



TRANSCONTINENTAL GAS PIPE LINE COMPANY, LLC

**APPENDIX D – OFFSHORE ENVIRONMENTAL SAMPLING REPORT AND
ERRATA AND ADDENDUM**

NORTHEAST SUPPLY ENHANCEMENT PROJECT

January 2020

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TRANSCONTINENTAL GAS PIPE LINE COMPANY, LLC

APPENDIX D-1 – OFFSHORE ENVIRONMENTAL SAMPLING REPORT

NORTHEAST SUPPLY ENHANCEMENT PROJECT

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**Fall/Winter 2016 Offshore
Environmental Sampling Report
for the Northeast Supply Enhancement
Project
New Jersey, New York**

June 2017

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List of Abbreviations and Acronyms

BTEX	Benzene, Toluene, Ethylbenzene, Xylene
CFR	Code of Federal Regulations
COC	Chemicals of Concern
DDD	dichlorodiphenyldichloroethane
DDE	dichlorodiphenyldichloroethylene
DDT	dichlorodiphenyltrichloroethane
DO	dissolved oxygen
ER-L	Effects Range Low (ER-L)
ER-M	Effects Range Median (ER-M)
°F	degrees Fahrenheit
E & E	Ecology and Environment, Inc.
EPA	U.S. Environmental Protection Agency
ESC	environmental screening criteria
FERC	Federal Energy Regulatory Commission
<i>H'</i>	Shannon-Weaver's Diversity Index
HDD	horizontal directional drill
MDS	multidimensional scaling
µg/kg	micrograms per kilogram
mg/L	milligrams per liter
mm	millimeters
mS/cm	milliSiemens per centimeter
nm	nautical miles
NOAA	National Oceanographic and Atmospheric Administration
NPL	National Priorities List
NTU	Nephelometric Turbidity Units
NJDEP	New Jersey Department of Environmental Protection
NYCDEP	New York City Department of Environmental Protection

List of Abbreviations and Acronyms (cont.)

NYSDEC	New York State Department of Environmental Conservation
PAHs	polycyclic aromatic hydrocarbons
PCBs	polychlorinated biphenyls
Pg/g	picograms per gram
Project	Northeast Supply Enhancement Project
PSU	practical salinity units
SAP/QAPP	Sampling and Analysis Plan/Quality Assurance Project Plan
SGVs	sediment guidance values
SVOC	semi-volatile organic compound
TOC	total organic carbon
TOGS	Technical and Operational Guidance Series
Transco	Transcontinental Gas Pipe Line Company, LLC
TSS	total suspended solids
USACE	U.S. Army Corps of Engineers
USGS	U.S. Geological Survey
VOC	volatile organic compound

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Introduction

1.1 Project Description

Transcontinental Gas Pipe Line Company, LLC (Transco), has filed an application with the Federal Energy Regulatory Commission (FERC) for a Certificate of Public Convenience and Necessity (Certificate) for the Northeast Supply Enhancement Project (Project) (Docket No. CP17-101-000). This Offshore Environmental Sampling Report was prepared to facilitate FERC's review and development of an environmental impact statement for the Project and to support the corresponding state-level evaluation of the Project.

The Project supports National Grid's long-term growth, reliability, and flexibility beginning in the 2019/2020 heating season. Transco is proposing to expand its existing interstate natural gas pipeline system in Pennsylvania and New Jersey and its existing offshore natural gas pipeline system in New Jersey and New York waters (see Figure A-1). The Project's 400,000 dekatherms per day capacity is fully subscribed by two entities of National Grid: Brooklyn Union Gas Company (d/b/a [doing business as] National Grid NY) and KeySpan Gas East Corporation (d/b/a National Grid), collectively referred to herein as "National Grid."

To provide the incremental capacity, Transco plans to expand portions of its system from the existing Compressor Station 195 in York County, Pennsylvania, to the Rockaway Transfer Point, in New York State waters. The Rockaway Transfer Point is the interconnection point between the Project and Transco's existing Rockaway Delivery Lateral.

The offshore portion of the Project includes a new 26-inch-diameter pipeline that will extend approximately 23.33 miles east-northeast across Raritan Bay and Lower New York Bay from the Borough of Sayreville shoreline in Middlesex County, New Jersey, to the Rockaway Transfer Point, located in the Atlantic Ocean approximately 3 miles seaward of the Rockaway Peninsula in Queens County, New York (see Figure A-2).

From the Rockaway Transfer Point, the Rockaway Delivery Lateral supplies gas to an existing onshore meter and regulating station located in Kings County, New York. Approximately 5.95 miles of the Raritan Bay Loop route cross New Jersey state waters, and approximately 17.38 miles cross New York state waters. The route passes offshore of Middlesex County and Monmouth County, New Jersey, and Richmond County and Queens County, New York. Approximately 0.16 mile of the route crosses onshore in Middlesex County, New Jersey.

The proposed Raritan Bay Loop route crosses a continuous expanse of open marine and estuarine waters, which comprise three major waterbodies—Raritan Bay, Lower New York Bay, and the Atlantic Ocean. The Project area is located within the Monmouth watershed management area and the Atlantic Ocean/Long Island Sound watershed, which drains most of the surrounding metropolitan areas and encompasses all marine waters in New York Harbor, Long Island Sound, Block Island Sound, Lower New York Bay/Raritan Bay, Sandy Hook Bay, and the waters that drain into them. The route crosses three federally authorized navigation channels, including the Ambrose Reach B (Ambrose Channel), the Chapel Hill North (Chapel Hill Channel), and the Raritan Bay West Reach (Raritan Bay Channel) (National Oceanic and Atmospheric Administration [NOAA] 2015). The Ambrose Channel was dredged within the last 10 years as part of the U.S. Army Corps of Engineers' (USACE) overall New York/New Jersey Harbor deepening project. Based on a Freedom of Information Act request submitted to the USACE, Transco determined the Chapel Hill Channel was last dredged in March 2012. Transco has not yet determined when the Raritan Bay Channel was last dredged.

1.2 Scope of Work

Transco conducted a field survey from October through December 2016 to evaluate the physical, chemical, and biological characteristics of sediment along the proposed Raritan Bay Loop route. The survey was conducted to support evaluation of the route for both engineering design and environmental review purposes. Physical properties of the water column were also measured at the sediment sampling sites. Transco contracted Ecology and Environment, Inc. (E & E) to support the environmental permitting effort for the Project. Therefore, E & E developed a sampling and analysis plan/quality assurance project plan (SAP/QAPP) prior to the offshore survey and submitted this plan to regulatory agencies for comment to ensure adequacy of the sediment data for agency review. The SAP/QAPP prepared for the offshore component of the Project is provided in Appendix C. Agency comments on initial versions of the SAP/QAPP are provided in Appendix D. Transco contracted Alpine Ocean (a Gardline company) to conduct the survey and arrange for sediment testing at onshore laboratories.

Figure A-3 shows the locations of the sites sampled along the proposed Raritan Bay Loop route during the 2016 offshore study and the locations of several sites sampled along an alternative route in Raritan Bay south of Staten Island. Transco added these sampling sites for an alternative route in response to comments from the New York State Department of Environmental Conservation (NYSDEC) on the SAP/QAPP.

1.3 Previous Investigations

Several previous investigations were completed within Raritan Bay, the Lower New York Bay, and/or the Atlantic Ocean near the Rockaway Peninsula as part of other projects to identify the physical characteristics of the sediments and the degree to which contaminants may exist (Adams and Benyl 2003; Adams et al.

1998; E & E 2003). In New York waters, water quality in the Raritan and Lower New York Bays has been monitored by the New York City Department of Environmental Protection (NYCDEP) since 1977 (NYCDEP 2012). Water quality in Raritan Bay in New Jersey has been monitored by NJDEP, and monitoring data is available going back to 1989 (NJDEP 2003a, 2003b, and 2003c).

Based on data collected by the U.S. Geological Survey (USGS) and available in USGS Open File Report OFR 03-241, the predominant sediment type in this area appears to be fine-to-coarse sands (Mecray et al. 2003). Greater silt and clay content was generally observed near the mouth of the Raritan River, in the entrance to Upper New York Bay, and in Sandy Hook Bay. However, sediment sample data obtained in 2002 as part of the Neptune Regional Transmission System project indicates that material primarily classified as silt may also extend throughout Raritan Bay (E & E 2003).

The sediment data obtained in 2002 for the Neptune Regional Transmission System project indicated a number of potential chemical contaminants were present in Raritan Bay and the Lower New York Bay (E & E 2003). Inorganic contaminants (i.e., metals) such as mercury, zinc, and arsenic; organic contaminants such as polychlorinated biphenyls (PCBs); and polycyclic aromatic hydrocarbons (PAHs) were identified in the sampling data. These sampling results are generally consistent with earlier sediment testing (Adams and Benyl 2003; Adams et al. 1998), but there was a wide variation in results, depending upon sampling location and depth.

Sediment testing was performed in association with the Raritan Bay Slag site along the shore and in Raritan Bay in Old Bridge Township and Sayreville, New Jersey, as part of the U.S. Environmental Protection Agency's (EPA) Remedial Investigation (NJDEP 2016). The Raritan Bay Slag site is located approximately 0.5 miles south of the proposed Raritan Bay Loop route. The site is included on the New Jersey Department of Environmental Protection's (NJDEP's) Known Contaminated Site list (NJDEP 2016) and is on the EPA National Priorities List (NPL) (EPA ID NJN000206276) (EPA 2016). The Project route crosses designated investigation Areas 7 and 11 (Jetty Sector) of the NPL site. Testing results for EPA sampling locations at the seaward end of Area 7, near the offshore Project route, indicated that elevated levels of some contaminants were present, but lead levels at the offshore sample locations were approximately one to two orders of magnitude lower than levels measured at the jetty or along the shore (CDM 2011).

The NJDEP Division of Water Monitoring and Standards, Bureau of Marine Water Monitoring, monitors water quality in Raritan Bay, generally collecting water samples near the surface of the water column (NJDEP 2003a, 2003b, and 2003c). Data on properties such as temperature, transparency, dissolved oxygen (DO), and fecal coliform were collected between 1989 through 2007 at monitoring sites that are close to the Project route (i.e., Stations 26A, 66, and 918). New York City, which has been responsible for monitoring the quality of offshore waters since

1977, currently monitors the Lower New York Bay and Raritan Bay for several water quality parameters (NYCDEP 2012). The sample results of the most recent “State of the Harbor” report, published in 2012, indicated that water quality has improved overall based on the concentrations of DO, bacterial cell counts, water clarity, chlorophyll α , and nitrogen and total suspended solids in wastewater treatment plant discharge (NYCDEP 2012).

More recent investigations conducted by E & E as part of the Rockaway Delivery Lateral project indicated that substrate immediately seaward of the Rockaway Peninsula was predominantly sandy and had minimal contaminant levels (E & E 2011). The 2009/2010 Rockaway Delivery Lateral sample results were predominantly below the Class A thresholds identified in the NYSDEC Technical and Operational Guidance Series (TOGS) 5.1.9 document, *In-Water and Riparian Management of Sediment and Dredged Material* (NYSDEC 2004), and none exceeded the Class C thresholds (definitions provided in Section 2).

1.4 Fall/Winter 2016 Survey Results

This report presents the results of sample collection and analyses supporting the sediment chemistry, benthic community, and water quality evaluations for the Project, including:

- Sediment chemical contaminants;
- Sediment grain size;
- Physical water quality parameters; and
- Benthic infauna characteristics.

Field data collected as part of the Fall/Winter 2016 survey are included in the appendices. Appendix A presents figures referenced in the body of this report; Appendix B presents tables that are referenced in the body of this report; Appendix C presents the SAP/QAPP developed in 2016 for the data collection effort; Appendix D presents comments received from agencies on the initial versions of the SAP/QAPP; Appendix E presents the tabularized laboratory results for all chemical parameters analyzed and grain size statistics; Appendix F presents the sediment chemistry laboratory reports; Appendix G presents the water quality results for all parameters analyzed; Appendix H presents the Benthic Laboratory Report that discusses the results of the benthic sampling performed at each sample location; and Appendix I presents the Data Usability Summary Reports.

Although sediment samples were analyzed extensively for geotechnical properties as part of the 2016 survey, only a summary of grain size analyses are included in this report. Complete sediment grab sample grain size distribution curves are provided in Appendix 1D to Resource Report 1 (General Project Description) of Transco’s application for a FERC Certificate. Geotechnical (deep) core logs are provided as Appendix B to Resource Report 6 (Soils) of Transco’s application for a FERC Certificate. Transco submitted these resource reports to FERC on March

27, 2017. Transco anticipates submitting geotechnical (shallow) core logs and complete grain size distribution curves on the FERC Docket by July 2017.

Transco is conducting additional shallow core (vibracore) sampling along the proposed offshore route and will submit the associated core logs following the completion of the laboratory analyses. Based on the results of these analyses, Transco will propose appropriate sediment handling and disposal methods during construction, in coordination with the applicable agencies.

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Sediment Sampling

The SAP/QAPP developed to evaluate the site-specific sediment conditions along the proposed pipeline route was designed specifically to address chemicals of concern (COCs) identified by NYSDEC and the NJDEP. These chemicals would be of concern if found above threshold levels. The threshold values utilized reflect where there could be harmful effects to aquatic life.

2.1 Thresholds for Chemicals of Concern

Thresholds for COCs in sediments sampled in New York State waters were taken from the TOGS 5.1.9 document, *In-Water and Riparian Management of Sediment and Dredged Material* (NYSDEC 2004) and the *Screening and Assessment of Contaminated Sediment* (NYSDEC 2014). Thresholds for COCs in sediments sampled in New Jersey waters were taken from *The Management and Regulation of Dredging Activities and Dredged Material in New Jersey's Tidal Waters* (NJDEP 1997). Additional guidance on COCs within the offshore Project area was taken from the USACE/EPA's *Guidance for Performing Tests on Dredged Material Proposed for Ocean Disposal* (2016). These agency documents were developed to provide guidance on the statutory and regulatory requirements for dredging activities and to promote uniformity in the certification and/or permitting of dredging projects.

In New York, in TOGS 5.1.9, the NYSDEC Division of Water established three classes of sediment quality thresholds for dredged material (sediment guidance values [SGVs]). This system is based upon the concentrations of contaminants within the dredged sediments, in contrast to the EPA's system, which is based upon bioaccumulation and biotoxicity. The three classes of dredged sediment provided in TOGS 5.1.9 are summarized here as follows:

- Class A – No appreciable contamination, no toxicity to aquatic life. Sediment chemistry is at or below the chemical concentrations that define this class. Dredging and in-water placement at approved locations can generally proceed.
- Class B – Moderate contamination, chronic toxicity to aquatic life. Several restrictions on dredging, applied based upon site-specific concerns and knowledge along with evaluation of sediment.
- Class C – High contamination, acute toxicity to aquatic life. This material may have stringent requirements for dredging and disposal. If contaminant levels exceed Class C, it is the responsibility of the applicant to ensure the material is not regulated as hazardous, as defined in 6 New York Code of Rules

and Regulations (NYCRR) Part 371. TOGS 5.1.9 does not cover hazardous materials/waste.

The discussion of sediment sampling results in Section 2.3 evaluates sediment contamination in terms of Class A and Class C thresholds only. If it is stated that a sediment sample exceeded the Class A threshold, it is understood that the sediment is a Class B. If the sediment sample exceeds the Class C threshold, it is understood that the sediment has exceeded both Class A and Class B thresholds and is considered a Class C sediment.

In New Jersey, the NJDEP's Site Remediation Program (SRP), Environmental Toxicology and Risk Assessment (ETRA) Unit, developed ecological screening criteria (ESC) for surface water, sediment, and soil. These ESCs were developed by the ERTA Unit using multiple sources and the most conservative criterion for each contaminant was used. The ESC are presented in terms of Effects Range Low (ER-L) and Effects Range Median (ER-M) levels for saline waters. The sediment and soil standards presented are not promulgated, and are intended as screening values for ecological assessments.

The EPA's Marine Protection, Research, and Sanctuaries Act provides the criteria for disposal of dredged sediments in the ocean. Under 40 Code of Federal Regulations (CFR) 227, Criteria for the Evaluation of Permit Applications for Ocean Dumping of Materials, there are three conditions that qualify dredged materials for ocean dumping without further testing. Two of these conditions are applicable to dredging materials proposed for placement at offshore sites, i.e., the historic area remediation site (HARS):

- Proposed dredged material is composed of predominantly sand, gravel, rock or any other naturally occurring bottom material with particle size larger than silt. Proposed dredge material is found in areas with high current or wave energy.
- Proposed dumping material is substantially the same as the substrate at the proposed dumping site, prior to dumping activities. Proposed dredging site is far removed from known and existing historical pollution sources, providing reasonable assurance that dredged material is not contaminated.

For materials that do not meet the above two conditions, and require further testing, 40 CFR 227 prohibits the ocean dumping of dredged materials containing anything greater than trace amounts of organohalogen compounds; mercury and mercury compounds; cadmium and cadmium compounds; oil of any kind or in any form; or known carcinogens, mutagens, or teratogens or any materials suspected of being such. Materials not excluded by this condition are subject to toxicity and bioaccumulation testing and must meet the conditions determined by the USACE/EPA guidance document. Based on the required testing and review by USACE/EPA, material may be approved for disposal at the HARS. A HARS plan must be reviewed and approved for this activity. This option is under considera-

tion based on results from the offshore survey for management of dredged material during construction.

2.2 Sampling Methods

Sediment was sampled by core boring, vibracoring, and surface grab sample collection at a total of 96 sites. The depths at each sample site reflect the maximum anticipated depth of disturbance during Project construction (see Table B-1), accounting for anticipated pipeline burial depths based upon burial guidelines for the Project provided by the USACE New York District as of June 2016 (Handell 2016).

Deep core samples (core boring) extending up to 125 feet below the seafloor were collected from 9 sample sites, all of which are within New Jersey waters. These deep core sites are located near the New Jersey shoreline and across Ambrose Channel where Transco proposes to install the pipeline using horizontal directional drill (HDD). The deep core depths represent the maximum depths for HDD installation. Deep core samples were analyzed for geotechnical properties only to be used in the engineering design of the HDDs and so are not further discussed in this report.

Shallow core samples (vibracores) were collected at 87 sites, 15 of which are in New Jersey waters and 72 of which are in New York waters. Of the 87, 69 sample sites were centered along the proposed route and the remainder, were centered along a route alternative (see Figure A-3 for the location of all shallow core sample sites) developed at the request of NYSDEC. The shallow core sample sites are identified as “VC” in Table B-1, and which were reviewed and approved by the New Jersey State Historic Preservation Office or the New York State Historic Preservation Office, as appropriate prior to the sampling. Sites identified with “-ALT” indicate those sample sites that were shifted from the original designated site to avoid potential cultural resources.

The shallow cores extended at least 12 feet below the seafloor outside navigation channels and up to 30 feet below the seafloor near navigation channels and designated anchorage areas. The shallow core samples were collected in areas where the pipeline would be installed by trenching methods (e.g., a clamshell dredge, a mechanical plough, and/or a jet sled) and where HDD entry/exit pits would be excavated using a clamshell dredge. Dredged material may be side-cast adjacent to the trench and, following pipeline installation, would be used to backfill the trench to the extent practicable. Shallow core samples were collected for testing and analysis of both geotechnical and bulk sediment chemistry properties. Duplicate shallow core samples were collected at three sample sites located within the proposed HDD pits (see Table B-1 for these sample sites). (Note: The geotechnical analysis of the shallow core samples is not addressed in this report.)

Once retrieved, the sediment core soil types were classified according to the United Soil Classification System, and sediment samples were collected from the core and shipped to a laboratory for chemical analysis. Each core was separated into

3-foot sections for shallow core samples. For shallow cores, distinct layers more than 1-foot thick were separated as unique sub-samples subject to sediment chemistry analyses if they appeared contaminated, based on the field geologist's evaluation of appearance and/or odor. The minimum 1-foot thickness provided sufficient sample volume for all sediment chemistry analyses. A total of 398 samples were collected, as identified in Table B-2. The tests performed, method, and quantities of samples collected at sample sites in New Jersey and New York waters are summarized in Table B-3, and a complete list of chemical analyses performed and the laboratory standard operating procedures are provided in Appendix B. The list of chemical analyses performed is based upon the NYSDEC TOGS 5.1.9 and the NJDEP Site Remediation Program ER-L and Effects Range Median ER-M ecological screening criteria. A summary of the results are discussed below, and the complete analytical results are provided in Appendix E.

Surface sediment grab samples were collected for analysis of benthic invertebrate populations and supplemental physical (grain size and total organic carbon [TOC]) analyses. The results of the analysis of benthic invertebrate populations are addressed in Section 4. Grab samples were collected separately from the vibracore samples and/or at a sufficient distance from the specific vibracore sample locations to ensure that the surface samples were undisturbed before collection.

Quality assurance/quality control (QA/QC) samples were collected in accordance with the SAP/QAPP (Appendix C). Analytical data have been validated for samples collected as part of this sampling effort. Field QC samples included one sediment duplicate per matrix per 20 samples for each analysis (excluding sediment samples where analysis for dioxins and furans would not occur¹). Trip blanks were collected to establish that the transport of sample containers to and from the field did not result in sample contamination from external sources. One trip blank was included in each cooler containing samples for volatiles analysis. Field equipment blanks were used at a rate of one per equipment set per day. Equipment blanks were only used on equipment sets that were subject to decontamination. Dedicated or disposable equipment did not require the use of equipment blanks.

The results of the bulk chemistry analysis of vibracore samples, and a summary of grain size analysis for vibracore and benthic grab samples are presented below.

2.3 Sediment Chemistry Results

Table B-3 presents a selection of analytes detected throughout the study corridor and the number of times both the SGVs and ESC were exceeded. Table B-3 also presents the range of concentrations detected at sample sites in each state that exceeded the state ESCs or SGVs. Table B-4 presents the number of analyte group exceedances of thresholds from both New Jersey and New York at each sample site.

¹ Only the upper (0- to 3-foot) sampling interval from sample sites in New York where clamshell dredging will not occur were analyzed for dioxins and furans.

Figures A-4, A-6, A-8, A-10, A-11, A-13, and A-14 show the number of exceedances at each sample site along the preferred route for each group of analytes based upon the lowest available threshold of either New Jersey or New York. Figures A-5, A-7, A-9, A-12, and A-15 show the number of exceedances at each depth sampled along the preferred route between 0 ft and 18 ft for each sample site by analyte group based upon the lowest available threshold of either New Jersey or New York. Figures A-16, A-17, A-18, A-19, and A-20 show the number of exceedances at each depth sampled along the alternative route between 0 ft and 18 ft for each sample site by analyte group based upon the lowest available threshold of either New Jersey or New York. Based on the limits of analysis and the lack of detections in samples, profile figures were not included for PCB Congeners and semi-volatile organic compound (SVOCs) (excluding PAHs).

In the following discussion, sample sites within the offshore study area were organized into four groups based upon the location of the proposed route (Table 2-1). Sample sites located within the alternative route comprise a fifth sampling group discussed in this draft report (Table 2-1).

The methods used to calculate the concentrations of the following analytes discussed below are presented in the SAP/QAPP (see Appendix C): sum of DDD (dichlorodiphenyldichloroethane) + DDE (dichlorodiphenyldichloroethylene) + DDT (dichlorodiphenyltrichloroethane), total PCB (Polychlorinated Biphenyls) Aroclors, total PCB congeners, total xylenes, total BTEX (Benzene, Toluene, Ethylbenzene, Xylene), total PAHs (Polycyclic Aromatic Hydrocarbons), and the total toxicity equivalency factor for dioxins and furans.

Table 2-1 Geographic Sediment Sample Groups

Group ID	Included Sample(s)	State
A	VC1-ALT to VC4	NJ
B	VC5 to VC44	NY
C	VC45-ALT to VC55	NJ
D	VC56 to VC69-ALT	NY
ALT	VC70 to VC87	NY

2.3.1 Group A – New Jersey

Metals

Each sediment sample was analyzed for 27 metals, including mercury (see Appendix C for a complete list of these metals). Of these metals, 16 have available ER-L and/or ER-M thresholds. Within this sample segment, all of the 27 metals tested for were detected in at least one sample in Group A. Table 2-2 lists the sample sites where metals were detected. Fourteen of the detected metals exceeded available NJDEP thresholds. The metals detected within this segment that exceeded ER-L and/or ER-M thresholds are presented in Table B-5.

Table 2-2 Number of Detections at Sample Sites in Group A

Sample Site	Number of Detections							
	VOCs	PAHs	Other SVOCs	Dioxins/Furans	Pesticides	PCB Congener	PCB Aroclor	Metals
VC1-ALT ¹	5	17	13	17	7	30	2	27
VC1B-ALT ¹	1	17	11	15	6	30	3	27
VC2	0	0	0	2	0	10	0	23
VC3-ALT	0	0	0	2	0	5	0	25
VC4	0	2	3	2	0	11	0	26

Key:

¹ Samples labeled VC1-ALT and VC1B-ALT were collected in the same location.

Cyanide

Samples from all sample sites in New Jersey were tested for cyanide. Cyanide was measured as total and amenable concentrations. No standard or guidance value is available for total or amenable cyanide. Total cyanide was detected within the 0- to 3-foot and 3- to 6-foot intervals at locations VC1-ALT and VC1-ALT-B at concentrations ranging from 0.37 to 1.5 milligrams per kilogram (mg/kg). Cyanide was not detected in any samples collected from VC2, VC3-ALT, and VC4.

Pesticides

Each sediment sample was analyzed for 27 pesticides (see Appendix C for a complete list of these pesticides). A total of seven pesticides (Dieldrin, O,P'-DDD, O,P'-DDE, O,P'-DDT, P,P'-DDD, P,P'-DDE, and P,P'-DDT) were detected in at least one sample in Group A. (Table 2-2 lists the sample sites where pesticides were detected.) Eleven pesticides tested for have available ER-L and/or ER-M thresholds and four of these (including the sum of three pesticides [DDD + DDE + DDT]) exceeded only the ER-L thresholds.

P,P'-DDD exceeded the ER-L threshold at the 0- to 3-foot and 3- to 6-foot depth intervals at VC1-ALT and VC1-ALT-B and at the 6- to 9-foot depth interval at VC1-ALT-B, with concentrations ranging from 4.48 to 14.7 micrograms per kilogram ($\mu\text{g/kg}$). P,P'-DDE exceeded the ER-L threshold at the 0- to 3-foot and 3- to 6-foot depth intervals at VC1-ALT and VC1-ALT-B and at the 6- to 9-foot depth interval at VC1-ALT-B with concentrations ranging from 5.5 to 56.5 $\mu\text{g/kg}$. P,P'-DDT exceeded the ER-L threshold at the 0- to 3-foot and 3- to 6 foot depth intervals at VC1-ALT and VC1-ALT-B with concentrations ranging from 2.39 to 5.37 $\mu\text{g/kg}$.

The sum of DDD + DDE + DDT exceeded the ER-L threshold value within the 0-3 ft and 3-6 ft depth intervals at VC1-ALT and VC1-ALT-B and the 6-9 ft depth interval at VC1-ALT-B with concentrations ranging from 14.21 to 92.57 $\mu\text{g/kg}$.

There were no pesticide detections in samples from VC2, VC3-ALT, and VC4.

Polychlorinated Biphenyls (PCBs)

Each sediment sample was analyzed for PCBs expressed as seven Aroclor compounds. Testing for 31 PCB congeners was also performed for samples from all sample sites in New Jersey. A complete list of the Aroclor compounds and PCB congeners included in the analysis is provided in Appendix C. Two PCB Aroclors, Aroclor 1254 and Aroclor 1260, and all 31 PCB congeners were detected in at least one sample in Group A. (Table 2-2 lists the sample sites where PCBs were detected.) ER-L thresholds are available for four Aroclor compounds and for the sum of Aroclor compounds. An ER-M threshold is also available for the sum of Aroclor compounds. While there are no available thresholds for individual PCB congeners, there are ER-L and ER-M thresholds for total PCB congeners. Of these, two Aroclor compounds, the sum of Aroclor compounds, and total PCB congeners exceeded ER-L and/or ER-M thresholds.

Aroclor 1254 and Aroclor 1260 exceeded the ER-L in the following samples: 0- to 3 feet and 3- to 6 feet at VC1-ALT; and 0- to 3 feet, 3- to 6 feet, and 6- to 9 feet at VC1B-ALT. The concentrations of Aroclor 1254 that exceeded the ER-L threshold ranged from 47.6 µg/kg to 714.0 µg/kg. The concentrations of Aroclor 1254 that exceeded the ER-L threshold ranged from 149 µg/kg to 340 µg/kg. The sum of Aroclors exceeded the ER-M threshold in the following samples: 0- to 3 feet and 3- to 6 feet at VC1-ALT; and 0- to 3 feet, 3- to 6 feet, and 6- to 9 feet at VC1B-ALT. The concentrations of the sum of Aroclors that exceeded the ER-M threshold ranged from 291.6 µg/kg to 1,140.0 µg/kg.

The sum of PCB congeners exceeded the ER-L threshold in the 6- to 9 feet sample at sample site VC1B-ALT, with a concentration of 44,100 picograms per gram (pg/g). The sum of PCB congeners also exceeded the ER-M threshold in the 0-3 ft and 3-6 ft samples at sample sites VC1-ALT and VC1B-ALT. Concentrations that exceeded the ER-M threshold ranged from 318,000 pg/g to 1,600,000 pg/g.

The sum of Aroclors and the sum of PCB congeners did not exceed the ER-L threshold in any samples from sample sites VC2, VC3-ALT, or VC4.

Volatile Organic Compounds (VOCs)

Each sediment sample was analyzed for the BTEX analytes, including all three isomers of xylene (m-, p-, and o-) and total xylenes. Benzene, ethylbenzene, o-xylene, and toluene were detected in at least one sample in Group A at sample sites VC1-ALT and VC1B-ALT. Only benzene, ethylbenzene, total xylene, and toluene have available ER-L thresholds. No VOCs have available ER-M thresholds. No VOCs were detected in exceedance of ER-L thresholds. No VOCs were detected at sample sites VC2, VC3-ALT, and VC4.

Polycyclic Aromatic Hydrocarbons (PAHs)

Each sediment sample was analyzed for 18 PAH compounds. Of the samples tested, 17 PAHs were detected (see Table 2-3 for a list of detected PAHs and Table 2-2 for the sample sites where they were detected). Seventeen PAHs and total

2 Sediment Sampling

PAHs have available ER-L and/or ER-M thresholds. The PAHs that exceeded the ER-L and/or ER-M thresholds are presented in Table B-6.

No PAHs were detected at sample sites VC2 and VC3-ALT.

Table 2-3 PAHs Detected in Sample Group A

PAH	Range (µg/kg)	PAH	Range (µg/kg)
2-Methylnaphthalene	7.83-144	Chrysene	4.87-600
Acenaphthene	9.21-61.2	Dibenz(A,H)Anthracene	7.75-116
Acenaphthylene	8.02-83.1	Fluoranthene	10.2-903
Anthracene	16.1-156	Fluorene	8.11-138
Benzo(A)Anthracene	6.46-643	Indeno(1,2,3-C,D)Pyrene	55.1-385
Benzo(A)Pyrene	39.1-567	Naphthalene	4.51-174
Benzo(B)Fluoranthene	7.92-717	Phenanthrene	6.7-510
Benzo(G,H,I)Perylene	34-477	Pyrene	11-1110
Benzo(K)Fluoranthene	19.1-209		

Semi-Volatile Organic Compounds (SVOCs)

An additional 46 SVOCs were tested in samples from all sample sites in New Jersey. (See Appendix C for a complete list of these SVOCs.) Of those tested for, 14 SVOCs were detected. (see Table 2.4 for a list of detected SVOCs and Table 2.2 for the sample sites where they were detected.) Sixteen SVOCs have available ER-L and/or ER-M thresholds. Four of the SVOCs were detected at concentrations that exceeded the ER-L and/or ER-M thresholds.

Table 2-4 SVOCs Detected in Sample Group A

SVOC	Range (µg/kg)	SVOC	Range (µg/kg)
1,2,4-Trichlorobenzene	5.23-45.9	Benzyl Butyl Phthalate	39.1-117
1,2-Dichlorobenzene	21.5-21.5	Bis(2-Ethylhexyl) Phthalate	34.6-37300
1,3-Dichlorobenzene	15.2-33.6	Carbazole	3.06-46.9
1,4-Dichlorobenzene	58.9-84.9	Dibenzofuan	5.32-64
2,4-Dimethylphenol	29.5-60.6	Di-N-Butyl Phthalate	32.7-32.7
2-Chlorophenol	5.62-5.62	Di-N-Octylphthalate	124-124
4-Methylphenol	24.8-56.1	Phenol	8.72-16.9

1,2,4-Trichlorobenzene exceeded the ER-M threshold in the following samples: 0- to 3 feet and 3- to 6 feet at VC1-ALT; and 0- to 3 feet, 3- to 6 feet, and 6- to 9 feet at VC1B-ALT. The concentrations that exceeded the ER-M threshold ranged from 5.23 µg/kg to 45.9 µg/kg.

2 Sediment Sampling

At 21.5 µg/kg, 1,2-dichlorobenzene exceeded the ER-M threshold in the 3- to 6-foot sample from sample site VC1-ALT.

Benzyl butyl phthalate exceeded the ER-M threshold in the following samples: 0- to 3 feet at VC1-ALT and 3- to 6 feet at VC1B-ALT. The concentrations that exceeded the ER-M threshold were 117 µg/kg and 69.3 µg/kg, respectively.

Bis(2-ethylhexyl) phthalate exceeded the ER-L threshold in the 3- to 6- foot samples from sample sites VC1-ALT and VC1B-ALT. The concentrations that exceeded the ER-L threshold were 2,300 µg/kg and 2,360 µg/kg, respectively. Bis(2-ethylhexyl) phthalate also exceeded the ER-M threshold in the 0- to 3-foot samples from sample sites VC1-ALT and VC1B-ALT. The concentrations that exceeded the ER-M threshold were 18,300 µg/kg and 37,300 µg/kg, respectively.

No SVOCs were detected at sample sites VC2 and VC3-ALT.

Dioxins/Furans

Sediment samples from each sample site were analyzed for dioxins and furans. (See Appendix C for a complete list of these dioxins and furans.) All dioxins and furans were detected in at least one sample from Group A (see Table 2.2 for the sample sites where they were detected). Of the dioxins and furans tested only the total toxicity equivalence factor of all dioxins and furans has an available ER-M.

For these sample sites, the total toxicity equivalency factor exceeded the ER-M threshold in the following samples: the 0- to 3 feet, 3- to 6 feet, and 6- to 9 feet depth intervals at VC1-ALT and VC1B-ALT; the 12- to 15 foot depth interval at VC1-ALT; the 6-to 9 foot depth interval at VC2; and the 0-to 3 feet, 3- to 6 feet, and 6- to 9 feet depth intervals at VC4. Concentrations in these samples ranged from 3.81 pg/g to 81.5 pg/g.

2.3.2 Group B – New York

Metals

Each sediment sample was analyzed for 27 metals, including mercury (see Appendix C for a complete list of these metals). Each of the 27 metals was detected in at least one sample in Group B (see Table B-7 for the sample sites where they were detected; due to the number of sample sites in Group B, this table is included in Appendix B). Seven of the detected metals exceeded Class A thresholds. Of these metals, nine have available Class A and/or Class C thresholds and all nine of these metals exceeded available NYSDEC thresholds. The metals detected within this segment that exceeded Class A and/or Class C thresholds are presented in Table B-8.

Cyanide

Samples from sample sites in New York where clamshell dredging may occur were tested for cyanide (see Table B-1 for these locations). This decision to expand the analysis of samples from these sites was based upon the anticipated need

for further testing to determine if these sediments were HARS compatible. Cyanide was measured as total and amenable concentrations. No standard or guidance value is available for total or amenable cyanide.

Total cyanide was detected in the following samples: 0- to 3 feet at VC7 and 9- to 12 feet at VC16 and VC17; 3- to 6 feet at VC3; and 3- to 6 feet and 9- to 12 feet at VC36. Detected concentrations ranged from 0.25 mg/kg to 0.97 mg/kg.

Pesticides

Each sediment sample was analyzed for 11 pesticides (see Appendix C for a complete list of these pesticides). Sample sites in New York where clamshell dredging may occur were sampled for more analytes than required by NYSDEC. See above for discussion of analytes included in the analysis of samples at clamshell sites. An additional 16 pesticides were analyzed for in samples from sample sites in New York where clamshell dredging may occur (see Table B-1 for these locations).

Non-Clamshell Dredge Sample Sites

Of the 11 pesticides tested for in samples from sample sites where clamshell dredging would not occur, Class A and Class C thresholds are available for three pesticides and the sum of DDT+DDE+DDD. No pesticides tested for were detected in samples from these sample sites.

Possible Clamshell Dredge Sample Sites

Of the pesticides tested for in samples from sample sites where clamshell dredging may occur, 12 have available Class A and/or Class C thresholds. A total of 8 pesticides (aldrin, endosulfan sulfate, endrin, O,P'-DDD, O,P'-DDE, P,P'-DDD, P,P'-DDE, and P,P'-DDT) were detected in at least one sample in Group B. (See Table B-7 for a list of the sample sites where pesticides were detected.) Of the detected pesticides, only endrin and the sum of DDT + DDE + DDD have available Class A and Class C thresholds, and only the sum of DDT + DDE + DDD exceeded the Class A threshold. The sum of DDT + DDE + DDD exceeded the Class A threshold in the 0- to 3-foot samples at VC6 and VC7; all samples from VC16 and VC17; and 0- to 3 foot sample at VC41-ALT. Concentrations that exceeded the Class A threshold ranged from 8.6 µg/kg to 99.0 µg/kg.

Polychlorinated Biphenyls (PCBs)

Each sediment sample was analyzed for PCBs expressed as seven Aroclor compounds. Samples from sample sites in New York where clamshell dredging may occur were tested for 31 PCB congeners (see Table B-1 for these locations). See above for discussion of analytes included in the analysis of samples at clamshell sites. A complete list of the Aroclor compounds and PCB congeners included in the analysis is provided in Appendix C. Class A and Class C thresholds are available for the sum of Aroclor compounds and total PCB congeners.

Non-Clamshell Dredge Sample Sites

No PCB Aroclors were detected in samples from sample sites where clamshell dredging would not occur.

Possible Clamshell Dredge Sample Sites

Two Aroclor compounds and all 31 PCB congeners were detected in at least one sample in Group B (see Table B-7 for the sample sites where they were detected). Class A thresholds were exceeded for both the sum of Aroclor compounds and total PCB congeners. The Class C threshold for total PCB congeners was also exceeded.

PCBs, expressed as the sum of Aroclor compounds, were detected in concentrations that exceeded the Class A threshold in the 0- to 3 feet samples at VC6 and VC7 and all samples from VC16 and VC17. Concentrations that exceeded the Class A threshold ranged from 161.6 µg/kg to 945.5 µg/kg .

PCBs expressed as the sum of congeners exceeded the Class A threshold in the following samples: 0- to 3 feet at VC6 and VC7; 0- to 3 feet, 3- to 6 feet, 6- to 9 feet, and 12- to 15 feet at VC16; and 0- to 3 feet, 3- to 6 feet, 6- to 12 feet, and 12- to 15 feet at VC17. The concentrations that exceeded the Class A threshold ranged from 149,000 pg/g to 727,000 pg/g. PCBs expressed as the sum of congeners also exceeded the Class C threshold in the 9- to 12-foot sample from VC16 with a concentration of 2,000,000 pg/g.

Volatile Organic Compounds (VOCs)

Each sediment sample was analyzed for the BTEX analytes, including all three isomers of xylene (m-, p-, and o-) and total xylenes. Benzene, ethylbenzene, total xylene, toluene, and total BTEX have available Class A and Class C thresholds. All VOC analytes were detected in at least one sample within Group B. (See Table B-7 for the sample sites where they were detected.) No detected VOCs exceeded the Class A criteria.

Polycyclic Aromatic Hydrocarbons (PAHs)

Each sediment sample was analyzed for 18 PAH compounds. All 18 PAHs were detected in at least one sample in Group B(see Table B-7 for the sample sites where PAHs were detected). Only total PAHs has available Class A and Class C thresholds.

Total PAHs detected only exceed the Class A criteria in the following samples: 0- 3 ft, 3- to 6 feet, 6- to 9 feet, 9- to 12 feet at VC16 and VC17; and 0- to 3feet at VC37 and VC38. The concentrations that exceeded the Class A threshold ranged from 4,540.0 µg/kg to 21,860.5 µg/kg.

Semi-Volatile Organic Compounds (SVOCs)

An additional 46 SVOCs were tested in samples from sample sites in New York where clamshell dredging may occur (see Table B-1 for these locations). See above for discussion of analytes included in the analysis of samples at clamshell sites. See Appendix C for a complete list of these SVOCs. Of those tested for, 11 SVOCs were detected (see Table 2-5 for a list of detected SVOCs and Table B-7 for the sample sites where SVOCs were detected). Class A and/or Class C thresholds are available for six SVOCs. None exceeded Class A thresholds.

Table 2-5 SVOCs Detected in Sample Group B

SVOC	Range (µg/kg)	SVOC	Range (µg/kg)
1,2,4-Trichlorobenzene	2.68-32.8	Dibenzofuan	7.34-85.4
1,4-Dichlorobenzene	48.4-48.4	Diethyl Phthalate	2.52-13.6
4-Methylphenol	17.2-108	Di-N-Butyl Phthalate	7.81-93.1
Benzyl Butyl Phthalate	23.9-386	Di-N-Octylphthalate	21.8-109
Bis(2-Ethylhexyl) Phthalate	19.1-18900	Phenol	6.81-17.7
Carbazole	3.63-39.8		

Dioxins/Furans

Sediment samples from each sample site were analyzed for dioxins and furans, but only the upper (0- to 3-foot) sampling interval was tested for samples from sample sites in New York where clamshell dredging will not occur (see Appendix C for a complete list of these dioxins and furans). See above for discussion of analytes included in the analysis of samples at clamshell sites. All dioxins and furans were detected in at least one sample in Group B (see Table B-7 for the sample sites where dioxins/furans were detected). Of the dioxins and furans tested for, Class A and Class C thresholds for only one dioxin (2,3,7,8-tetrachlorodibenzo-P-Dioxin) and the total toxicity equivalence factor of all dioxins and furans are available.

Non-Clamshell Dredge Sample Sites

There were no exceedances detected in samples analyzed from sample sites where clamshell dredging would not occur.

Possible Clamshell Dredge Sample Sites

The total toxicity equivalency factor only exceeded the Class A threshold in samples from sites where clamshell dredging may occur. 2,3,7,8-tetrachlorodibenzo-P-Dioxin did not exceed the Class A threshold. The samples where the total toxicity equivalency factor exceeded the Class A threshold were 3- to 6 feet at VC6; 3- to 6 feet at VC7; 9- to 12 feet at VC8; 0- to 3 feet and 6- to 9 feet at VC15; 0- to 3 feet and 6- to 9 feet at VC18; and 3- to 6 feet at VC39. The concentrations that exceeded the Class A threshold ranged from 4.6 pg/g to 8.01 pg/g.

2.3.3 Group C – New Jersey

Metals

Each sediment sample was analyzed for 27 metals, including mercury (see Appendix C for a complete list of these metals). Of these metals, 16 ER-L and/or ER-M thresholds are available. Within this sample segment, 25 metals tested for were detected in at least one sample in Group C (see Table 2-6 for the sample sites where metals were detected). The only two metals not detected were antimony and molybdenum. Three of the metals detected exceeded available NJDEP thresholds.

Table 2-6 Number of Detections at Sample Sites in Group C

Sample Site	Number of Detections							Metals
	VOCs	PAHs	Other SVOCs	Dioxins/ Furans	Pesticides	PCB Congener	PCB Aroclor	
VC45-ALT	0	11	0	1	0	2	0	21
VC46	0	17	2	1	0	0	0	23
VC47	0	17	2	1	0	0	0	23
VC48-ALT	0	3	1	1	0	18	0	17
VC49	1	12	1	3	0	15	0	20
VC50	0	0	0	1	0	1	0	21
VC51	0	0	1	1	0	0	0	22
VC52	0	0	0	1	0	0	0	22
VC53	0	0	1	1	0	2	0	20
VC54 ¹	0	17	5	15	0	3	0	24
VC54B ¹	0	17	5	3	0	1	0	24
VC55 ¹	0	2	0	1	0	3	0	21
VC55B ¹	0	13	0	1	0	2	0	20

Key:

¹ - Samples labeled "VC#" and "VC#B" were collected in the same location.

Nickel exceeded only the ER-L threshold at the 9- to 12-foot sample at sample site VC47, with a concentration of 23 mg/kg.

Selenium exceeded the ER-M threshold in the following samples: 0- to 3 feet at VC46; 9- to 12 feet at VC47; 0- to 3 feet, 3- to 6 feet, 6- to 9 feet, 9- to 12 feet at VC50, 0- to 3 feet, 3- to 6 feet, 6- to 9 feet, 9- to 12 feet at VC51; 3- to 6 feet, and 6- to 9 feet at VC52; 0- to 3 feet, 3- to 6 feet, 6- to 9 feet, 9- to 12 feet at VC53; 0- to 3 feet, 3- to 6 feet, 6- to 9 feet, 9- to 12 feet, 12- to 15 feet, and 15- to 17.63 feet at VC54; 0- to 3 feet, 3- to 6 feet, 6- to 9 feet, and 9- to 12 feet at VC54B; and 9- to 12 feet at VC55. Concentrations that exceeded the ER-M threshold ranged from 1.00 mg/kg to 4.13 mg/kg.

Mercury exceeded only the ER-L threshold in the following samples: 0- to 3 feet at VC47; 3- to 6 feet and 6- to 9 feet at VC54 and VC54-B, with concentrations ranged from 0.195 to 0.506 mg/kg.

Manganese exceed the ER-M threshold in the following samples: 0- to 3 feet and 3- to 6 feet at VC48-ALT and 0- to 3 feet at VC49. Concentrations that exceeded the ER-M threshold ranged from 422 mg/kg to 724 mg/kg.

Cyanide

Samples from all sample sites in New Jersey were tested for cyanide. Cyanide was measured as total and amenable concentrations. There are no standard or guidance values available for total or amenable cyanide. Total cyanide was detected in three of the sample sites. Detections occurred at the 6- to 9.7-foot interval at location VC48-ALT, the 9- to 12-foot interval at location VC51, and the 3-

to 6-foot and 6- to 99 foot intervals at location VC55 with concentrations ranging from 0.21 to 0.62 mg/kg.

Pesticides

Each sediment sample was analyzed for 27 pesticides (see Appendix C for a complete list of these pesticides). ER-L and/or ER-M thresholds were available for 11 pesticides. Pesticides were not detected in any sediment samples.

Polychlorinated Biphenyls (PCBs)

Each sediment sample was analyzed for PCBs expressed as seven Aroclor compounds. Testing for 22 PCB congeners was also performed for samples from all sample sites in New Jersey. A complete list of the Aroclor compounds and PCB congeners included in the analysis is provided in Appendix C. ER-L thresholds are available for four Aroclor compounds and for the sum of Aroclor compounds, and an ER-M threshold is also available for the sum of Aroclor compounds. While there are no available thresholds for individual PCB congeners, there are ER-L and ER-M thresholds for total PCB congeners.

PCBs, expressed as the sum of Aroclor compounds, were not detected in any sediment samples collected from these sample sites. Eighteen PCB congeners were detected in samples from these sample sites (see Table 2-7 for a list of these PCB congeners and Table 2-6 for the sample sites where they were detected). PCBs expressed as the sum of congeners were detected at locations VC45-ALT, VC48-ALT, VC49, VC50, VC53, VC54-B, VC54, VC55, and VC55-B and did not exceed the ER-L thresholds.

Table 2-7 PCB Congeners Detected in Sample Group C

PCB Congener	Range (µg/kg)	PCB Congener	Range (µg/kg)
PCB-8	14.2-19.4	PCB-52	6.2-42
PCB-170	8.52-24.7	PCB-66	7.42-73.1
PCB-193/180	20.7-74.1	PCB-69/49	30.6-46.1
PCB-183/185	29.7-29.7	PCB-77	7.97-12.9
PCB-187	13.8-67.8	PCB-105	8.45-14.9
PCB-138/163/129	31.4-127	PCB-113/90/101	30.4-54.3
PCB-153/168	32.1-134	PCB-118	34.8-53.8
PCB-20/28	67.4-84.4	PCB-206	7.78-12.1
PCB-44/65/47	39.5-60.3	PCB-209	8.34-25.1

Volatile Organic Compounds (VOCs)

Each sediment sample was analyzed for the BTEX analytes, including all three isomers of xylene (m-, p-, and o-) and total xylenes. Only benzene, ethylbenzene, total xylene, and toluene have available ER-L thresholds. ER-M thresholds are not available for VOCs.

Benzene was detected in only one sample at VC-49. This single detection was below the ER-L threshold. No other VOC detections occurred.

Polycyclic Aromatic Hydrocarbons (PAHs)

Each sediment sample was analyzed for 18 PAH compounds and 17 PAHs were detected (see Table 2-8 for a list of detected SVOCs and Table 2-6 for the sample sites where they were detected). The total toxicity equivalency factor exceeded the ER-M threshold in the 6-to 9 foot sample from sample site VC54 with a concentration of 5.83 pg/g.

Table 2-8 PAHs Detected in Sample Group C

PAH	Range (µg/kg)	PAH	Range (µg/kg)
2-Methylnaphthalene	5.25-41.5	Chrysene	3.57-1160
Acenaphthene	4.18-172	Dibenz(A,H)Anthracene	5.68-211
Acenaphthylene	4.41-131	Fluoranthene	3.24-2490
Anthracene	4.02-989	Fluorene	3.2-263
Benzo(A)Anthracene	3.75-1670	Indeno(1,2,3-C,D)Pyrene	3.76-753
Benzo(A)Pyrene	4.85-1330	Naphthalene	3.15-125
Benzo(B)Fluoranthene	7.37-1450	Phenanthrene	4.44-1570
Benzo(G,H,I)Perylene	4.59-708	Pyrene	3.09-2270
Benzo(K)Fluoranthene	3.29-488		

Semi-Volatile Organic Compounds (SVOCs)

An additional 46 SVOCs were tested in samples from all sample sites in New Jersey (see Appendix C for a complete list of these SVOCs). Five of the 46 SVOCs were detected (4-chloroaniline, 4-methylphenol, benzyl butyl phthalate, dibenzofuran, and phenol). ER-L and/or ER-M thresholds for 16 SVOCs are available. No SVOCs exceeded the ER-L and/or ER-M thresholds.

Dioxins/Furans

Sediment samples from each sample site were analyzed for dioxins and furans (see Appendix C for a complete list of these dioxins and furans). Of these, only the total toxicity equivalence factor of all dioxins and furans has an available ER-M. Dioxins and furans that were detected are listed in Table 2-9 See Table 2-6 for the sample sites where they were detected.

The total toxicity equivalency factor exceeded the ER-M threshold in the 6-to 9 foot sample from sample site VC54 with a concentration of 5.83 pg/g.

Table 2-9 Dioxins and Furans Detected in Sample Group C

SVOC	Range (µg/kg)	SVOC	Range (µg/kg)
1,2,3,4,6,7,8-Heptachlorodibenzofuran	22.6-22.6	1,2,3,7,8,9-Hexachlorodibenzo-P-Dioxin	3.07-3.07
1,2,3,4,6,7,8-Heptachlorodibenzo-P-Dioxin	1.78-14.7	1,2,3,7,8-Pentachlorodibenzofuran	1.69-1.69
1,2,3,4,7,8,9-Heptachlorodibenzofuran	3.72-3.72	2,3,4,6,7,8-Hexachlorodibenzofuran	5.9-5.9
1,2,3,4,7,8-Hexachlorodibenzofuran	5.52-5.52	2,3,4,7,8-Pentachlorodibenzofuran	3.02-3.02
1,2,3,4,7,8-Hexachlorodibenzo-P-Dioxin	1.98-1.98	2,3,7,8-Tetrachlorodibenzofuran	0.349-0.654
1,2,3,6,7,8-Hexachlorodibenzofuran	5.49-5.49	Octachlorodibenzofuran	11-11
1,2,3,6,7,8-Hexachlorodibenzo-P-Dioxin	1.95-1.95	Octachlorodibenzo-P-Dioxin	2.92-171
1,2,3,7,8,9-Hexachlorodibenzofuran	2.22-2.22		

2.3.4 Group D – New York

Metals

Each sediment sample was analyzed for 27 metals, including mercury (see Appendix C for a complete list of these metals). Twenty-six of the 27 metals were detected in at least one sample in Group D (see Table 2-10 for the sample sites where metals were detected). The only metal not detected was antimony. Of these metals, nine have available Class A and/or Class C thresholds and sampling results for four of these metals exceeded available NYSDEC thresholds.

Arsenic exceeded only the Class A threshold in the 0- to 3-foot sample at sample site VC60 and the 3- to 5-foot sample site at VC62. The concentrations that exceeded the Class A threshold were 8.27mg/kg and 10.3 mg/kg, respectively.

Copper exceeded only the Class A threshold in the 0- to 3-foot sample at sample site VC60 with a concentration of 43.1 mg/kg.

Lead exceeded only the Class A threshold in the 0- to 3-foot sample at sample site VC60 and the 3- to 5-foot sample at sample site VC62. The concentrations that exceeded the Class A threshold were 86.3 mg/kg and 77.6 mg/kg, respectively.

Mercury exceeded the Class A threshold in the following samples: 0- to 3 feet at VC60 and VC61-ALT; 3- to 6 feet at VC64; and 3- to 4.8 feet at VC65. Concentrations that exceeded the Class A threshold ranged from 0.169 mg/kg to 0.354 mg/kg. Mercury also exceeded the Class C threshold in the 6- to 6.1-foot sample from sample site VC64 with a concentration of 4.55 mg/kg.

Table 2-10 Number of Detections at Sample Sites in Group D

Sample Site ¹	Number of Detections							
	VOCs	PAHs	Other SVOCs	Dioxins/ Furans	Pesticides	PCB Congener	PCB Aroclor	Metals
VC56	0	0	0	1	0	0	0	17
VC57	1	0	0	0	0	0	0	22
VC58	0	1	0	1	0	0	0	22
VC59	0	3	0	0	0	0	0	19

Table 2-10 Number of Detections at Sample Sites in Group D

Sample Site ¹	Number of Detections							
	VOCs	PAHs	Other SVOCs	Dioxins/Furans	Pesticides	PCB Congener	PCB Aroclor	Metals
VC60	0	17	0	1	0	0	0	24
VC61-ALT	0	17	0	1	0	0	0	24
VC62	0	18	0	1	0	0	0	22
VC63	0	18	0	5	6	0	2	24
VC64	0	17	0	3	0	0	0	22
VC65	0	17	0	1	0	0	0	22
VC66	0	10	0	1	0	0	0	20
VC67	0	2	0	1	0	0	0	20
VC68	0	0	0	0	0	0	0	19
VC69-ALT	1	1	0	1	0	0	0	20

Key:

¹ Dioxins and furans were analyzed only in the samples taken from 0- to 3 feet at sites in New York where clamshell dredging is not anticipated to occur. Dioxin/furan samples for additional depths at these sites were archived. PCB congeners were not tested at sites in New York where clamshell dredging is not anticipated to occur.

Cyanide

Samples from sampling sites in New York where clamshell dredging may occur were tested for cyanide (see Table B-1 for these locations). See above for discussion of analytes included in the analysis of samples at clamshell sites. However, because sample sites in Group D are not located in areas of planned clamshell dredging, no sample sites within these locations were tested for cyanide.

Pesticides

Each sediment sample was analyzed for 11 pesticides (see Appendix C for a complete list of these pesticides). Samples from sample sites in New York where clamshell dredging may occur were analyzed for an additional 16 pesticides (see Table B-1 for these locations). See above for discussion of analytes included in the analysis of samples at clamshell sites.

Class A and Class C thresholds and the sum of DDT+DDE+DDD were available for 3 of the 11 pesticides. A total of six pesticides (O,P'-DDD, O,P'-DDE, P,P'-DDD, P,P'-DDE, P,P'-DDT, and trans-chlordane) were detected in at least one sample in Group D. Pesticides were only detected at sample site VC63.

A standard or guidance value is not available for any of the detected pesticides. The sum of DDT + DDE + DDD in the 0- to 3 foot sample at sample site VC63 did not exceed the Class A threshold. The concentration of the sum of DDT + DDE + DDD detected was 3.56 µg/kg.

No sample sites in Group D were at locations where clamshell dredging might occur.

Polychlorinated Biphenyls (PCBs)

Each sediment sample was analyzed for PCBs expressed as seven Aroclor compounds. Samples from sample sites in New York where clamshell dredging may occur were tested for 31 PCB congeners (see Table B-1 for these locations). See above for discussion of analytes included in the analysis of samples at clamshell sites. A complete list of the Aroclor compounds and PCB congeners included in the analysis is provided in Appendix C. Class A and Class C thresholds are available for the sum of Aroclor compounds and total PCB congeners.

Non-Clamshell Dredge Sample Sites

Two Aroclor compounds, Aroclor 1254 and 1260, were detected in at least one sample from Group D, from sample site VC63. Neither Aroclor compound exceeded the Class A threshold. The sum of PCB Aroclors did not exceed the Class A threshold in any samples from these sample sites.

No sample sites in Group D were at locations where clamshell dredging might occur.

Volatile Organic Compounds (VOCs)

Each sediment sample was analyzed for the BTEX analytes, including all three isomers of xylene (m-, p-, and o-) and total xylenes. Class A and Class C thresholds are available for benzene, ethylbenzene, total xylene, toluene, and total BTEX. One VOC (toluene) was detected in samples from these sample sites (see Table 2-10 for the sample sites where it was detected). Concentrations of toluene (0.14 µg/kg and 0.16 µg/kg) did not exceed the Class A criteria.

Polycyclic Aromatic Hydrocarbons (PAHs)

Each sediment sample was analyzed for 18 PAH compounds. All 18 PAHs were detected in at least one sample in Group D (see Table 2-10 for the sample sites where they were detected). Class A and Class C thresholds are available only for total PAHs.

Total PAHs exceeded only the Class A threshold in the following samples: 3- to 5 feet at VC62; 6- to 7 feet at VC63; 3- to 6 feet, and 6- to 6.1 foot at VC64. Concentrations that exceeded the Class A threshold ranged from 4,813 µg/kg to 18,500 µg/kg.

Semi-Volatile Organic Compounds (SVOCs)

An additional 46 SVOCs were tested in samples from sample sites in New York where clamshell dredging may occur (see Table B-1 for these locations). See above for discussion of analytes included in the analysis of samples at clamshell sites. See Appendix C for a complete list of these SVOCs. No sample sites in Group D were at locations where clamshell dredging might occur.

Dioxins/Furans

Sediment samples from each sample site were analyzed for dioxins and furans, but only the upper (0- to 3-foot) sampling interval was tested for samples from sample sites in New York where clamshell dredging will not occur. See above for

discussion of analytes included in the analysis of samples at clamshell sites. See Appendix C for a complete list of these dioxins and furans. Of the dioxins and furans tested, only one dioxin (2,3,7,8-tetrachlorodibenzo-p-dioxin) and the total toxicity equivalence factor of all dioxins and furans have available Class A and Class C thresholds.

Three dioxins (1,2,3,4,6,7,8-heptachlorodibenzo-p-dioxin, 2,3,7,8-tetrachlorodibenzo-p-dioxin, and octachlorodibenzo-p-dioxin) and two furans (1,2,3,4,6,7,8-heptachlorodibenzofuran and 2,3,7,8-tetrachlorodibenzofuran) were detected in at least one sample in Group D (see Table 2.10 for the sample sites where they were detected). No detected dioxins or furans exceeded the Class A thresholds. The total toxicity equivalency factor did not exceed the Class A threshold.

No sample sites in Group D were at locations where clamshell dredging might occur.

2.3.5 Alternative Route

Metals

Each sediment sample was analyzed for 27 metals, including mercury (see Appendix C for a complete list of these metals). Each of the 27 metals was detected in at least one sample in the alternative route (see Table 2-11 for the sample sites where metals were detected). Class A and/or Class C thresholds for nine of these metals are available, and all nine exceeded the thresholds. The metals detected within this segment that exceeded Class A and/or Class C thresholds are presented in Table B-10.

Table 2-11 Number of Detections at Sample Sites Along Alternative Route

Sample Site ¹	Number of Detections							
	VOCs	PAHs	Other SVOCs	Dioxins/ Furans	Pesticides	PCB Congener	PCB Aroclor	Metals
VC70	0	17	0	17	5	0	2	27
VC71	0	8	0	2	0	0	0	26
VC72	0	12	0	3	0	0	0	23
VC73-ALT	0	16	0	2	4	0	3	24
VC74	0	14	0	2	0	0	1	22
VC75	0	17	0	2	1	0	0	26
VC76	5	17	0	7	5	0	3	26
VC77	0	17	1	7	4	29	3	26
VC78	0	17	5	14	2	28	0	27
VC79-ALT	0	16	2	15	2	27	0	26
VC80	0	16	0	16	11	30	2	27
VC81	0	17	0	17	5	31	2	26
VC82	0	17	0	2	0	0	1	25
VC83-ALT	0	0	0	2	0	0	0	24
VC84-ALT	0	0	0	2	0	0	0	24

Table 2-11 Number of Detections at Sample Sites Along Alternative Route

Sample Site ¹	Number of Detections							
	VOCs	PAHs	Other SVOCs	Dioxins/ Furans	Pesticides	PCB Congener	PCB Aroclor	Metals
VC85	0	11	0	2	0	0	0	24
VC86-ALT	0	11	0	1	0	0	0	24
VC87	0	2	0	2	0	0	0	24

Key:

¹ Dioxins and furans were analyzed only in the samples taken from 0- to 3 feet at sites in New York where clamshell dredging is not anticipated to occur. Dioxin/furan samples for additional depths at these sites were archived. PCB congeners were not tested at sites in New York where clamshell dredging is not anticipated to occur.

Cyanide

Samples from sampling sites in New York where clamshell dredging may occur were tested for cyanide (see Table B-1 for these locations). See above for discussion of analytes included in the analysis of samples at clamshell sites. Cyanide was measured as total and amenable concentrations. No standard or guidance values are available for total or amenable cyanide. Total cyanide was detected in three of the sample sites. Total cyanide was detected in the following samples: 0- to 3 feet, 3- to 6 feet, and 6- to 9 feet at VC80; and 0- to 3 feet, 6- to 9 feet, 9- to 12 feet, and 12- to 14.75 feet at VC81. Concentrations in these samples ranged from 0.38 mg/kg to 0.66 mg/kg.

Pesticides

Each sediment sample was analyzed for 11 pesticides (see Appendix C for a complete list of these pesticides). In samples from sites in New York where clamshell dredging may occur an additional 16 pesticides were analyzed (see Table B-1 for these locations). See above for discussion of analytes included in the analysis of samples at clamshell sites.

Non-Clamshell Dredge Sample Sites

In samples from sample sites where clamshell dredging would not occur three of the 11 pesticides and the sum of DDT+DDE+DDD have available Class A and Class C thresholds. Five pesticides were detected (O,P'-DDD, O,P'-DDE, P,P'-DDD, P,P'-DDE, and P,P'-DDT) in at least one sample in the alternative route, none of which have available Class A thresholds (see Table 2.11 for the locations where these pesticides were detected). The sum of DDT+DDE+DDD exceeded only the Class A threshold in the 0- to 3-foot sample at sample site VC70 with a concentration of 52.2 µg/kg.

Possible Clamshell Dredge Sample Sites

Twelve off the 27 pesticides analyzed were detected in at least one sample in the alternative route (see Table 2-12 for the list of detected pesticides and Table 2-11 for the sample sites where pesticides were detected). Of these 12 pesticides, one (Mirex) has an available Class A threshold, which was not exceeded. The Class A threshold of the sum of DDT+DDE+DDD was exceeded in the 6- to 9-foot sample at sample site VC80 and the 9- to 12-foot sample at sample site VC81.

Concentrations that exceeded the Class A threshold were 63.1 µg/kg and 63.0 µg/kg, respectively.

Table 2-12 Pesticides Detected in the Alternative Route at Possible Clamshell Sites

Pesticide	Range (µg/kg)	Pesticide	Range (µg/kg)
Alpha BHC	0.742-0.967	P,P'-DDD	1.27-11.1
Endosulfan Sulfate	1.92-1.92	P,P'-DDE	0.399-32.3
Endrin Aldehyde	4.19-4.19	P,P'-DDT	0.574-1.96
Mirex	0.866-0.866	Trans-Chlordane	1.07-1.53
O,P'-DDD	0.719-21.4	Trans-Nonachlor	0.849-1.24
O,P'-DDE	0.388-15.8		

Polychlorinated Biphenyls (PCBs)

Each sediment sample was analyzed for PCBs expressed as seven Aroclor compounds. Samples from sample sites in New York where clamshell dredging may occur were tested for 31 PCB congeners (see Table B-1 for these locations). See above for discussion of analytes included in the analysis of samples at clamshell sites. A complete list of the Aroclor compounds and PCB congeners included in the analysis is provided in Appendix C.

Non-Clamshell Dredge Sample Sites

Three Aroclor compounds (Aroclor 1016, Aroclor 1254, and Aroclor 1260) were detected in at least one sample from the alternative route (see Table 2-11 for the sample sites where PCBs were detected). Class A thresholds were exceeded only for the sum of Aroclor compounds in the following samples: 0- to 3 feet at VC70 and VC76 and 9- to 12 feet at VC73 and VC74. Concentrations that exceeded the Class A threshold ranged from 300 µg/kg to 554 µg/kg.

Possible Clamshell Dredge Sample Sites

Three Aroclor compounds (Aroclor 1016, Aroclor 1254, and Aroclor 1260) and all 31 PCB congeners were detected in at least one sample in the alternative route (see Table 2.11 for the sample sites where they were detected). Class A thresholds were exceeded for both the sum of Aroclor compounds and total PCB congeners. The Class C threshold for total PCB congeners was also exceeded.

PCBs, expressed as the sum of Aroclor compounds, were detected in concentrations that exceeded the Class A threshold in the following samples: 0- to 3 feet at VC77; 0- to 3 feet, 3- to 6 feet, and 6- to 9 feet at VC80, and all samples from VC81. Concentrations that exceeded the Class A threshold ranged from 108.5 µg/kg to 725.5 µg/kg.

The total of PCB congeners exceeded the Class A threshold in the following samples: 0- to 3 feet at VC77, VC78, and VC79-ALT; 0- to 3 feet, 3- to 6 feet, and 6- to 9 feet at VC80 and VC81. Concentrations that exceeded the Class A threshold ranged from 112,000 pg/g to 652,000 pg/g. Total PCB congeners also exceeded

the Class C threshold in the 9- to 12-foot sample at sample site VC81, with a concentration of 1,200,000 pg/g.

Volatile Organic Compounds (VOCs)

Each sediment sample was analyzed for the BTEX analytes, including all three isomers of xylene (m-, p-, and o-) and total xylenes. Class A and Class C thresholds are available for benzene, ethylbenzene, total xylene, toluene, and total BTEX. Four VOCs (benzene, ethylbenzene, m,p-xylene, and toluene) were detected in at least one sample in the alternative route. VOCs were only detected at sample site VC76 and none of the detected VOCs, total xylenes, nor total BTEX exceeded Class A thresholds.

Polycyclic Aromatic Hydrocarbons (PAHs)

Each sediment sample was analyzed for 18 PAH compounds. All 18 PAHs were detected in at least one sample in the alternative route (see Table 2-11 for the sample sites where PAHs were detected). Class A and Class C thresholds are available only for total PAHs.

Total PAHs exceeded only the Class A threshold in the following samples: 0- to 3 feet at VC70, VC76, VC77, and VC78; 0- to 3 feet, 3- to 6 feet, and 6- to 9 feet at VC80; and 0- to 3 feet, 6- to 9 feet, and 9- to 12 feet at VC81. Concentrations that exceeded the Class A threshold ranged from 4,020 µg/kg to 11,600 µg/kg.

Semi-Volatile Organic Compounds (SVOCs)

Samples from sample sites in New York where clamshell dredging may occur (see Table B-1 for these locations) were tested for an additional 46 SVOCs. See above for discussion of analytes included in the analysis of samples at clamshell sites. See Appendix C for a complete list of these SVOCs. Six SVOCs have available Class A and/or Class C thresholds. Of those samples tested, five SVOCs were detected (4-methylphenol, bis(2-ethylhexyl) phthalate, carbazole, hexachlorocyclopentadiene, and phenol) in at least one sample in the alternative route (see Table 2-11 for the sample sites where SVOCs were detected). None exceeded Class A thresholds.

Dioxins/Furans

Sediment samples from each sample site were analyzed for dioxins and furans, but only the upper (0- to 3-foot) sampling interval was tested for samples from sample sites in New York where clamshell dredging will not occur. See above for discussion of analytes included in the analysis of samples at clamshell sites. (See Appendix A for a complete list of these dioxins and furans.) All dioxins and furans were detected in at least one sample in the alternative route (see Table 2-11 for the sample sites where dioxins/furans were detected). Of the dioxins and furans tested, only one dioxin (2,3,7,8-tetrachlorodibenzo-p-dioxin) and the total toxicity equivalence factor of all dioxins and furans have Class A and Class C thresholds.

Non-Clamshell Dredge Sample Sites

2,3,7,8-tetrachlorodibenzo-p-dioxin exceeded the Class A threshold in the 0- to 3 foot samples from sample sites VC70 and VC76. Concentrations that exceeded the Class A threshold were 6.04 pg/g and 1.38 pg/g, respectively. The total toxicity equivalency factor exceeded only the Class A threshold in the 0- to 3 foot samples at sample sites VC70, VC72, VC76, and VC85. Concentrations that exceeded the Class A threshold ranged from 4.51 pg/g to 19.56 pg/g.

Possible Clamshell Dredge Sample Sites

2,3,7,8-tetrachlorodibenzo-p-dioxin exceeded only the Class A threshold in the following samples: 0- to 3 feet at VC78 and VC79-ALT; 0- to 3 feet, 3- to 6 feet, and 6- to 9 feet at VC80; and 0- to 3 feet, 3- to 6 feet, 6- to 9 feet, and 9- to 12 feet at VC81. Concentrations that exceeded the Class A threshold ranged from 1.53 pg/g to 28.10 pg/g.

The total toxicity equivalency factor exceeded the Class A threshold in the following samples: 12- to 15.6 feet at VC77; 0- to 3 feet, 6- to 9 feet, 12- to 15 feet, and 15- to 17 feet at VC78; 0- to 3 feet, 3- to 6 feet, and 12- to 16 feet at VC79-ALT; 0- to 3 feet, 6- to 9 feet, 9- to 12 feet, and 12- to 15 feet at VC80; and 0- to 3 feet, 3- to 6 feet, and 9- to 12 feet at VC81. The concentrations that exceeded the Class A threshold ranged from 4.59 pg/g to 38.56 pg/g. The total toxicity equivalency factor also exceeded the Class C threshold in the 3- to 6-foot sample from sample site VC80 and the 6- to 9-foot sample from sample site VC81. Concentrations that exceeded the Class C threshold were 53.01 pg/g and 65.72 pg/g, respectively.

2.4 Sediment Grain Size Results

Both vibracores and sediment grab samples were analyzed for grain size. The field geologist determined the number of depth intervals from each vibracore included in this analysis. This determination was based upon the observed uniformity of sediment type within each vibracore. Grain size analysis of these samples was conducted by the geotechnical laboratory using the sieve-based particle size analysis methodology (ASTM D6913) and/or a hydrometer (ASTM D7928). The grain size analysis for sediment grab samples was conducted by the geotechnical laboratory using the sieve-based particle size analysis methodology for unconsolidated material in the grab samples. Of the three sediment grab samples collected at each sample site, only the central sample was analyzed for grain size. Further discussion of grain sizes in the sediment grab samples from the preferred and the alternative routes are provided in Sections 4.1.1 and 4.2.1. Results of the sediment grain-size analysis are presented in Tables B-11 and B-12. Sediment grain size curves for vibracore sample sites are presented in Appendix E.

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3

Physical Water Quality Survey Results

The offshore portion of the Raritan Bay Loop will cross a continuous expanse of open marine and estuarine waters, including three major and contiguous water-bodies: Raritan Bay, Lower New York Bay, and the Atlantic Ocean (see Figure A-21). Raritan Bay covers the shallower portions of the Project area east of the Sandy Hook Peninsula and south of Crookes Point on Staten Island. Raritan Bay and Lower New York Bay are included in the New York – New Jersey Harbor Estuary Program (NYNJHEP). The waters of the Atlantic Ocean are under state jurisdiction (i.e., are state waters) from the shoreline out to 3 nautical miles (nm), which is the boundary where federal jurisdiction begins. The 3 nm limit of state-controlled waters is measured from a line between Sandy Hook and the western tip of the Rockaway Peninsula, as shown on NOAA Chart 12327 for New York Harbor (NOAA Fisheries 2016).

The water quality of the offshore Project area is influenced by many physical factors, including sediment inputs and geographic characteristics. A survey of physical water quality obtained data regarding background conditions in the water column along both the proposed and alternative pipeline routes.

The survey of water quality included the collection of water quality profiles using a Seabird SBE 19 Plus water quality meter. The SBE 19 meter collected a profile of the following physical parameters: DO, temperature, salinity, turbidity, pH, and conductivity. Water quality survey sites were co-located with the 87 vibracore sediment sampling locations (see Figure A-1 and A-2), and collected from October through December 2016. One profile record was conducted at each site, prior to any sediment sampling, in order to ensure the water was not impacted by disturbed sediment. Water quality readings were taken in the field at 2-foot depth intervals with the first reading at 2 feet (see Table B-13 for the depths sampled at each site). The results of the readings from the water quality meter are summarized below. The complete data output from the SBE 19 meter is provided in Appendix G.

Sample collection and laboratory analyses were not proposed for the water samples collected as part of the pre-construction investigations since chemical components in an open water environment are constantly changing. Thus, samples collected on one day may not be representative of conditions during the construction stage.

3 Physical Water Quality Survey Results

3.1 Dissolved Oxygen (DO)

Based on the field survey results, the average measured DO value along the entire proposed route was 8.56 mg/L and the concentration ranged from 4.69 mg/L to 11.88 mg/L. The average measured DO value along the alternative route was 8.53 mg/L and the concentration ranged from 6.77 mg/L to 9.84 mg/L. The ranges and averages of concentrations of DO measured at each sampling depth are presented for the proposed route and the alternative route in Table 3-1

Table 3-1 Dissolved Oxygen (mg/L) Measured at Depth

Depth (ft)	Proposed Route			Alternative Route		
	Minimum	Maximum	Average	Minimum	Maximum	Average
2	6.57	11.88	8.60	7.05	9.64	8.05
4	5.06	10.34	8.41	6.77	9.30	8.31
6	5.78	10.46	8.40	7.17	9.84	8.72
8	7.21	9.60	8.67	7.16	9.70	8.77
10	6.93	9.59	8.69	7.19	9.71	8.76
12	6.80	9.58	8.72	7.21	9.71	8.75
14	6.59	9.59	8.70	7.20	9.68	8.74
16	5.95	9.59	8.67	7.25	9.71	8.74
18	4.69	9.61	8.60	7.32	9.04	8.56
20	7.56	9.60	8.62	7.32	9.17	8.51
22	7.89	9.37	8.50	7.26	9.33	8.45
24	7.67	8.90	8.40	7.26	8.98	7.87
26	7.63	8.91	8.39	7.22	8.97	7.83
28	8.06	8.90	8.39	7.21	8.95	7.83
30	8.03	8.89	8.35	7.26	8.93	8.10
32	8.07	8.87	8.32	7.23	8.96	8.10
34	7.94	8.86	8.31	7.19	7.19	7.19
36	7.89	8.77	8.22	7.16	7.16	7.16
38	7.95	8.41	8.17	--	--	--
40	7.92	8.37	8.15	--	--	--

Key:

“--” = Depth was not included in profile

3.2 Temperature

Based on the field survey results, the average measured temperature along the entire proposed route was 48.41°F and temperatures ranged from 40.78°F to 60.07°F. The average measured temperature along the alternative route was 48.66°F and the temperature ranged from 43.29°F to 57.11°F. The ranges and averages of concentrations of temperature measured at each sampling depth for the proposed route and the alternative route are presented in Table 3-2.

3 Physical Water Quality Survey Results

Table 3-2 Temperature (°F) Measured at Depth Alternative Route

Depth (ft)	Proposed Route			Alternative Route		
	Minimum	Maximum	Average	Minimum	Maximum	Average
2	40.78	60.07	48.82	45.09	57.11	49.27
4	42.45	54.42	48.25	43.29	53.28	48.14
6	42.51	54.02	48.26	46.07	53.49	48.27
8	42.73	53.94	48.28	46.15	53.49	48.27
10	42.82	53.83	48.31	46.36	53.53	48.28
12	42.81	54.08	48.33	46.39	53.61	48.27
14	42.77	54.49	48.38	46.40	53.66	48.24
16	42.74	54.88	48.43	46.40	53.72	48.19
18	44.67	55.09	48.69	46.42	53.75	48.56
20	46.31	52.76	48.98	46.43	53.76	48.63
22	47.01	52.75	49.47	46.43	53.80	49.13
24	47.01	52.74	49.88	46.84	53.81	51.36
26	47.77	52.82	50.22	46.81	53.80	51.36
28	47.74	52.78	50.44	46.79	53.79	51.36
30	47.73	52.85	50.66	46.72	53.53	50.12
32	47.71	53.06	50.77	46.66	53.56	50.11
34	47.55	53.14	50.90	53.58	53.58	53.58
36	47.57	53.14	51.40	53.60	53.60	53.60
38	50.70	53.17	52.17	—	—	—
40	51.77	53.18	52.54	—	—	—

Key:

“—” = Depth was not included in profile

3.3 Salinity

Based on the field survey results, the average measured salinity along the entire proposed route was 28.72 practical salinity units (PSU) and salinity ranged from 12.33 PSU to 34.73 PSU. The average measured salinity along the alternative route was 27.35 PSU, and the salinity ranged from 22.71 PSU to 30.56 PSU. The ranges and averages of salinity measured at each sampling depth are presented for the proposed route and the alternative route in Table 3-3.

Table 3-3 Salinity (PSU) Measured at Depth

Depth (ft)	Proposed Route			Alternative Route		
	Minimum	Maximum	Average	Minimum	Maximum	Average
2	12.33	34.73	27.06	22.71	28.51	26.74
4	21.40	34.56	28.00	24.95	30.56	27.28
6	21.45	33.59	27.91	25.00	28.13	27.12
8	21.98	33.79	27.95	24.95	28.16	27.18
10	23.08	33.64	28.02	25.20	28.16	27.24
12	23.31	33.65	28.10	25.49	28.16	27.31
14	23.58	33.65	28.27	25.70	28.21	27.37
16	23.59	33.67	28.44	26.13	28.25	27.44

3 Physical Water Quality Survey Results

Table 3-3 Salinity (PSU) Measured at Depth

Depth (ft)	Proposed Route			Alternative Route		
	Minimum	Maximum	Average	Minimum	Maximum	Average
18	24.91	33.66	28.82	26.12	28.26	27.46
20	25.03	33.66	29.16	26.86	28.29	27.72
22	25.80	33.65	29.90	26.87	28.32	27.71
24	27.48	33.68	30.86	28.01	28.34	28.16
26	27.50	33.68	31.54	28.08	28.34	28.18
28	27.50	33.69	31.59	28.10	28.34	28.18
30	27.51	33.72	31.81	28.09	28.13	28.11
32	27.53	33.79	31.82	28.10	28.15	28.12
34	27.53	33.76	31.63	28.16	28.16	28.16
36	27.60	33.78	31.94	28.16	28.16	28.16
38	33.00	33.78	33.45	—	—	—
40	33.48	33.79	33.62	—	—	—

Key:

“—” = Depth was not included in profile

Field survey results indicated that salinity values increase from east to west along the pipeline route, with an average value of 23.19 PSU at VC1-ALT and an average value of 33.74 PSU at VC69-ALT.

3.4 Turbidity

Based on the field survey results, the average measured turbidity along the entire proposed route was 9.74 nephelometric turbidity units (NTU) and turbidity ranged from 0.39 NTU to 27.78 NTU. The average turbidity along the alternative route was 9.69 NTU and turbidity ranged from 0.26 NTU to 14.25 NTU. The ranges and averages of turbidity measured at each sampling depth for the proposed route and the alternative route are presented in Table 3-4.

Table 3-4 Turbidity (NTU) Measured at Depth

Depth (ft)	Proposed Route			Alternative Route		
	Minimum	Maximum	Average	Minimum	Maximum	Average
2	0.39	27.78	6.82	0.26	10.84	5.54
4	0.61	17.13	9.48	6.42	14.25	10.31
6	3.97	15.74	10.10	9.44	10.55	10.07
8	6.56	12.04	10.10	9.49	11.23	10.23
10	6.69	11.43	10.06	9.58	10.45	10.13
12	5.95	10.97	10.01	9.20	10.75	10.04
14	6.27	11.03	9.91	9.49	10.67	10.07
16	7.72	11.50	10.14	8.79	11.45	10.07
18	8.59	11.36	10.07	9.74	10.52	10.01
20	9.06	11.60	10.16	9.73	10.27	9.94
22	9.32	10.94	10.15	9.99	10.94	10.33
24	9.50	11.63	10.23	9.90	10.27	10.11

3 Physical Water Quality Survey Results

Table 3-4 Turbidity (NTU) Measured at Depth

Depth (ft)	Proposed Route			Alternative Route		
	Minimum	Maximum	Average	Minimum	Maximum	Average
26	9.21	11.09	10.08	9.81	10.04	9.93
28	9.50	10.82	10.06	9.89	10.18	10.05
30	9.37	10.96	10.00	10.19	10.63	10.41
32	8.91	10.27	9.72	10.21	10.24	10.22
34	9.72	10.58	10.17	10.03	10.03	10.03
36	9.68	10.25	9.95	10.21	10.21	10.21
38	9.34	10.53	9.95	—	—	—
40	9.90	10.57	10.14	—	—	—

Key:

“—” = Depth was not included in profile

3.5 pH

Based on the field survey results, the average measured pH along the entire proposed route was 7.98, and pH ranged from 5.87 to 8.30. The average pH along the alternative route was 7.72, and pH ranged from 6.40 to 8.58. The ranges and averages of pH measured at each sampling depth are presented for the proposed route and the alternative route in Table 3-5.

Table 3-5 pH Measured at Depth

Depth (ft)	Proposed Route			Alternative Route		
	Minimum	Maximum	Average	Minimum	Maximum	Average
2	5.87	8.22	7.63	6.40	7.98	7.07
4	6.28	8.25	7.79	6.88	8.58	7.67
6	7.10	8.30	7.98	7.53	8.11	7.81
8	7.11	8.30	7.99	7.52	8.02	7.81
10	7.14	8.28	7.98	7.53	8.02	7.82
12	7.15	8.28	7.99	7.53	8.02	7.82
14	7.17	8.28	7.99	7.54	8.02	7.82
16	7.17	8.28	7.99	7.55	8.02	7.82
18	7.18	8.28	8.03	7.56	7.98	7.80
20	7.65	8.28	8.07	7.57	7.98	7.78
22	7.79	8.28	8.10	7.60	7.98	7.77
24	7.78	8.28	8.13	7.74	7.79	7.77
26	7.86	8.28	8.16	7.75	7.79	7.77
28	7.87	8.29	8.16	7.75	7.80	7.77
30	7.87	8.28	8.17	7.75	7.80	7.77
32	7.87	8.28	8.17	7.75	7.80	7.78
34	7.87	8.29	8.15	7.75	7.75	7.75
36	7.90	8.28	8.17	7.75	7.75	7.75
38	8.15	8.28	8.25	—	—	—
40	8.15	8.28	8.25	—	—	—

Key:

“—” = Depth was not included in profile

3 Physical Water Quality Survey Results

3.6 Conductivity

Based on the field survey results, the average measured conductivity along the entire proposed route was 31.37 milliSiemens per centimeter (mS/cm) and conductivity ranged from 12.46 mS/cm to 38.54 mS/cm. The average conductivity along the alternative route was 29.94 mS/cm and conductivity ranged from 27.16 mS/cm to 33.18 mS/cm. The ranges and averages of conductivity measured at each sampling depth are presented for the proposed route and the alternative route in Table 3-6.

Table 3-6 Conductivity (mS/cm) Measured at Depth

Depth (ft)	Proposed Route			Alternative Route		
	Minimum	Maximum	Average	Minimum	Maximum	Average
2	12.46	37.87	29.63	27.16	33.05	29.53
4	23.64	37.90	30.40	27.62	32.52	29.67
6	23.86	38.03	30.31	27.78	32.70	29.55
8	24.01	38.32	30.37	27.74	32.72	29.60
10	24.03	38.14	30.45	27.96	32.76	29.66
12	24.02	38.14	30.55	28.15	32.90	29.73
14	24.02	38.15	30.73	28.27	32.97	29.78
16	24.01	38.18	30.92	28.54	33.04	29.83
18	27.80	38.19	31.41	27.80	33.06	30.01
20	27.81	38.19	31.89	28.71	33.10	30.30
22	28.30	38.18	32.84	28.72	33.16	30.50
24	29.60	38.21	33.98	29.91	33.18	31.92
26	29.74	38.24	34.82	29.89	33.18	31.94
28	29.74	38.23	34.98	29.87	33.17	31.95
30	29.74	38.31	35.30	29.83	32.83	31.33
32	29.74	38.48	35.38	29.81	32.87	31.34
34	29.64	38.50	35.26	32.88	32.88	32.88
36	29.72	38.52	35.81	32.89	32.89	32.89
38	36.48	38.53	37.68	—	—	—
40	37.59	38.54	38.04	—	—	—

Key:

“—” = Depth was not included in profile

4

Benthic Community Analysis

As part of a 2016 offshore sediment sampling effort, Transco conducted a site-specific baseline benthic survey to assess the existing benthic community along the proposed pipeline route. Grab samples of surface sediments were collected at 69 sampling sites along the Raritan Bay Loop route and at 18 stations along the alternative route (for sample site locations see Figures A-1 and A-2). At each sample site, three discrete grab samples were taken: one centered on the proposed corridor and two located approximately 10 meters north (N) and south (S) of the central (C) sample location. A modified Day grab sampler was used to collect the samples from 1 square-foot (0.1 square-meter) sections of the seabed. Samples were transported to an onshore laboratory for specimen identification. Collected benthic infauna were identified to the lowest possible taxonomic category and benthic community parameters, including abundance, richness, dominant taxon, evenness of the distribution, and other community assemblage patterns were calculated.

4.1 Proposed Route

The survey identified 208 taxa that included annelids, crustaceans, round worms, ribbon worms, gastropods, bivalves, and shrimp. Table 4-1 below presents the top 25 taxa identified based on relative abundance. A complete list of identified taxa, along with numerical information on their occurrence is provided in Table B-14. Table B-15 presents a summary of sampling results from each sample site along the proposed route.

Table 4-1 Top 25 Taxa Identified for All Stations by Abundance for the Proposed Route

Rank	Taxon	Common Name	Frequency of Occurrence (N=207)	Total Number of Individuals	Relative Abundance (%)
1	<i>Mediomastus ambiseta</i>	polychaete	134	93041.8	56.83
2	<i>Streblospio benedicti</i>	polychaete	110	15020.7	9.18
3	<i>Oligochaeta</i>	oligochaete	177	8553.2	5.22
4	<i>Cirratulidae</i>	polychaete	64	3706.4	2.26
5	<i>Glycinde solitaria</i>	polychaete	84	3268.7	2.00
6	<i>Polygordius jouinae</i>	polychaete	99	2814.4	1.72
7	<i>Exogone dispar</i>	polychaete	61	2565.4	1.57
8	<i>Ameritella agilis</i>	mollusk	116	2199.7	1.34
9	<i>Ampelisca abdita</i>	amphipod	32	1942.1	1.19
10	<i>Sabellaria vulgaris</i>	polychaete	40	1798.7	1.10
11	<i>Tharyx acutus</i>	polychaete	60	1330.9	0.81

4 Benthic Community Analysis

Table 4-1 Top 25 Taxa Identified for All Stations by Abundance for the Proposed Route

Rank	Taxon	Common Name	Frequency of Occurrence (N=207)	Total Number of Individuals	Relative Abundance (%)
12	<i>Eumida sanguinea</i>	polychaete	56	1312.1	0.80
13	<i>Unciola serrata</i>	amphipod	47	1147.6	0.70
14	<i>Maldanidae</i>	polychaete	47	1128.3	0.69
15	<i>Protohaustorius cf. wigleyi</i>	amphipod	26	1126.7	0.69
16	<i>Parametopella cypris</i>	amphipod	10	1055.8	0.64
17	<i>Euclymene collaris</i>	polychaete	49	955.6	0.58
18	<i>Stenothoe minuta</i>	amphipod	6	900.8	0.55
19	<i>Caulleriella venefica</i>	polychaete	73	872.9	0.53
20	<i>Glycera americana</i>	polychaete	61	758.7	0.46
21	<i>Tritia trivittata</i>	gastropod	83	703.5	0.43
22	<i>Tubulanus pellucidus</i>	nemertean	49	654.2	0.40
23	<i>Heteromastus filiformis</i>	polychaete	36	551.0	0.34
24	<i>Crepidula fornicata</i>	gastropod	30	527.7	0.32
25	<i>Cyathura burbancki</i>	isopod	37	524.2	0.32

4.1.1 Sediment Grain Size

Sediment grain size was analyzed only for the central (C) grab sample. Sediment grain size generally is partitioned into two distinct groupings: fine-grained versus coarse-grained. The fine-grained fraction of a sediment is defined as silt (particles with diameters less than 62 microns down to 4 microns) plus clay (particles with diameters less than 4 microns, with colloidal clay being less than 0.1 microns) (Poppe et al. 2000). Coarse-grained sediments, not including shell fragments, were those having particle diameter greater than 62 microns. Although there is no specific guidance for labeling sediment types as fine or coarse grained, for this study, and based on information provided by the EPA (2015) for ocean disposal of dredged material, stations that had more than 10% fine-grained material in the composite analysis were considered ‘fine-grained’ habitat. Those having less than 10% fine-grained material were considered ‘sandy’ or coarse-grained habitat.

Generally, substrate structure transitioned from fine-grained sediment at western stations to sandy at eastern stations (Figure 4-1). This trend likely reflects depositional conditions to the west associated with Raritan Bay and Raritan River. Steimle et al. (1989) noted an irregular band of silt from the mouth of the Raritan River to Sandy Hook during their benthic survey. This study may have crossed similar habitat within the western portion of the route. In addition, a greater percentage of fine-grained sediments associated with the Chapel Hill South Channel were found between Stations VC37 through VC41-Alt. The presence of these sediments may reflect the depositional nature of the channel. This phenomenon is common, and concerns regarding the association of organic compounds within fine-grained, depositional channel sediments, was noted by Speight (2014).

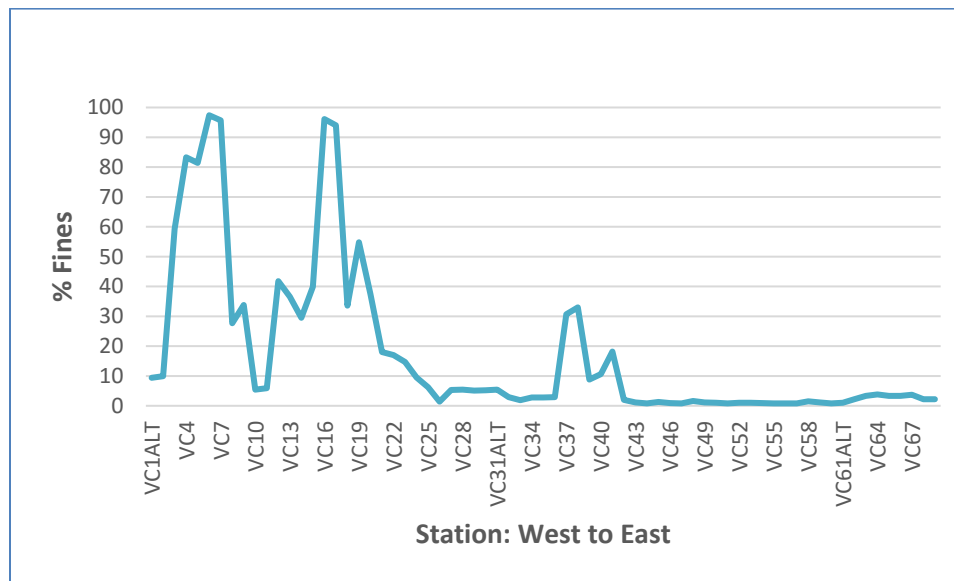


Figure 4-1 Fine-grained (>10%) Sediments at Stations Along the Proposed Route

4.1.2 Macrobenthic Invertebrate Densities

Macrobenthic invertebrate densities ranged from less than 20 to more than 4,000 organisms per 0.1 m² (mean = 791). Taxonomic richness ranged from 5 to 28 species (mean = 17.2). These relatively low richness values are typical for dynamic, stressed conditions in nearshore environments. Similar seasonal (fall-winter) richness values (~20 taxa per sample) were found by Reid et al. (1991) at inshore stations in their study of the New York Bight.

Two community parameters, Shannon-Weaver's diversity index and Pielou's evenness index, were calculated for measuring the consistency of taxa and numbers within each sample. Shannon-Weaver's (H') diversity index increases as the richness, or number of taxa, of the community increases. Pielou's (J') evenness index measures the relative abundance compared with all taxa that are found within a sample. Pielou's index can range from 0 to 1, with 1 being a community that exhibits a uniform distribution of species. The H' indices ranged from 0.411 to 2.85, and J' ranged from 0.0507 to 0.7982.

Generally, higher abundance was noted at stations that had higher percentages of fine-grained sediments. Correlation analysis (Pearson) revealed that although there was a positive (coefficient = 0.3594) relationship between abundance and percent fine-grained material, the relationship was not strong. A linear regression of abundance (base-10) for comparison with percent fine-grained sediment also did not reveal a statistically significant relationship, although a positive slope was observed (Figure 4-2).

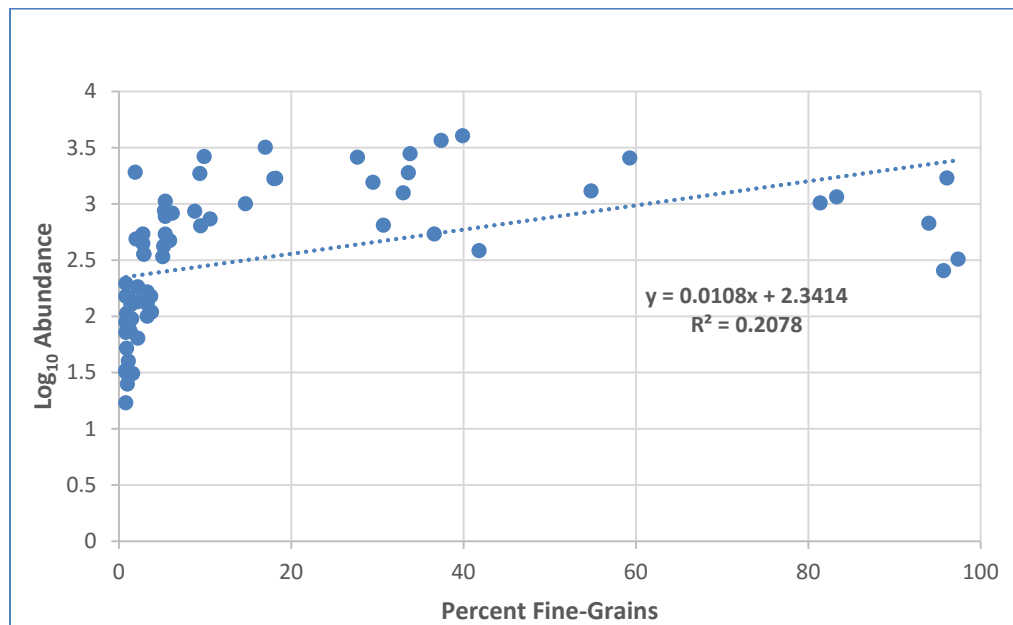


Figure 4-2 Linear Regression of Abundance (log-10) to Percent Fine-grained Sediment

Highest abundance was noted at stations to the west; for the top 20 stations with highest taxa abundance, all but one was west of the Chapel Hill South Channel. Fifteen of the top 20 stations in taxa abundance had fine-grained sediments that averaged 45 percent. Generally, at stations having either high or low percentages of fine-grained sediment, abundance was somewhat reduced, suggesting that mixed sediment types tend to support larger populations. This could likely be related to a more diverse habitat (i.e., variable grain size), greater organic carbon, higher productivity, and/or greater food resources. Higher abundance values were typically associated with an abundance of polychaete taxa and individuals.

It was also noted, generally, that stations having lower percentages of fine-grained sediment, especially those to the east, also had highest evenness values, but Pearson correlation analysis (coefficient = -0.5047) did not reveal a positive relationship between the two variables. Similarly, richness could not be predicted based on sediment type (coefficient = -0.1179). Generally, greater diversity was found at stations to the east and at stations associated with sandy habitat. Amphipods (*Ampelisca* spp., *Unciola* spp., *Protohaustorius wigleyi*, and *Stenothoe minuta*) were almost exclusively found at sandy stations. At these stations, the average number of gammarid amphipods per sample tended to be much greater than what Reid et al. (1991) reported (10 per 0.1 m²) for fall sampling at inshore New York and New Jersey locations. Greater diversity is likely a result of a more stable environment, compared with depositional, fine-grained sediment habitat that is typically in constant flux and associated with opportunistic, tolerant, early successional (Stage 1) species, such as polychaete genera *Mediomastus*, *Streblospio* and *Exogone* noted by McCall (1977).

4.1.3 Community Analysis

A Bray-Curtis multivariate (resemblance) cluster analysis revealed that there were three major community groups identified across the route (Figure 4-3). Resemblance measures such as cluster analysis have been shown to be one of the most consistent methods for analyzing benthic information (Jackson 1993). The major division was between stations at the western end of the pipeline (VC1-ALT – VC42) and those on the eastern section (VC43 – VC69). The most uniform of these three groups included stations VC2 to VC27. This group had similarities typically in the 60% to 70% range. A second group, related to the first, consisted of stations VC28 to VC40. There were three outliers in this section of the dendrogram. A single station, VC26, was the most distinctive, showing minimal similarity with any other site (<25%). Inspection of the faunal data revealed that the distinction was due to the high numbers of the polychaetes *Polycirrus* spp. and *Exogone dispar*, and the gastropod *Tritia trivittata*. In spite of the fact that sediments were similar to stations either side of VC26, there were very low numbers of the typical dominants for that section of the pipeline, i.e., *Mediomastus ambiseta*, *Streblospio benedicti*, and oligochaetes. The other outliers in this subset, Stations VC33-ALT and VC42, had unusually large numbers of two amphipod species in the samples, *Parametopella cypris* and *Stenothoe minuta*. The final cluster, Stations VC43 and above had lower overall similarity to each other and with several subsets. Within this group Stations VC63 – VC69, dominated by haustoriid amphipods, had the greatest overall similarity.

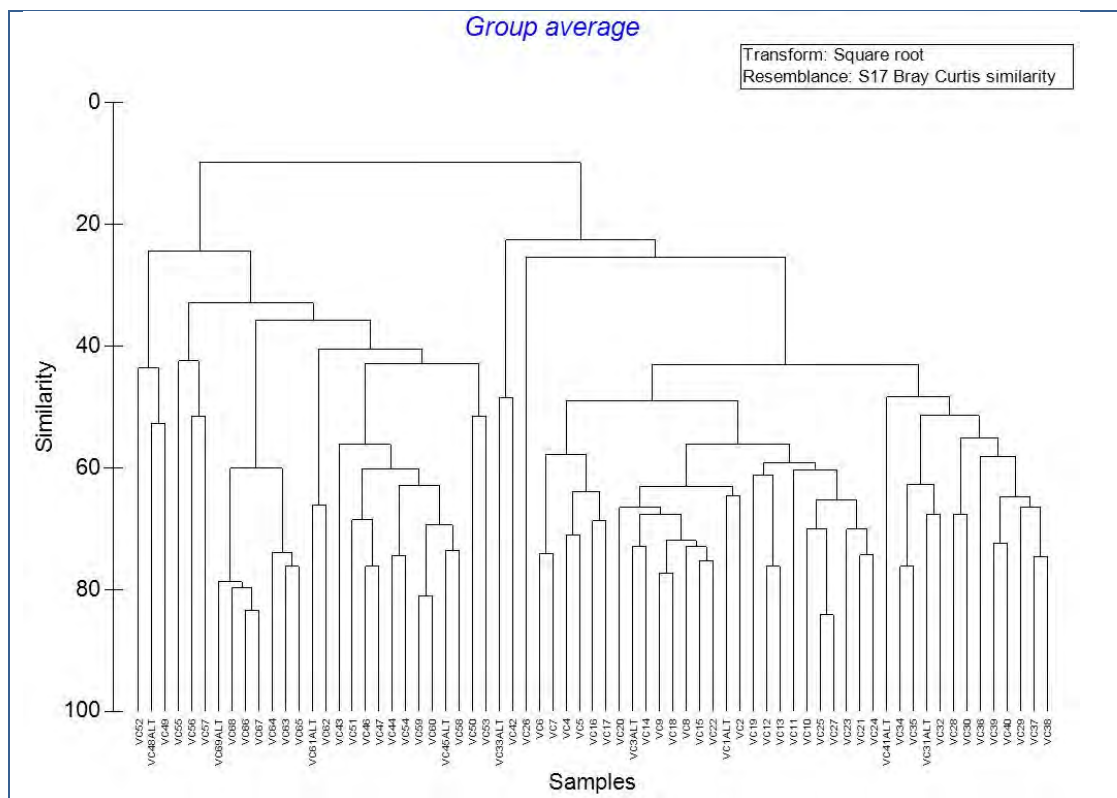


Figure 4-3 Multivariate Cluster Analysis of Pipeline Proposed Route Stations

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Faunal data were also subjected to non-metric multidimensional scaling (MDS), an ordination procedure where stations are placed along a set of axes reflecting their similarity. The results (Figure 4-4) show a close grouping of lower numbered stations up to VC42 with some separation of the lowest numbers higher on the y axis. At the left end of the x-axis, and showing lower overall similarity, are the stations in the 50s and 60s. MDS supports the grouping of stations observed by cluster analysis which shows a distinction between low numbered stations found at the western end of the route and those with higher numbers found to the east. Again, the separation of groups is indicative of varying sediment types found along the proposed pipeline route.

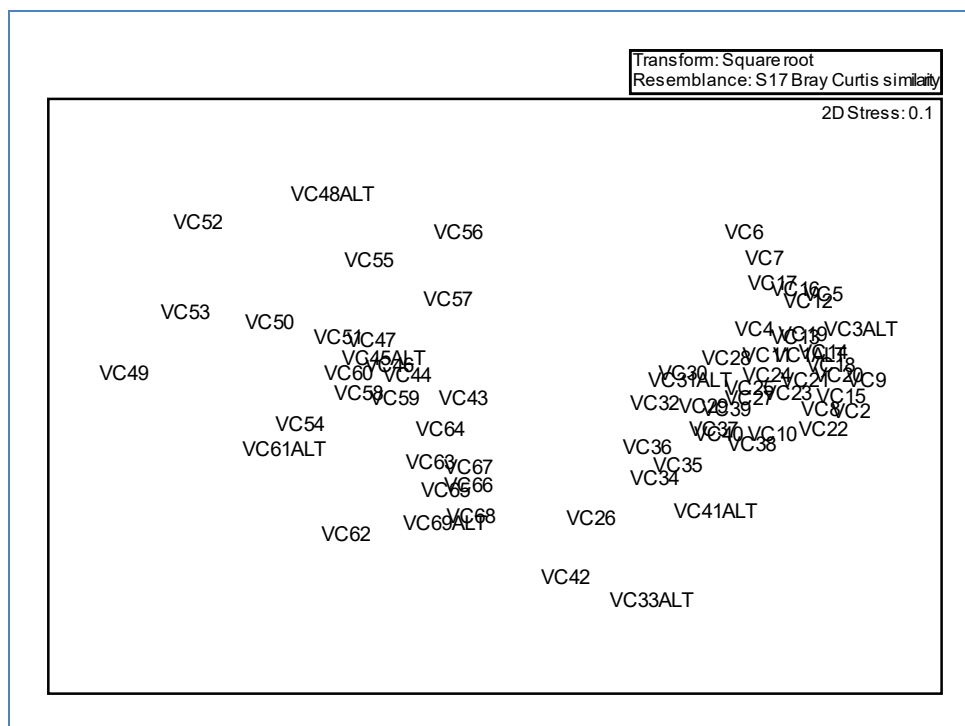


Figure 4-4 MDS for Station Similarity of Benthic Assemblage Along Proposed Route

4.1.4 Occurrence of Hard Clams

As a subset of the 2016 benthic macroinvertebrate survey, Transco performed a stand-alone analysis of hard clam (*Mercenaria mercenaria*) occurrence within a select portion (between MPs 14.40 and 21.60) of the proposed route. Stations selected for analysis were located in NYSDEC Uncertified Shellfish Areas and included those stations that were located within the NYSDEC special permit harvest area associated with a hard clam transplantation program. Data were obtained at designated (north [N], south [S] and center [C]) locations for stations VC7-VC28. For the analyses, the number of hard clam individuals found at all three locations (N, S and C), per station, were combined.

Hard clams were categorized based on size (hard clams are measured from end to end along a straight line that runs parallel to the hinge). Partitioned length groups

4 Benthic Community Analysis

included those individuals less than 25 millimeters (mm) (<25 mm) and greater than 25 mm (>25 mm). Of the 213 clams found along the section of the proposed route, 158 (74%) were <25 mm, and 55 (26%) were >25 mm (Table 4-2). Table 4-3 presents the descriptive statistics for the sample pool.

Table 4-2 Hard Clam Counts - Proposed Route Stations

Station	<25 mm	>25 mm	Total
VC7	0	0	0
VC8	32	0	32
VC9	0	0	0
VC10	21.3	3	24.3
VC11	7.1	1	8.1
VC12	0	8	8
VC13	10.9	9	19.9
VC14	0	2	2
VC15	16	3	19
VC16	0	0	0
VC17	0	0	0
VC18	0	8	8
VC19	0	7	7
VC20	0	3	3
VC21	0	3	3
VC22	64	2	66
VC23	6.4	0	6.4
VC24	0	1	1
VC25	0	1	1
VC26	0	1	1
VC27	0	1	1
VC28	0	2	2
Total	157.7	55	212.7
Percent of Total	74%	26%	

Table 4-3 Hard Clam Descriptive Statistics for Proposed Route Stations

Total	N	Mean	Std Dev.	Size Ratio ¹
212.7	22	9.7	15.4	2.8:1

Note:

¹ Ratio of individuals <25 mm to >25 mm

4.2 Alternative Route

As with the proposed route, sample data from the alternative route determined abundance, richness, dominant taxon, evenness of the distribution, and other community assemblage patterns from 18 stations (Table B-16). For each sample site, three discrete grab samples were taken: one centered on the proposed corridor, and two located approximately 10 meters north (N) and south (S) of the central (C) sample location. Abundance ranged from almost 5,000 individuals at VC72 to less than 100 at VC78. The survey identified 111 taxa that included pol-

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ychaetes, annelids, crustaceans, gastropods, and bivalves. The top 5 taxa made up more than 78% of the individuals identified (Table 4-4). A complete list of identified taxa, along with numerical information on their occurrence is provided in Table B-17.

Table 4-4 Top 25 Taxa Identified for all Stations by Abundance for the Alternative Route

Rank	Taxonomic Name	Common Name	Frequency of Occurrence (N=54)	Total Number of Individuals	Relative Abundance (%)
1	<i>Mediomastus ambiseta</i>	polychaete	54	28598.7	51.95
2	<i>Streblospio benedicti</i>	polychaete	35	5884.9	10.69
3	<i>Ampelisca abdita</i>	amphipod	21	3467.5	6.30
4	<i>Oligochaeta</i>	oligochaete	39	3373.9	6.13
5	<i>Exogone dispar</i>	polychaete	46	1835.1	3.33
6	<i>Glycinde solitaria</i>	polychaete	38	1367.4	2.48
7	<i>Opisthodonta longocirrata</i>	polychaete	13	759.7	1.38
8	<i>Ameritella agilis</i>	mollusk	28	685	1.24
9	<i>Euclymene collaris</i>	polychaete	24	679.7	1.23
10	<i>Caulleriella venefica</i>	polychaete	13	596.1	1.08
11	<i>Brania wellfleetensis</i>	polychaete	10	517.3	0.94
12	<i>Mercenaria mercenaria</i>	mollusk	34	487.9	0.89
13	<i>Eumida sanguinea</i>	polychaete	20	445.5	0.81
14	<i>Mulinia lateralis</i>	mollusk	14	431.6	0.78
15	<i>Cirratulidae</i>	polychaete	8	387.6	0.70
16	<i>Polydora cornuta</i>	polychaete	12	310.9	0.56
17	<i>Polycirrus</i> sp.	polychaete	13	297.2	0.54
18	<i>Tritia trivittata</i>	Gastropod	26	281.7	0.51
19	<i>Sabellaria vulgaris</i>	polychaete	9	245.5	0.45
20	<i>Hypereteone</i> sp.	polychaete	12	239.7	0.44
21	<i>Maldanidae</i>	polychaete	13	214.3	0.39
22	<i>Cyathura burbancki</i>	isopod	11	205.7	0.37
23	<i>Oxydromus obscurus</i>	polychaete	11	200.9	0.37
24	<i>Glycera americana</i>	polychaete	25	192.2	0.35
25	<i>Myrianida prolifera</i>	polychaete	7	182	0.33

4.2.1 Sediment Grain Size and Macrobenthic Invertebrate Densities

There was no clear spatial trend for substrate structure along the alternative route (Figure 4-5). Most stations (12) contained fine-grained sediment, but stations in the most easterly segment (VC82 – VC86) exhibited coarse or sandy substrates. These coarse sediments at the easterly end were somewhat different from those of the preferred route with a median grain size of approximately 0.4 mm. Stations at the eastern end of the preferred route, although having similar percentages of fines (2% – 3%) had median grain sizes of approximately 0.15 mm. As a result, the fauna were different, with haustoriid amphipods dominant at the proposed route, and virtually absent at the alternate route. Among the dominants in this area were several species that were absent or at low densities for the other segments of the alternative route, including the polychaetes *Opisthodonta longocirrata*, *Brania wellfleetensis*, *Polycirrus* sp., and *Polygordius jouinae*.

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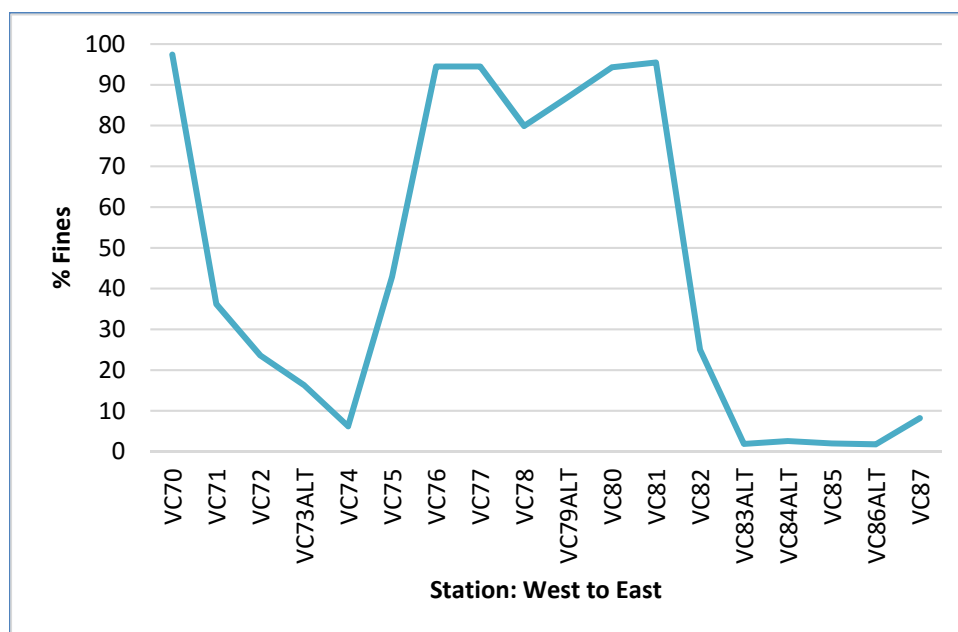


Figure 4-5 Fine-grained (>10%) Sediments at Stations Along the Alternative Route

Multivariate analysis (Figure 4-6) revealed three major clusters that represent three sediment groups. Fine sediments at the western end (VC71 – VC74), coarse sediments at the eastern end (VC83 – VC86), and the remaining group an assortment of intermediate sediments.

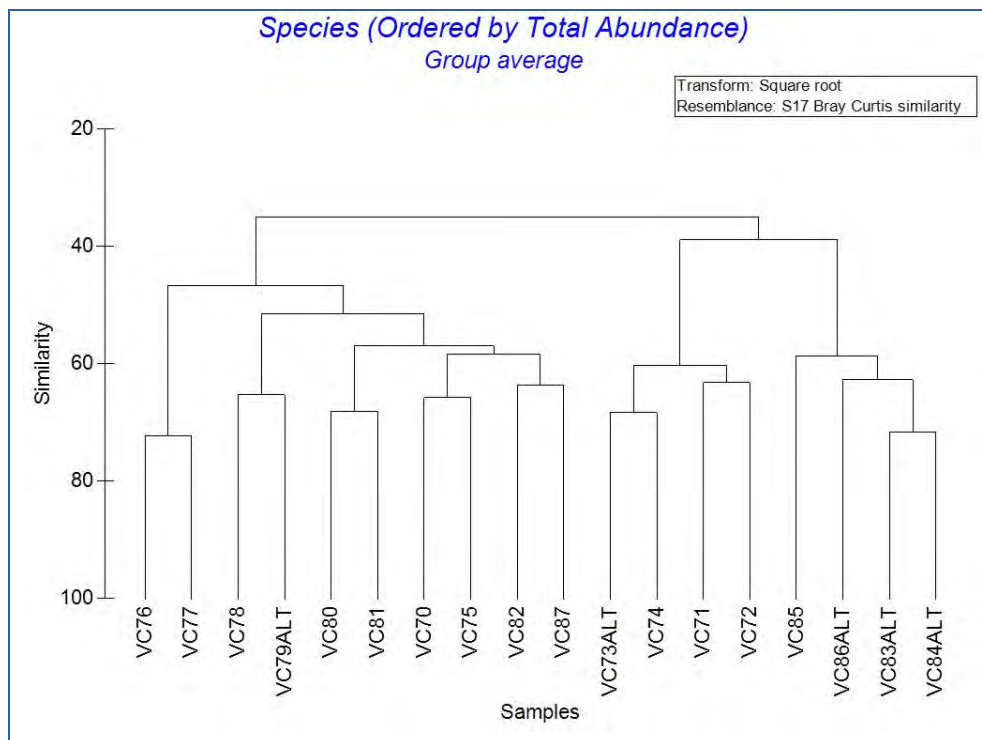


Figure 4-6 Multivariate Cluster Analysis of Pipeline Alternative Route Stations

4 Benthic Community Analysis

Non-metric multidimensional scaling produced a similar arrangement of groups with the eastern stations (VC83 – VC86) separated from the remaining sites along the y-axis and the fine sediment stations (VC71 – VC74) removed from the mixed sediment sites along the x-axis (Figure 4-7).

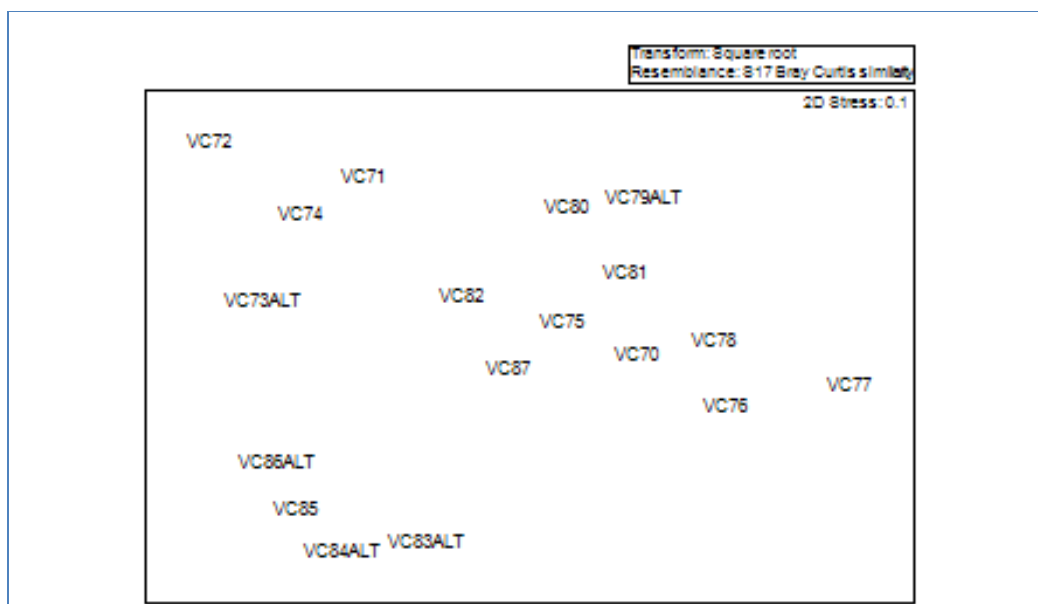


Figure 4-7 MDS for Station Similarity of Benthic Assemblage Along the Alternative Route

Overall, there was a significant overlap in the fauna between the proposed and alternative pipeline routes. This was particularly true at the western end where the polychaetes *Mediomastus ambiseta*, *Streblospio benedicti* and oligochaetes were numerically dominant in both data sets. In the mixed sediments of the middle sections most species found along the alternative route were also found along the proposed route. The major difference between the two routes was at the eastern end where a slight difference in the sediment composition resulted in a significant difference in the benthic fauna. Haustoriid amphipods such as *Protohaustorius wigleyi* and *Acanthohaustorius similis* were replaced as dominants by several polychaete species.

4.2.2 Occurrence of Hard Clams

A similar assessment of hard clam densities was performed for the alternative route under consideration. Stations selected for analysis were located in NYSDEC Uncertified Shellfish Areas and included those stations that were located within the NYSDEC special permit harvest area associated with a hard clam transplantation program. Data were obtained at designated (north [N], south [S] and center [C]) locations for stations VC70-VC87. As noted for the proposed

4 Benthic Community Analysis

route above, the number of hard clam individuals found at all three locations (N, S, and C), per station, were combined.

Hard clams were categorized based on size (hard clams are measured from end to end along a straight line that runs parallel to the hinge). Partitioned length groups included those individuals less than 25 mm (<25 mm) and greater than 25 mm (>25 mm). Of the 488 clams found along the selected route, 423 (86%) were <25 mm, and 65 (14%) were >25 mm (Table 4-5). Table 4-6 presents the descriptive statistics for the sample pool.

Table 4-5 Hard Clam Counts - Alternative Route Stations

Station	<25 mm	>25 mm	Total
VC70	0	0	0
VC71	25.6	3	28.6
VC72	128	1	129
VC73-Alt	114.7	3	117.7
VC74	81.6	1	82.6
VC75	0	8	8
VC76	8	6	14
VC77	31.5	11	42.5
VC78	6.4	4	10.4
VC79-Alt	0	4	4
VC80	0	0	0
VC81	0	1	1
VC82	16	13	29
VC83-Alt	0	0	0
VC84-Alt	0	1	1
VC85	3.6	1	4.6
VC86-Alt	0	2	2
VC87	7.6	6	13.6
Total	423	65	488
Percent of Total	86%	14%	

Table 4-6 Hard Clam Descriptive Statistics for Alternative Route Stations

Total	N	Mean	Std Dev.	Size Ratio ¹
488	18	27.1	40.7	6.5:1

Note:

¹ Ratio of individuals <25 mm to >25 mm

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5

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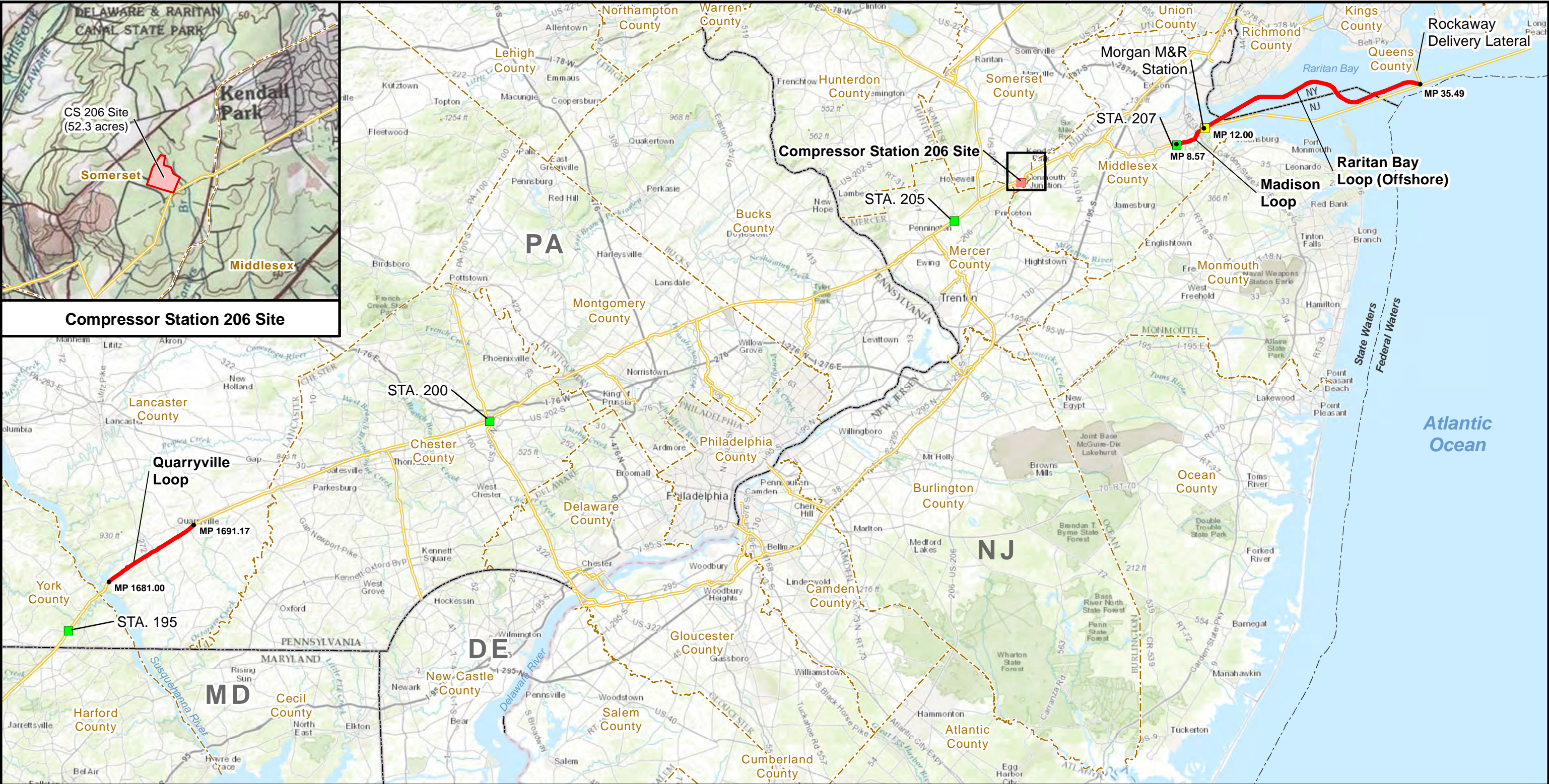
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A

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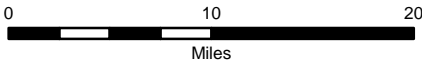
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Compressor Station 206 Site

Legend

- Milepost
- Existing Compressor Station
- Existing Meter & Regulating Station
- Compressor Station 206
- Proposed Pipeline
- Existing Transco Pipeline
- State Boundary
- County Boundary
- State/Federal Offshore Line



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C	11/14/2016	AL	ISSUED FOR FERC DRAFT FILING
D	3/20/2017	AL	ISSUED FOR FERC FILING
E	5/31/2017	RS	ISSUED FOR FERC SUPPLEMENTAL FILING
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1000891	JM	SM	
1000891	MK	SM	
1000891	MK		

TRANSCONTINENTAL GAS PIPE LINE COMPANY LLC
PROJECT LOCATION MAP
NORTHEAST SUPPLY ENHANCEMENT PROJECT
PENNSYLVANIA, NEW JERSEY, NEW YORK



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FIGURE A-1



Legend

Proposed Raritan Bay Loop (Offshore)

Raritan Bay Loop

Madison Loop

State Boundary

State/Federal Offshore Line

Lower NY Bay Lateral

Rockaway Delivery Lateral

Maintained Navigation Channel

0

2.5

5

Miles

SITE LOCATION

Quarryville Loop

CS 200

Madison Loop

CS 206

Raritan Bay Loop

DRAWING NO.

REFERENCE TITLE

A-2

TRANSCONTINENTAL GAS PIPE LINE COMPANY LLC

PROPOSED NORTHEAST SUPPLY ENHANCEMENT PROJECT

OFFSHORE LOCATION

NEW JERSEY AND NEW YORK

Williams

NO.

DATE

BY

REVISION DESCRIPTION

W.O. NO.

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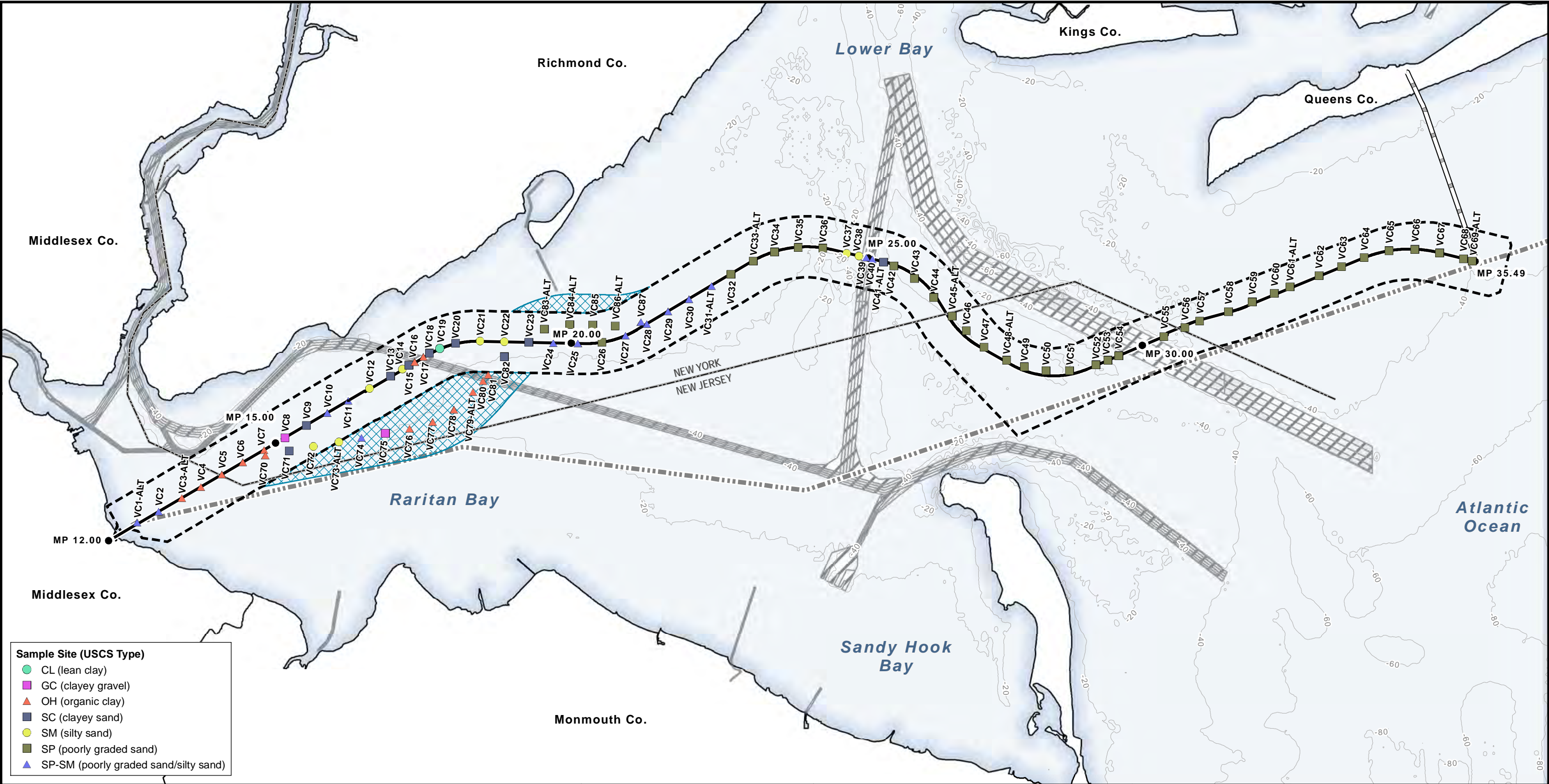
FIGURE A-2

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OF 1

Data Sources: E&E 2017; ESRI 2012; ESRI Base Map Services 2017; NYS Office of Information Technology Services GPO 2016; New Jersey Office of GIS 2016; U.S. Census Bureau 2016; BOEM 2010; Williams 2017.

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Sample Site (USCS Type)

- CL (lean clay)
- GC (clayey gravel)
- OH (organic clay)
- SC (clayey sand)
- SM (silty sand)
- SP (poorly graded sand)
- SP-SM (poorly graded sand/silty sand)

Legend

- Milepost
- Proposed Raritan Bay Loop
- Raritan Bay Loop Limits of Disturbance (LOD)
- NY/NJ Boundary
- Lower NY Bay Lateral
- Rockaway Delivery Lateral
- Maintained Navigation Channel
- Study Area Extension

0 1 2
Miles

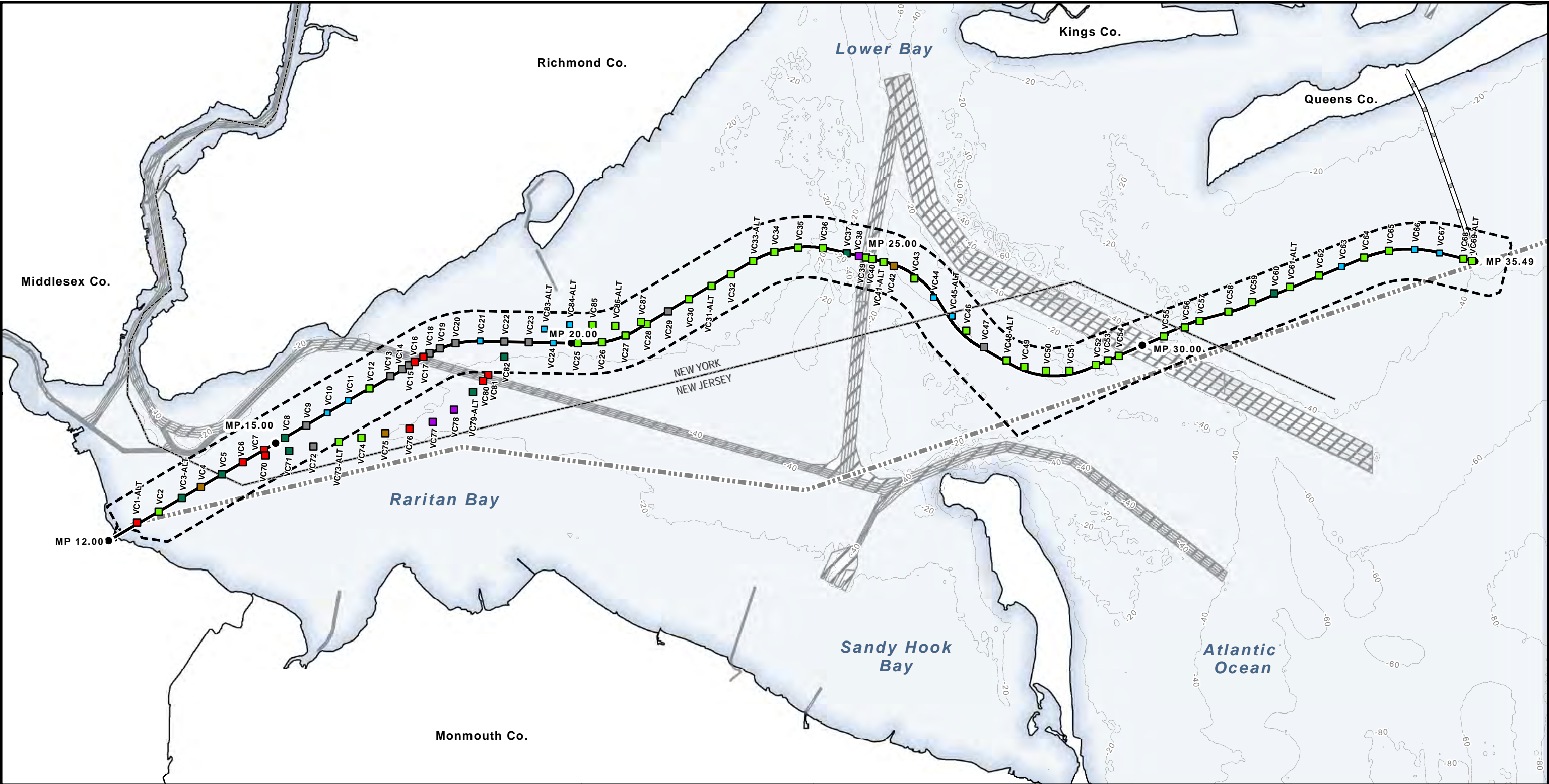


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TRANSCONTINENTAL GAS PIPE LINE COMPANY LLC
OFFSHORE SAMPLE SITE MAP
NORTHEAST SUPPLY ENHANCEMENT PROJECT
NEW JERSEY, NEW YORK

Williams

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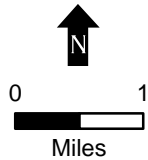
Metals Exceedances*

- 0
- 1-2
- 3-4
- 5-6
- 7-8
- 11-12
- 13-15

- Milepost
- Proposed Raritan Bay Loop
- Construction Workspace
- NY/NJ Boundary
- Lower NY Bay Lateral

- Rockaway Delivery Lateral
- Maintained Navigation Channel

*Number of analyte exceedances for lowest threshold of either the NJDEP Ecological Screening Criteria or NYSDEC Sediment Guidance Values.



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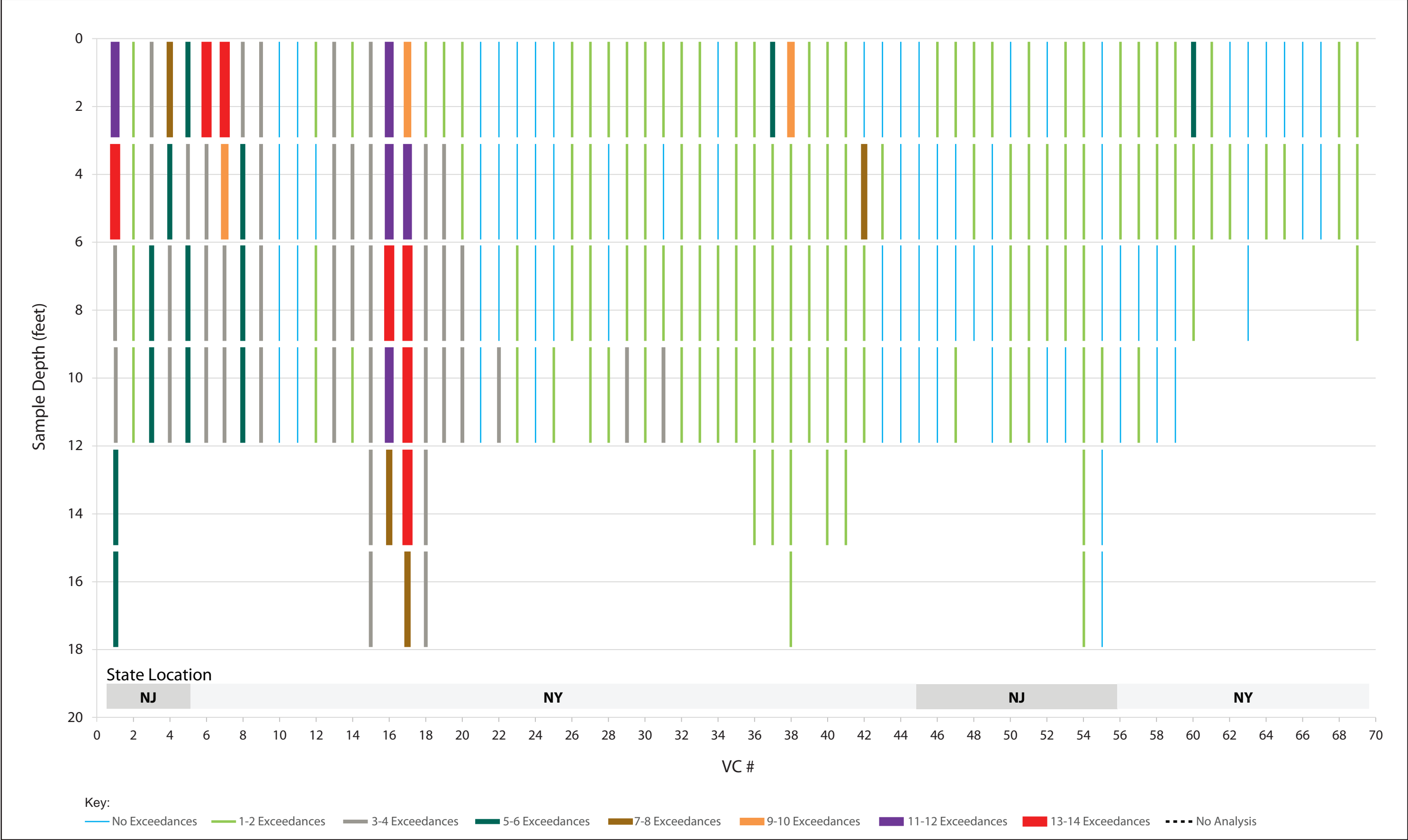
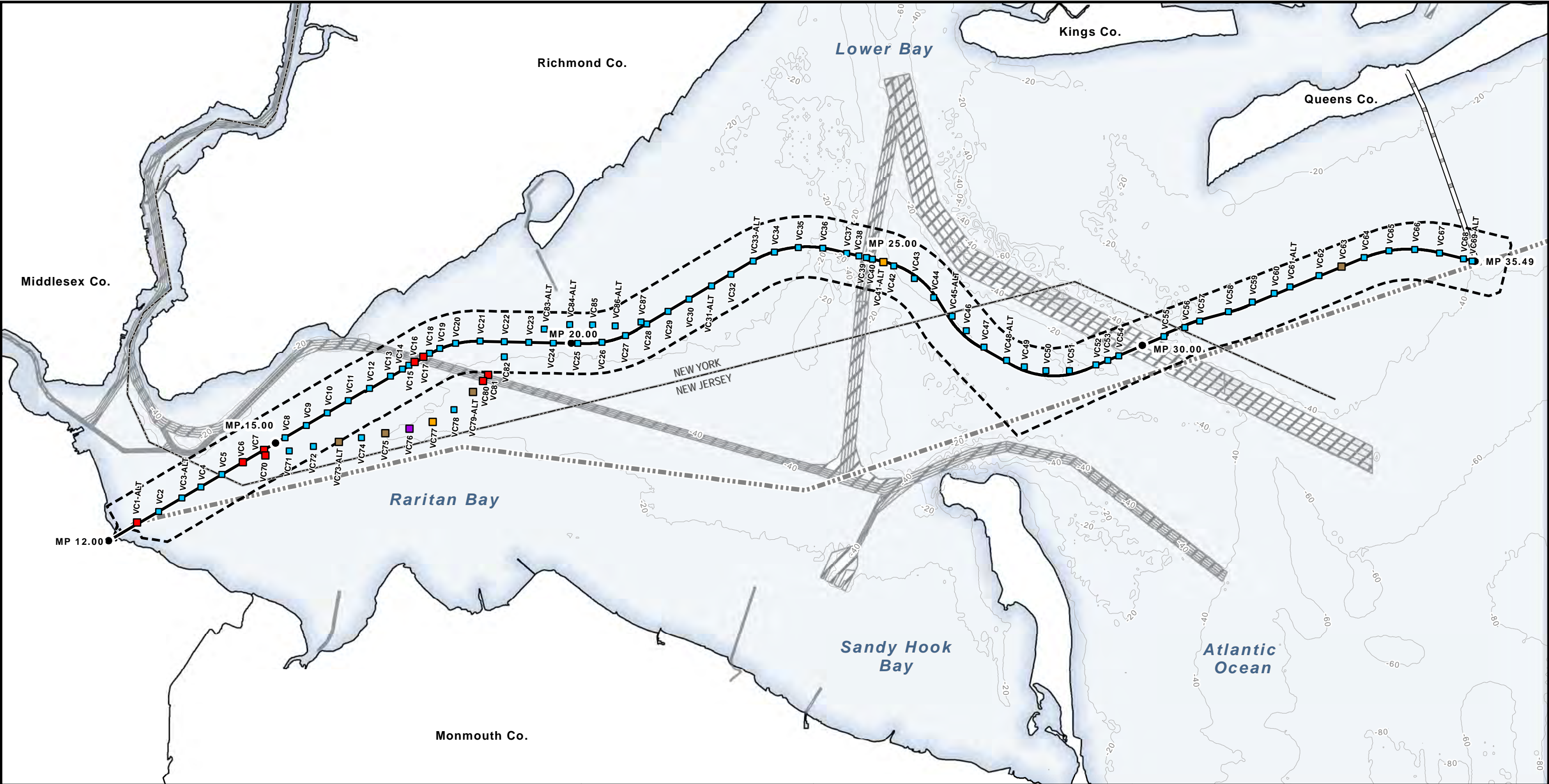


Figure A-5: Metal Exceedances at Depth Along the Preferred Route

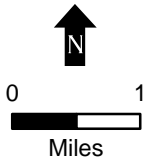


Legend

Pesticide Exceedances*

- 0
 - 1
 - 2
 - 3
 - 4
- Milepost
 - Proposed Raritan Bay Loop
 - Construction Workspace
 - NY/NJ Boundary
 - Lower NY Bay Lateral
 - Rockaway Delivery Lateral
 - Maintained Navigation Channel

*Number of analyte exceedances for lowest threshold of either the NJDEP Ecological Screening Criteria or NYSDEC Sediment Guidance Values.



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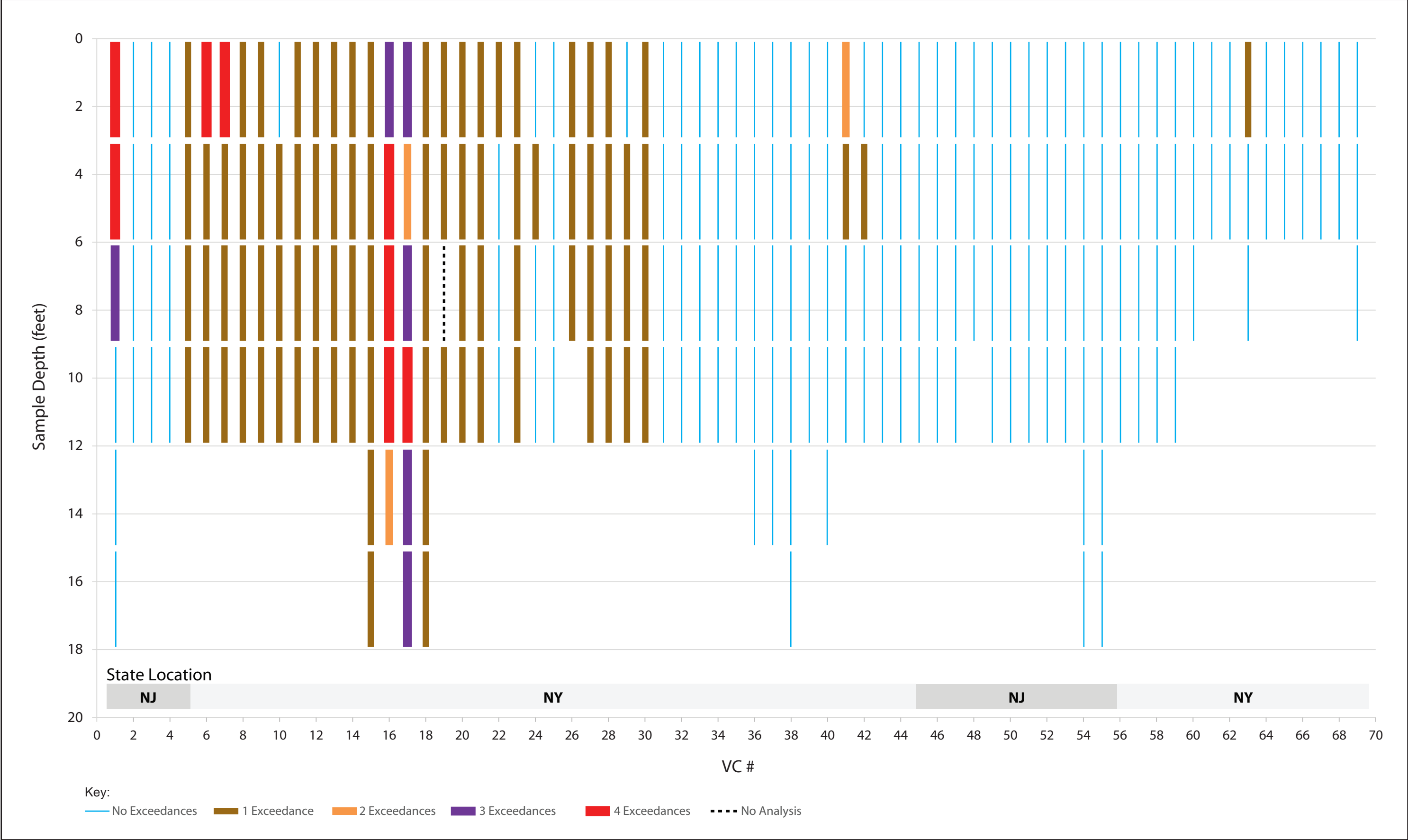
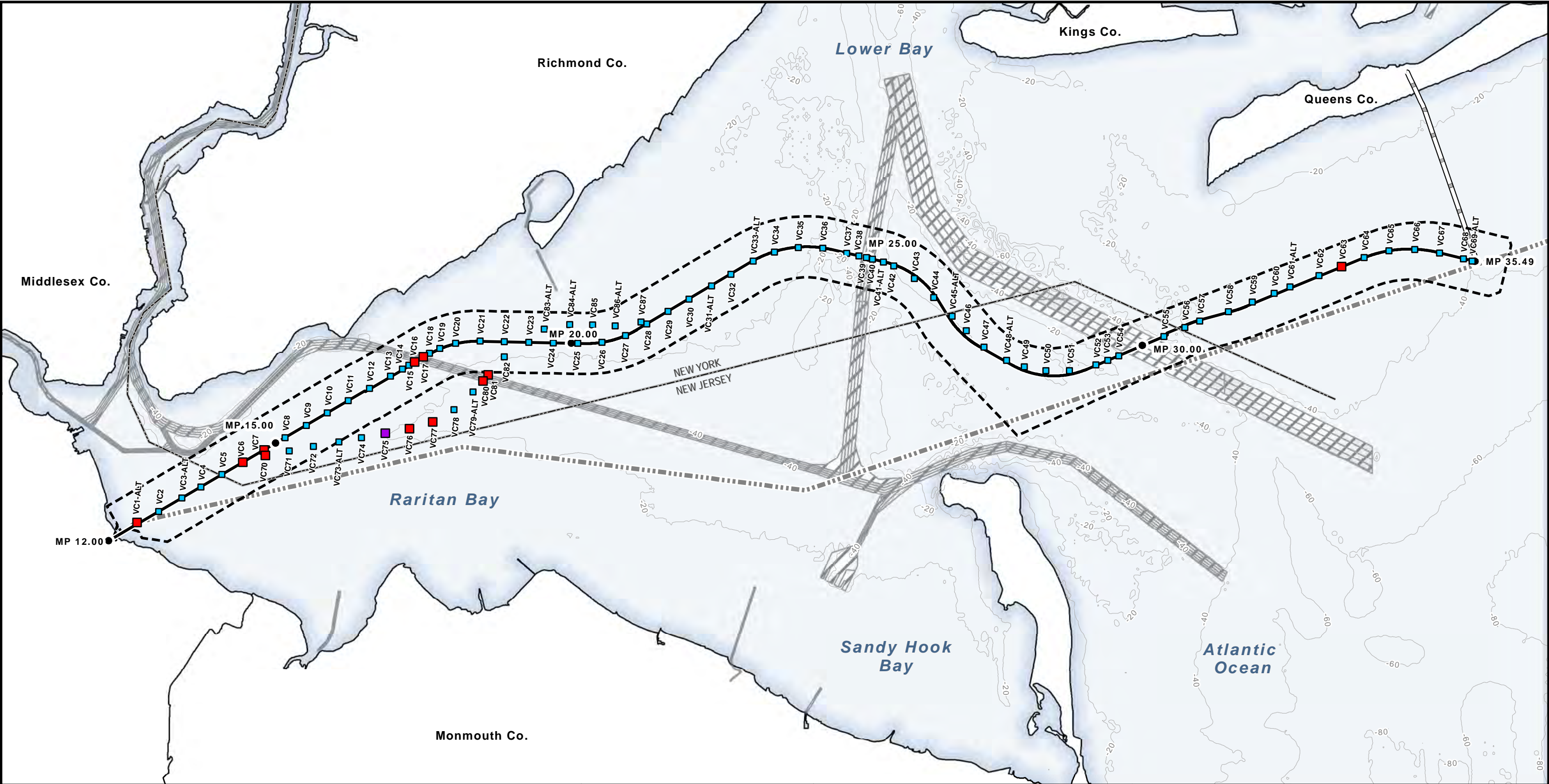


Figure A-7: Pesticide Exceedances at Depth Along the Preferred Route



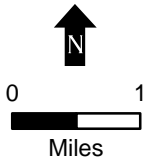
Legend

PCB Aroclor Exceedances*

- 0
- 1
- 2 - 3

- Milepost
- Proposed Raritan Bay Loop
- Construction Workspace
- NY/NJ Boundary
- Lower NY Bay Lateral
- Rockaway Delivery Lateral
- Maintained Navigation Channel

*Number of analyte exceedances for lowest threshold of either the NJDEP Ecological Screening Criteria or NYSDEC Sediment Guidance Values.



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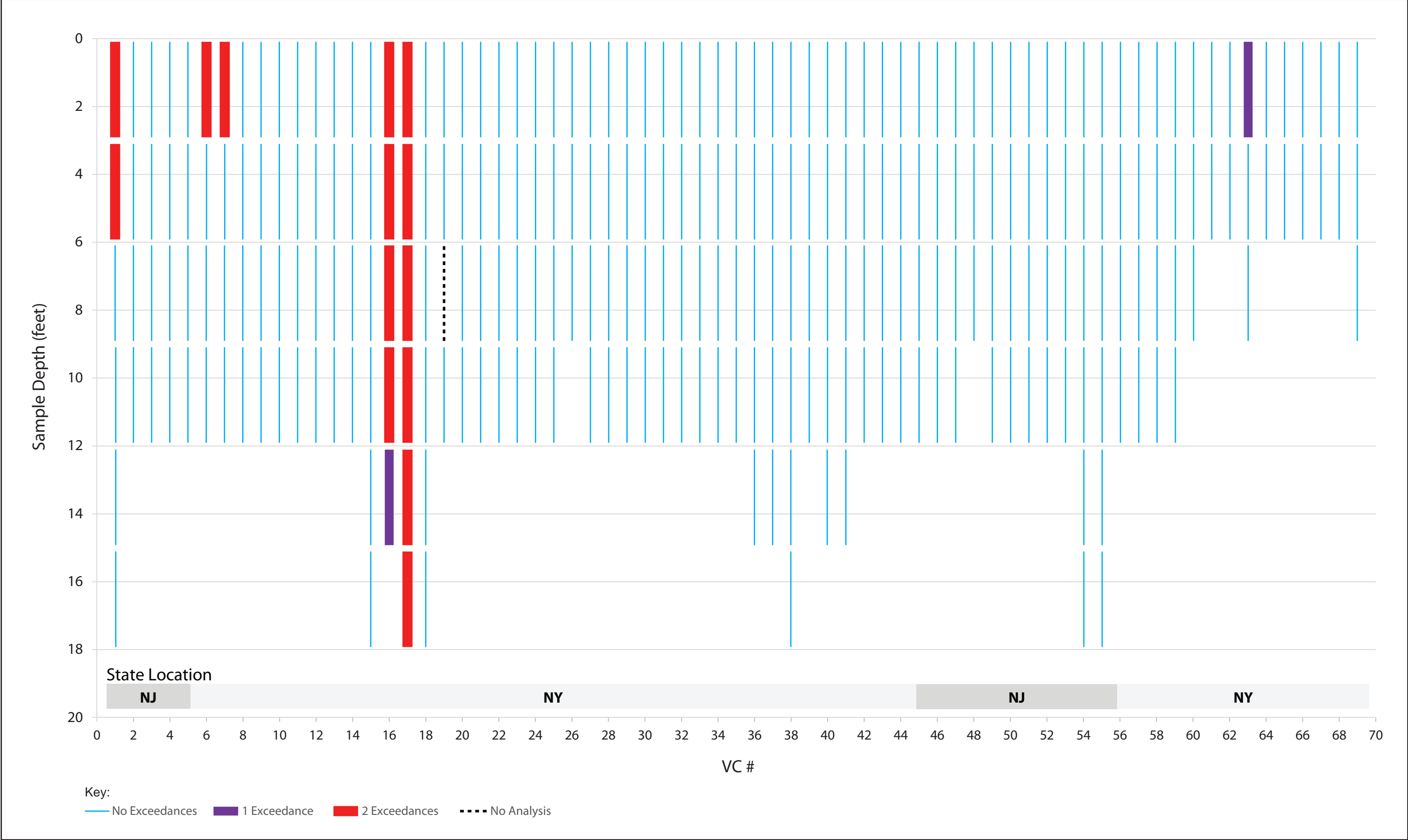
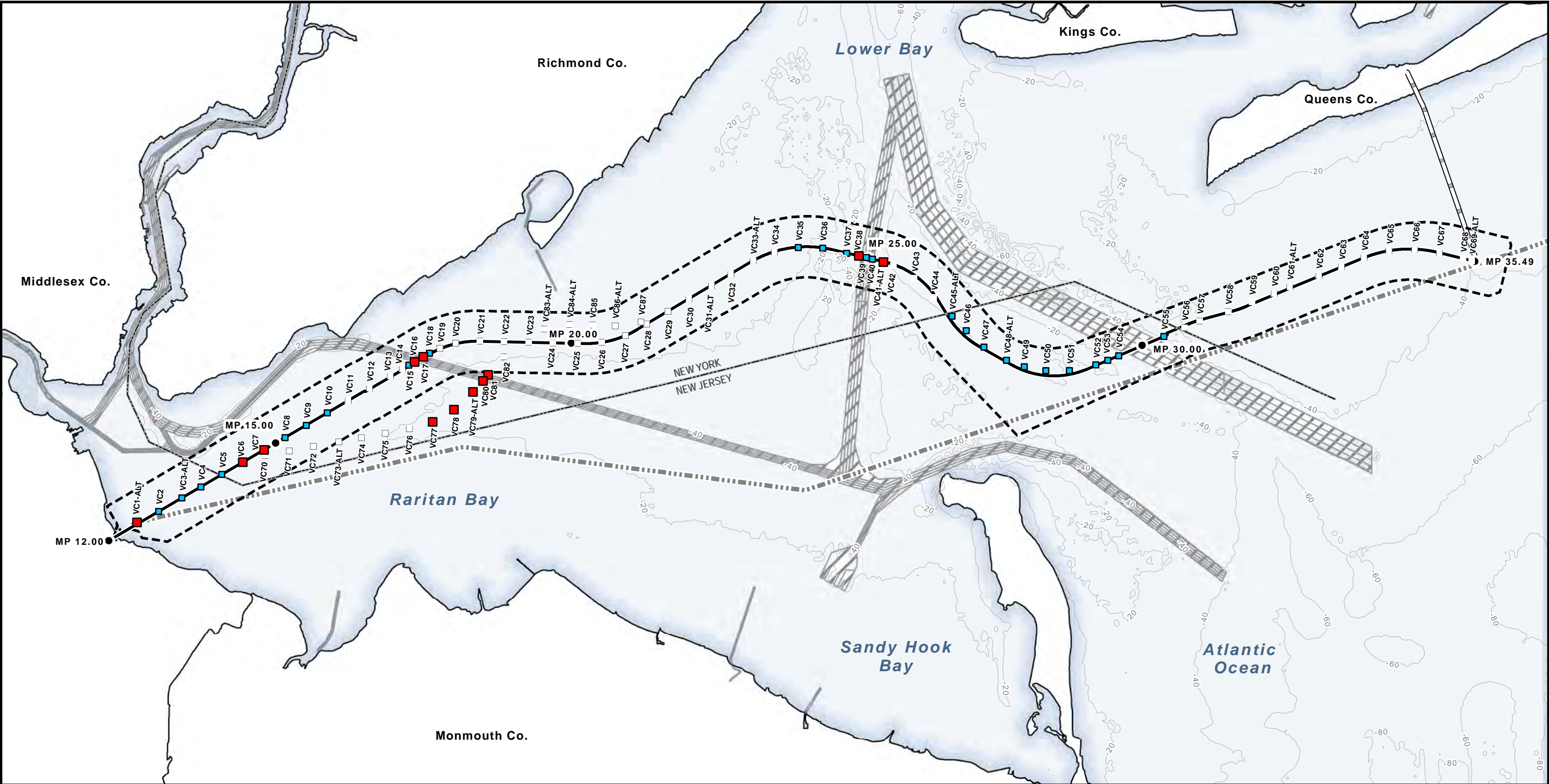


Figure A-9: PCB Aroclor Exceedances at Depth Along the Preferred Route



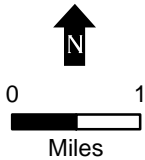
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PCB Congener Exceedances*

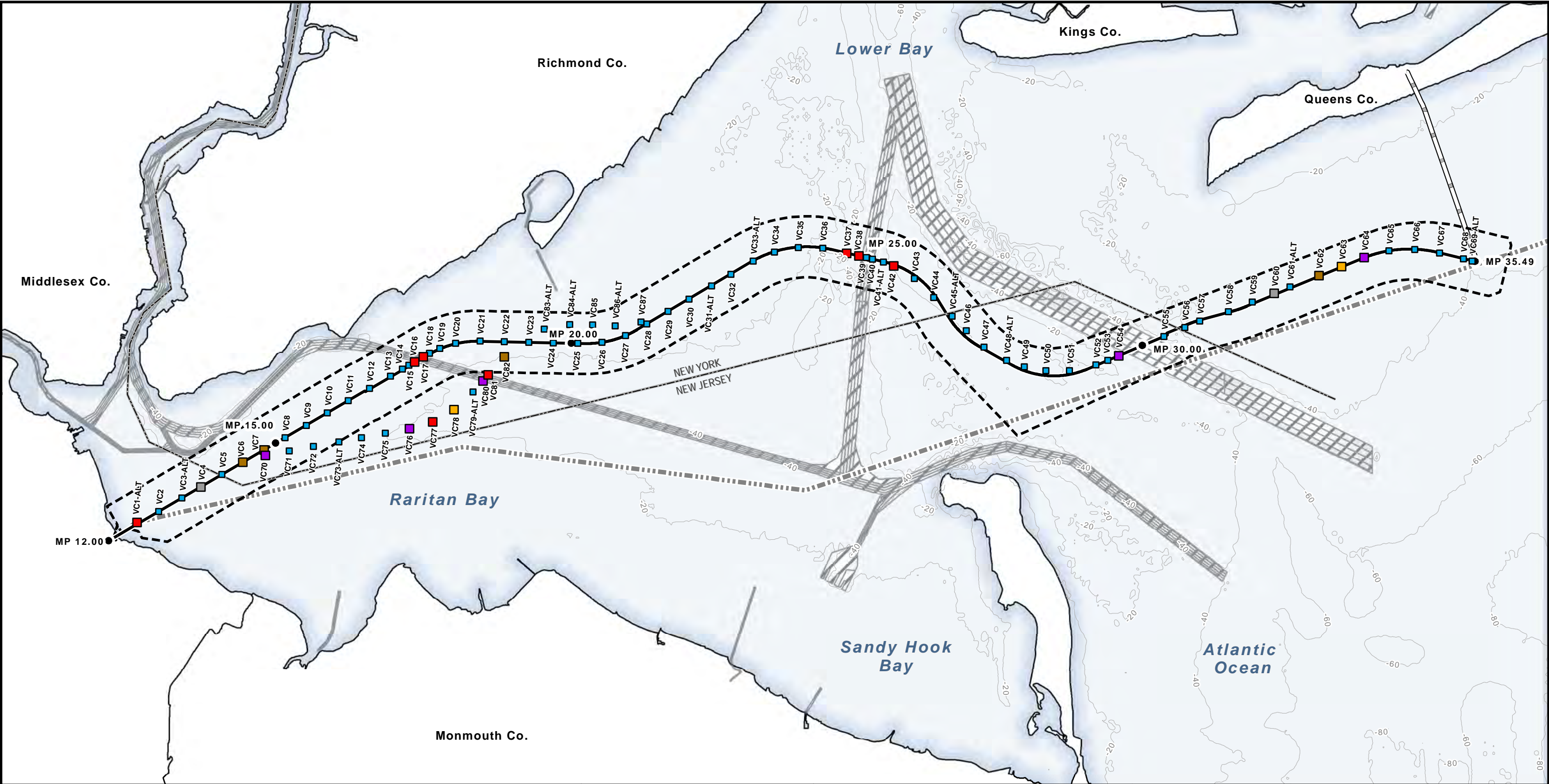
- 0
- 1
- No Analysis

- Milepost
- Proposed Raritan Bay Loop
- Construction Workspace
- NY/NJ Boundary
- Lower NY Bay Lateral
- Rockaway Delivery Lateral
- Maintained Navigation Channel

*Number of analyte exceedances for lowest threshold of either the NJDEP Ecological Screening Criteria or NYSDEC Sediment Guidance Values.



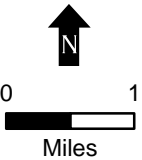
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Legend

- PAH Exceedances***
- 0
 - 1 - 3
 - 4 - 6
 - 7 - 9
 - 10 - 12
 - 13 - 15
 - 16 - 18
- Milepost
- Proposed Raritan Bay Loop
- - - Construction Workspace
- . - . - NY/NJ Boundary
- ▬ Rockaway Delivery Lateral
- ▨ Maintained Navigation Channel
- Lower NY Bay Lateral

*Number of analyte exceedances for lowest threshold of either the NJDEP Ecological Screening Criteria or NYSDEC Sediment Guidance Values.



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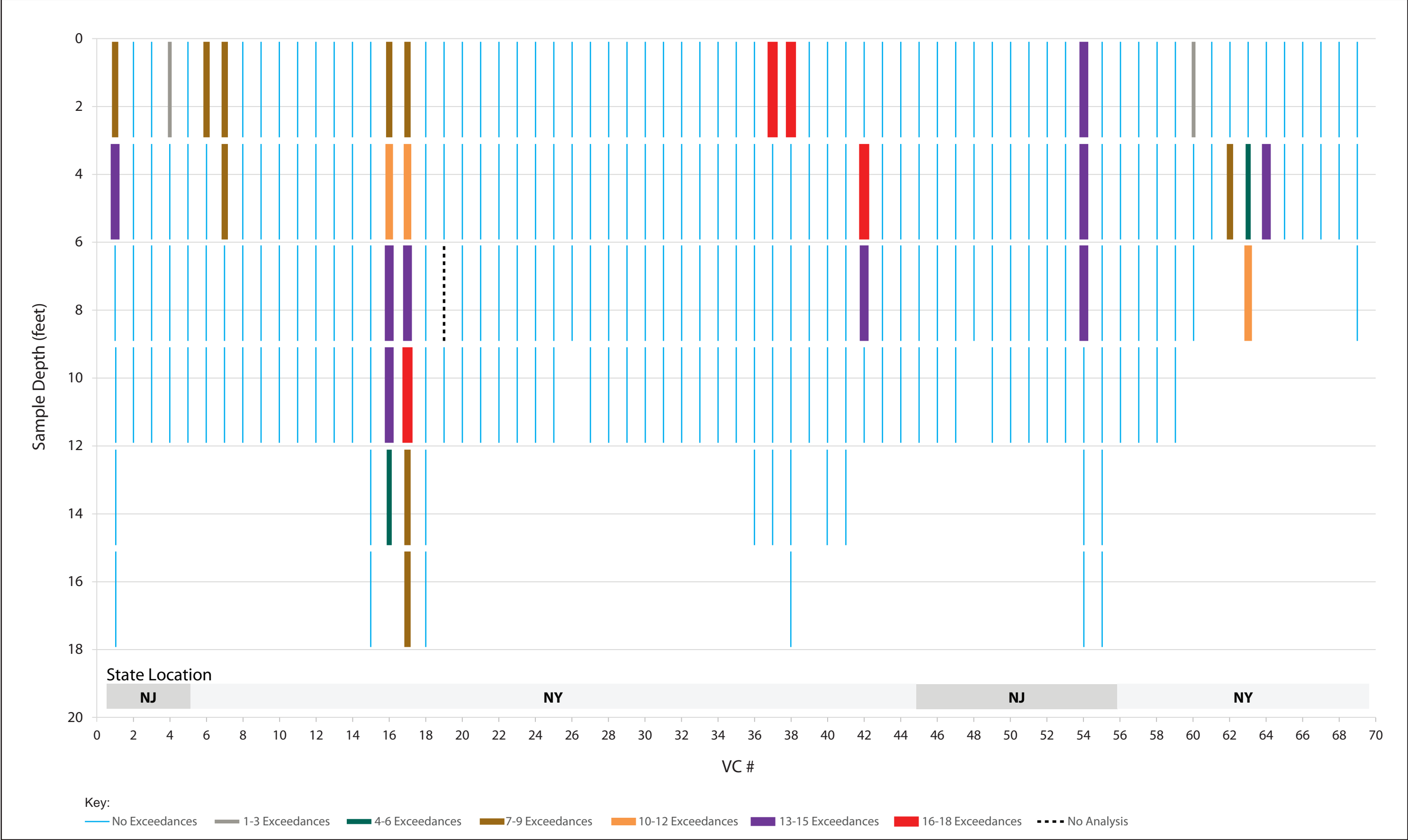
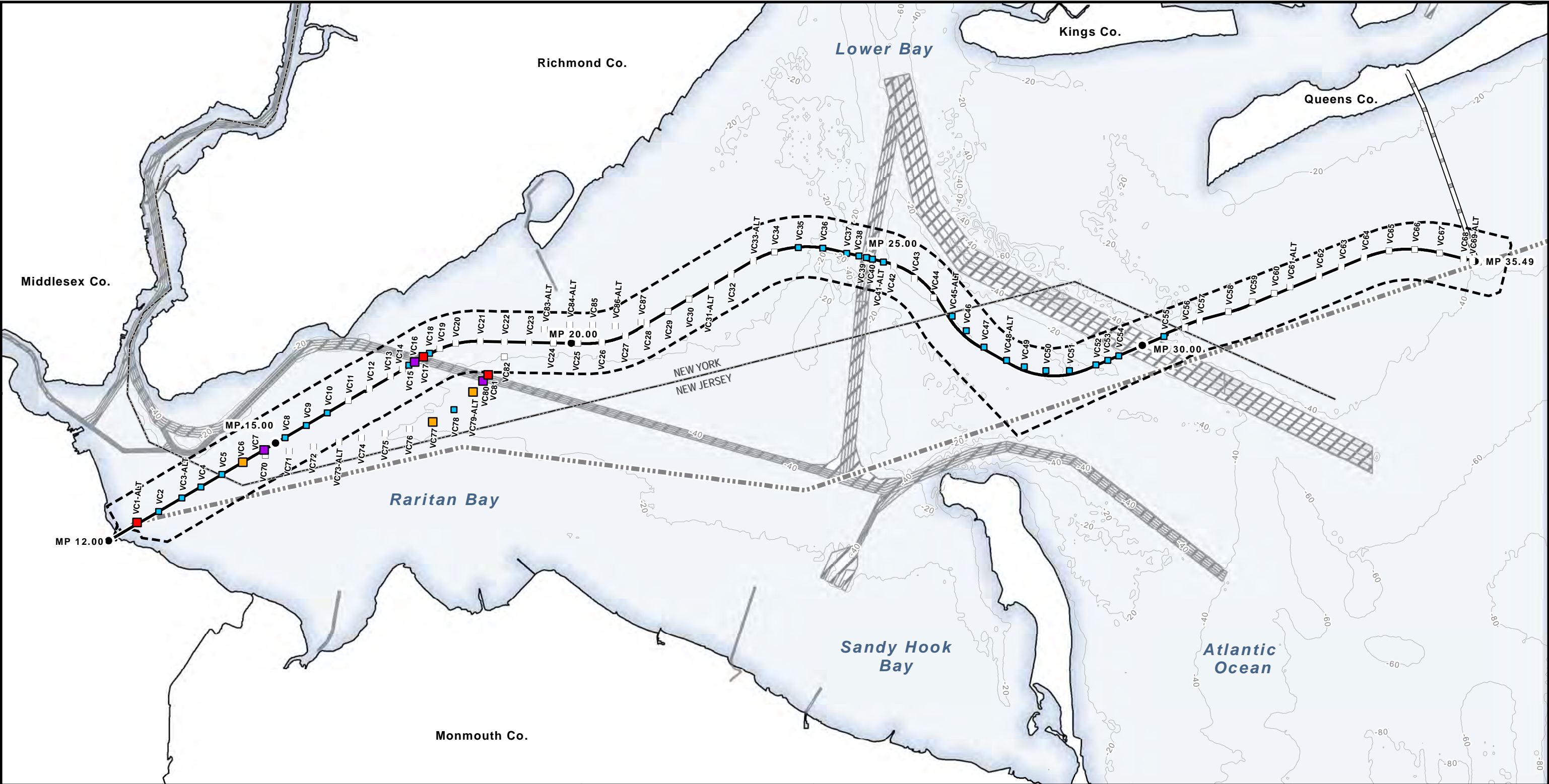


Figure A-12: PAH Exceedances at Depth Along the Preferred Route



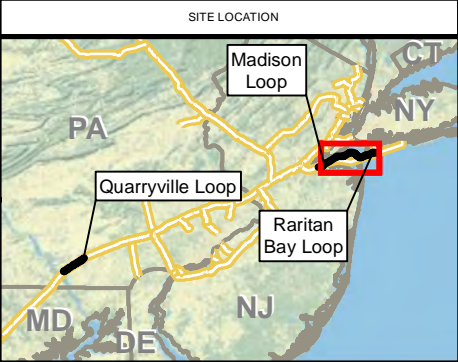
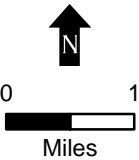
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Other SVOC Exceedances*

- 0
 - 1
 - 2 - 3
 - 4
 - No Analysis
- Milepost
 - Proposed Raritan Bay Loop
 - Construction Workspace
 - NY/NJ Boundary
 - Lower NY Bay Lateral

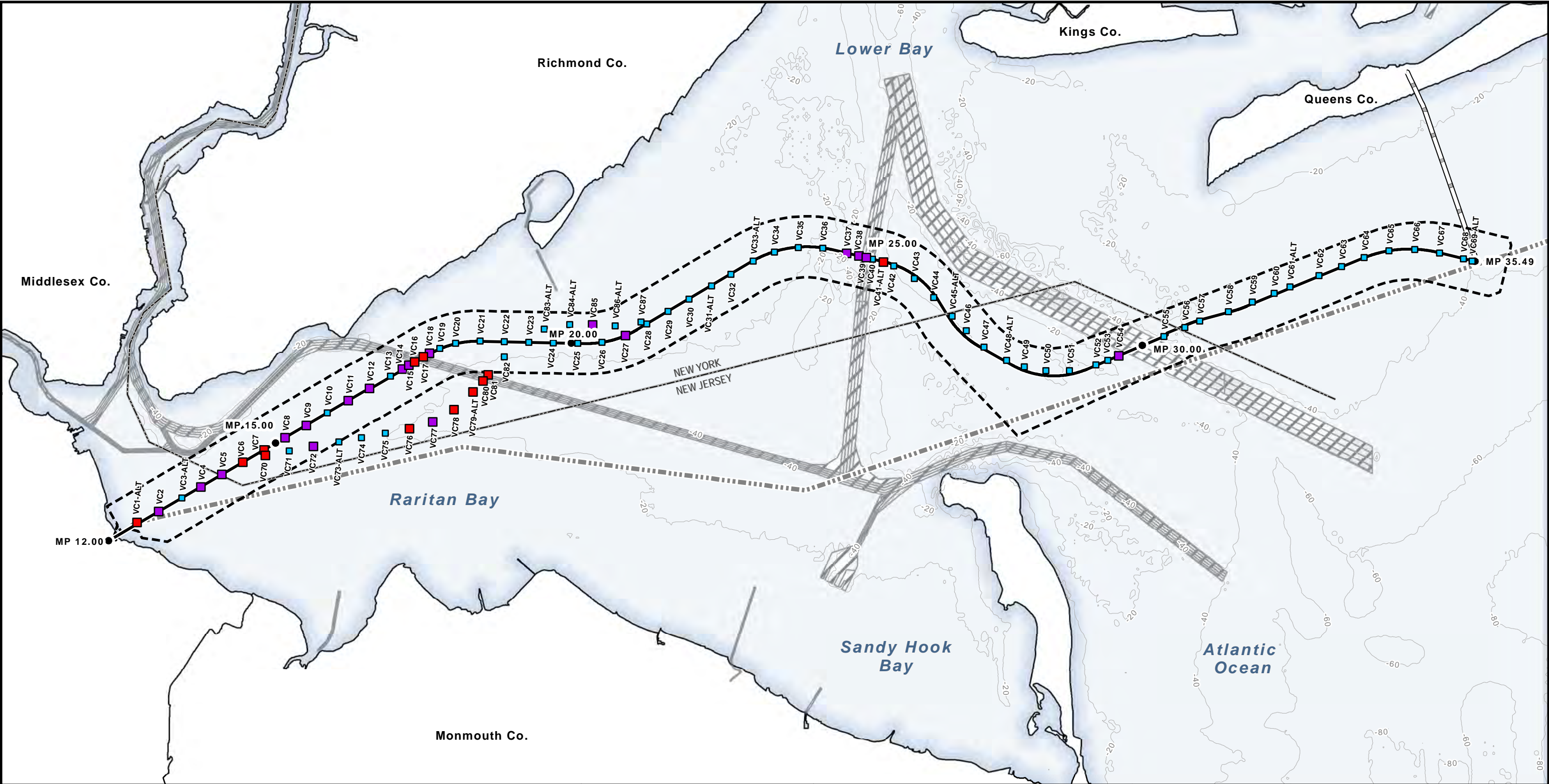
- Rockaway Delivery Lateral
- Maintained Navigation Channel

*Number of analyte exceedances for lowest threshold of either the NJDEP Ecological Screening Criteria or NYSDEC Sediment Guidance Values.



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TRANSCONTINENTAL GAS PIPE LINE COMPANY LLC OFFSHORE SEDIMENT SAMPLE CONTAMINATION RESULTS OTHER SVOCs NORTHEAST SUPPLY ENHANCEMENT PROJECT NEW JERSEY, NEW YORK							
Williams							
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Legend

Dioxin Furan Exceedances*

- 0
- 1
- 2

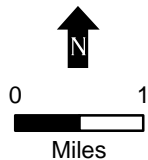
Milepost

- Proposed Raritan Bay Loop
- Construction Workspace
- NY/NJ Boundary
- Lower NY Bay Lateral

Rockaway Delivery Lateral

Maintained Navigation Channel

*Number of analyte exceedances for lowest threshold of either the NJDEP Ecological Screening Criteria or NYSDEC Sediment Guidance Values.



DRAWING NO.		REFERENCE TITLE	
		A-14	
NO.	DATE	BY	REVISION DESCRIPTION
A	6/2/2017	MK	
W.O. NO.	CHK.	APP.	
1000891			
DRAWN BY: MK		DATE: 6/2/2017	ISSUE FOR BID: N/A
CHECKED BY:		DATE:	ISSUE FOR CONSTRUCTION: N/A
APPROVED BY:		DATE:	DRAWING NUMBER:
WO: 1000891		11:17 AM 6/2/2017	
Figure A-14			SHEET 1 OF 1

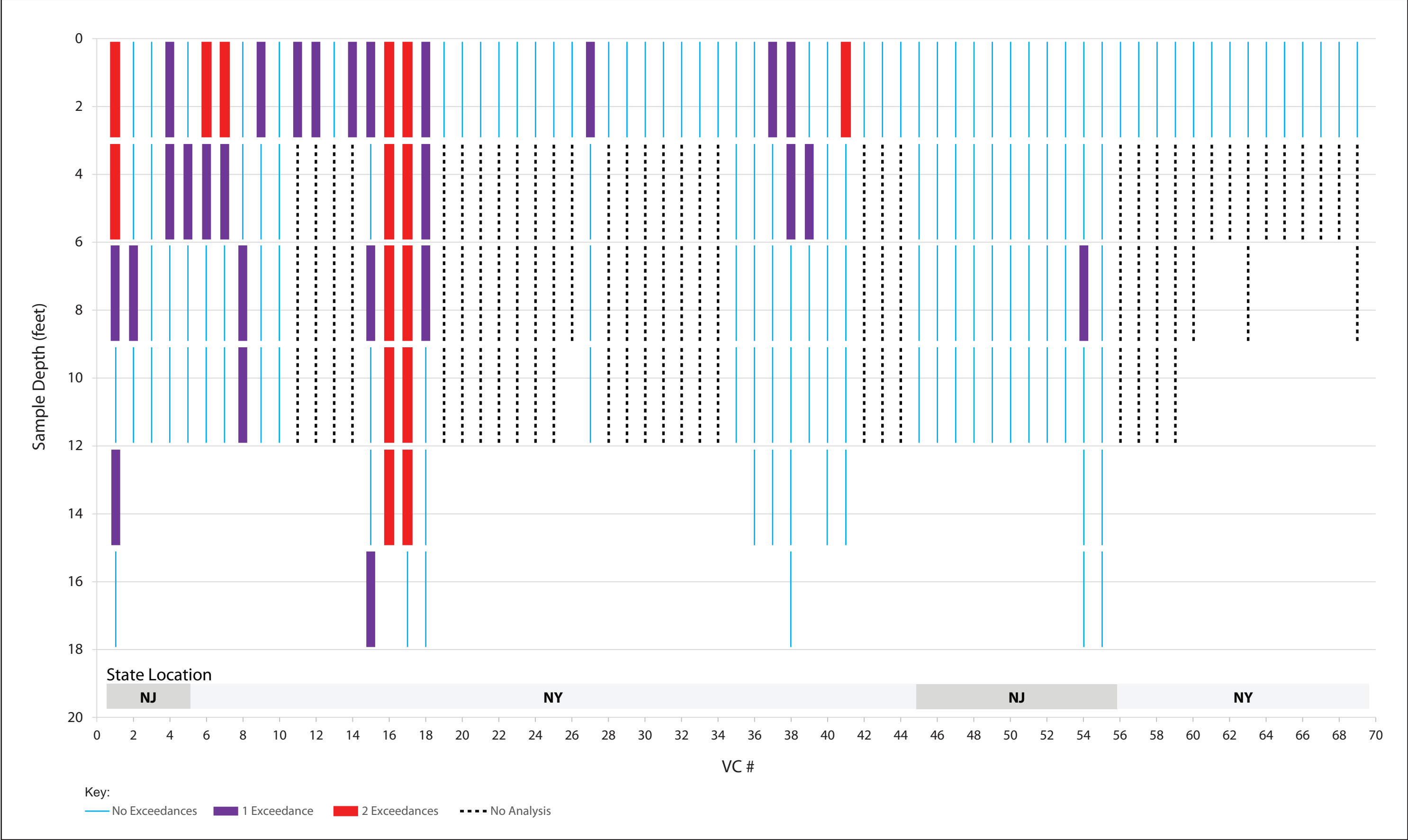


Figure A-15: Dioxin and Furan Exceedances at Depth Along the Preferred Route

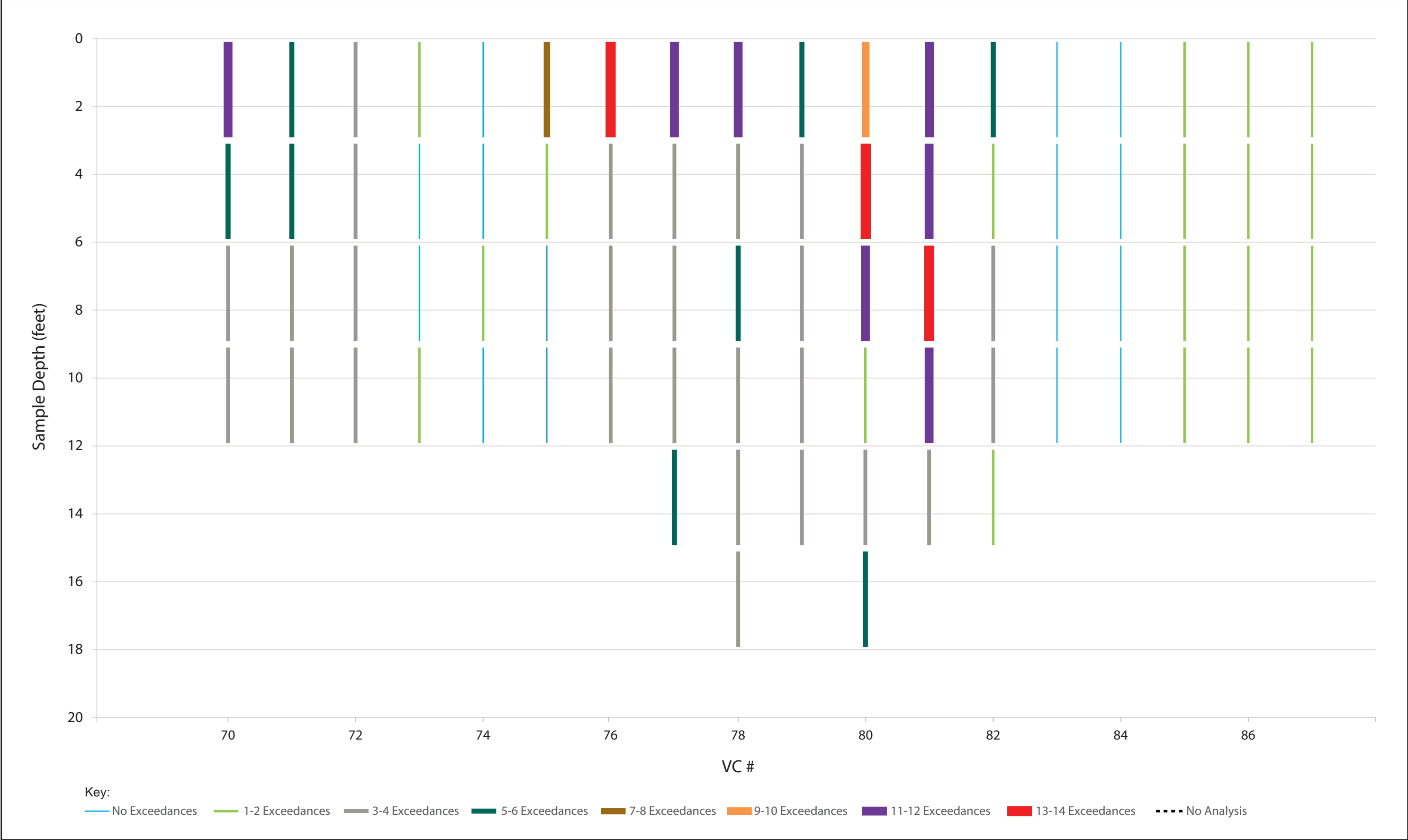


Figure A-16: Metals Exceedances at Depth Along the Alternative Route

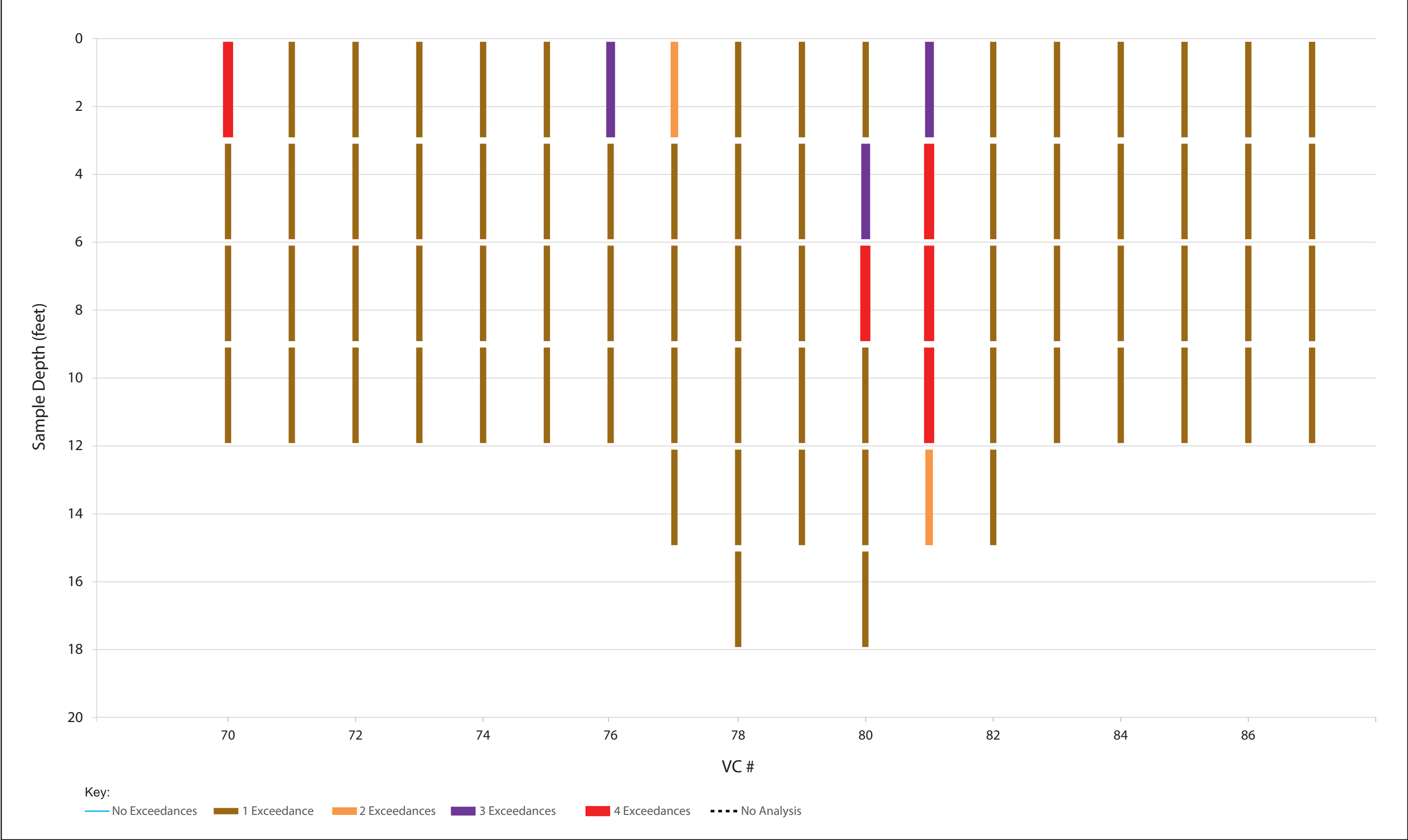


Figure A-17: Pesticide Exceedances at Depth Along the Alternative Route

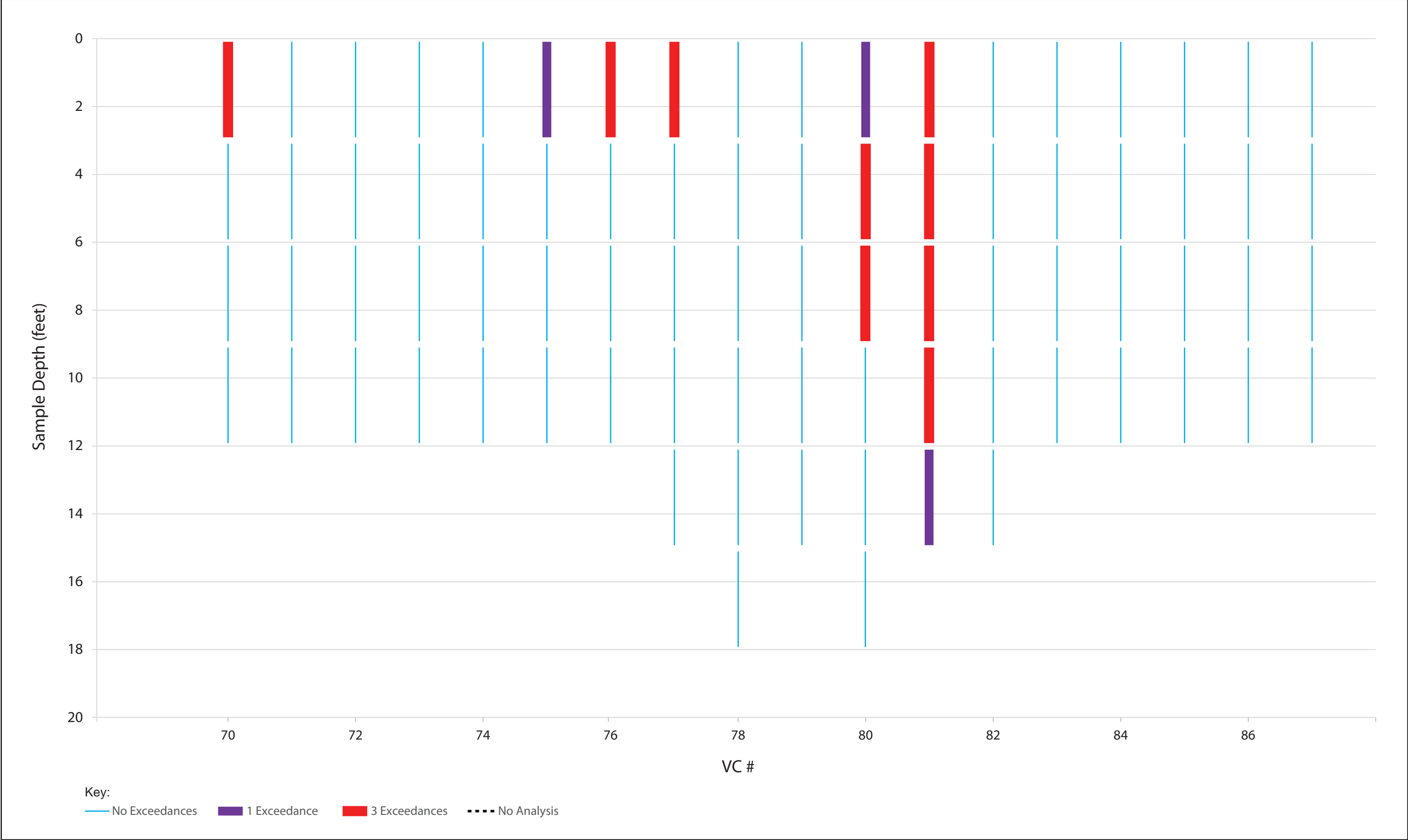


Figure A-18: PCB Aroclor Exceedances at Depth Along the Alternative Route

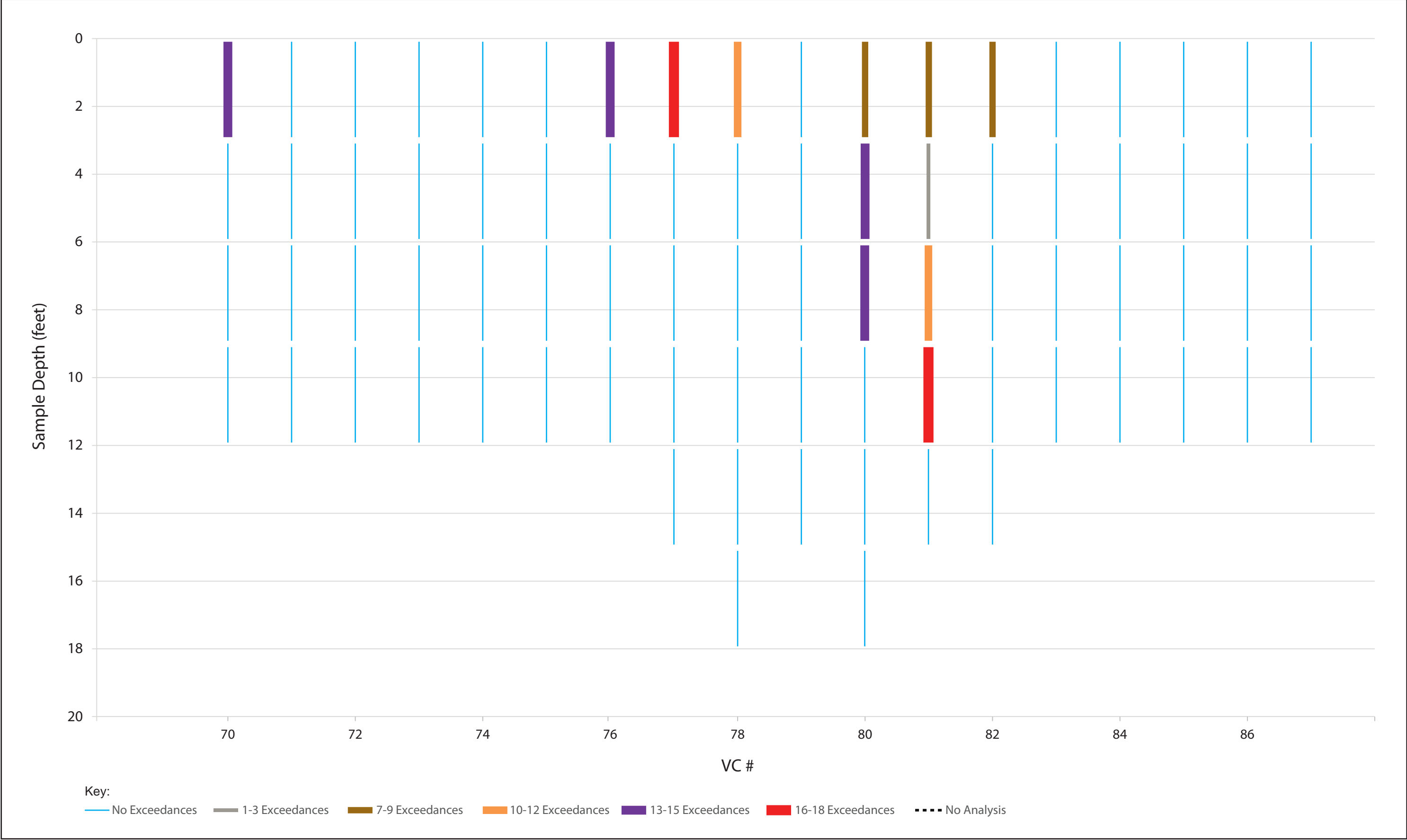


Figure A-19: PAH Exceedances at Depth Along the Alternative Route

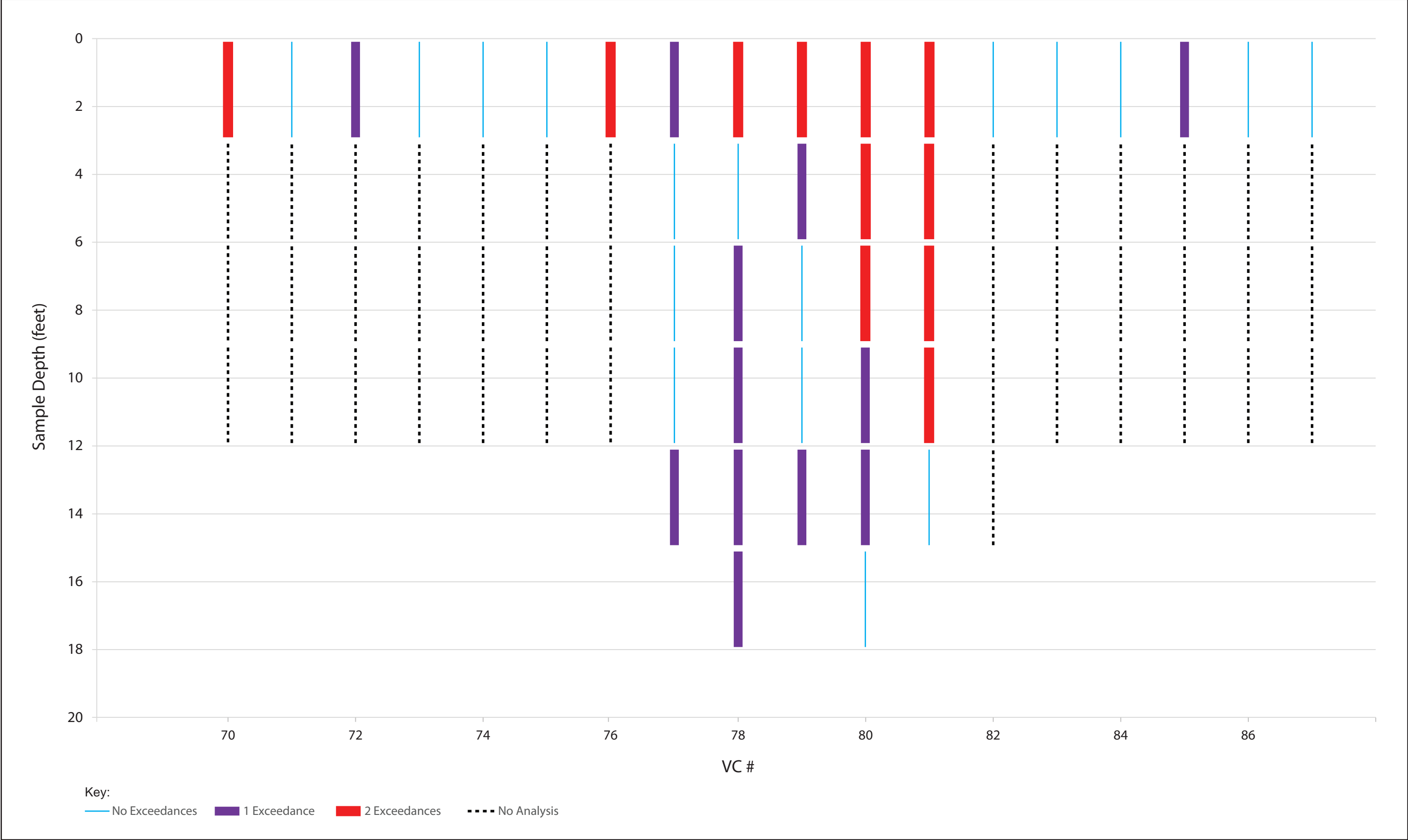
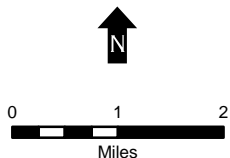


Figure A-20: Dioxin and Furan Exceedances at Depth Along the Alternative Route



Legend

- Milepost
- Existing Compressor Station
- Existing Meter & Regulating Station
- Proposed Pipeline
- Existing Pipeline
- - - County Boundary
- - - NY/NJ State Boundary
- - - State/Federal Offshore Line
- - - Approximate Offshore Waterbody Boundary



DRAWING NO.			REFERENCE TITLE			
			A-16			
NO.	DATE	BY	REVISION DESCRIPTION	W.O. NO.	CHK.	APP.
A	3/22/2017	DM	ISSUED FOR FERC FILING	1000891	MK	SM
B	6/1/2017	RH	ISSUED FOR FERC SUPPLEMENTAL FILING	1000891	MK	

TRANSCONTINENTAL GAS PIPE LINE COMPANY LLC OFFSHORE WATERBODIES NORTHEAST SUPPLY ENHANCEMENT PROJECT NEW JERSEY, NEW YORK							
DRAWN BY: RH	DATE: 6/1/2017	ISSUE FOR BID: N/A		SCALE: 1:115,000			
CHECKED BY: MK	DATE: 6/1/2017	ISSUE FOR CONSTRUCTION: N/A		Project features ver15			
APPROVED BY:	DATE:	DRAWING NUMBER:		FIGURE A-21		SHEET 1 OF 1	
WO: 1000891		11:55 AM 6/1/2017					

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B

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Table B-1 Vibracore and Grab Sample Locations

Sample Site ^a	State	Coring Depth (ft)^{d,e}	No. Off Samples Collected	Sample Site ^a	State	Coring Depth (ft)^{d,e}	No. Off Samples Collected
<i>VC1-ALT</i>	<i>NJ</i>	<i>16</i>	<i>11^b</i>	VC45-ALT	NJ	12	4
<i>VC2</i>	<i>NJ</i>	<i>10.5</i>	<i>4</i>	VC46	NJ	12	4
<i>VC3-ALT</i>	<i>NJ</i>	<i>12</i>	<i>4</i>	VC47	NJ	12	4
<i>VC4</i>	<i>NJ</i>	<i>12</i>	<i>4</i>	VC48-ALT	NJ	9.7	6 ^c
<i>VC5</i>	<i>NY</i>	<i>12</i>	<i>4</i>	VC49	NJ	12	4
<i>VC6</i>	<i>NY</i>	<i>12</i>	<i>4</i>	VC50	NJ	12	4
<i>VC7</i>	<i>NY</i>	<i>12</i>	<i>4</i>	VC51	NJ	12	4
<i>VC8</i>	<i>NY</i>	<i>12</i>	<i>4</i>	VC52	NJ	12	4
<i>VC9</i>	<i>NY</i>	<i>12</i>	<i>4</i>	<i>VC53</i>	<i>NJ</i>	<i>12</i>	<i>4</i>
<i>VC10</i>	<i>NY</i>	<i>10.4</i>	<i>4</i>	<i>VC54</i>	<i>NJ</i>	<i>17.6</i>	<i>12^b</i>
VC11	NY	12	4	<i>VC55</i>	<i>NJ</i>	<i>27.9</i>	<i>17^b</i>
VC12	NY	12	4	VC56	NY	12	4
VC13	NY	12	4	VC57	NY	11.6	4
VC14	NY	12	4	VC58	NY	12	4
<i>VC15</i>	<i>NY</i>	<i>16.5</i>	<i>12^c</i>	VC59	NY	12	4
<i>VC16</i>	<i>NY</i>	<i>15</i>	<i>5</i>	VC60	NY	8.7	3
<i>VC17</i>	<i>NY</i>	<i>17.5</i>	<i>6</i>	VC61-ALT	NY	5.1	2
<i>VC18</i>	<i>NY</i>	<i>16.2</i>	<i>6</i>	VC62	NY	5	2
VC19	NY	12	4	VC63	NY	7	3
VC20	NY	12	4	VC64	NY	6.1	3
VC21	NY	12	4	VC65	NY	4.8	4 ^c
VC22	NY	12	4	VC66	NY	5.1	2
VC23	NY	12	4	VC67	NY	5.7	2
VC24	NY	10.5	4	VC68	NY	6.8	2
VC25	NY	11.5	4	VC69-ALT	NY	8.1	3
VC26	NY	8.7	3	VC70	NY	12	4
VC27	NY	12	8 ^c	VC71	NY	12	4
VC28	NY	12	4	VC72	NY	12	4
VC29	NY	12	4	VC73-ALT	NY	12	4
VC30	NY	12	4	VC74	NY	12	4
VC31-ALT	NY	10.6	4	VC75	NY	12	4
VC32	NY	10.1	4	VC76	NY	12	4
VC33-ALT	NY	11.7	4	VC77	NY	15.6	5
VC34	NY	11	4	VC78	NY	17	6
<i>VC35</i>	<i>NY</i>	<i>10.9</i>	<i>4</i>	VC79-ALT	NY	16	5
<i>VC36</i>	<i>NY</i>	<i>15</i>	<i>5</i>	VC80	NY	16.5	6
<i>VC37</i>	<i>NY</i>	<i>14.6</i>	<i>5</i>	VC81	NY	14.75	5
<i>VC38</i>	<i>NY</i>	<i>17.6</i>	<i>6</i>	VC82	NY	16	5
<i>VC39</i>	<i>NY</i>	<i>12</i>	<i>4</i>	VC83-ALT	NY	10	4
<i>VC40</i>	<i>NY</i>	<i>12</i>	<i>5</i>	VC84-ALT	NY	12	4

Table B-1 Vibracore and Grab Sample Locations

Sample Site ^a	State	Coring Depth (ft) ^{d,e}	No. Off Samples Collected	Sample Site ^a	State	Coring Depth (ft) ^{d,e}	No. Off Samples Collected
<i>VC41-ALT</i>	<i>NY</i>	<i>14.6</i>	<i>5</i>	VC85	NY	12	8 ^c
VC42	NY	12	4	VC86-ALT	NY	11	4
VC43	NY	12	4	VC87	NY	12	4
VC44	NY	12	4				

a = Site in bold and italics indicate locations where clamshell dredging might occur.

b = Two vibracores were collected at this site.

c = Duplicate samples at each depth were collected at this site.

d = Depths provided represent actual recovery at each sample site.

e = If two Vibracores or duplicate samples were taken, this depth represents the greatest recovery depth at which samples were collected.

Key:

ft = feet

Table B-2 Selection of Sediment Chemistry Tests for Analytes Detected that Exceeded State Thresholds

Test Description	EPA Method	Unit	NYSDEC Required Method Detection Limits	NJDEP or USACE Required Reporting Limits ¹	NJDEP Effects Range Low (ER-L) ²	NJDEP Effects Range-Median (ER-M) ³	NYSDEC Class A	NYSDEC Class C
Arsenic	EPA 6020A	mg/Kg	3 [^]	1	8.2	70	8.2	70
Barium	EPA 6020A	mg/Kg	--	40	--	48	--	--
Cadmium	EPA 6020A	mg/Kg	1	1	1.2	9.6	1.2	9.6
Chromium	EPA 6020A	mg/Kg	--	1	81	370	81	370
Cobalt	EPA 6020A	mg/Kg	--	10	--	10	--	--
Copper	EPA 6020A	mg/Kg	5 [^]	1	34	270	34	270
Lead	EPA 6020A	mg/Kg	2 [^]	0.6	47	218	47	220
Manganese	EPA 6020A	mg/Kg	--	3	--	260	--	--
Mercury	EPA 7474	mg/Kg	0.2 [^]	0.1	0.15	0.71	0.15	0.71
Nickel	EPA 6020A	mg/Kg	--	1	21	52	21	52
Selenium	EPA 6020A	mg/Kg	--	1	--	1	--	--
Silver	EPA 6020A	mg/Kg	--	1	1	3.7	1	3.7
Zinc	EPA 6020A	mg/Kg	--	4	150	410	150	410
Benzene	EPA 8260C	µg/kg	0.3	10	340	N/A	460	1400
Total PAHs (sum of Target Compound List PAH)	EPA 8270D	µg/kg	330	--	4000	45000	4000	45000
Sum of DDT+DDE+DDD	EPA 8081B	µg/kg	3.3	--	1.6	46	44	5700
PCBs (sum of Aroclors)	EPA 8082A	µg/kg	33	<100	23	180	100	1000
PCBs (sum of congeners)	EPA 1668C	µg/kg	--	--	23	180	100	1000
Dioxins/Furans - Total Toxicity Equivalency Factor	EPA 1613B	pg/g	2000	--	--	3.65	4.5	50

Key:

-- = Guidance value not available

[^] = If the value found is less than the method detection limit, the laboratory reporting limit is listed.

Notes:

1. Unshaded cells present reporting limits from USACE/EPA *Guidance for Performing Tests on Dredged Material Proposed for Ocean Disposal* (2014). Shaded Cells present reporting limits from *The Management and Regulation of Dredging Activities and Dredged Material in New Jersey's Tidal Waters* (1997). If both documents provide reporting limits, only the lowest is shown here.
2. NJDEP Ecological Screening Criteria (2009)
3. NYS TOGS 5.1.9 (2004) and NYS *Screening and Assessment of Contaminated Sediment* (2014).

Table B-3 Summary of Sediment Sample Analytical Results that Exceeded Available Thresholds for the Proposed Route

Analyte	No. of Sites (and Samples) Included in Analysis	No. of Sites (and Samples) Where Analyte was Detected	Maximum Result	Location of Maximum Result	No. of Exceedances (and Range of Values in Exceedance) ³			
					NJDEP ER-L	NJDEP ER-M	NYSDEC Class A	NYSDEC Class C
Total BTEX (µg/kg)	69(314)	6(12)	9.81	VC16-D9-12E	N/A	N/A	0	0
Total PAHs (µg/kg)	69(313)	56(155)	21860.5	VC38-D0-3E	24(4230-21860.5)	0	24(4230-21860.5)	0
Dioxins and Furans Total Toxicity Equivalency Factor ¹ (pg/g)	69(219)	66(202)	81.499	VC1-ALT-D0-3E	N/A	45(3.70104-81.499)	26(4.60107-81.499)	1(81.499-81.499)
P,P'-DDE (µg/kg)	69(313)	7(21)	56.5	VC1B-ALT-D3-6E	19(4.1-56.5)	N/A	0	N/A
Sum of DDT + DDE + DDD (µg/kg)	69(313)	7(21)	99.003	VC6-D0-3E	21(3.393-99.003)	N/A	0	0
Total PCB Congeners ² (pg/g)	37(177)	28(135)	2000000	VC16-D9-12E	19(28800-2000000)	N/A	0	3(116000-2000000)
Total PCB Aroclors (µg/kg)	69(313)	6(19)	1140	VC1B-ALT-D0-3E	19(93.9-1140)	0	0	1(1140-1140)
Aluminum (mg/kg)	69(314)	69(314)	18000	VC16-D0-3E	N/A	N/A	0	N/A
Antimony (mg/kg)	69(314)	8(23)	15.8	VC6-D0-3E	N/A	4(73.497-99.003)	4(8.672-99.003)	N/A
Arsenic (mg/kg)	69(314)	69(314)	108	VC1-ALT-D3-6E	86(8.27-108)	15(233000-2000000)	16(149000-2000000)	3(87.8-108)
Barium (mg/kg)	69(314)	68(300)	135	VC1B-ALT-D0-3E	N/A	17(239.8-1140)	18(161.6-1140)	N/A
Cadmium (mg/kg)	69(314)	43(146)	3.49	VC16-D6-9E	12(1.3-3.49)	0	N/A	0
Chromium, Total (mg/kg)	69(314)	65(296)	202	VC16-D6-9E	14(86.5-202)	1(15.8-15.8)	N/A	0
Cobalt (mg/kg)	69(314)	69(313)	16.3	VC16-D6-9E	N/A	3(87.8-108)	86(8.27-108)	N/A
Copper (mg/kg)	69(314)	65(281)	504	VC1B-ALT-D0-3E	22(37.3-504)	17(48.8-135)	N/A	2(307-504)
Lead (mg/kg)	69(314)	69(314)	285	VC16-D6-9E	24(47.4-285)	0	12(1.3-3.49)	4(235-285)
Manganese (mg/kg)	69(314)	69(314)	906	VC16-D6-9E	N/A	0	14(86.5-202)	N/A
Nickel (mg/kg)	69(314)	68(301)	53.5	VC16-D6-9E	86(21.4-53.5)	45(10.1-16.3)	N/A	1(53.5-53.5)
Selenium (mg/kg)	69(314)	46(167)	18.6	VC1-ALT-D3-6E	N/A	2(307-504)	22(37.3-504)	N/A
Silver (mg/kg)	69(314)	13(34)	8.52	VC16-D9-12E	18(1.06-8.52)	4(235-285)	24(47.4-285)	8(3.92-8.52)

Table B-3 Summary of Sediment Sample Analytical Results that Exceeded Available Thresholds for the Proposed Route

Analyte	No. of Sites (and Samples) Included in Analysis	No. of Sites (and Samples) Where Analyte was Detected	Maximum Result	Location of Maximum Result	No. of Exceedances (and Range of Values in Exceedance) ³			
					NJDEP ER-L	NJDEP ER-M	NYSDEC Class A	NYSDEC Class C
Vanadium (mg/kg)	69(314)	64(279)	94.4	VC22-D9-12E	N/A	94(263-906)	N/A	N/A
Zinc (mg/kg)	69(314)	66(270)	494	VC16-D6-9E	18(154-494)	1(53.5-53.5)	86(21.4-53.5)	3(427-494)
Mercury (mg/kg)	69(314)	53(196)	5.28	VC1B-ALT-D0-3E	36(0.169-5.28)	156(1.01-18.6)	N/A	21(0.904-5.28)

Key:

DDD = dichloro-diphenyl-dichloroethane

DDE = dichloro-diphenyl-dichloroethylene

DDT = dichloro-diphenyl-trichloroethane

µg/kg = micrograms per kilogram

mg/kg = milligrams per kilogram

PCBs = polychlorinated biphenyls

PCBs = polychlorinated biphenyls

pg/g = picogram/gram

Notes:

1 Dioxins/Furans only analyzed in top 3 feet in NY non-clamshell.

2 Not analyzed in NY non-clamshell.

3 N/A indicates that there is no guidance value for that analyte, 0 indicates no exceedances of the guidance value. All measured concentrations of analytes detected in samples from New Jersey and New York were compared to both the SGVs and ESC.

Sources: NJDEP 2009, NYSDEC 2004, 2014c.

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Table B-4 Count of Exceedances in New York and New Jersey per Number of Available SGVs and ESCs

Analyte Group	VC1-ALT ¹		VC1B-ALT ¹		VC2		VC3-ALT		VC4		VC5		VC6		VC7		VC8		VC9		VC10		VC11 ²		VC12 ²		
	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	
VOCs ³	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	
SVOCs (excluding PAHs) ³	4/15	0/6	3/15	0/6	0/15	0/6	0/15	0/6	0/15	0/6	0/15	0/6	1/15	0/6	2/15	0/6	0/15	0/6	0/15	0/6	0/15	0/6	0/15	0/0	0/15	0/0	
PAHs ³	16/18	1/1	13/18	1/1	0/18	0/1	0/18	0/1	1/18	0/1	0/18	0/1	7/18	0/1	8/18	0/1	0/18	0/1	0/18	0/1	0/18	0/1	0/18	0/1	0/18	0/1	
Dioxins/ Furans ³	1/1	2/2	1/1	2/2	1/1	1/2	0/1	0/2	1/1	1/2	1/1	0/2	1/1	2/2	1/1	2/2	1/1	1/2	1/1	0/2	0/1	0/2	1/1	0/2	1/1	0/2	
Pesticides ³	4/11	1/11	4/11	1/11	0/11	0/11	0/11	0/11	0/11	0/11	0/11	0/11	4/11	1/11	4/11	1/11	0/11	0/11	0/11	0/11	0/11	0/11	0/11	0/4	0/11	0/4	
PCB Congener ³	1/1	1/1	1/1	1/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	1/1	1/1	1/1	1/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/0	0/1	0/0	
PCB Aroclor ³	3/5	1/1	3/5	1/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	3/5	1/1	3/5	1/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	
Metals ³	14/16	9/9	14/16	9/9	2/16	1/9	5/16	2/9	7/16	4/9	5/16	2/9	15/16	9/9	13/16	9/9	5/16	2/9	4/16	2/9	0/16	0/9	0/16	0/9	2/16	1/9	
Total	43/71	15/36	39/71	15/36	3/71	2/36	5/71	2/36	9/71	5/36	6/71	2/36	32/71	14/36	32/71	14/36	6/71	3/36	5/71	2/36	0/71	0/36	1/71	0/22	3/71	1/22	
Analyte Group	VC13 ²		VC14 ²		VC15		VC16		VC17		VC18		VC19 ²		VC20 ²		VC21 ²		VC22 ²		VC23 ²		VC24 ²		VC25 ²		
	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	
VOCs ³	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	
SVOCs (excluding PAHs) ³	0/15	0/0	0/15	0/0	0/15	0/6	3/15	0/6	4/15	0/6	0/15	0/6	0/15	0/0	0/15	0/0	0/15	0/0	0/15	0/0	0/15	0/0	0/15	0/0	0/15	0/0	
PAHs ³	0/18	0/1	0/18	0/1	0/18	0/1	17/18	1/1	17/18	1/1	0/18	0/1	0/18	0/1	0/18	0/1	0/18	0/1	0/18	0/1	0/18	0/1	0/18	0/1	0/18	0/1	
Dioxins/ Furans ³	0/1	0/2	1/1	0/2	1/1	1/2	1/1	2/2	1/1	2/2	1/1	1/2	0/1	0/2	0/1	0/2	0/1	0/2	0/1	0/2	0/1	0/2	0/1	0/2	0/1	0/2	
Pesticides ³	0/11	0/4	0/11	0/4	0/11	0/11	4/11	1/11	4/11	1/11	0/11	0/11	0/11	0/4	0/11	0/4	0/11	0/4	0/11	0/4	0/11	0/4	0/11	0/4	0/11	0/4	
PCB Congener ³	0/1	0/0	0/1	0/0	0/1	0/1	1/1	1/1	1/1	1/1	0/1	0/1	0/1	0/0	0/1	0/0	0/1	0/0	0/1	0/0	0/1	0/0	0/1	0/0	0/1	0/0	
PCB Aroclor ³	0/5	0/1	0/5	0/1	0/5	0/1	3/5	1/1	3/5	1/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	
Metals ³	3/16	2/9	3/16	2/9	4/16	2/9	14/16	9/9	13/16	9/9	4/16	2/9	4/16	2/9	4/16	2/9	0/16	0/9	3/16	1/9	3/16	2/9	0/16	0/9	1/16	1/9	
Total	3/71	2/22	4/71	2/22	5/71	3/36	43/71	15/36	43/71	15/36	5/71	3/36	4/71	2/22	4/71	2/22	0/71	0/22	3/71	1/22	3/71	2/22	0/71	0/22	1/71	1/22	
Analyte Group	VC26 ²		VC27 ²		VC28 ²		VC29 ²		VC30 ²		VC31-ALT ²		VC32 ²		VC33-ALT ²		VC34 ²		VC35		VC36		VC37		VC38		
	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	
VOCs ³	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	
SVOCs (excluding PAHs) ³	0/15	0/0	0/15	0/0	0/15	0/0	0/15	0/0	0/15	0/0	0/15	0/0	0/15	0/0	0/15	0/0	0/15	0/0	0/15	0/6	0/15	0/6	0/15	0/6	0/15	0/6	
PAHs ³	0/18	0/1	0/18	0/1	0/18	0/1	0/18	0/1	0/18	0/1	0/18	0/1	0/18	0/1	0/18	0/1	0/18	0/1	0/18	0/1	0/18	0/1	17/18	1/1	18/18	1/1	
Dioxins/ Furans ³	0/1	0/2	1/1	0/2	0/1	0/2	0/1	0/2	0/1	0/2	0/1	0/2	0/1	0/2	0/1	0/2	0/1	0/2	0/1	0/2	0/1	0/2	1/1	1/2	1/1	0/2	
Pesticides ³	0/11	0/4	0/11	0/4	0/11	0/4	0/11	0/4	0/11	0/4	0/11	0/4	0/11	0/4	0/11	0/4	0/11	0/4	0/11	0/4	0/11	0/11	0/11	0/11	0/11	0/11	
PCB Congener ³	0/1	0/0	0/1	0/0	0/1	0/0	0/1	0/0	0/1	0/0	0/1	0/0	0/1	0/0	0/1	0/0	0/1	0/0	0/1	0/1	0/1	0/1	0/1	0/1	1/1	0/1	
PCB Aroclor ³	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	
Metals ³	1/16	0/9	2/16	1/9	1/16	0/9	3/16	1/9	1/16	0/9	2/16	0/9	1/16	0/9	1/16	0/9	1/16	0/9	1/16	0/9	1/16	0/9	5/16	4/9	11/16	7/9	
Total	1/71	0/22	3/71	1/22	1/71	0/22	3/71	1/22	1/71	0/22	2/71	0/22	1/71	0/22	1/71	0/22	1/71	0/22	1/71	0/36	1/71	0/36	23/71	6/36	31/71	8/36	
Analyte Group	VC39		VC40		VC41-ALT		VC42 ²		VC43 ²		VC44 ²		VC45-ALT		VC46		VC47		VC48-ALT		VC49		VC50		VC51		
	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	
VOCs ³	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	
SVOCs (excluding PAHs) ³	0/15	0/6	0/15	0/6	0/15	0/6	0/15	0/0	0/15	0/0	0/15	0/0	0/15	0/6	0/15	0/6	0/15	0/6	0/15	0/6	0/15	0/6	0/15	0/6	0/15	0/6	
PAHs ³	0/18	0/1	0/18	0/1	0/18	0/1	17/18	1/1	0/18	0/1	0/18	0/1	0/18	0/1	0/18	0/1	0/18	0/1	0/18	0/1	0/18	0/1	0/18	0/1	0/18	0/1	
Dioxins/ Furans ³	1/1	1/2	0/1	0/2	1/1	1/2	0/1	0/2	0/1	0/2	0/1	0/2	0/1	0/2	0/1	0/2	0/1	0/2	0/1	0/2	0/1	0/2	0/1	0/2	0/1	0/2	
Pesticides ³	0/11	0/11	0/11	0/11	2/11	1/11	0/11	0/4	0/11	0/4	0/11	0/4	0/11	0/11	0/11	0/11	0/11	0/11	0/11	0/11	0/11	0/11	0/11	0/11	0/11	0/11	
PCB Congener ³	0/1	0/1	0/1	0/1	1/1	0/1	0/1	0/0	0/1	0/0	0/1	0/0	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	
PCB Aroclor ³	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	
Metals ³	1/16	0/9	1/16	0/9	2/16	1/9	8/16	6/9	1/16	0/9	0/16	0/9	0/16	0/9	1/16	0/9	3/16	2/9	1/16	0/9	1/16	0/9	1/16	0/9	1/16	0/9	
Total	2/71	1/36	1/71	0/36	6/71	3/36	25/71	7/22	1/71	0/22	0/71	0/22	0/71	0/36	1/71	0/36	3/71	2/36	1/71	0/36	1/71	0/36	1/71	0/36	1/71	0/36	

Table B-4 Count of Exceedances in New York and New Jersey per Number of Available SGVs and ESCs

Analyte Group	VC52		VC53		VC54 ¹		VC54B ¹		VC55 ¹		VC55B ¹		VC56 ²		VC57 ²		VC58 ²		VC59 ²		VC60 ²		VC61-ALT ²		VC62 ²	
	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY
VOCs ³	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5
SVOCs (excluding PAHs) ³	0/15	0/6	0/15	0/6	0/15	0/6	0/15	0/6	0/15	0/6	0/15	0/6	0/15	0/0	0/15	0/0	0/15	0/0	0/15	0/0	0/15	0/0	0/15	0/0	0/15	0/0
PAHs ³	0/18	0/1	0/18	0/1	15/18	1/1	15/18	1/1	0/18	0/1	0/18	0/1	0/18	0/1	0/18	0/1	0/18	0/1	0/18	0/1	1/18	1/1	0/18	0/1	9/18	1/1
Dioxins/ Furans ³	0/1	0/2	0/1	0/2	1/1	1/2	1/1	0/2	0/1	0/2	0/1	0/2	0/1	0/2	0/1	0/2	0/1	0/2	0/1	0/2	0/1	0/2	0/1	0/2	0/1	0/2
Pesticides ³	0/11	0/11	0/11	0/11	0/11	0/11	0/11	0/11	0/11	0/11	0/11	0/11	0/11	0/4	0/11	0/4	0/11	0/4	0/11	0/4	0/11	0/4	0/11	0/4	0/11	0/4
PCB Congener ³	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/0	0/1	0/0	0/1	0/0	0/1	0/0	0/1	0/0	0/1	0/0	0/1	0/0
PCB Aroclor ³	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1
Metals ³	1/16	0/9	1/16	0/9	2/16	1/9	2/16	1/9	1/16	0/9	0/16	0/9	1/16	0/9	1/16	0/9	1/16	0/9	1/16	0/9	5/16	4/9	2/16	1/9	2/16	2/9
Total	1/71	0/36	1/71	0/36	18/71	3/36	18/71	2/36	1/71	0/36	0/71	0/36	1/71	0/22	1/71	0/22	1/71	0/22	1/71	0/22	6/71	5/22	2/71	1/22	11/71	3/22

Analyte Group	VC63 ²		VC64 ²		VC65 ²		VC66 ²		VC67 ²		VC68 ²		VC69-ALT ²	
	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY
VOCs ³	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5
SVOCs (excluding PAHs) ³	0/15	0/0	0/15	0/0	0/15	0/0	0/15	0/0	0/15	0/0	0/15	0/0	0/15	0/0
PAHs ³	11/18	1/1	15/18	1/1	0/18	0/1	0/18	0/1	0/18	0/1	0/18	0/1	0/18	0/1
Dioxins/ Furans ³	0/1	0/2	0/1	0/2	0/1	0/2	0/1	0/2	0/1	0/2	0/1	0/2	0/1	0/2
Pesticides ³	1/11	0/4	0/11	0/4	0/11	0/4	0/11	0/4	0/11	0/4	0/11	0/4	0/11	0/4
PCB Congener ³	0/1	0/0	0/1	0/0	0/1	0/0	0/1	0/0	0/1	0/0	0/1	0/0	0/1	0/0
PCB Aroclor ³	2/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1
Metals ³	0/16	0/9	1/16	1/9	1/16	1/9	0/16	0/9	0/16	0/9	1/16	0/9	1/16	0/9
Total	14/71	1/22	16/71	2/22	1/71	1/22	0/71	0/22	0/71	0/22	1/71	0/22	1/71	0/22

Key

¹ Both samples of each set (VC1-ALT/VC1B-ALT, VC54/VC54B, and VC55/VC55B) were collected in the same location.

² Dioxins and furans were tested for only in the samples taken from 0-3 feet at sites in New York where clamshell dredging is not anticipated to occur. Dioxin/furan samples for additional depths at these sites were archived. PCB Congeners were not tested for at sites in New York where clamshell dredging is not anticipated to occur.

³ Highlighted cells indicate that ER-M or Class C thresholds were also exceeded.

Table B-5 Sample Sites and Samples in Group A Exceeding ER-L and/or ER-M Thresholds for Metals

Analyte	Concentrations that Exceeded Thresholds		Sample Site	Sample Depth(s)*
	Exceeded ER-L (mg/kg)	Exceeded ER-M (mg/kg)		
Arsenic	8.37-108	N/A	VC1-ALT	0-3 ft, 3-6 ft, 6-9 ft, 9-12 ft, 12-15 ft, 15-16 ft
			VC1B-ALT	0-3 ft, 3-6 ft, 6-9 ft, 9-12 ft, 12-15 ft
			VC2	0-3 ft, 6-9 ft
			VC3-ALT	0-3 ft, 3-6 ft, 6-9 ft, 9-10.5 ft
			VC4	0-3 ft, 3-6 ft, 6-9 ft, 9-12 ft
Barium	--	82.5-135	VC1-ALT	<i>0-3 ft, 3-6 ft</i>
			VC1B-ALT	<i>0-3 ft, 3-6 ft</i>
Cadmium	1.62-2.36	N/A	VC1-ALT	0-3 ft, 3-6 ft
			VC1B-ALT	0-3 ft, 3-6 ft
Chromium	97.6-145	N/A	VC1-ALT	0-3 ft, 3-6 ft
			VC1B-ALT	0-3 ft, 3-6 ft
Cobalt	--	10.1-11.6	VC1-ALT	<i>3-6 ft, 12-15 ft, 15-16 ft</i>
			VC1B-ALT	<i>12-15 ft</i>
			VC3-ALT	<i>3-6 ft, 6-9 ft, 9-10.5 ft</i>
			VC4	<i>0-3 ft, 3-6 ft</i>
Copper	237-504	N/A	VC1-ALT	0-3 ft, 3-6 ft
			VC1B-ALT	0-3 ft, 3-6 ft
Lead	47.4-235	N/A	VC1-ALT	0-3 ft, 3-6 ft
			VC1B-ALT	0-3 ft, 3-6 ft
			VC4	0-3 ft
Manganese	--	274-436	VC1-ALT	<i>3-6 ft, 6-9 ft, 9-12 ft</i>
			VC1B-ALT	<i>3-6 ft, 9-12 ft, 12-15 ft</i>
			VC3-ALT	<i>0-3 ft, 3-6 ft, 6-9 ft, 9-10.5 ft</i>
			VC4	<i>0-3 ft, 3-6 ft, 6-9 ft, 9-12 ft</i>
Nickel	24.3-40.7	N/A	VC1-ALT	0-3 ft, 3-6 ft, 6-9 ft, 9-12 ft, 12-15 ft, 15-16 ft
			VC1B-ALT	<i>0-3 ft, 3-6 ft, 9-12 ft, 12-15 ft</i>
			VC3-ALT	0-3 ft, 3-6 ft, 6-9 ft, 9-10.5 ft
			VC4	0-3 ft, 3-6 ft, 6-9 ft, 9-12 ft
Selenium	--	1.22-18.6	VC1-ALT	<i>0-3 ft, 3-6 ft, 6-9 ft, 9-12 ft, 12-15 ft, 15-16 ft</i>
			VC1B-ALT	<i>0-3 ft, 3-6 ft, 6-9 ft, 9-12 ft, 12-15 ft</i>
			VC2	<i>0-3 ft</i>
			VC3-ALT	<i>0-3 ft, 3-6 ft, 6-9 ft, 9-10.5 ft</i>
			VC4	<i>0-3 ft, 3-6 ft, 6-9 ft, 9-12 ft</i>
Silver	3.06-4.58	N/A	VC1-ALT	0-3 ft, 3-6 ft
			VC1B-ALT	0-3 ft, 3-6 ft
Vanadium	--	70.4-83.3	VC1-ALT	<i>0-3 ft, 3-6 ft, 6-9 ft, 9-12 ft, 12-15 ft, 15-16 ft</i>
			VC1B-ALT	<i>0-3 ft, 3-6 ft, 6-9 ft, 9-12 ft, 12-15 ft</i>

Table B-5 Sample Sites and Samples in Group A Exceeding ER-L and/or ER-M Thresholds for Metals

Analyte	Concentrations that Exceeded Thresholds		Sample Site	Sample Depth(s)*
	Exceeded ER-L (mg/kg)	Exceeded ER-M (mg/kg)		
Zinc	227-336	N/A	VC1-ALT	<i>03- ft, 3-6 ft</i>
			VC1B-ALT	<i>03- ft, 3-6 ft</i>
Mercury	0.294-0.32	2.53-5.28	VC1-ALT	<i>0-3 ft, 3-6 ft</i>
			VC1B-ALT	<i>0-3 ft, 3-6 ft, 6-9 ft</i>
			VC4	0-3 ft

Key:

-- = ER-L thresholds were not available.

N/A = Detected concentrations did not exceed the ER-M thresholds.

* Sample depths where ER-M thresholds were exceeded are in bold and italics.

Table B-6 Sample Sites and Samples in Group A Exceeding ER-L and/or ER-M Thresholds for PAHs

Analyte	Concentrations that Exceeded Thresholds		Sample Site	Sample Depth(s)
	Exceeded ER-L (µg/kg)	Exceeded ER-M (µg/kg)		
2-Methylnaphthalene	80-144	N/A	VC1-ALT	3-6 ft
			VC1B-ALT	0-3 ft, 3-6 ft
Acenaphthene	26.1-61.2	N/A	VC1-ALT	0-3 ft, 3-6 ft
			VC1B-ALT	3-6 ft
Acenaphthylene	73.4-83.1	N/A	VC1-ALT	3-6 ft
			VC1B-ALT	3-6 ft
Anthracene	89.5-156	N/A	VC1-ALT	0-3 ft, 3-6 ft
			VC1B-ALT	0-3 ft, 3-6 ft
Benzo(A)Anthracene	304-643	N/A	VC1-ALT	3-6 ft
			VC1B-ALT	0-3 ft, 3-6 ft
Benzo(A)Pyrene	567	N/A	VC1-ALT	3-6 ft
Benzo(G,H,I)Perylene	200-477	N/A	VC1-ALT	0-3 ft, 3-6 ft
			VC1B-ALT	0-3 ft, 3-6 ft
Chrysene	600	N/A	VC1-ALT	3-6 ft
Dibenz(A,H)Anthracene	93-116	N/A	VC1-ALT	3-6 ft
			VC1B-ALT	3-6 ft
Fluoranthene	691-903	N/A	VC1-ALT	3-6 ft
			VC1B-ALT	0-3 ft, 3-6 ft
Fluorene	21-138	N/A	VC1-ALT	0-3 ft, 3-6 ft
			VC1B-ALT	0-3 ft, 3-6 ft
			VC4	0-3 ft
Indeno(1,2,3-C,D)Pyrene	331-385	N/A	VC1-ALT	3-6 ft
			VC1B-ALT	3-6 ft
Naphthalene	174	N/A	VC1-ALT	3-6 ft
Phenanthrene	280-510	N/A	VC1-ALT	3-6 ft
			VC1B-ALT	3-6 ft
Pyrene	785-1110	N/A	VC1-ALT	3-6 ft
			VC1B-ALT	0-3 ft, 3-6 ft
Total PAHs	4230-7000	N/A	VC1-ALT	3-6 ft
			VC1B-ALT	0-3 ft, 3-6 ft

Key:

N/A = Detected concentrations did not exceed the ER-M thresholds.

Table B-7 Number of Detections at Sample Sites in Group B

Sample Site	Number of Detections							
	VOCs	PAHs	Other SVOCs	Dioxins/ Furans	Pesticides	PCB Congener	PCB Aroclor	Metals
VC5	0	7	2	2	0	24	0	26
VC6	0	17	7	14	5	30	2	27
VC7	0	17	9	14	5	29	2	27
VC8	0	0	2	4	0	5	0	25
VC9	0	2	1	2	0	13	0	23
VC10	0	7	1	1	0	2	0	21
VC11 ¹	0	14	0	2	0	0	0	23
VC12 ¹	0	16	0	2	0	0	0	25
VC13	0	17	0	2	0	0	0	24
VC14 ¹	0	15	0	2	0	0	0	23
VC15	0	12	2	3	0	14	0	24
VC16	5	17	6	16	5	30	2	26
VC17	1	17	7	16	7	30	2	26
VC18	0	11	2	3	0	20	0	24
VC19 ¹	0	16	0	2	0	0	0	24
VC20 ¹	0	17	0	2	0	0	0	24
VC21 ¹	0	15	0	2	0	0	0	23
VC22 ¹	0	15	0	3	0	0	0	23
VC23 ¹	0	14	0	3	0	0	0	24
VC24 ¹	0	15	0	2	0	0	0	24
VC25 ¹	0	18	0	1	0	0	0	22
VC26	0	1	0	2	0	0	0	23
VC27 ¹	0	6	0	2	0	0	0	25
VC28 ¹	0	10	0	2	0	0	0	24
VC29 ¹	0	4	0	2	0	0	0	24
VC30 ¹	0	5	0	1	0	0	0	23
VC31-ALT ¹	0	1	0	1	0	0	0	24
VC32 ¹	0	0	0	2	0	0	0	23
VC33-ALT ¹	0	1	0	1	0	0	0	23
VC34 ¹	0	0	0	2	0	0	0	23
VC35	0	0	0	2	0	3	0	24
VC36	0	11	0	2	0	4	0	26
VC37	0	17	5	5	0	14	0	27
VC38	0	17	4	5	2	28	0	27
VC39	NY	9	1	2	0	24	0	26
VC40	NY	1	1	3	0	2	0	25
VC41-ALT	NY	17	3	6	3	27	0	25
VC42 ¹	NY	18	0	3	0	0	0	25
VC43 ¹	NY	3	0	1	0	0	0	19
VC44 ¹	NY	3	0	1	0	0	0	19

Key:

1 - Dioxins and furans were only analyzed in the samples taken from 0-3 feet at sites in New York where clamshell dredging is not anticipated to occur. Dioxin/furan samples for additional depths at these sites were archived. PCB Congeners were not tested at sites in New York where clamshell dredging is not anticipated to occur.

Table B-8 Sample Sites and Samples in Group B Exceeding Class A and/or Class C Thresholds for Metals

Analyte	Concentrations that Exceeded Thresholds		Sample Site	Sample Depth(s)*
	Exceeded Class A (mg/kg)	Exceeded Class C (mg/kg)		
Arsenic	8.61-37.54	87.8	VC5	0-3 ft, 3-6ft, 6-9 ft, 9-12 ft
			VC6	0-3 ft , 3-6ft, 6-9 ft, 9-12 ft
			VC7	0-3 ft, 3-6ft, 6-9 ft, 9-12 ft
			VC8	0-3 ft, 3-6ft, 6-9 ft, 9-12 ft
			VC9	0-3 ft, 3-6ft, 6-9 ft, 9-12 ft
			VC12	0-3 ft
			VC13	0-3 ft, 3-6ft, 6-9 ft, 9-12 ft
			VC14	3-6 ft, 6-9 ft
			VC15	0-3 ft, 3-6ft, 6-9 ft, 9-12 ft, 12-15 ft, 15-16.5 ft
			VC16	0-3 ft, 3-6ft, 6-9 ft, 9-12 ft, 12-15 ft
			VC17	0-3 ft, 3-6ft, 6-9 ft, 9-12 ft, 12-15 ft, 15-17.5 ft
			VC18	3-6 ft, 6-9 ft, 9-12 ft, 12-15 ft, 15-16.2 ft
			VC19	3-6 ft, 6-9 ft, 9-12 ft
			VC20	6-9 ft, 9-12 ft
			VC22	9-12 ft
			VC23	9-12 ft
			VC25	9-11.5 ft
			VC37	0-3 ft
			VC38	0-3 ft
			VC42	3-6 ft
Cadmium	1.3-3.5	N/A	VC6	0-3 ft
			VC7	0-3 ft
			VC16	3-6 ft, 6-9 ft, 9-12 ft
			VC17	6-9 ft, 9-12 ft, 12-15 ft
Chromium	86.5-202.0	N/A	VC6	0-3 ft
			VC7	0-3 ft
			VC16	0-3 ft, f-6 ft, 6-9 ft, 9-12 ft
			VC17	3-6 ft, 6-9 ft, 9-12 ft, 12-15 ft
Copper	37.3-265.0	N/A	VC6	0-3 ft
			VC7	0-3 ft, 3-6 ft
			VC16	0-3 ft, 3-6ft, 6-9 ft, 9-12 ft, 12-15 ft
			VC17	0-3 ft, 3-6ft, 6-9 ft, 9-12 ft, 12-15 ft, 15-17.5 ft
			VC37	0-3 ft
			VC38	0-3 ft
			VC42	3-6 ft
Lead	51.0-198.0	235.0-285.0	VC6	0-3 ft
			VC7	0-3 ft, 3-6 ft
			VC16	0-3 ft, 3-6ft, 6-9 ft, 9-12 ft , 12-15 ft
			VC17	0-3 ft, 3-6ft, 6-9 ft , 9-12 ft, 12-15 ft, 15-17.5 ft
			VC37	0-3 ft
			VC38	0-3 ft
			VC42	3-6 ft
Nickel	21.4-48.7	53.5	VC5	0-3 ft, 3-6ft, 6-9 ft, 9-12 ft
			VC6	0-3 ft, 3-6ft, 6-9 ft, 9-12 ft
			VC7	0-3 ft, f-6 ft, 6-9 ft, 9-12 ft
			VC8	0-3 ft, f-6 ft, 6-9 ft, 9-12 ft
			VC9	0-3 ft, f-6 ft, 6-9 ft, 9-12 ft
			VC13	0-3 ft, f-6 ft, 6-9 ft, 9-12 ft
			VC14	0-3 ft, f-6 ft, 6-9 ft, 9-12 ft
			VC15	0-3 ft, f-6 ft, 6-9 ft, 9-12 ft, 12-15 ft, 15-16.5 ft
			VC16	0-3 ft, 3-6ft, 6-9 ft , 9-12 ft, 12-15 ft
			VC17	0-3 ft, 3-6ft, 6-9 ft, 9-12 ft, 12-15 ft, 15-17.5 ft

Table B-8 Sample Sites and Samples in Group B Exceeding Class A and/or Class C Thresholds for Metals

Analyte	Concentrations that Exceeded Thresholds		Sample Site	Sample Depth(s)*
	Exceeded Class A (mg/kg)	Exceeded Class C (mg/kg)		
			VC18	3-6 ft, 6-9 ft, 9-12 ft, 12-15 ft, 15-16.2 ft
			VC19	3-6 ft, 6-9 ft, 9-12 ft
			VC20	3-6 ft, 6-9 ft, 9-12 ft
			VC23	6-9 ft
			VC27	0-3 ft, 3-6 ft
			VC29	9-12 ft
			VC38	0-3 ft
			VC42	3-6 ft
Silver	1.06-3.55	4.78-8.52	VC6	0-3 ft
			VC7	0-3 ft
			VC16	0-3 ft, <i>3-6 ft, 6-9 ft, 9-12 ft</i> , 12-15 ft
			VC17	0-3 ft, 3-6 ft, <i>6-12 ft</i> , 12-17.5 ft
			VC38	0-3 ft
Zinc	154-390	427-494	VC6	0-3 ft
			VC7	0-3 ft, 3-6 ft
			VC16	0-3 ft, 3-6 ft, <i>6-9 ft, 9-12 ft</i>
			VC17	3-6 ft, 6-9 ft, <i>9-12 ft</i> , 12-17.5 ft
			VC38	0-3 ft
Mercury	0.265-0.515	0.904-4.22	VC6	<i>0-3 ft</i> , 3-6 ft
			VC7	<i>0-3 ft, 3-6 ft</i>
			VC16	<i>0-3 ft, 3-6 ft, 6-9 ft, 9-12 ft</i> , 12-15 ft
			VC17	<i>0-3 ft, 3-6 ft, 6-9 ft, 9-12 ft, 12-15 ft, 15-17.5 ft</i>
			VC37	<i>0-3 ft</i>
			VC38	<i>0-3 ft</i>
			VC41-ALT	0-3 ft
			VC42	<i>3-6 ft</i>

Key:

* Sample depths where Class C thresholds were exceeded are in bold and italics.

Table B-9 Sample Sites and Samples in Group C Exceeding ER-L and/or ER-M Thresholds for PAHs

Analyte	Concentrations that Exceeded Thresholds		Sample Site	Sample Depth(s)*
	Exceeded ER-L (µg/kg)	Exceeded ER-M (µg/kg)		
Acenaphthene	39.4-172	N/A	VC54	0-3 ft, 3-6 ft, 6-9 ft
			VC54B	0-3 ft, 3-6 ft, 6-9 ft
Acenaphthylene	46.3-131	N/A	VC54	0-3 ft, 3-6 ft, 6-9 ft
			VC54B	3-6 ft, 6-9 ft
Anthracene	122-989	N/A	VC54	0-3 ft, 3-6 ft, 6-9 ft
			VC54B	0-3 ft, 3-6 ft, 6-9 ft
Benzo(A)Anthracene	282-1580	1670	VC54	0-3 ft, 3-6 ft, <i>6-9 ft</i>
			VC54B	0-3 ft, 3-6 ft, 6-9 ft
Benzo(A)Pyrene	861-1330	N/A	VC54	0-3 ft, 3-6 ft, 6-9 ft
			VC54B	3-6 ft, 6-9 ft
Benzo(G,H,I)Perylene	440-708	N/A	VC54	0-3 ft, 3-6 ft, 6-9 ft
			VC54B	3-6 ft, 6-9 ft
Benzo(K)Fluoranthene	369-488	N/A	VC54	0-3 ft, 3-6 ft, 6-9 ft
			VC54B	3-6 ft, 6-9 ft
Chrysene	733-1160	N/A	VC54	0-3 ft, 3-6 ft, 6-9 ft
			VC54B	3-6 ft, 6-9 ft
Dibenz(A,H)Anthracene	134-211	N/A	VC54	0-3 ft, 3-6 ft, 6-9 ft
			VC54B	3-6 ft, 6-9 ft
Fluoranthene	1680-2490	N/A	VC54	0-3 ft, 3-6 ft, 6-9 ft
			VC54B	3-6 ft, 6-9 ft
Fluorene	46-263	N/A	VC54	0-3 ft, 3-6 ft, 6-9 ft
			VC54B	3-6 ft, 6-9 ft
Indeno(1,2,3-C,D)Pyrene	457-753	N/A	VC54	0-3 ft, 3-6 ft, 6-9 ft
			VC54B	3-6 ft, 6-9 ft
Phenanthrene	324-1440	1540-1570	VC54	0-3 ft, <i>3-6 ft</i> , 6-9 ft
			VC54B	3-6 ft, <i>6-9 ft</i>
Pyrene	1530-2270	N/A	VC54	0-3 ft, 3-6 ft, 6-9 ft
			VC54B	3-6 ft, 6-9 ft
Total PAHs	10400-15400	N/A	VC54	0-3 ft, 3-6 ft, 6-9 ft
			VC54B	3-6 ft, 6-9 ft

Key:

* Sample depths where ER-M thresholds were exceeded are in bold and italics.

N/A = Detected concentrations did not exceed the ER-M thresholds.

Table B-10 Sample Sites and Samples where Metals Exceeded Class A and/or Class C Thresholds in the Alternative Group

Analyte	Concentrations that Exceeded Thresholds		Sample Site	Sample Depth(s)*
	Exceeded Class A (mg/kg)	Exceeded Class C (mg/kg)		
Arsenic	8.27-49.6	N/A	VC70	0-3 ft, 3-6 ft, 6-9 ft, 9-12 ft
			VC71	0-3 ft, 3-6 ft, 6-9 ft, 9-12 ft
			VC72	0-3 ft, 3-6 ft, 6-9 ft, 9-12 ft
			VC73-ALT	0-3 ft, 9-12 ft
			VC74	6-9 ft
			VC75	0-3 ft
			VC76	0-3 ft, 3-6 ft, 6-9 ft, 9-12 ft
			VC77	0-3 ft, 3-6 ft, 6-9 ft, 9-12 ft, VC12-15.6 ft
			VC78	0-3 ft, 3-6 ft, 6-9 ft, 9-12 ft, VC12-15 ft, VC15-17 ft
			VC79	0-3 ft, 3-6 ft, 6-9 ft, 9-12 ft, VC12-16 ft
			VC80	0-3 ft, 3-6 ft, 6-9 ft, 9-12 ft, VC12-15 ft, VC15-16.5 ft
			VC81	0-3 ft, 3-6 ft, 6-9 ft, 9-12 ft, VC12-14.75 ft
			VC82	0-3 ft, 6-9 ft, 9-12 ft
Cadmium	1.23-3.36	N/A	VC70	0-3 ft
			VC76	0-3 ft
			VC80	3-6 ft, 6-9 ft
			VC81	3-6 ft, 6-9 ft, 9-12 ft
Chromium	85.2-198	N/A	VC70	0-3 ft
			VC76	0-3 ft
			VC77	0-3 ft
			VC80	3-6 ft, 6-9 ft
			VC81	0-3 ft, 3-6 ft, 6-9 ft, 9-12 ft
Copper	36.4-230	N/A	VC70	0-3 ft
			VC75	0-3 ft
			VC76	0-3 ft
			VC77	0-3 ft
			VC78	0-3 ft
			VC80	0-3 ft, 3-6 ft, 6-9 ft
			VC81	0-3 ft, 3-6 ft, 6-9 ft, 9-12 ft
			VC82	0-3 ft
Lead	67.9-194	223	VC70	0-3 ft
			VC75	0-3 ft
			VC76	0-3 ft
			VC77	0-3 ft
			VC78	0-3 ft, 6-9 ft
			VC80	0-3 ft, 3-6 ft , 6-9 ft
			VC81	0-3 ft, 3-6 ft, 6-9 ft, 9-12 ft
			VC82	0-3 ft
Nickel	22.3-48.4	N/A	VC70	0-3 ft, 3-6 ft, 6-9 ft, 9-12 ft
			VC71	0-3 ft, 3-6 ft, 6-9 ft, 9-12 ft
			VC72	0-3 ft, 3-6 ft, 6-9 ft, 9-12 ft
			VC75	0-3 ft
			VC76	0-3 ft, 3-6 ft, 6-9 ft, 9-12 ft
			VC77	0-3 ft, 3-6 ft, 6-9 ft, 9-12 ft, 12-15.6 ft
			VC78	0-3 ft, 3-6 ft, 6-9 ft, 9-12 ft, 12-15 ft, 15-17 ft
			VC79-ALT	0-3 ft, 3-6 ft, 6-9 ft, 9-12 ft, 12-16 ft
			VC80	0-3 ft, 3-6 ft, 6-9 ft, 9-12 ft, 12-15 ft, 15-16.5 ft
			VC81	0-3 ft, 3-6 ft, 6-9 ft, 9-12 ft, 12-14.75 ft
			VC82	0-3 ft, 3-6 ft, 6-9 ft, 9-12 ft, 12-16 ft

Table B-10 Sample Sites and Samples where Metals Exceeded Class A and/or Class C Thresholds in the Alternative Group

Analyte	Concentrations that Exceeded Thresholds		Sample Site	Sample Depth(s)*
	Exceeded Class A (mg/kg)	Exceeded Class C (mg/kg)		
Silver	1.68-2.74	3.98-7.09	VC70	<i>0-3 ft</i>
			VC76	<i>0-3 ft</i>
			VC77	0-3 ft
			VC78	0-3 ft
			VC80	0-3 ft, <i>3-6 ft, 6-9 ft</i>
			VC81	0-3 ft, <i>3-6 ft, 6-9 ft, 9-12 ft</i>
Zinc	190-404	N/A	VC70	0-3 ft
			VC76	0-3 ft
			VC77	0-3 ft
			VC78	0-3 ft
			VC80	0-3 ft, 3-6 ft, 6-9 ft
			VC81	0-3 ft, 3-6 ft, 6-9 ft, 9-12 ft
Mercury	0.191-0.337	1.03-3.49	VC70	<i>0-3 ft</i> , 3-6 ft
			VC73-ALT	0-3 ft
			VC75	<i>0-3 ft</i>
			VC76	<i>0-3 ft</i>
			VC77	<i>0-3 ft</i> , 3-6 ft
			VC78	<i>0-3 ft</i>
			VC79	0-3 ft
			VC80	<i>0-3 ft</i>
			VC81	<i>0-3 ft, 3-6 ft, 6-9 ft, 9-12 ft</i> , 12-14.75 ft
			VC82	<i>0-3 ft</i>

Key:

* Sample depths where Class C thresholds were exceeded are in bold and italics.

N/A = Detected concentrations did not exceed the Class C thresholds.

Table B-11 Sediment Grain Sizes from Vibracore Samples

Sample Site	Sample Depth	% Gravel (#4 Sieve) ¹	% Sand (#200 Sieve) ¹	% Fines (< #200 Sieve)	Water Content (%) ²	USCS Symbol ¹
VC2	2'9.5"-3'9.5"	8.4	61.7	29.9	46.8	SC
VC2	8'3.5"-9'3.5"	0.0	2.4	97.6	28.0	CH
VC3-ALT	0-1'	0.0	17.4	82.6	124.1	CH
VC3-ALT	5'11.04"	ND	ND	89.9	87.7	ND
VC4	1-2'	0.3	4.5	95.2	95.0	CH
VC4	2-2'9.5"	0.0	5.2	94.8	90.9	CH
VC4	4'2.04"	ND	ND	98.0	88.4	ND
VC5	1-2'3.5"	0.0	4.5	95.5	105.2	CH
VC5	4'2.04"	ND	ND	97.0	114.5	ND
VC6	3'2.04"	ND	ND	98.9	134.0	ND
VC6	9'6"	ND	ND	95.4	95.4	ND
VC7	0-1'	1.1	6.1	92.8	132.8	CH
VC7	3'-4'	0.5	8.0	91.5	88.2	CH
VC7	6'2.04"	ND	ND	96.8	108.3	ND
VC8	7'10"-8'10"	0.0	5.0	95.0	104.5	CH
VC9	2'9.5"-4'	0.1	5.9	94.0	113.0	CH
VC9	9'0"	ND	ND	98.4	94.4	ND
VC10	2'8"-4'	32.6	65.4	2.0	45.9	SP
VC10	8'7"-10'	32.0	65.6	2.4	42.2	SP
VC11	0-1'	21.1	68.7	10.2	36.9	SP-SM
VC12	6'4"-7'4"	15.1	82.5	2.4	19.1	SP
VC14	0-1'	3.7	7.0	89.3	88.7	CH
VC14	2'10"-4'	0.3	7.6	92.1	105.8	CH
VC14	5'9"-7'	0.0	7.2	92.8	105.3	CH
VC15	1"-1'1"	0.2	6.8	93.0	86.6	CH
VC15	6'2.04"	ND	ND	96.3	87.2	ND
VC15	12'2.04"	ND	ND	95.3	84.5	ND
VC16	0-1'	0.0	4.2	95.8	152.7	CH
VC16	2'11.04"	ND	ND	94.8	132.1	ND
VC16	12'0"	ND	ND	98.7	129.0	ND
VC17	0-1'	0.0	12.5	87.5	169.9	MH
VC17	3'-4'	0.0	5.0	95.0	136.3	MH
VC17	6'2.04"	ND	ND	93.0	106.7	ND
VC17	9'2.04"	ND	ND	94.7	88.8	ND
VC17	12'2.04"	ND	ND	95.2	83.1	ND
VC18	2'8"-4'	0.0	6.7	93.3	92.7	CH
VC18	11'9"	ND	ND	98.0	78.9	ND
VC18	13'9"	ND	ND	98.3	89.8	ND
VC19	0-1'	0.3	15.2	84.5	61.3	CH
VC19	2'9"-4'	0.0	8.9	91.1	84.0	CH
VC19	5'9"	ND	ND	91.1	72.4	ND
VC20	1"-1'1"	0.1	23.3	76.6	60.9	CL
VC20	3'9.6"	ND	ND	81.9	65.7	ND
VC21	2.5"-1'2.5"	0.1	79.3	20.6	31.3	SM
VC21	2'7.5"-4'	6.9	51.0	42.1	47.3	SC
VC21	5'7.5"-7'	0.6	23.1	76.3	92.2	CL
VC21	8'8"-10'	0.2	36.9	62.9	85.6	CL
VC21	10'7"-11'7"	0.9	55.9	43.2	66.8	SC
VC22	0-1'	0.0	58.7	41.3	35.3	SC
VC22	3'-4'	40.2	46.4	13.4	29.2	SM
VC22	6'-7'	12.2	86.6	1.2	27.8	SP

Table B-11 Sediment Grain Sizes from Vibracore Samples

Sample Site	Sample Depth	% Gravel (#4 Sieve) ¹	% Sand (#200 Sieve) ¹	% Fines (< #200 Sieve)	Water Content (%) ²	USCS Symbol ¹
VC22	9'-10'	29.7	68.2	2.1	37.8	SP
VC22	11'5"-12'5"	29.3	68.8	1.9	45.7	SP
VC23	0-1'	0.2	52.2	47.6	44.7	SC
VC23	2'7"-4'	0.7	29.2	70.1	73.7	CL
VC23	6'-7'	0.0	33.6	66.4	80.9	CL
VC23	9'-10'	0.3	28.9	70.8	80.7	CL
VC23	10'5.5-11'6"	1.6	42.1	56.3	69.0	CL
VC24	0-1'	0.2	70.3	29.5	33.5	SC
VC24	2'8"-4'	2.6	49.1	48.3	51.6	SC
VC24	6'-7'	1.0	78.8	20.2	34.8	SC
VC24	9'-10'	0.3	96.8	2.9	20.6	SP
VC24	10'-11'5.5"	18.7	77.0	4.3	21.0	SP
VC25	0-1'	5.1	89.1	5.8	13.3	SP-SM
VC25	3'-4'	18.9	78.7	2.4	28.0	SP
VC25	6'-7'	4.2	89.8	6.0	20.8	SP-SM
VC25	10'-11'4.5"	29.3	67.9	2.8	34.8	SP
VC26	0-1'	0.2	97.8	2.0	12.8	SP
VC27	0-1'	10.2	82.5	7.3	22.0	SP-SM
VC27	5'7.5"-7'	3.9	93.8	2.3	32.9	SP
VC27	10'6"-11'6"	0.0	95.8	4.2	34.8	SP
VC28	0-1'	0.6	81.3	18.1	28.8	SM
VC28	6'-7'	14.8	80.4	4.8	24.4	SP
VC28	9'-10'	27.3	69.4	3.3	30.6	SP
VC29	0-1'	1.9	75.9	22.2	28.4	SM
VC29	6'-7'	5.2	92.1	2.7	31.9	SP
VC29	9'11"-11'3.5"	31.0	67.5	1.5	32.0	SP
VC30	3'-4'	3.2	93.9	2.9	28.4	SW
VC30	5'11.5"-6'11.5"	0.7	97.2	2.1	22.6	SP
VC30	9'-10'	1.1	96.4	2.5	31.9	SP
VC31-ALT	0-1'	0.0	93.3	6.7	22.6	SP-SM
VC31-ALT	5'7"-7'	2.1	35.0	62.9	63.2	CL
VC31-ALT	10'7"-11'7"	7.5	89.9	2.6	34.9	SP
VC32	3'-4'	5.3	91.7	3.0	34.0	SP
VC32	9'-10'	0.5	96.2	3.3	37.6	SP
VC32	10'-11'1"	0.0	96.1	3.9	48.0	SP
VC33-ALT	0-1'	0.8	94.9	4.3	15.8	SP
VC33-ALT	6'-7'	0.0	95.5	4.5	26.6	SP
VC33-ALT	10'-11'5.5"	2.4	94.7	2.9	32.9	SP
VC34	0-1'	0.8	96.9	2.3	11.2	SP
VC34	6'-7'	0.5	94.2	5.3	32.8	SP-SM
VC35	0-1'	3.5	87.4	9.1	15.3	SP-SM
VC35	3'-4'	0.0	83.8	16.2	31.9	SM
VC35	6'-7'	2.8	96.0	1.2	23.1	SP
VC36	0-1'	0.4	66.9	32.7	33.4	SC
VC36	6'-7'	10.7	87.6	1.7	30.5	SP
VC36	9'-10'	1.8	96.7	1.5	39.3	SP
VC36	12'-13'	1.3	97.5	1.2	47.3	SP
VC36	14'5"-15'5"	0.7	98.4	0.9	29.2	SP
VC37	3'-4'	0.0	91.0	9.0	29.9	SP-SM
VC37	6'-7'	2.8	91.8	5.4	28.3	SP-SM
VC37	9'-10'	0.8	97.3	1.9	47.7	SP

Table B-11 Sediment Grain Sizes from Vibracore Samples

Sample Site	Sample Depth	% Gravel (#4 Sieve) ¹	% Sand (#200 Sieve) ¹	% Fines (< #200 Sieve)	Water Content (%) ²	USCS Symbol ¹
VC37	13'8.5"-15'5"	0.0	93.5	6.5	43.0	SP-SM
VC38	0-1'	0.0	31.6	68.4	70.3	OH
VC38	2'1"-4'	0.2	51.0	48.8	55.8	SM
VC38	6'-7'	2.0	87.9	10.1	39.1	SP-SM
VC38	9'-10'	1.2	97.1	1.7	46.9	SP
VC38	12'-13'	3.8	95.1	1.1	36.5	SP
VC38	14'3"-15'3"	2.5	94.2	3.3	42.5	SP
VC39	0-1'	0.5	80.7	18.8	27.3	SM
VC39	5'7.5"-7'	2.0	83.8	14.2	40.3	SM
VC39	9'-10'	4.2	91.0	4.8	25.4	SP
VC39	12'-13'	0.1	54.8	45.1	34.7	SC
VC39	14'2"-15'2"	0.0	80.6	19.4	30.0	SM
VC40	0-1'	0.0	94.7	5.3	26.8	SP-SM
VC40	6'-7'	0.5	88.7	10.8	28.1	SP-SM
VC40	12'-13'	0.0	80.9	19.1	38.8	SC
VC40	14'-15'5"	3.7	89.6	6.7	26.6	SP-SM
VC41-ALT	0-2.75"	12.1	77.9	10.0	19.3	SM
VC41-ALT	2'7.5"-3'11"	1.3	89.4	9.3	33.0	SP-SM
VC41-ALT	6'-7'	0.1	96.1	3.8	36.8	SP
VC41-ALT	9'-10'	0.0	97.0	3.0	35.4	SP
VC41-ALT	14'-15'6"	0.0	92.2	7.8	37.7	SP-SM
VC42	0-2"	10.2	86.5	3.3	6.8	SM
VC42	2"-1'2"	10.6	81.9	7.5	13.8	SP-SM
VC42	6'-7'	10.1	68.8	21.1	40.6	SM
VC42	10'-11'4"	0.4	97.8	1.8	43.9	SP
VC43	0-1'	0.2	99.4	0.4	7.4	SP
VC43	5'11"-7'	0.2	98.6	1.2	20.8	SP
VC43	10'11"-11'11"	0.1	97.7	2.2	31.8	SP
VC44	0-1'	0.6	99.0	0.4	9.7	SP
VC44	2'10"-4'	0.0	99.6	0.4	39.6	SP
VC44	5'10.5"-7'	1.3	98.2	0.5	24.9	SP
VC44	10'11.5"-12'	0.0	97.2	2.8	42.5	SP
VC45-ALT	0-1'	2.3	97.2	0.5	5.6	SP
VC45-ALT	2'9.5"-4'	0.1	99.6	0.3	28.2	SP
VC45-ALT	8'10"-10'	0.0	98.9	1.1	37.4	SP
VC45-ALT	10'10.5"-11'10"	0.0	98.3	1.7	39.4	SP
VC46	0-1'	12.9	73.8	13.3	21.6	SM
VC46	3'1"-4'1"	0.8	98.8	0.4	27.5	SP
VC46	6'1.5"-7'1.5"	0.2	98.7	1.1	42.9	SP
VC46	11'1.5"-12'2"	0.0	98.4	1.6	41.3	SP
VC47	0-1'	3.1	94.4	2.5	19.9	SP
VC47	3'6"	ND	ND	51.4	49.5	ND
VC47	5'9.5"-7'	0.9	98.7	0.4	30.4	SP
VC47	8'9"-10'	0.6	97.3	2.1	36.8	SP
VC47	10'8.5"-11'8.5"	0.1	97.8	2.1	39.8	SP
VC48-ALT	0-1'	1.0	98.1	0.9	12.9	SP
VC48-ALT	3'-4'	0.0	99.2	0.8	35.0	SP
VC48-ALT	6'-7'	0.3	99.0	0.7	39.3	SP
VC48-ALT	9'0.5"-10'0.5"	0.0	98.8	1.2	28.7	SP
VC48-ALT	10'6.5"-11'7"	0.0	98.1	1.9	52.0	SP

Table B-11 Sediment Grain Sizes from Vibracore Samples

Sample Site	Sample Depth	% Gravel (#4 Sieve) ¹	% Sand (#200 Sieve) ¹	% Fines (< #200 Sieve)	Water Content (%) ²	USCS Symbol ¹
VC49	2'11"-4'	0.0	98.3	1.7	16.7	SP
VC49	6'-7'	0.2	99.5	0.3	18.7	SP
VC49	11'-12'	0.0	98.2	1.8	40.2	SP
VC50	0-1'	0.8	98.0	1.2	28.7	SP
VC50	1-2'	0.0	98.7	1.3	28.7	SP
VC50	2'10.5"-4'	0.9	98.6	0.5	20.6	SP
VC50	5'11.5"-7'	0.0	100.0	0.0	27.1	SP
VC51	3'-4'	0.0	98.7	1.3	37.3	SP
VC51	6'1"-7'2"	0.7	96.1	3.2	28.3	SP
VC51	9'1.5"-10'1.5"	0.0	98.0	2.0	29.1	SP
VC52	2'9.5"-4'	0.0	99.1	0.9	35.9	SP
VC52	8'10.5"-10'	0.2	98.0	1.8	25.0	SP
VC53	0-1'	0.1	99.6	0.3	9.4	SP
VC53	2'11.5"-4'	3.2	95.4	1.4	33.7	SP
VC53	6'-7'	1.3	96.0	2.7	27.3	SP
VC53	9'-10'	0.2	96.6	3.2	32.9	SP
VC53	11'1"-12'1"	0.5	95.9	3.6	34.3	SP
VC54	0-1'	0.2	97.0	2.8	12.6	SP
VC54	5'11.5"-7'	0.1	92.9	7.0	30.6	SP-SM
VC54	11'0.5"-12'0.5"	0.1	79.6	20.3	36.0	SC
VC55	0-1'	0.0	99.4	0.6	12.3	SP
VC55	3'1"-4'1"	4.3	94.5	1.2	24.3	SP
VC55	6'3"-7'3"	14.4	84.7	0.9	45.4	SP
VC55	9'7.5"-12'4"	0.4	98.1	1.5	5.8	SP
VC55	12'4"-13'4"	0.1	98.9	1.0	40.3	SP
VC55	15'5"-16'5"	4.1	95.3	0.6	30.8	SP
VC55	18'6"-21'6"	8.1	90.1	1.8	7.7	SP
VC55	21'6"-22'6"	3.8	94.0	2.2	24.2	SP
VC55	24'7"-25'7"	4.9	92.9	2.2	31.5	SP
VC55	27'7.5"-28'5"	0.7	96.6	2.7	22.6	SP
VC56	0-1'	6.6	93.1	0.3	11.4	SP
VC56	2'9"-4'	0.2	99.5	0.3	17.4	SP
VC56	8'10"-10'	3.0	96.3	0.7	15.7	SP
VC57	0-1'	8.0	91.4	0.6	13.5	SP
VC57	2'11.5"-4'	3.8	93.7	2.5	39.1	SP
VC57	6'-7'	18.4	78.9	2.7	45.9	SP
VC57	9'0.5"-10'	2.5	95.9	1.6	28.9	SP
VC57	11'1"-12'1.5"	0.1	98.2	1.7	35.2	SP
VC58	0-1'	4.1	95.9	0.0	12.2	SP
VC58	2'11"-4'	0.0	99.4	0.6	24.7	SP
VC58	9'0.5"-10'	0.0	98.5	1.5	27.7	SP
VC58	11'-12'	0.0	96.9	3.1	35.7	SP
VC59	0-1'	3.2	96.0	0.8	15.9	SP
VC59	2'10.5"-4'	0.1	94.8	5.1	25.8	SP-SM
VC59	5'10"-7'	3.3	96.2	0.5	33.9	SP
VC60	0-1'	22.8	76.4	0.8	32.9	SP
VC60	2'10.5"-4'	0.0	99.6	0.4	30.9	SP
VC60	6'0.5"-7'	0.0	99.5	0.5	25.8	SP
VC61-ALT	0-1'	1.2	97.4	1.4	11.3	SP
VC61-ALT	3'-4'	0.0	99.5	0.5	40.1	SP

Table B-11 Sediment Grain Sizes from Vibracore Samples

Sample Site	Sample Depth	% Gravel (#4 Sieve) ¹	% Sand (#200 Sieve) ¹	% Fines (< #200 Sieve)	Water Content (%) ²	USCS Symbol ¹
VC62	0-1'	2.3	95.9	1.8	11.4	SP
VC62	3'-4'2"	4.0	94.4	1.6	21.8	SP
VC63	0-1'	0.2	91.7	8.1	26.8	SP-SM
VC63	3'-4'	0.0	94.5	5.5	37.0	SP-SM
VC63	6'-7'0.5"	0.0	96.2	3.8	40.0	SP
VC64	0-1'	0.5	95.9	3.6	24.5	SP
VC64	3'-4'	0.3	96.3	3.4	36.9	SP
VC64	5'-6'0.5"	11.1	87.6	1.3	27.8	SP
VC65	0-1'	2.8	94.4	2.8	10.1	SP
VC65	3'-4'2"	0.4	98.6	1.0	28.1	SP
VC66	0-1'	0.4	93.5	6.1	30.9	SP-SM
VC66	3'1"-4'8"	0.0	99.4	0.6	46.2	SP
VC67	0-1'	0.2	93.7	6.1	22.0	SP-SM
VC67	4'1"-4'11"	0.1	96.2	3.7	42.9	SP
VC68	0-1'	3.1	93.2	3.7	25.9	SP
VC68	3'-4'3"	0.0	95.4	4.6	32.2	SP
VC68	5'3"-6'3"	1.9	91.8	6.3	36.8	SP-SM
VC69-ALT	0-1'	4.1	93.5	2.4	20.8	SP
VC69-ALT	3'2"-4'2"	0.3	97.0	2.7	27.9	SP
VC69-ALT	6'3"-7'3"	0.7	92.9	6.4	38.9	SP-SM
VC70	3'-4'	2.2	8.0	89.8	115.1	CH
VC70	6'-7'	7.1	3.3	89.6	113.5	CH
VC71	0-1'	0.1	4.5	95.4	112.1	CH
VC72	6'6.5"-7'6.5"	0.0	2.5	97.5	115.8	CH
VC73-ALT	0-1'	4.0	91.9	4.1	20.4	SP
VC73-ALT	3'5.5"-4'5.5"	50.6	45.2	4.2	17.5	GP
VC73-ALT	9'-10'	19.6	78.0	2.4	14.3	SP
VC74-ALT	0-1'	5.3	88.5	6.2	17.2	SP-SM
VC74-ALT	6'-7'	8.7	89.6	1.7	39.4	SP
VC74-ALT	9'-10'	6.2	90.9	2.9	32.1	SP
VC75	0-1'	0.9	21.1	78.0	98.0	CH
VC75	2'6.5"-4'	19.0	68.5	12.5	48.2	SC
VC75	6'-7'	1.9	93.6	4.5	30.2	SP
VC75	9'-10'	0.7	96.8	2.5	27.7	SP
VC78	0-1'	0.9	10.7	88.4	114.9	CH
VC78	6'2.04"	ND	ND	94.8	90.8	ND
VC79-ALT	2'9.96"	ND	ND	93.5	94.5	ND
VC79-ALT	8'9"	ND	ND	96.9	105.8	ND
VC81	0-1'	0.0	12.2	87.8	187.0	CH
VC81	6'2.04"	ND	ND	96.7	131.3	ND
VC81	12'2.04"	ND	ND	94.9	87.7	ND
VC81	14'6.48"	ND	ND	98.1	75.9	ND
VC82	9'2.04"	ND	ND	82.1	61.5	ND
VC82	11'3"	ND	ND	96.7	70.0	ND
VC83-ALT	0-1'	1.2	94.6	4.2	24.6	SP
VC83-ALT	2'7"-4'	1.5	89.7	8.8	27.5	SP-SM
VC83-ALT	6'-7'	0.3	93.5	6.2	30.4	SP-SM
VC84-ALT	0-1'	4.6	87.4	8.0	21.6	SP-SM
VC84-ALT	5'8"-7'	26.3	70.9	2.8	26.8	SP
VC84-ALT	10'-11'1"	1.2	96.2	2.6	32.3	SP

Table B-11 Sediment Grain Sizes from Vibracore Samples

Sample Site	Sample Depth	% Gravel (#4 Sieve) ¹	% Sand (#200 Sieve) ¹	% Fines (< #200 Sieve)	Water Content (%) ²	USCS Symbol ¹
VC85	0-1'	1.8	93.5	4.7	32.7	SP
VC85	8'5"-9'5"	0.0	96.1	3.9	31.9	SP
VC85	9'5"-10'5"	7.6	82.8	9.6	42.1	SP-SM
VC86-ALT	0-1'	2.1	92.3	5.6	26.7	SP-SM
VC86-ALT	3'-4'	0.1	96.5	3.4	49.6	SP
VC86-ALT	6'-7'	3.7	94.8	1.5	35.9	SP
VC87	0-1'	0.2	72.5	27.3	26.6	SM
VC87	8'9"-9'8.5"	0.0	95.2	4.8	19.1	SP

¹ Samples with reported values of "ND" did not have an accompanying sieve analysis and have no available data.

² Water Content (%) is a measure of the ratio of water to sediment in a given sample. When the reported value exceeds 100%, more water than sediment was present in the sample.

Key:

CH = Inorganic clays of high plasticity, fat clays
 CL = Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
 GP = Poorly-graded gravels, gravel-sand mixtures, little or no fines
 MH = Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
 ND = no data
 OH = Organic clays of medium to high plasticity, organic silts
 SC = Clayey sands, sand-clay mixtures
 SM = Silty sands, sand-silt mixtures
 SP = Poorly graded sands, gravelly sands, little or no fines
 SW = Well-graded sands, gravelly sands, little or no fines
 USCS = Unified Soil Classification System

Table B-12 Sediment Grain Sizes from Benthic Grab Samples

Sample ID	% Gravel (#4 Sieve)	% Sand (#200 Sieve)	% Fines (< #200 Sieve)	Water Content (%)	USCS Symbol ¹
VC1-ALT	0.2	90.4	9.4	45.8	SP-SM
VC2	1.3	88.8	9.9	30.2	SP-SM
VC3-ALT	18.3	22.4	59.3	60.1	OH
VC4	6.0	10.7	83.3	105.0	OH
VC5	4.7	13.9	81.4	109.9	OH
VC6	0.0	2.6	97.4	128.6	OH
VC7	0.0	4.3	95.7	137.4	OH
VC8	39.1	33.2	27.7	40.9	GC
VC9	16.3	49.9	33.8	50.5	SC
VC10	12.5	82.1	5.4	28.2	SP-SM
VC11	2.4	91.7	5.9	24.5	SP-SM
VC12	21.0	37.2	41.8	14.4	SM
VC13	26.8	36.6	36.6	46.7	SC
VC14	33.0	37.5	29.5	52.3	SM
VC15	16.1	44.0	39.9	50.6	SC
VC16	0.0	3.9	96.1	122.0	OH
VC17	0.0	6.0	94.0	131.8	OH
VC18	32.3	34.1	33.6	47.5	SC
VC19	0.0	45.2	54.8	55.8	CL
VC20	12.4	50.2	37.4	48.5	SC
VC21	7.4	74.6	18.0	27.2	SM
VC22	20.1	62.9	17.0	40.7	SM
VC23	20.7	64.6	14.7	33.7	SC
VC24	2.4	88.1	9.5	30.5	SP-SM
VC25	0.3	93.5	6.2	29.5	SP-SM
VC26	2.5	96.1	1.4	23.7	SP
VC27	1.4	93.3	5.3	23.0	SP-SM
VC28	1.5	93.1	5.4	24.0	SP-SM
VC29	4.3	90.6	5.1	25.0	SP-SM
VC30	0.3	94.5	5.2	23.7	SP-SM
VC31-ALT	0.7	93.9	5.4	25.5	SP-SM
VC32	4.6	92.5	2.9	26.2	SP
VC33-ALT	0.6	97.5	1.9	22.0	SP
VC34	0.4	96.8	2.8	28.5	SP
VC35	3.2	94.0	2.8	17.8	SP
VC36	0.4	96.7	2.9	24.6	SP
VC37	3.3	66.0	30.7	55.3	SM
VC38	4.3	62.7	33.0	61.8	SM
VC39	0.2	91.0	8.8	35.2	SP-SM
VC40	0.0	89.4	10.6	27.6	SP-SM
VC41-ALT	20.1	61.7	18.2	41.1	SC

Table B-12 Sediment Grain Sizes from Benthic Grab Samples

Sample ID	% Gravel (#4 Sieve)	% Sand (#200 Sieve)	% Fines (< #200 Sieve)	Water Content (%)	USCS Symbol ¹
VC42	9.8	88.2	2.0	21.1	SP
VC43	1.6	97.3	1.1	22.1	SP
VC44	6.0	93.2	0.8	22.2	SP
VC45-ALT	6.5	92.2	1.3	22.6	SP
VC46	0.6	98.5	0.9	24.1	SP
VC47	0.2	99.0	0.8	24.0	SP
VC48-ALT	2.1	96.3	1.6	27.5	SP
VC49	0.0	98.9	1.1	32.3	SP
VC50	0.2	98.8	1.0	25.9	SP
VC51	0.8	98.4	0.8	24.9	SP
VC52	0.0	99.0	1.0	27.2	SP
VC53	0.0	99.0	1.0	26.0	SP
VC54	0.0	99.1	0.9	21.8	SP
VC55	0.0	99.2	0.8	19.7	SP
VC56	0.4	98.8	0.8	22.5	SP
VC57	11.4	87.8	0.8	19.7	SP
VC58	1.0	97.5	1.5	27.3	SP
VC59	0.9	98.0	1.1	25.6	SP
VC60	2.6	96.6	0.8	19.7	SP
VC61-ALT	0.0	99.0	1.0	26.7	SP
VC62	1.4	96.4	2.2	26.7	SP
VC63	0.0	96.7	3.3	25.5	SP
VC64	0.5	95.7	3.8	26.5	SP
VC65	0.6	96.1	3.3	33.4	SP
VC66	0.5	96.2	3.3	29.3	SP
VC67	0.4	95.9	3.7	31.2	SP
VC68	0.0	97.8	2.2	30.4	SP
VC69-ALT	0.0	97.8	2.2	27.3	SP
VC70	0.4	2.2	97.4	155.4	OH
VC71	22.2	41.6	36.2	53.4	SC
VC72	15.9	60.5	23.6	57.6	SM
VC73-ALT	18.0	65.7	16.3	50.7	SM
VC74	4.1	89.7	6.2	34.9	SP-SM
VC75	43.2	13.9	42.9	55.0	GC
VC76	0.2	5.3	94.5	120.0	OH
VC77	0.0	5.5	94.5	117.3	OH
VC78	15.2	4.9	79.9	100.8	OH
VC79-ALT	0.3	12.7	87.0	113.3	OH
VC80	0.0	5.7	94.3	123.1	OH
VC81	0.0	4.5	95.5	132.9	OH
VC82	31.5	43.4	25.1	44.4	SC

Table B-12 Sediment Grain Sizes from Benthic Grab Samples

Sample ID	% Gravel (#4 Sieve)	% Sand (#200 Sieve)	% Fines (< #200 Sieve)	Water Content (%)	USCS Symbol ¹
VC83-ALT	1.5	96.6	1.9	25.6	SP
VC84-ALT	0.9	96.5	2.6	24.1	SP
VC85	6.5	91.5	2.0	21.6	SP
VC86-ALT	1.4	96.8	1.8	18.6	SP
VC87	0.3	91.5	8.2	27.1	SP-SM

¹ Water Content (%) is a measure of the ratio of water to sediment in a given sample. When the reported value exceeds 100%, more water than sediment was present in the sample.

Key:

CL = Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays

GC = Clayey gravels, gravel-sand-clay mixtures

OH = Organic clays of medium to high plasticity, organic silts

SC = Clayey sands, sand-clay mixtures

SM = Silty sands, sand-silt mixtures

SP = Poorly graded sands, gravelly sands, little or no fines

USCS = Unified Soil Classification System

Table B-13 Physical Water Quality Sample Locations

Sample Site	State	Maximum Depth Sampled	Sample Site	State	Maximum Depth Sampled
VC1-ALT	NJ	16	VC45-ALT	NJ	18
VC2	NJ	12	VC46	NJ	20
VC3-ALT	NJ	14	VC47	NJ	18
VC4	NJ	16	VC48-ALT	NJ	18
VC5	NY	16	VC49	NJ	18
VC6	NY	18	VC50	NJ	18
VC7	NY	20	VC51	NJ	24
VC8	NY	18	VC52	NJ	22
VC9	NY	18	VC53	NJ	24
VC10	NY	14	VC54	NJ	40
VC11	NY	16	VC55	NJ	18
VC12	NY	16	VC56	NY	20
VC13	NY	16	VC57	NY	26
VC14	NY	18	VC58	NY	34
VC15	NY	22	VC59	NY	32
VC16	NY	34	VC60	NY	28
VC17	NY	36	VC61-ALT	NY	28
VC18	NY	20	VC62	NY	30
VC19	NY	18	VC63	NY	32
VC20	NY	22	VC64	NY	32
VC21	NY	20	VC65	NY	34
VC22	NY	20	VC66	NY	38
VC23	NY	20	VC67	NY	40
VC24	NY	18	VC68	NY	40
VC25	NY	20	VC69-ALT	NY	40
VC26	NY	18	VC70	NY	18
VC27	NY	20	VC71	NY	16
VC28	NY	22	VC72	NY	18
VC29	NY	22	VC73-ALT	NY	16
VC30	NY	20	VC74	NY	16
VC31-ALT	NY	18	VC75	NY	22
VC32	NY	18	VC76	NY	20
VC33-ALT	NY	20	VC77	NY	22
VC34	NY	22	VC78	NY	22
VC35	NY	24	VC79-ALT	NY	28
VC36	NY	24	VC80	NY	36
VC37	NY	24	VC81	NY	32
VC38	NY	28	VC82	NY	20
VC39	NY	36	VC83-ALT	NY	16
VC40	NY	36	VC84-ALT	NY	16
VC41-ALT	NY	28	VC85	NY	18
VC42	NY	16	VC86-ALT	NY	22
VC43	NY	16	VC87	NY	22
VC44	NY	18			

Table B-14 Benthic Macroinvertebrate Taxonomic List for Preferred Route

Taxonomic Name	Frequency of Occurrence	Count (N=207)	Relative Abundance (%)
<i>Acanthohaustorius shoemakeri</i>	11	25.0	0.0153
<i>Acanthohaustorius similis</i>	37	303.0	0.1851
<i>Acteocina canaliculata</i>	21	304.9	0.1862
<i>Alitta succinea</i>	15	226.9	0.1386
<i>Amastigos caperatus</i>	2	5.0	0.0031
<i>Americhelidium americanum</i>	18	53.7	0.0328
<i>Ameritella agilis</i>	116	2199.7	1.3437
<i>Ampelisca abdita</i>	32	1942.1	1.1864
<i>Ampelisca vadorum</i>	9	83.4	0.0509
<i>Ampelisca verrilli</i>	12	182.3	0.1113
<i>Ampharete oculata</i>	7	41.9	0.0256
<i>Amphiporeia virginiana</i>	1	1.0	0.0006
<i>Amphiporus bioculatus</i>	34	325.9	0.1991
<i>Amphiporus ochraceus</i>	4	42.0	0.0257
<i>Anachis lafresnayi</i>	1	1.0	0.0006
<i>Anadara transversa</i>	5	14.0	0.0086
<i>Ancinus depressus</i>	39	97.2	0.0594
<i>Aphelocheata</i> sp.	1	2.3	0.0014
<i>Apoprionospio pygmaea</i>	28	276.7	0.1690
<i>Aricidea</i> (Acmira) <i>catherinae</i>	6	50.7	0.0309
<i>Aricidea</i> (Acmira) <i>cerruti</i>	1	1.0	0.0006
<i>Aricidea</i> (Acmira) sp.	20	198.7	0.1214
<i>Aricidea wassi</i>	7	17.0	0.0104
<i>Asmunda elegantula</i>	5	134.9	0.0824
<i>Astyris lunata</i>	1	1.0	0.0006
<i>Batea catharinensis</i>	5	24.1	0.0147
<i>Bathyporeia quoddyensis</i>	9	27.0	0.0165
<i>Bivalvia</i>	5	73.2	0.0447
<i>Boonea impressa</i>	1	8.0	0.0049
<i>Boonea seminuda</i>	2	24.0	0.0147
<i>Brania wellfleetensis</i>	18	232.3	0.1419
<i>Caprella penantis</i>	2	11.2	0.0068
<i>Carinoma tremaphoros</i>	19	38.1	0.0233
<i>Caulleriella venefica</i>	73	872.9	0.5332
<i>Cerapus tubularis</i>	1	1.8	0.0011
<i>Cerebratulus lacteus</i>	4	5.8	0.0035
<i>Chaetozone diodontia</i>	2	40.0	0.0244
<i>Chaetozone</i> sp.	1	1.0	0.0006
<i>Chiridotea arenicola</i>	5	14.0	0.0086
<i>Chiridotea tuftsi</i>	16	19.0	0.0116
<i>Cirratulidae</i>	64	3706.4	2.2641
<i>Clymenella torquata</i>	6	57.1	0.0349
<i>Corambe obscura</i>	3	16.2	0.0099
<i>Crangon septemspinosa</i>	3	10.0	0.0061

Table B-14 Benthic Macroinvertebrate Taxonomic List for Preferred Route

Taxonomic Name	Frequency of Occurrence	Count (N=207)	Relative Abundance (%)
<i>Crepidula convexa</i>	2	9.6	0.0059
<i>Crepidula fornicata</i>	30	527.7	0.3223
<i>Crepidula plana</i>	14	88.6	0.0541
<i>Crepidula</i> sp.	7	43.4	0.0265
<i>Cyathura burbancki</i>	37	524.2	0.3202
<i>Deutella incerta</i>	3	113.8	0.0695
<i>Diastylis sculpta</i>	6	9.3	0.0057
<i>Diopatra cuprea</i>	10	45.9	0.0280
<i>Dipolydora socialis</i>	6	30.1	0.0184
<i>Dispio uncinata</i>	12	17.0	0.0104
<i>Donax variabilis</i>	5	7.0	0.0043
<i>Drilonereis longa</i>	16	95.0	0.0580
<i>Dyspanopeus sayi</i>	13	149.5	0.0913
<i>Edotia triloba</i>	53	192.7	0.1177
<i>Edwardsia elegans</i>	1	3.2	0.0020
<i>Elasmopus levis</i>	7	87.1	0.0532
<i>Ensis leei</i>	43	128.7	0.0786
<i>Eobrolgus spinosus</i>	4	48.0	0.0293
<i>Erichthonius brasiliensis</i>	10	411.3	0.2512
<i>Euclymene collaris</i>	49	955.6	0.5837
<i>Eumida sanguinea</i>	56	1312.1	0.8015
<i>Eupleura caudata</i>	19	112.4	0.0687
<i>Exogone dispar</i>	61	2565.4	1.5671
<i>Fargoa bartschi</i>	5	50.1	0.0306
Gastropoda	3	7.8	0.0048
<i>Gemma gemma</i>	3	45.3	0.0277
<i>Gilvossius setimanus</i>	1	4.0	0.0024
<i>Glycera americana</i>	61	758.7	0.4635
<i>Glycera dibranchiata</i>	31	259.5	0.1585
<i>Glycera</i> sp.	15	65.5	0.0400
<i>Glycinde solitaria</i>	84	3268.7	1.9967
Goniadidae	2	4.2	0.0026
<i>Grandidierella japonica</i>	2	16.0	0.0098
<i>Gyptis vittata</i>	37	404.2	0.2469
<i>Hemipodus</i> sp.	6	19.0	0.0116
<i>Hesionura elongata</i>	8	22.0	0.0134
<i>Heteromastus filiformis</i>	36	551.0	0.3366
<i>Heteromysis formosa</i>	4	33.0	0.0202
<i>Hypereteone heteropoda</i>	12	182.3	0.1113
<i>Hypereteone</i> sp.	29	298.0	0.1820
<i>Japonactaeon punctostriatus</i>	9	245.3	0.1499
<i>Jassa marmorata</i>	2	7.0	0.0043
<i>Kelliopsis elevata</i>	1	10.7	0.0065
<i>Leitoscoloplos fragilis</i>	15	107.9	0.0659

Table B-14 Benthic Macroinvertebrate Taxonomic List for Preferred Route

Taxonomic Name	Frequency of Occurrence	Count (N=207)	Relative Abundance (%)
<i>Leitoscoloplos robustus</i>	11	21.8	0.0133
<i>Leitoscoloplos</i> sp.	47	222.9	0.1362
<i>Lepidonotus sublevis</i>	5	87.5	0.0534
<i>Levinsenia gracilis</i>	1	2.0	0.0012
<i>Libinia dubia</i>	1	5.3	0.0033
<i>Lyonsia arenosa</i>	4	53.1	0.0325
<i>Lyonsia</i> sp.	14	165.7	0.1012
<i>Lysianopsis alba</i>	3	29.3	0.0179
<i>Magelona</i> sp.	35	76.0	0.0464
Maldanidae	47	1128.3	0.6892
<i>Mediomastus ambiseta</i>	134	93041.8	56.8347
<i>Mercenaria mercenaria</i>	60	317.5	0.1939
<i>Microphthalmus sczelkowi</i>	4	23.4	0.0143
<i>Microphthalmus similis</i>	1	1.0	0.0006
<i>Microphthalmus</i> sp.	1	1.0	0.0006
<i>Micrura</i> sp.	1	1.0	0.0006
<i>Monocorophium acherusicum</i>	5	17.1	0.0105
<i>Monocorophium</i> sp.	1	2.0	0.0012
<i>Monocorophium tuberculatum</i>	13	96.6	0.0590
<i>Mulinia lateralis</i>	22	224.6	0.1372
<i>Mya arenaria</i>	7	26.0	0.0159
<i>Myrianida prolifera</i>	19	267.0	0.1631
<i>Mytilus edulis</i>	7	62.5	0.0382
<i>Neanthes arenaceodentata</i>	3	7.3	0.0045
Nemertea	4	20.7	0.0126
<i>Nephtys buccera</i>	31	50.6	0.0309
<i>Nephtys picta</i>	38	211.3	0.1290
<i>Nereis zonata</i>	1	4.0	0.0024
<i>Neverita duplicata</i>	5	5.0	0.0031
<i>Notomastus</i> sp.	7	13.0	0.0079
<i>Nucula proxima</i>	27	475.7	0.2906
Nudibranchia	3	11.7	0.0072
<i>Odontosyllis fulgurans</i>	5	55.5	0.0339
<i>Odostomia eburnea</i>	1	4.0	0.0024
<i>Odostomia</i> sp.	2	8.5	0.0052
Oligochaeta	177	8553.2	5.2247
<i>Onuphis eremita</i>	12	33.0	0.0202
<i>Ophelia bicornis</i>	6	36.0	0.0220
Opheliidae	4	5.0	0.0031
<i>Opisthodonta longocirrata</i>	17	228.3	0.1395
<i>Orbinia ornata</i>	9	11.0	0.0067
<i>Orbinia</i> sp.	1	2.0	0.0012
<i>Ostrea edulis</i>	1	1.0	0.0006
<i>Ovalipes ocellatus</i>	1	1.0	0.0006

Table B-14 Benthic Macroinvertebrate Taxonomic List for Preferred Route

Taxonomic Name	Frequency of Occurrence	Count (N=207)	Relative Abundance (%)
<i>Oxydromus obscurus</i>	25	386.1	0.2358
<i>Oxyurostylis smithi</i>	7	48.2	0.0295
<i>Pagurus longicarpus</i>	34	290.4	0.1774
<i>Pagurus pollicaris</i>	2	2.0	0.0012
<i>Pandora glacialis</i>	1	2.3	0.0014
<i>Paracaprella tenuis</i>	7	119.2	0.0728
<i>Parahaustorius attenuatus</i>	8	11.0	0.0067
<i>Parahaustorius holmesi</i>	6	10.0	0.0061
<i>Parahaustorius longimerus</i>	18	190.0	0.1161
<i>Parametopella cypris</i>	10	1055.8	0.6449
<i>Paranaitis speciosa</i>	32	365.4	0.2232
Paraonidae	5	12.1	0.0074
<i>Paraprionospio pinnata</i>	10	55.7	0.0340
<i>Parougia caeca</i>	1	1.0	0.0006
<i>Pectinaria gouldii</i>	13	115.0	0.0702
<i>Petricolaria pholadiformis</i>	6	91.3	0.0558
<i>Photis pollex</i>	1	1.0	0.0006
<i>Phyllodoce arenae</i>	24	114.5	0.0699
<i>Phyllodoce</i> sp.	1	3.2	0.0020
Phyllodocidae	1	5.3	0.0033
Pilargidae	1	2.7	0.0016
<i>Pisione remota</i>	3	3.0	0.0018
<i>Pitar morrhuanus</i>	1	1.0	0.0006
<i>Politolana concharum</i>	3	3.0	0.0018
<i>Polycirrus eximius</i>	1	6.4	0.0039
<i>Polycirrus</i> sp.	35	444.2	0.2713
<i>Polydora cornuta</i>	30	484.2	0.2958
<i>Polydora</i> sp.	2	2.0	0.0012
<i>Polygordius jouinae</i>	99	2814.4	1.7192
<i>Protodorvillea gaspeensis</i>	6	21.0	0.0129
<i>Protohaustorius</i> cf. <i>wigleyi</i> [In LeCroy, 2002]	26	1126.7	0.6882
<i>Protohaustorius wigleyi</i>	33	210.0	0.1283
<i>Pseudoleptocuma minus</i>	13	27.0	0.0165
<i>Pseudunciola obliquua</i>	1	2.0	0.0012
<i>Retusa obtusa</i>	2	9.3	0.0057
<i>Rhepoxynius epistomus</i>	40	273.2	0.1669
<i>Rhepoxynius hudsoni</i>	21	147.2	0.0899
<i>Sabaco elongatus</i>	6	33.9	0.0207
<i>Sabellaria vulgaris</i>	40	1798.7	1.0987
Sabellidae	2	19.2	0.0117
<i>Salvatoria clavata</i>	6	88.0	0.0538
<i>Scalibregma inflatum</i>	1	1.0	0.0006
<i>Schistomeringos annulata</i>	1	5.3	0.0033

Table B-14 Benthic Macroinvertebrate Taxonomic List for Preferred Route

Taxonomic Name	Frequency of Occurrence	Count (N=207)	Relative Abundance (%)
<i>Scolecopsis</i> sp.	1	2.0	0.0012
<i>Scolecopsis squamata</i>	1	1.0	0.0006
<i>Scoletoma fragilis</i>	5	6.6	0.0040
<i>Scoloplos (Leodamus) rubra</i>	7	24.2	0.0148
<i>Sigalion arenicola</i>	16	43.6	0.0266
Solenidae	3	40.5	0.0248
Sphaerodoridae	5	13.7	0.0083
<i>Spiochaetopterus costarum oculatus</i>	10	57.2	0.0349
Spionidae	5	16.3	0.0099
<i>Spiophanes bombyx</i>	50	279.0	0.1704
<i>Spisula solidissima</i>	73	491.6	0.3003
<i>Stenothoe minuta</i>	6	900.8	0.5502
<i>Sthenelais boa</i>	19	125.8	0.0769
<i>Sthenelais limicola</i>	9	12.7	0.0077
<i>Streblospio benedicti</i>	110	15020.7	9.1754
<i>Streptosyllis verrilli</i>	19	81.3	0.0497
<i>Stylochus ellipticus</i>	6	28.2	0.0173
Syllidae	5	15.0	0.0092
<i>Syllis gracilis</i>	1	16.0	0.0098
<i>Tagelus plebius</i>	2	10.7	0.0065
<i>Tanaissus</i> sp.	35	375.0	0.2291
Terebellidae	2	14.4	0.0088
<i>Tharyx acutus</i>	60	1330.9	0.8130
<i>Travisia forbesii</i>	4	4.0	0.0024
<i>Tritia obsoleta</i>	17	255.9	0.1563
<i>Tritia trivittata</i>	83	703.5	0.4298
<i>Tubulanus pellucidus</i>	49	654.2	0.3996
<i>Turbellaria</i> sp.	7	267.0	0.1631
<i>Unciola dissimilis</i>	5	12.8	0.0078
<i>Unciola irrorata</i>	17	85.5	0.0522
<i>Unciola serrata</i>	47	1147.6	0.7010
<i>Upogebia affinis</i>	1	2.7	0.0016
<i>Urosalpinx cinerea</i>	10	76.2	0.0465
<i>Zygonemertes virescens</i>	5	24.6	0.0150

Table B-15 Summary of Results for Benthic Species Analysis (50 Most Abundant Species)

	Rank	Total Number of Individuals ¹	VC1ALT	VC2	VC3ALT	VC4	VC5	VC6	VC7	VC8	VC9	VC10	VC11	VC12	VC13	VC14
Mediomastus ambiseta	1	93041.8	4606.0	4421.3	6200.0	2371.2	2150.4	319.3	438.7	5829.3	5628.8	1237.3	572.0	605.4	894.3	3748.3
Streblospio benedicti	2	15020.7	360.0	2490.7	896.0	307.2	106.7	0.0	4.5	762.7	1075.2	170.7	280.9	64.2	67.8	388.3
Oligochaeta	3	8553.2	440.0	288.0	64.0	121.6	24.5	18.7	24.5	272.0	297.6	693.3	77.3	9.5	68.5	109.9
Cirratulidae	4	3706.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	37.3	0.0	0.0	2.6	0.0
Glycinde solitaria	5	3268.7	16.0	32.0	176.0	200.0	265.6	130.7	106.4	165.3	188.8	0.0	15.1	165.3	75.7	86.4
Polygordius jouinae	6	2814.4	0.0	0.0	0.0	12.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Exogone dispar	7	2565.4	0.0	0.0	0.0	0.0	0.0	0.0	4.3	16.0	176.0	413.3	185.3	32.4	55.3	5.3
Ameritella agilis	8	2199.7	8.0	0.0	0.0	32.0	0.0	2.0	0.0	58.7	0.0	26.7	4.0	0.0	0.0	0.0
Ampelisca abdita	9	1942.1	48.0	0.0	64.0	156.8	220.8	382.0	70.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sabellaria vulgaris	10	1798.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	42.7	51.2	0.0	12.5	2.3	30.5	16.0
Tharyx acutus	11	1330.9	0.0	16.0	0.0	0.0	0.0	0.0	0.0	32.0	0.0	29.3	0.0	0.0	0.0	12.8
Eumida sanguinea	12	1312.1	16.0	0.0	0.0	0.0	0.0	0.0	0.0	96.0	92.8	90.7	40.0	2.3	19.2	0.0
Unciola serrata	13	1147.5	0.0	21.3	0.0	0.0	0.0	0.0	0.0	0.0	41.6	21.3	0.0	0.0	13.2	5.3
Maldanidae	14	1128.3	8.0	80.0	0.0	0.0	25.6	0.0	9.3	32.0	172.8	0.0	90.2	2.3	0.0	0.0
Protohaustorius cf. wigleyi [In LeCroy, 2002]	15	1126.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Parametopella cypris	16	1055.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Euclymene collaris	17	955.5	0.0	0.0	8.0	0.0	5.3	0.0	7.2	0.0	32.0	0.0	1.8	80.9	46.3	53.3
Stenothoe minuta	18	900.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Caulleriella venefica	19	872.9	0.0	16.0	0.0	0.0	0.0	0.0	0.0	32.0	0.0	5.3	0.0	0.0	0.0	0.0
Glycera americana	20	758.7	0.0	0.0	0.0	16.0	0.0	8.7	6.7	0.0	115.2	18.7	13.3	13.7	31.2	10.7
Tritia trivittata	21	703.6	16.0	0.0	0.0	24.0	6.4	6.7	8.8	0.0	0.0	5.3	3.6	16.4	21.1	0.0
Tubulanus pellucidus	22	654.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.3
Heteromastus filiformis	23	551.0	0.0	32.0	16.0	16.0	64.0	15.3	7.2	16.0	16.0	0.0	0.0	23.2	13.4	21.3
Crepidula fornicata	24	527.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.0	8.0	1.8	0.0	5.3	0.0
Cyathura burbancki	25	524.2	0.0	0.0	8.0	12.8	0.0	2.7	5.9	80.0	115.2	66.7	0.0	9.5	57.4	34.1
Spisula solidissima	26	491.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Polydora cornuta	27	484.2	0.0	96.0	16.0	0.0	0.0	0.0	1.3	85.3	48.0	0.0	14.7	16.4	2.6	0.0
Nucula proxima	28	475.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.3
Polycirrus sp.	29	444.2	0.0	0.0	0.0	6.4	0.0	0.0	0.0	0.0	16.0	5.3	0.0	0.0	0.0	0.0
Erichthonius brasiliensis	30	411.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gyptis vittata	31	404.2	8.0	0.0	56.0	54.4	30.9	12.0	9.9	26.7	32.0	21.3	0.0	4.9	22.6	18.1
Oxydromus obscurus	32	386.1	0.0	37.3	16.0	0.0	38.4	0.0	0.0	0.0	41.6	82.7	0.0	13.7	28.0	12.8
Tanaissus sp. A	33	375.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Paranaitis speciosa	34	365.4	0.0	0.0	16.0	0.0	5.3	9.3	0.0	0.0	16.0	18.7	0.0	6.9	11.5	65.1
Amphiporus bioculatus	35	325.9	0.0	21.3	8.0	14.4	0.0	0.0	2.7	0.0	0.0	5.3	0.0	0.0	0.0	0.0
Mercenaria mercenaria	36	317.5	2.0	6.0	4.0	8.0	0.0	1.0	0.0	44.0	3.0	24.3	8.1	8.0	19.9	2.0
Acteocina canaliculata	37	304.9	32.0	0.0	0.0	24.0	0.0	8.0	2.7	32.0	0.0	0.0	0.0	14.4	8.3	0.0
Acanthohaustorius similis	38	303.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hypereteone sp.	39	298.0	0.0	69.3	8.0	8.0	5.3	4.7	4.0	32.0	57.6	16.0	8.0	11.8	5.3	5.3
Pagurus longicarpus	40	290.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.3	4.0	0.0	0.0	10.7
Spiophanes bombyx	41	279.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Apoprionospio pygmaea	42	276.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rhepoxynius epistomus	43	273.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Myrianida prolifera	44	267.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	32.0	0.0	10.7	10.7	0.0	21.8	0.0
Turbellaria sp. 1 NAI	45	267.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Glycera dibranchiata	46	259.5	16.0	112.0	0.0	0.0	5.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tritia obsoleta	47	255.9	0.0	0.0	0.0	0.0	10.7	2.0	4.5	0.0	67.2	0.0	0.0	13.7	7.9	5.3
Japonactaeon punctostriatus	48	245.3	0.0	0.0	0.0	0.0	0.0	0.0	2.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Brania wellfleetensis	49	232.4	0.0	0.0	0.0	6.4	0.0	0.0	0.0	0.0	0.0	8.0	0.0	0.0	0.0	0.0
Opisthodonta longocirrata	50	228.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.0	0.0	0.0	0.0	0.0	0.0	0.0

¹ Totals are fractional values because they reflect laboratory sub-sampling multiplication factors

Table B-15 Summary of Results for Benthic Species Analysis (50 Most Abundant Species)

	Rank	Total Number of Individuals ¹	VC15	VC16	VC17	VC18	VC19	VC20	VC21	VC22	VC23	VC24	VC25	VC26	VC27	VC28
Mediomastus ambiseta	1	93041.8	9840.0	3800.0	1507.7	4224.0	2474.7	9376.0	3470.2	5952.0	1782.4	1059.5	1385.3	2.1	1474.7	718.3
Streblospio benedicti	2	15020.7	896.0	21.3	8.0	490.7	160.0	298.7	588.4	1056.0	419.2	157.6	292.3	1.1	242.7	11.2
Oligochaeta	3	8553.2	128.0	181.3	86.9	133.3	69.3	186.7	241.8	560.0	36.8	85.6	302.9	5.3	269.3	143.2
Cirratulidae	4	3706.4	48.0	0.0	0.0	0.0	0.0	0.0	0.0	32.0	0.0	4.6	0.0	0.0	32.0	12.8
Glycinde solitaria	5	3268.7	128.0	88.0	33.6	176.0	290.7	197.3	124.4	80.0	41.6	139.8	49.3	0.0	50.7	99.5
Polygordius jouinae	6	2814.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.0	0.0	0.0
Exogone dispar	7	2565.4	64.0	0.0	8.0	90.7	130.7	240.0	56.9	368.0	147.2	36.9	128.0	96.3	178.7	86.1
Ameritella agilis	8	2199.7	16.0	8.0	0.0	0.0	21.3	10.7	30.2	64.0	35.2	26.4	30.7	29.1	32.0	125.5
Ampelisca abdita	9	1942.1	32.0	754.7	152.5	0.0	8.0	0.0	16.0	0.0	12.8	4.0	0.0	1.1	0.0	0.0
Sabellaria vulgaris	10	1798.7	16.0	0.0	0.0	48.0	0.0	16.0	14.2	192.0	67.2	6.4	0.0	0.0	0.0	0.0
Tharyx acutus	11	1330.9	16.0	0.0	0.0	0.0	0.0	0.0	40.9	32.0	14.4	24.1	25.1	0.0	16.0	5.9
Eumida sanguinea	12	1312.1	144.0	0.0	8.0	69.3	8.0	0.0	10.7	224.0	99.2	20.1	6.4	10.7	8.0	6.4
Unciola serrata	13	1147.5	0.0	0.0	0.0	32.0	0.0	64.0	24.9	0.0	8.0	27.5	18.1	0.0	26.7	0.0
Maldanidae	14	1128.3	80.0	0.0	3.2	48.0	0.0	64.0	0.0	96.0	20.8	12.8	4.0	1.0	0.0	0.0
Protohaustorius cf. wigleyi [In LeCroy, 2002]	15	1126.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Parametopella cypris	16	1055.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Euclymene collaris	17	955.5	96.0	0.0	0.0	26.7	317.3	21.3	28.4	0.0	0.0	51.0	18.1	0.0	13.3	41.5
Stenothoe minuta	18	900.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Caulieriella venefica	19	872.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.3	4.1	10.7	0.0
Glycera americana	20	758.7	96.0	10.7	0.0	16.0	61.3	10.7	10.7	64.0	12.8	31.5	0.0	0.0	10.7	7.9
Tritia trivittata	21	703.6	0.0	16.0	16.0	21.3	10.7	48.0	16.0	32.0	8.0	13.1	9.3	18.9	5.3	40.4
Tubulanus pellucidus	22	654.2	0.0	34.7	6.4	16.0	58.7	154.7	0.0	0.0	0.0	8.0	0.0	0.0	18.7	19.3
Heteromastus filiformis	23	551.0	32.0	0.0	0.0	10.7	21.3	154.7	28.4	0.0	12.8	24.6	0.0	0.0	0.0	3.2
Crepidula fornicata	24	527.7	16.0	0.0	0.0	0.0	0.0	0.0	46.2	48.0	22.4	20.8	0.0	0.0	5.3	0.0
Cyathura burbancki	25	524.2	32.0	0.0	0.0	0.0	0.0	0.0	0.0	16.0	8.0	8.0	0.0	3.0	5.3	2.7
Spisula solidissima	26	491.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Polydora cornuta	27	484.2	32.0	0.0	0.0	0.0	10.7	26.7	30.2	80.0	0.0	6.4	0.0	0.0	0.0	0.0
Nucula proxima	28	475.7	0.0	0.0	11.7	0.0	24.0	0.0	0.0	0.0	0.0	0.0	5.3	0.0	0.0	36.0
Polycirrus sp.	29	444.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	32.0	0.0	0.0	5.3	68.1	5.3	0.0
Erichthonius brasiliensis	30	411.3	0.0	0.0	0.0	0.0	10.7	0.0	0.0	32.0	0.0	0.0	5.3	0.0	5.3	10.0
Gyptis vittata	31	404.2	0.0	16.0	8.0	26.7	0.0	10.7	0.0	16.0	0.0	0.0	6.4	0.0	5.3	2.7
Oxydromus obscurus	32	386.1	16.0	0.0	0.0	26.7	0.0	0.0	0.0	48.0	20.8	0.0	0.0	2.1	0.0	0.0
Tanaissus sp. A	33	375.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Paranaitis speciosa	34	365.4	32.0	0.0	0.0	37.3	10.7	0.0	53.3	16.0	8.0	4.6	5.3	0.0	5.3	0.0
Amphiporus bioculatus	35	325.9	0.0	0.0	22.4	26.7	0.0	0.0	0.0	0.0	0.0	0.0	5.3	4.3	13.3	0.0
Mercenaria mercenaria	36	317.5	19.0	0.0	0.0	8.0	7.0	3.0	3.0	66.0	6.4	1.0	1.0	1.0	1.0	2.0
Acteocina canaliculata	37	304.9	0.0	8.0	5.3	10.7	8.0	10.7	48.0	0.0	0.0	12.8	0.0	0.0	0.0	64.0
Acanthohaustorius similis	38	303.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hypereteone sp.	39	298.0	0.0	26.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0
Pagurus longicarpus	40	290.4	16.0	0.0	0.0	0.0	0.0	16.0	0.0	32.0	8.0	0.0	0.0	0.0	16.0	9.6
Spiophanes bombyx	41	279.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.3	1.0	0.0	2.7
Apoprionospio pygmaea	42	276.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.4	0.0	0.0	0.0	0.0	0.0
Rhepoxynius epistomus	43	273.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Myrianida prolifera	44	267.0	32.0	0.0	0.0	0.0	8.0	0.0	0.0	32.0	35.2	11.0	0.0	0.0	0.0	2.0
Turbellaria sp. 1 NAI	45	267.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Glycera dibranchiata	46	259.5	0.0	0.0	0.0	0.0	0.0	0.0	16.0	16.0	0.0	8.6	10.7	3.1	10.7	6.4
Tritia obsoleta	47	255.9	32.0	8.0	3.2	16.0	85.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Japonactaeon punctostriatus	48	245.3	0.0	56.0	74.7	0.0	32.0	32.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.0
Brania wellfleetensis	49	232.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.6	26.7	0.0
Opisthodonta longocirrata	50	228.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	21.4	5.3	0.0

¹ Totals are fractional values because they reflect laboratory sub-sampling multiplication factors

Table B-15 Summary of Results for Benthic Species Analysis (50 Most Abundant Species)

	Rank	Total Number of Individuals ¹	VC29	VC30	VC31ALT	VC32	VC33ALT	VC34	VC35	VC36	VC37	VC38	VC39	VC40	VC41ALT	VC42
Mediomastus ambiseta	1	93041.8	311.8	637.3	1628.8	369.6	112.0	167.4	192.0	206.4	475.2	1453.3	682.7	458.7	240.0	0.0
Streblospio benedicti	2	15020.7	91.2	0.0	21.3	26.8	0.0	20.6	57.4	30.4	214.4	217.3	720.0	889.3	1096.0	8.0
Oligochaeta	3	8553.2	191.1	64.2	117.3	262.5	1204.6	103.8	219.7	33.2	200.5	468.0	90.7	180.0	92.8	12.2
Cirratulidae	4	3706.4	81.4	6.1	6.4	14.8	1391.2	414.1	194.9	49.2	81.6	238.7	5.3	65.3	833.6	117.2
Glycinde solitaria	5	3268.7	25.1	74.9	3.2	0.0	0.0	0.0	0.0	2.0	13.3	8.0	10.7	9.3	0.0	0.0
Polygordius jouinae	6	2814.4	0.0	10.7	29.9	50.4	373.3	130.4	275.7	62.8	19.7	8.0	5.3	13.3	163.2	277.0
Exogone dispar	7	2565.4	13.3	2.3	3.2	8.2	0.0	1.8	4.0	0.0	5.3	8.0	0.0	0.0	0.0	0.0
Ameritella agilis	8	2199.7	61.5	49.0	32.0	24.0	46.5	23.4	4.0	60.0	86.9	149.3	170.7	124.0	224.0	24.0
Ampelisca abdita	9	1942.1	0.0	4.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.7	4.0	0.0	0.0
Sabellaria vulgaris	10	1798.7	0.0	3.2	0.0	0.0	0.0	0.0	6.6	22.4	96.0	84.0	0.0	36.0	926.4	107.2
Tharyx acutus	11	1330.9	18.7	0.0	0.0	0.0	135.6	89.5	103.4	59.6	32.5	40.0	10.7	36.0	472.0	47.4
Eumida sanguinea	12	1312.1	14.4	32.0	0.0	18.3	5.3	11.8	21.1	25.6	59.7	66.7	5.3	16.0	64.0	0.0
Unciola serrata	13	1147.5	0.0	3.4	9.6	1.8	5.3	9.9	35.7	204.0	206.4	90.7	0.0	34.7	198.4	42.6
Maldanidae	14	1128.3	1.8	1.1	0.0	0.0	0.0	0.0	10.6	0.0	22.4	37.3	170.7	48.0	86.4	0.0
Protohaustorius cf. wigleyi [In LeCroy, 2002]	15	1126.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Parametopella cypris	16	1055.8	0.0	0.0	0.0	0.0	864.0	28.2	0.0	0.0	0.0	0.0	0.0	0.0	12.8	146.8
Euclymene collaris	17	955.5	30.4	9.9	10.7	7.2	0.0	19.7	10.6	0.0	18.7	0.0	0.0	0.0	0.0	0.0
Stenothoe minuta	18	900.8	0.0	0.0	0.0	0.0	672.0	4.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	222.2
Caulieriella venefica	19	872.9	9.1	63.6	145.1	44.9	24.4	80.9	107.1	24.8	11.7	0.0	0.0	0.0	40.0	129.6
Glycera americana	20	758.7	16.2	3.4	6.4	7.2	0.0	4.6	4.0	21.6	38.4	26.7	37.3	10.7	16.0	0.0
Tritia trivittata	21	703.6	6.2	18.8	19.2	4.0	22.1	6.4	18.0	32.0	34.1	32.0	16.0	36.0	68.8	1.0
Tubulanus pellucidus	22	654.2	40.2	49.6	24.5	0.0	0.0	4.6	10.0	0.0	41.6	97.3	26.7	4.0	8.0	0.0
Heteromastus filiformis	23	551.0	6.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.0	0.0	0.0	0.0	8.0	0.0
Crepidula fornicata	24	527.7	19.2	0.0	3.2	0.0	0.0	0.0	0.0	0.0	27.7	250.3	0.0	5.3	0.0	24.0
Cyathura burbancki	25	524.2	0.0	0.0	0.0	0.0	0.0	1.8	4.6	0.0	17.1	0.0	0.0	0.0	33.6	0.0
Spisula solidissima	26	491.6	0.0	0.0	0.0	0.0	4.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0
Polydora cornuta	27	484.2	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	5.3	10.7	0.0	0.0	0.0	0.0
Nucula proxima	28	475.7	0.0	16.0	0.0	0.0	0.0	0.0	0.0	0.0	16.0	74.7	208.0	0.0	0.0	0.0
Polycirrus sp.	29	444.2	0.0	22.6	42.7	42.5	35.0	37.6	67.7	5.2	5.3	0.0	0.0	0.0	28.8	16.2
Erichthonius brasiliensis	30	411.3	0.0	0.0	0.0	0.0	320.0	10.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.0
Gyptis vittata	31	404.2	0.0	2.9	10.7	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Oxydromus obscurus	32	386.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0
Tanaissus sp. A	33	375.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Paranaitis speciosa	34	365.4	3.6	0.0	3.2	0.0	0.0	0.0	4.0	0.0	0.0	14.7	10.7	0.0	8.0	0.0
Amphiporus bioculatus	35	325.9	0.0	8.4	6.4	8.0	120.4	18.9	8.6	6.0	0.0	0.0	10.7	0.0	12.8	0.0
Mercenaria mercenaria	36	317.5	1.0	0.0	3.0	14.5	0.0	4.6	1.0	0.0	0.0	42.7	1.0	0.0	0.0	0.0
Acteocina canaliculata	37	304.9	0.0	16.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Acanthohaustorius similis	38	303.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.0	0.0
Hypereteone sp.	39	298.0	0.0	0.0	10.7	0.0	0.0	7.1	0.0	0.0	0.0	0.0	0.0	0.0	16.0	0.0
Pagurus longicarpus	40	290.4	6.8	21.2	9.6	4.0	0.0	0.0	0.0	6.0	19.2	10.7	10.7	0.0	54.4	0.0
Spiophanes bombyx	41	279.0	15.3	8.4	13.9	0.0	2.3	2.7	4.0	22.4	10.7	8.0	16.0	24.0	54.4	32.0
Apoprionospio pygmaea	42	276.7	9.1	6.4	0.0	0.0	0.0	0.0	0.0	9.2	8.0	37.3	80.0	34.7	0.0	0.0
Rhepoxynius epistomus	43	273.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.2
Myrianida prolifera	44	267.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	11.7	0.0	0.0	0.0	48.0	8.0
Turbellaria sp. 1 NAI	45	267.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Glycera dibranchiata	46	259.5	5.3	7.8	3.2	1.8	2.3	0.0	2.0	2.0	5.3	0.0	5.3	14.7	0.0	0.0
Tritia obsoleta	47	255.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Japonactaeon punctostriatus	48	245.3	0.0	32.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Brania wellfleetensis	49	232.4	0.0	0.0	3.2	82.5	54.1	9.8	33.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Opisthodonta longocirrata	50	228.3	0.0	0.0	3.2	4.0	100.6	19.8	40.0	2.0	0.0	0.0	0.0	0.0	12.8	3.2

¹ Totals are fractional values because they reflect laboratory sub-sampling multiplication factors

Table B-15 Summary of Results for Benthic Species Analysis (50 Most Abundant Species)

	Rank	Total Number of Individuals ¹	VC43	VC44	VC45ALT	VC46	VC47	VC48ALT	VC49	VC50	VC51	VC52	VC53	VC54	VC55	VC56
Mediomastus ambiseta	1	93041.8	3.0	2.0	0.0	3.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Streblospio benedicti	2	15020.7	4.0	2.0	0.0	2.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Oligochaeta	3	8553.2	7.0	6.0	14.0	7.0	6.0	1.0	0.0	0.0	2.0	0.0	0.0	0.0	11.0	75.0
Cirratulidae	4	3706.4	14.0	3.0	5.0	0.0	1.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	1.0	0.0
Glycinde solitaria	5	3268.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Polygordius jouinae	6	2814.4	152.0	79.0	36.0	85.0	31.0	0.0	0.0	3.0	34.0	0.0	1.0	73.4	5.0	19.0
Exogone dispar	7	2565.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ameritella agilis	8	2199.7	68.0	4.0	0.0	1.0	2.0	0.0	0.0	2.0	0.0	0.0	0.0	4.2	1.0	8.0
Ampelisca abdita	9	1942.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sabellaria vulgaris	10	1798.7	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tharyx acutus	11	1330.9	5.0	1.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Eumida sanguinea	12	1312.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Unciola serrata	13	1147.5	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Maldanidae	14	1128.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Protohaustorius cf. wigleyi [In LeCroy, 2002]	15	1126.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Parametopella cypris	16	1055.8	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Euclymene collaris	17	955.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stenothoe minuta	18	900.8	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Caulieriella venefica	19	872.9	16.0	7.0	4.0	4.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	2.6	0.0	0.0
Glycera americana	20	758.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tritia trivittata	21	703.6	1.0	1.0	1.0	0.0	1.0	0.0	0.0	0.0	3.0	0.0	0.0	1.0	0.0	0.0
Tubulanus pellucidus	22	654.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Heteromastus filiformis	23	551.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Crepidula fornicata	24	527.7	5.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
Cyathura burbancki	25	524.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Spisula solidissima	26	491.6	49.0	21.0	38.0	26.0	23.0	23.0	11.0	13.0	25.0	33.0	3.0	1.0	5.0	11.0
Polydora cornuta	27	484.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nucula proxima	28	475.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Polycirrus sp.	29	444.2	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0
Erichthonius brasiliensis	30	411.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gyptis vittata	31	404.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Oxydromus obscurus	32	386.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tanaissus sp. A	33	375.0	20.0	98.0	11.0	0.0	0.0	0.0	0.0	0.0	1.0	3.0	18.0	150.0	9.0	0.0
Paranaitis speciosa	34	365.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Amphiporus bioculatus	35	325.9	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mercenaria mercenaria	36	317.5	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Acteocina canaliculata	37	304.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Acanthohaustorius similis	38	303.0	40.0	13.0	52.0	5.0	5.0	0.0	0.0	26.0	11.0	1.0	7.0	9.0	0.0	0.0
Hypereteone sp.	39	298.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pagurus longicarpus	40	290.4	1.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
Spiophanes bombyx	41	279.0	0.0	1.0	0.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Apoprionospio pygmaea	42	276.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rhepoxynius epistomus	43	273.2	6.0	3.0	6.0	8.0	2.0	4.0	44.0	2.0	0.0	0.0	2.0	20.0	0.0	0.0
Myrianida prolifera	44	267.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Turbellaria sp. 1 NAI	45	267.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	260.0
Glycera dibranchiata	46	259.5	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tritia obsoleta	47	255.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Japonactaeon punctostriatus	48	245.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Brania wellfleetensis	49	232.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Opisthodonta longocirrata	50	228.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

¹ Totals are fractional values because they reflect laboratory sub-sampling multiplication factors

Table B-15 Summary of Results for Benthic Species Analysis (50 Most Abundant Species)

	Rank	Total Number of Individuals ¹	VC57	VC58	VC59	VC60	VC61ALT	VC62	VC63	VC64	VC65	VC66	VC67	VC68	VC69ALT
Mediomastus ambiseta	1	93041.8	0.0	0.0	1.0	0.0	0.0	0.0	2.0	1.0	0.0	1.3	2.0	0.0	0.0
Streblospio benedicti	2	15020.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Oligochaeta	3	8553.2	125.0	13.0	12.0	8.0	3.0	2.0	3.0	7.0	7.0	13.7	16.0	24.0	10.0
Cirratulidae	4	3706.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	1.3	1.0	5.0	3.0
Glycinde solitaria	5	3268.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Polygordius jouinae	6	2814.4	327.0	60.0	28.0	20.0	5.0	1.0	52.0	143.0	132.0	35.3	18.0	23.0	5.0
Exogone dispar	7	2565.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ameritella agilis	8	2199.7	3.0	1.0	83.0	1.0	0.0	19.0	24.0	21.0	16.0	88.7	55.0	131.0	27.0
Ampelisca abdita	9	1942.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sabellaria vulgaris	10	1798.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tharyx acutus	11	1330.9	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	4.0	4.0	2.0
Eumida sanguinea	12	1312.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Unciola serrata	13	1147.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Maldanidae	14	1128.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Protohaustorius cf. wigleyi [In LeCroy, 2002]	15	1126.7	0.0	2.0	0.0	0.0	52.0	92.0	74.0	6.0	83.0	192.7	210.0	185.0	230.0
Parametopella cypris	16	1055.8	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0
Euclymene collaris	17	955.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stenothoe minuta	18	900.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Caulleriella venefica	19	872.9	0.0	4.0	9.0	11.0	5.0	2.0	1.0	1.0	16.0	10.7	6.0	9.0	9.0
Glycera americana	20	758.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tritia trivittata	21	703.6	0.0	0.0	0.0	1.0	0.0	0.0	3.0	6.0	4.0	2.7	1.0	0.0	0.0
Tubulanus pellucidus	22	654.2	0.0	0.0	0.0	0.0	0.0	0.0	3.0	2.0	3.0	1.0	3.0	11.0	3.0
Heteromastus filiformis	23	551.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Crepidula fornicata	24	527.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	0.0	0.0	0.0	0.0
Cyathura burbancki	25	524.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Spisula solidissima	26	491.6	36.0	34.0	14.0	13.0	3.0	0.0	28.0	37.0	6.0	4.3	19.0	4.0	3.0
Polydora cornuta	27	484.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nucula proxima	28	475.7	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	1.0	15.7	10.0	44.0	7.0
Polycirrus sp.	29	444.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Erichthonius brasiliensis	30	411.3	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gyptis vittata	31	404.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Oxydromus obscurus	32	386.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tanaissus sp. A	33	375.0	3.0	9.0	21.0	20.0	12.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Paranaitis speciosa	34	365.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Amphiporus bioculatus	35	325.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0
Mercenaria mercenaria	36	317.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Acteocina canaliculata	37	304.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Acanthohaustorius similis	38	303.0	0.0	34.0	16.0	20.0	43.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hypereteone sp.	39	298.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0
Pagurus longicarpus	40	290.4	0.0	2.0	0.0	0.0	0.0	0.0	1.0	0.0	1.0	17.3	3.0	1.0	3.0
Spiophanes bombyx	41	279.0	0.0	1.0	0.0	0.0	0.0	1.0	8.0	4.0	6.0	14.0	8.0	7.0	4.0
Apoprionospio pygmaea	42	276.7	0.0	0.0	0.0	0.0	0.0	0.0	9.0	38.0	29.0	4.7	4.0	0.0	1.0
Rhepoxynius epistomus	43	273.2	0.0	27.0	23.0	20.0	56.0	45.0	0.0	0.0	0.0	1.0	0.0	0.0	1.0
Myrianida prolifera	44	267.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Turbellaria sp. 1 NAI	45	267.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Glycera dibranchiata	46	259.5	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	1.0	0.0	0.0	2.0
Tritia obsoleta	47	255.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Japonactaeon punctostriatus	48	245.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Brania wellfleetensis	49	232.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Opisthodonta longocirrata	50	228.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

¹ Totals are fractional values because they reflect laboratory sub-sampling multiplication factors

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Table B-16 Benthic Biota Richness, Abundance, Diversity and Evenness at Alternative Route Stations

Station	Rep	Richness	Abundance	Diversity (H')	Evenness (P')
VC70	C	11	176.0	1.46	0.28
VC70	N	12	352.0	1.37	0.23
VC70	S	20	403.2	1.73	0.29
VC71	C	8	1512.4	0.77	0.10
VC71	N	10	2385.0	0.83	0.11
VC71	S	12	2944.0	0.83	0.10
VC72	C	16	5473.0	1.34	0.16
VC72	N	13	3413.3	1.28	0.16
VC72	S	21	4940.8	1.55	0.18
VC73ALT	C	26	1107.0	2.33	0.33
VC73ALT	N	12	1039.7	0.88	0.13
VC73ALT	S	18	1664.0	1.72	0.23
VC74	C	15	1712.0	1.69	0.23
VC74	N	15	1521.0	1.39	0.19
VC74	S	11	1497.6	1.39	0.19
VC75	C	19	486.0	1.98	0.32
VC75	N	18	690.0	1.37	0.21
VC75	S	17	148.0	2.11	0.42
VC76	C	7	269.3	1.07	0.19
VC76	N	18	942.8	1.49	0.22
VC76	S	17	460.0	1.50	0.25
VC77	C	17	686.4	1.40	0.21
VC77	N	12	601.3	0.91	0.14
VC77	S	10	941.7	0.75	0.11
VC78	C	21	281.6	2.09	0.37
VC78	N	16	90.0	2.20	0.49
VC78	S	19	532.2	1.48	0.24
VC79ALT	C	13	434.0	1.55	0.25
VC79ALT	N	15	462.0	1.70	0.28
VC79ALT	S	11	304.0	1.67	0.29
VC80	C	19	250.0	1.28	0.23
VC80	N	8	888.0	0.56	0.08
VC80	S	18	628.0	0.89	0.14
VC81	C	15	561.0	1.94	0.31
VC81	N	10	672.0	0.87	0.13
VC81	S	10	416.0	0.56	0.09
VC82	C	26	458.2	2.29	0.37
VC82	N	24	1034.0	1.35	0.19
VC82	S	13	1940.0	0.90	0.12
VC83ALT	C	26	390.2	2.15	0.36
VC83ALT	N	15	272.0	1.80	0.32
VC83ALT	S	27	199.9	2.84	0.54
VC84ALT	C	25	674.0	2.40	0.37
VC84ALT	N	22	447.3	2.32	0.38
VC84ALT	S	12	544.0	1.82	0.29
VC85	C	22	883.2	2.14	0.32
VC85	N	24	1508.6	2.16	0.30
VC85	S	15	1143.3	1.98	0.28
VC86ALT	C	19	743.3	1.88	0.28

Table B-16 Benthic Biota Richness, Abundance, Diversity and Evenness at Alternative Route Stations

Station	Rep	Richness	Abundance	Diversity (H')	Evenness (P')
VC86ALT	N	19	1174.3	2.14	0.30
VC86ALT	S	24	994.0	2.29	0.33
VC87	C	34	743.6	2.23	0.34
VC87	N	23	452.0	2.08	0.34
VC87	S	28	559.7	2.68	0.42

Table B-17 Benthic Macroinvertebrate Taxonomic List for Alternative Route

Taxonomic Name	Frequency of Occurrence	Count (N=54)	Relative Abundance (%)
<i>Acteocina canaliculata</i>	11	146.1	0.2655
<i>Alitta succinea</i>	4	61.2	0.1113
<i>Ameritella agilis</i>	28	685.0	1.2444
<i>Ampelisca abdita</i>	21	3467.5	6.2991
<i>Ampelisca vadorum</i>	6	68.5	0.1244
<i>Ampharete oculata</i>	2	5.0	0.0091
<i>Amphiporus bioculatus</i>	12	47.3	0.0860
<i>Asmunda elegantula</i>	10	100.6	0.1827
<i>Batea catharinensis</i>	2	8.9	0.0161
<i>Bivalvia</i>	3	28.7	0.0521
<i>Boonea bisuturalis</i>	2	7.2	0.0131
<i>Boonea impressa</i>	1	6.4	0.0116
<i>Brania wellfleetensis</i>	10	517.3	0.9398
<i>Caprella</i> sp.	1	8.0	0.0145
<i>Carinoma tremaphoros</i>	1	1.5	0.0026
<i>Caulleriella venefica</i>	13	596.1	1.0828
<i>Cerapus tubularis</i>	1	4.6	0.0083
<i>Chaetozone</i> sp.	1	6.4	0.0116
Cirratulidae	8	387.6	0.7040
<i>Crepidula fornicata</i>	4	41.1	0.0746
<i>Crepidula plana</i>	4	27.6	0.0501
<i>Cyathura burbancki</i>	11	205.7	0.3737
<i>Diopatra cuprea</i>	3	22.0	0.0400
<i>Drilonereis longa</i>	8	46.1	0.0838
<i>Dyspanopeus sayi</i>	11	125.9	0.2287
<i>Edotia triloba</i>	6	33.2	0.0602
<i>Edwardsia elegans</i>	2	6.0	0.0109
<i>Elasmopus levis</i>	1	3.2	0.0058
<i>Ensis leei</i>	14	27.0	0.0490
<i>Erichthonius brasiliensis</i>	8	90.3	0.1639
<i>Euclymene collaris</i>	24	679.7	1.2348
<i>Eumida sanguinea</i>	20	445.5	0.8092
<i>Eupleura caudata</i>	2	6.9	0.0126
<i>Exogone dispar</i>	46	1835.1	3.3338
<i>Fargoa bartschi</i>	2	59.2	0.1075
<i>Gastropoda</i>	1	16.0	0.0291
<i>Glycera americana</i>	25	192.2	0.3491
<i>Glycera dibranchiata</i>	3	11.4	0.0206
<i>Glycera</i> sp.	3	15.2	0.0277
<i>Glycinde solitaria</i>	38	1367.4	2.4841
<i>Gyptis vittata</i>	16	85.7	0.1556
<i>Heteromastus filiformis</i>	10	89.0	0.1616
<i>Hypereteone heteropoda</i>	5	64.6	0.1173
<i>Hypereteone</i> sp.	12	239.7	0.4355

Table B-17 Benthic Macroinvertebrate Taxonomic List for Alternative Route

Taxonomic Name	Frequency of Occurrence	Count (N=54)	Relative Abundance (%)
<i>Japonactaeon punctostriatus</i>	12	154.8	0.2813
<i>Jassa sp.</i>	1	1.0	0.0018
<i>Leitoscoloplos fragilis</i>	3	9.7	0.0176
<i>Leitoscoloplos sp.</i>	13	67.7	0.1230
<i>Libinia dubia</i>	1	4.0	0.0073
<i>Lyonsia arenosa</i>	4	23.5	0.0426
<i>Lyonsia sp.</i>	5	57.5	0.1045
<i>Lysianopsis alba</i>	2	13.3	0.0242
<i>Magelona sp.</i>	2	4.7	0.0085
<i>Maldanidae</i>	13	214.3	0.3893
<i>Mediomastus ambiseta</i>	54	28598.7	51.9533
<i>Mercenaria mercenaria</i>	34	487.9	0.8864
<i>Microphthalmus scelkowi</i>	4	11.9	0.0216
<i>Monocorophium acherusicum</i>	2	6.9	0.0126
<i>Monocorophium sp.</i>	1	1.6	0.0029
<i>Monocorophium tuberculatum</i>	5	27.9	0.0506
<i>Mulinia lateralis</i>	14	431.6	0.7840
<i>Myrianida prolifera</i>	7	182.0	0.3307
<i>Nephtys incisa</i>	1	2.0	0.0036
<i>Nephtys picta</i>	3	12.1	0.0220
<i>Nereis sp.</i>	1	16.0	0.0291
<i>Nereis zonata</i>	1	10.7	0.0194
<i>Neverita duplicata</i>	1	1.0	0.0018
<i>Nucula proxima</i>	17	179.0	0.3252
<i>Nudibranchia</i>	1	13.7	0.0249
<i>Odontosyllis fulgurans</i>	3	81.6	0.1482
<i>Oligochaeta</i>	39	3373.9	6.1292
<i>Opisthodonta longocirrata</i>	13	759.7	1.3800
<i>Orbiniidae</i>	1	5.3	0.0097
<i>Oxydromus obscurus</i>	11	200.9	0.3650
<i>Oxyurostylis smithi</i>	2	18.9	0.0344
<i>Pagurus longicarpus</i>	6	25.1	0.0455
<i>Pagurus sp.</i>	1	2.7	0.0048
<i>Pandora glacialis</i>	5	41.5	0.0754
<i>Paracaprella tenuis</i>	1	3.6	0.0065
<i>Paranaitis speciosa</i>	8	80.1	0.1455
<i>Paraprionospio pinnata</i>	9	57.6	0.1045
<i>Parasabella microphthalma</i>	1	1.6	0.0029
<i>Pectinaria gouldii</i>	6	29.8	0.0541
<i>Pectinariidae</i>	4	28.5	0.0518
<i>Petricolaria pholadiformis</i>	1	5.3	0.0097
<i>Phoronis sp.</i>	1	2.7	0.0048
<i>Phyllodoce arenae</i>	6	33.5	0.0609
<i>Polycirrus sp.</i>	13	297.2	0.5398

Table B-17 Benthic Macroinvertebrate Taxonomic List for Alternative Route

Taxonomic Name	Frequency of Occurrence	Count (N=54)	Relative Abundance (%)
<i>Polydora cornuta</i>	12	310.9	0.5649
<i>Polygordius jouinae</i>	9	118.9	0.2160
<i>Rhepoxynius hudsoni</i>	3	24.3	0.0442
<i>Sabaco elongatus</i>	12	74.7	0.1358
<i>Sabellaria vulgaris</i>	9	245.5	0.4460
<i>Salvatoria clavata</i>	8	106.7	0.1938
<i>Scolelepis</i> sp.	1	3.2	0.0058
<i>Spio setosa</i>	1	8.0	0.0145
<i>Spiochaetopterus costarum oculatus</i>	1	4.0	0.0073
<i>Spiophanes bombyx</i>	1	1.5	0.0026
<i>Sthenelais boa</i>	3	20.9	0.0379
<i>Streblospio benedicti</i>	35	5884.9	10.6907
<i>Streptosyllis verrilli</i>	4	36.8	0.0669
<i>Stylochus ellipticus</i>	3	12.8	0.0233
Syllidae	1	21.3	0.0388
<i>Tharyx acutus</i>	7	101.3	0.1841
<i>Tritia obsoleta</i>	9	66.0	0.1200
<i>Tritia trivittata</i>	26	281.7	0.5117
<i>Tubulanus pellucidus</i>	19	149.1	0.2708
Turbonillinae	1	5.3	0.0097
<i>Unciola dissimilis</i>	1	6.0	0.0109
<i>Unciola serrata</i>	9	60.4	0.1096
<i>Urosalpinx cinerea</i>	4	30.6	0.0555

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SAP/QAPP

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TRANSCONTINENTAL GAS PIPE LINE COMPANY, LLC

OFFSHORE SAMPLING AND ANALYSIS PLAN / QUALITY ASSURANCE PROJECT PLAN

VERSION 1.2

NORTHEAST SUPPLY ENHANCEMENT PROJECT

JUNE 2017

PUBLIC

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OFFSHORE SAMPLING AND ANALYSIS PLAN / QUALITY ASSURANCE PROJECT PLAN

REVISIONS TO VERSION 1.2

Page numbering was updated throughout.

Section 1.1, Table 1.1, page 2 and 3

Missing contractor information is provided for the Primary and Secondary Geotechnical Laboratory Contractors, and the Secondary Benthic Laboratory Contractor.

Section 1.2, page 4

Mileage of the Raritan Bay Loop has been updated.

Section 1.2.1, page 5

Information regard dredging of the Chapel Hill Channel has been added based a Freedom of Information Act request submitted to the USACE.

Section 1.3, page 7

The dates of pre-construction sampling and analysis activities have been updated.

Section 2.2.1, page 21

The depth discussed in reference to conducting a cone penetrometer test has been updated.

Section 2.2.2, page 21

During the survey, collection of vibracores for sediment chemistry analysis deviated from the previous version of the Sampling and Analysis Plan / Quality Assurance Project Plan (SAP/QAPP) in that certain samples were collected using a rigid plastic (polycarbonate) tube liner rather than a flexible polyethylene liner due to problems encountered with collapse of the flexible liner and retention of sample. The text has been updated to represent this modification of procedures.

Appendix B, Table 1A and Table 1B

In the previous version of the SAP/QAPP, sample site labels in Table 1B were incorrectly identified as "VCA". The table has been corrected.

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LIST OF ACRONYMS

ASTM	American Society for Testing and Materials
BTEX	benzene, toluene, ethylbenzene, xylene
CFR	Code of Federal Regulations
CLP	Contract Laboratory Program
COC	chain-of-custody
CPT	cone penetrometer test
DQO	data quality objectives
E & E	Ecology and Environment, Inc.
ELAP	Environmental Laboratory Accreditation Program
EPA	U.S. Environmental Protection Agency
FTP	file transfer protocol
GPS	global positioning system
HDD	horizontal directional drill
IDW	investigation-derived waste
kg	kilogram
LCS	laboratory control sample
mg	milligram
mL	milliliter
MLLW	mean lower low water
MP	milepost
MS/MSD	matrix spike/matrix spike duplicate
M&R	meter and regulating
NELAP	National Environmental Laboratory Accreditation Program
NJDEP	New Jersey Department of Environmental Protection
NYSDEC	New York State Department of Environmental Conservation
PAH	polycyclic aromatic hydrocarbon
PARCCS	precision, accuracy, representativeness, completeness, comparability, and sensitivity
PCB	polychlorinated biphenyl
pdf	portable document file
Project	Northeast Supply Enhancement Project
QA/QC	quality assurance/quality control
RPD	relative percent difference
RDL	Rockaway Delivery Lateral

RTK	real time kinetic
RTS	[Neptune] Regional Transmission System
SAP/QAPP	Sampling and Analysis Plan/Quality Assurance Project Plan
SOP	Standard Operating Procedure
SPT	standard penetration test
SVOCs	semi-volatile organic compounds
TOC	total organic carbon
TOGS	Technical and Operational Guidance Series
Transco	Transcontinental Gas Pipe Line Company, LLC
USGS	U.S. Geological Survey
VOCs	volatile organic compounds

1 PROJECT MANAGEMENT

This combined Offshore Sampling and Analysis Plan and Quality Assurance Project Plan (SAP/QAPP) has been prepared by Ecology and Environment, Inc. (E & E) for Transcontinental Gas Pipe Line Company, LLC (Transco) in support of the Northeast Supply Enhancement Project (Project). This SAP/QAPP is applicable to any offshore sediment or water sampling activities and associated field or laboratory analyses that generate data that may be submitted to state or federal agencies to support the regulatory evaluation of the Project. This SAP/QAPP does not apply to offshore hydrographic (remote-sensing) survey activities.

This SAP/QAPP presents the policies, organization, objectives, functional activities, and specific quality assurance/quality control (QA/QC) procedures that will be used by Transco to help ensure that all offshore technical sampling data generated are accurate, representative, and ultimately capable of withstanding judicial scrutiny. The SAP/QAPP has been prepared in accordance with the *United States Environmental Protection Agency (EPA) Requirements for Quality Assurance Project Plans*, EPA QA/R-5 (March 2001) and is formatted to address the four major sections listed in this 2001 guidance document: Project Management, Data Generation and Acquisition, Assessment and Oversight, and Data Validation and Usability.

1.1 Project Organization

In general, the sampling and field analyses will be conducted by the sampling contractor, Alpine Ocean Seismic Survey, Inc. (Alpine) and overseen by Transco representatives, likely including staff from Transco's consultants – E & E and INTECSEA (a division of the Worley Parsons Group). Samples will be processed on the sampling vessel and conveyed to the laboratories by the sampling contractor or Transco's representatives. It is anticipated that geotechnical data and information from the sampling contractor and geotechnical laboratory will be delivered simultaneously to Transco and INTECSEA (and/or Lake Superior Consulting), while chemical/benthic data and information from the sampling contractor and chemical/benthic laboratories will be delivered simultaneously to Transco and E & E. It is expected that INTECSEA will review and process the geotechnical data and laboratory report(s), then provide a summary geotechnical report to Transco for review and approval prior to final application for Project design and construction purposes. It is also expected that E & E will review and process the chemical and benthic laboratory reports, then provide a summary environmental report to Transco for review and approval prior to submittal to regulatory agencies. Table 1.1-1 below identifies points-of-contact and their responsibilities with respect to the offshore sampling and analysis activities.

Table 1.1-1
Key Offshore Sampling and Analysis Personnel

Name	Role	Responsibilities
Transco		
Chris Martinez	Offshore Project Engineering Lead	Overall authority for application of geotechnical data and reports to offshore pipeline design and construction.
Webb Winston	Offshore Engineer	Final QA review and approval of geotechnical data and reports prior to application for offshore pipeline design for Project
Scott Horner	Offshore Environmental Manager	Final QA review and approval of environmental reports (including chemical and benthic analyses) prior to submittal to regulatory agencies.
Ecology & Environment, Inc.		
Sara Mochrie	Consulting Environmental Project Manager	Overall responsibility for chemical/benthic sampling and analysis activities.
Dave Albers, P.E. (NY, NJ)	Lead Environmental Engineer	Provides QA review of environmental reports.
Marcia Galloway, CQA, CQM	Quality Manager	Overall QA oversight of chemical and benthic sampling and analysis.
Steven MacLeod	Offshore Technical Lead	Responsible for developing environmental sampling and analysis report.
Nischint Sundar	System Controls Lead	Responsible for managing chemical/benthic sediment survey data and report files.
Gene Florentino, P.G., PMP	Lead Project Geologist	Responsible for field oversight of sediment sampling.
Lynne Parker	Lead Project Chemist	Responsible for QA review of chemical analysis data.
David Trimm	Lead Project Marine Biologist	Responsible for QA review of benthic analysis data.
INTECSEA / Worley Parsons Group		
Vance Nixon	Consulting Engineering Project Manager	Overall responsibility for geotechnical sediment sampling and design activities.
Mike Paulin	Principal Geotechnical Engineer	Jointly responsible for QA oversight on geotechnical investigations and providing technical information on geotechnical considerations to the Williams/Transco offshore pipeline design and construction teams.
Bernard Remmes	Principal Geotechnical Engineer	
Lake Superior Consulting		
Paul Beardon	Consulting Project Director	Responsible for QA review of geotechnical sediment sampling and design activities with respect to horizontal directional drill (HDD) activities.
Riley Shuoo	Engineering Supervisor	Responsible for review of geotechnical data and providing technical information with respect to HDD activities.
Sampling Contractor / Alpine		
Mark Kosakowski	Operations Manager	Responsible for development of the survey vessel plan and client/agency communications.
Chuck Dill	Party Chief and Senior Geologist	Overseeing mobilization and demobilization, testing, and equipment trials. Supervise survey operations, including QA and sample transfer to laboratories. Complete daily reports and other QA documents.
Laboratory Contractor (Geological - Primary) / Terra Sense, LLC		
Rosella Thomas	Geotechnical Laboratory Managing Member	Overall responsibility for geotechnical data QA review and development of primary geotechnical laboratory report.

Table 1.1-1
Key Offshore Sampling and Analysis Personnel

Name	Role	Responsibilities
Laboratory Contractor (Geological - Secondary) / Geotesting Express		
Steve Garmon	Geotechnical Laboratory Project Manager	Overall responsibility for geotechnical data QA review and development of primary geotechnical laboratory report.
Laboratory Contractor (Chemical - Primary) / Alpha Analytical		
Liz Porta	Chemical Laboratory Project Manager	Overall responsibility for development of chemical laboratory report.
James Todaro	Quality Assurance Officer	Responsible for overall laboratory QA protocols and QA review of sediment chemistry data.
Laboratory Contractor (Benthic - Primary) / Normandeau Associates		
Hannah Proctor	Biological Laboratory Project Manager	Overall responsibility for benthic data QA review and development of primary benthic laboratory report.
Laboratory Contractor (Benthic - Secondary) / ESS Group		
Matt Ladewig, CLM	Biological Laboratory Project Scientist	Responsible for overseeing analysis of QC samples.

1.2 Project Description/Background (Problem Definition)

Transco, a subsidiary of Williams Partners, L.P., is developing the Project to support National Grid's long-term growth, reliability, and flexibility beginning in the 2019/2020 heating season. The Project would provide up to 400,000 dekatherms per day of additional firm transportation capacity by adding to existing onshore Transco facilities in Pennsylvania and New Jersey, as well as expanding existing offshore facilities in New Jersey and New York waters. Transco anticipates that construction of the Project will begin mid-2018 to meet an in-service date in late 2019.

The offshore portion of the proposed Project includes a new 26-inch outer diameter pipeline that would extend from the Borough of Sayreville shoreline in Middlesex County, New Jersey, to the Rockaway Transfer Point, which is the interconnection point between Transco's existing Rockaway Delivery Lateral (RDL) and the Lower New York Bay Lateral (LNYBL) in New York waters. The new offshore pipeline, referred to as the "Raritan Bay Loop," would extend approximately 23.33 miles east-northeast across Raritan Bay and Lower New York Bay to the Rockaway Transfer Point, located in the Atlantic Ocean approximately 3 statute miles seaward of Rockaway, New York. From the Rockaway Transfer Point, the RDL supplies gas to an existing onshore meter and regulating (M&R) station located in Kings County, New York. Approximately 6.11 miles of the Raritan Bay Loop route crosses New Jersey waters, while the remaining 17.38 miles crosses New York waters. The route passes offshore of Monmouth County and Middlesex County, New Jersey, and Richmond County and Queens County, New York.

Figures showing the location of a proposed offshore study area are provided in Appendix A. This offshore study area is a 5,000-foot wide corridor centered along the preferred route that is expected to serve as the offshore workspace, i.e., the area in which construction vessels will operate and anchor. Thus, the total offshore study area along the 23.33-mile route is approximately 69.3 million square yards. In addition to the 502,682 square yards that may be disturbed during the excavation/dredging for the pipeline trench, three temporary pits will be dredged at the offshore pipeline horizontal directional drill (HDD) entry/exit points. The sizes of these pits may total roughly 12,000 square yards, and Transco plans to collect two vibracore samples for chemical analysis at the sample sites for these potential pit locations in anticipation of the greater disturbance volume (versus one vibracore sample for chemical analysis at all other sites). An additional amount of hand-jetting is expected near the Rockaway Transfer Point, but previous sediment sampling was conducted in this area in 2009/2010. The 2009/2010 Rockaway Delivery Lateral sample results were predominantly below the Class A thresholds identified in the New York State Department of Environmental Conservation (NYSDEC) Technical and Operational Guidance Series (TOGS) 5.1.9 document, In-Water and Riparian Management of Sediment and Dredged Material (2004), and none exceeded the Class B thresholds.

In response to agency comments, Transco extended the offshore study area to evaluate a route alternative in Raritan Bay near Staten Island. The figures in Appendix A include this study area extension.

To support the design and evaluation of the Project, Transco will collect and analyze geotechnical, chemical, and benthic characteristics of sediment located along the proposed offshore route. Certain site water properties will also be investigated to document conditions present during the sampling periods. To ensure that sediment sampling and analysis is sufficient for their review of an in-water dredge/fill project, NYSDEC and the New Jersey State Department of Environmental Protection (NJDEP) recommend that applicants submit a sampling and analysis plan for review before initiating sampling activities. The sampling design and analytical methods were developed based on a review of the environmental conditions and previous sampling data described below. This SAP/QAPP has been updated to incorporate NYSDEC and NJDEP input provided as of the latest revision date.

1.2.1 Environmental Setting

The proposed geotechnical study area will cross a continuous expanse of open marine and estuarine waters, which consists of three major waterbodies—Raritan Bay, Lower New York Bay, and the Atlantic Ocean. The Project area is located within the Monmouth watershed

management area and the Atlantic Ocean/Long Island Sound watershed, which drains most of the surrounding metropolitan areas and encompasses all marine waters in New York Harbor, Long Island Sound, Block Island Sound, Lower New York Bay/Raritan Bay, Sandy Hook Bay, and the waters that drain into them. The study area would cross three federally authorized navigation channels, including Ambrose Reach B (Ambrose Channel), Chapel Hill North (Chapel Hill Channel), and Raritan Bay West Reach (Raritan Bay Channel) (National Oceanic and Atmospheric Administration [NOAA] 2015). Ambrose Channel was dredged within the last 10 years as part of the U.S. Army Corps of Engineers' (USACE) overall New York/New Jersey Harbor deepening project. Based on a Freedom of Information Act request submitted to the USACE, Transco determined the Chapel Hill Channel was last dredged in March 2012. Transco has not yet determined when the Raritan Bay Channel was last dredged.

Measuring from mean lower low water (MLLW), water depths along the route range from 0 to 77 feet. The minimum water depth is 0 feet at the shore. A proposed HDD segment exits in approximately 8 feet of water approximately 1,800 feet from the shoreline. From the shoreline to the Raritan Bay Channel the water depth varies from approximately 0 feet to 20 feet. The authorized depth within the Raritan Bay Channel at the proposed crossing is 35 feet, although actual depths extend to 46 feet along the Project route. From the Raritan Bay Channel to the Chapel Hill Channel the water depth ranges between approximately 14 feet and 25 feet. The authorized depth within the Chapel Hill Channel at the proposed crossing is 30 feet, though actual depths extend to 35 feet. The water depth for the route from Chapel Hill Channel to Ambrose Channel varies from approximately 10 feet to 41 feet. The maximum water depth (77 feet) is located within the Ambrose Channel. From Ambrose Channel to the Rockaway Transfer Point the water depth ranges from approximately 15 feet to 40 feet.

1.2.2 Sediment Characteristics and Potential Contaminants of Concern

Several previous investigations have been completed within Raritan Bay and Lower New York Bay and extending into the Atlantic Ocean near the Rockaway Peninsula to identify the physical characteristics of the sediments as well as the degree to which contaminants may exist. Based on data collected by the U.S. Geological Survey (USGS) and available in USGS Open File Report OFR 03-241 and on recent investigations conducted by E & E as part of the Rockaway Delivery Lateral Project (E & E 2009, 2011), the predominant sediment type in this area has been identified as mostly fine-to-coarse sands. Greater silt and clay content was generally observed near the mouth of the Raritan River, the entrance to Upper New York Bay, and Sandy Hook Bay. However, a review of sediment sample data obtained in 2002 as part of the Neptune Regional

Transmission System (RTS) project (E & E 2003) indicates that material primarily classified as silt may also extend throughout Raritan Bay.

Additionally, the 2002 sediment sample data obtained during the Neptune RTS project indicated that a number of potential chemical contaminants had been identified in the vicinity of the proposed route for the Project (E & E 2003). Inorganic contaminants (i.e., metals) such as mercury, zinc, and arsenic were present, while organic contaminants such as polychlorinated biphenyls (PCBs) and polycyclic aromatic hydrocarbons (PAHs) were detected to a much lesser degree. These sampling results are generally consistent with earlier sediment sampling in the vicinity of the Project (Adams and Benyi 2003; Adams et al. 1998), but there was a wide variation in results, depending upon sample location and depth. More recent investigations conducted by E & E as part of the Rockaway Delivery Lateral Project indicated that substrate immediately seaward of the Rockaway Peninsula was predominantly sandy with minimal contaminant levels (E & E 2009, 2011).

1.2.3 Benthic Community

The subsea conditions in the vicinity of the proposed Project are inherently dynamic and subject to regular disturbance, both anthropogenic and biogenic. Therefore, much of the benthic environment is inhabited by more adaptable fauna capable of rapid and prolific reproduction within silty and sandy environments. Data included in the Mid-Atlantic Ocean Data Portal indicate that the benthic environment within Raritan Bay is composed almost entirely of two benthic habitats—very shallow depression silt/mud and very shallow depression sand (depths ranging from 0 to 30 feet) (The Nature Conservancy 2010). Maps available from the NJDEP show that a segment of the proposed offshore route near the New Jersey shoreline will cross current or historical habitat for one or more species of shellfish, i.e., hard clam (*Mercenaria mercenaria*) and soft clam (*Mya Arenaria*) (Decanay 2016; NJDEP 2016). The proposed Project route will also cross a section of New York waters near Staten Island that is in a productive hard clam area (Barnes 2016). As the proposed route approaches Chapel Hill Channel and Ambrose Channel in Lower New York Bay, sediment size generally increases, and high gravel/sand flats and very shallow flat sand become the dominant types (The Nature Conservancy 2010). Near the Rockaway Transfer Point the substrate becomes more consistently sandy with relatively gradual slopes. Surveys conducted for Transco's Rockaway Delivery Lateral Project indicate that the Atlantic surfclam (*Spisula solidissima*) is the dominant shellfish species in this area (E & E 2009, 2011, 2015).

1.3 Sampling and Analysis Task Description

The goal of the sampling and analysis program is to support the design and evaluation of the Project. To achieve this goal at the pre-construction stage, the following major tasks will be performed:

1. Collect offshore sediment samples for geotechnical, chemical, and benthic analyses;
2. Evaluate physical/geotechnical properties of the sediment that could be disturbed during Project construction;
3. Identify the concentrations of chemical contaminants that are present in sediment that could be disturbed during Project construction; and
4. Characterize the macrobenthic invertebrate communities that may be affected by Project construction.

Figures showing the locations of the planned offshore sample sites are provided in Appendix A. Pre-construction sampling and analysis activities occurred between November and December, 2016.

1.4 Quality Goals and Objectives

Data quality objectives (DQOs) are qualitative and quantitative statements that clearly define the objectives of a project, define the most appropriate type of data, determine the appropriate procedures for data collection, and specify acceptable decision-error limits that establish the quantity and quality of data needed for decision-making. The Project's major sampling and analysis tasks are identified in Section 1.3 above. The general data quality objectives for each of these tasks are summarized in Table 1.4-1. Acceptance and performance criteria for field and analytical quality control samples are outlined in Section 2.

Acceptance and performance criteria are often specified in terms of precision, accuracy, representativeness, completeness, comparability, and sensitivity (PARCCS) parameters. Numerical acceptance criteria cannot be assigned to all PARCCS parameters, which are briefly described below, but general performance goals are established for most data-collection activities. Data assessment procedures throughout this SAP/QAPP outline the steps to be taken, responsible individuals, and implications if QA objectives are not met. Measurement performance criteria, if applicable, were established following selection of the analytical laboratories (see Table 1.4-2).

Table 1.4-1
Data Quality Objects for Offshore Sampling and Analysis Tasks

Task	Data Quality Objective	Standards/Guidance¹	Acceptance and Performance Criteria
Geotechnical Sampling and Analysis	Acquire geotechnical data sufficient to characterize offshore substrate for the purposes of engineering design, including the determination of suitable construction methods. Also determine sediment grain-size distribution as a basis for hydrodynamic modeling of potential Project-related sediment suspension and transport.	ASTM methods appropriate for sediment classification and each geotechnical test.	Criteria are based on the ASTM methods appropriate for each geotechnical test identified in Section 2 of this SAP/QAPP.
Sediment Chemistry Sample Collection and Analysis	Acquire sediment chemistry data (including basic physical properties) sufficient to characterize the potential level of contaminants within the sediment that may be disturbed during construction to assist in review of potential environmental effects of the Project.	NYSDEC TOGS 5.1.9 In-Water and Riparian Management of Sediment and Dredged Material (2004); NJDEP's The Management and Regulation of Dredging Activities and Dredged Material in New Jersey's Tidal Waters (1997) USACE/EPA Guidance for Performing Tests on Dredged Material Proposed for Ocean Disposal (2016)	Data must meet the acceptance and performance criteria documented in Section 2 of this SAP/QAPP.
Benthic Community Sample Collection and Analysis	Acquire macroinvertebrate population and surface sediment data sufficient to characterize the benthic community within the sediment that may be disturbed during construction to assist in review of potential environmental effects of the Project.	EPA National Coastal Condition Assessment 2015: Laboratory Operations Manual (EPA- 841-R-14-008)	For species identification, 90% concurrence between two independent laboratories.

Key:

ASTM = American Society for Testing and Materials
 NJDEP = New Jersey Department of Environmental Protection
 NYSDEC = New York State Department of Environmental Conservation
 SAP/QAPP = Sampling and Analysis Plan / Quality Assurance Project Plan
 TOGS = Technical and Operational Guidance Series

Notes:

(1) Actual procedures and criteria subject to Project-specific modification, as described in this SAP/QAPP.

Table 1.4-2
Summary of PARCCS Parameter Criteria

Sampling Parameter	Analytical Method	PARCCS Parameters	Measurement Performance Criteria
Geotechnical Analyses	See Section 2.4	Precision	Per ASTM methods
		Accuracy	Per ASTM methods
Inorganics/Metals	SW-846 6020A	Precision	MS/MSD or DUP RPD: ≤20%
		Accuracy	LCS: 75-125% MS/MSD: 75-125%
Mercury	SW-846 7474	Precision	MS/MSD or DUP RPD: ≤20%
		Accuracy	LCS: 80-120% MS/MSD: 80-120%
Volatiles	SW-846 8260C	Precision	MS/MSD RPD: 30%
		Accuracy	LCS: 70-130% MS/MSD: 70-130% For BTEX compounds and 1,4-dichlorobenzene.
Semi-volatiles	SW-846 8270D	Precision	MS/MSD RPD: ≤30%
		Accuracy	LCS and MS/MSD: Base/Neutral Compounds: 40-140% Acid Compounds: 30-130%
Pesticides	SW-846 8081B	Precision	MS/MSD RPD: ≤50%
		Accuracy	LCS: 40-140% MS/MSD: 40-140%
PCB Aroclors	SW-846 8082A	Precision	MS/MSD RPD: ≤50%
		Accuracy	LCS: 40-140% MS/MSD: 40-140%
PCB Congeners	EPA 1668C	Precision	MS/MSD RPD: ≤30%
		Accuracy	Recovery Native Analytes: 60-135% See laboratory SOP in Appendix D for Recoveries of Extraction Standards and Cleanup Standards.
Dioxins	SW-846 1613B	Precision	MS/MSD RPD: ≤20%
		Accuracy	LCS: In-house limits MS/MSD: In-house limits See laboratory SOP in Appendix D.
Cyanide	SW-846 9012	Precision	MS/MSD RPD: ≤35%
		Accuracy	LCS: 80-120% MS/MSD: ≤35%
TOC	EPA 9060A	Precision	MS/MSD RPD: ≤25%
		Accuracy	LCS: 75-125% MS/MSD: 75-125%

Key:

ASTM = American Society for Testing and Materials

BTEX = Benzene, toluene, ethylbenzene, xylene

LCS = Laboratory control samples

MS/MSD = Matrix spike/matrix spike duplicate

PARCCS = precision, accuracy, representativeness, completeness, comparability, and sensitivity (as described in Section 1.4)

RPD = Relative percent difference

SOP = Standard Operating Procedure

1.4.1 Precision

Precision measures the reproducibility of measurements under a given set of conditions. Specifically, it is a quantitative measure of the variability of a group of measurements compared with their average value, usually stated in terms of standard deviation or coefficient of variation. It may also be measured as the relative percent difference (RPD) between two values. Precision includes the interrelated concepts of instrument- or method-detection limits and multiple field sample variance. Sources of this variance are sample heterogeneity, sampling error, differences among observers, and analytical error. Communication between individuals in charge of sampling, via the field logbook or otherwise, should reduce any measurement- precision errors.

1.4.2 Accuracy

Accuracy measures the bias of the measurement system. Sources of this error are the sampling process, field contamination, preservation, handling, sample matrix, sample preparation, and analysis. Data interpretation and reporting may also be significant sources of error. Typically, analytical accuracy is assessed through the analysis of spiked samples and may be stated in terms of percent recovery or the average (arithmetic mean) of the percent recovery. Blank samples may also be analyzed to assess sampling and analytical bias (i.e., sample contamination). Background measurements similarly assess measurement bias. The number of samples collected will affect the confidence of the statistical data evaluation.

1.4.3 Representativeness

Representativeness expresses the degree to which data represent a characteristic of a population, a parameter variation at a sampling point, or an environmental condition. Representativeness is a qualitative parameter that is most concerned with proper design of the measurement program. Sample/measurement locations may be biased (judgmental) or unbiased (random or systematic). Representativeness of the sampling scheme will be determined with evaluation of the historical data and statistical evaluation of the results compared with the reference site or existing data.

1.4.4 Completeness

Completeness is defined as the percentage of measurements that are judged to be valid. Although a quantitative goal must be specified, the completeness goal is the same for all data uses — that a sufficient amount of valid data is generated. A completeness goal of 95% will be established for this Project.

1.4.5 Comparability

Comparability is a qualitative parameter that expresses the confidence with which one dataset may be compared with another. Sample data should be comparable with other measurement data for similar samples and sample conditions. This goal is achieved through the use of standard techniques to collect and analyze samples. Historical data will be evaluated to ensure the methods and reporting limits are comparable to the proposed sampling. Data will only be evaluated if it is determined to be comparable.

1.4.6 Sensitivity

Sensitivity refers to the capability of a method or instrument to detect a given analyte concentration and reliably quantitate the analyte at that concentration. Analytical results for samples that are non-detect for a particular analyte that have reporting limits greater than the applicable standards and/or screening levels cannot be used to demonstrate compliance with the applicable standards and/or screening levels.

1.5 Special Training/Certification

The geotechnical field and laboratory investigations are expected to be managed by engineers licensed in New York and New Jersey. The geotechnical core borings are expected to be conducted by a well driller or soil borer licensed in New Jersey pursuant to Chapter 7:9D New Jersey Administrative Code. The laboratory conducting geotechnical analyses is expected to be certified by the American Society for Testing and Materials (ASTM) for testing soil and rock. The laboratory conducting sediment chemistry analyses will be certified by the New York State Department of Health (NYSDOH) Environmental Laboratory Accreditation Program (ELAP) for Solid and Hazardous Waste and Contract Laboratory Program and/or current certification by the National Environmental Laboratory Accreditation Program (NELAP) in New Jersey.

1.6 Documentation and Records

Data generated during the sampling and analysis activities will be documented through the formats listed in Table 1.6-1. Field records will be generated in hard copy field logs or on Project-specific datasheets (i.e., paper media), then scanned or transferred into electronic format. Electronic Project records will be maintained on internal, secure Project drives that are accessible only to the Project team.

The Project documents identified in this SAP/QAPP that will be submitted to regulatory agencies include the sediment chemistry and benthic community laboratory reports, which will be provided as appendices to an Offshore Environmental Sampling and Analysis Summary Report

(see Sections 1.6.2 and 1.6.3 below for further discussion). The core logs and/or the overall Geotechnical Site Investigation Report may also be provided to regulatory agencies, as warranted. As applicable, Project documents will be submitted to regulatory agencies as portable document format (pdf) files via e-mail, electronic media (i.e., CD or DVD), and/or posted on a password-protected file transfer protocol (FTP) site. Abridged hard copies (i.e., certain appendices may not be printed) will also be provided to agencies.

Table 1.6-1
Offshore Sampling and Analysis Data Records

Document Type	Format	Originator	Repository	Submittal Frequency
Field Logbooks	Hard copy and Electronic (pdf and/or Excel spreadsheet)	Sampling Contractor	Sampling Contractor	As needed to consultant (E & E or INTECSEA) or Transco
Progress Reports and Sediment Core Log Sheets	Hard copy and Electronic (pdf and/or Excel spreadsheet)	Sampling Contractor	Sampling Contractor and Consultant (E & E or INTECSEA)	Electronic form only: Daily to Consultant (E & E and/or INTECSEA) and Transco Hard copy: Included as appendix with field report.
Laboratory Reports	Hard copy (with exceptions) ¹ and electronic (pdf and Excel spreadsheet or CSV)	Laboratories	Laboratories and Consultant (E & E or INTECSEA)	Preliminary and/or final sediment chemistry reports to consultant and Transco within 30 days of sample delivery. Preliminary and/or final benthic report to consultant and Transco within 60 days of sample delivery. Final sediment chemistry and benthic lab reports to regulatory agencies as part of survey summary report. ²
Summary Reports	Hard copy and Electronic (pdf)	Sampling Contractor, Consultant (E & E)	Sampling Contractor and/or Consultant (E & E or INTECSEA)	Draft and final survey summary reports to Transco. Final environmental (benthic/chemistry) survey summary report(s) to regulatory agencies. ²
<p>Key:</p> <p>CSV = comma separated value</p> <p>E & E = Ecology and Environment, Inc.</p> <p>Notes:</p> <p>⁽¹⁾ Very large appendices may be submitted only in electronic format, at Transco's discretion.</p> <p>⁽²⁾ Reports submitted to regulatory agencies as part of license/permit applications will be retained by those agencies according to their policies and state/federal laws.</p>				

1.6.1 Field Documentation and Reporting

The sampling contractor will maintain a daily operations log that records the time and description of all significant events during the investigation, which will be made available to Transco on request. Based on the daily operations logs, the sampling contractor will prepare a daily progress report that includes the following:

- 1) Brief summary of work performed and narrative of events
- 2) Changes to scope
- 3) Disputed time
- 4) Delays, malfunctions, deviations, and / or special problems encountered
- 5) Weather
- 6) Safety incidents
- 7) Tally of events including working time, depth of corings, downhole tests performed, standby time, downtime and cause (i.e., weather, equipment or vessel), consumables
- 8) Percentage of Work scope completed
- 9) Vessel location
- 10) Brief outline of findings
- 11) Work planned for next 24-hour period and three-day look-ahead
- 12) Company and contractor comments.

The sampling contractor will provide the daily progress report to Transco by 08:00 a.m. (Central Time) the following day.

The sampling contractor and/or Transco's designated field geologist or geotechnical engineer will visually inspect all deep and shallow core samples, documenting measurements for individual horizons or strata in a field logbook.

Individual field logs will be made for each geotechnical core sample. Logs will include the following information:

- 1) Full information on position, coordinate system, and water depth
- 2) Length in feet of final penetration and sample recovery
- 3) Visual description of and length of each individual sample
- 4) Results of index and shear strength testing

For sediment chemistry core samples, basic information collected will be recorded on a sediment core log and will include the following:

- 1) Project and core sample identification numbers
- 2) Latitude/longitude coordinates of the sample location
- 3) Digital photographs of each sample
- 4) Type of equipment used to obtain the sample
- 5) Visual classification of each major sediment horizon or strata encountered in accordance with the United Soil Classification System
- 6) Water depth and sea state core penetration length
- 7) Core recovery length
- 8) Presence of debris, contaminants, or living organisms.

Sediment testing results completed in the field will be reported in accordance with the procedures as defined in the various standards for the applicable tests (see Section 2.4 for a list of testing methods). Sediment test results will be produced in a hard copy format with data represented in appropriate tables of results and graphs showing test results. All test results will be tabulated, the tabulated summary of test results will be formatted as a Microsoft (MS) Excel data file. All geotechnical core logs (hard copies and electronic files) will be presented at the same vertical scale. The sampling contractor will provide these data to Transco within 24 hours after completion of activities for each sample site.

Site information for surface sediment grab samples will also be recorded in a field logbook, including the actual sampling coordinates, sample number, water depth, stage of the tide, time, and the sea/weather conditions.

The sampling contractor will compile a Field Investigation Report of the field sampling and analysis activities. The sampling contractor will submit the draft field report to INTECSEA and Transco following completion of all their field activities, at the time of vessel demobilization. The field report will include, at a minimum, the following:

- Brief assessment of sampling activities performed;
- Set of preliminary core logs as produced in the field, including full-size photocopies for any interpretation logs that are hand-drawn;
- Summary log of core information (samples, descriptions, and results of onboard tests);
- Sampling activity summary that concisely highlights all significant features;
- Copy of the daily operations log (hard and digital); and
- Results of geotechnical field tests.

The sampling contractor will issue a final version of the Field Investigation Report following review and approval by INTECSEA, Transco, and/or Lake Superior Consulting.

1.6.2 Laboratory Data Reporting

The sampling contractor and/or INTECSEA will be responsible for obtaining results of geotechnical analyses from the onshore laboratory in a format that can be incorporated into the Geotechnical Site Investigation Report (see Section 1.6.3 below).

After completing the sediment chemistry laboratory analysis program, it is anticipated that the laboratory will submit a Chemistry Analytical Data Report to the sampling contractor and the sampling contractor will provide the reports to Transco and E & E for review. The laboratory will provide a full laboratory report (Level IV or Contract Laboratory Program [CLP]-like deliverable) including QA/QC documentation in pdf format, electronic data deliverables, and excel summary tables of all results. The laboratory will submit revised reports as necessary to address QA/QC deficiencies or errors.

After completing the benthic analyses, it is anticipated that the laboratory will submit a draft Benthic Community Sampling Report to the sampling contractor, and the sampling contractor will provide the reports to Transco and E & E for review. The document will include summary tables of all results (e.g., number and type of species) and any relevant laboratory QA/QC documentation. Some report appendices may be in electronic format only, depending on size and content. The laboratory will submit revised reports as necessary to address data deficiencies or errors.

1.6.3 Summary Reports

It is anticipated that the sampling contractor or INTECSEA will develop a Geotechnical Site Investigation Report(s). This report will include a summary of all information collected during the geotechnical investigation, the Field Investigation Report, and the results of the standard and any advanced geotechnical testing that takes place at an onshore laboratory. A draft version of the Geotechnical Site Investigation Report will be submitted to Transco and Lake Superior Consulting following completion of all geotechnical laboratory analyses. The report will include the following information:

- An overview of the deep (core boring) and shallow (vibracoring) core results, with highlights of all hazards, obstructions, constraints and significant anomalies encountered;

- Purpose and defining limits of geotechnical investigation task, dates of acquisition, brief description of utilized equipment and vessel;
- Discussion of local sediment stratigraphy and an interpretation of the local sediment properties;
- Laboratory test results, including 'grouping' summaries for similar facies;
- Description of positioning systems, calibrations, data reduction, results, and performance;
- Description of geotechnical acquisition systems, calibrations, data reduction, results, and performance; and
- Supporting data, including final core profiles, vessel specifications, coring systems, positioning and water-depth measurements, field-sampling procedures, field-sediment testing, drill logs, and daily progress reports, if not previously submitted in the field report.

The sampling contractor or INTECSEA will issue a final version of the Geotechnical Site Investigation Report following Transco's review and approval of final edits.

In addition to reporting on hard copy media, the sampling contractor will submit the final Geotechnical Site Investigation Report in electronic format, including charts, drawings, figures, and plots. The media and precise format will be confirmed during reporting, but it is anticipated to be a browseable CD or DVD with the report presented in pdf format and all data in Microsoft Excel tables. All charts and maps will be made available in hard copy and AutoCAD 2000-compatible digital format.

An Offshore Environmental Sampling and Analysis Summary Report that synthesizes the results of the sediment chemistry and benthic community laboratory reports will also be prepared by E & E for inclusion as part of Project license and permit application packages. E & E will provide a draft version of this summary report in electronic format to Transco for review and approval. Following Transco's approval, a final version of the Offshore Environmental Sampling and Analysis Summary Report will be submitted to agencies to provide a more concise description of chemical and benthic characteristics of the sediment for ease of agency review. This summary report will include the original laboratory reports as appendices.

1.6.4 Record Retention

Transco's sampling contractor will keep accurate logs and records of all sampling activities and will provide Transco with complete, legible copies of logs and records upon completion of activities at each sample site. The sampling contractor will preserve all records in good condition until they are delivered and deemed acceptable by Transco. Transco will have the right to examine such records at any time prior to delivery.

The laboratories will submit all data and laboratory reports to the sampling contractor, who will forward them to Transco and the appropriate consultant (E & E, INTECSEA, and/or Lake Superior Consulting). The laboratories will retain data and reports for a period of time dictated by their individual protocols and certifications. Laboratory data and reports will also be retained by the consultants for the minimum period identified in Table 1.6-1.

2 DATA GENERATION AND ACQUISITION

This section of the SAP/QAPP describes the design and implementation of field, laboratory, and data-handling procedures for the Project's offshore sampling activities. The SAP/QAPP provides the basis for ensuring that appropriate methods are used and thoroughly documented.

2.1 Sampling Process Design

Deep core samples extending up to 125 feet below the seafloor will be collected from up to 22 sample sites¹, all of which are within New Jersey waters. The deep core sample sites are identified as "BHA" in Table 1B in Appendix B, which presents the planned coordinates and core depths for each site, which have been approved by the New Jersey Historic Preservation Office. Sites identified with "-ALT" indicate those that have been shifted to avoid potential cultural resources. These deep core sites are located near the New Jersey shoreline and across Ambrose Channel, the two offshore areas where Transco proposes to install the Project pipeline using HDD. The deep core depths represent the maximum depths for HDD during the Project. Deep core samples will be analyzed for geotechnical properties only (see Table 1.4-1). The geotechnical data will be used for planning the routing of the HDD portion of the pipeline.

Shallow core samples will be collected at 87 sites, 15 of which are in New Jersey waters and 72 of which are in New York waters. Of these, 69 sample sites are centered along the

¹ Three additional core boring sites associated with the Raritan Bay Loop shore crossing are located onshore and are therefore not discussed in detail in this document.

preferred route, while the remainder are along a route alternative. The shallow core sample sites are identified as “VC” in Tables 1A and 1B in Appendix B, all of which have been reviewed and approved by the New Jersey Historic Preservation Office and New York State Historic Preservation Office, as appropriate. Sites identified with “-ALT” indicate those that have been shifted to avoid potential cultural resources. The shallow cores will extend at least 12 feet below the seafloor outside navigation channels and up to 30 feet below the seafloor near navigation channels and designated anchorage areas. The shallow core samples will be collected in areas where pipeline would be installed by trenching methods and where HDD pits would be excavated, potentially using a clamshell dredge, a mechanical plough, and/or a jet sled. Dredged material may be side-cast adjacent to the trench and, following pipeline installation, would be used to backfill the trench to the extent practicable.

The NYSDEC TOGS 5.1.9 document recommends applying Balduck’s method for determining an appropriate number of sediment sample sites. Transco currently estimates that approximately 530,000 square yards of seafloor may be disturbed by trenching methods to install the pipeline along the entire offshore route (not including anchoring). An additional 12,000 square yards may be excavated for offshore HDD pits. Conservatively assuming a potential for contamination along the entire offshore route, a “dredge factor” of three would be applied to the Balduck equation, suggesting that 69 sample sites should be used to characterize the dredge area. This is consistent with the number of sample sites currently proposed in this SAP/QAPP.

Transco will collect samples to depths that reflect the maximum anticipated depth of disturbance during Project construction (see Appendix B, and Tables 1A and 1B), accounting for appropriate pipeline burial depths. The USACE New York District provided the following anticipated pipeline burial requirements for the Project based on information presented as of June 2016 (Handell 2016):

- Navigable waters located outside of designated channels and anchorage areas:
 - Minimum 4 feet of cover below present bottom in soft sediment
 - Minimum 2 feet of cover below present bottom in consolidated rock
- Designated navigation channels
 - Minimum burial 8 feet below authorized depth (including side-slopes), and
 - Minimum 4 feet of cover in soft sediment
- Designated (charted) anchorage grounds
 - Minimum 7 feet of cover below present bottom in soft sediment for un-maintained anchorage

- Minimum burial 11 feet below authorized (or actively maintained) depth for maintained (dredged) anchorage and minimum 7 feet of cover in soft sediment.

Shallow core samples will be collected for testing and analysis of both geotechnical and bulk sediment chemistry properties (see Table 1.4-1). Due to sample volume and analysis requirements, two separate shallow core samples will be collected at each shallow core sample site—one for geotechnical analyses and one for sediment chemistry analyses. In addition to these two shallow core samples, a third shallow core sample will also be collected for sediment chemistry analyses at the three shallow core sample sites that are closest to the anticipated HDD entry/exit locations (i.e., VC-1 ALT, VC-54, and VC-55). Thus, a total of 177 shallow core samples will be collected. Shallow core samples will be divided into sections at the time of collection. The size of the planned core sections will provide sufficient volume to allow for QA/QC analyses.

Surface sediment grab samples will be collected for analysis of benthic invertebrate populations as well as supplemental physical (grain size and total organic carbon [TOC]) analyses. Three surface sediment grab samples will be collected at each shallow core sample location identified as “VC” in Tables 1A and 1B in Appendix B, for a total of 270 sediment grab samples. Sufficient volume will be collected to allow for QA/QC analyses.

2.2 Sampling Methods

Summaries of offshore sampling methods are provided below. Unless otherwise noted in this SAP/QAPP, sampling procedures will substantially adhere to the applicable testing methods identified in Section 2.4. Sample sites will be located in the field using a real-time kinetic (RTK) differential global positioning system (GPS) equipment with an accuracy of approximately ± 3 feet. Water depths will be determined using a survey-grade echo sounder with an accuracy and precision of 3 feet or better.

2.2.1 Core Boring

A rotary drill system will be used to collect the deep core samples. Offshore core boring in deeper water (more than 20 feet) will use a jack-up barge with a drill rig mounted on the barge platform, working during daylight hours. The jack-up platform is lifted out of the water by jacking against the legs mounted on the platform. In shallow areas near the New Jersey shoreline, the drill rig used to collect deep cores may be mounted on a pontoon barge held in position with spuds or anchors.

A temporary 6-inch-diameter steel casing extending through the water column from the deck of the barge will be used to stabilize the sediments immediately below the seafloor; drilling

fluid additives will be used to stabilize the remaining depth of the borehole. The drilling fluid additives will consist primarily of attapulgite clay powder (e.g., ZeoGel) and possibly barite or guar gum, as necessary, to provide additional weight/density. Sediment samples will generally be taken at 5-foot intervals. The sediment samples will be obtained with a standard 2-inch outer-diameter split-spoon sampler, which is driven through four 6-inch intervals with a 140-pound hammer that freefalls for 30 inches. A standard penetration test (SPT) will be used to determine resistance at each sample interval, and the number of blows required to drive the sampler through each of the four 6-inch increments will be recorded, up to 100 blows (i.e., point of refusal). The procedures will generally adhere to ASTM D1586.

In uniformly cohesive soils, high quality (minimal sample disturbance) samples will be obtained utilizing 3-inch-diameter thin-walled Shelby tubes subsequent to obtaining a disturbed sample. Transco's designated field geologist or geotechnical engineer will make a field determination as to when it is appropriate to attempt a Shelby tube sample. The associated procedures generally follow ASTM D1587.

Core boring through all other substrate, which would require the use of diamond or tungsten bits, will be carried out using a split-inner, double-tube, swivel type core barrel (such as NWD4) to allow full core recovery. A conventional double-tube, swivel type core barrel may be employed. Single tube core barrels will not be used. Continuous core recovery will be obtained unless otherwise specified by the on-site Transco representative. Where a split inner tube is used, rock core will be transferred directly from the split inner tube to the core box (sheathed as required). Additional core boring procedures generally follow ASTM D2113. Each core box will be photographed in the field in accordance with ASTM D5079. In addition, the rock quality designation will be determined in accordance with ASTM D6032.

It is possible that a cone penetrometer test (CPT) will be conducted in addition to or in lieu of core boring at certain deep core sample sites. No sediment sample would be collected during the CPT. Rather, the CPT unit would be lowered to the seafloor and push rods would force the cone assembly through the sediment to the desired depth. Conducting a CPT to a depth of up to 125 feet may take a few hours, depending on the substrate encountered. The CPT procedures generally follow ASTM D5778 and/or ASTM D3441.

When the casing is raised to an elevation of approximately 1 to 3 feet below the mudline (i.e., seafloor), seawater will be pumped in through the bottom of the drill casing until fluid collected on deck runs clear. Approximately one deep core will be collected per day depending on site conditions, including weather and type of substrate encountered.

2.2.2 Vibracoring

Vibracoring will be used to collect shallow cores with a Rossfeller P-5 model vibracorer, or equivalent.² All vibracores samples will be taken from a vessel held on position under power; no seabed disturbance will occur at these sites other than taking the samples themselves. At each sample site, vibracore samples that are collected concurrently will be spaced approximately 20 feet from each other to avoid sediment disturbance. A steel core barrel with a 4-inch diameter will be employed. Prior to use, this barrel will be cleaned with a washdown pump or pressure washer using site water. Following the cleaning of the core barrel, a new core liner will be inserted into the core barrel. The liner for samples intended for geotechnical analyses will be a rigid plastic (polycarbonate); a flexible food-grade polyethylene liner will be used for sediment chemistry samples. Alternatively, a new, dedicated (single-use) rigid plastic liner may also be used for collection of sediment chemistry samples if the flexible liner results in poor recovery. A stainless steel core catcher will then be inserted into the end of the barrel and riveted or threaded in place. The vibracorer will then be deployed into the water column. When the core nose reaches the bottom, the vibracoring unit will be turned on. The vibracorer will continue vibrating and coring until reaching the desired depth or a point of refusal (i.e., penetration of less than 6 inches over a one-minute period). The unit will be laid horizontally on the deck, the core catcher will be removed, and the liner will be pulled from the core. The shallow core (vibracore) samples intended for geotechnical analyses will likely be cut into 3-foot sections, then capped and taped following any field tests. The shallow core samples intended for bulk sediment chemistry analyses will be cut into 3-foot (maximum) sections, which will be treated as sub-samples according to the depth intervals identified in Section 2.3. The physical features of the sediment sub-sample, such as color, texture, and odor will be noted in a field logbook. Distinct layers more than 1-foot thick will be separated as unique sub-samples subject to sediment chemistry analyses if they appear contaminated, based on the field geologist's evaluation of appearance and/or odor. The minimum 1-foot thickness will provide sufficient sample volume for all sediment chemistry analyses. Depending on site conditions such as weather and type of substrate encountered, approximately five to ten vibracore samples will be collected per day.

2.2.3 Sediment Grabs

Surface sediment grab samples will be collected separately from the vibracores samples and/or at a sufficient distance from the specific vibracore sample locations to ensure that the

² As a contingency if vibracoring activity is problematic at a particular sample site, shallow core samples may be obtained using a gravity-type piston core capable of penetrating the seabed to a minimum depth of 12 feet.

surface samples are undisturbed prior to collection. The grab samples will be used to evaluate the macrobenthic community (i.e., organisms larger than approximately 0.02 inch [500 microns]). Grab samples will be collected using a Day Grab sampler or equivalent. The grab sampler will be positioned above each sampling location, hoisted with a boom or winch, and allowed to freefall through the water column to the bottom. Upon contact with the bottom, the trigger on the spring-loaded jaws will be activated and the sampler will collect the sediment in a 1 square-foot (0.1 square-meter) section of the seabed. The sampler will be slowly hoisted through the water column to the surface and then brought onto the vessel where the contents of the sampler will be emptied into a clean catch basin. The approximate volume will be recorded and the physical features of the sediment sample, such as color, texture, and odor will be noted in a field logbook. The sample will be mixed and, from one grab sample per sample site, a sub-sample (minimum 250 milliliters [mL]) will be removed and stored in a clean container for subsequent grain size and TOC analysis at an onshore laboratory. The remaining catch basin contents will be poured carefully into a bucket sieve consisting of a 1,000-micron sieve, nested over a 500-micron sieve, and the sample will be gently washed through the sieves using seawater from the site. Any material that flows through the 500-micron sieve will be discarded. The material retained on both the 500- and 1,000-micron sieves will be collected and transferred to a laboratory container capable of holding all of the remaining sample volume. The liquid volume of the sample will be reduced to 50% of the container volume. A 20% formalin solution will be added until the container is filled, resulting in a 10% formalin concentration for sample preservation. The sample will then be transferred to a laboratory for analysis, where macrofauna will be identified to the lowest practicable taxa. Depending on site conditions such as weather and type of substrate encountered, approximately 15 to 30 surface sediment grab samples will be collected per day.

2.2.4 Contingency Resampling Procedures

When three contiguous samples or tests are missed during core boring, the sampling contractor will either restart the boring and testing program from the seafloor or obtain approval from Transco for a strategy capable of addressing the missed-sample issue. In the event that unsatisfactory deep-core recovery is persistent, the length of successive drill runs may be reduced until satisfactory core recovery is obtained, or the hole may be re-drilled, at the discretion of the sampling contractor with approval from Transco's on-site representative.

In the event of poor recovery, collapsing of the liner, or buckling of the core barrel during vibracoring, a second (and potentially third) attempt will be made in the same target area unless the presence of a hard layer is expected to be the cause of poor recovery or core barrel buckling.

If poor recovery or buckling of the core barrel is judged to be the result of encountering a hard layer, the Transco representative onboard the vessel will provide instructions on whether a second attempt shall be made at the same location, an offset location, or at all.

In the event that core boring or vibracoring is aborted for whatever reason, and the Transco representative onboard the vessel confirms that an additional attempt will be made at an offset location, the sampling contractor will relocate to not more than 20 feet from the primary location, and actual coordinates will be logged. For core boring, boreholes will be drilled without sampling or testing to one test cycle above the adjacent missed-sample depth, at which point testing and sampling will be resumed.

2.2.5 Equipment Decontamination

Because of the direct contact with sample material, the vibracorer nose catcher assembly will be washed with soap (Alconox or equivalent) and water to remove any debris before collecting each sample. Seawater from the site may be used to rinse the nose catcher assembly, given that it will be submerged in seawater immediately prior to sample collection. Implements used to process samples for sediment chemistry analyses (e.g., spoons, bowls, mixing blades) will be decontaminated by washing with soap (Alconox or equivalent) and thoroughly rinsing with distilled water, if available, or drinking water. A dilute acid rinse may also be used if allowed by the sampling contractor's vessel-safety policies. Contaminated protective clothing (i.e., disposal gloves) will be kept in plastic garbage bags to be isolated for separate disposal.

2.2.6 Investigation-Derived Waste (IDW)

Cuttings, drilling fluids, and hazardous decontamination fluids (e.g., acid rinse) will be disposed by the sampling contractor in compliance with state and federal requirements. The sampling contractor will record the quantity of cuttings retained at each core boring location.

2.3 Sample Handling and Custody

This section describes the general procedures that will be used from the time samples are initially logged onboard the sampling vessel to the time they are transferred to the onshore laboratories.

2.3.1 Sample Containers, Preservation, and Holding Times

Deep core (boring) samples extruded for geotechnical analyses will be wrapped or bagged in plastic and/or aluminum foil. Deep-core samples collected in Shelby tubes will be capped and retained in their tubes. Shallow-core (vibracoring) samples intended for geotechnical analyses will be retained in capped sections of the tube liners in which they are collected. All untested

samples will be retained by the sampling contractor (or designated laboratory) up to two years from the date of acquisition.

The volume of material, containers, and holding times required for each shallow core sub-sample intended for sediment chemistry analyses are indicated in Table 2.3-1. Table 2.3-2 presents the corresponding volume of water, containers, and holding times for equipment blanks. The laboratory will provide the necessary containers, labels, and chain-of-custody forms sufficient to accommodate any quality control replicates and an additional 10% contingency to cover breakage, etc. The laboratory will maintain a record of the sample bottle-lot numbers that were shipped in the event of a contamination problem.

Before processing, material from surface sediment grab samples will be collected in two 4-ounce glass jars with a Teflon-lined cap and stored at 4 degrees Celsius (°C) +/- 2°C. The material intended for TOC analysis will be tested within 28 days. Following bucket sieving, sediment grab samples will be transferred to plastic containers at least 2 liters in size and preserved with a 20% formalin solution (with a resulting liquid formalin concentration of 10%), then stored between 2°C and 26°C.

Table 2.3-1
Sediment Container and Holding Times for Chemical Analyses

Test Description	Type and Size of Container for each Group of Analytes	Number of Containers and Volume (per sample)	Preservative	Holding Time
Inorganics/Metals	16-oz glass jar with Teflon-lined cap	1 - fill completely	Cool to 4±2°C	6 months
Mercury				28 days
Cyanide				14 days
Semi-volatiles (including PAHs)				Extract within 14 days, analyze within 40 days
Pesticides				Extract within 14 days, analyze within 40 days
PCB Aroclors				Extract within 14 days, analyze within 40 days
Total Organic Carbon				28 days
Total Solids				7 days

Table 2.3-1
Sediment Container and Holding Times for Chemical Analyses

Test Description	Type and Size of Container for each Group of Analytes	Number of Containers and Volume (per sample)	Preservative	Holding Time
Dioxin/Furans	8-oz glass jar with Teflon-lined cap	1 - fill completely	Cool to 4±2°C	Extract within 365 days, analyze within 365 days.
PCB Congeners				
Volatiles	Terra Core Kit or equivalent (Method 5035)	One 40-mL vial with 15mL Methanol; fill with 15g sediment. Two 40-mL vials with 5mL Water; fill with 5g sediment.	Cool to 4±2°C (Freezing optional)	48 hours (up to 14 days if frozen)
Key: mL = Milliliters oz = Ounces PAH = Polycyclic aromatic hydrocarbon PCB = Polychlorinated biphenyl TOC = Total organic carbon				

Table 2.3-2
Equipment Blank Container and Holding Times for Chemical Analyses

Test Description	Type and Size of Container for each Group of Analytes	Number of Containers and Volume (per sample)	Preservative	Holding Time
Inorganics/Metals	250-mL HDPE preserved to pH ≤2 with HNO ₃	1	Cool to 4±2°C	6 months
Mercury				28 days
Cyanide	250-mL HDPE preserved to pH ≥10 with NaOH	1	Cool to 4±2°C	14 days
Semi-volatiles (including PAHs)	1-L Amber glass bottle with Teflon-lined cap	6 (3 minimum, plus 3 contingency)	Cool to 4±2°C	Extract within 7 days, analyze within 40 days
Pesticides				Extract within 7 days, analyze within 40 days
PCB Aroclors				Extract within 7 days, analyze within 40 days

Table 2.3-2
Equipment Blank Container and Holding Times for Chemical Analyses

Test Description	Type and Size of Container for each Group of Analytes	Number of Containers and Volume (per sample)	Preservative	Holding Time
Dioxin/Furans	1-L Amber glass bottle with Teflon-lined cap	4 (2 minimum, plus 2 contingency)	Cool to 4±2°C	Extract within 365 days, analyze within 365 days.
PCB Congeners				
Volatiles	40-mL VOA vial preserved to pH ≤2 with HCl	3	Cool to 4±2°C	14 days
Key: HCl = Hydrochloric Acid HDPE = High Density Polyethylene HNO ₃ = Nitric Acid L = Liter mL = Milliliters NaOH = Sodium Hydroxide oz = Ounces PAH = Polycyclic aromatic hydrocarbon PCB = Polychlorinated biphenyl				

2.3.2 Sample Handling

All sediment samples and core sections will be handled in a manner that minimizes disturbance, maintains integrity of the samples, and prevents detrimental effects due to the nature of the samples (e.g., contaminants). Any material potentially considered hazardous will be packaged, marked, labeled, and shipped according to the U.S. Department of Transportation regulations in 49 Code of Federal Regulations (CFR) 171 through 177.

Core samples extruded for geotechnical analyses will be sealed in bags (if disturbed) or wrapped (if intact) and placed in protective containers. Following sample preparation, all extruded sections will be photographed with a length scale and the core's identifying numbers or letters. Unextruded samples will be sealed and capped in a manner that preserves moisture content, with a clear indication of top and bottom. Both extruded and unextruded deep core samples will be labeled with company/project name, date, boring (location reference) number, sample number, sub-sample designation, and/or sample depth interval. Unextruded cores will be stored vertically according to their original orientation in the seabed. Rock core samples will be handled in general accordance with ASTM D5079, Standard Practices for Preserving and Transporting Rock Core Samples. The sampling contractor will transport deep-core samples to shore every 24 to 48

hours, weather permitting. The sampling contractor will transport shallow- core samples intended for geotechnical analyses to the shore approximately every 7 to 10 days.

Following inspection and logging of the shallow cores intended for sediment chemistry analyses, sediment sub-samples will be prepared for storage and transportation to the onshore laboratory. If these samples cannot be processed immediately, they will be stored in capped/sealed liners at $4^{\circ}\text{C} \pm 2^{\circ}\text{C}$ until processing. Samples for volatiles analysis will be collected first from each segment upon opening the liner in order to prevent loss of the analytes. After the samples for volatiles analysis have been collected, the core will be sampled for dioxin analysis and, in New Jersey and clamshell dredge sample sites only, PCB congener analysis. Samples for dioxin and/or PCB congener analyses will be collected from the area of the core sub-sample that most likely contain dioxins (e.g., high clay/silt content), as estimated by Transco's designated field geologist or geotechnical engineer. Each core sub-sample will then be composited. All sediment intended for chemical analyses (other than dioxin, PCB congeners, and volatiles) will be collected from this composite mixture and stored in suitable containers as noted in Table 2.3-1. Clean, dedicated implements (e.g., bowls, spoons, mixing blades) will be used to process each sub-sample for sediment chemistry analyses; stainless steel may be re-used following decontamination (see Section 2.2.6) while other materials will be considered disposable. The sediment chemistry sub-samples will be properly labelled (including sample name, date and time of collection, project name, and preservation), recorded on the chain-of-custody, and placed in a dedicated storage area immediately following processing and maintained at a temperature of $4^{\circ}\text{C} \pm 2^{\circ}\text{C}$. Samples intended for volatile analyses may be frozen if they cannot be analyzed within 48 hours. The sampling contractor will transport sediment chemistry samples to the shore every 24 to 48 hours, weather permitting.

At each benthic sample site, two 4-ounce jars (or one 8-ounce jar) of representative sediment will be collected from one of the three surface sediment grab samples and analyzed for grain size and TOC (at an onshore laboratory). The contents of each grab sample will then be carefully poured into a bucket sieve that consists of a 1,000-micron sieve nested over a 500-micron sieve. The sample will be gently washed through the sieves with site water. All material that flows through the 500-micron sieve will be discarded. The material retained on both the 500 and 1,000 micron sieves will be collected and transferred to a 2-liter (or larger) plastic container and the liquid volume will be reduced to 50% of the container volume. A 20% formalin solution will then be added until the container is filled, resulting in a 10% formalin concentration. The benthic sample container will be labeled and stored between 2°C and 26°C until delivered to the

laboratory. The sampling contractor will transport benthic samples to the shore approximately every 7 to 10 days.

2.3.3 Sample Identification

Samples (or sub-samples) will be assigned a unique, alphanumeric sample identification number by the sampling contractor. All pertinent information associated with this sub-sample will be entered into the sample log system, e.g., client name (Transco), date/time, sample description, and initials of the person entering the data. This number will be recorded on the core tube or sample container using a permanent (indelible) marker.

The sample identification format for samples that will be analyzed for geotechnical properties will include the sampling site number and the corresponding depth interval, e.g., “BHA-5, 20'-22'” for the interval of the deep core (boring) between 20 feet and 22 feet below the seafloor at sample site BHA5, and “VC1-ALT, 0'-3'” for the interval of a shallow core (vibracore) between 0 feet and 3 feet below the seafloor.

For sediment chemistry analyses, the sample numbering system will consist of the site number followed by a dash (-) and the subsequent depth (D) intervals, in feet. It is anticipated that the samples will be sub-sampled in the following intervals (in feet): 0-3, 3-6, 6-9, 9-12, and deeper intervals as applicable. The sub-sample intervals will not exceed 3 feet. Transco will notify and consult with NYSDEC and the NJDEP regarding any changes to the sample intervals. The letter “E” (for environmental) will follow this number. Table 2.3-3 contains the proposed list of sample identifications for the environmental cores. The final identification numbers will reflect the actual depths represented in the sub-sample, e.g., if a sub-sample is taken at a depth of 9 and 11 feet at location VC1-ALT, the final sample identification will be VC1-ALT-D9-11E. Sub-samples that are field-duplicated for quality control purposes will be identified in a manner that allows for “blind” submittal to the laboratory.

Table 2.3-3
Examples of Identification Numbers for Sediment Chemistry Sub-Samples

Location	Sample No. 0- to 3-Foot	Sample No. 3- to 6-Foot	Sample No. 6- to 9-Foot	Sample No. 9- to 12-Foot
VC1-ALT	VC1-ALT-D0-3E	VC1-ALT-D3-6E	VC1-ALT-D6-9E	VC1-ALT-D9-12E
VC2	VC2-D0-3E	VC2-D3-6E	VC2-D6-9E	VC2-D9-12E
VC3	VC3-D0-3E	VC3-D3-6E	VC3-D6-9E	VC3-D9-12E
Etc.	Etc.	Etc.	Etc.	Etc.

For benthic analyses, the sample numbering system will consist of the letter “B” (for benthic), followed by the site number, then the letter “C” (center line), the letter “N” (north of the centerline), or the letter “S” (south of the centerline). The sample identification number will end with the year of acquisition (i.e., 2016). Table 2.3-4 contains the proposed list of sample identifications for the benthic samples.

Table 2.3-4
Examples of Identification Numbers for Sediment Chemistry Sub-Samples

Location	Sample No. at Centerline	Sample No. North of Centerline	Sample No. South of Centerline
VC1	B1-C-2016	B1-N-2016	B1-S-2016
VC2	B2-C-2016	B2-N-2016	B2-S-2016
VC3	B3-C-2016	B3-N-2016	B3-S-2016
Etc.	Etc.	Etc.	Etc.

2.3.4 Sample Custody

A chain-of-custody (COC) will be prepared for all samples. The COC will contain the following information: sample identification number or borehole designation, date/time of sample collection, type of sample, sample matrix, preservative (if applicable), sample collection location (state), sample volume or core diameter and length, the analyses requested, and the number and type of sample containers.

The primary objective of COC procedures is to provide an accurate written or computerized record that can be used to trace the possession and handling of a sample from time of sampling through completion of all required analyses. A sample is in custody if it is:

- In the physical possession or view of an individual signing the COC (or representative designated by such an individual);
- Kept in a limited-access storage area on the sampling vessel that is reserved for samples only, in a container that is locked or taped shut with a custody seal at the end of each work day;
- Placed in a locked room or taped carrying container with a custody seal; or
- Stored at the laboratory in a manner consistent with the laboratory’s standard operating procedure (SOP).

The COC will initially be signed by an individual who assisted in the collection of the samples. A copy will be retained by this person while the remaining carbon copies of the form accompany the samples to the onshore laboratory.

2.4 Analytical Method Requirements

A standard testing program for deep core samples (i.e., core boring samples) will be used to identify some or all of the geotechnical properties listed in Table 2.4-1. The assigned geotechnical analyses will be determined in the field by Transco's designated geotechnical engineer based on the field characterization of the soil.

Table 2.4-1
Potential Standard Geotechnical Analyses for Deep Core Sediment Samples

Test Property	ASTM Standard
Soil Classification	ASTM D2487
Description and Identification of Soils	ASTM D2488
Moisture Content	ASTM D2216
Density (unit weight)	ASTM D7263
Relative density	ASTM 4254
Atterberg Limits ¹	ASTM D4318
Particle Size Distribution - sieve	ASTM D6913
Particle Size Distribution - hydrometer	ASTM D7928
Hand Vane (Torvane and/or torque watch) and/or Pocket Penetrometer Tests	ASTM WK27337 for pocket penetrometer
Miniature Vane Test	ASTM D4648
Remolded Miniature Vane Test	ASTM D4648
Unconsolidated Undrained Triaxial (UU)	ASTM D2850
Specific Gravity	ASTM D854
Carbonate Content (total and inorganic)	ASTM D4373
Soil pH	ASTM G51
Electrical Resistivity	ASTM G187
Sulfate Content	ASTM C1580
Rock Only	
Point Load Test	ASTM D5731
Compressive strength	ASTM D7012
Mohs Hardness	ASTM MNL46
Cerchar Abrasivity	ASTM D7625
Splitting Tensile Strength (Brazilian tensile strength)	ASTM D3967
Notes:	
(1) Test for Atterberg limits to be conducted at same elevation level as moisture contents.	
(2) The ASTM standard for pocket penetrometer is under development. There is no ASTM standard for Torvane or pocket vane. However, processes and procedures to use these tools exist.	

An advanced testing program may be conducted on selected deep-core sub-samples to provide additional geotechnical data in support of the engineering design. The advanced geotechnical program may include one or more tests for the properties listed in Table 2.4-2.

Table 2.4-2
Potential Advanced Geotechnical Analyses for Deep-Core Sediment Samples

Test Property	ASTM Standard
Consolidation (one-dimensional using incremental loading)	ASTM D2435
Consolidation (one-dimensional using controlled strain loading)	ASTM D4186
Constant Head Permeability (for granular soils)	ASTM D2434 ¹
Falling Head Permeability (for fine-grained soils)	ASTM D5856
Static Shear Tests (Consolidated-drained)	ASTM D3080
Static Shear Tests (Consolidated-undrained) (for cohesive soils)	ASTM D6528 ²
Static Triaxial Compression Tests (Ko- and anisotropically consolidated-undrained) with pore measurements	ASTM D4767
Thermal Conductivity	ASTM D5334
Notes: ⁽¹⁾ This still exists but was withdrawn by ASTM in 2015 as too much time had elapsed since last update. ⁽²⁾ This still exists but was withdrawn by ASTM in 2016, as too much time had elapsed since last update.	

Geotechnical analyses that may be performed on shallow core (i.e., vibracore) samples are identified in Table 2.4-3.

Table 2.4-3
Potential Standard Geotechnical Analyses for Shallow-Core Sediment Samples

Test Property	Field (F) or Laboratory (L) Analysis	ASTM Standard	Frequency
Soil Classification	F, L	ASTM D2487	As required
Description and Identification of Soils	F, L	ASTM D2488	As required
Moisture Content	F, L	ASTM D2216	In field, every sample interval, as appropriate. In lab, once every 3 feet
Density (Unit Weight)	L	ASTM D7263	Once every 3 feet
Soil pH	L	ASTM G51	Once every 3 feet
Electrical Resistivity	L	ASTM G187	Once every 3 feet
Sulfate Content	L	ASTM C1580	Once every 3 feet
Cohesive Soils Only			
Torvane or Pocket Penetrometer	F	ASTM WK27337 for Pocket Penetrometer ¹	As appropriate every sample interval
Atterberg Limits	L	ASTM D4318	Once every 3 feet
Miniature Vane Test	L	ASTM D4648	Once every 3 feet
Remolded Miniature Vane Test	L	ASTM D4648	Once every 6 feet
Particle Size - Hydrometer	L	ASTM D7928	Once every 6 feet
Specific Gravity	L	ASTM D854	One per core
Non-cohesive Soils Only			
Particle Size - Sieve	L	ASTM D6913	Once every 3 feet
Particle Size - Hydrometer	L	ASTM D7928	Once every 6 feet
Specific Gravity	L	ASTM D854	Two per core
Relative Density	L	ASTM D4254	One every 3 feet
Carbonate Content (Total and Inorganic)	L	ASTM D4373	Where applicable
Notes:			
⁽¹⁾ The ASTM standard for pocket penetrometer is under development. There is no ASTM standard for Torvane or pocket vane. However, processes and procedures to use these tools do exist.			

Chemical analyses to be conducted on shallow core samples are summarized in Tables A and B in Appendix C (assuming sufficient sub-sample volume is obtained) and may include metals, cyanide, volatiles, semi-volatiles (including PAHs), pesticides, PCBs, and dioxins. The samples will be analyzed in accordance with the laboratory's ELAP or NELAC certification and as outlined in the laboratory's SOPs included in Appendix D. Table A in Appendix C identifies the chemical analyses that will be performed for sample sites in New York waters where clamshell dredging would not occur during the Project. Table B in Appendix C identifies a more extensive list of chemical analyses that will be performed for sample sites in all New Jersey waters and in New York waters where clamshell dredging may occur during the Project. Tables 2.4-4 and 2.4-5 specify which sample sites are associated with Tables A and B in Appendix C. All analyses in Appendix C will be conducted on all sediment sub-samples, with the exception of dioxin analysis.

For each shallow core sample site in New York waters where clamshell dredging would not occur during the Project (Table 2.4-4), dioxin analysis will only be immediately performed on the sediment sub-sample most likely to contain dioxin (e.g., a high clay or silt content), as determined in the field by the field geologist or geotechnical engineer. Samples selected for immediate dioxin analysis will be indicated as such on the label and COC. Material from the other shallow core sub-samples will be archived for future dioxin analysis. The analytes noted in Appendix C were selected based on chemicals of concern listed in the NYSDEC TOGS 5.1.9 document, the NJDEP 1997 document titled *The Management and Regulation of Dredging Activities and Dredged Material in New Jersey's Tidal Waters*, the USACE/EPA 2016 document titled *Guidance for Performing Tests on Dredged Material Proposed for Ocean Disposal*, as well as feedback from NYSDEC and NJDEP agency staff. Laboratory analyses are not proposed for water samples at the pre-construction stage since it is generally not worthwhile to characterize the chemical components in an open water environment that is constantly changing when such results would only indicate a snapshot of water quality during the limited sampling period.

Table 2.4-4
Sample Sites in New York where Clamshell Dredging Will Not Occur

VC11	VC42	VC65	For sediment chemistry analyses to be performed at these sites, see Table A in Appendix C. New York Waters (no clamshell dredging)
VC12	VC43	VC66	
VC13	VC44	VC67	
VC14	VC45-ALT	VC68	
VC19	VC46	VC69-ALT	
VC20	VC47	VC70	
VC21	VC48-ALT	VC71	
VC22	VC49	VC72	
VC23	VC50	VC73-ALT	
VC24	VC51	VC74	
VC25	VC52	VC75	
VC26	VC56	VC76	
VC27	VC57	VC82	
VC28	VC58	VC83-ALT	
VC29	VC59	VC84-ALT	
VC30	VC60	VC85	
VC31-ALT	VC61-ALT	VC86-ALT	
VC32	VC62	VC87	
VC33-ALT	VC63		
VC34	VC64		

Table 2.4-5
Sample Sites in New Jersey and in New York where Clamshell Dredging May Occur

VC1 ALT	VC15	VC41-ALT	For sediment chemistry analyses to be performed at these sites, see Table B in Appendix C. New Jersey Waters or New York Waters (clamshell dredging)
VC2	VC16	VC53	
VC3-ALT	VC17	VC54	
VC4	VC18	VC55	
VC5	VC35	VC77	
VC6	VC36	VC78	
VC7	VC37	VC79-ALT	
VC8	VC38	VC80	
VC9	VC39	VC81	
VC10	VC40		

Benthic taxonomic identification will be performed on organisms isolated in each surface sediment grab sample. Organisms will be keyed to the lowest practical taxa. If more than 100 organisms are found in a particular sample, the sample will be sub-sampled and all of the organisms in the sub-sample keyed. Data from the triplicate samples will enable statistical analyses to be performed. The following community metrics will be calculated: abundance, richness, Shannon-Weiner diversity index, and evenness. In addition to the taxonomy work, grain size and TOC analyses will be performed on each sample to aid in interpretation of the data collected. The TOC analysis for surface sediment grab samples will be conducted by the sediment chemistry laboratory using the TOC analysis methodology that will be applied for the shallow core samples. The grain size analysis for sediment grab samples will be conducted by the geotechnical laboratory using the sieve-based particle size analysis methodology for unconsolidated material in the shallow core samples.

2.5 Quality Control

QC data are necessary to determine precision and accuracy and to demonstrate the absence of interferences such as contamination of sample containers/glassware and reagents.

Field and laboratory QC sample frequencies for chemical analyses are summarized on Tables 2.5-1 and 2.5-2, respectively. For geotechnical analyses, QC limits are described in the appropriate ASTM testing methods.

Table 2.5-1
Field Quality Control Samples for Chemical Analyses

QC Sample	Description	Acceptance Criteria	Corrective Action
Field Duplicate	One per matrix per 20 samples for each analysis. ¹	RPDs of 70% for sediments	Qualify related samples and assess data usability.
Field Equipment Blank	One per equipment set per day. Only equipment sets that are subject to decontamination require equipment blanks. Dedicated or disposable equipment do not require equipment blanks.	No positive detections >one-half the reporting limit in the equipment blank samples. Equipment blanks are not required for single-use (disposal) sample processing implements (e.g., spoons and bowls).	Qualify related samples and assess data usability. If time permits, modify equipment decontamination procedures.
Trip Blank	One per cooler containing samples for volatiles analysis.	No positive detections in the trip blank.	Qualify related samples assess data usability.
<p>Note:</p> <p>⁽¹⁾ Field duplicates are not required for sediment archived for dioxin analysis.</p> <p>Key:</p> <p>RPD = Relative percent difference</p>			

Table 2.5-2
Laboratory Quality Control Checks for Chemical Analyses

Methods	Quality Check	Frequency	Acceptance Criteria	Corrective Action
All methods	MB	One per matrix per preparation batch.	The goal is for method blanks to be free of contamination. Low-level contamination may be present but must be less than the reporting limit.	If contamination is more than the reporting limit, samples will be reanalyzed. If contaminants are present in the method blank but not in Project samples, no further action is required.
All methods	LCS	One per matrix per preparation batch for each analysis. The LCS must contain all target analytes of concern at the site.	The LCS recovery must be within method control limits to demonstrate acceptable method performance. Sporadic marginal failures of a few target analytes are allowed when more than five target analytes are reported.	If LCS recoveries are outside QC criteria for more than a few target analytes, recoveries are significantly low, or the compounds were detected in the samples, then corrective action should be taken according to the laboratory's standard operating procedures. Corrective action is normally to extract and reanalyze the batch if within holding times.
Organic Methods	Surrogate Spikes	All samples and QC checks.	Surrogate recoveries must be within QC criteria for method blanks and LCSs to demonstrate acceptable method performance. Surrogate recoveries that are outside QC criteria for a sample indicate a potential matrix effect.	If sample surrogates recoveries are outside of QC criteria, the laboratory will re-analyze the sample to confirm matrix effects. If confirmed, the results will be reviewed along with corresponding laboratory QC results.

Table 2.5-2
Laboratory Quality Control Checks for Chemical Analyses

Methods	Quality Check	Frequency	Acceptance Criteria	Corrective Action
All methods	MS/MSD	One per matrix for each analysis batch. The spike solution must contain a broad range of the analytes of concern at the site. The overall frequency of MS/MSD on project samples must be at least one set per 20 samples. ¹	Method QC criteria or LCS criteria if not specified. MS recoveries outside the control limits applied to the LCS indicate matrix effects. QC criteria for MSD RPDs are noted for each method in Table 1.4-2.	Sample clean-up procedures may be warranted for samples with severe matrix effects.
<p>Note: (¹) MS/MSD not required for sediment archived for dioxin analysis.</p> <p>Key: LCS = Laboratory control sample MB = Method blank MS/MSD = Matrix spike/matrix spike duplicate SDG = Sample delivery group</p>				

2.6 Instrument/Equipment Testing, Inspection, and Maintenance

Offshore sampling activities will not be authorized until Transco has accepted the sampling vessel(s) as operational and ready for work.

2.6.1 Field Equipment Testing and Maintenance

All of the onboard equipment will be supplied with adequate spare parts and back-up units for ordinary maintenance and repair at sea. The sampling contractor will provide Transco with a complete inventory of equipment, back-up systems, and spare parts available on the vessel(s). The sampling contractor will identify all equipment that is critical to maintaining full sampling vessel operability and define the contingency action in event of failure.

Deck trials will be conducted at time of vessel mobilization to demonstrate that all sampling and processing systems are operational. The trials will include testing all core boring, vibracoring, and grab sampling equipment and validating vessel positioning systems unless the sampling contractor can suitably document functionality or equipment redundancy to Transco through other means.

During offshore activities, all lifting equipment such as cranes, booms, hoists, spreader bars, slings, etc. will be inspected at least once per shift during the sampling activities.

All above activities will be documented as appropriate and reported to Transco.

2.6.2 Analysis Instrument Maintenance

Laboratory and field instruments and equipment used for sample analyses will be serviced and maintained only by qualified personnel. Laboratory instrument maintenance procedures will be evaluated according to the laboratory's SOP to verify that there will be no impacts on analysis of Project samples due to instrument malfunction. For example, the laboratory must have duplicate instrumentation and/or maintained major equipment under service agreements with the manufacturer that require rapid response by manufacturer-approved service agents.

Field instruments owned by the sampling contractor or rented through approved suppliers will have manufacturer-approved maintenance programs. Field equipment will be checked upon receipt to verify that instruments are in good working condition and are accompanied by appropriate calibration records or certifications. On-site operation will be performed in accordance with manufacturer manuals. If any problems occur, the instrument will be recalibrated and verified. If calibration cannot be verified, the instrument will be replaced.

2.7 Instrument/Equipment Calibration and Frequency

Before initiating sampling, the sampling contractor will calibrate any vessel instrumentation according to manufacturer's instructions and record the findings in the field logbook or records. The sampling contractor will provide the following information for Transco's review and approval:

- Evidence of recent (validated) calibration of field sampling equipment and onboard testing instruments;
- Calibration methods for vessel navigation and positioning systems;
- Detailed field calibration and operating procedures for sampling equipment and onboard testing instruments (including probes); and
- Calibration verification procedures for vessel positioning systems, field sampling equipment, and onboard testing instruments.

2.8 Inspection/Acceptance of Supplies and Consumables

The sampling contractor will be responsible for inventorying and ensuring that adequate supplies are available for the offshore sampling activities before beginning sampling, including spare equipment parts and personal protection equipment. At the time of delivery, the sampling contractor or Transco's designated representative will verify that coolers/crates, sample containers, custody seals, and COCs are in good condition and sufficient in number to maintain

the offshore sampling activities until the scheduled date/time for the next supply pick-up or delivery.

2.9 Non-Direct Measurements

Sampling activities will rely on some data collected by outside sources such as tidal stage and elevation information from NOAA tidal stations. If available, the precision and accuracy of such sources will be identified and reported as appropriate.

2.10 Data Management

The sampling contractor will create electronic logs or spreadsheets for all data collected in the field and transmit that information to Transco and the appropriate consultant(s). The laboratory performing geotechnical analyses will submit the results to the sampling contractor in a format that was determined following selection of the laboratory, and such data would be incorporated into the Geotechnical Site Investigation Report by the sampling contractor or INTECSEA. The laboratory performing sediment chemistry analyses will provide an electronic data deliverable for all Project data to E & E. Electronic spreadsheets will also be submitted to E & E for results of benthic laboratory analyses. Data would be retained on a secure server by the consultant(s) that use this data to produce summary reports for or on behalf of Transco. Electronic data for sediment chemistry analyses will be submitted to regulatory agencies in a format to be determined in consultation with NYSDEC and the NJDEP (e.g., NYSDEC EQulS™ format and NJDEP Hazsite format).

3 ASSESSMENT AND OVERSIGHT

Individual consultants and contractors will operate under their own internal quality programs that apply to their routine technical oversight programs. Project-specific assessment and oversight procedures are discussed below.

3.1 Assessment and Response Actions

The sampling contractor will provide checklists in the Geotechnical, Chemical, and Benthic Investigation Procedures for the offshore trials and calibrations. During the offshore sampling, the sampling contractor will complete procedural checklists for sampling activities and equipment calibrations, to be witnessed by a Transco representative.

3.1.1 Peer Review

All contractors and consultants are required to perform an independent technical review on the sampling and analysis reports before submitting the reports to Transco and regulatory agencies. The sample contractor's lead field personnel will review summary geotechnical and/or environmental reports to ensure accurate descriptions of field sampling activities, as warranted (e.g., statements not taken directly from the sampling contractor's field report).

3.1.2 Technical Systems Assessments

The entire Project offshore sampling and analysis team is responsible for ongoing assessment of the technical work performed by the team, identification of nonconformance with the Project objectives, and initiation, implementation, and documentation of corrective action.

During offshore activities, a Transco representative will be in the field observing sampling activities to help ensure compliance with the technical specifications of the SAP/QAPP and associated sampling and field testing methods. The Transco representative will have authority to stop work if the field operations do not comply with the specifications. The sampling vessel(s) will be subject to ongoing audits of safety and management systems by Transco. The sampling contractor will provide Transco with reasonable access to any part of the vessel, operational, or maintenance records as appropriate for the audit. Field audits will be coordinated through Transco.

The laboratories will implement a comprehensive program of internal audits to verify compliance of their systems with applicable laboratory-specific standard operating procedures and QA/QC manuals, consistent with their respective certifications (e.g., ASTM, ELAP or NELAP). External laboratory audits will be performed by the appropriate state agency in accordance with relevant certification programs.

For benthic population analysis, a second experienced, independent (third-party) onshore laboratory will perform QA/QC analysis of benthic sediment samples. A total of 10% of all samples will be randomly selected in the field by the sampling contractor or Transco's designated representative and, after analysis at the primary benthic laboratory, sent to the third-party laboratory for independent taxonomic verification.

3.1.3 Corrective Action

If field or laboratory QA/QC audits or checks identify any deficiencies, deviations, or nonconformance events, action will be taken to correct any deficiency and minimize the possibility

of recurrence. The sampling contractor or laboratory will notify Transco immediately of any potential impacts on the results for the Project.

If there is more than a 10% difference in individual sample results of benthic population analyses received from the third-party laboratory taxonomist, the company QA officer will arrange for a review of the identification procedures and achieve a consensus between the two taxonomists. This may result in the review of certain organisms in all of the samples.

3.2 Reports to Management

There will be regularly scheduled progress meetings between the Sampling Contractor, consultants and Transco on sampling and testing progress, results, and schedule, as appropriate. Other reports will be provided as detailed in Section 1.6.

4 DATA VALIDATION AND USABILITY

4.1 Data Review, Validation, and Verification Requirements

For sediment chemistry analyses, analytical reporting limits and target compounds and QC summary data for surrogates, method blanks, laboratory control samples (LCS), and matrix spike/ matrix spike duplicates (MS/MSD) samples will be compared with the limits listed in Table 1.4-2.

Data review and validation requirements for geotechnical analyses are identified in the respective ASTM testing methods.

4.2 Validation and Verification Methods

The analytical laboratories are responsible for internal data review. The QA officer and/or manager for each laboratory is expected to review at least 10% of the data packages. (Note: this percentage was verified following selection of the laboratories.) All levels of laboratory review will be fully documented and available for review by Transco if requested or if a laboratory is audited.

The results of the geotechnical field and laboratory analyses will be reviewed for quality by INTECSEA's geotechnical engineers.

For sediment chemistry analyses, calibration summary data will be checked by the laboratory to verify that all positive results for target compounds were generated under an acceptable calibration as defined by the analytical method. All deviations will be noted in the laboratory's case narrative.

After receipt of sediment chemistry results from the laboratory, E & E will evaluate the data for completeness by verifying that the laboratory information matches the field information and that the following items are included in the hard copy data package:

- COC forms and sample summary forms
- Case narrative describing any out-of-control events and summarizing analytical procedures
- Data report forms
- QA/QC summary forms.

Field data such as sample identifications and sample dates will be checked against the laboratory report. Raw data files from the field and laboratory will not be reviewed unless there is a significant problem noted with the summary information. If the data package is incomplete, the laboratory will be required to provide all missing information within one working day.

The complete sediment chemistry data packages will be evaluated for compliance by E & E's lead Project chemist (and/or designee), who will follow EPA Region 2 Data Validation Standard Operating Procedures. Compliance checks will include:

- Review of raw data for any apparent QC anomalies;
- Confirming that all analytical problems and corrections are reported in the case narrative and that appropriate laboratory qualifiers are added;
- If any problems are identified, review of these concerns with the laboratory, obtaining additional information if necessary, and checking all related data to determine the extent of the error; and,
- Review of non-analytical data in field logs to help identify potential causes for discrepancies.

The lead Project chemist will alert the E & E Project manager to any QC problems, obvious anomalous values, or other data discrepancies that may impact data usability. Tables summarizing samples with detectable concentrations of any analytes will be prepared for inclusion with the Offshore Environmental Sampling and Analysis Summary Report, along with a summary of data discrepancies and any associated corrective actions taken in accordance with Sections 3.1 and 4.3.

The results of benthic laboratory analyses will be reviewed by E & E's lead Project biologist (and/or designee), who will verify that laboratory sample information matches field information (e.g., consistent sample identification) and review calculations for accuracy. Results may also be compared with historical benthic data for the Project area, if available.

4.3 Reconciliation with User Requirements

The laboratory QA officer and/or manager, as well as Transco's appropriate consultant (E & E or INTECSEA) will work with Transco and relevant agencies in assessing data quality.

If there are discrepancies in the geotechnical data, the laboratory tests will typically be repeated. If there is inadequate sample to repeat the test, then a determination will be made by an INTECSEA or Transco geotechnical engineer on the validity and use of the original test results, accounting for potential inaccuracies.

The data quality assessment for sediment chemistry analyses may include some or all of the following actions:

- Data that are determined to be incomplete or not usable for the Project will be identified. E & E will discuss resolution of the issue with Transco and agency technical staff and implement appropriate corrective actions (e.g., re-testing if samples are within hold times or considering other sample/analyte results as surrogate data).
- Data that are non-detect but have elevated reporting limits due to blank contamination or matrix interference will be compared with screening criteria values (if available). If reporting limits exceed the screening criteria values, then results will be handled as incomplete data as described above.
- Data that are qualified as estimated will be used for all Project decision-making. Data assessors comparing results with screening criteria will have to account for the higher level of uncertainty in their statistical analysis.

If significant disagreements or uncertainties in benthic sample species identifications persist, additional samples may be sent to the second and/or a third independent laboratory for additional verification. However, it is more likely that the uncertain species will simply be classified at a higher taxonomic level that is agreed upon by all laboratories.

If discrepancies are identified in data results that may impact data usability following submittal of summary reports to agencies, Transco will notify such agencies and identify any proposed measures to correct or resolve resulting data gaps.

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Transcontinental Gas Pipe Line Company, LLC

**Appendices to Offshore Sampling and Analysis Plan /
Quality Assurance Project Plan**

Northeast Supply Enhancement Project

July 2016

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Appendix A Sample Site Figures

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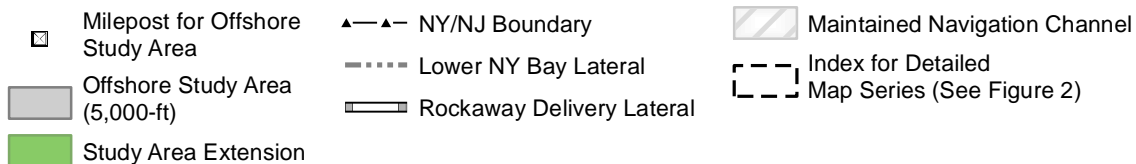
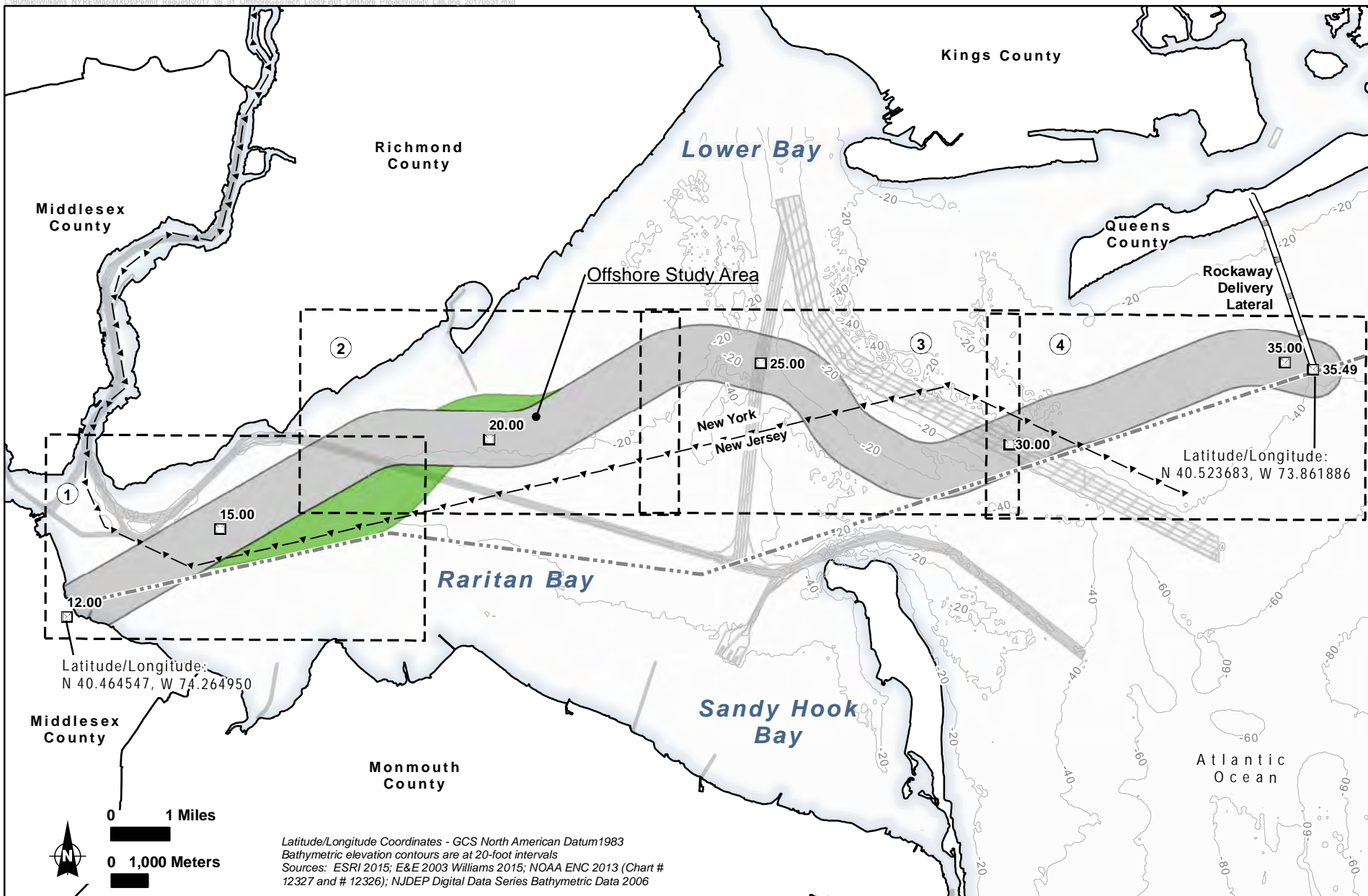
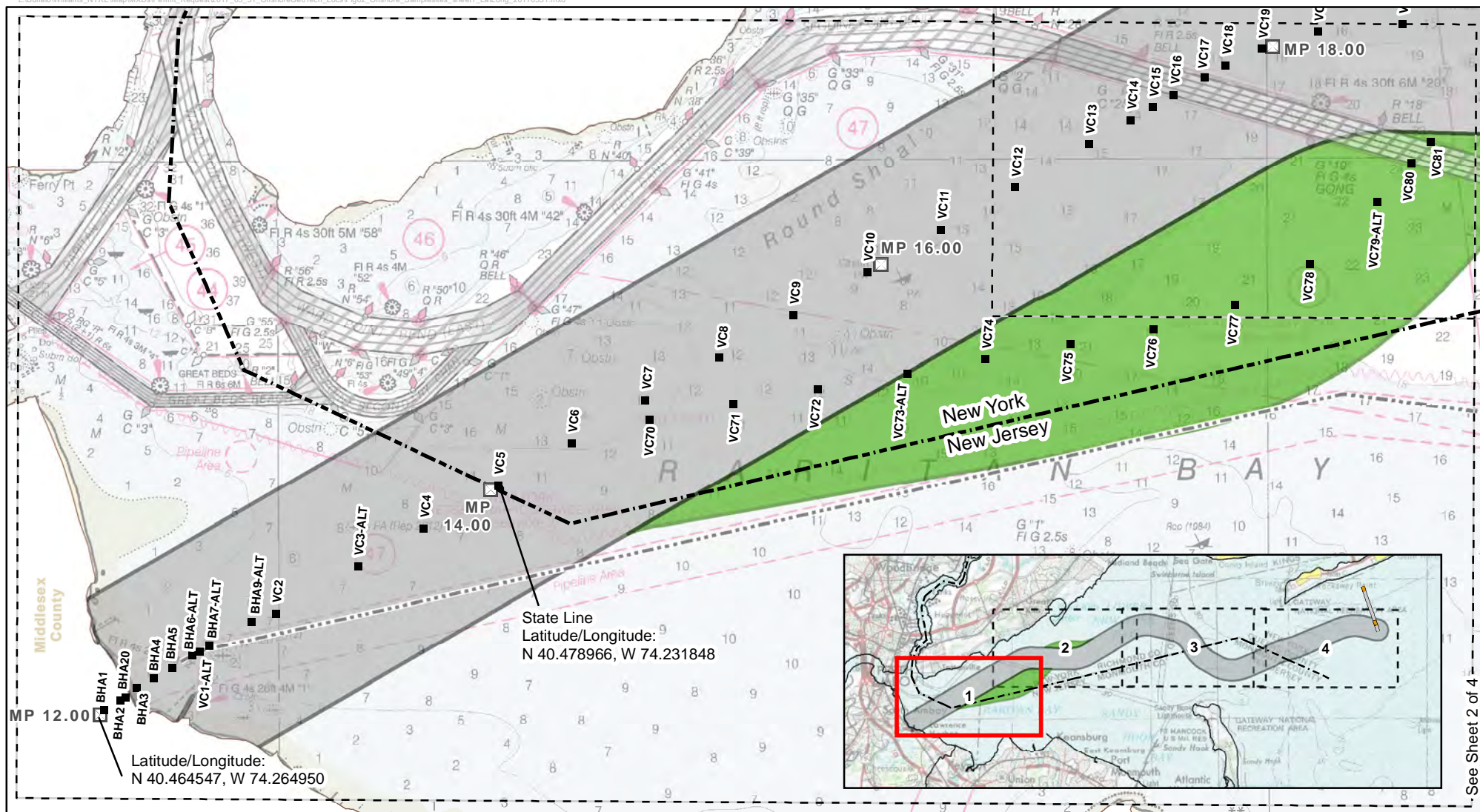


Figure 1: Raritan Bay and Lower New York Bay Vicinity Map
New Jersey, New York



0 0.25 Miles

0 500 Meters

- Sample Site
- Milepost for Offshore Study Area
- Offshore Study Area (5,000-ft)
- Study Area Extension
- Maintained Navigation Channel
- Map Sheet Match Line
- NY/NJ Boundary
- Lower NY Bay Lateral
- Rockaway Delivery Lateral

Latitude/Longitude Coordinates - GCS North American Datum1983

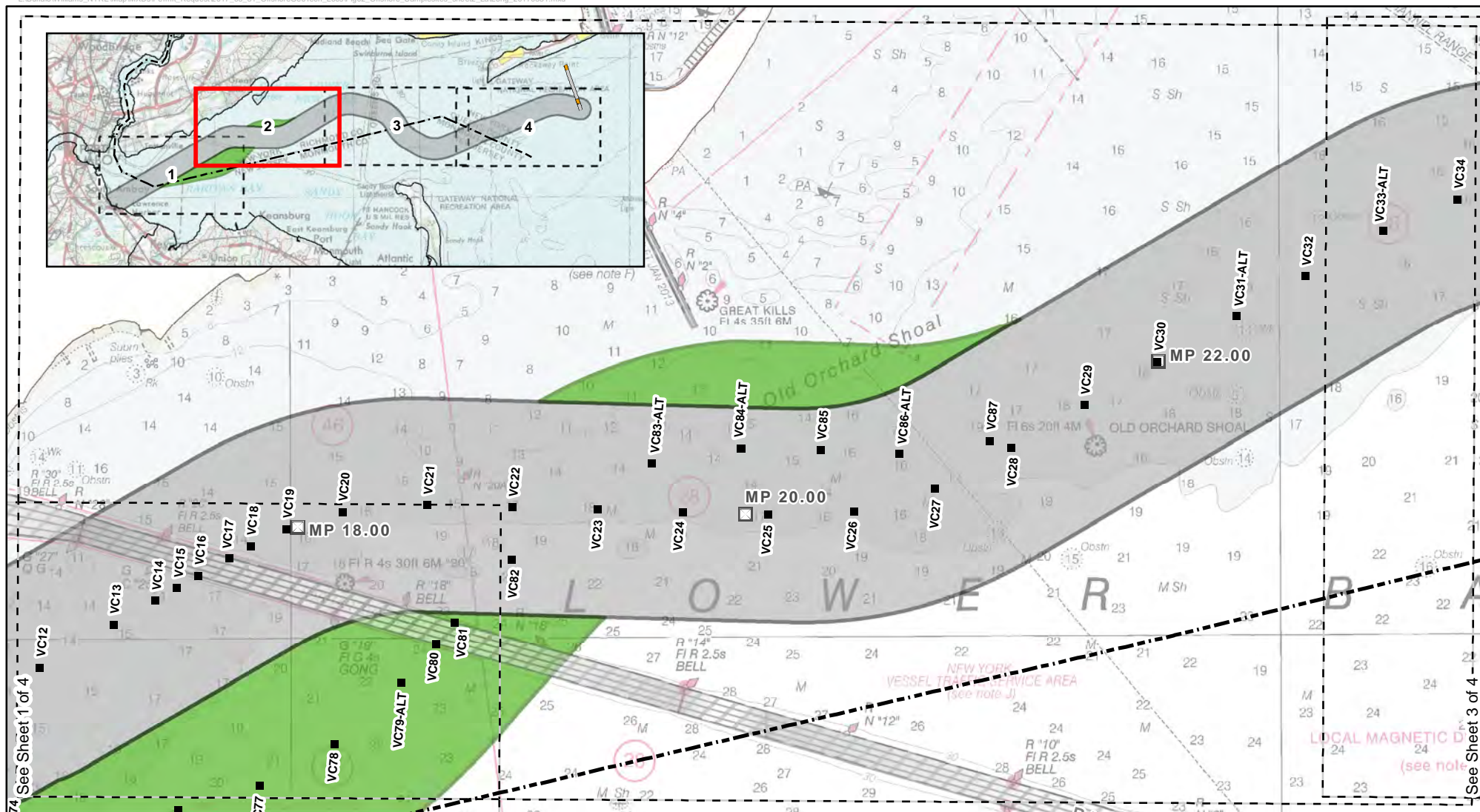
NOTE: Soundings are in feet Mean Lower Low Water (MLLW) as depicted on NOAA navigational charts. MLLW = -0.20 feet MLW at the nearest NOAA tidal station (Sandy Hook, NJ).

Figure 2: Sample Site Map
(Sheet 1 of 4)

New Jersey, New York

Service Layer Credits:
NOAA RNC Chart # 12327;
ESRI 2015; E&E 2003
Williams 2015; USFWS 1982-1997; NOAA ENC 2013

Revision Date: 5/31/2017



- Sample Site
- Milepost for Offshore Study Area
- Offshore Study Area (5,000-ft)
- Study Area Extension
- Maintained Navigation Channel
- Map Sheet Match Line
- NY/NJ Boundary
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- Rockaway Delivery Lateral

Figure 2: Sample Site Map
(Sheet 2 of 4)

New Jersey, New York

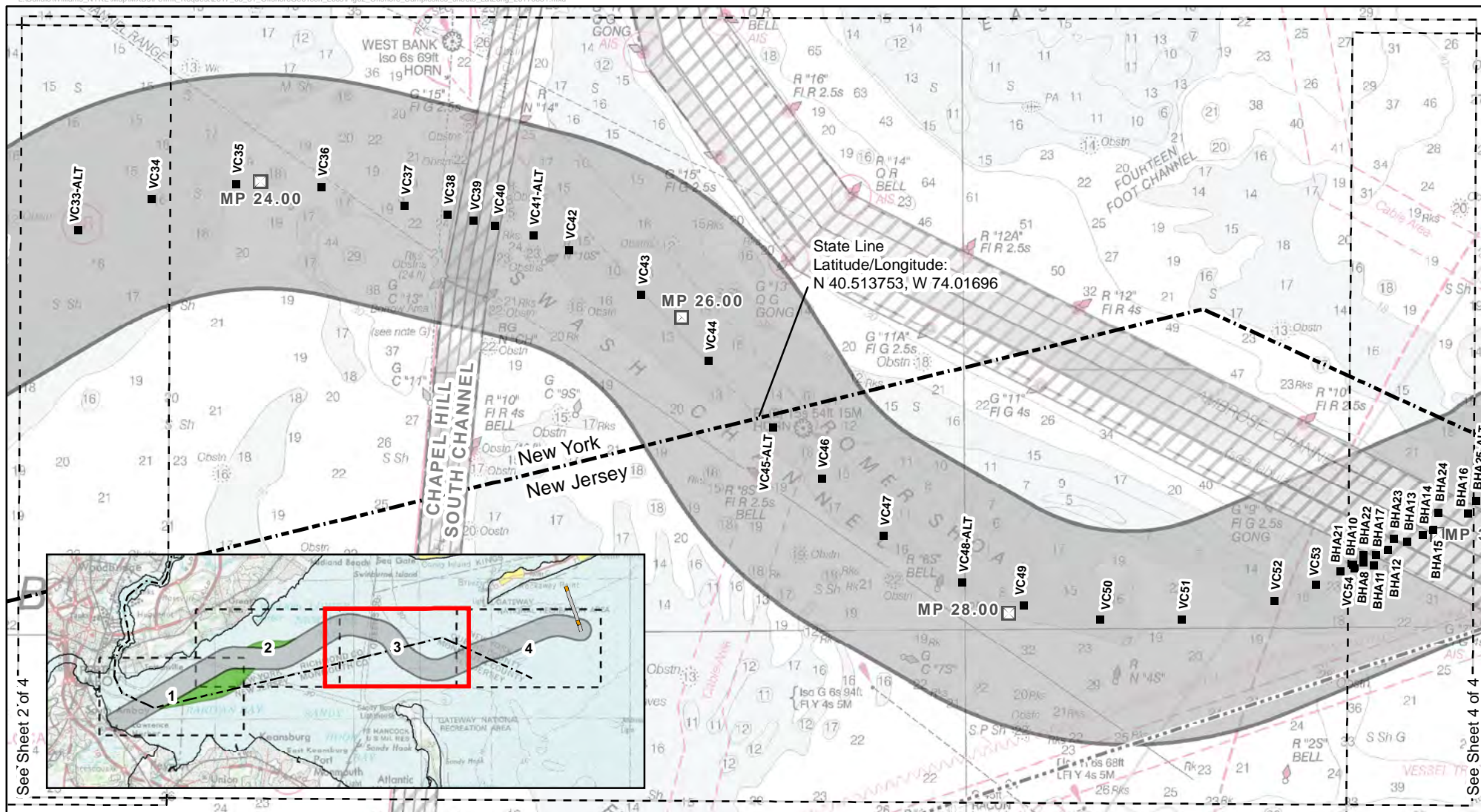
Latitude/Longitude Coordinates - GCS North American Datum 1983

NOTE: Soundings are in feet Mean Lower Low Water (MLLW) as depicted on NOAA navigational charts. MLLW = -0.20 feet MLW at the nearest NOAA tidal station (Sandy Hook, NJ).

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Revision Date: 5/31/2017



0 0.25 Miles



0 500 Meters



■ Sample Site

□ Milepost for Offshore Study Area

Offshore Study Area (5,000-ft)

Study Area Extension

Maintained Navigation Channel

--- Map Sheet Match Line

--- NY/NJ Boundary

--- Lower NY Bay Lateral

Rockaway Delivery Lateral

Figure 2: Sample Site Map
(Sheet 3 of 4)

New Jersey, New York

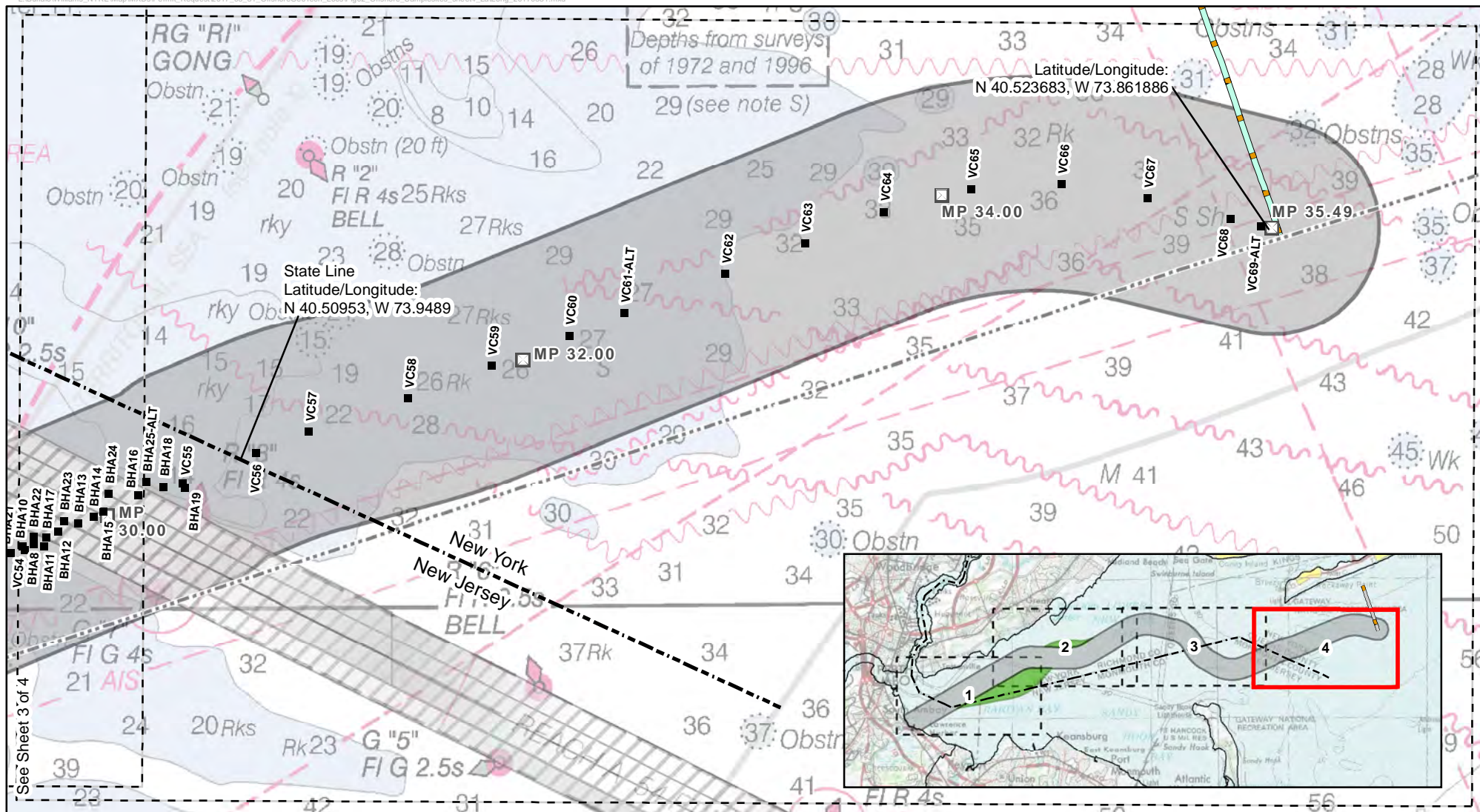
Latitude/Longitude Coordinates - GCS North American Datum 1983

NOTE: Soundings are in feet Mean Lower Low Water (MLLW) as depicted on NOAA navigational charts. MLLW = -0.20 feet MLW at the nearest NOAA tidal station (Sandy Hook, NJ).

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Revision Date: 5/31/2017



0 0.25 Miles

0 500 Meters

■ Sample Site

□ Milepost for Offshore Study Area

■ Offshore Study Area (5,000-ft)

■ Study Area Extension

■ Maintained Navigation Channel

--- Map Sheet Match Line

--- NY/NJ Boundary

--- Lower NY Bay Lateral

--- Rockaway Delivery Lateral

Figure 2: Sample Site Map

(Sheet 4 of 4)

New Jersey, New York

Latitude/Longitude Coordinates - GCS North American Datum1983

NOTE: Soundings are in feet Mean Lower Low Water (MLLW) as depicted on NOAA navigational charts. MLLW = -0.20 feet MLW at the nearest NOAA tidal station (Sandy Hook, NJ).

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NOAA RNC Chart # 12326;

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Williams 2015; USFWS 1982-1997; NOAA ENC 2013

Revision Date: 5/31/2017

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Appendix B Sample Site Coordinate Tables

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Table 1A: Sediment Sample Sites in New York State Waters^a

Sample Site ^{b,c,d}	Latitude	Longitude	Coring Depth	Sample Site ^{b,c,d}	Latitude	Longitude	Coring Depth
VC5	40.479100	-74.231542	12	VC41-ALT	40.525453	-74.036149	20
VC6	40.481830	-74.225304	12	VC42	40.524540	-74.033142	12
VC7	40.484562	-74.219061	12	VC43	40.521631	-74.027063	12
VC8	40.487286	-74.212836	12	VC44	40.517348	-74.021425	12
VC9	40.490016	-74.206593	12	VC56	40.509925	-73.947645	12
VC10	40.492746	-74.200352	12	VC57	40.511318	-73.943213	12
VC11	40.495473	-74.194115	12	VC58	40.513384	-73.934771	12
VC12	40.498201	-74.187873	12	VC59	40.515447	-73.927729	12
VC13	40.500929	-74.181632	12	VC60	40.517366	-73.921185	12
VC14	40.502472	-74.178102	12	VC61-ALT	40.518756	-73.916515	12
VC15	40.503286	-74.176237	20	VC62	40.521246	-73.907949	12
VC16	40.504057	-74.174471	20	VC63	40.523207	-73.901256	12
VC17	40.505196	-74.171867	20	VC64	40.525164	-73.894571	12
VC18	40.505968	-74.170079	20	VC65	40.526621	-73.887209	12
VC19	40.507049	-74.167031	12	VC66	40.526863	-73.879610	12
VC20	40.508123	-74.162337	12	VC67	40.525935	-73.872341	12
VC21	40.508567	-74.155187	12	VC68	40.524584	-73.865376	12
VC22	40.508392	-74.147998	12	VC69-ALT	40.524078	-73.862787	12
VC23	40.508217	-74.140810	12	VC70	40.483336	-74.218728	12
VC24	40.508041	-74.133621	12	VC71	40.484286	-74.211647	12
VC25	40.507865	-74.126433	12	VC72	40.485233	-74.204565	12
VC26	40.508033	-74.119256	12	VC73-ALT	40.486194	-74.196990	12
VC27	40.509493	-74.112343	12	VC74	40.487125	-74.190401	12
VC28	40.512078	-74.106004	12	VC75	40.488070	-74.183318	12
VC29	40.514823	-74.099775	12	VC76	40.489015	-74.176235	12
VC30	40.517568	-74.093546	12	VC77	40.490549	-74.169347	20
VC31-ALT	40.520506	-74.086879	12	VC78	40.493204	-74.163070	20
VC32	40.523057	-74.081086	12	VC79-ALT	40.497147	-74.157372	20
VC33-ALT	40.525932	-74.074540	12	VC80	40.499630	-74.154438	20
VC34	40.527932	-74.068241	12	VC81	40.500985	-74.152842	20
VC35	40.528898	-74.061174	12	VC82	40.505013	-74.148096	12
VC36	40.528653	-74.054002	20	VC83-ALT	40.511150	-74.136218	12
VC37	40.527473	-74.046977	20	VC84-ALT	40.512075	-74.128742	12
VC38	40.526834	-74.043371	20	VC85	40.511970	-74.122006	12
VC39	40.526449	-74.041158	20	VC86-ALT	40.511734	-74.115363	12
VC40	40.526125	-74.039373	20	VC87	40.512506	-74.107716	12

Reference datum: NAD 1983.

Notes:

- (a) Sample Sites as of November 11, 2016.
- (b) Sample Sites labeled "VC" indicate where vibracore and grab-sampling will occur.
- (c) Sample Sites labeled "-ALT" indicate shifts that occurred based on a Phase I archaeological survey.
- (d) Sample Sites in **bold and italicized** indicate where clamshell dredging may occur.

Table 1B
Sediment Sample Sites in New Jersey State Waters^a

Sample Site ^{b,c,d}	Latitude	Longitude	Coring Depth	Sample Site ^{b,c,d}	Latitude	Longitude	Coring Depth
BHA 1 ^e	40.464648	-74.265026	127	BHA21	40.503601	-73.968359	71
BHA 2 ^e	40.465324	-74.263463	147	BHA22	40.504657	-73.966412	88
BHA 3	40.466122	-74.261990	117	BHA23	40.505645	-73.963866	71
BHA 4	40.466756	-74.260539	117	BHA24	40.507361	-73.960056	65
BHA 5	40.467438	-74.258979	112	BHA25-ALT	40.508106	-73.956877	122
BHA 6-ALT	40.468215	-74.257285	102	VC1-ALT	40.468475	-74.256647	20
BHA 7-ALT	40.468837	-74.255837	102	VC2	40.470904	-74.250259	12
BHA 8	40.504154	-73.966412	95	VC3-ALT	40.473933	-74.243344	12
BHA 9-ALT	40.470373	-74.252342	72	VC4	40.476370	-74.237777	12
BHA 10	40.504030	-73.967324	77	VC45-ALT	40.513056	-74.016094	12
BHA 11	40.503991	-73.965562	72	VC46	40.509752	-74.011992	12
BHA 12	40.504967	-73.964348	92	VC47	40.506057	-74.006768	12
BHA 13	40.505491	-73.962680	77	VC48-ALT	40.503008	-74.000169	12
BHA 14	40.505903	-73.961371	92	VC49	40.501529	-73.995029	12
BHA 15	40.506229	-73.960524	72	VC50	40.500576	-73.988667	12
BHA 16	40.507266	-73.957570	92	VC51	40.500540	-73.981704	12
BHA 17	40.504620	-73.965346	79	VC52	40.501745	-73.973943	12
BHA 18	40.507776	-73.955418	127	VC53	40.502756	-73.970427	12
BHA 19	40.507737	-73.953656	82	VC54	40.503776	-73.967187	20
BHA20 ^e	40.465515	-74.262945	130	VC55	40.507991	-73.953793	30

Reference datum: NAD 1983.

Notes:

- (a) Sample Sites as of November 11, 2016.
- (b) Sample sites labeled "BHA" indicate where core boring will occur. Sites labeled "VC" indicate where vibracore and grab-sampling will occur.
- (c) Sample Sites labeled "-ALT" indicate shifts that occurred based on a Phase I archaeological survey.
- (d) Sample Sites in **bold and italicized** indicate where clamshell dredging may occur.
- (e) Onshore sites.

Appendix C Sediment Chemistry Test Tables

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Table A: Sediment Chemistry Tests for New York Sites with NO Clamshell Dredging

Vibracore Site Numbers [Total of 50]: VC11 through VC14; VC19 through VC34; VC42 through VC 44; VC 56 through VC 69; VC70 through VC76; and VC82 through VC87								
Test Analyte	EPA Method	NYSDEC Required Method Detection Limits (mg/kg, ppm)	NJDEP or USACE Required Reporting Limits ¹ (mg/kg, ppm)	NYSDEC No Appreciable Contamination Threshold Values ² (mg/kg, ppm)	NJDEP Low Effects Range ³ (mg/kg, ppm)	Listed in NYSDEC TOGs 5.1.9	Listed in USACE Reg2 Guidance	Listed in NJDEP 1997 Manual
METALS								
Aluminum	EPA 6020A	N/A	40	N/A	18000*			X
Antimony	EPA 6020A	N/A	12	N/A	9.3*			X
Arsenic	EPA 6020A	3^	1	<14 (<8.2)	8.2	X	X	X
Barium	EPA 6020A	N/A	40	N/A	48*			X
Beryllium	EPA 6020A	N/A	1	N/A	N/A			X
Cadmium	EPA 6020A	1	1	<1.2 (<1.2)	1.2	X	X	X
Calcium	EPA 6020A	N/A	1,000	N/A	N/A			X
Chromium	EPA 6020A	N/A	1	(<81)	81		X	X
Cobalt	EPA 6020A	N/A	10	N/A	10*			X
Copper	EPA 6020A	5^	1	<33 (<34)	34	X	X	X
Iron	EPA 6020A	N/A	20	N/A	N/A			X
Lead	EPA 6020A	2^	0.6	<33 (<47)	47	X	X	X
Magnesium	EPA 6020A	N/A	1,000	N/A	N/A			X
Manganese	EPA 6020A	N/A	3	N/A	260*			X
Mercury	EPA 7474	0.2^	0.1	<0.17 (<0.15)	0.15	X	X	X
Molybdenum	EPA 6020A	N/A	N/A	N/A	N/A			
Nickel	EPA 6020A	N/A	1	(<21)	21		X	X
Potassium	EPA 6020A	N/A	1,000	N/A	N/A			X
Selenium	EPA 6020A	N/A	1	N/A	1*			X
Silver	EPA 6020A	N/A	1	(<1.0)	1		X	X
Sodium	EPA 6020A	N/A	1,000	N/A	N/A			X
Strontium	EPA 6020A	N/A	N/A	N/A	N/A			
Thallium	EPA 6020A	N/A	2	N/A	N/A			X
Tin	EPA 6020A	N/A	N/A	N/A	N/A			
Titanium	EPA 6020A	N/A	N/A	N/A	N/A			
Vanadium	EPA 6020A	N/A	10	N/A	57*			X
Zinc	EPA 6020A	N/A	4	(<150)	150			X
PCB AROCLORS (Aroclor list from 1997 NJDEP manual applied for NY sum.)								
Aroclor-1016	EPA 8082A	N/A	0.033	N/A	0.007			(X)
Aroclor-1221	EPA 8082A	N/A	0.067	N/A	N/A			(X)
Aroclor-1232	EPA 8082A	N/A	0.033	N/A	N/A			(X)
Aroclor-1242	EPA 8082A	N/A	0.033	N/A	N/A			(X)
Aroclor-1248	EPA 8082A	N/A	0.033	N/A	0.03			(X)
Aroclor-1254	EPA 8082A	N/A	0.033	N/A	0.06			(X)
Aroclor-1260	EPA 8082A	N/A	0.033	N/A	0.005			(X)
PCBs (sum of aroclors)	EPA 8082A	0.033	<0.1	0.023 (<0.10)	0.023	X		
DIOXINS AND FURANS (ONLY ONE SUB-SAMPLE - ARCHIVE OTHERS)								
2,3,7,8 -TCDD	EPA 1613B	N/A	0.000001	(<0.0000005)	0.0000036*	X	X	X
1,2,3,7,8-PeCDD	EPA 1613B	N/A	0.0000025	N/A	N/A	X	X	X
1,2,3,4,7,8-HxCDD	EPA 1613B	N/A	0.000005	N/A	N/A	X	X	X
1,2,3,6,7,8-HxCDD	EPA 1613B	N/A	0.000005	N/A	N/A	X	X	X
1,2,3,7,8,9-HxCDD	EPA 1613B	N/A	0.000005	N/A	N/A	X	X	X
1,2,3,4,6,7,8-HpCDD	EPA 1613B	N/A	0.000005	N/A	N/A	X	X	X
OCDD	EPA 1613B	N/A	0.00001	N/A	N/A	X	X	X
2,3,7,8-TCDF	EPA 1613B	N/A	0.000001	N/A	N/A	X	X	X
1,2,3,7,8-PeCDF	EPA 1613B	N/A	0.0000025	N/A	N/A	X	X	X
2,3,4,7,8-PeCDF	EPA 1613B	N/A	0.0000025	N/A	N/A	X	X	X
1,2,3,4,7,8-HxCDF	EPA 1613B	N/A	0.000005	N/A	N/A	X	X	X
1,2,3,6,7,8-HxCDF	EPA 1613B	N/A	0.000005	N/A	N/A	X	X	X
2,3,4,6,7,8-HxCDF	EPA 1613B	N/A	0.000005	N/A	N/A	X	X	X
1,2,3,7,8,9-HxCDF	EPA 1613B	N/A	0.000005	N/A	N/A	X	X	X
1,2,3,4,6,7,8-HpCDF	EPA 1613B	N/A	0.000005	N/A	N/A	X	X	X
1,2,3,4,7,8,9-HpCDF	EPA 1613B	N/A	0.000005	N/A	N/A	X	X	X
OCDF	EPA 1613B	N/A	0.00001	N/A	N/A	X	X	X

Table A: Sediment Chemistry Tests for New York Sites with NO Clamshell Dredging

Test Analyte	EPA Method	NYSDEC Required Method Detection Limits (mg/kg, ppm)	NJDEP or USACE Required Reporting Limits ¹ (mg/kg, ppm)	NYSDEC No Appreciable Contamination Threshold Values ² (mg/kg, ppm)	NJDEP Low Effects Range ³ (mg/kg, ppm)	Listed in NYSDEC TOGs 5.1.9	Listed in USACE Reg2 Guidance	Listed in NJDEP 1997 Manual
Dioxins/Furans - Total Toxicity Equivalency Factor	EPA 1613B	0.000002	N/A	<0.0000045	0.00000365	X	X	X
PESTICIDES								
4,4'-DDE	EPA 8081B	N/A	0.001	N/A	0.0022		X	X
2,4'-DDE	EPA 8081B	N/A	0.001	N/A	N/A		X	
4,4'-DDD	EPA 8081B	N/A	0.001	N/A	0.002		X	X
2,4'-DDD	EPA 8081B	N/A	0.001	N/A	N/A		X	
4,4'-DDT	EPA 8081B	N/A	0.001	N/A	0.001		X	X
2,4'-DDT	EPA 8081B	N/A	0.001	N/A	N/A		X	
Sum of DDT+DDE+DDD	EPA 8081B	0.0033	N/A	<0.003 (<0.044)	0.0016	X	X	X
Mirex	EPA 8081B	0.189	N/A	<0.0014 (<0.12)	0.007	X	X	X
Chlordane (Total/Technical)	EPA 8081B	0.0017	N/A	<0.003 (<0.063)	0.007	X	X	X
Dieldrin	EPA 8081B	0.0033	0.001	<0.11 (<0.006)	0.002	X	X	X
PAHs								
Acenaphthene	EPA 8270D	N/A	0.1	N/A	0.016	X	X	X
Acenaphthylene	EPA 8270D	N/A	0.1	N/A	0.044	X	X	X
Anthracene	EPA 8270D	N/A	0.1	N/A	0.085	X	X	X
Benz(a)anthracene	EPA 8270D	N/A	0.1	N/A	0.261	X	X	X
Benzo(b)fluoranthene	EPA 8270D	N/A	0.1	N/A	1.8*	X	X	X
Benzo(k)fluoranthene	EPA 8270D	N/A	0.1	N/A	0.24	X	X	X
Benzo(g,h,i)perylene	EPA 8270D	N/A	0.1	N/A	0.17	X	X	X
Benzo(a)pyrene	EPA 8270D	N/A	0.1	N/A	0.43	X	X	X
2-Chloronaphthalene	EPA 8270D	0.1	0.66	N/A	N/A	X		X
Chrysene	EPA 8270D	N/A	0.1	N/A	0.384	X	X	X
Dibenz(a,h)anthracene	EPA 8270D	N/A	0.1	N/A	0.063	X	X	X
Fluoranthene	EPA 8270D	N/A	0.1	N/A	0.6	X	X	X
Fluorene	EPA 8270D	N/A	0.1	N/A	0.019	X	X	X
Indeno(1,2,3-c,d)-pyrene	EPA 8270D	N/A	0.1	N/A	0.2	X	X	X
2-Methylnaphthalene	EPA 8270D	0.1	0.66	N/A	0.07	X		X
Naphthalene	EPA 8270D	N/A	0.1	N/A	0.16	X	X	X
Phenanthrene	EPA 8270D	N/A	0.1	N/A	0.24	X	X	X
Pyrene	EPA 8270D	N/A	0.1	N/A	0.665	X	X	X
Total PAH (Sum of Target Compound List above)	EPA 8270D	0.33	N/A	<4 (<4)	4	X	X	X
VOLATILES								
Benzene	EPA 8260C	0.0003	0.01	<0.59 (<0.46)	0.34	X		X
Ethylbenzene	EPA 8260C	N/A	0.01	(<0.11)	1.4	X		X
Toluene	EPA 8260C	N/A	0.01	(<0.80)	2.5	X		X
Xylenes	EPA 8260C	N/A	0.01	(<0.091)	>0.12	X		X
Total BTEX	EPA 8260C	0.0008	0.01	<0.96	N/A	X		
MISCELLANEOUS								
Total Organic Carbon (TOC)	EPA 9060A	Not established	Not established	N/A	N/A	X	X	X

KEY:

N/A = Not available

1. Unshaded cells present reporting limits from USACE/EPA *Guidance for Performing Tests on Dredged Material Proposed for Ocean Disposal* (2014). Shaded Cells present reporting limits from *The Management and Regulation of Dredging Activities and Dredged Material in New Jersey's Tidal Waters* (1997). If both documents provide reporting limits, only the lowest is shown here.

2. Primary threshold value from NYS TOGS 5.1.9 (2004). Value in parenthesis from NYS *Screening and Assessment of Contaminated Sediment* (2014).

3. NJDEP Ecological Screening Criteria (2009). Values denoted with * are Effects Range Medium.

^Use the laboratory reporting limit if the value is less than the method detection limit shown in the table.

Table B: Sediment Chemistry Tests for New York Sites WITH Potential Clamshell Dredging AND ALL New Jersey Sites

Vibracore Site Numbers [Total of 37]: VC1 through VC10; VC15 through VC18; VC35 through VC41; VC45 through VC55; and VC77 through VC 81								
Test Analyte	EPA Method	NYSDEC Required Method Detection Limits (mg/kg, ppm)	NJDEP or USACE Required Reporting Limits ¹ (mg/kg, ppm)	NYSDEC No Appreciable Contamination Threshold Values ² (mg/kg, ppm)	NJDEP Low Effects Range ³ (mg/kg, ppm)	Listed in NYSDEC TOGs 5.1.9	Listed in USACE Reg2 Guidance	Listed in NJDEP 1997 Manual
METALS								
Arsenic	EPA 6020A	3 [^]	1	<14 (<8.2)	8.2	X	X	X
Aluminum	EPA 6020A	N/A	40	N/A	18000*			X
Antimony	EPA 6020A	N/A	12	N/A	9.3*			X
Barium	EPA 6020A	N/A	40	N/A	48*			X
Beryllium	EPA 6020A	N/A	1	N/A	N/A			X
Cadmium	EPA 6020A	1	1	<1.2 (<1.2)	1.2	X	X	X
Calcium	EPA 6020A	N/A	1,000	N/A	N/A			X
Chromium	EPA 6020A	N/A	1	(<81)	81		X	X
Cobalt	EPA 6020A	N/A	10	N/A	10*			X
Copper	EPA 6020A	5 [^]	1	<33 (<34)	34	X	X	X
Iron	EPA 6020A	N/A	20	N/A	N/A			X
Lead	EPA 6020A	2 [^]	0.6	<33 (<47)	47	X	X	X
Magnesium	EPA 6020A	N/A	1,000	N/A	N/A			X
Manganese	EPA 6020A	N/A	3	N/A	260*			X
Mercury	EPA 7474	0.2 [^]	0.1	<0.17 (<0.15)	0.15	X	X	X
Molybdenum	EPA 6020A	N/A	N/A	N/A	N/A			
Nickel	EPA 6020A	N/A	1	(<21)	21		X	X
Potassium	EPA 6020A	N/A	1,000	N/A	N/A			X
Selenium	EPA 6020A	N/A	1	N/A	1*			X
Silver	EPA 6020A	N/A	1	(<1.0)	1		X	X
Sodium	EPA 6020A	N/A	1,000	N/A	N/A			X
Strontium	EPA 6020A	N/A	N/A	N/A	N/A			
Thallium	EPA 6020A	N/A	2	N/A	N/A			X
Tin	EPA 6020A	N/A	N/A	N/A	N/A			
Titanium	EPA 6020A	N/A	N/A	N/A	N/A			
Vanadium	EPA 6020A	N/A	10	N/A	57*			X
Zinc	EPA 6020A	N/A	4	(<150)	150			X
PCB Congeners (NJDEP congener list confirmed by Mr. Jeff Thein on 10/19/2016)								
PCB 8	EPA 1668C	N/A	0.001	N/A	N/A		X	(X)
PCB 18	EPA 1668C	N/A	0.001	N/A	N/A		X	(X)
PCB 28	EPA 1668C	N/A	0.001	N/A	N/A		X	(X)
PCB 44	EPA 1668C	N/A	0.001	N/A	N/A		X	(X)
PCB 49	EPA 1668C	N/A	0.001	N/A	N/A		X	(X)
PCB 52	EPA 1668C	N/A	0.001	N/A	N/A		X	(X)
PCB 66	EPA 1668C	N/A	0.001	N/A	N/A		X	(X)
PCB 87	EPA 1668C	N/A	0.001	N/A	N/A		X	(X)
PCB 101	EPA 1668C	N/A	0.001	N/A	N/A		X	(X)
PCB 105	EPA 1668C	N/A	0.001	N/A	N/A		X	(X)
PCB 118	EPA 1668C	N/A	0.001	N/A	N/A		X	(X)
PCB 128	EPA 1668C	N/A	0.001	N/A	N/A		X	(X)
PCB 138	EPA 1668C	N/A	0.001	N/A	N/A		X	(X)
PCB 153	EPA 1668C	N/A	0.001	N/A	N/A		X	(X)
PCB 170	EPA 1668C	N/A	0.001	N/A	N/A		X	(X)
PCB 180	EPA 1668C	N/A	0.001	N/A	N/A		X	(X)
PCB 183	EPA 1668C	N/A	0.001	N/A	N/A		X	(X)
PCB 184	EPA 1668C	N/A	0.001	N/A	N/A		X	(X)
PCB 187	EPA 1668C	N/A	0.001	N/A	N/A		X	(X)
PCB 195	EPA 1668C	N/A	0.001	N/A	N/A		X	(X)
PCB 206	EPA 1668C	N/A	0.001	N/A	N/A		X	(X)
PCB 209	EPA 1668C	N/A	0.001	N/A	N/A		X	(X)
PCBs - Total Toxicity Equivalency Factor	EPA 1668C	N/A	N/A	0.023 (<0.10)	0.023			
PCB AROCLORS (Aroclor list from 1997 NJDEP manual applied for NY sum.)								
Aroclor-1016	EPA 8082A	N/A	0.033	N/A	0.007			(X)
Aroclor-1221	EPA 8082A	N/A	0.067	N/A	N/A			(X)
Aroclor-1232	EPA 8082A	N/A	0.033	N/A	N/A			(X)
Aroclor-1242	EPA 8082A	N/A	0.033	N/A	N/A			(X)
Aroclor-1248	EPA 8082A	N/A	0.033	N/A	0.03			(X)
Aroclor-1254	EPA 8082A	N/A	0.033	N/A	0.06			(X)
Aroclor-1260	EPA 8082A	N/A	0.033	N/A	0.005			(X)

Table B: Sediment Chemistry Tests for New York Sites WITH Potential Clamshell Dredging AND ALL New Jersey Sites

Test Analyte	EPA Method	NYSDEC Required Method Detection Limits (mg/kg, ppm)	NJDEP or USACE Required Reporting Limits ¹ (mg/kg, ppm)	NYSDEC No Appreciable Contamination Threshold Values ² (mg/kg, ppm)	NJDEP Low Effects Range ³ (mg/kg, ppm)	Listed in NYSDEC TOGs 5.1.9	Listed in USACE Reg2 Guidance	Listed in NJDEP 1997 Manual
PCBs (sum of aroclors)	EPA 8082A	0.033	<0.1	0.023 (<0.10)	0.023	X		
DIOXINS AND FURANS								
2,3,7,8 -TCDD	EPA 1613B	N/A	0.000001	(<0.0000005)	N/A	X	X	X
1,2,3,7,8-PeCDD	EPA 1613B	N/A	0.0000025	N/A	N/A	X	X	X
1,2,3,4,7,8-HxCDD	EPA 1613B	N/A	0.000005	N/A	N/A	X	X	X
1,2,3,6,7,8-HxCDD	EPA 1613B	N/A	0.000005	N/A	N/A	X	X	X
1,2,3,7,8,9-HxCDD	EPA 1613B	N/A	0.000005	N/A	N/A	X	X	X
1,2,3,4,6,7,8-HpCDD	EPA 1613B	N/A	0.000005	N/A	N/A	X	X	X
OCDD	EPA 1613B	N/A	0.00001	N/A	N/A	X	X	X
2,3,7,8-TCDF	EPA 1613B	N/A	0.000001	N/A	N/A	X	X	X
1,2,3,7,8-PeCDF	EPA 1613B	N/A	0.0000025	N/A	N/A	X	X	X
2,3,4,7,8-PeCDF	EPA 1613B	N/A	0.0000025	N/A	N/A	X	X	X
1,2,3,4,7,8-HxCDF	EPA 1613B	N/A	0.000005	N/A	N/A	X	X	X
1,2,3,6,7,8-HxCDF	EPA 1613B	N/A	0.000005	N/A	N/A	X	X	X
2,3,4,6,7,8-HxCDF	EPA 1613B	N/A	0.000005	N/A	N/A	X	X	X
1,2,3,7,8,9-HxCDF	EPA 1613B	N/A	0.000005	N/A	N/A	X	X	X
1,2,3,4,6,7,8-HpCDF	EPA 1613B	N/A	0.000005	N/A	N/A	X	X	X
1,2,3,4,7,8,9-HpCDF	EPA 1613B	N/A	0.000005	N/A	N/A	X	X	X
OCDF	EPA 1613B	N/A	0.00001	N/A	N/A	X	X	X
Dioxins/Furans - Total Toxicity Equivalency Factor	EPA 1613B	0.000002	N/A	<0.0000045	0.00000365	X	X	X
PESTICIDES								
alpha-BHC	EPA 8081B	N/A	0.0019	N/A	N/A			X
beta-BHC	EPA 8081B	N/A	0.0033	N/A	N/A			X
delta-BHC	EPA 8081B	N/A	0.0017	N/A	N/A			X
gamma-BHC (Lindane)	EPA 8081B	N/A	0.002	(<0.001)	N/A			X
Heptachlor	EPA 8081B	N/A	0.001	(<0.071)	0.0003*		X	X
Aldrin	EPA 8081B	N/A	0.001	N/A	0.002		X	X
Heptachlor epoxide	EPA 8081B	N/A	0.001	(<0.015)	0.005		X	X
Endosulfan I	EPA 8081B	N/A	0.001	(<0.0001)	N/A		X	X
Endrin	EPA 8081B	N/A	0.0036	(<0.006)	0.003			X
Endosulfan II	EPA 8081B	N/A	0.001	N/A	N/A		X	X
Endosulfan sulfate	EPA 8081B	N/A	0.001	N/A	N/A		X	X
Methoxychlor	EPA 8081B	N/A	0.017	(<0.059)	N/A			X
Endrin ketone	EPA 8081B	N/A	0.0033	N/A	N/A			X
Endrin aldehyde	EPA 8081B	N/A	0.0033	N/A	N/A			X
alpha-Chlordane	EPA 8081B	N/A	0.001	N/A	N/A		X	X
gamma-Chlordane	EPA 8081B	N/A	0.0017	N/A	N/A			X
Toxaphene	EPA 8081B	N/A	0.17	(<0.054)	N/A			X
Trans nonachlor	EPA 8081B	N/A	0.001	N/A	N/A		X	X
4,4'-DDE	EPA 8081B	N/A	0.001	N/A	0.0022		X	X
2,4'-DDE	EPA 8081B	N/A	0.001	N/A	N/A		X	
4,4'-DDD	EPA 8081B	N/A	0.001	N/A	0.002		X	X
2,4'-DDD	EPA 8081B	N/A	0.001	N/A	N/A		X	
4,4'-DDT	EPA 8081B	N/A	0.001	N/A	0.001		X	X
2,4'-DDT	EPA 8081B	N/A	0.001	N/A	N/A		X	
Sum of DDT+DDE+DDD	EPA 8081B	0.0033	N/A	<0.003 (<0.044)	0.0016	X	X	X
Mirex	EPA 8081B	0.189	N/A	<0.0014 (<0.12)	0.007	X	X	X
Chlordane (Total/Technical)	EPA 8081B	0.0017	N/A	<0.003 (<0.063)	0.007	X	X	X
Dieldrin	EPA 8081B	0.0033	0.001	<0.11 (<0.006)	0.002	X	X	X
SEMI-VOLATILES/PAHs								
Acenaphthene (LMW)	EPA 8270D	N/A	0.1	N/A	0.016	X	X	X
Acenaphthylene (LMW)	EPA 8270D	N/A	0.1	N/A	0.044	X	X	X
Anthracene (LMW)	EPA 8270D	N/A	0.1	N/A	0.085	X	X	X
Benz(a)anthracene (HMW)	EPA 8270D	N/A	0.1	N/A	0.261	X	X	X
Benzo(b)fluoranthene (HMW)	EPA 8270D	N/A	0.1	N/A	1.8*	X	X	X
Benzo(k)fluoranthene (HMW)	EPA 8270D	N/A	0.1	N/A	0.24	X	X	X
Benzo(g,h,i)perylene (HMW)	EPA 8270D	N/A	0.1	N/A	0.17	X	X	X
Benzo(a)pyrene (HMW)	EPA 8270D	N/A	0.1	N/A	0.43	X	X	X
2-Chloronaphthalene	EPA 8270D	0.1	0.66	N/A	N/A	X		X
Chrysene (HMW)	EPA 8270D	N/A	0.1	N/A	0.384	X	X	X
Dibenz(a,h)anthracene (HMW)	EPA 8270D	N/A	0.1	N/A	0.063	X	X	X
Fluoranthene (HMW)	EPA 8270D	N/A	0.1	N/A	0.6	X	X	X
Fluorene (LMW)	EPA 8270D	N/A	0.1	N/A	0.019	X	X	X

Table B: Sediment Chemistry Tests for New York Sites WITH Potential Clamshell Dredging AND ALL New Jersey Sites

Test Analyte	EPA Method	NYSDEC Required Method Detection Limits	NJDEP or USACE Required Reporting Limits ¹	NYSDEC No Appreciable Contamination Threshold Values ²	NJDEP Low Effects Range ³	Listed in NYSDEC TOGs 5.1.9	Listed in USACE Reg2 Guidance	Listed in NJDEP 1997 Manual
		(mg/kg, ppm)	(mg/kg, ppm)	(mg/kg, ppm)	(mg/kg, ppm)			
Indeno(1,2,3-c,d)-pyrene (HMW)	EPA 8270D	N/A	0.1	N/A	0.2	X	X	X
2-Methylnaphthalene	EPA 8270D	0.1	0.66	N/A	0.07	X		X
Naphthalene (LMW)	EPA 8270D	N/A	0.1	N/A	0.16	X	X	X
Phenanthrene (LMW)	EPA 8270D	N/A	0.1	N/A	0.24	X	X	X
Pyrene (HMW)	EPA 8270D	N/A	0.1	N/A	0.665	X	X	X
Total PAH (Sum of Target Compound List above)	EPA 8270D	0.33	N/A	<4 (<4)	4	X		X
Sum of Low-Molecular Weight (LMW) PAHs	EPA 8270D	N/A	0.1	N/A	N/A		X	
Sum of High-Molecular Weight (HMW) PAHs	EPA 8270D	N/A	0.1	N/A	N/A		X	
1,4-Dichlorobenzene	EPA 8270D	N/A	0.1	(<1.2)	0.110*		X	X
Phenol	EPA 8270D	N/A	0.66	N/A	0.130*			X
bis-(2-Chloroethyl)ether	EPA 8270D	N/A	0.66	N/A	N/A			X
2-Chlorophenol	EPA 8270D	N/A	0.66	N/A	0.008*			X
1,3-Dichlorobenzene	EPA 8270D	N/A	0.66	(<2.1)	N/A			X
1,2-Dichlorobenzene	EPA 8270D	N/A	0.66	(<0.85)	0.013*			X
2-Methylphenol	EPA 8270D	N/A	0.66	N/A	N/A			X
2,2'-oxybis(1-Chloropropane)	EPA 8270D	N/A	0.66	N/A	N/A			X
4-Methylphenol	EPA 8270D	N/A	0.66	N/A	N/A			X
N-Nitroso-di-n-propylamine	EPA 8270D	N/A	0.66	N/A	N/A			X
Hexachloroethane	EPA 8270D	N/A	0.66	N/A	0.073*			X
Nitrobenzene	EPA 8270D	N/A	0.66	N/A	N/A			X
Isophorone	EPA 8270D	N/A	0.66	N/A	N/A			X
2-Nitrophenol	EPA 8270D	N/A	0.66	N/A	N/A			X
2,4-Dimethylphenol	EPA 8270D	N/A	0.66	N/A	N/A			X
bis(2-Chloroethoxy)methane	EPA 8270D	N/A	0.66	N/A	N/A			X
2,4-Dichlorophenol	EPA 8270D	N/A	0.66	N/A	0.005*			X
1,2,4-Trichlorobenzene	EPA 8270D	N/A	0.66	(<2.0)	>0.0048			X
4-Chloroaniline	EPA 8270D	N/A	1.3	N/A	N/A			X
Hexachlorobutadiene	EPA 8270D	N/A	0.66	N/A	0.0013*			X
4-Chloro-3-methylphenol	EPA 8270D	N/A	1.3	N/A	N/A			X
Hexachlorocyclopentadiene	EPA 8270D	N/A	0.66	(<0.13)	N/A			X
2,4,6-Trichlorophenol	EPA 8270D	N/A	0.66	N/A	0.006*			X
2,4,5-Trichlorophenol	EPA 8270D	N/A	0.66	N/A	0.003*			X
2-Nitroaniline	EPA 8270D	N/A	3.3	N/A	N/A			X
Dimethylphthalate	EPA 8270D	N/A	0.66	N/A	N/A			X
2,6-Dinitrotoluene	EPA 8270D	N/A	0.66	N/A	N/A			X
3-Nitroaniline	EPA 8270D	N/A	3.3	N/A	N/A			X
2,4-Dinitrophenol	EPA 8270D	N/A	3.3	N/A	N/A			X
4-Nitrophenol	EPA 8270D	N/A	3.3	N/A	N/A			X
Dibenzofuran	EPA 8270D	N/A	0.66	N/A	N/A			X
2,4-Dinitrotoluene	EPA 8270D	N/A	0.66	N/A	N/A			X
Diethylphthalate	EPA 8270D	N/A	0.66	N/A	0.006*			X
4-Chlorophenyl-phenyl ether	EPA 8270D	N/A	0.66	N/A	N/A			X
4-Nitroaniline	EPA 8270D	N/A	0.83	N/A	N/A			X
4,6-Dinitro-2-methylphenol	EPA 8270D	N/A	3.3	N/A	N/A			X
N-Nitroso-diphenylamine	EPA 8270D	N/A	0.66	N/A	N/A			X
4-Bromophenyl-phenylether	EPA 8270D	N/A	0.66	N/A	N/A			X
Hexachlorobenzene	EPA 8270D	N/A	0.66	N/A	0.02			X
Pentachlorophenol	EPA 8270D	N/A	3.3	(<21)	N/A			X
Carbazole	EPA 8270D	N/A	0.33	N/A	N/A			X
Di-n-butylphthalate	EPA 8270D	N/A	0.33	N/A	0.058*			X
Butylbenzylphthalate	EPA 8270D	N/A	0.66	N/A	0.063*			X
3,3'-Dichlorobenzidine	EPA 8270D	N/A	1.3	N/A	N/A			X
bis(2-Ethylhexyl)phthalate	EPA 8270D	N/A	0.66	N/A	0.18216			X
Di-n-octylphthalate	EPA 8270D	N/A	0.66	N/A	N/A			X
VOLATILES								
Benzene	EPA 8260C	0.0003	0.01	<0.59 (<0.46)	0.34	X		X
Ethylbenzene	EPA 8260C	N/A	0.01	(<0.11)	1.4	X		X
Toluene	EPA 8260C	N/A	0.01	(<0.80)	2.5	X		X
Xylenes	EPA 8260C	N/A	0.01	(<0.091)	>0.12	X		X
Total BTEX	EPA 8260C	0.0008	0.01	<0.96	N/A	X		
MISCELLANEOUS								

Table B: Sediment Chemistry Tests for New York Sites WITH Potential Clamshell Dredging AND ALL New Jersey Sites

Test Analyte	EPA Method	NYSDEC Required Method Detection Limits (mg/kg, ppm)	NJDEP or USACE Required Reporting Limits ¹ (mg/kg, ppm)	NYSDEC No Appreciable Contamination Threshold Values ² (mg/kg, ppm)	NJDEP Low Effects Range ³ (mg/kg, ppm)	Listed in NYSDEC TOGs 5.1.9	Listed in USACE Reg2 Guidance	Listed in NJDEP 1997 Manual
Total Organic Carbon (TOC)	EPA 9060A	Not established	Not established	N/A	N/A	X	X	X
Cyanide (Total/Amenable)	EPA 9012B	N/A	0.5	N/A	N/A			X

KEY:

N/A = Not available

1. Unshaded cells present reporting limits from USACE/EPA *Guidance for Performing Tests on Dredged Material Proposed for Ocean Disposal* (2014). Shaded Cells present reporting limits from *The Management*

2. Primary threshold value from NYS TOGS 5.1.9 (2004). Value in parathesis from NYS *Screening and Assessment of Contaminated Sediment* (2014).

3. NJDEP Ecological Screening Criteria (2009). Values denoted with * are Effects Range Medium.

^Use the laboratory reporting limit if the value is less than the method detection limit shown in the table.

Appendix D Chemical Laboratory Standard Operating Procedures

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Percent Solids Determination

References: **SM 2540G**, Standard Methods for the Examination of Water and Wastewater. APHA-AWWA-WEF. Standard Methods Online.

1. Scope and Application

Matrices: This method is applicable to samples such as soils, sediments, sludges separated from water and wastewater treatment processes, sludge cakes, and any tissue.

Definitions: Refer to Alpha Analytical Quality Manual.

Percent solids are the total amount of solid material remaining in the weighing tin, after sample drying at a defined temperature, expressed as a percent. This measurement is used in the calculation of analytical results, both organic and inorganic, to express these results on a “dry” weight basis.

The data report packages present the documentation of any method modification related to the samples tested. Depending upon the nature of the modification and the extent of intended use, the laboratory may be required to demonstrate that the modifications will produce equivalent results for the matrix. Approval of all method modifications is by one or more of the following laboratory personnel before performing the modification: Area Supervisor, Department Supervisor, Laboratory Director, or Quality Assurance Officer.

This method is restricted to use by or under the supervision of experienced analysts and in the interpretation of data. Each analyst must demonstrate the ability to generate acceptable results with this method by performing an initial demonstration of capability.

2. Summary of Method

A well-mixed aliquot of solid sample is placed into an aluminum weighing tin. The aliquot dried to a constant weight, generally overnight, in an oven at 103°C - 105°C. The aliquot is then re-weighed, and calculations are applied (Section 11) to determine the percent of solid material.

2.1 Method Modifications from Reference

None.

3. Reporting Limits

Method Detection Limit (MDL) studies for the determination of quantitation limits, do not apply to this method or SOP.

4. Interferences

- 4.1** The temperature at which the sample is dried has an important bearing on the results because weight losses due to volatilization of organic matter, water crystallization, gases from heat

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induced chemical decomposition, as well as weight gains due to oxidation, are dependent on temperature and the time of heating. Oven temperature and time must be recorded at the time the samples are placed into the oven and at the time they are removed from the oven.

- 4.2** It is important that all weighing, pre- and post-sample drying, be performed quickly and at ambient temperatures. Sample cooling must take place in a desiccator, to avoid loss or gain of weight with temperature fluctuations and the re-introduction of moisture to the samples. Tongs must be used when handling weighing tins, as oil residue from hands may contribute to the sample weights. Small differences in weights can significantly affect the final calculation.
- 4.3** All weights must be recorded on the Top loading balance to the nearest 0.01g or on the Analytical balance to 0.0001g. The balance to be used depends upon the amount of sample being dried. If less than 1g is to be dried, smaller weighing tins, and the Analytical balance, must be used.

4.4 Decanting Standing Water from Sediments Samples

The practice of decanting standing water from sediments and soil samples is **only performed upon Client Request**. The Project Manager must be consulted prior to initiating the following protocol.

- Samples will be inspected upon arrival by the Sample Custodian for standing water.
- If the samples do not have standing water, or have 0.0 - 0.25 inches, or 0.0 – 1.0 centimeters of standing water, this will be considered to be pore water that has settled out of the sample during shipping. This water will be mixed back into the sample prior to the removal of any aliquot for percent solids determination.
- If the sample has more than 0.0 - 0.25 inches, or 0.0 – 1.0 centimeters of standing water, the Project Manager will be contacted by the Sample Custodian to inspect the samples. The Project Manager will give the instruction to decant the water, or to mix the water into the sample. The Project Manager must make this decision either through prior knowledge of the site and the client requirements, or must contact the client for instructions.
- If instructed to decant the water, all samples will be decanted at this time by the Sample Custodian or designee. An "X" will be marked on the top of the sample jar in indelible ink and a notation that the standing water has been decanted from the sample will be made in the Percent Solids logbook. The Project Manager will also note this in the project narrative to the client.
- If instructed to mix the standing water back into the sample, this will be done at the time the aliquot for percent solids is removed, and no further notations are needed.
- At no time are any analysts, other than the Sample Custodian or designee, to decant standing water from samples. If samples are removed from refrigerators or freezers and the analyst notes that there is standing water on the sample, this is to be mixed back into the sample, as this water is to be assumed to be due to further settling of the pore water.

5. Health and Safety

The toxicity or carcinogenicity of each reagent and standard used in this method is not fully established; however, each chemical compound must be treated as a potential health hazard. From

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this viewpoint, exposure to these chemicals must be reduced to the lowest possible level by whatever means available. A reference file of material data handling sheets is available to all personnel involved in the chemical analysis. Additional references to laboratory safety are available in the Chemical Hygiene Plan.

All personnel handling environmental samples known to contain or to have been in contact with municipal waste must follow safety practices for handling known disease causative agents.

- 5.1 The use of laboratory equipment and chemicals exposes the analyst to several potential hazards. Good laboratory techniques and safety practices shall be followed at all times. Eating, drinking, smoking, or the application of cosmetics is not permitted in the laboratory area. Horseplay of any kind is prohibited. Pipetting by mouth is not permitted. All Personal Protective Equipment (PPE) must be removed before leaving the laboratory area and before entering the employee lounge or eating area. Always wash your hands before leaving the laboratory. All relevant Material Safety Data Sheets (MSDSs) are kept alphabetically in the centrally located file storage, in the common area outside of the Information Technology (IT) offices.
- 5.2 Approved PPE, which includes Safety Glasses, Gloves and Lab Coats, must be worn at **all** times when handling samples, reagents, chemicals, or when in the vicinity of others handling these items, so that dermal contact is avoided. All standards, reagents and solvents shall be handled under a hood. All flammable solvents must be kept in the flammable storage cabinet, and returned to the cabinet immediately after use. When transporting chemicals, use a secure transporting device and/or secondary outer container. Chemical storage is properly segregated and adequately ventilated to reduce the possibility of hazardous reactions. Chemical storage in work areas shall be kept to a minimum. Storage on bench tops or other work surfaces, except temporary, is not permitted.
- 5.3 The toxicity or carcinogenicity of each compound or reagent used in this method has not been precisely defined; however, each chemical compound shall be treated as a potential health hazard. From this viewpoint, exposure to chemicals must be reduced to the lowest possible level by whatever means available. All standards and reagents shall be prepared in a hood while using the proper PPE.
- 5.4 Spilled samples, solvents, reagents, and water must be cleaned up from bench tops, instruments and autosampler surfaces immediately. A spill is considered a quantity of hazardous material if it is two times greater than the normal working volume. Concentrated solvents, acids or bases present a moderate to extreme hazard to the skin and mucous membranes. If contact with the skin occurs, immediately flush with large volumes of water. In the case of acidic/basic spills, the *Spill Kit* located in each laboratory shall be utilized before attempting to cleanup the spill. Although procedures are designed to minimize the possibility of an accident, all injuries or accidents, regardless of the nature or severity, are to be reported to the Department Manager immediately. If an employee discovers a potentially unsafe condition, this must be reported to the Department Manager immediately. No employee should feel compelled to work in a situation where they do not feel entirely informed, trained, or safe.
- 5.5 Tongs must always be used when removing hot aluminum weighing tins from the oven and transferring them to the desiccator to avoid burning the skin.

6. Sample Collection, Preservation, Shipping and Handling

6.1 Sample Collection

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Samples are typically collected in 4oz or 8oz glass jars.

6.2 Sample Preservation

No preservatives are used. See Section 6.4.

6.3 Sample Shipping

No special sample shipping requirements. Typical shipping procedures may be found in the Sample Receipt and Login SOP (SOP 1559).

6.4 Sample Handling

Samples are stored at $4^{\circ}\text{C} \pm 2^{\circ}\text{C}$. Sediment and tissue samples are stored at $-20^{\circ}\text{C} \pm 10^{\circ}\text{C}$.

Refer to the Sample Receipt and Login SOP (SOP 1559) and the Sample Custody SOP (SOP 1560).

7. Equipment and Supplies

7.1 Analytical balance: Capable of weighing to the nearest 0.0001g, and Top loading balance capable of weighing to the nearest 0.01g.

The balances used for each weighing (both Top loading and Analytical) for this method are checked daily before use with Class S-1 weights, in the weight range of use, by a designated analyst, or appointed alternate. These daily checks are documented in the "Balance Calibration" logbook. All balances are serviced annually by an outside service technician.

7.2 Aluminum weighing tins: "Standard" size from Fisher Scientific (No.: 08-732), or equivalent. "Small" size for weighing less than 1g of material from Perkin-Elmer (No.: N241-1362), or equivalent.

7.3 Drying oven: Set at $103^{\circ}\text{C} - 105^{\circ}\text{C}$, vented and/or placed under a fume hood if possible.

7.4 Clean stainless steel spatulas: One for each sample to be weighed.

7.5 Desiccator: With a desiccant containing a color indicator for moisture content.

7.6 Indelible ink Sharpie

7.7 Tongs and tweezers

8. Reagents and Standards

No standards or reagents are required for this method.

9. Quality Control

The laboratory must maintain records to document the quality of data that is generated. Ongoing data quality checks are compared with established performance criteria to determine if the results of analyses meet the performance characteristics of the method.

9.1 Blank(s)

Not applicable to this method.

9.2 Laboratory Control Sample (LCS)

Not applicable to this method.

9.3 Initial Calibration Verification (ICV)

Not applicable to this method.

9.4 Continuing Calibration Verification (CCV)

Not applicable to this method.

9.5 Matrix Spike

Not applicable to this method.

9.6 Laboratory Duplicate

Duplicate analyses are performed 1 per 20 samples, or at least 1 per batch, whichever is more frequent. The RPD between the duplicates must be less than 10%. If the RPD between the duplicates exceeds 10% the analyst shall check the calculations for errors. If no calculation errors are found, repeat the analysis for the batch.

9.7 Method-specific Quality Control Samples

None.

9.8 Method Sequence

- Samples 1-20
- Sample Duplicate

10. Procedure

10.1 Equipment Set-up

Samples are obtained from the Sample Custodian. Note removal of the samples in the Internal Tracking COC in the Sample Management office. If samples are removed from the freezer, note the date of removal from, and return to, the freezer, in the freezer logbook for hold time tracking purposes.

10.1.1 If a sample has been selected by the client for the Duplicate analysis, this sample must be weighed in duplicate. Otherwise, select the sample that appears to have the greatest total sample mass for the duplicate.

10.1.2 If samples are those that have been selected for re-extraction, the % Solids are **not** reset. The original % Solids data is used throughout the sample set.

10.2 Initial Calibration

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Not applicable to this method.

10.3 Equipment Operation and Sample Processing

10.3.1 Sample aliquots:

NOTE: If there is ever any question about the amount of sample that can be taken for the percent solid determination, see the Department Supervisor for guidance.

10.3.1.1 Soils, Sediments, Sludges and Tissue (homogenized tissue samples that yield greater than 20g of total weight):

- Mix the sample well. See Section 4.4 regarding Client requests for standing water and sediment samples.
- Use the Top loading balance and the *standard* size aluminum weighing tin.
- Label the tins with the dish number for each sample to be weighed using an indelible ink Sharpie.
- Tare the balance to read zero.
- Place the tin on the balance and allow the balance to stabilize. Record the weight of the empty tin in the "mass of dish" column "A" in the Percent Solids logbook to the nearest 0.01g.
- Aliquot approximately 5-10g of sample into the tin.
- Allow the balance to stabilize and record the weight of the sample plus the tin to the nearest 0.01g, in the "mass of dish & wet sample" column "B" in the Percent Solids logbook.

10.3.1.2 Tissue (homogenized tissue samples that yield between 5-20g of total weight) and other low weight solid samples:

- Mix the sample well. See Section 4.4 regarding Client requests for standing water and sediment samples. If weighing a homogenized tissue, use caution to preserve as much tissue sample as possible for future analyses.
- Use the Top loading balance and the *standard* size aluminum weighing tin.
- Label the tins with the dish number for each sample to be weighed using an indelible ink Sharpie.
- Tare the balance to read zero.
- Place the tin on the balance and allow the balance to stabilize. Record the weight of the empty tin in the "mass of dish" column "A" in the Percent Solids logbook to the nearest 0.01g.
- Aliquot approximately 1-2g of sample into the tin.
- Allow the balance to stabilize and record the weight of the sample plus the tin to the nearest 0.01g, in the "mass of dish & wet sample" column "B" in the Percent Solids logbook.

10.3.1.3 Tissue (homogenized tissue samples that yield less than 5g of total weight):

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- Carefully mix the homogenate, if possible, using caution to preserve the tissue sample for future analyses.
- Use the Analytical balance and either the *standard* or *small* size aluminum weighing tins.
- Label the tins with the dish number for each sample to be weighed using an indelible ink Sharpie.
- Tare the balance to read zero.
- Place the tin on the balance and allow the balance to stabilize. Record the weight of the empty tin in the "mass of dish" column "A" in the Percent Solids logbook to the nearest 0.0001g.
- Aliquot approximately 200-500mg of sample into the tin.
- Allow the balance to stabilize and record the weight of the sample plus the tin to the nearest 0.0001g, in the "mass of dish & wet sample" column "B" in the Percent Solids logbook.

10.3.2 Place the tins in the drying oven overnight, until a constant weight is achieved (see Section 10.3.5, 10.3.6). Record the oven temperature when samples are put into the oven.

10.3.3 Using tongs or tweezers, quickly and carefully, remove the samples from the oven and place them into the desiccator to cool to room temperature. The samples must stay in the desiccator for at least 20 minutes.

10.3.4 Tare the balance to zero.

10.3.5 Remove the samples one at a time from the desiccator and place the dried sample, in the tin, on the balance and allow the balance to stabilize. Record the weight to the appropriate decimal place in the "mass of dish & dry sample" column "C" of the Percent Solids logbook. All post-drying weighing must be performed as quickly as possible, preferably within 2 minutes, of removing the samples from the desiccator, to prevent any atmospheric moisture from returning to the dried samples.

10.3.6 If a constant weight is not achieved, the sample must be placed back into the oven for approximately one hour. Repeat the cooling and desiccating cycle after this hour. This cycle should be repeated until the weight change is less than 4% or 50mg of the previous weight, whichever is less.

10.4 Continuing Calibration

Not applicable to this method.

10.5 Preventive Maintenance

Ovens are calibrated on an annual basis by an instrument service company. Certificates are kept on file.

Analytical balances are calibrated on a semi-annual basis by an instrument service company. Certificates are kept on file. The calibration of the balances is verified on a daily basis and records are kept in a Logbook.

11. Data Evaluation, Calculations and Reporting

11.1 Calculations

11.1.1 Go to the Excel spreadsheet labeled "Percent" on the server.

11.1.2 Transcribe the logbook entries into the correct columns on the spreadsheet template. Save this template as the date the samples were initially weighted (*i.e.*, 081302.xls). The spreadsheet will calculate the % Solid and the RPD for the duplicate analysis, using the following formulas:

$$\% \text{ Solid} = \frac{\text{Mass of dish \& dry sample "C"} - \text{Mass of dish "A"}}{\text{Mass of dish \& wet sample "B"} - \text{Mass of dish "A"}} \times 100$$

$$\text{RPD} = \frac{R1 - R2}{\frac{R1 + R2}{2}} \times 100$$

where:

R1 = result of sample

R2 = result of the duplicate sample

If percent moisture is requested, as opposed to percent solid, apply the following formula:

$$\% \text{ Moisture} = 100 - \% \text{ Solid}$$

11.1.3 Go to the LIMS and "batch" and "associate" all samples in this analytical batch.

11.1.4 Enter the results obtained from the Excel spreadsheet.

11.1.5 Forward the hand recorded raw data from the Percent Solid logbook, the Excel spreadsheet and the LIMS batch printout to the Department Manager for secondary review.

11.1.6 Procedures for data and record management must adhere to the Quality Systems Manual, other subordinate documents covering record keeping, and the *Document Control* SOP 1729. All records shall be stored in such a manner as to be safe and accessible for at least 10 years.

11.1.7 Notebooks: Laboratory notebooks are designed to accommodate the specific analysis. If a sample requires re-analysis or re-extraction for any reason, a notation is made next to the sample entry in that log. Such logbooks shall be archived so as to remain available for at least 10 years. All laboratory notebooks must follow the specifications in the Logbook Usage Work Instructions (WI 1556), and all record keeping and document control practices.

11.2 Data Evaluation and Reporting

Printouts of this document may be out of date and should be considered uncontrolled. To accomplish work, the published version of the document should be viewed online.

All results are reportable without qualification if the QC criteria defined in Section 9 are met. If any QC parameters are not met, all associated samples must be evaluated for re-analysis. See Sections 9 for discussion, including corrective action, for any QC outlier.

12. Contingencies for Handling Out-of-Control Data or Unacceptable Data

Refer to Section 11.2.

13. Method Performance

13.1 Method Detection Limit Study (MDL) / Limit of Detection Study (LOD) / Limit of Quantitation (LOQ)

The laboratory follows the procedure to determine the MDL, LOD, and/or LOQ as outlined in Alpha SOP 1732. These studies performed by the laboratory are maintained on file for review.

MDL/LOD/LOQ Studies are not applicable to this method.

13.2 Demonstration of Capability Studies

Refer to Alpha SOP 1739 for further information regarding IDC/DOC Generation.

13.2.1 Initial (IDC)

The analyst must make an initial, one-time, demonstration of the ability to generate acceptable accuracy and precision with this method, prior to the processing of any samples.

13.2.2 Continuing (DOC)

The analyst must make a continuing, annual, demonstration of the ability to generate acceptable accuracy and precision with this method.

14. Pollution Prevention and Waste Management

The Alpha *Hazardous Waste and Sample Disposal* SOP (1797), must be referenced for disposal of used standards, solvents, acids, reagents or other chemicals.

All solid waste generated during this analysis must be stored in satellite containers in the preparation laboratory labeled "Soil/Solid Waste".

Once the solid waste satellite containers are full, they must be emptied into a 55-gallon drum marked "Soil/Solid Waste".

15. Referenced Documents

Sample Receipt and Login SOP (SOP 1559)

Sample Custody and Tracking SOP (SOP 1560)

Hazardous Waste and Sample Disposal SOP (1797)

Logbook Usage Work Instructions (WI 1556)

16. Attachments

Printouts of this document may be out of date and should be considered uncontrolled. To accomplish work, the published version of the document should be viewed online.

None.

Acid Digestion of Solid Samples for Metals Analysis

References: **Method 3050B**, Acid Digestion of Sediments, Sludges and Soils, Test Methods for Evaluating Solid Waste, SW-846, Third Edition (Revision 2) as promulgated in the Final Update, December 1996..

Method 6020A, Inductively Coupled Plasma-Mass Spectrometry, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, EPA SW-846, Draft Update IVA, May 1998.

EPA/625/R-96/110a, Compendium of Methods for the Determination of Inorganic Compounds in Ambient Air, Compendium Method IO-3.1. SELECTION, PREPARATION AND EXTRACTION OF FILTER MATERIAL. U.S. EPA, Cincinnati, OH 45269, June, 1999.

1. Scope and Application

Matrices: The method is applicable to soil and sediment.

Method Instrumentation: The method is applicable to ICP and ICP/MS analysis.

Definitions: Refer to Alpha Analytical Quality Manual.

Two procedures are discussed in this SOP.

Lab Method 3050:1T-restricted to non-regulatory sediment/tissue projects only

This acid digestion procedure is used to prepare solid samples for analysis of total metals by ICP/MS. Silver, antimony, and tin can be analyzed by ICP/MS using this digestion.

<u>Element</u>	<u>CASRN</u>
Antimony (Sb)	7440-36-0
Silver (Ag)	7440-22-4
Tin (Sn)	7440-31-5

Lab Method 3050:2T

Samples prepared by this method may be analyzed by ICP and ICP-MS for all the metals listed below.

The data report packages present the documentation of any method modification related to the samples tested. Depending upon the nature of the modification and the extent of intended use, the laboratory may be required to demonstrate that the modifications will produce equivalent results for the matrix. Approval of all method modifications is by one or more of the following laboratory personnel before performing the modification: Area Supervisor, Department Supervisor, Laboratory Director, or Quality Assurance Officer.

This method is restricted to use by or under the supervision of trained analysts. Each analyst must demonstrate the ability to generate acceptable results with this method by performing an initial demonstration of capability.

<u>Element</u>	<u>CASRN</u>	<u>Element</u>	<u>CASRN</u>	<u>Element</u>	<u>CASRN</u>
Aluminum (Al)	7429-90-5	Cobalt (Co)	7440-48-4	Nickel (Ni)	7440-02-0
Antimony (Sb)	7440-36-0	Copper (Cu)	7440-50-8	Selenium (Se)	7782-49-2
Arsenic (As)	7440-38-2	Iron (Fe)	7439-89-6	Sodium (Na)	7440-23-5
Barium (Ba)	7440-39-3	Potassium (K)	7440-09-7	Silver (Ag)	7440-22-4
Beryllium (Be)	7440-41-7	Lead (Pb)	7439-92-1	Thallium (Tl)	7440-28-0
Cadmium (Cd)	7440-43-9	Magnesium (Mg)	7439-95-4	Tin (Sn)	7440-31-5
Calcium (Ca)	7440-70-2	Manganese (Mn)	7439-96-5	Titanium (Ti)	7440-32-6
Chromium (Cr)	7440-47-3	Molybdenum (Mo)	7439-98-7	Vanadium (V)	7440-62-2
Cobalt (Co)	7440-48-4	Nickel (Ni)	7440-02-0	Zinc (Zn)	7440-66-6

2. Summary of Method

Lab Method 3050:1T

7.5 mL of concentrated hydrochloric acid and 2.5 mL of concentrated nitric acid are added to 1-2g of solid sample measured into a digestion tube. The sample is heated in a block at 90-95°C for 75 minutes. After cooling, the sample is diluted up to 50mL with deionized water.

If the sample should go to dryness, the sample must be re-prepared.

All solid samples require filtration due to insoluble silicates and the formation of precipitates during digestion.

Lab Method 3050:2T

5mL of 1:1 nitric acid is added to 1-2g of solid sample measured into a digestion tube. For analysis of an air sampling filter, cut a one inch by eight inch section of filter using high carbon steel scissors and place into a digestion vial. The sample is heated in a block at 90-95°C for 15 minutes. 2.5mL of concentrated nitric acid is added, and the sample is refluxed for 30 minutes. The sample is then cooled and 2.5mL of concentrated nitric acid is added again. The sample is refluxed for an additional 30 minutes. 0.5mL of 30% hydrogen peroxide is added to the cooled sample and the sample is re-heated in a block until the sample no longer is effervescing. 1.0mL of hydrogen peroxide is added to the sample three more times and sample is heated in the block between each aliquot addition of 30% hydrogen peroxide. After cooling, add 2.5 mL HCl and 5 mL H₂O to the sample digest and heat the sample to 95°C ± 5C. Reflux at 95°C ± 5C without boiling for 5 minutes then sample is diluted up to 50mL with deionized water.

If the sample should go to dryness, the sample must be re-prepared.

All solid samples require filtration due to insoluble silicates and the formation of precipitates during digestion.

2.1 Method Modifications from Reference

A final extract volume of 50mL is used instead of 100mL specified in the reference method. All reagent volumes have been reduced proportionately.

3. Reporting Limits

For information regarding the RLs, see the appropriate analytical SOPs. These values are equivalent to the lowest standard in the initial calibration curve, and may be approximately 3-5X the calculated MDL.

4. Interferences

All re-usable glassware or plastic must be acid cleaned prior to use to remove residual trace elements.

Based on historical information, or by sample observation, it may be noted that all solid samples will require filtration after digestion, and prior to analysis, due to insoluble silicates and the formation of precipitates. After sample digestion, the associated method blank and laboratory control sample must be filtered with the associated batch samples.

5. Health and Safety

The toxicity or carcinogenicity of each reagent and standard used in this method is not fully established; however, each chemical compound must be treated as a potential health hazard. From this viewpoint, exposure to these chemicals must be reduced to the lowest possible level by whatever means available. A reference file of material data handling sheets is available to all personnel involved in the chemical analysis. Additional references to laboratory safety are available in the Chemical Hygiene Plan.

All personnel handling environmental samples known to contain or to have been in contact with municipal waste must follow safety practices for handling known disease causative agents.

The use of laboratory equipment and chemicals exposes the analyst to several potential hazards. Good laboratory techniques and safety practices shall be followed at all times. Eating, drinking, smoking, or the application of cosmetics is not permitted in the laboratory area. Horseplay of any kind is prohibited. Pipetting by mouth is not permitted. All Personal Protective Equipment (PPE) must be removed before leaving the laboratory area and before entering the employee lounge or eating area. Always wash your hands before leaving the laboratory. All relevant Material Safety Data Sheets (MSDSs) are kept alphabetically in the centrally located file storage, in the common area outside of the Information Technology (IT) offices.

Approved PPE, which includes Safety Glasses, Gloves and Lab Coats, must be worn at **all** times when handling samples, reagents, chemicals, or when in the vicinity of others handling these items, so that dermal contact is avoided. All standards, reagents and solvents shall be handled under a hood using the proper PPE. All flammable solvents must be kept in the flammable storage cabinet, and returned to the cabinet immediately after use. When transporting chemicals, use a secure transporting device and/or a secondary outer container. Chemical storage is properly segregated and adequately ventilated to reduce the possibility of hazardous reactions. Chemical storage in work areas shall be kept to a minimum. Storage on bench tops or other work surfaces, except temporary, is not permitted.

Spilled samples, solvents, reagents, and water must be cleaned up from bench tops, instruments and autosampler surfaces immediately. A spill is considered a quantity of hazardous material if it is two times greater than the normal working volume. Concentrated solvents, acids or bases present a moderate to extreme hazard to the skin and mucous membranes. If contact with the skin occurs, immediately flush with large volumes of water. In the case of acidic/basic spills, the *Spill Kit* located in each laboratory shall be utilized before attempting to cleanup the spill. Although procedures are designed to minimize the possibility of an accident, all injuries or accidents, regardless of the nature

or severity, are to be reported to the Section Head Supervisor immediately. If an employee discovers a potentially unsafe condition, this must be reported to the Section Head Supervisor immediately. No employee should feel compelled to work in a situation where they do not feel entirely informed, trained, or safe.

Analytical instrumentation poses the unique possibility of exposure to high voltages. Other than the *routine* instrument maintenance, as listed in the front of every Instrument Maintenance Logbook, at no time shall an instrument operator attempt to maintain an instrument alone, or without the proper training, supervision or instruction. Caution must always be used in the presence of moving parts (autosamplers) and hot surfaces (injection ports).

Compressed gas cylinders shall only be moved with the dolly supplied for this specific purpose. The cap must be on the cylinder while it is being moved. The tank must be secured when in its final position. All spent tanks are to be returned in the same manner, and secured until removed by the vendor. Liquid argon or nitrogen represents a potential cryogenic hazard and safe-handling procedures must be used at all times.

All additional company safety practices shall be followed at all times as written in the *Chemical Hygiene Plan*.

6. Sample Collection, Preservation, Shipping and Handling

6.1 Sample Collection

A minimum of 10g of sample must be collected in a pre-cleaned 2oz or 4oz glass jar with a Teflon lined screw cap.

6.2 Sample Preservation

No preservatives are used. See Section 6.4.

6.3 Sample Shipping

No special sample shipping requirements. Typical shipping procedures may be found in the Alpha Sample Receipt & Log-In SOP (1559).

6.4 Sample Handling

Samples are stored at $4^{\circ}\text{C} \pm 2^{\circ}\text{C}$. Sediment and soil samples may be stored at $-20^{\circ}\text{C} \pm 10^{\circ}\text{C}$. The hold time for solid samples for metals digestion is 6 months. Air sampling filters may be stored at room temperature. Tissue samples are stored frozen with a hold time of 1 year.

Refer to the Sample Receipt & Log-In SOP (1559) for Sample Receipt, Login and internal Sample Custody information.

7. Equipment and Supplies

7.1 Digestion Tubes: Pre-cleaned, graduated, disposable, 50 mL volume. The 50mL volume of each Lot of tubes is verified and documented in a logbook (Form No.: 11453).

7.2 Watch covers

7.3 Filter Funnels: Glass or plastic

7.4 Electric Hot Plate: Adjustable and capable of maintaining a temperature of 90-95°C equipped with graphite carbon blocks that each have 36 positions to hold the sample tubes.

NOTE: Hotplate/Block temperatures are monitored and recorded regularly using NIST calibrated and traceable thermometers. If any thermometer is suspected to not be reading the temperatures correctly, see the QAO for a certified replacement thermometer.

7.5 Other: Adjustable Eppendorf pipettes and replacement tips, pre-cleaned Filter Mate from Environmental Express (2.0um filter paper and plunger), 100mL and 200mL Class-A volumetric flasks, high carbon steel scissors.

8. Reagents and Standards

ACS Trace Metal grade chemicals shall be used in all tests. Other grades may be used, provided it is first ascertained that the reagent is of sufficiently high purity to permit its use without lessening the accuracy of the determination. If the purity of a reagent is in question, analyze for contamination. If the concentration is less than the MDL then the reagent is acceptable.

Solutions below expire 6 months from preparation, or expire on the manufacturer's expiration date, whichever comes first. Standards are stored out of direct light at ambient temperature. Reagents are stored at ambient temperature, under a hood if necessary. Acids are kept in a storage crate under a hood. Once opened, initialed and dated, they are kept in a hood. Acid expiration dates are generally provided by the manufacturer and printed on the label.

8.1 Deionized (DI) water: The DI water is ASTM Type II laboratory reagent grade water or better (*i.e.*, Type I). The Barnstead NANO-pure system provides Type I water used in the preparation of samples and standards.

8.2 Hydrochloric acid, concentrated (HCl): ACS reagent grade, Fisher #A508-212, or equivalent. Hydrochloric acid (1:1 HCl) - Add 500mL concentrated HCl to 400mL DI water and dilute to 1L. Store in or under fume hoods. Prior to use, the acid is analyzed to determine levels of impurity. If the method blank is less than the RL, the acid can be used. Results of this analysis are kept in a logbook.

8.3 Nitric acid, concentrated (HNO₃): ACS reagent grade, Fisher #A509-212, or equivalent. Nitric Acid (1:1 HNO₃) - Add 500mL concentrated HNO₃ to 400mL DI water and dilute to 1L. Prepare 1% Nitric Acid by diluting 1mL of concentrated HNO₃ up to 100mL in DI water. Store in or under fume hoods. Prior to use, the acid is analyzed to determine levels of impurity. If the method blank is less than the RL, the acid can be used. Results of this analysis are kept in a logbook

8.4 Spiking solutions:

All standard solutions are stored in cabinets out of direct light.

8.4.1 Laboratory Control Sample (LCS) and Matrix Spiking (MS) solution for 3050:2T:
Spike 1mL of custom spike from Ultra Scientific into the LCS and MS samples. The final concentration in the LCS and MS samples are Sn at 1.0 mg/L; Be and Cd at 2.0mg/L; Sb, Ba, B, Cr, Cu, Co, Mn, Zn, Ni, Pb, V, Ti, As, Se and Mo at 4.0mg/L; Al, Ca, Fe, Mg, K, and Na at 20.0mg/L.

8.4.2 Laboratory Control Sample (LCS) and Matrix Spiking (MS) solution for 3050:1T:
Spike 0.8mL of S3 into the LCS and MS samples.

8.4.2.1 S3 Solution: Prepare by adding 5mL of concentrated HNO₃ to a 100mL volumetric flask using a 5mL glass pipette. Then add 2.5mL of IQC-026 (Ultra Scientific) Elements solution containing Al, Sb, As, Se, Ba, Be, B, Cd, Cr, Ca, Cu, Co, Fe, Pb, Mg, Mn, Mo, Ni, Ag, Na, Tl, Ti and Zn at a concentration of 100ppm, K at 1000ppm, and Si at 50ppm. This solution is brought to volume with DI water.

8.4.3 LCS and MS spiking for additional targets not in spike mixes for 3050:2T:

Additional target of Ag may be added to the LCS and MS. Add 0.5 mL of a 100 mg/L stock solution to the LCS and MS resulting in a concentration of 1 mg/L (final volume, as noted in Section 10, is 50 mL).

8.5 LCS Solid Matrix Sample: Catalog # 540 from ERA.

8.6 30% Hydrogen Peroxide (H₂O₂): ACS reagent grade, BDH #BDH3742-1, or equivalent. Stored under the hood, kept in the plastic bag it comes in and placed in a "spill" dish pan. Expires according to the manufacturer's date, or 18 months from date received, whichever comes first.

9. Quality Control

The laboratory must maintain records to document the quality of data that is generated. Ongoing data quality checks are compared with established performance criteria to determine if the results of analyses meet the performance characteristics of the method.

9.1 Blank(s)

A method blank must be prepared once per every 20 samples or per digestion batch, whichever is more frequent.

Metals elements of interest must not be detectable in the method blank at a concentration greater than the reporting limit.

If required, and a blank solid material of a similar matrix type of high enough purity can be obtained to meet required reporting limits, a solid material may be used in the Method Blank preparation to matrix match QC samples and field samples.

Corrective Action: Analysis according to the appropriate analytical SOP may be repeated once to see if an analytical error has occurred. Digestion of the method blank and all associated samples must be performed until the blank is in control. Samples cannot be analyzed until an acceptable method blank analysis is obtained. Exceptions may be made with approval of the Metals Section Head, Laboratory Director or QAO, if the samples associated with the out of control method blank are non-detect for the elements of interest, or if sample concentrations are greater than 10x the blank levels. In such cases, the sample results are accepted without corrective action for the high method blank and the client is notified in a project narrative associated with the sample results.

9.2 Laboratory Control Sample (LCS)

Laboratory control sample (LCS) must be prepared once per every 20 samples or per digestion batch, whichever is more frequent, and a solid LCS may be prepared to matrix match QC samples and field samples.

If required, an LCS may be prepared by spiking with a solution prepared with a second source.

The acceptable recovery QC limits are documented in the applicable analytical SOPs. The solid recovery limits are continuously monitored and documented in-house through control charts. The

Control Limit Generation SOP (1734) provides details explaining how control charts are generated and used for quality control.

Corrective Action: Analysis according to the appropriate analytical SOP may be repeated once to see if an analytical error has occurred. If the LCS recovery is still out of control, re-prepare and re-analyze the LCS and all associated samples. Samples cannot be reported until an acceptable LCS is obtained. Exceptions may be made with approval of the Metals Section Head, Laboratory Director or QAO, if the samples associated with the out of control LCS are also associated with a matrix spike that is in control. This is an acceptable measure of accuracy of the digestion and analytical procedures. An explanation of the out of control LCS recovery must be included in the project narrative to the client and the sample data reported noting the acceptable MS results as batch QC.

9.3 Initial Calibration Verification (ICV)

Not applicable to this method.

9.4 Continuing Calibration Verification (CCV)

Not applicable to this method.

9.5 Matrix Spike

A matrix spike (MS) sample must be performed once per 20 samples (5% frequency), or per digestion batch, whichever is more frequent. The MS contains all target elements of interest.

The acceptable % recovery QC limits are documented in the applicable analytical SOPs. The aqueous % recovery QC limits are continuously monitored and documented in-house through control charts. The Control Limit Generation SOP (1734) provides details explaining how control charts are generated and used for quality control.

Corrective Action: Analysis according to the appropriate analytical SOP may be repeated once to see if an analytical error has occurred. If the % recovery still exceeds the control limits and the LCS is compliant; include a project narrative with the results to client noting that there may be potential matrix effects on the accuracy of the reported results as evidenced by MS recovery outside of QC limits.

9.6 Laboratory Duplicate

Duplicate analyses (matrix or sample duplicate) must be performed once per 20 samples 5% frequency), or per digestion batch, whichever is more frequent.

Acceptable relative percent differences (RPD) of duplicates are documented in the applicable analytical SOPs. Acceptance criterion is not applicable to sample concentrations less than 5 times the reporting limit. Calculate the RPD as follows:

$$RPD = \frac{R1 - R2}{\frac{R1 + R2}{2}} \times 100$$

where:

R1 = sample Replicate #1

R2 = sample Replicate #2

The RPD limits are continuously monitored and documented in-house through control charts. The Control Limit Generation SOP (1734) provides details explaining how control charts are generated and used for quality control.

Corrective Action: Analysis according to the appropriate analytical SOP may be repeated once to see if an analytical error has occurred. If the % RPD still exceeds the control limits; include a project narrative with the results to client noting that there may be potential matrix effects on the precision of the reported metals results as evidenced by the matrix duplicate %RPD exceedance.

9.7 Method-specific Quality Control Samples

None.

9.8 Method Sequence

Refer to Analytical SOP 2137 for method sequence.

10. Procedure

10.1 Equipment Set-up

Samples are prioritized by the Metals Section Head or Preparation Group Leader for digestion based on hold time and client due date. Gather all samples for digestion from the Sample Custodian according to the procedures outlined in the Sample Receipt & Log-In SOP (1559). Batch the samples that are being digested in the LIMS. Include the method blank, LCS, MS and Duplicate samples. **Note:** The proportional volume of reagents used for the digestions have been reduced from the volumes cited in the reference methods.

10.2 Initial Calibration

Not applicable to this method.

10.3 Equipment Operation and Sample Processing

10.3.1 Sample Digestion according to Lab Method 3050:1T:

- 10.3.1.1 Turn on the electric hotplates and monitor the temperature to 90-100°C. The hot blocks take approximately 120 minutes to reach the proper temperature. Using a plastic spoon, homogenize sample and weigh 1-2g of sample (to achieve a 1g dry weight) into a digestion tube. Label each tube with the sample batch ID.
- 10.3.1.2 Add 7.5 mL of concentrated hydrochloric acid and 2.5 mL concentrated nitric acid to each sample and spike the LCS and MS sample using the solutions prepared in Section 8.4.1.
- 10.3.1.3 Place the tubes into the block. Cover the samples with a watch cover. Heat the samples for a timed 75 minutes using caution not to let the samples go to dryness.
- 10.3.1.4 Remove the samples and allow them to cool. Remove the watch covers and bring the samples up to the 50mL mark on the digestion tube with DI water. Cap the tubes and shake. There will be precipitate formed during digestion, such as silicates or other insoluble material that may clog the nebulizer, these samples will require filtration. See Section 10.3.3 for filtration procedures.

10.3.2 Sample Digestion according to Lab Method 3050:2T:

- 10.3.2.1 Turn on the electric hotplates and monitor the temperature to 90-100°C. The hot blocks take approximately 120 minutes to reach the proper temperature. Weigh 1-2g or sample (to achieve a 1g dry weight) into a digestion tube. For analysis of an air sampling filter, cut a one inch by eight inch section of filter using high

carbon steel scissors and place into a digestion vial. Label each tube with the sample batch ID.

- 10.3.2.2 Spike the LCS and MS sample using the solutions prepared in Section 8.4.2.
- 10.3.2.3 Add 5mL of 1:1 nitric acid to each sample and place the tubes into the block. Cover the samples with a watch cover. Heat the samples for a timed 15 minutes using caution not to let the samples go to dryness.
- 10.3.2.4 Remove the samples from the block. When cool, add 2.5mL of concentrated nitric acid to each sample. Cover the samples with a watch cover, and place them back into the block. Reflux the samples for 30 minutes, remove the sample and repeat by adding 2.5mL of concentrated nitric acid to each sample and heating for an additional 30 minutes. Continue and repeat adding nitric acid until NO brown fumes are given off by the sample indicating the complete reaction with the nitric acid.
- 10.3.2.5 Remove the sample, when cool SLOWLY add 0.5mL of 30% hydrogen peroxide and replace the watch cover, placing sample back into the block. Heat sample until effervescence subsides, then remove, and cool the sample. Once cool, add 1.0mL of 30% hydrogen peroxide, replace the watch cover, and heat in the block until the effervescence subsides. When the sample is removed from the block and cooled, 1.0mL of 30% hydrogen peroxide should be added 2 more times and the sample should effervesce and cool between each 1.0mL aliquot addition. This step may take up to 2 hours to complete.
- 10.3.2.6 Remove samples and allow them to cool, add 2.5 mL HCl and 5 mL H₂O to the sample digest and heat the sample to 95°C ± 5C, Reflux at 95°C ± 5C without boiling for 5 minutes. Then remove watch covers and bring the samples up to the 50mL mark on the digestion tube with DI water. Cap the tubes and shake. There will be precipitate formed during digestion, such as silicates or other insoluble material that may clog the nebulizer, these samples will require filtration. See Section 10.3.3 for filtration procedures.

10.3.3 Sample filtration after digestion:

- 10.3.3.1 After digestion, all samples, including the method blank and LCS are filtered with a pre-cleaned Filter Mate and plunger.
- 10.3.3.2 If, during the filtration step above, the digestion tube inadvertently cracks, have a clean new tube near by. Quickly transfer the remaining sample digestate (minimum of 5mL) to the new tube. If less than 5mL of digestate remains, the sample must be re-digested. *Under no circumstances should any foreign object be placed into the sample tube to retrieve or re-set the filter plunger, as this may cause sample contamination.*

10.4 Continuing Calibration

Not applicable to this method.

10.5 Preventive Maintenance

The Hot Block thermometers are calibrated on an annual basis by an instrument service company. Certificates are kept on file.

11. Data Evaluation, Calculations and Reporting

Procedures for data and record management for organic extraction must adhere to the Quality Systems Manual, other subordinate documents covering record keeping, and the *Document Control*

SOP (1729). All records must be stored in such a manner as to be safe and accessible for at least 10 years.

The digestion batch bench sheets and other relevant laboratory notebooks must follow the specifications in the *Laboratory Notebook Usage* Work Instruction (1556), and all record keeping and document control practices.

See the appropriate analytical SOPs, for details on sample analysis, data evaluation, calculations and data reporting.

All results for the metals elements of interests are reportable without qualification if digestion and analytical holding times are met, preservation (including cooler temperatures) are met, all QC criteria defined in the table below are met, and matrix interference is not suspected during digestion or analysis of the samples. If any of the below QC parameters are not met, all associated samples must be evaluated for re-extraction and/or re-analysis.

QC Parameter	Acceptance Criteria
Method Blank	< reporting limit
Laboratory Control Sample	See the applicable analytical SOP for acceptance criteria
Matrix Duplicate	See the applicable analytical SOP for acceptance criteria
Matrix Spike	See the applicable analytical SOP for acceptance criteria
Matrix Spike Duplicate (if needed)	See the applicable analytical SOP for acceptance criteria

12. Contingencies for Handling Out-of-Control Data or Unacceptable Data

Section 9 and the appropriate analytical SOPs outline sample batch QC acceptance criteria. If non-compliant inorganic element results are to be reported, the Metals Section Head and/or the Laboratory Director, and the QA Manager must approve the reporting of these results. The laboratory Project Manager shall be notified, and may chose to relay the non-compliance to the client, for approval, or other corrective action, such as re-sampling and re-analysis. The instrument analyst or Section Head performing the secondary analytical review initiates the project narrative, and the narrative must clearly document the non-compliance and provide a reason for acceptance of these results.

13. Method Performance

13.1 Method Detection Limit Study (MDL) / Limit of Detection Study (LOD) / Limit of Quantitation (LOQ)

The laboratory follows the procedure to determine the MDL, LOD, and/or LOQ as outlined in Alpha SOP/1732. These studies performed by the laboratory are maintained on file for review.

13.2 Demonstration of Capability Studies

Refer to Alpha SOP/1739 for further information regarding IDC/DOC Generation.

13.2.1 Initial (IDC)

Printouts of this document may be out of date and should be considered uncontrolled. To accomplish work, the published version of the document should be viewed online.

The analyst must make an initial, one-time, demonstration of the ability to generate acceptable accuracy and precision with this method, prior to the processing of any samples.

13.2.2 Continuing (DOC)

The analyst must make a continuing, annual, demonstration of the ability to generate acceptable accuracy and precision with this method.

14. Pollution Prevention and Waste Management

The *Hazardous Waste and Sample Disposal* SOP (1797), must be referenced for disposal of used standards, solvents, acids, reagents or other chemicals.

Once sample batches have completed digestion, the sample containers are stored in the metals lab and held for 30 days. If there is no sample remaining in the sample collection bottle, it may be rinsed and thrown away. It must be noted in the *Internal* COC that there is no sample remaining in the bottle, and the bottle was discarded.

Once the samples have been held for 30 days, any aqueous sample remaining must be disposed in a 55-gallon drum labeled "Corrosive Liquid".

Once satisfactory inorganic element results have been generated, the digestates are held for 30 days, or longer if specified by a client contract, then discarded into a 55-gallon drum labeled "Corrosive Liquid".

All reagent waste generated during digestion must be stored in satellite containers in the metals preparation laboratory.

Once the reagent waste satellite containers are full, they must be emptied into 55-gallon drums marked "Corrosive Liquid".

15. Referenced Documents

Chemical Hygiene Plan

Control Limit Generation SOP (1734)

Document Control SOP (1729)

Hazardous Waste and Sample Disposal SOP (1797)

SOP/1559 Sample Receipt & Log-In

SOP/1732 MDL Generation

SOP/1739 IDC Generation

16. Attachments

None.

Inductively Coupled Plasma - Mass Spectrometry

References: **Method 6020A**, Test Methods for Evaluating Solid Waste:
Physical/Chemical Methods, EPA SW-846, Revision 1, February 2007.

1. Scope and Application

Matrices: Inductively coupled plasma-mass spectroscopy (ICP-MS) is applicable to the determination of multi-element trace metals in water and other aqueous samples (surface and saline waters, groundwaters, domestic and industrial wastes), toxicity characteristic leaching procedure (TCLP) extracts, acid-volatile sulfide – simultaneously extractable metals (AVS-SEM)) and solid samples (soils, sediments, sludges, and tissues).

Definitions: Refer to Alpha Analytical Quality Manual.

Inductively coupled plasma-mass spectroscopy (ICP-MS) determines trace metal concentrations in solution. The method is applicable to all of the metals and matrices listed below. This method is approved for use in compliance monitoring programs such as the Clean Water Act (NPDES). All matrices, with the exception of dissolved metals samples, require extraction and/or digestion prior to analysis. The metals listed in the tables of Section 16 can accurately be determined in the range of 0.2 µg/L to 50,000 µg/L for aqueous samples, and in the range of 0.02 to 5000 mg/Kg for solid samples, for samples that do not require dilution.

The data report packages present the documentation of any method modification related to the samples tested. Depending upon the nature of the modification and the extent of intended use, the laboratory may be required to demonstrate that the modifications will produce equivalent results for the matrix. Approval of all method modifications is by one or more of the following laboratory personnel before performing the modification: Area Supervisor, Department Supervisor, Laboratory Director, or Quality Assurance Officer.

This method is restricted to use by or under the supervision of analysts experienced in the operation of the ICPMS and in the interpretation of ICPMS data. Each analyst must demonstrate the ability to generate acceptable results with this method by performing an initial demonstration of capability.

Parameter	CAS	Parameter	CAS	Parameter	CAS
Aluminum (Al)	7440-36-0	Copper (Cu)	7440-50-8	Strontium (Sr)	7440-24-6
Antimony (Sb)	7440-36-0	Iron (Fe)	7439-89-6	Silver (Ag)	7440-22-4
Arsenic (As)	7440-38-2	Lead (Pb)	7439-92-1	Sodium (Na)	7440-23-5
Barium (Ba)	7440-39-3	Magnesium (Mg)	7439-95-4	Thallium (Tl)	7440-28-0
Beryllium (Be)	7440-41-7	Manganese (Mn)	7439-96-5	Tin (Sn)	7440-31-5
Boron (B)	7440-42-8	Molybdenum (Mo)	7439-98-7	Titanium (Ti)	7440-32-6
Cadmium (Cd)	7440-43-9	Nickel (Ni)	7440-02-0	Vanadium (V)	7440-62-2
Calcium (Ca)	7440-70-2	Potassium (K)	97/7440	Zinc (Zn)	7440-66-6
Chromium (Cr)	7440-43-9	Selenium (Se)	7782-49-2		
Cobalt (Co)	7440-48-4				

2. Summary of Method

An aliquot of a well mixed, homogeneous aqueous or solid sample is accurately measured or weighed for sample preparation. Prior to analysis, all samples, with the exception of samples requiring dissolved metal analysis, must be "solubilized" or digested in acid using the appropriate

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sample preparation methods as noted in above. Dissolved metals do not require acid digestion if the samples are filtered and acid preserved prior to analysis. Once the samples have been digested, they are ready for analysis by ICP-MS.

This analytical method entails the simultaneous multi-elemental determination of sub- $\mu\text{g/L}$ concentrations of many trace metals by ICP-MS. The method measures ions produced by a radio-frequency inductively coupled plasma. Samples are nebulized and the resulting aerosol is transported to the plasma torch by argon gas. The ions produced by a radio-frequency inductively coupled plasma are then introduced into a quadrupole mass spectrometer. The ions produced in the plasma are sorted according to their mass-to-charge ratios and quantified with a channel electron multiplier. Interferences must be assessed and valid corrections applied or the data flagged to indicate problems. Interference correction must include compensation for background ions contributed by the plasma gas, reagents, and constituents of the sample matrix.

2.1 Method Modifications from Reference

The calibration blank is used as a reference to monitor changes in internal standard recoveries in QC samples and client samples. This deviates from the reference method which suggests the use of the initial calibration standard. The instrument software can not be changed to perform this analysis. There is no apparent impact to the quality of the data as indicated by successful analysis of PT samples over the period of operation of the instrument.

3. Reporting Limits

Reporting Limits are listed in Table 1.

4. Interferences

4.1 Isobaric elemental interferences occur when an isotope of one element is at the same nominal mass-to-charge ratio (m/z) as an isotope of another element (*i.e.*, Mo 98 and Ru 98). Corrections for isobaric interferences may be made by measuring the intensity due to the interfering element at another isotope and using its natural abundance ratios to correct for its presence at the analytical mass of interest. Most commonly used corrections for isobaric interferences are already present as default interference equations in the ELAN NT software. A list of the corrections used is given in the listing of the isotopes monitored in the 6020A method in Table 3 of this SOP.

Care should be taken that the isotope measured for correction purposes does not suffer from overlap with other isotopes that may be present in the sample. Extreme caution should be exercised when reporting metal concentrations where the "apparent concentration" from an interfering element accounts for 90% of the measured concentration. This can be estimated by closely monitoring the concentrations of the non-spiked metal concentrations in the daily analysis of the ICSA solution.

4.2 Isobaric molecular and doubly-charged ion interferences are caused by ions consisting of more than one atom or charge. Common molecular interferences include ArCl , ClO , nitrogen dimer, oxygen dimer, and oxide species. Most isobaric interferences have been identified in the literature. Isobaric molecular interferences can often be corrected for in the same manner as isobaric elemental interferences, *i.e.*, measuring the intensity present at another isotope and using isotope ratios to calculate the amount of the interfering species. For example, corrections for interferences of $\text{Ar}^{40}\text{Cl}^{35}$ on As at mass 75 may be made by measuring the intensity of ArCl present at mass 77 ($\text{Ar}^{40}\text{Cl}^{37}$) and converting to the apparent intensity of ArCl at mass 75 by using the isotopic ratio of Cl^{37} to Cl^{35} . A list of the

corrections used is given in the listing of the isotopes monitored in the ELAN 6020 method in Table 3 of this SOP.

It may be possible to eliminate or minimize isobaric interferences by using the DRCE ICP/MS equipped with a reaction cell. See Section 11.9.

Care should be taken that the isotope measured for correction purposes does not suffer from overlap with other isotopes that may be present in the sample. Extreme caution should be exercised when reporting metal concentrations where the "apparent concentration" from an interfering element accounts for 90% of the measured concentration. This can be estimated by closely monitoring the concentrations of the non-spiked metal concentrations in the daily analysis of the ICSA solution

- 4.3** Physical interferences are effects associated with the sample nebulization and transport processes. Changes in viscosity and surface tension can cause significant inaccuracies, especially in samples containing high dissolved solids or high acid concentrations. Differences in solution volatility can also cause inaccuracies when organic solvents are involved. If physical interferences are present, they must be reduced by diluting the sample. Another problem that can occur with high dissolved solids is salt buildup at the tip of the nebulizer, which affects aerosol flow rate and causes instrumental drift. The argon flow rate is controlled with a mass flow controller. Changing the nebulizer and removing salt buildup at the tip of the torch sample injector is used as an additional measure to control salt buildup when there is an obvious decrease in instrument sensitivity. An internal standard can also be used to correct for physical interferences, if it is carefully matched to the analyte so that the two elements are similarly affected by matrix changes. When the intensity level of an internal standard is outside of the 70% - 120% range for Method 6020A then the sample must be reanalyzed at a 5 X dilution.
- 4.4** Memory interference results when analytes in a previous sample contribute to the signals measured in a new sample. Sample deposition and buildup on the sampler and skimmer cones can be minimized by flushing the system with rinse blanks between samples. A normal rinse time of 60 seconds can be increased if memory interference is suspected. Any sample suspected of having memory interference must be reanalyzed.

5. Health and Safety

The toxicity or carcinogenicity of each reagent and standard used in this method is not fully established; however, each chemical compound should be treated as a potential health hazard. From this viewpoint, exposure to these chemicals must be reduced to the lowest possible level by whatever means available. A reference file of material safety data sheets is available to all personnel involved in the chemical analysis. Additional references to laboratory safety are available in the Chemical Hygiene Plan.

All personnel handling environmental samples known to contain or to have been in contact with municipal waste must follow safety practices for handling known disease causative agents.

- 5.1** The use of laboratory equipment and chemicals exposes the analyst to several potential hazards. Good laboratory techniques and safety practices shall be followed at all times. Eating, drinking, smoking, or the application of cosmetics is not permitted in the laboratory area. Horseplay of any kind is prohibited. Pipetting by mouth is not permitted. All Personal Protective Equipment (PPE) must be removed before leaving the laboratory area and before entering the employee lounge or eating area. Always wash your hands before leaving the laboratory. All relevant Material Safety Data Sheets (MSDSs) are kept AlphaNet.

- 5.2** Approved PPE, which includes Safety Glasses, Gloves and Lab Coats, must be worn at ***all*** times when handling samples, reagents, chemicals, or when in the vicinity of others handling these items, so that dermal contact is avoided. All standards, reagents and solvents shall be handled under a hood using the proper PPE. All flammable solvents must be kept in the flammable storage cabinet, and returned to the cabinet immediately after use. When transporting chemicals, use a secure transporting devise and/or secondary outer container. Chemical storage is properly segregated and adequately ventilated to reduce the possibility of hazardous reactions. Chemical storage in work areas shall be kept to a minimum. Storage on bench tops or other work surfaces, except temporary, is not permitted.
- 5.3** The toxicity or carcinogenicity of each compound or reagent used in this method has not been precisely defined; however, each chemical compound shall be treated as a potential health hazard. From this viewpoint, exposure to chemicals must be reduced to the lowest possible level by whatever means available. All standards and reagents shall be prepared in a hood while using the proper PPE.
- 5.4** Spilled samples, solvents, reagents, and water must be cleaned up from bench tops, instruments and autosampler surfaces immediately. A spill is considered a quantity of hazardous material if it is two times greater than the normal working volume. Concentrated solvents, acids or bases present a moderate to extreme hazard to the skin and mucous membranes. If contact with the skin occurs, immediately flush with large volumes of water. In the case of acidic/basic spills, the *Spill Kit* located in each laboratory shall be utilized before attempting to cleanup the spill. Although procedures are designed to minimize the possibility of an accident, all injuries or accidents, regardless of the nature or severity, are to be reported to the Section Head Supervisor immediately. If an employee discovers a potentially unsafe condition, this must be reported to the Section Head Supervisor immediately. No employee should feel compelled to work in a situation where they do not feel entirely informed, trained, or safe.
- 5.5** Analytical instrumentation poses the unique possibility of exposure to high voltages. Other than the *routine* instrument maintenance, as listed in the front of every Instrument Maintenance Logbook, at no time shall an instrument operator attempt to maintain an instrument alone, or without the proper training, supervision or instruction. Caution must always be used in the presence of moving parts (autosamplers) and hot surfaces (injection ports).
- 5.6** Compressed gas cylinders shall only be moved with the dolly supplied for this specific purpose. The cap must be on the cylinder while it is being moved. The tank must be secured when in its final position. All spent tanks are to be returned in the same manner, and secured until removed by the vendor. Liquid argon or nitrogen represents a potential cryogenic hazard and safe-handling procedures must be used at all times.
- 5.7** Care must be taken when handling all liquid samples, digestates, and standards since they are preserved to a pH <2.

6. Sample Collection, Preservation, Shipping and Handling

6.1 Sample Collection

Aqueous Samples for total metal analysis: The volume of sample required is dependent on the analyses requested. Typically, a 500 mL of sample is collected in plastic containers. Samples of this volume should be preserved with 0.5mL of concentrated nitric acid per liter of sample ($\text{pH} \leq 2$) at time of collection.

Solid samples: A minimum of 10.0 grams of sample must be collected in a glass jar.

6.2 Sample Preservation

Aqueous Samples for total metal analysis: For the determination of total parameters, the sample is preserved with 1:1 HNO_3 to $\text{pH} < 2$, not to exceed 10 ml of 1:1 HNO_3 per liter of sample. Usually 2 ml of 1:1 HNO_3 is sufficient for the preservation of waters. Samples must be $\text{pH} < 2$ for at least 24 hours prior to digestion if not preserved at the time of collection. If conditions do not permit field preservation, this must be noted on the COC and in the laboratory case narrative.

Aqueous samples for dissolved metal analysis: an aliquot of the unpreserved sample is filtered through a $0.45\mu\text{m}$ membrane filter within 24 hours of the collection time, and prior to sample digestion and analysis. The sample is filtered through a nitric acid presoaked glass filtration apparatus. Once a sufficient volume of the filtrate is obtained, the filtrate is preserved with 1:1 Nitric acid (HNO_3) to a $\text{pH} < 2$. Soluble samples must be held at $\text{pH} < 2$ for at least 24 hours prior to digestion if not preserved at the time of filtration. A separate SOP lists the sample preparation technique.

A plastic apparatus must be used when determination of boron or silica is critical.

Sample Shipping

None.

6.3 Sample Handling

Aqueous Samples for total metal analysis: The samples can be stored at room temperature or can be refrigerated and maintained at $4^\circ\pm 2^\circ\text{C}$ until digestion and analysis. All aqueous samples must be analyzed within 6 months from date of collection.

Solid samples: The samples must be refrigerated and maintained at $4^\circ\pm 2^\circ\text{C}$ until digestion and analysis. All solid samples must be analyzed within 6 months from the date of collection. The hold time for samples that require AVS/SEM analysis is 14 days.

Note: Although mercury is not typically analyzed by ICP-MS, the hold time for samples that require mercury analysis is 28 days.

7. Equipment and Supplies

7.1 Perkin-Elmer ELAN 6100 or ELAN DRCE inductively coupled argon plasma – mass spectrometer (ICP-MS): Capable of providing resolution better than or equal to 1 amu at 10% peak height. The system has a mass range from 6-240 amu with a data system that allows for correction for interferences and the application of the internal standard technique.

7.1.1 ELAN 6100 and DRCE computer system

- 7.1.2 ELAN software
- 7.1.3 Printer
- 7.1.4 Mixing block manifold for on-line addition of internal standards
- 7.1.5 Autosampler
- 7.1.6 Peristaltic pump tubing
 - 7.1.6.1 Sample Introduction; Black/Black - 0.76 mm (0.030") i.d
 - 7.1.6.2 Internal Standard Introduction; Green/Orange - 0.38 mm (0.015") i.d.
 - 7.1.6.3 Drain; Black/White – 3.18 mm (0.125") i.d
 - 7.1.6.4 Rinse; Red/Red - 1.14 mm (0.045") i.d
 - 7.1.6.5 Making Connections; Blue/Blue - 1.65 mm i.d
 - 7.1.6.6 Making Connections; Purple/Purple -2.06 mm i.d
- 7.2 **Liquid Argon** - 99.999% purity and regulator.
- 7.3 **Oxygen**: High purity gas and regulator
- 7.4 **Ammonia**: High purity gas and regulator
- 7.5 **Glassware** - Assorted Class-A volumetric flasks, beakers, graduated cylinders and pipettes of appropriate sizes for preparing reagents, standards, and measuring sample volumes
- 7.6 **Air Displacement pipetters**: Eppendorf brand or equivalent digital pipettes capable of delivering volumes ranging from 0.1 to 5000 µL with an assortment of high quality disposable pipette tips
- 7.7 **Autosampler tubes**: 15-mL plastic AS-91 and/or S10
- 7.8 **Digestion tubes**: 50-mL plastic with caps
- 7.9 **Analytical balance**: Capable of accurate measurement to the nearest 0.01 g

8. Reagents and Standards

Deionized (DI) water is ASTM Type II laboratory reagent grade water or better (*i.e.*, Type I). The Barnstead NANO-pure system provides Type I water used in the preparation of samples and standards. ACS Trace Metal grade chemicals shall be used in all tests. Other grades may be used, provided it is first ascertained that the reagent is of sufficiently high purity to permit its use without lessening the accuracy of the determination. If the purity of a reagent is in question, analyze for contamination. If the concentration is less than the RL then the reagent is acceptable.

Solutions below expire six months from preparation unless noted. All stock and working calibration standards expiration dates are based on manufacturer expiration date or one year from date received. All solutions are stored at room temperature

- 8.1 **Nitric acid (HNO₃)**, concentrated. Trace metal grade or ultra-pure from sub-boiling distillation is preferred. Suggested suppliers include: Seastar™- Sub-boiling distilled grade, Sidney, BC; J. T. Baker - ULTREX® Grade; and Fisher - Optima Grade. Lots should be checked for purity prior to use and the results stored in a reagent check log book.

8.2 Hydrochloric acid (HCL), concentrated. Trace metal grade or ultra-pure from sub-boiling distillation is preferred. Suggested suppliers include: Seastar™ - Sub-boiling distilled grade, Sidney, BC; J. T. Baker - ULTREX® Grade; and Fisher - Optima Grade. Lots should be checked for purity prior to use and the results stored in a reagent check log book.

8.3 2% (vol/vol) Nitric acid. Prepare by adding 40 mL of concentrated nitric acid to 2000 mL reagent water in a clean glass bottle or 180 mL of concentrated nitric acid to 9000 mL reagent water in a clean carboy. This acid minimizes the damage to the interface and also minimizes isobaric molecular-ion interferences.

8.4 10% (vol/vol) Nitric acid. Prepare by adding 200 mL of concentrated nitric acid to 2000 mL reagent water in a clean glass bottle or 900 mL of concentrated nitric acid to 9000 mL reagent water in a clean carboy. This acid is the maximum concentration used for calibration standards, samples and rinse acid as recommended by the instrument manufacturer.

8.5 0.1% (vol/vol) Sub-boiling distilled Nitric acid. Prepare by adding 1.0 mL of concentrated sub-boiling distilled nitric acid to 1000 mL reagent water in a clean polyethylene bottle.

8.6 5% (vol/vol) Nitric acid. Prepare by adding 50 ml of concentrated nitric acid to 950 mL reagent water in a clean polyethylene bottle.

8.7 Single element stock solutions for the following elements are typically maintained in the laboratory. These are normally purchased as 1000 mg/L standards from Fisher Scientific or equivalent. The ICP MS is capable of determining concentrations of 73 elements in the Periodic Table. Other calibration standards, not present in Table 4, may be purchased as necessary for non-routine analyses.

- 8.7.1 Arsenic
- 8.7.2 Beryllium
- 8.7.3 Selenium
- 8.7.4 Strontium
- 8.7.5 Tin
- 8.7.6 Zinc

8.8 Tuning Solution Stock standards consist of 1000 mg/L beryllium (Be), cobalt (Co), indium (In), thallium (Tl), and uranium (U).

8.8.1 100 mg/L Tuning Solution Intermediate Standard . Prepare 1:10 dilutions by pipetting 100 µL of each 1000 mg/L single element stock solutions of Co, In, Tl, and U into a 1 mL autosampler cup containing 900 µL 2% nitric acid.

8.8.2 Tuning solution: 150 µg/L Be and 10 µg/L Co, In, Tl, and U. Prepare by pipetting 100 µL of 100 mg/L tuning solution standard in 8.8.1 and 150 µL of 1000 mg/L Be into a 1 liter volumetric flask filled with 200 mL of reagent water and 20 mL of concentrated nitric acid. Dilute to a final volume of 1 liter with reagent water and mix well.

Can also order Perkin Elmer part # N812-2014 for the tuning solution.

8.9 The Internal Standard Solution is prepared from single element standards consisting of 100 mg/L Germanium (Ge), 100 mg/L indium (In), 100 mg/L lithium (Li⁶), 100

mg/L scandium (Sc) and 100, mg/L terbium (Tb). Alternately, a custom mix of internal standards may be purchased from Spex.

- 8.9.1 Add 10 mL of concentrated nitric acid to a 500 ml volumetric flask containing 250 ml of DI water.
- 8.9.2 Add 5 ml of 100 mg/L Li^6 . Li^6 is used routinely when analyzing beryllium and boron or other elements as needed. If these elements are not being analyzed then it is not necessary to add this internal standard.
- 8.9.3 Add 1.0 mL of a stock solution containing 100 mg/L of Sc.
- 8.9.4 Add 0.5 mL of 100 mg/L of In, Ge and Tb stock solutions

Note: All solutions including calibration blanks, calibration standards, samples, quality control standards, and quality control samples must be spiked with the same level of the internal standard spiking solution. Use the above solution in conjunction with the on-line mixing block for addition of internal standards to calibration standards and samples. Internal standard intensities should be between 100,000 cps and 150,000 cps. The internal standard solution as made here should be diluted 1:2 for the DRCE ICP MS instrument due to the greater sensitivity of the instrument. The internal standard mass should be no more than 50 AMU removed from an analyte.

Note: Other internal standards are suggested for use such as Y, Ho, Lu and Bi and may be used if poor performance is observed from the above standards

8.10 Calibration Stock Standard and Intermediate Working Standard Solutions

Intermediate Working Standard solutions are prepared from certified vendor Stock Standard solutions and include those analytes listed below. Vendor sources are subject to change and equivalent solutions may be used.

Mixed calibration standard solutions must contain the appropriate types and volumes of acids so that the standards are matrix matched with the sample digestates. The acid matrix for all standards is 0.1% HNO_3 or 5%. These concentrations do not damage to the ICP-MS interface and also minimizes isobaric molecular-ion interferences with the analytes. A diluent of the acid matrix preparation is described in 8.3 and 8.4. *Note: Silver and antimony may precipitate out of solution at higher concentrations between 50-500 $\mu\text{g/L}$. Higher silver concentrations (>500 $\mu\text{g/L}$) require additional HCl. Caution: Many metal salts are extremely toxic if inhaled or swallowed. The Health and Safety precautions noted in Section 5 must be followed.* All standards are stored in the metals instrument laboratory at room temperature. The expiration dates are monitored from vendor supplied dates. The element or mix of elements that expires first in a solution dictates the expiration date for the entire solution. Standard and spike solutions are labeled using an alpha-numeric system based on the date prepared. All standards or spikes that are prepared are recorded in the metals laboratory logbooks. It is suggested that standards with a final concentration of less than 1 mg/L be prepared daily

- 8.10.1 **CPI-19:** Sb, As, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Mo, Ni, Se, Tl, Ti, V and Zn from CPI containing all of the listed elements at 100 mg/L.

- 8.10.1.1 **(Date)-C1:** Intermediate working standard is prepared by adding 1 mL of CPI-19 (8.10.1) to 9 ml of 0.1% nitric acid. This standard

is prepared approximately every four weeks and is used to prepare the daily calibration standards

8.10.2 CPI-7: *K* at 1000 mg/L, *Si* at 50 µg/ml, and *Al, Ba, B, Ag and Na* at 100 mg/L from CPI at the concentrations noted.

8.10.2.1 (Date)-C2: Intermediate working standard is prepared by adding 1 mL of CPI-7 (8.10.2) to 9 ml of 0.1% Acid (8.5). This standard is prepared approximately every four weeks and is used to prepare daily calibration standards.

8.10.3 AT-3: *Al, Ca, Fe, Mg, K, and Na* a custom mix from Inorganic Ventures at 500 mg/L for each element.

8.10.3.1 (Date)-C3: Intermediate working standard is prepared by adding 1 mL of AT-3 (8.10.3) to 9 ml of 0.1% Acid (8.5). This standard is prepared approximately every four weeks and is used to prepare daily calibration standards.

8.10.3.2 (Date)-C4: This standard is prepared by pouring AT-3 (8.10.3) into a satellite container for use in preparing daily calibrations standards.

8.10.4 IQC-026: *Sb, Ag, Al, As, B, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Mo, Na, Ni, Se, Tl, Ti, V and Zn* at 100 mg/L, *Si* at 50 mg/L and *K* at 1000 mg/L from Ultra Scientific.

8.10.4.1 (Date)-I1: Intermediate working standard is prepared by adding 1 mL of IQC-026 (8.10.4) to 9 ml of 0.1% Acid (8.5). This standard is prepared approximately every four weeks and is used to prepare daily calibration standards.

8.10.5 XAQU-15: *Fe, Al, Mg, Na, Ca and K* a custom mix from SPEX at 500 mg/L for each element listed.

8.10.5.1 (Date)-I2: Intermediate working standard is prepared by pouring XAQU-15 (8.10.5) into a satellite container for use in preparing daily calibrations standards

8.10.6 Single Element Added Analytes: Sn, and other analytes may be added to the calibration standards, ICV, ICSAB, and LLCV. Two intermediate solutions from two separate sources are prepared. 0.5 ml of each 1000 mg/L stock solution is added to 50 mLs of 10% HNO₃ to a concentration of 10 mg/L, one is labelled Calibration intermediate and the second source is labelled ICV intermediate.

8.10.7 ICUS-3411: RL check standard stock solution, a custom mix from ULTRA. *Ag, Cd, Co, Pb, Tl*, at 1 mg/L, *Be* at 1.5 mg/L, *As, Ba, Cu, Cr, Mn, Mo, Ni, Sb, Sr, Ti* at 2.5 mg/L, *Se, V* at 5 mg/L, *B, Zn* at 25 mg/L, *Al, Fe, Mg* at 50 mg/L, *Ca, K, Na*, at 500 mg/L

8.11 Daily Calibration Standards

For USFSER work, an Initial Calibration Curve is prepared for each level and is described below. Every element is *not* in each level of the calibration curve. At minimum, a high level, a low level that confirms the reporting limit (STD1), and a calibration blank (STD0), is used. See Table 4 for a list of the initial calibration concentrations. Standards are prepared in either 0.1% or 5% nitric acid to matrix match standards to samples depending on the how samples and sample digests are diluted for analysis. Standards used to analyze undiluted Dissolved Aqueous samples are prepared in 0.1% nitric acid. Standards used to analyze undiluted Total Aqueous samples prepared by hot plate (2151) are prepared in 5% nitric acid. Soil/Sediment samples prepared by Hot Plate Method 3050 (2148) and Tissue

samples prepared by microwave oven (2150) and diluted 1:2 are prepared in 5% nitric acid. Standards used to analyze Total Aqueous samples prepared by hot plate (2151), diluted 1:5, and Soil/Sediment samples prepared by Hot Plate Method 3050 (2148), diluted 1:5, are prepared in 5% nitric acid.

- 8.11.1 STD0 (Calibration Blank):** Calibration Blank: A solution containing the same acid matrix as samples and standards
- 8.11.2 STD1 (Reporting Limit Standard):** Prepared from the RL check standard stock solution(8.10.7). Dilute stock solution to make RL intermediate(add 0.5 mL to 50 mL final volume in 2% HNO₃). Add 1 mL of the RL intermediate to 50 mL digestion tube and bring to volume with diluent acid. Ag, Cd, Co, Pb, Tl, at 0.2ug/L, Be at 0.3ug/L, As, Ba, Cu, Cr, Mn, Mo, Ni, Sb, Sr, Ti at 0.5 ug/L, Se, V at 1 ug/L, B, Zn at 5 ug/L, Al, Fe, Mg at 10 ug/L, Ca, K, Na, at 100 ug/L. Sn is added as a single element additional target using the Calibration Intermediate (Section 8.10.6). Calibration intermediate is serially diluted, 0.5 mLs added to 50 mLs of 10% HNO₃ resulting in a 100µg/L concentration. Add 0.25 mLs of the subsequent dilution and bring to 50 mL final volume with diluent acid. Concentrations are at or below the reporting limit.
- 8.11.3 STD2:** Add 50 µL of (Date)-C1 (8.10.1.1) and 100 µL of (Date)-C3 (8.10.3.1) to a 50mL digestion tube and bring to 50mL with the diluent acid. The final concentration of each element is: *As, Be, Cd, Co, Cr, Cu, Mn, Mo, Ni, Pb, Sb, Se, Ti, Tl, V and Zn* at 10 µg/L; *Al, Ca, Fe, and Mg* at 110 µg/L; *K and Na* at 100 µg/L; and *Si* at 5 µg/L. Note: only 16 of the 19 elements in this mix are evaluated at this concentration level. Add 50 µL of Calibration intermediate (8.10.6) (single element additional targets, e.g.,Sn) for a concentration of 10 µg/L.
- 8.11.4 STD3:** Add 100 µL of (Date)-C1 (8.10.1.1) and 100 µL of (Date)-C4 (8.10.3.2) to a 50mL digestion tube and bring to 50mL with the diluent acid. The final concentration of each element is: *As, Be, Cd, Co, Cr, Cu, Mn, Mo, Ni, Pb, Sb, Se, Ti, Tl, V and Zn* at 20 µg/L; *Al, Ca, Fe, and Mg* at 1020 µg/L; *K and Na* at 1000 µg/L; *Hg* at 5 µg/L, and *Si* at 10 µg/L. Note: only 16 of the 19 elements in this mix are evaluated at this concentration level. Add 100 µL of Calibration intermediate (8.10.6) (single element additional targets, e.g.,Sn) for a concentration of 20 µg/L.
- 8.11.5 STD4:** Add 500 µL of (Date)-C1 (8.10.1.1) and 1000 µL of (Date)-C4 (8.10.3.2) to a 50mL digestion tube and bring to 50mL with the diluent acid. The final concentration of each element is: *As, Be, Cd, Co, Cr, Cu, Mn, Mo, Ni, Pb, Sb, Se, Ti, Tl, V and Zn* at 100 µg/L; *Al, Ca, Fe, and Mg* at 10100 µg/L; *K and Na* at 10000 µg/L. Note: only 16 of the 19 elements in this mix are evaluated at this concentration level. Add 500 µL of Calibration intermediate (8.10.6) (single element additional targets, e.g.,Sn) for a concentration of 100 µg/L.
- 8.11.6 STD5:** Add 500 µL of (Date)-C2 (8.10.2.1) to a 50mL digestion tube and bring to 50mL with the diluent acid. The final concentration of each element is: *Ag, B and Ba* at 100 µg/L. Note: These three metals are only performed with a 3 point calibration rather (including the blank).
- 8.11.7** For non-USFSER and non-DOD work, a single point calibration is performed. Concentrations up to the linear range may be reported without qualification.

8.12 Initial calibration verification (ICV) and continuing calibration verification (CCV)

The ICV and CCV standards are prepared from sources separate from the initial calibration curve and are used to verify the initial calibration curve throughout the analytical sequence. See Table 4 for a list of the ICV/CCV concentrations. To prepare this solution add 0.25mL of (Date)-I1 (8.10.4.1) and 0.5mL of (Date)-I2 (8.10.5.1) to a 50mL digestion tube and bring to 50mL with the diluent acid. The final concentration of each element is: As, Ag, Sb, B, Ba, Be, Cd, Cr, Co, Cu, Pb, Mn, Mo, Ni, Se, Si, Ti, Tl, V and Zn at 50 µg/L; Al, Ca, Fe, and Mg at 5050 µg/L; K at 5500 µg/L; and Si at 25 µg/L. Add 250 µL of ICV intermediate (8.10.6) (single element additional targets, e.g., Sn) for a concentration of 50 µg/L.

8.13 Calibration blank (STD0), initial and continuing calibration blanks (ICB and CCB) are the analysis of the matrix diluent and are analyzed prior to the initial calibration curve and after the ICV and CCVs, respectively.

8.14 Reporting Limit check standard

Used to verify the reporting limit.

8.15 Interference Check Solutions – ICS

Two Interference Check Solutions (ICSA and ICSAB) are prepared to contain known concentrations of interfering elements and analytes that will provide an adequate test of correction factors. Concentrations of the interfering analytes correspond to concentrations in Table 1 of USEPA, "Method 6020A - Inductively Coupled Plasma-Mass Spectrometry," in Test Methods for Evaluating Solid Waste, SW-846, EPA SW-846, Revision 1, February 2007.

Dilution can reduce isobaric and physical interferences as well as instrument exposure to strong acids used in sample preparation.

Digests of water samples may be analyzed without dilution, at 1:5 dilution or higher to bring analyte concentrations within the linear dynamic range of the instrument. Digests of soil/sediment samples and tissue samples must be diluted 1:2 in DI water, at a minimum, to reduce the high acid concentration used in the preparation. The instrument manufacturer suggests a maximum acid concentration of 10% be used during analysis

Three solutions are used to prepare the interference check solutions ICSA and ICSAB.

8.15.1 6020ICS-9A: Supplied by Inorganic Ventures with concentrations of 20,000 ppm Cl⁻; 3000 ppm Ca; 2500 ppm Fe and Na; 1000 ppm Al, Mg, P, K, and S; 2000 ppm C; 20 ppm Mo and Ti

8.15.2 (Date)-C1: See 8.10.1.1

8.15.3 (Date)-C2: See 8.10.2.1

8.15.4 The ICSA Solution is prepared in a 50 ml screw cap digestion tube by adding 5 ml of 6020ICS-9A (8.15.1) to 0.1% nitric acid or 5% nitric depending on the acid being used for analysis (see section 8). This solution can be used for multiple analyses and can be stored until the expiration date of the standard.

8.15.5 The ICSAB Solution is prepared as a 50 ml aliquot in acid used for analysis according to the following table and must be prepared daily as some analytes are

not stable in solution. The final concentrations of analytes in (Date)-C1 are 100 µg/L and 50µg/L for (Date)-C2 with the exception of *Mo* and *Ti* which are present as interferences. Add 500 µL of Calibration intermediate (8.10.6) (single element additional targets, e.g., Sn) for a concentration of 100 µg/L.

Note: Method 6020A suggests a concentration of 200 µg/L for Cr, Co, Cu, Mn, Ni and V. The reduced concentrations prepared for this standard represent a more rigorous test of isobaric corrections.

Solution	mLs added (final volume 50 mLs)
6020ICS-9A (8.4.1)	5
(Date)-C1	0.5
(Date)-C2	0.25
Tin calibration intermediate	0.5

8.16 Laboratory Control Sample (LCS) or Laboratory Fortified Blank (LFB)

for aqueous samples is prepared from a source other than the calibration standard sources. It is prepared and stored for use in the metals preparation laboratory. The LCS for solid samples is a solid LCS purchased from ERA at known and certified values. See the metals preparation SOPs for LCS preparation details. See table 6 for spike levels.

8.17 Matrix Spike (MS) solution for aqueous and solid samples is the same solution as the aqueous LCS/LFB in 8.16. It is prepared and stored for use in the metals preparation laboratory. See the metals preparation SOPs for MS preparation details. See table 6 for spike levels.

8.18 Daily Performance Standard: Prepare by adding 0.1 ml of a 1:10 dilution of 1000 mg/L stock Ba, Ce, Mg, Pb, In, U and Rh standards to 1 L volumetric flask containing 100 ml of DI water with 20 ml of concentrated HNO₃. Mix and bring to volume with DI water.

8.19 Dual Detector Calibration Solution: Add 0.15 ml of CPI-19 stock (or equivalent), 0.15 ml of CPI-7 stock (or equivalent), 0.15 ml of 500 ml/L Al, Ca, Fe, K, Mg and Na stock and 0.1 ml each of 1000 mg/L As, Be, and Zn and 0.2 ml of 1000 mg/L Se stock to 100 ml volumetric flask containing 2% HNO₃. Bring to volume with 2% HNO₃. This solution is required for optimization of the pulse and analog state detectors. Other analytes may be added to this solution as needed.

9. Quality Control

The laboratory must maintain records to document the quality of data that is generated. Ongoing data quality checks are compared with established performance criteria to determine if the results of analyses meet the performance characteristics of the method.

9.1 Blank

- 9.1.1 A method blank must be analyzed once per every 20 samples or per metals digestion batch, whichever is more frequent.
- 9.1.2 Metal concentrations must not be detectable in the method blank at values greater than the reporting limit.

- 9.1.3** Corrective Action: Analysis according to the appropriate analytical SOP may be repeated once to see if an analytical error has occurred. Digestion of the method blank and all associated samples must be performed until the method blank for the out of control metal is in control. Samples cannot be analyzed until an acceptable method blank analysis is obtained. Exceptions may be made with approval of the Section Head if the samples associated with an out of control method blank are below the reporting limit for the affected metal or if the concentrations of the affected metal are greater than 10x the blank level in the samples. In such cases, the sample results are accepted without corrective action for the high method blank result. The client must be notified in the project narrative associated with the sample results.

9.2 Laboratory Control Sample (LCS) / Laboratory Fortified Blank (LFB)

- 9.2.1** The LCS/LFB is from a second source to verify the accuracy of the digestion and analytical procedures. The LCS/LFB is digested along with the samples. An LCS/LFB must be digested and analyzed once per every 20 samples or per metals digestion batch, whichever is more frequent.
- 9.2.2** The acceptable recovery QC limits are 80%-120% (Method 6020A) for an aqueous LCS/LFB and within manufacturer's control limits for the solid SRM LCS.
- 9.2.3** Corrective Action: May repeat analysis once to see if an analytical error has occurred. If the LCS/LFB recovery is still out of control, re-digest and re-analyze the LCS/LFB and all associated samples. Samples cannot be analyzed until an acceptable LCS/LFB is obtained. Exceptions may be made with approval of the Section Head if the samples associated with the out of control LCS/LFB are also associated with a matrix spike that is in control. This is an acceptable measure of accuracy of the digestion and analytical procedures. An explanation of this out of control LCS recovery must be included in the project narrative to the client and the sample data reported with the acceptable MS results as batch QC.

9.3 Initial Calibration Verification (ICV)

9.3.1 Initial Calibration

- 9.3.1.1** A three-point calibration curve must be performed if the CRI standard is not analyzed.
- 9.3.1.2** The correlation coefficient must be $r \geq 0.998$.
- 9.3.1.3** Corrective Action: Re-calibrate until criteria are met.

9.3.2 Initial Calibration Verification (ICV) Check Standard

- 9.3.2.1** The initial calibration verification check standard is from a second source to verify the accuracy of the standard curve. The concentration of the ICV is at approximately the mid-level of the calibration curve.
- 9.3.2.2** The acceptable recovery QC limits for the ICV is 90-110%. In addition, the relative standard deviation between three replicate readings must be less than 5% RSD.
- 9.3.2.3** Corrective Action: May repeat analysis once to see if an analytical error occurred. If the ICV still exceeds the control limits, re-calibrate the instrument.

9.3.3 Initial Calibration Blank (ICB)

- 9.3.3.1** An ICB must be analyzed immediately following the ICV.

- 9.3.3.2 The acceptance limit for the ICB is < RL
- 9.3.3.3 Corrective Action: May repeat analysis once to determine if analytical error has occurred. Results may be reported from the analysis if the ICB concentration is less than the reporting limit. If the ICB still exceeds the reporting limits, re-calibrate the instrument and re-analyze a fresh blank.

9.4 Continuing Calibration Verification (CCV)

9.4.1 Continuing Calibration Verification (CCV) Check Standard

- 9.4.1.1 A CCV must be analyzed at a minimum of every 10 samples and at the close of an analytical sequence. The concentration of the CCV is at approximately the mid-level of the calibration curve. This standard monitors instrument performance throughout the duration of the analytical sequence.
- 9.4.1.2 The acceptable recovery QC limits for the CCV is 90-110%. In addition, the relative standard deviation between three replicate readings must be less than 5% RSD.
- 9.4.1.3 Corrective Action: May repeat analysis once to see if an analytical error occurred. If the CCV still exceeds the control limits, re-calibrate and re-analyze all samples since the last acceptable CCV.

9.4.2 Continuing Calibration Blank (CCB)

- 9.4.2.1 A CCB must be analyzed immediately after every CCV
- 9.4.2.2 The acceptance limit for the CCB is <RL.
- 9.4.2.3 Corrective Action: Results may be reported from the analysis if the CCB concentration is less than the reporting limit. If not, repeat analysis once to see if an analytical error occurred. If the CCB still exceeds the reporting limit, re-calibrate the instrument and re-analyze a fresh blank. All samples associated with the out of control metals in the CCB must be re-analyzed (since the last acceptable CCB). Exceptions may be made with approval of the Section Head if the samples associated with the out of control method blank are non-detect for the affected metals or if sample concentrations for the affected metals are greater than 10x the blank levels. In such cases, the sample results are accepted without corrective action for the high CCB and the client is notified in a project narrative associated with the sample results.

9.5 Matrix Spike

- 9.5.1 A matrix spike must be performed once per 20 samples (5% frequency) and is from a second source to verify the accuracy of the digestion and analytical procedures. The matrix spike recovery is calculated as follows:

$$\% \text{ Recovery} = \frac{MS_{\text{recovery}} - R1}{MS_{\text{true value}}} \times 100$$

When project specifications dictate, a Matrix Spike Duplicate (MSD) may also need to be performed at the same frequency as the MS.

- 9.5.2 The acceptable recovery QC limits for a MS/MSD is 75%-125% for both the solid and aqueous MS/MSD pair. Calculate the %RPD as in 12.3.2 above when analyzing a MS/MSD pair. The acceptable %RPD is $\leq 20\%$.

- 9.5.3** Corrective Action: May repeat analysis once to see if an analytical error has occurred. If the % recovery or %RPD still exceeds the control limits and the LCS is compliant; include a project narrative with the results to client noting that there may be potential matrix effects on the accuracy or precision of the affected metals results as evidenced by matrix spike recovery or %RPD outside of QC limits.

9.6 Laboratory Duplicate

- 9.6.1** Duplicate analyses (matrix duplicate) must be performed once per 20 samples (5% frequency).
- 9.6.2** Acceptable relative percent difference (RPD) for duplicate analysis is ≤ 20 % for both aqueous and solid matrices. Acceptance criterion is not applicable to sample concentrations less than 5 times the reporting limit. Calculate RPD as follows:

$$RPD = \frac{R1 - R2}{\frac{[R1 + R2]}{2}} \times 100$$

- 9.6.3** Corrective Action: May repeat analysis once to see if an analytical error has occurred. If the % RPD still exceeds the control limits; include a project narrative with the results to client noting that there may be potential matrix effects on the precision of the affected metals results as evidenced by the matrix duplicate RPD exceedence

9.7 Method-specific Quality Control Samples

9.7.1 Tuning Solution, Mass Calibration, and Resolution Checks

- 9.7.1.1** The tuning solution, mass calibration, and resolution checks are required prior to sample analysis. The tuning solution must be analyzed 4 times prior to instrument set up at the beginning of the day.
- 9.7.1.2** The analytes in the tuning solution must meet ≤ 5 percent relative standard deviation. The mass calibration must not differ by more than 0.1 amu from the true value. The resolution must be less than 0.9 amu full width at 10 percent peak height.
- 9.7.1.3** Corrective Action: Adjust the mass calibration to the correct value or correct the problem until criteria are met.

9.7.2 LLCV (RL) Check Sample (Reporting Limit Standard)

This solution is used to verify instrument sensitivity at the reporting limit at the beginning and end of the sequence. The concentration of the LLCV is equivalent to the reporting limit for each element in STD1, see Table 1. See Section 8.11.2 for preparation details.

- 9.7.2.1** Results for all metals in the LLCV solution must be within the 70-130% recovery criteria. When performing work for the Department of Defense (DoD, Army Corps of Engineers or the US Navy) the CRI acceptable recovery criteria is 80-120%.
- 9.7.3** Corrective Action: If the LLCV solution exceeds the control limits, sample results which are sufficiently high (10X the RL) can be qualified. Samples that are < 10X the RL are re-analyzed.
- 9.7.4** Interference Check Samples (ICSA and ICSAB) Solutions

9.7.4.1 The ICSA and ICSAB solutions must be analyzed at the beginning of an analytical run or every 12-hour work shift, whichever is more frequent. These solutions verify the isobaric corrections.

9.7.4.2 Results for all spiked non-interference metals in the ICSAB solution must be within 80-120% recovery criteria. It may be necessary to correct concentrations measured in the ICSAB solution with background concentrations measured in the ICSA solution. Results for aluminum, calcium, iron, sodium, potassium, and magnesium in the ICSA solution should be within 80-120% recovery, however, depending on the sample dilution used, concentrations of these elements may be close to or exceed the linear range of the instrument which can cause the channel to saturate.

9.7.4.3 Corrective Action: May repeat analysis once to see if an analytical error occurred. If the ICSA or ICSAB solutions still exceed the control limits, re-calibrate and/or re-analyze a fresh ICSA or ICSAB. If the sample results are accepted without corrective action for the ICSA or ICSAB exceedance(s), the client must be notified in a project narrative associated with the sample results.

Note: If an interference is suspected, use of computerized compensation or comparison with an alternate method such as graphite furnace is recommended.

9.7.5 Internal Standard Recovery

9.7.5.1 Internal standard intensities must be monitored in all solutions.

9.7.5.2 Intensities of internal standards in all subsequent analyses of instrument QC samples (including ICV, ICB, CCV and CCB) solutions must be within 70% -120% of the levels in the original calibration blank. Intensities of internal standards in samples must be within the same limits as the QC samples.

9.7.5.3 Corrective Action: If the instrument QC sample does not meet criteria, may reanalyze once to determine if analytical error has occurred. If QC sample still does not meet criteria, terminate the analysis for analytes associated with the internal standard, correct the problem, re-calibrate, and reanalyze all affected samples since the last in-control CCV/CCB. If a sample does not meet criteria, may reanalyze the sample and/or dilute the sample five-fold and reanalyze. This procedure is followed for the sample until the internal standard intensities fall within the prescribed window.

9.7.6 Serial Dilution Analysis

9.7.6.1 Serial dilution analysis must be performed once per 20 samples (5% frequency).

9.7.6.2 Analysis of a 1:5 dilution must agree within 10% of the original determination, if the metal concentration is sufficiently high (minimally, a factor of 50 above the method detection limit) in the original undiluted analysis.

9.7.6.3 Corrective Action: Analysis may be repeated once to see if an analytical error has occurred. If the %D still exceeds the control limits; include a project narrative with the results to client noting that there may be

potential matrix effects on the accuracy of the affected metals results as evidenced by the serial dilution %D exceedance.

9.7.7 Post Digestion Spike (PDS)

- 9.7.7.1** Post digestion spike analysis may be performed if the MS or MSD does not meet recovery criteria. A known spike amount is added to a portion of a prepared sample, or its dilution. The spike addition should produce a minimum level of 10 times, and a maximum of 100 times, the reporting limit. If the spike is not recovered within the specified limits, a matrix effect should be suspected.
- 9.7.7.2** The post digestion spike recovery is 80%-120% of the known value.
- 9.7.7.3** Corrective Action: If the post digestion spike exceeds the control limits; include a project narrative with the results to client noting that there may be potential matrix effects on the accuracy of the affected metals results as evidenced by the post digestion spike exceedance.

9.8 Method Sequence

Initial calibration curve
ICV
ICB
LLCV
ICSA
ICSAB
Blank
Method Blank
LCS
Sample analysis
CCV
CCB
Sample analysis
CCV
CCB
Sample analysis
LLCV
CCV
CCB

10. Procedure

10.1 Equipment Set-up

- 10.1.1** Prior to using the Perkin-Elmer ELAN 6100 and DRCE ICP/MS, the operator must read and become familiar with the operating procedure guidelines specified in the operating manual. The analyst must be trained and familiarized with the instrument software provided by the manufacturer. The instrument must be set up with the proper operating parameters and conditions described in the Perkin-Elmer ELAN 6100 and DRCE ICP/MS operating manual. The criteria for the background correction points, analytical dynamic ranges, method and instrument detection limits and isobaric molecular-ion correction equations must be established and documented prior to initial calibration.
- 10.1.2** The plasma torch must be aligned before ignition and is done with an alignment tool supplied with the instrument. The procedure centers the torch within the load coil and

adjusts the distance of the torch to the sampler cone surface. This is outlined in the Elan 6100 Hardware Guide. This is not required on a routine basis, only initially upon instrument set up and following any changes, such as removal and cleaning of the plasma torch. The instrument must become thermally stable (usually 30-60 minutes) before beginning operation.

- 10.1.3** Isobaric corrections must be put into the equations page of any method used to generate quantitative analytical data. The correction equations can be found in Table 3. These corrections are based on natural isotopic abundance's and cannot be altered.
- 10.1.4** A linear dynamic range (LDR) study must be conducted every six months. The LDR is determined by analyzing increasingly higher standard concentrations of each element until the observed concentrations are no more than $\pm 10\%$ of the true value of the standard. Sample analyte concentrations that are above the linear dynamic range must be diluted and re-analyzed. The linear dynamic range must be established for each analytical run by analysis of a high level standard or Linear Range Verification (LRV) standard. Results greater than the daily calibration range but within the linear calibration can be reported provided that analyte recovery from the LRV is within 10% of the true value. If the recovery from the LRV is outside of the 10% acceptance limit then samples may be diluted below the concentration of the highest calibration standard or reanalyzed. The linear dynamic range must be checked and verified every six months. See Table 6 for the current linear range.

10.2 Initial Calibration

- 10.2.1** Prior to daily calibration, inspect the sample introduction system including the nebulizer, torch, injector tube and uptake tubing for salt deposits, dirt or debris that could constrict flow and affect instrument performance. Clean the system when needed following the manufacturer's instructions.
- 10.2.2** A series of calibration standards are prepared for the initial calibration curve as described in Section 8.0. The preparation date of these standards, the initials of the analyst, the lot number of the source material, stock concentrations, volumes used, final volumes, final concentrations and manufacturer must be recorded in the metals standard preparation logbook. All standards are traceable to NIST via internal and external calibration checks. *Certificates of Analysis* accompany the receipt of standard solutions and are kept on file in the laboratory. The Perkin-Elmer ELAN 6100 and DRCE are calibrated using a multi-point calibration curve consisting of a blank and a two to three standards per analyte. The standards are named, for example, "C" for calibration, plus "Date" for the date prepared, followed by the letter M and a number 1, 2, 3 etc. for first, second or third set of standards prepared that day. "I" is used to determine the ICV standard. Standard "I040402M1" is the first ICV standard for the ICP MS made on 04/04/02. Standard "I040202M2" is the second ICV standard for the ICP MS made on 04/02/02. This nomenclature is for traceability and to distinguish calibration standards from independent check standards and field samples.
- 10.2.3** A Linear Through Zero curve type is be selected for all analytes.

10.3 Equipment Operation and Sample Processing

Samples are prioritized by the Section Head for analysis based on hold time and client due date. Section 11 outlines the steps for data reporting that will contain the sample analysis final results.

- 10.3.1** Preliminary treatment or sample preparation of most matrices is necessary because of the complexity and variability of sample matrices. Aqueous dissolved samples that have

been pre-filtered and acidified do not require acid digestion as long **as the samples and standards are matrix matched**. See the sample preparation SOPs.

- 10.3.2 Ensure that the instrument configuration and operating procedures established in Section 10.1 are selected.
- 10.3.3 Affix clips to the peristaltic pump windings and open the Device window, click on Connect and click on the right pointing arrow (counterclockwise). Check that the fluid is flowing through all tubing and that waste is flowing out of the spray chamber. Initiate the plasma and allow a warm-up of 30-60 minutes.
- 10.3.4 Conduct mass calibration and resolution check.

Note: Tuning and optimization procedures are performed without the Internal Standard mixing block in-line for The ELAN 6100.

- 10.3.4.1 Open the Tuning workspace. Aspirate the Tuning Solution (8.8.2) solution containing Be, Co, In, Tl and U. Click on Tune Mass Spec. The measured mass difference must be less than 0.1 amu from the actual value. The resolution must be less than 0.9 amu full width at a 10% peak height (the instrument default setting is 0.65 amu). If the resolution is not achieved for an element, the Resolution Digital to Analog Conversion (Res. DAC) value is changed for that element (increasing the DAC value by 30 units will decrease the peak width by 0.1 amu). If the Measured Mass values are not within 0.1 amu of the exact value then the Mass DAC values must be changed. Increasing the Mass DAC increases the measured mass value. This is done daily before sample analysis. Print the calibration and store with the daily performance check.

Note: Extreme care must be taken when adjusting DAC values. Instrument performance can be severely degraded if tuning parameters are not correct.

- 10.3.4.2 Open the Daily Performance workspace

- 10.3.4.2.1 Aspirate the Daily Performance Solution (8.18).
- 10.3.4.2.2 Click on "Analyze Sample" in the manual sample window.
- 10.3.4.2.3 Monitor daily performance measures as recommended by Perkin Elmer for Ba, Ce, Mg, Rh, Pb, In and U sensitivity, background, % double charged and % oxide levels.
- 10.3.4.2.4 See Manufacturer's recommendations for sensitivity. If criteria are not met then follow optimization procedures specified by the manufacturer.
- 10.3.4.2.5 The background at mass 220 should be < 30 cps.
- 10.3.4.2.6 The % double charged ions (Ba^+/Ba^{++}) should < 3% and not to exceed 5%.
- 10.3.4.2.7 The % oxides (Ce/CeO) should be < 3% and not to exceed 5%.

- 10.3.5 Open the appropriate analytical method. Turn on the autosampler and click on the "Sampling" icon in the Method. Select "Go to Rinse" at which point the sampling probe should go to the rinse station. Click on "OK". It may not be necessary to analyze for all the metals listed in the 6020A method. The analyte list can be edited down for only those metals required. Go to the Timing Page in the method and highlight the metals to be deleted. Go to the Edit Menu and select "delete rows". Save the method as a different name. For reporting purposes, the Report File Name on the Report Page of the 6020 Method or edited Method is saved under c:\elandata\dataset\dataset\ **LIMS WG#**. etc. for each analysis on that date.

- 10.3.6** Open the "Sample" window and click on batch analysis to update with new sample information.
- 10.3.7** Open the 6020TEMP sample file or a previously used file and edit the table with sample names, autosampler positions and dilutions. Select the Method for analysis and record all standard ID's and acids used in the Description Column of the Batch Analysis page. Save the file as a different name.
- 10.3.8** Calibrate the instrument using the calibration standards listed in Section 8.0, Reagents and Standards. The system must be flushed with a rinse blank sample (equivalent to the calibration blank) between each standard to protect against potential carry-over. The average intensity of 3 multiple exposures must be performed for QC samples and field samples to reduce random instrument error. The calibration curve consists of a blank and two to three standards.
- 10.3.9** To ensure that there is sufficient sample to fill the loop of the 6 port valve, there should be at least 5 mLs in each autosampler tube.
- 10.3.10** The Calibration action for the first sample for which concentration results are desired must be "Analyze Blank, Standards, and Sample".
- 10.3.11** The calibration action for all other samples is usually "Analyze Sample", unless periodic re-calibration is desired.
- 10.3.12** Click on the "Dataset" Icon, go to the "File Menu" and click on "New". The dataset name is designated by **LIMS WG#**.
- 10.3.13** Select "Analyze Batch"
- 10.3.14** Flush the system with the rinse blank solution between samples. The rinse blank nitric acid concentration corresponds to the acid concentration in samples and standards. The DRCE, 10% nitric acid or 5% hydrochloric/5% nitric acid (for digests containing hydrochloric acid) is used for the rinse. The same time must be elapsed between CCVs and CCBs as is allowed between samples. Analyze the CCV and the CCB after each 10 samples and at the end of the analytical sequence.
- 10.3.15** The LLCV (RL check standard) must be analyzed at the beginning and end of an analytical run., ICSA, and ICSAB solutions must be analyzed at the beginning of an analytical run or once every 12 hours, whichever is more frequent. A rinse may be analyzed after ICSA and ICSAB in order to prevent carryover into samples.
- The LLCV analysis is not performed if a calibration standard is prepared at the reporting limit and included in the initial calibration curve. The calibration curve must always meet the criteria for linearity ($r = 0.998$).

10.3.16 Analysis Review

Two forms are used to primary and secondary review the analysis. These are called the "ICP MS Checklist" and the "Blank Reporting Limit Checklist" and are shown below.

10.3.16.1 ICP MS Checklist

This analysis review form is used by the analyst and secondary reviewer to note passing/failing QC standards and to record any other comments as communication for reporting sample results.

10.3.16.2 Blank Reporting Limit Checklist

This analysis review form is used to set the sample reporting limit based on the batch preparation blank and to compare instrument blanks (ICB and CCB's) to instrument detection limits. Instrument blanks are compared to the limit of 3 times

the IDL. Instrument blanks, which exceed the IDL limit, are recorded on the form and may require sample reanalysis or reporting limit elevation. This form is generated annually as IDL studies are completed.

- 10.3.17** Target analytes detected above the calibration range must be diluted and re-analyzed. See Section 9 for all Quality Control frequencies and criteria.

10.4 Continuing Calibration

See Section 9.4.

10.5 Preventive Maintenance

10.5.1 General cleaning tips for ICP-MS

- 10.5.1.1** Sampling and skimmer cones should be removed and cleaned on a weekly basis or more often under high usage. Remove the cones with the tool provided with the instrument and clean with 10% HCl, and rinse thoroughly with deionized water. Reinstall cones and perform XY alignment procedures after igniting the plasma and the instrument has warmed up for 30 minutes.
- 10.5.1.2** Peristaltic pump tubing must be inspected regularly for wear and changed if necessary. Sample and internal standard tubing should be changed weekly or more often if necessary. Rinse and drain tubing less often.
- 10.5.1.3** The aspiration chamber may be cleaned periodically using the sonication soap solution in the sonication bath for 0.5 hrs and rinsed with 10% HNO₃ and deionized water.
- 10.5.1.4** To clean the ion lens, the vacuum must be turned off, the cover to the vacuum chamber removed and the autolens taken out. Clean with Softscrub and a toothbrush, rinse with hot water, then DI water. Dry thoroughly and return to the chamber. Replace the cover and evacuate.

- 10.5.2** Electron multiplier voltages require periodic optimization if Daily Performance Standard criteria in Section 10.3.4.2 are not met (see Operators Manual).

11. Data Evaluation, Calculations and Reporting

- 11.1** All calculations necessary to convert raw data (ion counts/second) are performed by the ELAN software. The calculated quantities are selected by choosing the desired options in the Report Options screen. The default report option for the ELAN 6020 Method is 6020.rop.
- 11.2** All calculations performed in the ELAN software are based on the ratio of the analyte intensity (cps) to the internal standard intensity (cps). In all calculations where internal standards are used, the ratio of the analyte intensity to internal standard intensity is taken before any other calculation is performed. Note: Method 6020 requires the use of internal standards.
- 11.3** The metal results are calculated by the following equation:

Aqueous:

$$\text{Metal result in } \mu\text{g/L} = \frac{C \times B}{A} \times \text{DF}$$

where:

A = Initial sample volume in mL, typically 25 mL
B = Digestate final volume in mL, typically 25 mL

C = Concentration of sample from instrument read-out in µg/L
DF = Dilution Factor

Solid:

$$\text{Metal result in mg/Kg} = \frac{\frac{C \times B}{A} \times DF \times 100}{1000 \times DW}$$

where:

A = Initial sample weight in grams, typically 1 gram
B = Digestate final volume in mL, typically 50 mL
C = Concentration of sample from instrument read-out in µg/L
DF = Dilution Factor
DW = Dry Weight

11.4 To calculate Hardness:

(Ca result (in mg/L) x 2.5) + (Mg result (in mg/L) x 4.12) = Hardness in mg/L

11.5 All metal results should be reported to three significant figures

11.6 The primary analyst does data entry into the LIMS system. The LIMS is "linked" to the instrument, so the analyst must choose the sample(s) and elements to be reported from that analytical sequence. All associated preparation and instrumental QC samples and dilutions are also chosen. The laboratory generates two types of data packages from the LIMS: "Commercial" for routine projects, and "Full Deliverable" or "CLP-like" for fully data validated projects. A Commercial package consists of sample results and the associated method blank and LCS results. A Full Deliverable package includes all sample results, all preparation and instrumental QC results and the associated supporting raw data.

11.7 All solids including soils, sediments, and sludges must be reported on a dry-weight basis. Tissue results may be reported in wet-weight depending upon client request.

11.8 A secondary review is performed on all data.

11.9 If interferences on sample analysis resulting in false positive, false negative or biased results are suspected or have been determined, it may be possible to eliminate or minimize these interferences through use of the DRCE ICP MS equipped with a reaction cell. The reaction cell allows for the introduction of oxygen and ammonia to react with the analyte or the interfering ion.

11.9.1 Arsenic analysis

The ArCl interference (see section 4.2) on As at m/z of 75 can be removed by introducing oxygen into the reaction cell. Oxygen reacts with As to form AsO. This analyte is measured at m/z of 91 and is not affected by the ArCl interference. The internal standard used for this analysis is 300 µg/L In. The following conditions have been found to be suitable for analysis of As in seawater. Seawater is a source of high chloride concentration.

Analyte	Cell Gas	Flow Rate (ml/min)	RP ₀	RP _a
As	Oxygen	0.6	0	0.75
In	Oxygen	0.6	0	0.85

Note: These conditions may change to optimize the analysis for a particular sample matrix.

12. Contingencies for Handling Out-of-Control Data or Unacceptable Data

Section 9 outlines sample batch QC acceptance criteria. If non-compliant metals results are to be reported, the Department Manager and/or the Laboratory Director must approve the reporting of these results. The laboratory Project Manager shall be notified, and may choose to relay the non-compliance to the client, for approval, or other corrective action, such as re-sampling and re-analysis. The analyst or Section Head performing the secondary review initiates the project narrative, and the narrative must clearly document the non-compliance and provide a reason for acceptance of these results.

13. Method Performance

13.1 Method Detection Limit Study (MDL) / Limit of Detection Study (LOD) / Limit of Quantitation (LOQ)

The laboratory follows the procedure to determine the MDL, LOD, and/or LOQ as outlined in Alpha SOP 1732. These studies performed by the laboratory are maintained on file for review.

13.2 Instrument Detection Limit

The instrument detection limit (IDL) is the smallest signal above the background noise that an instrument can detect. The IDLs can be calculated by multiplying by 3, the average standard deviations for measurements of a reagent blank analyzed on three analytical runs on three non-consecutive days. Seven consecutive measurements must be taken per day. The IDLs are not required to go through sample digestion. Each measurement must be performed as though it were a separate sample. The current IDLs are available upon request.

13.3 Demonstration of Capability Studies

Refer to Alpha SOP 1739 for further information regarding IDC/DOC Generation.

13.3.1 Initial (IDC)

The analyst must make an initial, one-time, demonstration of the ability to generate acceptable accuracy and precision with this method, prior to the processing of any samples.

13.3.2 Continuing (DOC)

The analyst must make a continuing, annual, demonstration of the ability to generate acceptable accuracy and precision with this method.

14. Pollution Prevention and Waste Management

Refer to Alpha's Chemical Hygiene Plan and Waste Management and Disposal SOP for further pollution prevention and waste management information.

15. Referenced Documents

Chemical Hygiene Plan

SOP 1732 DL/LOD/LOQ Generation

SOP 1739 IDC/DOC Generation

SOP 1797 Waste Management and Disposal SOP

16. Attachments

Table 1: Reporting Limits

Table 2: QC Acceptance Criteria

Table 3: Isotopes Monitored and Equations Used

Table 4: Initial Calibration Levels and ICV/CCV Concentrations

Table 5: Initial Calibration Levels and ICV/CCV Concentrations for 1 Point Curve

Table 6: ELAN 6100 and DRCE Linear Ranges for Method 6020A

Table 1 – Reporting Limits

Metal	Aqueous (µg/L)	Solid - Hot Plate (mg/Kg)	Tissue – Microwave (mg/Kg)
Aluminum	100	10	10
Antimony	0.5	0.05	0.05
Arsenic	0.5	0.05	0.1
Barium	0.5	0.3	0.05
Beryllium	0.5	0.03	0.05
Boron	10	0.5	0.5
Cadmium	0.5	0.02	0.02
Calcium	100	50	20
Chromium	1.0	0.2	0.05
Cobalt	0.2	0.05	0.05
Copper	1.0	0.2	0.05
Iron	50	20	10
Lead	1.0	0.06	0.02
Magnesium	70	10	10
Manganese	0.5	0.2	0.1
Molybdenum	0.5	0.05	0.05
Nickel	0.5	0.1	0.05
Potassium	100	10	10
Selenium	5.0	0.2	0.1
Silver	0.2	0.05	0.05
Sodium	100	15	10
Strontium	0.5	0.1	0.05
Thallium	0.2	0.02	0.02
Tin	0.5	0.1	0.10
Titanium	0.5	0.2	0.1
Vanadium	5.0	0.1	0.1
Zinc	10	1.0	0.5

Table 2 – QC Acceptance Criteria

QC Parameter	Acceptance Criteria
Tuning Solution	$\leq 5\%$ RSD
Mass Calibration	Must not differ by more than 0.1 amu from true value
Resolution Checks	Less than 0.9 amu at 10% peak height
Initial Calibration Curve	$R \geq 0.998$
Method Blank	< reporting limit
Laboratory Control Sample	80-120%R for aqueous and Manufacturer's control limits for solid
Matrix Duplicate	$\leq 20\%$ RPD for results >5x reporting limit
Matrix Spike	75-125%R for solid and aqueous
Matrix Spike Duplicate (if requested)	75-125%R for solid and aqueous; and $\leq 20\%$ RPD
Initial and Continuing Calibration Verification	90-110%R
Initial and Continuing Calibration Blank	<RL
Reporting Limit Check	70-130% R (DoD = 80-120%R)
ICSA and ICSAB Solution	80-120%R for spiked analytes
Internal Standard	70-120%R (Method 6020A) for instrument QC samples and field samples
Serial Dilution Sample	<10% D
Post Digestion Spike	80-120%R

Table 3 - Isotopes Monitored and Equations Used

1.1.1.1 1.1.1.2 Analyte	Symb ol	Isotopes Monitored (primary in bold)	1.1.1.3 1.1.1.4 Correction Equations
Aluminum	Al	27	
Antimony	Sb	121 ,123	Sb 123 = Sb 123 - 0.127189 * Te 125
Arsenic	As	75	As 75 = As 75 - 3.127 * [ArCl 77 - (0.815*Se 82)]
Barium	Ba	135, 137	
Beryllium	Be	9	
Cadmium	Cd	106,108,111, 114	Cd 111 = Cd 111 - 1.073 * [MoO 108 -(0.712*Pd 106)] Cd 114 = Cd 114 - 0.026826 * Sn 118
Chromium	Cr	52 ,53	
Calcium	Ca	44	
Cobalt	Co	59	
Copper	Cu	63 ,65	
Iron	Fe	54	Fe 54 = Fe 54 - 0.028226 * Cr 52
Lead	Pb	206, 207 ,208	Pb 208 = Pb 208 + 1* Pb 206 + 1* Pb 207
Calcium	Ca	44	
Manganese	Mn	55	
Molybdenum	Mo	95, 97 ,98	Mo 98= Mo 98 - 0.110588 * Ru 101
Nickel	Ni	60 ,62	
Potassium	K	39	
Selenium	Se	77, 82	Se 82 = Se 82 - 1.008696 * Kr 83
Silver	Ag	107 ,109	
Sodium	Na	23	
Thallium	Tl	203, 205	
Tin	Sn	118	
Vanadium	V	51	V 51 = V 51 - 3.127*[ClO 53 - (0.113*Cr 52)]
Zinc	Zn	66 ,67,68	
1.1.1.4.1 Internal Standards (alternates in parentheses)			
Lithium	Li	6	
Scandium	Sc	45	
Germanium	Ge	74	
(Yttrium)	Y	89	
(Rhodium)	Rh	103	
Indium	In	115	
Terbium	Tb	159	
(Bismuth)	Bi	209	

Table 4 - Initial Calibration Levels and ICV/CCV Concentrations

Analyte	STD1	STD2	STD3	STD4	STD5	ICV,CCV
	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
Ag	0.20				100	50
Al	10	110	1020	10050		5050
As	0.50	10	20	100		50
B	5.0	10	20	100		50
Ba	0.50				100	50
Be	0.30	10	20	100		50
Ca	100	110	1020	10100		5050
Cd	0.20	10	20	100		50
Co	0.20	10	20	100		50
Cr	0.50	10	20	100		50
Cu	0.50	10	20	100		50
Fe	10	110	1020	10100		5050
K	100	100	1000	10000		5500
Mg	10	110	1020	10100		5050
Mn	0.50	10	20	100		50
Mo	0.50	10	20	100		50
Na	100	100	1000	10000		5050
Ni	0.50	10	20	100		50
Pb	0.20	10	20	100		50
Sb	0.50	10	20	100		50
Se	1.0	10	20	100		50
Si	0.05	5	10	50		25
Sn	0.10	10	20	100		50
Sr	0.50	10	20	100		50
Ti	0.50	10	20	100		50
Tl	0.20	10	20	100		50
V	1.0	10	20	100		50
Zn	5.0	10	20	100		50

Table 5 - Initial Calibration Levels and ICV/CCV Concentrations for 1 Point Curve

Analyte	STD1	STD2	ICV,CCV
	(µg/L)	(µg/L)	(µg/L)
Ag		100	50
Al	10050		5050
As	100		50
B	100		50
Ba		100	50
Be	100		50
Ca	10100		5050
Cd	100		50
Co	100		50
Cr	100		50
Cu	100		50
Fe	10100		5050
K	10000		5500
Mg	10100		5050
Mn	100		50
Mo	100		50
Na	10000		5050
Ni	100		50
Pb	100		50
Sb	100		50
Se	100		50
Si	50		25
Sn	100		50
Sr	100		50
Ti	100		50
Tl	100		50
V	100		50
Zn	100		50

Table 6 - ELAN DRCE Linear Range for Method 6020A.

Analyte	Mass	Linear Range (mg/L)
Ag	107	5
Al	27	50
As	75	5
B	11	5
Ba	138	5
Be	9	5
Ca	44	50
Cd	114	5
Co	59	5
Cr	52	5
Cu	63	5
Fe	57	50
K	39	50
Mg	24	50
Mn	55	5
Mo	98	5
Na	23	50
Ni	60	50
Pb	208	5
Sb	121	5
Se	82	5
Si	28	5
Sn	118	5
Ti	48	5
Tl	205	5
V	51	5
Zn	66	5

Table 6-LCS and Matrix Spike

Analyte	Liquid Concentration (mg/L)	Soil Concentration * (MS spike only) (mg/Kg)
Antimony	0.5	160
Arsenic	0.12	160
Barium	2.00	160
Beryllium	0.05	80
Cadmium	0.051	80
Chromium	0.20	160
Copper	0.25	160
Lead	0.51	160
Nickel	0.50	160
Selenium	0.12	160
Silver	0.05	40
Thallium	0.12	160
Zinc	0.50	160
Iron	1.00	800
Manganese	0.50	160
Calcium	10.0	800
Magnesium	10.0	800
Potassium	10.0	800
Sodium	10.0	800
Aluminum	2.00	800
Cobalt	0.50	160
Vanadium	0.50	160
Boron	1.0	NA
Molybdenum	1.0	NA
Titanium	1.0	NA

*MS spike of a solid based on 1.25g and a final volume of 50 mL; refer to method 3050 for spike amounts.

Note: Solids LCS is an SRM with certified value provided by the vendor on a lot basis.

Mercury Determination in Tissue and Soil/Sediment Samples by Cold Vapor Atomic Fluorescence Technique (CVAF)

References: **Method 7474**, Mercury in Sediment and Tissues by Atomic Fluorescence Spectrometry. SW-846, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, EPA SW-846, Revision 0, 2007.

Method 7471B, Mercury in Solid or Semisolid Waste (Manual Cold Vapor Technique). SW-846, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, EPA SW-846, Revision 2, February 2007.

1. Scope and Application

Matrices: The method is applicable to total mercury in tissue and soil/sediment samples.

Definitions: Refer to Alpha Analytical Quality Manual.

Two procedures for the analysis of mercury by cold vapor atomic fluorescence spectrometry are discussed in this SOP.

Mercury in Tissues - This method utilizes a microwave digestion followed by bromine chloride oxidation. Samples are then decolorized using hydroxylamine hydrochloride and analyzed following reduction with stannous chloride. Elemental mercury is then purged from solution and analyzed by atomic fluorescence spectrometry.

Mercury in Soil/Sediments - This method utilizes a hot plate digestion with aqua regia followed by bromine chloride oxidation. Samples are then decolorized using hydroxylamine hydrochloride and analyzed following reduction with stannous chloride. Elemental mercury is then purged from solution and analyzed by atomic fluorescence spectrometry.

The data report packages present the documentation of any method modification related to the samples tested. Depending upon the nature of the modification and the extent of intended use, the laboratory may be required to demonstrate that the modifications will produce equivalent results for the matrix. Approval of all method modifications is by one or more of the following laboratory personnel before performing the modification: Area Supervisor, Department Supervisor, Laboratory Director, or Quality Assurance Officer.

This method is restricted to use by or under the supervision of analysts experienced in the operation of the Mercury analyzer and in the interpretation of Mercury data. Each analyst must demonstrate the ability to generate acceptable results with this method by performing an initial demonstration of capability.

Parameter	CAS
Mercury	7439-97-6

2. Summary of Method

Mercury in tissue samples is determined by cold vapor atomic fluorescence spectrometry from an aliquot of a microwave digestion (see SOP 2150). A 10 mL aliquot of the digest is added to a 50 mL

screw cap polyethylene digestion tube along with 2 mL of an acidic bromine chloride solution. Bromine chloride is prepared by mixing potassium bromide with potassium bromate solutions with hydrochloric acid producing a yellow solution. Bromine chloride is known to oxidize inorganic and organomercury compounds. If a yellow color does not persist after addition of bromine chloride, then additional solution must be added until a yellow color persists. The same volume of bromine chloride solution is added to all samples and standards. This solution is allowed to stand for at least 12 hours. After digestion is complete, bring to 50 mL, add 0.4 mL of 12% hydroxyl amine hydrochloride solution and shake. Additional hydroxyl amine hydrochloride is added if the yellow color from the bromine chloride solution persists.

Samples and standards are placed in the autosampler rack for analysis following stannous chloride reduction and analysis by cold vapor atomic fluorescence spectrometry at a wavelength of 253.7 nm.

Mercury in soil/sediment samples is determined by cold vapor atomic fluorescence spectrometry from a hot plate digestion utilizing aqua regia. A 0.5 – 1 g wet sediment aliquot is added to a 50 mL screw cap polyethylene digestion tube along with 5 mL of DI water, 3.75 mL concentrated HCl and 1.25 mL of concentrated HNO₃. Samples are heated on the hot block for 2 minutes and allowed to cool. 25 mL of DI water are then added, the samples placed back on the hot block and heated for 30 minutes. The samples are then cooled and brought to 50 mL with DI water. A 10 mL aliquot of the digest is added to a 50 mL digestion tube along with 2 mL of an acidic bromine chloride solution. If a yellow color does not persist after addition of bromine chloride then additional solution must be added until a yellow color persists. The same volume of bromine chloride solution is added to all samples and standards. This solution is allowed to stand for at least 12 hours. After digestion is complete, bring to 50 mL, add 0.4 mL of 12% hydroxyl amine hydrochloride solution and shake. Additional hydroxyl amine hydrochloride is added if the yellow color from the bromine chloride solution persists.

Samples and standards are placed in the autosampler rack for analysis following stannous chloride reduction and analyzed by cold vapor atomic fluorescence spectrometry at a wavelength of 253.7 nm.

2.1 Method Modifications from Reference

Method 7474 calls for a microwave digestion for both tissues and soils/sediments with nitric and hydrochloric acids. The method has been modified for tissues to use an aliquot of a microwave digest utilizing nitric acid only. The method has been modified for soils/sediments to use a hot block digestion similar to that used for Method 7471B but without the addition of potassium permanganate. The change allows for more rapid preparation of samples and yields equivalent data to the reference method as indicated by the performance of PT samples.

Bromate/Bromide solution has been modified from the method reference.

3. Reporting Limit

The Reporting limit for mercury in tissues is 0.05 µg/L (0.0125 mg/kg) and the linear range of the analysis is 5 µg/L (1.25 mg/kg).

The Reporting limit for mercury in soil/sediment is 0.05 µg/L (0.0125 mg/kg) and the linear range of the analysis is 5 µg/L (1.25 mg/kg).

4. Interferences

Printouts of this document may be out of date and should be considered uncontrolled. To accomplish work, the published version of the document should be viewed online.

4.1 Gold, silver and iodide are known interference.

- 4.1.1** High concentrations of gold and silver in a sample may suppress mercury reduction.
- 4.1.2** Samples with iodide concentrations greater than 3 mg/L should be pre-reduced with stannous chloride to clarify the brown color. It may be necessary to clean the analytical system with 4N HCl following analysis of a sample with iodide concentrations greater than 30 mg/L.
- 4.1.3** Sulfide concentrations up to 24 mg/L produce no interference problems.

5. Health and Safety

The toxicity or carcinogenicity of each reagent and standard used in this method is not fully established; however, each chemical compound should be treated as a potential health hazard. From this viewpoint, exposure to these chemicals must be reduced to the lowest possible level by whatever means available. A reference file of material safety data sheets is available to all personnel involved in the chemical analysis. Additional references to laboratory safety are available in the Chemical Hygiene Plan.

All personnel handling environmental samples known to contain or to have been in contact with municipal waste must follow safety practices for handling known disease causative agents.

The use of laboratory equipment and chemicals exposes the analyst to several potential hazards. Good laboratory techniques and safety practices shall be followed at all times. Eating, drinking, smoking, or the application of cosmetics is not permitted in the laboratory area. Horseplay of any kind is prohibited. Pipetting by mouth is not permitted. All Personal Protective Equipment (PPE) must be removed before leaving the laboratory area and before entering the employee lounge or eating area. Always wash your hands before leaving the laboratory. All relevant Material Safety Data Sheets (MSDSs) are kept alphabetically in a centrally located file storage.

Approved PPE, which includes Safety Glasses, Gloves and Lab Coats, must be worn at **all** times when handling samples, reagents, chemicals, or when in the vicinity of others handling these items, so that dermal contact is avoided. All standards, reagents and solvents shall be handled under a hood using the proper PPE. All flammable solvents must be kept in the flammable storage cabinet, and returned to the cabinet immediately after use. When transporting chemicals, use a secure transporting device and/or secondary outer container. Chemical storage is properly segregated and adequately ventilated to reduce the possibility of hazardous reactions. Chemical storage in work areas shall be kept to a minimum. Storage on bench tops or other work surfaces, except temporary, is not permitted.

Spilled samples, solvents, reagents, and water must be cleaned up from bench tops, instruments and autosampler surfaces immediately. A spill is considered a quantity of hazardous material if it is moderate to extreme hazard to the skin and mucous membranes. If contact with the skin occurs, immediately flush with large volumes of water. In the case of acidic/basic spills, the *Spill Kit* located in each laboratory shall be utilized before attempting to cleanup the spill. Although procedures are designed to minimize the possibility of an accident, all injuries or accidents, regardless of the nature or severity, are to be reported to the Department Manager Supervisor immediately. If an employee discovers a potentially unsafe condition, this must be reported to the Department Manager Supervisor immediately. No employee should feel compelled to work in a situation where they do not feel entirely informed, trained, or safe.

Analytical instrumentation poses the unique possibility of exposure to high voltages. Other than the *routine* instrument maintenance, as listed in the front of every Instrument Maintenance Logbook, at no time shall an instrument operator attempt to maintain an instrument alone, or without the proper training, supervision or instruction. Caution must always be used in the presence of moving parts (autosamplers) and hot surfaces (injection ports).

Compressed gas cylinders shall only be moved with the dolly supplied for this specific purpose. The cap must be on the cylinder while it is being moved. The tank must be secured when in its final position. All spent tanks are to be returned in the same manner, and secured until removed by the vendor. Liquid argon or nitrogen represents a potential cryogenic hazard and safe-handling procedures must be used at all times.

All additional company safety practices shall be followed at all times as written in the *Chemical Hygiene Plan*.

6. Sample Collection, Preservation, Shipping and Handling

6.1 Sample Collection

A minimum of 10g of sample must be collected in a pre-cleaned 2oz or 4oz glass jar with a Teflon lined screw cap.

6.2 Sample Preservation

No preservatives are used. See Section 6.4.

6.3 Sample Shipping

No special sample shipping requirements.

6.4 Sample Handling

Samples are stored at $4^{\circ}\text{C} \pm 2^{\circ}\text{C}$. The hold time for soil/sediment and tissue samples is 28 days. Sediment and tissue samples may be stored frozen at $-20^{\circ}\text{C} \pm 10^{\circ}\text{C}$. The hold time for solid samples stored frozen may be extended unless specifically noted by project or client requirements.

7. Equipment and Supplies

7.1 Instrument: The PSA Millennium Merlin Atomic Fluorescence Analyzer equipped with a PC loaded with instrumental software, gold-amalgamation attachment (Millennium Gallahad) and PSA 20.400 autosampler. The instrument is connected to a source of high-purity, mercury free argon regulated to 50 PSI.

7.2 Santoprene Peristaltic Pump Tubing: Green/Green (PSA part number M025T002 or equivalent) for blank and autosampler rinse, Grey/Grey (PSA part number M055T005 or equivalent) for sample and stannous chloride.

7.3 Electric Hot Plate: Adjustable and capable of maintaining a temperature of $90-95^{\circ}\text{C}$ equipped with graphite carbon blocks that each have 36 positions to hold the sample tubes.

NOTE: Hotplate/Block temperatures are monitored regularly using NIST calibrated and traceable thermometers. If any thermometer is suspected to not be reading the temperatures correctly, it is replaced with another certified thermometer.

7.4 Milestone Ethos E Microwave Oven: Equipped with temperature control probe and high pressure perfluoropolymer vessels.

7.5 Digestion Tubes: 50mL disposable polyethylene screw cap digestion tubes.

7.6 Other: Adjustable Eppendorf pipettes and replacement tips

8. Reagents and Standards

ACS Trace Metal grade chemicals shall be used in all tests. Other grades may be used, provided it is first ascertained that the reagent is of sufficiently high purity to permit its use without lessening the accuracy of the determination. If the purity of a reagent is in question, analyze for contamination. If the concentration is less than the MDL then the reagent is acceptable.

Solutions below expire six months from preparation unless noted.

Stock standard solutions are stored in a cabinet, out of direct light

8.1 Deionized (DI) water: The Barnstead NANO-pure system provides Type I water used in the preparation of samples and standards.

8.2 Hydrochloric acid, concentrated (HCl): ACS reagent grade, Fisher #A508-212, or equivalent. Hydrochloric acid (1:1 HCl) - Add 500mL concentrated HCl to 400mL DI water and dilute to 1L. 10% HCl – Add 100 mL concentrated HCl to approximately 500 mL DI and bring to 1 L with DI. Lots should be checked for purity prior to use and the results stored in a reagent check log book.

8.3 Nitric acid, concentrated (HNO₃): ACS reagent grade, Fisher #A509-212, or equivalent. Nitric Acid (1:1 HNO₃) - Add 500mL concentrated HNO₃ to 400mL DI water and dilute to 1L. Prepare 1% Nitric Acid by diluting 1mL of concentrated HNO₃ up to 100mL in DI water. Lots should be checked for purity prior to use and the results stored in a reagent check log book.

8.4 Hydroxylamine hydrochloride (NH₂OH·HCl): ACS reagent grade, VWR #HX0770-1, or equivalent. Prepare 12% solution by adding 12 g per 100 mL of DI.

8.5 Stannous Chloride (SnCl₂·H₂O): ACS reagent grade, Fisher #T142-500, or equivalent. Prepare 2% solution by adding 20 g to 1L of 10% HCl. Prepare daily. Solution may be purged with argon at 2 L/minute for 30 minutes to remove Hg impurities.

8.6 Potassium Bromate (KBrO₃): ACS grade, Fisher #P207-250. May be baked in muffle furnace at 250°C for 8 hours to remove mercury impurities.

8.7 Potassium Bromide (KBr): ACS grade, Fisher #P205-500. May be baked in muffle furnace at 250°C for 8 hours to remove mercury impurities.

8.8 Bromine Chloride (BrCl): Prepare in a BOD bottle under a fume hood by adding 5.4 g KBr and 7.6 g KBrO₃ to 500mL of concentrated HCl and mix. Final concentration is 0.2N. Solution will turn yellow. **Free Halogens are generated from this solution. Seal the bottle when taking out of fume hood.**

8.9 Stock and Working Standards:

The 1000 µg/L working standards must be prepared in the same manner as samples. These standards are then diluted to make calibration and calibration check standards. After preparation, the 1000 µg/L working standards can be used for one week.

8.9.1 1000 mg/L Stock Calibration Mercury Standard: Ultra Scientific #ICP-080, or equivalent.

8.9.1.1 1000 µg/L Working Standard for Tissues: Prepare by adding 0.05 mL of 1000 mg/L stock to a microwave digestion vessel containing 10 mL of concentrated HNO₃. This standard is digested along with samples according to Method 3051 (SOP 2150). The standard is then brought to a 50 mL final volume with DI water in a screw cap digestion tube. This standard is identified as **C-date-VM** in the Mercury Standards Preparation Log.

8.9.1.2 1000 µg/L Working Standard for Soils/Sediments: Prepare by adding 0.05 mL of 1000 mg/L stock (Section 8.9.1) to a 50 mL screw cap digestion tube containing 5 mL of DI water, 1.25 mL of concentrated HNO₃ and 3.75 mL of concentrated HCl. This standard is digested along with samples. The standard is then brought to a 50 mL final volume with DI water. This standard is identified as **C-date-VH** in the Mercury Standards Preparation Log.

8.9.1.3 100 µg/L Intermediate Standard: Prepare by adding 0.1 mL of the 1000 µg/L working standard (Section 8.9.1.1 or 8.9.1.2) to 0.9 mL DI water. This intermediate standard is used for calibration standards preparation and then discarded.

8.9.1.4 10 µg/L Intermediate Standard: Prepare by adding 0.1 mL of the 100 µg/L working standard (Section 8.9.1.3) to 0.9 mL DI. This intermediate standard is used for calibration standards preparation and then discarded.

8.9.1.5 5 µg/L Intermediate Standard: Prepare by adding 0.25 mL of the 1000 µg/L working standard (Section 8.9.1.1 or 8.9.1.2) to 50 mL graduated digestion tube containing 2% HCl. Bring to 50 mL final volume.

8.9.2 1000 mg/L Stock ICV Mercury Standard: Inorganic Ventures #CGHG-1, or equivalent

8.9.2.1 1000 µg/L ICV Working Standard for Tissues: Prepare by adding 0.05 mL of 1000 mg/L stock to a microwave digestion vessel containing 10 mL of concentrated HNO₃. This standard is digested along with samples according to Method 3051 (SOP-2150). The standard is then brought to a 50 mL final volume with DI water in a screw cap digestion tube. This standard is identified as **I-date-VM** in the Mercury Standards Preparation Log.

8.9.2.2 1000 µg/L ICV Working Standard for Soils/Sediments: Prepare by adding 0.05 mL of 1000 mg/L stock to a 50 mL screw cap digestion tube containing 5 mL of DI water, 1.25 mL of concentrated HNO₃ and 3.75 mL of concentrated HCl. This standard is digested along with samples. The standard is then brought to a 50 mL final volume with DI water. This standard is identified as **I-date-VH** in the Mercury Standards Preparation Log.

8.9.2.3 5 µg/L Intermediate Standard: Prepare by adding 0.25 mL of the 1000 µg/L working standard (Section 8.9.2.1 or 8.9.2.2) to 50 mL graduated digestion tube containing 2% HCl. Bring to 50 mL final volume.

8.9.2.4 1000 µg/L LCS and Matrix Standard for Tissues and Soils/Sediments: Prepare by adding 0.1 mL of 1000 mg/L stock (8.9.2) to a 100 mL volumetric flask containing 2% HCL. This standard is identified as **I-date-V** in the Mercury Standards Preparation Log.

8.10 Calibration and Calibration Check Standards

8.10.1 Standards Preparation for Method 7474 Tissues

To 50 mL screw cap digestion tubes, add 10 mL of DI water and 2 mL of concentrated HNO₃. Add the volumes of each standard as indicated in the table below, 2 mL of BrCl solution and bring to 50 mL. The standard set is designated in the Mercury Standards Preparation Log as **C-date-VM1,2,3...** (for calibration standards) and **I-date-VM1,2,3...** (for the ICV) as successive sets of standards are prepared from the stock. The same volume of the 1000 µg/L ICV stock is added to the preparation batch LCS and matrix spike sample.

If more than 2 mL of BrCl solution was added to samples to maintain the yellow color, add the same amount to standards. 0.2 mL of 12% hydroxyl amine hydrochloride is added to each vial and shaken. The yellow color should disappear.

8.10.2 Standards Preparation for Method 7474 Soils/Sediments

To 50 mL screw cap digestion tubes, add 10 mL of DI water, 0.75 mL of concentrated HCl and 0.25 mL of concentrated HNO₃. Add the volumes of each standard as indicated in the table below, 2 mL of BrCl solution and bring to 50 mL. The standard set is designated in the Mercury Standards Preparation Log as **C-date-VH1,2,3...** (for calibration standards) and **I-date-VH1,2,3...** (for the ICV) as successive sets of standards are prepared from the stock. The same volume of the 1000 µg/L ICV stock is added to the preparation batch LCS and matrix spike sample.

If more than 2 mL of BrCl solution was added to samples to maintain the yellow color, add the same amount to standards. 0.2 mL of 12% hydroxyl amine hydrochloride is added to each vial and shaken. The yellow color should disappear.

8.10.3 Calibration, Calibration Check Standards, LCS and Matrix Spike

Calibration and calibration check standards are prepared by adding standard volumes to vials prepared for tissues and soils/sediments as designated in the following table:

Lower detection limits and analytical reporting limits may be required at times for some samples. Lower limits are attained by increasing the instrumental gain from 10 to 100 and by calibrating using lower concentration standards. Calibration standards and the LCS and MS are prepared as in the following table:

Standard ID	Vol. 5 µg/L Standard (Section 8.9.1.5) (mL)	Final Concentration (µg/L)
STD0	-	0.000
STD1	0.05	0.005
STD2	0.10	0.010
STD3	0.20	0.020
STD4	0.50	0.050
STD5	1.0	0.100
STD6	2.0	0.200
ICV,CCV,LCS, MS	1.0 (Section 8.9.2.3)	0.100

9. Quality Control

Standard ID	Vol. 1000 µg/L (mL) (Sec. 8.9.1.1 or 8.9.1.2)	Vol. 100 µg/L (mL) (Sec. 8.9.1.3)	Vol. 10 µg/L (mL) (Sec. 8.9.1.4)	Final Concentration (µg/L)
STD0	-	-	-	0.0
STD1	-	-	0.25	0.05
STD2	-	0.05	-	0.1
STD3	-	0.25	-	0.5
STD4	0.1	-	-	2.0
STD5	0.25	-	-	5.0
ICV, CCV	0.125 (Sec. 8.9.2.1 or 8.9.2.2)			2.5
LCS, MS	0.125 (Sec. 8.9.2.4)			2.5

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The laboratory must maintain records to document the quality of data that is generated. Ongoing data quality checks are compared with established performance criteria to determine if the results of analyses meet the performance characteristics of the method.

9.1 Blanks

9.1.1 Method Blank

A method blank must be prepared once per every 20 samples or per digestion batch, whichever is more frequent.

Mercury must not be detectable in the method blank at a concentration greater than the reporting limit.

Corrective Action: Analysis according to the appropriate analytical SOP may be repeated once to see if an analytical error has occurred. Digestion of the method blank and all associated samples must be performed until the blank is in control. Samples cannot be analyzed until an acceptable method blank analysis is obtained. Exceptions may be made with approval of the Metals Department Manager, Laboratory Director or QAO, if the samples associated with the out of control method blank are non-detect for the elements of interest, or if sample concentrations are greater than 10x the blank levels. In such cases, the sample results are accepted without corrective action for the high method blank and the client is notified in a project narrative associated with the sample results.

9.1.2 Initial Calibration Blank (ICB)

An initial calibration blank must be analyzed immediately following the ICV (see 9.3).

Mercury must not be detectable in the ICB at a concentration greater than the reporting limit.

Corrective Action: May reanalyze the standard once. If the concentration still exceeds the acceptance limit, stop and recalibrate the instrument. Samples cannot be analyzed until an acceptable ICB analysis is obtained. Exceptions may be made with approval of the Metals Department Manager, Laboratory Director or QAO, if the samples associated with the out of control blank are non-detect for mercury, or if sample concentrations are greater than 10x the blank levels. In such cases, the sample results are accepted without corrective action for the high blank and the client is notified in a project narrative associated with the sample results.

9.1.3 Continuing Calibration Blank

A continuing calibration blank must be analyzed immediately following the CCV (see 9.4).

Mercury must not be detectable in the CCB at a concentration greater than the reporting limit.

Corrective Action: May reanalyze the standard once. If the concentration still exceeds the acceptance limit, stop, recalibrate the instrument and reanalyze all associated samples. Samples cannot be analyzed until an acceptable CCB analysis is obtained. Exceptions may be made with approval of the Metals Department Manager, Laboratory Director or QAO, if the samples associated with the out of control blank are non-detect for the elements of interest, or if sample concentrations are greater than 10x the blank levels. In such cases, the sample results are accepted without corrective action for the high

method blank and the client is notified in a project narrative associated with the sample results.

9.2 Laboratory Control Sample (LCS)

Laboratory control sample (LCS) must be prepared once per every 20 samples or per digestion batch, whichever is more frequent, and spiked with a solution prepared from a second source or lot number, other than the source used to verify the accuracy of the standard curve for the determinative analytical method. The LCS contains all target elements of interest, and is digested along with the samples as verification of the accuracy of the entire digestion procedure.

The acceptable recovery QC limits are 80 – 120%. The recovery limits are continuously monitored and documented in-house through control charts. The *Control Limit Generation* SOP (1734) provides details explaining how control charts are generated and used for quality control.

Corrective Action: Analysis according to the appropriate analytical SOP may be repeated once to see if an analytical error has occurred. If the LCS recovery is still out of control, re-prepare and re-analyze the LCS and all associated samples. Samples cannot be reported until an acceptable LCS is obtained. Exceptions may be made with approval of the Metals Department Manager, Laboratory Director or QAO, if the samples associated with the out of control LCS are also associated with a matrix spike that is in control. This is an acceptable measure of accuracy of the digestion and analytical procedures. An explanation of the out of control LCS recovery must be included in the project narrative to the client and the sample data reported noting the acceptable MS results as batch QC.

9.3 Initial Calibration Verification (ICV)

An initial calibration verification standard from a source different from that used to calibrate the instrument (see 8.9.2) must be analyzed immediately following calibration as an independent check of instrument performance. Nominal acceptance limits are 90% - 110% of the true value.

Corrective Action: May reanalyze the standard once. If the concentration still exceeds the acceptance limit, stop and recalibrate the instrument. Samples cannot be analyzed until an acceptable ICV analysis is obtained. Exceptions may be made with approval of the Metals Department Manager, Laboratory Director or QAO, if the samples associated with a high recovery ICV are non-detect. In such cases, the sample results are accepted without corrective action for the high ICV recovery and the client is notified in a project narrative associated with the sample results.

9.4 Continuing Calibration Verification (CCV)

A continuing calibration verification standard must be analyzed after analysis of no more than 10 samples as an on-going check of instrument performance. Nominal acceptance limits are 90% - 110% of the true value.

Corrective Action: May reanalyze the standard once. If the concentration still exceeds the acceptance limit, stop, recalibrate the instrument and reanalyze all associated samples. Results cannot be accepted until an acceptable CCV analysis is obtained. Exceptions may be made with approval of the Metals Department Manager, Laboratory Director or QAO, if the samples associated with a high recovery CCV are non-detect. In such cases, the sample results are accepted without corrective action for the high CCV recovery and the client is notified in a project narrative associated with the sample results.

9.5 Matrix Spike

A matrix spike (MS) sample must be performed once per 20 samples (5% frequency), or per digestion batch, whichever is more frequent. The MS contains all target elements of interest.

The acceptable % recovery QC limits are 80% – 120%. The % recovery QC limits are continuously monitored and documented in-house through control charts. The *Control Limit Generation* SOP (1734) provides details explaining how control charts are generated and used for quality control.

Corrective Action: Analysis according to the appropriate analytical SOP may be repeated once to see if an analytical error has occurred. If the % recovery still exceeds the control limits and the LCS is compliant, include a project narrative with the results to the client noting that there may be potential matrix effects on the accuracy of the reported results as evidenced by MS recovery outside of QC limits.

9.6 Laboratory Duplicate

Duplicate analyses (matrix or sample duplicate) must be performed once per 20 samples 5% frequency), or per digestion batch, whichever is more frequent.

Acceptable relative percent differences (RPD) of duplicates is $\leq 20\%$. This acceptance criterion is not applicable to sample concentrations less than 5 times the reporting limit. Calculate the RPD as follows:

$$RPD = \frac{R1 - R2}{\frac{R1 + R2}{2}} \times 100$$

where:

R1 = sample Replicate #1
R2 = sample Replicate #2

The RPD limits are continuously monitored and documented in-house through control charts. The *Control Limit Generation* SOP (1734) provides details explaining how control charts are generated and used for quality control.

Corrective Action: Analysis may be repeated once to see if an analytical error has occurred. If the % RPD still exceeds the control limits; include a project narrative with the results to client noting that there may be potential matrix effects on the precision of the reported metals results as evidenced by the matrix duplicate %RPD exceedance.

9.7 Method-specific Quality Control Samples

None.

9.8 Method Sequence

- ICV
- ICB
- Method Blank
- Laboratory Control Sample
- Matrix QC Sample

- Matrix Duplicate
- Matrix Spike
- Samples 2-5
- CCV
- CCB
- Samples 6-15
- CCV
- CCB

10. Procedure

10.1 Equipment Set-up

Samples are prioritized by the Metals Department Manager or Preparation Group Leader for digestion based on hold time and client due date. The analyst must be familiar with instrument software and hardware as described in the user manuals supplied with the instrument before attempting to perform an analysis.

Power to the instrument, autosampler, PC and the argon gas supply are turned on. Peristaltic pump windings are inspected for wear and replaced if necessary. The winding clips are relaxed in between usage. The instrument manufacturer suggests that the pump tubing be changed once per month or more frequently as needed.

The stannous chloride solution is attached to the grey/grey pump tubing, 10% HCl is attached to the green/green autosampler rinse and DI is attached to the green/green rinse blank. The autosampler probe line is attached to a grey/grey pump tubing. The pumps are turned on via the software and the flow is checked to insure that solutions are delivered to the mixing valve.

10.1.1 Sample Preparation

10.1.1.1 Tissues

Tissue samples are prepared by microwave oven assisted acid digestion according to SOP 2150. The LCS and MS are spiked as indicated in the table in 8.10.3.

A 10 mL aliquot of each digest is added to a 50 mL screw cap digestion tube along with 2 mL of BrCl solution. The vial contents should remain a yellow color. If a yellow color does not remain, add more BrCl solution. This solution is allowed to stand for 12 hours. Bring the vial to 50 mL with DI water. The vials are then decolorized with 0.4 mL of 12% hydroxyl amine hydrochloride and shaken. The yellow color should disappear. If the solution remains yellow, add more hydroxyl amine until the color disappears. Add the same amount to all samples and standards.

10.1.1.2 Soils/Sediment

A 0.5 – 1.0 g wet weight well mixed aliquot of soil/sediment is added to a 50 mL screw cap digestion tube with 5 mL of DI water. The LCS and MS are spiked as

indicated in the table in 8.10.3. A 3.75 mL volume of concentrated HCl and 1.25 mL of concentrated HNO₃ are added and the tube placed on the hot block set to 95 ± 3 °C for 2 minutes. Samples are allowed to cool and then 25 mL of DI water is added to each vial and placed back on the hot block for 30 minutes.

After cooling bring to a final volume of 50 mL with DI water. Then a 10 mL aliquot of each digest is added to a 50 mL screw cap digestion tube along 2 mL of BrCl solution. The vial contents should remain a yellow color. If a yellow color does not remain, add more BrCl solution. Allow samples to react overnight. The vials are then decolorized with 0.4 mL of 12% hydroxyl amine hydrochloride, brought to a final volume of 50 mL and shaken. The yellow color should disappear. If the solution remains yellow, add more hydroxyl amine until the color disappears. Add the same amount to all samples and standards.

10.2 Initial Calibration

The instrument is calibrated prior to sample analysis and at least once every 24 hours. A linear least squares regression calibration curve is selected for Method 7474.

In all cases, a correlation coefficient ≥ 0.995 is required before the analysis of samples can begin. The calibration blank is included as a point in the calibration curve.

An ICV (Section 9.3) and ICB (Section 9.1.2) are analyzed after calibration.

10.3 Equipment Operation and Sample Processing

After initializing the Millennium software, the instrument is turned on via the software and allowed to warm up for 30 minutes. The analysis method is selected and the autosampler template is selected. Method 7474 is set up in the software which specifies delay, read and rinse times as well as pump speeds. An autosampler template is set up specifying calibration standard, QC standards and positions on the autosampler rack. Once sample ID's have been typed in, the file is saved as the Job number.

A Work Group is obtained from LIMS and used as the data file name.

The analysis is initiated by clicking on the start button on the analysis page.

Following analysis, the data file is exported to the LIMS on the O:\Metals\Millennium drive for data processing. The instrument and autosampler are then rinsed with DI water and turned off

10.4 Continuing Calibration

Periodically (after no more than 10 samples) and at the end of the analysis, CCV standards (Section 9.4) and CCB standards (Section 9.1.3) are analyzed.

10.5 Preventive Maintenance

Inspect pump tubing for signs of wear and replace monthly or more frequently if necessary.

Clean glass liquid separator when glass appears coated with yellow film.

Replace dryer tube annually.

11. Data Evaluation, Calculations and Reporting

Procedures for data and record management must adhere to the Quality Systems Manual, other subordinate documents covering record keeping, and the *Document Control* SOP (1729). All records must be stored in such a manner as to be safe and accessible for at least 10 years.

The digestion batch bench sheets and other relevant laboratory notebooks must follow the specifications in the *Laboratory Notebook Usage* Work Instruction (1556), and all record keeping and document control practices.

Sample concentrations are calculated as follows:

$$\text{Sample Concentration} = ((Dc \cdot Df) \cdot Dv) / ((Md \cdot (S\% / 100) \cdot 1000))$$

Where:

Dc = digest Concentration in µg/L

Df = Dilution factor

Dv = Digest volume in mL

Md = Mass of sample digested in g

S% = percent solid of the sample (if reported on wet weight basis then percent solid = 100)

All results are reportable without qualification if digestion and analytical holding times are met, preservation (including cooler temperatures) are met, all QC criteria defined in the table below are met, and matrix interference is not suspected during digestion or analysis of the samples. If any of the below QC parameters are not met, all associated samples must be evaluated for re-extraction and/or re-analysis

QC Parameter	Acceptance Criteria
Method Blank	< reporting limit
Laboratory Control Sample	80%-120% Recovery
Matrix Duplicate	≤ 20% RPD
Matrix Spike	80% - 120% Recovery
Matrix Spike Duplicate (if needed)	≤ 20% RPD, 80% - 120% Recovery

12. Contingencies for Handling Out-of-Control Data or Unacceptable Data

Section 9 outlines sample batch QC acceptance criteria. If non-compliant results are to be reported, the Metals Department Manager and/or the Laboratory Director, and the QA Manager must approve the reporting of the results. The laboratory Project Manager shall be notified, and may choose to relay the non-compliance to the client, for approval, or other corrective action, such as re-sampling and re-analysis. The instrument analyst or Department Manager performing the secondary analytical review initiates the project narrative, and the narrative must clearly document the non-compliance and provide a reason for acceptance of these results.

13. Method Performance

13.1 Detection Limit Study (DL) / Limit of Detection Study (LOD) / Limit of Quantitation (LOQ)

The laboratory follows the procedure to determine the DL, LOD, and/or LOQ as outlined in Alpha SOP/1732. These studies performed by the laboratory are maintained on file for review.

13.2 Demonstration of Capability Studies

Refer to Alpha SOP/1739 for further information regarding IDC/DOC Generation.

13.2.1 Initial (IDC)

The analyst must make an initial, one-time, demonstration of the ability to generate acceptable accuracy and precision with this method, prior to the processing of any samples.

13.2.2 Continuing (DOC)

The analyst must make a continuing, annual, demonstration of the ability to generate acceptable accuracy and precision with this method

13.3 Instrument Detection Limits

The instrument detection limit (IDL) is the smallest signal above the background noise that an instrument can detect. The IDL can be calculated taking the average of the standard deviations for three measurements of a reagent blank solution analyzed on three analytical runs on three non-consecutive days. Seven consecutive measurements must be taken per day. The IDLs are

not required to go through sample digestion. Each measurement must be performed as though it were a separate sample.

14. Pollution Prevention and Waste Management

The *Hazardous Waste and Sample Disposal* SOP (1797) must be referenced for disposal of used standards, solvents, acids, reagents or other chemicals.

Once sample batches have completed digestion, the sample containers are stored in the metals lab and held for 30 days. If there is no sample remaining in the sample collection bottle, it may be rinsed and thrown away. It must be noted in the *Internal* COC that there is no sample remaining in the bottle, and the bottle was discarded.

Once satisfactory results have been generated, the digestates are held for 30 days, or longer if specified by a client contract, then discarded into a 55-gallon drum labeled "Corrosive Liquid".

All reagent waste generated during digestion must be stored in satellite containers in the metals preparation laboratory.

Once the reagent waste satellite containers are full, they must be emptied into 55-gallon drums marked "Corrosive Liquid".

Refer to Alpha's Chemical Hygiene Plan and Waste Management and Disposal SOP for further pollution prevention and waste management information.

15. Referenced Documents

Chemical Hygiene Plan

SOP/1559 Sample Receipt & Log-In

SOP/1729 Document Control

SOP/1732 DL/LOD/LOQ Generation

SOP/1734 Control Limit Generation

SOP/1739 Demonstration of Capability Generation

SOP/1797 Hazardous Waste and Sample Disposal

SOP/2150 Microwave Assisted Acid Digestion of Sediments, Soils, Tissues and Waters

WI/1556 Laboratory Notebook Usage

16. Attachments

None.

VERIFY THE VALIDITY OF THIS SOP EACH DAY IN USE

STANDARD OPERATING PROCEDURE

FOR

THE ANALYSIS OF POLYCHLORINATED BIPHENYLS (PCBs)

BY

**HIGH-RESOLUTION GAS CHROMATOGRAPHY/HIGH-
RESOLUTION MASS SPECTROMETRY (HRGC/HRMS)**

(CF-OA-E-003)

APPLICABLE TO METHOD:
EPA Method 1668A and C

PROPRIETARY INFORMATION

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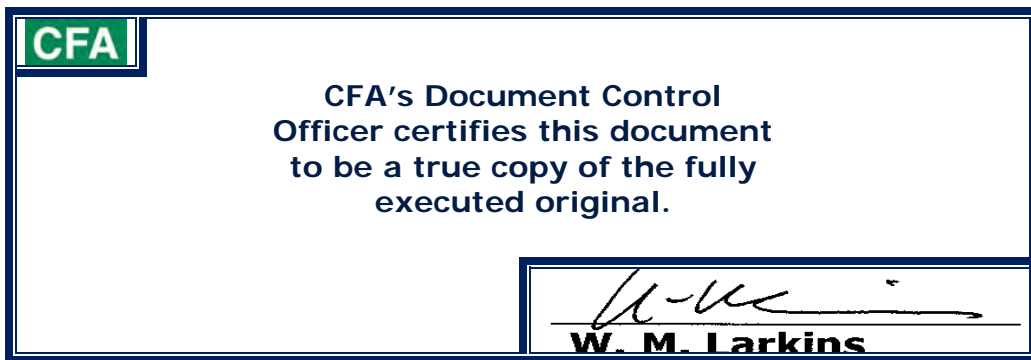


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1.0 STANDARD OPERATING PROCEDURE FOR THE ANALYSIS OF POLYCHLORINATED BIPHENYLS (PCB) BY HIGH-RESOLUTION GAS CHROMATOGRAPHY/HIGH-RESOLUTION MASS SPECTROMETRY (HRGC/HRMS)**2.0 METHOD OBJECTIVE, PURPOSE, CODE AND SUMMARY**

This standard operating procedure (SOP) covers the analytical determination of PCBs according to EPA Method 1668, Revisions A & C.

3.0 APPLICABLE MATRICES

Applicable matrices include groundwater, wastewater, surface water, leachate, soil, sediment, sludge, oil, and tissue.

4.0 METHOD SCOPE, APPLICABILITY AND DETECTION LIMIT

4.1 Method 1668 may be used to quantify PCBs that are soluble in methylene chloride and/or toluene. The compounds are separated using a gas chromatograph (GC) and detected using a high-resolution double focusing mass spectrometer (HRMS). Appendix 1 lists the analytes currently analyzed using these methods and their practical quantitation limits.

4.2 The practical quantitation limit (PQL) is the lowest level in the calibration curve. The PQL is the lowest level at which compounds may be accurately quantitated and is compound dependent. The calibration curve typically ranges from 0.5 ng/mL to 2000 ng/mL. These ranges reflect instrument readings, which are in ng/mL (ppb). It should be noted that the calibration range may vary between calibrations and instruments.

4.3 Method detection limit studies (MDLs) are performed and/or verified on an annual basis. MDLs are done for aqueous, solid, and tissue matrices. For more information regarding MDLs, refer to The Determination of Method Detection Limits, CF-LB-E-001.

4.4 Qualified analysts must demonstrate proficiency initially and annually thereafter with an IDOC, CDOC or PT study. Acceptability criteria may be found in the analytical method.

4.4.1 To establish the ability to generate acceptable accuracy and precision, the analyst should perform an "analyst validation study" or Initial Demonstration of Capability. Four LCS standards are extracted and analyzed. Calculate the average recovery and the standard deviation of the recovery for each analyte of interest using the four results. Then compare the average and the standard deviation with the corresponding criteria found in Table 6 of Method 1668A or C as appropriate. If the average and the standard deviation for all analytes of interest meet the acceptance criteria, then the analyst may begin work on actual samples. If the validation study fails for one or more of the compounds, then the study must be repeated for those compounds which failed.

5.0 METHOD VARIATIONS

5.1 Sample extracts are stored at room temperature to avoid analyte loss. Many of the target analytes in these methods form a strong cohesive bond with solids such as glass in cold temperatures; this type of analyte loss is not addressed in the method. (This is a variance from the following method recommendations: -10° to -20° C per DoD QSM.)

5.2 The analytical method does not address the reporting of EDL and EMPC. These values are reported only when requested by the client.

- 5.3 Project specific modifications are allowed to meet the data quality objectives of the Delaware River Basin Commission.

6.0 DEFINITIONS

- 6.1 Accuracy: The degree of agreement between an observed value and an accepted reference value.
- 6.2 AlphaLIMS: The Laboratory Information Management System used at CFA, LLC.
- 6.3 Blank: An aliquot of reagent water or other blank matrix that is treated exactly as a sample including exposure to all glassware, equipment, solvents, reagents, and standard additions that are used with other samples. The LMB (Lab Method Blank) is used to determine if method analytes or other interferences are present in the laboratory environment, the reagents, or the apparatus. Contamination may be derived during sampling, transportation, storage or analysis. The blank may be used to establish a background value.
- 6.4 Calibration Standard (CAL): An aliquot of a primary standard solution or stock standard solution. The CAL solutions are used to calibrate the instrument response with respect to analyte concentration.
- 6.5 Calibration Verification Standard (CVS, CCAL): A solution of target analytes with a concentration near the mid-point of the calibration range. It should be obtained from a second source vendor and is used to verify the initial calibration on a basis described in the determinative method.
- 6.6 Cleanup Standards: Isotopes added prior to cleanup that are used to measure the efficiency of the fractionation step alone. Method 1668 uses three compounds as the Cleanup Standards.
- 6.7 Duplicate Analysis: The analysis or measurement of the variable of interest performed identically on two field subsamples of the same sample. The results from duplicate analyses are used to evaluate analytical or measurement precision of sample, preservation, or storage internal to the laboratory.
- 6.8 Estimated Detection Limit (EDL): A calculation of the concentration of a given analyte required to produce a signal with a peak height of at least 2.5 times the background signal level. The EDL is calculated for each congener that is not identified.
- 6.9 Estimated Maximum Possible Concentration (EMPC): A calculation for a peak characterized by a response with a signal-to-noise ratio of at least 2.5 for both the quantitation ions, and meeting all identification criteria except ion ratio. EMPC is a worst-case estimate of the concentration.
- 6.10 Extraction Standards: Isotopes added prior to extraction that serve as internal standards for many PCB congeners. In addition, to measure the overall extraction and fractionation efficiencies. Method 1668 names them Labeled Compounds.
- 6.11 Injection Standards: Isotopes added prior to injection to determine the recoveries of the Extraction and Cleanup Standards. Method 1668 calls them Internal Standards.
- 6.12 Internal Standard (ISTD): A known amount of standard added to a test portion of a sample as a reference for evaluating the retention time and concentration of dependent analytes and controlling the precision and bias of the applied analytical method.

- 6.13 Laboratory Control Standard/Duplicate (LCS/LCSD): Aliquots of reagent water or other blank matrix to which known quantities of the method analytes are added in the laboratory. The LCS/LCSD are analyzed exactly like a sample, and the purpose is to determine whether the methodology is in control, and whether the laboratory is capable of making accurate and precise measurements.
- 6.14 Laboratory Duplicate (DUP): Aliquots of a sample taken from the same container and processed in the same manner under identical laboratory conditions. The aliquot is analyzed independently from the parent sample and the results are compared to measure precision and accuracy.
- 6.15 Matrix Spike and Matrix Spike Duplicate (MS and MSD): Two separate aliquots of an environmental sample to which known quantities of the method analytes are added in the laboratory. The MS and MSD are analyzed exactly like a sample, and their purpose is to determine whether the sample matrix contributes bias to the analytical results. The concentrations of the analytes in the sample matrix must be determined in a separate aliquot and the measured values in the MS/MSD adjusted. Percent recovery is calculated for both aliquots, and RPD is calculated between the two.
- 6.16 Method Detection Limit (MDL): The minimum concentration of an analyte that can be identified, measured and reported with 99% confidence that the analyte concentration is greater than zero.
- 6.17 Precision: The degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves, a data quality indicator. Precision is usually expressed as standard deviation, variance or range in either absolute or relative terms.
- 6.18 Quantitation Limits (also PQL, RL): The value at which an instrument can accurately measure an analyte at a specific concentration (i.e., a specific numeric concentration can be quantified). These points are established by the upper and lower limits of the linear calibration range.

7.0 INTERFERENCES/LIMITATIONS

- 7.1 Contaminants found in extraction glassware, solvents, and other sample processing hardware may jeopardize the integrity of this method.
- 7.2 Glassware must be scrupulously cleaned as soon as possible after extraction.
- 7.3 Contamination may also occur in the GC/MS system. High boiling materials tend to build up in the injection port and the front end of the column. The analyst should maintain a thorough working knowledge of keeping the injection port free of contamination, including changing out the septum, injection port liner, O-ring, ferrule, and gold seal.
- 7.4 Contamination by carryover can occur whenever high-level and low-level samples are sequentially analyzed. To reduce carryover, the sample syringe must be rinsed with solvent between samples. If carryover is suspected, potentially impacted samples should be re-analyzed after any needed maintenance, solvent replacement, and/or cleaning has been done.

8.0 SAFETY PRECAUTIONS AND WARNINGS

METHYLENE CHLORIDE IS A SUSPECTED CARCINOGEN AND A KNOWN SKIN IRRITANT. PCBs HAVE BEEN TENTATIVELY CLASSIFIED AS KNOWN OR SUSPECTED MAMMALIAN CARCINOGENS.

CONTACT WITH OXIDIZERS MAY GENERATE EXPLOSIVE MIXTURES.

PREVENT SKIN AND EYE CONTACT BY USING SPECIFIED PERSONAL PROTECTIVE EQUIPMENT WHEN MAKING STOCK REAGENTS.

WORK UNDER A HOOD TO PREVENT INHALATION WHEN MAKING STOCK REAGENTS FROM SOLIDS.

- 8.1 Eye protection should be worn when handling samples, reagents, or standards.
NOTE: Contact lenses pose a special problem; soft lenses may absorb irritants and all lenses concentrate them. DO NOT wear contact lenses in the laboratory.
- 8.2 Treat all chemicals and samples as potential health hazards and reduce exposure to these chemicals to the lowest level possible. CFA maintains a reference file of Material Safety Data Sheets (MSDS) for each chemical and standard. These documents and individual sample MSDS provided by clients are maintained in the laboratory.
- 8.3 Personal Protective Equipment (PPE)
 - 8.3.1 Gloves and eye protection should be worn when handling reagents, solvents, standards and samples.
 - 8.3.2 Analysts should prepare samples and standards under the hood.
- 8.4 All samples, chemicals, extracts, and extraction residues must be transferred, delivered, and disposed of safely according to all related SOPs.
- 8.5 Never leave gas cylinders unchained or untied.
- 8.6 In the event of an accident or medical emergency, call for help immediately. When time and safety permit, management should be notified of all accidents.
- 8.7 Fire escape routes are posted in the lab, and all personnel should be familiar with them. In addition, fire safety equipment such as fire extinguishers and fire blankets are located in the lab. Training is available on the proper operation of this equipment.
- 8.8 The analyst must use care when assembling and operating instrumentation. Check to see that the gas chromatograph equipment is properly assembled and hooked up to the proper gas cylinder and power, referencing the appropriate manual. Analytical equipment must only be operated by qualified personnel.
- 8.9 For further safety instructions, consult the Safety, Health and Chemical Hygiene Plan, CF-LB-N-001.

9.0 APPARATUS, EQUIPMENT AND INSTRUMENTATION

- 9.1 Equipment associated with this method includes:
 - 9.1.1 Gas tight syringes
 - 9.1.2 2 mL high recovery (conical) autosampler vials and storage racks
 - 9.1.3 Teflon crimp tops
 - 9.1.4 Crimper/De-crimper
 - 9.1.5 GC Column (SPB-Octyl or equivalent; 30m, 0.25 mm, 0.25 um)
 - 9.1.6 Quartz/Glass injection port liners
 - 9.1.7 Injection port liner O-ring seals
 - 9.1.8 Gold seals
 - 9.1.9 Ferrules
 - 9.1.10 Column cleaving tool

- 9.1.11 Septa (thermogreen)
- 9.1.12 0.5-10 uL adjustable air displacement pipette with disposable tips
- 9.2 Instrumentation
 - 9.2.1 Waters Autospec Premier high resolution mass spectrometer
 - 9.2.2 Agilent 7890 Gas Chromatograph
 - 9.2.2.1 A suggested temperature program follows:

Temperature 1	150° C
Time 1	2.0 min.
Rate	5° C/min.
Temperature 2	180° C
Time 2	1.5°/min
Final Temperature	265° C
Run Time:	55 minutes (may vary due to column length or flow rate)
Solvent Delay:	6.0 min.
Splitless Valve Time:	2.0 min.
Flow:	1.0 mL/min.
Mass Range:	See descriptor definitions (Table 2)
 - NOTE:** These instrument conditions and rates are guidelines which may change.
 - 9.2.3 LEAP Technologies GC PAL Autosampler
 - 9.2.3.1 Suggested parameters:

Sample volume – 1 µL
Air volume – 0.5 µL
Solvent push volume – 1 µL
Number of sample washes - 0
Solvent washes - 30
Sample viscosity wait – 1 second
Number of sample pumps - 0
Injection mode - Fast

10.0 REAGENTS AND STANDARDS

10.1 Reagents and standards

10.1.1 Nonane

10.1.2 Source Standards: Source Standards are purchased directly from vendors and may be diluted to make stock, intermediate, or working standards. These may include extraction standard, matrix spiking standard, cleanup standard, injection standard, as well as others. Source standards expire per the vendor expiration date or after five years from the date opened, whichever is shorter. Please reference CF-LB-E-007 for further information regarding standards and their preparation.

- 10.1.3 Initial Calibration (ICAL) Standards: Certified calibration standards are purchased from commercial vendors at a minimum of five concentration levels. One of the calibration standards is at a concentration near, but above, the method detection limit; the others should correspond to the expected range of compounds found in samples. Calibration standards expire after a maximum of five years and should be monitored frequently for signs of degradation.
- 10.1.4 Calibration Verification Standards (CVS, CCAL, CS3): A certified CVS is purchased from a second source commercial vendor at a concentration that is near to the midpoint of the calibration curve.
- 10.1.5 Window Defining Mix and Column Performance Mix (WDM and CPM): A standard containing the first and last eluters for each homolog group, as well as the isomers used to demonstrate isomer specificity on the GC column in use. Usually contained in the daily 209 injection mix.

11.0 SAMPLE HANDLING AND PRESERVATION

- 11.1 Samples have a one year holding time from the date of collection, and a one year holding time from the date of extraction.
- 11.2 Sample extracts are delivered from the prep lab to the instrument lab and are stored in a darkened hood at room temperature. The extracts are usually grouped according to batches and are accompanied by the batch pull sheet and other pertinent paperwork.
- 11.3 Custody of samples is monitored using the AlphaLIMS sample tracking system. Each analyst should scan the samples planned to run into their custody prior to analysis.
- 11.4 All sample extracts should be treated with caution as potential health hazards. Refer to Section 8.0 on safety.

12.0 SAMPLE PREPARATION

- 12.1 Before extracts can be analyzed on the instrument, they must first be evaporated to 18 uL nonane (added after cleanup steps) under nitrogen and then spiked with injection standard to set the final volume nominally at 20 μ L. A determination must also be made as to whether the extract should be diluted. The decision to dilute a sample extract is based on a number of factors: sample screening, historical data about the sample or sample site, the appearance of the extract (color, viscosity, incidental odor, turbidity, etc.), or regulatory considerations. The experience of the analyst is invaluable in making this determination.
NOTE: Sample extracts may contain multiple layers or sediment. Samples that contain sediment are returned to cleanup. Multiple layers are treated on a case-by-case basis. If the extract can be homogenized, then a uniform sample is achieved. If the extract remains bi-phasic, the PM and client are contacted for further guidance.
- 12.2 If a sample is to be analyzed without dilution ('neat'), 2 nanograms of injection standard solution is added to the extract using a pipette (2 μ L of a 1.0 ng/ μ L = 100 pg/ μ L extract concentration). A cap is then placed on the vial and secured by crimping before vortexing the sample to ensure complete mixing and vial wall washing.
- 12.3 If samples require dilution, the dilution is made using nonane or appropriate solvent. If not previously added, 2 nanograms of JS is added to the autosampler vial. Dilution prep may involve the addition of supplemental extraction standard (ES) and is documented in the injection prep logbook.

- 12.4 Once samples are prepped, they are ready to be injected onto the instrument. An autosampler is used to inject standards and sample extracts on the instrument.
- 12.5 The need for dilution may also be determined after analysis is performed, and may still be performed as above. Under normal circumstances, a sample would be diluted if any chromatographic peaks saturate the detector.

13.0 QUALITY CONTROL SAMPLES AND REQUIREMENTS

Typically a blank (LMB), laboratory control sample (LCS) and laboratory control sample duplicate (LCSD) are extracted and analyzed with each prep batch. Other client requirements may include a matrix spike (MS) and matrix spike duplicate (MSD) or sample duplicate (DUP).

13.1 Blanks

- 13.1.1 A blank is extracted with each batch of 20 or fewer samples to demonstrate that interferences from glassware, reagents and the analytical system are under control. Blanks are carried through all stages of sample preparation and analysis. An acceptable blank must be below the minimum levels listed in Table 2 of the method for all analytes.
- 13.1.2 The percent recovery of each labeled standard (extraction and cleanup) is calculated as shown in Sec. 19.1.3. Recoveries must be within the limits in Table 5.

13.2 Laboratory Control Samples and Matrix Spikes

- 13.2.1 The spiking standard for LCS/LCSDs and MS/MSDs contains all analytes listed in Table 4. For each LCS, LCSD, MS and MSD, the concentration of each analyte and its percent recovery are calculated as shown in Sec. 19.1.1 and 19.1.3. Recovered concentrations should be within the limits in Table 5.
- 13.2.2 If recovery is not within these limits, the data may need to be re-checked for errors, or the samples and QC may need to be re-analyzed. In addition, the instrumentation may need to be checked for performance problems. If the LCS fails to meet acceptance criteria due to low recovery, the associated samples may have to be re-extracted and re-analyzed when possible. If one or more recoveries are high in the LCS and these analytes are not detected in the samples, the event should be documented and data may be reported. If the MS and MSD both fail due to matrix interference and/or dilution, data may be reported provided the associated LCS passes acceptance criteria.
NOTE: Many clients have contract specific criteria that must be considered when evaluating recovery of the Quality Control samples.
- 13.2.3 The percent recovery of each labeled standard (extraction and cleanup) is calculated as shown in Sec. 19.1.3. Recoveries must be within the limits in Table 5.

13.3 Samples

- 13.3.1 The percent recovery of each labeled standard (as outlined in SOP CF-OA-E-001) is calculated as shown in Sec. 19.1.3. Recoveries must be within the limits in Table 5.
- 13.3.2 Calculated EDLs should be below the PQLs in Table 1. Any reported EDLs above the PQLs should be noted in the case narrative.

14.0 INSTRUMENT CALIBRATION, STANDARDIZATION AND PERFORMANCE**14.1 Mass spectrometer performance**

14.1.1 The mass spectrometer is operated in electron ionization mode. A static resolving power of at least 10,000 (10 percent valley definition) must be demonstrated at appropriate masses before any analysis is performed. Static resolving power checks must be performed at the beginning and at the end of each 12-hr period of operation. Corrective action must be implemented whenever the resolving power does not meet the requirement.

14.1.1.1 Chromatography time for PCBs exceeds the long term mass stability of the mass spectrometer. Because the instrument is operated in the high-resolution mode, mass drifts of a few ppm (e.g., 5 ppm in mass) can have serious adverse effects on instrument performance. Therefore, a mass drift correction is mandatory. A lock-mass ion from the reference compound PFK is used for tuning the mass spectrometer. The selection of the lock-mass ion is dependent on the masses of the ions monitored within each descriptor. Lock mass ions may be found in the descriptor table, Table 2. The level of the reference compound (PFK) metered into the ion chamber during HRGC/HRMS analyses should be adjusted so that the amplitude of the most intense selected lock-mass ion signal (regardless of the descriptor number) does not exceed 10 percent of the full scale deflection for a given set of detector parameters. Under these conditions, sensitivity changes that might occur during the analysis can be more effectively monitored. NOTE: Excessive PFK (or any other reference substance) may cause noise problems and contamination of the ion source resulting in an increase in downtime for source cleaning.

14.1.2 Documentation of the instrument resolving power must be accomplished by recording the peak profile of the high-mass reference signal (m/z 380.9760) obtained during the above peak matching experiment by using the low mass PFK ion at m/z 304.9824 as a reference. The minimum resolving power of 10,000 must be demonstrated on the high-mass ion while it is transmitted at a lower accelerating voltage than the low-mass reference ion, which is transmitted at full sensitivity. The format of the peak profile representation must allow manual determination of the resolution, i.e., the horizontal axis must be a calibrated mass scale (amu or ppm per division). The result of the peak width measurement (performed at 5 percent of the maximum, which corresponds to the 10 percent valley definition) must appear on the hard copy and cannot exceed 100 ppm at m/z 380.9760 (or 0.038 amu at that particular mass).

14.2 System Performance

System performance criteria are presented below. The laboratory may use the recommended GC column described in Sec. 9.1.5. The laboratory must document that all applicable system performance criteria were met before sample analysis begins. Sec. 9.2.2.1 provides recommended GC conditions that may be used to satisfy the required criteria. A GC column performance check is required at the beginning of each

12-hr period during which samples are analyzed. A continuing calibration must be performed at the beginning of the sequence.

14.2.1 Daily 209 injection mix

- 14.2.1.1 Inject 1 μ L of the daily 209 injection mix solution (Sec. 10.1.6) and acquire selected ion monitoring (SIM) data within a total cycle time of ≤ 1.5 second. The chromatographic separation between congeners 34-TrCB and 23-TrCB, and between congeners 187-HxCB and 182-HxCB, must be resolved with a valley of ≤ 40 percent, where:

$$\text{Valley percent} = (x/y) \times 100$$

x = the height of the valley

y = the peak height of the shorter of the two peaks

Congeners 156-HxCB and 157-HxCB must also co-elute within 2 seconds.

- 14.2.1.2 The daily 209 injection mix contains all 209 PCB congeners, and may thus be used to identify the first and last PCB eluters in each congener group, and in each analytical descriptor. Their retention times are used to determine the seven homologue retention time windows that are used for qualitative (Sec. 15.4.1.1) and quantitative purposes.

14.3 Initial Calibration

- 14.3.1 Prior to running a multi-level calibration, take precautions to ensure that the instrument meets system performance criteria. The analyst must document that all system performance criteria are met before analyzing an initial calibration.
- 14.3.2 Initial calibration is required before any samples are analyzed for PCBs and must meet the acceptance criteria in this section. Initial calibration is also required if any routine calibration does not meet the required criteria listed in Sec. 15.3, and at a minimum, annually.
- 14.3.3 At a minimum, all five high-resolution concentration calibration solutions listed in Table 4 must be used for the initial calibration. A lower calibration point of 0.5pg/ μ L is used for DRBC.
- 14.3.4 Tune the instrument with PFK to meet the above-specified system performance criteria.
- 14.3.5 Inject the daily 209 injection mix solution and acquire SIM mass spectral data. The laboratory must not perform any further analysis until it is demonstrated and documented that the criteria listed in Sec. 14.2.1 are met.
- 14.3.6 By using the same conditions (GC and MS) that produced acceptable results with the 209 injection mix solution, analyze each of the five concentration calibration solutions. Each injection must meet the following ion ratio and signal-to-noise (S/N) requirements:
- 14.3.6.1 The ratio of integrated ion current for the ions appearing in Table 2 (homologous series quantitation ions) must be within the indicated control limits (set for each homologous series) in Table 3. These ion ratio requirements must be within the specified control limits

simultaneously in one run. It is the analyst's responsibility to take corrective action if the ion abundance ratios are outside the limits.

- 14.3.6.2 For each selected ion current profile (SICP) and for each GC signal corresponding to the elution of a target analyte and of its labeled standards, the S/N ratio must be better than or equal to 10. Manual measurement of S/N is required for any GC peak that has an apparent S/N of less than 15:1. The result of the measurement must appear on the SICP above the GC peak in question. NOTE: An interference with PFK m/z 223.9872 may preclude meeting this requirement for DiCB congeners. Suspected column bleed interference may preclude meeting this requirement in other congeners groups. These interferences are noted in the low calibration levels, CS1 and below. If interference occurs, 10:1 S/N must be met at the CS2 level. The lower calibration points are still included in the initial calibration.

- 14.3.6.3 Manual integrations, if required, are performed and documented according to SOP CF-LB-E-017.

- 14.3.7 Calculate the relative response factors (RF) for unlabeled target analytes relative to their appropriate internal standards. Also calculate the RFs for the ESs and CSs relative to the appropriate injection standards according to the following formula:

$$RF = \frac{A_x C_{is}}{A_{is} C_x}$$

Where:

A_x = Sum of the Areas of the two characteristic ions for the compound being measured.

A_{is} = Sum of the Areas of the two characteristic ions for the specific internal standard.

C_{is} = Concentration of the specific internal standard.

C_x = Concentration of the compound being measured.

The RF is a dimensionless quantity; the units used to express C_{is} and C_x must be the same.

- 14.3.8 Because more than five calibration levels may be analyzed, the analyst may choose to deactivate one or more levels globally. If a level is not used, it will be deactivated in the method for all analytes in that calibration mixture. In some cases the upper level(s) of the calibration may be deactivated in order to meet method criteria for single compounds. This practice results in a narrower calibration range. Hits detected above the highest calibration level are re-analyzed at a dilution which brings the analytes into the calibration range. The low standard representing the PQL is not dropped. Please note that this practice does not represent "cherry picking," which is acknowledged as an unacceptable laboratory practice.

- 14.3.9 The average RF must be calculated for each compound as follows:

$$RF_{avg} = \frac{\sum_{i=1}^n X}{n}$$

Where:

N = number of calibration levels

X_i ; $i=1$ to n , are the compounds RF values for each calibration point

14.3.10 Criteria for acceptable initial calibration

The criteria listed below for acceptable calibration must be met before sample analyses are performed.

14.3.10.1 The percent relative standard deviations for the mean response factors from the unlabeled standards must not exceed ± 20 percent.

$$\%RSD = \frac{SD}{\bar{x}} \times 100$$

Where:

RSD = relative standard deviation

\bar{x} = mean of 5 or more initial RFs for a compound

SD = standard deviation of average RFs for a compound

$$SD = \sqrt{\frac{\sum_{i=1}^n (X - A)^2}{n - 1}}$$

where:

n = number of calibration levels

X_i ; $i=1$ to n , are the compounds RF values for each calibration point

A = average of the RFs from above

14.3.10.2 The percent relative standard deviations for the mean response factors from the labeled standards must not exceed ± 30 percent.

15.0 PROCEDURE FOR ANALYSIS AND INSTRUMENT OPERATION

15.1 Resolution check

15.1.1 At the beginning and end of each 12-hour window, mass resolution must be tuned and/or verified. A static resolving power of at least 10,000 must be demonstrated at appropriate masses before analysis is performed.

15.1.2 Using a PFK molecular leak, tune the instrument to the minimum required resolving power of 10,000 at m/z 330.9792 (for day to day operations, the instrument may be tuned to approximately 11,000). Verify that the exact mass of m/z 380.9760 is within 5 ppm of the required value. Due to the wide mass ranges required for PCB analysis, resolution may drop to 8000 at either end of the descriptor, but should be $>10,000$ at the midpoint.

15.2 Daily 209 injection mix

Inject 1 μ L of the daily 209 mix. Verify that all column performance and window defining criteria in Section 14.2.1 have been met.

15.3 Continuing Calibration

- 15.3.1 The initial calibration curve for each compound of interest must be verified once every 12 hours. Inject 1 uL of the CS3 standard. For 1668C, the Daily 209 injection mix is used to satisfy the calibration verification criteria.

Calculate the percent difference using:

$$\% \text{ Difference} = \frac{|\overline{RF}_i - RF_c|}{\overline{RF}_i} \times 100$$

Where:

\overline{RF}_i = average response factor from initial calibration

RF_c = response factor from current CS3

- 15.3.1.1 For Method 1668A, if the percent difference for each native analyte is $\leq 30\%$, and for each labeled analyte is $\leq 50\%$, the calibration is assumed to be valid. Method 1668C criteria are listed in Table 7. If the criteria are not met, corrective action should be taken. If no source of the problem can be determined after corrective action has been taken, a new initial calibration may need to be generated.

- 15.3.1.2 All ion ratios must be within the limits in Table 3.

15.4 Sample Analysis

15.4.1 Data Interpretation

15.4.1.1 Qualitative Analysis

For a peak to be identified as a PCB, it must meet all of the criteria listed below.

- 15.4.1.1.1 The signals for the two m/z's being monitored must be present and maximize within the same two scans.
- 15.4.1.1.2 The signal-to-noise ratio between the two m/z's must be ≥ 2.5 for each PCB detected in a sample extract, and ≥ 10 for all PCBs in the calibration and verification standards. (DiCBs suffer from PFK interference and are not required to meet 10:1 until the CS2. Other PCBs suffer from suspected column bleed interference and are only required to meet 2.5:1 in calibration points below the CS1.)
- 15.4.1.1.3 Ion ratios must be within the limits in Table 3.
- 15.4.1.1.4 The relative retention time of the peak for a PCB must be within the RRT limits calculated as specified in Table 8 based on the RT limits provided.
- 15.4.1.1.5 Congener overlap, interfering substances, or the loss of chlorine from a higher chlorinated congener may make it difficult to meet all identification criteria. In these cases, an experienced spectrometrists must determine the presence or absence of the congener.

15.4.1.2 Calibration Limit Exceedance

15.4.1.2.1 If a compound in a sample exceeds the upper calibration limit, all subsequent samples must be checked for carryover contamination.

15.4.1.2.2 When a subsequent sample is non-detect for the compound in question, the sequence is again considered acceptable for reporting.

15.4.1.2.3 All affected samples between the exceeding sample and the non-detect sample must be re-analyzed.

16.0 EQUIPMENT AND INSTRUMENT MAINTENANCE

16.1 Preventive maintenance on a HRGC/HRMS system involves the following basic areas:

16.1.1 Vacuum pumps for the inlets, source, and analyzer need a change of oil about every year or when system performance indicates it is needed.

16.1.2 The GC injection port is cleaned as needed, approximately once a week. It is recommended that the septum and injection port liner be replaced at the time of cleaning. Additionally, the gold plated seal should be cleaned or replaced.

16.1.3 Ion source maintenance is usage dependent. The type and quantity of samples that have been injected determine the frequency of ion source cleaning and filament replacement.

16.1.4 Autosampler maintenance is primarily that of cleanliness. Most autosamplers need their moving parts to be clean and lightly lubricated. The most frequent corrective maintenance is that of changing the syringe, usually about once per month.

16.1.5 Instrument maintenance logs are kept with each instrument and serve as a record of all the maintenance that has been done on the instrument.

16.2 Non-Routine Maintenance Procedures (Special, Operational or Failure Mode Maintenance)

16.2.1 Service is provided to the instrument via the analyst, the in-house instrument service engineer, or a technical support specialist from the manufacturer. When instrument failure occurs, different parts of the instrument are isolated to determine the root cause. For example, the injection port may be capped off if a leak is suspected to prove the leak is/is not coming from that source. Instrument maintenance logbooks are kept for each instrument detailing the type of maintenance performed on the instrument and when it was performed. Preventive maintenance visits are scheduled annually for the mass spectrometers.

16.2.2 Analytical GC columns are clipped or replaced when the existing column shows signs of excessive degradation or the inability to properly resolve chromatographic peaks. Excessive peak tailing, poor responses, and baseline disturbances may also indicate that the column needs to be replaced.

17.0 DATA RECORDING, CALCULATION AND REDUCTION METHODS

17.1 Data are evaluated qualitatively and quantitatively using a software program such as Waters MassLynx, or equivalent data system.

17.2 Data are reviewed, and a hard copy is generated. If manual integrations are made, a hard copy of the manual integration is printed and initialed by the analyst and included with the raw data.

17.3 Additional supporting documentation, such as totals pages generated by the software may be included with the data.

17.4 Quantitative Analysis

17.4.1 The concentration (ng/L for aqueous, ng/g for solids) of each identified compound in the sample is calculated as follows:

$$[PCB] = \frac{(A_{unk}^{ion1} + A_{unk}^{ion2})}{(A_{ES}^{ion1} + A_{ES}^{ion2})} \times \frac{Q_{ES}}{W_{unk} \times D \times \overline{RF}}$$

Where:

A_{unk} and A_{ES} = the integrated area for each ion monitored.

Q_{ES} = the amount of extraction standard added to the sample in nanograms

W_{unk} = the initial sample aliquot size, in liters for waters and in grams for solids.

D = (% moisture in sample)/100, or 1 for waters

\overline{RF} = Average RF from the ICAL for the compound

17.4.2 The concentration of each extraction and cleanup standard is calculated as follows:

$$[ES_{ng}] = \frac{(A_{ES}^{ion1} + A_{ES}^{ion2})}{(A_{JS}^{ion1} + A_{JS}^{ion2})} \times \frac{Q_{JS}}{\overline{RF}}$$

Where:

A_{ES} and A_{JS} = the integrated area for each ion monitored.

Q_{JS} = the amount of injection standard added to the sample in nanograms

\overline{RF} = Average RF from the ICAL for the compound

The cleanup standard concentration is calculated as above, substituting the area of the individual cleanup standard ions for the extraction standard ions.

17.4.3 Percent recovery is calculated as follows:

$$\%R = \frac{R_{ng}}{S_{ng}} \times 100$$

Where:

R_{ng} = the amount of standard recovered in nanograms.

S_{ng} = the amount of standard spiked in nanograms.

18.0 POLLUTION/CONTAMINATION

18.1 Work area should be maintained free of dust and dirt accumulations.

18.2 Fume hoods are utilized to remove fumes and reduce the risk of airborne contaminants to ensure personnel safety. Hoods are monitored in accordance with CF-FC-E-003 for Fume Hood Face Velocity Performance Checks.

18.3 The laboratory area is restricted to authorized personnel.

19.0 DATA REVIEW, APPROVAL AND TRANSMITTAL

- 19.1 A review process is used to insure the quality of the data. Raw data are reviewed first by the analyst, then by a second (peer) analyst or a data validator. When the analyst is satisfied that the data have been correctly processed and uploaded to the LIMS, a data report is generated from AlphaLIMS. The AlphaLIMS report along with the raw data and supporting documentation, such as a run log and case narrative, are submitted for review to the data validator or another experienced analyst. The reviewer goes through the raw data as if he/she was working it up for the first time and verifies that they are correct. In addition, he/she must make sure that the data have been correctly entered into AlphaLIMS. AlphaLIMS reports may be self-reviewed. If errors are discovered in either the raw data or the AlphaLIMS report, then the two analysts should discuss the differences and how best to resolve them. In some cases, the peer review process may uncover errors that lead to a sample being re-extracted or re-run. In cases such as these, a nonconformance report (NCR) should be completed and submitted to the Quality department. It is recommended that a copy of the NCR be given to the prep analyst if it involves a re-extraction and that a copy be kept with the original data.
- 19.2 Once the data review has been completed by the reviewer, the batch is returned to the analyst for corrections (if applicable) and the status is updated from REVW to DONE in AlphaLIMS.
- 19.3 Data may be transmitted automatically to AlphaLIMS. This automatic "upload" procedure may be activated prior to data review or after data review is complete. In either case, the data recorded in AlphaLIMS are checked by the analyst for accuracy and completeness.

20.0 CORRECTIVE ACTION FOR OUT-OF-CONTROL OR UNACCEPTABLE DATA

Corrective action for out-of-control data may require instrument maintenance, re-analysis, re-extraction, or a more complex set of actions. When troubleshooting measures fail to bring an analytical process or data into control, a nonconformance report and/or corrective action should be initiated in accordance with CF-QS-E-004 for the Documentation of Nonconformance Reporting and Dispositioning and Control of Nonconforming Items, and CF-QS-E-002 for Conducting Corrective Action.

21.0 CONTINGENCIES FOR HANDLING THESE SITUATIONS

Troubleshooting is used to determine the appropriate action to take when an initial or continuing calibration, blank and/or laboratory control sample fails to meet the acceptance criteria defined for the method. Troubleshooting may involve one or more of the following actions:

- 21.1 If analytes in a multi-point calibration fail to meet specified criteria, additional standards for the failing compounds may need to be reanalyzed. If they still do not meet specifications, instrument maintenance or new standards may be required before work is continued.
- 21.2 If a continuing calibration fails to meet specified criteria, instrument tuning or inlet maintenance may be required. If these attempts fail, a new initial calibration must be analyzed.
- 21.3 If a method blank fails to meet defined criteria, the source of contamination should be found and eliminated before proceeding with analysis.
- 21.4 If a LCS fails to meet specified criteria, the process should be reviewed to identify potential areas for failure. Any problem areas should be corrected before re-extraction or re-analysis is performed.

- 21.5 If a sample fails to meet recovery or detection limit criteria, the data should be reviewed to determine whether matrix interferences are present, and if further cleanup or a smaller volume extraction might improve recoveries.

22.0 RECORDS MANAGEMENT

- 22.1 Run logs are generated for each instrument each day that the instrument is run. These run logs serve as records of what is run on the instrument, including samples, QC, calibrations, tunes, etc. Additional information is provided in the run log, including the analyst's initials, run date and time, and file name.
- 22.2 Raw data are stored in the lab in filing cabinets and/or boxes as long as there is space available. When space runs out, the data are boxed and sent to storage.
- 22.3 All records generated as a result of this procedure are maintained as quality documents in accordance with CF-QS-E-008 for Quality Records Management and Disposition.

23.0 LABORATORY WASTE HANDLING AND DISPOSAL

Sample extracts that have been run are temporarily stored in case they have to be reanalyzed. Once space is no longer available to keep them in the lab, they are moved to Waste Disposal where they are handled and disposed in accordance with the Laboratory Waste Management Plan, CF-LB-G-001.

24.0 REFERENCES

Method 1668, Revision A, "Chlorinated Biphenyl Congeners in Water, Soil, Sediment, Biosolids, and Tissue by HRGC/HRMS" with corrections and changes through August 20, 2003

Method 1668C Chlorinated Biphenyl Congeners in Water, Soil, Sediment, Biosolids, and Tissue by HRGC/HRMS April 2010

DELAWARE RIVER ESTUARY STAGE 2 PCB TMDL Polychlorinated Biphenyls - EPA Method 1668A Project Quality Control Requirements 02/03/05

25.0 HISTORY

Revision 1: Section 15.4.1.2 added.

Revision 2: Calibration upper limit exceedance clarified.

Revision 3: Tables 1, 4, 5, and 6 updated. Table 8 added. 1668A references added.

Tridecane use removed. 1668C references and limits added.

Revision 4: Removed references to Version B.

Revision 5: Comments regarding DRBC modifications and references. Additions for DRBC ICAL exceptions.

Revision 6: Added holding time table.

TABLE 1: METHOD ANALYTES AND PQLs

Analyte	Liquid pg/L	Solid pg/g	Tissue pg/g
MoCB 1	20	2	2
MoCB 2	20	2	2
MoCB 3	20	2	2
DiCB 4	100	2	2
DiCB 10	100	2	2
DiCB 9	20	2	2
DiCB 7	20	2	2
DiCB 6	20	2	2
DiCB 5	20	2	2
DiCB 8	20	2	20
DiCB 14	20	2	2
DiCB 11	100	100	100
DiCB 13/12	40	4	8
DiCB 15	20	10	20
TrCB 19	20	2	2
TrCB 18/30	40	4	4
TrCB 17	20	2	2
TrCB 27	20	2	2
TrCB 24	20	2	2
TrCB 16	100	2	2
TrCB 32	20	2	2
TrCB 34	20	2	2
TrCB 23	20	2	2
TrCB 26/29	40	4	4
TrCB 25	20	2	2
TrCB 31	20	10	20
TrCB 20/28	40	20	40
TrCB 21/33	40	20	8
TrCB 22	20	10	20
TrCB 36	20	2	2
TrCB 39	20	2	2
TrCB 38	20	2	2
TrCB 35	20	2	2
TrCB 37	20	10	20
TeCB 54	20	2	2
TeCB 50/53	40	4	4
TeCB 45/51	40	4	4
TeCB 46	20	2	2
TeCB 52	20	2	4
TeCB 73	20	2	2
TeCB 43	20	2	2
TeCB 69/49	40	4	4
TeCB 48	20	2	2

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TeCB 44/65/47	60	6	6
TeCB 59/62/75	60	6	6
TeCB 42	20	2	2
TeCB 41	100	100	4
TeCB 40/71	40	4	4
TeCB 64	20	2	4
TeCB 72	20	2	2
TeCB 68	20	2	2
TeCB 57	20	2	2
TeCB 58	20	2	2
TeCB 67	20	2	4
TeCB 63	20	2	2
TeCB 61/76/70/74	80	8	16
TeCB 66	20	10	20
TeCB 55	20	2	2
TeCB 56	20	2	20
TeCB 60	20	2	4
TeCB 80	20	2	2
TeCB 79	20	2	2
TeCB 78	20	2	2
TeCB 81 WHO	20	2	4
TeCB 77 WHO	20	2	4
PeCB 104	20	2	2
PeCB 96	20	2	2
PeCB 103	20	2	2
PeCB 94	20	2	2
PeCB 95	20	2	2
PeCB 93/100	40	4	4
PeCB 102/98	40	4	4
PeCB 88/91	40	4	4
PeCB 84	20	2	2
PeCB 89	20	2	2
PeCB 121	20	2	2
PeCB 92	20	2	2
PeCB 113/90/101	60	6	6
PeCB 83	20	2	2
PeCB 99	100	2	2
PeCB 112	20	2	2
PeCB	120	12	12
PeCB 117/116/85	60	6	6
PeCB 110/115	40	4	4
PeCB 82	20	2	2
PeCB 111	20	2	2
PeCB 120	20	2	2
PeCB 108/124	40	4	4
PeCB 107	20	2	2
PeCB 123 WHO	100	2	4
PeCB 106	20	2	2

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PeCB 118 WHO	20	2	4
PeCB 122	20	2	2
PeCB 114 WHO	20	2	2
PeCB 105 WHO *	100	2	4
PeCB 127	20	2	2
PeCB 126 WHO	20	2	2
HxCB 155	20	2	2
HxCB 152	20	2	2
HxCB 150	20	2	2
HxCB 136	20	2	2
HxCB 145	20	2	2
HxCB 148	20	2	2
HxCB 151/135	40	4	4
HxCB 154	20	2	2
HxCB 144	20	2	2
HxCB 147/149	40	4	4
HxCB 134	100	2	2
HxCB 143	20	2	2
HxCB 139/140	40	4	4
HxCB 131	20	2	2
HxCB 142	20	2	2
HxCB 132	20	2	2
HxCB 133	20	2	2
HxCB 165	20	2	2
HxCB 146	20	2	2
HxCB 161	20	2	2
HxCB 153/168	40	4	4
HxCB 141	20	2	2
HxCB 130	20	2	2
HxCB 137	20	2	2
HxCB 164	20	2	2
HxCB 138/163/129	60	6	6
HxCB 160	20	2	2
HxCB 158	20	2	2
HxCB 128/166	40	4	4
HxCB 159	20	2	2
HxCB 162	20	2	2
HxCB 167 WHO	20	2	2
HxCB 156/157 WHO	40	4	4
HxCB 169 WHO	20	2	2
HpCB 188	20	2	2
HpCB 179	20	2	2
HpCB 184	20	2	2
HpCB 176	20	2	2
HpCB 186	20	2	2
HpCB 178	20	2	2
HpCB 175	20	2	2
HpCB 187	20	2	4

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HpCB 182	20	2	2
HpCB 183/185	40	4	4
HpCB 174	20	2	4
HpCB 177	20	2	4
HpCB 181	20	2	2
HpCB 173/171	40	4	4
HpCB 172	20	2	4
HpCB 192	20	2	4
HpCB 193/180	40	4	4
HpCB 191	20	2	2
HpCB 170	20	2	2
HpCB 190	20	2	2
HpCB 189 WHO	20	2	2
OcCB 202	20	2	2
OcCB 201	20	2	2
OcCB 204	20	2	2
OcCB 197/200	40	4	8
OcCB 198/199	40	4	4
OcCB 196	20	2	4
OcCB 203	20	2	2
OcCB 195	20	2	2
OcCB 194	20	2	2
OcCB 205	20	2	2
NoCB 208	20	2	2
NoCB 207	20	2	4
NoCB 206	20	2	4
DeCB 209	20	2	2

TABLE 2: MASS DESCRIPTORS

F1	Description*	Mass	Ion
1	13C-MoCB 1	200.0795	M
2	13C-MoCB 2	202.0766	M+2
3	13C-DiCB 1	234.0406	M
4	13C-DiCB 2	236.0376	M+2
5	MoCB 1	188.0393	M
6	MoCB 2	190.0363	M+2
7	DiCB 1	222.0003	M
8	DiCB 2	223.9974	M+2
9	Lock Mass	218.9856	PFK
F2	Description	Mass	Ion
1	13C-DiCB 1	234.0406	M
2	13C-DiCB 2	236.0376	M+2
3	13C-TrCB 1	268.0016	M
4	13C-TrCB 2	269.9986	M+2
5	13C-TeCB 1	301.9626	M
6	13C-TeCB 2	303.9597	M+2
7	DiCB 1	222.0003	M
8	DiCB 2	223.9974	M+2
9	TrCB 1	255.9613	M
10	TrCB 2	257.9584	M+2
11	TeCB 1	289.9224	M
12	TeCB 2	291.9194	M+2
-	DiCB 35 IC	255.9613	M
13	DiCB 35 ICQ	220.9924	M-35Cl
-	TrCB 35 IC	289.9224	M
14	TrCB 35 ICQ	254.9535	M-35Cl
15	Lock Mass	230.9856	PFK
F3	Description	Mass	Ion
1	13C-TrCB 1	268.0016	M
2	13C-TrCB 2	269.9986	M+2
3	13C-TeCB 1	301.9626	M
4	13C-TeCB 2	303.9597	M+2
5	13C-PeCB 1	337.9207	M+2
6	13C-PeCB 2	339.9178	M+4
7	TrCB 1	255.9613	M
8	TrCB 2	257.9584	M+2
9	TeCB 1	289.9224	M
10	TeCB 2	291.9194	M+2
11	PeCB 1	325.8804	M+2
12	PeCB 1	323.8834	M
13	PeCB 2	327.8775	M+4
-	TrCB 35 IC	289.9224	M

14	TrCB 35 ICQ	254.9535	M-35Cl
-	TeCB 35 IC	325.8804	M+2
15	TeCB 35 ICQ	288.9145	M-35Cl
-	TrCB 70 IC	325.8804	M+2
16	TrCB 70 ICQ	253.9457	M-35Cl2
17	Lock Mass	330.9792	PFK
F4	Description	Mass	Ion
1	13C-TeCB 1	301.9626	M
2	13C-TeCB 2	303.9597	M+2
3	13C-PeCB 1	337.9207	M+2
4	13C-PeCB 2	339.9178	M+4
5	13C-HxCB 1	371.8817	M+2
6	13C-HxCB 2	373.8788	M+4
7	TeCB 1	289.9224	M
8	TeCB 2	291.9194	M+2
9	PeCB 1	323.8834	M
10	PeCB2	325.8804	M+2
11	PeCB 3	327.8775	M+4
12	HxCB 1	359.8415	M+2
13	HxCB 2	361.8385	M+4
-	TeCB 35 IC	325.8804	M
14	TeCB 35 ICQ	288.9145	M-35Cl
-	PeCB 35 IC	359.8415	M+2
15	PeCB 35 ICQ	322.8756	M-35Cl
-	TeCB 70 IC	359.8415	M+2
16	TeCB 70 ICQ	287.9067	M-35Cl2
17	Lock Mass	330.9792	PFK
F5	Description	Mass	Ion
1	13C-PeCB 1	337.9207	M+2
2	13C-PeCB 2	339.9178	M+4
3	13C-HxCB 1	371.8817	M+2
4	13C-HxCB 2	373.8788	M+4
5	13C-HpCB 1	405.8428	M+2
6	13C-HpCB 2	407.8398	M+4
7	PeCB 1	323.8834	M
8	PeCB 2	325.8804	M+2
9	PeCB 3	327.8775	M+4
10	HxCB 1	359.8415	M+2
11	HxCB 2	361.8385	M+4
12	HpCB 1	393.8025	M+2
13	HpCB 2	395.7995	M+4
-	PeCB 35 IC	359.8415	M+2
14	PeCB 35 ICQ	322.8756	M-1
-	HxCB 35 IC	393.8025	M+2

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15	HxCB 35 ICQ	356.8366	M-35Cl
-	PeCB 70 IC	393.8025	M+2
16	PeCB 70 ICQ	321.8677	M-35Cl2
17	Lock Mass	330.9792	PFK
F6	Description	Mass	Ion
1	13C-HxCB 1	371.8817	M+2
2	13C-HxCB 2	373.8788	M+4
3	13C-HpCB 1	405.8428	M+2
4	13C-HpCB 2	407.8398	M+4
5	13C-OcCB 1	439.8038	M+2
6	13C-OcCB 2	441.8008	M+4
7	HxCB 1	359.8415	M+2
8	HxCB 2	361.8385	M+4
9	HpCB 1	393.8025	M+2
10	HpCB 2	395.7995	M+4
11	OcCB 1	427.7635	M+2
12	OcCB 2	429.7606	M+4
-	HxCB 35 IC	393.8025	M+2
13	HxCB 35 ICQ	356.8366	M-35Cl
-	HpCB 35 IC	427.7635	M+2
14	HpCB 35 ICQ	390.7976	M-35Cl
-	HxCB 70 IC	427.7635	M+2
15	HxCB 70 ICQ	355.8288	M-35Cl2
16	Lock Mass	380.9760	PFK
F7	Description	Mass	Ion
1	13C-HpCB 1	405.8428	M+2
2	13C-HpCB 2	407.8398	M+4
3	13C-OcCB 1	439.8038	M+2
4	13C-OcCB 2	441.8008	M+4
5	13C-NoCB 1	473.7648	M+2
6	13C-NoCB 2	475.7619	M+4
7	13C-DeCB 1	509.7229	M+4
8	13C-DeCB 2	511.7199	M+6
9	HpCB 1	393.8025	M+2
10	HpCB 2	395.7995	M+4
11	OcCB 1	427.7635	M+2
12	OcCB 2	429.7606	M+4
13	NoCB 1	461.7246	M+2
14	NoCB 2	463.7216	M+4
15	DeCB 1	497.6826	M+4
16	DeCB 2	499.6797	M+6
17	Lock Mass	430.9728	PFK

* IC – Interference Check ion

ICQ – Interference Check Quantitation ion

TABLE 3: THEORETICAL ION RATIOS AND CONTROL LIMITS

Homolog Group	M/Z Forming Ratio	Theoretical Ratio	Lower Limit	Upper Limit
Mono	M/M+2	3.13	2.66	3.60
Di	M/M+2	1.56	1.33	1.79
Tri	M/M+2	1.04	0.88	1.20
Tetra	M/M+2	0.77	0.65	0.89
Penta	M/M+2	0.61	0.52	0.71
Penta	M+2/M+4	1.55	1.32	1.78
Hexa	M+2/M+4	1.24	1.05	1.43
Hepta	M+2/M+4	1.05	0.89	1.21
Octa	M+2/M+4	0.89	0.76	1.02
Nona	M+2/M+4	0.77	0.65	0.89
Deca	M+4/M+6	1.16	0.99	1.33

TABLE 4: INITIAL CALIBRATION CONCENTRATIONS

Congener (#)	CS0. 5	CS1	CS2	CS3	CS4	CS5
Native Analytes						
2-MoCB (1)	0.5	1	5	50	400	2000
4-MoCB (3)	0.5	1	5	50	400	2000
2,2'-DiCB (4)	0.5	1	5	50	400	2000
4,4'-DiCB (15)	0.5	1	5	50	400	2000
2,2',6'-TrCB (19)	0.5	1	5	50	400	2000
3,4,4'-TrCB (37)	0.5	1	5	50	400	2000
2,2',6,6'-TeCB (54)	0.5	1	5	50	400	2000
3,3',4,4'-TeCB (77)	0.5	1	5	50	400	2000
3,4,4',5'-TeCB (81)	0.5	1	5	50	400	2000
2,2',4,6,6'-PeCB (104)	0.5	1	5	50	400	2000
2,3,3',4,4'-PeCB (105)	0.5	1	5	50	400	2000
2,3,4,4',5'-PeCB (114)	0.5	1	5	50	400	2000
2,3',4,4',5'-PeCB (118)	0.5	1	5	50	400	2000
2',3,4,4',5'-PeCB (123)	0.5	1	5	50	400	2000
3,3',4,4',5'-PeCB (126)	0.5	1	5	50	400	2000
2,2',4,4',6,6'-HxCB (155)	0.5	1	5	50	400	2000
2,3,3',4,4',5'-HxCB (156)	0.5	1	5	50	400	2000
2,3,3',4,4',5'-HxCB (157)	0.5	1	5	50	400	2000
2,3',4,4',5,5'-HxCB (167)	0.5	1	5	50	400	2000
3,3',4,4',5,5'-HxCB (169)	0.5	1	5	50	400	2000
2,2',3,4',5,6,6'-HpCB (188)	0.5	1	5	50	400	2000
2,3,3',4,4',5,5'-HpCB (189)	0.5	1	5	50	400	2000
2,2',3,3',5,5',6,6'-OoCB (202)	0.5	1	5	50	400	2000
2,3,3',4,4',5,5',6-OoCB (205)	0.5	1	5	50	400	2000
2,2',3,3',4,4',5,5',6-NoCB (206)	0.5	1	5	50	400	2000
2,2',3,3',4,4',5,5',6,6'-NoCB (208)	0.5	1	5	50	400	2000
DeCB (209)	0.5	1	5	50	400	2000
Extraction Standards						
13C12-2-MoCB (1L)	100	100	100	100	100	100
13C12-4-MoCB (3L)	100	100	100	100	100	100
13C12-2,2'-DiCB (4L)	100	100	100	100	100	100
13C12-4,4'-DiCB (15L)	100	100	100	100	100	100
13C12-2,2',6'-TrCB (19L)	100	100	100	100	100	100
13C12-3,4,4'-TrCB (37L)	100	100	100	100	100	100
13C12-2,2',6,6'-TeCB (54L)	100	100	100	100	100	100
13C12-3,3',4,4'-TeCB (77L)	100	100	100	100	100	100
13C12-3,4,4',5'-TeCB (81L)	100	100	100	100	100	100
13C12-2,2',4,6,6'-PeCB (104L)	100	100	100	100	100	100
13C12-2,3,3',4,4'-PeCB (105L)	100	100	100	100	100	100
13C12-2,3,4,4',5'-PeCB (114L)	100	100	100	100	100	100
13C12-2,3',4,4',5'-PeCB (118L)	100	100	100	100	100	100
13C12-2',3,4,4',5'-PeCB (123L)	100	100	100	100	100	100
13C12-3,3',4,4',5'-PeCB (126L)	100	100	100	100	100	100
13C12-2,2',4,4',6,6'-HxCB (155L)	100	100	100	100	100	100
13C12-2,3,3',4,4',5'-HxCB (156L)	100	100	100	100	100	100
13C12-2,3,3',4,4',5'-HxCB (157L)	100	100	100	100	100	100
13C12-2,3',4,4',5,5'-HxCB (167L)	100	100	100	100	100	100
13C12-3,3',4,4',5,5'-HxCB (169L)	100	100	100	100	100	100
13C12-2,2',3,4',5,6,6'-HpCB (188L)	100	100	100	100	100	100
13C12-2,3,3',4,4',5,5'-HpCB (189L)	100	100	100	100	100	100
13C12-2,2',3,3',5,5',6,6'-OoCB (202L)	100	100	100	100	100	100

(CONTD)

13C12-2,3,3',4,4',5,5',6-OcCB (205L)	100	100	100	100	100	100
13C12-2,2',3,3',4,4',5,5',6-NoCB (206L)	100	100	100	100	100	100
13C12-2,2',3,3',4',5,5',6,6'-NoCB (208L)	100	100	100	100	100	100
13C12-DeCB (209L)	100	100	100	100	100	100
Cleanup Standards						
13C12-2,4,4'-TrCB (28L)	100	100	100	100	100	100
13C12-2,3,3',5,5'-PeCB (111L)	100	100	100	100	100	100
13C12-2,2',3,3',5,5',6-HpCB (178L)	100	100	100	100	100	100
Injection Standards						
13C12-2,5-DiCB (9L)	100	100	100	100	100	100
13C12-2,2',5,5'-TeCB (52L)	100	100	100	100	100	100
13C12-2,2',4',5,5'-PeCB (101L)	100	100	100	100	100	100
13C12-2,2',3',4,4',5'-HxCB (138L)	100	100	100	100	100	100
13C12-2,2',3,3',4,4',5,5'-OcCB (194L)	100	100	100	100	100	100

TABLE 5: LCS LIMITS

Method 1668A

Native Analytes	Lower %	Upper %
2-MoCB (1)	50	150
4-MoCB (3)	50	150
2,2'-DiCB (4)	50	150
4,4'-DiCB (15)	50	150
2,2',6'-TrCB (19)	50	150
3,4,4'-TrCB (37)	50	150
2,2',6,6'-TeCB (54)	50	150
3,3',4,4'-TeCB (77)	50	150
3,4,4',5-TeCB (81)	50	150
2,2',4,6,6'-PeCB (104)	50	150
2,3,3',4,4'-PeCB (105)	50	150
2,3,4,4',5-PeCB (114)	50	150
2,3',4,4',5-PeCB (118)	50	150
2',3,4,4',5-PeCB (123)	50	150
3,3',4,4',5-PeCB (126)	50	150
2,2',4,4',6,6'-HxCB (155)	50	150
2,3,3',4,4',5-HxCB (156)	50	150
2,3,3',4,4',5'-HxCB (157)	50	150
2,3',4,4',5,5'-HxCB (167)	50	150
3,3',4,4',5,5'-HxCB (169)	50	150
2,2',3,4',5,6,6'-HpCB (188)	50	150
2,3,3',4,4',5,5'-HpCB (189)	50	150
2,2',3,3',5,5',6,6'-OxCB (202)	50	150
2,3,3',4,4',5,5',6-OxCB (205)	50	150
2,2',3,3',4,4',5,5',6-NoCB (206)	50	150
2,2',3,3',4',5,5',6,6'-NoCB (208)	50	150
DeCB (209)	50	150

Extraction Standards	Lower %	Upper %
13C12-2-MoCB (1L)	15	140
13C12-4-MoCB (3L)	15	140
13C12-2,2'-DiCB (4L)	30	140
13C12-4,4'-DiCB (15L)	30	140
13C12-2,2',6'-TrCB (19L)	30	140
13C12-3,4,4'-TrCB (37L)	30	140
13C12-2,2',6,6'-TeCB (54L)	30	140
13C12-3,3',4,4'-TeCB (77L)	30	140
13C12-3,4,4',5-TeCB (81L)	30	140
13C12-2,2',4,6,6'-PeCB (104L)	30	140
13C12-2,3,3',4,4'-PeCB (105L)	30	140
13C12-2,3,4,4',5-PeCB (114L)	30	140
13C12-2,3',4,4',5-PeCB (118L)	30	140
13C12-2',3,4,4',5-PeCB (123L)	30	140
13C12-3,3',4,4',5-PeCB (126L)	30	140
13C12-2,2',4,4',6,6'-HxCB (155L)	30	140
13C12-2,3,3',4,4',5-HxCB (156L)	30	140
13C12-2,3,3',4,4',5'-HxCB (157L)	30	140
13C12-2,3',4,4',5,5'-HxCB (167L)	30	140
13C12-3,3',4,4',5,5'-HxCB (169L)	30	140
13C12-2,2',3,4',5,6,6'-HpCB (188L)	30	140
13C12-2,3,3',4,4',5,5'-HpCB (189L)	30	140
13C12-2,2',3,3',5,5',6,6'-OxCB (202L)	30	140
13C12-2,3,3',4,4',5,5',6-OxCB (205L)	30	140
13C12-2,2',3,3',4,4',5,5',6-NoCB (206L)	30	140
13C12-2,2',3,3',4',5,5',6,6'-NoCB (208L)	30	140
13C12-DeCB (209L)	30	140
Cleanup Standards		
13C12-2,4,4'-TrCB (28L)	40	125
13C12-2,3,3',5,5'-PeCB (111L)	40	125
13C12-2,2',3,3',5,5',6-HpCB (178L)	40	125

Method 1668C (LCS Limits)

Native Analytes	Lower	Upper
	%	%
2-MoCB (1)	60	135
4-MoCB (3)	60	135
2,2'-DiCB (4)	60	135
4,4'-DiCB (15)	60	135
2,2',6'-TrCB (19)	60	135
3,4,4'-TrCB (37)	60	135
2,2',6,6'-TeCB (54)	60	135
3,3',4,4'-TeCB (77)	60	135
3,4,4',5-TeCB (81)	60	135
2,2',4,6,6'-PeCB (104)	60	135
2,3,3',4,4'-PeCB (105)	60	135
2,3,4,4',5-PeCB (114)	60	135
2,3',4,4',5-PeCB (118)	60	135
2',3,4,4',5-PeCB (123)	60	135
3,3',4,4',5-PeCB (126)	60	135
2,2',4,4',6,6'-HxCB (155)	60	135
2,3,3',4,4',5-HxCB (156)	60	135
2,3,3',4,4',5'-HxCB (157)	60	135
2,3',4,4',5,5'-HxCB (167)	60	135
3,3',4,4',5,5'-HxCB (169)	60	135
2,2',3,4',5,6,6'-HpCB (188)	60	135
2,3,3',4,4',5,5'-HpCB (189)	60	135
2,2',3,3',5,5',6,6'-OxCB (202)	60	135
2,3,3',4,4',5,5',6-OxCB (205)	60	135
2,2',3,3',4,4',5,5',6-NoCB (206)	60	135
2,2',3,3',4',5,5',6,6'-NoCB (208)	60	135
DeCB (209)	60	135

Extraction Standards	Lower	Upper
	%	%
13C12-2-MoCB (1L)	15	145
13C12-4-MoCB (3L)	15	145
13C12-2,2'-DiCB (4L)	15	145
13C12-4,4'-DiCB (15L)	15	145
13C12-2,2',6'-TrCB (19L)	15	145
13C12-3,4,4'-TrCB (37L)	15	145
13C12-2,2',6,6'-TeCB (54L)	15	145
13C12-3,3',4,4'-TeCB (77L)	40	145
13C12-3,4,4',5-TeCB (81L)	40	145
13C12-2,2',4,6,6'-PeCB (104L)	40	145
13C12-2,3,3',4,4'-PeCB (105L)	40	145
13C12-2,3,4,4',5-PeCB (114L)	40	145
13C12-2,3',4,4',5-PeCB (118L)	40	145
13C12-2',3,4,4',5-PeCB (123L)	40	145
13C12-3,3',4,4',5-PeCB (126L)	40	145
13C12-2,2',4,4',6,6'-HxCB (155L)	40	145
13C12-2,3,3',4,4',5-HxCB (156L)	40	145
13C12-2,3,3',4,4',5'-HxCB (157L)	40	145
13C12-2,3',4,4',5,5'-HxCB (167L)	40	145
13C12-3,3',4,4',5,5'-HxCB (169L)	40	145
13C12-2,2',3,4',5,6,6'-HpCB (188L)	40	145
13C12-2,3,3',4,4',5,5'-HpCB (189L)	40	145
13C12-2,2',3,3',5,5',6,6'-OxCB (202L)	40	145
13C12-2,3,3',4,4',5,5',6-OxCB (205L)	40	145
13C12-2,2',3,3',4,4',5,5',6-NoCB (206L)	40	145
13C12-2,2',3,3',4',5,5',6,6'-NoCB (208L)	40	145
13C12-DeCB (209L)	40	145
Cleanup Standards		
13C12-2,4,4'-TrCB (28L)	15	145
13C12-2,3,3',5,5'-PeCB (111L)	40	145
13C12-2,2',3,3',5,5',6-HpCB (178L)	40	145

TABLE 6: SAMPLE AND LMB RECOVERY LIMITS

Method 1668A

Extraction Standards	Lower r %	Upper %
13C12-2-MoCB (1L)	15	150
13C12-4-MoCB (3L)	15	150
13C12-2,2'-DiCB (4L)	25	150
13C12-4,4'-DiCB (15L)	25	150
13C12-2,2',6'-TrCB (19L)	25	150
13C12-3,4,4'-TrCB (37L)	25	150
13C12-2,2',6,6'-TeCB (54L)	25	150
13C12-3,3',4,4'-TeCB (77L)	25	150
13C12-3,4,4',5'-TeCB (81L)	25	150
13C12-2,2',4,6,6'-PeCB (104L)	25	150
13C12-2,3,3',4,4'-PeCB (105L)	25	150
13C12-2,3,4,4',5'-PeCB (114L)	25	150
13C12-2,3',4,4',5'-PeCB (118L)	25	150
13C12-2',3,4,4',5'-PeCB (123L)	25	150
13C12-3,3',4,4',5'-PeCB (126L)	25	150
13C12-2,2',4,4',6,6'-HxCB (155L)	25	150
13C12-2,3,3',4,4',5'-HxCB (156L)	25	150
13C12-2,3,3',4,4',5'-HxCB (157L)	25	150
13C12-2,3',4,4',5,5'-HxCB (167L)	25	150
13C12-3,3',4,4',5,5'-HxCB (169L)	25	150
13C12-2,2',3,4',5,6,6'-HpCB (188L)	25	150
13C12-2,3,3',4,4',5,5'-HpCB (189L)	25	150
13C12-2,2',3,3',5,5',6,6'-OcCB (202L)	25	150
13C12-2,3,3',4,4',5,5',6-OcCB (205L)	25	150
13C12-2,2',3,3',4,4',5,5',6-NoCB (206L)	25	150
13C12-2,2',3,3',4',5,5',6,6'-NoCB (208L)	25	150
13C12-DeCB (209L)	25	150
Cleanup Standards		
13C12-2,4,4'-TrCB (28L)	30	135
13C12-2,3,3',5,5'-PeCB (111L)	30	135
13C12-2,2',3,3',5,5',6-HpCB (178L)	30	135

Method 1668C (Sample and LMB Recovery Limits)

Extraction Standards	Lower	Upper
	%	%
13C12-2-MoCB (1L)	5	145
13C12-4-MoCB (3L)	5	145
13C12-2,2'-DiCB (4L)	5	145
13C12-4,4'-DiCB (15L)	5	145
13C12-2,2',6'-TrCB (19L)	5	145
13C12-3,4,4'-TrCB (37L)	5	145
13C12-2,2',6,6'-TeCB (54L)	5	145
13C12-3,3',4,4'-TeCB (77L)	10	145
13C12-3,4,4',5'-TeCB (81L)	10	145
13C12-2,2',4,6,6'-PeCB (104L)	10	145
13C12-2,3,3',4,4'-PeCB (105L)	10	145
13C12-2,3,4,4',5'-PeCB (114L)	10	145
13C12-2,3',4,4',5'-PeCB (118L)	10	145
13C12-2',3,4,4',5'-PeCB (123L)	10	145
13C12-3,3',4,4',5'-PeCB (126L)	10	145
13C12-2,2',4,4',6,6'-HxCB (155L)	10	145
13C12-2,3,3',4,4',5'-HxCB (156L)	10	145
13C12-2,3,3',4,4',5'-HxCB (157L)	10	145
13C12-2,3',4,4',5,5'-HxCB (167L)	10	145
13C12-3,3',4,4',5,5'-HxCB (169L)	10	145
13C12-2,2',3,4',5,6,6'-HpCB (188L)	10	145
13C12-2,3,3',4,4',5,5'-HpCB (189L)	10	145
13C12-2,2',3,3',5,5',6,6'-OcCB (202L)	10	145
13C12-2,3,3',4,4',5,5',6-OcCB (205L)	10	145
13C12-2,2',3,3',4,4',5,5',6-NoCB (206L)	10	145
13C12-2,2',3,3',4',5,5',6,6'-NoCB (208L)	10	145
13C12-DeCB (209L)	10	145
Cleanup Standards		
13C12-2,4,4'-TrCB (28L)	5	145
13C12-2,3,3',5,5'-PeCB (111L)	10	145
13C12-2,2',3,3',5,5',6-HpCB (178L)	10	145

TABLE 7: CONTINUING CALIBRATION LIMITS (VER)
Methods 1668A

Native Analytes	Lower	Upper	Extraction Standards	Lower	Upper
%	%	%	%	%	%
2-MoCB (1)	70	130	13C12-2-MoCB (1L)	50	150
4-MoCB (3)	70	130	13C12-4-MoCB (3L)	50	150
2,2'-DiCB (4)	70	130	13C12-2,2'-DiCB (4L)	50	150
4,4'-DiCB (15)	70	130	13C12-4,4'-DiCB (15L)	50	150
2,2',6'-TrCB (19)	70	130	13C12-2,2',6'-TrCB (19L)	50	150
3,4,4'-TrCB (37)	70	130	13C12-3,4,4'-TrCB (37L)	50	150
2,2',6,6'-TeCB (54)	70	130	13C12-2,2',6,6'-TeCB (54L)	50	150
3,3',4,4'-TeCB (77)	70	130	13C12-3,3',4,4'-TeCB (77L)	50	150
3,4,4',5-TeCB (81)	70	130	13C12-3,4,4',5-TeCB (81L)	50	150
2,2',4,6,6'-PeCB (104)	70	130	13C12-2,2',4,6,6'-PeCB (104L)	50	150
2,3,3',4,4'-PeCB (105)	70	130	13C12-2,3,3',4,4'-PeCB (105L)	50	150
2,3,4,4',5-PeCB (114)	70	130	13C12-2,3,4,4',5-PeCB (114L)	50	150
2,3',4,4',5-PeCB (118)	70	130	13C12-2,3',4,4',5-PeCB (118L)	50	150
2',3,4,4',5-PeCB (123)	70	130	13C12-2',3,4,4',5-PeCB (123L)	50	150
3,3',4,4',5-PeCB (126)	70	130	13C12-3,3',4,4',5-PeCB (126L)	50	150
2,2',4,4',6,6'-HxCB (155)	70	130	13C12-2,2',4,4',6,6'-HxCB (155L)	50	150
2,3,3',4,4',5-HxCB (156)	70	130	13C12-2,3,3',4,4',5-HxCB (156L)	50	150
2,3,3',4,4',5'-HxCB (157)	70	130	13C12-2,3,3',4,4',5'-HxCB (157L)	50	150
2,3',4,4',5,5'-HxCB (167)	70	130	13C12-2,3',4,4',5,5'-HxCB (167L)	50	150
3,3',4,4',5,5'-HxCB (169)	70	130	13C12-3,3',4,4',5,5'-HxCB (169L)	50	150
2,2',3,4',5,6,6'-HpCB (188)	70	130	13C12-2,2',3,4',5,6,6'-HpCB (188L)	50	150
2,3,3',4,4',5,5'-HpCB (189)	70	130	13C12-2,3,3',4,4',5,5'-HpCB (189L)	50	150
2,2',3,3',5,5',6,6'-OoCB (202)	70	130	13C12-2,2',3,3',5,5',6,6'-OoCB (202L)	50	150
2,3,3',4,4',5,5',6-OoCB (205)	70	130	13C12-2,3,3',4,4',5,5',6-OoCB (205L)	50	150
2,2',3,3',4,4',5,5',6-NoCB (206)	70	130	13C12-2,2',3,3',4,4',5,5',6-NoCB (206L)	50	150
2,2',3,3',4',5,5',6,6'-NoCB (208)	70	130	13C12-2,2',3,3',4',5,5',6,6'-NoCB (208L)	50	150
DeCB (209)	70	130	13C12-DeCB (209L)	50	150
			Cleanup Standards		
			13C12-2,4,4'-TrCB (28L)	60	130
			13C12-2,3,3',5,5'-PeCB (111L)	60	130
			13C12-2,2',3,3',5,5',6-HpCB (178L)	60	130

Method 1668C Continuing Calibration Limit (VER)

Native Analytes	Lower %	Upper %
2-MoCB (1)	75	125
4-MoCB (3)	75	125
2,2'-DiCB (4)	75	125
4,4'-DiCB (15)	75	125
2,2',6'-TrCB (19)	75	125
3,4,4'-TrCB (37)	75	125
2,2',6,6'-TeCB (54)	75	125
3,3',4,4'-TeCB (77)	75	125
3,4,4',5'-TeCB (81)	75	125
2,2',4,6,6'-PeCB (104)	75	125
2,3,3',4,4'-PeCB (105)	75	125
2,3,4,4',5'-PeCB (114)	75	125
2,3',4,4',5'-PeCB (118)	75	125
2',3,4,4',5'-PeCB (123)	75	125
3,3',4,4',5'-PeCB (126)	75	125
2,2',4,4',6,6'-HxCB (155)	75	125
2,3,3',4,4',5'-HxCB (156)	75	125
2,3,3',4,4',5'-HxCB (157)	75	125
2,3',4,4',5,5'-HxCB (167)	75	125
3,3',4,4',5,5'-HxCB (169)	75	125
2,2',3,4',5,6,6'-HpCB (188)	75	125
2,3,3',4,4',5,5'-HpCB (189)	75	125
2,2',3,3',5,5',6,6'-OcCB (202)	75	125
2,3,3',4,4',5,5',6'-OcCB (205)	75	125
2,2',3,3',4,4',5,5',6'-NoCB (206)	75	125
2,2',3,3',4',5,5',6,6'-NoCB (208)	75	125
DeCB (209)	75	125
Extraction Standards	Lower %	Upper %
13C12-2-MoCB (1L)	50	145
13C12-4-MoCB (3L)	50	145
13C12-2,2'-DiCB (4L)	50	145
13C12-4,4'-DiCB (15L)	50	145
13C12-2,2',6'-TrCB (19L)	50	145
13C12-3,4,4'-TrCB (37L)	50	145
13C12-2,2',6,6'-TeCB (54L)	50	145
13C12-3,3',4,4'-TeCB (77L)	50	145
13C12-3,4,4',5'-TeCB (81L)	50	145
13C12-2,2',4,6,6'-PeCB (104L)	50	145
13C12-2,3,3',4,4'-PeCB (105L)	50	145
13C12-2,3,4,4',5'-PeCB (114L)	50	145
13C12-2,3',4,4',5'-PeCB (118L)	50	145
13C12-2',3,4,4',5'-PeCB (123L)	50	145
13C12-3,3',4,4',5'-PeCB (126L)	50	145
13C12-2,2',4,4',6,6'-HxCB (155L)	50	145
13C12-2,3,3',4,4',5'-HxCB (156L)	50	145
13C12-2,3,3',4,4',5'-HxCB (157L)	50	145
13C12-2,3',4,4',5,5'-HxCB (167L)	50	145
13C12-3,3',4,4',5,5'-HxCB (169L)	50	145
13C12-2,2',3,4',5,6,6'-HpCB (188L)	50	145
13C12-2,3,3',4,4',5,5'-HpCB (189L)	50	145
13C12-2,2',3,3',5,5',6,6'-OcCB (202L)	50	145
13C12-2,3,3',4,4',5,5',6'-OcCB (205L)	50	145
13C12-2,2',3,3',4,4',5,5',6'-NoCB (206L)	50	145
13C12-2,2',3,3',4',5,5',6,6'-NoCB (208L)	50	145
13C12-DeCB (209L)	50	145
Cleanup Standards		
13C12-2,4,4'-TrCB (28L)	65	135
13C12-2,3,3',5,5'-PeCB (111L)	75	125
13C12-2,2',3,3',5,5',6'-HpCB (178L)	75	125

TABLE 8: RETENTION TIME LIMITS (and example relative retention time limits)

Reference 209 Mix Analyte	Example RT		Example RT Ref		Window (sec)		Example Resulting RRT Limits
	(min)	RT Ref	(min)		low	high	
MoCB-1	6.99	1L	6.98		-3	3	0.994 - 1.009
MoCB-2	8.64	3L	8.77		-3	3	0.979 - 0.991
MoCB-3	8.78	3L	8.77		-3	3	0.995 - 1.007
DiCB-4	8.99	4L	8.97		-3	3	0.997 - 1.008
DiCB-10	9.13	4L	8.97		-3	3	1.012 - 1.023
DiCB-9	10.65	4L	8.97		-3	3	1.182 - 1.193
DiCB-7	10.80	4L	8.97		-3	3	1.198 - 1.210
DiCB-6	11.01	4L	8.97		-3	3	1.222 - 1.233
DiCB-5	11.27	4L	8.97		-3	3	1.251 - 1.262
DiCB-8	11.38	4L	8.97		-3	3	1.263 - 1.274
DiCB-14	12.87	15L	14.25		-3	3	0.900 - 0.907
DiCB-11	13.66	15L	14.25		-3	3	0.955 - 0.962
DiCB-13/12	13.98	15L	14.25		-3	3	0.978 - 0.985
DiCB-15	14.26	15L	14.25		-3	3	0.997 - 1.004
TrCB-19	11.66	19L	11.65		-3	3	0.997 - 1.005
TrCB-18/30	13.35	19L	11.65		-3	3	1.142 - 1.150
TrCB-17	13.77	19L	11.65		-3	3	1.178 - 1.186
TrCB-27	13.96	19L	11.65		-3	3	1.194 - 1.203
TrCB-24	14.11	19L	11.65		-3	3	1.207 - 1.215
TrCB-16	14.22	19L	11.65		-3	3	1.216 - 1.225
TrCB-32	14.72	19L	11.65		-3	3	1.259 - 1.268
TrCB-34	15.98	19L	11.65		-3	3	1.367 - 1.376
TrCB-23	16.16	19L	11.65		-3	3	1.383 - 1.391
TrCB-26/29	16.49	19L	11.65		-5	5	1.408 - 1.423
TrCB-25	16.71	37L	21.93		-3	3	0.760 - 0.764
TrCB-31	17.04	37L	21.93		-3	3	0.775 - 0.779
TrCB-20/28	17.38	37L	21.93		-5	5	0.789 - 0.796
TrCB-21/33	17.61	37L	21.93		-5	5	0.799 - 0.807
TrCB-22	18.06	37L	21.93		-3	3	0.821 - 0.826
TrCB-36	19.81	37L	21.93		-3	3	0.901 - 0.906
TrCB-39	20.23	37L	21.93		-3	3	0.920 - 0.925
TrCB-38	20.93	37L	21.93		-3	3	0.952 - 0.957
TrCB-35	21.47	37L	21.93		-3	3	0.977 - 0.981
TrCB-37	21.96	37L	21.93		-3	3	0.999 - 1.004
TeCB-54	14.58	54L	14.55		-3	3	0.999 - 1.005
TeCB-50/53	16.77	54L	14.55		-5	5	1.147 - 1.158
TeCB-45/51	17.56	54L	14.55		-5	5	1.201 - 1.213

Analysis of PCBs by HRGC/HRMS

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TeCB-46	17.82	54L	14.55	-3	3	1.221	-	1.228
TeCB-52	19.38	54L	14.55	-3	3	1.329	-	1.335
TeCB-73	19.54	54L	14.55	-3	3	1.340	-	1.346
TeCB-43	19.67	54L	14.55	-3	3	1.348	-	1.355
TeCB-69/49	19.92	54L	14.55	-5	5	1.363	-	1.375
TeCB-48	20.29	54L	14.55	-3	3	1.391	-	1.398
TeCB-44/65/47	20.59	54L	14.55	-5	5	1.409	-	1.421
TeCB-59/62/75	20.93	54L	14.55	-5	5	1.433	-	1.444
TeCB-42	21.17	54L	14.55	-3	3	1.452	-	1.458
TeCB-41	21.63	54L	14.55	-5	5	1.481	-	1.492
TeCB-40/71	21.76	54L	14.55	-5	5	1.490	-	1.501
TeCB-64	22.03	54L	14.55	-3	3	1.511	-	1.518
TeCB-72	23.04	81L	30.73	-3	3	0.748	-	0.751
TeCB-68	23.40	81L	30.73	-3	3	0.760	-	0.763
TeCB-57	23.93	81L	30.73	-3	3	0.777	-	0.780
TeCB-58	24.23	81L	30.73	-3	3	0.787	-	0.790
TeCB-67	24.45	81L	30.73	-3	3	0.794	-	0.797
TeCB-63	24.79	81L	30.73	-3	3	0.805	-	0.808
TeCB-61/76/70/74	25.20	81L	30.73	-6	6	0.817	-	0.823
TeCB-66	25.63	81L	30.73	-3	3	0.832	-	0.836
TeCB-55	25.84	81L	30.73	-3	3	0.839	-	0.842
TeCB-56	26.49	81L	30.73	-3	3	0.860	-	0.864
TeCB-60	26.78	81L	30.73	-3	3	0.870	-	0.873
TeCB-80	27.34	81L	30.73	-3	3	0.888	-	0.891
TeCB-79	29.39	81L	30.73	-3	3	0.955	-	0.958
TeCB-78	30.16	81L	30.73	-3	3	0.980	-	0.983
TeCB-81 WHO	30.76	81L	30.73	-3	3	0.999	-	1.003
TeCB-77 WHO	31.54	77L	31.51	-3	3	0.999	-	1.003
PeCB-104	20.51	104L	20.48	-3	3	0.999	-	1.004
PeCB-96	20.93	104L	20.48	-5	5	1.018	-	1.026
PeCB-103	23.28	104L	20.48	-3	3	1.134	-	1.139
PeCB-94	23.55	104L	20.48	-3	3	1.147	-	1.152
PeCB-95	24.09	104L	20.48	-5	5	1.172	-	1.180
PeCB-93/100	24.39	104L	20.48	-5	5	1.187	-	1.195
PeCB-102/98	24.57	104L	20.48	-5	5	1.196	-	1.204
PeCB-88/91	25.19	104L	20.48	-6	6	1.225	-	1.235
PeCB-84	25.47	104L	20.48	-3	3	1.241	-	1.246
PeCB-89	26.10	104L	20.48	-3	3	1.272	-	1.277
PeCB-121	26.67	104L	20.48	-3	3	1.300	-	1.305
PeCB-92	27.15	123L	34.37	-3	3	0.788	-	0.791
PeCB-113/90/101	27.91	123L	34.37	-5	5	0.810	-	0.814
PeCB-83	28.55	123L	34.37	-6	6	0.828	-	0.834
PeCB-99	28.72	123L	34.37	-5	5	0.833	-	0.838

PeCB-112	28.87	123L	34.37	-3	3	0.839	-	0.841
PeCB-86/87/97/109/119/125	29.38	123L	34.37	-8	8	0.851	-	0.859
PeCB-117/116/85	30.38	123L	34.37	-5	5	0.881	-	0.886
PeCB-110/115	30.73	123L	34.37	-5	5	0.892	-	0.897
PeCB-82	31.05	123L	34.37	-3	3	0.902	-	0.905
PeCB-111	31.62	123L	34.37	-3	3	0.919	-	0.921
PeCB-120	32.28	123L	34.37	-3	3	0.938	-	0.941
PeCB-108/124	33.88	123L	34.37	-8	8	0.982	-	0.990
PeCB-107	34.23	123L	34.37	-5	5	0.994	-	0.998
PeCB-123 WHO	34.40	123L	34.37	-3	3	0.999	-	1.002
PeCB-106	34.56	123L	34.37	-3	3	1.004	-	1.007
PeCB-118 WHO	34.86	118L	34.85	-3	3	0.999	-	1.002
PeCB-122	35.36	118L	34.85	-3	3	1.013	-	1.016
PeCB-114 WHO	35.64	114L	35.60	-3	3	1.000	-	1.003
PeCB-105 WHO	36.57	105L	36.54	-3	3	0.999	-	1.002
PeCB-127	38.78	105L	36.54	-3	3	1.060	-	1.063
PeCB-126 WHO	41.17	126L	41.14	-3	3	1.000	-	1.002
HxCB-155	27.64	155L	27.61	-3	3	0.999	-	1.003
HxCB-152	27.88	155L	27.61	-3	3	1.008	-	1.012
HxCB-150	28.12	155L	27.61	-3	3	1.017	-	1.020
HxCB-136	28.58	155L	27.61	-3	3	1.033	-	1.037
HxCB-145	29.00	155L	27.61	-3	3	1.049	-	1.052
HxCB-148	31.10	155L	27.61	-3	3	1.125	-	1.128
HxCB-151/135	31.94	155L	27.61	-5	5	1.154	-	1.160
HxCB-154	32.29	155L	27.61	-5	5	1.166	-	1.173
HxCB-144	32.72	155L	27.61	-3	3	1.183	-	1.187
HxCB-147/149	33.22	155L	27.61	-5	5	1.200	-	1.206
HxCB-134	33.48	155L	27.61	-5	5	1.210	-	1.216
HxCB-143	33.64	155L	27.61	-5	5	1.215	-	1.221
HxCB-139/140	34.08	155L	27.61	-5	5	1.231	-	1.237
HxCB-131	34.35	155L	27.61	-3	3	1.242	-	1.246
HxCB-142	34.58	155L	27.61	-3	3	1.251	-	1.254
HxCB-132	35.01	155L	27.61	-5	5	1.265	-	1.271
HxCB-133	35.77	155L	27.61	-3	3	1.294	-	1.297
HxCB-165	36.36	167L	44.03	-3	3	0.825	-	0.827
HxCB-146	36.73	167L	44.03	-3	3	0.833	-	0.835
HxCB-161	36.92	167L	44.03	-3	3	0.837	-	0.840
HxCB-153/168	37.68	167L	44.03	-5	5	0.854	-	0.858
HxCB-141	37.89	167L	44.03	-3	3	0.859	-	0.862
HxCB-130	38.49	167L	44.03	-3	3	0.873	-	0.875
HxCB-137	38.85	167L	44.03	-3	3	0.881	-	0.883
HxCB-164	39.00	167L	44.03	-3	3	0.885	-	0.887

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HxCB-138/163/129	39.48	167L	44.03	-7	7	0.894 - 0.899
HxCB-160	39.71	167L	44.03	-5	5	0.900 - 0.904
HxCB-158	40.06	167L	44.03	-3	3	0.909 - 0.911
HxCB-128/166	41.31	167L	44.03	-5	5	0.936 - 0.940
HxCB-159	42.90	167L	44.03	-3	3	0.973 - 0.975
HxCB-162	43.33	167L	44.03	-3	3	0.983 - 0.985
HxCB-167 WHO	44.06	167L	44.03	-3	3	1.000 - 1.002
HxCB-156/157 WHO	45.81	156L	45.76	-3	3	1.000 - 1.002
HxCB-169 WHO	50.88	169L	50.83	-3	3	1.000 - 1.002
HpCB-188	35.64	188L	35.61	-3	3	0.999 - 1.002
HpCB-179	36.11	188L	35.61	-3	3	1.013 - 1.015
HpCB-184	36.92	188L	35.61	-3	3	1.035 - 1.038
HpCB-176	37.41	188L	35.61	-3	3	1.049 - 1.052
HpCB-186	38.08	188L	35.61	-3	3	1.068 - 1.071
HpCB-178	40.17	188L	35.61	-3	3	1.127 - 1.129
HpCB-175	41.12	188L	35.61	-3	3	1.153 - 1.156
HpCB-187	41.54	188L	35.61	-3	3	1.165 - 1.168
HpCB-182	41.86	188L	35.61	-3	3	1.174 - 1.177
HpCB-183/185	42.48	188L	35.61	-3	3	1.192 - 1.194
HpCB-174	42.80	188L	35.61	-3	3	1.201 - 1.203
HpCB-177	43.47	188L	35.61	-3	3	1.219 - 1.222
HpCB-181	44.09	188L	35.61	-3	3	1.237 - 1.240
HpCB-173/171	44.41	188L	35.61	-5	5	1.245 - 1.249
HpCB-172	46.99	189L	54.86	-3	3	0.856 - 0.857
HpCB-192	47.42	189L	54.86	-3	3	0.863 - 0.865
HpCB-193/180	47.93	189L	54.86	-3	3	0.873 - 0.875
HpCB-191	48.55	189L	54.86	-3	3	0.884 - 0.886
HpCB-170	49.94	189L	54.86	-3	3	0.909 - 0.911
HpCB-190	50.77	189L	54.86	-3	3	0.925 - 0.926
HpCB-189 WHO	54.89	189L	54.86	-3	3	1.000 - 1.001
OcCB-202	43.68	202L	43.65	-3	3	1.000 - 1.002
OcCB-201	45.11	202L	43.65	-5	5	1.032 - 1.035
OcCB-204	46.16	202L	43.65	-3	3	1.056 - 1.059
OcCB-197/200	46.51	202L	43.65	-3	3	1.064 - 1.067
OcCB-198/199	51.05	202L	43.65	-5	5	1.168 - 1.171
OcCB-196	52.12	205L	58.97	-3	3	0.883 - 0.885
OcCB-203	52.44	205L	58.97	-3	3	0.888 - 0.890
OcCB-195	54.48	205L	58.97	-3	3	0.923 - 0.925
OcCB-194	58.26	205L	58.97	-3	3	0.987 - 0.989
OcCB-205	59.00	205L	58.97	-3	3	1.000 - 1.001
NoCB-208	54.14	208L	54.11	-3	3	1.000 - 1.001
NoCB-207	55.63	208L	54.11	-3	3	1.027 - 1.029
NoCB-206	61.88	206L	61.85	-3	3	1.000 - 1.001

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DeCB-209	64.86	209L	64.81	-3	3	1.000 - 1.002
MoCB-1L	6.98	9L	10.63	-15	15	0.633 - 0.680
MoCB-3L	8.77	9L	10.63	-15	15	0.802 - 0.849
DiCB-4L	8.97	9L	10.63	-15	15	0.820 - 0.867
DiCB-15L	14.25	9L	10.63	-10	10	1.325 - 1.356
TrCB-19L	11.65	9L	10.63	-15	15	1.072 - 1.119
TrCB-37L	21.93	52L	19.37	-15	15	1.119 - 1.145
TeCB-54L	14.55	52L	19.37	-10	10	0.743 - 0.760
TeCB-81L	30.73	52L	19.37	-10	10	1.578 - 1.595
TeCB-77L	31.51	52L	19.37	-10	10	1.618 - 1.635
PeCB-104L	20.48	101L	27.90	-10	10	0.728 - 0.740
PeCB-123L	34.37	101L	27.90	-10	10	1.226 - 1.238
PeCB-118L	34.85	101L	27.90	-10	10	1.243 - 1.255
PeCB-114L	35.60	101L	27.90	-10	10	1.270 - 1.282
PeCB-105L	36.54	101L	27.90	-10	10	1.304 - 1.316
PeCB-126L	41.14	101L	27.90	-10	10	1.469 - 1.481
HxCB-155L	27.61	138L	39.43	-10	10	0.696 - 0.704
HxCB-167L	44.03	138L	39.43	-10	10	1.112 - 1.121
HxCB-156L/157L	45.76	138L	39.43	-10	10	1.156 - 1.165
HxCB-169L	50.83	138L	39.43	-10	10	1.285 - 1.293
HpCB-188L	35.61	194L	58.23	-10	10	0.609 - 0.614
HpCB-189L	54.86	194L	58.23	-10	10	0.939 - 0.945
OcCB-202L	43.65	194L	58.23	-10	10	0.747 - 0.752
OcCB-205L	58.97	194L	58.23	-15	15	1.008 - 1.017
NoCB-208L	54.11	194L	58.23	-10	10	0.926 - 0.932
NoCB-206L	61.85	194L	58.23	-15	15	1.058 - 1.066
DeCB-209L	64.81	194L	58.23	-15	15	1.109 - 1.117
TrCB-28L CU	17.35	9L	19.37	-10	10	0.887 - 0.904
PeCB-111L CU	31.59	101L	27.90	-10	10	1.126 - 1.138
HpCB-178L CU	40.12	138L	39.43	-10	10	1.013 - 1.022
DiCB-9L IS	10.63	138L	39.43	-12.5	12.5	0.264 - 0.275
TeCB-52L IS	19.37	138L	39.43	-12.5	12.5	0.486 - 0.497
PeCB-101L IS	27.90	138L	39.43	-12.5	12.5	0.702 - 0.713
HxCB-138L IS	39.43	138L	39.43	-50	50	0.979 - 1.021
OcCB-194 IS	58.23	138L	39.43	-12.5	12.5	1.472 - 1.482

The retention time limits are applied to the daily 209 mix resulting in RRT limits for calibrations and samples, including QC samples.

OcCB-194 IS upper limit example: $(58.23 + (12.5/60))/39.43 = 1.482$

TABLE 9: METHOD HOLDING TIMES

Method	Collection to Extraction	Extraction to Analysis
8290A *	30 days	45 days
1613B	365 days	365 days
DLM02.2	365 days	365 days
M23	30 days	45 days
TO-9a	7 days	40 days
CBC01.2	35 days collect to analysis	
1668A/C	365 days	365 days

* NOTE: The holding times listed in method 8290 are recommendations. PCDDs and PCDFs are very stable in a variety of matrices, and holding times under the conditions listed in this section may be as long as a year for certain matrices.

Determination of Polychlorinated Biphenyls (PCBs) as Aroclors or Congeners by Gas Chromatography/Electron Capture Detection (GC/ECD)

References: Method 8082A, Rev. 1, February 2007 and Method 8000C Test Methods for Evaluating Solid Waste, SW-846, Third Edition, Final update III, December 1996 (USEPA, Office of Solid Waste and Emergency Response, Washington, DC).

Quality Assurance and Quality Control for SW-846 Method 8082, Polychlorinated Biphenyls (PCBs) by Gas Chromatography (GC) for the Massachusetts Contingency Plan (MCP)

Compendium Method TO10A – Determination of Pesticides and PCBs in Ambient Air Using Low Volume Polyurethane Foam (PUF) Sampling Followed by GC/ECD Detection

1. Scope and Application

Matrices: Water, soil, sediment, sludge, product, PUF, and tissue (either animal or vegetable)

Definitions: Refer to Alpha Analytical Quality Manual.

This method is applicable to the analysis and quantification of sample extracts for Polychlorinated Biphenyls (PCBs) as Aroclors or Congeners as well as Total PCB by gas chromatography/electron capture detector. See Table I for the target compound list of PCB as Aroclors and PCB Congeners with CAS Registry Number included. The sensitivity of the method usually depends on the concentration of interferences rather than on instrumental limitations. If interferences prevent detection of the analytes, the method may also be performed on samples that have undergone cleanup.

Quantitation of PCBs as Aroclors is appropriate for many regulatory compliance determinations, but is particularly difficult when the Aroclors have been weathered by long exposure in the environment. Therefore, the 8082 method provides procedures for the determination of selected individual PCB Congeners and should be used depending on regulatory requirements and project needs. The PCB Congener approach potentially affords greater quantitative accuracy when PCBs are known to be present. The PCB Congener method is of particular value in determining weathered Aroclors. Caution should be used when using the PCB Congener method where regulatory requirements are based on Aroclor concentrations. The base list of components can be found in Table I. Additional congeners may be added to this base list of targets. Additional targets must be run under the same GC conditions to document retention times on both analytical columns. Congeners may be added without additional method proficiency demonstration.

The following extraction and cleanup methods may apply, prior to sample analysis:

- *Extraction of Water Samples by Separatory Funnel* (2156),
- *Microscale Solvent Extraction - 3570* (2172)
- *Soxhlet Extraction* (2173)
- *Soxhlet Extraction of PUFs* (2167)
- *Tissue Preparation and Homogenization* (2166),
- *Shaker Table Extraction* (2261),
- *Sulfur Cleanup* (2168),
- *Sulfuric Acid Cleanup* (2169),
- *Silica Gel cleanup* (2170)
- *GPC Cleanup by HPLC* (2167)

The data report packages present the documentation of any method modification related to the samples tested. Depending upon the nature of the modification and the extent of intended use, the laboratory may be required to demonstrate that the modifications will produce equivalent results for the matrix. Approval of all method modifications is by one or more of the following laboratory personnel before performing the modification: Area Supervisor, Department Supervisor, Laboratory Director, or Quality Assurance Officer.

This method is restricted to use by or under the supervision of analysts experienced in the operation of the GC-ECD and in the interpretation of GC-ECD data. Each analyst must demonstrate the ability to generate acceptable results with this method by performing an initial demonstration of capability.

2. Summary of Method

Sample extracts are analyzed on a gas chromatograph which is fitted with two capillary columns of differing polarities each employing separate detectors. The extracts of PCB Congeners are spiked with internal standard prior to analysis. The target analytes are resolved on each column and detected using an electron capture detector (ECD). Analytes are introduced into the GC/ECD by injecting a known volume of the calibration standards, quality control samples, and sample extracts into the GC which is temperature and flow programmed to separate the analytes. Identification of target analytes is accomplished by confirming a target hit on two dissimilar columns using Retention Time (RT) and Pattern Recognition (PR). Concentrations are calculated from the ECD response using either external (for PCB Aroclors) or internal (PCB Congeners) standard techniques. For all PCB Aroclors, the concentrations are derived from a multi-level calibration curve, either linear using a least square regression, or non-linear. For PCB Congeners, the concentrations are determined using mean Relative Response Factor derived from multi-level calibration curve. Alternatively, different calibration models may be employed for either Congeners or Aroclors.

2.1 Method Modifications from Reference

None.

3. Reporting Limits

Generally, the Reporting Limit for aqueous samples is 0.02 ug/L for individual Aroclors and 0.001 ug/L for individual Congeners. This value is based on a 1mL final volume and 500 or 1000 mL of sample extracted. The Reporting Limit for solid/tissue samples is 4 ug/Kg for individual Aroclors and 0.2 ug/Kg or for individual Congeners, based on 1 mL final volume and 5 g of the sample extracted (wet weight) using extraction method 3570 (MSE). Utilizing extraction method 3540C (Soxhlets) the achievable RL for client samples at a 30g extraction weight is 1.33 ug/Kg or for individual Congeners, based on 4 mL final volume. The Reporting Limit for Aroclors in PUF air samples is 20-100ng/PUF cartridge, based on the Soxhlet extraction of one low volume PUF and a final volume of 1mL. Detection limits will vary with the individual sample matrix, sample preparation procedures, instrument calibration range, and volume of sample analyzed.

4. Interferences

- 4.1 Contaminants in solvents, reagents, glassware, syringes, and other sample processing hardware may cause interferences that lead to discrete artifacts, biases, and/or elevated baselines. Demonstrate that all of these materials are free from interferences under the conditions of the preparation and analysis by extracting and analyzing a laboratory method blank with each batch of up to 20 samples. Also new solvent lots are prescreened and approved by GC/ECD analyst prior to use. All glassware and equipment should be properly cleaned and solvent rinsed prior to use. Never use any glassware, or other implements such as syringes, on multiple samples within the batch unless there has been thorough cleaning and decontamination between samples.

- 4.2** Contaminants co-extracted from the sample may cause matrix interferences. The extent of matrix interferences will vary considerably from sample to sample, depending upon the nature of the environment and matrix being investigated. In some cases depending on the severity of the observed interferences, a target hit on one column may be biased high when interfered with. Skilled analyst judgment is imperative in determining if a chromatographic peak appears interfered with. In these cases the non-interfered, non-biased hit can be forced for reporting purposes providing a more suitable value. In extreme cases of interference additional cleanups can be employed, or it may be necessary to analytically re-run the sample at a dilution.
- 4.3** The ECD is theoretically a halogen specific detector. However, phthalate esters can be a major source of contamination in that they do respond to the ECD and can interfere with accurate determination of the analytes of interest. No forms of plastic or any material containing plasticizers (phthalates) should be used in conjunction with any part of this analysis.
- 4.4** Elemental sulfur is readily extracted from soil samples and may cause chromatographic interferences in the determination of pesticides. Sulfur can be removed through the use of Method 3660B. In addition, all samples for PCB analysis are acid cleaned following Method 3665A. Associated SOPs are noted in Section 1.0, above.
- 4.5** Care must be taken to ensure a complete hexane exchange is performed on the extract, because residual methylene chloride would be an interferent in the analysis. Residual methylene chloride can also damage the electron capture detectors.
- 4.6** The injector system of the gas chromatograph can become contaminated with non-volatile components from samples. This can act to decrease the resolution and responsiveness of the system. Maintenance of the analytical system should be performed when system performance degrades (liner changes, injection port cleaning, etc.) to avoid prolonged down time.
- 4.7** Aldol condensation products (4-methyl-4-hydroxy-2-pentanone and 4-methyl-3-pentene-2-one) can arise during soil extraction when using methylene chloride:acetone. These products may interfere with detection of analytes and should be monitored.
- 4.8** Raw GC data from all blanks, samples, and spikes must be evaluated for interferences or carryover. Contamination by carryover can occur whenever high-concentration and low-concentration samples are sequentially analyzed.
- 4.9** Oven-drying of glassware used for PCB analysis can increase contamination because PCBs are readily volatilized in the oven and spread to other glassware. Therefore, exercise caution, and do not dry glassware from samples containing high concentrations of PCBs with glassware that may be used for trace analyses, unless glassware has undergone meticulous cleaning.
- 4.10** Per method 8082A each analytical column analyzing for PCB congeners must be evaluated for the presence of coelutions amongst PCB congeners with pesticides. An aliquot of PCB congeners/pesticide LCS solution is prepared and analyzed routinely on each analytical column in the laboratory. The subsequent coelutions of these compounds are documented and stored internally in the "ECD Standard Verification Logbook" within the facility.

5. Health and Safety

The toxicity or carcinogenicity of each reagent and standard used in this method is not fully established; however, each chemical compound should be treated as a potential health hazard. From this viewpoint, exposure to these chemicals must be reduced to the lowest possible level by whatever means available. A reference file of material safety data sheets is available to all personnel involved in the chemical analysis. Additional references to laboratory safety are available in the Chemical Hygiene Plan.

All personnel handling environmental samples known to contain or to have been in contact with municipal waste must follow safety practices for handling known disease causative agents.

6. Sample Collection, Preservation, Shipping and Handling

6.1 Sample Collection

Aqueous samples are collected in 500mL, 1L or 2L amber glass bottles and stored without preservative at 4°C

1-5g of tissue sample are required.

Soil/sediment samples are collected in 4oz. glass soil jars,

Air PUF samples are collected following the guidance in reference method TO-10A Compendium.

6.2 Sample Preservation

Aqueous and Air PUF samples are stored without preservative at 4°C

Tissue Samples are stored at 4°C, or if desired, frozen.

Soil/sediment samples are stored at 4°C, or if desired, frozen.

6.3 Sample Shipping

No special shipping requirements.

6.4 Sample Handling

The hold time for this method is 7 days for the extraction of aqueous and Air PUF samples, and 14 days for the extraction of solid and tissue samples. If a sediment or tissue samples are frozen, this suspends the holding time until removal from the freezer. All extracts must be analyzed within 40 days of the extraction date.

7. Equipment and Supplies

7.1 Gas Chromatograph: The instrumentation is a temperature-programmable gas chromatograph with heating range from 40°C to 325°C and splitless-type inlet system with electron capture detectors (Hewlett-Packard HP 5890 Series II GC, HP 6890 Plus, or similar).

7.1.1 The injection port is designed for splitless injection onto a capillary column. The injection port utilizes a uniliner for direct injection, to decrease the potential for breakdown of compounds in the injection port and to increase sensitivity. These uniliners are used in place of the standard splitless liners. The 6890 model requires a drilled uniliner due to Electronic pressure control. The injection port will require maintenance on an as needed basis if degradation or contamination is apparent.

7.1.2 Columns and supplies:

7.1.2.1 Restek's proprietary "RTX-5" Stationary Phase, 60m length x 0.25mm ID, 0.25µm film thickness - Restek Corporation, PN 10226, or equivalent.

7.1.2.2 Restek's proprietary "RTX-CLPesticide II" Stationary Phase, 60m length x 0.25mm ID, 0.2µm film thickness - Restek Corporation, PN 11326, or equivalent.

7.1.2.3 Guard column, deactivated fused silica phenyl-methyl, 5 m x 0.32 mm ID. Restek PN 10027 or equivalent.

7.1.2.4 The flow from the guard column can be split between the two analytical columns using a Siltek MXT-Y connector Restek PN 20396

7.1.3 The GC/ECD utilizes one injector with guard column sealed to the uniliner inside the injection port. Connector splits the guard column into the two dissimilar columns listed above. Each column is then attached to a separate detector. Rtx-5 is always the front detector column and the CLP II is the back detector column.

7.2 **Autosampler:** Adapted onto the Gas Chromatograph. Model is HP 6890 series autosampler with a GC autosampler controller and HP 5890 series autosampler with controller, or equivalent.

7.3 **Computer:** With Windows NT operating software utilizing HP Enviroquant G1701BA Version B.01.00 software.

7.4 **Gases:** Hydrogen, ultra high purity grade (99.9999% pure) and Nitrogen of equivalent purity. Hydrogen is generally supplied by a Proton Hogen GC 600 Hydrogen generator.

7.5 **Glassware:** Assorted Class-A volumetric flasks consisting of 5mL through 200mL flasks with ground-glass stoppers for preparing reagents, standards, and measuring sample volumes for sample requiring dilution beyond 1:100.

7.6 **Pipettes:** Disposable Pasteur brand, or equivalent.

7.7 **Cahn balance:** Capable of accurate measurement to the nearest 0.001 mg.

7.8 **Analytical balance:** Capable of accurate measurement to the nearest 0.0001 g.

7.9 **Top-loading analytical balance:** Capable of accurate measurement to the nearest 0.1g.

7.10 **Micro syringes:** 10, 25, 50, 100, 250, 500, and 1000 µL.

7.11 **VOA vials:** Non-preserved, certified, pre-cleaned VOA vials, 40 mL, with Teflon-lined screw caps.

7.12 **Vials:** 2 mL, with Teflon-lined screw caps for standard solutions (amber) and sample extracts (clear).

7.13 **Spatula:** Stainless steel.

8. Reagents and Standards

8.1 **Solvents:** All solvent expirations determined as indicated by manufacturer guidelines.

8.1.1 **Methylene Chloride,** ACS approved, Pesticide grade, see SOP *Reagent, Solvent, and Standard Control* (1816) for additional details regarding solvent purity.

- 8.1.2 **Acetone**, ACS approved, Pesticide grade, see SOP *Reagent, Solvent, and Standard Control* (1816) for additional details regarding solvent purity.
- 8.1.3 **Hexane**, ACS approved, Pesticide grade, see SOP *Reagent, Solvent, and Standard Control* (1816) for additional details regarding solvent purity.
- 8.1.4 **Methanol**, Purge and Trap grade, see SOP *Reagent, Solvent, and Standard Control* (1816) for additional details regarding solvent purity.

8.2 Primary Standard Solutions: All Primary standard solutions are purchased from commercial vendors as flame sealed ampule certified solutions. When a flame sealed ampule primary solution is opened, it is transferred to a labeled amber 2mL vial.

Primary Standards are stored as indicated by the vendor, away from light when not in use. Primary standards are discarded as indicated by the vendor expiration. If breakdown of a solution is observed, the solution will be discarded.

- 8.2.1 **Aroclor 1016 Solution:** Obtained from Accustandard at a concentration of 100ug/mL (catalog # C-216S-H-10X-PAK) – for the calibration curve and LCS and obtained from Restek at a concentration of 1000 ug/mL (catalog # 32006) – for ICV.
- 8.2.2 **Aroclor 1260 Solution:** Obtained from Accustandard at a concentration of 100ug/mL (catalog # C-260S-H-10X-PAK) – for the calibration curve and LCS and obtained from Restek at a concentration of 1000ug/mL (catalog # C32012) – for LCS and ICV.
- 8.2.3 **Aroclor Solution:** Obtained from Accustandard at a concentration of 100ug/mL or 1000ug/mL for the calibration curve.

<u>Compound</u>	<u>Part Number</u>
Aroclor 1221	APP-9-159
Aroclor 1232	APP-9-160
Aroclor 1242	C-242S-H-10X
Aroclor 1248	C-248S-H-10X
Aroclor 1254	C-254S-H-10X
Aroclor 1262	APP-9-165
Aroclor 1268	APP-9-166

- 8.2.4 **Aroclor Solution:** Obtained from Ultra at a concentration of 100ug/mL for ICV

<u>Compound</u>	<u>Part Number</u>
Aroclor 1221	PP-291
Aroclor 1232	PP-301
Aroclor 1242	PP-311
Aroclor 1248	PP-341
Aroclor 1254	PP-351
Aroclor 1262	PP-371
Aroclor 1268	PP-381

- 8.2.5 **Pesticides Surrogate Standard Spiking Solution:** Obtained from Ultra at a concentration of 200ug/mL (catalog # ISM-320) – for PCB Aroclors analysis.

- 8.2.6 **4,4'-Dibromooctafluorobiphenyl Solution-DBOB:** Obtained from Ultra at a concentration of 5000ug/mL (catalog # PPS-172) – for PCB Congeners analysis.
- 8.2.7 **2,2',3,3',4,5,5',6-Octachlorobiphenyl Solution-BZ#198:** Obtained from Ultra at a concentration of 100ug/mL (catalog # RPC-075S) – for PCB Congeners analysis.
- 8.2.8 **Internal Standard Solution:** 2,3,3',4,5,5',6 Heptachlorobiphenyl Solution-BZ#192 –obtained from Ultra at a concentration of 100ug/mL (catalog # RPC-165S) – for PCB Congeners analysis.
- 8.2.9 **Custom PCB Standard:** Obtained from Accustandard at a concentration of 100ug/mL (catalog # S-7911-2X) – for the calibration curve, for PCB Congeners analysis.
- 8.2.10 **EPA PCB Congener Calibration Check Solution:** Obtained from Ultra at a concentration of 0.2ug/mL (catalog # RPC-EPA) – for ICV, for PCB Congeners analysis.

8.3 Stock Standard Solutions: All Stock Standard Solutions are prepared volumetrically by diluting and mixing the appropriate primary standard solutions in hexane. Stock standards expire 1 year from the date of preparation or sooner if routine QC tests indicate a problem. All stock solutions are stored in the freezer (-20°C -10°C) in 10-40mL vials depending on the amount prepared. If breakdown of a solution is observed, the solution will be discarded.

- 8.3.1 **Aroclor 1660 Calibration Stock Solution:** Consists of the Aroclor 1016 and 1260 from Accustandard or equivalent, mixed with the extraction surrogates (TMX and DCB), at a stock concentration of 20,000ug/L for AR1660 and 1000ug/L for surrogates, in hexane. To prepare calibration stock solution, add 1mL of *Aroclor 1016/1260 Primary Solution* at 1000ug/mL and 0.5mL of *Pesticides Surrogate Standard Spiking Solution* at 200ug/mL to a 50mL volumetric flask. Dilute to the volume with hexane.
- 8.3.2 **Aroclor 1660 ICV Stock Solution:** Consists of the Aroclor 1016 and 1260 from Restek or equivalent, at a stock concentration of 20,000ug/L in hexane. To prepare calibration stock solution, add 1mL of an individual *Aroclor Primary Solution* at 1000ug/mL to a 50mL volumetric flask. Dilute to the volume with hexane.
- 8.3.3 **Other Aroclors Calibration Stock Solution:** Consists of the individual Aroclor from Accustandard or equivalent at a stock concentration of 20,000ug/L, in hexane. To prepare calibration stock solution, add 1mL of an *Aroclor Primary Solution* at 1000ug/mL to a 50mL volumetric flask. Dilute to the volume with hexane.
- 8.3.4 **Other Aroclors ICV Stock Solution:** Consists of the individual Aroclor from Ultra or equivalent at a stock concentration of 10,000ug/L, in hexane. To prepare calibration stock solution, add 1mL of an *Aroclor Primary Solution* at 100ug/mL to a 10mL volumetric flask. Dilute to the volume with hexane.
- 8.3.5 **NOAA 22 Congeners Stock Solution:** Consists of the NOAA 22 Congeners from Accustandard or equivalent, at the concentration of 5000ug/L in hexane. To prepare congeners stock solution, add 1.25mL of *Custom PCB Standard* at 100ug/mL to a 25mL volumetric flask. Dilute to the volume with hexane.
- 8.3.6 **Pesticides Surrogate Stock Solution:** Consists of Pesticides Surrogates (TMX and DCB) from Ultra or equivalent, at a stock concentration of 5000ug/L. To prepare pest surrogate stock solution add 0.625 mL of *Pesticides Surrogate*

Standard Spiking Solution at 200ug/L to a 25mL volumetric flask. Dilute to the volume with hexane.

8.3.7 DBOB and BZ 198 Surrogate Stock Solution: Consists of DBOB and BZ198 from Ultra or equivalent, at a stock concentration of 5000ug/L, in hexane. To prepare surrogate stock solution add 25uL of *DBOB Primary Solution* at 5000ug/mL and 1.25mL of *BZ#198 Primary Solution* at 100ug/mL to a 25mL volumetric flask. Dilute to the volume with hexane.

8.4 Working/Spiking Standard Solutions: All working/spiking standard solutions are prepared volumetrically by diluting and mixing appropriate primary or stock standard solutions in acetone, hexane or methylene chloride. Working/Spiking standards expire 6 months from the date of preparation or sooner if routine QC tests indicate the problem. All working/spiking solutions are stored in the freezer (-20°C -10 °C) in 10-40mL vials depending on the amount prepared. All spiking solutions must be assayed for use by analysis before release to the preparation lab. All compounds must be within 20% of their true value. If breakdown of a solution is observed, the solution will be discarded.

Aroclor 1660 calibration standard solution: Consists of Aroclor 1016 and 1260 from our "Aroclor 1660 calibration stock solution" combined into one standard called Aroclor 1660 and the extraction surrogates (TMX and DCB) through dilution of Aroclor 1660 Calibration Stock solution. The extraction surrogates will only be combined with the 1660 calibration. An ICAL is run for each of the nine Aroclors before analysis. A 7 pt calibration is analyzed for the 1660 while 1pt calibration is allowed per method for the other 7 aroclors.

7-Level Curve Preparation for Aroclors

<u>Calibration Level</u>	<u>Aroclor Conc.</u>	<u>Surrogate Conc.</u>	<u>Volume of Std Added</u>	<u>Final Volume in Hexane</u>
Stock	20 00µg/L	2000µg/L		
Level 1	20µg/L	2.0µg/mL	0.1mL of Level 7	10mL
Level 2	50µg/L	5.0µg/L	0.25mL of Level 7	10mL
Level 3	100µg/L	10µg/mL	0.5mL of Level 7	10mL
Level 4	250µg/L	25µg/mL	1.25mL of Level 7	10mL
Level 5**	500µg/L	50µg/mL	1.25mL of Stock	50mL
Level 6	1000µg/L	100µg/mL	0.5mL of Stock	10mL
Level 7	2000µg/L	200µg/mL	1mL of stock	10mL

** CCV Level

8.4.1 Congener Calibration standard solution: Consist of 22 NOAA Congeners and the extraction surrogates (DBOB and BZ#198) through dilution of *NOAA 22 Congeners Stock Solution* listed in 8.3.2 and *DBOB and BZ 198 Surrogate Stock Solution* listed in 8.3.4. 8 levels are described, however a minimum 5 levels are required for initial calibration.

Multi-Level Calibration Solution Preparation for Congeners and Surrogates

<u>Calibration Level</u>	<u>Analyte Conc. ug/L</u>	<u>Surrogate Conc. ug/L</u>	<u>Volume of Std Added</u>	<u>Volume in Hexane</u>
Level 1	1	1	0.05mL of Level 8	10mL
Level 2	5	5	0.25mL of Level 8	10mL
Level 3	10	10	0.50mL of Level 8	10mL

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Level 4	20	20	0.04mL of Cong stock and 0.04mL of Surr. stock	10mL
Level 5	50	50	0.1mL of Cong stock and 0.1mL of Surr. stock	10mL
Level 6**	100	100	0.5mL of Cong stock and 0.5mL of Surr. stock	25mL
Level 7	150	150	0.3mL of Cong stock and 0.3mL of Surr. stock	10mL
Level 8	200	200	0.4 mL of Cong stock and 0.4 mL of Surr. stock	10 mL

** CCV Level

8.4.2 PEST/PCB Surrogate Spike Solution: TMX and DCB obtained from Ultra Scientific or equivalent, at a concentration of 1000ug/L in Acetone. To prepare:

- Surrogate spiking solutions add 1mL of *Pesticides Surrogate Standard Spiking Solution* (at 200ug/mL) into a 200mL volumetric flask and dilute to the volume with acetone.

All samples, blank and matrix spike are spiked with 1mL of the surrogate solution prior to extraction to monitor efficiency of sample extraction, chromatographic and calibration system. This amount may be adjusted to meet project specific concentrations, as needed.

8.4.3 PEST/CONG Surrogate Spike Solution: DBOB and BZ 198 obtained from Ultra or equivalent, at a concentration of 100ug/L in Acetone. To prepare surrogate spiking solutions add 5mL of DBOB and BZ 198 Surrogate Stock Solution (at 5000ug/L) into a 250mL volumetric flask and dilute to the volume with acetone. All samples, blank and matrix spike are spiked with 1mL of the surrogate solution prior to extraction to monitor efficiency of sample extraction, chromatographic and calibration system. This amount may be adjusted to meet project specific concentrations, as needed.

8.4.4 PCB Aroclors LCS/LCSD/MS/MSD: Aroclor 1660 commercially obtained from Accustandard at the concentration of 10,000ug/L in Acetone. To prepare:

Spiking solution add 1mL of each primary solution at 1000µg/mL to a 100mL volumetric flask and bring it to volume with Acetone.

1mL is spiked into each QC and field QC sample. This amount may be adjusted to meet project specific concentrations, as needed.

8.4.5 NOAA 22 Cong LCS/LCSD/MS/MSD: NOAA 22 Congeners obtained from Ultra or equivalent, at the concentration of 100ug/L in Acetone. To prepare spiking solution add 1mL of NOAA 22 Congeners Stock Solution at 5000µg/L to a 50mL volumetric flask and bring it to volume with Acetone. 1mL is spiked into each QC and field QC sample. This amount may be adjusted to meet project specific concentrations, as needed.

8.4.6 Independent Verification Standard (ICV) for Aroclors: This is a source separate from the calibration curve containing one of the nine Aroclors, obtained from Ultra or Restek. Prepare from Stock Solution by diluting in hexane to the concentration of 500ug/L

8.4.7 Independent Verification Standard (ICV) for Congeners: This is a source separate from the calibration curve obtained from Ultra, at the concentration of 100ug/mL in hexane. This standard must be analyzed with the appropriate concentration of the internal standard.

- 8.4.8 **Internal Standards (IS): BZ#192:** Prepared so that a 20-uL spiked into the sample extract prior to analysis, will produce a mid-calibration range response at 50ng/mL in final sample extract. To prepare add 0.625mL of primary solution at 100ug/mL to a 25mL volumetric flask and bring it to volume with hexane. Final concentration is 2.5ug/mL.

9. Quality Control

The laboratory must maintain records to document the quality of data that is generated. Ongoing data quality checks are compared with established performance criteria to determine if the results of analyses meet the performance characteristics of the method.

Quality Control (QC) samples are necessary to monitor both the sample extraction and instrument analysis procedures. The Quality Control samples described below are considered the method defaults, and are the minimum requirements, except where noted. Client and Project specific Data Quality Objectives (DQOs) supersede the requirements in this section where applicable. Client or Project specified DQOs shall be included, or referenced, in the final report to the client.

9.1 Blank(s)

- 9.1.1 A method blank must be extracted (spiked with surrogates and/or internal standards) and analyzed once per every 20 samples or per extraction batch, whichever is more frequent. The analysis of the method blank extract will demonstrate the background contamination.
- 9.1.2 An *acceptable* method blank should not contain any individual compound at the concentration of reporting limit, or above. All efforts must be made to identify and eliminate the source of contamination. The presence of analytes at concentrations at or above the reporting limit will warrant application of a "B" qualifier to that target compound(s) on all associated report forms, and perhaps re-extraction of all associated samples. The results are qualified with a "B" for any associated sample concentrations that are less than 10x the blank concentration for the analyte. Surrogate and internal standard recoveries must meet the QC limits for the method blank, see Sections 12.5 and 12.6. Re-extraction must be initiated immediately so that the minimum of time is wasted before re-extraction can occur - if at all possible, this re-extraction should take place within holding time. Re-extraction *corrective action* that would exceed the sample holding time criteria should be discussed with the client, Laboratory Director, QA Manager, and/or Section Supervisor prior to implementation. Exceptions may be made with approval of the Section Supervisor if the samples associated with an out of control method blank are non-detect for the affected compound(s) or if the concentrations of the affected compound(s) are greater than 5x the blank level in the samples. In such cases, the sample results are accepted without corrective action for the high method blank result. The client must be notified, via the project narrative, of any method blank non-compliance associated with the sample results. Since air PUF samples cannot be re-extracted, re-analysis for confirmation of any issues must be performed. If similar results are observed, the data is reported with a narrative note discussing the non-compliance.

9.2 Laboratory Control Sample / Laboratory Control Sample (LCS / LCSD)

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- 9.2.1 The LCS/ LCSD are extracted along with the samples as a measure of precision and accuracy. At a minimum, one LCS/LCSD sample set must be analyzed at a frequency of once per 20 samples, or per analytical batch, whichever is more frequent. The LCS contains Aroclor 1660 for PCB's as Aroclors analysis and all 22 NOAA Congeners for PCB Congeners analysis.
- 9.2.2 The acceptable recovery QC limits are found in Section 12 for an aqueous, solid, and tissue LCS.
- 9.2.3 Acceptable relative percent difference (RPD) for LCS/LCSD analysis is $\pm 50\%$ for both aqueous and solid matrices. See section 12 for QA acceptance criteria. Calculate RPD as follows:

$$RPD = \frac{R1 - R2}{\frac{R1 + R2}{2}} \times 100$$

- 9.2.4 Corrective Action: Repeat analysis or check to see if an analytical error has occurred. If the LCS recovery is still out of control, re-extract and re-analyze the LCS and all samples associated with that LCS/LCSD. If the LCS/LCSD do not meet quality control criteria for recovery of some of the spike and surrogate compounds, the results for the other samples and quality control samples within the batch must be evaluated to determine if this is an isolated problem for the LCS/LCSD and whether the data should be reported with the affected LCS/LCSD. If the recoveries for all components in the LCS/LCSD are outside of criteria, the entire analytical batch should be re-extracted and re-analyzed. Exceptions may be made with approval of the Department Manager if the samples associated with the out of control LCS/LCSD are also associated with a matrix spike and matrix spike duplicate that is in control which demonstrates an isolated problem pertaining to the LCS/LCSD only. An explanation of this out of control LCS/LCSD recovery must be included in the project narrative to the client and the sample data reported with the acceptable MS/MSD results as batch QC. Since air PUF samples cannot be re-extracted, re-analysis for confirmation of any issues must be performed. If similar results are observed, the data is reported with a narrative note discussing the non-compliance.

9.3 Initial Calibration Verification (ICV)

Refer to section 10.2

9.4 Continuing Calibration Verification (CCV)

Refer to section 10.4

9.5 Matrix Spike / Matrix Spike Duplicate (MS / MSD)

- 9.5.1 MS/MSD analyses are performed once per 20 samples (5% frequency) only per client request. It is preferable to extract samples that have been selected specifically by the client. If none have been assigned then the laboratory analyst must choose a representative sample for each type of matrix prepared. The MS/MSD must be matrix specific. Aqueous and air PUF MS/MSD cannot be done unless client supplies sufficient sample. These samples are also spiked with extraction surrogate. MS/MSD are spiked with the LCS spiking solution (Aroclor 1660 or NOAA 22 Congeners) at the same level as LCS/LCSD.

- 9.5.2 The acceptable recovery and RPD QC limits are found in Section 12 for an aqueous, solid, tissue and product MS/MSDs.
- 9.5.3 Acceptable relative percent difference (RPD) for matrix spike analysis is $\pm 50\%$ for both aqueous and solid matrices. Calculate RPD as follows:

$$RPD = \frac{R1 - R2}{\frac{R1 + R2}{2}} \times 100$$

- 9.5.4 Corrective Action: The recovery of the matrix spikes are evaluated relative to the what was in the unspiked sample to indicate how well the methods worked on extraction of the analytes of interest from the sample matrix. The results for the unspiked and MS/MSD samples need to be compared carefully to determine how well the spiking study worked and if there was any indication of matrix-related problems that might affect the analytical batch. Re-extraction of the sample based on the MS results is rare. Repeat analysis or check to see if an analytical error has occurred. If the % recovery or %RPD still exceeds the control limits and the associated LCS is within control, include a project narrative with the results to client noting that there may be potential matrix effects on the accuracy or precision of the affected results as evidenced by the matrix spike and matrix spike duplicate exceedance. Since air PUF samples cannot be re-extracted, re-analysis for confirmation of any issues must be performed. If similar results are observed, the data is reported with a narrative note discussing the non-compliance.

9.6 Laboratory Duplicate

- 9.6.1 Laboratory matrix or sample duplicates are analyzed if requested by the client. The client must supply sufficient additional sample volume for this duplicate. Duplicates are used to evaluate the precision of the method. The QC limit is 50% RPD for target compounds found above 5 times the reporting limit.
- 9.6.2 Corrective Action: If the %RPD exceeds the 50% control limit and the associated MS/MSD %RPD is within 50%, include a project narrative with the results to client noting that there may be potential matrix effects on the precision of the results isolated to this sample, as evidenced by the matrix duplicate exceedance and the MS/MSD acceptance. If both the sample/duplicate and the MS/MSD exceed the control limits, include a project narrative with the results to client noting that there may be potential matrix effects on the precision of the results as evidenced by the sample/duplicate and the MS/MSD exceedances. Since air PUF samples cannot be re-extracted, re-analysis for confirmation of any issues must be performed. If similar results are observed, the data is reported with a narrative note discussing the non-compliance.

9.7 Method-specific Quality Control Samples

9.7.1 Surrogates

- 9.7.1.1 Surrogates are monitored for recovery for all matrices. Two surrogates are used, one that elutes at the beginning and one at the end of GC run: TMX/DCB for Aroclors and DBOB/BZ#198 for Congeners. Every sample, blank, and quality control sample (LCS, MS, MSD, Dup) must be spiked

with the surrogates prior to extraction. The recovery limits are found in Section 12.

- 9.7.1.2** Corrective Action: Check to see if an analytical, spiking, or dilution error occurred and re-calculate. If only one surrogate falls below the recovery limit and all QC samples have acceptable recovery indicating a matrix effect isolated to the sample, the exceedance is noted, with approval of the Section Supervisor, and the results are reported to the client with a notation in the case narrative. If all surrogates are recovered below the limit or there are outliers in any QC, re-extract the sample. If re-extraction occurred beyond the holding time and the re-extract surrogates are within the QC limits, report the re-extract results along with the original results. If the surrogates are recovered below the limit in the re-extract, this confirms suspected matrix interference on the surrogates, and only the original analysis needs to be reported unless a specific QAPP requires otherwise. If the chromatogram shows obvious matrix interference, no re-analysis or re-extraction is necessary. *This decision must be made with approval of the Section Supervisor and/or Project Manager.* Surrogate outliers and sample re-extracts must be noted in the case narrative to the client.

9.7.2 Internal Standards

- 9.7.2.1** Internal Standards will be evaluated for relative retention time drift and relative area counts compared to the associated opening CCV for PCB Congeners *only*. Internal standards are added to every field sample, QC sample, standard, and method blank. The internal standard retention times for associated samples should be ± 0.05 minutes relative to the retention times from the associated opening CCV. The area counts for the internal standards in the associated samples should be $\pm 50\%$ of the area of the internal standard calculated during initial calibration. The daily opening CCV IS areas are also compared to the ICAL.

- 9.7.2.2** Corrective Action: Check to see if an analytical, dilution or spiking error occurred. If the chromatogram shows obvious matrix interference, no re-analysis is necessary. *This decision must be made with approval of the Department Manager.* Note the exceedance in the case narrative to the client. If no obvious interference is present, re-analyze the extract. If internal standards are now within the acceptance limits, report only the re-analysis, as long as the re-analysis occurred within the 40-day analytical hold time. If the re-analysis occurred outside of the 40-day analytical hold time, both the original and re-analysis must be reported. If the internal standards again are outside the acceptance limits, after re-analysis, either within or outside of the 40-day hold time, report only the original analysis, and include a narrative to the client that the suspected matrix interference on the internal standards was confirmed by sample re-analysis. If specified by the client or project data quality objectives (DQOs) or other specifications, both results of both analysis might have to be reported.

9.7.3 Standard Reference Materials (SRMs)

- 9.7.3.1** Standard reference materials (SRMs) are available from the National Institute of Standards and Technology (NIST) and are extracted and analyzed with samples on a project specific basis. For sediment and

tissue sample batches, a certified SRM will be analyzed at the rate of one per batch of up to 20 samples per matrix for PCB Congeners *only*. These are not used as controls, but to evaluate potential matrix effects in associated samples for the target compounds being evaluated.

9.7.3.2 Measured results will be compared against certified values for those target analytes that are certified in these SRMs as follows. Acceptance criteria for SRM analysis will vary from project to project depending upon client data quality objectives (DQOs). Generally, $\pm 50\%$ difference (%D) based on the true certified values of the target compounds of interest, or 40% - 140% recovery, serve as advisory acceptance criteria.

9.7.3.3 Corrective Action: Repeat analysis and/or check to see if an analytical error has occurred. If the % recovery or %D still exceeds the control limits and the associated LCS/LCSD and/or MS/MSD are within control, include a project narrative with the results to client noting that the observed recovered of the SRM are isolated to this sample as evidenced by the LCS/LCSD and/or MS/MSD acceptance. Individual analyte exceedances will be narrated and may be used to assess potential interferences or system bias for individual analytes.

9.8 Method Sequence

An example sequence for 8082 Aroclor analysis, created 12/04 on ECD4. CCV identifiers and/or nomenclature can be associated according to date/instrument or a specifically generated WG (workgroup) reference number assigned by the company LIMS system.

1. Primer
2. Hexane
3. C4120401STD1242 AR1242 Level 5 @ 500ug/L *
4. C4120401STD1248 AR1248 Level 5 @ 500ug/L *
5. C4120401STD1254 AR1254 Level 5 @ 500ug/L *
6. C4120401STD1660 AR1660 Level 5 @ 500ug/L
7. C4120401STD2162 AR1262 Level 5 @ 500ug/L *
8. C4120401STD3268 AR1268 Level 5 @ 500ug/L *
9. Method Blank
10. Method LCS
11. Method LCSD
12. 7 client samples
13. C4120402STD1242 AR1242 Level 5 @ 500ug/L *
14. C4120402STD1248 AR1248 Level 5 @ 500ug/L *
15. C4120402STD1254 AR1254 Level 5 @ 500ug/L *
16. C4120402STD1660 AR1660 Level 5 @ 500ug/L
17. C4120402STD2162 AR1262 Level 5 @ 500ug/L *
18. C4120402STD3268 AR1268 Level 5 @ 500ug/L *
19. about 10 client samples
20. C4120403STD1242 AR1242 Level 5 @ 500ug/L *
21. C4120403STD1248 AR1248 Level 5 @ 500ug/L *
22. C4120403STD1254 AR1254 Level 5 @ 500ug/L *
23. C4120403STD1660 AR1660 Level 5 @ 500ug/L
24. C4120403STD2162 AR1262 Level 5 @ 500ug/L *
25. C4120403STD3268 AR1268 Level 5 @ 500ug/L *

*optional CCV levels may be employed to account for the presence of variable Aroclor patterns within client samples.

An example sequence for 8082 Congener analysis, created 12/04 on ECD3. CCV identifiers and/or nomenclature can be associated according to date/instrument or a specifically generated WG (workgroup) reference number assigned by the company LIMS system.

Primer
Hexane
C3120401STD50
Method Blank
Method LCS
Method LCSD
7 client samples
C3120402STD50
10 client samples
C3120403STD50

10. Procedure

10.1 Equipment Set-up

- 10.1.1 Prior to performing GC/ECD analysis, the operator must read and become familiar with the operating procedure guidelines specified in the instrument operating manuals. The analyst must be trained and familiarized with the instrument software

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provided by the manufacturer. The instrument must be set up with the proper operating parameters (data acquisition and processing) and conditions described in the operating manual. The criteria for the analytical calibration ranges and method and instrument detection limits must be established and documented prior to initial calibration. All analytical equipment is traceable to NIST via internal and external calibration checks and *Certificates of Analysis* that are received with the calibration standards.

10.1.2 GC Instrumental Conditions

10.1.2.1 Inject an aliquot of 1uL into the capillary column of the gas chromatograph at the following conditions.

Parameters	Settings for Aroclors Analysis	Settings for Congeners Analysis
Injector A Temp	220°C	220°C
Detector Temp	300°C (HP)	300°C (HP)
Oven Temp	125°C	100°C
Initial Value	125°C	100°C
Initial Time	0 minute	0 minute
Rate	25°/minute to 197°C	25°/minute to 197°C
Hold. Time	0 minutes	2.00 minutes
Rate	5°/minute to 280°C	1°/minute to 210°C
Hold. Time	8.50 minutes	0 minutes
Rate	-	5°/minute to 210°C
Hold. Time	-	7.12 minutes
Purge/Valve A <u>ON</u>	OFF	OFF
Run Time	27.98 minutes	40.00 minutes
Mode	Splitless	Splitless

10.1.2.2 Establish daily retention time windows as the retention time of the component in the opening verification standard ± 0.05 . Retention time windows are calculated each time a new GC column is installed. It has been found that this window works well, being wide enough to eliminate false-negatives while being tight enough to eliminate false-positives. Windows that are calculated using the procedure recommended in Method 8000 tend to be very narrow, creating the risk of false negative results. The window listed above is used as guidance; however the experience of the analyst weighs heavily in the interpretation of the chromatograms.

10.2 Initial Calibration

10.2.1 Before analysis of sample extracts, establish a multi-point calibration curve showing the linear range of the analysis for all nine Aroclors. The ICAL for 1660 will have extraction surrogates added in the solution. Each other Aroclor will have an individual curve. The calibration curve for 1660 and associated surrogates are generated during initial calibration through the analysis of, at minimum, 5-level calibration standards, which define the working range of the method. A 1pt calibration curve is employed for the other 7 aroclors. See Section 8 for the preparation of the standard solutions for the initial calibration curve.

- The method of external standard calibration is used **for Aroclors** analysis. The response of each individual peak and the total response of the PCB in the sample are compared to a calibration curve to determine the analyte concentration in the sample.
 - * Using the GC system software, the analyst must choose 3-5 peaks from the pattern which are characteristic of the Aroclor and are the least subject to degradation and weathering to obtain the response for the component of interest. Choose peaks that are at least 25% of the height of the largest Aroclor peak, the set of 3 to 5 peaks should include at least one peak that is unique to that Aroclor. Use at least 5 peaks for the AR1660, none of which should be found in both. Tabulate the peak area for each analyte against the mass injected of the analyte in the standard analyzed to obtain a calibration curve for each analyte across the working range of the method.
- Calibration Factors or Response Factor are determined for individual peaks. Choose 3 to 5 peaks in the standard to calculate calibration factors for each Aroclor. The calibration factors are then used to calculate the concentration of each corresponding peak in the sample. The 3 to 5 resulting concentrations are averaged to provide the final result for the Aroclor for the sample.
- The method of internal standard calibration is used **for Congener** analysis. The response of each individual peak relative to the internal standard response is compared to a calibration curve to determine the analyte concentration in the sample.

10.2.2 The following analytical sequence order should be followed for initial calibration of the system. The primer is used at the beginning of the analysis sequence to ensure all sites of activation in the system have been covered or deactivated prior to performing trace level analysis. The sequence below is a general sequence for determination of PCBs as Aroclors and uses a minimum of 5 levels for AR1660 and a single-point initial calibration for the remaining Aroclors near the mid-point of the expected calibration range. Typically, a 7 point calibration is employed for AR1660. Construct an analytical sequence using the HP Enviroquant software:

- Click on the "Instrument" icon to open the Chem Station
- Go into the "GC Top Environmental" screen
- Go into "Sequence"
- Edit the "Sample Table Log" by entering the "Vial" number starting at position 1, the "Data File ID" same as the "Sample Name" (for the initial calibration curve the nomenclature is "I" for initial calibration "4" for instrument ID ECD4, the date, and the standard number "01, 02, etc." such as, I4120401, I4120402, etc.), the

acquisition method (A412041660.m), which indicates the type of method and the date the method was created), and finally the "Miscellaneous Information" (such as, "PW120407A 20ug/L", for the first standard ID and concentration level, etc.). When complete, click "OK".

- Go back into "Sequence" and "Save" the sequence as the date, such as, C4120401.s. The ending "01" indicates the first sequence created on 12/04.
- Go back in to "Sequence" and "Print" the sequence that was just saved. This will become part of the instrument run log. See Section 15.0 for additional instrument run log details.
- Go back into "Sequence" and "Load and Run" the sequence that was just saved.

Example initial calibration sequence for Aroclor analysis, created on 11/16 on ECD4:

1. Primer
2. Hexane
3. I4111611011660L1 AR1660 (PW111611O @ 20ug/L)
4. I4111611011660L2 AR1660 (PW111611N @ 50ug/L) - optional
5. I4111611011660L3 AR1660 (PW111611M @ 100ug/L)
6. I4111611011660L4 AR1660 (PW111611L @ 250ug/L)
7. I4111611011660L5 AR1660 (PW111611K @ 500ug/L)
8. I4111611011660L6 AR1660 (PW111611J @ 1000ug/L)
9. I4111611011660L7 AR1660 (PW11616I @ 2000ug/L)
10. HEXANE
11. I411611STD500 AR1660 (PW092711A @ 500ug/L)
12. HEXANE
13. I4111611011221/1262L5 AR1221/1262 (PW040814R @ 500ug/L)
14. I4111611011221/1262ICV AR1221/1262 (PW032814D @ 500ug/L)
15. I4111611011232/1268L5 AR1232/1268 (PW031314A @ 500ug/L)
16. I4111611011232/1268ICV AR1232/1268 (PW032814E @ 500ug/L)
17. I4111611011242L5 AR1242 (PW040714 @ 500ug/L)
18. I4111611011242ICV AR1242 (PW032814A @ 500ug/L)
19. I4111611011248L5 AR1248 (PW040714C @ 500ug/L)
20. I4111611011248ICV AR1248 (PW032814B @ 500ug/L)
21. I4111611011254L5 AR1254 (PW030614 @ 500ug/L)
22. I4111611011254ICV AR1254 (PW030614H @ 500ug/L)

Example initial calibration sequence for Congener analysis, created on 02/04 on ECD3:

1. Primer
2. Hexane
3. I3020401STD1 Level 1 (PW020407A @ 1ug/L)
4. I3020402STD5 Level 2 (PW020407B @ 5 ug/L)
5. I3020403STD10 Level 3 (PW020407C @ 10ug/L)
6. I3020404STD20 Level 4 (PW020407D @ 20ug/L)
7. I3020405STD50 Level 5 (PW020407E @ 50ug/L)
8. I3020406STD100 Level 6 (PW020407F @ 100ug/L)
9. I3020407STD150 Level 7 (PW020407G @ 150ug/L)
10. I3020408STD200 Level 8 (PW020407H @ 200ug/L)
11. HEXANE
12. I3020409STD100 ICV (PW120407J @ 100ug/L)

10.2.3 When the sequence has finished running, the Enviroquant software will generate "Not Reviewed" quantitation reports. All reports must be "Quant Reviewed" before they can become part of the initial calibration acquisition method for sample analysis.

- Enter into the "Environmental Data Analysis" (off-line) screen.
- Go to "File" and under method select the method (A302041660.m) that the initial calibration standards were analyzed under, then select the first data file.
- Go into "Quant" and select "QEdit Quant Results" to process the data files. Refer to SOP 2160 for details and processing of PCB Aroclor/Congener standards.
- When processing is complete for the first standard, "Save" the changes and "Exit." Re-print the re-processed data file by "Generating Quant Report," and save the hard copy for each level of the initial calibration.
- Repeat these steps for all initial calibration standards analyzed within the sequence.
- When all levels have been processed, go into "IntiCal," and select "Update Levels," and enter all levels for the initial calibration at the proper concentrations.
- After all responses are entered, "Save" the completed method and print the resulting response factor summary by selecting "Response Factors to Printer."

10.2.4 Acceptance Criteria:

- If average calibration factor or average relative response factor used, % RSD \leq 20% over the working range of the curve for all analytes.
- If calibration curve used, the correlation coefficient must be ≥ 0.99 – for linear model or the COD or r^2 must be ≥ 0.99 – for non-linear model. Statistical considerations in developing a non-linear calibration model require more data than the more traditional linear approach. A quadratic model requires six standards, and a third order polynomial requires seven standards. In setting model parameters, do not force the line through the origin. The COD or r^2 must be ≥ 0.99 . The analyst should select the regression order that introduces the least calibration error into the quantitation.

10.2.5 The following *corrective actions* are recommended for failing initial calibrations:

- Check the calibration of the standard preparation that was performed. If the problem appears to be isolated to a single standard, the standard may be reanalyzed within twelve hours.
- Perform instrument maintenance and repeat the initial calibration.

The choice of corrective action must be made in consultation with the Department Manager, QA Manager, Project Manager, and/or the client.

10.2.6 Complete the initial calibration by filling out the *Initial Calibration Checklist*. The initial calibration, along with any corresponding continuing calibration data and sample data, is then forwarded for secondary review.

10.2.7 Initial Calibration Verification - ICV (separate source)

The analysis of separate source standard must follow the initial calibration curve. All target analytes in this verification standard are at the mid-point concentration. Note: If this standard was analyzed immediately following the initial calibration curve, it must be re-"Calculated and Generated" in the "QEdit" field, against the completed initial

calibration curve method and then re-processed, before it can be reviewed for acceptability.

Acceptance Criteria: ICV has to be analyzed from the separate source and % recoveries must be +/-20% for all targets. Aroclors must use the average of the 5 chosen/representative peaks to be +/-20%.

10.3 Equipment Operation and Sample Processing

Samples are prioritized by analyst for analysis based on hold time and client due date. All samples and standard solutions must be allowed to warm to ambient temperature before analysis.

10.3.1 Samples are retrieved from the sample storage refrigerator, spiked with 20uL of the chosen internal standard solution per 1mL extract – for congeners only, sulfuric acid cleaned and loaded into the instrument autosampler trays following the generalized sequence below.

10.3.2 Analyze extracts using the same experimental conditions used for the analysis of the calibration standards. Ensure that calibration verification standards are interspersed, at least, every 10-20 samples or every 12 hour period. Area measurements should all be to baseline unless an unresolved complex mixture (UCM) is observed, in which case, the areas measured should skim the top of the UCM.

1. Primer
2. Hexane
3. AR1660/ Congener CCV – C1060501 @ 500ug/L/50ug/L
- 3*. AR1242/1248/1254 1-point ICAL levels @ 500ug/L (optional)
4. 10 samples + QC's
5. AR1660/ Congener CCV – C1060501 @ 500ug/L/50ug/L
- 6*. AR1242/1248/1254 CCV @ 500ug/L (optional)
7. 10 samples
8. AR1660/ Congener CCV – C1060501 @ 500ug/L/50ug/L
- 9*. AR1242/1248/1254 CCV @ 500ug/L (optional)

10.3.3 After sample analysis, "Not Reviewed" quantitation reports are generated by the software system. Samples are processed from "Not Reviewed" data files, to "Quant Reviewed" data files in a similar way the standards were previously processed. See Section 11 for details on sample processing. If a CCV fails the criteria outlined in Section 10.4.4, all samples since the last acceptable CCV must be re-analyzed (refer to Section 10.4.5).

10.3.4 If the on-column concentration of any compound exceeds the calibration range of 2000ug/L – for Aroclors and 200ug/L – for Congeners, the sample must be diluted, re-spiked with the appropriate amount of internal standard and re-analyzed. Assuming all samples are at a 1mL final volume, the following example dilutions would apply. Adjust the volumes accordingly for other sample final volume amounts and other desired dilutions.

- 1:2 dilution = 500uL of sample : 500uL Hexane and 10uL of IS
- 1:4 dilution = 250uL of sample : 750uL Hexane and 15uL of IS
- 1:5 dilution = 200uL of sample : 800uL Hexane and 16uL of IS
- 1:10 dilution = 100uL of sample : 900uL Hexane and 18uL of IS, etc.

10.4 Continuing Calibration

The systems performance and calibration for each compound of interest must be checked and verified before sample analysis. A continuing calibration verification (CCV) standard, at the concentration of the mid-level of the initial calibration curve, must be analyzed at the beginning and end of every analytical sequence, and every 12 hours or at the minimum of every 20 samples whichever is more frequent. However, it is recommended that the CCV is run every ten samples to minimize the number of samples requiring reanalysis.

10.4.1 Create the sequence: "Edit" the "Sample Table Log" to include the CCV standard (C1060501, where "C" is for CCV, "1" is for instrument number 1, followed by the date, and "01" for the first CCV analyzed this day), and acquire the CCV against the correct initial calibration method. "Save," then "Load and Run" the sequence.

10.4.2 When the sequence has finished running, the Enviroquant software will generate a "Not Reviewed" quantitation report. All reports must be "Quant Reviewed" against the acquisition method for sample analysis.

- Enter into the "Environmental Data Analysis" (off-line) screen.
- Go to "File" and under method, select the method that the CCV was analyzed under, then select the CCV data file.
- Go into "Quant" and select "QEdit Quant Results" to process the CCV file. please refer to SOP 2160 for manual integration details and processing of PCB standards
- When processing is complete, go into "ConCal," and select "Evaluate Data File as Continuing Calibration".
- Establish daily retention time windows as the retention time of the component in the opening verification standard ± 0.05 min window.

10.4.3 Acceptance Criteria: Compare the CCV resulting response against the average response for the initial calibration for each calibrated analyte and calculate the % difference (%D). See Section 11 for the calculations. If the $\%D \leq \pm 20\%$, sample analysis may take place following this verification standard. For aroclors the average of the 5 representative peaks is used to calculate the %D. If a noncompliant analyte exhibits an increase in response in the noncompliant CCV and is not detected in the associated samples, the analyses may be reported and the CCV noncompliance narrated. In this case CCV data or a detailed narrative must be provided to the client. Otherwise, corrective action must take place.

10.4.4 If the CCV does not meet the criteria for each calibrated analyte, the following *corrective actions* are recommended:

- Check the standard preparation. If the problem appears to be isolated to a single standard reanalyzed the standard
- If the verification is the beginning standard of the sequence, corrective action may consist of prepping the injection port (replace injection liner, clip column, gold seal, and septa) and re-analysis of the standard. If, after re-analyzing the standards, the acceptance criteria are still not met, a new initial calibration must be performed. The system must be in-control with all calibration criteria before sample analysis may proceed.
- If the verification is the ending standard, corrective action depends upon the severity of the verification results. For Congeners the closing CCV is not required if all samples are acquired within 12hr and IS areas met the criteria in section

9.7.2.1. Aroclors still need closing CCVs to meet $\pm 20\%$ D, with the average of the 5 representative peaks. The closing CCV can be re-analyzed once to verify the results (e.g. if there are high responses for the CCV that could mean that re-concentration took place and fresh aliquot should be analyzed).

- If the CCV is a closing CCV, the data for the samples run before this CCV may be evaluated for hits. If there are no hits for the compounds that did not meet %D criteria, those samples do not need to be reanalyzed provided that the response of the analyte had increased and would have been detected in the sample if it were present.
- Both columns should meet QC criteria, however, they may be evaluated with the above corrective actions in mind.
- The choice of corrective action must be made in consultation with the Department Manager, QA Manager, Project Manager, and/or the client. The reasoning for choosing one of the above options must be documented in the project narrative to the client.

10.5 Preventive Maintenance

10.5.1 Preventive maintenance may or may not include the following; replacing system uniliner, o-ring, merlin septum, MXTY connector or clipping a length of guard column.

10.5.2 Additionally, preventive or routine maintenance for GC/ECD systems may involve baking out the ECD detectors, replacing guard, RTX-5 or CLPII columns.

11. Data Evaluation, Calculations and Reporting

11.1 Qualitative identification of multicomponent analytes (Aroclors) requires pattern matching between the calibration standards and the response observed in the sample on both columns. Retention time windows should be used as a gauge; however, pattern recognition for the multicomponent analytes is most important. Qualitative identification for Congeners is made when a peak in a sample is observed within the retention time window for a calibrated analyte on both columns. In other words, an analyte is not considered present in a sample unless the analyte is detected on both columns within the retention time windows for that analyte established during calibration.

11.2 For samples with PCB Aroclors positively identified on both columns, compare the responses of the 3 to 5 major peaks in the single point calibration standard for that Aroclor with the responses of the peaks observed in the sample extract. For Aroclor 1660 use calibration curve to determine concentration of the detected Aroclor. The relative peaks and number of peaks in the sample should be similar to that observed in the standard; however, degradation, weathering and interferences may cause the sample pattern to differ from that observed from the standard. The peaks chosen for quantitation must be free from interferences. Calculate the concentration of each corresponding peak in the sample chromatogram and the 3 to 5 resulting concentrations are averaged to provide the final result for the sample.

11.3 If Total PCB is requested the following rule will apply:

- The Reporting Limit for Total PCB will be set to match the lowest Reporting Limit for individual Aroclor
- All Aroclors detected above RL will be sum together to provide Total PCB

- Total PCB will be calculated based on the amount of Aroclors requested by the client
- Total PCB can only be reported if individual Aroclors are reported as well
- If individual Aroclor is detected above working range of the calibration curve the E qualified results will not be included in the summation for Total PCB

11.4 Calculate the relative percent difference (RPD) between compound concentrations on both columns. If the calculated RPD is >40%, check the chromatograms to see if an overlapping peak is causing an erroneously high result. If no overlapping peaks are noted, examine baseline parameters established by the data system (or operator) during peak integration.

- *If no anomalies are noted, review the chromatographic conditions. If there is no evidence of chromatographic problems, report the higher result. This approach is conservative relative to protection of the environment. The disparity between the two columns should be noted by a "P" qualifier.
- *If the high RPD is clearly the result of an interference on one of the columns, the lower result is reported with an "I" qualifier on the report.
- If one of the two results for a target appears to have a biased response due to interference the analyst can force the quantitation from the column providing the more accurate value. Any target hit forced off of the compliant column due to interference on the alternate column will be flagged with an "I" on the report only if the RPD between the two columns is greater than 40%.
- In the instance that a Congener co-elutes with another Congener or other target compound on one column, the compound will be "C" flagged and reported off the unbiased conformant column (i.e.: on the RTX-5 column, BZ#184 and BZ#153 co-elute). Studies of independent targets have been conducted for reference of co-eluting pesticides and congeners.

11.5 Calculate the recovery for the surrogates TMX and DCB for Aroclors, and DBOB and BZ 198 for Congeners, in each field, blank, and quality control sample extract on both columns. Calculate the recovery of the matrix spike and LCS compounds in the appropriate samples on both columns.

11.6 Evaluate whether or not a dilution of an extract is needed by ensuring that all target PCBs areas measured fall within the calibration range of the instrument. If the range is exceeded, a dilution analysis is required. Dilute the extract to bring the out-of-range component(s) to within 50-100% of the full calibration range. Also evaluate the sample chromatogram for possible saturation of the detector.

11.7 If a dilution analysis is made, compare this run to the initial analysis to ensure that the chromatography is similar, that compound detection is similar, and that the reported values for detected compounds make sense (i.e., that the final value for any compound detected in both analyses is about the same value). If the dilution run is not comparable to the initial run, corrective action should take place.

11.7.1 *Corrective Action:* Re-evaluate both analyses (un-diluted and diluted) ensuring that integration of all peaks was performed properly and that the correct calibration curves were used for quantitation. Determine whether or not the results are off by a systematic bias which might be indicative of a poor injection or of an inaccurate dilution. If the initial run's injection is determined to have been poor and if this analysis does not need to be reported to the client (based on project specific requirements) then the results of the dilution analysis only should be reported to the client (unless there are special project requirements to

report data at specific reporting limits). If an inaccurate dilution is suspected, a new dilution of the extract should be made and this second dilution analyzed. The results from all three runs should be compared to verify the corrective action and to determine which result should be reported to the client.

- 11.7.2 Reporting of the results for a sample where two different dilution analyses are conducted, two data sheets should be prepared for reporting the sample with all components reported from the initial run with the "E" flag for the over-range component, which should be reported from the dilution. The project narrative must accurately explain how the data are reported whether one or two data sheets are used to report one sample.

11.8 Calculations

- 11.8.1 To calculate the **Relative Standard Deviation** (RSD) of all target compounds for the initial calibration, use the formula below. See Section 10.2.4 for initial calibration acceptance criteria. Additionally, use the initial multi-point calibration to determine **Relative Response Factors** (RRF_is) – *Internal Standard Calibration* or for or **Calibration Factor** (CF_i) – for *External/Standard Calibration Model* at each concentration level, for each analyte. Average the RRF_is from the initial multi-point calibration, to generate mean RRF_is, for quantification of each analyte. Follow the same calculations for each surrogate compound.

The RRF_is are based on the internal standard compounds and are calculated using the formula below.

$$\text{RSD} = \text{SD} / \text{mean RRF}_i \times 100$$

where:

SD = Standard deviation between the five points, for that target analyte.

$$\text{RRF}_i = \frac{(A_c \times C_{IS})}{(A_{IS} \times C_c)} \\ \text{CF}_i = \frac{A_a}{C_c}$$

where:

A_c = Area of the standard compound to be measured.
A_{IS} = Area of the representative internal standard compound.
C_{IS} = Concentration of the representative internal standard compound (ug/L).
C_c = Concentration of the standard compound to be measured (ug/L).

- 11.8.2 Based on the mean RRF_is, calculate the raw concentration for each target analyte and surrogate in the sample extracts using the following formula:

$$C_a = (A_a \times C_{IS}) / (A_{IS} \times \text{RRF}_i)$$

where:

C_a = Calculated concentration of the target analyte, from quantitation report (ug/L).

A_a = Area of the target analyte.

A_{IS} = Area of the representative internal standard compound.

C_{IS} = Concentration of the internal standard compound added to each extract (ug/L).

11.8.3 Calculate the **Sample Concentration** (C) for each target compound by the following formula:

$$C = \frac{(C_a / V_s) \times FV \times DF}{\text{where:}}$$

C = Concentration in the sample (ug/L liquid, ug/Kg solid, ng/PUF).

V_s = Original volume or weight of sample extracted, corrected for % solids, if applicable. (To correct for % solids, multiply the sample weight by the % solid as expressed as a decimal. For example: $15.24g \times 0.843 = 12.85$, for a sample size of 15.24g at 84.3% solid).

DF = Dilution factor or fraction of the original extract to which internal standard is added.

FV = Sample Final Volume.

If the response of any analyte in a sample exceeds the linear response range, as defined by the initial calibration standards in Section 13.0, dilute the extract so that the concentrations of all target compounds fall within the range of the calibration curve.

11.8.4 Calculate the **Surrogate Recoveries** relative to the internal standards by the following formula:

$$\%R = \frac{C_s \times DF}{C_{\text{Strue}}} \times 100$$

where:

C_{Strue} = Actual concentration of the surrogate in the extract (ug/L).

C_s = Calculated concentration of the surrogate, from quantitation report (ug/L).

DF = Dilution factor or fraction of the original extract.

11.8.5 Compare results for each analyte in the **Continuing Calibration Verification** (CCV), to the true value by determining the percent difference.

$$\text{Percent Difference (\%D)} = ([C_{\text{true}} - C_c] / C_{\text{true}}) \times 100$$

where:

C_{true} = Actual concentration of the compound in the CCV (ug/L).

C_c = Calculated concentration of the compound in the CCV, from quantitation report.

11.9 All solids including soils, sediments, and sludges must be reported on a dry-weight basis. Tissue results may be reported in wet-weight, or “as received,” depending upon client request. Air PUF samples are reported on an “as received” basis.

11.10 The primary analyst does data entry, or upload of the data, into the LIMS system. The LIMS is “linked” to the instrument, so the analyst must choose the sample(s) to be reported from that instrument’s analytical sequence. All associated preparation and instrumental QC samples and dilutions are also chosen. Once the data/samples have been selected and “associated” with the proper QC samples, the batched data set is sent to the LIMS.

11.11 Procedures for data and record management must adhere to the Quality Systems Manual, other subordinate documents covering record keeping, and the *Document Control* SOP, SOP/1729. All records shall be stored in such a manner as to be safe and accessible for at least 10 years.

11.12 Notebooks: Laboratory notebooks are designed to accommodate the specific analysis. Instrument printouts are used to document run sequences, and each daily sequence printout is filed in a three-ring notebook. If a sample requires re-analysis or re-extraction for any reason, a notation is made next to the sample entry on the sequence log. Requests for re-extraction are further documented in the “Request for Re-extraction” logbook. After one year of sample analysis, the sequence run log is permanently bound, assigned an internal ID number, and filed accordingly. Such files shall be archived so as to remain available for at least 10 years. All laboratory notebooks must follow the specifications in the *Laboratory Notebook Usage* Work Instructions, WI-108-01, and all record keeping and document control practices.

11.13 Electronic records: All data files from computers, attached to instruments, shall be backed up daily onto the proper directory on the server. The backups shall be stored so as to be accessible for 10 years. Movement of the data files to the server is the responsibility of the primary analyst. Server backup and storage is the responsibility of the IT department.

12. Contingencies for Handling Out-of-Control Data or Unacceptable Data

All PCB Aroclor and Congener results are reportable without qualification if analytical holding times are met, preservation requirements (including cooler temperatures) are met, and all QC criteria defined in the table below are met. If any of the below QC parameters are not met, all associated samples must be evaluated for re-analysis.

QC Parameter	Acceptance Criteria
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Initial Calibration Curve	20% RSD for all target analytes Correlation coefficient must be ≥ 0.99 – for linear model The COD or r^2 must be ≥ 0.99 – for non-linear model
Independent Check Verification	+/- 20% recovery of the true values, For Aroclors the Average of the 5 representative peaks are calculated to get the %D.
Continuing Calibration Verification	Analyzed every 12hr or at the minimum of every 20 samples, 20% D for all target analytes. For Aroclors the Average of the 5 representative peaks are calculated to get the %D.
Method Blank	No analyte at or above the reporting limit, “B” qualify analyte if detected $< 10\times$ the blank contamination
Laboratory Control Sample	Soil/Tissue/Aqueous/PUF: 40-140%; 50% RPD
Matrix Spike / Matrix Spike Duplicate	Same as for LCS; 50% RPD between the duplicates.
Sample / Sample Duplicate	50% RPD between the duplicates.
Surrogates	Soil: 30-150%; Aqueous: 30-150%; PUF: 60-120%
Internal Standards	50% - 200% of the daily CCV area for the Internal Standards
SRM	Same as for LCS, 40% - 140% recovery

Any deviations and observations made about the analyses must be documented in the instrument logbook and or project narrative. If a problem arises during analysis, document the problem and initiate corrective action. If there is a problem with a sample analysis which indicates that re-extraction should be performed, and if there is no additional sample available for re-extraction, the Project Manager needs to be informed immediately so that the client can be involved in the corrective action process. Re-extraction of a sample should be done within holding time if at all possible.

Evaluation of a sample result often requires knowledge about the results of all samples within a job. Therefore, use all of the data, if possible, from a job to judge whether or not corrective actions are needed. For example, if a sample is run and the surrogates are low, one might request a re-extraction immediately only to find that a MS/MSD were also done on this sample, with low surrogate and MS recoveries, confirming a matrix effect. In this case, a re-extraction is not required and the results would be reported with a narration explaining the evidence of a matrix effect on the low surrogate recoveries. The characteristics of the overall job may be invaluable in deciding how to report the data to the client.

If non-compliant PCB Aroclor or PCB Congener results are to be reported, the Department Manager and/or the Laboratory Director, and the QA Manager must approve the reporting of these results. The laboratory Project Manager shall be notified, and may chose to relay the non-compliance to the client, for approval, or other corrective action, such as re-sampling and re-analysis. The analyst or Department Manager performing the secondary review initiates the project narrative, and the narrative must clearly document the non-compliance and provide a reason for acceptance of these results.

13. Method Performance

13.1 Method Detection Limit Study (MDL) / Limit of Detection Study (LOD) / Limit of Quantitation (LOQ)

The laboratory follows the procedure to determine the MDL, LOD, and/or LOQ as outlined in Alpha SOP 1732. These studies performed by the laboratory are maintained on file for review.

13.2 Demonstration of Capability Studies

Refer to Alpha SOP 1739 for further information regarding IDC/DOC Generation.

13.2.1 Initial (IDC)

The analyst must make an initial, one-time, demonstration of the ability to generate acceptable accuracy and precision with this method, prior to the processing of any samples.

13.2.2 Continuing (DOC)

The analyst must make a continuing, annual, demonstration of the ability to generate acceptable accuracy and precision with this method.

14. Pollution Prevention and Waste Management

Once satisfactory analytical results have been generated, the extracts are held for 30 days, or longer if specified by a client contract, then discarded into a 55-gallon drum labeled "Vial Waste".

Refer to Alpha's Chemical Hygiene Plan and Waste Management and Disposal SOP for further pollution prevention and waste management information.

15. Referenced Documents

Chemical Hygiene Plan
SOP/1732 MDL/LOD/LOQ Generation
SOP/1739 IDC/DOC Generation
1797 Waste Management and Disposal SOP
1816 Reagent, Solvent, and Standard Control SOP
SOP 1729 Document Control
SOP 1731 Manual Integration

16. Attachments

Table I: Reporting Limits (RLs) and Method Detection Limits (MDLs) for PCB Aroclors and Congeners by GC/ECD
Table II: LCS/LCSD, MS/MSD and Precision and Accuracy Evaluation Criteria
Table III: Surrogate Recovery Evaluation Criteria

Table I

**Reporting Limits (RLs) and Method Detection Limits (MDLs)
 for PCB Aroclors and Congeners by GC/ECD**

Compound	CAS Registry No	Aqueous in µg/L		Solid in µg/Kg		PUF in ng/PUF	
		MDLs	RLs	MDL	RLs	MDL	RLs
Aroclor 1016	12674-11-2	0.0050	0.03	8.01	30	8.01	30
Aroclor 1221	11104-28-2	0.0103	0.03	27.6	100	27.6	100
Aroclor 1232	11141-16-5	0.0092	0.03	9.98	30	9.98	30
Aroclor 1242	53469-21-9	0.0055	0.03	5.63	20	5.63	20
Aroclor 1248	12672-29-6	0.0051	0.03	5.62	20	5.62	20
Aroclor 1254	11097-69-1	0.0105	0.03	6.72	20	6.72	20
Aroclor 1260	11096-82-5	0.0045	0.03	6.22	20	6.22	20
Aroclor 1262	11100-14-4	0.0092	0.03	5.51	20	5.51	20
Aroclor 1268	37324-23-5	0.0032	0.03	4.89	20	4.89	20

IUPAC Name	BZ #	CAS Registry No.	Aqueous RL in µg/L	Solid RL in µg/Kg
2,4'-Dichlorobiphenyl	BZ 8	34883-43-7	0.003	2.0
2,2',5-Trichlorobiphenyl	BZ 18	37680-65-2	0.001	1.0
2,4,4'-Trichlorobiphenyl	BZ 28	7012-37-5	0.001	1.0
2,2',3,5'-Tetrachlorobiphenyl	BZ 44	41464-39-5	0.001	1.0
2,2',5,5'-Tetrachlorobiphenyl	BZ 52	35693-99-3	0.001	1.0
2,3',4,4'-Tetrachlorobiphenyl	BZ 66	32598-10-0	0.001	1.0
3,3',4,4'-Tetrachlorobiphenyl	BZ 77	32598-13-3	0.001	1.0
2,2',4,4',5-Pentachlorobiphenyl	BZ 99	38380-01-7	0.001	1.0
2,2',4,5,5'-pentachlorobiphenyl	BZ 101	37680-73-2	0.001	1.0
2,3,3',4,4'-pentachlorobiphenyl	BZ 105	32598-14-4	0.001	1.0
2,3',4,4',5-Pentachlorobiphenyl	BZ 118	31508-00-6	0.001	1.0
3,3',4,4',5-Pentachlorobiphenyl	BZ 126	57465-28-8	0.001	1.0
2,2',3,3',4,4'-Hexachlorobiphenyl	BZ 128	38380-07-3	0.001	1.0
2,2',3,4,4',5'-Hexachlorobiphenyl	BZ 138	35065-28-2	0.001	1.0
2,2',4,4',5,5'-Hexachlorobiphenyl	BZ 153	35065-27-1	0.001	1.0
3,3',4,4',5,5'-hexachlorobiphenyl	BZ 169	32774-16-6	0.001	1.0
2,2',3,3',4,4',5-Heptachlorobiphenyl	BZ 170	35065-30-6	0.001	1.0
2,2',3,4,4',5,5'-Heptachlorobiphenyl	BZ 180	35065-29-3	0.001	1.0
2,2',3,4',5,5',6-Heptachlorobiphenyl	BZ 187	52663-68-0	0.001	1.0
2,2',3,3',4,4',5,6-Octachlorobiphenyl	BZ 195	52663-78-2	0.001	1.0
2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl	BZ 206	40186-72-9	0.001	1.0
2,2',3,3',4,4',5,5',6,6'-Decachlorobiphenyl	BZ 209	2051-24-3	0.001	1.0

Note: The reporting limits used for "Solid" refer to the matrices of soil, sediment, tissue, and any other possible non-aqueous matrix. The table above represents an example of reporting limits generally used in this analysis. The RLs for this analysis can vary based on sample matrix, amount extracted, final volume and cleanup schemes. Adjustments to these limits can be made to satisfy specific workplan or data quality objective requirements and specialty matrices.

Table II
LCS/LCSD, MS/MSD and Precision and Accuracy Evaluation Criteria

Spiked Component	Aqueous/Solid/Tissue/PUF (% recovery)	RPD
AR1016	40-140	50
AR1260	40-140	50
Congener	40-140	50

Table III
Surrogate Recovery Evaluation Criteria

Surrogate	Aqueous/Solid/Tissue (% recovery)	PUF (% recovery)
2,4,5,6-tetrachloro-m-ylen(TMX)	30-150	60-120
Decachlorobiphenyl (DCB)	30-150	60-120
DBOB	30-150	NA
BZ 198	30-150	NA

NOTE: Depending on project specific requirements, MS/LCS/Surrogate recoveries may be validated against a specified project QAPP, 8082 SW-846, TO-10A, CLP OLM04.2, DoD QSM 5.3, or in-house determined limits.

VERIFY THE VALIDITY OF THIS SOP EACH DAY IN USE

STANDARD OPERATING PROCEDURE
FOR
THE ANALYSIS OF POLYCHLORINATED DIBENZO-p-DIOXINS
AND POLYCHLORINATED DIBENZOFURANS (PCDDs/PCDFs)
BY
HIGH-RESOLUTION GAS CHROMATOGRAPHY/HIGH-
RESOLUTION MASS SPECTROMETRY (HRGC/HRMS)

CF-OA-E-002

APPLICABLE TO METHODS:

EPA SW-846 Method 8290A, EPA Method 1613B, EPA SW-846 Method 0023A, EPA Method TO-9a

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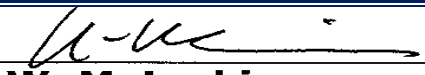
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1.0 STANDARD OPERATING PROCEDURE FOR THE ANALYSIS OF POLYCHLORINATED DIBENZO-P-DIOXINS AND POLYCHLORINATED DIBENZOFURANS (PCDD/PCDF) BY HIGH-RESOLUTION GAS CHROMATOGRAPHY/HIGH-RESOLUTION MASS SPECTROMETRY (HRGC/HRMS)

2.0 METHOD OBJECTIVE, PURPOSE, CODE, AND SUMMARY

This standard operating procedure (SOP) covers the analytical determination of PCDD/PCDFs according to the following methods:

- 2.1 SW-846 Method 8290A
- 2.2 EPA Method 1613B
- 2.3 SW-846 Method 0023A
- 2.4 EPA Method TO-9a (Jan 99)

3.0 APPLICABLE MATRICES

Applicable matrices for methods 8290A and 1613B include groundwater, wastewater, surface water, leachate, soil, sediment, sludge, oil, and tissue. The applicable matrix for method 0023A is an air sampling train, which may contain XAD resin (a hydrophobic crosslinked polystyrene copolymer resin, supplied as 20-60 mesh size white insoluble beads), filters, impinger water and solvent rinses. TO-9a is an ambient air sampling train which may contain polyurethane foam (PUF, a polyurethane foam, supplied as 1-3 inch cylinders approximately 3 inches long), XAD resin, filters, and solvent rinses.

4.0 METHOD SCOPE, APPLICABILITY, AND DETECTION LIMIT

- 4.1 Methods 8290A, 1613B and 0023A may be used to quantify PCDD/PCDFs that are soluble in methylene chloride and/or toluene. The compounds are separated using a gas chromatograph (GC) and detected using a high-resolution double focusing mass spectrometer (HRMS). Appendix 1 lists the analytes currently analyzed using these methods and their practical quantitation limits.
- 4.2 The practical quantitation limit (PQL) is the lowest level in the calibration curve. The PQL is the lowest level at which compounds may be accurately quantitated and is compound dependent. The calibration curve typically ranges from 1.0 ng/mL to 1000 ng/mL for methods 8290A, 0023A, and TO-9a, and from 0.5 ng/mL to 2000 ng/mL for method 1613B. These ranges reflect instrument readings, which are in ng/mL (ppb). It should be noted that the calibration range may vary between calibrations and instruments.
- 4.3 Method detection limit studies (MDLs) are performed and/or verified on an annual basis. MDLs are done for aqueous, solid, tissue and XAD matrices. For more information regarding MDLs, refer to The Determination of Method Detection Limits, CF-LB-E-001.
- 4.4 Qualified analysts must demonstrate proficiency initially and annually thereafter with an IDOC, CDOC, or PT study. Acceptability criteria may be found in the applicable analytical method.
 - 4.4.1 To establish the ability to generate acceptable accuracy and precision, the analyst should perform an "analyst validation study" or Initial Demonstration of Capability. Four LCS standards are extracted and analyzed. Calculate the average recovery and the standard deviation of the recovery for each analyte of interest using the four results. Then compare the average and the standard

deviation with the corresponding criteria found in Table 6 of method 1613B, or with the determined limits for methods 8290A and 0023A. If the average and the standard deviation for all analytes of interest meet the acceptance criteria, then the analyst may begin work on actual samples. If the validation study fails for one or more of the compounds, then the study must be repeated for those compounds which failed.

5.0 METHOD VARIATIONS

- 5.1 Cape Fear Analytical analyzes a calibration point at 0.25 ng/mL, which is below the method required low point.
- 5.2 Standards and sample extracts are stored at room temperature to avoid analyte loss. Many of the target analytes in these methods form a strong cohesive bond with solids such as glass in cold temperatures; this type of analyte loss is not addressed in the method. (This is a variance from the following method recommendations: $\leq 6^\circ$ per method 8290A; $< -10^\circ\text{C}$ per 1613B; -10° to -20°C per DoD QSM.)
- 5.3 Cape Fear Analytical utilizes the DB-5ms GC column (and may use the ultra inert version), which is capable of better resolution of the TCDF isomers. This column exhibits a different elution pattern than the DB-5 column referenced in the analytical methods. Relative retention time limits have been determined for this column for use with method 1613B, and are listed in Table 9.
- 5.4 Method 1613B does not address the reporting of EDL and EMPC. These values are reported for this method only when requested by the client.

6.0 DEFINITIONS

- 6.1 Accuracy: The degree of agreement between an observed value and an accepted reference value.
- 6.2 AlphaLIMS: The Laboratory Information Management System used at CFA, LLC.
- 6.3 Blank: An aliquot of reagent water or other blank matrix that is treated exactly as a sample including exposure to all glassware, equipment, solvents, reagents, and standard additions that are used with other samples. The LMB (Lab Method Blank) is used to determine if method analytes or other interferences are present in the laboratory environment, the reagents, or the apparatus. Contamination may be derived during sampling, transportation, storage or analysis. The blank may be used to establish a background value.
- 6.4 Calibration Standard (CAL): An aliquot of a primary standard solution or stock standard solution. The CAL solutions are used to calibrate the instrument response with respect to analyte concentration.
- 6.5 Calibration Verification Standard (CVS, CCAL, CS3WT): A solution of target analytes with a concentration near the mid-point of the calibration range. It should be obtained from a second source vendor and is used to verify the initial calibration on a basis described in the determinative method. This solution may also contain the window defining analytes and the column performance mix.
- 6.6 Cleanup Standards: Isotopes added prior to cleanup that are used to measure the efficiency of the fractionation step alone. Method 1613B uses one compound (37Cl4-2378-TCDD) as the Cleanup Standard. Method 8290A does not address the use of cleanup standards.

- 6.7 Duplicate Analysis: The analysis or measurement of the variable of interest performed identically on two field subsamples of the same sample. The results from duplicate analyses are used to evaluate analytical or measurement precision of sample, preservation, or storage internal to the laboratory.
- 6.8 Estimated Detection Limit (EDL): A calculation of the concentration of a given analyte required to produce a signal with a peak height of at least 2.5 times the background signal level. The EDL is calculated for each 2378-substituted congener that is not identified.
- 6.9 Estimated Maximum Possible Concentration (EMPC): A calculation for a peak characterized by a response with a signal-to-noise ratio of at least 2.5 for both the quantitation ions, and meeting all identification criteria except ion ratio. EMPC is a worst-case estimate of the concentration.
- 6.10 Extraction Standards: Isotopes added prior to extraction that serve as internal standards for many 2,3,7,8 substituted congeners. In addition, to measure the overall extraction and fractionation efficiencies. Method 8290A names them Internal Standards while Method 1613B uses the Labeled Compounds terminology.
- 6.11 Injection Standards: Isotopes added prior to injection to determine the recoveries of the Extraction and Cleanup Standards. Method 8290A names them Recovery Standards while Method 1613B calls them Internal Standards.
- 6.12 Internal Standard (ISTD): A known amount of standard added to a test portion of a sample as a reference for evaluating the retention time and concentration of dependent analytes and controlling the precision and bias of the applied analytical method.
- 6.13 Laboratory Control Standard (LCS): An aliquot of reagent water or other blank matrix to which known quantities of the method analytes are added in the laboratory. The LCS is analyzed exactly like a sample, and its purpose is to determine whether the methodology is in control, and whether the laboratory is capable of making accurate and precise measurements.
- 6.14 Laboratory Duplicate (DUP): Aliquots of a sample taken from the same container and processed in the same manner under identical laboratory conditions. The aliquot is analyzed independently from the parent sample and the results are compared to measure precision and accuracy.
- 6.15 Matrix Spike and Matrix Spike Duplicate (MS and MSD): Two separate aliquots of an environmental sample to which known quantities of the method analytes are added in the laboratory. The MS and MSD are analyzed exactly like a sample, and their purpose is to determine whether the sample matrix contributes bias to the analytical results. The concentrations of the analytes in the sample matrix must be determined in a separate aliquot and the measured values in the MS/MSD adjusted. Percent recovery is calculated for both aliquots, and RPD is calculated between the two.
- 6.16 Method Detection Limit (MDL): The minimum concentration of an analyte that can be identified, measured and reported with 99% confidence that the analyte concentration is greater than zero.
- 6.17 Precision: The degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves, a data quality

indicator. Precision is usually expressed as standard deviation, variance or range in either absolute or relative terms.

- 6.18 Quantitation Limits (also PQL, RL): The value at which an instrument can accurately measure an analyte at a specific concentration (i.e., a specific numeric concentration can be quantified). These points are established by the upper and lower limits of the linear calibration range.
- 6.19 Sampling Standards: Isotopes added prior to field sampling for Method 0023A and Method TO-9a that are used to measure the efficiency of the sampling step alone.

7.0 INTERFERENCES/LIMITATIONS

- 7.1 Contaminants found in extraction glassware, solvents, and other sample processing hardware may jeopardize the integrity of this method.
- 7.2 Glassware must be scrupulously cleaned as soon as possible after extraction.
- 7.3 Contamination may also occur in the GC/MS system. High boiling materials tend to build up in the injection port and the front end of the column. The analyst should maintain a thorough working knowledge of keeping the injection port free of contamination, including changing out the septum, injection port liner, O-ring, ferrule, and gold seal.
- 7.4 Contamination by carryover can occur whenever high-level and low-level samples are sequentially analyzed. To reduce carryover, the sample syringe must be rinsed with solvent between samples. If carryover is suspected, potentially impacted samples must be re-analyzed after any needed maintenance, solvent replacement, and/or cleaning has been done.
- 7.5 Upon review of a completed sequence, if one is required to perform a 200x or greater dilution because of a sample's target concentrations, that the rinse vials on the instrument that determined this dilution need must have its solvent replaced. This action should be documented in the maintenance log.

8.0 SAFETY PRECAUTIONS AND WARNINGS

METHYLENE CHLORIDE IS A SUSPECTED CARCINOGEN AND A KNOWN SKIN IRRITANT. NO OCCUPATIONAL EXPOSURE LIMIT FOR DIOXIN HAS BEEN ESTABLISHED. IT IS A KNOWN AND PROBABLE HUMAN CARCINOGEN.

CONTACT WITH OXIDIZERS MAY GENERATE EXPLOSIVE MIXTURES.

PREVENT SKIN AND EYE CONTACT BY USING SPECIFIED PERSONAL PROTECTIVE EQUIPMENT WHEN MAKING STOCK REAGENTS.

WORK UNDER A HOOD TO PREVENT INHALATION WHEN USING METHYLENE CHLORIDE.

- 8.1 Eye protection should be worn when handling samples, reagents, or standards.
NOTE: Contact lenses pose a special problem; soft lenses may absorb irritants and all lenses concentrate them. DO NOT wear contact lenses in the laboratory.
- 8.2 Treat all chemicals and samples as potential health hazards and reduce exposure to these chemicals to the lowest level possible. CFA maintains a current reference file of Material Safety Data Sheets (MSDS). These documents and individual sample MSDS provided by clients are maintained in the laboratory.
- 8.3 Personal Protective Equipment (PPE)
- 8.3.1 Gloves and eye protection should be worn when handling reagents, solvents, standards and samples.

8.3.2 Analysts should prepare samples and standards under the hood.

- 8.4 All samples, chemicals, extracts, and extraction residues must be transferred, delivered, and disposed of safely according to all related SOPs.
- 8.5 Never leave gas cylinders unchained or untied.
- 8.6 In the event of an accident or medical emergency, call for help immediately. When time and safety permit, management should be notified of all accidents.
- 8.7 Fire escape routes are posted in the lab, and all personnel should be familiar with them. In addition, fire safety equipment such as fire extinguishers and fire blankets are located in the lab. Training is available on the proper operation of this equipment.
- 8.8 The analyst must use care when assembling and operating instrumentation. Check to see that the gas chromatograph equipment is properly assembled and hooked up to the proper gas cylinder and power, referencing the appropriate manual. Analytical equipment must only be operated by qualified personnel.
- 8.9 For further safety instructions, consult the Safety Manual, CF-LB-N-001.

9.0 APPARATUS, EQUIPMENT AND INSTRUMENTATION

9.1 Equipment associated with this method includes:

- 9.1.1 Gas tight syringes
- 9.1.2 2 mL high recovery (conical) autosampler vials and storage racks
- 9.1.3 Teflon crimp tops
- 9.1.4 Crimper/De-crimper
- 9.1.5 GC Columns
 - 9.1.5.1 Agilent DB5-MS or equivalent (i.e. ui); 60 m, 0.25 mm, 0.25 um
 - 9.1.5.2 Agilent DB-225 or equivalent; 30 m, 0.25 mm, 0.25 um
- 9.1.6 Quartz/Glass injection port liners
- 9.1.7 Injection port liner O-ring seals
- 9.1.8 Gold seals
- 9.1.9 Ferrules
- 9.1.10 Column cleaving tool
- 9.1.11 Septa (thermogreen)
- 9.1.12 10-100 uL adjustable air displacement pipette with disposable tips

9.2 Instrumentation

- 9.2.1 Waters Autospec Premier high resolution mass spectrometer
- 9.2.2 Agilent 7890 Gas Chromatograph
 - 9.2.2.1 A suggested temperature program for primary analysis follows:

Initial Temp.	140° C
Hold Time	1.0 min.
Rate 1	20° C/min.
Temperature 2	180° C
Time 2	2°/min
Temperature 3	235° C

Rate 3 30° C/min.
Final Temp. 290° C
Hold Time 13 min.
Run Time: 45 minutes (may vary due to column length or flow rate)
Solvent Delay: 18.0 min.
Splitless Valve Time: 1.5 min.
Flow: 1.8 mL/min.
Mass Range: See descriptor definitions (Table 2)

NOTE: These instrument conditions and rates are guidelines which may change.

9.2.3 LEAP Technologies GC PAL Autosampler

9.2.3.1 Suggested parameters:

Sample volume – 1 µL
Air volume – 0.5 µL
Solvent push volume – 1 µL
Number of sample washes - 0
Solvent washes - 30
Sample viscosity wait – 1 second
Number of sample pumps - 0
Injection mode - Fast

10.0 REAGENTS AND STANDARDS

10.1 Reagents and standards

10.1.1 Nonane

10.1.2 Source Standards: Source Standards are purchased directly from vendors and may be diluted to make stock, intermediate, or working standards. These may include extraction standard, matrix spiking standard, cleanup standard, injection standard, as well as others. Source standards expire per the vendor expiration date or after five years from the date opened, whichever is shorter. Please reference CF-LB-E-007 and CF-OA-E-002 for further information regarding standards and their preparation.

10.1.3 Initial Calibration (ICAL) Standards: Certified calibration standards are purchased from commercial vendors at a minimum of five concentration levels. One of the calibration standards is at a concentration near, but above, the method detection limit; the others should correspond to the expected range of compounds found in samples. Calibration standards expire after a maximum of five years and should be monitored frequently for signs of degradation.

10.1.4 Calibration Verification Standards (CVS, CCAL, CS3WT): A certified CVS is purchased from a second source commercial vendor at a concentration that is near to the midpoint of the calibration curve.

10.1.5 Window Defining Mix and Column Performance Mix (WDM and CPM): A standard containing the first and last eluters for each homolog group, as well as the dioxin and furan isomers used to demonstrate isomer specificity on the GC column in use. These may be contained in the same standard as the calibration verification (known as CS3WT).

11.0 SAMPLE HANDLING AND PRESERVATION

- 11.1 Sample extracts have a 45-day holding time from the date of extraction by methods 8290A and 0023A, and a 365 day holding time from the date of extraction by 1613B. Note that per method 8290A, tissue extracts must be completely analyzed by 45 days from collection. TO-9a cartridges are considered clean for 30 days from preparation, samples must be extracted 7 days from collection and analyzed 40 days from extraction. See Table 13.
- 11.2 Sample extracts are delivered from the prep lab to the instrument lab and are stored in a darkened hood at room temperature. The extracts are usually grouped according to preparation batches and are accompanied by the batch pull sheet and other pertinent paperwork.
- 11.3 Custody of samples is monitored using the AlphaLIMS sample tracking system. Each analyst should scan the samples planned to run into their custody prior to analysis.
- 11.4 All sample extracts should be treated with caution as potential health hazards. Refer to Section 8.0 on safety.

12.0 SAMPLE PREPARATION

- 12.1 Before extracts can be analyzed on the instrument, they must first be evaporated to dryness under nitrogen and then spiked with injection standard to set the final volume nominally at 20 μ L. A determination must also be made as to whether the extract should be diluted. The decision to dilute a sample extract is based on a number of factors: sample screening, historical data about the sample or sample site, the appearance of the extract (color, viscosity, incidental odor, turbidity, etc.), or regulatory considerations. The experience of the analyst is invaluable in making this determination.
NOTE: Sample extracts may contain multiple layers or sediment. Samples that contain sediment are returned to cleanup. Multiple layers are treated on a case-by-case basis. If the extract can be homogenized, then a uniform sample is achieved. If the extract remains bi-phasic, the PM and client are contacted for further guidance.
- 12.2 If a sample is to be analyzed without dilution ('neat'), 2 nanograms of injection standard solution is added to the extract using a pipette (20 μ L of a 0.1 ng/ μ L = 100 pg/ μ L extract concentration). A cap is then placed on the vial and secured by crimping before vortexing the sample to ensure complete mixing and vial wall washing.
- 12.3 If samples require dilution, the dilution is made using nonane or appropriate solvent. If not previously added, 2 nanograms of JS is added to the autosampler vial. Dilution prep may involve the addition of supplemental extraction standard (ES) and is documented in the injection prep logbook.
- 12.4 Once samples are prepped, they are ready to be injected onto the instrument. An autosampler is used to inject standards and sample extracts on the instrument.
- 12.5 The need for dilution may also be determined after analysis is performed, and may still be performed as above. Under normal circumstances, a sample would be diluted if any chromatographic peaks saturate the detector.

13.0 QUALITY CONTROL REQUIREMENTS

Typically a blank (LMB), laboratory control sample (LCS) and laboratory control sample duplicate (LCSD) are extracted and analyzed with each prep batch. Other client requirements may include a matrix spike (MS) and matrix spike duplicate (MSD) or sample duplicate (DUP).

13.1 Blanks

- 13.1.1 A blank is extracted with each batch of 20 or fewer samples to demonstrate that interferences from glassware, reagents and the analytical system are under control. Blanks are carried through all stages of sample preparation and analysis. For Method 1613B, an acceptable blank must be below the minimum levels listed in Table 2 of the method for all analytes. For Methods 8290A, 0023A, and TO-9a, all analytes must be below the Lower Method Calibration Limits.
- 13.1.2 The percent recovery of each labeled standard (extraction and cleanup) is calculated as shown in Sec. 17.4.5. Recoveries must be within the limits in Table 7 for method 1613B. For methods 8290A and 0023A, extraction standard recoveries must be within 40-135%. Sampling standards for Method 0023A must be within 70-130%. For method TO-9a, extraction standards must be within 50-120% for tetra- through hexa- and within 40-120% for hepta- and OCDD. Sampling standards for Method TO-9a must be within 50-120%.

13.2 Laboratory Control Samples and Matrix Spikes

- 13.2.1 The spiking standard for LCS/LCSDs and MS/MSDs contains all analytes listed in Table 5. For each LCS, LCSD, MS and MSD, the concentration of each analyte and its percent recovery are calculated as shown in Sec. 17.4.1 and 17.4.5. For methods 8290A and 0023A, percent recoveries should be within 70-130%. For method 1613B, recovered concentrations should be within the limits in Table 6.
- 13.2.2 If recovery is not within these limits, the data may need to be re-checked for errors, or the samples and QC may need to be re-analyzed. In addition, the instrumentation may need to be checked for performance problems. If the LCS fails to meet acceptance criteria due to low recovery, the associated samples may have to be re-extracted and re-analyzed when possible. If one or more recoveries are high in the LCS and these analytes are not detected in the samples, the event should be documented and data may be reported. If the MS and MSD both fail due to matrix interference and/or dilution, data may be reported provided the associated LCS passes acceptance criteria.
NOTE: Many clients have contract specific criteria that must be considered when evaluating recovery of the Quality Control samples.
- 13.2.3 The percent recovery of each labeled standard (extraction and cleanup) is calculated as shown in Sec. 17.4.5. Recoveries must be within the limits in Table 6 for method 1613B. For methods 8290A and 0023A, extraction standard recoveries must be within 40-135%. Sampling standards for Method 0023A must be within 70-130%. For method TO-9a, extraction standards must be within 50-120% for tetra- through hexa- and within 40-120% for

hepta- and OCDD. Sampling standards for Method TO-9a must be within 50-120%.

13.3 Samples

13.3.1 The percent recovery of each labeled standard (as listed in SOP CF-OA-E-001) is calculated as shown in Sec. 17.4.5. Recoveries must be within the limits in Table 7 for method 1613B or 40-135% for method 8290A. For method TO-9a, extraction standards must be within 50-120% for tetra-through hexa- and within 40-120% for hepta- and OCDD. Sampling standards for Method TO-9a must be within 50-120%.

13.3.2 Calculated EDLs should be below the PQLs in Table 1. Any reported EDLs above the PQLs should be noted in the case narrative.

14.0 INSTRUMENT CALIBRATION, STANDARDIZATION, AND PERFORMANCE

14.1 Mass spectrometer performance

14.1.1 The mass spectrometer is operated in electron ionization mode. A static resolving power of at least 10,000 (10 percent valley definition) must be demonstrated at appropriate masses before any analysis is performed. Static resolving power checks must be performed at the beginning and at the end of each 12-hr period of operation. Corrective action must be implemented whenever the resolving power does not meet the requirement.

14.1.1.1 Chromatography time for PCDDs and PCDFs exceeds the long term mass stability of the mass spectrometer. Because the instrument is operated in the high-resolution mode, mass drifts of a few ppm (e.g., 5 ppm in mass) can have serious adverse effects on instrument performance. Therefore, a mass drift correction is mandatory. A lock-mass ion from the reference compound PFK is used for tuning the mass spectrometer. The selection of the lock-mass ion is dependent on the masses of the ions monitored within each descriptor. Lock mass ions may be found in the descriptor table, Table 2. The level of the reference compound (PFK) metered into the ion chamber during HRGC/HRMS analyses should be adjusted so that the amplitude of the most intense selected lock-mass ion signal (regardless of the descriptor number) does not exceed 10 percent of the full scale deflection for a given set of detector parameters. Under these conditions, sensitivity changes that might occur during the analysis can be more effectively monitored. NOTE: Excessive PFK (or any other reference substance) may cause noise problems and contamination of the ion source resulting in an increase in downtime for source cleaning.

14.1.2 Documentation of the instrument resolving power must be accomplished by recording the peak profile of the high-mass reference signal (m/z 380.9760) obtained during the above peak matching experiment by using the low mass PFK ion at m/z 304.9824 as a reference. The minimum resolving power of 10,000 must be demonstrated on the high-mass ion while it is transmitted at a lower accelerating voltage than the low-mass reference ion, which is transmitted at full sensitivity. The format of the peak profile representation (Figure 2) must allow manual determination of the resolution, i.e., the

horizontal axis must be a calibrated mass scale (amu or ppm per division). The result of the peak width measurement (performed at 5 percent of the maximum, which corresponds to the 10 percent valley definition) must appear on the hard copy and cannot exceed 100 ppm at m/z 380.9760 (or 0.038 amu at that particular mass).

14.2 System Performance

System performance criteria are presented below. The laboratory may use the recommended GC column described in Sec. 9.1. The laboratory must document that all applicable system performance criteria are met before sample analysis begins. Sec. 9.2.2 provides recommended GC conditions that may be used to satisfy the required criteria. Mass spectrometer resolving power checks must be performed at the beginning and the end of each 12-hr period of operation. A GC column performance check is required at the beginning of each 12-hr period during which samples are analyzed. For Method 1613B, a continuing calibration must be performed at the beginning of the sequence, while for Methods 0023A and 8290A, continuing calibrations must be performed at both the beginning and the end of a sequence. An ending continuing calibration may also serve as the beginning check for the next sequence.

14.2.1 GC Column performance check

- 14.2.1.1 Inject 1 μ L of an aliquot of the column performance check solution (Sec. 10.1.5) and acquire selected ion monitoring (SIM) data within a total cycle time of ≤ 1 second. The chromatographic separation between 2,3,7,8-TCDD and the peaks representing any other unlabeled TCDD isomers must be resolved with a valley of ≤ 25 percent (Figure 1), where:

$$\text{Valley percent} = (x/y) \times 100$$

x = measured as in Figure 1 from the 2,3,7,8-closest TCDD eluting isomer

y = the peak height of 2,3,7,8-TCDD

For 2378-TCDF confirmatory analysis, the chromatographic separation between 2378-TCDF and its closest eluters must be resolved with a valley of ≤ 25 percent.

- 14.2.1.2 It is the responsibility of the laboratory to verify the conditions suitable for the appropriate resolution of 2,3,7,8-TCDD from all other TCDD isomers. The GC column performance check solution also contains the known first and last PCDD/PCDF eluters under the conditions described in this SOP. Their retention times are used to determine the five homologue retention time windows that are used for qualitative (Sec. 15.3.1.1) and quantitative purposes. All peaks (including 13C12-2,3,7,8-TCDD) should be labeled and identified on the chromatograms. All first eluters of a homologous series should be labeled with the letter "F," and all last eluters of a homologous series should be labeled with the letter "L". Any individual selected ion current profile (SICP) or the reconstructed homologue ion current constitutes an acceptable form of data presentation. A SICP for the labeled compounds is also required.

- 14.2.1.3 Particular caution should be exercised for the switching time between the last tetra-chlorinated congener (1,2,8,9-TCDF) and the first penta-chlorinated congener (1,3,4,6,8-PeCDF), as these two compounds elute within 15 sec of each other on the 60m DB-5 column, and overlap on the 60m DB-5ms column. Both congeners must be acquired within one analysis.
- 14.2.1.4 The absolute retention time of $^{13}\text{C}_{12}$ -1,2,3,4-TCDD must exceed 25.0 minutes on the primary GC column in use, and 15.0 minutes on the confirmatory GC column.

14.3 Initial Calibration

- 14.3.1 Prior to running a multi-level calibration, take precautions to ensure that the instrument meets system performance criteria. The analyst must document that all system performance criteria are met before analyzing an initial calibration.
- 14.3.2 Initial calibration is required before any samples are analyzed for PCDDs and PCDFs and must meet the acceptance criteria listed below. Initial calibration is also required if any routine calibration does not meet the required criteria listed in Sec. 15.2, and at a minimum, annually.
- 14.3.3 At a minimum, all five high-resolution concentration calibration solutions listed in Table 5 must be used for the initial calibration.
- 14.3.4 Tune the instrument with PFK to meet the above-specified system performance criteria.
- 14.3.5 Inject the GC column performance check solution and acquire SIM mass spectral data. The total cycle time for each descriptor must be < 1 second. The laboratory must not perform any further analysis until it is demonstrated and documented that the criteria listed in Sec. 15.1.1.1 are met.
- 14.3.6 By using the same conditions (GC and MS) that produced acceptable results with the column performance check solution, analyze each of the five concentration calibration solutions. Each injection must meet the following ion ratio and signal-to-noise (S/N) requirements:
 - 14.3.6.1 The ratio of the areas of the integrated ion current for the ions appearing in Table 2 (homologous series quantitation ions) must be within the indicated control limits (set for each homologous series) in Table 3. These ion ratio requirements must be within the specified control limits simultaneously in one run. It is the analyst's responsibility to take corrective action if the ion abundance ratios are outside the limits.
 - 14.3.6.2 For each selected ion current profile (SICP) and for each GC signal corresponding to the elution of a target analyte and of its labeled standards, the S/N ratio must be better than or equal to 10. Manual measurement of S/N is required for any GC peak that has an apparent S/N of less than 15:1. The result of the calculation must appear on the SICP above the GC peak in question.
- 14.3.7 Calculate the 17 relative response factors (RF) for unlabeled target analytes relative to their appropriate internal standards (see Table 10). Also calculate

the RFs for the ESs and CSs relative to the appropriate injection standards according to the following formula:

$$RF = \frac{A_x C_{is}}{A_{is} C_x}$$

Where:

A_x = Sum of the Areas of the two characteristic ions for the compound being measured.

A_{is} = Sum of the Areas of the two characteristic ions for the specific internal standard.

C_{is} = Concentration of the specific internal standard.

C_x = Concentration of the compound being measured.

The RF is a dimensionless quantity; the units used to express C_{is} and C_x must be the same.

- 14.3.8 The RF for other isomers within a homolog group shall be determined from the average RF of the 2,3,7,8-substituted isomers. For example, the RF for non-2,3,7,8-substituted HxCDD isomers (totals peaks) is the average of the three 2,3,7,8-substituted isomers. NOTE: If only one 2,3,7,8-substituted isomer is present in the calibration then use that isomer's RF for all isomers within its homolog group.
- 14.3.9 Because more than five calibration levels may be analyzed, the analyst may choose to deactivate one or more levels globally. If a level is not used, it will be deactivated in the method for all analytes in that calibration mixture. In some cases the upper level(s) of the calibration may be deactivated in order to meet method criteria for single compounds. This practice results in a narrower calibration range. The low standard representing the PQL cannot be dropped. Please note that this practice does not represent "cherry picking," which is acknowledged as an unacceptable laboratory practice.
- 14.3.10 The average RF must be calculated for each compound as follows:

$$RF_{avg} = \frac{\sum_{i=1}^n X}{n}$$

Where:

N = number of calibration levels

X_i; i=1 to n, are the compounds RF values for each calibration point

- 14.3.11 Criteria for acceptable initial calibration

The criteria listed below for acceptable calibration must be met before sample analyses are performed.

- 14.3.11.1 Per method 8290A, the percent relative standard deviations for the mean response factors from the 17 unlabeled standards must not exceed ± 20 percent, and those for the nine labeled reference compounds must not exceed ± 20 percent. These limits also apply to Method 0023A. Per method 1613B, the percent relative standard deviations for the mean response factors from the 17

unlabeled standards must not exceed ± 20 percent, and those for the fifteen labeled reference compounds must not exceed ± 35 percent. See Table 12 for method TO-9a minimum requirements.

$$\%RSD = \frac{SD}{\bar{x}} \times 100$$

Where:

RSD = relative standard deviation

\bar{x} = mean of 5 or more initial RFs for a compound

SD = standard deviation of average RFs for a compound

$$SD = \sqrt{\frac{\sum_{i=1}^n (X - A)^2}{n - 1}}$$

where:

n = number of calibration levels

X_i ; $i=1$ to n , are the compounds RF values for each calibration point

A = average of the RFs from above

15.0 PROCEDURE FOR ANALYSIS AND INSTRUMENT OPERATION

15.1 Resolution check

15.1.1 At the beginning and end of each 12-hour window, mass resolution must be tuned and/or verified. A static resolving power of at least 10,000 must be demonstrated at appropriate masses before analysis is performed.

15.1.2 Using a PFK molecular leak, tune the instrument to the minimum required resolving power of 10,000 at m/z 330.9792 (for day to day operations, the instrument may be tuned to approximately 11,000). Verify that the exact mass of m/z 380.9760 is within 5 ppm of the required value.

15.2 Column Performance/Window Defining/Continuing Calibration Check (CS3WT)

15.2.1 Inject 1 μ L of the CS3WT or CPM. This standard is obtained from a different manufacturer or is a different lot from the same manufacturer than the initial calibration standard. Note that for NC drinking waters a different manufacture must be used. Verify that all column performance and window defining criteria in Section 14.2.1 have been met.

15.2.2 The CS3WT also contains the analytes for continuing calibration. The initial calibration curve for each compound of interest must be verified once every 12 hours.

Calculate the percent difference using:

$$\% \text{ Difference} = \frac{|\overline{RF}_i - RF_c|}{\overline{RF}_i} \times 100$$

Where:

\overline{RF}_i = average response factor from initial calibration

RF_c = response factor from current CS3WT

Calculate analyte concentrations using:

$$\left[PCDD / PCDF \right] = \frac{(A_{unk}^{ion1} + A_{unk}^{ion2})}{(A_{ES}^{ion1} + A_{ES}^{ion2})} \times \frac{Q_{ES}}{RF}$$

Where:

A_{unk} and A_{ES} = the integrated area for each ion monitored.

Q_{ES} = the amount of extraction standard in pg/uL

RF = Average RF from the ICAL for the compound

- 15.2.2.1 For methods 0023A and 8290A, if the percent difference for each native analyte in the CS3WT is $\leq 20\%$, and for each labeled analyte is $\leq 30\%$, the initial calibration is assumed to be valid. For method 1613B, analyte concentrations must fall within the limits in Table 8. If the criteria are not met, corrective action should be taken. If no source of the problem can be determined after corrective action has been taken, a new calibration may need to be generated. For Method TO-9a See Table 12 for minimum requirements.
- 15.2.2.2 All ion ratios must be within the limits in Table 3.
- 15.2.2.3 For methods 0023A and 8290A, if no more than two unrelated compounds in the continuing calibration check performed at the end of a 12-hour period fail by no more than $\pm 25\%$ for the 17 unlabeled compounds and $\pm 35\%$ for the 9 labeled compounds, the average RF values from the beginning and ending continuing calibration checks should be used to compute the analyte concentrations, instead of the RF values obtained from the initial calibration. No further sample analyses should be performed until an acceptable calibration is achieved.

15.3 Sample Analysis

15.3.1 Data Interpretation

15.3.1.1 Qualitative Determination

For a peak to be identified as a PCDD or PCDF, it must meet all of the criteria listed below.

- 15.3.1.1.1 The signals for the two m/z's being monitored must be present and maximize within ± 2 seconds of each other.
- 15.3.1.1.2 The signal-to-noise ratio between the two m/z's must be ≥ 2.5 for native compounds and ≥ 10 for labeled compounds.
- 15.3.1.1.3 Ion ratios must be within the limits in Table 3.
- 15.3.1.1.4 Relative Retention Times
 - 15.3.1.1.4.1 For Methods 0023A and 8290A, congeners which have an isotopically labeled compound must fall within -1 to +3 seconds of the labeled compound. Congeners with no labeled compound must be within 0.005 retention time units of the RRT measured in the continuing

calibration. (See Table 11.) For method TO-9a, congeners which have an isotopically labeled compound must fall within -3 to +3 seconds of the labeled compound. Congeners with no labeled compound must be within 0.005 retention time units of the RRT measured in the continuing calibration.

15.3.1.1.4.2 For Method 1613B, relative retention times must be within the RRT limits found in Table 9.

15.3.1.1.4.3 For non-2378 peaks, retention times must be within the retention time windows established by the analysis of the window defining mixture (Sec. 14.2.1.2).

15.3.1.1.5 For PCDFs, no peak may be present in the associated PCDPE channel at the same retention time. If a PCDPE peak is present, the PCDF peak should be reported with a flag denoting the interference.

15.3.1.1.6 Any sample in which 2378-TCDF has been identified at or above the method reporting limit must be confirmed on a second column (DB-225 or equivalent).

15.3.1.2 Calibration Limit Exceedance

15.3.1.2.1 If a compound in a sample exceeds the upper calibration limit, all subsequent samples must be checked for carryover contamination.

15.3.1.2.2 When a subsequent sample is non-detect for the compound in question, the sequence is again considered acceptable for reporting.

15.3.1.2.3 All affected samples between the exceeding sample and the non-detect sample must be re-analyzed.

16.0 EQUIPMENT AND INSTRUMENT MAINTENANCE

16.1 Preventive maintenance on a HRGC/HRMS system involves the following basic areas:

16.1.1 Vacuum pumps for the inlets, source, and analyzer need a change of oil about every year or when system performance indicates it is needed.

16.1.2 The GC injection port is cleaned as needed, approximately once a week. It is recommended that the septum and injection port liner be replaced at the time of cleaning. Additionally, the gold plated seal should be cleaned or replaced.

16.1.3 Ion source maintenance is usage dependent. The type and quantity of samples that have been injected determine the frequency of ion source cleaning and filament replacement.

- 16.1.4 Autosampler maintenance is primarily that of cleanliness. Most autosamplers need their moving parts to be clean and lightly lubricated. The most frequent corrective maintenance is that of changing the syringe, usually about once per month.
- 16.1.5 Instrument maintenance logs are kept with each instrument and serve as a record of all the maintenance that has been done on the instrument.
- 16.2 Non-Routine Maintenance Procedures (Special, Operational or Failure Mode Maintenance)
 - 16.2.1 Service is provided to the instrument via the analyst, the in-house instrument service engineer, or a technical support specialist from the manufacturer. When instrument failure occurs, different parts of the instrument are isolated to determine the root cause. For example, the injection port may be capped off if a leak is suspected to prove the leak is/is not coming from that source. Instrument maintenance logbooks are kept for each instrument detailing the type of maintenance performed on the instrument and when it was performed. Preventive maintenance visits are scheduled annually for the mass spectrometers.
 - 16.2.2 Analytical GC columns are clipped or replaced when the existing column shows signs of excessive degradation or the inability to properly resolve chromatographic peaks. Excessive peak tailing, poor responses, and baseline disturbances may also indicate that the column needs to be replaced.

17.0 DATA RECORDING, CALCULATION AND REDUCTION METHODS

- 17.1 Data are evaluated qualitatively and quantitatively using a software program such as Waters MassLynx, or equivalent data system.
- 17.2 Data are reviewed, and a hard copy is generated. If manual integrations are made, a hard copy of the manual integration is printed and initialed by the analyst and included with the raw data.
- 17.3 Additional supporting documentation, such as totals pages generated by the software may be included with the data.
- 17.4 Quantitative Analysis
 - 17.4.1 The concentration (ng/L for aqueous, ng/g for solids) of each identified compound in the sample is calculated as follows:

$$[PCDD / PCDF] = \frac{(A_{unk}^{ion1} + A_{unk}^{ion2})}{(A_{ES}^{ion1} + A_{ES}^{ion2})} \times \frac{Q_{ES}}{W_{unk} \times D \times \overline{RF}}$$

Where:

A_{unk} and A_{ES} = the integrated area for each ion monitored.

Q_{ES} = the amount of extraction standard added to the sample in nanograms

W_{unk} = the initial sample aliquot size, in liters for waters and in grams for solids.

D = (% moisture in sample)/100, or 1 for waters

\overline{RF} = Average RF from the ICAL for the compound

- 17.4.2 The estimated detection limit (EDL) is calculated as follows:

$$[EDL_{ppt}] = 2.5 \times \frac{(H_{unk}^{ion1} + H_{unk}^{ion2})}{(H_{ES}^{ion1} + H_{ES}^{ion2})} \times \frac{Q_{ES}}{W_{unk} \times \overline{RF}}$$

Where:

H_{unk} = the height of the noise present in each ion monitored.

H_{ES} = the height of the extraction standard peak in each ion monitored.

2.5 = signal-to-noise factor for minimum height of peak.

17.4.3 The estimated maximum possible concentration (EMPC) is calculated in the same manner as a concentration (Section 17.4.1).

17.4.4 The concentration of each extraction and cleanup standard is calculated as follows:

$$[ES_{ng}] = \frac{(A_{ES}^{ion1} + A_{ES}^{ion2})}{(A_{JS}^{ion1} + A_{JS}^{ion2})} \times \frac{Q_{JS}}{\overline{RF}}$$

Where:

A_{ES} and A_{JS} = the integrated area for each ion monitored.

Q_{JS} = the amount of injection standard added to the sample in nanograms

\overline{RF} = Average RF from the ICAL for the compound

The cleanup standard concentration is calculated as above, substituting the area of the individual cleanup standard ions for the extraction standard ions.

17.4.5 Percent recovery is calculated as follows:

$$\%R = \frac{R_{ng}}{S_{ng}} \times 100$$

Where:

R_{ng} = the amount of standard recovered in nanograms.

S_{ng} = the amount of standard spiked in nanograms.

18.0 POLLUTION/CONTAMINATION

18.1 Work area should be maintained free of dust and dirt accumulations.

18.2 Fume hoods are utilized to remove fumes and reduce the risk of airborne contaminants to ensure personnel safety. Hoods are monitored in accordance with CF-FC-E-003 for Fume Hood Face Velocity Performance Checks.

18.3 The laboratory area is restricted to authorized personnel.

19.0 DATA REVIEW, APPROVAL AND TRANSMITTAL

19.1 A review process is used to insure the quality of the data. Raw data are reviewed first by the analyst, then by a second (peer) analyst or a data validator. When the analyst is satisfied that the data have been correctly processed and uploaded to the LIMS, a data report is generated from AlphaLIMS. The AlphaLIMS report along with the raw data and supporting documentation, such as a run log and case narrative, are submitted for review to the data validator or another experienced analyst. The reviewer goes through the raw data as if he/she was working it up for the first time and verifies that they are correct. In addition, he/she must make sure that the data have been correctly entered into AlphaLIMS. AlphaLIMS reports may be self-reviewed. If errors are discovered in either the raw data or the AlphaLIMS report, then the two analysts should discuss the differences and how best to resolve them. In some cases, the peer review process may

uncover errors that lead to a sample being re-extracted or re-run. In cases such as these, a nonconformance report (NCR) should be completed and submitted to the Quality department. It is recommended that a copy of the NCR be given to the prep analyst if it involves a re-extraction and that a copy be kept with the original data.

19.2 Once the data review has been completed by the reviewer, the batch is returned to the analyst for corrections (if applicable) and the status is updated from REVW to DONE in AlphaLIMS.

19.3 Data may be transmitted automatically to AlphaLIMS. This automatic "upload" procedure may be activated prior to data review or after data review is complete. In either case, the data recorded in AlphaLIMS are checked by the analyst for accuracy and completeness.

20.0 CORRECTIVE ACTION FOR OUT-OF-CONTROL OR UNACCEPTABLE DATA

Corrective action for out-of-control data may require instrument maintenance, re-analysis, re-extraction, or a more complex set of actions. When troubleshooting measures fail to bring an analytical process or data into control, a nonconformance report and/or corrective action should be initiated in accordance with CF-QS-E-004 for the Documentation of Nonconformance Reporting and Dispositioning and Control of Nonconforming Items, and CF-QS-E-002 for Conducting Corrective Action.

21.0 CONTINGENCIES FOR HANDLING THESE SITUATIONS

Troubleshooting is used to determine the appropriate action to take when an initial or continuing calibration, blank and/or laboratory control sample fails to meet the acceptance criteria defined for the method. Troubleshooting may involve one or more of the following actions:

- 21.1 If analytes in a multi-point calibration fail to meet specified criteria, additional standards for the failing compounds may need to be reanalyzed. If they still do not meet specifications, instrument maintenance or new standards may be required before work is continued.
- 21.2 If a continuing calibration fails to meet specified criteria, instrument tuning or inlet maintenance may be required. If routine maintenance procedures fail to produce a second consecutive calibration verification within acceptance criteria, then the laboratory must demonstrate acceptable performance after further corrective action with two consecutive calibration verifications, or a new initial calibration must be analyzed.
- 21.3 If a method blank fails to meet defined criteria, the source of contamination should be found and eliminated before proceeding with analysis.
- 21.4 If normal equipment and software operating procedures do not resolve troubleshooting efforts, the manuals for software, hardware and other equipment discussed in this SOP are available for consultation and resolution. On-line support may be available from software and instrument manufacturers, as well. Any revisions, repairs or corrective actions required must be documented in accordance with the laboratory's Quality System as described in CF-QS-B-001.

22.0 RECORDS MANAGEMENT

- 22.1 Run logs are generated for each instrument each day that the instrument is run. These run logs serve as records of what is run on the instrument, including samples, QC, calibrations, tunes, etc. Additional information is provided in the run log, including the analyst's initials, run date and time, and file name.

22.2 Raw data are stored in the lab in filing cabinets and/or boxes as long as there is space available. When space runs out, the data are boxed and sent to storage.

22.3 All records generated as a result of this procedure are maintained as quality documents in accordance with CF-QS-E-008 for Quality Records Management and Disposition.

23.0 LABORATORY WASTE HANDLING AND DISPOSAL

Sample extracts that have been run are temporarily stored in case they have to be reanalyzed. Once space is no longer available to keep them in the lab, they are moved to Waste Disposal where they are handled and disposed in accordance with the Laboratory Waste Management Plan, CF-LB-G-001.

24.0 REFERENCES

- 24.1 Test Methods for Evaluating Solid Waste: Laboratory Manual Physical/ Chemical Methods, Volume 1B, SW-846, 3rd Edition, Feb. 2007. Method 8290A, “Polychlorinated Dibenzodioxins (PCDDs) and Polychlorinated Dibenzofurans (PCDFs) by High Resolution Gas Chromatography/ High Resolution Mass Spectrometry (HRGC/HRMS),” Rev. 1, Feb. 2007. USEPA, Office of Solid Waste and Emergency Response, Washington, DC 20460.
- 24.2 Method 1613, “Tetra- through Octa-Chlorinated Dioxins and Furans by Isotope Dilution HRGC/HRMS,” Rev. B, Oct. 1994. USEPA, Office of Water, Engineering and Analysis Division, 401 M Street SW, Washington, D.C. 20460.
- 24.3 Test Methods for Evaluating Solid Waste: Laboratory Manual Physical/ Chemical Methods, Volume 1B, SW-846, 3rd Edition, Feb. 2007. Method 0023A, “Sampling Method for Polychlorinated Dibenzo-p-Dioxins and Polychlorinated Dibenzofuran Emissions From Stationary Sources,” Rev. 1, Dec. 1996. USEPA, Office of Solid Waste and Emergency Response, Washington, DC 20460.
- 24.4 Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, Second Edition. “Compendium Method TO-9A, Determination of Polychlorinated, Polybrominated and Brominated/Chlorinated Dibenzo-p-Dioxins and Dibenzofurans in Ambient Air.” January 1999. Center for Environmental Research Information, Office of Research and Development, USEPA, Cincinnati, OH 45268.
- 24.5 The NELAC Institute, (TNI) 2009 Standard, EL-V1-2009.

25.0 HISTORY

Revision 1: Section 15.3.1.2 added.

Revision 2: Absolute RT information added in 14.2.1.4; Calibration limit exceedance information added in section 15.3.1.2; Table 8 footnote describing RRT window adjustment to column used.

Revision 3: Method 0023A requirements added.

Revision 4: 2378-TCDF confirmation procedure and requirements added.

Revision 5: Injection standard changed from Tridecane to nonane. Discussion of equipment use and operation instructions was added, per DoD ELAP gray box 22.

Revision 6: Added TO-9a support and additional Tables for Method 8290.

Revision 7: Removed references to 8290 cleanup standard. Added TO-9a reference.

Revision 8: RRT limits for 1613 adjusted to method limits, except for three which have methods widths but db-5ms centers.

Revision 9: Added air matrix descriptions.

Revision 10: Table 9 updated. Maintenance rule for highly contaminated samples. TNI reference updated.

Revision 11: Changed EDL signal to noise value to 2.5. Updated Table references.

Revision 12: Added Table 13, Method Holding Times.

Revision 13: Added a NC requirement that a 1613 DW CCAL standard must only be obtained from a different manufacturer.

Revision 14: Adjusted TO-9a SS limits, added DB-5ms ui column use.

TABLE 1: METHOD ANALYTES AND PQLs

Analyte	Solid/Tissues (pg/g)	Aqueous (pg/L)	Air (pg)	CAS Number*
2378-TCDD	1	10	10	1746-01-6
12378-PeCDD	5	50	50	40321-76-4
123478-HxCDD	5	50	50	39227-28-6
123678-HxCDD	5	50	50	57653-85-7
123789-HxCDD	5	50	50	19408-74-3
1234678-HpCDD	5	50	50	35822-39-4
OCDD	10	100	100	3268-87-9
2378-TCDF	1	10	10	51207-31-9
12378-PeCDF	5	50	50	57117-41-6
23478-PeCDF	5	50	50	57117-31-4
123478-HxCDF	5	50	50	70648-26-9
123678-HxCDF	5	50	50	57117-44-9
234678-HxCDF	5	50	50	60851-34-5
123789-HxCDF	5	50	50	72918-21-9
1234678-HpCDF	5	50	50	67562-39-4
1234789-HpCDF	5	50	50	55673-89-7
OCDF	10	100	100	39001-02-0

* Chemical Abstract Services number

TABLE 2: MASS DESCRIPTORS

Function (#)	Channel (#)	Mass (amu)	Dwell Time (ms)	I.C. Delay (ms)
1	1	303.9016	50	10
1	2	305.8987	50	10
1	3	315.9419	50	10
1	4	304.9824	50	10
1	5	304.9824	(Lock)	10
1	6	317.9389	50	10
1	7	319.8965	50	10
1	8	321.8936	50	10
1	9	327.8847	50	10
1	10	331.9368	50	10
1	11	333.9339	50	10
1	12	339.8597	50	10
1	13	341.8568	50	10
1	14	375.8364	50	10
2	1	339.8597	50	10
2	2	341.8568	50	10
2	3	351.9	50	10
2	4	353.897	50	10
2	5	355.8546	50	10
2	6	357.8517	50	10
2	7	366.9792	50	10
2	8	366.9792	(Lock)	10
2	9	367.8949	50	10
2	10	369.8919	50	10
2	11	409.7974	50	10
3	1	373.8207	50	10
3	2	375.8178	50	10
3	3	380.976	50	10

Function (#)	Channel (#)	Mass (amu)	Dwell Time (ms)	I.C. Delay (ms)
3	4	380.976	(Lock)	10
3	5	383.8639	50	10
3	6	385.861	50	10
3	7	389.8156	50	10
3	8	391.8127	50	10
3	9	401.8559	50	10
3	10	403.853	50	10
3	11	445.7555	50	10
4	1	407.7818	50	10
4	2	409.7788	50	10
4	3	417.8253	50	10
4	4	419.822	50	10
4	5	423.7767	50	10
4	6	425.7737	50	10
4	7	430.9728	50	10
4	8	430.9728	(Lock)	10
4	9	435.8169	50	10
4	10	437.814	50	10
4	11	479.7165	50	10
5	1	441.7427	50	10
5	2	443.7398	50	10
5	3	454.9728	50	10
5	4	454.9728	(Lock)	10
5	5	457.7377	50	10
5	6	459.7348	50	10
5	7	469.778	50	10
5	8	471.775	50	10
5	9	513.6775	50	10

TABLE 3: THEORETICAL ION RATIOS AND CONTROL LIMITS

Level of Chlorination	Theoretical Ratio	Control Limits	
		Lower	Upper
4	0.77	0.65	0.89
5	1.55	1.32	1.78
6	1.24	1.05	1.43
6 ^a	0.51	0.43	0.59
7	1.05	0.88	1.20
7 ^b	0.44	0.37	0.51
8	0.89	0.76	1.02

^a Used only for ¹³C-HxCDF^b Used only for ¹³C-HpCDF**TABLE 4: 1613B LIMITS FOR TETRA ONLY TESTS**

Compound Name	Test Conc. (pg/μL)	CCAL Limits (pg/μL)	OPR Limits (pg/μL)	Sample Limits (pg/μL)
2,3,7,8-TCDD	10	8.2 - 12.3	7.3 - 14.6	-
2,3,7,8-TCDF	10	8.6 - 11.6	8.0 - 14.7	-
¹³ C ₁₂ -2,3,7,8-TCDD	100	85 - 117	25 - 141	31 - 137
¹³ C ₁₂ -2,3,7,8-TCDF	100	76 - 131	26 - 126	29 - 140
³⁷ Cl ₄ -2,3,7,8-TCDD	10	8.3 - 12.1	3.7 - 15.8	4.2 - 16.4

TABLE 5: INITIAL CALIBRATION CONCENTRATIONS

Analyte	Concentration (pg/uL)				
	CS-0.5	CS-2	CS-3	CS-4	CS-5
2378-TCDD	0.25	2	10	40	200
2378-TCDF	0.25	2	10	40	200
12378-PeCDD	1.25	10	50	200	1000
12378-PeCDF	1.25	10	50	200	1000
23478-PeCDF	1.25	10	50	200	1000
123478-HxCDD	1.25	10	50	200	1000
123678-HxCDD	1.25	10	50	200	1000
123789-HxCDD	1.25	10	50	200	1000
123478-HxCDF	1.25	10	50	200	1000
123678-HxCDF	1.25	10	50	200	1000
123789-HxCDF	1.25	10	50	200	1000
234678-HxCDF	1.25	10	50	200	1000
1234678-HpCDD	1.25	10	50	200	1000
1234678-HpCDF	1.25	10	50	200	1000
1234789-HpCDF	1.25	10	50	200	1000
OCDD	2.5	20	100	400	2000
OCDF	2.5	20	100	400	2000
<u>Extraction Standards</u>					
¹³ C-2378-TCDD	100	100	100	100	100
¹³ C-2378-TCDF	100	100	100	100	100
¹³ C-12378-PeCDD	100	100	100	100	100
¹³ C-12378-PeCDF	100	100	100	100	100
¹³ C-23478-PeCDF	100	100	100	100	100
¹³ C-123678-HxCDD	100	100	100	100	100
¹³ C-123478-HxCDD	100	100	100	100	100
¹³ C-123478-HxCDF	100	100	100	100	100
¹³ C-123678-HxCDF	100	100	100	100	100
¹³ C-123789-HxCDF	100	100	100	100	100
¹³ C-234678-HxCDF	100	100	100	100	100
¹³ C-1234678-HpCDD	100	100	100	100	100
¹³ C-1234678-HpCDF	100	100	100	100	100
¹³ C-1234789-HpCDF	100	100	100	100	100
¹³ C-OCDD	200	200	200	200	200
<u>Cleanup Standards</u>					
³⁷ Cl-2378-TCDD	0.25	2	10	40	200
<u>Injection Standards</u>					
¹³ C-1234-TCDD	100	100	100	100	100
¹³ C-123789-HxCDD	100	100	100	100	100

TABLE 6: METHOD 1613B LCS LIMITS

LCS Recovery Limits		
Analyte	Amount Spiked	Limit
	(pg/uL)	(pg/uL)
2378-TCDD	10	6.7-15.8
12378-PeCDD	50	35-71
123478-HxCDD	50	35-82
123678-HxCDD	50	38-67
123789-HxCDD	50	32-81
1234678-HpCDD	50	35-70
OCDD	100	78-144
2378-TCDF	10	7.5-15.8
12378-PeCDF	50	40-67
23478-PeCDF	50	34-80
123478-HxCDF	50	36-67
123678-HxCDF	50	42-65
123789-HxCDF	50	39-65
234678-HxCDF	50	35-78
1234678-HpCDF	50	41-61
1234789-HpCDF	50	39-69
OCDF	100	63-170
¹³ C-2378-TCDD	100	20-175
¹³ C-12378-PeCDD	100	21-227
¹³ C-123478-HxCDD	100	21-193
¹³ C-123678-HxCDD	100	25-163
¹³ C-1234678-HpCDD	100	26-166
¹³ C-OCDD	200	26-397
¹³ C-2378-TCDF	100	22-152
¹³ C-12378-PeCDF	100	21-192
¹³ C-23478-PeCDF	100	13-328
¹³ C-123478-HxCDF	100	19-202
¹³ C-123678-HxCDF	100	21-159
¹³ C-123789-HxCDF	100	17-205
¹³ C-234678-HxCDF	100	22-176
¹³ C-1234678-HpCDF	100	21-158
¹³ C-1234789-HpCDF	100	20-186
³⁷ Cl-2378-TCDD	10	3.1-19.1

TABLE 7: METHOD 1613B ES (SAMPLES & LMB) RECOVERY LIMITS

Compound Name	Amount Spiked (pg/μL)	Limits %
¹³ C ₁₂ -2,3,7,8-TCDD	100	25 - 164
¹³ C ₁₂ -1,2,3,7,8-PeCDD	100	25 - 181
¹³ C ₁₂ -1,2,3,4,7,8-HxCDD	100	32 - 141
¹³ C ₁₂ -1,2,3,6,7,8-HxCDD	100	28 - 130
¹³ C ₁₂ -1,2,3,4,6,7,8-HpCDD	100	23 - 140
¹³ C ₁₂ -OCDD	200	17 - 157
¹³ C ₁₂ -2,3,7,8-TCDF	100	24 - 169
¹³ C ₁₂ -1,2,3,7,8-PeCDF	100	24 - 185
¹³ C ₁₂ -2,3,4,7,8-PeCDF	100	21 - 178
¹³ C ₁₂ -1,2,3,4,7,8-HxCDF	100	26 - 152
¹³ C ₁₂ -1,2,3,6,7,8-HxCDF	100	26 - 123
¹³ C ₁₂ -2,3,4,6,7,8-HxCDF	100	28 - 136
¹³ C ₁₂ -1,2,3,7,8,9-HxCDF	100	29 - 147
¹³ C ₁₂ -1,2,3,4,6,7,8-HpCDF	100	28 - 143
¹³ C ₁₂ -1,2,3,4,7,8,9-HpCDF	100	26 - 138
³⁷ Cl ₄ -2,3,7,8-TCDD	10	35 - 197

TABLE 8: METHOD 1613B CONTINUING CALIBRATION LIMITS

Compound Name	CCAL (pg/μL)	Limits (pg/μL)	Compound Name	CCAL (pg/μL)	Limits (pg/μL)
2,3,7,8-TCDD	10	7.8 - 12.9	¹³ C ₁₂ -2,3,7,8-TCDD	100	82 - 121
1,2,3,7,8-PeCDD	50	39 - 65	¹³ C ₁₂ -1,2,3,7,8-PeCDD	100	62 - 160
1,2,3,4,7,8-HxCDD	50	39 - 64	¹³ C ₁₂ -1,2,3,4,7,8-HxCDD	100	85 - 117
1,2,3,6,7,8-HxCDD	50	39 - 64	¹³ C ₁₂ -1,2,3,6,7,8-HxCDD	100	85 - 118
1,2,3,7,8,9-HxCDD	50	41 - 61	¹³ C ₁₂ -1,2,3,4,6,7,8-HpCDD	100	72 - 138
1,2,3,4,6,7,8-HpCDD	50	43 - 58	¹³ C ₁₂ -OCDD	200	96 - 415
OCDD	100	79 - 126	¹³ C ₁₂ -2,3,7,8-TCDF	100	71 - 140
2,3,7,8-TCDF	10	8.4 - 12	¹³ C ₁₂ -1,2,3,7,8-PeCDF	100	76 - 130
1,2,3,7,8-PeCDF	50	41 - 60	¹³ C ₁₂ -2,3,4,7,8-PeCDF	100	77 - 130
2,3,4,7,8-PeCDF	50	41 - 61	¹³ C ₁₂ -1,2,3,4,7,8-HxCDF	100	76 - 131
1,2,3,4,7,8-HxCDF	50	45 - 56	¹³ C ₁₂ -1,2,3,6,7,8-HxCDF	100	70 - 143
1,2,3,6,7,8-HxCDF	50	44 - 57	¹³ C ₁₂ -2,3,4,6,7,8-HxCDF	100	73 - 137
2,3,4,6,7,8-HxCDF	50	44 - 57	¹³ C ₁₂ -1,2,3,7,8,9-HxCDF	100	74 - 135
1,2,3,7,8,9-HxCDF	50	45 - 56	¹³ C ₁₂ -1,2,3,4,6,7,8-HpCDF	100	78 - 129
1,2,3,4,6,7,8-HpCDF	50	45 - 55	¹³ C ₁₂ -1,2,3,4,7,8,9-HpCDF	100	77 - 129
1,2,3,4,7,8,9-HpCDF	50	43 - 58	³⁷ Cl ₄ -2,3,7,8-TCDD	10	7.9 - 12.7
OCDF	100	63 - 159			

TABLE 9: METHOD 1613B RELATIVE RETENTION TIME LIMITS

Compound	RRT Reference	RRT Limits
2,3,7,8-TCDD	13C -2,3,7,8-TCDD	0.999 - 1.002
1,2,3,7,8-PeCDD	13C -1,2,3,7,8-PeCDD	0.999 - 1.002
1,2,3,4,7,8-HxCDD	13C -1,2,3,4,7,8-HxCDD	0.999 - 1.001
1,2,3,6,7,8-HxCDD	13C -1,2,3,6,7,8-HxCDD	0.997 - 1.003
1,2,3,7,8,9-HxCDD	13C -1,2,3,6,7,8-HxCDD	0.997 - 1.016
1,2,3,4,6,7,8-HpCDD	13C -1,2,3,4,6,7,8-HpCDD	0.999 - 1.001
OCDD	13C -OCDD	0.999 - 1.001
2,3,7,8-TCDF	13C -2,3,7,8-TCDF	0.999 - 1.003
1,2,3,7,8-PeCDF	13C -1,2,3,7,8-PeCDF	0.999 - 1.002
2,3,4,7,8-PeCDF	13C -2,3,4,7,8-PeCDF	0.999 - 1.002
1,2,3,4,7,8-HxCDF	13C -1,2,3,4,7,8-HxCDF	0.999 - 1.001
1,2,3,6,7,8-HxCDF	13C -1,2,3,6,7,8-HxCDF	0.996 - 1.004
2,3,4,6,7,8-HxCDF	13C -2,3,4,6,7,8-HxCDF	0.999 - 1.001
1,2,3,7,8,9-HxCDF	13C -1,2,3,7,8,9-HxCDF	0.999 - 1.001
1,2,3,4,6,7,8-HpCDF	13C -1,2,3,4,6,7,8-HpCDF	0.999 - 1.001
1,2,3,4,7,8,9-HpCDF	13C -1,2,3,4,7,8,9-HpCDF	0.999 - 1.001
OCDF	13C -OCDD	1.002 - 1.011
13C -2,3,7,8-TCDD	13C -1,2,3,4-TCDD	0.986 - 1.053
13C -1,2,3,7,8-PeCDD	13C -1,2,3,4-TCDD	0.849 - 1.416
13C -1,2,3,4,7,8-HxCDD	13C -1,2,3,7,8,9-HxCDD	0.980 - 1.003
13C -1,2,3,6,7,8-HxCDD	13C -1,2,3,7,8,9-HxCDD	0.983 - 1.005
13C -1,2,3,4,6,7,8-HpCDD	13C -1,2,3,7,8,9-HxCDD	1.068 - 1.092
13C -OCDD	13C -1,2,3,7,8,9-HxCDD	1.050 - 1.329
13C -2,3,7,8-TCDF	13C -1,2,3,4-TCDD	0.904 - 1.084
13C -1,2,3,7,8-PeCDF	13C -1,2,3,4-TCDD	0.893 - 1.318
13C -2,3,4,7,8-PeCDF	13C -1,2,3,4-TCDD	0.869 - 1.384
13C -1,2,3,4,7,8-HxCDF	13C -1,2,3,7,8,9-HxCDD	0.960 - 0.986
13C -1,2,3,6,7,8-HxCDF	13C -1,2,3,7,8,9-HxCDD	0.962 - 0.988
13C -2,3,4,6,7,8-HxCDF	13C -1,2,3,7,8,9-HxCDD	0.957 - 1.019
13C -1,2,3,7,8,9-HxCDF	13C -1,2,3,7,8,9-HxCDD	0.973 - 1.043
13C -1,2,3,4,6,7,8-HpCDF	13C -1,2,3,7,8,9-HxCDD	1.026 - 1.068
13C -1,2,3,4,7,8,9-HpCDF	13C -1,2,3,7,8,9-HxCDD	1.050 - 1.144
37Cl -2,3,7,8-TCDD	13C -1,2,3,4-TCDD	0.988 - 1.051

Due to the use of the DB-5ms column, some compounds exhibit slightly different elution times, resulting in RRT limits which vary from the method. The widths of the limits are the same as the method, only the center of the window has been adjusted to the DB-5ms's elution times.

TABLE 10: Method 8290 IS assignments**Internal Standard References
Method 8290**

Analytes	Internal Standards
2378-TCDD	¹³ C-2378-TCDD
12378-PeCDD	¹³ C-12378-PeCDD
123478-HxCDD	¹³ C-123678-HxCDD
123678-HxCDD	¹³ C-123678-HxCDD
123789-HxCDD	¹³ C-123678-HxCDD
1234678-HpCDD	¹³ C-1234678-HpCDD
OCDD	¹³ C-OCDD
2378-TCDF	¹³ C-2378-TCDF
12378-PeCDF	¹³ C-12378-PeCDF
23478-PeCDF	¹³ C-12378-PeCDF
123478-HxCDF	¹³ C-123678-HxCDF
123678-HxCDF	¹³ C-123678-HxCDF
123789-HxCDF	¹³ C-123678-HxCDF
234678-HxCDF	¹³ C-123678-HxCDF
1234678-HpCDF	¹³ C-1234678-HpCDF
1234789-HpCDF	¹³ C-1234678-HpCDF
OCDF	¹³ C-OCDD
Extraction Standards	Injection Standards
¹³ C-2378-TCDD	¹³ C-1234-TCDD
¹³ C-12378-PeCDD	¹³ C-1234-TCDD
¹³ C-123678-HxCDD	¹³ C-123789-HxCDD
¹³ C-1234678-HpCDD	¹³ C-123789-HxCDD
¹³ C-OCDD	¹³ C-123789-HxCDD
¹³ C-2378-TCDF	¹³ C-1234-TCDD
¹³ C-12378-PeCDF	¹³ C-1234-TCDD
¹³ C-123678-HxCDF	¹³ C-123789-HxCDD
¹³ C-1234678-HpCDF	¹³ C-123789-HxCDD
Injection Standards	
¹³ C-1234-TCDD	NA
¹³ C-123789-HxCDD	NA

TABLE 11: 8290 Retention time limits

Retention Time Limits
Method 8290

Analytes	Description	Limits
2378-TCDD	2,3,7,8-substituted congeners, which have an isotopically-labeled standard present in the sample extract	must be within -1 to +3 seconds of the isotopically-labeled standard
12378-PeCDD		
123678-HxCDD		
123789-HxCDD		
1234678-HpCDD		
OCDD		
2378-TCDF		
12378-PeCDF		
123678-HxCDF		
123789-HxCDF		
1234678-HpCDF		
123478-HxCDD	2,3,7,8-substituted compounds that do not have an isotopically-labeled standard present in the sample extract	must fall within 0.005 retention time units of the relative retention time as determined from the daily routine calibration
23478-PeCDF		
123478-HxCDF		
234678-HxCDF		
1234789-HpCDF		
OCDF	Non-2,3,7,8-substituted target compounds	must be within the corresponding homologous retention time windows established by analyzing the column performance check solution, relative to an isotopically-labeled standard in the sample
Total TCDDs		
Total PeCDDs		
Total HxCDDs		
Total HpCDDs		
Total TCDFs		
Total PeCDFs		
Total HxCDFs		
Total HpCDFs	Isotopically-labeled standards	No method limits: allowed to shift as long as the predicted RT of the native window defining isomers established by analyzing the column performance check solution remain within the descriptor switching time
¹³ C-2378-TCDD		
¹³ C-12378-PeCDD		
¹³ C-123678-HxCDD		
¹³ C-1234678-HpCDD		
¹³ C-OCDD		
¹³ C-2378-TCDF		
¹³ C-12378-PeCDF		
¹³ C-123678-HxCDF		
¹³ C-1234678-HpCDF		
¹³ C-1234-TCDD		
¹³ C-123789-HxCDD		

TABLE 12: METHOD TO-9A MINIMUM REQUIREMENTS FOR INITIAL AND DAILY**CALIBRATION**

Unlabeled Analytes	ICAL (RSD)	CVS (%D)
2,3,7,8-TCDD	25	25
2,3,7,8-TCDF	25	25
1,2,3,7,8-PeCDD	25	25
1,2,3,7,8-PeCDF	25	25
2,3,4,7,8-PeCDF	25	25
1,2,4,5,7,8-HxCDD	25	25
1,2,3,6,7,8-HxCDD	25	25
1,2,3,7,8,9-HxCDD	25	25
1,2,3,4,7,8-HxCDF	25	25
1,2,3,6,7,8-HxCDF	25	25
1,2,3,7,8,9-HxCDF	25	25
2,3,4,6,7,8-HxCDF	25	25
1,2,3,4,6,7,8-HpCDD	25	25
1,2,3,4,6,7,8-HpCDF	25	25
OCDD	25	25
OCDF	30	30

Internal Standards

13C-2,3,7,8-TCDD	25	25
13C-1,2,3,7,8-PeCDD	30	30
13C-1,2,3,6,7,8-HxCDD	25	25
13C-1,2,3,4,6,7,8-HpCDD	30	30
13C-OCDD	30	30
13C-2,3,7,8-TCDF	30	30
13C-1,2,3,7,8-PeCDF	30	30
13C-1,2,3,4,7,8-HxCDF	30	30
13C-1,2,3,4,6,7,8-HpCDF	30	30

Surrogate Sampling Standards

37Cl-2,3,7,8-TCDD	25	25
13C-2,3,4,7,8-PeCDF	25	25
13C-1,2,3,4,7,8-HxCDD	25	25
13C-1,2,3,4,7,8-HxCDF	25	25
13C-1,2,3,4,7,8,9-HpCDF	25	25

TABLE 13: METHOD HOLDING TIMES

Method	Collection to Extraction	Extraction to Analysis
8290A *	30 days	45 days
1613B	365 days	365 days
DLM02.2	365 days	365 days
M23	30 days	45 days
TO-9a	7 days	40 days
CBC01.2	35 days collect to analysis	
1668A/C	365 days	365 days

* NOTE: The holding times listed in method 8290 are recommendations. PCDDs and PCDFs are very stable in a variety of matrices, and holding times under the conditions listed in this section may be as long as a year for certain matrices.

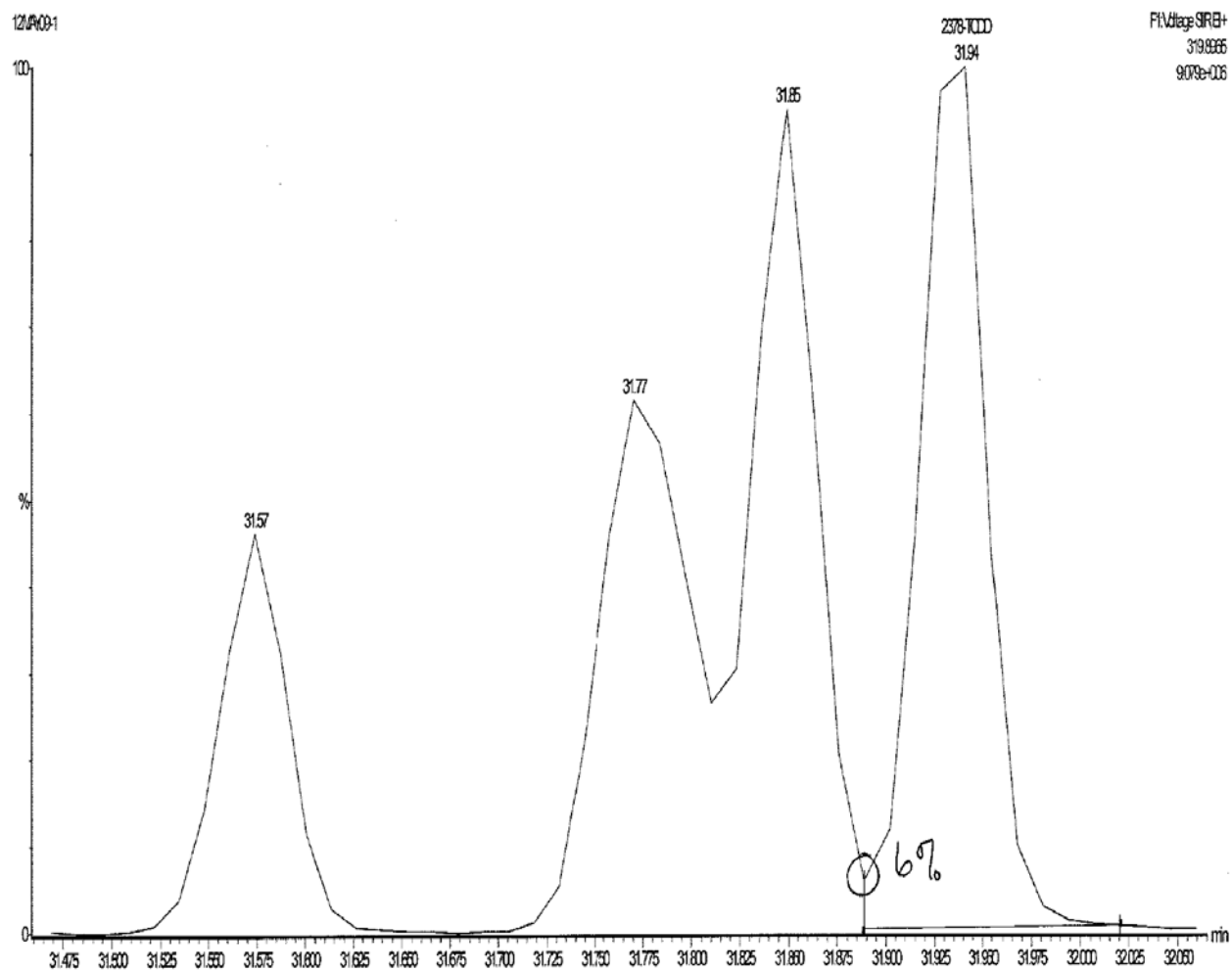
FIGURE 1: 2378-TCDD CHROMATOGRAPHIC SEPARATION

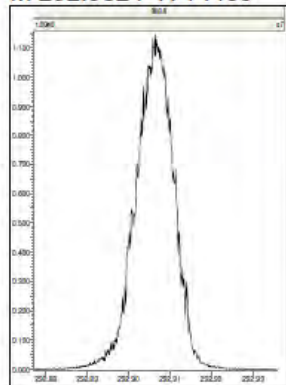
FIGURE 2: INSTRUMENT RESOLVING POWER (EXAMPLE)**Experiment Calibration Report****MassLynx 4.1**

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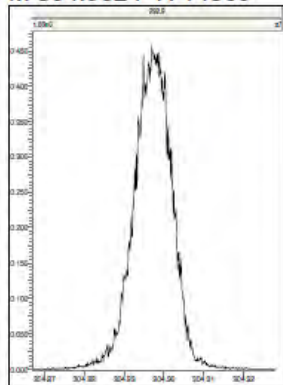
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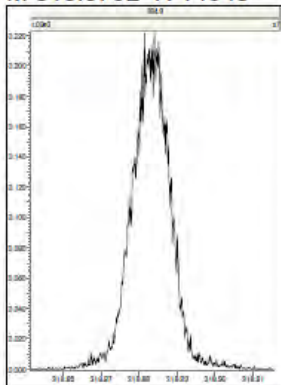
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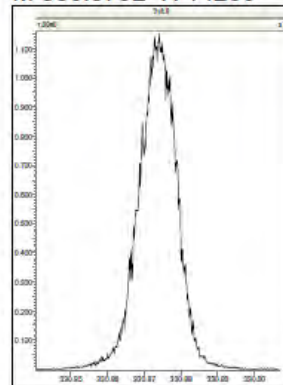
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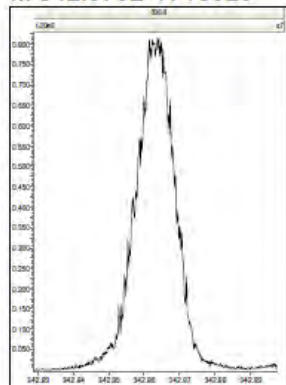
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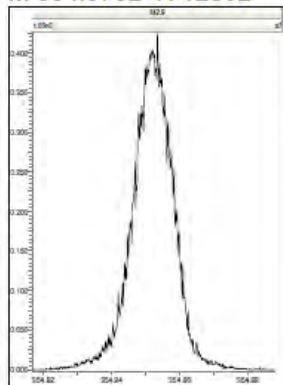
M 330.9792 R 14200



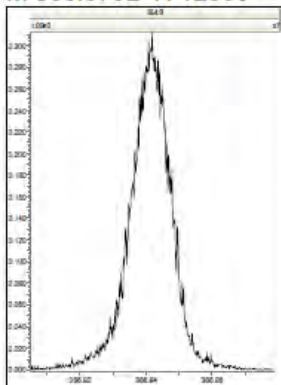
M 342.9792 R 13020



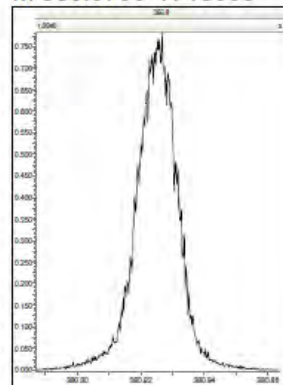
M 354.9792 R 12502



M 366.9792 R 12500



M 380.9760 R 13093



Determination of Organochlorine Pesticides By Gas Chromatography/Electron Capture Detection (GC/ECD)

References: Method 8081B Rev. 2, Update IV, Feb 2007, and Method 8000C Test Methods for Evaluating Solid Waste, SW-846, Third Edition, Final Update III, December 1996 (USEPA, Office of Solid Waste and Emergency Response, Washington, DC).

USEPA Contract Laboratory Program Statement of Work for Organics Analysis Multi-Media, Multi-Concentration" August 1991. Document Number OLM03.1 and OLM04.2.

Massachusetts Contingency Plan (MCP) WSC-CAM for SW846 Method 8081 Pesticides by GC/ECD. Section VB Rev4. August 2004 (Massachusetts Department of Environmental Protection Bureau of Waste site cleanup)

1. Scope and Application

Matrices: This method is applicable to the quantification of Organochlorine Pesticides in water, soil, sediment, sludge, product, and tissue (either animal or vegetative).

Definitions: Refer to Alpha Analytical Quality Manual.

This method is applicable to the analysis and quantification of sample extracts for Organochlorine Pesticides by gas chromatography/electron capture detector. Target analytes include a wide range of pesticides, a basic list of which is included below. The sensitivity of the method usually depends on the concentration of interferences as well as instrumental limitations. If interferences prevent detection of the analytes, the method may also be performed on samples that have undergone cleanup. Typical reporting limits are based on the lowest level of the initial calibration curve and generally correspond to limits derived from quarterly LOQ studies to verify our MDLs.. Detection limits will vary with the individual sample matrix, sample preparation procedures, instrument calibration range, and volume of sample analyzed.

This method is in substantial conformance with the guidelines established in SW-846 for performing chromatographic analysis as defined in the Method 8000B ("Gas Chromatography"), Method 8081B ("Organochlorine Pesticides"), Method 3510C ("Separatory Funnel Liquid - Liquid Extraction"), and Method 3570 Microscale Extraction. The data quality objectives of these methods are met or exceeded by this SOP. The following extraction and cleanup methods may also apply, depending on project specifications:

- Extraction of Water Samples by Separatory Funnel (2156)
- Tissue Preparation and Homogenization (2166)
- Shaker Table Extraction (2261)
- Sulfur Cleanup (2168)
- Microscale Solvent Extraction - 3570 (2172)
- Silica cleanup (2170)
- GPC Cleanup by HPLC (2167)

The data report packages present the documentation of any method modification related to the samples tested. Depending upon the nature of the modification and the extent of intended use, the laboratory may be required to demonstrate that the modifications will produce equivalent results for the matrix. Approval of all method modifications is by one or more of the following laboratory

personnel before performing the modification: Area Supervisor, Department Supervisor, Laboratory Director, or Quality Assurance Officer.

This method is restricted to use by or under the supervision of analysts experienced in the operation of the GC/ECD and in the interpretation of GC/ECD data. Each analyst must demonstrate the ability to generate acceptable results with this method by performing an initial demonstration of capability.

Table 2: Target Analytes for Pesticides by GC/ECD

Parameter	CAS
alpha-BHC	319-84-6
beta-BHC	319-85-7
gamma-BHC (Lindane)	58-89-9
delta-BHC	319-86-8
Heptachlor	76-44-8
Aldrin	309-00-2
alpha-Chlordane	5103-71-9
gamma-Chlordane	5103-74-2
Heptachlor epoxide	1024-57-3
Oxychlordane	27304-13-8
Dieldrin	60-57-1
Endrin	72-20-8
Endrin aldehyde	7421-93-4
Endrin ketone	53494-70-5
4,4'-DDD	72-54-8
4,4'-DDE	72-55-9
4,4'-DDT	50-29-3
2,4'-DDD	53-19-0
2,4'-DDE	3424-82-6
2,4'-DDT	789-02-6
Endosulfan I	959-98-8
Endosulfan II	33213-65-9
Endosulfan sulfate	1031-07-8
Methoxychlor	72-43-5
Mirex	2385-85-5
Cis-Nonachlor	5103-73-1
Trans-Chlordane	5103-74-2
Hexachlorobenzene	118-74-1
Toxaphene	72-43-5
Chlordane	57-74-9

2. Summary of Method

An aliquot of a well mixed, homogeneous aqueous, solid, or tissue sample is accurately measured or weighed for sample preparation. Generally, 500mL or 1000mL of water sample, 1-5g of tissue sample, or 5g to 30g of sediment/soil sample is extracted. Water, soil/sediment, and tissue samples are spiked with surrogate compounds and then extracted using methylene chloride or a methylene chloride/acetone mixture. The extract is dried and exchanged into hexane during sample concentration. After extraction, cleanup techniques are applied. Generally extracts are cleaned by GPC (for hydrocarbon or lipid removal) and silica cartridge or automated silica column followed by copper (for sulfur removal). The extract is exchanged into hexane and concentrated to the appropriate volume, generally 5mL or 10mL, for analysis. Alternatively, this method can be employed for lower detection limits by decreasing the final volume to 1-5 mL.

After cleanup and re-concentration, the extracts are spiked with internal standards, and analyzed on a gas chromatograph, which is fitted with two capillary columns of differing polarities each employing a separate detector. The target analytes are resolved on each column and detected using an electron capture detector (ECD). Analytes are introduced into the GC/ECD by injecting a known volume of the calibration standards, quality control samples, and sample extracts into the GC that is temperature and flow programmed to separate the compounds of interest. Identification of target analytes is accomplished by confirming a target hit on two dissimilar columns using Retention Time and Pattern Recognition. Concentrations are calculated from the ECD response using internal standard techniques, additionally external standard techniques can also be utilized circumstantially. Concentrations are determined using Mean Relative Response Factor from a multi-level calibration curve. Response factors for target analytes and surrogate compounds are determined relative to the internal standards.

2.1 Method Modifications from Reference

This method exhibits some modification from the reference method. Method 8081B discusses the allowed shelf life for stock solutions as one year and working solutions as six months. The standard expiration protocol for the lab is the same however, if there is a significant amount of working spike or surrogate solution expired after the six-month period the lab will re-QC the solution. If the QC of the solution still passes the lab will extend the expiration date by another month. The method also indicates that a mid level multi-component standard is analyzed with the initial calibration for multi component compounds such as Toxaphene and Chlordane. The current lab procedure is to run the lowest possible level of the multi-component standard and include it with the Initial Calibration so the analyst can determine the lowest level at which the multi-component targets can be detected. If the multi-component analyte is then detected in a sample extract the analyst will then analyze a mid level standard for a single-point quantitation.

3. Reporting Limits

Table 1 lists the routine reporting limits.

4. Interferences

- 4.1** Contaminants in solvents, reagents, glassware, syringes, and other sample processing hardware may cause inferences that lead to discrete artifacts, biases, and/or elevated baselines. Demonstrate that all of these materials are free from interferences under the conditions of the preparation and analysis by extracting and analyzing a laboratory method blank with each batch of up to 20 samples. Also new solvent lots are to be prescreened and approved by GC/ECD analyst prior to use. All glassware and equipment should be

properly cleaned and solvent rinsed prior to use. Never use any glassware, or other implements such as syringes, on multiple samples within the batch unless there has been thorough cleaning and decontamination between samples.

- 4.2** Contaminants co-extracted from the sample may cause matrix interferences. The extent of matrix interferences will vary considerably from sample to sample, depending upon the nature of the environment and matrix being investigated. In some cases depending on the severity of the observed interferences, a target hit on one column may be biased high when interfered with. Skilled analyst judgment is imperative in determining if a chromatographic peak appears interfered with. In these cases the non-interfered, non-biased hit can be forced for reporting purposes providing a more suitable value. In extreme cases of interference additional cleanups can be employed, or it may be necessary to analytically re-run the sample at a dilution.
- 4.3** The ECD is theoretically a halogen specific detector. However, phthalate esters can be a major source of contamination in that they do respond to the ECD and can interfere with accurate determination of the compounds of interest. No forms of plastic or any material containing plasticizers (phthalates) should be used in conjunction with any part of this analysis.
- 4.4** Elemental sulfur is readily extracted from soil and sediment samples and may cause chromatographic interferences in the determination of pesticides. Sulfur can be removed through the use of Method 3660B.
- 4.5** Care must be taken to ensure a complete hexane exchange is performed on the extract, because residual methylene chloride would be an interferent in the analysis. Residual methylene chloride can also damage the electron capture detectors.
- 4.6** The injector system of the gas chromatograph can become contaminated with non-volatile components from samples. This can act to decrease the resolution and responsiveness of the system. The analysis of a DDT/Endrin breakdown standard is the best indicator of the condition of the injector system and the condition of the column. As the percent breakdown increases gradually the system should undergo general maintenance (liner changes, injection port cleaning, etc.) to avoid prolonged down time.
- 4.7** Aldol condensation products (4-methyl-4-hydroxy-2-pentanone and 4-methyl-3-pentene-2-one) can arise during soil extraction when using methylene chloride: acetone. These products may interfere with detection of analytes and should be monitored.
- 4.8** Raw GC/ECD data from all blanks, samples, and spikes must be evaluated for interferences or carryover. Contamination by carryover can occur whenever high-concentration and low-concentration samples are sequentially analyzed.

5. Health and Safety

The toxicity or carcinogenicity of each reagent and standard used in this method is not fully established; however, each chemical compound should be treated as a potential health hazard. From this viewpoint, exposure to these chemicals must be reduced to the lowest possible level by whatever means available. A reference file of material safety data sheets is available to all personnel involved in the chemical analysis. Additional references to laboratory safety are available in the Chemical Hygiene Plan.

All personnel handling environmental samples known to contain or to have been in contact with municipal waste must follow safety practices for handling known disease causative agents.

6. Sample Collection, Preservation, Shipping and Handling

6.1 Sample Collection

Aqueous samples should be collected in 500mL, 1L or 2L amber glass bottles and stored without preservative at 4°C. The minimum amount of sample needed to reach the reporting limits on Table 1 in Section 16 for this method for aqueous samples is 500mL. Additional sample is needed (approximately 3X the minimum amount) if MS/MSD analyses are to be performed.

Soil/sediment and Tissue samples should be collected in glass soil jars and stored at 4°C, or if desired, frozen. The minimum amount of sample needed to reach the reporting limits on Table 1 in Section 16 for solid and tissue matrices is 50g. Additional sample is needed (approximately 3X the minimum amount) if MS/MSD analyses are to be performed.

6.2 Sample Preservation

Aqueous samples should be stored without preservative at 4°C.

Soil/sediment and Tissue samples should be stored at 4°C, or if desired, frozen.

6.3 Sample Shipping

Sample Receipt & Login SOP 1559 describes how samples are normally shipped or obtained by the laboratory, precautions to be used in opening sample shipments, and sample storage conditions.

6.4 Sample Handling

The hold time for this method is 7 days for the extraction of aqueous samples and 14 days for the extraction of solid and tissue samples. If a sediment or tissue samples are frozen, this suspends the holding time until removal from the freezer. All extracts must be analyzed within 40 days of the extraction date. Extracts are stored in a refrigerator at 2-6°C.

7. Equipment and Supplies

7.1 Gas Chromatograph: The instrumentation is a temperature-programmable gas chromatograph with heating range from 40°C to 325°C and splitless-type inlet system with electron capture detectors (Hewlett-Packard HP 5890 Series II GC, HP 6890 Plus, or similar).

7.2 Injection Port: Designed for splitless injection onto a capillary column. The injection port utilizes a uniliner for direct injection, to decrease the potential for breakdown of compounds in the injection port and to increase sensitivity. These uniliners are used in place of the standard splitless liners. The 6890 model requires a drilled uniliner due to Electronic Pressure Control (EPC). The injection port will require maintenance on an as needed basis if degradation or contamination is apparent. Please refer to the front of the *Instrument Maintenance Logbook*, which outlines the routine maintenance procedures

7.3 Columns and supplies

7.3.1 Restek's proprietary "RTX-5" Stationary Phase, 60m length x 0.25mm ID, 0.25µm film thickness - Restek Corporation, PN 10226, or equivalent.

7.3.2 Restek's proprietary "RTX-CLPesticide II" Stationary Phase, 60m length x 0.25mm ID, 0.2µm film thickness - Restek Corporation, PN 11326, or equivalent.

7.3.3 Guard column, deactivated fuse silica phenyl-methyl, 5 m x 0.32 mm ID. Restek PN 10027 or equivalent.

7.3.4 flow from the guard column can be split between the two analytical columns using a Siltek MXT-Y connector Restek PN 20396

7.4 Guard Column: The GC/ECD utilizes one injector with guard column sealed to the uniliner inside the injection port. The guard column is split by connector into the two dissimilar columns listed above. Each column is then attached to a separate detector. The Rtx-5 is always the front detector column and the CLP II is the back detector column.

7.5 Auto sampler: Adapted onto the Gas Chromatograph. Model is HP 6890 series autosampler with a GC autosampler controller and HP 5890 series autosampler with controller, or equivalent.

7.6 Computer: with Windows XP operating software utilizing HP Enviroquant G1701DA Version D.03.00 software, or equivalent.

7.7 Gases: Hydrogen, ultra high purity grade (99.9999% pure) and Nitrogen of equivalent purity. Hydrogen is generally supplied by a Proton Hogen GC 600 Hydrogen generator.

7.8 Syringes: Hamilton Gas tight, various sizes.

7.9 Glass Pasteur Pipettes

7.10 Volumetric Flasks: Class A, various sizes

7.11 Vials: 2ml, 4ml, 10ml

8. Reagents and Standards

Reagent grade or pesticide grade chemicals are used in all tests. Unless otherwise indicated, it is intended that all reagents shall conform to specifications of the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available. See SOP *Reagent, Solvent, and Standard Control* (1816) for additional details regarding solvent purity. All solvent expirations determined as indicated by manufacturer guidelines

Analytical Standards are stored at 2-6°C, according to manufacturer's recommended procedure. Primary standards are discarded as indicated by the vendor expiration. Stock standards are given 1 year expiration from the preparation date or the expiration of the primary vendor solution, whichever occurs first. Working standards are given a six month expiration from the preparation date or the expiration of the primary solution whichever occurs first. If breakdown of a solution is observed the solution will be discarded. All analytical standards are prepared in Hexane. All prep standards are prepared in Acetone or Hexane.

8.1 Methylene Chloride: ACS approved, Pesticide grade.

8.2 Acetone: ACS approved, Pesticide grade.

8.3 Hexane: ACS approved, Pesticide grade.

8.4 Methanol: Purge and Trap grade.

8.5 Surrogate Spiking Solution: Two surrogates are used for this method, 2,4,5,6-tetrachloro-m-xylene (TMX) and Decachlorobiphenyl (DCB). Alternate surrogates may be employed to avoid co-elutions or when DCB is a target analyte. Example alternate

surrogates would be DBOB (4,4'-Dibromooctafluorobiphenyl) BZ-198 (2,2',3,3',4,5,5',6 Octachlorobiphenyl). Surrogate Spiking solutions are stored in 40ml pre-cleaned amber VOA vials and placed in a standards freezer in the preparatory lab. The Pest/PCB Surrogate is made from the *Pesticides Surrogate Standard Spiking Solution* (catalog # ISM-320) commercially obtained from Ultra at a concentration of 200ug/mL. The spiking solution is the "Pest/PCB Surrogate" spike, which is made by diluting the primary standard appropriately to achieve a concentration of 1000ug/L. All solutions are made volumetrically in Acetone at desired final volume. Generally 200ml of standard is made but this can vary depending on use, need, and preference. The solution must be assayed by analysis before release to the preparation lab. Generally 1ml of surrogate spiking solution is spiked into the samples and QC. Alternative solution concentration and spiking amount can be used.

8.6 LCS and Matrix spiking solution: Two Pest LCS Spiking solutions are generally used in this method. Alternatively, solutions with project specific targets may be used. The LCS spiking solutions are stored in the same manner as surrogate solutions. The Pest LCS solutions are made from a combination of Restek Pest Mix 8081AB#1 cat#32291 at concentration 200ug/ml and Hexachlorobenzene and Additional Pesticide Mix (Quote#041310-632 from Ultra at a concentration of 100ug/ml. The spiking solution is labeled "Pest LCS" spike and is prepared by diluting the appropriate aliquot of each of the two primary solutions to obtain a spike solution concentration of 1000ug/L. All solutions are made volumetrically in Acetone at desired final volume. Generally 100ml of spiking solution standard is made but this amount can vary depending on use, need and preference. Generally 1 mL of LCS spiking solution is added into each laboratory control spike, matrix spike, and spike duplicate QC samples. Alternative solution concentration and spiking amount can be used.

8.7 Internal Standards (IS): PCB congener BZ 192 (2,2',3,4,4',5,6,6'-octachlorobiphenyl) This solution is commercially obtained from Ultra at 100ug/mL. The IS solution is prepped by making a volumetric dilution of the primary standard in hexane to achieve a concentration of 2.5ug/ml. For method quantification by internal standard 20ul of internal standard is added into 1ml extracts, to produce a mid-calibration range response on column at 50ng/mL in final sample extract.

8.8 Breakdown Mix: This solution is commercially obtained from Ultra (PN ISM-450) containing Endrin at 1 µg/mL and 4,4'-DDT at 2ug/ml. The primary solution is volumetrically diluted to achieve a working standard concentration of 100ug/L for Endrin and 200 ug/L for 4,4'-DDT.

8.9 Toxaphene Calibration solution: Toxaphene solution is commercially obtained from Ultra (PP-270) at a concentration of 100ug/ml. The stock solution at the concentration of 10,000ug/L is prepared as an intermediate solution. The stock solution is diluted volumetrically to obtain a mixture at the concentration of 25ug/L. The 25ug/L solution is injected as a low standard and run with the calibration curve. If Toxaphene is detected an additional mid level Toxaphene standard is used for the one point quantitation of this compound. The stock solution is appropriately diluted volumetrically to obtain a concentration of 1000 ug/L for the Toxaphene and includes TMX/DCB at 100ug/L.

Toxaphene ICV solution is commercially obtained from NST (111-M) at a concentration of 2000ug/ml. The stock solution at the concentration of 20,000ug/L is prepared as an intermediate solution. The stock solution is appropriately diluted volumetrically to obtain a concentration of 1000 ug/L for the Toxaphene ICV working standard.

8.10 Chlordane Calibration solution: Chlordane solution is commercially obtained from Ultra (PP-151) at a concentration of 100ug/ml. The stock solution at the concentration of 10,000ug/L is prepared as an intermediate solution. The stock solution is diluted

volumetrically in hexane to obtain a mixture at the concentration of 25ug/L. The 25ug/L solution is injected as a low standard and run with the calibration curve. If Chlordane is detected and additional mid level Chlordane standard is utilized for the one point quantitation of this compound. The stock solution is appropriately diluted volumetrically to obtain a concentration of 500ug/L for Chlordane and includes TMX/DCB at 100ug/L

Chlordane ICV solution is commercially obtained from Restek (32021) at a concentration of 1000ug/ml. The stock solution at the concentration of 20,000ug/L is prepared as an intermediate solution. The solution is appropriately diluted volumetrically to obtain a concentration of 500 ug/L for the Toxaphene ICV working standard.

8.11 Independent Calibration Verification (ICV) standard: This is a secondary source standard separate from the calibration curve standards containing target pesticides compounds. The ICV can be made two ways as a combination of "Custom Standard – Pesticide Mix" (Quote#041310-631) and "Custom Standard – Additional Pesticide Mix" (Quote#041310-632) both commercially obtained from Ultra at a concentration of 100ug/ml. Alternatively, use Restek Pest Mix 8081AB#1 cat#32291 at concentration 200ug/ml and Hexachlorobenzene and Additional Pesticide Mix (Quote#041310-632) from Ultra at a concentration of 100ug/ml. Cis-Nonachlor obtained from Ultra at (PP-490) concentration 100ug/ml and Chlorpyrifos obtained from Restek (32212) at concentration 1000ug/ml are added to both mixtures to obtain all targets compounds. The ICV is prepared by diluting the appropriate aliquot of each of the two primary solutions to obtain a spike solution at the concentration of 50ug/L. This standard must be spiked with 20uL of the internal standard as referenced in section 8.7.

8.12 SRM: 1944 – *New York/New Jersey Waterway Sediment*, and SRM 2974a – *Organics in Freeze Dried Mussel Tissue*, from National Institute of Standards & Technology (NIST). Please refer to the individual certifications for the assigned true values. These SRMs may be extracted and analyzed with sample batches as part of the overall QC evaluation, if requested by the client. Other certified SRMs may be used on a project specific basis.

8.13 Pesticide Calibration Standard: Commercially obtained primary solutions are used to volumetrically create stock solutions. All stock solutions are made by adding the appropriate amount of primary standard to a 25 mL volumetric flask to obtain the concentration of 5000 ug/L. The stock solutions are then used in various combinations and serial dilutions to make calibration curve standards (see Table 3).

Calibration standards are always prepared in hexane. The basic calibration curve is made from MCP Pest Stock, Additional Pest Stock, Chlorpyrifos/Cis-nonachlor Stock and DBOB/BZ198 Surrogate Stock. MCP Pest Stock is derived from primary *Custom Pesticide Standard* (PN # S-9553-SS) commercially obtained from Accustandard, Additional Pest Stock is made from primary *Custom Pesticide Standard* (PN#S-14378-R1) commercially obtained from Accustandard, and DBOB/BZ198 Surrogate Stock is prepared from primary surrogate solutions commercially obtained from Ultra: DBOB – at a concentration of 5000 ug/mL (*catalog # PPS-172*) and BZ#198 – at a concentration of 100 ug/mL (*catalog # RPC-075S*). Chlorpyrifos/Cis-nonachlor Stock is prepared from primary solutions commercially obtained from Accustandard at a concentration of 100 ug/mL: Chlorpyrifos (Dursban) (*catalog # P-094S*) and Cis-nonachlor (*catalog # P-297S*).

9. Quality Control

The laboratory must maintain records to document the quality of data that is generated. Ongoing data quality checks are compared with established performance criteria to determine if the results of analyses meet the performance characteristics of the method.

9.1 Blank

9.1.1 Method Blank

9.1.1.1 A method blank must be extracted (spiked with surrogates) and analyzed once per every 20 samples or per extraction batch, whichever is more frequent.

9.1.1.2 Because the analysis of a method blank is used to determine background contamination, an *acceptable* method blank should not contain any individual compound at the concentration of reporting limit, or above. For contaminated blanks all efforts must be made to identify and eliminate the source of contamination. The presence of analytes at concentrations at or above the reporting limit will warrant application of a "B" qualifier to that target compound(s) on all associated report forms, and perhaps re-extraction of all associated samples. The results are qualified with a "B" for any associated sample concentrations that are less than 10x the blank concentration for the analyte. Surrogate and internal standard recoveries must meet the QC limits for the method blank, see Sections 9.7.1 and 9.7.2. Re-extraction must be initiated immediately so that minimum time is wasted before re-extraction can occur - if at all possible, this re-extraction should take place within holding time. Re-extraction *corrective action* that would exceed the sample holding time criteria should be discussed with the client, Laboratory Director, QA Manager, and/or Section Supervisor prior to implementation. Exceptions may be made with approval of the Section Supervisor if the samples associated with an out of control method blank are non-detect for the affected compound(s) or if the concentration of the affected compound(s) in the sample is greater than 10x the blank level. In such cases, the sample results are accepted without corrective action for the high method blank result. The client must be notified, via the project narrative, of any method blank non-compliance associated with the sample results.

9.2 Laboratory Control Sample (LCS)

9.2.1 The laboratory control sample (LCS/LCSD) generally contains all Pesticides listed in Table 1, Section 16 except for Toxaphene & Chlordane. The number of Pesticide compounds in the LCS may vary with client specific requests. The Pesticide list reported to the client on the recovery form depends on the target list requested by the client and may also vary between different projects. The LCS/LCSD is extracted along with the samples and must be extracted and analyzed once per every 20 samples or per extraction batch, whichever is more frequent.

9.2.2 The acceptable recovery QC limits as well as RPD limits are found in Table 2 Section 16 for an aqueous, solid, and tissue LCS/LCSD. All recovery limits should

be monitored and documented in-house through control charts and updated as needed.

- 9.2.3** Corrective Action: Repeat analysis or check to see if an analytical or spiking error has occurred. If the LCS/LCSD recoveries are still out of control, re-extract and re-analyze the LCS/LCSD and all associated samples. Samples cannot be approved until an acceptable LCS is obtained. Exceptions may be made with approval of the Section Supervisor if the samples associated with the out of control LCS are also associated with a matrix spike and matrix spike duplicate that is in control which demonstrates an isolated problem pertaining to the LCS only. An explanation of this out of control LCS/LCSD recovery must be included in the project narrative to the client and the sample data reported with the acceptable MS/MSD results as batch QC. For specific work plans the project requirements may supersede existing acceptance criteria. E.g., if the LCS/LCSD do not meet quality control criteria for recovery of some of the spike and surrogate compounds, the results for the other samples and quality control samples within the batch must be evaluated to determine if this is an isolated problem for the LCS/LCSD and whether the data should be reported with the affected LCS/LCSD.

9.3 Initial Calibration Verification (ICV)

Refer to Section 10.2.4

9.4 Continuing Calibration Verification (CCV)

Refer to Section 10.4

9.5 Matrix Spike

- 9.5.1** Matrix spike and matrix spike duplicate analyses are performed on a project specific basis. If a project calls for a MS/MSD one is performed per 20 samples and per matrix.
- 9.5.2** The acceptable recovery and RPD QC limits are found in Table 2 for an aqueous, solid, tissue, and product MS/MSDs. All recovery limits should be monitored and documented in-house through control charts and updated as needed.
- 9.5.3** Corrective Action: Repeat analysis or check to see if an analytical error has occurred. If the % recovery or %RPD still exceeds the control limits and the associated LCS is within control, include a project narrative with the results to client noting that there may be potential matrix effects on the accuracy or precision of the affected results as evidenced by the matrix spike and matrix spike duplicate exceedance.

9.6 Laboratory Duplicate

- 9.6.1** Laboratory matrix or sample duplicates are analyzed if requested by the client. The QC limit is 50% RPD for target compounds.
- 9.6.2** Corrective Action: If the %RPD exceeds the 50% control limit and the associated LCS/LCSD %RPD is within 50%, include a project narrative with the results to client noting that there may be potential matrix effects on the precision of the results isolated to this sample, as evidenced by the matrix duplicate exceedance and the LCS/LCSD acceptance. If an MS/MSD was also extracted with the batch and the sample/duplicate as well as the MS/MSD exceed the control limits, include a project narrative with the results to client noting that there may be potential matrix effects on the precision of the results as evidenced by the sample/duplicate and the MS/MSD exceedances.

9.7 Method-specific Quality Control Samples

9.7.1 Surrogate

9.7.1.1 Surrogates are monitored for recovery for all matrices. Two surrogates are used, one that elutes at the beginning and one at the end of GC run. Every sample, blank, and quality control sample (LCS, LCSD, MS, MSD, Dup) must be spiked with the surrogates prior to extraction. The recovery limits are found in Table 2. The recovery limits should be monitored and documented in-house through control charts and updated as necessary.

9.7.1.2 Corrective Action: Check to see if an analytical, spiking, or dilution error occurred and re-calculate. If only one surrogate falls below the recovery limit and all QC samples have acceptable recovery indicating a matrix effect isolated to the sample, the exceedance is noted, with approval of the Section Supervisor, and the results are reported to the client with a notation in the case narrative. If all surrogates are recovered below the limit or there are outliers in any QC, re-extract the sample. If re-extraction occurred beyond the holding time and the re-extract surrogates are within the QC limits, report the re-extract results along with the original results. If the surrogates are recovered below the limit in the re-extract, this confirms suspected matrix interference on the surrogates, and only the original analysis needs to be reported unless a specific QAPP requires otherwise. If the chromatogram shows obvious matrix interference, no re-analysis or re-extraction is necessary. *This decision must be made with approval of the Section Supervisor and/or Data reviewer.* Surrogate outliers and sample re-extracts must be noted in the case narrative to the client.

9.7.2 Internal Standards

9.7.2.1 Internal standards are added to every field sample, QC sample, standard, and method blank. The Daily opening CCV IS areas are compared to the ICAL; for subsequent samples analyzed following CCVs – the IS areas are compared to the nearest opening CCV for each sample. The acceptance limits are -50% to +200% of the internal standard response (or area) of the daily continuing calibration verification standard.

9.7.2.2 Corrective Action: Check to see if an analytical, dilution or spiking error occurred. If the chromatogram shows obvious matrix interference, no re-analysis is necessary. *This decision must be made with approval of the Section Supervisor.* Note the exceedance in the case narrative to the client. If no obvious interference is present, re-analyze the extract. If internal standards are now within the acceptance limits, report only the re-analysis, as long as the re-analysis occurred within the 40-day analytical hold time. If the re-analysis occurred outside of the 40-day analytical hold time, both the original and re-analysis must be reported. If the internal standards again are outside the acceptance limits, after re-analysis, either within or outside of the 40-day hold time, report only the original analysis, and include a narrative to the client that the suspected matrix interference on the internal standards was confirmed by sample re-analysis.

9.7.3 SRMs

- 9.7.3.1** Standard reference materials (SRMs) are available from the National Institute of Standards and Technology (NIST) and are extracted and analyzed with samples on a project specific basis. These are not used as controls, but to evaluate potential matrix effects in associated samples for the target compounds being evaluated.
- 9.7.3.2** Acceptance criteria for SRM analysis will vary from project to project depending upon client data quality objectives (DQOs). Generally, 40% - 140% recovery based on the true certified values of the target compounds of interest, serve as advisory acceptance criteria.
- 9.7.3.3** Corrective Action: Repeat analysis and/or check to see if an analytical error has occurred. If the % recovery still exceeds the control limits and the associated LCS and/or MS/MSD are within control, include a project narrative with the results to client noting that the observed recovered of the SRM are isolated to this sample as evidenced by the LCS and/or MS/MSD acceptance.
- 9.7.4** Evaluate the percent degradation of 4,4'-DDT (to 4,4'-DDE and 4,4'-DDD) and Endrin (to Endrin Aldehyde and Endrin Ketone) in the Performance evaluation mixture (PEM) to monitor the integrity of the injection system (see section 11.10 for calculation). The breakdown mixture must be analyzed daily to verify that degradation in the system is not excessive. Degradation is not considered to be a problem if the percent degradation of 4,4'-DDT and Endrin are $\leq 15\%$. If either compound does exceed 15% breakdown, the analysis must be stopped, the injection port serviced and other maintenance may need to be performed.

9.8 Method Sequence

PEM3060501	(PEM)
C3060501	(CCV at 50ug/L)
Prep Blank ID	Method Blank
LCD ID	LCS
LCSD ID	LCSD
Sample ID	about 10 samples
PEM3060502	(PEM)
C3060502	(CCV at 50ug/L)
Sample ID	about 10 samples
PEM3060503	(PEM)
C3060503	(CCV at 50ug/L)
Sample ID	about 10 samples
C3060504	(Closing CCV at 50ug/L)

10. Procedure

10.1 Equipment Set-up

- 10.1.1** Prior to the analysis of any standards or samples, the instrument acquisition and process methods must be set up. This includes the GC run parameters and retention time windows. An initial calibration must be analyzed to establish linearity of the instrument. The target analytes are resolved on each column and detected using an electron capture detector (ECD). Calibration standards, quality control samples, and sample extracts are injected into the GC which is temperature and flow programmed to separate the compounds of interest. Identification of target analytes is accomplished by confirming a target hit on two dissimilar columns using Retention time and pattern recognition. Concentrations are calculated from the ECD response using internal standard techniques. Concentrations are determined using Average Response Factor from a multi-level calibration curve. The calibration curves are generated during initial

calibration through the analysis of standards which define the working range of the method. The integrity of the chromatography system must be maintained throughout a run sequence. The chromatographer should ensure that all aspects of the system, from injection through data generation is done in a consistent manner across each batch.

10.1.2 PEM Evaluation

- 10.1.2.1** Prior to initial calibration and at the start of each run a PEM must be analyzed and evaluated as mentioned above in the quality control section 9.7.4.

10.1.3 GC/ECD Instrumental Conditions

- 10.1.3.1** Generally a 1 to 3uL aliquot is injected into a uniliner and onto the capillary column of the gas chromatograph at the conditions listed below. Once injected the aliquot moves through the Siltek guard column and into a MXT-Y connector allowing one injection to split onto the two dissimilar columns connected to two separate ECD detectors

GC Parameter	Setting	GC Parameter	Setting
Injector Temp:	250°C	Ramp Rate 3:	5 °C / minute
Initial Oven Temp	125°C	Final Temperature 3:	260 °C
Flow:	33.6 mL/min	Final Hold Time 3:	0 minutes
Initial Hold Time:	0 minutes	Ramp Rate 4:	25 °C / minute
Ramp Rate 1:	25 °C / minute	Final Temperature 4:	280 °C
Final Temperature 1:	197 °C	Final Hold Time 4:	9 minutes
Final Hold Time 1:	2 minutes	Total runtime:	37.68 minutes
Ramp Rate 2:	1 °C / minute	Mode:	Splitless / Ramped Flow
Final Temperature 2:	210 °C	Purge:	25mL / minute – on at 1 minute
Final Hold Time 2:	0 minutes	Detector temp:	300 °C

The settings listed may vary if situation arises requiring an adjustment to the chromatography. *Injection temperature, hold time, flow rate, purge time, and injection volume can affect chromatographic resolution and detection limits.* Only a trained and experienced GC analyst has the authority to change any setting. All standards and samples must be acquired using the same set of parameters. If any parameters are changed, a new initial calibration must be analyzed and accepted before any samples can be analyzed.

10.2 Initial Calibration

- 10.2.1** Before analysis of sample extracts, establish a multi-point response factor calibration curve showing the linear range of the analysis for all target analytes. At least 5 levels of standards must be analyzed generally the concentrations run are 0.5, 1, 10, 20, 50, 100 and 200. See Section 8.11 for the preparation of the standard solutions for the initial calibration curve.
- 10.2.2** Construct an analytical sequence using the HP Enviroquant software. ICAL standards are identified in a sequence with an "I" designation followed by the instrument number, the

date, and the sequential number assignment. In the comment section beside each level of the curve add the assigned calibration standard ID. In sequence editor construct a sequence similar to the example listed below:

An example initial calibration sequence, created on 06/05, follows:

Primer1	
PEM3060501	(PEM)
Hexane	
I3060501STD.5	(0.5ng/mL standard)
I3060502STD1	(1ng/mL standard)
I3060504STD10	(10ng/mL standard)
I3060505STD20	(20ng/mL standard)
I3060506STD50	(50ng/mL standard)
I3060507STD100	(100ng/mL standard)
I3060509STD200	(200ng/mL standard)
Hexane	
CQ3060510STD50	ICV@50ng/mL Initial Calibration Verification
Hexane	
I3060511STD25	(Toxaphene @ 25 ng/mL)
I3060512STD25	(Chlordane @ 25 ng/mL)

10.2.3 When the sequence has finished running, the Enviroquant software will generate "Not Reviewed" quantitation reports. All reports must be "Quant Reviewed" before they can become part of the initial calibration acquisition method for sample analysis.

- Enter into the "Environmental Data Analysis"
- Go to "File" and under method, select the appropriate quant method and then select the first data file.
- Go into "Quant" and select "QEdit Quant Results" to process the data files. See Section 11.0 for manual integration details and processing guidelines.
- When processing, peak identification, and retention update is complete for the first standard, "Save" the changes and "Exit." Re-print the re-processed data file by "Generating Quant Report," and save the hard copy for each level of the initial calibration.
- Repeat these steps for all initial calibration standards analyzed within the sequence.
- When all levels have been processed, go into "InitCal," and select "Update Levels," and enter all levels for the initial calibration at the proper concentrations.
- After all responses are entered, "Save" the completed method and print the resulting response factor summary by selecting "Response Factors to Printer" as well as "Response Factors to Forms File".

10.2.3.1 Acceptance Criteria: 20% RSD for all target compounds. All calibration standards must be analyzed within 12 hours.

10.2.3.2 The following *corrective actions* are recommended for failing initial calibrations:

- If a curve has outliers and greater than five calibration solutions were utilized in the initial calibration, standards can be excluded from either extreme to generate a passing calibration. That is, the low-level standard or the high-level standard may be dropped to generate a five-level initial calibration. However the analyst needs to be aware that dropping the low standard can affect the RLs for the project being analyzed. An intermediate-level calibration standard must not be dropped to convert a failing initial calibration curve into a passing five-level initial calibration curve. Reduction in the number of calibration standards must also reduce the linear dynamic range used to quantify analytes in the samples. The resulting average response factor for each target analyte in the initial calibration curve will be used by the computer software to calculate actual sample concentrations. See Section 11.0 for additional calculation details.
- Perform instrument maintenance and repeat the initial calibration

The choice of corrective action must be made in consultation with the Section Supervisor, QA Manager, Project Manager, and/or the client.

10.2.3.3 Alternately, a linear regression model may be employed, provided that the correlation factor (r) is ≥ 0.99 . Otherwise, construct a non-linear calibration of no more than a third order equation. Statistical considerations in developing a non-linear calibration model require more data than the more traditional linear approach. A quadratic (second order) model requires six standards, and a third order polynomial requires seven standards. In setting model parameters, do not force the line through the origin. The COD (coefficient of determination) or r^2 must be greater than or equal to 0.99. The experienced analyst must select the regression order, which introduces the least calibration error into the quantitation.

10.2.3.4 Complete the initial calibration by filling out the *Initial Calibration Checklist*. The initial calibration, along with any corresponding continuing calibration data and sample data, is then forwarded for secondary review.

10.2.4 Initial Calibration Verification - ICV (separate source)

10.2.4.1 The analysis of separate source standard must follow the initial calibration curve. All target analytes in this verification standard are at the mid-point concentration. Note: This standard must be re-“Calculated and Generated” in the “QEdit” field, against the completed initial calibration curve method and processed, before it can be reviewed for acceptability.

After final processing, calculate the percent recovery of each target by using the following calculation:

$$\% \text{ Recovery} = (\text{Found Amount} / \text{True Value}) \times 100$$

Acceptance Criteria: All recoveries must be +/- 20% of the true values.

10.3 Equipment Operation and Sample Processing

10.3.1 Evaluate the PEM as described in Sections 9.7.4

10.3.2 After successful analysis of the PEM, “Edit” the “Sample Table Log” to include the 50 ug/L CCV standard (C3060501, where “C” is for CCV, “3” is for instrument number 3,

followed by the date, and "01" for the first CCV analyzed this day), and acquire the CCV against the correct initial calibration method. "Save," then "Load and Run" the sequence.

- 10.3.3** When the sequence has finished running, the Enviroquant software will generate a "Not Reviewed" quantitation report. All reports must be "Quant Reviewed" against the acquisition method for sample analysis.
- 10.3.4** Samples are processed from "Not Reviewed" data files, to "Quant Reviewed" data files in a similar way the standards were previously processed. See Section 11.0 for details on sample processing. If a CCV fails the criteria outlined in Section 10.4.2, all samples since the last acceptable CCV must be re-analyzed.
- 10.3.5** If the on-column concentration of any compound exceeds the calibration range of 200 ug/L, the sample must be diluted, re-spiked with the appropriate amount of internal standard and re-analyzed. Assuming all samples are at a 1mL final volume, the following example dilutions would apply. Adjust the volumes accordingly for other sample final volume amounts and other desired dilutions.
- 1:2 dilution = 500uL of sample: 500uL Hexane and 10uL of IS
 - 1:4 dilution = 250uL of sample: 750uL Hexane and 15uL of IS
 - 1:5 dilution = 200uL of sample: 800uL Hexane and 16uL of IS
 - 1:10 dilution = 100uL of sample: 900uL Hexane and 18uL of IS, etc

10.4 Continuing Calibration

- 10.4.1** A continuing calibration verification (CCV) standard, at the concentration of the mid-level of the initial calibration curve, must be analyzed at the beginning and end of every analytical sequence, and every 12 hours within the sequence, to confirm instrument stability, via response factor, for each calibrated pesticide.
- 10.4.2** Acceptance Criteria: Compare the CCV resulting concentration against the concentration of the compound in the injected solution for each calibrated pesticide, and calculate the % difference (%D). See Section 11.0 for the calculations. The %D for each calibrated pesticide must be below 20%D. Due to the nature of the dual column method, this criterion is applied to each set of column results. If multiple CCVs are analyzed within an analytical sequence, each CCV must be analyzed within 12 hours of the previous CCV, and each CCV, including the ending CCV, must meet the acceptance criteria. Note: closing CCV is not required as long as all samples are analyzed within 12h and the IS meets the acceptance criteria in section 9.7.2.1. If the CCV meets the acceptance criteria, save the hard copy for each CCV standard and include it with the *Continuing Calibration Checklist*. The retention times from the ICAL should be updated to the retention times identified in the CCV. The samples associated to that CCV should be calculated against the retention times of that CCV.
- 10.4.3** If the CCV does not meet the criteria for each calibrated analyte, the following *corrective actions* are recommended:
- Perform instrument maintenance and repeat the CCV. If the CCV fails again the initial calibration may need to be repeated
 - If CCV is biased high and samples are non-detect the data may be usable
 - If there is a CCV outlier for a target compound on one column, the analyst can make a judgment to force hits for that target in associated samples from the opposing acceptable column.
 - If within 12 hours and no maintenance or adjustments have been made to the instrument the closing CCV can be re-injected once in case of mis-inject etc.

The choice of corrective action must be made in consultation with the Section Supervisor, QA Manager, Project Manager, and/or the client. The reasoning for choosing the second option must be documented in the project narrative to the client.

10.5 Preventive Maintenance

- 10.5.1 Preventive maintenance may or may not include the following: replacing system uniliner, o-ring, merlin septum, MXTY connector or clipping a length of guard column.
- 10.5.2 Additionally, preventive or routine maintenance for GC/ECD systems may involve baking out the ECD detector's, replacing guard, RTX-5 or CLP11 columns.

11. Data Evaluation, Calculations and Reporting

11.1 Analyze extracts using the same conditions used for the analysis of the calibration standards. After sample analysis, "Not Reviewed" quantitation reports are generated by the software system. It is expected that situations will arise when the automated quantitation procedures of the chromatographic software provide inappropriate quantitations or integrations. Those situations will warrant the analyst perform manual integrations. Due to the especially low levels of the calibration curve, limitations of the software, and nature of the ECD, low level standards may require considerable manual integration. Because of this, a detailed report of both the low level standard and mid level standard will be submitted to QC for integration review and comparison.

11.2 Identification of the Pesticide compounds are based on gas chromatographic relative retention times (RRTs) and pattern recognition from the analysis of initial calibration standards. For these compounds, manual quantitations are performed, if necessary, by integrating the area of the peak. Qualitative identification for pesticides is made when a discrete peak in a sample is observed within the retention time window for a calibrated analyte on both columns. A pesticide hit can only be acceptable if confirmed by identification on the second column. If a Pesticide hit is not accurate on one of the two columns, i.e. outside of the retention window or absent, then the hit should not be quantitated. If manual integration of a candidate peak is necessary a straight-line integration to the baseline, taking into account background noise should be made. Area measurements should all be to baseline unless an unresolved complex mixture (UCM) is observed, in which case, the areas measured should skim the top of the UCM. Manual integrations may also be necessary when there are interferences or co-eluting peaks. Please refer to the manual integration SOP for further information.

Note: Manual integration is not to be used solely to meet QC criteria, nor is it to be used as a substitute for corrective action on the chromatographic system.

11.3 Due to the nature of this method requiring confirmation on two dissimilar columns, two quantitations are acquired. Calculate the relative percent difference (RPD) between compound concentrations between both columns. If the calculated RPD is >40%, check the chromatograms to see if an overlapping peak is causing an erroneously high result. If no overlapping peaks are noted, examine baseline parameters established by the data system (or operator) during peak integration.

- If no anomalies are noted, review the chromatographic conditions. If there is no evidence of chromatographic problems, report the higher result. This approach is conservative relative to the protection of the environment. The disparity between the two columns should be flagged with a "P" on the report.

- If the high RPD is clearly the result of an interference on one of the columns, the lower result is reported with an "IP" qualifier on the report.

11.4 Evaluate all samples according to the following criteria:

- Surrogates and internal standards should meet the acceptance criteria in Table 2.
- Examine the chromatograms for evidence of saturated targets. Re-analyze the sample(s) at the appropriate dilution(s), see Section 10.3.5, as needed for reference.
- Establish daily retention time windows as the retention time of the component in the opening verification standard ± 0.05 . It has been found that this window works well, being wide enough to eliminate false-negatives while being tight enough to eliminate false-positives. Windows that are calculated using the procedure recommended in Method 8000 tend to be very narrow, creating the risk of false negative results. The window listed above is used as guidance; however the experience of the analyst weighs heavily in the interpretation of the chromatograms.
- If one of the two results for a target appears to have a biased response due to interference the analyst can force the quantitation from the column providing the more accurate value. Any target hit forced off of the compliant column due to interference on the alternate column will be flagged with an "I" on the report only if the RPD between the two columns is greater than 40%.
- In the instance that a Pesticide co-elutes with another Pesticide or other target compound on one column, the compound will be "C" flagged and reported off the unbiased conformant column (i.e.: on the RTX-5 column Heptachlor Epoxide/oxychlordane co-elute). Studies of independent targets have been conducted for reference of co-eluting pesticides and congeners.

11.5 In instances where manual integrations have been performed, the analyst must identify/acknowledge such edits or manual procedures by initialing and dating the raw quantitation report. The initialed hard copy/printed report, will display a "m" qualifier next to any modified or manually integrated compound(s) and shall be included in the raw data for secondary review. These requirements apply to all QC samples, field samples and blanks. For all samples the signed hard copy will be a detailed report submitted for secondary review. As mentioned above there are guidelines for appropriate manual integrations and analyst initials indicate that they accept the "m" flagged changes as appropriate.

11.6 Qualitative identification of multicomponent pesticides requires pattern matching between the calibration standards and the response observed in the sample on both columns. Retention time windows should be used as a gauge, however, pattern recognition for the multicomponent analytes is most important for samples with Toxaphene or chlordane positively identified on both columns, inject an analytical standard at the mid-level or at a concentration estimated to be similar to the sample amount, and re-inject the sample. Quantitation is generally performed using 3 to 5 major representative peaks.

11.6.1 Multi-component analytes are quantitated on the basis of 3 to 5 major peaks using an internal standard approach to calculate individual response factors for each peak. Separate calibration standards are necessary for each multi-component target analyte (e.g., toxaphene and chlordane). Analysts should evaluate the specific toxaphene standard carefully. Some toxaphene components, particularly the more heavily chlorinated components, are subject to dechlorination reactions. As a result, standards from different vendors may

exhibit marked differences which could lead to possible false negative results or to large differences in quantitative results. The relative peaks and number of peaks in the sample should be similar to that observed in the standard; however, degradation, weathering and interferences may cause the sample pattern to differ from that observed from the standard.

11.7 To calculate the **Relative Standard Deviation** (RSD) of all Pesticide targets and surrogate compounds for the initial calibration, use the formula below. See Section 10.2.3 for initial calibration acceptance criteria. Additionally, use the initial multi-point calibration to determine **Relative Response Factors** (RRF_Is) at each concentration level, for each Pesticide. Average the RRF_Is from the initial multi-point calibration, to generate mean RRF_Is, for quantification of each Pesticide. Follow the same calculations for each surrogate compound. The RRF_Is are based on the internal standard compounds, and are calculated using the formula below. See Table I, for the listing of target compounds, RLs, and their associated internal standards for quantification.

$$\text{RSD} = \text{SD} / \text{mean RRF}_I \times 100$$

where:

SD = Standard deviation between the five points, for that target analyte.

$$\text{RRF}_I = (A_c \times C_{IS}) / (A_{IS} \times C_c)$$

where:

A_c = Area of the characteristic ion for the standard compound to be measured.
A_{IS} = Area of the characteristic ion for the representative internal standard compound.
C_{IS} = Concentration of the representative internal standard compound (ng/mL).
C_c = Concentration of the standard compound to be measured (ng/mL).

11.8 Based on the mean RRF_Is, calculate the **Raw Concentration** (C_a) for each target analyte and surrogate in the sample extracts using the following formula:

$$C_a = (A_a \times C_{IS}) / (A_{IS} \times \text{RRF}_I)$$

where:

C_a = Calculated concentration of the target analyte, from quantitation report (ug/L).
A_a = Area of the target analyte.
A_{IS} = Area of the representative internal standard compound.
C_{IS} = Concentration of the internal standard compound added to each extract (ug/L).

11.9 Calculate the **Sample Concentration** (C) for each Pesticide by the following formula:

$$C = (C_a / V_s) \times FV \times DF$$

where:

C = Concentration in the sample (ug/L liquid or ug/Kg solid).
V_s = Original volume or weight of sample extracted, corrected for % solids, if applicable. (To correct for % solids, multiply the sample weight by the % solid as expressed as a decimal. For example: 15.24g x 0.843 = 12.85, for a sample size of

15.24g at 84.3% solid).

DF = Dilution factor or fraction of the original extract to which internal standard is added.

FV = Sample Final Volume

If the response of any analyte in a sample exceeds the linear response range, as defined by the initial calibration standards in Section 10.2, dilute the extract so that the concentrations of all target compounds fall within the range of the calibration curve.

11.10 The calculation for percentage breakdown for DDT and Endrin are:

$$\% \text{Breakdown DDT} = \frac{(\text{Area DDD} + \text{Area DDE})}{(\text{Area DDD} + \text{Area DDT} + \text{Area DDE})} \times 100$$

$$\% \text{Breakdown Endrin} = \frac{(\text{Area Endrin Ketone} + \text{Area Endrin Aldehyde})}{(\text{Area Endrin} + \text{Area Endrin Ketone} + \text{Area Endrin Aldehyde})} \times 100$$

11.11 Calculate the **Surrogate Recoveries** (%R) relative to the internal standards by the following formula:

$$\%R = \frac{C_S \times DF}{C_{\text{Strue}}} \times 100$$

where:

C_{Strue} = Actual concentration of the surrogate in the extract (ug/L).

C_S = Calculated concentration of the surrogate, from quantitation report (ug/L).

DF = Dilution factor or fraction of the original extract

11.12 Compare results for each analyte in the **Continuing Calibration Verification** (CCV), to the true value by determining the percent difference.

$$\text{Percent Difference (\%D)} = ([C_{\text{true}} - C_c] / C_{\text{true}}) \times 100$$

where:

C_{true} = Actual concentration of the compound in the CCV (ug/L).

C_c = Calculated concentration of the compound in the CCV, from quantitation report

11.13 All results must be reported to three significant figures. All solids including soils, sediments, and sludges must be reported on a dry-weight basis. Tissue results may be reported in wet-weight, or "as received," depending upon client request.

11.14 The primary analyst does data entry, or upload of the data, into the LIMS system. The LIMS is "linked" to the instrument, so the analyst must choose the sample(s) to be reported from that instrument's analytical sequence. All associated preparation and instrumental QC samples and dilutions are also chosen. Once the data/samples have been selected and "associated" with the proper QC samples, the batched data set is sent to print.

11.15 The laboratory generates two types of data packages from the LIMS: "Commercial" for routine projects, and "Full Deliverable" or "CLP-like" for fully data validated projects. A

Commercial package consists of sample results and the associated method blank and LCS results. A Full Deliverable package includes all sample results, all preparation and instrumental QC results and the associated supporting raw data. Check the "Report Type" on the project folder to ensure all required deliverables are included. A secondary review is performed on all data.

11.16 Procedures for data and record management must adhere to the Quality Systems Manual, other subordinate documents covering record keeping, and the *Document Control* SOP, 08-01. All records shall be stored in such a manner as to be safe and accessible for at least 10 years.

11.17 Notebooks: Laboratory notebooks are designed to accommodate the specific analysis. Instrument printouts are used to document run sequences, and each sequence printouts are filed in a three-ring notebook. If a sample requires re-analysis or re-extraction for any reason, a notation is made next to the sample entry on the sequence log. Requests for re-extraction are further documented in the "Request for Re-extraction" logbook. Once a sequence binder is full, the sequence run log is permanently bound, given page numbers and filed accordingly. Such files shall be archived so as to remain available for at least 10 years. All laboratory notebooks must follow the specifications in the *Laboratory Notebook Usage* SOP, G-009, and all record keeping and document control practices.

11.18 Electronic records: All data files from computers, attached to instruments, shall be backed up onto the proper directory on the server. The backups shall be stored so as to be accessible for 10 years. Movement of the data files to the server is the responsibility of the primary analyst. Server backup and storage is the responsibility of the IT department.

12. Contingencies for Handling Out-of-Control Data or Unacceptable Data

12.1 Section 9, Quality Control defines the corrective actions that must be taken in instances where QC outliers exist. If the corrective actions have been followed and the data is still unacceptable.

12.2 Table 2 outlines sample batch QC acceptance criteria. If non-compliant Pesticide results are to be reported, the Section Supervisor and/or the Laboratory Director, and the QA Manager must approve the reporting of these results. The laboratory Project Manager shall be notified, and may choose to relay the non-compliance to the client, for approval, or other corrective action, such as re-sampling and re-analysis. The analyst or Section Supervisor performing the secondary review initiates the project narrative, and the narrative must clearly document the non-compliance and provide a reason for acceptance of these results.

13. Method Performance

13.1 Method Detection Limit Study (MDL) / Limit of Detection Study (LOD) / Limit of Quantitation (LOQ)

The laboratory follows the procedure to determine the MDL, LOD, and/or LOQ as outlined in Alpha SOP 1732. These studies performed by the laboratory are maintained on file for review.

13.2 Demonstration of Capability Studies

Refer to Alpha SOP 1739 for further information regarding IDC/DOC Generation.

13.2.1 Initial (IDC)

The analyst must make an initial, one-time, demonstration of the ability to generate acceptable accuracy and precision with this method, prior to the processing of any samples.

13.2.2 Continuing (DOC)

The analyst must make a continuing, annual, demonstration of the ability to generate acceptable accuracy and precision with this method.

14. Pollution Prevention and Waste Management

Refer to Alpha's Chemical Hygiene Plan and Waste Management and Disposal SOP for further pollution prevention and waste management information.

15. Referenced Documents

Chemical Hygiene Plan
SOP 1559 Sample Receipt and Login
SOP 1729 Document Control
SOP 1732 MDL/LOD/LOQ Generation
SOP 1739 IDC/DOC Generation
SOP 1797 Hazardous Waste and Disposal
SOP 2165 Extraction of Water Samples by Separatory Funnel
SOP 2166 Tissue Preparation and Homogenization
SOP 2167 GPC Cleanup by HPLC
SOP 2168 Sulfur Cleanup
SOP 2261 Shaker Table Extraction
SOP 2267 Silica cleanup
SOP 2172 Microscale Solvent Extraction

16. Attachments

Table 1: Reporting Limits
Table 2: QC Acceptance Criteria
Table 3: 5-8 Level Curve Preparation for Individual Components

Table 1: Reporting Limits (RLs) for Pesticides by GC/ECD

Parameter	Solid Samples (ug/Kg)	Aqueous Samples (ug/L)
alpha-BHC	0.0333	0.0005
beta-BHC	0.0333	0.0005
gamma-BHC (Lindane)	0.0333	0.0005
delta-BHC	0.0333	0.0005
Heptachlor	0.0333	0.0005
Aldrin	0.0333	0.001
Hexachlorobenzene	0.0666	0.001
alpha-Chlordane	0.0333	0.0005
gamma-Chlordane	0.0333	0.0005
Heptachlor epoxide	0.0333	0.0005
Oxychlordane	0.0666	0.001
Cis-Nonachlor	0.0333	0.0005
Trans-Nonachlor	0.0333	0.0005
Dieldrin	0.0333	0.0005
Endrin	0.0333	0.0005
Endrin aldehyde	0.1	0.0005
Endrin ketone	0.0333	0.0005
4,4'-DDD	0.0333	0.0005
4,4'-DDE	0.0333	0.0005
4,4'-DDT	0.0333	0.0005
2,4'-DDD	0.0333	0.0005
2,4'-DDE	0.0333	0.0005
2,4'-DDT	0.0333	0.0005
Endosulfan I	0.0333	0.0005
Endosulfan II	0.0333	0.0005
Endosulfan sulfate	0.0333	0.0005
Methoxychlor	0.333	0.005
Mirex	0.0333	0.0005
Toxaphene	1.67	0.025
Chlordane	1.67	0.025

Note: The reporting limits used for "Solid" refer to the matrices of soil, sediment, tissue, and any other possible non-aqueous matrix. The table above represents an example of the range of reporting limits generally used in this analysis. The RLs for this analysis can vary based on sample matrix, amount extracted, final volume and cleanup schemes. Adjustments to these limits can be made to satisfy specific workplan or data quality objective requirements and specialty matrices.

The quantitation Internal Standard for all the targets is BZ 192.

Table 2: QC Acceptance Criteria

QC Parameter	Acceptance Criteria
Initial Calibration Curve	20% RSD for all target analytes, r is ≥ 0.99 , the COD (coefficient of determination) or $r^2 \geq 0.99$
Independent Check Verification	+/- 20% recovery of the true values
Continuing Calibration Verification	Analyzed every 12 hours, 20% D
Method Blank	No analyte at or above the reporting limit, "B" qualify analyte if detected
Laboratory Control Sample	40-140% (Sporadic Marginal Failure Criteria allowed)
Matrix Spike / Matrix Spike Duplicate	Same as for LCS; 50% RPD between the duplicates.
Sample / Sample Duplicate	50% RPD between the duplicates.
Surrogates	30-150%
Internal Standards	50% - 200% of the daily CCV area for the Internal Standards
SRM	40-140%
%RPD between dual column	+/- 40%, "P" qualify analyte

Table 3: 5-8 Level Curve Preparation for Individual Components

Calibration Level	Volume of Pesticide/Surrogate Stocks added*	Aliquot of High Calibration level** added	Volume of Hexane added
Level 1 – 0.5 ug/L	NA	0.025 ml	10 mL final volume
Level 2 – 1.0 ug/L	NA	0.05 ml	10 mL final volume
Level 3 – 5.0 ug/L	NA	0.25 ml	10 mL final volume
Level 4 – 10 ug/L	NA	0.5 ml	10 mL final volume
Level 5 – 20 ug/L	NA	1.0 ml	10 mL final volume
Level 6 – 50 ug/L	0.25 mL	NA	25 mL final volume
Level 7 – 100ug/L	0.2 mL	NA	10 mL final volume
Level 8 – 150ug/L	0.3 mL	NA	10 mL final volume
Level 9 – 200ug/L	0.4 mL	NA	10 mL final volume

Up to 10 levels may be analyzed. Standards chosen should bracket the linear range of the instrument. A minimum of a 5-level curve must be analyzed, but 6-levels, or more, may be analyzed and evaluated depending upon client specific project detection limits. This is an example of possible curve levels, the curve used may vary based on project and instrument performance.

* Each calibration level is a combination of four stock solutions prepared at the concentration of 5000ug/L added at the indicated amount.

**High calibration level is 200ug/L.

Note: 20uL of the 2.5ug/mL chosen Internal Standard mix is added to each calibration level.

Microscale Solvent Extraction (MSE)

References: **EPA Method 3570**, Test Methods for Evaluating Solid Waste, SW-846, November 2002, Revision 0, (USEPA, Office of Solid Waste and Emergency Response, Washington, DC).

Method 3500C, Test Methods for Evaluating Solid Waste, SW-846, Third Edition, Final Update III, February 2007, Revision 3, (USEPA, Office of Solid Waste and Emergency Response, Washington, DC)

Method 8081B, Reference: SW-846, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, EPA SW-846, Revision 2, February 2007.

Method 8082A, Reference: SW-846, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, EPA SW-846, Revision 1, February 2007.

Method 8270D, Reference: SW-846, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, EPA SW-846, Update IV, February 2007

1. Scope and Application

Matrices: This method is applicable to solid samples (soils, sludges, tissues, sediments, and solids).

Definitions: Refer to Alpha Analytical Quality Manual.

This method is recommended for the extraction of the organic compound classes in solids. This method may be used on a project specific basis as determined by the Project Manager and the Laboratory Director. This method is appropriate when the sample size may be limited due to uncontrollable factors.

The data report packages present the documentation of any method modification related to the samples tested. Depending upon the nature of the modification and the extent of intended use, the laboratory may be required to demonstrate that the modifications will produce equivalent results for the matrix. Approval of all method modifications is by one or more of the following laboratory personnel before performing the modification: Area Supervisor, Department Supervisor, Laboratory Director, or Quality Assurance Officer.

This method is restricted to use by or under the supervision of trained analysts. Each analyst must demonstrate the ability to generate acceptable results with this method by performing an initial demonstration of capability.

2. Summary of Method

Samples are weighed on an appropriate balance (analytical or top loading), spiked with surrogate, and prepared by shake or spin extraction with an organic solvent in a sealed vessel. Sample extracts are dried and concentrated using the Kuderna-Danish (K-D) or Buchi and brought to the appropriate analytical final volume.

2.1 Method Modifications from Reference

- 2.1.1** Extraction time can be lengthened to one 4 hour tumble, then 1 hour tumble, then 30 minute tumble if necessary.

3. Reporting Limits

Printouts of this document may be out of date and should be considered uncontrolled. To accomplish work, the published version of the document should be viewed online.

Refer to analytical SOPs for Reporting Limit information.

4. Interferences

- 4.1 Solvents, reagents and glassware may introduce interferences. These must be demonstrated to be free of interferences by the analysis of a method blank. See the *Reagent, Solvent and Standard Control* SOP (ID No: 1816) and *Laboratory Glassware Cleaning* SOP (ID No: 1753), for additional details.
- 4.2 Many interferences can be removed by sample cleanup. Other cleanup methods performed include the following: *Alumina Column Cleanup of Organic Extracts* (ID No: 2260), *Sulfur Cleanup* (ID No: 2168), *Sulfuric Acid* (ID No: 2169), and *GPC Cleanup* (ID No: 2167). Only appropriate cleanup techniques must be performed based on the suspected interference and the compounds of interest. For example, sulfuric acid cleanup is not applicable to samples requiring pesticide analysis because this rigorous cleanup will destroy the majority of pesticides.
- 4.3 Soapy residue may result in basic conditions on glassware and may cause degradation of the pesticides Aldrin and Heptachlor, and some organophosphorous pesticides. All glassware must be rinsed thoroughly with deionized water and solvent to remove soapy residue. See the *Laboratory Glassware Cleaning* SOP (ID No: 1753), for additional details.
- 4.4 Phthalate esters can be a major source of contamination if any material containing plasticizers (phthalates) comes in contact with the sample during the extraction process. Use of plastic or any material containing plasticizers (phthalates) should be avoided during extraction, cleanup, or analysis.

5. Health and Safety

The toxicity or carcinogenicity of each reagent and standard used in this method is not fully established; however, each chemical compound should be treated as a potential health hazard. From this viewpoint, exposure to these chemicals must be reduced to the lowest possible level by whatever means available. A reference file of material safety data sheets is available to all personnel involved in the chemical analysis. Additional references to laboratory safety are available in the Chemical Hygiene Plan.

All personnel handling environmental samples known to contain or to have been in contact with municipal waste must follow safety practices for handling known disease causative agents.

- 5.1 Lab coats, safety glasses, and gloves must be worn when handling samples, extracts, standards or solvents and when washing glassware.
- 5.2 All extract concentration steps must be performed in the extraction hoods. All solvent and extract transfers must also be handled in the hood.
- 5.3 All expired stock standards, working standards, and spent sample extracts must be placed into the waste bucket in the lab, for future disposal by the Hazardous Waste Manager. The container must be properly labeled with hazard warning labels indicating the container contents.
- 5.4 Bottles containing flammable solvents must be stored in the flammables cabinet or in the vented cabinets found under the hoods.

- 5.5** All waste solvents must be transferred to the satellite waste storage containers located in the extraction lab. Separate containers are provided for chlorinated and non-chlorinated solvents and must be used accordingly. Under no circumstances are solvents to be poured down the sink drains.
- 5.6** Inspect all glassware prior to use. Do not use any glassware that is chipped, cracked or etched if it could present a safety hazard. Damaged glassware is put aside for repair, otherwise discard the piece.

6. Sample Collection, Preservation, Shipping and Handling

6.1 Sample Collection

Sample collection and preservation requirements are described in the various analytical method SOPs.

6.2 Sample Preservation

None.

6.3 Sample Shipping

No specific requirements.

6.4 Sample Handling

The samples must be refrigerated and maintained at 4°C \pm 2°C until extraction and analysis. All solid/tissue samples must be extracted within 14 days from the date of collection. Alternatively, samples may be stored frozen at -15°C \pm 5°C for up to one year if the project specifies. This effectively arrests the hold time until samples are thawed for extraction. Sample extracts must be refrigerated and maintained at 4°C \pm 2°C until analysis. Sample extracts must be analyzed within 40 days from date of extraction.

7. Equipment and Supplies

- 7.1 Vials:** 60mL, pre-cleaned, open-top screw cap with PTFE-lined silicone septum and 250ml Teflon wide mouth bottles.

7.2 Balances

7.2.1 Top-loading: Capable of weighing to 0.01g

7.2.2 Analytical: Capable of weighing to 0.0001g.

7.3 Spatulas: Stainless steel

7.4 Syringes: .100-10mL, varying volumes.

7.5 Custom Tumbler Set-up

7.6 Brady Labeling System

7.7 Kuderna-Danish (KD) Apparatus:

7.7.1 Evaporation Flask: 250 and 500mL KD flasks.

7.7.2 Concentrator Tube: 10mL or 25mL

7.7.3 3-Ball Macro Snyder Column

7.7.4 Plastic clips.

7.8 Buchi Concentration System:

7.8.1 Base unit, chiller, pump block, controller and 180mL glass vessels

7.9 Boiling Chips: Solvent rinsed, approximately 10/40 mesh (silicon carbide, or equivalent).

7.10 N-EVAP: Organomation; utilized for micro blow down.

7.11 Glass vials and Screw caps: 2, 4, 10mL volume

7.12 500 mL Erlenmeyer flask

7.13 Powder Funnels: Glass or stainless steel

7.14 Glass wool: Purified by heating to 400°C for 1 hour.

7.15 Disposable Glass Transfer Pipets.

7.16 SEVAP: Organomation; utilized for concentration

7.17 Whatman Paper Filters: Number 40, 150mm Ashless Circles

7.18 Recirculator: Set at 11°C \pm 3°C

7.19 Centrifuge

8. Reagents and Standards

Pesticide or reagent grade chemicals are used in all tests. All reagents conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available. Other grades may be used, provided it is first ascertained that the reagent is of sufficiently high purity to permit its use without lessening the accuracy of the determination.

8.1 Reagent Water: All references to water in this method refer to reagent water from Alpha's DI water treatment system.

8.2 Methylene Chloride (DCM): Ultra Resi quality or equivalent.

8.3 Acetone: Ultra Resi quality or equivalent.

8.4 Hexane: Ultra Resi quality or equivalent.

8.5 Sodium Sulfate (Na₂SO₄): Granular anhydrous; purified by baking at 400°C for 4 hours in a stainless steel cylinder. Store in closed glass containers. All references to sodium sulfate in this method refer to this prepared reagent.

8.6 Copper: Granular, 20-30 mesh

8.7 Spiking Solutions: There are various surrogate and LCS/MS spiking solutions used in the extraction steps. The preparation of these solutions is described in the analytical SOPs.

9. Quality Control

The laboratory must maintain records to document the quality of data that is generated. Ongoing data quality checks are compared with established performance criteria to determine if the results of analyses meet the performance characteristics of the method.

Each extraction batch contains various QC samples used to ensure the validity of the sample results. The particular QC elements performed for a given extraction batch are determined by the requirements of the determinative method. The purpose and definition of the QC samples performed are listed below.

9.1 Blank

A method blank must be prepared in sodium sulfate once per every 20 samples or per extraction batch, whichever is more frequent. If samples will be extracted for a variety of determinative analyses (*i.e.*, PAH, Pesticide and PCBs within the same extraction batch) a method blank for *each* analysis must be prepared and carried through the same extraction procedures as the samples.

9.2 Laboratory Control Sample / Laboratory Control Sample Duplicate (LCS/LCSD)

Laboratory control samples (LCS/LCSD) must be prepared once per every 20 samples or per extraction batch, whichever is more frequent, in sodium sulfate and spiked with a solution prepared from a second source or lot number, other than the source used to verify the accuracy of the standard curve for the determinative analytical method. The LCS/LCSD contains all target compounds of interest, and is extracted along with the samples as verification of the accuracy of the entire extraction procedure. If samples will be extracted for a variety of determinative analyses (*i.e.*, PAH, Pesticide and PCBs within the same extraction batch) a LCS/LCSD for *each* analysis must be prepared and carried through the same procedures as the samples.

9.3 Initial Calibration Verification (ICV)

Not Applicable.

9.4 Continuing Calibration Verification (CCV)

Not Applicable.

9.5 Matrix Spike

Matrix spike / matrix spike duplicate (MS/MSD) samples are performed once per 20 samples (5% frequency) per client request. If samples will be extracted for a variety of determinative analyses (*i.e.*, PAH, Pesticide and PCBs within the same extraction batch) a MS/MSD pair for *each* analysis must be prepared and carried through the same procedures as the samples. If less than 20 samples are prepared in a one-week time frame, a MS/MSD pair will be extracted at the beginning of each week.

9.6 Laboratory Duplicate

Duplicate analyses (matrix or sample duplicate) are performed once per 20 samples (5% frequency) per client request. For Organic analyses, the matrix duplicate is usually in the form of the matrix spike duplicate, see Section 9.5.

9.7 Method-specific Quality Control Samples

9.7.1 Surrogates

Surrogates are compounds specified by the analytical method that are added to all samples and QC samples prior to beginning the extraction process. Surrogate recoveries are calculated and serve as a sample specific quantitative check of the extraction. The various spiking solutions are prepared according to the directions found in the analytical SOPs.

9.8 Method Sequence

See Section 10.

10. Procedure

Samples are prioritized by the Organic Department Manager or Preparation Group Leader for extraction based on hold time and client due date. If tissue samples will be extracted, refer to the *Tissue Preparation and Homogenization SOP* (2166) for initial sample processing details that must be employed prior to MSE extraction.

10.1 Sample Preparation and Extraction

10.1.1 Using a solvent cleaned spatula, weigh approximately 5 or 10 grams, determined by Total Solid Percentage, of homogenized sample into a pre-labeled 60mL VOA vial. For Blank, LCS, LCSD samples use only sodium sulfate. Smaller sample weights may be used, depending upon the sample volume received. Sample weights of less than 1.0g must be weighed on the Analytical balance. See MSE Extraction Chart (Form No.: 13022) for additional details as needed.

10.1.1.1 30g MSE Extraction: Using a solvent cleaned spatula, weigh approximately 30 grams of homogenized sample into a pre-rinsed Teflon bottle. For Blank, LCS, LCSD samples use only sodium sulfate.

10.1.2 Spike all samples with the appropriate volume of surrogate solution, and spike all QC samples with the appropriate MS and/or LCS solution. See MSE Extraction Chart (Form No.: 13022) for specific spiking details. Add 30mL of DCM to each sample depending on analysis. See MSE Extraction Chart (Form No.: 13022) for more information on different analyses. Add sodium sulfate to dry the sample. For sediment/soil samples, add approximately 2-5g of activated copper with the extraction solvent. If the sample turns the copper black add more copper until is the sample no longer turns black. This copper addition will aid in the reduction of sulfur in the sediment samples. For the preparation, storage, and expiration of activated copper, see the Sulfur Cleanup SOP (2168)

10.1.2.1 30g MSE Extraction: Spike all samples with the appropriate volume of surrogate solution and spike all QC samples with the appropriate MS and/or LCS solution. Add 100mLs of methylene chloride (DCM) to each sample followed by sodium sulfate to dry the sample. For sediment samples add approximately 2-5 g of activated copper with DCM. Vigorously shake sample until the slurry is free flowing. Breakup any chunks with a spatula if necessary.

10.1.3 Spin the extraction vessels for at least 4 hours end over end on the automated tumbler, and then allow them to settle.

10.1.4 Decant the extract through a powder funnel into a pre-labeled KD, Buchi tube or a 500mL Erlenmeyer flask, and cap. Centrifuge the VOA vials if there is a suspension and the extraction solvent cannot be decanted. If sample material is fine use a Whatman # 40 paper filter in the funnel instead of glass wool and sodium sulfate.

10.1.5 Add 30mLs of Methylene Chloride to the samples depending on analysis. The volume may vary, however the samples must be completely covered with Methylene Chloride.

- 10.1.5.1 30g MSE Extraction:** Add another 100mLs of Methylene Chloride to the samples. Make sure all of the sample is covered with DCM.
- 10.1.6** Tumble the samples on the automated tumbler for 1 hour, and then let the samples and Methylene Chloride settle. Alternatively, samples can be shaken by hand for 2 minutes depending on analysis.
- 10.1.7** Decant the sample extract into the pre-labeled collection vessel, adding this extract directly into the extract from 10.1.4 and cap. Centrifuge the VOA vials if there is a suspension and the Methylene Chloride cannot be decanted.
- 10.1.8** Repeat steps 10.1.5 thru 10.1.7, this time tumbling the samples for 30 minutes or hand shaking again for 2 minutes depending on analysis.
- 10.1.9** Samples are now ready for concentration by KD or Buchi. Samples that are not concentrated immediately are stored in a refrigerator.

10.2 Initial Concentration: KD Technique

- 10.2.1** If the sample was collected in a 500mL Erlenmeyer flask then you will need to assemble the Kuderna-Danish (KD) apparatus (Section 7.7) by attaching a 10mL or 25mL KD tube to a 250 or 500mL KD flask. Rinse the apparatus completely.
- 10.2.2** Transfer the sample extract from the Erlenmeyer flask into the 250 or 500-mL K-D flask with the 10mL or 25mL concentrator tube clipped to the bottom. Once the transfer is complete, rinse the Erlenmeyer flask with approx 5ml of DCM and transfer that rinse into the KD.
- 10.2.3** Place the K-D flask on the SEVAP with 1-2 boiling chips in the bottom of the tube and the macro Snyder column on top. The bath temperature should be $80 \pm 5^{\circ}\text{C}$. Macro-concentrate the sample to approximately 4mL. This will take approximately 35-40 minutes. If the sample requires solvent exchange, add 25mL of the exchange solvent to the KD when it reaches approximately 5mLs. Move samples to an SEVAP bath set at 95°C and add another 25ml of the exchange solvent to the KD when it reaches approximately 5mLs. Blow samples down to approximately 4mls or to the final volume required by method. At the proper rate of distillation, the balls of the column will chatter, but the column should not flood with condensed solvent. See Table I, Section 16 for solvent exchange information.
- 10.2.4** If the extract appears extremely viscous and reduces in volume very slowly, a final volume of greater than 10mL may be used to ensure that there is no loss of surrogates or the compounds of interest. See the Section Supervisor or Laboratory Director for additional guidance on troublesome matrices. See Organic Prep Lab Final Volumes (Form No.:102-20) for guidance on sample final volumes.
- 10.2.5** Remove the sample from the bath and allow it to settle and cool for approximately 10 minutes. Remove the clip from the KD and then dry the outside of the KD using a paper tissue. Remove the KD flask from the concentrator tube..
- 10.2.6** Move the cooled sample, still in the concentrator tube, to the N-EVAP unit for micro-concentration, and bring the extract to the final volume required before cleanup. The extract must be concentrated under a *gentle* steady stream of nitrogen. The solvent level of the sample must be positioned to prevent water from condensing into the sample (*i.e.*, the solvent level should be below the level of the water in the NEVAP). If sample has been solvent exchanged place cooled samples on the 67°C N-EVAP to finish the solvent exchange. Re-concentrate to the final volume according to the Organic Prep Lab Final Volumes (Form No.:102-20).

- 10.2.7** If the extract appears extremely viscous and reduces in volume very slowly then a final volume of 5-10 mL should be used to ensure that there is no loss of surrogates or the compounds of interest. Note: Micro-concentration may not be needed depending upon the determinative analytical method. Client specifications may be different than this SOP. Always see the Section Supervisor or Laboratory Director for additional guidance when needed. See Organic Prep Lab Final Volumes (Form No.: 102-20) for guidance on sample final volumes.
- 10.2.8** If the sample in the concentrator tube is dark and viscous, an "auto-vial", pre-fitted with a filtration disk, can be employed to remove particulate material. This is particularly evident in heavily contaminated petroleum samples. Reduce the extract to just less than 10mL. Remove it from the concentrator tube with an appropriate size syringe. Pass it through the auto-vial, and back into the concentrator tube. Rinse the syringe, tube and auto-vial as needed to ensure a thorough transfer. The extract may now concentrate more easily with the majority of the particulate matter removed. However, do not force the concentration as this may jeopardize the surrogate and the compounds of interest recoveries.
- 10.2.9** In some heavily contaminated petroleum extracts, it is possible to perform an extra step of hexane exchange to remove the asphaltene material that precipitates out in hexane. This decision must be made with the Department Supervisor approval. This may preserve the integrity of surrogates and the compounds of interest. This extract can also be auto-vialed to further remove any unwanted particulate materials. Micro-concentration may then continue.
- 10.2.10** Transfer the sample extract from the concentrator tube to a vial of the appropriate final volume size. The sample may now undergo any necessary cleanup that may be required prior to analysis. If the sample does not require cleanup, it may be directly transferred at the correct final volume, with copies of the sample preparation extraction log.

10.3 Alternative Concentration Technique: Buchi

- 10.3.1** Refer to Buchi Work Instruction ID No: 16257 for concentration instructions.

10.4 Preventive Maintenance

10.4.1 SEVAP

- 10.4.1.1** The SEVAP should be kept full at all times. Add reagent water as necessary.
- 10.4.1.2** Keep unit clean. Avoid solvent spills on or around unit. Clean periodically with a damp cloth.

11. Data Evaluation, Calculations and Reporting

Not Applicable.

12. Contingencies for Handling Out-of-Control Data or Unacceptable Data

Holding time exceedence, improper preservation and observed sample headspace are noted on the nonconformance report form.

When analysis of samples indicates possible extraction problems, such as poor surrogate recoveries, poor LCS/MS/MSD recoveries, or suspected contamination in blanks or samples, re-extractions are required. Depending on the particular failure, the re-extraction may be of a specific sample or the entire extraction batch.

The analyst that determines the need for re-extraction must fill out a sample re-extract request form. This form notes the reason for the re-extraction request along with any special requirements, and the date and time that the re-extract is needed. Re-extraction request forms are maintained on file to help track the cause for re-extractions, and to be used as a tool in improving systems to minimize the need for re-extractions.

Depending on the results of the re-extraction, the first, second, or both sets of results may be reported to the client, along with a narrative report detailing the problems encountered and the resolution.

13. Method Performance

13.1 Method Detection Limit Study (MDL) / Limit of Detection Study (LOD) / Limit of Quantitation (LOQ)

The laboratory follows the procedure to determine the MDL, LOD, and/or LOQ as outlined in Alpha SOP 1732. These studies performed by the laboratory are maintained on file for review.

13.2 Demonstration of Capability Studies

Refer to Alpha SOP 1739 for further information regarding IDC/DOC Generation.

13.2.1 Initial (IDC)

The analyst must make an initial, one-time, demonstration of the ability to generate acceptable accuracy and precision with this method, prior to the processing of any samples.

13.2.2 Continuing (DOC)

The analyst must make a continuing, annual, demonstration of the ability to generate acceptable accuracy and precision with this method.

14. Pollution Prevention and Waste Management

Refer to Alpha's Chemical Hygiene Plan and Waste Management and Disposal SOP for further pollution prevention and waste management information.

15. Referenced Documents

Chemical Hygiene Plan
1559 Sample Receipt & Log-In
1732 MDL/LOD/LOQ Generation
1739 IDC/DOC Generation
1797 Hazardous Waste and Sample Disposal
1816 Reagent, Solvent and Standard Control
1753 Laboratory Glassware Cleaning

2166 Tissue Preparation and Homogenization
2167 GPC Cleanup
2168 Sulfur Cleanup
2260 Alumina Column Cleanup of Organic Extracts
2169 Sulfuric Acid
Form 13022 – MSE Extraction Chart

16. Attachments

Table 1: Solvent Exchange per Method

Table 1
Solvent Exchange per Method

Method	Exchange Solvent
8081B	HEXANE
8081B-low	HEXANE
8082	HEXANE
8082-low	HEXANE
Congener	HEXANE
Homolog	HEXANE
209 PCB	HEXANE
8270D	NONE
PAH-SIM	NONE

Semivolatile Organic Compounds By Gas Chromatography / Mass Spectrometry (GC/MS)

References: **EPA 8270D**, SW-846, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, EPA SW-846, Revision IV, February 2007.

EPA 8000C, SW-846, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, EPA SW-846, Revision III, March 2003.

Massachusetts DEP Bureau of Waste Site Cleanup - Quality Control Requirements and Performance Standards for the Analysis of Semivolatile Organic Compounds by GC/MS in Support of Response Actions under the Massachusetts Contingency Plan (MCP), Revision 1, July 2010.

NJDEP Site Remediation Program, Data of Known Quality Protocol, Version 1, April 2014.

1. Scope and Application

Matrices: Solid, waste and waste water, soil, sediment, tissue and ground water.

Definitions: Refer to Alpha Analytical Quality Manual.

This method is applicable to the quantification of acidic, neutral and basic organic compounds soluble in methylene chloride. The extraction and cleanup methods that are typically used for this method are listed in Section 10.3.1. Please see the appropriate extraction SOP(s) for further information. The individual target compounds are found in Section 16, Table D, and include polynuclear aromatic hydrocarbons, chlorinated hydrocarbons, pesticides, phthalate esters, nitrosamines, aldehydes, ethers, anilines, pyridines, aromatic nitro compounds and phenols, including nitro phenols.

The data report packages present the documentation of any method modification related to the samples tested. Depending upon the nature of the modification and the extent of intended use, the laboratory may be required to demonstrate that the modifications will produce equivalent results for the matrix. Approval of all method modifications is by one or more of the following laboratory personnel before performing the modification: Area Supervisor, Department Supervisor, Laboratory Director, or Quality Assurance Officer.

This method is restricted to use by or under the supervision of analysts experienced in the operation of the GC/MS and in the interpretation of GC/MS data. Each analyst must demonstrate the ability to generate acceptable results with this method by performing an initial demonstration of capability.

2. Summary of Method

Aqueous samples are extracted with methylene chloride in a 2 Liter Separatory Funnel (Method 3510) at the required pH. Soil samples are generally extracted by Microscale Solvent Extraction (Method 3570), however other extraction methods can be applied. The extract is concentrated to its final volume in preparation for analysis, or may now undergo cleanups.

Analytes are introduced into the GC/MS by injecting a known volume of the calibration standards, quality control samples, and sample extracts into the GC equipped with a narrow-bore capillary

column. The GC column is temperature programmed to separate the analytes, which are then detected with a mass spectrometer (MS). Identification of target analytes is accomplished by comparing their mass spectra with the electron impact spectra of the calibration standards. Concentrations are determined using mean relative response factors from a multi-level calibration curve. Response factors for target analytes and surrogate compounds are determined relative to the internal standards.

2.1 Method Modifications from Reference

None.

3. Reporting Limits

Analytes determined are measured in the range of 0.5 to 25ug/L for water samples, and 33.3 to 1667ug/Kg for soils, sediments, and solids. Tissue samples are measured in the range of 200 to 10000ug/Kg. Detection limits will vary with the individual sample matrix, sample preparation procedures, instrument calibration range, and volume of sample analyzed. Analytes detected over these concentration ranges will be diluted and re-analyzed for accurate quantification.

4. Interferences

- 4.1 Phthalate esters can be a major source of contamination if any material containing plasticizers (phthalates) comes in contact with the sample during the extraction process. Use of plastic or any material containing plasticizers (phthalates) should be avoided during extraction or analysis.
- 4.2 The injection port of the gas chromatograph can become contaminated with high boiling compounds resulting in the loss of sensitivity of Pentachlorophenol, 2,4-Dinitrophenol, 4-Nitrophenol, Benzoic Acid, Benzaldehyde, 4,6-dinitro-2-methylphenol, 4-chloro-3-methylphenol, 4-chloroaniline, benzyl alcohol, 2,4-Dinitrotoluene and 2, 3, and 4-Nitroaniline. It may be necessary to replace the injection port liner routinely to prevent this loss of sensitivity. Clipping off approximately four inches of the column at the injection end may also increase sensitivity of the phenolic compounds. Low instrument response can be detected during the daily tuning procedure by including pentachlorophenol and benzidine in the daily tuning mix.
- 4.3 Raw GC/MS data from all blanks, samples, and spikes must be evaluated for interferences or carryover. Contamination by carryover can occur whenever high-concentration and low-concentration samples are sequentially analyzed.
- 4.4 Solvents, reagents and glassware may introduce interferences. These must be demonstrated to be free of interferences by the analysis of a method blank. See the *Reagent, Solvent and Standard Control SOP* (1816) and *Laboratory Glassware Cleaning SOP* (1753), for additional details.
- 4.5 Many interferences can be removed by sample cleanup. The cleanup methods performed include those listed in Section 10.3.1. Only appropriate cleanup techniques must be performed based on the suspected interference and the compounds of interest.
- 4.6 Benzidine and pyridine may be subject to oxidative losses during solvent concentration and demonstrate poor chromatographic behavior.
- 4.7 Hexachlorocyclopentadiene and pyridine are subject to thermal decomposition in the injection inlet, and hexachlorocyclopentadiene is subject to chemical reaction with acetone, and photochemical decomposition.
- 4.8 N-nitrosodimethylamine is difficult to separate from the solvent front under the

chromatographic conditions described within.

N-nitrosodiphenylamine decomposes in the GC inlet and cannot be separated from diphenylamine.

5. Health and Safety

The toxicity or carcinogenicity of each reagent and standard used in this method is not fully established; however, each chemical compound should be treated as a potential health hazard. From this viewpoint, exposure to these chemicals must be reduced to the lowest possible level by whatever means available. A reference file of material safety data sheets is available to all personnel involved in the chemical analysis. Additional references to laboratory safety are available in the Chemical Hygiene Plan.

All personnel handling environmental samples known to contain or to have been in contact with municipal waste must follow safety practices for handling known disease causative agents.

6. Sample Collection, Preservation, Shipping and Handling

6.1 Sample Collection

Solid samples: A minimum of 100 grams of sample must be collected in a glass jar with a Teflon lined screw cap.

Water samples: A minimum of 2 liters of sample must be collected in amber glass bottles.

Tissue samples: A minimum of 20 grams of sample must be collected in a glass jar with a Teflon lined screw cap.

6.2 Sample Preservation

Solid samples: The samples must be refrigerated and maintained at $4\pm 2^{\circ}\text{C}$ until extraction and analysis. Sediment samples can be frozen at $-20\pm 5^{\circ}\text{C}$ until extraction to extend hold time. The extracts must be refrigerated and maintained at $4\pm 2^{\circ}\text{C}$ until analysis.

Water samples: The samples must not be preserved except by refrigeration at $4\pm 2^{\circ}\text{C}$ until extraction and analysis. The extracts must be refrigerated and maintained at $4\pm 2^{\circ}\text{C}$ until analysis.

Tissue samples: The samples must be stored frozen at $-20\pm 5^{\circ}\text{C}$ until extraction. The extracts must be refrigerated and maintained at $4\pm 2^{\circ}\text{C}$ until analysis.

6.3 Sample Shipping

No special shipping requirements.

6.4 Sample Handling

Solid samples: All solid samples must be extracted within 14 days from the date of collection. Frozen sample hold times are monitored up to 14 days from the date removed from the freezer. The extracts must be refrigerated and maintained at $4\pm 2^{\circ}\text{C}$ until analysis. Sample extracts must be analyzed within 40 days from date of extraction.

Water samples: All water samples must be extracted within 7 days from the date of collection. Sample extracts must be analyzed within 40 days from date of extraction.

Tissue samples: Frozen sample hold times are monitored up to 14 days from the date removed from the freezer. The extracts must be refrigerated and maintained at $4\pm 2^{\circ}\text{C}$ until analysis. Sample extracts must be analyzed within 40 days from date of extraction.

7. Equipment and Supplies

- 7.1 Gas chromatograph:** Programmable, heating range from 40C to 350C; split-splitless-type inlet system, (Agilent 7890 or similar); mass selective detector (Agilent 5975 or similar); automatic injector (Agilent 7683 or similar).
- 7.2 Chromatography Column:** Fused silica capillary column, 0.25mm ID x 30m length, .25um film thickness (Zebron ZB-SemiVolatiles, Phenomenex Corporation, 5% Polysilarylene - 95% Polydimethylsiloxane , or equivalent).
- 7.3 Data Acquisition System:** Computerized system for collecting, storing, and processing detector output (Hewlett Packard Enviroquant target software) or equivalent.
- 7.4 Gases:** Ultra high purity BIP helium (99.9995%); Compressed Nitrogen for N-Evap.
- 7.5 Syringes:** 10uL to 1.0mL.
- 7.6 Glass:** Class A volumetric glass with varying volumes
- 7.7 GC Injection Port Liner:** Phenomenex Direct Connect Top Hole

8. Reagents and Standards

Use reagent grade chemicals for all reagents. Deionized (DI) water is ASTM Type II laboratory reagent grade water.

- 8.1 Methylene Chloride:** ACS approved, Pesticide grade, see *Reagent, Solvent and Standard Control SOP* (1816) for additional details regarding solvent purity.
- 8.2 Acetone:** ACS approved, Pesticide grade, see *Reagent, Solvent and Standard Control SOP* (1816) for additional details regarding solvent purity.
- 8.3 Hexane:** ACS approved, Pesticide grade, see *Reagent, Solvent and Standard Control SOP* (1816) for additional details regarding solvent purity.
- 8.4 Methanol:** ACS approved, Pesticide grade, see *Reagent, Solvent and Standard Control SOP* (1816) for additional details regarding solvent purity.
- 8.5 Ether:** ACS approved, Pesticide grade, see *Reagent, Solvent and Standard Control SOP* (1816) for additional details regarding solvent purity.
- 8.6 Analytical Standards:** Standards should be stored at -10°C or less, away from light when not in use. They should be discarded after 1 year unless the vendor expiration date states otherwise or if breakdown is observed. Stock standards are given a 1 year expiration from the preparation date, or the expiration of the primary vendor solution, whichever occurs first. Working standards are given a 6 months expiration from the preparation date or the expiration of the primary solution whichever occurs first.
- 8.6.1 Surrogates:** Base/Neutral stock surrogate (5000ug/mL) – includes Nitrobenzene-d5, 2-Fluorobiphenyl, and Terphenyl-d14. Acid stock surrogate

(10000 ug/mL) - includes Phenol-d5, 2-Fluorophenol, and 2,4,6-Tribromophenol. Restek, Ultra Scientific, or equivalent.

8.6.1.1 To prepare the surrogate spiking solution mix for 8270: Add 4.0mL of the base neutral mix (5000 ug/mL) and 2.0mL of the acid surrogate mix (10000 ug/mL) to a 250mL volumetric flask. Dilute to volume with Acetone to provide an 80 ug/mL surrogate solution.

8.6.2 Stock Calibration Mix Standards: Pre-made, commercially available solutions.

- PAH Mix - ECS-A-032 (2000ug/mL)
- EPA 8270 Add-ons - ECS-A-031 (2000ug/mL)
- EPA 625 B/N Mix#1 - ECS-A-030 (2000ug/mL)
- Benzidines Mix - ECS-A-007 (2000ug/mL)
- Phenols Mix - ECS-A-006 (2000ug/mL)
- Custom Semivolatiles Mix (containing acetophenone, atrazine, benzaldehyde, biphenyl, and caprolactam) – Restek – cat # 57685 (2000ug/mL)
- PAH Two Component Mixture – C.I.L. (2000uf/mL)
- Custom Four Component Mixture - N.S.I Q-7610-O (2000ug/ml)

The surrogate stock mixes noted in sections 8.6.1 are also added to the stock standard mixture. Due to the highly reactive nature of Benzidine and Benzaldehyde and their tendency to degrade when mixed with all the other target analytes found in this method, two separate ICAL solutions are prepared.

8.6.2.1 Preparation of the first stock standard (100ug/mL) to **10mL** stock solution in methylene chloride is as follows:

- 8.6.2.1.1** EPA 8270 Add-ons (2000ug/mL): 0.5mL
- 8.6.2.1.2** EPA 625 B/N Mix #1 (2000ug/mL): 0.5mL
- 8.6.2.1.3** Phenols Mix (2000ug/mL): 0.5mL
- 8.6.2.1.4** PAH Mix (2000ug/mL): 0.5mL
- 8.6.2.1.5** Acid Surrogate (10000ug/mL): 100uL
- 8.6.2.1.6** B/N Surrogate (5000ug/mL): 200uL
- 8.6.2.1.7** Cust. Field Surrogate Mix (2000ug/mL): 0.5mL
- 8.6.2.1.8** Custom Four Component Mixture (2000ug/ml): 0.5ml

8.6.2.2 Preparation of the second stock standard (100ug/mL) to 10mL in methylene chloride is as follows:

- 8.6.2.2.1** Benzidines Mix (2000ug/mL): 0.5mL
- 8.6.2.2.2** Custom Semivolatiles Mix (2000ug/mL): 0.5mL

8.6.2.3 Preparation of calibration levels using the above stock solutions. Eight levels are prepared using the first stock solution. Only 7 additional levels are prepared using the second stock solution.

- 8.6.2.3.1 Level 8 (50ug/mL):** 0.5mL of Calibration Stock diluted to a final volume of 1.0mL in methylene chloride.
- 8.6.2.3.2 Level 7 (25ug/mL):** 2.5mL of Calibration Stock diluted to a final volume of 10mL in methylene chloride
- 8.6.2.3.3 Level 6 (15ug/mL):** 1.5mL of Calibration Stock diluted to a final volume of 10mL in methylene chloride.
- 8.6.2.3.4 Level 5 (10ug/mL):** 1.0mL of Calibration Stock diluted to a final volume of 10mL in methylene chloride.
- 8.6.2.3.5 Level 4 (5.0ug/mL):** 0.5mL of Calibration Stock diluted to a final volume of 10mL in methylene chloride.
- 8.6.2.3.6 Level 3 (2.0ug/mL):** 0.20mL of Calibration Stock diluted to a final volume of 10mL in methylene chloride.
- 8.6.2.3.7 Level 2 (1.0ug/mL):** 0.1mL of Calibration Stock diluted to a final volume of 10mL in Methylene chloride.
- 8.6.2.3.8 Level 1 (0.5ug/mL):** 0.05mL of Calibration stock diluted to a final volume of 10mL in methylene chloride.

8.6.3 Initial Calibration Verification (ICV):

Initial Calibration Verification primary solutions (200ug/mL):

Benzoic Acid Solution (2000ug/mL): Restek
Benzaldehyde Solution (2000ug/mL): Restek
Benzidine solution (1000ug/mL): Restek
Custom 8270 Mix (2000ug/ml): Restek
8270 Megamix (1000ug/ml): Restek

- 8.6.3.1 Initial Calibration Verification solution (10ug/mL):** 0.05mL of Custom 8270 Mix and 0.1ml of 8270 Megamix diluted to a final volume of 10mL in methylene chloride.
- 8.6.3.2 Initial Calibration Verification solution for Benzoic Acid (10ug/mL):** 50 uL of Benzoic Acid Solution diluted to a final volume of 10mL in Methylene chloride.
- 8.6.3.3 Initial Calibration Verification solution for Benzidine (10ug/mL):** 100uL of Benzidine Solution diluted to a final volume of 10ml in Methylene Chloride.
- 8.6.3.4 Initial Calibration Verification solution for Benzaldehyde (10ug/ml):** 50uL of Benzaldehyde solution diluted to a final volume of 10ml in Methylene Chloride.

8.6.4 Continuing Calibration Verification (CCV) solution (10ug/mL):

1.0mL of Calibration Stock diluted to a final volume of 10mL in methylene chloride. This solution is also used as the Level 5 of the ICAL.

- 8.6.5 LCS1/Matrix Spiking Solution (100/500ug/mL):** Prepared with the same standards and volumes used to formulate the first ICAL stock as seen in section

8.6.2.1., minus the 3 surrogate solutions, with additional Benzoic Acid. Brought to a final volume of 10ml in Methanol. Formulation Below.

8.6.5.1 EPA 8270 Add-ons (2000ug/mL): 0.5mL

8.6.5.2 EPA 625 B/N Mix #1 (2000ug/mL): 0.5mL

8.6.5.2.1 Phenols Mix (2000ug/mL): 0.5mL

8.6.5.2.2 PAH Mix (2000ug/mL): 0.5mL

8.6.5.2.3 Custom Four Component Mixture (2000ug/ml): 0.5ml

8.6.5.2.4 Benzoic Acid Solution (Restek 2000ug/ml): 2.0ml

8.6.6 LCS2/Matrix Spiking Solution (100ug/mL): Prepared by diluting 0.5ml of the Restek Custom Semivolatiles Mix Cat# 57685(2000ug/ml) to 10mL in Methanol.

8.6.7 LCS3/Matrix Spiking Solution (100/250ug/mL): Prepared by diluting 0.5ml of Benzidines Mix (ECS-A-007 - 2000ug/mL), and 1.5ml of Benzidine Solution (Restek 31441 1000ug/ml) to 10mL in Methanol.

8.6.8 Internal Standard Primary Standard: Six component standard commercially available from Restek – PN 31206-510. 2000ug/mL solution containing 1,4-Dichlorobenzene-d4, Naphthalene-d8, Acenaphthene-d10, Phenanthrene-d10, Chrysene-d12, and Perylene-d12.

8.6.8.1 8270 IS working solution (250ug/mL): 3.125mL of Internal Standard Primary Standard diluted to a final volume of 25mL in methylene chloride. 20uL of the solution is spiked into 1mL sample and standard vials. The final concentration on column is 5.0ug/mL.

8.6.9 DFTPP Primary Standard: Four component standard commercially available from UltraScientific – PN GCM-150. 1000ug/mL solution containing Decafluorotriphenylphosphine, Benzidine, Pentachlorophenol, and 4,4'-DDT.

8.6.9.1 8270 GC/MS Tuning Solution (50ug/mL): 1.25mL of DFTPP Primary Standard diluted to a final volume of 25mL in methylene chloride.

9. Quality Control

The laboratory must maintain records to document the quality of data that is generated. Ongoing data quality checks are compared with established performance criteria to determine if the results of analyses meet the performance characteristics of the method.

9.1 Blank(s)

9.1.1 Method Blank: A method blank must be prepared once per every 20 samples or per extraction batch, whichever is more frequent.

Compounds of interest must not be detectable in the method blank at a concentration greater than the reporting limit.

Corrective Action: Extraction of the method blank and all associated samples must be performed until the blank is in control. Samples cannot be analyzed until an acceptable method blank analysis is obtained. The results are qualified with a "B" flag for any associated sample concentrations that are less than 10x the blank concentration for the analyte. For New Jersey regulatory work, all target analytes must be < RL except phthalates which must be < 5X the RL. Sample results are qualified with a "B" flag for analytes observed in the blank > RL and phthalates observed in the blank > 5X RL. Exceptions may be made with if the samples associated with the out of control method blank are non-detect for the compound of interest, or if sample concentrations are greater than 10x the blank levels. In such cases when the sample results are accepted, the client is notified in a project narrative associated with the sample results.

9.2 Laboratory Control Sample (LCS)/ Laboratory Control Sample Duplicate (LCSD)

Laboratory control sample (LCS) and laboratory control duplicate (LCSD) must be prepared once per every 20 samples or per extraction batch, whichever is more frequent. The LCS/D may contain all target compounds of interest, or a smaller subset may be analyzed, and is extracted along with the samples as verification of the accuracy of the entire extraction procedure.

Project specific requirements, QAPPs, and/or other DQOs may supersede general limits and QC requirements.

Corrective Action: Base/Neutral compounds should be recovered at 40%-140% and Acid compounds at 30%-130%. If $\leq 10\%$ of the total compounds are outside of these limits, and the recovery is at least 10% for these compounds, re-extraction is not required. If the LCS recovery is still out of control, re-extract and re-analyze the LCS and all associated samples. Samples cannot be reported until an acceptable LCS is obtained. Exceptions may be made in some cases for documented difficult/poor performing compounds such as Benzidine, Benzoic Acid, 4-Nitrophenol, Aniline, Pentachlorophenol, 2,4-Dinitrophenol, 2,4-Dimethylphenol, 4,6-Dinitro-2-methylphenol, Benzaldehyde, Caprolactam and Pyridine. An explanation of any out of control LCS recovery must be included in the project narrative to the client.

9.3 Initial Calibration Verification (ICV)

The initial calibration for each compound of interest must be verified prior to sample analysis. This is accomplished by analyzing a second source calibration standard (Section 8.6.3).

Calculate the percent recovery for each analyte. If the percent recovery for each analyte is within 70%-130% of their true value, then the calibration is assumed to be valid. If any compounds do not meet this criterion, attempts should be made to locate and correct the source of the problem. 10% of all analytes are allowed to be outside of 70%-130%, but must be within 60%-140%. The ICV may be reanalyzed once. If the standard failure continues, corrective action must be taken prior to sample analysis.

A new initial calibration must be performed and acceptable ICV results obtained prior to any sample analysis.

9.4 Continuing Calibration Verification (CCV)

On a daily basis after the DFTPP has passed, a mid-level (10ug/mL) continuing calibration standard which contains all of the analytes of interest is analyzed.

Refer to Section 10.4 for further information.

9.5 Matrix Spike/ Matrix Spike Duplicate (MS/MSD)

Matrix spike / matrix spike duplicate (MS/MSD) samples will be performed per batch of 20 samples of the same matrix processed together in those cases where the client does not specify omitting the MS/MSD for the analyses of their samples.

See Section 12 for MS/MSD recovery limits and %RPD limits. Calculate the %RPD as described in Section 9.6.

Corrective Action: Repeat analysis or check to see that an analytical error has occurred. If the % recovery and/or RPD still exceeds the control limits, and the LCS/D is compliant; include a project narrative with the results to client noting that there may be potential matrix effects on the accuracy or precision of the reported results as evidenced by MS/MSD recoveries and/or %RPD outside of QC limits.

9.6 Laboratory Duplicate

Duplicate analyses are performed upon client and/or QAPP request. *For Organic analyses, the matrix duplicate is usually in the form of the matrix spike duplicate, see Section 9.5.*

Acceptable relative percent differences (RPD) of duplicates is listed in Section 12. Acceptance criterion is not applicable to sample concentrations less than 5 times the reporting limit. Calculate the RPD as follows:

$$RPD = \frac{R1 - R2}{\frac{[R1 + R2]}{2}} \times 100$$

where:

R1 = sample Replicate #1

R2 = sample Replicate #2

Corrective Action: Repeat analysis if an analytical error is suspected. If the % RPD still exceeds the control limits; include a project narrative with the results to client noting that there may be potential matrix effects on the precision of the reported organic results as evidenced by the matrix duplicate % RPD outlier.

9.7 Method-specific Quality Control Samples

9.7.1 Surrogate Spikes: Surrogate spikes must be added to QC and field samples to evaluate the extraction method performance.

See Section 12 for surrogate recovery acceptance criteria.

Corrective Action: Up to one surrogate can be out in each fraction (Acid and Base/Neutral) but not less than 10% recovery, before any corrective action is necessary. Analysis must be repeated once if an analytical error is suspected. If the percent recovery still exceeds the control limits the sample must be re-extracted and re-analyzed to confirm the sample matrix. If *obvious* matrix interferences are noted, consultation with the Semivolatiles Department Manager, Laboratory Director or QA Officer may be necessary to confirm the

need for sample re-extraction. If no re-extraction occurs, the surrogate results and reasons for the no re-extract decision must be discussed in the project narrative to the client.

9.7.2 Internal Standards: Internal standards must be added to all sample extracts, QC samples and standards for quantitation purposes.

The internal standards in the samples should remain at constant area counts with respect to the continuing calibration analyzed at the beginning of the run. Sample IS areas must be 50% to 200% of the Internal Standards in the Continuing Calibration. Additionally, the RRT of the detected sample compounds must be within 0.06RRT units of the retention times of the associated continuing calibration standard.

Corrective Action: Analysis must be repeated once unless there are obvious sample matrix interferences, e.g. If the sample extract was very colored and viscous, or there are obvious chromatographic interferences. If *obvious* matrix interferences are noted, consultation with the Semivolatiles Department Manager, Laboratory Director or QA Officer may be necessary to confirm the need for sample re-analysis.

9.8 Method Sequence

- Tune
- CCV
- Method Blank
- LCS
- LCSD
- Samples

10. Procedure

10.1 Equipment Set-up

10.1.1 The basic GC parameters are as follows:

Injection Port Temp: 260°C
Oven Equib Time: 0.50 min
Oven Max: 350°C
Oven: On
Cryo: Off
Ambient: 45°C
Cryo Blast: Off

Initial Temp.: 40°C
Initial Time: 1.00 min

Level	Rate (°C /min)	Final Temp. (°C)	Final Time (min)
1	25.00	200	0
2	9.00	270	0
3	12.00	320	4

Final Time: 23.344

Please note that this may differ slightly from one instrument to another.

The basic injection port parameters are as follows:

Pulsed Splitless "Split" mode
Equilibrium Time: 0.50 minute
Temp: 260°C
Pressure: 9.2752 psi
Total Flow: 34.2mL/min
Split: NA
Split Flow: NA
Septum Purge Flow: 3mL/min
Injection Pulse Pressure: 30psi Until 0.2min
Purge Flow to Split Vent: 30mL/min at 0.6 min
Injection volume: 1uL

This may differ slightly from one instrument to another.

10.1.2 Column conditions parameters are as follows:

Constant Pressure: 9.1473 psi
Column flow: 1.2mL/min
Linear Velocity: 39.723 cm/sec

This may differ slightly from one instrument to another.

10.1.3 Mass Spectrometer Scan Parameters

Scan from mass 35.0 amu to 450 amu

10.1.4 Tuning

Tune acceptance must be verified at the beginning of every 12 hour analytical sequence. The DFTPP may be combined with the calibration verification standard as long as both tuning and calibration acceptance criteria are met.

Before the analytical standards are analyzed the mass spectrometer must be adjusted to meet the proper ion criteria for DFTPP. This is demonstrated by injecting into the GC/MS system 1 uL of a 50 ug/mL DFTPP solution.

Note: Within the Enviroquant software, Autofind is used first to evaluate Tune. Three scans (the peak apex scan and the scans immediately preceding and following the apex) are acquired and averaged.

Background subtraction is required, and must be accomplished using a single scan acquired within 20 scans of the elution of DFTPP. The background subtraction should be designed only to eliminate column bleed or instrument background ions. Do not subtract part of the DFTPP peak or any other discrete peak that does not coelute with DFTPP.

Average or single scan may be used, if Autofind does not pass, but caution should be used in tuning on a single scan too close to the front or back of the DFTPP peak. If the system will not tune under ideal conditions, injection port maintenance, retuning, and/or a source clean should be performed.

The response of Benzidine and Pentachlorophenol, when monitored on a daily basis, will indicate the efficiency of the chromatography system. Benzidine and Pentachlorophenol should be present at their normal responses and no peak tailing should be visible. The tailing factor of Benzidine and Pentachlorophenol must not exceed 2. DDT breakdown must be <20%. Although moderate tailing may indicate maintenance on the instrument will be required soon, these additional compounds in the DFTPP standard are included as an aid in instrument performance evaluation.

The following DFTPP mass intensity criteria should be used:

DFTPP KEY MASSES AND ABUNDANCE CRITERIA

Mass	m/z Abundance criteria
51	10-80% of Base Peak.
68	Less than 2% of mass 69.
70	Less than 2% of mass 69.
127	10-80% of Base Peak.
197	Less than 2% of mass 198.
198	Base peak, or > 50% of Mass 442.
199	5-9% of mass 198.
275	10-60% of Base Peak.
365	Greater than 1% of mass 198.
441	Present but less than 24% of mass 442.
442	Base Peak, or > 50% of mass 198.
443	15-24% of mass 442.

10.2 Initial Calibration

- 10.2.1** After the DFTPP passes criteria, a set of multi-level calibration standards listed in Section 8.6.2.3 are analyzed, from low concentration to high. A minimum of five calibration levels are analyzed. The calibration standards are stored in the standards freezer. When the Initial Calibration is typed into a sequence, the standard ID for each of the levels must be noted in the "comments" of the sequence. (Refer to the Reagent Solvent and Standard Control SOP (1816) for further information regarding standard labeling convention.)
- 10.2.2** Once the standards have been analyzed, they are reduced by the search software of the Enviroquant data system. Once all the components are identified, a linear curve is calculated for the components. The criteria for evaluation are as follows:

The average response factor and the response factor of the lowest calibration standard of each target analyte should be checked against the recommended minimum response factor criteria found in Table C. This information may help to quickly identify poor responding compounds and the source of failure for initial calibrations. The %RSD for each target analyte must not exceed 20%. If the %RSD for any target exceeds 20%, then the linear or quadratic calibration models must be employed. A linear fit is acceptable if the correlation coefficient is greater than 0.99. A minimum of 5 levels are required for a linear calibration model and a minimum of 6 levels are required for a quadratic calibration model. When calculating calibration curves using the linear regression model, a quantitation check must be performed on the lowest calibration point, or the point that corresponds to that compound's established reporting limit. This recalculated concentration should be within +/-30% of the true value. If this criterion is not met then corrective action must take place and a new initial calibration must be performed prior to sample analysis.

- 10.2.3** Once the calibration curve is accepted, the Initial Calibration Verification (ICV) must be analyzed.

Reference standards from a separate source or different lot are analyzed after every initial calibration for evaluation of the calibration standard solutions. The response factors for all compounds should be evaluated against the minimum RF listed in Table C. The percent difference should not be greater than +/-30% of the true value for all target compounds. If any compounds do not meet this criterion, attempts should be made to locate and correct the source of the problem. 10% of all analytes are allowed to be outside of 70%-130%, but must be within 60%-140%. The ICV may be reanalyzed once. If the standard failure continues, corrective action must be taken prior to sample analysis.

A new initial calibration must be performed and acceptable ICV results obtained prior to any sample analysis.

10.3 Equipment Operation and Sample Processing

10.3.1 Sample Extraction and Cleanup

Samples for 8270 are generally extracted using one of the following SOPs:

- *Shaker Table Extraction* (2261)
- *Separatory Funnel Extraction* 3510C (2165)
- *Microscale Solvent Extraction* 3570 (2172)

Samples for 8270 may be cleaned up before transfer to the instrument laboratory using one of the following SOPs:

- *Gel Permeation Column Cleanup* SOP (2167)
- *Silica Gel Clean-up* SOP (2170) – limited target compounds only.

10.3.2 The preparation lab staff will transfer the samples to the instrument laboratory. The samples are generally brought to a 1.0 to 5.0mL final volume; 1.0mL is transferred and any remaining sample is put into archive. One aliquot of each sample is then logged into the Internal Chain of Custody book and placed in the sample extract holding refrigerator located in the instrument laboratory.

10.3.3 All samples and standards are spiked with the six Internal Standards (IS) compounds before analysis, Section 8.6.8.1. The internal standard is intended to be used for both quantitation and the establishment of relative retention times. Samples at a volume of 1.0mL (including the QC samples of a method blank and LCS) are spiked with 20uL of internal standard for a concentration of 5ug/mL. The samples are shaken briefly after the internal standard is added to ensure mixing. If a different volume of sample is transferred the volume of internal standard added is adjusted accordingly.

10.3.4 The analyst may decide to screen any samples to determine if an upfront dilution is needed. An analyst might decide a dilution is needed prior to analysis for high target analyte concentration or to protect the instrument from matrix related interferences.

10.3.5 After the samples have been analyzed, the data files from the Instrument are transferred to the server. The samples are quantitated versus the proper method. The QCPRN1.MAC macro creates a form with which to easily check internal standard and surrogate criteria. The istdrpt macro may, also, be utilized to check the internal standard and surrogate criteria. The following should be reviewed initially:

10.3.5.1 Are all the surrogates within QC criteria? Please see Section 12 for surrogate information.

10.3.5.2 Are all the internal standards of the samples within 50-200% of the daily CCV standard? If not, the samples should be checked for matrix interferences that may be causing these issues. The IS peaks should also be evaluated for peak splitting or incorrect integration by the software. A sample may not need to be reanalyzed if it can be determined (with guidance from a supervisor) that the QC is exceeded due to matrix interference.

- 10.3.5.3** Are all target analytes within calibration range? If not, the sample should be diluted and re-analyzed. If a dilution is performed after the internal standard has already been added, it will be necessary to add additional IS in order to provide a concentration of 5ug/mL. Conversely, if a sample has been over-diluted, it may need to be analyzed at a lesser dilution to detect target analytes that may have been diluted out.
- 10.3.5.4** Are all analyses within 12 hour tune time? If a sample is analyzed outside tune time, it will need to be re-analyzed in another tune clock.
- 10.3.6** The sequence should be printed out from Environmental Data Analysis, initialed and dated, placed in the standard logbook.
- 10.3.7** If anything in the initial review of the data indicates that there should be a re-analysis or a re-extract, the reason for re-analysis or re-extract should be noted on the sequence.
- 10.3.8** If a re-extract is required, the "Organics Re-Prep Request Form" google doc should be filled out and an email should be sent to the extractions lab.
- 10.3.9** A standard sequence (saved as S8073001;"S" for semivolatile;"8" for BNA8; 0730 for July 30, and 01 is the first sequence that day) would appear as follows:

Tune: WG#-1, -4, etc. This is the Analytical working group number generated by the Alpha LIMS that denotes the Tune.

CCV: WG#-2, -3, etc. This is the Analytical working group number generated by the Alpha LIMS that denotes the calibration verification.

10.4 Continuing Calibration Verification (CCV)

- 10.4.1** On a daily basis after the DFTPP has passed, a mid-level (10ug/mL) continuing calibration standard which contains all of the analytes of interest is analyzed. The criteria for acceptance are:
- 10.4.1.1** The %D for all targets must be $\leq 20\%$. Up to 20% of all targets are allowed to have %D > 20% with high bias as long as all associated samples are non-detect for those analytes. If any of the targets have %D > 20% with low bias corrective action must take place and all associated samples must be reanalyzed. The retention times of the internal standards must be within 0.5min of the mid-level standard of the most recent ICAL.
- 10.4.1.2** The area counts of the internal standards within the continuing calibration must be within 50 to 200% of the mid-level in previous ICAL.

10.5 Preventative Maintenance

All repair and non-routine maintenance records including outside service visits are maintained in the instrument maintenance logbooks.

Injection Port Maintenance: Maintenance should be done when the daily CCAL starts to demonstrate degradation. The type of samples analyzed will have an effect on how soon maintenance should be performed.

Septum Maintenance: The septum needs to be changed approximately every two-hundred injections. Unscrew the top septum nut, remove the pierced septum, and replace with a new 11mm Thermolite green septum (Restek) or equivalent. Screw the top septum nut back on.

Column Maintenance: Maintenance should be done when the daily CCAL starts to demonstrate degradation. The type of samples analyzed will have an effect on how soon maintenance should be performed. Generally maintenance is performed by trimming 6 cm off the front of the column. The column is then installed into the injection port liner, and the inlet nut is tightened.

11. Data Evaluation, Calculations and Reporting

11.1 Qualitative Analysis

- 11.1.1 The qualitative identification of compounds determined by this method is based on retention time and on comparison of mass spectrum, after background correction, with characteristic ions in a reference mass spectrum. The reference mass spectrum must be generated by the laboratory using the conditions of this method. The characteristic ions from the reference mass spectrum are defined as three ions of greatest relative intensity, or any ions over 30% relative intensity, if less than three such ions occur in the reference spectrum. Compounds are identified when the following criteria are met.
- 11.1.2 The intensities of the characteristic ions of a compound must maximize in the same scan or within one scan of each other. A peak selected by the data system, based on the presence of target specific ions at a target specific retention time will be accepted as meeting this criteria.
- 11.1.3 The relative retention time of the sample component is within ± 0.06 RRT units of the RRT of the standard component, taking into consideration matrix effects which may cause retention time shifts.
- 11.1.4 The relative intensities of the characteristic ions agree within 30% of the relative intensities of these ions in the reference spectrum. (Example: For an ion with an abundance of 50% in the reference spectrum, the corresponding abundance in a sample spectrum can range between 20% and 80%). Outlying abundances may be included due to the presence of non-target interference.
- 11.1.5 Structural isomers that produce very similar mass spectra should be identified as individual isomers if they have sufficiently different GC retention times. Sufficient GC resolution is achieved if the height of the valley between two isomer peaks is less than 50% the average of the two peak heights. Otherwise, structural isomers are identified as isomeric pairs.
- 11.1.6 Identification is hampered when sample components are not resolved chromatographically and produce mass spectra containing ions contributed by

more than one analyte. When gas chromatographic peaks obviously represent more than one sample component (i.e. a broadened peak with shoulder(s) or a valley between two or more maxima), appropriate selection of analyte spectra and background spectra is important.

11.1.7 Examination of extracted ion current profiles of appropriate ions can aid in the selection of spectra and in qualitative identification of compounds. When analytes coelute, (i.e. only one chromatographic peak is apparent), the identification criteria may be met, but each analyte spectrum may contain extraneous ions contributed by the coeluting compound.

11.1.8 For samples containing components not associated with the calibration standards, a library search may be made for the purpose of tentative identification. The necessity to perform this type of identification (TICs) will be determined by the purpose of the analyses being conducted. Data system library searches must not use normalization routines that would misrepresent the library or unknown spectra when compared to each other.

11.1.8.1 For example, the RCRA permit or waste delisting requirements may require the reporting of non target analytes. Only after a visual comparison of sample spectra with the nearest library searches may the analyst assign a tentative identification. Guidelines for tentative identification are:

11.1.8.1.1 Relative intensities of major ions in the reference spectrum (ions >10% of the most abundant ion) should be present in the sample spectrum.

11.1.8.1.2 The spectral library match must be $\geq 85\%$ for a tentatively identification to be made.

11.1.8.1.3 The relative intensities of the major ions should agree within $\pm 20\%$. (Example: For an ion with an abundance of 50% in the standard spectrum, the corresponding sample ion abundance must be between 30-70%).

11.1.8.1.4 Molecular ions in the reference spectrum should be present in the sample spectrum.

11.1.8.1.5 Ions present in the sample spectrum but not in the reference spectrum should be reviewed for background contamination or presence of co-eluting compounds.

11.1.8.1.6 Ions present in the reference spectrum but not in the sample spectrum should be reviewed for possible subtraction from the sample spectrum because of background contamination or co-eluting peaks. Data system library reduction programs can sometimes create these discrepancies.

11.2 Quantitative Analysis

11.2.1 Response factors and % RSD to evaluate Initial Calibration acceptability.

Calculate RF by:
$$RF = \frac{area_{cmp}}{area_{is} \times conc_{is}}$$

where:

area cmp = Area of the characteristic ion for the compound being measured.

area is = Area of the characteristic ion for the specific internal standard.

conc. is = Concentration of the specific internal standard.

conc. cmp = Concentration of the compound being measured.

Calculate %RSD by:
$$\%RSD = \frac{SD}{\bar{x}} \times 100 \quad SD = \sqrt{\frac{\sum_{i=1}^N (x_i - \bar{x})^2}{N-1}}$$

where:

%RSD = Percent Relative Standard Deviation

\bar{x} = Average of RF's

SD = Standard Deviation

x_i = Analytical results of each level in the final reporting units

N=Number of results (levels)

11.2.2 For compounds in the initial calibration in which the Average of Response Factors calibration model is used:

Calculate %Difference (%D):
$$\%D = \frac{RF_i - RF_c}{RF_c} \times 100$$

where:

RF_i - Initial Calibration average RF

RF_c = Continuing Calibration RF

11.2.3 For compounds in the Initial Calibration for which the Linear Regression calibration model is used:

$$\% \text{ Drift} = \frac{\text{Calculated []} - \text{Theoretical []}}{\text{Theoretical []}} \times 100$$

11.2.4 Results of Water Analysis- calculation as performed in report form:

$$\text{Concentration (ug/L)} = \frac{(\text{Conc}) (\text{Vf}) (\text{DF})}{(\text{Vi})} \times 1000$$

where:

Conc =Raw on-column concentration obtained from the quantitation report using Initial Calibration results.

Vf = Final volume of extract (mL)

Vi = Volume of sample extracted (mL)

DF = Dilution factor, for manually prepared dilutions

11.2.5 Results of Sediment/Soil and Sludge Analysis- calculation as performed in report form:

$$\text{Concentration (ug/Kg)} = \frac{(\text{Conc}) (\text{Vf}) (\text{DF})}{(\text{W}) (\%S)} \times 1000$$

where:

Conc =Raw on-column concentration obtained from the quantitation report using Initial Calibration results.

DF = Dilution factor, for manually prepared dilutions, not instrumental "dilutions".

Vf = Extract final volume (mL)

W = Aliquot of sample (wet), g

%S = Sample % solid (in decimal form)

11.2.6 The calculation for percentage breakdown for DDT is:

$$\% \text{ Breakdown DDT} = \frac{(\text{Area DDD} + \text{Area DDE})}{(\text{Area DDD} + \text{Area DDT} + \text{Area DDE})} \times 100$$

12. Contingencies for Handling Out-of-Control Data or Unacceptable Data

All results for the organic compounds of interests are reportable without qualification if extraction and analytical holding times are met, preservation (including cooler temperatures) are met, all QC criteria are met, and matrix interference is not suspected during extraction or analysis of the samples. If any of the below QC parameters are not met, all associated samples must be evaluated for the necessity of re-extraction and/or re-analysis.

If non-compliant organic compound results are to be reported, the Semi volatile Organics Department Manager, the Laboratory Director, and/or the QA Officer must approve the reporting of these results. The laboratory Project Manager shall be notified, and may chose to relay the non-compliance to the client, for approval, or other corrective action, such as re-sampling and re-analysis. The analyst or Department Manager performing the secondary review initiates the project narrative, and the narrative must clearly document the non-compliance and provide a reason for acceptance of these results.

QC Parameter	Acceptance Criteria
Initial Calibration Curve	$\leq 20\% \text{RSD}$ or ≥ 0.99 linear/quadratic for all targets. If the linear or quadratic calibration model is used, recalculation of the lowest calibration standard is required to be within $\pm 30\%$ of the true value. Average RFs and the lowest calibration standard should be checked against the recommended minimum RFs listed in Table C as a troubleshooting tool.
Independent Check Verification	$\pm 30\% \text{D}$ for all compounds; ICV is still accepted if up to 10% of all compounds that fail to meet $\pm 30\% \text{D}$, are within 60%-140%D
Continuing Calibration Verification	Analyzed every 12hr or at the minimum of every 20 samples; $\leq 20\% \text{D}$ for all compounds.
Method Blank	No analyte detected at or above the reporting limit, "B" qualify analyte if detected concentration is less than 10X the concentration found in the associated sample(s)
Laboratory Control Sample / Lab Control Sample Duplicate	40%-140% (Base/Neutral compounds) and 30%-130% (Acid compounds) for all matrices; 30% RPD for soils; 20% RPD for waters; 10% allowed out provided %Recovery is at least 10%, exception made for "difficult" compounds (Section 9.2)
Matrix Spike / Matrix Spike Duplicate	Same as for LCS/D
Sample / Sample Duplicate	30% RPD for soils; 20% RPD for waters
Surrogates	Soil: 30-130% Waters: 30-130% for BN and 15-115% for Acid
Internal Standards	50% - 200% of the daily CCV area for the Internal Standards
Project specific QAPP and DQOs supersede the above limits.	

13. Method Performance

13.1 Method Detection Limit Study (MDL) / Limit of Detection Study (LOD) / Limit of Quantitation (LOQ)

The laboratory follows the procedure to determine the MDL, LOD, and/or LOQ as outlined in Alpha SOP 1732. These studies performed by the laboratory are maintained on file for review.

13.2 Demonstration of Capability Studies

Refer to Alpha SOP 1739 for further information regarding IDC/DOC Generation.

13.2.1 Initial (IDC)

The analyst must make an initial, one-time, demonstration of the ability to generate acceptable accuracy and precision with this method, prior to the processing of any samples.

13.2.2 Continuing (DOC)

The analyst must make a continuing, annual, demonstration of the ability to generate acceptable accuracy and precision with this method.

14. Pollution Prevention and Waste Management

Refer to Alpha's Chemical Hygiene Plan and Waste Management and Disposal SOPs for further pollution prevention and waste management information.

15. Referenced Documents

Chemical Hygiene Plan

SOP 1732 MDL/LOD/LOQ Generation

SOP 1739 IDC/DOC Generation

SOP 1797 Waste Management and Disposal

SOP 1731 Manual Integration

SOP 1816 Solvent, Reagent, and Standard Control

SOP 1753 Laboratory Glassware Cleaning

16. Attachments

Table A: Surrogate Recovery Acceptance Criteria

Water: 15-115% for Acid compounds and 30-130% for Base/Neutral Compounds
Soils: 30-130%

Note: The above limits will be replaced by laboratory limits, when available. Limits are determined by sample DQO and matrix. The limits above may also vary with project specific requirements, QAPP, or DQOs.

Table B: Target Compounds and Quantitation Ions

Compound	Quantitation Ions	
	Primary	Secondary
Aniline*	93	39, 93
Acenaphthene (CCC)	153	154, 152
Acenaphthene-d10 (IS)	164	162, 160
Acenaphthylene	152	151, 153
Acetophenone	105	77, 51
Anthracene	178	176, 179
Azobenzene *	182	77
Atrazine	200	173, 215
Benzaldehyde	77	105, 106
Benzo(a)Anthracene	228	229, 226
Benzo(a)pyrene D12 (SURR)	264	132
Benzidine*	184	183, 92
Benzo(b)fluoranthene	252	253, 125
Benzo(k)fluoranthene	252	253, 125
Benzo(g,h,i)perylene	276	138, 277
Benzo(a)pyrene	252	253, 125
Benzoic Acid*	105	122, 77
Biphenyl	154	153, 76
Benzyl Alcohol	108	79, 77
Bis(2-chloroethoxy)methane	93	95, 123
Bis(2-chloroethyl)ether	93	63, 95
Bis(2-chloroisopropyl)ether	45	77, 79
Bis(2-ethylhexyl)phthalate	149	167, 279
4-Bromophenylphenylether	248	250, 141
Butylbenzylphthalate	149	91, 206
Carbazole*	167	139, 166
Caprolactam	113	55, 56
2-Chloroaniline	127	129
4-Chloroaniline	127	129
4-Chloro-3-methylphenol (CCC)	107	144, 142
2-Chloronaphthalene	162	127, 164
2-Chlorophenol	128	64, 130
4-Chlorophenylphenylether	204	206, 141
Hexachlorobenzene	284	142, 249

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Chrysene	228	226, 229
Chrysene-d12 (IS)	240	120, 236

Table B, continued: Target Compounds and Quantitation Ions

Compound	Quantitation Ions	
	Primary	Secondary
Dibenz(a,h)anthracene	278	139, 279
Dibenzofuran	168	139
Di-n-butylphthalate	149	150, 104
1,2-Dichlorobenzene	146	148, 113
1,3-Dichlorobenzene	146	148, 113
1,4-Dichlorobenzene (CCC)	146	148, 113
1,4-Dichlorobenzene-d4 (IS)	152	115
3,3'-Dichlorobenzidine*	252	254, 126
2,4-Dichlorophenol (CCC)	162	164, 98
Diethylphthalate	149	177, 150
2,4-Dimethylphenol	107	122, 121
Dimethylphthalate	163	194, 164
4,6-Dinitro-2-methylphenol	198	182, 77
2,4-Dinitrophenol (SPCC)	184	63, 154
2,4-Dinitrotoluene	165	63, 182
2,6-Dinitrotoluene	165	63, 121
Di-n-octylphthalate (CCC)	149	167, 150
Fluoranthene (CCC)	202	101, 100
Fluoranthene D10 (SURR)	212	106
Fluorene	166	165, 167
2-Fluorobiphenyl (SURR)	172	171, 173
2-Fluorophenol (SURR)	112	64, 91
Hexachlorobutadiene (CCC)	225	223, 227
Hexachlorocyclopentadiene (SPCC)	237	235, 272
Hexachloroethane	117	201, 199
Isophorone	82	95, 138
Indeno(1,2,3-cd)pyrene	276	138, 227
2-Methylnaphthalene	142	141
2-Methylphenol	108	107
4-Methylphenol	108	107
Naphthalene	128	129, 127
Naphthalene-d8 (IS)	136	68
2-Nitroaniline	65	92, 138
3-Nitroaniline	138	108, 92
4-Nitroaniline	138	108, 92
Nitrobenzene	77	123, 65
Nitrobenzene-d5 (SURR)	82	128, 54
2-Nitrophenol (CCC)	139	109, 65
4-Nitrophenol (SPCC)	109	139, 65
N-Nitrosodiphenylamine (CCC)	69	168, 167
N-Nitroso-di-n-propylamine (SPCC)	169	42, 101, 130
N-Nitrosodimethylamine*	74	42, 44
Pentachlorophenol (CCC)	266	264, 268
Pentachloronitrobenzene	237	214, 249
Perylene-d12 (IS)	264	260, 265

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Phenanthrene	178	179, 176
Phenanthrene-d10 (IS)	188	94, 80
Phenol (CCC)	94	65, 66

Table B, continued: Target Compounds and Quantitation Ions

Compound	Quantitation Ions	
	Primary	Secondary
Phenol-d5 (SURR)	99	42, 71
Pyrene	202	200, 203
Pyridine	79	52
Terphenyl-d14 (SURR)	244	122, 212
1,2,4,5-Tetrachlorobenzene	216	214, 179
2,3,4,6-Tetrachlorophenol	232	131, 230
2,4,6-Tribromophenol (SURR)	330	332, 141
1,2,4-Trichlorobenzene	180	182, 145
2,4,5-Trichlorophenol	196	198, 97, 132, 99
2,4,6-Trichlorophenol (CCC)	196	198, 200

* Indicates compound is not part of standard reporting list.

Note: Target list will vary based on project specific requirements.

Table C: Recommended Minimum Response Factor Initial and Continuing Calibration

Semivolatile Compounds	Minimum Response Factor (RF)
Benzaldehyde	0.01
Phenol	0.8
Bis(2-chloroethyl)ether	0.7
2-Chlorophenol	0.8
2-Methylphenol	0.7
2,2'-Oxybis-(1-chloropropane)	0.01
Acetophenone	0.01
4-Methylphenol	0.6
N-Nitroso-di-n-propylamine	0.5
Hexachloroethane	0.3
Nitrobenzene	0.2
Isophorone	0.4
2-Nitrophenol	0.1
2,4-Dimethylphenol	0.2
Bis(2-chloroethoxy)methane	0.3
2,4-Dichlorophenol	0.2
Naphthalene	0.7
4-Chloroaniline	0.01

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Hexachlorobutadiene	0.01
	0.01

Caprolactam

Table C Continued: Recommended
Minimum Response Factor Initial and
Continuing Calibration

Semivolatile Compounds	Minimum Response Factor (RF)
Hexachlorocyclopentadiene	0.05
1,1'-Biphenyl	0.01
2-Chloronaphthalene	0.8
2-Nitroaniline	0.01
Dimethyl phthalate	0.01
2,6-Dinitrotoluene	0.2
Acenaphthylene	0.9
3-Nitroaniline	0.01
Acenaphthene	0.9
2,4-Dinitrophenol	0.01
4-Nitrophenol	0.01
Dibenzofuran	0.8
2,4-Dinitrotoluene	0.2
Diethyl phthalate	0.01
1,2,4,5-Tetrachlorobenzene	0.01
4-Chlorophenyl-phenyl ether	0.4
Fluorene	0.9
4-Nitroaniline	0.01
4,6-Dinitro-2-methylphenol	0.01
4-Bromophenyl-phenyl ether	0.1
N-Nitrosodiphenylamine	0.01
Hexachlorobenzene	0.1
Atrazine	0.01
Pentachlorophenol	0.05
Phenanthrene	0.7
Anthracene	0.7
Carbazole	0.01
Di-n-butyl phthalate	0.01
Fluoranthene	0.6
Pyrene	0.6
Butyl benzyl phthalate	0.01
3,3'-Dichlorobenzidine	0.01
Benzo(a)anthracene	0.8

Chrysene	0.7
Bis-(2-ethylhexyl)phthalate	0.01
Di-n-octyl phthalate	0.01

**Table C Continued: Recommended
Minimum Response Factor Initial and
Continuing Calibration**

Semivolatile Compounds	Minimum Response Factor (RF)
Benzo(b)fluoranthene	0.7
Indeno(1,2,3-cd)pyrene	0.5
Dibenz(a,h)anthracene	0.4
Benzo(g,h,i)perylene	0.5
2,3,4,6-Tetrachlorophenol	0.01

Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS)

References: **Method 8260C**, SW-846, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, EPA SW-846, 2006.

Method 5035A, Closed System Purge & Trap and Extraction for Volatile Organics in Soil and Waste Samples. SW-846, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, EPA SW-846, Update IV, Draft, July 2002.

Method 5030B, Purge & Trap for Aqueous Samples. SW-846, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, EPA SW-846, Update III, December, 1996.

Method 5030C, Purge & Trap for Aqueous Samples. SW-846, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, EPA SW-846, Update IV, May, 2003.

1. Scope and Application

Matrices: Method 8260 is used to determine volatile organic compounds in a variety of solid waste matrices. This method is applicable to nearly all types of samples, regardless of water content, including various air sampling trapping media, ground and surface water, aqueous sludges, caustic liquors, acid liquors, waste solvents, oily wastes, mousses, tars, fibrous wastes, polymeric emulsions, filter cakes, spent carbons, spent catalysts, soils, and sediments.

Definitions: Refer to Alpha Analytical Quality Manual.

The following compounds may be determined by this method:

8260C LIST OF ANALYTES		
Dichlorodifluoromethane	Carbon tetrachloride	Isopropylbenzene
Chloromethane	1,2-Dichloroethane	1,4-Dichloro-2-butane
Vinyl chloride	Benzene	1,1,2,2-Tetrachloroethane
Chloroethane	Trichloroethene	Trans-1,4-dichloro-2-butene
Bromomethane	1,2-Dichloropropane	1,2,3-Trichloropropane
Trichlorofluoromethane	Bromodichloromethane	n-Propylbenzene
Ethyl ether	Dibromomethane	Bromobenzene
Acetone	4-Methyl-2-pentanone	2-Chlorotoluene
1,1-Dichloroethene	cis-1,3-Dichloropropene	1,3,5-Trimethylbenzene
Carbon disulfide	Toluene	4-Chlorotoluene
Methylene chloride	Trans-1,3-dichloropropene	Tert-butylbenzene
Acrylonitrile	Ethyl-methacrylate	1,2,4-Trimethylbenzene
Methyl-tert-butyl ether	1,1,2-Trichloroethane	Sec-butylbenzene
Trans-1,2-dichloroethene	2-Hexanone	p-Isopropyltoluene
1,1-Dichloroethane	1,3-Dichloropropane	1,3-Dichlorobenzene
Vinyl acetate	Tetrachloroethene	1,4-Dichlorobenzene
2-Butanone	Chlorodibromomethane	n-Butylbenzene
2,2-Dichloropropane	1,2-Dibromoethane	1,2-Dichlorobenzene
Cis-1,2-dichloroethene	Chlorobenzene	1,2-Dibromo-3-chloropropane
Chloroform	1,1,1,2-Tetrachloroethane	1,2,4-Trichlorobenzene
Bromochloromethane	Ethyl benzene	Hexachlorobutadiene
Tetrahydrofuran	p/m Xylene	Naphthalene
1,1,1-Trichloroethane	o Xylene	1,2,3-Trichlorobenzene

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8260C LIST OF ANALYTES (continued)		
1,1-Dichloropropene	Styrene	Bromoform
Acrolein	2-Chloroethylvinyl ether	Ethanol
Cyclohexanone	Ethyl acetate	1,3,5-Trichlorobenzene
Iodomethane	Methyl methacrylate	Tert-amyl methyl ether
Di-isopropyl ether	n-Butanol	1,4-Dioxane
Ethyl Tert-Butyl Ether	Pentachloroethane	Isopropyl Alcohol (IPA)

There are various techniques by which these components may be introduced into the GC/MS system. Purge-and-trap, by Methods 5030C (aqueous samples) and 5035A (solid and waste oil samples), is the most commonly used technique for volatile organic analytes. However, other techniques are also appropriate and necessary for some analytes. One technique is direct injection of an aqueous sample (concentration permitting).

The data report packages present the documentation of any method modification related to the samples tested. Depending upon the nature of the modification and the extent of intended use, the laboratory may be required to demonstrate that the modifications will produce equivalent results for the matrix. Approval of all method modifications is by one or more of the following laboratory personnel before performing the modification: Area Supervisor, Department Supervisor, Laboratory Director, or Quality Assurance Officer.

This method is restricted to use by or under the supervision of analysts experienced in the operation of the gas chromatograph/mass spectrometers and in the interpretation of mass spectra and their use as a quantitative tool. Each analyst must demonstrate the ability to generate acceptable results with this method by performing an initial demonstration of capability.

2. Summary of Method

The volatile compounds are introduced into the gas chromatograph by the purge-and-trap method or by direct injection. The analytes are introduced to a narrow-bore capillary column for analysis. The Gas Chromatograph (GC) is temperature-programmed to separate the analytes, which are then detected with a mass spectrometer (MS) interfaced to the GC.

Analytes eluted from the capillary column are introduced into the mass spectrometer via a direct connection. Identification of target analytes is accomplished by comparing their mass spectra with the electron impact (or electron impact-like) spectra of authentic standards. Quantitation is accomplished by comparing the response of a major (quantitation) ion relative to an internal standard, comparing sample response to the calibration standards.

2.1 Method Modifications from Reference

None.

3. Reporting Limits

Table 1 lists our typical reporting limits.

4. Interferences

- 4.1** Impurities in the purge gas, organic compounds out-gassing from the plumbing ahead of the trap, and solvent vapors in the laboratory account for the majority of contamination problems. The analytical system must be free from contamination under the conditions of the analysis. Running laboratory reagent blanks as described in Section 10.3 and 9.1

demonstrates the system is free of contamination. The use of non-Teflon plastic tubing, non-Teflon thread sealants, or flow controllers with rubber components in the purge and trap system must be avoided.

- 4.2** Sample contamination occurs by diffusion of volatile organics (particularly fluorocarbons and methylene chloride) through the septum seal into the sample during shipment and storage. A trip blank or a field reagent blank prepared from reagent water and carried through the sampling and handling protocol serves as a check on such contamination.

4.2.1 Storage blanks shall be analyzed if contamination is suspect. If contamination is confirmed by positive detections in the sample storage blanks, all data from samples contained in the relative refrigerator or freezer shall be evaluated for possible contamination. If the samples contain suspected contamination, the Client Services department shall be notified in order to contact the necessary clients regarding the contamination. Samples shall be reanalyzed if so desired by the client. If suspected contamination is not confirmed by storage blanks, no further action shall be pursued concerning said blanks. It is recommended that further action be taken to determine the possible cause of suspected contamination.

- 4.3** Contamination by carry-over can occur whenever high level and low level samples are sequentially analyzed. Whenever a highly concentrated sample is being encountered, it should be followed by an analysis of reagent water (instrument blank) to check for potential contamination. If carry-over is suspected, then numerous instrument blanks may be required; additionally all affected samples are rerun for confirmation.. In case of severe contamination, preventive maintenance of the entire system may be required.

5. Health and Safety

The toxicity or carcinogenicity of each reagent and standard used in this method is not fully established; however, each chemical compound should be treated as a potential health hazard. From this viewpoint, exposure to these chemicals must be reduced to the lowest possible level by whatever means available. A reference file of material safety data sheets is available to all personnel involved in the chemical analysis. Additional references to laboratory safety are available in the Chemical Hygiene Plan.

All personnel handling environmental samples known to contain or to have been in contact with municipal waste must follow safety practices for handling known disease causative agents.

The following method analytes have been tentatively classified as known or suspected human or mammalian carcinogens: benzene, carbon tetrachloride, 1,4-dichlorobenzene, 1,2-dichloroethane, hexachlorobutadiene, 1,1,2,2-tetrachloroethane, 1,1,2-trichloroethane, chloroform, 1,2-dibromoethane, tetrachloroethene, trichloroethene, and vinyl chloride. Pure standard materials and stock standard solutions of these compounds should be handled in a hood. A NIOSH/MESA approved toxic gas respirator should be worn when the analyst handles high concentrations of these toxic compounds.

- 5.1** Lab coats, safety glasses, and gloves must be worn when handling samples, standards, or solvents.
- 5.2** All stock solution standard preparation must be performed in the volatiles hood. Initial calibration, continuing calibration, laboratory control sample and client sample dilutions do not need to be performed in the hood.

- 5.3** All expired standards must be placed into the waste bucket in the lab, for future disposal. The container must be labeled properly with hazard warning labels indicating the container contents.
- 5.4** Bottles containing Methanol must be stored in the flammables cabinet.

6. Sample Collection, Preservation, Storage, Shipping and Handling

6.1 Sample Collection and Preservation

6.1.1 Aqueous Samples

Grab samples are collected in standard 40mL amber glass screw-cap vials with Teflon lined silicon septa (VOA vial). Two or more VOA vials should be filled per sample location. EPA Method 8260 requires that samples be acidified to eliminate the possibility of biological degradation. Unless otherwise directed for project-specific reasons, all VOA vials are delivered to the client with approximately 2 – 4 drops of 1:1 HCl added to the vial, which is sufficient to adjust the pH of the sample to < 2. Prepared trip blanks are provided to the client to accompany field samples for QC purposes.

Fill the sample vial to the point of overflowing so that no headspace is contained within. Samples must be introduced into the vials gently to reduce agitation, which might drive off volatile compounds or cause loss of the HCl preservative.

Seal the bottle so that no air bubbles are in the VOA vial. If preservative has been added, shake vigorously for one minute. Invert the bottle and tap to check for air bubbles. Recollect the samples if any air bubbles are present.

Maintain the hermetic seal on the VOA vial until time of analysis.

6.1.2 Soil Samples

The recommended sampling method for soil samples is EPA 5035A. Method 5035A provides for two distinct sampling procedures, depending on the required reporting limits and suspected or known concentration levels of target analytes. These methods are referred to as the High Level and Low Level methods. Both are listed below, but depending on the samples only one of the methods may be required. If concentration levels are unknown, it is recommended that samples be collected using both procedures. The Lab will analyze the high level sample first, followed by the low level sample if the results from the high level analysis show that the sample is clean or contains analytes at low levels. The typical reporting levels of the two methods are listed in Table 1.

6.1.2.1 High Level Soil Samples

Collect sample in a standard 40mL amber glass screw-cap vial with Teflon lined silicon septa (VOA vial). The vial is provided containing 15mL of Purge and Trap Grade methanol, and is labeled and weighed prior to addition of sample. Record the weight of the vial with methanol on the vial label. Prepared trip blanks are provided to the client to accompany field samples for QC purposes.

Approximately 15g of soil is added to the vial in the field, making sure that the sample is completely covered by the methanol.

Maintain the hermetic seal on the VOA vial until the time of analysis.

An additional sample of the soil must also be obtained (without methanol) to be used for the determination of soil moisture content to allow for the calculation of the dry weight results, and to calculate the methanol dilution effect. (See Sections 11.1.2.2.2 and 11.1.2.2.3)

6.1.2.2 Low Level Soil Samples

Collect sample in a standard 40mL amber glass screw-cap vials with Teflon lined silicon septa (VOA vial). Two samples should be taken per sample location. Vials are provided containing a magnetic stirring bar and 5 mL of either 200g/L sodium bisulfate solution or water, prepared by a certified vendor. These vials are labeled and weighed prior to addition of sample. Record the weight of the vial with the stirring bar and preservative on the vial label.

Approximately 5g of soil is added to the vial in the field, making sure that the sample is completely covered by the sodium bisulfate solution or water.

Maintain the hermetic seal on the VOA until the time of analysis.

6.2 Sample Handling and Storage

Document client specific sample handling, preservation and collection criteria in the project file. The laboratory Log-in staff documents sample temperature at the time of receipt.

Record deviations from this SOP or client specific criteria on the chain of custody form.

Record holding time exceedence, improper preservation and observed sample headspace on the nonconformance report form.

6.2.1 Aqueous Samples

Ice or refrigerate all samples from the time of collection until analysis, maintaining the sample temperature between 1 and 4 °C. Sample receiving personnel note on the sample delivery group form when samples received at the laboratory are not within the temperature criteria. If more than one vial is received for a sample the vials are stored in separate refrigerators. Storing the vials apart provides a useful check if laboratory contamination of a sample is suspected. Samples must be analyzed within 14 days of collection. Unpreserved samples requiring aromatic analysis must be analyzed within 7 days of collection.

6.2.2 High Level Soil Samples

Ice or refrigerate all samples from the time of collection until analysis, maintaining the sample temperature between 2 and 6 °C. Sample receiving personnel note on the nonconformance report form when samples received at the laboratory are not within the temperature criteria.

6.2.3 Low Level Soil Samples

Ice or refrigerate samples preserved with water or sodium bisulfate from the time of collection until analysis, maintaining the sample temperature between 2 and 6 °C. Samples preserved with water are to be immediately frozen after sampling. Sample receiving personnel note on the nonconformance report form when samples received at the laboratory are not within the temperature criteria.

6.3 Sample Shipping

Samples requiring shipment to the laboratory are shipped in ice-packed coolers via an overnight delivery service in accordance with applicable Department of Transportation regulations.

7. Equipment and Supplies

7.1 Purge and Trap System (For Aqueous samples and High Level Soils): The purge-and-trap system consists of two separate pieces of equipment: a purging device (autosampler) (Varian Archon/8100, Tekmar Solatek, EST Centurion) coupled to the desorber (concentrator) (Tekmar Velocity or EST Encon).

- 7.1.1 Purge gas = Helium, analytical grade (99.999%).
- 7.1.2 The purging device is configured with 25 mL sample purge tubes, and the helium purge gas is introduced at the bottom of the water column as finely divided bubbles
- 7.1.3 The trap used in the desorber is typically a Supelco "K" trap. Different traps may be used if equivalent performance is demonstrated.
- 7.1.4 The desorber is capable of rapidly heating the trap to 260°C. The trap is not heated above manufacturer's specifications

7.2. Purge and Trap System (For Low Level Soil Samples): The purge and trap system consists of two separate pieces of equipment: a purging device (autosampler) coupled to the desorber (concentrator) (Varian Archon/8100, Tekmar Solatek, EST Centurion with EST Encon, Tekmar Velocity, or equivalents).

- 7.2.1. Purge gas = Helium, analytical grade (99.999%).
- 7.2.2. The autosampler purging device is a closed system, designed to accept the 40mL VOA vials. The VOA vial, containing the soil sample, water (or sodium bisulfate), and stirring bar is placed into the autosampler tray. The instrument automatically adds reagent water, internal standards, and surrogates to the unopened VOA vial. The vial is heated to 40 °C, and the helium purge gas is introduced into the aqueous portion to purge the volatile components onto the trap.
- 7.2.3. The trap used in the desorber is typically a Supelco "K" trap. Different traps may be used if equivalent performance is demonstrated.
- 7.2.4. The desorber is capable of rapidly heating the trap to 260 °C. The trap is not heated above manufacturer specifications.

7.3 Gas Chromatography/Mass Spectrometer/Data System:

- 7.3.1 **Gas Chromatograph, Agilent 6890/7890 or equivalent:** An analytical system complete with a temperature-programmable gas chromatograph with appropriate interface for sample introduction device. The system includes all required accessories, including syringes, analytical columns, and gases. The capillary column is directly coupled to the source of the GC/MS system.

7.3.2 Typical Gas Chromatographic Columns:

7.3.2.1 Column 1: Restek 502.2, 40 meter, 0.18mm ID, or equivalent.

7.3.2.2 Column 2: Restek RTX-VMS, 30 meter, 0.25mm ID, or equivalent

7.3.3 **Mass Spectrometer, Agilent 5973/5975/5978 or equivalent:** Scanning from 35 to 300 amu every 2 seconds or less, using 70 volts (nominal) electron energy in the electron impact ionization mode. The mass spectrometer must be capable of producing a mass spectrum for 4-Bromofluorobenzene (BFB) which meets all of the criteria in Table 3, when 50ng of the GC/MS tuning standard (BFB) are injected through the GC. For all SIM analysis, the mass spectrometer must also be able to acquire data in a dual acquisition mode (SIM and full scan).

7.3.4 **Data System:** Hewlett-Packard EnviroQuant software is used for data acquisition, and allows the continuous acquisition and storage on machine-readable media of all mass spectra obtained throughout the duration of the chromatographic program.

Thruput Target 4.12 software or Enviroquant E.02.02 (or equivalent) is used for data processing, and allows searching of any GC/MS data file for ions of a specified mass, and plotting such ion abundances versus time or scan-number.

The most recent version of the EPA/NIST Mass Spectral Library is loaded onto the Target / Enviroquant data system.

7.4 **Wiretrol or Microsyringes:** 10µL - 1,000µL.

7.5 **Syringes:** 5mL, 10mL, or 25mL, glass with Luerlock tip.

7.6 **Balances:** Top-loading, capable of weighing 0.1g.

7.7 **Vials:** 2mL, 4mL.

7.8 **Disposable Pipets.**

7.9 **Volumetric Flasks:** Class A, appropriate sizes, with ground-glass stoppers.

7.10 **Eppendorf Pipets**

8. Reagents and Standards

Reagent grade organic chemicals shall be used in all tests. Unless otherwise indicated, it is intended that all organic reagents shall conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available. Other grades may be used, provided it is first ascertained that the reagent is of sufficiently high purity to permit its use without lessening the accuracy of the determination.

Great care must be taken to maintain the integrity of all standard solutions. Standards in methanol are stored at -10°C or less, in amber vials with PTFE-lined screw-caps.

8.1 Organic-free Reagent Water:

All references to water in this method refer to organic-free reagent water, which is tap water passed through activated carbon and air bubbled through.

8.2 Methanol:

Purge and Trap Grade or equivalent. Store in flammables cabinet.

8.3 Stock Solutions:

All stock standard solutions are purchased from commercial vendors as ampulated certified solutions. When an ampulated stock solution is opened, it is transferred to a labeled amber screw-cap vial with minimal headspace. The expiration date of the stock solution is either the vendor specified expiration date or 6 months from the date the ampule was opened, whichever is sooner. Typical stock standard concentrations are listed in Table 4.

8.4 Intermediate Standards: Intermediate standards are prepared volumetrically by diluting the appropriate stock standard(s) with methanol. Initial Calibration solutions expire 2 months from the date of preparation, or sooner if daily continuing calibration checks do not achieve the method acceptance criteria. If the Intermediate Standards are used as a second source to verify a valid Initial Calibration solution, there is no expiration date.

8.4.1 Internal Standard Solutions:

The internal standards are Fluorobenzene, Chlorobenzene-d₅, and 1,4-Dichlorobenzene-d₄. The intermediate IS solution is prepared by diluting the stock solution(s) with methanol to a concentration of 100 µg/mL. The appropriate amount of IS solution is added to the water or soil sample or QC sample to achieve a final concentration of 100 ng/sample or standard. Internal standard is added at the same concentration to all standards, samples, and QC samples.

8.4.2 Surrogate Standard Solutions:

The surrogate standards are Dibromofluoromethane, 1,2-Dichloroethane-d₄, Toluene-d₈, and 4-Bromofluorobenzene. The intermediate surrogate solution is prepared by diluting the stock solution(s) with methanol to a concentration of 100 µg/mL. The appropriate amount of surrogate solution is added to the water or soil sample or QC sample to achieve a final concentration of 100 ng/sample.

8.4.3 Target Compound Solutions:

The target analytes routinely reported by this method are listed in the beginning of this SOP. The intermediate target compound solutions are prepared by diluting the stock solution(s) with methanol. This set of solutions, at concentrations of 200 µg/mL, is used for preparation of the calibration standards.

8.4.4 4-Bromofluorobenzene (BFB) Tune solution:

A solution containing BFB at a concentration of 50 µg/mL is prepared by volumetrically diluting the BFB stock solution. 1 µL of this solution is direct-injected or purged into the GC/MS system to verify system performance prior to any standard or sample analysis.

8.5 Calibration Standards:

There are two types of calibration standards used for this method – initial calibration standards and calibration verification standards.

8.5.1 Initial Calibration Standards:

Initial calibration standards can be prepared at the levels listed in Table 4 (other/different levels are allowed). The Initial Calibration needs to have a minimum of 5 standards, 6 if a quadratic curve fit is used. Prepare these solutions in organic-free reagent water. The standards correspond to the range of concentrations found in typical samples and do not exceed the working range of the GC/MS system. Initial calibration should be mixed from fresh stock standards and dilution standards when generating an initial calibration curve.

8.5.2 Initial Calibration Verification Standard (ICV):

The initial calibration verification standard is at the same concentration as the level 3 initial calibration standard. This standard is made from a second source than the Initial Calibration Standards.

8.5.3 Continuing Calibration Verification Standard:

The continuing calibration verification standard, or calibration check standard, should be analyzed near the action level of the project. Since most projects are focused on achieving low reporting limits, the continuing calibration verification standard is at the same concentrations as the level 3 initial calibration standard. This standard is run at the beginning of each analytical sequence, following the BFB tune standard, to verify system performance.

9. Quality Control

The laboratory must maintain records to document the quality of data that is generated. Ongoing data quality checks are compared with established performance criteria to determine if the results of analyses meet the performance characteristics of the method.

9.1 Blank(s)

Blank samples must be matrix specific, i.e. methanol samples need to have methanol in the blank; sodium bisulfate samples need to have a sodium bisulfate blank analyzed; TCLP samples need a TCLP blank.

Analyze a matrix-specific blank each day prior to sample analysis to demonstrate that interferences from the analytical system are under control. The blank must contain the internal standards and surrogates.

Analyze the reagent water blank from the same source of water used for preparing the standards, QC samples and making sample dilutions. The method blank must not contain any target analytes at or above the compound reporting limits.

9.2 Laboratory Control Sample (LCS)/ Laboratory Control Sample Duplicate (LCSD)

A LCS/LCSD pair is analyzed at the beginning of each analytical sequence. Since the LCS contains the same compounds at the same concentrations as the continuing calibration check standard, the same analysis is used to satisfy both QC elements. The LCS/LCSD acceptance criteria are based on in-house control limits, unless specified by project/regulation.

9.3 Initial Calibration Verification (ICV)

Refer to Section 10.2.5.

9.4 Continuing Calibration Verification (CCV)

Refer to Section 10.4.4.

9.5 Matrix Spike/ Matrix Spike Duplicate

Upon Client Request, a matrix spike/matrix spike duplicate pair may be analyzed with each batch of 20 or less samples. The MS/MSD are sample aliquots spiked with the target compounds at the same concentration as the continuing calibration standard. The MS/MSD acceptance criteria are based on in-house control limits. If the MS/MSD does not meet the criteria, but the LCSD does, the failure may be attributed to sample matrix. Report the MS/MSD, including a narrative sheet for inclusion with the client report.

9.6 Laboratory Duplicate

Not applicable.

9.7 Method-specific Quality Control Samples

9.7.1 Internal Standards

Area counts of the internal standard peaks in all samples and QC samples must be between 50-200% of the areas of the internal standards in the QC check standard.

If any individual percent recovery falls outside the range, that parameter has failed the acceptance criteria. For calibration standards, CCVs, LCS/LCSD or blanks the internal standard must be within the range for data to be reported to the clients. For samples, matrix spikes and duplicates: if the data is not within the range, the sample is rerun to confirm that the failure is due to sample matrix. A nonconformance report form is completed to ensure client notification and reporting if matrix effect is confirmed.

9.7.2 Surrogates

Surrogates are added to each field sample and QC sample. The laboratory must evaluate surrogate recovery data from individual samples versus the surrogate control limits developed by the laboratory. The surrogate acceptance criteria are listed in Table 2. Since the SIM analysis is acquired in dual mode, the surrogates from the full scan are used to evaluate the entire sample (SIM and full scan).

9.8 Method Sequence

In a 12-hour period, the typical analytical sequence is as follows:

- BFB
- QC Check Standard/Laboratory Control Sample/LCSD
- Method Blank
- Samples
- MS/MSD (upon Client request, may be run anytime after the Method Blank)

10. Procedure

10.1 Equipment Set-up

Typical instrument operating conditions are listed below. Alternate conditions are allowed, as long as method performance criteria can be met.

10.1.1 GC Conditions:

Temperature 1:	35°C	Carrier gas:	Helium, 99.999%
Hold Time 1:	4 minutes	Carrier mode:	Constant flow
Ramp 1:	6°C/minute	Carrier flow:	1 mL/minute
Temperature 2:	150°C		
Hold Time 2:	0 minutes		
Ramp 2:	8°C/minute		
Temperature 3:	220°C		
Final Time:	1 minute		

10.1.2 MS Conditions:

Mass scan range:	35 – 260 amu
Scan time:	0.5 minutes/scan
Source temperature:	230°C

10.1.3 Velocity Concentrator Purge and Trap Conditions:

Purge time:	11 minutes
Dry purge:	2 minutes
Desorb preheat:	250°C
Desorb temp:	255°C
Desorb time:	2 minutes
Bake temp:	290°C
Bake time:	10 minutes

10.1.4 Encon Concentrator Purge and Trap Conditions:

Purge time:	11 minutes
Dry purge:	1 minute
Desorb preheat:	245°C
Desorb temp:	255°C
Desorb time:	1 minute
Bake temp:	270°C
Bake time:	10 minutes

10.2 Initial Calibration

- 10.2.1** The initial calibration is performed at a minimum of five (5) concentration levels listed in Table 4, the low level of the either at or below the reporting limit. The calibration is performed using instrument conditions listed in Section 10.1.

BFB must be analyzed prior to analysis of the initial calibration standards, and must pass the criteria listed in Table 3. The mass spectrum of BFB should be acquired in the following manner:

- (1) Three scans (the peak apex scan, the scan immediately preceding the apex and the scan immediately following the apex) are acquired and averaged.
- (2) Background subtraction is performed using a single scan of no more than 20 scans prior to the elution of BFB.

This is done automatically with the ThruPut Target / Enviroquant software.

- 10.2.1.1 Low Level/High Level Soil Curve on Archon or Centurion:** To prepare a calibration standard, add the appropriate volume of standard solution(s) to a 50mL volumetric flask using a microsyringe. Remove the needle quickly and mix by inverting the flask 3 times. Pour several mLs of the aqueous standard into the waste vessel, then gently fill a 5mL syringe with standard and transfer to a 40mL VOA vial containing a magnetic stir bar. Load the vial onto Archon Autosampler.

- 10.2.1.2 Aqueous/High Level Soil Curve on Solatek or Centurion:** To prepare a calibration standard, add the appropriate volume of standard solution(s) to a 100mL volumetric flask using a microsyringe. Remove the needle quickly and mix by inverting the flask 3 times. Pour several mLs of the aqueous standard into the waste vessel, then gently fill a 40mL VOA vial to the top. Load the vial onto the Autosampler.

- 10.2.2** Establish the GC operating conditions by loading the appropriate GC method. Typical instrument conditions are listed in Section 10.1. The same operating conditions are used for calibration and sample analyses. Create the analytical sequence using the HP Enviroquant data acquisition software.

Relative Response Factors: The internal standard calibration technique is used. In each calibration standard, calculate the relative response factor for each analyte and the relative standard deviation (RSD) of the response factors using the Target / Enviroquant data processing software. The response factors are calculated using the areas of the characteristic (quantitation) ion for each target analyte and internal standard. The calculations are performed automatically using the Target / Enviroquant software, using the formulae listed in Alpha's Quality Manual.

- 10.2.3 Initial Calibration Criteria:** The following sections outline the method acceptance criteria for an initial calibration curve. All criteria must be met for the calibration to be deemed acceptable, and for sample analysis to proceed.

- 10.2.3.1 Relative Standard Deviation Criteria:** If the RSD for each target analyte is less than or equal to 20%, then the response for this compound is considered linear over the calibration range and the mean calibration factor can be used to

quantitate sample results. If the 20% RSD criterion is not met for an analyte linear regression may be used if $r \geq 0.990$, weighted linear with a weighting factor of $1/SD^2$ and $r > 0.990$, or quadratic fit if $r^2 \geq 0.995$. A minimum of six points is required and the low point of the calibration must be re-quantitated and recover within 70-130% to be deemed acceptable. The calibration must be repeated for any compounds that fail. If more than 10% of the compounds exceed the 20% RSD limit and do not achieve the minimum correlation coefficient for alternative curve fits, sample analysis cannot proceed.

10.2.3.2 Minimum Response Factors: Table 1 lists the suggested minimum response factors for the most common analytes. Each calibration level must be evaluated against the specified criteria. Analytes that fall below the criteria, but are greater than or equal to 0.05, are narrated for inclusion on the final report. There are certain very poor purgers (1,4-Dioxane, Acrolein, ketones, alcohols and other water soluble compounds) that should meet a 0.001 response factor. If an analyte falls below 0.05 (or 0.001 for 1,4-Dioxane, Acrolein, ketones, alcohols and other water soluble compounds), then corrective action must be taken to resolve the problem before analysis can proceed.

10.2.4 Evaluation of Retention Times: The relative retention times used for identification of target analytes are ± 0.06 RRT (Relative Retention Time) units, based on the most recent standard run. It has been determined that these limits work well, being wide enough to eliminate false-negative results while being tight enough to eliminate false positive results. Due to the selectivity of the mass spectrometer, compound identification is more definitive than when using a less selective detector.

10.2.5 Initial Calibration Verification: After each calibration and before the analysis of samples, an ICV must be analyzed at or near the midpoint of the curve. The ICV must be prepared using a different source than the Initial Calibration and must contain all target analytes. The percent recoveries must be between 70% and 130% for target analytes except for "difficult" analytes (Table 7), which must exhibit percent recoveries between 40% and 160%. Corrective action is required if greater than 10% of all analytes are outside the prescribed criteria.

10.3 Equipment Operation and Sample Processing

The same GC, MS, and Purge and Trap conditions used for the initial calibration must be employed for sample analysis. After verification of system performance by analysis of BFB, the continuing calibration standard and method blank, samples are analyzed and processed as described below.

10.3.1 Analysis of Samples

Retrieve sample VOA vials from the sample bank refrigerator just prior to loading onto the purge and trap system. High level soil samples must be shaken for 1 – 2 minutes to extract the volatile components into the methanol. Let sample settle prior to taking methanol aliquot. Low level soil sample should be shaken briefly to ensure that the stir bar is loose, and will spin on the Archon or Centurion unit.

10.3.1.1 Low level soil samples: (Archon or Centurion)

Take the low level VOA vial and place directly into the rack of the Archon sampling unit. Surrogate and internal standards are added automatically by the Archon prior to sample purging.

10.3.1.2 Aqueous samples: (Solatex or Centurion)

Load the VOA vial directly on the sampling rack. Dilutions may be prepared volumetrically and poured into VOA vials ensuring there is no headspace left in the vial. The auto-sampler will then sample 10mL from the VOA vial.

10.3.1.3 High level soil samples: (Archon/Solatek/Centurion)

Shake for 2 minutes, ensuring the methanol has completely penetrated the soil in the vial.

10.3.1.3.1 Through liquid path

Load a maximum of 430µL or appropriate dilution of the methanol into a half-full VOA vial. Fill the VOA vial up to the top with water and cap with no headspace. Allow the auto-sampler to sample 10mL out of the VOA vial which would be equivalent to injecting 100µL of the methanol extract. Prepare dilutions accordingly.

10.3.1.3.2 Through soil path

Into a VOA vial with a stir bar added, load 4.9mL of water plus a maximum of 100 µL of methanol or appropriate dilution of methanol extract from a 5mL luerlock syringe. Cap the vial and load onto the auto-sampler.

10.3.2 Qualitative Analysis:

10.3.2.1 The qualitative identification of each compound is based on retention time and on comparison of the sample mass spectrum with the reference mass spectrum. The reference mass spectrum must be generated by the laboratory on the same GC/MS system. The characteristic ions from the reference mass spectrum are defined to be the three ions of greatest relative intensity, or any ions over 30% relative intensity if less than three such ions occur in the reference spectrum. Compounds are identified as present when the following criteria are met:

10.3.2.1.1 The intensities of the characteristic ions of a compound maximize in the same scan or within one scan of each other. The Target / Enviroquant data system is configured to make this check.

10.3.2.1.2 The relative retention time (RRT) of the sample component is within ± 0.06 RRT units of the RRT of the standard component.

10.3.2.1.3 The relative intensities of the characteristic ions agree within 30% of the relative intensities of these ions in the reference spectrum. (Example: For an ion with an abundance of 50% in the reference spectrum, the corresponding abundance in a sample spectrum can range between 20% and 80%.)

10.3.2.1.4 Structural isomers that produce very similar mass spectra should be identified as individual isomers if they have sufficiently different GC retention times. Sufficient GC resolution is achieved if the height of the valley between two isomer peaks is less than 25% of the sum of the two peak heights. Otherwise, structural isomers are identified as isomeric pairs (i.e., m and p-xylene).

- 10.3.2.1.5** Identification is hampered when sample components are not resolved chromatographically and produce mass spectra containing ions contributed by more than one analyte. When gas chromatographic peaks obviously represent more than one sample component (i.e., a broadened peak with shoulder(s) or a valley between two or more maxima), appropriate selection of analyte spectra and background spectra is important.
- 10.3.2.1.6** Examination of extracted ion current profiles of appropriate ions can aid in the selection of spectra, and in qualitative identification of compounds. When analytes coelute (i.e., only one chromatographic peak is apparent), the identification criteria may be met, but each analyte spectrum will contain extraneous ions contributed by the coeluting compound.
- 10.3.2.2** For samples containing non-target analytes, a library search will be performed at client request. Compound identification will be classified as "tentative", and the concentration will be reported as an estimate as no quantitative standards are run for these compounds.
- 1) Relative intensities of major ions in the reference spectrum (ions greater than 10% of the most abundant ion) should be present in the sample spectrum.
 - 2) The relative intensities of the major ions should agree within $\pm 20\%$. (Example: For an ion with an abundance of 50% in the standard spectrum, the corresponding sample ion abundance must be between 30 and 70%.)
 - 3) Molecular ions present in the reference spectrum should be present in the sample spectrum.
 - 4) Ions present in the sample spectrum but not in the reference spectrum should be reviewed for possible background contamination or presence of coeluting compounds.
 - 5) Ions present in the reference spectrum but not in the sample spectrum should be reviewed for possible subtraction from the sample spectrum because of background contamination or coeluting peaks.

10.3.3 Quantitative Analysis:

- 10.3.3.1** Quantitation of a target compound detected in a sample is performed automatically by the Target / Enviroquant data processing software, using the formulae found in Alpha's Quality Manual. Either the average response factor or calibration curve will be used for sample quantitation, depending on how the particular analyte was processed in the initial calibration curve.

If non-target compounds are to be reported, the quantitation is performed automatically by the Target / Enviroquant software using the total area of the compound and the nearest internal standard, and assuming a relative response factor of 1.0.

10.4 Continuing Calibration

Calibration verification consists of three steps that are performed at the beginning of each 12-hour analytical shift.

- 10.4.1** Prior to the analysis of samples or calibration standards, inject or purge 1 μ L (50 ng) of the 4-Bromofluorobenzene standard (Section 8.4.4) into the GC/MS system. The resultant mass spectra for the BFB must meet the criteria given in Table 3 before sample analysis begins.
- 10.4.2** The initial calibration curve for each compound of interest must be verified once every 12 hours prior to sample analysis. This is accomplished by analyzing the continuing calibration check standard (Section 8.5.3).
- 10.4.3** A method blank must be analyzed prior to any samples, typically immediately following the continuing calibration check standard, to ensure that the analytical system is free of contaminants. The method blank must not contain any target analytes at or above the required compound reporting limits.
- 10.4.4** The percent difference or drift for each target analyte must be less than or equal to 20% (30% for all SIM compounds). If greater than 20% of target analytes exceed the %D criteria corrective action must be taken prior to the analysis of samples. If less than or equal to 20% of compounds exceed the criteria, corrective action is not required.
- 10.4.5** The continuing calibration standard must also be evaluated for the suggested minimum response factor criteria, as specified in section 10.2.3.2

10.4.6 Internal Standard Retention Time:

The retention times of the internal standards in the calibration verification standard are evaluated after data acquisition. If the retention time for any internal standard changes by more than 30 seconds from that in the mid-point standard level of the most recent initial calibration sequence, then the chromatographic system must be inspected for malfunctions and corrections must be made, as required. When corrections are made, reanalysis of samples analyzed while the system was malfunctioning is required.

10.4.7 Internal Standard Response:

If the area for any of the internal standards in the calibration verification standard changes by a factor of two (-50% to +100%) from that in the mid-point standard level of the most recent initial calibration sequence, the mass spectrometer must be inspected for malfunctions and corrections must be made, as appropriate. When corrections are made, re-analysis of samples analyzed while the system was malfunctioning is required.

10.5 Preventive Maintenance

Routine preventive maintenance should be performed on the analytical system. This includes replacement of GC septa and periodic rinsing or replacement of purge and trap tubes and sparge needles. The trap should be replaced every six months, or sooner if performance criteria cannot be met. Periodic cleaning (typically twice per year) of the mass spectrometer ion source is required. More frequent source cleaning may be needed, especially if dirty samples are analyzed.

If system performance deteriorates, additional maintenance may be required. This includes replacement of injector ports and seals, clipping several inches off of the front end of the GC column, or in extreme cases the replacement of the GC column. Flushing or replacement of purge and trap lines may be necessary if they become contaminated or develop active sites.

Perform routine preventative maintenance as described throughout this SOP. Record all maintenance in the instrument logbook.

11. Data Evaluation, Calculations and Reporting

11.1.1 LIMS Data Corrections

Please note that the Laboratory Information Management System (LIMS) automatically adjusts soil sample results to account for the % Total Solids of the sample (as determined per Alpha SOP/07-38) and the methanol preservation dilution effect.

11.1.2 Data Calculations

11.1.2.1 Results of Aqueous Sample Analysis:

$$\text{concentration (ug/L)} = \frac{(\text{Conc.}) (Vp) (DF)}{(Vs)}$$

where:

Conc. = On-column concentration obtained from the quantitation report.
Vp = Volume purged, 10 mL is standard
Vs = Volume of sample purged
DF = Dilution factor, for manually prepared dilutions, not instrumental "dilutions".

11.1.2.2 Results of Sediment/Soil, Sludge, and Waste Analysis:

All solids including soils, sediments, and sludges must be reported on a dry-weight basis.

11.1.2.2.1 Low-Level Samples:

$$\text{concentration (ug/Kg)} = \frac{(\text{Conc.}) (Vp) (DF)}{(W) (\%S)}$$

11.1.2.2.2 High-Level Samples:

$$\text{concentration (ug/Kg)} = \frac{(\text{Conc.}) (Vp) (5000) (DF)}{(W) (Ve) (\%S)}$$

where:

Conc. = On-column concentration obtained from the quantitation report.
DF = Dilution factor, for manually prepared dilutions, not instrumental "dilutions".
Ve = Extract volume, mL
Vp = Volume purged, 5 mL is standard
W = Aliquot of sample (wet), g
%S = Sample % solid
5000 = Constant representing the final volume of the methanol extraction.

11.1.2.2.3 High-Level Samples Corrected for Total Water/Solvent Mixture (V_t):

Samples that are extracted prior to analysis in a water miscible solvent such as methanol are diluted by the total volume of the water/solvent mixture. The total mixture volume can only be calculated based on the sample moisture present as determined by the % moisture calculation.

$$\% \text{ moisture} = \frac{g \text{ of sample} - g \text{ of dry sample}}{g \text{ of sample}} \times 100$$

$$V_t = \frac{[mL \text{ of solvent} + (\% \text{ moisture} \times g \text{ of sample})]}{100} \times 1000 mL/mL$$

The calculated V_t value is now added to the volume of methanol in the sample (typically 5000 μ L), and the corrected concentration is calculated using the equation below:

$$\text{Corrected concentration (mg/Kg)} = \frac{(\text{Conc.}) (V_t + \text{methanol vol.}) (V_p) (DF)}{(W) (V_e) (\%S)}$$

12. Contingencies for Handling Out-of-Control Data or Unacceptable Data

All batch and sample specific QC criteria outlined in section 10 are evaluated by the analyst prior to approval of the data. When any QC criteria fail, the cause for the failure must be identified and corrected. This may include instrument recalibration followed by sample reanalysis, sample cleanup, or sample re-extraction. If it is determined that the failure is due to sample matrix effects, a project narrative report is written by the analyst for inclusion in the data report. If there is insufficient sample volume to perform the re-analysis for confirmation, this is also noted in the narrative and included in the client report.

13. Method Performance

13.1 Method Detection Limit Study (MDL) / Limit of Detection Study (LOD) / Limit of Quantitation (LOQ)

The laboratory follows the procedure to determine the MDL, LOD, and/or LOQ as outlined in Alpha SOP/08-05. These studies performed by the laboratory are maintained on file for review.

13.2 Demonstration of Capability Studies

Refer to Alpha SOP/08-12 for further information regarding IDC/DOC Generation.

13.2.1 Initial (IDC)

The analyst must make an initial, one-time, demonstration of the ability to generate acceptable accuracy and precision with this method, prior to the processing of any samples.

13.2.2 Continuing (DOC)

The analyst must make a continuing, annual, demonstration of the ability to generate acceptable accuracy and precision with this method.

14. Pollution Prevention and Waste Management

Refer to Alpha's Chemical Hygiene Plan and Waste Management and Disposal SOP for further pollution prevention and waste management information.

15. Referenced Documents

Chemical Hygiene Plan
SOP/08-05 MDL/LOD/LOQ Generation
SOP/08-12 IDC/DOC Generation
SOP/14-01 Waste Management and Disposal SOP

16. Attachments

TABLE 1: 8260 REPORTING LIMITS
TABLE 2: 8260 QC ACCEPTANCE CRITERIA
TABLE 3: BFB TUNING CRITERIA
TABLE 4: STANDARD SOLUTIONS
TABLE 5: 8260C Volatile Internal Standards with Corresponding Target Compounds and Surrogates Assigned for Quantitation
TABLE 6: 8260C Quantitation Ions

Table 1
Standard Reported Detection Limits
US EPA METHOD 8260C and 5035A/8260C

Analyte	Recommended Minimum Response Factor	RDL (µg/L)	RDL(µg/KG) ⁽¹⁾	RDL (µg/KG) ⁽²⁾
Acetone ^(3,4,5)	0.100	5.0	10	250
Acrolein ⁽⁵⁾		5.0	25	1250
Acrylonitrile ^(3,4)		5.0	5	200
Benzene ^(3,4,5)	0.500	0.5	1	50
Bromobenzene ^(3,4)		2.5	5	250
Bromochloromethane ^(3,4,5)		2.5	5	250
Bromodichloromethane ^(3,4,5)	0.200	0.5	1	50
Bromoform ^(3,4,5)	0.100	2.0	4	200
Bromomethane ^(3,4,5)	0.100	1.0	2	100
2-Butanone ^(3,4,5)	0.100	5.0	10	500
n-Butyl benzene ^(3,4)		0.5	1	50
sec-Butyl benzene ^(3,4)		0.5	1	50
tert-Butyl benzene ^(3,4)		2.5	5	250
Carbon disulfide ^(3,4,5)	0.100	5.0	10	500
Carbon tetrachloride ^(3,4,5)	0.100	0.5	1	50
Chlorobenzene ^(3,4,5)		0.5	1	50
Chloroethane ^(3,4,5)	0.100	1.0	2	100
2-Chloroethylvinyl ether ⁽³⁾		10.0	20	1000
Chloroform ^(3,4,5)	0.200	0.75	1.5	75
Chloromethane ^(3,4,5)	0.100	2.5	5	250
o-Chlorotoluene ^(3,4)		2.5	5	250
Cyclohexane ⁽⁵⁾	0.100	10	20	1000
Cyclohexanone		10	20	1000
p-Chlorotoluene ^(3,4)		2.5	5	250
Dibromochloromethane ^(3,4,5)	0.100	0.5	1	50
1,2-Dibromo-3-chloropropane ^(3,4,5)	0.050	2.5	5	250
1,2-Dibromoethane ^(3,4,5)	0.100	2.0	5	250
Dibromomethane ^(3,4)		5.0	10	500
1,2-Dichlorobenzene ^(3,4,5)	0.400	2.5	5	250
1,3-Dichlorobenzene ^(3,4,5)	0.600	2.5	5	250
1,4-Dichlorobenzene ^(3,4,5)	0.500	2.5	5	250
1,4-Dichlorobutane ^(3,4)		5.0	10	500
trans-1,4-Dichloro-2-butene ^(3,4)		2.5	5	250
Dichlorodifluoromethane ^(3,4,5)		5.0	10	500
1,1-Dichloroethane ^(3,4,5)	0.200	0.75	1.5	75
1,2-Dichloroethane ^(3,4,5)	0.100	0.5	1	50
1,1-Dichloroethene ^(3,4,5)	0.100	0.5	1	50
cis-1,2-Dichloroethene ^(3,4,5)	0.100	0.5	1	50
trans-1,2-Dichloroethene ^(3,4,5)	0.100	0.75	1.5	75

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Table 1 (continued)
Standard Reported Detection Limits
US EPA METHOD 8260C and 5035A/8260C

Analyte	Recommended Minimum Response Factor	RDL (µg/L)	RDL(µg/KG) ⁽¹⁾	RDL (µg/KG) ⁽²⁾
1,2-Dichloropropane ^(3,4,5)	0.100	1.75	3.5	175
1,3-Dichloropropane ^(3,4)		2.5	5	250
2,2-Dichloropropane ^(3,4)		2.5	5	250
1,1-Dichloropropene ^(3,4)		2.5	2.5	250
cis-1,3-Dichloropropene ^(3,4,5)	0.200	0.5	1	50
p-Diethylbenzene ⁽⁴⁾		2.0	4	200
Diisopropyl Ether ⁽⁶⁾		2.0	4	200
1,4-Dioxane ⁽⁵⁾ (non-SIM)		250	100	5000
trans-1,3-Dichloropropene ^(3,4,5)	0.200	0.5	1	50
Ethanol ⁽⁷⁾		N/A	1000	50000
Ethyl acetate		10.0	20	1000
Ethylbenzene ^(3,4,5)	0.100	0.5	1	50
Ethyl ether ^(3,4)		2.5	5	250
4-Ethyltoluene ⁽⁴⁾		2.0	4	200
Ethyl methacrylate ^(3,4)		5.0	10	500
Ethyl-Tert-Butyl-Ether ⁽⁶⁾		2.0	4	200
Freon-113 ⁽⁵⁾		10.0	20	1000
Hexachlorobutadiene ^(3,4)		0.5	5	250
2-Hexanone ^(3,4,5)	0.100	5.0	10	500
Iodomethane		5.0		
Isopropyl Alcohol (IPA)		25		
Isopropylbenzene ^(3,4,5)	0.100	0.5	1	50
p-Isopropyltoluene ^(3,4)		0.5	1	50
Methyl Acetate ⁽⁵⁾	0.100	20	20	1000
Methylene chloride ^(3,4,5)	0.100	3.0	10	500
Methyl Cyclohexane ⁽⁵⁾	0.100	20	4	200
Methyl Methacrylate		1.0		
4-Methyl-2-pentanone ^(3,4,5)	0.100	5.0	10	500
Methyl-tert-butyl-ether ^(3,4,5)	0.100	1.0	2	100
Naphthalene ^(3,4)		2.5	5	250
n-Butanol ⁽⁵⁾		100	200	10000
n-Propylbenzene ^(3,4)		0.5	1	50
Pentachloroethane		2.0	N/A	N/A
Styrene ^(3,4,5)	0.300	1.0	2	100
Tert-Butyl Alcohol ⁽⁵⁾		30	100	5000
Tertiary-Amyl Methyl Ether ⁽⁶⁾		2.0	4	200
1,1,1,2-Tetrachloroethane ^(3,4)		0.5	1	50
1,2,4,5-Tetramethylbenzene ⁽⁴⁾		2.0	4	200

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Analyte	Recommended Minimum Response Factor	RDL (µg/L)	RDL(µg/KG) ⁽¹⁾	RDL(µg/KG) ⁽²⁾
1,1,2,2-Tetrachloroethane ^(3,4,5)	0.300	0.5	1	50
Tetrachloroethene ^(3,4,5)	0.200	0.5	1	50
Tetrahydrofuran ⁽³⁾		10.0	20	1000
Toluene ^(3,4,5)	0.400	0.75	1	75
1,2,3-Trichlorobenzene ^(3,4,5)		2.5	5	250
1,2,4-Trichlorobenzene ^(3,4,5)	0.200	2.5	5	250
1,3,5-Trichlorobenzene ⁽⁶⁾		2.0	5	250
1,1,1-Trichloroethane ^(3,4,5)	0.100	0.5	1	50
1,1,2-Trichloroethane ^(3,4,5)	0.100	0.75	1.5	75
Trichloroethene ^(3,4,5)	0.200	0.5	1	50
Trichlorofluoromethane ^(3,4,5)	0.100	2.5	5	250
1,2,3-Trichloropropane ^(3,4)		5.0	10	500
1,2,4-Trimethylbenzene ^(3,4)		2.5	5	250
1,3,5-Trimethylbenzene ^(3,4)		2.5	5	250
Vinyl acetate ^(3,4)		5.0	10	500
Vinyl chloride ^(3,4,5)	0.100	1.0	2	100
m/p-Xylenes ^(3,4,5)	0.100	1.0	2	100
o-Xylene ^(3,4,5)	0.300	1.0	2	100
1,4-Dioxane ⁽⁵⁾ SIM		3.0		
1,1,2,2-Tetrachloroethane SIM		0.1		

- (1) Detection Limits are for Low-level Aqueous preserved samples.
- (2) Detection Limits are for High-level Methanol preserved samples.
- (3) Analyte reported by standard 8260 reporting list.
- (4) Analyte reported by New York TCL reporting list.
- (5) Analyte reported by New Jersey TCL reporting list.
- (6) Analyte reported for New Hampshire in addition to standard 8260 reporting list.
- (7) Analyte only reported for New York TCL report upon client request.

Note: Reporting Limits are based on standard 8260 reporting list, RL's may vary for New York and New Jersey reporting lists.

Table 2

QUALITY CONTROL ACCEPTANCE CRITERIA

Surrogate Spike Percent Recovery	Aqueous Limits		Soil Limits	
	Lower Control Limit	Upper Control Limit	Lower Control Limit	Upper Control Limit
1,2-Dichloroethane-d ₄	70%	130%	70%	130%
4-Bromofluorobenzene	70%	130%	70%	130%
Toluene-d ₈	70%	130%	70%	130%
Dibromofluoromethane	70%	130%	70%	130%

Table 3
BFB (4-BROMOFLUOROBENZENE) MASS INTENSITY CRITERIA

m/z	Required Intensity (relative abundance)
50	15 to 40% of m/z 95
75	30 to 60% of m/z 95
95	Base peak, 100% relative abundance
96	5 to 9% of m/z 95
173	Less than 2% of m/z 174
174	Greater than 50% of m/z 95
175	5 to 9% of m/z 174
176	Greater than 95% but less than 101% of m/z 174
177	5 to 9% of m/z 176

Table 4

Stock Standard Concentrations and Suggested Calibration Concentration Levels

Target Compound	Stock (µg/mL)	Level 1 (µg/L)	Level 2 (µg/L)	Level 3 (µg/L)	Level 4 (µg/L)	Level 5 (µg/L)	Level 6 (µg/L)	Level 7 (µg/L)	Level 8 (µg/L)
Acetone	2000	0.5	2	10	20	30	50	100	200
Acrolein	2000	0.5	2	10	20	30	50	100	200
Acrylonitrile	2000	0.5	2	10	20	30	50	100	200
Benzene	2000	0.5	2	10	20	30	50	100	200
Bromobenzene	2000	0.5	2	10	20	30	50	100	200
Bromochloromethane	2000	0.5	2	10	20	30	50	100	200
Bromodichloromethane	2000	0.5	2	10	20	30	50	100	200
Bromoform	2000	0.5	2	10	20	30	50	100	200
Bromomethane	2000	0.5	2	10	20	30	50	100	200
2-Butanone	2000	0.5	2	10	20	30	50	100	200
n-Butyl benzene	2000	0.5	2	10	20	30	50	100	200
sec-Butyl benzene	2000	0.5	2	10	20	30	50	100	200
tert-Butyl benzene	2000	0.5	2	10	20	30	50	100	200
Carbon disulfide	2000	0.5	2	10	20	30	50	100	200
Carbon tetrachloride	2000	0.5	2	10	20	30	50	100	200
Chlorobenzene	2000	0.5	2	10	20	30	50	100	200
Chloroethane	2000	0.5	2	10	20	30	50	100	200
2-Chloroethylvinyl Ether	2000	0.5	2	10	20	30	50	100	200
Chloroform	2000	0.5	2	10	20	30	50	100	200
Chloromethane	2000	0.5	2	10	20	30	50	100	200
o-Chlorotoluene	2000	0.5	2	10	20	30	50	100	200
p-Chlorotoluene	2000	0.5	2	10	20	30	50	100	200
Cyclohexane	2000	0.5	2	10	20	30	50	100	200
Cyclohexanone	2000	0.5	2	10	20	30	50	100	200
Dibromochloromethane	2000	0.5	2	10	20	30	50	100	200
1,2-Dibromo-3-chloropropane	2000	0.5	2	10	20	30	50	100	200
1,2-Dibromoethane	2000	0.5	2	10	20	30	50	100	200
Dibromomethane	2000	0.5	2	10	20	30	50	100	200
1,2-Dichlorobenzene	2000	0.5	2	10	20	30	50	100	200
1,3-Dichlorobenzene	2000	0.5	2	10	20	30	50	100	200
1,4-Dichlorobenzene	2000	0.5	2	10	20	30	50	100	200
1,4-Dichlorobutane	2000	0.5	2	10	20	30	50	100	200
trans-1,4-Dichloro-2-butene	2000	0.5	2	10	20	30	50	100	200
Dichlorodifluoromethane	2000	0.5	2	10	20	30	50	100	200
1,1-Dichloroethane	2000	0.5	2	10	20	30	50	100	200
1,2-Dichloroethane	2000	0.5	2	10	20	30	50	100	200
1,1-Dichloroethene	2000	0.5	2	10	20	30	50	100	200
cis-1,2-Dichloroethene	2000	0.5	2	10	20	30	50	100	200
trans-1,2-Dichloroethene	2000	0.5	2	10	20	30	50	100	200
1,2-Dichloropropane	2000	0.5	2	10	20	30	50	100	200
1,3-Dichloropropane	2000	0.5	2	10	20	30	50	100	200
2,2-Dichloropropane	2000	0.5	2	10	20	30	50	100	200
1,1-Dichloropropene	2000	0.5	2	10	20	30	50	100	200

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Table 4 (continued)

Stock Standard Concentrations and Suggested Calibration Concentration Levels

Target Compound	Stock (µg/mL)	Level 1 (µg/L)	Level 2 (µg/L)	Level 3 (µg/L)	Level 4 (µg/L)	Level 5 (µg/L)	Level 6 (µg/L)	Level 7 (µg/L)	Level 8 (µg/L)
cis-1,3-Dichloropropene	2000	0.5	2	10	20	30	50	100	200
trans-1,3-Dichloropropene	2000	0.5	2	10	20	30	50	100	200
p-Diethylbenzene	2000	0.5	2	10	20	30	50	100	200
Diisopropyl Ether	2000	0.5	2	10	20	30	50	100	200
1,4-Dioxane (non-SIM)	10000	100	400	1000	2000	3000	4000	5000	6000
Ethanol	10000	100	200	300	500	1000	2500	5000	N/A
Ethyl Acetate	2000	0.5	2	10	20	30	50	100	200
Ethylbenzene	2000	0.5	2	10	20	30	50	100	200
Ethyl ether	2000	0.5	2	10	20	30	50	100	200
Ethyl methacrylate	2000	0.5	2	10	20	30	50	100	200
Ethyl Tert-Butyl Ether	2000	0.5	2	10	20	30	50	100	200
4-Ethyltoluene	2000	0.5	2	10	20	30	50	100	200
Freon-113	2000	0.5	2	10	20	30	50	100	200
Halothane	2000	0.5	2	10	20	30	50	100	200
Hexachlorobutadiene	2000	0.5	2	10	20	30	50	100	200
2-Hexanone	2000	0.5	2	10	20	30	50	100	200
Iodomethane	2000	0.5	2	10	20	30	50	100	200
Isopropyl Alcohol (IPA)	10000	2.5	10	50	100	150	250	500	1000
Isopropylbenzene	2000	0.5	2	10	20	30	50	100	200
p-Isopropyltoluene	2000	0.5	2	10	20	30	50	100	200
Methyl Acetate	2000	0.5	2	10	20	30	50	100	200
Methylene Chloride	2000	0.5	2	10	20	30	50	100	200
Methyl Cyclohexane	2000	0.5	2	10	20	30	50	100	200
Methyl Methacrylate	2000	0.5	2	10	20	30	50	100	200
4-Methyl-2-pentanone	2000	0.5	2	10	20	30	50	100	200
Methyl-tert-butyl-ether	2000	0.5	2	10	20	30	50	100	200
Naphthalene	2000	0.5	2	10	20	30	50	100	200
n-Butanol	5000	2.5	10	50	100	150	250	500	N/A
n-Propylbenzene	2000	0.5	2	10	20	30	50	100	200
Pentachloroethane	1000	0.5	2	10	20	30	50	100	200
Styrene	4000	1	4	20	40	60	100	200	400
Tert-Butyl alcohol	10000	2.5	10	50	100	150	250	500	1000
Tertiary-Amyl Methyl Ether	2000	0.5	2	10	20	30	50	100	200
1,1,1,2-Tetrachloroethane	2000	0.5	2	10	20	30	50	100	200
1,1,2,2-Tetrachloroethane	2000	0.5	2	10	20	30	50	100	200
Tetrachloroethene	2000	0.5	2	10	20	30	50	100	200
Tetrahydrofuran	2000	0.5	2	10	20	30	50	100	200
1,2,4,5-Tetramethylbenzene	2000	0.5	2	10	20	30	50	100	200
Toluene	2000	0.5	2	10	20	30	50	100	200
1,2,3-Trichlorobenzene	2000	0.5	2	10	20	30	50	100	200

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Table 4 (continued)

Stock Standard Concentrations and Suggested Calibration Concentration Levels

Target Compound	Stock (µg/mL)	Level 1 (µg/L)	Level 2 (µg/L)	Level 3 (µg/L)	Level 4 (µg/L)	Level 5 (µg/L)	Level 6 (µg/L)	Level 7 (µg/L)	Level 8 (µg/L)
1,2,4-Trichlorobenzene	2000	0.5	2	10	20	30	50	100	200
1,3,5-Trichlorobenzene	2000	0.5	2	10	20	30	50	100	200
1,1,1-Trichloroethane	2000	0.5	2	10	20	30	50	100	200
1,1,2-Trichloroethane	2000	0.5	2	10	20	30	50	100	200
Trichloroethene	2000	0.5	2	10	20	30	50	100	200
Trichlorofluoromethane	2000	0.5	2	10	20	30	50	100	200
1,2,3-Trichloropropane	2000	0.5	2	10	20	30	50	100	200
1,2,4-Trimethylbenzene	2000	0.5	2	10	20	30	50	100	200
1,3,5-Trimethylbenzene	2000	0.5	2	10	20	30	50	100	200
Vinyl acetate	2000	0.5	2	10	20	30	50	100	200
Vinyl chloride	2000	0.5	2	10	20	30	50	100	200
m/p-Xylenes	4000	1	4	20	40	60	100	200	400
o-Xylene	4000	1	4	20	40	60	100	200	400
1,4-Dioxane (SIM)	100	0.5	2	10	20	30	50	100	200
1,1,2,2-Tetrachloroethane (SIM)		0.05	0.1	0.2	0.5	1.0	2.0	5.0	10.0

Target Compounds	Stock (µg/mL)	Level 1 (µg/L)	Level 2 (µg/L)	Level 3 (µg/L)	Level 4 (µg/L)	Level 5 (µg/L)	Level 6 (µg/L)	Level 7 (µg/L)	Level 8 (µg/L)
Internal Standards									
Fluorobenzene	2500	10	10	10	10	10	10	10	10
Chlorobenzene-d5	2500	10	10	10	10	10	10	10	10
1,4-Dichlorobenzene-d4	2500	10	10	10	10	10	10	10	10
Surrogates									
Dibromofluoromethane	2500	10	10	10	10	10	10	10	10
1,2-Dichloroethane-d4	2500	10	10	10	10	10	10	10	10
Toluene-d8	2500	10	10	10	10	10	10	10	10
4-Bromofluorobenzene	2500	10	10	10	10	10	10	10	10

- For Low Level Soil analysis, the calibration levels are the same in µg/Kg units.
- For High Level Soil analysis, the calibration levels are at 50x the levels listed due to sample preparation requirements.

TABLE 5

8260C Volatile Internal Standards with Corresponding Target Compounds and Surrogates Assigned for Quantitation

<u>Fluorobenzene</u>	<u>Chlorobenzene-d5</u>	<u>1,4-Dichlorobenzene-d4</u>
Dichlorodifluoromethane	Toluene-d8 (surr)	Isopropylbenzene
Chloromethane	Toluene	Bromoform
Vinyl Chloride	Ethyl Methacrylate	1,4-dichloro-2-butane
Bromomethane	Trans-1,3-dichloropropene	1,1,2,2,-tetrachloroethane
Chloroethane	1,1,2-trichloroethane	4-bromofluorobenzene (surr)
Trichlorofluoromethane	2-hexanone	1,2,3-trichloropropane
Ethyl Ether	1,3-dichloropropane	trans-1,4-dichloro-2-butene
Freon 113	Tetrachloroethene	n-propylbenzene
Acrolein	Chlorodibromomethane	Bromobenzene
Acetone	1,2-dibromoethane	4-ethyltoluene
Ethanol	Chlorobenzene	1,3,5-trimethylbenzene
1,1,-dichloroethene	1,1,1,2-tetrachloroethane	2-chlorotoluene
Tert-Butyl Alcohol	Ethylbenzene	4-chlorotoluene
Methyl Acetate	p/m xylene	tert-butylbenzene
Carbon Disulfide	o xylene	1,2,4-trimethylbenzene
Methylene Chloride	Styrene	sec-butylbenzene
Acrylonitrile		p-isopropyltoluene
Methyl Tert Butyl Ether		1,3-dichlorobenzene
Halothane		1,4-dichlorobenzene
Trans-1,2-dichloroethene		n-butylbenzene
Diisopropyl Ether		p-diethylbenzene
Vinyl Acetate		1,2-dichlorobenzene
1,1-dichloroethane		1,2,4,5-tetramethylbenzene
Ethyl-Tert-Butyl-Ether		1,2-dibromo-3-chloropropane
2-butanone		1,3,5-trichlorobenzene
2,2-dichloropropane		1,2,4-trichlorobenzene
Cis-1,2-dichloroethene		Hexachlorobutadiene
Chloroform		Naphthalene
Bromochloromethane		1,2,3-trichlorobenzene
Tetrahydrofuran		Cyclohexanone
Dibromofluoromethane (surr)		1,3,5-Trichlorobenzene
1,1,1-trichloroethane		Pentachloroethane
Cyclohexane		
1,1-dichloropropene		
Carbon Tetrachloride		
Tertiary-Amyl Methyl Ether		
1,2-dichloroethane-d4 (surr)		
1,2-dichloroethane		
Benzene		
Trichloroethene		
Methyl Cyclohexane		
1,2-dichloropropane		
Bromodichloromethane		
1,4-Dioxane		
Dibromomethane		
2-Chloroethylvinyl Ether		
4-methyl-2-pentanone		
Cis-1,3-dichloropropene		
Iodomethane		
Methyl methacrylate		
n-Butanol		
Ethyl acetate		
Isopropyl Alcohol (IPA)		

TABLE 6
8260C Quantitation Ions

Analyte	Quantitation Ion	Analyte	Quantitation Ion
Dichlorodifluoromethane	85	Ethyl Methacrylate	69
Chloromethane	50	Trans-1,3-dichloropropene	75
Vinyl Chloride	62	1,1,2-trichloroethane	83
Bromomethane	94	2-hexanone	43
Chloroethane	64	1,3-dichloropropane	76
Trichlorofluoromethane	101	Tetrachloroethene	166
Ethyl Ether	74	Chlorodibromomethane	129
Freon 113	101	1,2-dibromoethane	107
Acrolein	56	Chlorobenzene	112
Acetone	43	1,1,1,2-tetrachloroethane	131
1,1,-dichloroethene	96	Ethylbenzene	91
Tert-Butyl Alcohol	59	p/m xylene	106
Methyl Acetate	43	o xylene	106
Carbon Disulfide	84	Styrene	104
Methylene Chloride	76	Isopropylbenzene	105
Acrylonitrile	53	Bromoform	173
Methyl Tert Butyl Ether	73	1,4-dichloro-2-butane	55
Halothane	117	1,1,2,2,-tetrachloroethane	83
Trans-1,2-dichloroethene	96	1,2,3-trichloropropane	75
Diisopropyl Ether	45	Trans-1,4-dichloro-2-butene	53
Vinyl Acetate	43	n-propylbenzene	91
1,1-dichloroethane	63	Bromobenzene	156
Ethyl-Tert-Butyl-Ether	59	4-ethyltoluene	105
2-butanone	43	1,3,5-trimethylbenzene	105
2,2-dichloropropane	77	2-chlorotoluene	91
Cis-1,2-dichloroethene	96	4-chlorotoluene	91
Chloroform	83	tert-butylbenzene	119
Bromochloromethane	128	1,2,4-trimethylbenzene	105
Tetrahydrofuran	42	sec-butylbenzene	105
1,1,1-trichloroethane	97	p-isopropyltoluene	119
Cyclohexane	56	1,3-dichlorobenzene	146
1,1-dichloropropene	75	1,4-dichlorobenzene	146
Carbon Tetrachloride	117	n-butylbenzene	91
Tertiary-Amyl Methyl Ether	73	p-diethylbenzene	119
1,2-dichloroethane	62	1,2-dichlorobenzene	146
Benzene	78	1,2,4,5-tetramethylbenzene	119
Trichloroethene	95	1,2-dibromo-3-chloropropane	75
Methyl Cyclohexane	83	1,3,5-trichlorobenzene	180
1,2-dichloropropane	63	1,2,4-trichlorobenzene	180
Bromodichloromethane	83	Hexachlorobutadiene	225
1,4-dioxane	88	Naphthalene	128
Dibromomethane	93	1,2,3-trichlorobenzene	180
2-Chloroethylvinyl Ether	63	Ethanol	45
4-methyl-2-pentanone	58	Cyclohexanone	55
Cis-1,3-dichloropropene	75	Ethyl acetate	43

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TABLE 6
8260C Quantitation Ions (continued)

Analyte	Quantitation Ion	Analyte	Quantitation Ion
Toluene	92	Iodomethane	142
Methyl methacrylate	69	n-Butanol	56
Pentachloroethane	167	Isopropyl Alcohol (IPA)	45

Table 7

List of 8260 Difficult Analytes:

1,1,2,2-Tetrachloroethane
1,2-Dibromo-3-chloropropane (DBCP)
1,4-Dioxane
2-Butanone
2-chloroethylvinyl ether
2-Hexanone
2,2-dichloropropane
4-Methyl-2-pentanone
Acetone
Bromoform
Bromomethane
Carbon disulfide
Chloroethane
Chloromethane
cis-1,3-Dichloropropene
Dichlorodifluoromethane (Freon 12)
Ethanol
Iodomethane
Isobutyl Alcohol
naphthalene
n-butanol
Styrene
Tert-Butyl Alcohol
Trichlorofluoromethane (Freon 11)
Isopropyl Alcohol (IPA)

Total Organic Carbon and Soot in Soil, Sediment

References: Perkin Elmer, "PE 2400 Series II CHNS/O Analyzer User's Manual," The Perkin-Elmer Corporation, April 1998.

USEPA, "Method 9060A Total Organic Carbon," in Test Methods for Evaluating Solid Waste, SW846, Revision 1 November 2004.

"Quantification of the Dilute Sedimentary Soot Phase: Implications for PAH Speciation and Bioavailability" published in Environmental Science and Technology, Vol. 31, No. 1, 1997 by Gustafsson, Haghseta, Chan, McFarlane and Gschwend.

"Reinterpreting Literature Sorption Data Considering Both Absorption into Organic Carbon and Adsorption onto Black Carbon" published in Environmental Science and Technology, Vol. 37, No. 1, 2003 by Accardi-Dey and Gschwend

1. Scope and Application

Matrices: This method is applicable for solid samples (soils, sediments, sludges).

Definitions: Refer to Alpha Analytical Quality Manual.

The organic carbon in a sample consists of a variety of organic compounds in various oxidation states. Some of these compounds may be oxidized by biological or chemical processes and can be measured by the Biochemical Oxygen Demand or Chemical Oxygen Demand tests. To measure the amount of organically bound carbon, the organic carbon molecules are broken down into single carbon units, and converted into a form that can be measured quantitatively.

The PE 2400 Series II CHNS/O Analyzer can simultaneously determine carbon (C), hydrogen (H), nitrogen (N), sulfur (S), and oxygen (O) in organic material. In the CHN mode, the PE 2400 Series II CHNS/O Analyzer uses a combustion method to convert the sample elements to simple gases (CO₂, H₂O, and N₂). The resulting gases are homogenized and controlled to exact conditions of pressure, temperature, and volume. The homogenized gases are allowed to de-pressurize through a column where they are separated in a stepwise steady-state manner and detected as a function of their thermal conductivity and reported as a percentage for solid samples. Treated with hydrochloric acid prior to analysis, the Total Organic Carbon (TOC) content is determined by the amount of CO₂ in the sample. If the sample is analyzed without pretreatment, the Total Carbon (TC) content is determined. Total Inorganic Carbon can be determined by subtraction of the TOC from the TC values.

This method is applicable to the measurement of TOC and Soot in solid samples $\geq 100\text{mg/Kg}$ or $\geq 0.01\%$, dry weight. According to the instrument manufacturer, a sample of up to 70% carbon can be analyzed without dilution.

The data report packages present the documentation of any method modification related to the samples tested. Depending upon the nature of the modification and the extent of intended use, the laboratory may be required to demonstrate that the modifications will produce equivalent results for the matrix. Approval of all method modifications is by one or more of the following laboratory personnel before performing the modification: Area Supervisor, Department Supervisor, Laboratory Director, or Quality Assurance Officer.

This method is restricted to use by or under the supervision of analysts experienced in the operation of the TOC Analyzer and in the interpretation of the data. Each analyst must demonstrate the ability to generate acceptable results with this method by performing an initial demonstration of capability.

2. Summary of Method

An aliquot of solid sample is dried, homogenized, weighed into a tin capsule, pre-treated with hydrochloric acid and heated to 75°C to convert the inorganic carbon (*i.e.*, carbonate and bicarbonate in the form of CO₂) prior to analysis.

Organic carbon is measured using combustion and a carbon analyzer. The sample, of approximately 5-10 (masses less than 5 mg must be avoided since balance is not calibrated below 5 mg)mg corrected sample weight (a larger aliquot may be used for heterogeneous, or low- carbon samples to improve reproducibility), is oxidized in a pure oxygen environment, introduced into a furnace by a 60-slot Autosampler, then combusted. A greater mass may be weighed if the sample observations indicate low carbon content. As much as 20-25mg may be utilized. The carrier gas (O₂) is combined with the carbon content of the combusted sample to form CO₂. Elements, such as halogens and sulfur, are removed by scrubbing reagents in the combustion zone. A thermal conductivity detector then measures the CO₂. The amount of CO₂ derived from a sample is directly proportional to the concentration of organic carbon material in the sample.

For Soot, the sample will be transferred to an aluminum tin. The tins will be placed in an oven or muffle furnace for 24 hours at 375°C. After sample is in the muffle furnace for 24hrs sample is reduced to a powder with a mortar and pestle, weighed into a tin capsule, then treated with acid then re-dried and analyzed on the TOC Analyzer.

2.1 Method Modifications from Reference

Samples are analyzed using 2 replicates unless otherwise specified by the Client. Hydrochloric acid is substituted for phosphoric acid. The use of this acid has been validated and documented by the laboratory.

3. Reporting Limits

The Practical Quantitation Limit (PQL) or Reporting Limit (RL) is 0.01 (or 100mg/Kg) for solid samples.

4. Interferences

- 4.1 To determine the TOC/Soot content, the inorganic fractions (carbonate and bicarbonate) must be removed prior to analysis by lowering the pH of the sample to ≤ 2 . When removing the inorganic carbon, care must be taken in sample pretreatment to minimize the potential of loss of volatile organic carbon present in the sample.
- 4.2 Maintaining the samples at $4 \pm 2^\circ\text{C}$, and analyzing within the specified holding time minimizes bacterial decomposition and volatilization of the organic material.
- 4.3 Elements, such as halogens and sulfur, are removed by scrubbing reagents in the combustion zone. Large and/or complex organic molecules such as tannins, lignins, or humic acids may be oxidized slowly. If these compounds are suspected to be present, it is advisable to check the efficiency of the oxidation procedure with a selected representative sample, and adjust the analysis (sample size) as needed.
- 4.4 Oils from skin, or contact with any organic material, such as plastic containers and rubber tubing, can contaminate samples. Handle the weighing tins with tweezers.
- 4.5 Sample heterogeneity can be a major source of imprecision in TOC/Soot results. Recommend to clients to perform a client-specific duplicate, to evaluate precision and representativeness of the TOC/Soot results to the site.

5. Health and Safety

The toxicity or carcinogenicity of each reagent and standard used in this method is not fully established; however, each chemical compound must be treated as a potential health hazard. From this viewpoint, exposure to these chemicals must be reduced to the lowest possible level by whatever means available. A reference file of material data handling sheets is available to all personnel involved in the chemical analysis. Additional references to laboratory safety are available in the Chemical Hygiene Plan.

All personnel handling environmental samples known to contain or to have been in contact with municipal waste must follow safety practices for handling known disease causative agents.

The use of laboratory equipment and chemicals exposes the analyst to several potential hazards. Good laboratory techniques and safety practices shall be followed at all times. All relevant Material Safety Data Sheets (MSDSs) are kept on file.

Approved PPE, which includes Safety Glasses, Gloves and Lab Coats, must be worn at **all** times when handling samples, reagents, chemicals, or when in the vicinity of others handling these items, so that dermal contact is avoided. All standards, reagents and solvents shall be handled using the proper PPE. All flammable solvents must be kept in the flammable storage cabinet, and returned to the cabinet immediately after use. When transporting chemicals, use a secure transporting device and/or secondary outer container. Chemical storage is properly segregated and adequately ventilated to reduce the possibility of hazardous reactions. Chemical storage in work areas shall be kept to a minimum. Storage on bench tops or other work surfaces, except temporary, is not permitted.

All standards and reagents shall be prepared in a hood while using the proper PPE.

Analytical instrumentation poses the unique possibility of exposure to high voltages. Other than the *routine* instrument maintenance, as listed in the front of every Instrument Maintenance Logbook, at no time shall an instrument operator attempt to maintain an instrument alone, or without the proper training, supervision or instruction. Caution must always be used in the presence of moving parts (autosamplers) and hot surfaces (injection ports).

All additional company safety practices shall be followed at all times as written in the *Chemical Hygiene Plan*.

All TOC standard solutions must be handled with caution. See pages 5-3 through 5-5 of the PE 2400 Series II CHNS/O Analyzer User's Manual for additional and specific Warnings and Precautions.

6. Sample Collection, Preservation, Shipping and Handling

6.1 Sample Collection

A minimum of 5 grams of sample must be collected in a glass jar.

6.2 Sample Preservation

Soil samples must be refrigerated and maintained at $4^{\circ}\pm 2^{\circ}\text{C}$ until drying and analysis.

Sediment samples are either processed within 28 days (or can be frozen (for programs with an EPA approved holding time extension for frozen storage) at -15°C to -20°C until processing.

6.3 Sample Shipping

The *Sample Receipt & Login SOP* (1559) describes how samples are normally shipped or obtained by the laboratory, precautions to be used in opening sample shipments, and sample storage conditions.

6.4 Sample Handling

Soil samples must be refrigerated and maintained at $4^{\circ}\pm 2^{\circ}\text{C}$ until drying and analysis.

Sediment samples are either processed within 28 days or can be frozen at -15°C to -20°C until processing (for programs with an EPA approved holding time extension for frozen storage)

All solid samples must be analyzed within 28 days from the date of collection unless extended hold times are provided in client specific QAPP.

The *Sample Receipt & Login SOP* (1559) describes the responsibilities of sample custody including all proper documentation, verification, and tracking procedures, following Chain of Custody (COC) protocols and sample receipt procedures using the *Sample Receipt Checklist*, which includes the check for proper sample preservation and cooler temperature verification.

Internal COC procedures for sample tracking include the use of sample tracking logbooks. These procedures are also described in the *Sample Receipt & Login SOP* (1559).

7. Equipment and Supplies

7.1 Instrument: Perkin Elmer 2400 Series II CHNS/O Analyzer with computer and PE software

7.2 Detector: Thermal Conductivity

7.3 Mortar and pestle

7.4 Oven: $75 \pm 2^{\circ}\text{C}$

7.5 Muffle Furnace: Capable of maintaining temperature of 375°C

7.6 Dessicator

7.7 Volumetric Flasks: Class-A, various volumes

7.8 Microbalance: Perkin-Elmer, Model AD-6. See the Manufacturer User's Manual, Section 1.2, pages 3-4, for Microbalance and weighing instructions. The Microbalance calibration is verified every day using 5.0mg - 200mg weights, in the range of daily use, and be accurate within +/1%. If the balance needs to be re-calibrated, see the Manufacturer User's Manual SOP, Section 1.1, page 3, for details.

7.9 Tweezers: Anti-Magnetic

7.10 Tin Boats: 5 X 8 mm.

7.11 Polypropylene beakers: 50 mL, for weighing wet samples.

7.12 Glass Beads: Filter Aid 400, High-density; from Perkin Elmer or 3M. Used as the CCB/Method Blank media. Beads must be muffled at 375°C prior to use to remove any trace carbon.

7.13 Gas-tight syringes: Various measuring sizes, including 10µL for direct sample spiking

7.14 Transfer pipets and/or Eppendorf pipettor for delivering HCl: Polypropylene.

7.15 Printer : OKIDATA Microline 320 Turbo-9 Pin or equivalent

Note: All maintenance records including routine upkeep and outside service visits are maintained in the instrument maintenance logbooks. See the Manufacturers User's Manual for detailed troubleshooting instructions and routine maintenance, as needed.

8. Reagents and Standards

Use reagent grade chemicals for all reagents. All reagents and standards are stored at room temperature and expire 6 months from preparation, unless otherwise indicated below.

8.1 Deionized (DI) water: All references to DI water refer to ASTM Type II reagent grade water which has been boiled, cooled and capped to eliminate CO₂. Water must be replaced weekly.

8.2 10% Hydrochloric Acid solution: Add 300mL of concentrated HCl (34-37%) to 700mL of DI water. Mix thoroughly and cool to room temperature before use. Store in a glass bottle and keep at room temperature. This solution is stable for 6 months.

8.3 Potassium Hydrogen Phthalate (KHP), CCV or K-Factor for TOC:

CCV- 10,000mg/L equivalent to 10,000mg/Kg Carbon, or 1.0 % TOC:

Dry potassium hydrogen phthalate (KHP) (primary standard grade) at 110°C for 1 hour. Cool to room temperature in a dessicator. Dissolve 2.128g of KHP (primary standard grade) in ASTM DI water, and dilute to 100mL in a volumetric flask. This standard is good for 6 months, stored at room temperature. Discard solution if discoloration or any signs of bacterial growth are observed.

8.4 Potassium Hydrogen Phthalate (KHP) Spiking Solution/MS/ICV: 10,000mg/L equivalent to 10,000mg/Kg Carbon, or 1.0 % TOC. From a separate source than the solution in Section 8.3, Sigma Aldrich or equivalent.

Dry KHP (primary standard grade) at 110°C for 1 hour. Cool to room temperature in a dessicator. Dissolve 2.128g of KHP (primary standard grade) in ASTM DI water, and dilute to 100mL in a volumetric flask. *Use a separate source or different lot of KHP from that used to prepare the calibration standards.*

This stock may be stored up to six months at room temperature. Discard solution if discoloration or any signs of bacterial growth are observed. Use at 1.0 % TOC concentration for solid samples, and at 10,000mg/L for aqueous samples.

8.5 Solid Standard Reference Materials: Standard Reference Material (SRM) NIST 1944, a separate source from the calibration standard that is certified at the concentration of 4.4% TOC for solid samples. SRM 1650b for Soot, this material has no certified value, however has a reference value of 78% soot carbon. ("Quantification of the Dilute Sedimentary Soot Phase: Implications for PAH Speciation and Bioavailability" published in Environmental Science and Technology, Vol. 31, No. 1, 1997 by Gustafsson, Haghseta, Chan, McFarlane and Gschwend.)

9. Quality Control

The laboratory must maintain records to document the quality of data that is generated. Ongoing data quality checks are compared with established performance criteria to determine if the results of analyses meet the performance characteristics of the method.

9.1 Blank(s)

9.1.1 Method Blank: A method blank must be analyzed once per every 20 samples or per TOC/Soot batch, whichever is more frequent. The Blank consists of 30-50mg of Filter Aid acidified with HCl and dried. (Section 7.11).

TOC must not be detectable in the method blank at a concentration greater than the reporting limit for the given matrix (Section 3).

Corrective Action: Analysis of the method blank and all associated samples must be performed until the blank is in control. Samples cannot be analyzed until an acceptable method blank analysis is obtained. Exceptions may be made with approval of the Department Manager, if the samples associated with the out of control method blank are non-detect for TOC/Soot, or if sample TOC/Soot concentrations are greater than 10X the blank levels. In such cases, the sample results are accepted without corrective action for the high method blank and the client is notified in a project narrative associated with the sample results.

9.1.2 Continuing Calibration Blank: A CCB must be analyzed immediately after every CCV. The CCB is 30-50mg of Filter Aid acidified with HCl and dried. (Section 7.10).

The CCB concentration must not be greater than the reporting limit for the given matrix (Section 3).

Corrective Action: Repeat analysis once to see if an analytical error occurred. If the CCB still exceeds the control limits, re-calibrate and/or re-analyze a fresh

blank. All samples associated with the out of control CCB must be re-analyzed (since the last acceptable CCB). Exceptions may be made with approval of the Department Manager if the samples associated with the out of control method blank are non-detect for TOC/Soot or if sample TOC/Soot concentrations are greater than 10X the blank levels. In such cases, the sample results are accepted without corrective action for the high CCB and the client is notified in a project narrative associated with the sample results.

- 9.1.3 Instrument Blank:** An Instrument Blank must be analyzed during Calibration.run2. The Instrument Blank consists of 30-50mg of Filter Aid acidified with HCl and dried at 75°C. (Section 7.10).

9.2 Laboratory Control Sample (LCS)

Laboratory control sample (LCS) must be from a second source or lot number to verify the accuracy of the standard curve. The LCS is analyzed along with the samples. A LCS must be analyzed once per every 20 samples or per TOC batch, whichever is more frequent. For *solid* samples, the LCS is the NIST SRM at 4.4% TOC. The LCS is treated identically as samples with HCl and dried at 75°C.

LCS consists of approximately 5.0mg of SRM 1944 with a true value of 4.4% TOC (Section 8.6). This SRM is NOT evaluated for Soot since no certified concentration for Soot is published.

The acceptable recovery QC range is 75%-125% for the LCS.

Corrective Action: Repeat analysis once to see if an analytical error has occurred. If the LCS recovery is still out of control, re-calibrate and re-analyze the LCS and all associated samples. Samples cannot be analyzed until an acceptable LCS is obtained. Exceptions may be made with approval of the Department Manager if the samples associated with the out of control LCS are also associated with a matrix spike that is in control. This is an acceptable measure of accuracy of the analytical procedures. An explanation of this out of control LCS recovery must be included in the project narrative to the client and the sample data reported with the acceptable MS results as batch QC.

9.3 Initial Calibration Verification (ICV)

Second source analyzed at the beginning of the run. Sample matrix of ICV is a 1.0% carbon solution of KHP.

The acceptable recovery QC range for the ICV is 80-120%.

The **ICV** is prepared by adding 10µL of *Spiking Solution* (Section 8.4), (with a 1% TOC true value). The weight recorded is the Calibration Solution only. (10µL of solution should weigh approximately 10mg).

Corrective Action: Repeat analysis once to see if an analytical error occurred. If the ICV still exceeds the control limits, re-calibrate and re-analyze all samples since last acceptable ICV.

9.4 Continuing Calibration Verification (CCV)

A CCV must be analyzed at a minimum of every 10 burns and at the close of an analytical sequence. This standard monitors instrument performance throughout the duration of the analytical run. Sample matrix of CCV is a 1.0% carbon solution of KHP.

The **CCV** is prepared by adding 10 μ L of *Calibration Solution* (Section 8.3), (with a 1% TOC true value). The weight recorded is the Calibration Solution only. (10 μ L of solution should weigh approximately 10mg).

The acceptable recovery QC range for the CCV is 80-120%.

Corrective Action: Repeat analysis once to see if an analytical error occurred. If the CCV still exceeds the control limits, re-calibrate and re-analyze all samples since last acceptable CCV.

9.5 Matrix Spike

A matrix spike must be performed once per 10 samples (10% frequency). When project specifications dictate, a Matrix Spike Duplicate (MSD) may also need to be performed at the same frequency as the MS. Prepare the MS according to Section 8.4 for the given matrix.

A **Matrix Spike** sample is spiked with 10 μ L of *Spiking Solution* (Section 8.4), at a 1.0 % TOC true value. The weight recorded is the sample weight prior to spiking.

The acceptable recovery QC range is 75%-125% for the MS/MSD. Calculate the %RPD as in Section 9.6 when analyzing a MS/MSD pair. The acceptable %RPD is $\leq 25\%$ for solid samples.

Corrective Action: If sample concentration exceeds 4X the spike amount, narrate. Repeat analysis once to see if an analytical error has occurred. If the % recovery or %RPD still exceeds the criteria and the LCS is compliant; include a project narrative with the results to the client noting that there may be potential matrix effects on the accuracy or precision of the TOC/Soot results as evidenced by matrix spike recovery or %RPD outside of QC limits.

9.6 Laboratory Duplicate

Duplicate analyses (matrix duplicate) must be performed once per 20 samples (5% frequency).

Acceptable relative percent difference (RPD) of duplicates is $\leq 25\%$. Acceptance criterion is not applicable to sample concentrations less than 5X the reporting limit. Calculate RPD as follows:

$$\%RPD = \frac{R1 - R2}{\frac{R1 + R2}{2}} \times 100$$

where:

R1 = highest result

R2 = lower result

Corrective Action: Repeat analysis once to see if an analytical error has occurred. If the % RPD still exceeds the control limits; include a project narrative with the results to the client noting that there may be potential matrix effects on the precision of the TOC/Soot results as evidenced by the matrix duplicate RPD exceedance.

9.7 Method-specific Quality Control Samples

High level Initial Calibration Verification (HLICV - linearity check):

This sample consists of 4% carbon solution (high calibration point).

Aliquot 50 µL using a syringe into a tin boat, record weight and analyze. (Equivalent to a 5 mg sample containing 40% TOC).

The acceptable recovery QC range for the HLICV is 80-120%.

Corrective Action: Repeat analysis once to see if an analytical error occurred. If the HLICV still exceeds the control limits, re-calibrate.

9.8 Method Sequence

- Calibration Curve generation
- ICV
- ICB
- HLICV
- Method Blank
- LCS
- Laboratory Duplicate
- Matrix Spike
- Samples 1 – 8
- CCV
- CCB
- Samples 9 – 18
- CCV
- CCB

10. Procedure

10.1 Equipment Set-up

Samples are prioritized by the Department Manager for analysis based on hold time and client due date. Section 15.5 outlines the steps for final TOC reporting that will contain the sample analysis final results.

The analyst initials, date, sample ID #'s, sample weights (solids), or volumes (aqueous), of all Standards, QC samples and field samples, are entered into the TOC logbook. Include the standard, LCS and MS IDs and concentrations. Use TOC weight spreadsheet to record all information.

10.1.1 Pretreatment for Total Organic Carbon:

This procedure is used to remove the inorganic compounds in the sample prior to the determination of Total Organic Carbon. If Total Carbon is to be determined, addition of the acid solution is omitted.

- 10.1.1.1 Aliquot 10-15g of wet solid sample into a weighing vessel. Remove shells, rocks and other large non-representative materials with tweezers. Record weight of vessel and vessel + wet sample.
- 10.1.1.2 Heat for 4 hours at 75 +/- 2 °C. Return sample to oven if additional drying time is required(in ½ hour increments) Record time in and out of oven. Cool sample to room temperature in dessicator. Record weight of vessel + dry sample.
- 10.1.1.3 Add 10% HCl (Section 8.2) dropwise to dry sample to induce effervescence (removal of inorganic carbon). Do not use excessive acid.. Only add enough acid to exhaust the effervescence. In lieu of additional acid, use DI water to wet the sample in order to form a slurry if necessary, to distribute the acid throughout the sample. Record the volume of HCl used for each sample.
- 10.1.1.4 Return the sample to the oven. Heat for 4 hours at 75 +/- 2 °C. Return sample to oven if additional drying time is required(in ½ hour increments) Record time in and out of oven. Cool to room temperature in dessicator. Record final weight of dry sample + vessel. The change in weight of dry sample after acidification is used to adjust the weight of the aliquots used for analysis.
- 10.1.1.5 Take a sub-aliquot of approximately 2-3 g of dry sample and perform moisture content using SM2540D. The corrected sample weight (CSW, see Section 11.4) is corrected using this result (see Section 11.4 for calculations)
- 10.1.1.6 Grind sample with mortar and pestle to homogenize. Place ground sample into a 4 mL vial.
 - 10.1.1.6.1 If Soot analysis is required, take a portion of the dried sample aliquot(prior to acidification), approximately 5-10 gm, and place into a muffle furnace at 375°C for 24 hours. Once the sample aliquot is cooled to room temperature, proceed to the acid addition step, Section 10.1.1.3. Samples for Soot are read analytically in the same way as Routine TOC.

- 10.1.1.7 Weigh (and record weight of) each replicate into a tin capsule (see Section 10.3 for appropriate weight range). Record the weight and use the TOC weight spreadsheet to calculate the corrected sample weight (CSW) which is entered into the analyzer.

10.2 Initial Calibration

On the accompanying computer, or "PC", Perkin Elmer software has been loaded to collect and save sample and standard analysis data. Create a file to store the data from each day's analytical sequence by clicking on the PE 2400 icon, go to "new" and "save" the file "as" the name of the date of the analysis (*i.e.*, 060503.chn). Data from each standard or sample analysis will be automatically stored in this file for future reference

- 10.2.1 Follow the instrument Manufacturers User's Manual for instrument set up and see Sections below for an outline of the initial, daily calibration procedure.

See the Manufacturers User's Manual, page 5-69, for the default instrument conditions when in the CHN operating mode.

10.2.2 Routine TOC/Soot Calibration Method:

TOC analyses use K-Factors (3 repeat analyses of a 1.0% TOC standard, Section 8.3) and Blanks, calculated and averaged by the instrument when the calibration is being performed. Follow the instrument Manufacturer's User's Manual, page 4-67. Calibration of the instrument using K-Factors and Blanks is performed once per day of analysis.

Load the Autosampler (Section 10.3.2) for combustion to analyze Blanks and Standards in the order listed below. All "Blanks" and "K-Factors" are prepared in the same way. Analyze the standards following the procedure in Section 10.3.

- **Instrument "Primer"** (~3.5mg of SRM 1944, with true value of 4.4% TOC) only if new column.
- **Blank 1** (30-50mg of Filter Aid) only if new column
- **K-Factor 1** (10 μ l of *Calibration Solution*, Section 10.3,) The weight recorded is the Calibration Solution, only.
- **Blank 2** (30.0mg of Filter Aid)
- **K-Factor 2** (10 μ l of *Calibration Solution*, Section 10.3,) The weight recorded is the Calibration Solution, only.
- **K-Factor 3** (10 μ l of *Calibration Solution*, Section 10.3,) The weight recorded is the Calibration Solution, only.

The K-Factors must reproduce from the mean value within +/- 15% of known K factor for each instrument for carbon. The calculation involves the comparison among the latest K-Factor run, the prior K-Factor run, and the current running average K-Factor. An "out of tolerance" message will be displayed if this criterion is not met.

The ICV/LCS and Method Blank are prepared to run immediately following the third K-Factor, given the instrument is "in tolerance".

Corrective Action: If, at any time during the 6-step process of calibration, one of the K-Factors or Blanks fail, repeat analysis of failing sample.

10.3 Equipment Operation and Sample Processing

Prepare a Calibration per Section 10.2.

An ICV/ICV and LCS/Method Blank are analyzed immediately following the third K-Factor of the Routine Calibration, provided the instrument is "in tolerance". The LCS and method blank must be run with the same number of replicates that are required for the samples in the run.

Remove all pretreated samples from the oven, and allow to cool in a dessicator.

Weigh approximately 5-10mg (to an accuracy of 0.01 mg) (masses less than 5 mg must be avoided since balance is not calibrated below 5 mg) of sample into a tin boat using the Perkin-Elmer Microbalance, Model AD-6, which is linked to the instrument. Samples that are known to be high in TOC may use a lesser sample aliquot. Samples where it is observed that the TOC may be low, weight as much as 20-25mg. Record the weights in the TOC/Soot logbook. Matrix Duplicate and Matrix Spike samples are weighed as separate samples, with their own replicates. As noted in Section 10.1.1.6, use the TOC weight spreadsheet to correct the sample weights for all replicates and re-analyses.

Any observations regarding the sample composition must be noted in the TOC/Soot logbook such as: sandy, contains shells or rocks, contains grass or roots, is light/white in coloration, etc.

Analyze a CCV/CCB (Section 9.4 and 9.1.3) after every 10 "burns", and at the end of the analytical sequence.

If following the *Lloyd Kahn* Calibration method, analyze the first set of batch QC samples, the ICV/LCS and Method Blank, followed by field samples with a CCV/CCB analyzed every 10 "burns", and at the end of the analytical sequence.

10.3.1 Multiple Sample Instrument Loading:

10.3.1.1 Each tin boat is carefully folded with anti-magnetic tweezers, and placed into its respective holding tray position. (See the Manufacturer User's Manual SOP, Section 1.2, page 4, for tin boat folding details.) Weights, sample tray position and Autosampler location are recorded in the TOC/Soot logbook. The analyst must be very careful when transferring samples. Documentation of sample consistency is very important. See Figure 1 for an example logbook page.

10.3.1.2 Adjust the Autosampler tray to begin sampling at auto-slot #1 and carefully transfer the folded tins containing the samples to the correct auto-slot, using tweezers. All Instrument Calibration Standards (Blanks, K-Factors and/or *Lloyd Kahn* Calibration Standards) are loaded first. Immediately following will be the first batch QC samples, the ICV/LCS and Method Blank for the run, followed by field samples. Rotate the Autosampler in a *counter clockwise* manner.

- 10.3.1.3** A maximum of 60 tins can be held on the Autosampler at one time. The instrument only allows for 100 total samples (including calibration/blank samples) to be programmed for any given run.

10.3.2 Sample Analysis

- 10.3.2.1** Select the *Auto Run* option on the keypad on the instrument. The following menu appears:

AUTO RUN NO. 1

1B 2K 3S

where: B = Blank

K = K-Factor

S = Sample

Assuming the *Instrument Standardization* occupies auto-slots 1-6, Enter "3" for Sample, then select "Enter". Enter the weight of the "Primer" Standard (position 1) and select "Enter".

- 10.3.2.2** You will be prompted for AUTO RUN NO. 2 as in Section 10.3.3.1, except now there is a function "4NP" which allows the analyst to stop/erase everything by selecting this feature.

- Enter "1" for the Blank. The weight will not be asked for.
- Enter "2" for the first K-Factor, then select "Enter". Enter the weight of your K-Factor (the standard weight should be ~ 10mg). Select "Enter".
- Enter "1" for the second Blank, then "Enter".
- Enter "2" for the second K-Factor, then "Enter". Enter the weight, then "Enter".
- Enter "2" for the third K-Factor, then "Enter". Enter the weight, then "Enter".

- 10.3.2.3** All remaining sample weights are added by entering "3" for Sample, and then by entering the sample weight. Continue adding all information to the run sequence, using the keypad. When entering sample identifications, and letters are necessary, refer to the Manufacturer's User's Manual, page 3-4, for instructions for converting numbers to letters.

- 10.3.2.4** When all sequence information is entered and complete, select "Start". The analyses will begin. The computer will continue to display the "AUTO RUN" menu during sample analysis.

- 10.3.2.5** The Standard and Sample data prints out as it is collected on the line printer, and is also collected on the linked computer using the PE 2400 software. The data on the computer is saved in a file named as the date of the analysis (*i.e.*, 060503.chn) for future reference, as noted in 10.2.

- 10.3.2.6** When all analyses are complete, refer to the Manufacturers User's Manual SOP, Section 3.1, page 7, for instructions to "Shut Down" the instrument.

10.3.2.7 Evaluate all batch QC samples first, to confirm or exclude the need for re-analyses. The ICV/LCS/HLICV, Method Blank, CCB/CCV samples must meet the acceptance criteria in Section 9. Follow the corrective action for any QC failures.

10.3.2.8 Evaluate the field samples, LCS/SRM, and MS/Duplicates next. If replicate "burns" vary by more than 30%, re-weigh two additional aliquots similar to the initial weights used, and re-analyze the sample. For a 2-replicate analysis, this provides a total of four burns/samples. If the second set of replicates also has RPD > 30%, report the first set. If the re-analysis has an RPD which passes, report the re-analysis. Three and four replicate analysis may be requested, and the average of the multiple burns is reported, unless otherwise indicated by the client. Analysts should use judgement in cases where there may have been an error with the autosampler or other factor (incorrect loading, etc.) which may have led to RPD failure. The Lloyd Kahn method requires that quadruplicate analysis be performed on one sample per batch of up to 20 samples and that the RSD must meet precision criteria of 3 times the standard deviation of laboratory generated sample data. One sample per batch of up to 20 must be analyzed in quadruplicate. RSD criteria is 40%. This value was generated using 30 data points of quadruplicate analysis of various concentrations and multiple instruments. The RSD was calculated for each sample in quadruplicate, and the RSD limit is based on 3 times the average standard deviation. Failure to meet this criteria requires that the entire batch be re-analyzed.

10.4 Continuing Calibration

A CCV must be analyzed as outlined in Section 10.3.3 at a minimum of every 10 burns and at the close of an analytical sequence.

10.5 Preventive Maintenance

The reduction column is changed after every 100-200 runs. The combustion column is replaced as needed.

11. Data Evaluation, Calculations and Reporting

11.1 Procedures for data and record management for TOC/Soot analysis must adhere to the Quality Systems Manual, other subordinate documents covering record keeping, and the *Document Control* SOP, 08-01. All records are stored in such a manner as to be safe and accessible for at least 10 years.

11.2 The relevant TOC/Soot laboratory notebooks must follow the specifications in the *Laboratory Notebook Usage* Work Instruction 1556, and all record keeping and document control practices.

11.3 Sample results for TOC/Soot are directly reported from the instrument printout.

11.4 Calculations: The following calculations are applied by the instrument when determining the percentage of Total Organic Carbon or Soot: Note: sample weights are corrected for sample mass changes due to acidification prior to analysis and entered into the instrument software as the corrected weights, therefore, no correction is required after analysis.

Corrected Sample Weight (CSW): Weight that is entered at the instrument, corrected for sample mass change after acidification.

$$CSW = \frac{\text{aliquot wt (mg)} * \text{total sample dry wt (g) (prior to acidification)} * \text{dry wt. @ (75°C)}}{\text{Total sample dry wt (g) (post acidification)} * \text{dry wt. @ (105°C)}}$$

Carbon Blank (CB): Used to make all other determinations, namely, K-Factor and weight percent calculations. When run alternately with samples, the instrument averages the blank values.

Carbon Blank (CB) = Carbon Read – Nitrogen Read

Carbon K-Factor (C KF): K-Factor, or detector calibration factor, is determined when a known standard is analyzed to calibrate the analyzer in terms of micrograms of carbon. This calibration factor is then used to determine unknowns.

$$C \text{ KF} = ((CR - NR) - CB \times 100) / (CSW \times C \text{ Theory Wt. \%})$$

where: CR = Carbon Read
NR = Nitrogen Read
CB = Carbon Blank
CSW = Corrected Sample Weight (mg) (using corrected weight recorded in Section 10.3)
C Theory Wt % = 1% (based on the concentration of the K-Factor standard)

Carbon (mg/Kg):

$$\text{Carbon (mg/Kg)} = ((CR - NR) - CB) \times 1000 / (SW \times C \text{ KF})$$

where: CR = Carbon Read
NR = Nitrogen Read
CB = Carbon Blank
CSW = Corrected Sample Weight (mg)
C KF = Carbon K-Factor

To convert to % C divide result in mg/Kg by 10000

Example Calculation of Percent TOC/Soot from the instrument, converted to mg of TOC/Soot:

If the result from the instrument is 1.083% and the sample weight is 10.76mg:

$$\begin{aligned} 1.083\% &= 100 \times [X / 10.76\text{mg}] && \text{(to solve for X, divide each side by 100)} \\ 0.01083 &= X / 10.76\text{mg} && \text{(multiply each side by 10.76mg)} \\ 0.116\text{mg} &= X \end{aligned}$$

11.5 Reporting Results

The following procedures must be followed for reporting of TOC/Soot results:

Go to the next page in the bound TOC/Soot logbook.

Retain all computer printouts for the standard and sample analyses of this sequence.

Print the sequence from the computer and review it to make sure that no weight or sample ID transcription errors were made.

Calculate the recoveries for the QC samples (IVC/LCS, CCV, MS and RPD between the duplicate samples) and ensure the Method Blank and CCB meet the criteria. Remember any "QC Failures" require corrective action. See Section 9.0 or 12.0.

After reviewing the final logbook entries, make a copy of the logbook page for secondary review.

Go to the LIMS and "batch" and "associate" the set of QC samples and field samples that were just analyzed.

Enter the Final Results into the LIMS report sheet and check for transcription errors.

Transfer all associated sample paperwork to the Department Manager for the second level review and approval.

All TOC/Soot results are reportable without qualification if analytical holding times are met, preservation (including pH and cooler temperatures) are met, all QC criteria defined in the table below are met, and matrix interference was not suspected during analysis of the TOC/Soot samples. If any of the below QC parameters are not met, all associated samples must be evaluated for re-analysis.

QC Parameter	Acceptance Criteria
Initial Calibration Curve, <i>Lloyd Kahn</i>	$r \geq 0.995$ and slope $\pm 10\%$ the historical curves
Initial Calibration Verification	80-120% of True Value
Linearity check (high level ICV)	80-120% of True Value
Method Blank	< reporting limit for matrix
Laboratory Control Sample	75-125% R
Matrix Duplicate	25%RPD for results <5x reporting limit
Replicate burns (each sample)	30% RPD
Quadruplicate analysis(1 per batch)	< 40 % RSD
Matrix Spike	75-125% R
Matrix Spike Duplicate if requested	75-125%R/25%RPD
Continuing Calibration Verification	80-120% of True Value
Continuing Calibration Blank	< reporting limit for matrix

12. Contingencies for Handling Out-of-Control Data or Unacceptable Data

Section 9 outlines sample batch QC acceptance criteria. If non-compliant TOC/Soot results are to be reported, the Department Manager and/or the Laboratory Director, and the QA Manager must approve the reporting of these results. The laboratory Project Manager is notified, and may choose to relay the non-compliance to the client, for approval, or other corrective action, such as re-sampling and re-analysis. The analyst or Department Manager performing the secondary review initiates the project narrative, and the narrative must clearly document the non-compliance and provide a reason for acceptance of these results.

13. Method Performance

13.1 Method Detection Limit Study (MDL) / Limit of Detection Study (LOD) / Limit of Quantitation (LOQ)

The laboratory follows the procedure to determine the MDL, LOD, and/or LOQ as outlined in Alpha SOP/1732. These studies performed by the laboratory are maintained on file for review.

13.2 Demonstration of Capability Studies

Refer to Alpha SOP/1739 for further information regarding IDC/DOC Generation.

13.2.1 Initial (IDC)

The analyst must make an initial, one-time, demonstration of the ability to generate acceptable accuracy and precision with this method, prior to the processing of any samples.

13.2.2 Continuing (DOC)

The analyst must make a continuing, annual, demonstration of the ability to generate acceptable accuracy and precision with this method.

14. Pollution Prevention and Waste Management

The *Hazardous Waste and Sample Disposal* SOP (1797) must be referenced for disposal of used standards, solvents, acids, reagents or other chemicals.

Once satisfactory TOC results have been generated, the sample containers must be scanned back into LIMS and returned to the appropriate sample refrigerator and held for 30 days.

All waste generated must be transferred to the waste disposal area. Dispose all solid samples in solid waste container. Aqueous samples must be poured into a 55-gallon drum marked acidic/non-chlorinated waste.

Refer to the *Chemical Hygiene Plan* and the *Hazardous Waste & Sample Disposal* SOP (1797) for further pollution prevention and waste management information.

15. Referenced Documents

Chemical Hygiene Plan
PE 2400 Series II CHNS/O Analyzer User's Manual
Sample Receipt & Login SOP (1559)
Perkin-Elmer, Model AD-6 Manufacturer User's Manual
Document Control SOP 1729
Laboratory Notebook Usage Work Instruction (WI 1556)
SOP/1732 MDL Generation
SOP/1739 IDC Generation
Hazardous Waste & Sample Disposal SOP (1797)

16. Attachments

None.

Total and Amenable Cyanide

References: **Method 9010C / 9012B**, SW-846, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, EPA SW-846, Revision 2 and Revision 3 2004

SM 4500CN-CEG. Standard Methods for the Examination of Water and Wastewater. APHA-AWWA-WEF. Standard Methods Online.

Method 10-204-00-1-A, Lachat Instruments, 6645 West Mill Road, Milwaukee, WI 53218, 1994.

Method 9014 (Modified). SW-846, Test Methods for Evaluating Solid Waste: Physical / Chemical Methods, EPA SW-846, Update III, 1997.

1. Scope and Application

Matrices: This method is applicable to waters, liquids, solids, soils and sludges.

Definitions: See Alpha Laboratories Quality Manual Appendix A.

The following SOP is a reflux-distillation procedure used to extract soluble cyanide salts and many insoluble cyanide complexes from wastes and leachates. It is based on the decomposition of nearly all cyanides by a reflux distillation procedure using a strong acid and a magnesium catalyst. Cyanide, in the form of hydrocyanic acid (HCN) is purged from the sample and captured into an alkaline scrubber solution. The concentration of cyanide in the scrubber solution is then determined by flow injection analysis on a Lachat Analyzer.

This method was designed to address the problem of "trace" analyses (<1000ppm). The method may also be used for "minor" (1000ppm – 10,000ppm) and "major" (>10,000ppm) analyses by adapting the appropriate sample dilution. However, the amount of sodium hydroxide in the standards and the sample analyzed must be the same.

The data report packages present the documentation of any method modification related to the samples tested. Depending upon the nature of the modification and the extent of intended use, the laboratory may be required to demonstrate that the modifications will produce equivalent results for the matrix. Approval of all method modifications is by one of the following laboratory personnel before performing the modification: Area Supervisor, Laboratory Services Manager, Laboratory Director, or Quality Assurance Officer

This method is restricted to use by or under the supervision of analysts experienced in the operation of the distillation unit and/or the Lachat Instrument, and in the interpretation of Lachat data. Each analyst must demonstrate the ability to generate acceptable results with this method by performing an initial demonstration of capability.

2. Summary of Method

The cyanide, as hydrocyanic acid (HCN), is released from samples containing cyanide by means of a reflux-distillation operation under acidic conditions and absorbed in a scrubber containing sodium hydroxide solution. The cyanide concentration in the absorbing solution is then determined colorimetrically by Lachat flow injection analysis.

2.1 Method Modifications from Reference

The sample size used is 50mL. The Midi distillation unit has demonstrated the ability to achieve the same RDL using 50mL instead of 500mL sample volume. Refer to EPA Method 335.4.

Modification for Method 9014: An automated determination of cyanide using the Lachat instrument is used instead of manual spectrophotometric determination.

Modification for amenable cyanide: Analysis is not prepped under amber light.

3. Detection Limits

The Reported Detection Limit for aqueous samples is 0.005mg/L; soil and solid samples is 1mg/Kg.

4. Interferences

4.1 Instrumental

None.

4.2 Parameters

- 4.2.1 Interferences are eliminated or reduced by using the distillation procedure. However, chlorine and sulfide are interferences. Refer to Section 9.1.
- 4.2.2 High results may be obtained for samples that contain nitrate and/or nitrite. During the distillation, nitrate and nitrite will form nitrous acid, which will react with some organic compounds to form oximes. These compounds once formed will decompose under test conditions to generate HCN. The possibility of interference of nitrate and nitrite is eliminated by pretreatment with sulfamic acid just before distillation. Nitrate and nitrite are interferences when present at levels higher than 10mg/L and in conjunction with certain organic compounds.
- 4.2.3 Thiocyanate is reported to be an interference when present at very high levels. Levels of 10mg/L were not found to interfere.
- 4.2.4 Fatty acids, detergents, surfactants, and other compounds may cause foaming during the distillation when they are present in high concentrations. Add anti-foaming agent to the sample during the distillation procedure (Section 9.2).
- 4.2.5 Carbonates and aldehydes are possible interferences

5. Safety

The toxicity or carcinogenicity of each reagent and standard used in this method is not fully established; however, each chemical compound should be treated as a potential health hazard. From this viewpoint, exposure to these chemicals must be reduced to the lowest possible level by whatever means available. A reference file of material data handling sheets is available to all personnel involved in the chemical analysis. Additional references to laboratory safety are available in the Chemical Hygiene Plan.

All personnel handling environmental samples known to contain or to have been in contact with municipal waste must follow safety practices for handling known disease causative agents.

The following chemicals have the potential to be highly toxic or hazardous. For detailed explanations consult the MSDS:

- Cyanide
- Sulfuric acid
- Pyridine
- Chloramine-T

6. Sample Collection, Preservation, and Handling

6.1 Sample Collection

Samples are collected in plastic or glass containers. All containers must be thoroughly cleaned and rinsed.

Oxidizing agents such as chlorine decompose most cyanides. Testing for chlorine must be done in the field prior to sample preservation.

6.2 Sample Preservation

Prior to preservation, samples must be tested for chlorine (Section 6.1).

Aqueous samples are preserved with 50% sodium hydroxide in the field to a pH ≥ 12 at the time of collection.

Samples and distillates are stored in the refrigerator at 4 ± 2 °C.

6.3 Sample Handling

When properly preserved, cyanide samples are stored for up to 14 days prior to sample preparation steps.

Distillates must be analyzed within 14 days of distillation. Samples must be analyzed within 14 days of receipt.

Note: for MCP-TCN samples must be analyzed within 24h after distillation.

7. Equipment and Supplies

7.1 Cyanide Midi Distillation Unit: Lab Crest, BGL or comparable midi distillation unit. With reaction vessels, collection vessels, cold fingers and impingers.

7.2 pH paper: Range 1-14

7.3 Lead Acetate Paper

7.4 Vacuum source

7.5 50mL centrifuge tubes: New, plastic, with caps.

- 7.6 **KI starch paper:** Residual Chlorine sensitivity
- 7.7 **Class A volumetric flasks:** 25, 50, 100, 500 and 1000mL
- 7.8 **Graduated cylinders:** 50mL glass or plastic
- 7.9 **Eppendorf pipettor or pipets:** 0.5, 1, 2, and 5mL
- 7.10 **Lachat 8000 Flow Analyzer:** Including Quick Chem software, autosampler, pump and accessories.
- 7.11 **Balance:** Capable of weighing to 0.0001gram
- 7.12 **Beakers:** 100mL
- 7.13 **Chiller**
- 7.14 **Stir plate**
- 7.15 **Stir bars**

8. Standards and Reagents

Reagent grade chemicals are used in all tests. Unless otherwise indicated, it is intended that all reagents shall conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available. Other grades may be used, provided it is first ascertained that the reagent is of sufficient high purity to permit its use without lessening the accuracy of the determination.

8.1 Standards and Reagents for Distillation

- 8.1.1 **Reagent Water:** All references to water in this method refer to Deionized Water (DI) from Alpha's water treatment system.
- 8.1.2 **Ascorbic Acid, $C_6H_8O_6$:** Powder. Store at room temperature. Expires upon manufacturer's specified date.
- 8.1.3 **Sodium hydroxide solution (1N), NaOH:** In a 1L volumetric flask, dissolve 40g of NaOH. Bring to volume with DI water. Store at room temperature. Expires one month from date of preparation.
- 8.1.4 **Sulfamic acid (0.4N), H_2NSO_3H :** In a 1L volumetric flask, dissolve 40g H_2NSO_3H . Bring to volume with DI water. Store at room temperature. Expires 6 months from date of preparation.
- 8.1.5 **Sulfuric acid (1:1), H_2SO_4 :** To a 1L volumetric flask, add 500mL DI water. Slowly and carefully add 500mL of concentrated H_2SO_4 . Store at room temperature. Expires one month from date of preparation.

- 8.1.6 Magnesium chloride solution (2.5M), $\text{MgCl}_2 \cdot 6\text{H}_2\text{O}$:** In a 1L volumetric flask, dissolve 510g of $\text{MgCl}_2 \cdot 6\text{H}_2\text{O}$. Bring to volume with DI water. Store at room temperature. Expires 6 months from date of preparation.
- 8.1.7 LCS, 1000ppm cyanide stock solution:** Commercially available standard with a certificate of analysis and from a different source than the Lachat calibration standards. Purchased from Ricca, Catalog # 2543-32. Store refrigerated at 4 ± 2 °C. Expires upon manufacturer's specified date.
- 8.1.8 LCS 10ppm cyanide working solution:** Pipet 1mL of 1000ppm cyanide stock solution (Section 8.1.7) into a 100mL volumetric flask. Add 10mL of 1N NaOH (Section 8.1.3). Bring to volume with DI water. Prepare each day of use.
- 8.1.9 1000ppm Stock Spiking Solution:** 1000ppm cyanide standard available commercially with a certificate of analysis. This is from a different source than the LCS (8.1.7). Purchased from LabChem Inc., Catalog # LC13545. Store refrigerated at 4 ± 2 °C. Expires upon manufacturer's specified date.
- 8.1.10 10ppm Working Cyanide Spiking Solution:** Pipet 1mL of the 1000ppm Stock Spiking Solution (Section 8.1.9) into a 100mL volumetric flask. Add 10mL 1N NaOH (Section 8.1.3). Bring to volume with DI water. Prepare fresh each day of use.
- 8.1.11 pH 4 Acetate Buffer solution:** In a 500mL volumetric flask, dissolve 410g of sodium acetate trihydrate. Bring to volume with DI water. Adjust to pH of 4.5 with acetic acid (Section 8.1.13). Store at room temperature. Expires 6 months from date of preparation.
- 8.1.12 Lead Carbonate Powder, $[\text{Pb}(\text{CO}_3)]$**
- 8.1.13 LCS 0.5 ppm Cyanide Working Solution:** Pipet 5mL of the 10ppm Working Cyanide Spiking Solution (Section 8.1.10) into a 100mL volumetric flask. Add 1mL of 10N NaOH (Section 8.1.16). Bring to volume with DI water. Prepare each day of use.
- 8.1.14 Concentrated Acetic Acid:** Store at room temperature. Expires upon manufacturer's specified date.
- 8.1.15 Ottawa Sand**
- 8.1.16 Sodium hydroxide solution (10N), NaOH:** In a 1L volumetric flask, dissolve 400g of NaOH. Bring to volume with DI water. Store at room temperature. Expires 6 months from date of preparation.
- 8.1.17 Total Cyanide SRM:** ERA catalog # 541. Store in room temperature. Expires upon manufacturer's specified date.
- 8.1.18 Calcium Hypochlorite Solution:** Dissolve 5g $\text{Ca}(\text{OCl})_2$ in 100mL Deionized water. Store in an amber colored bottle in the dark. Expires monthly.

8.2 Standards and Reagents for Lachat Analysis

- 8.2.1 Helium gas:** To prevent bubble formation, degas all solutions except the standards with helium. Use He at 140kPa (20 lb/in²) through a helium degassing tube (Lachat part number 50100). Bubble He vigorously through the solution for one minute.
- 8.2.2 Reagent 1. Carrier, 0.1N Sodium Hydroxide:** In a 1L plastic container add 10mL of 10N NaOH (Section 8.1.16). Bring to 1L volume with DI. Store at room temperature. Prepare fresh bi-weekly.

- 8.2.3 Reagent 2. Acetate Buffer, 2.68M:** In a 1L volumetric flask, dissolve 163g sodium acetate trihydrate (acetic acid, sodium salt trihydrate, $\text{CH}_3\text{CO}_2\text{Na}\cdot\text{H}_2\text{O}$) in approximately 800mL of water. Add 40mL of acetic acid to solution. Dilute to the mark and invert to mix. Store at room temperature. Prepare fresh monthly.
- 8.2.4 Reagent 3. Chloramine-T:** Dissolve 2.0g chloramine-T hydrate in 500mL DI. Prepare fresh daily.
- 8.2.5 Reagent 4. Pyridine-Barbituric Acid Reagent:** Under a fume hood, place 15g barbituric acid in a 1L beaker and add 100mL water, rinsing down the sides of the beaker to wet the barbituric acid. Add 75mL pyridine ($\text{C}_5\text{H}_5\text{N}$) while stirring and mix until the barbituric acid dissolves. Add the 15mL concentrated hydrochloric acid (12M HCl) and mix. Store at room temperature. Prepare fresh weekly.
- 8.2.6 0.5ppm Calibration standard:** Pipet 5mL of the 10ppm working cyanide spiking solution (Section 8.1.10) into a 100mL volumetric flask. Bring to volume with 0.1N NaOH. Prepare each day of use.
- 8.2.7 0.2ppm Calibration standard:** Pipet 2mL of the 10ppm working cyanide spiking solution (Section 8.1.10) into a 100mL volumetric flask. Bring to volume with 0.1N NaOH. Prepare each day of use.
- 8.2.8 0.1ppm Calibration standard:** Pipet 1mL of the 10ppm working cyanide spiking solution (Section 8.1.10) into a 100mL volumetric flask. Bring to volume with 0.1N NaOH. Prepare each day of use. This calibration standard is also used as the Continuing Calibration Verification sample.
- 8.2.9 0.04ppm Calibration standard:** Pipet 5mL of the 0.2ppm calibration standard (Section 8.2.7) into a 25mL volumetric flask. Bring to volume with 0.1N NaOH. Prepare each day of use.
- 8.2.10 0.02ppm Calibration standard:** Pipet 1mL of the 0.5ppm calibration standard (Section 8.2.6) into a 25mL volumetric flask. Bring to volume with 0.1N NaOH. Prepare each day of use.
- 8.2.11 0.01ppm Calibration standard:** Pipet 10mL of the 0.02ppm calibration standard (Section 8.2.10) and 10mL of 0.1N NaOH into a container and mix. Prepare each day of use.
- 8.2.12 0.004ppm Calibration standard:** Pipet 5mL of 0.04ppm calibration standard (Section 8.2.9) into a 50mL volumetric flask. Bring to volume with 0.1N NaOH. Prepare each day of use.
- 8.2.13 0.1ppm ICV standard:** Pipet 1mL of the 10ppm LCS cyanide working solution (8.1.8) into a 100mL volumetric flask. Bring to volume with 0.1N NaOH. Prepare each day of use.

9. Procedure

9.1 Screening for Chlorine and Sulfide Interference

9.1.1 Chlorine Interference

Oxidizing agents, such as chlorine, decompose most cyanides. Test by placing a drop of sample on a strip of potassium iodide (KI) - starch paper previously moistened with acetate buffer solution, pH 4. If positive indication is noted, then treat an aliquot of sample with Ascorbic Acid (Section 8.1.2). Repeat this test until the KI paper is negative. Immediately inform the Department Supervisor of this interference.

Manganese dioxide, nitrosyl chloride, etc., if present also may cause discoloration of the test paper.

9.1.2 Sulfide Interference

Oxidized products of sulfide convert CN^- to SCN^- rapidly, especially at high pH. Test for S^{2-} by placing a drop of sample on lead acetate test paper previously moistened with acetic acid buffer solution, pH 4 (Section 8.1.11). Darkening of the paper indicates presence of S^{2-} . Add powdered lead carbonate [$\text{Pb}(\text{CO}_3)$] in 1g increments to the whole sample volume. Re-test with acetate paper. Repeat test until a drop of treated sample no longer darkens the acidified lead acetate test paper. Record in the sample prep logbook the amount of lead carbonate added to the sample.

9.2 Distillation

9.2.1 Add 50mL of shaken liquid sample, or 1gram of a well-homogenized solid sample and 50mL of DI, to the 50mL reaction vessel.

9.2.2 For the Liquid High LCS, fill one 50mL reaction vessel with 50mL DI. For the soil High LCS, add 1g Ottawa Sand (Section 8.1.15) and 50mL of DI. After the system has been charged with air, add 1mL of 10ppm LCS cyanide working solution (8.1.8) to the closed system. (Final concentration equals 0.2mg/L.)

For the Liquid Low LCS, fill one 50mL reaction vessel with 50mL of DI. For a soil Low LCS, add 0.2-0.3 g of SRM (sec 8.1.17) and 50mL of DI. Record exact SRM weight. For liquid samples: After the system has been charged with air, add 0.5mL of 10ppm LCS cyanide working solution (Section 8.1.8) to the closed system. (Final concentration equals 0.1mg/L.) **Don't add liquid Cyanide Standard for soil samples!** Final LCS soil concentration will change based on SRM lot
Samples for Method 9010C/9012B: Prepare a LCS Duplicate along with the LCSs described above.

9.2.3 For the method blank for liquid samples, fill one 50mL reaction vessel with 50mL of DI. For the method blank for soil samples, fill a 50mL reaction vessel with 1g of Ottawa Sand (Section 8.1.15) and 50mL DI.

9.2.4 For the matrix spike, fill a 50mL reaction vessel with 50mL of sample that has been chosen to be spiked. For soil samples, use 1g of soil and add 50mL of DI water. After the system has been charged with air, add 1mL of 10ppm working cyanide spiking solution (8.1.10) to the closed system.

Samples for Method 9010C/9012B: Prepare a Matrix Spike Duplicate (MSD) in the same manner as the MS, as described above.

9.2.5 For the duplicate, fill a 50mL reaction vessel with a duplicate aliquot of 50mL, or 1g soil and 50mL DI water of a sample that has been chosen to be duplicated.

9.2.6 Into the receiver or scrubber tube add 5mL of a 1N NaOH solution and add 40mL of DI water.

9.2.7 Arrange tubes in the distillation unit noting in the logbook which sample is in which glassware. The glassware is numbered and consistently placed in the same position in the distillation unit.

- 9.2.8 Assemble the unit completely. Turn on the pump. There must be gas bubbling in each tube. Check to make sure all connections are tight and bubbles are flowing at an equal rate in each sample tube. If not, adjust flow rate with the knobs in front of each receiver tube and/or check lines to ensure they are not obstructed.
- 9.2.9 Add 5mL of 0.4N sulfamic acid (8.1.4) to each sample tube and rinse the closed 50mL reaction vessel with a squirt of DI. No residue is to be left of the vessel wall.
- 9.2.10 Add 5mL of 1:1 H₂SO₄ (8.1.5) to each sample tube and rinse the closed 50mL reaction vessel with a squirt of DI. No residue is to be left on the vessel wall. Turn on the heat. Samples are to come to a boil on all of the midi-still units.
- 9.2.11 After 2 minutes of heating, add 2mL of 2.5M MgCl₂ Solution (8.1.6) to each sample tube, followed by a rinse with DI. If foaming occurs, an additional 2mL of MgCl₂ Solution may be added. If foaming continues, stop the distillation for that sample and reduce the sample size by 2 – 5x (as determined by the severity of the foaming). Contact the Inorganics Supervisor for guidance.
- 9.2.12 Turn on the chiller.
- 9.2.13 Set the timer-dial on the distillation unit to “110”.
- 9.2.14 After 110 minutes the unit will shut off; leave the chiller running for an additional 30 minutes while the tubes cool down.
- 9.2.15 Pour contents of the scrubber tube into a new, labeled, centrifuge tube (Section 7.5). Carefully rinse the scrubber tube with DI water and add rinseate to the centrifuge tube to bring to 50mL volume. Cap and refrigerate for later analysis by the Lachat Instrument.

9.3 Initial Calibration of Lachat Instrument

- 9.3.1 Allow 15 minutes for heating unit to warm up to 60 °C.
- 9.3.2 Prepare a series of 7 calibration standards (Sections 8.2.6 – 8.2.12) and a 0.1N NaOH blank. Alternatively, calibration standards may be prepared by auto-diluting a 0.5ppm calibration standard (Section 8.2.6). Perform this function per the Lachat manufacturer's instructions for the Quick Chem 8000.
- 9.3.3 Set up manifold as shown in Table 1.
- 9.3.4 Input data system parameters as shown in Table 2.
- 9.3.5 Place standards and blank in the autosampler, per the manufacturer's instructions. Input the information required by the data system, such as concentration, replicates and QC scheme.
- 9.3.6 Inject the standards, per the manufacturer's instructions.
- 9.3.7 Prepare a standard curve by plotting instrument response against standard concentration values. A calibration curve is fitted to the calibration solution concentration/response data using the computer. The calibration coefficient of the curve must be greater than or equal to 0.995 before sample analysis can begin.

9.4 Standardization (Continuing Calibration Verification)

- 9.4.1 After the calibration has been established, it must be verified by the analysis of an Initial Calibration Verification Standard (ICV) (Section 8.2.13). The ICV of 0.1ppm must be made from a different source than the calibration standards. If the measurements exceed $\pm 10\%$ of 0.1ppm, the analysis is terminated. See Section 10.6 for Corrective Actions.
- 9.4.2 A Blank and a Continuing Calibration Verification (CCV) sample (Section 8.2.8) are analyzed after every 10 injections. The CCV measurements cannot exceed $\pm 10\%$ of the CCV value of 0.1ppm and the blank result must be less than the reporting limit of 0.005 mg/L. See Section 10.6 for CCV Corrective Actions and Section 10.2 for Blank corrective actions.

9.5 Lachat Analysis

- 9.5.1 Following initial calibration and standardization, (Section 9.3 and 9.4), place the samples in the autosampler, per the manufacturer's instructions. Input the information required by the data system, such as concentration, replicates and QC scheme.
- 9.5.2 Inject the samples, per the manufacturer's instructions.
- 9.5.3 The data system calculates sample concentration using the regression equation. Results are mg/L for Aqueous samples and mg/Kg for soil and solid samples.
- 9.5.4 If sample concentrations are greater than the highest calibration standard, the distilled sample is diluted with 0.1N sodium hydroxide (NaOH) diluent (Section 8.2.2), and reanalyzed. When the automated diluter is used, 0.1N NaOH is also used. **Do not dilute distilled samples or standards with DI water.**

9.6 Preventative Maintenance

Preventative maintenance is recorded in the instrument maintenance logbook and is performed on the Lachat instrument as follows:

Daily:

- 1) Clean the autosampler
- 2) Clean the surfaces on the auto-dilutor
- 3) Prime the dilutor with fresh DI water
- 4) Clean the pump surfaces
- 5) Clean the detector with DI and dry with Kim-Wipes
- 6) Clean the instrument surfaces with DI, wipe clean with a paper towel

Bi-weekly:

- 1) Clean the injection ports with DI. Take apart the injection valve and inspect it for corrosion. Make sure that the valve connectors are tight and the o-rings are not worn. If the O-rings look worn replace with new ones.
- 2) Perform a scan disk and disk de-fragmentation on the computer.

Monthly:

- 1) Using DI water, clean the unions and the tees that are associated with the manifold.
- 2) Delete Temporary files on the computer, and clear the hard drive of all unnecessary files.

Every 6 months:

- 1) Replace the o-rings in the injection valve.
- 2) Replace the o-rings in the manifold
- 3) Back up the files on the computer. Delete backed files on the hard drive.

9.7 Calculations

- 9.7.1** The Lachat data system calculates sample concentration using the regression equation.
- 9.7.2** Report only those values that fall between the lowest and the highest calibration standards.
- 9.7.3** Report results in mg CN/L for liquids and in mg CN/kg for soils.

9.8 Amenable Cyanide Prep

- 9.8.1** Add 25mL, or 1g and 25mL of DI (8.1.1), to a 100mL beaker with a stir bar.
- 9.8.2** Add 1mL of 10ppm LCS cyanide working solution (8.1.8) to beaker.
- 9.8.3** Prep one sample in duplicate.
- 9.8.4** Add 1-2mL of calcium hypochlorite solution (8.1.18) to all samples and QC under the hood.
- 9.8.5** Check for the presence of chlorine by placing a drop of the sample on a KI-starch paper (7.6). It should turn blue if there is sufficient chlorine.
- 9.8.6** Check samples every 15 minutes for one hour for the presence of chlorine and add more calcium hypochlorite if needed.
- 9.8.7** After one hour of digesting, add ascorbic acid (8.1.2) until KI strip no longer turns blue.
- 9.8.8** Bring sample volume up to 50mL and distill following steps 9.2.6 thru 9.2.15.

10. Quality Control and Data Assessment

The laboratory must maintain records to document the quality of data that is generated. Ongoing data quality checks are compared with established performance criteria to determine if the results of analyses meet the performance characteristics of the method. When results of sample spikes indicate atypical method performance, a calibration verification standard is used to confirm the measurements were performed in an in-control mode of operation.

10.1 Demonstration of Capability

Refer to Alpha SOP/ 1734 and 1739 for DOC information.

10.2 Blank

A minimum of one method blank is distilled and analyzed per batch of 20 or less samples. The Method Blank is utilized to determine if contamination or any memory effects are occurring. (Section 9.2.1) The blank result must be less than the reporting limit of 0.005 mg/L for liquids and 1 mg/kg for soils. If the blank result is outside of acceptance criteria, it is injected another time. If failure continues, sample analysis is terminated and the source of the problem is found and corrected. All samples analyzed since the last acceptable blank analysis must be reanalyzed.

10.3 Laboratory Control Samples (LCS) / Laboratory Control Sample Duplicate (LCSD)

Distill and analyze two LCSs per batch of 20 samples. A Low LCS is analyzed at 0.1mg/L and a high LCS is analyzed at 0.2mg/L. (Section 9.2.2)

LCS measurements for Method SM 4500 CN-CE must be within $\pm 10\%$. For Method 9010C/9012B, the LCS measurements must be within $\pm 15\%$ for liquids and $\pm 20\%$ for soils.

Samples for Method 9010C/9012B: LCSDs are distilled and analyzed along with the LCSs, as described above. The RPD between LCS and LCSD must be $\leq 20\%$ for liquids and $\leq 35\%$ for soils.

For soil samples: LCS and LCSD recovery must be within vendor specified acceptance criteria (it will be different for different lots of SRM)

If any LCS fails acceptance criteria for either % Recovery or RPD, analysis is terminated and samples are redigested and analyzed.

10.4 Matrix Spike

Distill and analyze one spike per batch of 20 samples. For Method 9010C/9012B distill and analyze one spike per batch of 10 samples.

For Method 9010C/9012B, the % Recovery must be within $\pm 20\%$ for liquids and $\pm 35\%$ for solids. For SM 4500CN-CE, the % Recovery must be within $\pm 10\%$. (Section 9.2.4).

Samples for Method 9010C/9012B: A Matrix Spike Duplicate (MSD) is distilled and analyzed along with the MS, as described above. The RPD between MS and MCSD must be $\leq 20\%$ for liquids and $\leq 35\%$ for soils.

10.5 Duplicates

Analyze one duplicate sample for every 20 samples. A duplicate sample is a sample brought through the entire sample preparation and analytical process. (Section 9.2.5)

The RPD must be 20% or less for liquids and 35% or less for soils and solids. See Section 12 for Corrective Action if these criteria are not met.

10.6 Initial Calibration Verification (ICV) and Continuing Calibration Verification (CCV)

The Initial Calibration Verification Standard (ICV) (Section 8.2.13) is analyzed immediately following the calibration to verify the curve. If the measurements exceeds $\pm 10\%$ of 0.1ppm, the analysis is terminated and recalibration must occur. An acceptable result for the ICV must be obtained prior to any sample analysis.

The Continuing Calibration Verification Standard (CCV) (Section 8.2.8) is analyzed after every 10 injections. The CCV measurements cannot exceed $\pm 10\%$ of the of 0.1ppm. If the CCV is not within acceptance criteria, the standard is injected again. If failure continues, sample analysis is terminated and the source of the problem is found and corrected. All samples analyzed since the last acceptable calibration verification must be reanalyzed.

10.7 Control Limits

Refer to SOP/ 1734.

10.8 Analytical Sequence

The analytical sequence is:

- Screening of samples for chlorine and sulfide
- Prep of amenable cyanide, if needed
- Distillation:
 - Samples
 - LCS Low
 - LCS High
 - Blank
 - Matrix Spike
 - Duplicate
- Analysis:
 - Calibration and Standardization of Lachat Instrument
 - CCV
 - CCB
 - ICV
 - ICB
 - 10 samples
 - CCV
 - CCB
 - 10 samples
 - CCV
 - CCB
 - Calculation of sample cyanide concentration

11. Method Performance

Refer to SOP/ 1732 for MDL/LOD/LOQ information. Refer to SOP/ 1734 and 1739 for DOC information.

12. Corrective Actions

Holding time exceedence and improper preservation are noted on the nonconformance report form. The analyst narrates the nonconformance when the project is turned in for review. The narration must state what the nonconformance was and any corrective action taken.

Perform routine preventative maintenance according to Section 9.6. Record all maintenance in the instrument logbook. Notify the Department Manager if the instrument problems are not routine in nature. The Department Manager determines whether the problem can be corrected with in-house technical staff or if the instrument vendor should be contacted to schedule service. All service calls are documented in the Instrument logbook, and a copy of the service report is given to the Department Manager.

Review of standards, blanks and standard response for acceptable performance occurs for each batch of samples. If any part of batch quality control does not meet acceptance criteria, the Department Manager is notified. If enough sample remains and holding time has not expired, then the batch is redistilled and reanalyzed. If there is not sufficient sample remaining to allow redistillation, then that analysis is repeated and both sets of data are reported with the nonconformance narrated on the final report.

If either the ICV, ICB, Method Blank, LCS, LCSD, CCV, or CCB recovery falls outside the designated acceptance range, the laboratory performance is judged to be out of control, and the problem must be immediately identified and corrected. The analytical result in the unspiked samples is suspect and is only reported for regulatory compliance purposes with the appropriate nonconformance action form.

Immediate corrective action for a failing CCV/CCB includes reanalyzing the failing standard. If the standard passes the second time then the analysis may be continued. The raw data is noted. If the standard fails again, the problem must be found and corrected. The CCV/CCB standard is remade and reanalyzed. If the standard passes, all samples analyzed since the previous passing standard are reanalyzed. The raw data is noted and all data associated with the failing standard must have one line drawn through the data, indicating its unusability.

If the standard fails after instrument maintenance, the instrument is recalibrated. A new ICV/ICB is performed, and all samples analyzed since the previous passing CCV/CCB are reanalyzed.

If following reanalysis of the LCS, it is found to still be outside acceptance criteria, the entire sample batch must be redistilled and reanalyzed. If the %RPD between the LCS/LCSD fails after reinjection, then the entire sample batch must be redistilled and reanalyzed.

If the Method Blank fails it is re-poured and reinjected. If failure continues, the associated sample data is evaluated as follows: Sample results below the detection limit may be reported with a narrative included. If samples have positive results, and the results are greater than 10x the concentration found in the method blank, the data may be reported with a narrative included. Any positive samples with results less than 10x the concentration found in the method blank must be redistilled and reanalyzed.

If the Matrix Spike recovery does not meet acceptance criteria, and the LCS recovery is acceptable, matrix interference may be assumed. The associated data may be reported with a narrative included.

If sample Duplicates are outside of the acceptance criteria, the analyst examines the sample for homogeneity. If the sample is not homogenous, this is narrated on the final report. Clean, homogenous samples are redistilled and reanalyzed within holding time.

Sample nonconformance regarding a Matrix Spike recovery or a duplicate %RSD is narrated on the final report along with the corrective action(s) taken.

13. Pollution Prevention

See Chemical Hygiene Plan for pollution prevention operations.

14. Waste Management

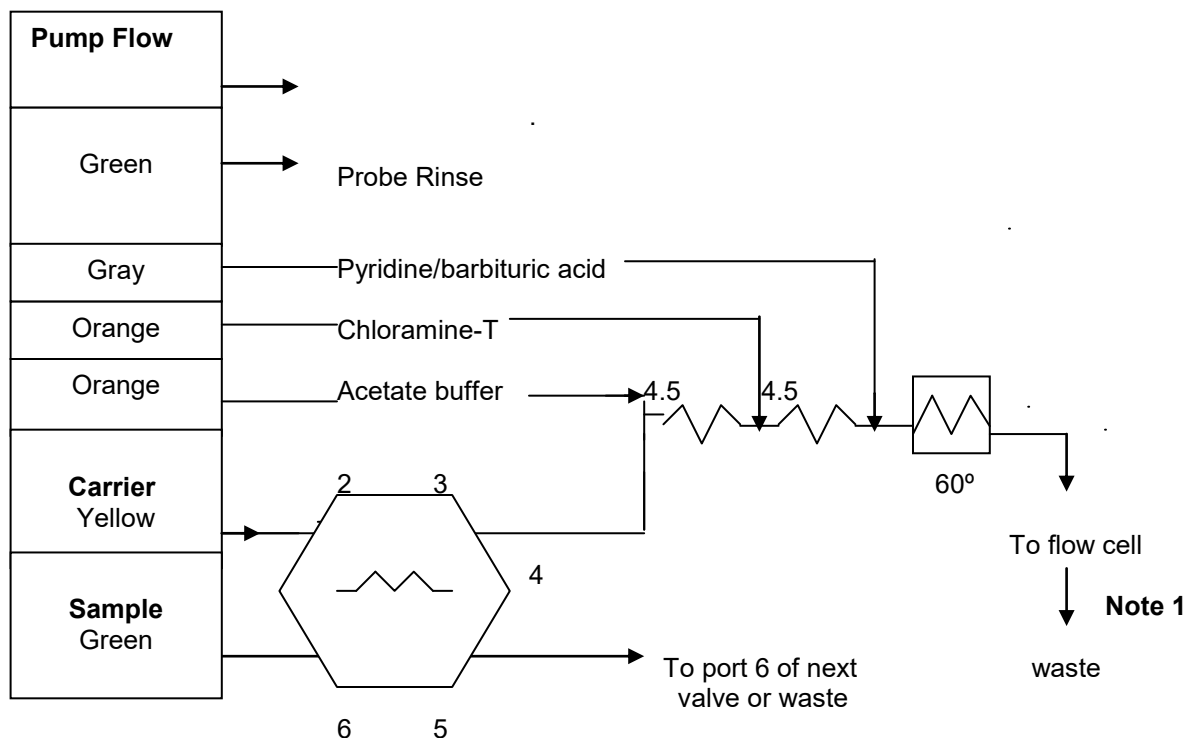
See Chemical Hygiene Plan for waste handling and disposal.

15. Attachments

TABLE 1: Cyanide Manifold Diagram

TABLE 2: Data System Parameters for QC 8000

TABLE 1
Cyanide Manifold Diagram



Sample Loop = 150cm x 0.8mm i.d. Interference Filter = 570nm
 QC8000 Sample loop = 150cm x 0.8mm i.d.

CARRIER is 0.1 N sodium hydroxide solution.

All manifold tubing is 0.8mm (0.030 in) i.d. This is 5.2µL/cm.

4.5 is 70.0cm of tubing on a 4.5cm coil support

APPARATUS: An injection valve, flow cell, a 10mm path length flow cell, and a colorimetric detector module are required.

The box  shows 650cm of tubing wrapped around the heater block at the specified temperature.

Note 1: 2 meter back pressure loop, 0.52mm i.d.

TABLE 2
Data system Parameters for QC 8000

The timing values listed below are approximate and will need to be optimized using graphical events programming.

Sample Throughput: 80 samples/hour, 45 s/sample
Pump Speed: 35
Cycle Period: 45

Analyte Data:

Concentration Units: mg CN⁻/L
Peak Base Width: 39 s
% Width Tolerance: 100
Threshold: 25000
Inject to Peak Start: 42 s
Chemistry: Direct

Calibration Data:

Levels	1	2	3	4	5	6	7	8
Concentration ug/50mL	25	10	5	2	1	0.5	0.2	0

Calibration Fit Type: 1st Order Polynomial
Calibration Rep. Handling: Replace
Weighting Method: 1/X
Concentration Scaling: None
Force Through Zero: No

Sampler Timing:

Min. Probe in Wash Period: 14 s
Probe in Sample Period: 20 s

Valve Timing:

Load Time: 0.0 s
Load Period: 20 s
Inject Period: 25 s

D

Agency Comments on Initial Versions of SAP/QAPP

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MacLeod, Steven

From: Thein, Jeff <Jeff.Thein@dep.nj.gov>
Sent: Tuesday, November 01, 2016 9:27 AM
To: MacLeod, Steven
Subject: RE: Raritan Bay Sediment Study

Hi Steve,

It is necessary to test for cyanide. We only require that you use a NJ Certified laboratory so I can't speak to the test method.

Jeff

From: MacLeod, Steven [mailto:SMacLeod@ene.com]
Sent: Monday, October 31, 2016 2:18 PM
To: Thein, Jeff
Cc: Kelly, Megan; Mochrie, Sara; Horner, Scott (Scott.Horner@williams.com)
Subject: RE: Raritan Bay Sediment Study

Hi Jeff,

Were you able to confirm if EPA Method 8270D SIM is an acceptable method for analyzing PCB congeners for this Project?

Also, please confirm whether it is necessary to test for cyanide. This analyte is included under the "metals" list in the NJDEP 1997 dredge manual appendix.

Thanks,
Steve



Steven MacLeod, *Environmental Scientist*
368 Pleasant View Drive, Lancaster, NY 14086
Office Phone: 716-684-8060 x3907 • Work Cell: 716-462-0845
smacleod@ene.com • www.ene.com

From: MacLeod, Steven
Sent: Thursday, October 27, 2016 5:22 PM
To: 'Thein, Jeff' <Jeff.Thein@dep.nj.gov>
Cc: Kelly, Megan <megan.kelly@dep.nj.gov>; Mochrie, Sara <SMochrie@ene.com>; Horner, Scott (Scott.Horner@williams.com) <Scott.Horner@williams.com>
Subject: RE: Raritan Bay Sediment Study
Importance: High

Jeff,
We would like to analyze PCB congeners using EPA method 8270D SIM. The lab we are using (Alpha Analytical) is certified in NJ to analyze PCBs as aroclors using method 8082A, and they are certified to analyze PAHs using method 8270D. However, the lab indicates that New Jersey does not offer certification for analyzing PCB congeners using the 8270D SIM method. The lab's PCB congener reporting limit using 8270D SIM is 0.8 microgram/Kg, which is below the 1 microgram/Kg PCB reporting limit listed in the NJDEP 1997 manual.

Is it acceptable to use the 8270D SIM method for PCB congener analysis? Attached in support of using this method is the lab's SOP for 8270D and results from standard reference material (SRM) tests for PCBs performed for the US Army Corps of Engineers between 2013 and 2016 – the SRM results demonstrate the range of PCB congener recoveries achieved using 8270D SIM.

Thank you,
Steve



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From: Thein, Jeff [<mailto:Jeff.Thein@dep.nj.gov>]
Sent: Wednesday, October 19, 2016 4:30 PM
To: MacLeod, Steven <SMacLeod@ene.com>
Cc: Kelly, Megan <megan.kelly@dep.nj.gov>; Mochrie, Sara <SMochrie@ene.com>; Horner, Scott (Scott.Horner@williams.com) <Scott.Horner@williams.com>
Subject: RE: Raritan Bay Sediment Study

Steve,

I don't know the testing method but we would require a NJ certified lab conduct the analysis.

The congener list is correct.

Jeff

From: MacLeod, Steven [<mailto:SMacLeod@ene.com>]
Sent: Wednesday, October 19, 2016 10:43 AM
To: Thein, Jeff
Cc: Kelly, Megan; Mochrie, Sara; Horner, Scott (Scott.Horner@williams.com)
Subject: RE: Raritan Bay Sediment Study

Jeff,
Extending on my question from yesterday, can you also clarify what set of PCB congeners should be tested?
The 1997 NJDEP manual says "These congener specific results will be converted to a total PCB value by multiplying the sum of the 22 individual congeners by a factor of 2..."
We note that the following 22 PCB congeners are identified in an example sample list in the attached USACE/EPA Regional Testing Manual.
Are these the congeners that NJDEP would like reported?
Congener nos. 8, 18, 28, 44, 49, 52, 66, 87, 101, 105, 118, 128, 138, 153, 170, 180, 183, 184, 187, 195, 206, 209

Thanks again,
Steve
716-684-8060 (office)
716-462-0845 (cell)

From: MacLeod, Steven
Sent: Tuesday, October 18, 2016 7:53 AM
To: 'Thein, Jeff' <Jeff.Thein@dep.nj.gov>
Cc: 'Kelly, Megan' <megan.kelly@dep.nj.gov>; Mochrie, Sara <SMochrie@ene.com>; 'Horner, Scott

(Scott.Horner@williams.com)' <Scott.Horner@williams.com>

Subject: RE: Raritan Bay Sediment Study

Hi Jeff,

The 1997 manual says "the Department will require congener specific based analysis for PCBs using the Sloan method, NOAA Technical Memorandum NOS ORCA-71 or its equivalent. This is the same methodology that the USEPA employs..."

This appears outdated. Does NJDEP have a currently preferred (or required) PCB testing method? Perhaps EPA Method 8082A (SW-846)?

Thanks,
Steve



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From: MacLeod, Steven

Sent: Friday, October 14, 2016 5:04 PM

To: 'Thein, Jeff' <Jeff.Thein@dep.nj.gov>

Cc: Kelly, Megan <megan.kelly@dep.nj.gov>; Mochrie, Sara <SMochrie@ene.com>; Horner, Scott

(<Scott.Horner@williams.com>) <Scott.Horner@williams.com>

Subject: RE: Raritan Bay Sediment Study

Jeff,
Thanks for the quick response earlier this week.
Based on your feedback, we will proceed with our current sampling approach to test the vibracores in roughly 3-foot sections. Sediment that extends at least 6 inches deeper than the proposed trench depth will be tested as part of a 3-foot section in each vibracore.

Regards,
Steve



Steven MacLeod, *Environmental Scientist*

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From: Thein, Jeff [<mailto:Jeff.Thein@dep.nj.gov>]

Sent: Wednesday, October 12, 2016 9:24 AM

To: MacLeod, Steven <SMacLeod@ene.com>

Cc: Kelly, Megan <megan.kelly@dep.nj.gov>; Mochrie, Sara <SMochrie@ene.com>; Horner, Scott

(<Scott.Horner@williams.com>) <Scott.Horner@williams.com>

Subject: RE: Raritan Bay Sediment Study

Steve,

- VOC testing would not be required.

- Congener analysis would be appropriate for sub sea plow or jet-sled as the material is kept on the sea floor and is therefore a concern for aquatic species
- Sampling is not required for any samples that have greater than 90% sand
- Samples should be taken to the proposed depth. Due to inaccuracies in dredging, we can allow a 1 to 2 feet of overdredge so the vibracore sample should be the project depth plus your projected overdredge, if any.
- While the trench is proposed to be backfilled with clean material, the material pushed out to create the trench would still be exposed, correct? If material removed from the trench will be exposed, the bottom 6 inches from the cores shall be sampled.

Jeff

From: MacLeod, Steven [<mailto:SMacLeod@ene.com>]
Sent: Tuesday, October 11, 2016 6:10 PM
To: Thein, Jeff
Cc: Kelly, Megan; Mochrie, Sara; Horner, Scott (Scott.Horner@williams.com)
Subject: FW: Raritan Bay Sediment Study
Importance: High

Jeff,

Thank you for the feedback. Please clarify the following points:

- Attachment 1 of Appendix B references a large number of volatiles. However, the text of the introduction language of Appendix B says “the volatile organic compounds list... will be required on a case by case basis” (Section a on Page 92 of 124). **Please verify whether testing for the entire list of VOCs is required along all portions of the route in NJ waters** (i.e., both near the Morgan shoreline and the area near Ambrose channel north of Sandy Hook).
- Attachment 1 of Appendix B identifies Aroclor testing, but the introduction language of Appendix B says congener analyses will be required instead for in-water placement (i.e., “where aquatic species impacts are a concern”) (Section b on Page 92 of 124). **Please confirm that aroclor testing (rather than congener analysis) is acceptable in areas where a subsea plow and/or jet-sled might be used.** We will plan to perform congener analysis for any areas where clamshell dredging may occur, regardless of the ultimate placement/disposal site.
- Appendix C (Dredging material data form) suggests that (chemistry) testing is not required for samples with greater than 90% sand (i.e., grain size diameter >0.0625 mm). **Please confirm that this exception applies.**
- The current sampling plan calls for chemical analysis of vibracore sections 3 feet in length (or less) partly to ensure sufficient sample volume for all analyses. The depth of vibracores will extend at least 2 feet below the max proposed dredge depth. We feel this satisfies your office’s requirement for testing material 6-inches below the anticipated trench depth. **Please confirm that the proposed sampling depths/intervals are acceptable.** *(Note that once installed, the pipe/trench would be backfilled with clean, compatible material, such that the trench bottom and side-walls would only temporarily be exposed to the water column.)*

If you like, we would be happy to discuss any of these issues by phone. Your prompt reply would be greatly appreciated to facilitate the commencement of sampling and testing this month.

Sincerely,
 Steve



Steven MacLeod, *Environmental Scientist*

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From: Thein, Jeff [<mailto:Jeff.Thein@dep.nj.gov>]

Sent: Tuesday, October 11, 2016 3:32 PM

To: MacLeod, Steven <SMacLeod@ene.com>

Subject: Raritan Bay Sediment Study

Hi Steve, I'm with the Office of Dredging and Sediment Technology and with respect to the sampling that would be required for the proposed project, please note that we are still evaluating whether we would allow re-profiling for pipe placement. The use of a clamshell bucket to remove material and place adjacent to the trench is not an approach that we've allowed. In the event that we approved some type of plowing operation, we would require bulk sediment chemistry testing on the parameters listed in Attachment 1 & 2 in Appendix B of the attached Technical Manual. In addition to sampling cores taken to the project depth, our office would also require the bottom 6 inches of each core to be sampled as that bottom 6 inches is representative to the material that will be exposed by the trenching.

Jeff

MacLeod, Steven

From: Thein, Jeff <Jeff.Thein@dep.nj.gov>
Sent: Tuesday, January 03, 2017 2:43 PM
To: MacLeod, Steven
Subject: RE: NESE Project Sediment Study Reporting

Categories: Agency Communication

Hi Steve,

DVD with excel spreadsheets is fine.

Jeff

From: MacLeod, Steven [mailto:SMacLeod@ene.com]
Sent: Tuesday, January 03, 2017 2:22 PM
To: Thein, Jeff
Cc: Kelly, Megan; Foster, Ruth; Clements, Blake; Martinez, Chris; Winston, Webb; Mochrie, Sara
Subject: NESE Project Sediment Study Reporting

Hello Jeff,

Transco completed its offshore sediment sampling effort for the Northeast Supply Enhancement Project on December 20th. The geotechnical, benthic, and chemical labs will be processing the samples over the next several weeks. We plan to submit a combined environmental sampling report to NJDEP with results of the sampling effort.

Does NJDEP have a preferred format for submittal of the bulk sediment chemistry lab data, which would be an appendix to the combined sampling report (e.g., DVD with PDF tables and/or Excel spreadsheets)?

Thank you,
Steve



ecology and environment, inc.

Steven MacLeod, *Environmental Scientist*
368 Pleasant View Drive, Lancaster, NY 14086
Office Phone: 716-684-8060 x3907 • Work Cell: 716-462-0845
smacleod@ene.com • www.ene.com

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Division of Environmental Permits & Pollution Prevention
625 Broadway, 4th Floor, Albany, New York 12233-1750
P: (518) 402-9167 | F: (518) 402-9168 | deppermitting@dec.ny.gov
www.dec.ny.gov

October 5, 2016

Timothy Powell
Transcontinental Gas Pipeline Company, LLC
2800 Post Oak Boulevard
Houston, Texas 77056

RE: Northeast Supply Enhancement Project; Raritan Bay and Lower New York Bay Sediment Study

Dear Mr. Powell:

This is in response to the submission on behalf of Transcontinental Gas Pipeline Company, LLC (Transco) from Sara Mochrie, Ecology and Environment (E&E), dated July 29, 2016 regarding the above referenced application. The submission was a response to the Notice of Incomplete Application issued by the New York State Department of Environmental Conservation (DEC) on June 2, 2016. The most recent submission included four attachments, including revised study area figures that show the new proposed route for the project.

New Proposed Route

As indicated in the conference call on August 24, 2016 with Transco and E&E representatives, DEC staff has significant concerns regarding the new proposed route, specifically miles 2-8. The original route proposed by Transco, which closely paralleled the NY/NJ state line through Raritan Bay, did not require any special provisions for either surfclams or hard clams. The new route, however, takes a significant jog north between mile 2 (about the NY/NJ line) and mile 8 (south of Great Kills Harbor/Crookes Point). This area is the most productive hard clam area in NY's portion of Raritan Bay and has been the area of an intensive shellfish transplant harvest program (not currently active, but likely to be revived in the future). It is also the site of DEC's hard clam



Department of
Environmental
Conservation

sampling for QPX (quahog parasite unknown). Transco has advised DEC that the proposed route change was primarily the result of consultation with the U.S. Coast Guard and Harbor Operations regarding anchorage areas in the New York Harbor area.

During the August 24th conference call DEC agreed to provide Transco with additional technical information related to the abundance of hard clams in the proposed project area. DEC also suggested during the call that Transco review this new resource information and determine if the route can be relocated to avoid or minimize the natural resource impacts identified by the DEC. (DEC provided the technical information on August 26, 2016).

On September 28, 2016, DEC staff met again with Transco regarding the new proposed route. During this meeting Transco took the opportunity to present the information (illustrated in a project map) that resulted in selecting the new proposed route. Transco also stated that the various competing resources illustrated in the project map provided little opportunity for any other significant route changes to avoid the hard shell clam area in New York.

Sediment and Benthic Sampling

DEC is aware that Transco wants to commence sediment and benthic sampling in the near term to take advantage of favorable ocean and weather conditions. Transco has indicated that this information is needed in order for it to analyze the new proposed route, both from an environmental and technical standpoint. As currently proposed, the sampling activity qualifies for coverage under DEC's statewide Water Quality Certificate because the test trench excavation originally proposed in the application has been eliminated. As such, an individual DEC approval is not required. However, Transco is seeking initial DEC concurrence regarding the new proposed route in order to avoid expending valuable resources sampling multiple routes.

Given the fact that the project is still only in the pre-application stage of the FERC review process and that an environmental analysis has yet to be completed on the project DEC cannot provide its concurrence on the new proposed route. At this time, DEC can only suggest that if Transcontinental Pipeline undertakes the sediment and benthic sampling along the new proposed route that it revise its sampling plan to include the whole area identified as "Special Permit Harvest Area".

This additional information will ultimately allow the Federal Energy Regulatory Commission, in its environmental review, to examine alternative routes that potentially avoid or minimize impacts to this important resource area. This information will also allow the DEC to more effectively review the new proposed route and any alternatives.

The DEC reserves its right to provide additional comments regarding the route and any alternatives upon review of the sediment and benthic sampling.

Thank you for the opportunity to comment on the Sediment and Benthic Sampling plan. If you have any questions regarding the above comments please contact me.

Sincerely,



Christopher M. Hogan
Deputy, Chief Permit Administrator

Cc: C. DeQuillfeldt
D. Barnes
K. Woodfield
D. English
S. Mochrie
S. McCleod
W. Little

MacLeod, Steven

From: Hogan, Chris M (DEC) <chris.hogan@dec.ny.gov>
Sent: Wednesday, September 07, 2016 1:24 PM
To: MacLeod, Steven
Cc: Mochrie, Sara
Subject: RE: Transco Raritan Bay and Lower NY Bay Sediment Study

Categories: Agency Communication

As indicated in the meeting last week the DEC has significant concerns regarding the new proposed route. The DEC realizes that Williams is seeking to mobilize the sediment sampling operations soon, but it does not make much sense to conduct surveys on a route that may ultimately change. Staff met internally this morning to discuss the project. I am revising the DEC letter to reflect what we discussed. In summary, DEC staff believe that Williams should propose additional alternatives based on the new surf calm population data provided by DEC. In addition, the alternative of utilizing the originally proposed route should be explored by either; 1) installing the line to the depth required by the ACOE; or 2) getting the ACOE to agree to a lesser depth.

Below are the DEC's comments on the sampling plan that will also be incorporated into the letter. The Department does not recommend Williams undertaking the sampling along the route as it is currently proposed until further discussion of alternatives can take place. The Department is willing to meet again in person but Williams must come to the meeting prepared with the information discussed above.

Sampling Plan Comments

Below are DEC staff's comments regarding the Sampling Plan;

1. Sediment core samples should be collected to the depth of disturbance for cable/pipeline installations and not to two feet below the bottom of the potential trench (as listed on page 28.)
2. Dividing each core sample into 3 foot increments, as proposed on page 36, is acceptable to NYSDEC. If any changes are made at the time of sampling NYSDEC should be notified and consulted.
3. Provide the total area of the offshore study area and an estimate of the total offshore area that will ultimately be disturbed by the project.
4. New York State requires all samples collected in NY to be analyzed by a NYSDOH ELAP certified lab.
5. On the table the sample sites should be labeled the same as they are on the sample location map. VCA6 vs VC6.
6. Provide information regarding the steepest angle (vertical:horizontal ratio) that the pipe can be laid to get underneath the deep navigation channels like the West Reach, Chapel Hill South Channel, and Ambrose Channel. It is likely that the pipe will have to be laid deeper when approaching and leaving these channels so the cores should be deeper as well to categorize the sediment that will be disturbed.
7. Provide information regarding the total area of the corridor? This information is helpful for evaluating the appropriate number of samples. Update details regarding the length of the new route, the exact length in New York and confirm whether the study area is still 5000 feet.

From: MacLeod, Steven [mailto:SMacLeod@ene.com]
Sent: Tuesday, August 30, 2016 6:07 PM
To: Hogan, Chris M (DEC) <chris.hogan@dec.ny.gov>
Cc: SMochrie@ene.com
Subject: RE: Transco Raritan Bay and Lower NY Bay Sediment Study

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Hi Chris, Any update on when we can get those SAP/QAPP comments? I know NYSDEC staff mentioned they were minor, but we have limited time left to review and incorporate them prior to contractor mobilization.

Thank you,
Steve



Steven MacLeod, *Environmental Scientist*
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From: Hogan, Chris M (DEC) [mailto:chris.hogan@dec.ny.gov]
Sent: Tuesday, August 23, 2016 9:55 AM
To: MacLeod, Steven <SMacLeod@ene.com>
Cc: Mochrie, Sara <SMochrie@ene.com>
Subject: RE: Transco Raritan Bay and Lower NY Bay Sediment Study

I was out yesterday. I can revise the comments and get them to you. However, Marine Resources has identified significant issues with the new route. Specifically, with miles 2-8. I think it would make sense to have a conference call to discuss before Williams proceeds with sampling. It does not make much sense to sample for an area where the DEC may have objections.

From: MacLeod, Steven [mailto:SMacLeod@ene.com]
Sent: Friday, August 19, 2016 11:04 AM
To: Hogan, Chris M (DEC) <chris.hogan@dec.ny.gov>
Cc: SMochrie@ene.com
Subject: RE: Transco Raritan Bay and Lower NY Bay Sediment Study

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Hi Chris,
Could you provided an updated estimate on when NYSDEC will be able to provide comments on the sampling plan? Do you wish to discuss any aspects of the plan before providing the written comments?

Thank you,
Steve



Steven MacLeod, *Environmental Scientist*
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smacleod@ene.com • www.ene.com

From: Hogan, Chris M (DEC) [<mailto:chris.hogan@dec.ny.gov>]
Sent: Monday, August 15, 2016 9:10 AM
To: MacLeod, Steven <SMacLeod@ene.com>
Cc: Mochrie, Sara <SMochrie@ene.com>
Subject: RE: Transco Raritan Bay and Lower NY Bay Sediment Study

I have a conference call with staff tomorrow. DOW has prepared comments regarding the sediment sampling portion of the plan. However, the plan was also sent to the DEC's dredge team and they commenced their own review. The purpose of the meeting is to coordinate the two efforts. Because this is not a dredge project my intent was for Karen and Diane to take the lead. I need to get everyone on the same page. I will be able to send the comments to you tomorrow PM after that meeting.

Charlie has been on vacation so I do not have comments on the benthic monitoring plan. I may have to get comments to you on that portion of the document later. I assume the benthic plan is consistent with the Rockaway Lateral plan.

From: MacLeod, Steven [<mailto:SMacLeod@ene.com>]
Sent: Friday, August 12, 2016 5:02 PM
To: Hogan, Chris M (DEC) <chris.hogan@dec.ny.gov>
Cc: SMochrie@ene.com
Subject: RE: Transco Raritan Bay and Lower NY Bay Sediment Study

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Chris,
I just realized that I have recently sent messages to your older e-mail address (cmhogan@gw.dec.state.ny.us). I did not receive any return-replies, but please let me know if these messages are not automatically forwarded and I will re-transmit. My apologies for any inconvenience.

Have a good weekend.

-Steve

From: MacLeod, Steven
Sent: Thursday, August 11, 2016 1:48 PM
To: Chris Hogan (cmhogan@gw.dec.state.ny.us) <cmhogan@gw.dec.state.ny.us>
Cc: Mochrie, Sara (SMochrie@ene.com) <SMochrie@ene.com>
Subject: RE: Transco Raritan Bay and Lower NY Bay Sediment Study

Hi Chris,
Could you tell us when we can expect to receive NYSDEC comments on the Sampling and Analysis Plan/QAPP for the Northeast Supply Enhancement Project offshore sediment study?

Thank you,
Steve



Steven MacLeod, *Environmental Scientist*
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From: MacLeod, Steven

Sent: Friday, July 29, 2016 8:35 PM

To: Chris Hogan (cmhogan@gw.dec.state.ny.us) <cmhogan@gw.dec.state.ny.us>

Cc: deQuillfeldt, Charles (charles.dequillfeldt@dec.ny.gov) <charles.dequillfeldt@dec.ny.gov>; Horner, Scott (Scott.Horner@williams.com) <Scott.Horner@williams.com>; Gavelek, Jim (Jim.Gavelek@Williams.com) <Jim.Gavelek@Williams.com>; 'Martinez, Chris' <Chris.Martinez@williams.com>; Clements, Blake <Blake.Clements@williams.com>; Kellogg, Stephen (Stephen.Kellogg@Williams.com) <Stephen.Kellogg@Williams.com>; Maraglio, Matthew (DOS) (Matthew.Maraglio@dos.ny.gov) <Matthew.Maraglio@dos.ny.gov>; 'CR@dos.ny.gov' <CR@dos.ny.gov>; Fronckowiak, Megan L. (MFronckowiak@ene.com) <MFronckowiak@ene.com>; Mochrie, Sara (SMochrie@ene.com) <SMochrie@ene.com>; 'Naomi Handell' (Naomi.J.Handell@usace.army.mil) <Naomi.J.Handell@usace.army.mil>; 'dawn.mcreynolds@dec.ny.gov' <dawn.mcreynolds@dec.ny.gov>; karen.woodfield@dec.ny.gov; diane.english@dec.ny.gov; katie.axt@dec.ny.gov

Subject: Transco Raritan Bay and Lower NY Bay Sediment Study

Mr. Hogan,

Please find attached a response to the 2nd NOIA issued by NYSDEC on June 2, 2016 regarding the sediment sampling activities associated with Transco's Northeast Supply Enhancement Project.

A hard copy of this document will be sent to your office early next week.

Sincerely,
Steve



Steven MacLeod, *Environmental Scientist*

368 Pleasant View Drive, Lancaster, NY 14086

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MacLeod, Steven

From: Barnes, Debra (DEC) <debra.barnes@dec.ny.gov>
Sent: Friday, October 14, 2016 8:47 AM
To: MacLeod, Steven
Cc: Carden, Wade E (DEC); Horner, Scott (Scott.Horner@williams.com); Mochrie, Sara; Fronckowiak, Megan L.
Subject: RE: NESE benthic sampling
Categories: Agency Communication

Steve,

Your email accurately captures our telephone conversation regarding benthic sampling in Raritan Bay. After the sampling has been completed, we can determine if any further site specific sampling would be needed to quantify the population distribution of hard clams along the proposed project route.

Thank you.

Debbie

From: MacLeod, Steven [mailto:SMacLeod@ene.com]
Sent: Thursday, October 13, 2016 5:34 PM
To: Barnes, Debra (DEC) <debra.barnes@dec.ny.gov>
Cc: Carden, Wade E (DEC) <wade.carden@dec.ny.gov>; Horner, Scott (Scott.Horner@williams.com) <Scott.Horner@williams.com>; SMochrie@ene.com; Fronckowiak, Megan L. <MFronckowiak@ene.com>
Subject: NESE benthic sampling

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Hi Debbie,

Expanding on the Sampling and Analysis Plan (SAP/QAPP v0.2) for the Northeast Supply Enhancement (NESE) Project, Transco may collect additional sediment samples in the NY waters near Staten Island that have previously been part of NYSDC's hard clam transplantation program.

Per our conversation last Friday (10/7), You indicated that sediment grab samples (Smith-Mcintyre or equivalent) would be sufficient for providing a general comparison of shellfish densities along different NESE Project route alternatives through this special-permit harvest area.

You noted that the type of hydraulic clam dredge survey conducted by NJDEP is more robust than surface sediment grab samples, accounting for patchiness of shellfish beds, but you suggested that we just stick with the grab method proposed in the SAP/QAPP at this stage.

Please confirm that this accurately reflects your input on the matter.

Thanks,
Steve



Steven MacLeod, *Environmental Scientist*

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MacLeod, Steven

From: Hogan, Chris M (DEC) <chris.hogan@dec.ny.gov>
Sent: Thursday, November 10, 2016 3:18 PM
To: MacLeod, Steven
Subject: RE: Transco Sediment Study Update (USACE File No. NAN-2016-00908-EHA)

Categories: Agency Communication

Steve- Below our the comments from our Sediment Management Unit in DOW.

We have reviewed the proposed Enclosure 3 NESE SAP Test Tables and have the following comments. No sites in NY should have analyses only for the 22 PCB congeners unless the results will be multiplied by 2. It would be preferable if sites in NY waters are analyzed for PCB aroclors as well as the 22 congeners. All the metals analyzed by method 6010 b (which includes all the metals listed below) should also be reported in NY. In addition, some sediment at each NY sample location should be archived for future dioxin/furan analysis if necessary.

In the E+E letter dated September 20, 2016, which was a response to our comment letter, is an incorrect interpretation of our comment. Our comment stated that sediment core samples should be collected to the depth of disturbance for the cable/pipeline installations and not to two feet below the bottom of the potential trench. The Response was:

Response: We conservatively interpret this statement to mean **vibracore samples should be collected at least two feet below the bottom of the potential trench** or to the maximum depth of disturbance, whichever is greater. Transco will collect vibracore samples to depths that sufficiently reflect the maximum anticipated depth of disturbance. These sample depths are reflected in Appendix B, Tables 1 and 2 of the SAP/QAPP, except that the vibracore depths at the anticipated HDD entry/exit points (VC 1, VC 54 and VC 55) will be increased from 12 feet to 20 feet.

The goal of our comment is to assure that the collected samples accurately define the material to be disturbed and to preclude potentially diluting any results with underlying glacial till or non-contaminated material. Therefore, core samples should only be collected to a depth that will characterize the material to be disturbed and not two feet below the bottom of the potential trench - unless that material two feet below will definitely be disturbed by the installation. The sampling plan proposed to divide each core into three foot increments (page 36) which should be acceptable for defining the material. However, to reiterate our original comment on the plan, if there is any deviation from this proposed segmentation of the cores, DEC must be notified and consulted first. Based on the approved plan each core will be segmented and no core will be completely homogenized

Aluminum
Antimony
Arsenic
Barium
Beryllium
Boron
Cadmium
Calcium
Chromium
Cobalt
Copper
Iron

Lead
Lithium
Magnesium
Manganese
Mercury
Molybdenum
Nickel
Phosphorus
Potassium
Selenium
Silica (SiO)
Silver
Sodium
Strontium
Thallium
Tin
Titanium
Vanadium
Zinc

From: MacLeod, Steven [mailto:SMacLeod@ene.com]

Sent: Friday, November 04, 2016 8:39 PM

To: 'Naomi Handell' (Naomi.J.Handell@usace.army.mil) <Naomi.J.Handell@usace.army.mil>; Hogan, Chris M (DEC) <chris.hogan@dec.ny.gov>; Maraglio, Matthew (DOS) <Matthew.Maraglio@dos.ny.gov>; Allan Zaretsky (DCP) <AZARETSKY@planning.nyc.gov>

Cc: Mendez, Rosa E (DOS) <Rosa.Mendez@dos.ny.gov>; deQuillfeldt, Charles none (DEC) <charles.dequillfeldt@dec.ny.gov>; Barnes, Debra (DEC) <debra.barnes@dec.ny.gov>; MMarrel@planning.nyc.gov; Woodfield, Karen (DEC) <karen.woodfield@dec.ny.gov>; English, Diane M (DEC) <diane.english@dec.ny.gov>; Horner, Scott (Scott.Horner@williams.com) <Scott.Horner@williams.com>; Clements, Blake <Blake.Clements@williams.com>; SMochrie@ene.com; Eakin, Megan <MEakin@ene.com>; Martinez, Chris <Chris.Martinez@williams.com>

Subject: Transco Sediment Study Update (USACE File No. NAN-2016-00908-EHA)

ATTENTION: This email came from an external source. Do not open attachments or click on links from unknown senders or unexpected emails.

Greetings,

This message is a courtesy update on the offshore sediment study that Transco is conducting in support of the Northeast Supply Enhancement Project. Several sample site coordinates in New York and New Jersey have been adjusted since July to account for further engineering design analysis and the results of Phase I underwater archaeological surveys for all sample sites. The current sample sites are identified in the attached tables (Enclosure 1) and figures (Enclosure 2), which are revisions to the tables and figures that were submitted on July 29, 2016. Transco began collecting core boring samples in New Jersey waters in early October; Transco is awaiting additional New Jersey agency approval and suitable weather windows to complete the core boring activities. Transco anticipates collecting vibracore samples starting November 14th, or soon thereafter.

In addition to adjustments to previous site coordinates, new sites have been added. In particular, Transco has added vibracore sample sites VC70 through VC87 (in New York waters). These sites were added in response to a request from the New York State Department of Environmental Conservation (Bureau of Marine Resources) to consider an alternative to the currently preferred route. Further, Transco has determined that up to five additional core borings may be necessary in or near Ambrose Channel (in New Jersey waters) to fully inform the HDD engineering analysis. These potential core boring sites are identified as BHA 21 through BHA 25-ALT in the attached table and drawings.

The historic preservation offices (HPO) in New York and New Jersey have been notified of the Phase I archaeological survey results, and concurrence has been obtained as necessary.

Please note that since July 2016 Transco has also adjusted the list of sediment chemistry analyses that will be performed at vibracoring sites. These adjustments were made to account for guidance from the New Jersey Department of Environmental Protection (Office of Dredging and Sediment Technology) and information in the April 2016 U.S. Army Corps of Engineers (New York District) document titled *Guidance for Performing Tests on Dredged Material Proposed for Ocean Disposal*. Attached are two tables listing the currently planned chemical analyses; the applicable vibracore sample sites are listed at the top of each table (Enclosure 3).

Please feel free to contact me or Sara Mochrie at 716-684-8060 if you have any questions about this message.

Sincerely,
Steve MacLeod



Steven MacLeod, *Environmental Scientist*

368 Pleasant View Drive, Lancaster, NY 14086

Office Phone: 716-684-8060 x3907 • Work Cell: 716-462-0845

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MacLeod, Steven

From: Hogan, Chris M (DEC) <chris.hogan@dec.ny.gov>
Sent: Tuesday, November 15, 2016 9:07 AM
To: MacLeod, Steven; Mochrie, Sara
Subject: Responses

Categories: Agency Communication

See responses. Sorry for the delay.

1. In NY waters where clamshell dredging will not occur, we plan to collect one sample per vibracore from the 3-foot interval where dioxins are most likely be present, as determined by the onboard geologist. Samples with substantial silt/clay content will be analyzed immediately for dioxins, while samples with little or no silt/clay will be archived. *If you meant for us to archive a dioxin sample for each 3-foot vibracore interval (e.g., 4 samples for each 12-ft vibracore), please advise.* Please archive a sample from each segment. If there is high dioxin found in the part of the core that is analyzed, the archived segments can then be analyzed to determine the extent of the contamination. If nothing shows up in the first analysis, the archived segments can be discarded.
2. We assume that you want the dioxin sample archived approximately 4 to 6 months - long enough for NYSDEC to receive and review the other sediment chemistry results, and determine if the follow-up dioxin testing is warranted. *If you had a different time period in mind, please advise.* We agree with the proposed timeframe and the rationale behind it.
3. We intend to test for metals using method 6020A rather than 6010C (the latest update to method 6010B). We understand that 6020A is better at detecting certain analytes in marine sediment that are subject to interference by 6010B/C. *If NYSDEC prefers 6010C, please explain the reason.* Method 6020A is acceptable.
4. We propose to exclude the following four analytes from the "metals" list that you provided because they are problematic:
Boron, Lithium, Phosphorous, and Silica.
In particular, the laboratory currently under contract is not certified in New York to analyze these four analytes using method 6010C. Further, it does not appear there are any ecological screening criteria in New York State for these analytes. *Please advise if (and how) these analytes are critical to NYSDEC evaluation of the Project.* We agree that boron, lithium, phosphorous, and silica can be deleted from the list of analytes.

Christopher M. Hogan
Chief, Major Project Management Unit
Department of Environmental Conservation
Division of Environmental Permits
625 Broadway, 4th Floor
Albany, NY 12233-1750
(518) 402-9151
chris.hogan@dec.ny.gov

E

Complete Sediment Chemistry Data Tables and Grain Size Curves

This appendix is provided separately on DVD.

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F

Sediment Chemistry Laboratory Reports

This appendix is provided separately on DVD.

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Complete Water Quality Data Tables

This appendix is provided separately on DVD.

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Benthic Laboratory Results

This appendix is provided separately on DVD.

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Data Usability Summary Reports

This appendix is provided separately on DVD.

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J

Grain Size Curves

This appendix is provided separately on DVD.

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TRANSCONTINENTAL GAS PIPE LINE COMPANY, LLC

APPENDIX D-2 – ERRATA AND ADDENDUM

NORTHEAST SUPPLY ENHANCEMENT PROJECT

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**Fall/Winter 2016 Offshore
Environmental Sampling Report
for the Northeast Supply Enhancement
Project**

NEW JERSEY, NEW YORK

Errata Sheets

August 2017

Prepared for:

Transcontinental Gas Pipe Line Company, LLC

Prepared by:

ECOLOGY AND ENVIRONMENT, INC.

368 Pleasant View Drive
Lancaster, New York 14086

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1

Introduction

Transcontinental Gas Pipe Line Company, LLC. (Transco), an indirect wholly owned subsidiary of Williams Partners L.P. (Williams), is proposing the Northeast Supply Enhancement (NESE) Project (Project) to expand its existing interstate natural gas pipeline system in Pennsylvania and New Jersey and its existing offshore natural gas pipeline system in New Jersey and New York waters. The Project capacity is fully subscribed by two entities of National Grid: Brooklyn Union Gas Company (d/b/a [doing business as] National Grid NY) and KeySpan Gas East Corporation (d/b/a National Grid), collectively referred to herein as “National Grid.”

To provide the incremental 400,000 dekatherms per day (Dth/d) of capacity, Transco plans to expand portions of its system from the existing Compressor Station 195 in York County, Pennsylvania, to the Rockaway Transfer Point in New York State waters. As defined in executed precedent agreements with National Grid, the Rockaway Transfer Point is the interconnection point between Transco’s existing Lower New York Bay Lateral (LNYBL) and existing offshore Rockaway Delivery Lateral (RDL).

Transco filed its application for a Certificate of Public Convenience and Necessity with the Federal Energy Regulatory Commission (FERC) on March 27, 2017 (Certificate Application), and FERC assigned the Project Docket No. CP17-101. On June 27, 2017, Transco submitted its Offshore Environmental Sampling Report as Appendix J of Transco’s Joint Permit Application to the U.S. Army Corp of Engineers (USACE) and New York State Department of Environmental Conservation. Transco submitted its Offshore Environmental Sampling Report to FERC on June 30, 2017.

The following information consists of corrections to information initially presented in the Offshore Environmental Sampling Report. Please refer to the Offshore Environmental Sampling Report for the unchanged information. All revised information is listed in **red bold text** and removed features marked as ~~strike through text~~. The following items have corrections and are included in this document:

- Text for pesticides in Group B;
- Text for PCB Aroclors along the Alternative Route;



- Figures A-6, A-7, A-8, A-17, and A-18; and
- Tables B-5 and B-10.

2

Sediment Chemistry Results

2.3.2 Group B – New York, Page 1-10

Pesticides

Possible Clamshell Dredge Sample Sites

Of the pesticides tested for in samples from sample sites where clamshell dredging may occur, 12 have available Class A and/or Class C thresholds. A total of 8 pesticides (aldrin, endosulfan sulfate, endrin, O,P'-DDD, O,P'-DDE, P,P'-DDD, P,P'-DDE, and P,P'-DDT) were detected in at least one sample in Group B. (See Table B-7 for a list of the sample sites where pesticides were detected.) Of the detected pesticides, only endrin and the sum of DDT + DDE + DDD have available Class A and Class C thresholds, and only the sum of DDT + DDE + DDD exceeded the Class A threshold. The sum of DDT + DDE + DDD exceeded the Class A threshold in the 0- to 3-foot samples at VC6 and VC7; all samples from VC16 and VC17; and 0- to 3 foot **and 3- to 6 foot** sample at VC41-ALT. Concentrations that exceeded the Class A threshold ranged from ~~8.6~~ **3.9** µg/kg to 99.0 µg/kg.

2.3.5 Alternative Route, Page 1-21

Polychlorinated Biphenyls (PCBs)

Non-Clamshell Dredge Sample Sites

Three Aroclor compounds (Aroclor 1016, Aroclor 1254, and Aroclor 1260) were detected in at least one sample from the alternative route (see Table 2-11 for the sample sites where PCBs were detected). Class A thresholds were exceeded only for the sum of Aroclor compounds in the following samples: 0- to 3 feet at VC70 and VC76 ~~and 9- to 12 feet at VC73 and VC74~~. Concentrations that exceeded the Class A threshold ranged from 300 µg/kg to 554 µg/kg.

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Tables

Table B-5 Sample Sites and Samples in Group A Exceeding ER-L and/or ER-M Thresholds for Metals

Analyte	Concentrations that Exceeded Thresholds		Sample Site	Sample Depth(s)*
	Exceeded ER-L (mg/kg)	Exceeded ER-M (mg/kg)		
Arsenic	8.37-108 66.6	N/A 98.7-108.0	VC1-ALT	0-3 ft, 3-6 ft , 6-9 ft, 9-12 ft, 12-15 ft, 15-16 ft
			VC1B-ALT	0-3 ft, 3-6 ft , 6-9 ft, 9-12 ft, 12-15 ft
			VC2	0-3 ft, 6-9 ft
			VC3-ALT	0-3 ft, 3-6 ft, 6-9 ft, 9-10.5 ft
			VC4	0-3 ft, 3-6 ft, 6-9 ft, 9-12 ft
Barium	--	82.5-135	VC1-ALT	0-3 ft, 3-6 ft
			VC1B-ALT	0-3 ft, 3-6 ft
Cadmium	1.62-2.36	N/A	VC1-ALT	0-3 ft, 3-6 ft
			VC1B-ALT	0-3 ft, 3-6 ft
Chromium	97.6-145	N/A	VC1-ALT	0-3 ft, 3-6 ft
			VC1B-ALT	0-3 ft, 3-6 ft
Cobalt	--	10.1-11.6	VC1-ALT	3-6 ft, 12-15 ft, 15-16 ft
			VC1B-ALT	12-15 ft
			VC3-ALT	3-6 ft, 6-9 ft, 9-10.5 ft
			VC4	0-3 ft, 3-6 ft
Copper	237-504 256.0	N/A 307.0-504.0	VC1-ALT	0-3 ft , 3-6 ft
			VC1B-ALT	0-3 ft , 3-6 ft
Lead	47.4-235 214.0	N/A 235.0	VC1-ALT	0-3 ft, 3-6 ft
			VC1B-ALT	0-3 ft , 3-6 ft
			VC4	0-3 ft
Manganese	--	274-436	VC1-ALT	3-6 ft, 6-9 ft, 9-12 ft
			VC1B-ALT	3-6 ft, 9-12 ft, 12-15 ft
			VC3-ALT	0-3 ft, 3-6 ft, 6-9 ft, 9-10.5 ft
			VC4	0-3 ft, 3-6 ft, 6-9 ft, 9-12 ft
Nickel	24.3-40.7	N/A	VC1-ALT	0-3 ft, 3-6 ft, 6-9 ft, 9-12 ft, 12-15 ft, 15-16 ft
			VC1B-ALT	0-3 ft, 3-6 ft, 9-12 ft, 12-15 ft
			VC3-ALT	0-3 ft, 3-6 ft, 6-9 ft, 9-10.5 ft
			VC4	0-3 ft, 3-6 ft, 6-9 ft, 9-12 ft
Selenium	--	1.22-18.6	VC1-ALT	0-3 ft, 3-6 ft, 6-9 ft, 9-12 ft, 12-15 ft, 15-16 ft
			VC1B-ALT	0-3 ft, 3-6 ft, 6-9 ft, 9-12 ft, 12-15 ft
			VC2	0-3 ft
			VC3-ALT	0-3 ft, 3-6 ft, 6-9 ft, 9-10.5 ft
			VC4	0-3 ft, 3-6 ft, 6-9 ft, 9-12 ft
Silver	3.06-4.58	N/A	VC1-ALT	0-3 ft, 3-6 ft
			VC1B-ALT	0-3 ft , 3-6 ft
Vanadium	--	70.4-83.3	VC1-ALT	3-6 ft
			VC1B-ALT	3-6 ft
Zinc	227-336	N/A	VC1-ALT	03- ft, 3-6 ft
			VC1B-ALT	03- ft, 3-6 ft
Mercury	0.294-0.32	2.53-5.28	VC1-ALT	0-3 ft, 3-6 ft
			VC1B-ALT	0-3 ft, 3-6 ft , 6-9 ft
			VC4	0-3 ft

Key:

-- = ER-L thresholds were not available.

N/A = Detected concentrations did not exceed the ER-M thresholds.

* Sample depths where ER-M thresholds were exceeded are in bold and italics.

Table B-10 Sample Sites and Samples where Metals Exceeded Class A and/or Class C Thresholds in the Alternative Group

Analyte	Concentrations that Exceeded Thresholds		Sample Site	Sample Depth(s)*
	Exceeded Class A (mg/kg)	Exceeded Class C (mg/kg)		
Arsenic	8.27-49.6	N/A	VC70	0-3 ft, 3-6 ft, 6-9 ft, 9-12 ft
			VC71	0-3 ft, 3-6 ft, 6-9 ft, 9-12 ft
			VC72	0-3 ft, 3-6 ft, 6-9 ft, 9-12 ft
			VC73-ALT	0-3 ft, 9-12 ft
			VC74	6-9 ft
			VC75	0-3 ft
			VC76	0-3 ft, 3-6 ft, 6-9 ft, 9-12 ft
			VC77	0-3 ft, 3-6 ft, 6-9 ft, 9-12 ft, VC12-15.6 ft
			VC78	0-3 ft, 3-6 ft, 6-9 ft, 9-12 ft, VC12-15 ft, VC15-17 ft
			VC79	0-3 ft, 3-6 ft, 6-9 ft, 9-12 ft, VC12-16 ft
			VC80	0-3 ft, 3-6 ft, 6-9 ft, 9-12 ft, VC12-15 ft, VC15-16.5 ft
			VC81	0-3 ft, 3-6 ft, 6-9 ft, 9-12 ft, VC12-14.75 ft
			VC82	0-3 ft, 6-9 ft, 9-12 ft
Cadmium	1.23-3.36	N/A	VC70	0-3 ft
			VC76	0-3 ft
			VC80	3-6 ft, 6-9 ft
			VC81	3-6 ft, 6-9 ft, 9-12 ft
Chromium	85.2-198	N/A	VC70	0-3 ft
			VC76	0-3 ft
			VC77	0-3 ft
			VC80	3-6 ft, 6-9 ft
			VC81	0-3 ft, 3-6 ft, 6-9 ft, 9-12 ft
Copper	36.4-230	N/A	VC70	0-3 ft
			VC75	0-3 ft
			VC76	0-3 ft
			VC77	0-3 ft
			VC78	0-3 ft
			VC80	0-3 ft, 3-6 ft, 6-9 ft
			VC81	0-3 ft, 3-6 ft, 6-9 ft, 9-12 ft
			VC82	0-3 ft
Lead	67.9-194	223	VC70	0-3 ft
			VC75	0-3 ft
			VC76	0-3 ft
			VC77	0-3 ft
			VC78	0-3 ft, 6-9 ft
			VC80	0-3 ft, 3-6 ft , 6-9 ft
			VC81	0-3 ft, 3-6 ft, 6-9 ft, 9-12 ft
			VC82	0-3 ft
Nickel	22.3-48.4	N/A	VC70	0-3 ft, 3-6 ft, 6-9 ft, 9-12 ft
			VC71	0-3 ft, 3-6 ft, 6-9 ft, 9-12 ft
			VC72	0-3 ft, 3-6 ft, 6-9 ft, 9-12 ft
			VC75	0-3 ft
			VC76	0-3 ft, 3-6 ft, 6-9 ft, 9-12 ft
			VC77	0-3 ft, 3-6 ft, 6-9 ft, 9-12 ft, 12-15.6 ft
			VC78	0-3 ft, 3-6 ft, 6-9 ft, 9-12 ft, 12-15 ft, 15-17 ft
			VC79-ALT	0-3 ft, 3-6 ft, 6-9 ft, 9-12 ft, 12-16 ft
			VC80	0-3 ft, 3-6 ft, 6-9 ft, 9-12 ft, 12-15 ft, 15-16.5 ft
			VC81	0-3 ft, 3-6 ft, 6-9 ft, 9-12 ft, 12-14.75 ft
			VC82	0-3 ft, 3-6 ft, 6-9 ft, 9-12 ft, 12-16 ft

Table B-10 Sample Sites and Samples where Metals Exceeded Class A and/or Class C Thresholds in the Alternative Group

Analyte	Concentrations that Exceeded Thresholds		Sample Site	Sample Depth(s)*
	Exceeded Class A (mg/kg)	Exceeded Class C (mg/kg)		
Silver	1.68-2.74	3.98-7.09	VC70	<i>0-3 ft</i>
			VC76	<i>0-3 ft</i>
			VC77	0-3 ft
			VC78	0-3 ft
			VC80	0-3 ft, <i>3-6 ft, 6-9 ft</i>
			VC81	0-3 ft, <i>3-6 ft, 6-9 ft, 9-12 ft</i>
Zinc	190-404	N/A	VC70	0-3 ft
			VC76	0-3 ft
			VC77	0-3 ft
			VC78	0-3 ft
			VC80	0-3 ft, 3-6 ft, 6-9 ft
			VC81	0-3 ft, 3-6 ft, 6-9 ft, 9-12 ft
Mercury	0.191-0.337	0.976 1.03-3.49	VC70	<i>0-3 ft, 3-6 ft</i>
			VC73-ALT	0-3 ft
			VC75	<i>0-3 ft</i>
			VC76	<i>0-3 ft</i>
			VC77	<i>0-3 ft, 3-6 ft</i>
			VC78	<i>0-3 ft</i>
			VC79	0-3 ft
			VC80	<i>0-3 ft</i>
			VC81	<i>0-3 ft, 3-6 ft, 6-9 ft, 9-12 ft, 12-14.75 ft</i>
			VC82	<i>0-3 ft</i>

Key:

mg/kg = milligram per kilogram

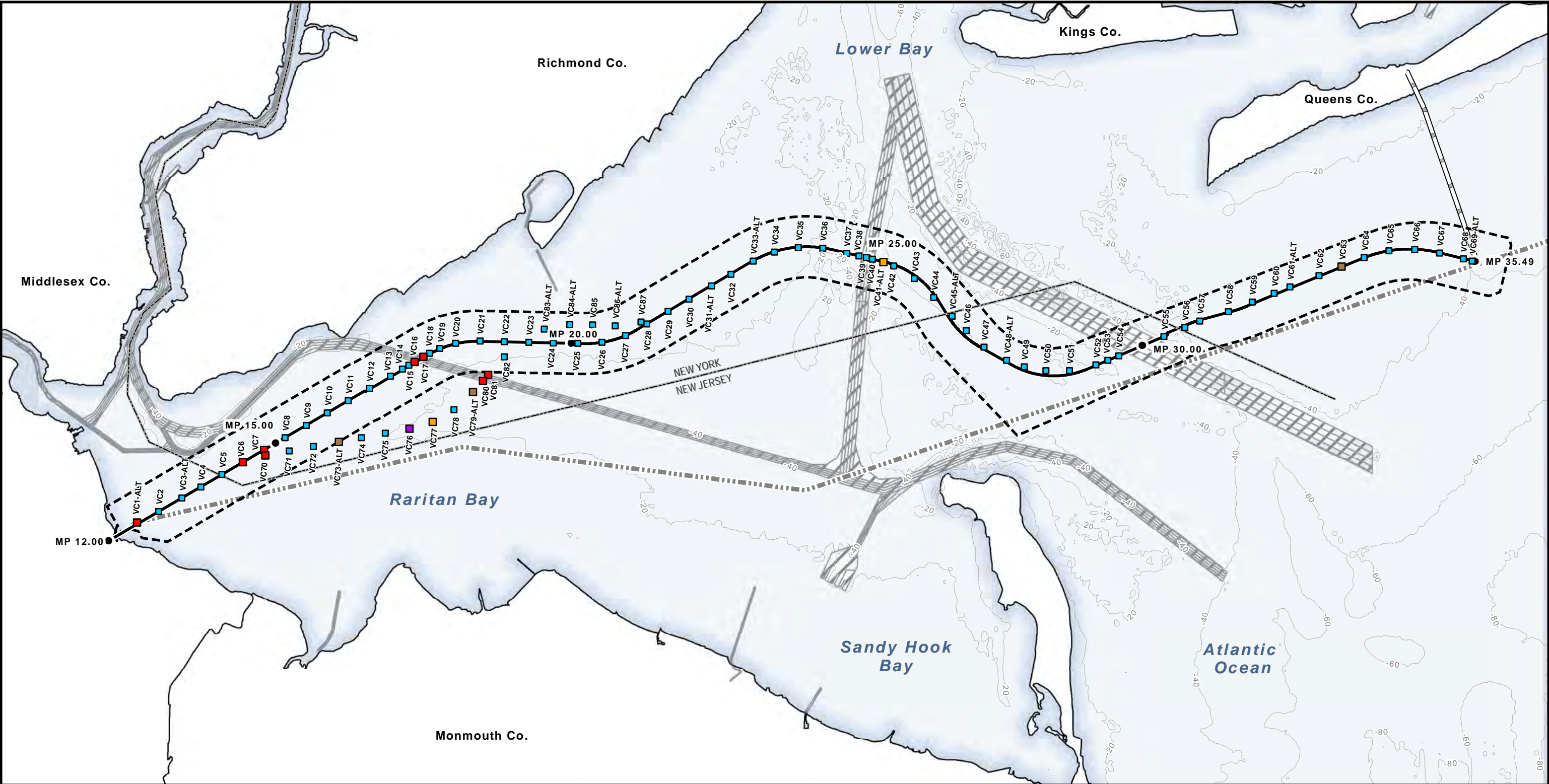
* Sample depths where Class C thresholds were exceeded are in bold and italics.

N/A = Detected concentrations did not exceed the Class C thresholds.

4

Figures

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Legend

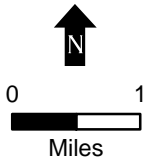
Pesticide Exceedances*

- 0
- 1
- 2
- 3
- 4

- Milepost
- Proposed Raritan Bay Loop
- Construction Workspace
- NY/NJ Boundary
- Lower NY Bay Lateral

- Rockaway Delivery Lateral
- Maintained Navigation Channel

*Number of analyte exceedances for lowest threshold of either the NJDEP Ecological Screening Criteria or NYSDEC Sediment Guidance Values.



DRAWING NO.		REFERENCE TITLE	
		A-6	
NO.	DATE	BY	REVISION DESCRIPTION
A	8/1/2017	MK	
W.O. NO.	CHK.	APP.	
1000891			
DRAWN BY: MK		DATE: 8/1/2017	ISSUE FOR BID: N/A
CHECKED BY:		DATE:	ISSUE FOR CONSTRUCTION: N/A
APPROVED BY:		DATE:	DRAWING NUMBER:
WO: 1000891		12:55 PM 8/1/2017	
Figure A-6			SHEET 1 OF 1

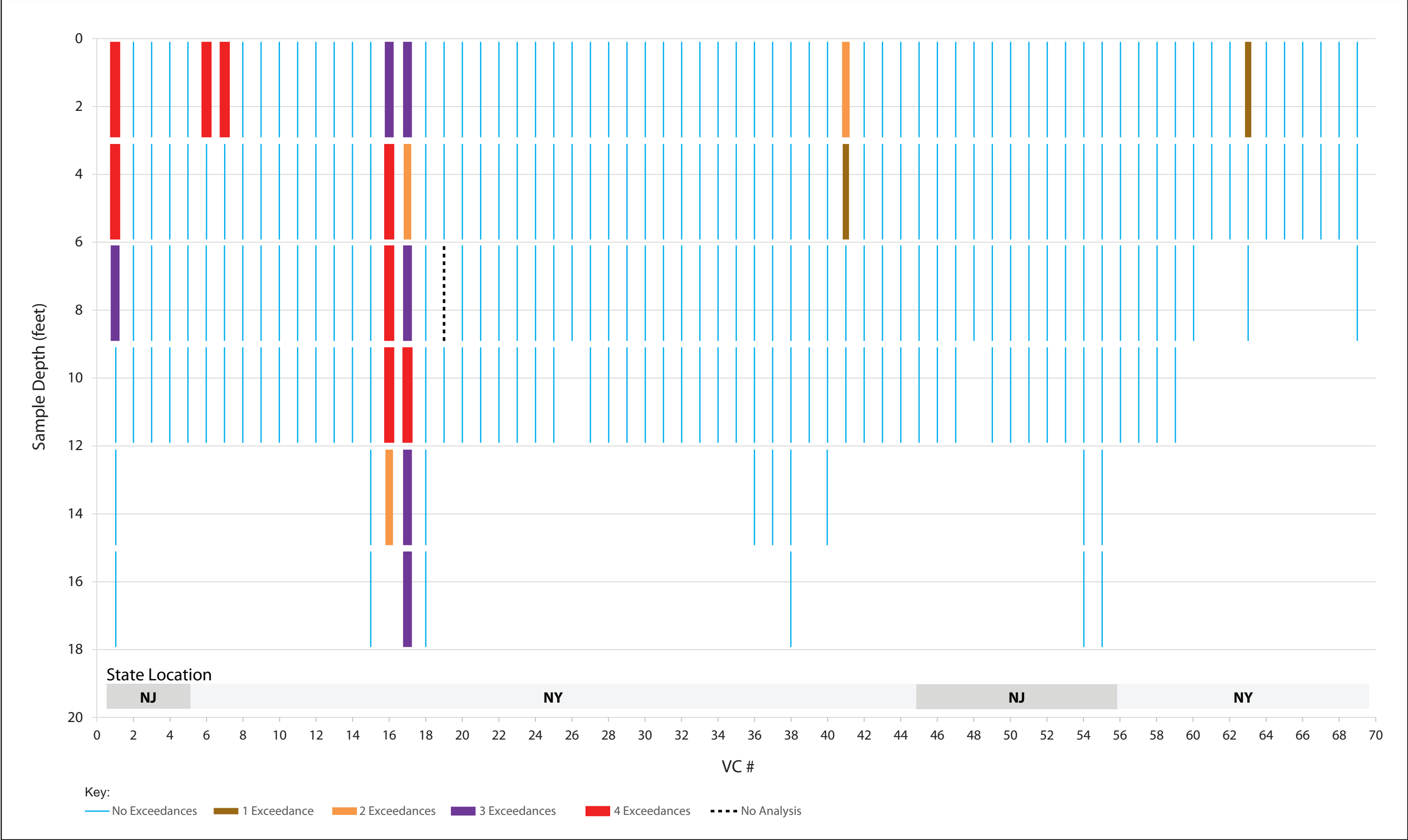
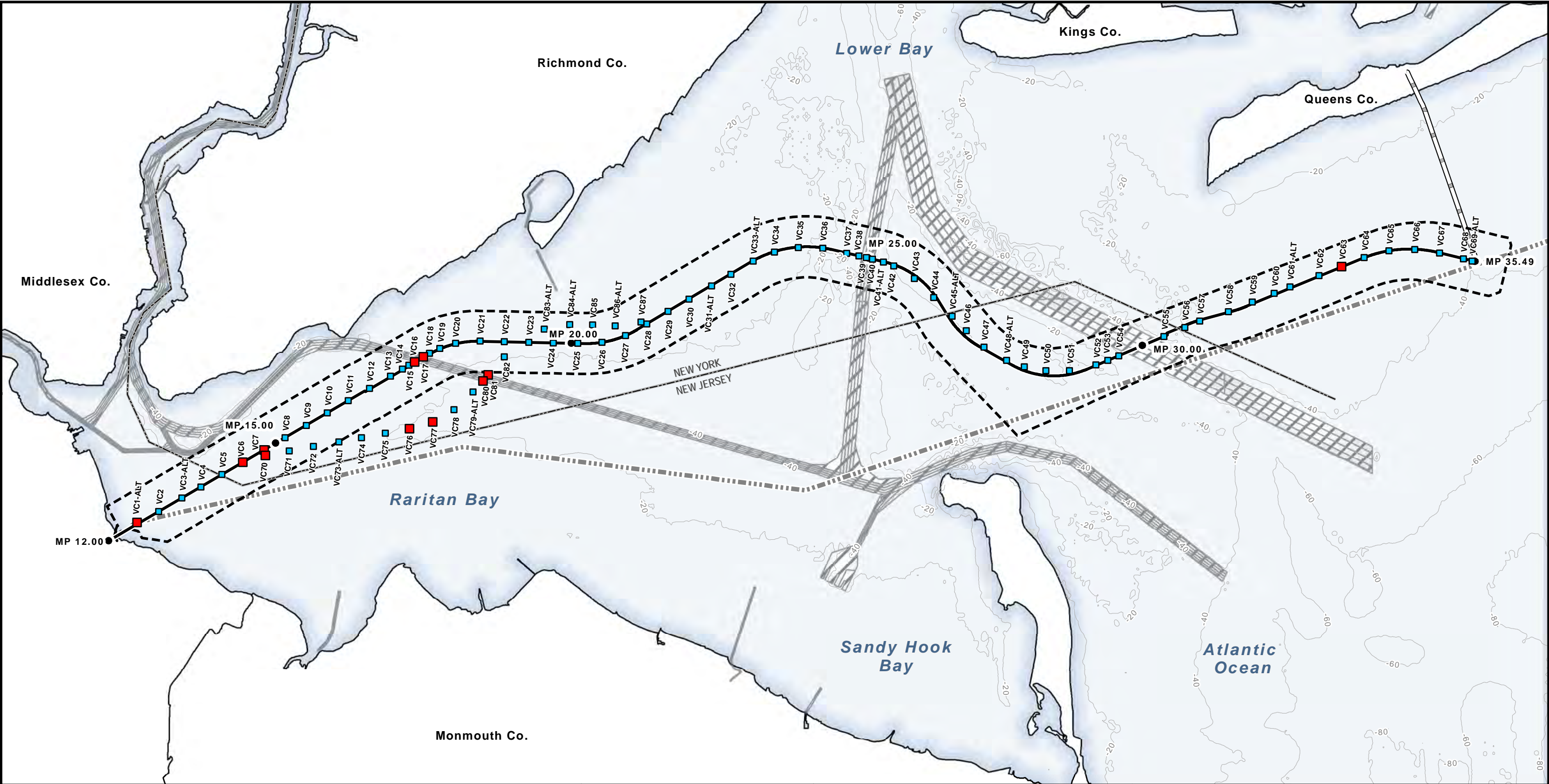


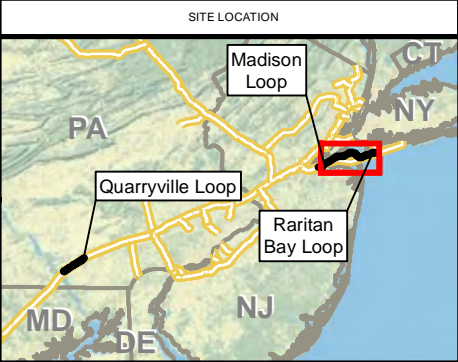
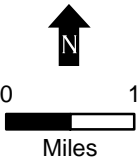
Figure A-7: Pesticide Exceedances at Depth Along the Preferred Route



Legend

- PCB Aroclor Exceedances***
- 0
 - 1
 - 2 - 3
- Milepost
- Proposed Raritan Bay Loop
- Construction Workspace
- NY/NJ Boundary
- Lower NY Bay Lateral
- Rockaway Delivery Lateral
- ▨ Maintained Navigation Channel

*Number of analyte exceedances for lowest threshold of either the NJDEP Ecological Screening Criteria or NYSDEC Sediment Guidance Values.



DRAWING NO.		REFERENCE TITLE					
		A-8					
NO.	DATE	BY	REVISION DESCRIPTION	W.O. NO.	CHK.	APP.	
A	8/1/2017	MK		1000891			

TRANSCONTINENTAL GAS PIPE LINE COMPANY LLC OFFSHORE SEDIMENT SAMPLE CONTAMINATION RESULTS PCB AROCLORS NORTHEAST SUPPLY ENHANCEMENT PROJECT NEW JERSEY, NEW YORK							
DRAWN BY: MK		DATE: 8/1/2017		ISSUE FOR BID: N/A		SCALE: 1:95,000	
CHECKED BY:		DATE:		ISSUE FOR CONSTRUCTION: N/A		Project features ver15	
APPROVED BY:		DATE:		DRAWING NUMBER:		SHEET 1	
WO: 1000891				12:52 PM 8/1/2017		OF 1	

Figure A-8

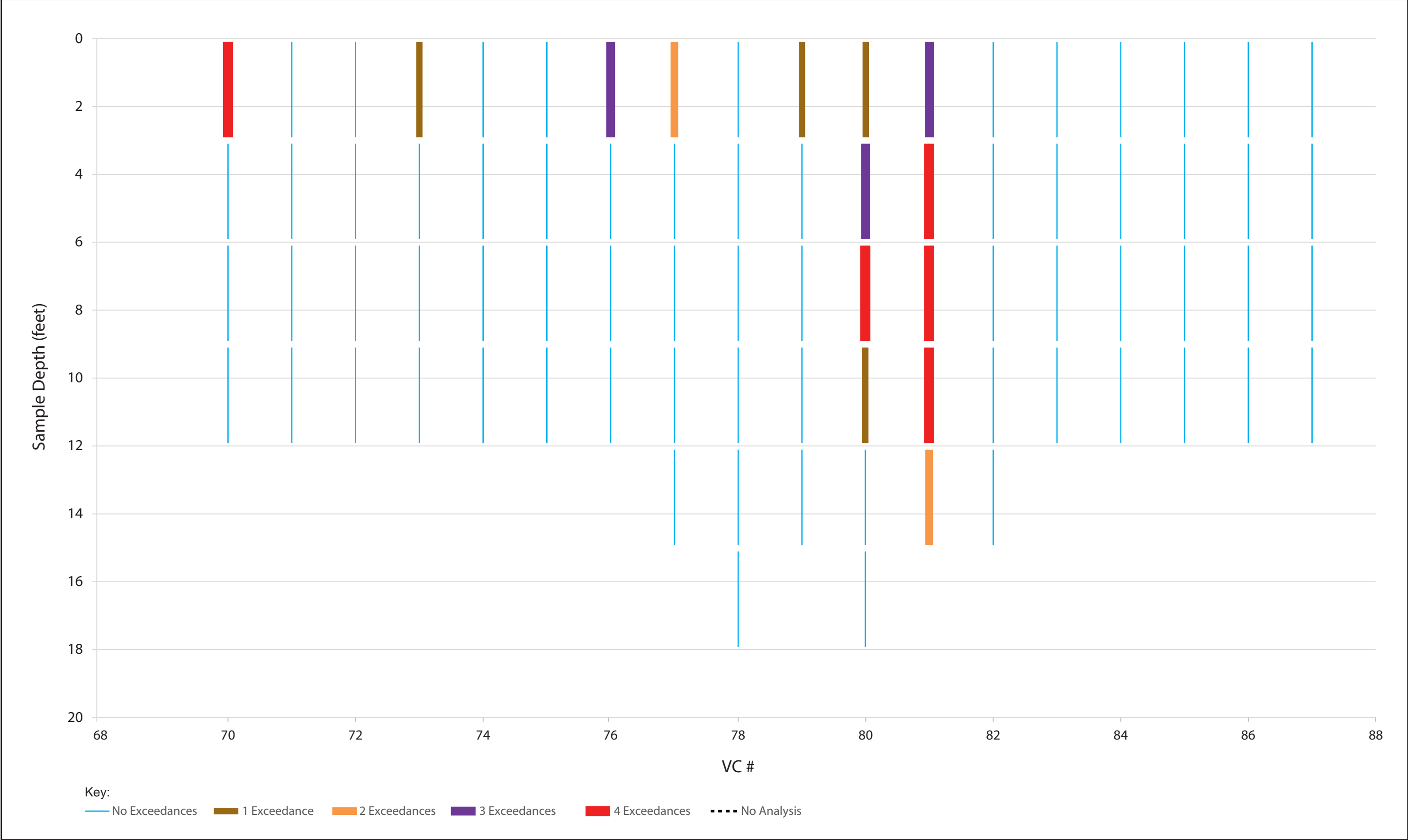


Figure A-17: Pesticide Exceedances at Depth Along Alternative Route

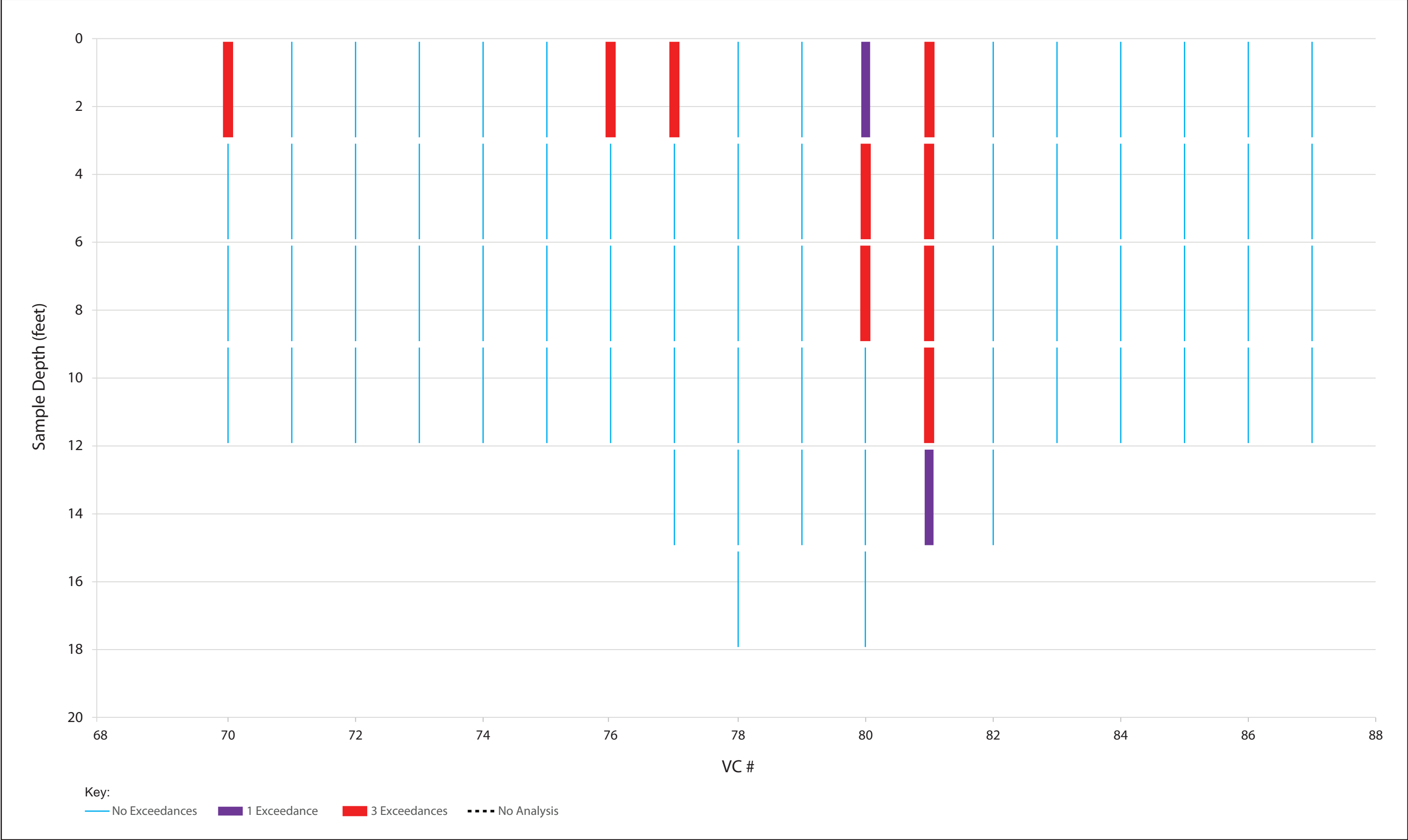


Figure A-18: PCB Aroclor Exceedances at Depth Along Alternative Route

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**Addendum to the
Fall/Winter 2016 Offshore
Environmental Sampling Report
for the Northeast Supply Enhancement
Project
New Jersey, New York**

September 2017

Prepared for:

Transcontinental Gas Pipe Line Company, LLC

Prepared by:

ECOLOGY AND ENVIRONMENT, INC.

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List of Abbreviations and Acronyms

CFR	Code of Federal Regulations
COC	chemicals of Concern
ER-L	Effects Range Low (ER-L)
ER-M	Effects Range Median (ER-M)
E & E	Ecology and Environment, Inc.
EPA	U.S. Environmental Protection Agency
ESC	environmental screening criteria
ETRA	Environmental Toxicology and Risk Assessment
FERC	Federal Energy Regulatory Commission
HARS	historic remediation site
HDD	horizontal directional drill
NJDEP	New Jersey Department of Environmental Protection
NYCDEP	New York City Department of Environmental Protection
NYSDEC	New York State Department of Environmental Conservation
Project	Northeast Supply Enhancement Project
QA/QC	quality assurance/quality control
SAP/QAPP	Sampling and Analysis Plan/Quality Assurance Project Plan
SGVs	sediment guidance values
SRP	Site Remediation Program
TOGS	Technical and Operational Guidance Series
Transco	Transcontinental Gas Pipe Line Company, LLC
USACE	U.S. Army Corps of Engineers
U.S.C.	United States Code

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1

Introduction

1.1 Project Description

Transcontinental Gas Pipe Line Company, LLC (Transco), has filed an application with the Federal Energy Regulatory Commission (FERC) for a Certificate of Public Convenience and Necessity (Certificate) for the Northeast Supply Enhancement Project (Project) (Docket No. CP17-101-000). The Offshore Environmental Sampling Report was prepared to facilitate FERC's review and development of an environmental impact statement for the Project and to support the corresponding state-level environmental evaluation of the Project. On June 27, 2017, Transco submitted its Offshore Environmental Sampling Report as Appendix J of Transco's application for a U.S. Army Corps of Engineers (USACE) permit. On June 30, 2017, Transco submitted its Offshore Environmental Sampling Report to FERC. See the Offshore Environmental Sampling Report for a Project Description.

1.2 Scope of Work

Transco conducted a supplemental field survey and laboratory analysis in May 2017 to evaluate the physical and chemical characteristics of sediment at the proposed anode sled installation and to further evaluate chemical data along the Raritan Bay Loop route. The survey was conducted to support evaluation of the route for both engineering design and environmental review purposes. Laboratory analysis was completed for a focused list of contaminants, specifically metals, based on historical contamination documented in the area. Transco contracted Ecology and Environment, Inc. (E & E) to support the environmental permitting effort for the Project. The Sampling and Analysis Plan/Quality Assurance Project Plan (SAP/QAPP) developed by E & E and reviewed by regulatory agencies for the previous offshore survey was used for this supplemental field survey. The SAP/QAPP prepared for the offshore component of the Project is provided in Appendix C of the Offshore Environmental Sampling Report. Agency comments on initial versions of the SAP/QAPP are provided in Appendix D of the Offshore Environmental Sampling Report. Transco contracted Alpine Ocean (a Gardline company) to conduct the survey and arrange for sediment testing at onshore laboratories.

Figure A-1 shows the locations of the sites sampled along the proposed Raritan Bay Loop route during the 2017 offshore study.

1.3 Previous Investigations

See the Offshore Environmental Sampling Report for a discussion of previous investigations.

1.4 Spring 2017 Survey Results

This report presents the results of sample collection and analyses supporting the sediment chemistry evaluation for the Project. Field data collected as part of the spring 2017 survey is included in the appendices. Appendix A contains figures referred to in the body of this report; Appendix B contains the tabularized laboratory results for all chemical parameters analyzed and grain size statistics; Appendix C contains the sediment chemistry laboratory reports; Appendix D contains the Data Usability Summary Reports; Appendix E contains grain size statistics; and Appendix F contains the previously unsubmitted core logs for samples collected in the 2016 survey. Supplemental vibracore logs from the May 2017 sampling will be provided in a Supplemental Information Filing anticipated to be submitted September 29, 2017.

2

Sediment Sampling

The SAP/QAPP developed to evaluate the site-specific sediment conditions along the proposed pipeline route was designed specifically to address chemicals of concern (COCs) identified by the New York State Department of Environmental Conservation (NYSDEC) and the New Jersey Department of Environmental Protection (NJDEP). These chemicals would be of concern if found above threshold levels. The threshold values indicate where there could be harmful effects to aquatic life.

2.1 Thresholds for Chemicals of Concern

As introduced in the Offshore Environmental Sampling Report, thresholds for COCs in sediments sampled in New York State waters were taken from the Technical and Operational Guidance Series (TOGS) 5.1.9 document, *In-Water and Riparian Management of Sediment and Dredged Material* (NYSDEC 2004) and the *Screening and Assessment of Contaminated Sediment* (NYSDEC 2014). Thresholds for COCs in sediments sampled in New Jersey waters were taken from *The Management and Regulation of Dredging Activities and Dredged Material in New Jersey's Tidal Waters* (NJDEP 1997). Additional guidance on COCs within the offshore Project area was taken from the USACE/U.S. Environmental Protection Agency's (EPA) *Guidance for Performing Tests on Dredged Material Proposed for Ocean Disposal* (2016). These agency documents were developed to provide guidance on the statutory and regulatory requirements for dredging activities and to promote uniformity in the certification and/or permitting of dredging projects.

In New York, under TOGS 5.1.9, the NYSDEC Division of Water established three classes of sediment quality thresholds for dredged material (sediment guidance values [SGVs]). This system is based upon the concentrations of contaminants within the dredged sediments, in contrast to the EPA's system, which is based upon bioaccumulation and biotoxicity. The three classes of dredged sediment provided in TOGS 5.1.9 are Class A, B, and C, where Class A has no appreciable contamination and Class C has high contamination. See the Offshore Environmental Sampling Report for further discussion.

In New Jersey, the NJDEP's Site Remediation Program (SRP), Environmental Toxicology and Risk Assessment (ETRA) Unit, developed ecological screening criteria (ESC) for surface water, sediment, and soil. These ESCs were developed by the ERTA Unit using multiple sources, and the most conservative criterion for each contaminant was used. The ESC are presented in terms of Effects Range

Low (ER-L) and Effects Range Median (ER-M) levels for saline waters. The sediment and soil standards presented are not promulgated and are intended as screening values for ecological assessments.

The EPA's Marine Protection, Research, and Sanctuaries Act provides the criteria for disposal of dredged sediments in the ocean. Under 40 Code of Federal Regulations (CFR) 227, Criteria for the Evaluation of Permit Applications for Ocean Dumping of Materials, there are three conditions that qualify dredged materials for ocean dumping without further testing. Two of these conditions are applicable to dredging materials proposed for placement at offshore sites, i.e., the historic area remediation site (HARS). They are further discussed in the Offshore Environmental Sampling Report.

For materials that do not meet the conditions for ocean dumping without further testing, 40 CFR 227 prohibits ocean dumping of dredged materials containing anything greater than trace amounts of organohalogen compounds; mercury and mercury compounds; cadmium and cadmium compounds; oil of any kind or in any form; or known carcinogens, mutagens, or teratogens or any materials suspected of being such. Materials not excluded by this condition are subject to toxicity and bioaccumulation testing and must meet the conditions determined by the USACE/EPA guidance document. Based on the required testing and review by USACE/EPA, material may be approved for disposal at the HARS. A HARS plan must be reviewed and approved for this activity. Transco is considering disposal at the HARS as an option under consideration based on results from the offshore survey for management of dredged material during construction.

2.2 Sampling Methods

During the initial sampling effort, deep core samples (core boring) extending up to 125 feet below the seafloor were collected from nine sample sites, all of which are within New Jersey waters. These deep core sites are located near the New Jersey shoreline and across the Ambrose Channel where Transco proposes to install the pipeline using horizontal directional drill (HDD). The deep core depths represent the maximum depths for HDD installation. Initially, deep core samples were analyzed only for geotechnical properties for use in the engineering design of the HDDs. In 2017, core samples from deep core sites BHA7-ALT and BHA9-ALT were analyzed for metals. These two cores were included for laboratory analysis due to the documented historical contamination in the area. Table 2-1 notes the depths sampled for analysis of metals and the number of samples collected at these two deep-core sample sites.

Table 2-1 Deep Core Samples Include in Analysis

Sample Site ^a	State	Maximum Sample Depth (ft) ^b	No. Of Samples Collected
<i>BHA7-ALT</i>	<i>NJ</i>	<i>17</i>	<i>7</i>
<i>BHA9-ALT</i>	<i>NJ</i>	<i>17</i>	<i>6</i>

^a Site in bold and italics indicate locations where clamshell dredging might occur.

^b Depths provided represent actual recovery at each sample site.

Key:

ft = feet

As part of the spring 2017 effort, shallow core samples (vibracores) were collected at six sites in New Jersey waters, to a maximum depth of 12 feet below the seafloor (see Table 2-2). Five of the sample sites were located between two previously sampled sites (VC1-ALT and VC2) along the proposed route, and the sixth sample was located at the location where the anode sled will be installed (see Figure A-1 for the locations of the supplemental shallow core sample sites). The shallow core sample sites are identified in Table 2-2, and were reviewed and cleared by the New Jersey State Historic Preservation Office prior to sampling.

Table 2-2 Vibracore Sample Locations

Sample Site ^a	State	Coring Depth (ft) ^c	No. Of Samples Collected
<i>VC88</i>	<i>NJ</i>	<i>10</i>	<i>5^b</i>
<i>VC89</i>	<i>NJ</i>	<i>10</i>	<i>5^b</i>
<i>VC90</i>	<i>NJ</i>	<i>10</i>	<i>5^b</i>
<i>VC91</i>	<i>NJ</i>	<i>9.6</i>	<i>3</i>
<i>VC92</i>	<i>NJ</i>	<i>10</i>	<i>5^b</i>
<i>VC93</i>	<i>NJ</i>	<i>10</i>	<i>4</i>

^a Site in bold and italics indicate locations where clamshell dredging might occur.

^b A duplicate sample at one depth interval was collected at this site.

^c Depths provided represent actual recovery at each sample site.

Key:

ft = feet

The shallow core samples were collected in areas where the pipeline would be installed by a clamshell dredge, where the HDD entry/exit pits would be excavated using a clamshell dredge, and where the anode sled would be installed.

Once retrieved, the sediment core soil types were classified according to the United Soil Classification System, and sediment samples were collected from the core and shipped to a laboratory for chemical analysis. Each core was separated into 3-foot sections for shallow core samples. Distinct layers more than 1-foot thick were separated as unique sub-samples subject to sediment chemistry analyses if they appeared contaminated, based on the field geologist's evaluation of appearance and/or odor. The minimum 1-foot thickness provided sufficient sam-

2 Sediment Sampling

ple volume for all sediment chemistry analyses. A total of 27 samples were collected, as identified in Table 2-2. The tests performed, method, and quantities of samples collected at sample sites in New Jersey waters are summarized in Table 2-3. The list of chemical analyses performed is based upon the NYSDEC TOGS 5.1.9 and the NJDEP Site Remediation Program ER-L and Effects Range Median ER-M ecological screening criteria. A summary of the results are discussed below, and the complete analytical results are provided in Appendix C of the Off-shore Environmental Sampling Report.

Table 2-3 Selection of Sediment Chemistry Tests for Metals Detected that Exceeded State Thresholds

Test Description	EPA Method	Unit	NYSDEC Required Method Detection Limits	NJDEP or USACE Required Reporting Limits ¹	NJDEP Effects Range Low (ER-L) ²	NJDEP Effects Range-Median (ER-M) ³	NYSDEC Class A	NYSDEC Class C
Arsenic	EPA 6020A	mg/Kg	3 [^]	1	8.2	70	8.2	70
Barium	EPA 6020A	mg/Kg	--	40	--	48	--	--
Cadmium	EPA 6020A	mg/Kg	1	1	1.2	9.6	1.2	9.6
Chromium	EPA 6020A	mg/Kg	--	1	81	370	81	370
Cobalt	EPA 6020A	mg/Kg	--	10	--	10	--	--
Copper	EPA 6020A	mg/Kg	5 [^]	1	34	270	34	270
Lead	EPA 6020A	mg/Kg	2 [^]	0.6	47	218	47	220
Manganese	EPA 6020A	mg/Kg	--	3	--	260	--	--
Mercury	EPA 7474	mg/Kg	0.2 [^]	0.1	0.15	0.71	0.15	0.71
Nickel	EPA 6020A	mg/Kg	--	1	21	52	21	52
Selenium	EPA 6020A	mg/Kg	--	1	--	1	--	--
Silver	EPA 6020A	mg/Kg	--	1	1	3.7	1	3.7
Vanadium	EPA 6020A	mg/Kg	--	10	--	57	--	--
Zinc	EPA 6020A	mg/Kg	--	4	150	410	150	410

Notes:

¹ Unshaded cells present reporting limits from USACE/EPA *Guidance for Performing Tests on Dredged Material Proposed for Ocean Disposal* (2014). Shaded cells present reporting limits from *The Management and Regulation of Dredging Activities and Dredged Material in New Jersey's Tidal Waters* (1997). If both documents provide reporting limits, only the lowest (most restrictive) reporting limits are shown here.

² NJDEP Ecological Screening Criteria (2009)

³ NYS TOGS 5.1.9 (2004) and NYS *Screening and Assessment of Contaminated Sediment* (2014).

Key:

-- = Guidance value not available

[^] = If the value found is less than the method detection limit, the laboratory reporting limit is listed.

mg/Kg = milligrams per kilogram

Quality assurance/quality control (QA/QC) samples were collected in accordance with the SAP/QAPP (Appendix C of the Offshore Environmental Sampling Report). Analytical data have been validated for samples collected as part of this sampling effort. Field QC samples included, at a minimum, one sediment duplicate per matrix per 20 samples for each analysis. Field equipment blanks were used at a rate of one per equipment set per day. Equipment blanks were only used

on equipment sets that were subject to decontamination. Dedicated or disposable equipment did not require the use of equipment blanks.

The results of the chemistry analysis for metals in vibracore samples is presented below.

2.3 Sediment Chemistry Results

Each sediment sample was analyzed for 27 metals, including mercury (see Appendix C of the Offshore Environmental Sampling Report for a complete list of these metals). Of these metals, 16 have available ER-L and/or ER-M thresholds. Within this sample set, all of the 27 metals tested for were detected in the 2017 survey. Sediment samples from BHA7-ALT and BHA9-ALT were analyzed for 26 of the 27 metals introduced above; the holding time for mercury analysis had been exceeded and, therefore, the samples were not analyzed for mercury. Of these metals, 15 have available ER-L and/or ER-M thresholds. Table 2-4 lists the number of metals detected at each sample site. Thirteen of the detected metals exceeded available NJDEP thresholds. The metals detected within this sample set that exceeded ER-L and/or ER-M thresholds are presented in Table 2-5. Table 2-6 presents the number of exceedances of metals for thresholds from both New Jersey and New York at each sample site.

Table 2-4 Number of Metals Detected at Sample Sites

Sample Site	Number of Metals Detected
VC88	25
VC89	25
VC90	25
VC91	25
VC92	21
VC93	24
BHA7-ALT	26
BHA9-ALT	24

Table 2-5 Sample Sites and Samples Exceeding ER-L and/or ER-M Thresholds for Metals

Analyte	Concentrations that Exceeded Thresholds		Sample Site	Sample Depth(s)*
	Exceeded ER-L (mg/Kg)	Exceeded ER-M (mg/Kg)		
Arsenic	8.37-66.6	94.6-118	VC88	6-9 ft, 9-10 ft
			VC89	6-9 ft, 9-10 ft
			VC90	3-6 ft, 6-9 ft, 9-10 ft
			VC91	3-6 ft, 6-9.6 ft
			BHA7-ALT	0-2 ft, 2-4 ft, 4-6 ft , 6-8 ft, 8-10 ft, 15-17 ft

Table 2-5 Sample Sites and Samples Exceeding ER-L and/or ER-M Thresholds for Metals

Analyte	Concentrations that Exceeded Thresholds		Sample Site	Sample Depth(s)*
	Exceeded ER-L (mg/Kg)	Exceeded ER-M (mg/Kg)		
Barium	--	49.6-84.2	BHA7-ALT	<i>0-2 ft, 2-4 ft, 4-6 ft, 6-8 ft</i>
Cadmium	1.55	N/A	BHA7-ALT	2-4 ft
Chromium	87.3-136	N/A	BHA7-ALT	2-4 ft, 4-6 ft
Cobalt	--	10.1-34.8	VC88	<i>9-10 ft</i>
			VC89	<i>9-10 ft</i>
			VC90	<i>9-10 ft</i>
			BHA7-ALT	<i>15-17 ft</i>
			BHA9-ALT	<i>6-8 ft, 8-10 ft, 10-12 ft</i>
Copper	138-145	294	BHA7-ALT	0-2 ft, <i>2-4 ft</i> , 4-6 ft, 6-8 ft
Lead	104-163	N/A	BHA7-ALT	0-2 ft, 2-4 ft, 4-6 ft, 6-8 ft
Manganese	--	265-380	VC88	<i>6-9 ft, 9-10 ft</i>
			VC89	<i>6-9 ft, 9-10 ft</i>
			VC90	<i>6-9 ft, 9-10 ft</i>
			BHA7-ALT	<i>0-2 ft, 4-6 ft, 8-10 ft, 15-17 ft</i>
Nickel	22.2-40.7	N/A	VC88	6-9 ft, 9-10 ft
			VC89	6-9 ft, 9-10 ft
			VC90	6-9 ft, 9-10 ft
			VC91	6-9.6 ft
			BHA7-ALT	0-2 ft, 2-4 ft, 4-6 ft, 6-8 ft, 15-17 ft
			BHA9-ALT	8-10 ft
Selenium	--	1.19-18.6	VC88	<i>3-6 ft, 6-9 ft, 9-10 ft</i>
			VC89	<i>0-3 ft, 3-6 ft, 6-9 ft, 9-10 ft</i>
			VC90	<i>0-3 ft, 3-6 ft, 6-9 ft, 9-10 ft</i>
			VC91	<i>0-3 ft, 3-6 ft, 6-9.6 ft</i>
			VC92	<i>0-3 ft, 3-6 ft, 6-9 ft, 9-10 ft,</i>
			VC93	<i>3-6 ft</i>
			BHA7-ALT	<i>0-2 ft, 2-4 ft, 4-6 ft, 6-8 ft, 8-10 ft, 10-12 ft, 15-17 ft</i>
			BHA9-ALT	<i>6-8 ft, 8-10 ft, 10-12 ft</i>
Silver	1.86-2.44	3.87	BHA7-ALT	0-2 ft, <i>2-4 ft</i> , 4-6 ft, 6-8 ft
Vanadium	--	57.1-66.2	BHA7-ALT	<i>2-4 ft, 4-6 ft, 6-8 ft</i>
Zinc	207-276	N/A	BHA7-ALT	0-2 ft, 2-4 ft, 4-6 ft, 6-8 ft

* Sample depths where ER-M thresholds were exceeded are in bold and italics.

Key:

-- = ER-L thresholds were not available.

N/A = Detected concentrations did not exceed the ER-M thresholds.

Table 2-6 Count of Exceedances in New York and New Jersey per Number of Available SGVs and ESCs

Analyte Group	VC 88		VC 89		VC 90		VC 91	
	NJ	NY	NJ	NY	NJ	NY	NJ	NY
Metals¹	2/16	1/9	5/16	2/9	5/16	2/9	5/16	2/9
Analyte Group	VC 92		VC93		BHA7-ALT		BHA9-ALT	
	NJ	NJ	NJ	NY	NJ	NY	NJ	NY
Metals¹	1/16	1/16	1/16	2/9	13/15	8/8	3/15	1/8

Key:

¹ .Highlighted cells indicate that ER-M or Class C thresholds also were exceeded.

Figure A-2 shows the number of exceedances at each sample site along the preferred route for metals based upon the lowest available threshold of either New Jersey or New York. Figure A-3 shows the number of exceedances for metals at each depth sampled along the preferred route between 0 ft and 10 ft for shallow core samples and 0 ft and 17 ft for deep core samples based upon the lowest available threshold of either New Jersey or New York.

2.4 Sediment Grain Size Results

The vibracore sample collected from VC93 was analyzed for grain size. The field geologist determined the number of depth intervals included in this analysis. This determination was based upon the observed uniformity of sediment type within the vibracore. Grain size analysis of these samples was conducted by the geotechnical laboratory using the sieve-based particle size analysis methodology (ASTM D6913) and/or a hydrometer (ASTM D7928). Results of the sediment grain-size analysis are presented in Table 2-7. Sediment grain size curves for VC93 are presented in Appendix E.

Table 2-7 Sediment Grain Sizes from VC93

Sample Depth	% Gravel (#4 Sieve)	% Sand (#200 Sieve)	% Fines (< #200 Sieve)	Water Content (%)	USCS Symbol
1.0"	0.4	98.6	1.0	22.9	SP
1.0'	0.0	98.7	1.3	21.9	SP
2.0'	0.0	97.5	2.5	20.3	SP
3.0'	5.7	95.1	4.9	21.4	SP
4.0'	0.0	83.4	16.6	25.3	SM
5.0'	0.0	92.3	7.7	24.4	SP-SM
6.0'	0.0	80.7	19.3	22.9	SM
7.0'	0.0	95.9	4.1	26.7	SP
8.0'	0.0	92.9	7.1	24.2	SP-SM
9.0'	0.0	94.4	5.6	23.3	SP-SM
10.0'	0.0	95.3	4.7	21.5	SP

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3

References

New Jersey Department of Environmental Protection (NJDEP). 1997. The Management and Regulation of Dredging Activities and Dredged Material in New Jersey's Tidal Waters. October 1997. Trenton, New Jersey.

_____. 2009. Ecological Screening Criteria. NJDEP Site Remediation Program. <http://www.nj.gov/dep/srp/guidance/ecoscreening/> Accessed February 1, 2017.

New York State Department of Environmental Conservation (NYSDEC). 2004. Technical & Operational Guidance Series (TOGS) 5.1.9: In-Water and Riparian Management of Sediment and Dredged Material. November 2004. Division of Water. Albany, New York.

_____. 2014. Screening and Assessment of Contaminated Sediment. June 2014. Division of Fish, Wildlife and Marine Resources. Bureau of Habitat. Albany, New York.

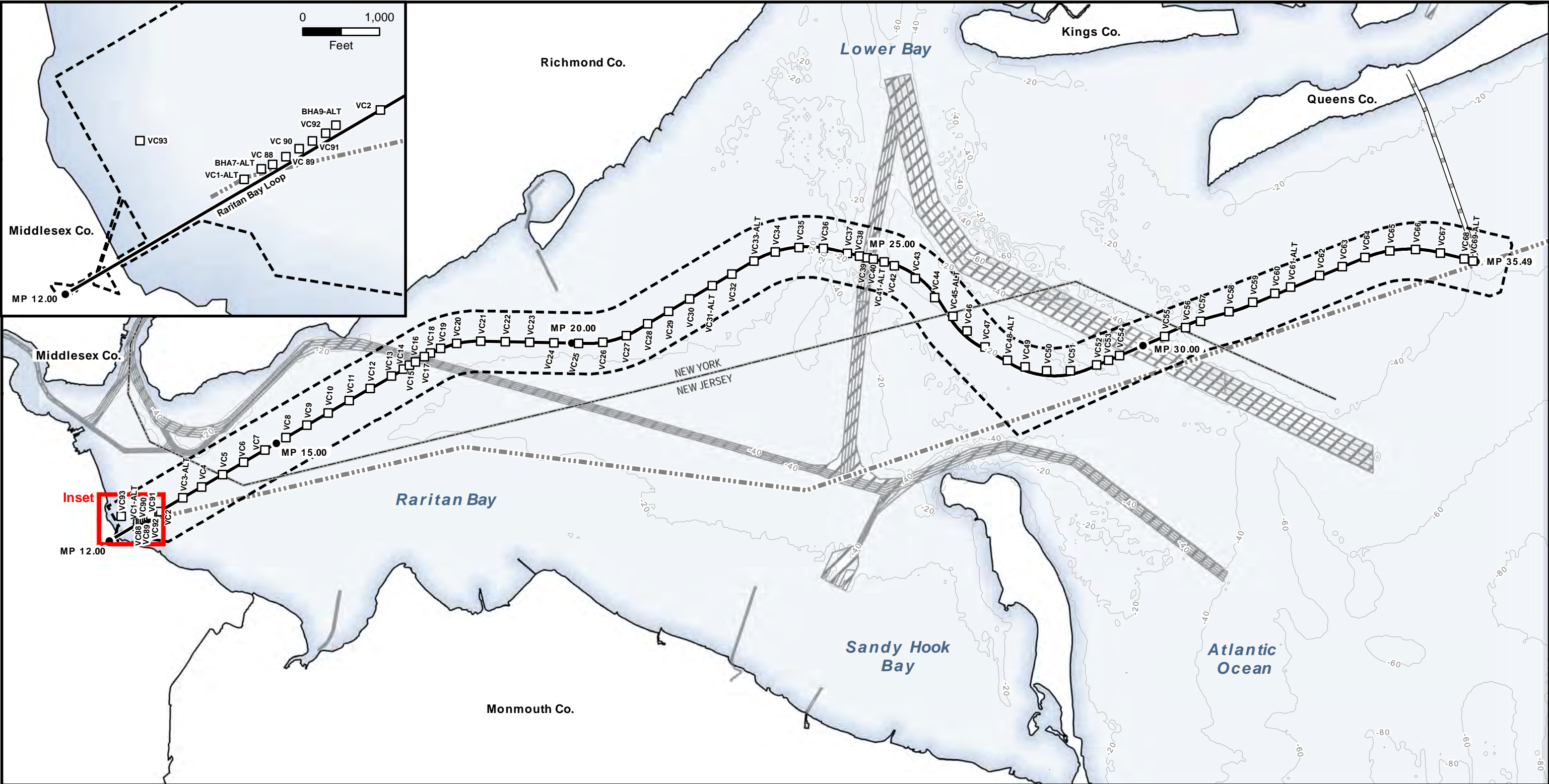
U.S. Army Corp of Engineers (USACE), EPA. 2016. Guidance for Performing Tests on Dredged Material Proposed for Ocean Disposal. April 2016. USACE New York District. EPA Region 2. New York, New York.

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A

Figures

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Legend

Sample Locations

Milepost

Rockaway Delivery Lateral

Proposed Raritan Bay Loop

Construction Workspace

NY/NJ Boundary

Lower NY Bay Lateral

Maintained Navigation Channel

MP 12.00

MP 15.00

MP 20.00

MP 25.00

MP 30.00

MP 35.49

VC1-ALT

VC2

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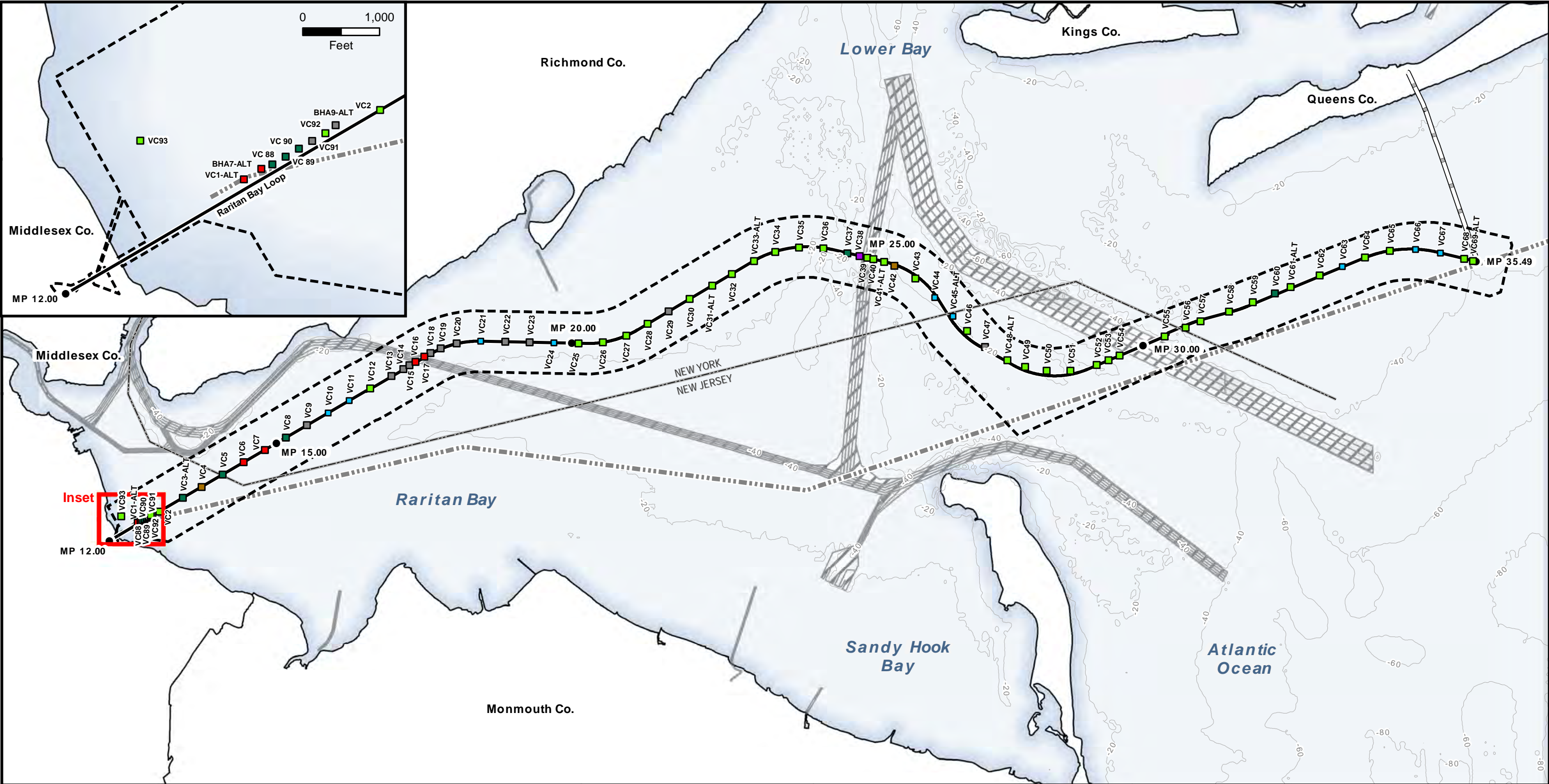
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Legend

Metals Exceedances*

0	5-6	Milepost	Rockaway Delivery Lateral
1-2	7-8	Proposed Raritan Bay Loop	Maintained Navigation Channel
3-4	11-12	Construction Workspace	
	13-15	NY/NJ Boundary	
		Lower NY Bay Lateral	

*Number of analyte exceedances for lowest threshold of either the NJDEP Ecological Screening Criteria or NYSDEC Sediment Guidance Values.

Site Location

DRAWING NO.		REFERENCE TITLE	
NO.	DATE	BY	REVISION DESCRIPTION
A	8/22/2017	AL	

W.O. NO.	CHK.	APP.
1000891		

DRAWN BY: AL	DATE: 8/22/2017	ISSUE FOR BID: N/A	SCALE: 1:95,000
CHECKED BY:	DATE:	ISSUE FOR CONSTRUCTION: N/A	Project features ver15
APPROVED BY:	DATE:	DRAWING NUMBER: 10:40 AM 8/22/2017	SHEET 1 OF 1

TRANSCONTINENTAL GAS PIPE LINE COMPANY LLC
OFFSHORE SEDIMENT SAMPLE CONTAMINATION RESULTS
METALS EXCEEDANCES
NORTHEAST SUPPLY ENHANCEMENT PROJECT
NEW JERSEY, NEW YORK

Williams

A-2

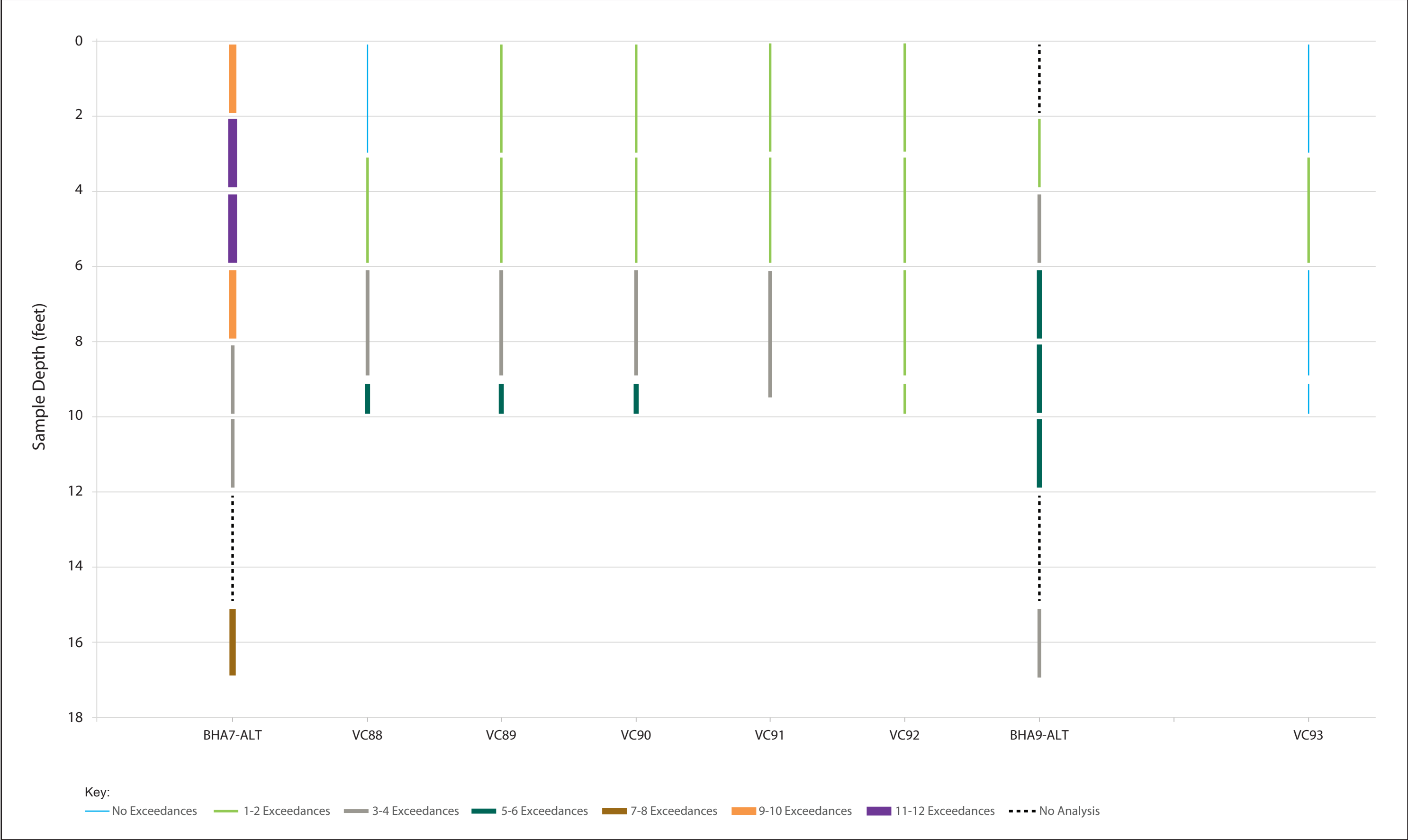


Figure A-3: Metals Exceedances at Depth

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B

Complete Sediment Chemistry Data Tables

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Summary of Analytical Results for Additional New Jersey Sediment Samples
Northeastern Supply Enhancement Project, New York and New Jersey

Analyte	Location ID:	BHA 7-ALT	BHA 7-ALT	BHA 7-ALT	BHA 7-ALT	BHA 7-ALT	BHA 7-ALT	BHA 7-ALT	BHA 7-ALT	BHA 9-ALT	BHA 9-ALT	BHA 9-ALT	BHA 9-ALT	BHA 9-ALT
	Sample Name:	BHA-7 SS1 0-2	BHA-7 SS2 2-4	BHA-7 SS3 4-6	BHA-7 SS4 6-8	BHA-7 SS5 8-10	BHA-7 SS6 10-12	BHA-7 SS7 15-17	BHA-7 SS7 15-17	BHA-9 SS2 2-4	BHA-9 SS3 4-6	BHA-9 SS4 6-8	BHA-9 SS5 8-10	BHA-9 SS6 10-12
	Depth:	0 - 2 ft	2 - 4 ft	4 - 6 ft	6 - 8 ft	8 - 10 ft	10 - 12 ft	15 - 17 ft	15 - 17 ft	2 - 4 ft	4 - 6 ft	6 - 8 ft	8 - 10 ft	10 - 12 ft
	Date:	10/08/16	10/08/16	10/08/16	10/08/16	10/08/16	10/08/16	10/08/16	10/08/16	10/08/16	10/08/16	10/08/16	10/08/16	10/08/16
Screening Criteria ⁽¹⁾														
Metals by Method SW-846 6020A (mg/kg)														
Aluminum	18000	10200	12200	11200	10500	10200	4800	15700	4710	4460	1680	1950	1440	
Antimony	9.3	6.80 J	8.32	7.15	6.19	1.06 U	0.475 U	0.458 U	0.396 U	0.403 U	0.226 U	0.256 U	0.290 U	
Arsenic	8.2	39.1 J	118	94.6	60.6	12.6	7.46	15.1	6.05	6.27	1.13	1.89	1.64	
Barium	48	50.9 J	84.2	58.6	49.6	22.2	11.5	28.5	10.6	9.50	18.8	16.8	8.82	
Beryllium	N/A	0.870	1.09	0.784	0.767	0.722	0.373 J	1.09	0.298 J	0.318 J	0.730	0.781	0.983	
Cadmium	1.2	1.00	1.55	0.676	0.94	0.248 J	0.034 U	0.426	0.109 J	0.099 J	0.031 U	0.030 U	0.030 U	
Calcium	N/A	5040 J	5010	3000	3390	6100	4580	7750	4020	6760	272 J	253 J	397 J	
Chromium, Total	81	69.3 J	136	87.3	78.4	28.9	12.8	37.9	15.2	13.4	5.16	5.81	5.72	
Cobalt	10	9.22	9.17	8.15	8.34	7.00	3.56	11.1	3.72	3.46	11.8	19.7	34.8	
Copper	34	140	294	145	138	19.0	7.65	18.8	9.88	7.42	11.1	8.38	11.0	
Iron	N/A	32400	41900	42300	32000	29100	13900	42900	14600	13800	1660	887	2660	
Lead	47	156	163	125	104	17.3	8.51	14.7	12.4	11.0	8.05	10.6	14.1	
Magnesium	N/A	5490	6430	5680	5110	5650	2510	7550	2850	2860	415	482	424	
Manganese	260	274 J	249	285	231	265	125	348	139	132	4.98	3.99	13.1	
Molybdenum	N/A	0.209 U	0.202 U	0.192 U	0.184 U	2.10	0.663 J	4.95	1.04 U	0.132 U	0.191 U	0.317 U	0.181 U	
Nickel	21	23.9	35.4	26.3	25.3	19.3	8.47	27.8	9.27	7.96	13.7	22.2	15.9	
Potassium	N/A	2370	2810	2350	2240	2570	1100	3570	1290	1200	684	716	718	
Selenium	1	3.36 J	7.22	4.24	4.44	1.88 J	1.19 J	2.27 J	1.03 U	0.924 U	3.01	3.78	2.61	
Silver	1	2.44	3.87	1.86	1.93	0.152 J	0.062 U	0.09 U	0.122 J	0.060 U	0.056 U	0.056 U	0.055 U	
Sodium	N/A	8960	11100	8510	7360	6430	3020	8180	3700	4070	1570	1870	1840	
Strontium	N/A	51.5	66.2	41.9	38.2	39.8	30.5	50.1	24.4	37.8	6.58	7.18	6.47	
Thallium	N/A	0.228 J	0.249 J	0.173 J	0.176 J	0.144 J	0.066 U	0.275 J	0.070 U	0.063 U	0.102 J	0.133 J	0.177 J	
Tin	N/A	19.1	28.2	21.4	18.1	0.183 U	0.878 J	1.55 U	1.01 U	0.876 U	0.624 U	0.478 U	0.583 U	
Titanium	N/A	362 J	472	503	455	203	104	245	113	116	18.1	21.6	31.2	
Vanadium	57	46.9	66.2	62.8	57.1	30.6	18.5	44.2	17.2	17.1	13.1	13.6	17.2	
Zinc	150	243	276	207	212	71.6	31.7	86.1	38.6	33.8	29.4	22.7	23.6	

Key:

Qualifiers

J = Estimated value

U = Not detected (method detection limit shown)

Other

mg/kg = milligrams per kilogram

N/A = No standard or guidance value available

Other:

Bold values denote a positive detection of the analyte.

Shaded values denote an exceedance of the screening criteria.

Notes:

1. NJDEP Ecological Screening Criteria (2009). Screening criteria are for sediment, saline water criteria, effects range low. If an effect range low value is not available, the effects range medium value was used. The effects range medium values are denoted with *.

Summary of Analytical Results for Additional New Jersey Sediment Samples
Northeastern Supply Enhancement Project, New York and New Jersey

Analyte	Location ID:	BHA 9-ALT
	Sample Name:	BHA-9 SS7 15-17
	Depth:	15 - 17 ft
	Date:	10/08/16
	Screening Criteria ⁽¹⁾	
Metals by Method SW-846 6020A (mg/kg)		
Aluminum	18000	554
Antimony	9.3	0.167 U
Arsenic	8.2	1.40
Barium	48	3.40 J
Beryllium	N/A	0.108 U
Cadmium	1.2	0.033 U
Calcium	N/A	289 J
Chromium, Total	81	5.70
Cobalt	10	0.203 J
Copper	34	5.92
Iron	N/A	2010
Lead	47	3.95
Magnesium	N/A	202
Manganese	260	3.73
Molybdenum	N/A	0.279 U
Nickel	21	0.584 J
Potassium	N/A	321
Selenium	1	0.936 U
Silver	1	0.060 U
Sodium	N/A	986
Strontium	N/A	2.37
Thallium	N/A	0.064 U
Tin	N/A	0.323 U
Titanium	N/A	69.4
Vanadium	57	8.44
Zinc	150	4.33 J

Key:

Qualifiers

J = Estimated value

U = Not detected (method detection limit shown)

Other

mg/kg = milligrams per kilogram

N/A = No standard or guidance value available

Other:

Bold values denote a positive detection of the analyte.

Shaded values denote an exceedance of the screening criteria.

Notes:

1. NJDEP Ecological Screening Criteria (2009). Screening criteria are for sediment, saline water criteria, effects range low. If an effect range low value is not available, the effects range medium value was used. The effects range medium values are denoted with *.

Summary of Analytical Results for Vibracore Sediment Samples
Northeastern Supply Enhancement Project, New York and New Jersey

Analyte	NJDEP Low Effects Range	Location ID:	VC 88		VC 88		VC 88		VC 88		VC 88		VC 89		VC 89		VC 89		VC 89
		Sample Name:	DUP-D9-10E		VC88-D0-3E		VC88-D3-6E		VC88-D6-9E		VC88-D9-10E		DUP-D0-3E		VC89-D0-3E		VC89-D3-6E		VC89-D6-9E
		Date:	5/19/17		5/19/17		5/19/17		5/19/17		5/19/17		5/19/17		5/19/17		5/19/17		5/19/17
		NYSDEC No Appreciable Contamination Threshold Values																	
Metals by Method SW-846 6020A (mg/kg)																			
Aluminum	18000*	N/A	15700		1150		3650		16100		16600		1500		1590		7700		15900
Antimony	9.3*	N/A	0.248	U	0.171	U	0.189	U	0.247	U	0.322	U	0.164	U	0.168	U	0.21	U	0.229
Arsenic	8.2	8.2	14		1.74		3.84		13.1		14.5		6.2		4.62		6.63		14.8
Barium	48*	N/A	26.9		2.12	U	7.14		26.4		27.6		1.75	U	2.4	U	17.7		28.1
Beryllium	N/A	N/A	0.974		0.112	J	0.26	J	1.05		1.05		0.216	J	0.187	J	0.575		0.997
Cadmium	1.2	1.2	0.132	J	0.033	U	0.055	J	0.121	J	0.088	J	0.032	U	0.033	U	0.085	J	0.101
Calcium	N/A	N/A	3070		4190		1660		2480		3000		773		747		1330		4000
Chromium, Total	81	81	33.6		4.63		10.5		34.3		36.1		11.3		7.8		18.2		34.7
Cobalt	10*	N/A	9.4		0.785		2.32		9.72		10.2		0.943		1.82		5.3		9.73
Copper	34	34	13.3		1.26	U	0.271	U	13.5		14.3		0.235	U	0.241	U	0.302	U	14.2
Iron	N/A	N/A	36100		6530		10600		37400		39100		13600		13000		21600		41500
Lead	47	47	13.1		1.76		4.12		13.2		13.6		2.15		2.57		9.83		13.4
Magnesium	N/A	N/A	7950		882		1970		8160		8390		776		880		3980		7830
Manganese	260*	N/A	277		25.4		74.3		269		308		22.4		24.9		139		276
Molybdenum	N/A	N/A	2.01		0.9	J	1.66		2.55		1.88		0.983		1.06		1.34		1.46
Nickel	21	21	24.4		1.74		5.65		24.4		25.3		2.76		2.24		12.4		24.6
Potassium	N/A	N/A	3530		295		848		3520		3710		293		350		1730		3410
Selenium	1*	N/A	11.2		0.958	U	3.08		10.4		12.3		1.58	J	1.86	J	9.02		11.8
Silver	1	1	0.089	U	0.062	U	0.068	U	0.089	U	0.087	U	0.059	U	0.061	U	0.076	U	0.083
Sodium	N/A	N/A	7660		2190		2950		7400		7530		2130		2180		3880		5460
Strontium	N/A	N/A	29		22.5		12.3		26.4		29.7		6.01		5.97		16.1		32.2
Thallium	N/A	N/A	0.142	J	0.065	U	0.072	U	0.155	J	0.157	J	0.063	U	0.188	J	0.082	J	0.141
Tin	N/A	N/A	0.515	J	0.157	U	0.173	U	0.495	J	0.568	J	0.15	U	0.154	U	0.493	J	0.548
Titanium	N/A	N/A	290		60.9		118		278		303		44		65.5		160		290
Vanadium	57*	N/A	38.9		9.49		15		40.4		39.9		19		20.3		27.4		39.7
Zinc	150	150	72.1		5.74	J	17.6		74.7		76.4		10.3	J	9.74	J	39.9		75.7
Mercury by Method SW-846 7474 (mg/kg)																			
Mercury	0.15	0.15	0.012	J	0.002	U	0.005	J	0.015	J	0.014	J	0.002	U	0.002	U	0.01	J	0.013

Summary of Analytical Results for Vibracore Sediment Samples
Northeastern Supply Enhancement Project, New York and New Jersey

Analyte	NJDEP Low Effects Range	Location ID: Sample Name: Date: NYSDEC No Appreciable Contamination Threshold Values		VC 89		VC 90		VC 90		VC 90		VC 90		VC 90		VC 91		VC 91	
				VC89-D9-10E		DUP-D6-9E		VC90-D0-3E		VC90-D3-6E		VC90-D6-9E		VC90-D9-10E		VC91-D0-3E		VC91-D3-6E	
				5/19/17		5/19/17		5/19/17		5/19/17		5/19/17		5/19/17		5/19/17		5/19/17	
Metals by Method SW-846 6020A (mg/kg)																			
Aluminum	18000*	N/A		17000		15300		3730		8420		15800		17000		2050		12500	
Antimony	9.3*	N/A	U	0.25	U	0.236	U	0.16	U	0.186	U	0.238	U	0.243	U	0.154	U	0.215	U
Arsenic	8.2	8.2		14		12.9		3.66		9.33		14.6		16.2		2.06		11.2	
Barium	48*	N/A		33.4		29.1		7.69		16.5		26.6		30.5		6.15		25.1	
Beryllium	N/A	N/A		1.02		0.99		0.289	J	0.636		1		1.04		0.201	J	0.84	
Cadmium	1.2	1.2	J	0.174	J	0.149	J	0.041	J	0.071	J	0.079	J	0.26	J	0.146	J	0.114	J
Calcium	N/A	N/A		3980		34100		11200		2950		2740		16500		260	J	11000	
Chromium, Total	81	81		37.4		34.2		9.58		21.2		34.1		38.1		8.18		27.7	
Cobalt	10*	N/A		10.1		8.94		2.82		5.59		9.42		10.1		1.41		7.6	
Copper	34	34		15.4		13.6		0.23	U	0.266	U	14.5		15.3		10.7		11.8	
Iron	N/A	N/A		52500		37200		11200		27300		38500		44200		7760		31700	
Lead	47	47		13.2		12.3		6.21		8.87		13.5		13.7		5.77		11.4	
Magnesium	N/A	N/A		7620		7320		1830		4880		7860		7880		797		6310	
Manganese	260*	N/A		291		282		102		158		275		375		25.7		227	
Molybdenum	N/A	N/A		1.91		2.29		0.587	J	2.63		1.3	J	3.81		0.243	J	1.56	
Nickel	21	21		27.2		23.8		5.73		13.7		24.7		27.4		3.5		18.9	
Potassium	N/A	N/A		3700		3490		771		1960		3500		3760		372		2800	
Selenium	1*	N/A		11.3		10.8		2.65		8.94		11.4		11.3		2.54		9.21	
Silver	1	1	U	0.09	U	0.085	U	0.058	U	0.067	U	0.086	U	0.088	U	0.056	U	0.078	U
Sodium	N/A	N/A		5570		6410		2610		4560		6100		6650		1760		5440	
Strontium	N/A	N/A		31.2		213		53.2		24		26.5		79.6		4.77		62.8	
Thallium	N/A	N/A	J	0.165	J	0.171	J	0.061	U	0.086	J	0.138	J	0.185	J	0.177	J	0.17	J
Tin	N/A	N/A	J	0.493	J	0.477	J	0.202	J	0.317	J	0.47	J	0.518	J	0.141	U	0.433	J
Titanium	N/A	N/A		328		343		101		183		272		335		43.9		233	
Vanadium	57*	N/A		41.6		38.3		14.3		34.8		38.2		41		17.1		31.4	
Zinc	150	150		82		69.8		18.5		47.1		76		77.1		13.3		58.7	
Mercury by Method SW-846 7474 (mg/kg)																			
Mercury	0.15	0.15	J	0.013	J	0.013	J	0.002	J	0.007	J	0.013	J	0.015	J	0.002	U	0.011	J

Summary of Analytical Results for Vibracore Sediment Samples
Northeastern Supply Enhancement Project, New York and New Jersey

			Location ID:		VC 91		VC 92		VC 92		VC 92		VC 92		VC 93	
			Sample Name:	Date:	VC91-D6-9.6E	5/19/17	DUP-D3-6E	5/19/17	VC92-D0-3E	5/19/17	VC92-D3-6E	5/19/17	VC92-D6-9E	5/19/17	VC92-D9-10E	5/19/17
Analyte		NJDEP Low Effects Range	NYSDEC No Appreciable Contamination Threshold Values													
Metals by Method SW-846 6020A (mg/kg)																
Aluminum	18000*	N/A	16000		2800		1290		3950		4620		2430		928	
Antimony	9.3*	N/A	0.235	U	0.17	U	0.177	U	0.169	U	0.264	U	0.176	U	0.404	U
Arsenic	8.2	8.2	12.8		4.51		1.57		7.81		5.22		3.05		3.71	
Barium	48*	N/A	28.9		4.5		3.17	U	6.38		9.34		6.22		2.36	J
Beryllium	N/A	N/A	1.04		0.236	J	0.114	U	0.374	J	0.343	J	0.214	J	0.148	J
Cadmium	1.2	1.2	0.152	J	0.055	J	0.035	U	0.039	J	0.075	J	0.053	J	0.108	J
Calcium	N/A	N/A	3410		345	J	1510		916		794		324	J	252	J
Chromium, Total	81	81	35.1		11.1		4.36		12		12.9		7.27		7.7	
Cobalt	10*	N/A	9.79		1.57		1.13		2.78		2.61		1.34		1.92	
Copper	34	34	15		0.244	U	1.44	U	0.243	U	0.261	U	0.252	U	12.9	
Iron	N/A	N/A	39900		12000		4890		15900		14400		9800		6890	
Lead	47	47	13.2		2.78		3.22		4.57		5.2		3.66		11.9	
Magnesium	N/A	N/A	7540		1190		878		1970		1800		965		485	
Manganese	260*	N/A	260		38.4		44.3		72.9		95.1		85.7		31.3	
Molybdenum	N/A	N/A	1.88		0.796	J	0.198	J	1.01		1.28		1.02	J	0.701	J
Nickel	21	21	26.5		3.78		1.97		6.39		6.65		3.34		4.94	
Potassium	N/A	N/A	3530		624		367		835		964		548		219	
Selenium	1*	N/A	12.7		2.3	J	1.67	J	3.29		4.14		2.55	J	0.948	J
Silver	1	1	0.085	U	0.061	U	0.064	U	0.061	U	0.066	U	0.063	U	0.138	J
Sodium	N/A	N/A	6370		2200		2430		2740		2520		2360		1840	
Strontium	N/A	N/A	29.8		5.6		11.5		9.64		9.76		5.92		4.11	
Thallium	N/A	N/A	0.182	J	0.065	U	0.068	U	0.065	U	0.102	J	0.067	U	0.063	U
Tin	N/A	N/A	0.546	J	0.156	U	0.162	U	0.155	U	0.265	J	0.161	U	1.29	J
Titanium	N/A	N/A	290		71.2		65.6		101		109		75		54.9	
Vanadium	57*	N/A	39.8		15		5.99		20.3		17.6		10.2		12.3	
Zinc	150	150	74.7		14.6		7.8	J	25.2		20.5		11.5	J	42.9	
Mercury by Method SW-846 7474 (mg/kg)																
Mercury	0.15	0.15	0.013	J	0.002	U	0.002	U	0.002	U	0.002	U	0.002	U	0.002	U

Summary of Analytical Results for Vibracore Sediment Samples
Northeastern Supply Enhancement Project, New York and New Jersey

Analyte

Key:

Qualifiers

J = Estimated value

U = Not detected (method detection limit shown)

Other

mg/kg = milligrams per kilogram

N/A = No standard or guidance value available.

Notes:

1. Bold value denotes a detection of the analyte. Shaded values denote an exceedance of the NYSDEC screening criteria, underlined values denote an exceedance of the NJDEP screening criteria and an underlined and shaded value denotes an exceedance of both criteria.

¹ Reporting limits from USACE/EPA Guidance for Performing Tests on Dredged Material Proposed for Ocean Disposal (2014). Present reporting limits from The Management and Regulation of Dredging Activities and Dredged Material in New Jersey’s Tidal Waters (1997). If both documents provide reporting limits, only the lowest is shown here.

² NJDEP Ecological Screening Criteria (2009). Values denoted with * are Effects Range Medium.

³ Primary threshold value from NYS TOGS 5.1.9 (2004). Value presented from NYS Screening and Assessment of Contaminated Sediment (2014).

C

Sediment Chemistry Laboratory Reports

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www.alphalab.com



Lab Number: L1710301

Client: Alpine Ocean Seismic Survey, Inc

ATTN: Mark Kosakowski

Project Name: NESE

Project Number: 1794

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Sample Delivery Group Information





Sample Delivery Group Form

Laboratory Job number: L1710301

Project Manager: Elizabeth Porta

Review Date: 04/05/2017

Project Number: 1794

Project Name: NESE

Received: 04/05/2017 00:00

Client Account: Alpine Ocean Seismic Survey Inc.

Received by: KB

Samples Delivered by: UPS

Call Tracker #

Bill Of Laden Yes

Trackingnum 1Z4R8F410192160708

Coc Present Present

Container Status Intact

Sample IDs

All Containers Accounted For? Yes

Were Extra Samples Received? No

Do Sample Labels and COC agree? Yes

Are Samples in Appropriate Containers? Yes

Are Samples Received within Holding time? No
all HG out of hold

pH of Samples upon Receipt N/A

Are samples Properly Preserved? Yes

Initial pH preserved in house with

Final pH

Other Issues

Chlorine Check N/A

Are VOA/VPV Vials Present? No

Aqueous: Do Vials Contain Head Space? N/A

Soils: Is MeOH Covering the Soil? N/A

Reagent H2O Preserved vials Frozen on N/A

Frozen by Client N/A

Cooler

Seal

Ice Present

Blue Ice Present

Temp. (Celsius)

Frozen upon Receipt

Delivered Direct from Site

A

Absent

No

No

14.9 - IR Gun

No

No

LIMS Chain of Custody

ALPHA ANALYTICAL LABORATORIES, INC.
LOGIN CHAIN OF CUSTODY REPORT
Apr 06 2017, 05:43 pm

Login Number: L1710301

Account: ALPINE Alpine Ocean Seismic Survey Inc. Project: 1794

Sample #	Client ID	Received: 05APR17 Mat PR Collected	Due Date: 06APR17 Container
----------	-----------	---------------------------------------	--------------------------------

L1710301-01 BHA-7 SS1 0-2' 3 2A 08OCT16 00:00 1-Glass-A.25

SUB Dioxin & PCBs for Cape Fear 1ZE306540194000068 PCB: No AR1262 or AR1268, Report List Made Pest, SVOC, VOC - Report Lists Made, NO TICs DPKG-FULL Package Due Date: 04/06/17

A2-MO-6020T,A2-SN-6020T,A2-SR-6020T,A2-TAL,A2-AG-6020T,A2-AL-6020T,A2-AS-6020T,A2-BA-6020T,A2-BE-6020T,A2-CA-6020T,A2-CD-6020T,A2-CO-6020T,A2-CR-6020T,A2-CU-6020T,A2-FE-6020T,A2-HG-7474T,A2-HGPREP-AF,A2-K-6020T,A2-MG-6020T,A2-MN-6020T,A2-NA-6020T,A2-NI-6020T,A2-PB-6020T,A2-PREP-3050:1T,A2-PREP-3050:2T,A2-SB-6020T,A2-SE-6020T,A2-TL-6020T,A2-V-6020T,A2-ZN-6020T,A2-TI-6020T,A2-TS,DPKG-FULL

L1710301-02 BHA-7 SS2 2-4' 3 2A 08OCT16 00:00 1-Glass-A.25

SUB Dioxin & PCBs for Cape Fear 1ZE306540194000068 PCB: No AR1262 or AR1268, Report List Made Pest, SVOC, VOC - Report Lists Made, NO TICs Package Due Date: 04/06/17

A2-MO-6020T,A2-SN-6020T,A2-SR-6020T,A2-TAL,A2-AG-6020T,A2-AL-6020T,A2-AS-6020T,A2-BA-6020T,A2-BE-6020T,A2-CA-6020T,A2-CD-6020T,A2-CO-6020T,A2-CR-6020T,A2-CU-6020T,A2-FE-6020T,A2-HG-7474T,A2-HGPREP-AF,A2-K-6020T,A2-MG-6020T,A2-MN-6020T,A2-NA-6020T,A2-NI-6020T,A2-PB-6020T,A2-PREP-3050:1T,A2-PREP-3050:2T,A2-SB-6020T,A2-SE-6020T,A2-TL-6020T,A2-V-6020T,A2-ZN-6020T,A2-TI-6020T,A2-TS

L1710301-03 BHA-7 SS3 4-6' 3 2A 08OCT16 00:00 1-Glass-A.25

SUB Dioxin & PCBs for Cape Fear 1ZE306540194000068 PCB: No AR1262 or AR1268, Report List Made Pest, SVOC, VOC - Report Lists Made, NO TICs Package Due Date: 04/06/17

A2-MO-6020T,A2-SN-6020T,A2-SR-6020T,A2-TAL,A2-AG-6020T,A2-AL-6020T,A2-AS-6020T,A2-BA-6020T,A2-BE-6020T,A2-CA-6020T,A2-CD-6020T,A2-CO-6020T,A2-CR-6020T,A2-CU-6020T,A2-FE-6020T,A2-HG-7474T,A2-HGPREP-AF,A2-K-6020T,A2-MG-6020T,A2-MN-6020T,A2-NA-6020T,A2-NI-6020T,A2-PB-6020T,A2-PREP-3050:1T,A2-PREP-3050:2T,A2-SB-6020T,A2-SE-6020T,A2-TL-6020T,A2-V-6020T,A2-ZN-6020T,A2-TI-6020T,A2-TS

L1710301-04 BHA-7 SS4 6-8' 3 2A 08OCT16 00:00 1-Glass-A.25

SUB Dioxin & PCBs for Cape Fear 1ZE306540194000068 PCB: No AR1262 or AR1268, Report List Made Pest, SVOC, VOC - Report Lists Made, NO TICs Package Due Date: 04/06/17

ALPHA ANALYTICAL LABORATORIES, INC.
LOGIN CHAIN OF CUSTODY REPORT
Apr 06 2017, 05:43 pm

Login Number: L1710301

Account: ALPINE Alpine Ocean Seismic Survey Inc. Project: 1794

Sample #	Client ID	Received: 05APR17 Mat PR Collected	Due Date: 06APR17 Container
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A2-MO-6020T,A2-SN-6020T,A2-SR-6020T,A2-TAL,A2-AG-6020T,A2-AL-6020T,A2-AS-6020T,A2-BA-6020T,A2-BE-6020T,A2-CA-6020T,A2-CD-6020T,A2-CO-6020T,A2-CR-6020T,A2-CU-6020T,A2-FE-6020T,A2-HG-7474T,A2-HGPREP-AF,A2-K-6020T,A2-MG-6020T,A2-MN-6020T,A2-NA-6020T,A2-NI-6020T,A2-PB-6020T,A2-PREP-3050:1T,A2-PREP-3050:2T,A2-SB-6020T,A2-SE-6020T,A2-TL-6020T,A2-V-6020T,A2-ZN-6020T,A2-TI-6020T,A2-TS

L1710301-05 BHA-7 SS5 8-10' 3 2A 08OCT16 00:00 1-Glass-A.25

SUB Dioxin & PCBs for Cape Fear 1ZE306540194000068 PCB: No AR1262 or AR1268, Report List Made Pest, SVOC, VOC - Report Lists Made, NO TICs Package Due Date: 04/06/17

A2-MO-6020T,A2-SN-6020T,A2-SR-6020T,A2-TAL,A2-AG-6020T,A2-AL-6020T,A2-AS-6020T,A2-BA-6020T,A2-BE-6020T,A2-CA-6020T,A2-CD-6020T,A2-CO-6020T,A2-CR-6020T,A2-CU-6020T,A2-FE-6020T,A2-HG-7474T,A2-HGPREP-AF,A2-K-6020T,A2-MG-6020T,A2-MN-6020T,A2-NA-6020T,A2-NI-6020T,A2-PB-6020T,A2-PREP-3050:1T,A2-PREP-3050:2T,A2-SB-6020T,A2-SE-6020T,A2-TL-6020T,A2-V-6020T,A2-ZN-6020T,A2-TI-6020T,A2-TS

L1710301-06 BHA-7 SS6 10-12' 3 2A 08OCT16 00:00 1-Glass-A.25

SUB Dioxin & PCBs for Cape Fear 1ZE306540194000068 PCB: No AR1262 or AR1268, Report List Made Pest, SVOC, VOC - Report Lists Made, NO TICs Package Due Date: 04/06/17

A2-MO-6020T,A2-SN-6020T,A2-SR-6020T,A2-TAL,A2-AG-6020T,A2-AL-6020T,A2-AS-6020T,A2-BA-6020T,A2-BE-6020T,A2-CA-6020T,A2-CD-6020T,A2-CO-6020T,A2-CR-6020T,A2-CU-6020T,A2-FE-6020T,A2-HG-7474T,A2-HGPREP-AF,A2-K-6020T,A2-MG-6020T,A2-MN-6020T,A2-NA-6020T,A2-NI-6020T,A2-PB-6020T,A2-PREP-3050:1T,A2-PREP-3050:2T,A2-SB-6020T,A2-SE-6020T,A2-TL-6020T,A2-V-6020T,A2-ZN-6020T,A2-TI-6020T,A2-TS

L1710301-07 BHA-7 SS7 15-17' 3 2A 08OCT16 00:00 1-Glass-A.25

SUB Dioxin & PCBs for Cape Fear 1ZE306540194000068 PCB: No AR1262 or AR1268, Report List Made Pest, SVOC, VOC - Report Lists Made, NO TICs Package Due Date: 04/06/17

A2-MO-6020T,A2-SN-6020T,A2-SR-6020T,A2-TAL,A2-AG-6020T,A2-AL-6020T,A2-AS-6020T,A2-BA-6020T,A2-BE-6020T,A2-CA-6020T,A2-CD-6020T,A2-CO-6020T,A2-CR-6020T,A2-CU-6020T,A2-FE-6020T,A2-HG-7474T,A2-HGPREP-AF,A2-K-6020T,A2-MG-6020T,A2-MN-6020T,A2-NA-6020T,A2-NI-6020T,A2-PB-6020T,A2-PREP-3050:1T,A2-PREP-3050:2T,A2-SB-6020T,A2-SE-6020T,A2-TL-6020T,A2-V-6020T,A2-ZN-6020T,A2-TI-6020T,A2-TS

ALPHA ANALYTICAL LABORATORIES, INC.
LOGIN CHAIN OF CUSTODY REPORT
Apr 06 2017, 05:43 pm

Login Number: L1710301

Account: ALPINE Alpine Ocean Seismic Survey Inc. Project: 1794

Sample #	Client ID	Received: 05APR17 Mat PR Collected	Due Date: 06APR17 Container
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L1710301-08	BHA-9 SS2 2-4'	3 2A 08OCT16 00:00	1-Glass-A.25
SUB Dioxin & PCBs for Cape Fear 1ZE306540194000068 PCB: No AR1262 or AR1268, Report List Made Pest, SVOC, VOC - Report Lists Made, NO TICs Package Due Date: 04/06/17			
A2-MO-6020T,A2-SN-6020T,A2-SR-6020T,A2-TAL,A2-AG-6020T,A2-AL-6020T,A2-AS-6020T,A2-BA-6020T,A2-BE-6020T,A2-CA-6020T,A2-CD-6020T,A2-CO-6020T,A2-CR-6020T,A2-CU-6020T,A2-FE-6020T,A2-HG-7474T,A2-HGPREP-AF,A2-K-6020T,A2-MG-6020T,A2-MN-6020T,A2-NA-6020T,A2-NI-6020T,A2-PB-6020T,A2-PREP-3050:1T,A2-PREP-3050:2T,A2-SB-6020T,A2-SE-6020T,A2-TL-6020T,A2-V-6020T,A2-ZN-6020T,A2-TI-6020T,A2-TS			
L1710301-09	BHA-9 SS3 4-6'	3 2A 08OCT16 00:00	1-Glass-A.25
SUB Dioxin & PCBs for Cape Fear 1ZE306540194000068 PCB: No AR1262 or AR1268, Report List Made Pest, SVOC, VOC - Report Lists Made, NO TICs Package Due Date: 04/06/17			
A2-MO-6020T,A2-SN-6020T,A2-SR-6020T,A2-TAL,A2-AG-6020T,A2-AL-6020T,A2-AS-6020T,A2-BA-6020T,A2-BE-6020T,A2-CA-6020T,A2-CD-6020T,A2-CO-6020T,A2-CR-6020T,A2-CU-6020T,A2-FE-6020T,A2-HG-7474T,A2-HGPREP-AF,A2-K-6020T,A2-MG-6020T,A2-MN-6020T,A2-NA-6020T,A2-NI-6020T,A2-PB-6020T,A2-PREP-3050:1T,A2-PREP-3050:2T,A2-SB-6020T,A2-SE-6020T,A2-TL-6020T,A2-V-6020T,A2-ZN-6020T,A2-TI-6020T,A2-TS			
L1710301-10	BHA-9 SS4 6-8'	3 2A 08OCT16 00:00	1-Glass-A.25
SUB Dioxin & PCBs for Cape Fear 1ZE306540194000068 PCB: No AR1262 or AR1268, Report List Made Pest, SVOC, VOC - Report Lists Made, NO TICs Package Due Date: 04/06/17			
A2-MO-6020T,A2-SN-6020T,A2-SR-6020T,A2-TAL,A2-AG-6020T,A2-AL-6020T,A2-AS-6020T,A2-BA-6020T,A2-BE-6020T,A2-CA-6020T,A2-CD-6020T,A2-CO-6020T,A2-CR-6020T,A2-CU-6020T,A2-FE-6020T,A2-HG-7474T,A2-HGPREP-AF,A2-K-6020T,A2-MG-6020T,A2-MN-6020T,A2-NA-6020T,A2-NI-6020T,A2-PB-6020T,A2-PREP-3050:1T,A2-PREP-3050:2T,A2-SB-6020T,A2-SE-6020T,A2-TL-6020T,A2-V-6020T,A2-ZN-6020T,A2-TI-6020T,A2-TS			
L1710301-11	BHA-9 SS5 8-10'	3 2A 08OCT16 00:00	1-Glass-A.25
SUB Dioxin & PCBs for Cape Fear 1ZE306540194000068 PCB: No AR1262 or AR1268, Report List Made Pest, SVOC, VOC - Report Lists Made, NO TICs Package Due Date: 04/06/17			

ALPHA ANALYTICAL LABORATORIES, INC.
LOGIN CHAIN OF CUSTODY REPORT
Apr 06 2017, 05:43 pm

Login Number: L1710301

Account: ALPINE Alpine Ocean Seismic Survey Inc. Project: 1794

Sample #	Client ID	Received: 05APR17 Mat PR Collected	Due Date: 06APR17 Container
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A2-MO-6020T,A2-SN-6020T,A2-SR-6020T,A2-TAL,A2-AG-6020T,A2-AL-6020T,A2-AS-6020T,A2-BA-6020T,A2-BE-6020T,A2-CA-6020T,A2-CD-6020T,A2-CO-6020T,A2-CR-6020T,A2-CU-6020T,A2-FE-6020T,A2-HG-7474T,A2-HGPREP-AF,A2-K-6020T,A2-MG-6020T,A2-MN-6020T,A2-NA-6020T,A2-NI-6020T,A2-PB-6020T,A2-PREP-3050:1T,A2-PREP-3050:2T,A2-SB-6020T,A2-SE-6020T,A2-TL-6020T,A2-V-6020T,A2-ZN-6020T,A2-TI-6020T,A2-TS

L1710301-12 BHA-9 SS6 10-12' 3 2A 08OCT16 00:00 1-Glass-A.25

SUB Dioxin & PCBs for Cape Fear 1ZE306540194000068 PCB: No AR1262 or AR1268, Report List Made Pest, SVOC, VOC - Report Lists Made, NO TICs Package Due Date: 04/06/17

A2-MO-6020T,A2-SN-6020T,A2-SR-6020T,A2-TAL,A2-AG-6020T,A2-AL-6020T,A2-AS-6020T,A2-BA-6020T,A2-BE-6020T,A2-CA-6020T,A2-CD-6020T,A2-CO-6020T,A2-CR-6020T,A2-CU-6020T,A2-FE-6020T,A2-HG-7474T,A2-HGPREP-AF,A2-K-6020T,A2-MG-6020T,A2-MN-6020T,A2-NA-6020T,A2-NI-6020T,A2-PB-6020T,A2-PREP-3050:1T,A2-PREP-3050:2T,A2-SB-6020T,A2-SE-6020T,A2-TL-6020T,A2-V-6020T,A2-ZN-6020T,A2-TI-6020T,A2-TS

L1710301-13 BHA-9 SS7 15-17' 3 2A 08OCT16 00:00 1-Glass-A.25

SUB Dioxin & PCBs for Cape Fear 1ZE306540194000068 PCB: No AR1262 or AR1268, Report List Made Pest, SVOC, VOC - Report Lists Made, NO TICs Package Due Date: 04/06/17

A2-MO-6020T,A2-SN-6020T,A2-SR-6020T,A2-TAL,A2-AG-6020T,A2-AL-6020T,A2-AS-6020T,A2-BA-6020T,A2-BE-6020T,A2-CA-6020T,A2-CD-6020T,A2-CO-6020T,A2-CR-6020T,A2-CU-6020T,A2-FE-6020T,A2-HG-7474T,A2-HGPREP-AF,A2-K-6020T,A2-MG-6020T,A2-MN-6020T,A2-NA-6020T,A2-NI-6020T,A2-PB-6020T,A2-PREP-3050:1T,A2-PREP-3050:2T,A2-SB-6020T,A2-SE-6020T,A2-TL-6020T,A2-V-6020T,A2-ZN-6020T,A2-TI-6020T,A2-TS

Container Tracking

ALPHA ANALYTICAL LABORATORIES
Container Tracking Report

Container ID	Type	Status	Transaction Date	From Response	Location	To Operator	Response	Location	Operator
L1710301-01D	Glass-A.25	INTACT	06-APR-17	A2-CUSTODY-REFRIDGE	A2-METALS PREP	Lauren Connolly	A2-CUSTODY-FRZ1-Y2	A2-CUSTODY-FRZ1-Y2	Lauren Connolly
L1710301-01D	Glass-A.25	INTACT	06-APR-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-FRZ1-Y2	Joshua Mertens	A2-METALS PREP	A2-METALS PREP	Joshua Mertens
L1710301-01D	Glass-A.25	INTACT	05-APR-17	A2-CUSTODY-REFRIDGE	A2-METALS PREP	Sonal Patel	A2-CUSTODY-FRZ1-Y2	A2-CUSTODY-FRZ1-Y2	Sonal Patel
L1710301-01D	Glass-A.25	INTACT	05-APR-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIDGE	Joshua Mertens	A2-METALS PREP	A2-METALS PREP	Joshua Mertens
L1710301-01D	Glass-A.25	INTACT	05-APR-17	A2-LOGIN	A2-LOGIN	Elizabeth Porta	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIDGE	Elizabeth Porta
L1710301-02D	Glass-A.25	INTACT	06-APR-17	A2-CUSTODY-REFRIDGE	A2-METALS PREP	Lauren Connolly	A2-CUSTODY-FRZ1-Y2	A2-CUSTODY-FRZ1-Y2	Lauren Connolly
L1710301-02D	Glass-A.25	INTACT	06-APR-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-FRZ1-Y2	Joshua Mertens	A2-METALS PREP	A2-METALS PREP	Joshua Mertens
L1710301-02D	Glass-A.25	INTACT	05-APR-17	A2-CUSTODY-REFRIDGE	A2-METALS PREP	Sonal Patel	A2-CUSTODY-FRZ1-Y2	A2-CUSTODY-FRZ1-Y2	Sonal Patel
L1710301-02D	Glass-A.25	INTACT	05-APR-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIDGE	Joshua Mertens	A2-METALS PREP	A2-METALS PREP	Joshua Mertens
L1710301-02D	Glass-A.25	INTACT	05-APR-17	A2-LOGIN	A2-LOGIN	Elizabeth Porta	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIDGE	Elizabeth Porta
L1710301-03D	Glass-A.25	INTACT	06-APR-17	A2-CUSTODY-REFRIDGE	A2-METALS PREP	Lauren Connolly	A2-CUSTODY-FRZ1-Y2	A2-CUSTODY-FRZ1-Y2	Lauren Connolly
L1710301-03D	Glass-A.25	INTACT	06-APR-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-FRZ1-Y2	Joshua Mertens	A2-METALS PREP	A2-METALS PREP	Joshua Mertens
L1710301-03D	Glass-A.25	INTACT	05-APR-17	A2-CUSTODY-REFRIDGE	A2-METALS PREP	Sonal Patel	A2-CUSTODY-FRZ1-Y2	A2-CUSTODY-FRZ1-Y2	Sonal Patel
L1710301-03D	Glass-A.25	INTACT	05-APR-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIDGE	Joshua Mertens	A2-METALS PREP	A2-METALS PREP	Joshua Mertens
L1710301-03D	Glass-A.25	INTACT	05-APR-17	A2-LOGIN	A2-LOGIN	Elizabeth Porta	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIDGE	Elizabeth Porta
L1710301-04D	Glass-A.25	INTACT	06-APR-17	A2-CUSTODY-REFRIDGE	A2-METALS PREP	Lauren Connolly	A2-CUSTODY-FRZ1-Y2	A2-CUSTODY-FRZ1-Y2	Lauren Connolly
L1710301-04D	Glass-A.25	INTACT	06-APR-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-FRZ1-Y2	Joshua Mertens	A2-METALS PREP	A2-METALS PREP	Joshua Mertens
L1710301-04D	Glass-A.25	INTACT	05-APR-17	A2-CUSTODY-REFRIDGE	A2-METALS PREP	Sonal Patel	A2-CUSTODY-FRZ1-Y2	A2-CUSTODY-FRZ1-Y2	Sonal Patel
L1710301-04D	Glass-A.25	INTACT	05-APR-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIDGE	Joshua Mertens	A2-METALS PREP	A2-METALS PREP	Joshua Mertens
L1710301-04D	Glass-A.25	INTACT	05-APR-17	A2-LOGIN	A2-LOGIN	Elizabeth Porta	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIDGE	Elizabeth Porta
L1710301-05D	Glass-A.25	INTACT	06-APR-17	A2-CUSTODY-REFRIDGE	A2-METALS PREP	Lauren Connolly	A2-CUSTODY-FRZ1-Y2	A2-CUSTODY-FRZ1-Y2	Lauren Connolly
L1710301-05D	Glass-A.25	INTACT	06-APR-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-FRZ1-Y2	Joshua Mertens	A2-METALS PREP	A2-METALS PREP	Joshua Mertens
L1710301-05D	Glass-A.25	INTACT	05-APR-17	A2-CUSTODY-REFRIDGE	A2-METALS PREP	Sonal Patel	A2-CUSTODY-FRZ1-Y2	A2-CUSTODY-FRZ1-Y2	Sonal Patel
L1710301-05D	Glass-A.25	INTACT	05-APR-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIDGE	Joshua Mertens	A2-METALS PREP	A2-METALS PREP	Joshua Mertens
L1710301-05D	Glass-A.25	INTACT	05-APR-17	A2-LOGIN	A2-LOGIN	Elizabeth Porta	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIDGE	Elizabeth Porta

Container ID	Type	Status	Transaction Date	From Response	Location	To Operator	Response	Location	Operator
L1710301-06D	Glass-A.25	INTACT	06-APR-17	A2-CUSTODY-REFRIDGE	A2-METALS	PREP Lauren Connolly	A2-CUSTODY-FRZ1-Y2	A2-CUSTODY-FRZ1-Y2	Lauren Connolly
L1710301-06D	Glass-A.25	INTACT	06-APR-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-FRZ1-Y2	Joshua Mertens	A2-METALS PREP	A2-METALS PREP	Joshua Mertens
L1710301-06D	Glass-A.25	INTACT	05-APR-17	A2-CUSTODY-REFRIDGE	A2-METALS	PREP Sonal Patel	A2-CUSTODY-FRZ1-Y2	A2-CUSTODY-FRZ1-Y2	Sonal Patel
L1710301-06D	Glass-A.25	INTACT	05-APR-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIDGE	Joshua Mertens	A2-METALS PREP	A2-METALS PREP	Joshua Mertens
L1710301-06D	Glass-A.25	INTACT	05-APR-17	A2-LOGIN	A2-LOGIN	Elizabeth Porta	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIDGE	Elizabeth Porta
L1710301-07D	Glass-A.25	INTACT	06-APR-17	A2-CUSTODY-REFRIDGE	A2-METALS	PREP Lauren Connolly	A2-CUSTODY-FRZ1-Y2	A2-CUSTODY-FRZ1-Y2	Lauren Connolly
L1710301-07D	Glass-A.25	INTACT	06-APR-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-FRZ1-Y2	Joshua Mertens	A2-METALS PREP	A2-METALS PREP	Joshua Mertens
L1710301-07D	Glass-A.25	INTACT	05-APR-17	A2-CUSTODY-REFRIDGE	A2-METALS	PREP Sonal Patel	A2-CUSTODY-FRZ1-Y2	A2-CUSTODY-FRZ1-Y2	Sonal Patel
L1710301-07D	Glass-A.25	INTACT	05-APR-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIDGE	Joshua Mertens	A2-METALS PREP	A2-METALS PREP	Joshua Mertens
L1710301-07D	Glass-A.25	INTACT	05-APR-17	A2-LOGIN	A2-LOGIN	Elizabeth Porta	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIDGE	Elizabeth Porta
L1710301-08D	Glass-A.25	INTACT	06-APR-17	A2-CUSTODY-REFRIDGE	A2-METALS	PREP Lauren Connolly	A2-CUSTODY-FRZ1-Y2	A2-CUSTODY-FRZ1-Y2	Lauren Connolly
L1710301-08D	Glass-A.25	INTACT	06-APR-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-FRZ1-Y2	Joshua Mertens	A2-METALS PREP	A2-METALS PREP	Joshua Mertens
L1710301-08D	Glass-A.25	INTACT	05-APR-17	A2-CUSTODY-REFRIDGE	A2-METALS	PREP Sonal Patel	A2-CUSTODY-FRZ1-Y2	A2-CUSTODY-FRZ1-Y2	Sonal Patel
L1710301-08D	Glass-A.25	INTACT	05-APR-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIDGE	Joshua Mertens	A2-METALS PREP	A2-METALS PREP	Joshua Mertens
L1710301-08D	Glass-A.25	INTACT	05-APR-17	A2-LOGIN	A2-LOGIN	Elizabeth Porta	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIDGE	Elizabeth Porta
L1710301-09D	Glass-A.25	INTACT	06-APR-17	A2-CUSTODY-REFRIDGE	A2-METALS	PREP Lauren Connolly	A2-CUSTODY-FRZ1-Y2	A2-CUSTODY-FRZ1-Y2	Lauren Connolly
L1710301-09D	Glass-A.25	INTACT	06-APR-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-FRZ1-Y2	Joshua Mertens	A2-METALS PREP	A2-METALS PREP	Joshua Mertens
L1710301-09D	Glass-A.25	INTACT	05-APR-17	A2-CUSTODY-REFRIDGE	A2-METALS	PREP Sonal Patel	A2-CUSTODY-FRZ1-Y2	A2-CUSTODY-FRZ1-Y2	Sonal Patel
L1710301-09D	Glass-A.25	INTACT	05-APR-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIDGE	Joshua Mertens	A2-METALS PREP	A2-METALS PREP	Joshua Mertens
L1710301-09D	Glass-A.25	INTACT	05-APR-17	A2-LOGIN	A2-LOGIN	Elizabeth Porta	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIDGE	Elizabeth Porta
L1710301-10D	Glass-A.25	INTACT	06-APR-17	A2-CUSTODY-REFRIDGE	A2-METALS	PREP Lauren Connolly	A2-CUSTODY-FRZ1-Y2	A2-CUSTODY-FRZ1-Y2	Lauren Connolly
L1710301-10D	Glass-A.25	INTACT	06-APR-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-FRZ1-Y2	Joshua Mertens	A2-METALS PREP	A2-METALS PREP	Joshua Mertens
L1710301-10D	Glass-A.25	INTACT	05-APR-17	A2-CUSTODY-REFRIDGE	A2-METALS	PREP Sonal Patel	A2-CUSTODY-FRZ1-Y2	A2-CUSTODY-FRZ1-Y2	Sonal Patel
L1710301-10D	Glass-A.25	INTACT	05-APR-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIDGE	Joshua Mertens	A2-METALS PREP	A2-METALS PREP	Joshua Mertens
L1710301-10D	Glass-A.25	INTACT	05-APR-17	A2-LOGIN	A2-LOGIN	Elizabeth Porta	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIDGE	Elizabeth Porta

Container ID	Type	Status	Transaction Date	From Response	Location	To Operator	Response	Location	Operator
L1710301-11D	Glass-A.25	INTACT	06-APR-17	A2-CUSTODY-REFRIDGE	A2-METALS PREP	Lauren Connolly	A2-CUSTODY-FRZ1-Y2	A2-CUSTODY-FRZ1-Y2	Lauren Connolly
L1710301-11D	Glass-A.25	INTACT	06-APR-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-FRZ1-Y2	Joshua Mertens	A2-METALS PREP	A2-METALS PREP	Joshua Mertens
L1710301-11D	Glass-A.25	INTACT	05-APR-17	A2-CUSTODY-REFRIDGE	A2-METALS PREP	Sonal Patel	A2-CUSTODY-FRZ1-Y2	A2-CUSTODY-FRZ1-Y2	Sonal Patel
L1710301-11D	Glass-A.25	INTACT	05-APR-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIDGE	Joshua Mertens	A2-METALS PREP	A2-METALS PREP	Joshua Mertens
L1710301-11D	Glass-A.25	INTACT	05-APR-17	A2-LOGIN	A2-LOGIN	Elizabeth Porta	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIDGE	Elizabeth Porta
L1710301-12D	Glass-A.25	INTACT	06-APR-17	A2-CUSTODY-REFRIDGE	A2-METALS PREP	Lauren Connolly	A2-CUSTODY-FRZ1-Y2	A2-CUSTODY-FRZ1-Y2	Lauren Connolly
L1710301-12D	Glass-A.25	INTACT	06-APR-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-FRZ1-Y2	Joshua Mertens	A2-METALS PREP	A2-METALS PREP	Joshua Mertens
L1710301-12D	Glass-A.25	INTACT	05-APR-17	A2-CUSTODY-REFRIDGE	A2-METALS PREP	Sonal Patel	A2-CUSTODY-FRZ1-Y2	A2-CUSTODY-FRZ1-Y2	Sonal Patel
L1710301-12D	Glass-A.25	INTACT	05-APR-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIDGE	Joshua Mertens	A2-METALS PREP	A2-METALS PREP	Joshua Mertens
L1710301-12D	Glass-A.25	INTACT	05-APR-17	A2-LOGIN	A2-LOGIN	Elizabeth Porta	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIDGE	Elizabeth Porta
L1710301-13D	Glass-A.25	INTACT	06-APR-17	A2-CUSTODY-REFRIDGE	A2-METALS PREP	Lauren Connolly	A2-CUSTODY-FRZ1-Y2	A2-CUSTODY-FRZ1-Y2	Lauren Connolly
L1710301-13D	Glass-A.25	INTACT	06-APR-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-FRZ1-Y2	Joshua Mertens	A2-METALS PREP	A2-METALS PREP	Joshua Mertens
L1710301-13D	Glass-A.25	INTACT	05-APR-17	A2-CUSTODY-REFRIDGE	A2-METALS PREP	Sonal Patel	A2-CUSTODY-FRZ1-Y2	A2-CUSTODY-FRZ1-Y2	Sonal Patel
L1710301-13D	Glass-A.25	INTACT	05-APR-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIDGE	Joshua Mertens	A2-METALS PREP	A2-METALS PREP	Joshua Mertens
L1710301-13D	Glass-A.25	INTACT	05-APR-17	A2-LOGIN	A2-LOGIN	Elizabeth Porta	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIDGE	Elizabeth Porta

Chain of Custody

Westborough, MA	Mansfield, MA
TEL: 508-898-9220	TEL: 508-822-9300
FAX: 508-898-9193	FAX: 508-822-3288

Client Information

Client: Alpine Ocean Seismic Survey, Inc.

Address: 155 Hudson Ave

Norwood, NJ 07648

Phone: (201) 768-8000

Fax: (201) 768-5750

Email: chuck@alpineocean.com

☐ These samples have been Previously analyzed by Alpha

Other Project Specific Requirements/Comments/Detection Limits:

☐ MS/MSD (at unit cost) will be omitted unless you check here

Project Information

Project Name: NESE

Project Location: Raritan Bay/NY

Project #: 1794

Project Manager: Chuck Dill

ALPHA Quote #:

Turn-Around Time

☐ Standard ☐ Rush (ONLY IF PRE-APPROVED)

Due Date: 4/26/17 Time:

ALPHA Lab ID
(Lab Use Only)

Sample ID

Collection

Date _____

Time

Sample
Matrix

**Sampler's
Initials**

[illegible]

Container Type

Preservative

Relinquished By:

Date/Time

Received By:

Date/Time



MANSFIELD CHAIN OF CUSTODY

PAGE 1 OF 1

Project Information

Westborough, MA Mansfield, MA
TEL: 508-898-9220 TEL: 508-822-9300
FAX: 508-898-9193 FAX: 508-822-3288

Project Name: NESE

Client Information

Project Location: Raritan Bay/NY

Client: Alpine Ocean Seismic Survey, Inc.

Project #: 1794

Address: 155 Hudson Ave

Project Manager: Chuck Dill

Norwood, NJ 07648

ALPHA Quote #:

Phone: (201) 768-8000

Turn-Around Time

Fax: (201) 768-5750

☐ Standard☐ Rush (ONLY IF PRE-APPROVED)

Email: chuck@alpineocean.com

☐ These samples have been Previously analyzed by Alpha

Due Date: 4/26/17

Time:

Other Project Specific Requirements/Comments/Detection Limits:

☐ MS/MSD (at unit cost) will be omitted unless you check here

Date Rec'd in Lab: 4/5/17

ALPHA Job #: L716301

Report Information Data Deliverables

☐ FAX☒ EMAIL☐ ADEx☐ Add'l Deliverables

Billing Information

☐ Same as Client info

PO #:

Regulatory Requirements/Report Limits

State/Fed Program

Criteria

ANALYSIS

SAMPLE HANDLING

Filtration

☐ Done☐ Not Needed☐ Lab to do

Preservation

☐ Lab to do

(Please specify below)

Sample Specific Comments

TOTAL # BOTTLES

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection		Sample Matrix	Sampler's Initials
		Date	Time		

10301, 08	BHA-9	8/9/16		Sediment	CD	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	2-4'; 100 ml	1
09	BHA-9	8/9/16		Sediment	CD	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	4-6'; 100 ml	1
10	BHA-9	8/9/16		Sediment	CD	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	6-8'; 100 ml	1
11	BHA-9	8/9/16		Sediment	CD	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	8-10'; 100 ml	1
12	BHA-9	8/9/16		Sediment	CD	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	10-12'; 100 ml	1
13	BHA-9	8/9/16		Sediment	CD	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	15-17'; 100 ml	1
						<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
						<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
						<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
						<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		

Container Type

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Preservative

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Relinquished By:

Date/Time

Received By:

Date/Time

Charles Dill
UPS

4/4/17
11:45

UPS
16m Charles, APC

4/5/17 10:11

Please print clearly, legibly and completely. Samples can not be logged in and turnaround time clock will not start until any ambiguities are resolved. All samples submitted are subject to Alpha's Payment Terms.

Metals

Mercury Analysis

Sample Raw Data

Analysis Report - Filename: C:\Program Files\P S Analytical\Millennium\Results\WG991676.rsrf

Pos	Runs	Type	Name	ID / Action	Conc	Pk Ht	Pk Area	Baseline	Message	Flag	Slope/ CFm	Intercept	Dilutio Factor	SD	RSD	Cal Method	Date/Time
7	1	Cal	0.00	STD0	0.00	0.509467	-77.965370	-0.375087	----		0.000000	0.000000	----	----	----	D 7474	06 Apr 17 10:36
8	1	Cal	0.050	STD1	0.050	10.608017	547.944397	0.062119	----		201.970993	0.509467	----	----	----	D 7474	06 Apr 17 10:38
9	1	Cal	0.100	STD2	0.100	19.410862	982.529907	-0.072449	----		189.013931	0.725418	----	----	----	D 7474	06 Apr 17 10:41
10	1	Cal	0.500	STD3	0.500	99.022522	5095.725586	-0.130154	----		197.168015	0.347919	----	----	----	D 7474	06 Apr 17 10:43
11	1	Cal	2.000	STD4	2.000	378.372284	19765.544922	-0.318152	----		188.778183	1.532190	----	----	----	D 7474	06 Apr 17 10:47
12	1	Cal	5.000	STD5	5.000	923.157959	48400.375000	-0.301786	----		184.526886	3.241733	----	----	----	D 7474	06 Apr 17 10:50
13	1	QC	ICV7474	Ignore	2.700093	501.481384	26002.761719	-0.288087	Pass		184.526886	3.241733	----	----	----	D 7474	06 Apr 17 10:55
7	1	QC	ICB7474	Ignore	-0.015173	0.441940	-193.220200	-0.441940	Fail		184.526886	3.241733	----	----	----	D 7474	06 Apr 17 10:59
14	1	Sample	WG991290-1-T- LC D5		-0.011438	1.131177	59.649754	-0.035214	----		184.526886	3.241733	1	----	----	D 7474	06 Apr 17 11:03
15	1	Sample	WG991290-2-T- LC D50		3.328540	617.446899	30159.392578	0.067619	----		184.526886	3.241733	1	----	----	D 7474	06 Apr 17 11:05
16	1	Sample	L1710301-01-T- LC D10		2.177063	404.968323	20026.052734	-0.063937	----		184.526886	3.241733	1	----	----	D 7474	06 Apr 17 11:14
17	1	Sample	WG991290-4-T- LC D10		1.825438	340.084076	16651.820313	-0.250710	----		184.526886	3.241733	1	----	----	D 7474	06 Apr 17 11:18
18	1	Sample	WG991290-3-T- LC D10		3.474664	644.410645	31865.345703	-0.396442	----		184.526886	3.241733	1	----	----	D 7474	06 Apr 17 11:21
19	1	Sample	L1710301-02-T- LC D10		4.148831	768.812622	37650.812500	-0.345974	----		184.526886	3.241733	1	----	----	D 7474	06 Apr 17 11:25
20	1	Sample	L1710301-03-T- LC D495 LC 04/06/17		3.799015	704.262146	36091.878906	-0.374701	----		184.526886	3.241733	1	----	----	D 7474	06 Apr 17 11:29
21	1	Sample	L1710301-04-T- LC D10-5 LC 04/06/17		3.477494	644.932922	33402.136719	-0.571019	----		184.526886	3.241733	1	----	----	D 7474	06 Apr 17 11:33
22	1	Sample	L1710301-05-T- LC D10-5 LC 04/06/17		0.369493	71.423164	3607.454590	-0.507546	----		184.526886	3.241733	1	----	----	D 7474	06 Apr 17 11:37
23	1	Sample	L1710301-06-T- LC D10-5 LC 04/06/17		0.089518	19.760132	886.733582	-0.654575	----		184.526886	3.241733	1	----	----	D 7474	06 Apr 17 11:39
13	1	QC	CCV7474	Ignore	2.552480	474.242981	24866.619141	-0.130473	Pass		184.526886	3.241733	----	----	----	D 7474	06 Apr 17 11:42
7	1	QC	CCB7474	Ignore	-0.012289	0.974149	-7.530665	-0.362970	Fail		184.526886	3.241733	----	----	----	D 7474	06 Apr 17 11:46
24	1	Sample	L1710301-07-T- LC D10-5 LC 04/06/17		0.065792	15.382107	772.037720	0.030213	----		184.526886	3.241733	1	----	----	D 7474	06 Apr 17 11:49
25	1	Sample	L1710301-08-T- LC D10-5 LC 04/06/17		0.173131	35.189075	1741.913696	-0.100185	----		184.526886	3.241733	1	----	----	D 7474	06 Apr 17 11:51
26	1	Sample	L1710301-09-T- LC D10-5 LC 04/06/17		0.113987	24.275446	1152.020264	-0.251372	----		184.526886	3.241733	1	----	----	D 7474	06 Apr 17 11:54
27	1	Sample	L1710301-10-T- LC D10-5 LC 04/06/17		0.049130	12.307567	581.602905	-0.326499	----		184.526886	3.241733	1	----	----	D 7474	06 Apr 17 11:56
28	1	Sample	L1710301-11-T- LC		0.085004	18.927256	934.960876	-0.115801	----		184.526886	3.241733	1	----	----	D 7474	06 Apr 17 11:59

Analysis Report - Filename: C:\Program Files\P S Analytical\Millennium\Results\WG991676.rs

Pos	Runs	Type	Name	ID / Action	Conc	Pk Ht	Pk Area	Baseline	Message	Flag	Slope/ CFm	Intercept	Dilutio Factor	SD	RSD	Cal Method	Date/Time
				D10-5 LC 04/06/17													
29	1	Sample	L1710301-12-T- LC D10-5 LC 04/06/17		0.023516	7.581129	354.971558	-0.196421	----		184.526886	3.241733	1	----	----	D 7474	06 Apr 17 12:01
30	1	Sample	L1710301-13-T- LC D5		0.003073	3.808709	171.785339	-0.075322	----		184.526886	3.241733	1	----	----	D 7474	06 Apr 17 12:04
13	1	QC	CCV7474	Ignore	2.502487	465.017853	24576.099609	-0.052271	Pass		184.526886	3.241733	----	----	----	D 7474	06 Apr 17 12:07
7	1	QC	CCB7474	Ignore	-0.012528	0.929934	26.728363	-0.078284	Fail		184.526886	3.241733	----	----	----	D 7474	06 Apr 17 12:11

Calibration Report -

General Details

Measured By :

Calibration #: Default

Fit Type : Least Squares

Unit : ppb

Slope : 184.526886

Y Intercept : 3.241733

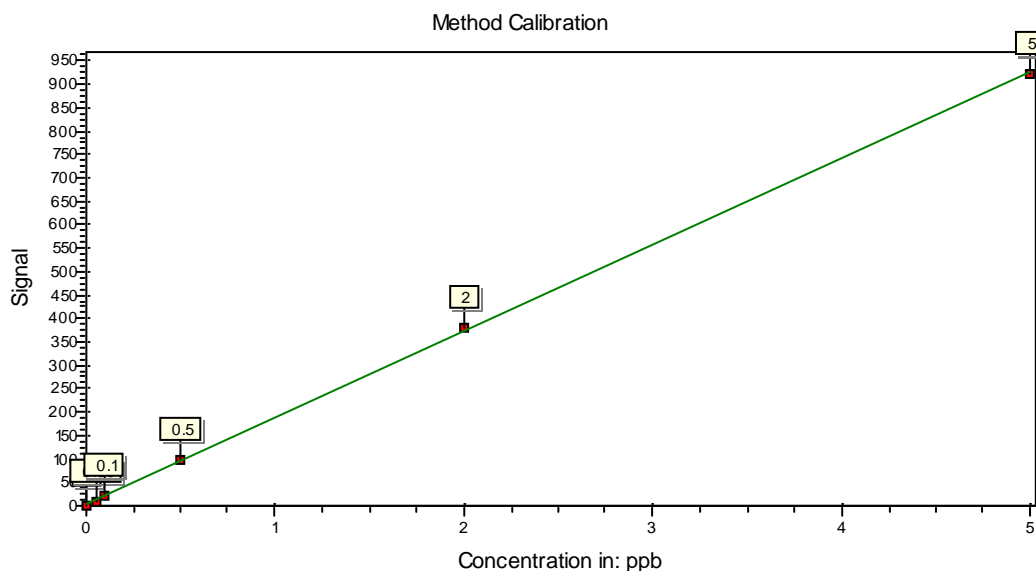
Correlation Coefficient : 0.999945

Reslope %:

Method Name: 7474

Definition of Standards

Include	Pos	Runs	Conc	Pk Ht	Pk Area	Res %	Res Conc	Date/Time
Yes	7	1	0.00	0.509467	-77.965370	0.000000	-0.014807	06 Apr 2017 10:36
Yes	8	1	0.050	10.608017	547.944397	-20.160318	-0.010080	06 Apr 2017 10:38
Yes	9	1	0.100	19.410862	982.529907	-12.375215	-0.012375	06 Apr 2017 10:41
Yes	10	1	0.500	99.022522	5095.725586	3.812285	0.019061	06 Apr 2017 10:43
Yes	11	1	2.000	378.372284	19765.544922	1.646584	0.032932	06 Apr 2017 10:47
Yes	12	1	5.000	923.157959	48400.375000	-0.294613	-0.014731	06 Apr 2017 10:50



Method Set-up Report: C:\Program Files\P S Analytical\Millennium\Methods\7474.mef

Name, Time, Originator/Modifier

Method Title :
Method History : 460
Method Type : Millennium Merlin
Method Name : 7474
Last Modified : 20 Mar 2017
Modified by :

Method Parameters

Unit :	ppb	Idle Actions Active:	Yes
Allow Auto-Range :	No	- Idle After :	6 mins
Gain :	10	- Switch off Pump 1:	Yes
Mode :	Ratio	- Switch off Pump 2 :	Yes
Measurement Mode :	Height	- Switch off Analysis Gas :	Yes
Baseline Check Type :	Units	- Switch off Dryer Gas:	No
Baseline Check Value:	1		
Filter Factor :	32	Over Range Action:	Run Wash
Auto Zero:	Yes	- Blank/Wash Sampler Pos:	7
Allow Negative Results:	Yes	- # Repeats:	1
Blank Subtraction:	No		

Instrument Parameters

Delay Period (s) : 20
Analysis Period (s) : 60
Memory Period (s) : 60

Pump 1 Speed (%) : 100%
Pump 2 Speed (%) : 100%
Valve Flush : On

Notes

CAL=C040517VH2
ICV=I0405VH2
10% HCl =MW120516A
SnCl2 = MW040617SnO2
MERCURYAF

Work Group

ALPHA ANALYTICAL LABORATORIES, INC.

Alpha WORK GROUP REPORT (wk02)

Apr 06 2017, 03:04 pm

Work Group: WG991290 for Department: 5 Inorganics Preparation

Created: 05-APR-17 Due: Operator: jm

Sample	Client ID	C Product	Matrix	Stat	UA	HOLD	DUE	PR	Location
L1710301-01	BHA-7 SS1 0-2'	C A2-HG-7474T	SOIL	DONE	U	1105	0406	2A	Glass-A.5
L1710301-02	BHA-7 SS2 2-4'	C A2-HG-7474T	SOIL	DONE	U	1105	0406	2A	Glass-A.5
L1710301-03	BHA-7 SS3 4-6'	C A2-HG-7474T	SOIL	DONE	U	1105	0406	2A	Glass-A.5
L1710301-04	BHA-7 SS4 6-8'	C A2-HG-7474T	SOIL	DONE	U	1105	0406	2A	Glass-A.5
L1710301-05	BHA-7 SS5 8-10'	C A2-HG-7474T	SOIL	DONE	U	1105	0406	2A	Glass-A.5
L1710301-06	BHA-7 SS6 10-12'	C A2-HG-7474T	SOIL	DONE	U	1105	0406	2A	Glass-A.5
L1710301-07	BHA-7 SS7 15-17'	C A2-HG-7474T	SOIL	DONE	U	1105	0406	2A	Glass-A.5
L1710301-08	BHA-9 SS2 2-4'	C A2-HG-7474T	SOIL	DONE	U	1105	0406	2A	Glass-A.5
L1710301-09	BHA-9 SS3 4-6'	C A2-HG-7474T	SOIL	DONE	U	1105	0406	2A	Glass-A.5
L1710301-10	BHA-9 SS4 6-8'	C A2-HG-7474T	SOIL	DONE	U	1105	0406	2A	Glass-A.5
L1710301-11	BHA-9 SS5 8-10'	C A2-HG-7474T	SOIL	DONE	U	1105	0406	2A	Glass-A.5
L1710301-12	BHA-9 SS6 10-12'	C A2-HG-7474T	SOIL	DONE	U	1105	0406	2A	Glass-A.5
L1710301-13	BHA-9 SS7 15-17'	C A2-HG-7474T	SOIL	DONE	U	1105	0406	2A	Glass-A.5
WG991290-1	Laboratory Method Bl	S A2-HG-7474T	SOIL	DONE	U				
WG991290-10	Cal Standard 4	S A2-HG-7474T	SOIL	DONE	U				
WG991290-11	Cal Standard 5	S A2-HG-7474T	SOIL	DONE	U				
WG991290-12	Initial Calibration	S A2-HG-7474T	SOIL	DONE	U				
WG991290-13	Initial Calibration	S A2-HG-7474T	SOIL	DONE	U				
WG991290-2	Laboratory Control S	S A2-HG-7474T	SOIL	DONE	U				
WG991290-3	Matrix Spike	S A2-HG-7474T	SOIL	DONE	U				
WG991290-4	Duplicate Sample	S A2-HG-7474T	SOIL	DONE	U				
WG991290-5	Serial Dilution	S A2-HG-7474T	SOIL	DONE	U				
WG991290-6	Calibration Blank	S A2-HG-7474T	SOIL	DONE	U				
WG991290-7	Cal Standard 1	S A2-HG-7474T	SOIL	DONE	U				
WG991290-8	Cal Standard 2	S A2-HG-7474T	SOIL	DONE	U				
WG991290-9	Cal Standard 3	S A2-HG-7474T	SOIL	DONE	U				
Comments:									
WG991290-3	L1710301-01								
WG991290-4	L1710301-01								
WG991290-5	L1710301-01								

Sample Preparation



METALS ELN REPORT

Workgroup: WG991290

Digestion

Prep Method	Acid Type 1	Acid 1 Lot	Acid Type 2	Acid 2 Lot	Spike Type	Lims Spike Lot	Spike Lot	Srm Spikelot Use	Srm For	Pipette Id
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EPA 7474	HNO3	MS022217A	BrCl	MW032817A	METALS	HPHGAF	I031517V	D091-540	Y	WHG-25
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Additional Reagent/Std	HCl	MS032117A
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Sample/ Type	Digestion Date	Analyst	Sample Weight g	Balance Id	Spike Amt ml	Start Date/Time	Hot Block Unit	Temperatur e (C)	Stop Date/Time	Reaction Start	Reaction Stop	Final Vol	Comments
WG991290-1 BLANK	04/05/17 12:14	Joshua Mertens	1	14621306		04/05/17 12:14	002082	95.1	04/05/17 12:55	04/05/17 14:00	04/06/17 08:00	50	
WG991290-2 LCS	04/05/17 12:14	Joshua Mertens	.54	14621306	.54	04/05/17 12:14	002082	95.1	04/05/17 12:55	04/05/17 14:00	04/06/17 08:00	50	
WG991290-3 MS	04/05/17 12:14	Joshua Mertens	1.08	14621306	.625	04/05/17 12:14	002082	95.1	04/05/17 12:55	04/05/17 14:00	04/06/17 08:00	50	
WG991290-4 DUP	04/05/17 12:14	Joshua Mertens	1.06	14621306		04/05/17 12:14	002082	95.1	04/05/17 12:55	04/05/17 14:00	04/06/17 08:00	50	
WG991290-5 SERDIL	04/05/17 12:14	Joshua Mertens	1.07	14621306		04/05/17 12:14	002082	95.1	04/05/17 12:55	04/05/17 14:00	04/06/17 08:00	50	
WG991290-6 CALBLANK	04/05/17 12:14	Joshua Mertens	1	14621306		04/05/17 12:14	002082	95.1	04/05/17 12:55	04/05/17 14:00	04/06/17 08:00	50	
WG991290-7 STD1	04/05/17 12:14	Joshua Mertens	1	14621306		04/05/17 12:14	002082	95.1	04/05/17 12:55	04/05/17 14:00	04/06/17 08:00	50	
WG991290-8 STD2	04/05/17 12:14	Joshua Mertens	1	14621306		04/05/17 12:14	002082	95.1	04/05/17 12:55	04/05/17 14:00	04/06/17 08:00	50	
WG991290-9 STD3	04/05/17 12:14	Joshua Mertens	1	14621306		04/05/17 12:14	002082	95.1	04/05/17 12:55	04/05/17 14:00	04/06/17 08:00	50	
L1710301-01 SAMP	04/05/17 12:14	Joshua Mertens	1.07	14621306		04/05/17 12:14	002082	95.1	04/05/17 12:55	04/05/17 14:00	04/06/17 08:00	50	
L1710301-02 SAMP	04/05/17 12:14	Joshua Mertens	.97	14621306		04/05/17 12:14	002082	95.1	04/05/17 12:55	04/05/17 14:00	04/06/17 08:00	50	
L1710301-03 SAMP	04/05/17 12:14	Joshua Mertens	1.06	14621306		04/05/17 12:14	002082	95.1	04/05/17 12:55	04/05/17 14:00	04/06/17 08:00	50	
L1710301-04 SAMP	04/05/17 12:14	Joshua Mertens	1.11	14621306		04/05/17 12:14	002082	95.1	04/05/17 12:55	04/05/17 14:00	04/06/17 08:00	50	



METALS ELN REPORT

Workgroup: WG991290

Sample/ Type	Digestion Date	Analyst	Sample Weight g	Balance Id	Spike Amt ml	Start Date/Time	Hot Block Unit	Temperature (C)	Stop Date/Time	Reaction Start	Reaction Stop	Final Vol	Comments
L1710301-05 SAMP	04/05/17 12:14	Joshua Mertens	1.03	14621306		04/05/17 12:14	002082	95.1	04/05/17 12:55	04/05/17 14:00	04/06/17 08:00	50	
L1710301-06 SAMP	04/05/17 12:14	Joshua Mertens	.96	14621306		04/05/17 12:14	002082	95.1	04/05/17 12:55	04/05/17 14:00	04/06/17 08:00	50	
L1710301-07 SAMP	04/05/17 12:14	Joshua Mertens	.94	14621306		04/05/17 12:14	002082	95.1	04/05/17 12:55	04/05/17 14:00	04/06/17 08:00	50	
L1710301-08 SAMP	04/05/17 12:14	Joshua Mertens	1.12	14621306		04/05/17 12:14	002082	95.1	04/05/17 12:55	04/05/17 14:00	04/06/17 08:00	50	
L1710301-09 SAMP	04/05/17 12:14	Joshua Mertens	1.01	14621306		04/05/17 12:14	002082	95.1	04/05/17 12:55	04/05/17 14:00	04/06/17 08:00	50	
L1710301-10 SAMP	04/05/17 12:14	Joshua Mertens	.95	14621306		04/05/17 12:14	002082	95.1	04/05/17 12:55	04/05/17 14:00	04/06/17 08:00	50	
L1710301-11 SAMP	04/05/17 12:14	Joshua Mertens	1.01	14621306		04/05/17 12:14	002082	95.1	04/05/17 12:55	04/05/17 14:00	04/06/17 08:00	50	
L1710301-12 SAMP	04/05/17 12:14	Joshua Mertens	1.01	14621306		04/05/17 12:14	002082	95.1	04/05/17 12:55	04/05/17 14:00	04/06/17 08:00	50	
L1710301-13 SAMP	04/05/17 12:14	Joshua Mertens	1.04	14621306		04/05/17 12:14	002082	95.1	04/05/17 12:55	04/05/17 14:00	04/06/17 08:00	50	
WG991290- 10 STD4	04/05/17 12:14	Joshua Mertens	1	14621306		04/05/17 12:14	002082	95.1	04/05/17 12:55	04/05/17 14:00	04/06/17 08:00	50	
WG991290- 11 STD5	04/05/17 12:14	Joshua Mertens	1	14621306		04/05/17 12:14	002082	95.1	04/05/17 12:55	04/05/17 14:00	04/06/17 08:00	50	
WG991290- 12 ICB	04/05/17 12:14	Joshua Mertens	1	14621306		04/05/17 12:14	002082	95.1	04/05/17 12:55	04/05/17 14:00	04/06/17 08:00	50	
WG991290- 13 ICV	04/05/17 12:14	Joshua Mertens	1	14621306		04/05/17 12:14	002082	95.1	04/05/17 12:55	04/05/17 14:00	04/06/17 08:00	50	



METALS ELN REPORT

Workgroup: WG991290

Reagent	Actual Volume	Units
Hydrochloric Acid (HCl)	3.75	ml
Nitric Acid (HNO3)	1.25	ml
Bromine Chloride (BrCl)	2	ml

True Values

Table IV: Initial Calibration Levels and ICV/CCV Concentrations

Analyte	STD1	STD2	ICV,CCV
	(µg/L)	(µg/L)	(µg/L)
Ag		100	50
Al	10050		5050
As	100		50
B	100		50
Ba		100	50
Be	100		50
Ca	10100		5050
Cd	100		50
Co	100		50
Cr	100		50
Cu	100		50
Fe	10100		5050
K	10000		5500
Mg	10100		5050
Mn	100		50
Mo	100		50
Na	10000		5050
Ni	100		50
Pb	100		50
Sb	100		50
Se	100		50
Si	50		25
Sn	100		50
Sr	100		50
Ti	100		50
Tl	100		50
V	100		50
Zn	100		50
W	1	100	50

Interferent ICSA, ICSAB	(mg/L)
Cl ⁻	2000
Ca	300
Fe, Na	250
Al, Mg, P, K, S	100
C	200
Mo, Ti	2

All analyte concentrations in ICSAB = 100 ppb except for Ag and Ba = 50 ppb

Table IV: Initial Calibration Levels and ICV/CCV Concentrations (MCP)

Analyte	STD1	STD2	STD3	STD4	STD5	ICV,CCV
			(µg/L)	(µg/L)		(µg/L)
Ag	0.2		10		100	50
Al	10	10000		20000		10100
As	0.5	100		1000		100
B	1	100		1000		100
Ba	1	100		1000		100
Be	0.3	100		1000		100
Ca	100	10000		20000		10100
Cd	0.2	100		1000		100
Co	0.2	100		1000		100
Cr	0.5	100		1000		100
Cu	0.5	100		1000		100
Fe	10	10000		20000		10100
K	100	10000		20000		11000
Mg	100	10000		20000		10100
Mn	10	100		1000		100
Mo	1	100		1000		100
Na	100	10000		20000		10100
Ni	0.5	100		1000		100
Pb	0.2	100		1000		100
Sb	0.5	10		100		50
Se	1	100		1000		100
Si	10	100		1000		25
Sn	1	100		1000		100
Sr	5	100		1000		100
Ti	5	100		1000		100
Tl	0.2	100		1000		100
V	5	100		1000		100
Zn	10	100		1000		100
W	5	100		1000		100

Interferent ICSA, ICSAB	(mg/L)
Cl ⁻	2000
Ca	300
Fe, Na	250
Al, Mg, P, K, S	100
C	200
Mo, Ti	2

All analyte concentrations in ICSAB = 100 ppb except for Ag and Ba = 50 ppb

Analyte	LCS,MS Water	LCS,MS soil	LCS,MS Tissue
	(µg/L)	(µg/L)	(µg/L)
Ag	20	40	40
Al	5000	20000	10000
As	1000	4000	2000
B	1000	4000	2000
Ba	1000	4000	2000
Be	500	2000	1000
Ca	5000	4000	10000
Cd	500	2000	1000
Co	1000	4000	2000
Cr	1000	4000	2000
Cu	1000	4000	2000
Fe	5000	20000	10000
K	5000	20000	10000
Mg	5000	20000	10000
Mn	1000	4000	2000
Mo	1000	4000	2000
Na	5000	20000	10000
Ni	1000	4000	2000
Pb	1000	4000	2000
Sb	20	40	40
Se	1000	4000	2000
Si	1000	4000	2000
Sn	250	1000	500
Sr	1000	4000	2000
Ti	1000	4000	2000
Tl	1000	4000	2000
V	1000	4000	2000
Zn	1000	4000	2000
W	100	200	200

Mercury: ICV, CCV, LCS and MS = 2.5 ppb.

Arsenic Hydride, Selenium Hydride: ICV, CCV, LCS and MS = 5 ppb.

Mercury by Method 1631: ICV,CCV = 0.005 ppb, LCS, MS = 0.005 ppb.

ICPMS Analysis

Sequence Logs

Sample List Summary

4/6/2017 7:06:18 AM



Instrument Name: Serial Number:

iCAP Q Undefined

Labbook: Labbook Path

WG991180_MSQ040517.imexp _Application Data\Workspace\LabBooks

Index	Label	Rack	Vial	Main Runs	Survey Runs	Start Time
1	rinse	0	1	3	1	4/5/2017 7:49:17 AM
2	Blank AM ICPMSQ	4	49	3	1	4/5/2017 7:52:38 AM
3	0.2/20 Cal	0	2	3	1	4/5/2017 7:56:03 AM
4	1.0/100 Cal	0	3	3	1	4/5/2017 7:59:24 AM
5	10/1000 Cal	0	4	3	1	4/5/2017 8:02:46 AM
6	120/12000	0	5	3	1	4/5/2017 8:06:08 AM
7	250/25000	0	6	3	1	4/5/2017 8:09:30 AM
8	500/50000	0	7	3	1	4/5/2017 8:12:54 AM
9	Rinse	0	1	3	1	4/5/2017 8:16:17 AM
10	ICV	0	9	3	1	4/5/2017 8:19:38 AM
11	XICB	0	10	3	1	4/5/2017 8:23:03 AM
12	ICB	0	10	3	1	4/5/2017 8:27:18 AM
13	LLICV	4	51	3	1	4/5/2017 8:30:43 AM
14	ICSA	4	53	3	1	4/5/2017 8:34:09 AM
15	ICSAB	4	55	3	1	4/5/2017 8:37:34 AM
16	Rinse	0	1	3	1	4/5/2017 8:41:00 AM
17	Sr 100ppb	4	57	3	1	4/5/2017 8:44:20 AM
18	CCV	0	9	3	1	4/5/2017 8:48:32 AM
19	CCB	0	10	3	1	4/5/2017 8:51:57 AM
20	WG991017-1 MCP-6020TL-10	1	1	3	1	4/5/2017 8:55:22 AM
21	WG991017-2D5 MCP-6020TL-10	1	2	3	1	4/5/2017 8:58:43 AM
22	WG991017-3D5 MCP-6020TL-10	1	3	3	1	4/5/2017 9:02:03 AM
23	L1710261-01 MCP-6020TL-10	1	4	3	1	4/5/2017 9:05:24 AM
24	L1710261-02 MCP-6020TL-10	1	5	3	1	4/5/2017 9:08:44 AM
25	L1710261-03 MCP-6020TL-10	1	6	3	1	4/5/2017 9:12:06 AM
26	L1710261-04 MCP-6020TL-10	1	7	3	1	4/5/2017 9:15:27 AM
27	L1710261-05 MCP-6020TL-10	1	8	3	1	4/5/2017 9:18:49 AM
28	L1710261-06 MCP-6020TL-10	1	9	3	1	4/5/2017 9:22:11 AM
29	L1710261-01 MCP-6020SL-10	1	10	3	1	4/5/2017 9:25:33 AM
30	CCV	0	9	3	1	4/5/2017 9:28:56 AM
31	CCB	0	10	3	1	4/5/2017 9:32:21 AM
32	WG991016-1 MCP-6020SL-10	1	11	3	1	4/5/2017 9:35:46 AM
33	WG991016-2D5 MCP-6020SL-10	1	12	3	1	4/5/2017 9:39:09 AM
34	WG991016-3D5 MCP-6020SL-10	1	13	3	1	4/5/2017 9:42:32 AM
35	WG991146-4 2008TL	1	19	3	1	4/5/2017 9:45:52 AM
36	L1710365-01 2008TL	1	20	3	1	4/5/2017 9:49:14 AM
37	L1710261-02 MCP-6020SL-10	1	14	3	1	4/5/2017 9:52:36 AM
38	L1710261-03 MCP-6020SL-10	1	15	3	1	4/5/2017 9:55:57 AM
39	L1710261-04 MCP-6020SL-10	1	16	3	1	4/5/2017 9:59:17 AM
40	L1710261-05 MCP-6020SL-10	1	17	3	1	4/5/2017 10:02:38 AM
41	L1710261-06 MCP-6020SL-10	1	18	3	1	4/5/2017 10:05:59 AM
42	CCV	0	9	3	1	4/5/2017 10:09:21 AM
43	CCB	0	10	3	1	4/5/2017 10:12:46 AM
44	WG991146-1 2008TL	1	21	3	1	4/5/2017 10:20:39 AM
45	WG987527-1D2 A2-6020T	1	27	3	1	4/5/2017 10:24:01 AM
46	WG991146-2D5 2008TL	1	22	3	1	4/5/2017 10:27:22 AM
47	WG991146-3D10 2008TL	1	23	3	1	4/5/2017 10:30:45 AM
48	WG987527-5D10 A2-6020T	1	28	3	1	4/5/2017 10:34:08 AM
49	WG987527-3D10 A2-6020T	1	29	3	1	4/5/2017 10:37:29 AM
50	WG987527-6D10 A2-6020T	1	30	3	1	4/5/2017 10:40:50 AM
51	L1710186-01 2008TL	1	25	3	1	4/5/2017 10:44:12 AM

Sample List Summary

4/6/2017 7:06:18 AM



Index	Label	Rack	Vial	Main Runs	Survey Runs	Start Time
52	L1710186-02 2008TL	1	26	3	1	4/5/2017 10:47:32 AM
53	L1710124-01 2008TL	1	24	3	1	4/5/2017 10:50:52 AM
54	CCV	0	9	3	1	4/5/2017 10:54:16 AM
55	CCB	0	10	3	1	4/5/2017 10:57:41 AM
56	WG990559-1 6020SL	1	33	3	1	4/5/2017 11:02:54 AM
57	WG990559-2D5 6020SL	1	34	3	1	4/5/2017 11:06:17 AM
58	WG987527-4D2 A2-6020T	1	32	3	1	4/5/2017 11:09:39 AM
59	L1708560-02D2 A2-6020T	1	31	3	1	4/5/2017 11:13:02 AM
60	WG990559-5D10 6020SL	1	36	3	1	4/5/2017 11:16:23 AM
61	WG990559-3D10 6020SL	1	35	3	1	4/5/2017 11:19:47 AM
62	WG990559-6D5 6020SL	1	37	3	1	4/5/2017 11:23:10 AM
63	WG990559-4 6020SL	1	38	3	1	4/5/2017 11:26:30 AM
64	L1709643-01 6020SL	1	39	3	1	4/5/2017 11:29:51 AM
65	L1709643-02 6020SL	1	40	3	1	4/5/2017 11:33:05 AM
66	CCV	0	9	3	1	4/5/2017 11:36:26 AM
67	CCB	0	10	3	1	4/5/2017 11:39:51 AM
68	L1709643-03 6020SL	1	41	3	1	4/5/2017 11:44:58 AM
69	L1709738-01 6020SL	1	42	3	1	4/5/2017 11:48:19 AM
70	L1709738-02 6020SL	1	43	3	1	4/5/2017 11:51:41 AM
71	L1709811-01 6020SL	1	44	3	1	4/5/2017 11:55:03 AM
72	L1709811-02 6020SL	1	45	3	1	4/5/2017 11:58:25 AM
73	L1709811-03 6020SL	1	46	3	1	4/5/2017 12:01:47 PM
74	L1709811-04 6020SL	1	47	3	1	4/5/2017 12:05:10 PM
75	L1709811-05 6020SL	1	48	3	1	4/5/2017 12:08:33 PM
76	L1709811-06 6020SL	1	49	3	1	4/5/2017 12:11:56 PM
77	L1709811-07 6020SL	1	50	3	1	4/5/2017 12:15:17 PM
78	CCV	0	9	3	1	4/5/2017 12:18:38 PM
79	CCB	0	10	3	1	4/5/2017 12:22:03 PM
80	WG989905-1 6020TL	1	54	3	1	4/5/2017 12:25:29 PM
81	WG989905-2D5 6020TL	1	55	3	1	4/5/2017 12:28:51 PM
82	WG989905-3D10 6020TL	1	56	3	1	4/5/2017 12:32:13 PM
83	WG989905-4D10 6020TL	1	57	3	1	4/5/2017 12:35:35 PM
84	WG989905-5D10 6020TL	1	58	3	1	4/5/2017 12:38:58 PM
85	WG989905-6D5 6020TL	1	59	3	1	4/5/2017 12:42:21 PM
86	L1709265-23 6020TL	1	60	3	1	4/5/2017 12:45:44 PM
87	L1709811-08 6020SL	1	51	3	1	4/5/2017 12:49:07 PM
88	L1709811-09 6020SL	1	52	3	1	4/5/2017 12:52:28 PM
89	L1709811-10 6020SL	1	53	3	1	4/5/2017 12:55:49 PM
90	CCV	0	9	3	1	4/5/2017 12:59:10 PM
91	CCB	0	10	3	1	4/5/2017 1:02:35 PM
92	L1709265-21 6020TL	2	3	3	1	4/5/2017 1:07:49 PM
93	L1709265-19 6020TL	2	1	3	1	4/5/2017 1:11:11 PM
94	L1709265-20 6020TL	2	2	3	1	4/5/2017 1:14:32 PM
95	L1709265-22 6020TL	2	4	3	1	4/5/2017 1:17:54 PM
96	L1709265-24 6020TL	2	5	3	1	4/5/2017 1:21:15 PM
97	L1709265-25 6020TL	2	6	3	1	4/5/2017 1:24:37 PM
98	L1709265-26 6020TL	2	7	3	1	4/5/2017 1:27:58 PM
99	L1709265-28 6020TL	2	8	3	1	4/5/2017 1:31:20 PM
100	L1709265-29 6020TL	2	9	3	1	4/5/2017 1:34:43 PM
101	L1709265-30 6020TL	2	10	3	1	4/5/2017 1:38:05 PM
102	CCV	0	9	3	1	4/5/2017 1:41:28 PM
103	CCB	0	10	3	1	4/5/2017 1:44:53 PM
104	L1709265-31 6020TL	2	11	3	1	4/5/2017 1:48:56 PM
105	L1709680-01 6020TL	2	12	3	1	4/5/2017 1:52:19 PM
106	L1709680-02 6020TL	2	13	3	1	4/5/2017 1:55:42 PM
107	L1709680-03 6020TL	2	14	3	1	4/5/2017 1:59:04 PM
108	L1709680-04 6020TL	2	15	3	1	4/5/2017 2:02:26 PM
109	L1709680-05 6020TL	2	16	3	1	4/5/2017 2:05:47 PM
110	L1709680-06 6020TL	2	17	3	1	4/5/2017 2:09:09 PM
111	L1709680-07 6020TL	2	18	3	1	4/5/2017 2:12:24 PM
112	L1709680-08 6020TL	2	19	3	1	4/5/2017 2:15:46 PM

Sample List Summary

4/6/2017 7:06:18 AM



Index	Label	Rack	Vial	Main Runs	Survey Runs	Start Time
113	L1709265-28D20 6020TL	2	20	3	1	4/5/2017 2:19:00 PM
114	CCV	0	9	3	1	4/5/2017 2:22:23 PM
115	CCB	0	10	3	1	4/5/2017 2:25:48 PM
116	WG991289-1D10 A2-6020T	2	21	3	1	4/5/2017 2:29:13 PM
117	WG991289-2D10 A2-6020T	2	22	3	1	4/5/2017 2:32:36 PM
118	WG991289-3D10 A2-6020T	2	23	3	1	4/5/2017 2:35:59 PM
119	WG991289-5D50 A2-6020T	2	24	3	1	4/5/2017 2:39:22 PM
120	WG991289-4D10 A2-6020T	2	26	3	1	4/5/2017 2:42:45 PM
121	L1710301-01D10 A2-6020T	2	27	3	1	4/5/2017 2:46:08 PM
122	L1710301-02D10 A2-6020T	2	28	3	1	4/5/2017 2:49:30 PM
123	L1710301-03D10 A2-6020T	2	29	3	1	4/5/2017 2:52:52 PM
124	L1710301-04D10 A2-6020T	2	30	3	1	4/5/2017 2:56:07 PM
125	WG991289-6D50 A2-6020T	2	25	3	1	4/5/2017 2:59:29 PM
126	CCV	0	9	3	1	4/5/2017 3:02:51 PM
127	CCB	0	10	3	1	4/5/2017 3:06:16 PM
128	L1710301-05D10 A2-6020T	2	31	3	1	4/5/2017 3:12:43 PM
129	L1710301-06D10 A2-6020T	2	32	3	1	4/5/2017 3:16:05 PM
130	L1710301-07D10 A2-6020T	2	33	3	1	4/5/2017 3:19:28 PM
131	L1710301-08D10 A2-6020T	2	34	3	1	4/5/2017 3:22:50 PM
132	L1710301-09D10 A2-6020T	2	35	3	1	4/5/2017 3:26:13 PM
133	L1710301-10D10 A2-6020T	2	36	3	1	4/5/2017 3:29:36 PM
134	xL1710301-11D10 A2-6020T	2	37	3	1	4/5/2017 3:33:00 PM
135	xL1710301-12D10 A2-6020T	2	38	3	1	4/5/2017 3:36:22 PM
136	L1710301-13D10 A2-6020T	2	39	3	1	4/5/2017 3:39:44 PM
137	0301-01 SCAN	2	40	3	1	4/5/2017 3:43:07 PM
138	CCV	0	9	3	1	4/5/2017 3:46:29 PM
139	CCB	0	10	3	1	4/5/2017 3:49:54 PM
140	WG990895-1 6020TL	2	41	3	1	4/5/2017 3:53:20 PM
141	L1709991-01 6020TL	2	49	3	1	4/5/2017 3:56:43 PM
142	WG990895-2D5 6020TL	2	42	3	1	4/5/2017 4:00:06 PM
143	WG990895-3D10 6020TL	2	43	3	1	4/5/2017 4:03:28 PM
144	WG990895-5D10 6020TL	2	44	3	1	4/5/2017 4:06:51 PM
145	WG990895-6D5 6020TL	2	45	3	1	4/5/2017 4:10:13 PM
146	WG990895-4 6020TL	2	46	3	1	4/5/2017 4:13:36 PM
147	L1709899-01 6020TL	2	47	3	1	4/5/2017 4:16:59 PM
148	L1710173-01 6020TL	2	48	3	1	4/5/2017 4:20:22 PM
149	0173-02 SCAN	2	50	3	1	4/5/2017 4:23:45 PM
150	CCV	0	9	3	1	4/5/2017 4:27:08 PM
151	CCB	0	10	3	1	4/5/2017 4:30:33 PM
152	L170978-18 6020TL	2	51	3	1	4/5/2017 4:33:59 PM
153	L1709964-07 6020TL	3	1	3	1	4/5/2017 4:37:22 PM
154	L1710301-11D10 A2-6020T	3	5	3	1	4/5/2017 4:40:45 PM
155	L1710301-12D10 A2-6020T	3	6	3	1	4/5/2017 4:44:08 PM
156	L1709890-08 6020TL	2	52	3	1	4/5/2017 4:47:31 PM
157	L1709899-02 6020TL	2	53	3	1	4/5/2017 4:50:54 PM
158	L1709899-03 6020TL	2	54	3	1	4/5/2017 4:54:17 PM
159	L1709899-04 6020TL	2	55	3	1	4/5/2017 4:57:39 PM
160	L1709899-05 6020TL	2	56	3	1	4/5/2017 5:01:02 PM
161	9964-10 SCAN	3	2	3	1	4/5/2017 5:04:25 PM
162	CCV	0	9	3	1	4/5/2017 5:07:48 PM
163	CCB	0	10	3	1	4/5/2017 5:11:13 PM
164	WG991289-2D10 A2-6020T	3	4	3	1	4/5/2017 5:14:39 PM
165	L1709899-06 6020TL	2	57	3	1	4/5/2017 5:18:02 PM
166	L1709899-07 6020TL	2	58	3	1	4/5/2017 5:21:25 PM
167	L1709899-08 6020TL	2	59	3	1	4/5/2017 5:24:48 PM
168	L1709899-09 6020TL	2	60	3	1	4/5/2017 5:28:11 PM
169	9899-02 SCAN	3	3	3	1	4/5/2017 5:31:34 PM
170	CCV	0	9	3	1	4/5/2017 5:34:57 PM
171	CCB	0	10	3	1	4/5/2017 5:38:23 PM
172	CCV	0	9	3	1	4/5/2017 5:41:48 PM
173	LLCCV	4	51	3	1	4/5/2017 5:45:14 PM

Sample List Summary

4/6/2017 7:06:18 AM



Index	Label	Rack	Vial	Main Runs	Survey Runs	Start Time
174	CCB	0	10	3	1	4/5/2017 5:48:39 PM

User name

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Work Group

ALPHA ANALYTICAL LABORATORIES, INC.
Metals Batch Report - Total Metals (Mass Spec) - A2-6020T Batch WG991289 for dept. 5
Apr 06, 2017 15:04

Sample No.	Client No.	Sample I.D.	Mat	Due	As Sb	Ba B	Cd Be	Cu Cr	Ni Pb	Ag Se	Tl Sr	Ti Sn	Fe Zn	Ca Mn	Al Mg	Na K	V Co	Si Mo	Ha W	Zr W
L1710301-01		BHA-7 SS1 0-2'	3	0406	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
L1710301-02		BHA-7 SS2 2-4'	3	0406	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
L1710301-03		BHA-7 SS3 4-6'	3	0406	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
L1710301-04		BHA-7 SS4 6-8'	3	0406	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
L1710301-05		BHA-7 SS5 8-10'	3	0406	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
L1710301-06		BHA-7 SS6 10-12'	3	0406	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
L1710301-07		BHA-7 SS7 15-17'	3	0406	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
L1710301-08		BHA-9 SS2 2-4'	3	0406	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
L1710301-09		BHA-9 SS3 4-6'	3	0406	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
L1710301-10		BHA-9 SS4 6-8'	3	0406	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
L1710301-11		BHA-9 SS5 8-10'	3	0406	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
L1710301-12		BHA-9 SS6 10-12'	3	0406	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
L1710301-13		BHA-9 SS7 15-17'	3	0406	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
WG991289-1		Laboratory Method	3		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
WG991289-2		Laboratory Contro	3		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
WG991289-3		Matrix Spike	3		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
WG991289-4		Duplicate Sample	3		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
WG991289-5		Post Digestion Sp	3		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
WG991289-6		Serial Dilution	3		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Comments:

WG991289-3 L1710301-01
WG991289-4 L1710301-01
WG991289-5 L1710301-01
WG991289-6 L1710301-01

Tune

System

Time 4/5/2017 7:31:59 AM
Instrument id iCAP Q
Operator ALPHALAB\metals-instrument
Template STD AGD
Serial number SN02236R
Last Autotune Autotune-SourceTune High Matrix Alpha Custom-20170331-081824203.imatdat
Solution 1 ppb Tune B in 2% HNO3 and 0.5% HCl.

Sensitivity & Stability Test

Result	Runs	Sweeps
Passed	5	10

Sensitivity

Analyte	Result	Value	Condition	Limit
Bkg4.5	Passed	0.0 CPS	Less than	2.0 CPS
Bkg220.7	Passed	0.0 CPS	Less than	2.0 CPS
7Li	Passed	5,771.0 CPS	Greater than	500.0 CPS
59Co	Passed	8,614.0 CPS	Greater than	1,000.0 CPS
238U	Passed	29,074.0 CPS	Greater than	2,000.0 CPS
140Ce.16O/140Ce	Passed	0.0126	Less than	0.025
137Ba++/137Ba	Passed	0.0055	Less than	0.034
115In	Passed	13,905.0 CPS	Greater than	5,000.0 CPS

Stability

Analyte	Value	Limit
7Li	1.8 %	5
59Co	1.5 %	5
238U	1.4 %	5
115In	1.3 %	5

Mass Calibration Test

Result	Channels	Dwell	MeasureWidth	PointSpacing	Sweeps
Passed	75	0.04	1.5	0.02	10

Analyte	Result	Centroid	Offset	Peak Width	Peak Width Min	Peak Width Max
7Li	Passed	7.0454	0.0294	0.686	0.650	0.850
59Co	Passed	58.9357	0.0025	0.691	0.650	0.850
115In	Passed	114.9125	0.0086	0.675	0.650	0.850
238U	Passed	238.0642	0.0134	0.681	0.650	0.850

Tune Settings

Parameter	Value
Additional Gas Flow 1	55.00
Additional Gas Flow 2	0.00
Additional Gas Flow 3	0.00
Angular Deflection	-364.99
Auxilliary Flow	0.80
CCT Bias	-2.01
CCT Entry Lens	-110.01
CCT Exit Lens	-160.01
CCT Focus Lens	-4.44
CCT1 Flow	0.00
CCT1 Shut-Off Valve	0.00
CCT2 Flow	0.00
CCT2 Shut-Off Valve	0.00
Cool Flow	14.00
D1 Lens	-200.05
D2 Lens	-90.01
Deflection Entry Lens	-35.00
Extraction Lens 1 Negative	0.00
Extraction Lens 1 Polarity	0.00
Extraction Lens 1 Positive	0.00
Extraction Lens 2	-111.22
Focus Lens	18.79
Nebulizer Flow	0.31
Peristaltic Pump Speed	20.00
Plasma Power	1550.00
Pole Bias	0.96
Quad Entry Lens	-19.61
Sampling Depth	5.00
Spray Chamber Temperature	2.70
Torch Horizontal Position	0.60
Torch Vertical Position	-0.96
Virtual CCT Mass Maximum Dac Limit Set	4095.00
Virtual CCT Mass parameter b	0.65
Virtual CCT Mass to Dac Factor	130.00
Virtual CCT Mass to Dac Offset	-220.00

Vacuum Check

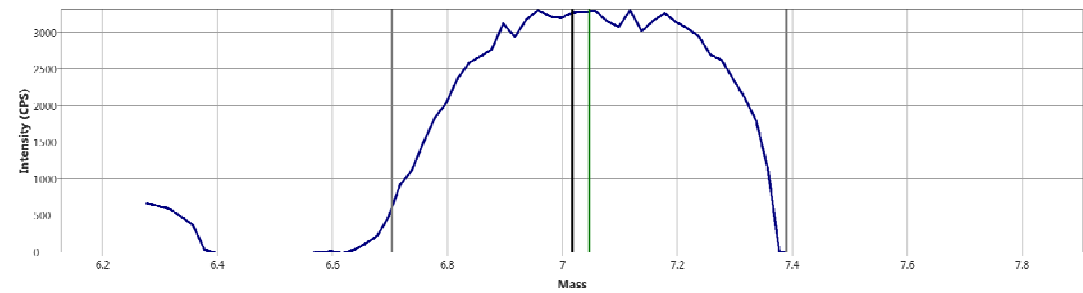
Parameter	Result	Value
Analyzer Pressure	Vacuum ok	3.010e-7
Interface Pressure		2.118e+0

Detector Voltages

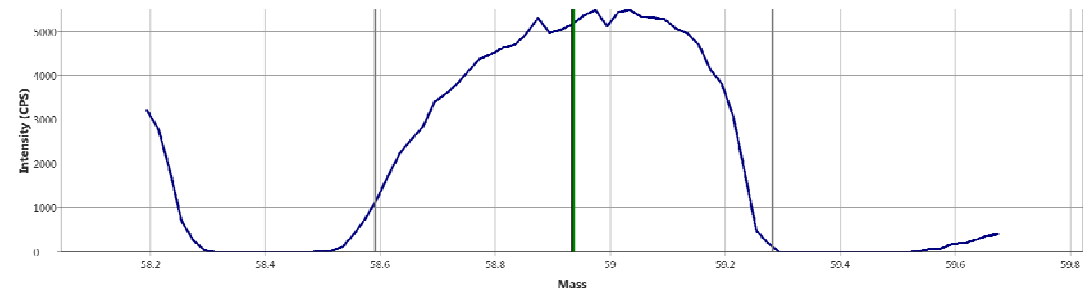
Analog	Counting
-1700.00	1525.00

Mass Calibration Peaks

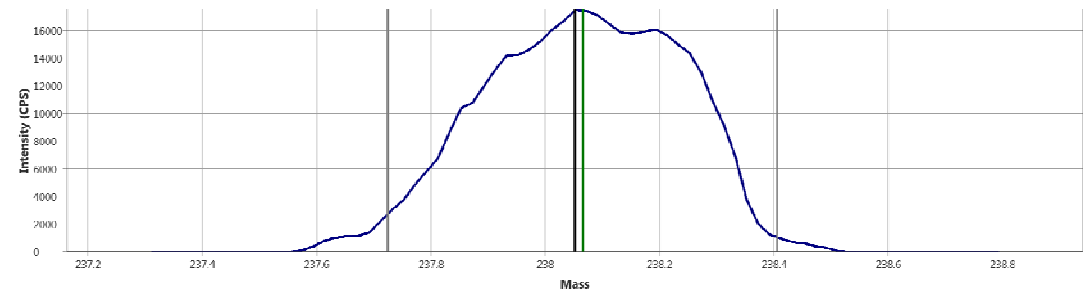
⁷Li



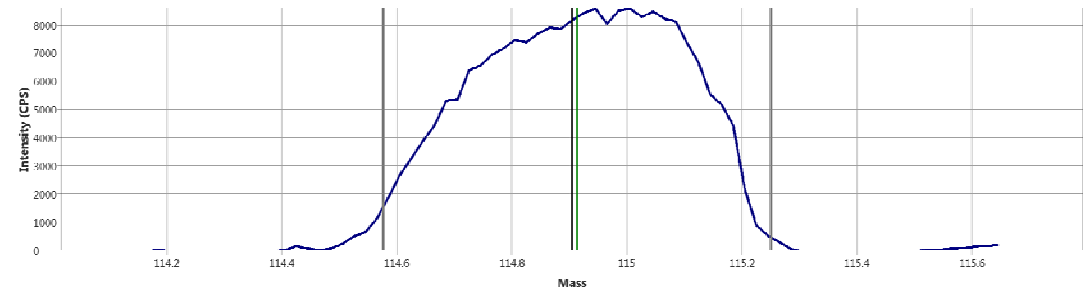
⁵⁹Co



²³⁸U



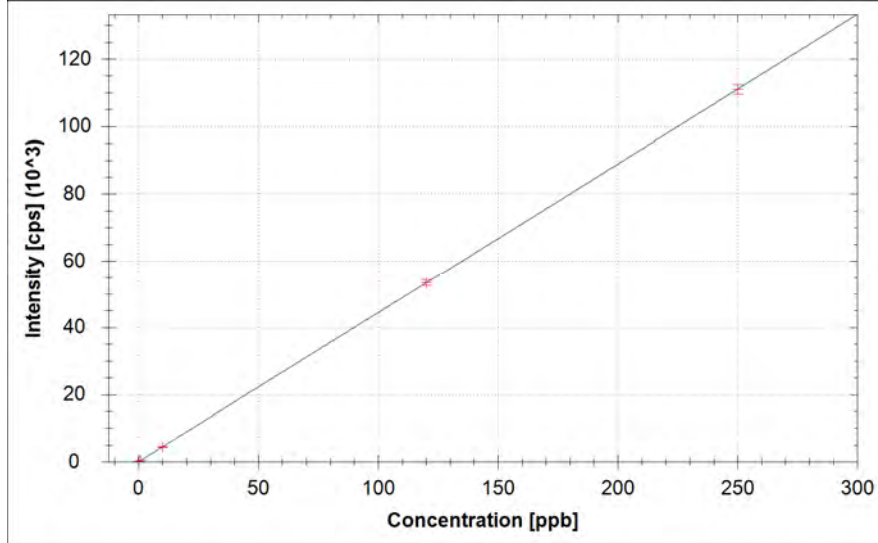
¹¹⁵In



Sample Raw Data

Calibration Curves:

9Be (STD AGD)



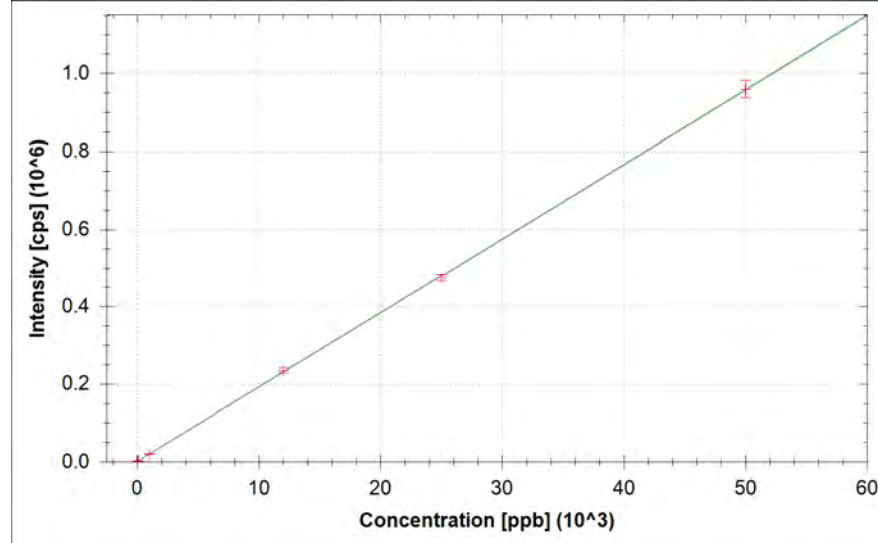
$$f(x) = 444.1900 \cdot x + 1.3189$$

$$R^2 = 1.0000$$

$$\text{BEC} = 0.003 \text{ ppb}$$

$$\text{LoD} = 0.0154 \text{ ppb}$$

23Na (KED AGD)



$$f(x) = 19.1284 \cdot x + 1039.2027$$

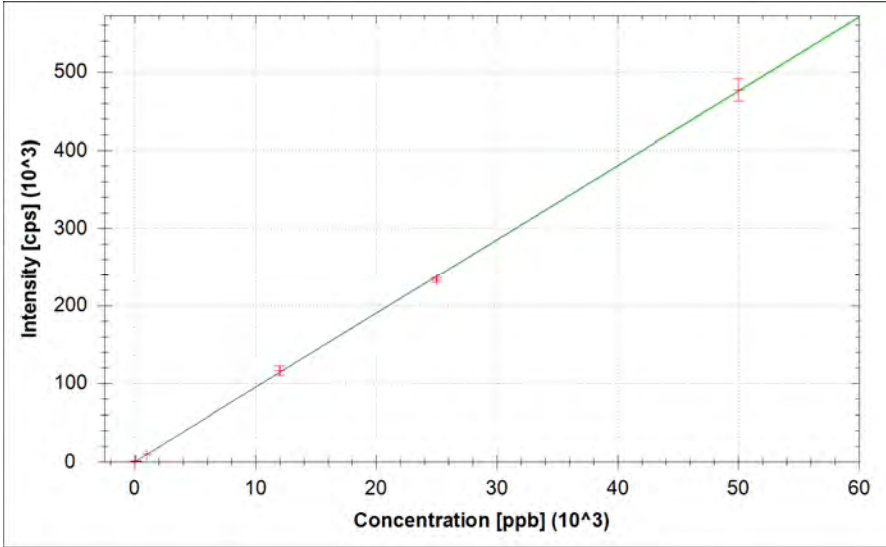
$$R^2 = 0.9999$$

$$\text{BEC} = 54.328 \text{ ppb}$$

$$\text{LoD} = 8.4527 \text{ ppb}$$

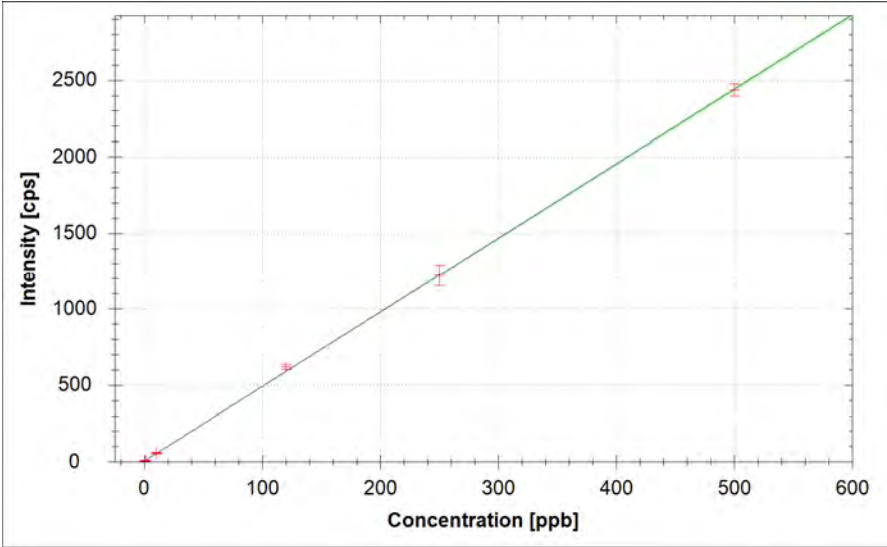


24Mg (KED AGD)



$f(x) = 9.5060 \cdot x + 13.3271$
 $R^2 = 0.9999$
BEC = 1.402 ppb
LoD = 4.8876 ppb

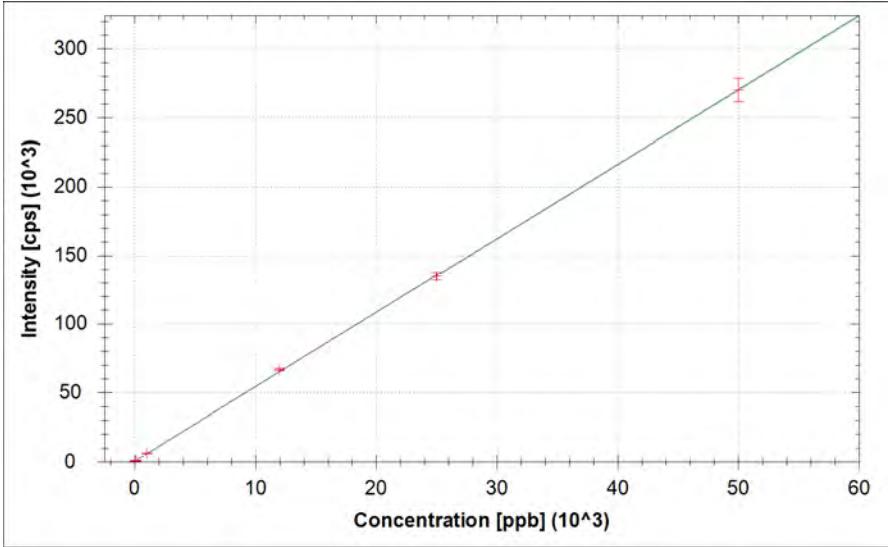
27Al (KED AGD)



$f(x) = 4.8718 \cdot x + 5.0284$
 $R^2 = 0.9998$
BEC = 1.032 ppb
LoD = 1.2800 ppb

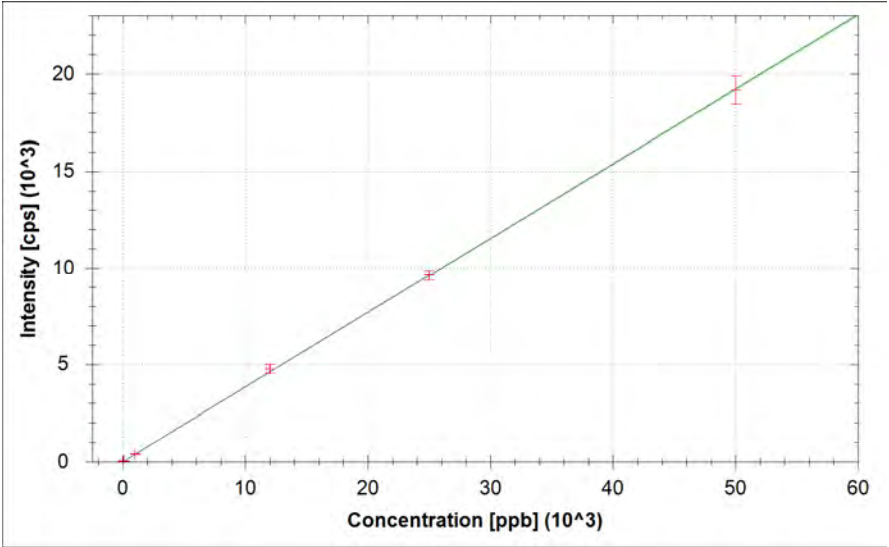


39K (KED AGD)



$f(x) = 5.3939 \cdot x + 436.8779$
 $R^2 = 1.0000$
BEC = 80.995 ppb
LoD = 15.3978 ppb

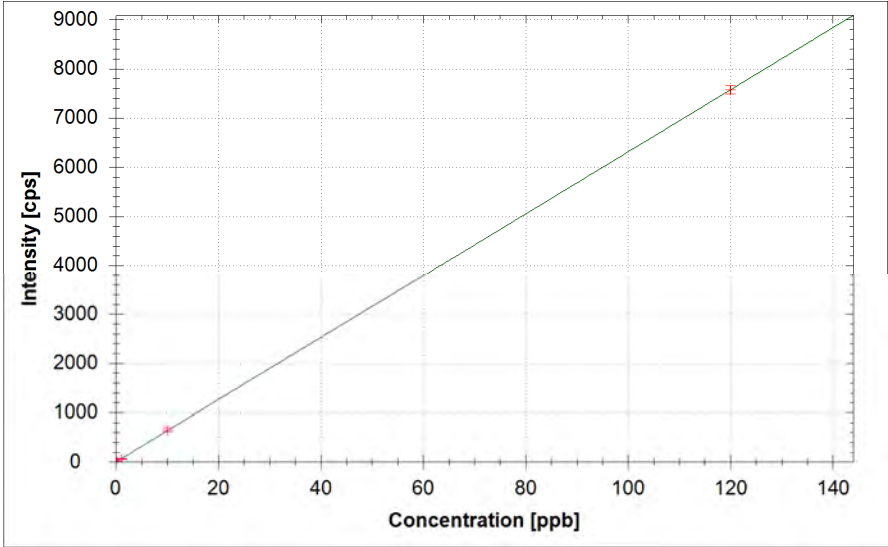
44Ca (KED AGD)



$f(x) = 0.3843 \cdot x + 2.6345$
 $R^2 = 0.9999$
BEC = 6.856 ppb
LoD = 8.7055 ppb

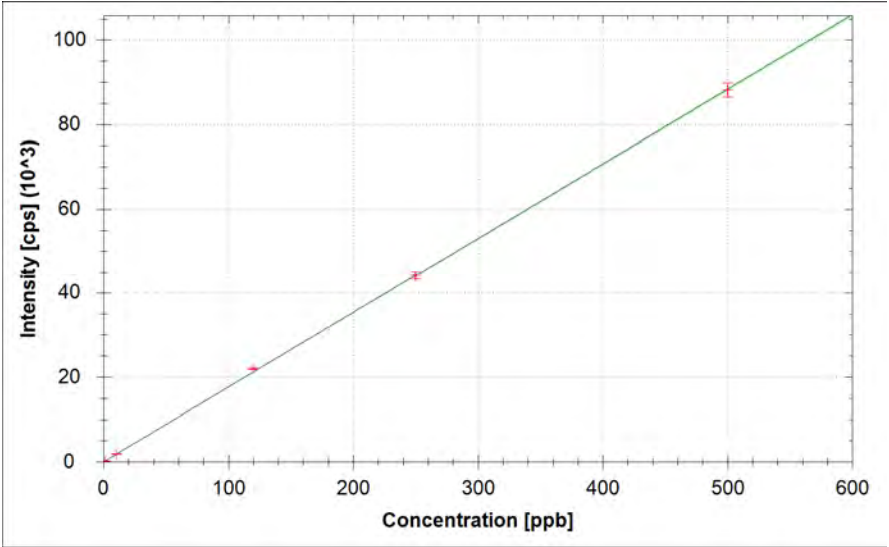


48Ti (KED AGD)



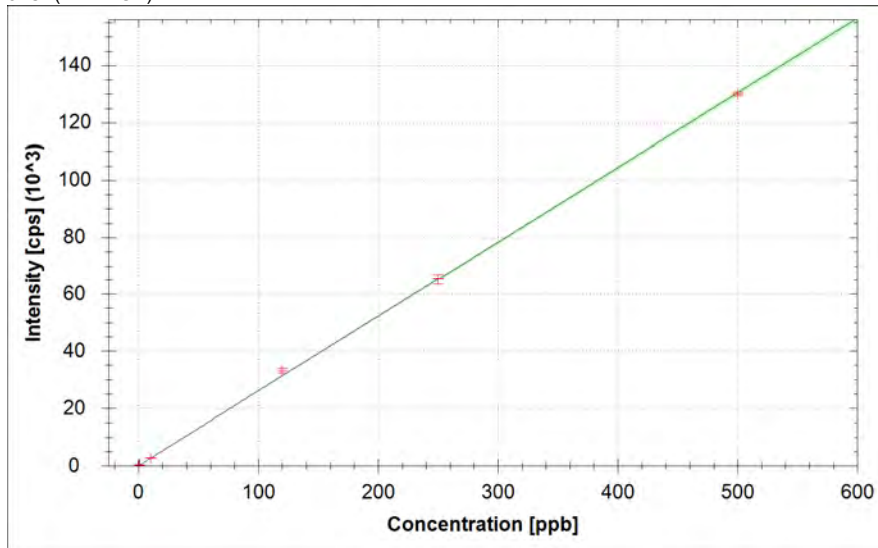
$f(x) = 63.0967 \cdot x$
 $R^2 = 1.0000$
BEC = 0.000 ppb
LoD = 0.0000 ppb

51V (KED AGD)



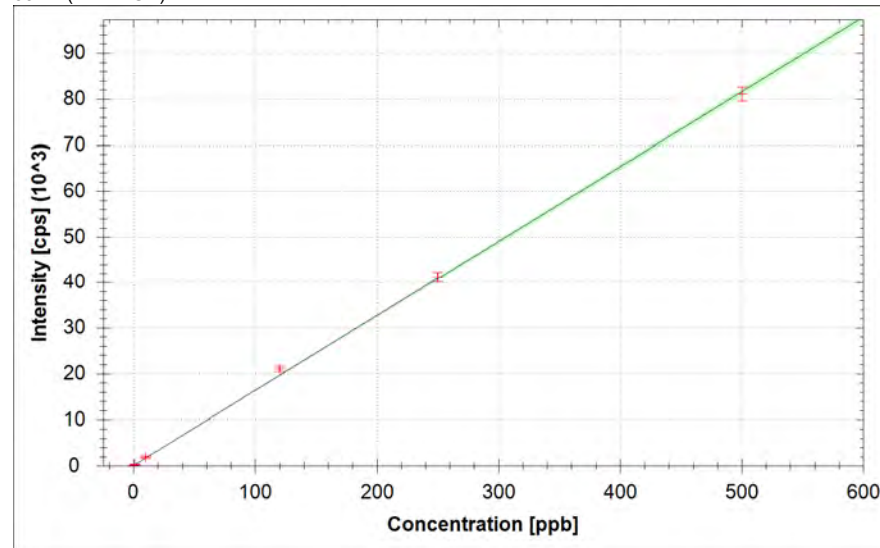
$f(x) = 176.6049 \cdot x$
 $R^2 = 0.9999$
BEC = 0.000 ppb
LoD = 0.0000 ppb

52Cr (KED AGD)



$f(x) = 260.7414 \cdot x + 35.0006$
 $R^2 = 0.9998$
BEC = 0.134 ppb
LoD = 0.0018 ppb

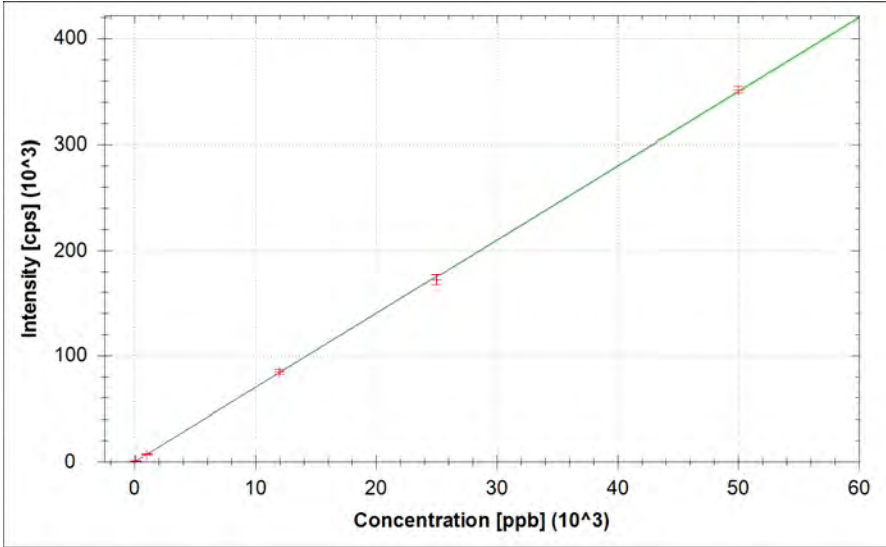
55Mn (KED AGD)



$f(x) = 162.9760 \cdot x + 73.3302$
 $R^2 = 0.9996$
BEC = 0.450 ppb
LoD = 0.1043 ppb

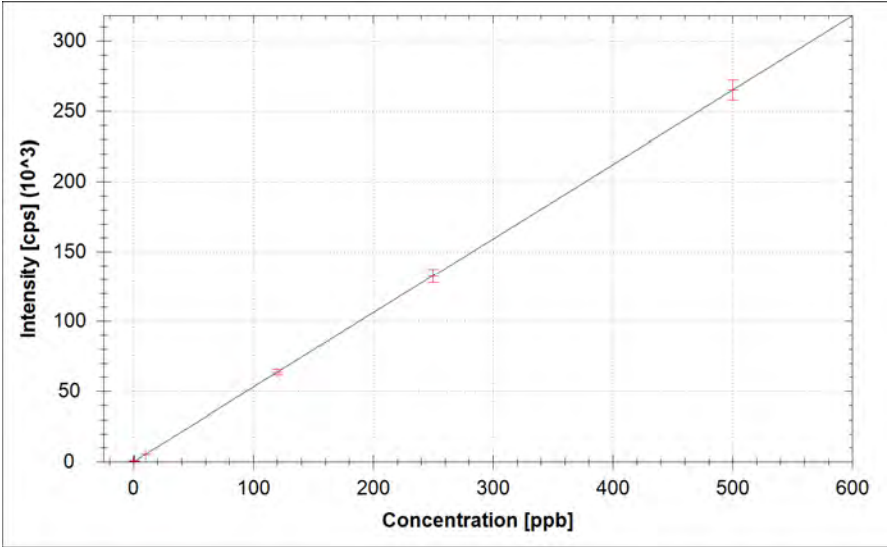


57Fe (KED AGD)



$f(x) = 6.9947 \cdot x + 23.3466$
 $R^2 = 0.9999$
BEC = 3.338 ppb
LoD = 6.5343 ppb

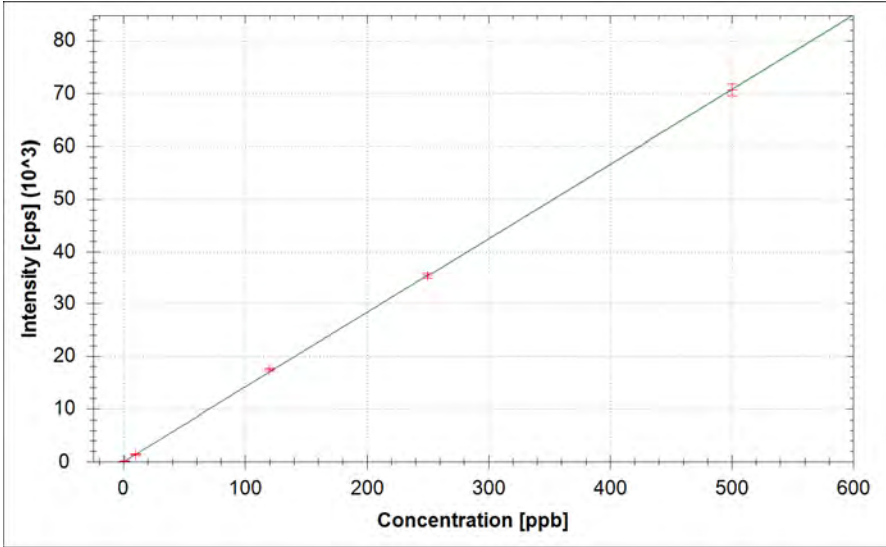
59Co (KED AGD)



$f(x) = 530.0427 \cdot x + 13.2998$
 $R^2 = 1.0000$
BEC = 0.025 ppb
LoD = 0.0318 ppb

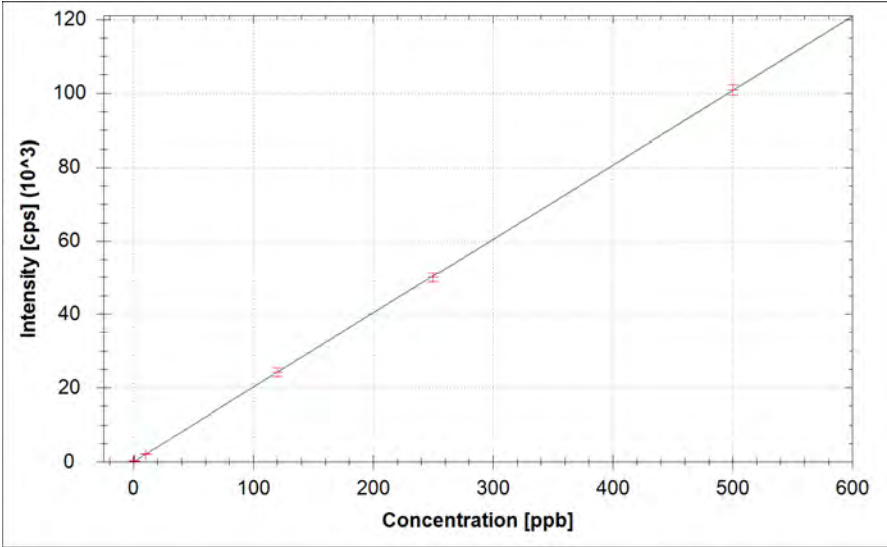


60Ni (KED AGD)



$f(x) = 141.4395 \cdot x + 6.6786$
 $R^2 = 1.0000$
BEC = 0.047 ppb
LoD = 0.1227 ppb

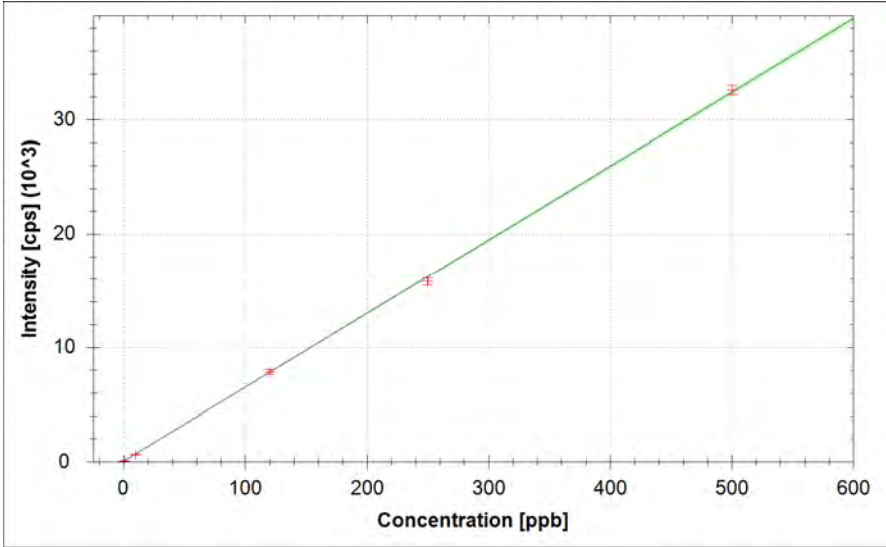
65Cu (KED AGD)



$f(x) = 201.3512 \cdot x + 13.1578$
 $R^2 = 1.0000$
BEC = 0.065 ppb
LoD = 0.2237 ppb

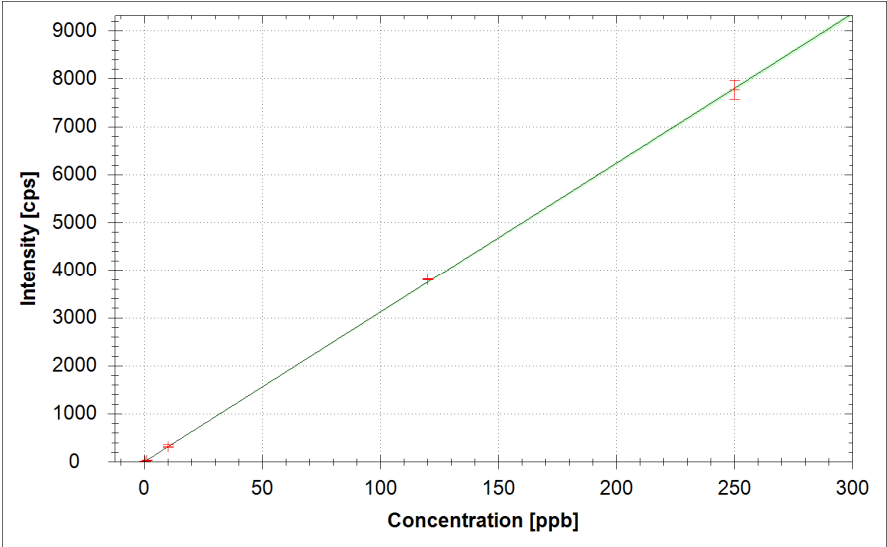


66Zn (KED AGD)



$f(x) = 64.6575 \cdot x + 47.4370$
 $R^2 = 0.9998$
BEC = 0.734 ppb
LoD = 0.3691 ppb

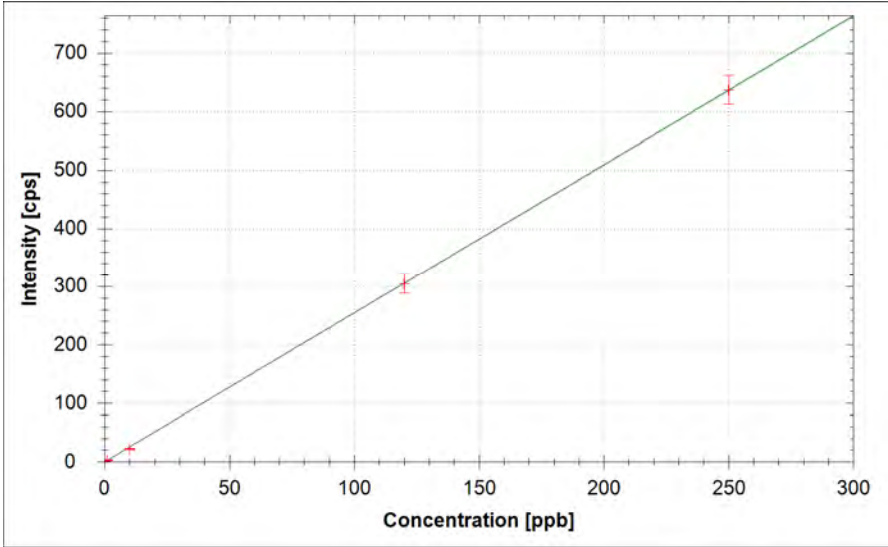
75As (KED AGD)



$f(x) = 31.1737 \cdot x + 1.6502$
 $R^2 = 0.9999$
BEC = 0.053 ppb
LoD = 0.1787 ppb

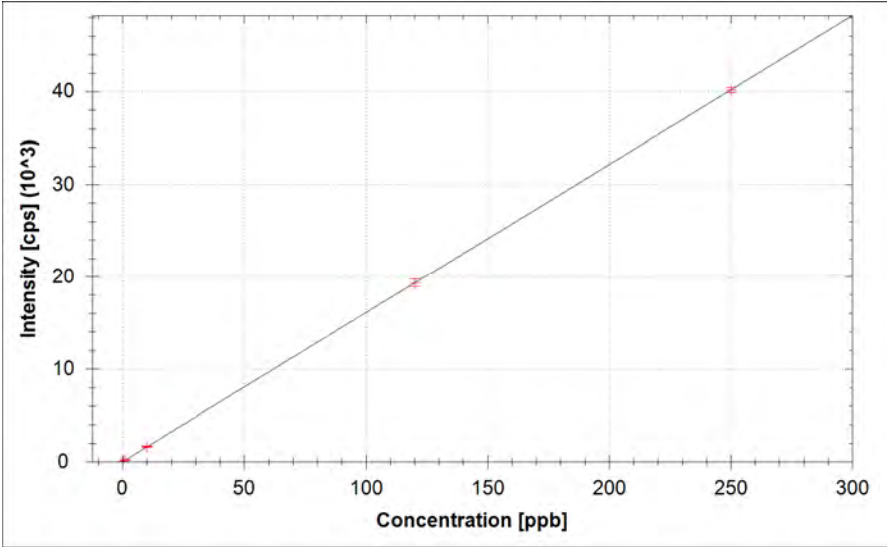


78Se (KED AGD)



$f(x) = 2.5463 \cdot x + -0.1428$
 $R^2 = 1.0000$
BEC = -0.056 ppb
LoD = 0.7212 ppb

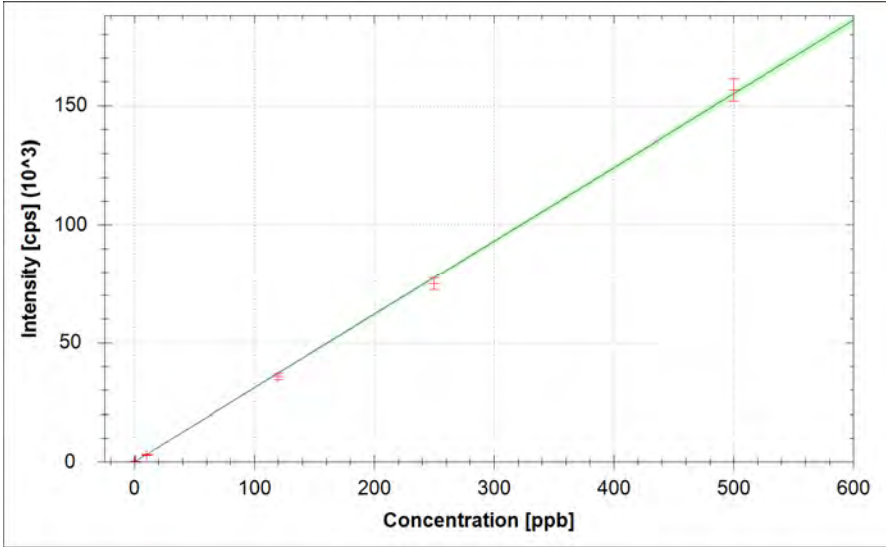
88Sr (KED AGD)



$f(x) = 160.6683 \cdot x + 6.0413$
 $R^2 = 1.0000$
BEC = 0.038 ppb
LoD = 0.1140 ppb

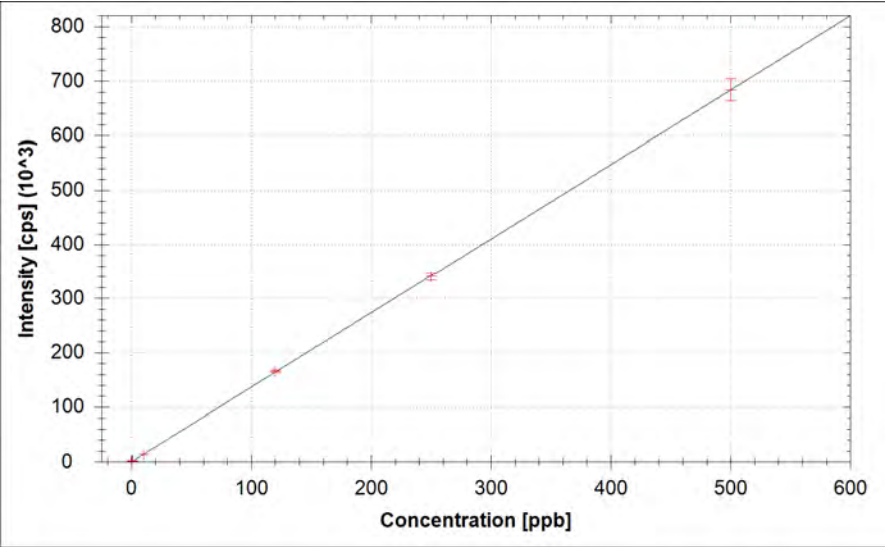


95Mo (KED AGD)



$f(x) = 309.8042 \cdot x + 6.6692$
 $R^2 = 0.9995$
BEC = 0.022 ppb
LoD = 0.0559 ppb

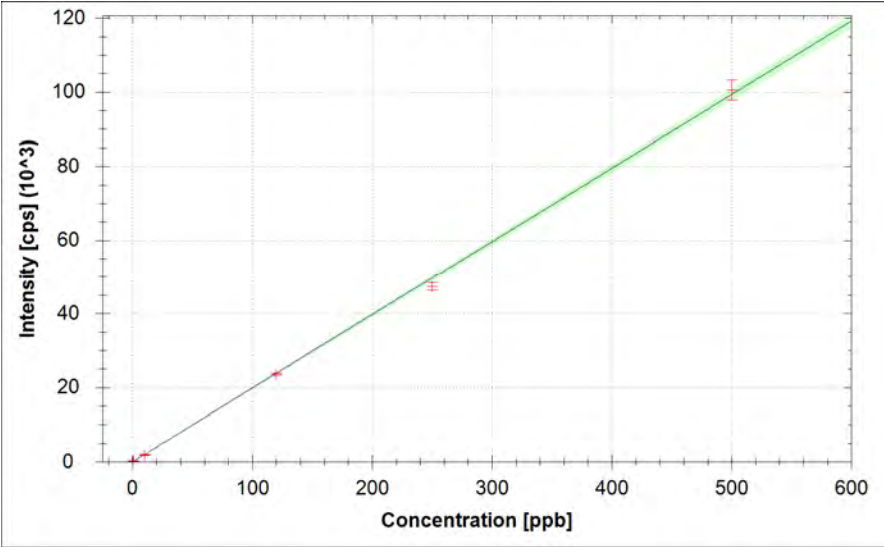
107Ag (KED AGD)



$f(x) = 1366.6404 \cdot x + 33.3278$
 $R^2 = 1.0000$
BEC = 0.024 ppb
LoD = 0.0227 ppb

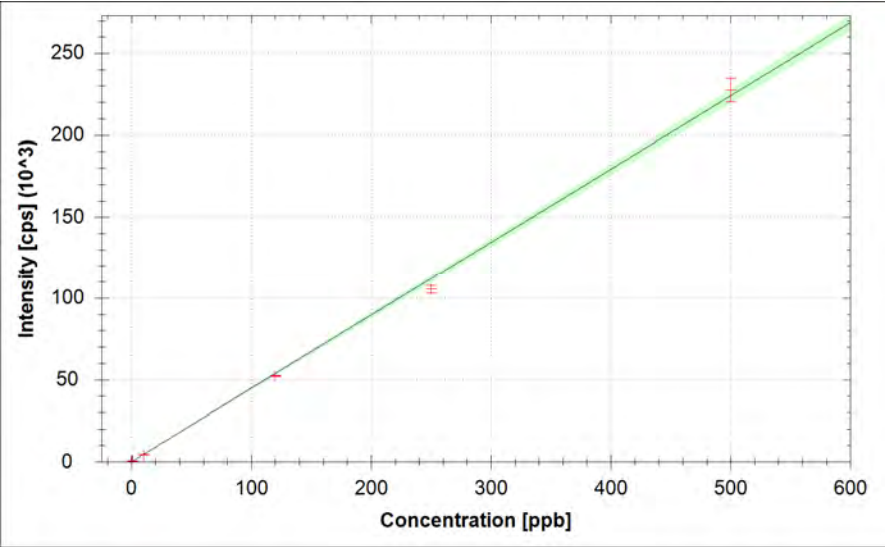


111Cd (KED AGD)



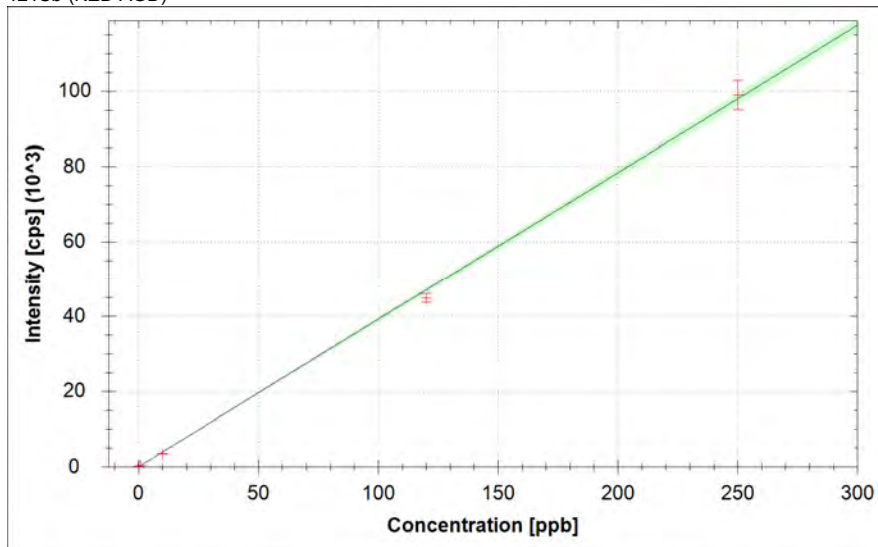
$f(x) = 198.5944 \cdot x + 0.6626$
 $R^2 = 0.9992$
BEC = 0.003 ppb
LoD = 0.0173 ppb

118Sn (KED AGD)



$f(x) = 447.7413 \cdot x + 53.3816$
 $R^2 = 0.9987$
BEC = 0.119 ppb
LoD = 0.0540 ppb

121Sb (KED AGD)



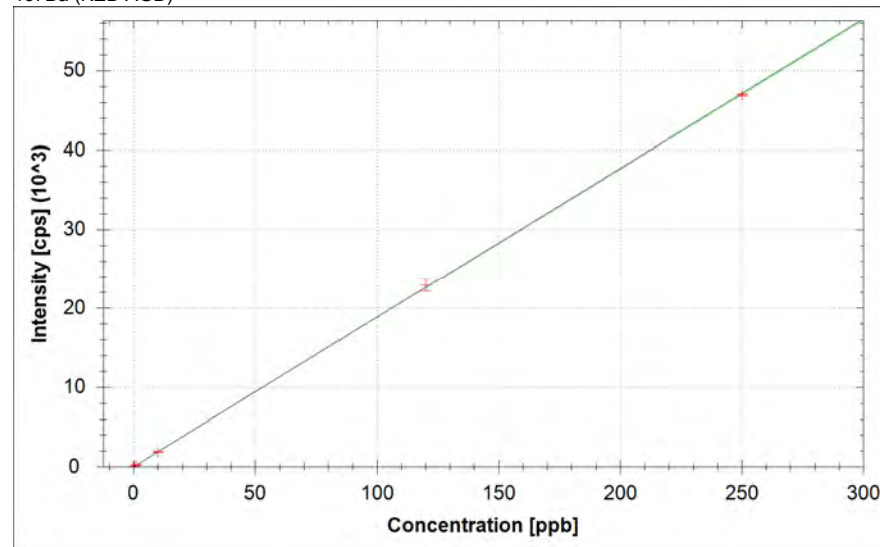
$$f(x) = 391.6275x + 9.9731$$

$$R^2 = 0.9993$$

$$\text{BEC} = 0.025 \text{ ppb}$$

$$\text{LoD} = 0.0768 \text{ ppb}$$

137Ba (KED AGD)



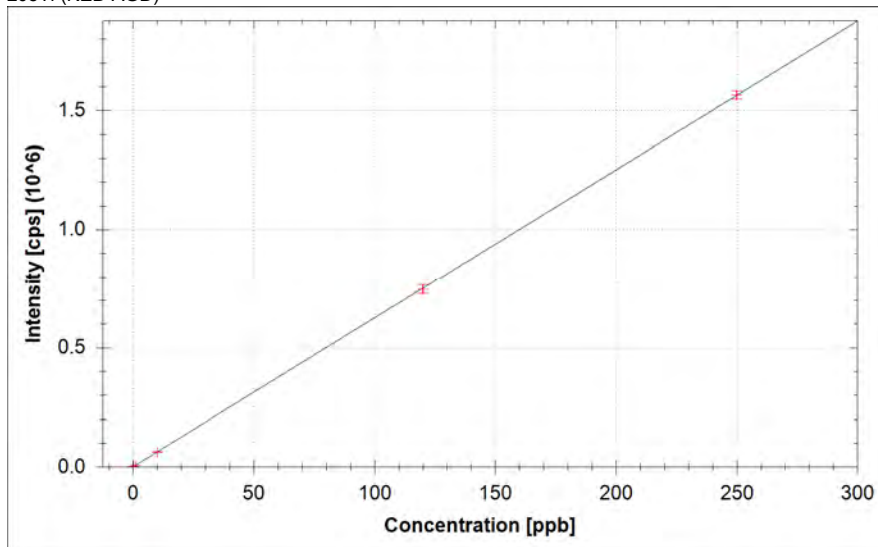
$$f(x) = 188.2091x + 9.8894$$

$$R^2 = 0.9999$$

$$\text{BEC} = 0.053 \text{ ppb}$$

$$\text{LoD} = 0.1554 \text{ ppb}$$

205TI (KED AGD)



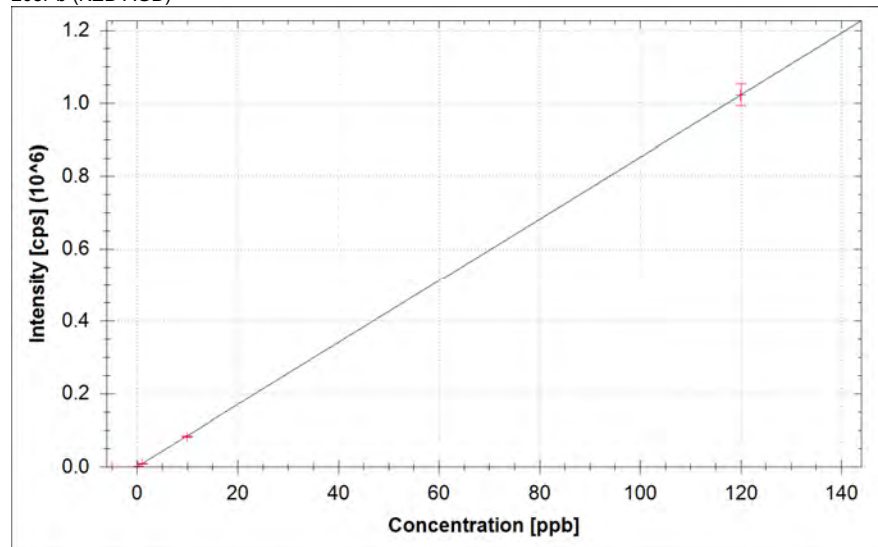
$$f(x) = 6251.5882 \cdot x + 64.9692$$

$$R^2 = 1.0000$$

$$\text{BEC} = 0.010 \text{ ppb}$$

$$\text{LoD} = 0.0021 \text{ ppb}$$

208Pb (KED AGD)



$$f(x) = 8516.3021 \cdot x + 120.1369$$

$$R^2 = 1.0000$$

$$\text{BEC} = 0.014 \text{ ppb}$$

$$\text{LoD} = 0.0068 \text{ ppb}$$

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Standards:

Analysis Index: 3
 Analysis Name: 0.2/20 Cal
 Analysis Type: STD
 Analysis Started at: 4/5/2017 7:56:03 AM
 Standard (Stock): Calibration Standard 6020/200.8
 Standard DF: 50000
 Rack: 0
 Vial: 2

Category	Concentration average	Concentration RSD	Standard Concentration
6Li (STD AGD)	100.548 %		
6Li (KED AGD)	103.771 %		
9Be (STD AGD)	0.199 ppb	12.5 %	0.200 ppb
23Na (KED AGD)	17.423 ppb	8.7 %	20.000 ppb
24Mg (KED AGD)	21.010 ppb	14.1 %	20.000 ppb
27Al (KED AGD)	-0.024 ppb	2,961.2 %	0.200 ppb
39K (KED AGD)	25.283 ppb	32.9 %	20.000 ppb
44Ca (KED AGD)	19.612 ppb	11.2 %	20.000 ppb
45Sc (KED AGD)	102.954 %		
45Sc (STD AGD)	97.037 %		
48Ti (KED AGD)	0.102 ppb	86.7 %	0.200 ppb
51V (KED AGD)	0.074 ppb	45.3 %	0.200 ppb
52Cr (KED AGD)	0.199 ppb	18.5 %	0.200 ppb
55Mn (KED AGD)	0.094 ppb	63.8 %	0.200 ppb
57Fe (KED AGD)	37.017 ppb	65.0 %	20.000 ppb
59Co (KED AGD)	0.181 ppb	11.8 %	0.200 ppb
60Ni (KED AGD)	0.141 ppb	31.9 %	0.200 ppb
65Cu (KED AGD)	0.167 ppb	63.1 %	0.200 ppb
66Zn (KED AGD)	-0.133 ppb	118.6 %	0.200 ppb
74Ge (KED AGD)	98.864 %		
75As (KED AGD)	0.082 ppb	24.3 %	0.200 ppb
78Se (KED AGD)	0.198 ppb	338.6 %	0.200 ppb
88Sr (KED AGD)	0.190 ppb	50.0 %	0.200 ppb
95Mo (KED AGD)	0.160 ppb	63.2 %	0.200 ppb
103Rh (KED AGD)	102.230 %		
107Ag (KED AGD)	0.178 ppb	12.9 %	0.200 ppb
111Cd (KED AGD)	0.172 ppb	23.3 %	0.200 ppb
115In (KED AGD)	99.027 %		
118Sn (KED AGD)	0.111 ppb	61.7 %	0.200 ppb
121Sb (KED AGD)	0.289 ppb	44.0 %	0.200 ppb
137Ba (KED AGD)	0.132 ppb	48.9 %	0.200 ppb
159Tb (KED AGD)	101.540 %		
175Lu (KED AGD)	100.552 %		
205Tl (KED AGD)	0.179 ppb	2.6 %	0.200 ppb
208Pb (KED AGD)	0.191 ppb	5.6 %	0.200 ppb
209Bi (KED AGD)	103.704 %		

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Standards:

Analysis Index: 4
 Analysis Name: 1.0/100 Cal
 Analysis Type: STD
 Analysis Started at: 4/5/2017 7:59:24 AM
 Standard (Stock): Calibration Standard 6020/200.8
 Standard DF: 10000
 Rack: 0
 Vial: 3

Category	Concentration average	Concentration RSD	Standard Concentration
6Li (STD AGD)	99.773 %		
6Li (KED AGD)	104.050 %		
9Be (STD AGD)	0.907 ppb	2.6 %	1.000 ppb
23Na (KED AGD)	101.100 ppb	10.8 %	100.000 ppb
24Mg (KED AGD)	97.360 ppb	14.2 %	100.000 ppb
27Al (KED AGD)	0.891 ppb	38.9 %	1.000 ppb
39K (KED AGD)	108.589 ppb	21.7 %	100.000 ppb
44Ca (KED AGD)	104.145 ppb	38.1 %	100.000 ppb
45Sc (KED AGD)	96.165 %		
45Sc (STD AGD)	98.102 %		
48Ti (KED AGD)	0.849 ppb	23.3 %	1.000 ppb
51V (KED AGD)	0.855 ppb	25.0 %	1.000 ppb
52Cr (KED AGD)	0.930 ppb	7.3 %	1.000 ppb
55Mn (KED AGD)	1.429 ppb	25.3 %	1.000 ppb
57Fe (KED AGD)	99.868 ppb	15.6 %	100.000 ppb
59Co (KED AGD)	1.046 ppb	7.7 %	1.000 ppb
60Ni (KED AGD)	1.254 ppb	20.7 %	1.000 ppb
65Cu (KED AGD)	1.052 ppb	17.9 %	1.000 ppb
66Zn (KED AGD)	0.784 ppb	26.5 %	1.000 ppb
74Ge (KED AGD)	98.694 %		
75As (KED AGD)	0.948 ppb	15.7 %	1.000 ppb
78Se (KED AGD)	1.111 ppb	41.7 %	1.000 ppb
88Sr (KED AGD)	1.103 ppb	14.1 %	1.000 ppb
95Mo (KED AGD)	0.798 ppb	8.7 %	1.000 ppb
103Rh (KED AGD)	98.352 %		
107Ag (KED AGD)	0.983 ppb	12.5 %	1.000 ppb
111Cd (KED AGD)	0.963 ppb	12.2 %	1.000 ppb
115In (KED AGD)	96.161 %		
118Sn (KED AGD)	0.985 ppb	21.8 %	1.000 ppb
121Sb (KED AGD)	0.927 ppb	2.3 %	1.000 ppb
137Ba (KED AGD)	1.174 ppb	18.9 %	1.000 ppb
159Tb (KED AGD)	98.750 %		
175Lu (KED AGD)	98.467 %		
205Tl (KED AGD)	0.974 ppb	5.9 %	1.000 ppb
208Pb (KED AGD)	0.965 ppb	4.0 %	1.000 ppb
209Bi (KED AGD)	101.744 %		



Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Standards:

Analysis Index: 5
Analysis Name: 10/1000 Cal
Analysis Type: STD
Analysis Started at: 4/5/2017 8:02:46 AM
Standard (Stock): Calibration Standard 6020/200.8
Standard DF: 1000
Rack: 0
Vial: 4

Category	Concentration average	Concentration RSD	Standard Concentration
6Li (STD AGD)	99.839 %		
6Li (KED AGD)	103.166 %		
9Be (STD AGD)	10.102 ppb	2.2 %	10.000 ppb
23Na (KED AGD)	976.940 ppb	3.1 %	1,000.000 ppb
24Mg (KED AGD)	1,005.123 ppb	1.5 %	1,000.000 ppb
27Al (KED AGD)	10.829 ppb	8.4 %	10.000 ppb
39K (KED AGD)	1,059.155 ppb	2.3 %	1,000.000 ppb
44Ca (KED AGD)	1,057.381 ppb	3.6 %	1,000.000 ppb
45Sc (KED AGD)	96.023 %		
45Sc (STD AGD)	100.410 %		
48Ti (KED AGD)	10.267 ppb	6.6 %	10.000 ppb
51V (KED AGD)	10.491 ppb	2.8 %	10.000 ppb
52Cr (KED AGD)	10.331 ppb	3.3 %	10.000 ppb
55Mn (KED AGD)	11.013 ppb	14.3 %	10.000 ppb
57Fe (KED AGD)	1,040.203 ppb	7.6 %	1,000.000 ppb
59Co (KED AGD)	10.043 ppb	1.5 %	10.000 ppb
60Ni (KED AGD)	9.702 ppb	9.6 %	10.000 ppb
65Cu (KED AGD)	10.264 ppb	5.9 %	10.000 ppb
66Zn (KED AGD)	9.159 ppb	4.4 %	10.000 ppb
74Ge (KED AGD)	100.717 %		
75As (KED AGD)	10.268 ppb	8.1 %	10.000 ppb
78Se (KED AGD)	8.531 ppb	4.2 %	10.000 ppb
88Sr (KED AGD)	10.095 ppb	4.2 %	10.000 ppb
95Mo (KED AGD)	9.297 ppb	6.0 %	10.000 ppb
103Rh (KED AGD)	96.808 %		
107Ag (KED AGD)	9.927 ppb	1.8 %	10.000 ppb
111Cd (KED AGD)	9.344 ppb	4.9 %	10.000 ppb
115In (KED AGD)	96.200 %		
118Sn (KED AGD)	9.495 ppb	5.5 %	10.000 ppb
121Sb (KED AGD)	8.748 ppb	2.6 %	10.000 ppb
137Ba (KED AGD)	9.864 ppb	2.4 %	10.000 ppb
159Tb (KED AGD)	96.211 %		
175Lu (KED AGD)	98.065 %		
205Tl (KED AGD)	9.972 ppb	2.6 %	10.000 ppb
208Pb (KED AGD)	9.722 ppb	2.5 %	10.000 ppb
209Bi (KED AGD)	100.049 %		



Alpha ICPMSQ Full

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Standards:

Analysis Index: 6
Analysis Name: 120/12000
Analysis Type: STD
Analysis Started at: 4/5/2017 8:06:08 AM
Standard (Stock): Calibration Standard 6020/200.8
Standard DF: 83.3333333
Rack: 0
Vial: 5

Category	Concentration average	Concentration RSD	Standard Concentration
6Li (STD AGD)	99.104 %		
6Li (KED AGD)	100.279 %		
9Be (STD AGD)	120.298 ppb	1.5 %	120.000 ppb
23Na (KED AGD)	12,197.996 ppb	3.1 %	12,000.000 ppb
24Mg (KED AGD)	12,226.009 ppb	5.0 %	12,000.000 ppb
27Al (KED AGD)	125.505 ppb	2.3 %	120.000 ppb
39K (KED AGD)	12,284.860 ppb	1.2 %	12,000.000 ppb
44Ca (KED AGD)	12,395.443 ppb	4.8 %	12,000.000 ppb
45Sc (KED AGD)	96.847 %		
45Sc (STD AGD)	99.897 %		
48Ti (KED AGD)	119.979 ppb	1.1 %	120.000 ppb
51V (KED AGD)	124.247 ppb	1.0 %	120.000 ppb
52Cr (KED AGD)	126.861 ppb	2.4 %	120.000 ppb
55Mn (KED AGD)	128.390 ppb	2.8 %	120.000 ppb
57Fe (KED AGD)	12,069.561 ppb	2.9 %	12,000.000 ppb
59Co (KED AGD)	119.776 ppb	3.0 %	120.000 ppb
60Ni (KED AGD)	122.889 ppb	1.8 %	120.000 ppb
65Cu (KED AGD)	119.807 ppb	4.8 %	120.000 ppb
66Zn (KED AGD)	120.399 ppb	2.7 %	120.000 ppb
74Ge (KED AGD)	99.898 %		
75As (KED AGD)	121.881 ppb	0.4 %	120.000 ppb
78Se (KED AGD)	119.842 ppb	5.3 %	120.000 ppb
88Sr (KED AGD)	120.066 ppb	2.1 %	120.000 ppb
95Mo (KED AGD)	115.168 ppb	3.3 %	120.000 ppb
103Rh (KED AGD)	96.164 %		
107Ag (KED AGD)	121.023 ppb	1.3 %	120.000 ppb
111Cd (KED AGD)	118.449 ppb	1.3 %	120.000 ppb
115In (KED AGD)	97.583 %		
118Sn (KED AGD)	116.629 ppb	0.9 %	120.000 ppb
121Sb (KED AGD)	114.450 ppb	2.6 %	120.000 ppb
137Ba (KED AGD)	121.675 ppb	3.4 %	120.000 ppb
159Tb (KED AGD)	97.953 %		
175Lu (KED AGD)	97.206 %		
205Tl (KED AGD)	119.464 ppb	2.5 %	120.000 ppb
208Pb (KED AGD)	120.023 ppb	2.9 %	120.000 ppb
209Bi (KED AGD)	98.472 %		

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Standards:

Analysis Index: 7
Analysis Name: 250/25000
Analysis Type: STD
Analysis Started at: 4/5/2017 8:09:30 AM
Standard (Stock): Calibration Standard 6020/200.8
Standard DF: 40
Rack: 0
Vial: 6

Category	Concentration average	Concentration RSD	Standard Concentration
6Li (STD AGD)	97.699 %		
6Li (KED AGD)	101.164 %		
9Be (STD AGD)	249.853 ppb	1.2 %	250.000 ppb
23Na (KED AGD)	24,738.736 ppb	1.5 %	25,000.000 ppb
24Mg (KED AGD)	24,560.357 ppb	1.3 %	25,000.000 ppb
27Al (KED AGD)	249.458 ppb	5.5 %	250.000 ppb
39K (KED AGD)	24,891.039 ppb	2.3 %	25,000.000 ppb
44Ca (KED AGD)	25,035.915 ppb	2.7 %	25,000.000 ppb
45Sc (KED AGD)	98.210 %		
45Sc (STD AGD)	99.137 %		
48Ti (KED AGD)	240.291 ppb	1.1 %	250.000 ppb
51V (KED AGD)	249.832 ppb	2.1 %	250.000 ppb
52Cr (KED AGD)	249.802 ppb	2.7 %	250.000 ppb
55Mn (KED AGD)	251.788 ppb	2.6 %	250.000 ppb
57Fe (KED AGD)	24,528.219 ppb	2.7 %	25,000.000 ppb
59Co (KED AGD)	249.811 ppb	3.6 %	250.000 ppb
60Ni (KED AGD)	249.713 ppb	1.5 %	250.000 ppb
65Cu (KED AGD)	248.315 ppb	2.6 %	250.000 ppb
66Zn (KED AGD)	243.457 ppb	1.8 %	250.000 ppb
74Ge (KED AGD)	99.132 %		
75As (KED AGD)	249.087 ppb	2.5 %	250.000 ppb
78Se (KED AGD)	250.134 ppb	3.9 %	250.000 ppb
88Sr (KED AGD)	249.964 ppb	0.6 %	250.000 ppb
95Mo (KED AGD)	241.784 ppb	3.4 %	250.000 ppb
103Rh (KED AGD)	96.088 %		
107Ag (KED AGD)	249.319 ppb	2.1 %	250.000 ppb
111Cd (KED AGD)	238.218 ppb	2.2 %	250.000 ppb
115In (KED AGD)	96.844 %		
118Sn (KED AGD)	235.544 ppb	2.2 %	250.000 ppb
121Sb (KED AGD)	252.714 ppb	3.9 %	250.000 ppb
137Ba (KED AGD)	249.201 ppb	0.3 %	250.000 ppb
159Tb (KED AGD)	96.451 %		
175Lu (KED AGD)	97.738 %		
205Tl (KED AGD)	250.258 ppb	1.1 %	250.000 ppb
208Pb (KED AGD)	241.038 ppb	2.0 %	250.000 ppb
209Bi (KED AGD)	98.723 %		



Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Standards:

Analysis Index: 8
 Analysis Name: 500/50000
 Analysis Type: STD
 Analysis Started at: 4/5/2017 8:12:54 AM
 Standard (Stock): Calibration Standard 6020/200.8
 Standard DF: 20
 Rack: 0
 Vial: 7

Category	Concentration average	Concentration RSD	Standard Concentration
6Li (STD AGD)	95.693 %		
6Li (KED AGD)	100.326 %		
9Be (STD AGD)	515.425 ppb	1.9 %	500.000 ppb
23Na (KED AGD)	50,083.573 ppb	2.3 %	50,000.000 ppb
24Mg (KED AGD)	50,165.482 ppb	3.0 %	50,000.000 ppb
27Al (KED AGD)	498.934 ppb	1.6 %	500.000 ppb
39K (KED AGD)	49,984.912 ppb	3.1 %	50,000.000 ppb
44Ca (KED AGD)	49,885.980 ppb	3.9 %	50,000.000 ppb
45Sc (KED AGD)	100.085 %		
45Sc (STD AGD)	99.960 %		
48Ti (KED AGD)	463.516 ppb	2.1 %	500.000 ppb
51V (KED AGD)	499.055 ppb	1.9 %	500.000 ppb
52Cr (KED AGD)	498.446 ppb	0.5 %	500.000 ppb
55Mn (KED AGD)	497.072 ppb	1.9 %	500.000 ppb
57Fe (KED AGD)	50,218.385 ppb	0.9 %	50,000.000 ppb
59Co (KED AGD)	500.147 ppb	2.6 %	500.000 ppb
60Ni (KED AGD)	499.456 ppb	1.6 %	500.000 ppb
65Cu (KED AGD)	500.883 ppb	1.5 %	500.000 ppb
66Zn (KED AGD)	503.193 ppb	1.2 %	500.000 ppb
74Ge (KED AGD)	95.790 %		
75As (KED AGD)	533.116 ppb	2.2 %	500.000 ppb
78Se (KED AGD)	529.945 ppb	1.4 %	500.000 ppb
88Sr (KED AGD)	521.219 ppb	2.1 %	500.000 ppb
95Mo (KED AGD)	505.282 ppb	3.0 %	500.000 ppb
103Rh (KED AGD)	93.632 %		
107Ag (KED AGD)	500.097 ppb	2.9 %	500.000 ppb
111Cd (KED AGD)	506.276 ppb	2.7 %	500.000 ppb
115In (KED AGD)	92.607 %		
118Sn (KED AGD)	508.047 ppb	3.2 %	500.000 ppb
121Sb (KED AGD)	561.072 ppb	6.6 %	500.000 ppb
137Ba (KED AGD)	527.012 ppb	5.2 %	500.000 ppb
159Tb (KED AGD)	93.679 %		
175Lu (KED AGD)	96.528 %		
205Tl (KED AGD)	536.769 ppb	2.0 %	500.000 ppb
208Pb (KED AGD)	539.013 ppb	2.7 %	500.000 ppb
209Bi (KED AGD)	93.516 %		

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index:	1	Analysis started at:	4/5/2017 7:49:17 AM	Rack:	0
Analysis label:	rinse	User name:	ALPHALAB\metals-instrument	Vial:	1

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 2 Analysis started at: 4/5/2017 7:52:38 AM Rack: 4
 Analysis label: Blank AM ICPMSQ User name: ALPHALAB\metals-instrument Vial: 49

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	100.000 %	100.000 %	0.000 ppb	0.000 ppb	0.000 ppb	0.000 ppb	0.000 ppb	0.000 ppb	100.000 %
Concentration per Run	100.000 %	100.000 %	0.000 ppb	0.000 ppb	0.000 ppb	0.000 ppb	0.000 ppb	0.000 ppb	100.000 %
Concentration RSD			1.7 %	0.1 %	1.2 %	0.4 %	0.1 %	0.4 %	

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	100.000 %	0.000 ppb	0.000 ppb	0.000 ppb	0.000 ppb	0.000 ppb	0.000 ppb	0.000 ppb	0.000 ppb
Concentration per Run	100.000 %	0.000 ppb	0.000 ppb	0.000 ppb	0.000 ppb	0.000 ppb	0.000 ppb	0.000 ppb	0.000 ppb
Concentration RSD				0.0 %	0.1 %	0.7 %	0.4 %	0.9 %	1.1 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	0.000 ppb	100.000 %	0.000 ppb	0.000 ppb	0.000 ppb	0.000 ppb	100.000 %	0.000 ppb	0.000 ppb
Concentration per Run	0.000 ppb	100.000 %	0.000 ppb	0.000 ppb	0.000 ppb	0.000 ppb	100.000 %	0.000 ppb	0.000 ppb
Concentration RSD	0.2 %		1.1 %	-4.3 %	1.0 %	0.9 %		0.3 %	1.7 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	100.000 %	0.000 ppb	0.000 ppb	0.000 ppb	100.000 %	100.000 %	0.000 ppb	0.000 ppb	100.000 %
Concentration per Run	100.000 %	0.000 ppb	0.000 ppb	0.000 ppb	100.000 %	100.000 %	0.000 ppb	0.000 ppb	100.000 %
Concentration RSD		0.2 %	1.0 %	1.0 %			0.1 %	0.2 %	

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 3 Analysis started at: 4/5/2017 7:56:03 AM Rack: 0
 Analysis label: 0.2/20 Cal User name: ALPHALAB\metals-instrument Vial: 2

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	100.548 %	103.771 %	0.199 ppb	17.423 ppb	21.010 ppb	-0.024 ppb	25.283 ppb	19.612 ppb	102.954 %
Concentration per Run 1	101.047 %	107.961 %	0.189 ppb	15.745 ppb	19.196 ppb	-0.841 ppb	16.349 ppb	22.124 ppb	106.420 %
Concentration per Run 2	100.002 %	102.095 %	0.227 ppb	18.683 ppb	24.430 ppb	0.380 ppb	26.698 ppb	18.119 ppb	101.477 %
Concentration per Run 3	100.594 %	101.257 %	0.181 ppb	17.841 ppb	19.404 ppb	0.389 ppb	32.803 ppb	18.594 ppb	100.966 %
Concentration RSD			12.5 %	8.7 %	14.1 %	2.961.2 %	32.9 %	11.2 %	

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	97.037 %	0.102 ppb	0.074 ppb	0.199 ppb	0.094 ppb	37.017 ppb	0.181 ppb	0.141 ppb	0.167 ppb
Concentration per Run 1	99.467 %	0.150 ppb	0.054 ppb	0.157 ppb	0.077 ppb	19.932 ppb	0.174 ppb	0.089 ppb	0.079 ppb
Concentration per Run 2	95.438 %	0.000 ppb	0.056 ppb	0.227 ppb	0.160 ppb	26.588 ppb	0.163 ppb	0.165 ppb	0.284 ppb
Concentration per Run 3	96.207 %	0.158 ppb	0.113 ppb	0.212 ppb	0.044 ppb	64.530 ppb	0.204 ppb	0.168 ppb	0.138 ppb
Concentration RSD		86.7 %	45.3 %	18.5 %	63.8 %	65.0 %	11.8 %	31.9 %	63.1 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	-0.133 ppb	98.864 %	0.082 ppb	0.198 ppb	0.190 ppb	0.160 ppb	102.230 %	0.178 ppb	0.172 ppb
Concentration per Run 1	-0.313 ppb	101.645 %	0.105 ppb	-0.173 ppb	0.143 ppb	0.133 ppb	105.406 %	0.200 ppb	0.133 ppb
Concentration per Run 2	-0.018 ppb	98.694 %	0.069 ppb	-0.204 ppb	0.299 ppb	0.075 ppb	101.110 %	0.154 ppb	0.169 ppb
Concentration per Run 3	-0.068 ppb	96.253 %	0.072 ppb	0.970 ppb	0.127 ppb	0.272 ppb	100.172 %	0.179 ppb	0.213 ppb
Concentration RSD	118.6 %		24.3 %	338.6 %	50.0 %	63.2 %		12.9 %	23.3 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	99.027 %	0.111 ppb	0.289 ppb	0.132 ppb	101.540 %	100.552 %	0.179 ppb	0.191 ppb	103.704 %
Concentration per Run 1	102.065 %	0.045 ppb	0.436 ppb	0.205 ppb	104.312 %	106.334 %	0.182 ppb	0.184 ppb	104.487 %
Concentration per Run 2	98.651 %	0.107 ppb	0.207 ppb	0.107 ppb	101.186 %	98.291 %	0.174 ppb	0.203 ppb	106.494 %
Concentration per Run 3	96.365 %	0.181 ppb	0.225 ppb	0.083 ppb	99.124 %	97.030 %	0.181 ppb	0.186 ppb	100.130 %
Concentration RSD		61.7 %	44.0 %	48.9 %			2.6 %	5.6 %	

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 4 Analysis started at: 4/5/2017 7:59:24 AM Rack: 0
 Analysis label: 1.0/100 Cal User name: ALPHALAB\metals-instrument Vial: 3

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	99.773 %	104.050 %	0.907 ppb	101.100 ppb	97.360 ppb	0.891 ppb	108.589 ppb	104.145 ppb	96.165 %
Concentration per Run 1	100.029 %	103.492 %	0.930 ppb	112.855 ppb	103.420 ppb	1.284 ppb	135.802 ppb	103.421 ppb	92.359 %
Concentration per Run 2	99.909 %	99.302 %	0.908 ppb	99.281 ppb	107.108 ppb	0.630 ppb	93.973 ppb	144.143 ppb	98.409 %
Concentration per Run 3	99.381 %	109.358 %	0.882 ppb	91.163 ppb	81.552 ppb	0.760 ppb	95.993 ppb	64.871 ppb	97.727 %
Concentration RSD			2.6 %	10.8 %	14.2 %	38.9 %	21.7 %	38.1 %	

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	98.102 %	0.849 ppb	0.855 ppb	0.930 ppb	1.429 ppb	99.868 ppb	1.046 ppb	1.254 ppb	1.052 ppb
Concentration per Run 1	98.721 %	0.853 ppb	0.667 ppb	0.952 ppb	1.507 ppb	117.811 ppb	0.970 ppb	0.996 ppb	1.024 ppb
Concentration per Run 2	98.710 %	1.044 ppb	1.088 ppb	0.854 ppb	1.035 ppb	91.642 ppb	1.037 ppb	1.515 ppb	0.879 ppb
Concentration per Run 3	96.875 %	0.648 ppb	0.811 ppb	0.983 ppb	1.745 ppb	90.150 ppb	1.131 ppb	1.253 ppb	1.253 ppb
Concentration RSD		23.3 %	25.0 %	7.3 %	25.3 %	15.6 %	7.7 %	20.7 %	17.9 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	0.784 ppb	98.694 %	0.948 ppb	1.111 ppb	1.103 ppb	0.798 ppb	98.352 %	0.983 ppb	0.963 ppb
Concentration per Run 1	1.007 ppb	97.321 %	0.936 ppb	1.484 ppb	0.947 ppb	0.873 ppb	97.430 %	1.071 ppb	1.029 ppb
Concentration per Run 2	0.596 ppb	100.678 %	1.102 ppb	0.593 ppb	1.106 ppb	0.786 ppb	99.598 %	0.843 ppb	0.827 ppb
Concentration per Run 3	0.750 ppb	98.084 %	0.806 ppb	1.256 ppb	1.257 ppb	0.736 ppb	98.027 %	1.035 ppb	1.034 ppb
Concentration RSD	26.5 %		15.7 %	41.7 %	14.1 %	8.7 %		12.5 %	12.2 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	96.161 %	0.985 ppb	0.927 ppb	1.174 ppb	98.750 %	98.467 %	0.974 ppb	0.965 ppb	101.744 %
Concentration per Run 1	97.611 %	1.195 ppb	0.927 ppb	1.213 ppb	99.662 %	98.557 %	0.921 ppb	1.002 ppb	100.210 %
Concentration per Run 2	95.675 %	0.766 ppb	0.906 ppb	1.374 ppb	98.036 %	96.867 %	1.035 ppb	0.967 ppb	102.051 %
Concentration per Run 3	95.196 %	0.993 ppb	0.949 ppb	0.935 ppb	98.552 %	99.978 %	0.965 ppb	0.926 ppb	102.970 %
Concentration RSD		21.8 %	2.3 %	18.9 %			5.9 %	4.0 %	

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 5 Analysis started at: 4/5/2017 8:02:46 AM Rack: 0
 Analysis label: 10/1000 Cal User name: ALPHALAB\metals-instrument Vial: 4

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	99.839 %	103.166 %	10.102 ppb	976.940 ppb	1,005.123 ppb	10.829 ppb	1,059.155 ppb	1,057.381 ppb	96.023 %
Concentration per Run 1	100.253 %	108.101 %	10.327 ppb	944.792 ppb	997.380 ppb	10.463 ppb	1,078.037 ppb	1,025.162 ppb	93.040 %
Concentration per Run 2	100.157 %	96.788 %	10.085 ppb	1,004.476 ppb	994.967 ppb	11.861 ppb	1,068.313 ppb	1,099.439 ppb	97.387 %
Concentration per Run 3	99.108 %	104.609 %	9.893 ppb	981.552 ppb	1,023.021 ppb	10.161 ppb	1,031.115 ppb	1,047.541 ppb	97.642 %
Concentration RSD			2.2 %	3.1 %	1.5 %	8.4 %	2.3 %	3.6 %	

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	100.410 %	10.267 ppb	10.491 ppb	10.331 ppb	11.013 ppb	1,040.203 ppb	10.043 ppb	9.702 ppb	10.264 ppb
Concentration per Run 1	97.650 %	10.417 ppb	10.591 ppb	10.097 ppb	12.688 ppb	1,129.701 ppb	10.168 ppb	10.222 ppb	10.528 ppb
Concentration per Run 2	103.232 %	10.857 ppb	10.723 ppb	10.725 ppb	10.793 ppb	979.638 ppb	9.870 ppb	8.622 ppb	10.691 ppb
Concentration per Run 3	100.347 %	9.528 ppb	10.161 ppb	10.172 ppb	9.559 ppb	1,011.269 ppb	10.091 ppb	10.260 ppb	9.574 ppb
Concentration RSD		6.6 %	2.8 %	3.3 %	14.3 %	7.6 %	1.5 %	9.6 %	5.9 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	9.159 ppb	100.717 %	10.268 ppb	8.531 ppb	10.095 ppb	9.297 ppb	96.808 %	9.927 ppb	9.344 ppb
Concentration per Run 1	8.952 ppb	98.186 %	10.848 ppb	8.280 ppb	9.795 ppb	9.939 ppb	99.104 %	9.830 ppb	8.839 ppb
Concentration per Run 2	9.624 ppb	101.468 %	10.641 ppb	8.368 ppb	10.576 ppb	8.958 ppb	94.885 %	10.130 ppb	9.474 ppb
Concentration per Run 3	8.899 ppb	102.498 %	9.316 ppb	8.945 ppb	9.914 ppb	8.994 ppb	96.433 %	9.823 ppb	9.719 ppb
Concentration RSD	4.4 %		8.1 %	4.2 %	4.2 %	6.0 %		1.8 %	4.9 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	96.200 %	9.495 ppb	8.748 ppb	9.864 ppb	96.211 %	98.065 %	9.972 ppb	9.722 ppb	100.049 %
Concentration per Run 1	95.668 %	10.085 ppb	8.632 ppb	9.596 ppb	100.397 %	98.080 %	9.695 ppb	9.461 ppb	102.912 %
Concentration per Run 2	96.175 %	9.310 ppb	8.604 ppb	10.054 ppb	96.248 %	98.224 %	10.009 ppb	9.952 ppb	98.609 %
Concentration per Run 3	96.756 %	9.089 ppb	9.009 ppb	9.941 ppb	91.989 %	97.892 %	10.212 ppb	9.754 ppb	98.626 %
Concentration RSD		5.5 %	2.6 %	2.4 %			2.6 %	2.5 %	

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 6 Analysis started at: 4/5/2017 8:06:08 AM Rack: 0
 Analysis label: 120/12000 User name: ALPHALAB\metals-instrument Vial: 5

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	99.104 %	100.279 %	120.298 ppb	12,197.996 ppb	12,226.009 ppb	125.505 ppb	12,284.860 ppb	12,395.443 ppb	96.847 %
Concentration per Run 1	100.045 %	99.441 %	118.168 ppb	12,638.524 ppb	12,885.875 ppb	125.723 ppb	12,268.487 ppb	12,987.107 ppb	95.512 %
Concentration per Run 2	100.047 %	99.581 %	121.385 ppb	11,951.061 ppb	11,680.645 ppb	122.510 ppb	12,146.375 ppb	11,790.409 ppb	100.711 %
Concentration per Run 3	97.219 %	101.816 %	121.341 ppb	12,004.401 ppb	12,111.507 ppb	128.284 ppb	12,439.718 ppb	12,408.813 ppb	94.319 %
Concentration RSD			1.5 %	3.1 %	5.0 %	2.3 %	1.2 %	4.8 %	

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	99.897 %	119.979 ppb	124.247 ppb	126.861 ppb	128.390 ppb	12,069.561 ppb	119.776 ppb	122.889 ppb	119.807 ppb
Concentration per Run 1	101.540 %	119.842 ppb	125.719 ppb	127.549 ppb	126.276 ppb	11,976.930 ppb	121.168 ppb	121.979 ppb	122.390 ppb
Concentration per Run 2	99.113 %	118.782 ppb	123.489 ppb	123.516 ppb	126.363 ppb	11,774.656 ppb	115.712 ppb	121.267 ppb	113.191 ppb
Concentration per Run 3	99.038 %	121.313 ppb	123.533 ppb	129.518 ppb	132.531 ppb	12,457.098 ppb	122.449 ppb	125.420 ppb	123.839 ppb
Concentration RSD		1.1 %	1.0 %	2.4 %	2.8 %	2.9 %	3.0 %	1.8 %	4.8 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	120.399 ppb	99.898 %	121.881 ppb	119.842 ppb	120.066 ppb	115.168 ppb	96.164 %	121.023 ppb	118.449 ppb
Concentration per Run 1	118.667 ppb	102.539 %	122.092 ppb	112.489 ppb	117.167 ppb	115.837 ppb	97.752 %	120.400 ppb	118.156 ppb
Concentration per Run 2	118.434 ppb	100.614 %	121.332 ppb	123.685 ppb	122.033 ppb	111.128 ppb	95.516 %	122.752 ppb	117.129 ppb
Concentration per Run 3	124.096 ppb	96.540 %	122.219 ppb	123.352 ppb	120.997 ppb	118.540 ppb	95.223 %	119.917 ppb	120.063 ppb
Concentration RSD	2.7 %		0.4 %	5.3 %	2.1 %	3.3 %		1.3 %	1.3 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	97.583 %	116.629 ppb	114.450 ppb	121.675 ppb	97.953 %	97.206 %	119.464 ppb	120.023 ppb	98.472 %
Concentration per Run 1	97.963 %	117.449 ppb	111.702 ppb	124.684 ppb	98.630 %	97.041 %	117.277 ppb	120.309 ppb	99.434 %
Concentration per Run 2	97.112 %	116.929 ppb	113.978 ppb	123.352 ppb	94.440 %	96.116 %	122.821 ppb	123.358 ppb	95.182 %
Concentration per Run 3	97.675 %	115.509 ppb	117.671 ppb	116.991 ppb	100.788 %	98.461 %	118.295 ppb	116.404 ppb	100.799 %
Concentration RSD		0.9 %	2.6 %	3.4 %			2.5 %	2.9 %	

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 7 Analysis started at: 4/5/2017 8:09:30 AM Rack: 0
 Analysis label: 250/25000 User name: ALPHALAB\metals-instrument Vial: 6

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	97.699 %	101.164 %	249.853 ppb	24,738.736 ppb	24,560.357 ppb	249.458 ppb	24,891.039 ppb	25,035.915 ppb	98.210 %
Concentration per Run 1	99.085 %	103.073 %	249.729 ppb	24,968.146 ppb	24,559.214 ppb	242.677 ppb	24,243.908 ppb	24,371.388 ppb	100.455 %
Concentration per Run 2	96.644 %	101.816 %	252.957 ppb	24,298.684 ppb	24,236.693 ppb	240.346 ppb	25,215.305 ppb	25,015.922 ppb	99.091 %
Concentration per Run 3	97.369 %	98.603 %	246.874 ppb	24,949.377 ppb	24,885.165 ppb	265.350 ppb	25,213.905 ppb	25,720.436 ppb	95.085 %
Concentration RSD			1.2 %	1.5 %	1.3 %	5.5 %	2.3 %	2.7 %	

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	99.137 %	240.291 ppb	249.832 ppb	249.802 ppb	251.788 ppb	24,528.219 ppb	249.811 ppb	249.713 ppb	248.315 ppb
Concentration per Run 1	101.024 %	241.925 ppb	244.907 ppb	243.899 ppb	249.189 ppb	23,993.862 ppb	244.654 ppb	245.469 ppb	241.490 ppb
Concentration per Run 2	97.283 %	241.766 ppb	249.277 ppb	248.227 ppb	246.884 ppb	24,322.468 ppb	244.578 ppb	250.962 ppb	254.356 ppb
Concentration per Run 3	99.103 %	237.181 ppb	255.311 ppb	257.279 ppb	259.290 ppb	25,268.328 ppb	260.201 ppb	252.708 ppb	249.100 ppb
Concentration RSD		1.1 %	2.1 %	2.7 %	2.6 %	2.7 %	3.6 %	1.5 %	2.6 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	243.457 ppb	99.132 %	249.087 ppb	250.134 ppb	249.964 ppb	241.784 ppb	96.088 %	249.319 ppb	238.218 ppb
Concentration per Run 1	238.860 ppb	101.435 %	250.782 ppb	243.011 ppb	250.263 ppb	244.371 ppb	95.738 %	245.659 ppb	232.830 ppb
Concentration per Run 2	247.793 ppb	95.486 %	254.323 ppb	261.215 ppb	251.253 ppb	232.555 ppb	97.008 %	246.941 ppb	238.502 ppb
Concentration per Run 3	243.719 ppb	100.476 %	242.155 ppb	246.176 ppb	248.377 ppb	248.426 ppb	95.517 %	255.358 ppb	243.323 ppb
Concentration RSD	1.8 %		2.5 %	3.9 %	0.6 %	3.4 %		2.1 %	2.2 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	96.844 %	235.544 ppb	252.714 ppb	249.201 ppb	96.451 %	97.738 %	250.258 ppb	241.038 ppb	98.723 %
Concentration per Run 1	100.718 %	229.704 ppb	241.341 ppb	248.630 ppb	96.678 %	96.698 %	247.282 ppb	237.201 ppb	101.579 %
Concentration per Run 2	93.727 %	236.990 ppb	259.291 ppb	250.131 ppb	96.328 %	98.276 %	250.583 ppb	239.362 ppb	96.729 %
Concentration per Run 3	96.086 %	239.940 ppb	257.510 ppb	248.841 ppb	96.346 %	98.241 %	252.910 ppb	246.552 ppb	97.862 %
Concentration RSD		2.2 %	3.9 %	0.3 %			1.1 %	2.0 %	

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 8 Analysis started at: 4/5/2017 8:12:54 AM Rack: 0
 Analysis label: 500/50000 User name: ALPHALAB\metals-instrument Vial: 7

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	95.693 %	100.326 %	515.425 ppb	50,083.573 ppb	50,165.482 ppb	498.934 ppb	49,984.912 ppb	49,885.980 ppb	100.085 %
Concentration per Run 1	95.980 %	96.927 %	524.099 ppb	51,426.857 ppb	51,898.521 ppb	507.766 ppb	51,771.113 ppb	51,750.524 ppb	100.795 %
Concentration per Run 2	94.842 %	104.609 %	517.673 ppb	49,362.109 ppb	49,312.243 ppb	493.291 ppb	48,835.694 ppb	49,997.255 ppb	99.517 %
Concentration per Run 3	96.258 %	99.441 %	504.503 ppb	49,461.753 ppb	49,285.681 ppb	495.744 ppb	49,347.927 ppb	47,910.162 ppb	99.943 %
Concentration RSD			1.9 %	2.3 %	3.0 %	1.6 %	3.1 %	3.9 %	

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	99.960 %	463.516 ppb	499.055 ppb	498.446 ppb	497.072 ppb	50,218.385 ppb	500.147 ppb	499.456 ppb	500.883 ppb
Concentration per Run 1	99.038 %	474.934 ppb	506.490 ppb	499.341 ppb	499.169 ppb	50,527.233 ppb	493.233 ppb	490.590 ppb	492.834 ppb
Concentration per Run 2	100.100 %	456.773 ppb	502.282 ppb	495.674 ppb	486.502 ppb	49,715.735 ppb	515.410 ppb	506.268 ppb	502.636 ppb
Concentration per Run 3	100.741 %	458.840 ppb	488.394 ppb	500.323 ppb	505.544 ppb	50,412.187 ppb	491.799 ppb	501.509 ppb	507.180 ppb
Concentration RSD		2.1 %	1.9 %	0.5 %	1.9 %	0.9 %	2.6 %	1.6 %	1.5 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	503.193 ppb	95.790 %	533.116 ppb	529.945 ppb	521.219 ppb	505.282 ppb	93.632 %	500.097 ppb	506.276 ppb
Concentration per Run 1	497.378 ppb	97.121 %	539.851 ppb	522.656 ppb	510.350 ppb	498.823 ppb	95.104 %	502.904 ppb	498.989 ppb
Concentration per Run 2	509.773 ppb	96.028 %	519.441 ppb	537.931 ppb	521.087 ppb	494.582 ppb	95.509 %	484.242 ppb	497.603 ppb
Concentration per Run 3	502.429 ppb	94.221 %	540.056 ppb	529.249 ppb	532.221 ppb	522.441 ppb	90.282 %	513.144 ppb	522.237 ppb
Concentration RSD	1.2 %		2.2 %	1.4 %	2.1 %	3.0 %		2.9 %	2.7 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	92.607 %	508.047 ppb	561.072 ppb	527.012 ppb	93.679 %	96.528 %	536.769 ppb	539.013 ppb	93.516 %
Concentration per Run 1	96.045 %	489.853 ppb	525.693 ppb	537.387 ppb	94.265 %	96.611 %	534.059 ppb	523.750 ppb	96.618 %
Concentration per Run 2	93.766 %	513.797 ppb	557.498 ppb	495.822 ppb	97.117 %	99.210 %	527.637 ppb	540.945 ppb	93.849 %
Concentration per Run 3	88.011 %	520.492 ppb	600.025 ppb	547.828 ppb	89.654 %	93.762 %	548.611 ppb	552.346 ppb	90.081 %
Concentration RSD		3.2 %	6.6 %	5.2 %			2.0 %	2.7 %	

Alpha ICPMSQ Full

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Analysis index:	9	Analysis started at:	4/5/2017 8:16:17 AM	Rack:	0
Analysis label:	Rinse	User name:	ALPHALAB\metals-instrument	Vial:	1

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 10 Analysis started at: 4/5/2017 8:19:38 AM Rack: 0
 Analysis label: ICV User name: ALPHALAB\metals-instrument Vial: 9

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	97.825 %	99.488 %	97.279 ppb	10,062.689 ppb	10,344.452 ppb	100.370 ppb	10,092.169 ppb	10,299.491 ppb	96.961 %
Concentration per Run 1	97.271 %	102.933 %	98.849 ppb	9,418.984 ppb	9,550.531 ppb	90.435 ppb	9,357.013 ppb	9,303.299 ppb	105.568 %
Concentration per Run 2	98.594 %	91.341 %	94.906 ppb	10,727.776 ppb	11,125.582 ppb	112.193 ppb	10,225.963 ppb	10,450.259 ppb	96.109 %
Concentration per Run 3	97.611 %	104.190 %	98.083 ppb	10,041.306 ppb	10,357.241 ppb	98.480 ppb	10,693.530 ppb	11,144.915 ppb	89.206 %
Recovery Percentage 1			97.279 %	100.627 %	103.445 %	100.370 %	100.922 %	102.995 %	
Concentration RSD	0.7 %	7.1 %	2.1 %	6.5 %	7.6 %	11.0 %	6.7 %	9.0 %	8.5 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	100.761 %	99.923 ppb	99.647 ppb	102.444 ppb	102.895 ppb	10,263.460 ppb	101.199 ppb	104.455 ppb	104.254 ppb
Concentration per Run 1	100.665 %	95.162 ppb	90.355 ppb	93.059 ppb	91.062 ppb	9,490.338 ppb	90.040 ppb	99.112 ppb	100.025 ppb
Concentration per Run 2	101.065 %	97.786 ppb	101.787 ppb	104.203 ppb	107.868 ppb	10,495.750 ppb	102.109 ppb	103.910 ppb	106.832 ppb
Concentration per Run 3	100.554 %	106.821 ppb	106.799 ppb	110.069 ppb	109.754 ppb	10,804.291 ppb	111.448 ppb	110.342 ppb	105.906 ppb
Recovery Percentage 1		99.923 %	99.647 %	102.444 %	102.895 %	102.635 %	101.199 %	104.455 %	104.254 %
Concentration RSD	0.3 %	6.1 %	8.5 %	8.4 %	10.0 %	6.7 %	10.6 %	5.4 %	3.5 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	100.361 ppb	97.537 %	100.718 ppb	101.802 ppb	100.725 ppb	101.447 ppb	96.947 %	98.367 ppb	101.169 ppb
Concentration per Run 1	93.508 ppb	101.190 %	93.305 ppb	101.626 ppb	96.325 ppb	96.626 ppb	97.855 %	97.067 ppb	98.062 ppb
Concentration per Run 2	100.165 ppb	99.490 %	100.961 ppb	95.194 ppb	101.930 ppb	100.621 ppb	97.174 %	98.738 ppb	102.424 ppb
Concentration per Run 3	107.412 ppb	91.932 %	107.886 ppb	108.586 ppb	103.921 ppb	107.095 ppb	95.811 %	99.296 ppb	103.021 ppb
Recovery Percentage 1	100.361 %	100.718 %	100.718 %	101.802 %	100.725 %	101.447 %		98.367 %	101.169 %
Concentration RSD	6.9 %	5.1 %	7.2 %	6.6 %	3.9 %	5.2 %	1.1 %	1.2 %	2.7 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	96.945 %	102.420 ppb	107.739 ppb	100.319 ppb	94.509 %	96.635 %	101.482 ppb	102.270 ppb	93.182 %
Concentration per Run 1	100.686 %	99.130 ppb	100.671 ppb	97.721 ppb	99.603 %	98.700 %	98.889 ppb	100.948 ppb	94.337 %
Concentration per Run 2	97.271 %	103.260 ppb	106.921 ppb	96.892 ppb	91.943 %	95.838 %	104.537 ppb	103.163 ppb	91.647 %
Concentration per Run 3	92.877 %	104.871 ppb	115.625 ppb	106.344 ppb	91.981 %	95.366 %	101.021 ppb	102.698 ppb	93.560 %
Recovery Percentage 1		102.420 %	107.739 %	100.319 %			101.482 %	102.270 %	
Concentration RSD	4.0 %	2.9 %	7.0 %	5.2 %	4.7 %	1.9 %	2.8 %	1.1 %	1.5 %

Alpha ICPMSQ Full

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Analysis index:	11	Analysis started at:	4/5/2017 8:23:03 AM	Rack:	0
Analysis label:	XICB	User name:	ALPHALAB\metals-instrument	Vial:	10

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 12 Analysis started at: 4/5/2017 8:27:18 AM Rack: 0
 Analysis label: ICB User name: ALPHALAB\metals-instrument Vial: 10

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	99.647 %	104.144 %	0.005 ppb	2.002 ppb	0.022 ppb	-0.210 ppb	20.204 ppb	4.101 ppb	95.341 %
Concentration per Run 1	100.521 %	103.212 %	0.002 ppb	4.012 ppb	-1.402 ppb	-0.038 ppb	32.121 ppb	-1.937 ppb	103.267 %
Concentration per Run 2	99.210 %	104.469 %	0.002 ppb	0.247 ppb	0.738 ppb	-0.399 ppb	2.542 ppb	4.355 ppb	91.165 %
Concentration per Run 3	99.211 %	104.749 %	0.011 ppb	1.747 ppb	0.730 ppb	-0.191 ppb	25.948 ppb	9.884 ppb	91.591 %
Recovery Percentage 1			0.912 %	2.002 %	0.031 %	-2.096 %	20.204 %	4.101 %	
Concentration RSD	0.8 %	0.8 %	114.8 %	94.7 %	5,611.4 %	86.5 %	77.2 %	144.2 %	7.2 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	100.853 %	0.080 ppb	0.039 ppb	-0.040 ppb	-0.093 ppb	0.671 ppb	-0.012 ppb	0.003 ppb	-0.014 ppb
Concentration per Run 1	99.011 %	0.155 ppb	0.056 ppb	-0.077 ppb	0.162 ppb	-0.468 ppb	-0.006 ppb	-0.047 ppb	-0.014 ppb
Concentration per Run 2	100.659 %	0.086 ppb	0.000 ppb	0.010 ppb	-0.319 ppb	-1.824 ppb	-0.025 ppb	0.027 ppb	-0.014 ppb
Concentration per Run 3	102.890 %	0.000 ppb	0.061 ppb	-0.052 ppb	-0.121 ppb	4.306 ppb	-0.005 ppb	0.028 ppb	-0.013 ppb
Recovery Percentage 1		16.065 %	0.780 %	-3.962 %	-9.263 %	1.343 %	-2.408 %	0.130 %	-1.372 %
Concentration RSD	1.9 %	96.6 %	86.9 %	113.3 %	261.1 %	479.7 %	94.0 %	1,661.4 %	5.0 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	-0.487 ppb	96.609 %	0.127 ppb	0.493 ppb	0.049 ppb	0.327 ppb	95.360 %	0.008 ppb	-0.003 ppb
Concentration per Run 1	-0.542 ppb	94.523 %	0.201 ppb	0.706 ppb	0.027 ppb	0.280 ppb	96.936 %	0.006 ppb	-0.003 ppb
Concentration per Run 2	-0.446 ppb	99.050 %	0.190 ppb	0.398 ppb	0.039 ppb	0.282 ppb	94.643 %	0.010 ppb	-0.003 ppb
Concentration per Run 3	-0.473 ppb	96.253 %	-0.011 ppb	0.376 ppb	0.080 ppb	0.420 ppb	94.502 %	0.006 ppb	-0.003 ppb
Recovery Percentage 1	-4.872 %	96.609 %	25.363 %	9.866 %	9.782 %	16.367 %		1.881 %	-1.668 %
Concentration RSD	10.2 %	2.4 %	94.4 %	37.4 %	56.1 %	24.6 %	1.4 %	30.7 %	

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	95.960 %	0.382 ppb	2.332 ppb	0.003 ppb	93.681 %	96.525 %	0.005 ppb	0.010 ppb	96.478 %
Concentration per Run 1	95.945 %	0.312 ppb	2.614 ppb	0.003 ppb	94.606 %	96.723 %	0.001 ppb	0.009 ppb	100.368 %
Concentration per Run 2	96.538 %	0.414 ppb	2.308 ppb	0.003 ppb	94.867 %	97.959 %	0.008 ppb	0.015 ppb	94.043 %
Concentration per Run 3	95.397 %	0.421 ppb	2.074 ppb	0.004 ppb	91.571 %	94.891 %	0.006 ppb	0.007 ppb	95.023 %
Recovery Percentage 1		12.734 %	58.300 %	0.699 %			1.032 %	2.095 %	96.478 %
Concentration RSD	0.6 %	15.9 %	11.6 %	20.0 %	2.0 %	1.6 %	75.0 %	40.8 %	3.5 %

Alpha ICPMSQ Full

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Analysis index: 13 Analysis started at: 4/5/2017 8:30:43 AM Rack: 4
 Analysis label: LLICV User name: ALPHALAB\metals-instrument Vial: 51

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	98.606 %	100.372 %	0.336 ppb	100.026 ppb	80.594 ppb	11.271 ppb	113.582 ppb	105.821 ppb	100.199 %
Concentration per Run 1	99.951 %	100.000 %	0.335 ppb	96.309 ppb	67.969 ppb	10.059 ppb	101.391 ppb	123.857 ppb	106.761 %
Concentration per Run 2	96.807 %	99.441 %	0.336 ppb	103.338 ppb	84.736 ppb	11.220 ppb	118.534 ppb	98.013 ppb	98.324 %
Concentration per Run 3	99.061 %	101.676 %	0.337 ppb	100.430 ppb	89.076 ppb	12.533 ppb	120.822 ppb	95.592 ppb	95.512 %
Recovery Percentage 1			111.981 %	100.026 %	115.134 %	112.707 %	113.582 %	105.821 %	
Concentration RSD	1.6 %	1.2 %	0.4 %	3.5 %	13.8 %	11.0 %	9.3 %	14.8 %	5.8 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	100.558 %	0.851 ppb	5.655 ppb	0.348 ppb	0.999 ppb	48.923 ppb	0.437 ppb	1.717 ppb	1.042 ppb
Concentration per Run 1	100.813 %	0.822 ppb	5.268 ppb	0.395 ppb	1.078 ppb	50.323 ppb	0.431 ppb	1.460 ppb	1.054 ppb
Concentration per Run 2	98.425 %	0.486 ppb	6.292 ppb	0.241 ppb	0.886 ppb	51.731 ppb	0.488 ppb	1.286 ppb	1.143 ppb
Concentration per Run 3	102.435 %	1.246 ppb	5.404 ppb	0.409 ppb	1.032 ppb	44.715 ppb	0.391 ppb	2.405 ppb	0.928 ppb
Recovery Percentage 1		170.255 %	113.095 %	69.675 %	99.873 %	97.846 %	87.319 %	85.849 %	104.174 %
Concentration RSD	2.0 %	44.7 %	9.8 %	26.7 %	10.0 %	7.6 %	11.1 %	35.1 %	10.4 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	12.095 ppb	95.829 %	0.615 ppb	6.941 ppb	0.484 ppb	1.982 ppb	96.219 %	0.468 ppb	0.225 ppb
Concentration per Run 1	11.181 ppb	99.864 %	0.670 ppb	6.940 ppb	0.558 ppb	1.488 ppb	100.728 %	0.433 ppb	0.199 ppb
Concentration per Run 2	13.363 ppb	92.845 %	0.508 ppb	7.348 ppb	0.467 ppb	2.209 ppb	94.552 %	0.508 ppb	0.223 ppb
Concentration per Run 3	11.740 ppb	94.778 %	0.667 ppb	6.533 ppb	0.425 ppb	2.251 ppb	93.378 %	0.462 ppb	0.252 ppb
Recovery Percentage 1	120.948 %		122.960 %	138.812 %	96.734 %	99.124 %		116.953 %	112.370 %
Concentration RSD	9.4 %	3.8 %	15.0 %	5.9 %	14.0 %	21.6 %	4.1 %	8.1 %	11.8 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	95.653 %	3.105 ppb	5.707 ppb	0.529 ppb	92.967 %	94.363 %	0.506 ppb	0.508 ppb	95.492 %
Concentration per Run 1	98.614 %	3.197 ppb	5.743 ppb	0.470 ppb	94.489 %	96.472 %	0.497 ppb	0.486 ppb	99.487 %
Concentration per Run 2	93.167 %	3.230 ppb	5.996 ppb	0.438 ppb	90.995 %	94.260 %	0.520 ppb	0.512 ppb	94.162 %
Concentration per Run 3	95.179 %	2.888 ppb	5.381 ppb	0.680 ppb	93.418 %	92.357 %	0.503 ppb	0.525 ppb	92.826 %
Recovery Percentage 1		103.509 %	142.673 %	105.874 %			101.294 %	101.509 %	
Concentration RSD	2.9 %	6.1 %	5.4 %	24.8 %	1.9 %	2.2 %	2.3 %	3.9 %	3.7 %

Alpha ICPMSQ Full

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Analysis index: 14 Analysis started at: 4/5/2017 8:34:09 AM Rack: 4
 Analysis label: ICSA User name: ALPHALAB\metals-instrument Vial: 53

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	93.404 %	93.994 %	0.013 ppb	53,856.548 ppb	21,448.793 ppb	20,529.330 ppb	20,817.776 ppb	62,707.118 ppb	91.251 %
Concentration per Run 1	94.275 %	91.061 %	0.007 ppb	56,391.024 ppb	22,797.384 ppb	22,074.672 ppb	21,740.419 ppb	66,883.822 ppb	88.439 %
Concentration per Run 2	93.130 %	97.346 %	0.012 ppb	51,870.425 ppb	20,690.542 ppb	19,829.050 ppb	21,621.132 ppb	63,099.328 ppb	90.143 %
Concentration per Run 3	92.806 %	93.575 %	0.021 ppb	53,308.195 ppb	20,858.454 ppb	19,684.266 ppb	19,091.778 ppb	58,138.202 ppb	95.171 %
Recovery Percentage 1				107.713 %	107.244 %	102.647 %	104.089 %	104.512 %	
Concentration RSD	0.8 %	3.4 %	57.2 %	4.3 %	5.5 %	6.5 %	7.2 %	7.0 %	3.8 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	90.366 %	459.210 ppb	0.000 ppb	0.669 ppb	0.555 ppb	54,546.566 ppb	0.620 ppb	0.361 ppb	0.755 ppb
Concentration per Run 1	92.089 %	503.340 ppb	0.000 ppb	0.450 ppb	0.933 ppb	60,686.338 ppb	0.697 ppb	0.350 ppb	0.938 ppb
Concentration per Run 2	92.140 %	443.000 ppb	0.000 ppb	0.834 ppb	0.354 ppb	52,824.594 ppb	0.466 ppb	0.489 ppb	0.576 ppb
Concentration per Run 3	86.868 %	431.289 ppb	0.000 ppb	0.725 ppb	0.378 ppb	50,128.766 ppb	0.696 ppb	0.245 ppb	0.750 ppb
Recovery Percentage 1		114.802 %				109.093 %			
Concentration RSD	3.4 %	8.4 %		29.6 %	59.0 %	10.1 %	21.4 %	33.9 %	24.0 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	1.444 ppb	94.032 %	0.233 ppb	0.195 ppb	1.001 ppb	423.844 ppb	89.191 %	0.066 ppb	0.095 ppb
Concentration per Run 1	1.836 ppb	89.335 %	0.216 ppb	0.346 ppb	1.232 ppb	435.353 ppb	91.067 %	0.110 ppb	0.122 ppb
Concentration per Run 2	1.392 ppb	94.269 %	0.331 ppb	0.252 ppb	0.893 ppb	418.338 ppb	87.372 %	0.076 ppb	0.066 ppb
Concentration per Run 3	1.105 ppb	98.491 %	0.151 ppb	-0.014 ppb	0.876 ppb	417.842 ppb	89.135 %	0.012 ppb	0.097 ppb
Recovery Percentage 1						105.961 %			
Concentration RSD	25.5 %	4.9 %	39.1 %	96.0 %	20.1 %	2.4 %	2.1 %	75.2 %	30.0 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	88.688 %	0.496 ppb	1.911 ppb	1.142 ppb	84.640 %	85.242 %	0.016 ppb	0.093 ppb	87.191 %
Concentration per Run 1	86.658 %	0.554 ppb	1.995 ppb	1.085 ppb	81.548 %	81.568 %	0.010 ppb	0.098 ppb	89.050 %
Concentration per Run 2	87.852 %	0.453 ppb	1.794 ppb	1.164 ppb	86.864 %	89.594 %	0.016 ppb	0.093 ppb	87.426 %
Concentration per Run 3	91.554 %	0.481 ppb	1.945 ppb	1.178 ppb	85.509 %	84.563 %	0.021 ppb	0.087 ppb	85.096 %
Recovery Percentage 1									
Concentration RSD	2.9 %	10.4 %	5.5 %	4.4 %	3.3 %	4.8 %	32.4 %	6.3 %	2.3 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 15 Analysis started at: 4/5/2017 8:37:34 AM Rack: 4
 Analysis label: ICSAB User name: ALPHALAB\metals-instrument Vial: 55

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	93.402 %	96.136 %	0.013 ppb	53,652.243 ppb	21,709.408 ppb	20,919.721 ppb	22,371.373 ppb	67,478.192 ppb	86.365 %
Concentration per Run 1	94.095 %	97.346 %	0.002 ppb	53,556.014 ppb	21,099.519 ppb	20,184.585 ppb	22,123.072 ppb	63,191.220 ppb	88.012 %
Concentration per Run 2	92.892 %	100.000 %	0.017 ppb	54,903.811 ppb	22,520.632 ppb	21,955.300 ppb	23,534.179 ppb	74,908.223 ppb	81.110 %
Concentration per Run 3	93.219 %	91.061 %	0.021 ppb	52,496.905 ppb	21,508.074 ppb	20,619.277 ppb	21,456.868 ppb	64,335.134 ppb	89.972 %
Recovery Percentage 1				107.304 %	108.547 %	104.599 %	111.857 %	112.464 %	
Concentration RSD	0.7 %	4.8 %	76.8 %	2.2 %	3.4 %	4.4 %	4.7 %	9.6 %	5.4 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	87.727 %	457.888 ppb	43.354 ppb	44.100 ppb	44.598 ppb	54,545.280 ppb	41.803 ppb	42.662 ppb	42.998 ppb
Concentration per Run 1	91.539 %	437.270 ppb	41.502 ppb	40.862 ppb	41.557 ppb	51,191.205 ppb	39.614 ppb	39.288 ppb	38.728 ppb
Concentration per Run 2	85.473 %	505.082 ppb	46.958 ppb	48.703 ppb	49.077 ppb	61,547.145 ppb	45.627 ppb	44.831 ppb	50.055 ppb
Concentration per Run 3	86.170 %	431.311 ppb	41.603 ppb	42.736 ppb	43.159 ppb	50,897.491 ppb	40.167 ppb	43.866 ppb	40.209 ppb
Recovery Percentage 1		114.472 %	108.386 %	110.251 %	111.494 %	109.091 %	104.507 %	106.654 %	107.494 %
Concentration RSD	3.8 %	8.9 %	7.2 %	9.3 %	8.9 %	11.1 %	7.9 %	6.9 %	14.3 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	22.465 ppb	93.986 %	21.255 ppb	23.531 ppb	43.959 ppb	423.540 ppb	86.706 %	10.117 ppb	21.799 ppb
Concentration per Run 1	19.690 ppb	99.293 %	19.868 ppb	24.052 ppb	43.318 ppb	394.993 ppb	91.830 %	9.807 ppb	20.388 ppb
Concentration per Run 2	26.334 ppb	86.678 %	22.186 ppb	25.025 ppb	46.707 ppb	459.283 ppb	82.972 %	10.661 ppb	23.194 ppb
Concentration per Run 3	21.370 ppb	95.986 %	21.712 ppb	21.517 ppb	41.851 ppb	416.344 ppb	85.316 %	9.885 ppb	21.814 ppb
Recovery Percentage 1	112.323 %		106.276 %	117.656 %	109.897 %	105.885 %		101.173 %	108.993 %
Concentration RSD	15.4 %	7.0 %	5.8 %	7.7 %	5.7 %	7.7 %	5.3 %	4.7 %	6.4 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	85.940 %	0.271 ppb	1.135 ppb	0.735 ppb	84.851 %	82.910 %	0.004 ppb	0.078 ppb	87.111 %
Concentration per Run 1	90.118 %	0.290 ppb	1.109 ppb	0.715 ppb	89.785 %	85.676 %	0.004 ppb	0.081 ppb	91.348 %
Concentration per Run 2	82.458 %	0.273 ppb	1.027 ppb	0.559 ppb	82.726 %	78.464 %	0.001 ppb	0.082 ppb	82.294 %
Concentration per Run 3	85.245 %	0.249 ppb	1.269 ppb	0.932 ppb	82.043 %	84.590 %	0.006 ppb	0.072 ppb	87.693 %
Recovery Percentage 1									
Concentration RSD	4.5 %	7.7 %	10.9 %	25.5 %	5.1 %	4.7 %	64.0 %	6.5 %	5.2 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index:	16	Analysis started at:	4/5/2017 8:41:00 AM	Rack:	0
Analysis label:	Rinse	User name:	ALPHALAB\metals-instrument	Vial:	1

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 17 Analysis started at: 4/5/2017 8:44:20 AM Rack: 4
 Analysis label: Sr 100ppb User name: ALPHALAB\metals-instrument Vial: 57

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	90.209 %	105.307 %	0.045 ppb	36.313 ppb	7.436 ppb	10.303 ppb	40.739 ppb	0.335 ppb	96.932 %
Concentration per Run 1	92.857 %	107.263 %	0.056 ppb	39.245 ppb	9.805 ppb	10.973 ppb	37.761 ppb	-20.986 ppb	98.580 %
Concentration per Run 2	89.717 %	102.095 %	0.043 ppb	39.104 ppb	-0.324 ppb	10.206 ppb	53.433 ppb	74.160 ppb	92.273 %
Concentration per Run 3	88.053 %	106.564 %	0.038 ppb	30.591 ppb	12.826 ppb	9.729 ppb	31.022 ppb	-52.169 ppb	99.943 %
Concentration RSD	2.7 %	2.7 %	19.8 %	13.6 %	92.6 %	6.1 %	28.2 %	19,638.3 %	4.2 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	82.158 %	0.328 ppb	0.038 ppb	-0.015 ppb	-0.323 ppb	31.691 ppb	0.020 ppb	0.099 ppb	0.158 ppb
Concentration per Run 1	85.949 %	0.323 ppb	0.058 ppb	-0.017 ppb	-0.324 ppb	27.573 ppb	0.033 ppb	0.099 ppb	0.038 ppb
Concentration per Run 2	80.349 %	0.341 ppb	0.000 ppb	0.029 ppb	-0.320 ppb	32.800 ppb	-0.025 ppb	0.027 ppb	0.294 ppb
Concentration per Run 3	80.175 %	0.319 ppb	0.057 ppb	-0.056 ppb	-0.325 ppb	34.700 ppb	0.052 ppb	0.171 ppb	0.141 ppb
Concentration RSD	4.0 %	3.6 %	86.6 %	294.3 %	0.8 %	11.6 %	199.7 %	73.0 %	81.7 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	0.165 ppb	96.130 %	0.101 ppb	0.253 ppb	97.298 ppb	0.542 ppb	95.286 %	0.000 ppb	0.037 ppb
Concentration per Run 1	0.265 ppb	95.071 %	0.073 ppb	0.597 ppb	95.958 ppb	0.512 ppb	97.404 %	-0.013 ppb	0.028 ppb
Concentration per Run 2	0.128 ppb	98.745 %	0.069 ppb	0.133 ppb	97.418 ppb	0.514 ppb	95.512 %	0.014 ppb	0.007 ppb
Concentration per Run 3	0.104 ppb	94.574 %	0.159 ppb	0.029 ppb	98.518 ppb	0.601 ppb	92.940 %	0.000 ppb	0.075 ppb
Concentration RSD	52.6 %	2.4 %	50.5 %	119.6 %	1.3 %	9.3 %	2.4 %	4,877.2 %	94.0 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	92.124 %	0.432 ppb	1.029 ppb	0.014 ppb	91.384 %	91.630 %	0.019 ppb	0.042 ppb	98.232 %
Concentration per Run 1	94.796 %	0.342 ppb	0.897 ppb	0.005 ppb	89.972 %	95.390 %	0.011 ppb	0.033 ppb	102.600 %
Concentration per Run 2	93.203 %	0.456 ppb	0.879 ppb	0.090 ppb	92.722 %	89.060 %	0.023 ppb	0.045 ppb	97.391 %
Concentration per Run 3	88.374 %	0.498 ppb	1.312 ppb	-0.053 ppb	91.458 %	90.441 %	0.024 ppb	0.048 ppb	94.703 %
Concentration RSD	3.6 %	18.8 %	23.8 %	504.3 %	1.5 %	3.6 %	37.5 %	18.2 %	4.1 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 18 Analysis started at: 4/5/2017 8:48:32 AM Rack: 0
 Analysis label: CCV User name: ALPHALAB\metals-instrument Vial: 9

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	98.586 %	103.073 %	94.836 ppb	9,889.896 ppb	10,004.355 ppb	101.720 ppb	10,112.351 ppb	10,159.882 ppb	95.540 %
Concentration per Run 1	98.949 %	100.000 %	94.407 ppb	10,302.624 ppb	10,584.140 ppb	103.412 ppb	10,175.705 ppb	10,388.406 ppb	98.239 %
Concentration per Run 2	98.341 %	106.006 %	94.084 ppb	9,649.892 ppb	9,753.365 ppb	100.547 ppb	10,205.697 ppb	10,451.810 ppb	92.273 %
Concentration per Run 3	98.469 %	103.212 %	96.017 ppb	9,717.172 ppb	9,675.561 ppb	101.200 ppb	9,955.651 ppb	9,639.430 ppb	96.108 %
Recovery Percentage 1			94.836 %	98.899 %	100.044 %	101.720 %	101.124 %	101.599 %	
Concentration RSD	0.3 %	2.9 %	1.1 %	3.6 %	5.0 %	1.5 %	1.4 %	4.4 %	3.2 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	98.946 %	100.978 ppb	100.310 ppb	99.534 ppb	102.906 ppb	10,155.912 ppb	100.726 ppb	99.593 ppb	98.581 ppb
Concentration per Run 1	97.814 %	102.928 ppb	100.643 ppb	96.217 ppb	98.850 ppb	10,402.904 ppb	101.186 ppb	103.130 ppb	94.423 ppb
Concentration per Run 2	97.911 %	100.209 ppb	103.498 ppb	103.547 ppb	107.821 ppb	10,319.805 ppb	101.367 ppb	95.077 ppb	104.527 ppb
Concentration per Run 3	101.111 %	99.796 ppb	96.788 ppb	98.838 ppb	102.046 ppb	9,745.028 ppb	99.626 ppb	100.571 ppb	96.792 ppb
Recovery Percentage 1		100.978 %	100.310 %	99.534 %	102.906 %	101.559 %	100.726 %	99.593 %	98.581 %
Concentration RSD	1.9 %	1.7 %	3.4 %	3.7 %	4.4 %	3.5 %	1.0 %	4.1 %	5.4 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	99.329 ppb	97.509 %	99.145 ppb	100.373 ppb	100.087 ppb	102.758 ppb	93.352 %	99.770 ppb	100.969 ppb
Concentration per Run 1	100.490 ppb	97.733 %	96.356 ppb	97.970 ppb	102.905 ppb	103.875 ppb	94.644 %	99.775 ppb	100.235 ppb
Concentration per Run 2	97.285 ppb	97.189 %	100.464 ppb	102.987 ppb	99.585 ppb	99.302 ppb	94.849 %	100.447 ppb	101.303 ppb
Concentration per Run 3	100.212 ppb	97.605 %	100.614 ppb	100.161 ppb	97.773 ppb	105.098 ppb	90.564 %	99.088 ppb	101.369 ppb
Recovery Percentage 1	99.329 %	99.145 %	100.373 %	100.087 %	102.758 %			99.770 %	100.969 %
Concentration RSD	1.8 %	0.3 %	2.4 %	2.5 %	2.6 %	3.0 %	2.6 %	0.7 %	0.6 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	91.002 %	100.197 ppb	101.699 ppb	101.435 ppb	93.279 %	91.569 %	102.957 ppb	102.648 ppb	88.896 %
Concentration per Run 1	95.472 %	97.722 ppb	100.017 ppb	100.939 ppb	93.328 %	92.199 %	103.536 ppb	105.333 ppb	88.319 %
Concentration per Run 2	88.562 %	103.197 ppb	101.915 ppb	102.717 ppb	94.436 %	91.936 %	103.699 ppb	101.208 ppb	90.136 %
Concentration per Run 3	88.974 %	99.673 ppb	103.166 ppb	100.648 ppb	92.075 %	90.573 %	101.635 ppb	101.404 ppb	88.234 %
Recovery Percentage 1		100.197 %	101.699 %	101.435 %			102.957 %	102.648 %	
Concentration RSD	4.3 %	2.8 %	1.6 %	1.1 %	1.3 %	1.0 %	1.1 %	2.3 %	1.2 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 19 Analysis started at: 4/5/2017 8:51:57 AM Rack: 0
 Analysis label: CCB User name: ALPHALAB\metals-instrument Vial: 10

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	99.367 %	99.721 %	0.029 ppb	16.130 ppb	1.554 ppb	-0.024 ppb	26.505 ppb	-5.171 ppb	91.364 %
Concentration per Run 1	100.454 %	93.156 %	0.037 ppb	21.212 ppb	4.200 ppb	0.496 ppb	22.985 ppb	-1.439 ppb	94.745 %
Concentration per Run 2	99.152 %	103.631 %	0.029 ppb	16.591 ppb	-0.324 ppb	0.031 ppb	15.205 ppb	-7.076 ppb	90.484 %
Concentration per Run 3	98.494 %	102.374 %	0.020 ppb	10.586 ppb	0.786 ppb	-0.600 ppb	41.323 ppb	-6.996 ppb	88.864 %
Recovery Percentage 1			5.756 %	16.130 %	2.220 %	-0.245 %	26.505 %	-5.171 %	
Concentration RSD	1.0 %	5.7 %	30.4 %	33.0 %	151.7 %	2,249.5 %	50.6 %	62.5 %	3.3 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	95.739 %	0.143 ppb	0.021 ppb	-0.031 ppb	-0.123 ppb	6.886 ppb	0.002 ppb	0.002 ppb	0.004 ppb
Concentration per Run 1	97.534 %	0.166 ppb	0.000 ppb	-0.054 ppb	-0.067 ppb	1.105 ppb	-0.006 ppb	0.026 ppb	-0.015 ppb
Concentration per Run 2	94.767 %	0.087 ppb	0.000 ppb	-0.009 ppb	-0.052 ppb	13.608 ppb	0.015 ppb	-0.047 ppb	-0.013 ppb
Concentration per Run 3	94.916 %	0.177 ppb	0.062 ppb	-0.029 ppb	-0.249 ppb	5.945 ppb	-0.005 ppb	0.029 ppb	0.039 ppb
Recovery Percentage 1		28.673 %	0.417 %	-3.063 %	-12.283 %	13.772 %	0.332 %	0.117 %	0.407 %
Concentration RSD	1.6 %	34.2 %	173.2 %	74.0 %	89.5 %	91.6 %	716.9 %	1,834.7 %	753.0 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	-0.508 ppb	97.541 %	0.206 ppb	0.720 ppb	0.031 ppb	0.886 ppb	95.361 %	0.057 ppb	0.015 ppb
Concentration per Run 1	-0.449 ppb	99.101 %	0.352 ppb	0.319 ppb	0.001 ppb	0.979 ppb	95.879 %	0.056 ppb	0.007 ppb
Concentration per Run 2	-0.537 ppb	96.100 %	0.114 ppb	0.860 ppb	0.066 ppb	0.993 ppb	95.251 %	0.038 ppb	0.029 ppb
Concentration per Run 3	-0.538 ppb	97.423 %	0.153 ppb	0.979 ppb	0.027 ppb	0.687 ppb	94.954 %	0.077 ppb	0.008 ppb
Recovery Percentage 1	-5.084 %	97.541 %	41.279 %	14.392 %	6.282 %	44.318 %		14.267 %	7.346 %
Concentration RSD	10.1 %	1.5 %	61.9 %	48.9 %	105.4 %	19.5 %	0.5 %	34.3 %	85.7 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	92.301 %	0.751 ppb	3.425 ppb	0.051 ppb	93.545 %	91.454 %	0.052 ppb	0.053 ppb	92.775 %
Concentration per Run 1	93.809 %	0.784 ppb	3.056 ppb	0.144 ppb	95.528 %	94.325 %	0.050 ppb	0.048 ppb	93.869 %
Concentration per Run 2	91.546 %	0.661 ppb	3.681 ppb	-0.024 ppb	92.125 %	91.327 %	0.055 ppb	0.056 ppb	92.482 %
Concentration per Run 3	91.549 %	0.807 ppb	3.537 ppb	0.034 ppb	92.981 %	88.711 %	0.052 ppb	0.054 ppb	91.972 %
Recovery Percentage 1		25.026 %	85.624 %	10.274 %			10.474 %	10.563 %	92.775 %
Concentration RSD	1.4 %	10.4 %	9.6 %	165.7 %	1.9 %	3.1 %	5.3 %	7.3 %	1.1 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 20 Analysis started at: 4/5/2017 8:55:22 AM Rack: 1
 Analysis label: WG991017-1 MCP-6020TL-10 User name: ALPHALAB\metals-instrument Vial: 1

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	96.649 %	101.164 %	0.027 ppb	20.738 ppb	-1.050 ppb	0.710 ppb	7.843 ppb	3.846 ppb	94.915 %
Concentration per Run 1	97.386 %	105.447 %	0.006 ppb	23.163 ppb	-0.345 ppb	1.051 ppb	3.287 ppb	4.155 ppb	92.614 %
Concentration per Run 2	96.401 %	96.927 %	0.039 ppb	20.648 ppb	-1.402 ppb	0.271 ppb	6.595 ppb	-1.368 ppb	92.444 %
Concentration per Run 3	96.161 %	101.117 %	0.035 ppb	18.402 ppb	-1.402 ppb	0.809 ppb	13.646 ppb	8.751 ppb	99.688 %
Concentration RSD	0.7 %	4.2 %	66.7 %	11.5 %	58.1 %	56.2 %	67.5 %	131.7 %	4.4 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	94.162 %	0.053 ppb	0.078 ppb	0.034 ppb	-0.022 ppb	2.167 ppb	0.014 ppb	0.003 ppb	0.055 ppb
Concentration per Run 1	94.111 %	0.000 ppb	0.000 ppb	0.031 ppb	-0.187 ppb	1.255 ppb	-0.005 ppb	0.028 ppb	-0.012 ppb
Concentration per Run 2	93.482 %	0.000 ppb	0.122 ppb	0.071 ppb	0.139 ppb	4.270 ppb	0.015 ppb	0.028 ppb	0.092 ppb
Concentration per Run 3	94.894 %	0.159 ppb	0.114 ppb	0.001 ppb	-0.018 ppb	0.974 ppb	0.032 ppb	-0.047 ppb	0.085 ppb
Concentration RSD	0.8 %	173.2 %	86.7 %	103.8 %	745.4 %	84.3 %	131.8 %	1,473.2 %	106.5 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	-0.520 ppb	96.575 %	0.031 ppb	0.365 ppb	0.024 ppb	0.230 ppb	93.765 %	0.010 ppb	0.004 ppb
Concentration per Run 1	-0.536 ppb	94.473 %	0.117 ppb	0.527 ppb	0.056 ppb	0.395 ppb	92.350 %	0.016 ppb	-0.003 ppb
Concentration per Run 2	-0.571 ppb	96.100 %	-0.053 ppb	0.363 ppb	0.027 ppb	0.146 ppb	96.490 %	0.014 ppb	0.018 ppb
Concentration per Run 3	-0.453 ppb	99.152 %	0.028 ppb	0.206 ppb	-0.012 ppb	0.150 ppb	92.454 %	-0.001 ppb	-0.003 ppb
Concentration RSD	11.6 %	2.5 %	276.6 %	44.0 %	142.6 %	62.1 %	2.5 %	91.4 %	320.9 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	90.554 %	0.403 ppb	1.431 ppb	0.016 ppb	90.357 %	91.052 %	0.017 ppb	0.024 ppb	94.173 %
Concentration per Run 1	89.956 %	0.538 ppb	1.178 ppb	0.065 ppb	91.609 %	94.067 %	0.014 ppb	0.017 ppb	96.778 %
Concentration per Run 2	90.670 %	0.350 ppb	1.446 ppb	-0.023 ppb	87.626 %	89.952 %	0.015 ppb	0.025 ppb	94.577 %
Concentration per Run 3	91.037 %	0.322 ppb	1.669 ppb	0.006 ppb	91.836 %	89.139 %	0.020 ppb	0.030 ppb	91.164 %
Concentration RSD	0.6 %	29.1 %	17.2 %	282.2 %	2.6 %	2.9 %	19.5 %	28.2 %	3.0 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 21 Analysis started at: 4/5/2017 8:58:43 AM Rack: 1
 Analysis label: WG991017-2D5 MCP-6020TL-10 User name: ALPHALAB\metals-instrument Vial: 2

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	97.710 %	102.607 %	10.182 ppb	2,058.734 ppb	2,128.154 ppb	413.754 ppb	2,074.004 ppb	2,120.064 ppb	93.978 %
Concentration per Run 1	98.908 %	106.983 %	10.247 ppb	2,004.708 ppb	2,053.468 ppb	406.902 ppb	2,046.177 ppb	2,091.345 ppb	92.870 %
Concentration per Run 2	98.043 %	101.257 %	10.157 ppb	2,104.798 ppb	2,228.856 ppb	436.367 ppb	2,169.013 ppb	2,252.357 ppb	90.313 %
Concentration per Run 3	96.179 %	99.581 %	10.141 ppb	2,066.697 ppb	2,102.138 ppb	397.994 ppb	2,006.822 ppb	2,016.492 ppb	98.750 %
Concentration RSD	1.4 %	3.8 %	0.6 %	2.5 %	4.3 %	4.9 %	4.1 %	5.7 %	4.6 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	96.238 %	178.017 ppb	100.634 ppb	41.041 ppb	103.520 ppb	217.435 ppb	102.051 ppb	100.449 ppb	51.005 ppb
Concentration per Run 1	95.901 %	181.722 ppb	98.772 ppb	41.616 ppb	98.690 ppb	182.104 ppb	99.307 ppb	99.396 ppb	47.788 ppb
Concentration per Run 2	96.948 %	183.548 ppb	105.359 ppb	41.749 ppb	110.459 ppb	239.357 ppb	105.660 ppb	104.588 ppb	54.945 ppb
Concentration per Run 3	95.864 %	168.782 ppb	97.770 ppb	39.759 ppb	101.413 ppb	230.842 ppb	101.186 ppb	97.364 ppb	50.282 ppb
Concentration RSD	0.6 %	4.5 %	4.1 %	2.7 %	6.0 %	14.2 %	3.2 %	3.7 %	7.1 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	102.381 ppb	97.424 %	25.455 ppb	28.134 ppb	205.121 ppb	195.404 ppb	92.461 %	9.972 ppb	11.055 ppb
Concentration per Run 1	103.456 ppb	97.614 %	24.775 ppb	31.390 ppb	201.054 ppb	180.870 ppb	95.774 %	9.834 ppb	10.895 ppb
Concentration per Run 2	101.167 ppb	97.004 %	25.054 ppb	29.696 ppb	208.626 ppb	203.341 ppb	90.715 %	10.025 ppb	10.806 ppb
Concentration per Run 3	102.521 ppb	97.653 %	26.537 ppb	23.315 ppb	205.681 ppb	202.002 ppb	90.894 %	10.058 ppb	11.464 ppb
Concentration RSD	1.1 %	0.4 %	3.7 %	15.1 %	1.9 %	6.5 %	3.1 %	1.2 %	3.2 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	90.548 %	203.190 ppb	103.349 ppb	408.765 ppb	92.202 %	90.643 %	24.565 ppb	107.537 ppb	92.102 %
Concentration per Run 1	90.043 %	197.342 ppb	98.628 ppb	400.746 ppb	93.476 %	91.637 %	23.620 ppb	100.968 ppb	93.401 %
Concentration per Run 2	91.747 %	208.069 ppb	105.442 ppb	415.242 ppb	90.186 %	88.749 %	25.374 ppb	112.240 ppb	91.060 %
Concentration per Run 3	89.853 %	204.160 ppb	105.977 ppb	410.305 ppb	92.945 %	91.541 %	24.701 ppb	109.401 ppb	91.847 %
Concentration RSD	1.2 %	2.7 %	4.0 %	1.8 %	1.9 %	1.8 %	3.6 %	5.5 %	1.3 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 22 Analysis started at: 4/5/2017 9:02:03 AM Rack: 1
 Analysis label: WG991017-3D5 MCP-6020TL-10 User name: Vial: 3

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	96.616 %	99.255 %	10.360 ppb	2,188.347 ppb	2,249.104 ppb	439.343 ppb	2,116.018 ppb	2,206.317 ppb	92.586 %
Concentration per Run 1	96.354 %	101.397 %	10.457 ppb	2,206.127 ppb	2,329.333 ppb	445.539 ppb	2,213.514 ppb	2,411.543 ppb	90.569 %
Concentration per Run 2	97.089 %	97.486 %	10.333 ppb	2,176.842 ppb	2,202.135 ppb	434.265 ppb	2,041.436 ppb	2,266.611 ppb	91.336 %
Concentration per Run 3	96.405 %	98.883 %	10.291 ppb	2,182.072 ppb	2,215.845 ppb	438.226 ppb	2,093.106 ppb	1,940.797 ppb	95.853 %
Concentration RSD	0.4 %	2.0 %	0.8 %	0.7 %	3.1 %	1.3 %	4.2 %	10.9 %	3.1 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	93.579 %	179.917 ppb	108.707 ppb	42.433 ppb	114.994 ppb	223.510 ppb	106.480 ppb	108.987 ppb	55.143 ppb
Concentration per Run 1	94.112 %	180.799 ppb	109.832 ppb	44.866 ppb	117.980 ppb	202.874 ppb	108.496 ppb	110.629 ppb	57.429 ppb
Concentration per Run 2	94.007 %	182.100 ppb	110.876 ppb	41.561 ppb	117.052 ppb	245.221 ppb	108.674 ppb	108.970 ppb	56.494 ppb
Concentration per Run 3	92.620 %	176.852 ppb	105.412 ppb	40.871 ppb	109.949 ppb	222.434 ppb	102.270 ppb	107.362 ppb	51.507 ppb
Concentration RSD	0.9 %	1.5 %	2.7 %	5.0 %	3.8 %	9.5 %	3.4 %	1.5 %	5.8 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	107.491 ppb	93.174 %	26.700 ppb	26.668 ppb	212.563 ppb	195.856 ppb	93.758 %	10.135 ppb	10.776 ppb
Concentration per Run 1	113.210 ppb	91.193 %	28.884 ppb	29.078 ppb	225.128 ppb	199.879 ppb	94.873 %	9.733 ppb	10.997 ppb
Concentration per Run 2	106.400 ppb	93.027 %	26.939 ppb	26.817 ppb	207.679 ppb	201.795 ppb	92.232 %	10.406 ppb	10.412 ppb
Concentration per Run 3	102.861 ppb	95.301 %	24.277 ppb	24.108 ppb	204.881 ppb	185.895 ppb	94.168 %	10.267 ppb	10.918 ppb
Concentration RSD	4.9 %	2.2 %	8.7 %	9.3 %	5.2 %	4.4 %	1.5 %	3.5 %	2.9 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	92.161 %	205.171 ppb	111.455 ppb	412.852 ppb	90.685 %	89.854 %	26.062 ppb	108.369 ppb	90.616 %
Concentration per Run 1	91.960 %	209.744 ppb	111.115 ppb	406.858 ppb	89.814 %	89.094 %	25.668 ppb	110.790 ppb	92.270 %
Concentration per Run 2	93.279 %	202.888 ppb	109.789 ppb	416.889 ppb	91.205 %	90.727 %	26.570 ppb	107.795 ppb	89.603 %
Concentration per Run 3	91.245 %	202.881 ppb	113.462 ppb	414.809 ppb	91.037 %	89.742 %	25.947 ppb	106.521 ppb	89.976 %
Concentration RSD	1.1 %	1.9 %	1.7 %	1.3 %	0.8 %	0.9 %	1.8 %	2.0 %	1.6 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 23 Analysis started at: 4/5/2017 9:05:24 AM Rack: 1
 Analysis label: L1710261-01 MCP-6020TL-10 User name: Vial: 4

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	94.674 %	95.717 %	0.007 ppb	32,960.938 ppb	820.568 ppb	8.647 ppb	902.376 ppb	5,052.156 ppb	93.296 %
Concentration per Run 1	95.061 %	96.788 %	0.002 ppb	31,630.923 ppb	784.078 ppb	6.708 ppb	817.279 ppb	4,624.268 ppb	99.261 %
Concentration per Run 2	94.994 %	97.626 %	0.011 ppb	34,274.961 ppb	862.654 ppb	10.141 ppb	1,041.416 ppb	5,609.725 ppb	86.905 %
Concentration per Run 3	93.968 %	92.737 %	0.007 ppb	32,976.929 ppb	814.970 ppb	9.091 ppb	848.434 ppb	4,922.477 ppb	93.722 %
Concentration RSD	0.6 %	2.7 %	72.2 %	4.0 %	4.8 %	20.3 %	13.5 %	10.0 %	6.6 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	90.570 %	7.510 ppb	0.058 ppb	0.137 ppb	6.319 ppb	41.930 ppb	0.013 ppb	0.202 ppb	8.362 ppb
Concentration per Run 1	90.275 %	8.051 ppb	0.114 ppb	0.193 ppb	5.331 ppb	43.904 ppb	0.050 ppb	0.165 ppb	7.117 ppb
Concentration per Run 2	92.654 %	7.981 ppb	0.000 ppb	0.127 ppb	7.248 ppb	35.305 ppb	-0.025 ppb	0.190 ppb	9.256 ppb
Concentration per Run 3	88.781 %	6.497 ppb	0.060 ppb	0.090 ppb	6.376 ppb	46.579 ppb	0.015 ppb	0.251 ppb	8.714 ppb
Concentration RSD	2.2 %	11.7 %	98.2 %	38.3 %	15.2 %	14.0 %	282.7 %	22.0 %	13.3 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	1.587 ppb	95.948 %	0.632 ppb	0.341 ppb	37.094 ppb	1.480 ppb	91.326 %	-0.011 ppb	0.004 ppb
Concentration per Run 1	1.486 ppb	100.729 %	0.586 ppb	0.305 ppb	35.950 ppb	1.179 ppb	91.591 %	-0.005 ppb	0.007 ppb
Concentration per Run 2	1.667 ppb	91.472 %	0.692 ppb	0.054 ppb	37.078 ppb	1.644 ppb	93.644 %	-0.016 ppb	0.008 ppb
Concentration per Run 3	1.608 ppb	95.642 %	0.620 ppb	0.664 ppb	38.254 ppb	1.617 ppb	88.743 %	-0.012 ppb	-0.003 ppb
Concentration RSD	5.8 %	4.8 %	8.5 %	89.8 %	3.1 %	17.6 %	2.7 %	54.0 %	160.0 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	92.052 %	2.171 ppb	6.073 ppb	6.052 ppb	87.804 %	88.501 %	0.021 ppb	0.128 ppb	92.135 %
Concentration per Run 1	94.610 %	2.265 ppb	5.669 ppb	6.142 ppb	88.079 %	87.755 %	0.013 ppb	0.133 ppb	92.750 %
Concentration per Run 2	89.682 %	1.986 ppb	6.013 ppb	5.968 ppb	89.463 %	91.316 %	0.022 ppb	0.126 ppb	93.306 %
Concentration per Run 3	91.862 %	2.262 ppb	6.538 ppb	6.046 ppb	85.868 %	86.431 %	0.029 ppb	0.124 ppb	90.349 %
Concentration RSD	2.7 %	7.4 %	7.2 %	1.4 %	2.1 %	2.9 %	37.0 %	3.5 %	1.7 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 24 Analysis started at: 4/5/2017 9:08:44 AM Rack: 1
Analysis label: L1710261-02 MCP-6020TL-10 User name: Vial: 5

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	95.840 %	99.441 %	0.003 ppb	32,305.575 ppb	808.503 ppb	9.366 ppb	861.060 ppb	5,249.683 ppb	89.859 %
Concentration per Run 1	95.412 %	103.492 %	0.011 ppb	32,063.258 ppb	819.965 ppb	8.798 ppb	862.926 ppb	5,072.880 ppb	93.552 %
Concentration per Run 2	96.444 %	94.972 %	-0.003 ppb	33,061.343 ppb	839.018 ppb	11.505 ppb	839.910 ppb	5,337.564 ppb	88.865 %
Concentration per Run 3	95.665 %	99.860 %	0.002 ppb	31,792.124 ppb	766.525 ppb	7.794 ppb	880.343 ppb	5,338.604 ppb	87.160 %
Concentration RSD	0.6 %	4.3 %	216.9 %	2.1 %	4.6 %	20.5 %	2.4 %	2.9 %	3.7 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	93.808 %	6.796 ppb	0.063 ppb	0.049 ppb	5.663 ppb	37.074 ppb	0.072 ppb	0.236 ppb	4.825 ppb
Concentration per Run 1	94.733 %	6.793 ppb	0.061 ppb	0.051 ppb	6.756 ppb	33.688 ppb	0.077 ppb	0.412 ppb	5.382 ppb
Concentration per Run 2	94.419 %	7.271 ppb	0.063 ppb	0.057 ppb	5.718 ppb	31.276 ppb	0.058 ppb	0.030 ppb	4.783 ppb
Concentration per Run 3	92.271 %	6.324 ppb	0.064 ppb	0.039 ppb	4.514 ppb	46.257 ppb	0.080 ppb	0.267 ppb	4.309 ppb
Concentration RSD	1.4 %	7.0 %	2.7 %	18.8 %	19.8 %	21.7 %	16.9 %	81.5 %	11.2 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	4.208 ppb	92.540 %	0.526 ppb	0.518 ppb	38.490 ppb	0.591 ppb	90.939 %	-0.018 ppb	0.004 ppb
Concentration per Run 1	4.107 ppb	91.421 %	0.649 ppb	1.169 ppb	38.437 ppb	0.513 ppb	90.281 %	-0.016 ppb	0.008 ppb
Concentration per Run 2	4.356 ppb	93.709 %	0.504 ppb	0.386 ppb	39.378 ppb	0.656 ppb	89.223 %	-0.020 ppb	-0.003 ppb
Concentration per Run 3	4.160 ppb	92.489 %	0.424 ppb	-0.003 ppb	37.655 ppb	0.603 ppb	93.314 %	-0.016 ppb	0.008 ppb
Concentration RSD	3.1 %	1.2 %	21.7 %	115.4 %	2.2 %	12.3 %	2.3 %	12.8 %	157.5 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	89.546 %	0.905 ppb	2.438 ppb	5.615 ppb	87.669 %	87.966 %	0.007 ppb	0.094 ppb	89.250 %
Concentration per Run 1	92.137 %	0.890 ppb	2.124 ppb	5.629 ppb	87.418 %	88.684 %	0.007 ppb	0.090 ppb	89.966 %
Concentration per Run 2	88.650 %	0.926 ppb	2.607 ppb	5.530 ppb	89.345 %	86.742 %	0.008 ppb	0.095 ppb	88.007 %
Concentration per Run 3	87.849 %	0.899 ppb	2.583 ppb	5.685 ppb	86.244 %	88.471 %	0.006 ppb	0.097 ppb	89.775 %
Concentration RSD	2.5 %	2.0 %	11.2 %	1.4 %	1.8 %	1.2 %	16.4 %	4.1 %	1.2 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 25 Analysis started at: 4/5/2017 9:12:06 AM Rack: 1
 Analysis label: L1710261-03 MCP-6020TL-10 User name: Vial: 6

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	93.346 %	96.881 %	0.012 ppb	33,163.333 ppb	860.107 ppb	10.912 ppb	942.097 ppb	5,144.878 ppb	91.563 %
Concentration per Run 1	94.632 %	89.246 %	0.007 ppb	34,671.677 ppb	928.657 ppb	11.447 ppb	948.308 ppb	5,262.646 ppb	91.506 %
Concentration per Run 2	92.848 %	92.598 %	0.021 ppb	33,778.019 ppb	838.578 ppb	10.626 ppb	985.298 ppb	5,194.346 ppb	90.654 %
Concentration per Run 3	92.557 %	108.799 %	0.007 ppb	31,040.305 ppb	813.086 ppb	10.663 ppb	892.685 ppb	4,977.642 ppb	92.529 %
Concentration RSD	1.2 %	10.8 %	73.4 %	5.7 %	7.1 %	4.2 %	4.9 %	2.9 %	1.0 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	90.612 %	8.191 ppb	0.083 ppb	0.257 ppb	6.395 ppb	37.417 ppb	0.050 ppb	0.418 ppb	6.323 ppb
Concentration per Run 1	92.105 %	9.150 ppb	0.123 ppb	0.282 ppb	5.786 ppb	30.595 ppb	0.117 ppb	0.333 ppb	5.992 ppb
Concentration per Run 2	87.817 %	7.005 ppb	0.125 ppb	0.269 ppb	5.880 ppb	47.470 ppb	0.017 ppb	0.503 ppb	6.417 ppb
Concentration per Run 3	91.913 %	8.418 ppb	0.000 ppb	0.221 ppb	7.520 ppb	34.187 ppb	0.016 ppb	0.418 ppb	6.560 ppb
Concentration RSD	2.7 %	13.3 %	86.6 %	12.6 %	15.2 %	23.8 %	115.9 %	20.4 %	4.7 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	3.505 ppb	91.149 %	0.370 ppb	0.770 ppb	40.774 ppb	0.361 ppb	89.476 %	-0.019 ppb	0.001 ppb
Concentration per Run 1	3.365 ppb	94.371 %	0.500 ppb	1.137 ppb	39.475 ppb	0.364 ppb	91.380 %	-0.020 ppb	-0.003 ppb
Concentration per Run 2	3.582 ppb	89.183 %	0.307 ppb	0.387 ppb	42.381 ppb	0.376 ppb	89.286 %	-0.020 ppb	-0.003 ppb
Concentration per Run 3	3.567 ppb	89.895 %	0.304 ppb	0.784 ppb	40.468 ppb	0.344 ppb	87.762 %	-0.016 ppb	0.008 ppb
Concentration RSD	3.5 %	3.1 %	30.3 %	48.8 %	3.6 %	4.5 %	2.0 %	13.4 %	1,175.0 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	88.709 %	0.474 ppb	1.330 ppb	5.625 ppb	87.652 %	85.635 %	0.003 ppb	0.082 ppb	91.297 %
Concentration per Run 1	90.292 %	0.586 ppb	1.289 ppb	6.292 ppb	90.612 %	85.113 %	0.001 ppb	0.081 ppb	92.624 %
Concentration per Run 2	91.051 %	0.509 ppb	1.333 ppb	5.079 ppb	84.967 %	84.520 %	-0.001 ppb	0.073 ppb	92.329 %
Concentration per Run 3	84.783 %	0.328 ppb	1.369 ppb	5.503 ppb	87.375 %	87.273 %	0.008 ppb	0.090 ppb	88.937 %
Concentration RSD	3.9 %	27.9 %	3.0 %	10.9 %	3.2 %	1.7 %	170.6 %	10.4 %	2.2 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 26 Analysis started at: 4/5/2017 9:15:27 AM Rack: 1
 Analysis label: L1710261-04 MCP-6020TL-10 User name: Vial: 7

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	93.640 %	97.393 %	0.013 ppb	32,682.063 ppb	824.369 ppb	8.693 ppb	968.472 ppb	5,229.153 ppb	89.972 %
Concentration per Run 1	94.308 %	95.391 %	0.007 ppb	33,745.955 ppb	832.127 ppb	6.549 ppb	965.910 ppb	5,594.568 ppb	89.205 %
Concentration per Run 2	94.341 %	99.022 %	0.007 ppb	32,588.435 ppb	804.169 ppb	11.594 ppb	977.985 ppb	5,249.343 ppb	90.228 %
Concentration per Run 3	92.270 %	97.765 %	0.026 ppb	31,711.799 ppb	836.812 ppb	7.936 ppb	961.521 ppb	4,843.547 ppb	90.484 %
Concentration RSD	1.3 %	1.9 %	86.6 %	3.1 %	2.1 %	30.0 %	0.9 %	7.2 %	0.8 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	90.965 %	7.388 ppb	0.083 ppb	0.069 ppb	7.156 ppb	36.620 ppb	0.043 ppb	0.183 ppb	4.388 ppb
Concentration per Run 1	92.683 %	6.725 ppb	0.126 ppb	0.079 ppb	7.696 ppb	31.368 ppb	0.037 ppb	0.186 ppb	4.436 ppb
Concentration per Run 2	91.546 %	7.943 ppb	0.124 ppb	0.012 ppb	7.278 ppb	38.399 ppb	0.036 ppb	0.257 ppb	4.109 ppb
Concentration per Run 3	88.665 %	7.497 ppb	0.000 ppb	0.117 ppb	6.495 ppb	40.091 ppb	0.057 ppb	0.105 ppb	4.619 ppb
Concentration RSD	2.3 %	8.3 %	86.6 %	76.4 %	8.5 %	12.6 %	26.8 %	41.4 %	5.9 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	1.447 ppb	94.303 %	0.458 ppb	0.261 ppb	38.119 ppb	0.211 ppb	90.699 %	-0.018 ppb	0.000 ppb
Concentration per Run 1	1.392 ppb	92.642 %	0.510 ppb	0.054 ppb	40.279 ppb	0.190 ppb	90.931 %	-0.020 ppb	-0.003 ppb
Concentration per Run 2	1.762 ppb	95.693 %	0.492 ppb	0.185 ppb	36.968 ppb	0.320 ppb	94.011 %	-0.016 ppb	0.008 ppb
Concentration per Run 3	1.186 ppb	94.574 %	0.372 ppb	0.543 ppb	37.112 ppb	0.123 ppb	87.153 %	-0.016 ppb	-0.003 ppb
Concentration RSD	20.2 %	1.6 %	16.4 %	97.1 %	4.9 %	47.4 %	3.8 %	13.6 %	1,805.9 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	89.939 %	0.503 ppb	0.992 ppb	5.770 ppb	88.307 %	90.892 %	0.003 ppb	0.040 ppb	90.643 %
Concentration per Run 1	91.833 %	0.491 ppb	0.717 ppb	6.164 ppb	86.811 %	93.694 %	0.002 ppb	0.033 ppb	91.386 %
Concentration per Run 2	89.431 %	0.406 ppb	1.047 ppb	5.977 ppb	88.578 %	89.654 %	0.001 ppb	0.050 ppb	90.218 %
Concentration per Run 3	88.553 %	0.612 ppb	1.213 ppb	5.169 ppb	89.532 %	89.329 %	0.006 ppb	0.037 ppb	90.326 %
Concentration RSD	1.9 %	20.6 %	25.4 %	9.2 %	1.6 %	2.7 %	83.8 %	22.0 %	0.7 %

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4/6/2017 7:04:22 AM



Analysis index: 27 Analysis started at: 4/5/2017 9:18:49 AM Rack: 1
 Analysis label: L1710261-05 MCP-6020TL-10 User name: Vial: 8

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	93.158 %	96.089 %	0.007 ppb	33,355.766 ppb	844.064 ppb	9.778 ppb	948.408 ppb	5,407.305 ppb	88.041 %
Concentration per Run 1	94.279 %	92.877 %	0.002 ppb	34,324.155 ppb	910.496 ppb	11.691 ppb	894.550 ppb	5,232.089 ppb	91.165 %
Concentration per Run 2	92.211 %	96.508 %	0.002 ppb	33,472.916 ppb	820.885 ppb	8.784 ppb	1,016.798 ppb	5,776.798 ppb	84.263 %
Concentration per Run 3	92.986 %	98.883 %	0.016 ppb	32,270.227 ppb	800.811 ppb	8.858 ppb	933.876 ppb	5,213.029 ppb	88.694 %
Concentration RSD	1.1 %	3.1 %	124.9 %	3.1 %	6.9 %	17.0 %	6.6 %	5.9 %	4.0 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	90.857 %	8.005 ppb	0.065 ppb	0.305 ppb	6.561 ppb	44.745 ppb	0.017 ppb	0.533 ppb	5.383 ppb
Concentration per Run 1	90.280 %	8.117 ppb	0.000 ppb	0.397 ppb	7.261 ppb	50.870 ppb	-0.004 ppb	0.507 ppb	5.200 ppb
Concentration per Run 2	90.024 %	7.343 ppb	0.131 ppb	0.287 ppb	6.836 ppb	42.021 ppb	0.039 ppb	0.666 ppb	5.507 ppb
Concentration per Run 3	92.267 %	8.556 ppb	0.064 ppb	0.231 ppb	5.587 ppb	41.345 ppb	0.017 ppb	0.425 ppb	5.442 ppb
Concentration RSD	1.4 %	7.7 %	101.1 %	27.6 %	13.3 %	11.9 %	123.9 %	23.0 %	3.0 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	4.643 ppb	90.776 %	0.375 ppb	0.637 ppb	39.190 ppb	0.301 ppb	89.903 %	-0.020 ppb	-0.003 ppb
Concentration per Run 1	5.135 ppb	87.555 %	0.313 ppb	-0.041 ppb	40.694 ppb	0.304 ppb	89.946 %	-0.020 ppb	-0.003 ppb
Concentration per Run 2	4.114 ppb	93.913 %	0.246 ppb	1.343 ppb	37.186 ppb	0.192 ppb	89.565 %	-0.020 ppb	-0.003 ppb
Concentration per Run 3	4.681 ppb	90.861 %	0.565 ppb	0.611 ppb	39.691 ppb	0.407 ppb	90.199 %	-0.020 ppb	-0.003 ppb
Concentration RSD	11.0 %	3.5 %	44.8 %	108.6 %	4.6 %	35.8 %	0.4 %	0.2 %	

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	88.874 %	0.217 ppb	0.712 ppb	5.612 ppb	85.821 %	85.642 %	0.001 ppb	0.055 ppb	89.609 %
Concentration per Run 1	90.889 %	0.189 ppb	0.526 ppb	6.040 ppb	86.138 %	83.560 %	-0.001 ppb	0.055 ppb	90.506 %
Concentration per Run 2	87.436 %	0.239 ppb	0.723 ppb	5.464 ppb	84.016 %	84.462 %	0.000 ppb	0.055 ppb	89.251 %
Concentration per Run 3	88.298 %	0.223 ppb	0.887 ppb	5.333 ppb	87.311 %	88.902 %	0.006 ppb	0.056 ppb	89.070 %
Concentration RSD	2.0 %	11.8 %	25.4 %	6.7 %	1.9 %	3.3 %	307.9 %	0.9 %	0.9 %

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4/6/2017 7:04:22 AM



Analysis index: 28
 Analysis label: L1710261-06 MCP-6020TL-10

Analysis started at: 4/5/2017 9:22:11 AM
 User name:

Rack: 1
 Vial: 9

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	91.702 %	96.881 %	0.013 ppb	31,980.113 ppb	818.463 ppb	10.247 ppb	925.901 ppb	4,996.048 ppb	90.540 %
Concentration per Run 1	93.121 %	97.626 %	0.007 ppb	32,151.834 ppb	811.241 ppb	9.448 ppb	987.938 ppb	4,908.732 ppb	90.910 %
Concentration per Run 2	91.582 %	92.458 %	0.022 ppb	33,057.362 ppb	801.015 ppb	10.913 ppb	894.611 ppb	5,141.549 ppb	89.887 %
Concentration per Run 3	90.402 %	100.559 %	0.012 ppb	30,731.143 ppb	843.133 ppb	10.381 ppb	895.154 ppb	4,937.862 ppb	90.824 %
Concentration RSD	1.5 %	4.2 %	56.4 %	3.7 %	2.7 %	7.2 %	5.8 %	2.5 %	0.6 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	89.253 %	7.711 ppb	0.168 ppb	0.227 ppb	6.753 ppb	49.015 ppb	0.010 ppb	0.734 ppb	4.535 ppb
Concentration per Run 1	89.801 %	6.863 ppb	0.062 ppb	0.075 ppb	6.292 ppb	38.561 ppb	-0.005 ppb	0.871 ppb	3.942 ppb
Concentration per Run 2	87.019 %	8.208 ppb	0.189 ppb	0.379 ppb	6.950 ppb	47.785 ppb	-0.025 ppb	1.060 ppb	4.833 ppb
Concentration per Run 3	90.940 %	8.061 ppb	0.251 ppb	0.228 ppb	7.018 ppb	60.699 ppb	0.060 ppb	0.271 ppb	4.829 ppb
Concentration RSD	2.3 %	9.6 %	57.7 %	66.8 %	5.9 %	22.7 %	443.7 %	56.1 %	11.3 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	1.694 ppb	89.979 %	0.541 ppb	0.058 ppb	39.795 ppb	0.138 ppb	86.969 %	-0.016 ppb	0.000 ppb
Concentration per Run 1	1.660 ppb	93.862 %	0.546 ppb	0.399 ppb	39.204 ppb	0.086 ppb	88.255 %	-0.016 ppb	-0.003 ppb
Concentration per Run 2	1.278 ppb	88.928 %	0.715 ppb	-0.081 ppb	42.190 ppb	0.090 ppb	85.629 %	-0.012 ppb	-0.003 ppb
Concentration per Run 3	2.143 ppb	87.148 %	0.361 ppb	-0.144 ppb	37.991 ppb	0.238 ppb	87.024 %	-0.020 ppb	0.008 ppb
Concentration RSD	25.6 %	3.9 %	32.7 %	510.9 %	5.4 %	62.5 %	1.5 %	26.6 %	1,366.9 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	87.935 %	0.258 ppb	0.581 ppb	6.089 ppb	86.689 %	86.476 %	0.003 ppb	0.044 ppb	86.654 %
Concentration per Run 1	87.569 %	0.263 ppb	0.439 ppb	6.545 ppb	90.431 %	88.518 %	0.004 ppb	0.035 ppb	89.253 %
Concentration per Run 2	87.959 %	0.262 ppb	0.660 ppb	6.175 ppb	85.257 %	86.609 %	0.002 ppb	0.053 ppb	82.089 %
Concentration per Run 3	88.276 %	0.249 ppb	0.644 ppb	5.548 ppb	84.378 %	84.301 %	0.002 ppb	0.042 ppb	88.621 %
Concentration RSD	0.4 %	3.1 %	21.2 %	8.3 %	3.8 %	2.4 %	35.0 %	20.6 %	4.6 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 29 Analysis started at: 4/5/2017 9:25:33 AM Rack: 1
 Analysis label: L1710261-01 MCP-6020SL-10 User name: Vial: 10

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	91.104 %	95.903 %	0.002 ppb	32,061.169 ppb	848.167 ppb	6.487 ppb	954.593 ppb	5,199.139 ppb	88.325 %
Concentration per Run 1	91.677 %	95.810 %	0.002 ppb	32,511.369 ppb	860.313 ppb	5.302 ppb	991.390 ppb	5,189.428 ppb	86.393 %
Concentration per Run 2	91.053 %	95.950 %	-0.003 ppb	31,837.405 ppb	833.887 ppb	7.207 ppb	885.024 ppb	5,392.497 ppb	88.950 %
Concentration per Run 3	90.582 %	95.950 %	0.007 ppb	31,834.733 ppb	850.301 ppb	6.952 ppb	987.366 ppb	5,015.493 ppb	89.631 %
Concentration RSD	0.6 %	0.1 %	249.6 %	1.2 %	1.6 %	15.9 %	6.3 %	3.6 %	1.9 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	85.640 %	7.170 ppb	0.064 ppb	0.017 ppb	2.210 ppb	23.728 ppb	-0.018 ppb	0.165 ppb	8.364 ppb
Concentration per Run 1	87.244 %	6.696 ppb	0.066 ppb	-0.023 ppb	2.178 ppb	36.380 ppb	-0.025 ppb	0.116 ppb	8.961 ppb
Concentration per Run 2	82.621 %	7.285 ppb	0.127 ppb	0.059 ppb	2.353 ppb	25.278 ppb	-0.025 ppb	0.188 ppb	7.830 ppb
Concentration per Run 3	87.054 %	7.530 ppb	0.000 ppb	0.016 ppb	2.100 ppb	9.525 ppb	-0.004 ppb	0.192 ppb	8.302 ppb
Concentration RSD	3.1 %	6.0 %	98.9 %	238.2 %	5.9 %	56.9 %	68.1 %	25.7 %	6.8 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	0.945 ppb	88.538 %	0.461 ppb	0.406 ppb	39.836 ppb	0.184 ppb	89.416 %	-0.019 ppb	0.000 ppb
Concentration per Run 1	0.734 ppb	86.385 %	0.457 ppb	0.424 ppb	41.682 ppb	0.235 ppb	88.642 %	-0.020 ppb	-0.003 ppb
Concentration per Run 2	0.733 ppb	91.319 %	0.430 ppb	0.557 ppb	38.398 ppb	0.194 ppb	89.439 %	-0.020 ppb	0.008 ppb
Concentration per Run 3	1.366 ppb	87.911 %	0.494 ppb	0.236 ppb	39.428 ppb	0.123 ppb	90.166 %	-0.016 ppb	-0.003 ppb
Concentration RSD	38.6 %	2.9 %	6.9 %	39.7 %	4.2 %	30.9 %	0.9 %	12.8 %	1,611.0 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	88.147 %	0.125 ppb	0.875 ppb	5.184 ppb	86.323 %	85.291 %	0.000 ppb	0.048 ppb	88.886 %
Concentration per Run 1	89.439 %	0.156 ppb	0.809 ppb	5.442 ppb	84.639 %	81.623 %	-0.005 ppb	0.049 ppb	90.362 %
Concentration per Run 2	89.966 %	0.154 ppb	0.944 ppb	5.259 ppb	87.085 %	89.068 %	0.003 ppb	0.038 ppb	87.907 %
Concentration per Run 3	85.035 %	0.064 ppb	0.872 ppb	4.851 ppb	87.246 %	85.182 %	0.001 ppb	0.058 ppb	88.390 %
Concentration RSD	3.1 %	42.1 %	7.7 %	5.8 %	1.7 %	4.4 %	990.1 %	20.5 %	1.5 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 30 Analysis started at: 4/5/2017 9:28:56 AM Rack: 0
 Analysis label: CCV User name: Vial: 9

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	92.860 %	98.790 %	98.798 ppb	9,771.459 ppb	10,250.880 ppb	96.747 ppb	10,124.049 ppb	10,015.663 ppb	92.529 %
Concentration per Run 1	93.374 %	98.184 %	98.569 ppb	9,675.875 ppb	10,341.632 ppb	95.439 ppb	10,427.459 ppb	10,270.698 ppb	92.870 %
Concentration per Run 2	92.480 %	93.994 %	99.027 ppb	10,087.934 ppb	10,664.352 ppb	99.789 ppb	9,682.858 ppb	10,211.138 ppb	91.847 %
Concentration per Run 3	92.725 %	104.190 %	98.799 ppb	9,550.567 ppb	9,746.656 ppb	95.014 ppb	10,261.829 ppb	9,565.154 ppb	92.870 %
Recovery Percentage 1			98.798 %	97.715 %	102.509 %	96.747 %	101.240 %	100.157 %	
Concentration RSD	0.5 %	5.2 %	0.2 %	2.9 %	4.5 %	2.7 %	3.9 %	3.9 %	0.6 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	90.651 %	97.325 ppb	100.992 ppb	99.691 ppb	102.579 ppb	10,120.153 ppb	102.782 ppb	102.795 ppb	101.465 ppb
Concentration per Run 1	89.055 %	96.850 ppb	102.638 ppb	98.835 ppb	101.495 ppb	10,249.689 ppb	103.735 ppb	102.597 ppb	97.496 ppb
Concentration per Run 2	93.440 %	95.030 ppb	103.502 ppb	99.766 ppb	101.301 ppb	9,790.662 ppb	97.531 ppb	100.934 ppb	103.046 ppb
Concentration per Run 3	89.458 %	100.094 ppb	96.836 ppb	100.471 ppb	104.941 ppb	10,320.106 ppb	107.078 ppb	104.856 ppb	103.853 ppb
Recovery Percentage 1		97.325 %	100.992 %	99.691 %	102.579 %	101.202 %	102.782 %	102.795 %	101.465 %
Concentration RSD	2.7 %	2.6 %	3.6 %	0.8 %	2.0 %	2.8 %	4.7 %	1.9 %	3.4 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	100.858 ppb	90.503 %	100.697 ppb	102.459 ppb	104.140 ppb	98.791 ppb	89.282 %	98.740 ppb	100.189 ppb
Concentration per Run 1	97.387 ppb	91.465 %	100.812 ppb	100.596 ppb	104.086 ppb	96.830 ppb	90.894 %	95.340 ppb	99.630 ppb
Concentration per Run 2	100.429 ppb	90.068 %	102.194 ppb	102.669 ppb	104.296 ppb	98.215 ppb	88.470 %	100.644 ppb	101.034 ppb
Concentration per Run 3	104.758 ppb	89.975 %	99.084 ppb	104.111 ppb	104.039 ppb	101.328 ppb	88.482 %	100.236 ppb	99.902 ppb
Recovery Percentage 1	100.858 %		100.697 %	102.459 %	104.140 %	98.791 %		98.740 %	100.189 %
Concentration RSD	3.7 %	0.9 %	1.5 %	1.7 %	0.1 %	2.3 %	1.6 %	3.0 %	0.7 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	89.211 %	98.087 ppb	100.470 ppb	102.506 ppb	86.138 %	88.723 %	101.843 ppb	99.394 ppb	85.977 %
Concentration per Run 1	90.105 %	96.612 ppb	99.979 ppb	102.471 ppb	86.737 %	90.428 %	100.497 ppb	99.168 ppb	85.750 %
Concentration per Run 2	90.826 %	96.416 ppb	99.169 ppb	104.966 ppb	86.880 %	88.350 %	101.847 ppb	99.812 ppb	87.472 %
Concentration per Run 3	86.703 %	101.234 ppb	102.263 ppb	100.081 ppb	84.796 %	87.389 %	103.184 ppb	99.203 ppb	84.708 %
Recovery Percentage 1		98.087 %	100.470 %	102.506 %			101.843 %	99.394 %	
Concentration RSD	2.5 %	2.8 %	1.6 %	2.4 %	1.4 %	1.8 %	1.3 %	0.4 %	1.6 %

Alpha ICPMSQ Full

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Analysis index: 31 Analysis started at: 4/5/2017 9:32:21 AM Rack: 0
Analysis label: CCB User name: Vial: 10

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	93.183 %	96.462 %	0.026 ppb	10.355 ppb	0.845 ppb	0.359 ppb	35.004 ppb	-3.174 ppb	91.393 %
Concentration per Run 1	92.569 %	92.039 %	0.021 ppb	13.643 ppb	0.885 ppb	0.753 ppb	52.084 ppb	-6.965 ppb	91.932 %
Concentration per Run 2	93.036 %	102.095 %	0.031 ppb	8.376 ppb	-0.313 ppb	0.041 ppb	19.785 ppb	-1.129 ppb	90.143 %
Concentration per Run 3	93.945 %	95.251 %	0.026 ppb	9.047 ppb	1.963 ppb	0.284 ppb	33.144 ppb	-1.427 ppb	92.103 %
Recovery Percentage 1			5.223 %	10.355 %	1.207 %	3.594 %	35.004 %	-3.174 %	
Concentration RSD	0.8 %	5.3 %	18.4 %	27.7 %	134.7 %	100.8 %	46.4 %	103.6 %	1.2 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	89.129 %	0.116 ppb	0.041 ppb	-0.058 ppb	-0.052 ppb	1.300 ppb	-0.018 ppb	0.210 ppb	0.043 ppb
Concentration per Run 1	89.877 %	0.173 ppb	0.000 ppb	-0.030 ppb	-0.115 ppb	1.344 ppb	-0.004 ppb	0.262 ppb	0.043 ppb
Concentration per Run 2	89.335 %	0.176 ppb	0.063 ppb	-0.092 ppb	-0.313 ppb	-1.741 ppb	-0.025 ppb	0.190 ppb	0.046 ppb
Concentration per Run 3	88.175 %	0.000 ppb	0.061 ppb	-0.052 ppb	0.273 ppb	4.297 ppb	-0.025 ppb	0.178 ppb	0.040 ppb
Recovery Percentage 1		23.244 %	0.827 %	-5.767 %	-5.180 %	2.600 %	-3.645 %	10.504 %	4.301 %
Concentration RSD	1.0 %	86.6 %	86.6 %	54.3 %	575.4 %	232.3 %	65.3 %	21.5 %	7.6 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	-0.554 ppb	91.878 %	0.137 ppb	0.512 ppb	0.021 ppb	0.508 ppb	91.079 %	0.055 ppb	0.008 ppb
Concentration per Run 1	-0.531 ppb	91.166 %	0.123 ppb	0.595 ppb	0.017 ppb	0.508 ppb	91.613 %	0.028 ppb	-0.003 ppb
Concentration per Run 2	-0.595 ppb	88.674 %	0.173 ppb	0.060 ppb	-0.024 ppb	0.443 ppb	91.062 %	0.054 ppb	-0.003 ppb
Concentration per Run 3	-0.538 ppb	95.795 %	0.115 ppb	0.880 ppb	0.069 ppb	0.575 ppb	90.562 %	0.083 ppb	0.029 ppb
Recovery Percentage 1	-5.544 %	91.878 %	27.382 %	10.237 %	4.154 %	25.420 %		13.752 %	3.767 %
Concentration RSD	6.3 %	3.9 %	23.0 %	81.4 %	224.2 %	13.0 %	0.6 %	50.5 %	249.9 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	89.440 %	0.756 ppb	3.381 ppb	-0.023 ppb	87.505 %	89.156 %	0.030 ppb	0.048 ppb	85.848 %
Concentration per Run 1	89.539 %	0.806 ppb	3.301 ppb	-0.053 ppb	85.917 %	87.088 %	0.036 ppb	0.052 ppb	82.835 %
Concentration per Run 2	85.090 %	0.733 ppb	3.718 ppb	-0.022 ppb	86.365 %	87.080 %	0.030 ppb	0.041 ppb	87.140 %
Concentration per Run 3	93.692 %	0.729 ppb	3.125 ppb	0.005 ppb	90.234 %	93.299 %	0.023 ppb	0.051 ppb	87.568 %
Recovery Percentage 1		25.204 %	84.533 %	-4.591 %			5.921 %	9.577 %	85.848 %
Concentration RSD	4.8 %	5.7 %	9.0 %	125.9 %	2.7 %	4.0 %	21.2 %	12.2 %	3.0 %

Alpha ICPMSQ Full

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Analysis index: 32 Analysis started at: 4/5/2017 9:35:46 AM Rack: 1
 Analysis label: WG991016-1 MCP-6020SL-10 User name: Vial: 11

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	92.533 %	91.527 %	0.007 ppb	14.840 ppb	-1.002 ppb	0.243 ppb	10.694 ppb	2.573 ppb	90.228 %
Concentration per Run 1	93.522 %	94.553 %	0.007 ppb	9.871 ppb	-1.402 ppb	0.710 ppb	3.755 ppb	4.192 ppb	93.978 %
Concentration per Run 2	93.433 %	87.849 %	0.002 ppb	16.435 ppb	-0.203 ppb	0.371 ppb	9.909 ppb	-7.027 ppb	87.671 %
Concentration per Run 3	90.645 %	92.179 %	0.012 ppb	18.214 ppb	-1.402 ppb	-0.352 ppb	18.416 ppb	10.553 ppb	89.035 %
Concentration RSD	1.8 %	3.7 %	73.8 %	29.6 %	69.0 %	222.9 %	68.8 %	346.0 %	3.7 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	88.423 %	0.117 ppb	0.042 ppb	0.020 ppb	-0.112 ppb	-0.728 ppb	-0.011 ppb	0.030 ppb	0.007 ppb
Concentration per Run 1	88.358 %	0.084 ppb	0.000 ppb	0.091 ppb	-0.056 ppb	-0.273 ppb	-0.005 ppb	0.105 ppb	-0.012 ppb
Concentration per Run 2	89.236 %	0.090 ppb	0.000 ppb	0.039 ppb	-0.035 ppb	-1.731 ppb	-0.025 ppb	0.032 ppb	-0.010 ppb
Concentration per Run 3	87.674 %	0.177 ppb	0.126 ppb	-0.070 ppb	-0.246 ppb	-0.178 ppb	-0.004 ppb	-0.047 ppb	0.043 ppb
Concentration RSD	0.9 %	44.4 %	173.2 %	410.9 %	103.4 %	119.6 %	103.8 %	255.0 %	441.2 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	-0.248 ppb	91.929 %	0.064 ppb	0.103 ppb	0.013 ppb	0.277 ppb	88.784 %	0.006 ppb	0.004 ppb
Concentration per Run 1	-0.400 ppb	92.336 %	0.077 ppb	0.286 ppb	-0.024 ppb	0.365 ppb	91.811 %	0.000 ppb	-0.003 ppb
Concentration per Run 2	-0.184 ppb	90.861 %	0.080 ppb	-0.309 ppb	0.046 ppb	0.271 ppb	87.347 %	0.001 ppb	-0.003 ppb
Concentration per Run 3	-0.160 ppb	92.591 %	0.034 ppb	0.333 ppb	0.018 ppb	0.197 ppb	87.192 %	0.017 ppb	0.019 ppb
Concentration RSD	53.5 %	1.0 %	40.6 %	345.8 %	266.3 %	30.3 %	3.0 %	163.6 %	309.8 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	88.036 %	0.507 ppb	1.269 ppb	-0.002 ppb	86.453 %	86.136 %	0.008 ppb	0.024 ppb	89.451 %
Concentration per Run 1	88.332 %	0.412 ppb	1.380 ppb	0.039 ppb	86.654 %	88.039 %	0.006 ppb	0.025 ppb	90.581 %
Concentration per Run 2	86.273 %	0.502 ppb	1.262 ppb	0.009 ppb	86.249 %	86.316 %	0.008 ppb	0.020 ppb	88.806 %
Concentration per Run 3	89.502 %	0.606 ppb	1.164 ppb	-0.053 ppb	86.456 %	84.052 %	0.010 ppb	0.026 ppb	88.965 %
Concentration RSD	1.9 %	19.1 %	8.5 %	2,818.2 %	0.2 %	2.3 %	26.1 %	14.4 %	1.1 %

Alpha ICPMSQ Full

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Analysis index: 33 Analysis started at: 4/5/2017 9:39:09 AM Rack: 1
Analysis label: WG991016-2D5 MCP-6020SL-10 User name: Vial: 12

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	93.622 %	95.903 %	9.933 ppb	2,140.973 ppb	2,199.051 ppb	422.555 ppb	2,125.114 ppb	2,118.029 ppb	91.734 %
Concentration per Run 1	93.562 %	95.112 %	9.992 ppb	2,198.155 ppb	2,266.687 ppb	434.115 ppb	2,165.695 ppb	2,146.776 ppb	91.592 %
Concentration per Run 2	93.555 %	92.039 %	9.867 ppb	2,070.952 ppb	2,138.101 ppb	413.032 ppb	1,942.915 ppb	1,981.440 ppb	98.068 %
Concentration per Run 3	93.750 %	100.559 %	9.939 ppb	2,153.811 ppb	2,192.364 ppb	420.519 ppb	2,266.733 ppb	2,225.871 ppb	85.541 %
Concentration RSD	0.1 %	4.5 %	0.6 %	3.0 %	2.9 %	2.5 %	7.8 %	5.9 %	6.8 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	90.716 %	172.174 ppb	104.380 ppb	41.563 ppb	103.130 ppb	219.093 ppb	99.903 ppb	103.728 ppb	52.381 ppb
Concentration per Run 1	90.237 %	171.509 ppb	107.838 ppb	42.152 ppb	102.522 ppb	214.601 ppb	102.739 ppb	100.450 ppb	50.778 ppb
Concentration per Run 2	89.723 %	160.594 ppb	93.951 ppb	40.160 ppb	96.848 ppb	216.650 ppb	97.561 ppb	101.163 ppb	54.061 ppb
Concentration per Run 3	92.186 %	184.420 ppb	111.351 ppb	42.378 ppb	110.020 ppb	226.029 ppb	99.408 ppb	109.572 ppb	52.303 ppb
Concentration RSD	1.4 %	6.9 %	8.8 %	2.9 %	6.4 %	2.8 %	2.6 %	4.9 %	3.1 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	104.418 ppb	90.777 %	26.373 ppb	25.813 ppb	215.715 ppb	195.963 ppb	86.581 %	10.196 ppb	10.787 ppb
Concentration per Run 1	106.554 ppb	95.376 %	24.917 ppb	24.910 ppb	217.680 ppb	195.050 ppb	86.523 %	10.278 ppb	10.864 ppb
Concentration per Run 2	101.967 ppb	87.238 %	26.151 ppb	25.661 ppb	213.880 ppb	197.256 ppb	86.867 %	10.011 ppb	10.766 ppb
Concentration per Run 3	104.733 ppb	89.718 %	28.052 ppb	26.868 ppb	215.585 ppb	195.584 ppb	86.353 %	10.297 ppb	10.730 ppb
Concentration RSD	2.2 %	4.6 %	6.0 %	3.8 %	0.9 %	0.6 %	0.3 %	1.6 %	0.6 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	90.365 %	192.644 ppb	98.549 ppb	401.220 ppb	87.411 %	86.499 %	24.743 ppb	104.727 ppb	88.073 %
Concentration per Run 1	93.531 %	185.356 ppb	93.934 ppb	395.162 ppb	89.251 %	86.950 %	25.607 ppb	109.565 ppb	85.960 %
Concentration per Run 2	88.436 %	193.571 ppb	99.668 ppb	402.978 ppb	86.932 %	88.297 %	24.578 ppb	103.490 ppb	88.851 %
Concentration per Run 3	89.128 %	199.007 ppb	102.047 ppb	405.520 ppb	86.049 %	84.249 %	24.045 ppb	101.126 ppb	89.408 %
Concentration RSD	3.1 %	3.6 %	4.2 %	1.3 %	1.9 %	2.4 %	3.2 %	4.2 %	2.1 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 34 Analysis started at: 4/5/2017 9:42:32 AM Rack: 1
Analysis label: WG991016-3D5 MCP-6020SL-10 User name: Vial: 13

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	93.180 %	98.371 %	10.024 ppb	2,055.052 ppb	2,114.607 ppb	413.259 ppb	2,121.880 ppb	2,288.442 ppb	91.592 %
Concentration per Run 1	94.660 %	102.654 %	9.945 ppb	1,923.951 ppb	1,938.937 ppb	385.846 ppb	2,030.795 ppb	1,953.051 ppb	93.126 %
Concentration per Run 2	92.390 %	94.693 %	10.006 ppb	2,145.942 ppb	2,234.530 ppb	436.555 ppb	2,116.304 ppb	2,529.250 ppb	91.421 %
Concentration per Run 3	92.491 %	97.765 %	10.122 ppb	2,095.262 ppb	2,170.354 ppb	417.377 ppb	2,218.541 ppb	2,383.026 ppb	90.228 %
Concentration RSD	1.4 %	4.1 %	0.9 %	5.7 %	7.4 %	6.2 %	4.4 %	13.1 %	1.6 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	91.806 %	173.920 ppb	103.314 ppb	40.276 ppb	102.873 ppb	217.692 ppb	99.693 ppb	98.621 ppb	52.112 ppb
Concentration per Run 1	92.271 %	163.516 ppb	100.013 ppb	38.030 ppb	99.144 ppb	229.962 ppb	92.111 ppb	95.856 ppb	47.500 ppb
Concentration per Run 2	90.338 %	178.696 ppb	107.176 ppb	40.964 ppb	102.218 ppb	217.479 ppb	106.835 ppb	96.684 ppb	53.590 ppb
Concentration per Run 3	92.809 %	179.548 ppb	102.752 ppb	41.834 ppb	107.255 ppb	205.634 ppb	100.134 ppb	103.322 ppb	55.245 ppb
Concentration RSD	1.4 %	5.2 %	3.5 %	4.9 %	4.0 %	5.6 %	7.4 %	4.1 %	7.8 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	100.427 ppb	91.578 %	25.565 ppb	26.993 ppb	204.895 ppb	190.919 ppb	88.980 %	9.842 ppb	10.526 ppb
Concentration per Run 1	98.888 ppb	93.189 %	23.447 ppb	26.248 ppb	190.606 ppb	182.126 ppb	92.514 %	9.270 ppb	9.877 ppb
Concentration per Run 2	101.415 ppb	91.116 %	25.913 ppb	27.040 ppb	215.672 ppb	197.588 ppb	86.615 %	10.143 ppb	11.143 ppb
Concentration per Run 3	100.978 ppb	90.430 %	27.334 ppb	27.689 ppb	208.406 ppb	193.042 ppb	87.809 %	10.112 ppb	10.560 ppb
Concentration RSD	1.3 %	1.6 %	7.7 %	2.7 %	6.3 %	4.2 %	3.5 %	5.0 %	6.0 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	88.027 %	197.930 ppb	107.546 ppb	401.659 ppb	86.361 %	86.738 %	24.470 ppb	104.298 ppb	88.386 %
Concentration per Run 1	89.064 %	178.850 ppb	98.301 ppb	380.801 ppb	88.990 %	92.413 %	23.395 ppb	101.089 ppb	88.634 %
Concentration per Run 2	87.489 %	211.760 ppb	113.910 ppb	411.864 ppb	84.331 %	81.804 %	25.471 ppb	107.354 ppb	86.334 %
Concentration per Run 3	87.528 %	203.180 ppb	110.427 ppb	412.311 ppb	85.762 %	85.999 %	24.544 ppb	104.450 ppb	90.192 %
Concentration RSD	1.0 %	8.6 %	7.6 %	4.5 %	2.8 %	6.2 %	4.3 %	3.0 %	2.2 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 35 Analysis started at: 4/5/2017 9:45:52 AM Rack: 1
 Analysis label: WG991146-4 2008TL User name: Vial: 19

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	89.120 %	92.085 %	0.009 ppb	60,343.934 ppb	3,836.220 ppb	10.080 ppb	4,366.887 ppb	18,551.003 ppb	86.876 %
Concentration per Run 1	89.798 %	91.899 %	0.002 ppb	59,336.395 ppb	3,833.343 ppb	8.651 ppb	4,427.023 ppb	18,960.330 ppb	86.564 %
Concentration per Run 2	89.159 %	91.201 %	0.012 ppb	63,221.684 ppb	3,837.168 ppb	11.642 ppb	4,280.345 ppb	18,601.032 ppb	87.246 %
Concentration per Run 3	88.403 %	93.156 %	0.012 ppb	58,473.723 ppb	3,838.148 ppb	9.946 ppb	4,393.295 ppb	18,091.647 ppb	86.819 %
Concentration RSD	0.8 %	1.1 %	66.6 %	4.2 %	0.1 %	14.9 %	1.8 %	2.4 %	0.4 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	87.179 %	25.439 ppb	0.129 ppb	0.546 ppb	1.508 ppb	35.759 ppb	1.319 ppb	0.647 ppb	8.694 ppb
Concentration per Run 1	87.987 %	25.872 ppb	0.259 ppb	0.545 ppb	2.060 ppb	45.248 ppb	1.232 ppb	0.670 ppb	9.322 ppb
Concentration per Run 2	86.865 %	24.094 ppb	0.000 ppb	0.527 ppb	1.243 ppb	42.722 ppb	1.409 ppb	0.523 ppb	9.216 ppb
Concentration per Run 3	86.686 %	26.352 ppb	0.129 ppb	0.565 ppb	1.221 ppb	19.308 ppb	1.316 ppb	0.749 ppb	7.543 ppb
Concentration RSD	0.8 %	4.7 %	100.1 %	3.5 %	31.7 %	40.0 %	6.7 %	17.7 %	11.5 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	5.759 ppb	89.250 %	0.337 ppb	1.049 ppb	133.409 ppb	1.558 ppb	84.095 %	0.007 ppb	0.025 ppb
Concentration per Run 1	6.381 ppb	90.709 %	0.390 ppb	0.437 ppb	131.687 ppb	1.044 ppb	86.738 %	0.014 ppb	0.008 ppb
Concentration per Run 2	5.656 ppb	86.436 %	0.319 ppb	1.313 ppb	139.949 ppb	1.590 ppb	83.229 %	0.002 ppb	0.009 ppb
Concentration per Run 3	5.241 ppb	90.607 %	0.302 ppb	1.398 ppb	128.590 ppb	2.039 ppb	82.319 %	0.006 ppb	0.057 ppb
Concentration RSD	10.0 %	2.7 %	13.8 %	50.7 %	4.4 %	32.0 %	2.8 %	77.9 %	112.5 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	84.393 %	2.435 ppb	8.947 ppb	5.084 ppb	86.048 %	84.060 %	0.020 ppb	0.228 ppb	86.963 %
Concentration per Run 1	86.819 %	2.195 ppb	8.353 ppb	4.497 ppb	87.189 %	85.611 %	0.018 ppb	0.222 ppb	91.195 %
Concentration per Run 2	81.320 %	2.595 ppb	9.661 ppb	5.851 ppb	83.376 %	84.610 %	0.019 ppb	0.226 ppb	84.896 %
Concentration per Run 3	85.041 %	2.515 ppb	8.827 ppb	4.903 ppb	87.578 %	81.960 %	0.024 ppb	0.235 ppb	84.799 %
Concentration RSD	3.3 %	8.7 %	7.4 %	13.7 %	2.7 %	2.2 %	15.5 %	3.0 %	4.2 %

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4/6/2017 7:04:22 AM



Analysis index: 36 Analysis started at: 4/5/2017 9:49:14 AM Rack: 1
 Analysis label: L1710365-01 2008TL User name: Vial: 20

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	87.952 %	94.553 %	0.021 ppb	58,056.080 ppb	3,734.366 ppb	7.444 ppb	4,034.580 ppb	17,977.367 ppb	86.677 %
Concentration per Run 1	89.341 %	102.095 %	0.007 ppb	55,143.966 ppb	3,554.643 ppb	7.213 ppb	3,811.607 ppb	17,963.312 ppb	88.183 %
Concentration per Run 2	88.361 %	93.436 %	0.028 ppb	58,651.409 ppb	3,765.337 ppb	8.181 ppb	4,035.610 ppb	17,456.287 ppb	89.546 %
Concentration per Run 3	86.154 %	88.128 %	0.028 ppb	60,372.865 ppb	3,883.120 ppb	6.938 ppb	4,256.524 ppb	18,512.503 ppb	82.303 %
Concentration RSD	1.9 %	7.5 %	57.4 %	4.6 %	4.5 %	8.8 %	5.5 %	2.9 %	4.4 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	85.210 %	27.426 ppb	0.280 ppb	0.480 ppb	1.091 ppb	42.789 ppb	1.388 ppb	0.324 ppb	9.075 ppb
Concentration per Run 1	87.441 %	26.078 ppb	0.450 ppb	0.672 ppb	1.223 ppb	45.421 ppb	1.455 ppb	0.355 ppb	8.135 ppb
Concentration per Run 2	85.423 %	25.842 ppb	0.190 ppb	0.358 ppb	0.921 ppb	38.175 ppb	1.408 ppb	0.584 ppb	9.586 ppb
Concentration per Run 3	82.766 %	30.359 ppb	0.202 ppb	0.410 ppb	1.128 ppb	44.772 ppb	1.300 ppb	0.034 ppb	9.503 ppb
Concentration RSD	2.8 %	9.3 %	52.4 %	35.0 %	14.2 %	9.4 %	5.7 %	85.2 %	9.0 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	5.290 ppb	89.624 %	0.245 ppb	0.660 ppb	131.705 ppb	0.547 ppb	83.626 %	0.002 ppb	0.017 ppb
Concentration per Run 1	4.833 ppb	87.657 %	0.130 ppb	0.607 ppb	135.197 ppb	0.589 ppb	83.383 %	0.015 ppb	0.020 ppb
Concentration per Run 2	5.346 ppb	89.539 %	0.351 ppb	0.820 ppb	131.811 ppb	0.553 ppb	82.294 %	-0.011 ppb	0.021 ppb
Concentration per Run 3	5.690 ppb	91.675 %	0.254 ppb	0.553 ppb	128.105 ppb	0.498 ppb	85.200 %	0.002 ppb	0.009 ppb
Concentration RSD	8.2 %	2.2 %	45.2 %	21.4 %	2.7 %	8.4 %	1.8 %	682.0 %	40.2 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	82.386 %	1.075 ppb	3.763 ppb	4.964 ppb	85.238 %	84.647 %	0.003 ppb	0.165 ppb	85.276 %
Concentration per Run 1	86.008 %	1.138 ppb	3.419 ppb	4.541 ppb	88.659 %	85.802 %	0.001 ppb	0.162 ppb	87.961 %
Concentration per Run 2	81.905 %	0.972 ppb	3.688 ppb	4.961 ppb	81.308 %	82.849 %	0.006 ppb	0.180 ppb	82.941 %
Concentration per Run 3	79.245 %	1.114 ppb	4.181 ppb	5.390 ppb	85.745 %	85.289 %	0.003 ppb	0.154 ppb	84.926 %
Concentration RSD	4.1 %	8.3 %	10.3 %	8.6 %	4.3 %	1.9 %	88.1 %	8.1 %	3.0 %

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4/6/2017 7:04:22 AM



Analysis index: 37 Analysis started at: 4/5/2017 9:52:36 AM Rack: 1
 Analysis label: L1710261-02 MCP-6020SL-10 User name: Vial: 14

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	88.933 %	94.832 %	0.016 ppb	31,862.079 ppb	813.591 ppb	33.259 ppb	934.846 ppb	4,964.311 ppb	87.728 %
Concentration per Run 1	89.347 %	90.782 %	0.012 ppb	32,382.274 ppb	858.019 ppb	33.680 ppb	954.800 ppb	4,767.481 ppb	88.012 %
Concentration per Run 2	88.625 %	97.905 %	0.022 ppb	32,103.654 ppb	844.128 ppb	36.347 ppb	890.699 ppb	5,173.287 ppb	86.393 %
Concentration per Run 3	88.827 %	95.810 %	0.012 ppb	31,100.311 ppb	738.625 ppb	29.749 ppb	959.040 ppb	4,952.164 ppb	88.779 %
Concentration RSD	0.4 %	3.9 %	37.7 %	2.1 %	8.0 %	10.0 %	4.1 %	4.1 %	1.4 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	86.103 %	7.761 ppb	0.150 ppb	0.193 ppb	1.804 ppb	32.896 ppb	0.018 ppb	0.515 ppb	5.088 ppb
Concentration per Run 1	87.240 %	7.126 ppb	0.065 ppb	0.281 ppb	1.724 ppb	31.021 ppb	0.018 ppb	0.682 ppb	5.075 ppb
Concentration per Run 2	87.026 %	8.208 ppb	0.130 ppb	0.063 ppb	2.337 ppb	30.630 ppb	0.017 ppb	0.350 ppb	5.083 ppb
Concentration per Run 3	84.042 %	7.950 ppb	0.255 ppb	0.234 ppb	1.351 ppb	37.037 ppb	0.018 ppb	0.512 ppb	5.106 ppb
Concentration RSD	2.1 %	7.3 %	64.8 %	59.6 %	27.6 %	10.9 %	2.1 %	32.2 %	0.3 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	3.760 ppb	88.623 %	0.432 ppb	0.180 ppb	38.961 ppb	0.495 ppb	87.139 %	-0.014 ppb	0.001 ppb
Concentration per Run 1	4.107 ppb	86.487 %	0.503 ppb	0.300 ppb	38.503 ppb	0.235 ppb	88.751 %	-0.008 ppb	-0.003 ppb
Concentration per Run 2	3.774 ppb	91.217 %	0.255 ppb	-0.025 ppb	38.384 ppb	0.673 ppb	87.129 %	-0.020 ppb	-0.003 ppb
Concentration per Run 3	3.398 ppb	88.165 %	0.539 ppb	0.264 ppb	39.995 ppb	0.577 ppb	85.537 %	-0.016 ppb	0.009 ppb
Concentration RSD	9.4 %	2.7 %	35.7 %	99.1 %	2.3 %	46.5 %	1.8 %	44.2 %	1,083.6 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	84.304 %	0.693 ppb	1.893 ppb	5.189 ppb	84.321 %	83.157 %	0.002 ppb	0.148 ppb	86.460 %
Concentration per Run 1	83.203 %	0.658 ppb	1.855 ppb	4.987 ppb	85.505 %	84.903 %	-0.001 ppb	0.134 ppb	90.496 %
Concentration per Run 2	85.688 %	0.690 ppb	1.931 ppb	5.268 ppb	84.068 %	80.691 %	0.004 ppb	0.160 ppb	84.231 %
Concentration per Run 3	84.021 %	0.732 ppb	1.891 ppb	5.311 ppb	83.391 %	83.876 %	0.004 ppb	0.150 ppb	84.654 %
Concentration RSD	1.5 %	5.4 %	2.0 %	3.4 %	1.3 %	2.6 %	108.5 %	8.9 %	4.0 %

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4/6/2017 7:04:22 AM



Analysis index: 38 Analysis started at: 4/5/2017 9:55:57 AM Rack: 1
 Analysis label: L1710261-03 MCP-6020SL-10 User name: Vial: 15

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	87.823 %	91.061 %	0.013 ppb	33,377.114 ppb	857.376 ppb	57.970 ppb	986.045 ppb	5,526.716 ppb	82.416 %
Concentration per Run 1	89.331 %	92.598 %	0.002 ppb	32,036.087 ppb	775.929 ppb	52.206 ppb	868.460 ppb	4,938.138 ppb	88.183 %
Concentration per Run 2	87.139 %	94.693 %	0.018 ppb	33,190.603 ppb	833.452 ppb	58.113 ppb	1,072.215 ppb	5,929.772 ppb	79.320 %
Concentration per Run 3	87.000 %	85.894 %	0.018 ppb	34,904.651 ppb	962.747 ppb	63.591 ppb	1,017.459 ppb	5,712.237 ppb	79.746 %
Concentration RSD	1.5 %	5.0 %	72.2 %	4.3 %	11.2 %	9.8 %	10.7 %	9.4 %	6.1 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	84.754 %	8.109 ppb	0.068 ppb	0.259 ppb	2.476 ppb	51.109 ppb	0.019 ppb	1.078 ppb	5.957 ppb
Concentration per Run 1	84.823 %	8.273 ppb	0.064 ppb	0.214 ppb	2.269 ppb	63.299 ppb	0.039 ppb	1.079 ppb	5.420 ppb
Concentration per Run 2	83.972 %	9.035 ppb	0.071 ppb	0.104 ppb	3.264 ppb	47.662 ppb	-0.002 ppb	1.163 ppb	6.608 ppb
Concentration per Run 3	85.469 %	7.020 ppb	0.070 ppb	0.460 ppb	1.896 ppb	42.364 ppb	0.021 ppb	0.991 ppb	5.842 ppb
Concentration RSD	0.9 %	12.5 %	5.2 %	70.2 %	28.5 %	21.3 %	106.1 %	8.0 %	10.1 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	8.279 ppb	85.114 %	0.482 ppb	0.350 ppb	39.616 ppb	0.258 ppb	84.482 %	-0.021 ppb	0.009 ppb
Concentration per Run 1	8.567 ppb	87.657 %	0.451 ppb	-0.226 ppb	39.761 ppb	0.323 ppb	83.120 %	-0.020 ppb	0.009 ppb
Concentration per Run 2	8.758 ppb	84.096 %	0.424 ppb	0.449 ppb	39.072 ppb	0.282 ppb	85.376 %	-0.024 ppb	0.009 ppb
Concentration per Run 3	7.512 ppb	83.588 %	0.570 ppb	0.829 ppb	40.014 ppb	0.169 ppb	84.948 %	-0.020 ppb	0.009 ppb
Concentration RSD	8.1 %	2.6 %	16.2 %	152.5 %	1.2 %	30.8 %	1.4 %	11.8 %	2.3 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	82.400 %	0.442 ppb	1.353 ppb	6.160 ppb	83.668 %	82.205 %	-0.002 ppb	0.168 ppb	84.592 %
Concentration per Run 1	82.865 %	0.378 ppb	1.309 ppb	6.000 ppb	85.677 %	83.914 %	-0.003 ppb	0.159 ppb	86.591 %
Concentration per Run 2	84.172 %	0.372 ppb	1.222 ppb	5.684 ppb	82.558 %	81.182 %	0.001 ppb	0.186 ppb	83.781 %
Concentration per Run 3	80.162 %	0.576 ppb	1.529 ppb	6.796 ppb	82.770 %	81.521 %	-0.005 ppb	0.161 ppb	83.403 %
Concentration RSD	2.5 %	26.2 %	11.7 %	9.3 %	2.1 %	1.8 %	136.2 %	8.9 %	2.1 %

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4/6/2017 7:04:22 AM



Analysis index: 39 Analysis started at: 4/5/2017 9:59:17 AM Rack: 1
 Analysis label: L1710261-04 MCP-6020SL-10 User name: Vial: 16

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	87.635 %	90.223 %	0.009 ppb	33,067.605 ppb	880.935 ppb	12.126 ppb	992.472 ppb	5,249.419 ppb	85.257 %
Concentration per Run 1	88.308 %	90.503 %	0.012 ppb	34,071.628 ppb	913.185 ppb	14.507 ppb	1,022.189 ppb	5,426.040 ppb	81.877 %
Concentration per Run 2	87.477 %	89.944 %	0.007 ppb	32,302.073 ppb	845.199 ppb	10.005 ppb	962.098 ppb	5,153.781 ppb	88.694 %
Concentration per Run 3	87.121 %	90.223 %	0.007 ppb	32,829.113 ppb	884.422 ppb	11.867 ppb	993.129 ppb	5,168.437 ppb	85.200 %
Concentration RSD	0.7 %	0.3 %	32.0 %	2.7 %	3.9 %	18.7 %	3.0 %	2.9 %	4.0 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	84.233 %	7.485 ppb	0.132 ppb	0.002 ppb	1.963 ppb	20.581 ppb	0.019 ppb	0.284 ppb	6.972 ppb
Concentration per Run 1	84.201 %	7.773 ppb	0.136 ppb	0.027 ppb	2.465 ppb	27.057 ppb	0.041 ppb	0.284 ppb	6.823 ppb
Concentration per Run 2	84.716 %	7.791 ppb	0.128 ppb	-0.091 ppb	1.851 ppb	17.815 ppb	-0.025 ppb	0.114 ppb	6.533 ppb
Concentration per Run 3	83.784 %	6.889 ppb	0.133 ppb	0.069 ppb	1.573 ppb	16.872 ppb	0.042 ppb	0.453 ppb	7.559 ppb
Concentration RSD	0.6 %	6.9 %	2.9 %	5,485.4 %	23.3 %	27.3 %	199.2 %	59.7 %	7.6 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	1.369 ppb	86.589 %	0.442 ppb	0.121 ppb	38.685 ppb	0.121 ppb	82.334 %	-0.017 ppb	0.001 ppb
Concentration per Run 1	1.512 ppb	88.623 %	0.401 ppb	-0.055 ppb	39.362 ppb	0.055 ppb	82.896 %	-0.024 ppb	0.009 ppb
Concentration per Run 2	1.465 ppb	86.690 %	0.457 ppb	0.157 ppb	37.733 ppb	0.173 ppb	81.712 %	-0.011 ppb	-0.003 ppb
Concentration per Run 3	1.130 ppb	84.452 %	0.470 ppb	0.259 ppb	38.959 ppb	0.134 ppb	82.393 %	-0.015 ppb	-0.003 ppb
Concentration RSD	15.2 %	2.4 %	8.3 %	132.8 %	2.2 %	49.8 %	0.7 %	40.2 %	1,020.5 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	82.499 %	0.320 ppb	1.050 ppb	5.729 ppb	81.728 %	81.209 %	0.003 ppb	0.049 ppb	84.337 %
Concentration per Run 1	83.849 %	0.201 ppb	0.939 ppb	5.898 ppb	80.457 %	83.822 %	0.000 ppb	0.037 ppb	86.749 %
Concentration per Run 2	82.853 %	0.285 ppb	1.069 ppb	5.557 ppb	82.909 %	79.440 %	0.001 ppb	0.053 ppb	82.834 %
Concentration per Run 3	80.794 %	0.475 ppb	1.142 ppb	5.731 ppb	81.818 %	80.365 %	0.009 ppb	0.056 ppb	83.427 %
Concentration RSD	1.9 %	43.7 %	9.8 %	3.0 %	1.5 %	2.8 %	147.6 %	21.5 %	2.5 %

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4/6/2017 7:04:22 AM



Analysis index: 40 Analysis started at: 4/5/2017 10:02:38 AM Rack: 1
Analysis label: L1710261-05 MCP-6020SL-10 User name: Vial: 17

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	87.106 %	94.367 %	0.014 ppb	31,196.668 ppb	815.939 ppb	15.534 ppb	873.894 ppb	5,230.286 ppb	86.478 %
Concentration per Run 1	87.552 %	98.045 %	0.018 ppb	31,112.572 ppb	803.383 ppb	15.476 ppb	933.198 ppb	5,414.966 ppb	82.217 %
Concentration per Run 2	86.296 %	90.782 %	0.018 ppb	32,572.308 ppb	854.765 ppb	18.860 ppb	963.492 ppb	5,223.000 ppb	83.155 %
Concentration per Run 3	87.472 %	94.274 %	0.007 ppb	29,905.124 ppb	789.670 ppb	12.265 ppb	724.992 ppb	5,052.893 ppb	94.063 %
Concentration RSD	0.8 %	3.8 %	42.1 %	4.3 %	4.2 %	21.2 %	14.9 %	3.5 %	7.6 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	82.627 %	7.480 ppb	0.109 ppb	0.057 ppb	2.210 ppb	18.385 ppb	0.054 ppb	0.583 ppb	4.169 ppb
Concentration per Run 1	83.408 %	9.461 ppb	0.138 ppb	0.006 ppb	3.227 ppb	22.921 ppb	0.021 ppb	0.560 ppb	4.150 ppb
Concentration per Run 2	82.491 %	5.561 ppb	0.067 ppb	0.068 ppb	1.542 ppb	16.417 ppb	-0.025 ppb	0.597 ppb	3.716 ppb
Concentration per Run 3	81.981 %	7.418 ppb	0.123 ppb	0.096 ppb	1.860 ppb	15.818 ppb	0.166 ppb	0.592 ppb	4.640 ppb
Concentration RSD	0.9 %	26.1 %	34.5 %	81.0 %	40.5 %	21.4 %	184.5 %	3.5 %	11.1 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	1.426 ppb	85.385 %	0.565 ppb	0.387 ppb	38.188 ppb	0.094 ppb	83.614 %	-0.021 ppb	0.001 ppb
Concentration per Run 1	1.550 ppb	80.892 %	0.640 ppb	1.545 ppb	38.522 ppb	0.056 ppb	84.893 %	-0.024 ppb	0.009 ppb
Concentration per Run 2	1.199 ppb	92.082 %	0.384 ppb	0.002 ppb	36.567 ppb	0.090 ppb	84.525 %	-0.016 ppb	-0.003 ppb
Concentration per Run 3	1.527 ppb	83.181 %	0.671 ppb	-0.384 ppb	39.477 ppb	0.136 ppb	81.424 %	-0.024 ppb	-0.003 ppb
Concentration RSD	13.8 %	6.9 %	27.9 %	263.6 %	3.9 %	43.0 %	2.3 %	23.6 %	1,104.7 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	82.418 %	0.658 ppb	0.820 ppb	5.840 ppb	81.646 %	81.938 %	0.000 ppb	0.048 ppb	82.653 %
Concentration per Run 1	84.803 %	0.645 ppb	0.668 ppb	5.959 ppb	84.025 %	83.666 %	-0.005 ppb	0.039 ppb	85.085 %
Concentration per Run 2	81.618 %	0.621 ppb	0.821 ppb	5.797 ppb	80.062 %	80.886 %	0.002 ppb	0.051 ppb	82.644 %
Concentration per Run 3	80.833 %	0.710 ppb	0.970 ppb	5.764 ppb	80.851 %	81.261 %	0.004 ppb	0.054 ppb	80.230 %
Concentration RSD	2.6 %	7.0 %	18.4 %	1.8 %	2.6 %	1.8 %	1,306.8 %	16.5 %	2.9 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 41 Analysis started at: 4/5/2017 10:05:59 AM Rack: 1
 Analysis label: L1710261-06 MCP-6020SL-10 User name: Vial: 18

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	88.169 %	89.013 %	0.004 ppb	31,183.490 ppb	807.207 ppb	8.238 ppb	851.598 ppb	4,907.443 ppb	90.597 %
Concentration per Run 1	88.210 %	83.240 %	0.002 ppb	32,746.579 ppb	903.763 ppb	6.836 ppb	948.594 ppb	5,081.284 ppb	88.524 %
Concentration per Run 2	88.090 %	92.598 %	0.002 ppb	29,981.117 ppb	749.655 ppb	8.163 ppb	796.914 ppb	4,855.683 ppb	94.745 %
Concentration per Run 3	88.207 %	91.201 %	0.007 ppb	30,822.774 ppb	768.203 ppb	9.716 ppb	809.285 ppb	4,785.363 ppb	88.524 %
Concentration RSD	0.1 %	5.7 %	76.2 %	4.5 %	10.4 %	17.5 %	9.9 %	3.2 %	4.0 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	84.058 %	6.279 ppb	0.106 ppb	-0.006 ppb	1.685 ppb	24.583 ppb	0.025 ppb	0.273 ppb	3.556 ppb
Concentration per Run 1	82.900 %	6.565 ppb	0.129 ppb	-0.047 ppb	1.592 ppb	29.573 ppb	0.018 ppb	0.362 ppb	3.871 ppb
Concentration per Run 2	83.324 %	5.733 ppb	0.061 ppb	0.010 ppb	1.413 ppb	21.605 ppb	0.016 ppb	0.264 ppb	3.424 ppb
Concentration per Run 3	85.949 %	6.539 ppb	0.128 ppb	0.018 ppb	2.051 ppb	22.571 ppb	0.039 ppb	0.193 ppb	3.372 ppb
Concentration RSD	2.0 %	7.5 %	37.0 %	558.9 %	19.5 %	17.7 %	51.0 %	31.0 %	7.7 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	0.778 ppb	86.640 %	0.396 ppb	0.646 ppb	38.520 ppb	0.107 ppb	82.034 %	-0.018 ppb	0.009 ppb
Concentration per Run 1	0.566 ppb	84.554 %	0.470 ppb	0.685 ppb	40.755 ppb	0.098 ppb	79.792 %	-0.011 ppb	0.022 ppb
Concentration per Run 2	1.169 ppb	87.403 %	0.498 ppb	-0.056 ppb	37.352 ppb	0.130 ppb	84.246 %	-0.024 ppb	-0.003 ppb
Concentration per Run 3	0.600 ppb	87.962 %	0.221 ppb	1.310 ppb	37.453 ppb	0.094 ppb	82.066 %	-0.020 ppb	0.009 ppb
Concentration RSD	43.5 %	2.1 %	38.4 %	105.8 %	5.0 %	18.4 %	2.7 %	37.9 %	138.7 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	83.241 %	0.230 ppb	0.640 ppb	5.363 ppb	82.902 %	83.053 %	0.001 ppb	0.041 ppb	82.064 %
Concentration per Run 1	81.558 %	0.305 ppb	0.661 ppb	5.522 ppb	83.337 %	82.880 %	-0.001 ppb	0.044 ppb	80.674 %
Concentration per Run 2	83.654 %	0.175 ppb	0.602 ppb	5.002 ppb	82.453 %	86.042 %	0.001 ppb	0.040 ppb	84.664 %
Concentration per Run 3	84.512 %	0.212 ppb	0.656 ppb	5.565 ppb	82.917 %	80.238 %	0.002 ppb	0.039 ppb	80.855 %
Concentration RSD	1.8 %	29.1 %	5.2 %	5.8 %	0.5 %	3.5 %	316.1 %	6.6 %	2.7 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 42 Analysis started at: 4/5/2017 10:09:21 AM
Analysis label: CCV User name:

Rack: 0
Vial: 9

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	89.550 %	92.877 %	97.761 ppb	9,942.435 ppb	10,135.174 ppb	97.944 ppb	10,038.934 ppb	10,395.082 ppb	88.410 %
Concentration per Run 1	89.578 %	92.458 %	98.264 ppb	10,052.696 ppb	10,170.844 ppb	101.828 ppb	9,836.243 ppb	10,506.078 ppb	89.376 %
Concentration per Run 2	90.404 %	89.944 %	96.353 ppb	10,102.754 ppb	10,263.093 ppb	93.313 ppb	10,444.983 ppb	10,242.549 ppb	89.376 %
Concentration per Run 3	88.669 %	96.229 %	98.664 ppb	9,671.855 ppb	9,971.585 ppb	98.691 ppb	9,835.576 ppb	10,436.618 ppb	86.478 %
Recovery Percentage 1			97.761 %	99.424 %	101.352 %	97.944 %	100.389 %	103.951 %	
Concentration RSD	1.0 %	3.4 %	1.3 %	2.4 %	1.5 %	4.4 %	3.5 %	1.3 %	1.9 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	87.317 %	99.926 ppb	100.917 ppb	99.819 ppb	101.391 ppb	10,146.346 ppb	101.041 ppb	99.168 ppb	103.523 ppb
Concentration per Run 1	86.387 %	94.223 ppb	101.144 ppb	97.079 ppb	100.132 ppb	10,042.468 ppb	96.701 ppb	92.365 ppb	102.624 ppb
Concentration per Run 2	88.102 %	99.418 ppb	98.440 ppb	101.169 ppb	99.105 ppb	9,836.914 ppb	98.713 ppb	97.833 ppb	95.621 ppb
Concentration per Run 3	87.461 %	106.138 ppb	103.168 ppb	101.208 ppb	104.936 ppb	10,559.656 ppb	107.709 ppb	107.306 ppb	112.322 ppb
Recovery Percentage 1		99.926 %	100.917 %	99.819 %	101.391 %	101.463 %	101.041 %	99.168 %	103.523 %
Concentration RSD	1.0 %	6.0 %	2.4 %	2.4 %	3.1 %	3.7 %	5.8 %	7.6 %	8.1 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	101.699 ppb	87.831 %	98.717 ppb	101.529 ppb	101.697 ppb	102.897 ppb	85.547 %	99.583 ppb	101.076 ppb
Concentration per Run 1	99.248 ppb	88.982 %	98.855 ppb	100.789 ppb	101.574 ppb	103.929 ppb	85.875 %	97.444 ppb	101.769 ppb
Concentration per Run 2	95.084 ppb	91.654 %	92.566 ppb	91.971 ppb	98.840 ppb	100.825 ppb	85.619 %	97.406 ppb	100.036 ppb
Concentration per Run 3	110.766 ppb	82.857 %	104.728 ppb	111.828 ppb	104.677 ppb	103.938 ppb	85.147 %	103.898 ppb	101.423 ppb
Recovery Percentage 1	101.699 %		98.717 %	101.529 %	101.697 %	102.897 %		99.583 %	101.076 %
Concentration RSD	8.0 %	5.1 %	6.2 %	9.8 %	2.9 %	1.7 %	0.4 %	3.8 %	0.9 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	85.914 %	98.045 ppb	100.871 ppb	99.930 ppb	83.963 %	83.176 %	102.465 ppb	100.307 ppb	81.719 %
Concentration per Run 1	88.042 %	96.230 ppb	95.147 ppb	94.346 ppb	84.351 %	85.648 %	102.793 ppb	100.443 ppb	82.190 %
Concentration per Run 2	83.891 %	98.753 ppb	104.275 ppb	102.479 ppb	84.792 %	80.643 %	104.606 ppb	101.530 ppb	79.760 %
Concentration per Run 3	85.810 %	99.153 ppb	103.192 ppb	102.966 ppb	82.746 %	83.237 %	99.997 ppb	98.948 ppb	83.207 %
Recovery Percentage 1		98.045 %	100.871 %	99.930 %			102.465 %	100.307 %	
Concentration RSD	2.4 %	1.6 %	4.9 %	4.8 %	1.3 %	3.0 %	2.3 %	1.3 %	2.2 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 43 Analysis started at: 4/5/2017 10:12:46 AM Rack: 0
Analysis label: CCB User name: ALPHALAB\metals-instrument Vial: 10

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	89.188 %	94.413 %	0.026 ppb	17.095 ppb	2.409 ppb	-0.583 ppb	3.901 ppb	2.779 ppb	89.717 %
Concentration per Run 1	89.769 %	96.927 %	0.022 ppb	13.366 ppb	-0.274 ppb	-0.811 ppb	9.466 ppb	4.539 ppb	88.950 %
Concentration per Run 2	88.984 %	93.715 %	0.038 ppb	18.182 ppb	4.256 ppb	-0.590 ppb	-10.731 ppb	-7.019 ppb	92.103 %
Concentration per Run 3	88.811 %	92.598 %	0.017 ppb	19.736 ppb	3.247 ppb	-0.349 ppb	12.968 ppb	10.816 ppb	88.098 %
Recovery Percentage 1			5.146 %	17.095 %	3.442 %	-5.833 %	3.901 %	2.779 %	
Concentration RSD	0.6 %	2.4 %	41.2 %	19.4 %	98.7 %	39.6 %	327.9 %	325.6 %	2.4 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	85.695 %	0.147 ppb	0.063 ppb	0.016 ppb	-0.177 ppb	4.111 ppb	0.032 ppb	0.082 ppb	0.085 ppb
Concentration per Run 1	85.121 %	0.000 ppb	0.000 ppb	0.013 ppb	-0.116 ppb	-0.249 ppb	-0.005 ppb	0.180 ppb	-0.013 ppb
Concentration per Run 2	85.344 %	0.259 ppb	0.123 ppb	0.012 ppb	-0.182 ppb	9.182 ppb	0.058 ppb	0.030 ppb	0.153 ppb
Concentration per Run 3	86.619 %	0.182 ppb	0.065 ppb	0.021 ppb	-0.234 ppb	3.399 ppb	0.042 ppb	0.037 ppb	0.115 ppb
Recovery Percentage 1		29.346 %	1.259 %	1.561 %	-17.748 %	8.221 %	6.320 %	4.115 %	8.499 %
Concentration RSD	0.9 %	90.5 %	98.1 %	32.5 %	33.3 %	115.7 %	102.9 %	102.6 %	102.4 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	-0.570 ppb	89.437 %	0.159 ppb	0.790 ppb	0.040 ppb	0.620 ppb	87.080 %	0.039 ppb	0.016 ppb
Concentration per Run 1	-0.571 ppb	97.677 %	0.112 ppb	0.677 ppb	0.096 ppb	0.615 ppb	88.875 %	0.033 ppb	0.008 ppb
Concentration per Run 2	-0.631 ppb	90.302 %	0.169 ppb	0.938 ppb	0.045 ppb	0.516 ppb	90.019 %	0.034 ppb	0.020 ppb
Concentration per Run 3	-0.509 ppb	80.333 %	0.196 ppb	0.755 ppb	-0.022 ppb	0.728 ppb	82.346 %	0.050 ppb	0.021 ppb
Recovery Percentage 1	-5.705 %	89.437 %	31.821 %	15.801 %	7.905 %	30.984 %		9.778 %	8.092 %
Concentration RSD	10.8 %	9.7 %	27.2 %	16.9 %	149.7 %	17.2 %	4.8 %	24.9 %	43.4 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	86.039 %	0.783 ppb	3.267 ppb	0.020 ppb	82.468 %	80.566 %	0.051 ppb	0.064 ppb	82.899 %
Concentration per Run 1	87.929 %	0.809 ppb	3.306 ppb	0.069 ppb	86.783 %	81.214 %	0.061 ppb	0.063 ppb	81.734 %
Concentration per Run 2	85.177 %	0.840 ppb	3.497 ppb	-0.021 ppb	82.495 %	82.745 %	0.046 ppb	0.081 ppb	85.033 %
Concentration per Run 3	85.009 %	0.700 ppb	2.997 ppb	0.013 ppb	78.124 %	77.739 %	0.045 ppb	0.048 ppb	81.931 %
Recovery Percentage 1		26.093 %	81.664 %	4.056 %			10.128 %	12.777 %	82.899 %
Concentration RSD	1.9 %	9.4 %	7.7 %	224.2 %	5.3 %	3.2 %	17.9 %	25.8 %	2.2 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 44 Analysis started at: 4/5/2017 10:20:39 AM Rack: 1
Analysis label: WG991146-1 2008TL User name: ALPHALAB\metals-instrument Vial: 21

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	91.517 %	96.648 %	0.005 ppb	15.680 ppb	-1.022 ppb	0.365 ppb	16.912 ppb	4.517 ppb	89.546 %
Concentration per Run 1	92.014 %	94.134 %	0.007 ppb	15.592 ppb	-1.402 ppb	0.493 ppb	29.116 ppb	4.022 ppb	94.318 %
Concentration per Run 2	90.952 %	97.346 %	-0.003 ppb	16.493 ppb	-0.262 ppb	-0.134 ppb	5.307 ppb	4.894 ppb	86.393 %
Concentration per Run 3	91.585 %	98.464 %	0.012 ppb	14.956 ppb	-1.402 ppb	0.738 ppb	16.313 ppb	4.634 ppb	87.927 %
Concentration RSD	0.6 %	2.3 %	143.6 %	4.9 %	64.4 %	123.1 %	70.5 %	9.9 %	4.7 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	85.828 %	0.092 ppb	0.042 ppb	0.031 ppb	-0.077 ppb	0.495 ppb	0.011 ppb	0.034 ppb	-0.007 ppb
Concentration per Run 1	84.875 %	0.000 ppb	0.061 ppb	0.073 ppb	-0.117 ppb	-0.216 ppb	-0.025 ppb	-0.047 ppb	-0.065 ppb
Concentration per Run 2	86.204 %	0.185 ppb	0.067 ppb	-0.021 ppb	-0.013 ppb	1.775 ppb	-0.002 ppb	-0.047 ppb	-0.005 ppb
Concentration per Run 3	86.406 %	0.090 ppb	0.000 ppb	0.041 ppb	-0.100 ppb	-0.073 ppb	0.061 ppb	0.195 ppb	0.048 ppb
Concentration RSD	1.0 %	100.8 %	86.9 %	155.9 %	72.5 %	224.3 %	399.8 %	416.7 %	778.4 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	-0.486 ppb	85.063 %	0.042 ppb	0.962 ppb	0.091 ppb	0.083 ppb	83.375 %	-0.015 ppb	0.005 ppb
Concentration per Run 1	-0.388 ppb	87.759 %	-0.053 ppb	0.284 ppb	0.048 ppb	0.015 ppb	87.713 %	0.001 ppb	0.008 ppb
Concentration per Run 2	-0.583 ppb	80.333 %	0.047 ppb	1.357 ppb	0.102 ppb	0.139 ppb	80.159 %	-0.024 ppb	0.009 ppb
Concentration per Run 3	-0.486 ppb	87.097 %	0.132 ppb	1.245 ppb	0.124 ppb	0.094 ppb	82.254 %	-0.020 ppb	-0.003 ppb
Concentration RSD	20.0 %	4.8 %	220.7 %	61.3 %	43.2 %	75.7 %	4.7 %	92.9 %	148.2 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	83.716 %	0.149 ppb	0.849 ppb	-0.021 ppb	82.357 %	81.773 %	0.001 ppb	0.007 ppb	86.445 %
Concentration per Run 1	85.523 %	0.116 ppb	0.781 ppb	-0.021 ppb	85.493 %	84.318 %	0.000 ppb	0.010 ppb	89.550 %
Concentration per Run 2	81.033 %	0.253 ppb	0.717 ppb	-0.053 ppb	79.111 %	78.431 %	0.001 ppb	0.009 ppb	84.179 %
Concentration per Run 3	84.592 %	0.079 ppb	1.050 ppb	0.011 ppb	82.466 %	82.571 %	0.003 ppb	0.004 ppb	85.606 %
Concentration RSD	2.8 %	61.5 %	20.8 %	151.6 %	3.9 %	3.7 %	145.5 %	43.0 %	3.2 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 45 Analysis started at: 4/5/2017 10:24:01 AM Rack: 1
 Analysis label: WG987527-1D2 A2-6020T User name: ALPHALAB\metals-instrument Vial: 27

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	85.141 %	89.199 %	0.011 ppb	28.007 ppb	-0.161 ppb	2.472 ppb	38.956 ppb	-2.626 ppb	79.405 %
Concentration per Run 1	85.835 %	94.693 %	0.008 ppb	29.395 ppb	1.065 ppb	1.910 ppb	43.511 ppb	-0.100 ppb	74.293 %
Concentration per Run 2	84.646 %	87.151 %	0.013 ppb	32.038 ppb	-1.402 ppb	2.848 ppb	50.490 ppb	-0.675 ppb	82.473 %
Concentration per Run 3	84.942 %	85.754 %	0.013 ppb	22.587 ppb	-0.146 ppb	2.658 ppb	22.867 ppb	-7.101 ppb	81.450 %
Concentration RSD	0.7 %	5.4 %	28.0 %	17.4 %	766.3 %	20.1 %	36.9 %	148.0 %	5.6 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	77.961 %	0.100 ppb	0.383 ppb	0.175 ppb	0.002 ppb	3.221 ppb	0.036 ppb	0.010 ppb	0.095 ppb
Concentration per Run 1	76.646 %	0.106 ppb	0.598 ppb	0.093 ppb	-0.210 ppb	5.930 ppb	-0.025 ppb	-0.047 ppb	-0.002 ppb
Concentration per Run 2	77.035 %	0.000 ppb	0.137 ppb	0.167 ppb	0.069 ppb	-1.613 ppb	0.134 ppb	-0.047 ppb	0.114 ppb
Concentration per Run 3	80.202 %	0.194 ppb	0.415 ppb	0.263 ppb	0.147 ppb	5.344 ppb	-0.002 ppb	0.124 ppb	0.174 ppb
Concentration RSD	2.5 %	97.2 %	60.6 %	49.0 %	8,969.6 %	130.3 %	241.8 %	1,001.4 %	94.4 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	-0.330 ppb	82.723 %	0.239 ppb	0.119 ppb	0.053 ppb	0.084 ppb	81.511 %	0.003 ppb	-0.003 ppb
Concentration per Run 1	-0.304 ppb	81.147 %	0.293 ppb	-0.108 ppb	0.054 ppb	0.098 ppb	81.248 %	0.012 ppb	-0.003 ppb
Concentration per Run 2	-0.511 ppb	83.435 %	0.284 ppb	0.382 ppb	0.022 ppb	0.056 ppb	82.480 %	0.002 ppb	-0.003 ppb
Concentration per Run 3	-0.175 ppb	83.588 %	0.139 ppb	0.083 ppb	0.083 ppb	0.097 ppb	80.804 %	-0.006 ppb	-0.003 ppb
Concentration RSD	51.4 %	1.7 %	36.1 %	207.7 %	57.2 %	28.2 %	1.1 %	337.3 %	

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	80.015 %	1.099 ppb	1.569 ppb	0.003 ppb	79.455 %	77.944 %	0.014 ppb	0.064 ppb	87.562 %
Concentration per Run 1	77.173 %	1.352 ppb	1.749 ppb	-0.053 ppb	80.960 %	78.988 %	0.014 ppb	0.069 ppb	88.610 %
Concentration per Run 2	82.074 %	1.014 ppb	1.462 ppb	0.014 ppb	78.067 %	76.064 %	0.012 ppb	0.057 ppb	88.681 %
Concentration per Run 3	80.796 %	0.933 ppb	1.495 ppb	0.047 ppb	79.338 %	78.781 %	0.017 ppb	0.066 ppb	85.395 %
Concentration RSD	3.2 %	20.2 %	10.0 %	1,840.2 %	1.8 %	2.1 %	18.9 %	9.7 %	2.1 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 46 Analysis started at: 4/5/2017 10:27:22 AM Rack: 1
 Analysis label: WG991146-2D5 2008TL User name: ALPHALAB\metals-instrument Vial: 22

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	89.088 %	92.365 %	10.119 ppb	2,050.403 ppb	2,115.215 ppb	414.587 ppb	2,006.649 ppb	2,067.124 ppb	88.041 %
Concentration per Run 1	90.314 %	96.089 %	9.995 ppb	1,895.484 ppb	1,955.900 ppb	380.867 ppb	1,871.582 ppb	1,940.648 ppb	96.023 %
Concentration per Run 2	89.025 %	91.480 %	10.497 ppb	2,135.028 ppb	2,204.493 ppb	423.004 ppb	2,155.714 ppb	2,091.831 ppb	83.326 %
Concentration per Run 3	87.924 %	89.525 %	9.863 ppb	2,120.698 ppb	2,185.252 ppb	439.890 ppb	1,992.651 ppb	2,168.894 ppb	84.774 %
Concentration RSD	1.3 %	3.6 %	3.3 %	6.6 %	6.5 %	7.3 %	7.1 %	5.6 %	7.9 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	84.601 %	165.931 ppb	98.365 ppb	38.755 ppb	102.501 ppb	211.882 ppb	96.734 ppb	99.056 ppb	51.630 ppb
Concentration per Run 1	83.212 %	154.463 ppb	93.928 ppb	35.631 ppb	99.160 ppb	168.573 ppb	90.511 ppb	95.389 ppb	52.490 ppb
Concentration per Run 2	85.839 %	175.237 ppb	99.510 ppb	40.028 ppb	103.082 ppb	222.151 ppb	98.688 ppb	105.540 ppb	49.013 ppb
Concentration per Run 3	84.751 %	168.095 ppb	101.658 ppb	40.607 ppb	105.261 ppb	244.923 ppb	101.002 ppb	96.239 ppb	53.388 ppb
Concentration RSD	1.6 %	6.4 %	4.1 %	7.0 %	3.0 %	18.5 %	5.7 %	5.7 %	4.5 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	100.355 ppb	87.973 %	26.240 ppb	24.167 ppb	207.553 ppb	186.957 ppb	85.694 %	9.798 ppb	10.844 ppb
Concentration per Run 1	97.367 ppb	89.069 %	25.181 ppb	22.637 ppb	202.154 ppb	180.401 ppb	86.721 %	9.682 ppb	10.445 ppb
Concentration per Run 2	99.802 ppb	90.355 %	26.374 ppb	23.228 ppb	205.210 ppb	190.163 ppb	83.849 %	9.938 ppb	10.820 ppb
Concentration per Run 3	103.896 ppb	84.494 %	27.165 ppb	26.636 ppb	215.294 ppb	190.308 ppb	86.511 %	9.775 ppb	11.268 ppb
Concentration RSD	3.3 %	3.5 %	3.8 %	8.9 %	3.3 %	3.0 %	1.9 %	1.3 %	3.8 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	84.425 %	191.644 ppb	97.167 ppb	406.486 ppb	85.009 %	83.472 %	25.047 ppb	107.431 ppb	83.224 %
Concentration per Run 1	86.186 %	185.945 ppb	93.808 ppb	405.469 ppb	85.760 %	85.448 %	25.016 ppb	104.878 ppb	84.283 %
Concentration per Run 2	83.282 %	192.033 ppb	98.651 ppb	404.937 ppb	84.473 %	81.364 %	24.927 ppb	108.313 ppb	82.545 %
Concentration per Run 3	83.808 %	196.954 ppb	99.042 ppb	409.053 ppb	84.793 %	83.603 %	25.198 ppb	109.104 ppb	82.845 %
Concentration RSD	1.8 %	2.9 %	3.0 %	0.6 %	0.8 %	2.4 %	0.6 %	2.1 %	1.1 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 47 Analysis started at: 4/5/2017 10:30:45 AM Rack: 1
 Analysis label: WG991146-3D10 2008TL User name: ALPHALAB\metals-instrument Vial: 23

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	89.581 %	89.385 %	5.194 ppb	6,686.249 ppb	1,455.168 ppb	213.071 ppb	1,437.043 ppb	2,809.278 ppb	88.325 %
Concentration per Run 1	89.572 %	89.525 %	5.156 ppb	6,564.765 ppb	1,467.007 ppb	205.631 ppb	1,438.271 ppb	2,941.376 ppb	92.784 %
Concentration per Run 2	89.843 %	88.268 %	5.422 ppb	6,860.297 ppb	1,460.686 ppb	211.839 ppb	1,455.950 ppb	2,809.488 ppb	86.052 %
Concentration per Run 3	89.329 %	90.363 %	5.005 ppb	6,633.685 ppb	1,437.811 ppb	221.742 ppb	1,416.906 ppb	2,676.971 ppb	86.137 %
Concentration RSD	0.3 %	1.2 %	4.1 %	2.3 %	1.1 %	3.8 %	1.4 %	4.7 %	4.4 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	86.609 %	85.510 ppb	49.392 ppb	19.975 ppb	52.093 ppb	102.614 ppb	49.160 ppb	48.948 ppb	25.906 ppb
Concentration per Run 1	85.996 %	82.602 ppb	46.104 ppb	18.985 ppb	50.257 ppb	98.501 ppb	48.972 ppb	49.684 ppb	24.708 ppb
Concentration per Run 2	86.191 %	84.567 ppb	50.767 ppb	20.803 ppb	51.077 ppb	96.420 ppb	48.335 ppb	49.635 ppb	26.173 ppb
Concentration per Run 3	87.641 %	89.361 ppb	51.307 ppb	20.136 ppb	54.945 ppb	112.922 ppb	50.172 ppb	47.526 ppb	26.837 ppb
Concentration RSD	1.0 %	4.1 %	5.8 %	4.6 %	4.8 %	8.8 %	1.9 %	2.5 %	4.2 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	50.063 ppb	86.996 %	12.493 ppb	13.103 ppb	115.727 ppb	98.795 ppb	84.731 %	5.055 ppb	5.781 ppb
Concentration per Run 1	47.436 ppb	89.081 %	12.648 ppb	11.823 ppb	113.883 ppb	100.359 ppb	87.649 %	4.857 ppb	5.220 ppb
Concentration per Run 2	51.207 ppb	85.903 %	12.095 ppb	12.808 ppb	119.277 ppb	99.748 ppb	83.469 %	5.107 ppb	6.089 ppb
Concentration per Run 3	51.544 ppb	86.005 %	12.737 ppb	14.680 ppb	114.020 ppb	96.277 ppb	83.074 %	5.200 ppb	6.035 ppb
Concentration RSD	4.6 %	2.1 %	2.8 %	11.1 %	2.7 %	2.2 %	3.0 %	3.5 %	8.4 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	86.328 %	94.801 ppb	60.187 ppb	197.592 ppb	84.117 %	82.529 %	12.707 ppb	53.072 ppb	84.101 %
Concentration per Run 1	88.938 %	92.353 ppb	58.843 ppb	190.348 ppb	86.473 %	84.416 %	12.654 ppb	52.056 ppb	84.253 %
Concentration per Run 2	84.237 %	98.522 ppb	61.356 ppb	200.343 ppb	82.612 %	80.290 %	12.896 ppb	53.540 ppb	83.171 %
Concentration per Run 3	85.808 %	93.529 ppb	60.363 ppb	202.084 ppb	83.267 %	82.880 %	12.570 ppb	53.621 ppb	84.878 %
Concentration RSD	2.8 %	3.5 %	2.1 %	3.2 %	2.5 %	2.5 %	1.3 %	1.7 %	1.0 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 48 Analysis started at: 4/5/2017 10:34:08 AM Rack: 1
 Analysis label: WG987527-5D10 A2-6020T User name: ALPHALAB\metals-instrument Vial: 28

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	89.988 %	97.439 %	51.702 ppb	12,443.370 ppb	12,011.604 ppb	12,515.407 ppb	7,858.261 ppb	7,857.546 ppb	87.530 %
Concentration per Run 1	91.148 %	97.905 %	51.524 ppb	12,158.387 ppb	11,908.838 ppb	11,979.011 ppb	7,189.208 ppb	7,294.299 ppb	93.722 %
Concentration per Run 2	89.297 %	98.883 %	51.821 ppb	12,343.359 ppb	11,619.938 ppb	12,474.375 ppb	7,938.364 ppb	7,728.386 ppb	86.990 %
Concentration per Run 3	89.520 %	95.531 %	51.761 ppb	12,828.364 ppb	12,506.036 ppb	13,092.835 ppb	8,447.210 ppb	8,549.954 ppb	81.877 %
Concentration RSD	1.1 %	1.8 %	0.3 %	2.8 %	3.8 %	4.5 %	8.1 %	8.1 %	6.8 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	84.934 %	563.149 ppb	116.806 ppb	103.813 ppb	427.633 ppb	30,900.065 ppb	58.990 ppb	75.733 ppb	120.662 ppb
Concentration per Run 1	85.446 %	532.199 ppb	114.499 ppb	97.957 ppb	395.759 ppb	29,512.588 ppb	56.003 ppb	72.084 ppb	114.364 ppb
Concentration per Run 2	85.289 %	553.523 ppb	116.688 ppb	102.542 ppb	437.470 ppb	31,453.272 ppb	60.484 ppb	74.247 ppb	121.762 ppb
Concentration per Run 3	84.069 %	603.724 ppb	119.232 ppb	110.941 ppb	449.671 ppb	31,734.335 ppb	60.483 ppb	80.869 ppb	125.859 ppb
Concentration RSD	0.9 %	6.5 %	2.0 %	6.3 %	6.6 %	3.9 %	4.4 %	6.0 %	4.8 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	182.886 ppb	86.939 %	66.565 ppb	56.938 ppb	93.097 ppb	54.704 ppb	85.162 %	26.533 ppb	53.158 ppb
Concentration per Run 1	176.555 ppb	90.915 %	65.628 ppb	55.935 ppb	90.509 ppb	53.537 ppb	85.448 %	26.295 ppb	50.804 ppb
Concentration per Run 2	182.773 ppb	84.087 %	65.779 ppb	55.803 ppb	97.080 ppb	57.476 ppb	85.101 %	26.866 ppb	54.420 ppb
Concentration per Run 3	189.330 ppb	85.816 %	68.289 ppb	59.076 ppb	91.701 ppb	53.099 ppb	84.937 %	26.436 ppb	54.250 ppb
Concentration RSD	3.5 %	4.1 %	2.2 %	3.3 %	3.8 %	4.4 %	0.3 %	1.1 %	3.8 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	83.048 %	61.478 ppb	68.536 ppb	82.533 ppb	83.023 %	83.165 %	48.472 ppb	148.761 ppb	87.244 %
Concentration per Run 1	86.179 %	60.035 ppb	65.793 ppb	80.536 ppb	83.217 %	83.580 %	46.352 ppb	144.262 ppb	89.613 %
Concentration per Run 2	81.540 %	62.068 ppb	68.124 ppb	83.267 ppb	82.687 %	81.925 %	48.550 ppb	146.411 ppb	89.014 %
Concentration per Run 3	81.426 %	62.331 ppb	71.692 ppb	83.794 ppb	83.166 %	83.991 %	50.513 ppb	155.609 ppb	83.104 %
Concentration RSD	3.3 %	2.0 %	4.3 %	2.1 %	0.4 %	1.3 %	4.3 %	4.1 %	4.1 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 49 Analysis started at: 4/5/2017 10:37:29 AM Rack: 1
 Analysis label: WG987527-3D10 A2-6020T User name: ALPHALAB\metals-instrument Vial: 29

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	91.364 %	97.393 %	10.152 ppb	11,833.265 ppb	10,265.569 ppb	16,532.732 ppb	5,329.375 ppb	5,767.500 ppb	88.211 %
Concentration per Run 1	91.061 %	99.721 %	10.352 ppb	12,010.521 ppb	10,470.197 ppb	17,186.453 ppb	5,576.080 ppb	6,246.463 ppb	82.985 %
Concentration per Run 2	92.521 %	91.620 %	10.086 ppb	12,017.794 ppb	10,550.201 ppb	16,840.646 ppb	5,232.230 ppb	5,231.422 ppb	91.251 %
Concentration per Run 3	90.510 %	100.838 %	10.020 ppb	11,471.480 ppb	9,776.308 ppb	15,571.096 ppb	5,179.815 ppb	5,824.614 ppb	90.398 %
Concentration RSD	1.1 %	5.2 %	1.7 %	2.6 %	4.1 %	5.1 %	4.0 %	8.8 %	5.2 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	86.167 %	846.617 ppb	190.002 ppb	100.917 ppb	517.113 ppb	30,273.855 ppb	110.215 ppb	123.725 ppb	144.281 ppb
Concentration per Run 1	87.164 %	932.162 ppb	199.897 ppb	110.825 ppb	576.793 ppb	32,120.160 ppb	118.447 ppb	130.904 ppb	147.742 ppb
Concentration per Run 2	85.719 %	807.433 ppb	189.977 ppb	96.707 ppb	480.504 ppb	29,471.237 ppb	108.217 ppb	123.823 ppb	142.047 ppb
Concentration per Run 3	85.619 %	800.256 ppb	180.131 ppb	95.220 ppb	494.044 ppb	29,230.167 ppb	103.980 ppb	116.449 ppb	143.053 ppb
Concentration RSD	1.0 %	8.8 %	5.2 %	8.5 %	10.1 %	5.3 %	6.7 %	5.8 %	2.1 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	238.393 ppb	83.911 %	42.259 ppb	29.565 ppb	269.638 ppb	196.612 ppb	83.496 %	62.820 ppb	11.317 ppb
Concentration per Run 1	245.634 ppb	84.339 %	44.043 ppb	30.533 ppb	274.488 ppb	201.284 ppb	83.188 %	63.536 ppb	11.560 ppb
Concentration per Run 2	239.406 ppb	83.767 %	41.130 ppb	30.883 ppb	268.745 ppb	195.965 ppb	82.929 %	63.044 ppb	10.821 ppb
Concentration per Run 3	230.139 ppb	83.627 %	41.604 ppb	27.279 ppb	265.681 ppb	192.586 ppb	84.370 %	61.881 ppb	11.571 ppb
Concentration RSD	3.3 %	0.4 %	3.7 %	6.7 %	1.7 %	2.2 %	0.9 %	1.4 %	3.8 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	82.360 %	218.086 ppb	99.771 ppb	459.301 ppb	83.697 %	82.433 %	24.178 ppb	227.421 ppb	84.537 %
Concentration per Run 1	82.522 %	224.302 ppb	100.161 ppb	455.796 ppb	81.938 %	81.869 %	23.596 ppb	230.252 ppb	85.048 %
Concentration per Run 2	84.702 %	208.491 ppb	98.503 ppb	461.220 ppb	86.121 %	82.910 %	24.692 ppb	226.208 ppb	85.928 %
Concentration per Run 3	79.856 %	221.466 ppb	100.648 ppb	460.887 ppb	83.033 %	82.519 %	24.248 ppb	225.802 ppb	82.635 %
Concentration RSD	2.9 %	3.9 %	1.1 %	0.7 %	2.6 %	0.6 %	2.3 %	1.1 %	2.0 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 50 Analysis started at: 4/5/2017 10:40:50 AM Rack: 1
 Analysis label: WG987527-6D10 A2-6020T User name: ALPHALAB\metals-instrument Vial: 30

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	91.759 %	92.923 %	0.760 ppb	7,313.927 ppb	8,034.635 ppb	15,338.632 ppb	2,424.991 ppb	3,495.106 ppb	83.893 %
Concentration per Run 1	92.809 %	88.687 %	0.744 ppb	7,616.069 ppb	8,430.041 ppb	15,991.124 ppb	2,376.028 ppb	3,590.567 ppb	82.814 %
Concentration per Run 2	91.998 %	96.229 %	0.745 ppb	6,969.313 ppb	7,680.799 ppb	14,827.488 ppb	2,491.195 ppb	3,142.924 ppb	88.694 %
Concentration per Run 3	90.469 %	93.855 %	0.793 ppb	7,356.398 ppb	7,993.066 ppb	15,197.285 ppb	2,407.750 ppb	3,751.826 ppb	80.172 %
Concentration RSD	1.3 %	4.1 %	3.7 %	4.4 %	4.7 %	3.9 %	2.5 %	9.0 %	5.2 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	85.114 %	462.633 ppb	70.176 ppb	47.809 ppb	660.448 ppb	32,356.600 ppb	10.570 ppb	23.551 ppb	66.979 ppb
Concentration per Run 1	85.335 %	461.892 ppb	73.717 ppb	50.466 ppb	674.430 ppb	34,172.610 ppb	10.808 ppb	21.898 ppb	65.909 ppb
Concentration per Run 2	86.201 %	454.931 ppb	68.473 ppb	44.926 ppb	649.883 ppb	30,684.658 ppb	9.806 ppb	23.295 ppb	68.196 ppb
Concentration per Run 3	83.805 %	471.075 ppb	68.339 ppb	48.034 ppb	657.031 ppb	32,212.531 ppb	11.095 ppb	25.461 ppb	66.831 ppb
Concentration RSD	1.4 %	1.8 %	4.4 %	5.8 %	1.9 %	5.4 %	6.4 %	7.6 %	1.7 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	124.180 ppb	87.026 %	18.446 ppb	0.936 ppb	42.040 ppb	4.300 ppb	85.820 %	0.905 ppb	0.135 ppb
Concentration per Run 1	129.638 ppb	85.915 %	18.282 ppb	0.241 ppb	43.623 ppb	4.635 ppb	86.937 %	0.899 ppb	0.152 ppb
Concentration per Run 2	122.306 ppb	87.061 %	18.241 ppb	1.129 ppb	42.114 ppb	3.611 ppb	85.876 %	0.929 ppb	0.107 ppb
Concentration per Run 3	120.596 ppb	88.102 %	18.815 ppb	1.440 ppb	40.383 ppb	4.655 ppb	84.646 %	0.888 ppb	0.145 ppb
Concentration RSD	3.9 %	1.3 %	1.7 %	66.5 %	3.9 %	13.9 %	1.3 %	2.3 %	18.1 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	81.030 %	6.714 ppb	1.223 ppb	24.994 ppb	79.577 %	80.799 %	0.424 ppb	96.661 ppb	87.550 %
Concentration per Run 1	82.982 %	6.983 ppb	0.997 ppb	25.627 ppb	79.049 %	80.192 %	0.349 ppb	97.342 ppb	88.666 %
Concentration per Run 2	80.428 %	6.474 ppb	1.640 ppb	24.287 ppb	80.918 %	81.251 %	0.430 ppb	97.762 ppb	86.659 %
Concentration per Run 3	79.681 %	6.684 ppb	1.034 ppb	25.068 ppb	78.764 %	80.954 %	0.491 ppb	94.877 ppb	87.325 %
Concentration RSD	2.1 %	3.8 %	29.5 %	2.7 %	1.5 %	0.7 %	16.8 %	1.6 %	1.2 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 51 Analysis started at: 4/5/2017 10:44:12 AM Rack: 1
 Analysis label: L1710186-01 2008TL User name: ALPHALAB\metals-instrument Vial: 25

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	86.583 %	95.205 %	0.035 ppb	88,322.684 ppb	8,123.289 ppb	122.970 ppb	8,985.454 ppb	18,193.162 ppb	88.069 %
Concentration per Run 1	87.424 %	89.804 %	0.013 ppb	89,512.325 ppb	8,142.427 ppb	128.857 ppb	8,944.276 ppb	18,579.630 ppb	90.313 %
Concentration per Run 2	85.733 %	91.760 %	0.039 ppb	93,220.091 ppb	8,505.806 ppb	123.579 ppb	9,158.824 ppb	17,613.318 ppb	85.626 %
Concentration per Run 3	86.592 %	104.050 %	0.054 ppb	82,235.636 ppb	7,721.635 ppb	116.474 ppb	8,853.261 ppb	18,386.536 ppb	88.268 %
Concentration RSD	1.0 %	8.1 %	59.9 %	6.3 %	4.8 %	5.1 %	1.7 %	2.8 %	2.7 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	82.128 %	36.344 ppb	0.493 ppb	0.862 ppb	123.766 ppb	841.720 ppb	0.536 ppb	1.516 ppb	51.664 ppb
Concentration per Run 1	80.175 %	37.491 ppb	0.760 ppb	1.070 ppb	124.597 ppb	855.467 ppb	0.489 ppb	1.882 ppb	53.923 ppb
Concentration per Run 2	84.577 %	36.697 ppb	0.525 ppb	0.687 ppb	126.235 ppb	889.897 ppb	0.603 ppb	1.168 ppb	48.882 ppb
Concentration per Run 3	81.630 %	34.844 ppb	0.194 ppb	0.828 ppb	120.466 ppb	779.796 ppb	0.516 ppb	1.496 ppb	52.188 ppb
Concentration RSD	2.7 %	3.7 %	57.8 %	22.5 %	2.4 %	6.7 %	11.1 %	23.6 %	5.0 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	38.159 ppb	86.792 %	0.347 ppb	0.744 ppb	104.023 ppb	0.705 ppb	83.306 %	0.585 ppb	0.058 ppb
Concentration per Run 1	39.735 ppb	85.724 %	0.368 ppb	0.728 ppb	106.373 ppb	1.001 ppb	85.003 %	0.564 ppb	0.057 ppb
Concentration per Run 2	38.011 ppb	88.776 %	0.400 ppb	0.851 ppb	100.619 ppb	0.473 ppb	83.299 %	0.581 ppb	0.046 ppb
Concentration per Run 3	36.730 ppb	85.877 %	0.274 ppb	0.653 ppb	105.076 ppb	0.641 ppb	81.616 %	0.610 ppb	0.071 ppb
Concentration RSD	4.0 %	2.0 %	18.7 %	13.5 %	2.9 %	38.3 %	2.0 %	3.9 %	21.5 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	81.485 %	0.863 ppb	0.787 ppb	29.396 ppb	83.316 %	81.741 %	0.112 ppb	1.204 ppb	81.461 %
Concentration per Run 1	83.638 %	0.789 ppb	0.739 ppb	27.878 ppb	82.843 %	81.305 %	0.067 ppb	1.147 ppb	83.044 %
Concentration per Run 2	79.935 %	1.092 ppb	0.847 ppb	31.070 ppb	83.990 %	79.489 %	0.116 ppb	1.237 ppb	80.799 %
Concentration per Run 3	80.882 %	0.708 ppb	0.777 ppb	29.241 ppb	83.115 %	84.428 %	0.153 ppb	1.228 ppb	80.541 %
Concentration RSD	2.4 %	23.5 %	7.0 %	5.4 %	0.7 %	3.1 %	38.5 %	4.1 %	1.7 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 52 Analysis started at: 4/5/2017 10:47:32 AM Rack: 1
 Analysis label: L1710186-02 2008TL User name: ALPHALAB\metals-instrument Vial: 26

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	86.853 %	92.179 %	0.011 ppb	114,122.481 ppb	8,566.801 ppb	22.473 ppb	8,985.089 ppb	19,043.578 ppb	84.405 %
Concentration per Run 1	87.467 %	92.039 %	0.007 ppb	119,512.765 ppb	8,822.458 ppb	24.258 ppb	9,256.205 ppb	19,164.925 ppb	82.388 %
Concentration per Run 2	87.603 %	96.369 %	0.012 ppb	105,888.864 ppb	8,228.782 ppb	24.190 ppb	8,564.590 ppb	19,049.515 ppb	88.183 %
Concentration per Run 3	85.489 %	88.128 %	0.013 ppb	116,965.815 ppb	8,649.163 ppb	18.970 ppb	9,134.471 ppb	18,916.294 ppb	82.644 %
Concentration RSD	1.4 %	4.5 %	28.4 %	6.3 %	3.6 %	13.5 %	4.1 %	0.7 %	3.9 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	86.515 %	30.627 ppb	0.313 ppb	0.391 ppb	86.739 ppb	48.995 ppb	0.366 ppb	0.579 ppb	11.979 ppb
Concentration per Run 1	88.458 %	32.812 ppb	0.406 ppb	0.528 ppb	88.976 ppb	50.374 ppb	0.438 ppb	0.529 ppb	12.432 ppb
Concentration per Run 2	86.243 %	31.296 ppb	0.192 ppb	0.363 ppb	85.457 ppb	44.879 ppb	0.208 ppb	0.746 ppb	10.760 ppb
Concentration per Run 3	84.844 %	27.772 ppb	0.342 ppb	0.282 ppb	85.784 ppb	51.732 ppb	0.451 ppb	0.463 ppb	12.744 ppb
Concentration RSD	2.1 %	8.4 %	35.1 %	32.0 %	2.2 %	7.4 %	37.4 %	25.6 %	8.9 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	25.655 ppb	87.623 %	0.235 ppb	0.939 ppb	101.200 ppb	0.478 ppb	82.784 %	0.027 ppb	0.009 ppb
Concentration per Run 1	27.163 ppb	89.132 %	0.443 ppb	1.180 ppb	98.341 ppb	0.473 ppb	83.113 %	0.020 ppb	0.021 ppb
Concentration per Run 2	23.866 ppb	90.048 %	0.170 ppb	1.569 ppb	99.359 ppb	0.432 ppb	83.679 %	0.028 ppb	0.009 ppb
Concentration per Run 3	25.935 ppb	83.689 %	0.091 ppb	0.068 ppb	105.902 ppb	0.529 ppb	81.559 %	0.034 ppb	-0.003 ppb
Concentration RSD	6.5 %	3.9 %	78.7 %	82.9 %	4.1 %	10.2 %	1.3 %	26.1 %	138.5 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	83.265 %	0.440 ppb	0.553 ppb	17.171 ppb	82.805 %	83.267 %	0.058 ppb	0.188 ppb	80.864 %
Concentration per Run 1	83.280 %	0.377 ppb	0.495 ppb	18.605 ppb	83.615 %	86.451 %	0.030 ppb	0.167 ppb	82.704 %
Concentration per Run 2	83.867 %	0.414 ppb	0.478 ppb	15.430 ppb	82.247 %	82.855 %	0.058 ppb	0.181 ppb	82.395 %
Concentration per Run 3	82.646 %	0.529 ppb	0.685 ppb	17.478 ppb	82.552 %	80.496 %	0.085 ppb	0.217 ppb	77.491 %
Concentration RSD	0.7 %	18.1 %	20.8 %	9.4 %	0.9 %	3.6 %	47.9 %	13.5 %	3.6 %

Alpha ICPMSQ Full

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Analysis index: 53 Analysis started at: 4/5/2017 10:50:52 AM Rack: 1
 Analysis label: L1710124-01 2008TL User name: ALPHALAB\metals-instrument Vial: 24

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	90.581 %	97.393 %	0.445 ppb	145,020.048 ppb	92,983.634 ppb	4,491.808 ppb	62,839.299 ppb	480,220.582 ppb	79.917 %
Concentration per Run 1	91.368 %	96.648 %	0.438 ppb	146,441.021 ppb	92,553.823 ppb	4,554.513 ppb	64,260.146 ppb	485,120.138 ppb	80.684 %
Concentration per Run 2	91.330 %	94.553 %	0.504 ppb	146,114.247 ppb	92,352.410 ppb	4,538.068 ppb	63,505.866 ppb	472,738.379 ppb	80.002 %
Concentration per Run 3	89.046 %	100.978 %	0.393 ppb	142,504.876 ppb	94,044.670 ppb	4,382.845 ppb	60,751.885 ppb	482,803.230 ppb	79.065 %
Concentration RSD	1.5 %	3.4 %	12.5 %	1.5 %	1.0 %	2.1 %	2.9 %	1.4 %	1.0 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	70.905 %	696.085 ppb	9.551 ppb	11.325 ppb	16,652.336 ppb	110,270.831 ppb	4.377 ppb	1.038 ppb	0.098 ppb
Concentration per Run 1	72.880 %	686.960 ppb	9.962 ppb	11.531 ppb	16,319.781 ppb	108,052.662 ppb	4.320 ppb	1.441 ppb	0.181 ppb
Concentration per Run 2	70.417 %	684.737 ppb	9.436 ppb	10.803 ppb	16,721.703 ppb	107,878.947 ppb	4.419 ppb	0.895 ppb	0.113 ppb
Concentration per Run 3	69.419 %	716.559 ppb	9.256 ppb	11.640 ppb	16,915.523 ppb	114,880.885 ppb	4.393 ppb	0.777 ppb	0.000 ppb
Concentration RSD	2.5 %	2.6 %	3.8 %	4.0 %	1.8 %	3.6 %	1.2 %	34.1 %	93.5 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	0.934 ppb	80.384 %	5.297 ppb	1.549 ppb	1,764.635 ppb	95.459 ppb	74.396 %	-0.023 ppb	0.024 ppb
Concentration per Run 1	0.721 ppb	80.841 %	5.516 ppb	1.251 ppb	1,784.932 ppb	95.335 ppb	75.130 %	-0.024 ppb	0.024 ppb
Concentration per Run 2	1.154 ppb	84.910 %	4.781 ppb	1.199 ppb	1,691.652 ppb	91.755 ppb	76.009 %	-0.024 ppb	0.024 ppb
Concentration per Run 3	0.926 ppb	75.399 %	5.593 ppb	2.198 ppb	1,817.321 ppb	99.286 ppb	72.047 %	-0.019 ppb	0.025 ppb
Concentration RSD	23.2 %	5.9 %	8.5 %	36.3 %	3.7 %	3.9 %	2.8 %	12.9 %	1.6 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	72.599 %	0.910 ppb	0.637 ppb	28.897 ppb	73.293 %	71.088 %	0.041 ppb	0.075 ppb	70.584 %
Concentration per Run 1	72.984 %	1.135 ppb	0.534 ppb	29.857 ppb	73.597 %	71.610 %	0.021 ppb	0.059 ppb	74.010 %
Concentration per Run 2	72.818 %	0.830 ppb	0.639 ppb	27.554 ppb	74.249 %	71.137 %	0.043 ppb	0.071 ppb	70.183 %
Concentration per Run 3	71.995 %	0.765 ppb	0.737 ppb	29.280 ppb	72.034 %	70.516 %	0.059 ppb	0.095 ppb	67.561 %
Concentration RSD	0.7 %	21.7 %	16.0 %	4.1 %	1.6 %	0.8 %	46.5 %	24.6 %	4.6 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 54 Analysis started at: 4/5/2017 10:54:16 AM Rack: 0
 Analysis label: CCV User name: ALPHALAB\metals-instrument Vial: 9

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	89.092 %	92.504 %	93.737 ppb	10,021.871 ppb	10,190.492 ppb	96.587 ppb	10,522.556 ppb	10,361.095 ppb	85.456 %
Concentration per Run 1	88.788 %	92.318 %	94.359 ppb	9,985.936 ppb	10,442.928 ppb	105.478 ppb	10,677.165 ppb	10,619.358 ppb	88.012 %
Concentration per Run 2	90.740 %	93.017 %	93.444 ppb	9,923.170 ppb	9,963.637 ppb	89.422 ppb	10,018.630 ppb	10,244.589 ppb	87.160 %
Concentration per Run 3	87.749 %	92.179 %	93.409 ppb	10,156.508 ppb	10,164.912 ppb	94.861 ppb	10,871.872 ppb	10,219.337 ppb	81.195 %
Recovery Percentage 1			93.737 %	100.219 %	101.905 %	96.587 %	105.226 %	103.611 %	
Concentration RSD	1.7 %	0.5 %	0.6 %	1.2 %	2.4 %	8.5 %	4.2 %	2.2 %	4.3 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	77.535 %	99.664 ppb	102.968 ppb	100.735 ppb	106.706 ppb	10,343.551 ppb	103.616 ppb	99.123 ppb	104.288 ppb
Concentration per Run 1	78.351 %	95.676 ppb	107.495 ppb	97.461 ppb	105.919 ppb	10,510.267 ppb	106.478 ppb	102.385 ppb	106.577 ppb
Concentration per Run 2	78.694 %	101.285 ppb	96.646 ppb	101.545 ppb	103.087 ppb	10,309.016 ppb	98.908 ppb	92.808 ppb	98.263 ppb
Concentration per Run 3	75.558 %	102.030 ppb	104.763 ppb	103.200 ppb	111.111 ppb	10,211.371 ppb	105.462 ppb	102.176 ppb	108.023 ppb
Recovery Percentage 1		99.664 %	102.968 %	100.735 %	106.706 %	103.436 %	103.616 %	99.123 %	104.288 %
Concentration RSD	2.2 %	3.5 %	5.5 %	2.9 %	3.8 %	1.5 %	4.0 %	5.5 %	5.1 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	105.274 ppb	81.669 %	105.546 ppb	104.810 ppb	103.858 ppb	100.833 ppb	82.771 %	100.280 ppb	104.027 ppb
Concentration per Run 1	110.766 ppb	79.665 %	110.166 ppb	104.801 ppb	108.262 ppb	101.817 ppb	83.311 %	99.113 ppb	101.537 ppb
Concentration per Run 2	99.931 ppb	85.807 %	100.428 ppb	100.876 ppb	98.657 ppb	101.692 ppb	84.667 %	99.284 ppb	101.516 ppb
Concentration per Run 3	105.124 ppb	79.536 %	106.044 ppb	108.752 ppb	104.654 ppb	98.990 ppb	80.334 %	102.443 ppb	109.029 ppb
Recovery Percentage 1	105.274 %		105.546 %	104.810 %	103.858 %	100.833 %		100.280 %	104.027 %
Concentration RSD	5.1 %	4.4 %	4.6 %	3.8 %	4.7 %	1.6 %	2.7 %	1.9 %	4.2 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	81.214 %	97.846 ppb	100.333 ppb	100.358 ppb	80.062 %	79.085 %	105.250 ppb	101.769 ppb	78.692 %
Concentration per Run 1	83.679 %	96.946 ppb	98.800 ppb	99.301 ppb	80.652 %	78.425 %	105.408 ppb	101.134 ppb	80.709 %
Concentration per Run 2	80.702 %	96.329 ppb	96.773 ppb	100.743 ppb	77.584 %	78.777 %	104.656 ppb	100.746 ppb	77.307 %
Concentration per Run 3	79.260 %	100.263 ppb	105.424 ppb	101.029 ppb	81.949 %	80.054 %	105.688 ppb	103.427 ppb	78.058 %
Recovery Percentage 1		97.846 %	100.333 %	100.358 %			105.250 %	101.769 %	
Concentration RSD	2.8 %	2.2 %	4.5 %	0.9 %	2.8 %	1.1 %	0.5 %	1.4 %	2.3 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 55 Analysis started at: 4/5/2017 10:57:41 AM Rack: 0
 Analysis label: CCB User name: ALPHALAB\metals-instrument Vial: 10

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	88.080 %	96.741 %	0.030 ppb	44.806 ppb	5.208 ppb	-0.111 ppb	41.298 ppb	24.366 ppb	82.672 %
Concentration per Run 1	88.110 %	97.346 %	0.007 ppb	47.126 ppb	5.604 ppb	-0.339 ppb	27.102 ppb	43.448 ppb	81.621 %
Concentration per Run 2	89.461 %	97.905 %	0.033 ppb	43.155 ppb	3.239 ppb	-0.344 ppb	43.873 ppb	30.729 ppb	82.217 %
Concentration per Run 3	86.670 %	94.972 %	0.050 ppb	44.135 ppb	6.781 ppb	0.349 ppb	52.917 ppb	-1.078 ppb	84.177 %
Recovery Percentage 1			5.971 %	44.806 %	7.440 %	-1.113 %	41.298 %	24.366 %	
Concentration RSD	1.6 %	1.6 %	71.1 %	4.6 %	34.6 %	358.3 %	31.7 %	94.1 %	1.6 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	76.209 %	0.222 ppb	0.091 ppb	0.026 ppb	0.557 ppb	12.060 ppb	0.027 ppb	0.009 ppb	0.012 ppb
Concentration per Run 1	78.085 %	0.192 ppb	0.068 ppb	-0.019 ppb	0.715 ppb	5.089 ppb	0.041 ppb	-0.047 ppb	0.049 ppb
Concentration per Run 2	75.703 %	0.096 ppb	0.138 ppb	-0.064 ppb	0.971 ppb	17.577 ppb	0.021 ppb	0.039 ppb	-0.005 ppb
Concentration per Run 3	74.839 %	0.376 ppb	0.067 ppb	0.161 ppb	-0.015 ppb	13.514 ppb	0.019 ppb	0.036 ppb	-0.007 ppb
Recovery Percentage 1		44.303 %	1.820 %	2.567 %	55.668 %	24.120 %	5.431 %	0.463 %	1.235 %
Concentration RSD	2.2 %	64.1 %	44.7 %	463.5 %	91.9 %	52.8 %	44.9 %	528.8 %	256.3 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	-0.528 ppb	85.639 %	0.105 ppb	0.520 ppb	0.131 ppb	0.745 ppb	85.845 %	0.073 ppb	0.017 ppb
Concentration per Run 1	-0.415 ppb	89.386 %	0.037 ppb	0.937 ppb	0.174 ppb	0.569 ppb	86.682 %	0.058 ppb	0.021 ppb
Concentration per Run 2	-0.545 ppb	81.757 %	0.192 ppb	0.625 ppb	0.067 ppb	0.786 ppb	84.830 %	0.089 ppb	-0.003 ppb
Concentration per Run 3	-0.625 ppb	85.775 %	0.087 ppb	-0.002 ppb	0.151 ppb	0.880 ppb	86.024 %	0.071 ppb	0.034 ppb
Recovery Percentage 1	-5.281 %	85.639 %	21.076 %	10.403 %	26.151 %	37.243 %		18.200 %	8.558 %
Concentration RSD	20.1 %	4.5 %	75.1 %	91.9 %	43.1 %	21.4 %	1.1 %	21.4 %	109.6 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	80.627 %	0.707 ppb	3.352 ppb	0.024 ppb	81.654 %	79.552 %	0.065 ppb	0.062 ppb	82.832 %
Concentration per Run 1	80.032 %	0.618 ppb	3.162 ppb	-0.053 ppb	83.498 %	77.581 %	0.047 ppb	0.062 ppb	82.996 %
Concentration per Run 2	81.949 %	0.685 ppb	3.455 ppb	0.045 ppb	80.980 %	81.604 %	0.069 ppb	0.069 ppb	81.952 %
Concentration per Run 3	79.902 %	0.817 ppb	3.439 ppb	0.080 ppb	80.485 %	79.471 %	0.078 ppb	0.054 ppb	83.547 %
Recovery Percentage 1		23.559 %	83.796 %	4.847 %			12.920 %	12.326 %	82.832 %
Concentration RSD	1.4 %	14.3 %	4.9 %	283.5 %	2.0 %	2.5 %	24.8 %	12.0 %	1.0 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 56 Analysis started at: 4/5/2017 11:02:54 AM Rack: 1
 Analysis label: WG990559-1 6020SL User name: ALPHALAB\metals-instrument Vial: 33

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	91.187 %	96.508 %	0.009 ppb	56.939 ppb	0.900 ppb	0.795 ppb	36.180 ppb	9.554 ppb	83.411 %
Concentration per Run 1	90.745 %	91.760 %	0.017 ppb	63.417 ppb	-0.197 ppb	0.153 ppb	43.176 ppb	11.916 ppb	82.132 %
Concentration per Run 2	91.922 %	98.743 %	0.007 ppb	56.019 ppb	1.987 ppb	0.972 ppb	38.499 ppb	11.088 ppb	86.564 %
Concentration per Run 3	90.895 %	99.022 %	0.002 ppb	51.381 ppb	0.911 ppb	1.259 ppb	26.864 ppb	5.658 ppb	81.536 %
Concentration RSD	0.7 %	4.3 %	88.4 %	10.7 %	121.3 %	72.2 %	23.2 %	35.6 %	3.3 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	80.472 %	0.129 ppb	0.088 ppb	0.010 ppb	-0.183 ppb	7.508 ppb	0.018 ppb	0.120 ppb	0.599 ppb
Concentration per Run 1	80.548 %	0.192 ppb	0.068 ppb	0.028 ppb	-0.081 ppb	8.658 ppb	-0.025 ppb	0.206 ppb	0.701 ppb
Concentration per Run 2	81.229 %	0.000 ppb	0.196 ppb	0.020 ppb	-0.167 ppb	3.244 ppb	0.105 ppb	0.115 ppb	0.619 ppb
Concentration per Run 3	79.638 %	0.194 ppb	0.000 ppb	-0.017 ppb	-0.300 ppb	10.624 ppb	-0.025 ppb	0.039 ppb	0.479 ppb
Concentration RSD	1.0 %	86.6 %	112.8 %	230.3 %	60.3 %	50.9 %	410.6 %	69.6 %	18.7 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	0.788 ppb	85.029 %	0.026 ppb	0.422 ppb	0.027 ppb	0.261 ppb	82.811 %	0.000 ppb	0.001 ppb
Concentration per Run 1	0.732 ppb	85.266 %	-0.053 ppb	0.286 ppb	0.052 ppb	0.213 ppb	81.461 %	0.017 ppb	-0.003 ppb
Concentration per Run 2	0.899 ppb	87.351 %	0.039 ppb	0.493 ppb	-0.023 ppb	0.397 ppb	83.747 %	-0.011 ppb	-0.003 ppb
Concentration per Run 3	0.734 ppb	82.469 %	0.093 ppb	0.486 ppb	0.053 ppb	0.173 ppb	83.226 %	-0.006 ppb	0.009 ppb
Concentration RSD	12.2 %	2.9 %	280.2 %	27.9 %	160.2 %	45.8 %	1.4 %	4,224.0 %	820.4 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	79.297 %	0.340 ppb	1.680 ppb	-0.041 ppb	80.192 %	79.990 %	0.022 ppb	0.024 ppb	83.494 %
Concentration per Run 1	78.585 %	0.350 ppb	1.890 ppb	-0.019 ppb	79.111 %	78.305 %	0.013 ppb	0.029 ppb	84.969 %
Concentration per Run 2	81.871 %	0.345 ppb	1.863 ppb	-0.053 ppb	81.341 %	82.721 %	0.027 ppb	0.016 ppb	83.151 %
Concentration per Run 3	77.435 %	0.327 ppb	1.287 ppb	-0.053 ppb	80.124 %	78.944 %	0.027 ppb	0.027 ppb	82.364 %
Concentration RSD	2.9 %	3.5 %	20.3 %	47.1 %	1.4 %	3.0 %	35.0 %	30.0 %	1.6 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 57 Analysis started at: 4/5/2017 11:06:17 AM Rack: 1
 Analysis label: WG990559-2D5 6020SL User name: ALPHALAB\metals-instrument Vial: 34

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	90.345 %	91.247 %	9.605 ppb	2,184.141 ppb	2,202.573 ppb	432.666 ppb	2,179.339 ppb	2,229.437 ppb	83.581 %
Concentration per Run 1	91.469 %	92.039 %	9.572 ppb	2,163.699 ppb	2,083.778 ppb	446.195 ppb	2,199.910 ppb	2,204.539 ppb	82.729 %
Concentration per Run 2	91.250 %	84.217 %	9.655 ppb	2,339.860 ppb	2,310.865 ppb	428.193 ppb	2,158.419 ppb	2,206.175 ppb	83.155 %
Concentration per Run 3	88.315 %	97.486 %	9.589 ppb	2,048.864 ppb	2,213.077 ppb	423.612 ppb	2,179.689 ppb	2,277.596 ppb	84.859 %
Concentration RSD	1.9 %	7.3 %	0.5 %	6.7 %	5.2 %	2.8 %	1.0 %	1.9 %	1.3 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	82.253 %	179.514 ppb	105.083 ppb	41.872 ppb	110.719 ppb	228.828 ppb	103.134 ppb	106.052 ppb	54.554 ppb
Concentration per Run 1	82.448 %	190.914 ppb	107.285 ppb	41.995 ppb	111.860 ppb	243.912 ppb	101.139 ppb	102.868 ppb	50.810 ppb
Concentration per Run 2	82.166 %	172.841 ppb	108.022 ppb	42.342 ppb	113.305 ppb	239.013 ppb	105.113 ppb	110.283 ppb	57.162 ppb
Concentration per Run 3	82.145 %	174.788 ppb	99.941 ppb	41.278 ppb	106.993 ppb	203.558 ppb	103.150 ppb	105.005 ppb	55.691 ppb
Concentration RSD	0.2 %	5.5 %	4.3 %	1.3 %	3.0 %	9.6 %	1.9 %	3.6 %	6.1 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	105.759 ppb	84.517 %	25.342 ppb	24.718 ppb	211.158 ppb	196.315 ppb	82.855 %	10.274 ppb	11.103 ppb
Concentration per Run 1	101.990 ppb	88.231 %	24.275 ppb	22.274 ppb	207.860 ppb	196.585 ppb	82.070 %	10.211 ppb	11.686 ppb
Concentration per Run 2	105.823 ppb	81.796 %	26.525 ppb	25.927 ppb	214.552 ppb	192.813 ppb	85.535 %	9.846 ppb	10.778 ppb
Concentration per Run 3	109.463 ppb	83.525 %	25.226 ppb	25.953 ppb	211.062 ppb	199.546 ppb	80.959 %	10.764 ppb	10.844 ppb
Concentration RSD	3.5 %	3.9 %	4.5 %	8.6 %	1.6 %	1.7 %	2.9 %	4.5 %	4.6 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	82.460 %	203.492 ppb	105.392 ppb	410.000 ppb	82.357 %	79.703 %	24.689 ppb	107.087 ppb	83.335 %
Concentration per Run 1	84.332 %	199.398 ppb	106.275 ppb	416.512 ppb	81.891 %	78.299 %	24.399 ppb	106.938 ppb	83.995 %
Concentration per Run 2	81.806 %	203.847 ppb	105.105 ppb	405.690 ppb	81.793 %	79.635 %	24.836 ppb	105.463 ppb	84.627 %
Concentration per Run 3	81.240 %	207.230 ppb	104.795 ppb	407.799 ppb	83.388 %	81.177 %	24.833 ppb	108.859 ppb	81.384 %
Concentration RSD	2.0 %	1.9 %	0.7 %	1.4 %	1.1 %	1.8 %	1.0 %	1.6 %	2.1 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 58 Analysis started at: 4/5/2017 11:09:39 AM Rack: 1
 Analysis label: WG987527-4D2 A2-6020T User name: ALPHALAB\metals-instrument Vial: 32

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	95.082 %	101.769 %	3.180 ppb	32,571.322 ppb	35,446.019 ppb	66,577.728 ppb	11,504.984 ppb	17,068.829 ppb	82.161 %
Concentration per Run 1	95.275 %	104.330 %	3.321 ppb	32,222.588 ppb	34,791.785 ppb	64,865.749 ppb	11,034.377 ppb	16,095.017 ppb	85.626 %
Concentration per Run 2	95.430 %	100.838 %	3.040 ppb	33,554.849 ppb	36,750.925 ppb	69,500.066 ppb	12,608.426 ppb	18,562.152 ppb	76.252 %
Concentration per Run 3	94.540 %	100.140 %	3.178 ppb	31,936.527 ppb	34,795.346 ppb	65,367.370 ppb	10,872.149 ppb	16,549.318 ppb	84.604 %
Concentration RSD	0.5 %	2.2 %	4.4 %	2.7 %	3.2 %	3.8 %	8.3 %	7.7 %	6.3 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	74.879 %	2,279.864 ppb	348.335 ppb	238.345 ppb	3,145.124 ppb	157,991.510 ppb	50.523 ppb	112.066 ppb	324.873 ppb
Concentration per Run 1	75.380 %	2,149.706 ppb	325.694 ppb	223.610 ppb	3,047.060 ppb	153,947.385 ppb	49.480 ppb	110.924 ppb	311.420 ppb
Concentration per Run 2	76.547 %	2,443.568 ppb	376.331 ppb	251.306 ppb	3,312.514 ppb	168,907.257 ppb	52.537 ppb	113.546 ppb	338.325 ppb
Concentration per Run 3	72.711 %	2,246.318 ppb	342.978 ppb	240.118 ppb	3,075.799 ppb	151,119.886 ppb	49.550 ppb	111.728 ppb	324.875 ppb
Concentration RSD	2.6 %	6.6 %	7.4 %	5.8 %	4.6 %	6.0 %	3.5 %	1.2 %	4.1 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	617.952 ppb	79.271 %	97.122 ppb	7.882 ppb	212.607 ppb	18.679 ppb	77.228 %	4.693 ppb	0.787 ppb
Concentration per Run 1	588.926 ppb	82.636 %	94.641 ppb	10.898 ppb	207.553 ppb	18.802 ppb	81.021 %	4.710 ppb	0.836 ppb
Concentration per Run 2	659.251 ppb	76.431 %	99.237 ppb	6.871 ppb	219.264 ppb	18.352 ppb	75.951 %	4.420 ppb	0.685 ppb
Concentration per Run 3	605.677 ppb	78.747 %	97.488 ppb	5.876 ppb	211.006 ppb	18.883 ppb	74.711 %	4.950 ppb	0.838 ppb
Concentration RSD	5.9 %	4.0 %	2.4 %	33.7 %	2.8 %	1.5 %	4.3 %	5.7 %	11.2 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	76.682 %	30.131 ppb	10.453 ppb	134.511 ppb	73.946 %	72.041 %	0.558 ppb	490.716 ppb	83.393 %
Concentration per Run 1	80.047 %	28.523 ppb	10.819 ppb	129.076 ppb	75.894 %	72.306 %	0.500 ppb	467.532 ppb	86.715 %
Concentration per Run 2	76.099 %	31.022 ppb	10.304 ppb	135.242 ppb	72.814 %	71.411 %	0.589 ppb	492.153 ppb	83.715 %
Concentration per Run 3	73.901 %	30.848 ppb	10.235 ppb	139.217 ppb	73.131 %	72.405 %	0.587 ppb	512.464 ppb	79.749 %
Concentration RSD	4.1 %	4.6 %	3.1 %	3.8 %	2.3 %	0.8 %	9.1 %	4.6 %	4.2 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 59 Analysis started at: 4/5/2017 11:13:02 AM Rack: 1
 Analysis label: L1708560-02D2 A2-6020T User name: ALPHALAB\metals-instrument Vial: 31

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	93.935 %	100.186 %	2.863 ppb	37,864.405 ppb	33,970.811 ppb	61,684.435 ppb	13,162.830 ppb	13,154.415 ppb	82.473 %
Concentration per Run 1	95.651 %	101.117 %	2.814 ppb	37,029.860 ppb	32,757.046 ppb	59,565.863 ppb	13,084.741 ppb	12,891.105 ppb	83.581 %
Concentration per Run 2	93.030 %	100.698 %	2.871 ppb	38,557.309 ppb	35,373.153 ppb	64,443.115 ppb	13,287.037 ppb	13,788.590 ppb	78.639 %
Concentration per Run 3	93.126 %	98.743 %	2.904 ppb	38,006.048 ppb	33,782.234 ppb	61,044.326 ppb	13,116.713 ppb	12,783.551 ppb	85.200 %
Concentration RSD	1.6 %	1.3 %	1.6 %	2.0 %	3.9 %	4.1 %	0.8 %	4.2 %	4.1 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	76.047 %	2,612.874 ppb	351.078 ppb	284.847 ppb	1,960.330 ppb	136,484.822 ppb	44.686 ppb	124.359 ppb	364.127 ppb
Concentration per Run 1	78.338 %	2,462.747 ppb	335.275 ppb	276.557 ppb	1,858.315 ppb	130,916.345 ppb	42.503 ppb	120.712 ppb	350.690 ppb
Concentration per Run 2	75.069 %	2,835.278 ppb	374.649 ppb	294.312 ppb	2,132.470 ppb	147,524.546 ppb	47.120 ppb	133.816 ppb	399.655 ppb
Concentration per Run 3	74.735 %	2,540.597 ppb	343.310 ppb	283.674 ppb	1,890.207 ppb	131,013.574 ppb	44.434 ppb	118.549 ppb	342.037 ppb
Concentration RSD	2.6 %	7.5 %	5.9 %	3.1 %	7.6 %	7.0 %	5.2 %	6.6 %	8.5 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	680.376 ppb	77.310 %	68.591 ppb	10.046 ppb	210.539 ppb	15.284 ppb	78.493 %	4.735 ppb	1.031 ppb
Concentration per Run 1	642.583 ppb	78.735 %	67.885 ppb	10.959 ppb	205.592 ppb	14.309 ppb	82.309 %	4.416 ppb	0.946 ppb
Concentration per Run 2	741.034 ppb	73.114 %	73.003 ppb	10.570 ppb	221.675 ppb	16.203 ppb	76.288 %	4.928 ppb	1.165 ppb
Concentration per Run 3	657.510 ppb	80.081 %	64.884 ppb	8.609 ppb	204.350 ppb	15.339 ppb	76.882 %	4.861 ppb	0.982 ppb
Concentration RSD	7.8 %	4.8 %	6.0 %	12.5 %	4.6 %	6.2 %	4.2 %	5.9 %	11.4 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	73.946 %	34.453 ppb	3.887 ppb	160.148 ppb	74.547 %	70.758 %	0.686 ppb	532.474 ppb	80.409 %
Concentration per Run 1	76.655 %	31.852 ppb	3.246 ppb	152.888 ppb	78.393 %	72.414 %	0.642 ppb	503.116 ppb	82.871 %
Concentration per Run 2	71.754 %	36.259 ppb	4.488 ppb	167.273 ppb	72.509 %	69.114 %	0.709 ppb	543.820 ppb	80.284 %
Concentration per Run 3	73.429 %	35.248 ppb	3.927 ppb	160.282 ppb	72.741 %	70.746 %	0.707 ppb	550.486 ppb	78.073 %
Concentration RSD	3.4 %	6.7 %	16.0 %	4.5 %	4.5 %	2.3 %	5.5 %	4.8 %	3.0 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 60 Analysis started at: 4/5/2017 11:16:23 AM Rack: 1
 Analysis label: WG990559-5D10 6020SL User name: ALPHALAB\metals-instrument Vial: 36

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	88.124 %	96.229 %	50.894 ppb	11,639.801 ppb	6,249.282 ppb	62.421 ppb	5,837.649 ppb	17,721.419 ppb	86.081 %
Concentration per Run 1	88.064 %	99.721 %	50.151 ppb	11,543.091 ppb	6,226.580 ppb	66.297 ppb	5,805.143 ppb	17,560.434 ppb	84.944 %
Concentration per Run 2	89.952 %	94.413 %	51.022 ppb	11,823.381 ppb	6,021.925 ppb	60.994 ppb	5,795.690 ppb	17,648.826 ppb	85.626 %
Concentration per Run 3	86.356 %	94.553 %	51.510 ppb	11,552.932 ppb	6,499.340 ppb	59.972 ppb	5,912.114 ppb	17,954.997 ppb	87.671 %
Concentration RSD	2.0 %	3.1 %	1.4 %	1.4 %	3.8 %	5.4 %	1.1 %	1.2 %	1.6 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	79.539 %	70.887 ppb	52.675 ppb	51.716 ppb	224.044 ppb	5,435.521 ppb	54.689 ppb	52.760 ppb	54.655 ppb
Concentration per Run 1	81.446 %	75.402 ppb	53.029 ppb	54.544 ppb	228.875 ppb	5,820.132 ppb	55.577 ppb	52.362 ppb	58.840 ppb
Concentration per Run 2	79.803 %	71.965 ppb	51.662 ppb	50.022 ppb	221.771 ppb	5,385.867 ppb	54.330 ppb	52.144 ppb	50.310 ppb
Concentration per Run 3	77.369 %	65.295 ppb	53.335 ppb	50.582 ppb	221.486 ppb	5,100.566 ppb	54.161 ppb	53.773 ppb	54.816 ppb
Concentration RSD	2.6 %	7.2 %	1.7 %	4.8 %	1.9 %	6.7 %	1.4 %	1.7 %	7.8 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	56.448 ppb	84.929 %	55.435 ppb	52.373 ppb	124.068 ppb	53.327 ppb	84.737 %	25.941 ppb	54.220 ppb
Concentration per Run 1	60.010 ppb	84.811 %	57.092 ppb	50.349 ppb	129.728 ppb	52.430 ppb	85.628 %	26.055 ppb	55.260 ppb
Concentration per Run 2	53.608 ppb	86.170 %	52.494 ppb	56.119 ppb	121.383 ppb	54.309 ppb	85.797 %	24.840 ppb	52.641 ppb
Concentration per Run 3	55.727 ppb	83.806 %	56.720 ppb	50.650 ppb	121.093 ppb	53.243 ppb	82.786 %	26.929 ppb	54.757 ppb
Concentration RSD	5.8 %	1.4 %	4.6 %	6.2 %	4.0 %	1.8 %	2.0 %	4.0 %	2.6 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	83.909 %	53.256 ppb	62.422 ppb	63.173 ppb	83.578 %	81.814 %	54.443 ppb	54.300 ppb	80.960 %
Concentration per Run 1	84.094 %	52.529 ppb	62.617 ppb	64.598 ppb	85.194 %	83.806 %	54.437 ppb	55.386 ppb	81.567 %
Concentration per Run 2	84.292 %	52.963 ppb	62.561 ppb	64.174 ppb	81.640 %	79.090 %	55.624 ppb	53.417 ppb	81.901 %
Concentration per Run 3	83.340 %	54.276 ppb	62.089 ppb	60.747 ppb	83.901 %	82.544 %	53.267 ppb	54.098 ppb	79.413 %
Concentration RSD	0.6 %	1.7 %	0.5 %	3.3 %	2.2 %	3.0 %	2.2 %	1.8 %	1.7 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 61 Analysis started at: 4/5/2017 11:19:47 AM Rack: 1
 Analysis label: WG990559-3D10 6020SL User name: ALPHALAB\metals-instrument Vial: 35

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	88.774 %	93.110 %	5.063 ppb	7,706.414 ppb	2,229.922 ppb	210.994 ppb	1,676.251 ppb	13,854.901 ppb	83.212 %
Concentration per Run 1	90.039 %	98.883 %	5.197 ppb	7,587.904 ppb	2,061.165 ppb	210.086 ppb	1,639.836 ppb	14,439.580 ppb	81.365 %
Concentration per Run 2	89.303 %	92.458 %	4.835 ppb	7,449.662 ppb	2,147.322 ppb	206.398 ppb	1,652.749 ppb	13,018.815 ppb	85.967 %
Concentration per Run 3	86.979 %	87.989 %	5.156 ppb	8,081.677 ppb	2,481.279 ppb	216.497 ppb	1,736.169 ppb	14,106.308 ppb	82.303 %
Concentration RSD	1.8 %	5.9 %	3.9 %	4.3 %	10.0 %	2.4 %	3.1 %	5.4 %	2.9 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	78.818 %	109.286 ppb	54.963 ppb	20.367 ppb	231.944 ppb	114.055 ppb	49.424 ppb	52.699 ppb	26.342 ppb
Concentration per Run 1	81.200 %	110.956 ppb	58.193 ppb	20.898 ppb	227.729 ppb	129.413 ppb	49.308 ppb	51.752 ppb	25.009 ppb
Concentration per Run 2	77.874 %	101.740 ppb	53.481 ppb	20.568 ppb	240.468 ppb	98.284 ppb	49.432 ppb	55.519 ppb	27.866 ppb
Concentration per Run 3	77.379 %	115.162 ppb	53.216 ppb	19.636 ppb	227.633 ppb	114.467 ppb	49.533 ppb	50.827 ppb	26.150 ppb
Concentration RSD	2.6 %	6.3 %	5.1 %	3.2 %	3.2 %	13.7 %	0.2 %	4.7 %	5.5 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	53.764 ppb	87.247 %	13.237 ppb	11.358 ppb	170.314 ppb	97.139 ppb	84.710 %	5.033 ppb	6.010 ppb
Concentration per Run 1	49.857 ppb	90.353 %	13.560 ppb	12.003 ppb	173.335 ppb	93.567 ppb	84.055 %	5.162 ppb	6.097 ppb
Concentration per Run 2	56.657 ppb	85.610 %	13.112 ppb	9.970 ppb	169.025 ppb	99.703 ppb	84.933 %	4.963 ppb	6.039 ppb
Concentration per Run 3	54.779 ppb	85.778 %	13.040 ppb	12.102 ppb	168.582 ppb	98.146 ppb	85.141 %	4.973 ppb	5.894 ppb
Concentration RSD	6.5 %	3.1 %	2.1 %	10.6 %	1.5 %	3.3 %	0.7 %	2.2 %	1.7 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	81.935 %	104.699 ppb	56.303 ppb	219.577 ppb	81.854 %	82.621 %	12.783 ppb	53.989 ppb	83.097 %
Concentration per Run 1	81.050 %	107.577 ppb	58.765 ppb	217.234 ppb	85.137 %	83.032 %	12.838 ppb	53.842 ppb	84.842 %
Concentration per Run 2	81.286 %	103.411 ppb	56.187 ppb	221.179 ppb	80.565 %	82.008 %	12.237 ppb	53.456 ppb	82.494 %
Concentration per Run 3	83.468 %	103.108 ppb	53.958 ppb	220.318 ppb	79.860 %	82.824 %	13.275 ppb	54.669 ppb	81.956 %
Concentration RSD	1.6 %	2.4 %	4.3 %	0.9 %	3.5 %	0.7 %	4.1 %	1.1 %	1.8 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 62 Analysis started at: 4/5/2017 11:23:10 AM Rack: 1
 Analysis label: WG990559-6D5 6020SL User name: ALPHALAB\metals-instrument Vial: 37

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	86.841 %	91.108 %	0.004 ppb	13,894.451 ppb	2,408.060 ppb	3.830 ppb	1,259.711 ppb	26,927.952 ppb	81.309 %
Concentration per Run 1	88.560 %	94.413 %	0.002 ppb	13,305.085 ppb	2,352.730 ppb	3.806 ppb	1,173.359 ppb	25,627.871 ppb	84.518 %
Concentration per Run 2	86.946 %	93.296 %	0.002 ppb	14,239.449 ppb	2,498.174 ppb	4.811 ppb	1,347.948 ppb	28,815.915 ppb	76.593 %
Concentration per Run 3	85.017 %	85.614 %	0.008 ppb	14,138.819 ppb	2,373.275 ppb	2.873 ppb	1,257.825 ppb	26,340.070 ppb	82.814 %
Concentration RSD	2.0 %	5.3 %	78.6 %	3.7 %	3.3 %	25.3 %	6.9 %	6.2 %	5.1 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	78.752 %	37.738 ppb	0.191 ppb	0.013 ppb	357.797 ppb	14.204 ppb	0.296 ppb	1.311 ppb	0.704 ppb
Concentration per Run 1	79.192 %	37.660 ppb	0.000 ppb	0.113 ppb	342.055 ppb	10.014 ppb	0.348 ppb	0.940 ppb	0.509 ppb
Concentration per Run 2	78.765 %	38.545 ppb	0.365 ppb	-0.011 ppb	379.246 ppb	14.846 ppb	0.262 ppb	1.382 ppb	0.618 ppb
Concentration per Run 3	78.299 %	37.007 ppb	0.207 ppb	-0.064 ppb	352.088 ppb	17.753 ppb	0.277 ppb	1.612 ppb	0.985 ppb
Concentration RSD	0.6 %	2.0 %	96.0 %	711.8 %	5.4 %	27.5 %	15.6 %	26.0 %	35.4 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	5.429 ppb	82.685 %	0.124 ppb	0.315 ppb	139.519 ppb	0.945 ppb	83.941 %	-0.004 ppb	0.070 ppb
Concentration per Run 1	4.986 ppb	87.289 %	0.131 ppb	0.637 ppb	136.477 ppb	0.742 ppb	83.439 %	-0.003 ppb	0.068 ppb
Concentration per Run 2	5.596 ppb	81.502 %	0.193 ppb	0.314 ppb	139.911 ppb	1.051 ppb	85.282 %	-0.011 ppb	0.083 ppb
Concentration per Run 3	5.704 ppb	79.265 %	0.048 ppb	-0.006 ppb	142.170 ppb	1.041 ppb	83.103 %	0.002 ppb	0.058 ppb
Concentration RSD	7.1 %	5.0 %	58.5 %	102.0 %	2.1 %	18.6 %	1.4 %	174.3 %	17.9 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	82.393 %	1.175 ppb	2.165 ppb	21.810 ppb	81.133 %	79.346 %	0.024 ppb	0.134 ppb	82.811 %
Concentration per Run 1	84.597 %	1.137 ppb	1.731 ppb	20.946 ppb	82.679 %	80.694 %	0.013 ppb	0.154 ppb	83.419 %
Concentration per Run 2	80.426 %	1.212 ppb	2.634 ppb	21.103 ppb	82.090 %	80.704 %	0.018 ppb	0.133 ppb	84.095 %
Concentration per Run 3	82.156 %	1.176 ppb	2.132 ppb	23.380 ppb	78.629 %	76.641 %	0.042 ppb	0.116 ppb	80.919 %
Concentration RSD	2.5 %	3.2 %	20.9 %	6.2 %	2.7 %	3.0 %	64.4 %	14.3 %	2.0 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 63 Analysis started at: 4/5/2017 11:26:30 AM Rack: 1
 Analysis label: WG990559-4 6020SL User name: ALPHALAB\metals-instrument Vial: 38

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	82.903 %	85.428 %	0.004 ppb	71,601.850 ppb	11,651.529 ppb	185.175 ppb	6,169.697 ppb	132,865.592 ppb	78.070 %
Concentration per Run 1	83.493 %	84.636 %	0.013 ppb	73,995.980 ppb	11,834.569 ppb	191.695 ppb	6,395.666 ppb	136,606.900 ppb	76.593 %
Concentration per Run 2	82.966 %	83.379 %	0.003 ppb	72,816.039 ppb	12,060.953 ppb	195.289 ppb	6,284.430 ppb	136,498.440 ppb	75.912 %
Concentration per Run 3	82.251 %	88.268 %	-0.003 ppb	67,993.532 ppb	11,059.066 ppb	168.540 ppb	5,828.994 ppb	125,491.436 ppb	81.706 %
Concentration RSD	0.8 %	3.0 %	193.5 %	4.4 %	4.5 %	7.8 %	4.9 %	4.8 %	4.1 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	75.338 %	197.317 ppb	0.964 ppb	0.191 ppb	1,801.195 ppb	34.091 ppb	1.686 ppb	4.602 ppb	4.215 ppb
Concentration per Run 1	75.526 %	207.040 ppb	1.167 ppb	0.186 ppb	1,871.650 ppb	18.465 ppb	1.264 ppb	5.041 ppb	4.214 ppb
Concentration per Run 2	74.498 %	201.141 ppb	0.951 ppb	0.162 ppb	1,761.068 ppb	40.152 ppb	1.828 ppb	4.125 ppb	3.680 ppb
Concentration per Run 3	75.989 %	183.771 ppb	0.775 ppb	0.224 ppb	1,770.866 ppb	43.657 ppb	1.966 ppb	4.640 ppb	4.750 ppb
Concentration RSD	1.0 %	6.1 %	20.4 %	16.5 %	3.4 %	40.0 %	22.1 %	10.0 %	12.7 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	25.768 ppb	80.061 %	0.623 ppb	2.811 ppb	718.382 ppb	2.007 ppb	76.991 %	-0.007 ppb	0.282 ppb
Concentration per Run 1	25.591 ppb	81.655 %	0.291 ppb	2.208 ppb	706.915 ppb	2.346 ppb	78.082 %	-0.024 ppb	0.347 ppb
Concentration per Run 2	24.696 ppb	83.130 %	0.673 ppb	3.864 ppb	715.470 ppb	1.924 ppb	76.011 %	-0.010 ppb	0.263 ppb
Concentration per Run 3	27.016 ppb	75.399 %	0.904 ppb	2.360 ppb	732.761 ppb	1.751 ppb	76.880 %	0.014 ppb	0.235 ppb
Concentration RSD	4.5 %	5.1 %	49.7 %	32.6 %	1.8 %	15.2 %	1.4 %	284.1 %	20.6 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	76.189 %	1.609 ppb	2.284 ppb	112.427 ppb	77.746 %	77.493 %	0.034 ppb	0.386 ppb	78.481 %
Concentration per Run 1	77.496 %	1.537 ppb	1.915 ppb	113.485 ppb	78.444 %	78.576 %	0.034 ppb	0.369 ppb	79.982 %
Concentration per Run 2	75.412 %	1.593 ppb	2.431 ppb	111.164 ppb	78.856 %	79.376 %	0.032 ppb	0.383 ppb	79.291 %
Concentration per Run 3	75.659 %	1.696 ppb	2.505 ppb	112.631 ppb	75.938 %	74.525 %	0.036 ppb	0.406 ppb	76.169 %
Concentration RSD	1.5 %	5.0 %	14.1 %	1.0 %	2.0 %	3.4 %	5.9 %	4.9 %	2.6 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 64 Analysis started at: 4/5/2017 11:29:51 AM Rack: 1
 Analysis label: L1709643-01 6020SL User name: ALPHALAB\metals-instrument Vial: 39

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	83.684 %	93.529 %	0.004 ppb	68,709.016 ppb	11,009.925 ppb	17.595 ppb	5,811.135 ppb	129,464.579 ppb	81.848 %
Concentration per Run 1	84.576 %	88.128 %	0.002 ppb	74,312.603 ppb	12,010.735 ppb	16.374 ppb	6,355.972 ppb	142,692.454 ppb	75.571 %
Concentration per Run 2	83.759 %	98.743 %	0.002 ppb	64,626.514 ppb	10,602.430 ppb	17.124 ppb	5,499.799 ppb	125,289.207 ppb	83.325 %
Concentration per Run 3	82.717 %	93.715 %	0.008 ppb	67,187.931 ppb	10,416.608 ppb	19.286 ppb	5,577.634 ppb	120,412.076 ppb	86.649 %
Concentration RSD	1.1 %	5.7 %	75.1 %	7.3 %	7.9 %	8.6 %	8.1 %	9.0 %	6.9 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	73.875 %	185.440 ppb	0.951 ppb	0.123 ppb	1,718.779 ppb	26.465 ppb	1.745 ppb	4.910 ppb	3.712 ppb
Concentration per Run 1	75.039 %	195.175 ppb	1.116 ppb	0.117 ppb	1,823.389 ppb	26.519 ppb	2.260 ppb	5.379 ppb	3.725 ppb
Concentration per Run 2	73.054 %	185.817 ppb	0.748 ppb	0.050 ppb	1,713.161 ppb	32.701 ppb	1.356 ppb	5.894 ppb	4.347 ppb
Concentration per Run 3	73.533 %	175.328 ppb	0.989 ppb	0.201 ppb	1,619.787 ppb	20.174 ppb	1.620 ppb	3.457 ppb	3.064 ppb
Concentration RSD	1.4 %	5.4 %	19.7 %	61.7 %	5.9 %	23.7 %	26.6 %	26.2 %	17.3 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	24.838 ppb	81.452 %	0.604 ppb	3.016 ppb	718.751 ppb	2.078 ppb	77.528 %	-0.020 ppb	0.283 ppb
Concentration per Run 1	25.245 ppb	78.095 %	0.564 ppb	2.638 ppb	757.736 ppb	2.542 ppb	76.301 %	-0.020 ppb	0.328 ppb
Concentration per Run 2	24.037 ppb	83.283 %	0.526 ppb	2.834 ppb	704.096 ppb	1.922 ppb	78.339 %	-0.020 ppb	0.299 ppb
Concentration per Run 3	25.232 ppb	82.977 %	0.722 ppb	3.576 ppb	694.421 ppb	1.769 ppb	77.945 %	-0.020 ppb	0.222 ppb
Concentration RSD	2.8 %	3.6 %	17.2 %	16.4 %	4.7 %	19.7 %	1.4 %	0.5 %	19.4 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	77.315 %	1.815 ppb	1.774 ppb	113.867 ppb	77.417 %	76.916 %	0.030 ppb	0.345 ppb	77.773 %
Concentration per Run 1	75.875 %	1.872 ppb	1.581 ppb	119.538 ppb	73.283 %	75.538 %	0.030 ppb	0.329 ppb	77.115 %
Concentration per Run 2	80.862 %	1.662 ppb	1.522 ppb	106.620 ppb	80.924 %	77.232 %	0.024 ppb	0.365 ppb	78.562 %
Concentration per Run 3	75.208 %	1.910 ppb	2.221 ppb	115.442 ppb	78.044 %	77.977 %	0.036 ppb	0.341 ppb	77.643 %
Concentration RSD	4.0 %	7.4 %	21.9 %	5.8 %	5.0 %	1.6 %	19.3 %	5.4 %	0.9 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 65 Analysis started at: 4/5/2017 11:33:05 AM Rack: 1
 Analysis label: L1709643-02 6020SL User name: ALPHALAB\metals-instrument Vial: 40

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	85.479 %	86.918 %	0.002 ppb	160,270.666 ppb	31,877.996 ppb	2.490 ppb	10,833.157 ppb	277,376.795 ppb	78.440 %
Concentration per Run 1	86.680 %	85.055 %	0.008 ppb	158,386.147 ppb	31,166.885 ppb	2.189 ppb	10,331.599 ppb	262,677.407 ppb	80.939 %
Concentration per Run 2	85.138 %	90.223 %	-0.003 ppb	152,244.150 ppb	30,435.935 ppb	1.148 ppb	9,815.733 ppb	264,885.363 ppb	80.002 %
Concentration per Run 3	84.619 %	85.475 %	0.002 ppb	170,181.700 ppb	34,031.168 ppb	4.132 ppb	12,352.139 ppb	304,567.614 ppb	74.378 %
Concentration RSD	1.3 %	3.3 %	226.4 %	5.7 %	6.0 %	60.8 %	12.4 %	8.5 %	4.5 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	74.758 %	407.874 ppb	0.317 ppb	0.103 ppb	1,340.194 ppb	22.255 ppb	6.487 ppb	7.395 ppb	0.418 ppb
Concentration per Run 1	76.627 %	391.014 ppb	0.140 ppb	0.151 ppb	1,280.177 ppb	23.254 ppb	6.670 ppb	7.587 ppb	0.552 ppb
Concentration per Run 2	73.455 %	396.780 ppb	0.356 ppb	0.011 ppb	1,289.441 ppb	16.590 ppb	6.469 ppb	5.796 ppb	0.443 ppb
Concentration per Run 3	74.192 %	435.828 ppb	0.453 ppb	0.147 ppb	1,450.965 ppb	26.922 ppb	6.323 ppb	8.803 ppb	0.260 ppb
Concentration RSD	2.2 %	6.0 %	50.6 %	77.6 %	7.2 %	23.5 %	2.7 %	20.5 %	35.3 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	1.204 ppb	78.311 %	0.564 ppb	9.940 ppb	1,126.408 ppb	2.466 ppb	75.660 %	-0.018 ppb	0.023 ppb
Concentration per Run 1	0.959 ppb	80.231 %	0.447 ppb	6.627 ppb	1,067.546 ppb	2.735 ppb	79.382 %	-0.024 ppb	0.035 ppb
Concentration per Run 2	1.365 ppb	77.383 %	0.517 ppb	12.432 ppb	1,115.344 ppb	2.294 ppb	76.412 %	-0.010 ppb	0.036 ppb
Concentration per Run 3	1.288 ppb	77.320 %	0.727 ppb	10.760 ppb	1,196.334 ppb	2.370 ppb	71.187 %	-0.019 ppb	-0.003 ppb
Concentration RSD	17.9 %	2.1 %	25.8 %	30.1 %	5.8 %	9.6 %	5.5 %	40.9 %	99.3 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	75.214 %	0.238 ppb	1.713 ppb	150.571 ppb	75.643 %	75.041 %	0.019 ppb	0.042 ppb	74.193 %
Concentration per Run 1	77.100 %	0.169 ppb	1.683 ppb	138.852 ppb	81.622 %	75.925 %	0.017 ppb	0.039 ppb	77.910 %
Concentration per Run 2	75.676 %	0.250 ppb	1.515 ppb	151.554 ppb	73.888 %	75.620 %	0.019 ppb	0.044 ppb	75.009 %
Concentration per Run 3	72.865 %	0.295 ppb	1.942 ppb	161.306 ppb	71.420 %	73.579 %	0.022 ppb	0.045 ppb	69.658 %
Concentration RSD	2.9 %	26.8 %	12.6 %	7.5 %	7.0 %	1.7 %	10.6 %	7.7 %	5.6 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 66 Analysis started at: 4/5/2017 11:36:26 AM Rack: 0
 Analysis label: CCV User name: ALPHALAB\metals-instrument Vial: 9

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	87.025 %	91.015 %	94.758 ppb	9,762.551 ppb	9,942.463 ppb	91.303 ppb	10,085.336 ppb	9,997.988 ppb	84.575 %
Concentration per Run 1	87.151 %	87.570 %	94.729 ppb	10,042.577 ppb	10,078.139 ppb	91.808 ppb	9,841.395 ppb	9,687.692 ppb	86.308 %
Concentration per Run 2	87.206 %	87.626 %	94.577 ppb	9,244.736 ppb	9,576.701 ppb	92.612 ppb	9,760.859 ppb	9,831.602 ppb	86.478 %
Concentration per Run 3	86.719 %	87.849 %	94.969 ppb	10,000.340 ppb	10,172.550 ppb	89.488 ppb	10,653.753 ppb	10,474.668 ppb	80.939 %
Recovery Percentage 1			94.758 %	97.626 %	99.425 %	91.303 %	100.853 %	99.980 %	
Concentration RSD	0.3 %	6.3 %	0.2 %	4.6 %	3.2 %	1.8 %	4.9 %	4.2 %	3.7 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	78.679 %	94.395 ppb	96.772 ppb	95.187 ppb	100.771 ppb	9,768.705 ppb	96.729 ppb	97.229 ppb	99.533 ppb
Concentration per Run 1	78.524 %	92.196 ppb	93.028 ppb	93.656 ppb	97.649 ppb	9,381.903 ppb	92.791 ppb	97.769 ppb	96.739 ppb
Concentration per Run 2	79.178 %	91.255 ppb	94.045 ppb	94.671 ppb	103.840 ppb	9,575.079 ppb	97.867 ppb	97.788 ppb	101.326 ppb
Concentration per Run 3	78.336 %	99.734 ppb	103.242 ppb	97.235 ppb	100.825 ppb	10,349.134 ppb	99.528 ppb	96.129 ppb	100.535 ppb
Recovery Percentage 1		94.395 %	96.772 %	95.187 %	100.771 %	97.687 %	96.729 %	97.229 %	99.533 %
Concentration RSD	0.6 %	4.9 %	5.8 %	1.9 %	3.1 %	5.2 %	3.6 %	1.0 %	2.5 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	99.155 ppb	83.330 %	99.107 ppb	99.485 ppb	103.615 ppb	94.311 ppb	80.861 %	99.697 ppb	100.130 ppb
Concentration per Run 1	96.034 ppb	83.019 %	99.048 ppb	102.210 ppb	102.449 ppb	91.392 ppb	83.514 %	94.506 ppb	94.929 ppb
Concentration per Run 2	100.517 ppb	82.549 %	101.674 ppb	101.718 ppb	105.818 ppb	95.078 ppb	79.087 %	100.183 ppb	102.864 ppb
Concentration per Run 3	100.913 ppb	84.422 %	96.599 ppb	94.526 ppb	102.577 ppb	96.462 ppb	79.982 %	104.402 ppb	102.596 ppb
Recovery Percentage 1	99.155 %	99.107 %	99.485 %	99.485 %	103.615 %	94.311 %		99.697 %	100.130 %
Concentration RSD	2.7 %	1.2 %	2.6 %	4.3 %	1.8 %	2.8 %	2.9 %	5.0 %	4.5 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	80.532 %	97.606 ppb	99.964 ppb	101.178 ppb	80.107 %	79.295 %	101.871 ppb	99.993 ppb	78.449 %
Concentration per Run 1	83.394 %	94.688 ppb	93.991 ppb	100.303 ppb	81.151 %	83.689 %	97.707 ppb	97.446 ppb	80.748 %
Concentration per Run 2	77.454 %	98.314 ppb	104.444 ppb	101.835 ppb	79.817 %	78.105 %	103.269 ppb	98.785 ppb	78.008 %
Concentration per Run 3	80.747 %	99.815 ppb	101.457 ppb	101.395 ppb	79.354 %	76.090 %	104.636 ppb	103.748 ppb	76.591 %
Recovery Percentage 1		97.606 %	99.964 %	101.178 %			101.871 %	99.993 %	
Concentration RSD	3.7 %	2.7 %	5.4 %	0.8 %	1.2 %	5.0 %	3.6 %	3.3 %	2.7 %

Alpha ICPMSQ Full

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Analysis index: 67 Analysis started at: 4/5/2017 11:39:51 AM Rack: 0
 Analysis label: CCB User name: ALPHALAB\metals-instrument Vial: 10

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	88.658 %	88.082 %	0.016 ppb	36.163 ppb	0.650 ppb	-0.311 ppb	44.988 ppb	5.440 ppb	82.445 %
Concentration per Run 1	89.066 %	89.804 %	0.017 ppb	30.029 ppb	-0.218 ppb	-0.338 ppb	3.278 ppb	10.800 ppb	87.671 %
Concentration per Run 2	88.757 %	88.966 %	0.012 ppb	35.604 ppb	2.289 ppb	-0.065 ppb	51.422 ppb	5.802 ppb	81.451 %
Concentration per Run 3	88.150 %	85.474 %	0.018 ppb	42.856 ppb	-0.121 ppb	-0.529 ppb	80.264 ppb	-0.281 ppb	78.212 %
Recovery Percentage 1			3.165 %	36.163 %	0.929 %	-3.106 %	44.988 %	5.440 %	
Concentration RSD	0.5 %	2.6 %	18.8 %	17.8 %	218.4 %	75.0 %	86.5 %	102.0 %	5.8 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	78.366 %	0.097 ppb	0.024 ppb	-0.012 ppb	-0.203 ppb	1.933 ppb	0.006 ppb	0.069 ppb	-0.065 ppb
Concentration per Run 1	79.398 %	0.091 ppb	0.000 ppb	0.043 ppb	-0.236 ppb	-0.003 ppb	-0.025 ppb	-0.047 ppb	-0.065 ppb
Concentration per Run 2	78.640 %	0.000 ppb	0.000 ppb	0.006 ppb	-0.077 ppb	-1.604 ppb	0.021 ppb	0.038 ppb	-0.065 ppb
Concentration per Run 3	77.061 %	0.202 ppb	0.072 ppb	-0.086 ppb	-0.296 ppb	7.405 ppb	0.022 ppb	0.217 ppb	-0.065 ppb
Recovery Percentage 1		19.498 %	0.478 %	-1.225 %	-20.295 %	3.866 %	1.167 %	3.469 %	-6.535 %
Concentration RSD	1.5 %	103.6 %	173.2 %	541.4 %	55.7 %	248.7 %	459.3 %	194.4 %	0.0 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	-0.424 ppb	83.011 %	0.156 ppb	1.004 ppb	0.013 ppb	0.621 ppb	81.733 %	0.043 ppb	0.009 ppb
Concentration per Run 1	-0.403 ppb	83.028 %	0.189 ppb	1.639 ppb	0.038 ppb	0.525 ppb	82.602 %	0.029 ppb	0.021 ppb
Concentration per Run 2	-0.287 ppb	83.842 %	0.139 ppb	0.261 ppb	0.008 ppb	0.732 ppb	80.496 %	0.048 ppb	0.009 ppb
Concentration per Run 3	-0.581 ppb	82.164 %	0.142 ppb	1.112 ppb	-0.007 ppb	0.607 ppb	82.102 %	0.052 ppb	-0.003 ppb
Recovery Percentage 1	-4.240 %	83.011 %	31.299 %	20.077 %	2.538 %	31.065 %		10.757 %	4.485 %
Concentration RSD	34.9 %	1.0 %	17.8 %	69.3 %	179.8 %	16.8 %	1.3 %	28.9 %	136.4 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	81.035 %	0.882 ppb	3.421 ppb	0.004 ppb	76.918 %	77.357 %	0.036 ppb	0.054 ppb	78.692 %
Concentration per Run 1	82.150 %	0.783 ppb	3.574 ppb	0.015 ppb	75.477 %	77.230 %	0.031 ppb	0.057 ppb	76.356 %
Concentration per Run 2	81.098 %	0.929 ppb	3.562 ppb	-0.019 ppb	78.834 %	78.167 %	0.035 ppb	0.062 ppb	78.293 %
Concentration per Run 3	79.856 %	0.933 ppb	3.127 ppb	0.015 ppb	76.442 %	76.673 %	0.042 ppb	0.044 ppb	81.427 %
Recovery Percentage 1		29.388 %	85.518 %	0.733 %			7.203 %	10.843 %	78.692 %
Concentration RSD	1.4 %	9.7 %	7.4 %	543.4 %	2.2 %	1.0 %	15.1 %	16.4 %	3.3 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 68 Analysis started at: 4/5/2017 11:44:58 AM Rack: 1
 Analysis label: L1709643-03 6020SL User name: ALPHALAB\metals-instrument Vial: 41

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	85.575 %	89.292 %	0.015 ppb	132,326.795 ppb	23,905.462 ppb	3.914 ppb	13,460.876 ppb	123,346.963 ppb	83.240 %
Concentration per Run 1	86.639 %	86.313 %	0.018 ppb	135,651.483 ppb	24,078.435 ppb	2.783 ppb	12,777.879 ppb	123,584.280 ppb	85.882 %
Concentration per Run 2	86.216 %	86.592 %	0.013 ppb	136,933.927 ppb	24,255.863 ppb	4.973 ppb	14,332.925 ppb	130,838.351 ppb	78.127 %
Concentration per Run 3	83.869 %	94.972 %	0.013 ppb	124,394.975 ppb	23,382.088 ppb	3.986 ppb	13,271.823 ppb	115,618.256 ppb	85.712 %
Concentration RSD	1.7 %	5.5 %	19.5 %	5.2 %	1.9 %	28.0 %	5.9 %	6.2 %	5.3 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	81.646 %	177.055 ppb	3.155 ppb	0.153 ppb	3,834.640 ppb	62.845 ppb	1.716 ppb	1.656 ppb	2.212 ppb
Concentration per Run 1	82.625 %	172.413 ppb	2.935 ppb	0.273 ppb	3,686.633 ppb	68.248 ppb	1.736 ppb	1.649 ppb	2.522 ppb
Concentration per Run 2	83.335 %	192.338 ppb	3.308 ppb	0.182 ppb	4,084.769 ppb	63.323 ppb	1.516 ppb	1.905 ppb	1.855 ppb
Concentration per Run 3	78.979 %	166.413 ppb	3.222 ppb	0.003 ppb	3,732.519 ppb	56.963 ppb	1.895 ppb	1.413 ppb	2.260 ppb
Concentration RSD	2.9 %	7.7 %	6.2 %	90.3 %	5.7 %	9.0 %	11.1 %	14.9 %	15.2 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	9.203 ppb	80.418 %	3.457 ppb	0.884 ppb	989.774 ppb	3.127 ppb	77.843 %	0.020 ppb	0.018 ppb
Concentration per Run 1	10.268 ppb	81.045 %	3.464 ppb	0.194 ppb	1,017.508 ppb	3.459 ppb	77.986 %	0.027 ppb	0.010 ppb
Concentration per Run 2	9.285 ppb	81.096 %	3.610 ppb	1.424 ppb	975.558 ppb	3.198 ppb	78.484 %	-0.001 ppb	0.022 ppb
Concentration per Run 3	8.057 ppb	79.112 %	3.295 ppb	1.035 ppb	976.255 ppb	2.723 ppb	77.059 %	0.033 ppb	0.023 ppb
Concentration RSD	12.0 %	1.4 %	4.6 %	71.1 %	2.4 %	11.9 %	0.9 %	93.0 %	40.5 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	77.669 %	2.129 ppb	2.196 ppb	95.479 ppb	78.099 %	76.005 %	0.014 ppb	0.076 ppb	78.687 %
Concentration per Run 1	76.723 %	2.425 ppb	2.183 ppb	100.654 ppb	78.061 %	77.316 %	0.013 ppb	0.076 ppb	79.963 %
Concentration per Run 2	80.051 %	1.710 ppb	1.941 ppb	90.895 ppb	78.765 %	76.407 %	0.014 ppb	0.068 ppb	78.329 %
Concentration per Run 3	76.235 %	2.251 ppb	2.464 ppb	94.889 ppb	77.470 %	74.292 %	0.016 ppb	0.083 ppb	77.768 %
Concentration RSD	2.7 %	17.5 %	11.9 %	5.1 %	0.8 %	2.0 %	13.2 %	10.4 %	1.4 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 69 Analysis started at: 4/5/2017 11:48:19 AM Rack: 1
 Analysis label: L1709738-01 6020SL User name: ALPHALAB\metals-instrument Vial: 42

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	96.672 %	101.955 %	0.010 ppb	62,844.773 ppb	9,912.473 ppb	4.311 ppb	11,984.351 ppb	102,769.865 ppb	88.580 %
Concentration per Run 1	97.444 %	101.397 %	-0.003 ppb	63,289.960 ppb	10,433.999 ppb	4.908 ppb	11,565.623 ppb	99,427.354 ppb	92.785 %
Concentration per Run 2	96.643 %	104.749 %	0.006 ppb	60,308.816 ppb	9,089.038 ppb	3.802 ppb	11,177.381 ppb	97,624.954 ppb	91.591 %
Concentration per Run 3	95.929 %	99.721 %	0.025 ppb	64,935.544 ppb	10,214.381 ppb	4.223 ppb	13,210.051 ppb	111,257.288 ppb	81.365 %
Concentration RSD	0.8 %	2.5 %	150.3 %	3.7 %	7.3 %	12.9 %	9.0 %	7.2 %	7.1 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	89.401 %	147.584 ppb	0.302 ppb	0.211 ppb	1,270.365 ppb	1,277.811 ppb	0.462 ppb	2.334 ppb	0.101 ppb
Concentration per Run 1	90.001 %	143.794 ppb	0.246 ppb	0.220 ppb	1,309.365 ppb	1,280.687 ppb	0.492 ppb	2.126 ppb	0.099 ppb
Concentration per Run 2	88.098 %	140.152 ppb	0.187 ppb	0.204 ppb	1,226.959 ppb	1,310.354 ppb	0.417 ppb	2.481 ppb	0.214 ppb
Concentration per Run 3	90.105 %	158.805 ppb	0.474 ppb	0.209 ppb	1,274.772 ppb	1,242.391 ppb	0.477 ppb	2.395 ppb	-0.009 ppb
Concentration RSD	1.3 %	6.7 %	50.2 %	3.9 %	3.3 %	2.7 %	8.6 %	7.9 %	110.3 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	0.408 ppb	89.691 %	0.496 ppb	0.538 ppb	432.043 ppb	0.525 ppb	88.121 %	-0.019 ppb	0.004 ppb
Concentration per Run 1	0.429 ppb	89.539 %	0.575 ppb	0.140 ppb	448.747 ppb	0.421 ppb	86.767 %	-0.020 ppb	0.008 ppb
Concentration per Run 2	0.173 ppb	87.555 %	0.267 ppb	0.976 ppb	435.029 ppb	0.707 ppb	89.085 %	-0.012 ppb	0.008 ppb
Concentration per Run 3	0.621 ppb	91.980 %	0.645 ppb	0.496 ppb	412.352 ppb	0.447 ppb	88.511 %	-0.024 ppb	-0.003 ppb
Concentration RSD	55.1 %	2.5 %	40.5 %	78.0 %	4.3 %	30.1 %	1.4 %	33.6 %	152.8 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	87.373 %	0.365 ppb	0.831 ppb	166.518 ppb	89.094 %	88.230 %	0.008 ppb	0.018 ppb	85.797 %
Concentration per Run 1	87.194 %	0.494 ppb	0.761 ppb	173.269 ppb	90.386 %	86.984 %	0.000 ppb	0.021 ppb	88.029 %
Concentration per Run 2	86.373 %	0.216 ppb	1.034 ppb	159.816 ppb	89.030 %	89.870 %	0.011 ppb	0.015 ppb	86.306 %
Concentration per Run 3	88.553 %	0.385 ppb	0.696 ppb	166.470 ppb	87.865 %	87.836 %	0.013 ppb	0.018 ppb	83.055 %
Concentration RSD	1.3 %	38.3 %	21.6 %	4.0 %	1.4 %	1.7 %	91.7 %	15.4 %	2.9 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 70 Analysis started at: 4/5/2017 11:51:41 AM Rack: 1
 Analysis label: L1709738-02 6020SL User name: ALPHALAB\metals-instrument Vial: 43

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	93.246 %	96.276 %	0.007 ppb	197,145.047 ppb	9,953.198 ppb	8.824 ppb	24,221.527 ppb	84,141.293 ppb	87.643 %
Concentration per Run 1	93.141 %	92.877 %	0.016 ppb	203,003.392 ppb	10,238.016 ppb	8.658 ppb	23,609.058 ppb	83,876.534 ppb	89.546 %
Concentration per Run 2	94.116 %	95.391 %	0.002 ppb	193,872.587 ppb	9,772.335 ppb	10.133 ppb	24,223.419 ppb	82,709.506 ppb	88.950 %
Concentration per Run 3	92.483 %	100.559 %	0.002 ppb	194,559.164 ppb	9,849.242 ppb	7.681 ppb	24,832.104 ppb	85,837.840 ppb	84.433 %
Concentration RSD	0.9 %	4.1 %	125.1 %	2.6 %	2.5 %	14.0 %	2.5 %	1.9 %	3.2 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	90.265 %	118.771 ppb	3.292 ppb	0.388 ppb	1,062.455 ppb	3,925.348 ppb	0.795 ppb	3.509 ppb	0.878 ppb
Concentration per Run 1	88.618 %	120.999 ppb	2.703 ppb	0.355 ppb	1,079.836 ppb	3,982.861 ppb	1.014 ppb	3.142 ppb	0.805 ppb
Concentration per Run 2	90.828 %	107.173 ppb	4.221 ppb	0.420 ppb	1,040.152 ppb	3,781.757 ppb	0.637 ppb	3.748 ppb	1.014 ppb
Concentration per Run 3	91.349 %	128.142 ppb	2.951 ppb	0.388 ppb	1,067.377 ppb	4,011.426 ppb	0.735 ppb	3.637 ppb	0.817 ppb
Concentration RSD	1.6 %	9.0 %	24.7 %	8.3 %	1.9 %	3.2 %	24.6 %	9.2 %	13.4 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	1.431 ppb	90.013 %	0.941 ppb	0.717 ppb	494.313 ppb	2.110 ppb	86.895 %	-0.017 ppb	0.016 ppb
Concentration per Run 1	1.804 ppb	92.133 %	1.168 ppb	0.835 ppb	506.232 ppb	2.395 ppb	86.664 %	-0.016 ppb	0.008 ppb
Concentration per Run 2	1.245 ppb	93.455 %	0.807 ppb	0.800 ppb	471.392 ppb	2.088 ppb	86.944 %	-0.024 ppb	0.008 ppb
Concentration per Run 3	1.244 ppb	84.452 %	0.848 ppb	0.517 ppb	505.315 ppb	1.848 ppb	87.075 %	-0.012 ppb	0.032 ppb
Concentration RSD	22.6 %	5.4 %	21.0 %	24.3 %	4.0 %	13.0 %	0.2 %	37.5 %	85.2 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	86.078 %	0.300 ppb	0.742 ppb	119.901 ppb	87.904 %	87.500 %	0.003 ppb	0.238 ppb	84.091 %
Concentration per Run 1	85.904 %	0.296 ppb	0.834 ppb	115.866 ppb	87.857 %	86.394 %	0.005 ppb	0.254 ppb	84.333 %
Concentration per Run 2	88.249 %	0.298 ppb	0.784 ppb	115.872 ppb	88.714 %	88.348 %	0.002 ppb	0.244 ppb	84.124 %
Concentration per Run 3	84.082 %	0.305 ppb	0.609 ppb	127.965 ppb	87.140 %	87.758 %	0.003 ppb	0.216 ppb	83.815 %
Concentration RSD	2.4 %	1.5 %	15.9 %	5.8 %	0.9 %	1.1 %	45.4 %	8.3 %	0.3 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 71 Analysis started at: 4/5/2017 11:55:03 AM Rack: 1
 Analysis label: L1709811-01 6020SL User name: ALPHALAB\metals-instrument Vial: 44

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	99.642 %	102.002 %	0.029 ppb	1,959.370 ppb	661.242 ppb	166.798 ppb	274.128 ppb	5,410.747 ppb	92.557 %
Concentration per Run 1	100.269 %	105.028 %	0.042 ppb	1,940.750 ppb	592.239 ppb	167.245 ppb	251.744 ppb	5,239.908 ppb	94.830 %
Concentration per Run 2	99.006 %	98.464 %	0.025 ppb	2,032.793 ppb	737.063 ppb	168.964 ppb	259.859 ppb	5,657.983 ppb	90.739 %
Concentration per Run 3	99.652 %	102.514 %	0.020 ppb	1,904.567 ppb	654.423 ppb	164.184 ppb	310.781 ppb	5,334.351 ppb	92.103 %
Concentration RSD	0.6 %	3.2 %	41.0 %	3.4 %	11.0 %	1.5 %	11.7 %	4.1 %	2.3 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	89.540 %	8.793 ppb	0.222 ppb	0.250 ppb	13.862 ppb	223.532 ppb	0.109 ppb	0.609 ppb	3.157 ppb
Concentration per Run 1	91.469 %	9.110 ppb	0.299 ppb	0.311 ppb	14.442 ppb	235.041 ppb	0.174 ppb	0.177 ppb	3.185 ppb
Concentration per Run 2	88.588 %	8.337 ppb	0.123 ppb	0.200 ppb	14.153 ppb	209.303 ppb	0.117 ppb	0.938 ppb	2.941 ppb
Concentration per Run 3	88.562 %	8.932 ppb	0.245 ppb	0.239 ppb	12.992 ppb	226.252 ppb	0.036 ppb	0.713 ppb	3.344 ppb
Concentration RSD	1.9 %	4.6 %	40.4 %	22.6 %	5.5 %	5.9 %	63.8 %	64.2 %	6.4 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	19.519 ppb	94.710 %	0.555 ppb	0.177 ppb	22.890 ppb	0.244 ppb	92.440 %	-0.018 ppb	0.030 ppb
Concentration per Run 1	19.351 ppb	94.676 %	0.498 ppb	0.243 ppb	23.380 ppb	0.222 ppb	92.158 %	-0.012 ppb	0.052 ppb
Concentration per Run 2	21.042 ppb	95.693 %	0.492 ppb	-0.109 ppb	22.749 ppb	0.289 ppb	92.580 %	-0.016 ppb	0.030 ppb
Concentration per Run 3	18.164 ppb	93.760 %	0.674 ppb	0.397 ppb	22.539 ppb	0.222 ppb	92.583 %	-0.024 ppb	0.008 ppb
Concentration RSD	7.4 %	1.0 %	18.6 %	146.5 %	1.9 %	16.0 %	0.3 %	34.4 %	72.8 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	88.531 %	0.136 ppb	0.663 ppb	16.112 ppb	90.252 %	89.837 %	0.002 ppb	0.328 ppb	94.864 %
Concentration per Run 1	90.931 %	0.188 ppb	0.508 ppb	16.568 ppb	90.991 %	91.607 %	0.001 ppb	0.319 ppb	95.748 %
Concentration per Run 2	88.311 %	0.095 ppb	0.652 ppb	15.977 ppb	90.040 %	89.817 %	0.001 ppb	0.328 ppb	94.219 %
Concentration per Run 3	86.351 %	0.126 ppb	0.828 ppb	15.792 ppb	89.723 %	88.087 %	0.004 ppb	0.337 ppb	94.627 %
Concentration RSD	2.6 %	34.5 %	24.1 %	2.5 %	0.7 %	2.0 %	113.4 %	2.7 %	0.8 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 72 Analysis started at: 4/5/2017 11:58:25 AM Rack: 1
 Analysis label: L1709811-02 6020SL User name: ALPHALAB\metals-instrument Vial: 45

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	110.603 %	99.581 %	0.045 ppb	16,803.946 ppb	4,344.492 ppb	115.651 ppb	1,362.663 ppb	25,246.503 ppb	89.120 %
Concentration per Run 1	111.649 %	100.698 %	0.054 ppb	16,877.277 ppb	4,366.882 ppb	108.873 ppb	1,345.057 ppb	25,042.623 ppb	89.887 %
Concentration per Run 2	110.144 %	100.000 %	0.038 ppb	16,694.225 ppb	4,307.791 ppb	124.183 ppb	1,419.413 ppb	25,553.812 ppb	89.035 %
Concentration per Run 3	110.018 %	98.045 %	0.043 ppb	16,840.335 ppb	4,358.802 ppb	113.898 ppb	1,323.520 ppb	25,143.074 ppb	88.438 %
Concentration RSD	0.8 %	1.4 %	18.0 %	0.6 %	0.7 %	6.7 %	3.7 %	1.1 %	0.8 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	91.042 %	38.341 ppb	0.504 ppb	0.200 ppb	366.880 ppb	199.759 ppb	0.211 ppb	0.497 ppb	2.525 ppb
Concentration per Run 1	93.297 %	40.985 ppb	0.818 ppb	0.250 ppb	376.747 ppb	193.658 ppb	0.268 ppb	0.581 ppb	3.133 ppb
Concentration per Run 2	90.791 %	37.265 ppb	0.503 ppb	0.015 ppb	355.351 ppb	191.427 ppb	0.223 ppb	0.416 ppb	2.570 ppb
Concentration per Run 3	89.037 %	36.774 ppb	0.190 ppb	0.336 ppb	368.541 ppb	214.193 ppb	0.141 ppb	0.495 ppb	1.874 ppb
Concentration RSD	2.4 %	6.0 %	62.4 %	83.1 %	2.9 %	6.3 %	30.7 %	16.6 %	25.0 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	0.984 ppb	92.637 %	0.556 ppb	0.359 ppb	182.189 ppb	1.888 ppb	89.209 %	-0.012 ppb	0.008 ppb
Concentration per Run 1	0.640 ppb	90.149 %	0.748 ppb	-0.026 ppb	188.852 ppb	2.022 ppb	87.830 %	-0.008 ppb	-0.003 ppb
Concentration per Run 2	1.205 ppb	93.850 %	0.546 ppb	0.820 ppb	178.564 ppb	1.624 ppb	88.828 %	-0.012 ppb	0.020 ppb
Concentration per Run 3	1.108 ppb	93.913 %	0.374 ppb	0.283 ppb	179.150 ppb	2.018 ppb	90.968 %	-0.016 ppb	0.008 ppb
Concentration RSD	30.7 %	2.3 %	33.6 %	119.2 %	3.2 %	12.1 %	1.8 %	35.9 %	143.1 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	87.530 %	0.301 ppb	0.669 ppb	69.932 ppb	88.717 %	86.833 %	0.003 ppb	0.588 ppb	90.400 %
Concentration per Run 1	87.986 %	0.172 ppb	0.596 ppb	72.770 ppb	90.274 %	88.705 %	0.004 ppb	0.610 ppb	91.686 %
Concentration per Run 2	84.659 %	0.552 ppb	0.696 ppb	69.125 ppb	87.080 %	85.848 %	0.003 ppb	0.568 ppb	89.296 %
Concentration per Run 3	89.943 %	0.179 ppb	0.714 ppb	67.902 ppb	88.798 %	85.948 %	0.001 ppb	0.588 ppb	90.218 %
Concentration RSD	3.1 %	72.2 %	9.5 %	3.6 %	1.8 %	1.9 %	48.3 %	3.6 %	1.3 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 73 Analysis started at: 4/5/2017 12:01:47 PM Rack: 1
 Analysis label: L1709811-03 6020SL User name: ALPHALAB\metals-instrument Vial: 46

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	97.001 %	103.259 %	0.005 ppb	55,541.142 ppb	19,682.713 ppb	2.545 ppb	1,037.498 ppb	99,283.550 ppb	92.813 %
Concentration per Run 1	97.754 %	106.844 %	0.006 ppb	56,686.028 ppb	20,374.278 ppb	2.377 ppb	1,105.543 ppb	104,981.970 ppb	87.331 %
Concentration per Run 2	97.401 %	103.212 %	0.002 ppb	55,188.439 ppb	19,308.172 ppb	2.257 ppb	922.665 ppb	94,057.176 ppb	96.960 %
Concentration per Run 3	95.849 %	99.721 %	0.006 ppb	54,748.960 ppb	19,365.689 ppb	3.000 ppb	1,084.284 ppb	98,811.504 ppb	94.148 %
Concentration RSD	1.0 %	3.4 %	56.4 %	1.8 %	3.0 %	15.7 %	9.6 %	5.5 %	5.3 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	86.421 %	139.145 ppb	0.101 ppb	-0.019 ppb	1,142.832 ppb	8.990 ppb	0.659 ppb	1.698 ppb	0.112 ppb
Concentration per Run 1	85.453 %	144.644 ppb	0.064 ppb	-0.070 ppb	1,175.546 ppb	10.914 ppb	0.744 ppb	1.351 ppb	-0.012 ppb
Concentration per Run 2	87.282 %	135.861 ppb	0.059 ppb	0.046 ppb	1,125.008 ppb	10.254 ppb	0.715 ppb	2.057 ppb	0.255 ppb
Concentration per Run 3	86.529 %	136.931 ppb	0.181 ppb	-0.032 ppb	1,127.941 ppb	5.803 ppb	0.518 ppb	1.687 ppb	0.094 ppb
Concentration RSD	1.1 %	3.4 %	68.1 %	319.2 %	2.5 %	30.9 %	18.7 %	20.8 %	119.4 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	1.150 ppb	93.099 %	0.277 ppb	0.742 ppb	364.508 ppb	0.413 ppb	87.713 %	-0.019 ppb	0.050 ppb
Concentration per Run 1	1.106 ppb	94.473 %	0.202 ppb	0.479 ppb	358.635 ppb	0.444 ppb	88.414 %	-0.024 ppb	0.076 ppb
Concentration per Run 2	1.130 ppb	91.421 %	0.167 ppb	1.055 ppb	369.336 ppb	0.377 ppb	88.091 %	-0.020 ppb	0.019 ppb
Concentration per Run 3	1.216 ppb	93.404 %	0.464 ppb	0.691 ppb	365.552 ppb	0.416 ppb	86.635 %	-0.012 ppb	0.055 ppb
Concentration RSD	5.0 %	1.7 %	58.4 %	39.2 %	1.5 %	8.1 %	1.1 %	34.4 %	57.1 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	87.975 %	0.689 ppb	0.337 ppb	245.361 ppb	89.330 %	89.303 %	0.003 ppb	0.018 ppb	89.508 %
Concentration per Run 1	88.823 %	0.584 ppb	0.290 ppb	244.122 ppb	89.554 %	90.410 %	0.001 ppb	0.015 ppb	90.371 %
Concentration per Run 2	88.601 %	0.750 ppb	0.363 ppb	246.442 ppb	89.180 %	89.799 %	0.009 ppb	0.015 ppb	86.500 %
Concentration per Run 3	86.500 %	0.731 ppb	0.357 ppb	245.518 ppb	89.257 %	87.701 %	-0.002 ppb	0.022 ppb	91.654 %
Concentration RSD	1.5 %	13.2 %	12.0 %	0.5 %	0.2 %	1.6 %	195.1 %	24.2 %	3.0 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 74 Analysis started at: 4/5/2017 12:05:10 PM Rack: 1
 Analysis label: L1709811-04 6020SL User name: ALPHALAB\metals-instrument Vial: 47

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	96.877 %	98.836 %	-0.003 ppb	44,776.112 ppb	23,866.793 ppb	4.218 ppb	1,210.695 ppb	97,337.958 ppb	91.648 %
Concentration per Run 1	98.151 %	104.330 %	-0.003 ppb	43,218.431 ppb	23,424.209 ppb	4.845 ppb	1,192.680 ppb	98,387.774 ppb	92.188 %
Concentration per Run 2	97.101 %	92.039 %	-0.003 ppb	46,946.191 ppb	25,090.455 ppb	3.880 ppb	1,224.918 ppb	96,807.119 ppb	91.847 %
Concentration per Run 3	95.379 %	100.140 %	-0.003 ppb	44,163.714 ppb	23,085.715 ppb	3.928 ppb	1,214.487 ppb	96,818.980 ppb	90.910 %
Concentration RSD	1.4 %	6.3 %	0.0 %	4.3 %	4.5 %	12.9 %	1.4 %	0.9 %	0.7 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	85.709 %	135.908 ppb	0.041 ppb	0.133 ppb	7.178 ppb	12.472 ppb	0.003 ppb	0.553 ppb	0.564 ppb
Concentration per Run 1	86.613 %	137.164 ppb	0.124 ppb	0.119 ppb	7.575 ppb	14.169 ppb	0.017 ppb	0.666 ppb	0.722 ppb
Concentration per Run 2	85.991 %	134.103 ppb	0.000 ppb	0.159 ppb	6.324 ppb	10.738 ppb	0.016 ppb	0.805 ppb	0.371 ppb
Concentration per Run 3	84.525 %	136.458 ppb	0.000 ppb	0.120 ppb	7.634 ppb	12.509 ppb	-0.025 ppb	0.188 ppb	0.599 ppb
Concentration RSD	1.3 %	1.2 %	173.2 %	17.1 %	10.3 %	13.8 %	879.5 %	58.5 %	31.6 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	2.627 ppb	88.840 %	0.129 ppb	0.351 ppb	332.729 ppb	0.754 ppb	86.776 %	-0.022 ppb	0.027 ppb
Concentration per Run 1	2.849 ppb	86.487 %	0.179 ppb	-0.084 ppb	339.071 ppb	0.861 ppb	88.317 %	-0.024 ppb	0.031 ppb
Concentration per Run 2	2.730 ppb	90.798 %	0.080 ppb	0.801 ppb	334.167 ppb	0.722 ppb	85.265 %	-0.020 ppb	0.020 ppb
Concentration per Run 3	2.301 ppb	89.233 %	0.127 ppb	0.335 ppb	324.949 ppb	0.680 ppb	86.746 %	-0.020 ppb	0.031 ppb
Concentration RSD	11.0 %	2.5 %	38.5 %	126.2 %	2.2 %	12.5 %	1.8 %	11.3 %	24.5 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	87.798 %	0.139 ppb	0.439 ppb	216.951 ppb	88.875 %	89.528 %	-0.001 ppb	0.026 ppb	89.153 %
Concentration per Run 1	87.575 %	0.110 ppb	0.338 ppb	216.406 ppb	88.775 %	92.121 %	-0.003 ppb	0.027 ppb	91.464 %
Concentration per Run 2	88.917 %	0.157 ppb	0.520 ppb	211.045 ppb	89.107 %	87.705 %	-0.007 ppb	0.022 ppb	87.339 %
Concentration per Run 3	86.901 %	0.150 ppb	0.458 ppb	223.403 ppb	88.743 %	88.757 %	0.008 ppb	0.030 ppb	88.657 %
Concentration RSD	1.2 %	18.2 %	21.0 %	2.9 %	0.2 %	2.6 %	1,375.5 %	15.8 %	2.4 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 75 Analysis started at: 4/5/2017 12:08:33 PM Rack: 1
 Analysis label: L1709811-05 6020SL User name: ALPHALAB\metals-instrument Vial: 48

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	94.587 %	99.348 %	0.016 ppb	53,538.019 ppb	6,427.990 ppb	12.320 ppb	2,309.193 ppb	65,255.095 ppb	88.978 %
Concentration per Run 1	96.025 %	97.765 %	0.011 ppb	55,987.907 ppb	6,493.195 ppb	12.864 ppb	2,276.425 ppb	64,058.900 ppb	91.762 %
Concentration per Run 2	94.341 %	102.654 %	0.031 ppb	52,235.878 ppb	6,481.764 ppb	12.841 ppb	2,375.545 ppb	68,419.439 ppb	85.115 %
Concentration per Run 3	93.393 %	97.626 %	0.007 ppb	52,390.272 ppb	6,309.010 ppb	11.255 ppb	2,275.610 ppb	63,286.946 ppb	90.058 %
Concentration RSD	1.4 %	2.9 %	78.4 %	4.0 %	1.6 %	7.5 %	2.5 %	4.2 %	3.9 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	87.075 %	93.202 ppb	0.127 ppb	-0.034 ppb	814.079 ppb	668.858 ppb	0.167 ppb	0.485 ppb	0.604 ppb
Concentration per Run 1	85.438 %	94.382 ppb	0.252 ppb	-0.049 ppb	809.434 ppb	703.746 ppb	0.212 ppb	0.682 ppb	0.398 ppb
Concentration per Run 2	89.013 %	96.804 ppb	0.065 ppb	-0.090 ppb	805.672 ppb	611.658 ppb	0.188 ppb	0.272 ppb	0.488 ppb
Concentration per Run 3	86.775 %	88.420 ppb	0.063 ppb	0.036 ppb	827.131 ppb	691.171 ppb	0.100 ppb	0.501 ppb	0.925 ppb
Concentration RSD	2.1 %	4.6 %	85.5 %	187.6 %	1.4 %	7.5 %	35.2 %	42.3 %	46.7 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	156.699 ppb	88.416 %	0.495 ppb	0.678 ppb	195.421 ppb	0.162 ppb	88.239 %	-0.012 ppb	0.004 ppb
Concentration per Run 1	163.766 ppb	83.079 %	0.621 ppb	1.225 ppb	208.315 ppb	0.238 ppb	88.575 %	-0.012 ppb	0.008 ppb
Concentration per Run 2	155.831 ppb	91.816 %	0.384 ppb	0.588 ppb	190.943 ppb	0.086 ppb	89.031 %	-0.008 ppb	0.008 ppb
Concentration per Run 3	150.501 ppb	90.353 %	0.480 ppb	0.219 ppb	187.004 ppb	0.162 ppb	87.112 %	-0.016 ppb	-0.003 ppb
Concentration RSD	4.3 %	5.3 %	24.1 %	75.1 %	5.8 %	46.8 %	1.1 %	34.8 %	154.2 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	87.894 %	0.038 ppb	0.656 ppb	102.831 ppb	87.543 %	88.028 %	0.000 ppb	0.034 ppb	88.231 %
Concentration per Run 1	90.538 %	0.017 ppb	0.670 ppb	102.215 ppb	86.225 %	88.384 %	0.000 ppb	0.031 ppb	87.550 %
Concentration per Run 2	85.241 %	0.051 ppb	0.528 ppb	105.878 ppb	86.567 %	87.445 %	0.001 ppb	0.037 ppb	86.936 %
Concentration per Run 3	87.903 %	0.046 ppb	0.771 ppb	100.398 ppb	89.836 %	88.254 %	0.001 ppb	0.033 ppb	90.209 %
Concentration RSD	3.0 %	48.4 %	18.6 %	2.7 %	2.3 %	0.6 %	159.7 %	8.6 %	2.0 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 76 Analysis started at: 4/5/2017 12:11:56 PM Rack: 1
 Analysis label: L1709811-06 6020SL User name: ALPHALAB\metals-instrument Vial: 49

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	97.658 %	101.676 %	0.003 ppb	10,362.737 ppb	4,196.657 ppb	6.631 ppb	3,896.684 ppb	23,631.832 ppb	90.086 %
Concentration per Run 1	97.338 %	103.911 %	0.006 ppb	10,089.821 ppb	4,062.806 ppb	7.310 ppb	3,799.715 ppb	22,013.307 ppb	93.722 %
Concentration per Run 2	99.705 %	98.743 %	0.002 ppb	10,459.325 ppb	4,242.525 ppb	5.693 ppb	3,864.768 ppb	23,905.069 ppb	91.080 %
Concentration per Run 3	95.931 %	102.374 %	0.002 ppb	10,539.064 ppb	4,284.638 ppb	6.891 ppb	4,025.568 ppb	24,977.119 ppb	85.456 %
Concentration RSD	2.0 %	2.6 %	83.6 %	2.3 %	2.8 %	12.7 %	3.0 %	6.4 %	4.7 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	87.810 %	34.480 ppb	0.208 ppb	0.141 ppb	78.408 ppb	7.194 ppb	0.140 ppb	0.960 ppb	2.916 ppb
Concentration per Run 1	88.167 %	31.191 ppb	0.304 ppb	0.113 ppb	75.012 ppb	5.902 ppb	0.138 ppb	1.022 ppb	3.327 ppb
Concentration per Run 2	89.894 %	34.880 ppb	0.124 ppb	0.160 ppb	79.197 ppb	2.933 ppb	0.202 ppb	0.960 ppb	2.492 ppb
Concentration per Run 3	85.369 %	37.369 ppb	0.195 ppb	0.151 ppb	81.014 ppb	12.746 ppb	0.080 ppb	0.898 ppb	2.930 ppb
Concentration RSD	2.6 %	9.0 %	43.5 %	17.9 %	3.9 %	70.0 %	43.6 %	6.4 %	14.3 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	274.508 ppb	92.234 %	0.369 ppb	-0.173 ppb	83.268 ppb	0.401 ppb	88.079 %	-0.016 ppb	0.038 ppb
Concentration per Run 1	273.239 ppb	91.573 %	0.648 ppb	-0.024 ppb	83.043 ppb	0.375 ppb	88.628 %	-0.016 ppb	0.042 ppb
Concentration per Run 2	276.819 ppb	91.370 %	0.255 ppb	-0.509 ppb	85.844 ppb	0.413 ppb	88.343 %	-0.020 ppb	0.064 ppb
Concentration per Run 3	273.467 ppb	93.760 %	0.204 ppb	0.016 ppb	80.916 ppb	0.413 ppb	87.266 %	-0.012 ppb	0.008 ppb
Concentration RSD	0.7 %	1.4 %	65.9 %	169.2 %	3.0 %	5.4 %	0.8 %	26.4 %	73.4 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	88.611 %	0.074 ppb	0.250 ppb	61.142 ppb	88.330 %	90.297 %	0.000 ppb	0.015 ppb	91.825 %
Concentration per Run 1	87.670 %	0.110 ppb	0.178 ppb	62.551 ppb	88.681 %	92.485 %	0.000 ppb	0.014 ppb	94.186 %
Concentration per Run 2	91.055 %	0.053 ppb	0.172 ppb	59.412 ppb	88.704 %	90.880 %	-0.002 ppb	0.017 ppb	93.897 %
Concentration per Run 3	87.109 %	0.060 ppb	0.399 ppb	61.464 ppb	87.605 %	87.526 %	0.002 ppb	0.013 ppb	87.393 %
Concentration RSD	2.4 %	41.8 %	51.9 %	2.6 %	0.7 %	2.8 %	964.5 %	13.7 %	4.2 %

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4/6/2017 7:04:22 AM



Analysis index: 77 Analysis started at: 4/5/2017 12:15:17 PM Rack: 1
 Analysis label: L1709811-07 6020SL User name: ALPHALAB\metals-instrument Vial: 50

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	96.448 %	101.629 %	0.005 ppb	2,587.010 ppb	2,608.981 ppb	12.115 ppb	2,739.729 ppb	11,024.772 ppb	89.291 %
Concentration per Run 1	97.068 %	106.983 %	0.006 ppb	2,480.431 ppb	2,585.806 ppb	9.570 ppb	2,580.174 ppb	10,787.511 ppb	91.677 %
Concentration per Run 2	96.932 %	94.134 %	0.006 ppb	2,770.767 ppb	2,771.181 ppb	15.539 ppb	2,934.829 ppb	11,931.429 ppb	84.945 %
Concentration per Run 3	95.343 %	103.771 %	0.002 ppb	2,509.832 ppb	2,469.957 ppb	11.237 ppb	2,704.184 ppb	10,355.375 ppb	91.251 %
Concentration RSD	1.0 %	6.6 %	54.7 %	6.2 %	5.8 %	25.4 %	6.6 %	7.4 %	4.2 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	87.009 %	16.480 ppb	0.062 ppb	0.021 ppb	46.360 ppb	31.811 ppb	0.046 ppb	0.932 ppb	1.234 ppb
Concentration per Run 1	88.533 %	17.125 ppb	0.125 ppb	-0.028 ppb	45.671 ppb	31.760 ppb	0.081 ppb	0.746 ppb	1.567 ppb
Concentration per Run 2	86.738 %	16.707 ppb	0.000 ppb	-0.067 ppb	48.502 ppb	29.651 ppb	0.040 ppb	1.251 ppb	1.122 ppb
Concentration per Run 3	85.755 %	15.607 ppb	0.062 ppb	0.159 ppb	44.906 ppb	34.020 ppb	0.016 ppb	0.798 ppb	1.011 ppb
Concentration RSD	1.6 %	4.8 %	100.3 %	573.0 %	4.1 %	6.9 %	71.8 %	29.8 %	23.8 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	1,189.758 ppb	89.505 %	0.169 ppb	0.635 ppb	41.536 ppb	0.170 ppb	90.320 %	-0.024 ppb	0.046 ppb
Concentration per Run 1	1,215.803 ppb	86.690 %	0.085 ppb	0.700 ppb	42.640 ppb	0.227 ppb	92.653 %	-0.024 ppb	0.030 ppb
Concentration per Run 2	1,205.286 ppb	89.132 %	0.172 ppb	0.659 ppb	38.549 ppb	0.014 ppb	91.383 %	-0.024 ppb	0.052 ppb
Concentration per Run 3	1,148.185 ppb	92.692 %	0.251 ppb	0.547 ppb	43.419 ppb	0.270 ppb	86.925 %	-0.024 ppb	0.055 ppb
Concentration RSD	3.1 %	3.4 %	48.8 %	12.5 %	6.3 %	80.5 %	3.3 %	0.0 %	29.5 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	88.665 %	0.142 ppb	0.301 ppb	20.171 ppb	89.750 %	88.877 %	0.000 ppb	0.018 ppb	93.807 %
Concentration per Run 1	88.741 %	0.157 ppb	0.261 ppb	20.871 ppb	91.330 %	92.268 %	-0.005 ppb	0.017 ppb	95.850 %
Concentration per Run 2	91.339 %	0.064 ppb	0.297 ppb	19.515 ppb	88.986 %	85.915 %	0.001 ppb	0.010 ppb	91.755 %
Concentration per Run 3	85.915 %	0.205 ppb	0.344 ppb	20.128 ppb	88.933 %	88.448 %	0.003 ppb	0.025 ppb	93.816 %
Concentration RSD	3.1 %	50.2 %	13.9 %	3.4 %	1.5 %	3.6 %	7,554.8 %	43.0 %	2.2 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 78 Analysis started at: 4/5/2017 12:18:38 PM Rack: 0
 Analysis label: CCV User name: ALPHALAB\metals-instrument Vial: 9

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	97.059 %	105.540 %	95.452 ppb	9,642.420 ppb	10,043.819 ppb	101.138 ppb	10,610.054 ppb	10,494.192 ppb	91.165 %
Concentration per Run 1	97.661 %	106.704 %	95.760 ppb	9,630.311 ppb	10,277.349 ppb	103.588 ppb	10,802.338 ppb	10,424.025 ppb	89.631 %
Concentration per Run 2	96.788 %	107.402 %	95.266 ppb	9,530.272 ppb	9,596.770 ppb	98.234 ppb	10,453.055 ppb	10,345.519 ppb	93.807 %
Concentration per Run 3	96.729 %	102.514 %	95.331 ppb	9,766.677 ppb	10,257.339 ppb	101.593 ppb	10,574.770 ppb	10,713.033 ppb	90.058 %
Recovery Percentage 1			95.452 %	96.424 %	100.438 %	101.138 %	106.101 %	104.942 %	
Concentration RSD	0.5 %	2.5 %	0.3 %	1.2 %	3.9 %	2.7 %	1.7 %	1.8 %	2.5 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	90.573 %	103.051 ppb	100.565 ppb	101.234 ppb	105.460 ppb	10,255.263 ppb	101.641 ppb	100.077 ppb	99.733 ppb
Concentration per Run 1	92.244 %	109.047 ppb	97.335 ppb	103.634 ppb	104.234 ppb	10,653.406 ppb	103.999 ppb	103.475 ppb	101.833 ppb
Concentration per Run 2	91.624 %	98.148 ppb	98.540 ppb	97.129 ppb	104.489 ppb	9,787.774 ppb	96.665 ppb	97.159 ppb	95.340 ppb
Concentration per Run 3	87.852 %	101.958 ppb	105.820 ppb	102.939 ppb	107.655 ppb	10,324.607 ppb	104.260 ppb	99.597 ppb	102.026 ppb
Recovery Percentage 1		103.051 %	100.565 %	101.234 %	105.460 %	102.553 %	101.641 %	100.077 %	99.733 %
Concentration RSD	2.6 %	5.4 %	4.6 %	3.5 %	1.8 %	4.3 %	4.2 %	3.2 %	3.8 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	98.173 ppb	95.532 %	98.073 ppb	102.205 ppb	101.967 ppb	97.149 ppb	90.991 %	98.629 ppb	101.791 ppb
Concentration per Run 1	98.006 ppb	95.887 %	99.657 ppb	102.736 ppb	101.417 ppb	94.366 ppb	93.439 %	96.938 ppb	103.693 ppb
Concentration per Run 2	96.800 ppb	96.474 %	98.453 ppb	102.615 ppb	103.954 ppb	98.147 ppb	89.710 %	99.376 ppb	101.546 ppb
Concentration per Run 3	99.715 ppb	94.236 %	96.108 ppb	101.266 ppb	100.530 ppb	98.935 ppb	89.826 %	99.573 ppb	100.134 ppb
Recovery Percentage 1	98.173 %	98.073 %		102.205 %	101.967 %	97.149 %		98.629 %	101.791 %
Concentration RSD	1.5 %	1.2 %	1.8 %	0.8 %	1.7 %	2.5 %	2.3 %	1.5 %	1.8 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	90.918 %	95.958 ppb	99.680 ppb	98.949 ppb	93.632 %	90.325 %	103.147 ppb	101.247 ppb	89.266 %
Concentration per Run 1	89.022 %	97.899 ppb	99.829 ppb	100.057 ppb	95.808 %	92.172 %	106.639 ppb	104.750 ppb	88.251 %
Concentration per Run 2	92.281 %	93.035 ppb	97.606 ppb	97.083 ppb	96.345 %	89.471 %	101.323 ppb	98.775 ppb	91.234 %
Concentration per Run 3	91.452 %	96.941 ppb	101.606 ppb	99.706 ppb	88.744 %	89.333 %	101.479 ppb	100.217 ppb	88.312 %
Recovery Percentage 1		95.958 %	99.680 %	98.949 %			103.147 %	101.247 %	
Concentration RSD	1.9 %	2.7 %	2.0 %	1.6 %	4.5 %	1.8 %	2.9 %	3.1 %	1.9 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 79 Analysis started at: 4/5/2017 12:22:03 PM Rack: 0
 Analysis label: CCB User name: ALPHALAB\metals-instrument Vial: 10

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	100.401 %	99.860 %	0.018 ppb	14.170 ppb	0.449 ppb	-0.252 ppb	21.899 ppb	4.102 ppb	93.097 %
Concentration per Run 1	101.830 %	102.095 %	0.010 ppb	11.943 ppb	0.700 ppb	-0.415 ppb	7.560 ppb	14.371 ppb	97.727 %
Concentration per Run 2	100.315 %	95.531 %	0.020 ppb	18.994 ppb	2.048 ppb	-0.354 ppb	34.764 ppb	5.028 ppb	86.734 %
Concentration per Run 3	99.058 %	101.955 %	0.024 ppb	11.573 ppb	-1.402 ppb	0.014 ppb	23.373 ppb	-7.093 ppb	94.830 %
Recovery Percentage 1			3.634 %	14.170 %	0.641 %	-2.516 %	21.899 %	4.102 %	
Concentration RSD	1.4 %	3.8 %	39.2 %	29.5 %	387.4 %	92.2 %	62.4 %	262.3 %	6.1 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	90.914 %	0.088 ppb	0.080 ppb	-0.011 ppb	-0.118 ppb	7.881 ppb	0.015 ppb	0.028 ppb	0.005 ppb
Concentration per Run 1	90.687 %	0.081 ppb	0.117 ppb	0.024 ppb	-0.133 ppb	7.023 ppb	0.014 ppb	0.100 ppb	0.090 ppb
Concentration per Run 2	88.388 %	0.181 ppb	0.064 ppb	-0.026 ppb	0.032 ppb	6.229 ppb	-0.004 ppb	0.031 ppb	-0.011 ppb
Concentration per Run 3	93.667 %	0.000 ppb	0.060 ppb	-0.032 ppb	-0.254 ppb	10.389 ppb	0.035 ppb	-0.047 ppb	-0.065 ppb
Recovery Percentage 1		17.502 %	1.605 %	-1.148 %	-11.839 %	15.761 %	3.020 %	1.390 %	0.455 %
Concentration RSD	2.9 %	103.7 %	39.2 %	267.7 %	121.1 %	28.0 %	131.2 %	264.3 %	1,735.6 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	-0.380 ppb	93.659 %	0.162 ppb	0.335 ppb	0.025 ppb	0.494 ppb	94.168 %	0.072 ppb	0.011 ppb
Concentration per Run 1	-0.443 ppb	94.982 %	0.116 ppb	-0.165 ppb	-0.011 ppb	0.457 ppb	94.121 %	0.073 ppb	-0.003 ppb
Concentration per Run 2	-0.431 ppb	93.811 %	0.161 ppb	0.067 ppb	0.002 ppb	0.423 ppb	94.501 %	0.050 ppb	0.018 ppb
Concentration per Run 3	-0.268 ppb	92.184 %	0.208 ppb	1.104 ppb	0.083 ppb	0.600 ppb	93.881 %	0.093 ppb	0.018 ppb
Recovery Percentage 1	-3.804 %	93.659 %	32.306 %	6.703 %	4.910 %	24.688 %		18.040 %	5.565 %
Concentration RSD	25.7 %	1.5 %	28.5 %	201.6 %	207.5 %	19.0 %	0.3 %	30.0 %	112.6 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	92.131 %	0.769 ppb	3.361 ppb	-0.014 ppb	92.959 %	91.411 %	0.034 ppb	0.062 ppb	92.083 %
Concentration per Run 1	92.119 %	0.656 ppb	3.254 ppb	-0.024 ppb	93.162 %	91.286 %	0.038 ppb	0.056 ppb	92.854 %
Concentration per Run 2	91.841 %	0.730 ppb	3.314 ppb	0.005 ppb	94.142 %	93.186 %	0.031 ppb	0.063 ppb	90.952 %
Concentration per Run 3	92.434 %	0.920 ppb	3.515 ppb	-0.024 ppb	91.572 %	89.762 %	0.032 ppb	0.066 ppb	92.443 %
Recovery Percentage 1		25.633 %	84.025 %	-2.863 %			6.727 %	12.360 %	92.083 %
Concentration RSD	0.3 %	17.7 %	4.1 %	114.4 %	1.4 %	1.9 %	11.3 %	8.3 %	1.1 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 80 Analysis started at: 4/5/2017 12:25:29 PM Rack: 1
 Analysis label: WG989905-1 6020TL User name: ALPHALAB\metals-instrument Vial: 54

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	98.859 %	104.656 %	0.006 ppb	16.448 ppb	-0.028 ppb	1.161 ppb	6.899 ppb	27.296 ppb	95.483 %
Concentration per Run 1	100.652 %	108.939 %	0.011 ppb	19.665 ppb	1.667 ppb	1.589 ppb	27.146 ppb	25.431 ppb	95.682 %
Concentration per Run 2	98.355 %	102.095 %	0.002 ppb	15.774 ppb	-1.402 ppb	1.273 ppb	-9.231 ppb	20.414 ppb	94.404 %
Concentration per Run 3	97.571 %	102.933 %	0.006 ppb	13.904 ppb	-0.349 ppb	0.620 ppb	2.780 ppb	36.043 ppb	96.364 %
Concentration RSD	1.6 %	3.6 %	72.2 %	17.9 %	5.598.8 %	42.6 %	268.7 %	29.2 %	1.0 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	89.859 %	0.083 ppb	0.020 ppb	0.021 ppb	-0.106 ppb	10.771 ppb	-0.019 ppb	0.129 ppb	0.039 ppb
Concentration per Run 1	91.248 %	0.083 ppb	0.059 ppb	-0.034 ppb	-0.003 ppb	5.582 ppb	-0.005 ppb	-0.047 ppb	0.141 ppb
Concentration per Run 2	90.634 %	0.084 ppb	0.000 ppb	0.029 ppb	-0.122 ppb	11.990 ppb	-0.025 ppb	0.181 ppb	-0.012 ppb
Concentration per Run 3	87.696 %	0.083 ppb	0.000 ppb	0.067 ppb	-0.192 ppb	14.743 ppb	-0.025 ppb	0.252 ppb	-0.012 ppb
Concentration RSD	2.1 %	1.1 %	173.2 %	248.3 %	90.5 %	43.6 %	61.0 %	121.6 %	227.1 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	-0.449 ppb	93.777 %	0.046 ppb	0.822 ppb	0.083 ppb	0.258 ppb	92.019 %	0.006 ppb	0.008 ppb
Concentration per Run 1	-0.477 ppb	96.863 %	0.071 ppb	1.265 ppb	0.080 ppb	0.253 ppb	93.020 %	0.015 ppb	0.008 ppb
Concentration per Run 2	-0.499 ppb	91.675 %	-0.009 ppb	0.618 ppb	0.084 ppb	0.083 ppb	92.496 %	0.011 ppb	0.008 ppb
Concentration per Run 3	-0.371 ppb	92.794 %	0.077 ppb	0.582 ppb	0.085 ppb	0.439 ppb	90.542 %	-0.008 ppb	0.008 ppb
Concentration RSD	15.3 %	2.9 %	104.0 %	46.8 %	2.8 %	68.8 %	1.4 %	205.9 %	1.8 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	91.263 %	0.325 ppb	1.239 ppb	0.006 ppb	91.359 %	89.289 %	0.009 ppb	0.026 ppb	95.830 %
Concentration per Run 1	92.048 %	0.354 ppb	1.221 ppb	0.005 ppb	92.909 %	90.614 %	0.010 ppb	0.031 ppb	96.002 %
Concentration per Run 2	91.729 %	0.271 ppb	1.063 ppb	-0.023 ppb	90.037 %	91.106 %	0.009 ppb	0.025 ppb	95.748 %
Concentration per Run 3	90.012 %	0.352 ppb	1.433 ppb	0.035 ppb	91.131 %	86.146 %	0.007 ppb	0.023 ppb	95.739 %
Concentration RSD	1.2 %	14.5 %	15.0 %	517.2 %	1.6 %	3.1 %	13.9 %	14.2 %	0.2 %

Alpha ICPMSQ Full

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Analysis index: 81 Analysis started at: 4/5/2017 12:28:51 PM Rack: 1
 Analysis label: WG989905-2D5 6020TL User name: ALPHALAB\metals-instrument Vial: 55

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	98.826 %	102.095 %	9.924 ppb	2,132.698 ppb	2,108.617 ppb	404.851 ppb	2,169.290 ppb	2,166.671 ppb	92.983 %
Concentration per Run 1	98.553 %	102.933 %	9.846 ppb	2,118.769 ppb	2,083.720 ppb	416.876 ppb	2,303.770 ppb	2,274.699 ppb	89.291 %
Concentration per Run 2	97.718 %	101.816 %	10.297 ppb	2,162.145 ppb	2,145.439 ppb	391.163 ppb	2,104.527 ppb	2,304.450 ppb	93.722 %
Concentration per Run 3	100.208 %	101.536 %	9.631 ppb	2,117.179 ppb	2,096.692 ppb	406.514 ppb	2,099.573 ppb	1,920.865 ppb	95.938 %
Concentration RSD	1.3 %	0.7 %	3.4 %	1.2 %	1.5 %	3.2 %	5.4 %	9.8 %	3.6 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	91.740 %	176.547 ppb	104.489 ppb	41.568 ppb	105.555 ppb	211.798 ppb	101.826 ppb	98.683 ppb	51.716 ppb
Concentration per Run 1	91.792 %	176.751 ppb	108.115 ppb	43.189 ppb	107.820 ppb	208.385 ppb	103.407 ppb	103.604 ppb	51.084 ppb
Concentration per Run 2	91.551 %	179.748 ppb	102.692 ppb	40.499 ppb	103.413 ppb	215.214 ppb	100.276 ppb	93.455 ppb	53.323 ppb
Concentration per Run 3	91.876 %	173.142 ppb	102.659 ppb	41.018 ppb	105.432 ppb	211.796 ppb	101.795 ppb	98.990 ppb	50.741 ppb
Concentration RSD	0.2 %	1.9 %	3.0 %	3.4 %	2.1 %	1.6 %	1.5 %	5.1 %	2.7 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	101.961 ppb	94.708 %	25.900 ppb	26.247 ppb	209.351 ppb	194.748 ppb	93.224 %	10.303 ppb	11.423 ppb
Concentration per Run 1	102.001 ppb	95.454 %	27.505 ppb	21.716 ppb	203.420 ppb	187.582 ppb	95.491 %	10.081 ppb	11.540 ppb
Concentration per Run 2	100.643 ppb	93.305 %	23.848 ppb	27.717 ppb	214.051 ppb	192.894 ppb	92.561 %	10.688 ppb	11.351 ppb
Concentration per Run 3	103.240 ppb	95.364 %	26.347 ppb	29.309 ppb	210.583 ppb	203.768 ppb	91.621 %	10.141 ppb	11.377 ppb
Concentration RSD	1.3 %	1.3 %	7.2 %	15.3 %	2.6 %	4.2 %	2.2 %	3.2 %	0.9 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	89.302 %	205.532 ppb	103.147 ppb	416.818 ppb	91.847 %	91.302 %	25.526 ppb	106.149 ppb	93.834 %
Concentration per Run 1	89.931 %	199.818 ppb	99.521 ppb	410.028 ppb	91.712 %	94.255 %	25.955 ppb	103.780 ppb	94.900 %
Concentration per Run 2	89.306 %	208.294 ppb	102.621 ppb	410.989 ppb	93.539 %	89.402 %	25.501 ppb	107.154 ppb	93.982 %
Concentration per Run 3	88.669 %	208.484 ppb	107.297 ppb	429.436 ppb	90.290 %	90.248 %	25.120 ppb	107.514 ppb	92.621 %
Concentration RSD	0.7 %	2.4 %	3.8 %	2.6 %	1.8 %	2.8 %	1.6 %	1.9 %	1.2 %

Alpha ICPMSQ Full

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Analysis index: 82 Analysis started at: 4/5/2017 12:32:13 PM Rack: 1
 Analysis label: WG989905-3D10 6020TL User name: ALPHALAB\metals-instrument Vial: 56

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	99.434 %	105.680 %	5.018 ppb	6,987.908 ppb	3,545.433 ppb	204.139 ppb	1,248.389 ppb	2,954.893 ppb	91.393 %
Concentration per Run 1	99.361 %	106.983 %	4.989 ppb	7,057.975 ppb	3,596.994 ppb	201.997 ppb	1,280.962 ppb	2,760.839 ppb	92.870 %
Concentration per Run 2	99.269 %	100.838 %	5.024 ppb	7,128.198 ppb	3,625.177 ppb	205.245 ppb	1,288.033 ppb	3,101.535 ppb	91.165 %
Concentration per Run 3	99.674 %	109.218 %	5.041 ppb	6,777.552 ppb	3,414.129 ppb	205.176 ppb	1,176.173 ppb	3,002.304 ppb	90.143 %
Concentration RSD	0.2 %	4.1 %	0.5 %	2.7 %	3.2 %	0.9 %	5.0 %	5.9 %	1.5 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	90.398 %	93.785 ppb	51.113 ppb	19.925 ppb	55.083 ppb	97.197 ppb	49.442 ppb	49.435 ppb	26.668 ppb
Concentration per Run 1	89.452 %	97.937 ppb	53.928 ppb	19.469 ppb	54.866 ppb	79.079 ppb	51.755 ppb	52.763 ppb	27.142 ppb
Concentration per Run 2	90.809 %	92.406 ppb	49.289 ppb	20.648 ppb	56.598 ppb	104.352 ppb	48.976 ppb	48.804 ppb	28.121 ppb
Concentration per Run 3	90.934 %	91.011 ppb	50.123 ppb	19.657 ppb	53.784 ppb	108.159 ppb	47.595 ppb	46.739 ppb	24.741 ppb
Concentration RSD	0.9 %	3.9 %	4.8 %	3.2 %	2.6 %	16.3 %	4.3 %	6.2 %	6.5 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	50.557 ppb	96.258 %	13.787 ppb	12.968 ppb	354.447 ppb	93.476 ppb	93.771 %	4.830 ppb	5.481 ppb
Concentration per Run 1	51.210 ppb	94.817 %	14.429 ppb	12.924 ppb	370.382 ppb	99.629 ppb	91.241 %	4.943 ppb	5.594 ppb
Concentration per Run 2	51.450 ppb	95.439 %	14.075 ppb	13.288 ppb	353.769 ppb	91.029 ppb	93.319 %	4.693 ppb	5.524 ppb
Concentration per Run 3	49.012 ppb	98.518 %	12.857 ppb	12.691 ppb	339.191 ppb	89.769 ppb	96.753 %	4.854 ppb	5.324 ppb
Concentration RSD	2.7 %	2.1 %	6.0 %	2.3 %	4.4 %	5.7 %	3.0 %	2.6 %	2.6 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	94.259 %	94.278 ppb	55.737 ppb	204.660 ppb	92.369 %	92.430 %	12.522 ppb	52.673 ppb	91.531 %
Concentration per Run 1	95.544 %	93.584 ppb	55.895 ppb	210.731 ppb	90.961 %	92.599 %	12.554 ppb	53.674 ppb	91.323 %
Concentration per Run 2	93.815 %	96.358 ppb	55.612 ppb	204.945 ppb	91.793 %	91.544 %	12.373 ppb	51.873 ppb	91.870 %
Concentration per Run 3	93.418 %	92.893 ppb	55.705 ppb	198.302 ppb	94.352 %	93.148 %	12.640 ppb	52.472 ppb	91.398 %
Concentration RSD	1.2 %	1.9 %	0.3 %	3.0 %	1.9 %	0.9 %	1.1 %	1.7 %	0.3 %

Alpha ICPMSQ Full

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Analysis index: 83 Analysis started at: 4/5/2017 12:35:35 PM Rack: 1
 Analysis label: WG989905-4D10 6020TL User name: ALPHALAB\metals-instrument Vial: 57

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	100.966 %	101.071 %	4.918 ppb	7,397.863 ppb	3,769.508 ppb	220.871 ppb	1,238.987 ppb	2,938.035 ppb	92.046 %
Concentration per Run 1	101.257 %	105.726 %	5.059 ppb	7,387.975 ppb	3,889.666 ppb	226.452 ppb	1,337.171 ppb	3,063.782 ppb	88.183 %
Concentration per Run 2	100.187 %	100.978 %	4.746 ppb	7,213.027 ppb	3,510.424 ppb	205.564 ppb	1,090.710 ppb	3,036.337 ppb	97.046 %
Concentration per Run 3	101.454 %	96.508 %	4.949 ppb	7,592.588 ppb	3,908.435 ppb	230.598 ppb	1,289.081 ppb	2,713.986 ppb	90.910 %
Concentration RSD	0.7 %	4.6 %	3.2 %	2.6 %	6.0 %	6.1 %	10.5 %	6.6 %	4.9 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	93.169 %	92.064 ppb	51.141 ppb	20.321 ppb	56.391 ppb	114.743 ppb	50.535 ppb	54.238 ppb	27.744 ppb
Concentration per Run 1	91.592 %	95.694 ppb	55.060 ppb	21.764 ppb	58.338 ppb	130.774 ppb	51.389 ppb	56.470 ppb	27.293 ppb
Concentration per Run 2	92.124 %	85.573 ppb	45.738 ppb	18.247 ppb	53.131 ppb	97.382 ppb	49.505 ppb	48.637 ppb	25.779 ppb
Concentration per Run 3	95.789 %	94.924 ppb	52.625 ppb	20.952 ppb	57.705 ppb	116.073 ppb	50.710 ppb	57.609 ppb	30.160 ppb
Concentration RSD	2.5 %	6.1 %	9.5 %	9.1 %	5.0 %	14.6 %	1.9 %	9.0 %	8.0 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	51.097 ppb	95.944 %	13.959 ppb	12.808 ppb	368.690 ppb	100.334 ppb	92.781 %	4.932 ppb	5.688 ppb
Concentration per Run 1	51.540 ppb	94.065 %	14.110 ppb	14.737 ppb	381.198 ppb	103.336 ppb	92.017 %	4.977 ppb	5.854 ppb
Concentration per Run 2	49.112 ppb	102.650 %	12.605 ppb	12.890 ppb	348.266 ppb	95.269 ppb	93.192 %	4.867 ppb	6.035 ppb
Concentration per Run 3	52.639 ppb	91.116 %	15.162 ppb	10.797 ppb	376.607 ppb	102.397 ppb	93.135 %	4.953 ppb	5.176 ppb
Concentration RSD	3.5 %	6.2 %	9.2 %	15.4 %	4.8 %	4.4 %	0.7 %	1.2 %	8.0 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	91.325 %	101.249 ppb	57.672 ppb	213.822 ppb	91.536 %	90.816 %	12.615 ppb	53.669 ppb	91.096 %
Concentration per Run 1	89.915 %	104.952 ppb	58.334 ppb	219.159 ppb	89.810 %	89.781 %	13.141 ppb	55.628 ppb	88.547 %
Concentration per Run 2	91.502 %	101.073 ppb	56.477 ppb	208.735 ppb	94.951 %	91.878 %	12.589 ppb	53.683 ppb	91.060 %
Concentration per Run 3	92.557 %	97.722 ppb	58.204 ppb	213.573 ppb	89.846 %	90.790 %	12.115 ppb	51.694 ppb	93.680 %
Concentration RSD	1.5 %	3.6 %	1.8 %	2.4 %	3.2 %	1.2 %	4.1 %	3.7 %	2.8 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 84 Analysis started at: 4/5/2017 12:38:58 PM Rack: 1
 Analysis label: WG989905-5D10 6020TL User name: ALPHALAB\metals-instrument Vial: 58

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	100.113 %	98.976 %	51.155 ppb	11,644.076 ppb	8,080.899 ppb	51.533 ppb	5,610.868 ppb	7,499.883 ppb	95.341 %
Concentration per Run 1	100.838 %	99.162 %	50.547 ppb	11,724.185 ppb	8,424.470 ppb	47.111 ppb	5,851.987 ppb	7,633.130 ppb	94.745 %
Concentration per Run 2	100.826 %	100.698 %	51.200 ppb	11,526.197 ppb	7,794.230 ppb	50.783 ppb	5,462.810 ppb	7,502.334 ppb	96.875 %
Concentration per Run 3	98.675 %	97.067 %	51.719 ppb	11,681.846 ppb	8,023.998 ppb	56.705 ppb	5,517.807 ppb	7,364.184 ppb	94.404 %
Concentration RSD	1.2 %	1.8 %	1.1 %	0.9 %	3.9 %	9.4 %	3.8 %	1.8 %	1.4 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	92.951 %	56.981 ppb	52.900 ppb	52.185 ppb	55.850 ppb	5,354.656 ppb	54.932 ppb	50.513 ppb	54.113 ppb
Concentration per Run 1	96.122 %	58.693 ppb	53.626 ppb	53.895 ppb	58.363 ppb	5,485.401 ppb	56.305 ppb	48.621 ppb	56.713 ppb
Concentration per Run 2	91.746 %	55.865 ppb	54.164 ppb	51.669 ppb	57.134 ppb	5,446.700 ppb	55.321 ppb	49.468 ppb	51.604 ppb
Concentration per Run 3	90.986 %	56.386 ppb	50.911 ppb	50.991 ppb	52.053 ppb	5,131.866 ppb	53.171 ppb	53.451 ppb	54.023 ppb
Concentration RSD	3.0 %	2.6 %	3.3 %	2.9 %	6.0 %	3.6 %	2.9 %	5.1 %	4.7 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	53.285 ppb	97.501 %	55.688 ppb	52.401 ppb	318.790 ppb	53.987 ppb	93.973 %	24.603 ppb	54.769 ppb
Concentration per Run 1	54.772 ppb	97.833 %	54.007 ppb	48.026 ppb	328.584 ppb	55.460 ppb	93.773 %	24.839 ppb	55.952 ppb
Concentration per Run 2	53.038 ppb	95.696 %	57.279 ppb	55.892 ppb	320.376 ppb	54.732 ppb	93.313 %	24.174 ppb	55.862 ppb
Concentration per Run 3	52.044 ppb	98.976 %	55.777 ppb	53.286 ppb	307.409 ppb	51.769 ppb	94.834 %	24.795 ppb	52.494 ppb
Concentration RSD	2.6 %	1.7 %	2.9 %	7.6 %	3.3 %	3.6 %	0.8 %	1.5 %	3.6 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	91.027 %	53.841 ppb	65.443 ppb	60.096 ppb	89.839 %	90.867 %	53.408 ppb	52.502 ppb	91.018 %
Concentration per Run 1	90.204 %	54.992 ppb	66.582 ppb	58.981 ppb	89.696 %	93.640 %	56.470 ppb	53.189 ppb	91.486 %
Concentration per Run 2	90.304 %	54.732 ppb	66.297 ppb	59.453 ppb	89.509 %	89.804 %	51.496 ppb	51.819 ppb	91.715 %
Concentration per Run 3	92.572 %	51.799 ppb	63.451 ppb	61.856 ppb	90.312 %	89.158 %	52.258 ppb	52.497 ppb	89.852 %
Concentration RSD	1.5 %	3.3 %	2.6 %	2.6 %	0.5 %	2.7 %	5.0 %	1.3 %	1.1 %

Alpha ICPMSQ Full

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Analysis index: 85 Analysis started at: 4/5/2017 12:42:21 PM Rack: 1
 Analysis label: WG989905-6D5 6020TL User name: ALPHALAB\metals-instrument Vial: 59

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	100.414 %	101.304 %	0.012 ppb	12,650.250 ppb	5,393.943 ppb	3.248 ppb	405.432 ppb	3,965.607 ppb	96.875 %
Concentration per Run 1	102.028 %	92.458 %	0.001 ppb	13,473.723 ppb	5,745.820 ppb	2.823 ppb	468.914 ppb	3,991.372 ppb	98.750 %
Concentration per Run 2	101.529 %	102.654 %	0.019 ppb	12,648.253 ppb	5,307.395 ppb	3.324 ppb	361.347 ppb	4,089.077 ppb	95.767 %
Concentration per Run 3	97.684 %	108.799 %	0.016 ppb	11,828.775 ppb	5,128.614 ppb	3.598 ppb	386.033 ppb	3,816.372 ppb	96.108 %
Concentration RSD	2.4 %	8.1 %	77.6 %	6.5 %	5.9 %	12.1 %	13.9 %	3.5 %	1.7 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	93.137 %	5.341 ppb	0.020 ppb	0.018 ppb	3.531 ppb	22.652 ppb	-0.012 ppb	0.075 ppb	0.020 ppb
Concentration per Run 1	92.506 %	5.371 ppb	0.000 ppb	0.001 ppb	3.822 ppb	25.495 ppb	-0.006 ppb	0.024 ppb	-0.015 ppb
Concentration per Run 2	94.421 %	4.879 ppb	0.000 ppb	0.046 ppb	2.939 ppb	21.977 ppb	-0.005 ppb	0.174 ppb	0.090 ppb
Concentration per Run 3	92.483 %	5.773 ppb	0.059 ppb	0.006 ppb	3.831 ppb	20.485 ppb	-0.025 ppb	0.026 ppb	-0.014 ppb
Concentration RSD	1.2 %	8.4 %	173.2 %	139.8 %	14.5 %	11.4 %	91.4 %	114.7 %	297.6 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	0.008 ppb	97.338 %	2.168 ppb	0.468 ppb	521.700 ppb	1.281 ppb	95.199 %	0.001 ppb	0.000 ppb
Concentration per Run 1	0.106 ppb	99.762 %	2.606 ppb	0.602 ppb	541.693 ppb	1.308 ppb	92.712 %	-0.016 ppb	0.008 ppb
Concentration per Run 2	0.038 ppb	96.354 %	1.779 ppb	0.580 ppb	529.822 ppb	1.230 ppb	95.073 %	0.033 ppb	-0.003 ppb
Concentration per Run 3	-0.121 ppb	95.897 %	2.120 ppb	0.221 ppb	493.586 ppb	1.306 ppb	97.811 %	-0.013 ppb	-0.003 ppb
Concentration RSD	1,535.9 %	2.2 %	19.2 %	45.7 %	4.8 %	3.5 %	2.7 %	2,370.0 %	1,938.8 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	94.013 %	0.855 ppb	1.492 ppb	15.064 ppb	91.892 %	92.251 %	0.046 ppb	0.045 ppb	93.119 %
Concentration per Run 1	91.073 %	0.775 ppb	1.458 ppb	16.263 ppb	92.290 %	96.881 %	0.049 ppb	0.043 ppb	91.572 %
Concentration per Run 2	96.961 %	0.884 ppb	1.440 ppb	14.615 ppb	95.047 %	90.123 %	0.049 ppb	0.049 ppb	91.017 %
Concentration per Run 3	94.005 %	0.907 ppb	1.577 ppb	14.314 ppb	88.338 %	89.751 %	0.040 ppb	0.044 ppb	96.767 %
Concentration RSD	3.1 %	8.2 %	5.0 %	7.0 %	3.7 %	4.4 %	12.3 %	7.1 %	3.4 %

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Analysis index: 86 Analysis started at: 4/5/2017 12:45:44 PM Rack: 1
 Analysis label: L1709265-23 6020TL User name: ALPHALAB\metals-instrument Vial: 60

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	98.947 %	103.166 %	0.006 ppb	65,547.476 ppb	25,811.805 ppb	7.027 ppb	1,825.646 ppb	20,219.951 ppb	89.603 %
Concentration per Run 1	98.856 %	96.508 %	0.006 ppb	68,961.797 ppb	27,110.823 ppb	6.132 ppb	1,769.102 ppb	19,449.151 ppb	92.870 %
Concentration per Run 2	99.534 %	105.168 %	-0.003 ppb	63,960.880 ppb	25,094.412 ppb	7.518 ppb	1,841.150 ppb	21,086.663 ppb	88.183 %
Concentration per Run 3	98.452 %	107.821 %	0.015 ppb	63,719.752 ppb	25,230.181 ppb	7.431 ppb	1,866.685 ppb	20,124.040 ppb	87.757 %
Concentration RSD	0.6 %	5.7 %	147.9 %	4.5 %	4.4 %	11.0 %	2.8 %	4.1 %	3.2 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	90.939 %	31.775 ppb	0.085 ppb	0.115 ppb	20.581 ppb	105.407 ppb	-0.011 ppb	0.185 ppb	0.310 ppb
Concentration per Run 1	90.930 %	27.750 ppb	0.000 ppb	0.009 ppb	18.294 ppb	110.996 ppb	-0.005 ppb	0.178 ppb	0.408 ppb
Concentration per Run 2	90.554 %	34.538 ppb	0.127 ppb	0.123 ppb	23.486 ppb	99.169 ppb	-0.004 ppb	0.108 ppb	0.311 ppb
Concentration per Run 3	91.334 %	33.037 ppb	0.128 ppb	0.213 ppb	19.962 ppb	106.055 ppb	-0.025 ppb	0.270 ppb	0.212 ppb
Concentration RSD	0.4 %	11.2 %	86.6 %	88.6 %	12.9 %	5.6 %	102.5 %	43.9 %	31.6 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	0.595 ppb	93.235 %	11.181 ppb	0.076 ppb	2,725.808 ppb	3.761 ppb	86.321 %	-0.013 ppb	0.000 ppb
Concentration per Run 1	0.674 ppb	95.083 %	10.106 ppb	-0.112 ppb	2,792.064 ppb	4.324 ppb	84.819 %	-0.016 ppb	-0.003 ppb
Concentration per Run 2	0.604 ppb	94.167 %	11.816 ppb	0.201 ppb	2,686.165 ppb	3.422 ppb	87.107 %	-0.008 ppb	0.008 ppb
Concentration per Run 3	0.508 ppb	90.454 %	11.621 ppb	0.140 ppb	2,699.194 ppb	3.537 ppb	87.036 %	-0.016 ppb	-0.003 ppb
Concentration RSD	14.1 %	2.6 %	8.4 %	217.1 %	2.1 %	13.1 %	1.5 %	35.7 %	1,510.3 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	88.887 %	0.878 ppb	1.233 ppb	79.411 ppb	89.733 %	91.237 %	0.017 ppb	0.071 ppb	92.621 %
Concentration per Run 1	89.902 %	0.700 ppb	1.180 ppb	83.610 ppb	91.010 %	90.174 %	0.018 ppb	0.083 ppb	91.617 %
Concentration per Run 2	90.050 %	0.986 ppb	1.182 ppb	78.258 ppb	88.552 %	91.986 %	0.012 ppb	0.068 ppb	93.289 %
Concentration per Run 3	86.709 %	0.947 ppb	1.338 ppb	76.365 ppb	89.638 %	91.552 %	0.022 ppb	0.061 ppb	92.955 %
Concentration RSD	2.1 %	17.7 %	7.3 %	4.7 %	1.4 %	1.0 %	30.2 %	16.2 %	1.0 %

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Analysis index: 87 Analysis started at: 4/5/2017 12:49:07 PM Rack: 1
 Analysis label: L1709811-08 6020SL User name: ALPHALAB\metals-instrument Vial: 51

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	96.085 %	97.579 %	0.011 ppb	53,835.146 ppb	3,647.304 ppb	10.875 ppb	2,400.055 ppb	43,498.205 ppb	92.358 %
Concentration per Run 1	96.913 %	97.765 %	0.002 ppb	56,481.112 ppb	3,715.916 ppb	13.376 ppb	2,425.645 ppb	43,942.840 ppb	93.466 %
Concentration per Run 2	96.766 %	92.318 %	0.006 ppb	54,350.256 ppb	3,680.825 ppb	9.978 ppb	2,519.661 ppb	43,424.698 ppb	93.978 %
Concentration per Run 3	94.575 %	102.654 %	0.026 ppb	50,674.068 ppb	3,545.172 ppb	9.269 ppb	2,254.859 ppb	43,127.076 ppb	89.631 %
Concentration RSD	1.4 %	5.3 %	113.1 %	5.5 %	2.5 %	20.2 %	5.6 %	0.9 %	2.6 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	89.624 %	62.642 ppb	0.146 ppb	0.338 ppb	4.631 ppb	40.865 ppb	0.016 ppb	1.478 ppb	4.610 ppb
Concentration per Run 1	90.723 %	60.996 ppb	0.061 ppb	0.428 ppb	5.178 ppb	49.956 ppb	0.037 ppb	1.357 ppb	5.084 ppb
Concentration per Run 2	90.369 %	60.671 ppb	0.060 ppb	0.336 ppb	4.456 ppb	37.832 ppb	0.015 ppb	1.160 ppb	4.020 ppb
Concentration per Run 3	87.779 %	66.259 ppb	0.315 ppb	0.250 ppb	4.260 ppb	34.808 ppb	-0.004 ppb	1.916 ppb	4.727 ppb
Concentration RSD	1.8 %	5.0 %	100.9 %	26.3 %	10.4 %	19.6 %	128.6 %	26.5 %	11.7 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	2.461 ppb	90.624 %	0.861 ppb	0.323 ppb	154.061 ppb	0.649 ppb	89.554 %	-0.022 ppb	0.076 ppb
Concentration per Run 1	2.756 ppb	88.013 %	0.858 ppb	0.622 ppb	161.393 ppb	0.635 ppb	88.727 %	-0.024 ppb	0.088 ppb
Concentration per Run 2	2.241 ppb	93.455 %	0.978 ppb	-0.221 ppb	149.838 ppb	0.615 ppb	90.473 %	-0.020 ppb	0.053 ppb
Concentration per Run 3	2.387 ppb	90.403 %	0.746 ppb	0.569 ppb	150.953 ppb	0.698 ppb	89.461 %	-0.020 ppb	0.086 ppb
Concentration RSD	10.8 %	3.0 %	13.5 %	146.1 %	4.1 %	6.7 %	1.0 %	10.9 %	25.7 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	88.444 %	0.599 ppb	1.069 ppb	63.222 ppb	89.800 %	90.472 %	0.006 ppb	0.065 ppb	91.676 %
Concentration per Run 1	87.475 %	0.542 ppb	0.945 ppb	66.984 ppb	92.131 %	91.199 %	0.007 ppb	0.061 ppb	92.224 %
Concentration per Run 2	87.710 %	0.594 ppb	1.081 ppb	63.616 ppb	87.863 %	92.050 %	0.006 ppb	0.059 ppb	91.601 %
Concentration per Run 3	90.146 %	0.662 ppb	1.180 ppb	59.065 ppb	89.407 %	88.168 %	0.005 ppb	0.074 ppb	91.202 %
Concentration RSD	1.7 %	10.0 %	11.0 %	6.3 %	2.4 %	2.3 %	12.3 %	12.2 %	0.6 %

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Analysis index: 88 Analysis started at: 4/5/2017 12:52:28 PM Rack: 1
 Analysis label: L1709811-09 6020SL User name: ALPHALAB\metals-instrument Vial: 52

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	94.397 %	97.160 %	0.011 ppb	109,692.178 ppb	5,228.689 ppb	12.900 ppb	3,269.009 ppb	40,934.088 ppb	87.387 %
Concentration per Run 1	94.529 %	92.877 %	0.016 ppb	112,371.233 ppb	5,386.072 ppb	14.346 ppb	3,343.372 ppb	42,496.483 ppb	88.950 %
Concentration per Run 2	94.411 %	101.117 %	0.002 ppb	110,175.520 ppb	5,189.776 ppb	13.184 ppb	3,307.513 ppb	40,201.255 ppb	84.944 %
Concentration per Run 3	94.252 %	97.486 %	0.016 ppb	106,529.779 ppb	5,110.218 ppb	11.170 ppb	3,156.142 ppb	40,104.527 ppb	88.268 %
Concentration RSD	0.1 %	4.3 %	72.8 %	2.7 %	2.7 %	12.5 %	3.0 %	3.3 %	2.5 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	89.704 %	59.160 ppb	0.191 ppb	0.507 ppb	881.208 ppb	2,518.784 ppb	1.446 ppb	2.277 ppb	1.421 ppb
Concentration per Run 1	90.503 %	57.379 ppb	0.317 ppb	0.360 ppb	886.896 ppb	2,601.855 ppb	1.407 ppb	2.871 ppb	1.537 ppb
Concentration per Run 2	89.080 %	62.484 ppb	0.130 ppb	0.634 ppb	892.046 ppb	2,456.353 ppb	1.466 ppb	2.147 ppb	1.177 ppb
Concentration per Run 3	89.528 %	57.616 ppb	0.127 ppb	0.529 ppb	864.683 ppb	2,498.142 ppb	1.467 ppb	1.813 ppb	1.550 ppb
Concentration RSD	0.8 %	4.9 %	57.0 %	27.2 %	1.7 %	3.0 %	2.4 %	23.8 %	14.9 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	7.387 ppb	93.150 %	6.220 ppb	0.149 ppb	195.231 ppb	0.418 ppb	87.030 %	-0.006 ppb	0.093 ppb
Concentration per Run 1	7.522 ppb	90.302 %	6.486 ppb	0.207 ppb	205.845 ppb	0.684 ppb	85.648 %	0.006 ppb	0.091 ppb
Concentration per Run 2	7.241 ppb	95.134 %	6.413 ppb	0.174 ppb	186.756 ppb	0.374 ppb	87.792 %	-0.020 ppb	0.098 ppb
Concentration per Run 3	7.399 ppb	94.015 %	5.761 ppb	0.067 ppb	193.093 ppb	0.195 ppb	87.650 %	-0.003 ppb	0.089 ppb
Concentration RSD	1.9 %	2.7 %	6.4 %	48.9 %	5.0 %	59.2 %	1.4 %	217.8 %	5.1 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	87.014 %	0.410 ppb	0.894 ppb	81.026 ppb	89.390 %	88.319 %	0.001 ppb	0.132 ppb	88.090 %
Concentration per Run 1	84.903 %	0.406 ppb	0.768 ppb	79.440 ppb	87.768 %	88.488 %	-0.004 ppb	0.132 ppb	89.224 %
Concentration per Run 2	89.655 %	0.403 ppb	0.927 ppb	83.174 ppb	90.925 %	87.496 %	0.002 ppb	0.129 ppb	87.383 %
Concentration per Run 3	86.484 %	0.422 ppb	0.988 ppb	80.463 ppb	89.476 %	88.972 %	0.004 ppb	0.136 ppb	87.664 %
Concentration RSD	2.8 %	2.4 %	12.7 %	2.4 %	1.8 %	0.9 %	526.8 %	2.6 %	1.1 %

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Analysis index: 89 Analysis started at: 4/5/2017 12:55:49 PM Rack: 1
 Analysis label: L1709811-10 6020SL User name: ALPHALAB\metals-instrument Vial: 53

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	96.966 %	102.048 %	0.003 ppb	3,638.768 ppb	5,706.209 ppb	1.339 ppb	434.392 ppb	17,102.449 ppb	88.836 %
Concentration per Run 1	97.298 %	106.006 %	0.006 ppb	3,492.120 ppb	5,557.141 ppb	1.680 ppb	457.354 ppb	16,603.688 ppb	91.847 %
Concentration per Run 2	97.754 %	99.162 %	-0.003 ppb	3,681.245 ppb	5,785.078 ppb	1.375 ppb	401.249 ppb	16,040.607 ppb	89.205 %
Concentration per Run 3	95.847 %	100.978 %	0.006 ppb	3,742.938 ppb	5,776.407 ppb	0.962 ppb	444.574 ppb	18,663.053 ppb	85.456 %
Concentration RSD	1.0 %	3.5 %	164.8 %	3.6 %	2.3 %	26.9 %	6.8 %	8.1 %	3.6 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	88.969 %	24.274 ppb	0.062 ppb	-0.034 ppb	82.220 ppb	8.778 ppb	0.038 ppb	0.113 ppb	0.285 ppb
Concentration per Run 1	88.916 %	21.865 ppb	0.124 ppb	-0.008 ppb	79.049 ppb	17.030 ppb	0.099 ppb	0.108 ppb	0.372 ppb
Concentration per Run 2	89.527 %	23.886 ppb	0.063 ppb	-0.092 ppb	79.288 ppb	7.695 ppb	-0.004 ppb	-0.047 ppb	0.151 ppb
Concentration per Run 3	88.463 %	27.071 ppb	0.000 ppb	-0.001 ppb	88.322 ppb	1.608 ppb	0.018 ppb	0.278 ppb	0.332 ppb
Concentration RSD	0.6 %	10.8 %	99.4 %	149.9 %	6.4 %	88.5 %	144.3 %	144.0 %	41.2 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	1.341 ppb	90.590 %	0.123 ppb	0.153 ppb	247.238 ppb	0.298 ppb	90.957 %	-0.018 ppb	0.008 ppb
Concentration per Run 1	0.901 ppb	90.404 %	0.080 ppb	0.311 ppb	250.337 ppb	0.298 ppb	91.179 %	-0.020 ppb	0.008 ppb
Concentration per Run 2	1.422 ppb	92.845 %	0.206 ppb	0.041 ppb	243.395 ppb	0.262 ppb	90.546 %	-0.012 ppb	0.008 ppb
Concentration per Run 3	1.701 ppb	88.521 %	0.083 ppb	0.108 ppb	247.983 ppb	0.335 ppb	91.145 %	-0.020 ppb	0.008 ppb
Concentration RSD	30.2 %	2.4 %	58.6 %	91.5 %	1.4 %	12.4 %	0.4 %	26.5 %	1.1 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	90.879 %	0.312 ppb	0.603 ppb	34.259 ppb	90.029 %	91.372 %	0.001 ppb	0.018 ppb	94.060 %
Concentration per Run 1	91.972 %	0.233 ppb	0.545 ppb	33.007 ppb	90.000 %	92.288 %	-0.006 ppb	0.010 ppb	98.618 %
Concentration per Run 2	90.678 %	0.350 ppb	0.710 ppb	34.166 ppb	88.082 %	88.883 %	0.007 ppb	0.021 ppb	94.920 %
Concentration per Run 3	89.987 %	0.352 ppb	0.554 ppb	35.604 ppb	92.004 %	92.944 %	0.004 ppb	0.022 ppb	88.642 %
Concentration RSD	1.1 %	21.7 %	15.3 %	3.8 %	2.2 %	2.4 %	481.8 %	36.8 %	5.4 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 90 Analysis started at: 4/5/2017 12:59:10 PM
Analysis label: CCV User name:

Rack: 0
Vial: 9

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	99.174 %	104.190 %	94.581 ppb	9,711.173 ppb	9,768.653 ppb	98.140 ppb	10,079.585 ppb	10,302.324 ppb	95.284 %
Concentration per Run 1	98.393 %	100.419 %	95.294 ppb	10,185.894 ppb	10,277.430 ppb	99.993 ppb	10,482.261 ppb	10,758.150 ppb	92.785 %
Concentration per Run 2	99.787 %	109.079 %	94.103 ppb	9,178.269 ppb	9,333.566 ppb	90.170 ppb	9,580.259 ppb	9,597.533 ppb	100.028 %
Concentration per Run 3	99.342 %	103.073 %	94.345 ppb	9,769.355 ppb	9,694.963 ppb	104.258 ppb	10,176.236 ppb	10,551.290 ppb	93.040 %
Recovery Percentage 1			94.581 %	97.112 %	97.687 %	98.140 %	100.796 %	103.023 %	
Concentration RSD	0.7 %	4.3 %	0.7 %	5.2 %	4.9 %	7.4 %	4.6 %	6.0 %	4.3 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	93.901 %	98.899 ppb	100.967 ppb	97.847 ppb	101.427 ppb	10,181.720 ppb	100.267 ppb	98.956 ppb	99.593 ppb
Concentration per Run 1	92.038 %	102.857 ppb	102.699 ppb	100.536 ppb	108.826 ppb	10,833.780 ppb	103.092 ppb	107.452 ppb	102.987 ppb
Concentration per Run 2	96.157 %	95.007 ppb	97.841 ppb	94.262 ppb	95.921 ppb	9,515.376 ppb	99.262 ppb	90.973 ppb	96.201 ppb
Concentration per Run 3	93.507 %	98.833 ppb	102.361 ppb	98.742 ppb	99.534 ppb	10,196.005 ppb	98.447 ppb	98.442 ppb	99.591 ppb
Recovery Percentage 1		98.899 %	100.967 %	97.847 %	101.427 %	101.817 %	100.267 %	98.956 %	99.593 %
Concentration RSD	2.2 %	4.0 %	2.7 %	3.3 %	6.6 %	6.5 %	2.5 %	8.3 %	3.4 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	99.958 ppb	94.170 %	102.789 ppb	101.008 ppb	102.954 ppb	98.142 ppb	93.305 %	98.077 ppb	100.873 ppb
Concentration per Run 1	100.675 ppb	91.262 %	106.722 ppb	103.996 ppb	106.809 ppb	100.160 ppb	93.572 %	98.338 ppb	101.184 ppb
Concentration per Run 2	99.327 ppb	95.205 %	102.879 ppb	98.649 ppb	99.050 ppb	93.836 ppb	93.385 %	97.929 ppb	100.824 ppb
Concentration per Run 3	99.871 ppb	96.043 %	98.765 ppb	100.379 ppb	103.002 ppb	100.431 ppb	92.960 %	97.963 ppb	100.610 ppb
Recovery Percentage 1	99.958 %	102.789 %	102.789 %	101.008 %	102.954 %	98.142 %		98.077 %	100.873 %
Concentration RSD	0.7 %	2.7 %	3.9 %	2.7 %	3.8 %	3.8 %	0.3 %	0.2 %	0.3 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	91.648 %	100.146 ppb	102.251 ppb	100.216 ppb	91.425 %	92.220 %	103.002 ppb	102.269 ppb	89.384 %
Concentration per Run 1	91.558 %	100.756 ppb	102.410 ppb	102.538 ppb	91.081 %	94.616 %	102.264 ppb	100.527 ppb	90.006 %
Concentration per Run 2	93.032 %	98.231 ppb	97.907 ppb	101.336 ppb	93.717 %	93.381 %	105.824 ppb	104.738 ppb	89.028 %
Concentration per Run 3	90.353 %	101.450 ppb	106.437 ppb	96.775 ppb	89.476 %	88.663 %	100.918 ppb	101.541 ppb	89.120 %
Recovery Percentage 1		100.146 %	102.251 %	100.216 %			103.002 %	102.269 %	
Concentration RSD	1.5 %	1.7 %	4.2 %	3.0 %	2.3 %	3.4 %	2.5 %	2.1 %	0.6 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 91 Analysis started at: 4/5/2017 1:02:35 PM Rack: 0
 Analysis label: CCB User name: Vial: 10

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	99.362 %	105.401 %	0.035 ppb	6.951 ppb	1.370 ppb	-0.206 ppb	9.299 ppb	3.949 ppb	94.858 %
Concentration per Run 1	100.185 %	106.425 %	0.033 ppb	5.546 ppb	0.697 ppb	0.209 ppb	14.532 ppb	-1.470 ppb	93.040 %
Concentration per Run 2	98.038 %	103.631 %	0.034 ppb	9.075 ppb	-0.343 ppb	-0.200 ppb	0.266 ppb	14.957 ppb	94.404 %
Concentration per Run 3	99.861 %	106.145 %	0.038 ppb	6.231 ppb	3.755 ppb	-0.627 ppb	13.099 ppb	-1.639 ppb	97.131 %
Recovery Percentage 1			7.001 %	6.951 %	1.957 %	-2.059 %	9.299 %	3.949 %	
Concentration RSD	1.2 %	1.5 %	7.2 %	26.9 %	155.6 %	203.0 %	84.5 %	241.4 %	2.2 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	91.998 %	0.055 ppb	0.040 ppb	0.001 ppb	-0.191 ppb	2.181 ppb	0.021 ppb	0.102 ppb	-0.048 ppb
Concentration per Run 1	94.573 %	0.000 ppb	0.060 ppb	0.009 ppb	-0.124 ppb	4.242 ppb	-0.005 ppb	0.177 ppb	-0.013 ppb
Concentration per Run 2	89.863 %	0.084 ppb	0.060 ppb	0.049 ppb	-0.190 ppb	-1.821 ppb	0.035 ppb	0.028 ppb	-0.065 ppb
Concentration per Run 3	91.557 %	0.082 ppb	0.000 ppb	-0.055 ppb	-0.258 ppb	4.122 ppb	0.034 ppb	0.101 ppb	-0.065 ppb
Recovery Percentage 1		11.056 %	0.803 %	0.101 %	-19.058 %	4.363 %	4.264 %	5.094 %	-4.795 %
Concentration RSD	2.6 %	86.6 %	86.6 %	5,156.2 %	35.3 %	158.9 %	107.5 %	73.2 %	62.8 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	-0.494 ppb	94.689 %	0.131 ppb	0.943 ppb	0.047 ppb	0.685 ppb	92.066 %	0.065 ppb	0.041 ppb
Concentration per Run 1	-0.474 ppb	96.100 %	0.114 ppb	0.303 ppb	0.056 ppb	0.399 ppb	90.566 %	0.047 ppb	-0.003 ppb
Concentration per Run 2	-0.504 ppb	94.003 %	0.032 ppb	0.695 ppb	0.056 ppb	0.811 ppb	92.696 %	0.090 ppb	0.029 ppb
Concentration per Run 3	-0.505 ppb	93.964 %	0.246 ppb	1.831 ppb	0.029 ppb	0.844 ppb	92.937 %	0.059 ppb	0.096 ppb
Recovery Percentage 1	-4.943 %	94.689 %	26.174 %	18.858 %	9.358 %	34.236 %		16.343 %	20.325 %
Concentration RSD	3.6 %	1.3 %	82.3 %	84.1 %	32.9 %	36.2 %	1.4 %	33.5 %	124.9 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	92.756 %	0.925 ppb	3.277 ppb	-0.022 ppb	91.015 %	91.523 %	0.042 ppb	0.058 ppb	93.863 %
Concentration per Run 1	94.616 %	0.969 ppb	3.254 ppb	-0.053 ppb	91.755 %	92.773 %	0.037 ppb	0.050 ppb	93.171 %
Concentration per Run 2	93.579 %	0.894 ppb	3.351 ppb	-0.053 ppb	95.022 %	91.249 %	0.039 ppb	0.065 ppb	95.510 %
Concentration per Run 3	90.073 %	0.913 ppb	3.225 ppb	0.038 ppb	86.267 %	90.549 %	0.050 ppb	0.058 ppb	92.909 %
Recovery Percentage 1		30.842 %	81.917 %	-4.483 %			8.411 %	11.564 %	93.863 %
Concentration RSD	2.6 %	4.2 %	2.0 %	232.8 %	4.9 %	1.2 %	16.7 %	13.1 %	1.5 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 92 Analysis started at: 4/5/2017 1:07:49 PM Rack: 2
 Analysis label: L1709265-21 6020TL User name: Vial: 3

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	105.141 %	106.844 %	0.001 ppb	90,566.211 ppb	47,063.062 ppb	3.774 ppb	8,005.667 ppb	120,383.200 ppb	91.734 %
Concentration per Run 1	104.586 %	106.844 %	0.001 ppb	90,130.397 ppb	46,031.197 ppb	2.007 ppb	7,631.239 ppb	115,339.369 ppb	96.534 %
Concentration per Run 2	105.110 %	107.402 %	0.001 ppb	90,618.945 ppb	48,086.969 ppb	4.890 ppb	8,454.558 ppb	124,792.101 ppb	88.183 %
Concentration per Run 3	105.726 %	106.285 %	0.001 ppb	90,949.290 ppb	47,071.021 ppb	4.426 ppb	7,931.203 ppb	121,018.129 ppb	90.484 %
Concentration RSD	0.5 %	0.5 %	2.0 %	0.5 %	2.2 %	41.0 %	5.2 %	4.0 %	4.7 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	88.687 %	185.311 ppb	0.041 ppb	0.182 ppb	198.913 ppb	91.948 ppb	0.291 ppb	0.610 ppb	2.235 ppb
Concentration per Run 1	87.866 %	173.928 ppb	0.060 ppb	0.212 ppb	198.928 ppb	89.542 ppb	0.181 ppb	0.650 ppb	2.208 ppb
Concentration per Run 2	87.407 %	191.236 ppb	0.064 ppb	0.167 ppb	201.082 ppb	85.971 ppb	0.353 ppb	0.503 ppb	2.730 ppb
Concentration per Run 3	90.789 %	190.771 ppb	0.000 ppb	0.167 ppb	196.729 ppb	100.331 ppb	0.340 ppb	0.678 ppb	1.766 ppb
Concentration RSD	2.1 %	5.3 %	86.7 %	14.3 %	1.1 %	8.1 %	32.9 %	15.4 %	21.6 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	5.369 ppb	87.758 %	2.112 ppb	0.755 ppb	16,063.587 ppb	7.672 ppb	85.770 %	-0.006 ppb	0.036 ppb
Concentration per Run 1	4.709 ppb	86.436 %	1.943 ppb	0.682 ppb	16,653.547 ppb	7.340 ppb	85.162 %	-0.011 ppb	0.045 ppb
Concentration per Run 2	5.095 ppb	91.726 %	2.136 ppb	0.472 ppb	15,597.939 ppb	6.998 ppb	88.261 %	-0.003 ppb	0.055 ppb
Concentration per Run 3	6.303 ppb	85.114 %	2.257 ppb	1.111 ppb	15,939.275 ppb	8.679 ppb	83.886 %	-0.003 ppb	0.009 ppb
Concentration RSD	15.5 %	4.0 %	7.5 %	43.2 %	3.4 %	11.6 %	2.6 %	82.7 %	67.5 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	84.695 %	0.464 ppb	1.331 ppb	30.309 ppb	86.980 %	86.105 %	0.016 ppb	0.359 ppb	86.022 %
Concentration per Run 1	83.435 %	0.402 ppb	1.318 ppb	30.828 ppb	84.873 %	85.425 %	0.011 ppb	0.350 ppb	88.779 %
Concentration per Run 2	85.637 %	0.493 ppb	1.196 ppb	29.917 ppb	86.188 %	85.416 %	0.016 ppb	0.364 ppb	83.991 %
Concentration per Run 3	85.014 %	0.496 ppb	1.480 ppb	30.182 ppb	89.878 %	87.474 %	0.020 ppb	0.362 ppb	85.295 %
Concentration RSD	1.3 %	11.5 %	10.7 %	1.5 %	3.0 %	1.4 %	26.3 %	2.1 %	2.9 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 93 Analysis started at: 4/5/2017 1:11:11 PM Rack: 2
 Analysis label: L1709265-19 6020TL User name: Vial: 1

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	98.281 %	100.233 %	0.006 ppb	13,766.340 ppb	72,055.451 ppb	6.384 ppb	1,465.785 ppb	57,737.136 ppb	87.047 %
Concentration per Run 1	98.135 %	102.514 %	0.016 ppb	13,472.913 ppb	69,082.401 ppb	4.996 ppb	1,599.756 ppb	55,345.230 ppb	89.205 %
Concentration per Run 2	98.415 %	91.201 %	-0.003 ppb	14,818.550 ppb	78,922.318 ppb	6.565 ppb	1,402.686 ppb	61,315.103 ppb	82.388 %
Concentration per Run 3	98.293 %	106.983 %	0.006 ppb	13,007.556 ppb	68,161.635 ppb	7.591 ppb	1,394.912 ppb	56,551.074 ppb	89.546 %
Concentration RSD	0.1 %	8.1 %	147.2 %	6.8 %	8.3 %	20.5 %	7.9 %	5.5 %	4.6 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	86.447 %	82.593 ppb	0.754 ppb	2.300 ppb	-0.052 ppb	19.418 ppb	0.010 ppb	0.754 ppb	0.498 ppb
Concentration per Run 1	86.835 %	79.423 ppb	0.950 ppb	2.245 ppb	-0.176 ppb	17.397 ppb	0.059 ppb	0.819 ppb	0.432 ppb
Concentration per Run 2	87.463 %	88.072 ppb	0.675 ppb	2.349 ppb	-0.017 ppb	15.066 ppb	-0.025 ppb	0.527 ppb	0.446 ppb
Concentration per Run 3	85.043 %	80.283 ppb	0.637 ppb	2.305 ppb	0.035 ppb	25.792 ppb	-0.004 ppb	0.916 ppb	0.615 ppb
Concentration RSD	1.5 %	5.8 %	22.7 %	2.3 %	209.8 %	29.1 %	433.6 %	26.9 %	20.6 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	3.794 ppb	88.894 %	0.276 ppb	1.827 ppb	909.519 ppb	1.241 ppb	87.129 %	-0.019 ppb	0.004 ppb
Concentration per Run 1	3.633 ppb	90.251 %	0.258 ppb	2.180 ppb	903.378 ppb	1.458 ppb	89.183 %	-0.024 ppb	0.019 ppb
Concentration per Run 2	4.025 ppb	89.793 %	0.439 ppb	1.509 ppb	904.837 ppb	1.107 ppb	88.205 %	-0.016 ppb	-0.003 ppb
Concentration per Run 3	3.724 ppb	86.639 %	0.132 ppb	1.792 ppb	920.341 ppb	1.160 ppb	83.998 %	-0.016 ppb	-0.003 ppb
Concentration RSD	5.4 %	2.2 %	55.7 %	18.5 %	1.0 %	15.2 %	3.2 %	26.4 %	313.3 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	86.789 %	0.317 ppb	0.771 ppb	52.602 ppb	89.592 %	87.220 %	0.005 ppb	0.091 ppb	87.908 %
Concentration per Run 1	90.388 %	0.325 ppb	0.707 ppb	50.095 ppb	91.912 %	89.080 %	0.002 ppb	0.087 ppb	87.983 %
Concentration per Run 2	85.309 %	0.338 ppb	0.926 ppb	54.461 ppb	89.220 %	88.305 %	0.005 ppb	0.087 ppb	88.297 %
Concentration per Run 3	84.669 %	0.289 ppb	0.680 ppb	53.249 ppb	87.644 %	84.274 %	0.008 ppb	0.100 ppb	87.445 %
Concentration RSD	3.6 %	8.0 %	17.5 %	4.3 %	2.4 %	3.0 %	55.5 %	8.2 %	0.5 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 94 Analysis started at: 4/5/2017 1:14:32 PM Rack: 2
 Analysis label: L1709265-20 6020TL User name: Vial: 2

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	99.584 %	106.145 %	0.008 ppb	45,086.057 ppb	117,539.660 ppb	5.255 ppb	5,340.128 ppb	86,637.605 ppb	88.211 %
Concentration per Run 1	99.320 %	107.263 %	0.015 ppb	44,638.134 ppb	117,244.185 ppb	6.953 ppb	5,281.480 ppb	88,652.433 ppb	89.461 %
Concentration per Run 2	101.346 %	102.374 %	0.002 ppb	47,138.210 ppb	121,458.423 ppb	3.329 ppb	5,574.452 ppb	85,150.443 ppb	87.075 %
Concentration per Run 3	98.085 %	108.799 %	0.006 ppb	43,481.826 ppb	113,916.371 ppb	5.484 ppb	5,164.452 ppb	86,109.938 ppb	88.097 %
Concentration RSD	1.7 %	3.2 %	90.9 %	4.1 %	3.2 %	34.7 %	4.0 %	2.1 %	1.4 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	85.555 %	126.602 ppb	0.149 ppb	0.709 ppb	193.158 ppb	30.498 ppb	0.580 ppb	0.748 ppb	0.636 ppb
Concentration per Run 1	84.916 %	129.983 ppb	0.189 ppb	0.782 ppb	182.172 ppb	25.117 ppb	0.912 ppb	0.654 ppb	0.916 ppb
Concentration per Run 2	86.623 %	126.846 ppb	0.194 ppb	0.696 ppb	198.572 ppb	35.556 ppb	0.466 ppb	0.911 ppb	0.493 ppb
Concentration per Run 3	85.126 %	122.976 ppb	0.064 ppb	0.650 ppb	198.730 ppb	30.821 ppb	0.361 ppb	0.677 ppb	0.501 ppb
Concentration RSD	1.1 %	2.8 %	49.2 %	9.4 %	4.9 %	17.1 %	50.4 %	19.0 %	38.0 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	17.918 ppb	89.759 %	0.248 ppb	0.159 ppb	4,362.432 ppb	2.865 ppb	86.269 %	-0.020 ppb	0.013 ppb
Concentration per Run 1	17.078 ppb	91.827 %	0.035 ppb	-0.148 ppb	4,352.525 ppb	3.076 ppb	85.896 %	-0.024 ppb	0.032 ppb
Concentration per Run 2	17.949 ppb	89.844 %	0.260 ppb	0.315 ppb	4,437.199 ppb	2.854 ppb	85.151 %	-0.011 ppb	0.009 ppb
Concentration per Run 3	18.727 ppb	87.606 %	0.451 ppb	0.311 ppb	4,297.573 ppb	2.665 ppb	87.759 %	-0.024 ppb	-0.003 ppb
Concentration RSD	4.6 %	2.4 %	83.8 %	167.4 %	1.6 %	7.2 %	1.6 %	37.4 %	144.5 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	84.111 %	0.194 ppb	0.543 ppb	29.097 ppb	87.638 %	86.408 %	0.007 ppb	0.085 ppb	86.532 %
Concentration per Run 1	84.623 %	0.131 ppb	0.529 ppb	30.772 ppb	88.993 %	86.787 %	0.011 ppb	0.077 ppb	86.831 %
Concentration per Run 2	83.311 %	0.108 ppb	0.601 ppb	28.338 ppb	85.341 %	85.793 %	0.005 ppb	0.104 ppb	85.834 %
Concentration per Run 3	84.397 %	0.342 ppb	0.500 ppb	28.181 ppb	88.581 %	86.645 %	0.005 ppb	0.074 ppb	86.931 %
Concentration RSD	0.8 %	66.7 %	9.5 %	5.0 %	2.3 %	0.6 %	43.9 %	19.7 %	0.7 %

Alpha ICPMSQ Full

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Analysis index: 95 Analysis started at: 4/5/2017 1:17:54 PM Rack: 2
 Analysis label: L1709265-22 6020TL User name: Vial: 4

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	103.451 %	108.939 %	0.009 ppb	74,581.826 ppb	5,101.662 ppb	45.239 ppb	3,633.183 ppb	14,803.070 ppb	91.478 %
Concentration per Run 1	103.712 %	110.196 %	0.001 ppb	74,257.876 ppb	5,026.672 ppb	44.142 ppb	3,664.266 ppb	14,327.245 ppb	93.722 %
Concentration per Run 2	103.613 %	105.726 %	0.015 ppb	75,003.913 ppb	5,207.677 ppb	48.296 ppb	3,511.552 ppb	14,742.511 ppb	92.529 %
Concentration per Run 3	103.029 %	110.894 %	0.010 ppb	74,483.687 ppb	5,070.637 ppb	43.280 ppb	3,723.733 ppb	15,339.455 ppb	88.183 %
Concentration RSD	0.4 %	2.6 %	76.7 %	0.5 %	1.9 %	5.9 %	3.0 %	3.4 %	3.2 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	85.715 %	24.472 ppb	0.411 ppb	0.327 ppb	11.283 ppb	73.957 ppb	0.023 ppb	1.067 ppb	1.261 ppb
Concentration per Run 1	87.949 %	22.718 ppb	0.425 ppb	0.401 ppb	11.500 ppb	70.623 ppb	0.036 ppb	1.099 ppb	1.282 ppb
Concentration per Run 2	84.673 %	24.711 ppb	0.553 ppb	0.261 ppb	11.493 ppb	76.038 ppb	0.016 ppb	0.570 ppb	1.130 ppb
Concentration per Run 3	84.523 %	25.988 ppb	0.255 ppb	0.319 ppb	10.855 ppb	75.212 ppb	0.017 ppb	1.534 ppb	1.372 ppb
Concentration RSD	2.3 %	6.7 %	36.3 %	21.4 %	3.3 %	3.9 %	48.7 %	45.2 %	9.7 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	11.006 ppb	90.993 %	1.756 ppb	0.263 ppb	1,113.162 ppb	2.777 ppb	87.453 %	-0.020 ppb	0.012 ppb
Concentration per Run 1	10.822 ppb	91.460 %	1.791 ppb	0.322 ppb	1,118.195 ppb	2.510 ppb	88.419 %	-0.020 ppb	0.020 ppb
Concentration per Run 2	10.135 ppb	90.912 %	1.758 ppb	0.922 ppb	1,102.333 ppb	3.072 ppb	87.844 %	-0.020 ppb	-0.003 ppb
Concentration per Run 3	12.061 ppb	90.607 %	1.720 ppb	-0.456 ppb	1,118.958 ppb	2.750 ppb	86.097 %	-0.020 ppb	0.020 ppb
Concentration RSD	8.9 %	0.5 %	2.0 %	263.0 %	0.8 %	10.2 %	1.4 %	0.2 %	110.6 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	86.674 %	0.197 ppb	0.586 ppb	73.684 ppb	89.504 %	89.187 %	0.000 ppb	0.301 ppb	89.620 %
Concentration per Run 1	87.845 %	0.236 ppb	0.553 ppb	70.574 ppb	91.440 %	88.728 %	-0.003 ppb	0.283 ppb	92.874 %
Concentration per Run 2	85.282 %	0.155 ppb	0.570 ppb	74.124 ppb	88.290 %	88.896 %	0.003 ppb	0.323 ppb	87.095 %
Concentration per Run 3	86.895 %	0.202 ppb	0.634 ppb	76.354 ppb	88.781 %	89.938 %	0.000 ppb	0.296 ppb	88.891 %
Concentration RSD	1.5 %	20.5 %	7.3 %	4.0 %	1.9 %	0.7 %	3,773.4 %	6.8 %	3.3 %

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Analysis index: 96 Analysis started at: 4/5/2017 1:21:15 PM Rack: 2
 Analysis label: L1709265-24 6020TL User name: ALPHALAB\metals-instrument Vial: 5

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	102.756 %	103.911 %	0.006 ppb	74,488.641 ppb	5,131.744 ppb	45.713 ppb	3,808.987 ppb	15,164.221 ppb	87.956 %
Concentration per Run 1	103.170 %	105.587 %	-0.003 ppb	74,967.109 ppb	5,125.188 ppb	39.252 ppb	3,749.064 ppb	15,642.856 ppb	89.291 %
Concentration per Run 2	102.430 %	99.302 %	0.001 ppb	74,265.960 ppb	5,179.986 ppb	44.417 ppb	3,839.117 ppb	14,001.053 ppb	92.700 %
Concentration per Run 3	102.668 %	106.844 %	0.019 ppb	74,232.854 ppb	5,090.056 ppb	53.470 ppb	3,838.779 ppb	15,848.755 ppb	81.877 %
Concentration RSD	0.4 %	3.9 %	198.7 %	0.6 %	0.9 %	15.7 %	1.4 %	6.7 %	6.3 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	85.988 %	22.592 ppb	0.364 ppb	0.208 ppb	10.990 ppb	67.823 ppb	0.064 ppb	0.575 ppb	1.004 ppb
Concentration per Run 1	85.133 %	25.029 ppb	0.378 ppb	0.185 ppb	11.165 ppb	53.502 ppb	0.058 ppb	0.497 ppb	1.239 ppb
Concentration per Run 2	88.757 %	19.680 ppb	0.241 ppb	0.231 ppb	11.421 ppb	71.437 ppb	0.093 ppb	0.540 ppb	0.597 ppb
Concentration per Run 3	84.074 %	23.066 ppb	0.473 ppb	0.208 ppb	10.384 ppb	78.530 ppb	0.041 ppb	0.688 ppb	1.176 ppb
Concentration RSD	2.9 %	12.0 %	32.2 %	11.1 %	4.9 %	19.0 %	41.6 %	17.4 %	35.3 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	9.228 ppb	94.286 %	1.591 ppb	0.311 ppb	1,075.392 ppb	2.487 ppb	84.724 %	-0.016 ppb	0.036 ppb
Concentration per Run 1	8.766 ppb	92.336 %	1.734 ppb	0.551 ppb	1,103.645 ppb	2.282 ppb	82.866 %	-0.020 ppb	0.020 ppb
Concentration per Run 2	9.358 ppb	99.712 %	1.766 ppb	0.419 ppb	1,040.352 ppb	2.832 ppb	85.427 %	-0.020 ppb	0.044 ppb
Concentration per Run 3	9.560 ppb	90.811 %	1.274 ppb	-0.039 ppb	1,082.180 ppb	2.347 ppb	85.878 %	-0.007 ppb	0.043 ppb
Concentration RSD	4.5 %	5.0 %	17.3 %	99.7 %	3.0 %	12.1 %	1.9 %	45.8 %	37.3 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	86.446 %	0.225 ppb	0.412 ppb	71.875 ppb	87.202 %	87.919 %	-0.001 ppb	0.271 ppb	88.447 %
Concentration per Run 1	86.135 %	0.152 ppb	0.490 ppb	73.949 ppb	90.293 %	89.845 %	0.000 ppb	0.290 ppb	87.894 %
Concentration per Run 2	85.333 %	0.221 ppb	0.394 ppb	71.551 ppb	85.043 %	88.420 %	0.000 ppb	0.256 ppb	87.730 %
Concentration per Run 3	87.871 %	0.301 ppb	0.353 ppb	70.126 ppb	86.268 %	85.493 %	-0.003 ppb	0.268 ppb	89.717 %
Concentration RSD	1.5 %	33.1 %	17.0 %	2.7 %	3.1 %	2.5 %	122.4 %	6.4 %	1.2 %

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Analysis index: 97 Analysis started at: 4/5/2017 1:24:37 PM Rack: 2
Analysis label: L1709265-25 6020TL User name: ALPHALAB\metals-instrument Vial: 6

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	94.475 %	99.628 %	0.011 ppb	4,691.073 ppb	19,620.759 ppb	27.194 ppb	7,279.942 ppb	94,583.000 ppb	91.506 %
Concentration per Run 1	94.192 %	104.190 %	0.021 ppb	4,516.514 ppb	18,708.673 ppb	25.223 ppb	6,686.365 ppb	88,392.273 ppb	95.086 %
Concentration per Run 2	94.217 %	94.553 %	0.011 ppb	4,882.187 ppb	20,216.650 ppb	30.393 ppb	7,659.296 ppb	97,599.791 ppb	88.779 %
Concentration per Run 3	95.016 %	100.140 %	0.002 ppb	4,674.518 ppb	19,936.953 ppb	25.967 ppb	7,494.166 ppb	97,756.936 ppb	90.654 %
Concentration RSD	0.5 %	4.9 %	84.1 %	3.9 %	4.1 %	10.3 %	7.2 %	5.7 %	3.5 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	83.673 %	146.315 ppb	2.230 ppb	9.797 ppb	332.302 ppb	1,054.413 ppb	1.122 ppb	15.941 ppb	325.812 ppb
Concentration per Run 1	84.402 %	139.738 ppb	2.120 ppb	9.680 ppb	320.170 ppb	997.593 ppb	1.152 ppb	14.240 ppb	324.753 ppb
Concentration per Run 2	83.186 %	148.894 ppb	1.986 ppb	10.135 ppb	352.982 ppb	1,129.078 ppb	1.005 ppb	17.261 ppb	338.236 ppb
Concentration per Run 3	83.429 %	150.312 ppb	2.585 ppb	9.575 ppb	323.754 ppb	1,036.568 ppb	1.209 ppb	16.322 ppb	314.448 ppb
Concentration RSD	0.8 %	3.9 %	14.1 %	3.0 %	5.4 %	6.4 %	9.4 %	9.7 %	3.7 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	125.497 ppb	86.945 %	4.114 ppb	1.125 ppb	209.914 ppb	5.519 ppb	87.004 %	-0.003 ppb	0.036 ppb
Concentration per Run 1	120.436 ppb	87.301 %	3.345 ppb	1.388 ppb	213.251 ppb	5.699 ppb	88.301 %	0.001 ppb	0.079 ppb
Concentration per Run 2	131.416 ppb	86.945 %	4.975 ppb	1.466 ppb	209.355 ppb	5.467 ppb	86.276 %	-0.007 ppb	-0.003 ppb
Concentration per Run 3	124.638 ppb	86.589 %	4.022 ppb	0.522 ppb	207.135 ppb	5.391 ppb	86.434 %	-0.003 ppb	0.032 ppb
Concentration RSD	4.4 %	0.4 %	19.9 %	46.6 %	1.5 %	2.9 %	1.3 %	125.8 %	115.1 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	85.048 %	0.697 ppb	0.805 ppb	42.090 ppb	88.995 %	87.161 %	0.006 ppb	19.875 ppb	89.296 %
Concentration per Run 1	84.949 %	0.759 ppb	0.498 ppb	42.794 ppb	88.463 %	88.277 %	0.006 ppb	19.204 ppb	92.797 %
Concentration per Run 2	84.687 %	0.603 ppb	0.991 ppb	41.724 ppb	89.731 %	86.715 %	0.008 ppb	20.066 ppb	89.481 %
Concentration per Run 3	85.509 %	0.727 ppb	0.925 ppb	41.752 ppb	88.790 %	86.490 %	0.003 ppb	20.355 ppb	85.611 %
Concentration RSD	0.5 %	11.8 %	33.3 %	1.4 %	0.7 %	1.1 %	50.7 %	3.0 %	4.0 %

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Analysis index: 98 Analysis started at: 4/5/2017 1:27:58 PM Rack: 2
Analysis label: L1709265-26 6020TL User name: ALPHALAB\metals-instrument Vial: 7

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	95.439 %	97.812 %	-0.001 ppb	14,990.829 ppb	46,890.970 ppb	5.577 ppb	1,603.067 ppb	83,409.759 ppb	91.279 %
Concentration per Run 1	96.182 %	97.346 %	-0.003 ppb	15,044.967 ppb	44,828.658 ppb	4.996 ppb	1,531.288 ppb	81,934.606 ppb	93.637 %
Concentration per Run 2	95.314 %	94.972 %	-0.003 ppb	15,156.636 ppb	47,473.829 ppb	5.069 ppb	1,568.482 ppb	80,908.116 ppb	93.552 %
Concentration per Run 3	94.822 %	101.117 %	0.002 ppb	14,770.883 ppb	48,370.424 ppb	6.666 ppb	1,709.430 ppb	87,386.556 ppb	86.649 %
Concentration RSD	0.7 %	3.2 %	201.7 %	1.3 %	3.9 %	16.9 %	5.9 %	4.2 %	4.4 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	83.729 %	117.928 ppb	0.272 ppb	2.140 ppb	2.850 ppb	72.056 ppb	0.037 ppb	0.507 ppb	0.769 ppb
Concentration per Run 1	83.299 %	115.799 ppb	0.368 ppb	2.049 ppb	2.632 ppb	68.786 ppb	0.058 ppb	0.421 ppb	1.044 ppb
Concentration per Run 2	84.369 %	116.045 ppb	0.122 ppb	2.233 ppb	2.424 ppb	65.434 ppb	0.058 ppb	0.419 ppb	0.762 ppb
Concentration per Run 3	83.521 %	121.940 ppb	0.326 ppb	2.137 ppb	3.496 ppb	81.948 ppb	-0.003 ppb	0.682 ppb	0.502 ppb
Concentration RSD	0.7 %	2.9 %	48.2 %	4.3 %	19.9 %	12.1 %	94.6 %	29.8 %	35.2 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	38.277 ppb	88.047 %	0.403 ppb	1.316 ppb	567.881 ppb	1.131 ppb	84.928 %	-0.016 ppb	0.005 ppb
Concentration per Run 1	37.803 ppb	87.708 %	0.313 ppb	1.553 ppb	568.001 ppb	1.301 ppb	87.935 %	-0.016 ppb	0.008 ppb
Concentration per Run 2	37.733 ppb	88.521 %	0.583 ppb	1.654 ppb	569.099 ppb	1.319 ppb	82.690 %	-0.011 ppb	0.009 ppb
Concentration per Run 3	39.294 ppb	87.911 %	0.312 ppb	0.742 ppb	566.544 ppb	0.774 ppb	84.160 %	-0.020 ppb	-0.003 ppb
Concentration RSD	2.3 %	0.5 %	38.7 %	38.0 %	0.2 %	27.3 %	3.2 %	28.4 %	149.6 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	84.182 %	0.159 ppb	0.528 ppb	63.990 ppb	87.587 %	86.439 %	-0.003 ppb	0.078 ppb	86.797 %
Concentration per Run 1	85.870 %	0.101 ppb	0.490 ppb	64.602 ppb	91.552 %	88.552 %	-0.006 ppb	0.081 ppb	89.324 %
Concentration per Run 2	82.839 %	0.163 ppb	0.617 ppb	62.743 ppb	87.639 %	85.377 %	-0.001 ppb	0.081 ppb	86.155 %
Concentration per Run 3	83.837 %	0.214 ppb	0.477 ppb	64.626 ppb	83.568 %	85.390 %	-0.001 ppb	0.072 ppb	84.913 %
Concentration RSD	1.8 %	35.5 %	14.6 %	1.7 %	4.6 %	2.1 %	105.6 %	6.9 %	2.6 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 99 Analysis started at: 4/5/2017 1:31:20 PM Rack: 2
 Analysis label: L1709265-28 6020TL User name: ALPHALAB\metals-instrument Vial: 8

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	89.229 %	91.620 %	0.019 ppb	534,479.479 ppb	178,333.553 ppb	64.159 ppb	289,230.324 ppb	240,234.970 ppb	90.455 %
Concentration per Run 1	89.420 %	92.598 %	0.022 ppb	530,693.313 ppb	167,600.206 ppb	64.350 ppb	277,373.183 ppb	227,352.159 ppb	93.210 %
Concentration per Run 2	88.592 %	93.994 %	0.012 ppb	540,796.325 ppb	182,576.430 ppb	65.569 ppb	305,317.639 ppb	256,715.790 ppb	86.564 %
Concentration per Run 3	89.675 %	88.268 %	0.022 ppb	531,948.800 ppb	184,824.023 ppb	62.559 ppb	285,000.149 ppb	236,636.963 ppb	91.592 %
Concentration RSD	0.6 %	3.3 %	30.3 %	1.0 %	5.3 %	2.4 %	5.0 %	6.2 %	3.8 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	93.556 %	344.434 ppb	8.388 ppb	22.517 ppb	8,394.850 ppb	20,323.488 ppb	11.358 ppb	50.339 ppb	16.896 ppb
Concentration per Run 1	94.737 %	348.442 ppb	7.716 ppb	22.338 ppb	8,106.984 ppb	19,094.328 ppb	11.443 ppb	48.407 ppb	15.534 ppb
Concentration per Run 2	92.894 %	350.917 ppb	9.255 ppb	23.444 ppb	8,674.172 ppb	21,175.596 ppb	13.026 ppb	52.267 ppb	19.606 ppb
Concentration per Run 3	93.035 %	333.944 ppb	8.194 ppb	21.769 ppb	8,403.394 ppb	20,700.541 ppb	9.605 ppb	50.344 ppb	15.547 ppb
Concentration RSD	1.1 %	2.7 %	9.4 %	3.8 %	3.4 %	5.4 %	15.1 %	3.8 %	13.9 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	44.056 ppb	88.199 %	39.672 ppb	0.983 ppb	1,202.661 ppb	1.659 ppb	81.612 %	0.007 ppb	0.029 ppb
Concentration per Run 1	42.208 ppb	89.640 %	38.244 ppb	1.408 ppb	1,189.213 ppb	1.231 ppb	83.262 %	0.002 ppb	0.045 ppb
Concentration per Run 2	47.179 ppb	85.165 %	41.020 ppb	0.363 ppb	1,224.322 ppb	1.700 ppb	81.462 %	0.003 ppb	0.021 ppb
Concentration per Run 3	42.780 ppb	89.793 %	39.751 ppb	1.178 ppb	1,194.449 ppb	2.045 ppb	80.113 %	0.016 ppb	0.021 ppb
Concentration RSD	6.2 %	3.0 %	3.5 %	55.9 %	1.6 %	24.6 %	1.9 %	116.3 %	47.0 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	81.927 %	1.694 ppb	2.222 ppb	1,125.558 ppb	88.031 %	86.474 %	0.001 ppb	1.382 ppb	80.268 %
Concentration per Run 1	82.474 %	1.671 ppb	2.041 ppb	1,099.298 ppb	89.461 %	86.888 %	0.001 ppb	1.293 ppb	83.021 %
Concentration per Run 2	81.520 %	1.874 ppb	2.198 ppb	1,155.331 ppb	85.741 %	86.242 %	0.006 ppb	1.453 ppb	79.505 %
Concentration per Run 3	81.786 %	1.537 ppb	2.428 ppb	1,122.047 ppb	88.890 %	86.293 %	-0.004 ppb	1.398 ppb	78.276 %
Concentration RSD	0.6 %	10.0 %	8.8 %	2.5 %	2.3 %	0.4 %	641.4 %	5.9 %	3.1 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 100 Analysis started at: 4/5/2017 1:34:43 PM Rack: 2
 Analysis label: L1709265-29 6020TL User name: ALPHALAB\metals-instrument Vial: 9

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	94.649 %	99.255 %	0.018 ppb	13,359.108 ppb	26,326.004 ppb	192.251 ppb	2,432.083 ppb	137,920.788 ppb	94.631 %
Concentration per Run 1	96.249 %	100.419 %	0.021 ppb	13,466.364 ppb	27,059.737 ppb	192.215 ppb	2,358.107 ppb	141,412.292 ppb	93.637 %
Concentration per Run 2	94.799 %	94.972 %	0.011 ppb	13,551.301 ppb	25,734.975 ppb	199.680 ppb	2,343.061 ppb	135,736.801 ppb	97.131 %
Concentration per Run 3	92.899 %	102.374 %	0.021 ppb	13,059.659 ppb	26,183.301 ppb	184.858 ppb	2,595.082 ppb	136,613.270 ppb	93.125 %
Concentration RSD	1.8 %	3.9 %	31.4 %	2.0 %	2.6 %	3.9 %	5.8 %	2.2 %	2.3 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	90.045 %	199.728 ppb	0.521 ppb	0.894 ppb	27.493 ppb	1,591.211 ppb	0.539 ppb	0.897 ppb	4.887 ppb
Concentration per Run 1	90.222 %	198.269 ppb	0.546 ppb	0.851 ppb	31.263 ppb	1,632.507 ppb	0.643 ppb	1.016 ppb	5.440 ppb
Concentration per Run 2	90.529 %	202.986 ppb	0.648 ppb	1.045 ppb	23.272 ppb	1,555.821 ppb	0.433 ppb	0.700 ppb	4.648 ppb
Concentration per Run 3	89.385 %	197.929 ppb	0.370 ppb	0.787 ppb	27.943 ppb	1,585.307 ppb	0.540 ppb	0.975 ppb	4.574 ppb
Concentration RSD	0.7 %	1.4 %	27.0 %	15.0 %	14.6 %	2.4 %	19.6 %	19.2 %	9.8 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	16.389 ppb	90.607 %	1.335 ppb	0.308 ppb	358.377 ppb	0.417 ppb	87.741 %	0.008 ppb	0.019 ppb
Concentration per Run 1	15.919 ppb	92.590 %	1.595 ppb	0.416 ppb	351.271 ppb	0.302 ppb	88.902 %	0.004 ppb	0.030 ppb
Concentration per Run 2	16.117 ppb	92.286 %	1.080 ppb	0.660 ppb	350.706 ppb	0.461 ppb	84.967 %	0.014 ppb	0.020 ppb
Concentration per Run 3	17.132 ppb	86.945 %	1.329 ppb	-0.151 ppb	373.154 ppb	0.488 ppb	89.355 %	0.004 ppb	0.008 ppb
Concentration RSD	4.0 %	3.5 %	19.3 %	135.1 %	3.6 %	24.2 %	2.8 %	74.9 %	57.2 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	88.830 %	0.501 ppb	0.434 ppb	101.570 ppb	89.103 %	90.765 %	0.008 ppb	1.081 ppb	89.627 %
Concentration per Run 1	90.972 %	0.496 ppb	0.482 ppb	103.127 ppb	87.840 %	92.998 %	0.006 ppb	1.062 ppb	90.229 %
Concentration per Run 2	86.951 %	0.495 ppb	0.471 ppb	100.843 ppb	90.848 %	88.858 %	0.012 ppb	1.102 ppb	91.163 %
Concentration per Run 3	88.568 %	0.511 ppb	0.349 ppb	100.740 ppb	88.620 %	90.439 %	0.005 ppb	1.080 ppb	87.490 %
Concentration RSD	2.3 %	1.8 %	17.0 %	1.3 %	1.8 %	2.3 %	44.8 %	1.8 %	2.1 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 101 Analysis started at: 4/5/2017 1:38:05 PM Rack: 2
 Analysis label: L1709265-30 6020TL User name: ALPHALAB\metals-instrument Vial: 10

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	96.136 %	102.421 %	0.006 ppb	11,321.263 ppb	17,632.048 ppb	13.805 ppb	3,427.269 ppb	115,549.144 ppb	88.012 %
Concentration per Run 1	96.790 %	108.520 %	0.020 ppb	10,874.971 ppb	16,895.757 ppb	13.055 ppb	3,207.981 ppb	116,198.178 ppb	90.995 %
Concentration per Run 2	96.493 %	97.905 %	0.002 ppb	11,577.384 ppb	18,164.808 ppb	13.116 ppb	3,498.886 ppb	113,558.010 ppb	88.524 %
Concentration per Run 3	95.126 %	100.838 %	-0.003 ppb	11,511.433 ppb	17,835.580 ppb	15.246 ppb	3,574.941 ppb	116,891.245 ppb	84.518 %
Concentration RSD	0.9 %	5.4 %	193.7 %	3.4 %	3.7 %	9.0 %	5.7 %	1.5 %	3.7 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	90.516 %	163.025 ppb	0.085 ppb	0.604 ppb	2.240 ppb	37.628 ppb	0.003 ppb	0.580 ppb	0.447 ppb
Concentration per Run 1	91.119 %	161.151 ppb	0.062 ppb	0.599 ppb	2.896 ppb	37.144 ppb	0.016 ppb	0.414 ppb	0.096 ppb
Concentration per Run 2	90.058 %	163.898 ppb	0.127 ppb	0.726 ppb	1.882 ppb	25.371 ppb	0.017 ppb	0.896 ppb	0.704 ppb
Concentration per Run 3	90.370 %	164.024 ppb	0.066 ppb	0.487 ppb	1.940 ppb	50.369 ppb	-0.025 ppb	0.431 ppb	0.541 ppb
Concentration RSD	0.6 %	1.0 %	43.1 %	19.8 %	25.4 %	33.2 %	926.5 %	47.2 %	70.4 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	3.555 ppb	92.260 %	0.310 ppb	0.488 ppb	315.240 ppb	0.201 ppb	85.116 %	-0.019 ppb	0.001 ppb
Concentration per Run 1	3.850 ppb	92.998 %	0.250 ppb	1.274 ppb	320.061 ppb	0.203 ppb	83.779 %	-0.020 ppb	0.008 ppb
Concentration per Run 2	2.856 ppb	91.217 %	0.211 ppb	0.015 ppb	311.196 ppb	0.126 ppb	86.366 %	-0.016 ppb	-0.003 ppb
Concentration per Run 3	3.957 ppb	92.566 %	0.468 ppb	0.177 ppb	314.463 ppb	0.274 ppb	85.203 %	-0.020 ppb	-0.003 ppb
Concentration RSD	17.1 %	1.0 %	44.7 %	140.2 %	1.4 %	37.0 %	1.5 %	12.5 %	1,167.1 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	88.261 %	0.141 ppb	0.307 ppb	97.634 ppb	89.422 %	88.634 %	0.003 ppb	0.063 ppb	91.313 %
Concentration per Run 1	86.626 %	0.138 ppb	0.297 ppb	99.548 ppb	89.588 %	90.238 %	0.000 ppb	0.070 ppb	93.278 %
Concentration per Run 2	90.660 %	0.214 ppb	0.258 ppb	98.065 ppb	87.562 %	89.437 %	0.005 ppb	0.049 ppb	91.423 %
Concentration per Run 3	87.498 %	0.072 ppb	0.366 ppb	95.289 ppb	91.117 %	86.225 %	0.006 ppb	0.070 ppb	89.239 %
Concentration RSD	2.4 %	50.5 %	17.9 %	2.2 %	2.0 %	2.4 %	90.2 %	19.1 %	2.2 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 102 Analysis started at: 4/5/2017 1:41:28 PM Rack: 0
 Analysis label: CCV User name: ALPHALAB\metals-instrument Vial: 9

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	96.783 %	100.885 %	96.587 ppb	9,932.984 ppb	10,236.298 ppb	96.317 ppb	10,642.771 ppb	10,848.290 ppb	92.188 %
Concentration per Run 1	97.862 %	103.631 %	95.657 ppb	9,689.641 ppb	10,044.534 ppb	90.549 ppb	10,315.396 ppb	10,366.462 ppb	98.068 %
Concentration per Run 2	96.522 %	96.229 %	97.829 ppb	10,033.763 ppb	10,365.618 ppb	99.966 ppb	10,308.651 ppb	10,692.229 ppb	94.915 %
Concentration per Run 3	95.965 %	102.793 %	96.276 ppb	10,075.547 ppb	10,298.741 ppb	98.437 ppb	11,304.266 ppb	11,486.178 ppb	83.581 %
Recovery Percentage 1			96.587 %	99.330 %	102.363 %	96.317 %	106.428 %	108.483 %	
Concentration RSD	1.0 %	4.0 %	1.2 %	2.1 %	1.7 %	5.2 %	5.4 %	5.3 %	8.3 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	90.738 %	101.240 ppb	98.750 ppb	103.783 ppb	101.283 ppb	10,129.433 ppb	104.923 ppb	98.937 ppb	103.279 ppb
Concentration per Run 1	89.714 %	94.502 ppb	95.955 ppb	101.369 ppb	98.543 ppb	10,047.443 ppb	105.131 ppb	93.425 ppb	106.407 ppb
Concentration per Run 2	90.281 %	97.336 ppb	96.105 ppb	100.860 ppb	96.865 ppb	9,921.569 ppb	101.559 ppb	98.280 ppb	101.141 ppb
Concentration per Run 3	92.218 %	111.883 ppb	104.191 ppb	109.119 ppb	108.442 ppb	10,419.287 ppb	108.079 ppb	105.106 ppb	102.289 ppb
Recovery Percentage 1		101.240 %	98.750 %	103.783 %	101.283 %	101.294 %	104.923 %	98.937 %	103.279 %
Concentration RSD	1.4 %	9.2 %	4.8 %	4.5 %	6.2 %	2.6 %	3.1 %	5.9 %	2.7 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	104.037 ppb	90.040 %	104.902 ppb	103.630 ppb	105.027 ppb	99.427 ppb	89.183 %	99.435 ppb	104.642 ppb
Concentration per Run 1	104.062 ppb	88.132 %	111.175 ppb	100.787 ppb	112.092 ppb	99.105 ppb	86.664 %	102.685 ppb	108.019 ppb
Concentration per Run 2	101.280 ppb	92.087 %	102.536 ppb	100.320 ppb	100.669 ppb	96.886 ppb	90.123 %	97.340 ppb	101.467 ppb
Concentration per Run 3	106.767 ppb	89.900 %	100.995 ppb	109.785 ppb	102.320 ppb	102.291 ppb	90.761 %	98.280 ppb	104.440 ppb
Recovery Percentage 1	104.037 %	104.902 %	103.630 %	105.027 %	99.427 %			99.435 %	104.642 %
Concentration RSD	2.6 %	2.2 %	5.2 %	5.1 %	5.9 %	2.7 %	2.5 %	2.9 %	3.1 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	89.172 %	101.462 ppb	102.695 ppb	102.286 ppb	89.785 %	90.148 %	103.930 ppb	103.433 ppb	87.686 %
Concentration per Run 1	86.455 %	104.206 ppb	104.744 ppb	105.608 ppb	88.563 %	89.228 %	107.183 ppb	107.658 ppb	86.206 %
Concentration per Run 2	92.002 %	96.865 ppb	98.517 ppb	99.930 ppb	92.102 %	91.750 %	106.369 ppb	103.219 ppb	86.452 %
Concentration per Run 3	89.057 %	103.316 ppb	104.825 ppb	101.320 ppb	88.691 %	89.464 %	98.238 ppb	99.421 ppb	90.401 %
Recovery Percentage 1		101.462 %	102.695 %	102.286 %			103.930 %	103.433 %	
Concentration RSD	3.1 %	3.9 %	3.5 %	2.9 %	2.2 %	1.5 %	4.8 %	4.0 %	2.7 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 103 Analysis started at: 4/5/2017 1:44:53 PM Rack: 0
 Analysis label: CCB User name: ALPHALAB\metals-instrument Vial: 10

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	100.693 %	104.376 %	0.019 ppb	9.047 ppb	1.431 ppb	-0.126 ppb	-0.737 ppb	4.109 ppb	92.813 %
Concentration per Run 1	101.348 %	105.866 %	0.015 ppb	11.719 ppb	1.806 ppb	-0.187 ppb	-6.537 ppb	-1.132 ppb	89.631 %
Concentration per Run 2	101.079 %	104.469 %	0.028 ppb	7.669 ppb	0.722 ppb	0.014 ppb	-0.566 ppb	4.202 ppb	92.700 %
Concentration per Run 3	99.652 %	102.793 %	0.015 ppb	7.752 ppb	1.763 ppb	-0.204 ppb	4.894 ppb	9.257 ppb	96.108 %
Recovery Percentage 1			3.892 %	9.047 %	2.044 %	-1.258 %	-0.737 %	4.109 %	
Concentration RSD	0.9 %	1.5 %	39.6 %	25.6 %	42.9 %	96.3 %	776.1 %	126.4 %	3.5 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	95.988 %	0.145 ppb	0.062 ppb	-0.050 ppb	-0.163 ppb	5.429 ppb	-0.005 ppb	0.056 ppb	-0.029 ppb
Concentration per Run 1	96.878 %	0.353 ppb	0.063 ppb	0.015 ppb	-0.179 ppb	4.554 ppb	-0.025 ppb	0.108 ppb	-0.011 ppb
Concentration per Run 2	95.019 %	0.000 ppb	0.122 ppb	-0.072 ppb	-0.318 ppb	5.849 ppb	-0.005 ppb	-0.047 ppb	-0.065 ppb
Concentration per Run 3	96.067 %	0.083 ppb	0.000 ppb	-0.094 ppb	0.009 ppb	5.885 ppb	0.016 ppb	0.106 ppb	-0.011 ppb
Recovery Percentage 1		29.055 %	1.230 %	-5.047 %	-16.253 %	10.859 %	-0.953 %	2.789 %	-2.900 %
Concentration RSD	1.0 %	126.9 %	98.9 %	113.6 %	101.2 %	14.0 %	427.9 %	159.9 %	108.6 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	-0.475 ppb	91.624 %	0.163 ppb	0.387 ppb	0.013 ppb	0.668 ppb	90.012 %	0.071 ppb	0.011 ppb
Concentration per Run 1	-0.496 ppb	91.929 %	0.165 ppb	0.177 ppb	-0.010 ppb	0.584 ppb	90.100 %	0.080 ppb	0.008 ppb
Concentration per Run 2	-0.503 ppb	94.320 %	0.330 ppb	0.448 ppb	0.030 ppb	0.691 ppb	89.200 %	0.086 ppb	0.019 ppb
Concentration per Run 3	-0.427 ppb	88.623 %	-0.008 ppb	0.536 ppb	0.018 ppb	0.730 ppb	90.735 %	0.049 ppb	0.008 ppb
Recovery Percentage 1	-4.754 %	91.624 %	32.532 %	7.744 %	2.523 %	33.424 %		17.864 %	5.748 %
Concentration RSD	8.9 %	3.1 %	103.9 %	48.3 %	164.3 %	11.3 %	0.9 %	27.7 %	56.3 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	90.920 %	0.906 ppb	3.196 ppb	-0.013 ppb	90.354 %	89.247 %	0.036 ppb	0.040 ppb	90.978 %
Concentration per Run 1	93.494 %	0.623 ppb	3.030 ppb	-0.024 ppb	91.229 %	91.997 %	0.030 ppb	0.036 ppb	91.621 %
Concentration per Run 2	90.904 %	0.902 ppb	3.226 ppb	0.036 ppb	89.380 %	87.277 %	0.044 ppb	0.049 ppb	91.958 %
Concentration per Run 3	88.362 %	1.193 ppb	3.330 ppb	-0.053 ppb	90.454 %	88.469 %	0.034 ppb	0.035 ppb	89.355 %
Recovery Percentage 1		30.191 %	79.891 %	-2.697 %			7.201 %	7.930 %	90.978 %
Concentration RSD	2.8 %	31.5 %	4.8 %	334.4 %	1.0 %	2.7 %	20.0 %	19.5 %	1.6 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 104 Analysis started at: 4/5/2017 1:48:56 PM Rack: 2
 Analysis label: L1709265-31 6020TL User name: Vial: 11

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	94.720 %	98.138 %	0.029 ppb	21,916.241 ppb	48,069.389 ppb	284.584 ppb	3,454.425 ppb	269,974.129 ppb	93.921 %
Concentration per Run 1	93.891 %	97.905 %	0.036 ppb	22,250.616 ppb	48,193.358 ppb	294.109 ppb	3,459.684 ppb	266,360.654 ppb	93.296 %
Concentration per Run 2	95.169 %	97.067 %	0.035 ppb	21,890.534 ppb	48,671.635 ppb	284.019 ppb	3,368.252 ppb	272,354.833 ppb	93.466 %
Concentration per Run 3	95.099 %	99.441 %	0.016 ppb	21,607.574 ppb	47,343.172 ppb	275.624 ppb	3,535.338 ppb	271,206.901 ppb	95.000 %
Concentration RSD	0.8 %	1.2 %	38.5 %	1.5 %	1.4 %	3.3 %	2.4 %	1.2 %	1.0 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	88.919 %	386.595 ppb	1.488 ppb	0.986 ppb	281.844 ppb	2,107.157 ppb	3.075 ppb	3.097 ppb	3.327 ppb
Concentration per Run 1	89.424 %	386.820 ppb	1.410 ppb	0.843 ppb	283.932 ppb	2,127.727 ppb	3.203 ppb	3.758 ppb	2.630 ppb
Concentration per Run 2	87.846 %	393.325 ppb	1.467 ppb	1.027 ppb	276.478 ppb	2,186.515 ppb	3.171 ppb	2.739 ppb	3.112 ppb
Concentration per Run 3	89.487 %	379.639 ppb	1.586 ppb	1.089 ppb	285.122 ppb	2,007.229 ppb	2.850 ppb	2.795 ppb	4.237 ppb
Concentration RSD	1.0 %	1.8 %	6.1 %	13.0 %	1.7 %	4.3 %	6.4 %	18.5 %	24.8 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	27.467 ppb	87.589 %	0.861 ppb	0.658 ppb	798.128 ppb	0.477 ppb	85.844 %	0.030 ppb	0.024 ppb
Concentration per Run 1	25.418 ppb	88.928 %	0.895 ppb	0.357 ppb	796.238 ppb	0.537 ppb	85.879 %	0.034 ppb	0.008 ppb
Concentration per Run 2	28.009 ppb	89.386 %	0.935 ppb	0.690 ppb	783.098 ppb	0.425 ppb	85.791 %	0.031 ppb	0.068 ppb
Concentration per Run 3	28.974 ppb	84.453 %	0.754 ppb	0.926 ppb	815.049 ppb	0.469 ppb	85.861 %	0.023 ppb	-0.003 ppb
Concentration RSD	6.7 %	3.1 %	11.1 %	43.4 %	2.0 %	11.8 %	0.1 %	20.5 %	157.9 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	85.963 %	0.334 ppb	1.419 ppb	232.918 ppb	88.792 %	89.165 %	0.018 ppb	1.490 ppb	87.237 %
Concentration per Run 1	89.197 %	0.345 ppb	1.368 ppb	228.067 ppb	87.013 %	92.459 %	0.014 ppb	1.459 ppb	89.167 %
Concentration per Run 2	84.546 %	0.420 ppb	1.519 ppb	235.856 ppb	88.854 %	89.532 %	0.019 ppb	1.511 ppb	86.325 %
Concentration per Run 3	84.146 %	0.237 ppb	1.371 ppb	234.831 ppb	90.510 %	85.505 %	0.021 ppb	1.500 ppb	86.221 %
Concentration RSD	3.3 %	27.5 %	6.1 %	1.8 %	2.0 %	3.9 %	21.4 %	1.9 %	1.9 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 105 Analysis started at: 4/5/2017 1:52:19 PM Rack: 2
 Analysis label: L1709680-01 6020TL User name: Vial: 12

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	93.616 %	97.952 %	0.003 ppb	25,333.357 ppb	2,353.252 ppb	9.232 ppb	1,467.297 ppb	15,565.810 ppb	89.518 %
Concentration per Run 1	93.253 %	100.279 %	-0.003 ppb	25,047.187 ppb	2,405.288 ppb	8.987 ppb	1,441.933 ppb	15,683.772 ppb	92.870 %
Concentration per Run 2	93.553 %	98.883 %	0.007 ppb	25,328.518 ppb	2,337.084 ppb	8.054 ppb	1,439.505 ppb	14,924.662 ppb	87.245 %
Concentration per Run 3	94.041 %	94.693 %	0.007 ppb	25,624.365 ppb	2,317.385 ppb	10.655 ppb	1,520.454 ppb	16,088.995 ppb	88.438 %
Concentration RSD	0.4 %	3.0 %	160.8 %	1.1 %	2.0 %	14.3 %	3.1 %	3.8 %	3.3 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	87.121 %	22.345 ppb	0.000 ppb	0.192 ppb	52.115 ppb	894.826 ppb	0.044 ppb	0.214 ppb	1.566 ppb
Concentration per Run 1	87.446 %	22.889 ppb	0.000 ppb	0.197 ppb	52.976 ppb	878.974 ppb	0.057 ppb	0.029 ppb	1.226 ppb
Concentration per Run 2	88.034 %	22.483 ppb	0.000 ppb	0.213 ppb	52.111 ppb	913.922 ppb	-0.004 ppb	0.425 ppb	2.234 ppb
Concentration per Run 3	85.883 %	21.662 ppb	0.000 ppb	0.166 ppb	51.258 ppb	891.581 ppb	0.079 ppb	0.187 ppb	1.237 ppb
Concentration RSD	1.3 %	2.8 %		12.5 %	1.6 %	2.0 %	98.0 %	93.3 %	37.0 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	1.472 ppb	92.421 %	0.280 ppb	0.051 ppb	667.918 ppb	17.351 ppb	90.387 %	-0.005 ppb	0.034 ppb
Concentration per Run 1	1.311 ppb	92.082 %	0.296 ppb	-0.212 ppb	694.257 ppb	18.029 ppb	89.899 %	-0.016 ppb	0.019 ppb
Concentration per Run 2	1.478 ppb	92.285 %	0.208 ppb	0.099 ppb	656.550 ppb	17.105 ppb	90.582 %	0.004 ppb	0.031 ppb
Concentration per Run 3	1.628 ppb	92.896 %	0.336 ppb	0.266 ppb	652.947 ppb	16.918 ppb	90.680 %	-0.004 ppb	0.053 ppb
Concentration RSD	10.8 %	0.5 %	23.4 %	474.8 %	3.4 %	3.4 %	0.5 %	193.6 %	49.3 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	87.693 %	0.262 ppb	0.757 ppb	30.543 ppb	90.215 %	90.331 %	-0.001 ppb	0.150 ppb	93.939 %
Concentration per Run 1	87.577 %	0.237 ppb	0.759 ppb	30.221 ppb	89.549 %	91.290 %	-0.002 ppb	0.138 ppb	96.742 %
Concentration per Run 2	86.640 %	0.279 ppb	0.649 ppb	32.111 ppb	90.157 %	89.119 %	0.002 ppb	0.158 ppb	92.082 %
Concentration per Run 3	88.863 %	0.270 ppb	0.862 ppb	29.297 ppb	90.938 %	90.583 %	-0.002 ppb	0.155 ppb	92.992 %
Concentration RSD	1.3 %	8.4 %	14.1 %	4.7 %	0.8 %	1.2 %	320.5 %	7.2 %	2.6 %

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4/6/2017 7:04:22 AM



Analysis index: 106 Analysis started at: 4/5/2017 1:55:42 PM Rack: 2
 Analysis label: L1709680-02 6020TL User name: Vial: 13

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	96.671 %	102.095 %	0.008 ppb	9,110.796 ppb	50,844.764 ppb	25.794 ppb	4,160.456 ppb	87,470.571 ppb	88.609 %
Concentration per Run 1	98.391 %	101.257 %	0.006 ppb	9,448.333 ppb	50,972.593 ppb	29.408 ppb	4,518.073 ppb	93,636.180 ppb	84.774 %
Concentration per Run 2	96.953 %	101.676 %	0.016 ppb	9,189.781 ppb	52,191.942 ppb	24.668 ppb	4,186.389 ppb	88,791.304 ppb	86.393 %
Concentration per Run 3	94.668 %	103.352 %	0.002 ppb	8,694.275 ppb	49,369.758 ppb	23.307 ppb	3,776.907 ppb	79,984.227 ppb	94.659 %
Concentration RSD	1.9 %	1.1 %	89.6 %	4.2 %	2.8 %	12.4 %	8.9 %	7.9 %	6.0 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	88.949 %	128.195 ppb	0.237 ppb	0.866 ppb	12.752 ppb	649.424 ppb	0.336 ppb	0.961 ppb	3.784 ppb
Concentration per Run 1	90.237 %	138.298 ppb	0.330 ppb	1.229 ppb	13.417 ppb	752.931 ppb	0.366 ppb	1.090 ppb	4.290 ppb
Concentration per Run 2	89.610 %	131.225 ppb	0.258 ppb	0.716 ppb	12.299 ppb	581.477 ppb	0.228 ppb	0.978 ppb	3.766 ppb
Concentration per Run 3	87.002 %	115.063 ppb	0.122 ppb	0.653 ppb	12.539 ppb	613.863 ppb	0.413 ppb	0.816 ppb	3.297 ppb
Concentration RSD	1.9 %	9.3 %	44.7 %	36.4 %	4.6 %	14.0 %	28.6 %	14.4 %	13.1 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	4.651 ppb	89.267 %	1.298 ppb	0.004 ppb	484.672 ppb	5.463 ppb	86.528 %	-0.016 ppb	0.047 ppb
Concentration per Run 1	5.209 ppb	89.183 %	1.207 ppb	0.208 ppb	486.252 ppb	5.802 ppb	87.727 %	-0.020 ppb	0.020 ppb
Concentration per Run 2	4.504 ppb	92.692 %	1.248 ppb	-0.251 ppb	473.892 ppb	5.294 ppb	86.288 %	-0.020 ppb	0.067 ppb
Concentration per Run 3	4.239 ppb	85.928 %	1.441 ppb	0.054 ppb	493.873 ppb	5.291 ppb	85.569 %	-0.007 ppb	0.055 ppb
Concentration RSD	10.8 %	3.8 %	9.6 %	6,356.1 %	2.1 %	5.4 %	1.3 %	46.4 %	52.0 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	86.222 %	0.321 ppb	0.546 ppb	47.261 ppb	88.031 %	86.746 %	0.001 ppb	0.300 ppb	88.149 %
Concentration per Run 1	86.437 %	0.190 ppb	0.520 ppb	46.586 ppb	88.150 %	85.637 %	0.002 ppb	0.288 ppb	89.195 %
Concentration per Run 2	85.193 %	0.442 ppb	0.569 ppb	46.208 ppb	90.018 %	85.967 %	0.000 ppb	0.315 ppb	87.756 %
Concentration per Run 3	87.036 %	0.330 ppb	0.548 ppb	48.991 ppb	85.926 %	88.635 %	0.002 ppb	0.296 ppb	87.496 %
Concentration RSD	1.1 %	39.3 %	4.6 %	3.2 %	2.3 %	1.9 %	107.7 %	4.6 %	1.0 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 107
Analysis label: L1709680-03 6020TL

Analysis started at: 4/5/2017 1:59:04 PM
User name:

Rack: 2
Vial: 14

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	93.611 %	99.674 %	0.005 ppb	50,403.436 ppb	41,554.953 ppb	18.307 ppb	3,495.654 ppb	124,901.708 ppb	88.552 %
Concentration per Run 1	94.501 %	101.536 %	0.007 ppb	50,588.976 ppb	41,332.906 ppb	19.534 ppb	3,657.985 ppb	128,312.641 ppb	90.910 %
Concentration per Run 2	93.356 %	102.095 %	0.012 ppb	50,500.109 ppb	42,129.428 ppb	17.147 ppb	3,574.106 ppb	128,970.346 ppb	84.433 %
Concentration per Run 3	92.975 %	95.391 %	-0.003 ppb	50,121.223 ppb	41,202.526 ppb	18.241 ppb	3,254.870 ppb	117,422.137 ppb	90.313 %
Concentration RSD	0.8 %	3.7 %	145.6 %	0.5 %	1.2 %	6.5 %	6.1 %	5.2 %	4.0 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	84.617 %	182.151 ppb	0.194 ppb	0.254 ppb	1.322 ppb	58.804 ppb	0.088 ppb	2.307 ppb	0.618 ppb
Concentration per Run 1	85.332 %	189.696 ppb	0.063 ppb	0.272 ppb	0.928 ppb	64.369 ppb	0.124 ppb	2.600 ppb	0.447 ppb
Concentration per Run 2	84.579 %	185.665 ppb	0.395 ppb	0.221 ppb	1.590 ppb	60.185 ppb	0.124 ppb	2.187 ppb	0.707 ppb
Concentration per Run 3	83.940 %	171.092 ppb	0.125 ppb	0.268 ppb	1.446 ppb	51.859 ppb	0.017 ppb	2.134 ppb	0.700 ppb
Concentration RSD	0.8 %	5.4 %	90.7 %	11.3 %	26.4 %	10.8 %	70.4 %	11.1 %	23.9 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	2.985 ppb	89.731 %	0.218 ppb	13.458 ppb	305.848 ppb	12.641 ppb	86.881 %	-0.019 ppb	0.008 ppb
Concentration per Run 1	3.319 ppb	85.535 %	0.322 ppb	15.672 ppb	324.779 ppb	13.356 ppb	84.718 %	-0.012 ppb	0.008 ppb
Concentration per Run 2	3.138 ppb	92.516 %	0.251 ppb	13.075 ppb	298.822 ppb	11.979 ppb	85.115 %	-0.024 ppb	0.020 ppb
Concentration per Run 3	2.499 ppb	91.142 %	0.079 ppb	11.629 ppb	293.943 ppb	12.586 ppb	90.811 %	-0.020 ppb	-0.003 ppb
Concentration RSD	14.4 %	4.1 %	57.5 %	15.2 %	5.4 %	5.5 %	3.9 %	34.7 %	141.0 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	86.744 %	0.125 ppb	0.716 ppb	29.092 ppb	89.233 %	88.148 %	0.012 ppb	0.074 ppb	85.623 %
Concentration per Run 1	88.639 %	0.107 ppb	0.709 ppb	29.317 ppb	89.053 %	87.995 %	0.010 ppb	0.086 ppb	85.973 %
Concentration per Run 2	84.928 %	0.156 ppb	0.573 ppb	29.334 ppb	87.777 %	86.417 %	0.013 ppb	0.054 ppb	83.156 %
Concentration per Run 3	86.667 %	0.112 ppb	0.867 ppb	28.624 ppb	90.869 %	90.033 %	0.012 ppb	0.082 ppb	87.741 %
Concentration RSD	2.1 %	21.5 %	20.6 %	1.4 %	1.7 %	2.1 %	12.1 %	24.0 %	2.7 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 108 Analysis started at: 4/5/2017 2:02:26 PM Rack: 2
Analysis label: L1709680-04 6020TL User name: ALPHALAB\metals-instrument Vial: 15

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	93.645 %	96.369 %	0.013 ppb	48,539.550 ppb	79,239.269 ppb	54.737 ppb	3,205.484 ppb	185,786.758 ppb	88.893 %
Concentration per Run 1	94.531 %	98.184 %	0.021 ppb	49,179.699 ppb	79,128.171 ppb	53.629 ppb	3,223.725 ppb	187,341.652 ppb	88.098 %
Concentration per Run 2	93.609 %	99.581 %	0.016 ppb	48,128.317 ppb	79,577.346 ppb	50.883 ppb	3,309.348 ppb	196,217.339 ppb	84.263 %
Concentration per Run 3	92.796 %	91.341 %	0.002 ppb	48,310.632 ppb	79,012.289 ppb	59.701 ppb	3,083.378 ppb	173,801.283 ppb	94.319 %
Concentration RSD	0.9 %	4.6 %	76.0 %	1.2 %	0.4 %	8.2 %	3.6 %	6.1 %	5.7 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	81.970 %	267.697 ppb	0.273 ppb	0.212 ppb	15.068 ppb	116.662 ppb	0.241 ppb	4.149 ppb	0.333 ppb
Concentration per Run 1	80.977 %	277.853 ppb	0.259 ppb	0.195 ppb	16.310 ppb	113.410 ppb	0.410 ppb	4.358 ppb	0.396 ppb
Concentration per Run 2	84.273 %	268.315 ppb	0.133 ppb	0.180 ppb	14.678 ppb	135.759 ppb	0.149 ppb	4.430 ppb	0.331 ppb
Concentration per Run 3	80.660 %	256.922 ppb	0.429 ppb	0.261 ppb	14.216 ppb	100.818 ppb	0.164 ppb	3.659 ppb	0.273 ppb
Concentration RSD	2.4 %	3.9 %	54.3 %	20.4 %	7.3 %	15.2 %	60.9 %	10.3 %	18.4 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	0.792 ppb	86.639 %	0.393 ppb	5.561 ppb	782.863 ppb	3.009 ppb	82.777 %	-0.019 ppb	0.017 ppb
Concentration per Run 1	1.063 ppb	85.317 %	0.276 ppb	4.824 ppb	819.295 ppb	3.306 ppb	82.690 %	-0.020 ppb	0.009 ppb
Concentration per Run 2	0.533 ppb	89.284 %	0.532 ppb	5.311 ppb	758.476 ppb	2.781 ppb	83.706 %	-0.020 ppb	0.009 ppb
Concentration per Run 3	0.781 ppb	85.317 %	0.371 ppb	6.548 ppb	770.817 ppb	2.939 ppb	81.933 %	-0.016 ppb	0.033 ppb
Concentration RSD	33.4 %	2.6 %	32.9 %	16.0 %	4.1 %	9.0 %	1.1 %	13.8 %	82.7 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	84.417 %	0.070 ppb	0.352 ppb	25.696 ppb	84.868 %	84.353 %	0.013 ppb	0.132 ppb	82.305 %
Concentration per Run 1	83.183 %	0.082 ppb	0.358 ppb	26.484 ppb	84.032 %	83.173 %	0.007 ppb	0.154 ppb	80.483 %
Concentration per Run 2	84.730 %	0.052 ppb	0.395 ppb	24.226 ppb	86.217 %	84.213 %	0.020 ppb	0.133 ppb	82.428 %
Concentration per Run 3	85.340 %	0.077 ppb	0.304 ppb	26.378 ppb	84.354 %	85.674 %	0.012 ppb	0.110 ppb	84.006 %
Concentration RSD	1.3 %	23.0 %	13.0 %	5.0 %	1.4 %	1.5 %	46.6 %	16.4 %	2.1 %

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4/6/2017 7:04:22 AM



Analysis index: 109 Analysis started at: 4/5/2017 2:05:47 PM Rack: 2
 Analysis label: L1709680-05 6020TL User name: ALPHALAB\metals-instrument Vial: 16

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	94.164 %	98.557 %	0.010 ppb	67,780.398 ppb	68,128.625 ppb	4.369 ppb	4,792.257 ppb	207,619.532 ppb	87.558 %
Concentration per Run 1	93.660 %	101.397 %	0.012 ppb	66,698.104 ppb	68,711.885 ppb	4.448 ppb	4,597.266 ppb	204,723.593 ppb	86.990 %
Concentration per Run 2	94.440 %	97.765 %	0.002 ppb	69,201.566 ppb	68,137.677 ppb	5.509 ppb	5,169.055 ppb	214,406.706 ppb	85.200 %
Concentration per Run 3	94.394 %	96.508 %	0.016 ppb	67,441.524 ppb	67,536.313 ppb	3.149 ppb	4,610.450 ppb	203,728.296 ppb	90.484 %
Concentration RSD	0.5 %	2.6 %	74.4 %	1.9 %	0.9 %	27.1 %	6.8 %	2.8 %	3.1 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	83.115 %	301.874 ppb	0.212 ppb	0.184 ppb	0.103 ppb	20.318 ppb	0.074 ppb	4.429 ppb	1.837 ppb
Concentration per Run 1	82.967 %	307.483 ppb	0.260 ppb	0.196 ppb	0.323 ppb	26.109 ppb	0.126 ppb	4.478 ppb	1.974 ppb
Concentration per Run 2	82.855 %	306.165 ppb	0.065 ppb	0.153 ppb	-0.240 ppb	17.747 ppb	0.017 ppb	5.362 ppb	1.643 ppb
Concentration per Run 3	83.523 %	291.975 ppb	0.312 ppb	0.204 ppb	0.225 ppb	17.096 ppb	0.079 ppb	3.446 ppb	1.894 ppb
Concentration RSD	0.4 %	2.8 %	61.2 %	15.0 %	292.7 %	24.7 %	73.5 %	21.6 %	9.4 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	2.187 ppb	90.637 %	0.701 ppb	5.808 ppb	634.124 ppb	2.629 ppb	83.754 %	-0.013 ppb	0.017 ppb
Concentration per Run 1	2.476 ppb	87.962 %	0.723 ppb	3.870 ppb	646.301 ppb	2.322 ppb	84.416 %	-0.016 ppb	0.008 ppb
Concentration per Run 2	2.073 ppb	92.324 %	0.732 ppb	7.559 ppb	623.935 ppb	2.787 ppb	82.264 %	-0.015 ppb	0.033 ppb
Concentration per Run 3	2.010 ppb	91.624 %	0.649 ppb	5.995 ppb	632.137 ppb	2.776 ppb	84.584 %	-0.007 ppb	0.008 ppb
Concentration RSD	11.6 %	2.6 %	6.5 %	31.9 %	1.8 %	10.1 %	1.5 %	38.3 %	85.8 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	84.596 %	0.127 ppb	0.497 ppb	21.406 ppb	86.192 %	84.387 %	0.040 ppb	0.051 ppb	84.755 %
Concentration per Run 1	85.977 %	0.140 ppb	0.449 ppb	20.319 ppb	86.450 %	87.479 %	0.050 ppb	0.041 ppb	85.922 %
Concentration per Run 2	82.317 %	0.097 ppb	0.576 ppb	22.578 ppb	85.814 %	83.363 %	0.033 ppb	0.060 ppb	82.793 %
Concentration per Run 3	85.492 %	0.142 ppb	0.467 ppb	21.321 ppb	86.311 %	82.320 %	0.038 ppb	0.053 ppb	85.551 %
Concentration RSD	2.3 %	20.1 %	13.8 %	5.3 %	0.4 %	3.2 %	21.4 %	19.5 %	2.0 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 110 Analysis started at: 4/5/2017 2:09:09 PM Rack: 2
 Analysis label: L1709680-06 6020TL User name: ALPHALAB\metals-instrument Vial: 17

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	95.242 %	100.000 %	0.013 ppb	18,369.546 ppb	93,570.269 ppb	86.943 ppb	3,055.596 ppb	182,004.670 ppb	83.127 %
Concentration per Run 1	97.331 %	100.838 %	0.016 ppb	18,303.407 ppb	92,160.757 ppb	85.952 ppb	2,961.211 ppb	181,151.029 ppb	85.797 %
Concentration per Run 2	94.864 %	98.743 %	0.021 ppb	18,114.660 ppb	91,810.340 ppb	88.390 ppb	2,921.291 ppb	170,974.669 ppb	85.882 %
Concentration per Run 3	93.531 %	100.419 %	0.002 ppb	18,690.571 ppb	96,739.709 ppb	86.485 ppb	3,284.286 ppb	193,888.311 ppb	77.701 %
Concentration RSD	2.0 %	1.1 %	76.7 %	1.6 %	2.9 %	1.5 %	6.5 %	6.3 %	5.7 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	82.007 %	262.863 ppb	0.989 ppb	0.146 ppb	3.866 ppb	25.187 ppb	0.204 ppb	1.883 ppb	0.607 ppb
Concentration per Run 1	83.285 %	269.487 ppb	1.117 ppb	0.110 ppb	3.883 ppb	23.106 ppb	0.171 ppb	2.645 ppb	0.734 ppb
Concentration per Run 2	80.145 %	244.380 ppb	0.851 ppb	0.220 ppb	4.284 ppb	31.157 ppb	0.213 ppb	1.329 ppb	0.500 ppb
Concentration per Run 3	82.591 %	274.723 ppb	0.997 ppb	0.106 ppb	3.430 ppb	21.296 ppb	0.228 ppb	1.674 ppb	0.588 ppb
Concentration RSD	2.0 %	6.2 %	13.5 %	44.4 %	11.1 %	20.8 %	14.6 %	36.2 %	19.4 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	0.046 ppb	87.487 %	0.820 ppb	0.432 ppb	2,661.193 ppb	4.622 ppb	83.259 %	-0.014 ppb	0.009 ppb
Concentration per Run 1	0.190 ppb	87.504 %	1.002 ppb	0.238 ppb	2,674.817 ppb	4.222 ppb	84.321 %	-0.016 ppb	0.021 ppb
Concentration per Run 2	-0.276 ppb	88.674 %	0.626 ppb	0.459 ppb	2,652.477 ppb	4.646 ppb	84.638 %	-0.016 ppb	-0.003 ppb
Concentration per Run 3	0.225 ppb	86.284 %	0.832 ppb	0.597 ppb	2,656.283 ppb	4.997 ppb	80.818 %	-0.011 ppb	0.009 ppb
Concentration RSD	604.3 %	1.4 %	22.9 %	41.9 %	0.4 %	8.4 %	2.5 %	19.9 %	136.3 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	82.801 %	0.082 ppb	0.384 ppb	20.011 ppb	85.602 %	83.706 %	0.011 ppb	0.044 ppb	81.910 %
Concentration per Run 1	84.334 %	0.132 ppb	0.441 ppb	19.293 ppb	87.897 %	83.225 %	0.006 ppb	0.048 ppb	84.027 %
Concentration per Run 2	82.771 %	0.069 ppb	0.282 ppb	20.758 ppb	85.508 %	84.133 %	0.019 ppb	0.034 ppb	82.285 %
Concentration per Run 3	81.299 %	0.045 ppb	0.428 ppb	19.984 ppb	83.399 %	83.761 %	0.009 ppb	0.049 ppb	79.417 %
Concentration RSD	1.8 %	54.3 %	23.1 %	3.7 %	2.6 %	0.5 %	61.4 %	20.0 %	2.8 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 111 Analysis started at: 4/5/2017 2:12:24 PM Rack: 2
 Analysis label: L1709680-07 6020TL User name: ALPHALAB\metals-instrument Vial: 18

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	91.813 %	98.324 %	0.009 ppb	62,694.304 ppb	13,504.273 ppb	19.397 ppb	2,255.898 ppb	53,519.147 ppb	87.018 %
Concentration per Run 1	93.016 %	97.486 %	0.007 ppb	63,045.148 ppb	13,505.068 ppb	18.875 ppb	2,316.815 ppb	54,077.676 ppb	88.779 %
Concentration per Run 2	91.561 %	101.257 %	0.017 ppb	59,617.853 ppb	12,985.180 ppb	17.567 ppb	2,257.574 ppb	52,071.400 ppb	87.416 %
Concentration per Run 3	90.864 %	96.229 %	0.002 ppb	65,419.912 ppb	14,022.572 ppb	21.748 ppb	2,193.306 ppb	54,408.367 ppb	84.859 %
Concentration RSD	1.2 %	2.7 %	88.5 %	4.7 %	3.8 %	11.0 %	2.7 %	2.4 %	2.3 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	82.490 %	77.925 ppb	0.259 ppb	0.198 ppb	2.073 ppb	60.887 ppb	0.061 ppb	0.559 ppb	1.735 ppb
Concentration per Run 1	81.004 %	78.083 ppb	0.316 ppb	0.101 ppb	1.870 ppb	58.516 ppb	0.121 ppb	0.265 ppb	1.298 ppb
Concentration per Run 2	82.473 %	74.695 ppb	0.260 ppb	0.241 ppb	2.308 ppb	67.625 ppb	0.040 ppb	0.525 ppb	2.472 ppb
Concentration per Run 3	83.994 %	80.997 ppb	0.202 ppb	0.253 ppb	2.039 ppb	56.520 ppb	0.020 ppb	0.887 ppb	1.435 ppb
Concentration RSD	1.8 %	4.0 %	22.1 %	42.5 %	10.7 %	9.7 %	88.2 %	55.8 %	37.0 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	0.815 ppb	86.470 %	0.401 ppb	1.075 ppb	177.349 ppb	4.721 ppb	86.398 %	-0.017 ppb	0.036 ppb
Concentration per Run 1	0.895 ppb	92.082 %	0.252 ppb	-0.011 ppb	172.575 ppb	5.015 ppb	87.939 %	-0.016 ppb	0.055 ppb
Concentration per Run 2	0.525 ppb	85.521 %	0.416 ppb	0.956 ppb	173.185 ppb	4.303 ppb	87.006 %	-0.016 ppb	0.043 ppb
Concentration per Run 3	1.025 ppb	81.808 %	0.535 ppb	2.278 ppb	186.285 ppb	4.845 ppb	84.249 %	-0.020 ppb	0.009 ppb
Concentration RSD	31.9 %	6.0 %	35.4 %	107.0 %	4.4 %	7.9 %	2.2 %	13.4 %	67.3 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	85.265 %	0.073 ppb	0.566 ppb	22.438 ppb	87.655 %	86.831 %	0.007 ppb	0.164 ppb	87.843 %
Concentration per Run 1	86.263 %	0.075 ppb	0.669 ppb	21.465 ppb	87.596 %	87.398 %	0.000 ppb	0.166 ppb	89.054 %
Concentration per Run 2	86.572 %	0.048 ppb	0.489 ppb	22.632 ppb	88.422 %	86.963 %	0.012 ppb	0.164 ppb	88.250 %
Concentration per Run 3	82.959 %	0.095 ppb	0.540 ppb	23.217 ppb	86.949 %	86.133 %	0.008 ppb	0.164 ppb	86.225 %
Concentration RSD	2.3 %	32.5 %	16.3 %	4.0 %	0.8 %	0.7 %	98.1 %	0.8 %	1.7 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 112 Analysis started at: 4/5/2017 2:15:46 PM Rack: 2
 Analysis label: L1709680-08 6020TL User name: ALPHALAB\metals-instrument Vial: 19

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	91.760 %	95.763 %	0.005 ppb	67,924.431 ppb	14,624.594 ppb	19.932 ppb	2,305.873 ppb	55,568.046 ppb	85.172 %
Concentration per Run 1	92.277 %	98.743 %	0.017 ppb	70,568.222 ppb	15,057.485 ppb	19.042 ppb	2,363.632 ppb	58,918.671 ppb	82.473 %
Concentration per Run 2	93.246 %	96.927 %	0.002 ppb	64,628.352 ppb	14,008.489 ppb	20.742 ppb	2,401.855 ppb	54,019.213 ppb	86.734 %
Concentration per Run 3	89.757 %	91.620 %	-0.003 ppb	68,576.719 ppb	14,807.808 ppb	20.012 ppb	2,152.132 ppb	53,766.254 ppb	86.308 %
Concentration RSD	2.0 %	3.9 %	196.4 %	4.5 %	3.7 %	4.3 %	5.8 %	5.2 %	2.8 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	81.424 %	82.522 ppb	0.243 ppb	0.241 ppb	2.909 ppb	57.253 ppb	0.026 ppb	0.450 ppb	1.807 ppb
Concentration per Run 1	84.217 %	85.596 ppb	0.205 ppb	0.305 ppb	3.386 ppb	46.415 ppb	-0.002 ppb	0.376 ppb	1.592 ppb
Concentration per Run 2	79.321 %	82.934 ppb	0.197 ppb	0.200 ppb	2.632 ppb	55.277 ppb	0.064 ppb	0.701 ppb	1.875 ppb
Concentration per Run 3	80.733 %	79.036 ppb	0.326 ppb	0.218 ppb	2.709 ppb	70.069 ppb	0.018 ppb	0.274 ppb	1.954 ppb
Concentration RSD	3.1 %	4.0 %	29.6 %	23.2 %	14.3 %	20.9 %	128.6 %	49.5 %	10.5 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	1.395 ppb	85.843 %	0.537 ppb	2.269 ppb	187.463 ppb	4.968 ppb	84.065 %	-0.011 ppb	0.053 ppb
Concentration per Run 1	1.918 ppb	84.554 %	0.469 ppb	1.077 ppb	189.658 ppb	5.244 ppb	82.933 %	-0.007 ppb	0.046 ppb
Concentration per Run 2	1.430 ppb	83.435 %	0.475 ppb	2.585 ppb	188.587 ppb	4.968 ppb	87.038 %	-0.012 ppb	0.055 ppb
Concentration per Run 3	0.837 ppb	89.539 %	0.666 ppb	3.146 ppb	184.142 ppb	4.692 ppb	82.225 %	-0.016 ppb	0.057 ppb
Concentration RSD	38.8 %	3.8 %	20.8 %	47.2 %	1.6 %	5.6 %	3.1 %	39.3 %	11.8 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	83.497 %	0.062 ppb	0.536 ppb	24.181 ppb	86.123 %	85.127 %	0.006 ppb	0.183 ppb	85.755 %
Concentration per Run 1	81.849 %	0.017 ppb	0.469 ppb	25.179 ppb	87.489 %	84.600 %	0.008 ppb	0.167 ppb	87.314 %
Concentration per Run 2	85.428 %	0.155 ppb	0.722 ppb	25.279 ppb	85.339 %	87.452 %	0.004 ppb	0.180 ppb	85.121 %
Concentration per Run 3	83.214 %	0.015 ppb	0.418 ppb	22.085 ppb	85.541 %	83.329 %	0.007 ppb	0.201 ppb	84.830 %
Concentration RSD	2.2 %	129.6 %	30.4 %	7.5 %	1.4 %	2.5 %	36.4 %	9.3 %	1.6 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 113 Analysis started at: 4/5/2017 2:19:00 PM Rack: 2
 Analysis label: L1709265-28D20 6020TL User name: ALPHALAB\metals-instrument Vial: 20

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	92.433 %	101.024 %	0.000 ppb	25,145.576 ppb	8,987.453 ppb	2.865 ppb	13,976.925 ppb	12,274.776 ppb	86.450 %
Concentration per Run 1	93.688 %	101.536 %	0.002 ppb	25,023.645 ppb	9,088.755 ppb	2.038 ppb	13,603.096 ppb	12,531.215 ppb	86.819 %
Concentration per Run 2	92.436 %	100.559 %	-0.003 ppb	25,868.054 ppb	9,067.864 ppb	3.486 ppb	14,463.347 ppb	12,625.307 ppb	82.558 %
Concentration per Run 3	91.174 %	100.978 %	0.002 ppb	24,545.030 ppb	8,805.739 ppb	3.071 ppb	13,864.332 ppb	11,667.806 ppb	89.972 %
Concentration RSD	1.4 %	0.5 %	934.9 %	2.7 %	1.8 %	26.0 %	3.2 %	4.3 %	4.3 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	82.796 %	17.757 ppb	0.460 ppb	1.044 ppb	419.041 ppb	1,007.699 ppb	0.576 ppb	2.821 ppb	0.948 ppb
Concentration per Run 1	83.991 %	20.396 ppb	0.327 ppb	1.220 ppb	431.879 ppb	1,039.539 ppb	0.633 ppb	2.997 ppb	1.384 ppb
Concentration per Run 2	81.329 %	17.188 ppb	0.611 ppb	0.852 ppb	423.257 ppb	1,046.846 ppb	0.510 ppb	3.541 ppb	0.748 ppb
Concentration per Run 3	83.069 %	15.688 ppb	0.441 ppb	1.061 ppb	401.987 ppb	936.711 ppb	0.585 ppb	1.923 ppb	0.711 ppb
Concentration RSD	1.6 %	13.5 %	31.0 %	17.6 %	3.7 %	6.1 %	10.7 %	29.2 %	39.9 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	1.819 ppb	87.097 %	1.779 ppb	0.549 ppb	57.819 ppb	0.217 ppb	85.538 %	-0.022 ppb	0.001 ppb
Concentration per Run 1	1.796 ppb	85.114 %	2.114 ppb	1.207 ppb	59.833 ppb	0.356 ppb	85.705 %	-0.024 ppb	-0.003 ppb
Concentration per Run 2	1.977 ppb	86.741 %	1.705 ppb	-0.195 ppb	58.262 ppb	0.168 ppb	84.831 %	-0.016 ppb	0.008 ppb
Concentration per Run 3	1.683 ppb	89.437 %	1.518 ppb	0.636 ppb	55.362 ppb	0.127 ppb	86.079 %	-0.024 ppb	-0.003 ppb
Concentration RSD	8.1 %	2.5 %	17.1 %	128.3 %	3.9 %	56.4 %	0.7 %	23.0 %	1,198.1 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	85.499 %	0.076 ppb	0.228 ppb	55.882 ppb	87.539 %	88.378 %	-0.003 ppb	0.062 ppb	86.271 %
Concentration per Run 1	83.418 %	0.081 ppb	0.309 ppb	57.651 ppb	87.635 %	86.699 %	-0.004 ppb	0.067 ppb	84.992 %
Concentration per Run 2	86.678 %	0.061 ppb	0.239 ppb	56.265 ppb	87.642 %	87.789 %	-0.006 ppb	0.059 ppb	87.243 %
Concentration per Run 3	86.400 %	0.087 ppb	0.137 ppb	53.730 ppb	87.338 %	90.647 %	0.002 ppb	0.061 ppb	86.577 %
Concentration RSD	2.1 %	18.0 %	37.9 %	3.6 %	0.2 %	2.3 %	141.4 %	6.2 %	1.3 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 114 Analysis started at: 4/5/2017 2:22:23 PM Rack: 0
 Analysis label: CCV User name: ALPHALAB\metals-instrument Vial: 9

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	92.174 %	94.972 %	95.303 ppb	9,863.578 ppb	10,085.708 ppb	100.466 ppb	10,281.488 ppb	10,445.130 ppb	86.109 %
Concentration per Run 1	91.494 %	95.950 %	94.493 ppb	9,866.225 ppb	10,202.835 ppb	96.698 ppb	10,270.735 ppb	10,966.353 ppb	83.922 %
Concentration per Run 2	93.876 %	93.994 %	94.459 ppb	9,712.023 ppb	9,897.169 ppb	105.812 ppb	10,017.770 ppb	9,834.894 ppb	91.762 %
Concentration per Run 3	91.152 %	94.972 %	96.956 ppb	10,012.485 ppb	10,157.120 ppb	98.888 ppb	10,555.960 ppb	10,534.142 ppb	82.643 %
Recovery Percentage 1			95.303 %	98.636 %	100.857 %	100.466 %	102.815 %	104.451 %	
Concentration RSD	1.6 %	1.0 %	1.5 %	1.5 %	1.6 %	4.7 %	2.6 %	5.5 %	5.7 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	85.308 %	98.359 ppb	103.910 ppb	98.540 ppb	100.740 ppb	10,123.364 ppb	100.301 ppb	96.128 ppb	102.367 ppb
Concentration per Run 1	83.214 %	100.713 ppb	104.535 ppb	102.694 ppb	100.477 ppb	10,494.990 ppb	103.824 ppb	104.527 ppb	103.289 ppb
Concentration per Run 2	87.187 %	90.293 ppb	96.572 ppb	94.868 ppb	97.680 ppb	9,531.915 ppb	97.193 ppb	84.637 ppb	101.330 ppb
Concentration per Run 3	85.523 %	104.069 ppb	110.623 ppb	98.059 ppb	104.063 ppb	10,343.186 ppb	99.885 ppb	99.220 ppb	102.482 ppb
Recovery Percentage 1		98.359 %	103.910 %	98.540 %	100.740 %	101.234 %	100.301 %	96.128 %	102.367 %
Concentration RSD	2.3 %	7.3 %	6.8 %	4.0 %	3.2 %	5.1 %	3.3 %	10.7 %	1.0 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	100.542 ppb	87.770 %	100.761 ppb	96.975 ppb	103.935 ppb	98.727 ppb	87.111 %	97.376 ppb	99.491 ppb
Concentration per Run 1	105.085 ppb	85.930 %	104.543 ppb	102.765 ppb	108.321 ppb	101.489 ppb	87.892 %	99.908 ppb	100.324 ppb
Concentration per Run 2	96.256 ppb	88.916 %	97.559 ppb	93.012 ppb	101.974 ppb	95.053 ppb	88.577 %	93.002 ppb	93.663 ppb
Concentration per Run 3	100.287 ppb	88.464 %	100.181 ppb	95.149 ppb	101.511 ppb	99.638 ppb	84.864 %	99.220 ppb	104.485 ppb
Recovery Percentage 1	100.542 %		100.761 %	96.975 %	103.935 %	98.727 %		97.376 %	99.491 %
Concentration RSD	4.4 %	1.8 %	3.5 %	5.3 %	3.7 %	3.4 %	2.3 %	3.9 %	5.5 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	87.702 %	96.930 ppb	99.860 ppb	99.723 ppb	89.343 %	88.999 %	101.063 ppb	100.814 ppb	88.982 %
Concentration per Run 1	88.301 %	97.402 ppb	100.534 ppb	100.120 ppb	89.772 %	89.921 %	103.435 ppb	101.893 ppb	87.824 %
Concentration per Run 2	90.386 %	92.375 ppb	95.520 ppb	95.093 ppb	89.994 %	90.664 %	96.376 ppb	95.570 ppb	93.011 %
Concentration per Run 3	84.419 %	101.012 ppb	103.527 ppb	103.957 ppb	88.262 %	86.412 %	103.377 ppb	104.979 ppb	86.110 %
Recovery Percentage 1		96.930 %	99.860 %	99.723 %			101.063 %	100.814 %	
Concentration RSD	3.5 %	4.5 %	4.1 %	4.5 %	1.1 %	2.6 %	4.0 %	4.8 %	4.0 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 115 Analysis started at: 4/5/2017 2:25:48 PM Rack: 0
 Analysis label: CCB User name: ALPHALAB\metals-instrument Vial: 10

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	93.295 %	98.696 %	0.018 ppb	9.066 ppb	0.509 ppb	-0.429 ppb	28.199 ppb	1.062 ppb	84.263 %
Concentration per Run 1	94.317 %	96.089 %	0.011 ppb	2.152 ppb	0.905 ppb	0.104 ppb	23.315 ppb	17.166 ppb	85.456 %
Concentration per Run 2	93.459 %	101.117 %	0.012 ppb	14.391 ppb	-0.276 ppb	-0.587 ppb	53.149 ppb	-6.974 ppb	84.518 %
Concentration per Run 3	92.110 %	98.883 %	0.031 ppb	10.655 ppb	0.898 ppb	-0.805 ppb	8.132 ppb	-7.006 ppb	82.814 %
Recovery Percentage 1			3.626 %	9.066 %	0.727 %	-4.293 %	28.199 %	1.062 %	
Concentration RSD	1.2 %	2.6 %	63.4 %	69.2 %	133.6 %	110.5 %	81.2 %	1,313.2 %	1.6 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	87.459 %	0.063 ppb	0.067 ppb	-0.029 ppb	-0.163 ppb	7.790 ppb	0.011 ppb	0.036 ppb	-0.008 ppb
Concentration per Run 1	88.424 %	0.093 ppb	0.066 ppb	-0.045 ppb	-0.020 ppb	5.008 ppb	0.019 ppb	0.035 ppb	-0.065 ppb
Concentration per Run 2	87.304 %	0.000 ppb	0.066 ppb	-0.045 ppb	-0.238 ppb	9.737 ppb	0.018 ppb	-0.047 ppb	-0.010 ppb
Concentration per Run 3	86.649 %	0.095 ppb	0.068 ppb	0.004 ppb	-0.230 ppb	8.625 ppb	-0.003 ppb	0.121 ppb	0.053 ppb
Recovery Percentage 1		12.542 %	1.334 %	-2.867 %	-16.261 %	15.580 %	2.278 %	1.824 %	-0.753 %
Concentration RSD	1.0 %	86.6 %	1.8 %	98.3 %	76.0 %	31.7 %	106.3 %	231.1 %	783.6 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	-0.378 ppb	87.487 %	0.100 ppb	0.528 ppb	0.047 ppb	0.647 ppb	88.770 %	0.075 ppb	0.000 ppb
Concentration per Run 1	-0.373 ppb	85.927 %	0.180 ppb	0.652 ppb	0.090 ppb	0.740 ppb	90.120 %	0.077 ppb	0.008 ppb
Concentration per Run 2	-0.320 ppb	91.675 %	0.078 ppb	0.674 ppb	0.018 ppb	0.630 ppb	88.147 %	0.089 ppb	-0.003 ppb
Concentration per Run 3	-0.440 ppb	84.859 %	0.041 ppb	0.256 ppb	0.034 ppb	0.571 ppb	88.044 %	0.059 ppb	-0.003 ppb
Recovery Percentage 1	-3.777 %	87.487 %	19.993 %	10.550 %	9.464 %	32.364 %		18.764 %	0.189 %
Concentration RSD	16.0 %	4.2 %	71.8 %	44.6 %	79.7 %	13.3 %	1.3 %	19.9 %	1,700.9 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	87.354 %	0.784 ppb	3.216 ppb	-0.022 ppb	88.131 %	87.845 %	0.037 ppb	0.055 ppb	90.118 %
Concentration per Run 1	90.483 %	0.746 ppb	3.177 ppb	-0.023 ppb	87.781 %	87.123 %	0.047 ppb	0.060 ppb	89.283 %
Concentration per Run 2	85.170 %	0.809 ppb	3.386 ppb	-0.022 ppb	89.153 %	87.761 %	0.029 ppb	0.056 ppb	90.190 %
Concentration per Run 3	86.408 %	0.798 ppb	3.087 ppb	-0.022 ppb	87.460 %	88.651 %	0.034 ppb	0.048 ppb	90.882 %
Recovery Percentage 1		26.143 %	80.412 %	-4.453 %			7.306 %	10.964 %	90.118 %
Concentration RSD	3.2 %	4.2 %	4.8 %	1.9 %	1.0 %	0.9 %	26.0 %	11.4 %	0.9 %

Alpha ICPMSQ Full

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Analysis index: 116 Analysis started at: 4/5/2017 2:29:13 PM Rack: 2
 Analysis label: WG991289-1D10 A2-6020T User name: ALPHALAB\metals-instrument Vial: 21

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	93.013 %	98.790 %	0.000 ppb	8.443 ppb	-0.646 ppb	0.302 ppb	28.239 ppb	2.892 ppb	87.103 %
Concentration per Run 1	93.365 %	95.950 %	-0.003 ppb	9.145 ppb	-1.402 ppb	0.761 ppb	20.976 ppb	10.764 ppb	87.842 %
Concentration per Run 2	92.648 %	101.117 %	-0.003 ppb	9.500 ppb	0.866 ppb	0.091 ppb	35.725 ppb	-0.859 ppb	82.984 %
Concentration per Run 3	93.026 %	99.302 %	0.007 ppb	6.684 ppb	-1.402 ppb	0.053 ppb	28.016 ppb	-1.228 ppb	90.484 %
Concentration RSD	0.4 %	2.7 %	2,046.3 %	18.2 %	202.8 %	131.9 %	26.1 %	235.8 %	4.4 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	87.002 %	0.059 ppb	0.021 ppb	-0.053 ppb	-0.289 ppb	5.341 ppb	0.003 ppb	0.059 ppb	-0.029 ppb
Concentration per Run 1	85.483 %	0.000 ppb	0.000 ppb	-0.026 ppb	-0.037 ppb	3.056 ppb	-0.004 ppb	0.110 ppb	0.044 ppb
Concentration per Run 2	88.807 %	0.000 ppb	0.000 ppb	-0.021 ppb	-0.450 ppb	5.033 ppb	-0.003 ppb	0.035 ppb	-0.065 ppb
Concentration per Run 3	86.715 %	0.176 ppb	0.063 ppb	-0.113 ppb	-0.381 ppb	7.936 ppb	0.018 ppb	0.033 ppb	-0.065 ppb
Concentration RSD	1.9 %	173.2 %	173.2 %	97.1 %	76.4 %	46.0 %	352.8 %	74.2 %	220.2 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	-0.452 ppb	88.962 %	0.023 ppb	0.517 ppb	0.038 ppb	0.138 ppb	87.398 %	0.015 ppb	0.004 ppb
Concentration per Run 1	-0.597 ppb	91.726 %	-0.053 ppb	0.526 ppb	0.019 ppb	0.127 ppb	85.048 %	0.044 ppb	-0.003 ppb
Concentration per Run 2	-0.379 ppb	88.826 %	0.082 ppb	0.235 ppb	0.074 ppb	0.160 ppb	89.111 %	0.005 ppb	-0.003 ppb
Concentration per Run 3	-0.380 ppb	86.334 %	0.040 ppb	0.790 ppb	0.020 ppb	0.126 ppb	88.036 %	-0.003 ppb	0.020 ppb
Concentration RSD	27.8 %	3.0 %	299.2 %	53.7 %	85.0 %	14.0 %	2.4 %	167.4 %	302.2 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	85.911 %	0.270 ppb	1.290 ppb	-0.032 ppb	87.338 %	86.722 %	0.008 ppb	0.015 ppb	93.018 %
Concentration per Run 1	87.306 %	0.265 ppb	1.267 ppb	-0.053 ppb	84.663 %	84.979 %	0.009 ppb	0.014 ppb	93.884 %
Concentration per Run 2	85.621 %	0.310 ppb	1.222 ppb	-0.053 ppb	88.092 %	87.641 %	0.017 ppb	0.014 ppb	92.541 %
Concentration per Run 3	84.806 %	0.235 ppb	1.380 ppb	0.009 ppb	89.259 %	87.546 %	0.000 ppb	0.018 ppb	92.630 %
Concentration RSD	1.5 %	14.0 %	6.3 %	109.5 %	2.7 %	1.7 %	98.6 %	16.1 %	0.8 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 117 Analysis started at: 4/5/2017 2:32:36 PM Rack: 2
 Analysis label: WG991289-2D10 A2-6020T User name: ALPHALAB\metals-instrument Vial: 22

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	92.116 %	97.020 %	76.511 ppb	627.844 ppb	2,039.139 ppb	4,978.555 ppb	1,758.685 ppb	4,537.660 ppb	89.461 %
Concentration per Run 1	92.777 %	97.486 %	78.265 ppb	643.398 ppb	2,167.956 ppb	5,101.503 ppb	1,914.421 ppb	5,053.957 ppb	85.200 %
Concentration per Run 2	92.554 %	97.486 %	75.945 ppb	609.156 ppb	1,943.722 ppb	4,848.376 ppb	1,661.567 ppb	4,332.261 ppb	93.466 %
Concentration per Run 3	91.017 %	96.089 %	75.325 ppb	630.979 ppb	2,005.740 ppb	4,985.785 ppb	1,700.067 ppb	4,226.762 ppb	89.717 %
Concentration RSD	1.0 %	0.8 %	2.0 %	2.8 %	5.7 %	2.5 %	7.7 %	9.9 %	4.6 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	87.679 %	206.151 ppb	89.979 ppb	114.571 ppb	253.828 ppb	13,174.025 ppb	119.589 ppb	97.747 ppb	138.002 ppb
Concentration per Run 1	87.414 %	223.610 ppb	95.317 ppb	115.657 ppb	260.120 ppb	13,802.480 ppb	125.991 ppb	102.988 ppb	147.979 ppb
Concentration per Run 2	87.058 %	193.200 ppb	82.682 ppb	112.894 ppb	246.993 ppb	12,896.286 ppb	114.190 ppb	97.368 ppb	137.090 ppb
Concentration per Run 3	88.566 %	201.643 ppb	91.938 ppb	115.161 ppb	254.372 ppb	12,823.310 ppb	118.586 ppb	92.884 ppb	128.938 ppb
Concentration RSD	0.9 %	7.6 %	7.3 %	1.3 %	2.6 %	4.1 %	5.0 %	5.2 %	6.9 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	154.119 ppb	90.668 %	120.558 ppb	143.017 ppb	78.308 ppb	91.124 ppb	88.547 %	25.465 ppb	71.420 ppb
Concentration per Run 1	159.381 ppb	93.434 %	114.956 ppb	146.124 ppb	78.898 ppb	90.492 ppb	86.857 %	24.924 ppb	72.838 ppb
Concentration per Run 2	149.733 ppb	88.808 %	120.843 ppb	145.045 ppb	78.201 ppb	93.281 ppb	89.557 %	25.687 ppb	69.846 ppb
Concentration per Run 3	153.242 ppb	89.762 %	125.874 ppb	137.882 ppb	77.825 ppb	89.599 ppb	89.227 %	25.784 ppb	71.576 ppb
Concentration RSD	3.2 %	2.7 %	4.5 %	3.1 %	0.7 %	2.1 %	1.7 %	1.9 %	2.1 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	87.410 %	120.857 ppb	201.356 ppb	165.167 ppb	87.333 %	88.585 %	114.459 ppb	114.436 ppb	91.935 %
Concentration per Run 1	86.998 %	123.919 ppb	208.093 ppb	168.526 ppb	86.258 %	87.401 %	118.273 ppb	117.966 ppb	89.808 %
Concentration per Run 2	86.907 %	121.320 ppb	198.207 ppb	165.907 ppb	87.318 %	90.172 %	113.115 ppb	112.545 ppb	92.037 %
Concentration per Run 3	88.324 %	117.333 ppb	197.768 ppb	161.069 ppb	88.424 %	88.183 %	111.991 ppb	112.797 ppb	93.961 %
Concentration RSD	0.9 %	2.7 %	2.9 %	2.3 %	1.2 %	1.6 %	2.9 %	2.7 %	2.3 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 118 Analysis started at: 4/5/2017 2:35:59 PM Rack: 2
 Analysis label: WG991289-3D10 A2-6020T User name: ALPHALAB\metals-instrument Vial: 23

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	92.617 %	97.160 %	10.396 ppb	14,133.517 ppb	9,384.400 ppb	15,911.085 ppb	5,002.961 ppb	6,570.080 ppb	97.330 %
Concentration per Run 1	93.638 %	99.162 %	10.323 ppb	13,627.827 ppb	9,008.291 ppb	15,216.086 ppb	4,676.065 ppb	6,474.744 ppb	101.989 %
Concentration per Run 2	92.078 %	98.603 %	10.245 ppb	14,011.194 ppb	9,294.574 ppb	15,841.514 ppb	4,975.788 ppb	6,407.437 ppb	98.580 %
Concentration per Run 3	92.133 %	93.715 %	10.621 ppb	14,761.531 ppb	9,850.336 ppb	16,675.654 ppb	5,357.031 ppb	6,828.060 ppb	91.421 %
Concentration RSD	1.0 %	3.1 %	1.9 %	4.1 %	4.6 %	4.6 %	6.8 %	3.4 %	5.5 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	88.140 %	812.345 ppb	156.816 ppb	140.000 ppb	374.583 ppb	38,460.646 ppb	98.568 ppb	123.935 ppb	238.457 ppb
Concentration per Run 1	89.606 %	714.494 ppb	145.398 ppb	130.437 ppb	345.573 ppb	36,515.714 ppb	91.171 ppb	120.618 ppb	224.372 ppb
Concentration per Run 2	87.329 %	784.502 ppb	158.151 ppb	146.185 ppb	380.995 ppb	38,353.030 ppb	101.897 ppb	131.326 ppb	246.946 ppb
Concentration per Run 3	87.485 %	938.038 ppb	166.899 ppb	143.378 ppb	397.182 ppb	40,513.195 ppb	102.635 ppb	119.862 ppb	244.054 ppb
Concentration RSD	1.4 %	14.1 %	6.9 %	6.0 %	7.0 %	5.2 %	6.5 %	5.2 %	5.2 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	410.850 ppb	91.668 %	83.778 ppb	30.288 ppb	250.624 ppb	180.635 ppb	89.365 %	60.574 ppb	12.139 ppb
Concentration per Run 1	387.116 ppb	94.792 %	80.195 ppb	28.144 ppb	240.643 ppb	177.776 ppb	92.062 %	59.017 ppb	11.631 ppb
Concentration per Run 2	424.767 ppb	87.594 %	86.973 ppb	31.047 ppb	261.419 ppb	177.736 ppb	89.068 %	61.802 ppb	12.594 ppb
Concentration per Run 3	420.668 ppb	92.618 %	84.167 ppb	31.673 ppb	249.811 ppb	186.393 ppb	86.964 %	60.904 ppb	12.193 ppb
Concentration RSD	5.0 %	4.0 %	4.1 %	6.2 %	4.2 %	2.8 %	2.9 %	2.3 %	4.0 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	87.274 %	223.730 ppb	129.532 ppb	466.761 ppb	88.550 %	88.402 %	21.878 ppb	303.656 ppb	95.261 %
Concentration per Run 1	85.642 %	221.809 ppb	127.394 ppb	459.579 ppb	86.929 %	88.066 %	21.281 ppb	294.857 ppb	97.156 %
Concentration per Run 2	87.869 %	218.243 ppb	131.755 ppb	479.534 ppb	88.714 %	90.048 %	22.129 ppb	304.825 ppb	95.868 %
Concentration per Run 3	88.312 %	231.139 ppb	129.447 ppb	461.168 ppb	90.006 %	87.094 %	22.223 ppb	311.287 ppb	92.760 %
Concentration RSD	1.6 %	3.0 %	1.7 %	2.4 %	1.7 %	1.7 %	2.4 %	2.7 %	2.4 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 119 Analysis started at: 4/5/2017 2:39:22 PM Rack: 2
 Analysis label: WG991289-5D50 A2-6020T User name: ALPHALAB\metals-instrument Vial: 24

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	93.601 %	96.089 %	50.640 ppb	7,602.230 ppb	6,876.487 ppb	2,822.140 ppb	6,076.115 ppb	6,980.368 ppb	90.683 %
Concentration per Run 1	93.788 %	96.369 %	50.072 ppb	7,589.393 ppb	6,750.060 ppb	2,794.098 ppb	6,172.247 ppb	7,051.075 ppb	92.955 %
Concentration per Run 2	94.111 %	95.251 %	51.066 ppb	7,560.547 ppb	6,792.806 ppb	2,831.129 ppb	6,115.091 ppb	6,880.373 ppb	89.461 %
Concentration per Run 3	92.904 %	96.648 %	50.781 ppb	7,656.749 ppb	7,086.594 ppb	2,841.192 ppb	5,941.008 ppb	7,009.655 ppb	89.632 %
Concentration RSD	0.7 %	0.8 %	1.0 %	0.6 %	2.7 %	0.9 %	2.0 %	1.3 %	2.2 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	88.634 %	149.525 ppb	65.156 ppb	71.428 ppb	124.651 ppb	13,425.048 ppb	54.517 ppb	59.807 ppb	88.131 ppb
Concentration per Run 1	87.957 %	150.388 ppb	62.246 ppb	70.742 ppb	123.464 ppb	13,279.819 ppb	52.861 ppb	52.613 ppb	90.457 ppb
Concentration per Run 2	89.275 %	147.251 ppb	69.499 ppb	75.025 ppb	128.766 ppb	13,718.275 ppb	57.445 ppb	66.687 ppb	89.009 ppb
Concentration per Run 3	88.668 %	150.937 ppb	63.724 ppb	68.517 ppb	121.722 ppb	13,277.049 ppb	53.244 ppb	60.122 ppb	84.927 ppb
Concentration RSD	0.7 %	1.3 %	5.9 %	4.6 %	2.9 %	1.9 %	4.7 %	11.8 %	3.3 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	115.263 ppb	94.810 %	64.340 ppb	56.304 ppb	66.957 ppb	52.505 ppb	90.611 %	24.066 ppb	53.869 ppb
Concentration per Run 1	111.356 ppb	96.292 %	62.301 ppb	58.320 ppb	66.296 ppb	50.783 ppb	93.949 %	23.260 ppb	53.410 ppb
Concentration per Run 2	120.739 ppb	94.768 %	67.762 ppb	52.644 ppb	67.927 ppb	48.995 ppb	90.283 %	23.871 ppb	53.095 ppb
Concentration per Run 3	113.695 ppb	93.371 %	62.957 ppb	57.949 ppb	66.649 ppb	57.738 ppb	87.599 %	25.068 ppb	55.101 ppb
Concentration RSD	4.2 %	1.5 %	4.6 %	5.6 %	1.3 %	8.8 %	3.5 %	3.8 %	2.0 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	91.763 %	56.804 ppb	63.433 ppb	66.188 ppb	90.895 %	90.826 %	52.905 ppb	93.392 ppb	91.946 %
Concentration per Run 1	92.197 %	57.975 ppb	64.752 ppb	65.271 ppb	92.279 %	94.125 %	51.392 ppb	93.864 ppb	91.989 %
Concentration per Run 2	92.237 %	56.205 ppb	61.144 ppb	68.683 ppb	90.819 %	89.912 %	53.434 ppb	90.544 ppb	93.851 %
Concentration per Run 3	90.854 %	56.231 ppb	64.404 ppb	64.610 ppb	89.586 %	88.439 %	53.888 ppb	95.767 ppb	89.997 %
Concentration RSD	0.9 %	1.8 %	3.1 %	3.3 %	1.5 %	3.2 %	2.5 %	2.8 %	2.1 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 120 Analysis started at: 4/5/2017 2:42:45 PM Rack: 2
 Analysis label: WG991289-4D10 A2-6020T User name: ALPHALAB\metals-instrument Vial: 26

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	94.492 %	97.067 %	1.216 ppb	12,752.460 ppb	7,643.912 ppb	15,188.713 ppb	3,312.299 ppb	8,328.817 ppb	92.983 %
Concentration per Run 1	95.636 %	101.257 %	1.279 ppb	12,403.919 ppb	7,604.842 ppb	14,834.737 ppb	3,289.791 ppb	8,110.596 ppb	95.682 %
Concentration per Run 2	95.692 %	91.341 %	1.137 ppb	12,947.331 ppb	7,783.065 ppb	15,334.563 ppb	3,137.770 ppb	7,961.563 ppb	95.852 %
Concentration per Run 3	92.147 %	98.603 %	1.231 ppb	12,906.129 ppb	7,543.830 ppb	15,396.840 ppb	3,509.334 ppb	8,914.293 ppb	87.416 %
Concentration RSD	2.1 %	5.3 %	5.9 %	2.4 %	1.6 %	2.0 %	5.6 %	6.2 %	5.2 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	89.421 %	662.232 ppb	72.826 ppb	112.486 ppb	319.403 ppb	50,082.388 ppb	12.358 ppb	34.993 ppb	204.617 ppb
Concentration per Run 1	89.740 %	637.112 ppb	70.318 ppb	111.749 ppb	317.999 ppb	49,263.605 ppb	12.212 ppb	34.046 ppb	209.190 ppb
Concentration per Run 2	89.180 %	649.245 ppb	71.371 ppb	105.918 ppb	306.266 ppb	48,009.377 ppb	12.946 ppb	33.544 ppb	187.498 ppb
Concentration per Run 3	89.342 %	700.338 ppb	76.787 ppb	119.789 ppb	333.944 ppb	52,974.181 ppb	11.918 ppb	37.390 ppb	217.162 ppb
Concentration RSD	0.3 %	5.1 %	4.8 %	6.2 %	4.3 %	5.2 %	4.3 %	6.0 %	7.5 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	350.234 ppb	90.291 %	77.130 ppb	6.508 ppb	79.609 ppb	3.014 ppb	89.498 %	3.210 ppb	1.409 ppb
Concentration per Run 1	346.288 ppb	90.747 %	77.308 ppb	8.165 ppb	78.550 ppb	3.024 ppb	91.289 %	3.306 ppb	1.659 ppb
Concentration per Run 2	326.649 ppb	94.092 %	72.489 ppb	7.507 ppb	77.376 ppb	2.903 ppb	89.128 %	3.243 ppb	1.207 ppb
Concentration per Run 3	377.765 ppb	86.032 %	81.591 ppb	3.852 ppb	82.899 ppb	3.114 ppb	88.075 %	3.083 ppb	1.361 ppb
Concentration RSD	7.4 %	4.5 %	5.9 %	35.7 %	3.7 %	3.5 %	1.8 %	3.6 %	16.3 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	89.574 %	28.431 ppb	11.899 ppb	86.174 ppb	88.716 %	87.531 %	0.384 ppb	198.404 ppb	93.749 %
Concentration per Run 1	89.721 %	28.955 ppb	11.594 ppb	86.888 ppb	92.630 %	89.722 %	0.313 ppb	194.547 ppb	96.381 %
Concentration per Run 2	90.178 %	28.231 ppb	12.106 ppb	85.714 ppb	86.543 %	85.629 %	0.391 ppb	197.661 ppb	93.715 %
Concentration per Run 3	88.822 %	28.108 ppb	11.998 ppb	85.922 ppb	86.976 %	87.241 %	0.448 ppb	203.006 ppb	91.152 %
Concentration RSD	0.8 %	1.6 %	2.3 %	0.7 %	3.8 %	2.4 %	17.7 %	2.2 %	2.8 %

Alpha ICPMSQ Full

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Analysis index: 121 Analysis started at: 4/5/2017 2:46:08 PM Rack: 2
 Analysis label: L1710301-01D10 A2-6020T User name: ALPHALAB\metals-instrument Vial: 27

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	96.286 %	99.348 %	1.123 ppb	11,557.890 ppb	7,085.663 ppb	13,114.883 ppb	3,055.686 ppb	6,508.501 ppb	94.290 %
Concentration per Run 1	96.772 %	101.536 %	1.103 ppb	11,497.272 ppb	7,095.970 ppb	13,212.849 ppb	3,183.402 ppb	6,587.480 ppb	93.637 %
Concentration per Run 2	96.975 %	96.927 %	1.042 ppb	11,451.115 ppb	7,063.224 ppb	13,001.753 ppb	2,954.404 ppb	6,479.320 ppb	97.727 %
Concentration per Run 3	95.111 %	99.581 %	1.224 ppb	11,725.283 ppb	7,097.795 ppb	13,130.049 ppb	3,029.251 ppb	6,458.702 ppb	91.506 %
Concentration RSD	1.1 %	2.3 %	8.2 %	1.3 %	0.3 %	0.8 %	3.8 %	1.1 %	3.4 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	87.251 %	466.939 ppb	60.512 ppb	89.374 ppb	354.269 ppb	41,779.916 ppb	11.903 ppb	30.846 ppb	180.581 ppb
Concentration per Run 1	87.509 %	470.919 ppb	60.106 ppb	88.398 ppb	349.337 ppb	42,390.338 ppb	11.888 ppb	30.360 ppb	182.682 ppb
Concentration per Run 2	84.918 %	463.353 ppb	60.009 ppb	85.342 ppb	349.621 ppb	41,326.857 ppb	11.590 ppb	31.451 ppb	181.448 ppb
Concentration per Run 3	89.325 %	466.544 ppb	61.423 ppb	94.383 ppb	363.850 ppb	41,622.553 ppb	12.231 ppb	30.726 ppb	177.612 ppb
Concentration RSD	2.5 %	0.8 %	1.3 %	5.1 %	2.3 %	1.3 %	2.7 %	1.8 %	1.5 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	313.978 ppb	90.175 %	50.505 ppb	4.334 ppb	66.468 ppb	2.683 ppb	89.811 %	3.153 ppb	1.294 ppb
Concentration per Run 1	315.279 ppb	90.646 %	51.122 ppb	4.370 ppb	68.750 ppb	2.710 ppb	91.130 %	3.073 ppb	1.289 ppb
Concentration per Run 2	313.015 ppb	88.471 %	52.182 ppb	4.485 ppb	65.234 ppb	2.615 ppb	89.727 %	3.091 ppb	1.326 ppb
Concentration per Run 3	313.641 ppb	91.409 %	48.211 ppb	4.146 ppb	65.419 ppb	2.724 ppb	88.577 %	3.294 ppb	1.267 ppb
Concentration RSD	0.4 %	1.7 %	4.1 %	4.0 %	3.0 %	2.2 %	1.4 %	3.9 %	2.3 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	87.060 %	24.685 ppb	8.772 ppb	65.734 ppb	89.409 %	86.947 %	0.294 ppb	201.278 ppb	91.655 %
Concentration per Run 1	88.823 %	25.507 ppb	9.424 ppb	67.482 ppb	88.511 %	85.870 %	0.256 ppb	204.200 ppb	91.522 %
Concentration per Run 2	85.838 %	23.332 ppb	8.563 ppb	63.910 ppb	88.681 %	87.260 %	0.289 ppb	195.492 ppb	93.562 %
Concentration per Run 3	86.519 %	25.215 ppb	8.327 ppb	65.811 ppb	91.036 %	87.712 %	0.336 ppb	204.143 ppb	89.879 %
Concentration RSD	1.8 %	4.8 %	6.6 %	2.7 %	1.6 %	1.1 %	13.6 %	2.5 %	2.0 %

Alpha ICPMSQ Full

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Analysis index: 122 Analysis started at: 4/5/2017 2:49:30 PM Rack: 2
 Analysis label: L1710301-02D10 A2-6020T User name: ALPHALAB\metals-instrument Vial: 28

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	96.633 %	105.168 %	1.458 ppb	14,815.877 ppb	8,593.297 ppb	16,282.560 ppb	3,758.151 ppb	6,692.304 ppb	95.455 %
Concentration per Run 1	96.924 %	113.827 %	1.427 ppb	14,192.463 ppb	8,335.353 ppb	15,454.457 ppb	3,676.545 ppb	6,547.123 ppb	98.239 %
Concentration per Run 2	97.540 %	105.028 %	1.517 ppb	14,940.475 ppb	8,559.375 ppb	16,708.511 ppb	3,640.143 ppb	6,972.825 ppb	92.273 %
Concentration per Run 3	95.435 %	96.648 %	1.432 ppb	15,314.695 ppb	8,885.162 ppb	16,684.713 ppb	3,957.764 ppb	6,556.964 ppb	95.852 %
Concentration RSD	1.1 %	8.2 %	3.5 %	3.9 %	3.2 %	4.4 %	4.6 %	3.6 %	3.1 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	88.505 %	630.423 ppb	88.512 ppb	181.861 ppb	332.750 ppb	56,038.979 ppb	12.251 ppb	47.379 ppb	393.591 ppb
Concentration per Run 1	89.925 %	632.754 ppb	88.091 ppb	178.511 ppb	333.565 ppb	52,939.265 ppb	12.605 ppb	47.592 ppb	385.345 ppb
Concentration per Run 2	89.221 %	643.340 ppb	89.472 ppb	182.175 ppb	330.872 ppb	56,584.593 ppb	12.781 ppb	47.488 ppb	395.268 ppb
Concentration per Run 3	86.368 %	615.174 ppb	87.972 ppb	184.897 ppb	333.814 ppb	58,593.080 ppb	11.366 ppb	47.057 ppb	400.160 ppb
Concentration RSD	2.1 %	2.3 %	0.9 %	1.8 %	0.5 %	5.1 %	6.3 %	0.6 %	1.9 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	368.839 ppb	90.592 %	157.545 ppb	9.654 ppb	88.504 ppb	2.838 ppb	91.323 %	5.171 ppb	2.072 ppb
Concentration per Run 1	358.286 ppb	93.138 %	155.580 ppb	9.816 ppb	86.903 ppb	2.508 ppb	91.396 %	5.307 ppb	2.187 ppb
Concentration per Run 2	370.719 ppb	91.917 %	154.579 ppb	9.254 ppb	88.797 ppb	2.822 ppb	90.401 %	4.889 ppb	1.868 ppb
Concentration per Run 3	377.511 ppb	86.720 %	162.475 ppb	9.891 ppb	89.812 ppb	3.183 ppb	92.172 %	5.318 ppb	2.160 ppb
Concentration RSD	2.6 %	3.8 %	2.7 %	3.6 %	1.7 %	11.9 %	1.0 %	4.7 %	8.5 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	88.253 %	37.682 ppb	11.123 ppb	112.587 ppb	88.697 %	88.195 %	0.333 ppb	217.676 ppb	94.713 %
Concentration per Run 1	90.879 %	35.173 ppb	11.022 ppb	111.500 ppb	90.684 %	93.034 %	0.318 ppb	215.358 ppb	95.742 %
Concentration per Run 2	88.004 %	39.414 ppb	11.260 ppb	114.897 ppb	88.192 %	86.435 %	0.360 ppb	217.471 ppb	95.130 %
Concentration per Run 3	85.876 %	38.458 ppb	11.088 ppb	111.365 ppb	87.214 %	85.117 %	0.321 ppb	220.199 ppb	93.269 %
Concentration RSD	2.8 %	5.9 %	1.1 %	1.8 %	2.0 %	4.8 %	7.1 %	1.1 %	1.4 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 123 Analysis started at: 4/5/2017 2:52:52 PM Rack: 2
 Analysis label: L1710301-03D10 A2-6020T User name: ALPHALAB\metals-instrument Vial: 29

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	96.992 %	99.581 %	1.100 ppb	11,944.172 ppb	7,970.999 ppb	15,657.325 ppb	3,293.583 ppb	4,218.202 ppb	93.381 %
Concentration per Run 1	99.227 %	97.626 %	1.043 ppb	11,948.068 ppb	8,001.564 ppb	15,694.227 ppb	3,233.670 ppb	4,003.126 ppb	96.023 %
Concentration per Run 2	96.555 %	99.860 %	0.992 ppb	12,102.433 ppb	7,929.056 ppb	15,729.124 ppb	3,224.389 ppb	4,326.422 ppb	90.825 %
Concentration per Run 3	95.196 %	101.257 %	1.266 ppb	11,782.013 ppb	7,982.377 ppb	15,548.625 ppb	3,422.690 ppb	4,325.058 ppb	93.296 %
Concentration RSD	2.1 %	1.8 %	13.2 %	1.3 %	0.5 %	0.6 %	3.4 %	4.4 %	2.8 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	87.983 %	706.054 ppb	88.163 ppb	122.578 ppb	400.349 ppb	59,434.370 ppb	11.434 ppb	36.892 ppb	203.471 ppb
Concentration per Run 1	90.538 %	677.440 ppb	83.610 ppb	116.997 ppb	385.453 ppb	58,524.136 ppb	11.098 ppb	34.741 ppb	197.447 ppb
Concentration per Run 2	88.324 %	721.992 ppb	91.972 ppb	127.187 ppb	421.440 ppb	60,289.450 ppb	11.828 ppb	37.609 ppb	206.282 ppb
Concentration per Run 3	85.088 %	718.729 ppb	88.907 ppb	123.550 ppb	394.154 ppb	59,489.524 ppb	11.377 ppb	38.326 ppb	206.686 ppb
Concentration RSD	3.1 %	3.5 %	4.8 %	4.2 %	4.7 %	1.5 %	3.2 %	5.1 %	2.6 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	289.995 ppb	90.454 %	132.851 ppb	5.953 ppb	58.767 ppb	2.557 ppb	90.519 %	2.609 ppb	0.949 ppb
Concentration per Run 1	293.089 ppb	90.759 %	135.050 ppb	6.164 ppb	56.081 ppb	2.531 ppb	92.908 %	2.475 ppb	0.847 ppb
Concentration per Run 2	285.876 ppb	91.319 %	128.649 ppb	4.632 ppb	60.306 ppb	2.156 ppb	88.055 %	2.713 ppb	1.019 ppb
Concentration per Run 3	291.022 ppb	89.284 %	134.855 ppb	7.064 ppb	59.915 ppb	2.984 ppb	90.592 %	2.637 ppb	0.982 ppb
Concentration RSD	1.3 %	1.2 %	2.7 %	20.7 %	4.0 %	16.2 %	2.7 %	4.7 %	9.6 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	87.696 %	30.044 ppb	10.038 ppb	82.254 ppb	88.824 %	87.661 %	0.243 ppb	175.786 ppb	94.203 %
Concentration per Run 1	90.414 %	29.229 ppb	10.093 ppb	83.599 ppb	88.168 %	88.108 %	0.236 ppb	171.176 ppb	97.672 %
Concentration per Run 2	84.546 %	31.560 ppb	10.147 ppb	82.742 ppb	89.591 %	87.673 %	0.211 ppb	175.593 ppb	93.581 %
Concentration per Run 3	88.128 %	29.342 ppb	9.876 ppb	80.422 ppb	88.713 %	87.202 %	0.282 ppb	180.589 ppb	91.358 %
Concentration RSD	3.4 %	4.4 %	1.4 %	2.0 %	0.8 %	0.5 %	14.8 %	2.7 %	3.4 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 124 Analysis started at: 4/5/2017 2:56:07 PM Rack: 2
 Analysis label: L1710301-04D10 A2-6020T User name: ALPHALAB\metals-instrument Vial: 30

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	97.087 %	106.425 %	1.126 ppb	10,798.733 ppb	7,494.951 ppb	15,382.743 ppb	3,295.685 ppb	4,971.116 ppb	91.222 %
Concentration per Run 1	96.148 %	106.425 %	1.045 ppb	10,974.160 ppb	7,619.907 ppb	15,247.357 ppb	3,187.656 ppb	4,852.093 ppb	92.870 %
Concentration per Run 2	97.754 %	108.380 %	1.161 ppb	10,634.702 ppb	7,490.398 ppb	15,569.496 ppb	3,239.261 ppb	5,146.793 ppb	88.524 %
Concentration per Run 3	97.360 %	104.469 %	1.173 ppb	10,787.335 ppb	7,374.548 ppb	15,331.377 ppb	3,460.139 ppb	4,914.461 ppb	92.273 %
Concentration RSD	0.9 %	1.8 %	6.3 %	1.6 %	1.6 %	1.1 %	4.4 %	3.1 %	2.6 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	85.355 %	668.408 ppb	83.767 ppb	115.131 ppb	339.240 ppb	47,032.532 ppb	12.236 ppb	37.104 ppb	203.228 ppb
Concentration per Run 1	85.877 %	665.014 ppb	87.478 ppb	118.282 ppb	332.981 ppb	46,036.081 ppb	11.473 ppb	36.867 ppb	196.484 ppb
Concentration per Run 2	84.306 %	673.326 ppb	86.192 ppb	114.798 ppb	351.148 ppb	48,021.502 ppb	12.587 ppb	37.374 ppb	207.498 ppb
Concentration per Run 3	85.880 %	666.884 ppb	77.630 ppb	112.314 ppb	333.592 ppb	47,040.012 ppb	12.647 ppb	37.072 ppb	205.701 ppb
Concentration RSD	1.1 %	0.7 %	6.4 %	2.6 %	3.0 %	2.1 %	5.4 %	0.7 %	2.9 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	312.049 ppb	91.514 %	89.019 ppb	6.526 ppb	56.123 ppb	2.927 ppb	89.170 %	2.827 ppb	1.379 ppb
Concentration per Run 1	300.531 ppb	92.578 %	89.350 ppb	8.041 ppb	56.028 ppb	2.717 ppb	90.076 %	2.843 ppb	1.220 ppb
Concentration per Run 2	328.530 ppb	90.188 %	90.719 ppb	4.751 ppb	56.318 ppb	3.139 ppb	88.369 %	2.892 ppb	1.585 ppb
Concentration per Run 3	307.085 ppb	91.777 %	86.989 ppb	6.785 ppb	56.023 ppb	2.926 ppb	89.066 %	2.746 ppb	1.333 ppb
Concentration RSD	4.7 %	1.3 %	2.1 %	25.4 %	0.3 %	7.2 %	1.0 %	2.6 %	13.5 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	88.553 %	26.604 ppb	9.087 ppb	72.876 ppb	87.789 %	86.059 %	0.259 ppb	152.350 ppb	92.466 %
Concentration per Run 1	92.009 %	25.957 ppb	9.164 ppb	72.465 ppb	89.787 %	85.876 %	0.240 ppb	147.798 ppb	95.376 %
Concentration per Run 2	87.102 %	26.816 ppb	8.369 ppb	71.396 ppb	85.280 %	86.265 %	0.272 ppb	153.429 ppb	91.448 %
Concentration per Run 3	86.549 %	27.041 ppb	9.729 ppb	74.769 ppb	88.301 %	86.037 %	0.264 ppb	155.824 ppb	90.573 %
Concentration RSD	3.4 %	2.2 %	7.5 %	2.4 %	2.6 %	0.2 %	6.5 %	2.7 %	2.8 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 125 Analysis started at: 4/5/2017 2:59:29 PM Rack: 2
 Analysis label: WG991289-6D50 A2-6020T User name: ALPHALAB\metals-instrument Vial: 25

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	97.228 %	103.352 %	0.218 ppb	2,215.507 ppb	1,383.219 ppb	2,564.693 ppb	596.979 ppb	1,289.483 ppb	93.097 %
Concentration per Run 1	97.051 %	101.536 %	0.222 ppb	2,241.899 ppb	1,422.331 ppb	2,591.939 ppb	552.933 ppb	1,325.749 ppb	94.574 %
Concentration per Run 2	97.496 %	105.587 %	0.206 ppb	2,169.582 ppb	1,371.493 ppb	2,563.693 ppb	644.053 ppb	1,267.264 ppb	91.421 %
Concentration per Run 3	97.136 %	102.933 %	0.226 ppb	2,235.042 ppb	1,355.834 ppb	2,538.446 ppb	593.950 ppb	1,275.436 ppb	93.296 %
Concentration RSD	0.2 %	2.0 %	4.6 %	1.8 %	2.5 %	1.0 %	7.6 %	2.5 %	1.7 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	87.904 %	90.154 ppb	11.795 ppb	17.667 ppb	67.012 ppb	8,062.368 ppb	2.324 ppb	5.918 ppb	34.887 ppb
Concentration per Run 1	86.554 %	90.537 ppb	11.726 ppb	17.291 ppb	66.423 ppb	7,995.145 ppb	2.111 ppb	6.678 ppb	36.487 ppb
Concentration per Run 2	88.055 %	91.417 ppb	11.997 ppb	18.162 ppb	65.877 ppb	7,869.119 ppb	2.291 ppb	5.276 ppb	33.730 ppb
Concentration per Run 3	89.103 %	88.507 ppb	11.662 ppb	17.549 ppb	68.736 ppb	8,322.840 ppb	2.570 ppb	5.800 ppb	34.443 ppb
Concentration RSD	1.5 %	1.7 %	1.5 %	2.5 %	2.3 %	2.9 %	10.0 %	12.0 %	4.1 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	60.665 ppb	91.773 %	8.777 ppb	0.951 ppb	12.561 ppb	0.754 ppb	89.590 %	0.583 ppb	0.277 ppb
Concentration per Run 1	61.362 ppb	92.629 %	8.179 ppb	0.783 ppb	12.393 ppb	0.759 ppb	90.358 %	0.539 ppb	0.276 ppb
Concentration per Run 2	59.392 ppb	94.422 %	8.671 ppb	1.211 ppb	12.139 ppb	0.802 ppb	88.582 %	0.663 ppb	0.297 ppb
Concentration per Run 3	61.240 ppb	88.267 %	9.481 ppb	0.861 ppb	13.149 ppb	0.701 ppb	89.832 %	0.549 ppb	0.257 ppb
Concentration RSD	1.8 %	3.4 %	7.5 %	23.9 %	4.2 %	6.7 %	1.0 %	11.8 %	7.2 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	88.326 %	4.646 ppb	1.670 ppb	13.310 ppb	88.796 %	87.763 %	0.066 ppb	39.455 ppb	90.032 %
Concentration per Run 1	89.987 %	4.610 ppb	1.593 ppb	14.945 ppb	89.655 %	86.716 %	0.053 ppb	39.491 ppb	89.680 %
Concentration per Run 2	86.476 %	4.704 ppb	1.630 ppb	12.033 ppb	91.595 %	90.312 %	0.070 ppb	38.742 ppb	92.235 %
Concentration per Run 3	88.516 %	4.624 ppb	1.787 ppb	12.952 ppb	85.137 %	86.262 %	0.076 ppb	40.131 ppb	88.181 %
Concentration RSD	2.0 %	1.1 %	6.2 %	11.2 %	3.7 %	2.5 %	17.8 %	1.8 %	2.3 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 126 Analysis started at: 4/5/2017 3:02:51 PM Rack: 0
 Analysis label: CCV User name: ALPHALAB\metals-instrument Vial: 9

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	96.111 %	102.980 %	92.163 ppb	9,416.502 ppb	9,584.514 ppb	95.118 ppb	10,058.688 ppb	9,932.094 ppb	94.716 %
Concentration per Run 1	97.441 %	100.698 %	90.679 ppb	9,172.847 ppb	9,244.032 ppb	91.673 ppb	9,263.250 ppb	9,207.990 ppb	102.841 %
Concentration per Run 2	95.418 %	106.145 %	91.757 ppb	9,535.053 ppb	9,500.904 ppb	98.843 ppb	10,541.651 ppb	10,453.361 ppb	91.080 %
Concentration per Run 3	95.473 %	102.095 %	94.054 ppb	9,541.605 ppb	10,008.606 ppb	94.838 ppb	10,371.162 ppb	10,134.931 ppb	90.228 %
Recovery Percentage 1			92.163 %	94.165 %	95.845 %	95.118 %	100.587 %	99.321 %	
Concentration RSD	1.2 %	2.7 %	1.9 %	2.2 %	4.1 %	3.8 %	6.9 %	6.5 %	7.4 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	85.647 %	95.917 ppb	96.136 ppb	96.362 ppb	99.147 ppb	9,679.230 ppb	97.092 ppb	91.344 ppb	97.293 ppb
Concentration per Run 1	85.469 %	85.297 ppb	86.795 ppb	89.888 ppb	95.168 ppb	8,847.963 ppb	90.588 ppb	82.244 ppb	95.574 ppb
Concentration per Run 2	85.862 %	95.507 ppb	95.375 ppb	98.576 ppb	101.795 ppb	10,202.586 ppb	98.554 ppb	96.648 ppb	95.619 ppb
Concentration per Run 3	85.610 %	106.947 ppb	106.238 ppb	100.622 ppb	100.479 ppb	9,987.141 ppb	102.133 ppb	95.140 ppb	100.686 ppb
Recovery Percentage 1		95.917 %	96.136 %	96.362 %	99.147 %	96.792 %	97.092 %	91.344 %	97.293 %
Concentration RSD	0.2 %	11.3 %	10.1 %	5.9 %	3.5 %	7.5 %	6.1 %	8.7 %	3.0 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	97.604 ppb	93.717 %	100.034 ppb	98.332 ppb	100.683 ppb	94.697 ppb	90.409 %	97.493 ppb	99.389 ppb
Concentration per Run 1	94.290 ppb	92.293 %	102.238 ppb	100.877 ppb	99.442 ppb	92.702 ppb	92.129 %	97.319 ppb	98.895 ppb
Concentration per Run 2	101.628 ppb	93.906 %	100.046 ppb	96.302 ppb	98.103 ppb	93.093 ppb	90.452 %	98.352 ppb	98.853 ppb
Concentration per Run 3	96.895 ppb	94.950 %	97.819 ppb	97.818 ppb	104.505 ppb	98.295 ppb	88.645 %	96.808 ppb	100.419 ppb
Recovery Percentage 1	97.604 %	100.034 %	98.332 %	98.332 %	100.683 %	94.697 %		97.493 %	99.389 %
Concentration RSD	3.8 %	1.4 %	2.2 %	2.4 %	3.4 %	3.3 %	1.9 %	0.8 %	0.9 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	91.831 %	96.023 ppb	96.973 ppb	97.906 ppb	90.314 %	87.871 %	101.400 ppb	99.175 ppb	89.889 %
Concentration per Run 1	91.627 %	95.727 ppb	92.639 ppb	97.536 ppb	91.487 %	86.821 %	100.728 ppb	97.467 ppb	90.109 %
Concentration per Run 2	92.585 %	96.880 ppb	95.887 ppb	97.520 ppb	91.541 %	88.953 %	99.581 ppb	99.643 ppb	90.656 %
Concentration per Run 3	91.280 %	95.462 ppb	102.393 ppb	98.661 ppb	87.914 %	87.840 %	103.890 ppb	100.415 ppb	88.903 %
Recovery Percentage 1		96.023 %	96.973 %	97.906 %			101.400 %	99.175 %	
Concentration RSD	0.7 %	0.8 %	5.1 %	0.7 %	2.3 %	1.2 %	2.2 %	1.5 %	1.0 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 127 Analysis started at: 4/5/2017 3:06:16 PM Rack: 0
 Analysis label: CCB User name: ALPHALAB\metals-instrument Vial: 10

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	96.330 %	97.626 %	0.014 ppb	17.917 ppb	1.841 ppb	0.244 ppb	14.043 ppb	8.697 ppb	90.597 %
Concentration per Run 1	96.860 %	103.073 %	0.016 ppb	15.698 ppb	3.950 ppb	0.863 ppb	3.549 ppb	-1.392 ppb	92.699 %
Concentration per Run 2	96.204 %	90.782 %	0.025 ppb	20.150 ppb	-1.402 ppb	-1.032 ppb	12.697 ppb	28.896 ppb	86.393 %
Concentration per Run 3	95.926 %	99.022 %	0.002 ppb	17.903 ppb	2.976 ppb	0.900 ppb	25.884 ppb	-1.413 ppb	92.699 %
Recovery Percentage 1			2.857 %	17.917 %	2.631 %	2.435 %	14.043 %	8.697 %	
Concentration RSD	0.5 %	6.4 %	82.9 %	12.4 %	154.8 %	453.7 %	80.0 %	201.1 %	4.0 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	86.807 %	0.116 ppb	0.000 ppb	-0.007 ppb	-0.178 ppb	11.798 ppb	0.016 ppb	0.057 ppb	0.027 ppb
Concentration per Run 1	86.565 %	0.171 ppb	0.000 ppb	-0.051 ppb	-0.116 ppb	20.058 ppb	0.037 ppb	0.107 ppb	0.044 ppb
Concentration per Run 2	87.515 %	0.091 ppb	0.000 ppb	-0.002 ppb	-0.100 ppb	3.165 ppb	-0.004 ppb	0.033 ppb	0.102 ppb
Concentration per Run 3	86.339 %	0.086 ppb	0.000 ppb	0.032 ppb	-0.317 ppb	12.170 ppb	0.016 ppb	0.030 ppb	-0.065 ppb
Recovery Percentage 1		23.224 %	0.000 %	-0.720 %	-17.763 %	23.595 %	3.263 %	2.831 %	2.686 %
Concentration RSD	0.7 %	41.3 %		577.5 %	68.1 %	71.7 %	124.1 %	77.8 %	316.4 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	-0.278 ppb	90.603 %	0.139 ppb	0.373 ppb	0.067 ppb	0.582 ppb	91.139 %	0.078 ppb	0.015 ppb
Concentration per Run 1	-0.359 ppb	90.188 %	0.169 ppb	0.746 ppb	0.031 ppb	0.619 ppb	90.926 %	0.077 ppb	0.019 ppb
Concentration per Run 2	-0.248 ppb	90.149 %	0.080 ppb	0.586 ppb	0.126 ppb	0.540 ppb	92.709 %	0.087 ppb	0.019 ppb
Concentration per Run 3	-0.228 ppb	91.471 %	0.166 ppb	-0.213 ppb	0.045 ppb	0.587 ppb	89.781 %	0.071 ppb	0.008 ppb
Recovery Percentage 1	-2.784 %	90.603 %	27.737 %	7.462 %	13.452 %	29.088 %		19.524 %	7.652 %
Concentration RSD	25.4 %	0.8 %	36.4 %	137.8 %	76.1 %	6.8 %	1.6 %	10.4 %	39.9 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	88.759 %	0.810 ppb	3.126 ppb	0.037 ppb	89.433 %	87.587 %	0.046 ppb	0.067 ppb	91.126 %
Concentration per Run 1	89.891 %	0.726 ppb	3.262 ppb	-0.023 ppb	88.523 %	86.712 %	0.044 ppb	0.067 ppb	90.910 %
Concentration per Run 2	90.875 %	0.741 ppb	3.276 ppb	0.094 ppb	90.914 %	90.038 %	0.043 ppb	0.066 ppb	93.230 %
Concentration per Run 3	85.511 %	0.962 ppb	2.841 ppb	0.039 ppb	88.861 %	86.011 %	0.050 ppb	0.069 ppb	89.240 %
Recovery Percentage 1		26.991 %	78.162 %	7.313 %			9.158 %	13.481 %	91.126 %
Concentration RSD	3.2 %	16.3 %	7.9 %	159.2 %	1.4 %	2.5 %	8.0 %	2.2 %	2.2 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 128 Analysis started at: 4/5/2017 3:12:43 PM Rack: 2
 Analysis label: L1710301-05D10 A2-6020T User name: ALPHALAB\metals-instrument Vial: 31

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	99.290 %	106.378 %	1.223 ppb	10,890.231 ppb	9,570.404 ppb	17,210.817 ppb	4,354.522 ppb	10,326.905 ppb	92.927 %
Concentration per Run 1	99.434 %	107.402 %	1.161 ppb	11,286.846 ppb	10,011.939 ppb	17,201.661 ppb	4,430.150 ppb	10,494.387 ppb	91.166 %
Concentration per Run 2	99.646 %	101.257 %	1.281 ppb	10,902.448 ppb	9,523.738 ppb	17,430.446 ppb	4,472.290 ppb	10,351.774 ppb	94.489 %
Concentration per Run 3	98.789 %	110.475 %	1.228 ppb	10,481.398 ppb	9,175.536 ppb	17,000.344 ppb	4,161.127 ppb	10,134.555 ppb	93.125 %
Concentration RSD	0.4 %	4.4 %	4.9 %	3.7 %	4.4 %	1.3 %	3.9 %	1.8 %	1.8 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	89.183 %	343.869 ppb	51.831 ppb	48.907 ppb	449.180 ppb	49,316.945 ppb	11.865 ppb	32.670 ppb	32.285 ppb
Concentration per Run 1	88.986 %	355.002 ppb	53.450 ppb	49.674 ppb	467.847 ppb	50,409.522 ppb	11.910 ppb	32.623 ppb	32.253 ppb
Concentration per Run 2	89.963 %	340.805 ppb	49.002 ppb	49.159 ppb	442.437 ppb	49,985.108 ppb	11.243 ppb	31.780 ppb	31.977 ppb
Concentration per Run 3	88.600 %	335.800 ppb	53.041 ppb	47.888 ppb	437.256 ppb	47,556.204 ppb	12.442 ppb	33.607 ppb	32.624 ppb
Concentration RSD	0.8 %	2.9 %	4.7 %	1.9 %	3.6 %	3.1 %	5.1 %	2.8 %	1.0 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	121.404 ppb	90.595 %	21.394 ppb	3.181 ppb	67.363 ppb	3.560 ppb	90.299 %	0.258 ppb	0.420 ppb
Concentration per Run 1	120.467 ppb	93.596 %	22.673 ppb	3.780 ppb	68.373 ppb	3.527 ppb	91.233 %	0.303 ppb	0.390 ppb
Concentration per Run 2	122.326 ppb	89.209 %	21.952 ppb	3.290 ppb	66.511 ppb	3.812 ppb	91.598 %	0.229 ppb	0.447 ppb
Concentration per Run 3	121.419 ppb	88.979 %	19.557 ppb	2.472 ppb	67.206 ppb	3.341 ppb	88.068 %	0.242 ppb	0.423 ppb
Concentration RSD	0.8 %	2.9 %	7.6 %	20.8 %	1.4 %	6.7 %	2.1 %	15.3 %	6.8 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	86.977 %	3.874 ppb	1.793 ppb	37.548 ppb	87.123 %	85.521 %	0.244 ppb	29.381 ppb	91.933 %
Concentration per Run 1	88.810 %	3.782 ppb	1.486 ppb	38.672 ppb	87.819 %	84.954 %	0.246 ppb	27.831 ppb	97.687 %
Concentration per Run 2	85.019 %	3.880 ppb	2.069 ppb	37.356 ppb	87.312 %	85.084 %	0.248 ppb	29.556 ppb	89.835 %
Concentration per Run 3	87.100 %	3.961 ppb	1.824 ppb	36.616 ppb	86.239 %	86.524 %	0.239 ppb	30.756 ppb	88.277 %
Concentration RSD	2.2 %	2.3 %	16.3 %	2.8 %	0.9 %	1.0 %	1.8 %	5.0 %	5.5 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 129 Analysis started at: 4/5/2017 3:16:05 PM Rack: 2
 Analysis label: L1710301-06D10 A2-6020T User name: ALPHALAB\metals-instrument Vial: 32

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	96.920 %	101.723 %	0.736 ppb	5,945.236 ppb	4,952.944 ppb	9,462.258 ppb	2,173.241 ppb	9,018.369 ppb	94.688 %
Concentration per Run 1	96.650 %	103.631 %	0.714 ppb	6,184.561 ppb	4,915.493 ppb	9,503.683 ppb	2,318.960 ppb	9,388.793 ppb	90.399 %
Concentration per Run 2	98.216 %	104.609 %	0.757 ppb	5,661.985 ppb	5,195.343 ppb	9,395.623 ppb	2,256.490 ppb	9,052.948 ppb	94.830 %
Concentration per Run 3	95.895 %	96.927 %	0.736 ppb	5,989.162 ppb	4,747.997 ppb	9,487.468 ppb	1,944.272 ppb	8,613.367 ppb	98.835 %
Concentration RSD	1.2 %	4.1 %	2.9 %	4.4 %	4.6 %	0.6 %	9.2 %	4.3 %	4.5 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	86.225 %	204.687 ppb	36.526 ppb	25.276 ppb	246.970 ppb	27,411.632 ppb	7.027 ppb	16.692 ppb	15.069 ppb
Concentration per Run 1	89.226 %	209.226 ppb	38.706 ppb	25.946 ppb	259.125 ppb	27,870.886 ppb	7.496 ppb	17.465 ppb	15.764 ppb
Concentration per Run 2	85.117 %	209.565 ppb	35.676 ppb	26.217 ppb	248.129 ppb	27,989.969 ppb	7.451 ppb	18.421 ppb	16.402 ppb
Concentration per Run 3	84.332 %	195.269 ppb	35.196 ppb	23.667 ppb	233.656 ppb	26,374.039 ppb	6.134 ppb	14.191 ppb	13.040 ppb
Concentration RSD	3.0 %	4.0 %	5.2 %	5.5 %	5.2 %	3.3 %	11.0 %	13.3 %	11.9 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	62.423 ppb	90.980 %	14.694 ppb	2.337 ppb	60.124 ppb	1.306 ppb	90.787 %	0.073 ppb	0.060 ppb
Concentration per Run 1	59.455 ppb	91.268 %	14.210 ppb	1.716 ppb	59.028 ppb	1.395 ppb	94.276 %	0.066 ppb	0.074 ppb
Concentration per Run 2	67.190 ppb	87.657 %	15.999 ppb	2.325 ppb	62.115 ppb	1.517 ppb	88.314 %	0.067 ppb	0.066 ppb
Concentration per Run 3	60.624 ppb	94.015 %	13.873 ppb	2.971 ppb	59.228 ppb	1.008 ppb	89.769 %	0.085 ppb	0.041 ppb
Concentration RSD	6.7 %	3.5 %	7.8 %	26.9 %	2.9 %	20.3 %	3.4 %	14.9 %	27.9 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	89.295 %	1.731 ppb	0.936 ppb	22.701 ppb	88.892 %	88.388 %	0.117 ppb	16.764 ppb	93.561 %
Concentration per Run 1	90.243 %	1.874 ppb	0.881 ppb	22.580 ppb	89.847 %	91.595 %	0.118 ppb	16.115 ppb	96.395 %
Concentration per Run 2	87.243 %	1.634 ppb	0.779 ppb	23.576 ppb	87.280 %	85.816 %	0.122 ppb	17.089 ppb	93.039 %
Concentration per Run 3	90.398 %	1.686 ppb	1.148 ppb	21.948 ppb	89.548 %	87.752 %	0.111 ppb	17.087 ppb	91.248 %
Concentration RSD	2.0 %	7.3 %	20.4 %	3.6 %	1.6 %	3.3 %	4.8 %	3.3 %	2.8 %

Alpha ICPMSQ Full

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Analysis index: 130 Analysis started at: 4/5/2017 3:19:28 PM Rack: 2
 Analysis label: L1710301-07D10 A2-6020T User name: ALPHALAB\metals-instrument Vial: 33

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	98.209 %	104.237 %	1.470 ppb	11,064.713 ppb	10,204.301 ppb	21,247.956 ppb	4,821.091 ppb	10,476.236 ppb	94.148 %
Concentration per Run 1	98.300 %	102.095 %	1.386 ppb	11,512.389 ppb	10,437.541 ppb	22,078.290 ppb	5,003.195 ppb	11,100.026 ppb	92.955 %
Concentration per Run 2	98.871 %	103.771 %	1.610 ppb	10,800.009 ppb	9,922.581 ppb	20,355.782 ppb	4,625.311 ppb	10,138.626 ppb	96.705 %
Concentration per Run 3	97.455 %	106.844 %	1.413 ppb	10,881.742 ppb	10,252.782 ppb	21,309.795 ppb	4,834.767 ppb	10,190.056 ppb	92.785 %
Concentration RSD	0.7 %	2.3 %	8.3 %	3.5 %	2.6 %	4.1 %	3.9 %	5.2 %	2.4 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	87.841 %	330.870 ppb	59.779 ppb	51.228 ppb	470.359 ppb	58,014.815 ppb	15.032 ppb	37.539 ppb	25.350 ppb
Concentration per Run 1	88.709 %	339.452 ppb	64.143 ppb	50.476 ppb	480.242 ppb	58,272.517 ppb	15.408 ppb	38.297 ppb	25.590 ppb
Concentration per Run 2	87.348 %	329.332 ppb	55.944 ppb	51.430 ppb	457.296 ppb	57,348.374 ppb	14.641 ppb	37.589 ppb	25.024 ppb
Concentration per Run 3	87.467 %	323.827 ppb	59.249 ppb	51.778 ppb	473.539 ppb	58,423.554 ppb	15.047 ppb	36.733 ppb	25.437 ppb
Concentration RSD	0.9 %	2.4 %	6.9 %	1.3 %	2.5 %	1.0 %	2.6 %	2.1 %	1.2 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	116.397 ppb	89.043 %	20.384 ppb	3.066 ppb	67.759 ppb	6.697 ppb	88.153 %	0.091 ppb	0.576 ppb
Concentration per Run 1	119.210 ppb	87.594 %	19.939 ppb	2.317 ppb	69.123 ppb	6.779 ppb	89.207 %	0.074 ppb	0.579 ppb
Concentration per Run 2	112.419 ppb	88.827 %	21.125 ppb	3.682 ppb	66.274 ppb	6.962 ppb	88.083 %	0.068 ppb	0.648 ppb
Concentration per Run 3	117.564 ppb	90.709 %	20.088 ppb	3.200 ppb	67.879 ppb	6.351 ppb	87.168 %	0.130 ppb	0.499 ppb
Concentration RSD	3.0 %	1.8 %	3.2 %	22.6 %	2.1 %	4.7 %	1.2 %	38.0 %	12.9 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	88.220 %	2.099 ppb	0.619 ppb	38.485 ppb	84.861 %	85.102 %	0.371 ppb	19.858 ppb	89.152 %
Concentration per Run 1	90.274 %	2.135 ppb	0.599 ppb	37.392 ppb	88.418 %	86.176 %	0.415 ppb	20.218 ppb	87.399 %
Concentration per Run 2	85.784 %	2.294 ppb	0.587 ppb	40.054 ppb	83.167 %	82.007 %	0.347 ppb	19.213 ppb	91.655 %
Concentration per Run 3	88.604 %	1.868 ppb	0.672 ppb	38.010 ppb	82.997 %	87.122 %	0.352 ppb	20.143 ppb	88.403 %
Concentration RSD	2.6 %	10.3 %	7.4 %	3.6 %	3.6 %	3.2 %	10.2 %	2.8 %	2.5 %

Alpha ICPMSQ Full

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Analysis index: 131 Analysis started at: 4/5/2017 3:22:50 PM Rack: 2
Analysis label: L1710301-08D10 A2-6020T User name: ALPHALAB\metals-instrument Vial: 34

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	97.487 %	102.142 %	0.545 ppb	6,776.685 ppb	5,217.720 ppb	8,639.857 ppb	2,358.786 ppb	7,367.122 ppb	88.097 %
Concentration per Run 1	98.871 %	106.844 %	0.488 ppb	6,592.504 ppb	5,147.674 ppb	8,433.139 ppb	2,353.951 ppb	7,769.102 ppb	87.075 %
Concentration per Run 2	97.153 %	96.369 %	0.586 ppb	7,145.476 ppb	5,267.569 ppb	9,177.197 ppb	2,445.940 ppb	7,339.195 ppb	85.797 %
Concentration per Run 3	96.438 %	103.212 %	0.562 ppb	6,592.073 ppb	5,237.917 ppb	8,309.235 ppb	2,276.466 ppb	6,993.069 ppb	91.421 %
Concentration RSD	1.3 %	5.2 %	9.3 %	4.7 %	1.2 %	5.4 %	3.6 %	5.3 %	3.3 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	87.196 %	207.583 ppb	31.592 ppb	27.790 ppb	254.359 ppb	26,754.416 ppb	6.816 ppb	16.988 ppb	18.113 ppb
Concentration per Run 1	88.118 %	226.585 ppb	33.304 ppb	28.206 ppb	253.684 ppb	26,763.667 ppb	7.527 ppb	17.628 ppb	18.385 ppb
Concentration per Run 2	86.581 %	176.283 ppb	31.234 ppb	29.024 ppb	262.944 ppb	27,284.054 ppb	5.939 ppb	16.182 ppb	16.617 ppb
Concentration per Run 3	86.890 %	219.882 ppb	30.237 ppb	26.139 ppb	246.448 ppb	26,215.526 ppb	6.980 ppb	17.153 ppb	19.337 ppb
Concentration RSD	0.9 %	13.2 %	5.0 %	5.4 %	3.3 %	2.0 %	11.8 %	4.3 %	7.6 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	70.782 ppb	90.806 %	11.096 ppb	1.739 ppb	44.780 ppb	1.912 ppb	87.779 %	0.223 ppb	0.200 ppb
Concentration per Run 1	73.174 ppb	91.980 %	10.076 ppb	1.089 ppb	44.800 ppb	1.535 ppb	88.110 %	0.263 ppb	0.272 ppb
Concentration per Run 2	70.163 ppb	90.912 %	11.127 ppb	2.039 ppb	44.704 ppb	2.342 ppb	86.078 %	0.206 ppb	0.162 ppb
Concentration per Run 3	69.009 ppb	89.527 %	12.087 ppb	2.089 ppb	44.837 ppb	1.859 ppb	89.150 %	0.201 ppb	0.166 ppb
Concentration RSD	3.0 %	1.4 %	9.1 %	32.4 %	0.2 %	21.2 %	1.8 %	15.2 %	31.1 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	87.250 %	1.860 ppb	0.726 ppb	19.467 ppb	85.785 %	85.035 %	0.110 ppb	22.832 ppb	88.172 %
Concentration per Run 1	87.736 %	1.627 ppb	0.602 ppb	19.242 ppb	85.769 %	85.686 %	0.092 ppb	22.888 ppb	89.562 %
Concentration per Run 2	84.924 %	2.052 ppb	0.682 ppb	20.823 ppb	84.097 %	84.623 %	0.115 ppb	22.903 ppb	88.092 %
Concentration per Run 3	89.091 %	1.901 ppb	0.894 ppb	18.334 ppb	87.489 %	84.795 %	0.123 ppb	22.705 ppb	86.862 %
Concentration RSD	2.4 %	11.6 %	20.8 %	6.5 %	2.0 %	0.7 %	14.5 %	0.5 %	1.5 %

Alpha ICPMSQ Full

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Analysis index: 132 Analysis started at: 4/5/2017 3:26:13 PM Rack: 2
 Analysis label: L1710301-09D10 A2-6020T User name: ALPHALAB\metals-instrument Vial: 35

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	94.419 %	102.886 %	0.652 ppb	8,320.811 ppb	5,861.849 ppb	9,119.861 ppb	2,459.829 ppb	13,840.702 ppb	90.626 %
Concentration per Run 1	95.659 %	102.514 %	0.633 ppb	8,548.088 ppb	5,813.548 ppb	9,263.774 ppb	2,581.034 ppb	14,315.720 ppb	87.757 %
Concentration per Run 2	93.230 %	105.587 %	0.699 ppb	8,141.891 ppb	5,756.116 ppb	8,894.401 ppb	2,297.758 ppb	13,780.365 ppb	91.847 %
Concentration per Run 3	94.366 %	100.559 %	0.623 ppb	8,272.454 ppb	6,015.882 ppb	9,201.408 ppb	2,500.696 ppb	13,426.020 ppb	92.273 %
Concentration RSD	1.3 %	2.5 %	6.4 %	2.5 %	2.3 %	2.2 %	5.9 %	3.2 %	2.8 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	83.619 %	236.747 ppb	35.047 ppb	27.442 ppb	270.781 ppb	28,339.743 ppb	7.087 ppb	16.286 ppb	15.180 ppb
Concentration per Run 1	85.258 %	232.480 ppb	35.868 ppb	27.163 ppb	271.662 ppb	28,787.696 ppb	7.285 ppb	16.399 ppb	15.445 ppb
Concentration per Run 2	81.451 %	232.048 ppb	34.063 ppb	26.423 ppb	258.710 ppb	26,996.637 ppb	6.627 ppb	18.525 ppb	15.414 ppb
Concentration per Run 3	84.146 %	245.712 ppb	35.210 ppb	28.741 ppb	281.971 ppb	29,234.895 ppb	7.349 ppb	13.934 ppb	14.681 ppb
Concentration RSD	2.3 %	3.3 %	2.6 %	4.3 %	4.3 %	4.2 %	5.6 %	14.1 %	2.8 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	69.240 ppb	89.374 %	12.827 ppb	1.850 ppb	77.409 ppb	2.407 ppb	90.306 %	0.103 ppb	0.203 ppb
Concentration per Run 1	68.079 ppb	90.990 %	12.070 ppb	1.999 ppb	77.332 ppb	2.657 ppb	90.163 %	0.110 ppb	0.187 ppb
Concentration per Run 2	65.254 ppb	93.138 %	12.269 ppb	1.496 ppb	75.942 ppb	2.054 ppb	91.257 %	0.113 ppb	0.299 ppb
Concentration per Run 3	74.387 ppb	83.995 %	14.141 ppb	2.055 ppb	78.952 ppb	2.510 ppb	89.499 %	0.088 ppb	0.124 ppb
Concentration RSD	6.8 %	5.3 %	8.9 %	16.6 %	1.9 %	13.1 %	1.0 %	13.2 %	43.4 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	88.255 %	1.792 ppb	0.825 ppb	19.443 ppb	86.688 %	87.266 %	0.106 ppb	22.482 ppb	91.186 %
Concentration per Run 1	90.074 %	1.768 ppb	0.784 ppb	19.916 ppb	88.491 %	89.002 %	0.106 ppb	22.268 ppb	92.172 %
Concentration per Run 2	89.436 %	1.950 ppb	0.925 ppb	19.994 ppb	83.927 %	86.618 %	0.107 ppb	22.599 ppb	90.994 %
Concentration per Run 3	85.255 %	1.659 ppb	0.765 ppb	18.418 ppb	87.647 %	86.178 %	0.105 ppb	22.579 ppb	90.392 %
Concentration RSD	3.0 %	8.2 %	10.6 %	4.6 %	2.8 %	1.7 %	0.9 %	0.8 %	1.0 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 133 Analysis started at: 4/5/2017 3:29:36 PM Rack: 2
 Analysis label: L1710301-10D10 A2-6020T User name: ALPHALAB\metals-instrument Vial: 36

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	95.670 %	94.739 %	1.579 ppb	3,400.458 ppb	897.538 ppb	3,636.273 ppb	1,479.683 ppb	588.357 ppb	96.989 %
Concentration per Run 1	95.771 %	96.089 %	1.516 ppb	3,499.845 ppb	935.367 ppb	3,703.932 ppb	1,459.291 ppb	609.796 ppb	95.511 %
Concentration per Run 2	95.637 %	95.670 %	1.551 ppb	3,305.359 ppb	830.106 ppb	3,543.927 ppb	1,490.037 ppb	537.055 ppb	99.517 %
Concentration per Run 3	95.602 %	92.458 %	1.669 ppb	3,396.170 ppb	927.141 ppb	3,660.961 ppb	1,489.723 ppb	618.220 ppb	95.938 %
Concentration RSD	0.1 %	2.1 %	5.0 %	2.9 %	6.5 %	2.3 %	1.2 %	7.6 %	2.3 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	88.029 %	39.098 ppb	28.326 ppb	11.153 ppb	10.766 ppb	3,594.395 ppb	25.569 ppb	29.650 ppb	23.981 ppb
Concentration per Run 1	87.538 %	35.536 ppb	28.134 ppb	11.769 ppb	11.180 ppb	3,578.201 ppb	25.472 ppb	30.033 ppb	25.733 ppb
Concentration per Run 2	87.564 %	36.698 ppb	28.414 ppb	10.477 ppb	9.950 ppb	3,628.744 ppb	24.658 ppb	29.901 ppb	24.186 ppb
Concentration per Run 3	88.984 %	45.060 ppb	28.429 ppb	11.211 ppb	11.167 ppb	3,576.241 ppb	26.575 ppb	29.015 ppb	22.025 ppb
Concentration RSD	0.9 %	13.3 %	0.6 %	5.8 %	6.6 %	0.8 %	3.8 %	1.9 %	7.8 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	63.686 ppb	90.423 %	2.444 ppb	6.515 ppb	14.245 ppb	0.413 ppb	88.450 %	0.042 ppb	0.047 ppb
Concentration per Run 1	64.043 ppb	86.286 %	2.871 ppb	6.411 ppb	14.147 ppb	0.378 ppb	89.719 %	0.066 ppb	0.054 ppb
Concentration per Run 2	65.636 ppb	91.537 %	2.624 ppb	8.035 ppb	14.761 ppb	0.381 ppb	86.802 %	0.035 ppb	0.020 ppb
Concentration per Run 3	61.381 ppb	93.446 %	1.838 ppb	5.099 ppb	13.828 ppb	0.480 ppb	88.829 %	0.026 ppb	0.067 ppb
Concentration RSD	3.4 %	4.1 %	22.1 %	22.6 %	3.3 %	14.0 %	1.7 %	50.4 %	51.6 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	85.999 %	1.350 ppb	0.488 ppb	40.742 ppb	89.179 %	85.059 %	0.220 ppb	17.422 ppb	93.671 %
Concentration per Run 1	86.799 %	1.292 ppb	0.399 ppb	41.158 ppb	90.013 %	84.973 %	0.217 ppb	17.447 ppb	93.136 %
Concentration per Run 2	86.292 %	1.288 ppb	0.342 ppb	40.369 ppb	89.633 %	86.952 %	0.216 ppb	16.977 ppb	95.236 %
Concentration per Run 3	84.907 %	1.468 ppb	0.723 ppb	40.700 ppb	87.890 %	83.253 %	0.227 ppb	17.841 ppb	92.642 %
Concentration RSD	1.1 %	7.6 %	42.0 %	1.0 %	1.3 %	2.2 %	2.8 %	2.5 %	1.5 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 134 Analysis started at: 4/5/2017 3:33:00 PM Rack: 2
 Analysis label: xL1710301-11D10 A2-6020T User name: ALPHALAB\metals-instrument Vial: 37

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	108.991 %	100.605 %	1.500 ppb	3,890.423 ppb	949.676 ppb	4,009.266 ppb	1,535.400 ppb	502.952 ppb	96.108 %
Concentration per Run 1	108.529 %	100.000 %	1.444 ppb	3,962.140 ppb	966.543 ppb	4,127.927 ppb	1,485.361 ppb	428.723 ppb	96.279 %
Concentration per Run 2	110.137 %	103.352 %	1.446 ppb	3,834.353 ppb	922.543 ppb	3,947.169 ppb	1,499.767 ppb	525.700 ppb	95.597 %
Concentration per Run 3	108.308 %	98.464 %	1.608 ppb	3,874.777 ppb	959.941 ppb	3,952.701 ppb	1,621.072 ppb	554.431 ppb	96.449 %
Concentration RSD	0.9 %	2.5 %	6.3 %	1.7 %	2.5 %	2.6 %	4.9 %	13.1 %	0.5 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	92.211 %	59.603 ppb	28.684 ppb	13.153 ppb	9.003 ppb	2,004.865 ppb	40.641 ppb	48.122 ppb	18.681 ppb
Concentration per Run 1	92.998 %	41.219 ppb	29.263 ppb	13.688 ppb	9.808 ppb	1,953.285 ppb	39.848 ppb	47.008 ppb	18.358 ppb
Concentration per Run 2	92.023 %	59.787 ppb	30.169 ppb	12.861 ppb	9.281 ppb	2,117.475 ppb	41.979 ppb	49.581 ppb	20.008 ppb
Concentration per Run 3	91.612 %	77.804 ppb	26.620 ppb	12.910 ppb	7.922 ppb	1,943.835 ppb	40.094 ppb	47.775 ppb	17.678 ppb
Concentration RSD	0.8 %	30.7 %	6.4 %	3.5 %	10.8 %	4.9 %	2.9 %	2.7 %	6.4 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	49.466 ppb	90.377 %	4.297 ppb	8.642 ppb	14.567 ppb	0.385 ppb	89.804 %	0.018 ppb	0.008 ppb
Concentration per Run 1	48.927 ppb	91.157 %	3.688 ppb	8.776 ppb	15.262 ppb	0.265 ppb	89.587 %	0.017 ppb	0.008 ppb
Concentration per Run 2	50.590 ppb	89.021 %	4.405 ppb	6.992 ppb	14.392 ppb	0.412 ppb	89.581 %	0.013 ppb	0.008 ppb
Concentration per Run 3	48.880 ppb	90.953 %	4.798 ppb	10.160 ppb	14.045 ppb	0.478 ppb	90.244 %	0.025 ppb	0.008 ppb
Concentration RSD	2.0 %	1.3 %	13.1 %	18.4 %	4.3 %	28.3 %	0.4 %	33.8 %	1.7 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	87.303 %	0.909 ppb	0.290 ppb	36.688 ppb	89.914 %	88.950 %	0.294 ppb	22.966 ppb	91.998 %
Concentration per Run 1	88.948 %	0.996 ppb	0.346 ppb	36.694 ppb	91.402 %	90.622 %	0.288 ppb	23.177 ppb	94.331 %
Concentration per Run 2	85.825 %	0.801 ppb	0.314 ppb	34.839 ppb	90.402 %	88.888 %	0.319 ppb	22.596 ppb	92.384 %
Concentration per Run 3	87.136 %	0.931 ppb	0.209 ppb	38.530 ppb	87.938 %	87.338 %	0.276 ppb	23.126 ppb	89.279 %
Concentration RSD	1.8 %	10.9 %	24.9 %	5.0 %	2.0 %	1.8 %	7.6 %	1.4 %	2.8 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 135 Analysis started at: 4/5/2017 3:36:22 PM Rack: 2
 Analysis label: xL1710301-12D10 A2-6020T User name: ALPHALAB\metals-instrument Vial: 38

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	93.964 %	98.464 %	2.018 ppb	3,998.416 ppb	920.547 ppb	3,149.765 ppb	1,406.197 ppb	794.564 ppb	94.290 %
Concentration per Run 1	95.140 %	96.648 %	2.005 ppb	4,154.293 ppb	1,023.186 ppb	3,275.332 ppb	1,460.961 ppb	946.132 ppb	92.870 %
Concentration per Run 2	93.973 %	102.933 %	1.942 ppb	3,893.468 ppb	873.304 ppb	3,059.626 ppb	1,319.431 ppb	675.975 ppb	92.870 %
Concentration per Run 3	92.780 %	95.810 %	2.108 ppb	3,947.487 ppb	865.151 ppb	3,114.336 ppb	1,438.197 ppb	761.585 ppb	97.131 %
Concentration RSD	1.3 %	4.0 %	4.2 %	3.4 %	9.7 %	3.6 %	5.4 %	17.4 %	2.6 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	89.015 %	89.365 ppb	36.876 ppb	13.266 ppb	28.794 ppb	5,695.495 ppb	76.832 ppb	36.129 ppb	25.807 ppb
Concentration per Run 1	91.730 %	56.984 ppb	37.089 ppb	14.140 ppb	27.680 ppb	5,945.134 ppb	78.426 ppb	35.672 ppb	25.736 ppb
Concentration per Run 2	88.131 %	54.848 ppb	34.395 ppb	12.687 ppb	28.819 ppb	5,453.359 ppb	78.364 ppb	34.602 ppb	25.800 ppb
Concentration per Run 3	87.184 %	156.264 ppb	39.144 ppb	12.971 ppb	29.882 ppb	5,687.991 ppb	73.706 ppb	38.112 ppb	25.884 ppb
Concentration RSD	2.7 %	64.8 %	6.5 %	5.8 %	3.8 %	4.3 %	3.5 %	5.0 %	0.3 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	52.989 ppb	90.549 %	3.700 ppb	6.123 ppb	13.727 ppb	0.392 ppb	87.852 %	0.067 ppb	0.023 ppb
Concentration per Run 1	52.773 ppb	90.532 %	4.248 ppb	8.587 ppb	13.812 ppb	0.598 ppb	87.897 %	0.071 ppb	0.008 ppb
Concentration per Run 2	53.440 ppb	90.481 %	3.542 ppb	5.041 ppb	14.035 ppb	0.346 ppb	86.660 %	0.051 ppb	0.031 ppb
Concentration per Run 3	52.753 ppb	90.634 %	3.312 ppb	4.740 ppb	13.334 ppb	0.231 ppb	88.998 %	0.078 ppb	0.031 ppb
Concentration RSD	0.7 %	0.1 %	13.2 %	34.9 %	2.6 %	47.8 %	1.3 %	21.3 %	56.6 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	88.861 %	1.253 ppb	0.414 ppb	20.266 ppb	90.510 %	87.813 %	0.399 ppb	31.446 ppb	92.348 %
Concentration per Run 1	88.803 %	1.403 ppb	0.334 ppb	20.576 ppb	88.427 %	87.117 %	0.417 ppb	31.754 ppb	92.405 %
Concentration per Run 2	89.000 %	1.210 ppb	0.476 ppb	20.969 ppb	90.231 %	88.112 %	0.378 ppb	31.397 ppb	92.529 %
Concentration per Run 3	88.781 %	1.147 ppb	0.432 ppb	19.255 ppb	92.873 %	88.210 %	0.403 ppb	31.187 ppb	92.110 %
Concentration RSD	0.1 %	10.6 %	17.5 %	4.4 %	2.5 %	0.7 %	4.9 %	0.9 %	0.2 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 136 Analysis started at: 4/5/2017 3:39:44 PM Rack: 2
 Analysis label: L1710301-13D10 A2-6020T User name: ALPHALAB\metals-instrument Vial: 39

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	94.936 %	101.490 %	0.139 ppb	1,992.591 ppb	407.849 ppb	1,120.275 ppb	648.639 ppb	584.723 ppb	93.523 %
Concentration per Run 1	96.684 %	104.330 %	0.156 ppb	2,013.604 ppb	421.065 ppb	1,156.643 ppb	691.221 ppb	646.185 ppb	91.421 %
Concentration per Run 2	95.374 %	97.207 %	0.125 ppb	2,075.433 ppb	388.677 ppb	1,143.545 ppb	628.822 ppb	623.365 ppb	93.466 %
Concentration per Run 3	92.749 %	102.933 %	0.134 ppb	1,888.737 ppb	413.803 ppb	1,060.638 ppb	625.874 ppb	484.619 ppb	95.682 %
Concentration RSD	2.1 %	3.7 %	11.6 %	4.8 %	4.2 %	4.6 %	5.7 %	15.0 %	2.3 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	87.117 %	140.129 ppb	17.043 ppb	11.526 ppb	7.534 ppb	4,068.289 ppb	0.410 ppb	1.179 ppb	11.964 ppb
Concentration per Run 1	89.238 %	132.694 ppb	17.150 ppb	12.014 ppb	7.444 ppb	4,164.865 ppb	0.349 ppb	1.200 ppb	13.605 ppb
Concentration per Run 2	88.547 %	142.464 ppb	16.778 ppb	11.030 ppb	7.274 ppb	4,096.706 ppb	0.341 ppb	1.402 ppb	11.970 ppb
Concentration per Run 3	83.566 %	145.228 ppb	17.201 ppb	11.534 ppb	7.884 ppb	3,943.294 ppb	0.539 ppb	0.936 ppb	10.317 ppb
Concentration RSD	3.6 %	4.7 %	1.4 %	4.3 %	4.2 %	2.8 %	27.3 %	19.8 %	13.7 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	8.752 ppb	91.179 %	2.820 ppb	1.403 ppb	4.787 ppb	0.564 ppb	89.650 %	-0.004 ppb	0.027 ppb
Concentration per Run 1	8.537 ppb	90.047 %	2.442 ppb	0.974 ppb	5.392 ppb	0.558 ppb	88.727 %	0.000 ppb	0.019 ppb
Concentration per Run 2	8.139 ppb	91.980 %	2.826 ppb	1.824 ppb	4.805 ppb	0.653 ppb	90.470 %	-0.012 ppb	0.031 ppb
Concentration per Run 3	9.582 ppb	91.510 %	3.192 ppb	1.411 ppb	4.164 ppb	0.479 ppb	89.752 %	0.000 ppb	0.030 ppb
Concentration RSD	8.5 %	1.1 %	13.3 %	30.3 %	12.8 %	15.5 %	1.0 %	183.4 %	23.6 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	88.781 %	0.653 ppb	0.185 ppb	6.868 ppb	88.225 %	89.141 %	0.115 ppb	7.988 ppb	93.957 %
Concentration per Run 1	87.991 %	0.769 ppb	0.120 ppb	6.819 ppb	88.311 %	88.160 %	0.120 ppb	7.807 ppb	95.603 %
Concentration per Run 2	88.186 %	0.578 ppb	0.192 ppb	7.925 ppb	87.652 %	87.998 %	0.119 ppb	7.968 ppb	94.314 %
Concentration per Run 3	90.165 %	0.612 ppb	0.244 ppb	5.859 ppb	88.711 %	91.265 %	0.107 ppb	8.188 ppb	91.954 %
Concentration RSD	1.4 %	15.6 %	33.8 %	15.1 %	0.6 %	2.1 %	6.0 %	2.4 %	2.0 %

Alpha ICPMSQ Full

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Analysis index: 137 Analysis started at: 4/5/2017 3:43:07 PM Rack: 2
Analysis label: 0301-01 SCAN User name: ALPHALAB\metals-instrument Vial: 40

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	96.776 %	98.557 %	0.003 ppb	7.654 ppb	-1.021 ppb	1.380 ppb	9.761 ppb	0.887 ppb	88.921 %
Concentration per Run 1	97.758 %	96.369 %	0.006 ppb	3.342 ppb	-1.402 ppb	2.258 ppb	13.755 ppb	-1.320 ppb	91.165 %
Concentration per Run 2	96.424 %	102.933 %	0.002 ppb	9.501 ppb	-1.402 ppb	1.340 ppb	23.207 ppb	-1.085 ppb	88.524 %
Concentration per Run 3	96.147 %	96.369 %	0.002 ppb	10.119 ppb	-0.260 ppb	0.541 ppb	-7.678 ppb	5.066 ppb	87.075 %
Concentration RSD	0.9 %	3.8 %	81.0 %	49.0 %	64.6 %	62.3 %	162.1 %	408.2 %	2.3 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	87.296 %	0.059 ppb	0.000 ppb	-0.070 ppb	-0.199 ppb	5.133 ppb	-0.004 ppb	0.032 ppb	-0.011 ppb
Concentration per Run 1	86.435 %	0.087 ppb	0.000 ppb	-0.092 ppb	-0.246 ppb	2.999 ppb	0.017 ppb	0.110 ppb	-0.010 ppb
Concentration per Run 2	89.088 %	0.089 ppb	0.000 ppb	-0.070 ppb	-0.179 ppb	6.082 ppb	-0.004 ppb	-0.047 ppb	-0.012 ppb
Concentration per Run 3	86.365 %	0.000 ppb	0.000 ppb	-0.047 ppb	-0.173 ppb	6.319 ppb	-0.025 ppb	0.032 ppb	-0.010 ppb
Concentration RSD	1.8 %	86.6 %		32.1 %	20.4 %	36.1 %	492.0 %	249.0 %	9.6 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	-0.498 ppb	91.641 %	0.006 ppb	0.471 ppb	0.004 ppb	0.002 ppb	91.660 %	-0.022 ppb	0.000 ppb
Concentration per Run 1	-0.492 ppb	88.928 %	0.037 ppb	0.549 ppb	0.046 ppb	-0.022 ppb	89.378 %	-0.020 ppb	0.008 ppb
Concentration per Run 2	-0.268 ppb	94.676 %	-0.053 ppb	0.394 ppb	0.002 ppb	0.013 ppb	92.716 %	-0.024 ppb	-0.003 ppb
Concentration per Run 3	-0.734 ppb	91.319 %	0.035 ppb	0.470 ppb	-0.038 ppb	0.013 ppb	92.887 %	-0.020 ppb	-0.003 ppb
Concentration RSD	46.8 %	3.2 %	806.0 %	16.4 %	1,161.9 %	1,217.9 %	2.2 %	10.9 %	1,366.3 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	87.162 %	0.005 ppb	0.106 ppb	-0.012 ppb	89.472 %	89.455 %	0.000 ppb	0.008 ppb	89.022 %
Concentration per Run 1	87.091 %	-0.043 ppb	0.091 ppb	-0.053 ppb	92.451 %	88.901 %	-0.002 ppb	0.003 ppb	91.745 %
Concentration per Run 2	86.953 %	0.086 ppb	0.107 ppb	0.008 ppb	87.325 %	88.634 %	-0.002 ppb	0.016 ppb	87.041 %
Concentration per Run 3	87.441 %	-0.030 ppb	0.120 ppb	0.008 ppb	88.641 %	90.830 %	0.003 ppb	0.005 ppb	88.278 %
Concentration RSD	0.3 %	1,556.6 %	13.9 %	289.4 %	3.0 %	1.3 %	1,387.7 %	85.8 %	2.7 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 138 Analysis started at: 4/5/2017 3:46:29 PM Rack: 0
 Analysis label: CCV User name: ALPHALAB\metals-instrument Vial: 9

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	95.304 %	99.814 %	93.997 ppb	9,841.656 ppb	9,952.629 ppb	99.001 ppb	9,895.845 ppb	10,214.112 ppb	92.415 %
Concentration per Run 1	96.015 %	97.626 %	96.314 ppb	10,090.018 ppb	10,250.573 ppb	99.495 ppb	10,136.316 ppb	10,649.950 ppb	92.273 %
Concentration per Run 2	95.237 %	99.860 %	93.326 ppb	9,820.704 ppb	10,025.334 ppb	98.982 ppb	9,777.949 ppb	9,923.032 ppb	92.785 %
Concentration per Run 3	94.660 %	101.955 %	92.352 ppb	9,614.247 ppb	9,581.979 ppb	98.526 ppb	9,773.268 ppb	10,069.355 ppb	92.188 %
Recovery Percentage 1			93.997 %	98.417 %	99.526 %	99.001 %	98.958 %	102.141 %	
Concentration RSD	0.7 %	2.2 %	2.2 %	2.4 %	3.4 %	0.5 %	2.1 %	3.8 %	0.3 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	90.261 %	98.505 ppb	101.919 ppb	98.599 ppb	99.410 ppb	10,063.572 ppb	100.413 ppb	99.855 ppb	102.014 ppb
Concentration per Run 1	91.541 %	97.475 ppb	105.398 ppb	101.249 ppb	105.925 ppb	10,220.269 ppb	103.563 ppb	104.570 ppb	104.041 ppb
Concentration per Run 2	89.539 %	101.219 ppb	98.861 ppb	96.382 ppb	96.312 ppb	10,216.167 ppb	100.420 ppb	98.896 ppb	99.150 ppb
Concentration per Run 3	89.704 %	96.820 ppb	101.498 ppb	98.166 ppb	95.993 ppb	9,754.280 ppb	97.256 ppb	96.098 ppb	102.851 ppb
Recovery Percentage 1		98.505 %	101.919 %	98.599 %	99.410 %	100.636 %	100.413 %	99.855 %	102.014 %
Concentration RSD	1.2 %	2.4 %	3.2 %	2.5 %	5.7 %	2.7 %	3.1 %	4.3 %	2.5 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	100.831 ppb	91.952 %	99.881 ppb	100.363 ppb	100.505 ppb	99.270 ppb	92.239 %	99.146 ppb	101.296 ppb
Concentration per Run 1	102.936 ppb	89.314 %	102.489 ppb	105.973 ppb	101.999 ppb	100.234 ppb	94.129 %	94.995 ppb	97.472 ppb
Concentration per Run 2	99.798 ppb	93.643 %	101.715 ppb	99.726 ppb	100.203 ppb	99.330 ppb	89.823 %	101.666 ppb	107.476 ppb
Concentration per Run 3	99.760 ppb	92.898 %	95.439 ppb	95.392 ppb	99.314 ppb	98.245 ppb	92.766 %	100.777 ppb	98.939 ppb
Recovery Percentage 1	100.831 %		99.881 %	100.363 %	100.505 %	99.270 %		99.146 %	101.296 %
Concentration RSD	1.8 %	2.5 %	3.9 %	5.3 %	1.4 %	1.0 %	2.4 %	3.7 %	5.3 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	89.167 %	98.643 ppb	95.777 ppb	100.285 ppb	91.027 %	91.040 %	102.629 ppb	100.034 ppb	90.157 %
Concentration per Run 1	92.513 %	99.278 ppb	93.589 ppb	95.853 ppb	94.204 %	92.343 %	100.384 ppb	97.425 ppb	93.803 %
Concentration per Run 2	85.715 %	100.514 ppb	96.959 ppb	103.862 ppb	88.456 %	88.216 %	106.126 ppb	104.687 ppb	85.588 %
Concentration per Run 3	89.275 %	96.138 ppb	96.784 ppb	101.139 ppb	90.421 %	92.560 %	101.378 ppb	97.989 ppb	91.081 %
Recovery Percentage 1		98.643 %	95.777 %	100.285 %			102.629 %	100.034 %	
Concentration RSD	3.8 %	2.3 %	2.0 %	4.1 %	3.2 %	2.7 %	3.0 %	4.0 %	4.6 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 139 Analysis started at: 4/5/2017 3:49:54 PM Rack: 0
 Analysis label: CCB User name: ALPHALAB\metals-instrument Vial: 10

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	95.162 %	101.164 %	0.022 ppb	12.751 ppb	1.146 ppb	0.624 ppb	24.193 ppb	2.602 ppb	90.881 %
Concentration per Run 1	97.751 %	104.190 %	0.020 ppb	11.212 ppb	1.777 ppb	0.010 ppb	2.756 ppb	-1.415 ppb	93.551 %
Concentration per Run 2	94.602 %	98.743 %	0.026 ppb	14.071 ppb	3.064 ppb	1.164 ppb	21.485 ppb	4.701 ppb	88.950 %
Concentration per Run 3	93.132 %	100.559 %	0.021 ppb	12.971 ppb	-1.402 ppb	0.697 ppb	48.337 ppb	4.519 ppb	90.143 %
Recovery Percentage 1			4.484 %	12.751 %	1.637 %	6.238 %	24.193 %	2.602 %	
Concentration RSD	2.5 %	2.7 %	12.9 %	11.3 %	200.5 %	93.0 %	94.7 %	133.8 %	2.6 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	88.431 %	0.116 ppb	0.021 ppb	-0.029 ppb	-0.291 ppb	9.116 ppb	0.008 ppb	0.108 ppb	-0.013 ppb
Concentration per Run 1	87.428 %	0.085 ppb	0.000 ppb	-0.032 ppb	-0.450 ppb	7.264 ppb	0.035 ppb	0.028 ppb	0.039 ppb
Concentration per Run 2	89.696 %	0.089 ppb	0.000 ppb	-0.005 ppb	-0.106 ppb	11.054 ppb	-0.025 ppb	0.269 ppb	-0.065 ppb
Concentration per Run 3	88.170 %	0.175 ppb	0.062 ppb	-0.050 ppb	-0.317 ppb	9.030 ppb	0.016 ppb	0.029 ppb	-0.013 ppb
Recovery Percentage 1		23.212 %	0.413 %	-2.932 %	-29.104 %	18.232 %	1.682 %	5.416 %	-1.288 %
Concentration RSD	1.3 %	43.8 %	173.2 %	77.5 %	59.5 %	20.8 %	363.5 %	128.2 %	406.2 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	-0.290 ppb	93.811 %	0.105 ppb	0.655 ppb	0.020 ppb	0.567 ppb	92.642 %	0.062 ppb	0.008 ppb
Concentration per Run 1	-0.343 ppb	95.592 %	0.115 ppb	0.803 ppb	0.015 ppb	0.731 ppb	93.940 %	0.050 ppb	0.007 ppb
Concentration per Run 2	-0.286 ppb	90.047 %	0.170 ppb	0.529 ppb	0.017 ppb	0.405 ppb	91.029 %	0.065 ppb	-0.003 ppb
Concentration per Run 3	-0.241 ppb	95.795 %	0.031 ppb	0.634 ppb	0.028 ppb	0.564 ppb	92.957 %	0.071 ppb	0.019 ppb
Recovery Percentage 1	-2.900 %	93.811 %	21.030 %	13.109 %	4.043 %	28.331 %		15.453 %	3.785 %
Concentration RSD	17.6 %	3.5 %	66.5 %	21.0 %	35.2 %	28.7 %	1.6 %	17.6 %	145.2 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	90.903 %	0.793 ppb	3.674 ppb	0.016 ppb	91.445 %	88.709 %	0.050 ppb	0.061 ppb	95.224 %
Concentration per Run 1	93.637 %	0.774 ppb	3.565 ppb	0.032 ppb	95.401 %	90.539 %	0.055 ppb	0.057 ppb	96.627 %
Concentration per Run 2	88.064 %	0.705 ppb	3.950 ppb	0.038 ppb	87.519 %	88.929 %	0.047 ppb	0.058 ppb	96.235 %
Concentration per Run 3	91.008 %	0.899 ppb	3.508 ppb	-0.023 ppb	91.415 %	86.659 %	0.047 ppb	0.067 ppb	92.811 %
Recovery Percentage 1		26.427 %	91.862 %	3.106 %			9.937 %	12.105 %	95.224 %
Concentration RSD	3.1 %	12.4 %	6.6 %	218.2 %	4.3 %	2.2 %	8.7 %	9.4 %	2.2 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 140 Analysis started at: 4/5/2017 3:53:20 PM Rack: 2
 Analysis label: WG990895-1 6020TL User name: ALPHALAB\metals-instrument Vial: 41

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	95.661 %	99.814 %	0.011 ppb	9.094 ppb	0.452 ppb	2.483 ppb	9.907 ppb	-1.113 ppb	88.012 %
Concentration per Run 1	96.375 %	98.184 %	0.025 ppb	15.194 ppb	0.823 ppb	2.245 ppb	8.135 ppb	-1.244 ppb	90.313 %
Concentration per Run 2	94.705 %	99.441 %	0.011 ppb	4.313 ppb	-0.276 ppb	2.742 ppb	30.069 ppb	4.933 ppb	86.478 %
Concentration per Run 3	95.903 %	101.816 %	-0.003 ppb	7.775 ppb	0.811 ppb	2.463 ppb	-8.483 ppb	-7.027 ppb	87.245 %
Concentration RSD	0.9 %	1.8 %	125.9 %	61.1 %	139.5 %	10.0 %	195.2 %	537.5 %	2.3 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	88.348 %	0.060 ppb	0.086 ppb	0.226 ppb	-0.312 ppb	1.465 ppb	0.010 ppb	0.032 ppb	-0.010 ppb
Concentration per Run 1	86.681 %	0.000 ppb	0.000 ppb	0.273 ppb	-0.244 ppb	4.694 ppb	0.017 ppb	0.033 ppb	-0.009 ppb
Concentration per Run 2	90.066 %	0.000 ppb	0.065 ppb	0.084 ppb	-0.311 ppb	-3.338 ppb	0.017 ppb	0.032 ppb	-0.010 ppb
Concentration per Run 3	88.296 %	0.180 ppb	0.192 ppb	0.320 ppb	-0.381 ppb	3.040 ppb	-0.004 ppb	0.031 ppb	-0.011 ppb
Concentration RSD	1.9 %	173.2 %	114.2 %	55.2 %	22.1 %	289.4 %	121.8 %	2.3 %	9.7 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	-0.468 ppb	90.603 %	0.109 ppb	0.459 ppb	0.044 ppb	0.213 ppb	91.658 %	0.000 ppb	0.004 ppb
Concentration per Run 1	-0.312 ppb	87.148 %	0.085 ppb	0.196 ppb	0.032 ppb	0.191 ppb	92.415 %	0.007 ppb	-0.003 ppb
Concentration per Run 2	-0.596 ppb	91.573 %	0.166 ppb	0.979 ppb	0.058 ppb	0.121 ppb	90.491 %	-0.004 ppb	0.019 ppb
Concentration per Run 3	-0.497 ppb	93.087 %	0.076 ppb	0.201 ppb	0.043 ppb	0.328 ppb	92.067 %	-0.004 ppb	-0.003 ppb
Concentration RSD	30.8 %	3.4 %	45.4 %	98.2 %	29.8 %	49.4 %	1.1 %	2,057.0 %	317.8 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	90.096 %	0.303 ppb	1.259 ppb	0.027 ppb	88.781 %	89.870 %	0.016 ppb	0.032 ppb	96.243 %
Concentration per Run 1	90.615 %	0.165 ppb	0.993 ppb	0.066 ppb	87.934 %	89.775 %	0.015 ppb	0.033 ppb	98.232 %
Concentration per Run 2	92.090 %	0.342 ppb	1.337 ppb	0.006 ppb	90.211 %	88.587 %	0.015 ppb	0.026 ppb	94.881 %
Concentration per Run 3	87.585 %	0.403 ppb	1.445 ppb	0.008 ppb	88.200 %	91.248 %	0.017 ppb	0.038 ppb	95.615 %
Concentration RSD	2.5 %	40.8 %	18.8 %	129.0 %	1.4 %	1.5 %	8.2 %	19.6 %	1.8 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 141 Analysis started at: 4/5/2017 3:56:43 PM Rack: 2
 Analysis label: L1709991-01 6020TL User name: ALPHALAB\metals-instrument Vial: 49

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	94.696 %	99.022 %	-0.001 ppb	24.493 ppb	0.827 ppb	2.555 ppb	29.311 ppb	9.402 ppb	88.552 %
Concentration per Run 1	94.011 %	93.855 %	-0.003 ppb	25.067 ppb	0.862 ppb	1.623 ppb	27.642 ppb	8.691 ppb	91.847 %
Concentration per Run 2	96.624 %	102.235 %	-0.003 ppb	24.357 ppb	1.905 ppb	3.103 ppb	44.990 ppb	9.658 ppb	87.501 %
Concentration per Run 3	93.453 %	100.978 %	0.002 ppb	24.053 ppb	-0.285 ppb	2.937 ppb	15.300 ppb	9.857 ppb	86.308 %
Concentration RSD	1.8 %	4.6 %	206.8 %	2.1 %	132.4 %	31.8 %	50.9 %	6.6 %	3.3 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	86.554 %	0.212 ppb	0.022 ppb	0.134 ppb	-0.222 ppb	5.704 ppb	-0.018 ppb	0.033 ppb	-0.028 ppb
Concentration per Run 1	86.869 %	0.000 ppb	0.000 ppb	0.033 ppb	-0.115 ppb	9.156 ppb	-0.025 ppb	-0.047 ppb	-0.065 ppb
Concentration per Run 2	86.618 %	0.362 ppb	0.000 ppb	0.172 ppb	-0.241 ppb	8.031 ppb	-0.004 ppb	0.033 ppb	0.047 ppb
Concentration per Run 3	86.176 %	0.274 ppb	0.065 ppb	0.196 ppb	-0.310 ppb	-0.074 ppb	-0.025 ppb	0.114 ppb	-0.065 ppb
Concentration RSD	0.4 %	89.0 %	173.2 %	65.8 %	44.5 %	88.3 %	68.8 %	242.8 %	232.7 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	8.434 ppb	89.776 %	0.095 ppb	0.058 ppb	0.613 ppb	0.121 ppb	91.330 %	-0.016 ppb	0.000 ppb
Concentration per Run 1	8.243 ppb	91.115 %	0.167 ppb	-0.508 ppb	0.686 ppb	0.049 ppb	91.159 %	-0.020 ppb	0.008 ppb
Concentration per Run 2	8.922 ppb	88.776 %	0.127 ppb	0.341 ppb	0.568 ppb	0.120 ppb	92.365 %	-0.008 ppb	-0.003 ppb
Concentration per Run 3	8.137 ppb	89.437 %	-0.008 ppb	0.340 ppb	0.585 ppb	0.193 ppb	90.466 %	-0.020 ppb	-0.003 ppb
Concentration RSD	5.0 %	1.3 %	96.2 %	848.3 %	10.5 %	59.6 %	1.1 %	42.0 %	1,882.5 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	89.311 %	0.210 ppb	0.674 ppb	1.410 ppb	91.161 %	89.575 %	0.004 ppb	0.016 ppb	95.910 %
Concentration per Run 1	91.446 %	0.161 ppb	0.699 ppb	1.390 ppb	92.771 %	90.450 %	-0.002 ppb	0.016 ppb	99.800 %
Concentration per Run 2	90.526 %	0.214 ppb	0.540 ppb	1.425 ppb	89.303 %	88.708 %	0.007 ppb	0.012 ppb	95.112 %
Concentration per Run 3	85.961 %	0.256 ppb	0.784 ppb	1.415 ppb	91.409 %	89.568 %	0.009 ppb	0.020 ppb	92.818 %
Concentration RSD	3.3 %	22.5 %	18.4 %	1.3 %	1.9 %	1.0 %	134.8 %	23.5 %	3.7 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 142 Analysis started at: 4/5/2017 4:00:06 PM Rack: 2
 Analysis label: WG990895-2D5 6020TL User name: ALPHALAB\metals-instrument Vial: 42

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	94.833 %	97.998 %	9.914 ppb	2,120.394 ppb	2,173.648 ppb	416.887 ppb	2,100.759 ppb	2,314.465 ppb	89.546 %
Concentration per Run 1	96.640 %	98.324 %	10.078 ppb	2,122.521 ppb	2,047.987 ppb	407.026 ppb	2,117.907 ppb	2,290.042 ppb	91.080 %
Concentration per Run 2	95.154 %	98.883 %	9.991 ppb	2,112.051 ppb	2,199.930 ppb	411.852 ppb	2,080.956 ppb	2,158.953 ppb	89.290 %
Concentration per Run 3	92.704 %	96.788 %	9.673 ppb	2,126.611 ppb	2,273.027 ppb	431.784 ppb	2,103.414 ppb	2,494.399 ppb	88.268 %
Concentration RSD	2.1 %	1.1 %	2.1 %	0.4 %	5.3 %	3.1 %	0.9 %	7.3 %	1.6 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	87.748 %	180.361 ppb	108.477 ppb	41.522 ppb	107.432 ppb	208.887 ppb	102.232 ppb	105.024 ppb	51.464 ppb
Concentration per Run 1	90.066 %	186.803 ppb	108.674 ppb	40.863 ppb	103.532 ppb	222.951 ppb	100.198 ppb	103.764 ppb	51.154 ppb
Concentration per Run 2	87.106 %	172.182 ppb	103.992 ppb	42.473 ppb	108.668 ppb	213.065 ppb	101.454 ppb	108.144 ppb	52.322 ppb
Concentration per Run 3	86.073 %	182.098 ppb	112.764 ppb	41.229 ppb	110.096 ppb	190.644 ppb	105.045 ppb	103.165 ppb	50.916 ppb
Concentration RSD	2.4 %	4.1 %	4.0 %	2.0 %	3.2 %	7.9 %	2.5 %	2.6 %	1.5 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	103.837 ppb	92.804 %	25.750 ppb	26.250 ppb	206.712 ppb	191.870 ppb	90.248 %	10.268 ppb	11.135 ppb
Concentration per Run 1	104.424 ppb	93.901 %	26.003 ppb	23.424 ppb	210.159 ppb	192.001 ppb	88.733 %	10.079 ppb	11.111 ppb
Concentration per Run 2	104.844 ppb	92.249 %	23.543 ppb	27.697 ppb	207.620 ppb	196.434 ppb	88.126 %	10.588 ppb	11.188 ppb
Concentration per Run 3	102.242 ppb	92.261 %	27.703 ppb	27.630 ppb	202.357 ppb	187.175 ppb	93.885 %	10.135 ppb	11.106 ppb
Concentration RSD	1.3 %	1.0 %	8.1 %	9.3 %	1.9 %	2.4 %	3.5 %	2.7 %	0.4 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	88.926 %	200.281 ppb	103.218 ppb	423.952 ppb	89.949 %	88.568 %	26.145 ppb	110.692 ppb	91.739 %
Concentration per Run 1	89.245 %	200.762 ppb	102.151 ppb	433.286 ppb	88.506 %	88.088 %	26.358 ppb	109.981 ppb	93.871 %
Concentration per Run 2	89.988 %	196.519 ppb	100.766 ppb	416.554 ppb	90.542 %	91.176 %	26.055 ppb	114.752 ppb	88.849 %
Concentration per Run 3	87.546 %	203.563 ppb	106.737 ppb	422.017 ppb	90.799 %	86.440 %	26.023 ppb	107.344 ppb	92.496 %
Concentration RSD	1.4 %	1.8 %	3.0 %	2.0 %	1.4 %	2.7 %	0.7 %	3.4 %	2.8 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 143 Analysis started at: 4/5/2017 4:03:28 PM Rack: 2
 Analysis label: WG990895-3D10 6020TL User name: ALPHALAB\metals-instrument Vial: 43

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	90.176 %	92.504 %	4.987 ppb	238,280.999 ppb	20,231.825 ppb	286.403 ppb	9,552.400 ppb	8,373.477 ppb	85.711 %
Concentration per Run 1	90.727 %	93.855 %	4.707 ppb	235,283.974 ppb	19,772.672 ppb	280.327 ppb	9,441.528 ppb	8,095.599 ppb	86.478 %
Concentration per Run 2	90.293 %	94.832 %	5.294 ppb	241,414.248 ppb	20,546.553 ppb	288.271 ppb	9,970.164 ppb	8,670.540 ppb	80.002 %
Concentration per Run 3	89.508 %	88.827 %	4.960 ppb	238,144.776 ppb	20,376.251 ppb	290.612 ppb	9,245.510 ppb	8,354.292 ppb	90.654 %
Concentration RSD	0.7 %	3.5 %	5.9 %	1.3 %	2.0 %	1.9 %	3.9 %	3.4 %	6.3 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	88.430 %	99.038 ppb	54.800 ppb	21.118 ppb	54.226 ppb	287.758 ppb	48.115 ppb	50.416 ppb	26.490 ppb
Concentration per Run 1	88.303 %	95.076 ppb	55.717 ppb	21.340 ppb	54.371 ppb	260.143 ppb	47.920 ppb	50.094 ppb	26.591 ppb
Concentration per Run 2	86.907 %	102.679 ppb	56.879 ppb	21.777 ppb	54.214 ppb	323.172 ppb	50.092 ppb	51.562 ppb	25.587 ppb
Concentration per Run 3	90.081 %	99.359 ppb	51.806 ppb	20.236 ppb	54.094 ppb	279.958 ppb	46.333 ppb	49.593 ppb	27.291 ppb
Concentration RSD	1.8 %	3.8 %	4.8 %	3.8 %	0.3 %	11.2 %	3.9 %	2.0 %	3.2 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	56.125 ppb	90.217 %	13.063 ppb	11.300 ppb	219.131 ppb	101.184 ppb	83.948 %	4.830 ppb	5.477 ppb
Concentration per Run 1	55.881 ppb	88.623 %	13.353 ppb	10.719 ppb	213.045 ppb	96.718 ppb	86.027 %	4.756 ppb	5.155 ppb
Concentration per Run 2	58.147 ppb	90.912 %	13.658 ppb	13.415 ppb	221.873 ppb	103.135 ppb	83.722 %	5.025 ppb	5.453 ppb
Concentration per Run 3	54.347 ppb	91.115 %	12.179 ppb	9.767 ppb	222.475 ppb	103.700 ppb	82.095 %	4.711 ppb	5.822 ppb
Concentration RSD	3.4 %	1.5 %	6.0 %	16.7 %	2.4 %	3.8 %	2.4 %	3.5 %	6.1 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	82.743 %	102.752 ppb	70.178 ppb	209.399 ppb	87.517 %	85.348 %	12.088 ppb	53.339 ppb	84.913 %
Concentration per Run 1	82.634 %	102.468 ppb	68.825 ppb	211.990 ppb	89.275 %	86.190 %	11.921 ppb	51.557 ppb	87.577 %
Concentration per Run 2	82.169 %	103.094 ppb	73.013 ppb	208.257 ppb	86.630 %	83.264 %	11.934 ppb	54.399 ppb	83.482 %
Concentration per Run 3	83.426 %	102.693 ppb	68.695 ppb	207.950 ppb	86.645 %	86.591 %	12.409 ppb	54.061 ppb	83.680 %
Concentration RSD	0.8 %	0.3 %	3.5 %	1.1 %	1.7 %	2.1 %	2.3 %	2.9 %	2.7 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 144 Analysis started at: 4/5/2017 4:06:51 PM Rack: 2
 Analysis label: WG990895-5D10 6020TL User name: ALPHALAB\metals-instrument Vial: 44

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	90.671 %	89.897 %	51.665 ppb	249,024.950 ppb	26,260.204 ppb	114.605 ppb	14,092.608 ppb	12,885.444 ppb	87.671 %
Concentration per Run 1	91.191 %	89.944 %	51.695 ppb	250,026.178 ppb	26,141.596 ppb	117.506 ppb	14,643.089 ppb	13,148.893 ppb	88.523 %
Concentration per Run 2	91.562 %	89.665 %	51.587 ppb	244,878.441 ppb	25,546.315 ppb	109.898 ppb	13,358.243 ppb	12,655.468 ppb	88.438 %
Concentration per Run 3	89.260 %	90.084 %	51.712 ppb	252,170.229 ppb	27,092.701 ppb	116.412 ppb	14,276.492 ppb	12,851.973 ppb	86.052 %
Concentration RSD	1.4 %	0.2 %	0.1 %	1.5 %	3.0 %	3.6 %	4.7 %	1.9 %	1.6 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	89.998 %	67.404 ppb	53.416 ppb	53.936 ppb	55.645 ppb	5,625.400 ppb	53.071 ppb	50.940 ppb	54.335 ppb
Concentration per Run 1	92.014 %	67.259 ppb	51.650 ppb	52.481 ppb	57.410 ppb	5,569.156 ppb	51.506 ppb	51.515 ppb	52.154 ppb
Concentration per Run 2	88.122 %	66.922 ppb	51.780 ppb	52.737 ppb	52.863 ppb	5,488.518 ppb	53.493 ppb	46.257 ppb	57.564 ppb
Concentration per Run 3	89.858 %	68.030 ppb	56.818 ppb	56.589 ppb	56.663 ppb	5,818.524 ppb	54.214 ppb	55.048 ppb	53.285 ppb
Concentration RSD	2.2 %	0.8 %	5.5 %	4.3 %	4.4 %	3.1 %	2.6 %	8.7 %	5.3 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	59.347 ppb	88.567 %	56.561 ppb	54.108 ppb	176.201 ppb	57.249 ppb	83.216 %	24.026 ppb	56.600 ppb
Concentration per Run 1	61.601 ppb	90.535 %	56.022 ppb	49.515 ppb	177.029 ppb	57.380 ppb	84.318 %	24.221 ppb	55.968 ppb
Concentration per Run 2	54.864 ppb	88.716 %	54.986 ppb	56.088 ppb	176.596 ppb	56.116 ppb	81.006 %	23.432 ppb	56.692 ppb
Concentration per Run 3	61.576 ppb	86.451 %	58.674 ppb	56.722 ppb	174.977 ppb	58.252 ppb	84.326 %	24.425 ppb	57.139 ppb
Concentration RSD	6.5 %	2.3 %	3.4 %	7.4 %	0.6 %	1.9 %	2.3 %	2.2 %	1.0 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	83.221 %	55.423 ppb	67.131 ppb	56.730 ppb	86.488 %	86.413 %	54.763 ppb	54.855 ppb	82.378 %
Concentration per Run 1	84.251 %	56.435 ppb	69.177 ppb	55.914 ppb	89.738 %	89.461 %	53.976 ppb	54.261 ppb	84.546 %
Concentration per Run 2	82.881 %	54.931 ppb	65.178 ppb	57.201 ppb	85.154 %	87.090 %	53.762 ppb	53.729 ppb	84.709 %
Concentration per Run 3	82.531 %	54.904 ppb	67.038 ppb	57.075 ppb	84.571 %	82.689 %	56.551 ppb	56.574 ppb	77.878 %
Concentration RSD	1.1 %	1.6 %	3.0 %	1.3 %	3.3 %	4.0 %	2.8 %	2.8 %	4.7 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 145 Analysis started at: 4/5/2017 4:10:13 PM Rack: 2
 Analysis label: WG990895-6D5 6020TL User name: ALPHALAB\metals-instrument Vial: 45

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	89.685 %	92.551 %	0.036 ppb	483,913.320 ppb	39,538.415 ppb	120.003 ppb	17,160.725 ppb	14,085.039 ppb	87.274 %
Concentration per Run 1	89.906 %	96.927 %	0.047 ppb	466,867.547 ppb	37,799.669 ppb	109.506 ppb	16,136.292 ppb	13,752.097 ppb	91.421 %
Concentration per Run 2	89.784 %	89.106 %	0.022 ppb	509,238.038 ppb	41,338.867 ppb	123.091 ppb	18,128.123 ppb	14,678.196 ppb	83.325 %
Concentration per Run 3	89.367 %	91.620 %	0.037 ppb	475,634.377 ppb	39,476.710 ppb	127.413 ppb	17,217.760 ppb	13,824.824 ppb	87.075 %
Concentration RSD	0.3 %	4.3 %	35.5 %	4.6 %	4.5 %	7.8 %	5.8 %	3.7 %	4.6 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	88.951 %	25.221 ppb	0.839 ppb	1.622 ppb	3.248 ppb	377.573 ppb	0.144 ppb	1.487 ppb	1.136 ppb
Concentration per Run 1	89.071 %	23.765 ppb	0.677 ppb	1.344 ppb	2.938 ppb	365.865 ppb	0.239 ppb	0.867 ppb	1.212 ppb
Concentration per Run 2	88.550 %	25.807 ppb	0.744 ppb	2.086 ppb	3.787 ppb	397.757 ppb	0.154 ppb	2.133 ppb	0.932 ppb
Concentration per Run 3	89.231 %	26.091 ppb	1.095 ppb	1.435 ppb	3.020 ppb	369.095 ppb	0.039 ppb	1.461 ppb	1.263 ppb
Concentration RSD	0.4 %	5.0 %	26.8 %	24.9 %	14.4 %	4.6 %	70.0 %	42.6 %	15.7 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	9.987 ppb	90.132 %	0.630 ppb	0.571 ppb	235.089 ppb	1.552 ppb	83.207 %	-0.010 ppb	0.122 ppb
Concentration per Run 1	9.035 ppb	94.167 %	0.631 ppb	0.611 ppb	233.220 ppb	1.968 ppb	85.143 %	0.001 ppb	0.044 ppb
Concentration per Run 2	11.095 ppb	85.266 %	0.559 ppb	0.761 ppb	246.050 ppb	1.325 ppb	83.419 %	-0.011 ppb	0.167 ppb
Concentration per Run 3	9.831 ppb	90.963 %	0.699 ppb	0.340 ppb	225.998 ppb	1.365 ppb	81.058 %	-0.020 ppb	0.155 ppb
Concentration RSD	10.4 %	5.0 %	11.2 %	37.4 %	4.3 %	23.2 %	2.5 %	107.5 %	55.7 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	84.053 %	1.225 ppb	1.238 ppb	2.484 ppb	86.367 %	87.706 %	0.100 ppb	0.488 ppb	81.892 %
Concentration per Run 1	85.857 %	1.153 ppb	1.070 ppb	2.474 ppb	88.719 %	90.322 %	0.078 ppb	0.484 ppb	84.197 %
Concentration per Run 2	82.701 %	1.202 ppb	1.452 ppb	2.646 ppb	84.634 %	86.382 %	0.089 ppb	0.483 ppb	81.455 %
Concentration per Run 3	83.601 %	1.321 ppb	1.192 ppb	2.332 ppb	85.749 %	86.413 %	0.134 ppb	0.497 ppb	80.025 %
Concentration RSD	1.9 %	7.1 %	15.8 %	6.3 %	2.4 %	2.6 %	29.6 %	1.6 %	2.6 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 146 Analysis started at: 4/5/2017 4:13:36 PM Rack: 2
 Analysis label: WG990895-4 6020TL User name: ALPHALAB\metals-instrument Vial: 46

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	83.092 %	83.798 %	0.031 ppb	2,525,279.450 ppb	208,079.219 ppb	708.340 ppb	88,769.047 ppb	75,370.201 ppb	76.991 %
Concentration per Run 1	82.168 %	85.055 %	0.019 ppb	2,552,823.871 ppb	215,550.665 ppb	751.319 ppb	91,245.140 ppb	79,493.811 ppb	75.315 %
Concentration per Run 2	83.989 %	81.983 %	0.040 ppb	2,563,229.185 ppb	209,745.544 ppb	693.405 ppb	89,948.327 ppb	74,593.153 ppb	75.486 %
Concentration per Run 3	83.117 %	84.357 %	0.035 ppb	2,459,785.294 ppb	198,941.450 ppb	680.296 ppb	85,113.673 ppb	72,023.638 ppb	80.172 %
Concentration RSD	1.1 %	1.9 %	35.0 %	2.3 %	4.1 %	5.3 %	3.6 %	5.0 %	3.6 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	89.225 %	126.483 ppb	4.000 ppb	10.593 ppb	17.959 ppb	2,214.805 ppb	0.845 ppb	8.690 ppb	6.614 ppb
Concentration per Run 1	87.875 %	127.398 ppb	3.868 ppb	10.856 ppb	18.682 ppb	2,283.695 ppb	0.806 ppb	9.005 ppb	6.366 ppb
Concentration per Run 2	91.112 %	126.446 ppb	4.398 ppb	11.038 ppb	17.731 ppb	2,109.242 ppb	0.960 ppb	10.188 ppb	7.152 ppb
Concentration per Run 3	88.688 %	125.605 ppb	3.734 ppb	9.884 ppb	17.464 ppb	2,251.479 ppb	0.770 ppb	6.877 ppb	6.325 ppb
Concentration RSD	1.9 %	0.7 %	8.8 %	5.9 %	3.6 %	4.2 %	11.9 %	19.3 %	7.0 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	51.169 ppb	79.375 %	3.231 ppb	0.753 ppb	1,265.132 ppb	8.302 ppb	71.348 %	0.028 ppb	0.345 ppb
Concentration per Run 1	51.883 ppb	79.214 %	3.249 ppb	0.496 ppb	1,302.353 ppb	8.698 ppb	71.052 %	0.032 ppb	0.287 ppb
Concentration per Run 2	50.709 ppb	77.790 %	3.668 ppb	0.695 ppb	1,226.128 ppb	7.606 ppb	72.058 %	0.026 ppb	0.368 ppb
Concentration per Run 3	50.915 ppb	81.122 %	2.777 ppb	1.069 ppb	1,266.914 ppb	8.602 ppb	70.935 %	0.026 ppb	0.380 ppb
Concentration RSD	1.2 %	2.1 %	13.8 %	38.7 %	3.0 %	7.3 %	0.9 %	11.3 %	14.6 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	74.062 %	0.970 ppb	1.458 ppb	13.868 ppb	75.590 %	74.963 %	0.053 ppb	2.413 ppb	70.656 %
Concentration per Run 1	73.589 %	1.018 ppb	1.465 ppb	14.176 ppb	74.302 %	75.340 %	0.040 ppb	2.369 ppb	72.550 %
Concentration per Run 2	73.704 %	0.847 ppb	1.369 ppb	13.506 ppb	77.175 %	76.091 %	0.050 ppb	2.416 ppb	71.109 %
Concentration per Run 3	74.892 %	1.043 ppb	1.542 ppb	13.923 ppb	75.293 %	73.459 %	0.069 ppb	2.454 ppb	68.310 %
Concentration RSD	1.0 %	11.0 %	5.9 %	2.4 %	1.9 %	1.8 %	27.4 %	1.8 %	3.1 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 147 Analysis started at: 4/5/2017 4:16:59 PM Rack: 2
 Analysis label: L1709899-01 6020TL User name: ALPHALAB\metals-instrument Vial: 47

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	93.201 %	89.246 %	0.034 ppb	2,486,298.612 ppb	198,534.598 ppb	638.496 ppb	91,555.974 ppb	74,387.758 ppb	83.070 %
Concentration per Run 1	93.367 %	87.430 %	0.035 ppb	2,524,754.256 ppb	191,269.601 ppb	630.784 ppb	94,219.860 ppb	77,224.586 ppb	81.280 %
Concentration per Run 2	93.045 %	89.246 %	0.045 ppb	2,438,805.494 ppb	202,737.846 ppb	614.692 ppb	89,390.680 ppb	71,702.879 ppb	85.541 %
Concentration per Run 3	93.191 %	91.061 %	0.021 ppb	2,495,336.087 ppb	201,596.347 ppb	670.011 ppb	91,057.382 ppb	74,235.809 ppb	82.388 %
Concentration RSD	0.2 %	2.0 %	35.9 %	1.8 %	3.2 %	4.5 %	2.7 %	3.7 %	2.7 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	104.909 %	128.114 ppb	3.879 ppb	9.092 ppb	16.867 ppb	2,011.378 ppb	0.739 ppb	7.326 ppb	5.959 ppb
Concentration per Run 1	105.628 %	128.760 ppb	4.490 ppb	9.000 ppb	17.265 ppb	2,024.284 ppb	0.703 ppb	6.425 ppb	6.172 ppb
Concentration per Run 2	103.777 %	123.641 ppb	3.764 ppb	8.762 ppb	14.980 ppb	2,046.364 ppb	0.677 ppb	8.495 ppb	5.923 ppb
Concentration per Run 3	105.324 %	131.942 ppb	3.384 ppb	9.515 ppb	18.356 ppb	1,963.486 ppb	0.837 ppb	7.058 ppb	5.782 ppb
Concentration RSD	0.9 %	3.3 %	14.5 %	4.2 %	10.2 %	2.1 %	11.6 %	14.5 %	3.3 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	49.877 ppb	86.602 %	2.670 ppb	0.239 ppb	1,222.079 ppb	8.240 ppb	76.712 %	0.015 ppb	0.324 ppb
Concentration per Run 1	48.113 ppb	84.656 %	2.607 ppb	-0.280 ppb	1,200.430 ppb	8.509 ppb	78.011 %	0.013 ppb	0.204 ppb
Concentration per Run 2	51.495 ppb	86.589 %	2.225 ppb	0.431 ppb	1,231.201 ppb	8.038 ppb	76.533 %	0.004 ppb	0.306 ppb
Concentration per Run 3	50.021 ppb	88.560 %	3.178 ppb	0.568 ppb	1,234.605 ppb	8.174 ppb	75.593 %	0.029 ppb	0.463 ppb
Concentration RSD	3.4 %	2.3 %	18.0 %	190.2 %	1.5 %	2.9 %	1.6 %	81.9 %	40.2 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	77.434 %	2.288 ppb	1.339 ppb	12.321 ppb	80.055 %	79.356 %	0.042 ppb	2.350 ppb	71.499 %
Concentration per Run 1	77.580 %	2.173 ppb	1.214 ppb	13.220 ppb	82.958 %	82.678 %	0.031 ppb	2.210 ppb	74.031 %
Concentration per Run 2	79.042 %	2.400 ppb	1.255 ppb	12.060 ppb	77.126 %	77.153 %	0.046 ppb	2.405 ppb	70.633 %
Concentration per Run 3	75.679 %	2.291 ppb	1.548 ppb	11.683 ppb	80.081 %	78.236 %	0.049 ppb	2.434 ppb	69.834 %
Concentration RSD	2.2 %	5.0 %	13.6 %	6.5 %	3.6 %	3.7 %	22.9 %	5.2 %	3.1 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 148 Analysis started at: 4/5/2017 4:20:22 PM Rack: 2
 Analysis label: L1710173-01 6020TL User name: ALPHALAB\metals-instrument Vial: 48

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	103.025 %	109.544 %	0.006 ppb	71,198.482 ppb	27.826 ppb	2,381.512 ppb	108,724.439 ppb	213,687.581 ppb	98.438 %
Concentration per Run 1	103.712 %	107.682 %	0.001 ppb	72,911.091 ppb	27.009 ppb	2,463.864 ppb	110,771.998 ppb	219,417.607 ppb	99.006 %
Concentration per Run 2	103.506 %	112.850 %	0.014 ppb	70,134.694 ppb	27.641 ppb	2,271.578 ppb	102,938.892 ppb	200,164.750 ppb	103.778 %
Concentration per Run 3	101.856 %	108.101 %	0.001 ppb	70,549.662 ppb	28.829 ppb	2,409.093 ppb	112,462.427 ppb	221,480.386 ppb	92.529 %
Concentration RSD	1.0 %	2.6 %	130.9 %	2.1 %	3.3 %	4.2 %	4.7 %	5.5 %	5.7 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	105.392 %	307.542 ppb	1.974 ppb	0.437 ppb	0.205 ppb	101.839 ppb	0.331 ppb	15.207 ppb	0.448 ppb
Concentration per Run 1	106.713 %	311.210 ppb	2.648 ppb	0.549 ppb	0.051 ppb	99.033 ppb	0.400 ppb	14.174 ppb	0.447 ppb
Concentration per Run 2	105.279 %	288.454 ppb	1.328 ppb	0.260 ppb	0.095 ppb	101.476 ppb	0.257 ppb	15.543 ppb	0.436 ppb
Concentration per Run 3	104.184 %	322.961 ppb	1.946 ppb	0.504 ppb	0.469 ppb	105.007 ppb	0.337 ppb	15.903 ppb	0.460 ppb
Concentration RSD	1.2 %	5.7 %	33.5 %	35.5 %	112.1 %	2.9 %	21.8 %	6.0 %	2.7 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	0.267 ppb	96.083 %	2.970 ppb	1.348 ppb	5,922.908 ppb	8.120 ppb	92.104 %	-0.015 ppb	0.000 ppb
Concentration per Run 1	0.161 ppb	95.999 %	2.459 ppb	2.006 ppb	6,053.264 ppb	8.704 ppb	89.621 %	-0.016 ppb	-0.003 ppb
Concentration per Run 2	0.425 ppb	96.914 %	3.218 ppb	0.867 ppb	5,856.097 ppb	8.219 ppb	95.077 %	-0.017 ppb	0.007 ppb
Concentration per Run 3	0.215 ppb	95.337 %	3.232 ppb	1.171 ppb	5,859.363 ppb	7.435 ppb	91.613 %	-0.013 ppb	-0.003 ppb
Concentration RSD	52.2 %	0.8 %	14.9 %	43.7 %	1.9 %	7.9 %	3.0 %	15.1 %	3,098.4 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	95.351 %	0.531 ppb	0.926 ppb	151.455 ppb	91.089 %	91.683 %	0.013 ppb	0.179 ppb	87.535 %
Concentration per Run 1	95.622 %	0.478 ppb	1.158 ppb	151.362 ppb	90.801 %	91.694 %	0.002 ppb	0.199 ppb	86.790 %
Concentration per Run 2	94.936 %	0.506 ppb	0.839 ppb	150.016 ppb	91.883 %	91.630 %	0.010 ppb	0.160 ppb	87.654 %
Concentration per Run 3	95.496 %	0.608 ppb	0.782 ppb	152.986 ppb	90.584 %	91.724 %	0.028 ppb	0.178 ppb	88.162 %
Concentration RSD	0.4 %	12.9 %	21.8 %	1.0 %	0.8 %	0.1 %	104.9 %	10.8 %	0.8 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 149 Analysis started at: 4/5/2017 4:23:45 PM Rack: 2
 Analysis label: 0173-02 SCAN User name: ALPHALAB\metals-instrument Vial: 50

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	104.569 %	105.726 %	0.003 ppb	241.809 ppb	13.841 ppb	2.321 ppb	57.913 ppb	40.234 ppb	99.659 %
Concentration per Run 1	105.915 %	101.257 %	0.001 ppb	193.075 ppb	2.753 ppb	4.845 ppb	26.988 ppb	22.660 ppb	101.307 %
Concentration per Run 2	103.990 %	106.425 %	-0.003 ppb	247.169 ppb	20.931 ppb	0.958 ppb	80.064 ppb	43.275 ppb	100.369 %
Concentration per Run 3	103.803 %	109.498 %	0.010 ppb	285.184 ppb	17.841 ppb	1.161 ppb	66.686 ppb	54.767 ppb	97.301 %
Concentration RSD	1.1 %	3.9 %	237.6 %	19.1 %	70.3 %	94.3 %	47.7 %	40.4 %	2.1 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	101.956 %	0.080 ppb	0.019 ppb	-0.064 ppb	-0.308 ppb	1.390 ppb	-0.019 ppb	0.045 ppb	-0.049 ppb
Concentration per Run 1	103.016 %	0.078 ppb	0.000 ppb	-0.058 ppb	-0.267 ppb	3.762 ppb	-0.025 ppb	-0.047 ppb	-0.065 ppb
Concentration per Run 2	102.287 %	0.000 ppb	0.056 ppb	-0.096 ppb	-0.268 ppb	-0.507 ppb	-0.006 ppb	-0.047 ppb	-0.016 ppb
Concentration per Run 3	100.564 %	0.161 ppb	0.000 ppb	-0.038 ppb	-0.389 ppb	0.914 ppb	-0.025 ppb	0.231 ppb	-0.065 ppb
Concentration RSD	1.2 %	101.0 %	173.2 %	46.3 %	22.8 %	156.4 %	57.1 %	353.3 %	57.7 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	-0.592 ppb	102.543 %	-0.013 ppb	0.192 ppb	0.831 ppb	0.044 ppb	98.026 %	-0.022 ppb	-0.003 ppb
Concentration per Run 1	-0.610 ppb	99.814 %	0.028 ppb	-0.006 ppb	0.635 ppb	0.045 ppb	96.377 %	-0.021 ppb	-0.003 ppb
Concentration per Run 2	-0.581 ppb	101.899 %	-0.053 ppb	0.430 ppb	0.784 ppb	0.044 ppb	97.988 %	-0.021 ppb	-0.003 ppb
Concentration per Run 3	-0.584 ppb	105.918 %	-0.015 ppb	0.150 ppb	1.075 ppb	0.042 ppb	99.714 %	-0.024 ppb	-0.003 ppb
Concentration RSD	2.7 %	3.0 %	298.6 %	115.3 %	27.0 %	3.1 %	1.7 %	10.0 %	

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	97.500 %	0.048 ppb	0.198 ppb	0.003 ppb	94.997 %	95.100 %	0.001 ppb	-0.002 ppb	92.385 %
Concentration per Run 1	95.682 %	0.056 ppb	0.228 ppb	-0.025 ppb	95.949 %	93.805 %	0.000 ppb	-0.007 ppb	91.851 %
Concentration per Run 2	97.100 %	-0.027 ppb	0.146 ppb	0.031 ppb	93.551 %	93.993 %	-0.002 ppb	-0.001 ppb	92.020 %
Concentration per Run 3	99.719 %	0.117 ppb	0.219 ppb	0.002 ppb	95.490 %	97.504 %	0.003 ppb	0.001 ppb	93.285 %
Concentration RSD	2.1 %	148.7 %	22.7 %	1,030.6 %	1.3 %	2.2 %	485.1 %	166.8 %	0.8 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 150 Analysis started at: 4/5/2017 4:27:08 PM Rack: 0
Analysis label: CCV User name: ALPHALAB\metals-instrument Vial: 9

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	103.096 %	105.494 %	97.749 ppb	10,061.250 ppb	10,398.782 ppb	103.486 ppb	10,212.479 ppb	10,577.224 ppb	100.597 %
Concentration per Run 1	103.921 %	109.637 %	99.081 ppb	10,076.671 ppb	10,432.812 ppb	109.321 ppb	10,097.672 ppb	11,211.401 ppb	96.364 %
Concentration per Run 2	103.050 %	105.307 %	97.535 ppb	10,100.401 ppb	10,456.605 ppb	100.086 ppb	10,297.796 ppb	10,736.068 ppb	102.755 %
Concentration per Run 3	102.315 %	101.536 %	96.630 ppb	10,006.678 ppb	10,306.928 ppb	101.051 ppb	10,241.969 ppb	9,784.203 ppb	102.670 %
Recovery Percentage 1			97.749 %	100.612 %	103.988 %	103.486 %	102.125 %	105.772 %	
Concentration RSD	0.8 %	3.8 %	1.3 %	0.5 %	0.8 %	4.9 %	1.0 %	6.9 %	3.6 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	102.111 %	101.209 ppb	103.493 ppb	100.159 ppb	98.511 ppb	9,961.887 ppb	98.656 ppb	100.658 ppb	98.271 ppb
Concentration per Run 1	103.196 %	106.519 ppb	112.272 ppb	108.237 ppb	105.671 ppb	10,606.500 ppb	101.806 ppb	99.046 ppb	99.440 ppb
Concentration per Run 2	102.645 %	100.419 ppb	98.400 ppb	94.567 ppb	93.375 ppb	9,448.388 ppb	94.764 ppb	103.074 ppb	99.880 ppb
Concentration per Run 3	100.492 %	96.688 ppb	99.807 ppb	97.672 ppb	96.488 ppb	9,830.773 ppb	99.399 ppb	99.855 ppb	95.492 ppb
Recovery Percentage 1		101.209 %	103.493 %	100.159 %	98.511 %	99.619 %	98.656 %	100.658 %	98.271 %
Concentration RSD	1.4 %	4.9 %	7.4 %	7.2 %	6.5 %	5.9 %	3.6 %	2.1 %	2.5 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	102.881 ppb	98.874 %	102.444 ppb	105.666 ppb	105.530 ppb	101.298 ppb	94.396 %	99.574 ppb	103.375 ppb
Concentration per Run 1	105.707 ppb	99.974 %	102.323 ppb	102.453 ppb	107.809 ppb	108.078 ppb	96.393 %	101.756 ppb	106.667 ppb
Concentration per Run 2	100.518 ppb	99.858 %	99.300 ppb	103.206 ppb	102.537 ppb	100.192 ppb	91.771 %	100.532 ppb	103.910 ppb
Concentration per Run 3	102.418 ppb	96.791 %	105.708 ppb	111.339 ppb	106.245 ppb	95.626 ppb	95.025 %	96.434 ppb	99.548 ppb
Recovery Percentage 1	102.881 %	102.444 %	102.444 %	105.666 %	105.530 %	101.298 %		99.574 %	103.375 %
Concentration RSD	2.6 %	1.8 %	3.1 %	4.7 %	2.6 %	6.2 %	2.5 %	2.8 %	3.5 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	96.382 %	99.552 ppb	99.667 ppb	103.151 ppb	93.935 %	93.786 %	104.361 ppb	101.496 ppb	91.584 %
Concentration per Run 1	93.349 %	106.925 ppb	103.016 ppb	108.188 ppb	91.653 %	92.019 %	107.536 ppb	105.708 ppb	88.902 %
Concentration per Run 2	98.497 %	96.160 ppb	97.587 ppb	102.233 ppb	93.945 %	94.428 %	104.593 ppb	99.733 ppb	93.010 %
Concentration per Run 3	97.299 %	95.569 ppb	98.396 ppb	99.032 ppb	96.206 %	94.910 %	100.955 ppb	99.047 ppb	92.839 %
Recovery Percentage 1		99.552 %	99.667 %	103.151 %			104.361 %	101.496 %	
Concentration RSD	2.8 %	6.4 %	2.9 %	4.5 %	2.4 %	1.7 %	3.2 %	3.6 %	2.5 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 151 Analysis started at: 4/5/2017 4:30:33 PM Rack: 0
 Analysis label: CCB User name: ALPHALAB\metals-instrument Vial: 10

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	101.056 %	105.866 %	0.019 ppb	51.477 ppb	3.133 ppb	0.071 ppb	11.823 ppb	-1.595 ppb	93.836 %
Concentration per Run 1	101.003 %	105.168 %	0.015 ppb	58.740 ppb	3.912 ppb	0.225 ppb	9.902 ppb	-1.395 ppb	91.762 %
Concentration per Run 2	100.522 %	109.917 %	0.033 ppb	43.043 ppb	4.785 ppb	-0.217 ppb	-7.163 ppb	-7.151 ppb	92.785 %
Concentration per Run 3	101.643 %	102.514 %	0.010 ppb	52.648 ppb	0.703 ppb	0.205 ppb	32.730 ppb	3.761 ppb	96.960 %
Recovery Percentage 1			3.863 %	51.477 %	4.476 %	0.713 %	11.823 %	-1.595 %	
Concentration RSD	0.6 %	3.5 %	61.6 %	15.4 %	68.6 %	350.2 %	169.3 %	342.2 %	2.9 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	103.042 %	0.028 ppb	0.000 ppb	-0.039 ppb	-0.298 ppb	-1.313 ppb	0.002 ppb	0.028 ppb	-0.030 ppb
Concentration per Run 1	103.024 %	0.000 ppb	0.000 ppb	-0.052 ppb	-0.319 ppb	-0.294 ppb	-0.025 ppb	0.028 ppb	-0.065 ppb
Concentration per Run 2	102.851 %	0.085 ppb	0.000 ppb	-0.052 ppb	-0.319 ppb	-1.810 ppb	0.035 ppb	0.028 ppb	-0.013 ppb
Concentration per Run 3	103.251 %	0.000 ppb	0.000 ppb	-0.014 ppb	-0.257 ppb	-1.834 ppb	-0.005 ppb	0.028 ppb	-0.012 ppb
Recovery Percentage 1		5.681 %	0.000 %	-3.933 %	-29.815 %	-2.626 %	0.334 %	1.388 %	-3.012 %
Concentration RSD	0.2 %	173.2 %		55.3 %	12.0 %	67.2 %	1,843.5 %	1.2 %	101.3 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	-0.046 ppb	94.740 %	0.159 ppb	0.624 ppb	0.059 ppb	0.618 ppb	94.181 %	0.094 ppb	0.014 ppb
Concentration per Run 1	-0.022 ppb	97.016 %	0.154 ppb	0.578 ppb	0.054 ppb	0.594 ppb	93.329 %	0.072 ppb	0.007 ppb
Concentration per Run 2	-0.044 ppb	94.778 %	0.116 ppb	0.443 ppb	0.106 ppb	0.420 ppb	95.286 %	0.109 ppb	0.018 ppb
Concentration per Run 3	-0.073 ppb	92.426 %	0.207 ppb	0.851 ppb	0.016 ppb	0.841 ppb	93.928 %	0.100 ppb	0.018 ppb
Recovery Percentage 1	-0.464 %	94.740 %	31.832 %	12.478 %	11.750 %	30.921 %		23.486 %	7.137 %
Concentration RSD	55.9 %	2.4 %	28.7 %	33.3 %	77.5 %	34.3 %	1.1 %	20.4 %	42.9 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	95.939 %	0.790 ppb	3.524 ppb	0.004 ppb	93.348 %	93.619 %	0.044 ppb	0.051 ppb	96.099 %
Concentration per Run 1	96.626 %	0.796 ppb	3.282 ppb	0.032 ppb	92.922 %	92.374 %	0.039 ppb	0.056 ppb	94.908 %
Concentration per Run 2	96.590 %	0.878 ppb	3.697 ppb	-0.024 ppb	92.500 %	94.402 %	0.045 ppb	0.047 ppb	96.377 %
Concentration per Run 3	94.602 %	0.695 ppb	3.591 ppb	0.004 ppb	94.622 %	94.080 %	0.048 ppb	0.049 ppb	97.012 %
Recovery Percentage 1		26.327 %	88.090 %	0.714 %			8.712 %	10.146 %	96.099 %
Concentration RSD	1.2 %	11.6 %	6.1 %	783.8 %	1.2 %	1.2 %	10.4 %	9.1 %	1.1 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 152 Analysis started at: 4/5/2017 4:33:59 PM Rack: 2
 Analysis label: L170978-18 6020TL User name: ALPHALAB\metals-instrument Vial: 51

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	96.534 %	100.140 %	0.003 ppb	63.192 ppb	0.046 ppb	2.715 ppb	13.533 ppb	7.513 ppb	94.290 %
Concentration per Run 1	97.093 %	100.000 %	0.002 ppb	66.629 ppb	-1.402 ppb	2.089 ppb	30.782 ppb	8.922 ppb	97.472 %
Concentration per Run 2	96.068 %	98.603 %	0.002 ppb	60.440 ppb	1.854 ppb	2.153 ppb	6.316 ppb	9.301 ppb	95.000 %
Concentration per Run 3	96.442 %	101.816 %	0.006 ppb	62.506 ppb	-0.312 ppb	3.903 ppb	3.501 ppb	4.318 ppb	90.398 %
Concentration RSD	0.5 %	1.6 %	83.2 %	5.0 %	3,571.1 %	37.9 %	110.9 %	36.9 %	3.8 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	96.024 %	0.140 ppb	0.059 ppb	0.209 ppb	-0.428 ppb	-0.307 ppb	-0.019 ppb	0.003 ppb	0.188 ppb
Concentration per Run 1	97.288 %	0.162 ppb	0.115 ppb	0.176 ppb	-0.450 ppb	-1.904 ppb	-0.006 ppb	-0.047 ppb	0.278 ppb
Concentration per Run 2	96.044 %	0.083 ppb	0.000 ppb	0.229 ppb	-0.385 ppb	-1.836 ppb	-0.025 ppb	-0.047 ppb	0.195 ppb
Concentration per Run 3	94.739 %	0.174 ppb	0.062 ppb	0.221 ppb	-0.450 ppb	2.819 ppb	-0.025 ppb	0.104 ppb	0.092 ppb
Concentration RSD	1.3 %	35.2 %	97.6 %	13.5 %	8.7 %	881.9 %	57.8 %	2,736.9 %	49.4 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	-0.258 ppb	98.271 %	0.016 ppb	0.742 ppb	0.092 ppb	0.321 ppb	93.680 %	0.000 ppb	0.000 ppb
Concentration per Run 1	-0.154 ppb	102.967 %	-0.014 ppb	0.935 ppb	0.075 ppb	0.111 ppb	95.617 %	-0.002 ppb	-0.003 ppb
Concentration per Run 2	-0.344 ppb	95.439 %	0.031 ppb	-0.197 ppb	0.094 ppb	0.392 ppb	93.082 %	0.015 ppb	0.007 ppb
Concentration per Run 3	-0.277 ppb	96.405 %	0.030 ppb	1.488 ppb	0.107 ppb	0.462 ppb	92.341 %	-0.013 ppb	-0.003 ppb
Concentration RSD	37.2 %	4.2 %	162.4 %	115.8 %	17.6 %	57.8 %	1.8 %	8,472.2 %	2,786.6 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	95.576 %	0.457 ppb	1.560 ppb	0.013 ppb	93.420 %	93.817 %	0.016 ppb	0.036 ppb	99.467 %
Concentration per Run 1	97.696 %	0.511 ppb	1.549 ppb	0.030 ppb	94.726 %	96.713 %	0.008 ppb	0.032 ppb	103.354 %
Concentration per Run 2	94.989 %	0.470 ppb	1.566 ppb	-0.024 ppb	92.721 %	93.648 %	0.019 ppb	0.030 ppb	96.725 %
Concentration per Run 3	94.044 %	0.392 ppb	1.566 ppb	0.033 ppb	92.811 %	91.090 %	0.021 ppb	0.047 ppb	98.321 %
Concentration RSD	2.0 %	13.2 %	0.6 %	249.0 %	1.2 %	3.0 %	45.4 %	25.9 %	3.5 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 153 Analysis started at: 4/5/2017 4:37:22 PM Rack: 3
 Analysis label: L1709964-07 6020TL User name: ALPHALAB\metals-instrument Vial: 1

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	97.980 %	100.978 %	0.006 ppb	44.372 ppb	0.365 ppb	1.058 ppb	28.792 ppb	2.415 ppb	95.767 %
Concentration per Run 1	97.748 %	109.358 %	0.015 ppb	44.779 ppb	1.746 ppb	1.670 ppb	19.041 ppb	6.412 ppb	89.631 %
Concentration per Run 2	98.984 %	97.626 %	0.002 ppb	48.509 ppb	-0.322 ppb	1.076 ppb	23.905 ppb	-4.694 ppb	97.131 %
Concentration per Run 3	97.208 %	95.950 %	0.002 ppb	39.828 ppb	-0.329 ppb	0.428 ppb	43.431 ppb	5.527 ppb	100.540 %
Concentration RSD	0.9 %	7.2 %	128.1 %	9.8 %	327.7 %	58.7 %	44.8 %	255.6 %	5.8 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	97.172 %	0.027 ppb	0.000 ppb	0.033 ppb	-0.217 ppb	0.585 ppb	-0.019 ppb	-0.047 ppb	-0.013 ppb
Concentration per Run 1	96.540 %	0.000 ppb	0.000 ppb	0.016 ppb	-0.312 ppb	-1.725 ppb	-0.025 ppb	-0.047 ppb	-0.009 ppb
Concentration per Run 2	98.095 %	0.082 ppb	0.000 ppb	0.024 ppb	-0.196 ppb	-0.382 ppb	-0.006 ppb	-0.047 ppb	-0.065 ppb
Concentration per Run 3	96.881 %	0.000 ppb	0.000 ppb	0.058 ppb	-0.142 ppb	3.861 ppb	-0.025 ppb	-0.047 ppb	0.036 ppb
Concentration RSD	0.8 %	173.2 %		67.2 %	40.1 %	498.8 %	60.6 %	0.0 %	391.5 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	10.121 ppb	93.676 %	0.004 ppb	0.317 ppb	1.744 ppb	0.176 ppb	91.757 %	-0.011 ppb	0.000 ppb
Concentration per Run 1	11.507 ppb	87.301 %	-0.007 ppb	-0.183 ppb	2.012 ppb	0.159 ppb	90.164 %	-0.008 ppb	-0.003 ppb
Concentration per Run 2	9.400 ppb	96.202 %	-0.053 ppb	0.644 ppb	1.592 ppb	0.150 ppb	93.132 %	-0.013 ppb	-0.003 ppb
Concentration per Run 3	9.456 ppb	97.525 %	0.071 ppb	0.490 ppb	1.629 ppb	0.220 ppb	91.975 %	-0.012 ppb	0.008 ppb
Concentration RSD	11.9 %	5.9 %	1,758.2 %	138.8 %	13.3 %	21.6 %	1.6 %	22.3 %	1,666.3 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	91.479 %	0.263 ppb	0.801 ppb	5.156 ppb	89.775 %	92.167 %	0.007 ppb	0.013 ppb	92.574 %
Concentration per Run 1	91.285 %	0.150 ppb	0.676 ppb	4.927 ppb	89.055 %	93.307 %	0.005 ppb	0.016 ppb	91.864 %
Concentration per Run 2	93.917 %	0.358 ppb	0.767 ppb	5.161 ppb	90.535 %	92.675 %	0.006 ppb	0.007 ppb	92.676 %
Concentration per Run 3	89.236 %	0.281 ppb	0.961 ppb	5.380 ppb	89.736 %	90.518 %	0.011 ppb	0.014 ppb	93.182 %
Concentration RSD	2.6 %	39.8 %	18.2 %	4.4 %	0.8 %	1.6 %	42.9 %	35.9 %	0.7 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 154 Analysis started at: 4/5/2017 4:40:45 PM Rack: 3
 Analysis label: L1710301-11D10 A2-6020T User name: ALPHALAB\metals-instrument Vial: 5

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	98.227 %	96.136 %	1.717 ppb	4,117.398 ppb	1,059.045 ppb	4,291.501 ppb	1,573.807 ppb	557.075 ppb	102.471 %
Concentration per Run 1	100.538 %	92.458 %	1.832 ppb	4,377.407 ppb	1,121.155 ppb	4,712.296 ppb	1,769.276 ppb	638.982 ppb	95.256 %
Concentration per Run 2	97.438 %	99.441 %	1.669 ppb	3,888.155 ppb	995.917 ppb	4,051.159 ppb	1,528.332 ppb	509.274 ppb	107.358 %
Concentration per Run 3	96.703 %	96.508 %	1.650 ppb	4,086.631 ppb	1,060.065 ppb	4,111.048 ppb	1,423.814 ppb	522.968 ppb	104.801 %
Concentration RSD	2.1 %	3.6 %	5.8 %	6.0 %	5.9 %	8.5 %	11.3 %	12.8 %	6.2 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	107.731 %	47.444 ppb	30.012 ppb	12.773 ppb	8.775 ppb	1,949.888 ppb	43.377 ppb	48.696 ppb	18.418 ppb
Concentration per Run 1	111.100 %	51.664 ppb	34.086 ppb	14.212 ppb	8.435 ppb	2,209.404 ppb	46.106 ppb	52.862 ppb	19.701 ppb
Concentration per Run 2	105.084 %	50.469 ppb	28.832 ppb	11.397 ppb	8.999 ppb	1,806.532 ppb	42.208 ppb	46.462 ppb	18.526 ppb
Concentration per Run 3	107.010 %	40.198 ppb	27.119 ppb	12.710 ppb	8.893 ppb	1,833.729 ppb	41.818 ppb	46.765 ppb	17.025 ppb
Concentration RSD	2.9 %	13.3 %	12.1 %	11.0 %	3.4 %	11.5 %	5.5 %	7.4 %	7.3 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	50.002 ppb	95.556 %	4.156 ppb	8.318 ppb	15.792 ppb	0.696 ppb	91.582 %	0.035 ppb	0.015 ppb
Concentration per Run 1	55.009 ppb	89.401 %	4.205 ppb	9.542 ppb	16.867 ppb	0.478 ppb	90.931 %	0.019 ppb	0.029 ppb
Concentration per Run 2	49.357 ppb	97.350 %	4.775 ppb	8.831 ppb	15.632 ppb	1.014 ppb	92.028 %	0.047 ppb	0.007 ppb
Concentration per Run 3	45.640 ppb	99.918 %	3.489 ppb	6.582 ppb	14.876 ppb	0.596 ppb	91.786 %	0.039 ppb	0.008 ppb
Concentration RSD	9.4 %	5.7 %	15.5 %	18.6 %	6.4 %	40.5 %	0.6 %	40.3 %	84.9 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	94.283 %	1.051 ppb	0.564 ppb	37.039 ppb	96.662 %	93.632 %	0.292 ppb	23.350 ppb	95.216 %
Concentration per Run 1	94.841 %	1.045 ppb	0.552 ppb	37.410 ppb	96.538 %	92.685 %	0.271 ppb	23.328 ppb	93.524 %
Concentration per Run 2	94.604 %	1.178 ppb	0.595 ppb	36.594 ppb	95.525 %	93.869 %	0.296 ppb	23.552 ppb	96.042 %
Concentration per Run 3	93.404 %	0.929 ppb	0.545 ppb	37.114 ppb	97.925 %	94.341 %	0.307 ppb	23.172 ppb	96.082 %
Concentration RSD	0.8 %	11.9 %	4.8 %	1.1 %	1.2 %	0.9 %	6.3 %	0.8 %	1.5 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 155 Analysis started at: 4/5/2017 4:44:08 PM Rack: 3
 Analysis label: L1710301-12D10 A2-6020T User name: ALPHALAB\metals-instrument Vial: 6

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	97.243 %	100.186 %	2.195 ppb	4,118.434 ppb	947.119 ppb	3,225.168 ppb	1,602.961 ppb	887.545 ppb	97.926 %
Concentration per Run 1	98.378 %	100.140 %	2.247 ppb	4,013.861 ppb	895.127 ppb	3,222.451 ppb	1,602.411 ppb	880.806 ppb	98.324 %
Concentration per Run 2	97.967 %	97.905 %	2.192 ppb	4,241.104 ppb	965.864 ppb	3,301.780 ppb	1,598.220 ppb	867.069 ppb	96.279 %
Concentration per Run 3	95.384 %	102.514 %	2.146 ppb	4,100.336 ppb	980.365 ppb	3,151.272 ppb	1,608.252 ppb	914.758 ppb	99.176 %
Concentration RSD	1.7 %	2.3 %	2.3 %	2.8 %	4.8 %	2.3 %	0.3 %	2.8 %	1.5 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	104.752 %	69.742 ppb	38.352 ppb	12.769 ppb	29.345 ppb	5,941.489 ppb	77.721 ppb	35.581 ppb	24.590 ppb
Concentration per Run 1	104.667 %	61.677 ppb	38.992 ppb	11.833 ppb	29.309 ppb	5,663.263 ppb	77.210 ppb	39.445 ppb	28.123 ppb
Concentration per Run 2	104.203 %	74.642 ppb	38.676 ppb	13.856 ppb	30.931 ppb	6,115.685 ppb	76.600 ppb	32.640 ppb	22.365 ppb
Concentration per Run 3	105.385 %	72.906 ppb	37.389 ppb	12.620 ppb	27.796 ppb	6,045.518 ppb	79.353 ppb	34.658 ppb	23.283 ppb
Concentration RSD	0.6 %	10.1 %	2.2 %	8.0 %	5.3 %	4.1 %	1.9 %	9.8 %	12.6 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	52.666 ppb	94.362 %	3.673 ppb	5.830 ppb	14.446 ppb	0.404 ppb	92.975 %	0.056 ppb	0.026 ppb
Concentration per Run 1	52.947 ppb	90.673 %	3.610 ppb	5.716 ppb	14.469 ppb	0.354 ppb	96.085 %	0.070 ppb	0.017 ppb
Concentration per Run 2	52.927 ppb	96.677 %	3.685 ppb	5.572 ppb	14.316 ppb	0.562 ppb	93.136 %	0.043 ppb	0.008 ppb
Concentration per Run 3	52.126 ppb	95.735 %	3.725 ppb	6.204 ppb	14.554 ppb	0.296 ppb	89.703 %	0.057 ppb	0.052 ppb
Concentration RSD	0.9 %	3.4 %	1.6 %	5.7 %	0.8 %	34.5 %	3.4 %	24.5 %	91.2 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	94.024 %	1.301 ppb	0.648 ppb	19.692 ppb	95.603 %	93.718 %	0.396 ppb	31.529 ppb	96.347 %
Concentration per Run 1	97.867 %	1.271 ppb	0.625 ppb	19.061 ppb	100.084 %	95.938 %	0.351 ppb	29.586 ppb	100.137 %
Concentration per Run 2	92.574 %	1.267 ppb	0.581 ppb	19.224 ppb	93.503 %	94.315 %	0.430 ppb	31.774 ppb	95.004 %
Concentration per Run 3	91.629 %	1.366 ppb	0.739 ppb	20.790 ppb	93.222 %	90.901 %	0.408 ppb	33.229 ppb	93.900 %
Concentration RSD	3.6 %	4.3 %	12.6 %	4.8 %	4.1 %	2.7 %	10.3 %	5.8 %	3.5 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 156 Analysis started at: 4/5/2017 4:47:31 PM Rack: 2
Analysis label: L1709890-08 6020TL User name: ALPHALAB\metals-instrument Vial: 52

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	94.361 %	95.624 %	0.067 ppb	122,734.690 ppb	1,712.049 ppb	1,412.796 ppb	1,165.513 ppb	8,890.838 ppb	93.722 %
Concentration per Run 1	95.964 %	94.134 %	0.058 ppb	129,241.388 ppb	1,748.920 ppb	1,489.041 ppb	1,185.220 ppb	9,290.798 ppb	92.273 %
Concentration per Run 2	94.214 %	96.229 %	0.054 ppb	121,580.958 ppb	1,667.147 ppb	1,382.679 ppb	1,200.722 ppb	8,706.764 ppb	90.569 %
Concentration per Run 3	92.904 %	96.508 %	0.089 ppb	117,381.722 ppb	1,720.080 ppb	1,366.667 ppb	1,110.598 ppb	8,674.950 ppb	98.324 %
Concentration RSD	1.6 %	1.4 %	28.4 %	4.9 %	2.4 %	4.7 %	4.1 %	3.9 %	4.3 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	97.995 %	16.644 ppb	19.581 ppb	2.947 ppb	23.016 ppb	1,243.089 ppb	2.987 ppb	4.149 ppb	6.996 ppb
Concentration per Run 1	100.225 %	15.785 ppb	19.872 ppb	3.099 ppb	23.370 ppb	1,255.208 ppb	3.126 ppb	3.790 ppb	7.084 ppb
Concentration per Run 2	97.122 %	18.635 ppb	19.633 ppb	2.860 ppb	22.825 ppb	1,270.173 ppb	3.235 ppb	4.222 ppb	7.480 ppb
Concentration per Run 3	96.637 %	15.511 ppb	19.239 ppb	2.883 ppb	22.853 ppb	1,203.887 ppb	2.600 ppb	4.436 ppb	6.423 ppb
Concentration RSD	2.0 %	10.4 %	1.6 %	4.5 %	1.3 %	2.8 %	11.4 %	7.9 %	7.6 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	31.221 ppb	91.455 %	2.663 ppb	0.686 ppb	49.101 ppb	0.290 ppb	88.756 %	-0.005 ppb	0.087 ppb
Concentration per Run 1	32.523 ppb	88.420 %	2.897 ppb	1.363 ppb	53.045 ppb	0.237 ppb	86.846 %	-0.003 ppb	0.089 ppb
Concentration per Run 2	31.187 ppb	94.778 %	3.210 ppb	0.276 ppb	45.891 ppb	0.331 ppb	90.341 %	0.004 ppb	0.085 ppb
Concentration per Run 3	29.954 ppb	91.167 %	1.884 ppb	0.421 ppb	48.368 ppb	0.302 ppb	89.080 %	-0.016 ppb	0.087 ppb
Concentration RSD	4.1 %	3.5 %	26.0 %	86.0 %	7.4 %	16.5 %	2.0 %	193.4 %	1.9 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	89.372 %	0.221 ppb	0.363 ppb	74.924 ppb	92.007 %	90.099 %	0.063 ppb	1.393 ppb	88.028 %
Concentration per Run 1	88.127 %	0.184 ppb	0.278 ppb	79.579 ppb	90.187 %	87.326 %	0.068 ppb	1.429 ppb	87.182 %
Concentration per Run 2	91.268 %	0.272 ppb	0.393 ppb	70.055 ppb	93.137 %	92.386 %	0.057 ppb	1.381 ppb	87.507 %
Concentration per Run 3	88.722 %	0.207 ppb	0.418 ppb	75.137 ppb	92.698 %	90.584 %	0.064 ppb	1.369 ppb	89.394 %
Concentration RSD	1.9 %	20.5 %	20.6 %	6.4 %	1.7 %	2.8 %	8.7 %	2.3 %	1.4 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 157 Analysis started at: 4/5/2017 4:50:54 PM Rack: 2
Analysis label: L1709899-02 6020TL User name: ALPHALAB\metals-instrument Vial: 53

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	91.891 %	90.828 %	0.022 ppb	383,836.187 ppb	33,620.591 ppb	199.957 ppb	21,108.055 ppb	25,403.659 ppb	89.859 %
Concentration per Run 1	91.310 %	92.458 %	0.036 ppb	397,888.598 ppb	35,519.765 ppb	221.148 ppb	22,211.416 ppb	29,005.301 ppb	84.092 %
Concentration per Run 2	93.020 %	90.922 %	0.012 ppb	376,748.443 ppb	32,751.710 ppb	188.009 ppb	20,540.436 ppb	23,540.179 ppb	92.870 %
Concentration per Run 3	91.344 %	89.106 %	0.017 ppb	376,871.519 ppb	32,590.298 ppb	190.713 ppb	20,572.315 ppb	23,665.498 ppb	92.614 %
Concentration RSD	1.1 %	1.8 %	60.9 %	3.2 %	4.9 %	9.2 %	4.5 %	12.3 %	5.6 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	95.165 %	40.469 ppb	2.016 ppb	1.079 ppb	39.969 ppb	793.720 ppb	0.351 ppb	1.673 ppb	1.544 ppb
Concentration per Run 1	95.137 %	43.519 ppb	1.934 ppb	1.196 ppb	42.863 ppb	874.196 ppb	0.238 ppb	2.252 ppb	1.766 ppb
Concentration per Run 2	96.390 %	37.012 ppb	2.028 ppb	1.054 ppb	39.870 ppb	757.114 ppb	0.368 ppb	1.506 ppb	1.253 ppb
Concentration per Run 3	93.968 %	40.877 ppb	2.085 ppb	0.988 ppb	37.172 ppb	749.851 ppb	0.447 ppb	1.260 ppb	1.613 ppb
Concentration RSD	1.3 %	8.1 %	3.8 %	9.9 %	7.1 %	8.8 %	30.0 %	30.9 %	17.0 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	9.142 ppb	89.539 %	1.746 ppb	0.344 ppb	262.352 ppb	0.729 ppb	82.967 %	-0.011 ppb	0.165 ppb
Concentration per Run 1	10.013 ppb	88.013 %	2.185 ppb	0.661 ppb	277.560 ppb	0.905 ppb	81.996 %	-0.003 ppb	0.183 ppb
Concentration per Run 2	9.375 ppb	89.284 %	1.433 ppb	0.830 ppb	259.652 ppb	0.670 ppb	82.014 %	-0.020 ppb	0.152 ppb
Concentration per Run 3	8.039 ppb	91.319 %	1.620 ppb	-0.459 ppb	249.845 ppb	0.612 ppb	84.893 %	-0.012 ppb	0.161 ppb
Concentration RSD	11.0 %	1.9 %	22.4 %	203.8 %	5.4 %	21.3 %	2.0 %	76.0 %	9.7 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	86.824 %	0.125 ppb	0.425 ppb	10.642 ppb	88.471 %	87.390 %	0.013 ppb	0.375 ppb	81.302 %
Concentration per Run 1	88.635 %	0.108 ppb	0.321 ppb	10.436 ppb	87.672 %	85.783 %	0.007 ppb	0.386 ppb	81.358 %
Concentration per Run 2	85.588 %	0.102 ppb	0.480 ppb	11.515 ppb	88.050 %	89.059 %	0.011 ppb	0.367 ppb	82.305 %
Concentration per Run 3	86.251 %	0.165 ppb	0.475 ppb	9.974 ppb	89.691 %	87.327 %	0.022 ppb	0.371 ppb	80.243 %
Concentration RSD	1.8 %	27.8 %	21.3 %	7.4 %	1.2 %	1.9 %	58.4 %	2.7 %	1.3 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 158 Analysis started at: 4/5/2017 4:54:17 PM Rack: 2
 Analysis label: L1709899-03 6020TL User name: ALPHALAB\metals-instrument Vial: 54

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	90.098 %	87.989 %	0.075 ppb	776,055.470 ppb	76,002.913 ppb	902.861 ppb	29,218.542 ppb	27,462.621 ppb	90.313 %
Concentration per Run 1	90.694 %	89.944 %	0.086 ppb	758,427.827 ppb	73,796.040 ppb	880.332 ppb	27,734.092 ppb	26,020.292 ppb	95.938 %
Concentration per Run 2	90.404 %	88.687 %	0.052 ppb	765,859.255 ppb	75,878.990 ppb	878.148 ppb	29,421.539 ppb	27,738.397 ppb	89.291 %
Concentration per Run 3	89.196 %	85.335 %	0.087 ppb	803,879.327 ppb	78,333.708 ppb	950.104 ppb	30,499.995 ppb	28,629.173 ppb	85.711 %
Concentration RSD	0.9 %	2.7 %	27.1 %	3.1 %	3.0 %	4.5 %	4.8 %	4.8 %	5.7 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	95.669 %	82.572 ppb	3.503 ppb	2.511 ppb	53.457 ppb	1,100.516 ppb	1.237 ppb	2.786 ppb	8.071 ppb
Concentration per Run 1	95.118 %	80.061 ppb	2.839 ppb	2.453 ppb	53.095 ppb	1,063.600 ppb	1.367 ppb	3.001 ppb	8.286 ppb
Concentration per Run 2	97.042 %	83.453 ppb	4.022 ppb	2.528 ppb	52.176 ppb	1,139.563 ppb	0.984 ppb	3.013 ppb	8.299 ppb
Concentration per Run 3	94.846 %	84.201 ppb	3.648 ppb	2.551 ppb	55.100 ppb	1,098.385 ppb	1.360 ppb	2.343 ppb	7.627 ppb
Concentration RSD	1.3 %	2.7 %	17.3 %	2.0 %	2.8 %	3.5 %	17.7 %	13.8 %	4.8 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	19.709 ppb	87.759 %	1.569 ppb	0.935 ppb	462.211 ppb	4.401 ppb	80.127 %	0.000 ppb	0.047 ppb
Concentration per Run 1	20.263 ppb	85.317 %	1.642 ppb	0.447 ppb	484.367 ppb	3.701 ppb	81.267 %	-0.007 ppb	0.033 ppb
Concentration per Run 2	19.241 ppb	86.385 %	1.623 ppb	0.750 ppb	455.919 ppb	4.646 ppb	78.834 %	0.017 ppb	0.098 ppb
Concentration per Run 3	19.624 ppb	91.573 %	1.442 ppb	1.608 ppb	446.348 ppb	4.856 ppb	80.280 %	-0.011 ppb	0.009 ppb
Concentration RSD	2.6 %	3.8 %	7.0 %	64.4 %	4.3 %	14.0 %	1.5 %	314,891.7 %	98.5 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	81.171 %	1.373 ppb	0.743 ppb	13.357 ppb	86.545 %	86.987 %	0.018 ppb	1.148 ppb	80.107 %
Concentration per Run 1	83.598 %	1.092 ppb	0.778 ppb	13.016 ppb	88.394 %	90.526 %	0.018 ppb	1.071 ppb	83.073 %
Concentration per Run 2	79.317 %	1.464 ppb	0.740 ppb	14.140 ppb	85.045 %	85.309 %	0.015 ppb	1.142 ppb	80.383 %
Concentration per Run 3	80.597 %	1.563 ppb	0.712 ppb	12.914 ppb	86.198 %	85.125 %	0.019 ppb	1.231 ppb	76.863 %
Concentration RSD	2.7 %	18.1 %	4.4 %	5.1 %	2.0 %	3.5 %	12.0 %	7.0 %	3.9 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 159 Analysis started at: 4/5/2017 4:57:39 PM Rack: 2
 Analysis label: L1709899-04 6020TL User name: ALPHALAB\metals-instrument Vial: 55

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	92.053 %	95.205 %	0.008 ppb	225,901.482 ppb	8,731.708 ppb	50.633 ppb	9,363.025 ppb	37,228.017 ppb	90.029 %
Concentration per Run 1	92.018 %	96.508 %	-0.003 ppb	232,767.751 ppb	8,734.175 ppb	51.245 ppb	10,098.319 ppb	40,378.510 ppb	84.263 %
Concentration per Run 2	92.362 %	95.810 %	-0.003 ppb	219,016.618 ppb	8,539.960 ppb	44.166 ppb	8,740.927 ppb	35,727.511 ppb	94.148 %
Concentration per Run 3	91.779 %	93.296 %	0.031 ppb	225,920.075 ppb	8,920.989 ppb	56.489 ppb	9,249.828 ppb	35,578.029 ppb	91.677 %
Concentration RSD	0.3 %	1.8 %	234.1 %	3.0 %	2.2 %	12.2 %	7.3 %	7.3 %	5.7 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	94.979 %	54.302 ppb	1.008 ppb	0.643 ppb	28.423 ppb	2,977.177 ppb	0.232 ppb	1.334 ppb	1.506 ppb
Concentration per Run 1	95.623 %	58.956 ppb	1.190 ppb	0.625 ppb	28.539 ppb	3,015.903 ppb	0.234 ppb	1.564 ppb	1.946 ppb
Concentration per Run 2	94.014 %	53.264 ppb	0.971 ppb	0.709 ppb	30.173 ppb	3,029.445 ppb	0.282 ppb	0.951 ppb	1.510 ppb
Concentration per Run 3	95.298 %	50.687 ppb	0.863 ppb	0.596 ppb	26.558 ppb	2,886.182 ppb	0.180 ppb	1.486 ppb	1.064 ppb
Concentration RSD	0.9 %	7.8 %	16.5 %	9.2 %	6.4 %	2.7 %	22.1 %	25.0 %	29.3 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	28.538 ppb	91.298 %	15.832 ppb	0.372 ppb	257.608 ppb	0.703 ppb	84.293 %	-0.014 ppb	3.504 ppb
Concentration per Run 1	29.458 ppb	91.002 %	15.449 ppb	0.232 ppb	266.511 ppb	0.835 ppb	85.004 %	-0.016 ppb	2.962 ppb
Concentration per Run 2	27.968 ppb	90.200 %	16.360 ppb	0.883 ppb	262.629 ppb	0.746 ppb	81.765 %	-0.007 ppb	3.830 ppb
Concentration per Run 3	28.188 ppb	92.692 %	15.689 ppb	0.002 ppb	243.685 ppb	0.529 ppb	86.109 %	-0.020 ppb	3.721 ppb
Concentration RSD	2.8 %	1.4 %	3.0 %	122.7 %	4.7 %	22.4 %	2.7 %	47.3 %	13.5 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	86.471 %	0.113 ppb	0.337 ppb	13.031 ppb	88.449 %	89.051 %	0.006 ppb	0.565 ppb	84.402 %
Concentration per Run 1	87.906 %	0.122 ppb	0.367 ppb	13.108 ppb	86.925 %	91.714 %	0.001 ppb	0.530 ppb	88.953 %
Concentration per Run 2	87.205 %	0.047 ppb	0.340 ppb	13.327 ppb	87.546 %	87.548 %	0.006 ppb	0.622 ppb	79.520 %
Concentration per Run 3	84.302 %	0.171 ppb	0.304 ppb	12.657 ppb	90.876 %	87.890 %	0.011 ppb	0.543 ppb	84.733 %
Concentration RSD	2.2 %	54.9 %	9.4 %	2.6 %	2.4 %	2.6 %	83.4 %	8.8 %	5.6 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 160 Analysis started at: 4/5/2017 5:01:02 PM Rack: 2
 Analysis label: L1709899-05 6020TL User name: ALPHALAB\metals-instrument Vial: 56

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	88.757 %	91.620 %	0.137 ppb	411,893.037 ppb	10,489.361 ppb	2,110.290 ppb	20,709.225 ppb	53,941.753 ppb	91.308 %
Concentration per Run 1	89.378 %	92.179 %	0.147 ppb	396,839.290 ppb	9,876.136 ppb	2,061.276 ppb	19,790.164 ppb	51,194.036 ppb	96.194 %
Concentration per Run 2	89.357 %	92.318 %	0.128 ppb	417,099.271 ppb	10,655.308 ppb	2,140.837 ppb	20,876.839 ppb	55,125.818 ppb	90.313 %
Concentration per Run 3	87.537 %	90.363 %	0.135 ppb	421,740.550 ppb	10,936.639 ppb	2,128.756 ppb	21,460.673 ppb	55,505.405 ppb	87.416 %
Concentration RSD	1.2 %	1.2 %	7.2 %	3.2 %	5.2 %	2.0 %	4.1 %	4.4 %	4.9 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	95.665 %	116.681 ppb	20.830 ppb	27.049 ppb	94.284 ppb	19,023.630 ppb	1.426 ppb	4.317 ppb	43.979 ppb
Concentration per Run 1	98.979 %	112.937 ppb	21.024 ppb	26.535 ppb	89.300 ppb	19,015.264 ppb	1.404 ppb	5.096 ppb	45.254 ppb
Concentration per Run 2	94.173 %	117.927 ppb	19.687 ppb	25.919 ppb	95.383 ppb	18,909.766 ppb	1.559 ppb	4.421 ppb	40.693 ppb
Concentration per Run 3	93.843 %	119.178 ppb	21.779 ppb	28.693 ppb	98.169 ppb	19,145.860 ppb	1.315 ppb	3.435 ppb	45.991 ppb
Concentration RSD	3.0 %	2.8 %	5.1 %	5.4 %	4.8 %	0.6 %	8.7 %	19.3 %	6.5 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	441.926 ppb	88.657 %	13.164 ppb	1.278 ppb	932.062 ppb	1.445 ppb	82.910 %	0.054 ppb	7.157 ppb
Concentration per Run 1	443.997 ppb	85.622 %	14.947 ppb	2.398 ppb	942.012 ppb	1.170 ppb	83.331 %	0.041 ppb	6.837 ppb
Concentration per Run 2	428.660 ppb	93.150 %	11.743 ppb	0.626 ppb	915.793 ppb	1.181 ppb	83.089 %	0.036 ppb	7.263 ppb
Concentration per Run 3	453.122 ppb	87.199 %	12.802 ppb	0.810 ppb	938.381 ppb	1.985 ppb	82.311 %	0.086 ppb	7.371 ppb
Concentration RSD	2.8 %	4.5 %	12.4 %	76.3 %	1.5 %	32.3 %	0.6 %	50.6 %	3.9 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	85.581 %	5.868 ppb	1.033 ppb	113.711 ppb	87.150 %	86.285 %	0.026 ppb	38.882 ppb	85.158 %
Concentration per Run 1	86.422 %	5.593 ppb	0.897 ppb	113.809 ppb	92.114 %	89.573 %	0.028 ppb	38.439 ppb	86.233 %
Concentration per Run 2	86.519 %	6.101 ppb	1.011 ppb	110.765 ppb	84.241 %	85.544 %	0.026 ppb	38.855 ppb	85.550 %
Concentration per Run 3	83.802 %	5.912 ppb	1.191 ppb	116.557 ppb	85.093 %	83.738 %	0.022 ppb	39.352 ppb	83.691 %
Concentration RSD	1.8 %	4.4 %	14.3 %	2.5 %	5.0 %	3.5 %	12.5 %	1.2 %	1.5 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 161 Analysis started at: 4/5/2017 5:04:25 PM Rack: 3
 Analysis label: 9964-10 SCAN User name: ALPHALAB\metals-instrument Vial: 2

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	96.224 %	99.348 %	0.000 ppb	168.464 ppb	1.840 ppb	1.369 ppb	34.025 ppb	33.289 ppb	94.375 %
Concentration per Run 1	96.648 %	96.508 %	0.002 ppb	136.965 ppb	0.798 ppb	0.903 ppb	34.304 ppb	42.065 ppb	94.574 %
Concentration per Run 2	96.603 %	97.905 %	-0.003 ppb	183.595 ppb	2.881 ppb	1.891 ppb	31.885 ppb	19.017 ppb	98.665 %
Concentration per Run 3	95.421 %	103.631 %	0.002 ppb	184.833 ppb	1.842 ppb	1.314 ppb	35.885 ppb	38.785 ppb	89.887 %
Concentration RSD	0.7 %	3.8 %	1,750.6 %	16.2 %	56.6 %	36.2 %	5.9 %	37.5 %	4.7 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	95.908 %	0.111 ppb	0.000 ppb	-0.027 ppb	-0.128 ppb	1.172 ppb	-0.012 ppb	0.126 ppb	0.002 ppb
Concentration per Run 1	98.309 %	0.084 ppb	0.000 ppb	-0.033 ppb	-0.061 ppb	1.191 ppb	0.015 ppb	0.177 ppb	-0.013 ppb
Concentration per Run 2	93.945 %	0.160 ppb	0.000 ppb	0.001 ppb	-0.140 ppb	0.987 ppb	-0.025 ppb	0.095 ppb	0.084 ppb
Concentration per Run 3	95.470 %	0.088 ppb	0.000 ppb	-0.050 ppb	-0.181 ppb	1.338 ppb	-0.025 ppb	0.106 ppb	-0.065 ppb
Concentration RSD	2.3 %	39.0 %		96.3 %	47.9 %	15.1 %	194.7 %	35.1 %	3,762.0 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	-0.258 ppb	96.372 %	-0.011 ppb	0.283 ppb	0.226 ppb	0.036 ppb	92.569 %	-0.019 ppb	0.008 ppb
Concentration per Run 1	-0.407 ppb	94.879 %	-0.011 ppb	0.480 ppb	0.248 ppb	0.012 ppb	96.817 %	-0.021 ppb	0.007 ppb
Concentration per Run 2	-0.330 ppb	99.915 %	-0.013 ppb	0.054 ppb	0.225 ppb	0.013 ppb	89.567 %	-0.016 ppb	0.008 ppb
Concentration per Run 3	-0.036 ppb	94.320 %	-0.010 ppb	0.314 ppb	0.204 ppb	0.084 ppb	91.324 %	-0.020 ppb	0.008 ppb
Concentration RSD	76.0 %	3.2 %	11.0 %	75.8 %	9.9 %	112.7 %	4.1 %	12.7 %	3.1 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	92.681 %	0.005 ppb	0.153 ppb	-0.004 ppb	93.291 %	91.451 %	-0.005 ppb	0.021 ppb	92.089 %
Concentration per Run 1	94.069 %	-0.012 ppb	0.178 ppb	-0.053 ppb	95.453 %	93.092 %	-0.005 ppb	0.010 ppb	94.719 %
Concentration per Run 2	92.141 %	0.050 ppb	0.155 ppb	0.063 ppb	91.767 %	93.304 %	-0.005 ppb	0.023 ppb	92.061 %
Concentration per Run 3	91.832 %	-0.022 ppb	0.127 ppb	-0.024 ppb	92.654 %	87.957 %	-0.004 ppb	0.029 ppb	89.486 %
Concentration RSD	1.3 %	738.3 %	16.5 %	1,360.0 %	2.1 %	3.3 %	13.4 %	46.2 %	2.8 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 162 Analysis started at: 4/5/2017 5:07:48 PM Rack: 0
 Analysis label: CCV User name: ALPHALAB\metals-instrument Vial: 9

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	95.686 %	97.346 %	99.001 ppb	10,187.531 ppb	10,486.555 ppb	108.533 ppb	10,507.676 ppb	10,251.412 ppb	94.716 %
Concentration per Run 1	95.749 %	93.575 %	98.775 ppb	10,362.696 ppb	10,828.053 ppb	116.377 ppb	10,686.850 ppb	10,246.869 ppb	94.148 %
Concentration per Run 2	95.833 %	96.788 %	97.827 ppb	10,112.374 ppb	10,258.429 ppb	102.412 ppb	10,336.827 ppb	10,095.343 ppb	96.875 %
Concentration per Run 3	95.476 %	101.676 %	100.401 ppb	10,087.524 ppb	10,373.182 ppb	106.811 ppb	10,499.351 ppb	10,412.024 ppb	93.125 %
Recovery Percentage 1			99.001 %	101.875 %	104.866 %	108.533 %	105.077 %	102.514 %	
Concentration RSD	0.2 %	4.2 %	1.3 %	1.5 %	2.9 %	6.6 %	1.7 %	1.5 %	2.0 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	96.375 %	100.122 ppb	98.119 ppb	99.736 ppb	104.545 ppb	10,091.145 ppb	102.274 ppb	99.680 ppb	99.521 ppb
Concentration per Run 1	97.927 %	105.835 ppb	98.340 ppb	101.658 ppb	109.165 ppb	10,427.638 ppb	106.668 ppb	102.119 ppb	104.115 ppb
Concentration per Run 2	97.365 %	95.006 ppb	96.927 ppb	98.456 ppb	104.144 ppb	9,671.887 ppb	101.364 ppb	93.194 ppb	98.593 ppb
Concentration per Run 3	93.833 %	99.525 ppb	99.091 ppb	99.096 ppb	100.326 ppb	10,173.910 ppb	98.790 ppb	103.729 ppb	95.856 ppb
Recovery Percentage 1		100.122 %	98.119 %	99.736 %	104.545 %	100.911 %	102.274 %	99.680 %	99.521 %
Concentration RSD	2.3 %	5.4 %	1.1 %	1.7 %	4.2 %	3.8 %	3.9 %	5.7 %	4.2 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	99.732 ppb	95.359 %	99.356 ppb	101.581 ppb	106.637 ppb	101.979 ppb	91.187 %	99.216 ppb	101.647 ppb
Concentration per Run 1	103.563 ppb	91.908 %	101.638 ppb	108.405 ppb	109.444 ppb	103.031 ppb	91.266 %	100.203 ppb	103.318 ppb
Concentration per Run 2	99.651 ppb	95.125 %	101.284 ppb	106.218 ppb	104.990 ppb	101.888 ppb	91.982 %	98.255 ppb	101.531 ppb
Concentration per Run 3	95.983 ppb	99.044 %	95.145 ppb	90.121 ppb	105.476 ppb	101.017 ppb	90.312 %	99.190 ppb	100.092 ppb
Recovery Percentage 1	99.732 %	99.356 %	99.356 %	101.581 %	106.637 %	101.979 %		99.216 %	101.647 %
Concentration RSD	3.8 %	3.7 %	3.7 %	9.8 %	2.3 %	1.0 %	0.9 %	1.0 %	1.6 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	93.648 %	98.987 ppb	97.727 ppb	104.502 ppb	92.520 %	92.433 %	101.708 ppb	99.888 ppb	91.707 %
Concentration per Run 1	92.080 %	101.112 ppb	99.115 ppb	107.667 ppb	94.165 %	94.082 %	103.083 ppb	103.532 ppb	89.398 %
Concentration per Run 2	93.729 %	97.413 ppb	95.823 ppb	101.825 ppb	90.919 %	90.199 %	100.630 ppb	98.879 ppb	92.672 %
Concentration per Run 3	95.137 %	98.435 ppb	98.243 ppb	104.016 ppb	92.476 %	93.017 %	101.411 ppb	97.254 ppb	93.052 %
Recovery Percentage 1		98.987 %	97.727 %	104.502 %			101.708 %	99.888 %	
Concentration RSD	1.6 %	1.9 %	1.7 %	2.8 %	1.8 %	2.2 %	1.2 %	3.3 %	2.2 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 163 Analysis started at: 4/5/2017 5:11:13 PM Rack: 0
 Analysis label: CCB User name: ALPHALAB\metals-instrument Vial: 10

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	97.998 %	98.091 %	0.034 ppb	31.227 ppb	3.271 ppb	0.998 ppb	21.675 ppb	5.497 ppb	97.585 %
Concentration per Run 1	98.911 %	99.302 %	0.033 ppb	33.207 ppb	5.014 ppb	1.058 ppb	42.468 ppb	14.375 ppb	97.301 %
Concentration per Run 2	97.133 %	96.369 %	0.020 ppb	31.866 ppb	4.081 ppb	1.109 ppb	21.820 ppb	3.892 ppb	95.426 %
Concentration per Run 3	97.949 %	98.603 %	0.048 ppb	28.607 ppb	0.718 ppb	0.827 ppb	0.736 ppb	-1.776 ppb	100.028 %
Recovery Percentage 1			6.751 %	31.227 %	4.673 %	9.979 %	21.675 %	5.497 %	
Concentration RSD	0.9 %	1.6 %	40.5 %	7.6 %	69.1 %	15.1 %	96.3 %	149.1 %	2.4 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	97.518 %	0.027 ppb	0.020 ppb	0.009 ppb	-0.409 ppb	4.439 ppb	0.045 ppb	0.049 ppb	0.017 ppb
Concentration per Run 1	97.738 %	0.081 ppb	0.000 ppb	0.041 ppb	-0.326 ppb	2.427 ppb	0.089 ppb	-0.047 ppb	0.182 ppb
Concentration per Run 2	95.976 %	0.000 ppb	0.059 ppb	-0.014 ppb	-0.450 ppb	5.581 ppb	0.014 ppb	0.100 ppb	-0.065 ppb
Concentration per Run 3	98.841 %	0.000 ppb	0.000 ppb	0.001 ppb	-0.450 ppb	5.311 ppb	0.032 ppb	0.096 ppb	-0.065 ppb
Recovery Percentage 1		5.403 %	0.394 %	0.918 %	-40.858 %	8.879 %	8.986 %	2.466 %	1.704 %
Concentration RSD	1.5 %	173.2 %	173.2 %	312.1 %	17.5 %	39.4 %	86.6 %	169.6 %	837.5 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	-0.189 ppb	99.047 %	0.203 ppb	0.554 ppb	0.035 ppb	0.601 ppb	95.335 %	0.132 ppb	0.036 ppb
Concentration per Run 1	-0.303 ppb	101.899 %	0.262 ppb	0.523 ppb	0.037 ppb	0.795 ppb	97.634 %	0.108 ppb	0.039 ppb
Concentration per Run 2	-0.190 ppb	97.258 %	0.071 ppb	0.828 ppb	0.040 ppb	0.554 ppb	94.531 %	0.163 ppb	0.028 ppb
Concentration per Run 3	-0.075 ppb	97.983 %	0.275 ppb	0.310 ppb	0.027 ppb	0.454 ppb	93.841 %	0.126 ppb	0.041 ppb
Recovery Percentage 1	-1.893 %	99.047 %	40.542 %	11.075 %	6.980 %	30.063 %		33.119 %	17.938 %
Concentration RSD	60.4 %	2.5 %	56.4 %	47.0 %	19.5 %	29.1 %	2.1 %	21.3 %	19.3 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	93.964 %	0.753 ppb	3.548 ppb	-0.015 ppb	93.403 %	91.920 %	0.067 ppb	0.080 ppb	93.462 %
Concentration per Run 1	95.102 %	0.727 ppb	3.754 ppb	0.004 ppb	93.847 %	92.545 %	0.068 ppb	0.087 ppb	93.429 %
Concentration per Run 2	97.361 %	0.914 ppb	3.338 ppb	0.002 ppb	95.921 %	91.658 %	0.080 ppb	0.074 ppb	90.957 %
Concentration per Run 3	89.430 %	0.617 ppb	3.553 ppb	-0.053 ppb	90.439 %	91.555 %	0.052 ppb	0.080 ppb	96.001 %
Recovery Percentage 1		25.090 %	88.708 %	-3.094 %			13.342 %	16.066 %	93.462 %
Concentration RSD	4.3 %	20.0 %	5.9 %	207.6 %	3.0 %	0.6 %	20.8 %	8.0 %	2.7 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 164 Analysis started at: 4/5/2017 5:14:39 PM Rack: 3
 Analysis label: WG991289-2D10 A2-6020T User name: ALPHALAB\metals-instrument Vial: 4

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	96.359 %	100.000 %	7.641 ppb	91.680 ppb	208.993 ppb	505.712 ppb	288.281 ppb	434.902 ppb	98.182 %
Concentration per Run 1	97.352 %	97.905 %	7.221 ppb	85.928 ppb	225.215 ppb	510.581 ppb	475.651 ppb	415.192 ppb	105.057 %
Concentration per Run 2	97.057 %	101.676 %	7.803 ppb	104.904 ppb	208.276 ppb	521.788 ppb	236.112 ppb	470.396 ppb	87.927 %
Concentration per Run 3	94.668 %	100.419 %	7.899 ppb	84.209 ppb	193.487 ppb	484.768 ppb	153.078 ppb	419.118 ppb	101.562 %
Concentration RSD	1.5 %	1.9 %	4.8 %	12.5 %	7.6 %	3.8 %	58.1 %	7.1 %	9.2 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	96.816 %	20.680 ppb	8.982 ppb	11.476 ppb	26.071 ppb	1,360.978 ppb	11.953 ppb	9.499 ppb	13.891 ppb
Concentration per Run 1	98.428 %	21.092 ppb	8.300 ppb	11.160 ppb	25.007 ppb	1,344.718 ppb	11.579 ppb	10.602 ppb	14.112 ppb
Concentration per Run 2	96.798 %	20.938 ppb	10.347 ppb	12.027 ppb	28.443 ppb	1,422.325 ppb	12.325 ppb	8.876 ppb	13.942 ppb
Concentration per Run 3	95.223 %	20.010 ppb	8.299 ppb	11.242 ppb	24.765 ppb	1,315.891 ppb	11.955 ppb	9.019 ppb	13.620 ppb
Concentration RSD	1.7 %	2.8 %	13.2 %	4.2 %	7.9 %	4.0 %	3.1 %	10.1 %	1.8 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	15.427 ppb	92.735 %	13.449 ppb	14.582 ppb	8.310 ppb	8.933 ppb	91.323 %	2.550 ppb	7.280 ppb
Concentration per Run 1	15.972 ppb	91.917 %	14.288 ppb	13.635 ppb	8.196 ppb	8.712 ppb	94.128 %	2.497 ppb	6.816 ppb
Concentration per Run 2	14.297 ppb	94.116 %	12.958 ppb	13.491 ppb	8.494 ppb	8.955 ppb	90.789 %	2.664 ppb	7.958 ppb
Concentration per Run 3	16.012 ppb	92.171 %	13.101 ppb	16.619 ppb	8.242 ppb	9.134 ppb	89.053 %	2.490 ppb	7.068 ppb
Concentration RSD	6.3 %	1.3 %	5.4 %	12.1 %	1.9 %	2.4 %	2.8 %	3.9 %	8.2 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	94.544 %	11.273 ppb	19.486 ppb	16.212 ppb	91.402 %	93.041 %	11.163 ppb	11.044 ppb	95.796 %
Concentration per Run 1	95.165 %	11.467 ppb	18.323 ppb	16.240 ppb	94.981 %	94.980 %	10.987 ppb	10.868 ppb	97.948 %
Concentration per Run 2	91.995 %	10.833 ppb	21.473 ppb	16.507 ppb	87.378 %	91.207 %	11.243 ppb	11.106 ppb	95.350 %
Concentration per Run 3	96.471 %	11.520 ppb	18.663 ppb	15.890 ppb	91.848 %	92.937 %	11.258 ppb	11.159 ppb	94.090 %
Concentration RSD	2.4 %	3.4 %	8.9 %	1.9 %	4.2 %	2.0 %	1.4 %	1.4 %	2.1 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 165 Analysis started at: 4/5/2017 5:18:02 PM Rack: 2
 Analysis label: L1709899-06 6020TL User name: ALPHALAB\metals-instrument Vial: 57

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	86.392 %	91.015 %	0.012 ppb	716,790.750 ppb	17,906.750 ppb	86.415 ppb	18,604.868 ppb	72,421.309 ppb	89.376 %
Concentration per Run 1	86.928 %	91.061 %	0.018 ppb	745,646.279 ppb	18,704.289 ppb	87.343 ppb	18,619.794 ppb	73,684.639 ppb	87.586 %
Concentration per Run 2	87.296 %	93.296 %	0.018 ppb	689,231.127 ppb	17,226.827 ppb	77.966 ppb	18,211.642 ppb	70,531.895 ppb	92.785 %
Concentration per Run 3	84.951 %	88.687 %	0.002 ppb	715,494.845 ppb	17,789.133 ppb	93.935 ppb	18,983.167 ppb	73,047.392 ppb	87.757 %
Concentration RSD	1.5 %	2.5 %	70.7 %	3.9 %	4.2 %	9.3 %	2.1 %	2.3 %	3.3 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	94.308 %	108.478 ppb	0.957 ppb	0.935 ppb	6.521 ppb	306.709 ppb	0.061 ppb	5.925 ppb	2.296 ppb
Concentration per Run 1	93.977 %	112.217 ppb	1.291 ppb	0.980 ppb	7.515 ppb	318.847 ppb	0.082 ppb	5.742 ppb	2.360 ppb
Concentration per Run 2	94.815 %	103.276 ppb	0.994 ppb	0.900 ppb	5.142 ppb	295.655 ppb	0.060 ppb	6.258 ppb	1.929 ppb
Concentration per Run 3	94.131 %	109.941 ppb	0.585 ppb	0.923 ppb	6.907 ppb	305.624 ppb	0.040 ppb	5.774 ppb	2.600 ppb
Concentration RSD	0.5 %	4.3 %	37.1 %	4.4 %	18.9 %	3.8 %	34.3 %	4.9 %	14.8 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	344.618 ppb	85.911 %	1.471 ppb	0.290 ppb	875.715 ppb	0.229 ppb	80.565 %	0.031 ppb	11.096 ppb
Concentration per Run 1	340.533 ppb	88.267 %	1.767 ppb	0.033 ppb	869.499 ppb	0.130 ppb	84.277 %	0.028 ppb	10.541 ppb
Concentration per Run 2	350.086 ppb	84.656 %	1.086 ppb	0.727 ppb	867.437 ppb	0.378 ppb	79.399 %	0.025 ppb	11.282 ppb
Concentration per Run 3	343.235 ppb	84.808 %	1.559 ppb	0.111 ppb	890.209 ppb	0.180 ppb	78.020 %	0.041 ppb	11.466 ppb
Concentration RSD	1.4 %	2.4 %	23.7 %	131.0 %	1.4 %	57.1 %	4.1 %	26.2 %	4.4 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	82.716 %	3.633 ppb	1.356 ppb	834.699 ppb	83.946 %	85.882 %	0.058 ppb	1.180 ppb	81.664 %
Concentration per Run 1	84.234 %	3.887 ppb	1.346 ppb	809.660 ppb	87.592 %	88.059 %	0.057 ppb	1.121 ppb	84.228 %
Concentration per Run 2	83.591 %	3.433 ppb	1.348 ppb	815.005 ppb	84.102 %	85.157 %	0.052 ppb	1.168 ppb	81.287 %
Concentration per Run 3	80.325 %	3.580 ppb	1.374 ppb	879.431 ppb	80.144 %	84.429 %	0.067 ppb	1.250 ppb	79.476 %
Concentration RSD	2.5 %	6.4 %	1.1 %	4.7 %	4.4 %	2.2 %	12.5 %	5.5 %	2.9 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 166 Analysis started at: 4/5/2017 5:21:25 PM Rack: 2
 Analysis label: L1709899-07 6020TL User name: ALPHALAB\metals-instrument Vial: 58

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	89.313 %	92.318 %	0.010 ppb	323,331.213 ppb	24,806.713 ppb	58.015 ppb	14,990.172 ppb	48,314.465 ppb	92.785 %
Concentration per Run 1	90.099 %	92.039 %	0.007 ppb	325,315.013 ppb	24,719.521 ppb	56.701 ppb	15,367.730 ppb	49,838.842 ppb	92.785 %
Concentration per Run 2	88.916 %	91.620 %	0.017 ppb	312,698.718 ppb	24,342.498 ppb	59.326 ppb	14,002.078 ppb	45,298.356 ppb	97.045 %
Concentration per Run 3	88.924 %	93.296 %	0.007 ppb	331,979.908 ppb	25,358.119 ppb	58.018 ppb	15,600.709 ppb	49,806.198 ppb	88.524 %
Concentration RSD	0.8 %	0.9 %	56.2 %	3.0 %	2.1 %	2.3 %	5.8 %	5.4 %	4.6 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	97.291 %	71.580 ppb	1.774 ppb	2.376 ppb	176.597 ppb	15,501.438 ppb	0.320 ppb	1.613 ppb	1.516 ppb
Concentration per Run 1	96.833 %	75.511 ppb	1.583 ppb	3.391 ppb	176.759 ppb	15,365.704 ppb	0.278 ppb	1.468 ppb	1.475 ppb
Concentration per Run 2	97.169 %	67.056 ppb	1.462 ppb	1.907 ppb	163.296 ppb	14,697.564 ppb	0.229 ppb	1.713 ppb	1.896 ppb
Concentration per Run 3	97.871 %	72.174 ppb	2.275 ppb	1.831 ppb	189.737 ppb	16,441.045 ppb	0.452 ppb	1.658 ppb	1.175 ppb
Concentration RSD	0.5 %	5.9 %	24.7 %	37.0 %	7.5 %	5.7 %	36.6 %	8.0 %	23.9 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	9.280 ppb	94.448 %	5.281 ppb	0.313 ppb	341.587 ppb	0.881 ppb	86.230 %	0.023 ppb	0.534 ppb
Concentration per Run 1	9.685 ppb	93.811 %	5.477 ppb	0.946 ppb	360.203 ppb	1.189 ppb	85.751 %	0.027 ppb	0.600 ppb
Concentration per Run 2	8.530 ppb	95.834 %	5.610 ppb	0.204 ppb	328.169 ppb	0.618 ppb	89.027 %	0.029 ppb	0.465 ppb
Concentration per Run 3	9.625 ppb	93.697 %	4.757 ppb	-0.210 ppb	336.390 ppb	0.836 ppb	83.913 %	0.014 ppb	0.538 ppb
Concentration RSD	7.0 %	1.3 %	8.7 %	187.1 %	4.9 %	32.8 %	3.0 %	34.8 %	12.7 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	88.072 %	0.623 ppb	0.581 ppb	29.567 ppb	90.420 %	90.218 %	0.015 ppb	1.267 ppb	85.505 %
Concentration per Run 1	87.301 %	0.688 ppb	0.649 ppb	30.527 ppb	85.440 %	88.830 %	0.010 ppb	1.247 ppb	84.537 %
Concentration per Run 2	87.788 %	0.527 ppb	0.465 ppb	28.307 ppb	93.231 %	93.933 %	0.016 ppb	1.276 ppb	86.468 %
Concentration per Run 3	89.128 %	0.656 ppb	0.630 ppb	29.865 ppb	92.590 %	87.892 %	0.019 ppb	1.279 ppb	85.510 %
Concentration RSD	1.1 %	13.7 %	17.4 %	3.9 %	4.8 %	3.6 %	28.2 %	1.4 %	1.1 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 167 Analysis started at: 4/5/2017 5:24:48 PM Rack: 2
 Analysis label: L1709899-08 6020TL User name: ALPHALAB\metals-instrument Vial: 59

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	97.588 %	104.144 %	0.023 ppb	79,483.418 ppb	2,933.214 ppb	296.263 ppb	3,717.584 ppb	35,964.072 ppb	96.165 %
Concentration per Run 1	98.823 %	106.145 %	0.024 ppb	79,060.343 ppb	2,863.246 ppb	296.542 ppb	3,634.105 ppb	35,926.572 ppb	99.517 %
Concentration per Run 2	97.058 %	109.916 %	0.025 ppb	76,391.637 ppb	2,782.051 ppb	283.506 ppb	3,647.260 ppb	35,681.672 ppb	96.705 %
Concentration per Run 3	96.882 %	96.369 %	0.020 ppb	82,998.275 ppb	3,154.344 ppb	308.740 ppb	3,871.386 ppb	36,283.972 ppb	92.273 %
Concentration RSD	1.1 %	6.7 %	11.0 %	4.2 %	6.7 %	4.3 %	3.6 %	0.8 %	3.8 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	98.735 %	59.193 ppb	3.016 ppb	6.092 ppb	214.867 ppb	2,672.031 ppb	0.484 ppb	5.890 ppb	4.316 ppb
Concentration per Run 1	100.249 %	57.296 ppb	2.954 ppb	6.213 ppb	220.026 ppb	2,805.811 ppb	0.485 ppb	6.464 ppb	3.609 ppb
Concentration per Run 2	96.077 %	57.718 ppb	2.996 ppb	5.704 ppb	210.409 ppb	2,526.730 ppb	0.614 ppb	4.448 ppb	4.611 ppb
Concentration per Run 3	99.879 %	62.566 ppb	3.099 ppb	6.359 ppb	214.164 ppb	2,683.551 ppb	0.355 ppb	6.758 ppb	4.729 ppb
Concentration RSD	2.3 %	4.9 %	2.5 %	5.6 %	2.3 %	5.2 %	26.8 %	21.3 %	14.3 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	61.880 ppb	100.424 %	3.356 ppb	0.643 ppb	410.923 ppb	1.635 ppb	94.626 %	0.004 ppb	3.659 ppb
Concentration per Run 1	61.813 ppb	100.271 %	3.512 ppb	0.424 ppb	423.114 ppb	1.309 ppb	95.816 %	0.014 ppb	3.904 ppb
Concentration per Run 2	61.000 ppb	104.341 %	3.493 ppb	0.948 ppb	393.270 ppb	1.754 ppb	95.798 %	0.006 ppb	3.303 ppb
Concentration per Run 3	62.827 ppb	96.660 %	3.063 ppb	0.556 ppb	416.385 ppb	1.843 ppb	92.264 %	-0.009 ppb	3.769 ppb
Concentration RSD	1.5 %	3.8 %	7.6 %	42.4 %	3.8 %	17.5 %	2.2 %	285.4 %	8.6 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	92.688 %	0.210 ppb	0.776 ppb	16.228 ppb	94.800 %	93.269 %	0.016 ppb	2.029 ppb	92.485 %
Concentration per Run 1	92.805 %	0.229 ppb	0.715 ppb	15.526 ppb	95.148 %	92.908 %	0.014 ppb	1.963 ppb	94.341 %
Concentration per Run 2	92.839 %	0.133 ppb	0.824 ppb	16.196 ppb	95.538 %	94.925 %	0.021 ppb	1.959 ppb	95.385 %
Concentration per Run 3	92.421 %	0.267 ppb	0.788 ppb	16.962 ppb	93.715 %	91.973 %	0.013 ppb	2.165 ppb	87.729 %
Concentration RSD	0.3 %	33.0 %	7.2 %	4.4 %	1.0 %	1.6 %	25.2 %	5.8 %	4.5 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 168 Analysis started at: 4/5/2017 5:28:11 PM Rack: 2
 Analysis label: L1709899-09 6020TL User name: ALPHALAB\metals-instrument Vial: 60

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	94.081 %	93.715 %	0.024 ppb	268,935.307 ppb	10,021.245 ppb	216.838 ppb	15,620.947 ppb	23,164.561 ppb	93.665 %
Concentration per Run 1	94.876 %	94.134 %	0.021 ppb	261,970.579 ppb	9,625.059 ppb	209.997 ppb	14,793.857 ppb	21,631.261 ppb	98.153 %
Concentration per Run 2	94.941 %	94.553 %	0.025 ppb	267,404.536 ppb	10,217.334 ppb	221.449 ppb	15,998.084 ppb	23,134.598 ppb	92.529 %
Concentration per Run 3	92.425 %	92.458 %	0.026 ppb	277,430.808 ppb	10,221.342 ppb	219.068 ppb	16,070.900 ppb	24,727.823 ppb	90.313 %
Concentration RSD	1.5 %	1.2 %	12.2 %	2.9 %	3.4 %	2.8 %	4.6 %	6.7 %	4.3 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	98.594 %	37.129 ppb	1.592 ppb	1.538 ppb	34.041 ppb	2,466.768 ppb	0.373 ppb	2.174 ppb	1.705 ppb
Concentration per Run 1	98.603 %	36.544 ppb	1.261 ppb	1.612 ppb	31.423 ppb	2,150.387 ppb	0.354 ppb	1.726 ppb	1.670 ppb
Concentration per Run 2	98.235 %	34.533 ppb	1.524 ppb	1.557 ppb	34.075 ppb	2,525.978 ppb	0.440 ppb	1.995 ppb	1.524 ppb
Concentration per Run 3	98.945 %	40.311 ppb	1.992 ppb	1.445 ppb	36.624 ppb	2,723.939 ppb	0.324 ppb	2.799 ppb	1.922 ppb
Concentration RSD	0.4 %	7.9 %	23.2 %	5.5 %	7.6 %	11.8 %	16.1 %	25.7 %	11.8 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	4.674 ppb	96.270 %	3.822 ppb	0.810 ppb	159.656 ppb	1.841 ppb	88.078 %	-0.012 ppb	0.027 ppb
Concentration per Run 1	4.202 ppb	101.086 %	3.650 ppb	1.608 ppb	150.984 ppb	1.570 ppb	90.305 %	-0.024 ppb	0.018 ppb
Concentration per Run 2	4.772 ppb	94.320 %	3.911 ppb	0.698 ppb	167.743 ppb	2.004 ppb	87.280 %	0.001 ppb	0.031 ppb
Concentration per Run 3	5.048 ppb	93.404 %	3.906 ppb	0.124 ppb	160.240 ppb	1.948 ppb	86.648 %	-0.012 ppb	0.031 ppb
Concentration RSD	9.2 %	4.4 %	3.9 %	92.3 %	5.3 %	12.8 %	2.2 %	106.7 %	28.0 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	90.055 %	0.163 ppb	0.556 ppb	14.518 ppb	90.384 %	92.426 %	0.008 ppb	0.549 ppb	89.934 %
Concentration per Run 1	95.150 %	0.127 ppb	0.363 ppb	13.892 ppb	96.144 %	96.841 %	0.002 ppb	0.496 ppb	97.774 %
Concentration per Run 2	87.135 %	0.124 ppb	0.689 ppb	14.409 ppb	90.343 %	89.468 %	0.013 ppb	0.542 ppb	88.850 %
Concentration per Run 3	87.878 %	0.237 ppb	0.617 ppb	15.253 ppb	84.664 %	90.970 %	0.010 ppb	0.607 ppb	83.177 %
Concentration RSD	4.9 %	39.8 %	30.8 %	4.7 %	6.4 %	4.2 %	69.7 %	10.2 %	8.2 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 169 Analysis started at: 4/5/2017 5:31:34 PM Rack: 3
Analysis label: 9899-02 SCAN User name: ALPHALAB\metals-instrument Vial: 3

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	97.954 %	109.172 %	0.008 ppb	89.968 ppb	2.005 ppb	0.453 ppb	16.744 ppb	7.440 ppb	95.398 %
Concentration per Run 1	97.706 %	105.726 %	0.006 ppb	85.308 ppb	1.765 ppb	0.841 ppb	17.038 ppb	9.849 ppb	92.529 %
Concentration per Run 2	100.080 %	109.637 %	0.006 ppb	93.227 ppb	0.612 ppb	0.355 ppb	-1.382 ppb	8.736 ppb	98.409 %
Concentration per Run 3	96.076 %	112.151 %	0.011 ppb	91.369 ppb	3.638 ppb	0.163 ppb	34.577 ppb	3.735 ppb	95.256 %
Concentration RSD	2.1 %	3.0 %	37.0 %	4.6 %	76.2 %	77.2 %	107.4 %	43.8 %	3.1 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	98.481 %	0.139 ppb	0.000 ppb	-0.035 ppb	-0.386 ppb	1.050 ppb	-0.025 ppb	-0.023 ppb	-0.049 ppb
Concentration per Run 1	99.320 %	0.169 ppb	0.000 ppb	-0.074 ppb	-0.386 ppb	-1.866 ppb	-0.025 ppb	-0.047 ppb	-0.016 ppb
Concentration per Run 2	102.232 %	0.080 ppb	0.000 ppb	-0.037 ppb	-0.450 ppb	3.884 ppb	-0.025 ppb	0.024 ppb	-0.065 ppb
Concentration per Run 3	93.892 %	0.166 ppb	0.000 ppb	0.006 ppb	-0.322 ppb	1.133 ppb	-0.025 ppb	-0.047 ppb	-0.065 ppb
Concentration RSD	4.3 %	36.4 %		114.4 %	16.6 %	273.9 %	0.0 %	175.6 %	58.6 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	-0.472 ppb	100.153 %	-0.013 ppb	0.287 ppb	0.064 ppb	0.033 ppb	97.536 %	-0.019 ppb	-0.003 ppb
Concentration per Run 1	-0.641 ppb	103.730 %	-0.014 ppb	0.273 ppb	0.012 ppb	0.043 ppb	98.690 %	-0.021 ppb	-0.003 ppb
Concentration per Run 2	-0.298 ppb	99.813 %	0.027 ppb	0.287 ppb	0.075 ppb	0.044 ppb	98.671 %	-0.021 ppb	-0.003 ppb
Concentration per Run 3	-0.477 ppb	96.914 %	-0.053 ppb	0.300 ppb	0.105 ppb	0.012 ppb	95.248 %	-0.017 ppb	-0.003 ppb
Concentration RSD	36.4 %	3.4 %	303.7 %	4.6 %	74.6 %	54.6 %	2.0 %	11.8 %	

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	97.286 %	-0.008 ppb	0.133 ppb	-0.006 ppb	94.475 %	94.683 %	-0.003 ppb	-0.003 ppb	93.658 %
Concentration per Run 1	98.978 %	-0.029 ppb	0.117 ppb	0.002 ppb	94.667 %	97.007 %	-0.005 ppb	0.002 ppb	93.252 %
Concentration per Run 2	96.949 %	0.008 ppb	0.146 ppb	-0.025 ppb	94.244 %	93.022 %	-0.003 ppb	-0.008 ppb	93.172 %
Concentration per Run 3	95.931 %	-0.003 ppb	0.135 ppb	0.003 ppb	94.513 %	94.020 %	0.000 ppb	-0.002 ppb	94.549 %
Concentration RSD	1.6 %	237.7 %	11.0 %	249.0 %	0.2 %	2.2 %	92.5 %	189.2 %	0.8 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 170 Analysis started at: 4/5/2017 5:34:57 PM Rack: 0
 Analysis label: CCV User name: ALPHALAB\metals-instrument Vial: 9

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	98.774 %	103.864 %	99.956 ppb	10,227.492 ppb	10,646.097 ppb	100.351 ppb	10,737.674 ppb	10,910.162 ppb	94.773 %
Concentration per Run 1	99.149 %	104.749 %	100.653 ppb	10,268.198 ppb	10,992.023 ppb	105.116 ppb	11,005.941 ppb	11,318.628 ppb	91.932 %
Concentration per Run 2	98.836 %	106.425 %	98.515 ppb	10,044.702 ppb	10,186.970 ppb	97.414 ppb	10,528.026 ppb	10,825.675 ppb	96.193 %
Concentration per Run 3	98.337 %	100.419 %	100.700 ppb	10,369.575 ppb	10,759.299 ppb	98.522 ppb	10,679.054 ppb	10,586.181 ppb	96.194 %
Recovery Percentage 1			99.956 %	102.275 %	106.461 %	100.351 %	107.377 %	109.102 %	
Concentration RSD	0.4 %	3.0 %	1.2 %	1.6 %	3.9 %	4.1 %	2.3 %	3.4 %	2.6 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	101.102 %	102.899 ppb	102.485 ppb	102.740 ppb	106.165 ppb	10,342.907 ppb	102.250 ppb	100.038 ppb	103.172 ppb
Concentration per Run 1	102.958 %	106.715 ppb	107.940 ppb	105.027 ppb	109.324 ppb	10,854.354 ppb	105.662 ppb	101.046 ppb	109.929 ppb
Concentration per Run 2	100.727 %	98.739 ppb	102.687 ppb	104.401 ppb	106.956 ppb	10,227.043 ppb	103.791 ppb	102.938 ppb	102.255 ppb
Concentration per Run 3	99.621 %	103.242 ppb	96.827 ppb	98.792 ppb	102.215 ppb	9,947.325 ppb	97.298 ppb	96.130 ppb	97.331 ppb
Recovery Percentage 1		102.899 %	102.485 %	102.740 %	106.165 %	103.429 %	102.250 %	100.038 %	103.172 %
Concentration RSD	1.7 %	3.9 %	5.4 %	3.3 %	3.4 %	4.5 %	4.3 %	3.5 %	6.2 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	101.400 ppb	100.674 %	99.557 ppb	106.043 ppb	103.789 ppb	99.590 ppb	94.793 %	99.045 ppb	101.375 ppb
Concentration per Run 1	101.095 ppb	100.761 %	100.606 ppb	108.547 ppb	106.672 ppb	100.487 ppb	91.400 %	101.274 ppb	108.120 ppb
Concentration per Run 2	105.020 ppb	99.068 %	99.894 ppb	111.016 ppb	104.447 ppb	100.543 ppb	97.883 %	97.417 ppb	98.437 ppb
Concentration per Run 3	98.085 ppb	102.192 %	98.171 ppb	98.566 ppb	100.248 ppb	97.741 ppb	95.095 %	98.443 ppb	97.567 ppb
Recovery Percentage 1	101.400 %		99.557 %	106.043 %	103.789 %	99.590 %		99.045 %	101.375 %
Concentration RSD	3.4 %	1.6 %	1.3 %	6.2 %	3.1 %	1.6 %	3.4 %	2.0 %	5.8 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	96.878 %	101.094 ppb	99.095 ppb	103.952 ppb	94.683 %	94.638 %	105.672 ppb	102.941 ppb	91.663 %
Concentration per Run 1	95.342 %	103.407 ppb	99.639 ppb	104.647 ppb	95.003 %	97.077 %	107.287 ppb	103.750 ppb	90.848 %
Concentration per Run 2	99.104 %	100.908 ppb	96.748 ppb	104.112 ppb	95.741 %	94.473 %	107.489 ppb	101.927 ppb	92.210 %
Concentration per Run 3	96.189 %	98.968 ppb	100.898 ppb	103.095 ppb	93.305 %	92.365 %	102.239 ppb	103.147 ppb	91.930 %
Recovery Percentage 1		101.094 %	99.095 %	103.952 %			105.672 %	102.941 %	
Concentration RSD	2.0 %	2.2 %	2.1 %	0.8 %	1.3 %	2.5 %	2.8 %	0.9 %	0.8 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 171 Analysis started at: 4/5/2017 5:38:23 PM Rack: 0
 Analysis label: CCB User name: ALPHALAB\metals-instrument Vial: 10

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	102.746 %	102.421 %	0.023 ppb	23.249 ppb	1.766 ppb	0.155 ppb	1.891 ppb	-1.654 ppb	98.097 %
Concentration per Run 1	104.330 %	103.771 %	0.010 ppb	23.738 ppb	-0.377 ppb	-0.832 ppb	24.679 ppb	-1.824 ppb	101.392 %
Concentration per Run 2	103.851 %	107.402 %	0.032 ppb	23.380 ppb	2.736 ppb	-0.421 ppb	-6.383 ppb	-1.474 ppb	95.000 %
Concentration per Run 3	100.056 %	96.089 %	0.029 ppb	22.628 ppb	2.939 ppb	1.717 ppb	-12.624 ppb	-1.665 ppb	97.898 %
Recovery Percentage 1			4.682 %	23.249 %	2.523 %	1.548 %	1.891 %	-1.654 %	
Concentration RSD	2.3 %	5.6 %	50.2 %	2.4 %	105.3 %	884.0 %	1,056.8 %	10.6 %	3.3 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	103.006 %	0.106 ppb	0.077 ppb	-0.018 ppb	-0.325 ppb	5.719 ppb	-0.006 ppb	-0.025 ppb	0.048 ppb
Concentration per Run 1	105.393 %	0.156 ppb	0.055 ppb	-0.022 ppb	-0.390 ppb	3.569 ppb	-0.025 ppb	0.021 ppb	0.124 ppb
Concentration per Run 2	103.018 %	0.000 ppb	0.118 ppb	0.005 ppb	-0.260 ppb	2.551 ppb	-0.006 ppb	-0.047 ppb	0.035 ppb
Concentration per Run 3	100.608 %	0.161 ppb	0.057 ppb	-0.037 ppb	-0.326 ppb	11.035 ppb	0.013 ppb	-0.047 ppb	-0.016 ppb
Recovery Percentage 1		21.117 %	1.537 %	-1.802 %	-32.547 %	11.437 %	-1.206 %	-1.228 %	4.786 %
Concentration RSD	2.3 %	86.6 %	46.3 %	119.4 %	20.1 %	81.0 %	313.8 %	159.8 %	148.0 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	-0.254 ppb	102.760 %	0.091 ppb	0.588 ppb	0.012 ppb	0.561 ppb	96.261 %	0.091 ppb	0.017 ppb
Concentration per Run 1	-0.380 ppb	106.465 %	0.060 ppb	1.055 ppb	0.011 ppb	0.526 ppb	97.921 %	0.076 ppb	0.017 ppb
Concentration per Run 2	-0.264 ppb	100.119 %	0.148 ppb	-0.102 ppb	0.001 ppb	0.646 ppb	95.412 %	0.105 ppb	0.007 ppb
Concentration per Run 3	-0.119 ppb	101.696 %	0.066 ppb	0.810 ppb	0.025 ppb	0.510 ppb	95.451 %	0.090 ppb	0.028 ppb
Recovery Percentage 1	-2.543 %	102.760 %	18.241 %	11.753 %	2.472 %	28.027 %		22.662 %	8.740 %
Concentration RSD	51.5 %	3.2 %	53.7 %	103.7 %	101.2 %	13.3 %	1.5 %	15.9 %	60.2 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	97.154 %	0.668 ppb	3.627 ppb	-0.025 ppb	94.108 %	93.632 %	0.045 ppb	0.054 ppb	95.042 %
Concentration per Run 1	98.267 %	0.575 ppb	3.363 ppb	-0.025 ppb	96.113 %	92.088 %	0.040 ppb	0.058 ppb	96.268 %
Concentration per Run 2	97.014 %	0.745 ppb	3.948 ppb	-0.025 ppb	94.915 %	94.276 %	0.051 ppb	0.057 ppb	96.073 %
Concentration per Run 3	96.182 %	0.685 ppb	3.570 ppb	-0.024 ppb	91.296 %	94.532 %	0.045 ppb	0.047 ppb	92.785 %
Recovery Percentage 1		22.279 %	90.675 %	-4.952 %			8.992 %	10.799 %	95.042 %
Concentration RSD	1.1 %	12.9 %	8.2 %	2.1 %	2.7 %	1.4 %	12.0 %	11.9 %	2.1 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 172 Analysis started at: 4/5/2017 5:41:48 PM Rack: 0
 Analysis label: CCV User name: ALPHALAB\metals-instrument Vial: 9

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	99.766 %	103.771 %	98.091 ppb	10,075.045 ppb	10,400.099 ppb	98.350 ppb	10,466.805 ppb	10,656.577 ppb	96.961 %
Concentration per Run 1	100.751 %	107.263 %	97.809 ppb	9,836.399 ppb	9,966.645 ppb	92.613 ppb	10,347.043 ppb	10,616.728 ppb	100.199 %
Concentration per Run 2	99.935 %	97.207 %	98.012 ppb	10,794.385 ppb	11,161.185 ppb	102.724 ppb	11,076.458 ppb	11,490.839 ppb	91.933 %
Concentration per Run 3	98.613 %	106.844 %	98.451 ppb	9,594.352 ppb	10,072.468 ppb	99.712 ppb	9,976.914 ppb	9,862.164 ppb	98.750 %
Recovery Percentage 1			98.091 %	100.750 %	104.001 %	98.350 %	104.668 %	106.566 %	
Concentration RSD	1.1 %	5.5 %	0.3 %	6.3 %	6.4 %	5.3 %	5.3 %	7.6 %	4.6 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	101.170 %	102.575 ppb	102.979 ppb	101.806 ppb	105.747 ppb	10,101.832 ppb	100.687 ppb	100.001 ppb	100.438 ppb
Concentration per Run 1	101.995 %	98.804 ppb	104.906 ppb	95.699 ppb	103.022 ppb	9,744.316 ppb	99.696 ppb	98.912 ppb	100.183 ppb
Concentration per Run 2	101.451 %	110.439 ppb	104.304 ppb	108.103 ppb	113.957 ppb	10,556.126 ppb	103.192 ppb	105.219 ppb	102.040 ppb
Concentration per Run 3	100.066 %	98.483 ppb	99.728 ppb	101.615 ppb	100.261 ppb	10,005.054 ppb	99.172 ppb	95.872 ppb	99.089 ppb
Recovery Percentage 1		102.575 %	102.979 %	101.806 %	105.747 %	101.018 %	100.687 %	100.001 %	100.438 %
Concentration RSD	1.0 %	6.6 %	2.7 %	6.1 %	6.8 %	4.1 %	2.2 %	4.8 %	1.5 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	98.474 ppb	97.755 %	102.761 ppb	102.278 ppb	106.185 ppb	101.097 ppb	94.952 %	99.651 ppb	102.890 ppb
Concentration per Run 1	95.504 ppb	99.415 %	100.360 ppb	97.824 ppb	103.817 ppb	96.417 ppb	96.836 %	95.053 ppb	98.064 ppb
Concentration per Run 2	101.958 ppb	98.954 %	102.261 ppb	104.983 ppb	107.871 ppb	102.685 ppb	94.879 %	103.342 ppb	107.984 ppb
Concentration per Run 3	97.960 ppb	94.897 %	105.663 ppb	104.027 ppb	106.868 ppb	104.188 ppb	93.142 %	100.559 ppb	102.620 ppb
Recovery Percentage 1	98.474 %		102.761 %	102.278 %	106.185 %	101.097 %		99.651 %	102.890 %
Concentration RSD	3.3 %	2.5 %	2.6 %	3.8 %	2.0 %	4.1 %	1.9 %	4.2 %	4.8 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	95.069 %	99.710 ppb	101.070 ppb	105.531 ppb	94.949 %	93.510 %	100.768 ppb	99.787 ppb	93.018 %
Concentration per Run 1	97.166 %	94.021 ppb	93.552 ppb	103.677 ppb	99.320 %	95.998 %	95.920 ppb	95.702 ppb	96.763 %
Concentration per Run 2	92.056 %	105.819 ppb	106.338 ppb	107.147 ppb	90.871 %	92.216 %	104.609 ppb	104.357 ppb	89.349 %
Concentration per Run 3	95.985 %	99.291 ppb	103.321 ppb	105.768 ppb	94.656 %	92.316 %	101.775 ppb	99.301 ppb	92.942 %
Recovery Percentage 1		99.710 %	101.070 %	105.531 %			100.768 %	99.787 %	
Concentration RSD	2.8 %	5.9 %	6.6 %	1.7 %	4.5 %	2.3 %	4.4 %	4.4 %	4.0 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 173 Analysis started at: 4/5/2017 5:45:14 PM Rack: 4
 Analysis label: LLCVV User name: ALPHALAB\metals-instrument Vial: 51

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	100.242 %	107.728 %	0.373 ppb	119.055 ppb	85.843 ppb	10.920 ppb	146.274 ppb	115.950 ppb	99.034 %
Concentration per Run 1	102.289 %	108.240 %	0.401 ppb	125.121 ppb	83.553 ppb	8.703 ppb	140.386 ppb	128.274 ppb	99.091 %
Concentration per Run 2	98.929 %	108.380 %	0.346 ppb	121.327 ppb	84.372 ppb	12.644 ppb	130.510 ppb	132.991 ppb	99.432 %
Concentration per Run 3	99.508 %	106.564 %	0.373 ppb	110.718 ppb	89.606 ppb	11.412 ppb	167.925 ppb	86.586 ppb	98.580 %
Recovery Percentage 1			124.478 %	119.055 %	122.633 %	109.197 %	146.274 %	115.950 %	
Concentration RSD	1.8 %	0.9 %	7.4 %	6.3 %	3.8 %	18.5 %	13.3 %	22.0 %	0.4 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	102.362 %	0.720 ppb	5.774 ppb	0.659 ppb	0.992 ppb	46.661 ppb	0.629 ppb	2.039 ppb	1.055 ppb
Concentration per Run 1	104.295 %	0.878 ppb	5.413 ppb	0.637 ppb	1.460 ppb	48.296 ppb	0.580 ppb	2.361 ppb	1.076 ppb
Concentration per Run 2	103.757 %	0.635 ppb	5.877 ppb	0.688 ppb	0.890 ppb	46.217 ppb	0.609 ppb	2.185 ppb	0.957 ppb
Concentration per Run 3	99.035 %	0.646 ppb	6.032 ppb	0.653 ppb	0.626 ppb	45.469 ppb	0.699 ppb	1.570 ppb	1.132 ppb
Recovery Percentage 1		143.980 %	115.482 %	131.838 %	99.204 %	93.321 %	125.865 %	101.926 %	105.512 %
Concentration RSD	2.8 %	19.1 %	5.6 %	3.9 %	43.0 %	3.1 %	9.9 %	20.4 %	8.5 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	12.012 ppb	99.212 %	0.634 ppb	6.416 ppb	0.577 ppb	2.769 ppb	97.081 %	0.560 ppb	0.235 ppb
Concentration per Run 1	12.212 ppb	100.514 %	0.626 ppb	7.849 ppb	0.514 ppb	2.433 ppb	97.915 %	0.579 ppb	0.249 ppb
Concentration per Run 2	11.956 ppb	103.171 %	0.648 ppb	5.321 ppb	0.533 ppb	2.786 ppb	97.241 %	0.540 ppb	0.288 ppb
Concentration per Run 3	11.870 ppb	93.952 %	0.629 ppb	6.077 ppb	0.683 ppb	3.088 ppb	96.087 %	0.560 ppb	0.168 ppb
Recovery Percentage 1	120.124 %		126.886 %	128.312 %	115.377 %	138.455 %		139.934 %	117.443 %
Concentration RSD	1.5 %	4.8 %	1.9 %	20.2 %	16.0 %	11.8 %	1.0 %	3.5 %	26.0 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	95.103 %	3.547 ppb	8.416 ppb	0.397 ppb	94.922 %	94.209 %	0.598 ppb	0.618 ppb	94.964 %
Concentration per Run 1	100.720 %	3.256 ppb	8.264 ppb	0.294 ppb	98.597 %	95.816 %	0.592 ppb	0.620 ppb	94.934 %
Concentration per Run 2	91.486 %	3.999 ppb	8.135 ppb	0.663 ppb	94.188 %	95.405 %	0.604 ppb	0.615 ppb	96.703 %
Concentration per Run 3	93.104 %	3.386 ppb	8.849 ppb	0.235 ppb	91.982 %	91.406 %	0.597 ppb	0.618 ppb	93.255 %
Recovery Percentage 1		118.235 %	210.396 %	79.426 %			119.605 %	123.551 %	
Concentration RSD	5.2 %	11.2 %	4.5 %	58.4 %	3.5 %	2.6 %	1.0 %	0.5 %	1.8 %

Alpha ICPMSQ Full

4/6/2017 7:04:22 AM



Analysis index: 174 Analysis started at: 4/5/2017 5:48:39 PM Rack: 0
 Analysis label: CCB User name: ALPHALAB\metals-instrument Vial: 10

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	100.296 %	101.024 %	0.009 ppb	19.047 ppb	2.441 ppb	0.465 ppb	18.106 ppb	7.005 ppb	100.000 %
Concentration per Run 1	103.365 %	104.330 %	0.006 ppb	18.108 ppb	3.877 ppb	0.421 ppb	35.225 ppb	9.656 ppb	94.148 %
Concentration per Run 2	100.263 %	95.391 %	0.011 ppb	20.661 ppb	1.784 ppb	0.409 ppb	7.959 ppb	8.185 ppb	103.352 %
Concentration per Run 3	97.260 %	103.352 %	0.011 ppb	18.372 ppb	1.663 ppb	0.564 ppb	11.135 ppb	3.175 ppb	102.500 %
Recovery Percentage 1			1.809 %	19.047 %	3.488 %	4.649 %	18.106 %	7.005 %	
Concentration RSD	3.0 %	4.9 %	32.3 %	7.4 %	51.0 %	18.5 %	82.3 %	48.5 %	5.1 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	102.345 %	0.026 ppb	0.000 ppb	-0.083 ppb	-0.347 ppb	-0.973 ppb	0.000 ppb	0.048 ppb	-0.016 ppb
Concentration per Run 1	112.814 %	0.000 ppb	0.000 ppb	-0.094 ppb	-0.322 ppb	-1.852 ppb	0.014 ppb	0.099 ppb	-0.014 ppb
Concentration per Run 2	99.265 %	0.000 ppb	0.000 ppb	-0.116 ppb	-0.270 ppb	-0.530 ppb	-0.007 ppb	-0.047 ppb	0.033 ppb
Concentration per Run 3	94.954 %	0.077 ppb	0.000 ppb	-0.040 ppb	-0.450 ppb	-0.537 ppb	-0.007 ppb	0.091 ppb	-0.065 ppb
Recovery Percentage 1		5.159 %	0.000 %	-8.333 %	-34.717 %	-1.946 %	0.058 %	2.387 %	-1.555 %
Concentration RSD	9.1 %	173.2 %		46.4 %	26.7 %	78.2 %	4,071.2 %	172.4 %	316.9 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	-0.331 ppb	100.102 %	0.134 ppb	0.346 ppb	0.004 ppb	0.287 ppb	96.929 %	0.040 ppb	0.000 ppb
Concentration per Run 1	-0.259 ppb	99.101 %	0.028 ppb	-0.410 ppb	-0.025 ppb	0.274 ppb	98.194 %	0.039 ppb	-0.003 ppb
Concentration per Run 2	-0.304 ppb	99.712 %	0.229 ppb	0.811 ppb	0.013 ppb	0.313 ppb	95.104 %	0.033 ppb	0.007 ppb
Concentration per Run 3	-0.430 ppb	101.492 %	0.145 ppb	0.638 ppb	0.025 ppb	0.273 ppb	97.490 %	0.048 ppb	-0.003 ppb
Recovery Percentage 1	-3.308 %	100.102 %	26.793 %	6.928 %	0.893 %	14.335 %		9.977 %	0.074 %
Concentration RSD	26.8 %	1.2 %	75.3 %	190.7 %	585.1 %	8.1 %	1.7 %	18.8 %	4,090.2 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	96.330 %	0.298 ppb	1.657 ppb	-0.015 ppb	93.863 %	92.777 %	0.027 ppb	0.027 ppb	95.412 %
Concentration per Run 1	98.335 %	0.371 ppb	1.463 ppb	-0.053 ppb	94.167 %	95.239 %	0.027 ppb	0.032 ppb	95.311 %
Concentration per Run 2	96.968 %	0.273 ppb	1.747 ppb	0.031 ppb	93.612 %	90.956 %	0.022 ppb	0.022 ppb	94.781 %
Concentration per Run 3	93.688 %	0.250 ppb	1.759 ppb	-0.024 ppb	93.810 %	92.136 %	0.031 ppb	0.026 ppb	96.146 %
Recovery Percentage 1		9.934 %	41.416 %	-3.044 %			5.374 %	5.306 %	95.412 %
Concentration RSD	2.5 %	21.4 %	10.1 %	279.5 %	0.3 %	2.4 %	17.9 %	19.5 %	0.7 %

Sample Preparation



METALS ELN REPORT

Workgroup: WG991289

Digestion

Prep Method	Acid Type 1	Acid 1 Lot	Acid Type 2	Acid 2 Lot	Spike Type	Lims Spike Lot	Spike Lot	Post Spike Spikelot	Spike Lot	Srm Spikelot	Use Srm For Lcs	Use Srm For	Use Srm For	Use Srm For	Use Srm For
EPA 3050B	HNO3	MS022217A	HCL	MS032117A	METALS	METSPIKE2	FPS,IPS,MIX	METPSMS	FPS,IPS,MIX	D091-540	Y	WHG-25			

Additional Reagent/Std

Sample/ Type	Digestion Date	Analyst	Sample Weight g	Balance Id	Spike Amt ml	Start Date/Time	Hot Block Unit	Temperature (C)	Stop Date/Time	Final Vol	Comments
WG991289-1 BLANK	04/05/17 12:23	Joshua Mertens	1	14621306		04/05/17 12:23	002082	95.1	04/05/17 13:29	50	FPS170928152 5MG;IPS17092 81615MG;MIX1 709281715MG
WG991289-2 LCS	04/05/17 12:23	Joshua Mertens	.398	25	.398	04/05/17 12:23	002082	95.1	04/05/17 13:29	50	AG1709282000 FC
WG991289-3 MS	04/05/17 12:23	Joshua Mertens	1.3	14621306	1	04/05/17 12:23	002082	95.1	04/05/17 13:29	50	
WG991289-4 DUP	04/05/17 12:23	Joshua Mertens	1.3	14621306		04/05/17 12:23	002082	95.1	04/05/17 13:29	50	
WG991289-5 PS	04/05/17 12:23	Joshua Mertens	1.27	14621306		04/05/17 12:23	002082	95.1	04/05/17 13:29	50	
WG991289-6 SERDIL	04/05/17 12:23	Joshua Mertens	1.27	14621306		04/05/17 12:23	002082	95.1	04/05/17 13:29	50	
L1710301-01 SAMP	04/05/17 12:23	Joshua Mertens	1.27	14621306		04/05/17 12:23	002082	95.1	04/05/17 13:29	50	
L1710301-02 SAMP	04/05/17 12:23	Joshua Mertens	1.29	14621306		04/05/17 12:23	002082	95.1	04/05/17 13:29	50	
L1710301-03 SAMP	04/05/17 12:23	Joshua Mertens	1.26	14621306		04/05/17 12:23	002082	95.1	04/05/17 13:29	50	
L1710301-04 SAMP	04/05/17 12:23	Joshua Mertens	1.32	14621306		04/05/17 12:23	002082	95.1	04/05/17 13:29	50	
L1710301-05 SAMP	04/05/17 12:23	Joshua Mertens	1.27	14621306		04/05/17 12:23	002082	95.1	04/05/17 13:29	50	
L1710301-06 SAMP	04/05/17 12:23	Joshua Mertens	1.26	14621306		04/05/17 12:23	002082	95.1	04/05/17 13:29	50	
L1710301-07 SAMP	04/05/17 12:23	Joshua Mertens	1.28	14621306		04/05/17 12:23	002082	95.1	04/05/17 13:29	50	
L1710301-08 SAMP	04/05/17 12:23	Joshua Mertens	1.28	14621306		04/05/17 12:23	002082	95.1	04/05/17 13:29	50	



METALS ELN REPORT

Workgroup: WG991289

Sample/ Type	Digestion Date	Analyst	Sample Weight g	Balance Id	Spike Amt ml	Start Date/Time	Hot Block Unit	Temperature (C)	Stop Date/Time	Final Vol	Comments
L1710301-09 SAMP	04/05/17 12:23	Joshua Mertens	1.32	14621306		04/05/17 12:23	002082	95.1	04/05/17 13:29	50	
L1710301-10 SAMP	04/05/17 12:23	Joshua Mertens	1.28	14621306		04/05/17 12:23	002082	95.1	04/05/17 13:29	50	
L1710301-11 SAMP	04/05/17 12:23	Joshua Mertens	1.29	14621306		04/05/17 12:23	002082	95.1	04/05/17 13:29	50	
L1710301-12 SAMP	04/05/17 12:23	Joshua Mertens	1.32	14621306		04/05/17 12:23	002082	95.1	04/05/17 13:29	50	
L1710301-13 SAMP	04/05/17 12:23	Joshua Mertens	1.3	14621306		04/05/17 12:23	002082	95.1	04/05/17 13:29	50	

Reagent	Actual Volume	Units
Nitric Acid (HNO3)	2	ml
Hydrochloric Acid (HCl)	3	ml

True Values

Table IV: Initial Calibration Levels and ICV/CCV Concentrations

Analyte	STD1	STD2	ICV,CCV
	(µg/L)	(µg/L)	(µg/L)
Ag		100	50
Al	10050		5050
As	100		50
B	100		50
Ba		100	50
Be	100		50
Ca	10100		5050
Cd	100		50
Co	100		50
Cr	100		50
Cu	100		50
Fe	10100		5050
K	10000		5500
Mg	10100		5050
Mn	100		50
Mo	100		50
Na	10000		5050
Ni	100		50
Pb	100		50
Sb	100		50
Se	100		50
Si	50		25
Sn	100		50
Sr	100		50
Ti	100		50
Tl	100		50
V	100		50
Zn	100		50
W	1	100	50

Interferent ICSA, ICSAB	(mg/L)
Cl ⁻	2000
Ca	300
Fe, Na	250
Al, Mg, P, K, S	100
C	200
Mo, Ti	2

All analyte concentrations in ICSAB = 100 ppb except for Ag and Ba = 50 ppb

Table IV: Initial Calibration Levels and ICV/CCV Concentrations (MCP)

Analyte	STD1	STD2	STD3	STD4	STD5	ICV,CCV
			(µg/L)	(µg/L)		(µg/L)
Ag	0.2		10		100	50
Al	10	10000		20000		10100
As	0.5	100		1000		100
B	1	100		1000		100
Ba	1	100		1000		100
Be	0.3	100		1000		100
Ca	100	10000		20000		10100
Cd	0.2	100		1000		100
Co	0.2	100		1000		100
Cr	0.5	100		1000		100
Cu	0.5	100		1000		100
Fe	10	10000		20000		10100
K	100	10000		20000		11000
Mg	100	10000		20000		10100
Mn	10	100		1000		100
Mo	1	100		1000		100
Na	100	10000		20000		10100
Ni	0.5	100		1000		100
Pb	0.2	100		1000		100
Sb	0.5	10		100		50
Se	1	100		1000		100
Si	10	100		1000		25
Sn	1	100		1000		100
Sr	5	100		1000		100
Ti	5	100		1000		100
Tl	0.2	100		1000		100
V	5	100		1000		100
Zn	10	100		1000		100
W	5	100		1000		100

Interferent ICSA, ICSAB	(mg/L)
Cl ⁻	2000
Ca	300
Fe, Na	250
Al, Mg, P, K, S	100
C	200
Mo, Ti	2

All analyte concentrations in ICSAB = 100 ppb except for Ag and Ba = 50 ppb

Analyte	LCS,MS Water	LCS,MS soil	LCS,MS Tissue
	(µg/L)	(µg/L)	(µg/L)
Ag	20	40	40
Al	5000	20000	10000
As	1000	4000	2000
B	1000	4000	2000
Ba	1000	4000	2000
Be	500	2000	1000
Ca	5000	4000	10000
Cd	500	2000	1000
Co	1000	4000	2000
Cr	1000	4000	2000
Cu	1000	4000	2000
Fe	5000	20000	10000
K	5000	20000	10000
Mg	5000	20000	10000
Mn	1000	4000	2000
Mo	1000	4000	2000
Na	5000	20000	10000
Ni	1000	4000	2000
Pb	1000	4000	2000
Sb	20	40	40
Se	1000	4000	2000
Si	1000	4000	2000
Sn	250	1000	500
Sr	1000	4000	2000
Ti	1000	4000	2000
Tl	1000	4000	2000
V	1000	4000	2000
Zn	1000	4000	2000
W	100	200	200

Mercury: ICV, CCV, LCS and MS = 2.5 ppb.

Arsenic Hydride, Selenium Hydride: ICV, CCV, LCS and MS = 5 ppb.

Mercury by Method 1631: ICV,CCV = 0.005 ppb, LCS, MS = 0.005 ppb.

Wet Chemistry

Total Solids / Percent Moisture Analysis

Sample Raw Data

Last Change 3/26/13
File A2-TS_S.xlt

Scale Serial#: 14621307

Comments:

Work Group

ALPHA ANALYTICAL LABORATORIES, INC.

Alpha WORK GROUP REPORT (wk02)

Apr 06 2017, 09:20 am

Work Group: WG991372 for Department: 7 Wet Chemistry

Created: 05-APR-17 Due: Operator: sp

Sample	Client ID	C Product	Matrix	Stat	UA	HOLD	DUE	PR	Location
L1710301-01	BHA-7 SS1 0-2'	S A2-TS	SOIL	DONE	U	1015	0406	2A	Glass-A.5
L1710301-02	BHA-7 SS2 2-4'	S A2-TS	SOIL	DONE	U	1015	0406	2A	Glass-A.5
L1710301-03	BHA-7 SS3 4-6'	S A2-TS	SOIL	DONE	U	1015	0406	2A	Glass-A.5
L1710301-04	BHA-7 SS4 6-8'	S A2-TS	SOIL	DONE	U	1015	0406	2A	Glass-A.5
L1710301-05	BHA-7 SS5 8-10'	S A2-TS	SOIL	DONE	U	1015	0406	2A	Glass-A.5
L1710301-06	BHA-7 SS6 10-12'	S A2-TS	SOIL	DONE	U	1015	0406	2A	Glass-A.5
L1710301-07	BHA-7 SS7 15-17'	S A2-TS	SOIL	DONE	U	1015	0406	2A	Glass-A.5
L1710301-08	BHA-9 SS2 2-4'	S A2-TS	SOIL	DONE	U	1015	0406	2A	Glass-A.5
L1710301-09	BHA-9 SS3 4-6'	S A2-TS	SOIL	DONE	U	1015	0406	2A	Glass-A.5
L1710301-10	BHA-9 SS4 6-8'	S A2-TS	SOIL	DONE	U	1015	0406	2A	Glass-A.5
L1710301-11	BHA-9 SS5 8-10'	S A2-TS	SOIL	DONE	U	1015	0406	2A	Glass-A.5
L1710301-12	BHA-9 SS6 10-12'	S A2-TS	SOIL	DONE	U	1015	0406	2A	Glass-A.5
L1710301-13	BHA-9 SS7 15-17'	S A2-TS	SOIL	DONE	U	1015	0406	2A	Glass-A.5
WG991372-1	Duplicate Sample	S A2-TS	SOIL	DONE	U				
Comments:									
WG991372-1	L1710301-01								

Alpha Report



ANALYTICAL REPORT

Lab Number:	L1710301
Client:	Alpine Ocean Seismic Survey Inc. 155 Hudson Avenue Norwood, NJ 07648
ATTN:	Mark Kosakowski
Phone:	(201) 768-8000
Project Name:	NESE
Project Number:	1794
Report Date:	04/06/17

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Certifications & Approvals: MA (M-MA030), NH NELAP (2062), NJ NELAP (MA015), CT (PH-0141), FL (E87814), IL (200081), LA (85084), ME (MA00030), MD (350), NY (11627), NC (685), OH (CL106), PA (68-02089), RI (LAO00299), TX (T104704419), VT (VT-0015), VA (460194), WA (C954), US Army Corps of Engineers, USDA (Permit #P330-13-00067), USFWS (Permit #LE2069641).

320 Forbes Boulevard, Mansfield, MA 02048-1806
508-822-9300 (Fax) 508-822-3288 800-624-9220 - www.alphalab.com



Project Name: NESE

Project Number: 1794

Lab Number: L1710301

Report Date: 04/06/17

Alpha Sample ID	Client ID	Matrix	Sample Location	Collection Date/Time	Receive Date
L1710301-01	BHA-7 SS1 0-2'	SEDIMENT	RARITAN BAY, NY	10/08/16 00:00	04/05/17
L1710301-02	BHA-7 SS2 2-4'	SEDIMENT	RARITAN BAY, NY	10/08/16 00:00	04/05/17
L1710301-03	BHA-7 SS3 4-6'	SEDIMENT	RARITAN BAY, NY	10/08/16 00:00	04/05/17
L1710301-04	BHA-7 SS4 6-8'	SEDIMENT	RARITAN BAY, NY	10/08/16 00:00	04/05/17
L1710301-05	BHA-7 SS5 8-10'	SEDIMENT	RARITAN BAY, NY	10/08/16 00:00	04/05/17
L1710301-06	BHA-7 SS6 10-12'	SEDIMENT	RARITAN BAY, NY	10/08/16 00:00	04/05/17
L1710301-07	BHA-7 SS7 15-17'	SEDIMENT	RARITAN BAY, NY	10/08/16 00:00	04/05/17
L1710301-08	BHA-9 SS2 2-4'	SEDIMENT	RARITAN BAY, NY	10/08/16 00:00	04/05/17
L1710301-09	BHA-9 SS3 4-6'	SEDIMENT	RARITAN BAY, NY	10/08/16 00:00	04/05/17
L1710301-10	BHA-9 SS4 6-8'	SEDIMENT	RARITAN BAY, NY	10/08/16 00:00	04/05/17
L1710301-11	BHA-9 SS5 8-10'	SEDIMENT	RARITAN BAY, NY	10/08/16 00:00	04/05/17
L1710301-12	BHA-9 SS6 10-12'	SEDIMENT	RARITAN BAY, NY	10/08/16 00:00	04/05/17
L1710301-13	BHA-9 SS7 15-17'	SEDIMENT	RARITAN BAY, NY	10/08/16 00:00	04/05/17

Project Name: NESE
Project Number: 1794

Lab Number: L1710301
Report Date: 04/06/17

Case Narrative

The samples were received in accordance with the Chain of Custody and no significant deviations were encountered during the preparation or analysis unless otherwise noted. Sample Receipt, Container Information, and the Chain of Custody are located at the back of the report.

Results contained within this report relate only to the samples submitted under this Alpha Lab Number and meet NELAP requirements for all NELAP accredited parameters unless otherwise noted in the following narrative. The data presented in this report is organized by parameter (i.e. VOC, SVOC, etc.). Sample specific Quality Control data (i.e. Surrogate Spike Recovery) is reported at the end of the target analyte list for each individual sample, followed by the Laboratory Batch Quality Control at the end of each parameter. Tentatively Identified Compounds (TICs), if requested, are reported for compounds identified to be present and are not part of the method/program Target Compound List, even if only a subset of the TCL are being reported. If a sample was re-analyzed or re-extracted due to a required quality control corrective action and if both sets of data are reported, the Laboratory ID of the re-analysis or re-extraction is designated with an "R" or "RE", respectively. When multiple Batch Quality Control elements are reported (e.g. more than one LCS), the associated samples for each element are noted in the grey shaded header line of each data table. Any Laboratory Batch, Sample Specific % recovery or RPD value that is outside the listed Acceptance Criteria is bolded in the report. All specific QC information is also incorporated in the Data Usability format of our Data Merger tool where it can be reviewed along with any associated usability implications. Soil/sediments, solids and tissues are reported on a dry weight basis unless otherwise noted. Definitions of all data qualifiers and acronyms used in this report are provided in the Glossary located at the back of the report.

In reference to questions H (CAM) or 4 (RCP) when "NO" is checked, the performance criteria for CAM and RCP methods allow for some quality control failures to occur and still be within method compliance. In these instances the specific failure is not narrated but noted in the associated QC table. The information is also incorporated in the Data Usability format of our Data Merger tool where it can be reviewed along with any associated usability implications.

Please see the associated ADEx data file for a comparison of laboratory reporting limits that were achieved with the regulatory Numerical Standards requested on the Chain of Custody.

HOLD POLICY

For samples submitted on hold, Alpha's policy is to hold samples (with the exception of Air canisters) free of charge for 21 calendar days from the date the project is completed. After 21 calendar days, we will dispose of all samples submitted including those put on hold unless you have contacted your Client Service Representative and made arrangements for Alpha to continue to hold the samples. Air canisters will be disposed after 3 business days from the date the project is completed.

Please contact Client Services at 800-624-9220 with any questions.

Project Name: NESE
Project Number: 1794

Lab Number: L1710301
Report Date: 04/06/17

Case Narrative (continued)

Report Submission

All non-detect (ND) or estimated concentrations (J-qualified) have been quantitated to the limit noted in the MDL column.

Sample Receipt

The date of collection on the COC is incorrect and was confirmed via email from Alpine to be 10/8/16. In addition, the samples have been stored at ambient temperature, and were received at 14.9C.

Mercury

L1710301-01 through -13: Samples were received and analyzed in exceedance of the hold time at the request of the client.

Metals

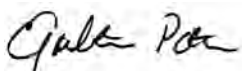
The WG991289-3 MS recoveries for Aluminum (594%) and Iron (0%), performed on L1710301-01, do not apply because the sample concentration is greater than four times the spike amount added.

The WG991289-3 MS recovery, performed on L1710301-01, is outside the acceptance criteria for Arsenic (134%), Calcium (0%), Manganese (13%), Selenium (126%) and Titanium (167%). A post digestion spike was performed and was within acceptance criteria.

The WG991289-4 Laboratory Duplicate RPD, performed on L1710301-01, is outside the acceptance criteria for Antimony (28%), Arsenic (40%), Barium (25%), Calcium (22%), Chromium (21%) and Titanium (32%). The elevated RPD has been attributed to the non-homogeneous nature of the native sample.

I, the undersigned, attest under the pains and penalties of perjury that, to the best of my knowledge and belief and based upon my personal inquiry of those responsible for providing the information contained in this analytical report, such information is accurate and complete. This certificate of analysis is not complete unless this page accompanies any and all pages of this report.

Authorized Signature:

 Elizabeth Porta

Title: Technical Director/Representative

Date: 04/06/17

METALS

Project Name: NESE

Lab Number: L1710301

Project Number: 1794

Report Date: 04/06/17

SAMPLE RESULTS

Lab ID: L1710301-01
 Client ID: BHA-7 SS1 0-2'
 Sample Location: RARITAN BAY, NY
 Matrix: Sediment
 Percent Solids: 51%

Date Collected: 10/08/16 00:00
 Date Received: 04/05/17
 Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Aluminum, Total	10200		mg/kg	194	28.7	10	04/05/17 12:23	04/05/17 14:46	EPA 3050B	1,6020A	AM
Antimony, Total	6.80		mg/kg	3.10	0.262	10	04/05/17 12:23	04/05/17 14:46	EPA 3050B	1,6020A	AM
Arsenic, Total	39.1		mg/kg	0.969	0.128	10	04/05/17 12:23	04/05/17 14:46	EPA 3050B	1,6020A	AM
Barium, Total	50.9		mg/kg	5.81	0.409	10	04/05/17 12:23	04/05/17 14:46	EPA 3050B	1,6020A	AM
Beryllium, Total	0.870		mg/kg	0.581	0.169	10	04/05/17 12:23	04/05/17 14:46	EPA 3050B	1,6020A	AM
Cadmium, Total	1.00		mg/kg	0.388	0.051	10	04/05/17 12:23	04/05/17 14:46	EPA 3050B	1,6020A	AM
Calcium, Total	5040		mg/kg	969	118.	10	04/05/17 12:23	04/05/17 14:46	EPA 3050B	1,6020A	AM
Chromium, Total	69.3		mg/kg	3.88	0.907	10	04/05/17 12:23	04/05/17 14:46	EPA 3050B	1,6020A	AM
Cobalt, Total	9.22		mg/kg	0.969	0.103	10	04/05/17 12:23	04/05/17 14:46	EPA 3050B	1,6020A	AM
Copper, Total	140		mg/kg	3.88	0.376	10	04/05/17 12:23	04/05/17 14:46	EPA 3050B	1,6020A	AM
Iron, Total	32400		mg/kg	388	39.9	10	04/05/17 12:23	04/05/17 14:46	EPA 3050B	1,6020A	AM
Lead, Total	156		mg/kg	1.16	0.283	10	04/05/17 12:23	04/05/17 14:46	EPA 3050B	1,6020A	AM
Magnesium, Total	5490		mg/kg	194	23.9	10	04/05/17 12:23	04/05/17 14:46	EPA 3050B	1,6020A	AM
Manganese, Total	274		mg/kg	3.88	0.860	10	04/05/17 12:23	04/05/17 14:46	EPA 3050B	1,6020A	AM
Mercury, Total	2.00		mg/kg	0.046	0.006	10	04/05/17 12:14	04/06/17 11:14	EPA 7474	1,7474	LC
Molybdenum, Total	2.08		mg/kg	1.55	0.209	10	04/05/17 12:23	04/05/17 14:46	EPA 3050B	1,6020A	AM
Nickel, Total	23.9		mg/kg	1.94	0.518	10	04/05/17 12:23	04/05/17 14:46	EPA 3050B	1,6020A	AM
Potassium, Total	2370		mg/kg	194	30.8	10	04/05/17 12:23	04/05/17 14:46	EPA 3050B	1,6020A	AM
Selenium, Total	3.36	J	mg/kg	3.88	1.46	10	04/05/17 12:23	04/05/17 14:46	EPA 3050B	1,6020A	AM
Silver, Total	2.44		mg/kg	0.969	0.095	10	04/05/17 12:23	04/05/17 14:46	EPA 3050B	1,6020A	AM
Sodium, Total	8960		mg/kg	291	22.7	10	04/05/17 12:23	04/05/17 14:46	EPA 3050B	1,6020A	AM
Strontium, Total	51.5		mg/kg	1.94	0.475	10	04/05/17 12:23	04/05/17 14:46	EPA 3050B	1,6020A	AM
Thallium, Total	0.228	J	mg/kg	0.388	0.100	10	04/05/17 12:23	04/05/17 14:46	EPA 3050B	1,6020A	AM
Tin, Total	19.1		mg/kg	2.32	0.240	10	04/05/17 12:23	04/05/17 14:46	EPA 3050B	1,6020A	AM
Titanium, Total	362		mg/kg	0.969	0.167	10	04/05/17 12:23	04/05/17 14:46	EPA 3050B	1,6020A	AM
Vanadium, Total	46.9		mg/kg	1.94	0.735	10	04/05/17 12:23	04/05/17 14:46	EPA 3050B	1,6020A	AM
Zinc, Total	243		mg/kg	19.4	5.04	10	04/05/17 12:23	04/05/17 14:46	EPA 3050B	1,6020A	AM



Project Name: NESE
Project Number: 1794

Lab Number: L1710301
Report Date: 04/06/17

SAMPLE RESULTS

Lab ID: L1710301-02
Client ID: BHA-7 SS2 2-4'
Sample Location: RARITAN BAY, NY
Matrix: Sediment
Percent Solids: 52%

Date Collected: 10/08/16 00:00
Date Received: 04/05/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Aluminum, Total	12200		mg/kg	187	27.7	10	04/05/17 12:23	04/05/17 14:49	EPA 3050B	1,6020A	AM
Antimony, Total	8.32		mg/kg	2.99	0.253	10	04/05/17 12:23	04/05/17 14:49	EPA 3050B	1,6020A	AM
Arsenic, Total	118		mg/kg	0.935	0.123	10	04/05/17 12:23	04/05/17 14:49	EPA 3050B	1,6020A	AM
Barium, Total	84.2		mg/kg	5.61	0.395	10	04/05/17 12:23	04/05/17 14:49	EPA 3050B	1,6020A	AM
Beryllium, Total	1.09		mg/kg	0.561	0.163	10	04/05/17 12:23	04/05/17 14:49	EPA 3050B	1,6020A	AM
Cadmium, Total	1.55		mg/kg	0.374	0.049	10	04/05/17 12:23	04/05/17 14:49	EPA 3050B	1,6020A	AM
Calcium, Total	5010		mg/kg	935	114.	10	04/05/17 12:23	04/05/17 14:49	EPA 3050B	1,6020A	AM
Chromium, Total	136		mg/kg	3.74	0.875	10	04/05/17 12:23	04/05/17 14:49	EPA 3050B	1,6020A	AM
Cobalt, Total	9.17		mg/kg	0.935	0.100	10	04/05/17 12:23	04/05/17 14:49	EPA 3050B	1,6020A	AM
Copper, Total	294		mg/kg	3.74	0.363	10	04/05/17 12:23	04/05/17 14:49	EPA 3050B	1,6020A	AM
Iron, Total	41900		mg/kg	374	38.5	10	04/05/17 12:23	04/05/17 14:49	EPA 3050B	1,6020A	AM
Lead, Total	163		mg/kg	1.12	0.273	10	04/05/17 12:23	04/05/17 14:49	EPA 3050B	1,6020A	AM
Magnesium, Total	6430		mg/kg	187	23.0	10	04/05/17 12:23	04/05/17 14:49	EPA 3050B	1,6020A	AM
Manganese, Total	249		mg/kg	3.74	0.830	10	04/05/17 12:23	04/05/17 14:49	EPA 3050B	1,6020A	AM
Mercury, Total	4.13		mg/kg	0.050	0.006	10	04/05/17 12:14	04/06/17 11:25	EPA 7474	1,7474	LC
Molybdenum, Total	2.12		mg/kg	1.50	0.202	10	04/05/17 12:23	04/05/17 14:49	EPA 3050B	1,6020A	AM
Nickel, Total	35.4		mg/kg	1.87	0.500	10	04/05/17 12:23	04/05/17 14:49	EPA 3050B	1,6020A	AM
Potassium, Total	2810		mg/kg	187	29.7	10	04/05/17 12:23	04/05/17 14:49	EPA 3050B	1,6020A	AM
Selenium, Total	7.22		mg/kg	3.74	1.41	10	04/05/17 12:23	04/05/17 14:49	EPA 3050B	1,6020A	AM
Silver, Total	3.87		mg/kg	0.935	0.091	10	04/05/17 12:23	04/05/17 14:49	EPA 3050B	1,6020A	AM
Sodium, Total	11100		mg/kg	280	21.9	10	04/05/17 12:23	04/05/17 14:49	EPA 3050B	1,6020A	AM
Strontium, Total	66.2		mg/kg	1.87	0.459	10	04/05/17 12:23	04/05/17 14:49	EPA 3050B	1,6020A	AM
Thallium, Total	0.249	J	mg/kg	0.374	0.097	10	04/05/17 12:23	04/05/17 14:49	EPA 3050B	1,6020A	AM
Tin, Total	28.2		mg/kg	2.24	0.232	10	04/05/17 12:23	04/05/17 14:49	EPA 3050B	1,6020A	AM
Titanium, Total	472		mg/kg	0.935	0.162	10	04/05/17 12:23	04/05/17 14:49	EPA 3050B	1,6020A	AM
Vanadium, Total	66.2		mg/kg	1.87	0.709	10	04/05/17 12:23	04/05/17 14:49	EPA 3050B	1,6020A	AM
Zinc, Total	276		mg/kg	18.7	4.86	10	04/05/17 12:23	04/05/17 14:49	EPA 3050B	1,6020A	AM



Project Name: NESE

Lab Number: L1710301

Project Number: 1794

Report Date: 04/06/17

SAMPLE RESULTS

Lab ID: L1710301-03
 Client ID: BHA-7 SS3 4-6'
 Sample Location: RARITAN BAY, NY
 Matrix: Sediment
 Percent Solids: 56%

Date Collected: 10/08/16 00:00
 Date Received: 04/05/17
 Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Aluminum, Total	11200		mg/kg	178	26.4	10	04/05/17 12:23	04/05/17 14:52	EPA 3050B	1,6020A	AM
Antimony, Total	7.15		mg/kg	2.85	0.241	10	04/05/17 12:23	04/05/17 14:52	EPA 3050B	1,6020A	AM
Arsenic, Total	94.6		mg/kg	0.890	0.118	10	04/05/17 12:23	04/05/17 14:52	EPA 3050B	1,6020A	AM
Barium, Total	58.6		mg/kg	5.34	0.376	10	04/05/17 12:23	04/05/17 14:52	EPA 3050B	1,6020A	AM
Beryllium, Total	0.784		mg/kg	0.534	0.155	10	04/05/17 12:23	04/05/17 14:52	EPA 3050B	1,6020A	AM
Cadmium, Total	0.676		mg/kg	0.356	0.047	10	04/05/17 12:23	04/05/17 14:52	EPA 3050B	1,6020A	AM
Calcium, Total	3000		mg/kg	890	108.	10	04/05/17 12:23	04/05/17 14:52	EPA 3050B	1,6020A	AM
Chromium, Total	87.3		mg/kg	3.56	0.834	10	04/05/17 12:23	04/05/17 14:52	EPA 3050B	1,6020A	AM
Cobalt, Total	8.15		mg/kg	0.890	0.095	10	04/05/17 12:23	04/05/17 14:52	EPA 3050B	1,6020A	AM
Copper, Total	145		mg/kg	3.56	0.346	10	04/05/17 12:23	04/05/17 14:52	EPA 3050B	1,6020A	AM
Iron, Total	42300		mg/kg	356	36.7	10	04/05/17 12:23	04/05/17 14:52	EPA 3050B	1,6020A	AM
Lead, Total	125		mg/kg	1.07	0.260	10	04/05/17 12:23	04/05/17 14:52	EPA 3050B	1,6020A	AM
Magnesium, Total	5680		mg/kg	178	21.9	10	04/05/17 12:23	04/05/17 14:52	EPA 3050B	1,6020A	AM
Manganese, Total	285		mg/kg	3.56	0.791	10	04/05/17 12:23	04/05/17 14:52	EPA 3050B	1,6020A	AM
Mercury, Total	1.61		mg/kg	0.021	0.003	5	04/05/17 12:14	04/06/17 11:29	EPA 7474	1,7474	LC
Molybdenum, Total	1.82		mg/kg	1.42	0.192	10	04/05/17 12:23	04/05/17 14:52	EPA 3050B	1,6020A	AM
Nickel, Total	26.3		mg/kg	1.78	0.476	10	04/05/17 12:23	04/05/17 14:52	EPA 3050B	1,6020A	AM
Potassium, Total	2350		mg/kg	178	28.3	10	04/05/17 12:23	04/05/17 14:52	EPA 3050B	1,6020A	AM
Selenium, Total	4.24		mg/kg	3.56	1.35	10	04/05/17 12:23	04/05/17 14:52	EPA 3050B	1,6020A	AM
Silver, Total	1.86		mg/kg	0.890	0.087	10	04/05/17 12:23	04/05/17 14:52	EPA 3050B	1,6020A	AM
Sodium, Total	8510		mg/kg	267	20.9	10	04/05/17 12:23	04/05/17 14:52	EPA 3050B	1,6020A	AM
Strontium, Total	41.9		mg/kg	1.78	0.437	10	04/05/17 12:23	04/05/17 14:52	EPA 3050B	1,6020A	AM
Thallium, Total	0.173	J	mg/kg	0.356	0.092	10	04/05/17 12:23	04/05/17 14:52	EPA 3050B	1,6020A	AM
Tin, Total	21.4		mg/kg	2.14	0.221	10	04/05/17 12:23	04/05/17 14:52	EPA 3050B	1,6020A	AM
Titanium, Total	503		mg/kg	0.890	0.154	10	04/05/17 12:23	04/05/17 14:52	EPA 3050B	1,6020A	AM
Vanadium, Total	62.8		mg/kg	1.78	0.675	10	04/05/17 12:23	04/05/17 14:52	EPA 3050B	1,6020A	AM
Zinc, Total	207		mg/kg	17.8	4.63	10	04/05/17 12:23	04/05/17 14:52	EPA 3050B	1,6020A	AM



Project Name: NESE
Project Number: 1794

Lab Number: L1710301
Report Date: 04/06/17

SAMPLE RESULTS

Lab ID: L1710301-04
Client ID: BHA-7 SS4 6-8'
Sample Location: RARITAN BAY, NY
Matrix: Sediment
Percent Solids: 56%

Date Collected: 10/08/16 00:00
Date Received: 04/05/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Aluminum, Total	10500		mg/kg	170	25.2	10	04/05/17 12:23	04/05/17 14:56	EPA 3050B	1,6020A	AM
Antimony, Total	6.19		mg/kg	2.72	0.230	10	04/05/17 12:23	04/05/17 14:56	EPA 3050B	1,6020A	AM
Arsenic, Total	60.6		mg/kg	0.852	0.112	10	04/05/17 12:23	04/05/17 14:56	EPA 3050B	1,6020A	AM
Barium, Total	49.6		mg/kg	5.11	0.360	10	04/05/17 12:23	04/05/17 14:56	EPA 3050B	1,6020A	AM
Beryllium, Total	0.767		mg/kg	0.511	0.148	10	04/05/17 12:23	04/05/17 14:56	EPA 3050B	1,6020A	AM
Cadmium, Total	0.940		mg/kg	0.341	0.045	10	04/05/17 12:23	04/05/17 14:56	EPA 3050B	1,6020A	AM
Calcium, Total	3390		mg/kg	852	104.	10	04/05/17 12:23	04/05/17 14:56	EPA 3050B	1,6020A	AM
Chromium, Total	78.4		mg/kg	3.41	0.797	10	04/05/17 12:23	04/05/17 14:56	EPA 3050B	1,6020A	AM
Cobalt, Total	8.34		mg/kg	0.852	0.091	10	04/05/17 12:23	04/05/17 14:56	EPA 3050B	1,6020A	AM
Copper, Total	138		mg/kg	3.41	0.330	10	04/05/17 12:23	04/05/17 14:56	EPA 3050B	1,6020A	AM
Iron, Total	32000		mg/kg	341	35.1	10	04/05/17 12:23	04/05/17 14:56	EPA 3050B	1,6020A	AM
Lead, Total	104		mg/kg	1.02	0.249	10	04/05/17 12:23	04/05/17 14:56	EPA 3050B	1,6020A	AM
Magnesium, Total	5110		mg/kg	170	21.0	10	04/05/17 12:23	04/05/17 14:56	EPA 3050B	1,6020A	AM
Manganese, Total	231		mg/kg	3.41	0.756	10	04/05/17 12:23	04/05/17 14:56	EPA 3050B	1,6020A	AM
Mercury, Total	1.41		mg/kg	0.020	0.003	5	04/05/17 12:14	04/06/17 11:33	EPA 7474	1,7474	LC
Molybdenum, Total	1.99		mg/kg	1.36	0.184	10	04/05/17 12:23	04/05/17 14:56	EPA 3050B	1,6020A	AM
Nickel, Total	25.3		mg/kg	1.70	0.455	10	04/05/17 12:23	04/05/17 14:56	EPA 3050B	1,6020A	AM
Potassium, Total	2240		mg/kg	170	27.0	10	04/05/17 12:23	04/05/17 14:56	EPA 3050B	1,6020A	AM
Selenium, Total	4.44		mg/kg	3.41	1.29	10	04/05/17 12:23	04/05/17 14:56	EPA 3050B	1,6020A	AM
Silver, Total	1.93		mg/kg	0.852	0.083	10	04/05/17 12:23	04/05/17 14:56	EPA 3050B	1,6020A	AM
Sodium, Total	7360		mg/kg	255	20.0	10	04/05/17 12:23	04/05/17 14:56	EPA 3050B	1,6020A	AM
Strontium, Total	38.2		mg/kg	1.70	0.418	10	04/05/17 12:23	04/05/17 14:56	EPA 3050B	1,6020A	AM
Thallium, Total	0.176	J	mg/kg	0.341	0.088	10	04/05/17 12:23	04/05/17 14:56	EPA 3050B	1,6020A	AM
Tin, Total	18.1		mg/kg	2.04	0.211	10	04/05/17 12:23	04/05/17 14:56	EPA 3050B	1,6020A	AM
Titanium, Total	455		mg/kg	0.852	0.147	10	04/05/17 12:23	04/05/17 14:56	EPA 3050B	1,6020A	AM
Vanadium, Total	57.1		mg/kg	1.70	0.646	10	04/05/17 12:23	04/05/17 14:56	EPA 3050B	1,6020A	AM
Zinc, Total	212		mg/kg	17.0	4.43	10	04/05/17 12:23	04/05/17 14:56	EPA 3050B	1,6020A	AM



Project Name: NESE

Lab Number: L1710301

Project Number: 1794

Report Date: 04/06/17

SAMPLE RESULTS

Lab ID: L1710301-05
 Client ID: BHA-7 SS5 8-10'
 Sample Location: RARITAN BAY, NY
 Matrix: Sediment
 Percent Solids: 67%

Date Collected: 10/08/16 00:00
 Date Received: 04/05/17
 Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Aluminum, Total	10200		mg/kg	148	21.8	10	04/05/17 12:23	04/05/17 15:12	EPA 3050B	1,6020A	AM
Antimony, Total	1.06	J	mg/kg	2.36	0.200	10	04/05/17 12:23	04/05/17 15:12	EPA 3050B	1,6020A	AM
Arsenic, Total	12.6		mg/kg	0.738	0.097	10	04/05/17 12:23	04/05/17 15:12	EPA 3050B	1,6020A	AM
Barium, Total	22.2		mg/kg	4.43	0.312	10	04/05/17 12:23	04/05/17 15:12	EPA 3050B	1,6020A	AM
Beryllium, Total	0.722		mg/kg	0.443	0.129	10	04/05/17 12:23	04/05/17 15:12	EPA 3050B	1,6020A	AM
Cadmium, Total	0.248	J	mg/kg	0.295	0.039	10	04/05/17 12:23	04/05/17 15:12	EPA 3050B	1,6020A	AM
Calcium, Total	6100		mg/kg	738	89.7	10	04/05/17 12:23	04/05/17 15:12	EPA 3050B	1,6020A	AM
Chromium, Total	28.9		mg/kg	2.95	0.690	10	04/05/17 12:23	04/05/17 15:12	EPA 3050B	1,6020A	AM
Cobalt, Total	7.00		mg/kg	0.738	0.079	10	04/05/17 12:23	04/05/17 15:12	EPA 3050B	1,6020A	AM
Copper, Total	19.0		mg/kg	2.95	0.286	10	04/05/17 12:23	04/05/17 15:12	EPA 3050B	1,6020A	AM
Iron, Total	29100		mg/kg	295	30.4	10	04/05/17 12:23	04/05/17 15:12	EPA 3050B	1,6020A	AM
Lead, Total	17.3		mg/kg	0.885	0.215	10	04/05/17 12:23	04/05/17 15:12	EPA 3050B	1,6020A	AM
Magnesium, Total	5650		mg/kg	148	18.2	10	04/05/17 12:23	04/05/17 15:12	EPA 3050B	1,6020A	AM
Manganese, Total	265		mg/kg	2.95	0.655	10	04/05/17 12:23	04/05/17 15:12	EPA 3050B	1,6020A	AM
Mercury, Total	0.134		mg/kg	0.018	0.002	5	04/05/17 12:14	04/06/17 11:37	EPA 7474	1,7474	LC
Molybdenum, Total	2.10		mg/kg	1.18	0.159	10	04/05/17 12:23	04/05/17 15:12	EPA 3050B	1,6020A	AM
Nickel, Total	19.3		mg/kg	1.48	0.394	10	04/05/17 12:23	04/05/17 15:12	EPA 3050B	1,6020A	AM
Potassium, Total	2570		mg/kg	148	23.4	10	04/05/17 12:23	04/05/17 15:12	EPA 3050B	1,6020A	AM
Selenium, Total	1.88	J	mg/kg	2.95	1.12	10	04/05/17 12:23	04/05/17 15:12	EPA 3050B	1,6020A	AM
Silver, Total	0.152	J	mg/kg	0.738	0.072	10	04/05/17 12:23	04/05/17 15:12	EPA 3050B	1,6020A	AM
Sodium, Total	6430		mg/kg	221	17.3	10	04/05/17 12:23	04/05/17 15:12	EPA 3050B	1,6020A	AM
Strontium, Total	39.8		mg/kg	1.48	0.362	10	04/05/17 12:23	04/05/17 15:12	EPA 3050B	1,6020A	AM
Thallium, Total	0.144	J	mg/kg	0.295	0.076	10	04/05/17 12:23	04/05/17 15:12	EPA 3050B	1,6020A	AM
Tin, Total	2.29		mg/kg	1.77	0.183	10	04/05/17 12:23	04/05/17 15:12	EPA 3050B	1,6020A	AM
Titanium, Total	203		mg/kg	0.738	0.127	10	04/05/17 12:23	04/05/17 15:12	EPA 3050B	1,6020A	AM
Vanadium, Total	30.6		mg/kg	1.48	0.560	10	04/05/17 12:23	04/05/17 15:12	EPA 3050B	1,6020A	AM
Zinc, Total	71.6		mg/kg	14.8	3.84	10	04/05/17 12:23	04/05/17 15:12	EPA 3050B	1,6020A	AM



Project Name: NESE

Lab Number: L1710301

Project Number: 1794

Report Date: 04/06/17

SAMPLE RESULTS

Lab ID: L1710301-06
 Client ID: BHA-7 SS6 10-12'
 Sample Location: RARITAN BAY, NY
 Matrix: Sediment
 Percent Solids: 78%

Date Collected: 10/08/16 00:00
 Date Received: 04/05/17
 Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Aluminum, Total	4800		mg/kg	127	18.8	10	04/05/17 12:23	04/05/17 15:16	EPA 3050B	1,6020A	AM
Antimony, Total	0.475	J	mg/kg	2.03	0.172	10	04/05/17 12:23	04/05/17 15:16	EPA 3050B	1,6020A	AM
Arsenic, Total	7.46		mg/kg	0.634	0.084	10	04/05/17 12:23	04/05/17 15:16	EPA 3050B	1,6020A	AM
Barium, Total	11.5		mg/kg	3.80	0.268	10	04/05/17 12:23	04/05/17 15:16	EPA 3050B	1,6020A	AM
Beryllium, Total	0.373	J	mg/kg	0.380	0.111	10	04/05/17 12:23	04/05/17 15:16	EPA 3050B	1,6020A	AM
Cadmium, Total	ND		mg/kg	0.254	0.034	10	04/05/17 12:23	04/05/17 15:16	EPA 3050B	1,6020A	AM
Calcium, Total	4580		mg/kg	634	77.1	10	04/05/17 12:23	04/05/17 15:16	EPA 3050B	1,6020A	AM
Chromium, Total	12.8		mg/kg	2.54	0.594	10	04/05/17 12:23	04/05/17 15:16	EPA 3050B	1,6020A	AM
Cobalt, Total	3.56		mg/kg	0.634	0.068	10	04/05/17 12:23	04/05/17 15:16	EPA 3050B	1,6020A	AM
Copper, Total	7.65		mg/kg	2.54	0.246	10	04/05/17 12:23	04/05/17 15:16	EPA 3050B	1,6020A	AM
Iron, Total	13900		mg/kg	254	26.1	10	04/05/17 12:23	04/05/17 15:16	EPA 3050B	1,6020A	AM
Lead, Total	8.51		mg/kg	0.761	0.185	10	04/05/17 12:23	04/05/17 15:16	EPA 3050B	1,6020A	AM
Magnesium, Total	2510		mg/kg	127	15.6	10	04/05/17 12:23	04/05/17 15:16	EPA 3050B	1,6020A	AM
Manganese, Total	125		mg/kg	2.54	0.563	10	04/05/17 12:23	04/05/17 15:16	EPA 3050B	1,6020A	AM
Mercury, Total	0.030		mg/kg	0.017	0.002	5	04/05/17 12:14	04/06/17 11:39	EPA 7474	1,7474	LC
Molybdenum, Total	0.663	J	mg/kg	1.01	0.137	10	04/05/17 12:23	04/05/17 15:16	EPA 3050B	1,6020A	AM
Nickel, Total	8.47		mg/kg	1.27	0.339	10	04/05/17 12:23	04/05/17 15:16	EPA 3050B	1,6020A	AM
Potassium, Total	1100		mg/kg	127	20.1	10	04/05/17 12:23	04/05/17 15:16	EPA 3050B	1,6020A	AM
Selenium, Total	1.19	J	mg/kg	2.54	0.959	10	04/05/17 12:23	04/05/17 15:16	EPA 3050B	1,6020A	AM
Silver, Total	ND		mg/kg	0.634	0.062	10	04/05/17 12:23	04/05/17 15:16	EPA 3050B	1,6020A	AM
Sodium, Total	3020		mg/kg	190	14.9	10	04/05/17 12:23	04/05/17 15:16	EPA 3050B	1,6020A	AM
Strontium, Total	30.5		mg/kg	1.27	0.311	10	04/05/17 12:23	04/05/17 15:16	EPA 3050B	1,6020A	AM
Thallium, Total	ND		mg/kg	0.254	0.066	10	04/05/17 12:23	04/05/17 15:16	EPA 3050B	1,6020A	AM
Tin, Total	0.878	J	mg/kg	1.52	0.157	10	04/05/17 12:23	04/05/17 15:16	EPA 3050B	1,6020A	AM
Titanium, Total	104		mg/kg	0.634	0.110	10	04/05/17 12:23	04/05/17 15:16	EPA 3050B	1,6020A	AM
Vanadium, Total	18.5		mg/kg	1.27	0.481	10	04/05/17 12:23	04/05/17 15:16	EPA 3050B	1,6020A	AM
Zinc, Total	31.7		mg/kg	12.7	3.30	10	04/05/17 12:23	04/05/17 15:16	EPA 3050B	1,6020A	AM



Project Name: NESE
Project Number: 1794

Lab Number: L1710301
Report Date: 04/06/17

SAMPLE RESULTS

Lab ID: L1710301-07
 Client ID: BHA-7 SS7 15-17'
 Sample Location: RARITAN BAY, NY
 Matrix: Sediment
 Percent Solids: 53%

Date Collected: 10/08/16 00:00
 Date Received: 04/05/17
 Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Aluminum, Total	15700		mg/kg	185	27.4	10	04/05/17 12:23	04/05/17 15:19	EPA 3050B	1,6020A	AM
Antimony, Total	0.458	J	mg/kg	2.96	0.250	10	04/05/17 12:23	04/05/17 15:19	EPA 3050B	1,6020A	AM
Arsenic, Total	15.1		mg/kg	0.925	0.122	10	04/05/17 12:23	04/05/17 15:19	EPA 3050B	1,6020A	AM
Barium, Total	28.5		mg/kg	5.55	0.391	10	04/05/17 12:23	04/05/17 15:19	EPA 3050B	1,6020A	AM
Beryllium, Total	1.09		mg/kg	0.555	0.161	10	04/05/17 12:23	04/05/17 15:19	EPA 3050B	1,6020A	AM
Cadmium, Total	0.426		mg/kg	0.370	0.049	10	04/05/17 12:23	04/05/17 15:19	EPA 3050B	1,6020A	AM
Calcium, Total	7750		mg/kg	925	112.	10	04/05/17 12:23	04/05/17 15:19	EPA 3050B	1,6020A	AM
Chromium, Total	37.9		mg/kg	3.70	0.866	10	04/05/17 12:23	04/05/17 15:19	EPA 3050B	1,6020A	AM
Cobalt, Total	11.1		mg/kg	0.925	0.098	10	04/05/17 12:23	04/05/17 15:19	EPA 3050B	1,6020A	AM
Copper, Total	18.8		mg/kg	3.70	0.359	10	04/05/17 12:23	04/05/17 15:19	EPA 3050B	1,6020A	AM
Iron, Total	42900		mg/kg	370	38.1	10	04/05/17 12:23	04/05/17 15:19	EPA 3050B	1,6020A	AM
Lead, Total	14.7		mg/kg	1.11	0.270	10	04/05/17 12:23	04/05/17 15:19	EPA 3050B	1,6020A	AM
Magnesium, Total	7550		mg/kg	185	22.8	10	04/05/17 12:23	04/05/17 15:19	EPA 3050B	1,6020A	AM
Manganese, Total	348		mg/kg	3.70	0.821	10	04/05/17 12:23	04/05/17 15:19	EPA 3050B	1,6020A	AM
Mercury, Total	0.033		mg/kg	0.025	0.003	5	04/05/17 12:14	04/06/17 11:49	EPA 7474	1,7474	LC
Molybdenum, Total	4.95		mg/kg	1.48	0.200	10	04/05/17 12:23	04/05/17 15:19	EPA 3050B	1,6020A	AM
Nickel, Total	27.8		mg/kg	1.85	0.494	10	04/05/17 12:23	04/05/17 15:19	EPA 3050B	1,6020A	AM
Potassium, Total	3570		mg/kg	185	29.4	10	04/05/17 12:23	04/05/17 15:19	EPA 3050B	1,6020A	AM
Selenium, Total	2.27	J	mg/kg	3.70	1.40	10	04/05/17 12:23	04/05/17 15:19	EPA 3050B	1,6020A	AM
Silver, Total	ND		mg/kg	0.925	0.090	10	04/05/17 12:23	04/05/17 15:19	EPA 3050B	1,6020A	AM
Sodium, Total	8180		mg/kg	277	21.7	10	04/05/17 12:23	04/05/17 15:19	EPA 3050B	1,6020A	AM
Strontium, Total	50.1		mg/kg	1.85	0.454	10	04/05/17 12:23	04/05/17 15:19	EPA 3050B	1,6020A	AM
Thallium, Total	0.275	J	mg/kg	0.370	0.095	10	04/05/17 12:23	04/05/17 15:19	EPA 3050B	1,6020A	AM
Tin, Total	1.55	J	mg/kg	2.22	0.229	10	04/05/17 12:23	04/05/17 15:19	EPA 3050B	1,6020A	AM
Titanium, Total	245		mg/kg	0.925	0.160	10	04/05/17 12:23	04/05/17 15:19	EPA 3050B	1,6020A	AM
Vanadium, Total	44.2		mg/kg	1.85	0.701	10	04/05/17 12:23	04/05/17 15:19	EPA 3050B	1,6020A	AM
Zinc, Total	86.1		mg/kg	18.5	4.81	10	04/05/17 12:23	04/05/17 15:19	EPA 3050B	1,6020A	AM



Project Name: NESE

Lab Number: L1710301

Project Number: 1794

Report Date: 04/06/17

SAMPLE RESULTS

Lab ID: L1710301-08
 Client ID: BHA-9 SS2 2-4'
 Sample Location: RARITAN BAY, NY
 Matrix: Sediment
 Percent Solids: 72%

Date Collected: 10/08/16 00:00
 Date Received: 04/05/17
 Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Aluminum, Total	4710		mg/kg	136	20.2	10	04/05/17 12:23	04/05/17 15:22	EPA 3050B	1,6020A	AM
Antimony, Total	0.396	J	mg/kg	2.18	0.184	10	04/05/17 12:23	04/05/17 15:22	EPA 3050B	1,6020A	AM
Arsenic, Total	6.05		mg/kg	0.682	0.090	10	04/05/17 12:23	04/05/17 15:22	EPA 3050B	1,6020A	AM
Barium, Total	10.6		mg/kg	4.09	0.288	10	04/05/17 12:23	04/05/17 15:22	EPA 3050B	1,6020A	AM
Beryllium, Total	0.298	J	mg/kg	0.409	0.119	10	04/05/17 12:23	04/05/17 15:22	EPA 3050B	1,6020A	AM
Cadmium, Total	0.109	J	mg/kg	0.273	0.036	10	04/05/17 12:23	04/05/17 15:22	EPA 3050B	1,6020A	AM
Calcium, Total	4020		mg/kg	682	82.9	10	04/05/17 12:23	04/05/17 15:22	EPA 3050B	1,6020A	AM
Chromium, Total	15.2		mg/kg	2.73	0.638	10	04/05/17 12:23	04/05/17 15:22	EPA 3050B	1,6020A	AM
Cobalt, Total	3.72		mg/kg	0.682	0.073	10	04/05/17 12:23	04/05/17 15:22	EPA 3050B	1,6020A	AM
Copper, Total	9.88		mg/kg	2.73	0.264	10	04/05/17 12:23	04/05/17 15:22	EPA 3050B	1,6020A	AM
Iron, Total	14600		mg/kg	273	28.1	10	04/05/17 12:23	04/05/17 15:22	EPA 3050B	1,6020A	AM
Lead, Total	12.4		mg/kg	0.818	0.199	10	04/05/17 12:23	04/05/17 15:22	EPA 3050B	1,6020A	AM
Magnesium, Total	2850		mg/kg	136	16.8	10	04/05/17 12:23	04/05/17 15:22	EPA 3050B	1,6020A	AM
Manganese, Total	139		mg/kg	2.73	0.606	10	04/05/17 12:23	04/05/17 15:22	EPA 3050B	1,6020A	AM
Mercury, Total	0.054		mg/kg	0.016	0.002	5	04/05/17 12:14	04/06/17 11:51	EPA 7474	1,7474	LC
Molybdenum, Total	1.04	J	mg/kg	1.09	0.147	10	04/05/17 12:23	04/05/17 15:22	EPA 3050B	1,6020A	AM
Nickel, Total	9.27		mg/kg	1.36	0.364	10	04/05/17 12:23	04/05/17 15:22	EPA 3050B	1,6020A	AM
Potassium, Total	1290		mg/kg	136	21.6	10	04/05/17 12:23	04/05/17 15:22	EPA 3050B	1,6020A	AM
Selenium, Total	ND		mg/kg	2.73	1.03	10	04/05/17 12:23	04/05/17 15:22	EPA 3050B	1,6020A	AM
Silver, Total	0.122	J	mg/kg	0.682	0.067	10	04/05/17 12:23	04/05/17 15:22	EPA 3050B	1,6020A	AM
Sodium, Total	3700		mg/kg	204	16.0	10	04/05/17 12:23	04/05/17 15:22	EPA 3050B	1,6020A	AM
Strontium, Total	24.4		mg/kg	1.36	0.334	10	04/05/17 12:23	04/05/17 15:22	EPA 3050B	1,6020A	AM
Thallium, Total	ND		mg/kg	0.273	0.070	10	04/05/17 12:23	04/05/17 15:22	EPA 3050B	1,6020A	AM
Tin, Total	1.01	J	mg/kg	1.64	0.169	10	04/05/17 12:23	04/05/17 15:22	EPA 3050B	1,6020A	AM
Titanium, Total	113		mg/kg	0.682	0.118	10	04/05/17 12:23	04/05/17 15:22	EPA 3050B	1,6020A	AM
Vanadium, Total	17.2		mg/kg	1.36	0.517	10	04/05/17 12:23	04/05/17 15:22	EPA 3050B	1,6020A	AM
Zinc, Total	38.6		mg/kg	13.6	3.55	10	04/05/17 12:23	04/05/17 15:22	EPA 3050B	1,6020A	AM



Project Name: NESE

Lab Number: L1710301

Project Number: 1794

Report Date: 04/06/17

SAMPLE RESULTS

Lab ID: L1710301-09
 Client ID: BHA-9 SS3 4-6'
 Sample Location: RARITAN BAY, NY
 Matrix: Sediment
 Percent Solids: 78%

Date Collected: 10/08/16 00:00
 Date Received: 04/05/17
 Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Aluminum, Total	4460		mg/kg	122	18.1	10	04/05/17 12:23	04/05/17 15:26	EPA 3050B	1,6020A	AM
Antimony, Total	0.403	J	mg/kg	1.96	0.165	10	04/05/17 12:23	04/05/17 15:26	EPA 3050B	1,6020A	AM
Arsenic, Total	6.27		mg/kg	0.611	0.081	10	04/05/17 12:23	04/05/17 15:26	EPA 3050B	1,6020A	AM
Barium, Total	9.50		mg/kg	3.66	0.258	10	04/05/17 12:23	04/05/17 15:26	EPA 3050B	1,6020A	AM
Beryllium, Total	0.318	J	mg/kg	0.366	0.106	10	04/05/17 12:23	04/05/17 15:26	EPA 3050B	1,6020A	AM
Cadmium, Total	0.099	J	mg/kg	0.244	0.032	10	04/05/17 12:23	04/05/17 15:26	EPA 3050B	1,6020A	AM
Calcium, Total	6760		mg/kg	611	74.3	10	04/05/17 12:23	04/05/17 15:26	EPA 3050B	1,6020A	AM
Chromium, Total	13.4		mg/kg	2.44	0.572	10	04/05/17 12:23	04/05/17 15:26	EPA 3050B	1,6020A	AM
Cobalt, Total	3.46		mg/kg	0.611	0.065	10	04/05/17 12:23	04/05/17 15:26	EPA 3050B	1,6020A	AM
Copper, Total	7.42		mg/kg	2.44	0.237	10	04/05/17 12:23	04/05/17 15:26	EPA 3050B	1,6020A	AM
Iron, Total	13800		mg/kg	244	25.2	10	04/05/17 12:23	04/05/17 15:26	EPA 3050B	1,6020A	AM
Lead, Total	11.0		mg/kg	0.733	0.178	10	04/05/17 12:23	04/05/17 15:26	EPA 3050B	1,6020A	AM
Magnesium, Total	2860		mg/kg	122	15.0	10	04/05/17 12:23	04/05/17 15:26	EPA 3050B	1,6020A	AM
Manganese, Total	132		mg/kg	2.44	0.542	10	04/05/17 12:23	04/05/17 15:26	EPA 3050B	1,6020A	AM
Mercury, Total	0.036		mg/kg	0.016	0.002	5	04/05/17 12:14	04/06/17 11:54	EPA 7474	1,7474	LC
Molybdenum, Total	1.18		mg/kg	0.978	0.132	10	04/05/17 12:23	04/05/17 15:26	EPA 3050B	1,6020A	AM
Nickel, Total	7.96		mg/kg	1.22	0.326	10	04/05/17 12:23	04/05/17 15:26	EPA 3050B	1,6020A	AM
Potassium, Total	1200		mg/kg	122	19.4	10	04/05/17 12:23	04/05/17 15:26	EPA 3050B	1,6020A	AM
Selenium, Total	ND		mg/kg	2.44	0.924	10	04/05/17 12:23	04/05/17 15:26	EPA 3050B	1,6020A	AM
Silver, Total	ND		mg/kg	0.611	0.060	10	04/05/17 12:23	04/05/17 15:26	EPA 3050B	1,6020A	AM
Sodium, Total	4070		mg/kg	183	14.3	10	04/05/17 12:23	04/05/17 15:26	EPA 3050B	1,6020A	AM
Strontium, Total	37.8		mg/kg	1.22	0.300	10	04/05/17 12:23	04/05/17 15:26	EPA 3050B	1,6020A	AM
Thallium, Total	ND		mg/kg	0.244	0.063	10	04/05/17 12:23	04/05/17 15:26	EPA 3050B	1,6020A	AM
Tin, Total	0.876	J	mg/kg	1.47	0.152	10	04/05/17 12:23	04/05/17 15:26	EPA 3050B	1,6020A	AM
Titanium, Total	116		mg/kg	0.611	0.106	10	04/05/17 12:23	04/05/17 15:26	EPA 3050B	1,6020A	AM
Vanadium, Total	17.1		mg/kg	1.22	0.463	10	04/05/17 12:23	04/05/17 15:26	EPA 3050B	1,6020A	AM
Zinc, Total	33.8		mg/kg	12.2	3.18	10	04/05/17 12:23	04/05/17 15:26	EPA 3050B	1,6020A	AM



Project Name: NESE

Lab Number: L1710301

Project Number: 1794

Report Date: 04/06/17

SAMPLE RESULTS

Lab ID: L1710301-10
 Client ID: BHA-9 SS4 6-8'
 Sample Location: RARITAN BAY, NY
 Matrix: Sediment
 Percent Solids: 85%

Date Collected: 10/08/16 00:00
 Date Received: 04/05/17
 Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Aluminum, Total	1680		mg/kg	116	17.1	10	04/05/17 12:23	04/05/17 15:29	EPA 3050B	1,6020A	AM
Antimony, Total	0.226	J	mg/kg	1.85	0.156	10	04/05/17 12:23	04/05/17 15:29	EPA 3050B	1,6020A	AM
Arsenic, Total	1.13		mg/kg	0.578	0.076	10	04/05/17 12:23	04/05/17 15:29	EPA 3050B	1,6020A	AM
Barium, Total	18.8		mg/kg	3.47	0.244	10	04/05/17 12:23	04/05/17 15:29	EPA 3050B	1,6020A	AM
Beryllium, Total	0.730		mg/kg	0.347	0.101	10	04/05/17 12:23	04/05/17 15:29	EPA 3050B	1,6020A	AM
Cadmium, Total	ND		mg/kg	0.231	0.031	10	04/05/17 12:23	04/05/17 15:29	EPA 3050B	1,6020A	AM
Calcium, Total	272	J	mg/kg	578	70.3	10	04/05/17 12:23	04/05/17 15:29	EPA 3050B	1,6020A	AM
Chromium, Total	5.16		mg/kg	2.31	0.541	10	04/05/17 12:23	04/05/17 15:29	EPA 3050B	1,6020A	AM
Cobalt, Total	11.8		mg/kg	0.578	0.062	10	04/05/17 12:23	04/05/17 15:29	EPA 3050B	1,6020A	AM
Copper, Total	11.1		mg/kg	2.31	0.224	10	04/05/17 12:23	04/05/17 15:29	EPA 3050B	1,6020A	AM
Iron, Total	1660		mg/kg	231	23.8	10	04/05/17 12:23	04/05/17 15:29	EPA 3050B	1,6020A	AM
Lead, Total	8.05		mg/kg	0.693	0.169	10	04/05/17 12:23	04/05/17 15:29	EPA 3050B	1,6020A	AM
Magnesium, Total	415		mg/kg	116	14.2	10	04/05/17 12:23	04/05/17 15:29	EPA 3050B	1,6020A	AM
Manganese, Total	4.98		mg/kg	2.31	0.513	10	04/05/17 12:23	04/05/17 15:29	EPA 3050B	1,6020A	AM
Mercury, Total	0.015	J	mg/kg	0.016	0.002	5	04/05/17 12:14	04/06/17 11:56	EPA 7474	1,7474	LC
Molybdenum, Total	0.191	J	mg/kg	0.924	0.125	10	04/05/17 12:23	04/05/17 15:29	EPA 3050B	1,6020A	AM
Nickel, Total	13.7		mg/kg	1.16	0.309	10	04/05/17 12:23	04/05/17 15:29	EPA 3050B	1,6020A	AM
Potassium, Total	684		mg/kg	116	18.4	10	04/05/17 12:23	04/05/17 15:29	EPA 3050B	1,6020A	AM
Selenium, Total	3.01		mg/kg	2.31	0.874	10	04/05/17 12:23	04/05/17 15:29	EPA 3050B	1,6020A	AM
Silver, Total	ND		mg/kg	0.578	0.056	10	04/05/17 12:23	04/05/17 15:29	EPA 3050B	1,6020A	AM
Sodium, Total	1570		mg/kg	173	13.5	10	04/05/17 12:23	04/05/17 15:29	EPA 3050B	1,6020A	AM
Strontium, Total	6.58		mg/kg	1.16	0.283	10	04/05/17 12:23	04/05/17 15:29	EPA 3050B	1,6020A	AM
Thallium, Total	0.102	J	mg/kg	0.231	0.060	10	04/05/17 12:23	04/05/17 15:29	EPA 3050B	1,6020A	AM
Tin, Total	0.624	J	mg/kg	1.39	0.143	10	04/05/17 12:23	04/05/17 15:29	EPA 3050B	1,6020A	AM
Titanium, Total	18.1		mg/kg	0.578	0.100	10	04/05/17 12:23	04/05/17 15:29	EPA 3050B	1,6020A	AM
Vanadium, Total	13.1		mg/kg	1.16	0.438	10	04/05/17 12:23	04/05/17 15:29	EPA 3050B	1,6020A	AM
Zinc, Total	29.4		mg/kg	11.6	3.00	10	04/05/17 12:23	04/05/17 15:29	EPA 3050B	1,6020A	AM



Project Name: NESE

Lab Number: L1710301

Project Number: 1794

Report Date: 04/06/17

SAMPLE RESULTS

Lab ID: L1710301-11

Date Collected: 10/08/16 00:00

Client ID: BHA-9 SS5 8-10'

Date Received: 04/05/17

Sample Location: RARITAN BAY, NY

Field Prep: Not Specified

Matrix: Sediment

Percent Solids: 85%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Aluminum, Total	1950		mg/kg	114	16.8	10	04/05/17 12:23	04/05/17 16:40	EPA 3050B	1,6020A	AM
Antimony, Total	0.256	J	mg/kg	1.82	0.154	10	04/05/17 12:23	04/05/17 16:40	EPA 3050B	1,6020A	AM
Arsenic, Total	1.89		mg/kg	0.569	0.075	10	04/05/17 12:23	04/05/17 16:40	EPA 3050B	1,6020A	AM
Barium, Total	16.8		mg/kg	3.41	0.240	10	04/05/17 12:23	04/05/17 16:40	EPA 3050B	1,6020A	AM
Beryllium, Total	0.781		mg/kg	0.341	0.099	10	04/05/17 12:23	04/05/17 16:40	EPA 3050B	1,6020A	AM
Cadmium, Total	ND		mg/kg	0.227	0.030	10	04/05/17 12:23	04/05/17 16:40	EPA 3050B	1,6020A	AM
Calcium, Total	253	J	mg/kg	569	69.1	10	04/05/17 12:23	04/05/17 16:40	EPA 3050B	1,6020A	AM
Chromium, Total	5.81		mg/kg	2.27	0.532	10	04/05/17 12:23	04/05/17 16:40	EPA 3050B	1,6020A	AM
Cobalt, Total	19.7		mg/kg	0.569	0.061	10	04/05/17 12:23	04/05/17 16:40	EPA 3050B	1,6020A	AM
Copper, Total	8.38		mg/kg	2.27	0.221	10	04/05/17 12:23	04/05/17 16:40	EPA 3050B	1,6020A	AM
Iron, Total	887		mg/kg	227	23.4	10	04/05/17 12:23	04/05/17 16:40	EPA 3050B	1,6020A	AM
Lead, Total	10.6		mg/kg	0.682	0.166	10	04/05/17 12:23	04/05/17 16:40	EPA 3050B	1,6020A	AM
Magnesium, Total	482		mg/kg	114	14.0	10	04/05/17 12:23	04/05/17 16:40	EPA 3050B	1,6020A	AM
Manganese, Total	3.99		mg/kg	2.27	0.505	10	04/05/17 12:23	04/05/17 16:40	EPA 3050B	1,6020A	AM
Mercury, Total	0.025		mg/kg	0.015	0.002	5	04/05/17 12:14	04/06/17 11:59	EPA 7474	1,7474	LC
Molybdenum, Total	0.317	J	mg/kg	0.910	0.123	10	04/05/17 12:23	04/05/17 16:40	EPA 3050B	1,6020A	AM
Nickel, Total	22.2		mg/kg	1.14	0.304	10	04/05/17 12:23	04/05/17 16:40	EPA 3050B	1,6020A	AM
Potassium, Total	716		mg/kg	114	18.1	10	04/05/17 12:23	04/05/17 16:40	EPA 3050B	1,6020A	AM
Selenium, Total	3.78		mg/kg	2.27	0.860	10	04/05/17 12:23	04/05/17 16:40	EPA 3050B	1,6020A	AM
Silver, Total	ND		mg/kg	0.569	0.056	10	04/05/17 12:23	04/05/17 16:40	EPA 3050B	1,6020A	AM
Sodium, Total	1870		mg/kg	170	13.3	10	04/05/17 12:23	04/05/17 16:40	EPA 3050B	1,6020A	AM
Strontium, Total	7.18		mg/kg	1.14	0.279	10	04/05/17 12:23	04/05/17 16:40	EPA 3050B	1,6020A	AM
Thallium, Total	0.133	J	mg/kg	0.227	0.059	10	04/05/17 12:23	04/05/17 16:40	EPA 3050B	1,6020A	AM
Tin, Total	0.478	J	mg/kg	1.36	0.141	10	04/05/17 12:23	04/05/17 16:40	EPA 3050B	1,6020A	AM
Titanium, Total	21.6		mg/kg	0.569	0.098	10	04/05/17 12:23	04/05/17 16:40	EPA 3050B	1,6020A	AM
Vanadium, Total	13.6		mg/kg	1.14	0.431	10	04/05/17 12:23	04/05/17 16:40	EPA 3050B	1,6020A	AM
Zinc, Total	22.7		mg/kg	11.4	2.96	10	04/05/17 12:23	04/05/17 16:40	EPA 3050B	1,6020A	AM



Project Name: NESE

Lab Number: L1710301

Project Number: 1794

Report Date: 04/06/17

SAMPLE RESULTS

Lab ID: L1710301-12
 Client ID: BHA-9 SS6 10-12'
 Sample Location: RARITAN BAY, NY
 Matrix: Sediment
 Percent Solids: 85%

Date Collected: 10/08/16 00:00
 Date Received: 04/05/17
 Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Aluminum, Total	1440		mg/kg	112	16.6	10	04/05/17 12:23	04/05/17 16:44	EPA 3050B	1,6020A	AM
Antimony, Total	0.290	J	mg/kg	1.79	0.151	10	04/05/17 12:23	04/05/17 16:44	EPA 3050B	1,6020A	AM
Arsenic, Total	1.64		mg/kg	0.560	0.074	10	04/05/17 12:23	04/05/17 16:44	EPA 3050B	1,6020A	AM
Barium, Total	8.82		mg/kg	3.36	0.236	10	04/05/17 12:23	04/05/17 16:44	EPA 3050B	1,6020A	AM
Beryllium, Total	0.983		mg/kg	0.336	0.098	10	04/05/17 12:23	04/05/17 16:44	EPA 3050B	1,6020A	AM
Cadmium, Total	ND		mg/kg	0.224	0.030	10	04/05/17 12:23	04/05/17 16:44	EPA 3050B	1,6020A	AM
Calcium, Total	397	J	mg/kg	560	68.0	10	04/05/17 12:23	04/05/17 16:44	EPA 3050B	1,6020A	AM
Chromium, Total	5.72		mg/kg	2.24	0.524	10	04/05/17 12:23	04/05/17 16:44	EPA 3050B	1,6020A	AM
Cobalt, Total	34.8		mg/kg	0.560	0.060	10	04/05/17 12:23	04/05/17 16:44	EPA 3050B	1,6020A	AM
Copper, Total	11.0		mg/kg	2.24	0.217	10	04/05/17 12:23	04/05/17 16:44	EPA 3050B	1,6020A	AM
Iron, Total	2660		mg/kg	224	23.0	10	04/05/17 12:23	04/05/17 16:44	EPA 3050B	1,6020A	AM
Lead, Total	14.1		mg/kg	0.672	0.163	10	04/05/17 12:23	04/05/17 16:44	EPA 3050B	1,6020A	AM
Magnesium, Total	424		mg/kg	112	13.8	10	04/05/17 12:23	04/05/17 16:44	EPA 3050B	1,6020A	AM
Manganese, Total	13.1		mg/kg	2.24	0.497	10	04/05/17 12:23	04/05/17 16:44	EPA 3050B	1,6020A	AM
Mercury, Total	0.007	J	mg/kg	0.015	0.002	5	04/05/17 12:14	04/06/17 12:01	EPA 7474	1,7474	LC
Molybdenum, Total	0.181	J	mg/kg	0.895	0.121	10	04/05/17 12:23	04/05/17 16:44	EPA 3050B	1,6020A	AM
Nickel, Total	15.9		mg/kg	1.12	0.299	10	04/05/17 12:23	04/05/17 16:44	EPA 3050B	1,6020A	AM
Potassium, Total	718		mg/kg	112	17.8	10	04/05/17 12:23	04/05/17 16:44	EPA 3050B	1,6020A	AM
Selenium, Total	2.61		mg/kg	2.24	0.846	10	04/05/17 12:23	04/05/17 16:44	EPA 3050B	1,6020A	AM
Silver, Total	ND		mg/kg	0.560	0.055	10	04/05/17 12:23	04/05/17 16:44	EPA 3050B	1,6020A	AM
Sodium, Total	1840		mg/kg	168	13.1	10	04/05/17 12:23	04/05/17 16:44	EPA 3050B	1,6020A	AM
Strontium, Total	6.47		mg/kg	1.12	0.274	10	04/05/17 12:23	04/05/17 16:44	EPA 3050B	1,6020A	AM
Thallium, Total	0.177	J	mg/kg	0.224	0.058	10	04/05/17 12:23	04/05/17 16:44	EPA 3050B	1,6020A	AM
Tin, Total	0.583	J	mg/kg	1.34	0.139	10	04/05/17 12:23	04/05/17 16:44	EPA 3050B	1,6020A	AM
Titanium, Total	31.2		mg/kg	0.560	0.097	10	04/05/17 12:23	04/05/17 16:44	EPA 3050B	1,6020A	AM
Vanadium, Total	17.2		mg/kg	1.12	0.424	10	04/05/17 12:23	04/05/17 16:44	EPA 3050B	1,6020A	AM
Zinc, Total	23.6		mg/kg	11.2	2.91	10	04/05/17 12:23	04/05/17 16:44	EPA 3050B	1,6020A	AM



Project Name: NESE

Lab Number: L1710301

Project Number: 1794

Report Date: 04/06/17

SAMPLE RESULTS

Lab ID: L1710301-13
 Client ID: BHA-9 SS7 15-17'
 Sample Location: RARITAN BAY, NY
 Matrix: Sediment
 Percent Solids: 78%

Date Collected: 10/08/16 00:00
 Date Received: 04/05/17
 Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Aluminum, Total	554		mg/kg	124	18.3	10	04/05/17 12:23	04/05/17 15:39	EPA 3050B	1,6020A	AM
Antimony, Total	ND		mg/kg	1.98	0.167	10	04/05/17 12:23	04/05/17 15:39	EPA 3050B	1,6020A	AM
Arsenic, Total	1.40		mg/kg	0.619	0.082	10	04/05/17 12:23	04/05/17 15:39	EPA 3050B	1,6020A	AM
Barium, Total	3.40	J	mg/kg	3.71	0.261	10	04/05/17 12:23	04/05/17 15:39	EPA 3050B	1,6020A	AM
Beryllium, Total	ND		mg/kg	0.371	0.108	10	04/05/17 12:23	04/05/17 15:39	EPA 3050B	1,6020A	AM
Cadmium, Total	ND		mg/kg	0.248	0.033	10	04/05/17 12:23	04/05/17 15:39	EPA 3050B	1,6020A	AM
Calcium, Total	289	J	mg/kg	619	75.2	10	04/05/17 12:23	04/05/17 15:39	EPA 3050B	1,6020A	AM
Chromium, Total	5.70		mg/kg	2.48	0.579	10	04/05/17 12:23	04/05/17 15:39	EPA 3050B	1,6020A	AM
Cobalt, Total	0.203	J	mg/kg	0.619	0.066	10	04/05/17 12:23	04/05/17 15:39	EPA 3050B	1,6020A	AM
Copper, Total	5.92		mg/kg	2.48	0.240	10	04/05/17 12:23	04/05/17 15:39	EPA 3050B	1,6020A	AM
Iron, Total	2010		mg/kg	248	25.5	10	04/05/17 12:23	04/05/17 15:39	EPA 3050B	1,6020A	AM
Lead, Total	3.95		mg/kg	0.742	0.181	10	04/05/17 12:23	04/05/17 15:39	EPA 3050B	1,6020A	AM
Magnesium, Total	202		mg/kg	124	15.2	10	04/05/17 12:23	04/05/17 15:39	EPA 3050B	1,6020A	AM
Manganese, Total	3.73		mg/kg	2.48	0.549	10	04/05/17 12:23	04/05/17 15:39	EPA 3050B	1,6020A	AM
Mercury, Total	ND		mg/kg	0.016	0.002	5	04/05/17 12:14	04/06/17 12:04	EPA 7474	1,7474	LC
Molybdenum, Total	0.279	J	mg/kg	0.990	0.134	10	04/05/17 12:23	04/05/17 15:39	EPA 3050B	1,6020A	AM
Nickel, Total	0.584	J	mg/kg	1.24	0.331	10	04/05/17 12:23	04/05/17 15:39	EPA 3050B	1,6020A	AM
Potassium, Total	321		mg/kg	124	19.6	10	04/05/17 12:23	04/05/17 15:39	EPA 3050B	1,6020A	AM
Selenium, Total	ND		mg/kg	2.48	0.936	10	04/05/17 12:23	04/05/17 15:39	EPA 3050B	1,6020A	AM
Silver, Total	ND		mg/kg	0.619	0.060	10	04/05/17 12:23	04/05/17 15:39	EPA 3050B	1,6020A	AM
Sodium, Total	986		mg/kg	186	14.5	10	04/05/17 12:23	04/05/17 15:39	EPA 3050B	1,6020A	AM
Strontium, Total	2.37		mg/kg	1.24	0.303	10	04/05/17 12:23	04/05/17 15:39	EPA 3050B	1,6020A	AM
Thallium, Total	ND		mg/kg	0.248	0.064	10	04/05/17 12:23	04/05/17 15:39	EPA 3050B	1,6020A	AM
Tin, Total	0.323	J	mg/kg	1.48	0.153	10	04/05/17 12:23	04/05/17 15:39	EPA 3050B	1,6020A	AM
Titanium, Total	69.4		mg/kg	0.619	0.107	10	04/05/17 12:23	04/05/17 15:39	EPA 3050B	1,6020A	AM
Vanadium, Total	8.44		mg/kg	1.24	0.469	10	04/05/17 12:23	04/05/17 15:39	EPA 3050B	1,6020A	AM
Zinc, Total	4.33	J	mg/kg	12.4	3.22	10	04/05/17 12:23	04/05/17 15:39	EPA 3050B	1,6020A	AM



Project Name: NESE

Lab Number: L1710301

Project Number: 1794

Report Date: 04/06/17

Method Blank Analysis Batch Quality Control

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Total Metals - Mansfield Lab for sample(s): 01-13 Batch: WG991289-1										
Aluminum, Total	ND		mg/kg	125	18.5	10	04/05/17 12:23	04/05/17 14:29	1,6020A	AM
Antimony, Total	0.645	J	mg/kg	2.00	0.169	10	04/05/17 12:23	04/05/17 14:29	1,6020A	AM
Arsenic, Total	ND		mg/kg	0.625	0.083	10	04/05/17 12:23	04/05/17 14:29	1,6020A	AM
Barium, Total	ND		mg/kg	3.75	0.264	10	04/05/17 12:23	04/05/17 14:29	1,6020A	AM
Beryllium, Total	ND		mg/kg	0.375	0.109	10	04/05/17 12:23	04/05/17 14:29	1,6020A	AM
Cadmium, Total	ND		mg/kg	0.250	0.033	10	04/05/17 12:23	04/05/17 14:29	1,6020A	AM
Calcium, Total	ND		mg/kg	625	76.0	10	04/05/17 12:23	04/05/17 14:29	1,6020A	AM
Chromium, Total	ND		mg/kg	2.50	0.585	10	04/05/17 12:23	04/05/17 14:29	1,6020A	AM
Cobalt, Total	ND		mg/kg	0.625	0.067	10	04/05/17 12:23	04/05/17 14:29	1,6020A	AM
Copper, Total	ND		mg/kg	2.50	0.242	10	04/05/17 12:23	04/05/17 14:29	1,6020A	AM
Iron, Total	ND		mg/kg	250	25.8	10	04/05/17 12:23	04/05/17 14:29	1,6020A	AM
Lead, Total	ND		mg/kg	0.750	0.182	10	04/05/17 12:23	04/05/17 14:29	1,6020A	AM
Magnesium, Total	ND		mg/kg	125	15.4	10	04/05/17 12:23	04/05/17 14:29	1,6020A	AM
Manganese, Total	ND		mg/kg	2.50	0.555	10	04/05/17 12:23	04/05/17 14:29	1,6020A	AM
Molybdenum, Total	ND		mg/kg	1.00	0.135	10	04/05/17 12:23	04/05/17 14:29	1,6020A	AM
Nickel, Total	ND		mg/kg	1.25	0.334	10	04/05/17 12:23	04/05/17 14:29	1,6020A	AM
Potassium, Total	ND		mg/kg	125	19.8	10	04/05/17 12:23	04/05/17 14:29	1,6020A	AM
Selenium, Total	ND		mg/kg	2.50	0.945	10	04/05/17 12:23	04/05/17 14:29	1,6020A	AM
Silver, Total	ND		mg/kg	0.625	0.061	10	04/05/17 12:23	04/05/17 14:29	1,6020A	AM
Sodium, Total	ND		mg/kg	188	14.6	10	04/05/17 12:23	04/05/17 14:29	1,6020A	AM
Strontium, Total	ND		mg/kg	1.25	0.306	10	04/05/17 12:23	04/05/17 14:29	1,6020A	AM
Thallium, Total	ND		mg/kg	0.250	0.065	10	04/05/17 12:23	04/05/17 14:29	1,6020A	AM
Tin, Total	ND		mg/kg	1.50	0.155	10	04/05/17 12:23	04/05/17 14:29	1,6020A	AM
Titanium, Total	ND		mg/kg	0.625	0.108	10	04/05/17 12:23	04/05/17 14:29	1,6020A	AM
Vanadium, Total	ND		mg/kg	1.25	0.474	10	04/05/17 12:23	04/05/17 14:29	1,6020A	AM
Zinc, Total	ND		mg/kg	12.5	3.25	10	04/05/17 12:23	04/05/17 14:29	1,6020A	AM

Prep Information

Digestion Method: EPA 3050B



Project Name: NESE

Lab Number: L1710301

Project Number: 1794

Report Date: 04/06/17

Method Blank Analysis Batch Quality Control

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Total Metals - Mansfield Lab for sample(s): 01-13 Batch: WG991290-1										
Mercury, Total	ND		mg/kg	0.013	0.002	5	04/05/17 12:14	04/06/17 11:03	1,7474	LC

Prep Information

Digestion Method: EPA 7474

Lab Control Sample Analysis

Batch Quality Control

Project Name: NESE

Project Number: 1794

Lab Number: L1710301

Report Date: 04/06/17

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 01-13 Batch: WG991289-2 SRM Lot Number: D091-540								
Aluminum, Total	77		-		52-148	-		20
Antimony, Total	20		-		1-200	-		20
Arsenic, Total	104		-		80-121	-		20
Barium, Total	99		-		84-117	-		20
Beryllium, Total	99		-		83-117	-		20
Cadmium, Total	102		-		83-117	-		20
Calcium, Total	100		-		81-118	-		20
Chromium, Total	101		-		80-119	-		20
Cobalt, Total	97		-		84-115	-		20
Copper, Total	100		-		82-117	-		20
Iron, Total	111		-		47-154	-		20
Lead, Total	99		-		82-118	-		20
Magnesium, Total	97		-		77-123	-		20
Manganese, Total	103		-		82-118	-		20
Molybdenum, Total	98		-		79-121	-		20
Nickel, Total	95		-		83-117	-		20
Potassium, Total	92		-		72-128	-		20
Selenium, Total	101		-		79-121	-		20
Silver, Total	102		-		76-124	-		20
Sodium, Total	91		-		73-126	-		20
Strontium, Total	94		-		81-120	-		20

Lab Control Sample Analysis Batch Quality Control

Project Name: NESE

Project Number: 1794

Lab Number: L1710301

Report Date: 04/06/17

Parameter	LCS %Recovery	LCSD %Recovery	%Recovery Limits	RPD	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 01-13 Batch: WG991289-2 SRM Lot Number: D091-540					
Thallium, Total	102	-	80-121	-	20
Tin, Total	106	-	77-122	-	20
Titanium, Total	82	-	31-169	-	20
Vanadium, Total	98	-	78-122	-	20
Zinc, Total	100	-	82-118	-	20
Total Metals - Mansfield Lab Associated sample(s): 01-13 Batch: WG991290-2 SRM Lot Number: D091-540					
Mercury, Total	125	-	72-128	-	20

Matrix Spike Analysis

Batch Quality Control

Project Name: NESE
Project Number: 1794

Lab Number: L1710301
Report Date: 04/06/17

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	Qual	MSD Found	MSD %Recovery	Qual	Recovery Limits	RPD	Qual	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 01-13			QC Batch ID: WG991289-3			QC Sample: L1710301-01			Client ID: BHA-7 SS1 0-2'			
Aluminum, Total	10200	303	12000	594	Q	-	-		75-125	-		20
Antimony, Total	6.80	75.7	98.1	120		-	-		75-125	-		20
Arsenic, Total	39.1	18.2	63.4	134	Q	-	-		75-125	-		20
Barium, Total	50.9	303	353	100		-	-		75-125	-		20
Beryllium, Total	0.870	7.57	7.87	92		-	-		75-125	-		20
Cadmium, Total	1.00	7.72	9.19	106		-	-		75-125	-		20
Calcium, Total	5040	1510	4970	0	Q	-	-		75-125	-		20
Chromium, Total	69.3	30.3	106	121		-	-		75-125	-		20
Cobalt, Total	9.22	75.7	74.6	86		-	-		75-125	-		20
Copper, Total	140.	37.8	180	106		-	-		75-125	-		20
Iron, Total	32400	151	29100	0	Q	-	-		75-125	-		20
Lead, Total	156.	77.2	230	96		-	-		75-125	-		20
Magnesium, Total	5490	1510	7100	106		-	-		75-125	-		20
Manganese, Total	274.	75.7	284	13	Q	-	-		75-125	-		20
Molybdenum, Total	2.08	151	137	89		-	-		75-125	-		20
Nickel, Total	23.9	75.7	93.8	92		-	-		75-125	-		20
Potassium, Total	2370	1510	3790	94		-	-		75-125	-		20
Selenium, Total	3.36J	18.2	22.9	126	Q	-	-		75-125	-		20
Silver, Total	2.44	45.4	45.9	96		-	-		75-125	-		20
Sodium, Total	8960	1510	10700	115		-	-		75-125	-		20
Strontium, Total	51.5	151	190	91		-	-		75-125	-		20

Matrix Spike Analysis

Batch Quality Control

Project Name: NESE
Project Number: 1794

Lab Number: L1710301
Report Date: 04/06/17

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	MSD Found	MSD %Recovery	Recovery Limits	RPD	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 01-13 QC Batch ID: WG991289-3 QC Sample: L1710301-01 Client ID: BHA-7 SS1 0-2'									
Thallium, Total	0.228J	18.2	16.6	91	-	-	75-125	-	20
Tin, Total	19.1	151	169	99	-	-	75-125	-	20
Titanium, Total	362.	151	615	167	Q	-	75-125	-	20
Vanadium, Total	46.9	75.7	119	95	-	-	75-125	-	20
Zinc, Total	243.	75.7	311	90	-	-	75-125	-	20
Total Metals - Mansfield Lab Associated sample(s): 01-13 QC Batch ID: WG991290-3 QC Sample: L1710301-01 Client ID: BHA-7 SS1 0-2'									
Mercury, Total	2.00	1.14	3.17	103	-	-	80-120	-	20

Lab Duplicate Analysis Batch Quality Control

Project Name: NESE

Project Number: 1794

Lab Number: L1710301

Report Date: 04/06/17

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 01-13 QC Batch ID: WG991289-4 QC Sample: L1710301-01 Client ID: BHA-7 SS1 0-2'						
Aluminum, Total	10200	11500	mg/kg	12		20
Antimony, Total	6.80	9.01	mg/kg	28	Q	20
Arsenic, Total	39.1	58.4	mg/kg	40	Q	20
Barium, Total	50.9	65.2	mg/kg	25	Q	20
Beryllium, Total	0.870	0.920	mg/kg	6		20
Cadmium, Total	1.00	1.07	mg/kg	7		20
Calcium, Total	5040	6300	mg/kg	22	Q	20
Chromium, Total	69.3	85.2	mg/kg	21	Q	20
Cobalt, Total	9.22	9.36	mg/kg	2		20
Copper, Total	140.	155	mg/kg	10		20
Iron, Total	32400	37900	mg/kg	16		20
Lead, Total	156.	150	mg/kg	4		20
Magnesium, Total	5490	5790	mg/kg	5		20
Manganese, Total	274.	242	mg/kg	12		20
Molybdenum, Total	2.08	2.28	mg/kg	9		20
Nickel, Total	23.9	26.5	mg/kg	10		20
Potassium, Total	2370	2510	mg/kg	6		20
Selenium, Total	3.36J	4.93	mg/kg	NC		20
Silver, Total	2.44	2.43	mg/kg	0		20

Lab Duplicate Analysis Batch Quality Control

Project Name: NESE

Project Number: 1794

Lab Number: L1710301

Report Date: 04/06/17

Parameter	Native Sample	Duplicate Sample	Units	RPD	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 01-13 QC Batch ID: WG991289-4 QC Sample: L1710301-01 Client ID: BHA-7 SS1 0-2'					
Sodium, Total	8960	9660	mg/kg	8	20
Strontium, Total	51.5	60.3	mg/kg	16	20
Thallium, Total	0.228J	0.291J	mg/kg	NC	20
Tin, Total	19.1	21.5	mg/kg	12	20
Titanium, Total	362.	501	mg/kg	32	Q 20
Vanadium, Total	46.9	55.1	mg/kg	16	20
Zinc, Total	243.	265	mg/kg	9	20
Total Metals - Mansfield Lab Associated sample(s): 01-13 QC Batch ID: WG991290-4 QC Sample: L1710301-01 Client ID: BHA-7 SS1 0-2'					
Mercury, Total	2.00	1.69	mg/kg	17	20

INORGANICS & MISCELLANEOUS

Project Name: NESE

Project Number: 1794

Lab Number: L1710301

Report Date: 04/06/17

SAMPLE RESULTS

Lab ID: L1710301-01
Client ID: BHA-7 SS1 0-2'
Sample Location: RARITAN BAY, NY
Matrix: Sediment

Date Collected: 10/08/16 00:00
Date Received: 04/05/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Mansfield Lab										
Solids, Total	50.8		%	0.100	0.100	1	-	04/05/17 14:15	121,2540G	SP



Project Name: NESE

Project Number: 1794

Lab Number: L1710301

Report Date: 04/06/17

SAMPLE RESULTS

Lab ID: L1710301-02

Client ID: BHA-7 SS2 2-4'

Sample Location: RARITAN BAY, NY

Matrix: Sediment

Date Collected: 10/08/16 00:00

Date Received: 04/05/17

Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Mansfield Lab										
Solids, Total	51.8		%	0.100	0.100	1	-	04/05/17 14:15	121,2540G	SP



Project Name: NESE

Project Number: 1794

Lab Number: L1710301

Report Date: 04/06/17

SAMPLE RESULTS

Lab ID: L1710301-03

Client ID: BHA-7 SS3 4-6'

Sample Location: RARITAN BAY, NY

Matrix: Sediment

Date Collected: 10/08/16 00:00

Date Received: 04/05/17

Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Mansfield Lab										
Solids, Total	55.7		%	0.100	0.100	1	-	04/05/17 14:15	121,2540G	SP



Project Name: NESE

Project Number: 1794

Lab Number: L1710301

Report Date: 04/06/17

SAMPLE RESULTS

Lab ID: L1710301-04

Client ID: BHA-7 SS4 6-8'

Sample Location: RARITAN BAY, NY

Matrix: Sediment

Date Collected: 10/08/16 00:00

Date Received: 04/05/17

Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Mansfield Lab										
Solids, Total	55.6		%	0.100	0.100	1	-	04/05/17 14:15	121,2540G	SP



Project Name: NESE

Project Number: 1794

Lab Number: L1710301

Report Date: 04/06/17

SAMPLE RESULTS

Lab ID: L1710301-05

Client ID: BHA-7 SS5 8-10'

Sample Location: RARITAN BAY, NY

Matrix: Sediment

Date Collected: 10/08/16 00:00

Date Received: 04/05/17

Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Mansfield Lab										
Solids, Total	66.7		%	0.100	0.100	1	-	04/05/17 14:15	121,2540G	SP



Project Name: NESE

Project Number: 1794

Lab Number: L1710301

Report Date: 04/06/17

SAMPLE RESULTS

Lab ID: L1710301-06
Client ID: BHA-7 SS6 10-12'
Sample Location: RARITAN BAY, NY
Matrix: Sediment

Date Collected: 10/08/16 00:00
Date Received: 04/05/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Mansfield Lab										
Solids, Total	78.2		%	0.100	0.100	1	-	04/05/17 14:15	121,2540G	SP



Project Name: NESE

Project Number: 1794

Lab Number: L1710301

Report Date: 04/06/17

SAMPLE RESULTS

Lab ID: L1710301-07
Client ID: BHA-7 SS7 15-17'
Sample Location: RARITAN BAY, NY
Matrix: Sediment

Date Collected: 10/08/16 00:00
Date Received: 04/05/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Mansfield Lab										
Solids, Total	52.8		%	0.100	0.100	1	-	04/05/17 14:15	121,2540G	SP



Project Name: NESE

Project Number: 1794

Lab Number: L1710301

Report Date: 04/06/17

SAMPLE RESULTS

Lab ID: L1710301-08

Client ID: BHA-9 SS2 2-4'

Sample Location: RARITAN BAY, NY

Matrix: Sediment

Date Collected: 10/08/16 00:00

Date Received: 04/05/17

Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Mansfield Lab										
Solids, Total	71.6		%	0.100	0.100	1	-	04/05/17 14:15	121,2540G	SP



Project Name: NESE

Project Number: 1794

Lab Number: L1710301

Report Date: 04/06/17

SAMPLE RESULTS

Lab ID: L1710301-09

Client ID: BHA-9 SS3 4-6'

Sample Location: RARITAN BAY, NY

Matrix: Sediment

Date Collected: 10/08/16 00:00

Date Received: 04/05/17

Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Mansfield Lab										
Solids, Total	77.5		%	0.100	0.100	1	-	04/05/17 14:15	121,2540G	SP



Project Name: NESE

Project Number: 1794

Lab Number: L1710301

Report Date: 04/06/17

SAMPLE RESULTS

Lab ID: L1710301-10

Client ID: BHA-9 SS4 6-8'

Sample Location: RARITAN BAY, NY

Matrix: Sediment

Date Collected: 10/08/16 00:00

Date Received: 04/05/17

Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Mansfield Lab										
Solids, Total	84.5		%	0.100	0.100	1	-	04/05/17 14:15	121,2540G	SP



Project Name: NESE

Project Number: 1794

Lab Number: L1710301

Report Date: 04/06/17

SAMPLE RESULTS

Lab ID: L1710301-11
Client ID: BHA-9 SS5 8-10'
Sample Location: RARITAN BAY, NY
Matrix: Sediment

Date Collected: 10/08/16 00:00
Date Received: 04/05/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Mansfield Lab										
Solids, Total	85.2		%	0.100	0.100	1	-	04/05/17 14:15	121,2540G	SP



Project Name: NESE

Project Number: 1794

Lab Number: L1710301

Report Date: 04/06/17

SAMPLE RESULTS

Lab ID: L1710301-12
Client ID: BHA-9 SS6 10-12'
Sample Location: RARITAN BAY, NY
Matrix: Sediment

Date Collected: 10/08/16 00:00
Date Received: 04/05/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Mansfield Lab										
Solids, Total	84.6		%	0.100	0.100	1	-	04/05/17 14:15	121,2540G	SP



Project Name: NESE

Project Number: 1794

Lab Number: L1710301

Report Date: 04/06/17

SAMPLE RESULTS

Lab ID: L1710301-13
Client ID: BHA-9 SS7 15-17'
Sample Location: RARITAN BAY, NY
Matrix: Sediment

Date Collected: 10/08/16 00:00
Date Received: 04/05/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Mansfield Lab										
Solids, Total	77.7		%	0.100	0.100	1	-	04/05/17 14:15	121,2540G	SP



Lab Duplicate Analysis
Batch Quality Control

Project Name: NESE

Project Number: 1794

Lab Number: L1710301

Report Date: 04/06/17

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits
General Chemistry - Mansfield Lab Associated sample(s): 01-13 QC Batch ID: WG991372-1 QC Sample: L1710301-01 Client ID: BHA-7 SS1 0-2'						
Solids, Total	50.8	52.0	%	2		10

Project Name: NESE

Project Number: 1794

Lab Number: L1710301

Report Date: 04/06/17

Sample Receipt and Container Information

Were project specific reporting limits specified? YES

Cooler Information Custody Seal**Cooler**

A Absent

Container Information

Container ID	Container Type	Cooler	pH	Temp deg C	Pres	Seal	Analysis(*)
L1710301-01D	Glass 250ml/8oz unpreserved	A	N/A	14.9	Y	Absent	A2-FE-6020T(180),A2-MO-6020T(180),A2-PB-6020T(180),A2-BA-6020T(180),A2-NI-6020T(180),A2-SB-6020T(180),A2-ZN-6020T(180),A2-HG-7474T(28),A2-K-6020T(180),A2-CR-6020T(180),A2-TL-6020T(180),A2-TS(7),A2-AS-6020T(180),A2-CO-6020T(180),A2-MN-6020T(180),A2-SR-6020T(180),A2-BE-6020T(180),A2-CD-6020T(180),A2-HGPREP-AF(28),A2-V-6020T(180),A2-MG-6020T(180),A2-PREP-3050:2T(180),A2-SE-6020T(180),A2-AG-6020T(180),A2-AL-6020T(180),A2-CA-6020T(180),A2-CU-6020T(180),A2-NA-6020T(180),A2-PREP-3050:1T(180),A2-SN-6020T(180),A2-TI-6020T(180)

*Values in parentheses indicate holding time in days



Project Name: NESE

Project Number: 1794

Lab Number: L1710301

Report Date: 04/06/17

Container Information

Container ID	Container Type	Cooler	pH	Temp deg C	Pres	Seal	Analysis(*)
L1710301-02D	Glass 250ml/8oz unpreserved	A	N/A	14.9	Y	Absent	A2-FE-6020T(180),A2-MO-6020T(180),A2-PB-6020T(180),A2-BA-6020T(180),A2-NI-6020T(180),A2-SB-6020T(180),A2-ZN-6020T(180),A2-HG-7474T(28),A2-K-6020T(180),A2-CR-6020T(180),A2-TL-6020T(180),A2-TS(7),A2-AS-6020T(180),A2-CO-6020T(180),A2-MN-6020T(180),A2-SR-6020T(180),A2-BE-6020T(180),A2-CD-6020T(180),A2-HGPREP-AF(28),A2-V-6020T(180),A2-MG-6020T(180),A2-PREP-3050:2T(180),A2-SE-6020T(180),A2-AG-6020T(180),A2-AL-6020T(180),A2-CA-6020T(180),A2-CU-6020T(180),A2-NA-6020T(180),A2-PREP-3050:1T(180),A2-SN-6020T(180),A2-TI-6020T(180)
L1710301-03D	Glass 250ml/8oz unpreserved	A	N/A	14.9	Y	Absent	A2-FE-6020T(180),A2-MO-6020T(180),A2-PB-6020T(180),A2-BA-6020T(180),A2-NI-6020T(180),A2-SB-6020T(180),A2-ZN-6020T(180),A2-HG-7474T(28),A2-K-6020T(180),A2-CR-6020T(180),A2-TL-6020T(180),A2-TS(7),A2-AS-6020T(180),A2-CO-6020T(180),A2-MN-6020T(180),A2-SR-6020T(180),A2-BE-6020T(180),A2-CD-6020T(180),A2-HGPREP-AF(28),A2-V-6020T(180),A2-MG-6020T(180),A2-PREP-3050:2T(180),A2-SE-6020T(180),A2-AG-6020T(180),A2-AL-6020T(180),A2-CA-6020T(180),A2-CU-6020T(180),A2-NA-6020T(180),A2-PREP-3050:1T(180),A2-SN-6020T(180),A2-TI-6020T(180)

*Values in parentheses indicate holding time in days



Project Name: NESE

Project Number: 1794

Lab Number: L1710301

Report Date: 04/06/17

Container Information

Container ID	Container Type	Cooler	pH	Temp deg C	Pres	Seal	Analysis(*)
L1710301-04D	Glass 250ml/8oz unpreserved	A	N/A	14.9	Y	Absent	A2-FE-6020T(180),A2-MO-6020T(180),A2-PB-6020T(180),A2-BA-6020T(180),A2-NI-6020T(180),A2-SB-6020T(180),A2-ZN-6020T(180),A2-HG-7474T(28),A2-K-6020T(180),A2-CR-6020T(180),A2-TL-6020T(180),A2-TS(7),A2-AS-6020T(180),A2-CO-6020T(180),A2-MN-6020T(180),A2-SR-6020T(180),A2-BE-6020T(180),A2-CD-6020T(180),A2-HGPREP-AF(28),A2-V-6020T(180),A2-MG-6020T(180),A2-PREP-3050:2T(180),A2-SE-6020T(180),A2-AG-6020T(180),A2-AL-6020T(180),A2-CA-6020T(180),A2-CU-6020T(180),A2-NA-6020T(180),A2-PREP-3050:1T(180),A2-SN-6020T(180),A2-TI-6020T(180)
L1710301-05D	Glass 250ml/8oz unpreserved	A	N/A	14.9	Y	Absent	A2-FE-6020T(180),A2-MO-6020T(180),A2-PB-6020T(180),A2-BA-6020T(180),A2-NI-6020T(180),A2-SB-6020T(180),A2-ZN-6020T(180),A2-HG-7474T(28),A2-K-6020T(180),A2-CR-6020T(180),A2-TL-6020T(180),A2-TS(7),A2-AS-6020T(180),A2-CO-6020T(180),A2-MN-6020T(180),A2-SR-6020T(180),A2-BE-6020T(180),A2-CD-6020T(180),A2-HGPREP-AF(28),A2-V-6020T(180),A2-MG-6020T(180),A2-PREP-3050:2T(180),A2-SE-6020T(180),A2-AG-6020T(180),A2-AL-6020T(180),A2-CA-6020T(180),A2-CU-6020T(180),A2-NA-6020T(180),A2-PREP-3050:1T(180),A2-SN-6020T(180),A2-TI-6020T(180)

*Values in parentheses indicate holding time in days



Project Name: NESE

Project Number: 1794

Lab Number: L1710301

Report Date: 04/06/17

Container Information

Container ID	Container Type	Cooler	pH	Temp deg C	Pres	Seal	Analysis(*)
L1710301-06D	Glass 250ml/8oz unpreserved	A	N/A	14.9	Y	Absent	A2-FE-6020T(180),A2-MO-6020T(180),A2-PB-6020T(180),A2-BA-6020T(180),A2-NI-6020T(180),A2-SB-6020T(180),A2-ZN-6020T(180),A2-HG-7474T(28),A2-K-6020T(180),A2-CR-6020T(180),A2-TL-6020T(180),A2-TS(7),A2-AS-6020T(180),A2-CO-6020T(180),A2-MN-6020T(180),A2-SR-6020T(180),A2-BE-6020T(180),A2-CD-6020T(180),A2-HGPREP-AF(28),A2-V-6020T(180),A2-MG-6020T(180),A2-PREP-3050:2T(180),A2-SE-6020T(180),A2-AG-6020T(180),A2-AL-6020T(180),A2-CA-6020T(180),A2-CU-6020T(180),A2-NA-6020T(180),A2-PREP-3050:1T(180),A2-SN-6020T(180),A2-TI-6020T(180)
L1710301-07D	Glass 250ml/8oz unpreserved	A	N/A	14.9	Y	Absent	A2-FE-6020T(180),A2-MO-6020T(180),A2-PB-6020T(180),A2-BA-6020T(180),A2-NI-6020T(180),A2-SB-6020T(180),A2-ZN-6020T(180),A2-HG-7474T(28),A2-K-6020T(180),A2-CR-6020T(180),A2-TL-6020T(180),A2-TS(7),A2-AS-6020T(180),A2-CO-6020T(180),A2-MN-6020T(180),A2-SR-6020T(180),A2-BE-6020T(180),A2-CD-6020T(180),A2-HGPREP-AF(28),A2-V-6020T(180),A2-MG-6020T(180),A2-PREP-3050:2T(180),A2-SE-6020T(180),A2-AG-6020T(180),A2-AL-6020T(180),A2-CA-6020T(180),A2-CU-6020T(180),A2-NA-6020T(180),A2-PREP-3050:1T(180),A2-SN-6020T(180),A2-TI-6020T(180)

*Values in parentheses indicate holding time in days



Project Name: NESE

Project Number: 1794

Lab Number: L1710301

Report Date: 04/06/17

Container Information

Container ID	Container Type	Cooler	pH	Temp deg C	Pres	Seal	Analysis(*)
L1710301-08D	Glass 250ml/8oz unpreserved	A	N/A	14.9	Y	Absent	A2-FE-6020T(180),A2-MO-6020T(180),A2-PB-6020T(180),A2-BA-6020T(180),A2-NI-6020T(180),A2-SB-6020T(180),A2-ZN-6020T(180),A2-HG-7474T(28),A2-K-6020T(180),A2-CR-6020T(180),A2-TL-6020T(180),A2-TS(7),A2-AS-6020T(180),A2-CO-6020T(180),A2-MN-6020T(180),A2-SR-6020T(180),A2-BE-6020T(180),A2-CD-6020T(180),A2-HGPREP-AF(28),A2-V-6020T(180),A2-MG-6020T(180),A2-PREP-3050:2T(180),A2-SE-6020T(180),A2-AG-6020T(180),A2-AL-6020T(180),A2-CA-6020T(180),A2-CU-6020T(180),A2-NA-6020T(180),A2-PREP-3050:1T(180),A2-SN-6020T(180),A2-TI-6020T(180)
L1710301-09D	Glass 250ml/8oz unpreserved	A	N/A	14.9	Y	Absent	A2-FE-6020T(180),A2-MO-6020T(180),A2-PB-6020T(180),A2-BA-6020T(180),A2-NI-6020T(180),A2-SB-6020T(180),A2-ZN-6020T(180),A2-HG-7474T(28),A2-K-6020T(180),A2-CR-6020T(180),A2-TL-6020T(180),A2-TS(7),A2-AS-6020T(180),A2-CO-6020T(180),A2-MN-6020T(180),A2-SR-6020T(180),A2-BE-6020T(180),A2-CD-6020T(180),A2-HGPREP-AF(28),A2-V-6020T(180),A2-MG-6020T(180),A2-PREP-3050:2T(180),A2-SE-6020T(180),A2-AG-6020T(180),A2-AL-6020T(180),A2-CA-6020T(180),A2-CU-6020T(180),A2-NA-6020T(180),A2-PREP-3050:1T(180),A2-SN-6020T(180),A2-TI-6020T(180)

*Values in parentheses indicate holding time in days



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Report Date: 04/06/17

Container Information

Container ID	Container Type	Cooler	pH	Temp deg C	Pres	Seal	Analysis(*)
L1710301-10D	Glass 250ml/8oz unpreserved	A	N/A	14.9	Y	Absent	A2-FE-6020T(180),A2-MO-6020T(180),A2-PB-6020T(180),A2-BA-6020T(180),A2-NI-6020T(180),A2-SB-6020T(180),A2-ZN-6020T(180),A2-HG-7474T(28),A2-K-6020T(180),A2-CR-6020T(180),A2-TL-6020T(180),A2-TS(7),A2-AS-6020T(180),A2-CO-6020T(180),A2-MN-6020T(180),A2-SR-6020T(180),A2-BE-6020T(180),A2-CD-6020T(180),A2-HGPREP-AF(28),A2-V-6020T(180),A2-MG-6020T(180),A2-PREP-3050:2T(180),A2-SE-6020T(180),A2-AG-6020T(180),A2-AL-6020T(180),A2-CA-6020T(180),A2-CU-6020T(180),A2-NA-6020T(180),A2-PREP-3050:1T(180),A2-SN-6020T(180),A2-TI-6020T(180)
L1710301-11D	Glass 250ml/8oz unpreserved	A	N/A	14.9	Y	Absent	A2-FE-6020T(180),A2-MO-6020T(180),A2-PB-6020T(180),A2-BA-6020T(180),A2-NI-6020T(180),A2-SB-6020T(180),A2-ZN-6020T(180),A2-HG-7474T(28),A2-K-6020T(180),A2-CR-6020T(180),A2-TL-6020T(180),A2-TS(7),A2-AS-6020T(180),A2-CO-6020T(180),A2-MN-6020T(180),A2-SR-6020T(180),A2-BE-6020T(180),A2-CD-6020T(180),A2-HGPREP-AF(28),A2-V-6020T(180),A2-MG-6020T(180),A2-PREP-3050:2T(180),A2-SE-6020T(180),A2-AG-6020T(180),A2-AL-6020T(180),A2-CA-6020T(180),A2-CU-6020T(180),A2-NA-6020T(180),A2-PREP-3050:1T(180),A2-SN-6020T(180),A2-TI-6020T(180)

*Values in parentheses indicate holding time in days



Project Name: NESE

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Report Date: 04/06/17

Container Information

Container ID	Container Type	Cooler	pH	Temp deg C	Pres	Seal	Analysis(*)
L1710301-12D	Glass 250ml/8oz unpreserved	A	N/A	14.9	Y	Absent	A2-FE-6020T(180),A2-MO-6020T(180),A2-PB-6020T(180),A2-BA-6020T(180),A2-NI-6020T(180),A2-SB-6020T(180),A2-ZN-6020T(180),A2-HG-7474T(28),A2-K-6020T(180),A2-CR-6020T(180),A2-TL-6020T(180),A2-TS(7),A2-AS-6020T(180),A2-CO-6020T(180),A2-MN-6020T(180),A2-SR-6020T(180),A2-BE-6020T(180),A2-CD-6020T(180),A2-HGPREP-AF(28),A2-V-6020T(180),A2-MG-6020T(180),A2-PREP-3050:2T(180),A2-SE-6020T(180),A2-AG-6020T(180),A2-AL-6020T(180),A2-CA-6020T(180),A2-CU-6020T(180),A2-NA-6020T(180),A2-PREP-3050:1T(180),A2-SN-6020T(180),A2-TI-6020T(180)
L1710301-13D	Glass 250ml/8oz unpreserved	A	N/A	14.9	Y	Absent	A2-FE-6020T(180),A2-MO-6020T(180),A2-PB-6020T(180),A2-BA-6020T(180),A2-NI-6020T(180),A2-SB-6020T(180),A2-ZN-6020T(180),A2-HG-7474T(28),A2-K-6020T(180),A2-CR-6020T(180),A2-TL-6020T(180),A2-TS(7),A2-AS-6020T(180),A2-CO-6020T(180),A2-MN-6020T(180),A2-SR-6020T(180),A2-BE-6020T(180),A2-CD-6020T(180),A2-HGPREP-AF(28),A2-V-6020T(180),A2-MG-6020T(180),A2-PREP-3050:2T(180),A2-SE-6020T(180),A2-AG-6020T(180),A2-AL-6020T(180),A2-CA-6020T(180),A2-CU-6020T(180),A2-NA-6020T(180),A2-PREP-3050:1T(180),A2-SN-6020T(180),A2-TI-6020T(180)

*Values in parentheses indicate holding time in days



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GLOSSARY

Acronyms

EDL	- Estimated Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The EDL includes any adjustments from dilutions, concentrations or moisture content, where applicable. The use of EDLs is specific to the analysis of PAHs using Solid-Phase Microextraction (SPME).
EPA	- Environmental Protection Agency.
LCS	- Laboratory Control Sample: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.
LCSD	- Laboratory Control Sample Duplicate: Refer to LCS.
LFB	- Laboratory Fortified Blank: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.
MDL	- Method Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The MDL includes any adjustments from dilutions, concentrations or moisture content, where applicable.
MS	- Matrix Spike Sample: A sample prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available.
MSD	- Matrix Spike Sample Duplicate: Refer to MS.
NA	- Not Applicable.
NC	- Not Calculated: Term is utilized when one or more of the results utilized in the calculation are non-detect at the parameter's reporting unit.
NDPA/DPA	- N-Nitrosodiphenylamine/Diphenylamine.
NI	- Not Ignitable.
NP	- Non-Plastic: Term is utilized for the analysis of Atterberg Limits in soil.
RL	- Reporting Limit: The value at which an instrument can accurately measure an analyte at a specific concentration. The RL includes any adjustments from dilutions, concentrations or moisture content, where applicable.
RPD	- Relative Percent Difference: The results from matrix and/or matrix spike duplicates are primarily designed to assess the precision of analytical results in a given matrix and are expressed as relative percent difference (RPD). Values which are less than five times the reporting limit for any individual parameter are evaluated by utilizing the absolute difference between the values; although the RPD value will be provided in the report.
SRM	- Standard Reference Material: A reference sample of a known or certified value that is of the same or similar matrix as the associated field samples.
STLP	- Semi-dynamic Tank Leaching Procedure per EPA Method 1315.
TIC	- Tentatively Identified Compound: A compound that has been identified to be present and is not part of the target compound list (TCL) for the method and/or program. All TICs are qualitatively identified and reported as estimated concentrations.

Footnotes

- 1 - The reference for this analyte should be considered modified since this analyte is absent from the target analyte list of the original method.

Terms

Total: With respect to Organic analyses, a 'Total' result is defined as the summation of results for individual isomers or Aroclors. If a 'Total' result is requested, the results of its individual components will also be reported. This is applicable to 'Total' results for methods 8260, 8081 and 8082.

Analytical Method: Both the document from which the method originates and the analytical reference method. (Example: EPA 8260B is shown as 1,8260B.) The codes for the reference method documents are provided in the References section of the Addendum.

Data Qualifiers

- A** - Spectra identified as "Aldol Condensation Product".
- B** - The analyte was detected above the reporting limit in the associated method blank. Flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For MCP-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For DOD-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank AND the analyte was detected above one-half the reporting limit (or above the reporting limit for common lab contaminants) in the associated method blank. For NJ-Air-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte above the reporting limit. For NJ-related projects (excluding Air), flag only applies to associated field samples that have detectable concentrations of the analyte, which was detected above the reporting limit in the associated method blank or above five times the

Report Format: DU Report with 'J' Qualifiers



Project Name: NESE
Project Number: 1794

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Report Date: 04/06/17

Data Qualifiers

- reporting limit for common lab contaminants (Phthalates, Acetone, Methylene Chloride, 2-Butanone).
- C** - Co-elution: The target analyte co-elutes with a known lab standard (i.e. surrogate, internal standards, etc.) for co-extracted analyses.
- D** - Concentration of analyte was quantified from diluted analysis. Flag only applies to field samples that have detectable concentrations of the analyte.
- E** - Concentration of analyte exceeds the range of the calibration curve and/or linear range of the instrument.
- G** - The concentration may be biased high due to matrix interferences (i.e. co-elution) with non-target compound(s). The result should be considered estimated.
- H** - The analysis of pH was performed beyond the regulatory-required holding time of 15 minutes from the time of sample collection.
- I** - The lower value for the two columns has been reported due to obvious interference.
- M** - Reporting Limit (RL) exceeds the MCP CAM Reporting Limit for this analyte.
- NJ** - Presumptive evidence of compound. This represents an estimated concentration for Tentatively Identified Compounds (TICs), where the identification is based on a mass spectral library search.
- P** - The RPD between the results for the two columns exceeds the method-specified criteria.
- Q** - The quality control sample exceeds the associated acceptance criteria. For DOD-related projects, LCS and/or Continuing Calibration Standard exceedences are also qualified on all associated sample results. Note: This flag is not applicable for matrix spike recoveries when the sample concentration is greater than 4x the spike added or for batch duplicate RPD when the sample concentrations are less than 5x the RL. (Metals only.)
- R** - Analytical results are from sample re-analysis.
- RE** - Analytical results are from sample re-extraction.
- S** - Analytical results are from modified screening analysis.
- J** - Estimated value. The Target analyte concentration is below the quantitation limit (RL), but above the Method Detection Limit (MDL) or Estimated Detection Limit (EDL) for SPME-related analyses. This represents an estimated concentration for Tentatively Identified Compounds (TICs).
- ND** - Not detected at the method detection limit (MDL) for the sample, or estimated detection limit (EDL) for SPME-related analyses.

Report Format: DU Report with 'J' Qualifiers



Project Name: NESE
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Report Date: 04/06/17

REFERENCES

- 1 Test Methods for Evaluating Solid Waste: Physical/Chemical Methods. EPA SW-846. Third Edition. Updates I - IV, 2007.
- 121 Standard Methods for the Examination of Water and Wastewater. APHA-AWWA-WEF. Standard Methods Online.

LIMITATION OF LIABILITIES

Alpha Analytical performs services with reasonable care and diligence normal to the analytical testing laboratory industry. In the event of an error, the sole and exclusive responsibility of Alpha Analytical shall be to re-perform the work at it's own expense. In no event shall Alpha Analytical be held liable for any incidental, consequential or special damages, including but not limited to, damages in any way connected with the use of, interpretation of, information or analysis provided by Alpha Analytical.

We strongly urge our clients to comply with EPA protocol regarding sample volume, preservation, cooling, containers, sampling procedures, holding time and splitting of samples in the field.



Alpha Analytical, Inc.

ID No.:17873

Facility: **Company-wide**

Revision 10

Department: **Quality Assurance**

Published Date: 1/16/2017 11:00:05 AM

Title: **Certificate/Approval Program Summary**

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Certification Information

The following analytes are not included in our Primary NELAP Scope of Accreditation:

Westborough Facility**EPA 624:** m/p-xylene, o-xylene**EPA 8260C:** NPW: 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene, Azobenzene; SCM: Iodomethane (methyl iodide), Methyl methacrylate, 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene.**EPA 8270D:** NPW: Dimethylnaphthalene, 1,4-Diphenylhydrazine; SCM: Dimethylnaphthalene, 1,4-Diphenylhydrazine.**EPA 300:** DW: Bromide**EPA 6860:** NPW and SCM: Perchlorate**EPA 9010:** NPW and SCM: Amenable Cyanide Distillation**EPA 9012B:** NPW: Total Cyanide**EPA 9050A:** NPW: Specific Conductance**SM3500:** NPW: Ferrous Iron**SM4500:** NPW: Amenable Cyanide, Dissolved Oxygen; SCM: Total Phosphorus, TKN, NO₂, NO₃.**SM5310C:** DW: Dissolved Organic Carbon**Mansfield Facility****SM 2540D:** TSS**EPA 3005A** NPW**EPA 8082A:** NPW: PCB: 1, 5, 31, 87, 101, 110, 141, 151, 153, 180, 183, 187.**EPA TO-15:** Halothane, 2,4,4-Trimethyl-2-pentene, 2,4,4-Trimethyl-1-pentene, Thiophene, 2-Methylthiophene, 3-Methylthiophene, 2-Ethylthiophene, 1,2,3-Trimethylbenzene, Indan, Indene, 1,2,4,5-Tetramethylbenzene, Benzothiophene, 1-Methylnaphthalene.**Biological Tissue Matrix:** EPA 3050B

The following analytes are included in our Massachusetts DEP Scope of Accreditation

Westborough Facility:**Drinking Water****EPA 300.0:** Nitrate-N, Fluoride, Sulfate; **EPA 353.2:** Nitrate-N, Nitrite-N; **SM4500NO3-F:** Nitrate-N, Nitrite-N; **SM4500F-C, SM4500CN-CE, EPA 180.1, SM2130B, SM4500CI-D, SM2320B, SM2540C, SM4500H-B****EPA 332:** Perchlorate; **EPA 524.2:** THMs and VOCs; **EPA 504.1:** EDB, DBCP.**Microbiology:** **SM9215B; SM9223-P/A, SM9223B-Colilert-QT, SM9222D.****Non-Potable Water****SM4500H,B, EPA 120.1, SM2510B, SM2540C, SM2320B, SM4500CL-E, SM4500F-BC, SM4500NH3-BH, EPA 350.1:** Ammonia-N, **LACHAT 10-107-06-1-B:** Ammonia-N, **SM4500NO3-F, EPA 353.2:** Nitrate-N, **EPA 351.1, SM4500P-E, SM4500P-B, E, SM4500SO4-E, SM5220D, EPA 410.4, SM5210B, SM5310C, SM4500CL-D, EPA 1664, EPA 420.1, SM4500-CN-CE, SM2540D.****EPA 624:** Volatile Halocarbons & Aromatics,**EPA 608:** Chlordane, Toxaphene, Aldrin, alpha-BHC, beta-BHC, gamma-BHC, delta-BHC, Dieldrin, DDD, DDE, DDT, Endosulfan I, Endosulfan II, Endosulfan sulfate, Endrin, Endrin Aldehyde, Heptachlor, Heptachlor Epoxide, PCBs**EPA 625:** SVOC (Acid/Base/Neutral Extractables), **EPA 600/4-81-045:** PCB-Oil.**Microbiology:** **SM9223B-Colilert-QT; Enterolert-QT, SM9221E.****Mansfield Facility:****Drinking Water****EPA 200.7:** Ba, Be, Cd, Cr, Cu, Ni, Na, Ca. **EPA 200.8:** Sb, As, Ba, Be, Cd, Cr, Cu, Pb, Ni, Se, TL. **EPA 245.1 Hg.****Non-Potable Water****EPA 200.7:** Al, Sb, As, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Mo, Ni, K, Se, Ag, Na, Sr, TL, Ti, V, Zn.**EPA 200.8:** Al, Sb, As, Be, Cd, Cr, Cu, Pb, Mn, Ni, Se, Ag, TL, Zn.**EPA 245.1 Hg.****SM2340B**

For a complete listing of analytes and methods, please contact your Alpha Project Manager.



MANSFIELD CHAIN OF CUSTODY

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Project Information

Westborough, MA Mansfield, MA
 TEL: 508-898-9220 TEL: 508-822-9300
 FAX: 508-898-9193 FAX: 508-822-3288

Client Information

Client: Alpine Ocean Seismic Survey, Inc.

Address: 155 Hudson Ave

Norwood, NJ 07648

Phone: (201) 768-8000

Fax: (201) 768-5750

Email: chuck@alpineocean.com

☐ These samples have been Previously analyzed by Alpha

Project Name: NESE

Project Location: Raritan Bay/NY

Project #: 1794

Project Manager: Chuck Dill

ALPHA Quote #:

Turn-Around Time

☐ Standard☐ Rush (ONLY IF PRE-APPROVED)

Due Date: 4/26/17

Time:

Other Project Specific Requirements/Comments/Detection Limits:

☐ MS/MSD (at unit cost) will be omitted unless you check here

Date Rec'd in Lab:

4/15/17

ALPHA Job #:

L1710301

Report Information Data Deliverables

☐ FAX☒ EMAIL☐ ADEx☐ Add'l Deliverables

Billing Information

☐ Same as Client info

PO #:

Regulatory Requirements/Report Limits

State/Fed Program

Criteria

ANALYSIS

SAMPLE HANDLING

Filtration

☐ Done☐ Not Needed☐ Lab to do

Preservation

☐ Lab to do

(Please specify below)

Sample Specific Comments

TOTAL # BOTTLES

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection		Sample Matrix	Sampler's Initials	6020A													Sample Specific Comments	
		Date	Time																	
10301, 01	BHA-7	8/9/16		Sediment	CD	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0-2'; 100ml	1
02	BHA-7	8/9/16		Sediment	CD	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	2-4'; 100ml	1
03	BHA-7	8/9/16		Sediment	CD	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	4-6'; 100ml	1
04	BHA-7	8/9/16		Sediment	CD	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	6-8'; 100ml	1
05	BHA-7	8/9/16		Sediment	CD	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	8-10'; 100ml	1
06	BHA-7	8/9/16		Sediment	CD	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	10-12'; 100ml	1
07	BHA-7	8/9/16		Sediment	CD	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	15-17'; 100ml	1
						<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
						<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
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Relinquished By:

Date/Time

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Chuck Dill
 UPS

4/17
 6:45

UPS
 Kim [Signature] - AAL

4/17 10:11

Please print clearly, legibly and completely. Samples can not be logged in and turnaround time clock will not start until any ambiguities are resolved. All samples submitted are subject to Alpha's Payment Terms.



MANSFIELD CHAIN OF CUSTODY

PAGE 1 OF 1

Project Information

Westborough, MA Mansfield, MA
 TEL: 508-898-9220 TEL: 508-822-9300
 FAX: 508-898-9193 FAX: 508-822-3288

Project Name: NESE

Client Information

Project Location: Raritan Bay/NY

Client: Alpine Ocean Seismic Survey, Inc.

Project #: 1794

Address: 155 Hudson Ave

Project Manager: Chuck Dill

Norwood, NJ 07648

ALPHA Quote #:

Phone: (201) 768-8000

Turn-Around Time

Fax: (201) 768-5750

☐ Standard☐ Rush (ONLY IF PRE-APPROVED)

Email: chuck@alpineocean.com

☐ These samples have been Previously analyzed by Alpha

Due Date: 4/26/17

Time:

Other Project Specific Requirements/Comments/Detection Limits:

☐ MS/MSD (at unit cost) will be omitted unless you check hereALPHA Lab ID
(Lab Use Only)

Sample ID

Collection

Date

Time

Sample
MatrixSampler's
Initials

6020A

10301, 08	BHA-9	8/9/16		Sediment	CD	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	2-4'; 100 ml	1
09	BHA-9	8/9/16		Sediment	CD	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	4-6'; 100 ml	1
10	BHA-9	8/9/16		Sediment	CD	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	6-8'; 100 ml	1
11	BHA-9	8/9/16		Sediment	CD	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	8-10'; 100 ml	1
12	BHA-9	8/9/16		Sediment	CD	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	10-12'; 100 ml	1
13	BHA-9	8/9/16		Sediment	CD	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	15-17'; 100 ml	1
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Date/Time

Received By:

Date/Time

Charles Dill
 UPS

4/4/17
 11:45

UPS
 11m Charles, APC

4/5/17 10:11

Please print clearly, legibly and completely. Samples can not be logged in and turnaround time clock will not start until any ambiguities are resolved. All samples submitted are subject to Alpha's Payment Terms.

Alpha Summary Forms



Inorganic Summary Forms

Form 1 METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : NESE
 Lab ID : L1710301-01
 Client ID : BHA-7 SS1 0-2'
 Sample Location : RARITAN BAY, NY
 Sample Matrix : Sediment
 Analytical Method : 1,6020A
 Lab File ID : WG991180.pdf
 Sample Amount : 1.27g
 Digestion Method : EPA 3050B

Lab Number : L1710301
 Project Number : 1794
 Date Collected : 10/08/16 00:00
 Date Received : 04/05/17
 Date Analyzed : 04/05/17 14:46
 Dilution Factor : 10
 Analyst : AM
 Instrument ID : ICPMSQ
 %Solids : 51
 Date Digested : 04/05/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7429-90-5	Aluminum, Total	10200	194	28.7	
7440-36-0	Antimony, Total	6.80	3.10	0.262	
7440-38-2	Arsenic, Total	39.1	0.969	0.128	
7440-39-3	Barium, Total	50.9	5.81	0.409	
7440-41-7	Beryllium, Total	0.870	0.581	0.169	
7440-43-9	Cadmium, Total	1.00	0.388	0.051	
7440-70-2	Calcium, Total	5040	969	118.	
7440-47-3	Chromium, Total	69.3	3.88	0.907	
7440-48-4	Cobalt, Total	9.22	0.969	0.103	
7440-50-8	Copper, Total	140	3.88	0.376	
7439-89-6	Iron, Total	32400	388	39.9	
7439-92-1	Lead, Total	156	1.16	0.283	
7439-95-4	Magnesium, Total	5490	194	23.9	
7439-96-5	Manganese, Total	274	3.88	0.860	
7439-98-7	Molybdenum, Total	2.08	1.55	0.209	
7440-02-0	Nickel, Total	23.9	1.94	0.518	
7440-09-7	Potassium, Total	2370	194	30.8	
7782-49-2	Selenium, Total	3.36	3.88	1.46	J
7440-22-4	Silver, Total	2.44	0.969	0.095	
7440-23-5	Sodium, Total	8960	291	22.7	
7440-24-6	Strontium, Total	51.5	1.94	0.475	
7440-28-0	Thallium, Total	0.228	0.388	0.100	J
7440-31-5	Tin, Total	19.1	2.32	0.240	
7440-32-6	Titanium, Total	362	0.969	0.167	
7440-62-2	Vanadium, Total	46.9	1.94	0.735	
7440-66-6	Zinc, Total	243	19.4	5.04	



Form 1 METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : NESE
 Lab ID : L1710301-02
 Client ID : BHA-7 SS2 2-4'
 Sample Location : RARITAN BAY, NY
 Sample Matrix : Sediment
 Analytical Method : 1,6020A
 Lab File ID : WG991180.pdf
 Sample Amount : 1.29g
 Digestion Method : EPA 3050B

Lab Number : L1710301
 Project Number : 1794
 Date Collected : 10/08/16 00:00
 Date Received : 04/05/17
 Date Analyzed : 04/05/17 14:49
 Dilution Factor : 10
 Analyst : AM
 Instrument ID : ICPMSQ
 %Solids : 52
 Date Digested : 04/05/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7429-90-5	Aluminum, Total	12200	187	27.7	
7440-36-0	Antimony, Total	8.32	2.99	0.253	
7440-38-2	Arsenic, Total	118	0.935	0.123	
7440-39-3	Barium, Total	84.2	5.61	0.395	
7440-41-7	Beryllium, Total	1.09	0.561	0.163	
7440-43-9	Cadmium, Total	1.55	0.374	0.049	
7440-70-2	Calcium, Total	5010	935	114.	
7440-47-3	Chromium, Total	136	3.74	0.875	
7440-48-4	Cobalt, Total	9.17	0.935	0.100	
7440-50-8	Copper, Total	294	3.74	0.363	
7439-89-6	Iron, Total	41900	374	38.5	
7439-92-1	Lead, Total	163	1.12	0.273	
7439-95-4	Magnesium, Total	6430	187	23.0	
7439-96-5	Manganese, Total	249	3.74	0.830	
7439-98-7	Molybdenum, Total	2.12	1.50	0.202	
7440-02-0	Nickel, Total	35.4	1.87	0.500	
7440-09-7	Potassium, Total	2810	187	29.7	
7782-49-2	Selenium, Total	7.22	3.74	1.41	
7440-22-4	Silver, Total	3.87	0.935	0.091	
7440-23-5	Sodium, Total	11100	280	21.9	
7440-24-6	Strontium, Total	66.2	1.87	0.459	
7440-28-0	Thallium, Total	0.249	0.374	0.097	J
7440-31-5	Tin, Total	28.2	2.24	0.232	
7440-32-6	Titanium, Total	472	0.935	0.162	
7440-62-2	Vanadium, Total	66.2	1.87	0.709	
7440-66-6	Zinc, Total	276	18.7	4.86	



Form 1 METALS

Client : Alpine Ocean Seismic Survey Inc.
Project Name : NESE
Lab ID : L1710301-03
Client ID : BHA-7 SS3 4-6'
Sample Location : RARITAN BAY, NY
Sample Matrix : Sediment
Analytical Method : 1,6020A
Lab File ID : WG991180.pdf
Sample Amount : 1.26g
Digestion Method : EPA 3050B

Lab Number : L1710301
Project Number : 1794
Date Collected : 10/08/16 00:00
Date Received : 04/05/17
Date Analyzed : 04/05/17 14:52
Dilution Factor : 10
Analyst : AM
Instrument ID : ICPMSQ
%Solids : 56
Date Digested : 04/05/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7429-90-5	Aluminum, Total	11200	178	26.4	
7440-36-0	Antimony, Total	7.15	2.85	0.241	
7440-38-2	Arsenic, Total	94.6	0.890	0.118	
7440-39-3	Barium, Total	58.6	5.34	0.376	
7440-41-7	Beryllium, Total	0.784	0.534	0.155	
7440-43-9	Cadmium, Total	0.676	0.356	0.047	
7440-70-2	Calcium, Total	3000	890	108.	
7440-47-3	Chromium, Total	87.3	3.56	0.834	
7440-48-4	Cobalt, Total	8.15	0.890	0.095	
7440-50-8	Copper, Total	145	3.56	0.346	
7439-89-6	Iron, Total	42300	356	36.7	
7439-92-1	Lead, Total	125	1.07	0.260	
7439-95-4	Magnesium, Total	5680	178	21.9	
7439-96-5	Manganese, Total	285	3.56	0.791	
7439-98-7	Molybdenum, Total	1.82	1.42	0.192	
7440-02-0	Nickel, Total	26.3	1.78	0.476	
7440-09-7	Potassium, Total	2350	178	28.3	
7782-49-2	Selenium, Total	4.24	3.56	1.35	
7440-22-4	Silver, Total	1.86	0.890	0.087	
7440-23-5	Sodium, Total	8510	267	20.9	
7440-24-6	Strontium, Total	41.9	1.78	0.437	
7440-28-0	Thallium, Total	0.173	0.356	0.092	J
7440-31-5	Tin, Total	21.4	2.14	0.221	
7440-32-6	Titanium, Total	503	0.890	0.154	
7440-62-2	Vanadium, Total	62.8	1.78	0.675	
7440-66-6	Zinc, Total	207	17.8	4.63	



Form 1 METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : NESE
 Lab ID : L1710301-04
 Client ID : BHA-7 SS4 6-8'
 Sample Location : RARITAN BAY, NY
 Sample Matrix : Sediment
 Analytical Method : 1,6020A
 Lab File ID : WG991180.pdf
 Sample Amount : 1.32g
 Digestion Method : EPA 3050B

Lab Number : L1710301
 Project Number : 1794
 Date Collected : 10/08/16 00:00
 Date Received : 04/05/17
 Date Analyzed : 04/05/17 14:56
 Dilution Factor : 10
 Analyst : AM
 Instrument ID : ICPMSQ
 %Solids : 56
 Date Digested : 04/05/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7429-90-5	Aluminum, Total	10500	170	25.2	
7440-36-0	Antimony, Total	6.19	2.72	0.230	
7440-38-2	Arsenic, Total	60.6	0.852	0.112	
7440-39-3	Barium, Total	49.6	5.11	0.360	
7440-41-7	Beryllium, Total	0.767	0.511	0.148	
7440-43-9	Cadmium, Total	0.940	0.341	0.045	
7440-70-2	Calcium, Total	3390	852	104.	
7440-47-3	Chromium, Total	78.4	3.41	0.797	
7440-48-4	Cobalt, Total	8.34	0.852	0.091	
7440-50-8	Copper, Total	138	3.41	0.330	
7439-89-6	Iron, Total	32000	341	35.1	
7439-92-1	Lead, Total	104	1.02	0.249	
7439-95-4	Magnesium, Total	5110	170	21.0	
7439-96-5	Manganese, Total	231	3.41	0.756	
7439-98-7	Molybdenum, Total	1.99	1.36	0.184	
7440-02-0	Nickel, Total	25.3	1.70	0.455	
7440-09-7	Potassium, Total	2240	170	27.0	
7782-49-2	Selenium, Total	4.44	3.41	1.29	
7440-22-4	Silver, Total	1.93	0.852	0.083	
7440-23-5	Sodium, Total	7360	255	20.0	
7440-24-6	Strontium, Total	38.2	1.70	0.418	
7440-28-0	Thallium, Total	0.176	0.341	0.088	J
7440-31-5	Tin, Total	18.1	2.04	0.211	
7440-32-6	Titanium, Total	455	0.852	0.147	
7440-62-2	Vanadium, Total	57.1	1.70	0.646	
7440-66-6	Zinc, Total	212	17.0	4.43	



Form 1 METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : NESE
 Lab ID : L1710301-05
 Client ID : BHA-7 SS5 8-10'
 Sample Location : RARITAN BAY, NY
 Sample Matrix : Sediment
 Analytical Method : 1,6020A
 Lab File ID : WG991180.pdf
 Sample Amount : 1.27g
 Digestion Method : EPA 3050B

Lab Number : L1710301
 Project Number : 1794
 Date Collected : 10/08/16 00:00
 Date Received : 04/05/17
 Date Analyzed : 04/05/17 15:12
 Dilution Factor : 10
 Analyst : AM
 Instrument ID : ICPMSQ
 %Solids : 67
 Date Digested : 04/05/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7429-90-5	Aluminum, Total	10200	148	21.8	
7440-36-0	Antimony, Total	1.06	2.36	0.200	J
7440-38-2	Arsenic, Total	12.6	0.738	0.097	
7440-39-3	Barium, Total	22.2	4.43	0.312	
7440-41-7	Beryllium, Total	0.722	0.443	0.129	
7440-43-9	Cadmium, Total	0.248	0.295	0.039	J
7440-70-2	Calcium, Total	6100	738	89.7	
7440-47-3	Chromium, Total	28.9	2.95	0.690	
7440-48-4	Cobalt, Total	7.00	0.738	0.079	
7440-50-8	Copper, Total	19.0	2.95	0.286	
7439-89-6	Iron, Total	29100	295	30.4	
7439-92-1	Lead, Total	17.3	0.885	0.215	
7439-95-4	Magnesium, Total	5650	148	18.2	
7439-96-5	Manganese, Total	265	2.95	0.655	
7439-98-7	Molybdenum, Total	2.10	1.18	0.159	
7440-02-0	Nickel, Total	19.3	1.48	0.394	
7440-09-7	Potassium, Total	2570	148	23.4	
7782-49-2	Selenium, Total	1.88	2.95	1.12	J
7440-22-4	Silver, Total	0.152	0.738	0.072	J
7440-23-5	Sodium, Total	6430	221	17.3	
7440-24-6	Strontium, Total	39.8	1.48	0.362	
7440-28-0	Thallium, Total	0.144	0.295	0.076	J
7440-31-5	Tin, Total	2.29	1.77	0.183	
7440-32-6	Titanium, Total	203	0.738	0.127	
7440-62-2	Vanadium, Total	30.6	1.48	0.560	
7440-66-6	Zinc, Total	71.6	14.8	3.84	



Form 1 METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : NESE
 Lab ID : L1710301-06
 Client ID : BHA-7 SS6 10-12'
 Sample Location : RARITAN BAY, NY
 Sample Matrix : Sediment
 Analytical Method : 1,6020A
 Lab File ID : WG991180.pdf
 Sample Amount : 1.26g
 Digestion Method : EPA 3050B

Lab Number : L1710301
 Project Number : 1794
 Date Collected : 10/08/16 00:00
 Date Received : 04/05/17
 Date Analyzed : 04/05/17 15:16
 Dilution Factor : 10
 Analyst : AM
 Instrument ID : ICPMSQ
 %Solids : 78
 Date Digested : 04/05/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7429-90-5	Aluminum, Total	4800	127	18.8	
7440-36-0	Antimony, Total	0.475	2.03	0.172	J
7440-38-2	Arsenic, Total	7.46	0.634	0.084	
7440-39-3	Barium, Total	11.5	3.80	0.268	
7440-41-7	Beryllium, Total	0.373	0.380	0.111	J
7440-43-9	Cadmium, Total	ND	0.254	0.034	U
7440-70-2	Calcium, Total	4580	634	77.1	
7440-47-3	Chromium, Total	12.8	2.54	0.594	
7440-48-4	Cobalt, Total	3.56	0.634	0.068	
7440-50-8	Copper, Total	7.65	2.54	0.246	
7439-89-6	Iron, Total	13900	254	26.1	
7439-92-1	Lead, Total	8.51	0.761	0.185	
7439-95-4	Magnesium, Total	2510	127	15.6	
7439-96-5	Manganese, Total	125	2.54	0.563	
7439-98-7	Molybdenum, Total	0.663	1.01	0.137	J
7440-02-0	Nickel, Total	8.47	1.27	0.339	
7440-09-7	Potassium, Total	1100	127	20.1	
7782-49-2	Selenium, Total	1.19	2.54	0.959	J
7440-22-4	Silver, Total	ND	0.634	0.062	U
7440-23-5	Sodium, Total	3020	190	14.9	
7440-24-6	Strontium, Total	30.5	1.27	0.311	
7440-28-0	Thallium, Total	ND	0.254	0.066	U
7440-31-5	Tin, Total	0.878	1.52	0.157	J
7440-32-6	Titanium, Total	104	0.634	0.110	
7440-62-2	Vanadium, Total	18.5	1.27	0.481	
7440-66-6	Zinc, Total	31.7	12.7	3.30	



Form 1 METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : NESE
 Lab ID : L1710301-07
 Client ID : BHA-7 SS7 15-17'
 Sample Location : RARITAN BAY, NY
 Sample Matrix : Sediment
 Analytical Method : 1,6020A
 Lab File ID : WG991180.pdf
 Sample Amount : 1.28g
 Digestion Method : EPA 3050B

Lab Number : L1710301
 Project Number : 1794
 Date Collected : 10/08/16 00:00
 Date Received : 04/05/17
 Date Analyzed : 04/05/17 15:19
 Dilution Factor : 10
 Analyst : AM
 Instrument ID : ICPMSQ
 %Solids : 53
 Date Digested : 04/05/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7429-90-5	Aluminum, Total	15700	185	27.4	
7440-36-0	Antimony, Total	0.458	2.96	0.250	J
7440-38-2	Arsenic, Total	15.1	0.925	0.122	
7440-39-3	Barium, Total	28.5	5.55	0.391	
7440-41-7	Beryllium, Total	1.09	0.555	0.161	
7440-43-9	Cadmium, Total	0.426	0.370	0.049	
7440-70-2	Calcium, Total	7750	925	112.	
7440-47-3	Chromium, Total	37.9	3.70	0.866	
7440-48-4	Cobalt, Total	11.1	0.925	0.098	
7440-50-8	Copper, Total	18.8	3.70	0.359	
7439-89-6	Iron, Total	42900	370	38.1	
7439-92-1	Lead, Total	14.7	1.11	0.270	
7439-95-4	Magnesium, Total	7550	185	22.8	
7439-96-5	Manganese, Total	348	3.70	0.821	
7439-98-7	Molybdenum, Total	4.95	1.48	0.200	
7440-02-0	Nickel, Total	27.8	1.85	0.494	
7440-09-7	Potassium, Total	3570	185	29.4	
7782-49-2	Selenium, Total	2.27	3.70	1.40	J
7440-22-4	Silver, Total	ND	0.925	0.090	U
7440-23-5	Sodium, Total	8180	277	21.7	
7440-24-6	Strontium, Total	50.1	1.85	0.454	
7440-28-0	Thallium, Total	0.275	0.370	0.095	J
7440-31-5	Tin, Total	1.55	2.22	0.229	J
7440-32-6	Titanium, Total	245	0.925	0.160	
7440-62-2	Vanadium, Total	44.2	1.85	0.701	
7440-66-6	Zinc, Total	86.1	18.5	4.81	



Form 1

METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : NESE
 Lab ID : L1710301-08
 Client ID : BHA-9 SS2 2-4'
 Sample Location : RARITAN BAY, NY
 Sample Matrix : Sediment
 Analytical Method : 1,6020A
 Lab File ID : WG991180.pdf
 Sample Amount : 1.28g
 Digestion Method : EPA 3050B

Lab Number : L1710301
 Project Number : 1794
 Date Collected : 10/08/16 00:00
 Date Received : 04/05/17
 Date Analyzed : 04/05/17 15:22
 Dilution Factor : 10
 Analyst : AM
 Instrument ID : ICPMSQ
 %Solids : 72
 Date Digested : 04/05/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7429-90-5	Aluminum, Total	4710	136	20.2	
7440-36-0	Antimony, Total	0.396	2.18	0.184	J
7440-38-2	Arsenic, Total	6.05	0.682	0.090	
7440-39-3	Barium, Total	10.6	4.09	0.288	
7440-41-7	Beryllium, Total	0.298	0.409	0.119	J
7440-43-9	Cadmium, Total	0.109	0.273	0.036	J
7440-70-2	Calcium, Total	4020	682	82.9	
7440-47-3	Chromium, Total	15.2	2.73	0.638	
7440-48-4	Cobalt, Total	3.72	0.682	0.073	
7440-50-8	Copper, Total	9.88	2.73	0.264	
7439-89-6	Iron, Total	14600	273	28.1	
7439-92-1	Lead, Total	12.4	0.818	0.199	
7439-95-4	Magnesium, Total	2850	136	16.8	
7439-96-5	Manganese, Total	139	2.73	0.606	
7439-98-7	Molybdenum, Total	1.04	1.09	0.147	J
7440-02-0	Nickel, Total	9.27	1.36	0.364	
7440-09-7	Potassium, Total	1290	136	21.6	
7782-49-2	Selenium, Total	ND	2.73	1.03	U
7440-22-4	Silver, Total	0.122	0.682	0.067	J
7440-23-5	Sodium, Total	3700	204	16.0	
7440-24-6	Strontium, Total	24.4	1.36	0.334	
7440-28-0	Thallium, Total	ND	0.273	0.070	U
7440-31-5	Tin, Total	1.01	1.64	0.169	J
7440-32-6	Titanium, Total	113	0.682	0.118	
7440-62-2	Vanadium, Total	17.2	1.36	0.517	
7440-66-6	Zinc, Total	38.6	13.6	3.55	



Form 1 METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : NESE
 Lab ID : L1710301-09
 Client ID : BHA-9 SS3 4-6'
 Sample Location : RARITAN BAY, NY
 Sample Matrix : Sediment
 Analytical Method : 1,6020A
 Lab File ID : WG991180.pdf
 Sample Amount : 1.32g
 Digestion Method : EPA 3050B

Lab Number : L1710301
 Project Number : 1794
 Date Collected : 10/08/16 00:00
 Date Received : 04/05/17
 Date Analyzed : 04/05/17 15:26
 Dilution Factor : 10
 Analyst : AM
 Instrument ID : ICPMSQ
 %Solids : 78
 Date Digested : 04/05/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7429-90-5	Aluminum, Total	4460	122	18.1	
7440-36-0	Antimony, Total	0.403	1.96	0.165	J
7440-38-2	Arsenic, Total	6.27	0.611	0.081	
7440-39-3	Barium, Total	9.50	3.66	0.258	
7440-41-7	Beryllium, Total	0.318	0.366	0.106	J
7440-43-9	Cadmium, Total	0.099	0.244	0.032	J
7440-70-2	Calcium, Total	6760	611	74.3	
7440-47-3	Chromium, Total	13.4	2.44	0.572	
7440-48-4	Cobalt, Total	3.46	0.611	0.065	
7440-50-8	Copper, Total	7.42	2.44	0.237	
7439-89-6	Iron, Total	13800	244	25.2	
7439-92-1	Lead, Total	11.0	0.733	0.178	
7439-95-4	Magnesium, Total	2860	122	15.0	
7439-96-5	Manganese, Total	132	2.44	0.542	
7439-98-7	Molybdenum, Total	1.18	0.978	0.132	
7440-02-0	Nickel, Total	7.96	1.22	0.326	
7440-09-7	Potassium, Total	1200	122	19.4	
7782-49-2	Selenium, Total	ND	2.44	0.924	U
7440-22-4	Silver, Total	ND	0.611	0.060	U
7440-23-5	Sodium, Total	4070	183	14.3	
7440-24-6	Strontium, Total	37.8	1.22	0.300	
7440-28-0	Thallium, Total	ND	0.244	0.063	U
7440-31-5	Tin, Total	0.876	1.47	0.152	J
7440-32-6	Titanium, Total	116	0.611	0.106	
7440-62-2	Vanadium, Total	17.1	1.22	0.463	
7440-66-6	Zinc, Total	33.8	12.2	3.18	



Form 1 METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : NESE
 Lab ID : L1710301-10
 Client ID : BHA-9 SS4 6-8'
 Sample Location : RARITAN BAY, NY
 Sample Matrix : Sediment
 Analytical Method : 1,6020A
 Lab File ID : WG991180.pdf
 Sample Amount : 1.28g
 Digestion Method : EPA 3050B

Lab Number : L1710301
 Project Number : 1794
 Date Collected : 10/08/16 00:00
 Date Received : 04/05/17
 Date Analyzed : 04/05/17 15:29
 Dilution Factor : 10
 Analyst : AM
 Instrument ID : ICPMSQ
 %Solids : 85
 Date Digested : 04/05/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7429-90-5	Aluminum, Total	1680	116	17.1	
7440-36-0	Antimony, Total	0.226	1.85	0.156	J
7440-38-2	Arsenic, Total	1.13	0.578	0.076	
7440-39-3	Barium, Total	18.8	3.47	0.244	
7440-41-7	Beryllium, Total	0.730	0.347	0.101	
7440-43-9	Cadmium, Total	ND	0.231	0.031	U
7440-70-2	Calcium, Total	272	578	70.3	J
7440-47-3	Chromium, Total	5.16	2.31	0.541	
7440-48-4	Cobalt, Total	11.8	0.578	0.062	
7440-50-8	Copper, Total	11.1	2.31	0.224	
7439-89-6	Iron, Total	1660	231	23.8	
7439-92-1	Lead, Total	8.05	0.693	0.169	
7439-95-4	Magnesium, Total	415	116	14.2	
7439-96-5	Manganese, Total	4.98	2.31	0.513	
7439-98-7	Molybdenum, Total	0.191	0.924	0.125	J
7440-02-0	Nickel, Total	13.7	1.16	0.309	
7440-09-7	Potassium, Total	684	116	18.4	
7782-49-2	Selenium, Total	3.01	2.31	0.874	
7440-22-4	Silver, Total	ND	0.578	0.056	U
7440-23-5	Sodium, Total	1570	173	13.5	
7440-24-6	Strontium, Total	6.58	1.16	0.283	
7440-28-0	Thallium, Total	0.102	0.231	0.060	J
7440-31-5	Tin, Total	0.624	1.39	0.143	J
7440-32-6	Titanium, Total	18.1	0.578	0.100	
7440-62-2	Vanadium, Total	13.1	1.16	0.438	
7440-66-6	Zinc, Total	29.4	11.6	3.00	



Form 1 METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : NESE
 Lab ID : L1710301-11
 Client ID : BHA-9 SS5 8-10'
 Sample Location : RARITAN BAY, NY
 Sample Matrix : Sediment
 Analytical Method : 1,6020A
 Lab File ID : WG991180.pdf
 Sample Amount : 1.29g
 Digestion Method : EPA 3050B

Lab Number : L1710301
 Project Number : 1794
 Date Collected : 10/08/16 00:00
 Date Received : 04/05/17
 Date Analyzed : 04/05/17 16:40
 Dilution Factor : 10
 Analyst : AM
 Instrument ID : ICPMSQ
 %Solids : 85
 Date Digested : 04/05/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7429-90-5	Aluminum, Total	1950	114	16.8	
7440-36-0	Antimony, Total	0.256	1.82	0.154	J
7440-38-2	Arsenic, Total	1.89	0.569	0.075	
7440-39-3	Barium, Total	16.8	3.41	0.240	
7440-41-7	Beryllium, Total	0.781	0.341	0.099	
7440-43-9	Cadmium, Total	ND	0.227	0.030	U
7440-70-2	Calcium, Total	253	569	69.1	J
7440-47-3	Chromium, Total	5.81	2.27	0.532	
7440-48-4	Cobalt, Total	19.7	0.569	0.061	
7440-50-8	Copper, Total	8.38	2.27	0.221	
7439-89-6	Iron, Total	887	227	23.4	
7439-92-1	Lead, Total	10.6	0.682	0.166	
7439-95-4	Magnesium, Total	482	114	14.0	
7439-96-5	Manganese, Total	3.99	2.27	0.505	
7439-98-7	Molybdenum, Total	0.317	0.910	0.123	J
7440-02-0	Nickel, Total	22.2	1.14	0.304	
7440-09-7	Potassium, Total	716	114	18.1	
7782-49-2	Selenium, Total	3.78	2.27	0.860	
7440-22-4	Silver, Total	ND	0.569	0.056	U
7440-23-5	Sodium, Total	1870	170	13.3	
7440-24-6	Strontium, Total	7.18	1.14	0.279	
7440-28-0	Thallium, Total	0.133	0.227	0.059	J
7440-31-5	Tin, Total	0.478	1.36	0.141	J
7440-32-6	Titanium, Total	21.6	0.569	0.098	
7440-62-2	Vanadium, Total	13.6	1.14	0.431	
7440-66-6	Zinc, Total	22.7	11.4	2.96	



Form 1 METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : NESE
 Lab ID : L1710301-12
 Client ID : BHA-9 SS6 10-12'
 Sample Location : RARITAN BAY, NY
 Sample Matrix : Sediment
 Analytical Method : 1,6020A
 Lab File ID : WG991180.pdf
 Sample Amount : 1.32g
 Digestion Method : EPA 3050B

Lab Number : L1710301
 Project Number : 1794
 Date Collected : 10/08/16 00:00
 Date Received : 04/05/17
 Date Analyzed : 04/05/17 16:44
 Dilution Factor : 10
 Analyst : AM
 Instrument ID : ICPMSQ
 %Solids : 85
 Date Digested : 04/05/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7429-90-5	Aluminum, Total	1440	112	16.6	
7440-36-0	Antimony, Total	0.290	1.79	0.151	J
7440-38-2	Arsenic, Total	1.64	0.560	0.074	
7440-39-3	Barium, Total	8.82	3.36	0.236	
7440-41-7	Beryllium, Total	0.983	0.336	0.098	
7440-43-9	Cadmium, Total	ND	0.224	0.030	U
7440-70-2	Calcium, Total	397	560	68.0	J
7440-47-3	Chromium, Total	5.72	2.24	0.524	
7440-48-4	Cobalt, Total	34.8	0.560	0.060	
7440-50-8	Copper, Total	11.0	2.24	0.217	
7439-89-6	Iron, Total	2660	224	23.0	
7439-92-1	Lead, Total	14.1	0.672	0.163	
7439-95-4	Magnesium, Total	424	112	13.8	
7439-96-5	Manganese, Total	13.1	2.24	0.497	
7439-98-7	Molybdenum, Total	0.181	0.895	0.121	J
7440-02-0	Nickel, Total	15.9	1.12	0.299	
7440-09-7	Potassium, Total	718	112	17.8	
7782-49-2	Selenium, Total	2.61	2.24	0.846	
7440-22-4	Silver, Total	ND	0.560	0.055	U
7440-23-5	Sodium, Total	1840	168	13.1	
7440-24-6	Strontium, Total	6.47	1.12	0.274	
7440-28-0	Thallium, Total	0.177	0.224	0.058	J
7440-31-5	Tin, Total	0.583	1.34	0.139	J
7440-32-6	Titanium, Total	31.2	0.560	0.097	
7440-62-2	Vanadium, Total	17.2	1.12	0.424	
7440-66-6	Zinc, Total	23.6	11.2	2.91	



Form 1 METALS

Client : Alpine Ocean Seismic Survey Inc.
Project Name : NESE
Lab ID : L1710301-13
Client ID : BHA-9 SS7 15-17'
Sample Location : RARITAN BAY, NY
Sample Matrix : Sediment
Analytical Method : 1,6020A
Lab File ID : WG991180.pdf
Sample Amount : 1.3g
Digestion Method : EPA 3050B

Lab Number : L1710301
Project Number : 1794
Date Collected : 10/08/16 00:00
Date Received : 04/05/17
Date Analyzed : 04/05/17 15:39
Dilution Factor : 10
Analyst : AM
Instrument ID : ICPMSQ
%Solids : 78
Date Digested : 04/05/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7429-90-5	Aluminum, Total	554	124	18.3	
7440-36-0	Antimony, Total	ND	1.98	0.167	U
7440-38-2	Arsenic, Total	1.40	0.619	0.082	
7440-39-3	Barium, Total	3.40	3.71	0.261	J
7440-41-7	Beryllium, Total	ND	0.371	0.108	U
7440-43-9	Cadmium, Total	ND	0.248	0.033	U
7440-70-2	Calcium, Total	289	619	75.2	J
7440-47-3	Chromium, Total	5.70	2.48	0.579	
7440-48-4	Cobalt, Total	0.203	0.619	0.066	J
7440-50-8	Copper, Total	5.92	2.48	0.240	
7439-89-6	Iron, Total	2010	248	25.5	
7439-92-1	Lead, Total	3.95	0.742	0.181	
7439-95-4	Magnesium, Total	202	124	15.2	
7439-96-5	Manganese, Total	3.73	2.48	0.549	
7439-98-7	Molybdenum, Total	0.279	0.990	0.134	J
7440-02-0	Nickel, Total	0.584	1.24	0.331	J
7440-09-7	Potassium, Total	321	124	19.6	
7782-49-2	Selenium, Total	ND	2.48	0.936	U
7440-22-4	Silver, Total	ND	0.619	0.060	U
7440-23-5	Sodium, Total	986	186	14.5	
7440-24-6	Strontium, Total	2.37	1.24	0.303	
7440-28-0	Thallium, Total	ND	0.248	0.064	U
7440-31-5	Tin, Total	0.323	1.48	0.153	J
7440-32-6	Titanium, Total	69.4	0.619	0.107	
7440-62-2	Vanadium, Total	8.44	1.24	0.469	
7440-66-6	Zinc, Total	4.33	12.4	3.22	J



Form 1 METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : NESE
 Lab ID : WG991289-1
 Client ID : WG991289-1BLANK
 Sample Location :
 Sample Matrix : SOIL
 Analytical Method : 1,6020A
 Lab File ID : WG991180.pdf
 Sample Amount : 1g
 Digestion Method : EPA 3050B

Lab Number : L1710301
 Project Number : 1794
 Date Collected : NA
 Date Received : NA
 Date Analyzed : 04/05/17 14:29
 Dilution Factor : 10
 Analyst : AM
 Instrument ID : ICPMSQ
 %Solids : NA
 Date Digested : 04/05/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7429-90-5	Aluminum, Total	ND	125	18.5	U
7440-36-0	Antimony, Total	0.645	2.00	0.169	J
7440-38-2	Arsenic, Total	ND	0.625	0.083	U
7440-39-3	Barium, Total	ND	3.75	0.264	U
7440-41-7	Beryllium, Total	ND	0.375	0.109	U
7440-43-9	Cadmium, Total	ND	0.250	0.033	U
7440-70-2	Calcium, Total	ND	625	76.0	U
7440-47-3	Chromium, Total	ND	2.50	0.585	U
7440-48-4	Cobalt, Total	ND	0.625	0.067	U
7440-50-8	Copper, Total	ND	2.50	0.242	U
7439-89-6	Iron, Total	ND	250	25.8	U
7439-92-1	Lead, Total	ND	0.750	0.182	U
7439-95-4	Magnesium, Total	ND	125	15.4	U
7439-96-5	Manganese, Total	ND	2.50	0.555	U
7439-98-7	Molybdenum, Total	ND	1.00	0.135	U
7440-02-0	Nickel, Total	ND	1.25	0.334	U
7440-09-7	Potassium, Total	ND	125	19.8	U
7782-49-2	Selenium, Total	ND	2.50	0.945	U
7440-22-4	Silver, Total	ND	0.625	0.061	U
7440-23-5	Sodium, Total	ND	188	14.6	U
7440-24-6	Strontium, Total	ND	1.25	0.306	U
7440-28-0	Thallium, Total	ND	0.250	0.065	U
7440-31-5	Tin, Total	ND	1.50	0.155	U
7440-32-6	Titanium, Total	ND	0.625	0.108	U
7440-62-2	Vanadium, Total	ND	1.25	0.474	U
7440-66-6	Zinc, Total	ND	12.5	3.25	U



Form 1 METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : NESE
 Lab ID : WG991289-4
 Client ID : BHA-7 SS1 0-2'DUP
 Sample Location :
 Sample Matrix : SOIL
 Analytical Method : 1,6020A
 Lab File ID : WG991180.pdf
 Sample Amount : 1.3g
 Digestion Method : EPA 3050B

Lab Number : L1710301
 Project Number : 1794
 Date Collected : 10/08/16 00:00
 Date Received : 04/05/17
 Date Analyzed : 04/05/17 14:42
 Dilution Factor : 10
 Analyst : AM
 Instrument ID : ICPMSQ
 %Solids : 51
 Date Digested : 04/05/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7429-90-5	Aluminum, Total	11500	189	28.0	
7440-36-0	Antimony, Total	9.01	3.03	0.256	
7440-38-2	Arsenic, Total	58.4	0.946	0.125	
7440-39-3	Barium, Total	65.2	5.68	0.400	
7440-41-7	Beryllium, Total	0.920	0.568	0.165	
7440-43-9	Cadmium, Total	1.07	0.378	0.050	
7440-70-2	Calcium, Total	6300	946	115.	
7440-47-3	Chromium, Total	85.2	3.78	0.886	
7440-48-4	Cobalt, Total	9.36	0.946	0.101	
7440-50-8	Copper, Total	155.	3.78	0.367	
7439-89-6	Iron, Total	37900	378	39.0	
7439-92-1	Lead, Total	150.	1.14	0.276	
7439-95-4	Magnesium, Total	5790	189	23.3	
7439-96-5	Manganese, Total	242.	3.78	0.840	
7439-98-7	Molybdenum, Total	2.28	1.51	0.204	
7440-02-0	Nickel, Total	26.5	1.89	0.506	
7440-09-7	Potassium, Total	2510	189	30.0	
7782-49-2	Selenium, Total	4.93	3.78	1.43	
7440-22-4	Silver, Total	2.43	0.946	0.092	
7440-23-5	Sodium, Total	9660	284	22.2	
7440-24-6	Strontium, Total	60.3	1.89	0.464	
7440-28-0	Thallium, Total	0.291	0.378	0.098	J
7440-31-5	Tin, Total	21.5	2.27	0.235	
7440-32-6	Titanium, Total	501.	0.946	0.164	
7440-62-2	Vanadium, Total	55.1	1.89	0.718	
7440-66-6	Zinc, Total	265.	18.9	4.92	



Form 2A

Initial and Continuing Calibration Verification

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : NESE
 Instrument ID : ICPMSQ

Lab Number : L1710301
 Project Number : 1794
 Units : ug/l

Parameter	Initial Calibration			Continuing Calibration(s)							
	Lab ID	Date Analyzed		True	Found	%R	True	Found	%R	Found	%R
	R955527-1	04/05/17 08:19					R955527-5	04/05/17 08:48		R955527-7	04/05/17 09:28
										R955527-9	04/05/17 10:09
Aluminum				100.0000	100.0000	100	100.0000	102.0000	102	96.7000	97
Antimony				100.0000	108.0000	108	100.0000	102.0000	102	100.0000	100
Arsenic				100.0000	101.0000	101	100.0000	99.1000	99	101.0000	101
Barium				100.0000	100.0000	100	100.0000	101.0000	101	102.0000	102
Beryllium				100.0000	97.3000	97	100.0000	94.8000	95	98.8000	99
Cadmium				100.0000	101.0000	101	100.0000	101.0000	101	100.0000	100
Calcium				10000.0000	10300.0000	103	10000.0000	10200.0000	102	10000.0000	100
Chromium				100.0000	102.0000	102	100.0000	99.5000	100	99.7000	100
Cobalt				100.0000	101.0000	101	100.0000	101.0000	101	103.0000	103
Copper				100.0000	104.0000	104	100.0000	98.6000	99	101.0000	101
Iron				10000.0000	10300.0000	103	10000.0000	10200.0000	102	10100.0000	101
Lead				100.0000	102.0000	102	100.0000	103.0000	103	99.4000	99
Magnesium				10000.0000	10300.0000	103	10000.0000	10000.0000	100	10200.0000	102
Manganese				100.0000	103.0000	103	100.0000	103.0000	103	102.0000	102
Molybdenum				100.0000	101.0000	101	100.0000	103.0000	103	98.8000	99
Nickel				100.0000	104.0000	104	100.0000	99.6000	100	103.0000	103
Potassium				10000.0000	10100.0000	101	10000.0000	10100.0000	101	10100.0000	101
Selenium				100.0000	102.0000	102	100.0000	100.0000	100	102.0000	102
Silver				100.0000	98.4000	98	100.0000	99.8000	100	98.7000	99
Sodium				10000.0000	10100.0000	101	10000.0000	9890.0000	99	9770.0000	98
Strontium				100.0000	101.0000	101	100.0000	100.0000	100	104.0000	104
Thallium				100.0000	101.0000	101	100.0000	103.0000	103	102.0000	102
Titanium				100.0000	99.9000	100	100.0000	101.0000	101	97.3000	97
Tin				100.0000	102.0000	102	100.0000	100.0000	100	98.1000	98
Vanadium				100.0000	99.6000	100	100.0000	100.0000	100	101.0000	101

Acceptance Criteria:

ICV: 95-105% (Methods 200.7, 245.1)
 90-110% (Methods 200.8, 6010, 6020, 7470, 7471, 7474)
 85-115% (Method 1631)

CCV: 90-110% (Methods 200.7, 245.1, 6010, 6020, 7474)
 85-115% (Methods 200.8, 1631)
 80-120% (Methods 7470, 7471)



Form 2A

Initial and Continuing Calibration Verification

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : NESE
 Instrument ID : ICPMSQ

Lab Number : L1710301
 Project Number : 1794
 Units : ug/l

Parameter	Lab ID : Date Analyzed :	Initial Calibration			Continuing Calibration(s)						
		True	Found	%R	R955527-11 04/05/17 10:54			R955527-14 04/05/17 11:36		R955527-16 04/05/17 12:18	
					True	Found	%R	Found	%R	Found	%R
Aluminum					100.0000	96.6000	97	91.3000	91	101.0000	101
Antimony					100.0000	100.0000	100	100.0000	100	99.7000	100
Arsenic					100.0000	106.0000	106	99.1000	99	98.1000	98
Barium					100.0000	100.0000	100	101.0000	101	98.9000	99
Beryllium					100.0000	93.7000	94	94.8000	95	95.4000	95
Cadmium					100.0000	104.0000	104	100.0000	100	102.0000	102
Calcium					10000.0000	10400.0000	104	10000.0000	100	10500.0000	105
Chromium					100.0000	101.0000	101	95.2000	95	101.0000	101
Cobalt					100.0000	104.0000	104	96.7000	97	102.0000	102
Copper					100.0000	104.0000	104	99.5000	100	99.7000	100
Iron					10000.0000	10300.0000	103	9770.0000	98	10200.0000	102
Lead					100.0000	102.0000	102	100.0000	100	101.0000	101
Magnesium					10000.0000	10200.0000	102	9940.0000	99	10000.0000	100
Manganese					100.0000	107.0000	107	101.0000	101	105.0000	105
Molybdenum					100.0000	101.0000	101	94.3000	94	97.1000	97
Nickel					100.0000	99.1000	99	97.2000	97	100.0000	100
Potassium					10000.0000	10500.0000	105	10100.0000	101	10600.0000	106
Selenium					100.0000	105.0000	105	99.5000	100	102.0000	102
Silver					100.0000	100.0000	100	99.7000	100	98.6000	99
Sodium					10000.0000	10000.0000	100	9760.0000	98	9640.0000	96
Strontium					100.0000	104.0000	104	104.0000	104	102.0000	102
Thallium					100.0000	105.0000	105	102.0000	102	103.0000	103
Titanium					100.0000	99.7000	100	94.4000	94	103.0000	103
Tin					100.0000	97.8000	98	97.6000	98	96.0000	96
Vanadium					100.0000	103.0000	103	96.8000	97	100.0000	100

Acceptance Criteria:

ICV: 95-105% (Methods 200.7, 245.1)
 90-110% (Methods 200.8, 6010, 6020, 7470, 7471, 7474)
 85-115% (Method 1631)

CCV: 90-110% (Methods 200.7, 245.1, 6010, 6020, 7474)
 85-115% (Methods 200.8, 1631)
 80-120% (Methods 7470, 7471)



Form 2A

Initial and Continuing Calibration Verification

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : NESE
 Instrument ID : ICPMSQ

Lab Number : L1710301
 Project Number : 1794
 Units : ug/l

Parameter	Lab ID : Date Analyzed :	Initial Calibration			Continuing Calibration(s)						
		True	Found	%R	R955527-18 04/05/17 12:59			R955527-20 04/05/17 13:41		R955527-22 04/05/17 14:22	
					True	Found	%R	Found	%R	Found	%R
Aluminum					100.0000	98.1000	98	96.3000	96	100.0000	100
Antimony					100.0000	102.0000	102	103.0000	103	99.9000	100
Arsenic					100.0000	103.0000	103	105.0000	105	101.0000	101
Barium					100.0000	100.0000	100	102.0000	102	99.7000	100
Beryllium					100.0000	94.6000	95	96.6000	97	95.3000	95
Cadmium					100.0000	101.0000	101	105.0000	105	99.5000	100
Calcium					10000.0000	10300.0000	103	10800.0000	108	10400.0000	104
Chromium					100.0000	97.8000	98	104.0000	104	98.5000	98
Cobalt					100.0000	100.0000	100	105.0000	105	100.0000	100
Copper					100.0000	99.6000	100	103.0000	103	102.0000	102
Iron					10000.0000	10200.0000	102	10100.0000	101	10100.0000	101
Lead					100.0000	102.0000	102	103.0000	103	101.0000	101
Magnesium					10000.0000	9770.0000	98	10200.0000	102	10100.0000	101
Manganese					100.0000	101.0000	101	101.0000	101	101.0000	101
Molybdenum					100.0000	98.1000	98	99.4000	99	98.7000	99
Nickel					100.0000	99.0000	99	98.9000	99	96.1000	96
Potassium					10000.0000	10100.0000	101	10600.0000	106	10300.0000	103
Selenium					100.0000	101.0000	101	104.0000	104	97.0000	97
Silver					100.0000	98.1000	98	99.4000	99	97.4000	97
Sodium					10000.0000	9710.0000	97	9930.0000	99	9860.0000	99
Strontium					100.0000	103.0000	103	105.0000	105	104.0000	104
Thallium					100.0000	103.0000	103	104.0000	104	101.0000	101
Titanium					100.0000	98.9000	99	101.0000	101	98.4000	98
Tin					100.0000	100.0000	100	101.0000	101	96.9000	97
Vanadium					100.0000	101.0000	101	98.8000	99	104.0000	104

Acceptance Criteria:

ICV: 95-105% (Methods 200.7, 245.1)
 90-110% (Methods 200.8, 6010, 6020, 7470, 7471, 7474)
 85-115% (Method 1631)

CCV: 90-110% (Methods 200.7, 245.1, 6010, 6020, 7474)
 85-115% (Methods 200.8, 1631)
 80-120% (Methods 7470, 7471)



Form 2A

Initial and Continuing Calibration Verification

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : NESE
 Instrument ID : ICPMSQ

Lab Number : L1710301
 Project Number : 1794
 Units : ug/l

Parameter	Lab ID : Date Analyzed :	Initial Calibration		Continuing Calibration(s)							
		True	Found	%R	R955527-24			R955527-26		R955527-28	
					04/05/17 15:02			04/05/17 15:46		04/05/17 16:27	
					True	Found	%R	Found	%R	Found	%R
Aluminum					100.0000	95.1000	95	99.0000	99	103.0000	103
Antimony					100.0000	97.0000	97	95.8000	96	99.7000	100
Arsenic					100.0000	100.0000	100	99.9000	100	102.0000	102
Barium					100.0000	97.9000	98	100.0000	100	103.0000	103
Beryllium					100.0000	92.2000	92	94.0000	94	97.7000	98
Cadmium					100.0000	99.4000	99	101.0000	101	103.0000	103
Calcium					10000.0000	9930.0000	99	10200.0000	102	10600.0000	106
Chromium					100.0000	96.4000	96	98.6000	99	100.0000	100
Cobalt					100.0000	97.1000	97	100.0000	100	98.6000	99
Copper					100.0000	97.3000	97	102.0000	102	98.3000	98
Iron					10000.0000	9680.0000	97	10100.0000	101	9960.0000	100
Lead					100.0000	99.2000	99	100.0000	100	101.0000	101
Magnesium					10000.0000	9580.0000	96	9950.0000	100	10400.0000	104
Manganese					100.0000	99.1000	99	99.4000	99	98.5000	98
Molybdenum					100.0000	94.7000	95	99.3000	99	101.0000	101
Nickel					100.0000	91.3000	91	99.8000	100	101.0000	101
Potassium					10000.0000	10000.0000	100	9900.0000	99	10200.0000	102
Selenium					100.0000	98.3000	98	100.0000	100	106.0000	106
Silver					100.0000	97.5000	98	99.1000	99	99.6000	100
Sodium					10000.0000	9420.0000	94	9840.0000	98	10100.0000	101
Strontium					100.0000	101.0000	101	100.0000	100	106.0000	106
Thallium					100.0000	101.0000	101	103.0000	103	104.0000	104
Titanium					100.0000	95.9000	96	98.5000	98	101.0000	101
Tin					100.0000	96.0000	96	98.6000	99	99.6000	100
Vanadium					100.0000	96.1000	96	102.0000	102	103.0000	103

Acceptance Criteria:

ICV: 95-105% (Methods 200.7, 245.1)
 90-110% (Methods 200.8, 6010, 6020, 7470, 7471, 7474)
 85-115% (Method 1631)

CCV: 90-110% (Methods 200.7, 245.1, 6010, 6020, 7474)
 85-115% (Methods 200.8, 1631)
 80-120% (Methods 7470, 7471)



Form 2A

Initial and Continuing Calibration Verification

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : NESE
 Instrument ID : ICPMSQ

Lab Number : L1710301
 Project Number : 1794
 Units : ug/l

Parameter	Lab ID : Date Analyzed :	Initial Calibration			Continuing Calibration(s)						
		True	Found	%R	R955527-30 04/05/17 17:07			R955527-32 04/05/17 17:34			
					True	Found	%R	Found	%R	Found	%R
Aluminum					100.0000	108.0000	108	100.0000	100		
Antimony					100.0000	97.7000	98	99.1000	99		
Arsenic					100.0000	99.4000	99	99.6000	100		
Barium					100.0000	104.0000	104	104.0000	104		
Beryllium					100.0000	99.0000	99	100.0000	100		
Cadmium					100.0000	102.0000	102	101.0000	101		
Calcium					10000.0000	10200.0000	102	10900.0000	109		
Chromium					100.0000	99.7000	100	103.0000	103		
Cobalt					100.0000	102.0000	102	102.0000	102		
Copper					100.0000	99.5000	100	103.0000	103		
Iron					10000.0000	10100.0000	101	10300.0000	103		
Lead					100.0000	99.9000	100	103.0000	103		
Magnesium					10000.0000	10500.0000	105	10600.0000	106		
Manganese					100.0000	104.0000	104	106.0000	106		
Molybdenum					100.0000	102.0000	102	99.6000	100		
Nickel					100.0000	99.7000	100	100.0000	100		
Potassium					10000.0000	10500.0000	105	10700.0000	107		
Selenium					100.0000	102.0000	102	106.0000	106		
Silver					100.0000	99.2000	99	99.0000	99		
Sodium					10000.0000	10200.0000	102	10200.0000	102		
Strontium					100.0000	107.0000	107	104.0000	104		
Thallium					100.0000	102.0000	102	106.0000	106		
Titanium					100.0000	100.0000	100	103.0000	103		
Tin					100.0000	99.0000	99	101.0000	101		
Vanadium					100.0000	98.1000	98	102.0000	102		

Acceptance Criteria:

ICV:	95-105%	(Methods 200.7, 245.1)
	90-110%	(Methods 200.8, 6010, 6020, 7470, 7471, 7474)
	85-115%	(Method 1631)
CCV:	90-110%	(Methods 200.7, 245.1, 6010, 6020, 7474)
	85-115%	(Methods 200.8, 1631)
	80-120%	(Methods 7470, 7471)



Form 2A

Initial and Continuing Calibration Verification

Client	: Alpine Ocean Seismic Survey Inc.	Lab Number	: L1710301
Project Name	: NESE	Project Number	: 1794
Instrument ID	: ICPMSQ	Units	: ug/l

Parameter	Lab ID : Date Analyzed :	Initial Calibration			Continuing Calibration(s)						
		True	Found	%R	R955527-30			R955527-32			
					True	Found	%R	Found	%R	Found	%R
Zinc					100.0000	99.7000	100	101.0000	101		

Acceptance Criteria:

ICV:	95-105%	(Methods 200.7, 245.1)
	90-110%	(Methods 200.8, 6010, 6020, 7470, 7471, 7474)
	85-115%	(Method 1631)
CCV:	90-110%	(Methods 200.7, 245.1, 6010, 6020, 7474)
	85-115%	(Methods 200.8, 1631)
	80-120%	(Methods 7470, 7471)



Form 2A

Initial and Continuing Calibration Verification

Client	: Alpine Ocean Seismic Survey Inc.	Lab Number	: L1710301
Project Name	: NESE	Project Number	: 1794
Instrument ID	: ICPMSQ	Units	: ug/l

Parameter	Lab ID : Date Analyzed :	Initial Calibration			Continuing Calibration(s)						
		True	Found	%R	R955527-30			R955527-32			
					True	Found	%R	Found	%R	Found	%R
Zinc					100.0000	99.7000	100	101.0000	101		

Acceptance Criteria:

ICV:	95-105%	(Methods 200.7, 245.1)
	90-110%	(Methods 200.8, 6010, 6020, 7470, 7471, 7474)
	85-115%	(Method 1631)
CCV:	90-110%	(Methods 200.7, 245.1, 6010, 6020, 7474)
	85-115%	(Methods 200.8, 1631)
	80-120%	(Methods 7470, 7471)



Form 2A

Initial and Continuing Calibration Verification

Client : Alpine Ocean Seismic Survey Inc. Lab Number : L1710301
 Project Name : NESE Project Number : 1794
 Instrument ID : ICPMSQ Units : ug/l

Parameter	Lab ID : Date Analyzed :	Initial Calibration			Continuing Calibration(s)						
		True	Found	%R	R955527-30			R955527-32			
					True	Found	%R	Found	%R	Found	%R
Zinc					100.0000	99.7000	100	101.0000	101		

Acceptance Criteria:

ICV: 95-105% (Methods 200.7, 245.1)
 90-110% (Methods 200.8, 6010, 6020, 7470, 7471, 7474)
 85-115% (Method 1631)

CCV: 90-110% (Methods 200.7, 245.1, 6010, 6020, 7474)
 85-115% (Methods 200.8, 1631)
 80-120% (Methods 7470, 7471)



Form 2A

Initial and Continuing Calibration Verification

Client	: Alpine Ocean Seismic Survey Inc.	Lab Number	: L1710301
Project Name	: NESE	Project Number	: 1794
Instrument ID	: ICPMSQ	Units	: ug/l

Parameter	Lab ID : Date Analyzed :	Initial Calibration			Continuing Calibration(s)						
		True	Found	%R	R955527-30			R955527-32			
					True	Found	%R	Found	%R	Found	%R
Zinc					100.0000	99.7000	100	101.0000	101		

Acceptance Criteria:

ICV:	95-105%	(Methods 200.7, 245.1)
	90-110%	(Methods 200.8, 6010, 6020, 7470, 7471, 7474)
	85-115%	(Method 1631)
CCV:	90-110%	(Methods 200.7, 245.1, 6010, 6020, 7474)
	85-115%	(Methods 200.8, 1631)
	80-120%	(Methods 7470, 7471)



Form 2A

Initial and Continuing Calibration Verification

Client	: Alpine Ocean Seismic Survey Inc.	Lab Number	: L1710301
Project Name	: NESE	Project Number	: 1794
Instrument ID	: ICPMSQ	Units	: ug/l

Parameter	Lab ID : Date Analyzed :	Initial Calibration			Continuing Calibration(s)						
		True	Found	%R	R955527-30			R955527-32			
					True	Found	%R	Found	%R	Found	%R
Zinc					100.0000	99.7000	100	101.0000	101		

Acceptance Criteria:

ICV:	95-105%	(Methods 200.7, 245.1)
	90-110%	(Methods 200.8, 6010, 6020, 7470, 7471, 7474)
	85-115%	(Method 1631)
CCV:	90-110%	(Methods 200.7, 245.1, 6010, 6020, 7474)
	85-115%	(Methods 200.8, 1631)
	80-120%	(Methods 7470, 7471)



Form 3 Blanks

Client : Alpine Ocean Seismic Survey Inc.
Project Name : NESE
Instrument ID : ICPMSQ

Lab Number : L1710301
Project Number : 1794

Parameter	Initial Calibration Blank		Continuing Calibration Blank(s)				Preparation Blank	
	ug/l	Q	ug/l	Q	ug/l	Q	ug/l	Q
Aluminum	37.0	U	37.0	U	37.0	U	37.0	U
Antimony	2.33	J	3.42	J	3.38	J	3.27	J
Arsenic	0.165	U	0.206	J	0.165	U	0.165	U
Barium	0.528	U	0.528	U	0.528	U	0.528	U
Beryllium	0.218	U	0.218	U	0.218	U	0.218	U
Cadmium	0.0660	U	0.0660	U	0.0660	U	0.0660	U
Calcium	152.	U	152.	U	152.	U	152.	U
Chromium	1.17	U	1.17	U	1.17	U	1.17	U
Cobalt	0.133	U	0.133	U	0.133	U	0.133	U
Copper	0.485	U	0.485	U	0.485	U	0.485	U
Iron	51.5	U	51.5	U	51.5	U	51.5	U
Lead	0.365	U	0.365	U	0.365	U	0.365	U
Magnesium	30.8	U	30.8	U	30.8	U	30.8	U
Manganese	1.11	U	1.11	U	1.11	U	1.11	U
Molybdenum	0.327	J	0.886	J	0.508	J	0.620	J
Nickel	0.668	U	0.668	U	0.668	U	0.668	U
Potassium	39.7	U	39.7	U	39.7	U	39.7	U
Selenium	1.89	U	1.89	U	1.89	U	1.89	U
Silver	0.122	U	0.122	U	0.122	U	0.122	U
Sodium	29.3	U	29.3	U	29.3	U	29.3	U
Strontium	0.613	U	0.613	U	0.613	U	0.613	U
Thallium	0.129	U	0.129	U	0.129	U	0.129	U
Tin	0.382	J	0.751	J	0.756	J	0.783	J
Titanium	0.216	U	0.216	U	0.216	U	0.216	U
Vanadium	0.948	U	0.948	U	0.948	U	0.948	U
Zinc	6.50	U	6.50	U	6.50	U	6.50	U



Form 3 Blanks

Client : Alpine Ocean Seismic Survey Inc.
Project Name : NESE
Instrument ID : ICPMSQ

Lab Number : L1710301
Project Number : 1794

Parameter	Initial Calibration		Continuing Calibration						Preparation
	Blank		Blank(s)						Blank
	Lab ID	Date Analyzed	R955527-12	04/05/17 10:57	R955527-15	04/05/17 11:39	R955527-17	04/05/17 12:22	
	ug/l	Q	ug/l	Q	ug/l	Q	ug/l	Q	Q
Aluminum			37.0	U	37.0	U	37.0	U	
Antimony			3.35	J	3.42	J	3.36	J	
Arsenic			0.165	U	0.165	U	0.165	U	
Barium			0.528	U	0.528	U	0.528	U	
Beryllium			0.218	U	0.218	U	0.218	U	
Cadmium			0.0660	U	0.0660	U	0.0660	U	
Calcium			152.	U	152.	U	152.	U	
Chromium			1.17	U	1.17	U	1.17	U	
Cobalt			0.133	U	0.133	U	0.133	U	
Copper			0.485	U	0.485	U	0.485	U	
Iron			51.5	U	51.5	U	51.5	U	
Lead			0.365	U	0.365	U	0.365	U	
Magnesium			30.8	U	30.8	U	30.8	U	
Manganese			1.11	U	1.11	U	1.11	U	
Molybdenum			0.745	J	0.621	J	0.494	J	
Nickel			0.668	U	0.668	U	0.668	U	
Potassium			41.3	J	45.0	J	39.7	U	
Selenium			1.89	U	1.89	U	1.89	U	
Silver			0.122	U	0.122	U	0.122	U	
Sodium			44.8	J	36.2	J	29.3	U	
Strontium			0.613	U	0.613	U	0.613	U	
Thallium			0.129	U	0.129	U	0.129	U	
Titanium			0.222	J	0.216	U	0.216	U	
Tin			0.707	J	0.882	J	0.769	J	
Vanadium			0.948	U	0.948	U	0.948	U	
Zinc			6.50	U	6.50	U	6.50	U	



Form 3 Blanks

Client : Alpine Ocean Seismic Survey Inc.
Project Name : NESE
Instrument ID : ICPMSQ

Lab Number : L1710301
Project Number : 1794

Parameter	Initial Calibration Blank		Continuing Calibration Blank(s)						Preparation Blank	
	ug/l	Q	ug/l	Q	ug/l	Q	ug/l	Q		Q
Aluminum			37.0	U	37.0	U	37.0	U		
Antimony			3.28	J	3.20	J	3.22	J		
Arsenic			0.165	U	0.165	U	0.165	U		
Barium			0.528	U	0.528	U	0.528	U		
Beryllium			0.218	U	0.218	U	0.218	U		
Cadmium			0.0660	U	0.0660	U	0.0660	U		
Calcium			152.	U	152.	U	152.	U		
Chromium			1.17	U	1.17	U	1.17	U		
Cobalt			0.133	U	0.133	U	0.133	U		
Copper			0.485	U	0.485	U	0.485	U		
Iron			51.5	U	51.5	U	51.5	U		
Lead			0.365	U	0.365	U	0.365	U		
Magnesium			30.8	U	30.8	U	30.8	U		
Manganese			1.11	U	1.11	U	1.11	U		
Molybdenum			0.685	J	0.668	J	0.647	J		
Nickel			0.668	U	0.668	U	0.668	U		
Potassium			39.7	U	39.7	U	39.7	U		
Selenium			1.89	U	1.89	U	1.89	U		
Silver			0.122	U	0.122	U	0.122	U		
Sodium			29.3	U	29.3	U	29.3	U		
Strontium			0.613	U	0.613	U	0.613	U		
Thallium			0.129	U	0.129	U	0.129	U		
Titanium			0.216	U	0.216	U	0.216	U		
Tin			0.925	J	0.906	J	0.784	J		
Vanadium			0.948	U	0.948	U	0.948	U		
Zinc			6.50	U	6.50	U	6.50	U		



Form 3 Blanks

Client : Alpine Ocean Seismic Survey Inc.
Project Name : NESE
Instrument ID : ICPMSQ

Lab Number : L1710301
Project Number : 1794

Parameter	Initial Calibration Blank		Continuing Calibration Blank(s)						Preparation Blank
	ug/l	Q	ug/l	Q	ug/l	Q	ug/l	Q	Q
Aluminum			37.0	U	37.0	U	37.0	U	
Antimony			3.13	J	3.67	J	3.52	J	
Arsenic			0.165	U	0.165	U	0.165	U	
Barium			0.528	U	0.528	U	0.528	U	
Beryllium			0.218	U	0.218	U	0.218	U	
Cadmium			0.0660	U	0.0660	U	0.0660	U	
Calcium			152.	U	152.	U	152.	U	
Chromium			1.17	U	1.17	U	1.17	U	
Cobalt			0.133	U	0.133	U	0.133	U	
Copper			0.485	U	0.485	U	0.485	U	
Iron			51.5	U	51.5	U	51.5	U	
Lead			0.365	U	0.365	U	0.365	U	
Magnesium			30.8	U	30.8	U	30.8	U	
Manganese			1.11	U	1.11	U	1.11	U	
Molybdenum			0.582	J	0.567	J	0.618	J	
Nickel			0.668	U	0.668	U	0.668	U	
Potassium			39.7	U	39.7	U	39.7	U	
Selenium			1.89	U	1.89	U	1.89	U	
Silver			0.122	U	0.122	U	0.122	U	
Sodium			29.3	U	29.3	U	51.5	J	
Strontium			0.613	U	0.613	U	0.613	U	
Thallium			0.129	U	0.129	U	0.129	U	
Titanium			0.216	U	0.216	U	0.216	U	
Tin			0.810	J	0.793	J	0.790	J	
Vanadium			0.948	U	0.948	U	0.948	U	
Zinc			6.50	U	6.50	U	6.50	U	



Form 3 Blanks

Client : Alpine Ocean Seismic Survey Inc. Lab Number : L1710301
 Project Name : NESE Project Number : 1794
 Instrument ID : ICPMSQ

Parameter	Initial Calibration Blank		Continuing Calibration Blank(s)				Preparation Blank	
	ug/l	Q	ug/l	Q	ug/l	Q	ug/l	Q
Aluminum			37.0	U	37.0	U		
Antimony			3.55	J	3.63	J		
Arsenic			0.203	J	0.165	U		
Barium			0.528	U	0.528	U		
Beryllium			0.218	U	0.218	U		
Cadmium			0.0660	U	0.0660	U		
Calcium			152.	U	152.	U		
Chromium			1.17	U	1.17	U		
Cobalt			0.133	U	0.133	U		
Copper			0.485	U	0.485	U		
Iron			51.5	U	51.5	U		
Lead			0.365	U	0.365	U		
Magnesium			30.8	U	30.8	U		
Manganese			1.11	U	1.11	U		
Molybdenum			0.601	J	0.560	J		
Nickel			0.668	U	0.668	U		
Potassium			39.7	U	39.7	U		
Selenium			1.89	U	1.89	U		
Silver			0.132	J	0.122	U		
Sodium			31.2	J	29.3	U		
Strontium			0.613	U	0.613	U		
Thallium			0.129	U	0.129	U		
Titanium			0.216	U	0.216	U		
Tin			0.753	J	0.668	J		
Vanadium			0.948	U	0.948	U		
Zinc			6.50	U	6.50	U		



Form 4a Interference Check Sample

Client : Alpine Ocean Seismic Survey Inc.
Project Name : NESE
Instrument ID : ICPMSQ

Lab Number : L1710301
Project Number : 1794
Concentration Units : ug/l

Analyte	True		Initial Found				Final Found			
	Lab ID : Analysis Date :		R955527-3 04/05/17 08:34				R955527-4 04/05/17 08:37			
	Sol. A	Sol. AB	Sol. A	%R	Sol. AB	%R	Sol. A	%R	Sol. AB	%R
Aluminum	20000	20000	20500	102	20900	104				
Antimony			1.91							
Arsenic		20	0.233		21.2	106				
Barium			1.14							
Beryllium			0.0132							
Cadmium		20	0.0948		21.8	109				
Calcium	60000	60000	62700	104	67500	112				
Chromium		40	0.669		44.1	110				
Cobalt		40	0.620		41.8	104				
Copper		40	0.755		43.0	108				
Iron	50000	50000	54500	109	54500	109				
Lead			0.0927							
Magnesium	20000	20000	21400	107	21700	108				
Manganese		40	0.555		44.6	112				
Molybdenum	400	400	424.	106	424.	106				
Nickel		40	0.361		42.7	107				
Potassium	20000	20000	20800	104	22400	112				
Selenium		20	0.194		23.5	118				
Silver		10	0.0662		10.1	101				
Sodium	50000	50000	53800	108	53600	107				
Strontium		40	1.00		44.0	110				
Thallium			0.0157							
Titanium	400	400	459.	115	458.	114				
Tin			0.496							
Vanadium		40	0.00		43.4	108				
Zinc		20	1.44		22.5	112				

Acceptance Criteria: Methods 200.7, 200.8, 6010, 6020

ICSA: 80-120%

ICSAB: 80-120%



Form 5a Matrix Spike

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : NESE
 Client Sample ID : BHA-7 SS1 0-2'
 Lab Sample ID : L1710301-01
 Matrix Spike : WG991289-3
 Matrix Spike Dup :

Lab Number : L1710301
 Project Number : 1794
 Matrix : SOIL
 MS Analysis Date : 04/05/17 14:35
 MSD Analysis Date :

Parameter	Sample Conc. (mg/kg)	Matrix Spike Sample		%R	Matrix Spike Duplicate		%R	RPD	Recovery Limits	RPD Limit
		Spike Added (mg/kg)	Spike Conc. (mg/kg)		Spike Added (mg/kg)	Spike Conc. (mg/kg)				
Aluminum, Total	10200	303	12000	594 Q					75-125	20
Antimony, Total	6.80	75.7	98.1	120					75-125	20
Arsenic, Total	39.1	18.2	63.4	134 Q					75-125	20
Barium, Total	50.9	303	353.	100					75-125	20
Beryllium, Total	0.870	7.57	7.87	92					75-125	20
Cadmium, Total	1.00	7.72	9.19	106					75-125	20
Calcium, Total	5040	1510	4970	0 Q					75-125	20
Chromium, Total	69.3	30.3	106.	121					75-125	20
Cobalt, Total	9.22	75.7	74.6	86					75-125	20
Copper, Total	140.	37.8	180.	106					75-125	20
Iron, Total	32400	151	29100	0 Q					75-125	20
Lead, Total	156.	77.2	230.	96					75-125	20
Magnesium, Total	5490	1510	7100	106					75-125	20
Manganese, Total	274.	75.7	284.	13 Q					75-125	20
Molybdenum, Total	2.08	151	137.	89					75-125	20
Nickel, Total	23.9	75.7	93.8	92					75-125	20
Potassium, Total	2370	1510	3790	94					75-125	20
Selenium, Total	3.36J	18.2	22.9	126 Q					75-125	20
Silver, Total	2.44	45.4	45.9	96					75-125	20
Sodium, Total	8960	1510	10700	115					75-125	20
Strontium, Total	51.5	151	190.	91					75-125	20
Thallium, Total	0.228J	18.2	16.6	91					75-125	20
Tin, Total	19.1	151	169.	99					75-125	20
Titanium, Total	362.	151	615.	167 Q					75-125	20



Form 5a Matrix Spike

Client : Alpine Ocean Seismic Survey Inc.	Lab Number : L1710301
Project Name : NESE	Project Number : 1794
Client Sample ID : BHA-7 SS1 0-2'	Matrix : SOIL
Lab Sample ID : L1710301-01	
Matrix Spike : L1710301-01	MS Analysis Date : 04/05/17 14:35
Matrix Spike Dup :	MSD Analysis Date :

Parameter	Sample Conc. (mg/kg)	Matrix Spike Sample		%R	Matrix Spike Duplicate		%R	RPD	Recovery Limits	RPD Limit
		Spike Added (mg/kg)	Spike Conc. (mg/kg)		Spike Added (mg/kg)	Spike Conc. (mg/kg)				
Vanadium, Total	46.9	75.7	119.	95					75-125	20
Zinc, Total	243.	75.7	311.	90					75-125	20

Form 6 Lab Duplicates

Client	: Alpine Ocean Seismic Survey Inc.	Lab Number	: L1710301
Project Name	: NESE	Project Number	: 1794
Client Sample ID	: BHA-7 SS1 0-2'	Matrix	: SOIL
Lab Sample ID	: L1710301-01	Analysis Date	: 04/05/17 14:46
Dup Sample ID	: WG991289-4	DUP Analysis Date	: 04/05/17 14:42

Parameter	Sample Concentration (mg/kg)	Duplicate Concentration (mg/kg)	RPD	RPD Limit
Aluminum, Total	10200	11500	12	20
Antimony, Total	6.80	9.01	28 Q	20
Arsenic, Total	39.1	58.4	40 Q	20
Barium, Total	50.9	65.2	25 Q	20
Beryllium, Total	0.870	0.920	6	20
Cadmium, Total	1.00	1.07	7	20
Calcium, Total	5040	6300	22 Q	20
Chromium, Total	69.3	85.2	21 Q	20
Cobalt, Total	9.22	9.36	2	20
Copper, Total	140	155	10	20
Iron, Total	32400	37900	16	20
Lead, Total	156	150	4	20
Magnesium, Total	5490	5790	5	20
Manganese, Total	274	242	12	20
Molybdenum, Total	2.08	2.28	9	20
Nickel, Total	23.9	26.5	10	20
Potassium, Total	2370	2510	6	20
Selenium, Total	3.36J	4.93	NC	20
Silver, Total	2.44	2.43	0	20
Sodium, Total	8960	9660	8	20
Strontium, Total	51.5	60.3	16	20
Thallium, Total	0.228J	0.291J	NC	20
Tin, Total	19.1	21.5	12	20
Titanium, Total	362	501	32 Q	20
Vanadium, Total	46.9	55.1	16	20
Zinc, Total	243	265	9	20

Form 7

Laboratory Control Sample

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : NESE
 Client Sample ID : NA
 Lab Sample ID : WG991289-2
 Dup Sample ID :

Lab Number : L1710301
 Project Number : 1794
 Matrix : SOIL
 LCS Analysis Date : 04/05/17 14:32
 LCSD Analysis Date:

Parameter	Laboratory Control Sample			Laboratory Control Duplicate			RPD	Recovery Limits	RPD Limit
	True (mg/kg)	Found (mg/kg)	%R	True (mg/kg)	Found (mg/kg)	%R			
Aluminum, Total	8080	6250	77.					52-148	20
Arsenic, Total	145.	151.	104.					80-121	20
Barium, Total	209.	207.	99.					84-117	20
Beryllium, Total	97.3	96.1	99.					83-117	20
Cadmium, Total	87.6	89.7	102.					83-117	20
Calcium, Total	5690	5700	100.					81-118	20
Chromium, Total	143.	144.	101.					80-119	20
Cobalt, Total	154.	150.	97.					84-115	20
Copper, Total	173.	173.	100.					82-117	20
Iron, Total	15000	16600	111.					47-154	20
Lead, Total	146.	144.	99.					82-118	20
Magnesium, Total	2640	2560	97.					77-123	20
Manganese, Total	309.	319.	103.					82-118	20
Molybdenum, Total	116.	114.	98.					79-121	20
Nickel, Total	129.	123.	95.					83-117	20
Potassium, Total	2400	2210	92.					72-128	20
Selenium, Total	178.	180.	101.					79-121	20
Silver, Total	31.3	32.0	102.					76-124	20
Sodium, Total	869.	789.	91.					73-126	20
Strontium, Total	105.	98.4	94.					81-120	20
Thallium, Total	141.	144.	102.					80-121	20
Tin, Total	144.	152.	106.					77-122	20
Titanium, Total	316.	259.	82.					31-169	20
Vanadium, Total	115.	113.	98.					78-122	20
Zinc, Total	194.	194.	100.					82-118	20



Form 7 Laboratory Control Sample

Client : Alpine Ocean Seismic Survey Inc. Project Name : NESE Client Sample ID : NA Lab Sample ID : WG991289-2 Dup Sample ID :	Lab Number : L1710301 Project Number : 1794 Matrix : SOIL LCS Analysis Date : 04/05/17 17:14 LCSD Analysis Date :
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Parameter	Laboratory Control Sample			Laboratory Control Duplicate			RPD	Recovery Limits	RPD Limit
	True (mg/kg)	Found (mg/kg)	%R	True (mg/kg)	Found (mg/kg)	%R			
Antimony, Total	123.	24.5	20.					1-200	20

Form 12 Preparation Log

Client	: Alpine Ocean Seismic Survey Inc.	Lab Number	: L1710301
Project Name	: NESE	Project Number	: 1794
Matrix	: SOIL	Prep Method	: EPA 3050B

Sample Number	Preparation Date	Weight (gram)	Volume (mL)
L1710301-01	04/05/17 12:23	1.27	-
L1710301-02	04/05/17 12:23	1.29	-
L1710301-03	04/05/17 12:23	1.26	-
L1710301-04	04/05/17 12:23	1.32	-
L1710301-05	04/05/17 12:23	1.27	-
L1710301-06	04/05/17 12:23	1.26	-
L1710301-07	04/05/17 12:23	1.28	-
L1710301-08	04/05/17 12:23	1.28	-
L1710301-09	04/05/17 12:23	1.32	-
L1710301-10	04/05/17 12:23	1.28	-
L1710301-11	04/05/17 12:23	1.29	-
L1710301-12	04/05/17 12:23	1.32	-
L1710301-13	04/05/17 12:23	1.30	-
WG991289-1	04/05/17 12:23	1.00	-
WG991289-2	04/05/17 12:23	0.40	-
WG991289-3	04/05/17 12:23	1.30	-
WG991289-4	04/05/17 12:23	1.30	-
WG991289-5	04/05/17 12:23	1.27	-
WG991289-6	04/05/17 12:23	1.27	-

Form 13 Analysis Run Log

Client : Alpine Ocean Seismic Survey Inc.
Project Name : NESE
Instrument ID : ICPMSQ
Start Date : 04/05/17 07:31

Lab Number : L1710301
Project Number : 1794
Analysis Method : 1,6020A
End Date : 04/05/17 17:38

	Sample Number	Dilution Factor	Analysis Time	Aluminum, Total	Antimony, Total	Arsenic, Total	Barium, Total	Beryllium, Total	Cadmium, Total	Calcium, Total	Chromium, Total	Cobalt, Total	Copper, Total	Iron, Total	Lead, Total	Magnesium, Total	Manganese, Total	Molybdenum, Total	Nickel, Total	Potassium, Total	Selenium, Total	Silver, Total	Sodium, Total	Strontium, Total	Thallium, Total	Tin, Total	Titanium, Total	Vanadium, Total	Zinc, Total
	R955527-13 TUNE		07:31:00																										
	R955527-1 ICV	1	08:19:38	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
X	R955527-2 ICB	1	08:27:18	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
X	R955527-3 ICSA	1	08:34:09	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
X	R955527-4 ICSAB	1	08:37:34	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
X	R955527-5 CCV	1	08:48:32	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
X	R955527-6 CCB	1	08:51:57	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
X	R955527-7 CCV	1	09:28:56	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
X	R955527-8 CCB	1	09:32:21	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
X	R955527-9 CCV	1	10:09:21	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
X	R955527-10 CCB	1	10:12:46	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
X	R955527-11 CCV	1	10:54:16	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
X	R955527-12 CCB	1	10:57:41	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
X	R955527-14 CCV	1	11:36:26	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
X	R955527-15 CCB	1	11:39:51	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
X	R955527-16 CCV	1	12:18:38	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
X	R955527-17 CCB	1	12:22:03	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
X	R955527-18 CCV	1	12:59:10	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
X	R955527-19 CCB	1	13:02:35	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
X	R955527-20 CCV	1	13:41:28	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
X	R955527-21 CCB	1	13:44:53	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
X	R955527-22 CCV	1	14:22:23	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
X	R955527-23 CCB	1	14:25:48	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
X	WG991289-1 BLANK	10	14:29:13	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
X	WG991289-2 LCS	10	14:32:36	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
X	WG991289-3 MS	10	14:35:59	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
X	WG991289-5 PS	50	14:39:22																										

Form 13 Analysis Run Log

Client : Alpine Ocean Seismic Survey Inc.
Project Name : NESE
Instrument ID : ICPMSQ
Start Date : 04/05/17 07:31

Lab Number : L1710301
Project Number : 1794
Analysis Method : 1,6020A
End Date : 04/05/17 17:38

				Aluminum, Total	Antimony, Total	Arsenic, Total	Barium, Total	Beryllium, Total	Cadmium, Total	Calcium, Total	Chromium, Total	Cobalt, Total	Copper, Total	Iron, Total	Lead, Total	Magnesium, Total	Manganese, Total	Molybdenum, Total	Nickel, Total	Potassium, Total	Selenium, Total	Silver, Total	Sodium, Total	Strontium, Total	Thallium, Total	Tin, Total	Titanium, Total	Vanadium, Total	Zinc, Total	
	Sample Number	Dilution Factor	Analysis Time	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
X	L1710301-01	10	14:46:08	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
X	L1710301-02	10	14:49:30	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
X	L1710301-03	10	14:52:52	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
X	L1710301-04	10	14:56:07	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
X	WG991289-6 SERDIL	50	14:59:29																											
	R955527-24 CCV	1	15:02:51	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
X	R955527-25 CCB	1	15:06:16	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
X	L1710301-05	10	15:12:43	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
X	L1710301-06	10	15:16:05	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
X	L1710301-07	10	15:19:28	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
X	L1710301-08	10	15:22:50	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
X	L1710301-09	10	15:26:13	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
X	L1710301-10	10	15:29:36	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
X	L1710301-13	10	15:39:44	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
X	R955527-26 CCV	1	15:46:29	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
X	R955527-27 CCB	1	15:49:54	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
X	R955527-28 CCV	1	16:27:08	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
X	R955527-29 CCB	1	16:30:33	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
X	L1710301-11	10	16:40:45	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
X	L1710301-12	10	16:44:08	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
X	R955527-30 CCV	1	17:07:48	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
X	R955527-31 CCB	1	17:11:13	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
X	WG991289-2 LCS	10	17:14:39		X																									
	R955527-32 CCV	1	17:34:57	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
X	R955527-33 CCB	1	17:38:23	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
X																														

Form 14

ICP-MS Tune

Client : Alpine Ocean Seismic Survey Inc.
Project Name : NESE
Lab Sample ID : R955527-13
ICP-MS Instrument : iCAP Q

Lab Number : L1710301
Project Number : 1794
Analysis Date : 04/05/17 07:31

Mass Element	Avg Measured Mass (amu)	Avg. Peak Width at 10% Peak Height (amu)	%RSD
59 Co	58.9357	0.691	1.5
115 In	114.9125	0.675	1.3
7 Li	7.0454	0.686	1.8
238 U	238.0642	0.681	1.4



Form 15

ICP-MS Internal Standards Relative Intensity Summary

Client	: Alpine Ocean Seismic Survey Inc.	Lab Number	: L1710301
Project Name	: NESE	Project Number	: 1794
Instrument ID	: ICPMSQ	Analysis Method	: 1,6020A
Start Date	: 04/05/17	End Date	: 04/05/17

Sample #	Time	Internal Standards %RI For:				
		Lithium	Scandium	Ge	In	Bismuth
R955527-1 ICV	08:19:38	98	97	98	97	93
R955527-2 ICB	08:27:18	100	95	97	96	96
R955527-3 ICSA	08:34:09	93	91	94	89	87
R955527-4 ICSAB	08:37:34	93	86	94	86	87
R955527-5 CCV	08:48:32	98	96	98	91	89
R955527-6 CCB	08:51:57	99	91	98	92	93
R955527-7 CCV	09:28:56	93	92	90	89	86
R955527-8 CCB	09:32:21	93	91	92	89	86
R955527-9 CCV	10:09:21	90	88	88	86	82
R955527-10 CCB	10:12:46	89	90	89	86	83
R955527-11 CCV	10:54:16	89	85	82	81	79
R955527-12 CCB	10:57:41	88	83	86	81	83
R955527-14 CCV	11:36:26	87	84	83	80	78
R955527-15 CCB	11:39:51	89	82	83	81	79
R955527-16 CCV	12:18:38	97	91	96	91	89
R955527-17 CCB	12:22:03	100	93	94	92	92
R955527-18 CCV	12:59:10	99	95	94	92	89
R955527-19 CCB	13:02:35	99	95	95	93	94
R955527-20 CCV	13:41:28	97	92	90	89	88
R955527-21 CCB	13:44:53	101	93	92	91	91
R955527-22 CCV	14:22:23	92	86	88	88	89
R955527-23 CCB	14:25:48	93	84	87	87	90
WG991289-1 BLANK	14:29:13	93	87	89	86	93
WG991289-2 LCS	14:32:36	92	89	91	87	92
WG991289-3 MS	14:35:59	93	97	92	87	95
WG991289-5 PS	14:39:22	94	91	95	92	92
WG991289-4 DUP	14:42:45	94	93	90	90	94

Form 15

ICP-MS Internal Standards Relative Intensity Summary

Client	: Alpine Ocean Seismic Survey Inc.	Lab Number	: L1710301
Project Name	: NESE	Project Number	: 1794
Instrument ID	: ICPMSQ	Analysis Method	: 1,6020A
Start Date	: 04/05/17	End Date	: 04/05/17

Sample #	Time	Internal Standards %RI For:				
		Lithium	Scandium	Ge	In	Bismuth
L1710301-01	14:46:08	96	94	90	87	92
L1710301-02	14:49:30	97	95	90	88	95
L1710301-03	14:52:52	97	93	90	88	94
L1710301-04	14:56:07	97	91	92	88	92
WG991289-6 SERDIL	14:59:29	97	93	92	88	90
R955527-24 CCV	15:02:51	96	95	94	92	90
R955527-25 CCB	15:06:16	96	90	91	89	91
L1710301-05	15:12:43	99	93	90	87	92
L1710301-06	15:16:05	97	95	91	89	94
L1710301-07	15:19:28	98	94	89	88	89
L1710301-08	15:22:50	97	88	91	87	88
L1710301-09	15:26:13	94	91	89	88	91
L1710301-10	15:29:36	96	97	90	86	94
L1710301-13	15:39:44	95	94	91	89	94
R955527-26 CCV	15:46:29	95	92	92	89	90
R955527-27 CCB	15:49:54	95	91	94	91	95
R955527-28 CCV	16:27:08	103	100	99	96	92
R955527-29 CCB	16:30:33	101	94	95	96	96
L1710301-11	16:40:45	98	102	96	94	95
L1710301-12	16:44:08	97	98	94	94	96
R955527-30 CCV	17:07:48	96	95	95	94	92
R955527-31 CCB	17:11:13	98	98	99	94	93
WG991289-2 LCS	17:14:39	96	98	93	94	96
R955527-32 CCV	17:34:57	99	95	101	97	92
R955527-33 CCB	17:38:23	103	98	103	97	95

Form 1 METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : NESE
 Lab ID : L1710301-01
 Client ID : BHA-7 SS1 0-2'
 Sample Location : RARITAN BAY, NY
 Sample Matrix : Sediment
 Analytical Method : 1,7474
 Lab File ID : WG991676.pcl
 Sample Amount : 1.07g
 Digestion Method : EPA 7474

Lab Number : L1710301
 Project Number : 1794
 Date Collected : 10/08/16 00:00
 Date Received : 04/05/17
 Date Analyzed : 04/06/17 11:14
 Dilution Factor : 10
 Analyst : LC
 Instrument ID : MERCURYAF
 %Solids : 51
 Date Digested : 04/05/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7439-97-6	Mercury, Total	2.00	0.046	0.006	



Form 1 METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : NESE
 Lab ID : L1710301-02
 Client ID : BHA-7 SS2 2-4'
 Sample Location : RARITAN BAY, NY
 Sample Matrix : Sediment
 Analytical Method : 1,7474
 Lab File ID : WG991676.pcl
 Sample Amount : 0.97g
 Digestion Method : EPA 7474

Lab Number : L1710301
 Project Number : 1794
 Date Collected : 10/08/16 00:00
 Date Received : 04/05/17
 Date Analyzed : 04/06/17 11:25
 Dilution Factor : 10
 Analyst : LC
 Instrument ID : MERCURYAF
 %Solids : 52
 Date Digested : 04/05/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7439-97-6	Mercury, Total	4.13	0.050	0.006	



Form 1 METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : NESE
 Lab ID : L1710301-03
 Client ID : BHA-7 SS3 4-6'
 Sample Location : RARITAN BAY, NY
 Sample Matrix : Sediment
 Analytical Method : 1,7474
 Lab File ID : WG991676.pcl
 Sample Amount : 1.06g
 Digestion Method : EPA 7474

Lab Number : L1710301
 Project Number : 1794
 Date Collected : 10/08/16 00:00
 Date Received : 04/05/17
 Date Analyzed : 04/06/17 11:29
 Dilution Factor : 5
 Analyst : LC
 Instrument ID : MERCURYAF
 %Solids : 56
 Date Digested : 04/05/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7439-97-6	Mercury, Total	1.61	0.021	0.003	



Form 1

METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : NESE
 Lab ID : L1710301-04
 Client ID : BHA-7 SS4 6-8'
 Sample Location : RARITAN BAY, NY
 Sample Matrix : Sediment
 Analytical Method : 1,7474
 Lab File ID : WG991676.pcl
 Sample Amount : 1.11g
 Digestion Method : EPA 7474

Lab Number : L1710301
 Project Number : 1794
 Date Collected : 10/08/16 00:00
 Date Received : 04/05/17
 Date Analyzed : 04/06/17 11:33
 Dilution Factor : 5
 Analyst : LC
 Instrument ID : MERCURYAF
 %Solids : 56
 Date Digested : 04/05/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7439-97-6	Mercury, Total	1.41	0.020	0.003	



Form 1

METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : NESE
 Lab ID : L1710301-05
 Client ID : BHA-7 SS5 8-10'
 Sample Location : RARITAN BAY, NY
 Sample Matrix : Sediment
 Analytical Method : 1,7474
 Lab File ID : WG991676.pcl
 Sample Amount : 1.03g
 Digestion Method : EPA 7474

Lab Number : L1710301
 Project Number : 1794
 Date Collected : 10/08/16 00:00
 Date Received : 04/05/17
 Date Analyzed : 04/06/17 11:37
 Dilution Factor : 5
 Analyst : LC
 Instrument ID : MERCURYAF
 %Solids : 67
 Date Digested : 04/05/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7439-97-6	Mercury, Total	0.134	0.018	0.002	



Form 1

METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : NESE
 Lab ID : L1710301-06
 Client ID : BHA-7 SS6 10-12'
 Sample Location : RARITAN BAY, NY
 Sample Matrix : Sediment
 Analytical Method : 1,7474
 Lab File ID : WG991676.pcl
 Sample Amount : 0.96g
 Digestion Method : EPA 7474

Lab Number : L1710301
 Project Number : 1794
 Date Collected : 10/08/16 00:00
 Date Received : 04/05/17
 Date Analyzed : 04/06/17 11:39
 Dilution Factor : 5
 Analyst : LC
 Instrument ID : MERCURYAF
 %Solids : 78
 Date Digested : 04/05/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7439-97-6	Mercury, Total	0.030	0.017	0.002	



Form 1

METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : NESE
 Lab ID : L1710301-07
 Client ID : BHA-7 SS7 15-17'
 Sample Location : RARITAN BAY, NY
 Sample Matrix : Sediment
 Analytical Method : 1,7474
 Lab File ID : WG991676.pcl
 Sample Amount : 0.94g
 Digestion Method : EPA 7474

Lab Number : L1710301
 Project Number : 1794
 Date Collected : 10/08/16 00:00
 Date Received : 04/05/17
 Date Analyzed : 04/06/17 11:49
 Dilution Factor : 5
 Analyst : LC
 Instrument ID : MERCURYAF
 %Solids : 53
 Date Digested : 04/05/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7439-97-6	Mercury, Total	0.033	0.025	0.003	



Form 1 METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : NESE
 Lab ID : L1710301-08
 Client ID : BHA-9 SS2 2-4'
 Sample Location : RARITAN BAY, NY
 Sample Matrix : Sediment
 Analytical Method : 1,7474
 Lab File ID : WG991676.pcl
 Sample Amount : 1.12g
 Digestion Method : EPA 7474

Lab Number : L1710301
 Project Number : 1794
 Date Collected : 10/08/16 00:00
 Date Received : 04/05/17
 Date Analyzed : 04/06/17 11:51
 Dilution Factor : 5
 Analyst : LC
 Instrument ID : MERCURYAF
 %Solids : 72
 Date Digested : 04/05/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7439-97-6	Mercury, Total	0.054	0.016	0.002	



Form 1

METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : NESE
 Lab ID : L1710301-09
 Client ID : BHA-9 SS3 4-6'
 Sample Location : RARITAN BAY, NY
 Sample Matrix : Sediment
 Analytical Method : 1,7474
 Lab File ID : WG991676.pcl
 Sample Amount : 1.01g
 Digestion Method : EPA 7474

Lab Number : L1710301
 Project Number : 1794
 Date Collected : 10/08/16 00:00
 Date Received : 04/05/17
 Date Analyzed : 04/06/17 11:54
 Dilution Factor : 5
 Analyst : LC
 Instrument ID : MERCURYAF
 %Solids : 78
 Date Digested : 04/05/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7439-97-6	Mercury, Total	0.036	0.016	0.002	



Form 1 METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : NESE
 Lab ID : L1710301-10
 Client ID : BHA-9 SS4 6-8'
 Sample Location : RARITAN BAY, NY
 Sample Matrix : Sediment
 Analytical Method : 1,7474
 Lab File ID : WG991676.pcl
 Sample Amount : 0.95g
 Digestion Method : EPA 7474

Lab Number : L1710301
 Project Number : 1794
 Date Collected : 10/08/16 00:00
 Date Received : 04/05/17
 Date Analyzed : 04/06/17 11:56
 Dilution Factor : 5
 Analyst : LC
 Instrument ID : MERCURYAF
 %Solids : 85
 Date Digested : 04/05/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7439-97-6	Mercury, Total	0.015	0.016	0.002	J



Form 1 METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : NESE
 Lab ID : L1710301-11
 Client ID : BHA-9 SS5 8-10'
 Sample Location : RARITAN BAY, NY
 Sample Matrix : Sediment
 Analytical Method : 1,7474
 Lab File ID : WG991676.pcl
 Sample Amount : 1.01g
 Digestion Method : EPA 7474

Lab Number : L1710301
 Project Number : 1794
 Date Collected : 10/08/16 00:00
 Date Received : 04/05/17
 Date Analyzed : 04/06/17 11:59
 Dilution Factor : 5
 Analyst : LC
 Instrument ID : MERCURYAF
 %Solids : 85
 Date Digested : 04/05/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7439-97-6	Mercury, Total	0.025	0.015	0.002	



Form 1 METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : NESE
 Lab ID : L1710301-12
 Client ID : BHA-9 SS6 10-12'
 Sample Location : RARITAN BAY, NY
 Sample Matrix : Sediment
 Analytical Method : 1,7474
 Lab File ID : WG991676.pcl
 Sample Amount : 1.01g
 Digestion Method : EPA 7474

Lab Number : L1710301
 Project Number : 1794
 Date Collected : 10/08/16 00:00
 Date Received : 04/05/17
 Date Analyzed : 04/06/17 12:01
 Dilution Factor : 5
 Analyst : LC
 Instrument ID : MERCURYAF
 %Solids : 85
 Date Digested : 04/05/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7439-97-6	Mercury, Total	0.007	0.015	0.002	J



Form 1

METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : NESE
 Lab ID : L1710301-13
 Client ID : BHA-9 SS7 15-17'
 Sample Location : RARITAN BAY, NY
 Sample Matrix : Sediment
 Analytical Method : 1,7474
 Lab File ID : WG991676.pcl
 Sample Amount : 1.04g
 Digestion Method : EPA 7474

Lab Number : L1710301
 Project Number : 1794
 Date Collected : 10/08/16 00:00
 Date Received : 04/05/17
 Date Analyzed : 04/06/17 12:04
 Dilution Factor : 5
 Analyst : LC
 Instrument ID : MERCURYAF
 %Solids : 78
 Date Digested : 04/05/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7439-97-6	Mercury, Total	ND	0.016	0.002	U



Form 1 METALS

Client	: Alpine Ocean Seismic Survey Inc.	Lab Number	: L1710301
Project Name	: NESE	Project Number	: 1794
Lab ID	: WG991290-1	Date Collected	: NA
Client ID	: WG991290-1BLANK	Date Received	: NA
Sample Location	:	Date Analyzed	: 04/06/17 11:03
Sample Matrix	: SOIL	Dilution Factor	: 5
Analytical Method	: 1,7474	Analyst	: LC
Lab File ID	: WG991676.pcl	Instrument ID	: MERCURYAF
Sample Amount	: 1g	%Solids	: NA
Digestion Method	: EPA 7474	Date Digested	: 04/05/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7439-97-6	Mercury, Total	ND	0.013	0.002	U



Form 1 METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : NESE
 Lab ID : WG991290-4
 Client ID : BHA-7 SS1 0-2'DUP
 Sample Location :
 Sample Matrix : SOIL
 Analytical Method : 1,7474
 Lab File ID : WG991676.pcl
 Sample Amount : 1.06g
 Digestion Method : EPA 7474

Lab Number : L1710301
 Project Number : 1794
 Date Collected : 10/08/16 00:00
 Date Received : 04/05/17
 Date Analyzed : 04/06/17 11:18
 Dilution Factor : 10
 Analyst : LC
 Instrument ID : MERCURYAF
 %Solids : 51
 Date Digested : 04/05/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7439-97-6	Mercury, Total	1.69	0.046	0.006	



Form 2A

Initial and Continuing Calibration Verification

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : NESE
 Instrument ID : MERCURYAF

Lab Number : L1710301
 Project Number : 1794
 Units : mg/l

Parameter	Initial Calibration			Continuing Calibration(s)						
	True	Found	%R	True	Found	%R	Found	%R	Found	%R
Lab ID :	R955979-7			R955979-9			R955979-11			
Date Analyzed :	04/06/17 10:55			04/06/17 11:42			04/06/17 12:07			
Mercury	0.0025	0.0027	108.	0.0025	0.0026	102.	0.0025	100.		

Acceptance Criteria:

ICV: 95-105% (Methods 200.7, 245.1)
 90-110% (Methods 200.8, 6010, 6020, 7470, 7471, 7474)
 85-115% (Method 1631)

CCV: 90-110% (Methods 200.7, 245.1, 6010, 6020, 7474)
 85-115% (Methods 200.8, 1631)
 80-120% (Methods 7470, 7471)



Form 3 Blanks

Client	: Alpine Ocean Seismic Survey Inc.	Lab Number	: L1710301
Project Name	: NESE	Project Number	: 1794
Instrument ID	: MERCURYAF		

Parameter	Initial Calibration		Continuing Calibration				Preparation	
	Blank		Blank(s)				Blank	
Lab ID	: R955979-8		R955979-10		R955979-12		WG991290-1	
Date Analyzed	: 04/06/17 10:59		04/06/17 11:46		04/06/17 12:11		04/06/17 11:03	
	mg/l	Q	mg/l	Q	mg/l	Q	mg/kg	Q
Mercury	0.00000640	U	0.00000640	U	0.00000640	U	0.002	U

Form 5a Matrix Spike

Client : Alpine Ocean Seismic Survey Inc.	Lab Number : L1710301
Project Name : NESE	Project Number : 1794
Client Sample ID : BHA-7 SS1 0-2'	Matrix : SOIL
Lab Sample ID : L1710301-01	
Matrix Spike : WG991290-3	MS Analysis Date : 04/06/17 11:21
Matrix Spike Dup :	MSD Analysis Date :

Parameter	Sample Conc. (mg/kg)	Matrix Spike Sample		%R	Matrix Spike Duplicate		%R	RPD	Recovery Limits	RPD Limit
		Spike Added (mg/kg)	Spike Conc. (mg/kg)		Spike Added (mg/kg)	Spike Conc. (mg/kg)				
Mercury, Total	2.00	1.14	3.17	103					80-120	20

Form 6 Lab Duplicates

Client	: Alpine Ocean Seismic Survey Inc.	Lab Number	: L1710301
Project Name	: NESE	Project Number	: 1794
Client Sample ID	: BHA-7 SS1 0-2'	Matrix	: SOIL
Lab Sample ID	: L1710301-01	Analysis Date	: 04/06/17 11:14
Dup Sample ID	: WG991290-4	DUP Analysis Date	: 04/06/17 11:18

Parameter	Sample Concentration (mg/kg)	Duplicate Concentration (mg/kg)	RPD	RPD Limit
Mercury, Total	2.00	1.69	17	20



Form 7 **Laboratory Control Sample**

Client	: Alpine Ocean Seismic Survey Inc.	Lab Number	: L1710301
Project Name	: NESE	Project Number	: 1794
Client Sample ID	: NA	Matrix	: SOIL
Lab Sample ID	: WG991290-2	LCS Analysis Date	: 04/06/17 11:05
Dup Sample ID	:	LCSD Analysis Date:	

Parameter	Laboratory Control Sample			Laboratory Control Duplicate			RPD	Recovery Limits	RPD Limit
	True (mg/kg)	Found (mg/kg)	%R	True (mg/kg)	Found (mg/kg)	%R			
Mercury, Total	12.3	15.4	125.					72-128	20

Form 12 Preparation Log

Client	: Alpine Ocean Seismic Survey Inc.	Lab Number	: L1710301
Project Name	: NESE	Project Number	: 1794
Matrix	: SOIL	Prep Method	: EPA 7474

Sample Number	Preparation Date	Weight (gram)	Volume (mL)
L1710301-01	04/05/17 12:14	1.07	-
L1710301-02	04/05/17 12:14	0.97	-
L1710301-03	04/05/17 12:14	1.06	-
L1710301-04	04/05/17 12:14	1.11	-
L1710301-05	04/05/17 12:14	1.03	-
L1710301-06	04/05/17 12:14	0.96	-
L1710301-07	04/05/17 12:14	0.94	-
L1710301-08	04/05/17 12:14	1.12	-
L1710301-09	04/05/17 12:14	1.01	-
L1710301-10	04/05/17 12:14	0.95	-
L1710301-11	04/05/17 12:14	1.01	-
L1710301-12	04/05/17 12:14	1.01	-
L1710301-13	04/05/17 12:14	1.04	-
WG991290-1	04/05/17 12:14	1.00	-
WG991290-2	04/05/17 12:14	0.54	-
WG991290-3	04/05/17 12:14	1.08	-
WG991290-4	04/05/17 12:14	1.06	-

Form 13

Analysis Run Log

Client : Alpine Ocean Seismic Survey Inc.
Project Name : NESE
Instrument ID : MERCURYAF
Start Date : 04/06/17 10:36

Lab Number : L1710301
Project Number : 1794
Analysis Method : 1,7474
End Date : 04/06/17 12:11

Sample Number	Dilution Factor	Analysis Time	Mercury, Total
R955979-7 ICV	1	10:55:00	X
R955979-8 ICB	1	10:59:00	X
WG991290-1 BLANK	5	11:03:00	X
WG991290-2 LCS	50	11:05:00	X
L1710301-01	10	11:14:00	X
WG991290-4 DUP	10	11:18:00	X
WG991290-3 MS	10	11:21:00	X
L1710301-02	10	11:25:00	X
L1710301-03	5	11:29:00	X
L1710301-04	5	11:33:00	X
L1710301-05	5	11:37:00	X
L1710301-06	5	11:39:00	X
R955979-9 CCV	1	11:42:00	X
R955979-10 CCB	1	11:46:00	X
L1710301-07	5	11:49:00	X
L1710301-08	5	11:51:00	X
L1710301-09	5	11:54:00	X
L1710301-10	5	11:56:00	X
L1710301-11	5	11:59:00	X
L1710301-12	5	12:01:00	X
L1710301-13	5	12:04:00	X
R955979-11 CCV	1	12:07:00	X
R955979-12 CCB	1	12:11:00	X



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Lab Number: L1717026

Client: Alpine Ocean Seismic Survey, Inc

ATTN: Mark Kosakowski

Project Name: WILLIAMS (1794)

Project Number: 1794

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Sample Delivery Group Information





Sample Delivery Group Form

Laboratory Job number: L1717026

Project Manager: Elizabeth Porta

Review Date: 05/26/2017

Project Number: 1794

Project Name: WILLIAMS (1794)

Received: 05/24/2017 15:19

Client Account: Alpine Ocean Seismic Survey Inc.

Received by: BB

Samples Delivered by: COURIER

Call Tracker #

Bill Of Laden N/A

Trackingnum

Coc Present Present

Container Status Intact

Sample IDs

All Containers Accounted For? Yes

Were Extra Samples Received? No

Do Sample Labels and COC agree? No

-23 THROUGH 26 TIME ON COC WAS 13:58 BUT CONTAINERS WERE 14:26.

Are Samples in Appropriate Containers? Yes

Are Samples Received within Holding time? Yes

pH of Samples upon Receipt <2

Are samples Properly Preserved? Yes

Initial pH preserved in house with

Final pH

Other Issues

Chlorine Check N/A

Are VOA/VPV Vials Present? No

Aqueous: Do Vials Contain Head Space? N/A

Soils: Is MeOH Covering the Soil? N/A

Reagent H2O Preserved vials Frozen on N/A

Frozen by Client N/A

Cooler	Seal	Ice Present	Blue Ice Present	Temp. (Celsius)	Frozen upon Receipt	Delivered Direct from Site
A	Absent	Yes	No	3.2 - IR Gun	No	No

LIMS Chain of Custody

ALPHA ANALYTICAL LABORATORIES, INC.
LOGIN CHAIN OF CUSTODY REPORT
Jun 15 2017, 02:48 pm

Login Number: L1717026

Account: ALPINE Alpine Ocean Seismic Survey Inc. Project: 1794

Sample #	Client ID	Received: 24MAY17 Mat PR Collected	Due Date: 15JUN17 Container
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L1717026-01	VC88-D0-3E	3 S0 19MAY17 17:07	1-Glass-A.120
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| DPKG-FULL Package Due Date: 06/15/17

A2-MO-6020T,A2-SN-6020T,A2-SR-6020T,A2-TAL,A2-AG-6020T,A2-AL-6020T,A2-AS-6020T,A2-BA-6020T,A2-BE-6020T,A2-CA-6020T,A2-CD-6020T,A2-CO-6020T,A2-CR-6020T,A2-CU-6020T,A2-FE-6020T,A2-HG-7474T,A2-HGPREP-AF,A2-K-6020T,A2-MG-6020T,A2-MN-6020T,A2-NA-6020T,A2-NI-6020T,A2-PB-6020T,A2-PREP-3050:1T,A2-PREP-3050:2T,A2-SB-6020T,A2-SE-6020T,A2-TL-6020T,A2-V-6020T,A2-ZN-6020T,A2-TI-6020T,A2-TS,DPKG-FULL

L1717026-02	VC88-D3-6E	3 S0 19MAY17 17:07	1-Glass-A.120
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| Package Due Date: 06/15/17

A2-MO-6020T,A2-SN-6020T,A2-SR-6020T,A2-TAL,A2-AG-6020T,A2-AL-6020T,A2-AS-6020T,A2-BA-6020T,A2-BE-6020T,A2-CA-6020T,A2-CD-6020T,A2-CO-6020T,A2-CR-6020T,A2-CU-6020T,A2-FE-6020T,A2-HG-7474T,A2-HGPREP-AF,A2-K-6020T,A2-MG-6020T,A2-MN-6020T,A2-NA-6020T,A2-NI-6020T,A2-PB-6020T,A2-PREP-3050:1T,A2-PREP-3050:2T,A2-SB-6020T,A2-SE-6020T,A2-TL-6020T,A2-V-6020T,A2-ZN-6020T,A2-TI-6020T,A2-TS

L1717026-03	VC88-D6-9E	3 S0 19MAY17 17:07	1-Glass-A.120
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| Package Due Date: 06/15/17

A2-MO-6020T,A2-SN-6020T,A2-SR-6020T,A2-TAL,A2-AG-6020T,A2-AL-6020T,A2-AS-6020T,A2-BA-6020T,A2-BE-6020T,A2-CA-6020T,A2-CD-6020T,A2-CO-6020T,A2-CR-6020T,A2-CU-6020T,A2-FE-6020T,A2-HG-7474T,A2-HGPREP-AF,A2-K-6020T,A2-MG-6020T,A2-MN-6020T,A2-NA-6020T,A2-NI-6020T,A2-PB-6020T,A2-PREP-3050:1T,A2-PREP-3050:2T,A2-SB-6020T,A2-SE-6020T,A2-TL-6020T,A2-V-6020T,A2-ZN-6020T,A2-TI-6020T,A2-TS

L1717026-04	VC88-D9-10E	3 S0 19MAY17 17:07	1-Glass-A.120
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| Package Due Date: 06/15/17

A2-MO-6020T,A2-SN-6020T,A2-SR-6020T,A2-TAL,A2-AG-6020T,A2-AL-6020T,A2-AS-6020T,A2-BA-6020T,A2-BE-6020T,A2-CA-6020T,A2-CD-6020T,A2-CO-6020T,A2-CR-6020T,A2-CU-6020T,A2-FE-6020T,A2-HG-7474T,A2-HGPREP-AF,A2-K-6020T,A2-MG-6020T,A2-MN-6020T,A2-NA-6020T,A2-NI-6020T,A2-PB-6020T,A2-PREP-3050:1T,A2-PREP-3050:2T,A2-SB-6020T,A2-SE-6020T,A2-TL-6020T,A2-V-6020T,A2-ZN-6020T,A2-TI-6020T,A2-TS

ALPHA ANALYTICAL LABORATORIES, INC.
LOGIN CHAIN OF CUSTODY REPORT
Jun 15 2017, 02:48 pm

Login Number: L1717026

Account: ALPINE Alpine Ocean Seismic Survey Inc. Project: 1794

Sample #	Client ID	Received: 24MAY17 Mat PR Collected	Due Date: 15JUN17 Container
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L1717026-05	VC89-D0-3E	3 S0 19MAY17 16:15	1-Glass-A.120
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L1717026-05 MS L1717026-05 MSD Package Due Date: 06/15/17

A2-MO-6020T,A2-MS/MSD,A2-SN-6020T,A2-SR-6020T,A2-TAL,A2-AG-6020T,A2-AL-6020T,A2-AS-6020T,A2-BA-6020T,A2-BE-6020T,A2-CA-6020T,A2-CD-6020T,A2-CO-6020T,A2-CR-6020T,A2-CU-6020T,A2-FE-6020T,A2-HG-7474T,A2-HGPREP-AF,A2-K-6020T,A2-MG-6020T,A2-MN-6020T,A2-NA-6020T,A2-NI-6020T,A2-PB-6020T,A2-PREP-3050:1T,A2-PREP-3050:2T,A2-SB-6020T,A2-SE-6020T,A2-TL-6020T,A2-V-6020T,A2-ZN-6020T,A2-TI-6020T,A2-TS

L1717026-06	VC89-D3-6E	3 S0 19MAY17 16:15	1-Glass-A.120
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| Package Due Date: 06/15/17

A2-MO-6020T,A2-SN-6020T,A2-SR-6020T,A2-TAL,A2-AG-6020T,A2-AL-6020T,A2-AS-6020T,A2-BA-6020T,A2-BE-6020T,A2-CA-6020T,A2-CD-6020T,A2-CO-6020T,A2-CR-6020T,A2-CU-6020T,A2-FE-6020T,A2-HG-7474T,A2-HGPREP-AF,A2-K-6020T,A2-MG-6020T,A2-MN-6020T,A2-NA-6020T,A2-NI-6020T,A2-PB-6020T,A2-PREP-3050:1T,A2-PREP-3050:2T,A2-SB-6020T,A2-SE-6020T,A2-TL-6020T,A2-V-6020T,A2-ZN-6020T,A2-TI-6020T,A2-TS

L1717026-07	VC89-D6-9E	3 S0 19MAY17 16:15	1-Glass-A.120
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| Package Due Date: 06/15/17

A2-MO-6020T,A2-SN-6020T,A2-SR-6020T,A2-TAL,A2-AG-6020T,A2-AL-6020T,A2-AS-6020T,A2-BA-6020T,A2-BE-6020T,A2-CA-6020T,A2-CD-6020T,A2-CO-6020T,A2-CR-6020T,A2-CU-6020T,A2-FE-6020T,A2-HG-7474T,A2-HGPREP-AF,A2-K-6020T,A2-MG-6020T,A2-MN-6020T,A2-NA-6020T,A2-NI-6020T,A2-PB-6020T,A2-PREP-3050:1T,A2-PREP-3050:2T,A2-SB-6020T,A2-SE-6020T,A2-TL-6020T,A2-V-6020T,A2-ZN-6020T,A2-TI-6020T,A2-TS

L1717026-08	VC89-D9-10E	3 S0 19MAY17 16:15	1-Glass-A.120
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| Package Due Date: 06/15/17

A2-MO-6020T,A2-SN-6020T,A2-SR-6020T,A2-TAL,A2-AG-6020T,A2-AL-6020T,A2-AS-6020T,A2-BA-6020T,A2-BE-6020T,A2-CA-6020T,A2-CD-6020T,A2-CO-6020T,A2-CR-6020T,A2-CU-6020T,A2-FE-6020T,A2-HG-7474T,A2-HGPREP-AF,A2-K-6020T,A2-MG-6020T,A2-MN-6020T,A2-NA-6020T,A2-NI-6020T,A2-PB-6020T,A2-PREP-3050:1T,A2-PREP-3050:2T,A2-SB-6020T,A2-SE-6020T,A2-TL-6020T,A2-V-6020T,A2-ZN-6020T,A2-TI-6020T,A2-TS

ALPHA ANALYTICAL LABORATORIES, INC.
LOGIN CHAIN OF CUSTODY REPORT
Jun 15 2017, 02:48 pm

Login Number: L1717026

Account: ALPINE Alpine Ocean Seismic Survey Inc. Project: 1794

Sample #	Client ID	Received: 24MAY17 Mat PR Collected	Due Date: 15JUN17 Container
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L1717026-09 DUP-D9-10E	3 S0 19MAY17 17:07	1-Glass-A.120
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| Package Due Date: 06/15/17

A2-MO-6020T,A2-SN-6020T,A2-SR-6020T,A2-TAL,A2-AG-6020T,A2-AL-6020T,A2-AS-6020T,A2-BA-6020T,A2-BE-6020T,A2-CA-6020T,A2-CD-6020T,A2-CO-6020T,A2-CR-6020T,A2-CU-6020T,A2-FE-6020T,A2-HG-7474T,A2-HGPREP-AF,A2-K-6020T,A2-MG-6020T,A2-MN-6020T,A2-NA-6020T,A2-NI-6020T,A2-PB-6020T,A2-PREP-3050:1T,A2-PREP-3050:2T,A2-SB-6020T,A2-SE-6020T,A2-TL-6020T,A2-V-6020T,A2-ZN-6020T,A2-TI-6020T,A2-TS

L1717026-10 DUP-D0-3E	3 S0 19MAY17 16:15	1-Glass-A.120
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| Package Due Date: 06/15/17

A2-MO-6020T,A2-SN-6020T,A2-SR-6020T,A2-TAL,A2-AG-6020T,A2-AL-6020T,A2-AS-6020T,A2-BA-6020T,A2-BE-6020T,A2-CA-6020T,A2-CD-6020T,A2-CO-6020T,A2-CR-6020T,A2-CU-6020T,A2-FE-6020T,A2-HG-7474T,A2-HGPREP-AF,A2-K-6020T,A2-MG-6020T,A2-MN-6020T,A2-NA-6020T,A2-NI-6020T,A2-PB-6020T,A2-PREP-3050:1T,A2-PREP-3050:2T,A2-SB-6020T,A2-SE-6020T,A2-TL-6020T,A2-V-6020T,A2-ZN-6020T,A2-TI-6020T,A2-TS

L1717026-11 VC90-D0-3E	3 S0 19MAY17 15:42	1-Glass-A.120
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| Package Due Date: 06/15/17

A2-MO-6020T,A2-SN-6020T,A2-SR-6020T,A2-TAL,A2-AG-6020T,A2-AL-6020T,A2-AS-6020T,A2-BA-6020T,A2-BE-6020T,A2-CA-6020T,A2-CD-6020T,A2-CO-6020T,A2-CR-6020T,A2-CU-6020T,A2-FE-6020T,A2-HG-7474T,A2-HGPREP-AF,A2-K-6020T,A2-MG-6020T,A2-MN-6020T,A2-NA-6020T,A2-NI-6020T,A2-PB-6020T,A2-PREP-3050:1T,A2-PREP-3050:2T,A2-SB-6020T,A2-SE-6020T,A2-TL-6020T,A2-V-6020T,A2-ZN-6020T,A2-TI-6020T,A2-TS

L1717026-12 VC90-D3-6E	3 S0 19MAY17 15:42	1-Glass-A.120
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| Package Due Date: 06/15/17

A2-MO-6020T,A2-SN-6020T,A2-SR-6020T,A2-TAL,A2-AG-6020T,A2-AL-6020T,A2-AS-6020T,A2-BA-6020T,A2-BE-6020T,A2-CA-6020T,A2-CD-6020T,A2-CO-6020T,A2-CR-6020T,A2-CU-6020T,A2-FE-6020T,A2-HG-7474T,A2-HGPREP-AF,A2-K-6020T,A2-MG-6020T,A2-MN-6020T,A2-NA-6020T,A2-NI-6020T,A2-PB-6020T,A2-PREP-3050:1T,A2-PREP-3050:2T,A2-SB-6020T,A2-SE-6020T,A2-TL-6020T,A2-V-6020T,A2-ZN-6020T,A2-TI-6020T,A2-TS

ALPHA ANALYTICAL LABORATORIES, INC.
LOGIN CHAIN OF CUSTODY REPORT
Jun 15 2017, 02:48 pm

Login Number: L1717026

Account: ALPINE Alpine Ocean Seismic Survey Inc. Project: 1794

Sample #	Client ID	Received: 24MAY17 Mat PR Collected	Due Date: 15JUN17 Container
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L1717026-13	VC90-D6-9E	3 S0 19MAY17 15:42	1-Glass-A.120
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| Package Due Date: 06/15/17

A2-MO-6020T,A2-SN-6020T,A2-SR-6020T,A2-TAL,A2-AG-6020T,A2-AL-6020T,A2-AS-6020T,A2-BA-6020T,A2-BE-6020T,A2-CA-6020T,A2-CD-6020T,A2-CO-6020T,A2-CR-6020T,A2-CU-6020T,A2-FE-6020T,A2-HG-7474T,A2-HGPREP-AF,A2-K-6020T,A2-MG-6020T,A2-MN-6020T,A2-NA-6020T,A2-NI-6020T,A2-PB-6020T,A2-PREP-3050:1T,A2-PREP-3050:2T,A2-SB-6020T,A2-SE-6020T,A2-TL-6020T,A2-V-6020T,A2-ZN-6020T,A2-TI-6020T,A2-TS

L1717026-14	VC90-D9-10E	3 S0 19MAY17 15:42	1-Glass-A.120
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| Package Due Date: 06/15/17

A2-MO-6020T,A2-SN-6020T,A2-SR-6020T,A2-TAL,A2-AG-6020T,A2-AL-6020T,A2-AS-6020T,A2-BA-6020T,A2-BE-6020T,A2-CA-6020T,A2-CD-6020T,A2-CO-6020T,A2-CR-6020T,A2-CU-6020T,A2-FE-6020T,A2-HG-7474T,A2-HGPREP-AF,A2-K-6020T,A2-MG-6020T,A2-MN-6020T,A2-NA-6020T,A2-NI-6020T,A2-PB-6020T,A2-PREP-3050:1T,A2-PREP-3050:2T,A2-SB-6020T,A2-SE-6020T,A2-TL-6020T,A2-V-6020T,A2-ZN-6020T,A2-TI-6020T,A2-TS

L1717026-15	VC91-D0-3E	3 S0 19MAY17 15:10	1-Glass-A.120
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| Package Due Date: 06/15/17

A2-MO-6020T,A2-SN-6020T,A2-SR-6020T,A2-TAL,A2-AG-6020T,A2-AL-6020T,A2-AS-6020T,A2-BA-6020T,A2-BE-6020T,A2-CA-6020T,A2-CD-6020T,A2-CO-6020T,A2-CR-6020T,A2-CU-6020T,A2-FE-6020T,A2-HG-7474T,A2-HGPREP-AF,A2-K-6020T,A2-MG-6020T,A2-MN-6020T,A2-NA-6020T,A2-NI-6020T,A2-PB-6020T,A2-PREP-3050:1T,A2-PREP-3050:2T,A2-SB-6020T,A2-SE-6020T,A2-TL-6020T,A2-V-6020T,A2-ZN-6020T,A2-TI-6020T,A2-TS

L1717026-16	VC91-D3-6E	3 S0 19MAY17 15:10	1-Glass-A.120
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| Package Due Date: 06/15/17

A2-MO-6020T,A2-SN-6020T,A2-SR-6020T,A2-TAL,A2-AG-6020T,A2-AL-6020T,A2-AS-6020T,A2-BA-6020T,A2-BE-6020T,A2-CA-6020T,A2-CD-6020T,A2-CO-6020T,A2-CR-6020T,A2-CU-6020T,A2-FE-6020T,A2-HG-7474T,A2-HGPREP-AF,A2-K-6020T,A2-MG-6020T,A2-MN-6020T,A2-NA-6020T,A2-NI-6020T,A2-PB-6020T,A2-PREP-3050:1T,A2-PREP-3050:2T,A2-SB-6020T,A2-SE-6020T,A2-TL-6020T,A2-V-6020T,A2-ZN-6020T,A2-TI-6020T,A2-TS

ALPHA ANALYTICAL LABORATORIES, INC.
LOGIN CHAIN OF CUSTODY REPORT
Jun 15 2017, 02:48 pm

Login Number: L1717026

Account: ALPINE Alpine Ocean Seismic Survey Inc. Project: 1794

Sample #	Client ID	Received: 24MAY17 Mat PR Collected	Due Date: 15JUN17 Container
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L1717026-17	VC91-D6-9.6E	3 S0 19MAY17 15:10	1-Glass-A.120
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| Package Due Date: 06/15/17

A2-MO-6020T,A2-SN-6020T,A2-SR-6020T,A2-TAL,A2-AG-6020T,A2-AL-6020T,A2-AS-6020T,A2-BA-6020T,A2-BE-6020T,A2-CA-6020T,A2-CD-6020T,A2-CO-6020T,A2-CR-6020T,A2-CU-6020T,A2-FE-6020T,A2-HG-7474T,A2-HGPREP-AF,A2-K-6020T,A2-MG-6020T,A2-MN-6020T,A2-NA-6020T,A2-NI-6020T,A2-PB-6020T,A2-PREP-3050:1T,A2-PREP-3050:2T,A2-SB-6020T,A2-SE-6020T,A2-TL-6020T,A2-V-6020T,A2-ZN-6020T,A2-TI-6020T,A2-TS

L1717026-18	DUP-D6-9E	3 S0 19MAY17 15:42	1-Glass-A.120
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| Package Due Date: 06/15/17

A2-MO-6020T,A2-SN-6020T,A2-SR-6020T,A2-TAL,A2-AG-6020T,A2-AL-6020T,A2-AS-6020T,A2-BA-6020T,A2-BE-6020T,A2-CA-6020T,A2-CD-6020T,A2-CO-6020T,A2-CR-6020T,A2-CU-6020T,A2-FE-6020T,A2-HG-7474T,A2-HGPREP-AF,A2-K-6020T,A2-MG-6020T,A2-MN-6020T,A2-NA-6020T,A2-NI-6020T,A2-PB-6020T,A2-PREP-3050:1T,A2-PREP-3050:2T,A2-SB-6020T,A2-SE-6020T,A2-TL-6020T,A2-V-6020T,A2-ZN-6020T,A2-TI-6020T,A2-TS

L1717026-19	VC92-D0-3E	3 S0 19MAY17 14:38	1-Glass-A.120
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| Package Due Date: 06/15/17

A2-MO-6020T,A2-SN-6020T,A2-SR-6020T,A2-TAL,A2-AG-6020T,A2-AL-6020T,A2-AS-6020T,A2-BA-6020T,A2-BE-6020T,A2-CA-6020T,A2-CD-6020T,A2-CO-6020T,A2-CR-6020T,A2-CU-6020T,A2-FE-6020T,A2-HG-7474T,A2-HGPREP-AF,A2-K-6020T,A2-MG-6020T,A2-MN-6020T,A2-NA-6020T,A2-NI-6020T,A2-PB-6020T,A2-PREP-3050:1T,A2-PREP-3050:2T,A2-SB-6020T,A2-SE-6020T,A2-TL-6020T,A2-V-6020T,A2-ZN-6020T,A2-TI-6020T,A2-TS

L1717026-20	VC92-D3-6E	3 S0 19MAY17 14:38	1-Glass-A.120
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| Package Due Date: 06/15/17

A2-MO-6020T,A2-SN-6020T,A2-SR-6020T,A2-TAL,A2-AG-6020T,A2-AL-6020T,A2-AS-6020T,A2-BA-6020T,A2-BE-6020T,A2-CA-6020T,A2-CD-6020T,A2-CO-6020T,A2-CR-6020T,A2-CU-6020T,A2-FE-6020T,A2-HG-7474T,A2-HGPREP-AF,A2-K-6020T,A2-MG-6020T,A2-MN-6020T,A2-NA-6020T,A2-NI-6020T,A2-PB-6020T,A2-PREP-3050:1T,A2-PREP-3050:2T,A2-SB-6020T,A2-SE-6020T,A2-TL-6020T,A2-V-6020T,A2-ZN-6020T,A2-TI-6020T,A2-TS

ALPHA ANALYTICAL LABORATORIES, INC.
LOGIN CHAIN OF CUSTODY REPORT
Jun 15 2017, 02:48 pm

Login Number: L1717026

Account: ALPINE Alpine Ocean Seismic Survey Inc. Project: 1794

Sample #	Client ID	Received: 24MAY17 Mat PR Collected	Due Date: 15JUN17 Container
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L1717026-21	VC92-D6-9E	3 S0 19MAY17 14:38	1-Glass-A.120
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| Package Due Date: 06/15/17

A2-MO-6020T,A2-SN-6020T,A2-SR-6020T,A2-TAL,A2-AG-6020T,A2-AL-6020T,A2-AS-6020T,A2-BA-6020T,A2-BE-6020T,A2-CA-6020T,A2-CD-6020T,A2-CO-6020T,A2-CR-6020T,A2-CU-6020T,A2-FE-6020T,A2-HG-7474T,A2-HGPREP-AF,A2-K-6020T,A2-MG-6020T,A2-MN-6020T,A2-NA-6020T,A2-NI-6020T,A2-PB-6020T,A2-PREP-3050:1T,A2-PREP-3050:2T,A2-SB-6020T,A2-SE-6020T,A2-TL-6020T,A2-V-6020T,A2-ZN-6020T,A2-TI-6020T,A2-TS

L1717026-22	VC92-D9-10E	3 S0 19MAY17 14:38	1-Glass-A.120
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| Package Due Date: 06/15/17

A2-MO-6020T,A2-SN-6020T,A2-SR-6020T,A2-TAL,A2-AG-6020T,A2-AL-6020T,A2-AS-6020T,A2-BA-6020T,A2-BE-6020T,A2-CA-6020T,A2-CD-6020T,A2-CO-6020T,A2-CR-6020T,A2-CU-6020T,A2-FE-6020T,A2-HG-7474T,A2-HGPREP-AF,A2-K-6020T,A2-MG-6020T,A2-MN-6020T,A2-NA-6020T,A2-NI-6020T,A2-PB-6020T,A2-PREP-3050:1T,A2-PREP-3050:2T,A2-SB-6020T,A2-SE-6020T,A2-TL-6020T,A2-V-6020T,A2-ZN-6020T,A2-TI-6020T,A2-TS

L1717026-23	VC93-D0-3E	3 S0 20MAY17 13:58	1-Glass-A.120
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L1717026-23 MS L1717026-23 MSD Package Due Date: 06/15/17

A2-MO-6020T,A2-MS/MSD,A2-SN-6020T,A2-SR-6020T,A2-TAL,A2-AG-6020T,A2-AL-6020T,A2-AS-6020T,A2-BA-6020T,A2-BE-6020T,A2-CA-6020T,A2-CD-6020T,A2-CO-6020T,A2-CR-6020T,A2-CU-6020T,A2-FE-6020T,A2-HG-7474T,A2-HGPREP-AF,A2-K-6020T,A2-MG-6020T,A2-MN-6020T,A2-NA-6020T,A2-NI-6020T,A2-PB-6020T,A2-PREP-3050:1T,A2-PREP-3050:2T,A2-SB-6020T,A2-SE-6020T,A2-TL-6020T,A2-V-6020T,A2-ZN-6020T,A2-TI-6020T,A2-TS

L1717026-24	VC93-D3-6E	3 S0 20MAY17 13:58	1-Glass-A.120
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| Package Due Date: 06/15/17

A2-MO-6020T,A2-SN-6020T,A2-SR-6020T,A2-TAL,A2-AG-6020T,A2-AL-6020T,A2-AS-6020T,A2-BA-6020T,A2-BE-6020T,A2-CA-6020T,A2-CD-6020T,A2-CO-6020T,A2-CR-6020T,A2-CU-6020T,A2-FE-6020T,A2-HG-7474T,A2-HGPREP-AF,A2-K-6020T,A2-MG-6020T,A2-MN-6020T,A2-NA-6020T,A2-NI-6020T,A2-PB-6020T,A2-PREP-3050:1T,A2-PREP-3050:2T,A2-SB-6020T,A2-SE-6020T,A2-TL-6020T,A2-V-6020T,A2-ZN-6020T,A2-TI-6020T,A2-TS

ALPHA ANALYTICAL LABORATORIES, INC.
LOGIN CHAIN OF CUSTODY REPORT
Jun 15 2017, 02:48 pm

Login Number: L1717026

Account: ALPINE Alpine Ocean Seismic Survey Inc. Project: 1794

Sample #	Client ID	Received: 24MAY17 Mat PR Collected	Due Date: 15JUN17 Container
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L1717026-25 VC93-D6-9E	3 S0 20MAY17 13:58	1-Glass-A.120
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| Package Due Date: 06/15/17

A2-MO-6020T,A2-SN-6020T,A2-SR-6020T,A2-TAL,A2-AG-6020T,A2-AL-6020T,A2-AS-6020T,A2-BA-6020T,A2-BE-6020T,A2-CA-6020T,A2-CD-6020T,A2-CO-6020T,A2-CR-6020T,A2-CU-6020T,A2-FE-6020T,A2-HG-7474T,A2-HGPREP-AF,A2-K-6020T,A2-MG-6020T,A2-MN-6020T,A2-NA-6020T,A2-NI-6020T,A2-PB-6020T,A2-PREP-3050:1T,A2-PREP-3050:2T,A2-SB-6020T,A2-SE-6020T,A2-TL-6020T,A2-V-6020T,A2-ZN-6020T,A2-TI-6020T,A2-TS

L1717026-26 VC93-D9-10E	3 S0 20MAY17 13:58	1-Glass-A.120
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| Package Due Date: 06/15/17

A2-MO-6020T,A2-SN-6020T,A2-SR-6020T,A2-TAL,A2-AG-6020T,A2-AL-6020T,A2-AS-6020T,A2-BA-6020T,A2-BE-6020T,A2-CA-6020T,A2-CD-6020T,A2-CO-6020T,A2-CR-6020T,A2-CU-6020T,A2-FE-6020T,A2-HG-7474T,A2-HGPREP-AF,A2-K-6020T,A2-MG-6020T,A2-MN-6020T,A2-NA-6020T,A2-NI-6020T,A2-PB-6020T,A2-PREP-3050:1T,A2-PREP-3050:2T,A2-SB-6020T,A2-SE-6020T,A2-TL-6020T,A2-V-6020T,A2-ZN-6020T,A2-TI-6020T,A2-TS

L1717026-27 DUP-D3-6E	3 S0 19MAY17 14:38	1-Glass-A.120
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| Package Due Date: 06/15/17

A2-MO-6020T,A2-SN-6020T,A2-SR-6020T,A2-TAL,A2-AG-6020T,A2-AL-6020T,A2-AS-6020T,A2-BA-6020T,A2-BE-6020T,A2-CA-6020T,A2-CD-6020T,A2-CO-6020T,A2-CR-6020T,A2-CU-6020T,A2-FE-6020T,A2-HG-7474T,A2-HGPREP-AF,A2-K-6020T,A2-MG-6020T,A2-MN-6020T,A2-NA-6020T,A2-NI-6020T,A2-PB-6020T,A2-PREP-3050:1T,A2-PREP-3050:2T,A2-SB-6020T,A2-SE-6020T,A2-TL-6020T,A2-V-6020T,A2-ZN-6020T,A2-TI-6020T,A2-TS

L1717026-28 RINSE2	1 S0 24MAY17 12:00	1-Plastic-C.25
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| Package Due Date: 06/15/17

A2-MO-6020T,A2-SN-6020T,A2-SR-6020T,A2-TAL,A2-AG-6020T,A2-AL-6020T,A2-AS-6020T,A2-BA-6020T,A2-BE-6020T,A2-CA-6020T,A2-CD-6020T,A2-CO-6020T,A2-CR-6020T,A2-CU-6020T,A2-FE-6020T,A2-HG-7474T,A2-HGPREP-AF,A2-K-6020T,A2-MG-6020T,A2-MN-6020T,A2-NA-6020T,A2-NI-6020T,A2-PB-6020T,A2-PREP-3020,A2-SB-6020T,A2-SE-6020T,A2-TL-6020T,A2-V-6020T,A2-ZN-6020T,A2-TI-6020T

ALPHA ANALYTICAL LABORATORIES, INC.
LOGIN CHAIN OF CUSTODY REPORT
Jun 15 2017, 02:48 pm

Login Number: L1717026

Account: ALPINE Alpine Ocean Seismic Survey Inc. Project: 1794

Sample #	Client ID	Received: 24MAY17 Mat PR Collected	Due Date: 15JUN17 Container
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L1717026-29 RINSE1	1 S0 19MAY17 18:04	1-Plastic-C.25
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| Package Due Date: 06/15/17

A2-MO-6020T,A2-SN-6020T,A2-SR-6020T,A2-TAL,A2-AG-6020T,A2-AL-6020T,A2-AS-6020T,A2-BA-6020T,A2-BE-6020T,A2-CA-6020T,A2-CD-6020T,A2-CO-6020T,A2-CR-6020T,A2-CU-6020T,A2-FE-6020T,A2-HG-7474T,A2-HGPREP-AF,A2-K-6020T,A2-MG-6020T,A2-MN-6020T,A2-NA-6020T,A2-NI-6020T,A2-PB-6020T,A2-PREP-3020,A2-SB-6020T,A2-SE-6020T,A2-TL-6020T,A2-V-6020T,A2-ZN-6020T,A2-TI-6020T

Container Tracking

ALPHA ANALYTICAL LABORATORIES
Container Tracking Report

Container ID	Type	Status	Transaction Date	From Response	Location	To Operator	Response	Location	Operator
L1717026-01A	Glass-A.120	INTACT	31-MAY-17	A2-CUSTODY-REFRIDGE	A2-WET CHEMISTRY	Sonal Patel	A2-CUSTODY-FRZ1-U4	A2-CUSTODY-FRZ1-U4	Sonal Patel
L1717026-01A	Glass-A.120	INTACT	31-MAY-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIG-D1	Sonal Patel	A2-WET CHEMISTRY	A2-WET CHEMISTRY	Sonal Patel
L1717026-01A	Glass-A.120	INTACT	30-MAY-17	A2-CUSTODY-REFRIDGE	A2-METALS PREP	Malak Gabra	A2-CUSTODY-REFRIG-D1	A2-CUSTODY-REFRIG-D1	Malak Gabra
L1717026-01A	Glass-A.120	INTACT	30-MAY-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-FRZ1-U4	Camilla Akbas	A2-METALS PREP	A2-METALS PREP	Camilla Akbas
L1717026-01A	Glass-A.120	INTACT	26-MAY-17	A2-CUSTODY-REFRIDGE	A2-METALS PREP	Fatima Cofie	A2-CUSTODY-FRZ1-U4	A2-CUSTODY-FRZ1-U4	Fatima Cofie
L1717026-01A	Glass-A.120	INTACT	26-MAY-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIG-D1	Fatima Cofie	A2-METALS PREP	A2-METALS PREP	Fatima Cofie
L1717026-01A	Glass-A.120	INTACT	25-MAY-17	CUSTODY	A2-CUSTODY-REFRIDGE	Christopher Collins	A2-CUSTODY-REFRIG-D1	A2-CUSTODY-REFRIG-D1	Christopher Collins
L1717026-01A	Glass-A.120	INTACT	25-MAY-17	A2-LOGIN	A2-LOGIN	Christopher Collins	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIDGE	Christopher Collins
L1717026-02A	Glass-A.120	INTACT	31-MAY-17	A2-CUSTODY-REFRIDGE	A2-WET CHEMISTRY	Sonal Patel	A2-CUSTODY-FRZ1-U4	A2-CUSTODY-FRZ1-U4	Sonal Patel
L1717026-02A	Glass-A.120	INTACT	31-MAY-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIG-D1	Sonal Patel	A2-WET CHEMISTRY	A2-WET CHEMISTRY	Sonal Patel
L1717026-02A	Glass-A.120	INTACT	30-MAY-17	A2-CUSTODY-REFRIDGE	A2-METALS PREP	Malak Gabra	A2-CUSTODY-REFRIG-D1	A2-CUSTODY-REFRIG-D1	Malak Gabra
L1717026-02A	Glass-A.120	INTACT	30-MAY-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-FRZ1-U4	Camilla Akbas	A2-METALS PREP	A2-METALS PREP	Camilla Akbas
L1717026-02A	Glass-A.120	INTACT	26-MAY-17	A2-CUSTODY-REFRIDGE	A2-METALS PREP	Fatima Cofie	A2-CUSTODY-FRZ1-U4	A2-CUSTODY-FRZ1-U4	Fatima Cofie
L1717026-02A	Glass-A.120	INTACT	26-MAY-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIG-D1	Fatima Cofie	A2-METALS PREP	A2-METALS PREP	Fatima Cofie
L1717026-02A	Glass-A.120	INTACT	25-MAY-17	CUSTODY	A2-CUSTODY-REFRIDGE	Christopher Collins	A2-CUSTODY-REFRIG-D1	A2-CUSTODY-REFRIG-D1	Christopher Collins
L1717026-02A	Glass-A.120	INTACT	25-MAY-17	A2-LOGIN	A2-LOGIN	Christopher Collins	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIDGE	Christopher Collins
L1717026-03A	Glass-A.120	INTACT	31-MAY-17	A2-CUSTODY-REFRIDGE	A2-WET CHEMISTRY	Sonal Patel	A2-CUSTODY-FRZ1-U4	A2-CUSTODY-FRZ1-U4	Sonal Patel
L1717026-03A	Glass-A.120	INTACT	31-MAY-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIG-D1	Sonal Patel	A2-WET CHEMISTRY	A2-WET CHEMISTRY	Sonal Patel
L1717026-03A	Glass-A.120	INTACT	30-MAY-17	A2-CUSTODY-REFRIDGE	A2-METALS PREP	Malak Gabra	A2-CUSTODY-REFRIG-D1	A2-CUSTODY-REFRIG-D1	Malak Gabra
L1717026-03A	Glass-A.120	INTACT	30-MAY-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-FRZ1-U4	Camilla Akbas	A2-METALS PREP	A2-METALS PREP	Camilla Akbas
L1717026-03A	Glass-A.120	INTACT	26-MAY-17	A2-CUSTODY-REFRIDGE	A2-METALS PREP	Fatima Cofie	A2-CUSTODY-FRZ1-U4	A2-CUSTODY-FRZ1-U4	Fatima Cofie
L1717026-03A	Glass-A.120	INTACT	26-MAY-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIG-D1	Fatima Cofie	A2-METALS PREP	A2-METALS PREP	Fatima Cofie
L1717026-03A	Glass-A.120	INTACT	25-MAY-17	CUSTODY	A2-CUSTODY-REFRIDGE	Christopher Collins	A2-CUSTODY-REFRIG-D1	A2-CUSTODY-REFRIG-D1	Christopher Collins
L1717026-03A	Glass-A.120	INTACT	25-MAY-17	A2-LOGIN	A2-LOGIN	Christopher Collins	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIDGE	Christopher Collins
L1717026-04A	Glass-A.120	INTACT	31-MAY-17	A2-CUSTODY-REFRIDGE	A2-WET CHEMISTRY	Sonal Patel	A2-CUSTODY-FRZ1-U4	A2-CUSTODY-FRZ1-U4	Sonal Patel

Container ID	Type	Status	Transaction Date	From Response	Location	To Operator	Response	Location	Operator
L1717026-04A	Glass-A.120	INTACT	31-MAY-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIG-D1	Sonal Patel	A2-WET CHEMISTRY	A2-WET CHEMISTRY	Sonal Patel
L1717026-04A	Glass-A.120	INTACT	30-MAY-17	A2-CUSTODY-REFRIDGE	A2-METALS PREP	Malak Gabra	A2-CUSTODY-REFRIG-D1	A2-CUSTODY-REFRIG-D1	Malak Gabra
L1717026-04A	Glass-A.120	INTACT	30-MAY-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-FRZ1-U4	Camilla Akbas	A2-METALS PREP	A2-METALS PREP	Camilla Akbas
L1717026-04A	Glass-A.120	INTACT	26-MAY-17	A2-CUSTODY-REFRIDGE	A2-METALS PREP	Fatima Cofie	A2-CUSTODY-FRZ1-U4	A2-CUSTODY-FRZ1-U4	Fatima Cofie
L1717026-04A	Glass-A.120	INTACT	26-MAY-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIG-D1	Fatima Cofie	A2-METALS PREP	A2-METALS PREP	Fatima Cofie
L1717026-04A	Glass-A.120	INTACT	25-MAY-17	CUSTODY	A2-CUSTODY-REFRIDGE	Christopher Collins	A2-CUSTODY-REFRIG-D1	A2-CUSTODY-REFRIG-D1	Christopher Collins
L1717026-04A	Glass-A.120	INTACT	25-MAY-17	A2-LOGIN	A2-LOGIN	Christopher Collins	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIDGE	Christopher Collins
L1717026-05A	Glass-A.120	INTACT	31-MAY-17	A2-CUSTODY-REFRIDGE	A2-WET CHEMISTRY	Sonal Patel	A2-CUSTODY-FRZ1-U4	A2-CUSTODY-FRZ1-U4	Sonal Patel
L1717026-05A	Glass-A.120	INTACT	31-MAY-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIG-D1	Sonal Patel	A2-WET CHEMISTRY	A2-WET CHEMISTRY	Sonal Patel
L1717026-05A	Glass-A.120	INTACT	30-MAY-17	A2-CUSTODY-REFRIDGE	A2-METALS PREP	Malak Gabra	A2-CUSTODY-REFRIG-D1	A2-CUSTODY-REFRIG-D1	Malak Gabra
L1717026-05A	Glass-A.120	INTACT	30-MAY-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-FRZ1-U4	Camilla Akbas	A2-METALS PREP	A2-METALS PREP	Camilla Akbas
L1717026-05A	Glass-A.120	INTACT	26-MAY-17	A2-CUSTODY-REFRIDGE	A2-METALS PREP	Fatima Cofie	A2-CUSTODY-FRZ1-U4	A2-CUSTODY-FRZ1-U4	Fatima Cofie
L1717026-05A	Glass-A.120	INTACT	26-MAY-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIG-D1	Fatima Cofie	A2-METALS PREP	A2-METALS PREP	Fatima Cofie
L1717026-05A	Glass-A.120	INTACT	25-MAY-17	CUSTODY	A2-CUSTODY-REFRIDGE	Christopher Collins	A2-CUSTODY-REFRIG-D1	A2-CUSTODY-REFRIG-D1	Christopher Collins
L1717026-05A	Glass-A.120	INTACT	25-MAY-17	A2-LOGIN	A2-LOGIN	Christopher Collins	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIDGE	Christopher Collins
L1717026-06A	Glass-A.120	INTACT	31-MAY-17	A2-CUSTODY-REFRIDGE	A2-WET CHEMISTRY	Sonal Patel	A2-CUSTODY-FRZ1-U4	A2-CUSTODY-FRZ1-U4	Sonal Patel
L1717026-06A	Glass-A.120	INTACT	31-MAY-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIG-D1	Sonal Patel	A2-WET CHEMISTRY	A2-WET CHEMISTRY	Sonal Patel
L1717026-06A	Glass-A.120	INTACT	30-MAY-17	A2-CUSTODY-REFRIDGE	A2-METALS PREP	Malak Gabra	A2-CUSTODY-REFRIG-D1	A2-CUSTODY-REFRIG-D1	Malak Gabra
L1717026-06A	Glass-A.120	INTACT	30-MAY-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-FRZ1-U4	Camilla Akbas	A2-METALS PREP	A2-METALS PREP	Camilla Akbas
L1717026-06A	Glass-A.120	INTACT	26-MAY-17	A2-CUSTODY-REFRIDGE	A2-METALS PREP	Fatima Cofie	A2-CUSTODY-FRZ1-U4	A2-CUSTODY-FRZ1-U4	Fatima Cofie
L1717026-06A	Glass-A.120	INTACT	26-MAY-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIG-D1	Fatima Cofie	A2-METALS PREP	A2-METALS PREP	Fatima Cofie
L1717026-06A	Glass-A.120	INTACT	25-MAY-17	CUSTODY	A2-CUSTODY-REFRIDGE	Christopher Collins	A2-CUSTODY-REFRIG-D1	A2-CUSTODY-REFRIG-D1	Christopher Collins
L1717026-06A	Glass-A.120	INTACT	25-MAY-17	A2-LOGIN	A2-LOGIN	Christopher Collins	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIDGE	Christopher Collins
L1717026-07A	Glass-A.120	INTACT	31-MAY-17	A2-CUSTODY-REFRIDGE	A2-WET CHEMISTRY	Sonal Patel	A2-CUSTODY-FRZ1-U4	A2-CUSTODY-FRZ1-U4	Sonal Patel
L1717026-07A	Glass-A.120	INTACT	31-MAY-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIG-D1	Sonal Patel	A2-WET CHEMISTRY	A2-WET CHEMISTRY	Sonal Patel

Container ID	Type	Status	Transaction Date	From Response	Location	To Operator	Response	Location	Operator
L1717026-07A	Glass-A.120	INTACT	30-MAY-17	A2-CUSTODY-REFRIDGE	A2-METALS PREP	Malak Gabra	A2-CUSTODY-REFRIG-D1	A2-CUSTODY-REFRIG-D1	Malak Gabra
L1717026-07A	Glass-A.120	INTACT	30-MAY-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-FRZ1-U4	Camilla Akbas	A2-METALS PREP	A2-METALS PREP	Camilla Akbas
L1717026-07A	Glass-A.120	INTACT	26-MAY-17	A2-CUSTODY-REFRIDGE	A2-METALS PREP	Fatima Cofie	A2-CUSTODY-FRZ1-U4	A2-CUSTODY-FRZ1-U4	Fatima Cofie
L1717026-07A	Glass-A.120	INTACT	26-MAY-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIG-D1	Fatima Cofie	A2-METALS PREP	A2-METALS PREP	Fatima Cofie
L1717026-07A	Glass-A.120	INTACT	25-MAY-17	CUSTODY	A2-CUSTODY-REFRIDGE	Christopher Collins	A2-CUSTODY-REFRIG-D1	A2-CUSTODY-REFRIG-D1	Christopher Collins
L1717026-07A	Glass-A.120	INTACT	25-MAY-17	A2-LOGIN	A2-LOGIN	Christopher Collins	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIDGE	Christopher Collins
L1717026-08A	Glass-A.120	INTACT	31-MAY-17	A2-CUSTODY-REFRIDGE	A2-WET CHEMISTRY	Sonal Patel	A2-CUSTODY-FRZ1-U4	A2-CUSTODY-FRZ1-U4	Sonal Patel
L1717026-08A	Glass-A.120	INTACT	31-MAY-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIG-D1	Sonal Patel	A2-WET CHEMISTRY	A2-WET CHEMISTRY	Sonal Patel
L1717026-08A	Glass-A.120	INTACT	30-MAY-17	A2-CUSTODY-REFRIDGE	A2-METALS PREP	Malak Gabra	A2-CUSTODY-REFRIG-D1	A2-CUSTODY-REFRIG-D1	Malak Gabra
L1717026-08A	Glass-A.120	INTACT	30-MAY-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-FRZ1-U4	Camilla Akbas	A2-METALS PREP	A2-METALS PREP	Camilla Akbas
L1717026-08A	Glass-A.120	INTACT	26-MAY-17	A2-CUSTODY-REFRIDGE	A2-METALS PREP	Fatima Cofie	A2-CUSTODY-FRZ1-U4	A2-CUSTODY-FRZ1-U4	Fatima Cofie
L1717026-08A	Glass-A.120	INTACT	26-MAY-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIG-D1	Fatima Cofie	A2-METALS PREP	A2-METALS PREP	Fatima Cofie
L1717026-08A	Glass-A.120	INTACT	25-MAY-17	CUSTODY	A2-CUSTODY-REFRIDGE	Christopher Collins	A2-CUSTODY-REFRIG-D1	A2-CUSTODY-REFRIG-D1	Christopher Collins
L1717026-08A	Glass-A.120	INTACT	25-MAY-17	A2-LOGIN	A2-LOGIN	Christopher Collins	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIDGE	Christopher Collins
L1717026-09A	Glass-A.120	INTACT	31-MAY-17	A2-CUSTODY-REFRIDGE	A2-WET CHEMISTRY	Sonal Patel	A2-CUSTODY-FRZ1-U4	A2-CUSTODY-FRZ1-U4	Sonal Patel
L1717026-09A	Glass-A.120	INTACT	31-MAY-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIG-D1	Sonal Patel	A2-WET CHEMISTRY	A2-WET CHEMISTRY	Sonal Patel
L1717026-09A	Glass-A.120	INTACT	30-MAY-17	A2-CUSTODY-REFRIDGE	A2-METALS PREP	Malak Gabra	A2-CUSTODY-REFRIG-D1	A2-CUSTODY-REFRIG-D1	Malak Gabra
L1717026-09A	Glass-A.120	INTACT	30-MAY-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-FRZ1-U4	Camilla Akbas	A2-METALS PREP	A2-METALS PREP	Camilla Akbas
L1717026-09A	Glass-A.120	INTACT	26-MAY-17	A2-CUSTODY-REFRIDGE	A2-METALS PREP	Fatima Cofie	A2-CUSTODY-FRZ1-U4	A2-CUSTODY-FRZ1-U4	Fatima Cofie
L1717026-09A	Glass-A.120	INTACT	26-MAY-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIG-D1	Fatima Cofie	A2-METALS PREP	A2-METALS PREP	Fatima Cofie
L1717026-09A	Glass-A.120	INTACT	25-MAY-17	CUSTODY	A2-CUSTODY-REFRIDGE	Christopher Collins	A2-CUSTODY-REFRIG-D1	A2-CUSTODY-REFRIG-D1	Christopher Collins
L1717026-09A	Glass-A.120	INTACT	25-MAY-17	A2-LOGIN	A2-LOGIN	Christopher Collins	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIDGE	Christopher Collins
L1717026-10A	Glass-A.120	INTACT	31-MAY-17	A2-CUSTODY-REFRIDGE	A2-WET CHEMISTRY	Sonal Patel	A2-CUSTODY-FRZ1-U4	A2-CUSTODY-FRZ1-U4	Sonal Patel
L1717026-10A	Glass-A.120	INTACT	31-MAY-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIG-D1	Sonal Patel	A2-WET CHEMISTRY	A2-WET CHEMISTRY	Sonal Patel
L1717026-10A	Glass-A.120	INTACT	30-MAY-17	A2-CUSTODY-REFRIDGE	A2-METALS PREP	Malak Gabra	A2-CUSTODY-REFRIG-D1	A2-CUSTODY-REFRIG-D1	Malak Gabra

Container ID	Type	Status	Transaction Date	From Response	Location	To Operator	Response	Location	Operator
L1717026-10A	Glass-A.120	INTACT	30-MAY-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-FRZ1-U4	Camilla Akbas	A2-METALS PREP	A2-METALS PREP	Camilla Akbas
L1717026-10A	Glass-A.120	INTACT	26-MAY-17	A2-CUSTODY-REFRIDGE	A2-METALS PREP	Fatima Cofie	A2-CUSTODY-FRZ1-U4	A2-CUSTODY-FRZ1-U4	Fatima Cofie
L1717026-10A	Glass-A.120	INTACT	26-MAY-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIG-D1	Fatima Cofie	A2-METALS PREP	A2-METALS PREP	Fatima Cofie
L1717026-10A	Glass-A.120	INTACT	25-MAY-17	CUSTODY	A2-CUSTODY-REFRIDGE	Christopher Collins	A2-CUSTODY-REFRIG-D1	A2-CUSTODY-REFRIG-D1	Christopher Collins
L1717026-10A	Glass-A.120	INTACT	25-MAY-17	A2-LOGIN	A2-LOGIN	Christopher Collins	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIDGE	Christopher Collins
L1717026-11A	Glass-A.120	INTACT	31-MAY-17	A2-CUSTODY-REFRIDGE	A2-WET CHEMISTRY	Sonal Patel	A2-CUSTODY-FRZ1-U4	A2-CUSTODY-FRZ1-U4	Sonal Patel
L1717026-11A	Glass-A.120	INTACT	31-MAY-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIG-D1	Sonal Patel	A2-WET CHEMISTRY	A2-WET CHEMISTRY	Sonal Patel
L1717026-11A	Glass-A.120	INTACT	30-MAY-17	A2-CUSTODY-REFRIDGE	A2-METALS PREP	Malak Gabra	A2-CUSTODY-REFRIG-D1	A2-CUSTODY-REFRIG-D1	Malak Gabra
L1717026-11A	Glass-A.120	INTACT	30-MAY-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-FRZ1-U4	Camilla Akbas	A2-METALS PREP	A2-METALS PREP	Camilla Akbas
L1717026-11A	Glass-A.120	INTACT	26-MAY-17	A2-CUSTODY-REFRIDGE	A2-METALS PREP	Fatima Cofie	A2-CUSTODY-FRZ1-U4	A2-CUSTODY-FRZ1-U4	Fatima Cofie
L1717026-11A	Glass-A.120	INTACT	26-MAY-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIG-D1	Fatima Cofie	A2-METALS PREP	A2-METALS PREP	Fatima Cofie
L1717026-11A	Glass-A.120	INTACT	25-MAY-17	CUSTODY	A2-CUSTODY-REFRIDGE	Christopher Collins	A2-CUSTODY-REFRIG-D1	A2-CUSTODY-REFRIG-D1	Christopher Collins
L1717026-11A	Glass-A.120	INTACT	25-MAY-17	A2-LOGIN	A2-LOGIN	Christopher Collins	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIDGE	Christopher Collins
L1717026-12A	Glass-A.120	INTACT	31-MAY-17	A2-CUSTODY-REFRIDGE	A2-WET CHEMISTRY	Sonal Patel	A2-CUSTODY-FRZ1-U4	A2-CUSTODY-FRZ1-U4	Sonal Patel
L1717026-12A	Glass-A.120	INTACT	31-MAY-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIG-D1	Sonal Patel	A2-WET CHEMISTRY	A2-WET CHEMISTRY	Sonal Patel
L1717026-12A	Glass-A.120	INTACT	30-MAY-17	A2-CUSTODY-REFRIDGE	A2-METALS PREP	Malak Gabra	A2-CUSTODY-REFRIG-D1	A2-CUSTODY-REFRIG-D1	Malak Gabra
L1717026-12A	Glass-A.120	INTACT	30-MAY-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-FRZ1-U4	Camilla Akbas	A2-METALS PREP	A2-METALS PREP	Camilla Akbas
L1717026-12A	Glass-A.120	INTACT	26-MAY-17	A2-CUSTODY-REFRIDGE	A2-METALS PREP	Fatima Cofie	A2-CUSTODY-FRZ1-U4	A2-CUSTODY-FRZ1-U4	Fatima Cofie
L1717026-12A	Glass-A.120	INTACT	26-MAY-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIG-D1	Fatima Cofie	A2-METALS PREP	A2-METALS PREP	Fatima Cofie
L1717026-12A	Glass-A.120	INTACT	25-MAY-17	CUSTODY	A2-CUSTODY-REFRIDGE	Christopher Collins	A2-CUSTODY-REFRIG-D1	A2-CUSTODY-REFRIG-D1	Christopher Collins
L1717026-12A	Glass-A.120	INTACT	25-MAY-17	A2-LOGIN	A2-LOGIN	Christopher Collins	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIDGE	Christopher Collins
L1717026-13A	Glass-A.120	INTACT	31-MAY-17	A2-CUSTODY-REFRIDGE	A2-WET CHEMISTRY	Sonal Patel	A2-CUSTODY-FRZ1-U4	A2-CUSTODY-FRZ1-U4	Sonal Patel
L1717026-13A	Glass-A.120	INTACT	31-MAY-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIG-D1	Sonal Patel	A2-WET CHEMISTRY	A2-WET CHEMISTRY	Sonal Patel
L1717026-13A	Glass-A.120	INTACT	30-MAY-17	A2-CUSTODY-REFRIDGE	A2-METALS PREP	Malak Gabra	A2-CUSTODY-REFRIG-D1	A2-CUSTODY-REFRIG-D1	Malak Gabra
L1717026-13A	Glass-A.120	INTACT	30-MAY-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-FRZ1-U4	Camilla Akbas	A2-METALS PREP	A2-METALS PREP	Camilla Akbas

Container ID	Type	Status	Transaction Date	From Response	Location	To Operator	Response	Location	Operator
L1717026-13A	Glass-A.120	INTACT	26-MAY-17	A2-CUSTODY-REFRIDGE	A2-METALS	PREP Fatima Cofie	A2-CUSTODY-FRZ1-U4	A2-CUSTODY-FRZ1-U4	Fatima Cofie
L1717026-13A	Glass-A.120	INTACT	26-MAY-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIG-D1	Fatima Cofie	A2-METALS	PREP Fatima Cofie	Fatima Cofie
L1717026-13A	Glass-A.120	INTACT	25-MAY-17	CUSTODY	A2-CUSTODY-REFRIDGE	Christopher Collins	A2-CUSTODY-REFRIG-D1	A2-CUSTODY-REFRIG-D1	Christopher Collins
L1717026-13A	Glass-A.120	INTACT	25-MAY-17	A2-LOGIN	A2-LOGIN	Christopher Collins	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIDGE	Christopher Collins
L1717026-14A	Glass-A.120	INTACT	31-MAY-17	A2-CUSTODY-REFRIDGE	A2-WET CHEMISTRY	Sonal Patel	A2-CUSTODY-FRZ1-U4	A2-CUSTODY-FRZ1-U4	Sonal Patel
L1717026-14A	Glass-A.120	INTACT	31-MAY-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIG-D1	Sonal Patel	A2-WET CHEMISTRY	A2-WET CHEMISTRY	Sonal Patel
L1717026-14A	Glass-A.120	INTACT	30-MAY-17	A2-CUSTODY-REFRIDGE	A2-METALS	PREP Malak Gabra	A2-CUSTODY-REFRIG-D1	A2-CUSTODY-REFRIG-D1	Malak Gabra
L1717026-14A	Glass-A.120	INTACT	30-MAY-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-FRZ1-U4	Camilla Akbas	A2-METALS	PREP Camilla Akbas	Camilla Akbas
L1717026-14A	Glass-A.120	INTACT	26-MAY-17	A2-CUSTODY-REFRIDGE	A2-METALS	PREP Fatima Cofie	A2-CUSTODY-FRZ1-U4	A2-CUSTODY-FRZ1-U4	Fatima Cofie
L1717026-14A	Glass-A.120	INTACT	26-MAY-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIG-D1	Fatima Cofie	A2-METALS	PREP Fatima Cofie	Fatima Cofie
L1717026-14A	Glass-A.120	INTACT	25-MAY-17	CUSTODY	A2-CUSTODY-REFRIDGE	Christopher Collins	A2-CUSTODY-REFRIG-D1	A2-CUSTODY-REFRIG-D1	Christopher Collins
L1717026-14A	Glass-A.120	INTACT	25-MAY-17	A2-LOGIN	A2-LOGIN	Christopher Collins	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIDGE	Christopher Collins
L1717026-15A	Glass-A.120	INTACT	31-MAY-17	A2-CUSTODY-REFRIDGE	A2-WET CHEMISTRY	Sonal Patel	A2-CUSTODY-FRZ1-U4	A2-CUSTODY-FRZ1-U4	Sonal Patel
L1717026-15A	Glass-A.120	INTACT	31-MAY-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIG-D1	Sonal Patel	A2-WET CHEMISTRY	A2-WET CHEMISTRY	Sonal Patel
L1717026-15A	Glass-A.120	INTACT	30-MAY-17	A2-CUSTODY-REFRIDGE	A2-METALS	PREP Malak Gabra	A2-CUSTODY-REFRIG-D1	A2-CUSTODY-REFRIG-D1	Malak Gabra
L1717026-15A	Glass-A.120	INTACT	30-MAY-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-FRZ1-U4	Camilla Akbas	A2-METALS	PREP Camilla Akbas	Camilla Akbas
L1717026-15A	Glass-A.120	INTACT	26-MAY-17	A2-CUSTODY-REFRIDGE	A2-METALS	PREP Fatima Cofie	A2-CUSTODY-FRZ1-U4	A2-CUSTODY-FRZ1-U4	Fatima Cofie
L1717026-15A	Glass-A.120	INTACT	26-MAY-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIG-D1	Fatima Cofie	A2-METALS	PREP Fatima Cofie	Fatima Cofie
L1717026-15A	Glass-A.120	INTACT	25-MAY-17	CUSTODY	A2-CUSTODY-REFRIDGE	Christopher Collins	A2-CUSTODY-REFRIG-D1	A2-CUSTODY-REFRIG-D1	Christopher Collins
L1717026-15A	Glass-A.120	INTACT	25-MAY-17	A2-LOGIN	A2-LOGIN	Christopher Collins	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIDGE	Christopher Collins
L1717026-16A	Glass-A.120	INTACT	31-MAY-17	A2-CUSTODY-REFRIDGE	A2-WET CHEMISTRY	Sonal Patel	A2-CUSTODY-FRZ1-U4	A2-CUSTODY-FRZ1-U4	Sonal Patel
L1717026-16A	Glass-A.120	INTACT	31-MAY-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIG-D1	Sonal Patel	A2-WET CHEMISTRY	A2-WET CHEMISTRY	Sonal Patel
L1717026-16A	Glass-A.120	INTACT	30-MAY-17	A2-CUSTODY-REFRIDGE	A2-METALS	PREP Malak Gabra	A2-CUSTODY-REFRIG-D1	A2-CUSTODY-REFRIG-D1	Malak Gabra
L1717026-16A	Glass-A.120	INTACT	30-MAY-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-FRZ1-U4	Camilla Akbas	A2-METALS	PREP Camilla Akbas	Camilla Akbas
L1717026-16A	Glass-A.120	INTACT	26-MAY-17	A2-CUSTODY-REFRIDGE	A2-METALS	PREP Fatima Cofie	A2-CUSTODY-FRZ1-U4	A2-CUSTODY-FRZ1-U4	Fatima Cofie

Container ID	Type	Status	Transaction Date	From Response	Location	To Operator	Response	Location	Operator
L1717026-16A	Glass-A.120	INTACT	26-MAY-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIG-D1	Fatima Cofie	A2-METALS PREP	A2-METALS PREP	Fatima Cofie
L1717026-16A	Glass-A.120	INTACT	25-MAY-17	CUSTODY	A2-CUSTODY-REFRIDGE	Christopher Collins	A2-CUSTODY-REFRIG-D1	A2-CUSTODY-REFRIG-D1	Christopher Collins
L1717026-16A	Glass-A.120	INTACT	25-MAY-17	A2-LOGIN	A2-LOGIN	Christopher Collins	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIDGE	Christopher Collins
L1717026-17A	Glass-A.120	INTACT	31-MAY-17	A2-CUSTODY-REFRIDGE	A2-WET CHEMISTRY	Sonal Patel	A2-CUSTODY-FRZ1-U4	A2-CUSTODY-FRZ1-U4	Sonal Patel
L1717026-17A	Glass-A.120	INTACT	31-MAY-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIG-D1	Sonal Patel	A2-WET CHEMISTRY	A2-WET CHEMISTRY	Sonal Patel
L1717026-17A	Glass-A.120	INTACT	30-MAY-17	A2-CUSTODY-REFRIDGE	A2-METALS PREP	Malak Gabra	A2-CUSTODY-REFRIG-D1	A2-CUSTODY-REFRIG-D1	Malak Gabra
L1717026-17A	Glass-A.120	INTACT	30-MAY-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-FRZ1-U4	Camilla Akbas	A2-METALS PREP	A2-METALS PREP	Camilla Akbas
L1717026-17A	Glass-A.120	INTACT	26-MAY-17	A2-CUSTODY-REFRIDGE	A2-METALS PREP	Fatima Cofie	A2-CUSTODY-FRZ1-U4	A2-CUSTODY-FRZ1-U4	Fatima Cofie
L1717026-17A	Glass-A.120	INTACT	26-MAY-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIG-D1	Fatima Cofie	A2-METALS PREP	A2-METALS PREP	Fatima Cofie
L1717026-17A	Glass-A.120	INTACT	25-MAY-17	CUSTODY	A2-CUSTODY-REFRIDGE	Christopher Collins	A2-CUSTODY-REFRIG-D1	A2-CUSTODY-REFRIG-D1	Christopher Collins
L1717026-17A	Glass-A.120	INTACT	25-MAY-17	A2-LOGIN	A2-LOGIN	Christopher Collins	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIDGE	Christopher Collins
L1717026-18A	Glass-A.120	INTACT	31-MAY-17	A2-CUSTODY-REFRIDGE	A2-WET CHEMISTRY	Sonal Patel	A2-CUSTODY-FRZ1-U4	A2-CUSTODY-FRZ1-U4	Sonal Patel
L1717026-18A	Glass-A.120	INTACT	31-MAY-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIG-D1	Sonal Patel	A2-WET CHEMISTRY	A2-WET CHEMISTRY	Sonal Patel
L1717026-18A	Glass-A.120	INTACT	30-MAY-17	A2-CUSTODY-REFRIDGE	A2-METALS PREP	Malak Gabra	A2-CUSTODY-REFRIG-D1	A2-CUSTODY-REFRIG-D1	Malak Gabra
L1717026-18A	Glass-A.120	INTACT	30-MAY-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-FRZ1-U4	Camilla Akbas	A2-METALS PREP	A2-METALS PREP	Camilla Akbas
L1717026-18A	Glass-A.120	INTACT	26-MAY-17	A2-CUSTODY-REFRIDGE	A2-METALS PREP	Fatima Cofie	A2-CUSTODY-FRZ1-U4	A2-CUSTODY-FRZ1-U4	Fatima Cofie
L1717026-18A	Glass-A.120	INTACT	26-MAY-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIG-D1	Fatima Cofie	A2-METALS PREP	A2-METALS PREP	Fatima Cofie
L1717026-18A	Glass-A.120	INTACT	25-MAY-17	CUSTODY	A2-CUSTODY-REFRIDGE	Christopher Collins	A2-CUSTODY-REFRIG-D1	A2-CUSTODY-REFRIG-D1	Christopher Collins
L1717026-18A	Glass-A.120	INTACT	25-MAY-17	A2-LOGIN	A2-LOGIN	Christopher Collins	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIDGE	Christopher Collins
L1717026-19A	Glass-A.120	INTACT	31-MAY-17	A2-CUSTODY-REFRIDGE	A2-WET CHEMISTRY	Sonal Patel	A2-CUSTODY-FRZ1-U4	A2-CUSTODY-FRZ1-U4	Sonal Patel
L1717026-19A	Glass-A.120	INTACT	31-MAY-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIG-D1	Sonal Patel	A2-WET CHEMISTRY	A2-WET CHEMISTRY	Sonal Patel
L1717026-19A	Glass-A.120	INTACT	30-MAY-17	A2-CUSTODY-REFRIDGE	A2-METALS PREP	Malak Gabra	A2-CUSTODY-REFRIG-D1	A2-CUSTODY-REFRIG-D1	Malak Gabra
L1717026-19A	Glass-A.120	INTACT	30-MAY-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-FRZ1-U4	Camilla Akbas	A2-METALS PREP	A2-METALS PREP	Camilla Akbas
L1717026-19A	Glass-A.120	INTACT	26-MAY-17	A2-CUSTODY-REFRIDGE	A2-METALS PREP	Fatima Cofie	A2-CUSTODY-FRZ1-U4	A2-CUSTODY-FRZ1-U4	Fatima Cofie
L1717026-19A	Glass-A.120	INTACT	26-MAY-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIG-D1	Fatima Cofie	A2-METALS PREP	A2-METALS PREP	Fatima Cofie


Container ID	Type	Status	Transaction Date	From Response	Location	To Operator	Response	Location	Operator
L1717026-19A	Glass-A.120	INTACT	25-MAY-17	CUSTODY	A2-CUSTODY-REFRIDGE	Christopher Collins	A2-CUSTODY-REFRIG-D1	A2-CUSTODY-REFRIG-D1	Christopher Collins
L1717026-19A	Glass-A.120	INTACT	25-MAY-17	A2-LOGIN	A2-LOGIN	Christopher Collins	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIDGE	Christopher Collins
L1717026-20A	Glass-A.120	INTACT	02-JUN-17	A2-CUSTODY-REFRIDGE	A2-METALS PREP	Camilla Akbas	A2-CUSTODY-FRZ1-U4	A2-CUSTODY-FRZ1-U4	Camilla Akbas
L1717026-20A	Glass-A.120	INTACT	02-JUN-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-FRZ1-U4	Camilla Akbas	A2-METALS PREP	A2-METALS PREP	Camilla Akbas
L1717026-20A	Glass-A.120	INTACT	31-MAY-17	A2-CUSTODY-REFRIDGE	A2-WET CHEMISTRY	Sonal Patel	A2-CUSTODY-FRZ1-U4	A2-CUSTODY-FRZ1-U4	Sonal Patel
L1717026-20A	Glass-A.120	INTACT	31-MAY-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-FRZ1-U4	Sonal Patel	A2-WET CHEMISTRY	A2-WET CHEMISTRY	Sonal Patel
L1717026-20A	Glass-A.120	INTACT	26-MAY-17	A2-CUSTODY-REFRIDGE	A2-METALS PREP	Fatima Cofie	A2-CUSTODY-FRZ1-U4	A2-CUSTODY-FRZ1-U4	Fatima Cofie
L1717026-20A	Glass-A.120	INTACT	26-MAY-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIG-D1	Fatima Cofie	A2-METALS PREP	A2-METALS PREP	Fatima Cofie
L1717026-20A	Glass-A.120	INTACT	25-MAY-17	CUSTODY	A2-CUSTODY-REFRIDGE	Christopher Collins	A2-CUSTODY-REFRIG-D1	A2-CUSTODY-REFRIG-D1	Christopher Collins
L1717026-20A	Glass-A.120	INTACT	25-MAY-17	A2-LOGIN	A2-LOGIN	Christopher Collins	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIDGE	Christopher Collins
L1717026-21A	Glass-A.120	INTACT	02-JUN-17	A2-CUSTODY-REFRIDGE	A2-METALS PREP	Camilla Akbas	A2-CUSTODY-FRZ1-U4	A2-CUSTODY-FRZ1-U4	Camilla Akbas
L1717026-21A	Glass-A.120	INTACT	02-JUN-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-FRZ1-U4	Camilla Akbas	A2-METALS PREP	A2-METALS PREP	Camilla Akbas
L1717026-21A	Glass-A.120	INTACT	31-MAY-17	A2-CUSTODY-REFRIDGE	A2-WET CHEMISTRY	Sonal Patel	A2-CUSTODY-FRZ1-U4	A2-CUSTODY-FRZ1-U4	Sonal Patel
L1717026-21A	Glass-A.120	INTACT	31-MAY-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-FRZ1-U4	Sonal Patel	A2-WET CHEMISTRY	A2-WET CHEMISTRY	Sonal Patel
L1717026-21A	Glass-A.120	INTACT	26-MAY-17	A2-CUSTODY-REFRIDGE	A2-METALS PREP	Fatima Cofie	A2-CUSTODY-FRZ1-U4	A2-CUSTODY-FRZ1-U4	Fatima Cofie
L1717026-21A	Glass-A.120	INTACT	26-MAY-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIG-D1	Fatima Cofie	A2-METALS PREP	A2-METALS PREP	Fatima Cofie
L1717026-21A	Glass-A.120	INTACT	25-MAY-17	CUSTODY	A2-CUSTODY-REFRIDGE	Christopher Collins	A2-CUSTODY-REFRIG-D1	A2-CUSTODY-REFRIG-D1	Christopher Collins
L1717026-21A	Glass-A.120	INTACT	25-MAY-17	A2-LOGIN	A2-LOGIN	Christopher Collins	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIDGE	Christopher Collins
L1717026-22A	Glass-A.120	INTACT	02-JUN-17	A2-CUSTODY-REFRIDGE	A2-METALS PREP	Camilla Akbas	A2-CUSTODY-FRZ1-U4	A2-CUSTODY-FRZ1-U4	Camilla Akbas
L1717026-22A	Glass-A.120	INTACT	02-JUN-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-FRZ1-U4	Camilla Akbas	A2-METALS PREP	A2-METALS PREP	Camilla Akbas
L1717026-22A	Glass-A.120	INTACT	31-MAY-17	A2-CUSTODY-REFRIDGE	A2-WET CHEMISTRY	Sonal Patel	A2-CUSTODY-FRZ1-U4	A2-CUSTODY-FRZ1-U4	Sonal Patel
L1717026-22A	Glass-A.120	INTACT	31-MAY-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-FRZ1-U4	Sonal Patel	A2-WET CHEMISTRY	A2-WET CHEMISTRY	Sonal Patel
L1717026-22A	Glass-A.120	INTACT	26-MAY-17	A2-CUSTODY-REFRIDGE	A2-METALS PREP	Fatima Cofie	A2-CUSTODY-FRZ1-U4	A2-CUSTODY-FRZ1-U4	Fatima Cofie
L1717026-22A	Glass-A.120	INTACT	26-MAY-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIG-D1	Fatima Cofie	A2-METALS PREP	A2-METALS PREP	Fatima Cofie
L1717026-22A	Glass-A.120	INTACT	25-MAY-17	CUSTODY	A2-CUSTODY-REFRIDGE	Christopher Collins	A2-CUSTODY-REFRIG-D1	A2-CUSTODY-REFRIG-D1	Christopher Collins


Container ID	Type	Status	Transaction Date	From Response	Location	To Operator	Response	Location	Operator
L1717026-22A	Glass-A.120	INTACT	25-MAY-17	A2-LOGIN	A2-LOGIN	Christopher Collins	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIDGE	Christopher Collins
L1717026-23A	Glass-A.120	INTACT	02-JUN-17	A2-CUSTODY-REFRIDGE	A2-METALS	PREP Camilla Akbas	A2-CUSTODY-FRZ1-U4	A2-CUSTODY-FRZ1-U4	Camilla Akbas
L1717026-23A	Glass-A.120	INTACT	02-JUN-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-FRZ1-U4	Camilla Akbas	A2-METALS	PREP A2-METALS	PREP Camilla Akbas
L1717026-23A	Glass-A.120	INTACT	31-MAY-17	A2-CUSTODY-REFRIDGE	A2-WET CHEMISTRY	Sonal Patel	A2-CUSTODY-FRZ1-U4	A2-CUSTODY-FRZ1-U4	Sonal Patel
L1717026-23A	Glass-A.120	INTACT	31-MAY-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-FRZ1-U4	Sonal Patel	A2-WET CHEMISTRY	A2-WET CHEMISTRY	Sonal Patel
L1717026-23A	Glass-A.120	INTACT	26-MAY-17	A2-CUSTODY-REFRIDGE	A2-METALS	PREP Fatima Cofie	A2-CUSTODY-FRZ1-U4	A2-CUSTODY-FRZ1-U4	Fatima Cofie
L1717026-23A	Glass-A.120	INTACT	26-MAY-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIG-D1	Fatima Cofie	A2-METALS	PREP A2-METALS	PREP Fatima Cofie
L1717026-23A	Glass-A.120	INTACT	25-MAY-17	CUSTODY	A2-CUSTODY-REFRIDGE	Christopher Collins	A2-CUSTODY-REFRIG-D1	A2-CUSTODY-REFRIG-D1	Christopher Collins
L1717026-23A	Glass-A.120	INTACT	25-MAY-17	A2-LOGIN	A2-LOGIN	Christopher Collins	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIDGE	Christopher Collins
L1717026-24A	Glass-A.120	INTACT	02-JUN-17	A2-CUSTODY-REFRIDGE	A2-METALS	PREP Camilla Akbas	A2-CUSTODY-FRZ1-U4	A2-CUSTODY-FRZ1-U4	Camilla Akbas
L1717026-24A	Glass-A.120	INTACT	02-JUN-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-FRZ1-U4	Camilla Akbas	A2-METALS	PREP A2-METALS	PREP Camilla Akbas
L1717026-24A	Glass-A.120	INTACT	31-MAY-17	A2-CUSTODY-REFRIDGE	A2-WET CHEMISTRY	Sonal Patel	A2-CUSTODY-FRZ1-U4	A2-CUSTODY-FRZ1-U4	Sonal Patel
L1717026-24A	Glass-A.120	INTACT	31-MAY-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-FRZ1-U4	Sonal Patel	A2-WET CHEMISTRY	A2-WET CHEMISTRY	Sonal Patel
L1717026-24A	Glass-A.120	INTACT	26-MAY-17	A2-CUSTODY-REFRIDGE	A2-METALS	PREP Fatima Cofie	A2-CUSTODY-FRZ1-U4	A2-CUSTODY-FRZ1-U4	Fatima Cofie
L1717026-24A	Glass-A.120	INTACT	26-MAY-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIG-D1	Fatima Cofie	A2-METALS	PREP A2-METALS	PREP Fatima Cofie
L1717026-24A	Glass-A.120	INTACT	25-MAY-17	CUSTODY	A2-CUSTODY-REFRIDGE	Christopher Collins	A2-CUSTODY-REFRIG-D1	A2-CUSTODY-REFRIG-D1	Christopher Collins
L1717026-24A	Glass-A.120	INTACT	25-MAY-17	A2-LOGIN	A2-LOGIN	Christopher Collins	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIDGE	Christopher Collins
L1717026-25A	Glass-A.120	INTACT	02-JUN-17	A2-CUSTODY-REFRIDGE	A2-METALS	PREP Camilla Akbas	A2-CUSTODY-FRZ1-U4	A2-CUSTODY-FRZ1-U4	Camilla Akbas
L1717026-25A	Glass-A.120	INTACT	02-JUN-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-FRZ1-U4	Camilla Akbas	A2-METALS	PREP A2-METALS	PREP Camilla Akbas
L1717026-25A	Glass-A.120	INTACT	31-MAY-17	A2-CUSTODY-REFRIDGE	A2-WET CHEMISTRY	Sonal Patel	A2-CUSTODY-FRZ1-U4	A2-CUSTODY-FRZ1-U4	Sonal Patel
L1717026-25A	Glass-A.120	INTACT	31-MAY-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-FRZ1-U4	Sonal Patel	A2-WET CHEMISTRY	A2-WET CHEMISTRY	Sonal Patel
L1717026-25A	Glass-A.120	INTACT	26-MAY-17	A2-CUSTODY-REFRIDGE	A2-METALS	PREP Fatima Cofie	A2-CUSTODY-FRZ1-U4	A2-CUSTODY-FRZ1-U4	Fatima Cofie
L1717026-25A	Glass-A.120	INTACT	26-MAY-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIG-D1	Fatima Cofie	A2-METALS	PREP A2-METALS	PREP Fatima Cofie
L1717026-25A	Glass-A.120	INTACT	25-MAY-17	CUSTODY	A2-CUSTODY-REFRIDGE	Christopher Collins	A2-CUSTODY-REFRIG-D1	A2-CUSTODY-REFRIG-D1	Christopher Collins
L1717026-25A	Glass-A.120	INTACT	25-MAY-17	A2-LOGIN	A2-LOGIN	Christopher Collins	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIDGE	Christopher Collins

Container ID	Type	Status	Transaction Date	From Response	Location	To Operator	Response	Location	Operator
L1717026-26A	Glass-A.120	INTACT	02-JUN-17	A2-CUSTODY-REFRIDGE	A2-METALS PREP	Camilla Akbas	A2-CUSTODY-FRZ1-U4	A2-CUSTODY-FRZ1-U4	Camilla Akbas
L1717026-26A	Glass-A.120	INTACT	02-JUN-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-FRZ1-U4	Camilla Akbas	A2-METALS PREP	A2-METALS PREP	Camilla Akbas
L1717026-26A	Glass-A.120	INTACT	31-MAY-17	A2-CUSTODY-REFRIDGE	A2-WET CHEMISTRY	Sonal Patel	A2-CUSTODY-FRZ1-U4	A2-CUSTODY-FRZ1-U4	Sonal Patel
L1717026-26A	Glass-A.120	INTACT	31-MAY-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-FRZ1-U4	Sonal Patel	A2-WET CHEMISTRY	A2-WET CHEMISTRY	Sonal Patel
L1717026-26A	Glass-A.120	INTACT	26-MAY-17	A2-CUSTODY-REFRIDGE	A2-METALS PREP	Fatima Cofie	A2-CUSTODY-FRZ1-U4	A2-CUSTODY-FRZ1-U4	Fatima Cofie
L1717026-26A	Glass-A.120	INTACT	26-MAY-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIG-D1	Fatima Cofie	A2-METALS PREP	A2-METALS PREP	Fatima Cofie
L1717026-26A	Glass-A.120	INTACT	25-MAY-17	CUSTODY	A2-CUSTODY-REFRIDGE	Christopher Collins	A2-CUSTODY-REFRIG-D1	A2-CUSTODY-REFRIG-D1	Christopher Collins
L1717026-26A	Glass-A.120	INTACT	25-MAY-17	A2-LOGIN	A2-LOGIN	Christopher Collins	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIDGE	Christopher Collins
L1717026-27A	Glass-A.120	INTACT	02-JUN-17	A2-CUSTODY-REFRIDGE	A2-METALS PREP	Camilla Akbas	A2-CUSTODY-FRZ1-U4	A2-CUSTODY-FRZ1-U4	Camilla Akbas
L1717026-27A	Glass-A.120	INTACT	02-JUN-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-FRZ1-U4	Camilla Akbas	A2-METALS PREP	A2-METALS PREP	Camilla Akbas
L1717026-27A	Glass-A.120	INTACT	31-MAY-17	A2-CUSTODY-REFRIDGE	A2-WET CHEMISTRY	Sonal Patel	A2-CUSTODY-FRZ1-U4	A2-CUSTODY-FRZ1-U4	Sonal Patel
L1717026-27A	Glass-A.120	INTACT	31-MAY-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-FRZ1-U4	Sonal Patel	A2-WET CHEMISTRY	A2-WET CHEMISTRY	Sonal Patel
L1717026-27A	Glass-A.120	INTACT	26-MAY-17	A2-CUSTODY-REFRIDGE	A2-METALS PREP	Fatima Cofie	A2-CUSTODY-FRZ1-U4	A2-CUSTODY-FRZ1-U4	Fatima Cofie
L1717026-27A	Glass-A.120	INTACT	26-MAY-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIG-D1	Fatima Cofie	A2-METALS PREP	A2-METALS PREP	Fatima Cofie
L1717026-27A	Glass-A.120	INTACT	25-MAY-17	CUSTODY	A2-CUSTODY-REFRIDGE	Christopher Collins	A2-CUSTODY-REFRIG-D1	A2-CUSTODY-REFRIG-D1	Christopher Collins
L1717026-27A	Glass-A.120	INTACT	25-MAY-17	A2-LOGIN	A2-LOGIN	Christopher Collins	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIDGE	Christopher Collins
L1717026-28A	Plastic-C.25	INTACT	09-JUN-17	A2-CUSTODY-REFRIDGE	A2-METALS PREP	Camilla Akbas	A2-METALS DEAD CUSTODY	A2-METALS DEAD CUSTODY	Camilla Akbas
L1717026-28A	Plastic-C.25	INTACT	09-JUN-17	A2-CUSTODY-REFRIDGE	A2-METALS DEAD CUSTODY	Joshua Mertens	A2-METALS PREP	A2-METALS PREP	Joshua Mertens
L1717026-28A	Plastic-C.25	INTACT	01-JUN-17	CUSTODY	A2-METALS PREP	Joshua Mertens	A2-METALS DEAD CUSTODY	A2-METALS DEAD CUSTODY	Joshua Mertens
L1717026-28A	Plastic-C.25	INTACT	01-JUN-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-METPREP1	Joshua Mertens	A2-METALS PREP	A2-METALS PREP	Joshua Mertens
L1717026-28A	Plastic-C.25	INTACT	25-MAY-17	CUSTODY	A2-CUSTODY-REFRIDGE	Christopher Collins	A2-CUSTODY-METPREP1	A2-CUSTODY-METPREP1	Christopher Collins
L1717026-28A	Plastic-C.25	INTACT	25-MAY-17	A2-LOGIN	A2-LOGIN	Christopher Collins	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIDGE	Christopher Collins
L1717026-29A	Plastic-C.25	INTACT	09-JUN-17	A2-CUSTODY-REFRIDGE	A2-METALS PREP	Camilla Akbas	A2-METALS DEAD CUSTODY	A2-METALS DEAD CUSTODY	Camilla Akbas
L1717026-29A	Plastic-C.25	INTACT	09-JUN-17	A2-CUSTODY-REFRIDGE	A2-METALS DEAD CUSTODY	Joshua Mertens	A2-METALS PREP	A2-METALS PREP	Joshua Mertens
L1717026-29A	Plastic-C.25	INTACT	01-JUN-17	CUSTODY	A2-METALS PREP	Joshua Mertens	A2-METALS DEAD CUSTODY	A2-METALS DEAD CUSTODY	Joshua Mertens

Container ID Type	Status	Transaction Date	From Response	Location	To Operator	Response	Location	Operator
L1717026-29A Plastic-C.25	INTACT	01-JUN-17	A2-CUSTODY-REFRIDGE	A2-CUSTODY-METPREP1	Joshua Mertens	A2-METALS PREP	A2-METALS PREP	Joshua Mertens
L1717026-29A Plastic-C.25	INTACT	25-MAY-17	CUSTODY	A2-CUSTODY-REFRIDGE	Christopher Collins	A2-CUSTODY-METPREP1	A2-CUSTODY-METPREP1	Christopher Collins
L1717026-29A Plastic-C.25	INTACT	25-MAY-17	A2-LOGIN	A2-LOGIN	Christopher Collins	A2-CUSTODY-REFRIDGE	A2-CUSTODY-REFRIDGE	Christopher Collins

Chain of Custody

 NEW JERSEY CHAIN OF CUSTODY Westborough, MA 01581 8 Walkup Dr. TEL: 508-898-9220 FAX: 508-898-9193 Mansfield, MA 02048 320 Forbes Blvd TEL: 508-822-9300 FAX: 508-822-3288		Service Centers Mahwah, NJ 07430: 35 Whitney Rd, Suite 5 Albany, NY 12205: 14 Walker Way Tonawanda, NY 14150: 275 Cooper Ave, Suite 105		Page <u>1</u> of <u> </u>		Date Rec'd in Lab <u>5/25/17</u>		ALPHA Job # <u>L1717026</u>						
		Project Information Project Name: <u>Williams (1794)</u> Project Location: <u>Raritan Bay</u> Project # <u>1794</u> (Use Project name as Project #) <input type="checkbox"/>				Deliverables <input type="checkbox"/> NJ Full / Reduced <input type="checkbox"/> EQUIS (1 File) <input type="checkbox"/> EQUIS (4 File) <input type="checkbox"/> Other				Billing Information <input type="checkbox"/> Same as Client Info PO #				
		Client Information Client: <u>Alpine Ocean</u> Address: <u>155 Hudson Ave</u> <u>Norwood NJ 07648</u> Phone: <u>(201)-768-8000</u> Fax: <u> </u> Email: <u>mikosakowski@alpineocean.com</u>				Regulatory Requirement <input type="checkbox"/> SRS Residential/Non Residential <input type="checkbox"/> SRS Impact to Groundwater <input type="checkbox"/> NJ Ground Water Quality Standards <input type="checkbox"/> NJ IGW SPLP Leachate Criteria <input type="checkbox"/> Other				Site Information Is this site impacted by Petroleum? Yes <input type="checkbox"/> Petroleum Product:				
Turn-Around Time Standard <input type="checkbox"/> Due Date: <u> </u> Rush (only if pre approved) <input type="checkbox"/> # of Days: <u> </u>		These samples have been previously analyzed by Alpha <input type="checkbox"/>								ANALYSIS		Sample Filtration <input type="checkbox"/> Done <input type="checkbox"/> Lab to do Preservation <input type="checkbox"/> Lab to do (Please Specify below)		Total Bottles
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Preservative Code: A = None B = HCl C = HNO ₃ D = H ₂ SO ₄ E = NaOH F = MeOH G = NaHSO ₄ H = Na ₂ S ₂ O ₃ K/E = Zn Ac/NaOH O = Other		Container Code P = Plastic A = Amber Glass V = Vial G = Glass B = Bacteria Cup C = Cube O = Other E = Encore D = BOD Bottle		Westboro: Certification No: MA935 Mansfield: Certification No: MA015		Container Type		Preservative						
Relinquished By: <u>[Signature]</u> Date/Time: <u>5/24/17 15:19</u> <u>5/24/17 17:08</u> <u>5/24</u> <u>5/23/17 5:31</u>		Received By: <u>[Signature]</u> Date/Time: <u>5/24/17 15:19</u> <u>5/24 17:10</u> <u>5/24/17 2220</u> <u>5/23/17 5:31</u>		Please print clearly, legibly and completely. Samples can not be logged in and turnaround time clock will not start until any ambiguities are resolved. BY EXECUTING THIS COC, THE CLIENT HAS READ AND AGREES TO BE BOUND BY ALPHA'S TERMS & CONDITIONS. (See reverse side.)										

 NEW JERSEY CHAIN OF CUSTODY		Service Centers Mahwah, NJ 07430: 35 Whitney Rd, Suite 5 Albany, NY 12205: 14 Walker Way Tonawanda, NY 14150: 275 Cooper Ave, Suite 105		Page <u>2</u> of _____		Date Rec'd in Lab <u>5/25/17</u>		ALPHA Job # <u>L1717026</u>																								
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-11 <u>V190- D0- 3E</u>		<u>5/14/17</u> <u>15:42</u>		<u>Sed</u>	<u>RV</u>	<u>X</u>											1															
-12 <u>V190- D3- 6E</u>		<u>5/14/17</u> <u>15:42</u>		<u>Sed</u>	<u>RV</u>	<u>X</u>											1															
-13 <u>V190- D6- 9E</u>		<u>5/14/17</u> <u>15:42</u>		<u>Sed</u>	<u>RV</u>	<u>X</u>											1															
-14 <u>V190- D9- 10E</u>		<u>5/14/17</u> <u>15:42</u>		<u>Sed</u>	<u>RV</u>	<u>X</u>											1															
-15 <u>V191- D0- 3E</u>		<u>5/14/17</u> <u>15:10</u>		<u>Sed</u>	<u>RV</u>	<u>X</u>											1															
-16 <u>V191- D8- 6E</u>		<u>5/14/17</u> <u>15:10</u>		<u>Sed</u>	<u>RV</u>	<u>X</u>											1															
-17 <u>V191- D6- 9.6E</u>		<u>5/14/17</u> <u>15:10</u>		<u>Sed</u>	<u>RV</u>	<u>X</u>											1															
-18 <u>V191- D6- 9.6E</u>		<u>5/14/17</u> <u>15:10</u>		<u>Sed</u>	<u>RV</u>	<u>X</u>																										
-18 <u>Dup- D6- 9E</u>		<u>5/14/17</u> <u>15:42</u>		<u>Sed</u>	<u>RV</u>	<u>X</u>																										
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Relinquished By: <u>Bob Vito</u>		Date/Time: <u>5/24/17 15:19</u>		Received By: <u>John M. Pata</u>		Date/Time: <u>5/24/17 15:19</u>																										
<u>Jermaine Hines</u>		<u>5/24/17 17:08</u>		<u>John M. Pata</u>		<u>5/24/17 17:10</u>																										
<u>Nmoya</u>		<u>5/25/17 5:31</u>		<u>Belinda Belk</u>		<u>5/25/17 5:31</u>																										

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ALPHA Lab ID (Lab Use Only)		Sample ID		Collection Date Time		Sample Matrix		Sampler's Initials		TAL Metals + SN + SR + HD		Sample Specific Comments	
-19		V42-DO-3E		5/19/17 14:38		Sed		RV		X			
-20		V42-D3-6E		5/19/17 14:38		Sed		RV		X			
-21		V42-D6-9E		5/19/17 14:38		Sed		RV		X			
-22		V42-D9-10E		5/19/17 14:38		Sed		RV		X			
-23		V43-DO-3E		5/20/17 13:58		Sed		RV		X		MSI MSD	
-24		V43-D3-6E		5/20/17 13:58		Sed		RV		X			
-25		V43-D6-9E		5/20/17 13:58		Sed		RV		X			
-26		V43-D9-10E		5/20/17 13:58		Sed		RV		X			
-27		Dup-D3-6E		5/19/17 14:38		Sed		RV		X			
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<u>Oscarum Yumay</u>		<u>5/24/17 17:08</u>		<u>Yumay</u>		<u>5/24/17 17:10</u>							
<u>Bob VLE</u>		<u>5/28/17 8:31</u>		<u>Bob VLE</u>		<u>5/25/17 5:31</u>							

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Form No: 01-14 HC (rev. 30-Sept-2013)																													

Metals

Mercury Analysis

Sample Raw Data

Analysis Report - Filename: O:\Metals\Millenium\WG1010166.rsf

Pos	Runs	Type	Name	ID / Action	Conc	Pk Ht	Pk Area	Baseline	Message	Flag	Slope/ CFm	Intercept	Dilutio Factor	SD	RSD	Cal Method	Date/Time
7	1	Cal	0.00	STD0	0.00	0.175259	6.841619	0.018658	----		0.000000	0.000000	----	----	----	D 7474	06 Jun 17 09:48
8	1	Cal	0.050	STD1	0.050	2.583894	151.015442	0.042496	----		48.172703	0.175259	----	----	----	D 7474	06 Jun 17 09:51
9	1	Cal	0.100	STD2	0.100	5.080221	292.110992	0.010752	----		49.049622	0.160643	----	----	----	D 7474	06 Jun 17 09:53
10	1	Cal	0.500	STD3	0.500	24.571802	1469.925415	0.036468	----		48.805111	0.171963	----	----	----	D 7474	06 Jun 17 09:56
11	1	Cal	2.000	STD4	2.000	97.093140	5715.868164	0.047484	----		48.450703	0.221990	----	----	----	D 7474	06 Jun 17 09:58
12	1	Cal	5.000	STD5	5.000	237.993454	14135.838867	0.127742	----		47.594902	0.566130	----	----	----	D 7474	06 Jun 17 10:01
13	1	QC	ICV7474	Ignore	2.401937	114.886108	6740.761230	0.380777	Pass		47.594902	0.566130	----	----	----	D 7474	06 Jun 17 10:03
7	1	QC	ICB7474	Ignore	-0.007984	0.186120	-112.006516	0.132628	Fail		47.594902	0.566130	----	----	----	D 7474	06 Jun 17 10:05
14	1	Sample	WG1008098-1- T-D5	BV	-0.006853	0.239967	10.182106	-0.007672	----		47.594902	0.566130	1	----	----	D 7474	06 Jun 17 10:09
15	1	Sample	WG1008098-2- T-D10	BV	3.054848	145.961319	9094.175781	0.009114	----		47.594902	0.566130	1	----	----	D 7474	06 Jun 17 10:11
16	1	Sample	L1716972-01-T- D5	BV	0.041697	2.550675	131.564346	-0.170343	----		47.594902	0.566130	1	----	----	D 7474	06 Jun 17 10:14
17	1	Sample	WG1008098-4- T-D5	BV	0.028833	1.938412	108.803619	0.026659	----		47.594902	0.566130	1	----	----	D 7474	06 Jun 17 10:17
18	1	Sample	WG1008098-3- T-D5	BV	2.544135	121.653976	7199.756348	0.023206	----		47.594902	0.566130	1	----	----	D 7474	06 Jun 17 10:19
19	1	Sample	WG1008096-1- T-D5	BV	-0.008210	0.175395	-88.211899	0.190229	----		47.594902	0.566130	1	----	----	D 7474	06 Jun 17 10:22
20	1	Sample	WG1008096-2- T-D10	BV	3.065100	146.449249	9016.652344	0.008667	----		47.594902	0.566130	1	----	----	D 7474	06 Jun 17 10:24
21	1	Sample	L1717026-05-T- D5	BV	-0.006181	0.271927	-14.824818	-0.216023	----		47.594902	0.566130	1	----	----	D 7474	06 Jun 17 10:27
22	1	Sample	WG1008096-3- T-D5	BV	2.546488	121.765991	7324.450684	0.017333	----		47.594902	0.566130	1	----	----	D 7474	06 Jun 17 10:29
23	1	Sample	WG1008096-4- T-D5	BV	2.503696	119.729301	7103.893555	0.058203	----		47.594902	0.566130	1	----	----	D 7474	06 Jun 17 10:32
13	1	QC	CCV7474	Ignore	2.476142	118.417854	6879.015625	0.157350	Pass		47.594902	0.566130	----	----	----	D 7474	06 Jun 17 10:34
7	1	QC	CCB7474	Ignore	-0.009503	0.113857	-13.005899	-0.042607	Fail		47.594902	0.566130	----	----	----	D 7474	06 Jun 17 10:37
24	1	Sample	L1717026-01-T- D5	BV	-0.000888	0.523872	26.857100	0.010683	----		47.594902	0.566130	1	----	----	D 7474	06 Jun 17 10:40
25	1	Sample	L1717026-02-T- D5	BV	0.015365	1.297445	77.039230	0.029396	----		47.594902	0.566130	1	----	----	D 7474	06 Jun 17 10:42
26	1	Sample	L1717026-03-T- D5	BV	0.035224	2.242631	131.604034	0.005286	----		47.594902	0.566130	1	----	----	D 7474	06 Jun 17 10:45
27	1	Sample	L1717026-04-T- D5	BV	0.027699	1.884446	109.683495	-0.016612	----		47.594902	0.566130	1	----	----	D 7474	06 Jun 17 10:47
28	1	Sample	L1717026-06-T- D5	BV	0.027279	1.864490	110.008095	0.014681	----		47.594902	0.566130	1	----	----	D 7474	06 Jun 17 10:50

Printed: 6/6/2017 11:37:29 AM Measured by: _____

Generated by: _____

Signature: _____

Page

Analysis Report - Filename: O:\Metals\Millenium\WG1010166.rsrf

Pos	Runs	Type	Name	ID / Action	Conc	Pk Ht	Pk Area	Baseline	Message	Flag	Slope/ CFm	Intercept	Dilutio Factor	SD	RSD	Cal Method	Date/Time
			D5														
29	1	Sample	L1717026-07-T- BV D5		0.025494	1.779505	104.843338	0.007301	----		47.594902	0.566130	1	----	----	D 7474	06 Jun 17 10:52
30	1	Sample	L1717026-08-T- BV D5		0.025693	1.788964	104.493828	0.003800	----		47.594902	0.566130	1	----	----	D 7474	06 Jun 17 10:55
31	1	Sample	L1717026-09-T- BV D5		0.022735	1.648181	96.475815	-0.005126	----		47.594902	0.566130	1	----	----	D 7474	06 Jun 17 10:57
32	1	Sample	L1717026-10-T- BV D5		-0.004226	0.365014	19.541870	0.014502	----		47.594902	0.566130	1	----	----	D 7474	06 Jun 17 11:00
33	1	Sample	L1717026-11-T- BV D5		0.007200	0.908833	51.677788	-0.005357	----		47.594902	0.566130	1	----	----	D 7474	06 Jun 17 11:02
13	1	QC	CCV7474	Ignore	2.322552	111.107765	6569.445313	0.014727	Pass		47.594902	0.566130	----	----	----	D 7474	06 Jun 17 11:05
7	1	QC	CCB7474	Ignore	-0.008164	0.177557	2.982658	-0.029862	Fail		47.594902	0.566130	----	----	----	D 7474	06 Jun 17 11:08
34	1	Sample	L1717026-12-T- BV D5		0.018197	1.432224	84.244431	0.012817	----		47.594902	0.566130	1	----	----	D 7474	06 Jun 17 11:11
35	1	Sample	L1717026-13-T- BV D5		0.029120	1.952084	112.633049	0.018479	----		47.594902	0.566130	1	----	----	D 7474	06 Jun 17 11:13
36	1	Sample	L1717026-14-T- BV D5		0.030009	1.994397	117.017677	0.010466	----		47.594902	0.566130	1	----	----	D 7474	06 Jun 17 11:16
37	1	Sample	L1717026-15-T- BV D5		0.004045	0.758635	44.616562	0.009073	----		47.594902	0.566130	1	----	----	D 7474	06 Jun 17 11:18
38	1	Sample	L1717026-16-T- BV D5		0.031973	2.087865	121.361435	-0.011128	----		47.594902	0.566130	1	----	----	D 7474	06 Jun 17 11:21
39	1	Sample	L1717026-17-T- BV D5		0.034208	2.194243	127.167694	0.008716	----		47.594902	0.566130	1	----	----	D 7474	06 Jun 17 11:23
40	1	Sample	L1717026-18-T- BV D5		0.026649	1.834469	108.808830	-0.009123	----		47.594902	0.566130	1	----	----	D 7474	06 Jun 17 11:26
41	1	Sample	L1717026-19-T- BV D5		0.000102	0.570967	31.919308	0.006811	----		47.594902	0.566130	1	----	----	D 7474	06 Jun 17 11:28
13	1	QC	CCV7474	Ignore	2.315249	110.760185	6300.729980	0.008158	Pass		47.594902	0.566130	----	----	----	D 7474	06 Jun 17 11:30
7	1	QC	CCB7474	Ignore	-0.008620	0.155886	3.879447	-0.018385	Fail		47.594902	0.566130	----	----	----	D 7474	06 Jun 17 11:35

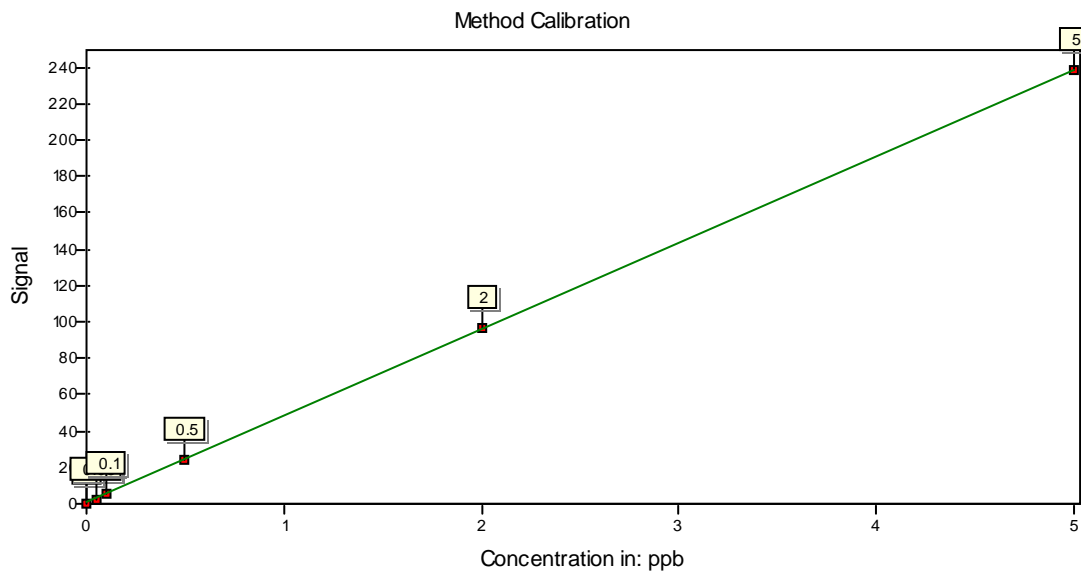
Calibration Report -

General Details

Measured By :
Calibration #: Default
Fit Type : Least Squares
Unit : ppb
Slope : 47.594902
Y Intercept : 0.566130
Correlation Coefficient : 0.999972
Reslope %:
Method Name: 7474

Definition of Standards

<i>Include</i>	<i>Pos</i>	<i>Runs</i>	<i>Conc</i>	<i>Pk Ht</i>	<i>Pk Area</i>	<i>Res %</i>	<i>Res Conc</i>	<i>Date/Time</i>
Yes	7	1	0.00	0.175259	6.841619	0.000000	-0.008212	06 Jun 2017 09:48
Yes	8	1	0.050	2.583894	151.015442	-15.210917	-0.007605	06 Jun 2017 09:51
Yes	9	1	0.100	5.080221	292.110992	-5.155993	-0.005156	06 Jun 2017 09:53
Yes	10	1	0.500	24.571802	1469.925415	0.874973	0.004375	06 Jun 2017 09:56
Yes	11	1	2.000	97.093140	5715.868164	1.404778	0.028096	06 Jun 2017 09:58
Yes	12	1	5.000	237.993454	14135.838867	-0.229935	-0.011497	06 Jun 2017 10:01



Method Set-up Report: C:\Program Files\P S Analytical\Millennium\Methods\7474.mef

Name, Time, Originator/Modifier

Method Title : 7474
Method History : 675
Method Type : Millennium Merlin
Method Name : 7474
Last Modified : 01 Jun 2017
Modified by :

Method Parameters

Unit :	ppb	Idle Actions Active:	Yes
Allow Auto-Range :	No	- Idle After :	6 mins
Gain :	10	- Switch off Pump 1:	Yes
Mode :	Ratio	- Switch off Pump 2 :	Yes
Measurement Mode :	Height	- Switch off Analysis Gas :	Yes
Baseline Check Type :	Units	- Switch off Dryer Gas:	Yes
Baseline Check Value:	1		
Filter Factor :	32	Over Range Action:	Run Blank Wash
Auto Zero:	Yes	- Blank/Wash Sampler Pos:	7
Allow Negative Results:	Yes	- # Repeats:	1
Blank Subtraction:	No	- Blank Pk Height:	1.00

Instrument Parameters

Delay Period (s) : 15
Analysis Period (s) : 60
Memory Period (s) : 60

Pump 1 Speed (%) : 100%
Pump 2 Speed (%) : 100%
Valve Flush : On

Notes

CAL= C053117VH10
ICV= I053117VH10
10% HCl= MW060617A
SnCl2= MW060617Sn02
MERCURYAF2
SEQUENCE REVIEWER

Analysis Report - Filename: O:\Metals\Millenium\WG1010776.rsrf

Pos	Runs	Type	Name	ID / Action	Conc	Pk Ht	Pk Area	Baseline	Message	Flag	Slope/ CFm	Intercept	Dilutio Factor	SD	RSD	Cal Method	Date/Time
7	1	Cal	0.00	STD0	0.00	0.062090	2.051589	0.001070	----		0.000000	0.000000	----	----	----	D 7474	07 Jun 17 14:31
8	1	Cal	0.050	STD1	0.050	2.017330	121.857079	-0.007258	----		39.104801	0.062090	----	----	----	D 7474	07 Jun 17 14:34
9	1	Cal	0.100	STD2	0.100	3.933531	238.578766	-0.009574	----		38.714413	0.068596	----	----	----	D 7474	07 Jun 17 14:36
10	1	Cal	0.500	STD3	0.500	20.127197	1225.137817	0.009748	----		40.223389	-0.001263	----	----	----	D 7474	07 Jun 17 14:39
11	1	Cal	2.000	STD4	2.000	81.309120	4904.021973	0.020662	----		40.667580	-0.063967	----	----	----	D 7474	07 Jun 17 14:41
12	1	Cal	5.000	STD5	5.000	189.652176	11757.225586	0.102228	----		38.066643	0.981937	----	----	----	D 7474	07 Jun 17 14:44
13	1	QC	ICV7474	Ignore	2.538316	97.607094	5868.314453	-0.069592	Pass		38.066643	0.981937	----	----	----	D 7474	07 Jun 17 14:46
7	1	QC	ICB7474	Ignore	-0.021515	0.162947	-112.359665	0.084258	Fail		38.066643	0.981937	----	----	----	D 7474	07 Jun 17 14:49
14	1	Sample	L1716447-02-T- D5	LC 93 LC 06/08/17	-0.021155	0.176646	2.094068	0.029952	----		38.066643	0.981937	1	----	----	D 7474	07 Jun 17 14:51
15	1	Sample	WG1010751-1- T-D10	LC 93 LC 06/08/17	3.653988	140.077011	8581.708008	0.048706	----		38.066643	0.981937	1	----	----	D 7474	07 Jun 17 14:54
16	1	Sample	WG1010751-2- T-D10	LC 93 LC 06/08/17	3.525421	135.182877	8110.681152	-0.185657	----		38.066643	0.981937	1	----	----	D 7474	07 Jun 17 14:57
17	1	Sample	WG1010751-3- T-D10	LC 93 LC 06/08/17	3.240696	124.344360	7402.183105	0.109800	----		38.066643	0.981937	1	----	----	D 7474	07 Jun 17 14:59
18	1	Sample	WG1010751-4- T-D10	LC	3.286404	126.084297	7678.910645	0.109446	----		38.066643	0.981937	1	----	----	D 7474	07 Jun 17 15:02
13	1	QC	CCV7474	Ignore	2.461644	94.688446	5618.266602	0.139265	Pass		38.066643	0.981937	----	----	----	D 7474	07 Jun 17 15:04
7	1	QC	CCB7474	Ignore	-0.022331	0.131879	-102.123741	0.068745	Fail		38.066643	0.981937	----	----	----	D 7474	07 Jun 17 15:06
19	1	Sample	WG1009290-1- T-D5	LC	-0.025582	0.008107	-10.495974	-0.008106	----		38.066643	0.981937	1	----	----	D 7474	07 Jun 17 15:20
20	1	Sample	WG1009290-2- T-D10	LC	1.022088	39.889397	3083.569336	-0.036271	----		38.066643	0.981937	1	----	----	D 7474	07 Jun 17 15:22
21	1	Sample	L1717026-20-T- D5	LC D5	-0.020559	0.199313	-33.652237	-0.199313	----	LC 06/08/17	38.066643	0.981937	1	----	----	D 7474	07 Jun 17 15:25
22	1	Sample	L1717026-21-T- D5	LC D5	-0.023497	0.087487	4.856977	-0.017002	----	SnCl low, refilled and restarted after CCV/CCB	38.066643	0.981937	1	----	----	D 7474	07 Jun 17 15:28
23	1	Sample	L1717026-22-T- D5	LC D5	-0.024284	0.057545	2.915566	0.005998	----		38.066643	0.981937	1	----	----	D 7474	07 Jun 17 15:30
24	1	Sample	L1717026-23-T- D5	LC D5	-0.023247	0.097017	6.386451	0.038750	----		38.066643	0.981937	1	----	----	D 7474	07 Jun 17 15:33
25	1	Sample	WG1009290-3- T-D5	LC	2.835144	108.906342	3048.789307	-0.009443	----		38.066643	0.981937	1	----	----	D 7474	07 Jun 17 15:35
13	1	QC	CCV7474	Ignore	2.432273	93.570412	5599.997559	-0.016451	Pass		38.066643	0.981937	----	----	----	D 7474	07 Jun 17 15:44
7	1	QC	CCB7474	Ignore	-0.022472	0.126509	-88.029747	-0.055458	Fail		38.066643	0.981937	----	----	----	D 7474	07 Jun 17 15:46
19	1	Sample	WG1009290-1- T-D5	LC	-0.022581	0.122348	3.088112	0.027652	----		38.066643	0.981937	1	----	----	D 7474	07 Jun 17 15:49
20	1	Sample	WG1009290-2- LC	LC	3.236544	124.186302	7699.689941	-0.011303	----		38.066643	0.981937	1	----	----	D 7474	07 Jun 17 15:51

Printed: 6/8/2017 8:22:31 AM

Measured by: _____

Generated by: _____

Signature: _____

Page

Analysis Report - Filename: O:\Metals\Millenium\WG1010776.rsrf

Pos	Runs	Type	Name	ID / Action	Conc	Pk Ht	Pk Area	Baseline	Message	Flag	Slope/ CFm	Intercept	Dilutio Factor	SD	RSD	Cal Method	Date/Time
			T-D10														
21	1	Sample	L1717026-20-T- LC D5		-0.013448	0.470001	-3.822855	-0.190834	----		38.066643	0.981937	1	----	----	D 7474	07 Jun 17 15:54
22	1	Sample	L1717026-21-T- LC D5		-0.002739	0.877660	49.484734	0.039699	----		38.066643	0.981937	1	----	----	D 7474	07 Jun 17 15:56
23	1	Sample	L1717026-22-T- LC D5		-0.008389	0.662582	36.422729	0.060396	----		38.066643	0.981937	1	----	----	D 7474	07 Jun 17 15:59
24	1	Sample	L1717026-23-T- LC D5		-0.001738	0.915768	52.963089	0.031802	----		38.066643	0.981937	1	----	----	D 7474	07 Jun 17 16:01
25	1	Sample	WG1009290-3- LC T-D5		2.554004	98.204292	6226.234375	0.010966	----		38.066643	0.981937	1	----	----	D 7474	07 Jun 17 16:04
26	1	Sample	WG1009290-4- LC T-D5		2.233523	86.004646	5340.187500	-0.039022	----		38.066643	0.981937	1	----	----	D 7474	07 Jun 17 16:06
27	1	Sample	L1717026-24-T- LC D5		-0.022157	0.138481	-84.163116	0.044606	----		38.066643	0.981937	1	----	----	D 7474	07 Jun 17 16:09
28	1	Sample	L1717026-25-T- LC D5		-0.022852	0.112044	1.106012	0.001609	----		38.066643	0.981937	1	----	----	D 7474	07 Jun 17 16:11
13	1	QC	CCV7474	Ignore	2.458013	94.550247	5641.101563	0.003295	Pass		38.066643	0.981937	----	----	----	D 7474	07 Jun 17 16:14
7	1	QC	CCB7474	Ignore	-0.022947	0.108429	-84.331856	-0.011556	Fail		38.066643	0.981937	----	----	----	D 7474	07 Jun 17 16:16
29	1	Sample	L1717026-26-T- LC D5		-0.022012	0.144019	4.855533	0.006639	----		38.066643	0.981937	1	----	----	D 7474	07 Jun 17 16:19
30	1	Sample	L1717026-27-T- LC D5		-0.006382	0.739006	43.712395	-0.005327	----		38.066643	0.981937	1	----	----	D 7474	07 Jun 17 16:21
13	1	QC	CCV7474	Ignore	2.428967	93.444565	5561.677246	0.058545	Pass		38.066643	0.981937	----	----	----	D 7474	07 Jun 17 16:24
7	1	QC	CCB7474	Ignore	-0.022409	0.128895	-80.642693	0.040483	Fail		38.066643	0.981937	----	----	----	D 7474	07 Jun 17 16:26

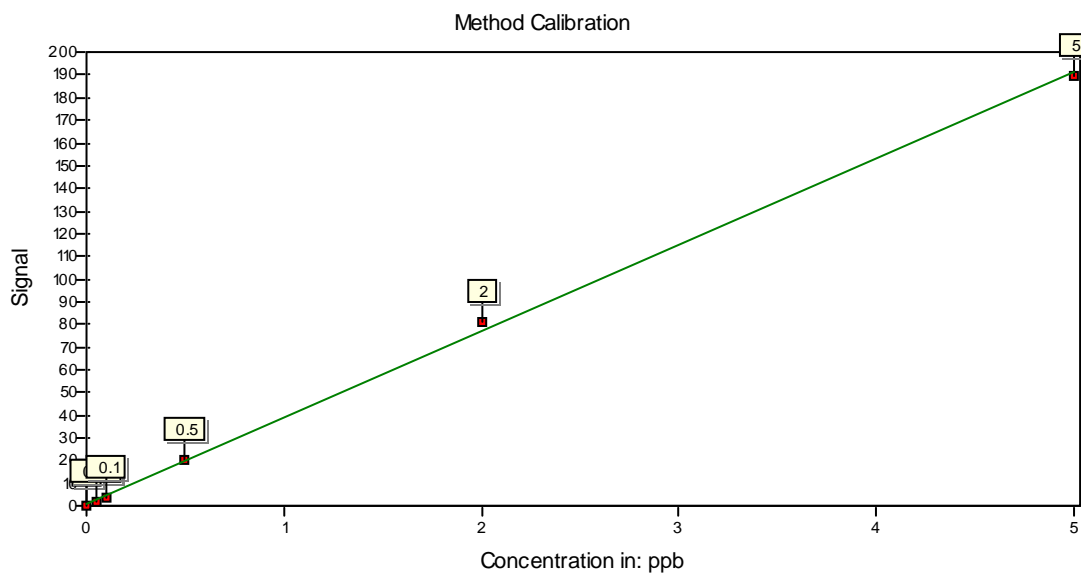
Calibration Report -

General Details

Measured By :
Calibration #: Default
Fit Type : Least Squares
Unit : ppb
Slope : 38.066643
Y Intercept : 0.981937
Correlation Coefficient : 0.999599
Reslope %:
Method Name: 7474

Definition of Standards

<i>Include</i>	<i>Pos</i>	<i>Runs</i>	<i>Conc</i>	<i>Pk Ht</i>	<i>Pk Area</i>	<i>Res %</i>	<i>Res Conc</i>	<i>Date/Time</i>
Yes	7	1	0.00	0.062090	2.051589	0.000000	-0.024164	07 Jun 2017 14:31
Yes	8	1	0.050	2.017330	121.857079	-45.601059	-0.022801	07 Jun 2017 14:34
Yes	9	1	0.100	3.933531	238.578766	-22.462465	-0.022462	07 Jun 2017 14:36
Yes	10	1	0.500	20.127197	1225.137817	0.588119	0.002941	07 Jun 2017 14:39
Yes	11	1	2.000	81.309120	4904.021973	5.508625	0.110173	07 Jun 2017 14:41
Yes	12	1	5.000	189.652176	11757.225586	-0.873718	-0.043686	07 Jun 2017 14:44



Method Set-up Report: C:\Program Files\P S Analytical\Millennium\Methods\7474.mef

Name, Time, Originator/Modifier

Method Title : 7474
Method History : 677
Method Type : Millennium Merlin
Method Name : 7474
Last Modified : 01 Jun 2017
Modified by :

Method Parameters

Unit :	ppb	Idle Actions Active:	Yes
Allow Auto-Range :	No	- Idle After :	6 mins
Gain :	10	- Switch off Pump 1:	Yes
Mode :	Ratio	- Switch off Pump 2 :	Yes
Measurement Mode :	Height	- Switch off Analysis Gas :	Yes
Baseline Check Type :	Units	- Switch off Dryer Gas:	Yes
Baseline Check Value:	1		
Filter Factor :	32	Over Range Action:	Run Blank Wash
Auto Zero:	Yes	- Blank/Wash Sampler Pos:	7
Allow Negative Results:	Yes	- # Repeats:	1
Blank Subtraction:	No	- Blank Pk Height:	1.00

Instrument Parameters

Delay Period (s) : 15
Analysis Period (s) : 60
Memory Period (s) : 60

Pump 1 Speed (%) : 100%
Pump 2 Speed (%) : 100%
Valve Flush : On

Notes

CAL= C060517VH12
ICV= I060517VH12
10% HCl= MW060617A
SnCl2= MW060717Sn02
MERCURYAF2
SEQUENCE REVIEWER

Analysis Report - Filename: O:\Metals\Millenium\WG1012106.rsf

Pos	Runs	Type	Name	ID / Action	Conc	Pk Ht	Pk Area	Baseline	Message	Flag	Slope/ CFm	Intercept	Dilutio Factor	SD	RSD	Cal Method	Date/Time
7	1	Cal	0.00	STD0	0.00	0.093411	3.753709	0.017214	----		0.000000	0.000000	----	----	----	D 7474	12 Jun 17 08:34
8	1	Cal	0.050	STD1	0.050	1.555594	87.376534	0.019407	----		29.243660	0.093411	----	----	----	D 7474	12 Jun 17 08:36
9	1	Cal	0.100	STD2	0.100	3.777467	213.785156	-0.010106	----		36.840561	-0.033204	----	----	----	D 7474	12 Jun 17 08:38
10	1	Cal	0.500	STD3	0.500	18.169138	1064.282593	0.013217	----		36.371689	-0.011497	----	----	----	D 7474	12 Jun 17 08:41
11	1	Cal	2.000	STD4	2.000	79.147720	4617.160156	0.019983	----		39.671650	-0.477308	----	----	----	D 7474	12 Jun 17 08:43
12	1	Cal	5.000	STD5	5.000	197.677643	11406.157227	0.134841	----		39.632835	-0.461703	----	----	----	D 7474	12 Jun 17 08:46
13	1	QC	ICV7474	Ignore	2.544405	100.380264	5689.105957	0.427838	Pass		39.632835	-0.461703	----	----	----	D 7474	12 Jun 17 08:48
7	1	QC	ICB7474	Ignore	0.034280	0.896908	-12.237884	0.196840	Pass		39.632835	-0.461703	----	----	----	D 7474	12 Jun 17 08:51
14	1	Sample	WG1011473-1-T	LC	0.030642	0.752735	43.812279	0.007333	----		39.632835	-0.461703	1	----	----	D 7474	12 Jun 17 08:56
15	1	Sample	WG1011473-2-T	LC	2.475348	97.643333	5659.753906	0.020813	----		39.632835	-0.461703	1	----	----	D 7474	12 Jun 17 08:59
16	1	Sample	L1717026-28-T	LC	0.022130	0.415356	-44.709412	0.212585	----		39.632835	-0.461703	1	----	----	D 7474	12 Jun 17 09:01
17	1	Sample	L1717026-29-T	LC	0.021245	0.380291	18.648354	0.015481	----		39.632835	-0.461703	1	----	----	D 7474	12 Jun 17 09:04
18	1	Sample	L1717285-18-T	LC	0.018636	0.276890	12.076468	0.010424	----		39.632835	-0.461703	1	----	----	D 7474	12 Jun 17 09:06
19	1	Sample	L1718989-01-T	LC	0.025680	0.556088	30.285601	0.012664	----		39.632835	-0.461703	1	----	----	D 7474	12 Jun 17 09:09
20	1	Sample	L1718989-02-T	LC	0.024004	0.489658	26.560635	0.037915	----		39.632835	-0.461703	1	----	----	D 7474	12 Jun 17 09:11
21	1	Sample	WG1011473-4-T	LC	0.027276	0.619327	36.194130	-0.001070	----		39.632835	-0.461703	1	----	----	D 7474	12 Jun 17 09:14
22	1	Sample	WG1011473-3-T	LC	2.773033	109.441460	6422.720703	-0.013891	----		39.632835	-0.461703	1	----	----	D 7474	12 Jun 17 09:16
23	1	Sample	L1718989-03-T	LC	0.087090	2.989939	133.445419	0.080198	----		39.632835	-0.461703	1	----	----	D 7474	12 Jun 17 09:19
13	1	QC	CCV7474	Ignore	2.614271	103.149254	5908.818359	0.003846	Pass		39.632835	-0.461703	----	----	----	D 7474	12 Jun 17 09:21
7	1	QC	CCB7474	Ignore	0.017345	0.225724	-68.798454	0.179901	Pass		39.632835	-0.461703	----	----	----	D 7474	12 Jun 17 09:24
24	1	Sample	L1718989-04-T	LC	0.034134	0.891106	49.590214	0.048231	----		39.632835	-0.461703	1	----	----	D 7474	12 Jun 17 09:26
25	1	Sample	L170989 -05-T	LC	0.025024	0.530055	29.047729	-0.003586	----		39.632835	-0.461703	1	----	----	D 7474	12 Jun 17 09:29
26	1	Sample	L170989 -06-T	LC	0.051943	1.596941	93.571526	0.007920	----		39.632835	-0.461703	1	----	----	D 7474	12 Jun 17 09:31
14	1	Sample	WG1011568-1-T	LC	0.021497	0.390283	20.751535	0.008613	----		39.632835	-0.461703	1	----	----	D 7474	12 Jun 17 09:34
15	1	Sample	WG1011568-2-T	LC	2.606913	102.857635	5854.639160	0.008908	----		39.632835	-0.461703	1	----	----	D 7474	12 Jun 17 09:36
16	1	Sample	L1716835-05-T	LC	0.016787	0.203613	-66.538597	0.191790	----		39.632835	-0.461703	1	----	----	D 7474	12 Jun 17 09:39
13	1	QC	CCV7474	Ignore	2.555085	100.803566	5782.465332	-0.001704	Pass		39.632835	-0.461703	----	----	----	D 7474	12 Jun 17 09:41
7	1	QC	CCB7474	Ignore	0.017654	0.237961	-72.529694	0.127006	Pass		39.632835	-0.461703	----	----	----	D 7474	12 Jun 17 09:43

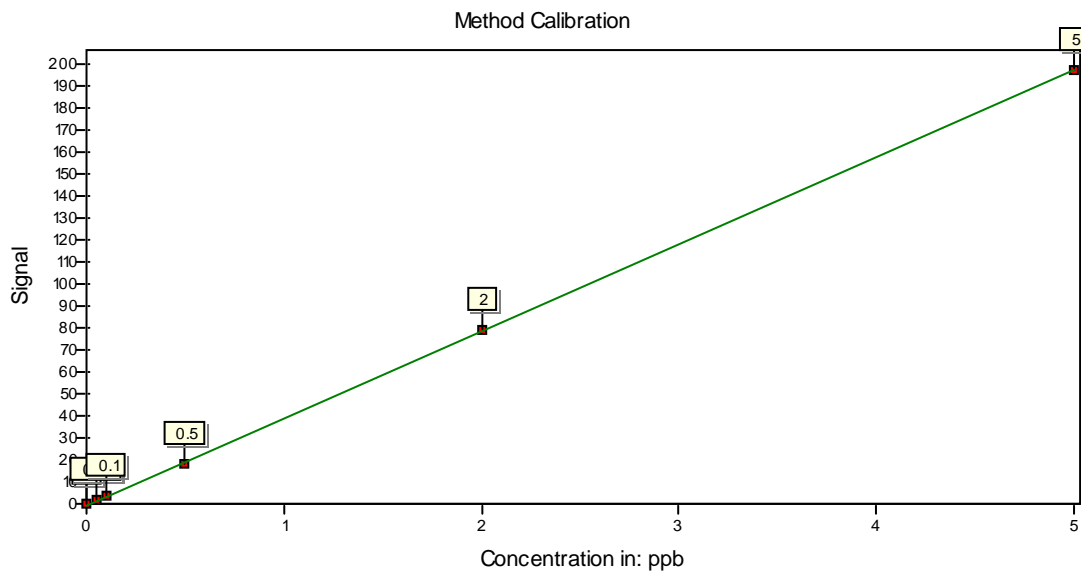
Calibration Report -

General Details

Measured By :
Calibration #: Default
Fit Type : Least Squares
Unit : ppb
Slope : 39.632835
Y Intercept : -0.461703
Correlation Coefficient : 0.999969
Reslope %:
Method Name: 7474

Definition of Standards

<i>Include</i>	<i>Pos</i>	<i>Runs</i>	<i>Conc</i>	<i>Pk Ht</i>	<i>Pk Area</i>	<i>Res %</i>	<i>Res Conc</i>	<i>Date/Time</i>
Yes	7	1	0.00	0.093411	3.753709	0.000000	0.014006	12 Jun 2017 08:34
Yes	8	1	0.050	1.555594	87.376534	1.799267	0.000900	12 Jun 2017 08:36
Yes	9	1	0.100	3.777467	213.785156	6.961053	0.006961	12 Jun 2017 08:38
Yes	10	1	0.500	18.169138	1064.282593	-5.982801	-0.029914	12 Jun 2017 08:41
Yes	11	1	2.000	79.147720	4617.160156	0.433671	0.008673	12 Jun 2017 08:43
Yes	12	1	5.000	197.677643	11406.157227	-0.012531	-0.000627	12 Jun 2017 08:46



Method Set-up Report: C:\Program Files\P S Analytical\Millennium\Methods\7474.mef

Name, Time, Originator/Modifier

Method Title : 7474
Method History : 679
Method Type : Millennium Merlin
Method Name : 7474
Last Modified : 01 Jun 2017
Modified by :

Method Parameters

Unit :	ppb	Idle Actions Active:	Yes
Allow Auto-Range :	No	- Idle After :	6 mins
Gain :	10	- Switch off Pump 1:	Yes
Mode :	Ratio	- Switch off Pump 2 :	Yes
Measurement Mode :	Height	- Switch off Analysis Gas :	Yes
Baseline Check Type :	Units	- Switch off Dryer Gas:	Yes
Baseline Check Value:	1		
Filter Factor :	32	Over Range Action:	Run Blank Wash
Auto Zero:	Yes	- Blank/Wash Sampler Pos:	7
Allow Negative Results:	Yes	- # Repeats:	1
Blank Subtraction:	No	- Blank Pk Height:	1.00

Instrument Parameters

Delay Period (s) : 15
Analysis Period (s) : 60
Memory Period (s) : 60

Pump 1 Speed (%) : 100%
Pump 2 Speed (%) : 100%
Valve Flush : On

Notes

CAL= C060117V1
ICV= I060117V1
10% HCl= MW060617A
SnCl2= MW060917Sn02
MERCURYAF2
SEQUENCE REVIEWER

Work Group

ALPHA ANALYTICAL LABORATORIES, INC.

Alpha WORK GROUP REPORT (wk02)

Jun 14 2017, 03:09 pm

Work Group: WG1008096 for Department: 5 Inorganics Preparation

Created: 30-MAY-17 Due: Operator: ca

Sample	Client ID	C Product	Matrix	Stat	UA	HOLD	DUE	PR	Location
L1717026-01	VC88-D0-3E	C A2-HG-7474T	SOIL	DONE	U	0616	0615	S0	Glass-A.25
L1717026-02	VC88-D3-6E	C A2-HG-7474T	SOIL	DONE	U	0616	0615	S0	Glass-A.25
L1717026-03	VC88-D6-9E	C A2-HG-7474T	SOIL	DONE	U	0616	0615	S0	Glass-A.25
L1717026-04	VC88-D9-10E	C A2-HG-7474T	SOIL	DONE	U	0616	0615	S0	Glass-A.25
L1717026-05	VC89-D0-3E	C A2-HG-7474T	SOIL	DONE	U	0616	0615	S0	Glass-A.25
L1717026-06	VC89-D3-6E	C A2-HG-7474T	SOIL	DONE	U	0616	0615	S0	Glass-A.25
L1717026-07	VC89-D6-9E	C A2-HG-7474T	SOIL	DONE	U	0616	0615	S0	Glass-A.25
L1717026-08	VC89-D9-10E	C A2-HG-7474T	SOIL	DONE	U	0616	0615	S0	Glass-A.25
L1717026-09	DUP-D9-10E	C A2-HG-7474T	SOIL	DONE	U	0616	0615	S0	Glass-A.25
L1717026-10	DUP-D0-3E	C A2-HG-7474T	SOIL	DONE	U	0616	0615	S0	Glass-A.25
L1717026-11	VC90-D0-3E	C A2-HG-7474T	SOIL	DONE	U	0616	0615	S0	Glass-A.25
L1717026-12	VC90-D3-6E	C A2-HG-7474T	SOIL	DONE	U	0616	0615	S0	Glass-A.25
L1717026-13	VC90-D6-9E	C A2-HG-7474T	SOIL	DONE	U	0616	0615	S0	Glass-A.25
L1717026-14	VC90-D9-10E	C A2-HG-7474T	SOIL	DONE	U	0616	0615	S0	Glass-A.25
L1717026-15	VC91-D0-3E	C A2-HG-7474T	SOIL	DONE	U	0616	0615	S0	Glass-A.25
L1717026-16	VC91-D3-6E	C A2-HG-7474T	SOIL	DONE	U	0616	0615	S0	Glass-A.25
L1717026-17	VC91-D6-9.6E	C A2-HG-7474T	SOIL	DONE	U	0616	0615	S0	Glass-A.25
L1717026-18	DUP-D6-9E	C A2-HG-7474T	SOIL	DONE	U	0616	0615	S0	Glass-A.25
L1717026-19	VC92-D0-3E	C A2-HG-7474T	SOIL	DONE	U	0616	0615	S0	Glass-A.25
WG1008096-1	Laboratory Method Bl	S A2-HG-7474T	SOIL	DONE	U				
WG1008096-10	Cal Standard 3	S A2-HG-7474T	SOIL	DONE	U				
WG1008096-11	Cal Standard 4	S A2-HG-7474T	SOIL	DONE	U				
WG1008096-12	Cal Standard 5	S A2-HG-7474T	SOIL	DONE	U				
WG1008096-13	Initial Calibration	S A2-HG-7474T	SOIL	DONE	U				
WG1008096-14	Initial Calibration	S A2-HG-7474T	SOIL	DONE	U				
WG1008096-2	Laboratory Control S	S A2-HG-7474T	SOIL	DONE	U				
WG1008096-3	Matrix Spike	S A2-HG-7474T	SOIL	DONE	U				
WG1008096-4	Matrix Spike Duplica	S A2-HG-7474T	SOIL	DONE	U				
WG1008096-5	Post Digestion Spike	S A2-HG-7474T	SOIL	DONE	U				
WG1008096-6	Serial Dilution	S A2-HG-7474T	SOIL	DONE	U				
WG1008096-7	Calibration Blank	S A2-HG-7474T	SOIL	DONE	U				
WG1008096-8	Cal Standard 1	S A2-HG-7474T	SOIL	DONE	U				
WG1008096-9	Cal Standard 2	S A2-HG-7474T	SOIL	DONE	U				
Comments:									
WG1008096-10	L1717026-05								
WG1008096-11	L1717026-05								
WG1008096-12	L1717026-05								
WG1008096-13	L1717026-05								
WG1008096-14	L1717026-05								
WG1008096-3	L1717026-05								
WG1008096-4	L1717026-05								
WG1008096-5	L1717026-05								
WG1008096-6	L1717026-05								
WG1008096-7	L1717026-05								
WG1008096-8	L1717026-05								
WG1008096-9	L1717026-05								

ALPHA ANALYTICAL LABORATORIES, INC.

Alpha WORK GROUP REPORT (wk02)

Jun 14 2017, 03:09 pm

Work Group: WG1009290 for Department: 5 Inorganics Preparation

Created: 02-JUN-17 Due: Operator: CA

Sample	Client ID	C Product	Matrix	Stat	UA	HOLD	DUE	PR	Location
L1717026-20	VC92-D3-6E	C A2-HG-7474T	SOIL	DONE	U	0616	0615	S0	Glass-A.25
L1717026-21	VC92-D6-9E	C A2-HG-7474T	SOIL	DONE	U	0616	0615	S0	Glass-A.25
L1717026-22	VC92-D9-10E	C A2-HG-7474T	SOIL	DONE	U	0616	0615	S0	Glass-A.25
L1717026-23	VC93-D0-3E	C A2-HG-7474T	SOIL	DONE	U	0617	0615	S0	Glass-A.25
L1717026-24	VC93-D3-6E	C A2-HG-7474T	SOIL	DONE	U	0617	0615	S0	Glass-A.25
L1717026-25	VC93-D6-9E	C A2-HG-7474T	SOIL	DONE	U	0617	0615	S0	Glass-A.25
L1717026-26	VC93-D9-10E	C A2-HG-7474T	SOIL	DONE	U	0617	0615	S0	Glass-A.25
L1717026-27	DUP-D3-6E	C A2-HG-7474T	SOIL	DONE	U	0616	0615	S0	Glass-A.25
WG1009290-1	Laboratory Method Bl	S A2-HG-7474T	SOIL	DONE	U				
WG1009290-10	Cal Standard 4	S A2-HG-7474T	SOIL	DONE	U				
WG1009290-11	Cal Standard 5	S A2-HG-7474T	SOIL	DONE	U				
WG1009290-12	Initial Calibration	S A2-HG-7474T	SOIL	DONE	U				
WG1009290-13	Initial Calibration	S A2-HG-7474T	SOIL	DONE	U				
WG1009290-2	Laboratory Control S	S A2-HG-7474T	SOIL	DONE	U				
WG1009290-3	Matrix Spike	S A2-HG-7474T	SOIL	DONE	U				
WG1009290-4	Matrix Spike Duplica	S A2-HG-7474T	SOIL	DONE	U				
WG1009290-5	Serial Dilution	S A2-HG-7474T	SOIL	DONE	U				
WG1009290-6	Calibration Blank	S A2-HG-7474T	SOIL	DONE	U				
WG1009290-7	Cal Standard 1	S A2-HG-7474T	SOIL	DONE	U				
WG1009290-8	Cal Standard 2	S A2-HG-7474T	SOIL	DONE	U				
WG1009290-9	Cal Standard 3	S A2-HG-7474T	SOIL	DONE	U				
Comments:									
WG1009290-3	L1717026-23								
WG1009290-4	L1717026-23								
WG1009290-5	L1717026-23								

ALPHA ANALYTICAL LABORATORIES, INC.

Alpha WORK GROUP REPORT (wk02)

Jun 14 2017, 03:09 pm

Work Group: WG1011473 for Department: 5 Inorganics Preparation

Created: 09-JUN-17 Due: Operator: CA

Sample	Client ID	C Product	Matrix	Stat	UA	HOLD	DUE	PR	Location
L1717026-28	RINSE2	C A2-HG-7474T	WATER	DONE	U	0621	0615	S0	Plastic-C.25
L1717026-29	RINSE1	C A2-HG-7474T	WATER	DONE	U	0616	0615	S0	Plastic-C.25
L1717285-18	BLANK	C A2-HG-7474T	WATER	DONE	U	0622	0616	S0	Plastic-C.25
L1718989-01	UC-500-NS-E	S A2-HG-7474T	WATER	DONE	U	0705	0621	S0	Plastic-C.25
L1718989-02	UC-500-MID-E	S A2-HG-7474T	WATER	DONE	U	0705	0621	S0	Plastic-C.25
L1718989-03	UC-500-NB-E	S A2-HG-7474T	WATER	DONE	U	0705	0621	S0	Plastic-C.25
L1718989-04	DC-500-NS-E	S A2-HG-7474T	WATER	DONE	U	0705	0621	S0	Plastic-C.25
L1718989-05	DC-500-MID-E	S A2-HG-7474T	WATER	DONE	U	0705	0621	S0	Plastic-C.25
L1718989-06	DC-500-NB-E	S A2-HG-7474T	WATER	DONE	U	0705	0621	S0	Plastic-C.25
WG1011473-1	Laboratory Method Bl	S A2-HG-7474T	WATER	DONE	U				
WG1011473-10	Cal Standard 4	S A2-HG-7474T	WATER	DONE	U				
WG1011473-11	Cal Standard 5	S A2-HG-7474T	WATER	DONE	U				
WG1011473-12	Initial Calibration	S A2-HG-7474T	WATER	DONE	U				
WG1011473-13	Initial Calibration	S A2-HG-7474T	WATER	DONE	U				
WG1011473-2	Laboratory Control S	S A2-HG-7474T	WATER	DONE	U				
WG1011473-3	Matrix Spike	S A2-HG-7474T	WATER	DONE	U				
WG1011473-4	Duplicate Sample	S A2-HG-7474T	WATER	DONE	U				
WG1011473-5	Serial Dilution	S A2-HG-7474T	WATER	DONE	U				
WG1011473-6	Calibration Blank	S A2-HG-7474T	WATER	DONE	U				
WG1011473-7	Cal Standard 1	S A2-HG-7474T	WATER	DONE	U				
WG1011473-8	Cal Standard 2	S A2-HG-7474T	WATER	DONE	U				
WG1011473-9	Cal Standard 3	S A2-HG-7474T	WATER	DONE	U				
Comments:									
WG1011473-3	L1718989-02								
WG1011473-4	L1718989-02								
WG1011473-5	L1718989-02								

Sample Preparation



METALS ELN REPORT

Workgroup: WG1009290

Digestion

Prep Method	Acid Type 1	Acid 1 Lot	Acid Type 2	Acid 2 Lot	Spike Type	Lims Spike Lot	Spike Lot	Srm Spikelot Use	Srm For	Pipette Id
EPA 7474	HNO3	MS051717A	BrCl	MW00217A	METALS	HPHGAF	I051717V	D091-540	Y	WHG-25

Additional Reagent/Std	HCl	MS051017A
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Sample/ Type	Digestion Date	Analyst	Sample Weight g	Balance Id	Spike Amt ml	Start Date/Time	Hot Block Unit	Temperature (C)	Stop Date/Time	Reaction Start	Reaction Stop	Final Vol	Comments
L1717026-20 SOIL	06/02/17 11:40	Camilla Akbas	0.94	14621306		06/02/17 11:47	002082	95.1	06/02/17 12:17	06/05/17 08:00	06/07/17 08:00	50	
L1717026-21 SOIL	06/02/17 11:40	Camilla Akbas	0.98	14621306		06/02/17 11:47	002082	95.1	06/02/17 12:17	06/05/17 08:00	06/07/17 08:00	50	
L1717026-22 SOIL	06/02/17 11:40	Camilla Akbas	0.88	14621306		06/02/17 11:47	002082	95.1	06/02/17 12:17	06/05/17 08:00	06/07/17 08:00	50	
L1717026-23 SOIL	06/02/17 11:40	Camilla Akbas	0.85	14621306		06/02/17 11:47	002082	95.1	06/02/17 12:17	06/05/17 08:00	06/07/17 08:00	50	
L1717026-24 SOIL	06/02/17 11:40	Camilla Akbas	0.86	14621306		06/02/17 11:47	002082	95.1	06/02/17 12:17	06/05/17 08:00	06/07/17 08:00	50	
L1717026-25 SOIL	06/02/17 11:40	Camilla Akbas	0.91	14621306		06/02/17 11:47	002082	95.1	06/02/17 12:17	06/05/17 08:00	06/07/17 08:00	50	
L1717026-26 SOIL	06/02/17 11:40	Camilla Akbas	0.91	14621306		06/02/17 11:47	002082	95.1	06/02/17 12:17	06/05/17 08:00	06/07/17 08:00	50	
L1717026-27 SOIL	06/02/17 11:40	Camilla Akbas	1.15	14621306		06/02/17 11:47	002082	95.1	06/02/17 12:17	06/05/17 08:00	06/07/17 08:00	50	
WG1009290-1 BLANK	06/02/17 11:40	Camilla Akbas	1	14621306		06/02/17 11:47	002082	95.1	06/02/17 12:17	06/05/17 08:00	06/07/17 08:00	50	
WG1009290-2 LCS	06/02/17 11:40	Camilla Akbas	0.159	14621306	0.159	06/02/17 11:47	002082	95.1	06/02/17 12:17	06/05/17 08:00	06/07/17 08:00	50	
WG1009290-3 MS	06/02/17 11:40	Camilla Akbas	0.83	14621306	0.625	06/02/17 11:47	002082	95.1	06/02/17 12:17	06/05/17 08:00	06/07/17 08:00	50	
WG1009290-4 MSD	06/02/17 11:40	Camilla Akbas	0.87	14621306	0.625	06/02/17 11:47	002082	95.1	06/02/17 12:17	06/05/17 08:00	06/07/17 08:00	50	



METALS ELN REPORT

Workgroup: WG1009290

Sample/ Type	Digestion Date	Analyst	Sample Weight g	Balance Id	Spike Amt ml	Start Date/Time	Hot Block Unit	Temperature (C)	Stop Date/Time	Reaction Start	Reaction Stop	Final Vol	Comments
WG1009290-5 SERDIL	06/02/17 11:40	Camilla Akbass	0.85	14621306		06/02/17 11:47	002082	95.1	06/02/17 12:17	06/05/17 08:00	06/07/17 08:00	50	
WG1009290-6 CALBLANK	06/02/17 11:40	Camilla Akbass	1	14621306		06/02/17 11:47	002082	95.1	06/02/17 12:17	06/05/17 08:00	06/07/17 08:00	50	
WG1009290-7 STD1	06/02/17 11:40	Camilla Akbass	1	14621306		06/02/17 11:47	002082	95.1	06/02/17 12:17	06/05/17 08:00	06/07/17 08:00	50	
WG1009290-8 STD2	06/02/17 11:40	Camilla Akbass	1	14621306		06/02/17 11:47	002082	95.1	06/02/17 12:17	06/05/17 08:00	06/07/17 08:00	50	
WG1009290-9 STD3	06/02/17 11:40	Camilla Akbass	1	14621306		06/02/17 11:47	002082	95.1	06/02/17 12:17	06/05/17 08:00	06/07/17 08:00	50	
WG1009290-10 STD4	06/02/17 11:40	Camilla Akbass	1	14621306		06/02/17 11:47	002082	95.1	06/02/17 12:17	06/05/17 08:00	06/07/17 08:00	50	
WG1009290-11 STD5	06/02/17 11:40	Camilla Akbass	1	14621306		06/02/17 11:47	002082	95.1	06/02/17 12:17	06/05/17 08:00	06/07/17 08:00	50	
WG1009290-12 ICB	06/02/17 11:40	Camilla Akbass	1	14621306		06/02/17 11:47	002082	95.1	06/02/17 12:17	06/05/17 08:00	06/07/17 08:00	50	
WG1009290-13 ICV	06/02/17 11:40	Camilla Akbass	1	14621306		06/02/17 11:47	002082	95.1	06/02/17 12:17	06/05/17 08:00	06/07/17 08:00	50	

Reagent	Actual Volume	Units
Hydrochloric Acid (HCl)	3.75	ml
Nitric Acid (HNO3)	1.25	ml
Bromine Chloride (BrCl)	2	ml



METALS ELN REPORT

Workgroup: WG1008096

Digestion

Prep Method	Acid Type 1	Acid 1 Lot	Acid Type 2	Acid 2 Lot	Spike Type	Lims Spike Lot	Spike Lot	Srm Spikelot	Use Srm For	Pipette Id
EPA 7474	HNO3	MS051717A	BrCl	MW053017A	METALS	HPHGAF	I051717V	D091-540	Y	WHG-5; 129

Additional Reagent/Std	HCl	MS051017A
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Sample/ Type	Digestion Date	Analyst	Sample Weight g	Balance Id	Spike Amt ml	Start Date/Time	Hot Block Unit	Temperature (C)	Stop Date/Time	Reaction Start	Reaction Stop	Final Vol	Comments
L1717026-01 SOIL	05/30/17 13:50	Camilla Akbas	0.92	14621306		05/30/17 15:33	002082	94.8	05/30/17 16:06	05/31/17 11:43	06/06/17 09:02	50	
L1717026-02 SOIL	05/30/17 13:50	Camilla Akbas	1.14	14621306		05/30/17 15:33	002082	94.8	05/30/17 16:06	05/31/17 11:43	06/06/17 09:02	50	
L1717026-03 SOIL	05/30/17 13:50	Camilla Akbas	1.06	14621306		05/30/17 15:33	002082	94.8	05/30/17 16:06	05/31/17 11:43	06/06/17 09:02	50	
L1717026-04 SOIL	05/30/17 13:50	Camilla Akbas	0.91	14621306		05/30/17 15:33	002082	94.8	05/30/17 16:06	05/31/17 11:43	06/06/17 09:02	50	
L1717026-05 SOIL	05/30/17 13:50	Camilla Akbas	0.92	14621306		05/30/17 15:33	002082	94.8	05/30/17 16:06	05/31/17 11:43	06/06/17 09:02	50	
L1717026-06 SOIL	05/30/17 13:50	Camilla Akbas	1.026	25		05/30/17 15:33	002082	94.8	05/30/17 16:06	05/31/17 11:43	06/06/17 09:02	50	
L1717026-07 SOIL	05/30/17 13:50	Camilla Akbas	0.878	25		05/30/17 15:33	002082	94.8	05/30/17 16:06	05/31/17 11:43	06/06/17 09:02	50	
L1717026-08 SOIL	05/30/17 13:50	Camilla Akbas	0.959	25		05/30/17 15:33	002082	94.8	05/30/17 16:06	05/31/17 11:43	06/06/17 09:02	50	
L1717026-09 SOIL	05/30/17 13:50	Camilla Akbas	0.894	25		05/30/17 15:33	002082	94.8	05/30/17 16:06	05/31/17 11:43	06/06/17 09:02	50	
L1717026-10 SOIL	05/30/17 13:50	Camilla Akbas	1.088	25		05/30/17 15:33	002082	94.8	05/30/17 16:06	05/31/17 11:43	06/06/17 09:02	50	
L1717026-11 SOIL	05/30/17 13:50	Camilla Akbas	1.184	25		05/30/17 15:33	002082	94.8	05/30/17 16:06	05/31/17 11:43	06/06/17 09:02	50	
L1717026-12 SOIL	05/30/17 13:50	Camilla Akbas	0.915	25		05/30/17 15:33	002082	94.8	05/30/17 16:06	05/31/17 11:43	06/06/17 09:02	50	
L1717026-13 SOIL	05/30/17 13:50	Camilla Akbas	0.997	25		05/30/17 15:33	002082	94.8	05/30/17 16:06	05/31/17 11:43	06/06/17 09:02	50	



METALS ELN REPORT

Workgroup: WG1008096

Sample/ Type	Digestion Date	Analyst	Sample Weight g	Balance Id	Spike Amt ml	Start Date/Time	Hot Block Unit	Temperature (C)	Stop Date/Time	Reaction Start	Reaction Stop	Final Vol	Comments
L1717026-14 SOIL	05/30/17 13:50	Camilla Akbass	0.898	25		05/30/17 15:33	002082	94.8	05/30/17 16:06	05/31/17 11:43	06/06/17 09:02	50	
L1717026-15 SOIL	05/30/17 13:50	Camilla Akbass	0.970	25		05/30/17 15:33	002082	94.8	05/30/17 16:06	05/31/17 11:43	06/06/17 09:02	50	
L1717026-16 SOIL	05/30/17 13:50	Camilla Akbass	1.150	25		05/30/17 15:33	002082	94.8	05/30/17 16:06	05/31/17 11:43	06/06/17 09:02	50	
L1717026-17 SOIL	05/30/17 13:50	Camilla Akbass	1.134	25		05/30/17 15:33	002082	94.8	05/30/17 16:06	05/31/17 11:43	06/06/17 09:02	50	
L1717026-18 SOIL	05/30/17 13:50	Camilla Akbass	0.942	25		05/30/17 15:33	002082	94.8	05/30/17 16:06	05/31/17 11:43	06/06/17 09:02	50	
L1717026-19 SOIL	05/30/17 13:50	Camilla Akbass	0.997	25		05/30/17 15:33	002082	94.8	05/30/17 16:06	05/31/17 11:43	06/06/17 09:02	50	
WG1008096-1 BLANK	05/30/17 13:50	Camilla Akbass	1	14621306		05/30/17 15:33	002082	94.8	05/30/17 16:06	05/31/17 11:43	06/06/17 09:02	50	
WG1008096-2 LCS	05/30/17 13:50	Camilla Akbass	0.158	25	0.158	05/30/17 15:33	002082	94.8	05/30/17 16:06	05/31/17 11:43	06/06/17 09:02	50	
WG1008096-3 MS	05/30/17 13:50	Camilla Akbass	0.923	14621306	0.625	05/30/17 15:33	002082	94.8	05/30/17 16:06	05/31/17 11:43	06/06/17 09:02	50	
WG1008096-4 MSD	05/30/17 13:50	Camilla Akbass	1.059	14621306	0.625	05/30/17 15:33	002082	94.8	05/30/17 16:06	05/31/17 11:43	06/06/17 09:02	50	
WG1008096-5 PS	05/30/17 13:50	Camilla Akbass	0.92	14621306		05/30/17 15:33	002082	94.8	05/30/17 16:06	05/31/17 11:43	06/06/17 09:02	50	
WG1008096-6 SERDIL	05/30/17 13:50	Camilla Akbass	0.92	14621306		05/30/17 15:33	002082	94.8	05/30/17 16:06	05/31/17 11:43	06/06/17 09:02	50	
WG1008096-7 CALBLANK	05/30/17 13:50	Camilla Akbass	1	14621306		05/30/17 15:33	002082	94.8	05/30/17 16:06	05/31/17 11:43	06/06/17 09:02	50	
WG1008096-8 STD1	05/30/17 13:50	Camilla Akbass	1	14621306		05/30/17 15:33	002082	94.8	05/30/17 16:06	05/31/17 11:43	06/06/17 09:02	50	

METALS ELN REPORT

Workgroup: WG1008096

Sample/ Type	Digestion Date	Analyst	Sample Weight g	Balance Id	Spike Amt ml	Start Date/Time	Hot Block Unit	Temperature (C)	Stop Date/Time	Reaction Start	Reaction Stop	Final Vol	Comments
WG1008096-9	05/30/17 13:50	Camilla Akbass	1	14621306		05/30/17 15:33	002082	94.8	05/30/17 16:06	05/31/17 11:43	06/06/17 09:02	50	
STD2													
WG1008096-10	05/30/17 13:50	Camilla Akbass	1	14621306		05/30/17 15:33	002082	94.8	05/30/17 16:06	05/31/17 11:43	06/06/17 09:02	50	
STD3													
WG1008096-11	05/30/17 13:50	Camilla Akbass	1	14621306		05/30/17 15:33	002082	94.8	05/30/17 16:06	05/31/17 11:43	06/06/17 09:02	50	
STD4													
WG1008096-12	05/30/17 13:50	Camilla Akbass	1	14621306		05/30/17 15:33	002082	94.8	05/30/17 16:06	05/31/17 11:43	06/06/17 09:02	50	
STD5													
WG1008096-13	05/30/17 13:50	Camilla Akbass	1	14621306		05/30/17 15:33	002082	94.8	05/30/17 16:06	05/31/17 11:43	06/06/17 09:02	50	
ICB													
WG1008096-14	05/30/17 13:50	Camilla Akbass	1	14621306		05/30/17 15:33	002082	94.8	05/30/17 16:06	05/31/17 11:43	06/06/17 09:02	50	
ICV													

Reagent	Actual Volume	Units
Hydrochloric Acid (HCl)	3.75	ml
Nitric Acid (HNO3)	1.25	ml
Bromine Chloride (BrCl)	2	ml



METALS ELN REPORT

Workgroup: WG1011473

Digestion

Prep Method	Acid Type	1	Acid 1 Lot	Spike Type	Lims Spike Lot	Spike Lot	Pipette Id
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EPA 7474	BrCl		MW053017A METALS	HPHGAF	I051717B	WHG-25	
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Additional Reagent/Std

Sample/ Type	Digestion Date	Analyst	Sample Vol ml	Spike Amt ml	Reaction Start	Reaction Stop	Final Vol	Comments
L1716835-05	06/09/17 11:26	Camilla Akbass	25		06/09/17 11:26		25	LIMITED VOLUME
L1717026-28 WATER	06/09/17 11:26	Camilla Akbass	50		06/09/17 11:26	06/12/17 08:00	50	
L1717026-29 WATER	06/09/17 11:26	Camilla Akbass	50		06/09/17 11:26	06/12/17 08:00	50	
L1717285-18 SAMP	06/09/17 11:26	Camilla Akbass	50		06/09/17 11:26	06/12/17 08:00	50	
L1718989-01 WATER	06/09/17 10:51	Camilla Akbass	50		06/09/17 10:51	06/12/17 08:00	50	
L1718989-02 WATER	06/09/17 10:51	Camilla Akbass	50		06/09/17 10:51	06/12/17 08:00	50	
L1718989-03 WATER	06/09/17 10:51	Camilla Akbass	50		06/09/17 10:51	06/12/17 08:00	50	
L1718989-04 WATER	06/09/17 10:51	Camilla Akbass	50		06/09/17 10:51	06/12/17 08:00	50	
L1718989-05 WATER	06/09/17 10:51	Camilla Akbass	50		06/09/17 10:51	06/12/17 08:00	50	
L1718989-06 WATER	06/09/17 10:51	Camilla Akbass	50		06/09/17 10:51	06/12/17 08:00	50	
WG1011473- 1 BLANK	06/09/17 10:51	Camilla Akbass	50		06/09/17 10:51	06/12/17 08:00	50	
WG1011473- 2 LCS	06/09/17 10:51	Camilla Akbass	50	0.125	06/09/17 10:51	06/12/17 08:00	50	
WG1011473- 3 MS	06/09/17 10:51	Camilla Akbass	50	0.125	06/09/17 10:51	06/12/17 08:00	50	



METALS ELN REPORT

Workgroup: WG1011473

Sample/ Type	Digestion Date	Analyst	Sample Vol ml	Spike Amt ml	Reaction Start	Reaction Stop	Final Vol	Comments
WG1011473-4 DUP	06/09/17 10:51	Camilla Akbab	50		06/09/17 10:51	06/12/17 08:00	50	
WG1011473-5 SERDIL	06/09/17 10:51	Camilla Akbab	50		06/09/17 10:51	06/12/17 08:00	50	
WG1011473-6 CALBLANK	06/09/17 10:51	Camilla Akbab	50		06/09/17 10:51	06/12/17 08:00	50	
WG1011473-7 STD1	06/09/17 10:51	Camilla Akbab	50		06/09/17 10:51	06/12/17 08:00	50	
WG1011473-8 STD2	06/09/17 10:51	Camilla Akbab	50		06/09/17 10:51	06/12/17 08:00	50	
WG1011473-9 STD3	06/09/17 10:51	Camilla Akbab	50		06/09/17 10:51	06/12/17 08:00	50	
WG1011473-10 STD4	06/09/17 10:51	Camilla Akbab	50		06/09/17 10:51	06/12/17 08:00	50	
WG1011473-11 STD5	06/09/17 10:51	Camilla Akbab	50		06/09/17 10:51	06/12/17 08:00	50	
WG1011473-12 ICB	06/09/17 10:51	Camilla Akbab	50		06/09/17 10:51	06/12/17 08:00	50	
WG1011473-13 ICV	06/09/17 10:51	Camilla Akbab	50		06/09/17 10:51	06/12/17 08:00	50	



METALS ELN REPORT

Workgroup: WG1011473

Reagent	Actual Volume	Units
Hydrochloric Acid (HCl)	0	ml
Nitric Acid (HNO3)	0	ml
Bromine Chloride (BrCl)	.25	ml

True Values

Table IV: Initial Calibration Levels and ICV/CCV Concentrations

Analyte	STD1	STD2	ICV,CCV
	(µg/L)	(µg/L)	(µg/L)
Ag		100	50
Al	10050		5050
As	100		50
B	100		50
Ba		100	50
Be	100		50
Ca	10100		5050
Cd	100		50
Co	100		50
Cr	100		50
Cu	100		50
Fe	10100		5050
K	10000		5500
Mg	10100		5050
Mn	100		50
Mo	100		50
Na	10000		5050
Ni	100		50
Pb	100		50
Sb	100		50
Se	100		50
Si	50		25
Sn	100		50
Sr	100		50
Ti	100		50
Tl	100		50
V	100		50
Zn	100		50
W	1	100	50

Interferent ICSA, ICSAB	(mg/L)
Cl ⁻	2000
Ca	300
Fe, Na	250
Al, Mg, P, K, S	100
C	200
Mo, Ti	2

All analyte concentrations in ICSAB = 100 ppb except for Ag and Ba = 50 ppb

Table IV: Initial Calibration Levels and ICV/CCV Concentrations (MCP)

Analyte	STD1	STD2	STD3	STD4	STD5	ICV,CCV
			(µg/L)	(µg/L)		(µg/L)
Ag	0.2		10		100	50
Al	10	10000		20000		10100
As	0.5	100		1000		100
B	1	100		1000		100
Ba	1	100		1000		100
Be	0.3	100		1000		100
Ca	100	10000		20000		10100
Cd	0.2	100		1000		100
Co	0.2	100		1000		100
Cr	0.5	100		1000		100
Cu	0.5	100		1000		100
Fe	10	10000		20000		10100
K	100	10000		20000		11000
Mg	100	10000		20000		10100
Mn	10	100		1000		100
Mo	1	100		1000		100
Na	100	10000		20000		10100
Ni	0.5	100		1000		100
Pb	0.2	100		1000		100
Sb	0.5	10		100		50
Se	1	100		1000		100
Si	10	100		1000		25
Sn	1	100		1000		100
Sr	5	100		1000		100
Ti	5	100		1000		100
Tl	0.2	100		1000		100
V	5	100		1000		100
Zn	10	100		1000		100
W	5	100		1000		100

Interferent ICSA, ICSAB	(mg/L)
Cl ⁻	2000
Ca	300
Fe, Na	250
Al, Mg, P, K, S	100
C	200
Mo, Ti	2

All analyte concentrations in ICSAB = 100 ppb except for Ag and Ba = 50 ppb

Analyte	LCS,MS Water	LCS,MS soil	LCS,MS Tissue
	(µg/L)	(µg/L)	(µg/L)
Ag	20	40	40
Al	5000	20000	10000
As	1000	4000	2000
B	1000	4000	2000
Ba	1000	4000	2000
Be	500	2000	1000
Ca	5000	4000	10000
Cd	500	2000	1000
Co	1000	4000	2000
Cr	1000	4000	2000
Cu	1000	4000	2000
Fe	5000	20000	10000
K	5000	20000	10000
Mg	5000	20000	10000
Mn	1000	4000	2000
Mo	1000	4000	2000
Na	5000	20000	10000
Ni	1000	4000	2000
Pb	1000	4000	2000
Sb	20	40	40
Se	1000	4000	2000
Si	1000	4000	2000
Sn	250	1000	500
Sr	1000	4000	2000
Ti	1000	4000	2000
Tl	1000	4000	2000
V	1000	4000	2000
Zn	1000	4000	2000
W	100	200	200

Mercury: ICV, CCV, LCS and MS = 2.5 ppb.

Arsenic Hydride, Selenium Hydride: ICV, CCV, LCS and MS = 5 ppb.

Mercury by Method 1631: ICV,CCV = 0.005 ppb, LCS, MS = 0.005 ppb.

ICPMS Analysis

Sequence Logs

Sample List Summary

6/7/2017 3:56:04 PM



Instrument Name: Serial Number:
iCAP Q Undefined

Labbook: Labbook Path
WG1010576_MSQ060717.imexp _Application Data\Workspace\LabBooks

Index	Label	Rack	Vial	Main Runs	Survey Runs	Start Time
1	rinse	0	1	3	1	6/7/2017 8:10:21 AM
2	Blank AM ICPMSQ	4	49	3	1	6/7/2017 8:13:41 AM
3	0.2/20 Cal	0	2	3	1	6/7/2017 8:17:07 AM
4	1.0/100 Cal	0	3	3	1	6/7/2017 8:20:28 AM
5	10/1000 Cal	0	4	3	1	6/7/2017 8:23:50 AM
6	120/12000	0	5	3	1	6/7/2017 8:27:12 AM
7	250/25000	0	6	3	1	6/7/2017 8:30:34 AM
8	500/50000	0	7	3	1	6/7/2017 8:33:57 AM
9	Rinse	0	1	3	1	6/7/2017 8:37:21 AM
10	Sr 100ppb	4	57	3	1	6/7/2017 8:40:42 AM
11	ICV	0	9	3	1	6/7/2017 8:45:15 AM
12	ICB	0	10	3	1	6/7/2017 8:48:40 AM
13	LLICV	4	51	3	1	6/7/2017 8:52:05 AM
14	ICSA	4	53	3	1	6/7/2017 8:55:31 AM
15	ICSAB	4	55	3	1	6/7/2017 8:58:57 AM
16	Rinse	0	1	3	1	6/7/2017 9:02:22 AM
17	CCV	0	9	3	1	6/7/2017 9:05:43 AM
18	CCB	0	10	3	1	6/7/2017 9:09:08 AM
19	WG1008335-1 2008TL	1	1	3	1	6/7/2017 9:12:33 AM
20	WG1008335-2 2008TL	1	2	3	1	6/7/2017 9:15:53 AM
21	XWG1008335-3D10 2008TL	1	3	3	1	6/7/2017 9:19:14 AM
22	WG1008335-4 2008TL	1	4	3	1	6/7/2017 9:22:34 AM
23	L1717598-01 2008TL	1	5	3	1	6/7/2017 9:25:55 AM
24	L1717598-02 2008TL	1	6	3	1	6/7/2017 9:29:16 AM
25	L1717598-03 2008TL	1	7	3	1	6/7/2017 9:32:38 AM
26	L1717598-04 2008TL	1	8	3	1	6/7/2017 9:36:00 AM
27	WG1008335-3D10 2008TL	1	27	3	1	6/7/2017 9:39:22 AM
28	WG1008707-6D5 A2-6020T	1	10	3	1	6/7/2017 9:42:42 AM
29	CCV	0	9	3	1	6/7/2017 9:46:05 AM
30	CCB	0	10	3	1	6/7/2017 9:49:30 AM
31	WG1008707-1 A2-6020T	1	11	3	1	6/7/2017 9:54:10 AM
32	WG1010157-1 CT-6020TL	1	19	3	1	6/7/2017 9:57:33 AM
33	L1717285-18 A2-6020T	1	18	3	1	6/7/2017 10:00:55 AM
34	WG1010157-2D5 CT-6020TL	1	20	3	1	6/7/2017 10:04:17 AM
35	WG1008707-2D5 A2-6020T	1	12	3	1	6/7/2017 10:07:39 AM
36	WG1008707-3D10 A2-6020T	1	13	3	1	6/7/2017 10:11:02 AM
37	WG1008707-5D10 A2-6020T	1	9	3	1	6/7/2017 10:14:22 AM
38	WG1008707-4 A2-6020T	1	14	3	1	6/7/2017 10:17:44 AM
39	L1715898-01 A2-6020T	1	15	3	1	6/7/2017 10:21:05 AM
40	L1717026-28 A2-6020T	1	16	3	1	6/7/2017 10:24:25 AM
41	CCV	0	9	3	1	6/7/2017 10:27:46 AM
42	CCB	0	10	3	1	6/7/2017 10:31:11 AM
43	WG1010556-1 2008TL	1	28	3	1	6/7/2017 10:34:37 AM
44	WG1010556-2D5 2008TL	1	29	3	1	6/7/2017 10:37:58 AM
45	WG1010556-3D10 2008TL	1	30	3	1	6/7/2017 10:41:19 AM
46	WG1010556-4 2008TL	1	31	3	1	6/7/2017 10:44:40 AM
47	L1718724-02 2008TL	1	32	3	1	6/7/2017 10:48:02 AM
48	L1718724-01 2008TL	1	33	3	1	6/7/2017 10:51:24 AM
49	L1718724-03 2008TL	1	34	3	1	6/7/2017 10:54:46 AM
50	L1718724-04 2008TL	1	35	3	1	6/7/2017 10:58:09 AM
51	WG1010557-4 2008TL	1	36	3	1	6/7/2017 11:01:32 AM

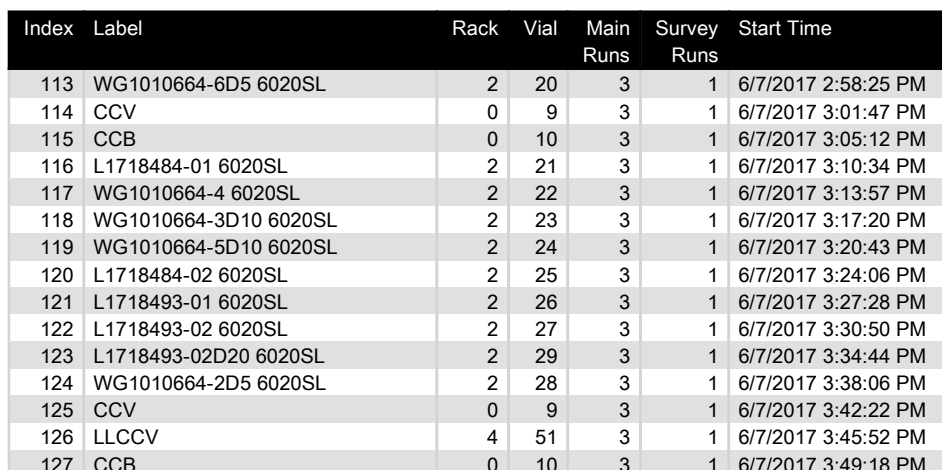
Sample List Summary

6/7/2017 3:56:04 PM



Index	Label	Rack	Vial	Main Runs	Survey Runs	Start Time
52	L1718577-01 2008TL	1	37	3	1	6/7/2017 11:04:55 AM
53	CCV	0	9	3	1	6/7/2017 11:09:36 AM
54	CCB	0	10	3	1	6/7/2017 11:13:01 AM
55	WG1010557-3D10 2008TL	1	38	3	1	6/7/2017 11:20:10 AM
56	L1718579-01 2008TL	1	42	3	1	6/7/2017 11:23:30 AM
57	L1718732-01 2008TL	1	46	3	1	6/7/2017 11:26:52 AM
58	L1718733-01 2008TL	1	47	3	1	6/7/2017 11:30:15 AM
59	L1718478-01 2008TL	1	39	3	1	6/7/2017 11:33:38 AM
60	L1718480-01 2008TL	1	40	3	1	6/7/2017 11:36:58 AM
61	L1718517-01 2008TL	1	41	3	1	6/7/2017 11:40:19 AM
62	L1718631-01 2008TL	1	43	3	1	6/7/2017 11:43:41 AM
63	L1718631-02 2008TL	1	44	3	1	6/7/2017 11:47:03 AM
64	L1718631-03 2008TL	1	45	3	1	6/7/2017 11:50:25 AM
65	CCV	0	9	3	1	6/7/2017 11:53:47 AM
66	XCCB	0	10	3	1	6/7/2017 11:57:12 AM
67	CCB	0	10	3	1	6/7/2017 12:08:24 PM
68	WG1008709-1 A2-MCP6020S-10	1	48	3	1	6/7/2017 12:13:30 PM
69	WG1008709-2D5 A2-MCP6020S-10	1	49	3	1	6/7/2017 12:16:53 PM
70	WG1008709-3D5 A2-MCP6020S-10	1	50	3	1	6/7/2017 12:20:14 PM
71	L1717997-01 CT-6020TL	1	21	3	1	6/7/2017 12:23:35 PM
72	L1718218-01 CT-6020TL	1	22	3	1	6/7/2017 12:26:57 PM
73	L1718218-02 CT-6020TL	1	23	3	1	6/7/2017 12:30:20 PM
74	L1718218-03 CT-6020TL	1	24	3	1	6/7/2017 12:33:43 PM
75	L1718218-04 CT-6020TL	1	25	3	1	6/7/2017 12:37:06 PM
76	L1718218-05 CT-6020TL	1	26	3	1	6/7/2017 12:40:27 PM
77	L1717026-29 A2-6020T	1	17	3	1	6/7/2017 12:43:40 PM
78	CCV	0	9	3	1	6/7/2017 12:47:01 PM
79	CCB	0	10	3	1	6/7/2017 12:50:27 PM
80	WG1009825-1 6020TL	1	51	3	1	6/7/2017 12:55:45 PM
81	WG1009825-2D5 6020TL	1	52	3	1	6/7/2017 12:59:06 PM
82	L1717187-02 A2-MCP6020S-10	1	53	3	1	6/7/2017 1:02:27 PM
83	L1717187-04 A2-MCP6020S-10	1	54	3	1	6/7/2017 1:05:48 PM
84	L1717187-06 A2-MCP6020S-10	1	55	3	1	6/7/2017 1:09:10 PM
85	WG1009825-6D5 6020TL	1	56	3	1	6/7/2017 1:12:32 PM
86	WG1009825-3D20 6020TL	1	57	3	1	6/7/2017 1:15:54 PM
87	WG1009825-4D20 6020TL	1	58	3	1	6/7/2017 1:19:16 PM
88	WG1009825-5D20 6020TL	1	59	3	1	6/7/2017 1:22:39 PM
89	577-05 SCAN	1	60	3	1	6/7/2017 1:26:02 PM
90	CCV	0	9	3	1	6/7/2017 1:29:26 PM
91	CCB	0	10	3	1	6/7/2017 1:32:51 PM
92	WG1009977-1 6020SL	2	3	3	1	6/7/2017 1:36:16 PM
93	WG1009977-2D5 6020SL	2	4	3	1	6/7/2017 1:39:38 PM
94	L1717935-01 6020TL	2	2	3	1	6/7/2017 1:42:59 PM
95	L1717935-02 6020TL	2	1	3	1	6/7/2017 1:46:21 PM
96	WG1009977-3D10 6020SL	2	5	3	1	6/7/2017 1:49:42 PM
97	WG1009977-5D10 6020SL	2	6	3	1	6/7/2017 1:53:04 PM
98	WG1009977-4 6020SL	2	8	3	1	6/7/2017 1:56:25 PM
99	L1717934-06 6020SL	2	9	3	1	6/7/2017 1:59:48 PM
100	L1717935-01D20 6020TL	2	11	3	1	6/7/2017 2:03:10 PM
101	WG1009825-6D100 6020TL	2	12	3	1	6/7/2017 2:06:33 PM
102	CCV	0	9	3	1	6/7/2017 2:09:57 PM
103	CCB	0	10	3	1	6/7/2017 2:13:22 PM
104	L1717934-10 6020SL	2	10	3	1	6/7/2017 2:20:19 PM
105	WG1009977-6D5 6020SL	2	7	3	1	6/7/2017 2:23:42 PM
106	WG1010662-1 2008SL	2	13	3	1	6/7/2017 2:34:52 PM
107	WG1010662-2D5 2008SL	2	14	3	1	6/7/2017 2:38:14 PM
108	xWG1010662-3D10 2008SL	2	15	3	1	6/7/2017 2:41:35 PM
109	WG1010662-4 2008SL	2	16	3	1	6/7/2017 2:44:57 PM
110	L1718517-01 2008SL	2	17	3	1	6/7/2017 2:48:19 PM
111	L1718448-02 2008SL	2	18	3	1	6/7/2017 2:51:41 PM
112	WG1010662-3D10 2008SL	2	19	3	1	6/7/2017 2:55:03 PM

6/7/2017 3:56:04 PM

[illegible]

Sample List Summary

6/10/2017 10:14:47 AM



Instrument Name: Serial Number:
iCAP Q ICAPQ01717

Labbook: Labbook Path
WG1011426_060917.imexp _Application Data\Workspace\LabBooks

Index	Label	Rack	Vial	Main Runs	Survey Runs	Start Time
1	rinse	0	1	3	1	6/9/2017 7:02:33 AM
2	rinse	0	1	3	1	6/9/2017 7:05:37 AM
3	Blank BV ICPMSQ2	0	10	3	1	6/9/2017 7:08:43 AM
4	0.2/20 Cal	0	2	3	1	6/9/2017 7:11:52 AM
5	1.0/100 Cal	0	3	3	1	6/9/2017 7:14:58 AM
6	10/1000 Cal	0	4	3	1	6/9/2017 7:18:05 AM
7	120/12000	0	5	3	1	6/9/2017 7:21:12 AM
8	250/25000	0	6	3	1	6/9/2017 7:24:18 AM
9	500/50000	0	7	3	1	6/9/2017 7:27:26 AM
10	Rinse	0	1	3	1	6/9/2017 7:30:34 AM
11	ICV	0	9	3	1	6/9/2017 7:33:39 AM
12	ICB	0	10	3	1	6/9/2017 7:40:14 AM
13	Sr 100ppb	4	57	3	1	6/9/2017 7:43:23 AM
14	LLICV	4	51	3	1	6/9/2017 7:46:33 AM
15	ICSA	4	53	3	1	6/9/2017 7:49:43 AM
16	ICSAB	4	55	3	1	6/9/2017 7:52:53 AM
17	Rinse	0	1	3	1	6/9/2017 7:56:03 AM
18	XCCV	0	9	3	1	6/9/2017 7:59:09 AM
19	XCCB	0	10	3	1	6/9/2017 8:02:18 AM
20	CCV	0	9	3	1	6/9/2017 8:07:38 AM
21	CCB	0	10	3	1	6/9/2017 8:10:48 AM
22	WG1011079-1 2008TL	1	1	3	1	6/9/2017 8:16:10 AM
23	WG1011079-2D5 2008TL	1	2	3	1	6/9/2017 8:19:16 AM
24	L1718742-01 2008TL	1	3	3	1	6/9/2017 8:22:22 AM
25	WG1011079-4 2008TL	1	4	3	1	6/9/2017 8:25:27 AM
26	WG1011079-3D10 2008TL	1	5	3	1	6/9/2017 8:28:34 AM
27	L1718518-01 2008TL	1	6	3	1	6/9/2017 8:31:40 AM
28	L1718518-02 2008TL	1	7	3	1	6/9/2017 8:34:47 AM
29	L1718753-01 2008TL	1	8	3	1	6/9/2017 8:37:54 AM
30	L1718753-02 2008TL	1	9	3	1	6/9/2017 8:41:01 AM
31	L1718985-01 2008TL	1	10	3	1	6/9/2017 8:44:09 AM
32	CCV	0	9	3	1	6/9/2017 8:47:17 AM
33	CCB	0	10	3	1	6/9/2017 8:50:26 AM
34	WG1010767-1 6020TL	1	12	3	1	6/9/2017 8:54:39 AM
35	WG1010767-2D5 6020TL	1	13	3	1	6/9/2017 8:57:48 AM
36	L1718985-02 2008TL	1	11	3	1	6/9/2017 9:00:52 AM
37	L1718726-02 6020TL	1	14	3	1	6/9/2017 9:04:00 AM
38	WG1010767-3D10 6020TL	1	15	3	1	6/9/2017 9:07:05 AM
39	WG1010767-4D10 6020TL	1	16	3	1	6/9/2017 9:10:10 AM
40	WG1010767-5D10 6020TL	1	17	3	1	6/9/2017 9:13:15 AM
41	WG1010767-6D5 6020TL	1	18	3	1	6/9/2017 9:16:21 AM
42	L1718484-01 6020TL	1	19	3	1	6/9/2017 9:19:27 AM
43	L1718484-02 6020TL	1	20	3	1	6/9/2017 9:22:33 AM
44	CCV	0	9	3	1	6/9/2017 9:25:39 AM
45	CCB	0	10	3	1	6/9/2017 9:28:48 AM
46	L1718493-01 6020TL	1	21	3	1	6/9/2017 9:31:58 AM
47	L1718493-02 6020TL	1	22	3	1	6/9/2017 9:35:05 AM
48	L1718584-01 6020TL	1	23	3	1	6/9/2017 9:38:12 AM
49	L1718584-02 6020TL	1	24	3	1	6/9/2017 9:41:19 AM
50	L1718584-03 6020TL	1	25	3	1	6/9/2017 9:44:27 AM
51	L1718584-04 6020TL	1	26	3	1	6/9/2017 9:47:32 AM

Sample List Summary

6/10/2017 10:14:47 AM



Index	Label	Rack	Vial	Main Runs	Survey Runs	Start Time
52	L1718584-05 6020TL	1	27	3	1	6/9/2017 9:50:36 AM
53	L1718584-06 6020TL	1	28	3	1	6/9/2017 9:53:41 AM
54	L1718584-07 6020TL	1	29	3	1	6/9/2017 9:56:47 AM
55	L1718706-08 6020TL	1	30	3	1	6/9/2017 9:59:52 AM
56	CCV	0	9	3	1	6/9/2017 10:02:58 AM
57	CCB	0	10	3	1	6/9/2017 10:06:07 AM
58	WG1009791-1 6020TL	1	34	3	1	6/9/2017 10:11:42 AM
59	WG1009791-2D5 6020TL	1	35	3	1	6/9/2017 10:14:49 AM
60	L1718726-01 6020TL	1	31	3	1	6/9/2017 10:17:57 AM
61	L1718726-03 6020TL	1	32	3	1	6/9/2017 10:21:03 AM
62	L1718726-04 6020TL	1	33	3	1	6/9/2017 10:24:09 AM
63	L1717934-04 6020TL	1	36	3	1	6/9/2017 10:27:16 AM
64	WG1009791-3D10 6020TL	1	37	3	1	6/9/2017 10:30:23 AM
65	WG1009791-4D10 6020TL	1	38	3	1	6/9/2017 10:33:28 AM
66	WG1009791-5D10 6020TL	1	39	3	1	6/9/2017 10:36:33 AM
67	WG1009791-6D5 6020TL	1	40	3	1	6/9/2017 10:39:38 AM
68	CCV	0	9	3	1	6/9/2017 10:42:43 AM
69	CCB	0	10	3	1	6/9/2017 10:45:53 AM
70	WG1011434-1 2008TL	1	60	3	1	6/9/2017 10:56:41 AM
71	WG1011434-2D5 2008TL	2	1	3	1	6/9/2017 10:59:48 AM
72	L1719124-01 2008TL	2	2	3	1	6/9/2017 11:02:54 AM
73	WG1011434-4 2008TL	2	3	3	1	6/9/2017 11:06:00 AM
74	WG1011434-3D10 2008TL	2	4	3	1	6/9/2017 11:09:06 AM
75	L1719124-02 2008TL	2	5	3	1	6/9/2017 11:12:12 AM
76	L1719124-03 2008TL	2	6	3	1	6/9/2017 11:15:18 AM
77	L1719124-04 2008TL	2	7	3	1	6/9/2017 11:18:24 AM
78	L1719127-01 2008TL	2	8	3	1	6/9/2017 11:21:30 AM
79	CCV	0	9	3	1	6/9/2017 11:24:36 AM
80	CCB	0	10	3	1	6/9/2017 11:27:46 AM
81	L1719196-01 2008TL	2	9	3	1	6/9/2017 11:30:56 AM
82	XWG1011435-4 2008TL	2	10	3	1	6/9/2017 11:34:02 AM
83	WG1011435-3D10 2008TL	2	11	3	1	6/9/2017 11:37:09 AM
84	L1719196-02 2008TL	2	12	3	1	6/9/2017 11:40:16 AM
85	L1719196-03 2008TL	2	13	3	1	6/9/2017 11:43:24 AM
86	L1719196-04 2008TL	2	14	3	1	6/9/2017 11:46:30 AM
87	L1719196-05 2008TL	2	15	3	1	6/9/2017 11:49:36 AM
88	WG1011435-4 2008TL	2	10	3	1	6/9/2017 11:52:42 AM
89	CCV	0	9	3	1	6/9/2017 11:55:49 AM
90	CCB	0	10	3	1	6/9/2017 11:58:59 AM
91	L1717934-01 6020TL	1	41	3	1	6/9/2017 12:04:49 PM
92	L1717934-02 6020TL	1	42	3	1	6/9/2017 12:07:55 PM
93	L1717934-03 6020TL	1	43	3	1	6/9/2017 12:11:00 PM
94	L1717934-05 6020TL	1	44	3	1	6/9/2017 12:14:07 PM
95	L1717934-07 6020TL	1	45	3	1	6/9/2017 12:17:13 PM
96	L1717934-08 6020TL	1	46	3	1	6/9/2017 12:20:20 PM
97	L1717934-09 6020TL	1	47	3	1	6/9/2017 12:23:26 PM
98	L1717934-11 6020TL	1	48	3	1	6/9/2017 12:26:34 PM
99	L1717934-12 6020TL	1	49	3	1	6/9/2017 12:29:41 PM
100	L1717934-14 6020TL	1	50	3	1	6/9/2017 12:32:47 PM
101	CCV	0	9	3	1	6/9/2017 12:35:52 PM
102	CCB	0	10	3	1	6/9/2017 12:39:02 PM
103	L1717934-15 6020TL	1	51	3	1	6/9/2017 12:44:37 PM
104	L1717934-16 6020TL	1	52	3	1	6/9/2017 12:47:43 PM
105	L1717934-17 6020TL	1	53	3	1	6/9/2017 12:50:48 PM
106	L1717934-18 6020TL	1	54	3	1	6/9/2017 12:53:54 PM
107	L1717934-19 6020TL	1	55	3	1	6/9/2017 12:56:59 PM
108	L1717934-20 6020TL	1	56	3	1	6/9/2017 1:00:05 PM
109	L1717934-21 6020TL	1	57	3	1	6/9/2017 1:03:12 PM
110	L1717934-22 6020TL	1	58	3	1	6/9/2017 1:06:18 PM
111	L1717934-25 6020TL	1	59	3	1	6/9/2017 1:09:25 PM
112	CCV	0	9	3	1	6/9/2017 1:12:32 PM

Sample List Summary

6/10/2017 10:14:47 AM



Index	Label	Rack	Vial	Main Runs	Survey Runs	Start Time
113	CCB	0	10	3	1	6/9/2017 1:15:42 PM
114	WG1007570-1D10 A2-6020T	2	16	3	1	6/9/2017 1:23:16 PM
115	WG1007570-2D10 A2-6020T	2	17	3	1	6/9/2017 1:26:22 PM
116	L1717026-05D10 A2-6020T	2	18	3	1	6/9/2017 1:29:28 PM
117	WG1007570-3D10 A2-6020T	2	19	3	1	6/9/2017 1:32:34 PM
118	WG1007570-4D10 A2-6020T	2	20	3	1	6/9/2017 1:35:41 PM
119	WG1007570-5D10 A2-6020T	2	21	3	1	6/9/2017 1:38:47 PM
120	WG1007570-6D50 A2-6020T	2	22	3	1	6/9/2017 1:41:54 PM
121	L1717026-01D10 A2-6020T	2	23	3	1	6/9/2017 1:45:01 PM
122	L1717026-02D10 A2-6020T	2	24	3	1	6/9/2017 1:48:08 PM
123	L1717026-03D10 A2-6020T	2	25	3	1	6/9/2017 1:51:16 PM
124	CCV	0	9	3	1	6/9/2017 1:54:22 PM
125	CCB	0	10	3	1	6/9/2017 1:57:32 PM
126	L1717026-04D10 A2-6020T	2	26	3	1	6/9/2017 2:00:42 PM
127	L1717026-06D10 A2-6020T	2	27	3	1	6/9/2017 2:03:49 PM
128	L1717026-07D10 A2-6020T	2	28	3	1	6/9/2017 2:06:55 PM
129	L1717026-08D10 A2-6020T	2	29	3	1	6/9/2017 2:10:02 PM
130	L1717026-09D10 A2-6020T	2	30	3	1	6/9/2017 2:13:08 PM
131	L1717026-10D10 A2-6020T	2	31	3	1	6/9/2017 2:16:15 PM
132	L1717026-11D10 A2-6020T	2	32	3	1	6/9/2017 2:19:21 PM
133	L1717026-12D10 A2-6020T	2	33	3	1	6/9/2017 2:22:28 PM
134	L1717026-13D10 A2-6020T	2	34	3	1	6/9/2017 2:25:35 PM
135	L1717026-14D10 A2-6020T	2	35	3	1	6/9/2017 2:28:42 PM
136	CCV	0	9	3	1	6/9/2017 2:31:49 PM
137	CCB	0	10	3	1	6/9/2017 2:34:59 PM
138	WG1007571-1D10 A2-6020T	2	42	3	1	6/9/2017 2:38:09 PM
139	WG1007571-2D10 A2-6020T	2	43	3	1	6/9/2017 2:41:15 PM
140	L1717026-15D10 A2-6020T	2	36	3	1	6/9/2017 2:44:22 PM
141	L1717026-16D10 A2-6020T	2	37	3	1	6/9/2017 2:47:30 PM
142	L1717026-17D10 A2-6020T	2	38	3	1	6/9/2017 2:50:37 PM
143	L1717026-18D10 A2-6020T	2	39	3	1	6/9/2017 2:53:44 PM
144	L1717026-19D10 A2-6020T	2	40	3	1	6/9/2017 2:56:51 PM
145	L1717026-20D10 A2-6020T	2	41	3	1	6/9/2017 2:59:58 PM
146	L1717026-23D10 A2-6020T	2	44	3	1	6/9/2017 3:03:04 PM
147	WG1007571-6D50 A2-6020T	2	48	3	1	6/9/2017 3:06:12 PM
148	CCV	0	9	3	1	6/9/2017 3:09:19 PM
149	CCB	0	10	3	1	6/9/2017 3:12:29 PM
150	WG1007571-3D10 A2-6020T	2	45	3	1	6/9/2017 3:15:39 PM
151	WG1007571-4D10 A2-6020T	2	46	3	1	6/9/2017 3:18:46 PM
152	WG1007571-5D10 A2-6020T	2	47	3	1	6/9/2017 3:21:53 PM
153	L1717026-21D10 A2-6020T	2	49	3	1	6/9/2017 3:25:00 PM
154	L1717026-22D10 A2-6020T	2	50	3	1	6/9/2017 3:28:07 PM
155	L1717026-24D10 A2-6020T	2	51	3	1	6/9/2017 3:31:14 PM
156	L1717026-25D10 A2-6020T	2	52	3	1	6/9/2017 3:34:21 PM
157	L1717026-26D10 A2-6020T	2	53	3	1	6/9/2017 3:37:29 PM
158	L1717026-27D10 A2-6020T	2	54	3	1	6/9/2017 3:40:36 PM
159	CCV	0	9	3	1	6/9/2017 3:43:43 PM
160	CCB	0	10	3	1	6/9/2017 3:46:53 PM
161	WG1011573-1D10 SPLP-6020T	2	55	3	1	6/9/2017 3:50:03 PM
162	WG1011573-2D10 SPLP-6020T	2	56	3	1	6/9/2017 3:53:10 PM
163	L1717676-02D10 SPLP-6020T	2	57	3	1	6/9/2017 3:56:17 PM
164	WG1011573-4D10 SPLP-6020T	2	58	3	1	6/9/2017 3:59:25 PM
165	WG1011573-3D10 SPLP-6020T	2	59	3	1	6/9/2017 4:02:32 PM
166	WG1011573-5D10 SPLP-6020T	2	60	3	1	6/9/2017 4:05:39 PM
167	WG1011573-6D50 SPLP-6020T	3	1	3	1	6/9/2017 4:08:47 PM
168	CCV	0	9	3	1	6/9/2017 4:11:55 PM
169	CCB	0	10	3	1	6/9/2017 4:15:04 PM
170	LLCCV	4	51	3	1	6/9/2017 4:18:14 PM
171	CCV	0	9	3	1	6/9/2017 4:21:25 PM
172	CCB	0	10	3	1	6/9/2017 4:24:35 PM

Work Group

ALPHA ANALYTICAL LABORATORIES, INC.
Metals Batch Report - Total Metals (Mass Spec) - A2-6020T Batch WG1007570 for dept. 5
Jun 15, 2017 12:06

Sample No.	Client No.	Sample I.D.	Mat Due	As Sb	Ba B	Cd Be	Cu Cr	Ni Pb	Ag Se	Tl Sr	Ti Sn	Fe Zn	Ca Mn	Al Mg	Na K	V Co	Si Mo	Ha W	Zr W
L1717026-01	VC88-D0-3E	3 0615	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X		
L1717026-02	VC88-D3-6E	3 0615	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X		
L1717026-03	VC88-D6-9E	3 0615	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X		
L1717026-04	VC88-D9-10E	3 0615	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X		
L1717026-05	VC89-D0-3E	3 0615	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X		
L1717026-06	VC89-D3-6E	3 0615	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X		
L1717026-07	VC89-D6-9E	3 0615	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X		
L1717026-08	VC89-D9-10E	3 0615	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X		
L1717026-09	DUP-D9-10E	3 0615	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X		
L1717026-10	DUP-D0-3E	3 0615	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X		
L1717026-11	VC90-D0-3E	3 0615	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X		
L1717026-12	VC90-D3-6E	3 0615	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X		
L1717026-13	VC90-D6-9E	3 0615	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X		
L1717026-14	VC90-D9-10E	3 0615	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X		
L1717026-15	VC91-D0-3E	3 0615	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X		
L1717026-16	VC91-D3-6E	3 0615	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X		
L1717026-17	VC91-D6-9.6E	3 0615	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X		
L1717026-18	DUP-D6-9E	3 0615	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X		
L1717026-19	VC92-D0-3E	3 0615	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X		
L1717026-20	VC92-D3-6E	3 0615	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X		
WG1007570-1	Laboratory Method	3	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X		
WG1007570-2	Laboratory Contro	3	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X		
WG1007570-3	Matrix Spike	3	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X		
WG1007570-4	Matrix Spike Dupl	3	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X		
WG1007570-5	Post Digestion Sp	3	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X		
WG1007570-6	Serial Dilution	3	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X		

ALPHA ANALYTICAL LABORATORIES, INC.
Metals Batch Report - Total Metals (Mass Spec) - A2-6020T Batch WG1007570 for dept. 5
Jun 15, 2017 12:06

Sample No.	Client No.	Sample I.D.	Mat	Due	As	Ba	Cd	Cu	Ni	Ag	Tl	Ti	Fe	Ca	Al	Na	V	Si	Ha	W	Zr
					Sb	B	Be	Cr	Pb	Se	Sr	Sn	Zn	Mn	Mg	K	Co	Mo	W	W	
Comments:																					
WG1007570-3		L1717026-05																			
WG1007570-4		L1717026-05																			
WG1007570-5		L1717026-05																			
WG1007570-6		L1717026-05																			

ALPHA ANALYTICAL LABORATORIES, INC.
Metals Batch Report - Total Metals (Mass Spec) - A2-6020T Batch WG1007571 for dept. 5
Jun 15, 2017 12:06

Sample No.	Client No.	Sample I.D.	Mat	Due	As	Ba	Cd	Cu	Ni	Ag	Tl	Ti	Fe	Ca	Al	Na	V	Si	Ha	Zr
					Sb	B	Be	Cr	Pb	Se	Sr	Sn	Zn	Mn	Mg	K	Co	Mo	W	W
L1717026-21		VC92-D6-9E	3	0615	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
L1717026-22		VC92-D9-10E	3	0615	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
L1717026-23		VC93-D0-3E	3	0615	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
L1717026-24		VC93-D3-6E	3	0615	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
L1717026-25		VC93-D6-9E	3	0615	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
L1717026-26		VC93-D9-10E	3	0615	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
L1717026-27		DUP-D3-6E	3	0615	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
WG1007571-1		Laboratory Method	3		X	X	X	X	X	X	X	X	X	X	X	X	X	X		
WG1007571-2		Laboratory Contro	3		X	X	X	X	X	X	X	X	X	X	X	X	X	X		
WG1007571-3		Matrix Spike	3		X	X	X	X	X	X	X	X	X	X	X	X	X	X		
WG1007571-4		Matrix Spike Dupl	3		X	X	X	X	X	X	X	X	X	X	X	X	X	X		
WG1007571-5		Post Digestion Sp	3		X	X	X	X	X	X	X	X	X	X	X	X	X	X		
WG1007571-6		Serial Dilution	3		X	X	X	X	X	X	X	X	X	X	X	X	X	X		

Comments:

WG1007571-3 L1717026-23
WG1007571-4 L1717026-23
WG1007571-5 L1717026-23
WG1007571-6 L1717026-23

ALPHA ANALYTICAL LABORATORIES, INC.
Metals Batch Report - Total Metals (Mass Spec) - A2-6020T Batch WG1008707 for dept. 5
Jun 15, 2017 12:06

Sample No.	Client No.	Sample I.D.	Mat Due	As	Ba	Cd	Cu	Ni	Ag	Tl	Ti	Fe	Ca	Al	Na	V	Si	Ha	Zr
				Sb	B	Be	Cr	Pb	Se	Sr	Sn	Zn	Mn	Mg	K	Co	Mo	W	W
L1715898-01	OK-01-05-WATER	1	0607				X	X	X	X	X		X	X					
L1717026-28	RINSE2	1	0615	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
L1717026-29	RINSE1	1	0615	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
L1717285-18	BLANK	1	0616	X			X	X	X	X	X		X						
WG1008707-1	Laboratory Method	1		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
WG1008707-2	Laboratory Contro	1		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
WG1008707-3	Matrix Spike	1		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
WG1008707-4	Duplicate Sample	1		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
WG1008707-5	Post Digestion Sp	1		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
WG1008707-6	Serial Dilution	1		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Comments:

WG1008707-3 L1715898-01
WG1008707-4 L1715898-01
WG1008707-5 L1715898-01
WG1008707-6 L1715898-01

Tune

System

Time 6/7/2017 7:42:48 AM
Instrument id iCAP Q
Operator ALPHALAB\metals-instrument
Template STD AGD
Serial number SN02236R
Last Autotune Autotune-SourceTune High Matrix Alpha Custom-20170526-102246351.imatdat
Solution 1 ppb Tune B in 2% HNO3 and 0.5% HCl.

Sensitivity & Stability Test

Result	Runs	Sweeps
Passed	5	10

Sensitivity

Analyte	Result	Value	Condition	Limit
Bkg4.5	Passed	0.0 CPS	Less than	2.0 CPS
Bkg220.7	Passed	0.0 CPS	Less than	2.0 CPS
7Li	Passed	7,919.0 CPS	Greater than	500.0 CPS
59Co	Passed	10,276.0 CPS	Greater than	1,000.0 CPS
238U	Passed	45,541.0 CPS	Greater than	2,000.0 CPS
140Ce.16O/140Ce	Passed	0.0126	Less than	0.025
137Ba++/137Ba	Passed	0.0067	Less than	0.034
115In	Passed	15,831.0 CPS	Greater than	5,000.0 CPS

Stability

Analyte	Value	Limit
7Li	1.0 %	5
59Co	2.1 %	5
238U	1.6 %	5
115In	1.0 %	5

Mass Calibration Test

Result	Channels	Dwell	MeasureWidth	PointSpacing	Sweeps
Passed	75	0.04	1.5	0.02	10

Analyte	Result	Centroid	Offset	Peak Width	Peak Width Min	Peak Width Max
7Li	Passed	7.0038	0.0122	0.706	0.650	0.850
59Co	Passed	58.9451	0.0119	0.652	0.650	0.850
115In	Passed	114.9079	0.0040	0.654	0.650	0.850
238U	Passed	238.0193	0.0315	0.690	0.650	0.850

Tune Settings

Parameter	Value
Additional Gas Flow 1	45.96
Additional Gas Flow 2	0.00
Additional Gas Flow 3	0.00
Angular Deflection	-364.99
Auxiliary Flow	0.80
CCT Bias	-2.01
CCT Entry Lens	-110.01
CCT Exit Lens	-160.01
CCT Focus Lens	-5.80
CCT1 Flow	0.00
CCT1 Shut-Off Valve	0.00
CCT2 Flow	0.00
CCT2 Shut-Off Valve	0.00
Cool Flow	14.00
D1 Lens	-200.05
D2 Lens	-90.01
Deflection Entry Lens	-35.00
Extraction Lens 1 Negative	0.00
Extraction Lens 1 Polarity	0.00
Extraction Lens 1 Positive	0.00
Extraction Lens 2	-181.44
Focus Lens	18.79
Nebulizer Flow	0.36
Peristaltic Pump Speed	20.00
Plasma Power	1550.00
Pole Bias	0.96
Quad Entry Lens	-19.61
Sampling Depth	5.00
Spray Chamber Temperature	2.70
Torch Horizontal Position	0.74
Torch Vertical Position	0.96
Virtual CCT Mass Maximum Dac Limit Set	4095.00
Virtual CCT Mass parameter b	0.65
Virtual CCT Mass to Dac Factor	130.00
Virtual CCT Mass to Dac Offset	-220.00

Vacuum Check

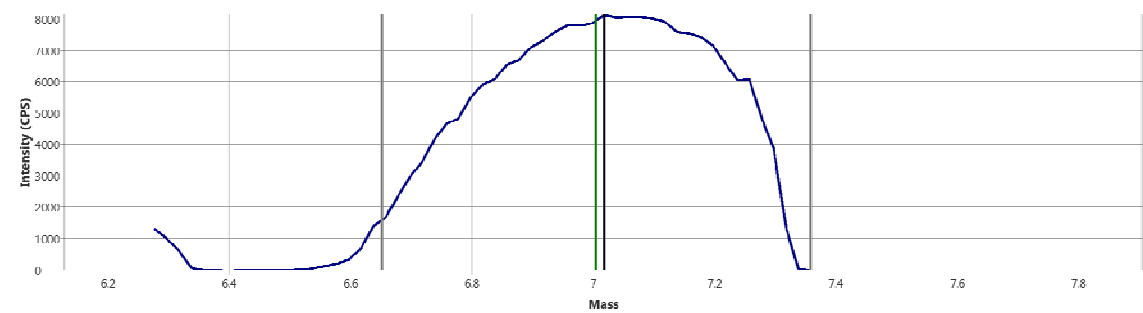
Parameter	Result	Value
Analyzer Pressure	Vacuum ok	3.855e-7
Interface Pressure		1.980e+0

Detector Voltages

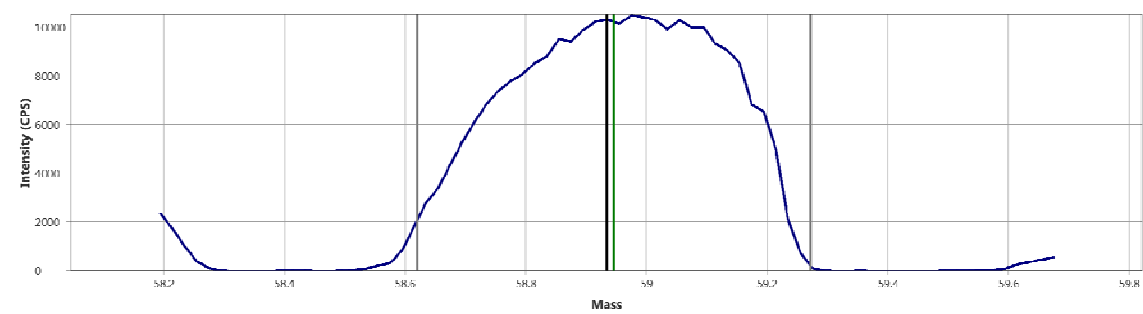
Analog	Counting
-1700.00	1600.00

Mass Calibration Peaks

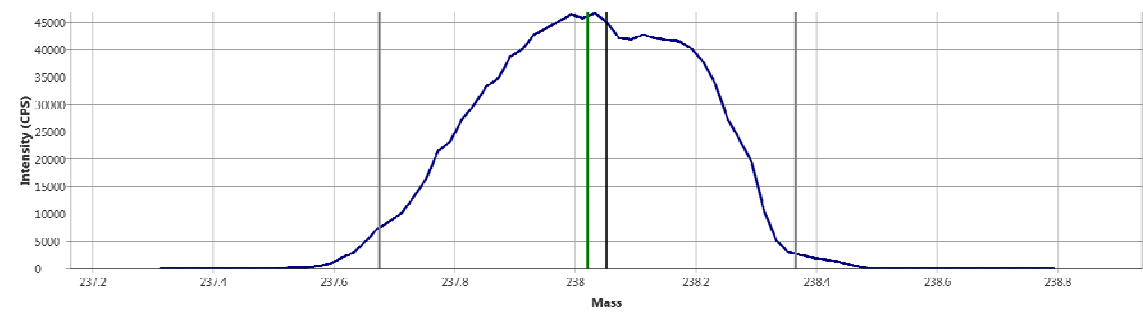
⁷Li



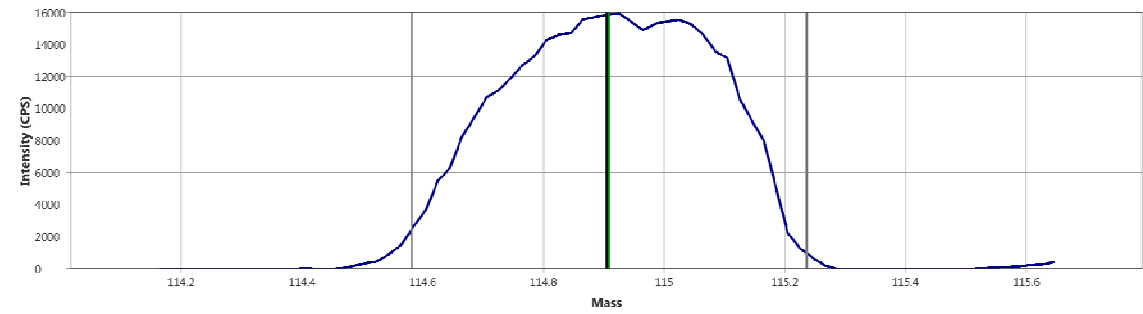
⁵⁹Co



²³⁸U



¹¹⁵In



System

Time 6/9/2017 6:45:45 AM
 Instrument id iCAP Q
 Operator ALPHALAB\metals-instrument
 Template STD AGD
 Serial number N/A
 Last Autotune Autotune-SourceTune High Matrix Alpha Custom-20170608-074955931.imatdat
 Solution 1 ppb Tune B in 2% HNO3 and 0.5% HCl.

Sensitivity & Stability Test

Result	Runs	Sweeps
Passed	5	10

Sensitivity

Analyte	Result	Value	Condition	Limit
Bkg4.5	Passed	0.0 CPS	Less than	2.0 CPS
Bkg220.7	Passed	0.0 CPS	Less than	2.0 CPS
7Li	Passed	30,771.0 CPS	Greater than	500.0 CPS
59Co	Passed	94,901.0 CPS	Greater than	1,000.0 CPS
238U	Passed	161,429.0 CPS	Greater than	20,000.0 CPS
140Ce.16O/140Ce	Passed	0.0099	Less than	0.025
137Ba++/137Ba	Passed	0.0288	Less than	0.034
115In	Passed	121,704.0 CPS	Greater than	5,000.0 CPS

Stability

Analyte	Value	Limit
7Li	1.0 %	5
59Co	0.5 %	5
238U	0.8 %	5
115In	1.3 %	5

Mass Calibration Test

Result	Channels	Dwell	MeasureWidth	PointSpacing	Sweeps
Passed	75	0.04	1.5	0.02	10

Analyte	Result	Centroid	Offset	Peak Width	Peak Width Min	Peak Width Max
7Li	Passed	7.0019	0.0141	0.709	0.650	0.850
59Co	Passed	58.9256	0.0076	0.692	0.650	0.850
115In	Passed	114.8965	0.0073	0.712	0.650	0.850
238U	Passed	238.0245	0.0263	0.715	0.650	0.850

Tune Settings

Parameter	Value
Additional Gas Flow 1	51.00
Additional Gas Flow 2	0.00
Additional Gas Flow 3	0.00
Angular Deflection	-274.99
Auxiliary Flow	0.80
CCT Bias	-2.01
CCT Entry Lens	-73.99
CCT Exit Lens	-160.01
CCT Focus Lens	-0.28
CCT1 Flow	0.00
CCT1 Shut-Off Valve	0.00
CCT2 Flow	0.00
CCT2 Shut-Off Valve	0.00
Cool Flow	14.00
D1 Lens	-189.99
D2 Lens	-80.00
Deflection Entry Lens	-35.01
Extraction Lens 1 Negative	0.00
Extraction Lens 1 Polarity	0.00
Extraction Lens 1 Positive	0.00
Extraction Lens 2	-200.00
Focus Lens	12.11
Nebulizer Flow	0.34
Peristaltic Pump Speed	20.00
Plasma Power	1550.00
Pole Bias	-1.03
Quad Entry Lens	-21.00
Sampling Depth	5.00
Spray Chamber Temperature	2.70
Torch Horizontal Position	-0.22
Torch Vertical Position	-0.52
Virtual CCT Mass Maximum Dac Limit Set	4095.00
Virtual CCT Mass parameter b	0.65
Virtual CCT Mass to Dac Factor	130.00
Virtual CCT Mass to Dac Offset	-185.00

Vacuum Check

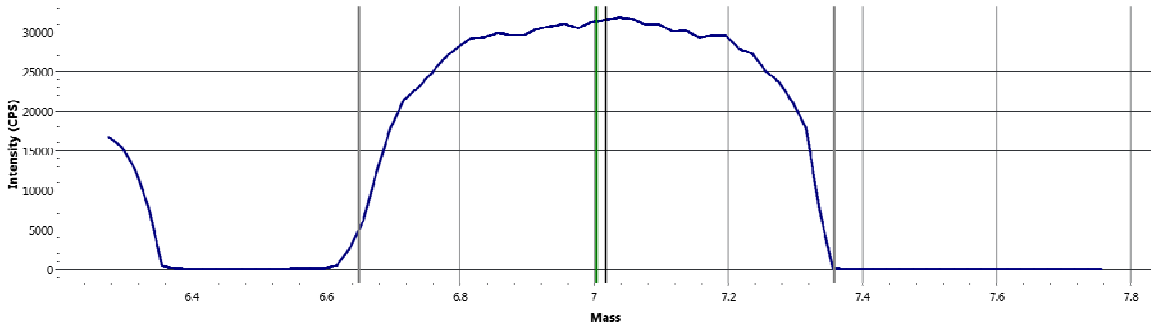
Parameter	Result	Value
Analyzer Pressure	Vacuum ok	4.828e-7
Interface Pressure		1.654e+0

Detector Voltages

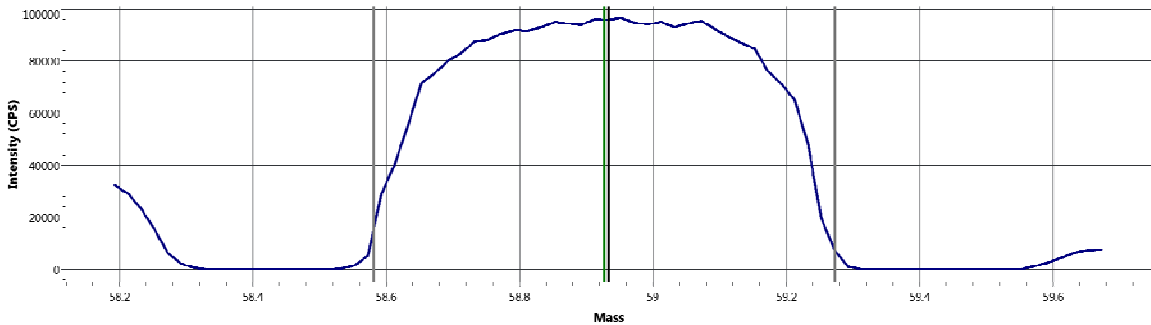
Analog	Counting
-2000.00	1375.00

Mass Calibration Peaks

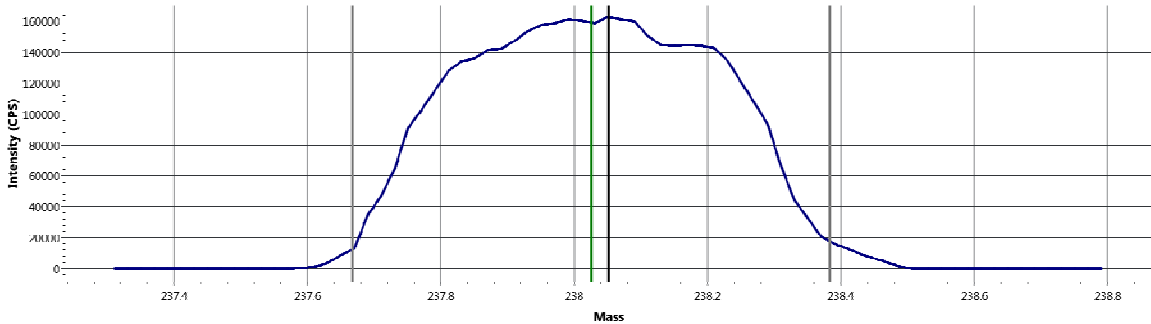
⁷Li



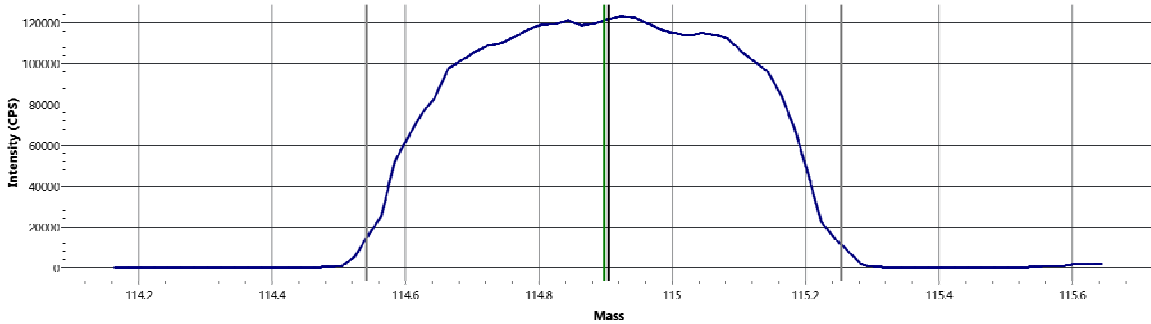
⁵⁹Co



²³⁸U



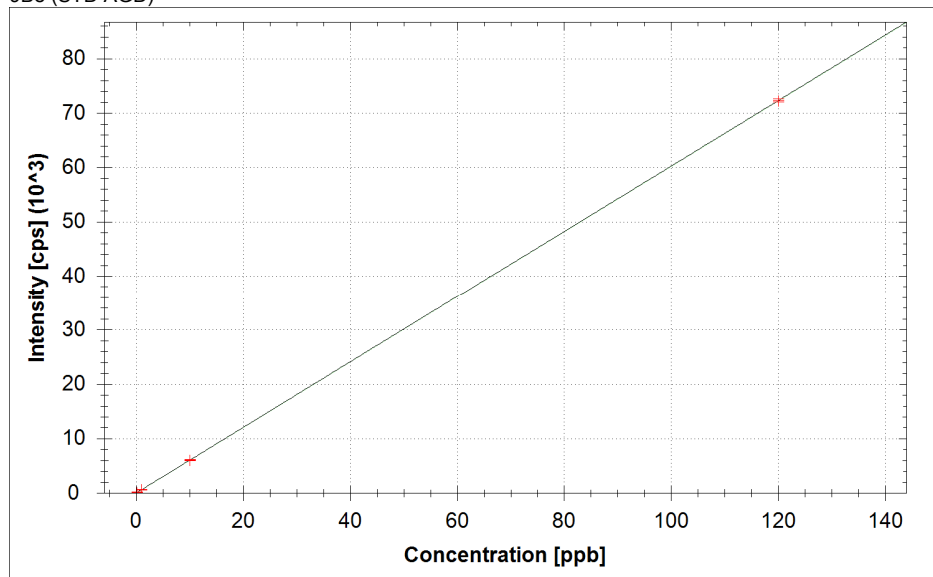
¹¹⁵In



Sample Raw Data

Calibration Curves:

9Be (STD AGD)



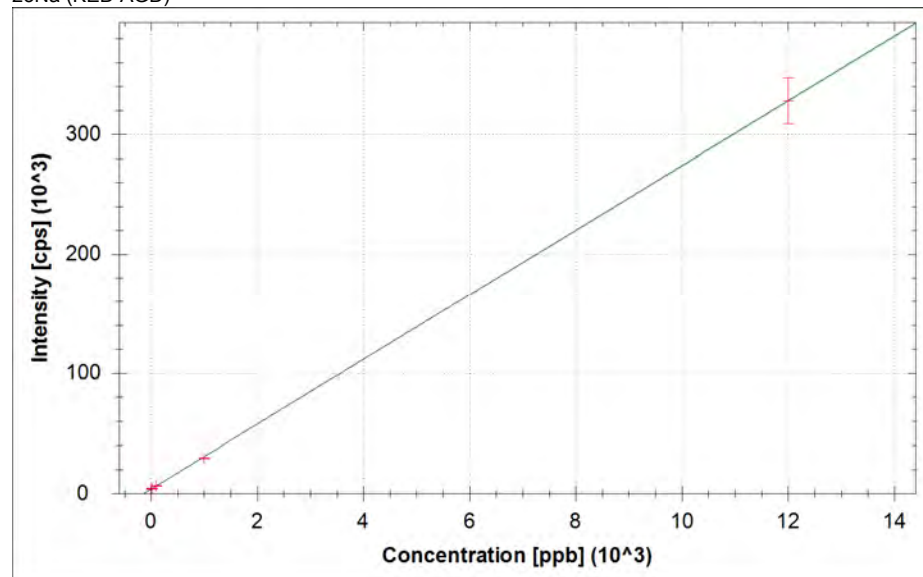
$$f(x) = 602.1745x + 7.3448$$

$$R^2 = 1.0000$$

$$\text{BEC} = 0.012 \text{ ppb}$$

$$\text{LoD} = 0.0321 \text{ ppb}$$

23Na (KED AGD)



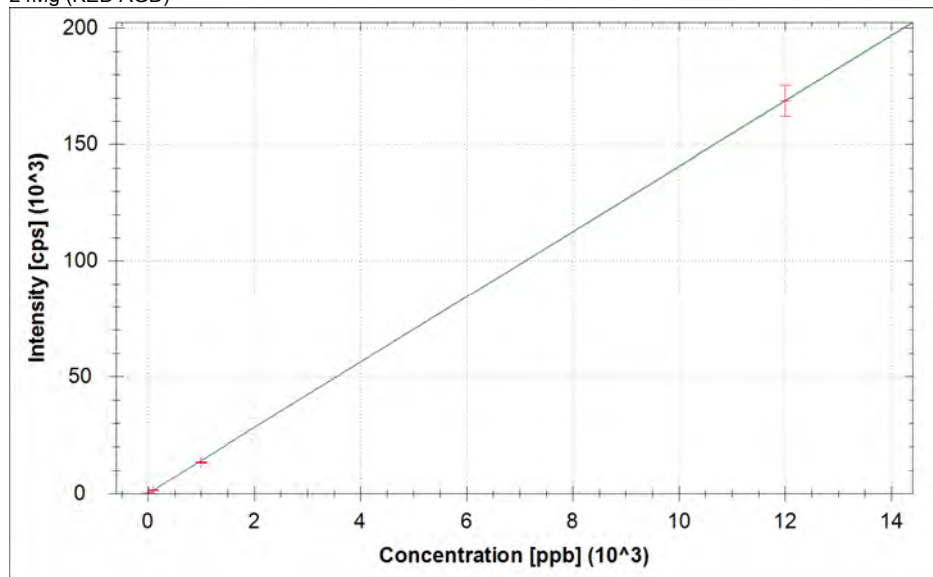
$$f(x) = 27.0270x + 3596.1608$$

$$R^2 = 1.0000$$

$$\text{BEC} = 133.058 \text{ ppb}$$

$$\text{LoD} = 13.2600 \text{ ppb}$$

24Mg (KED AGD)



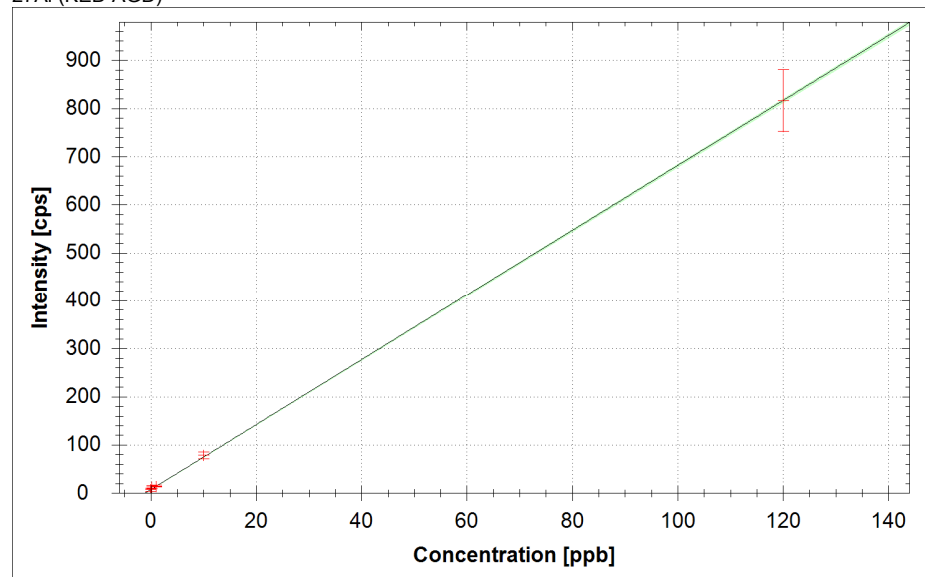
$$f(x) = 14.0566 \cdot x + 6.6984$$

$$R^2 = 1.0000$$

$$\text{BEC} = 0.477 \text{ ppb}$$

$$\text{LoD} = 1.2392 \text{ ppb}$$

27Al (KED AGD)



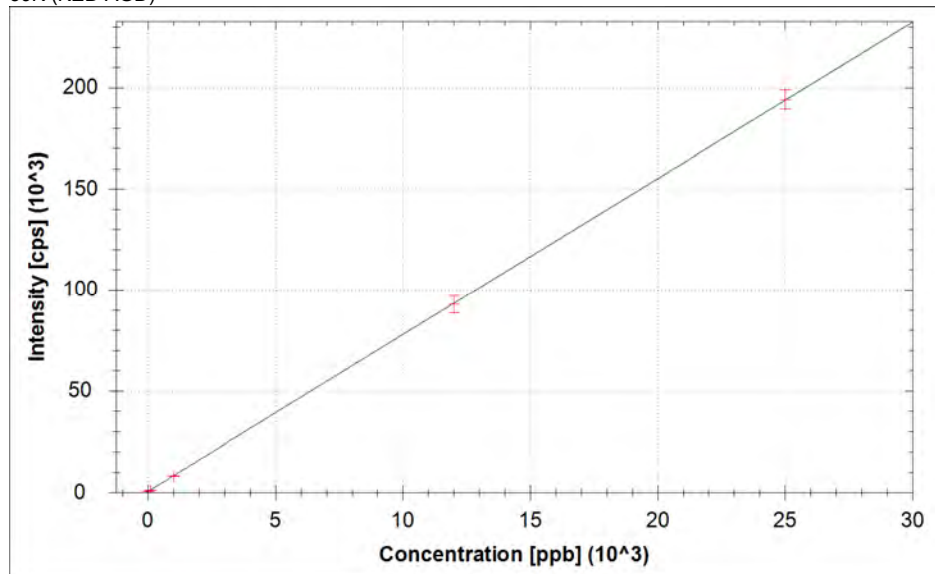
$$f(x) = 6.7439 \cdot x + 7.0631$$

$$R^2 = 0.9999$$

$$\text{BEC} = 1.047 \text{ ppb}$$

$$\text{LoD} = 1.4318 \text{ ppb}$$

39K (KED AGD)



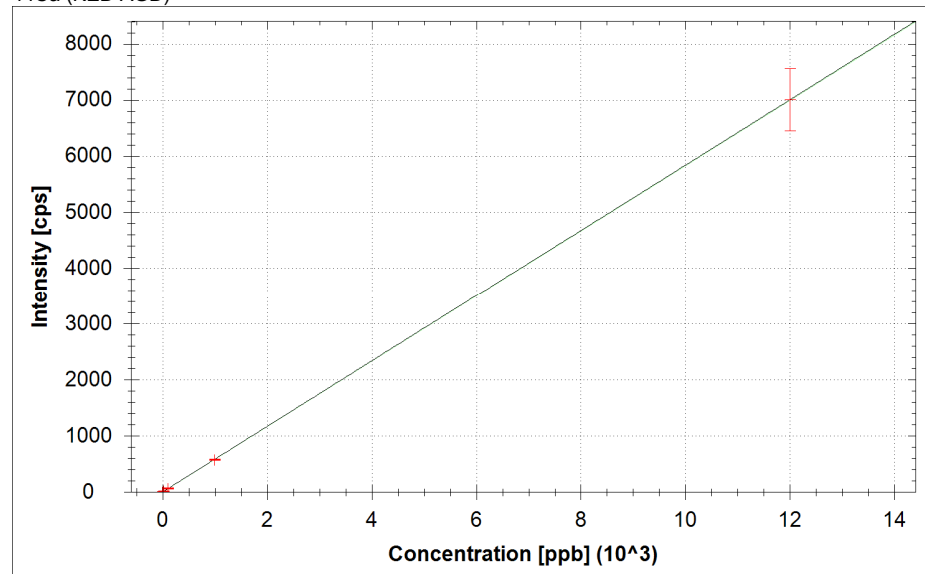
$$f(x) = 7.7288 \cdot x + 516.7975$$

$$R^2 = 1.0000$$

$$\text{BEC} = 66.867 \text{ ppb}$$

$$\text{LoD} = 2.2150 \text{ ppb}$$

44Ca (KED AGD)



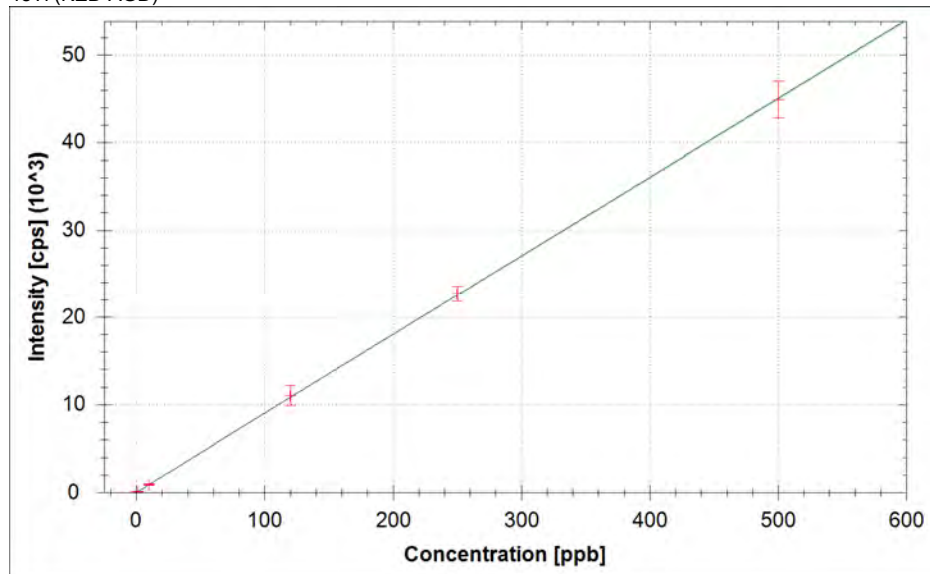
$$f(x) = 0.5837 \cdot x + 1.8033$$

$$R^2 = 1.0000$$

$$\text{BEC} = 3.089 \text{ ppb}$$

$$\text{LoD} = 16.9029 \text{ ppb}$$

48Ti (KED AGD)



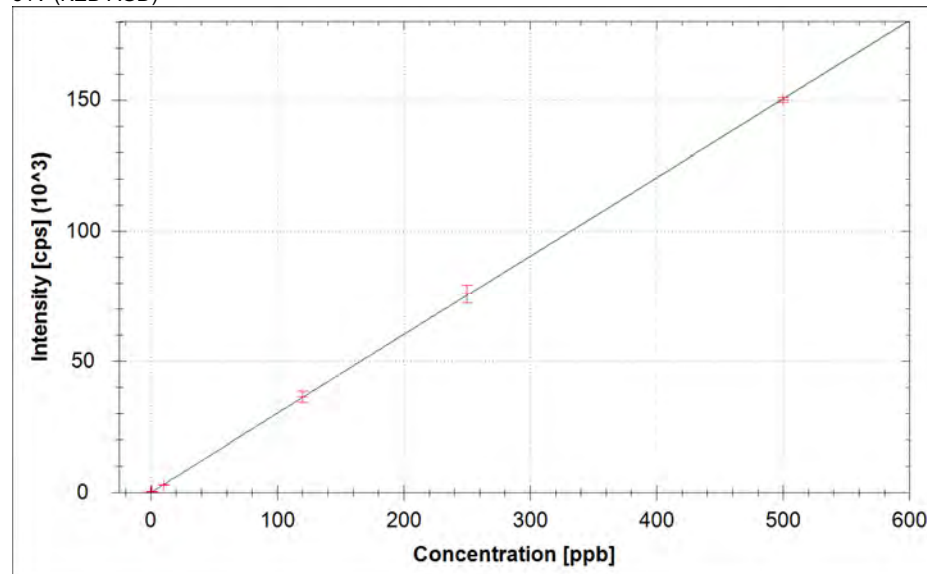
$$f(x) = 90.0487 \cdot x + 3.4431$$

$$R^2 = 0.9999$$

$$\text{BEC} = 0.038 \text{ ppb}$$

$$\text{LoD} = 0.0994 \text{ ppb}$$

51V (KED AGD)

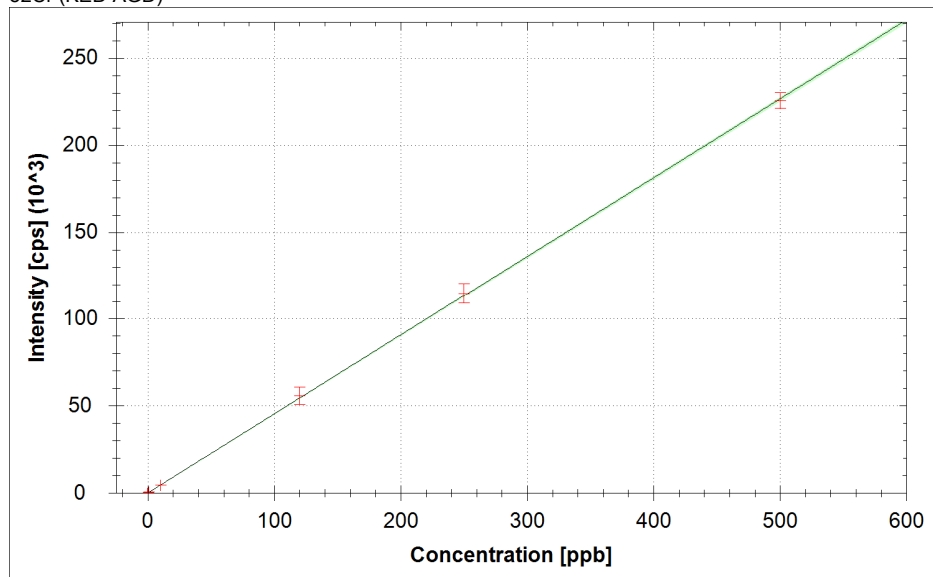


$$f(x) = 300.9635 \cdot x + 3.1270$$

$$R^2 = 1.0000$$

$$\text{BEC} = 0.010 \text{ ppb}$$

$$\text{LoD} = 0.0540 \text{ ppb}$$

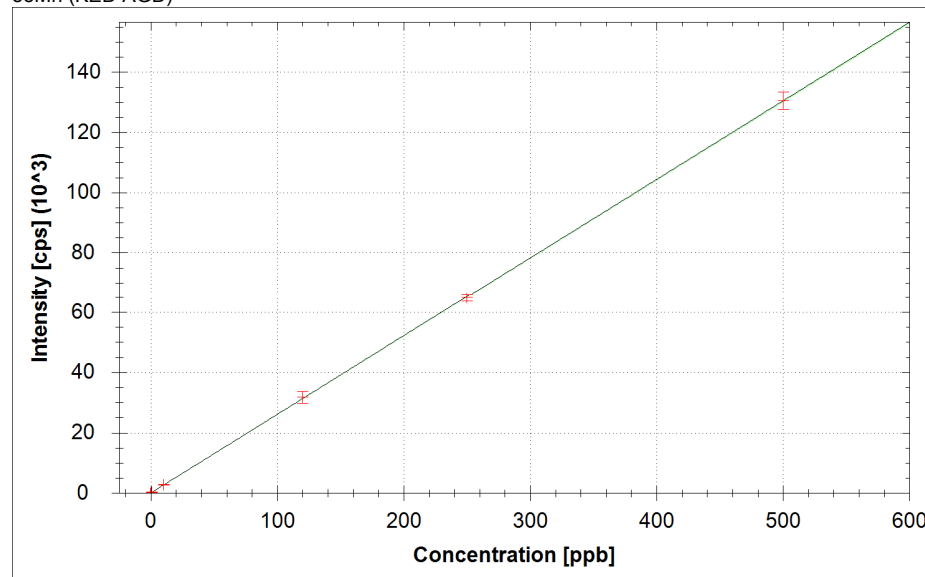
⁵²Cr (KED AGD)

$$f(x) = 453.0356 \cdot x + 48.5606$$

$$R^2 = 0.9999$$

$$\text{BEC} = 0.107 \text{ ppb}$$

$$\text{LoD} = 0.0372 \text{ ppb}$$

⁵⁵Mn (KED AGD)

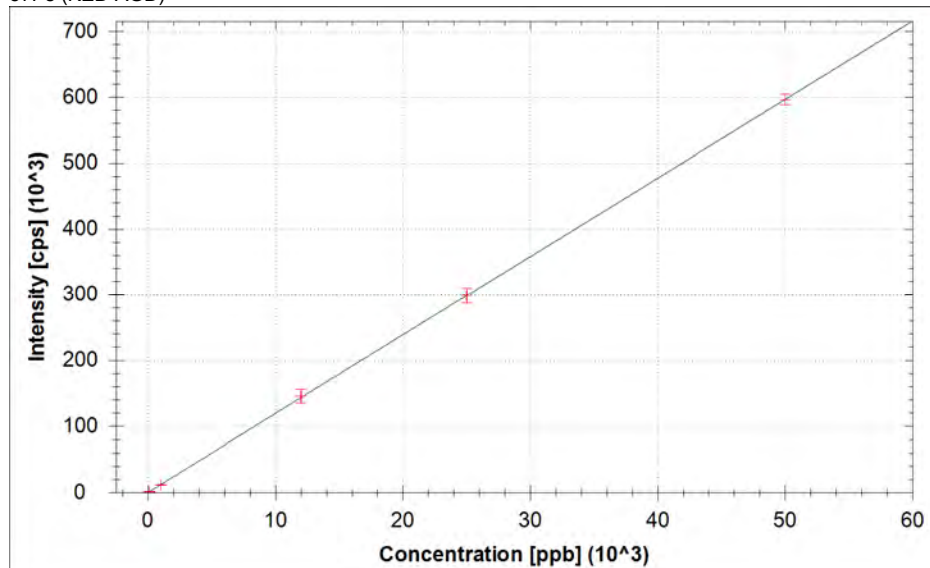
$$f(x) = 260.7975 \cdot x + 6.5040$$

$$R^2 = 1.0000$$

$$\text{BEC} = 0.025 \text{ ppb}$$

$$\text{LoD} = 0.0650 \text{ ppb}$$

57Fe (KED AGD)



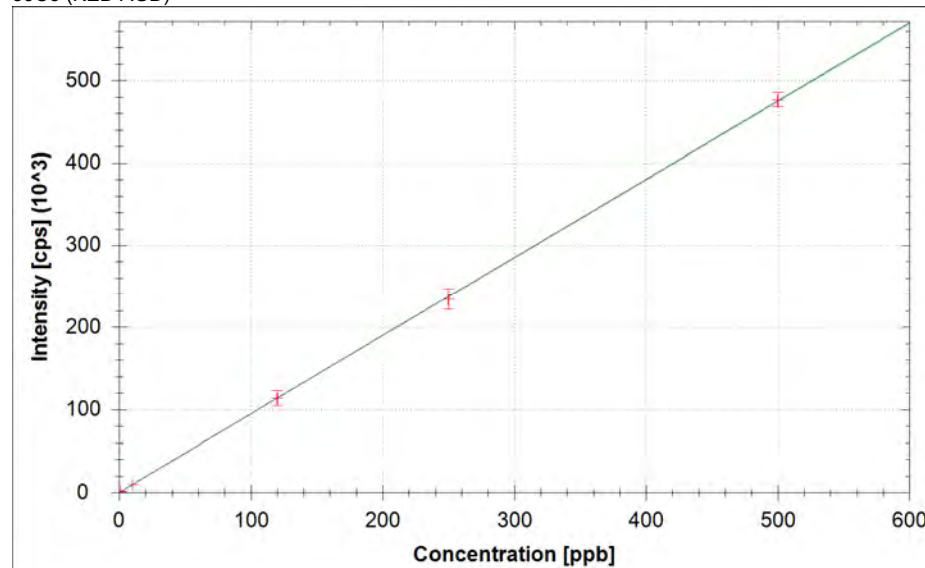
$$f(x) = 11.9283 \cdot x + 16.3776$$

$$R^2 = 1.0000$$

$$\text{BEC} = 1.373 \text{ ppb}$$

$$\text{LoD} = 3.6693 \text{ ppb}$$

59Co (KED AGD)



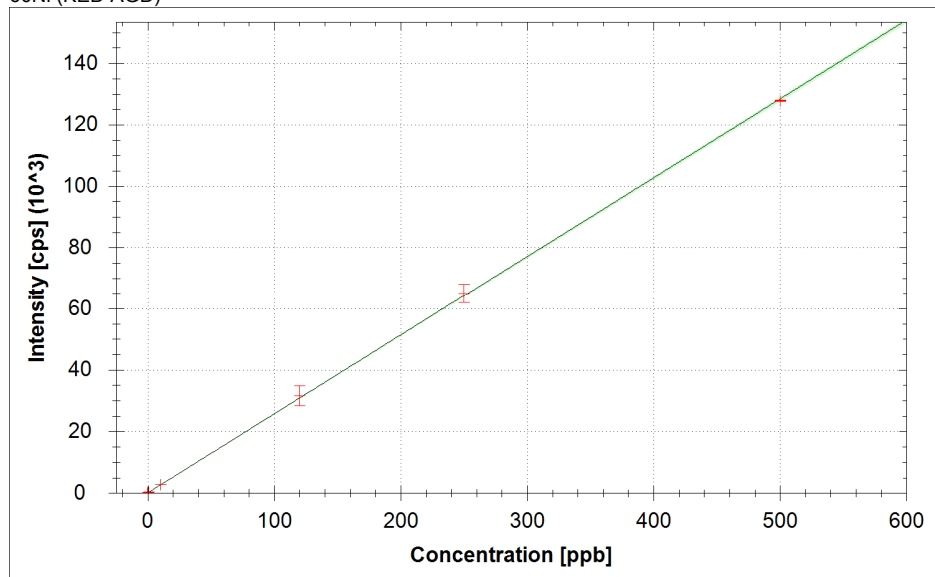
$$f(x) = 949.7318 \cdot x$$

$$R^2 = 0.9999$$

$$\text{BEC} = 0.000 \text{ ppb}$$

$$\text{LoD} = 0.0000 \text{ ppb}$$

60Ni (KED AGD)



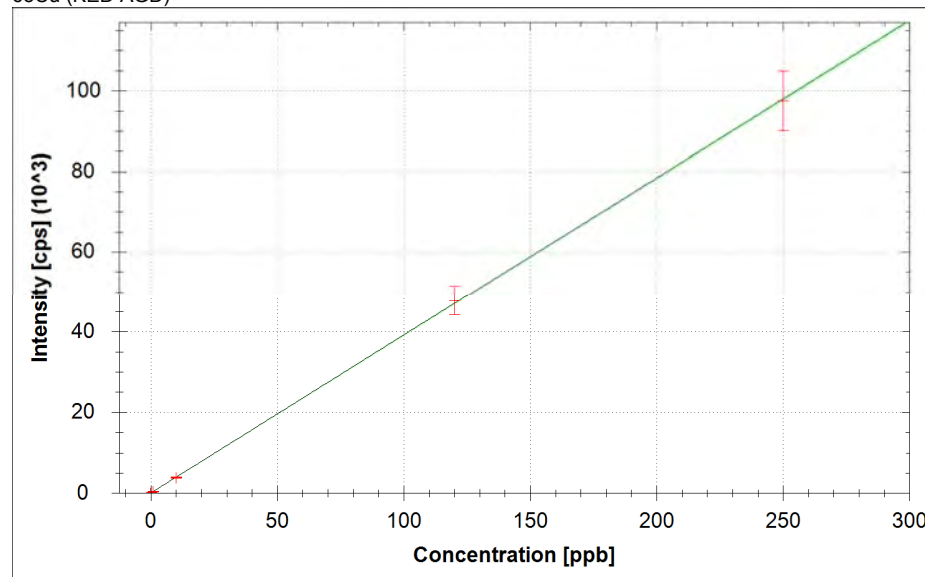
$$f(x) = 256.6274 \cdot x + 53.5490$$

$$R^2 = 0.9999$$

$$\text{BEC} = 0.209 \text{ ppb}$$

$$\text{LoD} = 0.0862 \text{ ppb}$$

65Cu (KED AGD)



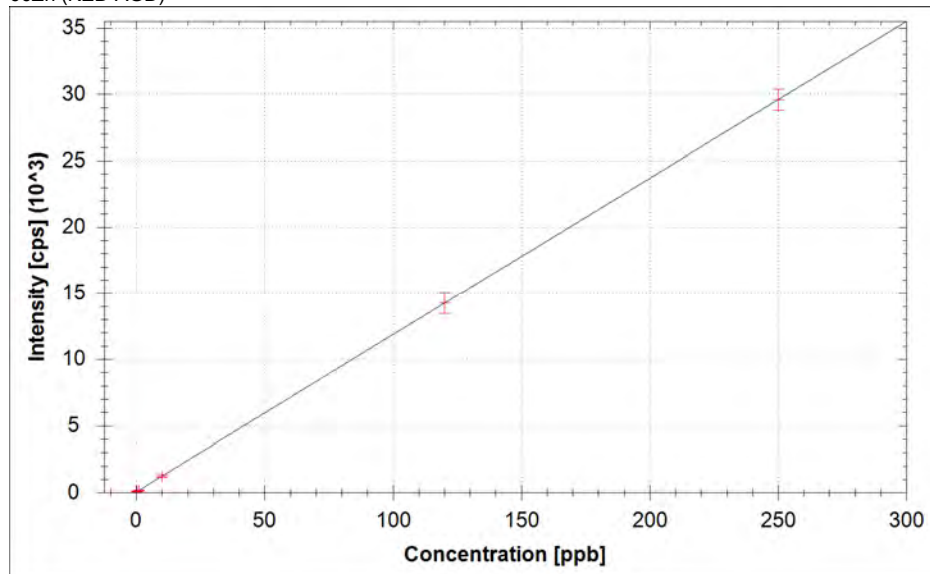
$$f(x) = 391.4661 \cdot x + 13.1192$$

$$R^2 = 0.9999$$

$$\text{BEC} = 0.034 \text{ ppb}$$

$$\text{LoD} = 0.0358 \text{ ppb}$$

66Zn (KED AGD)



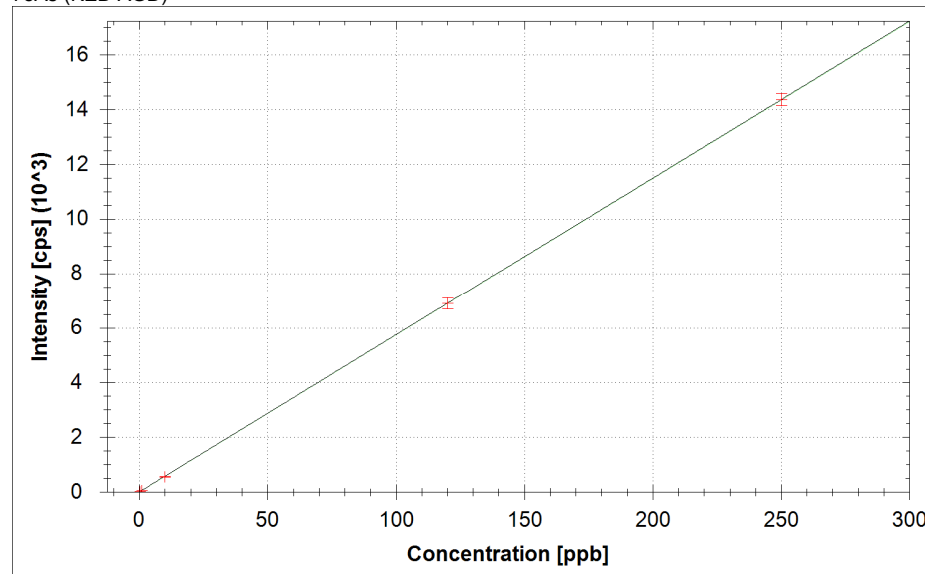
$$f(x) = 118.1842x + 39.2642$$

$$R^2 = 1.0000$$

$$\text{BEC} = 0.332 \text{ ppb}$$

$$\text{LoD} = 0.3197 \text{ ppb}$$

75As (KED AGD)



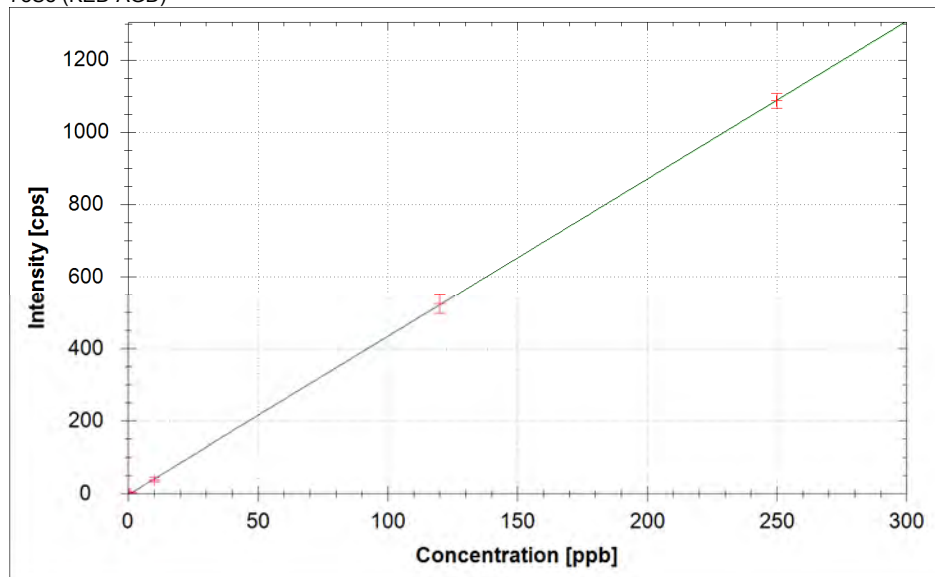
$$f(x) = 57.4417x + 0.3837$$

$$R^2 = 1.0000$$

$$\text{BEC} = 0.007 \text{ ppb}$$

$$\text{LoD} = 0.0347 \text{ ppb}$$

78Se (KED AGD)



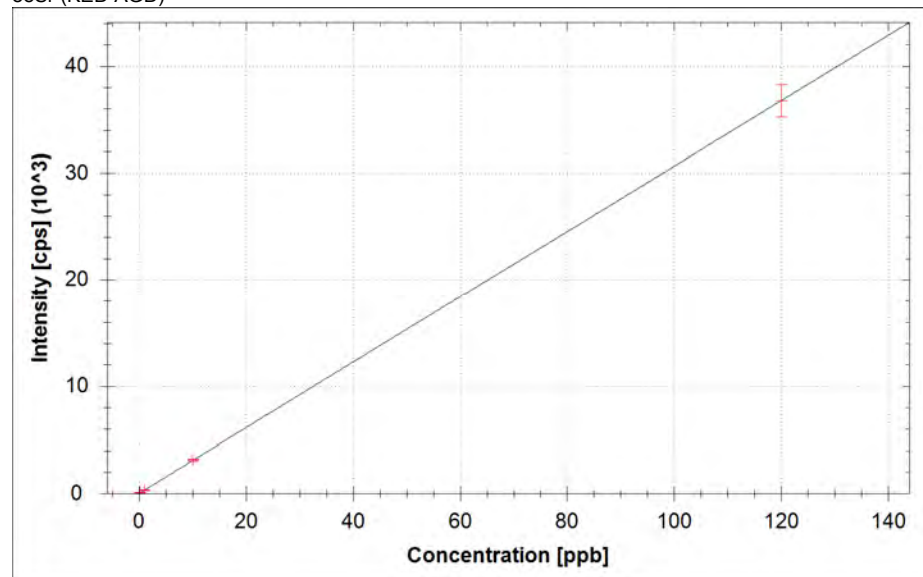
$$f(x) = 4.3682 \cdot x + -3.3985$$

$$R^2 = 1.0000$$

$$\text{BEC} = -0.778 \text{ ppb}$$

$$\text{LoD} = 0.7674 \text{ ppb}$$

88Sr (KED AGD)



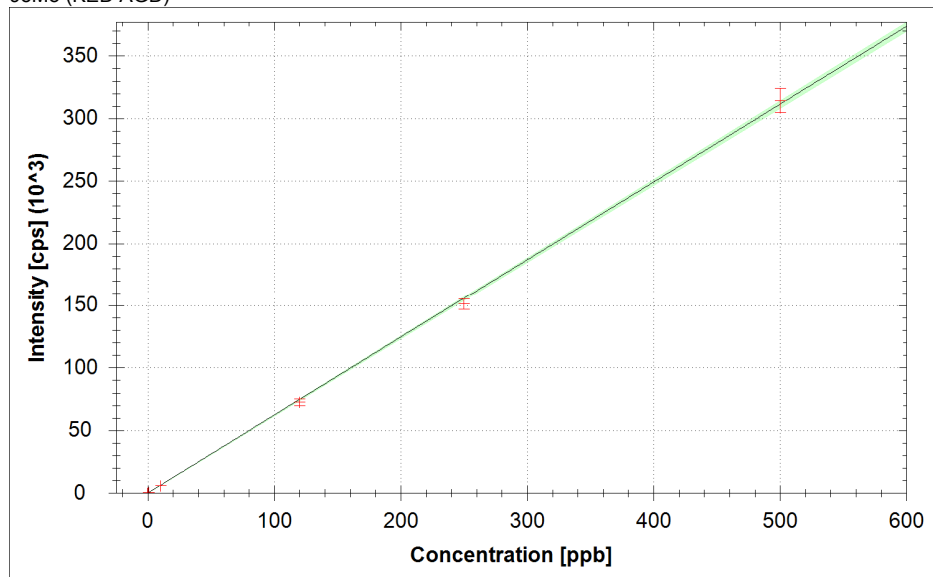
$$f(x) = 306.1688 \cdot x + 14.0607$$

$$R^2 = 1.0000$$

$$\text{BEC} = 0.046 \text{ ppb}$$

$$\text{LoD} = 0.0243 \text{ ppb}$$

95Mo (KED AGD)



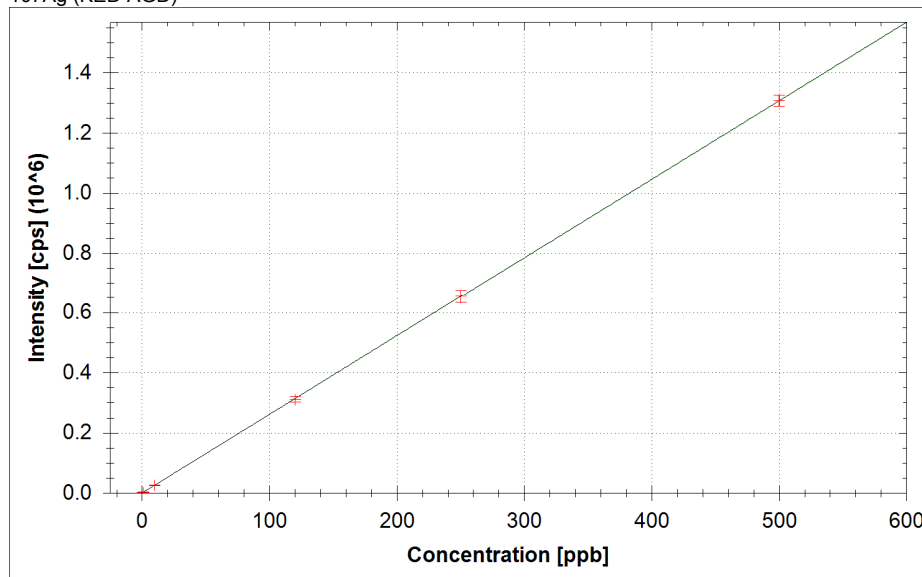
$$f(x) = 622.6129 \cdot x + 3.3699$$

$$R^2 = 0.9996$$

$$\text{BEC} = 0.005 \text{ ppb}$$

$$\text{LoD} = 0.0281 \text{ ppb}$$

107Ag (KED AGD)



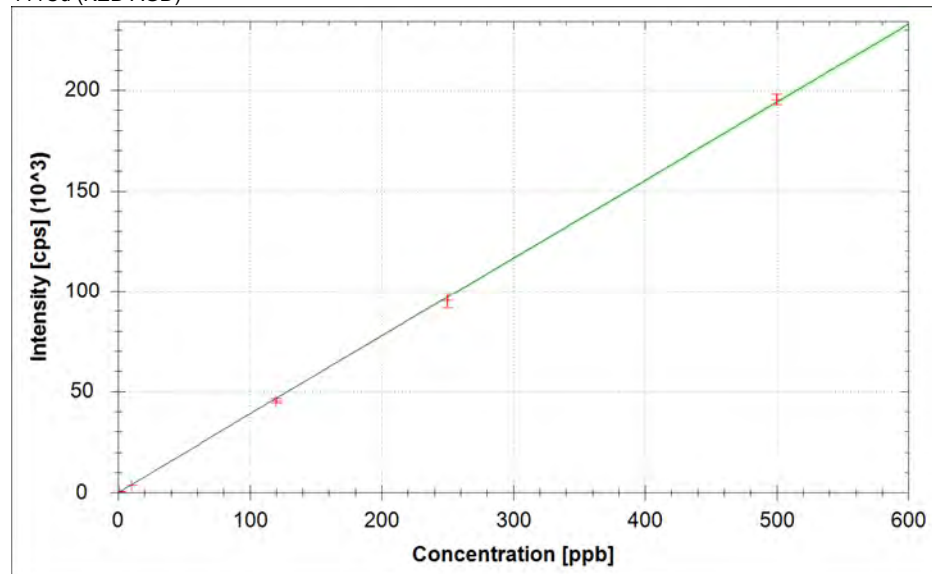
$$f(x) = 2613.2007 \cdot x + 16.6883$$

$$R^2 = 1.0000$$

$$\text{BEC} = 0.006 \text{ ppb}$$

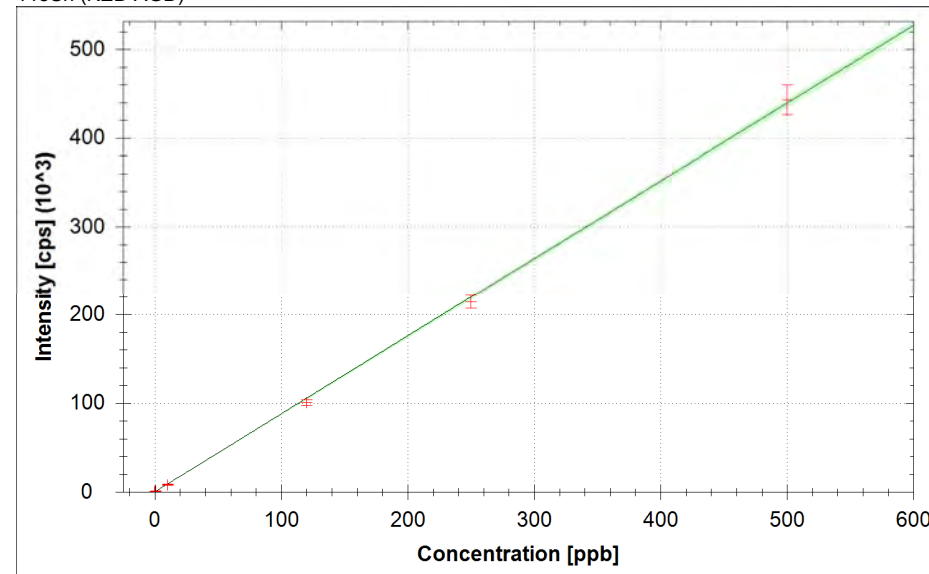
$$\text{LoD} = 0.0035 \text{ ppb}$$

111Cd (KED AGD)



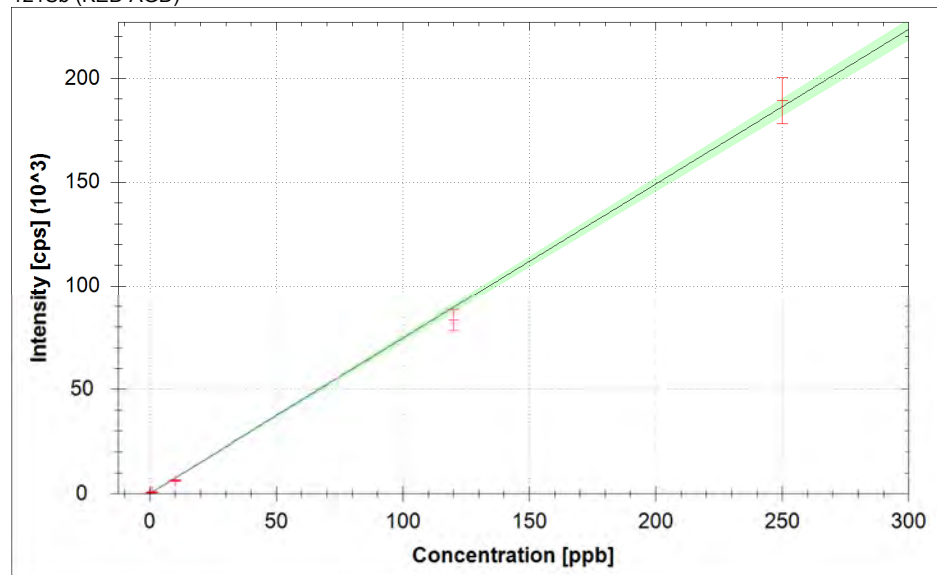
$f(x) = 388.0185 \cdot x$
 $R^2 = 0.9998$
BEC = 0.000 ppb
LoD = 0.0000 ppb

118Sn (KED AGD)



$f(x) = 877.8377 \cdot x + 196.0636$
 $R^2 = 0.9996$
BEC = 0.223 ppb
LoD = 0.0842 ppb

121Sb (KED AGD)



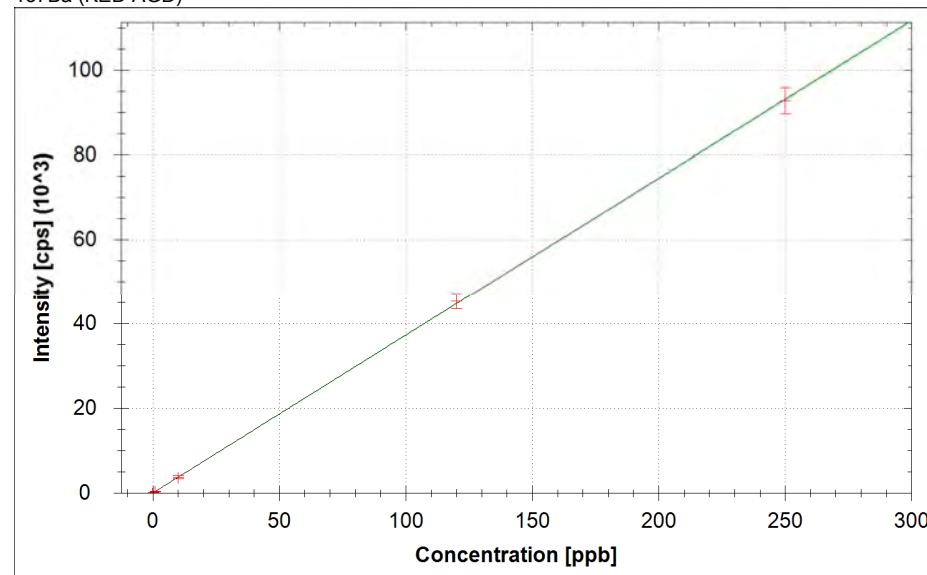
$$f(x) = 744.4745x + 21.7746$$

$$R^2 = 0.9984$$

$$\text{BEC} = 0.029 \text{ ppb}$$

$$\text{LoD} = 0.0156 \text{ ppb}$$

137Ba (KED AGD)



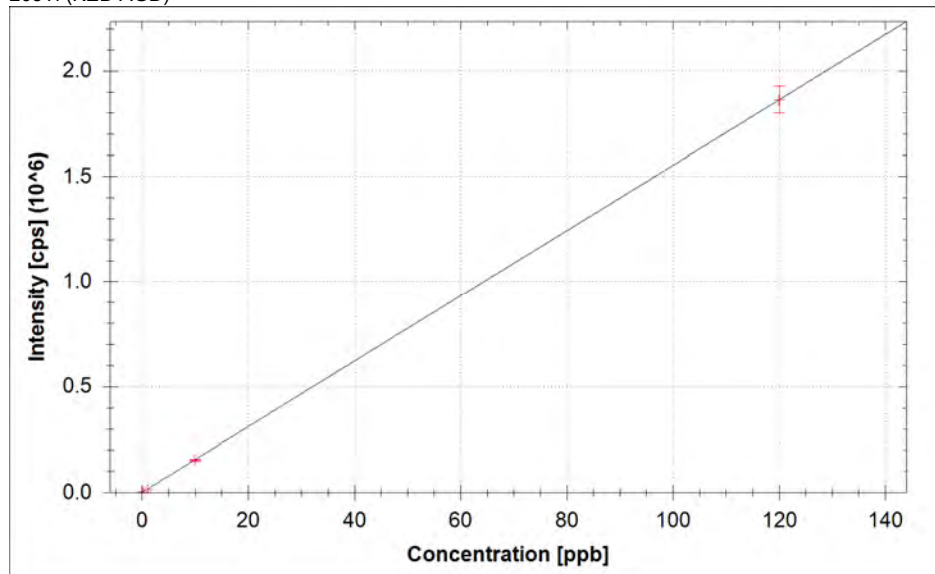
$$f(x) = 372.4171x + 6.7277$$

$$R^2 = 0.9999$$

$$\text{BEC} = 0.018 \text{ ppb}$$

$$\text{LoD} = 0.0252 \text{ ppb}$$

205Tl (KED AGD)



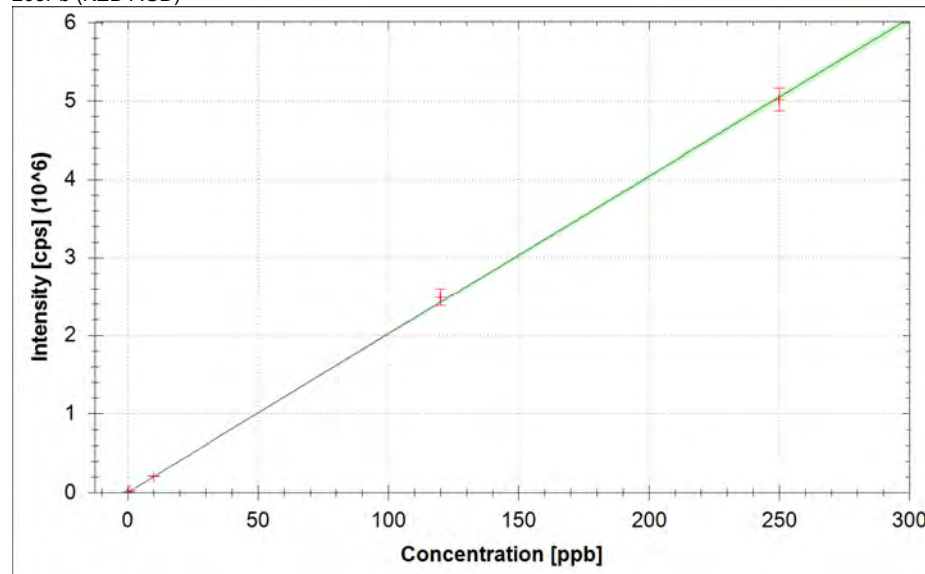
$$f(x) = 15516.3803x + 43.5179$$

$$R^2 = 1.0000$$

$$\text{BEC} = 0.003 \text{ ppb}$$

$$\text{LoD} = 0.0024 \text{ ppb}$$

208Pb (KED AGD)



$$f(x) = 20184.2038x + 169.4341$$

$$R^2 = 0.9997$$

$$\text{BEC} = 0.008 \text{ ppb}$$

$$\text{LoD} = 0.0055 \text{ ppb}$$

Alpha ICPMSQ Full

6/7/2017 3:54:49 PM



Standards:

Analysis Index: 3
Analysis Name: 0.2/20 Cal
Analysis Type: STD
Analysis Started at: 6/7/2017 8:17:07 AM
Standard (Stock): Calibration Standard 6020/200.8
Standard DF: 50000
Rack: 0
Vial: 2

Category	Concentration average	Concentration RSD	Standard Concentration
6Li (STD AGD)	100.215 %		
6Li (KED AGD)	96.374 %		
9Be (STD AGD)	0.208 ppb	25.3 %	0.200 ppb
23Na (KED AGD)	26.585 ppb	31.6 %	20.000 ppb
24Mg (KED AGD)	15.519 ppb	3.4 %	20.000 ppb
27Al (KED AGD)	0.731 ppb	66.5 %	0.200 ppb
39K (KED AGD)	19.224 ppb	18.3 %	20.000 ppb
44Ca (KED AGD)	20.870 ppb	45.8 %	20.000 ppb
45Sc (KED AGD)	102.382 %		
45Sc (STD AGD)	100.136 %		
48Ti (KED AGD)	0.125 ppb	35.6 %	0.200 ppb
51V (KED AGD)	0.220 ppb	14.0 %	0.200 ppb
52Cr (KED AGD)	0.188 ppb	47.4 %	0.200 ppb
55Mn (KED AGD)	0.384 ppb	47.2 %	0.200 ppb
57Fe (KED AGD)	18.883 ppb	23.4 %	20.000 ppb
59Co (KED AGD)	0.216 ppb	11.7 %	0.200 ppb
60Ni (KED AGD)	0.119 ppb	112.0 %	0.200 ppb
65Cu (KED AGD)	0.197 ppb	14.3 %	0.200 ppb
66Zn (KED AGD)	0.380 ppb	54.6 %	0.200 ppb
74Ge (KED AGD)	97.633 %		
75As (KED AGD)	0.245 ppb	41.4 %	0.200 ppb
78Se (KED AGD)	0.517 ppb	66.1 %	0.200 ppb
88Sr (KED AGD)	0.198 ppb	11.1 %	0.200 ppb
95Mo (KED AGD)	0.161 ppb	53.6 %	0.200 ppb
103Rh (KED AGD)	98.704 %		
107Ag (KED AGD)	0.187 ppb	14.8 %	0.200 ppb
111Cd (KED AGD)	0.165 ppb	7.2 %	0.200 ppb
115In (KED AGD)	97.265 %		
118Sn (KED AGD)	0.201 ppb	52.7 %	0.200 ppb
121Sb (KED AGD)	0.217 ppb	17.0 %	0.200 ppb
137Ba (KED AGD)	0.194 ppb	4.0 %	0.200 ppb
159Tb (KED AGD)	96.722 %		
175Lu (KED AGD)	96.124 %		
205Tl (KED AGD)	0.177 ppb	4.0 %	0.200 ppb
208Pb (KED AGD)	0.187 ppb	7.8 %	0.200 ppb
209Bi (KED AGD)	102.725 %		



Alpha ICPMSQ Full

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Standards:

Analysis Index: 4
Analysis Name: 1.0/100 Cal
Analysis Type: STD
Analysis Started at: 6/7/2017 8:20:28 AM
Standard (Stock): Calibration Standard 6020/200.8
Standard DF: 10000
Rack: 0
Vial: 3

Category	Concentration average	Concentration RSD	Standard Concentration
6Li (STD AGD)	98.106 %		
6Li (KED AGD)	90.196 %		
9Be (STD AGD)	1.016 ppb	5.0 %	1.000 ppb
23Na (KED AGD)	103.776 ppb	9.0 %	100.000 ppb
24Mg (KED AGD)	101.137 ppb	6.7 %	100.000 ppb
27Al (KED AGD)	1.084 ppb	32.9 %	1.000 ppb
39K (KED AGD)	84.929 ppb	18.4 %	100.000 ppb
44Ca (KED AGD)	106.552 ppb	15.4 %	100.000 ppb
45Sc (KED AGD)	95.201 %		
45Sc (STD AGD)	96.667 %		
48Ti (KED AGD)	0.955 ppb	22.6 %	1.000 ppb
51V (KED AGD)	1.034 ppb	24.8 %	1.000 ppb
52Cr (KED AGD)	0.966 ppb	4.9 %	1.000 ppb
55Mn (KED AGD)	1.141 ppb	26.7 %	1.000 ppb
57Fe (KED AGD)	92.154 ppb	9.8 %	100.000 ppb
59Co (KED AGD)	0.967 ppb	12.5 %	1.000 ppb
60Ni (KED AGD)	1.001 ppb	16.2 %	1.000 ppb
65Cu (KED AGD)	0.931 ppb	13.5 %	1.000 ppb
66Zn (KED AGD)	1.028 ppb	14.2 %	1.000 ppb
74Ge (KED AGD)	91.645 %		
75As (KED AGD)	0.957 ppb	8.7 %	1.000 ppb
78Se (KED AGD)	1.107 ppb	72.2 %	1.000 ppb
88Sr (KED AGD)	0.967 ppb	6.3 %	1.000 ppb
95Mo (KED AGD)	0.881 ppb	4.6 %	1.000 ppb
103Rh (KED AGD)	94.277 %		
107Ag (KED AGD)	0.948 ppb	4.5 %	1.000 ppb
111Cd (KED AGD)	0.898 ppb	9.1 %	1.000 ppb
115In (KED AGD)	92.620 %		
118Sn (KED AGD)	1.293 ppb	6.7 %	1.000 ppb
121Sb (KED AGD)	0.933 ppb	14.6 %	1.000 ppb
137Ba (KED AGD)	0.969 ppb	19.6 %	1.000 ppb
159Tb (KED AGD)	95.029 %		
175Lu (KED AGD)	93.073 %		
205Tl (KED AGD)	0.937 ppb	3.1 %	1.000 ppb
208Pb (KED AGD)	0.993 ppb	4.1 %	1.000 ppb
209Bi (KED AGD)	100.010 %		



Alpha ICPMSQ Full

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Standards:

Analysis Index: 5
Analysis Name: 10/1000 Cal
Analysis Type: STD
Analysis Started at: 6/7/2017 8:23:50 AM
Standard (Stock): Calibration Standard 6020/200.8
Standard DF: 1000
Rack: 0
Vial: 4

Category	Concentration average	Concentration RSD	Standard Concentration
6Li (STD AGD)	97.668 %		
6Li (KED AGD)	99.846 %		
9Be (STD AGD)	9.956 ppb	1.8 %	10.000 ppb
23Na (KED AGD)	950.210 ppb	1.4 %	1,000.000 ppb
24Mg (KED AGD)	951.097 ppb	2.1 %	1,000.000 ppb
27Al (KED AGD)	10.522 ppb	10.7 %	10.000 ppb
39K (KED AGD)	972.512 ppb	2.2 %	1,000.000 ppb
44Ca (KED AGD)	980.645 ppb	2.0 %	1,000.000 ppb
45Sc (KED AGD)	97.793 %		
45Sc (STD AGD)	97.554 %		
48Ti (KED AGD)	10.376 ppb	7.8 %	10.000 ppb
51V (KED AGD)	9.743 ppb	2.7 %	10.000 ppb
52Cr (KED AGD)	9.923 ppb	2.2 %	10.000 ppb
55Mn (KED AGD)	10.513 ppb	3.9 %	10.000 ppb
57Fe (KED AGD)	979.328 ppb	4.6 %	1,000.000 ppb
59Co (KED AGD)	9.939 ppb	1.6 %	10.000 ppb
60Ni (KED AGD)	10.605 ppb	2.4 %	10.000 ppb
65Cu (KED AGD)	9.647 ppb	3.3 %	10.000 ppb
66Zn (KED AGD)	9.923 ppb	9.5 %	10.000 ppb
74Ge (KED AGD)	92.947 %		
75As (KED AGD)	9.646 ppb	1.3 %	10.000 ppb
78Se (KED AGD)	9.460 ppb	15.7 %	10.000 ppb
88Sr (KED AGD)	10.148 ppb	3.0 %	10.000 ppb
95Mo (KED AGD)	9.405 ppb	2.1 %	10.000 ppb
103Rh (KED AGD)	95.769 %		
107Ag (KED AGD)	9.853 ppb	2.5 %	10.000 ppb
111Cd (KED AGD)	9.341 ppb	2.1 %	10.000 ppb
115In (KED AGD)	94.216 %		
118Sn (KED AGD)	9.327 ppb	7.0 %	10.000 ppb
121Sb (KED AGD)	8.333 ppb	4.8 %	10.000 ppb
137Ba (KED AGD)	9.911 ppb	8.3 %	10.000 ppb
159Tb (KED AGD)	96.770 %		
175Lu (KED AGD)	95.433 %		
205Tl (KED AGD)	9.814 ppb	3.0 %	10.000 ppb
208Pb (KED AGD)	10.303 ppb	3.4 %	10.000 ppb
209Bi (KED AGD)	100.560 %		



Alpha ICPMSQ Full

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Standards:

Analysis Index: 6
Analysis Name: 120/12000
Analysis Type: STD
Analysis Started at: 6/7/2017 8:27:12 AM
Standard (Stock): Calibration Standard 6020/200.8
Standard DF: 83.3333333
Rack: 0
Vial: 5

Category	Concentration average	Concentration RSD	Standard Concentration
6Li (STD AGD)	97.864 %		
6Li (KED AGD)	91.057 %		
9Be (STD AGD)	120.004 ppb	0.4 %	120.000 ppb
23Na (KED AGD)	12,004.107 ppb	6.0 %	12,000.000 ppb
24Mg (KED AGD)	12,004.073 ppb	4.0 %	12,000.000 ppb
27Al (KED AGD)	119.955 ppb	7.9 %	120.000 ppb
39K (KED AGD)	11,933.739 ppb	4.8 %	12,000.000 ppb
44Ca (KED AGD)	12,001.557 ppb	7.9 %	12,000.000 ppb
45Sc (KED AGD)	92.837 %		
45Sc (STD AGD)	97.702 %		
48Ti (KED AGD)	122.504 ppb	10.3 %	120.000 ppb
51V (KED AGD)	120.674 ppb	5.9 %	120.000 ppb
52Cr (KED AGD)	122.959 ppb	8.9 %	120.000 ppb
55Mn (KED AGD)	121.600 ppb	6.0 %	120.000 ppb
57Fe (KED AGD)	12,161.557 ppb	7.4 %	12,000.000 ppb
59Co (KED AGD)	120.000 ppb	8.1 %	120.000 ppb
60Ni (KED AGD)	122.661 ppb	10.3 %	120.000 ppb
65Cu (KED AGD)	122.031 ppb	7.5 %	120.000 ppb
66Zn (KED AGD)	120.090 ppb	5.5 %	120.000 ppb
74Ge (KED AGD)	89.125 %		
75As (KED AGD)	120.019 ppb	3.0 %	120.000 ppb
78Se (KED AGD)	120.713 ppb	5.0 %	120.000 ppb
88Sr (KED AGD)	119.988 ppb	4.1 %	120.000 ppb
95Mo (KED AGD)	116.287 ppb	3.9 %	120.000 ppb
103Rh (KED AGD)	93.262 %		
107Ag (KED AGD)	118.982 ppb	2.9 %	120.000 ppb
111Cd (KED AGD)	116.607 ppb	2.4 %	120.000 ppb
115In (KED AGD)	88.748 %		
118Sn (KED AGD)	114.406 ppb	3.1 %	120.000 ppb
121Sb (KED AGD)	111.768 ppb	6.0 %	120.000 ppb
137Ba (KED AGD)	121.693 ppb	4.0 %	120.000 ppb
159Tb (KED AGD)	94.662 %		
175Lu (KED AGD)	92.905 %		
205Tl (KED AGD)	120.016 ppb	3.4 %	120.000 ppb
208Pb (KED AGD)	123.292 ppb	4.3 %	120.000 ppb
209Bi (KED AGD)	99.420 %		



Alpha ICPMSQ Full

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Standards:

Analysis Index: 7
Analysis Name: 250/25000
Analysis Type: STD
Analysis Started at: 6/7/2017 8:30:34 AM
Standard (Stock): Calibration Standard 6020/200.8
Standard DF: 40
Rack: 0
Vial: 6

Category	Concentration average	Concentration RSD	Standard Concentration
6Li (STD AGD)	88.389 %		
6Li (KED AGD)	89.213 %		
9Be (STD AGD)	319.517 ppb	25.0 %	250.000 ppb
23Na (KED AGD)	24,608.762 ppb	3.1 %	25,000.000 ppb
24Mg (KED AGD)	24,837.957 ppb	2.6 %	25,000.000 ppb
27Al (KED AGD)	256.063 ppb	2.2 %	250.000 ppb
39K (KED AGD)	25,032.966 ppb	2.5 %	25,000.000 ppb
44Ca (KED AGD)	24,874.970 ppb	1.7 %	25,000.000 ppb
45Sc (KED AGD)	89.230 %		
45Sc (STD AGD)	82.238 %		
48Ti (KED AGD)	251.908 ppb	3.7 %	250.000 ppb
51V (KED AGD)	251.842 ppb	4.5 %	250.000 ppb
52Cr (KED AGD)	253.143 ppb	5.0 %	250.000 ppb
55Mn (KED AGD)	248.506 ppb	1.9 %	250.000 ppb
57Fe (KED AGD)	24,993.259 ppb	3.9 %	25,000.000 ppb
59Co (KED AGD)	246.557 ppb	5.4 %	250.000 ppb
60Ni (KED AGD)	253.006 ppb	4.8 %	250.000 ppb
65Cu (KED AGD)	249.040 ppb	7.6 %	250.000 ppb
66Zn (KED AGD)	249.960 ppb	2.7 %	250.000 ppb
74Ge (KED AGD)	87.263 %		
75As (KED AGD)	250.005 ppb	1.5 %	250.000 ppb
78Se (KED AGD)	249.679 ppb	1.9 %	250.000 ppb
88Sr (KED AGD)	242.367 ppb	3.1 %	250.000 ppb
95Mo (KED AGD)	242.557 ppb	2.9 %	250.000 ppb
103Rh (KED AGD)	91.598 %		
107Ag (KED AGD)	250.107 ppb	3.2 %	250.000 ppb
111Cd (KED AGD)	245.260 ppb	3.7 %	250.000 ppb
115In (KED AGD)	86.824 %		
118Sn (KED AGD)	243.734 ppb	3.5 %	250.000 ppb
121Sb (KED AGD)	254.018 ppb	5.9 %	250.000 ppb
137Ba (KED AGD)	249.191 ppb	3.3 %	250.000 ppb
159Tb (KED AGD)	92.092 %		
175Lu (KED AGD)	89.431 %		
205Tl (KED AGD)	229.300 ppb	2.7 %	250.000 ppb
208Pb (KED AGD)	248.408 ppb	2.9 %	250.000 ppb
209Bi (KED AGD)	97.762 %		



Alpha ICPMSQ Full

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Standards:

Analysis Index: 8
Analysis Name: 500/50000
Analysis Type: STD
Analysis Started at: 6/7/2017 8:33:57 AM
Standard (Stock): Calibration Standard 6020/200.8
Standard DF: 20
Rack: 0
Vial: 7

Category	Concentration average	Concentration RSD	Standard Concentration
6Li (STD AGD)	94.580 %		
6Li (KED AGD)	86.355 %		
9Be (STD AGD)	511.717 ppb	0.8 %	500.000 ppb
23Na (KED AGD)	48,119.292 ppb	4.6 %	50,000.000 ppb
24Mg (KED AGD)	48,545.296 ppb	5.5 %	50,000.000 ppb
27Al (KED AGD)	503.175 ppb	5.5 %	500.000 ppb
39K (KED AGD)	49,256.922 ppb	5.4 %	50,000.000 ppb
44Ca (KED AGD)	49,237.432 ppb	6.1 %	50,000.000 ppb
45Sc (KED AGD)	87.163 %		
45Sc (STD AGD)	95.691 %		
48Ti (KED AGD)	498.438 ppb	4.7 %	500.000 ppb
51V (KED AGD)	498.922 ppb	0.6 %	500.000 ppb
52Cr (KED AGD)	497.720 ppb	2.0 %	500.000 ppb
55Mn (KED AGD)	500.353 ppb	2.3 %	500.000 ppb
57Fe (KED AGD)	49,965.026 ppb	1.3 %	50,000.000 ppb
59Co (KED AGD)	501.723 ppb	1.8 %	500.000 ppb
60Ni (KED AGD)	497.846 ppb	0.2 %	500.000 ppb
65Cu (KED AGD)	509.498 ppb	2.2 %	500.000 ppb
66Zn (KED AGD)	513.209 ppb	0.3 %	500.000 ppb
74Ge (KED AGD)	83.844 %		
75As (KED AGD)	512.109 ppb	0.6 %	500.000 ppb
78Se (KED AGD)	514.134 ppb	4.2 %	500.000 ppb
88Sr (KED AGD)	494.808 ppb	6.0 %	500.000 ppb
95Mo (KED AGD)	504.625 ppb	3.1 %	500.000 ppb
103Rh (KED AGD)	88.183 %		
107Ag (KED AGD)	500.194 ppb	1.5 %	500.000 ppb
111Cd (KED AGD)	503.198 ppb	1.3 %	500.000 ppb
115In (KED AGD)	83.089 %		
118Sn (KED AGD)	504.488 ppb	3.8 %	500.000 ppb
121Sb (KED AGD)	565.366 ppb	5.2 %	500.000 ppb
137Ba (KED AGD)	508.112 ppb	3.7 %	500.000 ppb
159Tb (KED AGD)	90.489 %		
175Lu (KED AGD)	87.975 %		
205Tl (KED AGD)	452.765 ppb	1.5 %	500.000 ppb
208Pb (KED AGD)	484.120 ppb	2.0 %	500.000 ppb
209Bi (KED AGD)	96.116 %		



Alpha ICPMSQ Full

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Analysis index:	1	Analysis started at:	6/7/2017 8:10:21 AM	Rack:	0
Analysis label:	rinse	User name:	ALPHALAB\metals-instrument	Vial:	1

Alpha ICPMSQ Full

6/7/2017 3:54:49 PM



Analysis index: 2 Analysis started at: 6/7/2017 8:13:41 AM Rack: 4
 Analysis label: Blank AM ICPMSQ User name: ALPHALAB\metals-instrument Vial: 49

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	100.000 %	100.000 %	0.000 ppb	0.000 ppb	0.000 ppb	0.000 ppb	0.000 ppb	0.000 ppb	100.000 %
Concentration per Run	100.000 %	100.000 %	0.000 ppb	0.000 ppb	0.000 ppb	0.000 ppb	0.000 ppb	0.000 ppb	100.000 %
Concentration RSD			0.9 %	0.0 %	0.9 %	0.5 %	0.0 %	1.8 %	

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	100.000 %	0.000 ppb	0.000 ppb	0.000 ppb	0.000 ppb	0.000 ppb	0.000 ppb	0.000 ppb	0.000 ppb
Concentration per Run	100.000 %	0.000 ppb	0.000 ppb	0.000 ppb	0.000 ppb	0.000 ppb	0.000 ppb	0.000 ppb	0.000 ppb
Concentration RSD		0.9 %	1.7 %	0.1 %	0.9 %	0.9 %		0.1 %	0.4 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	0.000 ppb	100.000 %	0.000 ppb	0.000 ppb	0.000 ppb	0.000 ppb	100.000 %	0.000 ppb	0.000 ppb
Concentration per Run	0.000 ppb	100.000 %	0.000 ppb	0.000 ppb	0.000 ppb	0.000 ppb	100.000 %	0.000 ppb	0.000 ppb
Concentration RSD	0.3 %		1.7 %	-0.3 %	0.2 %	1.7 %		0.2 %	

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	100.000 %	0.000 ppb	0.000 ppb	0.000 ppb	100.000 %	100.000 %	0.000 ppb	0.000 ppb	100.000 %
Concentration per Run	100.000 %	0.000 ppb	0.000 ppb	0.000 ppb	100.000 %	100.000 %	0.000 ppb	0.000 ppb	100.000 %
Concentration RSD		0.1 %	0.2 %	0.5 %			0.3 %	0.2 %	

Alpha ICPMSQ Full

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Analysis index: 3 Analysis started at: 6/7/2017 8:17:07 AM Rack: 0
 Analysis label: 0.2/20 Cal User name: ALPHALAB\metals-instrument Vial: 2

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	100.215 %	96.374 %	0.208 ppb	26.585 ppb	15.519 ppb	0.731 ppb	19.224 ppb	20.870 ppb	102.382 %
Concentration per Run 1	99.512 %	105.286 %	0.168 ppb	21.833 ppb	16.069 ppb	0.660 ppb	20.337 ppb	30.726 ppb	119.389 %
Concentration per Run 2	101.409 %	93.208 %	0.188 ppb	21.633 ppb	15.030 ppb	1.249 ppb	22.049 ppb	20.259 ppb	100.000 %
Concentration per Run 3	99.725 %	90.627 %	0.267 ppb	36.288 ppb	15.456 ppb	0.284 ppb	15.286 ppb	11.624 ppb	87.758 %
Concentration RSD			25.3 %	31.6 %	3.4 %	66.5 %	18.3 %	45.8 %	

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	100.136 %	0.125 ppb	0.220 ppb	0.188 ppb	0.384 ppb	18.883 ppb	0.216 ppb	0.119 ppb	0.197 ppb
Concentration per Run 1	98.349 %	0.150 ppb	0.217 ppb	0.101 ppb	0.175 ppb	14.730 ppb	0.222 ppb	0.032 ppb	0.219 ppb
Concentration per Run 2	101.704 %	0.073 ppb	0.191 ppb	0.184 ppb	0.484 ppb	23.534 ppb	0.238 ppb	0.273 ppb	0.206 ppb
Concentration per Run 3	100.354 %	0.151 ppb	0.253 ppb	0.279 ppb	0.493 ppb	18.385 ppb	0.189 ppb	0.053 ppb	0.165 ppb
Concentration RSD		35.6 %	14.0 %	47.4 %	47.2 %	23.4 %	11.7 %	112.0 %	14.3 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	0.380 ppb	97.633 %	0.245 ppb	0.517 ppb	0.198 ppb	0.161 ppb	98.704 %	0.187 ppb	0.165 ppb
Concentration per Run 1	0.171 ppb	107.656 %	0.277 ppb	0.259 ppb	0.207 ppb	0.225 ppb	103.632 %	0.164 ppb	0.173 ppb
Concentration per Run 2	0.586 ppb	94.228 %	0.132 ppb	0.388 ppb	0.173 ppb	0.195 ppb	97.047 %	0.180 ppb	0.170 ppb
Concentration per Run 3	0.381 ppb	91.014 %	0.327 ppb	0.905 ppb	0.214 ppb	0.063 ppb	95.432 %	0.218 ppb	0.151 ppb
Concentration RSD	54.6 %		41.4 %	66.1 %	11.1 %	53.6 %		14.8 %	7.2 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	97.265 %	0.201 ppb	0.217 ppb	0.194 ppb	96.722 %	96.124 %	0.177 ppb	0.187 ppb	102.725 %
Concentration per Run 1	109.110 %	0.176 ppb	0.258 ppb	0.202 ppb	98.651 %	100.386 %	0.170 ppb	0.170 ppb	109.517 %
Concentration per Run 2	92.328 %	0.317 ppb	0.209 ppb	0.194 ppb	97.797 %	94.882 %	0.176 ppb	0.198 ppb	99.336 %
Concentration per Run 3	90.357 %	0.110 ppb	0.185 ppb	0.186 ppb	93.718 %	93.102 %	0.184 ppb	0.192 ppb	99.321 %
Concentration RSD		52.7 %	17.0 %	4.0 %			4.0 %	7.8 %	

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Analysis index: 4 Analysis started at: 6/7/2017 8:20:28 AM Rack: 0
 Analysis label: 1.0/100 Cal User name: ALPHALAB\metals-instrument Vial: 3

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	98.106 %	90.196 %	1.016 ppb	103.776 ppb	101.137 ppb	1.084 ppb	84.929 ppb	106.552 ppb	95.201 %
Concentration per Run 1	98.275 %	92.655 %	1.010 ppb	99.945 ppb	93.349 ppb	1.135 ppb	68.479 ppb	110.034 ppb	97.267 %
Concentration per Run 2	98.033 %	91.456 %	1.069 ppb	96.950 ppb	105.261 ppb	0.705 ppb	99.663 ppb	120.939 ppb	94.483 %
Concentration per Run 3	98.010 %	86.478 %	0.968 ppb	114.432 ppb	104.799 ppb	1.412 ppb	86.645 ppb	88.683 ppb	93.852 %
Concentration RSD			5.0 %	9.0 %	6.7 %	32.9 %	18.4 %	15.4 %	

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	96.667 %	0.955 ppb	1.034 ppb	0.966 ppb	1.141 ppb	92.154 ppb	0.967 ppb	1.001 ppb	0.931 ppb
Concentration per Run 1	96.023 %	1.165 ppb	0.988 ppb	0.912 ppb	1.493 ppb	101.944 ppb	1.103 ppb	0.976 ppb	0.829 ppb
Concentration per Run 2	97.552 %	0.964 ppb	0.804 ppb	0.987 ppb	0.960 ppb	84.036 ppb	0.928 ppb	1.175 ppb	1.072 ppb
Concentration per Run 3	96.425 %	0.734 ppb	1.311 ppb	0.998 ppb	0.970 ppb	90.481 ppb	0.871 ppb	0.853 ppb	0.892 ppb
Concentration RSD		22.6 %	24.8 %	4.9 %	26.7 %	9.8 %	12.5 %	16.2 %	13.5 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	1.028 ppb	91.645 %	0.957 ppb	1.107 ppb	0.967 ppb	0.881 ppb	94.277 %	0.948 ppb	0.898 ppb
Concentration per Run 1	0.920 ppb	93.606 %	1.038 ppb	2.021 ppb	0.981 ppb	0.928 ppb	97.410 %	0.977 ppb	0.833 ppb
Concentration per Run 2	0.969 ppb	91.506 %	0.872 ppb	0.758 ppb	0.900 ppb	0.857 ppb	93.718 %	0.967 ppb	0.870 ppb
Concentration per Run 3	1.194 ppb	89.822 %	0.962 ppb	0.542 ppb	1.020 ppb	0.858 ppb	91.704 %	0.899 ppb	0.990 ppb
Concentration RSD	14.2 %		8.7 %	72.2 %	6.3 %	4.6 %		4.5 %	9.1 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	92.620 %	1.293 ppb	0.933 ppb	0.969 ppb	95.029 %	93.073 %	0.937 ppb	0.993 ppb	100.010 %
Concentration per Run 1	96.964 %	1.297 ppb	0.952 ppb	0.779 ppb	98.348 %	96.809 %	0.935 ppb	0.948 ppb	102.387 %
Concentration per Run 2	90.897 %	1.377 ppb	1.059 ppb	0.968 ppb	94.287 %	91.299 %	0.967 ppb	1.005 ppb	98.426 %
Concentration per Run 3	90.001 %	1.204 ppb	0.789 ppb	1.159 ppb	92.453 %	91.112 %	0.908 ppb	1.027 ppb	99.217 %
Concentration RSD		6.7 %	14.6 %	19.6 %			3.1 %	4.1 %	

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Analysis index: 5 Analysis started at: 6/7/2017 8:23:50 AM Rack: 0
 Analysis label: 10/1000 Cal User name: ALPHALAB\metals-instrument Vial: 4

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	97.668 %	99.846 %	9.956 ppb	950.210 ppb	951.097 ppb	10.522 ppb	972.512 ppb	980.645 ppb	97.793 %
Concentration per Run 1	99.029 %	99.662 %	10.109 ppb	936.082 ppb	940.966 ppb	9.592 ppb	989.154 ppb	984.955 ppb	100.945 %
Concentration per Run 2	96.560 %	100.215 %	9.759 ppb	962.525 ppb	938.322 ppb	11.776 ppb	947.911 ppb	959.267 ppb	96.637 %
Concentration per Run 3	97.415 %	99.662 %	9.998 ppb	952.024 ppb	974.004 ppb	10.198 ppb	980.471 ppb	997.713 ppb	95.796 %
Concentration RSD			1.8 %	1.4 %	2.1 %	10.7 %	2.2 %	2.0 %	

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	97.554 %	10.376 ppb	9.743 ppb	9.923 ppb	10.513 ppb	979.328 ppb	9.939 ppb	10.605 ppb	9.647 ppb
Concentration per Run 1	98.964 %	9.762 ppb	9.530 ppb	9.677 ppb	10.112 ppb	933.798 ppb	9.925 ppb	10.369 ppb	9.892 ppb
Concentration per Run 2	96.491 %	11.289 ppb	9.661 ppb	10.013 ppb	10.940 ppb	1,022.997 ppb	9.790 ppb	10.879 ppb	9.288 ppb
Concentration per Run 3	97.206 %	10.077 ppb	10.039 ppb	10.080 ppb	10.486 ppb	981.189 ppb	10.101 ppb	10.568 ppb	9.760 ppb
Concentration RSD		7.8 %	2.7 %	2.2 %	3.9 %	4.6 %	1.6 %	2.4 %	3.3 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	9.923 ppb	92.947 %	9.646 ppb	9.460 ppb	10.148 ppb	9.405 ppb	95.769 %	9.853 ppb	9.341 ppb
Concentration per Run 1	8.841 ppb	94.539 %	9.513 ppb	9.061 ppb	9.891 ppb	9.180 ppb	97.551 %	10.120 ppb	9.416 ppb
Concentration per Run 2	10.600 ppb	91.241 %	9.658 ppb	11.108 ppb	10.488 ppb	9.571 ppb	96.371 %	9.623 ppb	9.493 ppb
Concentration per Run 3	10.329 ppb	93.061 %	9.767 ppb	8.212 ppb	10.067 ppb	9.465 ppb	93.386 %	9.816 ppb	9.114 ppb
Concentration RSD	9.5 %		1.3 %	15.7 %	3.0 %	2.1 %		2.5 %	2.1 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	94.216 %	9.327 ppb	8.333 ppb	9.911 ppb	96.770 %	95.433 %	9.814 ppb	10.303 ppb	100.560 %
Concentration per Run 1	96.500 %	8.682 ppb	7.927 ppb	8.963 ppb	99.059 %	98.374 %	9.534 ppb	9.904 ppb	103.572 %
Concentration per Run 2	94.200 %	9.985 ppb	8.344 ppb	10.400 ppb	95.260 %	93.876 %	9.786 ppb	10.425 ppb	99.740 %
Concentration per Run 3	91.947 %	9.316 ppb	8.729 ppb	10.371 ppb	95.990 %	94.050 %	10.122 ppb	10.580 ppb	98.368 %
Concentration RSD		7.0 %	4.8 %	8.3 %			3.0 %	3.4 %	

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Analysis index: 6 Analysis started at: 6/7/2017 8:27:12 AM Rack: 0
 Analysis label: 120/12000 User name: ALPHALAB\metals-instrument Vial: 5

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	97.864 %	91.057 %	120.004 ppb	12,004.107 ppb	12,004.073 ppb	119.955 ppb	11,933.739 ppb	12,001.557 ppb	92.837 %
Concentration per Run 1	97.249 %	93.024 %	119.578 ppb	11,575.854 ppb	11,641.318 ppb	113.502 ppb	11,294.316 ppb	11,038.865 ppb	102.259 %
Concentration per Run 2	97.433 %	96.527 %	119.957 ppb	11,606.741 ppb	11,828.542 ppb	115.532 ppb	12,107.110 ppb	12,027.381 ppb	96.322 %
Concentration per Run 3	98.911 %	83.620 %	120.476 ppb	12,829.725 ppb	12,542.360 ppb	130.831 ppb	12,399.790 ppb	12,938.425 ppb	79.931 %
Concentration RSD			0.4 %	6.0 %	4.0 %	7.9 %	4.8 %	7.9 %	

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	97.702 %	122.504 ppb	120.674 ppb	122.959 ppb	121.600 ppb	12,161.557 ppb	120.000 ppb	122.661 ppb	122.031 ppb
Concentration per Run 1	96.285 %	108.632 ppb	113.303 ppb	112.242 ppb	113.667 ppb	11,279.207 ppb	110.565 ppb	109.423 ppb	112.151 ppb
Concentration per Run 2	98.367 %	125.439 ppb	121.250 ppb	122.634 ppb	123.014 ppb	12,138.683 ppb	119.483 ppb	123.886 ppb	123.618 ppb
Concentration per Run 3	98.455 %	133.442 ppb	127.469 ppb	134.001 ppb	128.118 ppb	13,066.782 ppb	129.951 ppb	134.674 ppb	130.324 ppb
Concentration RSD		10.3 %	5.9 %	8.9 %	6.0 %	7.4 %	8.1 %	10.3 %	7.5 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	120.090 ppb	89.125 %	120.019 ppb	120.713 ppb	119.988 ppb	116.287 ppb	93.262 %	118.982 ppb	116.607 ppb
Concentration per Run 1	112.640 ppb	94.081 %	116.166 ppb	115.426 ppb	118.465 ppb	111.155 ppb	95.559 %	114.984 ppb	113.411 ppb
Concentration per Run 2	122.216 ppb	90.434 %	120.650 ppb	127.337 ppb	125.516 ppb	119.749 ppb	93.087 %	120.893 ppb	118.295 ppb
Concentration per Run 3	125.414 ppb	82.861 %	123.241 ppb	119.376 ppb	115.982 ppb	117.958 ppb	91.142 %	121.070 ppb	118.113 ppb
Concentration RSD	5.5 %		3.0 %	5.0 %	4.1 %	3.9 %		2.9 %	2.4 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	88.748 %	114.406 ppb	111.768 ppb	121.693 ppb	94.662 %	92.905 %	120.016 ppb	123.292 ppb	99.420 %
Concentration per Run 1	93.046 %	110.287 ppb	104.355 ppb	116.379 ppb	98.330 %	96.737 %	115.855 ppb	117.523 ppb	103.859 %
Concentration per Run 2	89.694 %	116.143 ppb	113.425 ppb	125.929 ppb	95.815 %	94.006 %	120.105 ppb	124.545 ppb	99.708 %
Concentration per Run 3	83.504 %	116.787 ppb	117.523 ppb	122.771 ppb	89.841 %	87.973 %	124.089 ppb	127.807 ppb	94.692 %
Concentration RSD		3.1 %	6.0 %	4.0 %			3.4 %	4.3 %	

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Analysis index: 7 Analysis started at: 6/7/2017 8:30:34 AM Rack: 0
 Analysis label: 250/25000 User name: ALPHALAB\metals-instrument Vial: 6

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	88.389 %	89.213 %	319.517 ppb	24,608.762 ppb	24,837.957 ppb	256.063 ppb	25,032.966 ppb	24,874.970 ppb	89.230 %
Concentration per Run 1	85.653 %	93.946 %	350.211 ppb	23,758.323 ppb	24,100.011 ppb	249.534 ppb	25,693.634 ppb	25,283.456 ppb	96.532 %
Concentration per Run 2	80.080 %	86.478 %	379.357 ppb	25,225.257 ppb	25,272.643 ppb	258.553 ppb	24,471.962 ppb	24,880.347 ppb	81.822 %
Concentration per Run 3	99.434 %	87.215 %	228.983 ppb	24,842.706 ppb	25,141.218 ppb	260.103 ppb	24,933.301 ppb	24,461.106 ppb	89.334 %
Concentration RSD			25.0 %	3.1 %	2.6 %	2.2 %	2.5 %	1.7 %	

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	82.238 %	251.908 ppb	251.842 ppb	253.143 ppb	248.506 ppb	24,993.259 ppb	246.557 ppb	253.006 ppb	249.040 ppb
Concentration per Run 1	75.866 %	243.781 ppb	242.618 ppb	239.995 ppb	243.201 ppb	23,885.722 ppb	232.340 ppb	239.262 ppb	230.383 ppb
Concentration per Run 2	72.237 %	262.105 ppb	264.585 ppb	265.013 ppb	249.748 ppb	25,643.734 ppb	258.427 ppb	261.779 ppb	268.165 ppb
Concentration per Run 3	98.611 %	249.837 ppb	248.322 ppb	254.423 ppb	252.569 ppb	25,450.321 ppb	248.904 ppb	257.977 ppb	248.571 ppb
Concentration RSD		3.7 %	4.5 %	5.0 %	1.9 %	3.9 %	5.4 %	4.8 %	7.6 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	249.960 ppb	87.263 %	250.005 ppb	249.679 ppb	242.367 ppb	242.557 ppb	91.598 %	250.107 ppb	245.260 ppb
Concentration per Run 1	243.651 ppb	93.393 %	245.942 ppb	244.712 ppb	244.253 ppb	234.554 ppb	95.746 %	241.049 ppb	236.511 ppb
Concentration per Run 2	257.276 ppb	81.850 %	250.602 ppb	250.402 ppb	234.163 ppb	246.674 ppb	88.504 %	253.767 ppb	244.742 ppb
Concentration per Run 3	248.952 ppb	86.546 %	253.471 ppb	253.922 ppb	248.685 ppb	246.443 ppb	90.546 %	255.504 ppb	254.527 ppb
Concentration RSD	2.7 %		1.5 %	1.9 %	3.1 %	2.9 %		3.2 %	3.7 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	86.824 %	243.734 ppb	254.018 ppb	249.191 ppb	92.092 %	89.431 %	229.300 ppb	248.408 ppb	97.762 %
Concentration per Run 1	92.920 %	234.800 ppb	237.479 ppb	240.049 ppb	94.982 %	94.354 %	222.441 ppb	240.008 ppb	101.237 %
Concentration per Run 2	82.301 %	244.840 ppb	258.155 ppb	251.521 ppb	88.820 %	85.533 %	230.960 ppb	253.441 ppb	95.812 %
Concentration per Run 3	85.252 %	251.563 ppb	266.421 ppb	256.003 ppb	92.475 %	88.406 %	234.500 ppb	251.775 ppb	96.236 %
Concentration RSD		3.5 %	5.9 %	3.3 %			2.7 %	2.9 %	

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Analysis index: 8 Analysis started at: 6/7/2017 8:33:57 AM Rack: 0
 Analysis label: 500/50000 User name: ALPHALAB\metals-instrument Vial: 7

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	94.580 %	86.355 %	511.717 ppb	48,119.292 ppb	48,545.296 ppb	503.175 ppb	49,256.922 ppb	49,237.432 ppb	87.163 %
Concentration per Run 1	96.090 %	85.925 %	512.341 ppb	46,039.528 ppb	46,117.149 ppb	471.082 ppb	46,369.045 ppb	45,818.808 ppb	82.453 %
Concentration per Run 2	93.382 %	89.889 %	515.565 ppb	47,887.124 ppb	48,079.028 ppb	517.253 ppb	49,762.837 ppb	50,466.771 ppb	89.754 %
Concentration per Run 3	94.270 %	83.251 %	507.244 ppb	50,431.225 ppb	51,439.712 ppb	521.191 ppb	51,638.885 ppb	51,426.717 ppb	89.282 %
Concentration RSD			0.8 %	4.6 %	5.5 %	5.5 %	5.4 %	6.1 %	

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	95.691 %	498.438 ppb	498.922 ppb	497.720 ppb	500.353 ppb	49,965.026 ppb	501.723 ppb	497.846 ppb	509.498 ppb
Concentration per Run 1	97.593 %	478.897 ppb	497.384 ppb	491.296 ppb	488.026 ppb	49,427.485 ppb	511.427 ppb	497.459 ppb	522.363 ppb
Concentration per Run 2	95.023 %	492.214 ppb	496.751 ppb	492.749 ppb	502.815 ppb	49,759.146 ppb	493.071 ppb	498.958 ppb	503.627 ppb
Concentration per Run 3	94.456 %	524.202 ppb	502.632 ppb	509.115 ppb	510.216 ppb	50,708.448 ppb	500.671 ppb	497.122 ppb	502.504 ppb
Concentration RSD		4.7 %	0.6 %	2.0 %	2.3 %	1.3 %	1.8 %	0.2 %	2.2 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	513.209 ppb	83.844 %	512.109 ppb	514.134 ppb	494.808 ppb	504.625 ppb	88.183 %	500.194 ppb	503.198 ppb
Concentration per Run 1	514.715 ppb	77.090 %	513.948 ppb	495.453 ppb	461.198 ppb	486.564 ppb	87.626 %	495.209 ppb	496.001 ppb
Concentration per Run 2	511.480 ppb	87.853 %	508.746 ppb	509.472 ppb	506.667 ppb	513.259 ppb	87.479 %	508.609 ppb	509.344 ppb
Concentration per Run 3	513.431 ppb	86.588 %	513.633 ppb	537.477 ppb	516.559 ppb	514.051 ppb	89.443 %	496.764 ppb	504.249 ppb
Concentration RSD	0.3 %		0.6 %	4.2 %	6.0 %	3.1 %		1.5 %	1.3 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	83.089 %	504.488 ppb	565.366 ppb	508.112 ppb	90.489 %	87.975 %	452.765 ppb	484.120 ppb	96.116 %
Concentration per Run 1	77.691 %	483.181 ppb	532.215 ppb	486.282 ppb	88.636 %	83.242 %	445.653 ppb	473.381 ppb	96.875 %
Concentration per Run 2	84.719 %	521.170 ppb	574.846 ppb	519.409 ppb	91.980 %	90.024 %	453.338 ppb	486.165 ppb	96.604 %
Concentration per Run 3	86.856 %	509.114 ppb	589.037 ppb	518.645 ppb	90.851 %	90.659 %	459.304 ppb	492.814 ppb	94.869 %
Concentration RSD		3.8 %	5.2 %	3.7 %			1.5 %	2.0 %	

Alpha ICPMSQ Full

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Analysis index:	9	Analysis started at:	6/7/2017 8:37:21 AM	Rack:	0
Analysis label:	Rinse	User name:	ALPHALAB\metals-instrument	Vial:	1

Alpha ICPMSQ Full

6/7/2017 3:54:49 PM



Analysis index: 10 Analysis started at: 6/7/2017 8:40:42 AM Rack: 4
 Analysis label: Sr 100ppb User name: ALPHALAB\metals-instrument Vial: 57

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	101.679 %	93.147 %	0.020 ppb	17.729 ppb	3.298 ppb	1.497 ppb	7.981 ppb	-0.404 ppb	93.380 %
Concentration per Run 1	102.845 %	93.946 %	0.020 ppb	18.208 ppb	1.819 ppb	1.350 ppb	-2.266 ppb	48.961 ppb	91.804 %
Concentration per Run 2	101.876 %	87.768 %	0.017 ppb	21.475 ppb	2.706 ppb	1.598 ppb	15.799 ppb	-20.168 ppb	91.331 %
Concentration per Run 3	100.316 %	97.726 %	0.024 ppb	13.504 ppb	5.367 ppb	1.542 ppb	10.408 ppb	-30.004 ppb	97.005 %
Concentration RSD	1.3 %	5.4 %	17.4 %	22.6 %	56.0 %	8.7 %	116.2 %	10,660.3 %	3.4 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	102.243 %	0.163 ppb	0.014 ppb	0.009 ppb	0.071 ppb	1.026 ppb	0.027 ppb	0.243 ppb	0.115 ppb
Concentration per Run 1	102.697 %	0.264 ppb	-0.010 ppb	-0.011 ppb	0.184 ppb	-0.460 ppb	0.011 ppb	0.386 ppb	0.133 ppb
Concentration per Run 2	103.134 %	0.206 ppb	0.063 ppb	0.052 ppb	-0.025 ppb	0.504 ppb	0.035 ppb	0.098 ppb	0.054 ppb
Concentration per Run 3	100.898 %	0.019 ppb	-0.010 ppb	-0.015 ppb	0.055 ppb	3.034 ppb	0.033 ppb	0.244 ppb	0.157 ppb
Concentration RSD	1.2 %	78.4 %	300.6 %	437.2 %	147.4 %	175.9 %	49.7 %	59.2 %	47.3 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	0.702 ppb	90.254 %	0.089 ppb	1.222 ppb	108.533 ppb	0.585 ppb	94.676 %	0.024 ppb	0.019 ppb
Concentration per Run 1	0.589 ppb	91.818 %	0.088 ppb	1.669 ppb	101.197 ppb	0.406 ppb	94.512 %	0.014 ppb	0.023 ppb
Concentration per Run 2	0.746 ppb	86.530 %	0.043 ppb	0.825 ppb	110.657 ppb	0.655 ppb	94.599 %	0.022 ppb	0.017 ppb
Concentration per Run 3	0.770 ppb	92.413 %	0.134 ppb	1.173 ppb	113.744 ppb	0.693 ppb	94.917 %	0.036 ppb	0.017 ppb
Concentration RSD	14.0 %	3.6 %	51.3 %	34.7 %	6.0 %	26.7 %	0.2 %	46.0 %	17.9 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	90.531 %	1.268 ppb	4.649 ppb	0.049 ppb	94.863 %	91.960 %	0.032 ppb	0.067 ppb	99.824 %
Concentration per Run 1	89.723 %	1.213 ppb	4.007 ppb	0.026 ppb	94.339 %	90.200 %	0.031 ppb	0.066 ppb	99.620 %
Concentration per Run 2	89.676 %	1.417 ppb	4.746 ppb	-0.003 ppb	93.276 %	92.405 %	0.033 ppb	0.060 ppb	100.200 %
Concentration per Run 3	92.195 %	1.174 ppb	5.194 ppb	0.124 ppb	96.973 %	93.276 %	0.032 ppb	0.074 ppb	99.652 %
Concentration RSD	1.6 %	10.3 %	12.9 %	136.8 %	2.0 %	1.7 %	3.3 %	10.9 %	0.3 %

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Analysis index: 11 Analysis started at: 6/7/2017 8:45:15 AM Rack: 0
 Analysis label: ICV User name: ALPHALAB\metals-instrument Vial: 9

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	99.738 %	93.423 %	97.328 ppb	10,468.579 ppb	10,643.059 ppb	110.026 ppb	10,837.458 ppb	10,869.132 ppb	97.233 %
Concentration per Run 1	99.689 %	92.286 %	97.590 ppb	10,388.420 ppb	10,382.845 ppb	107.813 ppb	10,478.451 ppb	10,407.495 ppb	91.908 %
Concentration per Run 2	100.284 %	88.229 %	97.550 ppb	10,686.467 ppb	10,872.263 ppb	111.352 ppb	10,959.317 ppb	10,695.347 ppb	93.432 %
Concentration per Run 3	99.239 %	99.754 %	96.844 ppb	10,330.851 ppb	10,674.071 ppb	110.912 ppb	11,074.606 ppb	11,504.554 ppb	106.358 %
Recovery Percentage 1			97.328 %	104.686 %	106.431 %	110.026 %	108.375 %	108.691 %	
Concentration RSD	0.5 %	6.3 %	0.4 %	1.8 %	2.3 %	1.8 %	2.9 %	5.2 %	8.2 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	99.456 %	103.248 ppb	100.599 ppb	100.142 ppb	105.372 ppb	10,304.758 ppb	99.995 ppb	99.244 ppb	99.892 ppb
Concentration per Run 1	98.409 %	100.602 ppb	100.179 ppb	101.863 ppb	104.019 ppb	10,304.560 ppb	100.135 ppb	102.037 ppb	99.537 ppb
Concentration per Run 2	99.797 %	102.626 ppb	105.609 ppb	102.674 ppb	107.769 ppb	10,563.220 ppb	103.191 ppb	100.371 ppb	103.725 ppb
Concentration per Run 3	100.161 %	106.518 ppb	96.009 ppb	95.891 ppb	104.328 ppb	10,046.492 ppb	96.657 ppb	95.322 ppb	96.413 ppb
Recovery Percentage 1		103.248 %	100.599 %	100.142 %	105.372 %	103.048 %	99.995 %	99.244 %	99.892 %
Concentration RSD	0.9 %	2.9 %	4.8 %	3.7 %	2.0 %	2.5 %	3.3 %	3.5 %	3.7 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	98.742 ppb	93.931 %	100.566 ppb	102.420 ppb	107.715 ppb	101.429 ppb	95.918 %	97.320 ppb	99.584 ppb
Concentration per Run 1	99.473 ppb	91.225 %	97.599 ppb	104.589 ppb	104.692 ppb	97.869 ppb	94.533 %	96.127 ppb	95.820 ppb
Concentration per Run 2	99.667 ppb	91.382 %	101.628 ppb	98.978 ppb	104.017 ppb	103.635 ppb	95.065 %	99.473 ppb	102.836 ppb
Concentration per Run 3	97.087 ppb	99.185 %	102.470 ppb	103.693 ppb	114.435 ppb	102.784 ppb	98.155 %	96.361 ppb	100.094 ppb
Recovery Percentage 1	98.742 %		100.566 %	102.420 %	107.715 %	101.429 %		97.320 %	99.584 %
Concentration RSD	1.5 %	4.8 %	2.6 %	2.9 %	5.4 %	3.1 %	2.0 %	1.9 %	3.6 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	96.284 %	100.186 ppb	107.550 ppb	103.722 ppb	94.957 %	95.236 %	99.174 ppb	101.276 ppb	100.843 %
Concentration per Run 1	95.601 %	96.118 ppb	101.523 ppb	103.386 ppb	92.443 %	93.887 %	97.902 ppb	98.732 ppb	102.206 %
Concentration per Run 2	90.731 %	102.828 ppb	110.398 ppb	103.193 ppb	94.432 %	91.983 %	99.012 ppb	102.146 ppb	100.170 %
Concentration per Run 3	102.518 %	101.612 ppb	110.729 ppb	104.587 ppb	97.995 %	99.838 %	100.609 ppb	102.951 ppb	100.152 %
Recovery Percentage 1		100.186 %	107.550 %	103.722 %			99.174 %	101.276 %	
Concentration RSD	6.2 %	3.6 %	4.9 %	0.7 %	3.0 %	4.3 %	1.4 %	2.2 %	1.2 %

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Analysis index: 12 Analysis started at: 6/7/2017 8:48:40 AM Rack: 0
 Analysis label: ICB User name: ALPHALAB\metals-instrument Vial: 10

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	103.869 %	95.728 %	0.020 ppb	4.885 ppb	-0.009 ppb	-0.183 ppb	17.011 ppb	1.238 ppb	105.430 %
Concentration per Run 1	105.232 %	97.910 %	0.007 ppb	1.323 ppb	0.253 ppb	-0.591 ppb	18.339 ppb	3.861 ppb	97.057 %
Concentration per Run 2	103.860 %	96.619 %	0.020 ppb	7.777 ppb	0.196 ppb	0.335 ppb	26.700 ppb	-0.316 ppb	116.447 %
Concentration per Run 3	102.516 %	92.655 %	0.033 ppb	5.555 ppb	-0.477 ppb	-0.292 ppb	5.993 ppb	0.170 ppb	102.784 %
Recovery Percentage 1			3.982 %	4.885 %	-0.013 %	-1.826 %	17.011 %	1.238 %	
Concentration RSD	1.3 %	2.9 %	66.4 %	67.1 %	4.434.3 %	258.6 %	61.2 %	184.5 %	9.4 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	103.164 %	-0.020 ppb	-0.010 ppb	-0.030 ppb	-0.025 ppb	0.802 ppb	0.003 ppb	-0.081 ppb	-0.017 ppb
Concentration per Run 1	104.909 %	-0.038 ppb	-0.010 ppb	-0.005 ppb	-0.025 ppb	2.078 ppb	0.000 ppb	-0.008 ppb	-0.007 ppb
Concentration per Run 2	102.824 %	-0.038 ppb	-0.010 ppb	-0.010 ppb	-0.025 ppb	0.880 ppb	0.000 ppb	-0.103 ppb	-0.010 ppb
Concentration per Run 3	101.759 %	0.016 ppb	-0.010 ppb	-0.075 ppb	-0.025 ppb	-0.551 ppb	0.010 ppb	-0.132 ppb	-0.034 ppb
Recovery Percentage 1		-4.039 %	-0.208 %	-2.995 %	-2.494 %	1.604 %	0.689 %	-4.053 %	-1.691 %
Concentration RSD	1.6 %	154.7 %	0.0 %	130.1 %	0.0 %	164.1 %	173.2 %	79.9 %	85.4 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	-0.123 ppb	101.028 %	0.050 ppb	0.379 ppb	-0.005 ppb	0.566 ppb	99.792 %	0.016 ppb	0.012 ppb
Concentration per Run 1	-0.141 ppb	97.364 %	0.038 ppb	0.797 ppb	-0.013 ppb	0.448 ppb	99.770 %	0.019 ppb	0.011 ppb
Concentration per Run 2	-0.097 ppb	104.856 %	0.076 ppb	-0.473 ppb	0.018 ppb	0.594 ppb	100.654 %	0.012 ppb	0.015 ppb
Concentration per Run 3	-0.132 ppb	100.863 %	0.036 ppb	0.814 ppb	-0.020 ppb	0.657 ppb	98.951 %	0.017 ppb	0.011 ppb
Recovery Percentage 1	-1.234 %	101.028 %	10.062 %	7.583 %	-0.997 %	28.316 %		4.006 %	5.991 %
Concentration RSD	18.7 %	3.7 %	45.0 %	194.7 %	398.7 %	18.9 %	0.9 %	21.0 %	20.7 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	99.883 %	0.822 ppb	3.255 ppb	-0.009 ppb	99.044 %	97.048 %	0.020 ppb	0.047 ppb	96.194 %
Concentration per Run 1	96.390 %	0.887 ppb	3.122 ppb	-0.004 ppb	97.715 %	94.557 %	0.020 ppb	0.047 ppb	96.333 %
Concentration per Run 2	105.952 %	0.791 ppb	3.371 ppb	-0.005 ppb	99.630 %	99.943 %	0.023 ppb	0.044 ppb	95.423 %
Concentration per Run 3	97.308 %	0.788 ppb	3.273 ppb	-0.018 ppb	99.787 %	96.644 %	0.017 ppb	0.048 ppb	96.826 %
Recovery Percentage 1		27.396 %	81.376 %	-1.820 %			3.947 %	9.304 %	96.194 %
Concentration RSD	5.3 %	6.8 %	3.9 %	85.4 %	1.2 %	2.8 %	14.9 %	3.9 %	0.7 %

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Analysis index: 13 Analysis started at: 6/7/2017 8:52:05 AM Rack: 4
 Analysis label: LLICV User name: ALPHALAB\metals-instrument Vial: 51

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	102.395 %	99.785 %	0.361 ppb	119.097 ppb	86.308 ppb	12.212 ppb	125.678 ppb	127.605 ppb	106.358 %
Concentration per Run 1	103.272 %	106.024 %	0.384 ppb	115.825 ppb	84.837 ppb	12.128 ppb	138.118 ppb	137.525 ppb	120.231 %
Concentration per Run 2	102.120 %	95.790 %	0.345 ppb	119.687 ppb	90.681 ppb	11.114 ppb	114.738 ppb	103.320 ppb	101.313 %
Concentration per Run 3	101.793 %	97.541 %	0.354 ppb	121.779 ppb	83.406 ppb	13.396 ppb	124.177 ppb	141.969 ppb	97.530 %
Recovery Percentage 1			120.286 %	119.097 %	123.297 %	122.125 %	125.678 %	127.605 %	
Concentration RSD	0.8 %	5.5 %	5.6 %	2.5 %	4.5 %	9.4 %	9.4 %	16.6 %	11.4 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	101.964 %	0.450 ppb	6.006 ppb	0.507 ppb	0.952 ppb	59.527 ppb	0.627 ppb	1.980 ppb	1.405 ppb
Concentration per Run 1	102.285 %	0.752 ppb	5.343 ppb	0.415 ppb	1.281 ppb	50.982 ppb	0.525 ppb	1.672 ppb	1.415 ppb
Concentration per Run 2	103.471 %	0.236 ppb	5.986 ppb	0.480 ppb	0.882 ppb	57.276 ppb	0.674 ppb	1.864 ppb	1.299 ppb
Concentration per Run 3	100.137 %	0.362 ppb	6.690 ppb	0.624 ppb	0.693 ppb	70.323 ppb	0.683 ppb	2.404 ppb	1.503 ppb
Recovery Percentage 1		90.000 %	120.127 %	101.336 %	95.195 %	119.055 %	125.460 %	98.980 %	140.537 %
Concentration RSD	1.7 %	59.9 %	11.2 %	21.1 %	31.5 %	16.6 %	14.1 %	19.2 %	7.3 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	10.286 ppb	102.489 %	0.587 ppb	6.040 ppb	0.683 ppb	2.155 ppb	100.577 %	0.461 ppb	0.234 ppb
Concentration per Run 1	9.462 ppb	112.168 %	0.343 ppb	5.896 ppb	0.744 ppb	2.002 ppb	104.227 %	0.504 ppb	0.207 ppb
Concentration per Run 2	10.859 ppb	101.745 %	0.657 ppb	5.925 ppb	0.560 ppb	2.439 ppb	100.971 %	0.414 ppb	0.218 ppb
Concentration per Run 3	10.539 ppb	93.554 %	0.760 ppb	6.298 ppb	0.745 ppb	2.025 ppb	96.533 %	0.466 ppb	0.279 ppb
Recovery Percentage 1	102.863 %		117.333 %	120.791 %	136.580 %	107.774 %		115.328 %	117.249 %
Concentration RSD	7.1 %	9.1 %	37.0 %	3.7 %	15.6 %	11.4 %	3.8 %	9.9 %	16.4 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	102.261 %	3.996 ppb	6.976 ppb	0.961 ppb	99.970 %	99.082 %	0.550 ppb	0.570 ppb	104.818 %
Concentration per Run 1	111.982 %	3.966 ppb	6.764 ppb	1.044 ppb	102.940 %	104.823 %	0.507 ppb	0.546 ppb	109.279 %
Concentration per Run 2	98.752 %	3.985 ppb	7.253 ppb	1.010 ppb	99.792 %	97.026 %	0.559 ppb	0.572 ppb	103.892 %
Concentration per Run 3	96.049 %	4.038 ppb	6.912 ppb	0.830 ppb	97.177 %	95.396 %	0.584 ppb	0.593 ppb	101.284 %
Recovery Percentage 1		133.206 %	174.403 %	192.222 %			109.986 %	114.044 %	
Concentration RSD	8.3 %	0.9 %	3.6 %	12.0 %	2.9 %	5.1 %	7.1 %	4.1 %	3.9 %

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Analysis index: 14 Analysis started at: 6/7/2017 8:55:31 AM Rack: 4
 Analysis label: ICSA User name: ALPHALAB\metals-instrument Vial: 53

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	87.345 %	82.421 %	0.011 ppb	51,781.531 ppb	21,462.547 ppb	21,436.141 ppb	20,721.831 ppb	62,381.207 ppb	87.566 %
Concentration per Run 1	87.978 %	82.237 %	0.003 ppb	51,201.945 ppb	21,010.996 ppb	20,854.986 ppb	20,340.682 ppb	60,363.661 ppb	92.224 %
Concentration per Run 2	87.160 %	83.343 %	0.018 ppb	52,381.287 ppb	21,999.258 ppb	22,008.696 ppb	21,010.086 ppb	63,890.853 ppb	81.979 %
Concentration per Run 3	86.898 %	81.683 %	0.011 ppb	51,761.361 ppb	21,377.387 ppb	21,444.742 ppb	20,814.724 ppb	62,889.108 ppb	88.494 %
Recovery Percentage 1				103.563 %	107.313 %	107.181 %	103.609 %	103.969 %	
Concentration RSD	0.6 %	1.0 %	72.2 %	1.1 %	2.3 %	2.7 %	1.7 %	2.9 %	5.9 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	86.231 %	443.492 ppb	0.141 ppb	0.643 ppb	1.062 ppb	51,211.991 ppb	0.592 ppb	1.248 ppb	0.911 ppb
Concentration per Run 1	86.386 %	433.547 ppb	0.135 ppb	0.607 ppb	1.115 ppb	48,909.991 ppb	0.700 ppb	1.046 ppb	0.910 ppb
Concentration per Run 2	85.798 %	462.142 ppb	0.110 ppb	0.570 ppb	1.166 ppb	52,611.171 ppb	0.562 ppb	1.589 ppb	0.983 ppb
Concentration per Run 3	86.510 %	434.786 ppb	0.180 ppb	0.753 ppb	0.904 ppb	52,114.813 ppb	0.514 ppb	1.109 ppb	0.839 ppb
Recovery Percentage 1		110.873 %				102.424 %			
Concentration RSD	0.4 %	3.6 %	25.0 %	15.1 %	13.1 %	3.9 %	16.3 %	23.8 %	7.9 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	7.681 ppb	86.096 %	0.137 ppb	0.390 ppb	0.899 ppb	410.224 ppb	86.256 %	0.090 ppb	0.200 ppb
Concentration per Run 1	7.367 ppb	88.105 %	0.117 ppb	0.450 ppb	0.898 ppb	402.541 ppb	89.180 %	0.084 ppb	0.184 ppb
Concentration per Run 2	7.895 ppb	86.945 %	0.119 ppb	0.016 ppb	0.935 ppb	418.066 ppb	84.719 %	0.071 ppb	0.149 ppb
Concentration per Run 3	7.781 ppb	83.238 %	0.176 ppb	0.705 ppb	0.864 ppb	410.063 ppb	84.870 %	0.114 ppb	0.266 ppb
Recovery Percentage 1						102.556 %			
Concentration RSD	3.6 %	3.0 %	24.6 %	89.2 %	4.0 %	1.9 %	2.9 %	24.7 %	30.1 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	84.866 %	1.019 ppb	1.176 ppb	1.424 ppb	87.632 %	87.163 %	0.019 ppb	0.132 ppb	94.648 %
Concentration per Run 1	89.700 %	0.966 ppb	1.091 ppb	1.454 ppb	87.197 %	90.106 %	0.025 ppb	0.123 ppb	99.847 %
Concentration per Run 2	82.377 %	1.016 ppb	1.265 ppb	1.408 ppb	87.118 %	85.490 %	0.019 ppb	0.137 ppb	91.901 %
Concentration per Run 3	82.522 %	1.075 ppb	1.171 ppb	1.410 ppb	88.580 %	85.894 %	0.013 ppb	0.135 ppb	92.195 %
Recovery Percentage 1									
Concentration RSD	4.9 %	5.3 %	7.4 %	1.8 %	0.9 %	2.9 %	32.6 %	6.0 %	4.8 %

Alpha ICPMSQ Full

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Analysis index: 15 Analysis started at: 6/7/2017 8:58:57 AM Rack: 4
 Analysis label: ICSAB User name: ALPHALAB\metals-instrument Vial: 55

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	83.698 %	84.511 %	0.013 ppb	49,653.847 ppb	20,651.547 ppb	20,304.092 ppb	20,637.531 ppb	62,631.574 ppb	82.645 %
Concentration per Run 1	84.854 %	83.527 %	0.015 ppb	53,777.131 ppb	22,547.982 ppb	22,869.061 ppb	23,028.814 ppb	71,623.425 ppb	75.203 %
Concentration per Run 2	83.686 %	88.137 %	0.004 ppb	46,169.764 ppb	18,764.178 ppb	17,867.459 ppb	19,435.680 ppb	55,842.274 ppb	86.550 %
Concentration per Run 3	82.553 %	81.868 %	0.020 ppb	49,014.644 ppb	20,642.481 ppb	20,175.756 ppb	19,448.099 ppb	60,429.022 ppb	86.182 %
Recovery Percentage 1				99.308 %	103.258 %	101.520 %	103.188 %	104.386 %	
Concentration RSD	1.4 %	3.8 %	64.7 %	7.7 %	9.2 %	12.3 %	10.0 %	13.0 %	7.8 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	82.959 %	448.579 ppb	41.446 ppb	41.572 ppb	41.330 ppb	50,850.546 ppb	39.571 ppb	39.644 ppb	38.929 ppb
Concentration per Run 1	84.811 %	505.524 ppb	47.975 ppb	47.559 ppb	45.635 ppb	56,214.130 ppb	44.426 ppb	44.141 ppb	42.047 ppb
Concentration per Run 2	82.920 %	398.157 ppb	37.697 ppb	37.025 ppb	38.071 ppb	46,008.517 ppb	36.667 ppb	36.904 ppb	33.923 ppb
Concentration per Run 3	81.146 %	442.058 ppb	38.665 ppb	40.133 ppb	40.285 ppb	50,328.990 ppb	37.620 ppb	37.887 ppb	40.819 ppb
Recovery Percentage 1		112.145 %	103.615 %	103.931 %	103.325 %	101.701 %	98.928 %	99.110 %	97.324 %
Concentration RSD	2.2 %	12.0 %	13.7 %	13.0 %	9.4 %	10.1 %	10.7 %	9.9 %	11.2 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	22.009 ppb	82.637 %	20.232 ppb	21.074 ppb	42.040 ppb	408.569 ppb	84.061 %	9.666 ppb	20.833 ppb
Concentration per Run 1	23.646 ppb	80.033 %	21.184 ppb	20.585 ppb	45.331 ppb	446.441 ppb	82.033 %	10.080 ppb	22.013 ppb
Concentration per Run 2	20.028 ppb	84.917 %	19.451 ppb	19.432 ppb	37.827 ppb	370.975 ppb	87.336 %	9.186 ppb	19.417 ppb
Concentration per Run 3	22.355 ppb	82.961 %	20.062 ppb	23.206 ppb	42.962 ppb	408.292 ppb	82.814 %	9.734 ppb	21.069 ppb
Recovery Percentage 1	110.047 %		101.162 %	105.371 %	105.101 %	102.142 %		96.665 %	104.165 %
Concentration RSD	8.3 %	3.0 %	4.3 %	9.2 %	9.1 %	9.2 %	3.4 %	4.7 %	6.3 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	82.008 %	0.521 ppb	1.016 ppb	0.805 ppb	85.099 %	84.256 %	0.007 ppb	0.084 ppb	91.647 %
Concentration per Run 1	78.646 %	0.599 ppb	1.132 ppb	0.912 ppb	83.008 %	82.167 %	0.007 ppb	0.091 ppb	88.962 %
Concentration per Run 2	85.817 %	0.419 ppb	0.953 ppb	0.645 ppb	88.290 %	88.237 %	0.008 ppb	0.081 ppb	95.645 %
Concentration per Run 3	81.561 %	0.543 ppb	0.963 ppb	0.858 ppb	83.998 %	82.364 %	0.006 ppb	0.080 ppb	90.334 %
Recovery Percentage 1									
Concentration RSD	4.4 %	17.7 %	9.9 %	17.5 %	3.3 %	4.1 %	10.9 %	6.7 %	3.9 %

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Analysis index:	16	Analysis started at:	6/7/2017 9:02:22 AM	Rack:	0
Analysis label:	Rinse	User name:	ALPHALAB\metals-instrument	Vial:	1

Alpha ICPMSQ Full

6/7/2017 3:54:49 PM



Analysis index: 17 Analysis started at: 6/7/2017 9:05:43 AM Rack: 0
 Analysis label: CCV User name: ALPHALAB\metals-instrument Vial: 9

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	91.642 %	85.095 %	100.704 ppb	10,101.406 ppb	10,161.814 ppb	99.814 ppb	9,817.388 ppb	10,425.205 ppb	84.081 %
Concentration per Run 1	91.697 %	84.910 %	100.692 ppb	10,107.134 ppb	10,338.390 ppb	95.574 ppb	9,389.397 ppb	10,255.454 ppb	91.961 %
Concentration per Run 2	92.300 %	80.577 %	101.791 ppb	9,974.793 ppb	10,131.548 ppb	93.154 ppb	9,648.661 ppb	10,364.968 ppb	78.565 %
Concentration per Run 3	90.929 %	89.797 %	99.629 ppb	10,222.290 ppb	10,015.505 ppb	110.715 ppb	10,414.105 ppb	10,655.192 ppb	81.717 %
Recovery Percentage 1			100.704 %	101.014 %	101.618 %	99.814 %	98.174 %	104.252 %	
Concentration RSD	0.7 %	5.4 %	1.1 %	1.2 %	1.6 %	9.5 %	5.4 %	2.0 %	8.3 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	90.839 %	99.317 ppb	99.908 ppb	102.583 ppb	101.766 ppb	10,176.467 ppb	101.006 ppb	100.358 ppb	100.934 ppb
Concentration per Run 1	91.418 %	97.368 ppb	96.305 ppb	96.047 ppb	98.422 ppb	9,615.152 ppb	94.575 ppb	92.877 ppb	95.147 ppb
Concentration per Run 2	91.426 %	94.601 ppb	102.073 ppb	104.824 ppb	98.480 ppb	10,437.058 ppb	103.537 ppb	104.044 ppb	103.789 ppb
Concentration per Run 3	89.674 %	105.983 ppb	101.347 ppb	106.880 ppb	108.397 ppb	10,477.191 ppb	104.906 ppb	104.154 ppb	103.866 ppb
Recovery Percentage 1		99.317 %	99.908 %	102.583 %	101.766 %	101.765 %	101.006 %	100.358 %	100.934 %
Concentration RSD	1.1 %	6.0 %	3.1 %	5.6 %	5.6 %	4.8 %	5.6 %	6.5 %	5.0 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	99.679 ppb	83.372 %	98.303 ppb	100.248 ppb	100.272 ppb	102.825 ppb	87.335 %	98.128 ppb	99.512 ppb
Concentration per Run 1	94.870 ppb	88.809 %	95.215 ppb	99.258 ppb	99.161 ppb	98.714 ppb	89.946 %	92.782 ppb	95.800 ppb
Concentration per Run 2	101.920 ppb	76.453 %	102.080 ppb	104.530 ppb	99.518 ppb	104.418 ppb	84.525 %	102.016 ppb	101.891 ppb
Concentration per Run 3	102.248 ppb	84.854 %	97.614 ppb	96.956 ppb	102.135 ppb	105.342 ppb	87.535 %	99.585 ppb	100.844 ppb
Recovery Percentage 1	99.679 %		98.303 %	100.248 %	100.272 %	102.825 %		98.128 %	99.512 %
Concentration RSD	4.2 %	7.6 %	3.5 %	3.9 %	1.6 %	3.5 %	3.1 %	4.9 %	3.3 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	82.523 %	101.071 ppb	105.086 ppb	98.731 ppb	86.876 %	85.043 %	98.811 ppb	101.030 ppb	94.192 %
Concentration per Run 1	86.878 %	94.978 ppb	101.068 ppb	97.845 ppb	89.007 %	88.772 %	94.281 ppb	95.786 ppb	98.014 %
Concentration per Run 2	75.652 %	103.871 ppb	107.407 ppb	100.409 ppb	84.438 %	80.651 %	102.702 ppb	104.010 ppb	90.493 %
Concentration per Run 3	85.040 %	104.363 ppb	106.781 ppb	97.940 ppb	87.184 %	85.708 %	99.449 ppb	103.294 ppb	94.068 %
Recovery Percentage 1		101.071 %	105.086 %	98.731 %			98.811 %	101.030 %	
Concentration RSD	7.3 %	5.2 %	3.3 %	1.5 %	2.6 %	4.8 %	4.3 %	4.5 %	4.0 %

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Analysis index: 18 Analysis started at: 6/7/2017 9:09:08 AM Rack: 0
 Analysis label: CCB User name: ALPHALAB\metals-instrument Vial: 10

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	95.570 %	86.140 %	0.010 ppb	17.169 ppb	0.631 ppb	0.127 ppb	6.091 ppb	4.447 ppb	89.457 %
Concentration per Run 1	97.113 %	84.449 %	0.019 ppb	20.026 ppb	1.134 ppb	-0.214 ppb	-0.481 ppb	4.235 ppb	92.907 %
Concentration per Run 2	94.765 %	92.009 %	-0.005 ppb	21.919 ppb	-0.477 ppb	0.572 ppb	22.415 ppb	4.286 ppb	91.173 %
Concentration per Run 3	94.831 %	81.960 %	0.016 ppb	9.563 ppb	1.237 ppb	0.022 ppb	-3.662 ppb	4.820 ppb	84.292 %
Recovery Percentage 1			1.955 %	17.169 %	0.902 %	1.266 %	6.091 %	4.447 %	
Concentration RSD	1.4 %	6.1 %	133.3 %	38.8 %	152.2 %	318.9 %	233.6 %	7.3 %	5.1 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	93.810 %	-0.016 ppb	0.002 ppb	0.042 ppb	-0.025 ppb	1.171 ppb	0.004 ppb	0.045 ppb	-0.004 ppb
Concentration per Run 1	94.992 %	-0.038 ppb	-0.010 ppb	0.036 ppb	-0.025 ppb	-0.459 ppb	0.000 ppb	0.005 ppb	-0.005 ppb
Concentration per Run 2	93.641 %	-0.038 ppb	0.027 ppb	0.066 ppb	-0.025 ppb	4.338 ppb	0.000 ppb	0.059 ppb	-0.004 ppb
Concentration per Run 3	92.795 %	0.028 ppb	-0.010 ppb	0.025 ppb	-0.025 ppb	-0.367 ppb	0.013 ppb	0.073 ppb	-0.003 ppb
Recovery Percentage 1		-3.243 %	0.039 %	4.225 %	-2.494 %	2.341 %	0.844 %	2.272 %	-0.395 %
Concentration RSD	1.2 %	235.2 %	1,088.1 %	50.1 %	0.0 %	234.3 %	173.2 %	79.3 %	35.1 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	-0.071 ppb	85.226 %	0.043 ppb	0.104 ppb	-0.001 ppb	0.548 ppb	89.939 %	0.021 ppb	0.006 ppb
Concentration per Run 1	-0.090 ppb	89.951 %	0.066 ppb	-0.094 ppb	-0.024 ppb	0.403 ppb	90.721 %	0.019 ppb	0.000 ppb
Concentration per Run 2	-0.017 ppb	83.705 %	0.071 ppb	-0.010 ppb	-0.001 ppb	0.409 ppb	91.101 %	0.028 ppb	0.018 ppb
Concentration per Run 3	-0.107 ppb	82.022 %	-0.007 ppb	0.418 ppb	0.023 ppb	0.832 ppb	87.996 %	0.016 ppb	0.000 ppb
Recovery Percentage 1	-0.711 %	85.226 %	8.685 %	2.088 %	-0.128 %	27.396 %		5.251 %	2.931 %
Concentration RSD	67.6 %	4.9 %	100.1 %	262.9 %	3,708.3 %	44.8 %	1.9 %	29.0 %	173.2 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	84.836 %	0.599 ppb	2.495 ppb	-0.002 ppb	88.489 %	85.012 %	0.023 ppb	0.044 ppb	88.685 %
Concentration per Run 1	88.359 %	0.575 ppb	2.435 ppb	-0.003 ppb	89.908 %	87.339 %	0.025 ppb	0.039 ppb	88.393 %
Concentration per Run 2	86.343 %	0.672 ppb	2.687 ppb	-0.018 ppb	89.638 %	86.449 %	0.018 ppb	0.049 ppb	90.039 %
Concentration per Run 3	79.807 %	0.551 ppb	2.361 ppb	0.014 ppb	85.922 %	81.249 %	0.024 ppb	0.044 ppb	87.622 %
Recovery Percentage 1		19.968 %	62.363 %	-0.448 %			4.533 %	8.831 %	88.685 %
Concentration RSD	5.3 %	10.7 %	6.8 %	723.1 %	2.5 %	3.9 %	16.4 %	10.9 %	1.4 %

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Analysis index: 19 Analysis started at: 6/7/2017 9:12:33 AM Rack: 1
 Analysis label: WG1008335-1 2008TL User name: ALPHALAB\metals-instrument Vial: 1

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	90.511 %	85.709 %	0.028 ppb	37.427 ppb	0.386 ppb	0.139 ppb	10.941 ppb	12.126 ppb	85.500 %
Concentration per Run 1	90.282 %	94.130 %	0.021 ppb	34.008 ppb	-0.477 ppb	0.689 ppb	4.858 ppb	29.643 ppb	93.748 %
Concentration per Run 2	90.480 %	82.421 %	0.017 ppb	34.292 ppb	-0.477 ppb	-0.122 ppb	7.062 ppb	10.000 ppb	78.092 %
Concentration per Run 3	90.773 %	80.577 %	0.046 ppb	43.982 ppb	2.112 ppb	-0.152 ppb	20.902 ppb	-3.264 ppb	84.659 %
Concentration RSD	0.3 %	8.6 %	56.3 %	15.2 %	386.9 %	344.0 %	79.5 %	136.5 %	9.2 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	90.549 %	0.069 ppb	0.078 ppb	0.005 ppb	0.067 ppb	2.973 ppb	0.004 ppb	0.081 ppb	0.129 ppb
Concentration per Run 1	89.935 %	0.081 ppb	0.133 ppb	-0.047 ppb	0.059 ppb	2.308 ppb	0.000 ppb	0.179 ppb	0.109 ppb
Concentration per Run 2	90.350 %	0.033 ppb	0.032 ppb	0.106 ppb	0.123 ppb	4.044 ppb	0.000 ppb	0.044 ppb	0.133 ppb
Concentration per Run 3	91.363 %	0.093 ppb	0.068 ppb	-0.042 ppb	0.020 ppb	2.566 ppb	0.012 ppb	0.020 ppb	0.146 ppb
Concentration RSD	0.8 %	45.9 %	65.8 %	1,594.3 %	77.4 %	31.5 %	173.2 %	106.2 %	14.2 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	-0.006 ppb	83.170 %	0.027 ppb	0.559 ppb	-0.006 ppb	0.481 ppb	88.954 %	0.006 ppb	0.002 ppb
Concentration per Run 1	-0.104 ppb	87.333 %	0.018 ppb	1.021 ppb	0.005 ppb	0.365 ppb	92.566 %	0.019 ppb	0.006 ppb
Concentration per Run 2	0.042 ppb	76.372 %	-0.007 ppb	0.742 ppb	-0.030 ppb	0.550 ppb	86.759 %	0.000 ppb	0.000 ppb
Concentration per Run 3	0.044 ppb	85.804 %	0.069 ppb	-0.085 ppb	0.007 ppb	0.530 ppb	87.537 %	0.000 ppb	0.000 ppb
Concentration RSD	1,394.3 %	7.1 %	143.8 %	102.8 %	343.6 %	21.1 %	3.5 %	163.3 %	173.2 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	83.767 %	0.970 ppb	1.358 ppb	0.043 ppb	89.687 %	86.456 %	0.011 ppb	0.047 ppb	103.655 %
Concentration per Run 1	90.077 %	0.913 ppb	1.211 ppb	0.070 ppb	92.703 %	91.710 %	0.011 ppb	0.043 ppb	110.938 %
Concentration per Run 2	78.147 %	1.114 ppb	1.424 ppb	0.047 ppb	87.850 %	82.805 %	0.010 ppb	0.050 ppb	99.609 %
Concentration per Run 3	83.076 %	0.882 ppb	1.437 ppb	0.013 ppb	88.507 %	84.853 %	0.011 ppb	0.047 ppb	100.420 %
Concentration RSD	7.2 %	13.0 %	9.4 %	65.9 %	2.9 %	5.4 %	5.6 %	7.7 %	6.1 %

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Analysis index: 20 Analysis started at: 6/7/2017 9:15:53 AM Rack: 1
Analysis label: WG1008335-2 2008TL User name: ALPHALAB\metals-instrument Vial: 2

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	87.597 %	83.159 %	51.467 ppb	10,530.526 ppb	10,599.567 ppb	2,153.353 ppb	10,223.070 ppb	10,104.060 ppb	82.750 %
Concentration per Run 1	88.100 %	77.903 %	50.994 ppb	10,536.589 ppb	10,494.722 ppb	2,012.671 ppb	9,800.399 ppb	9,500.246 ppb	80.561 %
Concentration per Run 2	87.385 %	83.159 %	52.225 ppb	10,594.563 ppb	10,803.786 ppb	2,242.944 ppb	10,529.306 ppb	10,882.677 ppb	81.191 %
Concentration per Run 3	87.305 %	88.414 %	51.181 ppb	10,460.428 ppb	10,500.192 ppb	2,204.445 ppb	10,339.504 ppb	9,929.257 ppb	86.497 %
Concentration RSD	0.5 %	6.3 %	1.3 %	0.6 %	1.7 %	5.7 %	3.7 %	7.0 %	3.9 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	88.314 %	907.342 ppb	500.811 ppb	204.092 ppb	497.407 ppb	1,063.558 ppb	491.281 ppb	489.661 ppb	248.670 ppb
Concentration per Run 1	88.670 %	869.591 ppb	489.475 ppb	197.813 ppb	482.790 ppb	973.660 ppb	488.560 ppb	490.035 ppb	245.803 ppb
Concentration per Run 2	87.806 %	921.708 ppb	502.779 ppb	207.677 ppb	496.626 ppb	1,104.403 ppb	501.346 ppb	488.194 ppb	252.293 ppb
Concentration per Run 3	88.466 %	930.728 ppb	510.180 ppb	206.785 ppb	512.805 ppb	1,112.611 ppb	483.937 ppb	490.753 ppb	247.914 ppb
Concentration RSD	0.5 %	3.6 %	2.1 %	2.7 %	3.0 %	7.3 %	1.8 %	0.3 %	1.3 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	505.329 ppb	82.289 %	120.132 ppb	123.044 ppb	984.360 ppb	993.220 ppb	87.223 %	49.523 ppb	53.419 ppb
Concentration per Run 1	500.871 ppb	79.395 %	115.096 ppb	120.682 ppb	914.623 ppb	951.266 ppb	87.848 %	49.002 ppb	51.343 ppb
Concentration per Run 2	502.775 ppb	83.494 %	121.197 ppb	121.280 ppb	982.918 ppb	1,001.418 ppb	86.975 %	50.412 ppb	55.230 ppb
Concentration per Run 3	512.341 ppb	83.977 %	124.105 ppb	127.169 ppb	1,055.539 ppb	1,026.977 ppb	86.845 %	49.156 ppb	53.685 ppb
Concentration RSD	1.2 %	3.1 %	3.8 %	2.9 %	7.2 %	3.9 %	0.6 %	1.6 %	3.7 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	80.625 %	1,005.932 ppb	561.373 ppb	1,989.282 ppb	88.029 %	85.522 %	119.356 ppb	497.265 ppb	98.818 %
Concentration per Run 1	79.021 %	965.511 ppb	520.929 ppb	1,866.585 ppb	88.768 %	84.470 %	117.306 ppb	479.341 ppb	101.568 %
Concentration per Run 2	80.013 %	1,026.267 ppb	577.913 ppb	2,071.029 ppb	87.063 %	85.651 %	119.753 ppb	502.290 ppb	98.396 %
Concentration per Run 3	82.841 %	1,026.018 ppb	585.278 ppb	2,030.231 ppb	88.255 %	86.445 %	121.008 ppb	510.165 ppb	96.491 %
Concentration RSD	2.5 %	3.5 %	6.3 %	5.4 %	1.0 %	1.2 %	1.6 %	3.2 %	2.6 %

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Analysis index: 21 Analysis started at: 6/7/2017 9:19:14 AM Rack: 1
 Analysis label: XWG1008335-3D10 2008TL User name: ALPHALAB\metals-instrument Vial: 3

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	111.988 %	89.397 %	0.064 ppb	29,418.223 ppb	9,250.236 ppb	1,765.907 ppb	8,739.894 ppb	15,533.133 ppb	88.967 %
Concentration per Run 1	111.024 %	81.868 %	0.084 ppb	36,360.420 ppb	10,721.357 ppb	1,966.094 ppb	10,436.906 ppb	17,462.317 ppb	90.543 %
Concentration per Run 2	112.416 %	82.698 %	0.059 ppb	39,187.458 ppb	12,746.356 ppb	2,476.506 ppb	11,985.952 ppb	21,403.095 ppb	85.395 %
Concentration per Run 3	112.525 %	103.627 %	0.050 ppb	12,706.791 ppb	4,282.995 ppb	855.120 ppb	3,796.824 ppb	7,733.989 ppb	90.964 %
Concentration RSD	0.7 %	13.8 %	27.3 %	49.4 %	47.8 %	46.9 %	49.8 %	45.3 %	3.5 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	106.169 %	729.045 ppb	393.526 ppb	159.007 ppb	431.799 ppb	1,321.499 ppb	377.691 ppb	378.291 ppb	195.271 ppb
Concentration per Run 1	105.485 %	806.590 ppb	455.401 ppb	177.029 ppb	481.900 ppb	1,398.860 ppb	436.978 ppb	443.807 ppb	229.267 ppb
Concentration per Run 2	106.169 %	1,018.280 ppb	534.799 ppb	221.055 ppb	609.333 ppb	1,902.946 ppb	519.405 ppb	522.869 ppb	270.550 ppb
Concentration per Run 3	106.854 %	362.266 ppb	190.379 ppb	78.936 ppb	204.163 ppb	662.690 ppb	176.691 ppb	168.197 ppb	85.997 ppb
Concentration RSD	0.6 %	45.9 %	45.8 %	45.8 %	48.0 %	47.2 %	47.4 %	49.2 %	49.6 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	414.434 ppb	88.619 %	95.262 ppb	101.043 ppb	806.786 ppb	791.044 ppb	91.197 %	37.074 ppb	40.812 ppb
Concentration per Run 1	476.461 ppb	84.839 %	115.059 ppb	121.291 ppb	934.197 ppb	888.435 ppb	92.526 %	43.685 ppb	46.505 ppb
Concentration per Run 2	581.063 ppb	83.982 %	131.815 ppb	143.983 ppb	1,180.296 ppb	1,172.521 ppb	82.518 %	54.654 ppb	61.309 ppb
Concentration per Run 3	185.778 ppb	97.036 %	38.911 ppb	37.856 ppb	305.866 ppb	312.175 ppb	98.548 %	12.882 ppb	14.622 ppb
Concentration RSD	49.4 %	8.2 %	52.0 %	55.3 %	55.9 %	55.4 %	8.9 %	58.4 %	58.5 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	87.347 %	794.003 ppb	491.073 ppb	1,556.777 ppb	93.140 %	94.628 %	96.690 ppb	409.565 ppb	87.879 %
Concentration per Run 1	87.190 %	886.129 ppb	537.369 ppb	1,775.378 ppb	95.586 %	93.803 %	112.107 ppb	445.749 ppb	103.553 %
Concentration per Run 2	78.863 %	1,204.713 ppb	691.836 ppb	2,349.608 ppb	82.911 %	82.585 %	133.953 ppb	565.544 ppb	91.747 %
Concentration per Run 3	95.989 %	291.166 ppb	244.015 ppb	545.346 ppb	100.922 %	107.497 %	44.010 ppb	217.401 ppb	68.337 %
Concentration RSD	9.8 %	58.4 %	46.3 %	59.2 %	9.9 %	13.2 %	48.5 %	43.2 %	20.4 %

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Analysis index: 22 Analysis started at: 6/7/2017 9:22:34 AM Rack: 1
 Analysis label: WG1008335-4 2008TL User name: ALPHALAB\metals-instrument Vial: 4

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	87.291 %	86.539 %	0.014 ppb	28,895.562 ppb	1,103.950 ppb	81.124 ppb	1,125.297 ppb	9,855.843 ppb	88.406 %
Concentration per Run 1	88.261 %	86.109 %	0.018 ppb	28,769.355 ppb	1,093.424 ppb	78.310 ppb	1,125.965 ppb	9,787.134 ppb	88.599 %
Concentration per Run 2	87.060 %	84.265 %	0.015 ppb	28,834.490 ppb	1,079.597 ppb	79.527 ppb	1,035.953 ppb	9,430.733 ppb	92.171 %
Concentration per Run 3	86.552 %	89.244 %	0.011 ppb	29,082.842 ppb	1,138.829 ppb	85.534 ppb	1,213.973 ppb	10,349.662 ppb	84.448 %
Concentration RSD	1.0 %	2.9 %	24.5 %	0.6 %	2.8 %	4.8 %	7.9 %	4.7 %	4.4 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	86.690 %	16.201 ppb	0.834 ppb	0.732 ppb	62.072 ppb	613.665 ppb	0.178 ppb	0.620 ppb	2.896 ppb
Concentration per Run 1	87.656 %	16.416 ppb	0.786 ppb	0.815 ppb	59.459 ppb	584.910 ppb	0.171 ppb	0.788 ppb	2.516 ppb
Concentration per Run 2	86.727 %	14.420 ppb	0.979 ppb	0.784 ppb	60.643 ppb	650.867 ppb	0.226 ppb	0.409 ppb	3.107 ppb
Concentration per Run 3	85.686 %	17.766 ppb	0.736 ppb	0.597 ppb	66.115 ppb	605.218 ppb	0.137 ppb	0.664 ppb	3.064 ppb
Concentration RSD	1.1 %	10.4 %	15.4 %	16.1 %	5.7 %	5.5 %	25.3 %	31.2 %	11.4 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	25.250 ppb	84.500 %	0.903 ppb	0.966 ppb	49.671 ppb	3.130 ppb	86.385 %	0.007 ppb	0.033 ppb
Concentration per Run 1	24.682 ppb	83.602 %	0.954 ppb	0.625 ppb	50.104 ppb	2.477 ppb	88.792 %	0.007 ppb	0.012 ppb
Concentration per Run 2	25.525 ppb	84.741 %	0.866 ppb	1.296 ppb	49.073 ppb	3.383 ppb	84.885 %	0.000 ppb	0.050 ppb
Concentration per Run 3	25.544 ppb	85.156 %	0.888 ppb	0.977 ppb	49.836 ppb	3.531 ppb	85.477 %	0.014 ppb	0.037 ppb
Concentration RSD	2.0 %	1.0 %	5.1 %	34.8 %	1.1 %	18.2 %	2.4 %	96.3 %	58.9 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	84.686 %	2.480 ppb	8.244 ppb	10.504 ppb	89.080 %	87.886 %	0.044 ppb	1.381 ppb	98.493 %
Concentration per Run 1	87.283 %	2.356 ppb	7.588 ppb	9.873 ppb	90.015 %	90.256 %	0.027 ppb	1.323 ppb	102.419 %
Concentration per Run 2	82.469 %	2.555 ppb	8.390 ppb	10.966 ppb	87.945 %	86.085 %	0.043 ppb	1.410 ppb	97.065 %
Concentration per Run 3	84.305 %	2.529 ppb	8.753 ppb	10.673 ppb	89.279 %	87.318 %	0.063 ppb	1.409 ppb	95.996 %
Concentration RSD	2.9 %	4.4 %	7.2 %	5.4 %	1.2 %	2.4 %	41.5 %	3.6 %	3.5 %

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Analysis index: 23 Analysis started at: 6/7/2017 9:25:55 AM Rack: 1
 Analysis label: L1717598-01 2008TL User name: ALPHALAB\metals-instrument Vial: 5

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	86.097 %	90.442 %	0.019 ppb	27,885.943 ppb	1,026.298 ppb	79.535 ppb	1,084.408 ppb	9,492.632 ppb	87.565 %
Concentration per Run 1	86.816 %	92.931 %	0.030 ppb	27,391.023 ppb	1,041.090 ppb	79.808 ppb	1,132.758 ppb	9,436.253 ppb	87.916 %
Concentration per Run 2	86.303 %	86.846 %	0.007 ppb	28,795.704 ppb	1,044.857 ppb	80.794 ppb	1,049.853 ppb	9,589.690 ppb	87.075 %
Concentration per Run 3	85.173 %	91.549 %	0.019 ppb	27,471.101 ppb	992.948 ppb	78.001 ppb	1,070.613 ppb	9,451.953 ppb	87.706 %
Concentration RSD	1.0 %	3.5 %	61.3 %	2.8 %	2.8 %	1.8 %	4.0 %	0.9 %	0.5 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	86.896 %	17.065 ppb	0.739 ppb	0.739 ppb	61.950 ppb	617.424 ppb	0.186 ppb	0.604 ppb	2.888 ppb
Concentration per Run 1	87.886 %	15.845 ppb	0.597 ppb	0.649 ppb	61.454 ppb	610.800 ppb	0.254 ppb	0.776 ppb	2.556 ppb
Concentration per Run 2	87.120 %	17.205 ppb	0.529 ppb	0.804 ppb	64.349 ppb	640.693 ppb	0.112 ppb	0.710 ppb	3.156 ppb
Concentration per Run 3	85.683 %	18.145 ppb	1.090 ppb	0.763 ppb	60.046 ppb	600.779 ppb	0.193 ppb	0.326 ppb	2.952 ppb
Concentration RSD	1.3 %	6.8 %	41.4 %	10.8 %	3.5 %	3.4 %	38.4 %	40.2 %	10.6 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	25.016 ppb	85.390 %	0.765 ppb	0.414 ppb	49.067 ppb	1.448 ppb	87.450 %	0.006 ppb	0.014 ppb
Concentration per Run 1	24.090 ppb	86.323 %	0.774 ppb	0.013 ppb	49.243 ppb	1.444 ppb	89.567 %	0.004 ppb	0.018 ppb
Concentration per Run 2	25.496 ppb	82.746 %	0.729 ppb	0.639 ppb	48.512 ppb	1.272 ppb	86.572 %	0.011 ppb	0.006 ppb
Concentration per Run 3	25.462 ppb	87.100 %	0.793 ppb	0.590 ppb	49.445 ppb	1.629 ppb	86.211 %	0.003 ppb	0.019 ppb
Concentration RSD	3.2 %	2.7 %	4.3 %	84.1 %	1.0 %	12.4 %	2.1 %	75.8 %	49.3 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	84.356 %	1.428 ppb	3.401 ppb	9.984 ppb	88.247 %	87.963 %	0.020 ppb	1.317 ppb	95.979 %
Concentration per Run 1	86.774 %	1.427 ppb	2.774 ppb	9.765 ppb	90.012 %	89.538 %	0.015 ppb	1.242 ppb	99.782 %
Concentration per Run 2	84.095 %	1.399 ppb	3.541 ppb	10.240 ppb	86.863 %	86.504 %	0.018 ppb	1.341 ppb	94.176 %
Concentration per Run 3	82.200 %	1.460 ppb	3.889 ppb	9.946 ppb	87.867 %	87.848 %	0.027 ppb	1.367 ppb	93.978 %
Concentration RSD	2.7 %	2.1 %	16.8 %	2.4 %	1.8 %	1.7 %	31.2 %	5.0 %	3.4 %

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Analysis index: 24 Analysis started at: 6/7/2017 9:29:16 AM Rack: 1
Analysis label: L1717598-02 2008TL User name: ALPHALAB\metals-instrument Vial: 6

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	81.485 %	80.854 %	0.012 ppb	274,179.089 ppb	11,315.196 ppb	15.601 ppb	5,937.687 ppb	66,035.455 ppb	81.034 %
Concentration per Run 1	82.383 %	79.010 %	0.016 ppb	279,031.515 ppb	11,423.731 ppb	13.948 ppb	5,894.232 ppb	67,163.230 ppb	79.195 %
Concentration per Run 2	82.223 %	81.683 %	0.004 ppb	270,483.363 ppb	11,232.702 ppb	16.663 ppb	5,849.735 ppb	63,476.091 ppb	83.923 %
Concentration per Run 3	79.850 %	81.868 %	0.017 ppb	273,022.388 ppb	11,289.156 ppb	16.192 ppb	6,069.092 ppb	67,467.045 ppb	79.983 %
Concentration RSD	1.7 %	2.0 %	59.0 %	1.6 %	0.9 %	9.3 %	2.0 %	3.4 %	3.1 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	83.968 %	85.722 ppb	0.318 ppb	0.443 ppb	603.724 ppb	2,729.055 ppb	0.504 ppb	1.642 ppb	0.908 ppb
Concentration per Run 1	83.877 %	86.106 ppb	0.239 ppb	0.334 ppb	597.216 ppb	2,713.403 ppb	0.508 ppb	1.330 ppb	0.780 ppb
Concentration per Run 2	85.340 %	85.894 ppb	0.310 ppb	0.466 ppb	599.700 ppb	2,737.786 ppb	0.490 ppb	1.895 ppb	0.916 ppb
Concentration per Run 3	82.687 %	85.166 ppb	0.406 ppb	0.529 ppb	614.258 ppb	2,735.976 ppb	0.515 ppb	1.700 ppb	1.026 ppb
Concentration RSD	1.6 %	0.6 %	26.3 %	22.4 %	1.5 %	0.5 %	2.6 %	17.5 %	13.6 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	36.454 ppb	80.431 %	0.769 ppb	0.159 ppb	425.754 ppb	1.996 ppb	80.945 %	0.003 ppb	0.048 ppb
Concentration per Run 1	36.066 ppb	82.721 %	0.783 ppb	0.316 ppb	417.194 ppb	1.922 ppb	82.441 %	0.003 ppb	0.057 ppb
Concentration per Run 2	36.885 ppb	79.248 %	0.817 ppb	-0.197 ppb	427.144 ppb	2.196 ppb	80.654 %	0.008 ppb	0.033 ppb
Concentration per Run 3	36.410 ppb	79.325 %	0.706 ppb	0.358 ppb	432.924 ppb	1.871 ppb	79.741 %	-0.002 ppb	0.053 ppb
Concentration RSD	1.1 %	2.5 %	7.3 %	194.3 %	1.9 %	8.8 %	1.7 %	151.1 %	27.8 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	78.390 %	0.795 ppb	2.597 ppb	69.488 ppb	85.314 %	84.202 %	0.016 ppb	0.290 ppb	90.113 %
Concentration per Run 1	80.022 %	0.810 ppb	2.470 ppb	66.737 ppb	86.404 %	85.314 %	0.012 ppb	0.287 ppb	92.555 %
Concentration per Run 2	78.295 %	0.810 ppb	2.638 ppb	71.307 ppb	85.880 %	84.638 %	0.016 ppb	0.286 ppb	89.376 %
Concentration per Run 3	76.854 %	0.764 ppb	2.682 ppb	70.420 ppb	83.659 %	82.653 %	0.020 ppb	0.297 ppb	88.408 %
Concentration RSD	2.0 %	3.4 %	4.3 %	3.5 %	1.7 %	1.6 %	23.6 %	2.0 %	2.4 %

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Analysis index: 25 Analysis started at: 6/7/2017 9:32:38 AM Rack: 1
 Analysis label: L1717598-03 2008TL User name: ALPHALAB\metals-instrument Vial: 7

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	81.759 %	82.482 %	0.139 ppb	243,148.424 ppb	15,723.491 ppb	2,195.099 ppb	7,181.086 ppb	35,953.150 ppb	83.485 %
Concentration per Run 1	81.609 %	82.513 %	0.130 ppb	237,899.699 ppb	15,094.730 ppb	2,085.537 ppb	6,917.229 ppb	34,387.625 ppb	82.294 %
Concentration per Run 2	81.744 %	77.719 %	0.118 ppb	255,665.460 ppb	16,505.200 ppb	2,245.882 ppb	7,369.423 ppb	36,755.026 ppb	80.036 %
Concentration per Run 3	81.925 %	87.215 %	0.170 ppb	235,880.114 ppb	15,570.541 ppb	2,253.877 ppb	7,256.607 ppb	36,716.798 ppb	88.126 %
Concentration RSD	0.2 %	5.8 %	19.5 %	4.5 %	4.6 %	4.3 %	3.3 %	3.8 %	5.0 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	84.307 %	139.517 ppb	6.907 ppb	19.001 ppb	411.249 ppb	11,418.652 ppb	1.913 ppb	5.650 ppb	40.178 ppb
Concentration per Run 1	83.975 %	127.836 ppb	7.398 ppb	18.732 ppb	401.816 ppb	11,317.991 ppb	1.802 ppb	5.035 ppb	41.076 ppb
Concentration per Run 2	83.263 %	149.060 ppb	6.314 ppb	20.199 ppb	415.208 ppb	11,567.656 ppb	1.937 ppb	6.331 ppb	39.826 ppb
Concentration per Run 3	85.683 %	141.654 ppb	7.008 ppb	18.073 ppb	416.723 ppb	11,370.308 ppb	2.000 ppb	5.583 ppb	39.631 ppb
Concentration RSD	1.5 %	7.7 %	8.0 %	5.7 %	2.0 %	1.2 %	5.3 %	11.5 %	2.0 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	198.569 ppb	83.694 %	4.558 ppb	0.317 ppb	273.570 ppb	1.933 ppb	82.112 %	0.109 ppb	0.567 ppb
Concentration per Run 1	199.075 ppb	81.243 %	4.679 ppb	0.256 ppb	268.496 ppb	1.917 ppb	82.118 %	0.102 ppb	0.639 ppb
Concentration per Run 2	199.124 ppb	84.295 %	4.800 ppb	-0.293 ppb	265.342 ppb	1.825 ppb	81.799 %	0.096 ppb	0.539 ppb
Concentration per Run 3	197.507 ppb	85.545 %	4.196 ppb	0.988 ppb	286.871 ppb	2.058 ppb	82.420 %	0.129 ppb	0.524 ppb
Concentration RSD	0.5 %	2.6 %	7.0 %	202.7 %	4.2 %	6.1 %	0.4 %	16.3 %	11.0 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	79.856 %	2.850 ppb	3.722 ppb	89.397 ppb	86.535 %	85.070 %	0.045 ppb	38.097 ppb	91.493 %
Concentration per Run 1	80.022 %	2.742 ppb	3.380 ppb	87.510 ppb	87.021 %	84.653 %	0.044 ppb	37.118 ppb	93.011 %
Concentration per Run 2	78.264 %	3.040 ppb	3.660 ppb	89.240 ppb	85.057 %	83.721 %	0.046 ppb	37.979 ppb	92.311 %
Concentration per Run 3	81.281 %	2.768 ppb	4.125 ppb	91.441 ppb	87.527 %	86.835 %	0.043 ppb	39.194 ppb	89.158 %
Concentration RSD	1.9 %	5.8 %	10.1 %	2.2 %	1.5 %	1.9 %	3.5 %	2.7 %	2.2 %

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Analysis index: 26 Analysis started at: 6/7/2017 9:36:00 AM Rack: 1
 Analysis label: L1717598-04 2008TL User name: ALPHALAB\metals-instrument Vial: 8

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	87.686 %	92.317 %	0.018 ppb	179,916.606 ppb	15,699.688 ppb	46.820 ppb	6,469.310 ppb	28,824.623 ppb	91.909 %
Concentration per Run 1	87.363 %	89.520 %	0.026 ppb	179,220.599 ppb	15,329.654 ppb	49.359 ppb	6,355.788 ppb	27,723.682 ppb	88.809 %
Concentration per Run 2	88.065 %	96.158 %	0.010 ppb	174,613.398 ppb	15,616.692 ppb	41.010 ppb	6,698.175 ppb	29,488.639 ppb	91.752 %
Concentration per Run 3	87.631 %	91.272 %	0.018 ppb	185,915.822 ppb	16,152.719 ppb	50.092 ppb	6,353.967 ppb	29,261.548 ppb	95.166 %
Concentration RSD	0.4 %	3.7 %	42.6 %	3.2 %	2.7 %	10.8 %	3.1 %	3.3 %	3.5 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	90.715 %	40.613 ppb	0.801 ppb	0.628 ppb	153.307 ppb	535.550 ppb	0.174 ppb	1.783 ppb	3.847 ppb
Concentration per Run 1	89.633 %	37.206 ppb	0.774 ppb	0.650 ppb	149.299 ppb	572.197 ppb	0.201 ppb	0.972 ppb	3.948 ppb
Concentration per Run 2	91.308 %	42.867 ppb	1.079 ppb	0.653 ppb	158.213 ppb	506.542 ppb	0.219 ppb	0.945 ppb	3.981 ppb
Concentration per Run 3	91.204 %	41.767 ppb	0.550 ppb	0.580 ppb	152.408 ppb	527.910 ppb	0.100 ppb	3.431 ppb	3.611 ppb
Concentration RSD	1.0 %	7.4 %	33.1 %	6.5 %	3.0 %	6.3 %	36.8 %	80.1 %	5.3 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	14.546 ppb	91.126 %	0.883 ppb	0.255 ppb	220.363 ppb	1.090 ppb	88.206 %	0.002 ppb	0.078 ppb
Concentration per Run 1	13.840 ppb	89.355 %	0.675 ppb	0.003 ppb	205.716 ppb	0.951 ppb	88.908 %	0.000 ppb	0.066 ppb
Concentration per Run 2	14.535 ppb	90.652 %	0.906 ppb	0.579 ppb	227.901 ppb	1.245 ppb	87.887 %	0.002 ppb	0.076 ppb
Concentration per Run 3	15.263 ppb	93.373 %	1.068 ppb	0.184 ppb	227.472 ppb	1.073 ppb	87.822 %	0.004 ppb	0.093 ppb
Concentration RSD	4.9 %	2.2 %	22.3 %	115.4 %	5.8 %	13.6 %	0.7 %	92.2 %	17.4 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	87.193 %	0.662 ppb	1.352 ppb	58.449 ppb	91.368 %	90.455 %	0.012 ppb	2.146 ppb	95.129 %
Concentration per Run 1	84.528 %	0.620 ppb	1.030 ppb	55.875 ppb	92.302 %	90.270 %	0.010 ppb	2.084 ppb	98.030 %
Concentration per Run 2	87.870 %	0.733 ppb	1.400 ppb	61.058 ppb	91.345 %	91.360 %	0.009 ppb	2.134 ppb	94.490 %
Concentration per Run 3	89.183 %	0.632 ppb	1.624 ppb	58.413 ppb	90.457 %	89.737 %	0.016 ppb	2.218 ppb	92.868 %
Concentration RSD	2.8 %	9.4 %	22.2 %	4.4 %	1.0 %	0.9 %	31.4 %	3.2 %	2.8 %

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Analysis index: 27 Analysis started at: 6/7/2017 9:39:22 AM Rack: 1
 Analysis label: WG1008335-3D10 2008TL User name: ALPHALAB\metals-instrument Vial: 27

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	97.891 %	99.939 %	5.232 ppb	3,936.557 ppb	1,208.186 ppb	242.926 ppb	1,219.380 ppb	2,034.385 ppb	102.171 %
Concentration per Run 1	98.650 %	104.087 %	5.096 ppb	3,677.176 ppb	1,153.279 ppb	230.738 ppb	1,133.089 ppb	2,059.741 ppb	104.098 %
Concentration per Run 2	97.224 %	104.733 %	5.309 ppb	4,051.969 ppb	1,247.639 ppb	255.404 ppb	1,314.207 ppb	2,077.267 ppb	105.464 %
Concentration per Run 3	97.799 %	90.995 %	5.289 ppb	4,080.526 ppb	1,223.641 ppb	242.636 ppb	1,210.845 ppb	1,966.147 ppb	96.952 %
Concentration RSD	0.7 %	7.8 %	2.2 %	5.7 %	4.1 %	5.1 %	7.5 %	2.9 %	4.5 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	96.653 %	96.728 ppb	51.089 ppb	20.428 ppb	59.400 ppb	164.180 ppb	50.555 ppb	48.163 ppb	24.705 ppb
Concentration per Run 1	96.882 %	84.791 ppb	48.409 ppb	18.802 ppb	55.767 ppb	162.533 ppb	48.700 ppb	45.071 ppb	24.357 ppb
Concentration per Run 2	95.176 %	104.294 ppb	52.289 ppb	21.578 ppb	61.174 ppb	164.189 ppb	51.038 ppb	49.572 ppb	25.017 ppb
Concentration per Run 3	97.902 %	101.100 ppb	52.568 ppb	20.903 ppb	61.259 ppb	165.818 ppb	51.926 ppb	49.847 ppb	24.741 ppb
Concentration RSD	1.4 %	10.8 %	4.6 %	7.1 %	5.3 %	1.0 %	3.3 %	5.6 %	1.3 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	57.531 ppb	97.227 %	13.266 ppb	13.387 ppb	115.689 ppb	102.533 ppb	95.862 %	5.066 ppb	5.304 ppb
Concentration per Run 1	54.443 ppb	99.763 %	13.463 ppb	12.581 ppb	114.036 ppb	96.960 ppb	97.503 %	4.931 ppb	5.237 ppb
Concentration per Run 2	59.049 ppb	97.799 %	12.304 ppb	14.214 ppb	122.887 ppb	103.761 ppb	96.480 %	5.057 ppb	5.337 ppb
Concentration per Run 3	59.100 ppb	94.119 %	14.031 ppb	13.367 ppb	110.143 ppb	106.880 ppb	93.602 %	5.211 ppb	5.337 ppb
Concentration RSD	4.6 %	2.9 %	6.6 %	6.1 %	5.6 %	4.9 %	2.1 %	2.8 %	1.1 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	95.768 %	100.530 ppb	53.475 ppb	212.636 ppb	95.743 %	95.479 %	12.820 ppb	57.817 ppb	97.689 %
Concentration per Run 1	95.783 %	99.061 ppb	52.782 ppb	214.981 ppb	97.164 %	97.411 %	12.734 ppb	57.143 ppb	97.352 %
Concentration per Run 2	99.239 %	100.772 ppb	53.121 ppb	214.547 ppb	96.525 %	97.335 %	12.751 ppb	58.144 ppb	99.003 %
Concentration per Run 3	92.281 %	101.757 ppb	54.522 ppb	208.380 ppb	93.539 %	91.692 %	12.975 ppb	58.164 ppb	96.710 %
Concentration RSD	3.6 %	1.4 %	1.7 %	1.7 %	2.0 %	3.4 %	1.0 %	1.0 %	1.2 %

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Analysis index: 28 Analysis started at: 6/7/2017 9:42:42 AM Rack: 1
 Analysis label: WG1008707-6D5 A2-6020T User name: ALPHALAB\metals-instrument Vial: 10

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	94.979 %	92.593 %	0.013 ppb	71,497.910 ppb	3,238.715 ppb	45.177 ppb	1,351.793 ppb	8,685.791 ppb	96.147 %
Concentration per Run 1	96.024 %	96.619 %	0.012 ppb	70,913.497 ppb	3,071.572 ppb	45.688 ppb	1,331.247 ppb	8,275.672 ppb	110.457 %
Concentration per Run 2	94.393 %	89.059 %	0.016 ppb	72,522.476 ppb	3,358.592 ppb	48.098 ppb	1,428.565 ppb	8,997.199 ppb	88.966 %
Concentration per Run 3	94.519 %	92.102 %	0.012 ppb	71,057.758 ppb	3,285.980 ppb	41.745 ppb	1,295.568 ppb	8,784.501 ppb	89.019 %
Concentration RSD	1.0 %	4.1 %	16.1 %	1.2 %	4.6 %	7.1 %	5.1 %	4.3 %	12.9 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	95.271 %	12.430 ppb	0.145 ppb	0.214 ppb	13.836 ppb	813.980 ppb	0.113 ppb	0.256 ppb	1.006 ppb
Concentration per Run 1	96.030 %	13.124 ppb	0.081 ppb	0.198 ppb	12.807 ppb	774.208 ppb	0.148 ppb	0.267 ppb	0.888 ppb
Concentration per Run 2	94.529 %	10.613 ppb	0.176 ppb	0.226 ppb	14.706 ppb	787.934 ppb	0.070 ppb	0.399 ppb	1.100 ppb
Concentration per Run 3	95.254 %	13.553 ppb	0.178 ppb	0.218 ppb	13.995 ppb	879.799 ppb	0.121 ppb	0.104 ppb	1.029 ppb
Concentration RSD	0.8 %	12.8 %	38.1 %	6.9 %	6.9 %	7.1 %	34.8 %	57.5 %	10.7 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	1.376 ppb	93.062 %	0.095 ppb	0.602 ppb	58.151 ppb	0.738 ppb	91.326 %	0.007 ppb	0.014 ppb
Concentration per Run 1	1.214 ppb	103.015 %	0.099 ppb	0.466 ppb	58.247 ppb	0.844 ppb	93.968 %	0.000 ppb	0.000 ppb
Concentration per Run 2	1.525 ppb	90.677 %	0.065 ppb	0.134 ppb	57.458 ppb	0.735 ppb	91.358 %	0.023 ppb	0.012 ppb
Concentration per Run 3	1.390 ppb	85.493 %	0.120 ppb	1.204 ppb	58.747 ppb	0.635 ppb	88.653 %	-0.002 ppb	0.030 ppb
Concentration RSD	11.3 %	9.7 %	29.3 %	91.1 %	1.1 %	14.2 %	2.9 %	202.7 %	108.6 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	89.861 %	1.136 ppb	2.037 ppb	7.590 ppb	92.454 %	91.561 %	0.010 ppb	0.326 ppb	96.368 %
Concentration per Run 1	96.684 %	1.162 ppb	1.813 ppb	7.464 ppb	96.048 %	97.424 %	0.008 ppb	0.315 ppb	100.634 %
Concentration per Run 2	87.140 %	1.086 ppb	2.038 ppb	7.806 ppb	91.334 %	89.201 %	0.012 ppb	0.345 ppb	94.533 %
Concentration per Run 3	85.759 %	1.160 ppb	2.258 ppb	7.500 ppb	89.979 %	88.058 %	0.011 ppb	0.319 ppb	93.938 %
Concentration RSD	6.6 %	3.8 %	10.9 %	2.5 %	3.4 %	5.6 %	21.0 %	5.0 %	3.8 %

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Analysis index: 29 Analysis started at: 6/7/2017 9:46:05 AM Rack: 0
 Analysis label: CCV User name: ALPHALAB\metals-instrument Vial: 9

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	97.359 %	95.052 %	101.428 ppb	10,088.607 ppb	10,175.692 ppb	95.969 ppb	10,186.590 ppb	10,368.978 ppb	98.108 %
Concentration per Run 1	97.565 %	93.300 %	101.948 ppb	10,317.825 ppb	10,505.597 ppb	92.667 ppb	10,334.671 ppb	10,347.390 ppb	98.108 %
Concentration per Run 2	99.017 %	99.017 %	100.664 ppb	9,817.504 ppb	9,702.186 ppb	95.954 ppb	10,102.425 ppb	10,179.438 ppb	97.110 %
Concentration per Run 3	95.496 %	92.839 %	101.672 ppb	10,130.492 ppb	10,319.293 ppb	99.287 ppb	10,122.675 ppb	10,580.108 ppb	99.106 %
Recovery Percentage 1			101.428 %	100.886 %	101.757 %	95.969 %	101.866 %	103.690 %	
Concentration RSD	1.8 %	3.6 %	0.7 %	2.5 %	4.1 %	3.4 %	1.3 %	1.9 %	1.0 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	97.207 %	100.958 ppb	97.081 ppb	97.169 ppb	97.459 ppb	9,744.444 ppb	97.197 ppb	94.809 ppb	96.492 ppb
Concentration per Run 1	97.567 %	105.741 ppb	101.945 ppb	99.878 ppb	99.058 ppb	10,058.581 ppb	99.056 ppb	99.742 ppb	100.021 ppb
Concentration per Run 2	99.346 %	100.338 ppb	92.861 ppb	94.149 ppb	95.832 ppb	9,524.379 ppb	94.905 ppb	92.853 ppb	93.463 ppb
Concentration per Run 3	94.708 %	96.795 ppb	96.437 ppb	97.480 ppb	97.486 ppb	9,650.373 ppb	97.631 ppb	91.832 ppb	95.991 ppb
Recovery Percentage 1		100.958 %	97.081 %	97.169 %	97.459 %	97.444 %	97.197 %	94.809 %	96.492 %
Concentration RSD	2.4 %	4.5 %	4.7 %	3.0 %	1.7 %	2.9 %	2.2 %	4.5 %	3.4 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	96.984 ppb	94.043 %	96.854 ppb	96.302 ppb	102.686 ppb	102.086 ppb	94.019 %	97.962 ppb	100.154 ppb
Concentration per Run 1	98.988 ppb	93.885 %	99.086 ppb	91.467 ppb	104.552 ppb	104.546 ppb	91.810 %	99.026 ppb	103.147 ppb
Concentration per Run 2	95.555 ppb	92.889 %	94.545 ppb	101.636 ppb	99.396 ppb	98.396 ppb	97.441 %	96.085 ppb	96.270 ppb
Concentration per Run 3	96.410 ppb	95.357 %	96.932 ppb	95.802 ppb	104.110 ppb	103.317 ppb	92.805 %	98.774 ppb	101.045 ppb
Recovery Percentage 1	96.984 %		96.854 %	96.302 %	102.686 %	102.086 %		97.962 %	100.154 %
Concentration RSD	1.8 %	1.3 %	2.3 %	5.3 %	2.8 %	3.2 %	3.2 %	1.7 %	3.5 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	92.066 %	99.358 ppb	106.325 ppb	99.077 ppb	95.415 %	93.971 %	99.345 ppb	101.891 ppb	99.841 %
Concentration per Run 1	91.425 %	102.087 ppb	105.148 ppb	100.344 ppb	94.756 %	92.697 %	100.827 ppb	104.150 ppb	98.025 %
Concentration per Run 2	94.720 %	94.082 ppb	102.876 ppb	95.337 ppb	97.706 %	96.287 %	96.986 ppb	98.305 ppb	102.634 %
Concentration per Run 3	90.052 %	101.905 ppb	110.952 ppb	101.550 ppb	93.784 %	92.930 %	100.222 ppb	103.220 ppb	98.865 %
Recovery Percentage 1		99.358 %	106.325 %	99.077 %			99.345 %	101.891 %	
Concentration RSD	2.6 %	4.6 %	3.9 %	3.3 %	2.1 %	2.1 %	2.1 %	3.1 %	2.5 %

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Analysis index: 30 Analysis started at: 6/7/2017 9:49:30 AM Rack: 0
 Analysis label: CCB User name: ALPHALAB\metals-instrument Vial: 10

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	96.520 %	93.515 %	0.015 ppb	28.760 ppb	0.288 ppb	0.016 ppb	7.064 ppb	7.962 ppb	92.486 %
Concentration per Run 1	98.174 %	91.549 %	0.018 ppb	36.815 ppb	0.294 ppb	-0.086 ppb	9.610 ppb	0.380 ppb	93.327 %
Concentration per Run 2	96.808 %	95.236 %	0.002 ppb	27.848 ppb	0.287 ppb	0.071 ppb	-6.023 ppb	19.349 ppb	90.753 %
Concentration per Run 3	94.579 %	93.761 %	0.027 ppb	21.616 ppb	0.284 ppb	0.062 ppb	17.604 ppb	4.158 ppb	93.379 %
Recovery Percentage 1			3.087 %	28.760 %	0.412 %	0.158 %	7.064 %	7.962 %	
Concentration RSD	1.9 %	2.0 %	82.4 %	26.6 %	1.8 %	555.5 %	170.1 %	126.1 %	1.6 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	95.079 %	0.002 ppb	0.026 ppb	0.024 ppb	0.031 ppb	0.740 ppb	0.000 ppb	-0.011 ppb	-0.005 ppb
Concentration per Run 1	97.693 %	-0.038 ppb	0.025 ppb	0.046 ppb	0.057 ppb	1.319 ppb	0.000 ppb	-0.042 ppb	-0.034 ppb
Concentration per Run 2	95.245 %	-0.038 ppb	0.063 ppb	-0.010 ppb	0.060 ppb	-1.373 ppb	0.000 ppb	-0.037 ppb	-0.005 ppb
Concentration per Run 3	92.299 %	0.081 ppb	-0.010 ppb	0.036 ppb	-0.025 ppb	2.273 ppb	0.000 ppb	0.046 ppb	0.023 ppb
Recovery Percentage 1		0.311 %	0.517 %	2.414 %	3.058 %	1.479 %	0.000 %	-0.540 %	-0.543 %
Concentration RSD	2.8 %	4,434.4 %	141.5 %	124.2 %	157.3 %	255.6 %		460.0 %	516.3 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	-0.092 ppb	91.472 %	0.081 ppb	0.340 ppb	0.004 ppb	0.586 ppb	91.477 %	0.024 ppb	0.011 ppb
Concentration per Run 1	-0.115 ppb	93.554 %	0.063 ppb	0.378 ppb	0.017 ppb	0.513 ppb	92.685 %	0.021 ppb	0.011 ppb
Concentration per Run 2	-0.071 ppb	90.858 %	0.065 ppb	0.505 ppb	0.012 ppb	0.564 ppb	90.046 %	0.030 ppb	0.006 ppb
Concentration per Run 3	-0.090 ppb	90.003 %	0.114 ppb	0.137 ppb	-0.017 ppb	0.681 ppb	91.699 %	0.021 ppb	0.017 ppb
Recovery Percentage 1	-0.922 %	91.472 %	16.164 %	6.803 %	0.793 %	29.305 %		5.969 %	5.699 %
Concentration RSD	23.7 %	2.0 %	35.7 %	54.9 %	466.4 %	14.7 %	1.5 %	22.6 %	49.5 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	89.416 %	0.863 ppb	2.905 ppb	-0.003 ppb	92.123 %	89.552 %	0.027 ppb	0.054 ppb	89.374 %
Concentration per Run 1	91.161 %	0.962 ppb	2.915 ppb	-0.004 ppb	93.542 %	89.963 %	0.026 ppb	0.056 ppb	87.470 %
Concentration per Run 2	87.380 %	0.804 ppb	2.875 ppb	-0.003 ppb	91.147 %	89.146 %	0.029 ppb	0.055 ppb	89.439 %
Concentration per Run 3	89.708 %	0.823 ppb	2.927 ppb	-0.003 ppb	91.681 %	89.548 %	0.025 ppb	0.052 ppb	91.212 %
Recovery Percentage 1		28.756 %	72.636 %	-0.654 %			5.376 %	10.873 %	89.374 %
Concentration RSD	2.1 %	10.0 %	0.9 %	7.7 %	1.4 %	0.5 %	7.9 %	4.2 %	2.1 %

Alpha ICPMSQ Full

6/7/2017 3:54:49 PM



Analysis index: 31 Analysis started at: 6/7/2017 9:54:10 AM Rack: 1
 Analysis label: WG1008707-1 A2-6020T User name: ALPHALAB\metals-instrument Vial: 11

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	94.672 %	90.719 %	0.010 ppb	41.901 ppb	0.555 ppb	1.011 ppb	19.509 ppb	12.901 ppb	92.066 %
Concentration per Run 1	94.675 %	94.960 %	0.005 ppb	35.593 ppb	1.036 ppb	0.689 ppb	23.223 ppb	7.905 ppb	93.064 %
Concentration per Run 2	94.414 %	91.733 %	0.009 ppb	40.279 ppb	0.305 ppb	1.236 ppb	20.386 ppb	8.111 ppb	90.227 %
Concentration per Run 3	94.927 %	85.463 %	0.016 ppb	49.830 ppb	0.324 ppb	1.107 ppb	14.918 ppb	22.688 ppb	92.907 %
Concentration RSD	0.3 %	5.3 %	53.0 %	17.3 %	75.1 %	28.3 %	21.6 %	65.7 %	1.7 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	93.120 %	0.022 ppb	0.014 ppb	-0.030 ppb	0.116 ppb	0.467 ppb	0.012 ppb	-0.079 ppb	0.184 ppb
Concentration per Run 1	92.585 %	0.022 ppb	0.026 ppb	-0.035 ppb	0.101 ppb	1.388 ppb	0.012 ppb	-0.166 ppb	0.194 ppb
Concentration per Run 2	93.653 %	0.023 ppb	0.026 ppb	0.003 ppb	0.145 ppb	-1.373 ppb	0.000 ppb	0.051 ppb	0.194 ppb
Concentration per Run 3	93.123 %	0.022 ppb	-0.010 ppb	-0.059 ppb	0.101 ppb	1.387 ppb	0.023 ppb	-0.123 ppb	0.165 ppb
Concentration RSD	0.6 %	4.0 %	151.2 %	103.1 %	22.2 %	341.0 %	100.0 %	145.2 %	9.0 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	0.139 ppb	88.886 %	0.034 ppb	0.099 ppb	-0.012 ppb	0.196 ppb	91.081 %	0.009 ppb	0.009 ppb
Concentration per Run 1	0.102 ppb	88.266 %	0.018 ppb	-0.701 ppb	-0.032 ppb	0.134 ppb	93.377 %	0.014 ppb	0.023 ppb
Concentration per Run 2	0.157 ppb	89.764 %	0.042 ppb	0.977 ppb	0.012 ppb	0.243 ppb	90.690 %	-0.002 ppb	0.006 ppb
Concentration per Run 3	0.158 ppb	88.629 %	0.042 ppb	0.022 ppb	-0.017 ppb	0.211 ppb	89.176 %	0.015 ppb	0.000 ppb
Concentration RSD	22.9 %	0.9 %	41.0 %	847.5 %	184.0 %	28.5 %	2.3 %	107.2 %	124.5 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	88.741 %	0.615 ppb	1.182 ppb	0.007 ppb	91.168 %	89.837 %	0.008 ppb	0.040 ppb	101.940 %
Concentration per Run 1	90.505 %	0.556 ppb	1.155 ppb	-0.003 ppb	92.505 %	91.770 %	0.010 ppb	0.040 ppb	107.374 %
Concentration per Run 2	90.459 %	0.619 ppb	1.214 ppb	-0.003 ppb	92.582 %	89.653 %	0.009 ppb	0.045 ppb	101.689 %
Concentration per Run 3	85.259 %	0.670 ppb	1.178 ppb	0.028 ppb	88.418 %	88.087 %	0.007 ppb	0.034 ppb	96.758 %
Concentration RSD	3.4 %	9.3 %	2.5 %	255.1 %	2.6 %	2.1 %	18.9 %	14.1 %	5.2 %

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Analysis index: 32 Analysis started at: 6/7/2017 9:57:33 AM Rack: 1
Analysis label: WG1010157-1 CT-6020TL User name: ALPHALAB\metals-instrument Vial: 19

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	92.090 %	89.920 %	0.012 ppb	40.701 ppb	1.115 ppb	1.064 ppb	1.734 ppb	11.485 ppb	92.872 %
Concentration per Run 1	92.698 %	90.627 %	0.024 ppb	36.230 ppb	-0.477 ppb	1.028 ppb	1.811 ppb	18.476 ppb	94.851 %
Concentration per Run 2	92.199 %	93.392 %	0.017 ppb	30.499 ppb	0.293 ppb	0.719 ppb	2.245 ppb	8.031 ppb	91.436 %
Concentration per Run 3	91.372 %	85.740 %	-0.005 ppb	55.375 ppb	3.530 ppb	1.444 ppb	1.147 ppb	7.949 ppb	92.329 %
Concentration RSD	0.7 %	4.3 %	126.3 %	32.0 %	190.6 %	34.2 %	31.9 %	52.7 %	1.9 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	90.644 %	0.002 ppb	-0.010 ppb	0.005 ppb	0.142 ppb	-1.373 ppb	0.000 ppb	0.092 ppb	0.154 ppb
Concentration per Run 1	89.978 %	0.021 ppb	-0.010 ppb	0.011 ppb	0.181 ppb	-1.373 ppb	0.000 ppb	0.044 ppb	0.273 ppb
Concentration per Run 2	91.382 %	-0.038 ppb	-0.010 ppb	0.026 ppb	0.059 ppb	-1.373 ppb	0.000 ppb	-0.037 ppb	0.108 ppb
Concentration per Run 3	90.572 %	0.022 ppb	-0.010 ppb	-0.022 ppb	0.187 ppb	-1.373 ppb	0.000 ppb	0.269 ppb	0.082 ppb
Concentration RSD	0.8 %	2,237.4 %	0.0 %	517.5 %	50.5 %			171.6 %	67.4 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	0.350 ppb	89.044 %	0.009 ppb	0.236 ppb	-0.007 ppb	0.201 ppb	92.122 %	0.001 ppb	0.002 ppb
Concentration per Run 1	0.260 ppb	90.107 %	0.017 ppb	1.005 ppb	-0.004 ppb	0.114 ppb	95.527 %	0.004 ppb	0.006 ppb
Concentration per Run 2	0.455 ppb	89.796 %	0.018 ppb	-0.198 ppb	-0.010 ppb	0.312 ppb	91.498 %	0.000 ppb	0.000 ppb
Concentration per Run 3	0.336 ppb	87.230 %	-0.007 ppb	-0.099 ppb	-0.009 ppb	0.176 ppb	89.340 %	-0.002 ppb	0.000 ppb
Concentration RSD	28.1 %	1.8 %	148.0 %	283.1 %	44.8 %	50.5 %	3.4 %	523.2 %	173.2 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	88.469 %	0.451 ppb	0.765 ppb	0.021 ppb	92.484 %	90.034 %	0.003 ppb	0.018 ppb	100.939 %
Concentration per Run 1	91.087 %	0.544 ppb	0.594 ppb	0.025 ppb	94.918 %	92.016 %	0.000 ppb	0.021 ppb	103.376 %
Concentration per Run 2	87.970 %	0.448 ppb	0.890 ppb	0.057 ppb	91.284 %	90.240 %	0.003 ppb	0.017 ppb	100.975 %
Concentration per Run 3	86.350 %	0.361 ppb	0.812 ppb	-0.018 ppb	91.250 %	87.846 %	0.007 ppb	0.015 ppb	98.467 %
Concentration RSD	2.7 %	20.2 %	20.0 %	176.2 %	2.3 %	2.3 %	95.7 %	15.9 %	2.4 %

Alpha ICPMSQ Full

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Analysis index: 33 Analysis started at: 6/7/2017 10:00:55 AM Rack: 1
 Analysis label: L1717285-18 A2-6020T User name: ALPHALAB\metals-instrument Vial: 18

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	91.732 %	99.324 %	0.002 ppb	50.589 ppb	6.937 ppb	1.450 ppb	21.676 ppb	34.413 ppb	91.541 %
Concentration per Run 1	92.643 %	95.790 %	0.002 ppb	51.537 ppb	4.867 ppb	0.871 ppb	15.567 ppb	41.381 ppb	90.175 %
Concentration per Run 2	91.708 %	100.676 %	0.010 ppb	39.683 ppb	8.555 ppb	2.283 ppb	17.087 ppb	27.160 ppb	87.338 %
Concentration per Run 3	90.843 %	101.506 %	-0.005 ppb	60.547 ppb	7.390 ppb	1.196 ppb	32.373 ppb	34.698 ppb	97.110 %
Concentration RSD	1.0 %	3.1 %	318.0 %	20.7 %	27.2 %	51.0 %	42.9 %	20.7 %	5.5 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	91.535 %	0.118 ppb	0.015 ppb	0.256 ppb	1.768 ppb	3.035 ppb	0.020 ppb	0.100 ppb	0.131 ppb
Concentration per Run 1	90.539 %	0.085 ppb	0.027 ppb	0.324 ppb	1.735 ppb	6.149 ppb	0.035 ppb	0.010 ppb	0.197 ppb
Concentration per Run 2	92.238 %	-0.038 ppb	0.028 ppb	0.239 ppb	1.543 ppb	2.562 ppb	0.025 ppb	0.251 ppb	0.119 ppb
Concentration per Run 3	91.829 %	0.307 ppb	-0.010 ppb	0.204 ppb	2.027 ppb	0.393 ppb	0.000 ppb	0.039 ppb	0.076 ppb
Concentration RSD	1.0 %	148.2 %	147.5 %	24.2 %	13.8 %	95.8 %	90.6 %	131.3 %	47.2 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	0.377 ppb	87.290 %	0.069 ppb	0.032 ppb	0.276 ppb	0.095 ppb	91.265 %	0.005 ppb	0.002 ppb
Concentration per Run 1	0.300 ppb	87.722 %	0.018 ppb	0.407 ppb	0.281 ppb	0.189 ppb	91.991 %	-0.004 ppb	0.006 ppb
Concentration per Run 2	0.457 ppb	82.228 %	0.125 ppb	0.611 ppb	0.272 ppb	0.013 ppb	90.704 %	0.019 ppb	0.000 ppb
Concentration per Run 3	0.375 ppb	91.921 %	0.064 ppb	-0.922 ppb	0.275 ppb	0.083 ppb	91.101 %	0.000 ppb	0.000 ppb
Concentration RSD	20.9 %	5.6 %	77.6 %	2,599.6 %	1.8 %	93.7 %	0.7 %	255.5 %	173.2 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	90.506 %	0.406 ppb	0.615 ppb	0.121 ppb	91.062 %	90.121 %	0.003 ppb	0.023 ppb	100.952 %
Concentration per Run 1	87.588 %	0.328 ppb	0.504 ppb	0.102 ppb	91.673 %	88.779 %	0.003 ppb	0.019 ppb	102.852 %
Concentration per Run 2	88.210 %	0.357 ppb	0.602 ppb	0.164 ppb	89.185 %	87.027 %	0.002 ppb	0.026 ppb	100.182 %
Concentration per Run 3	95.721 %	0.534 ppb	0.739 ppb	0.096 ppb	92.327 %	94.557 %	0.004 ppb	0.024 ppb	99.821 %
Concentration RSD	5.0 %	27.5 %	19.2 %	31.0 %	1.8 %	4.4 %	35.8 %	14.3 %	1.6 %

Alpha ICPMSQ Full

6/7/2017 3:54:49 PM



Analysis index: 34 Analysis started at: 6/7/2017 10:04:17 AM Rack: 1
 Analysis label: WG1010157-2D5 CT-6020TL User name: ALPHALAB\metals-instrument Vial: 20

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	90.607 %	92.501 %	10.449 ppb	2,034.835 ppb	2,044.841 ppb	468.758 ppb	2,052.193 ppb	1,998.404 ppb	93.275 %
Concentration per Run 1	90.392 %	90.073 %	10.448 ppb	1,974.989 ppb	1,966.996 ppb	424.973 ppb	1,955.640 ppb	1,804.240 ppb	93.012 %
Concentration per Run 2	91.204 %	95.236 %	10.415 ppb	2,108.763 ppb	2,086.755 ppb	517.939 ppb	2,155.528 ppb	2,150.027 ppb	97.531 %
Concentration per Run 3	90.224 %	92.194 %	10.485 ppb	2,020.753 ppb	2,080.771 ppb	463.362 ppb	2,045.413 ppb	2,040.944 ppb	89.282 %
Concentration RSD	0.6 %	2.8 %	0.3 %	3.3 %	3.3 %	10.0 %	4.9 %	8.8 %	4.4 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	88.022 %	175.070 ppb	103.462 ppb	40.173 ppb	103.960 ppb	192.293 ppb	96.138 ppb	96.009 ppb	48.441 ppb
Concentration per Run 1	87.065 %	166.203 ppb	98.438 ppb	39.109 ppb	95.579 ppb	200.656 ppb	94.487 ppb	94.266 ppb	51.947 ppb
Concentration per Run 2	87.218 %	179.749 ppb	104.894 ppb	40.786 ppb	106.859 ppb	195.747 ppb	97.473 ppb	97.965 ppb	44.748 ppb
Concentration per Run 3	89.783 %	179.256 ppb	107.055 ppb	40.623 ppb	109.443 ppb	180.476 ppb	96.454 ppb	95.794 ppb	48.629 ppb
Concentration RSD	1.7 %	4.4 %	4.3 %	2.3 %	7.1 %	5.5 %	1.6 %	1.9 %	7.4 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	101.942 ppb	90.641 %	25.470 ppb	26.244 ppb	199.529 ppb	182.191 ppb	89.316 %	10.032 ppb	10.773 ppb
Concentration per Run 1	103.511 ppb	84.859 %	26.383 ppb	25.374 ppb	194.136 ppb	179.415 ppb	89.574 %	10.223 ppb	10.544 ppb
Concentration per Run 2	101.340 ppb	95.163 %	24.879 ppb	27.633 ppb	208.975 ppb	179.951 ppb	89.560 %	9.953 ppb	10.820 ppb
Concentration per Run 3	100.975 ppb	91.902 %	25.147 ppb	25.726 ppb	195.476 ppb	187.207 ppb	88.815 %	9.919 ppb	10.956 ppb
Concentration RSD	1.3 %	5.8 %	3.1 %	4.6 %	4.1 %	2.4 %	0.5 %	1.7 %	1.9 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	88.577 %	182.187 ppb	100.296 ppb	416.594 ppb	89.652 %	89.044 %	24.534 ppb	110.549 ppb	93.099 %
Concentration per Run 1	84.211 %	181.497 ppb	97.867 ppb	414.531 ppb	89.233 %	88.011 %	24.365 ppb	107.904 ppb	94.679 %
Concentration per Run 2	94.439 %	181.134 ppb	99.310 ppb	423.075 ppb	92.391 %	92.399 %	24.493 ppb	111.227 ppb	93.712 %
Concentration per Run 3	87.082 %	183.929 ppb	103.710 ppb	412.177 ppb	87.332 %	86.721 %	24.744 ppb	112.517 ppb	90.906 %
Concentration RSD	6.0 %	0.8 %	3.0 %	1.4 %	2.9 %	3.3 %	0.8 %	2.2 %	2.1 %

Alpha ICPMSQ Full

6/7/2017 3:54:49 PM



Analysis index: 35 Analysis started at: 6/7/2017 10:07:39 AM Rack: 1
 Analysis label: WG1008707-2D5 A2-6020T User name: ALPHALAB\metals-instrument Vial: 12

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	91.983 %	89.121 %	10.367 ppb	2,409.157 ppb	2,228.085 ppb	467.822 ppb	2,285.613 ppb	2,182.816 ppb	92.837 %
Concentration per Run 1	92.907 %	93.485 %	10.299 ppb	2,396.698 ppb	2,243.868 ppb	461.115 ppb	2,327.497 ppb	2,186.008 ppb	107.829 %
Concentration per Run 2	92.056 %	90.442 %	10.327 ppb	2,386.068 ppb	2,208.740 ppb	474.932 ppb	2,283.424 ppb	2,236.258 ppb	86.287 %
Concentration per Run 3	90.987 %	83.435 %	10.473 ppb	2,444.706 ppb	2,231.648 ppb	467.418 ppb	2,245.917 ppb	2,126.180 ppb	84.396 %
Concentration RSD	1.0 %	5.8 %	0.9 %	1.3 %	0.8 %	1.5 %	1.8 %	2.5 %	14.0 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	89.514 %	185.747 ppb	101.538 ppb	40.665 ppb	105.475 ppb	215.363 ppb	97.188 ppb	97.437 ppb	48.930 ppb
Concentration per Run 1	90.052 %	175.165 ppb	93.367 ppb	36.653 ppb	103.142 ppb	193.846 ppb	85.901 ppb	87.530 ppb	43.816 ppb
Concentration per Run 2	90.312 %	188.817 ppb	104.988 ppb	42.957 ppb	108.562 ppb	260.557 ppb	102.225 ppb	100.460 ppb	49.268 ppb
Concentration per Run 3	88.179 %	193.258 ppb	106.259 ppb	42.386 ppb	104.720 ppb	191.686 ppb	103.440 ppb	104.321 ppb	53.704 ppb
Concentration RSD	1.3 %	5.1 %	7.0 %	8.6 %	2.6 %	18.2 %	10.1 %	9.0 %	10.1 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	99.580 ppb	89.605 %	25.314 ppb	26.799 ppb	217.012 ppb	200.997 ppb	88.639 %	10.094 ppb	10.628 ppb
Concentration per Run 1	95.297 ppb	97.373 %	23.652 ppb	26.205 ppb	221.413 ppb	196.556 ppb	93.228 %	9.947 ppb	10.543 ppb
Concentration per Run 2	101.140 ppb	87.399 %	26.291 ppb	25.319 ppb	213.990 ppb	200.374 ppb	87.106 %	10.061 ppb	10.769 ppb
Concentration per Run 3	102.303 ppb	84.043 %	26.001 ppb	28.874 ppb	215.632 ppb	206.060 ppb	85.583 %	10.274 ppb	10.571 ppb
Concentration RSD	3.8 %	7.7 %	5.7 %	6.9 %	1.8 %	2.4 %	4.6 %	1.6 %	1.2 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	89.008 %	197.538 ppb	106.996 ppb	419.266 ppb	88.278 %	89.284 %	24.829 ppb	111.696 ppb	92.325 %
Concentration per Run 1	97.441 %	189.531 ppb	102.049 ppb	417.080 ppb	94.000 %	95.219 %	24.059 ppb	109.220 ppb	95.885 %
Concentration per Run 2	86.196 %	202.226 ppb	108.948 ppb	418.092 ppb	89.412 %	87.443 %	24.655 ppb	111.806 ppb	92.227 %
Concentration per Run 3	83.388 %	200.857 ppb	109.990 ppb	422.626 ppb	81.421 %	85.191 %	25.774 ppb	114.061 ppb	88.864 %
Concentration RSD	8.4 %	3.5 %	4.0 %	0.7 %	7.2 %	5.9 %	3.5 %	2.2 %	3.8 %

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Analysis index: 36 Analysis started at: 6/7/2017 10:11:02 AM Rack: 1
Analysis label: WG1008707-3D10 A2-6020T User name: ALPHALAB\metals-instrument Vial: 13

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	91.147 %	86.047 %	5.280 ppb	38,013.122 ppb	2,665.184 ppb	245.407 ppb	1,633.000 ppb	5,266.022 ppb	91.068 %
Concentration per Run 1	90.295 %	89.151 %	5.249 ppb	37,534.593 ppb	2,646.518 ppb	239.997 ppb	1,552.463 ppb	5,147.367 ppb	92.907 %
Concentration per Run 2	91.574 %	86.570 %	5.275 ppb	37,451.414 ppb	2,591.406 ppb	236.724 ppb	1,639.938 ppb	5,128.285 ppb	90.385 %
Concentration per Run 3	91.572 %	82.421 %	5.316 ppb	39,053.360 ppb	2,757.627 ppb	259.501 ppb	1,706.599 ppb	5,522.414 ppb	89.912 %
Concentration RSD	0.8 %	3.9 %	0.6 %	2.4 %	3.2 %	5.0 %	4.7 %	4.2 %	1.8 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	90.743 %	96.667 ppb	48.426 ppb	20.004 ppb	56.869 ppb	480.542 ppb	48.508 ppb	48.174 ppb	25.476 ppb
Concentration per Run 1	90.187 %	94.787 ppb	48.926 ppb	19.403 ppb	55.949 ppb	471.665 ppb	47.330 ppb	47.116 ppb	24.361 ppb
Concentration per Run 2	91.174 %	97.343 ppb	47.975 ppb	20.896 ppb	55.326 ppb	502.880 ppb	49.164 ppb	49.431 ppb	26.116 ppb
Concentration per Run 3	90.867 %	97.870 ppb	48.379 ppb	19.713 ppb	59.334 ppb	467.081 ppb	49.029 ppb	47.975 ppb	25.953 ppb
Concentration RSD	0.6 %	1.7 %	1.0 %	3.9 %	3.8 %	4.1 %	2.1 %	2.4 %	3.8 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	51.352 ppb	86.863 %	12.003 ppb	12.800 ppb	133.915 ppb	99.795 ppb	86.172 %	5.080 ppb	5.643 ppb
Concentration per Run 1	50.773 ppb	89.427 %	12.263 ppb	13.607 ppb	132.121 ppb	96.459 ppb	88.469 %	5.011 ppb	5.764 ppb
Concentration per Run 2	51.406 ppb	86.149 %	11.494 ppb	12.898 ppb	135.082 ppb	100.591 ppb	84.619 %	5.169 ppb	5.272 ppb
Concentration per Run 3	51.878 ppb	85.015 %	12.253 ppb	11.895 ppb	134.542 ppb	102.333 ppb	85.426 %	5.059 ppb	5.892 ppb
Concentration RSD	1.1 %	2.6 %	3.7 %	6.7 %	1.2 %	3.0 %	2.4 %	1.6 %	5.8 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	82.864 %	99.734 ppb	64.216 ppb	208.396 ppb	87.682 %	86.276 %	12.129 ppb	55.836 ppb	89.901 %
Concentration per Run 1	85.755 %	93.885 ppb	61.607 ppb	203.612 ppb	90.598 %	90.398 %	11.999 ppb	54.183 ppb	92.115 %
Concentration per Run 2	80.748 %	101.709 ppb	65.473 ppb	211.299 ppb	85.054 %	84.567 %	12.201 ppb	56.448 ppb	88.579 %
Concentration per Run 3	82.087 %	103.609 ppb	65.567 ppb	210.277 ppb	87.394 %	83.861 %	12.187 ppb	56.878 ppb	89.008 %
Concentration RSD	3.1 %	5.2 %	3.5 %	2.0 %	3.2 %	4.2 %	0.9 %	2.6 %	2.1 %

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Analysis index: 37 Analysis started at: 6/7/2017 10:14:22 AM Rack: 1
 Analysis label: WG1008707-5D10 A2-6020T User name: ALPHALAB\metals-instrument Vial: 9

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	98.086 %	89.950 %	50.242 ppb	41,497.415 ppb	6,920.828 ppb	76.291 ppb	5,868.504 ppb	9,329.304 ppb	94.238 %
Concentration per Run 1	98.230 %	91.825 %	49.995 ppb	40,431.615 ppb	6,770.883 ppb	78.803 ppb	5,840.537 ppb	9,393.858 ppb	95.113 %
Concentration per Run 2	97.823 %	87.953 %	49.812 ppb	41,354.344 ppb	7,027.448 ppb	74.178 ppb	5,974.963 ppb	9,355.768 ppb	92.644 %
Concentration per Run 3	98.205 %	90.073 %	50.918 ppb	42,706.287 ppb	6,964.153 ppb	75.893 ppb	5,790.012 ppb	9,238.287 ppb	94.956 %
Concentration RSD	0.2 %	2.2 %	1.2 %	2.8 %	1.9 %	3.1 %	1.6 %	0.9 %	1.5 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	98.327 %	56.357 ppb	49.313 ppb	50.410 ppb	57.020 ppb	5,321.960 ppb	49.486 ppb	48.137 ppb	50.799 ppb
Concentration per Run 1	98.174 %	54.981 ppb	46.418 ppb	49.786 ppb	53.429 ppb	5,069.418 ppb	46.392 ppb	46.741 ppb	48.670 ppb
Concentration per Run 2	97.500 %	57.802 ppb	50.824 ppb	51.547 ppb	58.171 ppb	5,414.601 ppb	50.311 ppb	48.110 ppb	51.301 ppb
Concentration per Run 3	99.306 %	56.289 ppb	50.698 ppb	49.897 ppb	59.462 ppb	5,481.862 ppb	51.756 ppb	49.559 ppb	52.426 ppb
Concentration RSD	0.9 %	2.5 %	5.1 %	2.0 %	5.6 %	4.2 %	5.6 %	2.9 %	3.8 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	49.967 ppb	91.963 %	48.523 ppb	49.726 ppb	80.154 ppb	51.587 ppb	91.674 %	12.821 ppb	50.417 ppb
Concentration per Run 1	47.688 ppb	97.774 %	46.504 ppb	44.151 ppb	76.854 ppb	48.889 ppb	93.004 %	12.439 ppb	49.743 ppb
Concentration per Run 2	51.412 ppb	91.825 %	48.956 ppb	51.095 ppb	81.473 ppb	52.902 ppb	90.769 %	13.157 ppb	51.341 ppb
Concentration per Run 3	50.800 ppb	86.292 %	50.108 ppb	53.932 ppb	82.134 ppb	52.969 ppb	91.251 %	12.868 ppb	50.167 ppb
Concentration RSD	4.0 %	6.2 %	3.8 %	10.1 %	3.6 %	4.5 %	1.3 %	2.8 %	1.6 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	90.277 %	50.516 ppb	54.947 ppb	53.437 ppb	94.179 %	92.978 %	49.706 ppb	51.102 ppb	96.474 %
Concentration per Run 1	89.674 %	49.349 ppb	53.521 ppb	51.681 ppb	95.882 %	94.949 %	48.203 ppb	49.739 ppb	99.300 %
Concentration per Run 2	88.980 %	51.559 ppb	56.217 ppb	54.810 ppb	92.164 %	91.815 %	50.381 ppb	51.691 ppb	95.486 %
Concentration per Run 3	92.177 %	50.641 ppb	55.102 ppb	53.821 ppb	94.492 %	92.169 %	50.535 ppb	51.877 ppb	94.634 %
Concentration RSD	1.9 %	2.2 %	2.5 %	3.0 %	2.0 %	1.8 %	2.6 %	2.3 %	2.6 %

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Analysis index: 38 Analysis started at: 6/7/2017 10:17:44 AM Rack: 1
 Analysis label: WG1008707-4 A2-6020T User name: ALPHALAB\metals-instrument Vial: 14

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	86.637 %	85.248 %	0.021 ppb	346,224.976 ppb	15,646.731 ppb	205.005 ppb	6,161.335 ppb	41,450.518 ppb	83.205 %
Concentration per Run 1	87.093 %	84.910 %	0.037 ppb	348,247.728 ppb	15,577.346 ppb	208.958 ppb	6,297.661 ppb	40,111.461 ppb	88.389 %
Concentration per Run 2	86.970 %	89.981 %	0.003 ppb	343,808.607 ppb	15,786.963 ppb	211.388 ppb	6,178.628 ppb	42,721.378 ppb	86.865 %
Concentration per Run 3	85.849 %	80.854 %	0.023 ppb	346,618.593 ppb	15,575.882 ppb	194.668 ppb	6,007.716 ppb	41,518.715 ppb	74.363 %
Concentration RSD	0.8 %	5.4 %	81.9 %	0.6 %	0.8 %	4.4 %	2.4 %	3.2 %	9.2 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	89.118 %	57.868 ppb	0.832 ppb	1.113 ppb	65.929 ppb	4,099.365 ppb	0.488 ppb	1.281 ppb	4.257 ppb
Concentration per Run 1	89.852 %	53.302 ppb	0.669 ppb	1.148 ppb	61.693 ppb	3,862.691 ppb	0.385 ppb	1.263 ppb	3.753 ppb
Concentration per Run 2	90.161 %	60.682 ppb	0.678 ppb	0.909 ppb	70.140 ppb	4,142.409 ppb	0.557 ppb	1.538 ppb	4.458 ppb
Concentration per Run 3	87.342 %	59.622 ppb	1.148 ppb	1.283 ppb	65.955 ppb	4,292.996 ppb	0.520 ppb	1.040 ppb	4.561 ppb
Concentration RSD	1.7 %	6.9 %	32.9 %	17.0 %	6.4 %	5.3 %	18.5 %	19.5 %	10.3 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	3.910 ppb	82.971 %	0.532 ppb	0.898 ppb	266.809 ppb	1.303 ppb	83.436 %	0.060 ppb	0.026 ppb
Concentration per Run 1	3.521 ppb	86.426 %	0.446 ppb	0.475 ppb	263.535 ppb	1.065 ppb	87.227 %	0.044 ppb	0.018 ppb
Concentration per Run 2	3.945 ppb	87.100 %	0.494 ppb	1.654 ppb	278.330 ppb	1.498 ppb	83.359 %	0.068 ppb	0.025 ppb
Concentration per Run 3	4.264 ppb	75.388 %	0.656 ppb	0.563 ppb	258.561 ppb	1.345 ppb	79.722 %	0.068 ppb	0.034 ppb
Concentration RSD	9.5 %	7.9 %	20.7 %	73.2 %	3.9 %	16.8 %	4.5 %	22.6 %	32.1 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	80.135 %	1.665 ppb	2.998 ppb	35.515 ppb	86.882 %	83.834 %	0.040 ppb	1.318 ppb	95.807 %
Concentration per Run 1	86.090 %	1.701 ppb	2.655 ppb	34.092 ppb	91.430 %	88.686 %	0.034 ppb	1.208 ppb	100.399 %
Concentration per Run 2	81.719 %	1.705 ppb	2.975 ppb	36.405 ppb	87.403 %	84.951 %	0.042 ppb	1.344 ppb	97.291 %
Concentration per Run 3	72.596 %	1.589 ppb	3.363 ppb	36.047 ppb	81.814 %	77.864 %	0.044 ppb	1.401 ppb	89.730 %
Concentration RSD	8.6 %	3.9 %	11.8 %	3.5 %	5.6 %	6.6 %	12.5 %	7.5 %	5.7 %

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Analysis index: 39 Analysis started at: 6/7/2017 10:21:05 AM Rack: 1
 Analysis label: L1715898-01 A2-6020T User name: ALPHALAB\metals-instrument Vial: 15

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	88.436 %	84.449 %	0.020 ppb	349,329.367 ppb	15,815.845 ppb	210.348 ppb	6,227.768 ppb	41,178.484 ppb	82.470 %
Concentration per Run 1	89.475 %	90.903 %	0.029 ppb	336,890.411 ppb	14,947.990 ppb	198.139 ppb	6,041.542 ppb	38,572.528 ppb	90.070 %
Concentration per Run 2	87.108 %	72.556 %	0.014 ppb	370,670.243 ppb	16,752.778 ppb	216.754 ppb	6,331.263 ppb	42,318.490 ppb	72.471 %
Concentration per Run 3	88.724 %	89.889 %	0.018 ppb	340,427.449 ppb	15,746.767 ppb	216.152 ppb	6,310.499 ppb	42,644.433 ppb	84.869 %
Concentration RSD	1.4 %	12.2 %	36.6 %	5.3 %	5.7 %	5.0 %	2.6 %	5.5 %	11.0 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	90.606 %	61.512 ppb	0.716 ppb	1.101 ppb	67.507 ppb	4,168.637 ppb	0.460 ppb	1.320 ppb	4.841 ppb
Concentration per Run 1	90.815 %	57.779 ppb	0.622 ppb	0.956 ppb	63.988 ppb	3,748.596 ppb	0.464 ppb	0.983 ppb	4.540 ppb
Concentration per Run 2	89.839 %	65.831 ppb	0.634 ppb	1.346 ppb	69.002 ppb	4,490.946 ppb	0.542 ppb	1.528 ppb	5.177 ppb
Concentration per Run 3	91.165 %	60.926 ppb	0.891 ppb	1.000 ppb	69.530 ppb	4,266.369 ppb	0.373 ppb	1.450 ppb	4.805 ppb
Concentration RSD	0.8 %	6.6 %	21.3 %	19.4 %	4.5 %	9.1 %	18.4 %	22.3 %	6.6 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	4.159 ppb	80.708 %	0.487 ppb	0.112 ppb	273.612 ppb	0.723 ppb	83.729 %	0.046 ppb	0.033 ppb
Concentration per Run 1	3.397 ppb	86.634 %	0.471 ppb	-0.301 ppb	271.010 ppb	0.811 ppb	86.514 %	0.054 ppb	0.018 ppb
Concentration per Run 2	4.422 ppb	71.189 %	0.480 ppb	0.578 ppb	268.236 ppb	0.714 ppb	80.758 %	0.043 ppb	0.048 ppb
Concentration per Run 3	4.657 ppb	84.301 %	0.510 ppb	0.060 ppb	281.590 ppb	0.645 ppb	83.915 %	0.040 ppb	0.032 ppb
Concentration RSD	16.1 %	10.3 %	4.2 %	394.1 %	2.6 %	11.6 %	3.4 %	16.6 %	45.2 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	78.220 %	0.876 ppb	1.463 ppb	35.598 ppb	86.822 %	84.454 %	0.018 ppb	1.332 ppb	90.901 %
Concentration per Run 1	82.594 %	0.860 ppb	1.393 ppb	35.447 ppb	89.736 %	87.665 %	0.018 ppb	1.292 ppb	93.557 %
Concentration per Run 2	72.453 %	0.796 ppb	1.659 ppb	35.064 ppb	83.911 %	80.221 %	0.016 ppb	1.370 ppb	87.850 %
Concentration per Run 3	79.615 %	0.971 ppb	1.337 ppb	36.283 ppb	86.820 %	85.476 %	0.022 ppb	1.333 ppb	91.297 %
Concentration RSD	6.7 %	10.2 %	11.7 %	1.8 %	3.4 %	4.5 %	15.7 %	2.9 %	3.2 %

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Analysis index: 40 Analysis started at: 6/7/2017 10:24:25 AM Rack: 1
 Analysis label: L1717026-28 A2-6020T User name: ALPHALAB\metals-instrument Vial: 16

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	97.121 %	98.187 %	0.005 ppb	78.692 ppb	2.821 ppb	4.615 ppb	22.382 ppb	6.042 ppb	100.193 %
Concentration per Run 1	97.567 %	96.251 %	0.001 ppb	83.732 ppb	1.035 ppb	4.169 ppb	18.555 ppb	7.047 ppb	91.698 %
Concentration per Run 2	96.716 %	97.265 %	0.002 ppb	80.585 ppb	2.346 ppb	4.364 ppb	14.190 ppb	5.493 ppb	104.940 %
Concentration per Run 3	97.081 %	101.045 %	0.012 ppb	71.759 ppb	5.082 ppb	5.312 ppb	34.401 ppb	5.586 ppb	103.940 %
Concentration RSD	0.4 %	2.6 %	120.7 %	7.9 %	73.2 %	13.2 %	47.5 %	14.4 %	7.4 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	96.602 %	0.166 ppb	0.033 ppb	0.102 ppb	0.013 ppb	2.947 ppb	0.004 ppb	0.144 ppb	1.480 ppb
Concentration per Run 1	96.896 %	0.143 ppb	-0.010 ppb	0.085 ppb	-0.025 ppb	3.201 ppb	0.000 ppb	0.217 ppb	1.528 ppb
Concentration per Run 2	95.765 %	0.015 ppb	0.055 ppb	0.142 ppb	0.013 ppb	2.834 ppb	0.011 ppb	0.188 ppb	1.535 ppb
Concentration per Run 3	97.144 %	0.339 ppb	0.055 ppb	0.077 ppb	0.051 ppb	2.807 ppb	0.000 ppb	0.027 ppb	1.376 ppb
Concentration RSD	0.8 %	98.2 %	113.9 %	34.8 %	289.8 %	7.5 %	173.2 %	71.3 %	6.1 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	0.659 ppb	92.923 %	0.047 ppb	0.330 ppb	0.342 ppb	0.274 ppb	94.480 %	0.033 ppb	0.002 ppb
Concentration per Run 1	0.573 ppb	91.558 %	0.017 ppb	0.747 ppb	0.274 ppb	0.180 ppb	96.441 %	0.018 ppb	0.006 ppb
Concentration per Run 2	0.694 ppb	92.103 %	0.017 ppb	0.437 ppb	0.385 ppb	0.358 ppb	93.071 %	0.032 ppb	0.000 ppb
Concentration per Run 3	0.709 ppb	95.109 %	0.108 ppb	-0.193 ppb	0.369 ppb	0.284 ppb	93.927 %	0.048 ppb	0.000 ppb
Concentration RSD	11.3 %	2.1 %	110.9 %	144.9 %	17.4 %	32.5 %	1.9 %	46.4 %	173.2 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	94.677 %	0.608 ppb	0.761 ppb	0.923 ppb	95.404 %	94.263 %	0.005 ppb	0.053 ppb	103.245 %
Concentration per Run 1	91.775 %	0.569 ppb	0.655 ppb	0.886 ppb	95.250 %	93.782 %	0.002 ppb	0.054 ppb	105.477 %
Concentration per Run 2	96.115 %	0.654 ppb	0.816 ppb	1.058 ppb	95.981 %	94.433 %	0.006 ppb	0.055 ppb	102.549 %
Concentration per Run 3	96.141 %	0.601 ppb	0.810 ppb	0.825 ppb	94.980 %	94.575 %	0.008 ppb	0.049 ppb	101.709 %
Concentration RSD	2.7 %	7.0 %	12.0 %	13.1 %	0.5 %	0.4 %	61.8 %	5.7 %	1.9 %

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Analysis index: 41 Analysis started at: 6/7/2017 10:27:46 AM Rack: 0
 Analysis label: CCV User name: ALPHALAB\metals-instrument Vial: 9

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	97.684 %	95.390 %	100.473 ppb	10,554.577 ppb	10,622.716 ppb	107.434 ppb	10,598.092 ppb	10,681.868 ppb	103.888 %
Concentration per Run 1	97.272 %	95.974 %	100.970 ppb	10,197.073 ppb	10,361.724 ppb	98.630 ppb	10,005.112 ppb	10,119.816 ppb	105.885 %
Concentration per Run 2	98.383 %	99.662 %	100.258 ppb	10,608.355 ppb	10,631.922 ppb	120.603 ppb	10,926.722 ppb	11,101.079 ppb	111.980 %
Concentration per Run 3	97.397 %	90.534 %	100.192 ppb	10,858.302 ppb	10,874.503 ppb	103.067 ppb	10,862.440 ppb	10,824.709 ppb	93.800 %
Recovery Percentage 1			100.473 %	105.546 %	106.227 %	107.434 %	105.981 %	106.819 %	
Concentration RSD	0.6 %	4.8 %	0.4 %	3.2 %	2.4 %	10.8 %	4.9 %	4.7 %	8.9 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	97.174 %	102.614 ppb	96.293 ppb	98.065 ppb	102.283 ppb	9,815.173 ppb	94.605 ppb	94.168 ppb	93.830 ppb
Concentration per Run 1	97.011 %	97.236 ppb	94.849 ppb	95.630 ppb	98.618 ppb	9,356.389 ppb	91.563 ppb	91.602 ppb	91.946 ppb
Concentration per Run 2	97.501 %	99.424 ppb	90.564 ppb	94.311 ppb	99.351 ppb	9,577.979 ppb	89.613 ppb	88.092 ppb	90.355 ppb
Concentration per Run 3	97.012 %	111.183 ppb	103.466 ppb	104.254 ppb	108.880 ppb	10,511.153 ppb	102.639 ppb	102.809 ppb	99.189 ppb
Recovery Percentage 1		102.614 %	96.293 %	98.065 %	102.283 %	98.152 %	94.605 %	94.168 %	93.830 %
Concentration RSD	0.3 %	7.3 %	6.8 %	5.5 %	5.6 %	6.2 %	7.4 %	8.2 %	5.0 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	97.292 ppb	98.555 %	97.618 ppb	108.201 ppb	106.406 ppb	102.792 ppb	95.915 %	98.065 ppb	99.202 ppb
Concentration per Run 1	93.722 ppb	98.543 %	97.410 ppb	108.667 ppb	105.801 ppb	100.851 ppb	97.624 %	96.294 ppb	94.724 ppb
Concentration per Run 2	95.618 ppb	104.374 %	98.698 ppb	107.515 ppb	108.298 ppb	102.710 ppb	97.295 %	96.845 ppb	99.661 ppb
Concentration per Run 3	102.537 ppb	92.748 %	96.747 ppb	108.420 ppb	105.120 ppb	104.814 ppb	92.827 %	101.058 ppb	103.221 ppb
Recovery Percentage 1	97.292 %		97.618 %	108.201 %	106.406 %	102.792 %		98.065 %	99.202 %
Concentration RSD	4.8 %	5.9 %	1.0 %	0.6 %	1.6 %	1.9 %	2.8 %	2.7 %	4.3 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	96.927 %	100.245 ppb	106.441 ppb	102.273 ppb	96.531 %	95.817 %	100.283 ppb	103.643 ppb	98.531 %
Concentration per Run 1	100.270 %	96.687 ppb	101.957 ppb	100.159 ppb	98.646 %	98.345 %	98.756 ppb	101.699 ppb	100.140 %
Concentration per Run 2	99.102 %	102.466 ppb	108.679 ppb	102.842 ppb	97.452 %	97.884 %	99.731 ppb	104.264 ppb	98.735 %
Concentration per Run 3	91.409 %	101.581 ppb	108.689 ppb	103.817 ppb	93.496 %	91.223 %	102.362 ppb	104.965 ppb	96.719 %
Recovery Percentage 1		100.245 %	106.441 %	102.273 %			100.283 %	103.643 %	
Concentration RSD	5.0 %	3.1 %	3.6 %	1.9 %	2.8 %	4.2 %	1.9 %	1.7 %	1.7 %

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Analysis index: 42 Analysis started at: 6/7/2017 10:31:11 AM Rack: 0
 Analysis label: CCB User name: ALPHALAB\metals-instrument Vial: 10

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	93.781 %	94.407 %	0.008 ppb	21.876 ppb	0.744 ppb	0.021 ppb	5.045 ppb	3.724 ppb	100.210 %
Concentration per Run 1	97.298 %	95.882 %	0.015 ppb	25.725 ppb	1.737 ppb	-0.126 ppb	6.593 ppb	7.309 ppb	97.057 %
Concentration per Run 2	92.150 %	92.194 %	0.006 ppb	18.700 ppb	0.971 ppb	-0.450 ppb	-8.066 ppb	0.069 ppb	105.464 %
Concentration per Run 3	91.896 %	95.144 %	0.002 ppb	21.204 ppb	-0.477 ppb	0.639 ppb	16.609 ppb	3.793 ppb	98.108 %
Recovery Percentage 1			1.561 %	21.876 %	1.062 %	0.210 %	5.045 %	3.724 %	
Concentration RSD	3.3 %	2.1 %	85.4 %	16.3 %	151.1 %	2,663.5 %	246.0 %	97.2 %	4.6 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	89.518 %	-0.038 ppb	0.001 ppb	0.012 ppb	0.068 ppb	1.834 ppb	0.007 ppb	0.049 ppb	-0.008 ppb
Concentration per Run 1	92.947 %	-0.038 ppb	0.024 ppb	0.019 ppb	0.214 ppb	5.609 ppb	0.011 ppb	0.035 ppb	-0.034 ppb
Concentration per Run 2	86.481 %	-0.038 ppb	-0.010 ppb	0.010 ppb	-0.025 ppb	-1.373 ppb	0.000 ppb	-0.131 ppb	0.044 ppb
Concentration per Run 3	89.126 %	-0.038 ppb	-0.010 ppb	0.007 ppb	0.015 ppb	1.265 ppb	0.011 ppb	0.244 ppb	-0.034 ppb
Recovery Percentage 1		-7.647 %	0.022 %	1.208 %	6.810 %	3.668 %	1.472 %	2.473 %	-0.774 %
Concentration RSD	3.6 %	0.0 %	1,839.1 %	48.9 %	188.0 %	192.3 %	86.6 %	380.5 %	576.4 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	-0.140 ppb	94.098 %	0.039 ppb	0.364 ppb	-0.003 ppb	0.503 ppb	96.864 %	0.242 ppb	0.007 ppb
Concentration per Run 1	-0.172 ppb	94.642 %	0.039 ppb	0.201 ppb	0.015 ppb	0.356 ppb	99.010 %	0.204 ppb	0.000 ppb
Concentration per Run 2	-0.007 ppb	96.275 %	0.061 ppb	0.806 ppb	-0.012 ppb	0.611 ppb	96.529 %	0.258 ppb	0.005 ppb
Concentration per Run 3	-0.241 ppb	91.376 %	0.017 ppb	0.085 ppb	-0.011 ppb	0.541 ppb	95.053 %	0.263 ppb	0.017 ppb
Recovery Percentage 1	-1.402 %	94.098 %	7.831 %	7.278 %	-0.537 %	25.128 %		60.408 %	3.686 %
Concentration RSD	86.0 %	2.7 %	56.2 %	106.4 %	565.4 %	26.2 %	2.1 %	13.4 %	115.3 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	92.862 %	0.801 ppb	2.729 ppb	0.034 ppb	96.005 %	93.277 %	0.024 ppb	0.051 ppb	93.560 %
Concentration per Run 1	93.309 %	0.799 ppb	2.837 ppb	0.094 ppb	98.213 %	95.284 %	0.025 ppb	0.062 ppb	91.225 %
Concentration per Run 2	93.673 %	0.798 ppb	2.887 ppb	0.011 ppb	94.129 %	91.485 %	0.022 ppb	0.046 ppb	95.002 %
Concentration per Run 3	91.606 %	0.806 ppb	2.463 ppb	-0.004 ppb	95.672 %	93.063 %	0.025 ppb	0.046 ppb	94.454 %
Recovery Percentage 1		26.691 %	68.226 %	6.727 %			4.724 %	10.262 %	93.560 %
Concentration RSD	1.2 %	0.5 %	8.5 %	157.1 %	2.1 %	2.0 %	7.0 %	17.8 %	2.2 %

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Analysis index: 43 Analysis started at: 6/7/2017 10:34:37 AM Rack: 1
 Analysis label: WG1010556-1 2008TL User name: ALPHALAB\metals-instrument Vial: 28

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	91.154 %	86.908 %	0.008 ppb	51.517 ppb	0.653 ppb	4.653 ppb	3.512 ppb	34.360 ppb	84.309 %
Concentration per Run 1	90.853 %	92.194 %	0.017 ppb	36.223 ppb	0.295 ppb	3.613 ppb	-0.986 ppb	26.256 ppb	92.329 %
Concentration per Run 2	91.938 %	83.527 %	0.002 ppb	62.118 ppb	0.361 ppb	5.393 ppb	20.265 ppb	48.049 ppb	86.602 %
Concentration per Run 3	90.672 %	85.003 %	0.006 ppb	56.208 ppb	1.304 ppb	4.953 ppb	-8.744 ppb	28.774 ppb	73.995 %
Concentration RSD	0.8 %	5.3 %	90.3 %	26.3 %	86.4 %	19.9 %	427.7 %	34.7 %	11.1 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	90.105 %	0.152 ppb	-0.010 ppb	-0.014 ppb	0.024 ppb	-0.049 ppb	0.000 ppb	-0.068 ppb	0.132 ppb
Concentration per Run 1	90.561 %	0.265 ppb	-0.010 ppb	-0.022 ppb	-0.025 ppb	0.516 ppb	0.000 ppb	-0.076 ppb	0.055 ppb
Concentration per Run 2	90.681 %	0.154 ppb	-0.010 ppb	-0.018 ppb	0.019 ppb	-0.412 ppb	0.000 ppb	-0.075 ppb	0.170 ppb
Concentration per Run 3	89.074 %	0.037 ppb	-0.010 ppb	-0.003 ppb	0.078 ppb	-0.250 ppb	0.000 ppb	-0.052 ppb	0.170 ppb
Concentration RSD	1.0 %	75.3 %	0.0 %	67.5 %	214.9 %	1,017.3 %		19.4 %	50.4 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	0.253 ppb	82.494 %	0.010 ppb	0.762 ppb	0.068 ppb	0.236 ppb	85.758 %	0.022 ppb	0.004 ppb
Concentration per Run 1	0.140 ppb	83.673 %	0.019 ppb	0.648 ppb	0.067 ppb	0.158 ppb	90.134 %	0.013 ppb	0.006 ppb
Concentration per Run 2	0.208 ppb	88.163 %	0.018 ppb	0.524 ppb	0.059 ppb	0.271 ppb	86.669 %	0.011 ppb	0.000 ppb
Concentration per Run 3	0.410 ppb	75.646 %	-0.007 ppb	1.114 ppb	0.080 ppb	0.279 ppb	80.472 %	0.040 ppb	0.007 ppb
Concentration RSD	55.7 %	7.7 %	143.4 %	40.8 %	15.5 %	28.6 %	5.7 %	75.3 %	87.2 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	81.706 %	0.663 ppb	1.304 ppb	0.216 ppb	85.756 %	82.911 %	0.008 ppb	0.044 ppb	97.518 %
Concentration per Run 1	84.755 %	0.694 ppb	1.332 ppb	0.229 ppb	89.399 %	86.102 %	0.005 ppb	0.037 ppb	103.728 %
Concentration per Run 2	87.139 %	0.652 ppb	1.342 ppb	0.228 ppb	87.257 %	86.608 %	0.011 ppb	0.045 ppb	97.209 %
Concentration per Run 3	73.223 %	0.642 ppb	1.237 ppb	0.191 ppb	80.611 %	76.023 %	0.009 ppb	0.051 ppb	91.617 %
Concentration RSD	9.1 %	4.1 %	4.4 %	9.9 %	5.3 %	7.2 %	37.1 %	15.7 %	6.2 %

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Analysis index: 44 Analysis started at: 6/7/2017 10:37:58 AM Rack: 1
Analysis label: WG1010556-2D5 2008TL User name: ALPHALAB\metals-instrument Vial: 29

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	98.583 %	94.683 %	10.202 ppb	2,129.847 ppb	2,166.611 ppb	441.683 ppb	2,058.214 ppb	2,246.314 ppb	90.736 %
Concentration per Run 1	98.678 %	99.109 %	10.035 ppb	2,091.607 ppb	2,265.184 ppb	434.104 ppb	1,982.013 ppb	2,187.313 ppb	97.583 %
Concentration per Run 2	99.158 %	88.506 %	10.235 ppb	2,124.152 ppb	2,103.289 ppb	432.108 ppb	1,964.492 ppb	2,172.549 ppb	80.613 %
Concentration per Run 3	97.913 %	96.435 %	10.335 ppb	2,173.782 ppb	2,131.358 ppb	458.838 ppb	2,228.136 ppb	2,379.079 ppb	94.010 %
Concentration RSD	0.6 %	5.8 %	1.5 %	1.9 %	4.0 %	3.4 %	7.2 %	5.1 %	9.9 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	95.931 %	189.525 ppb	104.823 ppb	42.492 ppb	104.534 ppb	228.848 ppb	103.346 ppb	105.152 ppb	52.655 ppb
Concentration per Run 1	94.606 %	179.999 ppb	103.251 ppb	41.423 ppb	100.239 ppb	219.655 ppb	96.685 ppb	100.317 ppb	49.049 ppb
Concentration per Run 2	96.833 %	195.800 ppb	106.393 ppb	44.926 ppb	105.264 ppb	242.250 ppb	108.116 ppb	108.599 ppb	57.264 ppb
Concentration per Run 3	96.354 %	192.777 ppb	104.825 ppb	41.126 ppb	108.100 ppb	224.639 ppb	105.237 ppb	106.540 ppb	51.653 ppb
Concentration RSD	1.2 %	4.4 %	1.5 %	5.0 %	3.8 %	5.2 %	5.8 %	4.1 %	8.0 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	104.619 ppb	89.137 %	25.350 ppb	22.923 ppb	206.127 ppb	198.345 ppb	91.532 %	10.260 ppb	10.848 ppb
Concentration per Run 1	100.863 ppb	93.686 %	25.048 ppb	23.935 ppb	206.803 ppb	192.061 ppb	94.676 %	9.955 ppb	10.463 ppb
Concentration per Run 2	108.328 ppb	84.575 %	23.880 ppb	18.107 ppb	195.123 ppb	202.637 ppb	89.037 %	10.535 ppb	10.974 ppb
Concentration per Run 3	104.665 ppb	89.149 %	27.121 ppb	26.728 ppb	216.456 ppb	200.337 ppb	90.883 %	10.291 ppb	11.108 ppb
Concentration RSD	3.6 %	5.1 %	6.5 %	19.2 %	5.2 %	2.8 %	3.1 %	2.8 %	3.1 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	87.933 %	197.443 ppb	99.710 ppb	411.201 ppb	91.035 %	88.270 %	25.587 ppb	114.569 ppb	95.485 %
Concentration per Run 1	93.003 %	191.868 ppb	95.674 ppb	408.128 ppb	94.788 %	93.429 %	25.313 ppb	110.069 ppb	97.582 %
Concentration per Run 2	80.762 %	202.870 ppb	100.490 ppb	401.664 ppb	87.758 %	81.593 %	26.302 ppb	116.565 ppb	92.698 %
Concentration per Run 3	90.033 %	197.590 ppb	102.967 ppb	423.812 ppb	90.560 %	89.786 %	25.148 ppb	117.073 ppb	96.176 %
Concentration RSD	7.3 %	2.8 %	3.7 %	2.8 %	3.9 %	6.9 %	2.4 %	3.4 %	2.6 %

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Analysis index: 45 Analysis started at: 6/7/2017 10:41:19 AM Rack: 1
 Analysis label: WG1010556-3D10 2008TL User name: ALPHALAB\metals-instrument Vial: 30

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	92.256 %	89.090 %	5.138 ppb	6,245.076 ppb	1,725.765 ppb	287.069 ppb	1,332.388 ppb	4,286.028 ppb	82.715 %
Concentration per Run 1	92.896 %	81.683 %	4.875 ppb	6,264.022 ppb	1,752.827 ppb	281.174 ppb	1,335.213 ppb	4,225.124 ppb	73.627 %
Concentration per Run 2	92.882 %	92.563 %	5.173 ppb	6,164.623 ppb	1,677.512 ppb	298.775 ppb	1,428.593 ppb	4,253.944 ppb	88.021 %
Concentration per Run 3	90.990 %	93.024 %	5.364 ppb	6,306.582 ppb	1,746.955 ppb	281.259 ppb	1,233.357 ppb	4,379.017 ppb	86.497 %
Concentration RSD	1.2 %	7.2 %	4.8 %	1.2 %	2.4 %	3.5 %	7.3 %	1.9 %	9.6 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	89.315 %	97.682 ppb	49.373 ppb	20.189 ppb	190.883 ppb	410.371 ppb	48.820 ppb	49.381 ppb	25.920 ppb
Concentration per Run 1	90.403 %	97.026 ppb	50.024 ppb	21.109 ppb	188.694 ppb	445.450 ppb	51.407 ppb	51.064 ppb	28.472 ppb
Concentration per Run 2	89.598 %	95.383 ppb	48.318 ppb	19.209 ppb	187.979 ppb	417.820 ppb	47.518 ppb	45.993 ppb	24.323 ppb
Concentration per Run 3	87.944 %	100.638 ppb	49.777 ppb	20.249 ppb	195.976 ppb	367.844 ppb	47.534 ppb	51.087 ppb	24.965 ppb
Concentration RSD	1.4 %	2.8 %	1.9 %	4.7 %	2.3 %	9.6 %	4.6 %	5.9 %	8.6 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	49.134 ppb	84.412 %	12.432 ppb	12.633 ppb	107.354 ppb	94.640 ppb	86.006 %	4.847 ppb	5.394 ppb
Concentration per Run 1	49.174 ppb	77.097 %	12.684 ppb	11.444 ppb	99.896 ppb	94.538 ppb	84.047 %	4.985 ppb	5.610 ppb
Concentration per Run 2	50.032 ppb	88.481 %	11.950 ppb	12.671 ppb	109.423 ppb	95.719 ppb	87.612 %	4.715 ppb	5.192 ppb
Concentration per Run 3	48.196 ppb	87.658 %	12.661 ppb	13.785 ppb	112.743 ppb	93.661 ppb	86.360 %	4.842 ppb	5.380 ppb
Concentration RSD	1.9 %	7.5 %	3.4 %	9.3 %	6.2 %	1.1 %	2.1 %	2.8 %	3.9 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	83.635 %	91.281 ppb	57.876 ppb	197.210 ppb	87.496 %	84.539 %	12.195 ppb	55.577 ppb	90.890 %
Concentration per Run 1	75.135 %	92.446 ppb	57.771 ppb	191.932 ppb	85.919 %	80.006 %	12.478 ppb	56.087 ppb	87.984 %
Concentration per Run 2	89.320 %	89.221 ppb	56.447 ppb	196.095 ppb	88.740 %	87.490 %	11.894 ppb	55.303 ppb	92.477 %
Concentration per Run 3	86.450 %	92.176 ppb	59.411 ppb	203.603 ppb	87.830 %	86.120 %	12.212 ppb	55.341 ppb	92.208 %
Concentration RSD	9.0 %	2.0 %	2.6 %	3.0 %	1.6 %	4.7 %	2.4 %	0.8 %	2.8 %

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Analysis index: 46 Analysis started at: 6/7/2017 10:44:40 AM Rack: 1
 Analysis label: WG1010556-4 2008TL User name: ALPHALAB\metals-instrument Vial: 31

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	84.925 %	84.818 %	0.069 ppb	52,880.388 ppb	7,759.957 ppb	637.262 ppb	2,541.298 ppb	32,963.677 ppb	83.153 %
Concentration per Run 1	85.655 %	86.478 %	0.069 ppb	51,255.449 ppb	7,323.223 ppb	594.686 ppb	2,551.106 ppb	31,327.498 ppb	84.869 %
Concentration per Run 2	84.433 %	89.428 %	0.071 ppb	51,798.548 ppb	7,615.265 ppb	621.758 ppb	2,437.902 ppb	33,016.974 ppb	85.026 %
Concentration per Run 3	84.686 %	78.549 %	0.066 ppb	55,587.168 ppb	8,341.382 ppb	695.340 ppb	2,634.885 ppb	34,546.560 ppb	79.563 %
Concentration RSD	0.8 %	6.6 %	3.2 %	4.5 %	6.8 %	8.2 %	3.9 %	4.9 %	3.7 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	84.509 %	70.554 ppb	2.266 ppb	2.604 ppb	1,440.868 ppb	3,098.265 ppb	0.881 ppb	2.057 ppb	7.495 ppb
Concentration per Run 1	85.413 %	67.719 ppb	2.606 ppb	2.638 ppb	1,391.890 ppb	3,058.571 ppb	1.163 ppb	2.066 ppb	7.095 ppb
Concentration per Run 2	82.857 %	72.672 ppb	2.041 ppb	2.399 ppb	1,440.778 ppb	3,105.778 ppb	0.734 ppb	2.184 ppb	8.121 ppb
Concentration per Run 3	85.259 %	71.270 ppb	2.151 ppb	2.776 ppb	1,489.937 ppb	3,130.447 ppb	0.746 ppb	1.921 ppb	7.268 ppb
Concentration RSD	1.7 %	3.6 %	13.2 %	7.3 %	3.4 %	1.2 %	27.7 %	6.4 %	7.3 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	17.795 ppb	80.792 %	2.913 ppb	0.731 ppb	105.599 ppb	2.290 ppb	79.775 %	0.104 ppb	0.080 ppb
Concentration per Run 1	16.805 ppb	79.766 %	2.937 ppb	0.599 ppb	104.291 ppb	2.163 ppb	82.126 %	0.105 ppb	0.094 ppb
Concentration per Run 2	17.998 ppb	81.211 %	2.971 ppb	1.094 ppb	106.601 ppb	2.203 ppb	78.546 %	0.106 ppb	0.053 ppb
Concentration per Run 3	18.581 ppb	81.399 %	2.830 ppb	0.499 ppb	105.905 ppb	2.503 ppb	78.653 %	0.101 ppb	0.092 ppb
Concentration RSD	5.1 %	1.1 %	2.5 %	43.6 %	1.1 %	8.1 %	2.6 %	2.6 %	29.4 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	79.507 %	2.264 ppb	2.801 ppb	86.659 ppb	82.993 %	82.271 %	0.019 ppb	8.613 ppb	92.513 %
Concentration per Run 1	82.152 %	2.177 ppb	2.462 ppb	84.331 ppb	84.771 %	83.395 %	0.016 ppb	8.231 ppb	96.520 %
Concentration per Run 2	78.212 %	2.405 ppb	2.915 ppb	88.060 ppb	81.827 %	82.333 %	0.022 ppb	8.686 ppb	91.856 %
Concentration per Run 3	78.156 %	2.209 ppb	3.025 ppb	87.586 ppb	82.380 %	81.085 %	0.019 ppb	8.923 ppb	89.162 %
Concentration RSD	2.9 %	5.4 %	10.7 %	2.3 %	1.9 %	1.4 %	16.2 %	4.1 %	4.0 %

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Analysis index: 47 Analysis started at: 6/7/2017 10:48:02 AM Rack: 1
 Analysis label: L1718724-02 2008TL User name: ALPHALAB\metals-instrument Vial: 32

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	83.205 %	81.991 %	0.060 ppb	53,098.103 ppb	7,797.143 ppb	629.803 ppb	2,590.905 ppb	33,089.635 ppb	84.483 %
Concentration per Run 1	83.489 %	80.761 %	0.075 ppb	53,541.637 ppb	7,830.548 ppb	637.924 ppb	2,538.639 ppb	32,573.838 ppb	83.450 %
Concentration per Run 2	83.772 %	83.343 %	0.051 ppb	53,576.865 ppb	7,873.300 ppb	637.201 ppb	2,584.803 ppb	34,390.037 ppb	83.870 %
Concentration per Run 3	82.354 %	81.868 %	0.052 ppb	52,175.808 ppb	7,687.582 ppb	614.283 ppb	2,649.271 ppb	32,305.031 ppb	86.130 %
Concentration RSD	0.9 %	1.6 %	22.8 %	1.5 %	1.2 %	2.1 %	2.1 %	3.4 %	1.7 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	82.261 %	65.445 ppb	2.788 ppb	2.635 ppb	1,428.281 ppb	3,088.205 ppb	0.817 ppb	1.796 ppb	7.070 ppb
Concentration per Run 1	82.774 %	63.689 ppb	2.672 ppb	2.435 ppb	1,434.279 ppb	3,104.026 ppb	0.677 ppb	1.732 ppb	6.763 ppb
Concentration per Run 2	82.984 %	68.734 ppb	3.320 ppb	2.992 ppb	1,440.831 ppb	3,134.549 ppb	0.906 ppb	2.095 ppb	7.536 ppb
Concentration per Run 3	81.024 %	63.912 ppb	2.371 ppb	2.478 ppb	1,409.732 ppb	3,026.040 ppb	0.867 ppb	1.562 ppb	6.911 ppb
Concentration RSD	1.3 %	4.4 %	17.4 %	11.8 %	1.1 %	1.8 %	15.0 %	15.1 %	5.8 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	18.238 ppb	80.422 %	3.413 ppb	0.197 ppb	106.265 ppb	1.662 ppb	80.295 %	0.085 ppb	0.106 ppb
Concentration per Run 1	17.611 ppb	81.269 %	3.287 ppb	0.769 ppb	103.530 ppb	1.420 ppb	81.104 %	0.105 ppb	0.109 ppb
Concentration per Run 2	18.630 ppb	78.729 %	3.556 ppb	0.399 ppb	109.250 ppb	1.835 ppb	80.905 %	0.077 ppb	0.110 ppb
Concentration per Run 3	18.474 ppb	81.269 %	3.397 ppb	-0.576 ppb	106.015 ppb	1.731 ppb	78.876 %	0.074 ppb	0.098 ppb
Concentration RSD	3.0 %	1.8 %	4.0 %	352.0 %	2.7 %	13.0 %	1.5 %	20.1 %	6.0 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	79.263 %	1.320 ppb	1.693 ppb	86.620 ppb	83.748 %	82.762 %	0.009 ppb	8.682 ppb	90.397 %
Concentration per Run 1	80.197 %	1.291 ppb	1.433 ppb	86.482 ppb	84.847 %	83.881 %	0.010 ppb	8.372 ppb	93.071 %
Concentration per Run 2	79.188 %	1.504 ppb	1.858 ppb	86.926 ppb	83.093 %	81.056 %	0.007 ppb	8.748 ppb	90.218 %
Concentration per Run 3	78.405 %	1.166 ppb	1.788 ppb	86.451 ppb	83.305 %	83.349 %	0.010 ppb	8.925 ppb	87.902 %
Concentration RSD	1.1 %	13.0 %	13.5 %	0.3 %	1.1 %	1.8 %	18.4 %	3.3 %	2.9 %

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Analysis index: 48 Analysis started at: 6/7/2017 10:51:24 AM Rack: 1
 Analysis label: L1718724-01 2008TL User name: ALPHALAB\metals-instrument Vial: 33

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	84.302 %	86.078 %	0.122 ppb	52,312.626 ppb	7,824.451 ppb	812.928 ppb	2,559.020 ppb	34,120.236 ppb	83.223 %
Concentration per Run 1	83.521 %	85.832 %	0.131 ppb	53,622.913 ppb	7,852.688 ppb	794.809 ppb	2,634.298 ppb	34,445.985 ppb	81.717 %
Concentration per Run 2	84.247 %	88.414 %	0.114 ppb	50,251.909 ppb	7,686.655 ppb	816.402 ppb	2,440.725 ppb	33,992.504 ppb	82.715 %
Concentration per Run 3	85.136 %	83.988 %	0.121 ppb	53,063.056 ppb	7,934.010 ppb	827.572 ppb	2,602.037 ppb	33,922.220 ppb	85.236 %
Concentration RSD	1.0 %	2.6 %	7.0 %	3.5 %	1.6 %	2.0 %	4.1 %	0.8 %	2.2 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	83.092 %	74.578 ppb	2.960 ppb	3.234 ppb	1,503.712 ppb	3,820.458 ppb	0.912 ppb	2.289 ppb	9.361 ppb
Concentration per Run 1	83.220 %	76.411 ppb	2.687 ppb	3.072 ppb	1,481.149 ppb	3,637.444 ppb	0.939 ppb	2.255 ppb	8.648 ppb
Concentration per Run 2	82.175 %	78.252 ppb	3.226 ppb	3.417 ppb	1,522.518 ppb	4,055.069 ppb	0.919 ppb	2.140 ppb	9.639 ppb
Concentration per Run 3	83.882 %	69.071 ppb	2.968 ppb	3.214 ppb	1,507.470 ppb	3,768.861 ppb	0.877 ppb	2.474 ppb	9.796 ppb
Concentration RSD	1.0 %	6.5 %	9.1 %	5.4 %	1.4 %	5.6 %	3.4 %	7.4 %	6.6 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	26.152 ppb	79.136 %	3.332 ppb	1.071 ppb	105.157 ppb	1.399 ppb	81.009 %	0.117 ppb	0.133 ppb
Concentration per Run 1	25.012 ppb	79.714 %	3.075 ppb	1.354 ppb	103.440 ppb	1.397 ppb	81.908 %	0.119 ppb	0.154 ppb
Concentration per Run 2	26.754 ppb	79.973 %	2.960 ppb	0.569 ppb	105.256 ppb	1.592 ppb	79.233 %	0.122 ppb	0.117 ppb
Concentration per Run 3	26.690 ppb	77.719 %	3.962 ppb	1.290 ppb	106.774 ppb	1.208 ppb	81.885 %	0.112 ppb	0.128 ppb
Concentration RSD	3.8 %	1.6 %	16.5 %	40.7 %	1.6 %	13.7 %	1.9 %	4.3 %	14.2 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	79.465 %	0.954 ppb	1.328 ppb	87.830 ppb	84.508 %	84.231 %	0.015 ppb	11.284 ppb	91.882 %
Concentration per Run 1	79.597 %	0.917 ppb	1.209 ppb	84.260 ppb	84.689 %	84.338 %	0.016 ppb	10.796 ppb	93.815 %
Concentration per Run 2	79.341 %	0.985 ppb	1.541 ppb	91.582 ppb	84.123 %	83.630 %	0.017 ppb	11.350 ppb	91.671 %
Concentration per Run 3	79.456 %	0.961 ppb	1.236 ppb	87.647 ppb	84.714 %	84.724 %	0.012 ppb	11.705 ppb	90.161 %
Concentration RSD	0.2 %	3.6 %	13.9 %	4.2 %	0.4 %	0.7 %	18.0 %	4.1 %	2.0 %

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Analysis index: 49 Analysis started at: 6/7/2017 10:54:46 AM Rack: 1
 Analysis label: L1718724-03 2008TL User name: ALPHALAB\metals-instrument Vial: 34

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	83.248 %	88.352 %	0.034 ppb	50,087.216 ppb	7,194.024 ppb	157.859 ppb	2,414.036 ppb	31,404.318 ppb	86.725 %
Concentration per Run 1	84.848 %	89.520 %	0.015 ppb	49,514.954 ppb	7,041.050 ppb	153.227 ppb	2,406.978 ppb	30,719.482 ppb	90.175 %
Concentration per Run 2	83.681 %	90.073 %	0.071 ppb	48,733.841 ppb	7,038.057 ppb	162.889 ppb	2,382.609 ppb	30,859.891 ppb	87.758 %
Concentration per Run 3	81.214 %	85.463 %	0.016 ppb	52,012.852 ppb	7,502.965 ppb	157.462 ppb	2,452.520 ppb	32,633.582 ppb	82.242 %
Concentration RSD	2.2 %	2.8 %	93.2 %	3.4 %	3.7 %	3.1 %	1.5 %	3.4 %	4.7 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	81.623 %	68.099 ppb	0.970 ppb	0.761 ppb	1,370.459 ppb	1,729.031 ppb	0.451 ppb	1.023 ppb	3.067 ppb
Concentration per Run 1	82.952 %	43.647 ppb	1.031 ppb	0.784 ppb	1,312.829 ppb	1,681.944 ppb	0.525 ppb	1.031 ppb	2.921 ppb
Concentration per Run 2	82.471 %	43.558 ppb	0.917 ppb	0.717 ppb	1,396.758 ppb	1,761.840 ppb	0.353 ppb	1.007 ppb	3.212 ppb
Concentration per Run 3	79.444 %	117.091 ppb	0.962 ppb	0.781 ppb	1,401.790 ppb	1,743.310 ppb	0.476 ppb	1.031 ppb	3.067 ppb
Concentration RSD	2.3 %	62.3 %	5.9 %	5.0 %	3.6 %	2.4 %	19.7 %	1.3 %	4.7 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	15.795 ppb	82.167 %	2.583 ppb	0.435 ppb	102.097 ppb	1.285 ppb	82.759 %	0.023 ppb	0.038 ppb
Concentration per Run 1	14.887 ppb	86.038 %	2.802 ppb	0.187 ppb	99.495 ppb	1.242 ppb	84.622 %	0.023 ppb	0.043 ppb
Concentration per Run 2	16.123 ppb	79.196 %	2.518 ppb	0.384 ppb	104.733 ppb	1.217 ppb	82.354 %	0.012 ppb	0.025 ppb
Concentration per Run 3	16.376 ppb	81.269 %	2.430 ppb	0.735 ppb	102.063 ppb	1.397 ppb	81.302 %	0.034 ppb	0.045 ppb
Concentration RSD	5.0 %	4.3 %	7.5 %	63.8 %	2.6 %	7.6 %	2.1 %	46.7 %	29.0 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	81.335 %	0.563 ppb	1.092 ppb	79.187 ppb	86.549 %	85.232 %	0.002 ppb	2.343 ppb	93.563 %
Concentration per Run 1	82.261 %	0.535 ppb	1.071 ppb	77.286 ppb	87.589 %	86.868 %	-0.001 ppb	2.292 ppb	97.340 %
Concentration per Run 2	81.689 %	0.560 ppb	1.174 ppb	79.621 ppb	88.484 %	86.272 %	0.004 ppb	2.378 ppb	92.389 %
Concentration per Run 3	80.053 %	0.592 ppb	1.030 ppb	80.654 ppb	83.572 %	82.558 %	0.004 ppb	2.359 ppb	90.960 %
Concentration RSD	1.4 %	5.1 %	6.8 %	2.2 %	3.0 %	2.7 %	145.9 %	1.9 %	3.6 %

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6/7/2017 3:54:49 PM



Analysis index: 50 Analysis started at: 6/7/2017 10:58:09 AM Rack: 1
Analysis label: L1718724-04 2008TL User name: ALPHALAB\metals-instrument Vial: 35

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	85.215 %	88.721 %	0.007 ppb	54,515.644 ppb	9,025.156 ppb	14.615 ppb	2,644.402 ppb	37,032.418 ppb	89.878 %
Concentration per Run 1	85.624 %	87.400 %	0.019 ppb	53,133.933 ppb	8,767.421 ppb	11.584 ppb	2,491.523 ppb	34,999.886 ppb	88.599 %
Concentration per Run 2	85.020 %	82.605 %	-0.004 ppb	55,646.661 ppb	9,022.904 ppb	15.624 ppb	2,728.036 ppb	38,658.424 ppb	82.820 %
Concentration per Run 3	85.000 %	96.158 %	0.007 ppb	54,766.338 ppb	9,285.143 ppb	16.637 ppb	2,713.646 ppb	37,438.943 ppb	98.214 %
Concentration RSD	0.4 %	7.7 %	159.5 %	2.3 %	2.9 %	18.3 %	5.0 %	5.0 %	8.7 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	83.984 %	53.683 ppb	0.115 ppb	0.118 ppb	953.889 ppb	4.549 ppb	1.163 ppb	1.719 ppb	0.052 ppb
Concentration per Run 1	84.621 %	50.255 ppb	0.028 ppb	0.224 ppb	921.432 ppb	6.486 ppb	1.155 ppb	1.774 ppb	0.089 ppb
Concentration per Run 2	83.557 %	54.677 ppb	0.192 ppb	0.055 ppb	975.765 ppb	0.692 ppb	1.444 ppb	1.720 ppb	-0.034 ppb
Concentration per Run 3	83.773 %	56.116 ppb	0.126 ppb	0.075 ppb	964.469 ppb	6.469 ppb	0.890 ppb	1.664 ppb	0.101 ppb
Concentration RSD	0.7 %	5.7 %	71.7 %	78.5 %	3.0 %	73.4 %	23.9 %	3.2 %	142.5 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	0.326 ppb	84.336 %	0.053 ppb	0.352 ppb	512.712 ppb	0.586 ppb	82.825 %	-0.001 ppb	0.002 ppb
Concentration per Run 1	0.239 ppb	80.725 %	0.047 ppb	0.491 ppb	488.712 ppb	0.555 ppb	84.078 %	0.003 ppb	0.006 ppb
Concentration per Run 2	0.535 ppb	78.911 %	0.048 ppb	-0.038 ppb	518.017 ppb	0.611 ppb	81.452 %	-0.002 ppb	0.000 ppb
Concentration per Run 3	0.204 ppb	93.373 %	0.064 ppb	0.603 ppb	531.406 ppb	0.593 ppb	82.946 %	-0.004 ppb	0.000 ppb
Concentration RSD	55.8 %	9.3 %	17.2 %	97.3 %	4.3 %	4.9 %	1.6 %	351.2 %	173.2 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	83.879 %	0.393 ppb	0.735 ppb	180.728 ppb	86.314 %	85.541 %	0.020 ppb	0.034 ppb	93.689 %
Concentration per Run 1	81.577 %	0.375 ppb	0.698 ppb	177.150 ppb	86.104 %	84.414 %	0.022 ppb	0.033 ppb	96.678 %
Concentration per Run 2	81.060 %	0.407 ppb	0.810 ppb	182.060 ppb	85.461 %	83.494 %	0.026 ppb	0.038 ppb	92.174 %
Concentration per Run 3	89.000 %	0.398 ppb	0.697 ppb	182.974 ppb	87.377 %	88.716 %	0.013 ppb	0.032 ppb	92.215 %
Concentration RSD	5.3 %	4.2 %	8.8 %	1.7 %	1.1 %	3.3 %	32.5 %	9.1 %	2.8 %

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Analysis index: 51 Analysis started at: 6/7/2017 11:01:32 AM Rack: 1
 Analysis label: WG1010557-4 2008TL User name: ALPHALAB\metals-instrument Vial: 36

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	97.135 %	109.435 %	0.006 ppb	40,292.039 ppb	44,473.676 ppb	94.185 ppb	17,193.128 ppb	259,614.778 ppb	82.575 %
Concentration per Run 1	97.296 %	111.556 %	0.023 ppb	39,606.060 ppb	43,957.375 ppb	92.233 ppb	17,753.839 ppb	268,530.915 ppb	82.401 %
Concentration per Run 2	97.249 %	113.584 %	-0.002 ppb	39,158.280 ppb	44,025.303 ppb	102.543 ppb	17,323.777 ppb	254,386.423 ppb	86.340 %
Concentration per Run 3	96.859 %	103.165 %	-0.002 ppb	42,111.776 ppb	45,438.349 ppb	87.780 ppb	16,501.769 ppb	255,926.994 ppb	78.985 %
Concentration RSD	0.2 %	5.0 %	221.1 %	4.0 %	1.9 %	8.0 %	3.7 %	3.0 %	4.5 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	75.535 %	354.571 ppb	0.783 ppb	0.108 ppb	1,314.396 ppb	222.308 ppb	0.537 ppb	5.927 ppb	0.454 ppb
Concentration per Run 1	75.306 %	364.179 ppb	0.510 ppb	0.198 ppb	1,342.481 ppb	220.032 ppb	0.552 ppb	6.100 ppb	0.601 ppb
Concentration per Run 2	75.721 %	350.215 ppb	0.876 ppb	0.008 ppb	1,303.340 ppb	220.905 ppb	0.600 ppb	5.642 ppb	0.532 ppb
Concentration per Run 3	75.577 %	349.321 ppb	0.962 ppb	0.118 ppb	1,297.365 ppb	225.988 ppb	0.459 ppb	6.038 ppb	0.230 ppb
Concentration RSD	0.3 %	2.3 %	30.7 %	88.3 %	1.9 %	1.4 %	13.4 %	4.2 %	43.5 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	1.154 ppb	82.689 %	2.450 ppb	9.313 ppb	3,607.853 ppb	538.034 ppb	78.599 %	0.006 ppb	0.208 ppb
Concentration per Run 1	1.307 ppb	85.516 %	2.340 ppb	6.962 ppb	3,641.746 ppb	532.600 ppb	79.928 %	0.003 ppb	0.182 ppb
Concentration per Run 2	0.872 ppb	85.519 %	2.415 ppb	9.615 ppb	3,559.052 ppb	527.412 ppb	80.728 %	0.012 ppb	0.256 ppb
Concentration per Run 3	1.282 ppb	77.033 %	2.594 ppb	11.364 ppb	3,622.761 ppb	554.090 ppb	75.141 %	0.004 ppb	0.187 ppb
Concentration RSD	21.2 %	5.9 %	5.3 %	23.8 %	1.2 %	2.6 %	3.8 %	80.3 %	19.8 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	80.264 %	0.492 ppb	1.140 ppb	42.316 ppb	83.418 %	83.554 %	0.055 ppb	0.067 ppb	89.368 %
Concentration per Run 1	82.926 %	0.504 ppb	1.045 ppb	41.800 ppb	84.499 %	85.684 %	0.051 ppb	0.060 ppb	91.617 %
Concentration per Run 2	83.561 %	0.464 ppb	1.117 ppb	41.264 ppb	85.120 %	84.618 %	0.054 ppb	0.066 ppb	89.228 %
Concentration per Run 3	74.305 %	0.508 ppb	1.257 ppb	43.885 ppb	80.637 %	80.361 %	0.059 ppb	0.074 ppb	87.260 %
Concentration RSD	6.4 %	4.9 %	9.5 %	3.3 %	2.9 %	3.4 %	7.5 %	10.5 %	2.4 %

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Analysis index: 52 Analysis started at: 6/7/2017 11:04:55 AM Rack: 1
 Analysis label: L1718577-01 2008TL User name: ALPHALAB\metals-instrument Vial: 37

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	96.281 %	103.626 %	0.004 ppb	40,590.458 ppb	44,570.242 ppb	96.869 ppb	16,859.908 ppb	256,042.540 ppb	78.162 %
Concentration per Run 1	96.481 %	104.825 %	0.002 ppb	40,163.051 ppb	45,028.940 ppb	102.209 ppb	16,789.788 ppb	253,568.936 ppb	86.708 %
Concentration per Run 2	96.646 %	104.364 %	0.005 ppb	40,057.606 ppb	44,882.977 ppb	91.350 ppb	16,989.336 ppb	262,016.398 ppb	72.681 %
Concentration per Run 3	95.715 %	101.690 %	0.005 ppb	41,550.717 ppb	43,798.808 ppb	97.050 ppb	16,800.600 ppb	252,542.285 ppb	75.098 %
Concentration RSD	0.5 %	1.6 %	49.0 %	2.1 %	1.5 %	5.6 %	0.7 %	2.0 %	9.6 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	74.639 %	342.855 ppb	0.815 ppb	0.223 ppb	1,294.445 ppb	211.523 ppb	0.503 ppb	6.592 ppb	0.334 ppb
Concentration per Run 1	74.549 %	342.613 ppb	0.688 ppb	0.280 ppb	1,249.092 ppb	211.625 ppb	0.525 ppb	5.953 ppb	0.304 ppb
Concentration per Run 2	75.194 %	345.157 ppb	0.888 ppb	0.161 ppb	1,298.225 ppb	217.044 ppb	0.459 ppb	6.982 ppb	0.398 ppb
Concentration per Run 3	74.175 %	340.797 ppb	0.869 ppb	0.228 ppb	1,336.018 ppb	205.899 ppb	0.525 ppb	6.841 ppb	0.300 ppb
Concentration RSD	0.7 %	0.6 %	13.6 %	26.9 %	3.4 %	2.6 %	7.5 %	8.5 %	16.7 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	1.078 ppb	79.311 %	2.186 ppb	8.582 ppb	3,459.029 ppb	534.086 ppb	75.309 %	-0.002 ppb	0.147 ppb
Concentration per Run 1	0.951 ppb	81.684 %	1.942 ppb	7.474 ppb	3,550.567 ppb	522.680 ppb	77.124 %	-0.004 ppb	0.144 ppb
Concentration per Run 2	0.962 ppb	78.859 %	2.399 ppb	10.060 ppb	3,393.458 ppb	538.841 ppb	73.903 %	-0.004 ppb	0.163 ppb
Concentration per Run 3	1.321 ppb	77.389 %	2.217 ppb	8.211 ppb	3,433.061 ppb	540.738 ppb	74.900 %	0.001 ppb	0.134 ppb
Concentration RSD	19.5 %	2.8 %	10.5 %	15.5 %	2.4 %	1.9 %	2.2 %	143.4 %	9.7 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	74.519 %	0.593 ppb	1.070 ppb	42.737 ppb	80.730 %	79.308 %	0.057 ppb	0.049 ppb	86.096 %
Concentration per Run 1	79.238 %	0.572 ppb	0.955 ppb	42.630 ppb	83.478 %	80.913 %	0.050 ppb	0.048 ppb	89.462 %
Concentration per Run 2	72.443 %	0.543 ppb	1.052 ppb	41.426 ppb	78.720 %	77.428 %	0.057 ppb	0.049 ppb	84.662 %
Concentration per Run 3	71.877 %	0.665 ppb	1.204 ppb	44.154 ppb	79.993 %	79.583 %	0.063 ppb	0.051 ppb	84.164 %
Concentration RSD	5.5 %	10.8 %	11.7 %	3.2 %	3.1 %	2.2 %	11.2 %	3.3 %	3.4 %

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Analysis index: 53 Analysis started at: 6/7/2017 11:09:36 AM Rack: 0
 Analysis label: CCV User name: ALPHALAB\metals-instrument Vial: 9

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	82.469 %	86.539 %	99.157 ppb	10,195.114 ppb	10,202.253 ppb	102.657 ppb	10,253.354 ppb	10,377.122 ppb	80.894 %
Concentration per Run 1	82.855 %	90.903 %	97.450 ppb	9,427.468 ppb	9,028.776 ppb	83.468 ppb	9,227.353 ppb	9,133.421 ppb	87.286 %
Concentration per Run 2	83.417 %	86.201 %	98.547 ppb	9,952.273 ppb	9,906.075 ppb	103.269 ppb	10,148.376 ppb	9,988.596 ppb	82.662 %
Concentration per Run 3	81.135 %	82.513 %	101.473 ppb	11,205.600 ppb	11,671.908 ppb	121.233 ppb	11,384.332 ppb	12,009.348 ppb	72.734 %
Recovery Percentage 1			99.157 %	101.951 %	102.023 %	102.657 %	102.534 %	103.771 %	
Concentration RSD	1.4 %	4.9 %	2.1 %	9.0 %	13.2 %	18.4 %	10.6 %	14.2 %	9.2 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	80.326 %	104.387 ppb	101.927 ppb	102.190 ppb	107.634 ppb	10,282.261 ppb	101.831 ppb	99.979 ppb	101.851 ppb
Concentration per Run 1	81.123 %	87.661 ppb	91.053 ppb	86.515 ppb	96.227 ppb	8,958.029 ppb	91.874 ppb	86.524 ppb	91.480 ppb
Concentration per Run 2	81.343 %	100.206 ppb	97.141 ppb	97.560 ppb	109.160 ppb	10,126.578 ppb	95.537 ppb	97.061 ppb	96.581 ppb
Concentration per Run 3	78.511 %	125.294 ppb	117.587 ppb	122.496 ppb	117.515 ppb	11,762.177 ppb	118.083 ppb	116.350 ppb	117.492 ppb
Recovery Percentage 1		104.387 %	101.927 %	102.190 %	107.634 %	102.823 %	101.831 %	99.979 %	101.851 %
Concentration RSD	2.0 %	18.4 %	13.6 %	18.0 %	10.0 %	13.7 %	13.9 %	15.1 %	13.5 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	101.531 ppb	75.742 %	100.862 ppb	105.251 ppb	105.662 ppb	106.664 ppb	79.494 %	101.543 ppb	104.972 ppb
Concentration per Run 1	90.770 ppb	79.168 %	92.309 ppb	97.100 ppb	95.149 ppb	94.031 ppb	86.758 %	90.414 ppb	90.550 ppb
Concentration per Run 2	96.939 ppb	78.415 %	98.311 ppb	101.010 ppb	100.105 ppb	101.726 ppb	80.871 %	99.498 ppb	102.158 ppb
Concentration per Run 3	116.883 ppb	69.643 %	111.966 ppb	117.642 ppb	121.731 ppb	124.235 ppb	70.853 %	114.719 ppb	122.208 ppb
Recovery Percentage 1	101.531 %		100.862 %	105.251 %	105.662 %	106.664 %		101.543 %	104.972 %
Concentration RSD	13.4 %	7.0 %	10.0 %	10.4 %	13.4 %	14.7 %	10.1 %	12.1 %	15.3 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	76.925 %	102.075 ppb	107.391 ppb	101.523 ppb	83.560 %	81.173 %	102.925 ppb	106.962 ppb	87.694 %
Concentration per Run 1	83.808 %	89.880 ppb	92.528 ppb	88.095 ppb	89.637 %	89.114 %	95.507 ppb	94.814 ppb	93.798 %
Concentration per Run 2	77.230 %	97.219 ppb	104.112 ppb	98.968 ppb	84.614 %	80.745 %	98.952 ppb	102.507 ppb	90.183 %
Concentration per Run 3	69.735 %	119.126 ppb	125.535 ppb	117.507 ppb	76.430 %	73.661 %	114.317 ppb	123.566 ppb	79.101 %
Recovery Percentage 1		102.075 %	107.391 %	101.523 %			102.925 %	106.962 %	
Concentration RSD	9.2 %	14.9 %	15.6 %	14.6 %	8.0 %	9.5 %	9.7 %	13.9 %	8.7 %

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Analysis index: 54 Analysis started at: 6/7/2017 11:13:01 AM Rack: 0
 Analysis label: CCB User name: ALPHALAB\metals-instrument Vial: 10

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	83.885 %	84.203 %	0.024 ppb	76.358 ppb	1.252 ppb	0.400 ppb	19.568 ppb	10.724 ppb	79.721 %
Concentration per Run 1	83.533 %	83.988 %	0.040 ppb	88.887 ppb	2.090 ppb	0.917 ppb	13.152 ppb	25.870 ppb	82.190 %
Concentration per Run 2	83.607 %	85.556 %	0.016 ppb	70.712 ppb	0.391 ppb	-0.319 ppb	21.457 ppb	1.080 ppb	77.935 %
Concentration per Run 3	84.516 %	83.066 %	0.015 ppb	69.475 ppb	1.276 ppb	0.602 ppb	24.096 ppb	5.222 ppb	79.038 %
Recovery Percentage 1			4.721 %	76.358 %	1.789 %	4.002 %	19.568 %	10.724 %	
Concentration RSD	0.7 %	1.5 %	59.1 %	14.2 %	67.9 %	160.6 %	29.2 %	123.8 %	2.8 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	79.834 %	0.197 ppb	0.031 ppb	-0.023 ppb	0.057 ppb	2.157 ppb	0.018 ppb	-0.074 ppb	0.010 ppb
Concentration per Run 1	79.074 %	0.030 ppb	0.071 ppb	-0.012 ppb	0.022 ppb	4.842 ppb	0.000 ppb	-0.160 ppb	0.030 ppb
Concentration per Run 2	79.688 %	0.105 ppb	0.033 ppb	-0.021 ppb	0.075 ppb	3.002 ppb	0.000 ppb	-0.004 ppb	0.034 ppb
Concentration per Run 3	80.741 %	0.456 ppb	-0.010 ppb	-0.037 ppb	0.073 ppb	-1.373 ppb	0.054 ppb	-0.058 ppb	-0.034 ppb
Recovery Percentage 1		39.331 %	0.622 %	-2.348 %	5.686 %	4.314 %	3.621 %	-3.708 %	1.022 %
Concentration RSD	1.1 %	115.6 %	131.1 %	52.4 %	52.6 %	148.0 %	173.2 %	106.9 %	371.1 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	-0.078 ppb	76.640 %	0.050 ppb	0.702 ppb	0.035 ppb	0.744 ppb	80.377 %	0.036 ppb	0.011 ppb
Concentration per Run 1	-0.036 ppb	79.170 %	0.048 ppb	0.886 ppb	0.020 ppb	0.719 ppb	80.098 %	0.039 ppb	0.013 ppb
Concentration per Run 2	-0.109 ppb	74.818 %	0.080 ppb	0.750 ppb	0.021 ppb	0.622 ppb	81.077 %	0.025 ppb	0.013 ppb
Concentration per Run 3	-0.090 ppb	75.931 %	0.022 ppb	0.470 ppb	0.063 ppb	0.891 ppb	79.957 %	0.042 ppb	0.007 ppb
Recovery Percentage 1	-0.782 %	76.640 %	10.035 %	14.039 %	6.937 %	37.196 %		8.889 %	5.513 %
Concentration RSD	48.1 %	3.0 %	58.3 %	30.3 %	71.0 %	18.3 %	0.8 %	26.0 %	34.3 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	76.536 %	0.632 ppb	2.430 ppb	-0.007 ppb	83.397 %	81.216 %	0.025 ppb	0.053 ppb	83.073 %
Concentration per Run 1	78.230 %	0.639 ppb	2.727 ppb	-0.001 ppb	83.472 %	82.898 %	0.025 ppb	0.062 ppb	79.413 %
Concentration per Run 2	75.387 %	0.549 ppb	2.167 ppb	-0.018 ppb	83.214 %	79.574 %	0.023 ppb	0.049 ppb	84.847 %
Concentration per Run 3	75.992 %	0.707 ppb	2.395 ppb	-0.001 ppb	83.504 %	81.176 %	0.028 ppb	0.046 ppb	84.958 %
Recovery Percentage 1		21.066 %	60.746 %	-1.384 %			5.063 %	10.516 %	83.073 %
Concentration RSD	2.0 %	12.5 %	11.6 %	139.6 %	0.2 %	2.0 %	9.9 %	15.8 %	3.8 %

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Analysis index: 55 Analysis started at: 6/7/2017 11:20:10 AM Rack: 1
 Analysis label: WG1010557-3D10 2008TL User name: ALPHALAB\metals-instrument Vial: 38

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	88.080 %	89.674 %	5.235 ppb	5,685.956 ppb	6,039.644 ppb	230.013 ppb	2,796.237 ppb	26,036.269 ppb	83.661 %
Concentration per Run 1	87.950 %	89.797 %	5.314 ppb	5,586.858 ppb	5,797.181 ppb	216.759 ppb	2,668.307 ppb	24,569.372 ppb	89.807 %
Concentration per Run 2	89.453 %	92.655 %	5.189 ppb	5,655.375 ppb	6,113.133 ppb	231.117 ppb	2,773.179 ppb	27,079.751 ppb	80.246 %
Concentration per Run 3	86.838 %	86.570 %	5.203 ppb	5,815.635 ppb	6,208.619 ppb	242.162 ppb	2,947.224 ppb	26,459.684 ppb	80.929 %
Concentration RSD	1.5 %	3.4 %	1.3 %	2.1 %	3.6 %	5.5 %	5.0 %	5.0 %	6.4 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	81.960 %	126.216 ppb	52.263 ppb	20.648 ppb	184.428 ppb	140.852 ppb	48.969 ppb	51.763 ppb	24.889 ppb
Concentration per Run 1	81.219 %	115.680 ppb	46.952 ppb	19.383 ppb	165.573 ppb	143.600 ppb	46.872 ppb	49.631 ppb	24.470 ppb
Concentration per Run 2	83.946 %	132.118 ppb	56.871 ppb	21.186 ppb	198.115 ppb	133.654 ppb	49.257 ppb	51.780 ppb	23.428 ppb
Concentration per Run 3	80.716 %	130.849 ppb	52.966 ppb	21.376 ppb	189.594 ppb	145.302 ppb	50.778 ppb	53.877 ppb	26.769 ppb
Concentration RSD	2.1 %	7.2 %	9.6 %	5.3 %	9.1 %	4.5 %	4.0 %	4.1 %	6.9 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	51.281 ppb	80.840 %	13.110 ppb	13.419 ppb	448.987 ppb	153.691 ppb	81.342 %	5.028 ppb	5.293 ppb
Concentration per Run 1	50.788 ppb	81.010 %	13.168 ppb	11.855 ppb	438.699 ppb	152.822 ppb	83.690 %	4.822 ppb	4.947 ppb
Concentration per Run 2	50.213 ppb	81.386 %	13.023 ppb	14.938 ppb	461.050 ppb	153.515 ppb	80.005 %	5.087 ppb	5.392 ppb
Concentration per Run 3	52.840 ppb	80.123 %	13.138 ppb	13.464 ppb	447.214 ppb	154.737 ppb	80.331 %	5.176 ppb	5.541 ppb
Concentration RSD	2.7 %	0.8 %	0.6 %	11.5 %	2.5 %	0.6 %	2.5 %	3.7 %	5.8 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	81.153 %	98.302 ppb	65.717 ppb	206.185 ppb	84.847 %	83.533 %	13.078 ppb	58.274 ppb	87.197 %
Concentration per Run 1	84.293 %	93.770 ppb	61.770 ppb	199.552 ppb	85.952 %	84.023 %	13.003 ppb	57.469 ppb	87.657 %
Concentration per Run 2	79.458 %	100.577 ppb	67.488 ppb	212.380 ppb	85.601 %	82.823 %	13.021 ppb	58.846 ppb	86.975 %
Concentration per Run 3	79.707 %	100.558 ppb	67.892 ppb	206.622 ppb	82.988 %	83.754 %	13.209 ppb	58.508 ppb	86.959 %
Concentration RSD	3.4 %	4.0 %	5.2 %	3.1 %	1.9 %	0.8 %	0.9 %	1.2 %	0.5 %

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Analysis index: 56 Analysis started at: 6/7/2017 11:23:30 AM Rack: 1
Analysis label: L1718579-01 2008TL User name: ALPHALAB\metals-instrument Vial: 42

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	97.345 %	108.697 %	0.004 ppb	57,755.408 ppb	38,913.815 ppb	2,508.056 ppb	15,230.787 ppb	218,989.828 ppb	82.435 %
Concentration per Run 1	96.850 %	114.045 %	-0.002 ppb	55,122.707 ppb	35,872.096 ppb	2,267.481 ppb	14,446.031 ppb	200,924.652 ppb	84.711 %
Concentration per Run 2	99.259 %	103.811 %	0.005 ppb	59,840.518 ppb	40,627.404 ppb	2,630.672 ppb	15,711.558 ppb	226,988.827 ppb	80.351 %
Concentration per Run 3	95.925 %	108.236 %	0.009 ppb	58,302.999 ppb	40,241.944 ppb	2,626.016 ppb	15,534.772 ppb	229,056.004 ppb	82.242 %
Concentration RSD	1.8 %	4.7 %	134.4 %	4.2 %	6.8 %	8.3 %	4.5 %	7.2 %	2.7 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	76.177 %	300.864 ppb	0.442 ppb	0.190 ppb	236.639 ppb	780.371 ppb	0.040 ppb	0.696 ppb	0.238 ppb
Concentration per Run 1	76.060 %	279.242 ppb	0.228 ppb	0.104 ppb	216.082 ppb	715.833 ppb	0.051 ppb	0.504 ppb	0.281 ppb
Concentration per Run 2	77.775 %	315.259 ppb	0.409 ppb	0.312 ppb	250.285 ppb	840.921 ppb	0.041 ppb	0.747 ppb	0.133 ppb
Concentration per Run 3	74.694 %	308.089 ppb	0.690 ppb	0.154 ppb	243.551 ppb	784.360 ppb	0.027 ppb	0.836 ppb	0.298 ppb
Concentration RSD	2.0 %	6.3 %	52.6 %	57.1 %	7.7 %	8.0 %	31.0 %	24.7 %	38.2 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	0.815 ppb	76.298 %	1.183 ppb	-0.061 ppb	3,123.582 ppb	31.148 ppb	79.492 %	-0.001 ppb	0.026 ppb
Concentration per Run 1	0.964 ppb	79.481 %	1.031 ppb	0.225 ppb	2,769.222 ppb	26.809 ppb	85.593 %	-0.004 ppb	0.031 ppb
Concentration per Run 2	0.798 ppb	74.804 %	1.243 ppb	-0.383 ppb	3,298.728 ppb	33.286 ppb	77.103 %	0.004 ppb	0.014 ppb
Concentration per Run 3	0.682 ppb	74.609 %	1.276 ppb	-0.025 ppb	3,302.797 ppb	33.349 ppb	75.779 %	-0.001 ppb	0.034 ppb
Concentration RSD	17.4 %	3.6 %	11.2 %	503.4 %	9.8 %	12.1 %	6.7 %	667.7 %	41.6 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	77.526 %	1.444 ppb	0.544 ppb	33.362 ppb	84.711 %	82.592 %	0.017 ppb	0.095 ppb	92.820 %
Concentration per Run 1	83.194 %	1.159 ppb	0.458 ppb	29.573 ppb	89.738 %	87.514 %	0.011 ppb	0.085 ppb	99.771 %
Concentration per Run 2	73.829 %	1.531 ppb	0.589 ppb	36.509 ppb	81.716 %	78.829 %	0.022 ppb	0.104 ppb	90.559 %
Concentration per Run 3	75.555 %	1.642 ppb	0.585 ppb	34.003 ppb	82.679 %	81.434 %	0.017 ppb	0.096 ppb	88.128 %
Concentration RSD	6.4 %	17.5 %	13.7 %	10.5 %	5.2 %	5.4 %	34.1 %	10.5 %	6.6 %

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Analysis index: 57 Analysis started at: 6/7/2017 11:26:52 AM Rack: 1
 Analysis label: L1718732-01 2008TL User name: ALPHALAB\metals-instrument Vial: 46

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	99.033 %	103.473 %	0.003 ppb	40,822.539 ppb	43,682.451 ppb	231.016 ppb	16,056.022 ppb	246,885.551 ppb	79.896 %
Concentration per Run 1	100.281 %	99.293 %	0.005 ppb	40,089.292 ppb	43,467.484 ppb	233.415 ppb	15,775.890 ppb	240,050.723 ppb	82.505 %
Concentration per Run 2	99.461 %	107.591 %	0.012 ppb	40,102.716 ppb	43,304.195 ppb	240.918 ppb	16,375.650 ppb	254,852.028 ppb	77.251 %
Concentration per Run 3	97.358 %	103.534 %	-0.009 ppb	42,275.610 ppb	44,275.674 ppb	218.714 ppb	16,016.526 ppb	245,753.904 ppb	79.930 %
Concentration RSD	1.5 %	4.0 %	410.9 %	3.1 %	1.2 %	4.9 %	1.9 %	3.0 %	3.3 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	76.113 %	341.614 ppb	0.819 ppb	1.649 ppb	1,206.256 ppb	244.339 ppb	0.567 ppb	6.753 ppb	0.429 ppb
Concentration per Run 1	77.278 %	329.005 ppb	0.601 ppb	1.535 ppb	1,160.308 ppb	213.146 ppb	0.460 ppb	6.464 ppb	0.354 ppb
Concentration per Run 2	76.102 %	360.466 ppb	0.986 ppb	1.693 ppb	1,252.164 ppb	274.924 ppb	0.610 ppb	7.185 ppb	0.441 ppb
Concentration per Run 3	74.958 %	335.370 ppb	0.870 ppb	1.719 ppb	1,206.296 ppb	244.947 ppb	0.631 ppb	6.610 ppb	0.492 ppb
Concentration RSD	1.5 %	4.9 %	24.1 %	6.1 %	3.8 %	12.6 %	16.5 %	5.6 %	16.3 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	1.337 ppb	76.365 %	2.335 ppb	8.938 ppb	3,408.071 ppb	531.385 ppb	77.630 %	0.008 ppb	0.192 ppb
Concentration per Run 1	1.467 ppb	77.687 %	1.758 ppb	10.084 ppb	3,296.071 ppb	516.838 ppb	78.132 %	0.006 ppb	0.248 ppb
Concentration per Run 2	1.330 ppb	74.629 %	2.760 ppb	8.697 ppb	3,463.304 ppb	548.436 ppb	76.954 %	0.009 ppb	0.163 ppb
Concentration per Run 3	1.215 ppb	76.780 %	2.486 ppb	8.033 ppb	3,464.836 ppb	528.882 ppb	77.805 %	0.009 ppb	0.164 ppb
Concentration RSD	9.4 %	2.1 %	22.2 %	11.7 %	2.8 %	3.0 %	0.8 %	19.8 %	25.6 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	75.269 %	0.746 ppb	1.089 ppb	40.484 ppb	82.746 %	81.251 %	0.058 ppb	0.086 ppb	88.460 %
Concentration per Run 1	76.141 %	0.759 ppb	1.167 ppb	38.465 ppb	82.044 %	80.898 %	0.061 ppb	0.082 ppb	91.075 %
Concentration per Run 2	75.146 %	0.710 ppb	0.948 ppb	42.319 ppb	83.434 %	81.459 %	0.054 ppb	0.085 ppb	89.009 %
Concentration per Run 3	74.519 %	0.770 ppb	1.152 ppb	40.669 ppb	82.760 %	81.397 %	0.059 ppb	0.091 ppb	85.297 %
Concentration RSD	1.1 %	4.3 %	11.2 %	4.8 %	0.8 %	0.4 %	6.3 %	5.4 %	3.3 %

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Analysis index: 58 Analysis started at: 6/7/2017 11:30:15 AM Rack: 1
 Analysis label: L1718733-01 2008TL User name: ALPHALAB\metals-instrument Vial: 47

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	99.138 %	106.946 %	0.006 ppb	59,408.123 ppb	41,803.021 ppb	2,788.051 ppb	16,180.296 ppb	236,644.213 ppb	77.182 %
Concentration per Run 1	100.866 %	103.258 %	0.001 ppb	58,879.074 ppb	40,200.161 ppb	2,609.850 ppb	15,704.823 ppb	231,420.527 ppb	72.472 %
Concentration per Run 2	98.758 %	103.073 %	0.012 ppb	61,243.154 ppb	43,693.595 ppb	2,847.933 ppb	16,845.111 ppb	240,845.162 ppb	77.304 %
Concentration per Run 3	97.791 %	114.506 %	0.005 ppb	58,102.142 ppb	41,515.306 ppb	2,906.369 ppb	15,990.955 ppb	237,666.950 ppb	81.769 %
Concentration RSD	1.6 %	6.1 %	88.8 %	2.8 %	4.2 %	5.6 %	3.7 %	2.0 %	6.0 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	77.830 %	316.834 ppb	0.595 ppb	0.211 ppb	303.698 ppb	1,002.150 ppb	0.032 ppb	0.884 ppb	0.208 ppb
Concentration per Run 1	78.566 %	317.773 ppb	0.309 ppb	0.165 ppb	290.101 ppb	1,007.122 ppb	0.029 ppb	0.851 ppb	0.139 ppb
Concentration per Run 2	77.558 %	317.269 ppb	0.503 ppb	0.234 ppb	309.184 ppb	998.030 ppb	0.040 ppb	0.839 ppb	0.260 ppb
Concentration per Run 3	77.365 %	315.462 ppb	0.974 ppb	0.234 ppb	311.810 ppb	1,001.297 ppb	0.026 ppb	0.961 ppb	0.224 ppb
Concentration RSD	0.8 %	0.4 %	57.5 %	18.8 %	3.9 %	0.5 %	23.9 %	7.6 %	29.8 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	0.691 ppb	77.227 %	0.974 ppb	0.341 ppb	3,118.804 ppb	33.739 ppb	78.610 %	0.003 ppb	0.016 ppb
Concentration per Run 1	0.308 ppb	74.584 %	1.247 ppb	0.569 ppb	2,928.963 ppb	32.452 ppb	76.615 %	0.004 ppb	0.014 ppb
Concentration per Run 2	1.199 ppb	78.885 %	0.848 ppb	1.107 ppb	3,186.099 ppb	34.276 ppb	79.107 %	0.001 ppb	0.000 ppb
Concentration per Run 3	0.565 ppb	78.211 %	0.827 ppb	-0.654 ppb	3,241.350 ppb	34.488 ppb	80.109 %	0.003 ppb	0.033 ppb
Concentration RSD	66.4 %	3.0 %	24.3 %	264.8 %	5.3 %	3.3 %	2.3 %	55.4 %	104.5 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	73.179 %	0.654 ppb	0.419 ppb	36.317 ppb	82.439 %	79.812 %	0.012 ppb	0.036 ppb	89.875 %
Concentration per Run 1	68.647 %	0.711 ppb	0.333 ppb	35.481 ppb	81.260 %	77.616 %	0.014 ppb	0.033 ppb	90.438 %
Concentration per Run 2	73.674 %	0.682 ppb	0.419 ppb	36.225 ppb	82.499 %	80.007 %	0.012 ppb	0.036 ppb	91.119 %
Concentration per Run 3	77.215 %	0.569 ppb	0.504 ppb	37.244 ppb	83.557 %	81.814 %	0.011 ppb	0.040 ppb	88.068 %
Concentration RSD	5.9 %	11.5 %	20.4 %	2.4 %	1.4 %	2.6 %	10.2 %	10.8 %	1.8 %

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Analysis index: 59 Analysis started at: 6/7/2017 11:33:38 AM Rack: 1
 Analysis label: L1718478-01 2008TL User name: ALPHALAB\metals-instrument Vial: 39

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	79.211 %	83.620 %	0.127 ppb	21,853.041 ppb	9,427.907 ppb	2,245.700 ppb	11,700.389 ppb	26,440.185 ppb	79.983 %
Concentration per Run 1	79.556 %	80.024 %	0.151 ppb	21,420.906 ppb	9,093.576 ppb	2,126.183 ppb	11,195.039 ppb	24,071.335 ppb	83.345 %
Concentration per Run 2	79.671 %	85.187 %	0.109 ppb	22,259.798 ppb	9,801.462 ppb	2,293.700 ppb	11,703.783 ppb	27,503.514 ppb	78.722 %
Concentration per Run 3	78.405 %	85.648 %	0.120 ppb	21,878.420 ppb	9,388.682 ppb	2,317.217 ppb	12,202.345 ppb	27,745.706 ppb	77.882 %
Concentration RSD	0.9 %	3.7 %	17.3 %	1.9 %	3.8 %	4.6 %	4.3 %	7.8 %	3.7 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	75.098 %	65.181 ppb	3.258 ppb	1.931 ppb	357.630 ppb	1,521.535 ppb	1.292 ppb	6.105 ppb	72.054 ppb
Concentration per Run 1	75.678 %	60.306 ppb	3.181 ppb	1.886 ppb	340.314 ppb	1,464.821 ppb	1.451 ppb	6.137 ppb	76.998 ppb
Concentration per Run 2	76.298 %	66.469 ppb	3.021 ppb	2.129 ppb	365.105 ppb	1,511.083 ppb	1.223 ppb	5.987 ppb	69.789 ppb
Concentration per Run 3	73.317 %	68.766 ppb	3.573 ppb	1.777 ppb	367.470 ppb	1,588.703 ppb	1.203 ppb	6.192 ppb	69.375 ppb
Concentration RSD	2.1 %	6.7 %	8.7 %	9.3 %	4.2 %	4.1 %	10.7 %	1.7 %	5.9 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	24.324 ppb	76.903 %	2.116 ppb	1.323 ppb	266.573 ppb	3.290 ppb	80.201 %	0.138 ppb	0.421 ppb
Concentration per Run 1	24.813 ppb	72.997 %	2.191 ppb	1.443 ppb	262.769 ppb	3.193 ppb	81.069 %	0.130 ppb	0.424 ppb
Concentration per Run 2	24.780 ppb	79.740 %	1.848 ppb	1.255 ppb	265.103 ppb	3.279 ppb	81.050 %	0.150 ppb	0.358 ppb
Concentration per Run 3	23.378 ppb	77.972 %	2.309 ppb	1.272 ppb	271.847 ppb	3.398 ppb	78.484 %	0.135 ppb	0.482 ppb
Concentration RSD	3.4 %	4.5 %	11.3 %	7.9 %	1.8 %	3.1 %	1.9 %	7.8 %	14.7 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	75.047 %	3.215 ppb	39.009 ppb	46.509 ppb	82.721 %	81.232 %	0.109 ppb	4,712.669 ppb	91.714 %
Concentration per Run 1	74.319 %	3.067 ppb	38.457 ppb	45.763 ppb	83.663 %	82.024 %	0.100 ppb	4,572.528 ppb	95.068 %
Concentration per Run 2	76.112 %	3.512 ppb	39.523 ppb	46.308 ppb	82.561 %	82.831 %	0.115 ppb	4,786.119 ppb	90.135 %
Concentration per Run 3	74.709 %	3.064 ppb	39.045 ppb	47.457 ppb	81.939 %	78.840 %	0.113 ppb	4,779.361 ppb	89.940 %
Concentration RSD	1.3 %	8.0 %	1.4 %	1.9 %	1.1 %	2.6 %	7.4 %	2.6 %	3.2 %

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Analysis index: 60 Analysis started at: 6/7/2017 11:36:58 AM Rack: 1
 Analysis label: L1718480-01 2008TL User name: ALPHALAB\metals-instrument Vial: 40

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	80.650 %	87.768 %	0.013 ppb	17,404.521 ppb	6,662.278 ppb	75.456 ppb	3,735.747 ppb	16,970.502 ppb	78.267 %
Concentration per Run 1	81.138 %	92.102 %	0.025 ppb	16,897.854 ppb	6,323.228 ppb	72.963 ppb	3,669.353 ppb	16,988.066 ppb	79.195 %
Concentration per Run 2	80.846 %	83.804 %	0.008 ppb	17,844.346 ppb	6,900.391 ppb	81.095 ppb	3,753.132 ppb	16,876.202 ppb	77.356 %
Concentration per Run 3	79.966 %	87.400 %	0.004 ppb	17,471.364 ppb	6,763.215 ppb	72.310 ppb	3,784.754 ppb	17,047.237 ppb	78.250 %
Concentration RSD	0.8 %	4.7 %	85.8 %	2.7 %	4.5 %	6.5 %	1.6 %	0.5 %	1.2 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	77.488 %	23.756 ppb	0.385 ppb	0.225 ppb	91.470 ppb	218.244 ppb	0.161 ppb	1.738 ppb	5.577 ppb
Concentration per Run 1	77.631 %	22.991 ppb	0.410 ppb	0.312 ppb	89.424 ppb	198.711 ppb	0.107 ppb	2.020 ppb	5.662 ppb
Concentration per Run 2	77.378 %	26.178 ppb	0.372 ppb	0.288 ppb	92.804 ppb	230.346 ppb	0.160 ppb	1.709 ppb	5.786 ppb
Concentration per Run 3	77.455 %	22.100 ppb	0.372 ppb	0.076 ppb	92.183 ppb	225.675 ppb	0.215 ppb	1.484 ppb	5.284 ppb
Concentration RSD	0.2 %	9.0 %	5.7 %	57.6 %	2.0 %	7.8 %	33.7 %	15.5 %	4.7 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	4.957 ppb	79.185 %	0.323 ppb	-0.039 ppb	132.081 ppb	0.738 ppb	79.228 %	0.005 ppb	0.069 ppb
Concentration per Run 1	4.758 ppb	78.185 %	0.299 ppb	-0.462 ppb	131.997 ppb	0.823 ppb	79.983 %	0.006 ppb	0.078 ppb
Concentration per Run 2	4.870 ppb	81.036 %	0.289 ppb	0.121 ppb	131.580 ppb	0.654 ppb	80.188 %	0.003 ppb	0.060 ppb
Concentration per Run 3	5.243 ppb	78.335 %	0.382 ppb	0.223 ppb	132.666 ppb	0.738 ppb	77.513 %	0.006 ppb	0.068 ppb
Concentration RSD	5.1 %	2.0 %	15.9 %	943.3 %	0.4 %	11.5 %	1.9 %	29.0 %	13.0 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	76.466 %	0.372 ppb	11.912 ppb	30.100 ppb	82.353 %	80.691 %	0.024 ppb	93.646 ppb	90.803 %
Concentration per Run 1	78.844 %	0.345 ppb	11.179 ppb	29.346 ppb	83.071 %	82.070 %	0.025 ppb	89.375 ppb	94.591 %
Concentration per Run 2	75.261 %	0.311 ppb	12.155 ppb	30.271 ppb	81.357 %	79.591 %	0.027 ppb	94.462 ppb	89.383 %
Concentration per Run 3	75.293 %	0.461 ppb	12.404 ppb	30.684 ppb	82.632 %	80.412 %	0.021 ppb	97.100 ppb	88.435 %
Concentration RSD	2.7 %	21.0 %	5.4 %	2.3 %	1.1 %	1.6 %	13.3 %	4.2 %	3.6 %

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Analysis index: 61 Analysis started at: 6/7/2017 11:40:19 AM Rack: 1
Analysis label: L1718517-01 2008TL User name: ALPHALAB\metals-instrument Vial: 41

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	78.469 %	86.846 %	0.016 ppb	42,293.657 ppb	8,288.087 ppb	109.942 ppb	2,434.568 ppb	46,385.856 ppb	80.508 %
Concentration per Run 1	79.765 %	90.350 %	0.004 ppb	40,606.502 ppb	7,832.588 ppb	101.613 ppb	2,467.815 ppb	45,475.920 ppb	83.240 %
Concentration per Run 2	78.484 %	79.839 %	0.022 ppb	44,738.388 ppb	8,789.668 ppb	117.740 ppb	2,402.651 ppb	47,213.624 ppb	80.404 %
Concentration per Run 3	77.159 %	90.350 %	0.022 ppb	41,536.082 ppb	8,242.006 ppb	110.473 ppb	2,433.238 ppb	46,468.025 ppb	77.882 %
Concentration RSD	1.7 %	7.0 %	62.6 %	5.1 %	5.8 %	7.3 %	1.3 %	1.9 %	3.3 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	75.785 %	67.742 ppb	0.730 ppb	1.450 ppb	1,492.704 ppb	4,100.262 ppb	0.817 ppb	4.707 ppb	2.454 ppb
Concentration per Run 1	77.456 %	65.801 ppb	0.599 ppb	1.531 ppb	1,429.389 ppb	3,980.205 ppb	0.884 ppb	4.986 ppb	2.675 ppb
Concentration per Run 2	75.005 %	70.372 ppb	0.868 ppb	1.453 ppb	1,520.413 ppb	4,094.329 ppb	0.796 ppb	4.644 ppb	1.989 ppb
Concentration per Run 3	74.895 %	67.053 ppb	0.721 ppb	1.367 ppb	1,528.311 ppb	4,226.251 ppb	0.772 ppb	4.491 ppb	2.698 ppb
Concentration RSD	1.9 %	3.5 %	18.5 %	5.7 %	3.7 %	3.0 %	7.3 %	5.4 %	16.4 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	19.472 ppb	75.456 %	0.800 ppb	0.606 ppb	203.277 ppb	4.112 ppb	77.728 %	-0.001 ppb	0.027 ppb
Concentration per Run 1	18.929 ppb	76.035 %	0.764 ppb	-0.268 ppb	200.288 ppb	4.143 ppb	80.650 %	-0.006 ppb	0.032 ppb
Concentration per Run 2	19.325 ppb	75.542 %	0.742 ppb	1.155 ppb	203.353 ppb	4.059 ppb	76.555 %	0.004 ppb	0.020 ppb
Concentration per Run 3	20.162 ppb	74.791 %	0.895 ppb	0.931 ppb	206.189 ppb	4.135 ppb	75.978 %	-0.001 ppb	0.028 ppb
Concentration RSD	3.2 %	0.8 %	10.3 %	126.3 %	1.5 %	1.1 %	3.3 %	372.1 %	22.8 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	76.152 %	0.389 ppb	0.505 ppb	118.671 ppb	82.463 %	80.883 %	0.003 ppb	3.403 ppb	89.947 %
Concentration per Run 1	78.772 %	0.374 ppb	0.528 ppb	117.421 ppb	84.830 %	83.207 %	0.005 ppb	3.212 ppb	94.920 %
Concentration per Run 2	75.754 %	0.435 ppb	0.523 ppb	120.286 ppb	81.983 %	80.540 %	0.001 ppb	3.472 ppb	87.993 %
Concentration per Run 3	73.931 %	0.359 ppb	0.464 ppb	118.305 ppb	80.575 %	78.904 %	0.002 ppb	3.525 ppb	86.928 %
Concentration RSD	3.2 %	10.3 %	7.0 %	1.2 %	2.6 %	2.7 %	63.2 %	4.9 %	4.8 %

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Analysis index: 62 Analysis started at: 6/7/2017 11:43:41 AM Rack: 1
 Analysis label: L1718631-01 2008TL User name: ALPHALAB\metals-instrument Vial: 43

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	77.518 %	79.932 %	0.043 ppb	214,867.302 ppb	12,314.979 ppb	104.789 ppb	5,395.076 ppb	41,108.939 ppb	78.407 %
Concentration per Run 1	77.515 %	83.712 %	0.082 ppb	211,156.525 ppb	11,614.070 ppb	102.420 ppb	5,374.862 ppb	41,110.947 ppb	77.829 %
Concentration per Run 2	78.013 %	76.889 %	0.026 ppb	222,743.530 ppb	12,964.038 ppb	102.798 ppb	5,266.395 ppb	40,932.695 ppb	77.829 %
Concentration per Run 3	77.027 %	79.194 %	0.022 ppb	210,701.852 ppb	12,366.830 ppb	109.151 ppb	5,543.971 ppb	41,283.174 ppb	79.563 %
Concentration RSD	0.6 %	4.3 %	77.1 %	3.2 %	5.5 %	3.6 %	2.6 %	0.4 %	1.3 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	78.014 %	56.458 ppb	0.374 ppb	0.248 ppb	3,377.129 ppb	3,677.159 ppb	0.109 ppb	0.534 ppb	2.178 ppb
Concentration per Run 1	76.294 %	52.631 ppb	0.418 ppb	0.306 ppb	3,343.586 ppb	3,530.309 ppb	0.109 ppb	0.447 ppb	2.189 ppb
Concentration per Run 2	79.890 %	58.801 ppb	0.332 ppb	0.220 ppb	3,357.542 ppb	3,726.167 ppb	0.137 ppb	0.297 ppb	2.494 ppb
Concentration per Run 3	77.858 %	57.943 ppb	0.371 ppb	0.217 ppb	3,430.258 ppb	3,775.000 ppb	0.082 ppb	0.856 ppb	1.850 ppb
Concentration RSD	2.3 %	5.9 %	11.4 %	20.2 %	1.4 %	3.5 %	25.0 %	54.3 %	14.8 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	12.111 ppb	75.775 %	0.166 ppb	0.064 ppb	265.408 ppb	0.790 ppb	75.350 %	0.000 ppb	0.014 ppb
Concentration per Run 1	12.067 ppb	76.656 %	0.164 ppb	0.297 ppb	260.990 ppb	0.522 ppb	75.915 %	0.004 ppb	0.007 ppb
Concentration per Run 2	11.483 ppb	76.371 %	0.079 ppb	-0.218 ppb	268.648 ppb	1.057 ppb	75.324 %	-0.004 ppb	0.007 ppb
Concentration per Run 3	12.782 ppb	74.299 %	0.257 ppb	0.114 ppb	266.586 ppb	0.790 ppb	74.809 %	-0.001 ppb	0.028 ppb
Concentration RSD	5.4 %	1.7 %	53.5 %	406.6 %	1.5 %	33.8 %	0.7 %	863.7 %	87.1 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	74.864 %	0.306 ppb	0.275 ppb	33.142 ppb	81.598 %	79.572 %	0.002 ppb	0.629 ppb	87.146 %
Concentration per Run 1	74.270 %	0.355 ppb	0.327 ppb	34.488 ppb	82.131 %	80.089 %	0.003 ppb	0.595 ppb	89.267 %
Concentration per Run 2	75.872 %	0.277 ppb	0.208 ppb	32.093 ppb	81.063 %	79.390 %	0.000 ppb	0.666 ppb	86.865 %
Concentration per Run 3	74.449 %	0.286 ppb	0.291 ppb	32.844 ppb	81.599 %	79.236 %	0.003 ppb	0.627 ppb	85.306 %
Concentration RSD	1.2 %	14.0 %	22.3 %	3.7 %	0.7 %	0.6 %	78.1 %	5.7 %	2.3 %

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Analysis index: 63 Analysis started at: 6/7/2017 11:47:03 AM Rack: 1
Analysis label: L1718631-02 2008TL User name: ALPHALAB\metals-instrument Vial: 44

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	79.921 %	82.759 %	0.010 ppb	211,083.674 ppb	12,274.458 ppb	7.806 ppb	5,404.094 ppb	41,410.428 ppb	77.339 %
Concentration per Run 1	80.686 %	86.846 %	0.004 ppb	207,019.436 ppb	12,047.144 ppb	8.064 ppb	5,369.541 ppb	41,228.914 ppb	76.674 %
Concentration per Run 2	80.058 %	81.222 %	0.009 ppb	212,378.339 ppb	12,492.693 ppb	8.223 ppb	5,381.941 ppb	41,702.156 ppb	75.938 %
Concentration per Run 3	79.020 %	80.208 %	0.017 ppb	213,853.246 ppb	12,283.537 ppb	7.131 ppb	5,460.801 ppb	41,300.213 ppb	79.405 %
Concentration RSD	1.1 %	4.3 %	65.8 %	1.7 %	1.8 %	7.6 %	0.9 %	0.6 %	2.4 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	80.531 %	52.631 ppb	0.375 ppb	0.374 ppb	3,746.476 ppb	26.313 ppb	0.127 ppb	0.998 ppb	8.208 ppb
Concentration per Run 1	80.676 %	52.970 ppb	0.509 ppb	0.396 ppb	3,749.241 ppb	28.127 ppb	0.137 ppb	0.858 ppb	9.085 ppb
Concentration per Run 2	80.485 %	52.749 ppb	0.207 ppb	0.456 ppb	3,805.355 ppb	19.352 ppb	0.137 ppb	1.358 ppb	7.650 ppb
Concentration per Run 3	80.432 %	52.176 ppb	0.409 ppb	0.269 ppb	3,684.831 ppb	31.459 ppb	0.106 ppb	0.777 ppb	7.890 ppb
Concentration RSD	0.2 %	0.8 %	41.0 %	25.6 %	1.6 %	23.8 %	13.9 %	31.6 %	9.4 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	15.251 ppb	77.926 %	0.096 ppb	0.344 ppb	261.840 ppb	0.468 ppb	78.003 %	-0.003 ppb	0.031 ppb
Concentration per Run 1	15.980 ppb	76.812 %	0.050 ppb	0.729 ppb	255.356 ppb	0.486 ppb	79.076 %	-0.004 ppb	0.020 ppb
Concentration per Run 2	15.425 ppb	78.159 %	0.160 ppb	0.551 ppb	268.215 ppb	0.449 ppb	77.702 %	-0.001 ppb	0.055 ppb
Concentration per Run 3	14.347 ppb	78.807 %	0.076 ppb	-0.248 ppb	261.950 ppb	0.470 ppb	77.232 %	-0.004 ppb	0.020 ppb
Concentration RSD	5.4 %	1.3 %	60.4 %	151.2 %	2.5 %	4.0 %	1.2 %	47.6 %	63.9 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	76.686 %	0.273 ppb	0.238 ppb	32.085 ppb	84.048 %	82.189 %	0.001 ppb	0.611 ppb	88.421 %
Concentration per Run 1	76.668 %	0.286 ppb	0.247 ppb	33.211 ppb	84.692 %	82.687 %	0.002 ppb	0.605 ppb	90.376 %
Concentration per Run 2	74.378 %	0.218 ppb	0.202 ppb	31.561 ppb	81.713 %	80.440 %	0.002 ppb	0.620 ppb	86.550 %
Concentration per Run 3	79.013 %	0.314 ppb	0.265 ppb	31.483 ppb	85.739 %	83.439 %	0.001 ppb	0.609 ppb	88.337 %
Concentration RSD	3.0 %	18.2 %	13.5 %	3.0 %	2.5 %	1.9 %	65.5 %	1.2 %	2.2 %

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Analysis index: 64 Analysis started at: 6/7/2017 11:50:25 AM Rack: 1
Analysis label: L1718631-03 2008TL User name: ALPHALAB\metals-instrument Vial: 45

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	108.679 %	93.362 %	0.017 ppb	7,366,684.906 ppb	830,139.047 ppb	214.717 ppb	301,912.598 ppb	308,657.360 ppb	54.700 %
Concentration per Run 1	110.935 %	88.045 %	0.012 ppb	7,535,041.203 ppb	847,776.826 ppb	217.180 ppb	315,584.610 ppb	305,471.854 ppb	50.726 %
Concentration per Run 2	107.823 %	92.747 %	0.018 ppb	7,224,869.440 ppb	826,855.206 ppb	203.699 ppb	302,487.670 ppb	317,767.431 ppb	51.776 %
Concentration per Run 3	107.277 %	99.293 %	0.022 ppb	7,340,144.075 ppb	815,785.108 ppb	223.272 ppb	287,665.512 ppb	302,732.796 ppb	61.598 %
Concentration RSD	1.8 %	6.1 %	29.8 %	2.1 %	2.0 %	4.7 %	4.6 %	2.6 %	11.0 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	115.165 %	328.352 ppb	2.927 ppb	1.009 ppb	93.855 ppb	494.957 ppb	0.232 ppb	1.117 ppb	3.249 ppb
Concentration per Run 1	117.782 %	322.478 ppb	2.557 ppb	0.959 ppb	93.727 ppb	485.710 ppb	0.258 ppb	1.143 ppb	3.719 ppb
Concentration per Run 2	114.413 %	342.229 ppb	2.982 ppb	1.014 ppb	89.789 ppb	492.116 ppb	0.185 ppb	1.138 ppb	3.254 ppb
Concentration per Run 3	113.299 %	320.349 ppb	3.243 ppb	1.055 ppb	98.050 ppb	507.045 ppb	0.252 ppb	1.071 ppb	2.774 ppb
Concentration RSD	2.0 %	3.7 %	11.8 %	4.8 %	4.4 %	2.2 %	17.5 %	3.6 %	14.5 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	14.363 ppb	85.509 %	2.039 ppb	0.403 ppb	4,658.572 ppb	6.803 ppb	78.115 %	0.028 ppb	0.053 ppb
Concentration per Run 1	15.268 ppb	80.829 %	2.204 ppb	0.371 ppb	4,559.936 ppb	7.222 ppb	77.558 %	0.022 ppb	0.043 ppb
Concentration per Run 2	13.648 ppb	85.986 %	1.898 ppb	0.914 ppb	4,519.445 ppb	6.234 ppb	77.461 %	0.026 ppb	0.075 ppb
Concentration per Run 3	14.173 ppb	89.712 %	2.015 ppb	-0.074 ppb	4,896.336 ppb	6.952 ppb	79.327 %	0.037 ppb	0.040 ppb
Concentration RSD	5.8 %	5.2 %	7.6 %	122.7 %	4.4 %	7.5 %	1.3 %	28.3 %	36.4 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	73.317 %	0.524 ppb	0.515 ppb	13.546 ppb	79.123 %	76.162 %	0.009 ppb	1.624 ppb	82.563 %
Concentration per Run 1	67.866 %	0.533 ppb	0.525 ppb	13.156 ppb	77.080 %	73.288 %	0.008 ppb	1.608 ppb	82.189 %
Concentration per Run 2	75.127 %	0.472 ppb	0.530 ppb	12.871 ppb	78.639 %	76.523 %	0.008 ppb	1.653 ppb	82.086 %
Concentration per Run 3	76.957 %	0.565 ppb	0.490 ppb	14.612 ppb	81.650 %	78.674 %	0.011 ppb	1.611 ppb	83.413 %
Concentration RSD	6.6 %	9.1 %	4.2 %	6.9 %	2.9 %	3.6 %	19.7 %	1.6 %	0.9 %

Alpha ICPMSQ Full

6/7/2017 3:54:49 PM



Analysis index: 65 Analysis started at: 6/7/2017 11:53:47 AM Rack: 0
 Analysis label: CCV User name: ALPHALAB\metals-instrument Vial: 9

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	103.087 %	108.236 %	100.751 ppb	10,930.941 ppb	10,674.002 ppb	108.669 ppb	10,898.609 ppb	10,743.694 ppb	113.137 %
Concentration per Run 1	103.733 %	112.939 %	100.393 ppb	9,972.618 ppb	10,420.637 ppb	112.931 ppb	10,694.958 ppb	10,570.323 ppb	126.694 %
Concentration per Run 2	103.470 %	107.499 %	100.435 ppb	11,368.360 ppb	11,040.185 ppb	110.807 ppb	11,038.920 ppb	10,787.811 ppb	107.777 %
Concentration per Run 3	102.057 %	104.272 %	101.425 ppb	11,451.845 ppb	10,561.186 ppb	102.270 ppb	10,961.949 ppb	10,872.947 ppb	104.939 %
Recovery Percentage 1			100.751 %	109.309 %	106.740 %	108.669 %	108.986 %	107.437 %	
Concentration RSD	0.9 %	4.0 %	0.6 %	7.6 %	3.0 %	5.2 %	1.7 %	1.5 %	10.5 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	106.084 %	103.394 ppb	94.655 ppb	96.591 ppb	103.502 ppb	9,859.788 ppb	95.873 ppb	94.480 ppb	95.747 ppb
Concentration per Run 1	107.202 %	100.520 ppb	88.656 ppb	90.504 ppb	96.341 ppb	9,309.266 ppb	90.327 ppb	88.173 ppb	86.656 ppb
Concentration per Run 2	107.156 %	106.769 ppb	100.929 ppb	99.838 ppb	106.849 ppb	9,985.686 ppb	98.741 ppb	94.095 ppb	97.158 ppb
Concentration per Run 3	103.894 %	102.894 ppb	94.379 ppb	99.431 ppb	107.317 ppb	10,284.412 ppb	98.552 ppb	101.173 ppb	103.427 ppb
Recovery Percentage 1		103.394 %	94.655 %	96.591 %	103.502 %	98.598 %	95.873 %	94.480 %	95.747 %
Concentration RSD	1.8 %	3.1 %	6.5 %	5.5 %	6.0 %	5.1 %	5.0 %	6.9 %	8.9 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	96.304 ppb	103.757 %	99.230 ppb	103.911 ppb	107.554 ppb	104.596 ppb	102.605 %	98.502 ppb	99.148 ppb
Concentration per Run 1	94.305 ppb	108.297 %	99.445 ppb	109.692 ppb	112.310 ppb	102.174 ppb	106.341 %	95.363 ppb	95.325 ppb
Concentration per Run 2	97.900 ppb	104.608 %	99.609 ppb	105.414 ppb	105.720 ppb	105.764 ppb	102.398 %	100.275 ppb	100.970 ppb
Concentration per Run 3	96.707 ppb	98.367 %	98.635 ppb	96.626 ppb	104.631 ppb	105.851 ppb	99.077 %	99.868 ppb	101.149 ppb
Recovery Percentage 1	96.304 %		99.230 %	103.911 %	107.554 %	104.596 %		98.502 %	99.148 %
Concentration RSD	1.9 %	4.8 %	0.5 %	6.4 %	3.9 %	2.0 %	3.5 %	2.8 %	3.3 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	103.039 %	99.514 ppb	104.563 ppb	103.101 ppb	101.473 %	100.196 %	102.690 ppb	106.005 ppb	101.111 %
Concentration per Run 1	109.990 %	95.344 ppb	99.452 ppb	100.990 ppb	104.437 %	105.046 %	102.001 ppb	103.622 ppb	104.644 %
Concentration per Run 2	102.124 %	102.208 ppb	106.253 ppb	105.726 ppb	100.966 %	98.751 %	103.335 ppb	107.063 ppb	99.510 %
Concentration per Run 3	97.003 %	100.990 ppb	107.985 ppb	102.587 ppb	99.016 %	96.791 %	102.733 ppb	107.331 ppb	99.179 %
Recovery Percentage 1		99.514 %	104.563 %	103.101 %			102.690 %	106.005 %	
Concentration RSD	6.3 %	3.7 %	4.3 %	2.3 %	2.7 %	4.3 %	0.7 %	2.0 %	3.0 %

Alpha ICPMSQ Full

6/7/2017 3:54:49 PM



Analysis index:	66	Analysis started at:	6/7/2017 11:57:12 AM	Rack:	0
Analysis label:	XCCB	User name:	ALPHALAB\metals-instrument	Vial:	10

Alpha ICPMSQ Full

6/7/2017 3:54:49 PM



Analysis index: 67 Analysis started at: 6/7/2017 12:08:24 PM Rack: 0
 Analysis label: CCB User name: ALPHALAB\metals-instrument Vial: 10

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	103.385 %	103.842 %	0.003 ppb	90.760 ppb	3.286 ppb	-0.056 ppb	15.190 ppb	3.751 ppb	97.548 %
Concentration per Run 1	106.569 %	101.045 %	-0.003 ppb	95.004 ppb	2.330 ppb	-0.463 ppb	18.363 ppb	3.454 ppb	101.838 %
Concentration per Run 2	101.468 %	105.470 %	0.021 ppb	85.975 ppb	3.684 ppb	-0.176 ppb	2.851 ppb	3.590 ppb	99.264 %
Concentration per Run 3	102.116 %	105.009 %	-0.009 ppb	91.299 ppb	3.844 ppb	0.470 ppb	24.357 ppb	4.207 ppb	91.541 %
Recovery Percentage 1			0.585 %	90.760 %	4.694 %	-0.565 %	15.190 %	3.751 %	
Concentration RSD	2.7 %	2.3 %	532.5 %	5.0 %	25.3 %	845.3 %	73.1 %	10.7 %	5.5 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	102.433 %	0.019 ppb	0.002 ppb	-0.012 ppb	0.040 ppb	1.199 ppb	0.004 ppb	-0.116 ppb	-0.024 ppb
Concentration per Run 1	106.721 %	0.016 ppb	-0.010 ppb	0.002 ppb	0.051 ppb	0.298 ppb	0.000 ppb	-0.170 ppb	-0.034 ppb
Concentration per Run 2	100.327 %	0.018 ppb	-0.010 ppb	-0.040 ppb	0.053 ppb	3.754 ppb	0.000 ppb	0.030 ppb	-0.034 ppb
Concentration per Run 3	100.252 %	0.022 ppb	0.026 ppb	0.002 ppb	0.017 ppb	-0.454 ppb	0.012 ppb	-0.209 ppb	-0.005 ppb
Recovery Percentage 1		3.789 %	0.035 %	-1.211 %	4.048 %	2.399 %	0.770 %	-5.800 %	-2.415 %
Concentration RSD	3.6 %	16.6 %	1,212.7 %	199.5 %	50.1 %	187.1 %	173.2 %	110.5 %	67.1 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	-0.074 ppb	95.135 %	0.024 ppb	0.326 ppb	0.013 ppb	0.067 ppb	96.607 %	0.008 ppb	0.004 ppb
Concentration per Run 1	-0.076 ppb	98.193 %	0.038 ppb	0.618 ppb	0.014 ppb	0.044 ppb	97.230 %	0.006 ppb	0.005 ppb
Concentration per Run 2	-0.036 ppb	96.483 %	0.016 ppb	0.294 ppb	0.022 ppb	0.078 ppb	96.499 %	0.010 ppb	0.000 ppb
Concentration per Run 3	-0.109 ppb	90.728 %	0.017 ppb	0.066 ppb	0.003 ppb	0.079 ppb	96.093 %	0.008 ppb	0.006 ppb
Recovery Percentage 1	-0.739 %	95.135 %	4.719 %	6.520 %	2.606 %	3.355 %		1.923 %	1.826 %
Concentration RSD	49.2 %	4.1 %	51.7 %	85.0 %	72.2 %	29.8 %	0.6 %	27.3 %	86.6 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	92.411 %	0.125 ppb	0.234 ppb	-0.009 ppb	94.623 %	90.967 %	0.006 ppb	0.016 ppb	90.635 %
Concentration per Run 1	93.920 %	0.110 ppb	0.192 ppb	-0.004 ppb	95.893 %	90.823 %	0.006 ppb	0.013 ppb	89.789 %
Concentration per Run 2	91.532 %	0.143 ppb	0.234 ppb	-0.018 ppb	93.699 %	91.543 %	0.006 ppb	0.019 ppb	90.581 %
Concentration per Run 3	91.780 %	0.124 ppb	0.277 ppb	-0.004 ppb	94.279 %	90.535 %	0.007 ppb	0.016 ppb	91.534 %
Recovery Percentage 1		4.183 %	5.857 %	-1.708 %			1.263 %	3.220 %	90.635 %
Concentration RSD	1.4 %	13.4 %	18.2 %	96.6 %	1.2 %	0.6 %	7.4 %	19.0 %	1.0 %

Alpha ICPMSQ Full

6/7/2017 3:54:49 PM



Analysis index: 68 Analysis started at: 6/7/2017 12:13:30 PM Rack: 1
 Analysis label: WG1008709-1 A2-MCP6020S-10 User name: ALPHALAB\metals-instrument Vial: 48

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	97.019 %	99.293 %	-0.003 ppb	100.782 ppb	0.992 ppb	0.234 ppb	23.039 ppb	1.601 ppb	94.115 %
Concentration per Run 1	98.866 %	95.236 %	-0.012 ppb	98.148 ppb	0.977 ppb	0.159 ppb	23.566 ppb	0.118 ppb	101.050 %
Concentration per Run 2	96.050 %	105.102 %	0.012 ppb	95.373 ppb	0.982 ppb	0.185 ppb	15.396 ppb	0.589 ppb	88.704 %
Concentration per Run 3	96.140 %	97.541 %	-0.009 ppb	108.824 ppb	1.017 ppb	0.359 ppb	30.156 ppb	4.096 ppb	92.592 %
Concentration RSD	1.6 %	5.2 %	439.0 %	7.0 %	2.2 %	46.6 %	32.1 %	135.8 %	6.7 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	97.108 %	-0.020 ppb	0.061 ppb	0.066 ppb	0.112 ppb	0.386 ppb	0.000 ppb	-0.125 ppb	0.030 ppb
Concentration per Run 1	98.080 %	0.017 ppb	0.056 ppb	0.036 ppb	0.091 ppb	1.167 ppb	0.000 ppb	-0.169 ppb	0.045 ppb
Concentration per Run 2	96.608 %	-0.038 ppb	0.101 ppb	0.089 ppb	0.145 ppb	-0.450 ppb	0.000 ppb	-0.123 ppb	0.050 ppb
Concentration per Run 3	96.638 %	-0.038 ppb	0.026 ppb	0.072 ppb	0.099 ppb	0.441 ppb	0.000 ppb	-0.082 ppb	-0.006 ppb
Concentration RSD	0.9 %	160.8 %	62.2 %	40.8 %	25.9 %	209.8 %		34.8 %	104.0 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	0.070 ppb	94.061 %	0.032 ppb	-0.153 ppb	0.012 ppb	0.046 ppb	92.865 %	0.003 ppb	0.002 ppb
Concentration per Run 1	0.032 ppb	96.146 %	0.016 ppb	0.538 ppb	0.016 ppb	0.028 ppb	94.495 %	0.006 ppb	0.006 ppb
Concentration per Run 2	0.034 ppb	93.787 %	-0.007 ppb	-0.797 ppb	0.003 ppb	0.115 ppb	93.129 %	0.002 ppb	0.000 ppb
Concentration per Run 3	0.144 ppb	92.251 %	0.088 ppb	-0.199 ppb	0.018 ppb	-0.005 ppb	90.971 %	0.000 ppb	0.000 ppb
Concentration RSD	91.3 %	2.1 %	152.4 %	437.9 %	66.3 %	135.0 %	1.9 %	115.5 %	173.2 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	89.760 %	0.222 ppb	0.219 ppb	0.001 ppb	93.333 %	90.214 %	0.000 ppb	0.023 ppb	103.284 %
Concentration per Run 1	91.563 %	0.236 ppb	0.182 ppb	0.011 ppb	94.726 %	90.386 %	-0.001 ppb	0.022 ppb	107.214 %
Concentration per Run 2	88.702 %	0.173 ppb	0.219 ppb	-0.018 ppb	93.164 %	90.609 %	0.000 ppb	0.025 ppb	101.968 %
Concentration per Run 3	89.016 %	0.255 ppb	0.256 ppb	0.012 ppb	92.111 %	89.648 %	0.001 ppb	0.022 ppb	100.670 %
Concentration RSD	1.7 %	19.3 %	16.8 %	1,182.8 %	1.4 %	0.6 %	606.7 %	8.4 %	3.4 %

Alpha ICPMSQ Full

6/7/2017 3:54:49 PM



Analysis index: 69 Analysis started at: 6/7/2017 12:16:53 PM Rack: 1
 Analysis label: WG1008709-2D5 A2-MCP6020S-10 User name: ALPHALAB\metals-instrument Vial: 49

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	99.388 %	98.433 %	10.500 ppb	2,246.336 ppb	2,239.217 ppb	612.312 ppb	2,110.694 ppb	2,228.367 ppb	96.900 %
Concentration per Run 1	99.766 %	102.889 %	10.323 ppb	2,219.335 ppb	2,127.711 ppb	588.877 ppb	2,086.345 ppb	2,111.767 ppb	99.684 %
Concentration per Run 2	100.050 %	94.407 %	10.639 ppb	2,281.401 ppb	2,322.129 ppb	623.397 ppb	2,147.680 ppb	2,359.248 ppb	95.113 %
Concentration per Run 3	98.346 %	98.002 %	10.539 ppb	2,238.271 ppb	2,267.811 ppb	624.661 ppb	2,098.055 ppb	2,214.086 ppb	95.902 %
Concentration RSD	0.9 %	4.3 %	1.5 %	1.4 %	4.5 %	3.3 %	1.5 %	5.6 %	2.5 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	99.644 %	190.904 ppb	105.308 ppb	40.971 ppb	105.466 ppb	227.026 ppb	99.972 ppb	101.059 ppb	51.237 ppb
Concentration per Run 1	99.874 %	186.435 ppb	102.858 ppb	39.817 ppb	101.019 ppb	197.685 ppb	94.498 ppb	100.491 ppb	50.457 ppb
Concentration per Run 2	100.979 %	193.266 ppb	105.397 ppb	41.954 ppb	106.251 ppb	234.572 ppb	102.451 ppb	101.111 ppb	50.462 ppb
Concentration per Run 3	98.078 %	193.011 ppb	107.667 ppb	41.142 ppb	109.129 ppb	248.820 ppb	102.968 ppb	101.576 ppb	52.794 ppb
Concentration RSD	1.5 %	2.0 %	2.3 %	2.6 %	3.9 %	11.6 %	4.7 %	0.5 %	2.6 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	104.727 ppb	93.728 %	26.006 ppb	25.062 ppb	212.472 ppb	202.148 ppb	94.258 %	10.325 ppb	10.965 ppb
Concentration per Run 1	105.009 ppb	94.929 %	25.014 ppb	25.828 ppb	207.205 ppb	196.244 ppb	96.442 %	10.082 ppb	10.888 ppb
Concentration per Run 2	103.107 ppb	94.547 %	26.637 ppb	25.696 ppb	212.314 ppb	202.795 ppb	93.274 %	10.194 ppb	10.905 ppb
Concentration per Run 3	106.064 ppb	91.710 %	26.367 ppb	23.664 ppb	217.897 ppb	207.404 ppb	93.059 %	10.699 ppb	11.101 ppb
Concentration RSD	1.4 %	1.9 %	3.3 %	4.8 %	2.5 %	2.8 %	2.0 %	3.2 %	1.1 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	92.303 %	199.659 ppb	98.674 ppb	417.949 ppb	93.298 %	90.762 %	25.745 ppb	112.392 ppb	95.567 %
Concentration per Run 1	94.171 %	193.453 ppb	93.119 ppb	413.649 ppb	95.993 %	93.310 %	25.250 ppb	109.583 ppb	99.106 %
Concentration per Run 2	90.928 %	202.655 ppb	99.592 ppb	423.627 ppb	91.268 %	89.037 %	25.899 ppb	113.624 ppb	93.054 %
Concentration per Run 3	91.810 %	202.870 ppb	103.311 ppb	416.570 ppb	92.631 %	89.939 %	26.084 ppb	113.970 ppb	94.540 %
Concentration RSD	1.8 %	2.7 %	5.2 %	1.2 %	2.6 %	2.5 %	1.7 %	2.2 %	3.3 %

Alpha ICPMSQ Full

6/7/2017 3:54:49 PM



Analysis index: 70 Analysis started at: 6/7/2017 12:20:14 PM Rack: 1
 Analysis label: WG1008709-3D5 A2-MCP6020S-10 User name: ALPHALAB\metals-instrument Vial: 50

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	97.445 %	98.002 %	10.542 ppb	2,225.966 ppb	2,200.409 ppb	456.228 ppb	2,196.432 ppb	2,217.580 ppb	96.514 %
Concentration per Run 1	99.579 %	101.506 %	10.435 ppb	2,156.494 ppb	2,152.386 ppb	425.793 ppb	2,199.807 ppb	2,243.600 ppb	99.211 %
Concentration per Run 2	97.056 %	97.634 %	10.614 ppb	2,240.209 ppb	2,238.853 ppb	474.839 ppb	2,248.096 ppb	2,229.980 ppb	94.220 %
Concentration per Run 3	95.701 %	94.868 %	10.577 ppb	2,281.196 ppb	2,209.989 ppb	468.052 ppb	2,141.394 ppb	2,179.159 ppb	96.112 %
Concentration RSD	2.0 %	3.4 %	0.9 %	2.9 %	2.0 %	5.8 %	2.4 %	1.5 %	2.6 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	97.669 %	183.412 ppb	100.205 ppb	41.282 ppb	104.323 ppb	215.731 ppb	99.303 ppb	97.149 ppb	50.063 ppb
Concentration per Run 1	101.475 %	179.138 ppb	93.597 ppb	40.636 ppb	102.014 ppb	203.037 ppb	95.042 ppb	93.979 ppb	45.995 ppb
Concentration per Run 2	96.063 %	186.098 ppb	104.567 ppb	41.428 ppb	109.870 ppb	245.281 ppb	102.538 ppb	100.552 ppb	53.531 ppb
Concentration per Run 3	95.468 %	185.000 ppb	102.453 ppb	41.781 ppb	101.086 ppb	198.877 ppb	100.328 ppb	96.917 ppb	50.664 ppb
Concentration RSD	3.4 %	2.0 %	5.8 %	1.4 %	4.6 %	11.9 %	3.9 %	3.4 %	7.6 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	102.067 ppb	92.985 %	24.679 ppb	26.082 ppb	210.803 ppb	200.602 ppb	94.097 %	10.133 ppb	11.323 ppb
Concentration per Run 1	99.015 ppb	93.380 %	24.691 ppb	25.040 ppb	207.576 ppb	195.763 ppb	96.557 %	9.775 ppb	11.058 ppb
Concentration per Run 2	105.050 ppb	94.074 %	24.114 ppb	27.150 ppb	208.222 ppb	200.138 ppb	92.341 %	10.358 ppb	11.556 ppb
Concentration per Run 3	102.136 ppb	91.502 %	25.233 ppb	26.057 ppb	216.611 ppb	205.907 ppb	93.394 %	10.266 ppb	11.355 ppb
Concentration RSD	3.0 %	1.4 %	2.3 %	4.0 %	2.4 %	2.5 %	2.3 %	3.1 %	2.2 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	91.260 %	201.373 ppb	106.830 ppb	419.294 ppb	93.313 %	91.457 %	24.776 ppb	111.443 ppb	98.308 %
Concentration per Run 1	92.774 %	195.780 ppb	100.583 ppb	411.500 ppb	95.010 %	92.740 %	24.536 ppb	109.160 ppb	100.059 %
Concentration per Run 2	89.799 %	203.407 ppb	110.212 ppb	423.595 ppb	91.887 %	90.438 %	25.029 ppb	111.787 ppb	97.194 %
Concentration per Run 3	91.205 %	204.934 ppb	109.695 ppb	422.787 ppb	93.044 %	91.194 %	24.764 ppb	113.383 ppb	97.670 %
Concentration RSD	1.6 %	2.4 %	5.1 %	1.6 %	1.7 %	1.3 %	1.0 %	1.9 %	1.6 %

Alpha ICPMSQ Full

6/7/2017 3:54:49 PM



Analysis index: 71 Analysis started at: 6/7/2017 12:23:35 PM Rack: 1
 Analysis label: L1717997-01 CT-6020TL User name: ALPHALAB\metals-instrument Vial: 21

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	91.409 %	93.669 %	0.057 ppb	58,386.692 ppb	4,392.631 ppb	885.627 ppb	2,228.270 ppb	17,605.086 ppb	92.066 %
Concentration per Run 1	91.165 %	92.839 %	0.072 ppb	56,619.799 ppb	4,325.134 ppb	864.701 ppb	2,077.859 ppb	16,862.073 ppb	96.269 %
Concentration per Run 2	92.959 %	93.669 %	0.052 ppb	59,571.469 ppb	4,565.416 ppb	915.065 ppb	2,419.732 ppb	18,263.246 ppb	89.860 %
Concentration per Run 3	90.102 %	94.499 %	0.047 ppb	58,968.807 ppb	4,287.342 ppb	877.116 ppb	2,187.219 ppb	17,689.939 ppb	90.070 %
Concentration RSD	1.6 %	0.9 %	23.1 %	2.7 %	3.4 %	3.0 %	7.8 %	4.0 %	4.0 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	91.977 %	37.028 ppb	0.807 ppb	0.653 ppb	43.602 ppb	346.690 ppb	1.665 ppb	0.640 ppb	1.830 ppb
Concentration per Run 1	90.415 %	34.963 ppb	0.586 ppb	0.559 ppb	42.124 ppb	300.789 ppb	1.476 ppb	0.634 ppb	1.647 ppb
Concentration per Run 2	93.474 %	38.939 ppb	1.105 ppb	0.659 ppb	43.223 ppb	378.769 ppb	1.792 ppb	0.539 ppb	1.906 ppb
Concentration per Run 3	92.042 %	37.181 ppb	0.729 ppb	0.741 ppb	45.460 ppb	360.511 ppb	1.728 ppb	0.748 ppb	1.938 ppb
Concentration RSD	1.7 %	5.4 %	33.2 %	14.0 %	3.9 %	11.8 %	10.0 %	16.4 %	8.7 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	305.956 ppb	88.515 %	0.206 ppb	1.012 ppb	95.504 ppb	1.608 ppb	89.286 %	0.006 ppb	1.181 ppb
Concentration per Run 1	299.407 ppb	88.934 %	0.213 ppb	1.714 ppb	93.805 ppb	1.240 ppb	90.796 %	0.013 ppb	1.031 ppb
Concentration per Run 2	315.150 ppb	87.515 %	0.192 ppb	0.267 ppb	96.628 ppb	1.735 ppb	90.279 %	0.002 ppb	1.366 ppb
Concentration per Run 3	303.311 ppb	89.096 %	0.213 ppb	1.054 ppb	96.078 ppb	1.850 ppb	86.784 %	0.002 ppb	1.146 ppb
Concentration RSD	2.7 %	1.0 %	6.0 %	71.6 %	1.6 %	20.2 %	2.4 %	104.2 %	14.4 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	86.013 %	2.773 ppb	6.422 ppb	137.499 ppb	90.260 %	87.761 %	0.047 ppb	0.979 ppb	99.067 %
Concentration per Run 1	85.867 %	3.002 ppb	6.261 ppb	137.104 ppb	90.518 %	88.323 %	0.038 ppb	0.931 ppb	103.015 %
Concentration per Run 2	86.726 %	2.856 ppb	6.574 ppb	135.939 ppb	90.078 %	87.889 %	0.050 ppb	0.995 ppb	100.187 %
Concentration per Run 3	85.447 %	2.460 ppb	6.431 ppb	139.455 ppb	90.185 %	87.071 %	0.054 ppb	1.010 ppb	93.998 %
Concentration RSD	0.8 %	10.1 %	2.4 %	1.3 %	0.3 %	0.7 %	18.4 %	4.3 %	4.7 %

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Analysis index: 72 Analysis started at: 6/7/2017 12:26:57 PM Rack: 1
 Analysis label: L1718218-01 CT-6020TL User name: ALPHALAB\metals-instrument Vial: 22

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	96.496 %	97.480 %	0.011 ppb	43,705.451 ppb	60,745.447 ppb	32.511 ppb	23,183.639 ppb	217,308.513 ppb	104.466 %
Concentration per Run 1	96.899 %	92.102 %	0.022 ppb	44,045.397 ppb	61,011.126 ppb	31.096 ppb	23,260.736 ppb	219,933.492 ppb	96.689 %
Concentration per Run 2	96.328 %	96.896 %	-0.002 ppb	43,855.896 ppb	59,518.695 ppb	31.277 ppb	22,398.122 ppb	214,092.802 ppb	99.264 %
Concentration per Run 3	96.260 %	103.442 %	0.012 ppb	43,215.060 ppb	61,706.520 ppb	35.162 ppb	23,892.058 ppb	217,899.244 ppb	117.445 %
Concentration RSD	0.4 %	5.8 %	112.0 %	1.0 %	1.8 %	7.1 %	3.2 %	1.4 %	10.8 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	97.557 %	297.607 ppb	0.699 ppb	0.245 ppb	4,758.464 ppb	15,243.420 ppb	7.014 ppb	2.319 ppb	6.294 ppb
Concentration per Run 1	98.785 %	295.762 ppb	0.780 ppb	0.201 ppb	4,752.999 ppb	15,337.167 ppb	6.886 ppb	1.884 ppb	5.479 ppb
Concentration per Run 2	96.659 %	304.071 ppb	0.802 ppb	0.321 ppb	4,847.213 ppb	15,526.585 ppb	7.040 ppb	2.660 ppb	6.439 ppb
Concentration per Run 3	97.227 %	292.988 ppb	0.515 ppb	0.214 ppb	4,675.180 ppb	14,866.509 ppb	7.115 ppb	2.413 ppb	6.964 ppb
Concentration RSD	1.1 %	1.9 %	22.9 %	26.8 %	1.8 %	2.2 %	1.7 %	17.1 %	12.0 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	2.365 ppb	96.969 %	1.025 ppb	0.479 ppb	1,119.747 ppb	1.659 ppb	91.544 %	0.003 ppb	0.048 ppb
Concentration per Run 1	2.445 ppb	96.943 %	0.960 ppb	0.344 ppb	1,054.181 ppb	1.646 ppb	91.992 %	-0.004 ppb	0.023 ppb
Concentration per Run 2	2.047 ppb	93.827 %	0.946 ppb	0.035 ppb	1,082.125 ppb	1.730 ppb	89.503 %	0.002 ppb	0.047 ppb
Concentration per Run 3	2.603 ppb	100.138 %	1.170 ppb	1.058 ppb	1,222.935 ppb	1.600 ppb	93.138 %	0.010 ppb	0.075 ppb
Concentration RSD	12.1 %	3.3 %	12.2 %	109.6 %	8.1 %	4.0 %	2.0 %	272.6 %	53.7 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	91.348 %	1.008 ppb	1.826 ppb	100.879 ppb	92.031 %	92.981 %	0.257 ppb	0.112 ppb	96.486 %
Concentration per Run 1	89.287 %	0.946 ppb	1.770 ppb	95.817 ppb	94.396 %	90.968 %	0.246 ppb	0.107 ppb	98.316 %
Concentration per Run 2	86.266 %	1.038 ppb	1.914 ppb	99.860 ppb	92.541 %	89.317 %	0.260 ppb	0.116 ppb	95.198 %
Concentration per Run 3	98.492 %	1.040 ppb	1.795 ppb	106.961 ppb	89.157 %	98.660 %	0.266 ppb	0.114 ppb	95.945 %
Concentration RSD	7.0 %	5.3 %	4.2 %	5.6 %	2.9 %	5.4 %	4.1 %	4.3 %	1.7 %

Alpha ICPMSQ Full

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Analysis index: 73 Analysis started at: 6/7/2017 12:30:20 PM Rack: 1
 Analysis label: L1718218-02 CT-6020TL User name: ALPHALAB\metals-instrument Vial: 23

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	91.956 %	95.790 %	0.005 ppb	9,406.322 ppb	4,110.204 ppb	47.994 ppb	2,224.572 ppb	25,207.562 ppb	99.387 %
Concentration per Run 1	93.246 %	93.485 %	0.002 ppb	9,155.662 ppb	3,978.819 ppb	44.001 ppb	2,068.934 ppb	23,376.973 ppb	100.210 %
Concentration per Run 2	91.912 %	104.180 %	0.010 ppb	9,505.174 ppb	4,223.673 ppb	50.111 ppb	2,320.535 ppb	27,363.082 ppb	107.724 %
Concentration per Run 3	90.710 %	89.705 %	0.002 ppb	9,558.130 ppb	4,128.120 ppb	49.872 ppb	2,284.248 ppb	24,882.630 ppb	90.227 %
Concentration RSD	1.4 %	7.8 %	90.0 %	2.3 %	3.0 %	7.2 %	6.1 %	8.0 %	8.8 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	92.011 %	35.496 ppb	0.542 ppb	0.255 ppb	12.368 ppb	115.234 ppb	0.079 ppb	0.145 ppb	0.858 ppb
Concentration per Run 1	93.786 %	30.847 ppb	0.360 ppb	0.285 ppb	12.902 ppb	103.985 ppb	0.055 ppb	0.277 ppb	0.935 ppb
Concentration per Run 2	90.964 %	37.041 ppb	0.425 ppb	0.193 ppb	12.770 ppb	124.652 ppb	0.040 ppb	0.235 ppb	0.749 ppb
Concentration per Run 3	91.284 %	38.601 ppb	0.841 ppb	0.287 ppb	11.433 ppb	117.066 ppb	0.142 ppb	-0.077 ppb	0.890 ppb
Concentration RSD	1.7 %	11.6 %	48.2 %	21.1 %	6.6 %	9.1 %	70.0 %	133.5 %	11.3 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	1.227 ppb	94.461 %	0.087 ppb	0.793 ppb	81.226 ppb	0.369 ppb	92.322 %	0.001 ppb	0.004 ppb
Concentration per Run 1	1.329 ppb	92.647 %	0.181 ppb	1.120 ppb	76.522 ppb	0.405 ppb	94.560 %	0.004 ppb	0.000 ppb
Concentration per Run 2	1.209 ppb	103.015 %	0.036 ppb	0.895 ppb	86.761 ppb	0.330 ppb	93.134 %	0.002 ppb	0.005 ppb
Concentration per Run 3	1.142 ppb	87.722 %	0.043 ppb	0.363 ppb	80.396 ppb	0.374 ppb	89.272 %	-0.002 ppb	0.006 ppb
Concentration RSD	7.7 %	8.3 %	94.7 %	49.1 %	6.4 %	10.2 %	3.0 %	262.5 %	86.9 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	93.000 %	0.749 ppb	0.862 ppb	20.777 ppb	88.476 %	92.436 %	0.006 ppb	0.058 ppb	100.935 %
Concentration per Run 1	92.768 %	0.562 ppb	0.686 ppb	19.305 ppb	94.324 %	92.815 %	0.006 ppb	0.058 ppb	106.102 %
Concentration per Run 2	99.142 %	1.015 ppb	0.864 ppb	21.877 ppb	88.553 %	96.541 %	0.007 ppb	0.059 ppb	100.910 %
Concentration per Run 3	87.090 %	0.669 ppb	1.035 ppb	21.150 ppb	82.552 %	87.952 %	0.004 ppb	0.056 ppb	95.793 %
Concentration RSD	6.5 %	31.6 %	20.3 %	6.4 %	6.7 %	4.7 %	26.4 %	2.9 %	5.1 %

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6/7/2017 3:54:49 PM



Analysis index: 74 Analysis started at: 6/7/2017 12:33:43 PM Rack: 1
Analysis label: L1718218-03 CT-6020TL User name: ALPHALAB\metals-instrument Vial: 24

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	93.925 %	99.201 %	0.015 ppb	33,125.883 ppb	28,115.389 ppb	6.169 ppb	16,734.567 ppb	225,070.289 ppb	97.460 %
Concentration per Run 1	95.745 %	110.265 %	0.005 ppb	32,038.824 ppb	27,255.816 ppb	8.229 ppb	17,226.231 ppb	225,598.007 ppb	107.356 %
Concentration per Run 2	93.476 %	98.648 %	0.009 ppb	32,638.147 ppb	27,894.198 ppb	3.987 ppb	15,744.456 ppb	217,298.833 ppb	95.954 %
Concentration per Run 3	92.555 %	88.690 %	0.031 ppb	34,700.679 ppb	29,196.153 ppb	6.292 ppb	17,233.015 ppb	232,314.027 ppb	89.071 %
Concentration RSD	1.7 %	10.9 %	91.8 %	4.2 %	3.5 %	34.4 %	5.1 %	3.3 %	9.5 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	94.262 %	297.017 ppb	0.886 ppb	0.317 ppb	4.775 ppb	17.214 ppb	0.150 ppb	0.240 ppb	3.551 ppb
Concentration per Run 1	95.692 %	294.428 ppb	0.993 ppb	0.290 ppb	4.505 ppb	12.266 ppb	0.152 ppb	0.167 ppb	3.229 ppb
Concentration per Run 2	92.559 %	296.094 ppb	0.967 ppb	0.334 ppb	4.589 ppb	18.142 ppb	0.156 ppb	0.412 ppb	3.407 ppb
Concentration per Run 3	94.535 %	300.529 ppb	0.699 ppb	0.327 ppb	5.230 ppb	21.233 ppb	0.142 ppb	0.142 ppb	4.015 ppb
Concentration RSD	1.7 %	1.1 %	18.4 %	7.5 %	8.3 %	26.5 %	4.9 %	62.2 %	11.6 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	0.449 ppb	93.939 %	0.220 ppb	6.239 ppb	811.679 ppb	0.777 ppb	90.156 %	-0.004 ppb	0.023 ppb
Concentration per Run 1	0.561 ppb	100.443 %	0.167 ppb	6.430 ppb	840.145 ppb	0.732 ppb	94.018 %	-0.004 ppb	0.021 ppb
Concentration per Run 2	0.338 ppb	92.459 %	0.205 ppb	4.834 ppb	794.894 ppb	0.777 ppb	89.482 %	-0.002 ppb	0.023 ppb
Concentration per Run 3	0.448 ppb	88.914 %	0.287 ppb	7.452 ppb	799.998 ppb	0.821 ppb	86.968 %	-0.006 ppb	0.024 ppb
Concentration RSD	24.8 %	6.3 %	27.9 %	21.1 %	3.1 %	5.7 %	4.0 %	49.6 %	6.3 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	91.910 %	0.475 ppb	0.666 ppb	168.238 ppb	93.151 %	92.424 %	0.043 ppb	0.033 ppb	96.435 %
Concentration per Run 1	99.592 %	0.448 ppb	0.642 ppb	164.195 ppb	95.672 %	96.724 %	0.034 ppb	0.038 ppb	100.856 %
Concentration per Run 2	90.317 %	0.369 ppb	0.586 ppb	170.428 ppb	92.378 %	92.205 %	0.047 ppb	0.031 ppb	95.513 %
Concentration per Run 3	85.821 %	0.609 ppb	0.770 ppb	170.091 ppb	91.402 %	88.343 %	0.047 ppb	0.031 ppb	92.936 %
Concentration RSD	7.6 %	25.8 %	14.1 %	2.1 %	2.4 %	4.5 %	17.6 %	11.7 %	4.2 %

Alpha ICPMSQ Full

6/7/2017 3:54:49 PM



Analysis index: 75 Analysis started at: 6/7/2017 12:37:06 PM Rack: 1
Analysis label: L1718218-04 CT-6020TL User name: ALPHALAB\metals-instrument Vial: 25

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	89.592 %	96.281 %	0.040 ppb	6,085.023 ppb	3,792.870 ppb	30.223 ppb	543.024 ppb	38,107.078 ppb	90.525 %
Concentration per Run 1	90.472 %	95.974 %	0.050 ppb	6,048.173 ppb	3,684.043 ppb	27.242 ppb	525.997 ppb	37,083.820 ppb	92.959 %
Concentration per Run 2	89.657 %	93.946 %	0.036 ppb	6,186.407 ppb	3,903.269 ppb	33.326 ppb	546.582 ppb	38,883.926 ppb	90.122 %
Concentration per Run 3	88.647 %	98.924 %	0.033 ppb	6,020.489 ppb	3,791.299 ppb	30.101 ppb	556.492 ppb	38,353.489 ppb	88.494 %
Concentration RSD	1.0 %	2.6 %	23.4 %	1.5 %	2.9 %	10.1 %	2.9 %	2.4 %	2.5 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	86.994 %	50.822 ppb	0.435 ppb	0.127 ppb	2.311 ppb	7.506 ppb	0.071 ppb	0.366 ppb	0.328 ppb
Concentration per Run 1	87.907 %	47.612 ppb	0.461 ppb	0.146 ppb	1.876 ppb	4.195 ppb	0.094 ppb	0.530 ppb	0.428 ppb
Concentration per Run 2	86.906 %	54.296 ppb	0.400 ppb	0.178 ppb	2.878 ppb	10.986 ppb	0.072 ppb	0.280 ppb	0.319 ppb
Concentration per Run 3	86.169 %	50.558 ppb	0.445 ppb	0.057 ppb	2.180 ppb	7.337 ppb	0.049 ppb	0.289 ppb	0.236 ppb
Concentration RSD	1.0 %	6.6 %	7.3 %	49.4 %	22.2 %	45.3 %	31.4 %	38.7 %	29.4 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	1.428 ppb	85.353 %	0.265 ppb	0.947 ppb	93.873 ppb	0.426 ppb	87.137 %	0.000 ppb	0.020 ppb
Concentration per Run 1	1.410 ppb	86.627 %	0.244 ppb	0.957 ppb	91.708 ppb	0.560 ppb	88.594 %	0.000 ppb	0.012 ppb
Concentration per Run 2	1.619 ppb	85.441 %	0.248 ppb	0.655 ppb	94.777 ppb	0.293 ppb	86.553 %	0.003 ppb	0.012 ppb
Concentration per Run 3	1.256 ppb	83.990 %	0.304 ppb	1.230 ppb	95.132 ppb	0.426 ppb	86.262 %	-0.004 ppb	0.036 ppb
Concentration RSD	12.7 %	1.5 %	12.6 %	30.4 %	2.0 %	31.4 %	1.5 %	707.9 %	69.7 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	84.741 %	0.435 ppb	0.492 ppb	16.081 ppb	90.457 %	87.932 %	0.003 ppb	0.034 ppb	96.272 %
Concentration per Run 1	85.775 %	0.344 ppb	0.466 ppb	15.801 ppb	93.002 %	88.873 %	0.002 ppb	0.030 ppb	99.158 %
Concentration per Run 2	83.787 %	0.528 ppb	0.455 ppb	15.950 ppb	89.455 %	88.906 %	0.004 ppb	0.034 ppb	94.669 %
Concentration per Run 3	84.660 %	0.434 ppb	0.554 ppb	16.492 ppb	88.914 %	86.017 %	0.003 ppb	0.040 ppb	94.991 %
Concentration RSD	1.2 %	21.1 %	11.0 %	2.3 %	2.5 %	1.9 %	30.2 %	14.3 %	2.6 %

Alpha ICPMSQ Full

6/7/2017 3:54:49 PM



Analysis index: 76 Analysis started at: 6/7/2017 12:40:27 PM Rack: 1
Analysis label: L1718218-05 CT-6020TL User name: ALPHALAB\metals-instrument Vial: 26

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	88.026 %	91.487 %	0.045 ppb	5,703.814 ppb	1,272.837 ppb	71.379 ppb	860.113 ppb	3,991.140 ppb	83.748 %
Concentration per Run 1	89.815 %	93.392 %	0.029 ppb	5,620.441 ppb	1,263.129 ppb	69.798 ppb	856.550 ppb	3,672.832 ppb	86.707 %
Concentration per Run 2	88.588 %	91.087 %	0.055 ppb	5,690.026 ppb	1,257.516 ppb	69.873 ppb	839.782 ppb	4,169.306 ppb	82.294 %
Concentration per Run 3	85.674 %	89.981 %	0.050 ppb	5,800.976 ppb	1,297.866 ppb	74.466 ppb	884.008 ppb	4,131.283 ppb	82.242 %
Concentration RSD	2.4 %	1.9 %	31.8 %	1.6 %	1.7 %	3.7 %	2.6 %	6.9 %	3.1 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	85.058 %	7.062 ppb	0.531 ppb	0.310 ppb	7.001 ppb	27.997 ppb	0.026 ppb	0.576 ppb	0.162 ppb
Concentration per Run 1	86.930 %	7.536 ppb	0.683 ppb	0.417 ppb	7.105 ppb	24.973 ppb	0.012 ppb	0.519 ppb	0.236 ppb
Concentration per Run 2	85.275 %	5.994 ppb	0.356 ppb	0.245 ppb	7.119 ppb	33.905 ppb	0.026 ppb	0.567 ppb	0.159 ppb
Concentration per Run 3	82.969 %	7.657 ppb	0.555 ppb	0.268 ppb	6.778 ppb	25.112 ppb	0.038 ppb	0.643 ppb	0.091 ppb
Concentration RSD	2.3 %	13.1 %	30.9 %	30.1 %	2.8 %	18.3 %	51.0 %	10.9 %	44.9 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	1.793 ppb	81.951 %	0.011 ppb	0.216 ppb	28.428 ppb	0.090 ppb	85.629 %	0.000 ppb	0.025 ppb
Concentration per Run 1	1.532 ppb	84.793 %	0.019 ppb	0.390 ppb	27.013 ppb	0.087 ppb	87.429 %	0.005 ppb	0.018 ppb
Concentration per Run 2	1.940 ppb	78.677 %	0.021 ppb	-0.094 ppb	28.682 ppb	0.110 ppb	85.179 %	-0.002 ppb	0.025 ppb
Concentration per Run 3	1.908 ppb	82.384 %	-0.007 ppb	0.353 ppb	29.591 ppb	0.071 ppb	84.279 %	-0.002 ppb	0.031 ppb
Concentration RSD	12.7 %	3.8 %	139.2 %	124.5 %	4.6 %	21.8 %	1.9 %	1,093.3 %	26.5 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	82.755 %	0.305 ppb	0.351 ppb	21.504 ppb	86.254 %	85.019 %	0.004 ppb	0.035 ppb	95.222 %
Concentration per Run 1	85.317 %	0.323 ppb	0.276 ppb	20.465 ppb	88.038 %	86.614 %	0.004 ppb	0.030 ppb	98.085 %
Concentration per Run 2	80.549 %	0.298 ppb	0.343 ppb	22.265 ppb	84.585 %	83.716 %	0.005 ppb	0.039 ppb	94.105 %
Concentration per Run 3	82.399 %	0.293 ppb	0.432 ppb	21.783 ppb	86.140 %	84.725 %	0.004 ppb	0.036 ppb	93.477 %
Concentration RSD	2.9 %	5.2 %	22.3 %	4.3 %	2.0 %	1.7 %	11.6 %	12.4 %	2.6 %

Alpha ICPMSQ Full

6/7/2017 3:54:49 PM



Analysis index: 77 Analysis started at: 6/7/2017 12:43:40 PM Rack: 1
Analysis label: L1717026-29 A2-6020T User name: ALPHALAB\metals-instrument Vial: 17

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	90.085 %	90.473 %	0.005 ppb	282.683 ppb	7.051 ppb	1.757 ppb	23.039 ppb	35.525 ppb	85.237 %
Concentration per Run 1	91.248 %	90.995 %	0.006 ppb	292.651 ppb	10.685 ppb	1.287 ppb	23.063 ppb	37.866 ppb	87.180 %
Concentration per Run 2	90.414 %	94.038 %	0.010 ppb	263.220 ppb	4.926 ppb	2.503 ppb	18.788 ppb	17.682 ppb	90.017 %
Concentration per Run 3	88.593 %	86.385 %	-0.001 ppb	292.177 ppb	5.541 ppb	1.480 ppb	27.266 ppb	51.027 ppb	78.512 %
Concentration RSD	1.5 %	4.3 %	109.6 %	6.0 %	44.9 %	37.2 %	18.4 %	47.3 %	7.0 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	87.349 %	0.214 ppb	0.255 ppb	0.224 ppb	0.476 ppb	3.437 ppb	0.004 ppb	-0.069 ppb	3.388 ppb
Concentration per Run 1	88.561 %	0.154 ppb	0.298 ppb	0.316 ppb	0.289 ppb	3.542 ppb	0.000 ppb	-0.117 ppb	2.703 ppb
Concentration per Run 2	87.562 %	-0.038 ppb	0.140 ppb	0.156 ppb	0.633 ppb	-1.373 ppb	0.000 ppb	-0.028 ppb	3.910 ppb
Concentration per Run 3	85.924 %	0.526 ppb	0.326 ppb	0.200 ppb	0.508 ppb	8.141 ppb	0.013 ppb	-0.062 ppb	3.550 ppb
Concentration RSD	1.5 %	134.1 %	39.5 %	37.0 %	36.6 %	138.4 %	173.2 %	65.4 %	18.3 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	0.519 ppb	81.857 %	0.011 ppb	0.400 ppb	0.655 ppb	0.134 ppb	86.851 %	0.003 ppb	0.014 ppb
Concentration per Run 1	0.394 ppb	82.591 %	0.020 ppb	0.768 ppb	0.658 ppb	0.106 ppb	88.339 %	0.009 ppb	0.024 ppb
Concentration per Run 2	0.628 ppb	82.539 %	-0.007 ppb	0.339 ppb	0.623 ppb	0.051 ppb	87.434 %	-0.004 ppb	0.006 ppb
Concentration per Run 3	0.536 ppb	80.440 %	0.020 ppb	0.093 ppb	0.682 ppb	0.244 ppb	84.782 %	0.003 ppb	0.013 ppb
Concentration RSD	22.7 %	1.5 %	138.8 %	85.5 %	4.5 %	74.8 %	2.1 %	256.9 %	62.9 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	82.867 %	0.508 ppb	0.307 ppb	1.642 ppb	87.077 %	84.257 %	0.001 ppb	0.034 ppb	94.522 %
Concentration per Run 1	86.155 %	0.569 ppb	0.235 ppb	1.683 ppb	87.498 %	86.052 %	0.000 ppb	0.032 ppb	97.340 %
Concentration per Run 2	85.515 %	0.487 ppb	0.361 ppb	1.765 ppb	89.215 %	86.584 %	0.001 ppb	0.036 ppb	93.906 %
Concentration per Run 3	76.932 %	0.468 ppb	0.324 ppb	1.479 ppb	84.519 %	80.134 %	0.004 ppb	0.033 ppb	92.322 %
Concentration RSD	6.2 %	10.6 %	21.1 %	9.0 %	2.7 %	4.2 %	165.7 %	6.5 %	2.7 %

Alpha ICPMSQ Full

6/7/2017 3:54:49 PM



Analysis index: 78 Analysis started at: 6/7/2017 12:47:01 PM Rack: 0
 Analysis label: CCV User name: ALPHALAB\metals-instrument Vial: 9

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	88.038 %	82.974 %	102.638 ppb	10,435.630 ppb	10,411.327 ppb	102.505 ppb	10,406.685 ppb	10,327.064 ppb	82.715 %
Concentration per Run 1	88.628 %	82.605 %	103.535 ppb	10,476.291 ppb	10,823.796 ppb	107.127 ppb	10,493.518 ppb	9,905.725 ppb	89.071 %
Concentration per Run 2	87.846 %	80.577 %	101.756 ppb	10,255.877 ppb	9,842.443 ppb	104.054 ppb	10,363.681 ppb	10,662.769 ppb	75.045 %
Concentration per Run 3	87.641 %	85.740 %	102.621 ppb	10,574.721 ppb	10,567.742 ppb	96.332 ppb	10,362.857 ppb	10,412.697 ppb	84.028 %
Recovery Percentage 1			102.638 %	104.356 %	104.113 %	102.505 %	104.067 %	103.271 %	
Concentration RSD	0.6 %	3.1 %	0.9 %	1.6 %	4.9 %	5.4 %	0.7 %	3.7 %	8.6 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	86.739 %	103.620 ppb	96.427 ppb	101.489 ppb	99.629 ppb	10,135.457 ppb	101.033 ppb	99.233 ppb	101.185 ppb
Concentration per Run 1	86.560 %	105.460 ppb	94.585 ppb	98.961 ppb	97.682 ppb	9,843.624 ppb	94.646 ppb	94.334 ppb	96.217 ppb
Concentration per Run 2	86.174 %	99.033 ppb	97.377 ppb	104.063 ppb	96.689 ppb	10,151.328 ppb	104.697 ppb	100.210 ppb	103.367 ppb
Concentration per Run 3	87.481 %	106.367 ppb	97.320 ppb	101.444 ppb	104.516 ppb	10,411.419 ppb	103.755 ppb	103.155 ppb	103.971 ppb
Recovery Percentage 1		103.620 %	96.427 %	101.489 %	99.629 %	101.355 %	101.033 %	99.233 %	101.185 %
Concentration RSD	0.8 %	3.9 %	1.7 %	2.5 %	4.3 %	2.8 %	5.5 %	4.5 %	4.3 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	99.580 ppb	79.023 %	100.093 ppb	101.660 ppb	103.144 ppb	103.714 ppb	82.663 %	100.756 ppb	102.044 ppb
Concentration per Run 1	95.639 ppb	83.067 %	101.478 ppb	107.617 ppb	103.252 ppb	99.214 ppb	86.077 %	97.877 ppb	99.944 ppb
Concentration per Run 2	101.974 ppb	77.419 %	92.892 ppb	94.944 ppb	94.221 ppb	104.148 ppb	79.809 %	103.906 ppb	104.369 ppb
Concentration per Run 3	101.129 ppb	76.583 %	105.909 ppb	102.417 ppb	111.959 ppb	107.782 ppb	82.104 %	100.487 ppb	101.818 ppb
Recovery Percentage 1	99.580 %		100.093 %	101.660 %	103.144 %	103.714 %		100.756 %	102.044 %
Concentration RSD	3.5 %	4.5 %	6.6 %	6.3 %	8.6 %	4.1 %	3.8 %	3.0 %	2.2 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	78.682 %	102.192 ppb	109.041 ppb	100.360 ppb	85.319 %	82.260 %	103.190 ppb	105.092 ppb	89.953 %
Concentration per Run 1	84.184 %	97.821 ppb	101.247 ppb	98.897 ppb	88.470 %	86.899 %	101.122 ppb	103.274 ppb	92.470 %
Concentration per Run 2	71.430 %	104.040 ppb	111.249 ppb	98.912 ppb	81.505 %	76.398 %	103.330 ppb	105.573 ppb	88.535 %
Concentration per Run 3	80.433 %	104.714 ppb	114.627 ppb	103.269 ppb	85.981 %	83.484 %	105.117 ppb	106.429 ppb	88.854 %
Recovery Percentage 1		102.192 %	109.041 %	100.360 %			103.190 %	105.092 %	
Concentration RSD	8.3 %	3.7 %	6.4 %	2.5 %	4.1 %	6.5 %	1.9 %	1.6 %	2.4 %

Alpha ICPMSQ Full

6/7/2017 3:54:49 PM



Analysis index: 79 Analysis started at: 6/7/2017 12:50:27 PM Rack: 0
 Analysis label: CCB User name: ALPHALAB\metals-instrument Vial: 10

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	91.478 %	87.615 %	0.017 ppb	72.103 ppb	5.936 ppb	-0.036 ppb	19.016 ppb	6.488 ppb	81.314 %
Concentration per Run 1	91.733 %	83.435 %	0.010 ppb	69.802 ppb	4.795 ppb	0.609 ppb	15.114 ppb	5.427 ppb	78.092 %
Concentration per Run 2	92.164 %	88.783 %	0.024 ppb	74.668 ppb	6.130 ppb	-0.528 ppb	13.270 ppb	13.124 ppb	83.083 %
Concentration per Run 3	90.538 %	90.627 %	0.017 ppb	71.838 ppb	6.883 ppb	-0.189 ppb	28.662 ppb	0.913 ppb	82.767 %
Recovery Percentage 1			3.377 %	72.103 %	8.480 %	-0.361 %	19.016 %	6.488 %	
Concentration RSD	0.9 %	4.3 %	42.6 %	3.4 %	17.8 %	1,618.9 %	44.2 %	95.2 %	3.4 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	89.704 %	0.030 ppb	0.016 ppb	0.003 ppb	0.099 ppb	1.285 ppb	0.009 ppb	-0.069 ppb	0.017 ppb
Concentration per Run 1	91.704 %	0.033 ppb	-0.010 ppb	0.077 ppb	0.074 ppb	-1.373 ppb	0.014 ppb	-0.158 ppb	-0.034 ppb
Concentration per Run 2	90.050 %	0.028 ppb	0.069 ppb	-0.015 ppb	0.158 ppb	2.608 ppb	0.012 ppb	-0.024 ppb	0.087 ppb
Concentration per Run 3	87.359 %	0.029 ppb	-0.010 ppb	-0.054 ppb	0.067 ppb	2.619 ppb	0.000 ppb	-0.024 ppb	-0.003 ppb
Recovery Percentage 1		5.998 %	0.322 %	0.270 %	9.935 %	2.570 %	1.738 %	-3.439 %	1.660 %
Concentration RSD	2.4 %	8.7 %	285.1 %	2,502.6 %	50.9 %	179.2 %	86.8 %	112.7 %	376.9 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	-0.071 ppb	82.755 %	0.036 ppb	0.896 ppb	0.016 ppb	0.473 ppb	85.644 %	0.029 ppb	0.018 ppb
Concentration per Run 1	-0.047 ppb	76.657 %	-0.007 ppb	0.541 ppb	0.027 ppb	0.384 ppb	84.606 %	0.038 ppb	0.007 ppb
Concentration per Run 2	-0.094 ppb	85.856 %	0.095 ppb	0.838 ppb	0.030 ppb	0.501 ppb	85.568 %	0.027 ppb	0.018 ppb
Concentration per Run 3	-0.073 ppb	85.753 %	0.019 ppb	1.310 ppb	-0.008 ppb	0.533 ppb	86.759 %	0.022 ppb	0.029 ppb
Recovery Percentage 1	-0.712 %	82.755 %	7.115 %	17.929 %	3.290 %	23.641 %		7.274 %	8.991 %
Concentration RSD	33.0 %	6.4 %	148.3 %	43.2 %	129.3 %	16.6 %	1.3 %	27.9 %	63.6 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	83.421 %	0.761 ppb	2.467 ppb	-0.002 ppb	86.684 %	84.163 %	0.028 ppb	0.058 ppb	85.861 %
Concentration per Run 1	76.343 %	0.740 ppb	2.477 ppb	-0.001 ppb	84.420 %	80.091 %	0.032 ppb	0.066 ppb	84.483 %
Concentration per Run 2	85.738 %	0.786 ppb	2.489 ppb	-0.018 ppb	86.921 %	85.939 %	0.025 ppb	0.055 ppb	86.513 %
Concentration per Run 3	88.182 %	0.758 ppb	2.437 ppb	0.012 ppb	88.712 %	86.459 %	0.026 ppb	0.054 ppb	86.586 %
Recovery Percentage 1		25.369 %	61.686 %	-0.476 %			5.516 %	11.652 %	85.861 %
Concentration RSD	7.5 %	3.0 %	1.1 %	639.5 %	2.5 %	4.2 %	13.3 %	10.9 %	1.4 %

Alpha ICPMSQ Full

6/7/2017 3:54:49 PM



Analysis index: 80 Analysis started at: 6/7/2017 12:55:45 PM Rack: 1
 Analysis label: WG1009825-1 6020TL User name: ALPHALAB\metals-instrument Vial: 51

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	90.009 %	91.702 %	-0.001 ppb	55.926 ppb	0.040 ppb	0.660 ppb	1.555 ppb	9.510 ppb	88.424 %
Concentration per Run 1	91.847 %	91.272 %	-0.009 ppb	51.351 ppb	0.299 ppb	0.729 ppb	1.956 ppb	11.630 ppb	92.277 %
Concentration per Run 2	89.718 %	94.314 %	0.010 ppb	54.419 ppb	0.297 ppb	0.409 ppb	-0.808 ppb	12.065 ppb	89.335 %
Concentration per Run 3	88.462 %	89.520 %	-0.005 ppb	62.006 ppb	-0.477 ppb	0.841 ppb	3.518 ppb	4.835 ppb	83.660 %
Concentration RSD	1.9 %	2.6 %	915.3 %	9.8 %	1,126.6 %	34.0 %	140.9 %	42.6 %	5.0 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	88.917 %	0.023 ppb	0.029 ppb	0.025 ppb	0.152 ppb	1.180 ppb	0.000 ppb	-0.028 ppb	0.025 ppb
Concentration per Run 1	90.530 %	0.083 ppb	-0.010 ppb	-0.035 ppb	0.144 ppb	2.322 ppb	0.000 ppb	-0.079 ppb	0.052 ppb
Concentration per Run 2	88.225 %	0.024 ppb	0.027 ppb	-0.008 ppb	0.062 ppb	-0.421 ppb	0.000 ppb	-0.075 ppb	0.025 ppb
Concentration per Run 3	87.995 %	-0.038 ppb	0.069 ppb	0.117 ppb	0.250 ppb	1.638 ppb	0.000 ppb	0.071 ppb	-0.003 ppb
Concentration RSD	1.6 %	264.6 %	139.1 %	324.1 %	62.2 %	121.0 %		309.0 %	111.0 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	0.145 ppb	86.063 %	0.078 ppb	0.305 ppb	0.012 ppb	0.135 ppb	88.355 %	0.002 ppb	0.012 ppb
Concentration per Run 1	0.045 ppb	88.603 %	0.067 ppb	-0.115 ppb	-0.003 ppb	0.135 ppb	92.651 %	-0.002 ppb	0.017 ppb
Concentration per Run 2	0.173 ppb	86.245 %	0.044 ppb	0.717 ppb	0.007 ppb	0.143 ppb	86.773 %	0.003 ppb	0.012 ppb
Concentration per Run 3	0.215 ppb	83.342 %	0.124 ppb	0.313 ppb	0.031 ppb	0.127 ppb	85.641 %	0.007 ppb	0.006 ppb
Concentration RSD	61.2 %	3.1 %	52.7 %	136.5 %	147.6 %	6.0 %	4.3 %	188.1 %	46.7 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	85.668 %	0.447 ppb	0.842 ppb	0.012 ppb	90.347 %	87.770 %	0.006 ppb	0.034 ppb	98.189 %
Concentration per Run 1	89.217 %	0.515 ppb	0.621 ppb	0.041 ppb	93.839 %	90.466 %	0.005 ppb	0.031 ppb	101.788 %
Concentration per Run 2	84.384 %	0.395 ppb	0.856 ppb	-0.003 ppb	88.726 %	87.427 %	0.007 ppb	0.034 ppb	97.320 %
Concentration per Run 3	83.403 %	0.430 ppb	1.049 ppb	-0.002 ppb	88.475 %	85.418 %	0.005 ppb	0.039 ppb	95.458 %
Concentration RSD	3.6 %	13.7 %	25.4 %	209.7 %	3.4 %	2.9 %	18.3 %	11.7 %	3.3 %

Alpha ICPMSQ Full

6/7/2017 3:54:49 PM



Analysis index: 81 Analysis started at: 6/7/2017 12:59:06 PM Rack: 1
Analysis label: WG1009825-2D5 6020TL User name: ALPHALAB\metals-instrument Vial: 52

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	90.946 %	94.652 %	10.312 ppb	2,119.661 ppb	2,129.320 ppb	433.454 ppb	2,094.218 ppb	2,158.144 ppb	90.665 %
Concentration per Run 1	90.823 %	95.697 %	10.192 ppb	2,104.841 ppb	2,115.774 ppb	419.985 ppb	2,022.409 ppb	2,137.058 ppb	91.646 %
Concentration per Run 2	92.476 %	92.563 %	10.040 ppb	2,106.649 ppb	2,090.717 ppb	449.368 ppb	2,092.745 ppb	2,226.506 ppb	90.648 %
Concentration per Run 3	89.541 %	95.697 %	10.703 ppb	2,147.493 ppb	2,181.470 ppb	431.007 ppb	2,167.498 ppb	2,110.868 ppb	89.702 %
Concentration RSD	1.6 %	1.9 %	3.4 %	1.1 %	2.2 %	3.4 %	3.5 %	2.8 %	1.1 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	90.375 %	183.063 ppb	101.551 ppb	40.592 ppb	102.181 ppb	198.253 ppb	97.869 ppb	96.445 ppb	49.100 ppb
Concentration per Run 1	91.807 %	179.633 ppb	99.562 ppb	39.925 ppb	100.151 ppb	184.527 ppb	96.474 ppb	95.411 ppb	49.337 ppb
Concentration per Run 2	90.179 %	190.510 ppb	102.327 ppb	41.216 ppb	104.611 ppb	220.966 ppb	99.066 ppb	97.780 ppb	49.424 ppb
Concentration per Run 3	89.139 %	179.044 ppb	102.765 ppb	40.634 ppb	101.781 ppb	189.266 ppb	98.068 ppb	96.146 ppb	48.538 ppb
Concentration RSD	1.5 %	3.5 %	1.7 %	1.6 %	2.2 %	10.0 %	1.3 %	1.3 %	1.0 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	102.045 ppb	88.004 %	23.753 ppb	26.381 ppb	210.953 ppb	194.107 ppb	87.811 %	10.097 ppb	10.800 ppb
Concentration per Run 1	98.693 ppb	91.422 %	23.238 ppb	24.989 ppb	207.470 ppb	189.504 ppb	90.118 %	10.010 ppb	10.505 ppb
Concentration per Run 2	106.472 ppb	83.914 %	24.965 ppb	29.012 ppb	212.122 ppb	196.203 ppb	86.706 %	9.972 ppb	11.002 ppb
Concentration per Run 3	100.970 ppb	88.676 %	23.056 ppb	25.143 ppb	213.267 ppb	196.615 ppb	86.610 %	10.308 ppb	10.895 ppb
Concentration RSD	3.9 %	4.3 %	4.4 %	8.6 %	1.5 %	2.1 %	2.3 %	1.8 %	2.4 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	86.017 %	195.689 ppb	104.244 ppb	411.592 ppb	87.755 %	87.660 %	24.640 ppb	111.169 ppb	92.933 %
Concentration per Run 1	88.328 %	191.490 ppb	100.581 ppb	405.322 ppb	86.114 %	89.969 %	24.448 ppb	108.473 ppb	94.961 %
Concentration per Run 2	84.987 %	195.413 ppb	103.356 ppb	416.003 ppb	89.473 %	86.684 %	24.499 ppb	112.050 ppb	92.095 %
Concentration per Run 3	84.735 %	200.165 ppb	108.795 ppb	413.451 ppb	87.678 %	86.326 %	24.973 ppb	112.983 ppb	91.744 %
Concentration RSD	2.3 %	2.2 %	4.0 %	1.4 %	1.9 %	2.3 %	1.2 %	2.1 %	1.9 %

Alpha ICPMSQ Full

6/7/2017 3:54:49 PM



Analysis index: 82 Analysis started at: 6/7/2017 1:02:27 PM Rack: 1
 Analysis label: L1717187-02 A2-MCP6020S-10 User name: ALPHALABmetals-instrument Vial: 53

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	83.157 %	85.648 %	0.038 ppb	62,010.179 ppb	3,485.526 ppb	272.988 ppb	3,112.583 ppb	79,549.801 ppb	85.587 %
Concentration per Run 1	83.131 %	86.109 %	0.040 ppb	61,093.136 ppb	3,407.836 ppb	263.577 ppb	3,033.746 ppb	76,425.703 ppb	88.441 %
Concentration per Run 2	83.015 %	86.109 %	0.048 ppb	62,327.280 ppb	3,492.277 ppb	271.346 ppb	3,113.037 ppb	81,521.116 ppb	85.026 %
Concentration per Run 3	83.325 %	84.726 %	0.028 ppb	62,610.119 ppb	3,556.464 ppb	284.042 ppb	3,190.967 ppb	80,702.585 ppb	83.293 %
Concentration RSD	0.2 %	0.9 %	26.4 %	1.3 %	2.1 %	3.8 %	2.5 %	3.4 %	3.1 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	84.506 %	115.552 ppb	1.511 ppb	0.903 ppb	7,515.630 ppb	1,727.281 ppb	4.576 ppb	2.784 ppb	1.374 ppb
Concentration per Run 1	85.636 %	114.037 ppb	1.388 ppb	0.898 ppb	7,187.584 ppb	1,751.380 ppb	4.310 ppb	3.100 ppb	1.528 ppb
Concentration per Run 2	84.247 %	115.598 ppb	1.475 ppb	0.763 ppb	7,631.181 ppb	1,619.081 ppb	4.634 ppb	2.588 ppb	0.988 ppb
Concentration per Run 3	83.636 %	117.022 ppb	1.670 ppb	1.049 ppb	7,728.125 ppb	1,811.381 ppb	4.784 ppb	2.665 ppb	1.607 ppb
Concentration RSD	1.2 %	1.3 %	9.5 %	15.9 %	3.8 %	5.7 %	5.3 %	9.9 %	24.5 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	5.034 ppb	84.368 %	2.615 ppb	0.831 ppb	240.464 ppb	3.485 ppb	82.572 %	0.002 ppb	0.040 ppb
Concentration per Run 1	4.767 ppb	85.928 %	2.527 ppb	1.206 ppb	233.719 ppb	3.287 ppb	84.483 %	-0.002 ppb	0.031 ppb
Concentration per Run 2	4.944 ppb	84.975 %	2.969 ppb	0.846 ppb	246.886 ppb	3.926 ppb	80.460 %	0.003 ppb	0.052 ppb
Concentration per Run 3	5.391 ppb	82.202 %	2.349 ppb	0.440 ppb	240.789 ppb	3.241 ppb	82.774 %	0.005 ppb	0.038 ppb
Concentration RSD	6.4 %	2.3 %	12.2 %	46.1 %	2.7 %	11.0 %	2.4 %	166.5 %	26.6 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	81.464 %	2.308 ppb	4.373 ppb	36.581 ppb	86.981 %	84.517 %	0.024 ppb	1.678 ppb	94.574 %
Concentration per Run 1	83.850 %	2.343 ppb	4.299 ppb	35.752 ppb	88.058 %	86.225 %	0.023 ppb	1.625 ppb	98.078 %
Concentration per Run 2	79.492 %	2.362 ppb	4.546 ppb	36.738 ppb	86.494 %	83.039 %	0.027 ppb	1.700 ppb	92.923 %
Concentration per Run 3	81.051 %	2.218 ppb	4.275 ppb	37.252 ppb	86.392 %	84.286 %	0.023 ppb	1.710 ppb	92.721 %
Concentration RSD	2.7 %	3.4 %	3.4 %	2.1 %	1.1 %	1.9 %	10.8 %	2.8 %	3.2 %

Alpha ICPMSQ Full

6/7/2017 3:54:49 PM



Analysis index: 83 Analysis started at: 6/7/2017 1:05:48 PM Rack: 1
 Analysis label: L1717187-04 A2-MCP6020S-10 User name: ALPHALABmetals-instrument Vial: 54

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	83.303 %	88.690 %	0.082 ppb	117,200.783 ppb	11,562.137 ppb	1,561.897 ppb	10,578.846 ppb	108,270.152 ppb	88.021 %
Concentration per Run 1	83.497 %	82.605 %	0.103 ppb	118,661.861 ppb	11,181.119 ppb	1,491.395 ppb	10,050.541 ppb	101,039.834 ppb	86.182 %
Concentration per Run 2	84.156 %	86.109 %	0.047 ppb	118,184.371 ppb	12,054.186 ppb	1,562.507 ppb	11,073.271 ppb	113,674.040 ppb	79.510 %
Concentration per Run 3	82.257 %	97.357 %	0.097 ppb	114,756.118 ppb	11,451.106 ppb	1,631.789 ppb	10,612.726 ppb	110,096.581 ppb	98.371 %
Concentration RSD	1.2 %	8.7 %	37.3 %	1.8 %	3.9 %	4.5 %	4.8 %	6.0 %	10.9 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	85.014 %	184.718 ppb	4.486 ppb	3.392 ppb	2,065.618 ppb	2,722.671 ppb	7.941 ppb	3.711 ppb	11.089 ppb
Concentration per Run 1	85.342 %	170.488 ppb	4.440 ppb	3.232 ppb	2,010.785 ppb	2,679.697 ppb	7.714 ppb	3.104 ppb	11.191 ppb
Concentration per Run 2	84.595 %	189.590 ppb	5.361 ppb	3.970 ppb	2,164.649 ppb	2,914.389 ppb	8.233 ppb	4.064 ppb	12.153 ppb
Concentration per Run 3	85.104 %	194.076 ppb	3.656 ppb	2.974 ppb	2,021.422 ppb	2,573.928 ppb	7.876 ppb	3.963 ppb	9.924 ppb
Concentration RSD	0.4 %	6.8 %	19.0 %	15.2 %	4.2 %	6.4 %	3.3 %	14.2 %	10.1 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	9.200 ppb	85.989 %	2.789 ppb	0.635 ppb	393.773 ppb	13.080 ppb	82.414 %	0.025 ppb	0.148 ppb
Concentration per Run 1	8.699 ppb	81.023 %	2.782 ppb	1.198 ppb	386.351 ppb	12.382 ppb	84.477 %	0.037 ppb	0.182 ppb
Concentration per Run 2	9.584 ppb	80.952 %	3.085 ppb	0.211 ppb	386.068 ppb	13.967 ppb	80.470 %	0.032 ppb	0.135 ppb
Concentration per Run 3	9.316 ppb	95.991 %	2.499 ppb	0.496 ppb	408.900 ppb	12.892 ppb	82.296 %	0.007 ppb	0.129 ppb
Concentration RSD	4.9 %	10.1 %	10.5 %	80.1 %	3.3 %	6.2 %	2.4 %	63.3 %	19.5 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	84.248 %	1.013 ppb	1.712 ppb	112.321 ppb	87.611 %	87.362 %	0.027 ppb	9.961 ppb	92.146 %
Concentration per Run 1	81.289 %	1.009 ppb	1.390 ppb	109.288 ppb	88.845 %	87.734 %	0.027 ppb	9.552 ppb	95.504 %
Concentration per Run 2	80.238 %	1.189 ppb	2.041 ppb	113.557 ppb	86.584 %	84.693 %	0.022 ppb	10.217 ppb	89.779 %
Concentration per Run 3	91.216 %	0.841 ppb	1.704 ppb	114.119 ppb	87.404 %	89.660 %	0.031 ppb	10.114 ppb	91.156 %
Concentration RSD	7.2 %	17.2 %	19.0 %	2.4 %	1.3 %	2.9 %	16.4 %	3.6 %	3.2 %

Alpha ICPMSQ Full

6/7/2017 3:54:49 PM



Analysis index: 84 Analysis started at: 6/7/2017 1:09:10 PM Rack: 1
 Analysis label: L1717187-06 A2-MCP6020S-10 User name: ALPHALABmetals-instrument Vial: 55

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	85.973 %	93.423 %	0.066 ppb	17,847.913 ppb	15,439.311 ppb	823.656 ppb	6,217.867 ppb	134,621.210 ppb	95.009 %
Concentration per Run 1	87.017 %	94.775 %	0.079 ppb	16,337.851 ppb	13,887.922 ppb	718.994 ppb	5,605.234 ppb	123,746.668 ppb	95.377 %
Concentration per Run 2	85.752 %	93.485 %	0.058 ppb	18,813.030 ppb	16,382.306 ppb	895.100 ppb	6,581.343 ppb	135,609.919 ppb	104.940 %
Concentration per Run 3	85.150 %	92.009 %	0.062 ppb	18,392.857 ppb	16,047.705 ppb	856.874 ppb	6,467.025 ppb	144,507.042 ppb	84.711 %
Concentration RSD	1.1 %	1.5 %	17.5 %	7.4 %	8.8 %	11.2 %	8.6 %	7.7 %	10.7 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	86.178 %	204.076 ppb	2.305 ppb	1.980 ppb	2,946.025 ppb	18,024.760 ppb	0.859 ppb	0.945 ppb	1.624 ppb
Concentration per Run 1	86.089 %	186.905 ppb	2.219 ppb	1.755 ppb	2,685.794 ppb	15,928.212 ppb	0.665 ppb	1.067 ppb	1.436 ppb
Concentration per Run 2	84.652 %	206.235 ppb	2.138 ppb	1.849 ppb	2,921.133 ppb	17,630.856 ppb	0.890 ppb	0.948 ppb	1.708 ppb
Concentration per Run 3	87.792 %	219.088 ppb	2.557 ppb	2.336 ppb	3,231.148 ppb	20,515.212 ppb	1.024 ppb	0.822 ppb	1.727 ppb
Concentration RSD	1.8 %	7.9 %	9.6 %	15.8 %	9.3 %	12.9 %	21.1 %	13.0 %	10.0 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	4.378 ppb	86.997 %	1.133 ppb	0.509 ppb	601.429 ppb	0.458 ppb	86.197 %	0.004 ppb	0.008 ppb
Concentration per Run 1	4.210 ppb	88.163 %	0.882 ppb	1.413 ppb	530.249 ppb	0.446 ppb	89.130 %	0.002 ppb	0.006 ppb
Concentration per Run 2	4.360 ppb	91.014 %	1.167 ppb	-0.163 ppb	654.707 ppb	0.523 ppb	87.073 %	0.004 ppb	0.000 ppb
Concentration per Run 3	4.564 ppb	81.813 %	1.350 ppb	0.277 ppb	619.331 ppb	0.405 ppb	82.388 %	0.005 ppb	0.019 ppb
Concentration RSD	4.0 %	5.4 %	20.8 %	159.7 %	10.7 %	13.1 %	4.0 %	41.4 %	118.6 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	87.991 %	0.632 ppb	0.752 ppb	351.568 ppb	90.425 %	89.326 %	0.008 ppb	10.840 ppb	95.065 %
Concentration per Run 1	90.621 %	0.510 ppb	0.804 ppb	316.297 ppb	94.147 %	92.240 %	0.006 ppb	10.063 ppb	97.299 %
Concentration per Run 2	93.514 %	0.630 ppb	0.690 ppb	361.648 ppb	92.674 %	92.255 %	0.008 ppb	11.014 ppb	96.023 %
Concentration per Run 3	79.839 %	0.757 ppb	0.764 ppb	376.758 ppb	84.454 %	83.483 %	0.011 ppb	11.442 ppb	91.873 %
Concentration RSD	8.2 %	19.5 %	7.7 %	9.0 %	5.8 %	5.7 %	31.5 %	6.5 %	3.0 %

Alpha ICPMSQ Full

6/7/2017 3:54:49 PM



Analysis index: 85 Analysis started at: 6/7/2017 1:12:32 PM Rack: 1
Analysis label: WG1009825-6D5 6020TL User name: ALPHALAB\metals-instrument Vial: 56

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	89.883 %	88.721 %	0.005 ppb	112,587.303 ppb	2,830.268 ppb	17.068 ppb	24,827.370 ppb	4,015.581 ppb	91.594 %
Concentration per Run 1	91.101 %	95.052 %	-0.001 ppb	111,842.258 ppb	2,904.092 ppb	18.360 ppb	25,683.747 ppb	3,968.106 ppb	98.739 %
Concentration per Run 2	88.751 %	86.293 %	0.014 ppb	111,040.314 ppb	2,799.192 ppb	19.437 ppb	24,359.711 ppb	4,058.090 ppb	88.704 %
Concentration per Run 3	89.796 %	84.818 %	0.003 ppb	114,879.335 ppb	2,787.519 ppb	13.407 ppb	24,438.653 ppb	4,020.548 ppb	87.338 %
Concentration RSD	1.3 %	6.2 %	154.9 %	1.8 %	2.3 %	18.8 %	3.0 %	1.1 %	6.8 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	89.203 %	14.765 ppb	2.131 ppb	22.743 ppb	72.877 ppb	394.185 ppb	1.613 ppb	34.084 ppb	14.901 ppb
Concentration per Run 1	89.598 %	14.016 ppb	2.295 ppb	21.874 ppb	72.525 ppb	416.628 ppb	1.476 ppb	32.808 ppb	13.255 ppb
Concentration per Run 2	88.428 %	15.449 ppb	1.846 ppb	23.796 ppb	73.077 ppb	391.320 ppb	1.573 ppb	35.249 ppb	14.725 ppb
Concentration per Run 3	89.584 %	14.829 ppb	2.251 ppb	22.559 ppb	73.031 ppb	374.608 ppb	1.790 ppb	34.195 ppb	16.722 ppb
Concentration RSD	0.8 %	4.9 %	11.6 %	4.3 %	0.4 %	5.4 %	10.0 %	3.6 %	11.7 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	14.894 ppb	87.791 %	2.745 ppb	0.271 ppb	71.480 ppb	4.819 ppb	85.292 %	0.015 ppb	0.069 ppb
Concentration per Run 1	14.445 ppb	95.239 %	2.216 ppb	-0.345 ppb	71.597 ppb	4.541 ppb	87.167 %	0.017 ppb	0.075 ppb
Concentration per Run 2	15.205 ppb	83.835 %	3.212 ppb	-0.101 ppb	73.738 ppb	4.610 ppb	83.889 %	0.017 ppb	0.074 ppb
Concentration per Run 3	15.033 ppb	84.301 %	2.806 ppb	1.258 ppb	69.104 ppb	5.306 ppb	84.820 %	0.010 ppb	0.056 ppb
Concentration RSD	2.7 %	7.4 %	18.2 %	318.9 %	3.2 %	8.8 %	2.0 %	29.3 %	15.4 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	84.776 %	13.289 ppb	0.884 ppb	61.279 ppb	88.761 %	87.134 %	0.002 ppb	4.231 ppb	90.513 %
Concentration per Run 1	90.435 %	12.986 ppb	0.883 ppb	61.464 ppb	91.445 %	91.531 %	0.001 ppb	4.068 ppb	95.028 %
Concentration per Run 2	82.954 %	13.086 ppb	0.839 ppb	60.169 ppb	87.558 %	85.315 %	0.001 ppb	4.280 ppb	88.930 %
Concentration per Run 3	80.940 %	13.796 ppb	0.931 ppb	62.204 ppb	87.280 %	84.557 %	0.005 ppb	4.346 ppb	87.581 %
Concentration RSD	5.9 %	3.3 %	5.2 %	1.7 %	2.6 %	4.4 %	90.6 %	3.4 %	4.4 %

Alpha ICPMSQ Full

6/7/2017 3:54:49 PM



Analysis index: 86 Analysis started at: 6/7/2017 1:15:54 PM Rack: 1
 Analysis label: WG1009825-3D20 6020TL User name: ALPHALAB\metals-instrument Vial: 57

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	93.991 %	91.118 %	2.429 ppb	30,026.086 ppb	1,244.286 ppb	113.222 ppb	6,661.736 ppb	1,536.251 ppb	90.263 %
Concentration per Run 1	96.128 %	91.456 %	2.398 ppb	28,001.230 ppb	1,179.052 ppb	101.216 ppb	6,351.234 ppb	1,505.272 ppb	96.112 %
Concentration per Run 2	92.494 %	96.988 %	2.413 ppb	29,770.892 ppb	1,139.110 ppb	112.892 ppb	6,817.235 ppb	1,588.629 ppb	88.231 %
Concentration per Run 3	93.351 %	84.910 %	2.476 ppb	32,306.137 ppb	1,414.695 ppb	125.557 ppb	6,816.738 ppb	1,514.853 ppb	86.445 %
Concentration RSD	2.0 %	6.6 %	1.7 %	7.2 %	12.0 %	10.8 %	4.0 %	3.0 %	5.7 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	95.063 %	49.200 ppb	25.648 ppb	15.718 ppb	43.646 ppb	152.056 ppb	24.524 ppb	33.202 ppb	15.703 ppb
Concentration per Run 1	97.170 %	45.586 ppb	22.312 ppb	15.369 ppb	42.146 ppb	134.394 ppb	24.337 ppb	31.250 ppb	15.568 ppb
Concentration per Run 2	93.514 %	50.788 ppb	27.826 ppb	15.301 ppb	43.976 ppb	173.467 ppb	24.473 ppb	33.545 ppb	15.563 ppb
Concentration per Run 3	94.504 %	51.226 ppb	26.805 ppb	16.483 ppb	44.817 ppb	148.306 ppb	24.763 ppb	34.811 ppb	15.977 ppb
Concentration RSD	2.0 %	6.4 %	11.4 %	4.2 %	3.1 %	13.0 %	0.9 %	5.4 %	1.5 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	28.448 ppb	92.494 %	6.366 ppb	5.936 ppb	66.853 ppb	43.668 ppb	91.899 %	0.528 ppb	2.507 ppb
Concentration per Run 1	28.624 ppb	90.677 %	5.892 ppb	5.759 ppb	67.354 ppb	42.976 ppb	92.994 %	0.298 ppb	2.339 ppb
Concentration per Run 2	28.214 ppb	94.034 %	6.615 ppb	5.857 ppb	64.621 ppb	43.163 ppb	92.860 %	0.757 ppb	2.641 ppb
Concentration per Run 3	28.507 ppb	92.770 %	6.592 ppb	6.191 ppb	68.585 ppb	44.866 ppb	89.843 %	0.528 ppb	2.541 ppb
Concentration RSD	0.7 %	1.8 %	6.5 %	3.8 %	3.0 %	2.4 %	1.9 %	43.5 %	6.1 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	90.319 %	42.946 ppb	19.453 ppb	113.337 ppb	92.462 %	91.001 %	6.070 ppb	28.305 ppb	91.582 %
Concentration per Run 1	91.366 %	42.645 ppb	18.560 ppb	109.131 ppb	93.321 %	93.542 %	5.996 ppb	27.638 ppb	93.670 %
Concentration per Run 2	89.433 %	42.556 ppb	19.836 ppb	116.136 ppb	92.186 %	90.867 %	6.109 ppb	28.677 ppb	90.829 %
Concentration per Run 3	90.157 %	43.638 ppb	19.961 ppb	114.745 ppb	91.879 %	88.595 %	6.106 ppb	28.599 ppb	90.245 %
Concentration RSD	1.1 %	1.4 %	4.0 %	3.3 %	0.8 %	2.7 %	1.1 %	2.0 %	2.0 %

Alpha ICPMSQ Full

6/7/2017 3:54:49 PM



Analysis index: 87 Analysis started at: 6/7/2017 1:19:16 PM Rack: 1
 Analysis label: WG1009825-4D20 6020TL User name: ALPHALAB\metals-instrument Vial: 58

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	94.395 %	93.147 %	2.492 ppb	29,121.276 ppb	1,185.563 ppb	110.106 ppb	6,408.699 ppb	1,466.319 ppb	91.961 %
Concentration per Run 1	94.485 %	92.655 %	2.369 ppb	29,295.025 ppb	1,154.579 ppb	112.003 ppb	6,497.415 ppb	1,428.479 ppb	90.858 %
Concentration per Run 2	95.087 %	93.208 %	2.561 ppb	29,135.311 ppb	1,200.995 ppb	110.689 ppb	6,549.655 ppb	1,577.894 ppb	91.646 %
Concentration per Run 3	93.612 %	93.577 %	2.547 ppb	28,933.492 ppb	1,201.115 ppb	107.625 ppb	6,179.027 ppb	1,392.583 ppb	93.380 %
Concentration RSD	0.8 %	0.5 %	4.3 %	0.6 %	2.3 %	2.0 %	3.1 %	6.7 %	1.4 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	94.230 %	46.480 ppb	24.776 ppb	15.278 ppb	43.673 ppb	138.209 ppb	23.854 ppb	31.224 ppb	15.678 ppb
Concentration per Run 1	93.953 %	43.784 ppb	25.418 ppb	15.883 ppb	42.400 ppb	137.466 ppb	23.352 ppb	31.428 ppb	15.749 ppb
Concentration per Run 2	93.847 %	47.606 ppb	25.530 ppb	14.849 ppb	45.423 ppb	132.129 ppb	24.225 ppb	32.934 ppb	15.804 ppb
Concentration per Run 3	94.891 %	48.048 ppb	23.379 ppb	15.102 ppb	43.195 ppb	145.033 ppb	23.986 ppb	29.310 ppb	15.480 ppb
Concentration RSD	0.6 %	5.0 %	4.9 %	3.5 %	3.6 %	4.7 %	1.9 %	5.8 %	1.1 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	28.371 ppb	91.772 %	6.230 ppb	5.940 ppb	65.573 ppb	44.408 ppb	89.777 %	0.548 ppb	2.657 ppb
Concentration per Run 1	27.912 ppb	94.565 %	6.490 ppb	5.076 ppb	63.862 ppb	43.500 ppb	91.558 %	0.481 ppb	2.732 ppb
Concentration per Run 2	28.990 ppb	90.230 %	6.002 ppb	7.263 ppb	67.254 ppb	45.349 ppb	88.939 %	0.704 ppb	2.835 ppb
Concentration per Run 3	28.212 ppb	90.521 %	6.200 ppb	5.482 ppb	65.604 ppb	44.374 ppb	88.833 %	0.461 ppb	2.404 ppb
Concentration RSD	2.0 %	2.6 %	3.9 %	19.6 %	2.6 %	2.1 %	1.7 %	24.6 %	8.5 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	87.809 %	42.484 ppb	21.507 ppb	114.539 ppb	91.695 %	89.154 %	5.988 ppb	27.492 ppb	93.003 %
Concentration per Run 1	89.223 %	42.047 ppb	19.625 ppb	111.933 ppb	93.054 %	89.731 %	6.025 ppb	26.844 ppb	92.431 %
Concentration per Run 2	86.459 %	42.986 ppb	22.738 ppb	117.180 ppb	91.635 %	89.103 %	6.053 ppb	27.899 ppb	91.994 %
Concentration per Run 3	87.745 %	42.419 ppb	22.158 ppb	114.503 ppb	90.395 %	88.628 %	5.885 ppb	27.733 ppb	94.583 %
Concentration RSD	1.6 %	1.1 %	7.7 %	2.3 %	1.5 %	0.6 %	1.5 %	2.1 %	1.5 %

Alpha ICPMSQ Full

6/7/2017 3:54:49 PM



Analysis index: 88 Analysis started at: 6/7/2017 1:22:39 PM Rack: 1
Analysis label: WG1009825-5D20 6020TL User name: ALPHALAB\metals-instrument Vial: 59

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	93.385 %	89.151 %	51.168 ppb	33,883.062 ppb	5,858.756 ppb	55.130 ppb	10,972.642 ppb	6,126.848 ppb	88.844 %
Concentration per Run 1	93.688 %	88.414 %	50.998 ppb	34,418.572 ppb	5,814.287 ppb	51.550 ppb	10,911.010 ppb	6,124.020 ppb	94.903 %
Concentration per Run 2	92.963 %	94.591 %	50.669 ppb	33,493.735 ppb	5,840.356 ppb	58.717 ppb	11,226.447 ppb	6,204.409 ppb	94.483 %
Concentration per Run 3	93.504 %	84.449 %	51.835 ppb	33,736.879 ppb	5,921.624 ppb	55.123 ppb	10,780.468 ppb	6,052.115 ppb	77.146 %
Concentration RSD	0.4 %	5.7 %	1.2 %	1.4 %	1.0 %	6.5 %	2.1 %	1.2 %	11.4 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	94.405 %	55.598 ppb	52.119 ppb	57.070 ppb	68.287 ppb	5,162.339 ppb	50.640 ppb	58.821 ppb	56.390 ppb
Concentration per Run 1	93.556 %	52.761 ppb	51.352 ppb	54.486 ppb	67.600 ppb	5,018.255 ppb	48.869 ppb	56.290 ppb	53.367 ppb
Concentration per Run 2	94.279 %	56.006 ppb	51.599 ppb	56.286 ppb	68.301 ppb	5,092.264 ppb	48.300 ppb	57.544 ppb	54.074 ppb
Concentration per Run 3	95.380 %	58.025 ppb	53.405 ppb	60.438 ppb	68.960 ppb	5,376.497 ppb	54.752 ppb	62.628 ppb	61.729 ppb
Concentration RSD	1.0 %	4.8 %	2.2 %	5.3 %	1.0 %	3.7 %	7.1 %	5.7 %	8.2 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	54.774 ppb	86.685 %	49.316 ppb	48.220 ppb	66.820 ppb	52.753 ppb	88.317 %	3.588 ppb	51.725 ppb
Concentration per Run 1	53.193 ppb	89.530 %	48.415 ppb	51.444 ppb	68.207 ppb	49.957 ppb	90.870 %	3.641 ppb	49.794 ppb
Concentration per Run 2	54.125 ppb	91.146 %	48.866 ppb	48.761 ppb	69.877 ppb	53.926 ppb	88.804 %	3.670 ppb	52.387 ppb
Concentration per Run 3	57.004 ppb	79.379 %	50.667 ppb	44.456 ppb	62.375 ppb	54.376 ppb	85.276 %	3.453 ppb	52.995 ppb
Concentration RSD	3.6 %	7.4 %	2.4 %	7.3 %	5.9 %	4.6 %	3.2 %	3.3 %	3.3 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	83.024 %	54.458 ppb	55.159 ppb	64.308 ppb	90.678 %	86.914 %	51.246 ppb	54.428 ppb	91.704 %
Concentration per Run 1	88.549 %	52.728 ppb	52.049 ppb	63.805 ppb	94.837 %	92.416 %	50.884 ppb	53.471 ppb	93.887 %
Concentration per Run 2	85.759 %	53.588 ppb	55.512 ppb	65.191 ppb	90.925 %	88.048 %	49.838 ppb	53.734 ppb	93.270 %
Concentration per Run 3	74.765 %	57.058 ppb	57.916 ppb	63.929 ppb	86.273 %	80.279 %	53.016 ppb	56.078 ppb	87.954 %
Concentration RSD	8.8 %	4.2 %	5.3 %	1.2 %	4.7 %	7.1 %	3.2 %	2.6 %	3.6 %

Alpha ICPMSQ Full

6/7/2017 3:54:49 PM



Analysis index: 89 Analysis started at: 6/7/2017 1:26:02 PM Rack: 1
 Analysis label: 577-05 SCAN User name: ALPHALAB\metals-instrument Vial: 60

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	99.027 %	96.343 %	0.019 ppb	45.085 ppb	1.285 ppb	-0.156 ppb	7.091 ppb	0.360 ppb	93.958 %
Concentration per Run 1	99.609 %	100.400 %	0.028 ppb	48.540 ppb	0.972 ppb	-0.441 ppb	8.285 ppb	0.354 ppb	95.691 %
Concentration per Run 2	98.317 %	89.428 %	0.015 ppb	45.710 ppb	1.905 ppb	0.111 ppb	2.334 ppb	0.373 ppb	89.808 %
Concentration per Run 3	99.156 %	99.201 %	0.015 ppb	41.005 ppb	0.977 ppb	-0.137 ppb	10.653 ppb	0.354 ppb	96.374 %
Concentration RSD	0.7 %	6.2 %	39.8 %	8.4 %	41.8 %	177.6 %	60.4 %	3.1 %	3.8 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	99.720 %	0.021 ppb	0.002 ppb	0.020 ppb	0.140 ppb	2.819 ppb	0.030 ppb	-0.001 ppb	-0.025 ppb
Concentration per Run 1	99.320 %	0.078 ppb	-0.010 ppb	0.021 ppb	0.138 ppb	1.299 ppb	0.056 ppb	-0.001 ppb	-0.034 ppb
Concentration per Run 2	99.608 %	0.024 ppb	0.027 ppb	0.055 ppb	0.150 ppb	2.460 ppb	0.000 ppb	-0.074 ppb	-0.034 ppb
Concentration per Run 3	100.232 %	-0.038 ppb	-0.010 ppb	-0.016 ppb	0.134 ppb	4.700 ppb	0.033 ppb	0.073 ppb	-0.007 ppb
Concentration RSD	0.5 %	273.1 %	1,028.9 %	176.3 %	5.9 %	61.3 %	95.2 %	13,811.2 %	61.6 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	-0.122 ppb	91.057 %	0.079 ppb	0.348 ppb	0.017 ppb	0.619 ppb	93.200 %	0.326 ppb	0.017 ppb
Concentration per Run 1	-0.114 ppb	91.947 %	0.088 ppb	0.456 ppb	-0.004 ppb	0.511 ppb	93.741 %	0.247 ppb	0.028 ppb
Concentration per Run 2	-0.095 ppb	84.224 %	0.045 ppb	-0.035 ppb	0.066 ppb	0.662 ppb	90.847 %	0.383 ppb	0.000 ppb
Concentration per Run 3	-0.157 ppb	97.001 %	0.106 ppb	0.622 ppb	-0.012 ppb	0.684 ppb	95.011 %	0.347 ppb	0.022 ppb
Concentration RSD	26.1 %	7.1 %	39.3 %	98.1 %	254.6 %	15.2 %	2.3 %	21.7 %	88.6 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	89.692 %	0.582 ppb	1.625 ppb	0.061 ppb	93.710 %	90.620 %	0.027 ppb	0.060 ppb	89.045 %
Concentration per Run 1	91.334 %	0.535 ppb	1.594 ppb	0.039 ppb	95.275 %	92.577 %	0.031 ppb	0.068 ppb	86.970 %
Concentration per Run 2	83.442 %	0.727 ppb	1.612 ppb	0.106 ppb	89.684 %	85.461 %	0.025 ppb	0.054 ppb	86.785 %
Concentration per Run 3	94.301 %	0.482 ppb	1.668 ppb	0.038 ppb	96.171 %	93.821 %	0.026 ppb	0.059 ppb	93.378 %
Concentration RSD	6.3 %	22.2 %	2.4 %	63.2 %	3.8 %	5.0 %	12.6 %	11.0 %	4.2 %

Alpha ICPMSQ Full

6/7/2017 3:54:49 PM



Analysis index: 90 Analysis started at: 6/7/2017 1:29:26 PM Rack: 0
 Analysis label: CCV User name: ALPHALAB\metals-instrument Vial: 9

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	96.415 %	90.596 %	101.866 ppb	10,709.464 ppb	10,775.369 ppb	101.727 ppb	10,588.744 ppb	10,748.250 ppb	91.874 %
Concentration per Run 1	97.170 %	81.960 %	102.575 ppb	10,441.167 ppb	10,481.244 ppb	98.416 ppb	9,738.718 ppb	10,166.889 ppb	89.230 %
Concentration per Run 2	96.108 %	94.499 %	101.246 ppb	10,893.264 ppb	10,931.980 ppb	99.886 ppb	11,414.776 ppb	11,159.798 ppb	92.802 %
Concentration per Run 3	95.966 %	95.329 %	101.777 ppb	10,793.961 ppb	10,912.883 ppb	106.878 ppb	10,612.740 ppb	10,918.062 ppb	93.590 %
Recovery Percentage 1			101.866 %	107.095 %	107.754 %	101.727 %	105.887 %	107.482 %	
Concentration RSD	0.7 %	8.3 %	0.7 %	2.2 %	2.4 %	4.4 %	7.9 %	4.8 %	2.5 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	97.262 %	103.609 ppb	99.660 ppb	102.373 ppb	102.994 ppb	10,176.153 ppb	100.533 ppb	98.949 ppb	101.608 ppb
Concentration per Run 1	98.024 %	98.222 ppb	98.143 ppb	98.853 ppb	97.354 ppb	9,715.183 ppb	100.352 ppb	100.724 ppb	102.421 ppb
Concentration per Run 2	97.545 %	103.621 ppb	102.089 ppb	104.221 ppb	105.138 ppb	10,365.318 ppb	100.539 ppb	98.456 ppb	100.435 ppb
Concentration per Run 3	96.218 %	108.983 ppb	98.748 ppb	104.046 ppb	106.490 ppb	10,447.958 ppb	100.708 ppb	97.668 ppb	101.970 ppb
Recovery Percentage 1		103.609 %	99.660 %	102.373 %	102.994 %	101.762 %	100.533 %	98.949 %	101.608 %
Concentration RSD	1.0 %	5.2 %	2.1 %	3.0 %	4.8 %	3.9 %	0.2 %	1.6 %	1.0 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	101.104 ppb	91.036 %	99.944 ppb	101.339 ppb	105.042 ppb	106.118 ppb	92.533 %	101.217 ppb	102.370 ppb
Concentration per Run 1	97.853 ppb	85.109 %	101.013 ppb	99.714 ppb	100.033 ppb	106.830 ppb	92.509 %	101.650 ppb	103.822 ppb
Concentration per Run 2	102.977 ppb	93.373 %	98.247 ppb	102.418 ppb	109.397 ppb	106.729 ppb	92.106 %	101.764 ppb	101.712 ppb
Concentration per Run 3	102.481 ppb	94.627 %	100.572 ppb	101.884 ppb	105.697 ppb	104.796 ppb	92.985 %	100.237 ppb	101.575 ppb
Recovery Percentage 1	101.104 %		99.944 %	101.339 %	105.042 %	106.118 %		101.217 %	102.370 %
Concentration RSD	2.8 %	5.7 %	1.5 %	1.4 %	4.5 %	1.1 %	0.5 %	0.8 %	1.2 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	88.455 %	103.301 ppb	109.467 ppb	103.372 ppb	93.172 %	90.545 %	100.152 ppb	102.832 ppb	99.214 %
Concentration per Run 1	83.923 %	101.116 ppb	105.761 ppb	98.898 ppb	92.354 %	88.398 %	99.833 ppb	101.202 ppb	99.025 %
Concentration per Run 2	91.093 %	103.914 ppb	111.349 ppb	105.198 ppb	92.614 %	92.416 %	101.871 ppb	104.072 ppb	99.097 %
Concentration per Run 3	90.350 %	104.874 ppb	111.291 ppb	106.021 ppb	94.547 %	90.822 %	98.752 ppb	103.222 ppb	99.520 %
Recovery Percentage 1		103.301 %	109.467 %	103.372 %			100.152 %	102.832 %	
Concentration RSD	4.5 %	1.9 %	2.9 %	3.8 %	1.3 %	2.2 %	1.6 %	1.4 %	0.3 %

Alpha ICPMSQ Full

6/7/2017 3:54:49 PM



Analysis index: 91 Analysis started at: 6/7/2017 1:32:51 PM Rack: 0
 Analysis label: CCB User name: ALPHALAB\metals-instrument Vial: 10

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	101.043 %	98.156 %	0.012 ppb	43.049 ppb	2.697 ppb	-0.187 ppb	11.826 ppb	5.909 ppb	96.760 %
Concentration per Run 1	102.160 %	96.435 %	0.014 ppb	45.867 ppb	1.688 ppb	-0.148 ppb	3.994 ppb	13.679 ppb	101.155 %
Concentration per Run 2	101.254 %	98.187 %	0.014 ppb	43.011 ppb	2.421 ppb	0.010 ppb	24.041 ppb	3.565 ppb	98.213 %
Concentration per Run 3	99.715 %	99.846 %	0.008 ppb	40.268 ppb	3.983 ppb	-0.423 ppb	7.443 ppb	0.485 ppb	90.910 %
Recovery Percentage 1		2.374 %		43.049 %	3.853 %	-1.873 %	11.826 %	5.909 %	
Concentration RSD	1.2 %	1.7 %	29.9 %	6.5 %	43.5 %	116.9 %	90.6 %	116.8 %	5.5 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	101.689 %	-0.038 ppb	-0.010 ppb	0.008 ppb	0.095 ppb	0.940 ppb	0.000 ppb	-0.072 ppb	0.011 ppb
Concentration per Run 1	103.589 %	-0.038 ppb	-0.010 ppb	-0.040 ppb	0.131 ppb	-0.517 ppb	0.000 ppb	-0.088 ppb	-0.007 ppb
Concentration per Run 2	100.692 %	-0.038 ppb	-0.010 ppb	0.027 ppb	0.053 ppb	2.886 ppb	0.000 ppb	-0.130 ppb	0.018 ppb
Concentration per Run 3	100.784 %	-0.038 ppb	-0.010 ppb	0.038 ppb	0.100 ppb	0.450 ppb	0.000 ppb	0.003 ppb	0.022 ppb
Recovery Percentage 1		-7.647 %	-0.208 %	0.818 %	9.475 %	1.880 %	0.000 %	-3.586 %	1.104 %
Concentration RSD	1.6 %	0.0 %	0.0 %	518.8 %	41.4 %	186.5 %		94.3 %	141.0 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	-0.038 ppb	95.152 %	0.046 ppb	0.199 ppb	0.027 ppb	0.528 ppb	95.623 %	0.194 ppb	0.009 ppb
Concentration per Run 1	0.093 ppb	93.294 %	0.063 ppb	0.579 ppb	0.016 ppb	0.566 ppb	96.361 %	0.159 ppb	0.005 ppb
Concentration per Run 2	-0.075 ppb	98.738 %	0.060 ppb	-0.124 ppb	0.055 ppb	0.460 ppb	95.695 %	0.182 ppb	0.017 ppb
Concentration per Run 3	-0.131 ppb	93.424 %	0.017 ppb	0.142 ppb	0.010 ppb	0.556 ppb	94.814 %	0.241 ppb	0.005 ppb
Recovery Percentage 1	-0.377 %	95.152 %	9.289 %	3.983 %	5.369 %	26.378 %		48.428 %	4.565 %
Concentration RSD	310.1 %	3.3 %	55.8 %	178.3 %	91.0 %	11.1 %	0.8 %	21.8 %	70.4 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	94.006 %	0.829 ppb	2.621 ppb	0.015 ppb	95.893 %	93.774 %	0.026 ppb	0.055 ppb	93.660 %
Concentration per Run 1	95.808 %	0.909 ppb	2.453 ppb	-0.004 ppb	99.604 %	95.114 %	0.027 ppb	0.057 ppb	92.350 %
Concentration per Run 2	92.298 %	0.829 ppb	2.882 ppb	0.011 ppb	95.632 %	94.452 %	0.027 ppb	0.058 ppb	94.710 %
Concentration per Run 3	93.912 %	0.748 ppb	2.529 ppb	0.040 ppb	92.442 %	91.757 %	0.022 ppb	0.050 ppb	93.921 %
Recovery Percentage 1		27.630 %	65.537 %	3.051 %			5.126 %	10.963 %	93.660 %
Concentration RSD	1.9 %	9.7 %	8.7 %	146.4 %	3.7 %	1.9 %	11.2 %	8.2 %	1.3 %

Alpha ICPMSQ Full

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Analysis index: 92 Analysis started at: 6/7/2017 1:36:16 PM Rack: 2
 Analysis label: WG1009977-1 6020SL User name: ALPHALAB\metals-instrument Vial: 3

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	93.919 %	95.206 %	0.001 ppb	68.255 ppb	0.761 ppb	1.134 ppb	16.539 ppb	13.405 ppb	95.201 %
Concentration per Run 1	94.356 %	95.513 %	-0.005 ppb	74.764 ppb	1.012 ppb	0.814 ppb	26.460 ppb	18.174 ppb	95.691 %
Concentration per Run 2	93.551 %	95.421 %	0.013 ppb	65.978 ppb	1.748 ppb	1.269 ppb	4.300 ppb	17.907 ppb	96.532 %
Concentration per Run 3	93.851 %	94.683 %	-0.005 ppb	64.022 ppb	-0.477 ppb	1.319 ppb	18.859 ppb	4.133 ppb	93.380 %
Concentration RSD	0.4 %	0.5 %	1,301.0 %	8.4 %	148.9 %	24.6 %	68.1 %	59.9 %	1.7 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	94.108 %	0.041 ppb	0.001 ppb	0.305 ppb	0.179 ppb	1.295 ppb	0.000 ppb	0.000 ppb	0.075 ppb
Concentration per Run 1	93.640 %	0.020 ppb	0.024 ppb	0.320 ppb	0.216 ppb	0.380 ppb	0.000 ppb	-0.005 ppb	0.180 ppb
Concentration per Run 2	94.056 %	-0.038 ppb	-0.010 ppb	0.334 ppb	0.097 ppb	3.968 ppb	0.000 ppb	-0.084 ppb	-0.034 ppb
Concentration per Run 3	94.627 %	0.141 ppb	-0.010 ppb	0.262 ppb	0.224 ppb	-0.463 ppb	0.000 ppb	0.088 ppb	0.078 ppb
Concentration RSD	0.5 %	224.0 %	1,688.4 %	12.4 %	39.9 %	181.7 %		98,118.8 %	142.5 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	1.533 ppb	92.258 %	0.033 ppb	0.810 ppb	0.022 ppb	0.311 ppb	93.345 %	0.947 ppb	0.004 ppb
Concentration per Run 1	1.633 ppb	95.549 %	0.016 ppb	-0.255 ppb	0.023 ppb	0.285 ppb	93.401 %	0.895 ppb	0.006 ppb
Concentration per Run 2	1.535 ppb	90.858 %	0.041 ppb	1.129 ppb	0.053 ppb	0.324 ppb	93.343 %	1.010 ppb	0.006 ppb
Concentration per Run 3	1.431 ppb	90.365 %	0.041 ppb	1.557 ppb	-0.010 ppb	0.325 ppb	93.291 %	0.936 ppb	0.000 ppb
Concentration RSD	6.6 %	3.1 %	44.2 %	116.9 %	144.4 %	7.3 %	0.1 %	6.2 %	86.6 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	91.009 %	0.867 ppb	1.926 ppb	0.030 ppb	93.853 %	92.054 %	0.005 ppb	0.062 ppb	107.336 %
Concentration per Run 1	92.035 %	0.864 ppb	1.825 ppb	0.025 ppb	94.345 %	93.132 %	0.008 ppb	0.062 ppb	112.898 %
Concentration per Run 2	91.091 %	0.993 ppb	1.923 ppb	0.011 ppb	94.121 %	93.079 %	0.002 ppb	0.068 ppb	104.877 %
Concentration per Run 3	89.900 %	0.744 ppb	2.030 ppb	0.055 ppb	93.094 %	89.951 %	0.006 ppb	0.057 ppb	104.233 %
Concentration RSD	1.2 %	14.4 %	5.3 %	74.4 %	0.7 %	2.0 %	49.2 %	9.2 %	4.5 %

Alpha ICPMSQ Full

6/7/2017 3:54:49 PM



Analysis index: 93 Analysis started at: 6/7/2017 1:39:38 PM Rack: 2
 Analysis label: WG1009977-2D5 6020SL User name: ALPHALAB\metals-instrument Vial: 4

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	95.754 %	93.915 %	10.085 ppb	2,165.670 ppb	2,174.513 ppb	455.240 ppb	2,206.932 ppb	2,232.325 ppb	94.605 %
Concentration per Run 1	97.194 %	97.634 %	9.905 ppb	2,124.022 ppb	2,153.296 ppb	448.209 ppb	2,163.695 ppb	1,998.546 ppb	94.956 %
Concentration per Run 2	95.921 %	89.797 %	10.034 ppb	2,213.177 ppb	2,235.965 ppb	468.654 ppb	2,192.607 ppb	2,170.528 ppb	95.481 %
Concentration per Run 3	94.147 %	94.315 %	10.316 ppb	2,159.812 ppb	2,134.277 ppb	448.858 ppb	2,264.494 ppb	2,527.901 ppb	93.380 %
Concentration RSD	1.6 %	4.2 %	2.1 %	2.1 %	2.5 %	2.6 %	2.4 %	12.1 %	1.2 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	94.765 %	189.913 ppb	103.389 ppb	41.077 ppb	102.879 ppb	215.039 ppb	94.389 ppb	96.394 ppb	49.016 ppb
Concentration per Run 1	98.348 %	184.173 ppb	100.223 ppb	39.758 ppb	99.904 ppb	217.445 ppb	92.521 ppb	91.988 ppb	49.086 ppb
Concentration per Run 2	94.747 %	187.881 ppb	102.885 ppb	41.299 ppb	107.191 ppb	203.176 ppb	94.631 ppb	97.159 ppb	49.100 ppb
Concentration per Run 3	91.200 %	197.684 ppb	107.060 ppb	42.174 ppb	101.543 ppb	224.496 ppb	96.016 ppb	100.036 ppb	48.863 ppb
Concentration RSD	3.8 %	3.7 %	3.3 %	3.0 %	3.7 %	5.1 %	1.9 %	4.2 %	0.3 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	98.642 ppb	96.049 %	24.018 ppb	24.933 ppb	205.432 ppb	192.718 ppb	93.563 %	9.879 ppb	10.731 ppb
Concentration per Run 1	96.212 ppb	96.049 %	24.123 ppb	24.080 ppb	207.003 ppb	188.911 ppb	96.136 %	9.700 ppb	10.001 ppb
Concentration per Run 2	98.658 ppb	96.528 %	23.614 ppb	28.368 ppb	205.661 ppb	193.083 ppb	91.951 %	9.890 ppb	11.110 ppb
Concentration per Run 3	101.056 ppb	95.570 %	24.316 ppb	22.350 ppb	203.632 ppb	196.160 ppb	92.601 %	10.046 ppb	11.082 ppb
Concentration RSD	2.5 %	0.5 %	1.5 %	12.4 %	0.8 %	1.9 %	2.4 %	1.8 %	5.9 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	91.086 %	198.231 ppb	96.051 ppb	409.899 ppb	92.184 %	92.789 %	24.967 ppb	112.438 ppb	95.649 %
Concentration per Run 1	93.811 %	192.275 ppb	91.518 ppb	405.544 ppb	90.473 %	94.682 %	24.208 ppb	109.286 ppb	98.462 %
Concentration per Run 2	90.239 %	200.514 ppb	96.931 ppb	411.576 ppb	94.647 %	92.669 %	24.846 ppb	111.681 ppb	96.330 %
Concentration per Run 3	89.208 %	201.906 ppb	99.705 ppb	412.579 ppb	91.431 %	91.017 %	25.849 ppb	116.347 ppb	92.154 %
Concentration RSD	2.7 %	2.6 %	4.3 %	0.9 %	2.4 %	2.0 %	3.3 %	3.2 %	3.4 %

Alpha ICPMSQ Full

6/7/2017 3:54:49 PM



Analysis index: 94 Analysis started at: 6/7/2017 1:42:59 PM Rack: 2
 Analysis label: L1717935-01 6020TL User name: ALPHALAB\metals-instrument Vial: 2

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	100.259 %	97.756 %	0.061 ppb	526,581.655 ppb	13,339.608 ppb	94.680 ppb	121,443.500 ppb	22,537.393 ppb	85.587 %
Concentration per Run 1	100.550 %	93.577 %	0.071 ppb	527,628.042 ppb	12,968.377 ppb	89.382 ppb	115,513.866 ppb	21,602.825 ppb	85.762 %
Concentration per Run 2	99.525 %	98.095 %	0.055 ppb	544,765.788 ppb	13,863.064 ppb	99.383 ppb	128,631.396 ppb	24,032.897 ppb	78.249 %
Concentration per Run 3	100.702 %	101.598 %	0.058 ppb	507,351.133 ppb	13,187.382 ppb	95.275 ppb	120,185.236 ppb	21,976.457 ppb	92.750 %
Concentration RSD	0.6 %	4.1 %	14.0 %	3.6 %	3.5 %	5.3 %	5.5 %	5.8 %	8.5 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	88.908 %	80.369 ppb	11.795 ppb	113.096 ppb	371.321 ppb	2,073.568 ppb	8.185 ppb	175.416 ppb	84.563 ppb
Concentration per Run 1	88.666 %	79.982 ppb	11.624 ppb	111.008 ppb	362.129 ppb	1,950.344 ppb	7.750 ppb	173.008 ppb	86.650 ppb
Concentration per Run 2	88.771 %	81.860 ppb	12.721 ppb	120.859 ppb	386.986 ppb	2,250.341 ppb	8.796 ppb	185.285 ppb	84.937 ppb
Concentration per Run 3	89.287 %	79.264 ppb	11.039 ppb	107.421 ppb	364.849 ppb	2,020.017 ppb	8.008 ppb	167.956 ppb	82.101 ppb
Concentration RSD	0.4 %	1.7 %	7.2 %	6.2 %	3.7 %	7.6 %	6.7 %	5.1 %	2.7 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	104.347 ppb	84.671 %	15.436 ppb	0.382 ppb	368.201 ppb	21.951 ppb	82.017 %	0.086 ppb	0.385 ppb
Concentration per Run 1	101.078 ppb	82.642 %	15.162 ppb	0.898 ppb	357.671 ppb	21.628 ppb	82.473 %	0.083 ppb	0.389 ppb
Concentration per Run 2	110.273 ppb	83.575 %	16.077 ppb	0.022 ppb	365.013 ppb	21.609 ppb	80.882 %	0.073 ppb	0.406 ppb
Concentration per Run 3	101.690 ppb	87.794 %	15.069 ppb	0.225 ppb	381.920 ppb	22.617 ppb	82.694 %	0.102 ppb	0.359 ppb
Concentration RSD	4.9 %	3.2 %	3.6 %	120.2 %	3.4 %	2.6 %	1.2 %	17.4 %	6.1 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	80.404 %	68.105 ppb	8.604 ppb	309.657 ppb	87.076 %	84.858 %	0.048 ppb	20.580 ppb	91.750 %
Concentration per Run 1	79.980 %	66.559 ppb	7.815 ppb	299.765 ppb	88.148 %	84.635 %	0.048 ppb	19.617 ppb	94.771 %
Concentration per Run 2	77.731 %	68.923 ppb	9.204 ppb	317.356 ppb	85.547 %	82.886 %	0.044 ppb	20.939 ppb	90.752 %
Concentration per Run 3	83.500 %	68.832 ppb	8.794 ppb	311.851 ppb	87.534 %	87.053 %	0.052 ppb	21.184 ppb	89.728 %
Concentration RSD	3.6 %	2.0 %	8.3 %	2.9 %	1.6 %	2.5 %	8.5 %	4.1 %	2.9 %

Alpha ICPMSQ Full

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Analysis index: 95 Analysis started at: 6/7/2017 1:46:21 PM Rack: 2
 Analysis label: L1717935-02 6020TL User name: ALPHALAB\metals-instrument Vial: 1

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	93.103 %	95.421 %	0.000 ppb	18,058.468 ppb	35,737.889 ppb	51.304 ppb	5,560.972 ppb	194,202.223 ppb	97.040 %
Concentration per Run 1	93.242 %	94.591 %	-0.001 ppb	17,235.896 ppb	33,601.867 ppb	45.394 ppb	5,125.879 ppb	177,712.233 ppb	98.003 %
Concentration per Run 2	93.208 %	93.300 %	0.002 ppb	18,691.798 ppb	37,132.834 ppb	52.653 ppb	5,741.031 ppb	199,126.085 ppb	96.953 %
Concentration per Run 3	92.858 %	98.371 %	-0.001 ppb	18,247.711 ppb	36,478.966 ppb	55.866 ppb	5,816.005 ppb	205,768.350 ppb	96.164 %
Concentration RSD	0.2 %	2.8 %	676.3 %	4.1 %	5.3 %	10.5 %	6.8 %	7.5 %	1.0 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	92.690 %	255.187 ppb	0.404 ppb	0.785 ppb	672.535 ppb	148.713 ppb	0.421 ppb	4.662 ppb	2.774 ppb
Concentration per Run 1	91.598 %	242.887 ppb	0.302 ppb	0.737 ppb	651.148 ppb	137.590 ppb	0.363 ppb	5.359 ppb	2.817 ppb
Concentration per Run 2	92.574 %	254.854 ppb	0.437 ppb	0.842 ppb	673.641 ppb	162.617 ppb	0.428 ppb	3.692 ppb	3.121 ppb
Concentration per Run 3	93.897 %	267.820 ppb	0.473 ppb	0.776 ppb	692.818 ppb	145.931 ppb	0.471 ppb	4.936 ppb	2.383 ppb
Concentration RSD	1.2 %	4.9 %	22.4 %	6.8 %	3.1 %	8.6 %	12.9 %	18.6 %	13.4 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	10.164 ppb	92.768 %	0.705 ppb	-0.128 ppb	357.757 ppb	6.729 ppb	89.525 %	0.107 ppb	0.017 ppb
Concentration per Run 1	9.336 ppb	87.152 %	0.666 ppb	0.265 ppb	345.067 ppb	6.014 ppb	92.100 %	0.069 ppb	0.011 ppb
Concentration per Run 2	10.249 ppb	94.929 %	0.775 ppb	0.049 ppb	364.339 ppb	7.158 ppb	88.638 %	0.110 ppb	0.012 ppb
Concentration per Run 3	10.908 ppb	96.224 %	0.674 ppb	-0.696 ppb	363.866 ppb	7.015 ppb	87.836 %	0.142 ppb	0.029 ppb
Concentration RSD	7.8 %	5.3 %	8.6 %	395.2 %	3.1 %	9.3 %	2.5 %	34.4 %	58.1 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	90.541 %	1.085 ppb	1.818 ppb	107.396 ppb	92.472 %	90.565 %	0.016 ppb	0.243 ppb	96.247 %
Concentration per Run 1	90.686 %	1.018 ppb	1.630 ppb	102.296 ppb	93.520 %	90.556 %	0.012 ppb	0.221 ppb	101.394 %
Concentration per Run 2	90.047 %	1.123 ppb	1.855 ppb	111.472 ppb	91.199 %	89.975 %	0.017 ppb	0.266 ppb	95.431 %
Concentration per Run 3	90.890 %	1.116 ppb	1.968 ppb	108.422 ppb	92.696 %	91.164 %	0.018 ppb	0.243 ppb	91.916 %
Concentration RSD	0.5 %	5.4 %	9.5 %	4.4 %	1.3 %	0.7 %	18.7 %	9.3 %	5.0 %

Alpha ICPMSQ Full

6/7/2017 3:54:49 PM



Analysis index: 96 Analysis started at: 6/7/2017 1:49:42 PM Rack: 2
Analysis label: WG1009977-3D10 6020SL User name: ALPHALAB\metals-instrument Vial: 5

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	97.684 %	102.366 %	5.154 ppb	1,933.800 ppb	2,684.248 ppb	227.704 ppb	1,377.227 ppb	9,727.363 ppb	100.859 %
Concentration per Run 1	100.285 %	104.733 %	4.992 ppb	1,890.461 ppb	2,716.676 ppb	230.098 ppb	1,366.626 ppb	9,641.014 ppb	106.464 %
Concentration per Run 2	97.529 %	103.165 %	5.018 ppb	1,933.760 ppb	2,665.106 ppb	229.199 ppb	1,442.103 ppb	9,708.100 ppb	103.310 %
Concentration per Run 3	95.239 %	99.201 %	5.452 ppb	1,977.178 ppb	2,670.962 ppb	223.816 ppb	1,322.953 ppb	9,832.975 ppb	92.802 %
Concentration RSD	2.6 %	2.8 %	5.0 %	2.2 %	1.1 %	1.5 %	4.4 %	1.0 %	7.1 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	96.421 %	99.762 ppb	47.137 ppb	19.774 ppb	52.406 ppb	116.026 ppb	47.230 ppb	48.189 ppb	23.877 ppb
Concentration per Run 1	99.600 %	101.069 ppb	45.891 ppb	18.347 ppb	49.956 ppb	108.630 ppb	43.704 ppb	46.119 ppb	22.136 ppb
Concentration per Run 2	95.057 %	98.000 ppb	46.898 ppb	19.437 ppb	52.942 ppb	103.980 ppb	47.426 ppb	49.284 ppb	24.562 ppb
Concentration per Run 3	94.607 %	100.218 ppb	48.623 ppb	21.537 ppb	54.321 ppb	135.469 ppb	50.560 ppb	49.163 ppb	24.933 ppb
Concentration RSD	2.9 %	1.6 %	2.9 %	8.2 %	4.3 %	14.6 %	7.3 %	3.7 %	6.4 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	48.788 ppb	95.363 %	11.907 ppb	13.390 ppb	122.268 ppb	95.898 ppb	93.923 %	4.941 ppb	5.182 ppb
Concentration per Run 1	46.592 ppb	103.354 %	11.068 ppb	12.648 ppb	120.332 ppb	90.905 ppb	97.708 %	4.680 ppb	4.798 ppb
Concentration per Run 2	48.651 ppb	92.110 %	12.460 ppb	14.457 ppb	125.082 ppb	99.727 ppb	93.687 %	5.092 ppb	5.419 ppb
Concentration per Run 3	51.119 ppb	90.625 %	12.193 ppb	13.064 ppb	121.390 ppb	97.061 ppb	90.374 %	5.051 ppb	5.329 ppb
Concentration RSD	4.6 %	7.3 %	6.2 %	7.1 %	2.0 %	4.7 %	3.9 %	4.6 %	6.5 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	96.060 %	94.860 ppb	48.259 ppb	205.570 ppb	96.175 %	94.627 %	12.351 ppb	55.550 ppb	96.562 %
Concentration per Run 1	102.146 %	89.963 ppb	45.509 ppb	207.756 ppb	98.434 %	96.775 %	11.935 ppb	54.192 ppb	99.024 %
Concentration per Run 2	95.270 %	97.056 ppb	49.121 ppb	207.689 ppb	96.446 %	94.743 %	12.670 ppb	56.103 ppb	95.958 %
Concentration per Run 3	90.763 %	97.562 ppb	50.148 ppb	201.264 ppb	93.644 %	92.364 %	12.448 ppb	56.356 ppb	94.703 %
Concentration RSD	6.0 %	4.5 %	5.0 %	1.8 %	2.5 %	2.3 %	3.1 %	2.1 %	2.3 %

Alpha ICPMSQ Full

6/7/2017 3:54:49 PM



Analysis index: 97 Analysis started at: 6/7/2017 1:53:04 PM Rack: 2
 Analysis label: WG1009977-5D10 6020SL User name: ALPHALAB\metals-instrument Vial: 6

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	94.944 %	92.593 %	51.357 ppb	6,295.493 ppb	7,130.410 ppb	60.507 ppb	5,849.964 ppb	14,449.118 ppb	92.627 %
Concentration per Run 1	95.777 %	100.031 %	50.993 ppb	6,122.725 ppb	6,912.723 ppb	58.630 ppb	5,712.056 ppb	13,864.786 ppb	98.844 %
Concentration per Run 2	95.074 %	86.478 %	51.392 ppb	6,485.971 ppb	7,274.181 ppb	62.534 ppb	5,988.308 ppb	14,545.908 ppb	91.330 %
Concentration per Run 3	93.983 %	91.272 %	51.687 ppb	6,277.782 ppb	7,204.327 ppb	60.357 ppb	5,849.527 ppb	14,936.661 ppb	87.706 %
Concentration RSD	1.0 %	7.4 %	0.7 %	2.9 %	2.7 %	3.2 %	2.4 %	3.8 %	6.1 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	93.862 %	66.155 ppb	48.844 ppb	50.872 ppb	52.934 ppb	5,074.267 ppb	49.361 ppb	49.482 ppb	48.820 ppb
Concentration per Run 1	96.615 %	62.735 ppb	46.708 ppb	47.161 ppb	53.967 ppb	4,893.541 ppb	47.440 ppb	49.046 ppb	45.399 ppb
Concentration per Run 2	93.099 %	67.062 ppb	46.789 ppb	51.561 ppb	51.009 ppb	5,126.434 ppb	47.801 ppb	49.438 ppb	50.404 ppb
Concentration per Run 3	91.871 %	68.666 ppb	53.034 ppb	53.894 ppb	53.827 ppb	5,202.826 ppb	52.842 ppb	49.962 ppb	50.656 ppb
Concentration RSD	2.6 %	4.6 %	7.4 %	6.7 %	3.2 %	3.2 %	6.1 %	0.9 %	6.1 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	49.349 ppb	92.694 %	49.985 ppb	49.989 ppb	68.818 ppb	51.102 ppb	90.641 %	5.633 ppb	50.294 ppb
Concentration per Run 1	47.017 ppb	97.806 %	47.776 ppb	53.875 ppb	68.429 ppb	50.014 ppb	92.061 %	5.697 ppb	47.418 ppb
Concentration per Run 2	50.400 ppb	91.774 %	49.667 ppb	48.204 ppb	68.843 ppb	50.951 ppb	90.891 %	5.592 ppb	50.770 ppb
Concentration per Run 3	50.630 ppb	88.501 %	52.511 ppb	47.888 ppb	69.182 ppb	52.340 ppb	88.970 %	5.610 ppb	52.695 ppb
Concentration RSD	4.1 %	5.1 %	4.8 %	6.7 %	0.5 %	2.3 %	1.7 %	1.0 %	5.3 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	89.950 %	50.645 ppb	55.159 ppb	55.826 ppb	92.921 %	92.092 %	51.210 ppb	52.754 ppb	94.152 %
Concentration per Run 1	96.446 %	47.705 ppb	51.970 ppb	55.161 ppb	95.484 %	94.500 %	50.250 ppb	51.518 ppb	96.115 %
Concentration per Run 2	87.929 %	50.181 ppb	56.065 ppb	54.631 ppb	92.580 %	91.211 %	51.811 ppb	53.364 ppb	92.611 %
Concentration per Run 3	85.473 %	54.050 ppb	57.441 ppb	57.685 ppb	90.700 %	90.565 %	51.569 ppb	53.380 ppb	93.729 %
Concentration RSD	6.4 %	6.3 %	5.2 %	2.9 %	2.6 %	2.3 %	1.6 %	2.0 %	1.9 %

Alpha ICPMSQ Full

6/7/2017 3:54:49 PM



Analysis index: 98 Analysis started at: 6/7/2017 1:56:25 PM Rack: 2
 Analysis label: WG1009977-4 6020SL User name: ALPHALAB\metals-instrument Vial: 8

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	91.127 %	92.470 %	0.004 ppb	8,496.534 ppb	15,830.596 ppb	159.239 ppb	1,846.461 ppb	82,277.193 ppb	92.171 %
Concentration per Run 1	91.655 %	96.619 %	-0.001 ppb	8,203.283 ppb	15,204.613 ppb	152.191 ppb	1,768.207 ppb	80,261.465 ppb	93.485 %
Concentration per Run 2	91.269 %	90.166 %	-0.001 ppb	8,830.677 ppb	16,553.901 ppb	166.972 ppb	1,896.154 ppb	84,597.780 ppb	90.227 %
Concentration per Run 3	90.456 %	90.627 %	0.014 ppb	8,455.642 ppb	15,733.274 ppb	158.553 ppb	1,875.022 ppb	81,972.334 ppb	92.802 %
Concentration RSD	0.7 %	3.9 %	234.1 %	3.7 %	4.3 %	4.7 %	3.7 %	2.7 %	1.9 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	89.216 %	109.940 ppb	0.271 ppb	0.381 ppb	4.105 ppb	38.063 ppb	0.024 ppb	0.184 ppb	0.323 ppb
Concentration per Run 1	90.265 %	109.711 ppb	0.278 ppb	0.049 ppb	4.378 ppb	42.831 ppb	0.012 ppb	0.179 ppb	0.338 ppb
Concentration per Run 2	89.003 %	112.707 ppb	0.436 ppb	0.091 ppb	4.032 ppb	38.382 ppb	0.048 ppb	0.278 ppb	0.346 ppb
Concentration per Run 3	88.379 %	107.404 ppb	0.098 ppb	1.005 ppb	3.906 ppb	32.977 ppb	0.012 ppb	0.095 ppb	0.284 ppb
Concentration RSD	1.1 %	2.4 %	62.3 %	141.7 %	6.0 %	13.0 %	87.9 %	49.5 %	10.6 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	0.715 ppb	86.850 %	0.344 ppb	0.208 ppb	152.067 ppb	1.549 ppb	87.233 %	0.090 ppb	0.012 ppb
Concentration per Run 1	0.730 ppb	87.567 %	0.390 ppb	0.426 ppb	151.328 ppb	1.565 ppb	90.933 %	0.047 ppb	0.023 ppb
Concentration per Run 2	0.753 ppb	86.219 %	0.448 ppb	0.129 ppb	149.938 ppb	1.595 ppb	86.339 %	0.105 ppb	0.000 ppb
Concentration per Run 3	0.663 ppb	86.763 %	0.194 ppb	0.070 ppb	154.934 ppb	1.486 ppb	84.425 %	0.118 ppb	0.012 ppb
Concentration RSD	6.5 %	0.8 %	38.6 %	91.6 %	1.7 %	3.6 %	3.8 %	42.1 %	98.5 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	86.404 %	1.422 ppb	3.305 ppb	53.088 ppb	91.124 %	89.482 %	0.018 ppb	0.111 ppb	99.837 %
Concentration per Run 1	88.052 %	1.348 ppb	3.261 ppb	53.194 ppb	93.590 %	93.027 %	0.015 ppb	0.111 ppb	104.111 %
Concentration per Run 2	85.629 %	1.452 ppb	3.221 ppb	54.215 ppb	91.156 %	88.115 %	0.020 ppb	0.117 ppb	99.018 %
Concentration per Run 3	85.530 %	1.464 ppb	3.433 ppb	51.854 ppb	88.624 %	87.304 %	0.020 ppb	0.104 ppb	96.383 %
Concentration RSD	1.7 %	4.5 %	3.4 %	2.2 %	2.7 %	3.5 %	15.4 %	5.7 %	3.9 %

Alpha ICPMSQ Full

6/7/2017 3:54:49 PM



Analysis index: 99 Analysis started at: 6/7/2017 1:59:48 PM Rack: 2
 Analysis label: L1717934-06 6020SL User name: ALPHALAB\metals-instrument Vial: 9

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	90.564 %	94.468 %	0.009 ppb	8,578.943 ppb	15,965.034 ppb	33.664 ppb	1,831.959 ppb	84,496.334 ppb	88.231 %
Concentration per Run 1	90.825 %	94.775 %	0.024 ppb	8,496.293 ppb	15,798.511 ppb	35.732 ppb	1,835.258 ppb	82,201.799 ppb	90.227 %
Concentration per Run 2	91.250 %	94.775 %	0.002 ppb	8,643.788 ppb	16,165.077 ppb	33.339 ppb	1,904.956 ppb	88,577.891 ppb	85.341 %
Concentration per Run 3	89.617 %	93.853 %	-0.001 ppb	8,596.749 ppb	15,931.514 ppb	31.920 ppb	1,755.664 ppb	82,709.313 ppb	89.124 %
Concentration RSD	0.9 %	0.6 %	161.1 %	0.9 %	1.2 %	5.7 %	4.1 %	4.2 %	2.9 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	88.498 %	111.479 ppb	0.471 ppb	0.082 ppb	4.078 ppb	36.787 ppb	0.028 ppb	0.250 ppb	0.397 ppb
Concentration per Run 1	88.725 %	110.683 ppb	0.323 ppb	0.090 ppb	3.925 ppb	28.731 ppb	0.012 ppb	0.274 ppb	0.371 ppb
Concentration per Run 2	89.653 %	117.677 ppb	0.616 ppb	0.114 ppb	4.190 ppb	44.281 ppb	0.025 ppb	0.115 ppb	0.362 ppb
Concentration per Run 3	87.116 %	106.078 ppb	0.475 ppb	0.042 ppb	4.119 ppb	37.349 ppb	0.047 ppb	0.363 ppb	0.457 ppb
Concentration RSD	1.5 %	5.2 %	31.1 %	44.9 %	3.4 %	21.2 %	64.1 %	50.1 %	13.2 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	1.512 ppb	86.349 %	0.328 ppb	-0.107 ppb	153.812 ppb	0.900 ppb	85.769 %	0.068 ppb	0.008 ppb
Concentration per Run 1	1.815 ppb	87.541 %	0.291 ppb	-0.212 ppb	147.191 ppb	0.792 ppb	89.062 %	0.046 ppb	0.012 ppb
Concentration per Run 2	1.162 ppb	83.239 %	0.255 ppb	-0.362 ppb	158.410 ppb	0.947 ppb	84.682 %	0.066 ppb	0.006 ppb
Concentration per Run 3	1.561 ppb	88.266 %	0.438 ppb	0.254 ppb	155.837 ppb	0.960 ppb	83.564 %	0.093 ppb	0.006 ppb
Concentration RSD	21.8 %	3.1 %	29.6 %	301.1 %	3.8 %	10.4 %	3.4 %	34.8 %	40.0 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	84.358 %	0.759 ppb	1.229 ppb	53.681 ppb	87.956 %	86.733 %	0.008 ppb	0.066 ppb	96.182 %
Concentration per Run 1	87.023 %	0.685 ppb	1.032 ppb	53.515 ppb	89.261 %	87.836 %	0.005 ppb	0.059 ppb	101.394 %
Concentration per Run 2	84.282 %	0.706 ppb	1.364 ppb	54.707 ppb	88.210 %	85.874 %	0.011 ppb	0.071 ppb	94.630 %
Concentration per Run 3	81.768 %	0.887 ppb	1.291 ppb	52.822 ppb	86.398 %	86.488 %	0.009 ppb	0.067 ppb	92.521 %
Concentration RSD	3.1 %	14.6 %	14.2 %	1.8 %	1.6 %	1.2 %	39.7 %	8.8 %	4.8 %

Alpha ICPMSQ Full

6/7/2017 3:54:49 PM



Analysis index: 100 Analysis started at: 6/7/2017 2:03:10 PM Rack: 2
 Analysis label: L1717935-01D20 6020TL User name: ALPHALAB\metals-instrument Vial: 11

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	94.864 %	91.764 %	0.186 ppb	28,879.143 ppb	757.253 ppb	5.323 ppb	5,877.433 ppb	1,141.020 ppb	89.247 %
Concentration per Run 1	96.229 %	94.130 %	0.175 ppb	29,231.162 ppb	753.001 ppb	3.834 ppb	6,109.637 ppb	1,131.468 ppb	94.220 %
Concentration per Run 2	95.514 %	90.442 %	0.159 ppb	29,486.263 ppb	794.832 ppb	5.534 ppb	6,064.330 ppb	1,201.348 ppb	85.657 %
Concentration per Run 3	92.850 %	90.719 %	0.224 ppb	27,920.003 ppb	723.925 ppb	6.601 ppb	5,458.330 ppb	1,090.242 ppb	87.864 %
Concentration RSD	1.9 %	2.2 %	18.4 %	2.9 %	4.7 %	26.2 %	6.2 %	4.9 %	5.0 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	91.742 %	4.831 ppb	0.537 ppb	5.838 ppb	19.495 ppb	107.085 ppb	0.528 ppb	8.986 ppb	4.653 ppb
Concentration per Run 1	92.926 %	5.886 ppb	0.631 ppb	5.776 ppb	19.699 ppb	104.995 ppb	0.401 ppb	8.459 ppb	5.335 ppb
Concentration per Run 2	91.132 %	5.208 ppb	0.454 ppb	5.834 ppb	19.306 ppb	111.773 ppb	0.551 ppb	9.440 ppb	3.851 ppb
Concentration per Run 3	91.169 %	3.397 ppb	0.526 ppb	5.903 ppb	19.481 ppb	104.487 ppb	0.631 ppb	9.058 ppb	4.773 ppb
Concentration RSD	1.1 %	26.6 %	16.6 %	1.1 %	1.0 %	3.8 %	22.1 %	5.5 %	16.1 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	5.135 ppb	85.995 %	0.733 ppb	0.424 ppb	17.346 ppb	1.136 ppb	88.097 %	0.006 ppb	0.236 ppb
Concentration per Run 1	5.395 ppb	89.381 %	0.796 ppb	0.141 ppb	17.603 ppb	1.006 ppb	90.960 %	0.011 ppb	0.294 ppb
Concentration per Run 2	4.990 ppb	86.375 %	0.724 ppb	0.348 ppb	17.591 ppb	1.101 ppb	87.397 %	0.003 ppb	0.129 ppb
Concentration per Run 3	5.020 ppb	82.228 %	0.680 ppb	0.782 ppb	16.845 ppb	1.300 ppb	85.933 %	0.005 ppb	0.283 ppb
Concentration RSD	4.4 %	4.2 %	8.0 %	77.1 %	2.5 %	13.2 %	2.9 %	68.0 %	39.1 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	83.453 %	3.679 ppb	0.712 ppb	14.857 ppb	90.436 %	87.448 %	0.186 ppb	1.389 ppb	88.549 %
Concentration per Run 1	88.610 %	3.497 ppb	0.768 ppb	14.848 ppb	93.676 %	91.854 %	0.190 ppb	1.351 ppb	89.954 %
Concentration per Run 2	81.852 %	3.603 ppb	0.642 ppb	14.328 ppb	90.941 %	86.144 %	0.170 ppb	1.408 ppb	88.104 %
Concentration per Run 3	79.896 %	3.938 ppb	0.727 ppb	15.395 ppb	86.692 %	84.347 %	0.198 ppb	1.407 ppb	87.589 %
Concentration RSD	5.5 %	6.2 %	9.0 %	3.6 %	3.9 %	4.5 %	7.6 %	2.3 %	1.4 %

Alpha ICPMSQ Full

6/7/2017 3:54:49 PM



Analysis index: 101 Analysis started at: 6/7/2017 2:06:33 PM Rack: 2
 Analysis label: WG1009825-6D100 6020TL User name: ALPHALAB\metals-instrument Vial: 12

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	94.803 %	93.116 %	0.037 ppb	5,748.342 ppb	151.056 ppb	1.185 ppb	1,248.198 ppb	258.489 ppb	87.706 %
Concentration per Run 1	95.625 %	96.527 %	0.037 ppb	5,648.617 ppb	150.520 ppb	1.019 ppb	1,194.031 ppb	260.501 ppb	90.543 %
Concentration per Run 2	93.606 %	91.088 %	0.052 ppb	5,735.700 ppb	151.055 ppb	0.330 ppb	1,237.747 ppb	234.928 ppb	81.927 %
Concentration per Run 3	95.179 %	91.733 %	0.023 ppb	5,860.710 ppb	151.593 ppb	2.206 ppb	1,312.817 ppb	280.039 ppb	90.648 %
Concentration RSD	1.1 %	3.2 %	39.2 %	1.9 %	0.4 %	80.1 %	4.8 %	8.8 %	5.7 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	90.678 %	0.608 ppb	0.200 ppb	1.160 ppb	3.763 ppb	26.221 ppb	0.125 ppb	1.788 ppb	0.759 ppb
Concentration per Run 1	91.827 %	0.825 ppb	0.212 ppb	1.140 ppb	4.117 ppb	24.190 ppb	0.143 ppb	1.871 ppb	0.757 ppb
Concentration per Run 2	89.612 %	0.299 ppb	0.030 ppb	1.221 ppb	3.050 ppb	29.609 ppb	0.138 ppb	1.777 ppb	0.776 ppb
Concentration per Run 3	90.596 %	0.699 ppb	0.359 ppb	1.120 ppb	4.123 ppb	24.864 ppb	0.094 ppb	1.714 ppb	0.744 ppb
Concentration RSD	1.2 %	45.2 %	82.3 %	4.6 %	16.4 %	11.3 %	21.4 %	4.4 %	2.1 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	1.364 ppb	86.727 %	0.227 ppb	-0.039 ppb	3.660 ppb	0.279 ppb	89.005 %	0.004 ppb	0.034 ppb
Concentration per Run 1	1.417 ppb	85.721 %	0.145 ppb	0.175 ppb	3.821 ppb	0.263 ppb	91.158 %	0.002 ppb	0.035 ppb
Concentration per Run 2	1.155 ppb	86.660 %	0.244 ppb	-0.072 ppb	3.525 ppb	0.235 ppb	86.752 %	0.000 ppb	0.025 ppb
Concentration per Run 3	1.521 ppb	87.800 %	0.291 ppb	-0.220 ppb	3.633 ppb	0.338 ppb	89.103 %	0.009 ppb	0.041 ppb
Concentration RSD	13.8 %	1.2 %	32.7 %	511.8 %	4.1 %	19.1 %	2.5 %	117.4 %	24.7 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	85.112 %	0.889 ppb	0.365 ppb	2.972 ppb	89.332 %	85.941 %	0.037 ppb	0.285 ppb	90.866 %
Concentration per Run 1	85.574 %	0.846 ppb	0.306 ppb	2.707 ppb	88.832 %	86.120 %	0.037 ppb	0.270 ppb	91.076 %
Concentration per Run 2	82.280 %	0.940 ppb	0.350 ppb	2.954 ppb	89.387 %	83.212 %	0.037 ppb	0.312 ppb	89.159 %
Concentration per Run 3	87.482 %	0.882 ppb	0.437 ppb	3.254 ppb	89.778 %	88.491 %	0.036 ppb	0.274 ppb	92.365 %
Concentration RSD	3.1 %	5.3 %	18.3 %	9.2 %	0.5 %	3.1 %	1.1 %	8.0 %	1.8 %

Alpha ICPMSQ Full

6/7/2017 3:54:49 PM



Analysis index: 102 Analysis started at: 6/7/2017 2:09:57 PM Rack: 0
 Analysis label: CCV User name: ALPHALAB\metals-instrument Vial: 9

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	90.988 %	90.811 %	102.943 ppb	10,481.375 ppb	10,610.066 ppb	99.165 ppb	10,725.514 ppb	10,924.988 ppb	89.439 %
Concentration per Run 1	92.008 %	91.917 %	102.728 ppb	10,156.743 ppb	10,173.965 ppb	98.160 ppb	10,050.397 ppb	10,021.857 ppb	94.430 %
Concentration per Run 2	90.335 %	92.655 %	103.037 ppb	10,667.124 ppb	10,782.555 ppb	105.056 ppb	11,087.725 ppb	11,558.397 ppb	85.394 %
Concentration per Run 3	90.622 %	87.861 %	103.065 ppb	10,620.258 ppb	10,873.677 ppb	94.278 ppb	11,038.422 ppb	11,194.709 ppb	88.494 %
Recovery Percentage 1			102.943 %	104.814 %	106.101 %	99.165 %	107.255 %	109.250 %	
Concentration RSD	1.0 %	2.8 %	0.2 %	2.7 %	3.6 %	5.5 %	5.5 %	7.4 %	5.1 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	89.800 %	106.396 ppb	99.778 ppb	100.674 ppb	102.452 ppb	10,090.185 ppb	97.996 ppb	99.183 ppb	96.655 ppb
Concentration per Run 1	91.508 %	101.484 ppb	95.433 ppb	93.692 ppb	94.276 ppb	9,409.959 ppb	93.903 ppb	94.496 ppb	90.300 ppb
Concentration per Run 2	88.475 %	111.633 ppb	103.335 ppb	108.832 ppb	113.445 ppb	10,556.499 ppb	102.948 ppb	107.413 ppb	101.403 ppb
Concentration per Run 3	89.416 %	106.071 ppb	100.567 ppb	99.499 ppb	99.635 ppb	10,304.097 ppb	97.137 ppb	95.641 ppb	98.261 ppb
Recovery Percentage 1		106.396 %	99.778 %	100.674 %	102.452 %	100.902 %	97.996 %	99.183 %	96.655 %
Concentration RSD	1.7 %	4.8 %	4.0 %	7.6 %	9.7 %	6.0 %	4.7 %	7.2 %	5.9 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	98.117 ppb	88.815 %	98.631 ppb	103.159 ppb	104.473 ppb	102.284 ppb	88.008 %	100.393 ppb	103.343 ppb
Concentration per Run 1	93.418 ppb	91.806 %	92.185 ppb	92.358 ppb	100.831 ppb	98.650 ppb	90.013 %	97.687 ppb	99.670 ppb
Concentration per Run 2	102.422 ppb	86.921 %	104.559 ppb	107.876 ppb	106.684 ppb	104.430 ppb	87.624 %	100.667 ppb	104.086 ppb
Concentration per Run 3	98.513 ppb	87.719 %	99.148 ppb	109.244 ppb	105.903 ppb	103.773 ppb	86.388 %	102.825 ppb	106.273 ppb
Recovery Percentage 1	98.117 %		98.631 %	103.159 %	104.473 %	102.284 %		100.393 %	103.343 %
Concentration RSD	4.6 %	3.0 %	6.3 %	9.1 %	3.0 %	3.1 %	2.1 %	2.6 %	3.3 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	85.659 %	102.549 ppb	108.509 ppb	104.521 ppb	89.670 %	88.618 %	101.432 ppb	102.815 ppb	95.557 %
Concentration per Run 1	87.948 %	99.221 ppb	103.089 ppb	101.280 ppb	92.178 %	91.169 %	99.290 ppb	99.106 ppb	98.516 %
Concentration per Run 2	85.282 %	102.974 ppb	108.820 ppb	106.129 ppb	89.128 %	87.426 %	101.651 ppb	103.253 ppb	94.770 %
Concentration per Run 3	83.747 %	105.451 ppb	113.619 ppb	106.155 ppb	87.704 %	87.258 %	103.355 ppb	106.086 ppb	93.384 %
Recovery Percentage 1		102.549 %	108.509 %	104.521 %			101.432 %	102.815 %	
Concentration RSD	2.5 %	3.1 %	4.9 %	2.7 %	2.5 %	2.5 %	2.0 %	3.4 %	2.8 %

Alpha ICPMSQ Full

6/7/2017 3:54:49 PM



Analysis index: 103 Analysis started at: 6/7/2017 2:13:22 PM Rack: 0
 Analysis label: CCB User name: ALPHALAB\metals-instrument Vial: 10

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	95.101 %	90.196 %	0.011 ppb	48.520 ppb	2.913 ppb	-0.129 ppb	19.966 ppb	4.122 ppb	92.189 %
Concentration per Run 1	94.948 %	90.166 %	0.016 ppb	46.935 ppb	2.576 ppb	0.060 ppb	19.597 ppb	3.675 ppb	96.795 %
Concentration per Run 2	93.750 %	91.548 %	0.002 ppb	45.801 ppb	2.659 ppb	-0.393 ppb	35.123 ppb	4.302 ppb	89.807 %
Concentration per Run 3	96.604 %	88.875 %	0.015 ppb	52.825 ppb	3.503 ppb	-0.053 ppb	5.179 ppb	4.389 ppb	89.965 %
Recovery Percentage 1			2.217 %	48.520 %	4.161 %	-1.285 %	19.966 %	4.122 %	
Concentration RSD	1.5 %	1.5 %	70.9 %	7.8 %	17.6 %	183.4 %	75.0 %	9.5 %	4.3 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	91.813 %	0.062 ppb	-0.010 ppb	-0.010 ppb	0.045 ppb	2.909 ppb	0.015 ppb	0.009 ppb	0.033 ppb
Concentration per Run 1	91.623 %	0.077 ppb	-0.010 ppb	-0.037 ppb	0.056 ppb	4.887 ppb	0.023 ppb	-0.083 ppb	0.022 ppb
Concentration per Run 2	90.321 %	0.086 ppb	-0.010 ppb	0.016 ppb	0.018 ppb	4.268 ppb	0.012 ppb	0.054 ppb	0.024 ppb
Concentration per Run 3	93.495 %	0.024 ppb	-0.010 ppb	-0.008 ppb	0.061 ppb	-0.429 ppb	0.012 ppb	0.056 ppb	0.054 ppb
Recovery Percentage 1		12.449 %	-0.208 %	-0.986 %	4.523 %	5.818 %	3.086 %	0.443 %	3.327 %
Concentration RSD	1.7 %	54.1 %	0.0 %	272.8 %	52.4 %	99.9 %	40.2 %	896.5 %	52.9 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	-0.142 ppb	88.266 %	0.018 ppb	0.828 ppb	0.030 ppb	0.357 ppb	89.055 %	0.097 ppb	0.006 ppb
Concentration per Run 1	-0.184 ppb	89.407 %	0.042 ppb	1.312 ppb	0.063 ppb	0.210 ppb	89.759 %	0.068 ppb	0.006 ppb
Concentration per Run 2	-0.084 ppb	88.266 %	-0.007 ppb	0.399 ppb	0.028 ppb	0.395 ppb	88.144 %	0.083 ppb	0.006 ppb
Concentration per Run 3	-0.159 ppb	87.126 %	0.018 ppb	0.772 ppb	-0.001 ppb	0.466 ppb	89.262 %	0.139 ppb	0.006 ppb
Recovery Percentage 1	-1.424 %	88.266 %	3.573 %	16.556 %	6.009 %	17.840 %		24.127 %	2.910 %
Concentration RSD	36.5 %	1.3 %	136.2 %	55.5 %	108.2 %	37.1 %	0.9 %	38.9 %	2.2 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	88.349 %	0.652 ppb	2.491 ppb	0.002 ppb	89.005 %	87.654 %	0.022 ppb	0.048 ppb	89.576 %
Concentration per Run 1	91.447 %	0.593 ppb	2.382 ppb	0.011 ppb	90.772 %	89.425 %	0.019 ppb	0.050 ppb	88.972 %
Concentration per Run 2	87.443 %	0.656 ppb	2.711 ppb	-0.003 ppb	87.821 %	87.529 %	0.024 ppb	0.047 ppb	90.212 %
Concentration per Run 3	86.157 %	0.707 ppb	2.379 ppb	-0.003 ppb	88.421 %	86.009 %	0.024 ppb	0.048 ppb	89.545 %
Recovery Percentage 1		21.733 %	62.270 %	0.399 %			4.439 %	9.650 %	89.576 %
Concentration RSD	3.1 %	8.8 %	7.7 %	409.1 %	1.8 %	2.0 %	12.8 %	3.6 %	0.7 %

Alpha ICPMSQ Full

6/7/2017 3:54:49 PM



Analysis index: 104 Analysis started at: 6/7/2017 2:20:19 PM Rack: 2
 Analysis label: L1717934-10 6020SL User name: ALPHALAB\metals-instrument Vial: 10

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	91.478 %	96.066 %	0.007 ppb	7,877.427 ppb	18,639.967 ppb	7.074 ppb	2,586.273 ppb	128,565.369 ppb	95.780 %
Concentration per Run 1	91.069 %	102.520 %	0.006 ppb	7,698.918 ppb	18,537.613 ppb	6.427 ppb	2,540.496 ppb	123,175.022 ppb	111.087 %
Concentration per Run 2	92.283 %	93.300 %	0.006 ppb	7,961.859 ppb	18,687.523 ppb	9.065 ppb	2,554.741 ppb	131,882.848 ppb	88.861 %
Concentration per Run 3	91.082 %	92.378 %	0.010 ppb	7,971.506 ppb	18,694.765 ppb	5.731 ppb	2,663.583 ppb	130,638.238 ppb	87.390 %
Concentration RSD	0.8 %	5.8 %	30.2 %	2.0 %	0.5 %	24.9 %	2.6 %	3.7 %	13.9 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	89.033 %	171.420 ppb	0.078 ppb	0.102 ppb	0.666 ppb	7.378 ppb	0.022 ppb	0.261 ppb	1.162 ppb
Concentration per Run 1	88.782 %	165.898 ppb	-0.010 ppb	0.079 ppb	0.595 ppb	12.326 ppb	0.031 ppb	0.210 ppb	0.789 ppb
Concentration per Run 2	89.346 %	174.495 ppb	0.103 ppb	0.081 ppb	0.589 ppb	4.400 ppb	0.000 ppb	0.286 ppb	1.333 ppb
Concentration per Run 3	88.972 %	173.867 ppb	0.142 ppb	0.147 ppb	0.815 ppb	5.407 ppb	0.037 ppb	0.288 ppb	1.363 ppb
Concentration RSD	0.3 %	2.8 %	101.3 %	37.8 %	19.4 %	58.5 %	87.6 %	16.9 %	27.8 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	5.694 ppb	88.025 %	0.231 ppb	0.114 ppb	179.761 ppb	0.365 ppb	85.745 %	0.055 ppb	0.022 ppb
Concentration per Run 1	5.272 ppb	94.047 %	0.295 ppb	0.096 ppb	187.972 ppb	0.420 ppb	89.443 %	0.031 ppb	0.022 ppb
Concentration per Run 2	5.938 ppb	84.664 %	0.276 ppb	-0.334 ppb	179.721 ppb	0.453 ppb	83.941 %	0.043 ppb	0.012 ppb
Concentration per Run 3	5.872 ppb	85.364 %	0.121 ppb	0.582 ppb	171.591 ppb	0.223 ppb	83.852 %	0.092 ppb	0.031 ppb
Concentration RSD	6.4 %	5.9 %	41.4 %	400.4 %	4.6 %	34.0 %	3.7 %	58.0 %	43.4 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	88.609 %	0.473 ppb	0.994 ppb	66.583 ppb	89.148 %	89.373 %	0.007 ppb	0.071 ppb	97.234 %
Concentration per Run 1	97.133 %	0.524 ppb	0.751 ppb	65.513 ppb	92.143 %	95.826 %	0.006 ppb	0.069 ppb	104.375 %
Concentration per Run 2	85.488 %	0.429 ppb	1.028 ppb	67.966 ppb	87.543 %	85.543 %	0.009 ppb	0.072 ppb	94.128 %
Concentration per Run 3	83.205 %	0.465 ppb	1.205 ppb	66.271 ppb	87.759 %	86.750 %	0.006 ppb	0.072 ppb	93.199 %
Concentration RSD	8.4 %	10.2 %	23.0 %	1.9 %	2.9 %	6.3 %	31.5 %	2.1 %	6.4 %

Alpha ICPMSQ Full

6/7/2017 3:54:49 PM



Analysis index: 105 Analysis started at: 6/7/2017 2:23:42 PM Rack: 2
 Analysis label: WG1009977-6D5 6020SL User name: ALPHALAB\metals-instrument Vial: 7

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	93.846 %	96.158 %	0.004 ppb	1,747.711 ppb	3,251.796 ppb	7.942 ppb	395.700 ppb	17,280.040 ppb	90.297 %
Concentration per Run 1	94.842 %	95.790 %	0.005 ppb	1,760.760 ppb	3,231.344 ppb	7.103 ppb	400.175 ppb	16,737.592 ppb	93.590 %
Concentration per Run 2	94.176 %	95.144 %	0.002 ppb	1,746.297 ppb	3,307.480 ppb	8.622 ppb	370.557 ppb	17,767.828 ppb	89.334 %
Concentration per Run 3	92.521 %	97.541 %	0.006 ppb	1,736.075 ppb	3,216.564 ppb	8.101 ppb	416.366 ppb	17,334.701 ppb	87.969 %
Concentration RSD	1.3 %	1.3 %	47.9 %	0.7 %	1.5 %	9.7 %	5.9 %	3.0 %	3.2 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	90.083 %	23.025 ppb	0.100 ppb	0.032 ppb	0.770 ppb	5.734 ppb	0.004 ppb	0.050 ppb	0.119 ppb
Concentration per Run 1	91.708 %	23.260 ppb	0.061 ppb	0.023 ppb	0.799 ppb	8.548 ppb	0.011 ppb	0.127 ppb	0.077 ppb
Concentration per Run 2	88.928 %	23.601 ppb	0.213 ppb	0.017 ppb	0.922 ppb	4.275 ppb	0.000 ppb	0.098 ppb	0.168 ppb
Concentration per Run 3	89.613 %	22.215 ppb	0.027 ppb	0.056 ppb	0.588 ppb	4.380 ppb	0.000 ppb	-0.075 ppb	0.113 ppb
Concentration RSD	1.6 %	3.1 %	98.5 %	66.9 %	21.9 %	42.5 %	173.2 %	217.7 %	38.3 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	0.848 ppb	89.130 %	0.042 ppb	0.096 ppb	31.044 ppb	0.301 ppb	87.275 %	0.010 ppb	0.006 ppb
Concentration per Run 1	1.132 ppb	92.050 %	0.064 ppb	0.193 ppb	30.665 ppb	0.209 ppb	88.870 %	0.006 ppb	0.011 ppb
Concentration per Run 2	0.715 ppb	88.655 %	0.018 ppb	-0.069 ppb	30.993 ppb	0.439 ppb	86.118 %	0.009 ppb	0.006 ppb
Concentration per Run 3	0.698 ppb	86.686 %	0.044 ppb	0.164 ppb	31.475 ppb	0.254 ppb	86.838 %	0.014 ppb	0.000 ppb
Concentration RSD	28.9 %	3.0 %	55.5 %	149.0 %	1.3 %	40.5 %	1.6 %	37.1 %	98.7 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	88.271 %	0.241 ppb	0.323 ppb	10.083 ppb	91.103 %	89.158 %	0.001 ppb	0.015 ppb	93.240 %
Concentration per Run 1	91.417 %	0.206 ppb	0.366 ppb	10.106 ppb	93.202 %	90.268 %	0.000 ppb	0.015 ppb	95.082 %
Concentration per Run 2	87.495 %	0.212 ppb	0.376 ppb	9.957 ppb	90.192 %	88.549 %	0.002 ppb	0.018 ppb	92.058 %
Concentration per Run 3	85.902 %	0.305 ppb	0.227 ppb	10.186 ppb	89.914 %	88.658 %	0.000 ppb	0.012 ppb	92.579 %
Concentration RSD	3.2 %	23.1 %	25.8 %	1.2 %	2.0 %	1.1 %	106.8 %	21.2 %	1.7 %

Alpha ICPMSQ Full

6/7/2017 3:54:49 PM



Analysis index: 106 Analysis started at: 6/7/2017 2:34:52 PM Rack: 2
 Analysis label: WG1010662-1 2008SL User name: ALPHALAB\metals-instrument Vial: 13

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	90.336 %	93.270 %	0.005 ppb	62.954 ppb	4.003 ppb	2.127 ppb	22.150 ppb	24.008 ppb	87.548 %
Concentration per Run 1	91.623 %	92.839 %	0.006 ppb	67.662 ppb	4.124 ppb	2.310 ppb	14.074 ppb	26.366 ppb	92.697 %
Concentration per Run 2	90.557 %	96.435 %	0.006 ppb	54.049 ppb	1.085 ppb	2.239 ppb	9.251 ppb	24.832 ppb	84.921 %
Concentration per Run 3	88.827 %	90.534 %	0.003 ppb	67.150 ppb	6.800 ppb	1.831 ppb	43.127 ppb	20.826 ppb	85.026 %
Concentration RSD	1.6 %	3.2 %	38.1 %	12.3 %	71.4 %	12.1 %	82.7 %	11.9 %	5.1 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	86.632 %	0.131 ppb	0.102 ppb	0.040 ppb	0.110 ppb	2.250 ppb	0.000 ppb	-0.029 ppb	0.085 ppb
Concentration per Run 1	86.609 %	0.143 ppb	0.171 ppb	0.074 ppb	0.017 ppb	-0.444 ppb	0.000 ppb	0.052 ppb	0.140 ppb
Concentration per Run 2	87.731 %	0.093 ppb	0.068 ppb	-0.003 ppb	0.111 ppb	4.589 ppb	0.000 ppb	-0.070 ppb	0.119 ppb
Concentration per Run 3	85.555 %	0.158 ppb	0.068 ppb	0.049 ppb	0.202 ppb	2.607 ppb	0.000 ppb	-0.070 ppb	-0.003 ppb
Concentration RSD	1.3 %	26.0 %	58.1 %	97.7 %	83.8 %	112.6 %		242.3 %	90.5 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	2.082 ppb	84.500 %	0.045 ppb	0.296 ppb	0.013 ppb	0.082 ppb	86.112 %	0.027 ppb	0.002 ppb
Concentration per Run 1	2.004 ppb	86.711 %	0.043 ppb	-0.006 ppb	-0.008 ppb	0.050 ppb	87.405 %	0.029 ppb	0.006 ppb
Concentration per Run 2	2.308 ppb	83.601 %	0.045 ppb	0.174 ppb	0.024 ppb	0.203 ppb	85.396 %	0.016 ppb	0.000 ppb
Concentration per Run 3	1.932 ppb	83.187 %	0.046 ppb	0.720 ppb	0.024 ppb	-0.005 ppb	85.536 %	0.034 ppb	0.000 ppb
Concentration RSD	9.6 %	2.3 %	2.5 %	127.8 %	142.5 %	130.9 %	1.3 %	35.0 %	173.2 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	83.267 %	0.188 ppb	0.682 ppb	0.076 ppb	88.433 %	85.755 %	0.002 ppb	0.023 ppb	97.525 %
Concentration per Run 1	84.632 %	0.139 ppb	0.711 ppb	0.090 ppb	89.109 %	86.637 %	-0.001 ppb	0.021 ppb	102.824 %
Concentration per Run 2	82.618 %	0.223 ppb	0.656 ppb	0.077 ppb	87.521 %	84.663 %	0.001 ppb	0.016 ppb	96.198 %
Concentration per Run 3	82.552 %	0.202 ppb	0.680 ppb	0.060 ppb	88.668 %	85.965 %	0.007 ppb	0.031 ppb	93.554 %
Concentration RSD	1.4 %	23.3 %	4.1 %	19.7 %	0.9 %	1.2 %	152.9 %	33.1 %	4.9 %

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6/7/2017 3:54:49 PM



Analysis index: 107 Analysis started at: 6/7/2017 2:38:14 PM Rack: 2
 Analysis label: WG1010662-2D5 2008SL User name: ALPHALAB\metals-instrument Vial: 14

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	89.722 %	91.088 %	10.051 ppb	2,178.033 ppb	2,241.028 ppb	466.274 ppb	2,119.580 ppb	2,070.308 ppb	92.802 %
Concentration per Run 1	91.482 %	85.002 %	10.246 ppb	2,168.364 ppb	2,257.622 ppb	441.423 ppb	1,973.719 ppb	1,858.038 ppb	89.439 %
Concentration per Run 2	89.668 %	89.705 %	10.152 ppb	2,149.613 ppb	2,143.192 ppb	476.532 ppb	2,140.416 ppb	2,217.714 ppb	87.390 %
Concentration per Run 3	88.015 %	98.556 %	9.755 ppb	2,216.121 ppb	2,322.269 ppb	480.867 ppb	2,244.605 ppb	2,135.172 ppb	101.577 %
Concentration RSD	1.9 %	7.6 %	2.6 %	1.6 %	4.0 %	4.6 %	6.4 %	9.1 %	8.3 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	86.676 %	176.963 ppb	99.028 ppb	38.963 ppb	102.204 ppb	204.363 ppb	93.562 ppb	93.638 ppb	48.500 ppb
Concentration per Run 1	88.555 %	169.778 ppb	96.181 ppb	37.976 ppb	97.733 ppb	214.900 ppb	94.664 ppb	92.598 ppb	49.437 ppb
Concentration per Run 2	87.744 %	182.654 ppb	101.428 ppb	39.984 ppb	100.085 ppb	208.531 ppb	95.824 ppb	99.359 ppb	50.574 ppb
Concentration per Run 3	83.730 %	178.456 ppb	99.476 ppb	38.930 ppb	108.795 ppb	189.659 ppb	90.199 ppb	88.958 ppb	45.489 ppb
Concentration RSD	3.0 %	3.7 %	2.7 %	2.6 %	5.7 %	6.4 %	3.2 %	5.6 %	5.5 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	101.643 ppb	87.239 %	24.372 ppb	25.626 ppb	217.152 ppb	199.025 ppb	86.592 %	9.961 ppb	10.294 ppb
Concentration per Run 1	101.383 ppb	83.148 %	23.659 ppb	23.768 ppb	209.123 ppb	191.263 ppb	87.934 %	9.989 ppb	9.959 ppb
Concentration per Run 2	105.003 ppb	82.766 %	24.895 ppb	24.635 ppb	213.531 ppb	204.633 ppb	85.096 %	10.139 ppb	10.282 ppb
Concentration per Run 3	98.542 ppb	95.803 %	24.561 ppb	28.476 ppb	228.803 ppb	201.180 ppb	86.746 %	9.755 ppb	10.642 ppb
Concentration RSD	3.2 %	8.5 %	2.6 %	9.8 %	4.8 %	3.5 %	1.6 %	1.9 %	3.3 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	87.606 %	195.672 ppb	99.933 ppb	405.077 ppb	88.706 %	88.990 %	24.270 ppb	109.614 ppb	93.407 %
Concentration per Run 1	86.943 %	187.690 ppb	93.106 ppb	378.071 ppb	88.932 %	87.399 %	23.862 ppb	106.968 ppb	94.537 %
Concentration per Run 2	81.987 %	200.687 ppb	103.277 ppb	414.226 ppb	85.905 %	87.468 %	24.223 ppb	110.863 ppb	92.701 %
Concentration per Run 3	93.888 %	198.638 ppb	103.418 ppb	422.935 ppb	91.281 %	92.104 %	24.725 ppb	111.011 ppb	92.981 %
Concentration RSD	6.8 %	3.6 %	5.9 %	5.9 %	3.0 %	3.0 %	1.8 %	2.1 %	1.1 %

Alpha ICPMSQ Full

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Analysis index: 108 Analysis started at: 6/7/2017 2:41:35 PM Rack: 2
 Analysis label: xWG1010662-3D10 2008SL User name: ALPHALAB\metals-instrument Vial: 15

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	91.893 %	91.610 %	0.002 ppb	28.162 ppb	1.038 ppb	0.164 ppb	15.036 ppb	4.071 ppb	93.082 %
Concentration per Run 1	92.482 %	87.400 %	-0.001 ppb	24.039 ppb	0.328 ppb	-0.210 ppb	20.153 ppb	8.066 ppb	89.545 %
Concentration per Run 2	91.260 %	99.939 %	0.002 ppb	31.386 ppb	1.631 ppb	0.560 ppb	11.516 ppb	-0.186 ppb	102.784 %
Concentration per Run 3	91.937 %	87.492 %	0.006 ppb	29.062 ppb	1.155 ppb	0.143 ppb	13.439 ppb	4.331 ppb	86.918 %
Concentration RSD	0.7 %	7.9 %	159.0 %	13.3 %	63.5 %	234.5 %	30.2 %	101.5 %	9.1 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	89.516 %	0.127 ppb	0.028 ppb	0.039 ppb	0.102 ppb	-1.373 ppb	0.026 ppb	0.004 ppb	0.006 ppb
Concentration per Run 1	89.564 %	0.274 ppb	0.027 ppb	0.043 ppb	0.106 ppb	-1.373 ppb	0.024 ppb	0.015 ppb	0.026 ppb
Concentration per Run 2	89.489 %	0.016 ppb	-0.010 ppb	0.003 ppb	0.091 ppb	-1.373 ppb	0.043 ppb	0.070 ppb	-0.034 ppb
Concentration per Run 3	89.495 %	0.090 ppb	0.067 ppb	0.072 ppb	0.109 ppb	-1.373 ppb	0.012 ppb	-0.071 ppb	0.027 ppb
Concentration RSD	0.0 %	104.6 %	138.6 %	89.3 %	9.8 %		58.1 %	1,584.6 %	541.3 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	0.049 ppb	87.239 %	0.035 ppb	0.089 ppb	0.089 ppb	0.913 ppb	87.418 %	0.008 ppb	0.013 ppb
Concentration per Run 1	0.218 ppb	84.768 %	0.070 ppb	-0.033 ppb	0.060 ppb	0.825 ppb	87.909 %	0.002 ppb	0.012 ppb
Concentration per Run 2	0.020 ppb	93.528 %	0.017 ppb	0.233 ppb	0.105 ppb	0.979 ppb	88.353 %	0.008 ppb	0.017 ppb
Concentration per Run 3	-0.092 ppb	83.420 %	0.019 ppb	0.065 ppb	0.101 ppb	0.936 ppb	85.991 %	0.014 ppb	0.012 ppb
Concentration RSD	321.0 %	6.3 %	85.2 %	152.0 %	27.9 %	8.7 %	1.4 %	70.3 %	21.3 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	90.321 %	1.598 ppb	3.487 ppb	0.161 ppb	89.498 %	89.866 %	0.016 ppb	0.104 ppb	93.804 %
Concentration per Run 1	90.013 %	1.594 ppb	3.281 ppb	0.117 ppb	89.085 %	89.665 %	0.014 ppb	0.112 ppb	95.342 %
Concentration per Run 2	94.745 %	1.604 ppb	3.425 ppb	0.185 ppb	90.111 %	93.646 %	0.015 ppb	0.106 ppb	94.214 %
Concentration per Run 3	86.203 %	1.596 ppb	3.755 ppb	0.181 ppb	89.300 %	86.288 %	0.018 ppb	0.093 ppb	91.857 %
Concentration RSD	4.7 %	0.3 %	7.0 %	23.8 %	0.6 %	4.1 %	14.5 %	9.6 %	1.9 %

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Analysis index: 109 Analysis started at: 6/7/2017 2:44:57 PM Rack: 2
 Analysis label: WG1010662-4 2008SL User name: ALPHALAB\metals-instrument Vial: 16

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	86.440 %	87.400 %	-0.004 ppb	43,613.364 ppb	8,872.400 ppb	1.833 ppb	2,528.481 ppb	46,841.974 ppb	89.405 %
Concentration per Run 1	87.946 %	91.180 %	-0.012 ppb	42,792.733 ppb	8,629.269 ppb	2.343 ppb	2,641.010 ppb	46,664.809 ppb	100.525 %
Concentration per Run 2	86.333 %	86.293 %	-0.004 ppb	45,167.684 ppb	8,941.024 ppb	1.904 ppb	2,426.220 ppb	46,970.371 ppb	84.659 %
Concentration per Run 3	85.041 %	84.726 %	0.003 ppb	42,879.674 ppb	9,046.908 ppb	1.253 ppb	2,518.215 ppb	46,890.741 ppb	83.030 %
Concentration RSD	1.7 %	3.9 %	177.6 %	3.1 %	2.4 %	29.9 %	4.3 %	0.3 %	10.8 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	84.313 %	66.009 ppb	0.116 ppb	0.036 ppb	409.176 ppb	185.942 ppb	0.141 ppb	2.717 ppb	0.676 ppb
Concentration per Run 1	85.672 %	67.552 ppb	0.091 ppb	0.005 ppb	403.669 ppb	185.741 ppb	0.120 ppb	2.515 ppb	0.644 ppb
Concentration per Run 2	84.972 %	63.777 ppb	0.147 ppb	0.050 ppb	413.159 ppb	177.204 ppb	0.151 ppb	2.625 ppb	0.608 ppb
Concentration per Run 3	82.296 %	66.698 ppb	0.110 ppb	0.053 ppb	410.702 ppb	194.879 ppb	0.153 ppb	3.011 ppb	0.776 ppb
Concentration RSD	2.1 %	3.0 %	24.8 %	74.6 %	1.2 %	4.8 %	12.9 %	9.6 %	13.1 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	6.125 ppb	85.424 %	0.307 ppb	0.101 ppb	208.357 ppb	2.670 ppb	83.520 %	0.024 ppb	0.008 ppb
Concentration per Run 1	5.646 ppb	91.481 %	0.327 ppb	0.255 ppb	214.353 ppb	2.151 ppb	86.547 %	0.004 ppb	0.006 ppb
Concentration per Run 2	6.148 ppb	83.161 %	0.229 ppb	0.180 ppb	205.558 ppb	2.749 ppb	82.686 %	0.029 ppb	0.006 ppb
Concentration per Run 3	6.580 ppb	81.632 %	0.367 ppb	-0.132 ppb	205.159 ppb	3.112 ppb	81.327 %	0.038 ppb	0.013 ppb
Concentration RSD	7.6 %	6.2 %	23.1 %	203.2 %	2.5 %	18.2 %	3.2 %	73.3 %	46.4 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	85.352 %	0.840 ppb	1.746 ppb	98.933 ppb	87.957 %	87.346 %	0.002 ppb	0.080 ppb	96.404 %
Concentration per Run 1	92.338 %	0.796 ppb	1.852 ppb	98.520 ppb	90.591 %	92.657 %	0.001 ppb	0.083 ppb	100.866 %
Concentration per Run 2	81.366 %	0.897 ppb	1.734 ppb	100.717 ppb	88.089 %	85.667 %	0.002 ppb	0.074 ppb	96.581 %
Concentration per Run 3	82.351 %	0.826 ppb	1.651 ppb	97.561 ppb	85.190 %	83.713 %	0.003 ppb	0.084 ppb	91.766 %
Concentration RSD	7.1 %	6.2 %	5.8 %	1.6 %	3.1 %	5.4 %	42.6 %	6.3 %	4.7 %

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6/7/2017 3:54:49 PM



Analysis index: 110 Analysis started at: 6/7/2017 2:48:19 PM Rack: 2
 Analysis label: L1718517-01 2008SL User name: ALPHALAB\metals-instrument Vial: 17

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	86.422 %	85.494 %	0.001 ppb	42,717.447 ppb	8,430.738 ppb	3.310 ppb	2,422.510 ppb	45,704.449 ppb	86.865 %
Concentration per Run 1	87.584 %	83.066 %	-0.001 ppb	42,716.631 ppb	8,198.357 ppb	2.021 ppb	2,287.040 ppb	44,014.483 ppb	90.332 %
Concentration per Run 2	86.055 %	83.712 %	0.011 ppb	43,475.450 ppb	8,532.662 ppb	3.509 ppb	2,555.060 ppb	46,521.758 ppb	85.394 %
Concentration per Run 3	85.626 %	89.705 %	-0.008 ppb	41,960.261 ppb	8,561.195 ppb	4.400 ppb	2,425.430 ppb	46,577.105 ppb	84.869 %
Concentration RSD	1.2 %	4.3 %	1,564.2 %	1.8 %	2.4 %	36.3 %	5.5 %	3.2 %	3.5 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	85.027 %	60.295 ppb	0.170 ppb	0.121 ppb	399.142 ppb	178.057 ppb	0.109 ppb	3.346 ppb	0.744 ppb
Concentration per Run 1	86.679 %	56.851 ppb	0.176 ppb	0.080 ppb	381.737 ppb	171.172 ppb	0.073 ppb	3.250 ppb	0.773 ppb
Concentration per Run 2	84.617 %	64.805 ppb	0.108 ppb	0.129 ppb	399.659 ppb	172.700 ppb	0.127 ppb	3.744 ppb	0.590 ppb
Concentration per Run 3	83.784 %	59.227 ppb	0.227 ppb	0.156 ppb	416.031 ppb	190.299 ppb	0.127 ppb	3.044 ppb	0.871 ppb
Concentration RSD	1.8 %	6.8 %	35.1 %	31.9 %	4.3 %	6.0 %	28.8 %	10.8 %	19.1 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	7.147 ppb	81.466 %	0.304 ppb	0.022 ppb	202.988 ppb	2.516 ppb	82.430 %	0.018 ppb	0.011 ppb
Concentration per Run 1	7.186 ppb	83.394 %	0.385 ppb	-0.005 ppb	195.432 ppb	2.552 ppb	83.606 %	0.005 ppb	0.006 ppb
Concentration per Run 2	7.036 ppb	80.388 %	0.237 ppb	-0.514 ppb	205.482 ppb	2.535 ppb	82.032 %	0.017 ppb	0.006 ppb
Concentration per Run 3	7.220 ppb	80.615 %	0.290 ppb	0.584 ppb	208.050 ppb	2.462 ppb	81.652 %	0.031 ppb	0.019 ppb
Concentration RSD	1.4 %	2.1 %	24.7 %	2,487.5 %	3.3 %	1.9 %	1.3 %	73.6 %	70.1 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	81.267 %	0.590 ppb	0.998 ppb	97.656 ppb	86.945 %	84.506 %	0.001 ppb	0.059 ppb	93.343 %
Concentration per Run 1	82.910 %	0.604 ppb	0.893 ppb	96.377 ppb	88.952 %	85.532 %	0.003 ppb	0.053 ppb	95.059 %
Concentration per Run 2	80.358 %	0.624 ppb	1.040 ppb	100.369 ppb	85.368 %	84.113 %	0.000 ppb	0.063 ppb	92.249 %
Concentration per Run 3	80.533 %	0.544 ppb	1.061 ppb	96.223 ppb	86.515 %	83.873 %	0.001 ppb	0.062 ppb	92.722 %
Concentration RSD	1.8 %	7.1 %	9.1 %	2.4 %	2.1 %	1.1 %	77.7 %	9.0 %	1.6 %

Alpha ICPMSQ Full

6/7/2017 3:54:49 PM



Analysis index: 111 Analysis started at: 6/7/2017 2:51:41 PM Rack: 2
 Analysis label: L1718448-02 2008SL User name: ALPHALAB\metals-instrument Vial: 18

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	91.135 %	82.390 %	0.001 ppb	3,658,622.701 ppb	87,759.355 ppb	4.462 ppb	79,350.357 ppb	637,365.007 ppb	71.070 %
Concentration per Run 1	91.457 %	87.768 %	-0.001 ppb	3,494,860.840 ppb	82,238.561 ppb	1.188 ppb	73,402.184 ppb	607,721.190 ppb	72.576 %
Concentration per Run 2	91.314 %	78.180 %	0.006 ppb	3,789,275.201 ppb	91,262.766 ppb	5.914 ppb	83,811.454 ppb	675,945.938 ppb	67.481 %
Concentration per Run 3	90.634 %	81.222 %	-0.001 ppb	3,691,732.063 ppb	89,776.739 ppb	6.282 ppb	80,837.433 ppb	628,427.892 ppb	73.154 %
Concentration RSD	0.5 %	5.9 %	374.0 %	4.1 %	5.5 %	63.7 %	6.8 %	5.5 %	4.4 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	95.385 %	776.605 ppb	0.294 ppb	0.590 ppb	2,003.214 ppb	813.911 ppb	1.339 ppb	5.774 ppb	4.397 ppb
Concentration per Run 1	95.155 %	753.905 ppb	0.304 ppb	0.607 ppb	1,943.636 ppb	775.702 ppb	1.278 ppb	4.662 ppb	4.370 ppb
Concentration per Run 2	96.331 %	813.613 ppb	0.274 ppb	0.658 ppb	2,058.741 ppb	876.153 ppb	1.398 ppb	6.245 ppb	4.372 ppb
Concentration per Run 3	94.669 %	762.298 ppb	0.305 ppb	0.505 ppb	2,007.265 ppb	789.879 ppb	1.341 ppb	6.416 ppb	4.449 ppb
Concentration RSD	0.9 %	4.2 %	6.1 %	13.2 %	2.9 %	6.7 %	4.5 %	16.7 %	1.0 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	67.623 ppb	78.669 %	2.918 ppb	0.740 ppb	2,280.501 ppb	2.461 ppb	74.101 %	0.077 ppb	0.522 ppb
Concentration per Run 1	66.358 ppb	79.222 %	2.966 ppb	0.219 ppb	2,239.257 ppb	2.266 ppb	74.317 %	0.051 ppb	0.400 ppb
Concentration per Run 2	66.897 ppb	80.621 %	3.134 ppb	0.968 ppb	2,257.819 ppb	2.333 ppb	73.614 %	0.106 ppb	0.588 ppb
Concentration per Run 3	69.615 ppb	76.164 %	2.653 ppb	1.032 ppb	2,344.427 ppb	2.784 ppb	74.372 %	0.074 ppb	0.579 ppb
Concentration RSD	2.6 %	2.9 %	8.4 %	61.1 %	2.5 %	11.4 %	0.6 %	36.3 %	20.3 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	72.958 %	0.695 ppb	1.577 ppb	851.483 ppb	79.638 %	76.970 %	0.026 ppb	3.587 ppb	84.113 %
Concentration per Run 1	72.915 %	0.545 ppb	1.452 ppb	837.543 ppb	80.336 %	77.937 %	0.031 ppb	3.465 ppb	86.614 %
Concentration per Run 2	72.343 %	0.787 ppb	1.642 ppb	861.163 ppb	78.193 %	75.533 %	0.023 ppb	3.597 ppb	83.086 %
Concentration per Run 3	73.617 %	0.753 ppb	1.638 ppb	855.741 ppb	80.384 %	77.438 %	0.025 ppb	3.698 ppb	82.638 %
Concentration RSD	0.9 %	18.9 %	6.9 %	1.5 %	1.6 %	1.6 %	16.8 %	3.2 %	2.6 %

Alpha ICPMSQ Full

6/7/2017 3:54:49 PM



Analysis index: 112 Analysis started at: 6/7/2017 2:55:03 PM Rack: 2
 Analysis label: WG1010662-3D10 2008SL User name: ALPHALAB\metals-instrument Vial: 19

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	108.993 %	103.012 %	4.819 ppb	6,098.613 ppb	1,903.459 ppb	218.886 ppb	1,324.383 ppb	5,640.091 ppb	102.697 %
Concentration per Run 1	110.337 %	103.719 %	4.875 ppb	5,815.035 ppb	1,831.398 ppb	205.762 ppb	1,244.509 ppb	5,330.585 ppb	110.981 %
Concentration per Run 2	108.549 %	99.017 %	4.745 ppb	6,367.349 ppb	2,000.819 ppb	237.448 ppb	1,395.335 ppb	5,922.450 ppb	103.467 %
Concentration per Run 3	108.094 %	106.300 %	4.836 ppb	6,113.456 ppb	1,878.160 ppb	213.448 ppb	1,333.305 ppb	5,667.238 ppb	93.643 %
Concentration RSD	1.1 %	3.6 %	1.4 %	4.5 %	4.6 %	7.6 %	5.7 %	5.3 %	8.5 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	107.017 %	98.337 ppb	49.558 ppb	19.756 ppb	89.243 ppb	121.665 ppb	48.406 ppb	48.839 ppb	24.073 ppb
Concentration per Run 1	108.218 %	92.088 ppb	46.060 ppb	18.349 ppb	85.777 ppb	111.505 ppb	46.043 ppb	45.789 ppb	22.808 ppb
Concentration per Run 2	106.258 %	97.188 ppb	51.048 ppb	20.451 ppb	92.480 ppb	123.487 ppb	50.302 ppb	50.965 ppb	24.983 ppb
Concentration per Run 3	106.574 %	105.735 ppb	51.565 ppb	20.469 ppb	89.473 ppb	130.003 ppb	48.873 ppb	49.764 ppb	24.427 ppb
Concentration RSD	1.0 %	7.0 %	6.1 %	6.2 %	3.8 %	7.7 %	4.5 %	5.5 %	4.7 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	50.769 ppb	97.914 %	12.502 ppb	12.816 ppb	125.619 ppb	98.118 ppb	99.558 %	4.889 ppb	5.304 ppb
Concentration per Run 1	48.624 ppb	101.246 %	12.521 ppb	13.296 ppb	125.622 ppb	95.097 ppb	101.936 %	4.722 ppb	5.272 ppb
Concentration per Run 2	52.568 ppb	98.448 %	12.744 ppb	13.759 ppb	129.491 ppb	98.815 ppb	99.204 %	4.826 ppb	5.105 ppb
Concentration per Run 3	51.113 ppb	94.047 %	12.241 ppb	11.392 ppb	121.745 ppb	100.442 ppb	97.534 %	5.121 ppb	5.536 ppb
Concentration RSD	3.9 %	3.7 %	2.0 %	9.8 %	3.1 %	2.8 %	2.2 %	4.2 %	4.1 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	96.364 %	96.130 ppb	56.358 ppb	211.154 ppb	97.972 %	95.240 %	12.903 ppb	56.907 ppb	96.668 %
Concentration per Run 1	102.598 %	92.420 ppb	55.142 ppb	205.615 ppb	102.954 %	100.070 %	12.685 ppb	54.995 ppb	99.890 %
Concentration per Run 2	96.708 %	96.881 ppb	57.526 ppb	216.794 ppb	97.411 %	96.617 %	13.062 ppb	57.627 ppb	96.051 %
Concentration per Run 3	89.785 %	99.089 ppb	56.406 ppb	211.052 ppb	93.549 %	89.033 %	12.962 ppb	58.098 ppb	94.063 %
Concentration RSD	6.7 %	3.5 %	2.1 %	2.6 %	4.8 %	5.9 %	1.5 %	2.9 %	3.1 %

Alpha ICPMSQ Full

6/7/2017 3:54:49 PM



Analysis index: 113 Analysis started at: 6/7/2017 2:58:25 PM Rack: 2
 Analysis label: WG1010664-6D5 6020SL User name: ALPHALAB\metals-instrument Vial: 20

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	106.261 %	100.338 %	0.007 ppb	42,819.393 ppb	8,217.766 ppb	0.787 ppb	1,072.255 ppb	33,685.832 ppb	97.811 %
Concentration per Run 1	108.345 %	101.321 %	0.006 ppb	44,391.911 ppb	8,368.568 ppb	0.828 ppb	1,089.267 ppb	34,002.895 ppb	104.098 %
Concentration per Run 2	105.362 %	96.896 %	0.000 ppb	41,652.599 ppb	8,052.556 ppb	0.221 ppb	1,060.577 ppb	33,774.801 ppb	90.649 %
Concentration per Run 3	105.075 %	102.797 %	0.013 ppb	42,413.668 ppb	8,232.173 ppb	1.311 ppb	1,066.921 ppb	33,279.799 ppb	98.686 %
Concentration RSD	1.7 %	3.1 %	96.5 %	3.3 %	1.9 %	69.5 %	1.4 %	1.1 %	6.9 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	104.853 %	46.655 ppb	0.508 ppb	0.056 ppb	133.685 ppb	5.540 ppb	0.256 ppb	0.632 ppb	0.507 ppb
Concentration per Run 1	105.574 %	45.379 ppb	0.474 ppb	0.033 ppb	135.974 ppb	4.409 ppb	0.313 ppb	0.641 ppb	0.555 ppb
Concentration per Run 2	104.953 %	48.715 ppb	0.722 ppb	0.063 ppb	131.618 ppb	5.094 ppb	0.244 ppb	0.478 ppb	0.585 ppb
Concentration per Run 3	104.033 %	45.873 ppb	0.326 ppb	0.072 ppb	133.464 ppb	7.116 ppb	0.213 ppb	0.778 ppb	0.380 ppb
Concentration RSD	0.7 %	3.9 %	39.4 %	36.7 %	1.6 %	25.4 %	19.9 %	23.7 %	21.9 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	3.029 ppb	95.852 %	0.085 ppb	1.083 ppb	116.781 ppb	0.849 ppb	95.497 %	0.011 ppb	0.058 ppb
Concentration per Run 1	3.000 ppb	97.805 %	0.060 ppb	0.981 ppb	120.556 ppb	0.908 ppb	101.151 %	0.011 ppb	0.088 ppb
Concentration per Run 2	3.301 ppb	90.885 %	0.137 ppb	1.639 ppb	114.762 ppb	0.736 ppb	90.964 %	0.013 ppb	0.053 ppb
Concentration per Run 3	2.785 ppb	98.867 %	0.059 ppb	0.630 ppb	115.025 ppb	0.902 ppb	94.375 %	0.008 ppb	0.033 ppb
Concentration RSD	8.6 %	4.5 %	52.2 %	47.3 %	2.8 %	11.5 %	5.4 %	23.8 %	47.6 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	91.816 %	1.342 ppb	1.144 ppb	27.574 ppb	95.654 %	92.301 %	0.011 ppb	0.087 ppb	97.744 %
Concentration per Run 1	98.460 %	1.747 ppb	1.032 ppb	28.153 ppb	100.359 %	96.946 %	0.012 ppb	0.091 ppb	103.213 %
Concentration per Run 2	85.276 %	1.159 ppb	1.218 ppb	27.135 ppb	91.905 %	87.663 %	0.013 ppb	0.091 ppb	93.453 %
Concentration per Run 3	91.711 %	1.121 ppb	1.181 ppb	27.434 ppb	94.697 %	92.293 %	0.009 ppb	0.078 ppb	96.567 %
Concentration RSD	7.2 %	26.1 %	8.6 %	1.9 %	4.5 %	5.0 %	19.1 %	9.1 %	5.1 %

Alpha ICPMSQ Full

6/7/2017 3:54:49 PM



Analysis index: 114 Analysis started at: 6/7/2017 3:01:47 PM Rack: 0
 Analysis label: CCV User name: ALPHALAB\metals-instrument Vial: 9

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	105.600 %	89.981 %	99.471 ppb	10,901.173 ppb	10,873.709 ppb	101.433 ppb	10,569.302 ppb	10,425.692 ppb	98.546 %
Concentration per Run 1	107.017 %	93.761 %	98.849 ppb	10,053.771 ppb	9,796.298 ppb	88.888 ppb	9,833.948 ppb	9,554.900 ppb	97.847 %
Concentration per Run 2	105.095 %	86.478 %	99.870 ppb	11,510.078 ppb	11,568.866 ppb	114.289 ppb	10,971.362 ppb	10,970.300 ppb	95.166 %
Concentration per Run 3	104.687 %	89.705 %	99.693 ppb	11,139.670 ppb	11,255.964 ppb	101.122 ppb	10,902.596 ppb	10,751.876 ppb	102.627 %
Recovery Percentage 1			99.471 %	109.012 %	108.737 %	101.433 %	105.693 %	104.257 %	
Concentration RSD	1.2 %	4.1 %	0.5 %	6.9 %	8.7 %	12.5 %	6.0 %	7.3 %	3.8 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	106.361 %	101.719 ppb	100.757 ppb	100.881 ppb	103.087 ppb	10,142.803 ppb	100.872 ppb	102.269 ppb	99.632 ppb
Concentration per Run 1	106.817 %	99.146 ppb	93.656 ppb	97.625 ppb	97.275 ppb	9,663.287 ppb	97.911 ppb	102.015 ppb	100.343 ppb
Concentration per Run 2	106.673 %	106.352 ppb	105.741 ppb	104.070 ppb	103.795 ppb	10,594.578 ppb	102.280 ppb	104.493 ppb	100.670 ppb
Concentration per Run 3	105.595 %	99.658 ppb	102.874 ppb	100.948 ppb	108.191 ppb	10,170.545 ppb	102.425 ppb	100.300 ppb	97.884 ppb
Recovery Percentage 1		101.719 %	100.757 %	100.881 %	103.087 %	101.428 %	100.872 %	102.269 %	99.632 %
Concentration RSD	0.6 %	4.0 %	6.3 %	3.2 %	5.3 %	4.6 %	2.5 %	2.1 %	1.5 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	100.253 ppb	92.636 %	100.913 ppb	101.613 ppb	104.959 ppb	103.668 ppb	94.876 %	100.618 ppb	101.258 ppb
Concentration per Run 1	100.509 ppb	88.523 %	100.740 ppb	94.893 ppb	96.196 ppb	98.747 ppb	94.481 %	100.552 ppb	99.783 ppb
Concentration per Run 2	101.518 ppb	93.765 %	99.349 ppb	105.416 ppb	110.066 ppb	104.862 ppb	94.932 %	101.568 ppb	102.039 ppb
Concentration per Run 3	98.731 ppb	95.619 %	102.648 ppb	104.530 ppb	108.615 ppb	107.394 ppb	95.215 %	99.733 ppb	101.953 ppb
Recovery Percentage 1	100.253 %		100.913 %	101.613 %	104.959 %	103.668 %		100.618 %	101.258 %
Concentration RSD	1.4 %	4.0 %	1.6 %	5.7 %	7.3 %	4.3 %	0.4 %	0.9 %	1.3 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	90.785 %	102.543 ppb	107.659 ppb	105.856 ppb	91.910 %	90.636 %	102.233 ppb	104.162 ppb	99.255 %
Concentration per Run 1	87.072 %	97.541 ppb	102.459 ppb	102.798 ppb	91.970 %	86.315 %	101.904 ppb	101.558 ppb	99.062 %
Concentration per Run 2	90.609 %	103.629 ppb	108.267 ppb	103.944 ppb	95.289 %	93.032 %	103.312 ppb	105.764 ppb	99.194 %
Concentration per Run 3	94.675 %	106.457 ppb	112.250 ppb	110.826 ppb	88.471 %	92.562 %	101.484 ppb	105.163 ppb	99.508 %
Recovery Percentage 1		102.543 %	107.659 %	105.856 %			102.233 %	104.162 %	
Concentration RSD	4.2 %	4.4 %	4.6 %	4.1 %	3.7 %	4.1 %	0.9 %	2.2 %	0.2 %

Alpha ICPMSQ Full

6/7/2017 3:54:49 PM



Analysis index: 115 Analysis started at: 6/7/2017 3:05:12 PM Rack: 0
 Analysis label: CCB User name: ALPHALAB\metals-instrument Vial: 10

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	108.398 %	100.031 %	0.017 ppb	68.594 ppb	4.190 ppb	0.654 ppb	13.063 ppb	7.794 ppb	102.802 %
Concentration per Run 1	108.880 %	100.584 %	0.003 ppb	70.644 ppb	4.386 ppb	0.540 ppb	17.770 ppb	-0.012 ppb	104.571 %
Concentration per Run 2	107.606 %	95.974 %	0.025 ppb	75.542 ppb	3.133 ppb	0.451 ppb	-2.602 ppb	3.399 ppb	101.523 %
Concentration per Run 3	108.709 %	103.534 %	0.025 ppb	59.597 ppb	5.051 ppb	0.971 ppb	24.023 ppb	19.995 ppb	102.311 %
Recovery Percentage 1			3.498 %	68.594 %	5.986 %	6.540 %	13.063 %	7.794 %	
Concentration RSD	0.6 %	3.8 %	71.5 %	11.9 %	23.2 %	42.5 %	106.6 %	137.3 %	1.5 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	107.007 %	-0.002 ppb	0.044 ppb	-0.002 ppb	0.100 ppb	0.832 ppb	0.003 ppb	0.023 ppb	0.017 ppb
Concentration per Run 1	108.373 %	-0.038 ppb	0.022 ppb	-0.064 ppb	0.274 ppb	1.086 ppb	0.000 ppb	-0.094 ppb	0.017 ppb
Concentration per Run 2	106.016 %	0.071 ppb	0.055 ppb	-0.009 ppb	0.051 ppb	1.124 ppb	0.010 ppb	0.063 ppb	0.017 ppb
Concentration per Run 3	106.632 %	-0.038 ppb	0.055 ppb	0.067 ppb	-0.025 ppb	0.286 ppb	0.000 ppb	0.101 ppb	0.017 ppb
Recovery Percentage 1		-0.340 %	0.880 %	-0.222 %	10.001 %	1.664 %	0.698 %	1.163 %	1.738 %
Concentration RSD	1.1 %	3,720.8 %	43.8 %	2,957.6 %	155.3 %	56.9 %	173.2 %	443.2 %	0.9 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	-0.096 ppb	99.291 %	0.052 ppb	0.891 ppb	0.042 ppb	0.462 ppb	98.397 %	0.031 ppb	0.009 ppb
Concentration per Run 1	-0.130 ppb	99.023 %	-0.007 ppb	1.619 ppb	0.020 ppb	0.366 ppb	99.721 %	0.032 ppb	0.005 ppb
Concentration per Run 2	-0.163 ppb	99.541 %	0.125 ppb	0.821 ppb	0.040 ppb	0.617 ppb	97.410 %	0.025 ppb	0.005 ppb
Concentration per Run 3	0.006 ppb	99.308 %	0.037 ppb	0.233 ppb	0.067 ppb	0.403 ppb	98.060 %	0.036 ppb	0.016 ppb
Recovery Percentage 1	-0.959 %	99.291 %	10.338 %	17.823 %	8.445 %	23.096 %		7.811 %	4.366 %
Concentration RSD	93.4 %	0.3 %	129.3 %	78.1 %	55.5 %	29.4 %	1.2 %	17.8 %	68.3 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	97.795 %	0.900 ppb	2.561 ppb	0.067 ppb	93.400 %	95.843 %	0.030 ppb	0.062 ppb	93.697 %
Concentration per Run 1	99.004 %	0.850 ppb	2.415 ppb	0.051 ppb	94.274 %	96.937 %	0.029 ppb	0.064 ppb	94.239 %
Concentration per Run 2	94.857 %	1.014 ppb	2.752 ppb	0.099 ppb	88.195 %	93.795 %	0.031 ppb	0.066 ppb	92.651 %
Concentration per Run 3	99.523 %	0.837 ppb	2.515 ppb	0.050 ppb	97.731 %	96.797 %	0.031 ppb	0.055 ppb	94.201 %
Recovery Percentage 1		30.007 %	64.015 %	13.379 %			6.048 %	12.329 %	93.697 %
Concentration RSD	2.6 %	10.9 %	6.8 %	41.9 %	5.2 %	1.9 %	2.9 %	9.2 %	1.0 %

Alpha ICPMSQ Full

6/7/2017 3:54:49 PM



Analysis index: 116 Analysis started at: 6/7/2017 3:10:34 PM Rack: 2
 Analysis label: L1718484-01 6020SL User name: ALPHALAB\metals-instrument Vial: 21

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	95.467 %	91.887 %	0.007 ppb	212,668.121 ppb	41,558.992 ppb	7.848 ppb	5,188.521 ppb	163,002.432 ppb	95.359 %
Concentration per Run 1	96.623 %	92.931 %	0.012 ppb	204,745.188 ppb	39,421.271 ppb	8.969 ppb	5,007.691 ppb	157,522.670 ppb	99.054 %
Concentration per Run 2	94.657 %	93.116 %	0.005 ppb	215,032.361 ppb	42,473.774 ppb	7.226 ppb	5,398.926 ppb	166,405.815 ppb	93.274 %
Concentration per Run 3	95.121 %	89.612 %	0.005 ppb	218,226.815 ppb	42,781.931 ppb	7.349 ppb	5,158.947 ppb	165,078.810 ppb	93.748 %
Concentration RSD	1.1 %	2.1 %	50.9 %	3.3 %	4.5 %	12.4 %	3.8 %	2.9 %	3.4 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	97.270 %	215.986 ppb	1.672 ppb	0.329 ppb	637.060 ppb	15.993 ppb	1.144 ppb	3.068 ppb	2.256 ppb
Concentration per Run 1	97.202 %	214.689 ppb	1.495 ppb	0.417 ppb	616.616 ppb	17.130 ppb	1.203 ppb	3.184 ppb	2.313 ppb
Concentration per Run 2	95.932 %	221.991 ppb	2.070 ppb	0.322 ppb	654.486 ppb	15.034 ppb	1.136 ppb	3.108 ppb	2.238 ppb
Concentration per Run 3	98.677 %	211.279 ppb	1.451 ppb	0.248 ppb	640.078 ppb	15.816 ppb	1.093 ppb	2.912 ppb	2.217 ppb
Concentration RSD	1.4 %	2.5 %	20.7 %	25.7 %	3.0 %	6.6 %	4.9 %	4.6 %	2.2 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	15.431 ppb	90.295 %	0.283 ppb	3.436 ppb	591.895 ppb	1.005 ppb	88.022 %	0.034 ppb	0.290 ppb
Concentration per Run 1	15.395 ppb	89.614 %	0.212 ppb	3.944 ppb	586.258 ppb	0.728 ppb	89.899 %	0.032 ppb	0.276 ppb
Concentration per Run 2	15.532 ppb	90.132 %	0.308 ppb	3.667 ppb	600.134 ppb	1.132 ppb	86.607 %	0.036 ppb	0.283 ppb
Concentration per Run 3	15.365 ppb	91.137 %	0.328 ppb	2.697 ppb	589.292 ppb	1.156 ppb	87.560 %	0.033 ppb	0.311 ppb
Concentration RSD	0.6 %	0.9 %	22.0 %	19.1 %	1.2 %	23.9 %	1.9 %	5.5 %	6.4 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	86.700 %	0.728 ppb	1.282 ppb	136.941 ppb	89.875 %	87.771 %	0.013 ppb	0.069 ppb	97.154 %
Concentration per Run 1	86.715 %	0.673 ppb	1.200 ppb	134.850 ppb	91.898 %	89.513 %	0.010 ppb	0.069 ppb	100.143 %
Concentration per Run 2	85.326 %	0.649 ppb	1.170 ppb	139.894 ppb	88.176 %	87.269 %	0.016 ppb	0.071 ppb	95.534 %
Concentration per Run 3	88.059 %	0.862 ppb	1.477 ppb	136.081 ppb	89.551 %	86.530 %	0.015 ppb	0.069 ppb	95.784 %
Concentration RSD	1.6 %	16.0 %	13.2 %	1.9 %	2.1 %	1.8 %	23.1 %	1.9 %	2.7 %

Alpha ICPMSQ Full

6/7/2017 3:54:49 PM



Analysis index: 117 Analysis started at: 6/7/2017 3:13:57 PM Rack: 2
 Analysis label: WG1010664-4 6020SL User name: ALPHALAB\metals-instrument Vial: 22

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	93.243 %	92.593 %	0.002 ppb	213,343.598 ppb	41,313.891 ppb	4.233 ppb	5,389.491 ppb	165,445.878 ppb	90.998 %
Concentration per Run 1	94.354 %	93.761 %	0.005 ppb	213,058.903 ppb	41,152.015 ppb	2.981 ppb	5,326.457 ppb	162,457.642 ppb	90.543 %
Concentration per Run 2	93.199 %	94.499 %	-0.002 ppb	209,598.374 ppb	40,309.486 ppb	4.963 ppb	5,331.704 ppb	163,238.492 ppb	93.117 %
Concentration per Run 3	92.175 %	89.520 %	0.002 ppb	217,373.518 ppb	42,480.172 ppb	4.757 ppb	5,510.312 ppb	170,641.500 ppb	89.334 %
Concentration RSD	1.2 %	2.9 %	171.6 %	1.8 %	2.6 %	25.7 %	1.9 %	2.7 %	2.1 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	95.695 %	221.000 ppb	2.040 ppb	0.282 ppb	635.726 ppb	15.246 ppb	1.231 ppb	3.100 ppb	2.619 ppb
Concentration per Run 1	97.444 %	215.165 ppb	1.640 ppb	0.258 ppb	633.960 ppb	15.270 ppb	1.207 ppb	3.486 ppb	2.303 ppb
Concentration per Run 2	95.174 %	219.318 ppb	1.793 ppb	0.289 ppb	641.822 ppb	19.794 ppb	1.241 ppb	3.060 ppb	2.927 ppb
Concentration per Run 3	94.467 %	228.516 ppb	2.688 ppb	0.298 ppb	631.395 ppb	10.675 ppb	1.243 ppb	2.755 ppb	2.627 ppb
Concentration RSD	1.6 %	3.1 %	27.7 %	7.3 %	0.9 %	29.9 %	1.6 %	11.8 %	11.9 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	15.820 ppb	90.381 %	0.243 ppb	2.322 ppb	585.978 ppb	0.801 ppb	86.505 %	0.023 ppb	0.275 ppb
Concentration per Run 1	16.000 ppb	90.858 %	0.185 ppb	2.517 ppb	581.219 ppb	0.779 ppb	86.914 %	0.013 ppb	0.286 ppb
Concentration per Run 2	15.443 ppb	88.234 %	0.314 ppb	2.380 ppb	587.348 ppb	0.735 ppb	86.176 %	0.018 ppb	0.274 ppb
Concentration per Run 3	16.017 ppb	92.050 %	0.230 ppb	2.068 ppb	589.367 ppb	0.889 ppb	86.425 %	0.038 ppb	0.265 ppb
Concentration RSD	2.1 %	2.2 %	26.9 %	9.9 %	0.7 %	9.9 %	0.4 %	56.1 %	3.8 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	85.042 %	0.608 ppb	0.801 ppb	132.723 ppb	90.735 %	88.888 %	0.013 ppb	0.045 ppb	94.102 %
Concentration per Run 1	86.283 %	0.592 ppb	0.658 ppb	132.021 ppb	91.095 %	90.059 %	0.016 ppb	0.040 ppb	98.118 %
Concentration per Run 2	83.778 %	0.595 ppb	0.804 ppb	135.384 ppb	89.812 %	87.341 %	0.012 ppb	0.044 ppb	92.147 %
Concentration per Run 3	85.066 %	0.636 ppb	0.940 ppb	130.763 ppb	91.299 %	89.266 %	0.013 ppb	0.049 ppb	92.042 %
Concentration RSD	1.5 %	4.0 %	17.6 %	1.8 %	0.9 %	1.6 %	15.0 %	10.2 %	3.7 %

Alpha ICPMSQ Full

6/7/2017 3:54:49 PM



Analysis index: 118 Analysis started at: 6/7/2017 3:17:20 PM Rack: 2
 Analysis label: WG1010664-3D10 6020SL User name: ALPHALAB\metals-instrument Vial: 23

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	101.514 %	100.092 %	5.011 ppb	22,886.197 ppb	5,184.233 ppb	222.400 ppb	1,641.697 ppb	17,685.645 ppb	99.912 %
Concentration per Run 1	102.393 %	100.492 %	5.055 ppb	22,086.527 ppb	4,852.017 ppb	203.327 ppb	1,572.390 ppb	16,748.098 ppb	100.630 %
Concentration per Run 2	101.216 %	97.080 %	5.071 ppb	23,191.666 ppb	5,391.488 ppb	214.452 ppb	1,669.371 ppb	18,307.303 ppb	94.168 %
Concentration per Run 3	100.933 %	102.704 %	4.908 ppb	23,380.397 ppb	5,309.194 ppb	249.421 ppb	1,683.331 ppb	18,001.535 ppb	104.939 %
Concentration RSD	0.8 %	2.8 %	1.8 %	3.1 %	5.6 %	10.8 %	3.7 %	4.7 %	5.4 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	99.228 %	109.324 ppb	49.457 ppb	19.758 ppb	116.691 ppb	109.870 ppb	46.795 ppb	46.164 ppb	23.698 ppb
Concentration per Run 1	98.908 %	106.773 ppb	48.578 ppb	19.301 ppb	110.027 ppb	96.694 ppb	43.967 ppb	45.956 ppb	23.336 ppb
Concentration per Run 2	99.709 %	107.835 ppb	50.296 ppb	19.803 ppb	119.391 ppb	122.519 ppb	49.813 ppb	48.905 ppb	25.641 ppb
Concentration per Run 3	99.066 %	113.363 ppb	49.497 ppb	20.170 ppb	120.655 ppb	110.397 ppb	46.606 ppb	43.630 ppb	22.116 ppb
Concentration RSD	0.4 %	3.2 %	1.7 %	2.2 %	5.0 %	11.8 %	6.3 %	5.7 %	7.6 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	50.881 ppb	96.957 %	12.671 ppb	13.732 ppb	164.427 ppb	95.601 ppb	93.236 %	4.836 ppb	5.323 ppb
Concentration per Run 1	49.840 ppb	97.099 %	11.901 ppb	12.858 ppb	154.427 ppb	91.653 ppb	95.399 %	4.734 ppb	5.190 ppb
Concentration per Run 2	50.922 ppb	92.278 %	12.352 ppb	14.164 ppb	162.933 ppb	96.687 ppb	91.957 %	4.878 ppb	5.339 ppb
Concentration per Run 3	51.881 ppb	101.494 %	13.759 ppb	14.174 ppb	175.920 ppb	98.462 ppb	92.352 %	4.895 ppb	5.440 ppb
Concentration RSD	2.0 %	4.8 %	7.6 %	5.5 %	6.6 %	3.7 %	2.0 %	1.8 %	2.4 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	95.113 %	91.848 ppb	57.817 ppb	216.643 ppb	94.809 %	94.054 %	12.390 ppb	55.083 ppb	95.085 %
Concentration per Run 1	92.783 %	89.443 ppb	55.980 ppb	211.694 ppb	95.997 %	94.037 %	12.136 ppb	54.002 ppb	95.086 %
Concentration per Run 2	92.177 %	91.465 ppb	58.880 ppb	216.013 ppb	93.266 %	91.374 %	12.428 ppb	54.967 ppb	95.238 %
Concentration per Run 3	100.379 %	94.635 ppb	58.591 ppb	222.223 ppb	95.165 %	96.751 %	12.604 ppb	56.280 ppb	94.930 %
Concentration RSD	4.8 %	2.8 %	2.8 %	2.4 %	1.5 %	2.9 %	1.9 %	2.1 %	0.2 %

Alpha ICPMSQ Full

6/7/2017 3:54:49 PM



Analysis index: 119 Analysis started at: 6/7/2017 3:20:43 PM Rack: 2
 Analysis label: WG1010664-5D10 6020SL User name: ALPHALAB\metals-instrument Vial: 24

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	97.097 %	96.496 %	48.686 ppb	27,446.272 ppb	9,177.058 ppb	52.164 ppb	5,863.769 ppb	21,584.841 ppb	100.858 %
Concentration per Run 1	97.981 %	93.946 %	48.544 ppb	27,151.276 ppb	9,023.787 ppb	47.895 ppb	5,660.354 ppb	20,804.430 ppb	93.905 %
Concentration per Run 2	97.230 %	100.400 %	48.413 ppb	27,949.780 ppb	9,227.642 ppb	53.916 ppb	6,018.202 ppb	22,078.835 ppb	110.352 %
Concentration per Run 3	96.082 %	95.144 %	49.102 ppb	27,237.760 ppb	9,279.744 ppb	54.682 ppb	5,912.751 ppb	21,871.257 ppb	98.318 %
Concentration RSD	1.0 %	3.6 %	0.8 %	1.6 %	1.5 %	7.1 %	3.1 %	3.2 %	8.4 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	95.787 %	70.490 ppb	46.870 ppb	45.714 ppb	112.839 ppb	4,655.887 ppb	45.072 ppb	44.539 ppb	44.336 ppb
Concentration per Run 1	96.020 %	68.567 ppb	48.493 ppb	46.788 ppb	110.347 ppb	4,678.136 ppb	46.174 ppb	46.893 ppb	45.415 ppb
Concentration per Run 2	95.968 %	72.113 ppb	44.785 ppb	43.482 ppb	107.214 ppb	4,586.713 ppb	43.213 ppb	42.151 ppb	42.301 ppb
Concentration per Run 3	95.374 %	70.792 ppb	47.332 ppb	46.872 ppb	120.956 ppb	4,702.813 ppb	45.830 ppb	44.573 ppb	45.293 ppb
Concentration RSD	0.4 %	2.5 %	4.0 %	4.2 %	6.4 %	1.3 %	3.6 %	5.3 %	4.0 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	48.099 ppb	95.985 %	47.005 ppb	48.529 ppb	112.572 ppb	48.823 ppb	91.904 %	5.087 ppb	48.260 ppb
Concentration per Run 1	47.299 ppb	91.571 %	46.020 ppb	44.362 ppb	105.954 ppb	49.353 ppb	92.115 %	5.058 ppb	47.344 ppb
Concentration per Run 2	47.581 ppb	102.512 %	46.731 ppb	51.575 ppb	120.114 ppb	49.274 ppb	92.436 %	4.970 ppb	48.578 ppb
Concentration per Run 3	49.415 ppb	93.872 %	48.264 ppb	49.650 ppb	111.648 ppb	47.842 ppb	91.160 %	5.234 ppb	48.857 ppb
Concentration RSD	2.4 %	6.0 %	2.4 %	7.7 %	6.3 %	1.7 %	0.7 %	2.6 %	1.7 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	94.080 %	48.461 ppb	51.042 ppb	64.256 ppb	90.760 %	92.361 %	48.869 ppb	50.177 ppb	93.362 %
Concentration per Run 1	89.971 %	47.777 ppb	50.842 ppb	63.657 ppb	87.585 %	91.777 %	49.835 ppb	50.519 ppb	91.637 %
Concentration per Run 2	99.837 %	48.418 ppb	49.854 ppb	64.799 ppb	94.263 %	95.396 %	48.152 ppb	49.889 ppb	95.264 %
Concentration per Run 3	92.431 %	49.189 ppb	52.430 ppb	64.310 ppb	90.432 %	89.911 %	48.622 ppb	50.123 ppb	93.185 %
Concentration RSD	5.5 %	1.5 %	2.5 %	0.9 %	3.7 %	3.0 %	1.8 %	0.6 %	1.9 %

Alpha ICPMSQ Full

6/7/2017 3:54:49 PM



Analysis index: 120 Analysis started at: 6/7/2017 3:24:06 PM Rack: 2
 Analysis label: L1718484-02 6020SL User name: ALPHALAB\metals-instrument Vial: 25

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	91.817 %	96.343 %	0.006 ppb	210,358.707 ppb	41,299.659 ppb	8.906 ppb	5,568.490 ppb	165,778.443 ppb	95.446 %
Concentration per Run 1	92.079 %	103.166 %	-0.001 ppb	205,225.081 ppb	40,344.423 ppb	7.824 ppb	5,617.210 ppb	161,694.434 ppb	107.146 %
Concentration per Run 2	91.243 %	93.208 %	0.010 ppb	218,632.307 ppb	42,817.762 ppb	9.201 ppb	5,625.288 ppb	172,818.669 ppb	89.387 %
Concentration per Run 3	92.128 %	92.655 %	0.009 ppb	207,218.734 ppb	40,736.792 ppb	9.693 ppb	5,462.970 ppb	162,822.226 ppb	89.807 %
Concentration RSD	0.5 %	6.1 %	107.1 %	3.4 %	3.2 %	10.9 %	1.6 %	3.7 %	10.6 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	93.472 %	217.711 ppb	2.082 ppb	0.736 ppb	643.913 ppb	25.852 ppb	1.229 ppb	3.236 ppb	2.659 ppb
Concentration per Run 1	93.412 %	222.910 ppb	1.689 ppb	0.763 ppb	644.612 ppb	18.778 ppb	0.967 ppb	2.207 ppb	2.398 ppb
Concentration per Run 2	91.859 %	216.126 ppb	2.393 ppb	0.592 ppb	634.423 ppb	22.747 ppb	1.291 ppb	3.490 ppb	3.082 ppb
Concentration per Run 3	95.145 %	214.099 ppb	2.165 ppb	0.854 ppb	652.702 ppb	36.031 ppb	1.428 ppb	4.011 ppb	2.497 ppb
Concentration RSD	1.8 %	2.1 %	17.2 %	18.1 %	1.4 %	35.0 %	19.3 %	28.7 %	13.9 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	12.733 ppb	91.783 %	0.314 ppb	2.446 ppb	604.247 ppb	1.524 ppb	86.710 %	0.029 ppb	0.236 ppb
Concentration per Run 1	12.037 ppb	99.568 %	0.278 ppb	3.827 ppb	626.828 ppb	1.402 ppb	91.309 %	0.027 ppb	0.198 ppb
Concentration per Run 2	12.893 ppb	91.765 %	0.255 ppb	1.780 ppb	604.873 ppb	1.513 ppb	84.787 %	0.034 ppb	0.260 ppb
Concentration per Run 3	13.268 ppb	84.016 %	0.408 ppb	1.730 ppb	581.041 ppb	1.658 ppb	84.034 %	0.025 ppb	0.251 ppb
Concentration RSD	5.0 %	8.5 %	26.3 %	48.9 %	3.8 %	8.4 %	4.6 %	16.3 %	14.1 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	88.371 %	1.489 ppb	2.565 ppb	137.360 ppb	90.577 %	89.825 %	0.031 ppb	0.109 ppb	97.583 %
Concentration per Run 1	95.034 %	1.577 ppb	2.316 ppb	139.643 ppb	93.315 %	94.662 %	0.027 ppb	0.112 ppb	103.192 %
Concentration per Run 2	85.652 %	1.434 ppb	2.699 ppb	136.084 ppb	89.341 %	87.589 %	0.029 ppb	0.114 ppb	94.743 %
Concentration per Run 3	84.428 %	1.457 ppb	2.679 ppb	136.353 ppb	89.074 %	87.225 %	0.036 ppb	0.101 ppb	94.813 %
Concentration RSD	6.6 %	5.1 %	8.4 %	1.4 %	2.6 %	4.7 %	16.8 %	6.1 %	5.0 %

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Analysis index: 121 Analysis started at: 6/7/2017 3:27:28 PM Rack: 2
 Analysis label: L1718493-01 6020SL User name: ALPHALAB\metals-instrument Vial: 26

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	90.258 %	90.135 %	0.001 ppb	129,128.933 ppb	18,527.609 ppb	14.068 ppb	9,122.745 ppb	98,228.065 ppb	87.951 %
Concentration per Run 1	91.294 %	93.116 %	-0.001 ppb	127,241.595 ppb	18,055.445 ppb	12.111 ppb	9,138.807 ppb	98,044.027 ppb	89.702 %
Concentration per Run 2	90.705 %	90.166 %	0.006 ppb	127,541.656 ppb	18,372.674 ppb	16.395 ppb	8,984.466 ppb	96,697.745 ppb	90.070 %
Concentration per Run 3	88.774 %	87.123 %	-0.001 ppb	132,603.548 ppb	19,154.708 ppb	13.697 ppb	9,244.961 ppb	99,942.423 ppb	84.081 %
Concentration RSD	1.5 %	3.3 %	325.2 %	2.3 %	3.1 %	15.4 %	1.4 %	1.7 %	3.8 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	90.459 %	129.429 ppb	0.308 ppb	0.310 ppb	541.206 ppb	483.137 ppb	1.827 ppb	1.068 ppb	0.839 ppb
Concentration per Run 1	90.627 %	125.576 ppb	0.363 ppb	0.290 ppb	527.238 ppb	458.776 ppb	2.007 ppb	1.208 ppb	0.901 ppb
Concentration per Run 2	92.997 %	125.789 ppb	0.213 ppb	0.338 ppb	530.638 ppb	492.553 ppb	1.688 ppb	1.025 ppb	0.838 ppb
Concentration per Run 3	87.754 %	136.922 ppb	0.348 ppb	0.303 ppb	565.742 ppb	498.080 ppb	1.786 ppb	0.973 ppb	0.778 ppb
Concentration RSD	2.9 %	5.0 %	26.9 %	7.9 %	3.9 %	4.4 %	8.9 %	11.5 %	7.3 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	9.070 ppb	84.794 %	0.283 ppb	0.765 ppb	556.680 ppb	1.001 ppb	83.867 %	0.011 ppb	0.010 ppb
Concentration per Run 1	8.169 ppb	86.504 %	0.446 ppb	0.543 ppb	555.871 ppb	0.971 ppb	85.155 %	0.007 ppb	0.000 ppb
Concentration per Run 2	8.821 ppb	86.970 %	0.194 ppb	0.267 ppb	550.728 ppb	0.943 ppb	83.822 %	0.010 ppb	0.019 ppb
Concentration per Run 3	10.221 ppb	80.906 %	0.208 ppb	1.486 ppb	563.441 ppb	1.090 ppb	82.622 %	0.017 ppb	0.013 ppb
Concentration RSD	11.6 %	4.0 %	50.1 %	83.5 %	1.1 %	7.8 %	1.5 %	44.9 %	91.4 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	82.176 %	0.586 ppb	1.155 ppb	382.002 ppb	87.757 %	85.745 %	0.006 ppb	0.850 ppb	91.782 %
Concentration per Run 1	83.801 %	0.568 ppb	1.025 ppb	370.002 ppb	90.525 %	87.851 %	0.006 ppb	0.828 ppb	95.740 %
Concentration per Run 2	81.851 %	0.609 ppb	1.120 ppb	392.823 ppb	85.675 %	84.953 %	0.004 ppb	0.859 ppb	89.634 %
Concentration per Run 3	80.876 %	0.582 ppb	1.319 ppb	383.179 ppb	87.072 %	84.433 %	0.007 ppb	0.862 ppb	89.972 %
Concentration RSD	1.8 %	3.6 %	13.0 %	3.0 %	2.8 %	2.1 %	23.7 %	2.2 %	3.7 %

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Analysis index: 122 Analysis started at: 6/7/2017 3:30:50 PM Rack: 2
 Analysis label: L1718493-02 6020SL User name: ALPHALAB\metals-instrument Vial: 27

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	89.268 %	91.241 %	0.009 ppb	532,209.285 ppb	39,143.898 ppb	10.106 ppb	10,575.386 ppb	122,512.364 ppb	87.198 %
Concentration per Run 1	89.242 %	93.946 %	-0.001 ppb	529,323.945 ppb	39,206.741 ppb	10.419 ppb	10,788.764 ppb	124,678.932 ppb	85.184 %
Concentration per Run 2	89.477 %	86.017 %	0.010 ppb	541,299.099 ppb	39,660.488 ppb	9.689 ppb	10,314.687 ppb	119,509.289 ppb	90.437 %
Concentration per Run 3	89.086 %	93.761 %	0.018 ppb	526,004.809 ppb	38,564.465 ppb	10.210 ppb	10,622.706 ppb	123,348.872 ppb	85.972 %
Concentration RSD	0.2 %	5.0 %	105.9 %	1.5 %	1.4 %	3.7 %	2.3 %	2.2 %	3.2 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	92.129 %	159.547 ppb	0.168 ppb	0.304 ppb	384.462 ppb	172.401 ppb	0.321 ppb	0.918 ppb	0.454 ppb
Concentration per Run 1	91.494 %	155.895 ppb	0.185 ppb	0.191 ppb	387.877 ppb	168.220 ppb	0.297 ppb	0.479 ppb	0.478 ppb
Concentration per Run 2	92.215 %	157.348 ppb	0.212 ppb	0.300 ppb	374.419 ppb	167.773 ppb	0.357 ppb	1.204 ppb	0.346 ppb
Concentration per Run 3	92.677 %	165.398 ppb	0.106 ppb	0.421 ppb	391.088 ppb	181.211 ppb	0.309 ppb	1.071 ppb	0.537 ppb
Concentration RSD	0.6 %	3.2 %	32.9 %	37.8 %	2.3 %	4.4 %	9.9 %	42.0 %	21.6 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	7.170 ppb	85.241 %	0.692 ppb	0.243 ppb	772.675 ppb	1.172 ppb	83.726 %	0.021 ppb	0.015 ppb
Concentration per Run 1	7.460 ppb	84.813 %	0.917 ppb	0.498 ppb	763.016 ppb	1.140 ppb	85.787 %	0.014 ppb	0.000 ppb
Concentration per Run 2	6.655 ppb	86.297 %	0.650 ppb	-0.068 ppb	767.416 ppb	1.066 ppb	83.054 %	0.024 ppb	0.025 ppb
Concentration per Run 3	7.394 ppb	84.612 %	0.508 ppb	0.300 ppb	787.594 ppb	1.311 ppb	82.337 %	0.026 ppb	0.019 ppb
Concentration RSD	6.2 %	1.1 %	30.0 %	118.2 %	1.7 %	10.7 %	2.2 %	30.3 %	89.1 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	81.006 %	0.500 ppb	1.014 ppb	267.926 ppb	86.281 %	84.259 %	0.003 ppb	0.716 ppb	89.450 %
Concentration per Run 1	81.079 %	0.398 ppb	0.945 ppb	267.819 ppb	88.090 %	85.475 %	0.003 ppb	0.717 ppb	92.021 %
Concentration per Run 2	81.175 %	0.580 ppb	1.112 ppb	264.774 ppb	85.846 %	84.842 %	0.002 ppb	0.721 ppb	88.225 %
Concentration per Run 3	80.765 %	0.522 ppb	0.987 ppb	271.186 ppb	84.907 %	82.459 %	0.006 ppb	0.710 ppb	88.104 %
Concentration RSD	0.3 %	18.6 %	8.6 %	1.2 %	1.9 %	1.9 %	58.8 %	0.7 %	2.5 %

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Analysis index: 123 Analysis started at: 6/7/2017 3:34:44 PM Rack: 2
 Analysis label: L1718493-02D20 6020SL User name: ALPHALAB\metals-instrument Vial: 29

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	102.271 %	95.605 %	0.008 ppb	28,818.749 ppb	2,027.546 ppb	0.143 ppb	541.657 ppb	6,291.196 ppb	93.047 %
Concentration per Run 1	102.906 %	87.861 %	0.001 ppb	29,259.701 ppb	2,113.873 ppb	1.014 ppb	552.765 ppb	6,255.197 ppb	84.975 %
Concentration per Run 2	101.964 %	99.662 %	0.017 ppb	27,969.075 ppb	1,910.020 ppb	-0.280 ppb	514.441 ppb	6,243.521 ppb	93.958 %
Concentration per Run 3	101.943 %	99.293 %	0.007 ppb	29,227.470 ppb	2,058.744 ppb	-0.304 ppb	557.766 ppb	6,374.869 ppb	100.210 %
Concentration RSD	0.5 %	7.0 %	97.8 %	2.6 %	5.2 %	526.0 %	4.4 %	1.2 %	8.2 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	98.823 %	8.415 ppb	-0.010 ppb	0.015 ppb	19.616 ppb	9.823 ppb	0.004 ppb	-0.011 ppb	0.030 ppb
Concentration per Run 1	99.435 %	7.859 ppb	-0.010 ppb	-0.004 ppb	18.896 ppb	9.425 ppb	0.000 ppb	0.019 ppb	-0.004 ppb
Concentration per Run 2	99.547 %	7.991 ppb	-0.010 ppb	0.022 ppb	20.230 ppb	11.066 ppb	0.011 ppb	-0.126 ppb	0.047 ppb
Concentration per Run 3	97.488 %	9.397 ppb	-0.010 ppb	0.027 ppb	19.722 ppb	8.978 ppb	0.000 ppb	0.074 ppb	0.047 ppb
Concentration RSD	1.2 %	10.1 %	0.0 %	108.7 %	3.4 %	11.2 %	173.2 %	947.4 %	97.2 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	0.380 ppb	91.282 %	0.034 ppb	0.244 ppb	39.023 ppb	0.128 ppb	92.414 %	-0.001 ppb	0.004 ppb
Concentration per Run 1	0.181 ppb	86.012 %	0.069 ppb	0.384 ppb	36.921 ppb	0.085 ppb	90.355 %	0.000 ppb	0.000 ppb
Concentration per Run 2	0.508 ppb	94.927 %	0.016 ppb	0.285 ppb	38.967 ppb	0.166 ppb	92.924 %	0.000 ppb	0.006 ppb
Concentration per Run 3	0.452 ppb	92.906 %	0.017 ppb	0.065 ppb	41.182 ppb	0.132 ppb	93.964 %	-0.002 ppb	0.006 ppb
Concentration RSD	46.0 %	5.1 %	89.2 %	66.9 %	5.5 %	32.2 %	2.0 %	177.0 %	86.6 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	88.022 %	0.148 ppb	0.219 ppb	13.352 ppb	90.115 %	88.974 %	0.001 ppb	0.042 ppb	91.156 %
Concentration per Run 1	82.195 %	0.128 ppb	0.197 ppb	13.182 ppb	89.938 %	85.212 %	0.000 ppb	0.038 ppb	88.703 %
Concentration per Run 2	89.869 %	0.131 ppb	0.231 ppb	13.372 ppb	92.048 %	89.664 %	0.002 ppb	0.048 ppb	92.829 %
Concentration per Run 3	92.003 %	0.186 ppb	0.228 ppb	13.502 ppb	88.360 %	92.045 %	0.001 ppb	0.040 ppb	91.937 %
Concentration RSD	5.9 %	22.2 %	8.7 %	1.2 %	2.1 %	3.9 %	88.6 %	12.2 %	2.4 %

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6/7/2017 3:54:49 PM



Analysis index: 124 Analysis started at: 6/7/2017 3:38:06 PM Rack: 2
 Analysis label: WG1010664-2D5 6020SL User name: ALPHALAB\metals-instrument Vial: 28

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	98.193 %	96.466 %	10.385 ppb	2,239.758 ppb	2,196.013 ppb	457.028 ppb	2,219.621 ppb	2,151.427 ppb	93.625 %
Concentration per Run 1	99.072 %	96.251 %	10.286 ppb	2,188.891 ppb	2,118.905 ppb	460.955 ppb	2,161.794 ppb	2,262.165 ppb	94.273 %
Concentration per Run 2	98.054 %	96.158 %	10.428 ppb	2,248.004 ppb	2,264.050 ppb	454.205 ppb	2,245.343 ppb	2,084.064 ppb	93.695 %
Concentration per Run 3	97.454 %	96.988 %	10.440 ppb	2,282.380 ppb	2,205.085 ppb	455.924 ppb	2,251.726 ppb	2,108.052 ppb	92.907 %
Concentration RSD	0.8 %	0.5 %	0.8 %	2.1 %	3.3 %	0.8 %	2.3 %	4.5 %	0.7 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	95.409 %	190.044 ppb	102.550 ppb	40.934 ppb	102.649 ppb	214.439 ppb	99.465 ppb	99.443 ppb	48.983 ppb
Concentration per Run 1	95.617 %	191.306 ppb	102.963 ppb	41.352 ppb	101.564 ppb	224.650 ppb	97.781 ppb	97.356 ppb	47.149 ppb
Concentration per Run 2	95.734 %	188.020 ppb	102.089 ppb	39.556 ppb	102.565 ppb	207.585 ppb	99.507 ppb	101.493 ppb	49.217 ppb
Concentration per Run 3	94.878 %	190.806 ppb	102.596 ppb	41.895 ppb	103.818 ppb	211.082 ppb	101.106 ppb	99.480 ppb	50.584 ppb
Concentration RSD	0.5 %	0.9 %	0.4 %	3.0 %	1.1 %	4.2 %	1.7 %	2.1 %	3.5 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	102.323 ppb	89.559 %	26.039 ppb	28.559 ppb	211.221 ppb	199.925 ppb	90.678 %	9.968 ppb	10.667 ppb
Concentration per Run 1	100.720 ppb	88.766 %	26.461 ppb	30.155 ppb	204.234 ppb	197.304 ppb	92.178 %	9.590 ppb	10.569 ppb
Concentration per Run 2	102.492 ppb	89.317 %	25.384 ppb	24.635 ppb	215.812 ppb	205.013 ppb	89.130 %	10.213 ppb	10.782 ppb
Concentration per Run 3	103.757 ppb	90.593 %	26.272 ppb	30.886 ppb	213.616 ppb	197.458 ppb	90.725 %	10.103 ppb	10.649 ppb
Concentration RSD	1.5 %	1.0 %	2.2 %	12.0 %	2.9 %	2.2 %	1.7 %	3.3 %	1.0 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	88.209 %	199.091 ppb	99.441 ppb	408.981 ppb	90.933 %	89.452 %	24.118 ppb	109.671 ppb	95.884 %
Concentration per Run 1	89.922 %	192.439 ppb	92.816 ppb	395.831 ppb	91.887 %	91.919 %	23.704 ppb	105.436 ppb	98.000 %
Concentration per Run 2	87.618 %	202.135 ppb	98.872 ppb	416.281 ppb	90.607 %	88.266 %	24.645 ppb	110.926 ppb	95.559 %
Concentration per Run 3	87.088 %	202.699 ppb	106.634 ppb	414.830 ppb	90.305 %	88.170 %	24.004 ppb	112.651 ppb	94.093 %
Concentration RSD	1.7 %	2.9 %	7.0 %	2.8 %	0.9 %	2.4 %	2.0 %	3.4 %	2.1 %

Alpha ICPMSQ Full

6/7/2017 3:54:49 PM



Analysis index: 125 Analysis started at: 6/7/2017 3:42:22 PM Rack: 0
 Analysis label: CCV User name: ALPHALAB\metals-instrument Vial: 9

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	98.794 %	94.099 %	101.183 ppb	10,575.413 ppb	10,726.335 ppb	106.279 ppb	10,888.320 ppb	10,981.160 ppb	104.974 %
Concentration per Run 1	99.492 %	92.378 %	100.679 ppb	10,136.904 ppb	10,009.795 ppb	98.414 ppb	9,877.105 ppb	10,271.480 ppb	103.835 %
Concentration per Run 2	98.476 %	86.846 %	101.059 ppb	10,969.795 ppb	11,131.385 ppb	109.251 ppb	10,960.515 ppb	11,259.772 ppb	96.742 %
Concentration per Run 3	98.414 %	103.073 %	101.811 ppb	10,619.539 ppb	11,037.824 ppb	111.171 ppb	11,827.340 ppb	11,412.228 ppb	114.345 %
Recovery Percentage 1			101.183 %	105.754 %	107.263 %	106.279 %	108.883 %	109.812 %	
Concentration RSD	0.6 %	8.8 %	0.6 %	4.0 %	5.8 %	6.5 %	9.0 %	5.6 %	8.4 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	97.409 %	99.199 ppb	94.922 ppb	94.509 ppb	101.595 ppb	9,834.344 ppb	93.913 ppb	91.960 ppb	93.368 ppb
Concentration per Run 1	96.936 %	89.981 ppb	92.993 ppb	91.061 ppb	99.480 ppb	9,431.316 ppb	91.743 ppb	90.260 ppb	92.755 ppb
Concentration per Run 2	98.058 %	103.895 ppb	97.893 ppb	99.849 ppb	101.402 ppb	10,151.117 ppb	97.997 ppb	96.528 ppb	96.476 ppb
Concentration per Run 3	97.234 %	103.721 ppb	93.880 ppb	92.618 ppb	103.904 ppb	9,920.598 ppb	92.000 ppb	89.092 ppb	90.873 ppb
Recovery Percentage 1		99.199 %	94.922 %	94.509 %	101.595 %	98.343 %	93.913 %	91.960 %	93.368 %
Concentration RSD	0.6 %	8.0 %	2.8 %	5.0 %	2.2 %	3.7 %	3.8 %	4.3 %	3.1 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	95.833 ppb	96.963 %	98.518 ppb	103.952 ppb	109.361 ppb	103.748 ppb	92.402 %	98.179 ppb	101.301 ppb
Concentration per Run 1	95.136 ppb	93.787 %	96.441 ppb	107.000 ppb	102.900 ppb	103.192 ppb	93.236 %	97.537 ppb	98.814 ppb
Concentration per Run 2	95.120 ppb	94.063 %	100.587 ppb	94.840 ppb	106.699 ppb	104.586 ppb	89.538 %	100.521 ppb	102.765 ppb
Concentration per Run 3	97.242 ppb	103.039 %	98.526 ppb	110.015 ppb	118.484 ppb	103.466 ppb	94.432 %	96.480 ppb	102.323 ppb
Recovery Percentage 1	95.833 %		98.518 %	103.952 %	109.361 %	103.748 %		98.179 %	101.301 %
Concentration RSD	1.3 %	5.4 %	2.1 %	7.7 %	7.4 %	0.7 %	2.8 %	2.1 %	2.1 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	93.769 %	102.403 ppb	107.594 ppb	104.894 ppb	94.157 %	93.076 %	101.252 ppb	104.251 ppb	96.967 %
Concentration per Run 1	92.188 %	98.866 ppb	102.773 ppb	100.231 ppb	94.174 %	92.848 %	99.517 ppb	102.390 ppb	97.896 %
Concentration per Run 2	89.048 %	104.322 ppb	108.138 ppb	105.607 ppb	92.009 %	88.350 %	101.440 ppb	104.772 ppb	95.410 %
Concentration per Run 3	100.070 %	104.022 ppb	111.869 ppb	108.844 ppb	96.287 %	98.031 %	102.798 ppb	105.591 ppb	97.594 %
Recovery Percentage 1		102.403 %	107.594 %	104.894 %			101.252 %	104.251 %	
Concentration RSD	6.1 %	3.0 %	4.2 %	4.1 %	2.3 %	5.2 %	1.6 %	1.6 %	1.4 %

Alpha ICPMSQ Full

6/7/2017 3:54:49 PM



Analysis index: 126 Analysis started at: 6/7/2017 3:45:52 PM Rack: 4
 Analysis label: LLCCV User name: ALPHALAB\metals-instrument Vial: 51

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	99.123 %	95.605 %	0.332 ppb	187.777 ppb	82.221 ppb	13.944 ppb	141.969 ppb	131.662 ppb	102.189 %
Concentration per Run 1	99.248 %	100.307 %	0.340 ppb	179.419 ppb	76.409 ppb	12.327 ppb	138.259 ppb	118.375 ppb	105.517 %
Concentration per Run 2	98.478 %	99.478 %	0.373 ppb	178.623 ppb	82.154 ppb	15.948 ppb	158.774 ppb	133.686 ppb	105.938 %
Concentration per Run 3	99.643 %	87.031 %	0.281 ppb	205.290 ppb	88.100 ppb	13.557 ppb	128.873 ppb	142.927 ppb	95.113 %
Recovery Percentage 1			110.528 %	187.777 %	117.459 %	139.438 %	141.969 %	131.662 %	
Concentration RSD	0.6 %	7.8 %	14.1 %	8.1 %	7.1 %	13.2 %	10.8 %	9.4 %	6.0 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	96.591 %	0.723 ppb	5.361 ppb	0.507 ppb	1.195 ppb	55.295 ppb	0.514 ppb	1.659 ppb	1.065 ppb
Concentration per Run 1	95.051 %	0.704 ppb	4.404 ppb	0.415 ppb	1.355 ppb	56.032 ppb	0.487 ppb	1.559 ppb	1.013 ppb
Concentration per Run 2	95.286 %	0.860 ppb	5.884 ppb	0.593 ppb	1.275 ppb	55.794 ppb	0.536 ppb	1.666 ppb	0.729 ppb
Concentration per Run 3	99.436 %	0.606 ppb	5.795 ppb	0.513 ppb	0.954 ppb	54.060 ppb	0.518 ppb	1.752 ppb	1.452 ppb
Recovery Percentage 1		144.680 %	107.219 %	101.386 %	119.501 %	110.590 %	102.713 %	82.947 %	106.485 %
Concentration RSD	2.6 %	17.7 %	15.5 %	17.6 %	17.8 %	1.9 %	4.9 %	5.8 %	34.2 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	10.104 ppb	95.814 %	0.552 ppb	6.249 ppb	0.681 ppb	2.623 ppb	95.340 %	0.500 ppb	0.188 ppb
Concentration per Run 1	10.287 ppb	97.573 %	0.618 ppb	6.557 ppb	0.656 ppb	2.608 ppb	96.080 %	0.515 ppb	0.162 ppb
Concentration per Run 2	10.376 ppb	98.006 %	0.549 ppb	6.022 ppb	0.797 ppb	2.715 ppb	97.220 %	0.481 ppb	0.174 ppb
Concentration per Run 3	9.647 ppb	91.863 %	0.491 ppb	6.168 ppb	0.591 ppb	2.548 ppb	92.719 %	0.505 ppb	0.226 ppb
Recovery Percentage 1	101.036 %		110.488 %	124.980 %	136.260 %	131.173 %		125.095 %	93.756 %
Concentration RSD	3.9 %	3.6 %	11.6 %	4.4 %	15.5 %	3.2 %	2.5 %	3.6 %	18.0 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	95.965 %	4.448 ppb	7.509 ppb	0.727 ppb	95.210 %	94.584 %	0.559 ppb	0.604 ppb	98.640 %
Concentration per Run 1	99.465 %	4.647 ppb	7.158 ppb	0.801 ppb	97.289 %	98.365 %	0.564 ppb	0.582 ppb	99.837 %
Concentration per Run 2	97.849 %	4.169 ppb	7.518 ppb	0.594 ppb	95.042 %	94.891 %	0.548 ppb	0.617 ppb	98.352 %
Concentration per Run 3	90.580 %	4.528 ppb	7.852 ppb	0.785 ppb	93.300 %	90.497 %	0.565 ppb	0.614 ppb	97.732 %
Recovery Percentage 1		148.261 %	187.727 %	145.355 %			111.877 %	120.891 %	
Concentration RSD	4.9 %	5.6 %	4.6 %	15.8 %	2.1 %	4.2 %	1.7 %	3.2 %	1.1 %

Alpha ICPMSQ Full

6/7/2017 3:54:49 PM



Analysis index: 127 Analysis started at: 6/7/2017 3:49:18 PM Rack: 0
 Analysis label: CCB User name: ALPHALAB\metals-instrument Vial: 10

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	100.250 %	97.480 %	0.007 ppb	51.796 ppb	2.440 ppb	1.191 ppb	14.168 ppb	4.926 ppb	96.847 %
Concentration per Run 1	100.620 %	96.066 %	0.021 ppb	51.680 ppb	1.014 ppb	1.129 ppb	6.687 ppb	7.594 ppb	94.798 %
Concentration per Run 2	100.314 %	100.492 %	0.004 ppb	47.690 ppb	3.083 ppb	1.181 ppb	4.690 ppb	7.050 ppb	99.264 %
Concentration per Run 3	99.816 %	95.882 %	-0.006 ppb	56.016 ppb	3.223 ppb	1.265 ppb	31.129 ppb	0.134 ppb	96.479 %
Recovery Percentage 1			1.317 %	51.796 %	3.485 %	11.915 %	14.168 %	4.926 %	
Concentration RSD	0.4 %	2.7 %	202.5 %	8.0 %	50.7 %	5.7 %	103.9 %	84.4 %	2.3 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	97.330 %	-0.019 ppb	0.013 ppb	0.020 ppb	0.095 ppb	1.572 ppb	0.011 ppb	-0.031 ppb	-0.006 ppb
Concentration per Run 1	97.815 %	-0.038 ppb	-0.010 ppb	0.045 ppb	0.097 ppb	3.067 ppb	0.011 ppb	-0.085 ppb	-0.006 ppb
Concentration per Run 2	95.894 %	-0.038 ppb	0.024 ppb	0.018 ppb	0.174 ppb	0.374 ppb	0.022 ppb	0.119 ppb	-0.006 ppb
Concentration per Run 3	98.281 %	0.020 ppb	0.024 ppb	-0.003 ppb	0.015 ppb	1.274 ppb	0.000 ppb	-0.126 ppb	-0.006 ppb
Recovery Percentage 1		-3.796 %	0.250 %	1.957 %	9.526 %	3.143 %	2.215 %	-1.536 %	-0.634 %
Concentration RSD	1.3 %	175.7 %	158.5 %	122.6 %	83.1 %	87.3 %	99.6 %	427.0 %	0.7 %

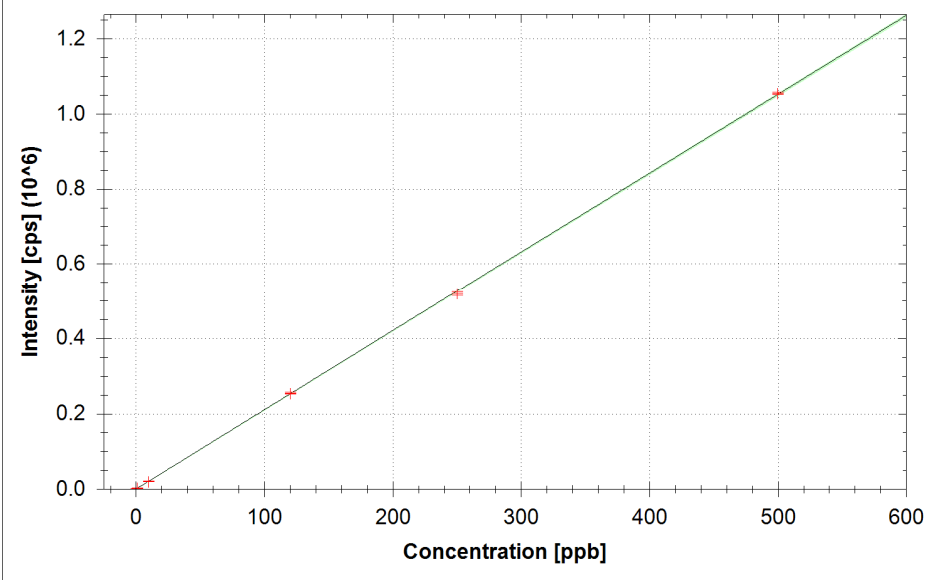
Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	-0.074 ppb	92.716 %	0.001 ppb	-0.147 ppb	0.030 ppb	0.205 ppb	91.709 %	0.020 ppb	0.021 ppb
Concentration per Run 1	-0.062 ppb	93.839 %	-0.007 ppb	-0.286 ppb	0.003 ppb	0.117 ppb	91.117 %	0.027 ppb	0.011 ppb
Concentration per Run 2	-0.206 ppb	91.376 %	0.017 ppb	-0.371 ppb	0.026 ppb	0.365 ppb	91.033 %	0.019 ppb	0.040 ppb
Concentration per Run 3	0.046 ppb	92.932 %	-0.007 ppb	0.216 ppb	0.059 ppb	0.133 ppb	92.977 %	0.014 ppb	0.011 ppb
Recovery Percentage 1	-0.740 %	92.716 %	0.252 %	-2.939 %	5.912 %	10.242 %		5.052 %	10.417 %
Concentration RSD	170.7 %	1.3 %	1,091.1 %	215.7 %	95.4 %	67.7 %	1.2 %	32.5 %	78.8 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	90.296 %	0.474 ppb	1.046 ppb	0.021 ppb	92.184 %	90.291 %	0.016 ppb	0.024 ppb	90.930 %
Concentration per Run 1	90.066 %	0.465 ppb	1.049 ppb	0.011 ppb	91.934 %	90.035 %	0.019 ppb	0.024 ppb	88.521 %
Concentration per Run 2	90.453 %	0.481 ppb	1.030 ppb	0.026 ppb	91.994 %	90.056 %	0.014 ppb	0.030 ppb	91.450 %
Concentration per Run 3	90.369 %	0.475 ppb	1.060 ppb	0.026 ppb	92.624 %	90.781 %	0.017 ppb	0.018 ppb	92.819 %
Recovery Percentage 1		15.791 %	26.156 %	4.232 %			3.274 %	4.794 %	90.930 %
Concentration RSD	0.2 %	1.7 %	1.4 %	39.8 %	0.4 %	0.5 %	14.9 %	23.4 %	2.4 %



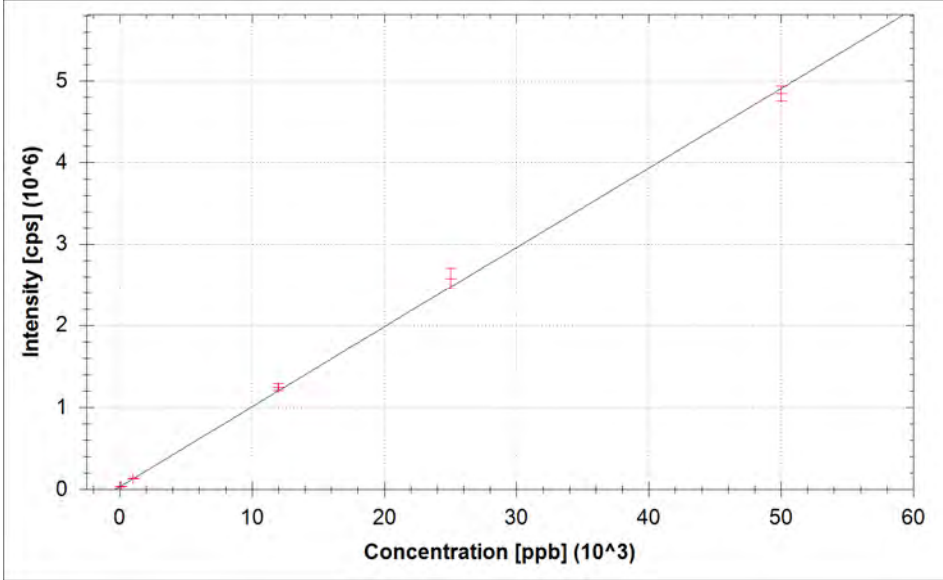
Calibration Curves:

9Be (STD AGD)



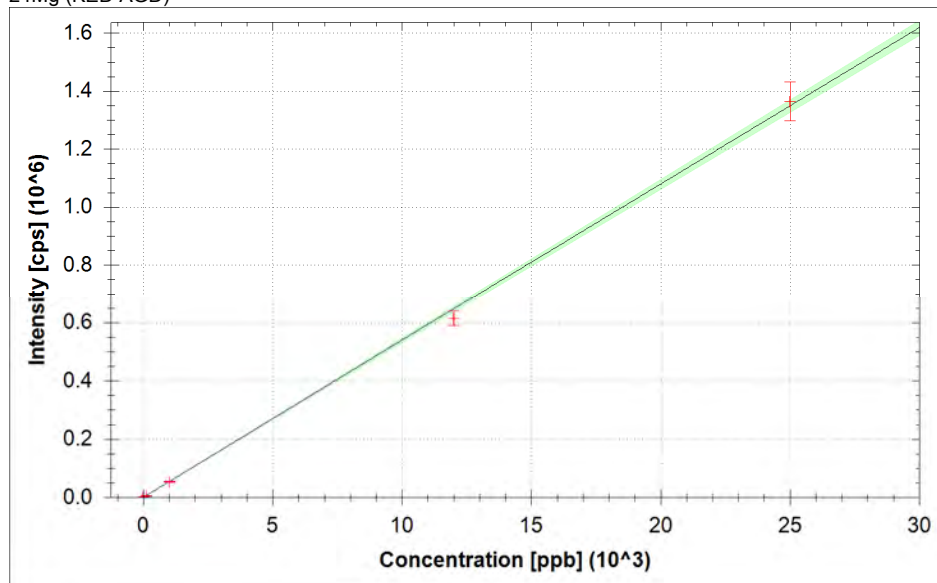
$f(x) = 2103.6210 \cdot x + 13.2993$
 $R^2 = 0.9999$
BEC = 0.006 ppb
LoD = 0.0057 ppb

23Na (KED AGD)



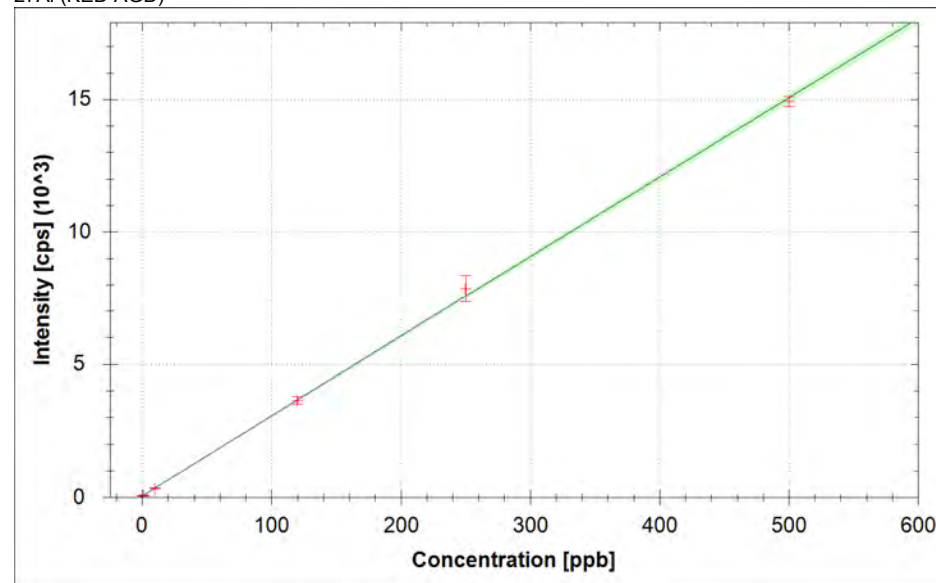
$f(x) = 97.5104 \cdot x + 29953.0711$
 $R^2 = 0.9992$
BEC = 307.178 ppb
LoD = 36.4814 ppb

24Mg (KED AGD)



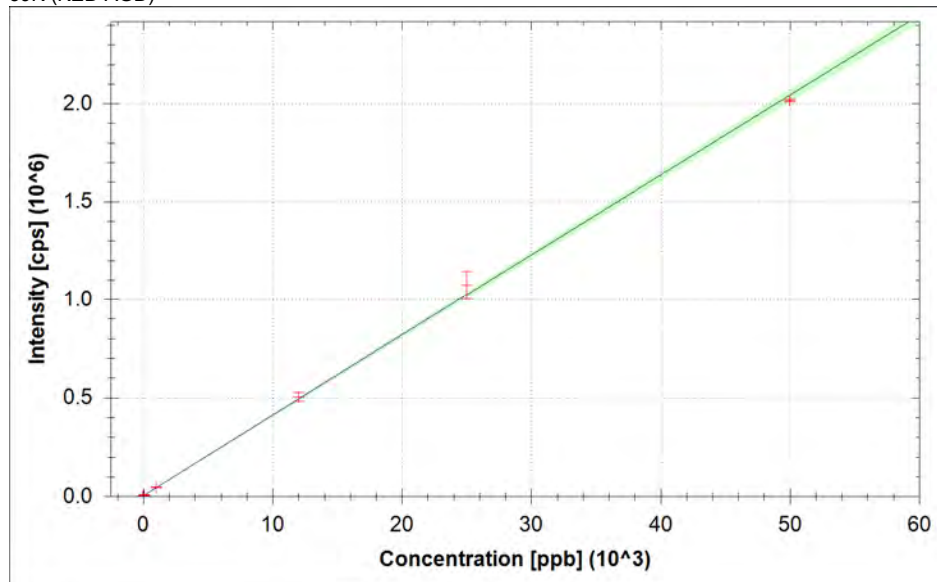
$f(x) = 53.9394 \cdot x + 70.4300$
 $R^2 = 0.9991$
BEC = 1.306 ppb
LoD = 2.2226 ppb

27Al (KED AGD)



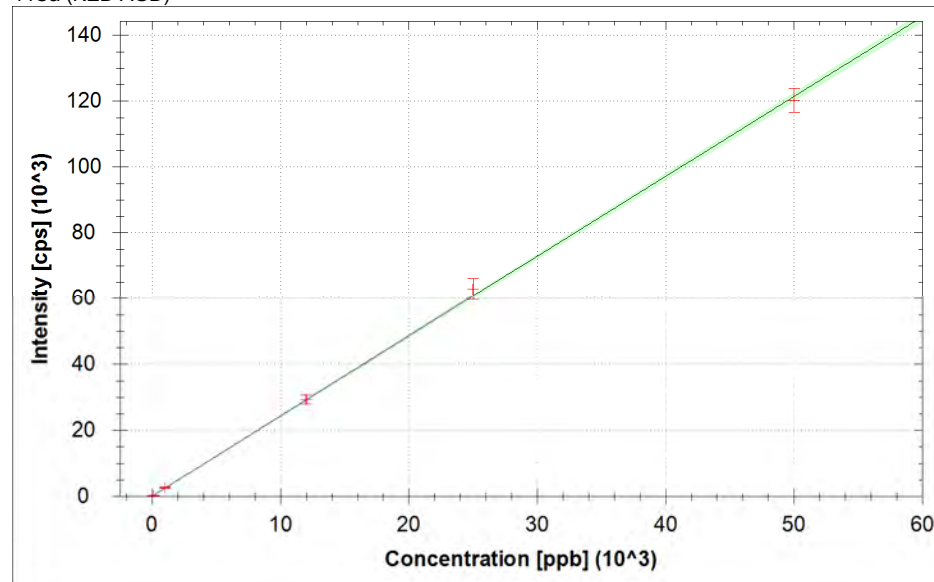
$f(x) = 30.0031 \cdot x + 54.1666$
 $R^2 = 0.9995$
BEC = 1.805 ppb
LoD = 1.2125 ppb

39K (KED AGD)



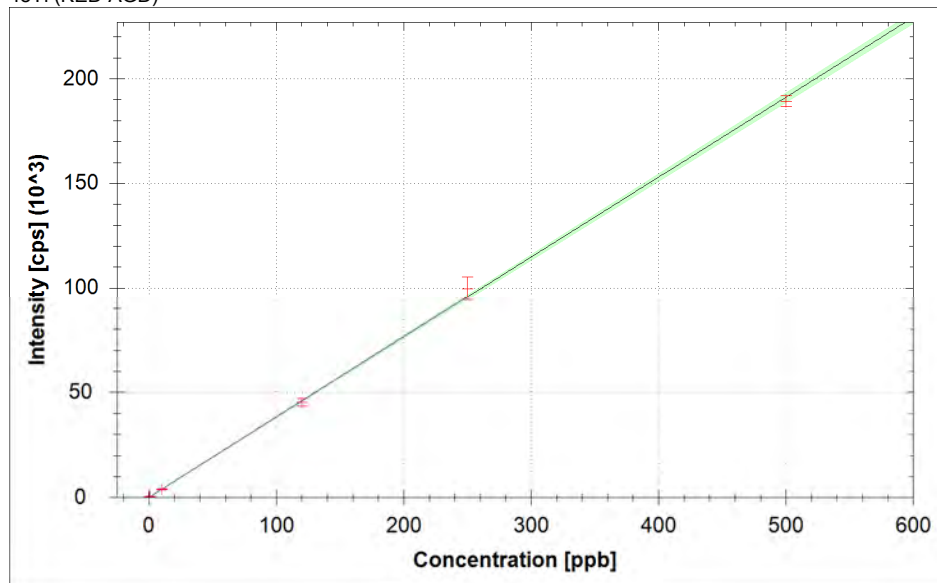
$f(x) = 40.7818 \cdot x + 3459.4115$
 $R^2 = 0.9991$
BEC = 84.827 ppb
LoD = 7.0858 ppb

44Ca (KED AGD)



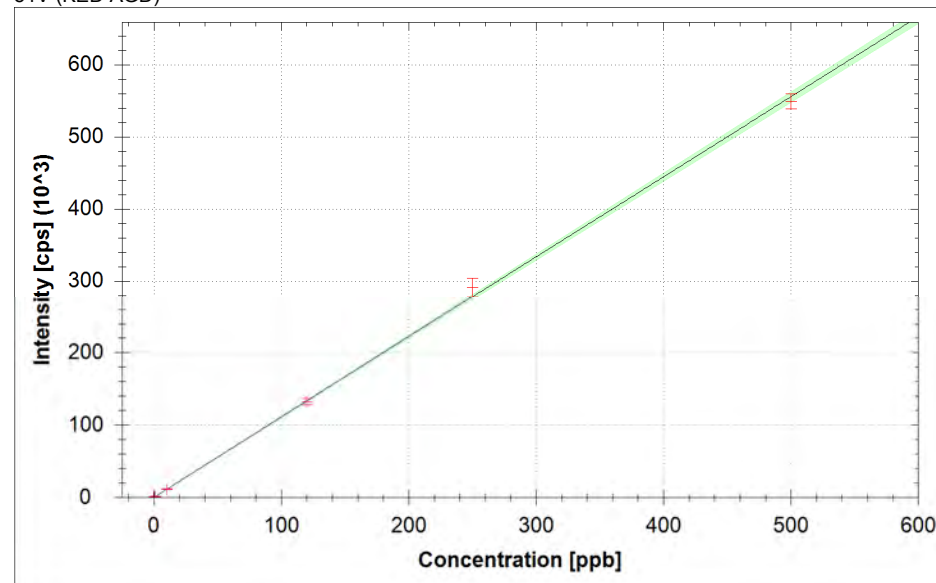
$f(x) = 2.4258 \cdot x + 35.1215$
 $R^2 = 0.9995$
BEC = 14.478 ppb
LoD = 11.3609 ppb

48Ti (KED AGD)



$f(x) = 382.0401 \cdot x + 14.9255$
 $R^2 = 0.9994$
BEC = 0.039 ppb
LoD = 0.0656 ppb

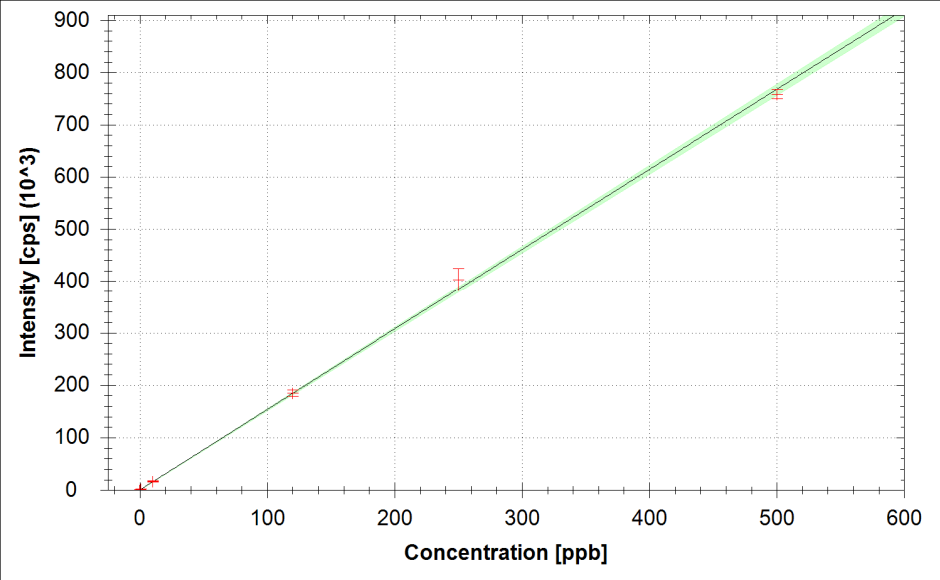
51V (KED AGD)



$f(x) = 1110.7552 \cdot x + 17.0758$
 $R^2 = 0.9992$
BEC = 0.015 ppb
LoD = 0.0431 ppb

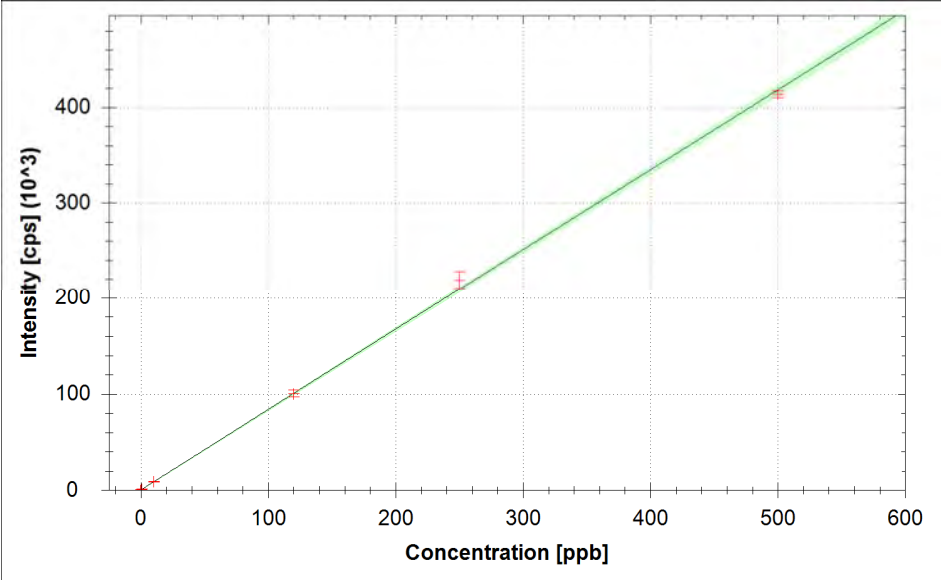


52Cr (KED AGD)



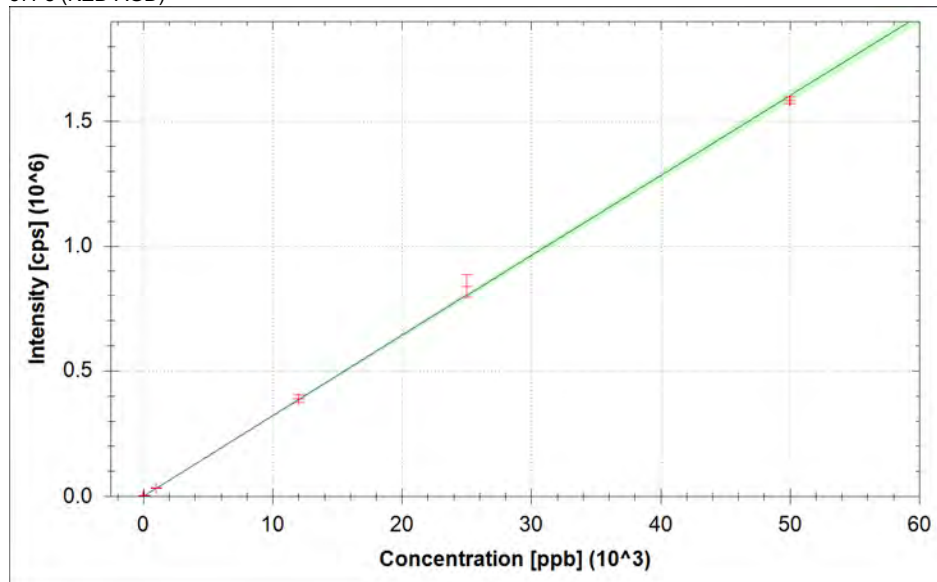
$f(x) = 1534.5268 \cdot x + 231.0427$
 $R^2 = 0.9991$
BEC = 0.151 ppb
LoD = 0.0909 ppb

55Mn (KED AGD)



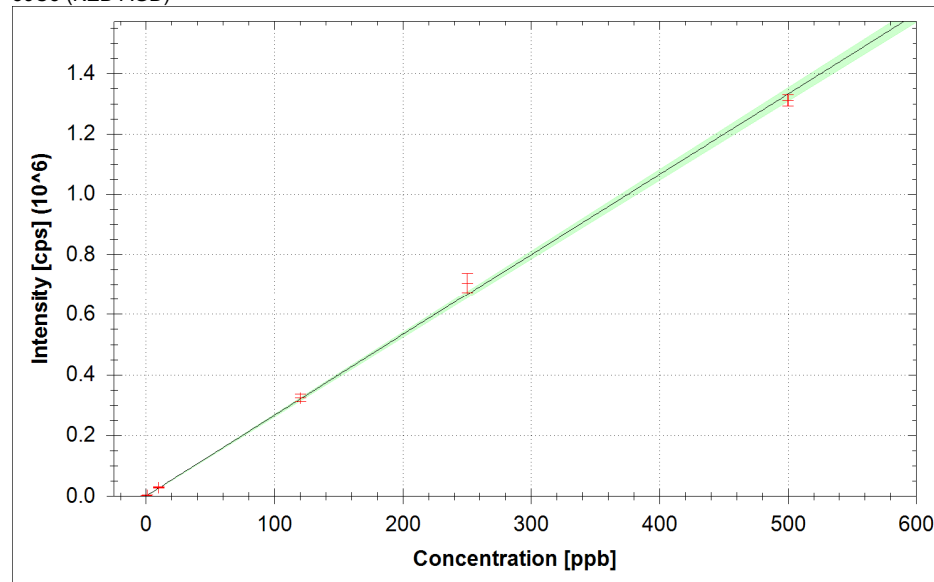
$f(x) = 836.1337 \cdot x + 117.4332$
 $R^2 = 0.9992$
BEC = 0.140 ppb
LoD = 0.1878 ppb

57Fe (KED AGD)



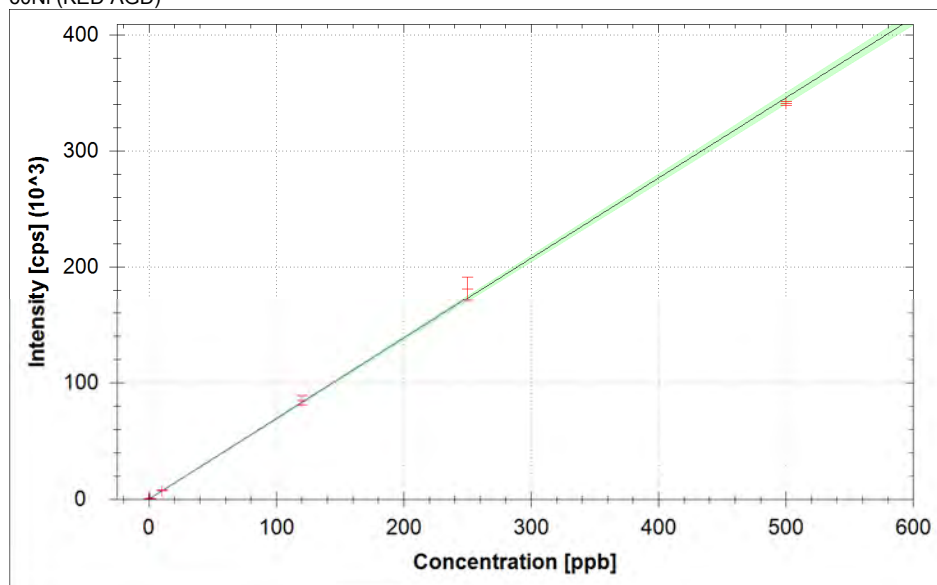
$f(x) = 32.0342 \cdot x + 40.9169$
 $R^2 = 0.9992$
BEC = 1.277 ppb
LoD = 2.7337 ppb

59Co (KED AGD)



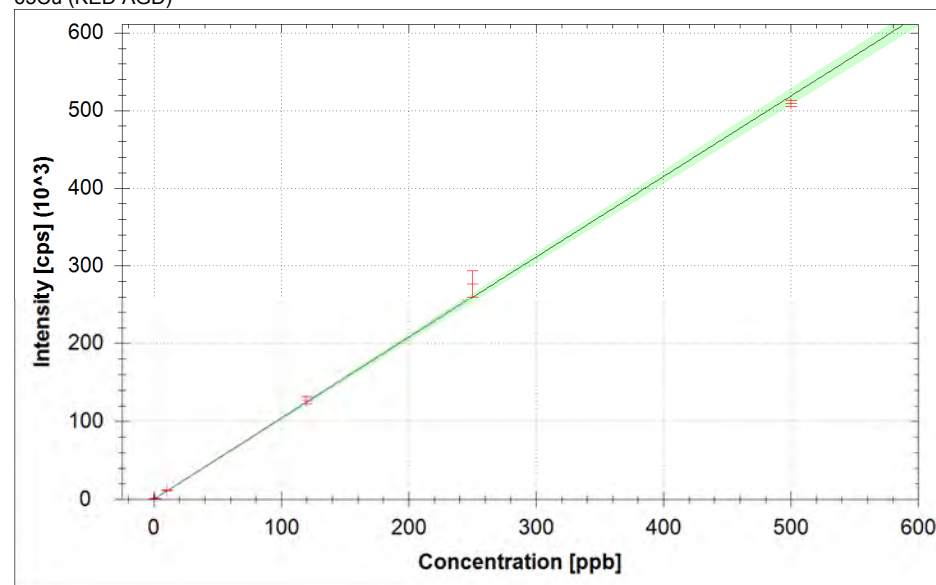
$f(x) = 2662.1062 \cdot x + 12.9996$
 $R^2 = 0.9987$
BEC = 0.005 ppb
LoD = 0.0169 ppb

60Ni (KED AGD)



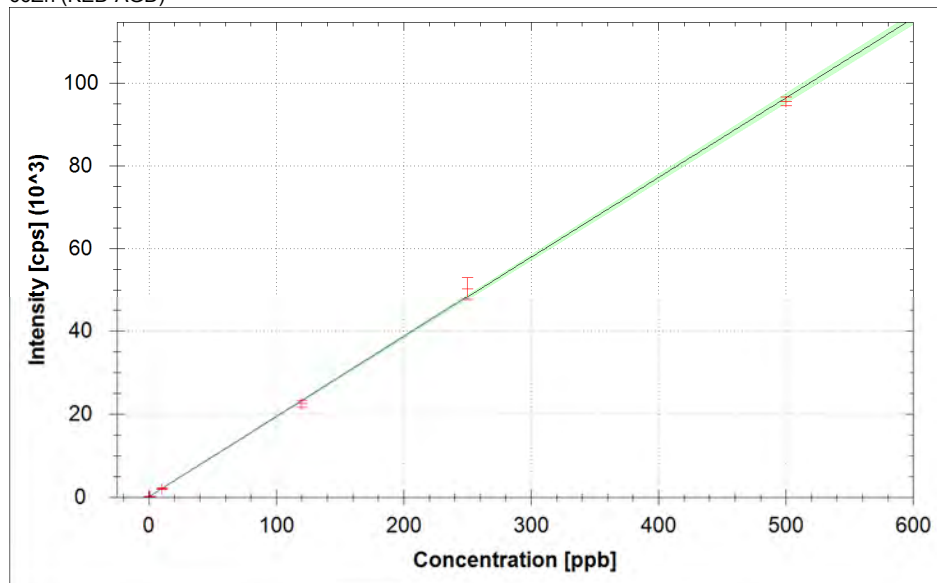
$f(x) = 691.0649 \cdot x + 83.0797$
 $R^2 = 0.9991$
BEC = 0.120 ppb
LoD = 0.0327 ppb

65Cu (KED AGD)



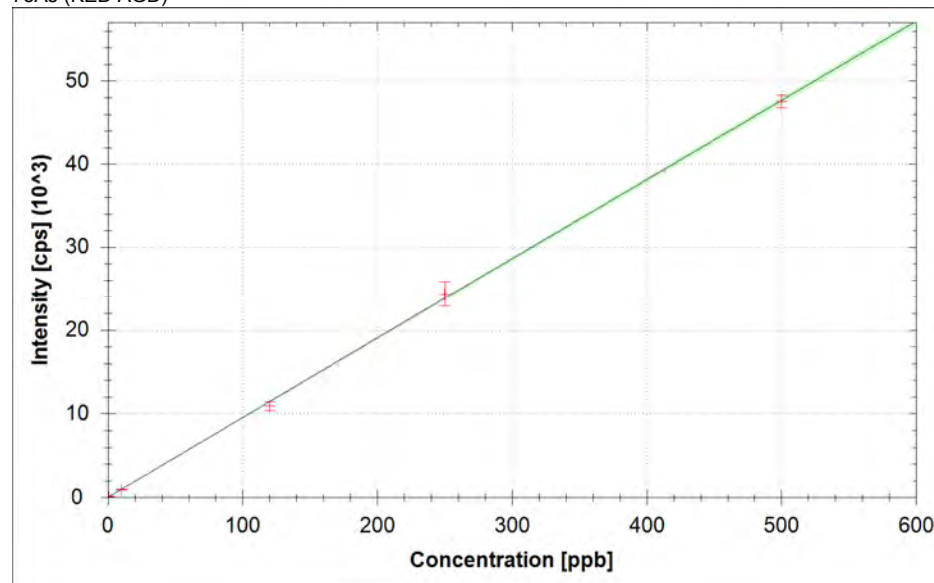
$f(x) = 1036.5842 \cdot x + 96.7007$
 $R^2 = 0.9983$
BEC = 0.093 ppb
LoD = 0.0301 ppb

66Zn (KED AGD)



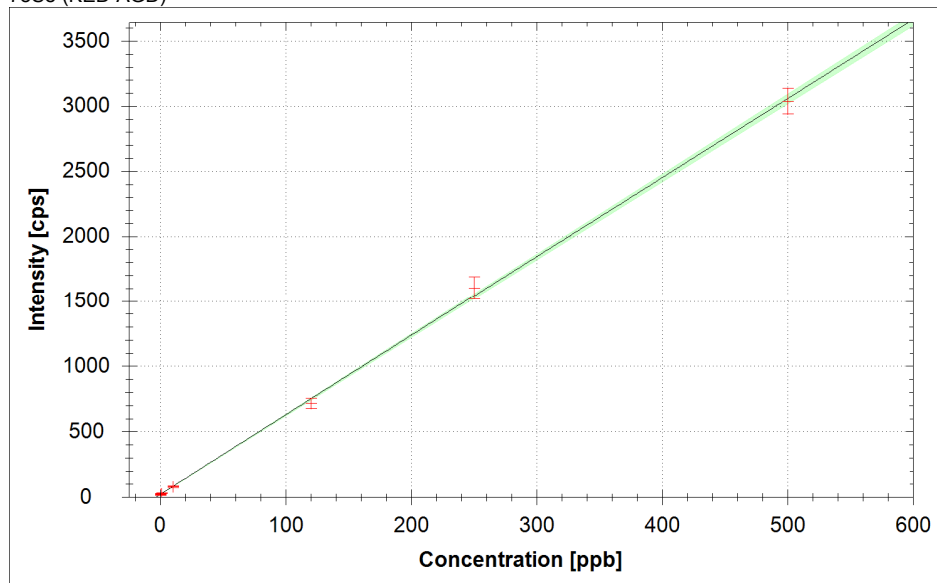
$f(x) = 192.5334 \cdot x + 157.4179$
 $R^2 = 0.9993$
BEC = 0.818 ppb
LoD = 0.3951 ppb

75As (KED AGD)



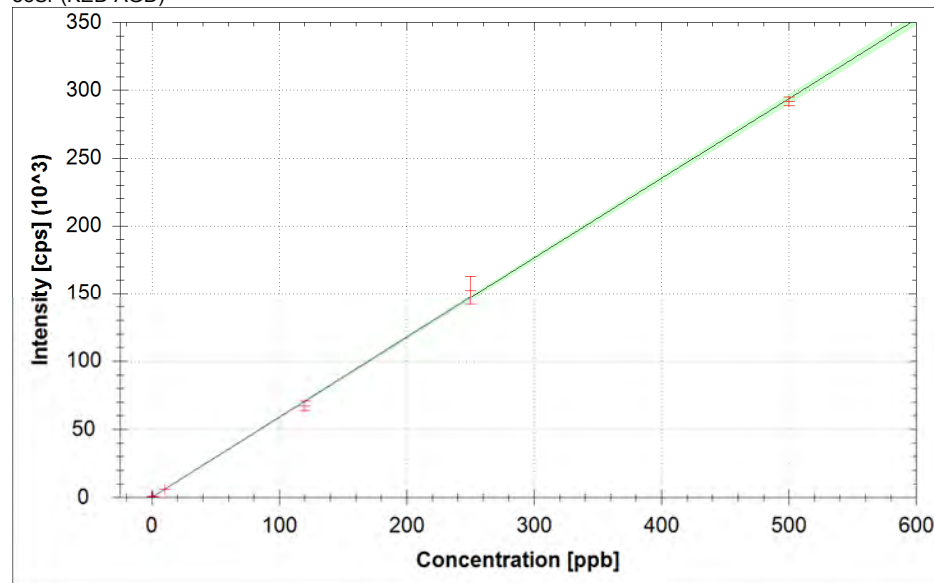
$f(x) = 95.2995 \cdot x$
 $R^2 = 0.9997$
BEC = 0.000 ppb
LoD = 0.0000 ppb

78Se (KED AGD)



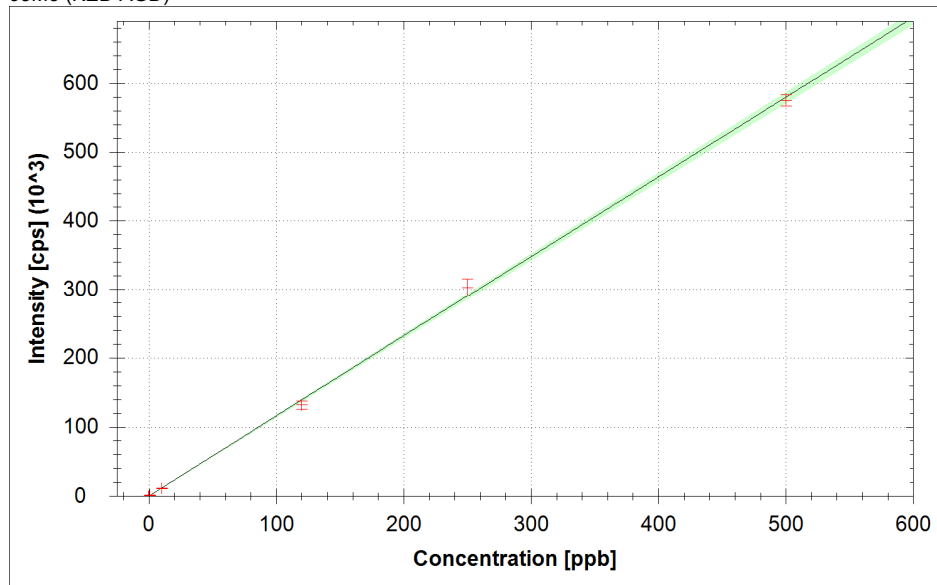
$f(x) = 6.0707 \cdot x + 22.4434$
 $R^2 = 0.9993$
BEC = 3.697 ppb
LoD = 1.5204 ppb

88Sr (KED AGD)



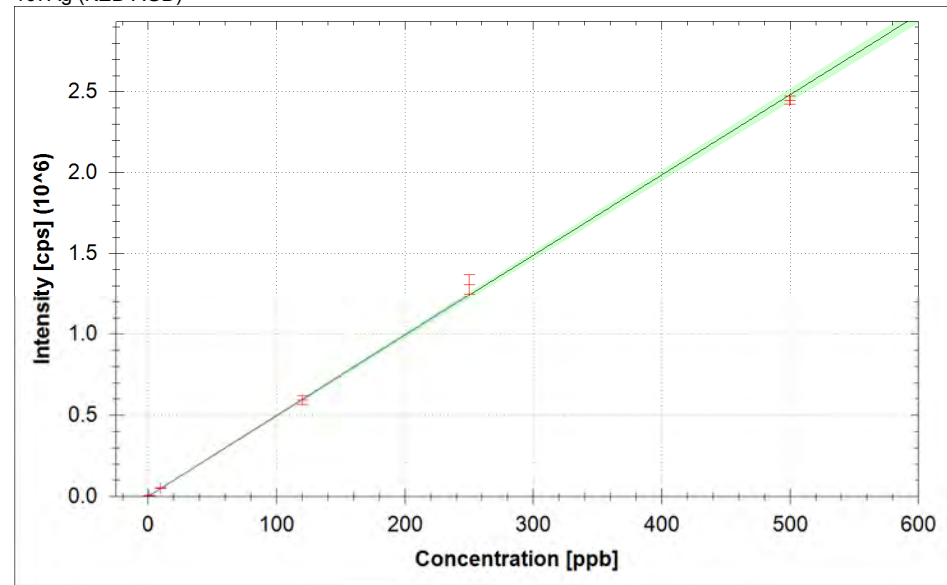
$f(x) = 586.9862 \cdot x + 67.1551$
 $R^2 = 0.9994$
BEC = 0.114 ppb
LoD = 0.0644 ppb

95Mo (KED AGD)



$f(x) = 1159.0533 \cdot x + 26.8328$
 $R^2 = 0.9992$
BEC = 0.023 ppb
LoD = 0.0171 ppb

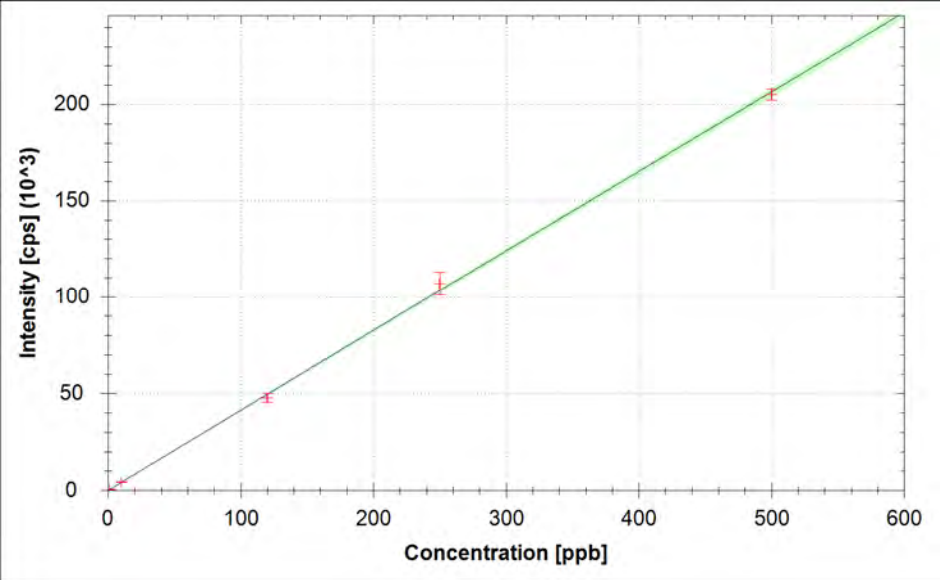
107Ag (KED AGD)



$f(x) = 4958.6203 \cdot x + 35.2216$
 $R^2 = 0.9989$
BEC = 0.007 ppb
LoD = 0.0058 ppb

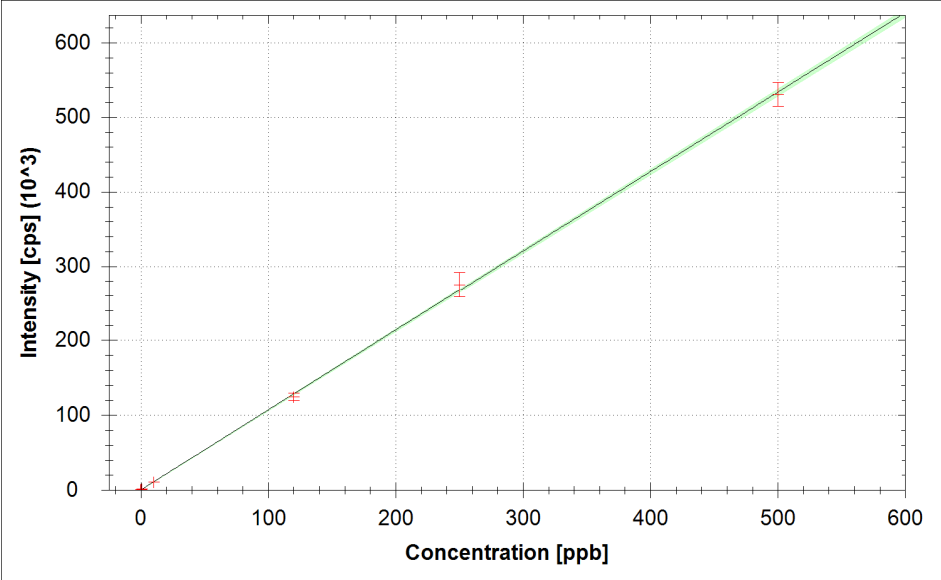


¹¹¹Cd (KED AGD)



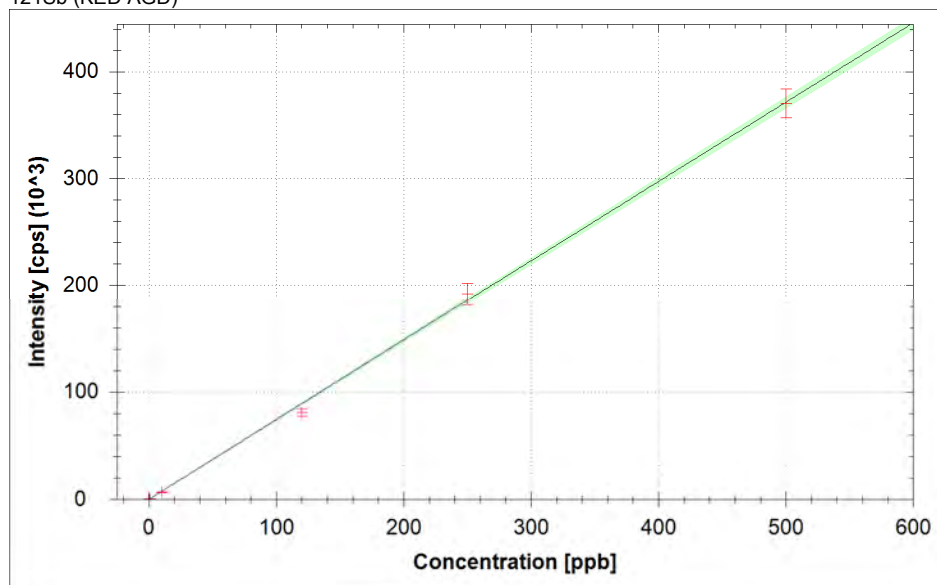
$f(x) = 412.8883 \cdot x$
 $R^2 = 0.9995$
BEC = 0.000 ppb
LoD = 0.0000 ppb

¹¹⁸Sn (KED AGD)



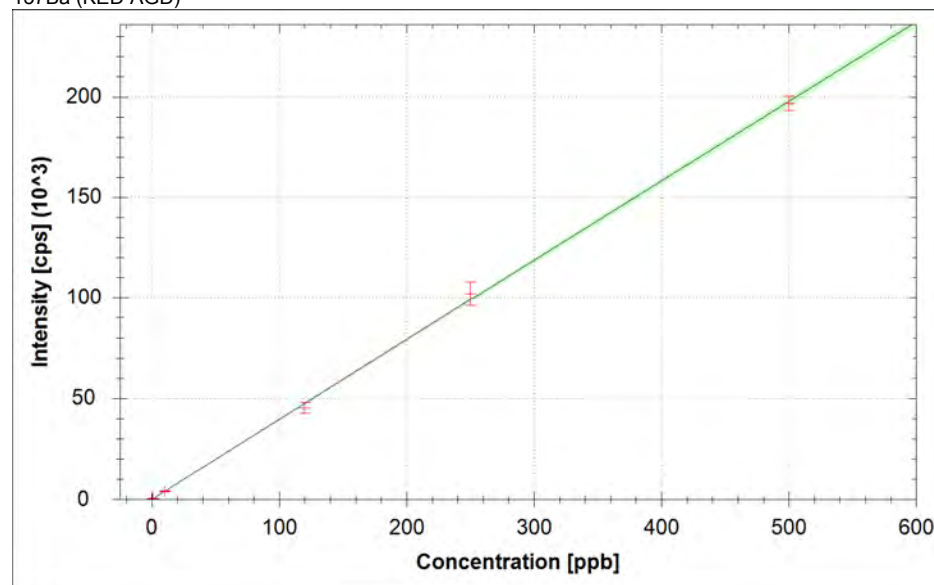
$f(x) = 1066.5386 \cdot x + 377.4165$
 $R^2 = 0.9996$
BEC = 0.354 ppb
LoD = 0.0863 ppb

121Sb (KED AGD)



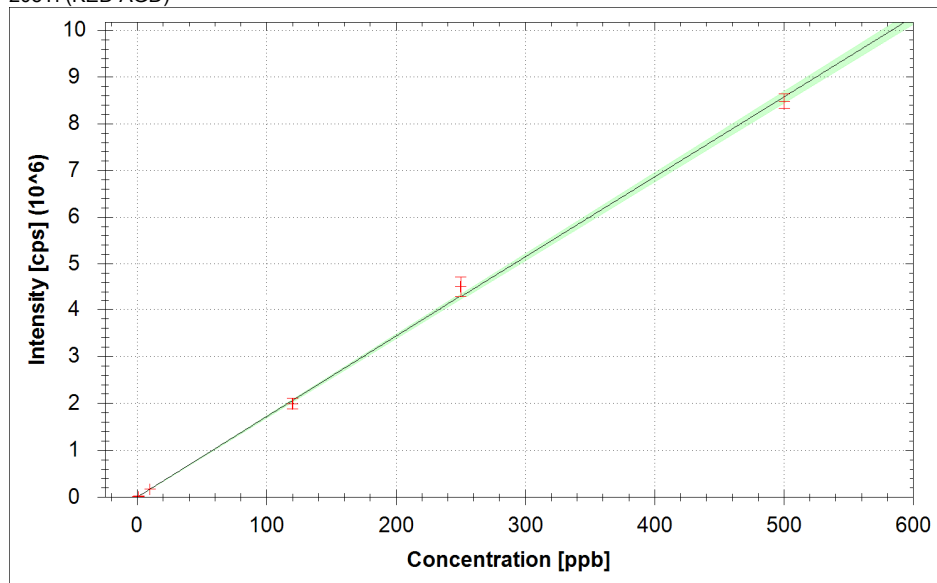
$f(x) = 742.4663 \cdot x + 24.7990$
 $R^2 = 0.9991$
BEC = 0.033 ppb
LoD = 0.0173 ppb

137Ba (KED AGD)



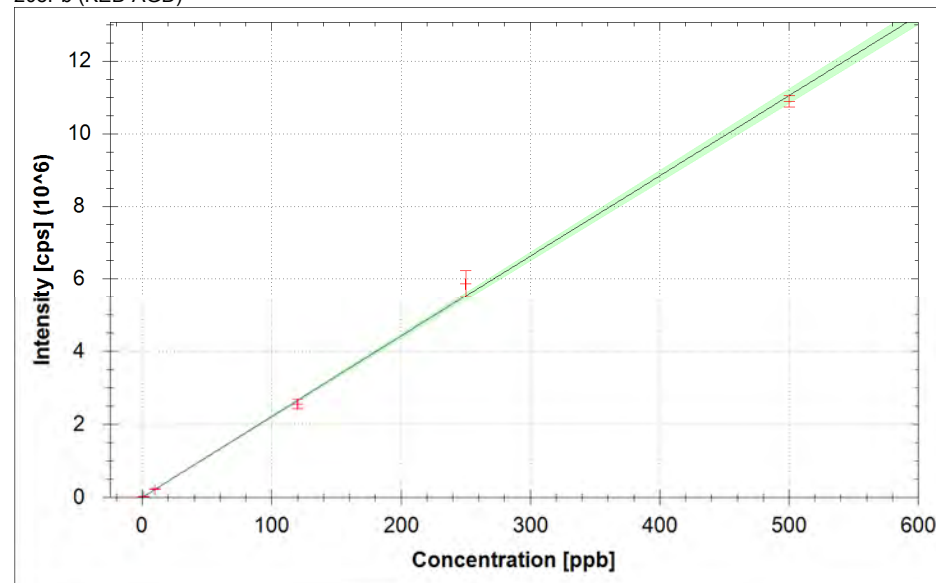
$f(x) = 395.2021 \cdot x + 25.1734$
 $R^2 = 0.9995$
BEC = 0.064 ppb
LoD = 0.0701 ppb

205Tl (KED AGD)



$f(x) = 17138.7995x + 71.0421$
 $R^2 = 0.9990$
BEC = 0.004 ppb
LoD = 0.0061 ppb

208Pb (KED AGD)



$f(x) = 22071.1531x + 374.3253$
 $R^2 = 0.9985$
BEC = 0.017 ppb
LoD = 0.0044 ppb

Standards:

Analysis Index: 4
 Analysis Name: 0.2/20 Cal
 Analysis Type: STD
 Analysis Started at: 6/9/2017 7:11:52 AM
 Standard (Stock): Calibration Standard 6020/200.8
 Standard DF: 50000
 Rack: 0
 Vial: 2

Category	Concentration average	Concentration RSD	Standard Concentration
6Li (STD AGD)	99.783 %	N/A	
6Li (KED AGD)	112.593 %	N/A	
9Be (STD AGD)	0.203 ppb	16.3 %	0.200 ppb
23Na (KED AGD)	-6.504 ppb	168.5 %	20.000 ppb
24Mg (KED AGD)	20.009 ppb	15.4 %	20.000 ppb
27Al (KED AGD)	-0.374 ppb	34.0 %	0.200 ppb
39K (KED AGD)	13.686 ppb	26.3 %	20.000 ppb
44Ca (KED AGD)	13.958 ppb	19.6 %	20.000 ppb
45Sc (KED AGD)	108.293 %	N/A	
45Sc (STD AGD)	99.119 %	N/A	
48Ti (KED AGD)	0.175 ppb	15.9 %	0.200 ppb
51V (KED AGD)	0.215 ppb	10.9 %	0.200 ppb
52Cr (KED AGD)	0.145 ppb	16.9 %	0.200 ppb
55Mn (KED AGD)	0.124 ppb	20.8 %	0.200 ppb
57Fe (KED AGD)	20.003 ppb	5.6 %	20.000 ppb
59Co (KED AGD)	0.202 ppb	13.6 %	0.200 ppb
60Ni (KED AGD)	0.315 ppb	18.0 %	0.200 ppb
65Cu (KED AGD)	0.182 ppb	19.3 %	0.200 ppb
66Zn (KED AGD)	-0.235 ppb	24.5 %	0.200 ppb
74Ge (KED AGD)	108.942 %	N/A	
75As (KED AGD)	0.168 ppb	19.9 %	0.200 ppb
78Se (KED AGD)	-0.326 ppb	287.7 %	0.200 ppb
88Sr (KED AGD)	0.203 ppb	9.2 %	0.200 ppb
95Mo (KED AGD)	0.155 ppb	24.7 %	0.200 ppb
103Rh (KED AGD)	108.549 %	N/A	
107Ag (KED AGD)	0.204 ppb	5.9 %	0.200 ppb
111Cd (KED AGD)	0.167 ppb	10.0 %	0.200 ppb
115In (KED AGD)	108.115 %	N/A	
118Sn (KED AGD)	0.006 ppb	941.4 %	0.200 ppb
121Sb (KED AGD)	0.165 ppb	22.6 %	0.200 ppb
137Ba (KED AGD)	0.268 ppb	27.3 %	0.200 ppb
159Tb (KED AGD)	107.716 %	N/A	
175Lu (KED AGD)	106.399 %	N/A	
205Tl (KED AGD)	0.192 ppb	4.0 %	0.200 ppb
208Pb (KED AGD)	0.184 ppb	4.9 %	0.200 ppb
209Bi (KED AGD)	110.840 %	N/A	

Standards:

Analysis Index: 5
 Analysis Name: 1.0/100 Cal
 Analysis Type: STD
 Analysis Started at: 6/9/2017 7:14:58 AM
 Standard (Stock): Calibration Standard 6020/200.8
 Standard DF: 10000
 Rack: 0
 Vial: 3

Category	Concentration average	Concentration RSD	Standard Concentration
6Li (STD AGD)	101.533 %	N/A	
6Li (KED AGD)	110.150 %	N/A	
9Be (STD AGD)	0.962 ppb	3.3 %	1.000 ppb
23Na (KED AGD)	75.896 ppb	8.0 %	100.000 ppb
24Mg (KED AGD)	90.134 ppb	4.5 %	100.000 ppb
27Al (KED AGD)	0.802 ppb	40.2 %	1.000 ppb
39K (KED AGD)	86.100 ppb	3.4 %	100.000 ppb
44Ca (KED AGD)	94.629 ppb	14.7 %	100.000 ppb
45Sc (KED AGD)	112.151 %	N/A	
45Sc (STD AGD)	100.928 %	N/A	
48Ti (KED AGD)	1.063 ppb	8.4 %	1.000 ppb
51V (KED AGD)	0.944 ppb	13.9 %	1.000 ppb
52Cr (KED AGD)	0.950 ppb	5.2 %	1.000 ppb
55Mn (KED AGD)	0.955 ppb	11.7 %	1.000 ppb
57Fe (KED AGD)	96.398 ppb	5.9 %	100.000 ppb
59Co (KED AGD)	1.021 ppb	4.5 %	1.000 ppb
60Ni (KED AGD)	0.933 ppb	15.9 %	1.000 ppb
65Cu (KED AGD)	0.951 ppb	15.1 %	1.000 ppb
66Zn (KED AGD)	0.716 ppb	21.1 %	1.000 ppb
74Ge (KED AGD)	110.172 %	N/A	
75As (KED AGD)	0.921 ppb	6.7 %	1.000 ppb
78Se (KED AGD)	0.911 ppb	48.0 %	1.000 ppb
88Sr (KED AGD)	0.941 ppb	7.3 %	1.000 ppb
95Mo (KED AGD)	0.932 ppb	6.1 %	1.000 ppb
103Rh (KED AGD)	110.118 %	N/A	
107Ag (KED AGD)	1.000 ppb	6.7 %	1.000 ppb
111Cd (KED AGD)	0.900 ppb	10.2 %	1.000 ppb
115In (KED AGD)	109.529 %	N/A	
118Sn (KED AGD)	0.800 ppb	7.6 %	1.000 ppb
121Sb (KED AGD)	0.796 ppb	5.5 %	1.000 ppb
137Ba (KED AGD)	0.914 ppb	12.7 %	1.000 ppb
159Tb (KED AGD)	107.268 %	N/A	
175Lu (KED AGD)	107.589 %	N/A	
205Tl (KED AGD)	0.921 ppb	2.9 %	1.000 ppb
208Pb (KED AGD)	0.941 ppb	1.7 %	1.000 ppb
209Bi (KED AGD)	110.476 %	N/A	

Standards:

Analysis Index: 6
 Analysis Name: 10/1000 Cal
 Analysis Type: STD
 Analysis Started at: 6/9/2017 7:18:05 AM
 Standard (Stock): Calibration Standard 6020/200.8
 Standard DF: 1000
 Rack: 0
 Vial: 4

Category	Concentration average	Concentration RSD	Standard Concentration
6Li (STD AGD)	102.936 %	N/A	
6Li (KED AGD)	107.506 %	N/A	
9Be (STD AGD)	9.660 ppb	1.7 %	10.000 ppb
23Na (KED AGD)	1,071.461 ppb	3.2 %	1,000.000 ppb
24Mg (KED AGD)	991.167 ppb	4.9 %	1,000.000 ppb
27Al (KED AGD)	9.307 ppb	6.6 %	10.000 ppb
39K (KED AGD)	1,039.302 ppb	5.0 %	1,000.000 ppb
44Ca (KED AGD)	1,055.245 ppb	6.5 %	1,000.000 ppb
45Sc (KED AGD)	106.008 %	N/A	
45Sc (STD AGD)	102.913 %	N/A	
48Ti (KED AGD)	9.984 ppb	9.1 %	10.000 ppb
51V (KED AGD)	10.338 ppb	6.5 %	10.000 ppb
52Cr (KED AGD)	10.657 ppb	5.4 %	10.000 ppb
55Mn (KED AGD)	10.423 ppb	2.9 %	10.000 ppb
57Fe (KED AGD)	1,042.030 ppb	3.6 %	1,000.000 ppb
59Co (KED AGD)	10.561 ppb	5.5 %	10.000 ppb
60Ni (KED AGD)	10.938 ppb	3.8 %	10.000 ppb
65Cu (KED AGD)	10.993 ppb	2.0 %	10.000 ppb
66Zn (KED AGD)	9.883 ppb	7.3 %	10.000 ppb
74Ge (KED AGD)	105.085 %	N/A	
75As (KED AGD)	9.498 ppb	5.7 %	10.000 ppb
78Se (KED AGD)	9.437 ppb	13.4 %	10.000 ppb
88Sr (KED AGD)	9.934 ppb	3.4 %	10.000 ppb
95Mo (KED AGD)	9.647 ppb	5.2 %	10.000 ppb
103Rh (KED AGD)	105.101 %	N/A	
107Ag (KED AGD)	10.486 ppb	3.0 %	10.000 ppb
111Cd (KED AGD)	10.053 ppb	4.3 %	10.000 ppb
115In (KED AGD)	103.997 %	N/A	
118Sn (KED AGD)	9.856 ppb	1.7 %	10.000 ppb
121Sb (KED AGD)	8.967 ppb	3.8 %	10.000 ppb
137Ba (KED AGD)	9.820 ppb	7.4 %	10.000 ppb
159Tb (KED AGD)	103.049 %	N/A	
175Lu (KED AGD)	102.946 %	N/A	
205Tl (KED AGD)	10.080 ppb	2.2 %	10.000 ppb
208Pb (KED AGD)	10.129 ppb	4.8 %	10.000 ppb
209Bi (KED AGD)	105.321 %	N/A	

Standards:

Analysis Index: 7
 Analysis Name: 120/12000
 Analysis Type: STD
 Analysis Started at: 6/9/2017 7:21:12 AM
 Standard (Stock): Calibration Standard 6020/200.8
 Standard DF: 83.3333333
 Rack: 0
 Vial: 5

Category	Concentration average	Concentration RSD	Standard Concentration
6Li (STD AGD)	97.821 %	N/A	
6Li (KED AGD)	107.809 %	N/A	
9Be (STD AGD)	120.788 ppb	1.0 %	120.000 ppb
23Na (KED AGD)	12,453.439 ppb	3.4 %	12,000.000 ppb
24Mg (KED AGD)	11,390.817 ppb	4.2 %	12,000.000 ppb
27Al (KED AGD)	119.336 ppb	3.9 %	120.000 ppb
39K (KED AGD)	12,286.499 ppb	4.5 %	12,000.000 ppb
44Ca (KED AGD)	12,064.331 ppb	4.4 %	12,000.000 ppb
45Sc (KED AGD)	106.415 %	N/A	
45Sc (STD AGD)	98.184 %	N/A	
48Ti (KED AGD)	118.480 ppb	3.9 %	120.000 ppb
51V (KED AGD)	118.914 ppb	3.6 %	120.000 ppb
52Cr (KED AGD)	120.047 ppb	3.2 %	120.000 ppb
55Mn (KED AGD)	119.897 ppb	3.9 %	120.000 ppb
57Fe (KED AGD)	12,112.137 ppb	3.9 %	12,000.000 ppb
59Co (KED AGD)	121.560 ppb	3.6 %	120.000 ppb
60Ni (KED AGD)	122.808 ppb	4.8 %	120.000 ppb
65Cu (KED AGD)	122.188 ppb	3.6 %	120.000 ppb
66Zn (KED AGD)	115.855 ppb	4.0 %	120.000 ppb
74Ge (KED AGD)	105.650 %	N/A	
75As (KED AGD)	114.386 ppb	5.0 %	120.000 ppb
78Se (KED AGD)	113.935 ppb	5.5 %	120.000 ppb
88Sr (KED AGD)	114.218 ppb	4.9 %	120.000 ppb
95Mo (KED AGD)	113.635 ppb	4.4 %	120.000 ppb
103Rh (KED AGD)	104.560 %	N/A	
107Ag (KED AGD)	119.335 ppb	4.7 %	120.000 ppb
111Cd (KED AGD)	115.567 ppb	4.8 %	120.000 ppb
115In (KED AGD)	104.787 %	N/A	
118Sn (KED AGD)	115.961 ppb	4.1 %	120.000 ppb
121Sb (KED AGD)	108.988 ppb	4.4 %	120.000 ppb
137Ba (KED AGD)	114.144 ppb	5.9 %	120.000 ppb
159Tb (KED AGD)	106.019 %	N/A	
175Lu (KED AGD)	104.284 %	N/A	
205Tl (KED AGD)	116.061 ppb	5.8 %	120.000 ppb
208Pb (KED AGD)	115.819 ppb	5.1 %	120.000 ppb
209Bi (KED AGD)	106.052 %	N/A	

Standards:

Analysis Index: 8
 Analysis Name: 250/25000
 Analysis Type: STD
 Analysis Started at: 6/9/2017 7:24:18 AM
 Standard (Stock): Calibration Standard 6020/200.8
 Standard DF: 40
 Rack: 0
 Vial: 6

Category	Concentration average	Concentration RSD	Standard Concentration
6Li (STD AGD)	97.917 %	N/A	
6Li (KED AGD)	100.706 %	N/A	
9Be (STD AGD)	246.940 ppb	1.0 %	250.000 ppb
23Na (KED AGD)	26,068.130 ppb	5.1 %	25,000.000 ppb
24Mg (KED AGD)	25,292.801 ppb	4.9 %	25,000.000 ppb
27Al (KED AGD)	259.586 ppb	6.2 %	250.000 ppb
39K (KED AGD)	26,195.820 ppb	6.7 %	25,000.000 ppb
44Ca (KED AGD)	25,886.984 ppb	5.1 %	25,000.000 ppb
45Sc (KED AGD)	102.945 %	N/A	
45Sc (STD AGD)	96.760 %	N/A	
48Ti (KED AGD)	260.584 ppb	5.6 %	250.000 ppb
51V (KED AGD)	261.615 ppb	4.6 %	250.000 ppb
52Cr (KED AGD)	262.218 ppb	5.3 %	250.000 ppb
55Mn (KED AGD)	261.568 ppb	4.0 %	250.000 ppb
57Fe (KED AGD)	26,156.618 ppb	5.6 %	25,000.000 ppb
59Co (KED AGD)	264.451 ppb	4.6 %	250.000 ppb
60Ni (KED AGD)	261.909 ppb	5.7 %	250.000 ppb
65Cu (KED AGD)	266.697 ppb	6.1 %	250.000 ppb
66Zn (KED AGD)	260.432 ppb	5.5 %	250.000 ppb
74Ge (KED AGD)	100.062 %	N/A	
75As (KED AGD)	255.410 ppb	6.1 %	250.000 ppb
78Se (KED AGD)	259.879 ppb	5.4 %	250.000 ppb
88Sr (KED AGD)	259.011 ppb	6.9 %	250.000 ppb
95Mo (KED AGD)	260.699 ppb	4.2 %	250.000 ppb
103Rh (KED AGD)	96.902 %	N/A	
107Ag (KED AGD)	263.601 ppb	4.6 %	250.000 ppb
111Cd (KED AGD)	258.636 ppb	5.5 %	250.000 ppb
115In (KED AGD)	99.819 %	N/A	
118Sn (KED AGD)	257.282 ppb	6.1 %	250.000 ppb
121Sb (KED AGD)	257.901 ppb	5.4 %	250.000 ppb
137Ba (KED AGD)	257.789 ppb	5.9 %	250.000 ppb
159Tb (KED AGD)	100.298 %	N/A	
175Lu (KED AGD)	98.975 %	N/A	
205Tl (KED AGD)	262.788 ppb	4.6 %	250.000 ppb
208Pb (KED AGD)	265.730 ppb	6.1 %	250.000 ppb
209Bi (KED AGD)	99.573 %	N/A	

Standards:

Analysis Index: 9
 Analysis Name: 500/50000
 Analysis Type: STD
 Analysis Started at: 6/9/2017 7:27:26 AM
 Standard (Stock): Calibration Standard 6020/200.8
 Standard DF: 20
 Rack: 0
 Vial: 7

Category	Concentration average	Concentration RSD	Standard Concentration
6Li (STD AGD)	93.817 %	N/A	
6Li (KED AGD)	101.602 %	N/A	
9Be (STD AGD)	501.348 ppb	0.3 %	500.000 ppb
23Na (KED AGD)	49,393.218 ppb	1.9 %	50,000.000 ppb
24Mg (KED AGD)	42,691.023 ppb	2.3 %	50,000.000 ppb
27Al (KED AGD)	495.381 ppb	1.3 %	500.000 ppb
39K (KED AGD)	49,332.575 ppb	0.4 %	50,000.000 ppb
44Ca (KED AGD)	49,539.977 ppb	3.0 %	50,000.000 ppb
45Sc (KED AGD)	106.715 %	N/A	
45Sc (STD AGD)	93.896 %	N/A	
48Ti (KED AGD)	495.073 ppb	1.4 %	500.000 ppb
51V (KED AGD)	494.447 ppb	1.9 %	500.000 ppb
52Cr (KED AGD)	493.867 ppb	1.2 %	500.000 ppb
55Mn (KED AGD)	494.232 ppb	0.9 %	500.000 ppb
57Fe (KED AGD)	49,393.944 ppb	0.9 %	50,000.000 ppb
59Co (KED AGD)	492.389 ppb	1.4 %	500.000 ppb
60Ni (KED AGD)	493.353 ppb	0.5 %	500.000 ppb
65Cu (KED AGD)	491.107 ppb	0.8 %	500.000 ppb
66Zn (KED AGD)	495.782 ppb	1.1 %	500.000 ppb
74Ge (KED AGD)	102.659 %	N/A	
75As (KED AGD)	498.652 ppb	1.6 %	500.000 ppb
78Se (KED AGD)	496.528 ppb	3.3 %	500.000 ppb
88Sr (KED AGD)	496.884 ppb	1.2 %	500.000 ppb
95Mo (KED AGD)	496.185 ppb	1.4 %	500.000 ppb
103Rh (KED AGD)	96.767 %	N/A	
107Ag (KED AGD)	493.350 ppb	1.0 %	500.000 ppb
111Cd (KED AGD)	496.745 ppb	1.4 %	500.000 ppb
115In (KED AGD)	101.652 %	N/A	
118Sn (KED AGD)	497.332 ppb	3.0 %	500.000 ppb
121Sb (KED AGD)	498.713 ppb	3.7 %	500.000 ppb
137Ba (KED AGD)	497.515 ppb	1.8 %	500.000 ppb
159Tb (KED AGD)	101.219 %	N/A	
175Lu (KED AGD)	99.709 %	N/A	
205Tl (KED AGD)	494.550 ppb	1.8 %	500.000 ppb
208Pb (KED AGD)	493.136 ppb	1.4 %	500.000 ppb
209Bi (KED AGD)	102.143 %	N/A	

Alpha ICPMSQ2 Full

6/10/2017 10:11:47 AM



Analysis index:	1	Analysis started at:	6/9/2017 7:02:33 AM	Rack:	0
Analysis label:	rinse	User name:	ALPHALAB\metals-instrument	Vial:	1

Alpha ICPMSQ2 Full

6/10/2017 10:11:47 AM



Analysis index:	2	Analysis started at:	6/9/2017 7:05:37 AM	Rack:	0
Analysis label:	rinse	User name:	ALPHALAB\metals-instrument	Vial:	1

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 3 Analysis started at: 6/9/2017 7:08:43 AM Rack: 0
 Analysis label: Blank BV ICPMSQ2 User name: ALPHALAB\metals-instrument Vial: 10

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	100.000 %	100.000 %	0.000 ppb	0.000 ppb	0.000 ppb	0.000 ppb	0.000 ppb	0.000 ppb	100.000 %
Concentration per Run	100.000 %	100.000 %	0.000 ppb	0.000 ppb	0.000 ppb	0.000 ppb	0.000 ppb	0.000 ppb	100.000 %
Concentration RSD	N/A	N/A	0.3 %	0.0 %	0.6 %	0.2 %	0.0 %	0.3 %	N/A

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	100.000 %	0.000 ppb	0.000 ppb	0.000 ppb	0.000 ppb	0.000 ppb	0.000 ppb	0.000 ppb	0.000 ppb
Concentration per Run	100.000 %	0.000 ppb	0.000 ppb	0.000 ppb	0.000 ppb	0.000 ppb	0.000 ppb	0.000 ppb	0.000 ppb
Concentration RSD	N/A	0.6 %	0.9 %	0.2 %	0.4 %	0.7 %	1.2 %	0.1 %	0.1 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	0.000 ppb	100.000 %	0.000 ppb	0.000 ppb	0.000 ppb	0.000 ppb	100.000 %	0.000 ppb	0.000 ppb
Concentration per Run	0.000 ppb	100.000 %	0.000 ppb	0.000 ppb	0.000 ppb	0.000 ppb	100.000 %	0.000 ppb	0.000 ppb
Concentration RSD	0.2 %	N/A		0.1 %	0.2 %	0.2 %	N/A	0.3 %	

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	100.000 %	0.000 ppb	0.000 ppb	0.000 ppb	100.000 %	100.000 %	0.000 ppb	0.000 ppb	100.000 %
Concentration per Run	100.000 %	0.000 ppb	0.000 ppb	0.000 ppb	100.000 %	100.000 %	0.000 ppb	0.000 ppb	100.000 %
Concentration RSD	N/A	0.1 %	0.2 %	0.4 %	N/A	N/A	0.5 %	0.1 %	N/A

Alpha ICPMSQ2 Full

6/10/2017 10:11:47 AM



Analysis index: 4 Analysis started at: 6/9/2017 7:11:52 AM Rack: 0
 Analysis label: 0.2/20 Cal User name: ALPHALAB\metals-instrument Vial: 2

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	99.783 %	112.593 %	0.203 ppb	-6.504 ppb	20.009 ppb	-0.374 ppb	13.686 ppb	13.958 ppb	108.293 %
Concentration per Run 1	100.672 %	115.674 %	0.182 ppb	-15.415 ppb	20.540 ppb	-0.264 ppb	17.227 ppb	11.329 ppb	109.613 %
Concentration per Run 2	99.328 %	119.236 %	0.241 ppb	-9.827 ppb	16.704 ppb	-0.513 ppb	10.039 ppb	13.746 ppb	108.475 %
Concentration per Run 3	99.349 %	102.868 %	0.185 ppb	5.732 ppb	22.782 ppb	-0.345 ppb	13.793 ppb	16.798 ppb	106.790 %
Concentration RSD	N/A	N/A	16.3 %	168.5 %	15.4 %	34.0 %	26.3 %	19.6 %	N/A

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	99.119 %	0.175 ppb	0.215 ppb	0.145 ppb	0.124 ppb	20.003 ppb	0.202 ppb	0.315 ppb	0.182 ppb
Concentration per Run 1	98.854 %	0.164 ppb	0.215 ppb	0.121 ppb	0.133 ppb	18.754 ppb	0.171 ppb	0.278 ppb	0.208 ppb
Concentration per Run 2	99.409 %	0.153 ppb	0.191 ppb	0.145 ppb	0.143 ppb	20.905 ppb	0.210 ppb	0.287 ppb	0.142 ppb
Concentration per Run 3	99.093 %	0.206 ppb	0.238 ppb	0.170 ppb	0.095 ppb	20.349 ppb	0.224 ppb	0.381 ppb	0.196 ppb
Concentration RSD	N/A	15.9 %	10.9 %	16.9 %	20.8 %	5.6 %	13.6 %	18.0 %	19.3 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	-0.235 ppb	108.942 %	0.168 ppb	-0.326 ppb	0.203 ppb	0.155 ppb	108.549 %	0.204 ppb	0.167 ppb
Concentration per Run 1	-0.177 ppb	108.353 %	0.133 ppb	0.402 ppb	0.202 ppb	0.151 ppb	109.412 %	0.207 ppb	0.186 ppb
Concentration per Run 2	-0.236 ppb	111.607 %	0.200 ppb	0.005 ppb	0.222 ppb	0.118 ppb	109.053 %	0.191 ppb	0.156 ppb
Concentration per Run 3	-0.293 ppb	106.865 %	0.172 ppb	-1.386 ppb	0.185 ppb	0.194 ppb	107.184 %	0.215 ppb	0.159 ppb
Concentration RSD	24.5 %	N/A	19.9 %	287.7 %	9.2 %	24.7 %	N/A	5.9 %	10.0 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	108.115 %	0.006 ppb	0.165 ppb	0.268 ppb	107.716 %	106.399 %	0.192 ppb	0.184 ppb	110.840 %
Concentration per Run 1	109.245 %	0.067 ppb	0.124 ppb	0.295 ppb	109.484 %	107.460 %	0.191 ppb	0.181 ppb	108.906 %
Concentration per Run 2	108.703 %	-0.043 ppb	0.198 ppb	0.324 ppb	106.690 %	106.604 %	0.184 ppb	0.176 ppb	114.768 %
Concentration per Run 3	106.398 %	-0.006 ppb	0.172 ppb	0.185 ppb	106.973 %	105.133 %	0.199 ppb	0.194 ppb	108.847 %
Concentration RSD	N/A	941.4 %	22.6 %	27.3 %	N/A	N/A	4.0 %	4.9 %	N/A

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 5 Analysis started at: 6/9/2017 7:14:58 AM Rack: 0
 Analysis label: 1.0/100 Cal User name: ALPHALAB\metals-instrument Vial: 3

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	101.533 %	110.150 %	0.962 ppb	75.896 ppb	90.134 ppb	0.802 ppb	86.100 ppb	94.629 ppb	112.151 %
Concentration per Run 1	102.260 %	112.313 %	0.940 ppb	71.353 ppb	94.169 ppb	1.028 ppb	82.968 ppb	89.287 ppb	113.468 %
Concentration per Run 2	100.785 %	109.960 %	0.998 ppb	73.552 ppb	90.208 ppb	0.433 ppb	88.656 ppb	84.199 ppb	113.183 %
Concentration per Run 3	101.554 %	108.178 %	0.948 ppb	82.784 ppb	86.024 ppb	0.945 ppb	86.676 ppb	110.401 ppb	109.803 %
Concentration RSD	N/A	N/A	3.3 %	8.0 %	4.5 %	40.2 %	3.4 %	14.7 %	N/A

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	100.928 %	1.063 ppb	0.944 ppb	0.950 ppb	0.955 ppb	96.398 ppb	1.021 ppb	0.933 ppb	0.951 ppb
Concentration per Run 1	101.406 %	1.082 ppb	1.045 ppb	0.929 ppb	0.847 ppb	95.647 ppb	0.993 ppb	0.886 ppb	1.116 ppb
Concentration per Run 2	100.033 %	1.140 ppb	0.796 ppb	1.007 ppb	0.948 ppb	91.112 ppb	1.074 ppb	0.813 ppb	0.853 ppb
Concentration per Run 3	101.346 %	0.965 ppb	0.992 ppb	0.914 ppb	1.071 ppb	102.436 ppb	0.996 ppb	1.099 ppb	0.886 ppb
Concentration RSD	N/A	8.4 %	13.9 %	5.2 %	11.7 %	5.9 %	4.5 %	15.9 %	15.1 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	0.716 ppb	110.172 %	0.921 ppb	0.911 ppb	0.941 ppb	0.932 ppb	110.118 %	1.000 ppb	0.900 ppb
Concentration per Run 1	0.839 ppb	110.933 %	0.981 ppb	0.460 ppb	0.874 ppb	0.995 ppb	111.092 %	0.968 ppb	0.812 ppb
Concentration per Run 2	0.760 ppb	113.239 %	0.858 ppb	1.334 ppb	0.939 ppb	0.919 ppb	111.187 %	0.955 ppb	0.894 ppb
Concentration per Run 3	0.547 ppb	106.343 %	0.925 ppb	0.940 ppb	1.011 ppb	0.883 ppb	108.077 %	1.077 ppb	0.995 ppb
Concentration RSD	21.1 %	N/A	6.7 %	48.0 %	7.3 %	6.1 %	N/A	6.7 %	10.2 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	109.529 %	0.800 ppb	0.796 ppb	0.914 ppb	107.268 %	107.589 %	0.921 ppb	0.941 ppb	110.476 %
Concentration per Run 1	110.891 %	0.781 ppb	0.747 ppb	0.779 ppb	108.194 %	108.260 %	0.951 ppb	0.945 ppb	108.924 %
Concentration per Run 2	111.017 %	0.751 ppb	0.827 ppb	0.978 ppb	107.627 %	109.059 %	0.914 ppb	0.923 ppb	112.186 %
Concentration per Run 3	106.680 %	0.868 ppb	0.816 ppb	0.983 ppb	105.984 %	105.448 %	0.898 ppb	0.954 ppb	110.317 %
Concentration RSD	N/A	7.6 %	5.5 %	12.7 %	N/A	N/A	2.9 %	1.7 %	N/A

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 6 Analysis started at: 6/9/2017 7:18:05 AM Rack: 0
 Analysis label: 10/1000 Cal User name: ALPHALAB\metals-instrument Vial: 4

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	102.936 %	107.506 %	9.660 ppb	1,071.461 ppb	991.167 ppb	9.307 ppb	1,039.302 ppb	1,055.245 ppb	106.008 %
Concentration per Run 1	102.389 %	105.792 %	9.823 ppb	1,051.913 ppb	945.489 ppb	8.594 ppb	1,002.171 ppb	1,045.329 ppb	102.771 %
Concentration per Run 2	103.288 %	108.212 %	9.497 ppb	1,111.281 ppb	1,042.204 ppb	9.628 ppb	1,099.341 ppb	1,128.744 ppb	106.470 %
Concentration per Run 3	103.131 %	108.515 %	9.661 ppb	1,051.189 ppb	985.809 ppb	9.698 ppb	1,016.395 ppb	991.660 ppb	108.783 %
Concentration RSD	N/A	N/A	1.7 %	3.2 %	4.9 %	6.6 %	5.0 %	6.5 %	N/A

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	102.913 %	9.984 ppb	10.338 ppb	10.657 ppb	10.423 ppb	1,042.030 ppb	10.561 ppb	10.938 ppb	10.993 ppb
Concentration per Run 1	103.244 %	9.757 ppb	9.699 ppb	10.587 ppb	10.087 ppb	1,012.640 ppb	10.144 ppb	10.876 ppb	10.852 ppb
Concentration per Run 2	101.696 %	10.986 ppb	11.034 ppb	11.263 ppb	10.502 ppb	1,084.400 ppb	11.224 ppb	11.384 ppb	11.248 ppb
Concentration per Run 3	103.798 %	9.208 ppb	10.281 ppb	10.120 ppb	10.681 ppb	1,029.048 ppb	10.315 ppb	10.556 ppb	10.880 ppb
Concentration RSD	N/A	9.1 %	6.5 %	5.4 %	2.9 %	3.6 %	5.5 %	3.8 %	2.0 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	9.883 ppb	105.085 %	9.498 ppb	9.437 ppb	9.934 ppb	9.647 ppb	105.101 %	10.486 ppb	10.053 ppb
Concentration per Run 1	9.253 ppb	102.590 %	9.651 ppb	10.100 ppb	9.689 ppb	10.011 ppb	103.242 %	10.247 ppb	9.650 ppb
Concentration per Run 2	10.665 ppb	104.489 %	9.951 ppb	10.234 ppb	10.318 ppb	9.855 ppb	105.611 %	10.848 ppb	10.508 ppb
Concentration per Run 3	9.730 ppb	108.176 %	8.893 ppb	7.978 ppb	9.795 ppb	9.075 ppb	106.451 %	10.362 ppb	10.000 ppb
Concentration RSD	7.3 %	N/A	5.7 %	13.4 %	3.4 %	5.2 %	N/A	3.0 %	4.3 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	103.997 %	9.856 ppb	8.967 ppb	9.820 ppb	103.049 %	102.946 %	10.080 ppb	10.129 ppb	105.321 %
Concentration per Run 1	100.727 %	9.676 ppb	8.745 ppb	9.250 ppb	99.264 %	100.491 %	9.938 ppb	9.859 ppb	102.949 %
Concentration per Run 2	104.325 %	10.017 ppb	9.362 ppb	10.634 ppb	103.150 %	100.883 %	10.329 ppb	10.690 ppb	103.878 %
Concentration per Run 3	106.940 %	9.875 ppb	8.795 ppb	9.577 ppb	106.732 %	107.465 %	9.973 ppb	9.836 ppb	109.137 %
Concentration RSD	N/A	1.7 %	3.8 %	7.4 %	N/A	N/A	2.2 %	4.8 %	N/A

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 7 Analysis started at: 6/9/2017 7:21:12 AM Rack: 0
 Analysis label: 120/12000 User name: ALPHALAB\metals-instrument Vial: 5

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	97.821 %	107.809 %	120.788 ppb	12,453.439 ppb	11,390.817 ppb	119.336 ppb	12,286.499 ppb	12,064.331 ppb	106.415 %
Concentration per Run 1	96.989 %	110.027 %	122.151 ppb	12,206.823 ppb	11,091.607 ppb	117.987 ppb	12,088.497 ppb	11,854.013 ppb	103.363 %
Concentration per Run 2	98.708 %	105.758 %	120.124 ppb	12,947.130 ppb	11,941.895 ppb	124.523 ppb	12,906.636 ppb	12,667.060 ppb	106.648 %
Concentration per Run 3	97.766 %	107.641 %	120.091 ppb	12,206.365 ppb	11,138.948 ppb	115.499 ppb	11,864.364 ppb	11,671.919 ppb	109.233 %
Concentration RSD	N/A	N/A	1.0 %	3.4 %	4.2 %	3.9 %	4.5 %	4.4 %	N/A

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	98.184 %	118.480 ppb	118.914 ppb	120.047 ppb	119.897 ppb	12,112.137 ppb	121.560 ppb	122.808 ppb	122.188 ppb
Concentration per Run 1	97.265 %	120.812 ppb	118.878 ppb	119.742 ppb	121.079 ppb	12,086.388 ppb	121.646 ppb	124.099 ppb	124.634 ppb
Concentration per Run 2	98.011 %	121.439 ppb	123.162 ppb	124.041 ppb	123.839 ppb	12,595.912 ppb	125.929 ppb	127.977 ppb	124.790 ppb
Concentration per Run 3	99.276 %	113.189 ppb	114.702 ppb	116.358 ppb	114.774 ppb	11,654.112 ppb	117.106 ppb	116.349 ppb	117.140 ppb
Concentration RSD	N/A	3.9 %	3.6 %	3.2 %	3.9 %	3.9 %	3.6 %	4.8 %	3.6 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	115.855 ppb	105.650 %	114.386 ppb	113.935 ppb	114.218 ppb	113.635 ppb	104.560 %	119.335 ppb	115.567 ppb
Concentration per Run 1	117.438 ppb	101.445 %	115.163 ppb	117.570 ppb	115.473 ppb	114.080 ppb	99.195 %	121.779 ppb	117.156 ppb
Concentration per Run 2	119.533 ppb	105.982 %	119.632 ppb	117.599 ppb	119.087 ppb	118.351 ppb	106.108 %	123.315 ppb	120.130 ppb
Concentration per Run 3	110.594 ppb	109.523 %	108.364 ppb	106.636 ppb	108.093 ppb	108.475 ppb	108.376 %	112.913 ppb	109.416 ppb
Concentration RSD	4.0 %	N/A	5.0 %	5.5 %	4.9 %	4.4 %	N/A	4.7 %	4.8 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	104.787 %	115.961 ppb	108.988 ppb	114.144 ppb	106.019 %	104.284 %	116.061 ppb	115.819 ppb	106.052 %
Concentration per Run 1	100.799 %	117.562 ppb	108.733 ppb	114.403 ppb	102.419 %	99.621 %	116.484 ppb	116.201 ppb	102.396 %
Concentration per Run 2	104.562 %	119.687 ppb	113.920 ppb	120.762 ppb	105.786 %	105.625 %	122.576 ppb	121.547 ppb	105.526 %
Concentration per Run 3	109.001 %	110.634 ppb	104.311 ppb	107.268 ppb	109.853 %	107.607 %	109.122 ppb	109.708 ppb	110.234 %
Concentration RSD	N/A	4.1 %	4.4 %	5.9 %	N/A	N/A	5.8 %	5.1 %	N/A

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 8 Analysis started at: 6/9/2017 7:24:18 AM Rack: 0
 Analysis label: 250/25000 User name: ALPHALAB\metals-instrument Vial: 6

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	97.917 %	100.706 %	246.940 ppb	26,068.130 ppb	25,292.801 ppb	259.586 ppb	26,195.820 ppb	25,886.984 ppb	102.945 %
Concentration per Run 1	98.147 %	95.709 %	246.707 ppb	27,503.552 ppb	26,716.104 ppb	278.046 ppb	27,994.407 ppb	27,229.855 ppb	97.092 %
Concentration per Run 2	97.052 %	101.423 %	249.552 ppb	25,801.628 ppb	24,763.050 ppb	253.000 ppb	26,079.672 ppb	25,838.987 ppb	103.482 %
Concentration per Run 3	98.552 %	104.985 %	244.562 ppb	24,899.210 ppb	24,399.248 ppb	247.712 ppb	24,513.381 ppb	24,592.108 ppb	108.261 %
Concentration RSD	N/A	N/A	1.0 %	5.1 %	4.9 %	6.2 %	6.7 %	5.1 %	N/A

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	96.760 %	260.584 ppb	261.615 ppb	262.218 ppb	261.568 ppb	26,156.618 ppb	264.451 ppb	261.909 ppb	266.697 ppb
Concentration per Run 1	96.408 %	275.243 ppb	273.739 ppb	277.923 ppb	272.764 ppb	27,855.828 ppb	278.399 ppb	278.918 ppb	285.454 ppb
Concentration per Run 2	96.354 %	260.437 ppb	261.329 ppb	257.530 ppb	259.745 ppb	25,384.511 ppb	259.014 ppb	255.815 ppb	257.613 ppb
Concentration per Run 3	97.520 %	246.073 ppb	249.776 ppb	251.201 ppb	252.196 ppb	25,229.516 ppb	255.940 ppb	250.996 ppb	257.025 ppb
Concentration RSD	N/A	5.6 %	4.6 %	5.3 %	4.0 %	5.6 %	4.6 %	5.7 %	6.1 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	260.432 ppb	100.062 %	255.410 ppb	259.879 ppb	259.011 ppb	260.699 ppb	96.902 %	263.601 ppb	258.636 ppb
Concentration per Run 1	276.833 ppb	94.113 %	273.421 ppb	275.002 ppb	279.466 ppb	271.997 ppb	91.460 %	277.635 ppb	274.563 ppb
Concentration per Run 2	254.112 ppb	103.199 %	246.177 ppb	257.642 ppb	251.307 ppb	259.775 ppb	99.476 %	257.879 ppb	254.262 ppb
Concentration per Run 3	250.352 ppb	102.875 %	246.633 ppb	246.993 ppb	246.259 ppb	250.327 ppb	99.771 %	255.289 ppb	247.082 ppb
Concentration RSD	5.5 %	N/A	6.1 %	5.4 %	6.9 %	4.2 %	N/A	4.6 %	5.5 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	99.819 %	257.282 ppb	257.901 ppb	257.789 ppb	100.298 %	98.975 %	262.788 ppb	265.730 ppb	99.573 %
Concentration per Run 1	93.838 %	275.456 ppb	273.907 ppb	275.151 ppb	95.457 %	93.974 %	276.705 ppb	284.486 ppb	94.729 %
Concentration per Run 2	101.988 %	248.853 ppb	250.211 ppb	250.337 ppb	101.052 %	100.542 %	255.346 ppb	257.920 ppb	100.778 %
Concentration per Run 3	103.631 %	247.536 ppb	249.586 ppb	247.878 ppb	104.385 %	102.411 %	256.312 ppb	254.785 ppb	103.213 %
Concentration RSD	N/A	6.1 %	5.4 %	5.9 %	N/A	N/A	4.6 %	6.1 %	N/A

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 9 Analysis started at: 6/9/2017 7:27:26 AM Rack: 0
 Analysis label: 500/50000 User name: ALPHALAB\metals-instrument Vial: 7

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	93.817 %	101.602 %	501.348 ppb	49,393.218 ppb	42,691.023 ppb	495.381 ppb	49,332.575 ppb	49,539.977 ppb	106.715 %
Concentration per Run 1	92.142 %	102.599 %	500.878 ppb	48,426.348 ppb	41,553.405 ppb	488.502 ppb	49,145.400 ppb	48,016.647 ppb	107.277 %
Concentration per Run 2	94.548 %	102.095 %	503.204 ppb	49,475.094 ppb	43,223.083 ppb	497.123 ppb	49,347.216 ppb	49,625.536 ppb	109.044 %
Concentration per Run 3	94.761 %	100.112 %	499.961 ppb	50,278.211 ppb	43,296.582 ppb	500.518 ppb	49,505.109 ppb	50,977.749 ppb	103.826 %
Concentration RSD	N/A	N/A	0.3 %	1.9 %	2.3 %	1.3 %	0.4 %	3.0 %	N/A

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	93.896 %	495.073 ppb	494.447 ppb	493.867 ppb	494.232 ppb	49,393.944 ppb	492.389 ppb	493.353 ppb	491.107 ppb
Concentration per Run 1	91.723 %	489.905 ppb	483.811 ppb	487.227 ppb	490.914 ppb	49,053.732 ppb	484.511 ppb	491.189 ppb	487.164 ppb
Concentration per Run 2	95.630 %	492.538 ppb	498.713 ppb	497.800 ppb	492.508 ppb	49,895.759 ppb	497.196 ppb	495.988 ppb	491.649 ppb
Concentration per Run 3	94.336 %	502.776 ppb	500.815 ppb	496.574 ppb	499.275 ppb	49,232.343 ppb	495.459 ppb	492.881 ppb	494.507 ppb
Concentration RSD	N/A	1.4 %	1.9 %	1.2 %	0.9 %	0.9 %	1.4 %	0.5 %	0.8 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	495.782 ppb	102.659 %	498.652 ppb	496.528 ppb	496.884 ppb	496.185 ppb	96.767 %	493.350 ppb	496.745 ppb
Concentration per Run 1	490.041 ppb	102.560 %	492.580 ppb	507.342 ppb	500.103 ppb	490.495 ppb	98.267 %	487.585 ppb	488.645 ppb
Concentration per Run 2	496.307 ppb	103.994 %	495.865 ppb	477.678 ppb	490.255 ppb	494.183 ppb	95.900 %	495.708 ppb	500.072 ppb
Concentration per Run 3	500.997 ppb	101.423 %	507.512 ppb	504.563 ppb	500.293 ppb	503.878 ppb	96.133 %	496.756 ppb	501.519 ppb
Concentration RSD	1.1 %	N/A	1.6 %	3.3 %	1.2 %	1.4 %	N/A	1.0 %	1.4 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	101.652 %	497.332 ppb	498.713 ppb	497.515 ppb	101.219 %	99.709 %	494.550 ppb	493.136 ppb	102.143 %
Concentration per Run 1	104.699 %	481.003 ppb	477.905 ppb	487.200 ppb	102.296 %	99.413 %	492.434 ppb	490.171 ppb	101.095 %
Concentration per Run 2	100.117 %	500.289 ppb	505.566 ppb	502.310 ppb	101.315 %	100.445 %	486.723 ppb	488.077 ppb	103.270 %
Concentration per Run 3	100.139 %	510.703 ppb	512.669 ppb	503.034 ppb	100.045 %	99.270 %	504.493 ppb	501.160 ppb	102.064 %
Concentration RSD	N/A	3.0 %	3.7 %	1.8 %	N/A	N/A	1.8 %	1.4 %	N/A

Alpha ICPMSQ2 Full

6/10/2017 10:11:47 AM



Analysis index:	10	Analysis started at:	6/9/2017 7:30:34 AM	Rack:	0
Analysis label:	Rinse	User name:	ALPHALAB\metals-instrument	Vial:	1

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 11 Analysis started at: 6/9/2017 7:33:39 AM Rack: 0
 Analysis label: ICV User name: ALPHALAB\metals-instrument Vial: 9

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	96.913 %	100.213 %	97.698 ppb	10,848.160 ppb	10,023.803 ppb	101.944 ppb	10,432.639 ppb	10,409.696 ppb	101.599 %
Concentration per Run 1	96.702 %	108.548 %	98.157 ppb	9,451.515 ppb	8,767.862 ppb	88.916 ppb	9,070.571 ppb	9,056.484 ppb	110.716 %
Concentration per Run 2	96.667 %	97.491 %	97.583 ppb	10,634.403 ppb	9,645.629 ppb	92.169 ppb	9,915.581 ppb	10,028.189 ppb	95.681 %
Concentration per Run 3	97.370 %	94.600 %	97.355 ppb	12,458.561 ppb	11,657.917 ppb	124.746 ppb	12,311.765 ppb	12,144.415 ppb	98.398 %
Recovery Percentage 1			97.698 %	108.482 %	100.238 %	101.944 %	104.326 %	104.097 %	
Concentration RSD	0.4 %	7.3 %	0.4 %	14.0 %	14.8 %	19.4 %	16.1 %	15.2 %	7.9 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	97.335 %	102.135 ppb	100.128 ppb	102.220 ppb	101.367 ppb	10,290.116 ppb	103.401 ppb	105.173 ppb	103.979 ppb
Concentration per Run 1	96.554 %	89.800 ppb	87.219 ppb	88.514 ppb	88.524 ppb	9,007.206 ppb	89.501 ppb	93.225 ppb	92.399 ppb
Concentration per Run 2	97.154 %	99.133 ppb	99.037 ppb	102.597 ppb	96.365 ppb	10,161.979 ppb	104.705 ppb	105.947 ppb	104.555 ppb
Concentration per Run 3	98.297 %	117.472 ppb	114.130 ppb	115.548 ppb	119.211 ppb	11,701.164 ppb	115.996 ppb	116.348 ppb	114.983 ppb
Recovery Percentage 1		102.135 %	100.128 %	102.220 %	101.367 %	102.901 %	103.401 %	105.173 %	103.979 %
Concentration RSD	0.9 %	13.8 %	13.5 %	13.2 %	15.7 %	13.1 %	12.9 %	11.0 %	10.9 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	98.875 ppb	100.942 %	97.020 ppb	98.984 ppb	98.968 ppb	102.679 ppb	99.273 %	100.726 ppb	103.075 ppb
Concentration per Run 1	87.398 ppb	110.519 %	86.419 ppb	88.917 ppb	85.419 ppb	89.656 ppb	107.489 %	88.142 ppb	91.179 ppb
Concentration per Run 2	98.860 ppb	94.671 %	95.773 ppb	89.335 ppb	97.551 ppb	102.838 ppb	97.033 %	101.823 ppb	101.359 ppb
Concentration per Run 3	110.367 ppb	97.636 %	108.867 ppb	118.700 ppb	113.934 ppb	115.544 ppb	93.296 %	112.214 ppb	116.689 ppb
Recovery Percentage 1	98.875 %	97.020 %	98.984 %	98.968 %	102.679 %			100.726 %	103.075 %
Concentration RSD	11.6 %	8.3 %	11.6 %	17.3 %	14.5 %	12.6 %	7.4 %	12.0 %	12.5 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	101.867 %	103.631 ppb	100.272 ppb	99.148 ppb	100.980 %	99.154 %	98.458 ppb	97.884 ppb	105.168 %
Concentration per Run 1	111.541 %	91.425 ppb	88.305 ppb	87.422 ppb	108.782 %	104.652 %	86.976 ppb	84.741 ppb	112.358 %
Concentration per Run 2	97.501 %	102.924 ppb	98.269 ppb	97.506 ppb	98.802 %	97.268 %	97.040 ppb	97.068 ppb	105.629 %
Concentration per Run 3	96.559 %	116.543 ppb	114.243 ppb	112.517 ppb	95.356 %	95.543 %	111.357 ppb	111.843 ppb	97.517 %
Recovery Percentage 1		103.631 %	100.272 %	99.148 %			98.458 %	97.884 %	
Concentration RSD	8.2 %	12.1 %	13.0 %	12.7 %	6.9 %	4.9 %	12.4 %	13.9 %	7.1 %

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6/10/2017 10:11:47 AM

Analysis index: 12 Analysis started at: 6/9/2017 7:40:14 AM Rack: 0
 Analysis label: ICB User name: ALPHALAB\metals-instrument Vial: 10

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	96.710 %	101.916 %	0.013 ppb	-14.368 ppb	-0.193 ppb	-0.426 ppb	1.930 ppb	2.234 ppb	101.297 %
Concentration per Run 1	97.830 %	100.280 %	0.019 ppb	-12.204 ppb	0.200 ppb	-0.787 ppb	4.936 ppb	3.049 ppb	96.392 %
Concentration per Run 2	96.606 %	107.641 %	0.011 ppb	-18.322 ppb	-0.789 ppb	-0.134 ppb	-3.295 ppb	0.324 ppb	107.691 %
Concentration per Run 3	95.694 %	97.827 %	0.008 ppb	-12.577 ppb	0.009 ppb	-0.356 ppb	4.150 ppb	3.329 ppb	99.806 %
Recovery Percentage 1			4.219 %	-14.368 %	-0.276 %	-4.256 %	1.930 %	2.234 %	
Concentration RSD	1.1 %	5.0 %	45.8 %	23.9 %	271.3 %	78.0 %	235.3 %	74.3 %	5.7 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	95.697 %	0.009 ppb	-0.009 ppb	0.009 ppb	0.059 ppb	0.175 ppb	0.004 ppb	-0.011 ppb	-0.043 ppb
Concentration per Run 1	96.454 %	0.015 ppb	0.003 ppb	0.008 ppb	0.058 ppb	0.985 ppb	0.003 ppb	0.015 ppb	-0.043 ppb
Concentration per Run 2	95.305 %	-0.015 ppb	-0.015 ppb	-0.021 ppb	0.081 ppb	-0.120 ppb	0.013 ppb	-0.013 ppb	-0.040 ppb
Concentration per Run 3	95.331 %	0.026 ppb	-0.015 ppb	0.039 ppb	0.039 ppb	-0.341 ppb	-0.005 ppb	-0.033 ppb	-0.045 ppb
Recovery Percentage 1		1.794 %	-0.183 %	0.870 %	5.935 %	0.350 %	0.702 %	-0.531 %	-4.275 %
Concentration RSD	0.7 %	237.7 %	117.7 %	340.2 %	35.7 %	406.5 %	248.4 %	226.7 %	6.5 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	0.111 ppb	101.779 %	0.043 ppb	-0.544 ppb	-0.004 ppb	0.049 ppb	100.291 %	0.008 ppb	0.003 ppb
Concentration per Run 1	0.170 ppb	96.852 %	0.054 ppb	-0.388 ppb	-0.010 ppb	0.065 ppb	98.434 %	0.005 ppb	0.005 ppb
Concentration per Run 2	-0.068 ppb	108.202 %	0.036 ppb	-1.175 ppb	0.017 ppb	0.034 ppb	105.113 %	0.007 ppb	0.000 ppb
Concentration per Run 3	0.230 ppb	100.283 %	0.039 ppb	-0.069 ppb	-0.018 ppb	0.047 ppb	97.327 %	0.012 ppb	0.005 ppb
Recovery Percentage 1	1.109 %	101.779 %	8.655 %	-10.877 %	-0.739 %	2.432 %		2.000 %	1.654 %
Concentration RSD	142.1 %	5.7 %	22.0 %	104.7 %	486.2 %	32.0 %	4.2 %	41.1 %	86.6 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	100.573 %	0.222 ppb	0.759 ppb	-0.026 ppb	100.564 %	100.323 %	0.005 ppb	0.005 ppb	106.604 %
Concentration per Run 1	98.703 %	0.259 ppb	0.724 ppb	-0.038 ppb	97.596 %	97.335 %	0.007 ppb	0.010 ppb	102.706 %
Concentration per Run 2	106.641 %	0.139 ppb	0.748 ppb	-0.028 ppb	105.590 %	106.131 %	0.003 ppb	0.002 ppb	113.237 %
Concentration per Run 3	96.374 %	0.268 ppb	0.805 ppb	-0.012 ppb	98.508 %	97.502 %	0.004 ppb	0.004 ppb	103.868 %
Recovery Percentage 1		7.400 %	18.978 %	-5.174 %			0.966 %	1.056 %	106.604 %
Concentration RSD	5.4 %	32.5 %	5.5 %	51.0 %	4.4 %	5.0 %	46.6 %	71.9 %	5.4 %

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Analysis index: 13 Analysis started at: 6/9/2017 7:43:23 AM Rack: 4
 Analysis label: Sr 100ppb User name: ALPHALAB\metals-instrument Vial: 57

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	97.828 %	107.540 %	0.010 ppb	-10.925 ppb	-0.145 ppb	0.397 ppb	2.707 ppb	-0.358 ppb	104.707 %
Concentration per Run 1	96.365 %	110.934 %	0.008 ppb	-20.321 ppb	0.232 ppb	0.260 ppb	4.994 ppb	-4.389 ppb	105.675 %
Concentration per Run 2	99.322 %	104.649 %	0.012 ppb	-1.150 ppb	-0.064 ppb	0.556 ppb	5.183 ppb	-0.653 ppb	104.300 %
Concentration per Run 3	97.797 %	107.036 %	0.008 ppb	-11.304 ppb	-0.604 ppb	0.375 ppb	-2.056 ppb	3.969 ppb	104.146 %
Concentration RSD	1.5 %	3.0 %	21.2 %	87.8 %	291.8 %	37.5 %	152.4 %	1,170.6 %	0.8 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	98.138 %	0.036 ppb	0.002 ppb	0.013 ppb	0.031 ppb	1.904 ppb	-0.002 ppb	0.203 ppb	0.030 ppb
Concentration per Run 1	97.058 %	0.048 ppb	-0.015 ppb	-0.010 ppb	0.124 ppb	2.336 ppb	-0.001 ppb	0.202 ppb	0.020 ppb
Concentration per Run 2	100.063 %	0.048 ppb	0.010 ppb	0.014 ppb	0.052 ppb	2.562 ppb	-0.001 ppb	0.139 ppb	0.015 ppb
Concentration per Run 3	97.293 %	0.011 ppb	0.011 ppb	0.037 ppb	-0.083 ppb	0.813 ppb	-0.005 ppb	0.267 ppb	0.054 ppb
Concentration RSD	1.7 %	59.7 %	815.0 %	175.4 %	339.0 %	50.0 %	83.3 %	31.5 %	71.2 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	0.122 ppb	104.559 %	0.026 ppb	-0.061 ppb	99.704 ppb	0.027 ppb	103.053 %	0.003 ppb	0.008 ppb
Concentration per Run 1	0.270 ppb	100.807 %	0.065 ppb	0.303 ppb	102.747 ppb	0.028 ppb	101.458 %	0.000 ppb	0.005 ppb
Concentration per Run 2	-0.078 ppb	107.713 %	0.012 ppb	-0.166 ppb	97.896 ppb	0.010 ppb	104.626 %	0.011 ppb	0.009 ppb
Concentration per Run 3	0.173 ppb	105.158 %	0.000 ppb	-0.320 ppb	98.470 ppb	0.043 ppb	103.075 %	-0.002 ppb	0.009 ppb
Concentration RSD	147.8 %	3.3 %	134.3 %	532.7 %	2.7 %	62.8 %	1.5 %	251.9 %	33.7 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	106.571 %	0.142 ppb	0.419 ppb	0.003 ppb	105.149 %	103.765 %	0.002 ppb	0.013 ppb	106.840 %
Concentration per Run 1	104.923 %	0.264 ppb	0.410 ppb	-0.039 ppb	101.595 %	100.199 %	0.001 ppb	0.006 ppb	104.380 %
Concentration per Run 2	107.445 %	0.074 ppb	0.376 ppb	0.019 ppb	106.697 %	105.339 %	0.002 ppb	0.011 ppb	106.160 %
Concentration per Run 3	107.346 %	0.087 ppb	0.471 ppb	0.031 ppb	107.155 %	105.757 %	0.004 ppb	0.023 ppb	109.982 %
Concentration RSD	1.3 %	74.9 %	11.5 %	1,069.6 %	2.9 %	3.0 %	49.7 %	64.8 %	2.7 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 14 Analysis started at: 6/9/2017 7:46:33 AM Rack: 4
 Analysis label: LLICV User name: ALPHALAB\metals-instrument Vial: 51

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	98.455 %	102.868 %	0.329 ppb	101.935 ppb	76.157 ppb	11.514 ppb	115.272 ppb	103.355 ppb	103.917 %
Concentration per Run 1	98.756 %	95.541 %	0.352 ppb	127.860 ppb	80.629 ppb	11.655 ppb	127.661 ppb	99.119 ppb	97.909 %
Concentration per Run 2	98.409 %	103.641 %	0.342 ppb	97.758 ppb	77.855 ppb	11.097 ppb	104.029 ppb	90.367 ppb	105.948 %
Concentration per Run 3	98.201 %	109.422 %	0.294 ppb	80.188 ppb	69.988 ppb	11.791 ppb	114.124 ppb	120.577 ppb	107.893 %
Recovery Percentage 1			109.750 %	101.935 %	108.796 %	115.144 %	115.272 %	103.355 %	
Concentration RSD	0.3 %	6.8 %	9.4 %	23.7 %	7.2 %	3.2 %	10.3 %	15.0 %	5.1 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	97.648 %	0.747 ppb	5.632 ppb	0.565 ppb	1.275 ppb	54.329 ppb	0.565 ppb	2.148 ppb	1.192 ppb
Concentration per Run 1	97.554 %	0.763 ppb	6.182 ppb	0.603 ppb	1.279 ppb	52.411 ppb	0.599 ppb	2.563 ppb	1.094 ppb
Concentration per Run 2	98.241 %	0.643 ppb	5.624 ppb	0.547 ppb	1.435 ppb	56.680 ppb	0.575 ppb	2.075 ppb	1.351 ppb
Concentration per Run 3	97.148 %	0.836 ppb	5.090 ppb	0.545 ppb	1.110 ppb	53.898 ppb	0.519 ppb	1.806 ppb	1.132 ppb
Recovery Percentage 1		149.490 %	112.641 %	112.945 %	127.498 %	108.659 %	112.909 %	107.394 %	119.218 %
Concentration RSD	0.6 %	13.1 %	9.7 %	5.8 %	12.8 %	4.0 %	7.3 %	17.9 %	11.7 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	9.909 ppb	101.805 %	0.529 ppb	5.264 ppb	0.553 ppb	2.049 ppb	102.101 %	0.454 ppb	0.206 ppb
Concentration per Run 1	10.570 ppb	97.381 %	0.485 ppb	6.269 ppb	0.568 ppb	2.043 ppb	98.397 %	0.484 ppb	0.246 ppb
Concentration per Run 2	9.911 ppb	102.447 %	0.716 ppb	3.515 ppb	0.563 ppb	2.105 ppb	104.878 %	0.422 ppb	0.192 ppb
Concentration per Run 3	9.246 ppb	105.587 %	0.385 ppb	6.008 ppb	0.529 ppb	1.998 ppb	103.028 %	0.455 ppb	0.181 ppb
Recovery Percentage 1	99.089 %		105.769 %	105.280 %	110.650 %	102.441 %		113.460 %	103.223 %
Concentration RSD	6.7 %	4.1 %	32.1 %	28.9 %	3.8 %	2.6 %	3.3 %	6.8 %	16.8 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	104.233 %	3.204 ppb	4.391 ppb	0.476 ppb	101.564 %	101.185 %	0.515 ppb	0.506 ppb	105.251 %
Concentration per Run 1	101.412 %	3.430 ppb	4.525 ppb	0.395 ppb	97.089 %	96.426 %	0.542 ppb	0.521 ppb	100.839 %
Concentration per Run 2	106.490 %	3.160 ppb	4.381 ppb	0.457 ppb	102.473 %	104.344 %	0.492 ppb	0.521 ppb	106.288 %
Concentration per Run 3	104.798 %	3.023 ppb	4.266 ppb	0.575 ppb	105.129 %	102.785 %	0.510 ppb	0.477 ppb	108.626 %
Recovery Percentage 1		106.814 %	109.767 %	95.156 %			102.934 %	101.216 %	
Concentration RSD	2.5 %	6.5 %	3.0 %	19.2 %	4.0 %	4.1 %	4.9 %	5.0 %	3.8 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 15 Analysis started at: 6/9/2017 7:49:43 AM Rack: 4
 Analysis label: ICSA User name: ALPHALAB\metals-instrument Vial: 53

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	95.019 %	103.921 %	0.012 ppb	54,829.426 ppb	21,712.186 ppb	21,770.311 ppb	22,804.319 ppb	67,328.025 ppb	100.916 %
Concentration per Run 1	95.508 %	103.809 %	0.014 ppb	56,141.576 ppb	22,360.626 ppb	22,466.697 ppb	22,998.396 ppb	68,072.310 ppb	101.572 %
Concentration per Run 2	95.248 %	104.649 %	0.009 ppb	54,090.526 ppb	21,078.128 ppb	21,400.249 ppb	22,894.376 ppb	67,846.648 ppb	101.099 %
Concentration per Run 3	94.300 %	103.305 %	0.013 ppb	54,256.177 ppb	21,697.805 ppb	21,443.987 ppb	22,520.187 ppb	66,065.117 ppb	100.079 %
Recovery Percentage 1				109.659 %	108.561 %	108.852 %	114.022 %	112.213 %	
Concentration RSD	0.7 %	0.7 %	22.8 %	2.1 %	3.0 %	2.8 %	1.1 %	1.6 %	0.8 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	89.687 %	487.338 ppb	0.124 ppb	0.868 ppb	0.844 ppb	54,646.221 ppb	0.713 ppb	1.129 ppb	1.199 ppb
Concentration per Run 1	88.836 %	491.660 ppb	0.091 ppb	0.842 ppb	0.827 ppb	55,757.999 ppb	0.704 ppb	1.238 ppb	1.291 ppb
Concentration per Run 2	91.035 %	495.866 ppb	0.117 ppb	0.893 ppb	0.856 ppb	54,750.424 ppb	0.729 ppb	1.108 ppb	1.246 ppb
Concentration per Run 3	89.190 %	474.489 ppb	0.163 ppb	0.868 ppb	0.849 ppb	53,430.241 ppb	0.705 ppb	1.041 ppb	1.060 ppb
Recovery Percentage 1		121.835 %				109.292 %			
Concentration RSD	1.3 %	2.3 %	29.4 %	2.9 %	1.8 %	2.1 %	2.0 %	8.9 %	10.2 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	6.874 ppb	102.968 %	0.157 ppb	0.152 ppb	1.007 ppb	434.401 ppb	96.655 %	0.092 ppb	0.132 ppb
Concentration per Run 1	7.159 ppb	100.863 %	0.117 ppb	0.499 ppb	0.944 ppb	448.618 ppb	95.303 %	0.102 ppb	0.101 ppb
Concentration per Run 2	7.084 ppb	103.831 %	0.165 ppb	0.145 ppb	1.082 ppb	430.930 ppb	97.076 %	0.084 ppb	0.146 ppb
Concentration per Run 3	6.379 ppb	104.212 %	0.189 ppb	-0.189 ppb	0.995 ppb	423.655 ppb	97.587 %	0.089 ppb	0.148 ppb
Recovery Percentage 1						108.600 %			
Concentration RSD	6.3 %	1.8 %	23.3 %	226.6 %	6.9 %	3.0 %	1.2 %	10.2 %	20.2 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	104.132 %	0.385 ppb	0.398 ppb	2.915 ppb	96.332 %	90.217 %	0.010 ppb	0.126 ppb	100.496 %
Concentration per Run 1	103.338 %	0.345 ppb	0.352 ppb	3.014 ppb	94.004 %	88.622 %	0.012 ppb	0.127 ppb	98.635 %
Concentration per Run 2	105.457 %	0.405 ppb	0.430 ppb	3.019 ppb	98.923 %	92.331 %	0.007 ppb	0.119 ppb	102.083 %
Concentration per Run 3	103.599 %	0.406 ppb	0.410 ppb	2.712 ppb	96.069 %	89.697 %	0.011 ppb	0.132 ppb	100.769 %
Recovery Percentage 1									
Concentration RSD	1.1 %	9.1 %	10.2 %	6.0 %	2.6 %	2.1 %	23.7 %	5.3 %	1.7 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 16 Analysis started at: 6/9/2017 7:52:53 AM Rack: 4
 Analysis label: ICSAB User name: ALPHALAB\metals-instrument Vial: 55

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	91.573 %	105.322 %	0.007 ppb	53,270.907 ppb	21,104.028 ppb	21,730.624 ppb	22,945.290 ppb	66,501.444 ppb	102.345 %
Concentration per Run 1	90.490 %	109.825 %	0.007 ppb	54,155.849 ppb	21,257.500 ppb	23,135.006 ppb	24,254.806 ppb	68,506.471 ppb	112.250 %
Concentration per Run 2	93.024 %	105.927 %	0.005 ppb	52,672.774 ppb	20,969.645 ppb	20,986.077 ppb	22,286.529 ppb	65,784.172 ppb	97.518 %
Concentration per Run 3	91.206 %	100.213 %	0.009 ppb	52,984.099 ppb	21,084.940 ppb	21,070.789 ppb	22,294.534 ppb	65,213.689 ppb	97.269 %
Recovery Percentage 1				106.542 %	105.520 %	108.653 %	114.726 %	110.836 %	
Concentration RSD	1.4 %	4.6 %	30.5 %	1.5 %	0.7 %	5.6 %	4.9 %	2.6 %	8.4 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	86.829 %	477.376 ppb	42.452 ppb	42.441 ppb	43.061 ppb	52,912.465 ppb	41.503 ppb	41.833 ppb	41.818 ppb
Concentration per Run 1	86.817 %	485.631 ppb	41.668 ppb	41.464 ppb	45.306 ppb	52,845.812 ppb	40.094 ppb	40.780 ppb	39.638 ppb
Concentration per Run 2	87.385 %	472.807 ppb	43.712 ppb	43.582 ppb	42.539 ppb	52,837.190 ppb	42.370 ppb	40.935 ppb	42.876 ppb
Concentration per Run 3	86.284 %	473.691 ppb	41.975 ppb	42.277 ppb	41.337 ppb	53,054.394 ppb	42.043 ppb	43.785 ppb	42.942 ppb
Recovery Percentage 1		119.344 %	106.130 %	106.102 %	107.652 %	105.825 %	103.757 %	104.583 %	104.546 %
Concentration RSD	0.6 %	1.5 %	2.6 %	2.5 %	4.7 %	0.2 %	3.0 %	4.0 %	4.5 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	23.030 ppb	102.874 %	20.823 ppb	20.899 ppb	43.558 ppb	424.165 ppb	96.393 %	10.043 ppb	21.349 ppb
Concentration per Run 1	22.344 ppb	111.175 %	20.136 ppb	21.898 ppb	46.258 ppb	426.412 ppb	100.730 %	9.910 ppb	21.388 ppb
Concentration per Run 2	24.154 ppb	98.565 %	21.117 ppb	18.963 ppb	42.652 ppb	418.922 ppb	95.466 %	10.182 ppb	21.284 ppb
Concentration per Run 3	22.593 ppb	98.881 %	21.216 ppb	21.835 ppb	41.766 ppb	427.162 ppb	92.983 %	10.037 ppb	21.373 ppb
Recovery Percentage 1	115.151 %		104.115 %	104.493 %	108.896 %	106.041 %		100.431 %	106.743 %
Concentration RSD	4.3 %	7.0 %	2.9 %	8.0 %	5.5 %	1.1 %	4.1 %	1.4 %	0.3 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	105.089 %	0.055 ppb	0.241 ppb	0.846 ppb	95.770 %	90.554 %	0.006 ppb	0.073 ppb	98.155 %
Concentration per Run 1	111.776 %	0.018 ppb	0.224 ppb	0.751 ppb	99.426 %	95.958 %	0.007 ppb	0.071 ppb	101.283 %
Concentration per Run 2	103.038 %	0.035 ppb	0.262 ppb	0.841 ppb	95.479 %	89.491 %	0.006 ppb	0.076 ppb	97.402 %
Concentration per Run 3	100.452 %	0.111 ppb	0.238 ppb	0.947 ppb	92.405 %	86.214 %	0.006 ppb	0.072 ppb	95.779 %
Recovery Percentage 1									
Concentration RSD	5.6 %	90.6 %	8.1 %	11.6 %	3.7 %	5.5 %	10.4 %	3.6 %	2.9 %

Alpha ICPMSQ2 Full

6/10/2017 10:11:47 AM



Analysis index:	17	Analysis started at:	6/9/2017 7:56:03 AM	Rack:	0
Analysis label:	Rinse	User name:	ALPHALAB\metals-instrument	Vial:	1

Alpha ICPMSQ2 Full

6/10/2017 10:11:47 AM



Analysis index:	18	Analysis started at:	6/9/2017 7:59:09 AM	Rack:	0
Analysis label:	XCCV	User name:	ALPHALAB\metals-instrument	Vial:	9

Alpha ICPMSQ2 Full

6/10/2017 10:11:47 AM



Analysis index:	19	Analysis started at:	6/9/2017 8:02:18 AM	Rack:	0
Analysis label:	XCCB	User name:	ALPHALAB\metals-instrument	Vial:	10

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 20 Analysis started at: 6/9/2017 8:07:38 AM Rack: 0
 Analysis label: CCV User name: ALPHALAB\metals-instrument Vial: 9

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	96.777 %	104.694 %	96.061 ppb	10,985.024 ppb	10,396.843 ppb	106.756 ppb	10,883.273 ppb	10,846.169 ppb	105.683 %
Concentration per Run 1	95.222 %	102.834 %	96.476 ppb	11,736.455 ppb	10,891.085 ppb	111.506 ppb	11,281.917 ppb	11,256.514 ppb	103.897 %
Concentration per Run 2	97.729 %	103.440 %	95.950 ppb	10,369.956 ppb	10,286.370 ppb	108.856 ppb	10,899.612 ppb	10,809.244 ppb	102.270 %
Concentration per Run 3	97.381 %	107.809 %	95.759 ppb	10,848.662 ppb	10,013.075 ppb	99.906 ppb	10,468.290 ppb	10,472.748 ppb	110.882 %
Recovery Percentage 1			96.061 %	109.850 %	103.968 %	106.756 %	108.833 %	108.462 %	
Concentration RSD	1.4 %	2.6 %	0.4 %	6.3 %	4.3 %	5.7 %	3.7 %	3.6 %	4.3 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	96.899 %	105.987 ppb	103.605 ppb	104.525 ppb	105.928 ppb	10,691.015 ppb	107.121 ppb	107.722 ppb	106.645 ppb
Concentration per Run 1	94.942 %	112.894 ppb	109.813 ppb	109.791 ppb	111.944 ppb	11,275.908 ppb	112.121 ppb	114.003 ppb	113.331 ppb
Concentration per Run 2	98.461 %	102.940 ppb	101.608 ppb	102.601 ppb	102.266 ppb	10,446.522 ppb	105.042 ppb	105.816 ppb	104.462 ppb
Concentration per Run 3	97.293 %	102.128 ppb	99.396 ppb	101.183 ppb	103.573 ppb	10,350.616 ppb	104.199 ppb	103.347 ppb	102.143 ppb
Recovery Percentage 1		105.987 %	103.605 %	104.525 %	105.928 %	106.910 %	107.121 %	107.722 %	106.645 %
Concentration RSD	1.9 %	5.7 %	5.3 %	4.4 %	5.0 %	4.8 %	4.1 %	5.2 %	5.5 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	103.011 ppb	102.541 %	98.094 ppb	101.546 ppb	104.841 ppb	106.085 ppb	100.589 %	103.854 ppb	103.994 ppb
Concentration per Run 1	108.867 ppb	100.833 %	103.902 ppb	105.175 ppb	110.696 ppb	112.509 ppb	99.283 %	107.878 ppb	108.072 ppb
Concentration per Run 2	100.534 ppb	100.244 %	93.477 ppb	98.772 ppb	102.749 ppb	103.969 ppb	97.267 %	103.233 ppb	103.497 ppb
Concentration per Run 3	99.632 ppb	106.547 %	96.903 ppb	100.690 ppb	101.078 ppb	101.776 ppb	105.216 %	100.450 ppb	100.412 ppb
Recovery Percentage 1	103.011 %	98.094 %	101.546 %	104.841 %	106.085 %			103.854 %	103.994 %
Concentration RSD	4.9 %	3.4 %	5.4 %	3.2 %	4.9 %	5.3 %	4.1 %	3.6 %	3.7 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	103.411 %	106.833 ppb	101.717 ppb	102.367 ppb	101.225 %	98.563 %	102.377 ppb	101.803 ppb	99.552 %
Concentration per Run 1	103.631 %	110.143 ppb	104.406 ppb	105.811 ppb	98.996 %	96.470 %	106.970 ppb	106.600 ppb	97.800 %
Concentration per Run 2	98.603 %	107.380 ppb	102.456 ppb	103.184 ppb	99.864 %	96.811 %	101.973 ppb	101.257 ppb	96.534 %
Concentration per Run 3	107.999 %	102.977 ppb	98.290 ppb	98.107 ppb	104.814 %	102.409 %	98.188 ppb	97.552 ppb	104.322 %
Recovery Percentage 1		106.833 %	101.717 %	102.367 %			102.377 %	101.803 %	
Concentration RSD	4.5 %	3.4 %	3.1 %	3.8 %	3.1 %	3.4 %	4.3 %	4.5 %	4.2 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 21 Analysis started at: 6/9/2017 8:10:48 AM Rack: 0
 Analysis label: CCB User name: ALPHALAB\metals-instrument Vial: 10

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	94.298 %	99.261 %	0.017 ppb	16.222 ppb	0.187 ppb	0.088 ppb	9.308 ppb	-1.095 ppb	100.906 %
Concentration per Run 1	92.729 %	102.902 %	0.019 ppb	3.822 ppb	-0.035 ppb	0.188 ppb	11.631 ppb	5.434 ppb	101.182 %
Concentration per Run 2	95.361 %	101.322 %	0.015 ppb	29.768 ppb	-0.039 ppb	0.143 ppb	11.450 ppb	-1.458 ppb	103.802 %
Concentration per Run 3	94.805 %	93.559 %	0.018 ppb	15.075 ppb	0.636 ppb	-0.066 ppb	4.844 ppb	-7.262 ppb	97.733 %
Recovery Percentage 1			5.744 %	16.222 %	0.268 %	0.884 %	9.308 %	-1.095 %	
Concentration RSD	1.5 %	5.0 %	13.9 %	80.2 %	207.4 %	153.4 %	41.6 %	580.2 %	3.0 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	93.836 %	-0.005 ppb	-0.004 ppb	0.002 ppb	0.205 ppb	2.152 ppb	0.004 ppb	0.020 ppb	-0.049 ppb
Concentration per Run 1	92.414 %	-0.013 ppb	0.011 ppb	-0.011 ppb	0.193 ppb	1.840 ppb	0.010 ppb	0.083 ppb	-0.006 ppb
Concentration per Run 2	95.049 %	0.037 ppb	-0.007 ppb	0.004 ppb	0.218 ppb	2.046 ppb	0.006 ppb	-0.036 ppb	-0.046 ppb
Concentration per Run 3	94.046 %	-0.039 ppb	-0.015 ppb	0.013 ppb	0.203 ppb	2.570 ppb	-0.005 ppb	0.014 ppb	-0.093 ppb
Recovery Percentage 1		-1.035 %	-0.071 %	0.186 %	20.492 %	4.304 %	0.753 %	1.003 %	-4.857 %
Concentration RSD	1.4 %	743.4 %	387.7 %	663.0 %	6.1 %	17.5 %	206.3 %	297.2 %	90.0 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	-0.013 ppb	99.387 %	0.021 ppb	0.849 ppb	0.001 ppb	0.120 ppb	96.245 %	0.036 ppb	0.007 ppb
Concentration per Run 1	0.061 ppb	98.644 %	0.000 ppb	0.326 ppb	0.005 ppb	0.084 ppb	96.002 %	0.087 ppb	0.005 ppb
Concentration per Run 2	-0.202 ppb	102.667 %	0.064 ppb	1.219 ppb	0.014 ppb	0.080 ppb	99.320 %	0.014 ppb	0.005 ppb
Concentration per Run 3	0.102 ppb	96.849 %	0.000 ppb	1.003 ppb	-0.014 ppb	0.196 ppb	93.414 %	0.007 ppb	0.010 ppb
Recovery Percentage 1	-0.130 %	99.387 %	4.263 %	16.984 %	0.274 %	6.005 %		8.978 %	3.369 %
Concentration RSD	1,268.5 %	3.0 %	173.2 %	54.9 %	1,039.5 %	55.0 %	3.1 %	122.8 %	47.3 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	97.303 %	0.182 ppb	0.947 ppb	-0.021 ppb	94.509 %	92.309 %	0.014 ppb	0.016 ppb	95.918 %
Concentration per Run 1	98.388 %	0.172 ppb	1.041 ppb	-0.024 ppb	93.865 %	92.413 %	0.019 ppb	0.013 ppb	96.036 %
Concentration per Run 2	100.758 %	0.173 ppb	0.938 ppb	0.025 ppb	97.851 %	96.070 %	0.014 ppb	0.017 ppb	98.873 %
Concentration per Run 3	92.762 %	0.202 ppb	0.862 ppb	-0.064 ppb	91.810 %	88.445 %	0.009 ppb	0.017 ppb	92.844 %
Recovery Percentage 1		6.081 %	23.680 %	-4.162 %			2.786 %	3.182 %	95.918 %
Concentration RSD	4.2 %	9.5 %	9.5 %	214.8 %	3.2 %	4.1 %	35.7 %	14.4 %	3.1 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 22 Analysis started at: 6/9/2017 8:16:10 AM Rack: 1
 Analysis label: WG1011079-1 2008TL User name: ALPHALAB\metals-instrument Vial: 1

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	91.590 %	104.717 %	0.006 ppb	10.319 ppb	-0.472 ppb	0.594 ppb	8.433 ppb	-0.545 ppb	101.146 %
Concentration per Run 1	90.638 %	106.666 %	0.005 ppb	-2.095 ppb	-0.230 ppb	0.852 ppb	11.662 ppb	-0.096 ppb	99.557 %
Concentration per Run 2	91.488 %	100.751 %	0.006 ppb	21.458 ppb	-1.123 ppb	0.427 ppb	3.904 ppb	-1.895 ppb	102.213 %
Concentration per Run 3	92.645 %	106.733 %	0.008 ppb	11.595 ppb	-0.063 ppb	0.502 ppb	9.732 ppb	0.357 ppb	101.667 %
Concentration RSD	1.1 %	3.3 %	22.3 %	114.6 %	120.8 %	38.3 %	47.9 %	218.7 %	1.4 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	91.196 %	0.056 ppb	0.008 ppb	0.244 ppb	0.030 ppb	1.411 ppb	0.005 ppb	0.298 ppb	-0.042 ppb
Concentration per Run 1	89.194 %	0.000 ppb	0.003 ppb	0.250 ppb	0.052 ppb	0.610 ppb	0.006 ppb	0.215 ppb	-0.035 ppb
Concentration per Run 2	92.631 %	0.115 ppb	0.020 ppb	0.254 ppb	-0.010 ppb	1.820 ppb	0.003 ppb	0.312 ppb	-0.045 ppb
Concentration per Run 3	91.764 %	0.051 ppb	0.002 ppb	0.228 ppb	0.048 ppb	1.803 ppb	0.006 ppb	0.366 ppb	-0.046 ppb
Concentration RSD	2.0 %	103.5 %	120.6 %	5.7 %	116.1 %	49.2 %	42.7 %	25.6 %	14.5 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	-0.336 ppb	99.459 %	0.035 ppb	0.251 ppb	0.004 ppb	0.049 ppb	99.385 %	0.014 ppb	0.005 ppb
Concentration per Run 1	-0.366 ppb	98.752 %	0.013 ppb	0.049 ppb	0.012 ppb	0.046 ppb	100.108 %	0.013 ppb	0.000 ppb
Concentration per Run 2	-0.317 ppb	98.731 %	0.066 ppb	0.480 ppb	-0.028 ppb	0.038 ppb	97.732 %	0.020 ppb	0.000 ppb
Concentration per Run 3	-0.324 ppb	100.894 %	0.026 ppb	0.224 ppb	0.028 ppb	0.063 ppb	100.314 %	0.008 ppb	0.015 ppb
Concentration RSD	7.9 %	1.2 %	78.8 %	86.3 %	686.3 %	25.3 %	1.4 %	42.8 %	173.2 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	99.929 %	-0.027 ppb	0.539 ppb	-0.017 ppb	98.203 %	96.572 %	0.008 ppb	0.001 ppb	104.177 %
Concentration per Run 1	99.816 %	-0.043 ppb	0.552 ppb	-0.038 ppb	97.124 %	94.706 %	0.005 ppb	-0.001 ppb	105.078 %
Concentration per Run 2	99.867 %	0.017 ppb	0.576 ppb	0.012 ppb	99.667 %	97.662 %	0.009 ppb	0.002 ppb	104.120 %
Concentration per Run 3	100.104 %	-0.054 ppb	0.490 ppb	-0.025 ppb	97.818 %	97.347 %	0.010 ppb	0.003 ppb	103.331 %
Concentration RSD	0.2 %	143.3 %	8.2 %	154.3 %	1.3 %	1.7 %	33.5 %	224.5 %	0.8 %

Alpha ICPMSQ2 Full

6/10/2017 10:11:47 AM



Analysis index: 23 Analysis started at: 6/9/2017 8:19:16 AM Rack: 1
 Analysis label: WG1011079-2D5 2008TL User name: ALPHALAB\metals-instrument Vial: 2

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	97.899 %	109.568 %	9.871 ppb	2,179.861 ppb	2,014.057 ppb	432.884 ppb	2,078.220 ppb	2,116.494 ppb	107.561 %
Concentration per Run 1	98.664 %	111.876 %	9.749 ppb	2,140.272 ppb	1,955.184 ppb	427.554 ppb	2,024.021 ppb	2,067.848 ppb	105.083 %
Concentration per Run 2	97.766 %	105.557 %	10.025 ppb	2,245.557 ppb	2,117.056 ppb	441.653 ppb	2,146.802 ppb	2,186.076 ppb	106.932 %
Concentration per Run 3	97.267 %	111.271 %	9.840 ppb	2,153.756 ppb	1,969.929 ppb	429.446 ppb	2,063.838 ppb	2,095.558 ppb	110.669 %
Concentration RSD	0.7 %	3.2 %	1.4 %	2.6 %	4.4 %	1.8 %	3.0 %	2.9 %	2.6 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	97.900 %	176.369 ppb	100.350 ppb	40.465 ppb	101.141 ppb	216.229 ppb	100.796 ppb	101.302 ppb	50.196 ppb
Concentration per Run 1	97.761 %	173.622 ppb	98.928 ppb	39.830 ppb	100.581 ppb	209.000 ppb	99.462 ppb	97.966 ppb	49.753 ppb
Concentration per Run 2	98.114 %	181.631 ppb	102.895 ppb	41.078 ppb	103.897 ppb	230.314 ppb	102.870 ppb	102.821 ppb	51.077 ppb
Concentration per Run 3	97.823 %	173.855 ppb	99.228 ppb	40.487 ppb	98.944 ppb	209.373 ppb	100.055 ppb	103.119 ppb	49.757 ppb
Concentration RSD	0.2 %	2.6 %	2.2 %	1.5 %	2.5 %	5.6 %	1.8 %	2.9 %	1.5 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	99.150 ppb	107.736 %	23.242 ppb	24.003 ppb	196.094 ppb	193.388 ppb	103.961 %	10.016 ppb	10.508 ppb
Concentration per Run 1	97.718 ppb	103.057 %	22.544 ppb	24.921 ppb	192.643 ppb	186.750 ppb	102.883 %	9.728 ppb	10.362 ppb
Concentration per Run 2	102.235 ppb	107.891 %	23.387 ppb	25.697 ppb	196.523 ppb	197.524 ppb	103.749 %	10.024 ppb	10.267 ppb
Concentration per Run 3	97.496 ppb	112.258 %	23.796 ppb	21.391 ppb	199.117 ppb	195.891 ppb	105.250 %	10.295 ppb	10.894 ppb
Concentration RSD	2.7 %	4.3 %	2.7 %	9.6 %	1.7 %	3.0 %	1.2 %	2.8 %	3.2 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	108.059 %	193.879 ppb	96.473 ppb	394.219 ppb	105.719 %	104.181 %	24.342 ppb	103.079 ppb	107.322 %
Concentration per Run 1	107.194 %	189.774 ppb	92.764 ppb	381.373 ppb	105.940 %	103.789 %	23.296 ppb	99.174 ppb	106.479 %
Concentration per Run 2	109.506 %	195.093 ppb	97.166 ppb	403.464 ppb	106.133 %	105.387 %	24.493 ppb	104.632 ppb	108.380 %
Concentration per Run 3	107.478 %	196.769 ppb	99.491 ppb	397.819 ppb	105.083 %	103.366 %	25.237 ppb	105.431 ppb	107.107 %
Concentration RSD	1.2 %	1.9 %	3.5 %	2.9 %	0.5 %	1.0 %	4.0 %	3.3 %	0.9 %

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6/10/2017 10:11:47 AM

Analysis index: 24 Analysis started at: 6/9/2017 8:22:22 AM Rack: 1
 Analysis label: L1718742-01 2008TL User name: ALPHALAB\metals-instrument Vial: 3

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	102.083 %	110.968 %	0.005 ppb	25,139.423 ppb	4,983.715 ppb	1.698 ppb	2,386.857 ppb	68,461.367 ppb	113.246 %
Concentration per Run 1	101.665 %	109.187 %	0.007 ppb	24,908.472 ppb	4,957.906 ppb	1.712 ppb	2,399.804 ppb	68,125.810 ppb	114.085 %
Concentration per Run 2	101.527 %	112.783 %	0.002 ppb	24,933.714 ppb	4,978.319 ppb	2.175 ppb	2,355.415 ppb	67,960.119 ppb	113.254 %
Concentration per Run 3	103.057 %	110.934 %	0.008 ppb	25,576.084 ppb	5,014.921 ppb	1.208 ppb	2,405.351 ppb	69,298.172 ppb	112.400 %
Concentration RSD	0.8 %	1.6 %	53.8 %	1.5 %	0.6 %	28.5 %	1.1 %	1.1 %	0.7 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	103.172 %	105.559 ppb	0.133 ppb	0.497 ppb	3.423 ppb	13.307 ppb	0.077 ppb	2.412 ppb	21.678 ppb
Concentration per Run 1	103.179 %	105.155 ppb	0.128 ppb	0.512 ppb	3.648 ppb	12.605 ppb	0.086 ppb	2.399 ppb	21.390 ppb
Concentration per Run 2	102.947 %	104.516 ppb	0.152 ppb	0.518 ppb	3.403 ppb	16.674 ppb	0.072 ppb	2.582 ppb	21.600 ppb
Concentration per Run 3	103.390 %	107.007 ppb	0.121 ppb	0.460 ppb	3.217 ppb	10.642 ppb	0.075 ppb	2.256 ppb	22.044 ppb
Concentration RSD	0.2 %	1.2 %	12.2 %	6.3 %	6.3 %	23.1 %	9.4 %	6.8 %	1.5 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	20.290 ppb	111.923 %	0.152 ppb	0.152 ppb	213.662 ppb	0.743 ppb	105.572 %	0.011 ppb	0.028 ppb
Concentration per Run 1	20.821 ppb	110.106 %	0.119 ppb	-0.758 ppb	216.169 ppb	0.727 ppb	104.141 %	0.008 ppb	0.040 ppb
Concentration per Run 2	20.298 ppb	112.728 %	0.140 ppb	-0.010 ppb	213.798 ppb	0.821 ppb	105.204 %	0.011 ppb	0.022 ppb
Concentration per Run 3	19.752 ppb	112.934 %	0.198 ppb	1.223 ppb	211.020 ppb	0.682 ppb	107.371 %	0.014 ppb	0.021 ppb
Concentration RSD	2.6 %	1.4 %	26.7 %	659.3 %	1.2 %	9.6 %	1.6 %	27.5 %	37.6 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	113.913 %	0.499 ppb	1.293 ppb	150.650 ppb	109.353 %	103.986 %	0.042 ppb	0.074 ppb	107.214 %
Concentration per Run 1	112.678 %	0.494 ppb	1.329 ppb	151.812 ppb	106.919 %	100.780 %	0.035 ppb	0.078 ppb	108.453 %
Concentration per Run 2	113.054 %	0.443 ppb	1.381 ppb	151.527 ppb	110.734 %	106.446 %	0.043 ppb	0.077 ppb	107.321 %
Concentration per Run 3	116.006 %	0.558 ppb	1.168 ppb	148.612 ppb	110.405 %	104.734 %	0.049 ppb	0.068 ppb	105.867 %
Concentration RSD	1.6 %	11.6 %	8.6 %	1.2 %	1.9 %	2.8 %	16.4 %	7.9 %	1.2 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 25 Analysis started at: 6/9/2017 8:25:27 AM Rack: 1
 Analysis label: WG1011079-4 2008TL User name: ALPHALAB\metals-instrument Vial: 4

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	101.170 %	106.050 %	0.007 ppb	25,887.648 ppb	5,142.983 ppb	4.070 ppb	2,446.261 ppb	70,155.456 ppb	110.179 %
Concentration per Run 1	100.964 %	99.306 %	0.010 ppb	26,850.978 ppb	5,350.159 ppb	8.002 ppb	2,571.399 ppb	73,638.196 ppb	101.703 %
Concentration per Run 2	100.803 %	110.565 %	0.008 ppb	25,461.197 ppb	5,056.895 ppb	2.212 ppb	2,394.163 ppb	69,733.594 ppb	113.243 %
Concentration per Run 3	101.742 %	108.279 %	0.005 ppb	25,350.769 ppb	5,021.893 ppb	1.996 ppb	2,373.220 ppb	67,094.577 ppb	115.591 %
Concentration RSD	0.5 %	5.6 %	32.4 %	3.2 %	3.5 %	83.7 %	4.5 %	4.7 %	6.7 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	103.222 %	109.847 ppb	0.099 ppb	0.251 ppb	3.505 ppb	11.986 ppb	0.080 ppb	2.300 ppb	22.213 ppb
Concentration per Run 1	103.065 %	115.416 ppb	0.083 ppb	0.283 ppb	3.905 ppb	13.091 ppb	0.082 ppb	2.207 ppb	23.294 ppb
Concentration per Run 2	103.423 %	109.716 ppb	0.121 ppb	0.192 ppb	2.978 ppb	9.336 ppb	0.076 ppb	2.465 ppb	22.413 ppb
Concentration per Run 3	103.178 %	104.408 ppb	0.095 ppb	0.279 ppb	3.633 ppb	13.531 ppb	0.081 ppb	2.228 ppb	20.932 ppb
Concentration RSD	0.2 %	5.0 %	19.5 %	20.6 %	13.6 %	19.2 %	4.0 %	6.2 %	5.4 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	20.774 ppb	106.157 %	0.134 ppb	0.661 ppb	225.904 ppb	0.494 ppb	102.733 %	0.000 ppb	0.033 ppb
Concentration per Run 1	22.708 ppb	97.443 %	0.175 ppb	1.198 ppb	244.323 ppb	0.328 ppb	98.524 %	0.002 ppb	0.028 ppb
Concentration per Run 2	19.987 ppb	109.682 %	0.120 ppb	0.310 ppb	219.121 ppb	0.540 ppb	104.242 %	-0.003 ppb	0.040 ppb
Concentration per Run 3	19.626 ppb	111.346 %	0.106 ppb	0.476 ppb	214.268 ppb	0.613 ppb	105.434 %	0.002 ppb	0.030 ppb
Concentration RSD	8.1 %	7.2 %	27.2 %	71.4 %	7.1 %	30.0 %	3.6 %	1,368.8 %	19.0 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	111.864 %	0.097 ppb	0.497 ppb	155.914 ppb	103.950 %	101.272 %	0.040 ppb	0.045 ppb	101.968 %
Concentration per Run 1	107.598 %	0.049 ppb	0.594 ppb	162.624 ppb	99.051 %	97.003 %	0.042 ppb	0.049 ppb	97.547 %
Concentration per Run 2	113.229 %	0.104 ppb	0.442 ppb	153.862 ppb	105.228 %	101.608 %	0.043 ppb	0.045 ppb	102.516 %
Concentration per Run 3	114.764 %	0.138 ppb	0.454 ppb	151.258 ppb	107.570 %	105.203 %	0.035 ppb	0.041 ppb	105.841 %
Concentration RSD	3.4 %	46.3 %	17.0 %	3.8 %	4.2 %	4.1 %	11.1 %	9.1 %	4.1 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 26 Analysis started at: 6/9/2017 8:28:34 AM Rack: 1
 Analysis label: WG1011079-3D10 2008TL User name: ALPHALAB\metals-instrument Vial: 5

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	101.579 %	106.610 %	5.071 ppb	3,788.275 ppb	1,559.990 ppb	232.267 ppb	1,326.578 ppb	7,909.277 ppb	108.236 %
Concentration per Run 1	103.370 %	105.557 %	4.953 ppb	3,968.622 ppb	1,665.227 ppb	240.022 ppb	1,372.047 ppb	8,275.659 ppb	106.340 %
Concentration per Run 2	100.913 %	103.272 %	5.175 ppb	3,750.708 ppb	1,529.894 ppb	234.195 ppb	1,334.793 ppb	7,867.918 ppb	104.793 %
Concentration per Run 3	100.454 %	111.002 %	5.084 ppb	3,645.494 ppb	1,484.848 ppb	222.583 ppb	1,272.894 ppb	7,584.255 ppb	113.574 %
Concentration RSD	1.5 %	3.7 %	2.2 %	4.4 %	6.0 %	3.8 %	3.8 %	4.4 %	4.3 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	101.050 %	103.512 ppb	53.613 ppb	21.569 ppb	53.184 ppb	116.112 ppb	52.146 ppb	53.650 ppb	29.130 ppb
Concentration per Run 1	102.728 %	110.394 ppb	56.087 ppb	22.648 ppb	55.777 ppb	117.891 ppb	55.159 ppb	56.545 ppb	31.527 ppb
Concentration per Run 2	100.288 %	102.003 ppb	53.609 ppb	21.004 ppb	52.048 ppb	107.773 ppb	50.530 ppb	52.182 ppb	27.954 ppb
Concentration per Run 3	100.135 %	98.139 ppb	51.143 ppb	21.056 ppb	51.727 ppb	122.671 ppb	50.751 ppb	52.223 ppb	27.910 ppb
Concentration RSD	1.4 %	6.1 %	4.6 %	4.3 %	4.2 %	6.6 %	5.0 %	4.7 %	7.1 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	52.799 ppb	108.995 %	12.588 ppb	12.308 ppb	125.165 ppb	102.510 ppb	104.670 %	5.326 ppb	5.536 ppb
Concentration per Run 1	56.073 ppb	105.781 %	13.768 ppb	12.183 ppb	132.648 ppb	110.752 ppb	102.201 %	5.428 ppb	5.634 ppb
Concentration per Run 2	50.215 ppb	107.551 %	12.301 ppb	11.020 ppb	119.230 ppb	98.657 ppb	102.778 %	5.179 ppb	5.613 ppb
Concentration per Run 3	52.110 ppb	113.652 %	11.696 ppb	13.721 ppb	123.616 ppb	98.122 ppb	109.030 %	5.369 ppb	5.362 ppb
Concentration RSD	5.7 %	3.8 %	8.5 %	11.0 %	5.5 %	7.0 %	3.6 %	2.4 %	2.7 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	107.062 %	103.273 ppb	51.615 ppb	220.635 ppb	103.021 %	100.217 %	13.004 ppb	56.584 ppb	100.140 %
Concentration per Run 1	105.728 %	108.752 ppb	53.259 ppb	235.503 ppb	99.842 %	98.403 %	13.702 ppb	59.833 ppb	98.245 %
Concentration per Run 2	104.088 %	100.052 ppb	50.757 ppb	214.503 ppb	101.341 %	95.028 %	12.949 ppb	55.650 ppb	95.863 %
Concentration per Run 3	111.370 %	101.016 ppb	50.829 ppb	211.899 ppb	107.880 %	107.219 %	12.361 ppb	54.269 ppb	106.312 %
Concentration RSD	3.6 %	4.6 %	2.8 %	5.9 %	4.1 %	6.3 %	5.2 %	5.1 %	5.5 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 27 Analysis started at: 6/9/2017 8:31:40 AM Rack: 1
 Analysis label: L1718518-01 2008TL User name: ALPHALAB\metals-instrument Vial: 6

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	98.811 %	106.353 %	0.007 ppb	28,659.263 ppb	1,130.166 ppb	40.146 ppb	490.149 ppb	6,645.343 ppb	106.529 %
Concentration per Run 1	98.801 %	103.036 %	0.004 ppb	30,570.261 ppb	1,193.853 ppb	42.035 ppb	517.919 ppb	7,005.410 ppb	106.257 %
Concentration per Run 2	98.817 %	111.506 %	0.013 ppb	25,988.699 ppb	1,013.147 ppb	36.751 ppb	438.664 ppb	6,085.370 ppb	111.048 %
Concentration per Run 3	98.815 %	104.516 %	0.003 ppb	29,418.828 ppb	1,183.498 ppb	41.653 ppb	513.864 ppb	6,845.249 ppb	102.283 %
Concentration RSD	0.0 %	4.3 %	77.7 %	8.3 %	9.0 %	7.3 %	9.1 %	7.4 %	4.1 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	98.142 %	10.583 ppb	0.145 ppb	0.661 ppb	34.196 ppb	54.072 ppb	0.028 ppb	0.270 ppb	0.506 ppb
Concentration per Run 1	97.958 %	11.257 ppb	0.179 ppb	0.798 ppb	36.560 ppb	58.382 ppb	0.037 ppb	0.259 ppb	0.564 ppb
Concentration per Run 2	97.134 %	9.210 ppb	0.131 ppb	0.576 ppb	30.729 ppb	46.957 ppb	0.019 ppb	0.272 ppb	0.440 ppb
Concentration per Run 3	99.334 %	11.282 ppb	0.126 ppb	0.609 ppb	35.300 ppb	56.877 ppb	0.028 ppb	0.277 ppb	0.513 ppb
Concentration RSD	1.1 %	11.2 %	20.3 %	18.1 %	9.0 %	11.5 %	32.7 %	3.5 %	12.4 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	37.013 ppb	106.400 %	0.226 ppb	-0.723 ppb	29.698 ppb	0.185 ppb	104.371 %	0.004 ppb	0.014 ppb
Concentration per Run 1	39.303 ppb	107.453 %	0.147 ppb	-0.230 ppb	31.425 ppb	0.183 ppb	103.491 %	-0.003 ppb	0.014 ppb
Concentration per Run 2	34.290 ppb	110.150 %	0.286 ppb	-0.999 ppb	28.092 ppb	0.199 ppb	108.248 %	0.008 ppb	0.009 ppb
Concentration per Run 3	37.445 ppb	101.597 %	0.245 ppb	-0.940 ppb	29.577 ppb	0.172 ppb	101.373 %	0.009 ppb	0.019 ppb
Concentration RSD	6.8 %	4.1 %	31.7 %	59.2 %	5.6 %	7.2 %	3.4 %	149.7 %	36.1 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	104.952 %	0.202 ppb	0.798 ppb	8.658 ppb	102.959 %	101.613 %	0.008 ppb	0.026 ppb	106.658 %
Concentration per Run 1	105.173 %	0.201 ppb	0.887 ppb	9.113 ppb	100.289 %	99.502 %	0.007 ppb	0.027 ppb	103.581 %
Concentration per Run 2	107.939 %	0.198 ppb	0.797 ppb	7.901 ppb	108.122 %	106.454 %	0.010 ppb	0.029 ppb	111.261 %
Concentration per Run 3	101.744 %	0.209 ppb	0.709 ppb	8.960 ppb	100.467 %	98.883 %	0.007 ppb	0.022 ppb	105.133 %
Concentration RSD	3.0 %	2.8 %	11.1 %	7.6 %	4.3 %	4.1 %	20.2 %	12.7 %	3.8 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 28 Analysis started at: 6/9/2017 8:34:47 AM Rack: 1
 Analysis label: L1718518-02 2008TL User name: ALPHALAB\metals-instrument Vial: 7

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	98.650 %	106.352 %	0.016 ppb	22,802.909 ppb	1,211.381 ppb	1,174.386 ppb	500.248 ppb	6,842.252 ppb	106.522 %
Concentration per Run 1	99.206 %	106.464 %	0.010 ppb	23,083.795 ppb	1,223.916 ppb	1,182.815 ppb	518.897 ppb	7,020.507 ppb	103.458 %
Concentration per Run 2	98.934 %	107.036 %	0.022 ppb	22,369.195 ppb	1,186.038 ppb	1,171.146 ppb	486.255 ppb	6,722.080 ppb	109.103 %
Concentration per Run 3	97.809 %	105.557 %	0.017 ppb	22,955.738 ppb	1,224.189 ppb	1,169.198 ppb	495.592 ppb	6,784.168 ppb	107.004 %
Concentration RSD	0.8 %	0.7 %	36.0 %	1.7 %	1.8 %	0.6 %	3.4 %	2.3 %	2.7 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	99.617 %	11.920 ppb	0.622 ppb	1.406 ppb	31.913 ppb	85.103 ppb	0.041 ppb	0.462 ppb	0.990 ppb
Concentration per Run 1	99.511 %	11.998 ppb	0.674 ppb	1.388 ppb	33.266 ppb	87.942 ppb	0.024 ppb	0.373 ppb	0.999 ppb
Concentration per Run 2	100.168 %	11.574 ppb	0.605 ppb	1.436 ppb	30.851 ppb	84.612 ppb	0.054 ppb	0.546 ppb	0.886 ppb
Concentration per Run 3	99.173 %	12.187 ppb	0.587 ppb	1.393 ppb	31.621 ppb	82.754 ppb	0.044 ppb	0.467 ppb	1.085 ppb
Concentration RSD	0.5 %	2.6 %	7.4 %	1.9 %	3.9 %	3.1 %	36.9 %	18.8 %	10.1 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	0.953 ppb	106.615 %	0.356 ppb	-0.033 ppb	30.254 ppb	0.127 ppb	104.024 %	0.003 ppb	0.015 ppb
Concentration per Run 1	0.947 ppb	102.058 %	0.283 ppb	-0.309 ppb	30.907 ppb	0.103 ppb	102.352 %	0.002 ppb	0.014 ppb
Concentration per Run 2	1.032 ppb	108.094 %	0.462 ppb	0.285 ppb	29.972 ppb	0.083 ppb	104.271 %	0.005 ppb	0.023 ppb
Concentration per Run 3	0.880 ppb	109.693 %	0.323 ppb	-0.074 ppb	29.883 ppb	0.195 ppb	105.449 %	0.001 ppb	0.009 ppb
Concentration RSD	8.0 %	3.8 %	26.4 %	915.8 %	1.9 %	46.9 %	1.5 %	101.0 %	45.9 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	106.326 %	0.019 ppb	0.381 ppb	8.908 ppb	103.874 %	103.787 %	0.009 ppb	0.152 ppb	106.619 %
Concentration per Run 1	106.081 %	0.032 ppb	0.355 ppb	9.101 ppb	102.131 %	100.876 %	0.010 ppb	0.154 ppb	104.291 %
Concentration per Run 2	106.297 %	0.013 ppb	0.358 ppb	9.240 ppb	104.236 %	105.251 %	0.009 ppb	0.145 ppb	107.206 %
Concentration per Run 3	106.601 %	0.011 ppb	0.430 ppb	8.382 ppb	105.256 %	105.234 %	0.008 ppb	0.158 ppb	108.360 %
Concentration RSD	0.2 %	60.8 %	11.2 %	5.2 %	1.5 %	2.4 %	12.0 %	4.2 %	2.0 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 29 Analysis started at: 6/9/2017 8:37:54 AM Rack: 1
 Analysis label: L1718753-01 2008TL User name: ALPHALAB\metals-instrument Vial: 8

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	93.327 %	106.061 %	0.033 ppb	73,463.683 ppb	6,715.660 ppb	136.695 ppb	10,444.209 ppb	16,750.662 ppb	105.462 %
Concentration per Run 1	93.663 %	104.179 %	0.036 ppb	76,309.929 ppb	7,077.543 ppb	141.783 ppb	10,855.013 ppb	17,196.898 ppb	103.648 %
Concentration per Run 2	93.018 %	105.590 %	0.030 ppb	71,233.848 ppb	6,570.023 ppb	130.982 ppb	10,198.221 ppb	16,348.307 ppb	106.755 %
Concentration per Run 3	93.301 %	108.414 %	0.033 ppb	72,847.272 ppb	6,499.415 ppb	137.320 ppb	10,279.392 ppb	16,706.783 ppb	105.984 %
Concentration RSD	0.3 %	2.0 %	8.7 %	3.5 %	4.7 %	4.0 %	3.4 %	2.5 %	1.5 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	93.354 %	34.841 ppb	0.437 ppb	0.583 ppb	112.233 ppb	657.938 ppb	0.351 ppb	1.306 ppb	62.554 ppb
Concentration per Run 1	93.851 %	36.175 ppb	0.401 ppb	0.596 ppb	115.541 ppb	664.357 ppb	0.392 ppb	1.118 ppb	63.955 ppb
Concentration per Run 2	92.325 %	30.109 ppb	0.415 ppb	0.546 ppb	108.649 ppb	653.482 ppb	0.323 ppb	1.403 ppb	60.620 ppb
Concentration per Run 3	93.884 %	38.240 ppb	0.495 ppb	0.606 ppb	112.507 ppb	655.976 ppb	0.336 ppb	1.398 ppb	63.087 ppb
Concentration RSD	1.0 %	12.1 %	11.6 %	5.5 %	3.1 %	0.9 %	10.5 %	12.5 %	2.8 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	57.006 ppb	105.354 %	0.627 ppb	0.949 ppb	82.645 ppb	0.282 ppb	104.412 %	0.060 ppb	0.083 ppb
Concentration per Run 1	59.018 ppb	104.429 %	0.603 ppb	1.124 ppb	83.662 ppb	0.261 ppb	102.811 %	0.060 ppb	0.076 ppb
Concentration per Run 2	54.254 ppb	106.047 %	0.519 ppb	0.568 ppb	80.408 ppb	0.284 ppb	107.239 %	0.063 ppb	0.082 ppb
Concentration per Run 3	57.745 ppb	105.588 %	0.758 ppb	1.154 ppb	83.865 ppb	0.301 ppb	103.186 %	0.059 ppb	0.090 ppb
Concentration RSD	4.3 %	0.8 %	19.3 %	34.8 %	2.3 %	7.1 %	2.4 %	3.5 %	8.7 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	102.845 %	0.250 ppb	0.340 ppb	25.056 ppb	103.219 %	107.046 %	0.012 ppb	1.615 ppb	106.882 %
Concentration per Run 1	101.648 %	0.273 ppb	0.348 ppb	25.294 ppb	102.299 %	104.284 %	0.013 ppb	1.613 ppb	105.396 %
Concentration per Run 2	105.645 %	0.285 ppb	0.323 ppb	24.389 ppb	106.265 %	109.929 %	0.011 ppb	1.544 ppb	108.408 %
Concentration per Run 3	101.243 %	0.193 ppb	0.350 ppb	25.483 ppb	101.092 %	106.924 %	0.013 ppb	1.687 ppb	106.840 %
Concentration RSD	2.4 %	20.1 %	4.3 %	2.3 %	2.6 %	2.6 %	9.0 %	4.4 %	1.4 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 30 Analysis started at: 6/9/2017 8:41:01 AM Rack: 1
 Analysis label: L1718753-02 2008TL User name: ALPHALAB\metals-instrument Vial: 9

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	91.373 %	97.121 %	0.010 ppb	108,037.680 ppb	6,577.310 ppb	12.094 ppb	11,572.964 ppb	16,999.524 ppb	98.809 %
Concentration per Run 1	90.774 %	101.961 %	0.005 ppb	100,517.869 ppb	6,122.095 ppb	11.570 ppb	10,848.375 ppb	15,963.339 ppb	102.344 %
Concentration per Run 2	91.770 %	95.844 %	0.013 ppb	115,205.170 ppb	6,918.978 ppb	13.070 ppb	12,191.058 ppb	18,241.921 ppb	94.281 %
Concentration per Run 3	91.573 %	93.559 %	0.010 ppb	108,390.000 ppb	6,690.857 ppb	11.641 ppb	11,679.458 ppb	16,793.312 ppb	99.803 %
Concentration RSD	0.6 %	4.5 %	42.9 %	6.8 %	6.2 %	7.0 %	5.9 %	6.8 %	4.2 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	93.572 %	28.887 ppb	0.297 ppb	0.469 ppb	5.957 ppb	29.940 ppb	0.082 ppb	0.573 ppb	13.787 ppb
Concentration per Run 1	92.631 %	32.170 ppb	0.343 ppb	0.474 ppb	5.378 ppb	30.585 ppb	0.060 ppb	0.463 ppb	12.323 ppb
Concentration per Run 2	94.077 %	27.774 ppb	0.290 ppb	0.478 ppb	6.735 ppb	28.120 ppb	0.071 ppb	0.538 ppb	14.998 ppb
Concentration per Run 3	94.008 %	26.719 ppb	0.259 ppb	0.456 ppb	5.758 ppb	31.116 ppb	0.115 ppb	0.718 ppb	14.039 ppb
Concentration RSD	0.9 %	10.0 %	14.3 %	2.5 %	11.7 %	5.3 %	35.7 %	22.9 %	9.8 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	26.964 ppb	98.227 %	0.294 ppb	0.223 ppb	84.035 ppb	0.273 ppb	95.115 %	0.005 ppb	0.027 ppb
Concentration per Run 1	24.347 ppb	106.006 %	0.285 ppb	0.522 ppb	76.398 ppb	0.287 ppb	101.667 %	0.003 ppb	0.034 ppb
Concentration per Run 2	28.854 ppb	94.839 %	0.305 ppb	-0.299 ppb	89.532 ppb	0.282 ppb	92.555 %	0.006 ppb	0.031 ppb
Concentration per Run 3	27.692 ppb	93.837 %	0.294 ppb	0.445 ppb	86.175 ppb	0.249 ppb	91.122 %	0.005 ppb	0.016 ppb
Concentration RSD	8.7 %	6.9 %	3.3 %	203.5 %	8.1 %	7.6 %	6.0 %	34.5 %	36.0 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	94.782 %	0.063 ppb	0.295 ppb	12.513 ppb	96.641 %	100.907 %	0.006 ppb	0.101 ppb	97.959 %
Concentration per Run 1	100.094 %	0.049 ppb	0.247 ppb	11.689 ppb	99.962 %	104.431 %	0.006 ppb	0.091 ppb	104.995 %
Concentration per Run 2	92.276 %	0.083 ppb	0.322 ppb	13.408 ppb	93.331 %	96.968 %	0.006 ppb	0.109 ppb	94.732 %
Concentration per Run 3	91.975 %	0.058 ppb	0.316 ppb	12.443 ppb	96.629 %	101.323 %	0.006 ppb	0.104 ppb	94.149 %
Concentration RSD	4.9 %	27.8 %	14.2 %	6.9 %	3.4 %	3.7 %	6.0 %	9.3 %	6.2 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 31 Analysis started at: 6/9/2017 8:44:09 AM Rack: 1
 Analysis label: L1718985-01 2008TL User name: ALPHALAB\metals-instrument Vial: 10

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	95.929 %	100.560 %	0.017 ppb	104,285.788 ppb	25,295.386 ppb	167.649 ppb	1,222.192 ppb	121,261.873 ppb	104.297 %
Concentration per Run 1	95.713 %	96.953 %	0.025 ppb	98,348.771 ppb	23,938.875 ppb	157.190 ppb	1,157.899 ppb	113,280.969 ppb	103.140 %
Concentration per Run 2	96.943 %	103.406 %	0.010 ppb	107,193.930 ppb	26,042.817 ppb	172.356 ppb	1,233.880 ppb	125,197.396 ppb	105.355 %
Concentration per Run 3	95.133 %	101.322 %	0.016 ppb	107,314.662 ppb	25,904.465 ppb	173.400 ppb	1,274.798 ppb	125,307.255 ppb	104.395 %
Concentration RSD	1.0 %	3.3 %	44.7 %	4.9 %	4.7 %	5.4 %	4.9 %	5.7 %	1.1 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	95.433 %	190.838 ppb	0.574 ppb	0.537 ppb	132.013 ppb	357.747 ppb	0.287 ppb	1.759 ppb	2.849 ppb
Concentration per Run 1	94.943 %	180.121 ppb	0.568 ppb	0.439 ppb	125.319 ppb	342.220 ppb	0.287 ppb	1.744 ppb	2.690 ppb
Concentration per Run 2	96.666 %	195.754 ppb	0.619 ppb	0.530 ppb	134.649 ppb	374.322 ppb	0.312 ppb	1.903 ppb	2.807 ppb
Concentration per Run 3	94.690 %	196.639 ppb	0.535 ppb	0.643 ppb	136.072 ppb	356.698 ppb	0.263 ppb	1.628 ppb	3.049 ppb
Concentration RSD	1.1 %	4.9 %	7.4 %	19.0 %	4.4 %	4.5 %	8.4 %	7.8 %	6.4 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	93.727 ppb	102.212 %	1.898 ppb	0.321 ppb	923.354 ppb	1.233 ppb	99.457 %	0.005 ppb	0.058 ppb
Concentration per Run 1	89.836 ppb	97.334 %	1.833 ppb	0.537 ppb	886.256 ppb	0.974 ppb	96.777 %	0.007 ppb	0.057 ppb
Concentration per Run 2	94.931 ppb	103.548 %	1.686 ppb	-0.343 ppb	961.150 ppb	1.390 ppb	100.542 %	0.005 ppb	0.061 ppb
Concentration per Run 3	96.416 ppb	105.753 %	2.174 ppb	0.770 ppb	922.656 ppb	1.334 ppb	101.052 %	0.003 ppb	0.055 ppb
Concentration RSD	3.7 %	4.3 %	13.2 %	182.6 %	4.1 %	18.3 %	2.3 %	46.1 %	5.2 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	105.228 %	0.105 ppb	0.234 ppb	52.203 ppb	102.052 %	100.125 %	0.014 ppb	1.146 ppb	99.576 %
Concentration per Run 1	103.642 %	0.067 ppb	0.240 ppb	49.048 ppb	101.532 %	99.235 %	0.011 ppb	1.085 ppb	98.573 %
Concentration per Run 2	104.424 %	0.248 ppb	0.235 ppb	54.490 ppb	102.861 %	99.784 %	0.014 ppb	1.175 ppb	100.311 %
Concentration per Run 3	107.618 %	0.000 ppb	0.226 ppb	53.071 ppb	101.765 %	101.355 %	0.017 ppb	1.178 ppb	99.842 %
Concentration RSD	2.0 %	121.8 %	3.0 %	5.4 %	0.7 %	1.1 %	20.0 %	4.6 %	0.9 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 32 Analysis started at: 6/9/2017 8:47:17 AM Rack: 0
 Analysis label: CCV User name: ALPHALAB\metals-instrument Vial: 9

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	96.075 %	102.879 %	97.476 ppb	10,450.950 ppb	9,644.099 ppb	100.348 ppb	10,167.722 ppb	10,157.026 ppb	105.613 %
Concentration per Run 1	95.890 %	100.650 %	97.568 ppb	10,335.312 ppb	9,538.385 ppb	98.169 ppb	9,920.819 ppb	10,020.690 ppb	102.096 %
Concentration per Run 2	96.103 %	101.255 %	97.419 ppb	10,546.291 ppb	9,772.421 ppb	103.229 ppb	10,319.079 ppb	9,966.144 ppb	108.889 %
Concentration per Run 3	96.233 %	106.733 %	97.440 ppb	10,471.246 ppb	9,621.491 ppb	99.647 ppb	10,263.268 ppb	10,484.243 ppb	105.853 %
Recovery Percentage 1			97.476 %	104.509 %	96.441 %	100.348 %	101.677 %	101.570 %	
Concentration RSD	0.2 %	3.3 %	0.1 %	1.0 %	1.2 %	2.6 %	2.1 %	2.8 %	3.2 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	95.796 %	101.965 ppb	97.404 ppb	98.100 ppb	99.664 ppb	10,024.849 ppb	101.188 ppb	101.520 ppb	101.848 ppb
Concentration per Run 1	94.808 %	98.735 ppb	95.795 ppb	95.958 ppb	100.073 ppb	10,043.078 ppb	102.086 ppb	101.181 ppb	101.473 ppb
Concentration per Run 2	95.781 %	102.720 ppb	97.568 ppb	97.584 ppb	100.140 ppb	10,016.917 ppb	100.262 ppb	102.909 ppb	103.226 ppb
Concentration per Run 3	96.799 %	104.441 ppb	98.849 ppb	100.758 ppb	98.778 ppb	10,014.553 ppb	101.218 ppb	100.472 ppb	100.846 ppb
Recovery Percentage 1		101.965 %	97.404 %	98.100 %	99.664 %	100.248 %	101.188 %	101.520 %	101.848 %
Concentration RSD	1.0 %	2.9 %	1.6 %	2.5 %	0.8 %	0.2 %	0.9 %	1.2 %	1.2 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	95.360 ppb	101.524 %	94.733 ppb	93.500 ppb	100.986 ppb	102.132 ppb	100.716 %	99.451 ppb	100.724 ppb
Concentration per Run 1	98.094 ppb	95.881 %	95.953 ppb	93.218 ppb	100.111 ppb	101.127 ppb	97.617 %	98.532 ppb	100.359 ppb
Concentration per Run 2	94.813 ppb	103.700 %	95.745 ppb	97.033 ppb	102.134 ppb	102.024 ppb	101.798 %	100.184 ppb	100.837 ppb
Concentration per Run 3	93.173 ppb	104.991 %	92.501 ppb	90.251 ppb	100.712 ppb	103.244 ppb	102.734 %	99.636 ppb	100.976 ppb
Recovery Percentage 1	95.360 %		94.733 %	93.500 %	100.986 %	102.132 %		99.451 %	100.724 %
Concentration RSD	2.6 %	4.9 %	2.0 %	3.6 %	1.0 %	1.0 %	2.7 %	0.8 %	0.3 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	102.191 %	102.985 ppb	90.364 ppb	98.036 ppb	100.732 %	102.234 %	99.668 ppb	99.412 ppb	102.047 %
Concentration per Run 1	98.409 %	102.806 ppb	90.395 ppb	97.414 ppb	96.755 %	98.440 %	98.711 ppb	96.561 ppb	99.475 %
Concentration per Run 2	104.584 %	102.410 ppb	90.571 ppb	99.351 ppb	103.193 %	104.190 %	99.873 ppb	101.592 ppb	102.495 %
Concentration per Run 3	103.578 %	103.739 ppb	90.127 ppb	97.345 ppb	102.250 %	104.071 %	100.419 ppb	100.083 ppb	104.170 %
Recovery Percentage 1		102.985 %	90.364 %	98.036 %			99.668 %	99.412 %	
Concentration RSD	3.2 %	0.7 %	0.2 %	1.2 %	3.5 %	3.2 %	0.9 %	2.6 %	2.3 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 33 Analysis started at: 6/9/2017 8:50:26 AM Rack: 0
 Analysis label: CCB User name: ALPHALAB\metals-instrument Vial: 10

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	96.902 %	107.193 %	0.008 ppb	0.380 ppb	-0.080 ppb	-0.193 ppb	4.983 ppb	-0.791 ppb	105.012 %
Concentration per Run 1	96.982 %	109.321 %	0.009 ppb	4.646 ppb	-0.094 ppb	-0.056 ppb	6.347 ppb	-3.021 ppb	104.419 %
Concentration per Run 2	97.239 %	107.742 %	0.006 ppb	-8.458 ppb	-0.443 ppb	-0.130 ppb	1.872 ppb	2.053 ppb	107.110 %
Concentration per Run 3	96.485 %	104.515 %	0.008 ppb	4.953 ppb	0.298 ppb	-0.395 ppb	6.731 ppb	-1.406 ppb	103.505 %
Recovery Percentage 1			2.691 %	0.380 %	-0.114 %	-1.934 %	4.983 %	-0.791 %	
Concentration RSD	0.4 %	2.3 %	19.0 %	2,013.6 %	465.9 %	92.2 %	54.2 %	327.6 %	1.8 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	96.758 %	0.011 ppb	0.007 ppb	0.021 ppb	0.053 ppb	0.203 ppb	-0.004 ppb	0.008 ppb	-0.002 ppb
Concentration per Run 1	96.049 %	0.011 ppb	0.019 ppb	-0.008 ppb	0.007 ppb	0.491 ppb	-0.001 ppb	0.043 ppb	0.015 ppb
Concentration per Run 2	98.170 %	-0.002 ppb	0.001 ppb	0.020 ppb	0.061 ppb	0.185 ppb	-0.005 ppb	-0.012 ppb	-0.030 ppb
Concentration per Run 3	96.054 %	0.024 ppb	0.002 ppb	0.051 ppb	0.091 ppb	-0.067 ppb	-0.005 ppb	-0.008 ppb	0.010 ppb
Recovery Percentage 1		2.181 %	0.149 %	2.106 %	5.301 %	0.406 %	-0.741 %	0.392 %	-0.172 %
Concentration RSD	1.3 %	121.9 %	132.5 %	141.2 %	80.8 %	137.8 %	55.2 %	391.0 %	1,429.8 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	0.089 ppb	105.680 %	0.037 ppb	0.057 ppb	-0.009 ppb	0.104 ppb	103.841 %	0.012 ppb	0.003 ppb
Concentration per Run 1	-0.061 ppb	108.040 %	0.036 ppb	0.602 ppb	-0.021 ppb	0.126 ppb	102.556 %	0.009 ppb	0.000 ppb
Concentration per Run 2	0.207 ppb	106.234 %	0.049 ppb	-1.133 ppb	-0.011 ppb	0.059 ppb	104.461 %	0.017 ppb	0.005 ppb
Concentration per Run 3	0.121 ppb	102.765 %	0.026 ppb	0.701 ppb	0.004 ppb	0.126 ppb	104.505 %	0.010 ppb	0.005 ppb
Recovery Percentage 1	0.889 %	105.680 %	7.428 %	1.136 %	-1.840 %	5.188 %		3.041 %	1.525 %
Concentration RSD	153.5 %	2.5 %	32.2 %	1,816.2 %	134.9 %	37.3 %	1.1 %	32.9 %	86.6 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	105.938 %	0.108 ppb	0.805 ppb	-0.023 ppb	104.040 %	105.073 %	0.012 ppb	0.019 ppb	106.965 %
Concentration per Run 1	104.733 %	0.117 ppb	0.813 ppb	0.010 ppb	102.320 %	103.297 %	0.011 ppb	0.023 ppb	104.588 %
Concentration per Run 2	107.872 %	0.125 ppb	0.750 ppb	-0.040 ppb	106.182 %	107.450 %	0.012 ppb	0.017 ppb	108.107 %
Concentration per Run 3	105.208 %	0.083 ppb	0.852 ppb	-0.039 ppb	103.617 %	104.472 %	0.013 ppb	0.017 ppb	108.200 %
Recovery Percentage 1		3.610 %	20.121 %	-4.659 %			2.394 %	3.793 %	106.965 %
Concentration RSD	1.6 %	20.3 %	6.4 %	122.4 %	1.9 %	2.0 %	8.3 %	17.0 %	1.9 %

Alpha ICPMSQ2 Full

6/10/2017 10:11:47 AM



Analysis index: 34 Analysis started at: 6/9/2017 8:54:39 AM Rack: 1
 Analysis label: WG1010767-1 6020TL User name: ALPHALAB\metals-instrument Vial: 12

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	97.420 %	105.378 %	0.006 ppb	-6.385 ppb	0.225 ppb	0.499 ppb	-3.048 ppb	22.380 ppb	103.114 %
Concentration per Run 1	98.546 %	102.969 %	0.010 ppb	5.760 ppb	-0.391 ppb	0.602 ppb	-2.428 ppb	17.229 ppb	99.463 %
Concentration per Run 2	96.692 %	104.011 %	0.005 ppb	-18.135 ppb	0.496 ppb	0.401 ppb	-3.780 ppb	22.325 ppb	101.605 %
Concentration per Run 3	97.023 %	109.153 %	0.003 ppb	-6.781 ppb	0.570 ppb	0.495 ppb	-2.935 ppb	27.587 ppb	108.273 %
Concentration RSD	1.0 %	3.1 %	68.9 %	187.2 %	237.8 %	20.1 %	22.4 %	23.1 %	4.5 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	96.514 %	0.045 ppb	0.011 ppb	0.016 ppb	0.024 ppb	0.548 ppb	-0.002 ppb	-0.034 ppb	-0.018 ppb
Concentration per Run 1	98.403 %	0.027 ppb	0.021 ppb	-0.026 ppb	0.076 ppb	0.288 ppb	-0.005 ppb	-0.004 ppb	-0.026 ppb
Concentration per Run 2	95.504 %	0.038 ppb	0.011 ppb	0.034 ppb	0.014 ppb	0.592 ppb	-0.001 ppb	-0.033 ppb	-0.025 ppb
Concentration per Run 3	95.635 %	0.070 ppb	0.001 ppb	0.040 ppb	-0.018 ppb	0.763 ppb	-0.001 ppb	-0.066 ppb	-0.003 ppb
Concentration RSD	1.7 %	49.7 %	87.0 %	230.5 %	197.5 %	43.9 %	85.5 %	89.7 %	74.1 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	-0.273 ppb	101.234 %	0.039 ppb	0.581 ppb	0.028 ppb	0.050 ppb	102.344 %	0.003 ppb	0.006 ppb
Concentration per Run 1	-0.287 ppb	100.015 %	0.026 ppb	1.086 ppb	0.036 ppb	0.046 ppb	98.931 %	0.003 ppb	0.015 ppb
Concentration per Run 2	-0.241 ppb	98.214 %	0.040 ppb	0.140 ppb	0.015 ppb	0.045 ppb	101.995 %	0.002 ppb	0.000 ppb
Concentration per Run 3	-0.290 ppb	105.473 %	0.050 ppb	0.516 ppb	0.034 ppb	0.058 ppb	106.106 %	0.004 ppb	0.005 ppb
Concentration RSD	10.0 %	3.7 %	30.5 %	82.0 %	41.0 %	14.5 %	3.5 %	42.0 %	116.8 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	103.733 %	-0.052 ppb	0.292 ppb	-0.019 ppb	102.064 %	102.238 %	0.003 ppb	0.010 ppb	107.581 %
Concentration per Run 1	100.824 %	-0.074 ppb	0.307 ppb	-0.025 ppb	97.769 %	98.777 %	0.002 ppb	0.007 ppb	103.082 %
Concentration per Run 2	103.636 %	-0.087 ppb	0.263 ppb	-0.015 ppb	103.078 %	102.591 %	0.003 ppb	0.011 ppb	107.997 %
Concentration per Run 3	106.739 %	0.007 ppb	0.305 ppb	-0.016 ppb	105.344 %	105.345 %	0.003 ppb	0.011 ppb	111.665 %
Concentration RSD	2.9 %	98.5 %	8.6 %	31.4 %	3.8 %	3.2 %	24.7 %	21.9 %	4.0 %

Alpha ICPMSQ2 Full

6/10/2017 10:11:47 AM



Analysis index: 35 Analysis started at: 6/9/2017 8:57:48 AM Rack: 1
 Analysis label: WG1010767-2D5 6020TL User name: ALPHALAB\metals-instrument Vial: 13

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	97.451 %	102.992 %	9.889 ppb	2,258.921 ppb	2,080.813 ppb	441.396 ppb	2,169.235 ppb	2,318.266 ppb	102.459 %
Concentration per Run 1	97.855 %	107.708 %	9.809 ppb	2,166.583 ppb	1,992.264 ppb	423.662 ppb	2,087.038 ppb	2,182.310 ppb	101.988 %
Concentration per Run 2	97.848 %	106.901 %	9.995 ppb	2,330.271 ppb	2,135.738 ppb	449.330 ppb	2,227.792 ppb	2,372.457 ppb	106.541 %
Concentration per Run 3	96.650 %	94.365 %	9.864 ppb	2,279.910 ppb	2,114.436 ppb	451.196 ppb	2,192.874 ppb	2,400.032 ppb	98.849 %
Concentration RSD	0.7 %	7.3 %	1.0 %	3.7 %	3.7 %	3.5 %	3.4 %	5.1 %	3.8 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	97.684 %	184.547 ppb	103.015 ppb	41.171 ppb	103.678 ppb	217.772 ppb	102.718 ppb	103.374 ppb	52.236 ppb
Concentration per Run 1	97.042 %	181.495 ppb	100.767 ppb	40.468 ppb	101.578 ppb	207.193 ppb	101.061 ppb	101.357 ppb	50.476 ppb
Concentration per Run 2	98.437 %	186.965 ppb	105.346 ppb	41.688 ppb	104.674 ppb	228.046 ppb	104.494 ppb	104.823 ppb	53.517 ppb
Concentration per Run 3	97.574 %	185.180 ppb	102.932 ppb	41.356 ppb	104.781 ppb	218.077 ppb	102.598 ppb	103.941 ppb	52.714 ppb
Concentration RSD	0.7 %	1.5 %	2.2 %	1.5 %	1.8 %	4.8 %	1.7 %	1.7 %	3.0 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	101.280 ppb	101.848 %	23.459 ppb	24.147 ppb	204.459 ppb	200.284 ppb	102.505 %	10.240 ppb	10.922 ppb
Concentration per Run 1	97.984 ppb	102.748 %	23.789 ppb	21.652 ppb	200.124 ppb	194.070 ppb	102.212 %	9.909 ppb	10.703 ppb
Concentration per Run 2	103.980 ppb	104.427 %	23.157 ppb	24.759 ppb	212.356 ppb	203.415 ppb	106.979 %	10.291 ppb	10.987 ppb
Concentration per Run 3	101.876 ppb	98.371 %	23.430 ppb	26.028 ppb	200.899 ppb	203.368 ppb	98.325 %	10.519 ppb	11.074 ppb
Concentration RSD	3.0 %	3.1 %	1.4 %	9.3 %	3.3 %	2.7 %	4.2 %	3.0 %	1.8 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	101.988 %	205.636 ppb	96.842 ppb	397.663 ppb	100.872 %	101.178 %	24.559 ppb	106.116 ppb	104.178 %
Concentration per Run 1	104.309 %	200.125 ppb	93.210 ppb	392.852 ppb	102.039 %	104.057 %	23.687 ppb	103.032 ppb	106.028 %
Concentration per Run 2	106.180 %	207.866 ppb	99.840 ppb	404.873 ppb	104.629 %	104.656 %	25.039 ppb	108.873 ppb	107.245 %
Concentration per Run 3	95.475 %	208.918 ppb	97.476 ppb	395.266 ppb	95.947 %	94.821 %	24.949 ppb	106.444 ppb	99.262 %
Concentration RSD	5.6 %	2.3 %	3.5 %	1.6 %	4.4 %	5.4 %	3.1 %	2.8 %	4.1 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 36 Analysis started at: 6/9/2017 9:00:52 AM Rack: 1
 Analysis label: L1718985-02 2008TL User name: ALPHALAB\metals-instrument Vial: 11

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	98.627 %	107.629 %	0.007 ppb	45,202.974 ppb	20,020.201 ppb	7.192 ppb	967.819 ppb	72,331.220 ppb	109.095 %
Concentration per Run 1	98.921 %	109.422 %	0.002 ppb	43,080.617 ppb	20,486.375 ppb	7.268 ppb	966.177 ppb	74,367.781 ppb	104.739 %
Concentration per Run 2	98.655 %	105.859 %	0.006 ppb	46,892.150 ppb	20,221.336 ppb	7.172 ppb	968.785 ppb	72,050.564 ppb	109.910 %
Concentration per Run 3	98.305 %	107.607 %	0.011 ppb	45,636.154 ppb	19,352.891 ppb	7.138 ppb	968.495 ppb	70,575.315 ppb	112.638 %
Concentration RSD	0.3 %	1.7 %	67.2 %	4.3 %	3.0 %	0.9 %	0.1 %	2.6 %	3.7 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	99.663 %	111.408 ppb	0.160 ppb	0.169 ppb	262.471 ppb	861.739 ppb	0.090 ppb	0.363 ppb	5.798 ppb
Concentration per Run 1	100.141 %	114.577 ppb	0.148 ppb	0.186 ppb	272.597 ppb	884.708 ppb	0.114 ppb	0.352 ppb	6.347 ppb
Concentration per Run 2	99.469 %	111.823 ppb	0.131 ppb	0.186 ppb	259.351 ppb	865.395 ppb	0.069 ppb	0.322 ppb	5.394 ppb
Concentration per Run 3	99.380 %	107.824 ppb	0.202 ppb	0.135 ppb	255.465 ppb	835.113 ppb	0.087 ppb	0.415 ppb	5.655 ppb
Concentration RSD	0.4 %	3.0 %	22.9 %	17.3 %	3.4 %	2.9 %	24.9 %	13.1 %	8.5 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	68.194 ppb	108.446 %	7.068 ppb	0.014 ppb	309.975 ppb	0.734 ppb	103.527 %	0.006 ppb	0.021 ppb
Concentration per Run 1	72.350 ppb	103.874 %	7.140 ppb	-0.516 ppb	319.042 ppb	0.753 ppb	101.588 %	0.007 ppb	0.032 ppb
Concentration per Run 2	66.636 ppb	112.467 %	7.016 ppb	0.004 ppb	302.762 ppb	0.700 ppb	103.883 %	0.010 ppb	0.013 ppb
Concentration per Run 3	65.597 ppb	108.997 %	7.049 ppb	0.556 ppb	308.121 ppb	0.749 ppb	105.110 %	0.001 ppb	0.018 ppb
Concentration RSD	5.3 %	4.0 %	0.9 %	3,704.0 %	2.7 %	4.1 %	1.7 %	72.4 %	46.9 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	110.319 %	0.470 ppb	1.562 ppb	52.398 ppb	106.392 %	104.371 %	0.011 ppb	0.308 ppb	104.136 %
Concentration per Run 1	107.406 %	0.465 ppb	1.599 ppb	53.269 ppb	102.720 %	100.293 %	0.014 ppb	0.332 ppb	102.682 %
Concentration per Run 2	112.450 %	0.486 ppb	1.660 ppb	52.427 ppb	107.906 %	105.447 %	0.011 ppb	0.308 ppb	103.828 %
Concentration per Run 3	111.101 %	0.458 ppb	1.426 ppb	51.499 ppb	108.549 %	107.374 %	0.007 ppb	0.285 ppb	105.899 %
Concentration RSD	2.4 %	3.2 %	7.8 %	1.7 %	3.0 %	3.5 %	33.3 %	7.7 %	1.6 %

Alpha ICPMSQ2 Full

6/10/2017 10:11:47 AM



Analysis index: 37 Analysis started at: 6/9/2017 9:04:00 AM Rack: 1
 Analysis label: L1718726-02 6020TL User name: ALPHALAB\metals-instrument Vial: 14

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	97.720 %	104.862 %	0.131 ppb	4,577.309 ppb	5,652.582 ppb	1,629.012 ppb	4,738.557 ppb	52,296.081 ppb	104.292 %
Concentration per Run 1	97.427 %	103.305 %	0.118 ppb	4,452.859 ppb	5,468.313 ppb	1,603.289 ppb	4,673.025 ppb	51,227.265 ppb	103.246 %
Concentration per Run 2	97.442 %	108.918 %	0.137 ppb	4,581.746 ppb	5,615.352 ppb	1,619.357 ppb	4,739.299 ppb	52,923.749 ppb	104.668 %
Concentration per Run 3	98.289 %	102.364 %	0.139 ppb	4,697.322 ppb	5,874.081 ppb	1,664.390 ppb	4,803.348 ppb	52,737.228 ppb	104.964 %
Concentration RSD	0.5 %	3.4 %	8.9 %	2.7 %	3.6 %	1.9 %	1.4 %	1.8 %	0.9 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	96.289 %	122.355 ppb	4.920 ppb	2.072 ppb	181.578 ppb	2,912.616 ppb	1.136 ppb	2.430 ppb	3.810 ppb
Concentration per Run 1	95.270 %	121.291 ppb	4.476 ppb	2.059 ppb	181.865 ppb	2,945.212 ppb	1.134 ppb	2.293 ppb	3.798 ppb
Concentration per Run 2	95.155 %	125.921 ppb	5.056 ppb	2.014 ppb	179.783 ppb	2,884.115 ppb	1.135 ppb	2.250 ppb	3.722 ppb
Concentration per Run 3	98.441 %	119.854 ppb	5.227 ppb	2.142 ppb	183.085 ppb	2,908.521 ppb	1.138 ppb	2.746 ppb	3.910 ppb
Concentration RSD	1.9 %	2.6 %	8.0 %	3.1 %	0.9 %	1.1 %	0.2 %	11.3 %	2.5 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	10.446 ppb	103.397 %	1.333 ppb	1.819 ppb	374.123 ppb	0.463 ppb	100.996 %	0.013 ppb	0.105 ppb
Concentration per Run 1	10.556 ppb	98.415 %	1.294 ppb	2.265 ppb	371.275 ppb	0.414 ppb	95.983 %	0.006 ppb	0.096 ppb
Concentration per Run 2	9.801 ppb	107.667 %	1.268 ppb	2.372 ppb	372.789 ppb	0.436 ppb	104.397 %	0.017 ppb	0.116 ppb
Concentration per Run 3	10.981 ppb	104.108 %	1.437 ppb	0.821 ppb	378.306 ppb	0.538 ppb	102.607 %	0.016 ppb	0.102 ppb
Concentration RSD	5.7 %	4.5 %	6.8 %	47.6 %	1.0 %	14.3 %	4.4 %	45.2 %	9.7 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	106.484 %	0.042 ppb	0.511 ppb	26.704 ppb	103.423 %	102.878 %	0.022 ppb	2.839 ppb	108.060 %
Concentration per Run 1	103.239 %	0.006 ppb	0.512 ppb	26.376 ppb	98.967 %	99.303 %	0.020 ppb	2.828 ppb	104.206 %
Concentration per Run 2	110.945 %	0.019 ppb	0.496 ppb	26.438 ppb	106.369 %	105.995 %	0.024 ppb	2.822 ppb	109.247 %
Concentration per Run 3	105.268 %	0.100 ppb	0.525 ppb	27.299 ppb	104.932 %	103.335 %	0.021 ppb	2.865 ppb	110.729 %
Concentration RSD	3.8 %	122.6 %	2.8 %	1.9 %	3.8 %	3.3 %	10.4 %	0.8 %	3.2 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 38 Analysis started at: 6/9/2017 9:07:05 AM Rack: 1
 Analysis label: WG1010767-3D10 6020TL User name: ALPHALAB\metals-instrument Vial: 15

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	96.928 %	108.940 %	4.929 ppb	1,585.480 ppb	1,628.255 ppb	417.358 ppb	1,602.534 ppb	6,419.082 ppb	108.309 %
Concentration per Run 1	95.868 %	112.918 %	4.869 ppb	1,638.441 ppb	1,683.606 ppb	450.964 ppb	1,702.271 ppb	6,721.706 ppb	111.785 %
Concentration per Run 2	96.701 %	108.985 %	5.064 ppb	1,558.880 ppb	1,631.031 ppb	405.296 ppb	1,583.207 ppb	6,283.281 ppb	106.280 %
Concentration per Run 3	98.214 %	104.918 %	4.852 ppb	1,559.119 ppb	1,570.127 ppb	395.814 ppb	1,522.124 ppb	6,252.258 ppb	106.862 %
Concentration RSD	1.2 %	3.7 %	2.4 %	2.9 %	3.5 %	7.1 %	5.7 %	4.1 %	2.8 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	97.484 %	101.816 ppb	52.306 ppb	20.292 ppb	69.961 ppb	403.870 ppb	51.218 ppb	51.313 ppb	25.976 ppb
Concentration per Run 1	97.158 %	102.961 ppb	52.154 ppb	20.014 ppb	71.209 ppb	403.496 ppb	50.036 ppb	49.505 ppb	25.117 ppb
Concentration per Run 2	97.388 %	101.688 ppb	52.831 ppb	20.809 ppb	71.768 ppb	415.467 ppb	53.241 ppb	51.955 ppb	26.207 ppb
Concentration per Run 3	97.905 %	100.798 ppb	51.932 ppb	20.054 ppb	66.907 ppb	392.648 ppb	50.376 ppb	52.478 ppb	26.605 ppb
Concentration RSD	0.4 %	1.1 %	0.9 %	2.2 %	3.8 %	2.8 %	3.4 %	3.1 %	3.0 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	51.828 ppb	107.090 %	12.057 ppb	12.887 ppb	142.092 ppb	97.470 ppb	105.608 %	5.059 ppb	5.376 ppb
Concentration per Run 1	51.121 ppb	111.296 %	11.647 ppb	12.133 ppb	147.181 ppb	100.709 ppb	104.104 %	5.077 ppb	5.348 ppb
Concentration per Run 2	52.492 ppb	105.370 %	12.538 ppb	11.808 ppb	138.935 ppb	96.519 ppb	107.862 %	4.924 ppb	5.374 ppb
Concentration per Run 3	51.870 ppb	104.606 %	11.987 ppb	14.721 ppb	140.160 ppb	95.183 ppb	104.860 %	5.175 ppb	5.408 ppb
Concentration RSD	1.3 %	3.4 %	3.7 %	12.4 %	3.1 %	3.0 %	1.9 %	2.5 %	0.6 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	108.533 %	87.455 ppb	47.230 ppb	204.234 ppb	105.807 %	108.403 %	12.194 ppb	53.139 ppb	108.330 %
Concentration per Run 1	108.018 %	90.728 ppb	48.622 ppb	209.740 ppb	104.342 %	109.516 %	12.046 ppb	53.283 ppb	107.165 %
Concentration per Run 2	110.505 %	86.295 ppb	46.235 ppb	199.008 ppb	106.481 %	108.812 %	12.116 ppb	52.728 ppb	109.112 %
Concentration per Run 3	107.076 %	85.343 ppb	46.832 ppb	203.954 ppb	106.599 %	106.880 %	12.420 ppb	53.406 ppb	108.714 %
Concentration RSD	1.6 %	3.3 %	2.6 %	2.6 %	1.2 %	1.3 %	1.6 %	0.7 %	0.9 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 39 Analysis started at: 6/9/2017 9:10:10 AM Rack: 1
 Analysis label: WG1010767-4D10 6020TL User name: ALPHALAB\metals-instrument Vial: 16

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	98.725 %	112.100 %	5.067 ppb	1,577.070 ppb	1,616.891 ppb	411.834 ppb	1,580.558 ppb	6,404.645 ppb	113.343 %
Concentration per Run 1	99.291 %	107.674 %	5.206 ppb	1,570.569 ppb	1,599.737 ppb	401.404 ppb	1,543.533 ppb	6,195.344 ppb	106.459 %
Concentration per Run 2	98.469 %	120.043 %	4.946 ppb	1,608.557 ppb	1,639.762 ppb	434.008 ppb	1,639.750 ppb	6,552.522 ppb	124.373 %
Concentration per Run 3	98.413 %	108.582 %	5.050 ppb	1,552.085 ppb	1,611.174 ppb	400.090 ppb	1,558.392 ppb	6,466.071 ppb	109.198 %
Concentration RSD	0.5 %	6.2 %	2.6 %	1.8 %	1.3 %	4.7 %	3.3 %	2.9 %	8.5 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	98.417 %	100.074 ppb	50.882 ppb	20.352 ppb	69.818 ppb	376.260 ppb	50.077 ppb	50.849 ppb	25.616 ppb
Concentration per Run 1	100.024 %	98.328 ppb	51.900 ppb	20.811 ppb	70.050 ppb	373.912 ppb	51.108 ppb	52.223 ppb	25.754 ppb
Concentration per Run 2	96.425 %	100.725 ppb	48.658 ppb	19.801 ppb	69.715 ppb	376.777 ppb	48.091 ppb	49.459 ppb	24.794 ppb
Concentration per Run 3	98.802 %	101.169 ppb	52.088 ppb	20.445 ppb	69.690 ppb	378.092 ppb	51.032 ppb	50.864 ppb	26.301 ppb
Concentration RSD	1.9 %	1.5 %	3.8 %	2.5 %	0.3 %	0.6 %	3.4 %	2.7 %	3.0 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	50.909 ppb	113.173 %	11.973 ppb	11.490 ppb	142.876 ppb	97.186 ppb	107.764 %	4.961 ppb	5.310 ppb
Concentration per Run 1	51.177 ppb	106.890 %	11.575 ppb	9.415 ppb	138.165 ppb	96.715 ppb	106.122 %	4.891 ppb	5.349 ppb
Concentration per Run 2	49.728 ppb	121.310 %	12.197 ppb	14.211 ppb	150.195 ppb	96.974 ppb	112.120 %	5.015 ppb	5.266 ppb
Concentration per Run 3	51.823 ppb	111.320 %	12.149 ppb	10.844 ppb	140.266 ppb	97.870 ppb	105.049 %	4.977 ppb	5.315 ppb
Concentration RSD	2.1 %	6.5 %	2.9 %	21.4 %	4.5 %	0.6 %	3.5 %	1.3 %	0.8 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	114.813 %	87.442 ppb	47.570 ppb	202.489 ppb	109.242 %	110.339 %	12.119 ppb	52.695 ppb	111.762 %
Concentration per Run 1	109.687 %	86.105 ppb	47.377 ppb	194.862 ppb	105.902 %	105.588 %	12.073 ppb	52.568 ppb	108.031 %
Concentration per Run 2	123.894 %	88.189 ppb	47.993 ppb	209.306 ppb	113.820 %	117.986 %	11.907 ppb	52.298 ppb	117.343 %
Concentration per Run 3	110.858 %	88.032 ppb	47.339 ppb	203.298 ppb	108.004 %	107.442 %	12.376 ppb	53.219 ppb	109.913 %
Concentration RSD	6.9 %	1.3 %	0.8 %	3.6 %	3.8 %	6.1 %	2.0 %	0.9 %	4.4 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 40 Analysis started at: 6/9/2017 9:13:15 AM Rack: 1
 Analysis label: WG1010767-5D10 6020TL User name: ALPHALAB\metals-instrument Vial: 17

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	99.066 %	109.938 %	49.105 ppb	5,529.501 ppb	5,270.486 ppb	209.478 ppb	5,531.145 ppb	9,883.353 ppb	114.771 %
Concentration per Run 1	100.659 %	106.733 %	49.014 ppb	5,213.967 ppb	5,051.266 ppb	191.435 ppb	5,133.085 ppb	9,338.793 ppb	107.290 %
Concentration per Run 2	97.243 %	106.700 %	49.523 ppb	5,548.021 ppb	5,246.727 ppb	210.192 ppb	5,471.816 ppb	9,798.487 ppb	113.219 %
Concentration per Run 3	99.297 %	116.380 %	48.777 ppb	5,826.516 ppb	5,513.466 ppb	226.806 ppb	5,988.534 ppb	10,512.779 ppb	123.806 %
Concentration RSD	1.7 %	5.1 %	0.8 %	5.5 %	4.4 %	8.4 %	7.8 %	6.0 %	7.3 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	98.585 %	59.243 ppb	46.600 ppb	46.455 ppb	65.549 ppb	5,140.311 ppb	48.203 ppb	48.428 ppb	47.043 ppb
Concentration per Run 1	99.363 %	55.842 ppb	45.207 ppb	45.199 ppb	61.780 ppb	4,964.444 ppb	46.198 ppb	46.026 ppb	45.869 ppb
Concentration per Run 2	97.381 %	57.939 ppb	47.022 ppb	47.613 ppb	65.017 ppb	5,118.971 ppb	49.433 ppb	50.614 ppb	48.724 ppb
Concentration per Run 3	99.011 %	63.947 ppb	47.570 ppb	46.552 ppb	69.850 ppb	5,337.518 ppb	48.977 ppb	48.646 ppb	46.537 ppb
Concentration RSD	1.1 %	7.1 %	2.7 %	2.6 %	6.2 %	3.6 %	3.6 %	4.8 %	3.2 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	47.810 ppb	111.618 %	46.022 ppb	48.351 ppb	84.812 ppb	49.130 ppb	108.389 %	4.946 ppb	47.952 ppb
Concentration per Run 1	46.122 ppb	105.968 %	43.960 ppb	44.232 ppb	78.311 ppb	46.912 ppb	105.168 %	4.624 ppb	46.094 ppb
Concentration per Run 2	48.920 ppb	108.725 %	46.690 ppb	50.855 ppb	83.859 ppb	50.451 ppb	107.504 %	5.191 ppb	48.003 ppb
Concentration per Run 3	48.390 ppb	120.159 %	47.414 ppb	49.967 ppb	92.266 ppb	50.027 ppb	112.495 %	5.022 ppb	49.759 ppb
Concentration RSD	3.1 %	6.7 %	4.0 %	7.4 %	8.3 %	3.9 %	3.5 %	5.9 %	3.8 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	113.530 %	48.717 ppb	46.185 ppb	50.281 ppb	109.863 %	112.139 %	46.983 ppb	46.960 ppb	111.353 %
Concentration per Run 1	108.222 %	46.793 ppb	44.255 ppb	47.767 ppb	106.046 %	107.106 %	44.931 ppb	44.763 ppb	107.114 %
Concentration per Run 2	110.118 %	49.831 ppb	46.537 ppb	51.132 ppb	108.037 %	108.663 %	49.216 ppb	48.506 ppb	108.074 %
Concentration per Run 3	122.249 %	49.528 ppb	47.763 ppb	51.945 ppb	115.505 %	120.647 %	46.800 ppb	47.612 ppb	118.870 %
Concentration RSD	6.7 %	3.4 %	3.9 %	4.4 %	4.5 %	6.6 %	4.6 %	4.2 %	5.9 %

Alpha ICPMSQ2 Full

6/10/2017 10:11:47 AM



Analysis index: 41 Analysis started at: 6/9/2017 9:16:21 AM Rack: 1
 Analysis label: WG1010767-6D5 6020TL User name: ALPHALAB\metals-instrument Vial: 18

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	98.769 %	109.019 %	0.034 ppb	892.552 ppb	1,113.123 ppb	329.535 ppb	931.094 ppb	10,318.621 ppb	108.051 %
Concentration per Run 1	99.787 %	109.657 %	0.044 ppb	893.214 ppb	1,128.883 ppb	334.433 ppb	950.817 ppb	10,694.725 ppb	105.225 %
Concentration per Run 2	98.165 %	108.380 %	0.027 ppb	888.638 ppb	1,107.421 ppb	329.012 ppb	909.943 ppb	10,108.726 ppb	109.079 %
Concentration per Run 3	98.355 %	109.019 %	0.032 ppb	895.803 ppb	1,103.065 ppb	325.161 ppb	932.521 ppb	10,152.413 ppb	109.850 %
Concentration RSD	0.9 %	0.6 %	26.1 %	0.4 %	1.2 %	1.4 %	2.2 %	3.2 %	2.3 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	97.385 %	24.151 ppb	1.095 ppb	0.397 ppb	35.981 ppb	570.694 ppb	0.218 ppb	0.408 ppb	0.647 ppb
Concentration per Run 1	97.814 %	24.944 ppb	1.112 ppb	0.399 ppb	36.508 ppb	585.495 ppb	0.244 ppb	0.386 ppb	0.771 ppb
Concentration per Run 2	96.898 %	23.697 ppb	1.091 ppb	0.413 ppb	36.109 ppb	558.561 ppb	0.174 ppb	0.448 ppb	0.551 ppb
Concentration per Run 3	97.444 %	23.813 ppb	1.084 ppb	0.380 ppb	35.326 ppb	568.026 ppb	0.236 ppb	0.391 ppb	0.620 ppb
Concentration RSD	0.5 %	2.9 %	1.3 %	4.2 %	1.7 %	2.4 %	17.5 %	8.4 %	17.4 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	1.838 ppb	105.639 %	0.294 ppb	0.081 ppb	73.869 ppb	0.187 ppb	103.580 %	0.003 ppb	0.021 ppb
Concentration per Run 1	2.092 ppb	106.343 %	0.371 ppb	0.354 ppb	72.977 ppb	0.161 ppb	101.922 %	0.003 ppb	0.014 ppb
Concentration per Run 2	1.971 ppb	105.071 %	0.262 ppb	0.227 ppb	74.054 ppb	0.175 ppb	104.251 %	0.004 ppb	0.027 ppb
Concentration per Run 3	1.451 ppb	105.503 %	0.249 ppb	-0.336 ppb	74.576 ppb	0.224 ppb	104.566 %	0.001 ppb	0.022 ppb
Concentration RSD	18.5 %	0.6 %	22.7 %	450.8 %	1.1 %	17.7 %	1.4 %	51.1 %	31.3 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	109.400 %	0.107 ppb	0.645 ppb	5.236 ppb	106.875 %	106.555 %	0.015 ppb	0.578 ppb	110.688 %
Concentration per Run 1	106.890 %	0.111 ppb	0.638 ppb	5.106 ppb	106.052 %	104.953 %	0.018 ppb	0.581 ppb	108.296 %
Concentration per Run 2	111.301 %	0.157 ppb	0.699 ppb	5.089 ppb	106.750 %	108.128 %	0.012 ppb	0.584 ppb	112.254 %
Concentration per Run 3	110.008 %	0.052 ppb	0.598 ppb	5.513 ppb	107.823 %	106.584 %	0.015 ppb	0.570 ppb	111.513 %
Concentration RSD	2.1 %	49.7 %	7.9 %	4.6 %	0.8 %	1.5 %	21.7 %	1.3 %	1.9 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 42 Analysis started at: 6/9/2017 9:19:27 AM Rack: 1
 Analysis label: L1718484-01 6020TL User name: ALPHALAB\metals-instrument Vial: 19

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	92.947 %	101.905 %	0.163 ppb	211,985.447 ppb	33,878.840 ppb	1,545.651 ppb	5,457.119 ppb	159,821.554 ppb	107.724 %
Concentration per Run 1	93.103 %	97.692 %	0.162 ppb	221,123.978 ppb	34,980.061 ppb	1,621.594 ppb	5,680.716 ppb	168,245.876 ppb	99.890 %
Concentration per Run 2	94.157 %	106.296 %	0.166 ppb	201,222.461 ppb	32,210.923 ppb	1,449.893 ppb	5,093.721 ppb	149,639.965 ppb	114.690 %
Concentration per Run 3	91.580 %	101.725 %	0.162 ppb	213,609.901 ppb	34,445.537 ppb	1,565.466 ppb	5,596.920 ppb	161,578.819 ppb	108.593 %
Concentration RSD	1.4 %	4.2 %	1.3 %	4.7 %	4.3 %	5.7 %	5.8 %	5.9 %	6.9 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	92.338 %	340.865 ppb	14.577 ppb	6.831 ppb	683.084 ppb	2,891.944 ppb	3.108 ppb	6.141 ppb	9.861 ppb
Concentration per Run 1	92.653 %	359.046 ppb	15.399 ppb	7.338 ppb	724.138 ppb	3,061.496 ppb	3.377 ppb	6.969 ppb	10.342 ppb
Concentration per Run 2	92.562 %	318.981 ppb	13.517 ppb	6.218 ppb	629.314 ppb	2,682.436 ppb	2.817 ppb	5.566 ppb	9.166 ppb
Concentration per Run 3	91.799 %	344.569 ppb	14.813 ppb	6.937 ppb	695.798 ppb	2,931.902 ppb	3.129 ppb	5.887 ppb	10.074 ppb
Concentration RSD	0.5 %	6.0 %	6.6 %	8.3 %	7.1 %	6.7 %	9.0 %	12.0 %	6.3 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	18.254 ppb	101.587 %	0.753 ppb	3.594 ppb	574.436 ppb	0.763 ppb	97.729 %	0.057 ppb	0.268 ppb
Concentration per Run 1	19.814 ppb	95.047 %	0.580 ppb	4.129 ppb	597.726 ppb	0.800 ppb	92.623 %	0.060 ppb	0.278 ppb
Concentration per Run 2	16.917 ppb	107.996 %	0.815 ppb	3.682 ppb	539.363 ppb	0.635 ppb	101.930 %	0.050 ppb	0.275 ppb
Concentration per Run 3	18.033 ppb	101.719 %	0.865 ppb	2.971 ppb	586.220 ppb	0.853 ppb	98.634 %	0.062 ppb	0.252 ppb
Concentration RSD	8.0 %	6.4 %	20.2 %	16.3 %	5.4 %	14.9 %	4.8 %	11.2 %	5.2 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	105.490 %	0.389 ppb	0.324 ppb	147.127 ppb	99.832 %	96.921 %	0.038 ppb	3.003 ppb	97.316 %
Concentration per Run 1	100.193 %	0.453 ppb	0.340 ppb	154.107 ppb	95.783 %	92.562 %	0.035 ppb	3.142 ppb	92.516 %
Concentration per Run 2	110.174 %	0.261 ppb	0.351 ppb	136.165 ppb	103.381 %	100.505 %	0.035 ppb	2.817 ppb	101.658 %
Concentration per Run 3	106.102 %	0.453 ppb	0.281 ppb	151.109 ppb	100.333 %	97.695 %	0.043 ppb	3.051 ppb	97.774 %
Concentration RSD	4.8 %	28.4 %	11.6 %	6.5 %	3.8 %	4.2 %	13.0 %	5.6 %	4.7 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 43 Analysis started at: 6/9/2017 9:22:33 AM Rack: 1
 Analysis label: L1718484-02 6020TL User name: ALPHALAB\metals-instrument Vial: 20

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	90.403 %	99.216 %	0.186 ppb	230,985.608 ppb	37,461.418 ppb	1,891.501 ppb	6,006.712 ppb	174,930.232 ppb	100.494 %
Concentration per Run 1	89.015 %	96.381 %	0.186 ppb	229,858.491 ppb	36,737.346 ppb	1,880.812 ppb	5,955.975 ppb	171,131.655 ppb	97.447 %
Concentration per Run 2	91.533 %	99.843 %	0.193 ppb	241,446.917 ppb	39,523.163 ppb	1,962.370 ppb	6,319.463 ppb	183,852.149 ppb	98.680 %
Concentration per Run 3	90.660 %	101.423 %	0.180 ppb	221,651.416 ppb	36,123.746 ppb	1,831.322 ppb	5,744.698 ppb	169,806.893 ppb	105.355 %
Concentration RSD	1.4 %	2.6 %	3.4 %	4.3 %	4.8 %	3.5 %	4.8 %	4.4 %	4.2 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	90.452 %	395.065 ppb	17.434 ppb	8.460 ppb	759.457 ppb	3,486.351 ppb	3.557 ppb	7.354 ppb	12.314 ppb
Concentration per Run 1	89.572 %	390.785 ppb	16.792 ppb	8.275 ppb	747.643 ppb	3,428.848 ppb	3.520 ppb	7.442 ppb	12.424 ppb
Concentration per Run 2	91.335 %	417.498 ppb	18.420 ppb	8.964 ppb	799.317 ppb	3,624.568 ppb	3.780 ppb	7.622 ppb	13.063 ppb
Concentration per Run 3	90.449 %	376.910 ppb	17.090 ppb	8.140 ppb	731.410 ppb	3,405.637 ppb	3.370 ppb	6.999 ppb	11.453 ppb
Concentration RSD	1.0 %	5.2 %	5.0 %	5.2 %	4.7 %	3.4 %	5.8 %	4.4 %	6.6 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	21.432 ppb	100.135 %	0.843 ppb	3.396 ppb	622.090 ppb	0.807 ppb	93.392 %	0.063 ppb	0.304 ppb
Concentration per Run 1	21.465 ppb	95.905 %	0.740 ppb	3.738 ppb	613.715 ppb	0.797 ppb	91.272 %	0.052 ppb	0.270 ppb
Concentration per Run 2	22.519 ppb	101.974 %	1.007 ppb	3.669 ppb	635.585 ppb	0.795 ppb	92.256 %	0.072 ppb	0.313 ppb
Concentration per Run 3	20.312 ppb	102.527 %	0.782 ppb	2.781 ppb	616.971 ppb	0.829 ppb	96.648 %	0.064 ppb	0.329 ppb
Concentration RSD	5.1 %	3.7 %	17.0 %	15.7 %	1.9 %	2.3 %	3.1 %	16.2 %	10.2 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	103.497 %	0.165 ppb	0.271 ppb	157.977 ppb	96.588 %	95.796 %	0.045 ppb	3.588 ppb	94.158 %
Concentration per Run 1	99.868 %	0.212 ppb	0.247 ppb	157.893 ppb	92.891 %	91.330 %	0.044 ppb	3.508 ppb	91.720 %
Concentration per Run 2	102.360 %	0.174 ppb	0.279 ppb	164.994 ppb	97.943 %	97.327 %	0.046 ppb	3.701 ppb	94.387 %
Concentration per Run 3	108.264 %	0.108 ppb	0.286 ppb	151.045 ppb	98.931 %	98.732 %	0.045 ppb	3.554 ppb	96.366 %
Concentration RSD	4.2 %	32.0 %	7.7 %	4.4 %	3.4 %	4.1 %	2.7 %	2.8 %	2.5 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 44 Analysis started at: 6/9/2017 9:25:39 AM Rack: 0
 Analysis label: CCV User name: ALPHALAB\metals-instrument Vial: 9

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	95.603 %	105.322 %	99.489 ppb	10,484.079 ppb	9,812.973 ppb	100.969 ppb	10,257.476 ppb	10,164.870 ppb	107.479 %
Concentration per Run 1	95.827 %	106.431 %	99.176 ppb	10,103.886 ppb	9,396.555 ppb	95.455 ppb	9,697.920 ppb	9,684.006 ppb	111.690 %
Concentration per Run 2	94.599 %	105.490 %	99.890 ppb	10,638.405 ppb	9,952.149 ppb	104.853 ppb	10,477.165 ppb	10,475.021 ppb	107.099 %
Concentration per Run 3	96.384 %	104.044 %	99.399 ppb	10,709.945 ppb	10,090.216 ppb	102.598 ppb	10,597.345 ppb	10,335.583 ppb	103.648 %
Recovery Percentage 1			99.489 %	104.841 %	98.130 %	100.969 %	102.575 %	101.649 %	
Concentration RSD	1.0 %	1.1 %	0.4 %	3.2 %	3.7 %	4.9 %	4.8 %	4.2 %	3.8 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	96.194 %	100.649 ppb	98.811 ppb	99.199 ppb	100.267 ppb	10,168.741 ppb	101.249 ppb	101.718 ppb	101.563 ppb
Concentration per Run 1	96.280 %	97.283 ppb	95.959 ppb	95.429 ppb	97.203 ppb	9,805.086 ppb	98.294 ppb	98.183 ppb	98.220 ppb
Concentration per Run 2	94.831 %	100.809 ppb	99.375 ppb	100.624 ppb	100.061 ppb	10,284.425 ppb	100.970 ppb	100.892 ppb	101.717 ppb
Concentration per Run 3	97.472 %	103.856 ppb	101.098 ppb	101.544 ppb	103.538 ppb	10,416.711 ppb	104.483 ppb	106.078 ppb	104.752 ppb
Recovery Percentage 1		100.649 %	98.811 %	99.199 %	100.267 %	101.687 %	101.249 %	101.718 %	101.563 %
Concentration RSD	1.4 %	3.3 %	2.6 %	3.3 %	3.2 %	3.2 %	3.1 %	3.9 %	3.2 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	97.959 ppb	105.640 %	94.973 ppb	98.112 ppb	100.564 ppb	102.234 ppb	104.531 %	98.434 ppb	99.344 ppb
Concentration per Run 1	95.837 ppb	103.770 %	94.636 ppb	100.230 ppb	98.100 ppb	99.863 ppb	105.298 %	96.313 ppb	96.891 ppb
Concentration per Run 2	98.211 ppb	107.105 %	95.241 ppb	96.505 ppb	101.355 ppb	102.076 ppb	105.920 %	98.493 ppb	100.423 ppb
Concentration per Run 3	99.827 ppb	106.045 %	95.044 ppb	97.602 ppb	102.237 ppb	104.764 ppb	102.375 %	100.496 ppb	100.718 ppb
Recovery Percentage 1	97.959 %		94.973 %	98.112 %	100.564 %	102.234 %		98.434 %	99.344 %
Concentration RSD	2.0 %	1.6 %	0.3 %	2.0 %	2.2 %	2.4 %	1.8 %	2.1 %	2.1 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	107.667 %	103.064 ppb	92.414 ppb	97.521 ppb	105.171 %	107.632 %	98.253 ppb	97.491 ppb	109.422 %
Concentration per Run 1	108.339 %	100.072 ppb	89.560 ppb	93.973 ppb	104.704 %	107.585 %	97.301 ppb	95.378 ppb	108.942 %
Concentration per Run 2	108.516 %	103.006 ppb	92.721 ppb	99.887 ppb	106.836 %	107.781 %	98.933 ppb	98.826 ppb	109.647 %
Concentration per Run 3	106.145 %	106.115 ppb	94.960 ppb	98.702 ppb	103.973 %	107.528 %	98.525 ppb	98.269 ppb	109.678 %
Recovery Percentage 1		103.064 %	92.414 %	97.521 %			98.253 %	97.491 %	
Concentration RSD	1.2 %	2.9 %	2.9 %	3.2 %	1.4 %	0.1 %	0.9 %	1.9 %	0.4 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 45 Analysis started at: 6/9/2017 9:28:48 AM Rack: 0
 Analysis label: CCB User name: ALPHALAB\metals-instrument Vial: 10

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	95.240 %	100.986 %	0.010 ppb	12.629 ppb	0.085 ppb	0.059 ppb	-1.805 ppb	-1.227 ppb	102.976 %
Concentration per Run 1	95.018 %	103.977 %	0.017 ppb	-0.797 ppb	0.469 ppb	-0.211 ppb	1.689 ppb	3.687 ppb	105.047 %
Concentration per Run 2	95.491 %	98.095 %	0.009 ppb	24.982 ppb	-0.003 ppb	0.131 ppb	-0.434 ppb	-5.223 ppb	101.335 %
Concentration per Run 3	95.211 %	100.885 %	0.005 ppb	13.701 ppb	-0.211 ppb	0.258 ppb	-6.669 ppb	-2.145 ppb	102.545 %
Recovery Percentage 1			3.331 %	12.629 %	0.121 %	0.590 %	-1.805 %	-1.227 %	
Concentration RSD	0.2 %	2.9 %	61.5 %	102.3 %	410.3 %	411.0 %	240.7 %	368.9 %	1.8 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	95.249 %	0.012 ppb	-0.001 ppb	0.008 ppb	0.051 ppb	1.448 ppb	0.001 ppb	-0.003 ppb	-0.002 ppb
Concentration per Run 1	94.222 %	0.048 ppb	-0.007 ppb	-0.017 ppb	-0.037 ppb	1.116 ppb	0.002 ppb	-0.009 ppb	-0.019 ppb
Concentration per Run 2	95.214 %	0.013 ppb	-0.015 ppb	0.037 ppb	0.144 ppb	0.274 ppb	0.003 ppb	0.009 ppb	0.042 ppb
Concentration per Run 3	96.311 %	-0.026 ppb	0.020 ppb	0.004 ppb	0.045 ppb	2.955 ppb	-0.001 ppb	-0.008 ppb	-0.028 ppb
Recovery Percentage 1		2.310 %	-0.017 %	0.817 %	5.070 %	2.896 %	0.244 %	-0.133 %	-0.188 %
Concentration RSD	1.1 %	323.2 %	2,166.4 %	328.7 %	179.6 %	94.7 %	175.5 %	392.8 %	2,010.1 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	0.052 ppb	102.431 %	0.029 ppb	0.619 ppb	0.034 ppb	0.143 ppb	101.468 %	0.014 ppb	0.012 ppb
Concentration per Run 1	-0.007 ppb	103.352 %	0.025 ppb	0.532 ppb	0.061 ppb	0.145 ppb	102.423 %	0.010 ppb	0.014 ppb
Concentration per Run 2	-0.019 ppb	99.655 %	0.000 ppb	0.269 ppb	0.019 ppb	0.115 ppb	99.768 %	0.022 ppb	0.000 ppb
Concentration per Run 3	0.183 ppb	104.285 %	0.063 ppb	1.055 ppb	0.021 ppb	0.170 ppb	102.213 %	0.011 ppb	0.024 ppb
Recovery Percentage 1	0.524 %	102.431 %	5.888 %	12.374 %	6.719 %	7.168 %		3.565 %	6.203 %
Concentration RSD	216.2 %	2.4 %	107.5 %	64.6 %	70.9 %	19.1 %	1.5 %	46.3 %	95.2 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	104.786 %	0.191 ppb	0.805 ppb	-0.019 ppb	103.594 %	107.291 %	0.012 ppb	0.023 ppb	107.476 %
Concentration per Run 1	107.979 %	0.176 ppb	0.769 ppb	-0.028 ppb	106.079 %	108.695 %	0.012 ppb	0.023 ppb	108.187 %
Concentration per Run 2	103.075 %	0.206 ppb	0.840 ppb	-0.014 ppb	102.394 %	106.099 %	0.014 ppb	0.022 ppb	105.357 %
Concentration per Run 3	103.303 %	0.191 ppb	0.805 ppb	-0.014 ppb	102.309 %	107.080 %	0.011 ppb	0.024 ppb	108.885 %
Recovery Percentage 1		6.371 %	20.120 %	-3.810 %			2.450 %	4.602 %	107.476 %
Concentration RSD	2.6 %	7.7 %	4.4 %	41.8 %	2.1 %	1.2 %	13.1 %	3.3 %	1.7 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 46 Analysis started at: 6/9/2017 9:31:58 AM Rack: 1
 Analysis label: L1718493-01 6020TL User name: ALPHALAB\metals-instrument Vial: 21

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	94.039 %	98.801 %	0.088 ppb	135,177.017 ppb	18,466.459 ppb	1,574.421 ppb	9,539.217 ppb	100,944.793 ppb	97.346 %
Concentration per Run 1	95.018 %	93.256 %	0.083 ppb	137,125.617 ppb	19,007.015 ppb	1,590.858 ppb	9,854.293 ppb	103,869.342 ppb	84.517 %
Concentration per Run 2	93.710 %	103.708 %	0.074 ppb	134,150.216 ppb	18,227.709 ppb	1,577.901 ppb	9,412.379 ppb	100,570.838 ppb	104.157 %
Concentration per Run 3	93.390 %	99.440 %	0.106 ppb	134,255.217 ppb	18,164.653 ppb	1,554.505 ppb	9,350.978 ppb	98,394.200 ppb	103.364 %
Concentration RSD	0.9 %	5.3 %	18.8 %	1.2 %	2.5 %	1.2 %	2.9 %	2.7 %	11.4 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	92.583 %	211.046 ppb	5.395 ppb	4.004 ppb	668.133 ppb	24,685.478 ppb	3.150 ppb	4.883 ppb	30.413 ppb
Concentration per Run 1	92.718 %	215.760 ppb	5.774 ppb	4.058 ppb	676.053 ppb	24,709.642 ppb	3.195 ppb	5.167 ppb	31.635 ppb
Concentration per Run 2	92.871 %	209.628 ppb	5.375 ppb	4.051 ppb	659.338 ppb	24,726.083 ppb	3.004 ppb	4.615 ppb	29.821 ppb
Concentration per Run 3	92.160 %	207.750 ppb	5.036 ppb	3.902 ppb	669.008 ppb	24,620.709 ppb	3.253 ppb	4.868 ppb	29.783 ppb
Concentration RSD	0.4 %	2.0 %	6.8 %	2.2 %	1.3 %	0.2 %	4.1 %	5.7 %	3.5 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	162.642 ppb	96.524 %	1.322 ppb	0.225 ppb	572.040 ppb	0.801 ppb	95.488 %	0.139 ppb	0.235 ppb
Concentration per Run 1	163.746 ppb	87.284 %	1.112 ppb	0.637 ppb	568.039 ppb	0.958 ppb	88.206 %	0.136 ppb	0.227 ppb
Concentration per Run 2	161.239 ppb	101.316 %	1.347 ppb	-0.439 ppb	576.915 ppb	0.579 ppb	99.914 %	0.134 ppb	0.216 ppb
Concentration per Run 3	162.941 ppb	100.971 %	1.508 ppb	0.478 ppb	571.166 ppb	0.865 ppb	98.344 %	0.147 ppb	0.262 ppb
Concentration RSD	0.8 %	8.3 %	15.1 %	257.7 %	0.8 %	24.7 %	6.7 %	4.7 %	10.1 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	102.530 %	2.210 ppb	0.974 ppb	503.687 ppb	98.929 %	97.902 %	0.021 ppb	95.733 ppb	100.316 %
Concentration per Run 1	93.291 %	2.417 ppb	1.008 ppb	507.109 ppb	92.263 %	91.302 %	0.020 ppb	96.211 ppb	93.980 %
Concentration per Run 2	108.003 %	2.142 ppb	0.879 ppb	505.095 ppb	100.030 %	100.397 %	0.019 ppb	94.719 ppb	102.929 %
Concentration per Run 3	106.297 %	2.070 ppb	1.036 ppb	498.857 ppb	104.496 %	102.006 %	0.024 ppb	96.271 ppb	104.038 %
Concentration RSD	7.8 %	8.3 %	8.6 %	0.9 %	6.3 %	5.9 %	11.1 %	0.9 %	5.5 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 47 Analysis started at: 6/9/2017 9:35:05 AM Rack: 1
 Analysis label: L1718493-02 6020TL User name: ALPHALAB\metals-instrument Vial: 22

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	84.952 %	90.758 %	0.255 ppb	562,827.746 ppb	34,970.198 ppb	3,930.367 ppb	11,316.091 ppb	131,489.645 ppb	97.928 %
Concentration per Run 1	85.300 %	97.524 %	0.252 ppb	535,233.616 ppb	33,614.118 ppb	3,747.946 ppb	10,948.873 ppb	126,526.534 ppb	101.810 %
Concentration per Run 2	85.082 %	84.988 %	0.249 ppb	581,453.487 ppb	35,590.243 ppb	4,082.698 ppb	11,666.148 ppb	135,135.894 ppb	94.966 %
Concentration per Run 3	84.473 %	89.760 %	0.265 ppb	571,796.136 ppb	35,706.233 ppb	3,960.457 ppb	11,333.251 ppb	132,806.508 ppb	97.008 %
Concentration RSD	0.5 %	7.0 %	3.4 %	4.3 %	3.4 %	4.3 %	3.2 %	3.4 %	3.6 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	87.051 %	332.388 ppb	11.285 ppb	10.317 ppb	509.751 ppb	32,516.191 ppb	2.125 ppb	7.269 ppb	36.643 ppb
Concentration per Run 1	87.236 %	319.950 ppb	10.802 ppb	9.844 ppb	478.518 ppb	31,265.884 ppb	2.222 ppb	6.984 ppb	34.526 ppb
Concentration per Run 2	86.882 %	344.392 ppb	11.846 ppb	10.624 ppb	540.946 ppb	34,021.991 ppb	2.222 ppb	7.771 ppb	39.133 ppb
Concentration per Run 3	87.035 %	332.822 ppb	11.208 ppb	10.484 ppb	509.788 ppb	32,260.697 ppb	1.931 ppb	7.052 ppb	36.269 ppb
Concentration RSD	0.2 %	3.7 %	4.7 %	4.0 %	6.1 %	4.3 %	7.9 %	6.0 %	6.3 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	244.711 ppb	96.657 %	6.099 ppb	1.338 ppb	833.580 ppb	1.035 ppb	88.569 %	0.170 ppb	0.716 ppb
Concentration per Run 1	236.608 ppb	99.938 %	6.054 ppb	2.218 ppb	811.613 ppb	0.928 ppb	92.200 %	0.194 ppb	0.681 ppb
Concentration per Run 2	251.705 ppb	92.913 %	5.862 ppb	0.431 ppb	853.636 ppb	1.147 ppb	84.764 %	0.170 ppb	0.799 ppb
Concentration per Run 3	245.818 ppb	97.119 %	6.380 ppb	1.367 ppb	835.492 ppb	1.029 ppb	88.742 %	0.145 ppb	0.667 ppb
Concentration RSD	3.1 %	3.7 %	4.3 %	66.8 %	2.5 %	10.6 %	4.2 %	14.6 %	10.1 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	89.502 %	2.809 ppb	1.202 ppb	437.988 ppb	88.212 %	93.424 %	0.050 ppb	269.757 ppb	90.935 %
Concentration per Run 1	93.595 %	2.594 ppb	1.141 ppb	419.116 ppb	90.302 %	95.676 %	0.049 ppb	256.201 ppb	94.013 %
Concentration per Run 2	83.167 %	3.349 ppb	1.313 ppb	459.117 ppb	83.658 %	87.174 %	0.049 ppb	280.995 ppb	86.191 %
Concentration per Run 3	91.743 %	2.485 ppb	1.152 ppb	435.730 ppb	90.675 %	97.423 %	0.052 ppb	272.075 ppb	92.600 %
Concentration RSD	6.2 %	16.7 %	8.0 %	4.6 %	4.5 %	5.9 %	3.2 %	4.7 %	4.6 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 48 Analysis started at: 6/9/2017 9:38:12 AM Rack: 1
 Analysis label: L1718584-01 6020TL User name: ALPHALAB\metals-instrument Vial: 23

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	88.000 %	92.516 %	0.013 ppb	461,944.001 ppb	24,128.444 ppb	29.766 ppb	41,086.297 ppb	91,465.203 ppb	97.723 %
Concentration per Run 1	86.560 %	91.306 %	0.011 ppb	477,070.030 ppb	24,939.147 ppb	31.337 ppb	41,718.870 ppb	94,627.420 ppb	94.127 %
Concentration per Run 2	89.665 %	95.944 %	0.019 ppb	454,872.790 ppb	23,749.729 ppb	27.383 ppb	40,661.212 ppb	88,816.196 ppb	102.687 %
Concentration per Run 3	87.777 %	90.299 %	0.008 ppb	453,889.184 ppb	23,696.457 ppb	30.579 ppb	40,878.807 ppb	90,951.994 ppb	96.354 %
Concentration RSD	1.8 %	3.3 %	46.0 %	2.8 %	2.9 %	7.0 %	1.4 %	3.2 %	4.5 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	91.963 %	143.539 ppb	2.386 ppb	0.708 ppb	24.346 ppb	400.566 ppb	0.159 ppb	3.131 ppb	10.807 ppb
Concentration per Run 1	90.826 %	147.404 ppb	2.855 ppb	0.839 ppb	24.673 ppb	391.323 ppb	0.193 ppb	3.402 ppb	11.226 ppb
Concentration per Run 2	92.715 %	140.951 ppb	2.001 ppb	0.640 ppb	23.926 ppb	409.555 ppb	0.147 ppb	2.655 ppb	10.632 ppb
Concentration per Run 3	92.348 %	142.262 ppb	2.303 ppb	0.644 ppb	24.440 ppb	400.819 ppb	0.138 ppb	3.335 ppb	10.562 ppb
Concentration RSD	1.1 %	2.4 %	18.1 %	16.1 %	1.6 %	2.3 %	18.6 %	13.2 %	3.4 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	40.740 ppb	98.099 %	1.472 ppb	0.179 ppb	1,134.172 ppb	17.998 ppb	92.809 %	0.018 ppb	0.060 ppb
Concentration per Run 1	41.779 ppb	95.622 %	1.799 ppb	0.544 ppb	1,174.758 ppb	18.822 ppb	92.212 %	0.022 ppb	0.054 ppb
Concentration per Run 2	40.721 ppb	100.720 %	1.369 ppb	-0.739 ppb	1,145.769 ppb	17.345 ppb	97.225 %	0.017 ppb	0.071 ppb
Concentration per Run 3	39.718 ppb	97.955 %	1.249 ppb	0.731 ppb	1,081.988 ppb	17.829 ppb	88.991 %	0.017 ppb	0.055 ppb
Concentration RSD	2.5 %	2.6 %	19.6 %	447.5 %	4.2 %	4.2 %	4.5 %	15.0 %	15.3 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	90.319 %	0.127 ppb	0.754 ppb	98.627 ppb	93.260 %	100.636 %	0.035 ppb	0.380 ppb	94.660 %
Concentration per Run 1	88.672 %	0.142 ppb	0.834 ppb	103.790 ppb	92.114 %	98.611 %	0.035 ppb	0.400 ppb	93.587 %
Concentration per Run 2	95.660 %	0.141 ppb	0.756 ppb	96.539 ppb	97.014 %	105.676 %	0.029 ppb	0.368 ppb	98.053 %
Concentration per Run 3	86.623 %	0.099 ppb	0.671 ppb	95.553 ppb	90.653 %	97.620 %	0.043 ppb	0.373 ppb	92.341 %
Concentration RSD	5.2 %	19.0 %	10.8 %	4.6 %	3.6 %	4.4 %	19.4 %	4.5 %	3.2 %

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6/10/2017 10:11:47 AM

Analysis index: 49 Analysis started at: 6/9/2017 9:41:19 AM Rack: 1
 Analysis label: L1718584-02 6020TL User name: ALPHALAB\metals-instrument Vial: 24

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	92.097 %	94.488 %	0.007 ppb	220,958.658 ppb	32,198.072 ppb	35.962 ppb	27,318.733 ppb	130,085.206 ppb	99.609 %
Concentration per Run 1	92.032 %	91.542 %	0.007 ppb	225,310.758 ppb	32,547.972 ppb	37.318 ppb	27,564.455 ppb	132,057.205 ppb	94.471 %
Concentration per Run 2	91.824 %	95.071 %	0.010 ppb	223,917.154 ppb	33,218.518 ppb	35.410 ppb	27,654.562 ppb	133,243.244 ppb	100.814 %
Concentration per Run 3	92.436 %	96.852 %	0.003 ppb	213,648.063 ppb	30,827.726 ppb	35.158 ppb	26,737.183 ppb	124,955.170 ppb	103.542 %
Concentration RSD	0.3 %	2.9 %	54.2 %	2.9 %	3.8 %	3.3 %	1.9 %	3.4 %	4.7 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	93.064 %	204.906 ppb	3.379 ppb	1.948 ppb	1.685 ppb	59.732 ppb	0.246 ppb	3.514 ppb	26.348 ppb
Concentration per Run 1	93.005 %	206.052 ppb	3.482 ppb	2.116 ppb	1.831 ppb	51.880 ppb	0.287 ppb	3.226 ppb	27.870 ppb
Concentration per Run 2	93.195 %	209.009 ppb	3.284 ppb	2.038 ppb	1.571 ppb	68.250 ppb	0.249 ppb	3.853 ppb	27.017 ppb
Concentration per Run 3	92.991 %	199.656 ppb	3.369 ppb	1.691 ppb	1.652 ppb	59.066 ppb	0.202 ppb	3.464 ppb	24.157 ppb
Concentration RSD	0.1 %	2.3 %	2.9 %	11.6 %	7.9 %	13.7 %	17.3 %	9.0 %	7.4 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	25.587 ppb	100.210 %	4.568 ppb	0.480 ppb	934.612 ppb	8.521 ppb	95.189 %	0.011 ppb	0.023 ppb
Concentration per Run 1	25.904 ppb	93.252 %	4.899 ppb	1.356 ppb	961.126 ppb	9.006 ppb	90.809 %	0.007 ppb	0.021 ppb
Concentration per Run 2	26.987 ppb	100.253 %	4.690 ppb	0.514 ppb	946.060 ppb	8.259 ppb	96.655 %	0.017 ppb	0.029 ppb
Concentration per Run 3	23.871 ppb	107.126 %	4.114 ppb	-0.430 ppb	896.652 ppb	8.300 ppb	98.102 %	0.009 ppb	0.019 ppb
Concentration RSD	6.2 %	6.9 %	8.9 %	186.2 %	3.6 %	4.9 %	4.1 %	49.2 %	23.2 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	101.337 %	0.047 ppb	1.639 ppb	62.224 ppb	99.136 %	102.339 %	0.028 ppb	0.063 ppb	97.353 %
Concentration per Run 1	96.084 %	0.067 ppb	1.696 ppb	65.412 ppb	92.848 %	96.283 %	0.028 ppb	0.066 ppb	93.251 %
Concentration per Run 2	103.299 %	0.028 ppb	1.666 ppb	61.108 ppb	102.321 %	104.804 %	0.028 ppb	0.064 ppb	98.528 %
Concentration per Run 3	104.627 %	0.046 ppb	1.555 ppb	60.152 ppb	102.238 %	105.929 %	0.027 ppb	0.057 ppb	100.281 %
Concentration RSD	4.5 %	42.0 %	4.5 %	4.5 %	5.5 %	5.2 %	2.4 %	7.8 %	3.8 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 50 Analysis started at: 6/9/2017 9:44:27 AM Rack: 1
 Analysis label: L1718584-03 6020TL User name: ALPHALAB\metals-instrument Vial: 25

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	74.112 %	86.758 %	0.008 ppb	2,586,162.225 ppb	203,724.055 ppb	22.156 ppb	128,343.581 ppb	193,615.693 ppb	96.514 %
Concentration per Run 1	74.122 %	86.467 %	0.010 ppb	2,643,492.393 ppb	204,225.609 ppb	22.981 ppb	130,064.514 ppb	195,872.191 ppb	94.460 %
Concentration per Run 2	74.474 %	88.181 %	0.008 ppb	2,593,672.439 ppb	205,757.800 ppb	21.977 ppb	129,912.121 ppb	197,282.652 ppb	96.984 %
Concentration per Run 3	73.739 %	85.626 %	0.007 ppb	2,521,321.843 ppb	201,188.757 ppb	21.512 ppb	125,054.109 ppb	187,692.236 ppb	98.099 %
Concentration RSD	0.5 %	1.5 %	23.6 %	2.4 %	1.1 %	3.4 %	2.2 %	2.7 %	1.9 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	76.868 %	304.221 ppb	2.460 ppb	0.944 ppb	57.949 ppb	220.044 ppb	0.344 ppb	1.707 ppb	15.730 ppb
Concentration per Run 1	77.046 %	310.891 ppb	2.473 ppb	0.949 ppb	59.379 ppb	220.866 ppb	0.383 ppb	2.016 ppb	15.668 ppb
Concentration per Run 2	77.344 %	305.769 ppb	2.582 ppb	0.943 ppb	58.318 ppb	215.121 ppb	0.354 ppb	1.813 ppb	16.178 ppb
Concentration per Run 3	76.214 %	296.002 ppb	2.324 ppb	0.940 ppb	56.150 ppb	224.145 ppb	0.294 ppb	1.292 ppb	15.344 ppb
Concentration RSD	0.8 %	2.5 %	5.3 %	0.5 %	2.8 %	2.1 %	13.2 %	21.9 %	2.7 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	182.858 ppb	89.636 %	4.176 ppb	1.656 ppb	2,589.017 ppb	18.587 ppb	78.353 %	0.046 ppb	0.137 ppb
Concentration per Run 1	184.620 ppb	87.318 %	4.416 ppb	2.421 ppb	2,582.627 ppb	19.102 ppb	78.887 %	0.049 ppb	0.162 ppb
Concentration per Run 2	187.546 ppb	88.914 %	4.383 ppb	2.603 ppb	2,671.494 ppb	19.567 ppb	79.332 %	0.040 ppb	0.095 ppb
Concentration per Run 3	176.408 ppb	92.675 %	3.730 ppb	-0.056 ppb	2,512.930 ppb	17.092 ppb	76.841 %	0.048 ppb	0.153 ppb
Concentration RSD	3.2 %	3.1 %	9.3 %	89.7 %	3.1 %	7.1 %	1.7 %	11.1 %	26.7 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	65.736 %	0.101 ppb	0.856 ppb	168.479 ppb	77.760 %	63.595 %	0.023 ppb	4.854 ppb	63.619 %
Concentration per Run 1	63.834 %	0.023 ppb	0.884 ppb	171.099 ppb	75.694 %	62.096 %	0.025 ppb	4.806 ppb	62.656 %
Concentration per Run 2	67.554 %	0.133 ppb	0.868 ppb	168.702 ppb	78.620 %	63.556 %	0.022 ppb	4.975 ppb	63.814 %
Concentration per Run 3	65.820 %	0.145 ppb	0.815 ppb	165.635 ppb	78.968 %	65.134 %	0.021 ppb	4.780 ppb	64.388 %
Concentration RSD	2.8 %	66.8 %	4.2 %	1.6 %	2.3 %	2.4 %	8.9 %	2.2 %	1.4 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 51 Analysis started at: 6/9/2017 9:47:32 AM Rack: 1
 Analysis label: L1718584-04 6020TL User name: ALPHALAB\metals-instrument Vial: 26

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	88.784 %	95.563 %	0.075 ppb	37,977.899 ppb	27,149.402 ppb	463.239 ppb	20,950.625 ppb	134,927.277 ppb	104.812 %
Concentration per Run 1	89.152 %	101.188 %	0.082 ppb	36,850.375 ppb	26,430.221 ppb	464.289 ppb	21,109.476 ppb	132,169.343 ppb	117.288 %
Concentration per Run 2	88.078 %	95.272 %	0.065 ppb	38,591.419 ppb	27,350.867 ppb	467.402 ppb	21,070.939 ppb	136,546.236 ppb	97.743 %
Concentration per Run 3	89.122 %	90.231 %	0.077 ppb	38,491.904 ppb	27,667.117 ppb	458.026 ppb	20,671.461 ppb	136,066.252 ppb	99.403 %
Concentration RSD	0.7 %	5.7 %	11.9 %	2.6 %	2.4 %	1.0 %	1.2 %	1.8 %	10.3 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	90.055 %	232.055 ppb	3.049 ppb	10.552 ppb	55.382 ppb	3,609.162 ppb	1.512 ppb	6.748 ppb	174.193 ppb
Concentration per Run 1	90.033 %	229.806 ppb	2.691 ppb	9.952 ppb	53.313 ppb	3,448.744 ppb	1.361 ppb	6.295 ppb	162.068 ppb
Concentration per Run 2	89.530 %	234.454 ppb	3.132 ppb	10.531 ppb	55.629 ppb	3,703.984 ppb	1.483 ppb	7.077 ppb	178.038 ppb
Concentration per Run 3	90.603 %	231.907 ppb	3.323 ppb	11.173 ppb	57.202 ppb	3,674.758 ppb	1.692 ppb	6.873 ppb	182.473 ppb
Concentration RSD	0.6 %	1.0 %	10.6 %	5.8 %	3.5 %	3.9 %	11.1 %	6.0 %	6.2 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	279.058 ppb	106.143 %	3.243 ppb	0.926 ppb	1,176.043 ppb	6.031 ppb	101.078 %	0.182 ppb	0.124 ppb
Concentration per Run 1	263.865 ppb	114.741 %	3.326 ppb	0.522 ppb	1,181.354 ppb	6.113 ppb	103.706 %	0.173 ppb	0.156 ppb
Concentration per Run 2	286.805 ppb	102.393 %	3.345 ppb	1.141 ppb	1,178.049 ppb	6.351 ppb	100.670 %	0.182 ppb	0.100 ppb
Concentration per Run 3	286.504 ppb	101.294 %	3.059 ppb	1.116 ppb	1,168.726 ppb	5.630 ppb	98.859 %	0.191 ppb	0.118 ppb
Concentration RSD	4.7 %	7.0 %	4.9 %	37.8 %	0.6 %	6.1 %	2.4 %	5.0 %	23.1 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	113.927 %	4.471 ppb	1.571 ppb	85.388 ppb	107.672 %	115.045 %	0.051 ppb	16.158 ppb	114.300 %
Concentration per Run 1	120.549 %	4.288 ppb	1.541 ppb	84.737 ppb	111.328 %	122.025 %	0.053 ppb	15.653 ppb	118.496 %
Concentration per Run 2	110.310 %	4.610 ppb	1.554 ppb	84.772 ppb	105.106 %	111.332 %	0.045 ppb	16.321 ppb	111.301 %
Concentration per Run 3	110.921 %	4.516 ppb	1.617 ppb	86.655 ppb	106.581 %	111.779 %	0.054 ppb	16.500 ppb	113.103 %
Concentration RSD	5.0 %	3.7 %	2.6 %	1.3 %	3.0 %	5.3 %	9.3 %	2.8 %	3.3 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 52 Analysis started at: 6/9/2017 9:50:36 AM Rack: 1
 Analysis label: L1718584-05 6020TL User name: ALPHALAB\metals-instrument Vial: 27

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	86.066 %	95.743 %	0.004 ppb	446,531.608 ppb	22,391.517 ppb	18.544 ppb	40,344.222 ppb	88,005.794 ppb	111.363 %
Concentration per Run 1	85.087 %	90.836 %	0.004 ppb	450,432.766 ppb	22,163.412 ppb	19.247 ppb	39,230.375 ppb	86,061.532 ppb	102.675 %
Concentration per Run 2	86.518 %	100.213 %	0.002 ppb	449,133.863 ppb	22,973.702 ppb	19.234 ppb	42,335.209 ppb	89,800.188 ppb	124.469 %
Concentration per Run 3	86.593 %	96.180 %	0.006 ppb	440,028.194 ppb	22,037.438 ppb	17.152 ppb	39,467.083 ppb	88,155.662 ppb	106.944 %
Concentration RSD	1.0 %	4.9 %	42.1 %	1.3 %	2.3 %	6.5 %	4.3 %	2.1 %	10.4 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	90.973 %	139.656 ppb	2.808 ppb	0.394 ppb	17.940 ppb	69.036 ppb	0.079 ppb	1.810 ppb	2.757 ppb
Concentration per Run 1	90.506 %	136.691 ppb	2.867 ppb	0.429 ppb	17.550 ppb	70.443 ppb	0.092 ppb	1.938 ppb	3.134 ppb
Concentration per Run 2	92.148 %	143.692 ppb	3.007 ppb	0.399 ppb	18.249 ppb	73.109 ppb	0.070 ppb	1.673 ppb	2.372 ppb
Concentration per Run 3	90.265 %	138.584 ppb	2.551 ppb	0.355 ppb	18.020 ppb	63.555 ppb	0.074 ppb	1.819 ppb	2.764 ppb
Concentration RSD	1.1 %	2.6 %	8.3 %	9.5 %	2.0 %	7.1 %	14.7 %	7.3 %	13.8 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	6.536 ppb	105.183 %	1.401 ppb	1.105 ppb	1,188.748 ppb	18.868 ppb	97.054 %	0.011 ppb	0.023 ppb
Concentration per Run 1	6.058 ppb	98.598 %	1.306 ppb	0.672 ppb	1,149.988 ppb	18.926 ppb	94.525 %	0.008 ppb	0.016 ppb
Concentration per Run 2	6.418 ppb	114.764 %	1.584 ppb	2.443 ppb	1,238.134 ppb	18.783 ppb	99.653 %	0.013 ppb	0.033 ppb
Concentration per Run 3	7.132 ppb	102.189 %	1.312 ppb	0.199 ppb	1,178.122 ppb	18.893 ppb	96.984 %	0.011 ppb	0.020 ppb
Concentration RSD	8.4 %	8.1 %	11.4 %	107.1 %	3.8 %	0.4 %	2.6 %	23.1 %	39.1 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	96.747 %	0.074 ppb	0.816 ppb	97.744 ppb	101.540 %	112.672 %	0.033 ppb	0.035 ppb	100.009 %
Concentration per Run 1	91.252 %	0.030 ppb	0.779 ppb	96.410 ppb	98.052 %	107.704 %	0.032 ppb	0.031 ppb	97.539 %
Concentration per Run 2	103.915 %	0.119 ppb	0.891 ppb	101.460 ppb	107.201 %	119.174 %	0.034 ppb	0.033 ppb	103.510 %
Concentration per Run 3	95.074 %	0.074 ppb	0.778 ppb	95.362 ppb	99.367 %	111.138 %	0.032 ppb	0.040 ppb	98.978 %
Concentration RSD	6.7 %	60.3 %	8.0 %	3.3 %	4.9 %	5.2 %	2.9 %	13.4 %	3.1 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 53 Analysis started at: 6/9/2017 9:53:41 AM Rack: 1
 Analysis label: L1718584-06 6020TL User name: ALPHALAB\metals-instrument Vial: 28

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	91.420 %	98.913 %	0.009 ppb	104,696.916 ppb	2,979.964 ppb	94.567 ppb	3,672.676 ppb	14,799.337 ppb	108.302 %
Concentration per Run 1	91.461 %	97.759 %	0.009 ppb	96,633.681 ppb	2,727.231 ppb	84.390 ppb	3,374.142 ppb	13,375.858 ppb	106.815 %
Concentration per Run 2	91.944 %	92.147 %	0.007 ppb	113,771.889 ppb	3,231.898 ppb	101.377 ppb	3,926.878 ppb	16,044.434 ppb	99.747 %
Concentration per Run 3	90.853 %	106.834 %	0.009 ppb	103,685.178 ppb	2,980.764 ppb	97.934 ppb	3,717.009 ppb	14,977.719 ppb	118.346 %
Concentration RSD	0.6 %	7.5 %	14.8 %	8.2 %	8.5 %	9.5 %	7.6 %	9.1 %	8.7 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	95.204 %	25.219 ppb	1.004 ppb	0.915 ppb	32.805 ppb	3,287.726 ppb	0.216 ppb	2.558 ppb	33.068 ppb
Concentration per Run 1	96.123 %	23.275 ppb	0.869 ppb	0.832 ppb	30.388 ppb	3,100.294 ppb	0.214 ppb	2.288 ppb	31.972 ppb
Concentration per Run 2	94.926 %	27.370 ppb	1.191 ppb	0.999 ppb	35.468 ppb	3,546.002 ppb	0.261 ppb	2.833 ppb	36.415 ppb
Concentration per Run 3	94.562 %	25.011 ppb	0.953 ppb	0.913 ppb	32.561 ppb	3,216.883 ppb	0.174 ppb	2.552 ppb	30.819 ppb
Concentration RSD	0.9 %	8.1 %	16.6 %	9.1 %	7.8 %	7.0 %	20.1 %	10.7 %	8.9 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	77.773 ppb	106.768 %	0.540 ppb	0.574 ppb	88.290 ppb	0.824 ppb	102.049 %	0.040 ppb	0.194 ppb
Concentration per Run 1	72.273 ppb	102.428 %	0.512 ppb	0.568 ppb	80.802 ppb	0.730 ppb	101.828 %	0.039 ppb	0.174 ppb
Concentration per Run 2	84.274 ppb	101.090 %	0.624 ppb	0.071 ppb	92.912 ppb	0.837 ppb	97.192 %	0.041 ppb	0.236 ppb
Concentration per Run 3	76.772 ppb	116.785 %	0.484 ppb	1.083 ppb	91.155 ppb	0.904 ppb	107.126 %	0.038 ppb	0.171 ppb
Concentration RSD	7.8 %	8.1 %	13.6 %	88.2 %	7.4 %	10.7 %	4.9 %	3.9 %	18.9 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	104.686 %	0.395 ppb	0.439 ppb	28.407 ppb	104.975 %	116.817 %	0.040 ppb	1.063 ppb	111.935 %
Concentration per Run 1	103.363 %	0.317 ppb	0.407 ppb	25.686 ppb	103.281 %	115.173 %	0.035 ppb	0.961 ppb	112.812 %
Concentration per Run 2	98.936 %	0.503 ppb	0.512 ppb	30.272 ppb	100.768 %	109.161 %	0.042 ppb	1.146 ppb	106.277 %
Concentration per Run 3	111.761 %	0.364 ppb	0.396 ppb	29.263 ppb	110.877 %	126.118 %	0.042 ppb	1.081 ppb	116.716 %
Concentration RSD	6.2 %	24.4 %	14.7 %	8.5 %	5.0 %	7.4 %	10.1 %	8.9 %	4.7 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 54 Analysis started at: 6/9/2017 9:56:47 AM Rack: 1
 Analysis label: L1718584-07 6020TL User name: ALPHALAB\metals-instrument Vial: 29

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	90.021 %	94.858 %	0.006 ppb	148,901.232 ppb	5,195.572 ppb	110.091 ppb	9,891.641 ppb	24,197.550 ppb	102.831 %
Concentration per Run 1	89.406 %	93.760 %	0.011 ppb	145,213.749 ppb	5,082.933 ppb	104.762 ppb	9,581.195 ppb	23,393.166 ppb	101.635 %
Concentration per Run 2	91.102 %	98.095 %	0.003 ppb	147,940.633 ppb	5,174.200 ppb	110.459 ppb	10,010.155 ppb	24,367.164 ppb	104.620 %
Concentration per Run 3	89.554 %	92.718 %	0.004 ppb	153,549.313 ppb	5,329.581 ppb	115.053 ppb	10,083.572 ppb	24,832.319 ppb	102.237 %
Concentration RSD	1.0 %	3.0 %	68.3 %	2.9 %	2.4 %	4.7 %	2.7 %	3.0 %	1.5 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	94.678 %	39.720 ppb	1.975 ppb	0.919 ppb	79.810 ppb	984.354 ppb	0.278 ppb	2.120 ppb	55.085 ppb
Concentration per Run 1	93.888 %	38.262 ppb	1.856 ppb	0.914 ppb	78.611 ppb	939.149 ppb	0.279 ppb	1.898 ppb	53.451 ppb
Concentration per Run 2	95.578 %	39.314 ppb	2.156 ppb	0.868 ppb	80.132 ppb	1,005.534 ppb	0.297 ppb	2.149 ppb	55.855 ppb
Concentration per Run 3	94.569 %	41.584 ppb	1.913 ppb	0.974 ppb	80.688 ppb	1,008.379 ppb	0.259 ppb	2.312 ppb	55.948 ppb
Concentration RSD	0.9 %	4.3 %	8.1 %	5.8 %	1.3 %	4.0 %	6.7 %	9.8 %	2.6 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	61.401 ppb	100.336 %	1.251 ppb	0.108 ppb	207.477 ppb	3.867 ppb	101.097 %	0.017 ppb	0.106 ppb
Concentration per Run 1	58.605 ppb	96.482 %	1.262 ppb	0.456 ppb	199.321 ppb	3.588 ppb	101.522 %	0.016 ppb	0.113 ppb
Concentration per Run 2	63.581 ppb	102.088 %	1.324 ppb	-0.062 ppb	211.343 ppb	4.119 ppb	101.225 %	0.019 ppb	0.141 ppb
Concentration per Run 3	62.018 ppb	102.439 %	1.166 ppb	-0.070 ppb	211.767 ppb	3.896 ppb	100.542 %	0.017 ppb	0.064 ppb
Concentration RSD	4.1 %	3.3 %	6.4 %	279.0 %	3.4 %	6.9 %	0.5 %	8.6 %	37.0 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	97.983 %	0.284 ppb	0.521 ppb	28.716 ppb	100.923 %	110.717 %	0.046 ppb	1.462 ppb	105.888 %
Concentration per Run 1	97.350 %	0.243 ppb	0.436 ppb	27.357 ppb	98.366 %	108.791 %	0.040 ppb	1.371 ppb	104.327 %
Concentration per Run 2	98.653 %	0.329 ppb	0.518 ppb	28.909 ppb	102.574 %	112.229 %	0.050 ppb	1.508 ppb	108.216 %
Concentration per Run 3	97.947 %	0.281 ppb	0.609 ppb	29.880 ppb	101.830 %	111.130 %	0.047 ppb	1.508 ppb	105.119 %
Concentration RSD	0.7 %	15.1 %	16.6 %	4.4 %	2.2 %	1.6 %	10.6 %	5.4 %	1.9 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 55 Analysis started at: 6/9/2017 9:59:52 AM Rack: 1
 Analysis label: L1718706-08 6020TL User name: ALPHALAB\metals-instrument Vial: 30

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	94.081 %	101.221 %	0.003 ppb	63,142.206 ppb	7,137.084 ppb	38.934 ppb	1,605.838 ppb	21,089.955 ppb	107.345 %
Concentration per Run 1	94.149 %	99.675 %	0.005 ppb	59,601.836 ppb	6,700.604 ppb	37.561 ppb	1,538.913 ppb	19,884.749 ppb	106.246 %
Concentration per Run 2	94.224 %	104.011 %	0.002 ppb	62,107.611 ppb	7,028.641 ppb	36.314 ppb	1,538.969 ppb	20,666.181 ppb	110.099 %
Concentration per Run 3	93.871 %	99.978 %	0.004 ppb	67,717.170 ppb	7,682.008 ppb	42.927 ppb	1,739.631 ppb	22,718.936 ppb	105.688 %
Concentration RSD	0.2 %	2.4 %	45.3 %	6.6 %	7.0 %	9.0 %	7.2 %	6.9 %	2.2 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	98.833 %	32.604 ppb	0.391 ppb	0.075 ppb	23.063 ppb	96.810 ppb	0.006 ppb	0.166 ppb	4.197 ppb
Concentration per Run 1	99.098 %	29.707 ppb	0.393 ppb	0.071 ppb	21.995 ppb	92.441 ppb	-0.001 ppb	0.195 ppb	4.283 ppb
Concentration per Run 2	99.535 %	32.263 ppb	0.387 ppb	0.087 ppb	22.167 ppb	93.696 ppb	0.012 ppb	0.053 ppb	3.882 ppb
Concentration per Run 3	97.867 %	35.841 ppb	0.394 ppb	0.066 ppb	25.027 ppb	104.292 ppb	0.006 ppb	0.251 ppb	4.427 ppb
Concentration RSD	0.9 %	9.4 %	1.0 %	15.1 %	7.4 %	6.7 %	121.7 %	61.6 %	6.7 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	0.598 ppb	105.727 %	3.975 ppb	0.794 ppb	93.057 ppb	0.215 ppb	104.699 %	0.000 ppb	0.006 ppb
Concentration per Run 1	0.348 ppb	104.691 %	3.834 ppb	0.159 ppb	86.324 ppb	0.225 ppb	104.408 %	0.000 ppb	0.000 ppb
Concentration per Run 2	0.859 ppb	107.778 %	4.019 ppb	1.590 ppb	92.319 ppb	0.172 ppb	105.665 %	-0.003 ppb	0.018 ppb
Concentration per Run 3	0.587 ppb	104.712 %	4.072 ppb	0.633 ppb	100.528 ppb	0.250 ppb	104.026 %	0.004 ppb	0.000 ppb
Concentration RSD	42.7 %	1.7 %	3.1 %	91.8 %	7.7 %	18.5 %	0.8 %	7,166.6 %	173.2 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	106.008 %	-0.068 ppb	0.360 ppb	13.433 ppb	106.161 %	115.118 %	0.006 ppb	0.108 ppb	112.941 %
Concentration per Run 1	105.769 %	-0.110 ppb	0.313 ppb	12.251 ppb	105.701 %	114.383 %	0.005 ppb	0.099 ppb	110.652 %
Concentration per Run 2	107.563 %	-0.040 ppb	0.374 ppb	13.153 ppb	108.833 %	116.934 %	0.005 ppb	0.107 ppb	116.412 %
Concentration per Run 3	104.691 %	-0.054 ppb	0.392 ppb	14.894 ppb	103.948 %	114.037 %	0.007 ppb	0.119 ppb	111.759 %
Concentration RSD	1.4 %	54.4 %	11.5 %	10.0 %	2.3 %	1.4 %	16.0 %	9.2 %	2.7 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 56 Analysis started at: 6/9/2017 10:02:58 AM Rack: 0
 Analysis label: CCV User name: ALPHALAB\metals-instrument Vial: 9

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	94.308 %	100.863 %	99.928 ppb	10,638.116 ppb	9,798.219 ppb	104.178 ppb	10,268.847 ppb	10,232.066 ppb	109.320 %
Concentration per Run 1	95.241 %	98.600 %	99.539 ppb	10,630.121 ppb	9,776.881 ppb	105.585 ppb	10,221.672 ppb	9,929.983 ppb	108.949 %
Concentration per Run 2	93.860 %	102.364 %	99.505 ppb	10,714.397 ppb	9,957.497 ppb	104.955 ppb	10,393.838 ppb	10,327.176 ppb	109.067 %
Concentration per Run 3	93.823 %	101.624 %	100.739 ppb	10,569.830 ppb	9,660.279 ppb	101.995 ppb	10,191.031 ppb	10,439.040 ppb	109.945 %
Recovery Percentage 1			99.928 %	106.381 %	97.982 %	104.178 %	102.688 %	102.321 %	
Concentration RSD	0.9 %	2.0 %	0.7 %	0.7 %	1.5 %	1.8 %	1.1 %	2.6 %	0.5 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	98.605 %	101.759 ppb	97.143 ppb	97.275 ppb	101.076 ppb	10,055.993 ppb	100.971 ppb	99.994 ppb	100.401 ppb
Concentration per Run 1	98.865 %	100.177 ppb	96.712 ppb	97.404 ppb	99.918 ppb	9,945.598 ppb	100.211 ppb	100.814 ppb	101.623 ppb
Concentration per Run 2	98.894 %	101.576 ppb	97.001 ppb	97.389 ppb	103.192 ppb	10,026.934 ppb	99.126 ppb	99.943 ppb	99.315 ppb
Concentration per Run 3	98.057 %	103.523 ppb	97.715 ppb	97.033 ppb	100.118 ppb	10,195.447 ppb	103.575 ppb	99.225 ppb	100.265 ppb
Recovery Percentage 1		101.759 %	97.143 %	97.275 %	101.076 %	100.560 %	100.971 %	99.994 %	100.401 %
Concentration RSD	0.5 %	1.7 %	0.5 %	0.2 %	1.8 %	1.3 %	2.3 %	0.8 %	1.2 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	97.047 ppb	107.808 %	95.293 ppb	98.810 ppb	102.813 ppb	101.794 ppb	105.619 %	99.205 ppb	100.834 ppb
Concentration per Run 1	96.656 ppb	105.959 %	95.096 ppb	101.470 ppb	101.989 ppb	101.681 ppb	104.300 %	98.509 ppb	100.768 ppb
Concentration per Run 2	96.436 ppb	108.834 %	96.632 ppb	98.055 ppb	102.880 ppb	100.479 ppb	107.365 %	98.460 ppb	99.837 ppb
Concentration per Run 3	98.051 ppb	108.630 %	94.152 ppb	96.903 ppb	103.570 ppb	103.223 ppb	105.191 %	100.645 ppb	101.899 ppb
Recovery Percentage 1	97.047 %		95.293 %	98.810 %	102.813 %	101.794 %		99.205 %	100.834 %
Concentration RSD	0.9 %	1.5 %	1.3 %	2.4 %	0.8 %	1.4 %	1.5 %	1.3 %	1.0 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	108.276 %	101.967 ppb	92.411 ppb	98.648 ppb	107.799 %	114.136 %	97.529 ppb	98.327 ppb	114.115 %
Concentration per Run 1	107.963 %	102.413 ppb	93.512 ppb	99.792 ppb	107.158 %	113.704 %	98.738 ppb	97.868 ppb	111.832 %
Concentration per Run 2	109.034 %	100.258 ppb	91.784 ppb	99.156 ppb	108.005 %	114.861 %	96.451 ppb	98.496 ppb	115.178 %
Concentration per Run 3	107.830 %	103.229 ppb	91.939 ppb	96.996 ppb	108.233 %	113.844 %	97.399 ppb	98.616 ppb	115.334 %
Recovery Percentage 1		101.967 %	92.411 %	98.648 %			97.529 %	98.327 %	
Concentration RSD	0.6 %	1.5 %	1.0 %	1.5 %	0.5 %	0.6 %	1.2 %	0.4 %	1.7 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 57 Analysis started at: 6/9/2017 10:06:07 AM Rack: 0
 Analysis label: CCB User name: ALPHALAB\metals-instrument Vial: 10

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	94.072 %	94.925 %	0.008 ppb	54.055 ppb	0.154 ppb	0.346 ppb	-0.328 ppb	-1.441 ppb	100.249 %
Concentration per Run 1	95.333 %	90.769 %	0.001 ppb	70.593 ppb	0.096 ppb	1.459 ppb	1.147 ppb	1.479 ppb	94.745 %
Concentration per Run 2	93.099 %	96.818 %	0.007 ppb	49.875 ppb	-0.199 ppb	-0.125 ppb	-3.411 ppb	-2.296 ppb	104.858 %
Concentration per Run 3	93.782 %	97.188 %	0.017 ppb	41.697 ppb	0.567 ppb	-0.295 ppb	1.281 ppb	-3.506 ppb	101.146 %
Recovery Percentage 1			2.724 %	54.055 %	0.221 %	3.464 %	-0.328 %	-1.441 %	
Concentration RSD	1.2 %	3.8 %	100.5 %	27.6 %	250.2 %	279.3 %	814.5 %	180.4 %	5.1 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	96.345 %	-0.008 ppb	0.012 ppb	-0.002 ppb	0.024 ppb	0.701 ppb	0.005 ppb	-0.013 ppb	0.014 ppb
Concentration per Run 1	96.925 %	0.002 ppb	0.023 ppb	-0.020 ppb	-0.040 ppb	1.344 ppb	-0.001 ppb	0.077 ppb	-0.013 ppb
Concentration per Run 2	94.728 %	-0.027 ppb	0.010 ppb	-0.017 ppb	0.064 ppb	0.206 ppb	0.013 ppb	-0.065 ppb	0.007 ppb
Concentration per Run 3	97.380 %	0.000 ppb	0.002 ppb	0.032 ppb	0.047 ppb	0.553 ppb	0.002 ppb	-0.050 ppb	0.047 ppb
Recovery Percentage 1		-1.643 %	0.235 %	-0.191 %	2.373 %	1.402 %	0.963 %	-0.634 %	1.390 %
Concentration RSD	1.5 %	194.4 %	86.7 %	1,528.2 %	235.2 %	83.2 %	150.4 %	614.8 %	218.2 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	0.001 ppb	101.961 %	0.030 ppb	0.601 ppb	0.007 ppb	0.180 ppb	102.271 %	0.014 ppb	0.008 ppb
Concentration per Run 1	-0.014 ppb	96.036 %	0.027 ppb	1.418 ppb	0.032 ppb	0.168 ppb	100.239 %	0.010 ppb	0.000 ppb
Concentration per Run 2	0.029 ppb	105.799 %	0.050 ppb	0.830 ppb	-0.007 ppb	0.142 ppb	103.882 %	0.017 ppb	0.018 ppb
Concentration per Run 3	-0.013 ppb	104.048 %	0.013 ppb	-0.446 ppb	-0.002 ppb	0.228 ppb	102.692 %	0.014 ppb	0.005 ppb
Recovery Percentage 1	0.006 %	101.961 %	5.967 %	12.012 %	1.464 %	8.975 %		3.422 %	3.811 %
Concentration RSD	3,785.1 %	5.1 %	62.5 %	158.6 %	288.1 %	24.5 %	1.8 %	25.7 %	124.7 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	105.074 %	0.197 ppb	0.782 ppb	0.020 ppb	100.987 %	109.261 %	0.018 ppb	0.021 ppb	107.669 %
Concentration per Run 1	101.228 %	0.232 ppb	0.854 ppb	0.116 ppb	95.787 %	103.730 %	0.023 ppb	0.024 ppb	101.514 %
Concentration per Run 2	107.089 %	0.150 ppb	0.795 ppb	-0.040 ppb	104.245 %	112.974 %	0.018 ppb	0.020 ppb	108.857 %
Concentration per Run 3	106.904 %	0.209 ppb	0.696 ppb	-0.015 ppb	102.929 %	111.079 %	0.013 ppb	0.019 ppb	112.634 %
Recovery Percentage 1		6.569 %	19.538 %	4.060 %			3.602 %	4.210 %	107.669 %
Concentration RSD	3.2 %	21.3 %	10.2 %	413.1 %	4.5 %	4.5 %	25.9 %	11.1 %	5.3 %

Alpha ICPMSQ2 Full

6/10/2017 10:11:47 AM



Analysis index: 58 Analysis started at: 6/9/2017 10:11:42 AM Rack: 1
 Analysis label: WG1009791-1 6020TL User name: ALPHALAB\metals-instrument Vial: 34

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	95.854 %	100.157 %	0.003 ppb	30.385 ppb	-0.350 ppb	0.929 ppb	-9.363 ppb	3.822 ppb	107.122 %
Concentration per Run 1	96.365 %	97.390 %	0.005 ppb	29.003 ppb	-0.390 ppb	0.682 ppb	-8.711 ppb	6.931 ppb	105.664 %
Concentration per Run 2	96.029 %	101.591 %	0.004 ppb	39.765 ppb	-0.593 ppb	1.035 ppb	-10.610 ppb	4.266 ppb	106.885 %
Concentration per Run 3	95.168 %	101.490 %	0.000 ppb	22.386 ppb	-0.068 ppb	1.071 ppb	-8.766 ppb	0.270 ppb	108.818 %
Concentration RSD	0.6 %	2.4 %	99.5 %	28.9 %	75.5 %	23.1 %	11.5 %	87.7 %	1.5 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	96.867 %	0.067 ppb	0.021 ppb	-0.003 ppb	0.103 ppb	0.768 ppb	-0.001 ppb	-0.021 ppb	-0.002 ppb
Concentration per Run 1	96.716 %	0.073 ppb	0.010 ppb	-0.020 ppb	0.111 ppb	0.216 ppb	-0.001 ppb	-0.092 ppb	0.028 ppb
Concentration per Run 2	97.823 %	0.071 ppb	0.027 ppb	-0.026 ppb	0.083 ppb	1.056 ppb	0.002 ppb	-0.026 ppb	-0.030 ppb
Concentration per Run 3	96.061 %	0.057 ppb	0.026 ppb	0.036 ppb	0.114 ppb	1.032 ppb	-0.005 ppb	0.054 ppb	-0.004 ppb
Concentration RSD	0.9 %	12.6 %	44.1 %	1,006.5 %	16.5 %	62.3 %	261.1 %	343.4 %	1,363.5 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	-0.205 ppb	105.774 %	0.037 ppb	-0.076 ppb	0.011 ppb	0.030 ppb	107.774 %	0.009 ppb	0.001 ppb
Concentration per Run 1	-0.286 ppb	102.896 %	0.013 ppb	-0.271 ppb	0.009 ppb	0.034 ppb	106.264 %	0.008 ppb	0.000 ppb
Concentration per Run 2	-0.120 ppb	107.256 %	0.024 ppb	-1.088 ppb	0.028 ppb	0.009 ppb	107.765 %	0.012 ppb	0.000 ppb
Concentration per Run 3	-0.210 ppb	107.170 %	0.073 ppb	1.132 ppb	-0.004 ppb	0.048 ppb	109.293 %	0.006 ppb	0.004 ppb
Concentration RSD	40.7 %	2.4 %	87.3 %	1,484.5 %	145.7 %	65.5 %	1.4 %	38.8 %	173.2 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	108.264 %	0.024 ppb	0.217 ppb	-0.020 ppb	106.607 %	112.120 %	0.004 ppb	0.007 ppb	118.180 %
Concentration per Run 1	106.687 %	-0.002 ppb	0.207 ppb	-0.016 ppb	104.625 %	111.116 %	0.004 ppb	0.003 ppb	117.021 %
Concentration per Run 2	108.554 %	0.005 ppb	0.240 ppb	-0.005 ppb	107.073 %	110.588 %	0.005 ppb	0.010 ppb	118.680 %
Concentration per Run 3	109.550 %	0.070 ppb	0.203 ppb	-0.040 ppb	108.123 %	114.655 %	0.003 ppb	0.008 ppb	118.838 %
Concentration RSD	1.3 %	163.0 %	9.4 %	88.9 %	1.7 %	2.0 %	18.2 %	54.3 %	0.9 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 59 Analysis started at: 6/9/2017 10:14:49 AM Rack: 1
 Analysis label: WG1009791-2D5 6020TL User name: ALPHALAB\metals-instrument Vial: 35

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	96.254 %	104.302 %	10.177 ppb	2,147.295 ppb	1,987.773 ppb	434.356 ppb	2,077.981 ppb	2,106.760 ppb	109.033 %
Concentration per Run 1	95.501 %	100.179 %	10.092 ppb	2,048.262 ppb	1,854.790 ppb	409.863 ppb	1,942.074 ppb	2,005.889 ppb	107.836 %
Concentration per Run 2	96.965 %	107.170 %	10.097 ppb	2,172.274 ppb	2,038.623 ppb	441.886 ppb	2,101.904 ppb	2,127.392 ppb	109.482 %
Concentration per Run 3	96.295 %	105.557 %	10.341 ppb	2,221.350 ppb	2,069.907 ppb	451.318 ppb	2,189.963 ppb	2,186.998 ppb	109.779 %
Concentration RSD	0.8 %	3.5 %	1.4 %	4.2 %	5.8 %	5.0 %	6.0 %	4.4 %	1.0 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	99.154 %	174.044 ppb	97.394 ppb	38.865 ppb	99.270 ppb	211.746 ppb	97.101 ppb	97.876 ppb	49.972 ppb
Concentration per Run 1	98.118 %	163.617 ppb	91.316 ppb	36.484 ppb	92.592 ppb	193.890 ppb	91.397 ppb	92.714 ppb	47.875 ppb
Concentration per Run 2	98.983 %	178.708 ppb	99.129 ppb	39.633 ppb	101.228 ppb	218.114 ppb	99.984 ppb	97.705 ppb	50.320 ppb
Concentration per Run 3	100.360 %	179.807 ppb	101.735 ppb	40.477 ppb	103.991 ppb	223.233 ppb	99.921 ppb	103.208 ppb	51.721 ppb
Concentration RSD	1.1 %	5.2 %	5.6 %	5.4 %	6.0 %	7.4 %	5.1 %	5.4 %	3.9 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	96.048 ppb	108.138 %	22.938 ppb	23.905 ppb	201.245 ppb	190.330 ppb	107.209 %	9.776 ppb	10.482 ppb
Concentration per Run 1	91.309 ppb	103.964 %	22.996 ppb	22.580 ppb	187.291 ppb	180.528 ppb	104.692 %	9.427 ppb	9.945 ppb
Concentration per Run 2	98.009 ppb	109.756 %	22.604 ppb	22.284 ppb	204.285 ppb	191.718 ppb	109.256 %	9.768 ppb	10.418 ppb
Concentration per Run 3	98.826 ppb	110.694 %	23.213 ppb	26.850 ppb	212.161 ppb	198.745 ppb	107.681 %	10.133 ppb	11.083 ppb
Concentration RSD	4.3 %	3.4 %	1.3 %	10.7 %	6.3 %	4.8 %	2.2 %	3.6 %	5.5 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	109.876 %	192.608 ppb	94.117 ppb	390.997 ppb	108.024 %	113.788 %	23.516 ppb	100.111 ppb	117.230 %
Concentration per Run 1	105.853 %	183.285 ppb	89.798 ppb	367.068 ppb	105.409 %	110.802 %	22.479 ppb	94.697 ppb	114.244 %
Concentration per Run 2	112.437 %	193.644 ppb	94.025 ppb	395.831 ppb	110.956 %	117.484 %	23.377 ppb	100.646 ppb	119.575 %
Concentration per Run 3	111.338 %	200.896 ppb	98.529 ppb	410.093 ppb	107.708 %	113.080 %	24.692 ppb	104.992 ppb	117.871 %
Concentration RSD	3.2 %	4.6 %	4.6 %	5.6 %	2.6 %	3.0 %	4.7 %	5.2 %	2.3 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 60 Analysis started at: 6/9/2017 10:17:57 AM Rack: 1
 Analysis label: L1718726-01 6020TL User name: ALPHALAB\metals-instrument Vial: 31

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	98.315 %	102.991 %	0.008 ppb	5,607.861 ppb	9,103.306 ppb	55.072 ppb	840.224 ppb	106,833.259 ppb	109.637 %
Concentration per Run 1	97.872 %	100.818 %	0.007 ppb	5,642.756 ppb	9,184.890 ppb	56.933 ppb	843.219 ppb	108,695.098 ppb	107.182 %
Concentration per Run 2	98.572 %	104.649 %	0.005 ppb	5,605.356 ppb	9,155.937 ppb	52.363 ppb	843.980 ppb	105,562.651 ppb	111.203 %
Concentration per Run 3	98.501 %	103.507 %	0.010 ppb	5,575.472 ppb	8,969.091 ppb	55.920 ppb	833.473 ppb	106,242.030 ppb	110.526 %
Concentration RSD	0.4 %	1.9 %	32.3 %	0.6 %	1.3 %	4.4 %	0.7 %	1.5 %	2.0 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	97.974 %	168.492 ppb	0.761 ppb	0.157 ppb	712.044 ppb	3,881.131 ppb	2.783 ppb	3.595 ppb	0.406 ppb
Concentration per Run 1	98.078 %	175.616 ppb	0.836 ppb	0.170 ppb	733.619 ppb	4,092.411 ppb	3.035 ppb	3.716 ppb	0.379 ppb
Concentration per Run 2	98.704 %	165.117 ppb	0.716 ppb	0.176 ppb	694.183 ppb	3,786.240 ppb	2.724 ppb	3.705 ppb	0.443 ppb
Concentration per Run 3	97.141 %	164.743 ppb	0.731 ppb	0.126 ppb	708.330 ppb	3,764.741 ppb	2.590 ppb	3.365 ppb	0.397 ppb
Concentration RSD	0.8 %	3.7 %	8.6 %	17.5 %	2.8 %	4.7 %	8.2 %	5.5 %	8.1 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	1.969 ppb	107.304 %	0.632 ppb	-0.051 ppb	617.422 ppb	0.722 ppb	104.712 %	0.003 ppb	0.011 ppb
Concentration per Run 1	1.856 ppb	105.658 %	0.671 ppb	0.059 ppb	624.141 ppb	0.785 ppb	102.778 %	0.004 ppb	0.004 ppb
Concentration per Run 2	2.100 ppb	109.073 %	0.602 ppb	-0.132 ppb	611.123 ppb	0.803 ppb	105.613 %	0.004 ppb	0.017 ppb
Concentration per Run 3	1.950 ppb	107.180 %	0.624 ppb	-0.079 ppb	617.003 ppb	0.578 ppb	105.745 %	0.002 ppb	0.013 ppb
Concentration RSD	6.3 %	1.6 %	5.6 %	194.4 %	1.1 %	17.3 %	1.6 %	33.7 %	56.2 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	115.909 %	0.376 ppb	1.263 ppb	28.922 ppb	110.272 %	107.919 %	0.041 ppb	0.362 ppb	111.971 %
Concentration per Run 1	113.248 %	0.315 ppb	1.357 ppb	29.332 ppb	106.795 %	103.361 %	0.038 ppb	0.387 ppb	109.487 %
Concentration per Run 2	117.989 %	0.412 ppb	1.286 ppb	29.409 ppb	112.222 %	111.111 %	0.040 ppb	0.356 ppb	113.333 %
Concentration per Run 3	116.491 %	0.401 ppb	1.146 ppb	28.026 ppb	111.798 %	109.286 %	0.044 ppb	0.342 ppb	113.094 %
Concentration RSD	2.1 %	14.0 %	8.5 %	2.7 %	2.7 %	3.8 %	8.1 %	6.4 %	1.9 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 61 Analysis started at: 6/9/2017 10:21:03 AM Rack: 1
 Analysis label: L1718726-03 6020TL User name: ALPHALAB\metals-instrument Vial: 32

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	96.932 %	104.168 %	0.006 ppb	10,623.030 ppb	6,473.704 ppb	80.540 ppb	1,567.671 ppb	52,184.471 ppb	110.424 %
Concentration per Run 1	97.768 %	99.171 %	0.009 ppb	10,949.938 ppb	6,851.490 ppb	83.245 ppb	1,636.618 ppb	54,137.080 ppb	104.242 %
Concentration per Run 2	96.443 %	105.523 %	0.004 ppb	10,596.697 ppb	6,388.208 ppb	86.481 ppb	1,566.208 ppb	52,417.164 ppb	112.057 %
Concentration per Run 3	96.583 %	107.809 %	0.005 ppb	10,322.454 ppb	6,181.416 ppb	71.896 ppb	1,500.187 ppb	49,999.169 ppb	114.975 %
Concentration RSD	0.8 %	4.3 %	47.8 %	3.0 %	5.3 %	9.5 %	4.4 %	4.0 %	5.0 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	99.179 %	83.828 ppb	0.380 ppb	0.198 ppb	57.793 ppb	249.112 ppb	0.130 ppb	0.407 ppb	0.485 ppb
Concentration per Run 1	99.085 %	85.017 ppb	0.245 ppb	0.211 ppb	60.597 ppb	272.798 ppb	0.123 ppb	0.428 ppb	0.490 ppb
Concentration per Run 2	99.857 %	84.419 ppb	0.525 ppb	0.174 ppb	57.694 ppb	242.911 ppb	0.093 ppb	0.479 ppb	0.569 ppb
Concentration per Run 3	98.597 %	82.049 ppb	0.371 ppb	0.209 ppb	55.088 ppb	231.627 ppb	0.174 ppb	0.314 ppb	0.395 ppb
Concentration RSD	0.6 %	1.9 %	36.9 %	10.7 %	4.8 %	8.5 %	31.5 %	20.7 %	18.0 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	2.356 ppb	107.830 %	0.276 ppb	0.369 ppb	354.707 ppb	0.239 ppb	106.796 %	0.002 ppb	0.022 ppb
Concentration per Run 1	2.518 ppb	101.798 %	0.271 ppb	0.841 ppb	367.779 ppb	0.199 ppb	100.655 %	0.002 ppb	0.023 ppb
Concentration per Run 2	2.562 ppb	110.128 %	0.262 ppb	-0.101 ppb	355.800 ppb	0.230 ppb	108.687 %	0.002 ppb	0.021 ppb
Concentration per Run 3	1.989 ppb	111.564 %	0.294 ppb	0.366 ppb	340.543 ppb	0.287 ppb	111.048 %	0.003 ppb	0.021 ppb
Concentration RSD	13.5 %	4.9 %	6.0 %	127.7 %	3.8 %	18.7 %	5.1 %	22.0 %	5.7 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	112.390 %	0.035 ppb	0.420 ppb	15.406 ppb	107.354 %	110.741 %	0.009 ppb	0.111 ppb	113.287 %
Concentration per Run 1	105.049 %	0.018 ppb	0.392 ppb	15.588 ppb	100.152 %	104.401 %	0.008 ppb	0.110 ppb	107.411 %
Concentration per Run 2	114.668 %	0.060 ppb	0.387 ppb	15.722 ppb	109.968 %	112.248 %	0.010 ppb	0.121 ppb	115.040 %
Concentration per Run 3	117.453 %	0.027 ppb	0.479 ppb	14.909 ppb	111.941 %	115.573 %	0.010 ppb	0.103 ppb	117.408 %
Concentration RSD	5.8 %	64.4 %	12.3 %	2.8 %	5.9 %	5.2 %	15.9 %	7.9 %	4.6 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 62 Analysis started at: 6/9/2017 10:24:09 AM Rack: 1
 Analysis label: L1718726-04 6020TL User name: ALPHALAB\metals-instrument Vial: 33

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	96.237 %	104.481 %	0.008 ppb	9,502.375 ppb	6,773.352 ppb	103.241 ppb	1,844.985 ppb	56,921.205 ppb	109.641 %
Concentration per Run 1	96.056 %	104.112 %	0.010 ppb	9,519.508 ppb	6,640.636 ppb	103.598 ppb	1,878.720 ppb	56,303.075 ppb	107.988 %
Concentration per Run 2	96.393 %	105.490 %	0.007 ppb	9,400.695 ppb	6,760.289 ppb	105.130 ppb	1,812.573 ppb	57,139.326 ppb	111.392 %
Concentration per Run 3	96.263 %	103.843 %	0.007 ppb	9,586.922 ppb	6,919.131 ppb	100.993 ppb	1,843.661 ppb	57,321.215 ppb	109.542 %
Concentration RSD	0.2 %	0.8 %	20.5 %	1.0 %	2.1 %	2.0 %	1.8 %	1.0 %	1.6 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	97.063 %	91.395 ppb	0.412 ppb	0.209 ppb	67.269 ppb	288.728 ppb	0.136 ppb	0.464 ppb	0.569 ppb
Concentration per Run 1	96.567 %	90.356 ppb	0.343 ppb	0.229 ppb	67.117 ppb	295.783 ppb	0.169 ppb	0.522 ppb	0.683 ppb
Concentration per Run 2	97.550 %	93.424 ppb	0.464 ppb	0.155 ppb	67.959 ppb	276.138 ppb	0.132 ppb	0.498 ppb	0.549 ppb
Concentration per Run 3	97.072 %	90.404 ppb	0.429 ppb	0.243 ppb	66.730 ppb	294.264 ppb	0.109 ppb	0.371 ppb	0.475 ppb
Concentration RSD	0.5 %	1.9 %	15.1 %	22.6 %	0.9 %	3.8 %	22.2 %	17.5 %	18.6 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	2.932 ppb	108.449 %	0.347 ppb	-0.273 ppb	386.210 ppb	0.229 ppb	106.902 %	-0.001 ppb	0.020 ppb
Concentration per Run 1	2.929 ppb	108.192 %	0.388 ppb	-0.191 ppb	375.791 ppb	0.266 ppb	107.273 %	0.004 ppb	0.013 ppb
Concentration per Run 2	2.863 ppb	108.801 %	0.338 ppb	-0.212 ppb	389.664 ppb	0.160 ppb	108.264 %	-0.001 ppb	0.026 ppb
Concentration per Run 3	3.006 ppb	108.355 %	0.315 ppb	-0.415 ppb	393.176 ppb	0.262 ppb	105.168 %	-0.005 ppb	0.022 ppb
Concentration RSD	2.4 %	0.3 %	10.8 %	45.3 %	2.4 %	26.2 %	1.5 %	679.8 %	33.0 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	113.417 %	-0.022 ppb	0.264 ppb	16.505 ppb	108.324 %	110.389 %	0.008 ppb	0.445 ppb	113.615 %
Concentration per Run 1	115.242 %	-0.047 ppb	0.260 ppb	16.630 ppb	106.117 %	108.948 %	0.007 ppb	0.445 ppb	114.221 %
Concentration per Run 2	114.044 %	0.021 ppb	0.264 ppb	17.110 ppb	108.501 %	110.439 %	0.009 ppb	0.439 ppb	112.489 %
Concentration per Run 3	110.964 %	-0.041 ppb	0.268 ppb	15.775 ppb	110.355 %	111.780 %	0.006 ppb	0.450 ppb	114.135 %
Concentration RSD	1.9 %	170.6 %	1.6 %	4.1 %	2.0 %	1.3 %	18.8 %	1.3 %	0.9 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 63 Analysis started at: 6/9/2017 10:27:16 AM Rack: 1
 Analysis label: L1717934-04 6020TL User name: ALPHALAB\metals-instrument Vial: 36

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	97.385 %	106.039 %	0.000 ppb	4,654.196 ppb	13,459.459 ppb	13.965 ppb	1,219.583 ppb	48,725.181 ppb	109.526 %
Concentration per Run 1	96.459 %	104.044 %	0.002 ppb	4,840.180 ppb	14,017.872 ppb	13.403 ppb	1,245.221 ppb	50,153.340 ppb	106.588 %
Concentration per Run 2	97.591 %	104.750 %	0.002 ppb	4,615.155 ppb	13,367.962 ppb	12.843 ppb	1,219.816 ppb	48,293.788 ppb	111.784 %
Concentration per Run 3	98.106 %	109.321 %	-0.003 ppb	4,507.253 ppb	12,992.541 ppb	15.650 ppb	1,193.712 ppb	47,728.414 ppb	110.206 %
Concentration RSD	0.9 %	2.7 %	1,720.1 %	3.6 %	3.9 %	10.6 %	2.1 %	2.6 %	2.4 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	100.264 %	76.577 ppb	0.098 ppb	0.089 ppb	11.803 ppb	33.969 ppb	0.031 ppb	0.119 ppb	0.157 ppb
Concentration per Run 1	98.875 %	79.327 ppb	0.129 ppb	0.101 ppb	12.889 ppb	32.308 ppb	0.031 ppb	0.099 ppb	0.217 ppb
Concentration per Run 2	100.841 %	75.939 ppb	0.065 ppb	0.101 ppb	11.414 ppb	34.367 ppb	0.015 ppb	0.205 ppb	0.072 ppb
Concentration per Run 3	101.076 %	74.463 ppb	0.099 ppb	0.066 ppb	11.106 ppb	35.231 ppb	0.047 ppb	0.052 ppb	0.181 ppb
Concentration RSD	1.2 %	3.3 %	32.4 %	22.5 %	8.1 %	4.4 %	50.6 %	66.3 %	48.2 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	0.437 ppb	107.971 %	0.340 ppb	-0.040 ppb	106.242 ppb	0.132 ppb	105.086 %	0.000 ppb	0.001 ppb
Concentration per Run 1	0.364 ppb	105.081 %	0.300 ppb	0.239 ppb	109.724 ppb	0.145 ppb	101.867 %	-0.001 ppb	0.000 ppb
Concentration per Run 2	0.354 ppb	110.443 %	0.369 ppb	-0.921 ppb	103.939 ppb	0.146 ppb	105.521 %	0.002 ppb	0.004 ppb
Concentration per Run 3	0.594 ppb	108.388 %	0.351 ppb	0.561 ppb	105.063 ppb	0.105 ppb	107.870 %	-0.002 ppb	0.000 ppb
Concentration RSD	31.1 %	2.5 %	10.5 %	1,933.8 %	2.9 %	17.9 %	2.9 %	936.2 %	173.2 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	112.278 %	-0.064 ppb	0.174 ppb	46.148 ppb	108.136 %	109.753 %	0.002 ppb	0.011 ppb	110.991 %
Concentration per Run 1	108.137 %	-0.076 ppb	0.152 ppb	48.589 ppb	104.908 %	107.431 %	0.004 ppb	0.016 ppb	108.365 %
Concentration per Run 2	113.337 %	-0.026 ppb	0.196 ppb	45.888 ppb	109.749 %	110.666 %	0.002 ppb	0.009 ppb	111.970 %
Concentration per Run 3	115.359 %	-0.089 ppb	0.173 ppb	43.966 ppb	109.749 %	111.162 %	0.001 ppb	0.008 ppb	112.639 %
Concentration RSD	3.3 %	51.7 %	12.7 %	5.0 %	2.6 %	1.8 %	48.4 %	41.6 %	2.1 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 64 Analysis started at: 6/9/2017 10:30:23 AM Rack: 1
 Analysis label: WG1009791-3D10 6020TL User name: ALPHALAB\metals-instrument Vial: 37

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	96.667 %	103.014 %	5.111 ppb	1,594.557 ppb	2,435.677 ppb	235.690 ppb	1,182.337 ppb	6,028.794 ppb	105.799 %
Concentration per Run 1	96.378 %	96.785 %	5.172 ppb	1,584.303 ppb	2,419.491 ppb	236.388 ppb	1,169.854 ppb	5,855.141 ppb	100.461 %
Concentration per Run 2	96.105 %	106.632 %	5.047 ppb	1,616.199 ppb	2,457.928 ppb	238.584 ppb	1,204.493 ppb	6,131.707 ppb	109.043 %
Concentration per Run 3	97.518 %	105.624 %	5.116 ppb	1,583.168 ppb	2,429.610 ppb	232.098 ppb	1,172.664 ppb	6,099.533 ppb	107.893 %
Concentration RSD	0.8 %	5.3 %	1.2 %	1.2 %	0.8 %	1.4 %	1.6 %	2.5 %	4.4 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	99.062 %	99.486 ppb	52.018 ppb	20.601 ppb	54.603 ppb	121.362 ppb	51.260 ppb	52.234 ppb	25.704 ppb
Concentration per Run 1	99.997 %	98.323 ppb	51.972 ppb	20.491 ppb	54.294 ppb	119.088 ppb	51.769 ppb	52.519 ppb	25.733 ppb
Concentration per Run 2	96.948 %	99.823 ppb	52.639 ppb	20.963 ppb	54.092 ppb	121.356 ppb	51.084 ppb	51.840 ppb	25.614 ppb
Concentration per Run 3	100.240 %	100.313 ppb	51.444 ppb	20.350 ppb	55.424 ppb	123.642 ppb	50.927 ppb	52.344 ppb	25.764 ppb
Concentration RSD	1.9 %	1.0 %	1.2 %	1.6 %	1.3 %	1.9 %	0.9 %	0.7 %	0.3 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	52.592 ppb	105.122 %	12.377 ppb	12.762 ppb	113.955 ppb	98.448 ppb	102.542 %	5.111 ppb	5.350 ppb
Concentration per Run 1	52.597 ppb	99.022 %	12.817 ppb	11.038 ppb	110.582 ppb	98.489 ppb	94.351 %	5.122 ppb	5.505 ppb
Concentration per Run 2	53.010 ppb	108.861 %	12.175 ppb	13.125 ppb	115.864 ppb	99.193 ppb	107.658 %	5.096 ppb	5.413 ppb
Concentration per Run 3	52.170 ppb	107.483 %	12.138 ppb	14.124 ppb	115.418 ppb	97.663 ppb	105.618 %	5.115 ppb	5.134 ppb
Concentration RSD	0.8 %	5.1 %	3.1 %	12.3 %	2.6 %	0.8 %	7.0 %	0.3 %	3.6 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	106.038 %	101.521 ppb	50.477 ppb	210.845 ppb	103.889 %	107.560 %	12.525 ppb	54.202 ppb	106.917 %
Concentration per Run 1	95.133 %	102.694 ppb	50.437 ppb	213.124 ppb	94.762 %	98.733 %	12.310 ppb	54.361 ppb	97.237 %
Concentration per Run 2	111.030 %	100.990 ppb	50.614 ppb	210.828 ppb	108.209 %	111.919 %	12.690 ppb	54.532 ppb	110.727 %
Concentration per Run 3	111.949 %	100.878 ppb	50.378 ppb	208.583 ppb	108.696 %	112.027 %	12.574 ppb	53.713 ppb	112.786 %
Concentration RSD	8.9 %	1.0 %	0.2 %	1.1 %	7.6 %	7.1 %	1.6 %	0.8 %	7.9 %

Alpha ICPMSQ2 Full

6/10/2017 10:11:47 AM



Analysis index: 65 Analysis started at: 6/9/2017 10:33:28 AM Rack: 1
 Analysis label: WG1009791-4D10 6020TL User name: ALPHALAB\metals-instrument Vial: 38

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	96.960 %	101.916 %	5.136 ppb	1,607.139 ppb	2,407.851 ppb	233.431 ppb	1,192.466 ppb	5,978.146 ppb	103.774 %
Concentration per Run 1	97.473 %	100.717 %	5.064 ppb	1,498.499 ppb	2,271.021 ppb	219.909 ppb	1,134.196 ppb	5,659.451 ppb	106.471 %
Concentration per Run 2	96.067 %	97.356 %	5.082 ppb	1,730.299 ppb	2,538.996 ppb	241.311 ppb	1,275.138 ppb	6,183.963 ppb	95.771 %
Concentration per Run 3	97.339 %	107.674 %	5.262 ppb	1,592.620 ppb	2,413.537 ppb	239.074 ppb	1,168.063 ppb	6,091.025 ppb	109.080 %
Concentration RSD	0.8 %	5.2 %	2.1 %	7.3 %	5.6 %	5.0 %	6.2 %	4.7 %	6.8 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	97.687 %	98.290 ppb	52.534 ppb	20.471 ppb	53.099 ppb	115.099 ppb	50.677 ppb	51.428 ppb	26.707 ppb
Concentration per Run 1	98.298 %	92.430 ppb	50.257 ppb	19.524 ppb	50.347 ppb	110.802 ppb	47.671 ppb	48.526 ppb	24.857 ppb
Concentration per Run 2	96.896 %	104.366 ppb	55.373 ppb	21.447 ppb	55.049 ppb	113.051 ppb	54.536 ppb	55.655 ppb	28.577 ppb
Concentration per Run 3	97.869 %	98.075 ppb	51.971 ppb	20.442 ppb	53.900 ppb	121.444 ppb	49.825 ppb	50.104 ppb	26.686 ppb
Concentration RSD	0.7 %	6.1 %	5.0 %	4.7 %	4.6 %	4.9 %	6.9 %	7.3 %	7.0 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	49.455 ppb	104.939 %	12.124 ppb	11.873 ppb	112.800 ppb	99.989 ppb	102.007 %	5.110 ppb	5.171 ppb
Concentration per Run 1	48.227 ppb	107.677 %	11.318 ppb	10.981 ppb	107.164 ppb	96.836 ppb	104.063 %	4.814 ppb	5.196 ppb
Concentration per Run 2	51.373 ppb	97.291 %	12.477 ppb	13.268 ppb	118.578 ppb	104.420 ppb	95.898 %	5.375 ppb	5.176 ppb
Concentration per Run 3	48.765 ppb	109.851 %	12.577 ppb	11.370 ppb	112.658 ppb	98.710 ppb	106.061 %	5.140 ppb	5.141 ppb
Concentration RSD	3.4 %	6.4 %	5.8 %	10.3 %	5.1 %	4.0 %	5.3 %	5.5 %	0.5 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	105.837 %	100.730 ppb	49.897 ppb	208.669 ppb	104.499 %	108.194 %	12.522 ppb	53.684 ppb	107.877 %
Concentration per Run 1	106.688 %	95.498 ppb	46.795 ppb	198.266 ppb	105.963 %	107.817 %	12.074 ppb	51.433 ppb	106.612 %
Concentration per Run 2	99.597 %	106.330 ppb	52.604 ppb	220.488 ppb	99.393 %	103.286 %	13.081 ppb	55.704 ppb	104.996 %
Concentration per Run 3	111.228 %	100.361 ppb	50.291 ppb	207.252 ppb	108.142 %	113.478 %	12.410 ppb	53.914 ppb	112.022 %
Concentration RSD	5.5 %	5.4 %	5.9 %	5.4 %	4.4 %	4.7 %	4.1 %	4.0 %	3.4 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 66 Analysis started at: 6/9/2017 10:36:33 AM Rack: 1
 Analysis label: WG1009791-5D10 6020TL User name: ALPHALAB\metals-instrument Vial: 39

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	95.504 %	99.888 %	49.078 ppb	5,694.487 ppb	6,207.706 ppb	53.018 ppb	5,302.588 ppb	9,856.309 ppb	101.412 %
Concentration per Run 1	95.482 %	101.961 %	49.513 ppb	5,661.146 ppb	6,173.764 ppb	54.910 ppb	5,354.084 ppb	9,963.413 ppb	100.008 %
Concentration per Run 2	96.205 %	101.490 %	48.490 ppb	5,809.366 ppb	6,269.133 ppb	52.276 ppb	5,273.730 ppb	9,448.080 ppb	109.198 %
Concentration per Run 3	94.825 %	96.214 %	49.231 ppb	5,612.949 ppb	6,180.221 ppb	51.867 ppb	5,279.949 ppb	10,157.434 ppb	95.031 %
Concentration RSD	0.7 %	3.2 %	1.1 %	1.8 %	0.9 %	3.1 %	0.8 %	3.7 %	7.1 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	96.214 %	59.362 ppb	48.909 ppb	49.605 ppb	51.839 ppb	5,132.518 ppb	51.179 ppb	50.519 ppb	50.548 ppb
Concentration per Run 1	97.520 %	60.152 ppb	48.812 ppb	49.616 ppb	53.309 ppb	5,171.183 ppb	51.937 ppb	52.015 ppb	50.444 ppb
Concentration per Run 2	95.717 %	58.749 ppb	48.560 ppb	49.179 ppb	49.121 ppb	5,023.002 ppb	50.331 ppb	49.921 ppb	49.308 ppb
Concentration per Run 3	95.404 %	59.184 ppb	49.353 ppb	50.020 ppb	53.089 ppb	5,203.369 ppb	51.269 ppb	49.621 ppb	51.891 ppb
Concentration RSD	1.2 %	1.2 %	0.8 %	0.8 %	4.5 %	1.9 %	1.6 %	2.6 %	2.6 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	49.445 ppb	100.785 %	47.894 ppb	48.218 ppb	60.188 ppb	50.957 ppb	101.611 %	5.178 ppb	49.372 ppb
Concentration per Run 1	50.411 ppb	100.176 %	48.351 ppb	46.433 ppb	59.420 ppb	51.634 ppb	99.331 %	5.191 ppb	49.337 ppb
Concentration per Run 2	47.987 ppb	105.689 %	47.374 ppb	50.862 ppb	60.768 ppb	50.563 ppb	104.495 %	5.230 ppb	48.489 ppb
Concentration per Run 3	49.937 ppb	96.491 %	47.957 ppb	47.360 ppb	60.375 ppb	50.673 ppb	101.008 %	5.114 ppb	50.289 ppb
Concentration RSD	2.6 %	4.6 %	1.0 %	4.8 %	1.2 %	1.2 %	2.6 %	1.1 %	1.8 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	103.438 %	51.245 ppb	48.689 ppb	53.618 ppb	100.882 %	103.147 %	49.442 ppb	49.462 ppb	104.586 %
Concentration per Run 1	101.780 %	52.083 ppb	49.371 ppb	54.593 ppb	98.852 %	101.646 %	49.640 ppb	49.174 ppb	103.493 %
Concentration per Run 2	109.008 %	50.448 ppb	48.412 ppb	52.399 ppb	104.555 %	110.216 %	48.741 ppb	49.442 ppb	109.554 %
Concentration per Run 3	99.525 %	51.204 ppb	48.283 ppb	53.862 ppb	99.238 %	97.577 %	49.945 ppb	49.770 ppb	100.711 %
Concentration RSD	4.8 %	1.6 %	1.2 %	2.1 %	3.2 %	6.3 %	1.3 %	0.6 %	4.3 %

Alpha ICPMSQ2 Full

6/10/2017 10:11:47 AM



Analysis index: 67 Analysis started at: 6/9/2017 10:39:38 AM Rack: 1
 Analysis label: WG1009791-6D5 6020TL User name: ALPHALAB\metals-instrument Vial: 40

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	99.732 %	105.646 %	0.006 ppb	895.181 ppb	2,670.023 ppb	2.736 ppb	223.183 ppb	9,393.450 ppb	109.099 %
Concentration per Run 1	100.490 %	104.212 %	0.004 ppb	884.393 ppb	2,658.573 ppb	2.251 ppb	212.943 ppb	9,202.315 ppb	107.538 %
Concentration per Run 2	99.494 %	107.405 %	0.007 ppb	886.151 ppb	2,637.252 ppb	3.831 ppb	231.276 ppb	9,458.594 ppb	109.992 %
Concentration per Run 3	99.212 %	105.322 %	0.008 ppb	915.000 ppb	2,714.245 ppb	2.124 ppb	225.330 ppb	9,519.440 ppb	109.767 %
Concentration RSD	0.7 %	1.5 %	32.3 %	1.9 %	1.5 %	34.8 %	4.2 %	1.8 %	1.2 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	99.535 %	14.058 ppb	0.007 ppb	-0.001 ppb	2.307 ppb	5.888 ppb	0.003 ppb	-0.018 ppb	-0.005 ppb
Concentration per Run 1	100.656 %	14.027 ppb	0.018 ppb	0.037 ppb	2.254 ppb	5.992 ppb	0.006 ppb	0.015 ppb	-0.003 ppb
Concentration per Run 2	98.610 %	13.506 ppb	0.009 ppb	-0.035 ppb	2.351 ppb	5.821 ppb	0.005 ppb	-0.028 ppb	-0.006 ppb
Concentration per Run 3	99.340 %	14.640 ppb	-0.007 ppb	-0.005 ppb	2.317 ppb	5.852 ppb	-0.001 ppb	-0.041 ppb	-0.005 ppb
Concentration RSD	1.0 %	4.0 %	190.8 %	4,547.0 %	2.1 %	1.5 %	126.2 %	160.4 %	24.7 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	-0.283 ppb	108.677 %	0.117 ppb	0.376 ppb	20.144 ppb	0.210 ppb	106.407 %	0.001 ppb	0.006 ppb
Concentration per Run 1	-0.265 ppb	107.116 %	0.098 ppb	-0.538 ppb	19.748 ppb	0.172 ppb	105.618 %	0.004 ppb	0.000 ppb
Concentration per Run 2	-0.260 ppb	109.875 %	0.096 ppb	0.820 ppb	20.178 ppb	0.242 ppb	106.483 %	-0.001 ppb	0.000 ppb
Concentration per Run 3	-0.323 ppb	109.040 %	0.156 ppb	0.846 ppb	20.508 ppb	0.217 ppb	107.118 %	0.000 ppb	0.018 ppb
Concentration RSD	12.4 %	1.3 %	29.5 %	210.7 %	1.9 %	16.8 %	0.7 %	193.0 %	173.2 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	111.176 %	0.085 ppb	0.636 ppb	8.998 ppb	108.454 %	111.221 %	0.014 ppb	0.030 ppb	113.242 %
Concentration per Run 1	110.539 %	0.105 ppb	0.625 ppb	8.835 ppb	107.586 %	110.260 %	0.014 ppb	0.029 ppb	111.796 %
Concentration per Run 2	112.356 %	0.072 ppb	0.666 ppb	8.870 ppb	110.305 %	112.678 %	0.014 ppb	0.035 ppb	113.951 %
Concentration per Run 3	110.634 %	0.079 ppb	0.617 ppb	9.289 ppb	107.472 %	110.726 %	0.015 ppb	0.026 ppb	113.979 %
Concentration RSD	0.9 %	20.2 %	4.2 %	2.8 %	1.5 %	1.2 %	4.1 %	16.2 %	1.1 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 68 Analysis started at: 6/9/2017 10:42:43 AM Rack: 0
 Analysis label: CCV User name: ALPHALAB\metals-instrument Vial: 9

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	96.184 %	106.039 %	98.030 ppb	10,454.339 ppb	9,652.728 ppb	102.720 ppb	10,228.358 ppb	10,223.591 ppb	111.961 %
Concentration per Run 1	98.066 %	110.666 %	98.054 ppb	10,009.713 ppb	9,175.296 ppb	95.630 ppb	9,780.501 ppb	9,790.403 ppb	115.259 %
Concentration per Run 2	96.328 %	103.977 %	97.530 ppb	10,689.410 ppb	9,970.093 ppb	107.027 ppb	10,382.522 ppb	10,451.723 ppb	112.187 %
Concentration per Run 3	94.158 %	103.473 %	98.505 ppb	10,663.895 ppb	9,812.796 ppb	105.503 ppb	10,522.050 ppb	10,428.645 ppb	108.439 %
Recovery Percentage 1			98.030 %	104.543 %	96.527 %	102.720 %	102.284 %	102.236 %	
Concentration RSD	2.0 %	3.8 %	0.5 %	3.7 %	4.4 %	6.0 %	3.9 %	3.7 %	3.1 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	98.137 %	99.325 ppb	96.489 ppb	95.341 ppb	98.763 ppb	9,823.410 ppb	97.811 ppb	98.411 ppb	98.147 ppb
Concentration per Run 1	99.255 %	92.247 ppb	92.286 ppb	91.996 ppb	98.175 ppb	9,553.604 ppb	95.790 ppb	94.685 ppb	96.478 ppb
Concentration per Run 2	98.807 %	101.963 ppb	97.489 ppb	98.020 ppb	100.369 ppb	9,921.770 ppb	97.928 ppb	100.308 ppb	98.602 ppb
Concentration per Run 3	96.349 %	103.765 ppb	99.690 ppb	96.008 ppb	97.745 ppb	9,994.858 ppb	99.715 ppb	100.240 ppb	99.362 ppb
Recovery Percentage 1		99.325 %	96.489 %	95.341 %	98.763 %	98.234 %	97.811 %	98.411 %	98.147 %
Concentration RSD	1.6 %	6.2 %	3.9 %	3.2 %	1.4 %	2.4 %	2.0 %	3.3 %	1.5 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	95.137 ppb	106.721 %	95.078 ppb	96.394 ppb	101.415 ppb	99.604 ppb	106.190 %	95.833 ppb	96.212 ppb
Concentration per Run 1	93.425 ppb	106.155 %	93.792 ppb	95.994 ppb	98.782 ppb	97.350 ppb	108.645 %	92.517 ppb	93.147 ppb
Concentration per Run 2	96.301 ppb	106.669 %	96.251 ppb	96.114 ppb	102.680 ppb	100.769 ppb	104.502 %	97.681 ppb	97.547 ppb
Concentration per Run 3	95.686 ppb	107.339 %	95.190 ppb	97.073 ppb	102.782 ppb	100.692 ppb	105.422 %	97.300 ppb	97.943 ppb
Recovery Percentage 1	95.137 %		95.078 %	96.394 %	101.415 %	99.604 %		95.833 %	96.212 %
Concentration RSD	1.6 %	0.6 %	1.3 %	0.6 %	2.2 %	2.0 %	2.0 %	3.0 %	2.8 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	110.039 %	99.836 ppb	93.683 ppb	96.579 ppb	107.311 %	110.871 %	96.598 ppb	95.726 ppb	111.286 %
Concentration per Run 1	110.719 %	96.221 ppb	90.954 ppb	94.277 ppb	106.511 %	111.806 %	93.680 ppb	92.656 ppb	112.673 %
Concentration per Run 2	109.680 %	100.823 ppb	94.667 ppb	96.975 ppb	107.449 %	110.371 %	97.226 ppb	96.107 ppb	112.473 %
Concentration per Run 3	109.720 %	102.462 ppb	95.427 ppb	98.484 ppb	107.973 %	110.436 %	98.887 ppb	98.416 ppb	108.711 %
Recovery Percentage 1		99.836 %	93.683 %	96.579 %			96.598 %	95.726 %	
Concentration RSD	0.5 %	3.2 %	2.6 %	2.2 %	0.7 %	0.7 %	2.8 %	3.0 %	2.0 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 69 Analysis started at: 6/9/2017 10:45:53 AM Rack: 0
 Analysis label: CCB User name: ALPHALAB\metals-instrument Vial: 10

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	97.305 %	108.817 %	0.013 ppb	3.211 ppb	1.259 ppb	0.207 ppb	-6.359 ppb	-0.060 ppb	113.568 %
Concentration per Run 1	96.604 %	116.615 %	0.009 ppb	-1.947 ppb	0.886 ppb	0.216 ppb	-2.217 ppb	0.621 ppb	120.541 %
Concentration per Run 2	97.775 %	106.229 %	0.014 ppb	0.846 ppb	2.262 ppb	0.415 ppb	-7.867 ppb	1.132 ppb	112.495 %
Concentration per Run 3	97.536 %	103.607 %	0.016 ppb	10.733 ppb	0.628 ppb	-0.010 ppb	-8.994 ppb	-1.934 ppb	107.668 %
Recovery Percentage 1			4.398 %	3.211 %	1.798 %	2.069 %	-6.359 %	-0.060 %	
Concentration RSD	0.6 %	6.3 %	25.9 %	207.5 %	69.8 %	102.6 %	57.1 %	2,727.2 %	5.7 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	97.989 %	0.025 ppb	0.003 ppb	0.025 ppb	0.027 ppb	1.509 ppb	0.019 ppb	0.015 ppb	-0.015 ppb
Concentration per Run 1	96.517 %	0.038 ppb	0.007 ppb	0.026 ppb	0.002 ppb	1.393 ppb	0.037 ppb	0.005 ppb	-0.009 ppb
Concentration per Run 2	99.082 %	0.066 ppb	0.009 ppb	0.007 ppb	-0.001 ppb	1.801 ppb	0.015 ppb	-0.042 ppb	-0.024 ppb
Concentration per Run 3	98.366 %	-0.027 ppb	-0.007 ppb	0.043 ppb	0.082 ppb	1.332 ppb	0.006 ppb	0.081 ppb	-0.013 ppb
Recovery Percentage 1		5.097 %	0.061 %	2.508 %	2.749 %	3.017 %	3.869 %	0.727 %	-1.513 %
Concentration RSD	1.4 %	186.5 %	287.7 %	72.7 %	170.9 %	16.9 %	83.4 %	428.8 %	50.4 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	0.020 ppb	109.889 %	0.040 ppb	0.231 ppb	0.033 ppb	0.218 ppb	108.036 %	0.018 ppb	0.018 ppb
Concentration per Run 1	0.010 ppb	111.793 %	0.035 ppb	0.515 ppb	0.064 ppb	0.228 ppb	109.392 %	0.023 ppb	0.025 ppb
Concentration per Run 2	-0.049 ppb	110.171 %	0.036 ppb	0.274 ppb	0.026 ppb	0.175 ppb	108.316 %	0.015 ppb	0.022 ppb
Concentration per Run 3	0.099 ppb	107.702 %	0.049 ppb	-0.097 ppb	0.010 ppb	0.252 ppb	106.398 %	0.015 ppb	0.009 ppb
Recovery Percentage 1	0.200 %	109.889 %	7.980 %	4.617 %	6.655 %	10.907 %		4.460 %	9.243 %
Concentration RSD	372.2 %	1.9 %	19.2 %	133.5 %	84.1 %	18.0 %	1.4 %	25.9 %	45.5 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	114.467 %	0.235 ppb	0.925 ppb	-0.026 ppb	107.359 %	112.368 %	0.028 ppb	0.030 ppb	113.077 %
Concentration per Run 1	120.957 %	0.227 ppb	0.939 ppb	-0.020 ppb	109.481 %	114.930 %	0.033 ppb	0.033 ppb	110.995 %
Concentration per Run 2	113.355 %	0.236 ppb	0.922 ppb	-0.006 ppb	107.137 %	112.135 %	0.028 ppb	0.029 ppb	114.839 %
Concentration per Run 3	109.089 %	0.241 ppb	0.914 ppb	-0.052 ppb	105.461 %	110.038 %	0.025 ppb	0.029 ppb	113.397 %
Recovery Percentage 1		7.817 %	23.127 %	-5.200 %			5.699 %	6.044 %	113.077 %
Concentration RSD	5.3 %	2.8 %	1.4 %	90.1 %	1.9 %	2.2 %	14.1 %	8.5 %	1.7 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 70 Analysis started at: 6/9/2017 10:56:41 AM Rack: 1
 Analysis label: WG1011434-1 2008TL User name: ALPHALAB\metals-instrument Vial: 60

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	97.343 %	105.960 %	0.003 ppb	6.428 ppb	-0.218 ppb	0.206 ppb	-2.986 ppb	-0.314 ppb	106.553 %
Concentration per Run 1	97.696 %	111.035 %	0.003 ppb	-4.481 ppb	-1.139 ppb	0.053 ppb	-10.156 ppb	-2.280 ppb	111.392 %
Concentration per Run 2	96.907 %	107.741 %	0.003 ppb	-4.383 ppb	-0.290 ppb	0.258 ppb	6.365 ppb	-1.682 ppb	111.677 %
Concentration per Run 3	97.426 %	99.104 %	0.003 ppb	28.149 ppb	0.776 ppb	0.309 ppb	-5.168 ppb	3.019 ppb	96.590 %
Concentration RSD	0.4 %	5.8 %	16.9 %	292.6 %	441.0 %	65.7 %	283.7 %	923.9 %	8.1 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	98.445 %	0.043 ppb	0.047 ppb	0.064 ppb	0.212 ppb	0.269 ppb	-0.004 ppb	-0.021 ppb	0.117 ppb
Concentration per Run 1	98.235 %	0.020 ppb	0.009 ppb	0.060 ppb	0.129 ppb	-0.434 ppb	-0.005 ppb	-0.055 ppb	0.090 ppb
Concentration per Run 2	97.613 %	0.055 ppb	0.065 ppb	0.050 ppb	0.338 ppb	-0.723 ppb	-0.002 ppb	0.008 ppb	0.103 ppb
Concentration per Run 3	99.487 %	0.056 ppb	0.069 ppb	0.083 ppb	0.170 ppb	1.963 ppb	-0.005 ppb	-0.015 ppb	0.157 ppb
Concentration RSD	1.0 %	47.2 %	70.5 %	25.9 %	52.3 %	548.4 %	51.0 %	154.7 %	30.8 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	-0.184 ppb	106.758 %	0.013 ppb	-0.696 ppb	-0.005 ppb	0.007 ppb	107.821 %	0.013 ppb	0.006 ppb
Concentration per Run 1	-0.255 ppb	110.476 %	0.012 ppb	-0.942 ppb	-0.016 ppb	0.000 ppb	111.418 %	0.009 ppb	0.004 ppb
Concentration per Run 2	-0.203 ppb	113.794 %	0.000 ppb	0.086 ppb	0.014 ppb	-0.008 ppb	109.492 %	0.015 ppb	0.013 ppb
Concentration per Run 3	-0.094 ppb	96.005 %	0.027 ppb	-1.232 ppb	-0.011 ppb	0.028 ppb	102.553 %	0.014 ppb	0.000 ppb
Concentration RSD	44.7 %	8.9 %	104.8 %	99.6 %	349.0 %	271.6 %	4.3 %	25.3 %	114.9 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	111.387 %	-0.004 ppb	0.220 ppb	-0.052 ppb	108.545 %	109.932 %	0.003 ppb	0.000 ppb	117.395 %
Concentration per Run 1	115.660 %	-0.074 ppb	0.208 ppb	-0.053 ppb	111.926 %	113.055 %	0.003 ppb	-0.001 ppb	119.957 %
Concentration per Run 2	115.203 %	0.124 ppb	0.230 ppb	-0.064 ppb	109.686 %	113.742 %	0.003 ppb	0.000 ppb	118.263 %
Concentration per Run 3	103.299 %	-0.064 ppb	0.222 ppb	-0.039 ppb	104.024 %	102.998 %	0.003 ppb	0.001 ppb	113.966 %
Concentration RSD	6.3 %	2,507.9 %	5.2 %	23.6 %	3.8 %	5.5 %	15.1 %	1,241.2 %	2.6 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 71 Analysis started at: 6/9/2017 10:59:48 AM Rack: 2
 Analysis label: WG1011434-2D5 2008TL User name: ALPHALAB\metals-instrument Vial: 1

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	98.431 %	106.879 %	10.238 ppb	2,209.299 ppb	2,070.709 ppb	445.994 ppb	2,100.220 ppb	2,135.107 ppb	112.013 %
Concentration per Run 1	98.515 %	108.783 %	10.222 ppb	2,123.061 ppb	1,999.300 ppb	433.646 ppb	2,004.986 ppb	2,050.722 ppb	111.440 %
Concentration per Run 2	96.827 %	105.221 %	10.213 ppb	2,230.044 ppb	2,084.601 ppb	451.546 ppb	2,173.824 ppb	2,197.707 ppb	111.060 %
Concentration per Run 3	99.952 %	106.632 %	10.278 ppb	2,274.793 ppb	2,128.225 ppb	452.790 ppb	2,121.851 ppb	2,156.893 ppb	113.539 %
Concentration RSD	1.6 %	1.7 %	0.3 %	3.5 %	3.2 %	2.4 %	4.1 %	3.6 %	1.2 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	100.564 %	178.740 ppb	100.483 ppb	40.189 ppb	102.625 ppb	213.850 ppb	100.014 ppb	100.289 ppb	50.177 ppb
Concentration per Run 1	100.511 %	175.217 ppb	98.352 ppb	39.894 ppb	100.340 ppb	210.393 ppb	96.431 ppb	98.608 ppb	48.776 ppb
Concentration per Run 2	100.232 %	181.003 ppb	101.679 ppb	39.906 ppb	102.999 ppb	208.965 ppb	101.641 ppb	99.187 ppb	50.796 ppb
Concentration per Run 3	100.951 %	180.000 ppb	101.417 ppb	40.767 ppb	104.537 ppb	222.192 ppb	101.971 ppb	103.074 ppb	50.959 ppb
Concentration RSD	0.4 %	1.7 %	1.8 %	1.2 %	2.1 %	3.4 %	3.1 %	2.4 %	2.4 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	97.396 ppb	110.427 %	23.963 ppb	24.650 ppb	204.873 ppb	194.035 ppb	110.111 %	9.944 ppb	10.550 ppb
Concentration per Run 1	94.730 ppb	109.155 %	24.091 ppb	23.424 ppb	200.210 ppb	190.052 ppb	108.203 %	9.865 ppb	10.518 ppb
Concentration per Run 2	98.240 ppb	110.789 %	23.594 ppb	25.280 ppb	205.085 ppb	194.873 ppb	111.264 %	9.757 ppb	10.392 ppb
Concentration per Run 3	99.218 ppb	111.336 %	24.204 ppb	25.245 ppb	209.323 ppb	197.181 ppb	110.867 %	10.210 ppb	10.740 ppb
Concentration RSD	2.4 %	1.0 %	1.4 %	4.3 %	2.2 %	1.9 %	1.5 %	2.4 %	1.7 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	113.425 %	201.289 ppb	95.757 ppb	398.747 ppb	110.398 %	112.594 %	23.885 ppb	104.100 ppb	113.398 %
Concentration per Run 1	111.379 %	197.603 ppb	93.344 ppb	388.169 ppb	108.179 %	108.959 %	23.094 ppb	101.081 ppb	112.793 %
Concentration per Run 2	115.630 %	201.341 ppb	95.561 ppb	402.607 ppb	112.838 %	115.181 %	24.213 ppb	105.316 ppb	114.322 %
Concentration per Run 3	113.264 %	204.924 ppb	98.366 ppb	405.464 ppb	110.176 %	113.642 %	24.348 ppb	105.904 ppb	113.079 %
Concentration RSD	1.9 %	1.8 %	2.6 %	2.3 %	2.1 %	2.9 %	2.9 %	2.5 %	0.7 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 72 Analysis started at: 6/9/2017 11:02:54 AM Rack: 2
 Analysis label: L1719124-01 2008TL User name: ALPHALAB\metals-instrument Vial: 2

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	92.620 %	105.770 %	0.025 ppb	50,425.903 ppb	7,346.282 ppb	176.085 ppb	2,569.331 ppb	32,545.849 ppb	110.330 %
Concentration per Run 1	93.739 %	103.238 %	0.024 ppb	50,940.038 ppb	7,252.785 ppb	206.477 ppb	2,552.350 ppb	32,427.914 ppb	104.941 %
Concentration per Run 2	92.581 %	101.826 %	0.034 ppb	50,128.351 ppb	7,441.711 ppb	32.387 ppb	2,478.244 ppb	31,437.000 ppb	109.625 %
Concentration per Run 3	91.539 %	112.245 %	0.019 ppb	50,209.320 ppb	7,344.350 ppb	289.391 ppb	2,677.398 ppb	33,772.633 ppb	116.426 %
Concentration RSD	1.2 %	5.3 %	30.1 %	0.9 %	1.3 %	74.5 %	3.9 %	3.6 %	5.2 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	93.988 %	58.736 ppb	1.162 ppb	0.933 ppb	2,004.155 ppb	6,475.495 ppb	0.592 ppb	1.150 ppb	2.275 ppb
Concentration per Run 1	94.683 %	57.792 ppb	1.284 ppb	0.996 ppb	1,984.069 ppb	6,521.339 ppb	0.637 ppb	1.408 ppb	2.256 ppb
Concentration per Run 2	93.673 %	59.503 ppb	1.148 ppb	0.770 ppb	1,983.347 ppb	6,473.566 ppb	0.560 ppb	1.123 ppb	2.395 ppb
Concentration per Run 3	93.609 %	58.912 ppb	1.055 ppb	1.032 ppb	2,045.049 ppb	6,431.582 ppb	0.580 ppb	0.919 ppb	2.174 ppb
Concentration RSD	0.6 %	1.5 %	9.9 %	15.2 %	1.8 %	0.7 %	6.7 %	21.4 %	4.9 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	7.505 ppb	108.416 %	3.332 ppb	0.501 ppb	99.182 ppb	1.772 ppb	104.769 %	0.023 ppb	0.038 ppb
Concentration per Run 1	7.514 ppb	103.458 %	3.450 ppb	0.848 ppb	98.443 ppb	1.919 ppb	102.315 %	0.029 ppb	0.041 ppb
Concentration per Run 2	7.274 ppb	106.996 %	3.228 ppb	0.015 ppb	96.155 ppb	1.598 ppb	103.325 %	0.019 ppb	0.036 ppb
Concentration per Run 3	7.728 ppb	114.795 %	3.320 ppb	0.640 ppb	102.948 ppb	1.799 ppb	108.667 %	0.022 ppb	0.037 ppb
Concentration RSD	3.0 %	5.4 %	3.3 %	86.5 %	3.5 %	9.2 %	3.3 %	22.0 %	7.3 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	113.837 %	0.563 ppb	1.606 ppb	86.211 ppb	110.242 %	112.194 %	0.008 ppb	2.614 ppb	111.385 %
Concentration per Run 1	108.046 %	0.511 ppb	1.721 ppb	86.422 ppb	106.198 %	105.731 %	0.006 ppb	2.645 ppb	108.303 %
Concentration per Run 2	110.755 %	0.655 ppb	1.687 ppb	86.716 ppb	109.285 %	109.898 %	0.009 ppb	2.602 ppb	110.218 %
Concentration per Run 3	122.710 %	0.525 ppb	1.410 ppb	85.495 ppb	115.245 %	120.954 %	0.011 ppb	2.596 ppb	115.634 %
Concentration RSD	6.9 %	14.1 %	10.6 %	0.7 %	4.2 %	7.0 %	26.9 %	1.0 %	3.4 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 73 Analysis started at: 6/9/2017 11:06:00 AM Rack: 2
 Analysis label: WG1011434-4 2008TL User name: ALPHALAB\metals-instrument Vial: 3

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	93.250 %	102.823 %	0.029 ppb	49,874.523 ppb	7,272.016 ppb	198.646 ppb	2,460.454 ppb	31,942.982 ppb	107.558 %
Concentration per Run 1	93.952 %	106.733 %	0.027 ppb	46,681.149 ppb	6,764.480 ppb	191.371 ppb	2,337.670 ppb	29,664.391 ppb	109.506 %
Concentration per Run 2	92.655 %	100.784 %	0.033 ppb	50,627.734 ppb	7,503.653 ppb	201.193 ppb	2,491.491 ppb	32,826.689 ppb	107.929 %
Concentration per Run 3	93.143 %	100.952 %	0.026 ppb	52,314.688 ppb	7,547.915 ppb	203.374 ppb	2,552.201 ppb	33,337.867 ppb	105.237 %
Concentration RSD	0.7 %	3.3 %	12.1 %	5.8 %	6.1 %	3.2 %	4.5 %	6.2 %	2.0 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	95.071 %	55.994 ppb	1.156 ppb	0.890 ppb	1,971.394 ppb	6,386.270 ppb	0.571 ppb	0.995 ppb	2.225 ppb
Concentration per Run 1	95.081 %	54.744 ppb	1.241 ppb	0.910 ppb	1,842.407 ppb	6,041.288 ppb	0.565 ppb	0.925 ppb	2.501 ppb
Concentration per Run 2	94.405 %	57.404 ppb	1.202 ppb	0.836 ppb	2,009.645 ppb	6,516.143 ppb	0.600 ppb	1.018 ppb	2.048 ppb
Concentration per Run 3	95.725 %	55.833 ppb	1.026 ppb	0.924 ppb	2,062.131 ppb	6,601.380 ppb	0.549 ppb	1.042 ppb	2.126 ppb
Concentration RSD	0.7 %	2.4 %	9.9 %	5.3 %	5.8 %	4.7 %	4.6 %	6.2 %	10.9 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	6.722 ppb	107.092 %	3.170 ppb	0.112 ppb	98.173 ppb	1.509 ppb	104.300 %	0.028 ppb	0.039 ppb
Concentration per Run 1	6.940 ppb	106.591 %	2.867 ppb	-0.065 ppb	91.687 ppb	1.564 ppb	106.578 %	0.018 ppb	0.040 ppb
Concentration per Run 2	6.368 ppb	108.224 %	3.398 ppb	-0.102 ppb	99.763 ppb	1.500 ppb	104.310 %	0.027 ppb	0.027 ppb
Concentration per Run 3	6.857 ppb	106.462 %	3.245 ppb	0.505 ppb	103.070 ppb	1.464 ppb	102.012 %	0.038 ppb	0.050 ppb
Concentration RSD	4.6 %	0.9 %	8.6 %	302.6 %	6.0 %	3.3 %	2.2 %	36.3 %	29.3 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	110.053 %	0.141 ppb	0.641 ppb	84.787 ppb	108.583 %	109.621 %	0.007 ppb	2.634 ppb	109.715 %
Concentration per Run 1	111.412 %	0.126 ppb	0.572 ppb	79.537 ppb	109.727 %	112.272 %	0.008 ppb	2.472 ppb	111.506 %
Concentration per Run 2	109.087 %	0.132 ppb	0.705 ppb	86.149 ppb	108.720 %	109.506 %	0.008 ppb	2.702 ppb	107.876 %
Concentration per Run 3	109.659 %	0.164 ppb	0.644 ppb	88.673 ppb	107.301 %	107.084 %	0.006 ppb	2.728 ppb	109.763 %
Concentration RSD	1.1 %	14.5 %	10.4 %	5.6 %	1.1 %	2.4 %	13.5 %	5.4 %	1.7 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 74 Analysis started at: 6/9/2017 11:09:06 AM Rack: 2
 Analysis label: WG1011434-3D10 2008TL User name: ALPHALAB\metals-instrument Vial: 4

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	97.716 %	102.902 %	5.037 ppb	6,544.195 ppb	1,816.669 ppb	250.194 ppb	1,310.957 ppb	4,227.722 ppb	110.163 %
Concentration per Run 1	97.820 %	101.994 %	5.029 ppb	6,464.900 ppb	1,787.931 ppb	241.310 ppb	1,308.952 ppb	4,116.419 ppb	110.645 %
Concentration per Run 2	98.327 %	102.834 %	5.038 ppb	6,589.292 ppb	1,821.527 ppb	254.227 ppb	1,309.566 ppb	4,223.184 ppb	110.455 %
Concentration per Run 3	97.000 %	103.876 %	5.044 ppb	6,578.392 ppb	1,840.548 ppb	255.045 ppb	1,314.352 ppb	4,343.563 ppb	109.388 %
Concentration RSD	0.7 %	0.9 %	0.2 %	1.1 %	1.5 %	3.1 %	0.2 %	2.7 %	0.6 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	100.022 %	96.151 ppb	50.873 ppb	19.975 ppb	249.276 ppb	761.677 ppb	49.749 ppb	50.172 ppb	25.451 ppb
Concentration per Run 1	98.502 %	94.812 ppb	49.938 ppb	19.680 ppb	244.169 ppb	751.512 ppb	48.939 ppb	48.648 ppb	24.806 ppb
Concentration per Run 2	101.055 %	96.278 ppb	51.127 ppb	20.161 ppb	252.292 ppb	763.631 ppb	50.357 ppb	50.742 ppb	26.024 ppb
Concentration per Run 3	100.509 %	97.363 ppb	51.553 ppb	20.083 ppb	251.366 ppb	769.887 ppb	49.950 ppb	51.127 ppb	25.521 ppb
Concentration RSD	1.3 %	1.3 %	1.6 %	1.3 %	1.8 %	1.2 %	1.5 %	2.7 %	2.4 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	50.615 ppb	109.130 %	12.440 ppb	11.161 ppb	112.759 ppb	97.162 ppb	105.766 %	4.980 ppb	5.252 ppb
Concentration per Run 1	49.308 ppb	110.107 %	12.529 ppb	9.854 ppb	110.209 ppb	97.080 ppb	105.039 %	5.011 ppb	4.958 ppb
Concentration per Run 2	50.856 ppb	107.730 %	12.972 ppb	11.308 ppb	113.506 ppb	97.556 ppb	106.670 %	4.922 ppb	5.464 ppb
Concentration per Run 3	51.682 ppb	109.553 %	11.821 ppb	12.321 ppb	114.562 ppb	96.849 ppb	105.588 %	5.007 ppb	5.335 ppb
Concentration RSD	2.4 %	1.1 %	4.7 %	11.1 %	2.0 %	0.4 %	0.8 %	1.0 %	5.0 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	112.727 %	99.018 ppb	50.792 ppb	208.955 ppb	109.241 %	109.808 %	12.134 ppb	52.386 ppb	111.686 %
Concentration per Run 1	113.394 %	97.924 ppb	49.766 ppb	206.703 ppb	107.619 %	107.901 %	11.769 ppb	51.824 ppb	110.570 %
Concentration per Run 2	113.317 %	98.471 ppb	51.465 ppb	208.658 ppb	109.265 %	109.736 %	12.307 ppb	52.925 ppb	111.456 %
Concentration per Run 3	111.470 %	100.658 ppb	51.147 ppb	211.505 ppb	110.840 %	111.787 %	12.324 ppb	52.410 ppb	113.031 %
Concentration RSD	1.0 %	1.5 %	1.8 %	1.2 %	1.5 %	1.8 %	2.6 %	1.1 %	1.1 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 75 Analysis started at: 6/9/2017 11:12:12 AM Rack: 2
 Analysis label: L1719124-02 2008TL User name: ALPHALAB\metals-instrument Vial: 5

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	95.710 %	101.961 %	0.033 ppb	51,791.496 ppb	7,807.370 ppb	305.465 ppb	2,707.588 ppb	34,222.617 ppb	107.399 %
Concentration per Run 1	95.632 %	100.246 %	0.040 ppb	50,786.914 ppb	7,749.859 ppb	353.881 ppb	2,858.502 ppb	33,879.032 ppb	108.889 %
Concentration per Run 2	97.382 %	103.910 %	0.027 ppb	51,900.296 ppb	7,737.624 ppb	279.236 ppb	2,631.494 ppb	34,516.945 ppb	106.518 %
Concentration per Run 3	94.117 %	101.725 %	0.032 ppb	52,687.277 ppb	7,934.627 ppb	283.277 ppb	2,632.767 ppb	34,271.874 ppb	106.791 %
Concentration RSD	1.7 %	1.8 %	20.7 %	1.8 %	1.4 %	13.7 %	4.8 %	0.9 %	1.2 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	98.525 %	63.420 ppb	1.318 ppb	1.031 ppb	2,139.625 ppb	6,320.395 ppb	0.676 ppb	1.374 ppb	3.379 ppb
Concentration per Run 1	98.438 %	61.030 ppb	1.188 ppb	1.045 ppb	2,122.063 ppb	6,140.133 ppb	0.621 ppb	1.515 ppb	3.394 ppb
Concentration per Run 2	101.141 %	64.970 ppb	1.090 ppb	0.979 ppb	2,144.565 ppb	6,408.010 ppb	0.701 ppb	1.205 ppb	3.572 ppb
Concentration per Run 3	95.995 %	64.261 ppb	1.675 ppb	1.070 ppb	2,152.245 ppb	6,413.044 ppb	0.706 ppb	1.402 ppb	3.171 ppb
Concentration RSD	2.6 %	3.3 %	23.8 %	4.6 %	0.7 %	2.5 %	7.0 %	11.4 %	5.9 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	8.963 ppb	107.484 %	3.376 ppb	0.435 ppb	102.928 ppb	1.761 ppb	103.785 %	0.033 ppb	0.037 ppb
Concentration per Run 1	9.023 ppb	107.069 %	3.469 ppb	0.930 ppb	101.598 ppb	1.651 ppb	105.133 %	0.041 ppb	0.049 ppb
Concentration per Run 2	9.079 ppb	107.431 %	3.350 ppb	0.236 ppb	102.865 ppb	1.865 ppb	102.955 %	0.036 ppb	0.058 ppb
Concentration per Run 3	8.786 ppb	107.952 %	3.310 ppb	0.141 ppb	104.321 ppb	1.768 ppb	103.268 %	0.021 ppb	0.004 ppb
Concentration RSD	1.7 %	0.4 %	2.5 %	99.0 %	1.3 %	6.1 %	1.1 %	32.7 %	77.1 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	110.222 %	0.450 ppb	0.634 ppb	90.950 ppb	107.345 %	107.801 %	0.008 ppb	3.525 ppb	110.262 %
Concentration per Run 1	110.165 %	0.470 ppb	0.660 ppb	90.845 ppb	105.910 %	105.785 %	0.009 ppb	3.470 ppb	110.571 %
Concentration per Run 2	110.607 %	0.359 ppb	0.607 ppb	90.244 ppb	108.227 %	108.843 %	0.008 ppb	3.501 ppb	110.786 %
Concentration per Run 3	109.895 %	0.522 ppb	0.635 ppb	91.760 ppb	107.898 %	108.774 %	0.007 ppb	3.603 ppb	109.429 %
Concentration RSD	0.3 %	18.4 %	4.2 %	0.8 %	1.2 %	1.6 %	10.1 %	2.0 %	0.7 %

Alpha ICPMSQ2 Full

6/10/2017 10:11:47 AM



Analysis index: 76 Analysis started at: 6/9/2017 11:15:18 AM Rack: 2
 Analysis label: L1719124-03 2008TL User name: ALPHALAB\metals-instrument Vial: 6

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	94.257 %	102.846 %	0.023 ppb	52,013.205 ppb	7,929.382 ppb	183.702 ppb	2,714.097 ppb	35,048.630 ppb	106.893 %
Concentration per Run 1	92.598 %	105.254 %	0.021 ppb	51,481.088 ppb	7,902.390 ppb	154.617 ppb	2,766.476 ppb	34,956.654 ppb	105.580 %
Concentration per Run 2	95.322 %	102.566 %	0.018 ppb	52,191.284 ppb	7,885.095 ppb	198.315 ppb	2,676.212 ppb	35,241.745 ppb	107.644 %
Concentration per Run 3	94.850 %	100.717 %	0.031 ppb	52,367.242 ppb	8,000.661 ppb	198.174 ppb	2,699.605 ppb	34,947.493 ppb	107.454 %
Concentration RSD	1.5 %	2.2 %	29.0 %	0.9 %	0.8 %	13.7 %	1.7 %	0.5 %	1.1 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	97.470 %	61.467 ppb	0.819 ppb	0.731 ppb	2,195.934 ppb	5,961.001 ppb	0.599 ppb	1.257 ppb	2.038 ppb
Concentration per Run 1	95.153 %	57.547 ppb	0.853 ppb	0.783 ppb	2,190.382 ppb	5,927.414 ppb	0.587 ppb	1.218 ppb	1.888 ppb
Concentration per Run 2	97.969 %	65.734 ppb	0.846 ppb	0.642 ppb	2,210.102 ppb	6,019.580 ppb	0.630 ppb	1.291 ppb	2.165 ppb
Concentration per Run 3	99.289 %	61.119 ppb	0.757 ppb	0.768 ppb	2,187.317 ppb	5,936.010 ppb	0.579 ppb	1.262 ppb	2.062 ppb
Concentration RSD	2.2 %	6.7 %	6.5 %	10.5 %	0.6 %	0.9 %	4.6 %	2.9 %	6.9 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	8.186 ppb	106.756 %	3.352 ppb	0.649 ppb	106.892 ppb	1.556 ppb	102.293 %	0.019 ppb	0.029 ppb
Concentration per Run 1	7.753 ppb	106.409 %	3.384 ppb	0.827 ppb	105.659 ppb	1.388 ppb	100.434 %	0.016 ppb	0.005 ppb
Concentration per Run 2	8.415 ppb	107.702 %	3.159 ppb	0.533 ppb	107.894 ppb	1.743 ppb	103.322 %	0.019 ppb	0.045 ppb
Concentration per Run 3	8.389 ppb	106.158 %	3.513 ppb	0.587 ppb	107.123 ppb	1.537 ppb	103.124 %	0.023 ppb	0.036 ppb
Concentration RSD	4.6 %	0.8 %	5.3 %	24.2 %	1.1 %	11.5 %	1.6 %	16.5 %	74.6 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	110.001 %	0.390 ppb	0.477 ppb	90.655 ppb	107.042 %	108.485 %	0.005 ppb	1.996 ppb	107.664 %
Concentration per Run 1	110.259 %	0.417 ppb	0.440 ppb	90.017 ppb	106.731 %	106.552 %	0.004 ppb	1.940 ppb	108.454 %
Concentration per Run 2	109.465 %	0.320 ppb	0.510 ppb	91.517 ppb	107.075 %	107.946 %	0.004 ppb	2.042 ppb	106.881 %
Concentration per Run 3	110.279 %	0.434 ppb	0.481 ppb	90.431 ppb	107.319 %	110.958 %	0.007 ppb	2.008 ppb	107.658 %
Concentration RSD	0.4 %	15.9 %	7.3 %	0.9 %	0.3 %	2.1 %	39.0 %	2.6 %	0.7 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 77 Analysis started at: 6/9/2017 11:18:24 AM Rack: 2
 Analysis label: L1719124-04 2008TL User name: ALPHALAB\metals-instrument Vial: 7

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	95.448 %	102.095 %	0.005 ppb	52,201.726 ppb	8,299.718 ppb	8.336 ppb	2,715.223 ppb	38,933.923 ppb	107.823 %
Concentration per Run 1	95.176 %	101.255 %	0.006 ppb	49,520.240 ppb	7,885.308 ppb	10.182 ppb	2,609.285 ppb	36,588.730 ppb	110.469 %
Concentration per Run 2	94.635 %	100.784 %	0.006 ppb	55,122.698 ppb	8,704.445 ppb	7.182 ppb	2,866.232 ppb	40,848.442 ppb	107.146 %
Concentration per Run 3	96.534 %	104.246 %	0.003 ppb	51,962.241 ppb	8,309.399 ppb	7.644 ppb	2,670.151 ppb	39,364.598 ppb	105.853 %
Concentration RSD	1.0 %	1.8 %	39.5 %	5.4 %	4.9 %	19.4 %	4.9 %	5.6 %	2.2 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	96.534 %	61.233 ppb	0.041 ppb	0.151 ppb	1,512.537 ppb	3.984 ppb	1.554 ppb	2.131 ppb	0.055 ppb
Concentration per Run 1	96.034 %	58.248 ppb	0.042 ppb	0.171 ppb	1,440.901 ppb	3.031 ppb	1.482 ppb	1.899 ppb	0.050 ppb
Concentration per Run 2	94.662 %	64.128 ppb	0.036 ppb	0.154 ppb	1,594.413 ppb	3.485 ppb	1.635 ppb	2.252 ppb	0.084 ppb
Concentration per Run 3	98.907 %	61.323 ppb	0.044 ppb	0.128 ppb	1,502.298 ppb	5.435 ppb	1.545 ppb	2.241 ppb	0.032 ppb
Concentration RSD	2.2 %	4.8 %	10.8 %	14.4 %	5.1 %	32.1 %	4.9 %	9.4 %	47.5 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	0.289 ppb	105.445 %	0.106 ppb	0.542 ppb	420.789 ppb	0.253 ppb	100.871 %	-0.001 ppb	0.003 ppb
Concentration per Run 1	0.199 ppb	106.139 %	0.025 ppb	0.592 ppb	405.405 ppb	0.236 ppb	102.307 %	0.000 ppb	0.000 ppb
Concentration per Run 2	0.330 ppb	101.667 %	0.219 ppb	0.283 ppb	444.074 ppb	0.278 ppb	99.704 %	-0.001 ppb	0.005 ppb
Concentration per Run 3	0.339 ppb	108.529 %	0.073 ppb	0.749 ppb	412.889 ppb	0.245 ppb	100.602 %	-0.001 ppb	0.005 ppb
Concentration RSD	27.2 %	3.3 %	96.0 %	43.8 %	4.9 %	8.8 %	1.3 %	54.6 %	86.6 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	107.745 %	0.049 ppb	0.320 ppb	232.391 ppb	105.313 %	108.927 %	0.031 ppb	0.015 ppb	104.866 %
Concentration per Run 1	108.494 %	0.044 ppb	0.265 ppb	218.809 ppb	106.756 %	111.088 %	0.028 ppb	0.014 ppb	105.037 %
Concentration per Run 2	106.255 %	-0.018 ppb	0.336 ppb	247.186 ppb	102.486 %	106.300 %	0.040 ppb	0.017 ppb	103.067 %
Concentration per Run 3	108.486 %	0.122 ppb	0.360 ppb	231.178 ppb	106.698 %	109.394 %	0.027 ppb	0.015 ppb	106.495 %
Concentration RSD	1.2 %	141.6 %	15.4 %	6.1 %	2.3 %	2.2 %	22.7 %	8.0 %	1.6 %

Alpha ICPMSQ2 Full

6/10/2017 10:11:47 AM



Analysis index: 78 Analysis started at: 6/9/2017 11:21:30 AM Rack: 2
 Analysis label: L1719127-01 2008TL User name: ALPHALAB\metals-instrument Vial: 8

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	95.495 %	100.818 %	0.003 ppb	54,038.357 ppb	8,457.573 ppb	7.685 ppb	2,801.105 ppb	39,618.361 ppb	103.821 %
Concentration per Run 1	95.960 %	99.440 %	-0.003 ppb	56,958.076 ppb	8,921.788 ppb	7.909 ppb	2,925.366 ppb	40,968.921 ppb	102.095 %
Concentration per Run 2	95.018 %	97.861 %	0.003 ppb	52,966.234 ppb	8,313.204 ppb	7.490 ppb	2,773.037 ppb	39,432.280 ppb	103.243 %
Concentration per Run 3	95.506 %	105.154 %	0.009 ppb	52,190.760 ppb	8,137.725 ppb	7.657 ppb	2,704.913 ppb	38,453.881 ppb	106.126 %
Concentration RSD	0.5 %	3.8 %	226.4 %	4.7 %	4.9 %	2.7 %	4.0 %	3.2 %	2.0 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	96.982 %	62.245 ppb	0.054 ppb	0.132 ppb	1,601.314 ppb	7.624 ppb	1.594 ppb	2.357 ppb	0.096 ppb
Concentration per Run 1	97.469 %	65.674 ppb	0.038 ppb	0.094 ppb	1,700.286 ppb	7.996 ppb	1.792 ppb	2.279 ppb	0.147 ppb
Concentration per Run 2	96.025 %	61.737 ppb	0.064 ppb	0.186 ppb	1,567.038 ppb	9.133 ppb	1.557 ppb	2.258 ppb	0.117 ppb
Concentration per Run 3	97.453 %	59.325 ppb	0.061 ppb	0.116 ppb	1,536.619 ppb	5.742 ppb	1.433 ppb	2.534 ppb	0.024 ppb
Concentration RSD	0.9 %	5.1 %	26.1 %	36.8 %	5.4 %	22.6 %	11.4 %	6.5 %	67.1 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	0.781 ppb	102.376 %	0.081 ppb	-0.119 ppb	399.022 ppb	0.197 ppb	99.283 %	-0.001 ppb	0.005 ppb
Concentration per Run 1	0.686 ppb	99.416 %	0.106 ppb	-0.460 ppb	421.034 ppb	0.134 ppb	98.189 %	-0.001 ppb	0.009 ppb
Concentration per Run 2	0.777 ppb	100.119 %	0.039 ppb	0.107 ppb	390.994 ppb	0.207 ppb	96.335 %	-0.002 ppb	0.005 ppb
Concentration per Run 3	0.878 ppb	107.593 %	0.098 ppb	-0.002 ppb	385.038 ppb	0.249 ppb	103.324 %	-0.001 ppb	0.000 ppb
Concentration RSD	12.3 %	4.4 %	44.7 %	253.8 %	4.8 %	29.5 %	3.6 %	31.1 %	99.2 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	105.512 %	-0.002 ppb	0.292 ppb	238.477 ppb	101.840 %	103.044 %	0.032 ppb	0.016 ppb	102.698 %
Concentration per Run 1	104.893 %	-0.022 ppb	0.321 ppb	249.757 ppb	99.678 %	101.262 %	0.030 ppb	0.018 ppb	101.030 %
Concentration per Run 2	102.242 %	0.018 ppb	0.273 ppb	235.658 ppb	99.446 %	101.189 %	0.032 ppb	0.015 ppb	100.019 %
Concentration per Run 3	109.400 %	-0.002 ppb	0.283 ppb	230.016 ppb	106.394 %	106.683 %	0.035 ppb	0.014 ppb	107.045 %
Concentration RSD	3.4 %	1,080.7 %	8.6 %	4.3 %	3.9 %	3.1 %	6.8 %	10.3 %	3.7 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 79 Analysis started at: 6/9/2017 11:24:36 AM Rack: 0
 Analysis label: CCV User name: ALPHALAB\metals-instrument Vial: 9

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	97.584 %	103.742 %	98.782 ppb	10,878.916 ppb	10,063.898 ppb	107.156 ppb	10,639.245 ppb	10,698.439 ppb	106.842 %
Concentration per Run 1	97.993 %	102.700 %	98.523 ppb	10,841.794 ppb	10,066.723 ppb	105.145 ppb	10,749.368 ppb	10,960.332 ppb	101.075 %
Concentration per Run 2	96.710 %	105.893 %	99.682 ppb	11,016.193 ppb	10,337.972 ppb	107.694 ppb	10,748.151 ppb	10,531.896 ppb	108.583 %
Concentration per Run 3	98.048 %	102.633 %	98.141 ppb	10,778.762 ppb	9,786.998 ppb	108.629 ppb	10,420.217 ppb	10,603.090 ppb	110.869 %
Recovery Percentage 1			98.782 %	108.789 %	100.639 %	107.156 %	106.392 %	106.984 %	
Concentration RSD	0.8 %	1.8 %	0.8 %	1.1 %	2.7 %	1.7 %	1.8 %	2.1 %	4.8 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	100.341 %	104.059 ppb	100.485 ppb	100.431 ppb	101.985 ppb	10,248.981 ppb	102.892 ppb	102.233 ppb	102.053 ppb
Concentration per Run 1	100.453 %	104.502 ppb	100.589 ppb	101.165 ppb	102.880 ppb	10,295.990 ppb	103.946 ppb	102.903 ppb	101.878 ppb
Concentration per Run 2	99.952 %	104.632 ppb	100.464 ppb	100.844 ppb	101.866 ppb	10,318.201 ppb	102.497 ppb	101.841 ppb	102.606 ppb
Concentration per Run 3	100.620 %	103.041 ppb	100.401 ppb	99.283 ppb	101.209 ppb	10,132.754 ppb	102.233 ppb	101.956 ppb	101.675 ppb
Recovery Percentage 1		104.059 %	100.485 %	100.431 %	101.985 %	102.490 %	102.892 %	102.233 %	102.053 %
Concentration RSD	0.3 %	0.8 %	0.1 %	1.0 %	0.8 %	1.0 %	0.9 %	0.6 %	0.5 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	98.354 ppb	104.864 %	94.821 ppb	102.020 ppb	103.565 ppb	103.213 ppb	103.427 %	99.800 ppb	101.617 ppb
Concentration per Run 1	97.808 ppb	101.613 %	96.942 ppb	100.555 ppb	103.877 ppb	105.396 ppb	101.531 %	101.411 ppb	101.356 ppb
Concentration per Run 2	99.056 ppb	103.134 %	93.922 ppb	100.366 ppb	101.083 ppb	101.219 ppb	100.248 %	99.263 ppb	101.425 ppb
Concentration per Run 3	98.197 ppb	109.843 %	93.600 ppb	105.139 ppb	105.734 ppb	103.024 ppb	108.503 %	98.726 ppb	102.069 ppb
Recovery Percentage 1	98.354 %		94.821 %	102.020 %	103.565 %	103.213 %		99.800 %	101.617 %
Concentration RSD	0.6 %	4.2 %	1.9 %	2.6 %	2.3 %	2.0 %	4.3 %	1.4 %	0.4 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	108.683 %	103.152 ppb	93.033 ppb	100.382 ppb	105.739 %	107.510 %	100.208 ppb	100.892 ppb	105.813 %
Concentration per Run 1	107.052 %	104.888 ppb	91.519 ppb	99.196 ppb	102.737 %	105.031 %	101.642 ppb	102.222 ppb	101.013 %
Concentration per Run 2	104.945 %	102.752 ppb	93.274 ppb	99.865 ppb	103.744 %	103.159 %	101.783 ppb	101.110 ppb	102.873 %
Concentration per Run 3	114.052 %	101.816 ppb	94.305 ppb	102.084 ppb	110.736 %	114.341 %	97.199 ppb	99.344 ppb	113.554 %
Recovery Percentage 1		103.152 %	93.033 %	100.382 %			100.208 %	100.892 %	
Concentration RSD	4.4 %	1.5 %	1.5 %	1.5 %	4.1 %	5.6 %	2.6 %	1.4 %	6.4 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 80 Analysis started at: 6/9/2017 11:27:46 AM Rack: 0
 Analysis label: CCB User name: ALPHALAB\metals-instrument Vial: 10

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	100.441 %	106.420 %	0.007 ppb	11.281 ppb	0.088 ppb	0.072 ppb	-2.167 ppb	-4.075 ppb	107.640 %
Concentration per Run 1	99.671 %	110.968 %	0.001 ppb	2.474 ppb	-0.463 ppb	0.166 ppb	-1.552 ppb	-8.322 ppb	108.949 %
Concentration per Run 2	101.230 %	107.103 %	0.016 ppb	14.358 ppb	0.395 ppb	-0.006 ppb	-1.202 ppb	-0.201 ppb	111.190 %
Concentration per Run 3	100.422 %	101.188 %	0.004 ppb	17.012 ppb	0.331 ppb	0.056 ppb	-3.746 ppb	-3.700 ppb	102.782 %
Recovery Percentage 1			2.402 %	11.281 %	0.125 %	0.721 %	-2.167 %	-4.075 %	
Concentration RSD	0.8 %	4.6 %	110.1 %	68.6 %	544.9 %	121.1 %	63.6 %	100.0 %	4.0 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	100.641 %	0.005 ppb	0.007 ppb	-0.004 ppb	0.046 ppb	0.192 ppb	0.001 ppb	-0.025 ppb	-0.009 ppb
Concentration per Run 1	100.004 %	0.045 ppb	0.034 ppb	-0.010 ppb	0.046 ppb	0.152 ppb	0.002 ppb	-0.041 ppb	-0.014 ppb
Concentration per Run 2	101.167 %	0.008 ppb	-0.007 ppb	-0.010 ppb	-0.011 ppb	-0.436 ppb	-0.002 ppb	-0.042 ppb	-0.015 ppb
Concentration per Run 3	100.752 %	-0.039 ppb	-0.007 ppb	0.008 ppb	0.105 ppb	0.861 ppb	0.002 ppb	0.007 ppb	0.001 ppb
Recovery Percentage 1		0.927 %	0.135 %	-0.390 %	4.647 %	0.385 %	0.197 %	-1.260 %	-0.925 %
Concentration RSD	0.6 %	908.4 %	350.9 %	274.8 %	125.4 %	337.4 %	220.3 %	112.0 %	100.5 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	-0.041 ppb	107.448 %	0.025 ppb	0.011 ppb	0.028 ppb	0.093 ppb	106.925 %	0.007 ppb	0.010 ppb
Concentration per Run 1	-0.105 ppb	109.551 %	0.024 ppb	-0.011 ppb	0.051 ppb	0.095 ppb	109.173 %	0.012 ppb	0.004 ppb
Concentration per Run 2	0.013 ppb	111.400 %	0.012 ppb	0.008 ppb	0.030 ppb	0.055 ppb	109.603 %	0.002 ppb	0.026 ppb
Concentration per Run 3	-0.032 ppb	101.391 %	0.039 ppb	0.037 ppb	0.003 ppb	0.129 ppb	101.998 %	0.009 ppb	0.000 ppb
Recovery Percentage 1	-0.414 %	107.448 %	4.969 %	0.222 %	5.604 %	4.664 %	1.872 %	1.872 %	5.025 %
Concentration RSD	143.9 %	5.0 %	54.5 %	217.9 %	85.7 %	39.8 %	4.0 %	67.6 %	138.0 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	111.483 %	0.211 ppb	0.796 ppb	-0.006 ppb	106.979 %	107.372 %	0.014 ppb	0.018 ppb	110.692 %
Concentration per Run 1	115.211 %	0.206 ppb	0.781 ppb	0.004 ppb	109.188 %	109.096 %	0.013 ppb	0.021 ppb	110.463 %
Concentration per Run 2	113.697 %	0.180 ppb	0.808 ppb	-0.007 ppb	108.493 %	109.633 %	0.015 ppb	0.014 ppb	112.796 %
Concentration per Run 3	105.540 %	0.247 ppb	0.799 ppb	-0.015 ppb	103.256 %	103.386 %	0.014 ppb	0.020 ppb	108.818 %
Recovery Percentage 1		7.022 %	19.902 %	-1.201 %			2.802 %	3.649 %	110.692 %
Concentration RSD	4.7 %	16.0 %	1.7 %	160.0 %	3.0 %	3.2 %	6.6 %	21.2 %	1.8 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 81 Analysis started at: 6/9/2017 11:30:56 AM Rack: 2
 Analysis label: L1719196-01 2008TL User name: ALPHALAB\metals-instrument Vial: 9

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	87.917 %	97.423 %	0.025 ppb	442,082.971 ppb	47,411.523 ppb	224.778 ppb	47,619.761 ppb	89,895.874 ppb	105.130 %
Concentration per Run 1	87.996 %	97.255 %	0.035 ppb	460,854.271 ppb	49,477.350 ppb	235.698 ppb	49,322.787 ppb	93,563.358 ppb	103.245 %
Concentration per Run 2	87.265 %	99.944 %	0.023 ppb	426,825.806 ppb	45,686.619 ppb	217.275 ppb	47,084.918 ppb	89,272.706 ppb	104.335 %
Concentration per Run 3	88.491 %	95.071 %	0.016 ppb	438,568.835 ppb	47,070.599 ppb	221.360 ppb	46,451.579 ppb	86,851.558 ppb	107.810 %
Concentration RSD	0.7 %	2.5 %	37.9 %	3.9 %	4.0 %	4.3 %	3.2 %	3.8 %	2.3 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	91.024 %	140.082 ppb	4.030 ppb	3.436 ppb	707.532 ppb	20,564.464 ppb	0.871 ppb	3.637 ppb	4.557 ppb
Concentration per Run 1	91.098 %	144.910 ppb	4.174 ppb	4.424 ppb	736.570 ppb	21,522.530 ppb	0.873 ppb	4.047 ppb	4.809 ppb
Concentration per Run 2	89.444 %	140.199 ppb	4.207 ppb	2.600 ppb	709.272 ppb	20,515.714 ppb	0.861 ppb	3.653 ppb	4.159 ppb
Concentration per Run 3	92.531 %	135.138 ppb	3.709 ppb	3.283 ppb	676.753 ppb	19,655.148 ppb	0.880 ppb	3.210 ppb	4.702 ppb
Concentration RSD	1.7 %	3.5 %	6.9 %	26.8 %	4.2 %	4.5 %	1.1 %	11.5 %	7.6 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	29.474 ppb	101.377 %	2.174 ppb	0.944 ppb	668.221 ppb	4.049 ppb	95.058 %	0.031 ppb	0.019 ppb
Concentration per Run 1	31.061 ppb	97.677 %	2.328 ppb	0.554 ppb	694.631 ppb	4.445 ppb	91.871 %	0.040 ppb	0.026 ppb
Concentration per Run 2	29.027 ppb	102.080 %	2.239 ppb	1.904 ppb	652.748 ppb	3.898 ppb	97.560 %	0.026 ppb	0.025 ppb
Concentration per Run 3	28.334 ppb	104.375 %	1.953 ppb	0.374 ppb	657.284 ppb	3.802 ppb	95.744 %	0.026 ppb	0.005 ppb
Concentration RSD	4.8 %	3.4 %	9.0 %	88.6 %	3.4 %	8.6 %	3.1 %	25.7 %	63.5 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	95.904 %	0.336 ppb	0.469 ppb	178.270 ppb	94.975 %	99.084 %	0.009 ppb	0.200 ppb	92.209 %
Concentration per Run 1	92.937 %	0.338 ppb	0.474 ppb	182.495 ppb	92.331 %	95.120 %	0.009 ppb	0.217 ppb	89.903 %
Concentration per Run 2	97.640 %	0.405 ppb	0.475 ppb	177.578 ppb	97.010 %	101.979 %	0.010 ppb	0.184 ppb	92.994 %
Concentration per Run 3	97.136 %	0.265 ppb	0.459 ppb	174.737 ppb	95.585 %	100.154 %	0.009 ppb	0.198 ppb	93.730 %
Concentration RSD	2.7 %	20.9 %	2.0 %	2.2 %	2.5 %	3.6 %	3.9 %	8.3 %	2.2 %

Alpha ICPMSQ2 Full

6/10/2017 10:11:47 AM



Analysis index:	82	Analysis started at:	6/9/2017 11:34:02 AM	Rack:	2
Analysis label:	XWG1011435-4 2008TL	User name:	ALPHALAB\metals-instrument	Vial:	10

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 83 Analysis started at: 6/9/2017 11:37:09 AM Rack: 2
 Analysis label: WG1011435-3D10 2008TL User name: ALPHALAB\metals-instrument Vial: 11

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	95.632 %	106.487 %	5.096 ppb	44,005.927 ppb	6,341.267 ppb	258.403 ppb	5,913.855 ppb	9,776.258 ppb	116.447 %
Concentration per Run 1	95.967 %	113.691 %	5.222 ppb	43,501.954 ppb	6,421.595 ppb	269.721 ppb	6,011.466 ppb	9,634.887 ppb	128.396 %
Concentration per Run 2	94.793 %	107.741 %	5.103 ppb	42,724.366 ppb	6,107.666 ppb	246.315 ppb	5,778.619 ppb	9,542.737 ppb	112.507 %
Concentration per Run 3	96.135 %	98.028 %	4.962 ppb	45,791.460 ppb	6,494.539 ppb	259.172 ppb	5,951.480 ppb	10,151.150 ppb	108.439 %
Concentration RSD	0.8 %	7.4 %	2.6 %	3.6 %	3.2 %	4.5 %	2.0 %	3.4 %	9.1 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	99.623 %	103.644 ppb	51.637 ppb	20.043 ppb	120.131 ppb	2,062.918 ppb	48.755 ppb	49.233 ppb	25.558 ppb
Concentration per Run 1	100.044 %	101.720 ppb	49.839 ppb	19.300 ppb	120.335 ppb	1,990.314 ppb	46.039 ppb	47.334 ppb	24.870 ppb
Concentration per Run 2	98.388 %	102.924 ppb	51.730 ppb	19.941 ppb	116.937 ppb	2,030.906 ppb	49.164 ppb	47.540 ppb	25.706 ppb
Concentration per Run 3	100.437 %	106.288 ppb	53.342 ppb	20.888 ppb	123.123 ppb	2,167.535 ppb	51.062 ppb	52.825 ppb	26.098 ppb
Concentration RSD	1.1 %	2.3 %	3.4 %	4.0 %	2.6 %	4.5 %	5.2 %	6.3 %	2.5 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	53.463 ppb	114.732 %	12.405 ppb	11.989 ppb	169.634 ppb	98.602 ppb	107.658 %	4.882 ppb	5.143 ppb
Concentration per Run 1	53.135 ppb	122.271 %	12.267 ppb	14.167 ppb	175.314 ppb	98.667 ppb	111.589 %	4.770 ppb	5.358 ppb
Concentration per Run 2	52.411 ppb	112.442 %	12.075 ppb	11.739 ppb	163.825 ppb	97.327 ppb	105.767 %	4.698 ppb	4.995 ppb
Concentration per Run 3	54.842 ppb	109.481 %	12.872 ppb	10.062 ppb	169.763 ppb	99.811 ppb	105.618 %	5.177 ppb	5.076 ppb
Concentration RSD	2.3 %	5.8 %	3.4 %	17.2 %	3.4 %	1.3 %	3.2 %	5.3 %	3.7 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	116.764 %	99.128 ppb	53.083 ppb	216.503 ppb	109.931 %	113.823 %	11.922 ppb	51.810 ppb	110.997 %
Concentration per Run 1	123.772 %	98.152 ppb	52.489 ppb	219.415 ppb	115.675 %	121.328 %	11.884 ppb	52.036 ppb	113.456 %
Concentration per Run 2	113.983 %	99.827 ppb	53.486 ppb	214.160 ppb	107.926 %	113.457 %	11.866 ppb	51.464 ppb	110.615 %
Concentration per Run 3	112.537 %	99.406 ppb	53.273 ppb	215.935 ppb	106.192 %	106.685 %	12.017 ppb	51.930 ppb	108.920 %
Concentration RSD	5.2 %	0.9 %	1.0 %	1.2 %	4.6 %	6.4 %	0.7 %	0.6 %	2.1 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 84 Analysis started at: 6/9/2017 11:40:16 AM Rack: 2
 Analysis label: L1719196-02 2008TL User name: ALPHALAB\metals-instrument Vial: 12

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	88.968 %	102.532 %	0.008 ppb	428,058.286 ppb	46,431.728 ppb	7.149 ppb	47,255.042 ppb	88,095.764 ppb	114.578 %
Concentration per Run 1	89.274 %	99.305 %	0.010 ppb	423,008.604 ppb	45,525.674 ppb	6.745 ppb	46,182.555 ppb	86,373.655 ppb	106.719 %
Concentration per Run 2	88.610 %	106.935 %	0.003 ppb	433,033.871 ppb	47,358.996 ppb	7.470 ppb	48,532.661 ppb	89,773.852 ppb	125.230 %
Concentration per Run 3	89.021 %	101.356 %	0.011 ppb	428,132.382 ppb	46,410.512 ppb	7.231 ppb	47,049.911 ppb	88,139.786 ppb	111.784 %
Concentration RSD	0.4 %	3.9 %	50.9 %	1.2 %	2.0 %	5.2 %	2.5 %	1.9 %	8.3 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	93.613 %	137.771 ppb	1.005 ppb	0.782 ppb	678.865 ppb	3,396.513 ppb	0.367 ppb	1.178 ppb	2.395 ppb
Concentration per Run 1	93.310 %	134.493 ppb	0.938 ppb	0.883 ppb	675.510 ppb	3,357.190 ppb	0.379 ppb	1.210 ppb	2.308 ppb
Concentration per Run 2	94.067 %	139.641 ppb	1.042 ppb	0.734 ppb	681.936 ppb	3,404.773 ppb	0.357 ppb	1.232 ppb	2.371 ppb
Concentration per Run 3	93.461 %	139.178 ppb	1.035 ppb	0.729 ppb	679.147 ppb	3,427.576 ppb	0.364 ppb	1.091 ppb	2.506 ppb
Concentration RSD	0.4 %	2.1 %	5.8 %	11.1 %	0.5 %	1.1 %	3.1 %	6.4 %	4.2 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	32.752 ppb	106.964 %	1.112 ppb	0.979 ppb	662.517 ppb	3.256 ppb	96.731 %	0.003 ppb	0.015 ppb
Concentration per Run 1	32.381 ppb	102.276 %	1.054 ppb	0.861 ppb	634.217 ppb	3.300 ppb	94.414 %	0.008 ppb	0.010 ppb
Concentration per Run 2	32.838 ppb	112.816 %	1.261 ppb	1.207 ppb	701.482 ppb	3.327 ppb	98.599 %	0.000 ppb	0.024 ppb
Concentration per Run 3	33.038 ppb	105.799 %	1.019 ppb	0.870 ppb	651.851 ppb	3.140 ppb	97.180 %	0.001 ppb	0.010 ppb
Concentration RSD	1.0 %	5.0 %	11.7 %	20.1 %	5.3 %	3.1 %	2.2 %	143.0 %	54.0 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	98.837 %	0.255 ppb	0.188 ppb	141.135 ppb	98.126 %	103.443 %	0.007 ppb	0.064 ppb	95.465 %
Concentration per Run 1	94.243 %	0.254 ppb	0.190 ppb	138.729 ppb	93.119 %	98.051 %	0.006 ppb	0.068 ppb	94.193 %
Concentration per Run 2	103.594 %	0.339 ppb	0.164 ppb	147.113 ppb	103.355 %	109.150 %	0.007 ppb	0.068 ppb	97.848 %
Concentration per Run 3	98.674 %	0.174 ppb	0.210 ppb	137.562 ppb	97.904 %	103.128 %	0.007 ppb	0.057 ppb	94.354 %
Concentration RSD	4.7 %	32.3 %	12.1 %	3.7 %	5.2 %	5.4 %	7.7 %	10.2 %	2.2 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 85 Analysis started at: 6/9/2017 11:43:24 AM Rack: 2
 Analysis label: L1719196-03 2008TL User name: ALPHALAB\metals-instrument Vial: 13

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	88.062 %	97.636 %	0.005 ppb	521,074.122 ppb	48,418.507 ppb	15.555 ppb	49,117.260 ppb	91,651.812 ppb	109.303 %
Concentration per Run 1	86.736 %	94.029 %	0.002 ppb	541,802.905 ppb	49,620.215 ppb	17.345 ppb	50,537.529 ppb	93,753.241 ppb	101.703 %
Concentration per Run 2	89.071 %	98.095 %	0.008 ppb	515,190.574 ppb	47,908.056 ppb	13.883 ppb	48,037.033 ppb	90,664.260 ppb	106.885 %
Concentration per Run 3	88.379 %	100.784 %	0.005 ppb	506,228.888 ppb	47,727.252 ppb	15.437 ppb	48,777.218 ppb	90,537.935 ppb	119.320 %
Concentration RSD	1.4 %	3.5 %	50.0 %	3.6 %	2.2 %	11.1 %	2.6 %	2.0 %	8.3 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	92.065 %	139.904 ppb	0.896 ppb	0.953 ppb	591.544 ppb	411.663 ppb	0.366 ppb	2.312 ppb	2.353 ppb
Concentration per Run 1	91.301 %	141.534 ppb	0.915 ppb	1.007 ppb	613.293 ppb	418.272 ppb	0.332 ppb	2.754 ppb	2.340 ppb
Concentration per Run 2	92.682 %	136.147 ppb	1.011 ppb	1.006 ppb	575.724 ppb	406.777 ppb	0.388 ppb	2.031 ppb	2.562 ppb
Concentration per Run 3	92.211 %	142.031 ppb	0.763 ppb	0.845 ppb	585.614 ppb	409.941 ppb	0.376 ppb	2.150 ppb	2.157 ppb
Concentration RSD	0.8 %	2.3 %	14.0 %	9.7 %	3.3 %	1.4 %	8.2 %	16.8 %	8.6 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	10.824 ppb	104.283 %	0.771 ppb	3.748 ppb	676.844 ppb	3.601 ppb	94.042 %	0.009 ppb	0.003 ppb
Concentration per Run 1	11.755 ppb	96.817 %	0.774 ppb	4.115 ppb	696.044 ppb	3.589 ppb	90.466 %	0.012 ppb	0.005 ppb
Concentration per Run 2	10.793 ppb	103.111 %	0.791 ppb	3.083 ppb	653.187 ppb	3.545 ppb	95.313 %	0.006 ppb	0.000 ppb
Concentration per Run 3	9.926 ppb	112.922 %	0.747 ppb	4.045 ppb	681.299 ppb	3.671 ppb	96.348 %	0.010 ppb	0.005 ppb
Concentration RSD	8.5 %	7.8 %	2.9 %	15.4 %	3.2 %	1.8 %	3.3 %	35.3 %	87.0 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	96.372 %	0.079 ppb	0.148 ppb	123.227 ppb	97.264 %	103.110 %	0.010 ppb	0.060 ppb	92.746 %
Concentration per Run 1	90.502 %	0.091 ppb	0.159 ppb	125.823 ppb	93.673 %	96.560 %	0.007 ppb	0.064 ppb	88.837 %
Concentration per Run 2	95.497 %	0.078 ppb	0.144 ppb	118.464 ppb	97.136 %	102.185 %	0.010 ppb	0.059 ppb	91.666 %
Concentration per Run 3	103.117 %	0.070 ppb	0.140 ppb	125.395 ppb	100.983 %	110.586 %	0.013 ppb	0.058 ppb	97.735 %
Concentration RSD	6.6 %	13.4 %	7.0 %	3.4 %	3.8 %	6.8 %	32.0 %	5.5 %	4.9 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 86 Analysis started at: 6/9/2017 11:46:30 AM Rack: 2
 Analysis label: L1719196-04 2008TL User name: ALPHALAB\metals-instrument Vial: 14

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	88.912 %	96.325 %	0.001 ppb	442,766.063 ppb	47,108.134 ppb	11.284 ppb	47,500.454 ppb	88,577.491 ppb	105.779 %
Concentration per Run 1	88.899 %	96.482 %	0.001 ppb	429,029.237 ppb	45,442.605 ppb	10.080 ppb	46,310.120 ppb	85,267.274 ppb	104.277 %
Concentration per Run 2	89.148 %	97.558 %	0.000 ppb	452,077.151 ppb	47,929.989 ppb	11.339 ppb	49,170.106 ppb	91,273.312 ppb	106.636 %
Concentration per Run 3	88.690 %	94.936 %	0.001 ppb	447,191.801 ppb	47,951.809 ppb	12.434 ppb	47,021.135 ppb	89,191.887 ppb	106.423 %
Concentration RSD	0.3 %	1.4 %	81.2 %	2.7 %	3.1 %	10.4 %	3.1 %	3.4 %	1.2 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	93.172 %	138.300 ppb	0.737 ppb	0.513 ppb	694.555 ppb	3,532.268 ppb	0.380 ppb	3.371 ppb	1.012 ppb
Concentration per Run 1	92.777 %	134.122 ppb	0.786 ppb	0.481 ppb	671.077 ppb	3,422.264 ppb	0.392 ppb	3.485 ppb	0.956 ppb
Concentration per Run 2	94.212 %	141.908 ppb	0.649 ppb	0.544 ppb	713.573 ppb	3,597.750 ppb	0.366 ppb	3.407 ppb	1.203 ppb
Concentration per Run 3	92.526 %	138.870 ppb	0.776 ppb	0.512 ppb	699.016 ppb	3,576.788 ppb	0.382 ppb	3.221 ppb	0.878 ppb
Concentration RSD	1.0 %	2.8 %	10.4 %	6.2 %	3.1 %	2.7 %	3.5 %	4.0 %	16.8 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	22.074 ppb	101.689 %	1.386 ppb	1.934 ppb	660.032 ppb	3.526 ppb	95.885 %	0.018 ppb	0.029 ppb
Concentration per Run 1	21.758 ppb	99.773 %	1.316 ppb	1.780 ppb	646.306 ppb	3.285 ppb	95.986 %	0.014 ppb	0.020 ppb
Concentration per Run 2	22.374 ppb	101.980 %	1.314 ppb	1.673 ppb	667.514 ppb	3.708 ppb	96.581 %	0.014 ppb	0.030 ppb
Concentration per Run 3	22.092 ppb	103.315 %	1.528 ppb	2.348 ppb	666.276 ppb	3.584 ppb	95.087 %	0.026 ppb	0.036 ppb
Concentration RSD	1.4 %	1.8 %	8.8 %	18.8 %	1.8 %	6.2 %	0.8 %	38.6 %	27.0 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	95.702 %	0.315 ppb	0.161 ppb	144.751 ppb	96.663 %	101.631 %	0.010 ppb	0.291 ppb	93.732 %
Concentration per Run 1	94.745 %	0.270 ppb	0.163 ppb	140.025 ppb	93.807 %	98.899 %	0.011 ppb	0.289 ppb	93.282 %
Concentration per Run 2	97.442 %	0.343 ppb	0.199 ppb	149.490 ppb	98.226 %	103.659 %	0.009 ppb	0.297 ppb	93.784 %
Concentration per Run 3	94.920 %	0.331 ppb	0.122 ppb	144.736 ppb	97.956 %	102.337 %	0.010 ppb	0.288 ppb	94.131 %
Concentration RSD	1.6 %	12.5 %	23.8 %	3.3 %	2.6 %	2.4 %	11.7 %	1.6 %	0.5 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 87 Analysis started at: 6/9/2017 11:49:36 AM Rack: 2
 Analysis label: L1719196-05 2008TL User name: ALPHALAB\metals-instrument Vial: 15

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	88.309 %	99.003 %	0.001 ppb	409,206.490 ppb	43,860.405 ppb	6.481 ppb	44,253.899 ppb	81,935.480 ppb	111.132 %
Concentration per Run 1	87.408 %	98.969 %	-0.001 ppb	377,924.565 ppb	40,800.511 ppb	5.085 ppb	40,697.369 ppb	73,993.215 ppb	112.805 %
Concentration per Run 2	89.652 %	102.129 %	0.002 ppb	411,777.207 ppb	43,508.548 ppb	6.914 ppb	44,332.785 ppb	81,408.005 ppb	114.073 %
Concentration per Run 3	87.867 %	95.911 %	0.001 ppb	437,917.698 ppb	47,272.155 ppb	7.444 ppb	47,731.543 ppb	90,405.221 ppb	106.518 %
Concentration RSD	1.3 %	3.1 %	192.0 %	7.4 %	7.4 %	19.1 %	7.9 %	10.0 %	3.6 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	93.200 %	124.370 ppb	0.734 ppb	0.285 ppb	617.238 ppb	2,725.885 ppb	0.338 ppb	2.419 ppb	1.639 ppb
Concentration per Run 1	93.381 %	110.361 ppb	0.700 ppb	0.248 ppb	565.863 ppb	2,458.073 ppb	0.296 ppb	1.980 ppb	1.463 ppb
Concentration per Run 2	93.401 %	124.824 ppb	0.747 ppb	0.301 ppb	608.986 ppb	2,745.237 ppb	0.326 ppb	2.667 ppb	1.689 ppb
Concentration per Run 3	92.817 %	137.925 ppb	0.754 ppb	0.305 ppb	676.867 ppb	2,974.346 ppb	0.390 ppb	2.611 ppb	1.764 ppb
Concentration RSD	0.4 %	11.1 %	4.0 %	11.2 %	9.1 %	9.5 %	14.2 %	15.8 %	9.5 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	20.555 ppb	108.682 %	1.025 ppb	0.981 ppb	606.266 ppb	2.885 ppb	100.340 %	0.003 ppb	0.024 ppb
Concentration per Run 1	19.104 ppb	109.205 %	0.746 ppb	0.566 ppb	541.190 ppb	2.742 ppb	101.920 %	0.007 ppb	0.028 ppb
Concentration per Run 2	20.655 ppb	110.356 %	1.204 ppb	0.762 ppb	618.642 ppb	2.812 ppb	100.452 %	0.001 ppb	0.024 ppb
Concentration per Run 3	21.905 ppb	106.484 %	1.124 ppb	1.617 ppb	658.964 ppb	3.101 ppb	98.647 %	0.002 ppb	0.020 ppb
Concentration RSD	6.8 %	1.8 %	23.9 %	56.9 %	9.9 %	6.6 %	1.6 %	94.1 %	18.1 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	101.082 %	0.075 ppb	0.140 ppb	129.784 ppb	101.085 %	108.056 %	0.009 ppb	0.062 ppb	100.408 %
Concentration per Run 1	103.725 %	0.049 ppb	0.123 ppb	115.535 ppb	102.488 %	110.928 %	0.007 ppb	0.053 ppb	102.072 %
Concentration per Run 2	100.034 %	0.072 ppb	0.139 ppb	133.065 ppb	101.886 %	108.031 %	0.012 ppb	0.064 ppb	101.464 %
Concentration per Run 3	99.488 %	0.103 ppb	0.159 ppb	140.752 ppb	98.881 %	105.210 %	0.007 ppb	0.070 ppb	97.689 %
Concentration RSD	2.3 %	36.7 %	13.0 %	10.0 %	1.9 %	2.6 %	35.7 %	13.3 %	2.4 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 88 Analysis started at: 6/9/2017 11:52:42 AM Rack: 2
 Analysis label: WG1011435-4 2008TL User name: ALPHALAB\metals-instrument Vial: 10

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	89.270 %	96.762 %	0.022 ppb	447,398.501 ppb	48,545.685 ppb	225.963 ppb	47,898.660 ppb	90,870.822 ppb	108.099 %
Concentration per Run 1	90.206 %	97.692 %	0.021 ppb	446,446.366 ppb	48,597.444 ppb	226.292 ppb	49,482.636 ppb	92,654.720 ppb	100.980 %
Concentration per Run 2	88.805 %	98.431 %	0.029 ppb	442,987.427 ppb	48,108.219 ppb	225.251 ppb	46,775.348 ppb	89,721.720 ppb	112.187 %
Concentration per Run 3	88.799 %	94.163 %	0.015 ppb	452,761.709 ppb	48,931.392 ppb	226.344 ppb	47,437.996 ppb	90,236.025 ppb	111.131 %
Concentration RSD	0.9 %	2.4 %	32.1 %	1.1 %	0.9 %	0.3 %	2.9 %	1.7 %	5.7 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	94.848 %	144.416 ppb	4.094 ppb	3.001 ppb	709.526 ppb	19,817.819 ppb	0.898 ppb	3.424 ppb	4.355 ppb
Concentration per Run 1	94.591 %	148.366 ppb	3.753 ppb	3.774 ppb	726.769 ppb	20,369.709 ppb	0.860 ppb	3.584 ppb	4.671 ppb
Concentration per Run 2	95.453 %	142.276 ppb	4.098 ppb	2.815 ppb	699.479 ppb	19,555.187 ppb	0.974 ppb	3.420 ppb	4.243 ppb
Concentration per Run 3	94.501 %	142.607 ppb	4.430 ppb	2.415 ppb	702.330 ppb	19,528.560 ppb	0.860 ppb	3.270 ppb	4.151 ppb
Concentration RSD	0.6 %	2.4 %	8.3 %	23.3 %	2.1 %	2.4 %	7.3 %	4.6 %	6.4 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	29.331 ppb	105.092 %	2.247 ppb	0.992 ppb	692.577 ppb	4.597 ppb	93.748 %	0.016 ppb	0.013 ppb
Concentration per Run 1	31.232 ppb	101.395 %	2.311 ppb	0.587 ppb	692.464 ppb	4.037 ppb	91.109 %	0.019 ppb	0.010 ppb
Concentration per Run 2	29.098 ppb	106.332 %	2.142 ppb	1.805 ppb	688.143 ppb	4.027 ppb	95.134 %	0.009 ppb	0.015 ppb
Concentration per Run 3	27.662 ppb	107.550 %	2.290 ppb	0.584 ppb	697.125 ppb	5.727 ppb	95.002 %	0.020 ppb	0.015 ppb
Concentration RSD	6.1 %	3.1 %	4.1 %	71.0 %	0.6 %	21.3 %	2.4 %	40.1 %	19.7 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	97.591 %	-0.049 ppb	0.085 ppb	182.527 ppb	96.092 %	103.146 %	0.003 ppb	0.169 ppb	90.693 %
Concentration per Run 1	95.158 %	-0.028 ppb	0.100 ppb	183.888 ppb	93.675 %	101.363 %	0.002 ppb	0.165 ppb	87.771 %
Concentration per Run 2	99.077 %	-0.037 ppb	0.095 ppb	182.369 ppb	98.076 %	104.143 %	0.006 ppb	0.172 ppb	92.704 %
Concentration per Run 3	98.539 %	-0.082 ppb	0.060 ppb	181.324 ppb	96.523 %	103.933 %	0.002 ppb	0.169 ppb	91.602 %
Concentration RSD	2.2 %	59.2 %	25.7 %	0.7 %	2.3 %	1.5 %	80.7 %	2.2 %	2.9 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 89 Analysis started at: 6/9/2017 11:55:49 AM Rack: 0
 Analysis label: CCV User name: ALPHALAB\metals-instrument Vial: 9

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	97.647 %	104.246 %	101.561 ppb	10,641.477 ppb	9,713.302 ppb	105.060 ppb	10,407.537 ppb	10,182.087 ppb	114.520 %
Concentration per Run 1	97.536 %	102.700 %	101.105 ppb	10,380.164 ppb	9,421.787 ppb	102.899 ppb	10,147.122 ppb	9,832.537 ppb	110.455 %
Concentration per Run 2	96.746 %	106.733 %	101.299 ppb	10,508.832 ppb	9,643.482 ppb	101.791 ppb	10,416.136 ppb	10,223.374 ppb	117.727 %
Concentration per Run 3	98.657 %	103.305 %	102.280 ppb	11,035.434 ppb	10,074.636 ppb	110.490 ppb	10,659.353 ppb	10,490.351 ppb	115.378 %
Recovery Percentage 1			101.561 %	106.415 %	97.133 %	105.060 %	104.075 %	101.821 %	
Concentration RSD	1.0 %	2.1 %	0.6 %	3.3 %	3.4 %	4.5 %	2.5 %	3.2 %	3.2 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	102.271 %	98.859 ppb	95.754 ppb	95.189 ppb	97.837 ppb	9,873.021 ppb	97.321 ppb	96.897 ppb	95.340 ppb
Concentration per Run 1	101.081 %	96.379 ppb	93.189 ppb	94.710 ppb	97.002 ppb	9,690.847 ppb	96.536 ppb	95.949 ppb	93.479 ppb
Concentration per Run 2	100.945 %	96.338 ppb	95.664 ppb	93.044 ppb	95.019 ppb	9,618.105 ppb	94.347 ppb	96.076 ppb	94.388 ppb
Concentration per Run 3	104.787 %	103.860 ppb	98.408 ppb	97.813 ppb	101.491 ppb	10,310.111 ppb	101.081 ppb	98.665 ppb	98.153 ppb
Recovery Percentage 1		98.859 %	95.754 %	95.189 %	97.837 %	98.730 %	97.321 %	96.897 %	95.340 %
Concentration RSD	2.1 %	4.4 %	2.7 %	2.5 %	3.4 %	3.9 %	3.5 %	1.6 %	2.6 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	94.197 ppb	112.160 %	93.331 ppb	95.933 ppb	100.915 ppb	97.371 ppb	109.505 %	95.354 ppb	97.407 ppb
Concentration per Run 1	92.795 ppb	109.795 %	90.679 ppb	91.532 ppb	97.099 ppb	93.479 ppb	107.024 %	91.398 ppb	94.435 ppb
Concentration per Run 2	91.448 ppb	113.725 %	93.864 ppb	92.989 ppb	101.231 ppb	97.614 ppb	112.506 %	95.416 ppb	96.963 ppb
Concentration per Run 3	98.348 ppb	112.962 %	95.451 ppb	103.278 ppb	104.416 ppb	101.020 ppb	108.984 %	99.250 ppb	100.822 ppb
Recovery Percentage 1	94.197 %	93.331 %	95.933 %	100.915 %	97.371 %			95.354 %	97.407 %
Concentration RSD	3.9 %	1.9 %	2.6 %	6.7 %	3.6 %	3.9 %	2.5 %	4.1 %	3.3 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	115.263 %	98.389 ppb	91.261 ppb	96.709 ppb	110.193 %	115.439 %	93.578 ppb	92.513 ppb	115.597 %
Concentration per Run 1	112.776 %	94.702 ppb	88.977 ppb	93.256 ppb	108.599 %	112.096 %	94.306 ppb	91.431 ppb	110.377 %
Concentration per Run 2	118.777 %	98.252 ppb	90.751 ppb	96.509 ppb	112.965 %	118.543 %	91.462 ppb	90.855 ppb	119.981 %
Concentration per Run 3	114.236 %	102.211 ppb	94.055 ppb	100.363 ppb	109.016 %	115.677 %	94.967 ppb	95.254 ppb	116.432 %
Recovery Percentage 1		98.389 %	91.261 %	96.709 %			93.578 %	92.513 %	
Concentration RSD	2.7 %	3.8 %	2.8 %	3.7 %	2.2 %	2.8 %	2.0 %	2.6 %	4.2 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 90 Analysis started at: 6/9/2017 11:58:59 AM Rack: 0
 Analysis label: CCB User name: ALPHALAB\metals-instrument Vial: 10

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	98.109 %	106.408 %	0.006 ppb	66.696 ppb	1.142 ppb	0.167 ppb	11.254 ppb	0.872 ppb	115.793 %
Concentration per Run 1	99.592 %	108.515 %	0.010 ppb	54.289 ppb	1.320 ppb	0.305 ppb	6.621 ppb	3.813 ppb	118.142 %
Concentration per Run 2	97.450 %	105.086 %	0.000 ppb	69.064 ppb	1.699 ppb	0.098 ppb	16.594 ppb	-0.285 ppb	118.071 %
Concentration per Run 3	97.285 %	105.624 %	0.008 ppb	76.736 ppb	0.408 ppb	0.097 ppb	10.548 ppb	-0.912 ppb	111.167 %
Recovery Percentage 1			1.964 %	66.696 %	1.632 %	1.668 %	11.254 %	0.872 %	
Concentration RSD	1.3 %	1.7 %	94.7 %	17.1 %	58.1 %	71.9 %	44.6 %	294.2 %	3.5 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	101.634 %	0.032 ppb	0.021 ppb	0.007 ppb	0.102 ppb	2.148 ppb	0.017 ppb	0.027 ppb	-0.012 ppb
Concentration per Run 1	101.009 %	0.050 ppb	0.046 ppb	0.013 ppb	0.124 ppb	2.981 ppb	0.008 ppb	-0.034 ppb	-0.027 ppb
Concentration per Run 2	101.435 %	0.039 ppb	0.008 ppb	0.013 ppb	0.064 ppb	1.936 ppb	0.037 ppb	0.079 ppb	-0.010 ppb
Concentration per Run 3	102.458 %	0.008 ppb	0.009 ppb	-0.004 ppb	0.117 ppb	1.526 ppb	0.005 ppb	0.036 ppb	0.002 ppb
Recovery Percentage 1		6.432 %	0.416 %	0.738 %	10.201 %	4.295 %	3.351 %	1.349 %	-1.170 %
Concentration RSD	0.7 %	67.2 %	104.3 %	135.3 %	32.2 %	34.9 %	105.4 %	210.7 %	125.0 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	0.097 ppb	114.069 %	0.034 ppb	-0.060 ppb	0.027 ppb	0.156 ppb	114.196 %	0.011 ppb	0.018 ppb
Concentration per Run 1	0.144 ppb	116.101 %	0.045 ppb	-0.220 ppb	0.038 ppb	0.133 ppb	115.922 %	0.014 ppb	0.033 ppb
Concentration per Run 2	0.154 ppb	114.498 %	0.034 ppb	-0.173 ppb	0.019 ppb	0.165 ppb	114.637 %	0.012 ppb	0.017 ppb
Concentration per Run 3	-0.007 ppb	111.607 %	0.024 ppb	0.212 ppb	0.023 ppb	0.170 ppb	112.028 %	0.008 ppb	0.004 ppb
Recovery Percentage 1	0.970 %	114.069 %	6.871 %	-1.205 %	5.364 %	7.796 %		2.869 %	8.900 %
Concentration RSD	93.0 %	2.0 %	31.6 %	393.5 %	37.6 %	12.8 %	1.7 %	28.1 %	80.2 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	118.308 %	0.172 ppb	0.780 ppb	0.017 ppb	110.200 %	114.510 %	0.018 ppb	0.052 ppb	117.386 %
Concentration per Run 1	119.977 %	0.109 ppb	0.808 ppb	0.024 ppb	111.476 %	116.149 %	0.019 ppb	0.025 ppb	116.693 %
Concentration per Run 2	118.616 %	0.210 ppb	0.848 ppb	0.036 ppb	109.390 %	114.343 %	0.019 ppb	0.021 ppb	117.944 %
Concentration per Run 3	116.330 %	0.196 ppb	0.683 ppb	-0.008 ppb	109.734 %	113.037 %	0.015 ppb	0.111 ppb	117.519 %
Recovery Percentage 1		5.735 %	19.490 %	3.481 %			3.508 %	10.439 %	117.386 %
Concentration RSD	1.6 %	31.8 %	11.0 %	130.1 %	1.0 %	1.4 %	13.5 %	96.8 %	0.5 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 91 Analysis started at: 6/9/2017 12:04:49 PM Rack: 1
 Analysis label: L1717934-01 6020TL User name: ALPHALAB\metals-instrument Vial: 41

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	101.156 %	109.545 %	0.014 ppb	130,669.552 ppb	16,808.108 ppb	89.566 ppb	1,405.444 ppb	105,891.268 ppb	117.786 %
Concentration per Run 1	101.229 %	106.330 %	0.007 ppb	132,221.970 ppb	17,081.291 ppb	94.626 ppb	1,430.093 ppb	105,945.035 ppb	115.449 %
Concentration per Run 2	101.353 %	112.313 %	0.015 ppb	130,198.994 ppb	16,605.413 ppb	86.141 ppb	1,398.746 ppb	105,708.832 ppb	117.228 %
Concentration per Run 3	100.887 %	109.993 %	0.019 ppb	129,587.691 ppb	16,737.618 ppb	87.932 ppb	1,387.493 ppb	106,019.937 ppb	120.681 %
Concentration RSD	0.2 %	2.8 %	45.9 %	1.1 %	1.5 %	5.0 %	1.6 %	0.2 %	2.3 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	104.002 %	163.608 ppb	0.299 ppb	0.310 ppb	69.403 ppb	172.898 ppb	0.125 ppb	0.568 ppb	1.685 ppb
Concentration per Run 1	105.214 %	164.518 ppb	0.300 ppb	0.353 ppb	70.248 ppb	178.271 ppb	0.135 ppb	0.550 ppb	1.617 ppb
Concentration per Run 2	104.221 %	166.082 ppb	0.329 ppb	0.267 ppb	70.810 ppb	178.155 ppb	0.116 ppb	0.528 ppb	1.815 ppb
Concentration per Run 3	102.569 %	160.225 ppb	0.268 ppb	0.309 ppb	67.151 ppb	162.267 ppb	0.123 ppb	0.625 ppb	1.622 ppb
Concentration RSD	1.3 %	1.9 %	10.1 %	13.8 %	2.8 %	5.3 %	8.0 %	9.0 %	6.7 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	6.686 ppb	116.290 %	0.801 ppb	0.189 ppb	191.835 ppb	0.638 ppb	103.969 %	0.007 ppb	0.013 ppb
Concentration per Run 1	6.665 ppb	109.204 %	0.951 ppb	0.412 ppb	196.389 ppb	0.607 ppb	102.192 %	0.007 ppb	0.018 ppb
Concentration per Run 2	6.673 ppb	119.485 %	0.705 ppb	0.627 ppb	195.126 ppb	0.669 ppb	109.401 %	0.010 ppb	0.008 ppb
Concentration per Run 3	6.720 ppb	120.181 %	0.746 ppb	-0.471 ppb	183.989 ppb	0.637 ppb	100.313 %	0.005 ppb	0.014 ppb
Concentration RSD	0.4 %	5.3 %	16.5 %	307.2 %	3.6 %	4.9 %	4.6 %	36.3 %	36.1 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	114.536 %	0.004 ppb	0.353 ppb	79.002 ppb	108.245 %	108.030 %	0.007 ppb	0.165 ppb	107.388 %
Concentration per Run 1	112.269 %	0.044 ppb	0.409 ppb	80.239 ppb	106.273 %	105.366 %	0.008 ppb	0.169 ppb	107.997 %
Concentration per Run 2	121.095 %	-0.008 ppb	0.331 ppb	77.967 ppb	112.295 %	113.565 %	0.006 ppb	0.160 ppb	110.158 %
Concentration per Run 3	110.243 %	-0.026 ppb	0.320 ppb	78.799 ppb	106.166 %	105.158 %	0.008 ppb	0.166 ppb	104.009 %
Concentration RSD	5.0 %	981.8 %	13.7 %	1.5 %	3.2 %	4.4 %	16.3 %	3.0 %	2.9 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 92 Analysis started at: 6/9/2017 12:07:55 PM Rack: 1
 Analysis label: L1717934-02 6020TL User name: ALPHALAB\metals-instrument Vial: 42

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	101.424 %	110.061 %	0.023 ppb	10,295.492 ppb	10,337.132 ppb	410.085 ppb	1,569.318 ppb	46,339.047 ppb	120.729 %
Concentration per Run 1	102.390 %	112.716 %	0.012 ppb	9,674.992 ppb	9,692.158 ppb	392.241 ppb	1,496.398 ppb	43,657.551 ppb	124.419 %
Concentration per Run 2	101.048 %	109.052 %	0.026 ppb	10,614.139 ppb	10,637.423 ppb	423.501 ppb	1,627.463 ppb	48,145.919 ppb	117.228 %
Concentration per Run 3	100.834 %	108.414 %	0.030 ppb	10,597.345 ppb	10,681.815 ppb	414.514 ppb	1,584.094 ppb	47,213.671 ppb	120.539 %
Concentration RSD	0.8 %	2.1 %	41.4 %	5.2 %	5.4 %	3.9 %	4.3 %	5.1 %	3.0 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	104.542 %	74.438 ppb	0.630 ppb	0.519 ppb	27.392 ppb	643.692 ppb	0.302 ppb	0.754 ppb	1.092 ppb
Concentration per Run 1	105.429 %	72.232 ppb	0.678 ppb	0.503 ppb	25.546 ppb	598.521 ppb	0.304 ppb	0.772 ppb	0.994 ppb
Concentration per Run 2	103.731 %	76.867 ppb	0.679 ppb	0.515 ppb	29.367 ppb	665.085 ppb	0.336 ppb	0.742 ppb	1.120 ppb
Concentration per Run 3	104.466 %	74.215 ppb	0.534 ppb	0.539 ppb	27.262 ppb	667.468 ppb	0.268 ppb	0.747 ppb	1.160 ppb
Concentration RSD	0.8 %	3.1 %	13.3 %	3.5 %	7.0 %	6.1 %	11.3 %	2.1 %	7.9 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	3.576 ppb	116.626 %	0.727 ppb	0.448 ppb	88.584 ppb	0.125 ppb	113.763 %	0.001 ppb	0.008 ppb
Concentration per Run 1	3.632 ppb	118.962 %	0.751 ppb	1.101 ppb	85.096 ppb	0.118 ppb	115.258 %	0.001 ppb	0.004 ppb
Concentration per Run 2	3.755 ppb	114.403 %	0.597 ppb	-0.881 ppb	91.798 ppb	0.145 ppb	112.095 %	0.001 ppb	0.008 ppb
Concentration per Run 3	3.342 ppb	116.514 %	0.834 ppb	1.125 ppb	88.859 ppb	0.112 ppb	113.936 %	0.000 ppb	0.012 ppb
Concentration RSD	5.9 %	2.0 %	16.5 %	257.0 %	3.8 %	14.1 %	1.4 %	127.2 %	50.6 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	124.627 %	-0.113 ppb	0.228 ppb	36.577 ppb	115.548 %	116.285 %	0.009 ppb	0.540 ppb	117.310 %
Concentration per Run 1	127.100 %	-0.124 ppb	0.215 ppb	35.310 ppb	117.629 %	119.790 %	0.008 ppb	0.487 ppb	123.106 %
Concentration per Run 2	123.047 %	-0.117 ppb	0.236 ppb	36.937 ppb	115.031 %	115.391 %	0.007 ppb	0.553 ppb	115.050 %
Concentration per Run 3	123.734 %	-0.099 ppb	0.233 ppb	37.484 ppb	113.982 %	113.673 %	0.013 ppb	0.581 ppb	113.775 %
Concentration RSD	1.7 %	11.5 %	5.0 %	3.1 %	1.6 %	2.7 %	31.7 %	8.9 %	4.3 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 93 Analysis started at: 6/9/2017 12:11:00 PM Rack: 1
 Analysis label: L1717934-03 6020TL User name: ALPHALAB\metals-instrument Vial: 43

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	101.387 %	108.895 %	0.012 ppb	3,959.846 ppb	10,230.048 ppb	176.090 ppb	1,263.551 ppb	37,646.942 ppb	117.790 %
Concentration per Run 1	100.124 %	111.842 %	0.007 ppb	3,944.050 ppb	10,141.881 ppb	176.553 ppb	1,255.318 ppb	38,046.618 ppb	119.566 %
Concentration per Run 2	100.142 %	108.346 %	0.016 ppb	4,022.525 ppb	10,320.429 ppb	179.434 ppb	1,282.372 ppb	37,582.513 ppb	119.138 %
Concentration per Run 3	103.894 %	106.498 %	0.014 ppb	3,912.963 ppb	10,227.834 ppb	172.284 ppb	1,252.963 ppb	37,311.694 ppb	114.666 %
Concentration RSD	2.1 %	2.5 %	39.5 %	1.4 %	0.9 %	2.0 %	1.3 %	1.0 %	2.3 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	104.448 %	59.204 ppb	0.312 ppb	0.423 ppb	15.928 ppb	255.425 ppb	0.138 ppb	0.554 ppb	0.683 ppb
Concentration per Run 1	103.303 %	59.864 ppb	0.364 ppb	0.456 ppb	15.977 ppb	253.000 ppb	0.123 ppb	0.544 ppb	0.641 ppb
Concentration per Run 2	103.383 %	57.943 ppb	0.288 ppb	0.397 ppb	15.301 ppb	251.201 ppb	0.161 ppb	0.630 ppb	0.705 ppb
Concentration per Run 3	106.660 %	59.806 ppb	0.284 ppb	0.417 ppb	16.505 ppb	262.074 ppb	0.130 ppb	0.489 ppb	0.704 ppb
Concentration RSD	1.8 %	1.8 %	14.4 %	7.2 %	3.8 %	2.3 %	14.7 %	12.7 %	5.4 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	2.156 ppb	115.154 %	0.646 ppb	0.731 ppb	79.703 ppb	0.112 ppb	111.582 %	-0.002 ppb	0.012 ppb
Concentration per Run 1	2.311 ppb	115.839 %	0.590 ppb	0.164 ppb	80.096 ppb	0.100 ppb	111.192 %	0.001 ppb	0.025 ppb
Concentration per Run 2	1.940 ppb	116.383 %	0.666 ppb	1.361 ppb	78.877 ppb	0.123 ppb	110.749 %	-0.002 ppb	0.008 ppb
Concentration per Run 3	2.217 ppb	113.239 %	0.683 ppb	0.669 ppb	80.135 ppb	0.114 ppb	112.804 %	-0.004 ppb	0.004 ppb
Concentration RSD	8.9 %	1.5 %	7.7 %	82.2 %	0.9 %	10.5 %	1.0 %	148.0 %	88.2 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	119.751 %	-0.117 ppb	0.156 ppb	27.287 ppb	111.531 %	114.240 %	0.004 ppb	0.204 ppb	114.984 %
Concentration per Run 1	119.983 %	-0.102 ppb	0.135 ppb	27.340 ppb	110.136 %	115.808 %	0.004 ppb	0.197 ppb	114.546 %
Concentration per Run 2	119.803 %	-0.130 ppb	0.191 ppb	27.601 ppb	111.903 %	111.035 %	0.002 ppb	0.212 ppb	114.985 %
Concentration per Run 3	119.468 %	-0.117 ppb	0.142 ppb	26.919 ppb	112.554 %	115.876 %	0.007 ppb	0.202 ppb	115.420 %
Concentration RSD	0.2 %	11.8 %	19.8 %	1.3 %	1.1 %	2.4 %	54.9 %	3.7 %	0.4 %

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6/10/2017 10:11:47 AM

Analysis index: 94 Analysis started at: 6/9/2017 12:14:07 PM Rack: 1
 Analysis label: L1717934-05 6020TL User name: ALPHALAB\metals-instrument Vial: 44

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	98.855 %	111.965 %	0.071 ppb	8,320.920 ppb	15,892.369 ppb	999.085 ppb	2,729.632 ppb	67,704.294 ppb	120.719 %
Concentration per Run 1	98.719 %	109.758 %	0.077 ppb	8,099.422 ppb	15,449.769 ppb	978.578 ppb	2,689.761 ppb	64,734.163 ppb	121.599 %
Concentration per Run 2	99.057 %	116.480 %	0.068 ppb	8,513.830 ppb	16,321.123 ppb	1,039.898 ppb	2,817.146 ppb	69,785.875 ppb	125.654 %
Concentration per Run 3	98.790 %	109.657 %	0.068 ppb	8,349.508 ppb	15,906.215 ppb	978.778 ppb	2,681.988 ppb	68,592.843 ppb	114.903 %
Concentration RSD	0.2 %	3.5 %	7.6 %	2.5 %	2.7 %	3.5 %	2.8 %	3.9 %	4.5 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	99.119 %	108.599 ppb	1.304 ppb	2.136 ppb	567.638 ppb	2,773.462 ppb	2.556 ppb	3.842 ppb	4.973 ppb
Concentration per Run 1	99.007 %	102.807 ppb	1.226 ppb	2.043 ppb	540.250 ppb	2,655.149 ppb	2.454 ppb	3.860 ppb	4.496 ppb
Concentration per Run 2	99.929 %	113.342 ppb	1.363 ppb	2.362 ppb	582.925 ppb	2,797.574 ppb	2.458 ppb	3.701 ppb	5.002 ppb
Concentration per Run 3	98.423 %	109.649 ppb	1.323 ppb	2.003 ppb	579.737 ppb	2,867.664 ppb	2.756 ppb	3.965 ppb	5.421 ppb
Concentration RSD	0.8 %	4.9 %	5.4 %	9.2 %	4.2 %	3.9 %	6.8 %	3.5 %	9.3 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	24.994 ppb	115.416 %	3.792 ppb	1.824 ppb	199.566 ppb	0.547 ppb	110.945 %	0.002 ppb	0.010 ppb
Concentration per Run 1	23.865 ppb	115.687 %	3.269 ppb	2.809 ppb	190.926 ppb	0.526 ppb	112.159 %	0.002 ppb	0.008 ppb
Concentration per Run 2	24.782 ppb	121.403 %	3.780 ppb	1.374 ppb	203.599 ppb	0.629 ppb	112.640 %	0.001 ppb	0.008 ppb
Concentration per Run 3	26.335 ppb	109.157 %	4.327 ppb	1.290 ppb	204.172 ppb	0.487 ppb	108.036 %	0.004 ppb	0.013 ppb
Concentration RSD	5.0 %	5.3 %	14.0 %	46.8 %	3.8 %	13.5 %	2.3 %	56.6 %	28.1 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	123.687 %	-0.029 ppb	0.150 ppb	180.691 ppb	113.806 %	115.598 %	0.013 ppb	2.699 ppb	116.913 %
Concentration per Run 1	125.059 %	-0.071 ppb	0.123 ppb	172.238 ppb	115.537 %	117.933 %	0.014 ppb	2.625 ppb	117.738 %
Concentration per Run 2	127.034 %	0.010 ppb	0.121 ppb	184.157 ppb	117.041 %	117.678 %	0.011 ppb	2.669 ppb	119.609 %
Concentration per Run 3	118.968 %	-0.025 ppb	0.205 ppb	185.679 ppb	108.841 %	111.183 %	0.014 ppb	2.803 ppb	113.393 %
Concentration RSD	3.4 %	141.1 %	31.9 %	4.1 %	3.8 %	3.3 %	15.2 %	3.4 %	2.7 %

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6/10/2017 10:11:47 AM

Analysis index: 95 Analysis started at: 6/9/2017 12:17:13 PM Rack: 1
 Analysis label: L1717934-07 6020TL User name: ALPHALAB\metals-instrument Vial: 45

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	101.185 %	112.694 %	0.005 ppb	14,375.329 ppb	17,322.364 ppb	25.152 ppb	1,863.226 ppb	86,476.417 ppb	120.585 %
Concentration per Run 1	100.419 %	104.817 %	0.001 ppb	14,723.629 ppb	17,619.184 ppb	22.936 ppb	1,864.893 ppb	86,193.349 ppb	110.812 %
Concentration per Run 2	99.929 %	110.565 %	0.010 ppb	14,511.509 ppb	17,320.505 ppb	25.608 ppb	1,841.206 ppb	87,004.346 ppb	113.195 %
Concentration per Run 3	103.208 %	122.699 %	0.004 ppb	13,890.850 ppb	17,027.402 ppb	26.913 ppb	1,883.580 ppb	86,231.555 ppb	137.749 %
Concentration RSD	1.7 %	8.1 %	89.0 %	3.0 %	1.7 %	8.1 %	1.1 %	0.5 %	12.4 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	104.026 %	133.961 ppb	0.067 ppb	0.114 ppb	95.134 ppb	414.071 ppb	0.015 ppb	0.230 ppb	0.162 ppb
Concentration per Run 1	102.252 %	135.126 ppb	0.034 ppb	0.125 ppb	96.408 ppb	419.020 ppb	0.016 ppb	0.199 ppb	0.237 ppb
Concentration per Run 2	103.411 %	134.102 ppb	0.072 ppb	0.093 ppb	96.482 ppb	433.360 ppb	0.015 ppb	0.220 ppb	0.108 ppb
Concentration per Run 3	106.417 %	132.653 ppb	0.097 ppb	0.123 ppb	92.512 ppb	389.832 ppb	0.015 ppb	0.269 ppb	0.140 ppb
Concentration RSD	2.1 %	0.9 %	47.2 %	16.0 %	2.4 %	5.4 %	4.1 %	15.5 %	41.9 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	1.417 ppb	117.698 %	1.202 ppb	0.156 ppb	148.911 ppb	0.134 ppb	108.425 %	-0.004 ppb	0.003 ppb
Concentration per Run 1	1.341 ppb	106.667 %	1.096 ppb	-0.122 ppb	150.371 ppb	0.195 ppb	101.644 %	-0.006 ppb	0.000 ppb
Concentration per Run 2	1.497 ppb	116.144 %	1.245 ppb	0.241 ppb	144.095 ppb	0.079 ppb	108.053 %	-0.003 ppb	0.008 ppb
Concentration per Run 3	1.412 ppb	130.282 %	1.263 ppb	0.349 ppb	152.268 ppb	0.128 ppb	115.578 %	-0.005 ppb	0.000 ppb
Concentration RSD	5.5 %	10.1 %	7.6 %	158.1 %	2.9 %	43.5 %	6.4 %	39.7 %	173.2 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	124.731 %	-0.066 ppb	0.101 ppb	113.781 ppb	115.858 %	115.923 %	0.001 ppb	0.038 ppb	111.715 %
Concentration per Run 1	114.308 %	-0.012 ppb	0.121 ppb	115.778 ppb	108.114 %	107.450 %	0.001 ppb	0.043 ppb	106.349 %
Concentration per Run 2	121.017 %	-0.101 ppb	0.094 ppb	112.127 ppb	114.464 %	113.351 %	0.002 ppb	0.040 ppb	109.531 %
Concentration per Run 3	138.869 %	-0.085 ppb	0.089 ppb	113.438 ppb	124.997 %	126.967 %	0.001 ppb	0.030 ppb	119.264 %
Concentration RSD	10.2 %	71.6 %	17.0 %	1.6 %	7.4 %	8.6 %	49.8 %	17.9 %	6.0 %

Alpha ICPMSQ2 Full



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Analysis index: 96 Analysis started at: 6/9/2017 12:20:20 PM Rack: 1
 Analysis label: L1717934-08 6020TL User name: ALPHALAB\metals-instrument Vial: 46

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	99.510 %	107.842 %	0.004 ppb	73,805.607 ppb	8,460.548 ppb	341.879 ppb	2,528.031 ppb	43,144.630 ppb	111.120 %
Concentration per Run 1	100.549 %	105.254 %	0.003 ppb	77,987.220 ppb	8,829.517 ppb	354.761 ppb	2,571.780 ppb	44,226.999 ppb	107.407 %
Concentration per Run 2	98.982 %	111.775 %	0.002 ppb	70,887.775 ppb	8,127.924 ppb	335.840 ppb	2,537.450 ppb	43,147.973 ppb	112.140 %
Concentration per Run 3	98.999 %	106.498 %	0.005 ppb	72,541.825 ppb	8,424.202 ppb	335.037 ppb	2,474.865 ppb	42,058.919 ppb	113.812 %
Concentration RSD	0.9 %	3.2 %	42.2 %	5.0 %	4.2 %	3.3 %	1.9 %	2.5 %	3.0 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	101.691 %	67.282 ppb	0.126 ppb	0.125 ppb	107.969 ppb	674.260 ppb	0.011 ppb	0.087 ppb	0.305 ppb
Concentration per Run 1	102.621 %	68.879 ppb	0.152 ppb	0.165 ppb	112.287 ppb	698.101 ppb	0.009 ppb	0.191 ppb	0.304 ppb
Concentration per Run 2	102.510 %	68.990 ppb	0.121 ppb	0.100 ppb	107.634 ppb	671.527 ppb	0.019 ppb	-0.042 ppb	0.332 ppb
Concentration per Run 3	99.941 %	63.977 ppb	0.104 ppb	0.109 ppb	103.985 ppb	653.154 ppb	0.005 ppb	0.112 ppb	0.279 ppb
Concentration RSD	1.5 %	4.3 %	19.5 %	28.4 %	3.9 %	3.4 %	63.3 %	136.5 %	8.7 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	3.937 ppb	109.327 %	10.575 ppb	-0.114 ppb	139.856 ppb	0.228 ppb	103.601 %	0.009 ppb	0.027 ppb
Concentration per Run 1	4.137 ppb	106.756 %	11.081 ppb	-0.819 ppb	147.769 ppb	0.222 ppb	100.481 %	0.012 ppb	0.046 ppb
Concentration per Run 2	3.866 ppb	110.727 %	10.421 ppb	1.475 ppb	135.244 ppb	0.245 ppb	104.612 %	0.004 ppb	0.013 ppb
Concentration per Run 3	3.807 ppb	110.498 %	10.224 ppb	-0.998 ppb	136.553 ppb	0.219 ppb	105.711 %	0.012 ppb	0.022 ppb
Concentration RSD	4.5 %	2.0 %	4.2 %	1,210.3 %	4.9 %	6.2 %	2.7 %	46.5 %	63.0 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	110.051 %	-0.120 ppb	0.115 ppb	886.755 ppb	106.088 %	108.240 %	0.001 ppb	0.018 ppb	108.252 %
Concentration per Run 1	106.270 %	-0.155 ppb	0.107 ppb	929.105 ppb	102.799 %	105.540 %	0.001 ppb	0.020 ppb	105.741 %
Concentration per Run 2	111.231 %	-0.138 ppb	0.083 ppb	871.624 ppb	106.665 %	107.018 %	0.001 ppb	0.022 ppb	106.658 %
Concentration per Run 3	112.651 %	-0.066 ppb	0.154 ppb	859.535 ppb	108.799 %	112.162 %	0.001 ppb	0.013 ppb	112.358 %
Concentration RSD	3.0 %	39.5 %	31.3 %	4.2 %	2.9 %	3.2 %	45.1 %	23.9 %	3.3 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 97 Analysis started at: 6/9/2017 12:23:26 PM Rack: 1
 Analysis label: L1717934-09 6020TL User name: ALPHALAB\metals-instrument Vial: 47

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	103.258 %	109.019 %	0.001 ppb	10,140.989 ppb	15,521.246 ppb	39.796 ppb	1,653.602 ppb	86,135.095 ppb	113.029 %
Concentration per Run 1	103.348 %	105.221 %	0.004 ppb	10,567.600 ppb	16,244.006 ppb	39.124 ppb	1,717.716 ppb	90,393.243 ppb	108.392 %
Concentration per Run 2	104.136 %	113.153 %	0.000 ppb	9,899.575 ppb	15,187.807 ppb	42.262 ppb	1,604.100 ppb	84,726.157 ppb	113.302 %
Concentration per Run 3	102.289 %	108.683 %	-0.001 ppb	9,955.791 ppb	15,131.924 ppb	38.002 ppb	1,638.989 ppb	83,285.884 ppb	117.395 %
Concentration RSD	0.9 %	3.6 %	235.3 %	3.7 %	4.0 %	5.5 %	3.5 %	4.4 %	4.0 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	105.505 %	133.086 ppb	0.080 ppb	0.173 ppb	21.398 ppb	68.316 ppb	0.055 ppb	0.201 ppb	0.131 ppb
Concentration per Run 1	105.211 %	142.178 ppb	0.085 ppb	0.130 ppb	22.570 ppb	75.278 ppb	0.065 ppb	0.257 ppb	0.123 ppb
Concentration per Run 2	107.614 %	131.477 ppb	0.087 ppb	0.210 ppb	20.367 ppb	67.175 ppb	0.054 ppb	0.182 ppb	0.149 ppb
Concentration per Run 3	103.690 %	125.604 ppb	0.069 ppb	0.180 ppb	21.257 ppb	62.494 ppb	0.046 ppb	0.163 ppb	0.120 ppb
Concentration RSD	1.9 %	6.3 %	12.4 %	23.2 %	5.2 %	9.5 %	17.1 %	24.7 %	12.4 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	0.340 ppb	113.468 %	0.268 ppb	-0.061 ppb	153.349 ppb	0.109 ppb	107.223 %	-0.003 ppb	0.007 ppb
Concentration per Run 1	0.433 ppb	106.626 %	0.320 ppb	-0.059 ppb	161.971 ppb	0.124 ppb	104.953 %	-0.003 ppb	0.013 ppb
Concentration per Run 2	0.281 ppb	116.144 %	0.181 ppb	0.810 ppb	147.808 ppb	0.063 ppb	108.752 %	-0.005 ppb	0.004 ppb
Concentration per Run 3	0.305 ppb	117.634 %	0.302 ppb	-0.935 ppb	150.269 ppb	0.141 ppb	107.964 %	0.000 ppb	0.004 ppb
Concentration RSD	24.2 %	5.3 %	28.2 %	1,426.3 %	4.9 %	37.7 %	1.9 %	94.5 %	72.0 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	120.157 %	-0.042 ppb	0.085 ppb	76.476 ppb	112.547 %	112.338 %	0.004 ppb	0.056 ppb	111.229 %
Concentration per Run 1	116.183 %	-0.082 ppb	0.065 ppb	80.100 ppb	107.357 %	107.455 %	0.004 ppb	0.059 ppb	106.965 %
Concentration per Run 2	122.393 %	-0.027 ppb	0.071 ppb	72.631 ppb	113.468 %	112.884 %	0.003 ppb	0.055 ppb	111.320 %
Concentration per Run 3	121.896 %	-0.018 ppb	0.118 ppb	76.696 ppb	116.815 %	116.676 %	0.004 ppb	0.054 ppb	115.402 %
Concentration RSD	2.9 %	81.9 %	34.1 %	4.9 %	4.3 %	4.1 %	15.1 %	5.3 %	3.8 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 98 Analysis started at: 6/9/2017 12:26:34 PM Rack: 1
 Analysis label: L1717934-11 6020TL User name: ALPHALAB\metals-instrument Vial: 48

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	101.528 %	109.545 %	0.005 ppb	9,010.417 ppb	17,236.005 ppb	54.550 ppb	2,073.303 ppb	117,423.631 ppb	115.478 %
Concentration per Run 1	101.383 %	106.599 %	0.007 ppb	8,964.836 ppb	17,346.567 ppb	56.538 ppb	2,091.387 ppb	119,747.737 ppb	108.844 %
Concentration per Run 2	100.875 %	112.010 %	0.001 ppb	8,887.494 ppb	17,100.224 ppb	53.709 ppb	2,042.876 ppb	116,042.718 ppb	120.432 %
Concentration per Run 3	102.325 %	110.027 %	0.008 ppb	9,178.922 ppb	17,261.225 ppb	53.404 ppb	2,085.646 ppb	116,480.437 ppb	117.157 %
Concentration RSD	0.7 %	2.5 %	66.8 %	1.7 %	0.7 %	3.2 %	1.3 %	1.7 %	5.2 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	102.033 %	183.637 ppb	0.225 ppb	0.127 ppb	679.455 ppb	225.081 ppb	0.147 ppb	0.412 ppb	0.582 ppb
Concentration per Run 1	101.185 %	186.600 ppb	0.249 ppb	0.154 ppb	682.738 ppb	202.967 ppb	0.150 ppb	0.462 ppb	0.637 ppb
Concentration per Run 2	100.677 %	181.125 ppb	0.187 ppb	0.135 ppb	668.624 ppb	243.027 ppb	0.159 ppb	0.366 ppb	0.631 ppb
Concentration per Run 3	104.236 %	183.186 ppb	0.240 ppb	0.090 ppb	687.004 ppb	229.248 ppb	0.132 ppb	0.407 ppb	0.479 ppb
Concentration RSD	1.9 %	1.5 %	14.7 %	25.8 %	1.4 %	9.0 %	9.5 %	11.6 %	15.4 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	27.446 ppb	113.726 %	0.385 ppb	-0.032 ppb	161.039 ppb	0.176 ppb	106.027 %	-0.002 ppb	0.073 ppb
Concentration per Run 1	27.739 ppb	109.977 %	0.347 ppb	0.393 ppb	160.575 ppb	0.152 ppb	101.039 %	-0.001 ppb	0.044 ppb
Concentration per Run 2	27.523 ppb	117.602 %	0.392 ppb	-0.507 ppb	160.563 ppb	0.212 ppb	107.237 %	-0.002 ppb	0.087 ppb
Concentration per Run 3	27.076 ppb	113.598 %	0.416 ppb	0.018 ppb	161.980 ppb	0.164 ppb	109.807 %	-0.002 ppb	0.089 ppb
Concentration RSD	1.2 %	3.4 %	9.1 %	1,413.1 %	0.5 %	18.1 %	4.3 %	14.0 %	34.8 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	121.333 %	-0.118 ppb	0.126 ppb	57.205 ppb	112.917 %	108.723 %	0.004 ppb	0.275 ppb	109.662 %
Concentration per Run 1	115.945 %	-0.139 ppb	0.119 ppb	57.279 ppb	109.597 %	102.728 %	0.002 ppb	0.264 ppb	106.414 %
Concentration per Run 2	122.560 %	-0.135 ppb	0.124 ppb	58.387 ppb	114.972 %	112.169 %	0.004 ppb	0.291 ppb	111.448 %
Concentration per Run 3	125.496 %	-0.079 ppb	0.136 ppb	55.949 ppb	114.182 %	111.273 %	0.005 ppb	0.270 ppb	111.124 %
Concentration RSD	4.0 %	28.2 %	7.1 %	2.1 %	2.6 %	4.8 %	36.4 %	5.1 %	2.6 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 99 Analysis started at: 6/9/2017 12:29:41 PM Rack: 1
 Analysis label: L1717934-12 6020TL User name: ALPHALAB\metals-instrument Vial: 49

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	102.042 %	110.386 %	0.010 ppb	27,563.233 ppb	19,501.029 ppb	182.620 ppb	2,064.074 ppb	89,284.490 ppb	114.050 %
Concentration per Run 1	101.929 %	109.355 %	0.016 ppb	27,251.372 ppb	19,152.199 ppb	169.779 ppb	2,052.854 ppb	89,120.566 ppb	108.618 %
Concentration per Run 2	101.956 %	110.430 %	0.006 ppb	27,762.849 ppb	19,850.342 ppb	191.461 ppb	2,078.597 ppb	89,063.629 ppb	115.342 %
Concentration per Run 3	102.241 %	111.371 %	0.009 ppb	27,675.479 ppb	19,500.546 ppb	186.619 ppb	2,060.770 ppb	89,669.276 ppb	118.189 %
Concentration RSD	0.2 %	0.9 %	49.9 %	1.0 %	1.8 %	6.2 %	0.6 %	0.4 %	4.3 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	102.980 %	141.740 ppb	0.529 ppb	0.841 ppb	116.851 ppb	455.860 ppb	0.140 ppb	1.110 ppb	1.684 ppb
Concentration per Run 1	101.848 %	138.001 ppb	0.493 ppb	0.750 ppb	117.018 ppb	472.997 ppb	0.135 ppb	0.907 ppb	1.673 ppb
Concentration per Run 2	104.137 %	143.365 ppb	0.471 ppb	0.887 ppb	116.142 ppb	445.736 ppb	0.127 ppb	1.114 ppb	1.637 ppb
Concentration per Run 3	102.954 %	143.856 ppb	0.623 ppb	0.886 ppb	117.391 ppb	448.846 ppb	0.157 ppb	1.308 ppb	1.742 ppb
Concentration RSD	1.1 %	2.3 %	15.5 %	9.4 %	0.5 %	3.3 %	11.2 %	18.1 %	3.2 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	18.024 ppb	110.251 %	1.162 ppb	0.282 ppb	217.384 ppb	0.426 ppb	104.740 %	-0.003 ppb	0.011 ppb
Concentration per Run 1	18.065 ppb	105.571 %	1.082 ppb	-0.096 ppb	216.260 ppb	0.426 ppb	103.041 %	-0.004 ppb	0.009 ppb
Concentration per Run 2	18.093 ppb	112.203 %	1.125 ppb	0.448 ppb	215.237 ppb	0.395 ppb	105.506 %	-0.001 ppb	0.013 ppb
Concentration per Run 3	17.915 ppb	112.978 %	1.280 ppb	0.496 ppb	220.654 ppb	0.458 ppb	105.674 %	-0.004 ppb	0.013 ppb
Concentration RSD	0.5 %	3.7 %	9.0 %	116.5 %	1.3 %	7.4 %	1.4 %	67.5 %	19.9 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	117.006 %	-0.079 ppb	0.104 ppb	283.489 ppb	109.600 %	108.855 %	0.008 ppb	0.358 ppb	108.027 %
Concentration per Run 1	113.936 %	-0.077 ppb	0.100 ppb	283.404 ppb	107.393 %	105.987 %	0.010 ppb	0.354 ppb	104.502 %
Concentration per Run 2	118.877 %	-0.100 ppb	0.111 ppb	284.018 ppb	110.272 %	112.040 %	0.007 ppb	0.353 ppb	109.951 %
Concentration per Run 3	118.205 %	-0.059 ppb	0.100 ppb	283.045 ppb	111.136 %	108.537 %	0.007 ppb	0.366 ppb	109.629 %
Concentration RSD	2.3 %	26.1 %	6.0 %	0.2 %	1.8 %	2.8 %	23.7 %	2.1 %	2.8 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 100 Analysis started at: 6/9/2017 12:32:47 PM Rack: 1
 Analysis label: L1717934-14 6020TL User name: ALPHALAB\metals-instrument Vial: 50

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	103.931 %	111.484 %	0.001 ppb	8,277.127 ppb	20,328.735 ppb	15.882 ppb	2,151.650 ppb	118,752.075 ppb	116.896 %
Concentration per Run 1	104.696 %	107.742 %	0.004 ppb	8,326.168 ppb	20,365.085 ppb	17.292 ppb	2,138.814 ppb	118,521.171 ppb	112.495 %
Concentration per Run 2	103.060 %	114.329 %	0.001 ppb	8,093.569 ppb	19,953.505 ppb	14.652 ppb	2,133.073 ppb	116,771.219 ppb	122.033 %
Concentration per Run 3	104.037 %	112.380 %	-0.003 ppb	8,411.645 ppb	20,667.615 ppb	15.703 ppb	2,183.063 ppb	120,963.834 ppb	116.161 %
Concentration RSD	0.8 %	3.0 %	465.5 %	2.0 %	1.8 %	8.4 %	1.3 %	1.8 %	4.1 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	104.289 %	182.661 ppb	0.091 ppb	0.163 ppb	23.611 ppb	8.429 ppb	0.011 ppb	0.176 ppb	0.277 ppb
Concentration per Run 1	105.691 %	182.235 ppb	0.130 ppb	0.188 ppb	22.987 ppb	10.243 ppb	0.002 ppb	0.089 ppb	0.318 ppb
Concentration per Run 2	104.039 %	181.324 ppb	0.067 ppb	0.155 ppb	23.018 ppb	7.370 ppb	0.020 ppb	0.271 ppb	0.236 ppb
Concentration per Run 3	103.139 %	184.424 ppb	0.078 ppb	0.146 ppb	24.828 ppb	7.674 ppb	0.011 ppb	0.170 ppb	0.278 ppb
Concentration RSD	1.2 %	0.9 %	36.6 %	13.6 %	4.5 %	18.7 %	82.3 %	51.7 %	14.8 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	1.154 ppb	112.561 %	1.434 ppb	-0.140 ppb	169.678 ppb	0.332 ppb	107.008 %	-0.003 ppb	0.004 ppb
Concentration per Run 1	1.042 ppb	109.117 %	1.324 ppb	-0.585 ppb	166.811 ppb	0.352 ppb	104.670 %	-0.001 ppb	0.008 ppb
Concentration per Run 2	1.083 ppb	115.012 %	1.520 ppb	-0.661 ppb	166.154 ppb	0.300 ppb	107.324 %	-0.004 ppb	0.000 ppb
Concentration per Run 3	1.337 ppb	113.554 %	1.457 ppb	0.825 ppb	176.069 ppb	0.345 ppb	109.029 %	-0.005 ppb	0.004 ppb
Concentration RSD	13.8 %	2.7 %	7.0 %	595.9 %	3.3 %	8.4 %	2.1 %	74.3 %	100.8 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	121.281 %	-0.116 ppb	0.086 ppb	92.230 ppb	114.786 %	109.562 %	0.001 ppb	0.013 ppb	110.470 %
Concentration per Run 1	119.056 %	-0.128 ppb	0.065 ppb	92.284 ppb	110.585 %	105.323 %	0.000 ppb	0.025 ppb	108.487 %
Concentration per Run 2	123.795 %	-0.164 ppb	0.080 ppb	93.546 ppb	118.345 %	112.685 %	0.000 ppb	0.005 ppb	112.231 %
Concentration per Run 3	120.992 %	-0.055 ppb	0.112 ppb	90.860 ppb	115.429 %	110.677 %	0.003 ppb	0.008 ppb	110.690 %
Concentration RSD	2.0 %	48.2 %	28.1 %	1.5 %	3.4 %	3.5 %	180.3 %	83.8 %	1.7 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 101 Analysis started at: 6/9/2017 12:35:52 PM Rack: 0
 Analysis label: CCV User name: ALPHALAB\metals-instrument Vial: 9

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	101.675 %	106.688 %	98.923 ppb	10,887.404 ppb	10,249.269 ppb	109.562 ppb	10,991.589 ppb	10,915.857 ppb	112.218 %
Concentration per Run 1	101.338 %	102.364 %	98.202 ppb	11,025.482 ppb	10,412.300 ppb	115.273 ppb	11,165.302 ppb	11,021.775 ppb	110.550 %
Concentration per Run 2	102.101 %	108.010 %	98.645 ppb	10,656.422 ppb	10,079.086 ppb	107.277 ppb	10,772.025 ppb	10,846.010 ppb	114.227 %
Concentration per Run 3	101.586 %	109.691 %	99.922 ppb	10,980.307 ppb	10,256.422 ppb	106.135 ppb	11,037.439 ppb	10,879.786 ppb	111.878 %
Recovery Percentage 1			98.923 %	108.874 %	102.493 %	109.562 %	109.916 %	109.159 %	
Concentration RSD	0.4 %	3.6 %	0.9 %	1.8 %	1.6 %	4.5 %	1.8 %	0.9 %	1.7 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	103.990 %	105.263 ppb	101.809 ppb	100.875 ppb	105.299 ppb	10,455.186 ppb	102.453 ppb	103.060 ppb	101.151 ppb
Concentration per Run 1	105.517 %	106.028 ppb	102.868 ppb	100.445 ppb	106.550 ppb	10,740.374 ppb	104.209 ppb	104.024 ppb	102.884 ppb
Concentration per Run 2	103.322 %	106.662 ppb	102.569 ppb	103.157 ppb	105.600 ppb	10,574.746 ppb	104.328 ppb	104.892 ppb	102.537 ppb
Concentration per Run 3	103.131 %	103.098 ppb	99.990 ppb	99.024 ppb	103.746 ppb	10,050.436 ppb	98.823 ppb	100.263 ppb	98.031 ppb
Recovery Percentage 1		105.263 %	101.809 %	100.875 %	105.299 %	104.552 %	102.453 %	103.060 %	101.151 %
Concentration RSD	1.3 %	1.8 %	1.6 %	2.1 %	1.4 %	3.4 %	3.1 %	2.4 %	2.7 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	100.360 ppb	109.673 %	98.562 ppb	99.363 ppb	105.636 ppb	105.672 ppb	107.406 %	100.633 ppb	102.611 ppb
Concentration per Run 1	103.728 ppb	105.599 %	101.523 ppb	100.955 ppb	109.105 ppb	108.416 ppb	105.188 %	101.860 ppb	104.586 ppb
Concentration per Run 2	98.280 ppb	112.160 %	98.407 ppb	98.266 ppb	105.603 ppb	105.254 ppb	107.786 %	100.852 ppb	101.792 ppb
Concentration per Run 3	99.072 ppb	111.260 %	95.756 ppb	98.869 ppb	102.200 ppb	103.345 ppb	109.244 %	99.187 ppb	101.456 ppb
Recovery Percentage 1	100.360 %		98.562 %	99.363 %	105.636 %	105.672 %		100.633 %	102.611 %
Concentration RSD	2.9 %	3.2 %	2.9 %	1.4 %	3.3 %	2.4 %	1.9 %	1.3 %	1.7 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	114.219 %	105.658 ppb	94.445 ppb	102.955 ppb	109.913 %	111.932 %	101.826 ppb	101.933 ppb	110.513 %
Concentration per Run 1	110.139 %	107.116 ppb	94.749 ppb	105.854 ppb	105.927 %	108.442 %	103.048 ppb	102.469 ppb	108.891 %
Concentration per Run 2	115.879 %	106.002 ppb	95.571 ppb	102.862 ppb	112.342 %	113.788 %	102.678 ppb	104.591 ppb	109.100 %
Concentration per Run 3	116.640 %	103.855 ppb	93.015 ppb	100.150 ppb	111.471 %	113.565 %	99.753 ppb	98.739 ppb	113.547 %
Recovery Percentage 1		105.658 %	94.445 %	102.955 %			101.826 %	101.933 %	
Concentration RSD	3.1 %	1.6 %	1.4 %	2.8 %	3.2 %	2.7 %	1.8 %	2.9 %	2.4 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 102 Analysis started at: 6/9/2017 12:39:02 PM Rack: 0
 Analysis label: CCB User name: ALPHALAB\metals-instrument Vial: 10

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	102.139 %	108.559 %	0.005 ppb	8.867 ppb	0.994 ppb	-0.076 ppb	-0.891 ppb	-0.725 ppb	112.191 %
Concentration per Run 1	101.678 %	110.733 %	0.007 ppb	4.483 ppb	0.872 ppb	0.273 ppb	2.105 ppb	1.587 ppb	110.562 %
Concentration per Run 2	101.701 %	109.691 %	0.009 ppb	5.059 ppb	0.865 ppb	-0.247 ppb	-0.851 ppb	1.863 ppb	112.590 %
Concentration per Run 3	103.039 %	105.254 %	-0.002 ppb	17.060 ppb	1.245 ppb	-0.255 ppb	-3.927 ppb	-5.626 ppb	113.420 %
Recovery Percentage 1			1.519 %	8.867 %	1.420 %	-0.765 %	-0.891 %	-0.725 %	
Concentration RSD	0.8 %	2.7 %	120.7 %	80.1 %	21.9 %	396.0 %	338.5 %	585.6 %	1.3 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	102.780 %	0.019 ppb	0.014 ppb	-0.009 ppb	0.061 ppb	1.123 ppb	0.010 ppb	0.064 ppb	0.001 ppb
Concentration per Run 1	101.826 %	-0.015 ppb	-0.007 ppb	-0.033 ppb	0.065 ppb	1.823 ppb	0.009 ppb	0.102 ppb	0.011 ppb
Concentration per Run 2	104.066 %	0.007 ppb	0.040 ppb	0.014 ppb	0.018 ppb	-0.176 ppb	0.008 ppb	0.045 ppb	0.042 ppb
Concentration per Run 3	102.446 %	0.065 ppb	0.008 ppb	-0.008 ppb	0.100 ppb	1.722 ppb	0.011 ppb	0.044 ppb	-0.051 ppb
Recovery Percentage 1		3.766 %	0.277 %	-0.891 %	6.100 %	2.246 %	1.902 %	3.183 %	0.066 %
Concentration RSD	1.1 %	218.8 %	175.6 %	261.5 %	67.6 %	100.2 %	18.2 %	51.8 %	7,206.1 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	0.051 ppb	113.812 %	0.057 ppb	0.131 ppb	0.010 ppb	0.110 ppb	109.399 %	0.013 ppb	0.004 ppb
Concentration per Run 1	0.166 ppb	111.075 %	0.035 ppb	-0.348 ppb	-0.027 ppb	0.135 ppb	108.035 %	0.019 ppb	0.004 ppb
Concentration per Run 2	0.003 ppb	114.393 %	0.046 ppb	0.727 ppb	0.017 ppb	0.087 ppb	108.419 %	0.012 ppb	0.000 ppb
Concentration per Run 3	-0.016 ppb	115.967 %	0.091 ppb	0.015 ppb	0.041 ppb	0.107 ppb	111.743 %	0.009 ppb	0.008 ppb
Recovery Percentage 1	0.511 %	113.812 %	11.467 %	2.627 %	2.048 %	5.478 %		3.350 %	2.110 %
Concentration RSD	194.9 %	2.2 %	51.1 %	416.1 %	339.1 %	22.4 %	1.9 %	40.4 %	99.1 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	116.447 %	0.151 ppb	0.824 ppb	-0.015 ppb	110.204 %	111.311 %	0.015 ppb	0.021 ppb	113.884 %
Concentration per Run 1	115.128 %	0.214 ppb	0.887 ppb	-0.008 ppb	110.354 %	113.141 %	0.015 ppb	0.024 ppb	112.674 %
Concentration per Run 2	116.289 %	0.196 ppb	0.858 ppb	-0.008 ppb	110.486 %	110.044 %	0.014 ppb	0.024 ppb	113.904 %
Concentration per Run 3	117.926 %	0.042 ppb	0.728 ppb	-0.030 ppb	109.771 %	110.750 %	0.015 ppb	0.016 ppb	115.074 %
Recovery Percentage 1		5.018 %	20.599 %	-3.057 %			2.956 %	4.231 %	113.884 %
Concentration RSD	1.2 %	63.0 %	10.3 %	85.4 %	0.3 %	1.5 %	3.1 %	22.1 %	1.1 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 103 Analysis started at: 6/9/2017 12:44:37 PM Rack: 1
 Analysis label: L1717934-15 6020TL User name: ALPHALAB\metals-instrument Vial: 51

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	104.346 %	113.859 %	0.006 ppb	20,832.669 ppb	12,904.293 ppb	2.352 ppb	2,229.601 ppb	105,929.225 ppb	119.321 %
Concentration per Run 1	103.464 %	104.918 %	0.007 ppb	21,626.415 ppb	13,408.564 ppb	2.555 ppb	2,301.803 ppb	109,059.211 ppb	111.654 %
Concentration per Run 2	104.905 %	120.110 %	0.006 ppb	20,109.344 ppb	12,185.519 ppb	1.849 ppb	2,174.991 ppb	102,521.931 ppb	124.051 %
Concentration per Run 3	104.669 %	116.548 %	0.003 ppb	20,762.248 ppb	13,118.795 ppb	2.653 ppb	2,212.010 ppb	106,206.533 ppb	122.259 %
Concentration RSD	0.7 %	7.0 %	44.5 %	3.7 %	5.0 %	18.7 %	2.9 %	3.1 %	5.6 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	104.840 %	165.987 ppb	0.095 ppb	0.108 ppb	2.386 ppb	5.236 ppb	0.010 ppb	0.131 ppb	0.091 ppb
Concentration per Run 1	103.393 %	168.804 ppb	0.058 ppb	0.142 ppb	2.505 ppb	5.024 ppb	0.012 ppb	0.053 ppb	0.105 ppb
Concentration per Run 2	105.965 %	162.546 ppb	0.109 ppb	0.090 ppb	2.089 ppb	6.361 ppb	0.004 ppb	0.176 ppb	0.049 ppb
Concentration per Run 3	105.161 %	166.609 ppb	0.117 ppb	0.092 ppb	2.563 ppb	4.324 ppb	0.013 ppb	0.163 ppb	0.119 ppb
Concentration RSD	1.3 %	1.9 %	33.7 %	27.6 %	10.8 %	19.8 %	49.7 %	51.4 %	40.3 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	0.204 ppb	116.286 %	0.212 ppb	-0.425 ppb	151.595 ppb	0.428 ppb	109.733 %	0.001 ppb	0.011 ppb
Concentration per Run 1	0.377 ppb	105.191 %	0.162 ppb	-0.160 ppb	160.465 ppb	0.479 ppb	102.269 %	0.004 ppb	0.013 ppb
Concentration per Run 2	0.063 ppb	120.581 %	0.218 ppb	-0.469 ppb	145.540 ppb	0.338 ppb	115.820 %	0.003 ppb	0.016 ppb
Concentration per Run 3	0.172 ppb	123.086 %	0.257 ppb	-0.645 ppb	148.779 ppb	0.467 ppb	111.109 %	-0.003 ppb	0.004 ppb
Concentration RSD	78.3 %	8.3 %	22.3 %	57.8 %	5.2 %	18.3 %	6.3 %	249.9 %	55.9 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	123.014 %	-0.040 ppb	0.222 ppb	76.741 ppb	117.223 %	111.688 %	0.022 ppb	0.010 ppb	113.228 %
Concentration per Run 1	115.847 %	-0.033 ppb	0.243 ppb	80.397 ppb	108.479 %	102.700 %	0.024 ppb	0.016 ppb	105.924 %
Concentration per Run 2	128.045 %	-0.064 ppb	0.214 ppb	73.699 ppb	123.151 %	118.579 %	0.023 ppb	0.006 ppb	118.717 %
Concentration per Run 3	125.148 %	-0.023 ppb	0.209 ppb	76.128 ppb	120.038 %	113.783 %	0.019 ppb	0.007 ppb	115.043 %
Concentration RSD	5.2 %	53.1 %	8.4 %	4.4 %	6.6 %	7.3 %	12.7 %	54.1 %	5.8 %

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6/10/2017 10:11:47 AM

Analysis index: 104 Analysis started at: 6/9/2017 12:47:43 PM Rack: 1
 Analysis label: L1717934-16 6020TL User name: ALPHALAB\metals-instrument Vial: 52

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	103.310 %	113.623 %	0.014 ppb	11,944.190 ppb	12,397.847 ppb	232.488 ppb	8,846.803 ppb	76,252.831 ppb	118.803 %
Concentration per Run 1	103.774 %	111.976 %	0.010 ppb	11,766.568 ppb	12,216.005 ppb	233.044 ppb	8,788.267 ppb	75,406.381 ppb	111.513 %
Concentration per Run 2	104.543 %	112.817 %	0.013 ppb	12,045.979 ppb	12,559.989 ppb	228.958 ppb	8,885.788 ppb	76,287.251 ppb	123.351 %
Concentration per Run 3	101.613 %	116.077 %	0.020 ppb	12,020.025 ppb	12,417.548 ppb	235.462 ppb	8,866.354 ppb	77,064.860 ppb	121.547 %
Concentration RSD	1.5 %	1.9 %	35.2 %	1.3 %	1.4 %	1.4 %	0.6 %	1.1 %	5.4 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	104.471 %	120.850 ppb	0.507 ppb	0.685 ppb	49.298 ppb	462.658 ppb	0.303 ppb	1.366 ppb	1.680 ppb
Concentration per Run 1	104.752 %	120.660 ppb	0.482 ppb	0.761 ppb	49.758 ppb	469.619 ppb	0.296 ppb	1.293 ppb	1.638 ppb
Concentration per Run 2	105.809 %	119.337 ppb	0.428 ppb	0.623 ppb	49.125 ppb	449.316 ppb	0.302 ppb	1.342 ppb	1.924 ppb
Concentration per Run 3	102.852 %	122.552 ppb	0.610 ppb	0.670 ppb	49.012 ppb	469.040 ppb	0.311 ppb	1.462 ppb	1.476 ppb
Concentration RSD	1.4 %	1.3 %	18.5 %	10.2 %	0.8 %	2.5 %	2.6 %	6.4 %	13.5 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	4.849 ppb	113.454 %	0.752 ppb	-0.837 ppb	127.192 ppb	0.859 ppb	108.256 %	0.001 ppb	0.029 ppb
Concentration per Run 1	4.835 ppb	105.736 %	0.732 ppb	-0.498 ppb	127.241 ppb	0.800 ppb	104.503 %	-0.002 ppb	0.035 ppb
Concentration per Run 2	4.660 ppb	116.438 %	0.722 ppb	-0.992 ppb	126.855 ppb	0.805 ppb	111.062 %	0.003 ppb	0.033 ppb
Concentration per Run 3	5.052 ppb	118.189 %	0.801 ppb	-1.021 ppb	127.480 ppb	0.973 ppb	109.203 %	0.001 ppb	0.020 ppb
Concentration RSD	4.0 %	5.9 %	5.7 %	35.1 %	0.2 %	11.5 %	3.1 %	320.8 %	26.1 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	120.452 %	-0.082 ppb	0.315 ppb	48.729 ppb	112.158 %	108.942 %	0.018 ppb	0.539 ppb	109.844 %
Concentration per Run 1	115.622 %	-0.101 ppb	0.353 ppb	48.214 ppb	107.212 %	101.618 %	0.020 ppb	0.542 ppb	104.155 %
Concentration per Run 2	123.043 %	-0.036 ppb	0.303 ppb	49.278 ppb	113.634 %	112.365 %	0.015 ppb	0.553 ppb	111.555 %
Concentration per Run 3	122.691 %	-0.108 ppb	0.290 ppb	48.694 ppb	115.627 %	112.841 %	0.018 ppb	0.523 ppb	113.822 %
Concentration RSD	3.5 %	48.7 %	10.5 %	1.1 %	3.9 %	5.8 %	14.6 %	2.8 %	4.6 %

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6/10/2017 10:11:47 AM

Analysis index: 105 Analysis started at: 6/9/2017 12:50:48 PM Rack: 1
 Analysis label: L1717934-17 6020TL User name: ALPHALAB\metals-instrument Vial: 53

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	102.756 %	113.030 %	0.030 ppb	13,442.675 ppb	14,097.834 ppb	271.609 ppb	2,253.010 ppb	69,332.560 ppb	115.259 %
Concentration per Run 1	103.741 %	113.052 %	0.029 ppb	13,208.838 ppb	13,847.690 ppb	275.261 ppb	2,216.731 ppb	69,204.034 ppb	110.408 %
Concentration per Run 2	101.940 %	111.909 %	0.027 ppb	13,593.611 ppb	14,122.966 ppb	270.031 ppb	2,235.661 ppb	68,391.230 ppb	119.044 %
Concentration per Run 3	102.587 %	114.128 %	0.034 ppb	13,525.577 ppb	14,322.847 ppb	269.534 ppb	2,306.637 ppb	70,402.417 ppb	116.327 %
Concentration RSD	0.9 %	1.0 %	11.0 %	1.5 %	1.7 %	1.2 %	2.1 %	1.5 %	3.8 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	101.787 %	107.358 ppb	0.499 ppb	0.456 ppb	729.497 ppb	2,315.969 ppb	0.531 ppb	0.838 ppb	3.056 ppb
Concentration per Run 1	101.578 %	106.312 ppb	0.418 ppb	0.471 ppb	723.451 ppb	2,289.804 ppb	0.519 ppb	0.803 ppb	3.133 ppb
Concentration per Run 2	100.584 %	106.384 ppb	0.527 ppb	0.378 ppb	726.792 ppb	2,300.465 ppb	0.534 ppb	0.876 ppb	3.307 ppb
Concentration per Run 3	103.199 %	109.378 ppb	0.554 ppb	0.519 ppb	738.246 ppb	2,357.637 ppb	0.539 ppb	0.834 ppb	2.730 ppb
Concentration RSD	1.3 %	1.6 %	14.4 %	15.7 %	1.1 %	1.6 %	2.0 %	4.4 %	9.7 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	24.249 ppb	114.212 %	4.684 ppb	0.532 ppb	163.886 ppb	0.457 ppb	109.559 %	-0.002 ppb	0.018 ppb
Concentration per Run 1	23.894 ppb	109.019 %	4.637 ppb	1.688 ppb	161.764 ppb	0.445 ppb	105.973 %	0.002 ppb	0.013 ppb
Concentration per Run 2	24.609 ppb	113.501 %	5.126 ppb	-0.198 ppb	165.632 ppb	0.460 ppb	109.679 %	-0.003 ppb	0.021 ppb
Concentration per Run 3	24.244 ppb	120.115 %	4.289 ppb	0.105 ppb	164.261 ppb	0.465 ppb	113.025 %	-0.006 ppb	0.020 ppb
Concentration RSD	1.5 %	4.9 %	9.0 %	190.4 %	1.2 %	2.2 %	3.2 %	186.4 %	24.4 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	119.494 %	0.004 ppb	0.131 ppb	1,056.769 ppb	112.188 %	108.449 %	0.008 ppb	6.931 ppb	110.143 %
Concentration per Run 1	115.719 %	-0.057 ppb	0.154 ppb	1,031.861 ppb	110.973 %	104.517 %	0.006 ppb	6.728 ppb	109.113 %
Concentration per Run 2	119.958 %	-0.048 ppb	0.123 ppb	1,071.438 ppb	111.243 %	109.524 %	0.010 ppb	6.909 ppb	110.476 %
Concentration per Run 3	122.807 %	0.118 ppb	0.117 ppb	1,067.009 ppb	114.349 %	111.307 %	0.007 ppb	7.157 ppb	110.839 %
Concentration RSD	3.0 %	2,257.2 %	15.0 %	2.1 %	1.7 %	3.2 %	22.9 %	3.1 %	0.8 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 106 Analysis started at: 6/9/2017 12:53:54 PM Rack: 1
 Analysis label: L1717934-18 6020TL User name: ALPHALAB\metals-instrument Vial: 54

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	99.633 %	105.994 %	0.007 ppb	226,221.454 ppb	842.365 ppb	3.291 ppb	1,308.489 ppb	4,089.765 ppb	104.205 %
Concentration per Run 1	100.575 %	101.087 %	0.006 ppb	242,662.816 ppb	892.177 ppb	3.642 ppb	1,397.780 ppb	4,301.562 ppb	100.849 %
Concentration per Run 2	98.985 %	107.338 %	0.008 ppb	219,623.183 ppb	812.928 ppb	3.336 ppb	1,290.940 ppb	3,998.086 ppb	104.252 %
Concentration per Run 3	99.338 %	109.556 %	0.007 ppb	216,378.364 ppb	821.992 ppb	2.897 ppb	1,236.746 ppb	3,969.648 ppb	107.514 %
Concentration RSD	0.8 %	4.1 %	14.9 %	6.3 %	5.1 %	11.4 %	6.3 %	4.5 %	3.2 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	98.266 %	6.427 ppb	0.039 ppb	0.125 ppb	4.800 ppb	60.826 ppb	0.001 ppb	0.050 ppb	0.089 ppb
Concentration per Run 1	98.783 %	6.559 ppb	0.030 ppb	0.147 ppb	5.126 ppb	69.720 ppb	-0.001 ppb	-0.003 ppb	0.085 ppb
Concentration per Run 2	98.355 %	6.490 ppb	0.053 ppb	0.158 ppb	4.442 ppb	53.462 ppb	0.009 ppb	0.109 ppb	0.103 ppb
Concentration per Run 3	97.658 %	6.231 ppb	0.035 ppb	0.072 ppb	4.831 ppb	59.296 ppb	-0.005 ppb	0.043 ppb	0.079 ppb
Concentration RSD	0.6 %	2.7 %	31.0 %	37.4 %	7.2 %	13.5 %	681.5 %	112.9 %	13.8 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	22.560 ppb	103.933 %	0.042 ppb	0.037 ppb	29.613 ppb	0.022 ppb	99.372 %	-0.002 ppb	0.007 ppb
Concentration per Run 1	24.202 ppb	96.230 %	0.055 ppb	0.411 ppb	32.065 ppb	-0.005 ppb	96.281 %	-0.001 ppb	0.015 ppb
Concentration per Run 2	21.150 ppb	110.052 %	0.048 ppb	-0.213 ppb	27.837 ppb	0.035 ppb	100.548 %	-0.004 ppb	0.005 ppb
Concentration per Run 3	22.329 ppb	105.516 %	0.025 ppb	-0.086 ppb	28.939 ppb	0.036 ppb	101.285 %	-0.001 ppb	0.000 ppb
Concentration RSD	6.8 %	6.8 %	36.6 %	885.9 %	7.4 %	107.2 %	2.7 %	89.3 %	116.4 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	100.241 %	-0.101 ppb	0.095 ppb	72.691 ppb	101.627 %	108.035 %	0.006 ppb	0.174 ppb	100.672 %
Concentration per Run 1	96.855 %	-0.064 ppb	0.108 ppb	76.789 ppb	97.399 %	103.773 %	0.005 ppb	0.178 ppb	97.092 %
Concentration per Run 2	102.086 %	-0.111 ppb	0.098 ppb	71.741 ppb	103.635 %	109.879 %	0.007 ppb	0.172 ppb	102.422 %
Concentration per Run 3	101.780 %	-0.128 ppb	0.077 ppb	69.542 ppb	103.846 %	110.454 %	0.005 ppb	0.172 ppb	102.501 %
Concentration RSD	2.9 %	33.2 %	16.6 %	5.1 %	3.6 %	3.4 %	16.8 %	1.9 %	3.1 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 107 Analysis started at: 6/9/2017 12:56:59 PM Rack: 1
 Analysis label: L1717934-19 6020TL User name: ALPHALAB\metals-instrument Vial: 55

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	99.775 %	104.918 %	0.016 ppb	99,923.621 ppb	10,144.348 ppb	5.031 ppb	2,986.209 ppb	39,925.076 ppb	107.681 %
Concentration per Run 1	100.585 %	99.742 %	0.006 ppb	98,421.991 ppb	9,874.962 ppb	4.835 ppb	3,001.031 ppb	39,649.586 ppb	102.807 %
Concentration per Run 2	99.684 %	108.145 %	0.019 ppb	98,782.233 ppb	10,055.384 ppb	4.896 ppb	2,939.111 ppb	39,209.955 ppb	111.451 %
Concentration per Run 3	99.057 %	106.868 %	0.022 ppb	102,566.640 ppb	10,502.699 ppb	5.361 ppb	3,018.484 ppb	40,915.687 ppb	108.783 %
Concentration RSD	0.8 %	4.3 %	53.9 %	2.3 %	3.2 %	5.7 %	1.4 %	2.2 %	4.1 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	98.846 %	62.381 ppb	0.060 ppb	0.337 ppb	47.654 ppb	4,899.538 ppb	0.044 ppb	0.478 ppb	1.037 ppb
Concentration per Run 1	99.134 %	61.477 ppb	0.073 ppb	0.341 ppb	47.211 ppb	4,784.479 ppb	0.062 ppb	0.338 ppb	1.048 ppb
Concentration per Run 2	98.880 %	61.462 ppb	0.049 ppb	0.347 ppb	46.093 ppb	4,891.241 ppb	0.049 ppb	0.530 ppb	1.139 ppb
Concentration per Run 3	98.525 %	64.203 ppb	0.059 ppb	0.322 ppb	49.656 ppb	5,022.895 ppb	0.020 ppb	0.565 ppb	0.923 ppb
Concentration RSD	0.3 %	2.5 %	19.5 %	3.9 %	3.8 %	2.4 %	49.9 %	25.7 %	10.5 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	29.021 ppb	105.757 %	0.209 ppb	-0.160 ppb	268.230 ppb	0.013 ppb	101.754 %	-0.002 ppb	0.008 ppb
Concentration per Run 1	29.295 ppb	99.592 %	0.264 ppb	0.205 ppb	267.385 ppb	0.003 ppb	96.744 %	-0.003 ppb	0.014 ppb
Concentration per Run 2	28.145 ppb	111.074 %	0.166 ppb	-0.632 ppb	265.053 ppb	0.017 ppb	104.622 %	0.000 ppb	0.009 ppb
Concentration per Run 3	29.625 ppb	106.604 %	0.197 ppb	-0.053 ppb	272.252 ppb	0.018 ppb	103.896 %	-0.001 ppb	0.000 ppb
Concentration RSD	2.7 %	5.5 %	24.0 %	268.1 %	1.4 %	64.0 %	4.3 %	78.6 %	93.3 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	108.701 %	-0.087 ppb	0.117 ppb	1,512.173 ppb	104.914 %	108.441 %	0.003 ppb	0.061 ppb	106.120 %
Concentration per Run 1	104.671 %	-0.080 ppb	0.140 ppb	1,504.798 ppb	100.242 %	105.425 %	0.001 ppb	0.067 ppb	101.153 %
Concentration per Run 2	111.212 %	-0.062 ppb	0.118 ppb	1,494.916 ppb	107.066 %	109.211 %	0.003 ppb	0.055 ppb	109.141 %
Concentration per Run 3	110.221 %	-0.120 ppb	0.094 ppb	1,536.806 ppb	107.433 %	110.686 %	0.004 ppb	0.062 ppb	108.068 %
Concentration RSD	3.2 %	33.6 %	19.6 %	1.4 %	3.9 %	2.5 %	55.3 %	9.5 %	4.1 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 108 Analysis started at: 6/9/2017 1:00:05 PM Rack: 1
 Analysis label: L1717934-20 6020TL User name: ALPHALAB\metals-instrument Vial: 56

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	100.089 %	106.946 %	0.439 ppb	12,427.371 ppb	27,589.136 ppb	8,213.595 ppb	3,638.485 ppb	152,772.905 ppb	107.190 %
Concentration per Run 1	101.036 %	102.431 %	0.429 ppb	12,456.904 ppb	27,881.235 ppb	8,337.284 ppb	3,623.880 ppb	151,765.559 ppb	103.838 %
Concentration per Run 2	99.662 %	109.153 %	0.470 ppb	12,307.560 ppb	27,247.064 ppb	8,137.803 ppb	3,616.728 ppb	151,869.277 ppb	109.257 %
Concentration per Run 3	99.570 %	109.254 %	0.418 ppb	12,517.649 ppb	27,639.109 ppb	8,165.697 ppb	3,674.846 ppb	154,683.878 ppb	108.474 %
Concentration RSD	0.8 %	3.7 %	6.2 %	0.9 %	1.2 %	1.3 %	0.9 %	1.1 %	2.7 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	95.704 %	257.266 ppb	11.090 ppb	13.984 ppb	2,471.930 ppb	16,383.473 ppb	10.999 ppb	24.127 ppb	18.871 ppb
Concentration per Run 1	95.811 %	255.475 ppb	11.161 ppb	13.837 ppb	2,480.473 ppb	16,404.302 ppb	11.315 ppb	24.250 ppb	18.764 ppb
Concentration per Run 2	96.383 %	254.488 ppb	10.861 ppb	13.758 ppb	2,434.880 ppb	16,223.599 ppb	10.740 ppb	23.756 ppb	18.461 ppb
Concentration per Run 3	94.919 %	261.834 ppb	11.247 ppb	14.357 ppb	2,500.438 ppb	16,522.518 ppb	10.942 ppb	24.376 ppb	19.388 ppb
Concentration RSD	0.8 %	1.5 %	1.8 %	2.3 %	1.4 %	0.9 %	2.7 %	1.4 %	2.5 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	147.223 ppb	109.543 %	4.739 ppb	4.643 ppb	299.283 ppb	0.469 ppb	101.790 %	0.020 ppb	0.319 ppb
Concentration per Run 1	146.965 ppb	105.619 %	5.266 ppb	5.355 ppb	296.768 ppb	0.458 ppb	98.478 %	0.021 ppb	0.338 ppb
Concentration per Run 2	147.290 ppb	111.556 %	4.115 ppb	4.666 ppb	296.884 ppb	0.429 ppb	102.490 %	0.023 ppb	0.274 ppb
Concentration per Run 3	147.414 ppb	111.455 %	4.836 ppb	3.907 ppb	304.196 ppb	0.520 ppb	104.400 %	0.016 ppb	0.344 ppb
Concentration RSD	0.2 %	3.1 %	12.3 %	15.6 %	1.4 %	10.0 %	3.0 %	17.9 %	12.1 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	117.015 %	-0.089 ppb	0.249 ppb	147.487 ppb	106.408 %	97.477 %	0.113 ppb	13.235 ppb	108.633 %
Concentration per Run 1	114.021 %	-0.106 ppb	0.230 ppb	146.800 ppb	103.235 %	93.590 %	0.110 ppb	13.046 ppb	106.330 %
Concentration per Run 2	118.231 %	-0.031 ppb	0.236 ppb	147.429 ppb	108.304 %	98.900 %	0.120 ppb	13.231 ppb	109.254 %
Concentration per Run 3	118.792 %	-0.131 ppb	0.281 ppb	148.231 ppb	107.684 %	99.940 %	0.109 ppb	13.428 ppb	110.316 %
Concentration RSD	2.2 %	58.5 %	11.2 %	0.5 %	2.6 %	3.5 %	5.4 %	1.4 %	1.9 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 109 Analysis started at: 6/9/2017 1:03:12 PM Rack: 1
 Analysis label: L1717934-21 6020TL User name: ALPHALAB\metals-instrument Vial: 57

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	97.882 %	105.759 %	0.000 ppb	223,610.080 ppb	831.328 ppb	5.089 ppb	1,286.416 ppb	3,946.382 ppb	109.107 %
Concentration per Run 1	97.370 %	104.481 %	0.001 ppb	224,540.948 ppb	851.966 ppb	4.989 ppb	1,274.147 ppb	3,919.194 ppb	109.044 %
Concentration per Run 2	99.157 %	110.867 %	-0.002 ppb	216,611.873 ppb	804.556 ppb	6.278 ppb	1,268.316 ppb	3,941.569 ppb	109.423 %
Concentration per Run 3	97.120 %	101.927 %	-0.001 ppb	229,677.418 ppb	837.463 ppb	3.999 ppb	1,316.784 ppb	3,978.385 ppb	108.854 %
Concentration RSD	1.1 %	4.4 %	345.8 %	2.9 %	2.9 %	22.5 %	2.1 %	0.8 %	0.3 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	99.289 %	6.360 ppb	0.015 ppb	0.095 ppb	4.892 ppb	55.424 ppb	0.000 ppb	0.033 ppb	0.158 ppb
Concentration per Run 1	98.735 %	6.285 ppb	0.018 ppb	0.084 ppb	5.200 ppb	60.948 ppb	-0.001 ppb	0.073 ppb	0.204 ppb
Concentration per Run 2	101.097 %	6.760 ppb	0.018 ppb	0.092 ppb	4.675 ppb	54.322 ppb	0.002 ppb	0.000 ppb	0.158 ppb
Concentration per Run 3	98.034 %	6.036 ppb	0.009 ppb	0.110 ppb	4.800 ppb	51.002 ppb	-0.001 ppb	0.026 ppb	0.111 ppb
Concentration RSD	1.6 %	5.8 %	32.4 %	14.3 %	5.6 %	9.1 %	871.7 %	110.9 %	29.6 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	19.661 ppb	105.556 %	0.025 ppb	-0.169 ppb	28.905 ppb	0.008 ppb	100.884 %	-0.001 ppb	0.006 ppb
Concentration per Run 1	20.589 ppb	101.351 %	0.013 ppb	-0.437 ppb	29.615 ppb	0.003 ppb	99.309 %	0.000 ppb	0.010 ppb
Concentration per Run 2	18.855 ppb	106.876 %	0.049 ppb	-0.047 ppb	28.539 ppb	0.010 ppb	100.995 %	-0.005 ppb	0.005 ppb
Concentration per Run 3	19.539 ppb	108.442 %	0.012 ppb	-0.023 ppb	28.562 ppb	0.010 ppb	102.349 %	0.002 ppb	0.005 ppb
Concentration RSD	4.4 %	3.5 %	85.5 %	137.5 %	2.1 %	55.8 %	1.5 %	319.9 %	45.5 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	102.134 %	-0.136 ppb	0.074 ppb	72.442 ppb	103.176 %	109.452 %	0.002 ppb	0.168 ppb	103.303 %
Concentration per Run 1	99.511 %	-0.189 ppb	0.102 ppb	72.827 ppb	101.024 %	107.476 %	0.001 ppb	0.162 ppb	100.048 %
Concentration per Run 2	104.769 %	-0.139 ppb	0.054 ppb	70.712 ppb	103.836 %	109.881 %	0.002 ppb	0.167 ppb	105.695 %
Concentration per Run 3	102.121 %	-0.079 ppb	0.066 ppb	73.787 ppb	104.668 %	110.998 %	0.004 ppb	0.174 ppb	104.167 %
Concentration RSD	2.6 %	40.7 %	33.3 %	2.2 %	1.9 %	1.6 %	79.7 %	3.6 %	2.8 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 110 Analysis started at: 6/9/2017 1:06:18 PM Rack: 1
 Analysis label: L1717934-22 6020TL User name: ALPHALAB\metals-instrument Vial: 58

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	103.671 %	113.948 %	0.001 ppb	21,483.653 ppb	13,371.473 ppb	1.797 ppb	2,311.837 ppb	110,630.759 ppb	119.486 %
Concentration per Run 1	103.917 %	109.590 %	0.000 ppb	21,599.310 ppb	13,557.277 ppb	2.183 ppb	2,312.600 ppb	111,232.632 ppb	115.591 %
Concentration per Run 2	103.048 %	119.068 %	-0.001 ppb	21,275.887 ppb	13,333.355 ppb	1.227 ppb	2,340.750 ppb	110,464.070 ppb	122.508 %
Concentration per Run 3	104.047 %	113.186 %	0.003 ppb	21,575.762 ppb	13,223.786 ppb	1.982 ppb	2,282.162 ppb	110,195.577 ppb	120.360 %
Concentration RSD	0.5 %	4.2 %	269.5 %	0.8 %	1.3 %	28.1 %	1.3 %	0.5 %	3.0 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	104.873 %	171.351 ppb	0.136 ppb	0.223 ppb	2.932 ppb	7.950 ppb	0.009 ppb	0.214 ppb	0.108 ppb
Concentration per Run 1	106.762 %	171.805 ppb	0.148 ppb	0.184 ppb	2.845 ppb	8.156 ppb	0.008 ppb	0.117 ppb	0.098 ppb
Concentration per Run 2	103.453 %	171.752 ppb	0.124 ppb	0.219 ppb	2.847 ppb	8.915 ppb	0.001 ppb	0.211 ppb	0.111 ppb
Concentration per Run 3	104.405 %	170.497 ppb	0.134 ppb	0.264 ppb	3.105 ppb	6.780 ppb	0.017 ppb	0.314 ppb	0.116 ppb
Concentration RSD	1.6 %	0.4 %	8.8 %	17.9 %	5.1 %	13.6 %	90.0 %	46.0 %	8.6 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	0.576 ppb	119.470 %	0.183 ppb	0.260 ppb	154.658 ppb	0.408 ppb	110.006 %	-0.002 ppb	0.011 ppb
Concentration per Run 1	0.553 ppb	116.155 %	0.204 ppb	1.024 ppb	153.254 ppb	0.413 ppb	108.852 %	0.000 ppb	0.012 ppb
Concentration per Run 2	0.624 ppb	122.509 %	0.247 ppb	0.181 ppb	155.607 ppb	0.405 ppb	111.985 %	-0.005 ppb	0.004 ppb
Concentration per Run 3	0.551 ppb	119.746 %	0.099 ppb	-0.424 ppb	155.112 ppb	0.408 ppb	109.181 %	-0.003 ppb	0.016 ppb
Concentration RSD	7.2 %	2.7 %	41.6 %	279.6 %	0.8 %	1.0 %	1.6 %	94.6 %	57.8 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	124.270 %	-0.081 ppb	0.101 ppb	80.551 ppb	118.034 %	114.711 %	0.023 ppb	-0.001 ppb	113.981 %
Concentration per Run 1	122.994 %	-0.044 ppb	0.086 ppb	80.159 ppb	117.845 %	112.686 %	0.022 ppb	-0.002 ppb	111.253 %
Concentration per Run 2	126.124 %	-0.115 ppb	0.100 ppb	80.194 ppb	120.114 %	116.100 %	0.023 ppb	-0.001 ppb	115.842 %
Concentration per Run 3	123.692 %	-0.084 ppb	0.118 ppb	81.299 ppb	116.143 %	115.348 %	0.023 ppb	-0.001 ppb	114.846 %
Concentration RSD	1.3 %	43.9 %	16.1 %	0.8 %	1.7 %	1.6 %	1.6 %	63.1 %	2.1 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 111 Analysis started at: 6/9/2017 1:09:25 PM Rack: 1
 Analysis label: L1717934-25 6020TL User name: ALPHALAB\metals-instrument Vial: 59

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	101.675 %	112.021 %	0.048 ppb	8,338.842 ppb	16,895.104 ppb	723.570 ppb	1,981.482 ppb	108,146.669 ppb	117.142 %
Concentration per Run 1	100.881 %	108.716 %	0.037 ppb	8,091.826 ppb	16,210.002 ppb	685.059 ppb	1,882.563 ppb	103,815.579 ppb	116.281 %
Concentration per Run 2	102.151 %	114.968 %	0.063 ppb	8,327.240 ppb	17,039.601 ppb	739.120 ppb	2,047.272 ppb	109,083.065 ppb	119.495 %
Concentration per Run 3	101.994 %	112.380 %	0.044 ppb	8,597.461 ppb	17,435.709 ppb	746.529 ppb	2,014.611 ppb	111,541.363 ppb	115.650 %
Concentration RSD	0.7 %	2.8 %	28.4 %	3.0 %	3.7 %	4.6 %	4.4 %	3.6 %	1.8 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	101.111 %	171.462 ppb	1.012 ppb	1.287 ppb	1,571.598 ppb	3,676.207 ppb	0.688 ppb	1.640 ppb	1.722 ppb
Concentration per Run 1	99.755 %	163.799 ppb	0.946 ppb	1.153 ppb	1,514.674 ppb	3,580.167 ppb	0.702 ppb	1.816 ppb	1.696 ppb
Concentration per Run 2	102.000 %	172.736 ppb	1.030 ppb	1.344 ppb	1,579.215 ppb	3,652.795 ppb	0.698 ppb	1.593 ppb	1.786 ppb
Concentration per Run 3	101.578 %	177.852 ppb	1.061 ppb	1.365 ppb	1,620.904 ppb	3,795.657 ppb	0.663 ppb	1.512 ppb	1.684 ppb
Concentration RSD	1.2 %	4.1 %	5.9 %	9.1 %	3.4 %	3.0 %	3.1 %	9.6 %	3.2 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	13.051 ppb	112.719 %	26.985 ppb	0.796 ppb	160.126 ppb	0.379 ppb	106.363 %	0.000 ppb	0.055 ppb
Concentration per Run 1	12.137 ppb	111.073 %	26.256 ppb	0.868 ppb	153.565 ppb	0.426 ppb	103.670 %	0.002 ppb	0.065 ppb
Concentration per Run 2	13.460 ppb	112.238 %	26.860 ppb	0.804 ppb	162.998 ppb	0.254 ppb	107.847 %	-0.001 ppb	0.033 ppb
Concentration per Run 3	13.556 ppb	114.847 %	27.840 ppb	0.716 ppb	163.816 ppb	0.457 ppb	107.572 %	-0.001 ppb	0.066 ppb
Concentration RSD	6.1 %	1.7 %	3.0 %	9.6 %	3.6 %	28.9 %	2.2 %	897.8 %	34.2 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	120.004 %	-0.121 ppb	0.118 ppb	140.906 ppb	112.071 %	108.421 %	0.008 ppb	1.783 ppb	109.880 %
Concentration per Run 1	117.125 %	-0.101 ppb	0.122 ppb	138.959 ppb	109.092 %	107.355 %	0.010 ppb	1.708 ppb	110.332 %
Concentration per Run 2	121.645 %	-0.099 ppb	0.112 ppb	142.154 ppb	114.779 %	108.721 %	0.006 ppb	1.841 ppb	109.873 %
Concentration per Run 3	121.242 %	-0.163 ppb	0.119 ppb	141.606 ppb	112.342 %	109.187 %	0.009 ppb	1.799 ppb	109.434 %
Concentration RSD	2.1 %	30.6 %	4.6 %	1.2 %	2.5 %	0.9 %	20.2 %	3.8 %	0.4 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 112 Analysis started at: 6/9/2017 1:12:32 PM Rack: 0
 Analysis label: CCV User name: ALPHALAB\metals-instrument Vial: 9

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	102.159 %	111.349 %	99.152 ppb	10,805.678 ppb	9,939.976 ppb	105.608 ppb	10,696.991 ppb	10,583.460 ppb	116.545 %
Concentration per Run 1	102.540 %	113.321 %	98.828 ppb	10,425.872 ppb	9,682.801 ppb	99.925 ppb	10,330.006 ppb	10,400.392 ppb	117.076 %
Concentration per Run 2	102.155 %	111.472 %	99.490 ppb	10,880.894 ppb	10,017.406 ppb	107.126 ppb	10,801.168 ppb	10,596.459 ppb	115.923 %
Concentration per Run 3	101.781 %	109.254 %	99.139 ppb	11,110.268 ppb	10,119.721 ppb	109.774 ppb	10,959.800 ppb	10,753.530 ppb	116.636 %
Recovery Percentage 1			99.152 %	108.057 %	99.400 %	105.608 %	106.970 %	105.835 %	
Concentration RSD	0.4 %	1.8 %	0.3 %	3.2 %	2.3 %	4.8 %	3.1 %	1.7 %	0.5 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	104.214 %	104.054 ppb	99.550 ppb	98.482 ppb	100.331 ppb	10,115.583 ppb	100.412 ppb	99.363 ppb	100.284 ppb
Concentration per Run 1	104.724 %	101.445 ppb	96.947 ppb	97.051 ppb	96.021 ppb	9,817.564 ppb	98.922 ppb	98.459 ppb	99.079 ppb
Concentration per Run 2	103.495 %	106.072 ppb	102.020 ppb	99.354 ppb	102.296 ppb	10,068.646 ppb	100.732 ppb	100.078 ppb	102.000 ppb
Concentration per Run 3	104.422 %	104.646 ppb	99.682 ppb	99.041 ppb	102.677 ppb	10,460.539 ppb	101.582 ppb	99.554 ppb	99.774 ppb
Recovery Percentage 1		104.054 %	99.550 %	98.482 %	100.331 %	101.156 %	100.412 %	99.363 %	100.284 %
Concentration RSD	0.6 %	2.3 %	2.6 %	1.3 %	3.7 %	3.2 %	1.4 %	0.8 %	1.5 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	97.025 ppb	112.995 %	96.996 ppb	101.293 ppb	102.931 ppb	99.968 ppb	109.215 %	97.032 ppb	100.244 ppb
Concentration per Run 1	94.836 ppb	112.097 %	95.454 ppb	101.777 ppb	99.334 ppb	97.925 ppb	109.573 %	94.993 ppb	98.362 ppb
Concentration per Run 2	98.585 ppb	112.799 %	97.599 ppb	100.768 ppb	103.369 ppb	99.988 ppb	109.004 %	98.051 ppb	101.432 ppb
Concentration per Run 3	97.652 ppb	114.088 %	97.937 ppb	101.334 ppb	106.090 ppb	101.991 ppb	109.069 %	98.052 ppb	100.938 ppb
Recovery Percentage 1	97.025 %		96.996 %	101.293 %	102.931 %	99.968 %		97.032 %	100.244 %
Concentration RSD	2.0 %	0.9 %	1.4 %	0.5 %	3.3 %	2.0 %	0.3 %	1.8 %	1.6 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	115.851 %	101.684 ppb	91.951 ppb	98.774 ppb	110.352 %	109.794 %	96.683 ppb	96.451 ppb	110.862 %
Concentration per Run 1	115.878 %	99.399 ppb	89.131 ppb	96.811 ppb	109.506 %	108.496 %	97.025 ppb	95.674 ppb	108.114 %
Concentration per Run 2	115.261 %	102.908 ppb	93.900 ppb	101.506 ppb	110.506 %	111.611 %	95.855 ppb	96.123 ppb	113.395 %
Concentration per Run 3	116.413 %	102.744 ppb	92.823 ppb	98.004 ppb	111.045 %	109.276 %	97.169 ppb	97.556 ppb	111.077 %
Recovery Percentage 1		101.684 %	91.951 %	98.774 %			96.683 %	96.451 %	
Concentration RSD	0.5 %	1.9 %	2.7 %	2.5 %	0.7 %	1.5 %	0.7 %	1.0 %	2.4 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 113 Analysis started at: 6/9/2017 1:15:42 PM Rack: 0
 Analysis label: CCB User name: ALPHALAB\metals-instrument Vial: 10

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	103.659 %	113.276 %	0.010 ppb	8.715 ppb	0.092 ppb	-0.036 ppb	-0.326 ppb	-0.208 ppb	117.300 %
Concentration per Run 1	103.846 %	109.657 %	0.007 ppb	11.769 ppb	0.340 ppb	-0.156 ppb	-6.472 ppb	-1.461 ppb	116.185 %
Concentration per Run 2	105.478 %	117.825 %	0.014 ppb	7.719 ppb	-0.035 ppb	0.254 ppb	0.132 ppb	-1.373 ppb	115.378 %
Concentration per Run 3	101.653 %	112.346 %	0.007 ppb	6.656 ppb	-0.028 ppb	-0.205 ppb	5.360 ppb	2.211 ppb	120.337 %
Recovery Percentage 1			3.176 %	8.715 %	0.132 %	-0.357 %	-0.326 %	-0.208 %	
Concentration RSD	1.9 %	3.7 %	44.6 %	31.0 %	231.5 %	707.5 %	1,816.1 %	1,009.0 %	2.3 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	104.063 %	-0.006 ppb	0.000 ppb	-0.005 ppb	0.073 ppb	2.230 ppb	0.001 ppb	-0.003 ppb	0.004 ppb
Concentration per Run 1	105.019 %	-0.028 ppb	0.000 ppb	-0.018 ppb	0.109 ppb	4.155 ppb	-0.005 ppb	0.006 ppb	-0.026 ppb
Concentration per Run 2	104.864 %	-0.005 ppb	0.008 ppb	0.005 ppb	0.087 ppb	1.154 ppb	0.008 ppb	-0.033 ppb	0.024 ppb
Concentration per Run 3	102.306 %	0.016 ppb	-0.008 ppb	-0.002 ppb	0.022 ppb	1.381 ppb	-0.002 ppb	0.016 ppb	0.015 ppb
Recovery Percentage 1		-1.145 %	0.003 %	-0.518 %	7.267 %	4.460 %	0.104 %	-0.173 %	0.439 %
Concentration RSD	1.5 %	379.2 %	5,550.3 %	223.3 %	62.3 %	74.9 %	1,298.2 %	744.4 %	600.0 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	0.083 ppb	114.073 %	0.035 ppb	-0.122 ppb	0.011 ppb	0.144 ppb	110.457 %	0.010 ppb	0.007 ppb
Concentration per Run 1	-0.034 ppb	113.174 %	0.058 ppb	-0.843 ppb	0.015 ppb	0.118 ppb	108.642 %	0.015 ppb	0.009 ppb
Concentration per Run 2	0.090 ppb	115.763 %	0.034 ppb	0.095 ppb	0.006 ppb	0.138 ppb	111.146 %	0.002 ppb	0.008 ppb
Concentration per Run 3	0.192 ppb	113.283 %	0.012 ppb	0.383 ppb	0.013 ppb	0.177 ppb	111.583 %	0.014 ppb	0.004 ppb
Recovery Percentage 1	0.825 %	114.073 %	6.910 %	-2.436 %	2.200 %	7.221 %		2.547 %	3.499 %
Concentration RSD	137.1 %	1.3 %	67.2 %	526.3 %	42.9 %	20.7 %	1.4 %	72.0 %	35.3 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	118.194 %	0.143 ppb	0.758 ppb	0.006 ppb	110.946 %	111.037 %	0.011 ppb	0.018 ppb	112.126 %
Concentration per Run 1	115.262 %	0.140 ppb	0.819 ppb	-0.007 ppb	109.286 %	108.267 %	0.012 ppb	0.023 ppb	107.966 %
Concentration per Run 2	120.128 %	0.148 ppb	0.769 ppb	0.024 ppb	110.569 %	111.122 %	0.008 ppb	0.016 ppb	114.709 %
Concentration per Run 3	119.191 %	0.140 ppb	0.686 ppb	0.002 ppb	112.984 %	113.722 %	0.015 ppb	0.014 ppb	113.703 %
Recovery Percentage 1		4.755 %	18.947 %	1.226 %			2.282 %	3.539 %	112.126 %
Concentration RSD	2.2 %	3.5 %	8.9 %	263.8 %	1.7 %	2.5 %	31.9 %	25.9 %	3.2 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 114 Analysis started at: 6/9/2017 1:23:16 PM Rack: 2
Analysis label: WG1007570-1D10 A2-6020T User name: ALPHALAB\metals-instrument Vial: 16

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	104.334 %	111.652 %	0.001 ppb	15.163 ppb	-0.932 ppb	-0.041 ppb	-5.319 ppb	-5.688 ppb	114.691 %
Concentration per Run 1	103.466 %	107.876 %	0.002 ppb	21.149 ppb	-1.306 ppb	-0.088 ppb	0.469 ppb	-1.576 ppb	105.771 %
Concentration per Run 2	104.643 %	114.598 %	0.000 ppb	9.958 ppb	-0.988 ppb	-0.097 ppb	-10.944 ppb	-8.152 ppb	119.210 %
Concentration per Run 3	104.894 %	112.481 %	0.000 ppb	14.382 ppb	-0.503 ppb	0.062 ppb	-5.484 ppb	-7.337 ppb	119.091 %
Concentration RSD	0.7 %	3.1 %	165.9 %	37.2 %	43.3 %	216.3 %	107.3 %	63.0 %	6.7 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	104.162 %	-0.008 ppb	0.005 ppb	0.052 ppb	-0.052 ppb	-0.377 ppb	-0.001 ppb	-0.030 ppb	-0.021 ppb
Concentration per Run 1	102.175 %	-0.002 ppb	0.002 ppb	0.034 ppb	-0.005 ppb	-0.687 ppb	-0.005 ppb	0.003 ppb	-0.048 ppb
Concentration per Run 2	104.231 %	-0.006 ppb	0.007 ppb	0.090 ppb	-0.050 ppb	-0.229 ppb	0.001 ppb	-0.035 ppb	0.020 ppb
Concentration per Run 3	106.079 %	-0.017 ppb	0.007 ppb	0.031 ppb	-0.100 ppb	-0.215 ppb	0.002 ppb	-0.058 ppb	-0.035 ppb
Concentration RSD	1.9 %	93.0 %	60.4 %	63.6 %	92.3 %	71.2 %	568.6 %	102.6 %	172.2 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	-0.050 ppb	113.341 %	0.035 ppb	-0.185 ppb	0.009 ppb	0.008 ppb	110.396 %	0.000 ppb	0.003 ppb
Concentration per Run 1	-0.022 ppb	105.669 %	0.050 ppb	0.438 ppb	-0.027 ppb	0.001 ppb	105.001 %	0.000 ppb	0.004 ppb
Concentration per Run 2	0.011 ppb	119.093 %	0.011 ppb	0.489 ppb	0.042 ppb	0.007 ppb	111.667 %	-0.004 ppb	0.004 ppb
Concentration per Run 3	-0.139 ppb	115.262 %	0.046 ppb	-1.480 ppb	0.013 ppb	0.014 ppb	114.520 %	0.004 ppb	0.000 ppb
Concentration RSD	157.9 %	6.1 %	59.9 %	607.9 %	372.0 %	84.6 %	4.4 %	1,058.9 %	86.8 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	115.559 %	-0.073 ppb	0.213 ppb	-0.037 ppb	109.200 %	108.491 %	0.004 ppb	-0.002 ppb	111.388 %
Concentration per Run 1	109.539 %	-0.075 ppb	0.212 ppb	-0.040 ppb	104.280 %	103.695 %	0.004 ppb	0.001 ppb	106.192 %
Concentration per Run 2	117.650 %	-0.106 ppb	0.269 ppb	-0.030 ppb	109.767 %	110.490 %	0.004 ppb	-0.005 ppb	113.207 %
Concentration per Run 3	119.488 %	-0.039 ppb	0.160 ppb	-0.042 ppb	113.554 %	111.287 %	0.005 ppb	-0.001 ppb	114.766 %
Concentration RSD	4.6 %	45.7 %	25.7 %	16.7 %	4.3 %	3.8 %	13.9 %	189.6 %	4.1 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 115 Analysis started at: 6/9/2017 1:26:22 PM Rack: 2
 Analysis label: WG1007570-2D10 A2-6020T User name: ALPHALAB\metals-instrument Vial: 17

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	101.429 %	111.495 %	75.566 ppb	718.456 ppb	2,042.213 ppb	5,534.251 ppb	1,843.557 ppb	4,611.604 ppb	118.419 %
Concentration per Run 1	99.709 %	107.170 %	75.783 ppb	750.206 ppb	2,170.101 ppb	5,860.798 ppb	1,915.992 ppb	4,915.487 ppb	111.428 %
Concentration per Run 2	101.725 %	112.850 %	75.169 ppb	705.776 ppb	1,993.227 ppb	5,384.051 ppb	1,800.446 ppb	4,465.066 ppb	119.827 %
Concentration per Run 3	102.855 %	114.464 %	75.748 ppb	699.387 ppb	1,963.310 ppb	5,357.904 ppb	1,814.232 ppb	4,454.258 ppb	124.004 %
Concentration RSD	1.6 %	3.4 %	0.5 %	3.9 %	5.5 %	5.1 %	3.4 %	5.7 %	5.4 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	102.967 %	230.350 ppb	86.948 ppb	111.514 ppb	244.446 ppb	12,993.641 ppb	121.175 ppb	103.701 ppb	139.509 ppb
Concentration per Run 1	102.650 %	247.156 ppb	93.262 ppb	118.645 ppb	263.284 ppb	14,090.458 ppb	129.804 ppb	111.864 ppb	151.271 ppb
Concentration per Run 2	102.410 %	225.888 ppb	85.967 ppb	109.649 ppb	237.803 ppb	12,505.355 ppb	116.726 ppb	101.228 ppb	134.339 ppb
Concentration per Run 3	103.841 %	218.007 ppb	81.617 ppb	106.249 ppb	232.250 ppb	12,385.109 ppb	116.995 ppb	98.010 ppb	132.917 ppb
Concentration RSD	0.7 %	6.5 %	6.8 %	5.7 %	6.8 %	7.3 %	6.2 %	7.0 %	7.3 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	150.283 ppb	112.462 %	116.607 ppb	145.375 ppb	82.101 ppb	88.558 ppb	110.305 %	25.669 ppb	68.290 ppb
Concentration per Run 1	161.904 ppb	103.440 %	129.584 ppb	167.424 ppb	88.913 ppb	93.933 ppb	105.183 %	27.463 ppb	71.955 ppb
Concentration per Run 2	144.313 ppb	117.231 %	109.596 ppb	136.648 ppb	77.774 ppb	85.315 ppb	111.483 %	24.690 ppb	66.145 ppb
Concentration per Run 3	144.633 ppb	116.714 %	110.641 ppb	132.054 ppb	79.617 ppb	86.426 ppb	114.249 %	24.854 ppb	66.770 ppb
Concentration RSD	6.7 %	7.0 %	9.6 %	13.2 %	7.3 %	5.3 %	4.2 %	6.1 %	4.7 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	116.496 %	114.499 ppb	107.420 ppb	163.558 ppb	110.297 %	108.147 %	109.098 ppb	111.951 ppb	111.592 %
Concentration per Run 1	111.054 %	121.116 ppb	112.298 ppb	173.737 ppb	104.559 %	101.347 %	116.219 ppb	118.607 ppb	105.594 %
Concentration per Run 2	119.283 %	109.221 ppb	102.788 ppb	158.373 ppb	113.930 %	111.608 %	105.796 ppb	109.158 ppb	113.471 %
Concentration per Run 3	119.153 %	113.159 ppb	107.172 ppb	158.563 ppb	112.402 %	111.485 %	105.278 ppb	108.088 ppb	115.712 %
Concentration RSD	4.0 %	5.3 %	4.4 %	5.4 %	4.6 %	5.4 %	5.7 %	5.2 %	4.8 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 116 Analysis started at: 6/9/2017 1:29:28 PM Rack: 2
 Analysis label: L1717026-05D10 A2-6020T User name: ALPHALAB\metals-instrument Vial: 18

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	100.522 %	108.100 %	0.375 ppb	4,390.187 ppb	1,766.960 ppb	3,185.695 ppb	703.661 ppb	1,500.235 ppb	111.631 %
Concentration per Run 1	101.979 %	105.355 %	0.368 ppb	4,185.644 ppb	1,672.624 ppb	3,056.321 ppb	668.089 ppb	1,424.315 ppb	106.912 %
Concentration per Run 2	99.777 %	112.380 %	0.389 ppb	4,452.931 ppb	1,791.599 ppb	3,189.091 ppb	724.848 ppb	1,568.107 ppb	115.817 %
Concentration per Run 3	99.811 %	106.565 %	0.368 ppb	4,531.987 ppb	1,836.657 ppb	3,311.673 ppb	718.047 ppb	1,508.282 ppb	112.164 %
Concentration RSD	1.3 %	3.5 %	3.3 %	4.1 %	4.8 %	4.0 %	4.4 %	4.8 %	4.0 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	101.769 %	131.541 ppb	40.842 ppb	15.675 ppb	50.062 ppb	26,150.866 ppb	3.649 ppb	4.499 ppb	6.031 ppb
Concentration per Run 1	103.561 %	124.777 ppb	39.236 ppb	14.897 ppb	48.986 ppb	24,577.275 ppb	3.504 ppb	4.352 ppb	5.932 ppb
Concentration per Run 2	101.943 %	136.227 ppb	41.754 ppb	16.016 ppb	50.792 ppb	26,818.300 ppb	3.670 ppb	4.268 ppb	6.010 ppb
Concentration per Run 3	99.804 %	133.618 ppb	41.537 ppb	16.110 ppb	50.407 ppb	27,057.022 ppb	3.772 ppb	4.877 ppb	6.150 ppb
Concentration RSD	1.9 %	4.6 %	3.4 %	4.3 %	1.9 %	5.2 %	3.7 %	7.3 %	1.8 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	19.572 ppb	108.131 %	9.272 ppb	3.738 ppb	11.989 ppb	2.122 ppb	103.673 %	0.012 ppb	0.044 ppb
Concentration per Run 1	17.769 ppb	103.539 %	8.989 ppb	5.132 ppb	11.443 ppb	1.970 ppb	96.868 %	0.014 ppb	0.033 ppb
Concentration per Run 2	19.891 ppb	109.968 %	9.670 ppb	2.166 ppb	12.244 ppb	2.192 ppb	107.136 %	0.011 ppb	0.048 ppb
Concentration per Run 3	21.057 ppb	110.887 %	9.155 ppb	3.916 ppb	12.278 ppb	2.204 ppb	107.015 %	0.009 ppb	0.052 ppb
Concentration RSD	8.5 %	3.7 %	3.8 %	39.9 %	3.9 %	6.2 %	5.7 %	20.1 %	22.4 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	110.983 %	0.269 ppb	0.270 ppb	4.813 ppb	104.892 %	103.124 %	0.377 ppb	5.160 ppb	108.187 %
Concentration per Run 1	105.290 %	0.343 ppb	0.322 ppb	4.654 ppb	101.201 %	99.441 %	0.241 ppb	5.035 ppb	102.151 %
Concentration per Run 2	113.509 %	0.285 ppb	0.249 ppb	4.983 ppb	107.115 %	105.678 %	0.406 ppb	5.201 ppb	111.328 %
Concentration per Run 3	114.151 %	0.178 ppb	0.241 ppb	4.802 ppb	106.358 %	104.253 %	0.486 ppb	5.244 ppb	111.082 %
Concentration RSD	4.5 %	31.0 %	16.5 %	3.4 %	3.1 %	3.2 %	33.1 %	2.1 %	4.8 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 117 Analysis started at: 6/9/2017 1:32:34 PM Rack: 2
 Analysis label: WG1007570-3D10 A2-6020T User name: ALPHALAB\metals-instrument Vial: 19

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	98.755 %	109.232 %	10.625 ppb	6,420.759 ppb	4,084.450 ppb	5,216.902 ppb	2,988.265 ppb	3,575.027 ppb	115.156 %
Concentration per Run 1	99.721 %	113.825 %	10.556 ppb	6,094.318 ppb	3,875.278 ppb	4,987.714 ppb	2,894.744 ppb	3,402.019 ppb	117.810 %
Concentration per Run 2	99.450 %	109.187 %	10.586 ppb	6,505.540 ppb	4,132.852 ppb	5,255.864 ppb	2,951.163 ppb	3,662.227 ppb	113.907 %
Concentration per Run 3	97.094 %	104.683 %	10.735 ppb	6,662.418 ppb	4,245.220 ppb	5,407.127 ppb	3,118.887 ppb	3,660.835 ppb	113.753 %
Concentration RSD	1.5 %	4.2 %	0.9 %	4.6 %	4.6 %	4.1 %	3.9 %	4.2 %	2.0 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	100.663 %	331.244 ppb	158.038 ppb	65.853 ppb	160.132 ppb	31,193.022 ppb	103.315 ppb	108.732 ppb	57.793 ppb
Concentration per Run 1	101.445 %	320.600 ppb	150.743 ppb	62.901 ppb	154.173 ppb	30,133.934 ppb	99.472 ppb	105.762 ppb	56.958 ppb
Concentration per Run 2	101.013 %	333.010 ppb	160.722 ppb	66.595 ppb	164.302 ppb	32,072.374 ppb	105.496 ppb	108.713 ppb	58.133 ppb
Concentration per Run 3	99.530 %	340.124 ppb	162.650 ppb	68.064 ppb	161.922 ppb	31,372.756 ppb	104.978 ppb	111.721 ppb	58.286 ppb
Concentration RSD	1.0 %	3.0 %	4.0 %	4.0 %	3.3 %	3.1 %	3.2 %	2.7 %	1.3 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	126.945 ppb	111.115 %	33.503 ppb	27.992 ppb	217.180 ppb	189.597 ppb	107.865 %	61.685 ppb	10.878 ppb
Concentration per Run 1	123.856 ppb	109.039 %	33.119 ppb	25.679 ppb	213.189 ppb	184.575 ppb	109.252 %	60.873 ppb	10.780 ppb
Concentration per Run 2	129.975 ppb	111.559 %	33.062 ppb	29.427 ppb	218.840 ppb	194.355 ppb	108.576 %	62.380 ppb	11.078 ppb
Concentration per Run 3	127.004 ppb	112.746 %	34.328 ppb	28.870 ppb	219.511 ppb	189.863 ppb	105.767 %	61.803 ppb	10.777 ppb
Concentration RSD	2.4 %	1.7 %	2.1 %	7.2 %	1.6 %	2.6 %	1.7 %	1.2 %	1.6 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	113.590 %	204.547 ppb	96.261 ppb	421.027 ppb	108.272 %	106.732 %	23.289 ppb	111.941 ppb	109.708 %
Concentration per Run 1	114.454 %	199.539 ppb	93.476 ppb	406.054 ppb	109.003 %	107.070 %	22.831 ppb	110.064 ppb	109.348 %
Concentration per Run 2	116.151 %	206.021 ppb	97.004 ppb	426.486 ppb	107.453 %	104.082 %	23.469 ppb	112.807 ppb	109.487 %
Concentration per Run 3	110.163 %	208.080 ppb	98.304 ppb	430.541 ppb	108.361 %	109.044 %	23.566 ppb	112.952 ppb	110.290 %
Concentration RSD	2.7 %	2.2 %	2.6 %	3.1 %	0.7 %	2.3 %	1.7 %	1.5 %	0.5 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 118 Analysis started at: 6/9/2017 1:35:41 PM Rack: 2
 Analysis label: WG1007570-4D10 A2-6020T User name: ALPHALAB\metals-instrument Vial: 20

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	98.292 %	109.781 %	10.849 ppb	6,544.608 ppb	3,692.871 ppb	4,368.933 ppb	2,901.622 ppb	3,673.995 ppb	113.203 %
Concentration per Run 1	97.239 %	110.397 %	10.884 ppb	6,296.026 ppb	3,538.031 ppb	4,217.306 ppb	2,796.907 ppb	3,487.243 ppb	113.456 %
Concentration per Run 2	97.501 %	112.749 %	10.734 ppb	6,556.179 ppb	3,759.392 ppb	4,347.562 ppb	2,917.929 ppb	3,692.504 ppb	113.765 %
Concentration per Run 3	100.136 %	106.195 %	10.930 ppb	6,781.620 ppb	3,781.190 ppb	4,541.930 ppb	2,990.029 ppb	3,842.237 ppb	112.389 %
Concentration RSD	1.6 %	3.0 %	0.9 %	3.7 %	3.6 %	3.7 %	3.4 %	4.9 %	0.6 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	100.181 %	311.826 ppb	143.026 ppb	59.217 ppb	155.791 ppb	25,478.841 ppb	105.541 ppb	109.014 ppb	57.860 ppb
Concentration per Run 1	99.502 %	307.964 ppb	139.972 ppb	58.783 ppb	155.450 ppb	25,334.724 ppb	104.374 ppb	108.103 ppb	56.817 ppb
Concentration per Run 2	99.843 %	305.924 ppb	141.916 ppb	58.380 ppb	153.965 ppb	25,353.905 ppb	105.704 ppb	108.712 ppb	58.695 ppb
Concentration per Run 3	101.199 %	321.591 ppb	147.192 ppb	60.489 ppb	157.959 ppb	25,747.893 ppb	106.544 ppb	110.228 ppb	58.069 ppb
Concentration RSD	0.9 %	2.7 %	2.6 %	1.9 %	1.3 %	0.9 %	1.0 %	1.0 %	1.7 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	124.157 ppb	110.877 %	32.976 ppb	28.691 ppb	222.828 ppb	198.845 ppb	109.472 %	63.460 ppb	11.411 ppb
Concentration per Run 1	122.917 ppb	109.277 %	32.539 ppb	31.025 ppb	215.884 ppb	191.050 ppb	109.833 %	61.097 ppb	10.509 ppb
Concentration per Run 2	123.464 ppb	112.987 %	32.389 ppb	26.860 ppb	222.227 ppb	199.527 ppb	108.726 %	64.014 ppb	11.713 ppb
Concentration per Run 3	126.089 ppb	110.369 %	33.999 ppb	28.189 ppb	230.373 ppb	205.958 ppb	109.857 %	65.268 ppb	12.010 ppb
Concentration RSD	1.4 %	1.7 %	2.7 %	7.4 %	3.3 %	3.8 %	0.6 %	3.4 %	7.0 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	112.894 %	214.037 ppb	103.812 ppb	431.569 ppb	107.390 %	104.294 %	24.164 ppb	112.964 ppb	108.043 %
Concentration per Run 1	114.092 %	208.287 ppb	100.728 ppb	419.498 ppb	106.832 %	104.627 %	23.854 ppb	110.515 ppb	109.476 %
Concentration per Run 2	113.291 %	215.619 ppb	104.960 ppb	433.470 ppb	107.418 %	103.727 %	23.904 ppb	112.756 ppb	107.924 %
Concentration per Run 3	111.299 %	218.206 ppb	105.749 ppb	441.738 ppb	107.919 %	104.529 %	24.736 ppb	115.620 ppb	106.729 %
Concentration RSD	1.3 %	2.4 %	2.6 %	2.6 %	0.5 %	0.5 %	2.1 %	2.3 %	1.3 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 119 Analysis started at: 6/9/2017 1:38:47 PM Rack: 2
 Analysis label: WG1007570-5D10 A2-6020T User name: ALPHALAB\metals-instrument Vial: 21

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	99.252 %	108.111 %	48.630 ppb	9,735.758 ppb	6,710.429 ppb	3,207.188 ppb	5,934.244 ppb	6,667.831 ppb	113.389 %
Concentration per Run 1	98.589 %	104.044 %	48.505 ppb	10,004.240 ppb	6,855.587 ppb	3,330.350 ppb	6,156.060 ppb	6,919.268 ppb	108.356 %
Concentration per Run 2	99.746 %	112.077 %	48.657 ppb	9,443.782 ppb	6,558.804 ppb	3,080.003 ppb	5,684.646 ppb	6,403.269 ppb	115.496 %
Concentration per Run 3	99.421 %	108.212 %	48.728 ppb	9,759.251 ppb	6,716.896 ppb	3,211.212 ppb	5,962.027 ppb	6,680.956 ppb	116.315 %
Concentration RSD	0.6 %	3.7 %	0.2 %	2.9 %	2.2 %	3.9 %	4.0 %	3.9 %	3.9 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	100.367 %	179.238 ppb	89.558 ppb	63.955 ppb	98.003 ppb	30,514.132 ppb	53.000 ppb	53.453 ppb	54.458 ppb
Concentration per Run 1	99.123 %	187.270 ppb	93.603 ppb	65.065 ppb	102.823 ppb	31,509.106 ppb	55.317 ppb	55.627 ppb	56.556 ppb
Concentration per Run 2	102.045 %	171.706 ppb	84.960 ppb	62.451 ppb	93.493 ppb	29,407.485 ppb	50.916 ppb	52.739 ppb	52.505 ppb
Concentration per Run 3	99.932 %	178.739 ppb	90.113 ppb	64.349 ppb	97.692 ppb	30,625.804 ppb	52.768 ppb	51.993 ppb	54.314 ppb
Concentration RSD	1.5 %	4.3 %	4.9 %	2.1 %	4.8 %	3.5 %	4.2 %	3.6 %	3.7 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	68.341 ppb	111.311 %	56.563 ppb	50.936 ppb	61.761 ppb	52.052 ppb	105.919 %	5.068 ppb	49.293 ppb
Concentration per Run 1	71.572 ppb	105.312 %	58.848 ppb	53.852 ppb	64.462 ppb	53.839 ppb	100.303 %	5.315 ppb	50.959 ppb
Concentration per Run 2	66.460 ppb	113.538 %	54.729 ppb	49.761 ppb	60.579 ppb	50.217 ppb	109.176 %	4.823 ppb	47.442 ppb
Concentration per Run 3	66.992 ppb	115.082 %	56.113 ppb	49.195 ppb	60.242 ppb	52.099 ppb	108.277 %	5.065 ppb	49.480 ppb
Concentration RSD	4.1 %	4.7 %	3.7 %	5.0 %	3.8 %	3.5 %	4.6 %	4.9 %	3.6 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	112.107 %	51.194 ppb	51.728 ppb	54.653 ppb	107.413 %	102.773 %	48.275 ppb	53.815 ppb	104.471 %
Concentration per Run 1	107.029 %	52.630 ppb	52.978 ppb	56.600 ppb	102.603 %	97.529 %	49.851 ppb	55.532 ppb	100.448 %
Concentration per Run 2	115.947 %	49.799 ppb	50.280 ppb	53.535 ppb	108.886 %	104.140 %	47.083 ppb	52.540 ppb	106.876 %
Concentration per Run 3	113.346 %	51.154 ppb	51.926 ppb	53.825 ppb	110.750 %	106.649 %	47.890 ppb	53.372 ppb	106.090 %
Concentration RSD	4.1 %	2.8 %	2.6 %	3.1 %	4.0 %	4.6 %	2.9 %	2.9 %	3.4 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 120 Analysis started at: 6/9/2017 1:41:54 PM Rack: 2
 Analysis label: WG1007570-6D50 A2-6020T User name: ALPHALAB\metals-instrument Vial: 22

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	102.416 %	112.447 %	0.079 ppb	884.404 ppb	348.991 ppb	634.388 ppb	137.246 ppb	283.863 ppb	117.027 %
Concentration per Run 1	102.501 %	109.792 %	0.085 ppb	900.194 ppb	355.155 ppb	646.852 ppb	138.209 ppb	278.073 ppb	114.962 %
Concentration per Run 2	101.683 %	115.707 %	0.086 ppb	846.787 ppb	330.358 ppb	608.788 ppb	123.314 ppb	276.239 ppb	120.894 %
Concentration per Run 3	103.065 %	111.842 %	0.066 ppb	906.232 ppb	361.460 ppb	647.523 ppb	150.217 ppb	297.277 ppb	115.223 %
Concentration RSD	0.7 %	2.7 %	14.5 %	3.7 %	4.7 %	3.5 %	9.8 %	4.1 %	2.9 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	103.959 %	26.936 ppb	7.909 ppb	3.124 ppb	10.126 ppb	5,195.424 ppb	0.736 ppb	0.911 ppb	1.096 ppb
Concentration per Run 1	102.619 %	27.432 ppb	7.963 ppb	3.207 ppb	11.161 ppb	5,279.225 ppb	0.728 ppb	0.972 ppb	1.166 ppb
Concentration per Run 2	105.296 %	25.216 ppb	7.502 ppb	2.886 ppb	8.801 ppb	4,897.324 ppb	0.715 ppb	0.995 ppb	1.100 ppb
Concentration per Run 3	103.963 %	28.160 ppb	8.262 ppb	3.280 ppb	10.416 ppb	5,409.723 ppb	0.766 ppb	0.765 ppb	1.022 ppb
Concentration RSD	1.3 %	5.7 %	4.8 %	6.7 %	11.9 %	5.1 %	3.6 %	13.9 %	6.6 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	3.686 ppb	114.023 %	1.800 ppb	0.516 ppb	2.473 ppb	0.415 ppb	109.516 %	0.001 ppb	0.014 ppb
Concentration per Run 1	3.434 ppb	110.400 %	1.628 ppb	0.488 ppb	2.286 ppb	0.332 ppb	109.038 %	0.001 ppb	0.021 ppb
Concentration per Run 2	3.643 ppb	117.972 %	2.050 ppb	0.456 ppb	2.484 ppb	0.496 ppb	111.039 %	-0.001 ppb	0.004 ppb
Concentration per Run 3	3.980 ppb	113.697 %	1.722 ppb	0.604 ppb	2.650 ppb	0.416 ppb	108.471 %	0.002 ppb	0.017 ppb
Concentration RSD	7.5 %	3.3 %	12.3 %	15.1 %	7.4 %	19.8 %	1.2 %	196.8 %	62.9 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	115.653 %	0.089 ppb	0.302 ppb	1.101 ppb	108.898 %	107.289 %	0.166 ppb	1.053 ppb	107.125 %
Concentration per Run 1	114.545 %	0.028 ppb	0.287 ppb	1.190 ppb	107.527 %	105.390 %	0.102 ppb	1.076 ppb	103.954 %
Concentration per Run 2	116.955 %	0.157 ppb	0.284 ppb	1.103 ppb	110.858 %	110.572 %	0.182 ppb	1.012 ppb	109.518 %
Concentration per Run 3	115.458 %	0.082 ppb	0.334 ppb	1.011 ppb	108.310 %	105.905 %	0.213 ppb	1.072 ppb	107.902 %
Concentration RSD	1.1 %	72.4 %	9.2 %	8.1 %	1.6 %	2.7 %	34.4 %	3.4 %	2.7 %

Alpha ICPMSQ2 Full

6/10/2017 10:11:47 AM



Analysis index: 121 Analysis started at: 6/9/2017 1:45:01 PM Rack: 2
 Analysis label: L1717026-01D10 A2-6020T User name: ALPHALAB\metals-instrument Vial: 23

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	98.538 %	108.963 %	0.221 ppb	4,324.041 ppb	1,740.981 ppb	2,263.121 ppb	582.148 ppb	8,267.684 ppb	113.022 %
Concentration per Run 1	98.149 %	108.649 %	0.197 ppb	4,119.968 ppb	1,654.332 ppb	2,168.638 ppb	538.816 ppb	7,869.112 ppb	114.228 %
Concentration per Run 2	99.655 %	107.170 %	0.234 ppb	4,495.363 ppb	1,837.394 ppb	2,347.752 ppb	599.973 ppb	8,434.204 ppb	112.329 %
Concentration per Run 3	97.809 %	111.069 %	0.233 ppb	4,356.791 ppb	1,731.218 ppb	2,272.974 ppb	607.656 ppb	8,499.736 ppb	112.507 %
Concentration RSD	1.0 %	1.8 %	9.5 %	4.4 %	5.3 %	4.0 %	6.5 %	4.2 %	0.9 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	99.244 %	120.180 ppb	18.737 ppb	9.142 ppb	50.128 ppb	12,891.064 ppb	1.549 ppb	3.437 ppb	2.492 ppb
Concentration per Run 1	99.191 %	113.683 ppb	17.576 ppb	8.636 ppb	46.295 ppb	12,009.285 ppb	1.438 ppb	3.252 ppb	2.371 ppb
Concentration per Run 2	99.899 %	124.952 ppb	19.701 ppb	9.379 ppb	51.131 ppb	13,188.652 ppb	1.634 ppb	3.633 ppb	2.689 ppb
Concentration per Run 3	98.642 %	121.906 ppb	18.932 ppb	9.409 ppb	52.959 ppb	13,475.255 ppb	1.576 ppb	3.425 ppb	2.414 ppb
Concentration RSD	0.6 %	4.9 %	5.7 %	4.8 %	6.9 %	6.0 %	6.5 %	5.5 %	6.9 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	11.336 ppb	112.976 %	3.436 ppb	1.867 ppb	44.363 ppb	1.777 ppb	106.123 %	0.003 ppb	0.044 ppb
Concentration per Run 1	10.558 ppb	113.243 %	3.227 ppb	0.781 ppb	42.221 ppb	1.674 ppb	105.706 %	0.004 ppb	0.044 ppb
Concentration per Run 2	11.865 ppb	112.859 %	3.249 ppb	1.970 ppb	45.051 ppb	1.817 ppb	105.928 %	0.007 ppb	0.026 ppb
Concentration per Run 3	11.586 ppb	112.825 %	3.832 ppb	2.849 ppb	45.818 ppb	1.839 ppb	106.735 %	-0.001 ppb	0.061 ppb
Concentration RSD	6.1 %	0.2 %	10.0 %	55.6 %	4.3 %	5.0 %	0.5 %	109.7 %	39.6 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	112.814 %	0.176 ppb	0.187 ppb	4.177 ppb	106.993 %	103.304 %	0.110 ppb	3.481 ppb	105.720 %
Concentration per Run 1	111.313 %	0.204 ppb	0.215 ppb	3.881 ppb	106.789 %	100.901 %	0.078 ppb	3.384 ppb	105.388 %
Concentration per Run 2	113.402 %	0.178 ppb	0.187 ppb	4.532 ppb	105.175 %	104.330 %	0.114 ppb	3.519 ppb	105.760 %
Concentration per Run 3	113.726 %	0.146 ppb	0.160 ppb	4.117 ppb	109.015 %	104.680 %	0.139 ppb	3.540 ppb	106.013 %
Concentration RSD	1.2 %	16.3 %	14.8 %	7.9 %	1.8 %	2.0 %	27.8 %	2.4 %	0.3 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 122 Analysis started at: 6/9/2017 1:48:08 PM Rack: 2
 Analysis label: L1717026-02D10 A2-6020T User name: ALPHALAB\metals-instrument Vial: 24

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	99.925 %	109.769 %	0.466 ppb	5,281.756 ppb	3,535.845 ppb	6,545.389 ppb	1,520.041 ppb	2,978.207 ppb	113.472 %
Concentration per Run 1	99.287 %	104.044 %	0.445 ppb	5,299.841 ppb	3,529.183 ppb	6,517.623 ppb	1,487.886 ppb	2,949.036 ppb	107.206 %
Concentration per Run 2	99.582 %	111.842 %	0.459 ppb	5,307.413 ppb	3,557.138 ppb	6,613.019 ppb	1,542.136 ppb	3,035.896 ppb	115.413 %
Concentration per Run 3	100.904 %	113.422 %	0.496 ppb	5,238.015 ppb	3,521.213 ppb	6,505.524 ppb	1,530.100 ppb	2,949.689 ppb	117.798 %
Concentration RSD	0.9 %	4.6 %	5.7 %	0.7 %	0.5 %	0.9 %	1.9 %	1.7 %	4.9 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	101.605 %	210.855 ppb	26.946 ppb	18.899 ppb	133.153 ppb	19,030.850 ppb	4.161 ppb	10.132 ppb	6.152 ppb
Concentration per Run 1	102.287 %	208.075 ppb	26.188 ppb	18.357 ppb	131.783 ppb	18,738.211 ppb	4.249 ppb	10.596 ppb	6.300 ppb
Concentration per Run 2	99.748 %	212.167 ppb	27.829 ppb	19.274 ppb	135.629 ppb	19,191.577 ppb	4.133 ppb	9.938 ppb	6.090 ppb
Concentration per Run 3	102.780 %	212.323 ppb	26.820 ppb	19.066 ppb	132.048 ppb	19,162.763 ppb	4.100 ppb	9.862 ppb	6.066 ppb
Concentration RSD	1.6 %	1.1 %	3.1 %	2.5 %	1.6 %	1.3 %	1.9 %	4.0 %	2.1 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	31.533 ppb	108.621 %	6.891 ppb	5.518 ppb	22.007 ppb	2.970 ppb	105.563 %	0.020 ppb	0.098 ppb
Concentration per Run 1	31.242 ppb	103.635 %	6.473 ppb	5.392 ppb	21.927 ppb	2.982 ppb	101.275 %	0.017 ppb	0.117 ppb
Concentration per Run 2	32.038 ppb	109.849 %	7.386 ppb	6.609 ppb	21.884 ppb	2.990 ppb	107.239 %	0.020 ppb	0.086 ppb
Concentration per Run 3	31.319 ppb	112.380 %	6.814 ppb	4.554 ppb	22.210 ppb	2.936 ppb	108.177 %	0.024 ppb	0.091 ppb
Concentration RSD	1.4 %	4.1 %	6.7 %	18.7 %	0.8 %	1.0 %	3.5 %	18.5 %	17.0 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	111.171 %	0.297 ppb	0.226 ppb	12.797 ppb	104.991 %	102.563 %	0.120 ppb	7.391 ppb	105.628 %
Concentration per Run 1	104.549 %	0.312 ppb	0.272 ppb	12.574 ppb	100.514 %	97.812 %	0.100 ppb	7.209 ppb	100.985 %
Concentration per Run 2	115.287 %	0.283 ppb	0.172 ppb	13.264 ppb	107.458 %	105.728 %	0.119 ppb	7.260 ppb	109.175 %
Concentration per Run 3	113.679 %	0.296 ppb	0.234 ppb	12.552 ppb	107.002 %	104.150 %	0.142 ppb	7.703 ppb	106.726 %
Concentration RSD	5.2 %	4.7 %	22.4 %	3.2 %	3.7 %	4.1 %	17.4 %	3.7 %	4.0 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 123 Analysis started at: 6/9/2017 1:51:16 PM Rack: 2
 Analysis label: L1717026-03D10 A2-6020T User name: ALPHALAB\metals-instrument Vial: 25

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	104.475 %	117.612 %	1.434 ppb	10,126.131 ppb	11,169.574 ppb	22,051.026 ppb	4,819.270 ppb	3,398.669 ppb	118.917 %
Concentration per Run 1	104.460 %	115.741 %	1.399 ppb	9,548.838 ppb	10,529.509 ppb	20,731.617 ppb	4,479.075 ppb	3,186.783 ppb	120.942 %
Concentration per Run 2	102.699 %	114.632 %	1.453 ppb	10,383.803 ppb	11,279.568 ppb	22,440.126 ppb	4,871.200 ppb	3,445.465 ppb	120.550 %
Concentration per Run 3	106.268 %	122.463 %	1.450 ppb	10,445.751 ppb	11,699.643 ppb	22,981.335 ppb	5,107.535 ppb	3,563.758 ppb	115.259 %
Concentration RSD	1.7 %	3.6 %	2.1 %	4.9 %	5.3 %	5.3 %	6.6 %	5.7 %	2.7 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	103.267 %	380.973 ppb	55.343 ppb	47.012 ppb	368.853 ppb	51,169.031 ppb	13.307 ppb	33.398 ppb	18.521 ppb
Concentration per Run 1	102.940 %	354.494 ppb	52.348 ppb	44.124 ppb	342.496 ppb	48,063.304 ppb	12.192 ppb	31.175 ppb	17.266 ppb
Concentration per Run 2	101.735 %	385.000 ppb	55.777 ppb	47.737 ppb	375.705 ppb	52,084.066 ppb	13.661 ppb	34.074 ppb	18.933 ppb
Concentration per Run 3	105.125 %	403.424 ppb	57.904 ppb	49.176 ppb	388.360 ppb	53,359.723 ppb	14.066 ppb	34.944 ppb	19.363 ppb
Concentration RSD	1.7 %	6.5 %	5.1 %	5.5 %	6.4 %	5.4 %	7.4 %	5.9 %	6.0 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	102.300 ppb	114.607 %	17.949 ppb	14.212 ppb	36.195 ppb	3.497 ppb	106.707 %	0.064 ppb	0.165 ppb
Concentration per Run 1	95.204 ppb	114.050 %	16.560 ppb	11.849 ppb	33.136 ppb	3.148 ppb	105.352 %	0.055 ppb	0.146 ppb
Concentration per Run 2	104.828 ppb	113.459 %	18.736 ppb	14.637 ppb	37.603 ppb	3.601 ppb	108.371 %	0.079 ppb	0.168 ppb
Concentration per Run 3	106.869 ppb	116.313 %	18.550 ppb	16.151 ppb	37.846 ppb	3.741 ppb	106.397 %	0.058 ppb	0.182 ppb
Concentration RSD	6.1 %	1.3 %	6.7 %	15.4 %	7.3 %	8.9 %	1.4 %	20.6 %	11.1 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	113.487 %	0.678 ppb	0.214 ppb	36.094 ppb	102.257 %	95.327 %	0.212 ppb	18.123 ppb	103.567 %
Concentration per Run 1	111.832 %	0.523 ppb	0.169 ppb	34.077 ppb	102.705 %	94.796 %	0.187 ppb	17.092 ppb	103.715 %
Concentration per Run 2	114.347 %	0.736 ppb	0.215 ppb	36.728 ppb	103.601 %	95.480 %	0.228 ppb	18.447 ppb	103.102 %
Concentration per Run 3	114.280 %	0.775 ppb	0.259 ppb	37.476 ppb	100.467 %	95.705 %	0.222 ppb	18.830 ppb	103.883 %
Concentration RSD	1.3 %	20.0 %	21.1 %	4.9 %	1.6 %	0.5 %	10.4 %	5.0 %	0.4 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 124 Analysis started at: 6/9/2017 1:54:22 PM Rack: 0
 Analysis label: CCV User name: ALPHALAB\metals-instrument Vial: 9

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	103.208 %	115.248 %	98.802 ppb	10,581.220 ppb	10,061.645 ppb	110.263 ppb	10,730.860 ppb	10,644.474 ppb	120.788 %
Concentration per Run 1	103.495 %	111.170 %	97.995 ppb	10,523.863 ppb	10,201.378 ppb	113.480 ppb	10,681.608 ppb	10,587.571 ppb	118.545 %
Concentration per Run 2	102.407 %	118.968 %	98.513 ppb	10,192.014 ppb	9,880.439 ppb	110.051 ppb	10,617.356 ppb	10,507.999 ppb	125.392 %
Concentration per Run 3	103.724 %	115.606 %	99.897 ppb	11,027.783 ppb	10,103.118 ppb	107.258 ppb	10,893.616 ppb	10,837.851 ppb	118.426 %
Recovery Percentage 1			98.802 %	105.812 %	100.616 %	110.263 %	107.309 %	106.445 %	
Concentration RSD	0.7 %	3.4 %	1.0 %	4.0 %	1.6 %	2.8 %	1.3 %	1.6 %	3.3 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	104.230 %	103.556 ppb	98.831 ppb	98.637 ppb	101.811 ppb	10,106.955 ppb	100.777 ppb	101.748 ppb	98.576 ppb
Concentration per Run 1	103.101 %	104.176 ppb	98.415 ppb	99.249 ppb	104.422 ppb	10,150.277 ppb	100.875 ppb	103.210 ppb	101.629 ppb
Concentration per Run 2	104.288 %	101.599 ppb	97.565 ppb	97.421 ppb	99.775 ppb	9,844.282 ppb	99.255 ppb	98.850 ppb	95.585 ppb
Concentration per Run 3	105.301 %	104.891 ppb	100.513 ppb	99.242 ppb	101.236 ppb	10,326.307 ppb	102.199 ppb	103.184 ppb	98.514 ppb
Recovery Percentage 1		103.556 %	98.831 %	98.637 %	101.811 %	101.070 %	100.777 %	101.748 %	98.576 %
Concentration RSD	1.1 %	1.7 %	1.5 %	1.1 %	2.3 %	2.4 %	1.5 %	2.5 %	3.1 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	99.920 ppb	115.568 %	99.505 ppb	101.664 ppb	103.388 ppb	102.455 ppb	107.996 %	97.607 ppb	101.076 ppb
Concentration per Run 1	100.923 ppb	113.816 %	99.821 ppb	101.066 ppb	101.639 ppb	102.810 ppb	106.599 %	95.826 ppb	100.570 ppb
Concentration per Run 2	99.567 ppb	116.260 %	100.093 ppb	106.558 ppb	103.940 ppb	102.799 ppb	109.080 %	97.055 ppb	101.004 ppb
Concentration per Run 3	99.271 ppb	116.629 %	98.602 ppb	97.369 ppb	104.587 ppb	101.755 ppb	108.311 %	99.938 ppb	101.655 ppb
Recovery Percentage 1	99.920 %		99.505 %	101.664 %	103.388 %	102.455 %		97.607 %	101.076 %
Concentration RSD	0.9 %	1.3 %	0.8 %	4.5 %	1.5 %	0.6 %	1.2 %	2.2 %	0.5 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	115.539 %	104.460 ppb	96.060 ppb	102.782 ppb	107.264 %	102.543 %	98.446 ppb	97.388 ppb	102.746 %
Concentration per Run 1	113.496 %	104.779 ppb	96.719 ppb	103.706 ppb	106.358 %	99.844 %	98.936 ppb	96.119 ppb	101.679 %
Concentration per Run 2	115.820 %	104.181 ppb	95.682 ppb	102.370 ppb	107.123 %	103.318 %	100.443 ppb	98.992 ppb	103.255 %
Concentration per Run 3	117.301 %	104.418 ppb	95.780 ppb	102.272 ppb	108.312 %	104.466 %	95.960 ppb	97.052 ppb	103.303 %
Recovery Percentage 1		104.460 %	96.060 %	102.782 %			98.446 %	97.388 %	
Concentration RSD	1.7 %	0.3 %	0.6 %	0.8 %	0.9 %	2.3 %	2.3 %	1.5 %	0.9 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 125 Analysis started at: 6/9/2017 1:57:32 PM Rack: 0
 Analysis label: CCB User name: ALPHALAB\metals-instrument Vial: 10

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	102.902 %	118.463 %	0.006 ppb	26.646 ppb	-0.790 ppb	0.361 ppb	-1.278 ppb	-1.052 ppb	120.313 %
Concentration per Run 1	102.101 %	119.405 %	0.008 ppb	18.490 ppb	-0.843 ppb	0.107 ppb	2.729 ppb	1.442 ppb	120.966 %
Concentration per Run 2	103.033 %	118.598 %	0.000 ppb	28.582 ppb	-0.380 ppb	0.742 ppb	-2.421 ppb	-2.849 ppb	121.939 %
Concentration per Run 3	103.573 %	117.388 %	0.010 ppb	32.867 ppb	-1.148 ppb	0.233 ppb	-4.143 ppb	-1.750 ppb	118.035 %
Recovery Percentage 1			1.996 %	26.646 %	-1.129 %	3.605 %	-1.278 %	-1.052 %	
Concentration RSD	0.7 %	0.9 %	87.3 %	27.7 %	49.0 %	93.2 %	279.8 %	211.8 %	1.7 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	103.451 %	0.019 ppb	-0.003 ppb	0.036 ppb	0.073 ppb	0.552 ppb	0.005 ppb	0.001 ppb	-0.026 ppb
Concentration per Run 1	103.500 %	0.015 ppb	-0.008 ppb	0.015 ppb	-0.001 ppb	0.284 ppb	0.008 ppb	0.001 ppb	-0.012 ppb
Concentration per Run 2	103.192 %	0.015 ppb	0.000 ppb	0.035 ppb	0.147 ppb	1.061 ppb	0.008 ppb	0.073 ppb	-0.061 ppb
Concentration per Run 3	103.659 %	0.027 ppb	0.000 ppb	0.059 ppb	0.072 ppb	0.309 ppb	-0.002 ppb	-0.071 ppb	-0.003 ppb
Recovery Percentage 1		3.826 %	-0.057 %	3.640 %	7.292 %	1.103 %	0.908 %	0.045 %	-2.555 %
Concentration RSD	0.2 %	37.7 %	154.5 %	61.4 %	101.9 %	80.0 %	119.1 %	8,084.8 %	121.0 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	0.104 ppb	118.063 %	0.059 ppb	0.178 ppb	0.023 ppb	0.123 ppb	109.728 %	0.007 ppb	0.006 ppb
Concentration per Run 1	0.193 ppb	118.494 %	0.100 ppb	-0.317 ppb	0.006 ppb	0.110 ppb	107.427 %	0.011 ppb	0.009 ppb
Concentration per Run 2	-0.083 ppb	117.635 %	0.034 ppb	0.962 ppb	0.035 ppb	0.115 ppb	110.749 %	0.004 ppb	0.008 ppb
Concentration per Run 3	0.203 ppb	118.059 %	0.045 ppb	-0.109 ppb	0.028 ppb	0.145 ppb	111.007 %	0.006 ppb	0.000 ppb
Recovery Percentage 1	1.045 %	118.063 %	11.866 %	3.567 %	4.593 %	6.154 %		1.821 %	2.817 %
Concentration RSD	155.7 %	0.4 %	60.0 %	384.8 %	65.3 %	15.5 %	1.8 %	47.9 %	86.6 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	117.814 %	0.148 ppb	0.814 ppb	0.038 ppb	107.233 %	104.240 %	0.028 ppb	0.015 ppb	104.095 %
Concentration per Run 1	116.020 %	0.150 ppb	0.801 ppb	0.062 ppb	105.891 %	103.514 %	0.019 ppb	0.017 ppb	102.143 %
Concentration per Run 2	118.920 %	0.114 ppb	0.818 ppb	0.059 ppb	107.647 %	105.761 %	0.033 ppb	0.017 ppb	103.144 %
Concentration per Run 3	118.501 %	0.179 ppb	0.822 ppb	-0.008 ppb	108.160 %	103.444 %	0.031 ppb	0.011 ppb	106.999 %
Recovery Percentage 1		4.933 %	20.343 %	7.533 %			5.566 %	3.030 %	104.095 %
Concentration RSD	1.3 %	22.0 %	1.4 %	104.8 %	1.1 %	1.3 %	27.1 %	21.3 %	2.5 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 126 Analysis started at: 6/9/2017 2:00:42 PM Rack: 2
 Analysis label: L1717026-04D10 A2-6020T User name: ALPHALAB\metals-instrument Vial: 26

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	103.881 %	115.931 %	1.468 ppb	10,529.772 ppb	11,736.917 ppb	23,253.894 ppb	5,187.459 ppb	4,193.580 ppb	119.060 %
Concentration per Run 1	103.570 %	112.279 %	1.424 ppb	11,076.016 ppb	12,076.637 ppb	24,207.536 ppb	5,324.748 ppb	4,382.662 ppb	115.532 %
Concentration per Run 2	103.840 %	116.682 %	1.458 ppb	9,958.426 ppb	11,648.677 ppb	22,812.969 ppb	5,073.566 ppb	4,071.004 ppb	121.025 %
Concentration per Run 3	104.234 %	118.833 %	1.522 ppb	10,554.873 ppb	11,485.437 ppb	22,741.178 ppb	5,164.063 ppb	4,127.075 ppb	120.621 %
Concentration RSD	0.3 %	2.9 %	3.4 %	5.3 %	2.6 %	3.6 %	2.5 %	4.0 %	2.6 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	102.865 %	423.770 ppb	55.855 ppb	50.516 ppb	430.548 ppb	54,620.764 ppb	14.206 ppb	35.413 ppb	19.996 ppb
Concentration per Run 1	102.157 %	435.324 ppb	57.253 ppb	51.771 ppb	446.005 ppb	55,386.701 ppb	14.806 ppb	35.921 ppb	21.355 ppb
Concentration per Run 2	102.935 %	417.042 ppb	54.791 ppb	49.051 ppb	419.439 ppb	52,678.606 ppb	13.788 ppb	35.088 ppb	19.437 ppb
Concentration per Run 3	103.502 %	418.945 ppb	55.521 ppb	50.727 ppb	426.202 ppb	55,796.986 ppb	14.024 ppb	35.230 ppb	19.195 ppb
Concentration RSD	0.7 %	2.4 %	2.3 %	2.7 %	3.2 %	3.1 %	3.8 %	1.3 %	5.9 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	106.896 ppb	112.193 %	20.269 ppb	17.181 ppb	41.512 ppb	2.625 ppb	105.928 %	0.079 ppb	0.123 ppb
Concentration per Run 1	109.874 ppb	109.520 %	21.124 ppb	16.474 ppb	42.295 ppb	2.885 ppb	102.944 %	0.078 ppb	0.121 ppb
Concentration per Run 2	104.803 ppb	113.439 %	20.361 ppb	20.415 ppb	40.815 ppb	2.502 ppb	108.252 %	0.080 ppb	0.121 ppb
Concentration per Run 3	106.009 ppb	113.620 %	19.322 ppb	14.655 ppb	41.425 ppb	2.489 ppb	106.587 %	0.078 ppb	0.127 ppb
Concentration RSD	2.5 %	2.1 %	4.5 %	17.1 %	1.8 %	8.6 %	2.6 %	1.4 %	2.9 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	112.562 %	0.795 ppb	0.451 ppb	38.670 ppb	100.898 %	93.950 %	0.220 ppb	19.064 ppb	100.676 %
Concentration per Run 1	111.290 %	0.890 ppb	0.436 ppb	39.627 ppb	98.522 %	91.370 %	0.216 ppb	19.279 ppb	98.163 %
Concentration per Run 2	113.845 %	0.694 ppb	0.424 ppb	37.905 ppb	103.551 %	95.631 %	0.222 ppb	19.060 ppb	102.298 %
Concentration per Run 3	112.550 %	0.800 ppb	0.491 ppb	38.479 ppb	100.620 %	94.849 %	0.221 ppb	18.854 ppb	101.567 %
Concentration RSD	1.1 %	12.3 %	7.9 %	2.3 %	2.5 %	2.4 %	1.3 %	1.1 %	2.2 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 127 Analysis started at: 6/9/2017 2:03:49 PM Rack: 2
 Analysis label: L1717026-06D10 A2-6020T User name: ALPHALAB\metals-instrument Vial: 27

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	101.377 %	110.218 %	0.923 ppb	6,235.806 ppb	6,382.615 ppb	12,358.609 ppb	2,777.430 ppb	2,137.720 ppb	114.975 %
Concentration per Run 1	101.672 %	109.960 %	0.897 ppb	6,168.614 ppb	6,204.662 ppb	12,114.801 ppb	2,767.734 ppb	2,081.925 ppb	111.405 %
Concentration per Run 2	101.682 %	108.817 %	0.931 ppb	6,274.839 ppb	6,551.009 ppb	12,537.886 ppb	2,826.719 ppb	2,146.522 ppb	117.869 %
Concentration per Run 3	100.777 %	111.876 %	0.941 ppb	6,263.964 ppb	6,392.173 ppb	12,423.139 ppb	2,737.838 ppb	2,184.714 ppb	115.650 %
Concentration RSD	0.5 %	1.4 %	2.5 %	0.9 %	2.7 %	1.8 %	1.6 %	2.4 %	2.9 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	101.169 %	256.512 ppb	43.967 ppb	29.160 ppb	222.795 ppb	34,728.962 ppb	8.502 ppb	19.870 ppb	14.563 ppb
Concentration per Run 1	99.316 %	254.348 ppb	44.582 ppb	28.642 ppb	219.167 ppb	34,226.515 ppb	8.384 ppb	20.440 ppb	14.235 ppb
Concentration per Run 2	101.630 %	259.123 ppb	43.762 ppb	29.410 ppb	225.625 ppb	35,413.234 ppb	8.647 ppb	19.850 ppb	14.943 ppb
Concentration per Run 3	102.559 %	256.066 ppb	43.557 ppb	29.428 ppb	223.595 ppb	34,547.138 ppb	8.474 ppb	19.321 ppb	14.513 ppb
Concentration RSD	1.7 %	0.9 %	1.2 %	1.5 %	1.5 %	1.8 %	1.6 %	2.8 %	2.5 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	64.096 ppb	109.347 %	10.643 ppb	14.485 ppb	25.852 ppb	2.143 ppb	101.959 %	0.045 ppb	0.136 ppb
Concentration per Run 1	61.915 ppb	107.739 %	10.642 ppb	16.215 ppb	25.038 ppb	1.856 ppb	100.340 %	0.048 ppb	0.101 ppb
Concentration per Run 2	65.832 ppb	108.944 %	10.869 ppb	13.216 ppb	26.489 ppb	2.370 ppb	102.895 %	0.043 ppb	0.157 ppb
Concentration per Run 3	64.541 ppb	111.357 %	10.418 ppb	14.024 ppb	26.028 ppb	2.203 ppb	102.641 %	0.046 ppb	0.149 ppb
Concentration RSD	3.1 %	1.7 %	2.1 %	10.7 %	2.9 %	12.2 %	1.4 %	5.6 %	22.4 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	109.211 %	0.791 ppb	0.238 ppb	28.405 ppb	101.308 %	92.905 %	0.131 ppb	15.778 ppb	97.910 %
Concentration per Run 1	108.034 %	0.449 ppb	0.244 ppb	27.624 ppb	98.867 %	91.620 %	0.130 ppb	15.493 ppb	95.867 %
Concentration per Run 2	110.084 %	1.448 ppb	0.236 ppb	28.855 ppb	102.201 %	93.105 %	0.128 ppb	16.024 ppb	97.290 %
Concentration per Run 3	109.515 %	0.476 ppb	0.234 ppb	28.736 ppb	102.855 %	93.989 %	0.136 ppb	15.818 ppb	100.571 %
Concentration RSD	1.0 %	72.0 %	2.2 %	2.4 %	2.1 %	1.3 %	3.1 %	1.7 %	2.5 %

Alpha ICPMSQ2 Full

6/10/2017 10:11:47 AM



Analysis index: 128 Analysis started at: 6/9/2017 2:06:55 PM Rack: 2
 Analysis label: L1717026-07D10 A2-6020T User name: ALPHALAB\metals-instrument Vial: 28

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	102.795 %	119.035 %	1.474 ppb	8,076.128 ppb	11,571.069 ppb	23,449.865 ppb	5,039.106 ppb	5,911.515 ppb	118.739 %
Concentration per Run 1	103.477 %	114.766 %	1.490 ppb	8,404.477 ppb	12,011.139 ppb	24,205.373 ppb	5,150.846 ppb	6,093.441 ppb	117.252 %
Concentration per Run 2	102.382 %	123.539 %	1.442 ppb	7,946.375 ppb	11,406.979 ppb	23,286.382 ppb	5,087.082 ppb	5,773.416 ppb	118.948 %
Concentration per Run 3	102.525 %	118.800 %	1.489 ppb	7,877.532 ppb	11,295.091 ppb	22,857.840 ppb	4,879.388 ppb	5,867.689 ppb	120.016 %
Concentration RSD	0.6 %	3.7 %	1.8 %	3.5 %	3.3 %	2.9 %	2.8 %	2.8 %	1.2 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	100.484 %	428.092 ppb	58.646 ppb	51.319 ppb	407.512 ppb	61,390.237 ppb	14.372 ppb	36.427 ppb	20.945 ppb
Concentration per Run 1	100.222 %	439.495 ppb	61.114 ppb	53.209 ppb	422.898 ppb	62,766.886 ppb	14.809 ppb	37.256 ppb	21.580 ppb
Concentration per Run 2	100.729 %	425.956 ppb	57.477 ppb	50.410 ppb	400.766 ppb	61,495.933 ppb	14.223 ppb	36.250 ppb	20.476 ppb
Concentration per Run 3	100.501 %	418.826 ppb	57.349 ppb	50.340 ppb	398.873 ppb	59,907.894 ppb	14.084 ppb	35.776 ppb	20.780 ppb
Concentration RSD	0.3 %	2.5 %	3.6 %	3.2 %	3.3 %	2.3 %	2.7 %	2.1 %	2.7 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	111.837 ppb	111.673 %	21.838 ppb	17.461 ppb	47.659 ppb	2.158 ppb	102.580 %	0.071 ppb	0.149 ppb
Concentration per Run 1	115.954 ppb	109.007 %	22.396 ppb	17.006 ppb	48.254 ppb	2.110 ppb	100.355 %	0.075 ppb	0.119 ppb
Concentration per Run 2	111.793 ppb	113.389 %	21.881 ppb	15.920 ppb	47.723 ppb	2.170 ppb	104.057 %	0.078 ppb	0.161 ppb
Concentration per Run 3	107.764 ppb	112.622 %	21.236 ppb	19.457 ppb	47.000 ppb	2.193 ppb	103.326 %	0.061 ppb	0.168 ppb
Concentration RSD	3.7 %	2.1 %	2.7 %	10.4 %	1.3 %	2.0 %	1.9 %	12.4 %	17.8 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	110.451 %	0.810 ppb	0.228 ppb	41.486 ppb	98.557 %	90.192 %	0.208 ppb	19.825 ppb	98.933 %
Concentration per Run 1	108.677 %	0.903 ppb	0.188 ppb	42.435 ppb	96.216 %	88.276 %	0.203 ppb	19.910 ppb	98.031 %
Concentration per Run 2	110.057 %	0.749 ppb	0.245 ppb	40.956 ppb	98.703 %	89.830 %	0.206 ppb	19.714 ppb	99.534 %
Concentration per Run 3	112.619 %	0.778 ppb	0.251 ppb	41.067 ppb	100.752 %	92.469 %	0.215 ppb	19.850 ppb	99.234 %
Concentration RSD	1.8 %	10.1 %	15.1 %	2.0 %	2.3 %	2.4 %	2.8 %	0.5 %	0.8 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 129 Analysis started at: 6/9/2017 2:10:02 PM Rack: 2
 Analysis label: L1717026-08D10 A2-6020T User name: ALPHALAB\metals-instrument Vial: 29

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	103.669 %	118.172 %	1.389 ppb	7,547.057 ppb	10,325.196 ppb	23,067.106 ppb	5,011.536 ppb	5,388.439 ppb	119.803 %
Concentration per Run 1	104.801 %	113.657 %	1.413 ppb	7,875.133 ppb	10,684.830 ppb	23,846.560 ppb	5,181.264 ppb	5,626.832 ppb	116.185 %
Concentration per Run 2	102.629 %	117.791 %	1.340 ppb	7,506.541 ppb	10,298.551 ppb	23,001.703 ppb	4,952.022 ppb	5,405.838 ppb	121.274 %
Concentration per Run 3	103.576 %	123.068 %	1.412 ppb	7,259.495 ppb	9,992.208 ppb	22,353.055 ppb	4,901.321 ppb	5,132.648 ppb	121.950 %
Concentration RSD	1.1 %	4.0 %	3.0 %	4.1 %	3.4 %	3.2 %	3.0 %	4.6 %	2.6 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	99.148 %	443.949 ppb	56.370 ppb	50.612 ppb	393.672 ppb	71,047.626 ppb	13.642 ppb	36.778 ppb	20.908 ppb
Concentration per Run 1	101.153 %	460.018 ppb	58.435 ppb	52.470 ppb	403.051 ppb	73,306.622 ppb	14.220 ppb	37.651 ppb	21.065 ppb
Concentration per Run 2	96.556 %	438.301 ppb	56.304 ppb	50.409 ppb	394.610 ppb	70,905.818 ppb	13.545 ppb	37.774 ppb	20.925 ppb
Concentration per Run 3	99.735 %	433.529 ppb	54.371 ppb	48.958 ppb	383.355 ppb	68,930.438 ppb	13.160 ppb	34.910 ppb	20.735 ppb
Concentration RSD	2.4 %	3.2 %	3.6 %	3.5 %	2.5 %	3.1 %	3.9 %	4.4 %	0.8 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	111.078 ppb	113.990 %	18.991 ppb	15.325 ppb	42.204 ppb	2.590 ppb	104.257 %	0.086 ppb	0.236 ppb
Concentration per Run 1	114.180 ppb	110.910 %	18.650 ppb	16.253 ppb	43.769 ppb	2.741 ppb	103.003 %	0.092 ppb	0.266 ppb
Concentration per Run 2	112.194 ppb	114.776 %	19.529 ppb	14.852 ppb	41.765 ppb	2.623 ppb	103.548 %	0.073 ppb	0.198 ppb
Concentration per Run 3	106.860 ppb	116.286 %	18.793 ppb	14.869 ppb	41.078 ppb	2.407 ppb	106.219 %	0.094 ppb	0.244 ppb
Concentration RSD	3.4 %	2.4 %	2.5 %	5.2 %	3.3 %	6.5 %	1.7 %	13.2 %	14.6 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	113.178 %	0.667 ppb	0.218 ppb	45.266 ppb	97.398 %	89.588 %	0.223 ppb	17.844 ppb	97.778 %
Concentration per Run 1	109.880 %	0.627 ppb	0.209 ppb	45.884 ppb	96.124 %	87.046 %	0.228 ppb	18.013 ppb	97.032 %
Concentration per Run 2	113.251 %	0.650 ppb	0.226 ppb	46.700 ppb	96.631 %	89.026 %	0.222 ppb	17.995 ppb	96.121 %
Concentration per Run 3	116.402 %	0.724 ppb	0.219 ppb	43.214 ppb	99.438 %	92.690 %	0.219 ppb	17.523 ppb	100.179 %
Concentration RSD	2.9 %	7.6 %	4.1 %	4.0 %	1.8 %	3.2 %	2.1 %	1.6 %	2.2 %

Alpha ICPMSQ2 Full

6/10/2017 10:11:47 AM



Analysis index: 130 Analysis started at: 6/9/2017 2:13:08 PM Rack: 2
 Analysis label: L1717026-09D10 A2-6020T User name: ALPHALAB\metals-instrument Vial: 30

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	102.763 %	118.923 %	1.329 ppb	10,449.104 ppb	10,845.870 ppb	21,427.842 ppb	4,816.934 ppb	4,184.058 ppb	118.958 %
Concentration per Run 1	103.219 %	115.069 %	1.356 ppb	10,186.994 ppb	10,578.972 ppb	20,976.106 ppb	4,651.451 ppb	4,023.419 ppb	115.689 %
Concentration per Run 2	101.605 %	121.925 %	1.334 ppb	10,503.994 ppb	10,836.289 ppb	21,228.850 ppb	4,795.225 ppb	4,219.616 ppb	121.939 %
Concentration per Run 3	103.467 %	119.774 %	1.296 ppb	10,656.324 ppb	11,122.348 ppb	22,078.571 ppb	5,004.127 ppb	4,309.140 ppb	119.245 %
Concentration RSD	1.0 %	2.9 %	2.3 %	2.3 %	2.5 %	2.7 %	3.7 %	3.5 %	2.6 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	99.211 %	395.500 ppb	53.037 ppb	45.875 ppb	377.504 ppb	49,310.475 ppb	12.825 ppb	33.290 ppb	18.175 ppb
Concentration per Run 1	98.185 %	389.187 ppb	51.830 ppb	45.302 ppb	374.291 ppb	49,020.658 ppb	12.741 ppb	33.469 ppb	18.033 ppb
Concentration per Run 2	98.327 %	395.034 ppb	52.783 ppb	46.199 ppb	374.836 ppb	48,822.277 ppb	12.758 ppb	32.725 ppb	17.854 ppb
Concentration per Run 3	101.122 %	402.280 ppb	54.497 ppb	46.125 ppb	383.386 ppb	50,088.491 ppb	12.976 ppb	33.676 ppb	18.637 ppb
Concentration RSD	1.7 %	1.7 %	2.5 %	1.1 %	1.4 %	1.4 %	1.0 %	1.5 %	2.3 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	98.380 ppb	112.710 %	19.127 ppb	15.356 ppb	39.534 ppb	2.740 ppb	103.133 %	0.070 ppb	0.181 ppb
Concentration per Run 1	98.815 ppb	107.045 %	19.554 ppb	14.273 ppb	39.123 ppb	2.532 ppb	101.904 %	0.062 ppb	0.125 ppb
Concentration per Run 2	96.476 ppb	115.815 %	18.538 ppb	15.272 ppb	39.144 ppb	2.855 ppb	104.080 %	0.094 ppb	0.207 ppb
Concentration per Run 3	99.850 ppb	115.271 %	19.289 ppb	16.525 ppb	40.336 ppb	2.832 ppb	103.414 %	0.054 ppb	0.210 ppb
Concentration RSD	1.8 %	4.4 %	2.8 %	7.3 %	1.8 %	6.6 %	1.1 %	30.2 %	27.0 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	109.947 %	0.703 ppb	0.269 ppb	36.703 ppb	97.493 %	90.073 %	0.194 ppb	17.854 ppb	95.734 %
Concentration per Run 1	106.587 %	0.873 ppb	0.264 ppb	35.548 ppb	95.958 %	88.695 %	0.184 ppb	17.461 ppb	91.835 %
Concentration per Run 2	112.566 %	0.641 ppb	0.261 ppb	37.511 ppb	100.097 %	92.722 %	0.202 ppb	17.742 ppb	98.249 %
Concentration per Run 3	110.689 %	0.595 ppb	0.284 ppb	37.049 ppb	96.425 %	88.801 %	0.196 ppb	18.358 ppb	97.118 %
Concentration RSD	2.8 %	21.2 %	4.6 %	2.8 %	2.3 %	2.5 %	4.6 %	2.6 %	3.6 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 131 Analysis started at: 6/9/2017 2:16:15 PM Rack: 2
 Analysis label: L1717026-10D10 A2-6020T User name: ALPHALAB\metals-instrument Vial: 31

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	101.484 %	119.505 %	0.446 ppb	4,387.428 ppb	1,601.672 ppb	3,098.504 ppb	604.189 ppb	1,595.470 ppb	119.250 %
Concentration per Run 1	101.864 %	120.783 %	0.431 ppb	4,045.690 ppb	1,482.847 ppb	2,894.194 ppb	558.728 ppb	1,493.022 ppb	118.393 %
Concentration per Run 2	101.033 %	119.169 %	0.435 ppb	4,504.792 ppb	1,645.309 ppb	3,152.872 ppb	604.802 ppb	1,564.060 ppb	120.728 %
Concentration per Run 3	101.556 %	118.564 %	0.473 ppb	4,611.802 ppb	1,676.861 ppb	3,248.447 ppb	649.038 ppb	1,729.327 ppb	118.629 %
Concentration RSD	0.4 %	1.0 %	5.3 %	6.9 %	6.5 %	5.9 %	7.5 %	7.6 %	1.1 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	100.784 %	90.817 ppb	39.290 ppb	23.272 ppb	46.314 ppb	27,997.509 ppb	1.945 ppb	5.689 ppb	6.984 ppb
Concentration per Run 1	101.351 %	83.918 ppb	35.923 ppb	21.915 ppb	42.909 ppb	25,771.471 ppb	1.723 ppb	5.205 ppb	6.574 ppb
Concentration per Run 2	99.785 %	91.782 ppb	39.630 ppb	23.520 ppb	46.333 ppb	28,201.386 ppb	1.957 ppb	5.687 ppb	6.947 ppb
Concentration per Run 3	101.218 %	96.751 ppb	42.317 ppb	24.382 ppb	49.701 ppb	30,019.670 ppb	2.155 ppb	6.176 ppb	7.430 ppb
Concentration RSD	0.9 %	7.1 %	8.2 %	5.4 %	7.3 %	7.6 %	11.1 %	8.5 %	6.1 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	21.321 ppb	116.156 %	12.801 ppb	3.272 ppb	12.407 ppb	2.028 ppb	107.655 %	0.005 ppb	0.042 ppb
Concentration per Run 1	20.102 ppb	115.458 %	11.928 ppb	2.363 ppb	11.136 ppb	1.842 ppb	106.149 %	0.004 ppb	0.044 ppb
Concentration per Run 2	21.086 ppb	116.199 %	13.016 ppb	3.870 ppb	12.982 ppb	2.175 ppb	110.218 %	0.006 ppb	0.043 ppb
Concentration per Run 3	22.777 ppb	116.811 %	13.460 ppb	3.583 ppb	13.104 ppb	2.067 ppb	106.600 %	0.007 ppb	0.039 ppb
Concentration RSD	6.3 %	0.6 %	6.2 %	24.5 %	8.9 %	8.4 %	2.1 %	24.7 %	5.9 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	113.146 %	0.066 ppb	0.300 ppb	3.612 ppb	105.245 %	97.776 %	0.035 ppb	4.440 ppb	102.751 %
Concentration per Run 1	111.474 %	0.124 ppb	0.213 ppb	3.376 ppb	103.352 %	96.098 %	0.029 ppb	4.106 ppb	100.967 %
Concentration per Run 2	115.040 %	0.002 ppb	0.291 ppb	3.466 ppb	106.458 %	99.853 %	0.031 ppb	4.495 ppb	104.937 %
Concentration per Run 3	112.925 %	0.071 ppb	0.395 ppb	3.995 ppb	105.924 %	97.378 %	0.045 ppb	4.720 ppb	102.350 %
Concentration RSD	1.6 %	92.3 %	30.4 %	9.3 %	1.6 %	2.0 %	25.2 %	7.0 %	2.0 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 132 Analysis started at: 6/9/2017 2:19:21 PM Rack: 2
 Analysis label: L1717026-11D10 A2-6020T User name: ALPHALAB\metals-instrument Vial: 32

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	100.674 %	115.920 %	0.611 ppb	5,507.469 ppb	3,864.898 ppb	7,870.652 ppb	1,629.054 ppb	23,621.406 ppb	117.588 %
Concentration per Run 1	100.618 %	111.573 %	0.624 ppb	5,721.199 ppb	3,963.761 ppb	8,024.744 ppb	1,651.644 ppb	23,948.380 ppb	116.090 %
Concentration per Run 2	101.215 %	116.716 %	0.616 ppb	5,339.869 ppb	3,822.976 ppb	7,784.132 ppb	1,621.462 ppb	23,389.913 ppb	117.513 %
Concentration per Run 3	100.190 %	119.472 %	0.594 ppb	5,461.338 ppb	3,807.955 ppb	7,803.082 ppb	1,614.054 ppb	23,525.925 ppb	119.162 %
Concentration RSD	0.5 %	3.5 %	2.6 %	3.5 %	2.2 %	1.7 %	1.2 %	1.2 %	1.3 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	99.495 %	213.160 ppb	30.166 ppb	20.225 ppb	215.599 ppb	23,680.887 ppb	5.966 ppb	12.103 ppb	9.132 ppb
Concentration per Run 1	98.153 %	218.471 ppb	30.904 ppb	20.206 ppb	218.017 ppb	24,191.800 ppb	6.242 ppb	12.891 ppb	9.275 ppb
Concentration per Run 2	102.841 %	209.724 ppb	29.917 ppb	19.914 ppb	213.935 ppb	23,171.544 ppb	5.755 ppb	11.493 ppb	8.630 ppb
Concentration per Run 3	97.491 %	211.285 ppb	29.677 ppb	20.553 ppb	214.845 ppb	23,679.317 ppb	5.903 ppb	11.925 ppb	9.490 ppb
Concentration RSD	2.9 %	2.2 %	2.2 %	1.6 %	1.0 %	2.2 %	4.2 %	5.9 %	4.9 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	39.029 ppb	113.614 %	7.722 ppb	5.590 ppb	112.308 ppb	1.239 ppb	104.790 %	0.027 ppb	0.085 ppb
Concentration per Run 1	39.438 ppb	111.482 %	7.712 ppb	6.589 ppb	112.557 ppb	1.421 ppb	104.382 %	0.028 ppb	0.081 ppb
Concentration per Run 2	37.904 ppb	116.368 %	7.271 ppb	5.478 ppb	109.087 ppb	1.033 ppb	105.775 %	0.023 ppb	0.105 ppb
Concentration per Run 3	39.744 ppb	112.994 %	8.183 ppb	4.703 ppb	115.280 ppb	1.263 ppb	104.212 %	0.030 ppb	0.071 ppb
Concentration RSD	2.5 %	2.2 %	5.9 %	17.0 %	2.8 %	15.8 %	0.8 %	13.6 %	20.7 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	111.777 %	0.427 ppb	0.184 ppb	16.252 ppb	103.034 %	94.370 %	0.082 ppb	13.123 ppb	97.225 %
Concentration per Run 1	109.707 %	0.389 ppb	0.160 ppb	16.775 ppb	101.776 %	92.428 %	0.078 ppb	13.435 ppb	94.424 %
Concentration per Run 2	113.131 %	0.384 ppb	0.222 ppb	15.718 ppb	104.023 %	95.546 %	0.085 ppb	12.812 ppb	99.344 %
Concentration per Run 3	112.492 %	0.509 ppb	0.170 ppb	16.263 ppb	103.302 %	95.135 %	0.084 ppb	13.124 ppb	97.906 %
Concentration RSD	1.6 %	16.6 %	18.0 %	3.3 %	1.1 %	1.8 %	5.0 %	2.4 %	2.6 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 133 Analysis started at: 6/9/2017 2:22:28 PM Rack: 2
 Analysis label: L1717026-12D10 A2-6020T User name: ALPHALAB\metals-instrument Vial: 33

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	103.185 %	118.721 %	1.159 ppb	8,298.009 ppb	8,884.475 ppb	15,343.611 ppb	3,563.570 ppb	5,369.204 ppb	120.594 %
Concentration per Run 1	103.978 %	116.211 %	1.168 ppb	8,538.599 ppb	9,147.874 ppb	15,799.768 ppb	3,646.043 ppb	5,630.431 ppb	117.098 %
Concentration per Run 2	103.823 %	119.774 %	1.142 ppb	8,104.675 ppb	8,741.909 ppb	15,248.935 ppb	3,560.493 ppb	5,278.362 ppb	121.832 %
Concentration per Run 3	101.754 %	120.178 %	1.167 ppb	8,250.754 ppb	8,763.641 ppb	14,982.131 ppb	3,484.173 ppb	5,198.820 ppb	122.852 %
Concentration RSD	1.2 %	1.8 %	1.3 %	2.7 %	2.6 %	2.7 %	2.3 %	4.3 %	2.5 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	101.266 %	333.961 ppb	63.370 ppb	38.526 ppb	287.288 ppb	49,805.366 ppb	10.178 ppb	24.965 ppb	16.600 ppb
Concentration per Run 1	102.202 %	347.137 ppb	65.838 ppb	39.884 ppb	299.272 ppb	51,435.201 ppb	10.532 ppb	25.376 ppb	17.317 ppb
Concentration per Run 2	101.262 %	332.885 ppb	61.810 ppb	37.645 ppb	285.909 ppb	49,236.155 ppb	10.202 ppb	25.065 ppb	16.699 ppb
Concentration per Run 3	100.333 %	321.860 ppb	62.460 ppb	38.047 ppb	276.682 ppb	48,744.741 ppb	9.800 ppb	24.454 ppb	15.783 ppb
Concentration RSD	0.9 %	3.8 %	3.4 %	3.1 %	4.0 %	2.9 %	3.6 %	1.9 %	4.6 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	85.780 ppb	112.684 %	16.993 ppb	16.294 ppb	43.630 ppb	4.794 ppb	103.575 %	0.047 ppb	0.130 ppb
Concentration per Run 1	87.932 ppb	110.777 %	17.156 ppb	16.949 ppb	45.087 ppb	4.732 ppb	100.134 %	0.036 ppb	0.145 ppb
Concentration per Run 2	84.251 ppb	114.413 %	16.325 ppb	15.299 ppb	43.222 ppb	4.898 ppb	105.345 %	0.053 ppb	0.108 ppb
Concentration per Run 3	85.158 ppb	112.862 %	17.498 ppb	16.634 ppb	42.580 ppb	4.752 ppb	105.248 %	0.052 ppb	0.137 ppb
Concentration RSD	2.2 %	1.6 %	3.5 %	5.4 %	3.0 %	1.9 %	2.9 %	20.7 %	14.9 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	112.384 %	0.578 ppb	0.152 ppb	30.007 ppb	100.518 %	92.470 %	0.157 ppb	16.161 ppb	96.099 %
Concentration per Run 1	109.864 %	0.631 ppb	0.141 ppb	31.495 ppb	96.779 %	90.856 %	0.168 ppb	16.781 ppb	93.144 %
Concentration per Run 2	115.043 %	0.640 ppb	0.155 ppb	29.141 ppb	101.754 %	94.902 %	0.151 ppb	16.103 ppb	95.998 %
Concentration per Run 3	112.244 %	0.461 ppb	0.161 ppb	29.384 ppb	103.021 %	91.651 %	0.152 ppb	15.599 ppb	99.156 %
Concentration RSD	2.3 %	17.5 %	6.6 %	4.3 %	3.3 %	2.3 %	6.1 %	3.7 %	3.1 %

Alpha ICPMSQ2 Full

6/10/2017 10:11:47 AM



Analysis index: 134 Analysis started at: 6/9/2017 2:25:35 PM Rack: 2
 Analysis label: L1717026-13D10 A2-6020T User name: ALPHALAB\metals-instrument Vial: 34

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	102.750 %	117.489 %	1.418 ppb	8,652.699 ppb	11,156.187 ppb	22,399.949 ppb	4,964.299 ppb	3,885.859 ppb	118.012 %
Concentration per Run 1	102.412 %	114.699 %	1.426 ppb	8,555.493 ppb	11,054.437 ppb	22,174.502 ppb	4,982.785 ppb	3,873.294 ppb	112.555 %
Concentration per Run 2	101.974 %	120.514 %	1.438 ppb	8,655.232 ppb	11,027.398 ppb	22,395.550 ppb	4,922.385 ppb	3,853.688 ppb	121.417 %
Concentration per Run 3	103.864 %	117.253 %	1.391 ppb	8,747.374 ppb	11,386.728 ppb	22,629.794 ppb	4,987.727 ppb	3,930.595 ppb	120.064 %
Concentration RSD	1.0 %	2.5 %	1.7 %	1.1 %	1.8 %	1.0 %	0.7 %	1.0 %	4.0 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	99.173 %	386.317 ppb	54.249 ppb	48.392 ppb	390.851 ppb	54,660.673 ppb	13.368 ppb	35.074 ppb	20.550 ppb
Concentration per Run 1	98.538 %	392.267 ppb	55.152 ppb	49.195 ppb	392.596 ppb	54,363.129 ppb	13.580 ppb	34.717 ppb	20.917 ppb
Concentration per Run 2	99.146 %	384.480 ppb	54.585 ppb	47.610 ppb	385.500 ppb	54,123.488 ppb	13.327 ppb	34.730 ppb	19.540 ppb
Concentration per Run 3	99.834 %	382.204 ppb	53.009 ppb	48.372 ppb	394.457 ppb	55,495.402 ppb	13.197 ppb	35.776 ppb	21.193 ppb
Concentration RSD	0.7 %	1.4 %	2.0 %	1.6 %	1.2 %	1.3 %	1.5 %	1.7 %	4.3 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	107.881 ppb	111.922 %	20.663 ppb	16.116 ppb	37.660 ppb	1.850 ppb	103.293 %	0.061 ppb	0.112 ppb
Concentration per Run 1	110.513 ppb	105.088 %	20.394 ppb	17.769 ppb	38.403 ppb	1.885 ppb	99.829 %	0.060 ppb	0.079 ppb
Concentration per Run 2	106.878 ppb	117.089 %	20.010 ppb	14.673 ppb	37.508 ppb	1.882 ppb	103.616 %	0.061 ppb	0.124 ppb
Concentration per Run 3	106.254 ppb	113.589 %	21.585 ppb	15.906 ppb	37.070 ppb	1.784 ppb	106.434 %	0.061 ppb	0.134 ppb
Concentration RSD	2.1 %	5.5 %	4.0 %	9.7 %	1.8 %	3.1 %	3.2 %	1.0 %	26.1 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	111.313 %	0.666 ppb	0.164 ppb	37.752 ppb	97.947 %	88.869 %	0.196 ppb	19.208 ppb	95.232 %
Concentration per Run 1	106.489 %	0.667 ppb	0.144 ppb	37.247 ppb	94.573 %	85.178 %	0.199 ppb	19.292 ppb	90.941 %
Concentration per Run 2	112.730 %	0.581 ppb	0.185 ppb	38.803 ppb	99.314 %	90.504 %	0.201 ppb	19.193 ppb	96.976 %
Concentration per Run 3	114.722 %	0.751 ppb	0.163 ppb	37.206 ppb	99.953 %	90.925 %	0.188 ppb	19.138 ppb	97.778 %
Concentration RSD	3.9 %	12.8 %	12.6 %	2.4 %	3.0 %	3.6 %	3.6 %	0.4 %	3.9 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 135 Analysis started at: 6/9/2017 2:28:42 PM Rack: 2
 Analysis label: L1717026-14D10 A2-6020T User name: ALPHALAB\metals-instrument Vial: 35

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	104.963 %	115.887 %	1.442 ppb	9,230.503 ppb	10,942.828 ppb	23,541.705 ppb	5,224.671 ppb	22,943.700 ppb	115.106 %
Concentration per Run 1	105.252 %	112.077 %	1.387 ppb	9,295.948 ppb	10,837.785 ppb	23,576.550 ppb	5,212.161 ppb	22,868.126 ppb	110.791 %
Concentration per Run 2	104.742 %	118.430 %	1.436 ppb	9,200.238 ppb	11,066.662 ppb	23,683.081 ppb	5,283.146 ppb	23,208.615 ppb	114.856 %
Concentration per Run 3	104.895 %	117.153 %	1.504 ppb	9,195.323 ppb	10,924.036 ppb	23,365.483 ppb	5,178.706 ppb	22,754.360 ppb	119.672 %
Concentration RSD	0.2 %	2.9 %	4.1 %	0.6 %	1.1 %	0.7 %	1.0 %	1.0 %	3.9 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	100.027 %	465.746 ppb	56.915 ppb	52.870 ppb	521.347 ppb	61,380.965 ppb	14.047 ppb	38.003 ppb	21.289 ppb
Concentration per Run 1	101.232 %	467.644 ppb	58.105 ppb	52.743 ppb	527.868 ppb	61,748.474 ppb	14.200 ppb	37.972 ppb	21.466 ppb
Concentration per Run 2	98.475 %	463.791 ppb	56.915 ppb	54.070 ppb	518.614 ppb	62,018.280 ppb	14.044 ppb	38.386 ppb	21.945 ppb
Concentration per Run 3	100.374 %	465.804 ppb	55.725 ppb	51.798 ppb	517.558 ppb	60,376.141 ppb	13.899 ppb	37.651 ppb	20.456 ppb
Concentration RSD	1.4 %	0.4 %	2.1 %	2.2 %	1.1 %	1.4 %	1.1 %	1.0 %	3.6 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	107.096 ppb	109.436 %	22.438 ppb	15.698 ppb	110.546 ppb	5.293 ppb	101.016 %	0.092 ppb	0.361 ppb
Concentration per Run 1	108.645 ppb	103.348 %	22.690 ppb	16.516 ppb	111.507 ppb	5.425 ppb	95.587 %	0.103 ppb	0.364 ppb
Concentration per Run 2	108.721 ppb	112.628 %	22.291 ppb	16.292 ppb	110.043 ppb	5.479 ppb	102.646 %	0.087 ppb	0.346 ppb
Concentration per Run 3	103.922 ppb	112.332 %	22.333 ppb	14.286 ppb	110.089 ppb	4.974 ppb	104.817 %	0.086 ppb	0.375 ppb
Concentration RSD	2.6 %	4.8 %	1.0 %	7.8 %	0.8 %	5.2 %	4.8 %	10.1 %	4.1 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	109.702 %	0.719 ppb	0.216 ppb	42.316 ppb	96.404 %	86.097 %	0.257 ppb	18.972 ppb	94.034 %
Concentration per Run 1	104.100 %	0.645 ppb	0.219 ppb	41.828 ppb	91.363 %	81.840 %	0.256 ppb	18.982 ppb	90.964 %
Concentration per Run 2	112.654 %	0.707 ppb	0.202 ppb	42.618 ppb	99.731 %	88.370 %	0.253 ppb	18.991 ppb	94.981 %
Concentration per Run 3	112.353 %	0.804 ppb	0.228 ppb	42.500 ppb	98.118 %	88.081 %	0.262 ppb	18.943 ppb	96.159 %
Concentration RSD	4.4 %	11.1 %	6.0 %	1.0 %	4.6 %	4.3 %	1.8 %	0.1 %	2.9 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 136 Analysis started at: 6/9/2017 2:31:49 PM Rack: 0
 Analysis label: CCV User name: ALPHALAB\metals-instrument Vial: 9

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	102.858 %	118.732 %	98.451 ppb	10,761.596 ppb	10,293.929 ppb	108.892 ppb	10,999.821 ppb	10,794.768 ppb	121.460 %
Concentration per Run 1	102.396 %	114.968 %	99.062 ppb	11,112.240 ppb	10,722.323 ppb	116.030 ppb	11,469.240 ppb	11,253.502 ppb	117.703 %
Concentration per Run 2	103.397 %	122.329 %	98.939 ppb	10,267.751 ppb	10,217.475 ppb	106.292 ppb	10,825.833 ppb	10,657.350 ppb	123.315 %
Concentration per Run 3	102.781 %	118.900 %	97.351 ppb	10,904.798 ppb	9,941.988 ppb	104.353 ppb	10,704.389 ppb	10,473.451 ppb	123.362 %
Recovery Percentage 1			98.451 %	107.616 %	102.939 %	108.892 %	109.998 %	107.948 %	
Concentration RSD	0.5 %	3.1 %	1.0 %	4.1 %	3.8 %	5.7 %	3.7 %	3.8 %	2.7 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	101.445 %	103.360 ppb	101.655 ppb	101.436 ppb	103.285 ppb	10,250.812 ppb	103.658 ppb	103.234 ppb	101.612 ppb
Concentration per Run 1	101.755 %	104.928 ppb	104.476 ppb	104.297 ppb	105.976 ppb	10,406.253 ppb	109.787 ppb	106.287 ppb	107.331 ppb
Concentration per Run 2	101.217 %	103.106 ppb	101.388 ppb	100.447 ppb	102.221 ppb	10,228.442 ppb	100.846 ppb	100.481 ppb	99.263 ppb
Concentration per Run 3	101.363 %	102.046 ppb	99.101 ppb	99.564 ppb	101.657 ppb	10,117.742 ppb	100.343 ppb	102.934 ppb	98.241 ppb
Recovery Percentage 1		103.360 %	101.655 %	101.436 %	103.285 %	102.508 %	103.658 %	103.234 %	101.612 %
Concentration RSD	0.3 %	1.4 %	2.7 %	2.5 %	2.3 %	1.4 %	5.1 %	2.8 %	4.9 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	100.511 ppb	118.874 %	98.320 ppb	102.222 ppb	101.793 ppb	103.541 ppb	107.705 %	99.101 ppb	101.503 ppb
Concentration per Run 1	105.104 ppb	116.451 %	103.016 ppb	106.160 ppb	104.481 ppb	106.199 ppb	105.479 %	102.646 ppb	105.883 ppb
Concentration per Run 2	99.764 ppb	119.289 %	97.205 ppb	99.473 ppb	101.638 ppb	102.963 ppb	109.331 %	96.209 ppb	99.885 ppb
Concentration per Run 3	96.666 ppb	120.883 %	94.738 ppb	101.033 ppb	99.260 ppb	101.461 ppb	108.305 %	98.449 ppb	98.742 ppb
Recovery Percentage 1	100.511 %		98.320 %	102.222 %	101.793 %	103.541 %		99.101 %	101.503 %
Concentration RSD	4.2 %	1.9 %	4.3 %	3.4 %	2.6 %	2.3 %	1.9 %	3.3 %	3.8 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	114.824 %	106.166 ppb	98.708 ppb	104.227 ppb	104.646 %	96.873 %	100.199 ppb	101.312 ppb	94.788 %
Concentration per Run 1	112.347 %	110.383 ppb	101.986 ppb	108.377 ppb	102.038 %	93.690 %	105.132 ppb	107.001 ppb	89.702 %
Concentration per Run 2	115.915 %	106.654 ppb	98.005 ppb	103.896 ppb	106.220 %	97.216 %	95.763 ppb	97.613 ppb	97.758 %
Concentration per Run 3	116.210 %	101.460 ppb	96.131 ppb	100.407 ppb	105.679 %	99.712 %	99.703 ppb	99.322 ppb	96.903 %
Recovery Percentage 1		106.166 %	98.708 %	104.227 %			100.199 %	101.312 %	
Concentration RSD	1.9 %	4.2 %	3.0 %	3.8 %	2.2 %	3.1 %	4.7 %	4.9 %	4.7 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 137 Analysis started at: 6/9/2017 2:34:59 PM Rack: 0
 Analysis label: CCB User name: ALPHALAB\metals-instrument Vial: 10

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	104.138 %	122.777 %	0.006 ppb	43.358 ppb	0.541 ppb	0.235 ppb	11.632 ppb	2.048 ppb	124.740 %
Concentration per Run 1	103.792 %	122.228 %	0.009 ppb	41.610 ppb	0.058 ppb	-0.253 ppb	10.475 ppb	1.178 ppb	122.545 %
Concentration per Run 2	105.546 %	127.202 %	0.002 ppb	40.622 ppb	0.734 ppb	0.657 ppb	9.779 ppb	5.210 ppb	127.302 %
Concentration per Run 3	103.075 %	118.900 %	0.006 ppb	47.841 ppb	0.832 ppb	0.301 ppb	14.642 ppb	-0.244 ppb	124.372 %
Recovery Percentage 1			1.860 %	43.358 %	0.773 %	2.348 %	11.632 %	2.048 %	
Concentration RSD	1.2 %	3.4 %	67.0 %	9.0 %	77.9 %	195.3 %	22.6 %	138.2 %	1.9 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	102.966 %	0.035 ppb	-0.008 ppb	0.007 ppb	0.022 ppb	1.853 ppb	0.005 ppb	0.006 ppb	0.033 ppb
Concentration per Run 1	103.177 %	0.036 ppb	-0.008 ppb	-0.003 ppb	0.087 ppb	1.306 ppb	0.001 ppb	0.000 ppb	0.011 ppb
Concentration per Run 2	105.206 %	0.043 ppb	-0.008 ppb	0.024 ppb	-0.008 ppb	1.694 ppb	0.007 ppb	0.006 ppb	0.030 ppb
Concentration per Run 3	100.515 %	0.024 ppb	-0.008 ppb	0.000 ppb	-0.013 ppb	2.559 ppb	0.007 ppb	0.011 ppb	0.059 ppb
Recovery Percentage 1		6.913 %	-0.162 %	0.725 %	2.177 %	3.706 %	1.058 %	0.285 %	3.340 %
Concentration RSD	2.3 %	27.7 %	1.8 %	207.2 %	258.4 %	34.6 %	64.6 %	95.8 %	71.4 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	0.025 ppb	120.522 %	0.065 ppb	0.053 ppb	-0.002 ppb	0.104 ppb	113.133 %	0.008 ppb	0.005 ppb
Concentration per Run 1	0.034 ppb	118.441 %	0.055 ppb	0.219 ppb	0.018 ppb	0.119 ppb	113.648 %	0.009 ppb	0.008 ppb
Concentration per Run 2	0.021 ppb	124.338 %	0.063 ppb	-0.348 ppb	-0.009 ppb	0.124 ppb	114.268 %	0.008 ppb	0.004 ppb
Concentration per Run 3	0.020 ppb	118.788 %	0.077 ppb	0.289 ppb	-0.014 ppb	0.068 ppb	111.484 %	0.007 ppb	0.004 ppb
Recovery Percentage 1	0.247 %	120.522 %	13.092 %	1.070 %	-0.345 %	5.196 %		1.993 %	2.714 %
Concentration RSD	31.6 %	2.7 %	17.0 %	652.7 %	983.4 %	30.0 %	1.3 %	14.5 %	42.0 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	121.376 %	0.069 ppb	0.758 ppb	-0.009 ppb	107.273 %	99.856 %	0.012 ppb	0.017 ppb	103.813 %
Concentration per Run 1	123.532 %	-0.013 ppb	0.745 ppb	0.003 ppb	105.466 %	99.486 %	0.010 ppb	0.018 ppb	101.103 %
Concentration per Run 2	122.909 %	0.046 ppb	0.827 ppb	0.012 ppb	110.564 %	99.950 %	0.011 ppb	0.017 ppb	106.493 %
Concentration per Run 3	117.686 %	0.176 ppb	0.702 ppb	-0.041 ppb	105.788 %	100.132 %	0.014 ppb	0.017 ppb	103.843 %
Recovery Percentage 1		2.316 %	18.952 %	-1.753 %			2.369 %	3.455 %	103.813 %
Concentration RSD	2.6 %	138.8 %	8.3 %	323.8 %	2.7 %	0.3 %	19.7 %	3.7 %	2.6 %

Alpha ICPMSQ2 Full

6/10/2017 10:11:47 AM



Analysis index: 138 Analysis started at: 6/9/2017 2:38:09 PM Rack: 2
 Analysis label: WG1007571-1D10 A2-6020T User name: ALPHALAB\metals-instrument Vial: 42

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	102.639 %	117.455 %	0.003 ppb	53.961 ppb	-0.501 ppb	0.148 ppb	5.483 ppb	-4.189 ppb	117.261 %
Concentration per Run 1	102.858 %	113.623 %	0.004 ppb	62.691 ppb	0.011 ppb	0.299 ppb	6.659 ppb	-7.553 ppb	111.452 %
Concentration per Run 2	102.715 %	121.724 %	-0.002 ppb	41.852 ppb	-1.153 ppb	0.056 ppb	9.629 ppb	-4.020 ppb	121.785 %
Concentration per Run 3	102.345 %	117.018 %	0.007 ppb	57.341 ppb	-0.361 ppb	0.090 ppb	0.162 ppb	-0.994 ppb	118.546 %
Concentration RSD	0.3 %	3.5 %	144.4 %	20.1 %	118.7 %	88.8 %	88.3 %	78.4 %	4.5 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	101.126 %	0.033 ppb	-0.002 ppb	0.035 ppb	-0.031 ppb	0.711 ppb	0.003 ppb	-0.049 ppb	-0.029 ppb
Concentration per Run 1	102.177 %	0.067 ppb	0.009 ppb	-0.007 ppb	-0.022 ppb	1.545 ppb	0.009 ppb	-0.042 ppb	-0.006 ppb
Concentration per Run 2	101.220 %	0.015 ppb	-0.008 ppb	0.043 ppb	0.008 ppb	0.528 ppb	0.004 ppb	-0.072 ppb	-0.037 ppb
Concentration per Run 3	99.982 %	0.016 ppb	-0.008 ppb	0.069 ppb	-0.079 ppb	0.061 ppb	-0.005 ppb	-0.033 ppb	-0.043 ppb
Concentration RSD	1.1 %	90.7 %	432.6 %	109.6 %	142.1 %	106.6 %	252.2 %	42.2 %	70.3 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	-0.372 ppb	114.422 %	0.039 ppb	0.132 ppb	0.000 ppb	0.051 ppb	106.654 %	0.003 ppb	0.003 ppb
Concentration per Run 1	-0.383 ppb	109.432 %	0.036 ppb	0.244 ppb	0.010 ppb	0.042 ppb	103.974 %	0.002 ppb	0.004 ppb
Concentration per Run 2	-0.438 ppb	119.931 %	0.011 ppb	0.061 ppb	-0.013 ppb	0.039 ppb	108.441 %	0.002 ppb	0.004 ppb
Concentration per Run 3	-0.295 ppb	113.903 %	0.069 ppb	0.092 ppb	0.002 ppb	0.072 ppb	107.549 %	0.005 ppb	0.000 ppb
Concentration RSD	19.5 %	4.6 %	75.4 %	73.8 %	5,023.3 %	35.5 %	2.2 %	48.5 %	86.6 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	112.641 %	-0.024 ppb	0.298 ppb	-0.044 ppb	102.282 %	95.690 %	0.010 ppb	0.002 ppb	97.056 %
Concentration per Run 1	110.682 %	-0.021 ppb	0.326 ppb	-0.052 ppb	100.377 %	90.878 %	0.009 ppb	0.003 ppb	94.935 %
Concentration per Run 2	112.626 %	-0.032 ppb	0.298 ppb	-0.064 ppb	103.443 %	99.088 %	0.013 ppb	0.000 ppb	98.884 %
Concentration per Run 3	114.615 %	-0.020 ppb	0.269 ppb	-0.017 ppb	103.025 %	97.105 %	0.008 ppb	0.001 ppb	97.348 %
Concentration RSD	1.7 %	25.5 %	9.6 %	54.6 %	1.6 %	4.5 %	25.9 %	82.4 %	2.1 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 139 Analysis started at: 6/9/2017 2:41:15 PM Rack: 2
 Analysis label: WG1007571-2D10 A2-6020T User name: ALPHALAB\metals-instrument Vial: 43

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	102.056 %	113.355 %	75.184 ppb	765.771 ppb	1,943.439 ppb	5,304.221 ppb	1,765.745 ppb	4,551.073 ppb	117.226 %
Concentration per Run 1	101.104 %	116.111 %	75.180 ppb	734.461 ppb	1,876.207 ppb	5,040.620 ppb	1,743.016 ppb	4,425.751 ppb	118.582 %
Concentration per Run 2	102.831 %	110.766 %	74.710 ppb	804.732 ppb	2,014.411 ppb	5,572.703 ppb	1,775.319 ppb	4,666.831 ppb	114.229 %
Concentration per Run 3	102.232 %	113.186 %	75.663 ppb	758.121 ppb	1,939.701 ppb	5,299.341 ppb	1,778.902 ppb	4,560.639 ppb	118.866 %
Concentration RSD	0.9 %	2.4 %	0.6 %	4.7 %	3.6 %	5.0 %	1.1 %	2.7 %	2.2 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	102.423 %	216.379 ppb	88.375 ppb	109.839 ppb	243.312 ppb	12,687.869 ppb	120.557 ppb	101.103 ppb	135.852 ppb
Concentration per Run 1	102.233 %	208.286 ppb	85.854 ppb	106.054 ppb	237.486 ppb	12,313.019 ppb	117.899 ppb	97.776 ppb	132.631 ppb
Concentration per Run 2	102.501 %	226.395 ppb	92.493 ppb	115.657 ppb	256.130 ppb	13,556.755 ppb	128.243 ppb	104.236 ppb	143.081 ppb
Concentration per Run 3	102.534 %	214.458 ppb	86.778 ppb	107.805 ppb	236.319 ppb	12,193.835 ppb	115.530 ppb	101.296 ppb	131.844 ppb
Concentration RSD	0.2 %	4.3 %	4.1 %	4.7 %	4.6 %	5.9 %	5.6 %	3.2 %	4.6 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	150.661 ppb	114.256 %	114.506 ppb	143.707 ppb	77.486 ppb	88.738 ppb	105.584 %	24.045 ppb	72.531 ppb
Concentration per Run 1	146.674 ppb	117.039 %	109.645 ppb	141.578 ppb	74.133 ppb	82.225 ppb	109.111 %	23.014 ppb	69.037 ppb
Concentration per Run 2	159.155 ppb	108.027 %	122.200 ppb	155.450 ppb	82.738 ppb	94.724 ppb	100.792 %	25.254 ppb	77.085 ppb
Concentration per Run 3	146.152 ppb	117.702 %	111.671 ppb	134.094 ppb	75.586 ppb	89.265 ppb	106.847 %	23.867 ppb	71.470 ppb
Concentration RSD	4.9 %	4.7 %	5.9 %	7.5 %	5.9 %	7.1 %	4.1 %	4.7 %	5.7 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	113.530 %	109.379 ppb	108.552 ppb	157.288 ppb	103.638 %	96.697 %	109.766 ppb	111.230 ppb	98.539 %
Concentration per Run 1	117.294 %	103.852 ppb	103.486 ppb	150.836 ppb	105.440 %	97.891 %	105.381 ppb	107.099 ppb	100.135 %
Concentration per Run 2	107.539 %	117.174 ppb	115.494 ppb	168.581 ppb	99.231 %	92.800 %	114.800 ppb	116.283 ppb	95.255 %
Concentration per Run 3	115.758 %	107.111 ppb	106.677 ppb	152.447 ppb	106.243 %	99.399 %	109.117 ppb	110.308 ppb	100.228 %
Concentration RSD	4.6 %	6.3 %	5.7 %	6.2 %	3.7 %	3.6 %	4.3 %	4.2 %	2.9 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 140 Analysis started at: 6/9/2017 2:44:22 PM Rack: 2
 Analysis label: L1717026-15D10 A2-6020T User name: ALPHALAB\metals-instrument Vial: 36

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	102.093 %	113.791 %	0.441 ppb	3,868.077 ppb	1,747.071 ppb	4,498.157 ppb	815.619 ppb	569.372 ppb	120.045 %
Concentration per Run 1	103.424 %	112.380 %	0.450 ppb	3,767.273 ppb	1,716.527 ppb	4,403.253 ppb	795.331 ppb	597.216 ppb	114.323 %
Concentration per Run 2	101.069 %	112.111 %	0.423 ppb	3,974.746 ppb	1,783.088 ppb	4,611.907 ppb	832.942 ppb	565.984 ppb	121.488 %
Concentration per Run 3	101.788 %	116.884 %	0.452 ppb	3,862.213 ppb	1,741.597 ppb	4,479.312 ppb	818.585 ppb	544.916 ppb	124.323 %
Concentration RSD	1.2 %	2.4 %	3.7 %	2.7 %	1.9 %	2.3 %	2.3 %	4.6 %	4.3 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	103.204 %	96.162 ppb	37.428 ppb	17.916 ppb	56.409 ppb	16,996.667 ppb	3.095 ppb	7.664 ppb	23.361 ppb
Concentration per Run 1	103.530 %	94.077 ppb	37.140 ppb	17.394 ppb	55.371 ppb	16,550.376 ppb	2.919 ppb	7.715 ppb	22.997 ppb
Concentration per Run 2	103.599 %	98.935 ppb	37.147 ppb	18.017 ppb	54.893 ppb	17,249.639 ppb	3.142 ppb	7.411 ppb	22.952 ppb
Concentration per Run 3	102.485 %	95.474 ppb	37.995 ppb	18.339 ppb	58.964 ppb	17,189.986 ppb	3.224 ppb	7.867 ppb	24.132 ppb
Concentration RSD	0.6 %	2.6 %	1.3 %	2.7 %	3.9 %	2.3 %	5.1 %	3.0 %	2.9 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	29.130 ppb	114.688 %	4.513 ppb	5.557 ppb	10.447 ppb	0.532 ppb	106.712 %	0.078 ppb	0.320 ppb
Concentration per Run 1	28.154 ppb	108.294 %	4.393 ppb	6.342 ppb	10.279 ppb	0.450 ppb	102.342 %	0.083 ppb	0.251 ppb
Concentration per Run 2	29.921 ppb	118.456 %	4.742 ppb	5.166 ppb	10.482 ppb	0.551 ppb	108.532 %	0.071 ppb	0.331 ppb
Concentration per Run 3	29.314 ppb	117.312 %	4.405 ppb	5.163 ppb	10.579 ppb	0.596 ppb	109.262 %	0.079 ppb	0.380 ppb
Concentration RSD	3.1 %	4.9 %	4.4 %	12.2 %	1.5 %	14.1 %	3.6 %	7.6 %	20.3 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	112.988 %	0.261 ppb	0.292 ppb	13.472 ppb	105.620 %	98.079 %	0.388 ppb	12.649 ppb	102.092 %
Concentration per Run 1	108.291 %	0.320 ppb	0.308 ppb	13.979 ppb	101.671 %	93.926 %	0.284 ppb	12.318 ppb	99.271 %
Concentration per Run 2	114.977 %	0.179 ppb	0.300 ppb	13.036 ppb	107.402 %	99.310 %	0.411 ppb	13.011 ppb	101.868 %
Concentration per Run 3	115.695 %	0.285 ppb	0.267 ppb	13.402 ppb	107.788 %	101.001 %	0.470 ppb	12.617 ppb	105.136 %
Concentration RSD	3.6 %	28.2 %	7.3 %	3.5 %	3.2 %	3.8 %	24.4 %	2.7 %	2.9 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 141 Analysis started at: 6/9/2017 2:47:30 PM Rack: 2
 Analysis label: L1717026-16D10 A2-6020T User name: ALPHALAB\metals-instrument Vial: 37

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	101.350 %	117.623 %	1.320 ppb	8,540.925 ppb	9,911.006 ppb	19,609.063 ppb	4,395.285 ppb	17,219.447 ppb	119.697 %
Concentration per Run 1	101.222 %	116.043 %	1.366 ppb	8,280.781 ppb	9,471.540 ppb	18,962.859 ppb	4,357.927 ppb	16,725.234 ppb	116.542 %
Concentration per Run 2	101.474 %	119.035 %	1.269 ppb	8,618.550 ppb	10,192.184 ppb	19,876.220 ppb	4,430.714 ppb	17,271.478 ppb	121.950 %
Concentration per Run 3	101.355 %	117.791 %	1.326 ppb	8,723.446 ppb	10,069.293 ppb	19,988.108 ppb	4,397.214 ppb	17,661.629 ppb	120.598 %
Concentration RSD	0.1 %	1.3 %	3.7 %	2.7 %	3.9 %	2.9 %	0.8 %	2.7 %	2.4 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	98.857 %	366.599 ppb	49.301 ppb	43.478 ppb	356.049 ppb	49,767.134 ppb	11.940 ppb	29.673 ppb	18.598 ppb
Concentration per Run 1	98.608 %	355.940 ppb	48.089 ppb	42.296 ppb	345.009 ppb	47,916.166 ppb	11.549 ppb	28.106 ppb	17.754 ppb
Concentration per Run 2	99.726 %	369.489 ppb	49.513 ppb	44.067 ppb	359.366 ppb	50,634.064 ppb	11.765 ppb	29.838 ppb	18.930 ppb
Concentration per Run 3	98.238 %	374.369 ppb	50.299 ppb	44.071 ppb	363.773 ppb	50,751.171 ppb	12.505 ppb	31.075 ppb	19.108 ppb
Concentration RSD	0.8 %	2.6 %	2.3 %	2.4 %	2.8 %	3.2 %	4.2 %	5.0 %	4.0 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	92.220 ppb	112.629 %	17.633 ppb	14.471 ppb	98.696 ppb	2.452 ppb	105.440 %	0.070 ppb	0.178 ppb
Concentration per Run 1	89.583 ppb	108.675 %	17.657 ppb	13.592 ppb	93.530 ppb	2.333 ppb	104.785 %	0.075 ppb	0.177 ppb
Concentration per Run 2	92.790 ppb	112.852 %	17.908 ppb	15.753 ppb	101.720 ppb	2.422 ppb	105.184 %	0.068 ppb	0.169 ppb
Concentration per Run 3	94.287 ppb	116.359 %	17.333 ppb	14.068 ppb	100.839 ppb	2.602 ppb	106.350 %	0.067 ppb	0.189 ppb
Concentration RSD	2.6 %	3.4 %	1.6 %	7.8 %	4.6 %	5.6 %	0.8 %	5.8 %	5.8 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	114.276 %	0.680 ppb	0.188 ppb	39.473 ppb	101.974 %	92.065 %	0.267 ppb	17.990 ppb	99.000 %
Concentration per Run 1	111.507 %	0.654 ppb	0.197 ppb	38.431 ppb	100.283 %	89.125 %	0.226 ppb	16.828 ppb	97.961 %
Concentration per Run 2	115.451 %	0.799 ppb	0.134 ppb	39.484 ppb	104.796 %	96.324 %	0.275 ppb	18.449 ppb	100.460 %
Concentration per Run 3	115.868 %	0.589 ppb	0.232 ppb	40.503 ppb	100.842 %	90.745 %	0.298 ppb	18.692 ppb	98.578 %
Concentration RSD	2.1 %	15.8 %	26.3 %	2.6 %	2.4 %	4.1 %	13.8 %	5.6 %	1.3 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 142 Analysis started at: 6/9/2017 2:50:37 PM Rack: 2
 Analysis label: L1717026-17D10 A2-6020T User name: ALPHALAB\metals-instrument Vial: 38

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	101.938 %	117.108 %	1.501 ppb	9,163.482 ppb	10,844.130 ppb	22,995.892 ppb	5,086.987 ppb	4,908.446 ppb	117.015 %
Concentration per Run 1	102.681 %	117.186 %	1.562 ppb	9,252.404 ppb	10,960.949 ppb	23,117.621 ppb	5,103.555 ppb	4,841.553 ppb	116.944 %
Concentration per Run 2	101.565 %	116.984 %	1.466 ppb	9,211.638 ppb	10,982.571 ppb	23,434.947 ppb	5,175.416 ppb	5,061.156 ppb	115.899 %
Concentration per Run 3	101.569 %	117.153 %	1.476 ppb	9,026.403 ppb	10,588.870 ppb	22,435.108 ppb	4,981.988 ppb	4,822.628 ppb	118.201 %
Concentration RSD	0.6 %	0.1 %	3.5 %	1.3 %	2.0 %	2.2 %	1.9 %	2.7 %	1.0 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	98.077 %	417.902 ppb	57.234 ppb	50.527 ppb	373.977 ppb	57,451.902 ppb	14.087 ppb	38.147 ppb	21.618 ppb
Concentration per Run 1	98.844 %	413.424 ppb	57.455 ppb	49.814 ppb	372.618 ppb	56,516.916 ppb	13.883 ppb	37.811 ppb	22.026 ppb
Concentration per Run 2	97.957 %	426.165 ppb	58.597 ppb	51.545 ppb	376.041 ppb	59,017.708 ppb	14.314 ppb	39.458 ppb	21.766 ppb
Concentration per Run 3	97.429 %	414.118 ppb	55.651 ppb	50.222 ppb	373.271 ppb	56,821.083 ppb	14.064 ppb	37.171 ppb	21.061 ppb
Concentration RSD	0.7 %	1.7 %	2.6 %	1.8 %	0.5 %	2.4 %	1.5 %	3.1 %	2.3 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	107.499 ppb	111.840 %	18.433 ppb	18.247 ppb	42.883 ppb	2.703 ppb	101.898 %	0.081 ppb	0.218 ppb
Concentration per Run 1	107.231 ppb	112.605 %	18.255 ppb	17.995 ppb	42.577 ppb	2.520 ppb	100.021 %	0.077 ppb	0.234 ppb
Concentration per Run 2	109.946 ppb	110.164 %	19.160 ppb	18.153 ppb	43.044 ppb	2.670 ppb	104.021 %	0.081 ppb	0.220 ppb
Concentration per Run 3	105.319 ppb	112.751 %	17.884 ppb	18.593 ppb	43.029 ppb	2.919 ppb	101.653 %	0.086 ppb	0.200 ppb
Concentration RSD	2.2 %	1.3 %	3.6 %	1.7 %	0.6 %	7.5 %	2.0 %	5.3 %	7.8 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	112.155 %	0.786 ppb	0.136 ppb	41.623 ppb	97.910 %	87.962 %	0.263 ppb	19.055 ppb	97.641 %
Concentration per Run 1	111.320 %	0.824 ppb	0.122 ppb	42.040 ppb	96.096 %	86.869 %	0.260 ppb	19.293 ppb	96.098 %
Concentration per Run 2	112.875 %	0.781 ppb	0.158 ppb	41.755 ppb	99.895 %	87.930 %	0.252 ppb	19.070 ppb	97.928 %
Concentration per Run 3	112.270 %	0.754 ppb	0.128 ppb	41.074 ppb	97.738 %	89.086 %	0.276 ppb	18.804 ppb	98.897 %
Concentration RSD	0.7 %	4.5 %	14.3 %	1.2 %	1.9 %	1.3 %	4.7 %	1.3 %	1.5 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 143 Analysis started at: 6/9/2017 2:53:44 PM Rack: 2
 Analysis label: L1717026-18D10 A2-6020T User name: ALPHALAB\metals-instrument Vial: 39

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	100.277 %	117.511 %	1.420 ppb	9,196.853 ppb	10,494.188 ppb	21,994.036 ppb	5,010.689 ppb	48,866.042 ppb	113.908 %
Concentration per Run 1	100.773 %	110.699 %	1.373 ppb	9,207.767 ppb	10,472.990 ppb	21,968.357 ppb	5,008.876 ppb	47,805.756 ppb	107.907 %
Concentration per Run 2	99.677 %	121.388 %	1.437 ppb	9,007.880 ppb	10,307.121 ppb	21,694.505 ppb	4,895.626 ppb	48,757.995 ppb	117.406 %
Concentration per Run 3	100.380 %	120.447 %	1.449 ppb	9,374.911 ppb	10,702.454 ppb	22,319.246 ppb	5,127.565 ppb	50,034.376 ppb	116.410 %
Concentration RSD	0.6 %	5.0 %	2.9 %	2.0 %	1.9 %	1.4 %	2.3 %	2.3 %	4.6 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	96.140 %	491.386 ppb	54.958 ppb	49.063 ppb	403.777 ppb	53,392.468 ppb	12.814 ppb	34.118 ppb	19.486 ppb
Concentration per Run 1	96.848 %	487.217 ppb	54.479 ppb	47.641 ppb	399.799 ppb	52,581.845 ppb	13.081 ppb	34.365 ppb	19.075 ppb
Concentration per Run 2	95.931 %	481.846 ppb	53.781 ppb	48.248 ppb	398.381 ppb	53,157.142 ppb	12.484 ppb	33.008 ppb	19.405 ppb
Concentration per Run 3	95.642 %	505.097 ppb	56.613 ppb	51.301 ppb	413.152 ppb	54,438.417 ppb	12.877 ppb	34.981 ppb	19.977 ppb
Concentration RSD	0.7 %	2.5 %	2.7 %	4.0 %	2.0 %	1.8 %	2.4 %	3.0 %	2.3 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	100.048 ppb	110.822 %	18.526 ppb	15.477 ppb	305.788 ppb	3.290 ppb	100.313 %	0.058 ppb	0.214 ppb
Concentration per Run 1	99.039 ppb	105.558 %	18.555 ppb	14.135 ppb	300.992 ppb	3.136 ppb	97.068 %	0.060 ppb	0.227 ppb
Concentration per Run 2	99.276 ppb	113.261 %	18.244 ppb	18.045 ppb	308.928 ppb	3.286 ppb	102.334 %	0.052 ppb	0.208 ppb
Concentration per Run 3	101.828 ppb	113.648 %	18.779 ppb	14.250 ppb	307.443 ppb	3.449 ppb	101.535 %	0.063 ppb	0.208 ppb
Concentration RSD	1.5 %	4.1 %	1.5 %	14.4 %	1.4 %	4.8 %	2.8 %	9.5 %	5.2 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	110.732 %	0.684 ppb	0.104 ppb	41.735 ppb	98.210 %	86.222 %	0.245 ppb	17.671 ppb	94.748 %
Concentration per Run 1	105.185 %	0.849 ppb	0.086 ppb	41.021 ppb	94.366 %	83.521 %	0.214 ppb	17.486 ppb	91.747 %
Concentration per Run 2	113.309 %	0.677 ppb	0.100 ppb	41.456 ppb	99.465 %	86.481 %	0.257 ppb	17.760 ppb	95.756 %
Concentration per Run 3	113.701 %	0.527 ppb	0.125 ppb	42.729 ppb	100.799 %	88.666 %	0.264 ppb	17.766 ppb	96.742 %
Concentration RSD	4.3 %	23.5 %	19.3 %	2.1 %	3.5 %	3.0 %	10.9 %	0.9 %	2.8 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 144 Analysis started at: 6/9/2017 2:56:51 PM Rack: 2
 Analysis label: L1717026-19D10 A2-6020T User name: ALPHALAB\metals-instrument Vial: 40

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	99.829 %	112.794 %	0.216 ppb	4,630.713 ppb	1,676.067 ppb	2,458.084 ppb	700.036 ppb	2,888.736 ppb	114.156 %
Concentration per Run 1	100.791 %	109.321 %	0.207 ppb	4,607.161 ppb	1,641.599 ppb	2,456.144 ppb	715.734 ppb	2,941.562 ppb	108.558 %
Concentration per Run 2	99.509 %	114.766 %	0.212 ppb	4,609.159 ppb	1,692.927 ppb	2,475.239 ppb	702.438 ppb	2,937.166 ppb	117.489 %
Concentration per Run 3	99.187 %	114.296 %	0.229 ppb	4,675.817 ppb	1,693.674 ppb	2,442.871 ppb	681.937 ppb	2,787.480 ppb	116.422 %
Concentration RSD	0.8 %	2.7 %	5.3 %	0.8 %	1.8 %	0.7 %	2.4 %	3.0 %	4.3 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	98.460 %	125.282 ppb	11.426 ppb	8.320 ppb	84.588 ppb	9,340.582 ppb	2.164 ppb	3.766 ppb	2.752 ppb
Concentration per Run 1	99.600 %	124.439 ppb	11.352 ppb	8.429 ppb	86.285 ppb	9,427.800 ppb	1.985 ppb	4.038 ppb	3.016 ppb
Concentration per Run 2	97.603 %	125.231 ppb	11.250 ppb	8.098 ppb	84.235 ppb	9,239.855 ppb	2.323 ppb	3.992 ppb	2.513 ppb
Concentration per Run 3	98.178 %	126.175 ppb	11.678 ppb	8.433 ppb	83.246 ppb	9,354.090 ppb	2.186 ppb	3.267 ppb	2.726 ppb
Concentration RSD	1.0 %	0.7 %	2.0 %	2.3 %	1.8 %	1.0 %	7.9 %	11.5 %	9.2 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	14.882 ppb	112.235 %	3.004 ppb	3.182 ppb	21.939 ppb	0.378 ppb	102.831 %	0.010 ppb	0.046 ppb
Concentration per Run 1	14.758 ppb	108.607 %	2.882 ppb	3.120 ppb	21.368 ppb	0.429 ppb	100.817 %	0.011 ppb	0.037 ppb
Concentration per Run 2	15.001 ppb	116.234 %	2.957 ppb	3.214 ppb	22.190 ppb	0.268 ppb	103.036 %	0.016 ppb	0.036 ppb
Concentration per Run 3	14.887 ppb	111.864 %	3.173 ppb	3.212 ppb	22.260 ppb	0.438 ppb	104.639 %	0.004 ppb	0.063 ppb
Concentration RSD	0.8 %	3.4 %	5.0 %	1.7 %	2.3 %	25.3 %	1.9 %	56.6 %	33.3 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	107.838 %	0.052 ppb	0.131 ppb	6.048 ppb	99.519 %	93.299 %	0.080 ppb	6.150 ppb	94.370 %
Concentration per Run 1	105.155 %	0.041 ppb	0.138 ppb	6.061 ppb	95.659 %	90.851 %	0.070 ppb	6.079 ppb	91.347 %
Concentration per Run 2	109.171 %	0.026 ppb	0.129 ppb	6.393 ppb	100.126 %	94.686 %	0.083 ppb	6.109 ppb	96.908 %
Concentration per Run 3	109.187 %	0.090 ppb	0.126 ppb	5.691 ppb	102.773 %	94.361 %	0.088 ppb	6.263 ppb	94.855 %
Concentration RSD	2.2 %	63.9 %	4.8 %	5.8 %	3.6 %	2.3 %	11.2 %	1.6 %	3.0 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 145 Analysis started at: 6/9/2017 2:59:58 PM Rack: 2
 Analysis label: L1717026-20D10 A2-6020T User name: ALPHALAB\metals-instrument Vial: 41

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	101.322 %	114.901 %	0.746 ppb	5,481.992 ppb	3,942.980 ppb	7,892.132 ppb	1,667.225 ppb	1,830.101 ppb	117.684 %
Concentration per Run 1	101.560 %	114.464 %	0.731 ppb	5,456.781 ppb	3,926.235 ppb	7,855.235 ppb	1,706.236 ppb	1,809.536 ppb	117.466 %
Concentration per Run 2	101.990 %	114.699 %	0.749 ppb	5,422.544 ppb	3,867.187 ppb	7,942.491 ppb	1,651.641 ppb	1,852.435 ppb	113.136 %
Concentration per Run 3	100.415 %	115.539 %	0.758 ppb	5,566.650 ppb	4,035.517 ppb	7,878.670 ppb	1,643.798 ppb	1,828.332 ppb	122.449 %
Concentration RSD	0.8 %	0.5 %	1.8 %	1.4 %	2.2 %	0.6 %	2.0 %	1.2 %	4.0 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	100.455 %	202.204 ppb	40.596 ppb	23.899 ppb	145.510 ppb	31,829.163 ppb	5.558 ppb	12.756 ppb	9.994 ppb
Concentration per Run 1	99.930 %	200.039 ppb	40.919 ppb	23.565 ppb	147.204 ppb	31,846.447 ppb	5.741 ppb	12.876 ppb	10.265 ppb
Concentration per Run 2	101.732 %	206.675 ppb	41.085 ppb	24.391 ppb	148.161 ppb	32,309.376 ppb	5.450 ppb	13.649 ppb	10.036 ppb
Concentration per Run 3	99.702 %	199.897 ppb	39.782 ppb	23.742 ppb	141.164 ppb	31,331.667 ppb	5.483 ppb	11.743 ppb	9.680 ppb
Concentration RSD	1.1 %	1.9 %	1.7 %	1.8 %	2.6 %	1.5 %	2.9 %	7.5 %	3.0 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	50.423 ppb	110.922 %	15.600 ppb	6.577 ppb	19.238 ppb	2.022 ppb	104.952 %	0.023 ppb	0.078 ppb
Concentration per Run 1	49.778 ppb	110.889 %	15.701 ppb	6.550 ppb	18.987 ppb	1.948 ppb	105.286 %	0.029 ppb	0.093 ppb
Concentration per Run 2	50.902 ppb	110.877 %	15.386 ppb	7.533 ppb	19.685 ppb	2.086 ppb	104.635 %	0.019 ppb	0.076 ppb
Concentration per Run 3	50.589 ppb	111.000 %	15.711 ppb	5.649 ppb	19.041 ppb	2.033 ppb	104.936 %	0.020 ppb	0.065 ppb
Concentration RSD	1.2 %	0.1 %	1.2 %	14.3 %	2.0 %	3.5 %	0.3 %	22.9 %	17.9 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	112.403 %	0.273 ppb	0.133 ppb	12.740 ppb	101.557 %	93.807 %	0.108 ppb	9.121 ppb	97.921 %
Concentration per Run 1	111.558 %	0.298 ppb	0.128 ppb	13.204 ppb	99.610 %	91.728 %	0.095 ppb	9.110 ppb	96.418 %
Concentration per Run 2	111.174 %	0.232 ppb	0.158 ppb	12.718 ppb	100.892 %	94.972 %	0.104 ppb	9.053 ppb	98.431 %
Concentration per Run 3	114.478 %	0.289 ppb	0.112 ppb	12.298 ppb	104.168 %	94.721 %	0.125 ppb	9.200 ppb	98.914 %
Concentration RSD	1.6 %	13.2 %	17.6 %	3.6 %	2.3 %	1.9 %	14.6 %	0.8 %	1.4 %

Alpha ICPMSQ2 Full

6/10/2017 10:11:47 AM



Analysis index: 146 Analysis started at: 6/9/2017 3:03:04 PM Rack: 2
 Analysis label: L1717026-23D10 A2-6020T User name: ALPHALAB\metals-instrument Vial: 44

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	102.216 %	113.130 %	0.300 ppb	3,737.268 ppb	986.846 ppb	1,888.420 ppb	445.420 ppb	513.569 ppb	114.947 %
Concentration per Run 1	102.412 %	115.640 %	0.308 ppb	3,419.489 ppb	886.000 ppb	1,731.711 ppb	426.721 ppb	464.084 ppb	112.852 %
Concentration per Run 2	101.789 %	111.103 %	0.284 ppb	3,935.328 ppb	1,046.763 ppb	1,970.767 ppb	454.885 ppb	531.486 ppb	114.761 %
Concentration per Run 3	102.447 %	112.649 %	0.309 ppb	3,856.988 ppb	1,027.774 ppb	1,962.781 ppb	454.655 ppb	545.136 ppb	117.228 %
Concentration RSD	0.4 %	2.0 %	4.7 %	7.4 %	8.9 %	7.2 %	3.6 %	8.4 %	1.9 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	101.877 %	111.785 ppb	24.978 ppb	15.678 ppb	63.689 ppb	14,026.932 ppb	3.903 ppb	10.057 ppb	26.319 ppb
Concentration per Run 1	101.880 %	104.152 ppb	23.385 ppb	14.868 ppb	59.683 ppb	13,172.364 ppb	3.784 ppb	9.979 ppb	24.808 ppb
Concentration per Run 2	102.467 %	115.210 ppb	25.711 ppb	16.383 ppb	66.775 ppb	14,531.226 ppb	4.015 ppb	10.045 ppb	27.526 ppb
Concentration per Run 3	101.285 %	115.993 ppb	25.838 ppb	15.781 ppb	64.609 ppb	14,377.208 ppb	3.911 ppb	10.148 ppb	26.624 ppb
Concentration RSD	0.6 %	5.9 %	5.5 %	4.9 %	5.7 %	5.3 %	3.0 %	0.8 %	5.3 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	87.376 ppb	111.110 %	7.552 ppb	1.930 ppb	8.366 ppb	1.427 ppb	105.361 %	0.282 ppb	0.219 ppb
Concentration per Run 1	80.204 ppb	108.598 %	7.557 ppb	1.711 ppb	7.842 ppb	1.432 ppb	105.189 %	0.259 ppb	0.172 ppb
Concentration per Run 2	91.718 ppb	111.195 %	7.410 ppb	2.722 ppb	8.744 ppb	1.496 ppb	105.102 %	0.285 ppb	0.263 ppb
Concentration per Run 3	90.207 ppb	113.536 %	7.689 ppb	1.356 ppb	8.511 ppb	1.352 ppb	105.793 %	0.302 ppb	0.221 ppb
Concentration RSD	7.2 %	2.2 %	1.8 %	36.7 %	5.6 %	5.1 %	0.4 %	7.8 %	20.7 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	111.055 %	2.630 ppb	0.823 ppb	4.805 ppb	103.297 %	96.578 %	0.052 ppb	24.315 ppb	100.980 %
Concentration per Run 1	111.686 %	2.421 ppb	0.699 ppb	4.645 ppb	104.365 %	96.112 %	0.051 ppb	22.129 ppb	100.664 %
Concentration per Run 2	110.301 %	2.709 ppb	0.874 ppb	4.875 ppb	102.319 %	98.013 %	0.049 ppb	25.333 ppb	101.306 %
Concentration per Run 3	111.177 %	2.761 ppb	0.896 ppb	4.894 ppb	103.206 %	95.610 %	0.057 ppb	25.482 ppb	100.969 %
Concentration RSD	0.6 %	7.0 %	13.1 %	2.9 %	1.0 %	1.3 %	7.9 %	7.8 %	0.3 %

Alpha ICPMSQ2 Full

6/10/2017 10:11:47 AM



Analysis index: 147 Analysis started at: 6/9/2017 3:06:12 PM Rack: 2
 Analysis label: WG1007571-6D50 A2-6020T User name: ALPHALAB\metals-instrument Vial: 48

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	100.782 %	114.497 %	0.062 ppb	766.043 ppb	198.355 ppb	376.073 ppb	90.257 ppb	92.574 ppb	117.031 %
Concentration per Run 1	100.638 %	110.800 %	0.058 ppb	780.842 ppb	193.886 ppb	389.245 ppb	90.848 ppb	101.135 ppb	115.331 %
Concentration per Run 2	100.617 %	120.245 %	0.063 ppb	749.663 ppb	195.593 ppb	372.322 ppb	88.067 ppb	79.928 ppb	121.998 %
Concentration per Run 3	101.090 %	112.447 %	0.065 ppb	767.622 ppb	205.585 ppb	366.650 ppb	91.856 ppb	96.660 ppb	113.766 %
Concentration RSD	0.3 %	4.4 %	6.0 %	2.0 %	3.2 %	3.1 %	2.2 %	12.1 %	3.7 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	99.395 %	22.288 ppb	4.987 ppb	3.193 ppb	12.992 ppb	2,813.581 ppb	0.799 ppb	2.006 ppb	5.255 ppb
Concentration per Run 1	100.076 %	23.364 ppb	5.584 ppb	3.320 ppb	13.470 ppb	2,949.476 ppb	0.797 ppb	1.922 ppb	5.481 ppb
Concentration per Run 2	98.769 %	21.061 ppb	4.496 ppb	3.182 ppb	12.227 ppb	2,768.323 ppb	0.799 ppb	2.272 ppb	5.147 ppb
Concentration per Run 3	99.340 %	22.439 ppb	4.880 ppb	3.078 ppb	13.279 ppb	2,722.943 ppb	0.802 ppb	1.824 ppb	5.137 ppb
Concentration RSD	0.7 %	5.2 %	11.1 %	3.8 %	5.1 %	4.3 %	0.3 %	11.7 %	3.7 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	16.951 ppb	112.974 %	1.427 ppb	0.735 ppb	1.632 ppb	0.295 ppb	107.173 %	0.051 ppb	0.067 ppb
Concentration per Run 1	17.574 ppb	107.483 %	1.625 ppb	1.544 ppb	1.766 ppb	0.366 ppb	102.932 %	0.053 ppb	0.090 ppb
Concentration per Run 2	17.087 ppb	118.918 %	1.349 ppb	-0.064 ppb	1.588 ppb	0.281 ppb	111.377 %	0.053 ppb	0.050 ppb
Concentration per Run 3	16.194 ppb	112.520 %	1.308 ppb	0.724 ppb	1.543 ppb	0.239 ppb	107.211 %	0.046 ppb	0.061 ppb
Concentration RSD	4.1 %	5.1 %	12.1 %	109.4 %	7.2 %	21.9 %	3.9 %	7.7 %	31.3 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	113.879 %	0.402 ppb	0.171 ppb	0.942 ppb	102.953 %	97.007 %	0.022 ppb	5.061 ppb	97.971 %
Concentration per Run 1	109.157 %	0.407 ppb	0.184 ppb	1.031 ppb	98.928 %	93.699 %	0.016 ppb	5.439 ppb	94.134 %
Concentration per Run 2	119.322 %	0.390 ppb	0.141 ppb	0.854 ppb	106.714 %	101.288 %	0.023 ppb	4.791 ppb	103.313 %
Concentration per Run 3	113.157 %	0.409 ppb	0.188 ppb	0.942 ppb	103.218 %	96.033 %	0.026 ppb	4.953 ppb	96.464 %
Concentration RSD	4.5 %	2.6 %	15.4 %	9.4 %	3.8 %	4.0 %	23.8 %	6.7 %	4.9 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 148 Analysis started at: 6/9/2017 3:09:19 PM Rack: 0
 Analysis label: CCV User name: ALPHALAB\metals-instrument Vial: 9

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	103.243 %	116.155 %	100.307 ppb	10,911.309 ppb	10,195.341 ppb	107.438 ppb	10,875.373 ppb	10,710.897 ppb	118.968 %
Concentration per Run 1	102.553 %	115.741 %	100.535 ppb	10,714.925 ppb	10,443.697 ppb	110.028 ppb	11,114.269 ppb	11,027.290 ppb	115.247 %
Concentration per Run 2	103.828 %	114.228 %	100.364 ppb	11,192.226 ppb	10,183.674 ppb	108.338 ppb	10,852.742 ppb	10,620.263 ppb	119.779 %
Concentration per Run 3	103.347 %	118.497 %	100.022 ppb	10,826.777 ppb	9,958.652 ppb	103.947 ppb	10,659.108 ppb	10,485.138 ppb	121.879 %
Recovery Percentage 1			100.307 %	109.113 %	101.953 %	107.438 %	108.754 %	107.109 %	
Concentration RSD	0.6 %	1.9 %	0.3 %	2.3 %	2.4 %	2.9 %	2.1 %	2.6 %	2.8 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	102.614 %	104.995 ppb	101.916 ppb	100.663 ppb	102.201 ppb	10,430.263 ppb	103.639 ppb	104.203 ppb	102.438 ppb
Concentration per Run 1	101.821 %	108.421 ppb	105.241 ppb	104.801 ppb	107.795 ppb	10,784.940 ppb	107.755 ppb	109.361 ppb	105.436 ppb
Concentration per Run 2	103.753 %	103.803 ppb	100.952 ppb	99.992 ppb	100.677 ppb	10,240.140 ppb	101.830 ppb	103.589 ppb	102.129 ppb
Concentration per Run 3	102.269 %	102.762 ppb	99.555 ppb	97.196 ppb	98.130 ppb	10,265.710 ppb	101.331 ppb	99.659 ppb	99.751 ppb
Recovery Percentage 1		104.995 %	101.916 %	100.663 %	102.201 %	104.303 %	103.639 %	104.203 %	102.438 %
Concentration RSD	1.0 %	2.9 %	2.9 %	3.8 %	4.9 %	2.9 %	3.4 %	4.7 %	2.8 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	100.458 ppb	114.510 %	101.455 ppb	100.443 ppb	104.452 ppb	104.741 ppb	105.109 %	99.874 ppb	102.264 ppb
Concentration per Run 1	103.916 ppb	111.077 %	103.799 ppb	103.081 ppb	107.236 ppb	107.690 ppb	103.253 %	103.301 ppb	105.006 ppb
Concentration per Run 2	100.181 ppb	115.538 %	100.977 ppb	97.535 ppb	102.904 ppb	103.043 ppb	105.498 %	98.787 ppb	100.852 ppb
Concentration per Run 3	97.277 ppb	116.916 %	99.589 ppb	100.713 ppb	103.216 ppb	103.488 ppb	106.576 %	97.534 ppb	100.933 ppb
Recovery Percentage 1	100.458 %		101.455 %	100.443 %	104.452 %	104.741 %		99.874 %	102.264 %
Concentration RSD	3.3 %	2.7 %	2.1 %	2.8 %	2.3 %	2.4 %	1.6 %	3.0 %	2.3 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	114.764 %	106.672 ppb	102.381 ppb	104.731 ppb	104.722 %	97.195 %	102.265 ppb	100.768 ppb	97.249 %
Concentration per Run 1	110.968 %	109.127 ppb	105.905 ppb	108.869 ppb	101.005 %	94.806 %	102.503 ppb	101.872 ppb	96.097 %
Concentration per Run 2	115.842 %	105.692 ppb	100.509 ppb	103.252 ppb	105.859 %	97.255 %	104.779 ppb	102.302 ppb	95.400 %
Concentration per Run 3	117.481 %	105.198 ppb	100.729 ppb	102.073 ppb	107.303 %	99.523 %	99.513 ppb	98.130 ppb	100.248 %
Recovery Percentage 1		106.672 %	102.381 %	104.731 %			102.265 %	100.768 %	
Concentration RSD	3.0 %	2.0 %	3.0 %	3.5 %	3.2 %	2.4 %	2.6 %	2.3 %	2.7 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 149 Analysis started at: 6/9/2017 3:12:29 PM Rack: 0
 Analysis label: CCB User name: ALPHALAB\metals-instrument Vial: 10

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	101.923 %	112.010 %	0.012 ppb	55.754 ppb	0.510 ppb	0.252 ppb	8.521 ppb	-2.036 ppb	113.544 %
Concentration per Run 1	101.409 %	108.380 %	0.010 ppb	64.797 ppb	0.908 ppb	0.214 ppb	4.064 ppb	0.167 ppb	109.413 %
Concentration per Run 2	101.669 %	113.355 %	0.012 ppb	46.102 ppb	-0.013 ppb	-0.036 ppb	12.368 ppb	-0.679 ppb	116.268 %
Concentration per Run 3	102.690 %	114.296 %	0.013 ppb	56.364 ppb	0.636 ppb	0.578 ppb	9.131 ppb	-5.596 ppb	114.951 %
Recovery Percentage 1			3.912 %	55.754 %	0.729 %	2.521 %	8.521 %	-2.036 %	
Concentration RSD	0.7 %	2.8 %	15.9 %	16.8 %	92.7 %	122.6 %	49.1 %	152.9 %	3.2 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	99.789 %	0.027 ppb	-0.005 ppb	0.011 ppb	0.077 ppb	1.121 ppb	0.009 ppb	-0.015 ppb	0.016 ppb
Concentration per Run 1	100.427 %	0.045 ppb	-0.015 ppb	-0.016 ppb	0.091 ppb	1.897 ppb	-0.005 ppb	-0.053 ppb	-0.030 ppb
Concentration per Run 2	98.808 %	0.006 ppb	0.000 ppb	0.037 ppb	0.044 ppb	0.867 ppb	0.014 ppb	0.029 ppb	0.047 ppb
Concentration per Run 3	100.131 %	0.029 ppb	0.000 ppb	0.013 ppb	0.096 ppb	0.599 ppb	0.018 ppb	-0.021 ppb	0.030 ppb
Recovery Percentage 1		5.324 %	-0.101 %	1.130 %	7.731 %	2.241 %	1.815 %	-0.759 %	1.560 %
Concentration RSD	0.9 %	73.6 %	178.1 %	233.2 %	37.0 %	61.1 %	134.4 %	272.1 %	261.4 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	0.095 ppb	113.962 %	0.034 ppb	-0.359 ppb	-0.004 ppb	0.110 ppb	105.313 %	0.017 ppb	0.009 ppb
Concentration per Run 1	0.199 ppb	106.454 %	0.025 ppb	0.511 ppb	0.000 ppb	0.103 ppb	100.945 %	0.029 ppb	0.005 ppb
Concentration per Run 2	0.108 ppb	116.807 %	0.034 ppb	-0.991 ppb	-0.012 ppb	0.070 ppb	108.355 %	0.014 ppb	0.013 ppb
Concentration per Run 3	-0.023 ppb	118.625 %	0.044 ppb	-0.599 ppb	0.000 ppb	0.157 ppb	106.640 %	0.007 ppb	0.009 ppb
Recovery Percentage 1	0.950 %	113.962 %	6.856 %	-7.190 %	-0.721 %	5.515 %		4.128 %	4.323 %
Concentration RSD	117.4 %	5.8 %	28.8 %	216.7 %	192.9 %	39.8 %	3.7 %	69.5 %	47.4 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	113.459 %	0.138 ppb	0.799 ppb	-0.017 ppb	103.078 %	96.212 %	0.023 ppb	0.021 ppb	97.808 %
Concentration per Run 1	107.316 %	0.077 ppb	0.832 ppb	-0.027 ppb	96.883 %	91.704 %	0.023 ppb	0.021 ppb	95.521 %
Concentration per Run 2	116.188 %	0.150 ppb	0.795 ppb	-0.007 ppb	105.843 %	96.739 %	0.022 ppb	0.019 ppb	99.129 %
Concentration per Run 3	116.875 %	0.187 ppb	0.772 ppb	-0.018 ppb	106.508 %	100.194 %	0.024 ppb	0.024 ppb	98.773 %
Recovery Percentage 1		4.595 %	19.984 %	-3.442 %			4.611 %	4.255 %	97.808 %
Concentration RSD	4.7 %	40.5 %	3.8 %	57.9 %	5.2 %	4.4 %	3.5 %	12.6 %	2.0 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 150 Analysis started at: 6/9/2017 3:15:39 PM Rack: 2
 Analysis label: WG1007571-3D10 A2-6020T User name: ALPHALAB\metals-instrument Vial: 45

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	100.588 %	115.539 %	10.345 ppb	6,029.135 ppb	3,200.772 ppb	3,445.817 ppb	2,595.318 ppb	3,466.506 ppb	116.569 %
Concentration per Run 1	100.042 %	114.800 %	10.353 ppb	5,890.732 ppb	3,122.209 ppb	3,403.072 ppb	2,554.602 ppb	3,360.362 ppb	112.604 %
Concentration per Run 2	101.524 %	117.052 %	10.367 ppb	6,037.535 ppb	3,236.680 ppb	3,435.173 ppb	2,626.505 ppb	3,508.832 ppb	119.958 %
Concentration per Run 3	100.197 %	114.766 %	10.313 ppb	6,159.136 ppb	3,243.426 ppb	3,499.205 ppb	2,604.846 ppb	3,530.325 ppb	117.145 %
Concentration RSD	0.8 %	1.1 %	0.3 %	2.2 %	2.1 %	1.4 %	1.4 %	2.7 %	3.2 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	100.876 %	294.691 ppb	129.374 ppb	55.088 ppb	168.271 ppb	16,300.832 ppb	103.191 ppb	118.117 ppb	77.255 ppb
Concentration per Run 1	99.732 %	292.847 ppb	130.656 ppb	54.635 ppb	169.686 ppb	16,296.723 ppb	101.126 ppb	116.027 ppb	76.867 ppb
Concentration per Run 2	102.529 %	292.335 ppb	126.946 ppb	55.134 ppb	166.047 ppb	16,226.679 ppb	104.443 ppb	118.862 ppb	76.203 ppb
Concentration per Run 3	100.368 %	298.889 ppb	130.519 ppb	55.495 ppb	169.079 ppb	16,379.094 ppb	104.005 ppb	119.462 ppb	78.696 ppb
Concentration RSD	1.5 %	1.2 %	1.6 %	0.8 %	1.2 %	0.5 %	1.7 %	1.6 %	1.7 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	202.355 ppb	112.533 %	35.971 ppb	28.325 ppb	209.929 ppb	188.001 ppb	107.086 %	61.197 ppb	10.802 ppb
Concentration per Run 1	199.404 ppb	109.222 %	34.980 ppb	25.844 ppb	204.931 ppb	178.866 ppb	107.734 %	57.930 ppb	10.408 ppb
Concentration per Run 2	204.923 ppb	115.130 %	36.351 ppb	29.439 ppb	210.343 ppb	195.181 ppb	107.591 %	62.035 ppb	10.926 ppb
Concentration per Run 3	202.737 ppb	113.246 %	36.583 ppb	29.692 ppb	214.511 ppb	189.954 ppb	105.932 %	63.626 ppb	11.072 ppb
Concentration RSD	1.4 %	2.7 %	2.4 %	7.6 %	2.3 %	4.4 %	0.9 %	4.8 %	3.2 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	112.983 %	207.913 ppb	102.387 ppb	419.873 ppb	105.495 %	99.219 %	22.947 ppb	124.767 ppb	101.849 %
Concentration per Run 1	109.379 %	198.582 ppb	98.332 ppb	408.526 ppb	102.532 %	96.412 %	22.791 ppb	119.615 ppb	99.838 %
Concentration per Run 2	116.150 %	209.620 ppb	103.305 ppb	421.454 ppb	108.486 %	100.430 %	23.074 ppb	127.798 ppb	101.433 %
Concentration per Run 3	113.420 %	215.538 ppb	105.524 ppb	429.638 ppb	105.466 %	100.814 %	22.975 ppb	126.889 ppb	104.275 %
Concentration RSD	3.0 %	4.1 %	3.6 %	2.5 %	2.8 %	2.5 %	0.6 %	3.6 %	2.2 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 151 Analysis started at: 6/9/2017 3:18:46 PM Rack: 2
 Analysis label: WG1007571-4D10 A2-6020T User name: ALPHALAB\metals-instrument Vial: 46

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	98.089 %	112.783 %	10.690 ppb	5,913.637 ppb	3,102.709 ppb	3,665.404 ppb	2,670.331 ppb	6,195.280 ppb	113.717 %
Concentration per Run 1	97.770 %	110.968 %	10.658 ppb	5,909.348 ppb	3,087.869 ppb	3,643.690 ppb	2,660.084 ppb	6,135.911 ppb	113.374 %
Concentration per Run 2	99.206 %	111.976 %	10.576 ppb	5,917.903 ppb	3,127.648 ppb	3,647.718 ppb	2,620.767 ppb	6,098.527 ppb	115.271 %
Concentration per Run 3	97.290 %	115.405 %	10.836 ppb	5,913.659 ppb	3,092.609 ppb	3,704.803 ppb	2,730.142 ppb	6,351.403 ppb	112.507 %
Concentration RSD	1.0 %	2.1 %	1.2 %	0.1 %	0.7 %	0.9 %	2.1 %	2.2 %	1.2 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	97.734 %	304.311 ppb	132.670 ppb	57.722 ppb	184.842 ppb	17,764.237 ppb	105.041 ppb	119.064 ppb	77.682 ppb
Concentration per Run 1	96.785 %	302.601 ppb	132.737 ppb	57.954 ppb	183.952 ppb	17,395.077 ppb	102.860 ppb	118.139 ppb	78.356 ppb
Concentration per Run 2	98.240 %	300.691 ppb	131.506 ppb	57.347 ppb	181.340 ppb	17,773.844 ppb	104.849 ppb	117.242 ppb	76.133 ppb
Concentration per Run 3	98.177 %	309.641 ppb	133.766 ppb	57.865 ppb	189.233 ppb	18,123.792 ppb	107.414 ppb	121.812 ppb	78.556 ppb
Concentration RSD	0.8 %	1.5 %	0.9 %	0.6 %	2.2 %	2.1 %	2.2 %	2.0 %	1.7 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	197.254 ppb	111.173 %	34.461 ppb	28.239 ppb	222.821 ppb	190.402 ppb	105.608 %	62.164 ppb	11.171 ppb
Concentration per Run 1	195.969 ppb	109.843 %	34.378 ppb	28.040 ppb	216.738 ppb	188.862 ppb	103.730 %	62.524 ppb	11.077 ppb
Concentration per Run 2	193.588 ppb	112.794 %	32.980 ppb	26.558 ppb	221.993 ppb	192.856 ppb	106.219 %	61.855 ppb	10.933 ppb
Concentration per Run 3	202.206 ppb	110.882 %	36.023 ppb	30.121 ppb	229.731 ppb	189.488 ppb	106.876 %	62.114 ppb	11.503 ppb
Concentration RSD	2.3 %	1.3 %	4.4 %	6.3 %	2.9 %	1.1 %	1.6 %	0.5 %	2.7 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	111.572 %	210.593 ppb	103.545 ppb	426.426 ppb	104.342 %	98.770 %	23.815 ppb	130.495 ppb	101.068 %
Concentration per Run 1	109.402 %	208.670 ppb	104.164 ppb	421.151 ppb	103.652 %	94.174 %	23.095 ppb	126.519 ppb	100.592 %
Concentration per Run 2	113.474 %	210.368 ppb	102.660 ppb	423.853 ppb	105.771 %	103.205 %	23.482 ppb	130.495 ppb	102.491 %
Concentration per Run 3	111.840 %	212.742 ppb	103.811 ppb	434.276 ppb	103.603 %	98.932 %	24.868 ppb	134.469 ppb	100.120 %
Concentration RSD	1.8 %	1.0 %	0.8 %	1.6 %	1.2 %	4.6 %	3.9 %	3.0 %	1.2 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 152 Analysis started at: 6/9/2017 3:21:53 PM Rack: 2
 Analysis label: WG1007571-5D10 A2-6020T User name: ALPHALAB\metals-instrument Vial: 47

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	98.395 %	111.618 %	49.172 ppb	8,851.061 ppb	5,803.355 ppb	1,885.820 ppb	5,520.356 ppb	5,467.615 ppb	115.663 %
Concentration per Run 1	98.337 %	109.624 %	49.086 ppb	9,274.765 ppb	5,960.752 ppb	1,950.604 ppb	5,719.103 ppb	5,617.155 ppb	113.410 %
Concentration per Run 2	97.231 %	111.271 %	48.901 ppb	8,543.021 ppb	5,655.630 ppb	1,845.824 ppb	5,421.964 ppb	5,368.968 ppb	114.714 %
Concentration per Run 3	99.617 %	113.960 %	49.528 ppb	8,735.397 ppb	5,793.684 ppb	1,861.032 ppb	5,420.000 ppb	5,416.723 ppb	118.866 %
Concentration RSD	1.2 %	2.0 %	0.7 %	4.3 %	2.6 %	3.0 %	3.1 %	2.4 %	2.5 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	99.540 %	157.832 ppb	70.056 ppb	62.597 ppb	109.919 ppb	18,231.209 ppb	52.749 ppb	57.942 ppb	73.718 ppb
Concentration per Run 1	99.558 %	164.388 ppb	73.532 ppb	64.873 ppb	113.964 ppb	18,760.081 ppb	54.834 ppb	59.469 ppb	75.827 ppb
Concentration per Run 2	98.986 %	155.113 ppb	68.016 ppb	61.394 ppb	106.864 ppb	18,169.464 ppb	51.901 ppb	57.272 ppb	71.592 ppb
Concentration per Run 3	100.075 %	153.995 ppb	68.621 ppb	61.522 ppb	108.928 ppb	17,764.081 ppb	51.513 ppb	57.084 ppb	73.736 ppb
Concentration RSD	0.5 %	3.6 %	4.3 %	3.2 %	3.3 %	2.7 %	3.4 %	2.3 %	2.9 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	132.839 ppb	110.888 %	55.373 ppb	51.936 ppb	56.367 ppb	50.001 ppb	107.629 %	5.388 ppb	48.789 ppb
Concentration per Run 1	139.214 ppb	107.542 %	57.809 ppb	54.344 ppb	58.052 ppb	51.372 ppb	109.783 %	5.536 ppb	49.021 ppb
Concentration per Run 2	129.209 ppb	109.213 %	53.485 ppb	54.326 ppb	56.377 ppb	50.012 ppb	104.725 %	5.332 ppb	48.745 ppb
Concentration per Run 3	130.094 ppb	115.911 %	54.827 ppb	47.139 ppb	54.671 ppb	48.619 ppb	108.379 %	5.297 ppb	48.600 ppb
Concentration RSD	4.2 %	4.0 %	4.0 %	8.0 %	3.0 %	2.8 %	2.4 %	2.4 %	0.4 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	115.499 %	52.584 ppb	50.426 ppb	53.575 ppb	106.981 %	101.771 %	47.694 ppb	71.838 ppb	102.840 %
Concentration per Run 1	117.663 %	52.435 ppb	50.210 ppb	54.463 ppb	107.433 %	101.915 %	48.428 ppb	73.296 ppb	102.221 %
Concentration per Run 2	112.120 %	52.548 ppb	50.475 ppb	52.751 ppb	104.580 %	100.750 %	47.614 ppb	70.599 ppb	101.074 %
Concentration per Run 3	116.714 %	52.770 ppb	50.592 ppb	53.510 ppb	108.931 %	102.647 %	47.040 ppb	71.618 ppb	105.225 %
Concentration RSD	2.6 %	0.3 %	0.4 %	1.6 %	2.1 %	0.9 %	1.5 %	1.9 %	2.1 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 153 Analysis started at: 6/9/2017 3:25:00 PM Rack: 2
 Analysis label: L1717026-21D10 A2-6020T User name: ALPHALAB\metals-instrument Vial: 49

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	102.394 %	115.461 %	0.638 ppb	4,688.857 ppb	3,352.879 ppb	8,581.764 ppb	1,791.132 ppb	1,475.114 ppb	117.624 %
Concentration per Run 1	101.923 %	116.346 %	0.644 ppb	4,565.053 ppb	3,290.292 ppb	8,444.263 ppb	1,765.152 ppb	1,484.121 ppb	117.845 %
Concentration per Run 2	103.709 %	116.984 %	0.613 ppb	4,698.369 ppb	3,350.394 ppb	8,611.259 ppb	1,785.483 ppb	1,476.255 ppb	118.699 %
Concentration per Run 3	101.550 %	113.052 %	0.658 ppb	4,803.148 ppb	3,417.952 ppb	8,689.768 ppb	1,822.760 ppb	1,464.966 ppb	116.327 %
Concentration RSD	1.1 %	1.8 %	3.6 %	2.5 %	1.9 %	1.5 %	1.6 %	0.7 %	1.0 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	101.930 %	202.214 ppb	32.770 ppb	23.942 ppb	176.799 ppb	26,682.581 ppb	4.845 ppb	12.359 ppb	9.476 ppb
Concentration per Run 1	102.163 %	206.671 ppb	32.419 ppb	23.635 ppb	174.338 ppb	26,571.782 ppb	5.052 ppb	11.969 ppb	9.677 ppb
Concentration per Run 2	100.923 %	203.028 ppb	33.266 ppb	24.300 ppb	179.687 ppb	26,836.838 ppb	4.464 ppb	12.853 ppb	9.376 ppb
Concentration per Run 3	102.703 %	196.942 ppb	32.626 ppb	23.892 ppb	176.371 ppb	26,639.122 ppb	5.019 ppb	12.254 ppb	9.375 ppb
Concentration RSD	0.9 %	2.4 %	1.3 %	1.4 %	1.5 %	0.5 %	6.8 %	3.7 %	1.8 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	38.125 ppb	112.544 %	9.703 ppb	7.698 ppb	18.145 ppb	2.390 ppb	106.718 %	0.029 ppb	0.139 ppb
Concentration per Run 1	37.466 ppb	110.398 %	9.801 ppb	7.244 ppb	18.427 ppb	2.201 ppb	106.859 %	0.025 ppb	0.155 ppb
Concentration per Run 2	38.430 ppb	115.512 %	10.080 ppb	8.065 ppb	17.880 ppb	2.383 ppb	105.552 %	0.034 ppb	0.140 ppb
Concentration per Run 3	38.479 ppb	111.721 %	9.228 ppb	7.786 ppb	18.128 ppb	2.585 ppb	107.743 %	0.028 ppb	0.124 ppb
Concentration RSD	1.5 %	2.4 %	4.5 %	5.4 %	1.5 %	8.0 %	1.0 %	15.8 %	11.3 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	115.142 %	0.492 ppb	0.492 ppb	17.356 ppb	107.259 %	99.420 %	0.189 ppb	9.657 ppb	104.035 %
Concentration per Run 1	115.346 %	0.562 ppb	0.453 ppb	16.209 ppb	106.140 %	99.881 %	0.158 ppb	9.609 ppb	102.902 %
Concentration per Run 2	113.444 %	0.514 ppb	0.505 ppb	17.680 ppb	106.376 %	99.428 %	0.196 ppb	9.709 ppb	104.410 %
Concentration per Run 3	116.635 %	0.401 ppb	0.516 ppb	18.178 ppb	109.261 %	98.951 %	0.213 ppb	9.652 ppb	104.793 %
Concentration RSD	1.4 %	16.7 %	6.9 %	5.9 %	1.6 %	0.5 %	14.9 %	0.5 %	1.0 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 154 Analysis started at: 6/9/2017 3:28:07 PM Rack: 2
 Analysis label: L1717026-22D10 A2-6020T User name: ALPHALAB\metals-instrument Vial: 50

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	100.546 %	115.875 %	0.412 ppb	4,540.369 ppb	1,856.273 ppb	4,679.452 ppb	1,054.979 ppb	622.786 ppb	117.746 %
Concentration per Run 1	100.861 %	114.901 %	0.390 ppb	4,628.833 ppb	1,882.838 ppb	4,710.061 ppb	1,054.852 ppb	640.904 ppb	115.591 %
Concentration per Run 2	101.617 %	118.329 %	0.405 ppb	4,393.462 ppb	1,785.114 ppb	4,554.959 ppb	1,057.597 ppb	610.396 ppb	119.506 %
Concentration per Run 3	99.160 %	114.396 %	0.440 ppb	4,598.813 ppb	1,900.866 ppb	4,773.335 ppb	1,052.487 ppb	617.057 ppb	118.142 %
Concentration RSD	1.3 %	1.8 %	6.3 %	2.8 %	3.4 %	2.4 %	0.2 %	2.6 %	1.7 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	100.560 %	144.346 ppb	19.658 ppb	13.991 ppb	164.824 ppb	18,863.109 ppb	2.578 ppb	6.427 ppb	6.259 ppb
Concentration per Run 1	100.120 %	144.179 ppb	18.998 ppb	13.940 ppb	160.028 ppb	18,588.618 ppb	2.373 ppb	6.084 ppb	6.321 ppb
Concentration per Run 2	102.069 %	143.261 ppb	20.062 ppb	13.946 ppb	164.103 ppb	18,870.065 ppb	2.682 ppb	6.331 ppb	6.337 ppb
Concentration per Run 3	99.490 %	145.597 ppb	19.913 ppb	14.087 ppb	170.340 ppb	19,130.642 ppb	2.678 ppb	6.867 ppb	6.120 ppb
Concentration RSD	1.3 %	0.8 %	2.9 %	0.6 %	3.2 %	1.4 %	6.9 %	6.2 %	1.9 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	22.143 ppb	113.163 %	5.864 ppb	4.900 ppb	11.388 ppb	1.966 ppb	107.576 %	0.016 ppb	0.102 ppb
Concentration per Run 1	22.081 ppb	113.115 %	5.913 ppb	5.615 ppb	11.166 ppb	1.861 ppb	107.426 %	0.023 ppb	0.112 ppb
Concentration per Run 2	21.981 ppb	113.566 %	5.738 ppb	5.281 ppb	11.701 ppb	2.265 ppb	108.306 %	0.009 ppb	0.120 ppb
Concentration per Run 3	22.366 ppb	112.808 %	5.941 ppb	3.803 ppb	11.297 ppb	1.772 ppb	106.996 %	0.016 ppb	0.074 ppb
Concentration RSD	0.9 %	0.3 %	1.9 %	19.7 %	2.4 %	13.3 %	0.6 %	42.8 %	24.2 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	114.754 %	0.307 ppb	0.246 ppb	11.969 ppb	106.495 %	97.786 %	0.109 ppb	7.051 ppb	101.871 %
Concentration per Run 1	115.370 %	0.283 ppb	0.200 ppb	12.265 ppb	106.339 %	96.463 %	0.084 ppb	6.979 ppb	101.432 %
Concentration per Run 2	115.112 %	0.325 ppb	0.264 ppb	11.882 ppb	107.980 %	98.807 %	0.113 ppb	7.022 ppb	102.729 %
Concentration per Run 3	113.780 %	0.313 ppb	0.275 ppb	11.761 ppb	105.164 %	98.087 %	0.128 ppb	7.151 ppb	101.451 %
Concentration RSD	0.7 %	7.0 %	16.4 %	2.2 %	1.3 %	1.2 %	20.6 %	1.3 %	0.7 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 155 Analysis started at: 6/9/2017 3:31:14 PM Rack: 2
 Analysis label: L1717026-24D10 A2-6020T User name: ALPHALAB\metals-instrument Vial: 51

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	100.303 %	110.554 %	0.316 ppb	4,371.667 ppb	996.151 ppb	2,343.197 ppb	451.666 ppb	323.605 ppb	111.982 %
Concentration per Run 1	100.873 %	105.859 %	0.298 ppb	4,632.154 ppb	1,077.118 ppb	2,516.209 ppb	467.223 ppb	334.269 ppb	107.858 %
Concentration per Run 2	101.567 %	113.186 %	0.319 ppb	4,248.704 ppb	964.369 ppb	2,250.745 ppb	433.324 ppb	293.256 ppb	114.785 %
Concentration per Run 3	98.471 %	112.615 %	0.330 ppb	4,234.142 ppb	946.966 ppb	2,262.637 ppb	454.452 ppb	343.291 ppb	113.302 %
Concentration RSD	1.6 %	3.7 %	5.1 %	5.2 %	7.1 %	6.4 %	3.8 %	8.2 %	3.3 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	100.737 %	101.788 ppb	21.735 ppb	9.846 ppb	45.544 ppb	11,264.086 ppb	1.958 ppb	3.117 ppb	2.137 ppb
Concentration per Run 1	99.780 %	108.582 ppb	23.365 ppb	10.436 ppb	48.781 ppb	11,875.053 ppb	2.085 ppb	3.541 ppb	2.307 ppb
Concentration per Run 2	102.012 %	97.734 ppb	21.494 ppb	9.347 ppb	43.734 ppb	10,963.662 ppb	1.853 ppb	2.850 ppb	2.010 ppb
Concentration per Run 3	100.420 %	99.048 ppb	20.348 ppb	9.755 ppb	44.117 ppb	10,953.543 ppb	1.937 ppb	2.960 ppb	2.093 ppb
Concentration RSD	1.1 %	5.8 %	7.0 %	5.6 %	6.2 %	4.7 %	6.0 %	11.9 %	7.2 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	12.465 ppb	109.887 %	5.049 ppb	3.483 ppb	7.973 ppb	0.470 ppb	104.750 %	0.005 ppb	0.030 ppb
Concentration per Run 1	12.300 ppb	104.147 %	5.660 ppb	3.921 ppb	8.242 ppb	0.466 ppb	101.543 %	0.003 ppb	0.028 ppb
Concentration per Run 2	12.257 ppb	113.292 %	4.675 ppb	2.460 ppb	7.839 ppb	0.550 ppb	106.557 %	0.005 ppb	0.017 ppb
Concentration per Run 3	12.838 ppb	112.221 %	4.813 ppb	4.067 ppb	7.837 ppb	0.393 ppb	106.148 %	0.007 ppb	0.043 ppb
Concentration RSD	2.6 %	4.5 %	10.6 %	25.5 %	2.9 %	16.7 %	2.7 %	42.4 %	43.9 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	111.384 %	2.071 ppb	0.183 ppb	4.012 ppb	102.737 %	95.575 %	0.054 ppb	3.970 ppb	97.709 %
Concentration per Run 1	105.566 %	2.126 ppb	0.198 ppb	4.280 ppb	98.905 %	90.145 %	0.048 ppb	4.210 ppb	92.974 %
Concentration per Run 2	113.490 %	2.094 ppb	0.166 ppb	3.914 ppb	103.428 %	96.649 %	0.053 ppb	3.856 ppb	99.253 %
Concentration per Run 3	115.096 %	1.993 ppb	0.184 ppb	3.841 ppb	105.879 %	99.930 %	0.061 ppb	3.844 ppb	100.901 %
Concentration RSD	4.6 %	3.4 %	8.8 %	5.9 %	3.4 %	5.2 %	12.3 %	5.2 %	4.3 %

Alpha ICPMSQ2 Full

6/10/2017 10:11:47 AM



Analysis index: 156 Analysis started at: 6/9/2017 3:34:21 PM Rack: 2
 Analysis label: L1717026-25D10 A2-6020T User name: ALPHALAB\metals-instrument Vial: 52

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	100.344 %	111.405 %	0.028 ppb	5,088.123 ppb	599.945 ppb	173.856 ppb	253.919 ppb	204.059 ppb	116.490 %
Concentration per Run 1	99.005 %	109.086 %	0.030 ppb	5,352.023 ppb	637.255 ppb	179.323 ppb	272.870 ppb	211.839 ppb	112.958 %
Concentration per Run 2	102.076 %	114.262 %	0.026 ppb	5,043.540 ppb	597.461 ppb	177.287 ppb	259.527 ppb	209.862 ppb	118.510 %
Concentration per Run 3	99.950 %	110.867 %	0.027 ppb	4,868.807 ppb	565.119 ppb	164.957 ppb	229.361 ppb	190.477 ppb	118.002 %
Concentration RSD	1.6 %	2.4 %	7.4 %	4.8 %	6.0 %	4.5 %	8.8 %	5.8 %	2.6 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	102.047 %	36.129 ppb	15.303 ppb	2.465 ppb	2.863 ppb	442.368 ppb	0.062 ppb	0.041 ppb	1.341 ppb
Concentration per Run 1	101.466 %	38.225 ppb	15.983 ppb	2.540 ppb	2.869 ppb	466.688 ppb	0.059 ppb	0.049 ppb	1.305 ppb
Concentration per Run 2	103.906 %	35.310 ppb	15.304 ppb	2.364 ppb	2.764 ppb	449.426 ppb	0.079 ppb	0.043 ppb	1.338 ppb
Concentration per Run 3	100.770 %	34.851 ppb	14.621 ppb	2.492 ppb	2.956 ppb	410.990 ppb	0.047 ppb	0.030 ppb	1.381 ppb
Concentration RSD	1.6 %	5.1 %	4.5 %	3.7 %	3.4 %	6.4 %	26.4 %	23.7 %	2.8 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	-0.040 ppb	111.673 %	0.444 ppb	1.354 ppb	4.473 ppb	0.057 ppb	105.117 %	-0.002 ppb	0.007 ppb
Concentration per Run 1	-0.083 ppb	109.214 %	0.518 ppb	0.869 ppb	4.687 ppb	0.027 ppb	102.032 %	-0.005 ppb	0.013 ppb
Concentration per Run 2	-0.082 ppb	112.831 %	0.454 ppb	1.071 ppb	4.394 ppb	0.087 ppb	108.780 %	0.002 ppb	0.000 ppb
Concentration per Run 3	0.045 ppb	112.975 %	0.361 ppb	2.122 ppb	4.338 ppb	0.058 ppb	104.541 %	-0.003 ppb	0.009 ppb
Concentration RSD	185.1 %	1.9 %	17.8 %	49.7 %	4.2 %	52.8 %	3.2 %	167.9 %	92.1 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	113.947 %	-0.027 ppb	0.086 ppb	1.953 ppb	104.196 %	98.407 %	0.030 ppb	2.510 ppb	100.959 %
Concentration per Run 1	111.479 %	-0.007 ppb	0.089 ppb	2.151 ppb	101.040 %	94.744 %	0.020 ppb	2.600 ppb	97.858 %
Concentration per Run 2	117.288 %	-0.032 ppb	0.095 ppb	1.905 ppb	106.315 %	100.234 %	0.031 ppb	2.559 ppb	102.188 %
Concentration per Run 3	113.074 %	-0.041 ppb	0.075 ppb	1.802 ppb	105.233 %	100.242 %	0.037 ppb	2.372 ppb	102.830 %
Concentration RSD	2.6 %	66.9 %	11.8 %	9.2 %	2.7 %	3.2 %	29.0 %	4.8 %	2.7 %

Alpha ICPMSQ2 Full

6/10/2017 10:11:47 AM



Analysis index: 157 Analysis started at: 6/9/2017 3:37:29 PM Rack: 2
 Analysis label: L1717026-26D10 A2-6020T User name: ALPHALAB\metals-instrument Vial: 53

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	101.237 %	112.929 %	0.022 ppb	4,562.423 ppb	546.897 ppb	206.040 ppb	207.998 ppb	209.265 ppb	118.368 %
Concentration per Run 1	102.374 %	112.716 %	0.021 ppb	4,423.670 ppb	523.333 ppb	203.326 ppb	217.785 ppb	201.920 ppb	116.814 %
Concentration per Run 2	100.409 %	113.960 %	0.021 ppb	4,627.160 ppb	559.032 ppb	204.624 ppb	211.362 ppb	183.725 ppb	119.957 %
Concentration per Run 3	100.928 %	112.111 %	0.023 ppb	4,636.439 ppb	558.325 ppb	210.169 ppb	194.846 ppb	242.149 ppb	118.332 %
Concentration RSD	1.0 %	0.8 %	5.5 %	2.6 %	3.7 %	1.8 %	5.7 %	14.3 %	1.3 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	103.069 %	33.249 ppb	8.166 ppb	5.186 ppb	3.017 ppb	784.094 ppb	0.068 ppb	0.075 ppb	1.429 ppb
Concentration per Run 1	103.490 %	31.760 ppb	7.935 ppb	5.205 ppb	3.076 ppb	748.823 ppb	0.061 ppb	0.071 ppb	1.282 ppb
Concentration per Run 2	103.568 %	33.668 ppb	8.378 ppb	5.146 ppb	3.088 ppb	798.911 ppb	0.065 ppb	0.028 ppb	1.415 ppb
Concentration per Run 3	102.147 %	34.320 ppb	8.184 ppb	5.208 ppb	2.886 ppb	804.547 ppb	0.079 ppb	0.127 ppb	1.589 ppb
Concentration RSD	0.8 %	4.0 %	2.7 %	0.7 %	3.7 %	3.9 %	13.2 %	66.2 %	10.8 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	0.271 ppb	113.517 %	0.812 ppb	1.469 ppb	4.428 ppb	0.077 ppb	107.401 %	0.000 ppb	0.068 ppb
Concentration per Run 1	0.286 ppb	110.183 %	0.680 ppb	1.491 ppb	4.293 ppb	0.058 ppb	105.512 %	-0.003 ppb	0.102 ppb
Concentration per Run 2	0.317 ppb	114.842 %	0.961 ppb	1.649 ppb	4.382 ppb	0.086 ppb	108.841 %	0.006 ppb	0.043 ppb
Concentration per Run 3	0.210 ppb	115.527 %	0.797 ppb	1.268 ppb	4.609 ppb	0.087 ppb	107.850 %	-0.003 ppb	0.061 ppb
Concentration RSD	20.4 %	2.6 %	17.4 %	13.0 %	3.7 %	21.6 %	1.6 %	7,714.3 %	43.8 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	113.207 %	-0.011 ppb	0.064 ppb	1.903 ppb	105.666 %	100.801 %	0.021 ppb	3.221 ppb	103.614 %
Concentration per Run 1	111.772 %	0.034 ppb	0.054 ppb	2.047 ppb	103.989 %	99.953 %	0.014 ppb	3.166 ppb	102.173 %
Concentration per Run 2	113.652 %	-0.051 ppb	0.053 ppb	1.833 ppb	106.465 %	100.860 %	0.021 ppb	3.211 ppb	105.198 %
Concentration per Run 3	114.198 %	-0.016 ppb	0.086 ppb	1.828 ppb	106.544 %	101.591 %	0.029 ppb	3.286 ppb	103.472 %
Concentration RSD	1.1 %	386.1 %	29.0 %	6.6 %	1.4 %	0.8 %	36.2 %	1.9 %	1.5 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 158 Analysis started at: 6/9/2017 3:40:36 PM Rack: 2
 Analysis label: L1717026-27D10 A2-6020T User name: ALPHALAB\metals-instrument Vial: 54

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	101.429 %	116.704 %	0.470 ppb	4,380.233 ppb	2,374.555 ppb	5,579.164 ppb	1,240.670 ppb	687.225 ppb	116.260 %
Concentration per Run 1	103.268 %	109.758 %	0.491 ppb	4,436.387 ppb	2,362.193 ppb	5,647.592 ppb	1,255.255 ppb	659.065 ppb	111.630 %
Concentration per Run 2	101.804 %	119.337 %	0.457 ppb	4,353.270 ppb	2,387.070 ppb	5,556.775 ppb	1,226.974 ppb	706.643 ppb	120.515 %
Concentration per Run 3	99.215 %	121.018 %	0.464 ppb	4,351.043 ppb	2,374.401 ppb	5,533.126 ppb	1,239.780 ppb	695.968 ppb	116.635 %
Concentration RSD	2.0 %	5.2 %	3.8 %	1.1 %	0.5 %	1.1 %	1.1 %	3.6 %	3.8 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	101.270 %	141.597 ppb	29.848 ppb	22.058 ppb	76.487 ppb	23,792.909 ppb	3.116 ppb	7.519 ppb	5.913 ppb
Concentration per Run 1	103.270 %	141.685 ppb	30.934 ppb	22.756 ppb	77.447 ppb	24,122.413 ppb	3.103 ppb	6.991 ppb	5.832 ppb
Concentration per Run 2	100.211 %	140.492 ppb	28.987 ppb	21.660 ppb	74.859 ppb	23,066.256 ppb	3.111 ppb	7.612 ppb	5.614 ppb
Concentration per Run 3	100.329 %	142.612 ppb	29.624 ppb	21.757 ppb	77.157 ppb	24,190.058 ppb	3.135 ppb	7.954 ppb	6.294 ppb
Concentration RSD	1.7 %	0.8 %	3.3 %	2.8 %	1.9 %	2.6 %	0.5 %	6.5 %	5.9 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	29.028 ppb	111.588 %	8.979 ppb	4.569 ppb	11.146 ppb	1.584 ppb	106.570 %	0.012 ppb	0.110 ppb
Concentration per Run 1	30.451 ppb	106.335 %	8.981 ppb	5.497 ppb	11.063 ppb	1.500 ppb	101.831 %	0.014 ppb	0.086 ppb
Concentration per Run 2	27.907 ppb	114.437 %	9.057 ppb	4.050 ppb	11.356 ppb	1.502 ppb	109.488 %	0.014 ppb	0.122 ppb
Concentration per Run 3	28.727 ppb	113.993 %	8.898 ppb	4.160 ppb	11.018 ppb	1.751 ppb	108.392 %	0.007 ppb	0.122 ppb
Concentration RSD	4.5 %	4.1 %	0.9 %	17.6 %	1.6 %	9.1 %	3.9 %	33.5 %	19.0 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	115.153 %	0.164 ppb	0.158 ppb	8.957 ppb	106.809 %	102.077 %	0.082 ppb	5.533 ppb	102.846 %
Concentration per Run 1	109.628 %	0.188 ppb	0.163 ppb	9.328 ppb	100.559 %	96.822 %	0.085 ppb	5.535 ppb	98.328 %
Concentration per Run 2	117.855 %	0.166 ppb	0.144 ppb	8.589 ppb	109.980 %	104.196 %	0.079 ppb	5.525 ppb	105.261 %
Concentration per Run 3	117.977 %	0.137 ppb	0.167 ppb	8.955 ppb	109.887 %	105.212 %	0.083 ppb	5.539 ppb	104.951 %
Concentration RSD	4.2 %	15.6 %	7.7 %	4.1 %	5.1 %	4.5 %	3.9 %	0.1 %	3.8 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 159 Analysis started at: 6/9/2017 3:43:43 PM Rack: 0
 Analysis label: CCV User name: ALPHALAB\metals-instrument Vial: 9

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	102.255 %	114.016 %	99.781 ppb	10,795.845 ppb	10,303.278 ppb	109.656 ppb	10,993.702 ppb	10,756.353 ppb	116.465 %
Concentration per Run 1	101.513 %	112.716 %	98.911 ppb	11,251.759 ppb	10,692.760 ppb	114.381 ppb	11,488.267 ppb	11,160.057 ppb	114.975 %
Concentration per Run 2	102.236 %	114.128 %	99.930 ppb	10,801.836 ppb	10,281.862 ppb	109.879 ppb	10,846.586 ppb	10,795.488 ppb	116.196 %
Concentration per Run 3	103.014 %	115.203 %	100.501 ppb	10,333.940 ppb	9,935.211 ppb	104.708 ppb	10,646.252 ppb	10,313.515 ppb	118.225 %
Recovery Percentage 1			99.781 %	107.958 %	103.033 %	109.656 %	109.937 %	107.564 %	
Concentration RSD	0.7 %	1.1 %	0.8 %	4.3 %	3.7 %	4.4 %	4.0 %	3.9 %	1.4 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	102.926 %	106.826 ppb	102.842 ppb	102.309 ppb	103.145 ppb	10,472.974 ppb	103.825 ppb	105.692 ppb	103.998 ppb
Concentration per Run 1	100.473 %	111.932 ppb	105.280 ppb	107.023 ppb	107.356 ppb	10,957.558 ppb	108.318 ppb	108.464 ppb	106.767 ppb
Concentration per Run 2	103.298 %	105.065 ppb	102.188 ppb	101.521 ppb	102.066 ppb	10,335.494 ppb	103.105 ppb	106.437 ppb	105.273 ppb
Concentration per Run 3	105.009 %	103.479 ppb	101.060 ppb	98.385 ppb	100.013 ppb	10,125.871 ppb	100.053 ppb	102.174 ppb	99.953 ppb
Recovery Percentage 1		106.826 %	102.842 %	102.309 %	103.145 %	104.730 %	103.825 %	105.692 %	103.998 %
Concentration RSD	2.2 %	4.2 %	2.1 %	4.3 %	3.7 %	4.1 %	4.0 %	3.0 %	3.4 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	102.190 ppb	110.392 %	102.438 ppb	103.552 ppb	106.087 ppb	106.821 ppb	104.612 %	100.361 ppb	102.733 ppb
Concentration per Run 1	104.643 ppb	109.036 %	106.369 ppb	103.961 ppb	110.145 ppb	110.882 ppb	102.834 %	105.458 ppb	107.336 ppb
Concentration per Run 2	101.355 ppb	110.873 %	101.354 ppb	104.145 ppb	104.327 ppb	105.587 ppb	104.962 %	98.923 ppb	102.656 ppb
Concentration per Run 3	100.573 ppb	111.267 %	99.591 ppb	102.551 ppb	103.790 ppb	103.992 ppb	106.039 %	96.703 ppb	98.208 ppb
Recovery Percentage 1	102.190 %		102.438 %	103.552 %	106.087 %	106.821 %		100.361 %	102.733 %
Concentration RSD	2.1 %	1.1 %	3.4 %	0.8 %	3.3 %	3.4 %	1.6 %	4.5 %	4.4 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	114.302 %	107.302 ppb	101.369 ppb	104.190 ppb	104.883 %	99.998 %	101.592 ppb	101.391 ppb	99.835 %
Concentration per Run 1	111.345 %	111.552 ppb	105.308 ppb	107.593 ppb	101.229 %	95.885 %	104.168 ppb	103.664 ppb	97.288 %
Concentration per Run 2	114.598 %	107.071 ppb	101.533 ppb	104.709 ppb	104.919 %	101.534 %	100.537 ppb	103.009 ppb	99.361 %
Concentration per Run 3	116.962 %	103.283 ppb	97.265 ppb	100.267 ppb	108.501 %	102.575 %	100.070 ppb	97.501 ppb	102.857 %
Recovery Percentage 1		107.302 %	101.369 %	104.190 %			101.592 %	101.391 %	
Concentration RSD	2.5 %	3.9 %	4.0 %	3.5 %	3.5 %	3.6 %	2.2 %	3.3 %	2.8 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 160 Analysis started at: 6/9/2017 3:46:53 PM Rack: 0
 Analysis label: CCB User name: ALPHALAB\metals-instrument Vial: 10

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	99.881 %	111.719 %	0.009 ppb	38.744 ppb	0.390 ppb	0.373 ppb	6.813 ppb	-0.870 ppb	115.375 %
Concentration per Run 1	100.536 %	112.918 %	0.017 ppb	29.048 ppb	0.322 ppb	0.036 ppb	5.414 ppb	1.598 ppb	115.010 %
Concentration per Run 2	99.296 %	109.153 %	-0.002 ppb	53.069 ppb	0.872 ppb	0.478 ppb	7.643 ppb	-2.503 ppb	112.426 %
Concentration per Run 3	99.812 %	113.086 %	0.012 ppb	34.115 ppb	-0.024 ppb	0.606 ppb	7.382 ppb	-1.705 ppb	118.688 %
Recovery Percentage 1			3.066 %	38.744 %	0.558 %	3.734 %	6.813 %	-0.870 %	
Concentration RSD	0.6 %	2.0 %	105.5 %	32.7 %	115.7 %	80.1 %	17.9 %	249.9 %	2.7 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	99.233 %	-0.017 ppb	0.008 ppb	0.026 ppb	0.075 ppb	1.100 ppb	0.002 ppb	-0.023 ppb	-0.006 ppb
Concentration per Run 1	99.530 %	-0.016 ppb	0.008 ppb	-0.008 ppb	0.058 ppb	1.184 ppb	-0.002 ppb	-0.044 ppb	-0.017 ppb
Concentration per Run 2	99.369 %	-0.039 ppb	0.009 ppb	0.055 ppb	0.114 ppb	2.598 ppb	0.002 ppb	-0.005 ppb	0.035 ppb
Concentration per Run 3	98.800 %	0.005 ppb	0.007 ppb	0.032 ppb	0.052 ppb	-0.481 ppb	0.005 ppb	-0.022 ppb	-0.036 ppb
Recovery Percentage 1		-3.347 %	0.162 %	2.604 %	7.500 %	2.201 %	0.326 %	-1.174 %	-0.588 %
Concentration RSD	0.4 %	132.1 %	7.1 %	122.6 %	45.5 %	140.1 %	193.1 %	83.7 %	619.7 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	0.017 ppb	114.131 %	0.046 ppb	-0.394 ppb	0.006 ppb	0.136 ppb	106.748 %	0.013 ppb	0.011 ppb
Concentration per Run 1	0.015 ppb	112.902 %	0.012 ppb	0.127 ppb	-0.003 ppb	0.112 ppb	106.463 %	0.017 ppb	0.017 ppb
Concentration per Run 2	0.000 ppb	113.273 %	0.093 ppb	-0.682 ppb	0.017 ppb	0.163 ppb	104.163 %	0.015 ppb	0.009 ppb
Concentration per Run 3	0.035 ppb	116.220 %	0.034 ppb	-0.626 ppb	0.003 ppb	0.132 ppb	109.618 %	0.006 ppb	0.008 ppb
Recovery Percentage 1	0.170 %	114.131 %	9.231 %	-7.877 %	1.166 %	6.782 %		3.137 %	5.705 %
Concentration RSD	103.7 %	1.6 %	91.0 %	114.6 %	173.7 %	18.8 %	2.6 %	44.3 %	42.9 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	116.386 %	0.158 ppb	0.719 ppb	-0.014 ppb	105.947 %	100.459 %	0.019 ppb	0.020 ppb	101.956 %
Concentration per Run 1	117.186 %	0.162 ppb	0.734 ppb	-0.041 ppb	104.628 %	98.327 %	0.016 ppb	0.021 ppb	98.509 %
Concentration per Run 2	111.078 %	0.164 ppb	0.812 ppb	0.019 ppb	102.660 %	100.580 %	0.020 ppb	0.023 ppb	99.513 %
Concentration per Run 3	120.893 %	0.149 ppb	0.611 ppb	-0.020 ppb	110.552 %	102.472 %	0.022 ppb	0.015 ppb	107.847 %
Recovery Percentage 1		5.278 %	17.979 %	-2.779 %			3.858 %	3.940 %	101.956 %
Concentration RSD	4.3 %	5.0 %	14.1 %	219.4 %	3.9 %	2.1 %	14.3 %	20.8 %	5.0 %

Alpha ICPMSQ2 Full

6/10/2017 10:11:47 AM



Analysis index: 161
Analysis label: WG1011573-1D10 SPLP-6020T

Analysis started at: 6/9/2017 3:50:03 PM
User name: ALPHALAB\metals-instrument

Rack: 2
Vial: 55

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	99.556 %	112.088 %	0.002 ppb	590.671 ppb	11.076 ppb	1.561 ppb	21.848 ppb	39.589 ppb	114.864 %
Concentration per Run 1	99.086 %	111.439 %	0.003 ppb	602.630 ppb	13.039 ppb	1.894 ppb	20.821 ppb	39.499 ppb	113.623 %
Concentration per Run 2	98.781 %	110.934 %	-0.001 ppb	573.050 ppb	10.105 ppb	1.434 ppb	18.719 ppb	30.840 ppb	116.992 %
Concentration per Run 3	100.800 %	113.892 %	0.003 ppb	596.334 ppb	10.085 ppb	1.354 ppb	26.004 ppb	48.427 ppb	113.978 %
Concentration RSD	1.1 %	1.4 %	111.1 %	2.6 %	15.3 %	18.7 %	17.2 %	22.2 %	1.6 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	99.493 %	0.151 ppb	0.024 ppb	0.156 ppb	0.173 ppb	2.189 ppb	0.006 ppb	0.257 ppb	0.150 ppb
Concentration per Run 1	98.548 %	0.111 ppb	0.016 ppb	0.191 ppb	0.196 ppb	2.021 ppb	0.008 ppb	0.300 ppb	0.102 ppb
Concentration per Run 2	98.880 %	0.174 ppb	0.047 ppb	0.137 ppb	0.233 ppb	1.983 ppb	0.005 ppb	0.297 ppb	0.170 ppb
Concentration per Run 3	101.049 %	0.168 ppb	0.008 ppb	0.141 ppb	0.091 ppb	2.563 ppb	0.005 ppb	0.172 ppb	0.178 ppb
Concentration RSD	1.4 %	23.2 %	85.1 %	19.2 %	42.7 %	14.8 %	31.8 %	28.5 %	27.9 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	0.225 ppb	113.025 %	0.035 ppb	-0.209 ppb	0.041 ppb	0.037 ppb	109.529 %	0.029 ppb	0.013 ppb
Concentration per Run 1	0.243 ppb	113.545 %	0.046 ppb	-1.211 ppb	0.009 ppb	0.016 ppb	107.090 %	0.036 ppb	0.009 ppb
Concentration per Run 2	0.126 ppb	111.945 %	0.023 ppb	0.057 ppb	0.032 ppb	0.046 ppb	111.560 %	0.029 ppb	0.004 ppb
Concentration per Run 3	0.306 ppb	113.584 %	0.035 ppb	0.527 ppb	0.081 ppb	0.047 ppb	109.937 %	0.023 ppb	0.026 ppb
Concentration RSD	40.5 %	0.8 %	32.8 %	430.5 %	90.2 %	47.6 %	2.1 %	22.6 %	88.9 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	115.230 %	0.188 ppb	0.325 ppb	1.174 ppb	105.567 %	100.892 %	0.014 ppb	0.029 ppb	108.391 %
Concentration per Run 1	115.945 %	0.175 ppb	0.312 ppb	1.089 ppb	105.692 %	98.880 %	0.006 ppb	0.031 ppb	108.300 %
Concentration per Run 2	116.303 %	0.202 ppb	0.360 ppb	1.241 ppb	106.654 %	102.662 %	0.019 ppb	0.028 ppb	108.090 %
Concentration per Run 3	113.444 %	0.186 ppb	0.303 ppb	1.191 ppb	104.356 %	101.134 %	0.016 ppb	0.030 ppb	108.781 %
Concentration RSD	1.4 %	7.1 %	9.5 %	6.6 %	1.1 %	1.9 %	49.1 %	5.0 %	0.3 %

Alpha ICPMSQ2 Full

6/10/2017 10:11:47 AM



Analysis index: 162
Analysis label: WG1011573-2D10 SPLP-6020T

Analysis started at: 6/9/2017 3:53:10 PM
User name: ALPHALAB\metals-instrument

Rack: 2
Vial: 56

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	99.840 %	112.324 %	5.445 ppb	1,830.749 ppb	1,136.733 ppb	243.567 ppb	1,153.076 ppb	1,224.764 ppb	115.022 %
Concentration per Run 1	99.870 %	111.271 %	5.476 ppb	1,854.443 ppb	1,120.509 ppb	247.562 ppb	1,141.396 ppb	1,204.550 ppb	114.120 %
Concentration per Run 2	99.549 %	116.548 %	5.366 ppb	1,787.755 ppb	1,147.431 ppb	237.600 ppb	1,118.396 ppb	1,226.723 ppb	117.228 %
Concentration per Run 3	100.101 %	109.153 %	5.492 ppb	1,850.049 ppb	1,142.259 ppb	245.540 ppb	1,199.435 ppb	1,243.017 ppb	113.717 %
Concentration RSD	0.3 %	3.4 %	1.3 %	2.0 %	1.3 %	2.2 %	3.6 %	1.6 %	1.7 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	100.586 %	93.589 ppb	54.275 ppb	21.345 ppb	55.177 ppb	119.047 ppb	52.956 ppb	54.103 ppb	27.584 ppb
Concentration per Run 1	100.458 %	93.250 ppb	55.257 ppb	21.077 ppb	57.101 ppb	108.936 ppb	52.820 ppb	54.805 ppb	28.224 ppb
Concentration per Run 2	100.602 %	93.844 ppb	52.968 ppb	20.817 ppb	54.396 ppb	128.386 ppb	52.787 ppb	53.607 ppb	27.417 ppb
Concentration per Run 3	100.699 %	93.673 ppb	54.599 ppb	22.141 ppb	54.036 ppb	119.821 ppb	53.262 ppb	53.896 ppb	27.112 ppb
Concentration RSD	0.1 %	0.3 %	2.2 %	3.3 %	3.0 %	8.2 %	0.5 %	1.2 %	2.1 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	54.183 ppb	113.229 %	13.279 ppb	13.186 ppb	105.263 ppb	103.207 ppb	108.244 %	5.129 ppb	5.705 ppb
Concentration per Run 1	53.677 ppb	112.171 %	13.669 ppb	13.450 ppb	105.523 ppb	103.996 ppb	106.835 %	5.141 ppb	5.861 ppb
Concentration per Run 2	54.347 ppb	113.835 %	12.586 ppb	12.582 ppb	104.819 ppb	102.366 ppb	110.196 %	5.181 ppb	5.498 ppb
Concentration per Run 3	54.524 ppb	113.680 %	13.583 ppb	13.527 ppb	105.447 ppb	103.259 ppb	107.701 %	5.066 ppb	5.756 ppb
Concentration RSD	0.8 %	0.8 %	4.5 %	4.0 %	0.4 %	0.8 %	1.6 %	1.1 %	3.3 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	115.700 %	107.288 ppb	57.088 ppb	218.030 ppb	107.472 %	102.983 %	12.357 ppb	54.366 ppb	105.971 %
Concentration per Run 1	115.958 %	107.698 ppb	56.990 ppb	217.213 ppb	105.731 %	100.401 %	12.447 ppb	54.667 ppb	103.994 %
Concentration per Run 2	115.940 %	105.113 ppb	56.777 ppb	214.263 ppb	108.921 %	102.797 %	12.199 ppb	54.208 ppb	107.514 %
Concentration per Run 3	115.203 %	109.052 ppb	57.497 ppb	222.614 ppb	107.763 %	105.751 %	12.425 ppb	54.222 ppb	106.406 %
Concentration RSD	0.4 %	1.9 %	0.6 %	1.9 %	1.5 %	2.6 %	1.1 %	0.5 %	1.7 %

Alpha ICPMSQ2 Full

6/10/2017 10:11:47 AM



Analysis index: 163
Analysis label: L1717676-02D10 SPLP-6020T

Analysis started at: 6/9/2017 3:56:17 PM
User name: ALPHALAB\metals-instrument

Rack: 2
Vial: 57

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	96.459 %	104.840 %	0.002 ppb	720.653 ppb	33.227 ppb	3.724 ppb	34.786 ppb	450.633 ppb	108.242 %
Concentration per Run 1	95.283 %	98.633 %	0.008 ppb	744.947 ppb	32.007 ppb	4.666 ppb	42.306 ppb	469.010 ppb	101.990 %
Concentration per Run 2	96.813 %	107.573 %	0.002 ppb	716.641 ppb	36.343 ppb	3.819 ppb	33.015 ppb	458.070 ppb	110.313 %
Concentration per Run 3	97.281 %	108.313 %	-0.002 ppb	700.373 ppb	31.331 ppb	2.688 ppb	29.036 ppb	424.821 ppb	112.424 %
Concentration RSD	1.1 %	5.1 %	224.9 %	3.1 %	8.2 %	26.6 %	19.6 %	5.1 %	5.1 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	96.887 %	0.879 ppb	0.035 ppb	0.070 ppb	2.378 ppb	66.983 ppb	0.133 ppb	0.292 ppb	-0.023 ppb
Concentration per Run 1	94.804 %	1.068 ppb	0.038 ppb	0.078 ppb	2.252 ppb	68.713 ppb	0.148 ppb	0.297 ppb	-0.055 ppb
Concentration per Run 2	97.130 %	0.815 ppb	0.025 ppb	0.083 ppb	2.654 ppb	69.104 ppb	0.141 ppb	0.233 ppb	-0.015 ppb
Concentration per Run 3	98.727 %	0.753 ppb	0.041 ppb	0.050 ppb	2.229 ppb	63.131 ppb	0.109 ppb	0.346 ppb	0.002 ppb
Concentration RSD	2.0 %	19.0 %	23.6 %	25.2 %	10.1 %	5.0 %	15.6 %	19.3 %	128.6 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	-0.073 ppb	107.037 %	0.074 ppb	-0.267 ppb	3.621 ppb	0.118 ppb	103.175 %	0.059 ppb	0.005 ppb
Concentration per Run 1	0.004 ppb	99.135 %	0.079 ppb	0.471 ppb	3.622 ppb	0.119 ppb	96.665 %	0.057 ppb	0.005 ppb
Concentration per Run 2	-0.057 ppb	110.650 %	0.059 ppb	-0.335 ppb	3.762 ppb	0.096 ppb	107.582 %	0.064 ppb	0.000 ppb
Concentration per Run 3	-0.166 ppb	111.325 %	0.083 ppb	-0.939 ppb	3.478 ppb	0.138 ppb	105.278 %	0.057 ppb	0.009 ppb
Concentration RSD	117.9 %	6.4 %	17.1 %	264.6 %	3.9 %	17.9 %	5.6 %	7.2 %	96.4 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	109.051 %	0.065 ppb	0.274 ppb	7.021 ppb	101.227 %	97.084 %	0.083 ppb	0.084 ppb	100.985 %
Concentration per Run 1	100.980 %	0.108 ppb	0.303 ppb	7.220 ppb	93.929 %	90.399 %	0.055 ppb	0.097 ppb	94.385 %
Concentration per Run 2	111.547 %	-0.025 ppb	0.307 ppb	7.208 ppb	104.920 %	99.220 %	0.093 ppb	0.082 ppb	103.773 %
Concentration per Run 3	114.625 %	0.111 ppb	0.212 ppb	6.636 ppb	104.832 %	101.633 %	0.102 ppb	0.074 ppb	104.796 %
Concentration RSD	6.6 %	119.7 %	19.8 %	4.8 %	6.2 %	6.1 %	29.7 %	14.0 %	5.7 %

Alpha ICPMSQ2 Full

6/10/2017 10:11:47 AM



Analysis index: 164
Analysis label: WG1011573-4D10 SPLP-6020T

Analysis started at: 6/9/2017 3:59:25 PM
User name: ALPHALAB\metals-instrument

Rack: 2
Vial: 58

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	98.165 %	112.772 %	0.001 ppb	676.228 ppb	32.341 ppb	3.356 ppb	26.411 ppb	471.741 ppb	111.780 %
Concentration per Run 1	97.882 %	111.439 %	0.003 ppb	694.657 ppb	35.028 ppb	2.739 ppb	26.560 ppb	471.771 ppb	108.807 %
Concentration per Run 2	99.273 %	113.556 %	0.000 ppb	661.526 ppb	29.773 ppb	3.283 ppb	27.422 ppb	465.554 ppb	113.112 %
Concentration per Run 3	97.339 %	113.321 %	0.000 ppb	672.502 ppb	32.222 ppb	4.045 ppb	25.252 ppb	477.896 ppb	113.421 %
Concentration RSD	1.0 %	1.0 %	183.4 %	2.5 %	8.1 %	19.6 %	4.1 %	1.3 %	2.3 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	98.201 %	0.861 ppb	0.014 ppb	0.022 ppb	3.042 ppb	63.768 ppb	0.125 ppb	0.151 ppb	-0.007 ppb
Concentration per Run 1	98.327 %	0.755 ppb	0.034 ppb	0.011 ppb	2.861 ppb	66.147 ppb	0.126 ppb	0.106 ppb	-0.013 ppb
Concentration per Run 2	98.513 %	0.850 ppb	0.008 ppb	0.050 ppb	2.937 ppb	65.791 ppb	0.114 ppb	0.209 ppb	-0.001 ppb
Concentration per Run 3	97.764 %	0.979 ppb	0.001 ppb	0.006 ppb	3.328 ppb	59.367 ppb	0.136 ppb	0.138 ppb	-0.007 ppb
Concentration RSD	0.4 %	13.1 %	122.2 %	109.1 %	8.2 %	6.0 %	9.0 %	34.9 %	91.4 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	-0.196 ppb	111.575 %	0.102 ppb	-0.273 ppb	3.572 ppb	0.037 ppb	108.518 %	-0.004 ppb	0.003 ppb
Concentration per Run 1	-0.159 ppb	108.823 %	0.072 ppb	-0.961 ppb	3.587 ppb	0.042 ppb	105.589 %	-0.004 ppb	0.004 ppb
Concentration per Run 2	-0.311 ppb	115.372 %	0.091 ppb	0.107 ppb	3.479 ppb	0.031 ppb	110.893 %	-0.004 ppb	0.000 ppb
Concentration per Run 3	-0.118 ppb	110.530 %	0.142 ppb	0.036 ppb	3.649 ppb	0.040 ppb	109.072 %	-0.003 ppb	0.004 ppb
Concentration RSD	51.9 %	3.0 %	35.6 %	218.8 %	2.4 %	15.7 %	2.5 %	12.8 %	86.6 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	113.905 %	-0.064 ppb	0.207 ppb	7.128 ppb	105.808 %	102.541 %	0.028 ppb	0.063 ppb	105.875 %
Concentration per Run 1	111.809 %	-0.051 ppb	0.183 ppb	7.248 ppb	103.821 %	100.326 %	0.017 ppb	0.064 ppb	103.329 %
Concentration per Run 2	115.643 %	-0.036 ppb	0.230 ppb	7.255 ppb	107.045 %	104.494 %	0.029 ppb	0.060 ppb	108.345 %
Concentration per Run 3	114.263 %	-0.107 ppb	0.207 ppb	6.881 ppb	106.559 %	102.804 %	0.036 ppb	0.065 ppb	105.951 %
Concentration RSD	1.7 %	57.9 %	11.4 %	3.0 %	1.6 %	2.0 %	35.1 %	4.5 %	2.4 %

Alpha ICPMSQ2 Full

6/10/2017 10:11:47 AM



Analysis index: 165
Analysis label: WG1011573-3D10 SPLP-6020T

Analysis started at: 6/9/2017 4:02:32 PM
User name: ALPHALAB\metals-instrument

Rack: 2
Vial: 59

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	96.764 %	107.159 %	4.838 ppb	1,794.749 ppb	1,066.173 ppb	232.288 ppb	1,074.231 ppb	1,524.875 ppb	108.728 %
Concentration per Run 1	96.484 %	102.935 %	4.900 ppb	1,784.938 ppb	1,052.912 ppb	235.033 ppb	1,078.791 ppb	1,515.898 ppb	104.183 %
Concentration per Run 2	97.597 %	109.355 %	4.808 ppb	1,810.071 ppb	1,090.783 ppb	234.127 ppb	1,073.009 ppb	1,548.151 ppb	110.313 %
Concentration per Run 3	96.211 %	109.187 %	4.804 ppb	1,789.237 ppb	1,054.825 ppb	227.703 ppb	1,070.894 ppb	1,510.576 ppb	111.689 %
Concentration RSD	0.8 %	3.4 %	1.1 %	0.7 %	2.0 %	1.7 %	0.4 %	1.3 %	3.7 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	98.699 %	89.569 ppb	49.739 ppb	19.821 ppb	52.665 ppb	171.950 ppb	48.968 ppb	48.574 ppb	24.655 ppb
Concentration per Run 1	97.853 %	90.911 ppb	49.627 ppb	19.996 ppb	53.522 ppb	180.006 ppb	49.211 ppb	48.213 ppb	24.991 ppb
Concentration per Run 2	100.824 %	90.321 ppb	50.456 ppb	19.722 ppb	52.879 ppb	165.061 ppb	48.816 ppb	48.165 ppb	24.983 ppb
Concentration per Run 3	97.420 %	87.477 ppb	49.133 ppb	19.744 ppb	51.594 ppb	170.784 ppb	48.877 ppb	49.345 ppb	23.992 ppb
Concentration RSD	1.9 %	2.1 %	1.3 %	0.8 %	1.9 %	4.4 %	0.4 %	1.4 %	2.3 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	48.808 ppb	107.649 %	11.990 ppb	12.246 ppb	102.280 ppb	97.039 ppb	105.094 %	4.801 ppb	5.182 ppb
Concentration per Run 1	49.543 ppb	99.656 %	12.092 ppb	12.234 ppb	103.830 ppb	98.278 ppb	100.585 %	4.840 ppb	5.030 ppb
Concentration per Run 2	48.284 ppb	110.923 %	12.509 ppb	13.209 ppb	101.181 ppb	97.806 ppb	108.520 %	4.755 ppb	5.332 ppb
Concentration per Run 3	48.596 ppb	112.367 %	11.368 ppb	11.297 ppb	101.829 ppb	95.033 ppb	106.178 %	4.808 ppb	5.183 ppb
Concentration RSD	1.3 %	6.5 %	4.8 %	7.8 %	1.4 %	1.8 %	3.9 %	0.9 %	2.9 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	110.408 %	98.726 ppb	52.344 ppb	204.902 ppb	102.920 %	100.123 %	11.529 ppb	50.894 ppb	101.457 %
Concentration per Run 1	103.847 %	98.689 ppb	52.469 ppb	204.380 ppb	97.300 %	95.139 %	11.682 ppb	50.192 ppb	97.379 %
Concentration per Run 2	113.763 %	99.732 ppb	52.703 ppb	202.849 ppb	104.876 %	101.778 %	11.219 ppb	50.533 ppb	104.986 %
Concentration per Run 3	113.615 %	97.756 ppb	51.860 ppb	207.476 ppb	106.585 %	103.452 %	11.685 ppb	51.958 ppb	102.006 %
Concentration RSD	5.1 %	1.0 %	0.8 %	1.2 %	4.8 %	4.4 %	2.3 %	1.8 %	3.8 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 166
Analysis label: WG1011573-5D10 SPLP-6020T

Analysis started at: 6/9/2017 4:05:39 PM
User name: ALPHALAB\metals-instrument
Rack: 2
Vial: 60

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	100.011 %	111.528 %	47.506 ppb	6,083.666 ppb	5,062.303 ppb	57.077 ppb	5,442.100 ppb	5,889.691 ppb	113.069 %
Concentration per Run 1	100.312 %	106.431 %	47.579 ppb	6,422.694 ppb	5,395.172 ppb	60.828 ppb	5,788.816 ppb	6,229.662 ppb	107.727 %
Concentration per Run 2	99.556 %	113.086 %	47.278 ppb	5,999.454 ppb	5,055.464 ppb	57.099 ppb	5,359.586 ppb	5,818.807 ppb	113.883 %
Concentration per Run 3	100.165 %	115.069 %	47.660 ppb	5,828.849 ppb	4,736.274 ppb	53.305 ppb	5,177.897 ppb	5,620.603 ppb	117.596 %
Concentration RSD	0.4 %	4.1 %	0.4 %	5.0 %	6.5 %	6.6 %	5.8 %	5.3 %	4.4 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	102.897 %	53.028 ppb	50.496 ppb	50.859 ppb	54.663 ppb	5,225.491 ppb	52.002 ppb	52.781 ppb	50.720 ppb
Concentration per Run 1	103.396 %	55.010 ppb	53.476 ppb	53.316 ppb	56.716 ppb	5,553.707 ppb	54.373 ppb	54.120 ppb	53.000 ppb
Concentration per Run 2	102.499 %	52.623 ppb	49.873 ppb	50.399 ppb	54.384 ppb	5,169.328 ppb	51.195 ppb	52.642 ppb	49.898 ppb
Concentration per Run 3	102.797 %	51.452 ppb	48.138 ppb	48.861 ppb	52.890 ppb	4,953.438 ppb	50.439 ppb	51.582 ppb	49.262 ppb
Concentration RSD	0.4 %	3.4 %	5.4 %	4.4 %	3.5 %	5.8 %	4.0 %	2.4 %	3.9 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	51.357 ppb	109.636 %	49.452 ppb	48.224 ppb	54.321 ppb	51.506 ppb	107.111 %	5.448 ppb	50.589 ppb
Concentration per Run 1	53.553 ppb	105.167 %	51.646 ppb	47.995 ppb	56.428 ppb	53.920 ppb	105.144 %	5.666 ppb	52.734 ppb
Concentration per Run 2	50.872 ppb	112.153 %	48.337 ppb	45.976 ppb	54.051 ppb	50.722 ppb	105.684 %	5.426 ppb	49.842 ppb
Concentration per Run 3	49.645 ppb	111.590 %	48.371 ppb	50.700 ppb	52.484 ppb	49.876 ppb	110.504 %	5.254 ppb	49.192 ppb
Concentration RSD	3.9 %	3.5 %	3.8 %	4.9 %	3.7 %	4.1 %	2.8 %	3.8 %	3.7 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	113.773 %	51.990 ppb	51.395 ppb	57.451 ppb	106.575 %	103.218 %	48.653 ppb	48.929 ppb	105.850 %
Concentration per Run 1	110.098 %	53.629 ppb	54.295 ppb	59.755 ppb	103.350 %	98.638 %	50.365 ppb	51.893 ppb	99.201 %
Concentration per Run 2	115.789 %	51.293 ppb	50.543 ppb	56.587 ppb	107.538 %	103.269 %	49.060 ppb	48.558 ppb	107.396 %
Concentration per Run 3	115.431 %	51.047 ppb	49.346 ppb	56.010 ppb	108.836 %	107.747 %	46.535 ppb	46.335 ppb	110.952 %
Concentration RSD	2.8 %	2.7 %	5.0 %	3.5 %	2.7 %	4.4 %	4.0 %	5.7 %	5.7 %

Alpha ICPMSQ2 Full

6/10/2017 10:11:47 AM



Analysis index: 167
Analysis label: WG1011573-6D50 SPLP-6020T

Analysis started at: 6/9/2017 4:08:47 PM
User name: ALPHALAB\metals-instrument

Rack: 3
Vial: 1

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	97.376 %	105.344 %	0.003 ppb	167.602 ppb	5.528 ppb	0.455 ppb	1.802 ppb	85.940 ppb	109.767 %
Concentration per Run 1	98.744 %	98.801 %	0.001 ppb	172.076 ppb	7.396 ppb	0.107 ppb	-1.338 ppb	80.042 ppb	106.316 %
Concentration per Run 2	97.057 %	107.775 %	0.004 ppb	156.831 ppb	5.597 ppb	1.060 ppb	6.419 ppb	83.170 ppb	112.863 %
Concentration per Run 3	96.328 %	109.456 %	0.005 ppb	173.897 ppb	3.593 ppb	0.198 ppb	0.324 ppb	94.607 ppb	110.123 %
Concentration RSD	1.3 %	5.4 %	52.1 %	5.6 %	34.4 %	115.7 %	226.7 %	8.9 %	3.0 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	98.439 %	0.196 ppb	0.023 ppb	0.003 ppb	0.466 ppb	10.676 ppb	0.031 ppb	0.070 ppb	-0.061 ppb
Concentration per Run 1	100.004 %	0.195 ppb	0.027 ppb	0.050 ppb	0.325 ppb	13.263 ppb	0.024 ppb	0.059 ppb	-0.093 ppb
Concentration per Run 2	97.224 %	0.194 ppb	0.041 ppb	-0.026 ppb	0.555 ppb	8.521 ppb	0.032 ppb	0.049 ppb	-0.050 ppb
Concentration per Run 3	98.089 %	0.198 ppb	0.001 ppb	-0.015 ppb	0.517 ppb	10.243 ppb	0.036 ppb	0.101 ppb	-0.041 ppb
Concentration RSD	1.4 %	1.2 %	88.3 %	1,337.2 %	26.5 %	22.5 %	20.1 %	39.4 %	45.3 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	-0.368 ppb	108.566 %	0.041 ppb	-0.055 ppb	0.748 ppb	0.080 ppb	104.657 %	0.008 ppb	0.000 ppb
Concentration per Run 1	-0.459 ppb	103.624 %	0.051 ppb	0.207 ppb	0.771 ppb	0.044 ppb	101.742 %	0.009 ppb	0.000 ppb
Concentration per Run 2	-0.348 ppb	109.595 %	0.036 ppb	0.081 ppb	0.760 ppb	0.115 ppb	105.389 %	0.004 ppb	0.000 ppb
Concentration per Run 3	-0.297 ppb	112.477 %	0.035 ppb	-0.453 ppb	0.711 ppb	0.080 ppb	106.840 %	0.011 ppb	0.000 ppb
Concentration RSD	22.5 %	4.2 %	21.6 %	638.2 %	4.3 %	44.0 %	2.5 %	45.9 %	N/A

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	112.609 %	-0.004 ppb	0.376 ppb	1.409 ppb	103.915 %	101.027 %	0.066 ppb	0.021 ppb	103.329 %
Concentration per Run 1	108.213 %	0.056 ppb	0.382 ppb	1.397 ppb	99.639 %	96.943 %	0.049 ppb	0.028 ppb	100.899 %
Concentration per Run 2	115.258 %	0.006 ppb	0.337 ppb	1.193 ppb	106.215 %	103.353 %	0.064 ppb	0.015 ppb	105.218 %
Concentration per Run 3	114.356 %	-0.074 ppb	0.409 ppb	1.637 ppb	105.891 %	102.787 %	0.083 ppb	0.019 ppb	103.871 %
Concentration RSD	3.4 %	1,615.5 %	9.6 %	15.8 %	3.6 %	3.5 %	26.4 %	31.8 %	2.1 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 168 Analysis started at: 6/9/2017 4:11:55 PM Rack: 0
 Analysis label: CCV User name: ALPHALAB\metals-instrument Vial: 9

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	96.763 %	105.938 %	99.703 ppb	10,970.619 ppb	10,120.049 ppb	105.422 ppb	10,756.641 ppb	10,573.863 ppb	110.906 %
Concentration per Run 1	96.361 %	103.776 %	100.005 ppb	10,872.829 ppb	10,003.493 ppb	102.467 ppb	10,817.351 ppb	10,525.302 ppb	104.774 %
Concentration per Run 2	98.068 %	105.389 %	99.379 ppb	10,995.197 ppb	10,088.803 ppb	106.547 ppb	10,731.064 ppb	10,471.821 ppb	115.354 %
Concentration per Run 3	95.862 %	108.649 %	99.725 ppb	11,043.833 ppb	10,267.853 ppb	107.253 ppb	10,721.508 ppb	10,724.466 ppb	112.590 %
Recovery Percentage 1			99.703 %	109.706 %	101.200 %	105.422 %	107.566 %	105.739 %	
Concentration RSD	1.2 %	2.3 %	0.3 %	0.8 %	1.3 %	2.5 %	0.5 %	1.3 %	4.9 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	97.866 %	103.434 ppb	100.067 ppb	100.315 ppb	102.767 ppb	10,108.185 ppb	101.804 ppb	101.114 ppb	101.338 ppb
Concentration per Run 1	97.823 %	104.010 ppb	99.553 ppb	99.611 ppb	103.167 ppb	10,045.739 ppb	100.813 ppb	101.011 ppb	99.997 ppb
Concentration per Run 2	97.965 %	102.412 ppb	99.810 ppb	99.170 ppb	100.767 ppb	10,028.384 ppb	100.255 ppb	99.391 ppb	100.782 ppb
Concentration per Run 3	97.809 %	103.882 ppb	100.837 ppb	102.164 ppb	104.368 ppb	10,250.433 ppb	104.345 ppb	102.940 ppb	103.234 ppb
Recovery Percentage 1		103.434 %	100.067 %	100.315 %	102.767 %	101.082 %	101.804 %	101.114 %	101.338 %
Concentration RSD	0.1 %	0.9 %	0.7 %	1.6 %	1.8 %	1.2 %	2.2 %	1.8 %	1.7 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	97.783 ppb	109.491 %	97.530 ppb	101.169 ppb	101.034 ppb	102.583 ppb	104.617 %	97.223 ppb	99.894 ppb
Concentration per Run 1	97.220 ppb	102.965 %	97.944 ppb	99.668 ppb	99.956 ppb	103.113 ppb	98.828 %	97.861 ppb	98.831 ppb
Concentration per Run 2	97.027 ppb	114.150 %	98.000 ppb	101.576 ppb	101.462 ppb	101.803 ppb	107.931 %	95.575 ppb	100.953 ppb
Concentration per Run 3	99.103 ppb	111.358 %	96.647 ppb	102.263 ppb	101.683 ppb	102.834 ppb	107.092 %	98.233 ppb	99.898 ppb
Recovery Percentage 1	97.783 %		97.530 %	101.169 %	101.034 %	102.583 %		97.223 %	99.894 %
Concentration RSD	1.2 %	5.3 %	0.8 %	1.3 %	0.9 %	0.7 %	4.8 %	1.5 %	1.1 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	113.280 %	102.641 ppb	95.771 ppb	100.883 ppb	105.492 %	100.565 %	100.260 ppb	99.721 ppb	100.920 %
Concentration per Run 1	107.500 %	102.808 ppb	96.000 ppb	101.703 ppb	100.888 %	97.401 %	100.235 ppb	98.734 ppb	97.506 %
Concentration per Run 2	117.131 %	101.209 ppb	94.959 ppb	99.195 ppb	106.573 %	100.410 %	99.126 ppb	100.700 ppb	102.213 %
Concentration per Run 3	115.209 %	103.905 ppb	96.353 ppb	101.751 ppb	109.014 %	103.884 %	101.421 ppb	99.730 ppb	103.040 %
Recovery Percentage 1		102.641 %	95.771 %	100.883 %			100.260 %	99.721 %	
Concentration RSD	4.5 %	1.3 %	0.8 %	1.4 %	4.0 %	3.2 %	1.1 %	1.0 %	3.0 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 169 Analysis started at: 6/9/2017 4:15:04 PM Rack: 0
 Analysis label: CCB User name: ALPHALAB\metals-instrument Vial: 10

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	98.892 %	109.299 %	0.010 ppb	20.947 ppb	-0.015 ppb	-0.061 ppb	2.898 ppb	-1.317 ppb	109.863 %
Concentration per Run 1	97.326 %	106.565 %	0.009 ppb	26.346 ppb	-0.433 ppb	-0.015 ppb	2.509 ppb	0.771 ppb	105.736 %
Concentration per Run 2	100.299 %	110.329 %	0.009 ppb	16.973 ppb	0.202 ppb	-0.060 ppb	4.681 ppb	1.455 ppb	111.084 %
Concentration per Run 3	99.051 %	111.002 %	0.013 ppb	19.521 ppb	0.186 ppb	-0.108 ppb	1.503 ppb	-6.177 ppb	112.768 %
Recovery Percentage 1			3.446 %	20.947 %	-0.021 %	-0.610 %	2.898 %	-1.317 %	
Concentration RSD	1.5 %	2.2 %	21.3 %	23.1 %	2.447.4 %	76.4 %	56.1 %	320.7 %	3.3 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	99.304 %	0.016 ppb	0.018 ppb	0.030 ppb	0.042 ppb	0.903 ppb	0.000 ppb	0.005 ppb	0.021 ppb
Concentration per Run 1	97.211 %	0.011 ppb	0.036 ppb	0.076 ppb	0.076 ppb	1.108 ppb	0.006 ppb	0.115 ppb	0.055 ppb
Concentration per Run 2	100.890 %	0.031 ppb	-0.007 ppb	-0.037 ppb	0.030 ppb	0.937 ppb	-0.005 ppb	-0.069 ppb	0.034 ppb
Concentration per Run 3	99.812 %	0.007 ppb	0.025 ppb	0.052 ppb	0.019 ppb	0.665 ppb	-0.002 ppb	-0.030 ppb	-0.025 ppb
Recovery Percentage 1		3.286 %	0.355 %	3.015 %	4.160 %	1.806 %	-0.035 %	0.267 %	2.141 %
Concentration RSD	1.9 %	79.2 %	126.5 %	197.3 %	73.2 %	24.7 %	3,121.4 %	1,817.2 %	192.6 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	0.035 ppb	110.205 %	0.028 ppb	-0.492 ppb	-0.009 ppb	0.139 ppb	105.232 %	0.008 ppb	0.006 ppb
Concentration per Run 1	0.042 ppb	103.278 %	0.025 ppb	0.209 ppb	-0.025 ppb	0.160 ppb	103.655 %	0.011 ppb	0.018 ppb
Concentration per Run 2	0.020 ppb	115.219 %	0.034 ppb	-1.023 ppb	-0.013 ppb	0.136 ppb	106.271 %	0.007 ppb	0.000 ppb
Concentration per Run 3	0.043 ppb	112.118 %	0.023 ppb	-0.661 ppb	0.011 ppb	0.121 ppb	105.769 %	0.006 ppb	0.000 ppb
Recovery Percentage 1	0.348 %	110.205 %	5.539 %	-9.841 %	-1.863 %	6.950 %		1.961 %	2.991 %
Concentration RSD	36.6 %	5.6 %	20.8 %	128.7 %	196.6 %	14.1 %	1.3 %	35.5 %	173.2 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	114.104 %	0.171 ppb	0.872 ppb	-0.002 ppb	105.093 %	101.305 %	0.027 ppb	0.021 ppb	102.057 %
Concentration per Run 1	110.105 %	0.100 ppb	0.837 ppb	0.008 ppb	101.516 %	97.594 %	0.023 ppb	0.027 ppb	97.209 %
Concentration per Run 2	114.517 %	0.164 ppb	0.929 ppb	0.005 ppb	106.361 %	101.430 %	0.026 ppb	0.019 ppb	103.290 %
Concentration per Run 3	117.691 %	0.247 ppb	0.849 ppb	-0.019 ppb	107.403 %	104.893 %	0.030 ppb	0.017 ppb	105.671 %
Recovery Percentage 1		5.684 %	21.791 %	-0.377 %			5.313 %	4.200 %	102.057 %
Concentration RSD	3.3 %	43.3 %	5.7 %	778.5 %	3.0 %	3.6 %	13.1 %	23.9 %	4.3 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 170 Analysis started at: 6/9/2017 4:18:14 PM Rack: 4
 Analysis label: LLCCV User name: ALPHALAB\metals-instrument Vial: 51

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	99.789 %	106.812 %	0.312 ppb	141.245 ppb	74.356 ppb	12.319 ppb	115.234 ppb	103.793 ppb	109.969 %
Concentration per Run 1	98.402 %	106.061 %	0.343 ppb	151.656 ppb	80.341 ppb	13.361 ppb	122.060 ppb	109.979 ppb	104.585 %
Concentration per Run 2	100.798 %	107.103 %	0.271 ppb	141.586 ppb	72.625 ppb	11.966 ppb	114.053 ppb	113.538 ppb	113.610 %
Concentration per Run 3	100.166 %	107.271 %	0.321 ppb	130.493 ppb	70.103 ppb	11.629 ppb	109.590 ppb	87.862 ppb	111.712 %
Recovery Percentage 1			103.914 %	141.245 %	106.223 %	123.187 %	115.234 %	103.793 %	
Concentration RSD	1.2 %	0.6 %	11.9 %	7.5 %	7.2 %	7.5 %	5.5 %	13.4 %	4.3 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	100.279 %	0.602 ppb	5.306 ppb	0.526 ppb	1.122 ppb	55.831 ppb	0.532 ppb	1.958 ppb	1.089 ppb
Concentration per Run 1	98.925 %	0.624 ppb	5.671 ppb	0.581 ppb	1.218 ppb	57.423 ppb	0.601 ppb	2.061 ppb	1.268 ppb
Concentration per Run 2	101.401 %	0.813 ppb	5.153 ppb	0.482 ppb	1.057 ppb	56.257 ppb	0.536 ppb	1.872 ppb	0.971 ppb
Concentration per Run 3	100.512 %	0.370 ppb	5.095 ppb	0.514 ppb	1.092 ppb	53.814 ppb	0.461 ppb	1.941 ppb	1.029 ppb
Recovery Percentage 1		120.444 %	106.129 %	105.118 %	112.230 %	111.663 %	106.478 %	97.904 %	108.941 %
Concentration RSD	1.3 %	36.9 %	6.0 %	9.6 %	7.6 %	3.3 %	13.2 %	4.9 %	14.4 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	9.879 ppb	111.248 %	0.518 ppb	4.868 ppb	0.491 ppb	2.032 ppb	105.837 %	0.393 ppb	0.244 ppb
Concentration per Run 1	10.837 ppb	105.038 %	0.612 ppb	4.647 ppb	0.507 ppb	1.998 ppb	102.048 %	0.414 ppb	0.238 ppb
Concentration per Run 2	9.298 ppb	114.436 %	0.448 ppb	6.021 ppb	0.424 ppb	2.034 ppb	108.154 %	0.380 ppb	0.213 ppb
Concentration per Run 3	9.501 ppb	114.270 %	0.495 ppb	3.935 ppb	0.543 ppb	2.062 ppb	107.308 %	0.384 ppb	0.280 ppb
Recovery Percentage 1	98.787 %		103.665 %	97.358 %	98.275 %	101.579 %		98.157 %	121.817 %
Concentration RSD	8.5 %	4.8 %	16.4 %	21.8 %	12.4 %	1.6 %	3.1 %	4.6 %	13.9 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	113.089 %	3.274 ppb	4.309 ppb	0.468 ppb	104.978 %	100.293 %	0.546 ppb	0.526 ppb	102.461 %
Concentration per Run 1	108.048 %	3.411 ppb	4.468 ppb	0.375 ppb	99.532 %	94.715 %	0.564 ppb	0.562 ppb	98.609 %
Concentration per Run 2	116.256 %	3.306 ppb	4.331 ppb	0.546 ppb	107.970 %	103.842 %	0.533 ppb	0.517 ppb	105.328 %
Concentration per Run 3	114.962 %	3.104 ppb	4.128 ppb	0.482 ppb	107.431 %	102.322 %	0.541 ppb	0.499 ppb	103.447 %
Recovery Percentage 1		109.125 %	107.729 %	93.550 %			109.184 %	105.204 %	
Concentration RSD	3.9 %	4.8 %	4.0 %	18.4 %	4.5 %	4.9 %	3.0 %	6.2 %	3.4 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 171 Analysis started at: 6/9/2017 4:21:25 PM Rack: 0
 Analysis label: CCV User name: ALPHALAB\metals-instrument Vial: 9

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	100.437 %	110.117 %	99.256 ppb	10,980.709 ppb	10,139.637 ppb	108.972 ppb	10,692.553 ppb	10,449.884 ppb	116.089 %
Concentration per Run 1	101.202 %	105.826 %	98.717 ppb	11,185.557 ppb	10,235.985 ppb	109.105 ppb	10,630.098 ppb	10,311.900 ppb	118.498 %
Concentration per Run 2	100.228 %	114.027 %	99.435 ppb	10,767.518 ppb	9,985.387 ppb	104.347 ppb	10,679.676 ppb	10,539.201 ppb	115.188 %
Concentration per Run 3	99.880 %	110.498 %	99.618 ppb	10,989.051 ppb	10,197.537 ppb	113.465 ppb	10,767.885 ppb	10,498.552 ppb	114.583 %
Recovery Percentage 1			99.256 %	109.807 %	101.396 %	108.972 %	106.926 %	104.499 %	
Concentration RSD	0.7 %	3.7 %	0.5 %	1.9 %	1.3 %	4.2 %	0.7 %	1.2 %	1.8 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	100.758 %	102.875 ppb	99.916 ppb	100.373 ppb	102.987 ppb	10,217.181 ppb	101.839 ppb	101.955 ppb	103.155 ppb
Concentration per Run 1	101.820 %	101.710 ppb	99.384 ppb	98.141 ppb	100.142 ppb	10,026.009 ppb	98.951 ppb	101.407 ppb	103.192 ppb
Concentration per Run 2	100.193 %	104.270 ppb	100.599 ppb	103.263 ppb	104.450 ppb	10,303.387 ppb	103.403 ppb	102.043 ppb	102.902 ppb
Concentration per Run 3	100.262 %	102.646 ppb	99.764 ppb	99.716 ppb	104.369 ppb	10,322.146 ppb	103.164 ppb	102.414 ppb	103.370 ppb
Recovery Percentage 1		102.875 %	99.916 %	100.373 %	102.987 %	102.172 %	101.839 %	101.955 %	103.155 %
Concentration RSD	0.9 %	1.3 %	0.6 %	2.6 %	2.4 %	1.6 %	2.5 %	0.5 %	0.2 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	100.213 ppb	110.415 %	99.049 ppb	100.551 ppb	103.495 ppb	103.228 ppb	107.389 %	98.030 ppb	101.260 ppb
Concentration per Run 1	99.819 ppb	108.051 %	99.619 ppb	104.908 ppb	103.124 ppb	102.927 ppb	107.654 %	96.740 ppb	102.099 ppb
Concentration per Run 2	100.072 ppb	111.079 %	100.363 ppb	99.002 ppb	103.842 ppb	102.462 ppb	107.001 %	98.541 ppb	99.777 ppb
Concentration per Run 3	100.749 ppb	112.116 %	97.164 ppb	97.745 ppb	103.519 ppb	104.295 ppb	107.512 %	98.810 ppb	101.904 ppb
Recovery Percentage 1	100.213 %		99.049 %	100.551 %	103.495 %	103.228 %		98.030 %	101.260 %
Concentration RSD	0.5 %	1.9 %	1.7 %	3.8 %	0.3 %	0.9 %	0.3 %	1.1 %	1.3 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	116.758 %	104.909 ppb	102.034 ppb	103.361 ppb	108.342 %	103.907 %	99.902 ppb	98.076 ppb	105.114 %
Concentration per Run 1	115.483 %	104.945 ppb	102.156 ppb	103.853 ppb	106.649 %	99.909 %	102.747 ppb	97.910 ppb	103.044 %
Concentration per Run 2	118.259 %	104.915 ppb	101.048 ppb	102.332 ppb	109.329 %	106.378 %	98.862 ppb	98.448 ppb	105.055 %
Concentration per Run 3	116.531 %	104.866 ppb	102.898 ppb	103.898 ppb	109.047 %	105.432 %	98.097 ppb	97.869 ppb	107.243 %
Recovery Percentage 1		104.909 %	102.034 %	103.361 %			99.902 %	98.076 %	
Concentration RSD	1.2 %	0.0 %	0.9 %	0.9 %	1.4 %	3.4 %	2.5 %	0.3 %	2.0 %

Alpha ICPMSQ2 Full



6/10/2017 10:11:47 AM

Analysis index: 172 Analysis started at: 6/9/2017 4:24:35 PM Rack: 0
 Analysis label: CCB User name: ALPHALAB\metals-instrument Vial: 10

Category	6Li (STD AGD)	6Li (KED AGD)	9Be (STD AGD)	23Na (KED AGD)	24Mg (KED AGD)	27Al (KED AGD)	39K (KED AGD)	44Ca (KED AGD)	45Sc (KED AGD)
Concentration average	99.988 %	109.332 %	0.006 ppb	20.907 ppb	0.194 ppb	-0.093 ppb	6.089 ppb	-3.506 ppb	113.235 %
Concentration per Run 1	100.295 %	107.137 %	0.001 ppb	22.398 ppb	0.529 ppb	0.191 ppb	10.891 ppb	-9.285 ppb	115.876 %
Concentration per Run 2	99.361 %	112.514 %	0.010 ppb	12.322 ppb	0.178 ppb	-0.027 ppb	0.276 ppb	0.536 ppb	112.365 %
Concentration per Run 3	100.306 %	108.347 %	0.008 ppb	28.001 ppb	-0.124 ppb	-0.442 ppb	7.100 ppb	-1.768 ppb	111.463 %
Recovery Percentage 1			2.117 %	20.907 %	0.278 %	-0.925 %	6.089 %	-3.506 %	
Concentration RSD	0.5 %	2.6 %	71.3 %	38.0 %	167.9 %	347.8 %	88.3 %	146.5 %	2.1 %

Category	45Sc (STD AGD)	48Ti (KED AGD)	51V (KED AGD)	52Cr (KED AGD)	55Mn (KED AGD)	57Fe (KED AGD)	59Co (KED AGD)	60Ni (KED AGD)	65Cu (KED AGD)
Concentration average	101.577 %	0.011 ppb	-0.010 ppb	0.026 ppb	0.079 ppb	0.759 ppb	0.000 ppb	-0.043 ppb	0.048 ppb
Concentration per Run 1	102.239 %	0.041 ppb	-0.015 ppb	0.021 ppb	0.039 ppb	0.111 ppb	0.002 ppb	-0.042 ppb	0.047 ppb
Concentration per Run 2	102.714 %	-0.004 ppb	-0.015 ppb	0.026 ppb	0.093 ppb	0.663 ppb	-0.005 ppb	-0.056 ppb	0.026 ppb
Concentration per Run 3	99.779 %	-0.004 ppb	0.001 ppb	0.030 ppb	0.105 ppb	1.503 ppb	0.002 ppb	-0.030 ppb	0.069 ppb
Recovery Percentage 1		2.169 %	-0.200 %	2.571 %	7.920 %	1.518 %	-0.083 %	-2.143 %	4.751 %
Concentration RSD	1.6 %	237.5 %	92.9 %	17.1 %	44.0 %	92.4 %	929.9 %	30.2 %	45.0 %

Category	66Zn (KED AGD)	74Ge (KED AGD)	75As (KED AGD)	78Se (KED AGD)	88Sr (KED AGD)	95Mo (KED AGD)	103Rh (KED AGD)	107Ag (KED AGD)	111Cd (KED AGD)
Concentration average	0.101 ppb	111.314 %	0.032 ppb	-0.367 ppb	0.018 ppb	0.141 ppb	107.498 %	0.007 ppb	0.006 ppb
Concentration per Run 1	-0.004 ppb	107.518 %	0.037 ppb	0.219 ppb	0.026 ppb	0.115 ppb	105.627 %	0.007 ppb	0.000 ppb
Concentration per Run 2	0.103 ppb	113.021 %	0.023 ppb	-0.762 ppb	-0.012 ppb	0.159 ppb	107.408 %	0.007 ppb	0.008 ppb
Concentration per Run 3	0.204 ppb	113.402 %	0.035 ppb	-0.559 ppb	0.041 ppb	0.149 ppb	109.460 %	0.007 ppb	0.008 ppb
Recovery Percentage 1	1.009 %	111.314 %	6.307 %	-7.344 %	3.679 %	7.043 %		1.783 %	2.794 %
Concentration RSD	103.1 %	3.0 %	22.9 %	141.1 %	151.1 %	16.3 %	1.8 %	4.2 %	86.6 %

Category	115In (KED AGD)	118Sn (KED AGD)	121Sb (KED AGD)	137Ba (KED AGD)	159Tb (KED AGD)	175Lu (KED AGD)	205Tl (KED AGD)	208Pb (KED AGD)	209Bi (KED AGD)
Concentration average	117.848 %	0.113 ppb	0.902 ppb	-0.008 ppb	107.356 %	102.353 %	0.016 ppb	0.014 ppb	105.514 %
Concentration per Run 1	115.260 %	0.117 ppb	0.916 ppb	0.005 ppb	104.725 %	99.508 %	0.017 ppb	0.015 ppb	102.157 %
Concentration per Run 2	120.006 %	0.161 ppb	0.906 ppb	0.002 ppb	110.601 %	105.282 %	0.015 ppb	0.014 ppb	105.663 %
Concentration per Run 3	118.277 %	0.061 ppb	0.885 ppb	-0.030 ppb	106.741 %	102.269 %	0.015 ppb	0.013 ppb	108.722 %
Recovery Percentage 1		3.762 %	22.557 %	-1.501 %			3.170 %	2.873 %	105.514 %
Concentration RSD	2.0 %	44.2 %	1.7 %	260.1 %	2.8 %	2.8 %	6.6 %	7.4 %	3.1 %



Sample Preparation



METALS ELN REPORT

Workgroup: WG1007571

Digestion

Prep Method	Acid Type 1	Acid 1 Lot	Acid Type 2	Acid 2 Lot	Spike Type	Lims Spike Lot	Spike Lot	Post Spike Spikelot	Spike Lot	Srm Spikelot	Use Srm For Use Srm For Use Srm For Use Srm For			
										Lcs				
EPA 3050B	HNO3	C795261	HNO3	C688235	METALS	METSPIKE2	FPS1720161	METPSMS	IPS1720161	D091-540	Y	141,15		
							425MG		250MG					

Additional Reagent/Std

AG1716191405MG

MIX1719121425MG

Sample/ Type	Digestion Date	Analyst	Sample Weight g	Balance Id	Spike Amt ml	Start Date/Time	Hot Block Unit	Temperature (C)	Stop Date/Time	Final Vol	Comments
L1717026-21 SOIL	05/26/17 18:48	Fatima Cofie	1.266	25		05/26/17 18:48	4	95.1	05/26/17 19:48	50	
L1717026-22 SOIL	05/26/17 18:48	Fatima Cofie	1.281	25		05/26/17 18:48	4	95.1	05/26/17 19:48	50	
L1717026-23 SOIL	05/26/17 18:48	Fatima Cofie	1.263	25		05/26/17 18:48	4	95.1	05/26/17 19:48	50	
L1717026-24 SOIL	05/26/17 18:48	Fatima Cofie	1.311	25		05/26/17 18:48	4	95.1	05/26/17 19:48	50	
L1717026-25 SOIL	05/26/17 18:48	Fatima Cofie	1.307	25		05/26/17 18:48	4	95.1	05/26/17 19:48	50	
L1717026-26 SOIL	05/26/17 18:48	Fatima Cofie	1.296	25		05/26/17 18:48	4	95.1	05/26/17 19:48	50	
L1717026-27 SOIL	05/26/17 18:48	Fatima Cofie	1.253	25		05/26/17 18:48	4	95.1	05/26/17 19:48	50	
WG1007571-1 BLANK	05/26/17 18:48	Fatima Cofie	1.250	25		05/26/17 18:48	4	95.1	05/26/17 19:48	50	
WG1007571-2 LCS	05/26/17 18:48	Fatima Cofie	.388	25	.388	05/26/17 18:48	4	95.1	05/26/17 19:48	50	
WG1007571-3 MS	05/26/17 18:48	Fatima Cofie	1.313	25	1	05/26/17 18:48	4	95.1	05/26/17 19:48	50	
WG1007571-4 MSD	05/26/17 18:48	Fatima Cofie	1.298	25	1	05/26/17 18:48	4	95.1	05/26/17 19:48	50	



METALS ELN REPORT

Workgroup: WG1007571

Sample/ Type	Digestion Date	Analyst	Sample Weight g	Balance Id	Spike Amt ml	Start Date/Time	Hot Block Unit	Temperature (C)	Stop Date/Time	Final Vol	Comments
WG1007571- 5 PS	05/26/17 18:48	Fatima Cofie	1.263	25		05/26/17 18:48	4	95.1	05/26/17 19:48	50	
WG1007571- 6 SERDIL	05/26/17 18:48	Fatima Cofie	1.263	25		05/26/17 18:48	4	95.1	05/26/17 19:48	50	

Reagent	Actual Volume	Units
Nitric Acid (HNO3)	1	ml
Hydrochloric Acid (HCl)	3	ml



METALS ELN REPORT

Workgroup: WG1008707

Digestion

Prep Method	Acid Type	1	Acid 1 Lot	Spike Type	Lims Spike Lot	Spike Lot	Post Spike Spikelot	Spike Lot	Pipette Id
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EPA 3020A	1:1 HNO3	tHNO317223METALS 01215PE	METSPIKE2	FPS,IPS,MIXMETPSMS	FPS,IPS,MIX140
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Additional Reagent/Std	HCl	tHCL1718051333PE
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Sample/ Type	Digestion Date	Analyst	Sample Vol ml	Ph	Spike Amt ml	Start Date/Time	Hot Block Unit	Temperature (C)	Stop Date/Time	Final Vol	Comments
L1715898-01 SAMP	06/01/17 06:15	Joshua Mertens	50	<2		06/01/17 06:15	7	93.9	06/01/17 09:15	50	SOME PARTICULATE
L1717026-28 WATER	06/01/17 06:15	Joshua Mertens	50	<2		06/01/17 06:15	7	93.9	06/01/17 09:15	50	
L1717026-29 WATER	06/01/17 06:15	Joshua Mertens	50	<2		06/01/17 06:15	7	93.9	06/01/17 09:15	50	
L1717285-18 SAMP	06/01/17 06:15	Joshua Mertens	50	<2		06/01/17 06:15	7	93.9	06/01/17 09:15	50	
WG1008707-1 BLANK	06/01/17 06:15	Joshua Mertens	50	<2		06/01/17 06:15	7	93.9	06/01/17 09:15	50	FPS172016142 5MG;IPS17201 61250MG;MIX1 719121425MG
WG1008707-2 LCS	06/01/17 06:15	Joshua Mertens	50	<2	.5	06/01/17 06:15	7	93.9	06/01/17 09:15	50	1mL OF 1:1 HNO3 ADDED TO EVERY VESSELE
WG1008707-3 MS	06/01/17 06:15	Joshua Mertens	50	<2	.5	06/01/17 06:15	7	93.9	06/01/17 09:15	50	0.5mL OF 1:1 HCL ADDED TO EVERY VESSELE
WG1008707-4 DUP	06/01/17 06:15	Joshua Mertens	50	<2		06/01/17 06:15	7	93.9	06/01/17 09:15	50	
WG1008707-5 PS	06/01/17 06:15	Joshua Mertens	50	<2		06/01/17 06:15	7	93.9	06/01/17 09:15	50	
WG1008707-6 SERDIL	06/01/17 06:15	Joshua Mertens	50	<2		06/01/17 06:15	7	93.9	06/01/17 09:15	50	



METALS ELN REPORT

Workgroup: WG1008707

Reagent	Actual Volume	Units
Nitric Acid (HNO ₃)	0	ml



METALS ELN REPORT

Workgroup: WG1007570

Digestion

Prep Method	Acid Type 1	Acid 1 Lot	Acid Type 2	Acid 2 Lot	Spike Type	Lims Spike Lot	Spike Lot	Post Spike Spikelot	Spike Lot	Srm Spikelot	Use Srm For Lcs	Use Srm For	Use Srm For	Use Srm For
EPA 3050B	HNO3	C795261	HNO3	C688235	METALS	METSPIKE2	FPS1720161 425MG	METPSMS	IPS1720161 250MG	D091-540	Y	141,15		

Additional Reagent/Std

AG1716191405MG

MIX1719121425MG

Sample/ Type	Digestion Date	Analyst	Sample Weight g	Balance Id	Spike Amt ml	Start Date/Time	Hot Block Unit	Temperature (C)	Stop Date/Time	Final Vol	Comments
L1717026-01 SOIL	05/26/17 18:48	Fatima Cofie	1.262	25		05/26/17 18:48	4	95.1	05/26/17 19:48	50	
L1717026-02 SOIL	05/26/17 18:48	Fatima Cofie	1.291	25		05/26/17 18:48	4	95.1	05/26/17 19:48	50	
L1717026-03 SOIL	05/26/17 18:48	Fatima Cofie	1.263	25		05/26/17 18:48	4	95.1	05/26/17 19:48	50	
L1717026-04 SOIL	05/26/17 18:48	Fatima Cofie	1.297	25		05/26/17 18:48	4	95.1	05/26/17 19:48	50	
L1717026-05 SOIL	05/26/17 18:48	Fatima Cofie	1.281	25		05/26/17 18:48	4	95.1	05/26/17 19:48	50	
L1717026-06 SOIL	05/26/17 18:48	Fatima Cofie	1.250	25		05/26/17 18:48	4	95.1	05/26/17 19:48	50	
L1717026-07 SOIL	05/26/17 18:48	Fatima Cofie	1.303	25		05/26/17 18:48	4	95.1	05/26/17 19:48	50	
L1717026-08 SOIL	05/26/17 18:48	Fatima Cofie	1.307	25		05/26/17 18:48	4	95.1	05/26/17 19:48	50	
L1717026-09 SOIL	05/26/17 18:48	Fatima Cofie	1.268	25		05/26/17 18:48	4	95.1	05/26/17 19:48	50	
L1717026-10 SOIL	05/26/17 18:48	Fatima Cofie	1.252	25		05/26/17 18:48	4	95.1	05/26/17 19:48	50	
L1717026-11 SOIL	05/26/17 18:48	Fatima Cofie	1.299	25		05/26/17 18:48	4	95.1	05/26/17 19:48	50	
L1717026-12 SOIL	05/26/17 18:48	Fatima Cofie	1.301	25		05/26/17 18:48	4	95.1	05/26/17 19:48	50	
L1717026-13 SOIL	05/26/17 18:48	Fatima Cofie	1.276	25		05/26/17 18:48	4	95.1	05/26/17 19:48	50	



METALS ELN REPORT

Workgroup: WG1007570

Sample/ Type	Digestion Date	Analyst	Sample Weight g	Balance Id	Spike Amt ml	Start Date/Time	Hot Block Unit	Temperature (C)	Stop Date/Time	Final Vol	Comments
L1717026-14 SOIL	05/26/17 18:48	Fatima Cofie	1.281	25		05/26/17 18:48	4	95.1	05/26/17 19:48	50	
L1717026-15 SOIL	05/26/17 18:48	Fatima Cofie	1.312	25		05/26/17 18:48	4	95.1	05/26/17 19:48	50	
L1717026-16 SOIL	05/26/17 18:48	Fatima Cofie	1.271	25		05/26/17 18:48	4	95.1	05/26/17 19:48	50	
L1717026-17 SOIL	05/26/17 18:48	Fatima Cofie	1.258	25		05/26/17 18:48	4	95.1	05/26/17 19:48	50	
L1717026-18 SOIL	05/26/17 18:48	Fatima Cofie	1.313	25		05/26/17 18:48	4	95.1	05/26/17 19:48	50	
L1717026-19 SOIL	05/26/17 18:48	Fatima Cofie	1.274	25		05/26/17 18:48	4	95.1	05/26/17 19:48	50	
L1717026-20 SOIL	05/26/17 18:48	Fatima Cofie	1.275	25		05/26/17 18:48	4	95.1	05/26/17 19:48	50	
WG1007570-1 BLANK	05/26/17 18:48	Fatima Cofie	1.250	25		05/26/17 18:48	4	95.1	05/26/17 19:48	50	
WG1007570-2 LCS	05/26/17 18:48	Fatima Cofie	.389	25	.389	05/26/17 18:48	4	95.1	05/26/17 19:48	50	
WG1007570-3 MS	05/26/17 18:48	Fatima Cofie	1.291	25	1	05/26/17 18:48	4	95.1	05/26/17 19:48	50	
WG1007570-4 MSD	05/26/17 18:48	Fatima Cofie	1.276	25	1	05/26/17 18:48	4	95.1	05/26/17 19:48	50	
WG1007570-5 PS	05/26/17 18:48	Fatima Cofie	1.281	25		05/26/17 18:48	4	95.1	05/26/17 19:48	50	
WG1007570-6 SERDIL	05/26/17 18:48	Fatima Cofie	1.281	25		05/26/17 18:48	4	95.1	05/26/17 19:48	50	



METALS ELN REPORT

Workgroup: WG1007570

Reagent	Actual Volume	Units
Nitric Acid (HNO ₃)	1	ml
Hydrochloric Acid (HCl)	3	ml

True Values

Table IV: Initial Calibration Levels and ICV/CCV Concentrations

Analyte	STD1	STD2	ICV,CCV
	(µg/L)	(µg/L)	(µg/L)
Ag		100	50
Al	10050		5050
As	100		50
B	100		50
Ba		100	50
Be	100		50
Ca	10100		5050
Cd	100		50
Co	100		50
Cr	100		50
Cu	100		50
Fe	10100		5050
K	10000		5500
Mg	10100		5050
Mn	100		50
Mo	100		50
Na	10000		5050
Ni	100		50
Pb	100		50
Sb	100		50
Se	100		50
Si	50		25
Sn	100		50
Sr	100		50
Ti	100		50
Tl	100		50
V	100		50
Zn	100		50
W	1	100	50

Interferent ICSA, ICSAB	(mg/L)
Cl ⁻	2000
Ca	300
Fe, Na	250
Al, Mg, P, K, S	100
C	200
Mo, Ti	2

All analyte concentrations in ICSAB = 100 ppb except for Ag and Ba = 50 ppb

Table IV: Initial Calibration Levels and ICV/CCV Concentrations (MCP)

Analyte	STD1	STD2	STD3	STD4	STD5	ICV,CCV
			(µg/L)	(µg/L)		(µg/L)
Ag	0.2		10		100	50
Al	10	10000		20000		10100
As	0.5	100		1000		100
B	1	100		1000		100
Ba	1	100		1000		100
Be	0.3	100		1000		100
Ca	100	10000		20000		10100
Cd	0.2	100		1000		100
Co	0.2	100		1000		100
Cr	0.5	100		1000		100
Cu	0.5	100		1000		100
Fe	10	10000		20000		10100
K	100	10000		20000		11000
Mg	100	10000		20000		10100
Mn	10	100		1000		100
Mo	1	100		1000		100
Na	100	10000		20000		10100
Ni	0.5	100		1000		100
Pb	0.2	100		1000		100
Sb	0.5	10		100		50
Se	1	100		1000		100
Si	10	100		1000		25
Sn	1	100		1000		100
Sr	5	100		1000		100
Ti	5	100		1000		100
Tl	0.2	100		1000		100
V	5	100		1000		100
Zn	10	100		1000		100
W	5	100		1000		100

Interferent ICSA, ICSAB	(mg/L)
Cl ⁻	2000
Ca	300
Fe, Na	250
Al, Mg, P, K, S	100
C	200
Mo, Ti	2

All analyte concentrations in ICSAB = 100 ppb except for Ag and Ba = 50 ppb

Analyte	LCS,MS Water	LCS,MS soil	LCS,MS Tissue
	(µg/L)	(µg/L)	(µg/L)
Ag	20	40	40
Al	5000	20000	10000
As	1000	4000	2000
B	1000	4000	2000
Ba	1000	4000	2000
Be	500	2000	1000
Ca	5000	4000	10000
Cd	500	2000	1000
Co	1000	4000	2000
Cr	1000	4000	2000
Cu	1000	4000	2000
Fe	5000	20000	10000
K	5000	20000	10000
Mg	5000	20000	10000
Mn	1000	4000	2000
Mo	1000	4000	2000
Na	5000	20000	10000
Ni	1000	4000	2000
Pb	1000	4000	2000
Sb	20	40	40
Se	1000	4000	2000
Si	1000	4000	2000
Sn	250	1000	500
Sr	1000	4000	2000
Ti	1000	4000	2000
Tl	1000	4000	2000
V	1000	4000	2000
Zn	1000	4000	2000
W	100	200	200

Mercury: ICV, CCV, LCS and MS = 2.5 ppb.

Arsenic Hydride, Selenium Hydride: ICV, CCV, LCS and MS = 5 ppb.

Mercury by Method 1631: ICV,CCV = 0.005 ppb, LCS, MS = 0.005 ppb.

Wet Chemistry

Total Solids / Percent Moisture Analysis

Sample Raw Data

WorkGroup WG1008366	Temp In (C) 105	Temp In (C) 105	Temp In (C)	Temp In (C)
Title Solids, Total	Temp Out (C) 105	Temp Out (C) 105	Temp Out (C)	Temp Out (C)
Method SM2540G	Time In 31-MAY-17 11:43	Time In 01-JUN-17 08:29	Time In	Time In
Instrument BALANCEWC1	Time Out 01-JUN-17 08:27	Time Out 01-JUN-17 10:46	Time Out	Time Out

Sample #	Analysis Date	Analyst	Tare Weight (gm)	Gross Weight (gm)	Net Weight (1) (gm)	Net Weight (2) (gm)	Net Weight (3) (gm)	Net Weight (4) (gm)	Result %	Comment
L1717026-01	31-MAY-17 11:29	SONAL PATEL	1.16	8.71	7.06	7.06			78.15	
L1717026-02	31-MAY-17 11:29	SONAL PATEL	1.18	7.35	5.47	5.46			69.37	
L1717026-03	31-MAY-17 11:29	SONAL PATEL	1.18	6.83	4.24	4.24			54.16	
L1717026-04	31-MAY-17 11:29	SONAL PATEL	1.17	7.98	4.84	4.85			53.89	
L1717026-05	31-MAY-17 11:29	SONAL PATEL	1.18	6.74	5.54	5.54			78.42	
L1717026-06	31-MAY-17 11:29	SONAL PATEL	1.18	7.43	5.19	5.2			64.16	
L1717026-07	31-MAY-17 11:29	SONAL PATEL	1.16	8.9	5.55	5.55			56.72	
L1717026-08	31-MAY-17 11:29	SONAL PATEL	1.17	8.95	5.2	5.2			51.80	
L1717026-09	31-MAY-17 11:29	SONAL PATEL	1.17	8.08	4.89	4.9			53.84	
L1717026-10	31-MAY-17 11:29	SONAL PATEL	1.18	10.15	8.57	8.58			82.39	
L1717026-11	31-MAY-17 11:29	SONAL PATEL	1.19	7.6	6.4	6.41			81.28	
L1717026-12	31-MAY-17 11:29	SONAL PATEL	1.19	8.63	6.4	6.4			70.03	
L1717026-13	31-MAY-17 11:29	SONAL PATEL	1.17	9.31	5.7	5.7			55.65	
L1717026-14	31-MAY-17 11:29	SONAL PATEL	1.18	7.79	4.76	4.76			54.16	
L1717026-15	31-MAY-17 11:29	SONAL PATEL	1.17	8.91	7.63	7.63			83.46	
L1717026-16	31-MAY-17 11:29	SONAL PATEL	1.19	7.65	5.18	5.18			61.76	
L1717026-17	31-MAY-17 11:29	SONAL PATEL	1.18	8.09	5.13	5.13			57.16	
L1717026-18	31-MAY-17 11:29	SONAL PATEL	1.17	8.92	5.4	5.41			54.58	
L1717026-19	31-MAY-17 11:29	SONAL PATEL	1.17	9.23	7.21	7.21			74.94	
L1717026-20	31-MAY-17 11:29	SONAL PATEL	1.18	8.87	7.2	7.21			78.28	
WG1008366-1	31-MAY-17 11:29	SONAL PATEL	1.15	8.69	6.97	6.97			77.19	

WorkGroup	WG1008367	Temp In (C)	105	Temp In (C)	105	Temp In (C)		Temp In (C)	
Title	Solids, Total	Temp Out (C)	105	Temp Out (C)	105	Temp Out (C)		Temp Out (C)	
Method	SM2540G	Time In	31-MAY-17 12:04	Time In	01-JUN-17 08:32	Time In		Time In	
Instrument	BALANCEWC1	Time Out	01-JUN-17 08:29	Time Out	01-JUN-17 10:48	Time Out		Time Out	

Sample #	Analysis Date	Analyst	Tare Weight (gm)	Gross Weight (gm)	Net Weight (1) (gm)	Net Weight (2) (gm)	Net Weight (3) (gm)	Net Weight (4) (gm)	Result %	Comment
L1717026-21	31-MAY-17 11:44	SONAL PATEL	1.17	6.43	5.03	5.03			73.38	
L1717026-22	31-MAY-17 11:44	SONAL PATEL	1.15	8.35	6.56	6.56			75.14	
L1717026-23	31-MAY-17 11:44	SONAL PATEL	1.16	7.14	5.98	5.98			80.60	
L1717026-24	31-MAY-17 11:44	SONAL PATEL	1.16	7.25	6.15	6.15			81.94	
L1717026-25	31-MAY-17 11:44	SONAL PATEL	1.16	5.99	4.9	4.9			77.43	
L1717026-26	31-MAY-17 11:44	SONAL PATEL	1.18	6.74	5.53	5.53			78.24	
L1717026-27	31-MAY-17 11:44	SONAL PATEL	1.18	8.56	7.04	7.04			79.40	
L1717286-01	31-MAY-17 11:44	SONAL PATEL	1.18	7.93	5.21	5.21			59.70	
L1717286-02	31-MAY-17 11:44	SONAL PATEL	1.15	7.19	4.67	4.66			58.11	
L1717286-03	31-MAY-17 11:44	SONAL PATEL	1.17	7.33	5.2	5.2			65.42	
L1717286-04	31-MAY-17 11:44	SONAL PATEL	1.15	7.75	4.7	4.69			53.64	
L1717286-05	31-MAY-17 11:44	SONAL PATEL	1.17	7.04	5	5			65.25	
L1717286-06	31-MAY-17 11:44	SONAL PATEL	1.16	6.92	3.31	3.3			37.15	
L1717286-07	31-MAY-17 11:44	SONAL PATEL	1.17	10.13	7.78	7.77			73.66	
L1717286-08	31-MAY-17 11:44	SONAL PATEL	1.14	8.97	6.88	6.88			73.31	
L1717286-09	31-MAY-17 11:44	SONAL PATEL	1.16	7.58	5.23	5.22			63.24	
WG1008367-1	31-MAY-17 11:44	SONAL PATEL	1.16	7.53	4.47	4.46			51.81	

Work Group

ALPHA ANALYTICAL LABORATORIES, INC.

Alpha WORK GROUP REPORT (wk02)

Jun 01 2017, 11:24 am

Work Group: WG1008366 for Department: 7 Wet Chemistry

Created: 31-MAY-17 Due: Operator: sp

Sample	Client ID	C Product	Matrix	Stat	UA	HOLD	DUE	PR	Location
L1717026-01	VC88-D0-3E	S A2-TS	SOIL	DONE	U	0526	0615	S0	Glass-A.06
L1717026-02	VC88-D3-6E	S A2-TS	SOIL	DONE	U	0526	0615	S0	Glass-A.06
L1717026-03	VC88-D6-9E	S A2-TS	SOIL	DONE	U	0526	0615	S0	Glass-A.06
L1717026-04	VC88-D9-10E	S A2-TS	SOIL	DONE	U	0526	0615	S0	Glass-A.06
L1717026-05	VC89-D0-3E	S A2-TS	SOIL	DONE	U	0526	0615	S0	Glass-A.06
L1717026-06	VC89-D3-6E	S A2-TS	SOIL	DONE	U	0526	0615	S0	Glass-A.06
L1717026-07	VC89-D6-9E	S A2-TS	SOIL	DONE	U	0526	0615	S0	Glass-A.06
L1717026-08	VC89-D9-10E	S A2-TS	SOIL	DONE	U	0526	0615	S0	Glass-A.06
L1717026-09	DUP-D9-10E	S A2-TS	SOIL	DONE	U	0526	0615	S0	Glass-A.06
L1717026-10	DUP-D0-3E	S A2-TS	SOIL	DONE	U	0526	0615	S0	Glass-A.06
L1717026-11	VC90-D0-3E	S A2-TS	SOIL	DONE	U	0526	0615	S0	Glass-A.06
L1717026-12	VC90-D3-6E	S A2-TS	SOIL	DONE	U	0526	0615	S0	Glass-A.06
L1717026-13	VC90-D6-9E	S A2-TS	SOIL	DONE	U	0526	0615	S0	Glass-A.06
L1717026-14	VC90-D9-10E	S A2-TS	SOIL	DONE	U	0526	0615	S0	Glass-A.06
L1717026-15	VC91-D0-3E	S A2-TS	SOIL	DONE	U	0526	0615	S0	Glass-A.06
L1717026-16	VC91-D3-6E	S A2-TS	SOIL	DONE	U	0526	0615	S0	Glass-A.06
L1717026-17	VC91-D6-9.6E	S A2-TS	SOIL	DONE	U	0526	0615	S0	Glass-A.06
L1717026-18	DUP-D6-9E	S A2-TS	SOIL	DONE	U	0526	0615	S0	Glass-A.06
L1717026-19	VC92-D0-3E	S A2-TS	SOIL	DONE	U	0526	0615	S0	Glass-A.06
L1717026-20	VC92-D3-6E	S A2-TS	SOIL	DONE	U	0526	0615	S0	Glass-A.06
WG1008366-1	Duplicate Sample	S A2-TS	SOIL	DONE	U				
Comments:									
WG1008366-1	L1717026-01								

ALPHA ANALYTICAL LABORATORIES, INC.

Alpha WORK GROUP REPORT (wk02)

Jun 01 2017, 11:24 am

Work Group: WG1008367 for Department: 7 Wet Chemistry

Created: 31-MAY-17 Due: Operator: sp

Sample	Client ID	C Product	Matrix	Stat	UA	HOLD	DUE	PR	Location
L1717026-21	VC92-D6-9E	S A2-TS	SOIL	DONE	U	0526	0615	S0	Glass-A.06
L1717026-22	VC92-D9-10E	S A2-TS	SOIL	DONE	U	0526	0615	S0	Glass-A.06
L1717026-23	VC93-D0-3E	S A2-TS	SOIL	DONE	U	0527	0615	S0	Glass-A.06
L1717026-24	VC93-D3-6E	S A2-TS	SOIL	DONE	U	0527	0615	S0	Glass-A.06
L1717026-25	VC93-D6-9E	S A2-TS	SOIL	DONE	U	0527	0615	S0	Glass-A.06
L1717026-26	VC93-D9-10E	S A2-TS	SOIL	DONE	U	0527	0615	S0	Glass-A.06
L1717026-27	DUP-D3-6E	S A2-TS	SOIL	DONE	U	0526	0615	S0	Glass-A.06
L1717286-01	A	C A2-TS	SOIL	DONE	U	0522	0616	S0	Plastic-A-GS
L1717286-01	A	C A2-MOISTURE-2540	SOIL	DONE	U	0522	0616	S0	Plastic-A-GS
L1717286-02	B	C A2-TS	SOIL	DONE	U	0522	0616	S0	Plastic-A-GS
L1717286-02	B	C A2-MOISTURE-2540	SOIL	DONE	U	0522	0616	S0	Plastic-A-GS
L1717286-03	C	C A2-TS	SOIL	DONE	U	0522	0616	S0	Plastic-A-GS
L1717286-03	C	C A2-MOISTURE-2540	SOIL	DONE	U	0522	0616	S0	Plastic-A-GS
L1717286-04	D	C A2-MOISTURE-2540	SOIL	DONE	U	0522	0616	S0	Plastic-A-GS
L1717286-04	D	C A2-TS	SOIL	DONE	U	0522	0616	S0	Plastic-A-GS
L1717286-05	E	C A2-TS	SOIL	DONE	U	0522	0616	S0	Plastic-A-GS
L1717286-05	E	C A2-MOISTURE-2540	SOIL	DONE	U	0522	0616	S0	Plastic-A-GS
L1717286-06	F	C A2-TS	SOIL	DONE	U	0522	0616	S0	Glass-A.25
L1717286-06	F	C A2-MOISTURE-2540	SOIL	DONE	U	0522	0616	S0	Glass-A.06
L1717286-07	G	C A2-MOISTURE-2540	SOIL	DONE	U	0522	0616	S0	Plastic-A-GS
L1717286-07	G	C A2-TS	SOIL	DONE	U	0522	0616	S0	Plastic-A-GS
L1717286-08	H	C A2-MOISTURE-2540	SOIL	DONE	U	0522	0616	S0	Plastic-A-GS
L1717286-08	H	C A2-TS	SOIL	DONE	U	0522	0616	S0	Plastic-A-GS
L1717286-09	COMP AB	C A2-TS	SOIL	DONE	U	0522	0616	S0	Glass-A.25
L1717286-09	COMP AB	C A2-MOISTURE-2540	SOIL	DONE	U	0522	0616	S0	Glass-A.06
WG1008367-1	Duplicate Sample	S A2-MOISTURE-2540	SOIL	DONE	U				
WG1008367-1	Duplicate Sample	S A2-TS	SOIL	DONE	U				
Comments:									
WG1008367-1	L1717286-04								

Alpha Report



ANALYTICAL REPORT

Lab Number:	L1717026
Client:	Alpine Ocean Seismic Survey Inc. 155 Hudson Avenue Norwood, NJ 07648
ATTN:	Mark Kosakowski
Phone:	(201) 768-8000
Project Name:	WILLIAMS (1794)
Project Number:	1794
Report Date:	06/14/17

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Certifications & Approvals: MA (M-MA030), NH NELAP (2062), NJ NELAP (MA015), CT (PH-0141), FL (E87814), IL (200081), LA (85084), ME (MA00030), MD (350), NY (11627), NC (685), OH (CL106), PA (68-02089), RI (LAO00299), TX (T104704419), VT (VT-0015), VA (460194), WA (C954), US Army Corps of Engineers, USDA (Permit #P330-13-00067), USFWS (Permit #LE2069641).

320 Forbes Boulevard, Mansfield, MA 02048-1806
508-822-9300 (Fax) 508-822-3288 800-624-9220 - www.alphalab.com



Project Name: WILLIAMS (1794)

Project Number: 1794

Lab Number: L1717026

Report Date: 06/14/17

Alpha Sample ID	Client ID	Matrix	Sample Location	Collection Date/Time	Receive Date
L1717026-01	VC88-D0-3E	SEDIMENT	RARITAN BAY	05/19/17 17:07	05/24/17
L1717026-02	VC88-D3-6E	SEDIMENT	RARITAN BAY	05/19/17 17:07	05/24/17
L1717026-03	VC88-D6-9E	SEDIMENT	RARITAN BAY	05/19/17 17:07	05/24/17
L1717026-04	VC88-D9-10E	SEDIMENT	RARITAN BAY	05/19/17 17:07	05/24/17
L1717026-05	VC89-D0-3E	SEDIMENT	RARITAN BAY	05/19/17 16:15	05/24/17
L1717026-06	VC89-D3-6E	SEDIMENT	RARITAN BAY	05/19/17 16:15	05/24/17
L1717026-07	VC89-D6-9E	SEDIMENT	RARITAN BAY	05/19/17 16:15	05/24/17
L1717026-08	VC89-D9-10E	SEDIMENT	RARITAN BAY	05/19/17 16:15	05/24/17
L1717026-09	DUP-D9-10E	SEDIMENT	RARITAN BAY	05/19/17 17:07	05/24/17
L1717026-10	DUP-D0-3E	SEDIMENT	RARITAN BAY	05/19/17 16:15	05/24/17
L1717026-11	VC90-D0-3E	SEDIMENT	RARITAN BAY	05/19/17 15:42	05/24/17
L1717026-12	VC90-D3-6E	SEDIMENT	RARITAN BAY	05/19/17 15:42	05/24/17
L1717026-13	VC90-D6-9E	SEDIMENT	RARITAN BAY	05/19/17 15:42	05/24/17
L1717026-14	VC90-D9-10E	SEDIMENT	RARITAN BAY	05/19/17 15:42	05/24/17
L1717026-15	VC91-D0-3E	SEDIMENT	RARITAN BAY	05/19/17 15:10	05/24/17
L1717026-16	VC91-D3-6E	SEDIMENT	RARITAN BAY	05/19/17 15:10	05/24/17
L1717026-17	VC91-D6-9.6E	SEDIMENT	RARITAN BAY	05/19/17 15:10	05/24/17
L1717026-18	DUP-D6-9E	SEDIMENT	RARITAN BAY	05/19/17 15:42	05/24/17
L1717026-19	VC92-D0-3E	SEDIMENT	RARITAN BAY	05/19/17 14:38	05/24/17
L1717026-20	VC92-D3-6E	SEDIMENT	RARITAN BAY	05/19/17 14:38	05/24/17
L1717026-21	VC92-D6-9E	SEDIMENT	RARITAN BAY	05/19/17 14:38	05/24/17
L1717026-22	VC92-D9-10E	SEDIMENT	RARITAN BAY	05/19/17 14:38	05/24/17
L1717026-23	VC93-D0-3E	SEDIMENT	RARITAN BAY	05/20/17 13:58	05/24/17
L1717026-24	VC93-D3-6E	SEDIMENT	RARITAN BAY	05/20/17 13:58	05/24/17

Alpha Sample ID	Client ID	Matrix	Sample Location	Collection Date/Time	Receive Date
L1717026-25	VC93-D6-9E	SEDIMENT	RARITAN BAY	05/20/17 13:58	05/24/17
L1717026-26	VC93-D9-10E	SEDIMENT	RARITAN BAY	05/20/17 13:58	05/24/17
L1717026-27	DUP-D3-6E	SEDIMENT	RARITAN BAY	05/19/17 14:38	05/24/17
L1717026-28	RINSE2	WATER	RARITAN BAY	05/24/17 12:00	05/24/17
L1717026-29	RINSE1	WATER	RARITAN BAY	05/19/17 18:04	05/24/17

Project Name: WILLIAMS (1794)
Project Number: 1794

Lab Number: L1717026
Report Date: 06/14/17

Case Narrative

The samples were received in accordance with the Chain of Custody and no significant deviations were encountered during the preparation or analysis unless otherwise noted. Sample Receipt, Container Information, and the Chain of Custody are located at the back of the report.

Results contained within this report relate only to the samples submitted under this Alpha Lab Number and meet NELAP requirements for all NELAP accredited parameters unless otherwise noted in the following narrative. The data presented in this report is organized by parameter (i.e. VOC, SVOC, etc.). Sample specific Quality Control data (i.e. Surrogate Spike Recovery) is reported at the end of the target analyte list for each individual sample, followed by the Laboratory Batch Quality Control at the end of each parameter. Tentatively Identified Compounds (TICs), if requested, are reported for compounds identified to be present and are not part of the method/program Target Compound List, even if only a subset of the TCL are being reported. If a sample was re-analyzed or re-extracted due to a required quality control corrective action and if both sets of data are reported, the Laboratory ID of the re-analysis or re-extraction is designated with an "R" or "RE", respectively. When multiple Batch Quality Control elements are reported (e.g. more than one LCS), the associated samples for each element are noted in the grey shaded header line of each data table. Any Laboratory Batch, Sample Specific % recovery or RPD value that is outside the listed Acceptance Criteria is bolded in the report. All specific QC information is also incorporated in the Data Usability format of our Data Merger tool where it can be reviewed along with any associated usability implications. Soil/sediments, solids and tissues are reported on a dry weight basis unless otherwise noted. Definitions of all data qualifiers and acronyms used in this report are provided in the Glossary located at the back of the report.

In reference to questions H (CAM) or 4 (RCP) when "NO" is checked, the performance criteria for CAM and RCP methods allow for some quality control failures to occur and still be within method compliance. In these instances the specific failure is not narrated but noted in the associated QC table. The information is also incorporated in the Data Usability format of our Data Merger tool where it can be reviewed along with any associated usability implications.

Please see the associated ADEx data file for a comparison of laboratory reporting limits that were achieved with the regulatory Numerical Standards requested on the Chain of Custody.

HOLD POLICY

For samples submitted on hold, Alpha's policy is to hold samples (with the exception of Air canisters) free of charge for 21 calendar days from the date the project is completed. After 21 calendar days, we will dispose of all samples submitted including those put on hold unless you have contacted your Client Service Representative and made arrangements for Alpha to continue to hold the samples. Air canisters will be disposed after 3 business days from the date the project is completed.

Please contact Client Services at 800-624-9220 with any questions.

Project Name: WILLIAMS (1794)
Project Number: 1794

Lab Number: L1717026
Report Date: 06/14/17

Case Narrative (continued)

Report Submission

All non-detect (ND) or estimated concentrations (J-qualified) have been quantitated to the limit noted in the MDL column.

Metals

The WG1007570-3/-4 MS/MSD recoveries for Aluminum (501%/371%) and Iron (2430%/857%), performed on L1717026-05, do not apply because the sample concentrations are greater than four times the spike amounts added.

The WG1007570-3 MS recovery, performed on L1717026-05, is outside the acceptance criteria for Zinc (127%). A post digestion spike was performed and yielded unacceptable recoveries for Zinc(136%). This has been attributed to sample matrix.

The WG1007571-3/-4 MS/MSD recoveries for Aluminum (371%/430%) and Iron (857%/1670%), performed on L1717026-23, do not apply because the sample concentrations are greater than four times the spike amounts added.

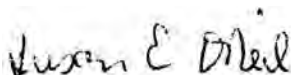
The WG1007571-3 MS recovery, performed on L1717026-23, is outside the acceptance criteria for calcium (174%). A post digestion spike was performed and was within acceptance criteria.

The WG1007571-4 MSD recovery, performed on L1717026-23, is outside the acceptance criteria for Calcium (310%). A post digestion spike was performed and was within acceptance criteria.

The WG1007571-3/-4 MS/MSD RPD for Calcium (57%), performed on L1717026-23, is above the acceptance criteria.

I, the undersigned, attest under the pains and penalties of perjury that, to the best of my knowledge and belief and based upon my personal inquiry of those responsible for providing the information contained in this analytical report, such information is accurate and complete. This certificate of analysis is not complete unless this page accompanies any and all pages of this report.

Authorized Signature:



Susan O'Neil

Title: Technical Director/Representative

Date: 06/14/17

METALS

Project Name: WILLIAMS (1794)

Lab Number: L1717026

Project Number: 1794

Report Date: 06/14/17

SAMPLE RESULTS

Lab ID: L1717026-01

Date Collected: 05/19/17 17:07

Client ID: VC88-D0-3E

Date Received: 05/24/17

Sample Location: RARITAN BAY

Field Prep: Not Specified

Matrix: Sediment

Percent Solids: 78%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Aluminum, Total	1150		mg/kg	127	18.7	10	05/26/17 18:48	06/09/17 13:45	EPA 3050B	1,6020A	BV
Antimony, Total	ND		mg/kg	2.03	0.171	10	05/26/17 18:48	06/09/17 13:45	EPA 3050B	1,6020A	BV
Arsenic, Total	1.74		mg/kg	0.633	0.084	10	05/26/17 18:48	06/09/17 13:45	EPA 3050B	1,6020A	BV
Barium, Total	2.12	J	mg/kg	3.80	0.268	10	05/26/17 18:48	06/09/17 13:45	EPA 3050B	1,6020A	BV
Beryllium, Total	0.112	J	mg/kg	0.380	0.110	10	05/26/17 18:48	06/09/17 13:45	EPA 3050B	1,6020A	BV
Cadmium, Total	ND		mg/kg	0.253	0.033	10	05/26/17 18:48	06/09/17 13:45	EPA 3050B	1,6020A	BV
Calcium, Total	4190		mg/kg	633	77.0	10	05/26/17 18:48	06/09/17 13:45	EPA 3050B	1,6020A	BV
Chromium, Total	4.63		mg/kg	2.53	0.593	10	05/26/17 18:48	06/09/17 13:45	EPA 3050B	1,6020A	BV
Cobalt, Total	0.785		mg/kg	0.633	0.067	10	05/26/17 18:48	06/09/17 13:45	EPA 3050B	1,6020A	BV
Copper, Total	1.26	J	mg/kg	2.53	0.246	10	05/26/17 18:48	06/09/17 13:45	EPA 3050B	1,6020A	BV
Iron, Total	6530		mg/kg	253	26.1	10	05/26/17 18:48	06/09/17 13:45	EPA 3050B	1,6020A	BV
Lead, Total	1.76		mg/kg	0.760	0.185	10	05/26/17 18:48	06/09/17 13:45	EPA 3050B	1,6020A	BV
Magnesium, Total	882		mg/kg	127	15.6	10	05/26/17 18:48	06/09/17 13:45	EPA 3050B	1,6020A	BV
Manganese, Total	25.4		mg/kg	2.53	0.562	10	05/26/17 18:48	06/09/17 13:45	EPA 3050B	1,6020A	BV
Mercury, Total	ND		mg/kg	0.017	0.002	5	05/30/17 13:50	06/06/17 10:40	EPA 7474	1,7474	BV
Molybdenum, Total	0.900	J	mg/kg	1.01	0.137	10	05/26/17 18:48	06/09/17 13:45	EPA 3050B	1,6020A	BV
Nickel, Total	1.74		mg/kg	1.27	0.338	10	05/26/17 18:48	06/09/17 13:45	EPA 3050B	1,6020A	BV
Potassium, Total	295		mg/kg	127	20.1	10	05/26/17 18:48	06/09/17 13:45	EPA 3050B	1,6020A	BV
Selenium, Total	ND		mg/kg	2.53	0.958	10	05/26/17 18:48	06/09/17 13:45	EPA 3050B	1,6020A	BV
Silver, Total	ND		mg/kg	0.633	0.062	10	05/26/17 18:48	06/09/17 13:45	EPA 3050B	1,6020A	BV
Sodium, Total	2190		mg/kg	190	14.8	10	05/26/17 18:48	06/09/17 13:45	EPA 3050B	1,6020A	BV
Strontium, Total	22.5		mg/kg	1.27	0.310	10	05/26/17 18:48	06/09/17 13:45	EPA 3050B	1,6020A	BV
Thallium, Total	ND		mg/kg	0.253	0.065	10	05/26/17 18:48	06/09/17 13:45	EPA 3050B	1,6020A	BV
Tin, Total	ND		mg/kg	1.52	0.157	10	05/26/17 18:48	06/09/17 13:45	EPA 3050B	1,6020A	BV
Titanium, Total	60.9		mg/kg	0.633	0.109	10	05/26/17 18:48	06/09/17 13:45	EPA 3050B	1,6020A	BV
Vanadium, Total	9.49		mg/kg	1.27	0.480	10	05/26/17 18:48	06/09/17 13:45	EPA 3050B	1,6020A	BV
Zinc, Total	5.74	J	mg/kg	12.7	3.29	10	05/26/17 18:48	06/09/17 13:45	EPA 3050B	1,6020A	BV



Project Name: WILLIAMS (1794)

Lab Number: L1717026

Project Number: 1794

Report Date: 06/14/17

SAMPLE RESULTS

Lab ID: L1717026-02

Date Collected: 05/19/17 17:07

Client ID: VC88-D3-6E

Date Received: 05/24/17

Sample Location: RARITAN BAY

Field Prep: Not Specified

Matrix: Sediment

Percent Solids: 69%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Aluminum, Total	3650		mg/kg	140	20.6	10	05/26/17 18:48	06/09/17 13:48	EPA 3050B	1,6020A	BV
Antimony, Total	ND		mg/kg	2.23	0.189	10	05/26/17 18:48	06/09/17 13:48	EPA 3050B	1,6020A	BV
Arsenic, Total	3.84		mg/kg	0.698	0.092	10	05/26/17 18:48	06/09/17 13:48	EPA 3050B	1,6020A	BV
Barium, Total	7.14		mg/kg	4.18	0.295	10	05/26/17 18:48	06/09/17 13:48	EPA 3050B	1,6020A	BV
Beryllium, Total	0.260	J	mg/kg	0.418	0.122	10	05/26/17 18:48	06/09/17 13:48	EPA 3050B	1,6020A	BV
Cadmium, Total	0.055	J	mg/kg	0.279	0.037	10	05/26/17 18:48	06/09/17 13:48	EPA 3050B	1,6020A	BV
Calcium, Total	1660		mg/kg	698	84.8	10	05/26/17 18:48	06/09/17 13:48	EPA 3050B	1,6020A	BV
Chromium, Total	10.5		mg/kg	2.79	0.653	10	05/26/17 18:48	06/09/17 13:48	EPA 3050B	1,6020A	BV
Cobalt, Total	2.32		mg/kg	0.698	0.074	10	05/26/17 18:48	06/09/17 13:48	EPA 3050B	1,6020A	BV
Copper, Total	3.43		mg/kg	2.79	0.271	10	05/26/17 18:48	06/09/17 13:48	EPA 3050B	1,6020A	BV
Iron, Total	10600		mg/kg	279	28.7	10	05/26/17 18:48	06/09/17 13:48	EPA 3050B	1,6020A	BV
Lead, Total	4.12		mg/kg	0.837	0.204	10	05/26/17 18:48	06/09/17 13:48	EPA 3050B	1,6020A	BV
Magnesium, Total	1970		mg/kg	140	17.2	10	05/26/17 18:48	06/09/17 13:48	EPA 3050B	1,6020A	BV
Manganese, Total	74.3		mg/kg	2.79	0.619	10	05/26/17 18:48	06/09/17 13:48	EPA 3050B	1,6020A	BV
Mercury, Total	0.005	J	mg/kg	0.016	0.002	5	05/30/17 13:50	06/06/17 10:42	EPA 7474	1,7474	BV
Molybdenum, Total	1.66		mg/kg	1.12	0.151	10	05/26/17 18:48	06/09/17 13:48	EPA 3050B	1,6020A	BV
Nickel, Total	5.65		mg/kg	1.40	0.373	10	05/26/17 18:48	06/09/17 13:48	EPA 3050B	1,6020A	BV
Potassium, Total	848		mg/kg	140	22.2	10	05/26/17 18:48	06/09/17 13:48	EPA 3050B	1,6020A	BV
Selenium, Total	3.08		mg/kg	2.79	1.05	10	05/26/17 18:48	06/09/17 13:48	EPA 3050B	1,6020A	BV
Silver, Total	ND		mg/kg	0.698	0.068	10	05/26/17 18:48	06/09/17 13:48	EPA 3050B	1,6020A	BV
Sodium, Total	2950		mg/kg	209	16.4	10	05/26/17 18:48	06/09/17 13:48	EPA 3050B	1,6020A	BV
Strontium, Total	12.3		mg/kg	1.40	0.342	10	05/26/17 18:48	06/09/17 13:48	EPA 3050B	1,6020A	BV
Thallium, Total	ND		mg/kg	0.279	0.072	10	05/26/17 18:48	06/09/17 13:48	EPA 3050B	1,6020A	BV
Tin, Total	ND		mg/kg	1.67	0.173	10	05/26/17 18:48	06/09/17 13:48	EPA 3050B	1,6020A	BV
Titanium, Total	118		mg/kg	0.698	0.120	10	05/26/17 18:48	06/09/17 13:48	EPA 3050B	1,6020A	BV
Vanadium, Total	15.0		mg/kg	1.40	0.529	10	05/26/17 18:48	06/09/17 13:48	EPA 3050B	1,6020A	BV
Zinc, Total	17.6		mg/kg	14.0	3.63	10	05/26/17 18:48	06/09/17 13:48	EPA 3050B	1,6020A	BV



Project Name: WILLIAMS (1794)

Lab Number: L1717026

Project Number: 1794

Report Date: 06/14/17

SAMPLE RESULTS

Lab ID: L1717026-03
 Client ID: VC88-D6-9E
 Sample Location: RARITAN BAY
 Matrix: Sediment
 Percent Solids: 54%

Date Collected: 05/19/17 17:07
 Date Received: 05/24/17
 Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Aluminum, Total	16100		mg/kg	183	27.0	10	05/26/17 18:48	06/09/17 13:51	EPA 3050B	1,6020A	BV
Antimony, Total	ND		mg/kg	2.92	0.247	10	05/26/17 18:48	06/09/17 13:51	EPA 3050B	1,6020A	BV
Arsenic, Total	13.1		mg/kg	0.913	0.120	10	05/26/17 18:48	06/09/17 13:51	EPA 3050B	1,6020A	BV
Barium, Total	26.4		mg/kg	5.48	0.386	10	05/26/17 18:48	06/09/17 13:51	EPA 3050B	1,6020A	BV
Beryllium, Total	1.05		mg/kg	0.548	0.159	10	05/26/17 18:48	06/09/17 13:51	EPA 3050B	1,6020A	BV
Cadmium, Total	0.121	J	mg/kg	0.365	0.048	10	05/26/17 18:48	06/09/17 13:51	EPA 3050B	1,6020A	BV
Calcium, Total	2480		mg/kg	913	111.	10	05/26/17 18:48	06/09/17 13:51	EPA 3050B	1,6020A	BV
Chromium, Total	34.3		mg/kg	3.65	0.854	10	05/26/17 18:48	06/09/17 13:51	EPA 3050B	1,6020A	BV
Cobalt, Total	9.72		mg/kg	0.913	0.097	10	05/26/17 18:48	06/09/17 13:51	EPA 3050B	1,6020A	BV
Copper, Total	13.5		mg/kg	3.65	0.354	10	05/26/17 18:48	06/09/17 13:51	EPA 3050B	1,6020A	BV
Iron, Total	37400		mg/kg	365	37.6	10	05/26/17 18:48	06/09/17 13:51	EPA 3050B	1,6020A	BV
Lead, Total	13.2		mg/kg	1.10	0.267	10	05/26/17 18:48	06/09/17 13:51	EPA 3050B	1,6020A	BV
Magnesium, Total	8160		mg/kg	183	22.5	10	05/26/17 18:48	06/09/17 13:51	EPA 3050B	1,6020A	BV
Manganese, Total	269		mg/kg	3.65	0.811	10	05/26/17 18:48	06/09/17 13:51	EPA 3050B	1,6020A	BV
Mercury, Total	0.015	J	mg/kg	0.022	0.003	5	05/30/17 13:50	06/06/17 10:45	EPA 7474	1,7474	BV
Molybdenum, Total	2.55		mg/kg	1.46	0.197	10	05/26/17 18:48	06/09/17 13:51	EPA 3050B	1,6020A	BV
Nickel, Total	24.4		mg/kg	1.83	0.488	10	05/26/17 18:48	06/09/17 13:51	EPA 3050B	1,6020A	BV
Potassium, Total	3520		mg/kg	183	29.0	10	05/26/17 18:48	06/09/17 13:51	EPA 3050B	1,6020A	BV
Selenium, Total	10.4		mg/kg	3.65	1.38	10	05/26/17 18:48	06/09/17 13:51	EPA 3050B	1,6020A	BV
Silver, Total	ND		mg/kg	0.913	0.089	10	05/26/17 18:48	06/09/17 13:51	EPA 3050B	1,6020A	BV
Sodium, Total	7400		mg/kg	274	21.4	10	05/26/17 18:48	06/09/17 13:51	EPA 3050B	1,6020A	BV
Strontium, Total	26.4		mg/kg	1.83	0.448	10	05/26/17 18:48	06/09/17 13:51	EPA 3050B	1,6020A	BV
Thallium, Total	0.155	J	mg/kg	0.365	0.094	10	05/26/17 18:48	06/09/17 13:51	EPA 3050B	1,6020A	BV
Tin, Total	0.495	J	mg/kg	2.19	0.226	10	05/26/17 18:48	06/09/17 13:51	EPA 3050B	1,6020A	BV
Titanium, Total	278		mg/kg	0.913	0.158	10	05/26/17 18:48	06/09/17 13:51	EPA 3050B	1,6020A	BV
Vanadium, Total	40.4		mg/kg	1.83	0.692	10	05/26/17 18:48	06/09/17 13:51	EPA 3050B	1,6020A	BV
Zinc, Total	74.7		mg/kg	18.3	4.75	10	05/26/17 18:48	06/09/17 13:51	EPA 3050B	1,6020A	BV



Project Name: WILLIAMS (1794)

Lab Number: L1717026

Project Number: 1794

Report Date: 06/14/17

SAMPLE RESULTS

Lab ID: L1717026-04
 Client ID: VC88-D9-10E
 Sample Location: RARITAN BAY
 Matrix: Sediment
 Percent Solids: 54%

Date Collected: 05/19/17 17:07
 Date Received: 05/24/17
 Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Aluminum, Total	16600		mg/kg	179	26.5	10	05/26/17 18:48	06/09/17 14:00	EPA 3050B	1,6020A	BV
Antimony, Total	0.322	J	mg/kg	2.86	0.242	10	05/26/17 18:48	06/09/17 14:00	EPA 3050B	1,6020A	BV
Arsenic, Total	14.5		mg/kg	0.894	0.118	10	05/26/17 18:48	06/09/17 14:00	EPA 3050B	1,6020A	BV
Barium, Total	27.6		mg/kg	5.36	0.378	10	05/26/17 18:48	06/09/17 14:00	EPA 3050B	1,6020A	BV
Beryllium, Total	1.05		mg/kg	0.536	0.156	10	05/26/17 18:48	06/09/17 14:00	EPA 3050B	1,6020A	BV
Cadmium, Total	0.088	J	mg/kg	0.358	0.047	10	05/26/17 18:48	06/09/17 14:00	EPA 3050B	1,6020A	BV
Calcium, Total	3000		mg/kg	894	109.	10	05/26/17 18:48	06/09/17 14:00	EPA 3050B	1,6020A	BV
Chromium, Total	36.1		mg/kg	3.58	0.837	10	05/26/17 18:48	06/09/17 14:00	EPA 3050B	1,6020A	BV
Cobalt, Total	10.2		mg/kg	0.894	0.095	10	05/26/17 18:48	06/09/17 14:00	EPA 3050B	1,6020A	BV
Copper, Total	14.3		mg/kg	3.58	0.347	10	05/26/17 18:48	06/09/17 14:00	EPA 3050B	1,6020A	BV
Iron, Total	39100		mg/kg	358	36.8	10	05/26/17 18:48	06/09/17 14:00	EPA 3050B	1,6020A	BV
Lead, Total	13.6		mg/kg	1.07	0.261	10	05/26/17 18:48	06/09/17 14:00	EPA 3050B	1,6020A	BV
Magnesium, Total	8390		mg/kg	179	22.0	10	05/26/17 18:48	06/09/17 14:00	EPA 3050B	1,6020A	BV
Manganese, Total	308		mg/kg	3.58	0.794	10	05/26/17 18:48	06/09/17 14:00	EPA 3050B	1,6020A	BV
Mercury, Total	0.014	J	mg/kg	0.026	0.003	5	05/30/17 13:50	06/06/17 10:47	EPA 7474	1,7474	BV
Molybdenum, Total	1.88		mg/kg	1.43	0.193	10	05/26/17 18:48	06/09/17 14:00	EPA 3050B	1,6020A	BV
Nickel, Total	25.3		mg/kg	1.79	0.478	10	05/26/17 18:48	06/09/17 14:00	EPA 3050B	1,6020A	BV
Potassium, Total	3710		mg/kg	179	28.4	10	05/26/17 18:48	06/09/17 14:00	EPA 3050B	1,6020A	BV
Selenium, Total	12.3		mg/kg	3.58	1.35	10	05/26/17 18:48	06/09/17 14:00	EPA 3050B	1,6020A	BV
Silver, Total	ND		mg/kg	0.894	0.087	10	05/26/17 18:48	06/09/17 14:00	EPA 3050B	1,6020A	BV
Sodium, Total	7530		mg/kg	268	21.0	10	05/26/17 18:48	06/09/17 14:00	EPA 3050B	1,6020A	BV
Strontium, Total	29.7		mg/kg	1.79	0.438	10	05/26/17 18:48	06/09/17 14:00	EPA 3050B	1,6020A	BV
Thallium, Total	0.157	J	mg/kg	0.358	0.092	10	05/26/17 18:48	06/09/17 14:00	EPA 3050B	1,6020A	BV
Tin, Total	0.568	J	mg/kg	2.14	0.222	10	05/26/17 18:48	06/09/17 14:00	EPA 3050B	1,6020A	BV
Titanium, Total	303		mg/kg	0.894	0.154	10	05/26/17 18:48	06/09/17 14:00	EPA 3050B	1,6020A	BV
Vanadium, Total	39.9		mg/kg	1.79	0.678	10	05/26/17 18:48	06/09/17 14:00	EPA 3050B	1,6020A	BV
Zinc, Total	76.4		mg/kg	17.9	4.65	10	05/26/17 18:48	06/09/17 14:00	EPA 3050B	1,6020A	BV



Project Name: WILLIAMS (1794)

Lab Number: L1717026

Project Number: 1794

Report Date: 06/14/17

SAMPLE RESULTS

Lab ID: L1717026-05

Date Collected: 05/19/17 16:15

Client ID: VC89-D0-3E

Date Received: 05/24/17

Sample Location: RARITAN BAY

Field Prep: Not Specified

Matrix: Sediment

Percent Solids: 78%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Aluminum, Total	1590		mg/kg	124	18.4	10	05/26/17 18:48	06/09/17 13:29	EPA 3050B	1,6020A	BV
Antimony, Total	ND		mg/kg	1.99	0.168	10	05/26/17 18:48	06/09/17 13:29	EPA 3050B	1,6020A	BV
Arsenic, Total	4.62		mg/kg	0.622	0.082	10	05/26/17 18:48	06/09/17 13:29	EPA 3050B	1,6020A	BV
Barium, Total	2.40	J	mg/kg	3.73	0.263	10	05/26/17 18:48	06/09/17 13:29	EPA 3050B	1,6020A	BV
Beryllium, Total	0.187	J	mg/kg	0.373	0.108	10	05/26/17 18:48	06/09/17 13:29	EPA 3050B	1,6020A	BV
Cadmium, Total	ND		mg/kg	0.249	0.033	10	05/26/17 18:48	06/09/17 13:29	EPA 3050B	1,6020A	BV
Calcium, Total	747		mg/kg	622	75.7	10	05/26/17 18:48	06/09/17 13:29	EPA 3050B	1,6020A	BV
Chromium, Total	7.80		mg/kg	2.49	0.582	10	05/26/17 18:48	06/09/17 13:29	EPA 3050B	1,6020A	BV
Cobalt, Total	1.82		mg/kg	0.622	0.066	10	05/26/17 18:48	06/09/17 13:29	EPA 3050B	1,6020A	BV
Copper, Total	3.00		mg/kg	2.49	0.241	10	05/26/17 18:48	06/09/17 13:29	EPA 3050B	1,6020A	BV
Iron, Total	13000		mg/kg	249	25.6	10	05/26/17 18:48	06/09/17 13:29	EPA 3050B	1,6020A	BV
Lead, Total	2.57		mg/kg	0.747	0.182	10	05/26/17 18:48	06/09/17 13:29	EPA 3050B	1,6020A	BV
Magnesium, Total	880		mg/kg	124	15.3	10	05/26/17 18:48	06/09/17 13:29	EPA 3050B	1,6020A	BV
Manganese, Total	24.9		mg/kg	2.49	0.553	10	05/26/17 18:48	06/09/17 13:29	EPA 3050B	1,6020A	BV
Mercury, Total	ND		mg/kg	0.017	0.002	5	05/30/17 13:50	06/06/17 10:27	EPA 7474	1,7474	BV
Molybdenum, Total	1.06		mg/kg	0.996	0.134	10	05/26/17 18:48	06/09/17 13:29	EPA 3050B	1,6020A	BV
Nickel, Total	2.24		mg/kg	1.24	0.332	10	05/26/17 18:48	06/09/17 13:29	EPA 3050B	1,6020A	BV
Potassium, Total	350		mg/kg	124	19.8	10	05/26/17 18:48	06/09/17 13:29	EPA 3050B	1,6020A	BV
Selenium, Total	1.86	J	mg/kg	2.49	0.941	10	05/26/17 18:48	06/09/17 13:29	EPA 3050B	1,6020A	BV
Silver, Total	ND		mg/kg	0.622	0.061	10	05/26/17 18:48	06/09/17 13:29	EPA 3050B	1,6020A	BV
Sodium, Total	2180		mg/kg	187	14.6	10	05/26/17 18:48	06/09/17 13:29	EPA 3050B	1,6020A	BV
Strontium, Total	5.97		mg/kg	1.24	0.305	10	05/26/17 18:48	06/09/17 13:29	EPA 3050B	1,6020A	BV
Thallium, Total	0.188	J	mg/kg	0.249	0.064	10	05/26/17 18:48	06/09/17 13:29	EPA 3050B	1,6020A	BV
Tin, Total	ND		mg/kg	1.49	0.154	10	05/26/17 18:48	06/09/17 13:29	EPA 3050B	1,6020A	BV
Titanium, Total	65.5		mg/kg	0.622	0.108	10	05/26/17 18:48	06/09/17 13:29	EPA 3050B	1,6020A	BV
Vanadium, Total	20.3		mg/kg	1.24	0.472	10	05/26/17 18:48	06/09/17 13:29	EPA 3050B	1,6020A	BV
Zinc, Total	9.74	J	mg/kg	12.4	3.24	10	05/26/17 18:48	06/09/17 13:29	EPA 3050B	1,6020A	BV



Project Name: WILLIAMS (1794)

Lab Number: L1717026

Project Number: 1794

Report Date: 06/14/17

SAMPLE RESULTS

Lab ID: L1717026-06

Date Collected: 05/19/17 16:15

Client ID: VC89-D3-6E

Date Received: 05/24/17

Sample Location: RARITAN BAY

Field Prep: Not Specified

Matrix: Sediment

Percent Solids: 64%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Aluminum, Total	7700		mg/kg	156	23.0	10	05/26/17 18:48	06/09/17 14:03	EPA 3050B	1,6020A	BV
Antimony, Total	ND		mg/kg	2.49	0.210	10	05/26/17 18:48	06/09/17 14:03	EPA 3050B	1,6020A	BV
Arsenic, Total	6.63		mg/kg	0.779	0.103	10	05/26/17 18:48	06/09/17 14:03	EPA 3050B	1,6020A	BV
Barium, Total	17.7		mg/kg	4.67	0.329	10	05/26/17 18:48	06/09/17 14:03	EPA 3050B	1,6020A	BV
Beryllium, Total	0.575		mg/kg	0.467	0.136	10	05/26/17 18:48	06/09/17 14:03	EPA 3050B	1,6020A	BV
Cadmium, Total	0.085	J	mg/kg	0.312	0.041	10	05/26/17 18:48	06/09/17 14:03	EPA 3050B	1,6020A	BV
Calcium, Total	1330		mg/kg	779	94.7	10	05/26/17 18:48	06/09/17 14:03	EPA 3050B	1,6020A	BV
Chromium, Total	18.2		mg/kg	3.12	0.729	10	05/26/17 18:48	06/09/17 14:03	EPA 3050B	1,6020A	BV
Cobalt, Total	5.30		mg/kg	0.779	0.083	10	05/26/17 18:48	06/09/17 14:03	EPA 3050B	1,6020A	BV
Copper, Total	9.07		mg/kg	3.12	0.302	10	05/26/17 18:48	06/09/17 14:03	EPA 3050B	1,6020A	BV
Iron, Total	21600		mg/kg	312	32.1	10	05/26/17 18:48	06/09/17 14:03	EPA 3050B	1,6020A	BV
Lead, Total	9.83		mg/kg	0.934	0.227	10	05/26/17 18:48	06/09/17 14:03	EPA 3050B	1,6020A	BV
Magnesium, Total	3980		mg/kg	156	19.2	10	05/26/17 18:48	06/09/17 14:03	EPA 3050B	1,6020A	BV
Manganese, Total	139		mg/kg	3.12	0.692	10	05/26/17 18:48	06/09/17 14:03	EPA 3050B	1,6020A	BV
Mercury, Total	0.010	J	mg/kg	0.019	0.002	5	05/30/17 13:50	06/06/17 10:50	EPA 7474	1,7474	BV
Molybdenum, Total	1.34		mg/kg	1.25	0.168	10	05/26/17 18:48	06/09/17 14:03	EPA 3050B	1,6020A	BV
Nickel, Total	12.4		mg/kg	1.56	0.416	10	05/26/17 18:48	06/09/17 14:03	EPA 3050B	1,6020A	BV
Potassium, Total	1730		mg/kg	156	24.7	10	05/26/17 18:48	06/09/17 14:03	EPA 3050B	1,6020A	BV
Selenium, Total	9.02		mg/kg	3.12	1.18	10	05/26/17 18:48	06/09/17 14:03	EPA 3050B	1,6020A	BV
Silver, Total	ND		mg/kg	0.779	0.076	10	05/26/17 18:48	06/09/17 14:03	EPA 3050B	1,6020A	BV
Sodium, Total	3880		mg/kg	234	18.2	10	05/26/17 18:48	06/09/17 14:03	EPA 3050B	1,6020A	BV
Strontium, Total	16.1		mg/kg	1.56	0.382	10	05/26/17 18:48	06/09/17 14:03	EPA 3050B	1,6020A	BV
Thallium, Total	0.082	J	mg/kg	0.312	0.080	10	05/26/17 18:48	06/09/17 14:03	EPA 3050B	1,6020A	BV
Tin, Total	0.493	J	mg/kg	1.87	0.193	10	05/26/17 18:48	06/09/17 14:03	EPA 3050B	1,6020A	BV
Titanium, Total	160		mg/kg	0.779	0.134	10	05/26/17 18:48	06/09/17 14:03	EPA 3050B	1,6020A	BV
Vanadium, Total	27.4		mg/kg	1.56	0.591	10	05/26/17 18:48	06/09/17 14:03	EPA 3050B	1,6020A	BV
Zinc, Total	39.9		mg/kg	15.6	4.05	10	05/26/17 18:48	06/09/17 14:03	EPA 3050B	1,6020A	BV



Project Name: WILLIAMS (1794)

Lab Number: L1717026

Project Number: 1794

Report Date: 06/14/17

SAMPLE RESULTS

Lab ID: L1717026-07

Date Collected: 05/19/17 16:15

Client ID: VC89-D6-9E

Date Received: 05/24/17

Sample Location: RARITAN BAY

Field Prep: Not Specified

Matrix: Sediment

Percent Solids: 57%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Aluminum, Total	15900		mg/kg	169	25.0	10	05/26/17 18:48	06/09/17 14:06	EPA 3050B	1,6020A	BV
Antimony, Total	ND		mg/kg	2.71	0.229	10	05/26/17 18:48	06/09/17 14:06	EPA 3050B	1,6020A	BV
Arsenic, Total	14.8		mg/kg	0.846	0.112	10	05/26/17 18:48	06/09/17 14:06	EPA 3050B	1,6020A	BV
Barium, Total	28.1		mg/kg	5.08	0.357	10	05/26/17 18:48	06/09/17 14:06	EPA 3050B	1,6020A	BV
Beryllium, Total	0.997		mg/kg	0.508	0.148	10	05/26/17 18:48	06/09/17 14:06	EPA 3050B	1,6020A	BV
Cadmium, Total	0.101	J	mg/kg	0.338	0.045	10	05/26/17 18:48	06/09/17 14:06	EPA 3050B	1,6020A	BV
Calcium, Total	4000		mg/kg	846	103.	10	05/26/17 18:48	06/09/17 14:06	EPA 3050B	1,6020A	BV
Chromium, Total	34.7		mg/kg	3.38	0.792	10	05/26/17 18:48	06/09/17 14:06	EPA 3050B	1,6020A	BV
Cobalt, Total	9.73		mg/kg	0.846	0.090	10	05/26/17 18:48	06/09/17 14:06	EPA 3050B	1,6020A	BV
Copper, Total	14.2		mg/kg	3.38	0.328	10	05/26/17 18:48	06/09/17 14:06	EPA 3050B	1,6020A	BV
Iron, Total	41500		mg/kg	338	34.8	10	05/26/17 18:48	06/09/17 14:06	EPA 3050B	1,6020A	BV
Lead, Total	13.4		mg/kg	1.02	0.247	10	05/26/17 18:48	06/09/17 14:06	EPA 3050B	1,6020A	BV
Magnesium, Total	7830		mg/kg	169	20.8	10	05/26/17 18:48	06/09/17 14:06	EPA 3050B	1,6020A	BV
Manganese, Total	276		mg/kg	3.38	0.751	10	05/26/17 18:48	06/09/17 14:06	EPA 3050B	1,6020A	BV
Mercury, Total	0.013	J	mg/kg	0.025	0.003	5	05/30/17 13:50	06/06/17 10:52	EPA 7474	1,7474	BV
Molybdenum, Total	1.46		mg/kg	1.35	0.183	10	05/26/17 18:48	06/09/17 14:06	EPA 3050B	1,6020A	BV
Nickel, Total	24.6		mg/kg	1.69	0.452	10	05/26/17 18:48	06/09/17 14:06	EPA 3050B	1,6020A	BV
Potassium, Total	3410		mg/kg	169	26.9	10	05/26/17 18:48	06/09/17 14:06	EPA 3050B	1,6020A	BV
Selenium, Total	11.8		mg/kg	3.38	1.28	10	05/26/17 18:48	06/09/17 14:06	EPA 3050B	1,6020A	BV
Silver, Total	ND		mg/kg	0.846	0.083	10	05/26/17 18:48	06/09/17 14:06	EPA 3050B	1,6020A	BV
Sodium, Total	5460		mg/kg	254	19.8	10	05/26/17 18:48	06/09/17 14:06	EPA 3050B	1,6020A	BV
Strontium, Total	32.2		mg/kg	1.69	0.415	10	05/26/17 18:48	06/09/17 14:06	EPA 3050B	1,6020A	BV
Thallium, Total	0.141	J	mg/kg	0.338	0.087	10	05/26/17 18:48	06/09/17 14:06	EPA 3050B	1,6020A	BV
Tin, Total	0.548	J	mg/kg	2.03	0.210	10	05/26/17 18:48	06/09/17 14:06	EPA 3050B	1,6020A	BV
Titanium, Total	290		mg/kg	0.846	0.146	10	05/26/17 18:48	06/09/17 14:06	EPA 3050B	1,6020A	BV
Vanadium, Total	39.7		mg/kg	1.69	0.642	10	05/26/17 18:48	06/09/17 14:06	EPA 3050B	1,6020A	BV
Zinc, Total	75.7		mg/kg	16.9	4.40	10	05/26/17 18:48	06/09/17 14:06	EPA 3050B	1,6020A	BV



Project Name: WILLIAMS (1794)

Lab Number: L1717026

Project Number: 1794

Report Date: 06/14/17

SAMPLE RESULTS

Lab ID: L1717026-08
 Client ID: VC89-D9-10E
 Sample Location: RARITAN BAY
 Matrix: Sediment
 Percent Solids: 52%

Date Collected: 05/19/17 16:15
 Date Received: 05/24/17
 Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Aluminum, Total	17000		mg/kg	185	27.3	10	05/26/17 18:48	06/09/17 14:10	EPA 3050B	1,6020A	BV
Antimony, Total	ND		mg/kg	2.95	0.250	10	05/26/17 18:48	06/09/17 14:10	EPA 3050B	1,6020A	BV
Arsenic, Total	14.0		mg/kg	0.923	0.122	10	05/26/17 18:48	06/09/17 14:10	EPA 3050B	1,6020A	BV
Barium, Total	33.4		mg/kg	5.54	0.390	10	05/26/17 18:48	06/09/17 14:10	EPA 3050B	1,6020A	BV
Beryllium, Total	1.02		mg/kg	0.554	0.161	10	05/26/17 18:48	06/09/17 14:10	EPA 3050B	1,6020A	BV
Cadmium, Total	0.174	J	mg/kg	0.369	0.049	10	05/26/17 18:48	06/09/17 14:10	EPA 3050B	1,6020A	BV
Calcium, Total	3980		mg/kg	923	112.	10	05/26/17 18:48	06/09/17 14:10	EPA 3050B	1,6020A	BV
Chromium, Total	37.4		mg/kg	3.69	0.864	10	05/26/17 18:48	06/09/17 14:10	EPA 3050B	1,6020A	BV
Cobalt, Total	10.1		mg/kg	0.923	0.098	10	05/26/17 18:48	06/09/17 14:10	EPA 3050B	1,6020A	BV
Copper, Total	15.4		mg/kg	3.69	0.358	10	05/26/17 18:48	06/09/17 14:10	EPA 3050B	1,6020A	BV
Iron, Total	52500		mg/kg	369	38.0	10	05/26/17 18:48	06/09/17 14:10	EPA 3050B	1,6020A	BV
Lead, Total	13.2		mg/kg	1.11	0.270	10	05/26/17 18:48	06/09/17 14:10	EPA 3050B	1,6020A	BV
Magnesium, Total	7620		mg/kg	185	22.7	10	05/26/17 18:48	06/09/17 14:10	EPA 3050B	1,6020A	BV
Manganese, Total	291		mg/kg	3.69	0.820	10	05/26/17 18:48	06/09/17 14:10	EPA 3050B	1,6020A	BV
Mercury, Total	0.013	J	mg/kg	0.025	0.003	5	05/30/17 13:50	06/06/17 10:55	EPA 7474	1,7474	BV
Molybdenum, Total	1.91		mg/kg	1.48	0.199	10	05/26/17 18:48	06/09/17 14:10	EPA 3050B	1,6020A	BV
Nickel, Total	27.2		mg/kg	1.85	0.493	10	05/26/17 18:48	06/09/17 14:10	EPA 3050B	1,6020A	BV
Potassium, Total	3700		mg/kg	185	29.3	10	05/26/17 18:48	06/09/17 14:10	EPA 3050B	1,6020A	BV
Selenium, Total	11.3		mg/kg	3.69	1.40	10	05/26/17 18:48	06/09/17 14:10	EPA 3050B	1,6020A	BV
Silver, Total	ND		mg/kg	0.923	0.090	10	05/26/17 18:48	06/09/17 14:10	EPA 3050B	1,6020A	BV
Sodium, Total	5570		mg/kg	277	21.6	10	05/26/17 18:48	06/09/17 14:10	EPA 3050B	1,6020A	BV
Strontium, Total	31.2		mg/kg	1.85	0.453	10	05/26/17 18:48	06/09/17 14:10	EPA 3050B	1,6020A	BV
Thallium, Total	0.165	J	mg/kg	0.369	0.095	10	05/26/17 18:48	06/09/17 14:10	EPA 3050B	1,6020A	BV
Tin, Total	0.493	J	mg/kg	2.22	0.229	10	05/26/17 18:48	06/09/17 14:10	EPA 3050B	1,6020A	BV
Titanium, Total	328		mg/kg	0.923	0.160	10	05/26/17 18:48	06/09/17 14:10	EPA 3050B	1,6020A	BV
Vanadium, Total	41.6		mg/kg	1.85	0.700	10	05/26/17 18:48	06/09/17 14:10	EPA 3050B	1,6020A	BV
Zinc, Total	82.0		mg/kg	18.5	4.80	10	05/26/17 18:48	06/09/17 14:10	EPA 3050B	1,6020A	BV



Project Name: WILLIAMS (1794)

Lab Number: L1717026

Project Number: 1794

Report Date: 06/14/17

SAMPLE RESULTS

Lab ID: L1717026-09

Date Collected: 05/19/17 17:07

Client ID: DUP-D9-10E

Date Received: 05/24/17

Sample Location: RARITAN BAY

Field Prep: Not Specified

Matrix: Sediment

Percent Solids: 54%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Aluminum, Total	15700		mg/kg	183	27.1	10	05/26/17 18:48	06/09/17 14:13	EPA 3050B	1,6020A	BV
Antimony, Total	ND		mg/kg	2.93	0.248	10	05/26/17 18:48	06/09/17 14:13	EPA 3050B	1,6020A	BV
Arsenic, Total	14.0		mg/kg	0.916	0.121	10	05/26/17 18:48	06/09/17 14:13	EPA 3050B	1,6020A	BV
Barium, Total	26.9		mg/kg	5.50	0.387	10	05/26/17 18:48	06/09/17 14:13	EPA 3050B	1,6020A	BV
Beryllium, Total	0.974		mg/kg	0.550	0.160	10	05/26/17 18:48	06/09/17 14:13	EPA 3050B	1,6020A	BV
Cadmium, Total	0.132	J	mg/kg	0.366	0.048	10	05/26/17 18:48	06/09/17 14:13	EPA 3050B	1,6020A	BV
Calcium, Total	3070		mg/kg	916	111.	10	05/26/17 18:48	06/09/17 14:13	EPA 3050B	1,6020A	BV
Chromium, Total	33.6		mg/kg	3.66	0.858	10	05/26/17 18:48	06/09/17 14:13	EPA 3050B	1,6020A	BV
Cobalt, Total	9.40		mg/kg	0.916	0.098	10	05/26/17 18:48	06/09/17 14:13	EPA 3050B	1,6020A	BV
Copper, Total	13.3		mg/kg	3.66	0.355	10	05/26/17 18:48	06/09/17 14:13	EPA 3050B	1,6020A	BV
Iron, Total	36100		mg/kg	366	37.7	10	05/26/17 18:48	06/09/17 14:13	EPA 3050B	1,6020A	BV
Lead, Total	13.1		mg/kg	1.10	0.268	10	05/26/17 18:48	06/09/17 14:13	EPA 3050B	1,6020A	BV
Magnesium, Total	7950		mg/kg	183	22.6	10	05/26/17 18:48	06/09/17 14:13	EPA 3050B	1,6020A	BV
Manganese, Total	277		mg/kg	3.66	0.814	10	05/26/17 18:48	06/09/17 14:13	EPA 3050B	1,6020A	BV
Mercury, Total	0.012	J	mg/kg	0.026	0.003	5	05/30/17 13:50	06/06/17 10:57	EPA 7474	1,7474	BV
Molybdenum, Total	2.01		mg/kg	1.46	0.198	10	05/26/17 18:48	06/09/17 14:13	EPA 3050B	1,6020A	BV
Nickel, Total	24.4		mg/kg	1.83	0.490	10	05/26/17 18:48	06/09/17 14:13	EPA 3050B	1,6020A	BV
Potassium, Total	3530		mg/kg	183	29.1	10	05/26/17 18:48	06/09/17 14:13	EPA 3050B	1,6020A	BV
Selenium, Total	11.2		mg/kg	3.66	1.38	10	05/26/17 18:48	06/09/17 14:13	EPA 3050B	1,6020A	BV
Silver, Total	ND		mg/kg	0.916	0.089	10	05/26/17 18:48	06/09/17 14:13	EPA 3050B	1,6020A	BV
Sodium, Total	7660		mg/kg	275	21.5	10	05/26/17 18:48	06/09/17 14:13	EPA 3050B	1,6020A	BV
Strontium, Total	29.0		mg/kg	1.83	0.449	10	05/26/17 18:48	06/09/17 14:13	EPA 3050B	1,6020A	BV
Thallium, Total	0.142	J	mg/kg	0.366	0.095	10	05/26/17 18:48	06/09/17 14:13	EPA 3050B	1,6020A	BV
Tin, Total	0.515	J	mg/kg	2.20	0.227	10	05/26/17 18:48	06/09/17 14:13	EPA 3050B	1,6020A	BV
Titanium, Total	290		mg/kg	0.916	0.158	10	05/26/17 18:48	06/09/17 14:13	EPA 3050B	1,6020A	BV
Vanadium, Total	38.9		mg/kg	1.83	0.695	10	05/26/17 18:48	06/09/17 14:13	EPA 3050B	1,6020A	BV
Zinc, Total	72.1		mg/kg	18.3	4.76	10	05/26/17 18:48	06/09/17 14:13	EPA 3050B	1,6020A	BV



Project Name: WILLIAMS (1794)

Lab Number: L1717026

Project Number: 1794

Report Date: 06/14/17

SAMPLE RESULTS

Lab ID: L1717026-10
 Client ID: DUP-D0-3E
 Sample Location: RARITAN BAY
 Matrix: Sediment
 Percent Solids: 82%

Date Collected: 05/19/17 16:15
 Date Received: 05/24/17
 Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Aluminum, Total	1500		mg/kg	121	17.9	10	05/26/17 18:48	06/09/17 14:16	EPA 3050B	1,6020A	BV
Antimony, Total	ND		mg/kg	1.94	0.164	10	05/26/17 18:48	06/09/17 14:16	EPA 3050B	1,6020A	BV
Arsenic, Total	6.20		mg/kg	0.606	0.080	10	05/26/17 18:48	06/09/17 14:16	EPA 3050B	1,6020A	BV
Barium, Total	1.75	J	mg/kg	3.63	0.256	10	05/26/17 18:48	06/09/17 14:16	EPA 3050B	1,6020A	BV
Beryllium, Total	0.216	J	mg/kg	0.363	0.106	10	05/26/17 18:48	06/09/17 14:16	EPA 3050B	1,6020A	BV
Cadmium, Total	ND		mg/kg	0.242	0.032	10	05/26/17 18:48	06/09/17 14:16	EPA 3050B	1,6020A	BV
Calcium, Total	773		mg/kg	606	73.7	10	05/26/17 18:48	06/09/17 14:16	EPA 3050B	1,6020A	BV
Chromium, Total	11.3		mg/kg	2.42	0.567	10	05/26/17 18:48	06/09/17 14:16	EPA 3050B	1,6020A	BV
Cobalt, Total	0.943		mg/kg	0.606	0.064	10	05/26/17 18:48	06/09/17 14:16	EPA 3050B	1,6020A	BV
Copper, Total	3.38		mg/kg	2.42	0.235	10	05/26/17 18:48	06/09/17 14:16	EPA 3050B	1,6020A	BV
Iron, Total	13600		mg/kg	242	25.0	10	05/26/17 18:48	06/09/17 14:16	EPA 3050B	1,6020A	BV
Lead, Total	2.15		mg/kg	0.727	0.177	10	05/26/17 18:48	06/09/17 14:16	EPA 3050B	1,6020A	BV
Magnesium, Total	776		mg/kg	121	14.9	10	05/26/17 18:48	06/09/17 14:16	EPA 3050B	1,6020A	BV
Manganese, Total	22.4		mg/kg	2.42	0.538	10	05/26/17 18:48	06/09/17 14:16	EPA 3050B	1,6020A	BV
Mercury, Total	ND		mg/kg	0.014	0.002	5	05/30/17 13:50	06/06/17 11:00	EPA 7474	1,7474	BV
Molybdenum, Total	0.983		mg/kg	0.969	0.131	10	05/26/17 18:48	06/09/17 14:16	EPA 3050B	1,6020A	BV
Nickel, Total	2.76		mg/kg	1.21	0.324	10	05/26/17 18:48	06/09/17 14:16	EPA 3050B	1,6020A	BV
Potassium, Total	293		mg/kg	121	19.2	10	05/26/17 18:48	06/09/17 14:16	EPA 3050B	1,6020A	BV
Selenium, Total	1.58	J	mg/kg	2.42	0.916	10	05/26/17 18:48	06/09/17 14:16	EPA 3050B	1,6020A	BV
Silver, Total	ND		mg/kg	0.606	0.059	10	05/26/17 18:48	06/09/17 14:16	EPA 3050B	1,6020A	BV
Sodium, Total	2130		mg/kg	182	14.2	10	05/26/17 18:48	06/09/17 14:16	EPA 3050B	1,6020A	BV
Strontium, Total	6.01		mg/kg	1.21	0.297	10	05/26/17 18:48	06/09/17 14:16	EPA 3050B	1,6020A	BV
Thallium, Total	ND		mg/kg	0.242	0.063	10	05/26/17 18:48	06/09/17 14:16	EPA 3050B	1,6020A	BV
Tin, Total	ND		mg/kg	1.45	0.150	10	05/26/17 18:48	06/09/17 14:16	EPA 3050B	1,6020A	BV
Titanium, Total	44.0		mg/kg	0.606	0.105	10	05/26/17 18:48	06/09/17 14:16	EPA 3050B	1,6020A	BV
Vanadium, Total	19.0		mg/kg	1.21	0.459	10	05/26/17 18:48	06/09/17 14:16	EPA 3050B	1,6020A	BV
Zinc, Total	10.3	J	mg/kg	12.1	3.15	10	05/26/17 18:48	06/09/17 14:16	EPA 3050B	1,6020A	BV



Project Name: WILLIAMS (1794)
Project Number: 1794

Lab Number: L1717026
Report Date: 06/14/17

SAMPLE RESULTS

Lab ID: L1717026-11
Client ID: VC90-D0-3E
Sample Location: RARITAN BAY
Matrix: Sediment
Percent Solids: 81%

Date Collected: 05/19/17 15:42
Date Received: 05/24/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Aluminum, Total	3730		mg/kg	118	17.5	10	05/26/17 18:48	06/09/17 14:19	EPA 3050B	1,6020A	BV
Antimony, Total	ND		mg/kg	1.89	0.160	10	05/26/17 18:48	06/09/17 14:19	EPA 3050B	1,6020A	BV
Arsenic, Total	3.66		mg/kg	0.592	0.078	10	05/26/17 18:48	06/09/17 14:19	EPA 3050B	1,6020A	BV
Barium, Total	7.69		mg/kg	3.55	0.250	10	05/26/17 18:48	06/09/17 14:19	EPA 3050B	1,6020A	BV
Beryllium, Total	0.289	J	mg/kg	0.355	0.103	10	05/26/17 18:48	06/09/17 14:19	EPA 3050B	1,6020A	BV
Cadmium, Total	0.041	J	mg/kg	0.237	0.031	10	05/26/17 18:48	06/09/17 14:19	EPA 3050B	1,6020A	BV
Calcium, Total	11200		mg/kg	592	72.0	10	05/26/17 18:48	06/09/17 14:19	EPA 3050B	1,6020A	BV
Chromium, Total	9.58		mg/kg	2.37	0.554	10	05/26/17 18:48	06/09/17 14:19	EPA 3050B	1,6020A	BV
Cobalt, Total	2.82		mg/kg	0.592	0.063	10	05/26/17 18:48	06/09/17 14:19	EPA 3050B	1,6020A	BV
Copper, Total	4.32		mg/kg	2.37	0.230	10	05/26/17 18:48	06/09/17 14:19	EPA 3050B	1,6020A	BV
Iron, Total	11200		mg/kg	237	24.4	10	05/26/17 18:48	06/09/17 14:19	EPA 3050B	1,6020A	BV
Lead, Total	6.21		mg/kg	0.710	0.173	10	05/26/17 18:48	06/09/17 14:19	EPA 3050B	1,6020A	BV
Magnesium, Total	1830		mg/kg	118	14.6	10	05/26/17 18:48	06/09/17 14:19	EPA 3050B	1,6020A	BV
Manganese, Total	102		mg/kg	2.37	0.526	10	05/26/17 18:48	06/09/17 14:19	EPA 3050B	1,6020A	BV
Mercury, Total	0.002	J	mg/kg	0.013	0.002	5	05/30/17 13:50	06/06/17 11:02	EPA 7474	1,7474	BV
Molybdenum, Total	0.587	J	mg/kg	0.947	0.128	10	05/26/17 18:48	06/09/17 14:19	EPA 3050B	1,6020A	BV
Nickel, Total	5.73		mg/kg	1.18	0.316	10	05/26/17 18:48	06/09/17 14:19	EPA 3050B	1,6020A	BV
Potassium, Total	771		mg/kg	118	18.8	10	05/26/17 18:48	06/09/17 14:19	EPA 3050B	1,6020A	BV
Selenium, Total	2.65		mg/kg	2.37	0.895	10	05/26/17 18:48	06/09/17 14:19	EPA 3050B	1,6020A	BV
Silver, Total	ND		mg/kg	0.592	0.058	10	05/26/17 18:48	06/09/17 14:19	EPA 3050B	1,6020A	BV
Sodium, Total	2610		mg/kg	178	13.9	10	05/26/17 18:48	06/09/17 14:19	EPA 3050B	1,6020A	BV
Strontium, Total	53.2		mg/kg	1.18	0.290	10	05/26/17 18:48	06/09/17 14:19	EPA 3050B	1,6020A	BV
Thallium, Total	ND		mg/kg	0.237	0.061	10	05/26/17 18:48	06/09/17 14:19	EPA 3050B	1,6020A	BV
Tin, Total	0.202	J	mg/kg	1.42	0.147	10	05/26/17 18:48	06/09/17 14:19	EPA 3050B	1,6020A	BV
Titanium, Total	101		mg/kg	0.592	0.102	10	05/26/17 18:48	06/09/17 14:19	EPA 3050B	1,6020A	BV
Vanadium, Total	14.3		mg/kg	1.18	0.449	10	05/26/17 18:48	06/09/17 14:19	EPA 3050B	1,6020A	BV
Zinc, Total	18.5		mg/kg	11.8	3.08	10	05/26/17 18:48	06/09/17 14:19	EPA 3050B	1,6020A	BV



Project Name: WILLIAMS (1794)

Lab Number: L1717026

Project Number: 1794

Report Date: 06/14/17

SAMPLE RESULTS

Lab ID: L1717026-12
 Client ID: VC90-D3-6E
 Sample Location: RARITAN BAY
 Matrix: Sediment
 Percent Solids: 70%

Date Collected: 05/19/17 15:42
 Date Received: 05/24/17
 Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Aluminum, Total	8420		mg/kg	137	20.3	10	05/26/17 18:48	06/09/17 14:22	EPA 3050B	1,6020A	BV
Antimony, Total	ND		mg/kg	2.20	0.186	10	05/26/17 18:48	06/09/17 14:22	EPA 3050B	1,6020A	BV
Arsenic, Total	9.33		mg/kg	0.686	0.091	10	05/26/17 18:48	06/09/17 14:22	EPA 3050B	1,6020A	BV
Barium, Total	16.5		mg/kg	4.12	0.290	10	05/26/17 18:48	06/09/17 14:22	EPA 3050B	1,6020A	BV
Beryllium, Total	0.636		mg/kg	0.412	0.120	10	05/26/17 18:48	06/09/17 14:22	EPA 3050B	1,6020A	BV
Cadmium, Total	0.071	J	mg/kg	0.274	0.036	10	05/26/17 18:48	06/09/17 14:22	EPA 3050B	1,6020A	BV
Calcium, Total	2950		mg/kg	686	83.4	10	05/26/17 18:48	06/09/17 14:22	EPA 3050B	1,6020A	BV
Chromium, Total	21.2		mg/kg	2.74	0.642	10	05/26/17 18:48	06/09/17 14:22	EPA 3050B	1,6020A	BV
Cobalt, Total	5.59		mg/kg	0.686	0.073	10	05/26/17 18:48	06/09/17 14:22	EPA 3050B	1,6020A	BV
Copper, Total	9.11		mg/kg	2.74	0.266	10	05/26/17 18:48	06/09/17 14:22	EPA 3050B	1,6020A	BV
Iron, Total	27300		mg/kg	274	28.3	10	05/26/17 18:48	06/09/17 14:22	EPA 3050B	1,6020A	BV
Lead, Total	8.87		mg/kg	0.824	0.200	10	05/26/17 18:48	06/09/17 14:22	EPA 3050B	1,6020A	BV
Magnesium, Total	4880		mg/kg	137	16.9	10	05/26/17 18:48	06/09/17 14:22	EPA 3050B	1,6020A	BV
Manganese, Total	158		mg/kg	2.74	0.609	10	05/26/17 18:48	06/09/17 14:22	EPA 3050B	1,6020A	BV
Mercury, Total	0.007	J	mg/kg	0.020	0.003	5	05/30/17 13:50	06/06/17 11:11	EPA 7474	1,7474	BV
Molybdenum, Total	2.63		mg/kg	1.10	0.148	10	05/26/17 18:48	06/09/17 14:22	EPA 3050B	1,6020A	BV
Nickel, Total	13.7		mg/kg	1.37	0.367	10	05/26/17 18:48	06/09/17 14:22	EPA 3050B	1,6020A	BV
Potassium, Total	1960		mg/kg	137	21.8	10	05/26/17 18:48	06/09/17 14:22	EPA 3050B	1,6020A	BV
Selenium, Total	8.94		mg/kg	2.74	1.04	10	05/26/17 18:48	06/09/17 14:22	EPA 3050B	1,6020A	BV
Silver, Total	ND		mg/kg	0.686	0.067	10	05/26/17 18:48	06/09/17 14:22	EPA 3050B	1,6020A	BV
Sodium, Total	4560		mg/kg	206	16.1	10	05/26/17 18:48	06/09/17 14:22	EPA 3050B	1,6020A	BV
Strontium, Total	24.0		mg/kg	1.37	0.336	10	05/26/17 18:48	06/09/17 14:22	EPA 3050B	1,6020A	BV
Thallium, Total	0.086	J	mg/kg	0.274	0.071	10	05/26/17 18:48	06/09/17 14:22	EPA 3050B	1,6020A	BV
Tin, Total	0.317	J	mg/kg	1.65	0.170	10	05/26/17 18:48	06/09/17 14:22	EPA 3050B	1,6020A	BV
Titanium, Total	183		mg/kg	0.686	0.118	10	05/26/17 18:48	06/09/17 14:22	EPA 3050B	1,6020A	BV
Vanadium, Total	34.8		mg/kg	1.37	0.520	10	05/26/17 18:48	06/09/17 14:22	EPA 3050B	1,6020A	BV
Zinc, Total	47.1		mg/kg	13.7	3.57	10	05/26/17 18:48	06/09/17 14:22	EPA 3050B	1,6020A	BV



Project Name: WILLIAMS (1794)

Lab Number: L1717026

Project Number: 1794

Report Date: 06/14/17

SAMPLE RESULTS

Lab ID: L1717026-13
 Client ID: VC90-D6-9E
 Sample Location: RARITAN BAY
 Matrix: Sediment
 Percent Solids: 56%

Date Collected: 05/19/17 15:42
 Date Received: 05/24/17
 Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Aluminum, Total	15800		mg/kg	176	26.1	10	05/26/17 18:48	06/09/17 14:25	EPA 3050B	1,6020A	BV
Antimony, Total	ND		mg/kg	2.82	0.238	10	05/26/17 18:48	06/09/17 14:25	EPA 3050B	1,6020A	BV
Arsenic, Total	14.6		mg/kg	0.881	0.116	10	05/26/17 18:48	06/09/17 14:25	EPA 3050B	1,6020A	BV
Barium, Total	26.6		mg/kg	5.28	0.372	10	05/26/17 18:48	06/09/17 14:25	EPA 3050B	1,6020A	BV
Beryllium, Total	1.00		mg/kg	0.528	0.154	10	05/26/17 18:48	06/09/17 14:25	EPA 3050B	1,6020A	BV
Cadmium, Total	0.079	J	mg/kg	0.352	0.047	10	05/26/17 18:48	06/09/17 14:25	EPA 3050B	1,6020A	BV
Calcium, Total	2740		mg/kg	881	107.	10	05/26/17 18:48	06/09/17 14:25	EPA 3050B	1,6020A	BV
Chromium, Total	34.1		mg/kg	3.52	0.824	10	05/26/17 18:48	06/09/17 14:25	EPA 3050B	1,6020A	BV
Cobalt, Total	9.42		mg/kg	0.881	0.094	10	05/26/17 18:48	06/09/17 14:25	EPA 3050B	1,6020A	BV
Copper, Total	14.5		mg/kg	3.52	0.342	10	05/26/17 18:48	06/09/17 14:25	EPA 3050B	1,6020A	BV
Iron, Total	38500		mg/kg	352	36.3	10	05/26/17 18:48	06/09/17 14:25	EPA 3050B	1,6020A	BV
Lead, Total	13.5		mg/kg	1.06	0.257	10	05/26/17 18:48	06/09/17 14:25	EPA 3050B	1,6020A	BV
Magnesium, Total	7860		mg/kg	176	21.7	10	05/26/17 18:48	06/09/17 14:25	EPA 3050B	1,6020A	BV
Manganese, Total	275		mg/kg	3.52	0.782	10	05/26/17 18:48	06/09/17 14:25	EPA 3050B	1,6020A	BV
Mercury, Total	0.013	J	mg/kg	0.023	0.003	5	05/30/17 13:50	06/06/17 11:13	EPA 7474	1,7474	BV
Molybdenum, Total	1.30	J	mg/kg	1.41	0.190	10	05/26/17 18:48	06/09/17 14:25	EPA 3050B	1,6020A	BV
Nickel, Total	24.7		mg/kg	1.76	0.471	10	05/26/17 18:48	06/09/17 14:25	EPA 3050B	1,6020A	BV
Potassium, Total	3500		mg/kg	176	28.0	10	05/26/17 18:48	06/09/17 14:25	EPA 3050B	1,6020A	BV
Selenium, Total	11.4		mg/kg	3.52	1.33	10	05/26/17 18:48	06/09/17 14:25	EPA 3050B	1,6020A	BV
Silver, Total	ND		mg/kg	0.881	0.086	10	05/26/17 18:48	06/09/17 14:25	EPA 3050B	1,6020A	BV
Sodium, Total	6100		mg/kg	264	20.6	10	05/26/17 18:48	06/09/17 14:25	EPA 3050B	1,6020A	BV
Strontium, Total	26.5		mg/kg	1.76	0.432	10	05/26/17 18:48	06/09/17 14:25	EPA 3050B	1,6020A	BV
Thallium, Total	0.138	J	mg/kg	0.352	0.091	10	05/26/17 18:48	06/09/17 14:25	EPA 3050B	1,6020A	BV
Tin, Total	0.470	J	mg/kg	2.11	0.218	10	05/26/17 18:48	06/09/17 14:25	EPA 3050B	1,6020A	BV
Titanium, Total	272		mg/kg	0.881	0.152	10	05/26/17 18:48	06/09/17 14:25	EPA 3050B	1,6020A	BV
Vanadium, Total	38.2		mg/kg	1.76	0.668	10	05/26/17 18:48	06/09/17 14:25	EPA 3050B	1,6020A	BV
Zinc, Total	76.0		mg/kg	17.6	4.58	10	05/26/17 18:48	06/09/17 14:25	EPA 3050B	1,6020A	BV



Project Name: WILLIAMS (1794)

Lab Number: L1717026

Project Number: 1794

Report Date: 06/14/17

SAMPLE RESULTS

Lab ID: L1717026-14
 Client ID: VC90-D9-10E
 Sample Location: RARITAN BAY
 Matrix: Sediment
 Percent Solids: 54%

Date Collected: 05/19/17 15:42
 Date Received: 05/24/17
 Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Aluminum, Total	17000		mg/kg	180	26.6	10	05/26/17 18:48	06/09/17 14:28	EPA 3050B	1,6020A	BV
Antimony, Total	ND		mg/kg	2.88	0.243	10	05/26/17 18:48	06/09/17 14:28	EPA 3050B	1,6020A	BV
Arsenic, Total	16.2		mg/kg	0.900	0.119	10	05/26/17 18:48	06/09/17 14:28	EPA 3050B	1,6020A	BV
Barium, Total	30.5		mg/kg	5.40	0.380	10	05/26/17 18:48	06/09/17 14:28	EPA 3050B	1,6020A	BV
Beryllium, Total	1.04		mg/kg	0.540	0.157	10	05/26/17 18:48	06/09/17 14:28	EPA 3050B	1,6020A	BV
Cadmium, Total	0.260	J	mg/kg	0.360	0.048	10	05/26/17 18:48	06/09/17 14:28	EPA 3050B	1,6020A	BV
Calcium, Total	16500		mg/kg	900	109.	10	05/26/17 18:48	06/09/17 14:28	EPA 3050B	1,6020A	BV
Chromium, Total	38.1		mg/kg	3.60	0.842	10	05/26/17 18:48	06/09/17 14:28	EPA 3050B	1,6020A	BV
Cobalt, Total	10.1		mg/kg	0.900	0.096	10	05/26/17 18:48	06/09/17 14:28	EPA 3050B	1,6020A	BV
Copper, Total	15.3		mg/kg	3.60	0.349	10	05/26/17 18:48	06/09/17 14:28	EPA 3050B	1,6020A	BV
Iron, Total	44200		mg/kg	360	37.1	10	05/26/17 18:48	06/09/17 14:28	EPA 3050B	1,6020A	BV
Lead, Total	13.7		mg/kg	1.08	0.263	10	05/26/17 18:48	06/09/17 14:28	EPA 3050B	1,6020A	BV
Magnesium, Total	7880		mg/kg	180	22.2	10	05/26/17 18:48	06/09/17 14:28	EPA 3050B	1,6020A	BV
Manganese, Total	375		mg/kg	3.60	0.799	10	05/26/17 18:48	06/09/17 14:28	EPA 3050B	1,6020A	BV
Mercury, Total	0.015	J	mg/kg	0.026	0.003	5	05/30/17 13:50	06/06/17 11:16	EPA 7474	1,7474	BV
Molybdenum, Total	3.81		mg/kg	1.44	0.194	10	05/26/17 18:48	06/09/17 14:28	EPA 3050B	1,6020A	BV
Nickel, Total	27.4		mg/kg	1.80	0.481	10	05/26/17 18:48	06/09/17 14:28	EPA 3050B	1,6020A	BV
Potassium, Total	3760		mg/kg	180	28.6	10	05/26/17 18:48	06/09/17 14:28	EPA 3050B	1,6020A	BV
Selenium, Total	11.3		mg/kg	3.60	1.36	10	05/26/17 18:48	06/09/17 14:28	EPA 3050B	1,6020A	BV
Silver, Total	ND		mg/kg	0.900	0.088	10	05/26/17 18:48	06/09/17 14:28	EPA 3050B	1,6020A	BV
Sodium, Total	6650		mg/kg	270	21.1	10	05/26/17 18:48	06/09/17 14:28	EPA 3050B	1,6020A	BV
Strontium, Total	79.6		mg/kg	1.80	0.441	10	05/26/17 18:48	06/09/17 14:28	EPA 3050B	1,6020A	BV
Thallium, Total	0.185	J	mg/kg	0.360	0.093	10	05/26/17 18:48	06/09/17 14:28	EPA 3050B	1,6020A	BV
Tin, Total	0.518	J	mg/kg	2.16	0.223	10	05/26/17 18:48	06/09/17 14:28	EPA 3050B	1,6020A	BV
Titanium, Total	335		mg/kg	0.900	0.156	10	05/26/17 18:48	06/09/17 14:28	EPA 3050B	1,6020A	BV
Vanadium, Total	41.0		mg/kg	1.80	0.683	10	05/26/17 18:48	06/09/17 14:28	EPA 3050B	1,6020A	BV
Zinc, Total	77.1		mg/kg	18.0	4.68	10	05/26/17 18:48	06/09/17 14:28	EPA 3050B	1,6020A	BV



Project Name: WILLIAMS (1794)

Lab Number: L1717026

Project Number: 1794

Report Date: 06/14/17

SAMPLE RESULTS

Lab ID: L1717026-15

Date Collected: 05/19/17 15:10

Client ID: VC91-D0-3E

Date Received: 05/24/17

Sample Location: RARITAN BAY

Field Prep: Not Specified

Matrix: Sediment

Percent Solids: 84%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Aluminum, Total	2050		mg/kg	114	16.9	10	05/26/17 18:48	06/09/17 14:44	EPA 3050B	1,6020A	BV
Antimony, Total	ND		mg/kg	1.82	0.154	10	05/26/17 18:48	06/09/17 14:44	EPA 3050B	1,6020A	BV
Arsenic, Total	2.06		mg/kg	0.570	0.075	10	05/26/17 18:48	06/09/17 14:44	EPA 3050B	1,6020A	BV
Barium, Total	6.15		mg/kg	3.42	0.241	10	05/26/17 18:48	06/09/17 14:44	EPA 3050B	1,6020A	BV
Beryllium, Total	0.201	J	mg/kg	0.342	0.100	10	05/26/17 18:48	06/09/17 14:44	EPA 3050B	1,6020A	BV
Cadmium, Total	0.146	J	mg/kg	0.228	0.030	10	05/26/17 18:48	06/09/17 14:44	EPA 3050B	1,6020A	BV
Calcium, Total	260	J	mg/kg	570	69.4	10	05/26/17 18:48	06/09/17 14:44	EPA 3050B	1,6020A	BV
Chromium, Total	8.18		mg/kg	2.28	0.534	10	05/26/17 18:48	06/09/17 14:44	EPA 3050B	1,6020A	BV
Cobalt, Total	1.41		mg/kg	0.570	0.061	10	05/26/17 18:48	06/09/17 14:44	EPA 3050B	1,6020A	BV
Copper, Total	10.7		mg/kg	2.28	0.221	10	05/26/17 18:48	06/09/17 14:44	EPA 3050B	1,6020A	BV
Iron, Total	7760		mg/kg	228	23.5	10	05/26/17 18:48	06/09/17 14:44	EPA 3050B	1,6020A	BV
Lead, Total	5.77		mg/kg	0.685	0.166	10	05/26/17 18:48	06/09/17 14:44	EPA 3050B	1,6020A	BV
Magnesium, Total	797		mg/kg	114	14.0	10	05/26/17 18:48	06/09/17 14:44	EPA 3050B	1,6020A	BV
Manganese, Total	25.7		mg/kg	2.28	0.507	10	05/26/17 18:48	06/09/17 14:44	EPA 3050B	1,6020A	BV
Mercury, Total	ND		mg/kg	0.015	0.002	5	05/30/17 13:50	06/06/17 11:18	EPA 7474	1,7474	BV
Molybdenum, Total	0.243	J	mg/kg	0.913	0.123	10	05/26/17 18:48	06/09/17 14:44	EPA 3050B	1,6020A	BV
Nickel, Total	3.50		mg/kg	1.14	0.305	10	05/26/17 18:48	06/09/17 14:44	EPA 3050B	1,6020A	BV
Potassium, Total	372		mg/kg	114	18.1	10	05/26/17 18:48	06/09/17 14:44	EPA 3050B	1,6020A	BV
Selenium, Total	2.54		mg/kg	2.28	0.863	10	05/26/17 18:48	06/09/17 14:44	EPA 3050B	1,6020A	BV
Silver, Total	ND		mg/kg	0.570	0.056	10	05/26/17 18:48	06/09/17 14:44	EPA 3050B	1,6020A	BV
Sodium, Total	1760		mg/kg	171	13.4	10	05/26/17 18:48	06/09/17 14:44	EPA 3050B	1,6020A	BV
Strontium, Total	4.77		mg/kg	1.14	0.280	10	05/26/17 18:48	06/09/17 14:44	EPA 3050B	1,6020A	BV
Thallium, Total	0.177	J	mg/kg	0.228	0.059	10	05/26/17 18:48	06/09/17 14:44	EPA 3050B	1,6020A	BV
Tin, Total	ND		mg/kg	1.37	0.141	10	05/26/17 18:48	06/09/17 14:44	EPA 3050B	1,6020A	BV
Titanium, Total	43.9		mg/kg	0.570	0.099	10	05/26/17 18:48	06/09/17 14:44	EPA 3050B	1,6020A	BV
Vanadium, Total	17.1		mg/kg	1.14	0.433	10	05/26/17 18:48	06/09/17 14:44	EPA 3050B	1,6020A	BV
Zinc, Total	13.3		mg/kg	11.4	2.97	10	05/26/17 18:48	06/09/17 14:44	EPA 3050B	1,6020A	BV



Project Name: WILLIAMS (1794)

Lab Number: L1717026

Project Number: 1794

Report Date: 06/14/17

SAMPLE RESULTS

Lab ID: L1717026-16
 Client ID: VC91-D3-6E
 Sample Location: RARITAN BAY
 Matrix: Sediment
 Percent Solids: 62%

Date Collected: 05/19/17 15:10
 Date Received: 05/24/17
 Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Aluminum, Total	12500		mg/kg	159	23.6	10	05/26/17 18:48	06/09/17 14:47	EPA 3050B	1,6020A	BV
Antimony, Total	ND		mg/kg	2.55	0.215	10	05/26/17 18:48	06/09/17 14:47	EPA 3050B	1,6020A	BV
Arsenic, Total	11.2		mg/kg	0.796	0.105	10	05/26/17 18:48	06/09/17 14:47	EPA 3050B	1,6020A	BV
Barium, Total	25.1		mg/kg	4.77	0.336	10	05/26/17 18:48	06/09/17 14:47	EPA 3050B	1,6020A	BV
Beryllium, Total	0.840		mg/kg	0.477	0.139	10	05/26/17 18:48	06/09/17 14:47	EPA 3050B	1,6020A	BV
Cadmium, Total	0.114	J	mg/kg	0.318	0.042	10	05/26/17 18:48	06/09/17 14:47	EPA 3050B	1,6020A	BV
Calcium, Total	11000		mg/kg	796	96.8	10	05/26/17 18:48	06/09/17 14:47	EPA 3050B	1,6020A	BV
Chromium, Total	27.7		mg/kg	3.18	0.745	10	05/26/17 18:48	06/09/17 14:47	EPA 3050B	1,6020A	BV
Cobalt, Total	7.60		mg/kg	0.796	0.085	10	05/26/17 18:48	06/09/17 14:47	EPA 3050B	1,6020A	BV
Copper, Total	11.8		mg/kg	3.18	0.309	10	05/26/17 18:48	06/09/17 14:47	EPA 3050B	1,6020A	BV
Iron, Total	31700		mg/kg	318	32.8	10	05/26/17 18:48	06/09/17 14:47	EPA 3050B	1,6020A	BV
Lead, Total	11.4		mg/kg	0.955	0.232	10	05/26/17 18:48	06/09/17 14:47	EPA 3050B	1,6020A	BV
Magnesium, Total	6310		mg/kg	159	19.6	10	05/26/17 18:48	06/09/17 14:47	EPA 3050B	1,6020A	BV
Manganese, Total	227		mg/kg	3.18	0.706	10	05/26/17 18:48	06/09/17 14:47	EPA 3050B	1,6020A	BV
Mercury, Total	0.011	J	mg/kg	0.018	0.002	5	05/30/17 13:50	06/06/17 11:21	EPA 7474	1,7474	BV
Molybdenum, Total	1.56		mg/kg	1.27	0.172	10	05/26/17 18:48	06/09/17 14:47	EPA 3050B	1,6020A	BV
Nickel, Total	18.9		mg/kg	1.59	0.425	10	05/26/17 18:48	06/09/17 14:47	EPA 3050B	1,6020A	BV
Potassium, Total	2800		mg/kg	159	25.3	10	05/26/17 18:48	06/09/17 14:47	EPA 3050B	1,6020A	BV
Selenium, Total	9.21		mg/kg	3.18	1.20	10	05/26/17 18:48	06/09/17 14:47	EPA 3050B	1,6020A	BV
Silver, Total	ND		mg/kg	0.796	0.078	10	05/26/17 18:48	06/09/17 14:47	EPA 3050B	1,6020A	BV
Sodium, Total	5440		mg/kg	239	18.6	10	05/26/17 18:48	06/09/17 14:47	EPA 3050B	1,6020A	BV
Strontium, Total	62.8		mg/kg	1.59	0.390	10	05/26/17 18:48	06/09/17 14:47	EPA 3050B	1,6020A	BV
Thallium, Total	0.170	J	mg/kg	0.318	0.082	10	05/26/17 18:48	06/09/17 14:47	EPA 3050B	1,6020A	BV
Tin, Total	0.433	J	mg/kg	1.91	0.197	10	05/26/17 18:48	06/09/17 14:47	EPA 3050B	1,6020A	BV
Titanium, Total	233		mg/kg	0.796	0.137	10	05/26/17 18:48	06/09/17 14:47	EPA 3050B	1,6020A	BV
Vanadium, Total	31.4		mg/kg	1.59	0.603	10	05/26/17 18:48	06/09/17 14:47	EPA 3050B	1,6020A	BV
Zinc, Total	58.7		mg/kg	15.9	4.14	10	05/26/17 18:48	06/09/17 14:47	EPA 3050B	1,6020A	BV



Project Name: WILLIAMS (1794)

Lab Number: L1717026

Project Number: 1794

Report Date: 06/14/17

SAMPLE RESULTS

Lab ID: L1717026-17
 Client ID: VC91-D6-9.6E
 Sample Location: RARITAN BAY
 Matrix: Sediment
 Percent Solids: 57%

Date Collected: 05/19/17 15:10
 Date Received: 05/24/17
 Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Aluminum, Total	16000		mg/kg	174	25.7	10	05/26/17 18:48	06/09/17 14:50	EPA 3050B	1,6020A	BV
Antimony, Total	ND		mg/kg	2.78	0.235	10	05/26/17 18:48	06/09/17 14:50	EPA 3050B	1,6020A	BV
Arsenic, Total	12.8		mg/kg	0.868	0.115	10	05/26/17 18:48	06/09/17 14:50	EPA 3050B	1,6020A	BV
Barium, Total	28.9		mg/kg	5.21	0.367	10	05/26/17 18:48	06/09/17 14:50	EPA 3050B	1,6020A	BV
Beryllium, Total	1.04		mg/kg	0.521	0.151	10	05/26/17 18:48	06/09/17 14:50	EPA 3050B	1,6020A	BV
Cadmium, Total	0.152	J	mg/kg	0.347	0.046	10	05/26/17 18:48	06/09/17 14:50	EPA 3050B	1,6020A	BV
Calcium, Total	3410		mg/kg	868	106.	10	05/26/17 18:48	06/09/17 14:50	EPA 3050B	1,6020A	BV
Chromium, Total	35.1		mg/kg	3.47	0.813	10	05/26/17 18:48	06/09/17 14:50	EPA 3050B	1,6020A	BV
Cobalt, Total	9.79		mg/kg	0.868	0.092	10	05/26/17 18:48	06/09/17 14:50	EPA 3050B	1,6020A	BV
Copper, Total	15.0		mg/kg	3.47	0.337	10	05/26/17 18:48	06/09/17 14:50	EPA 3050B	1,6020A	BV
Iron, Total	39900		mg/kg	347	35.8	10	05/26/17 18:48	06/09/17 14:50	EPA 3050B	1,6020A	BV
Lead, Total	13.2		mg/kg	1.04	0.254	10	05/26/17 18:48	06/09/17 14:50	EPA 3050B	1,6020A	BV
Magnesium, Total	7540		mg/kg	174	21.4	10	05/26/17 18:48	06/09/17 14:50	EPA 3050B	1,6020A	BV
Manganese, Total	260		mg/kg	3.47	0.771	10	05/26/17 18:48	06/09/17 14:50	EPA 3050B	1,6020A	BV
Mercury, Total	0.013	J	mg/kg	0.019	0.002	5	05/30/17 13:50	06/06/17 11:23	EPA 7474	1,7474	BV
Molybdenum, Total	1.88		mg/kg	1.39	0.188	10	05/26/17 18:48	06/09/17 14:50	EPA 3050B	1,6020A	BV
Nickel, Total	26.5		mg/kg	1.74	0.464	10	05/26/17 18:48	06/09/17 14:50	EPA 3050B	1,6020A	BV
Potassium, Total	3530		mg/kg	174	27.6	10	05/26/17 18:48	06/09/17 14:50	EPA 3050B	1,6020A	BV
Selenium, Total	12.7		mg/kg	3.47	1.31	10	05/26/17 18:48	06/09/17 14:50	EPA 3050B	1,6020A	BV
Silver, Total	ND		mg/kg	0.868	0.085	10	05/26/17 18:48	06/09/17 14:50	EPA 3050B	1,6020A	BV
Sodium, Total	6370		mg/kg	260	20.4	10	05/26/17 18:48	06/09/17 14:50	EPA 3050B	1,6020A	BV
Strontium, Total	29.8		mg/kg	1.74	0.426	10	05/26/17 18:48	06/09/17 14:50	EPA 3050B	1,6020A	BV
Thallium, Total	0.182	J	mg/kg	0.347	0.090	10	05/26/17 18:48	06/09/17 14:50	EPA 3050B	1,6020A	BV
Tin, Total	0.546	J	mg/kg	2.08	0.215	10	05/26/17 18:48	06/09/17 14:50	EPA 3050B	1,6020A	BV
Titanium, Total	290		mg/kg	0.868	0.150	10	05/26/17 18:48	06/09/17 14:50	EPA 3050B	1,6020A	BV
Vanadium, Total	39.8		mg/kg	1.74	0.659	10	05/26/17 18:48	06/09/17 14:50	EPA 3050B	1,6020A	BV
Zinc, Total	74.7		mg/kg	17.4	4.52	10	05/26/17 18:48	06/09/17 14:50	EPA 3050B	1,6020A	BV



Project Name: WILLIAMS (1794)

Lab Number: L1717026

Project Number: 1794

Report Date: 06/14/17

SAMPLE RESULTS

Lab ID: L1717026-18

Date Collected: 05/19/17 15:42

Client ID: DUP-D6-9E

Date Received: 05/24/17

Sample Location: RARITAN BAY

Field Prep: Not Specified

Matrix: Sediment

Percent Solids: 55%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Aluminum, Total	15300		mg/kg	174	25.8	10	05/26/17 18:48	06/09/17 14:53	EPA 3050B	1,6020A	BV
Antimony, Total	ND		mg/kg	2.79	0.236	10	05/26/17 18:48	06/09/17 14:53	EPA 3050B	1,6020A	BV
Arsenic, Total	12.9		mg/kg	0.872	0.115	10	05/26/17 18:48	06/09/17 14:53	EPA 3050B	1,6020A	BV
Barium, Total	29.1		mg/kg	5.23	0.368	10	05/26/17 18:48	06/09/17 14:53	EPA 3050B	1,6020A	BV
Beryllium, Total	0.990		mg/kg	0.523	0.152	10	05/26/17 18:48	06/09/17 14:53	EPA 3050B	1,6020A	BV
Cadmium, Total	0.149	J	mg/kg	0.349	0.046	10	05/26/17 18:48	06/09/17 14:53	EPA 3050B	1,6020A	BV
Calcium, Total	34100		mg/kg	872	106.	10	05/26/17 18:48	06/09/17 14:53	EPA 3050B	1,6020A	BV
Chromium, Total	34.2		mg/kg	3.49	0.816	10	05/26/17 18:48	06/09/17 14:53	EPA 3050B	1,6020A	BV
Cobalt, Total	8.94		mg/kg	0.872	0.093	10	05/26/17 18:48	06/09/17 14:53	EPA 3050B	1,6020A	BV
Copper, Total	13.6		mg/kg	3.49	0.338	10	05/26/17 18:48	06/09/17 14:53	EPA 3050B	1,6020A	BV
Iron, Total	37200		mg/kg	349	35.9	10	05/26/17 18:48	06/09/17 14:53	EPA 3050B	1,6020A	BV
Lead, Total	12.3		mg/kg	1.05	0.254	10	05/26/17 18:48	06/09/17 14:53	EPA 3050B	1,6020A	BV
Magnesium, Total	7320		mg/kg	174	21.5	10	05/26/17 18:48	06/09/17 14:53	EPA 3050B	1,6020A	BV
Manganese, Total	282		mg/kg	3.49	0.774	10	05/26/17 18:48	06/09/17 14:53	EPA 3050B	1,6020A	BV
Mercury, Total	0.013	J	mg/kg	0.024	0.003	5	05/30/17 13:50	06/06/17 11:26	EPA 7474	1,7474	BV
Molybdenum, Total	2.29		mg/kg	1.39	0.188	10	05/26/17 18:48	06/09/17 14:53	EPA 3050B	1,6020A	BV
Nickel, Total	23.8		mg/kg	1.74	0.466	10	05/26/17 18:48	06/09/17 14:53	EPA 3050B	1,6020A	BV
Potassium, Total	3490		mg/kg	174	27.7	10	05/26/17 18:48	06/09/17 14:53	EPA 3050B	1,6020A	BV
Selenium, Total	10.8		mg/kg	3.49	1.32	10	05/26/17 18:48	06/09/17 14:53	EPA 3050B	1,6020A	BV
Silver, Total	ND		mg/kg	0.872	0.085	10	05/26/17 18:48	06/09/17 14:53	EPA 3050B	1,6020A	BV
Sodium, Total	6410		mg/kg	262	20.4	10	05/26/17 18:48	06/09/17 14:53	EPA 3050B	1,6020A	BV
Strontium, Total	213		mg/kg	1.74	0.428	10	05/26/17 18:48	06/09/17 14:53	EPA 3050B	1,6020A	BV
Thallium, Total	0.171	J	mg/kg	0.349	0.090	10	05/26/17 18:48	06/09/17 14:53	EPA 3050B	1,6020A	BV
Tin, Total	0.477	J	mg/kg	2.09	0.216	10	05/26/17 18:48	06/09/17 14:53	EPA 3050B	1,6020A	BV
Titanium, Total	343		mg/kg	0.872	0.151	10	05/26/17 18:48	06/09/17 14:53	EPA 3050B	1,6020A	BV
Vanadium, Total	38.3		mg/kg	1.74	0.661	10	05/26/17 18:48	06/09/17 14:53	EPA 3050B	1,6020A	BV
Zinc, Total	69.8		mg/kg	17.4	4.53	10	05/26/17 18:48	06/09/17 14:53	EPA 3050B	1,6020A	BV



Project Name: WILLIAMS (1794)

Lab Number: L1717026

Project Number: 1794

Report Date: 06/14/17

SAMPLE RESULTS

Lab ID: L1717026-19

Date Collected: 05/19/17 14:38

Client ID: VC92-D0-3E

Date Received: 05/24/17

Sample Location: RARITAN BAY

Field Prep: Not Specified

Matrix: Sediment

Percent Solids: 75%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Aluminum, Total	1290		mg/kg	131	19.4	10	05/26/17 18:48	06/09/17 14:56	EPA 3050B	1,6020A	BV
Antimony, Total	ND		mg/kg	2.10	0.177	10	05/26/17 18:48	06/09/17 14:56	EPA 3050B	1,6020A	BV
Arsenic, Total	1.57		mg/kg	0.655	0.086	10	05/26/17 18:48	06/09/17 14:56	EPA 3050B	1,6020A	BV
Barium, Total	3.17	J	mg/kg	3.93	0.277	10	05/26/17 18:48	06/09/17 14:56	EPA 3050B	1,6020A	BV
Beryllium, Total	ND		mg/kg	0.393	0.114	10	05/26/17 18:48	06/09/17 14:56	EPA 3050B	1,6020A	BV
Cadmium, Total	ND		mg/kg	0.262	0.035	10	05/26/17 18:48	06/09/17 14:56	EPA 3050B	1,6020A	BV
Calcium, Total	1510		mg/kg	655	79.6	10	05/26/17 18:48	06/09/17 14:56	EPA 3050B	1,6020A	BV
Chromium, Total	4.36		mg/kg	2.62	0.613	10	05/26/17 18:48	06/09/17 14:56	EPA 3050B	1,6020A	BV
Cobalt, Total	1.13		mg/kg	0.655	0.070	10	05/26/17 18:48	06/09/17 14:56	EPA 3050B	1,6020A	BV
Copper, Total	1.44	J	mg/kg	2.62	0.254	10	05/26/17 18:48	06/09/17 14:56	EPA 3050B	1,6020A	BV
Iron, Total	4890		mg/kg	262	27.0	10	05/26/17 18:48	06/09/17 14:56	EPA 3050B	1,6020A	BV
Lead, Total	3.22		mg/kg	0.786	0.191	10	05/26/17 18:48	06/09/17 14:56	EPA 3050B	1,6020A	BV
Magnesium, Total	878		mg/kg	131	16.1	10	05/26/17 18:48	06/09/17 14:56	EPA 3050B	1,6020A	BV
Manganese, Total	44.3		mg/kg	2.62	0.582	10	05/26/17 18:48	06/09/17 14:56	EPA 3050B	1,6020A	BV
Mercury, Total	ND		mg/kg	0.017	0.002	5	05/30/17 13:50	06/06/17 11:28	EPA 7474	1,7474	BV
Molybdenum, Total	0.198	J	mg/kg	1.05	0.141	10	05/26/17 18:48	06/09/17 14:56	EPA 3050B	1,6020A	BV
Nickel, Total	1.97		mg/kg	1.31	0.350	10	05/26/17 18:48	06/09/17 14:56	EPA 3050B	1,6020A	BV
Potassium, Total	367		mg/kg	131	20.8	10	05/26/17 18:48	06/09/17 14:56	EPA 3050B	1,6020A	BV
Selenium, Total	1.67	J	mg/kg	2.62	0.990	10	05/26/17 18:48	06/09/17 14:56	EPA 3050B	1,6020A	BV
Silver, Total	ND		mg/kg	0.655	0.064	10	05/26/17 18:48	06/09/17 14:56	EPA 3050B	1,6020A	BV
Sodium, Total	2430		mg/kg	196	15.4	10	05/26/17 18:48	06/09/17 14:56	EPA 3050B	1,6020A	BV
Strontium, Total	11.5		mg/kg	1.31	0.321	10	05/26/17 18:48	06/09/17 14:56	EPA 3050B	1,6020A	BV
Thallium, Total	ND		mg/kg	0.262	0.068	10	05/26/17 18:48	06/09/17 14:56	EPA 3050B	1,6020A	BV
Tin, Total	ND		mg/kg	1.57	0.162	10	05/26/17 18:48	06/09/17 14:56	EPA 3050B	1,6020A	BV
Titanium, Total	65.6		mg/kg	0.655	0.113	10	05/26/17 18:48	06/09/17 14:56	EPA 3050B	1,6020A	BV
Vanadium, Total	5.99		mg/kg	1.31	0.497	10	05/26/17 18:48	06/09/17 14:56	EPA 3050B	1,6020A	BV
Zinc, Total	7.80	J	mg/kg	13.1	3.40	10	05/26/17 18:48	06/09/17 14:56	EPA 3050B	1,6020A	BV



Project Name: WILLIAMS (1794)

Lab Number: L1717026

Project Number: 1794

Report Date: 06/14/17

SAMPLE RESULTS

Lab ID: L1717026-20

Date Collected: 05/19/17 14:38

Client ID: VC92-D3-6E

Date Received: 05/24/17

Sample Location: RARITAN BAY

Field Prep: Not Specified

Matrix: Sediment

Percent Solids: 78%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Aluminum, Total	3950		mg/kg	125	18.5	10	05/26/17 18:48	06/09/17 14:59	EPA 3050B	1,6020A	BV
Antimony, Total	ND		mg/kg	2.00	0.169	10	05/26/17 18:48	06/09/17 14:59	EPA 3050B	1,6020A	BV
Arsenic, Total	7.81		mg/kg	0.626	0.083	10	05/26/17 18:48	06/09/17 14:59	EPA 3050B	1,6020A	BV
Barium, Total	6.38		mg/kg	3.76	0.264	10	05/26/17 18:48	06/09/17 14:59	EPA 3050B	1,6020A	BV
Beryllium, Total	0.374	J	mg/kg	0.376	0.109	10	05/26/17 18:48	06/09/17 14:59	EPA 3050B	1,6020A	BV
Cadmium, Total	0.039	J	mg/kg	0.250	0.033	10	05/26/17 18:48	06/09/17 14:59	EPA 3050B	1,6020A	BV
Calcium, Total	916		mg/kg	626	76.1	10	05/26/17 18:48	06/09/17 14:59	EPA 3050B	1,6020A	BV
Chromium, Total	12.0		mg/kg	2.50	0.586	10	05/26/17 18:48	06/09/17 14:59	EPA 3050B	1,6020A	BV
Cobalt, Total	2.78		mg/kg	0.626	0.067	10	05/26/17 18:48	06/09/17 14:59	EPA 3050B	1,6020A	BV
Copper, Total	5.00		mg/kg	2.50	0.243	10	05/26/17 18:48	06/09/17 14:59	EPA 3050B	1,6020A	BV
Iron, Total	15900		mg/kg	250	25.8	10	05/26/17 18:48	06/09/17 14:59	EPA 3050B	1,6020A	BV
Lead, Total	4.57		mg/kg	0.751	0.183	10	05/26/17 18:48	06/09/17 14:59	EPA 3050B	1,6020A	BV
Magnesium, Total	1970		mg/kg	125	15.4	10	05/26/17 18:48	06/09/17 14:59	EPA 3050B	1,6020A	BV
Manganese, Total	72.9		mg/kg	2.50	0.556	10	05/26/17 18:48	06/09/17 14:59	EPA 3050B	1,6020A	BV
Mercury, Total	ND		mg/kg	0.017	0.002	5	06/02/17 11:40	06/07/17 15:54	EPA 7474	1,7474	LC
Molybdenum, Total	1.01		mg/kg	1.00	0.135	10	05/26/17 18:48	06/09/17 14:59	EPA 3050B	1,6020A	BV
Nickel, Total	6.39		mg/kg	1.25	0.334	10	05/26/17 18:48	06/09/17 14:59	EPA 3050B	1,6020A	BV
Potassium, Total	835		mg/kg	125	19.9	10	05/26/17 18:48	06/09/17 14:59	EPA 3050B	1,6020A	BV
Selenium, Total	3.29		mg/kg	2.50	0.946	10	05/26/17 18:48	06/09/17 14:59	EPA 3050B	1,6020A	BV
Silver, Total	ND		mg/kg	0.626	0.061	10	05/26/17 18:48	06/09/17 14:59	EPA 3050B	1,6020A	BV
Sodium, Total	2740		mg/kg	188	14.7	10	05/26/17 18:48	06/09/17 14:59	EPA 3050B	1,6020A	BV
Strontium, Total	9.64		mg/kg	1.25	0.307	10	05/26/17 18:48	06/09/17 14:59	EPA 3050B	1,6020A	BV
Thallium, Total	ND		mg/kg	0.250	0.065	10	05/26/17 18:48	06/09/17 14:59	EPA 3050B	1,6020A	BV
Tin, Total	ND		mg/kg	1.50	0.155	10	05/26/17 18:48	06/09/17 14:59	EPA 3050B	1,6020A	BV
Titanium, Total	101		mg/kg	0.626	0.108	10	05/26/17 18:48	06/09/17 14:59	EPA 3050B	1,6020A	BV
Vanadium, Total	20.3		mg/kg	1.25	0.475	10	05/26/17 18:48	06/09/17 14:59	EPA 3050B	1,6020A	BV
Zinc, Total	25.2		mg/kg	12.5	3.26	10	05/26/17 18:48	06/09/17 14:59	EPA 3050B	1,6020A	BV



Project Name: WILLIAMS (1794)

Lab Number: L1717026

Project Number: 1794

Report Date: 06/14/17

SAMPLE RESULTS

Lab ID: L1717026-21

Date Collected: 05/19/17 14:38

Client ID: VC92-D6-9E

Date Received: 05/24/17

Sample Location: RARITAN BAY

Field Prep: Not Specified

Matrix: Sediment

Percent Solids: 73%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Aluminum, Total	4620		mg/kg	134	19.9	10	05/26/17 18:48	06/09/17 15:25	EPA 3050B	1,6020A	BV
Antimony, Total	0.264	J	mg/kg	2.15	0.182	10	05/26/17 18:48	06/09/17 15:25	EPA 3050B	1,6020A	BV
Arsenic, Total	5.22		mg/kg	0.672	0.089	10	05/26/17 18:48	06/09/17 15:25	EPA 3050B	1,6020A	BV
Barium, Total	9.34		mg/kg	4.04	0.284	10	05/26/17 18:48	06/09/17 15:25	EPA 3050B	1,6020A	BV
Beryllium, Total	0.343	J	mg/kg	0.404	0.117	10	05/26/17 18:48	06/09/17 15:25	EPA 3050B	1,6020A	BV
Cadmium, Total	0.075	J	mg/kg	0.269	0.036	10	05/26/17 18:48	06/09/17 15:25	EPA 3050B	1,6020A	BV
Calcium, Total	794		mg/kg	672	81.8	10	05/26/17 18:48	06/09/17 15:25	EPA 3050B	1,6020A	BV
Chromium, Total	12.9		mg/kg	2.69	0.630	10	05/26/17 18:48	06/09/17 15:25	EPA 3050B	1,6020A	BV
Cobalt, Total	2.61		mg/kg	0.672	0.072	10	05/26/17 18:48	06/09/17 15:25	EPA 3050B	1,6020A	BV
Copper, Total	5.10		mg/kg	2.69	0.261	10	05/26/17 18:48	06/09/17 15:25	EPA 3050B	1,6020A	BV
Iron, Total	14400		mg/kg	269	27.7	10	05/26/17 18:48	06/09/17 15:25	EPA 3050B	1,6020A	BV
Lead, Total	5.20		mg/kg	0.807	0.196	10	05/26/17 18:48	06/09/17 15:25	EPA 3050B	1,6020A	BV
Magnesium, Total	1800		mg/kg	134	16.6	10	05/26/17 18:48	06/09/17 15:25	EPA 3050B	1,6020A	BV
Manganese, Total	95.1		mg/kg	2.69	0.597	10	05/26/17 18:48	06/09/17 15:25	EPA 3050B	1,6020A	BV
Mercury, Total	ND		mg/kg	0.017	0.002	5	06/02/17 11:40	06/07/17 15:56	EPA 7474	1,7474	LC
Molybdenum, Total	1.28		mg/kg	1.08	0.145	10	05/26/17 18:48	06/09/17 15:25	EPA 3050B	1,6020A	BV
Nickel, Total	6.65		mg/kg	1.34	0.359	10	05/26/17 18:48	06/09/17 15:25	EPA 3050B	1,6020A	BV
Potassium, Total	964		mg/kg	134	21.4	10	05/26/17 18:48	06/09/17 15:25	EPA 3050B	1,6020A	BV
Selenium, Total	4.14		mg/kg	2.69	1.02	10	05/26/17 18:48	06/09/17 15:25	EPA 3050B	1,6020A	BV
Silver, Total	ND		mg/kg	0.672	0.066	10	05/26/17 18:48	06/09/17 15:25	EPA 3050B	1,6020A	BV
Sodium, Total	2520		mg/kg	202	15.8	10	05/26/17 18:48	06/09/17 15:25	EPA 3050B	1,6020A	BV
Strontium, Total	9.76		mg/kg	1.34	0.330	10	05/26/17 18:48	06/09/17 15:25	EPA 3050B	1,6020A	BV
Thallium, Total	0.102	J	mg/kg	0.269	0.069	10	05/26/17 18:48	06/09/17 15:25	EPA 3050B	1,6020A	BV
Tin, Total	0.265	J	mg/kg	1.61	0.167	10	05/26/17 18:48	06/09/17 15:25	EPA 3050B	1,6020A	BV
Titanium, Total	109		mg/kg	0.672	0.116	10	05/26/17 18:48	06/09/17 15:25	EPA 3050B	1,6020A	BV
Vanadium, Total	17.6		mg/kg	1.34	0.510	10	05/26/17 18:48	06/09/17 15:25	EPA 3050B	1,6020A	BV
Zinc, Total	20.5		mg/kg	13.4	3.50	10	05/26/17 18:48	06/09/17 15:25	EPA 3050B	1,6020A	BV



Project Name: WILLIAMS (1794)

Lab Number: L1717026

Project Number: 1794

Report Date: 06/14/17

SAMPLE RESULTS

Lab ID: L1717026-22
 Client ID: VC92-D9-10E
 Sample Location: RARITAN BAY
 Matrix: Sediment
 Percent Solids: 75%

Date Collected: 05/19/17 14:38
 Date Received: 05/24/17
 Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Aluminum, Total	2430		mg/kg	130	19.2	10	05/26/17 18:48	06/09/17 15:28	EPA 3050B	1,6020A	BV
Antimony, Total	ND		mg/kg	2.08	0.176	10	05/26/17 18:48	06/09/17 15:28	EPA 3050B	1,6020A	BV
Arsenic, Total	3.05		mg/kg	0.650	0.086	10	05/26/17 18:48	06/09/17 15:28	EPA 3050B	1,6020A	BV
Barium, Total	6.22		mg/kg	3.90	0.274	10	05/26/17 18:48	06/09/17 15:28	EPA 3050B	1,6020A	BV
Beryllium, Total	0.214	J	mg/kg	0.390	0.113	10	05/26/17 18:48	06/09/17 15:28	EPA 3050B	1,6020A	BV
Cadmium, Total	0.053	J	mg/kg	0.260	0.034	10	05/26/17 18:48	06/09/17 15:28	EPA 3050B	1,6020A	BV
Calcium, Total	324	J	mg/kg	650	79.0	10	05/26/17 18:48	06/09/17 15:28	EPA 3050B	1,6020A	BV
Chromium, Total	7.27		mg/kg	2.60	0.608	10	05/26/17 18:48	06/09/17 15:28	EPA 3050B	1,6020A	BV
Cobalt, Total	1.34		mg/kg	0.650	0.069	10	05/26/17 18:48	06/09/17 15:28	EPA 3050B	1,6020A	BV
Copper, Total	3.25		mg/kg	2.60	0.252	10	05/26/17 18:48	06/09/17 15:28	EPA 3050B	1,6020A	BV
Iron, Total	9800		mg/kg	260	26.8	10	05/26/17 18:48	06/09/17 15:28	EPA 3050B	1,6020A	BV
Lead, Total	3.66		mg/kg	0.780	0.190	10	05/26/17 18:48	06/09/17 15:28	EPA 3050B	1,6020A	BV
Magnesium, Total	965		mg/kg	130	16.0	10	05/26/17 18:48	06/09/17 15:28	EPA 3050B	1,6020A	BV
Manganese, Total	85.7		mg/kg	2.60	0.577	10	05/26/17 18:48	06/09/17 15:28	EPA 3050B	1,6020A	BV
Mercury, Total	ND		mg/kg	0.019	0.002	5	06/02/17 11:40	06/07/17 15:59	EPA 7474	1,7474	LC
Molybdenum, Total	1.02	J	mg/kg	1.04	0.140	10	05/26/17 18:48	06/09/17 15:28	EPA 3050B	1,6020A	BV
Nickel, Total	3.34		mg/kg	1.30	0.347	10	05/26/17 18:48	06/09/17 15:28	EPA 3050B	1,6020A	BV
Potassium, Total	548		mg/kg	130	20.6	10	05/26/17 18:48	06/09/17 15:28	EPA 3050B	1,6020A	BV
Selenium, Total	2.55	J	mg/kg	2.60	0.982	10	05/26/17 18:48	06/09/17 15:28	EPA 3050B	1,6020A	BV
Silver, Total	ND		mg/kg	0.650	0.063	10	05/26/17 18:48	06/09/17 15:28	EPA 3050B	1,6020A	BV
Sodium, Total	2360		mg/kg	195	15.2	10	05/26/17 18:48	06/09/17 15:28	EPA 3050B	1,6020A	BV
Strontium, Total	5.92		mg/kg	1.30	0.318	10	05/26/17 18:48	06/09/17 15:28	EPA 3050B	1,6020A	BV
Thallium, Total	ND		mg/kg	0.260	0.067	10	05/26/17 18:48	06/09/17 15:28	EPA 3050B	1,6020A	BV
Tin, Total	ND		mg/kg	1.56	0.161	10	05/26/17 18:48	06/09/17 15:28	EPA 3050B	1,6020A	BV
Titanium, Total	75.0		mg/kg	0.650	0.112	10	05/26/17 18:48	06/09/17 15:28	EPA 3050B	1,6020A	BV
Vanadium, Total	10.2		mg/kg	1.30	0.493	10	05/26/17 18:48	06/09/17 15:28	EPA 3050B	1,6020A	BV
Zinc, Total	11.5	J	mg/kg	13.0	3.38	10	05/26/17 18:48	06/09/17 15:28	EPA 3050B	1,6020A	BV



Project Name: WILLIAMS (1794)

Lab Number: L1717026

Project Number: 1794

Report Date: 06/14/17

SAMPLE RESULTS

Lab ID: L1717026-23

Date Collected: 05/20/17 13:58

Client ID: VC93-D0-3E

Date Received: 05/24/17

Sample Location: RARITAN BAY

Field Prep: Not Specified

Matrix: Sediment

Percent Solids: 81%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Aluminum, Total	928		mg/kg	123	18.2	10	05/26/17 18:48	06/09/17 15:03	EPA 3050B	1,6020A	BV
Antimony, Total	0.404	J	mg/kg	1.96	0.166	10	05/26/17 18:48	06/09/17 15:03	EPA 3050B	1,6020A	BV
Arsenic, Total	3.71		mg/kg	0.614	0.081	10	05/26/17 18:48	06/09/17 15:03	EPA 3050B	1,6020A	BV
Barium, Total	2.36	J	mg/kg	3.68	0.259	10	05/26/17 18:48	06/09/17 15:03	EPA 3050B	1,6020A	BV
Beryllium, Total	0.148	J	mg/kg	0.368	0.107	10	05/26/17 18:48	06/09/17 15:03	EPA 3050B	1,6020A	BV
Cadmium, Total	0.108	J	mg/kg	0.246	0.032	10	05/26/17 18:48	06/09/17 15:03	EPA 3050B	1,6020A	BV
Calcium, Total	252	J	mg/kg	614	74.6	10	05/26/17 18:48	06/09/17 15:03	EPA 3050B	1,6020A	BV
Chromium, Total	7.70		mg/kg	2.46	0.575	10	05/26/17 18:48	06/09/17 15:03	EPA 3050B	1,6020A	BV
Cobalt, Total	1.92		mg/kg	0.614	0.065	10	05/26/17 18:48	06/09/17 15:03	EPA 3050B	1,6020A	BV
Copper, Total	12.9		mg/kg	2.46	0.238	10	05/26/17 18:48	06/09/17 15:03	EPA 3050B	1,6020A	BV
Iron, Total	6890		mg/kg	246	25.3	10	05/26/17 18:48	06/09/17 15:03	EPA 3050B	1,6020A	BV
Lead, Total	11.9		mg/kg	0.737	0.179	10	05/26/17 18:48	06/09/17 15:03	EPA 3050B	1,6020A	BV
Magnesium, Total	485		mg/kg	123	15.1	10	05/26/17 18:48	06/09/17 15:03	EPA 3050B	1,6020A	BV
Manganese, Total	31.3		mg/kg	2.46	0.545	10	05/26/17 18:48	06/09/17 15:03	EPA 3050B	1,6020A	BV
Mercury, Total	ND		mg/kg	0.018	0.002	5	06/02/17 11:40	06/07/17 16:01	EPA 7474	1,7474	LC
Molybdenum, Total	0.701	J	mg/kg	0.982	0.133	10	05/26/17 18:48	06/09/17 15:03	EPA 3050B	1,6020A	BV
Nickel, Total	4.94		mg/kg	1.23	0.328	10	05/26/17 18:48	06/09/17 15:03	EPA 3050B	1,6020A	BV
Potassium, Total	219		mg/kg	123	19.5	10	05/26/17 18:48	06/09/17 15:03	EPA 3050B	1,6020A	BV
Selenium, Total	0.948	J	mg/kg	2.46	0.928	10	05/26/17 18:48	06/09/17 15:03	EPA 3050B	1,6020A	BV
Silver, Total	0.138	J	mg/kg	0.614	0.060	10	05/26/17 18:48	06/09/17 15:03	EPA 3050B	1,6020A	BV
Sodium, Total	1840		mg/kg	184	14.4	10	05/26/17 18:48	06/09/17 15:03	EPA 3050B	1,6020A	BV
Strontium, Total	4.11		mg/kg	1.23	0.301	10	05/26/17 18:48	06/09/17 15:03	EPA 3050B	1,6020A	BV
Thallium, Total	ND		mg/kg	0.246	0.063	10	05/26/17 18:48	06/09/17 15:03	EPA 3050B	1,6020A	BV
Tin, Total	1.29	J	mg/kg	1.47	0.152	10	05/26/17 18:48	06/09/17 15:03	EPA 3050B	1,6020A	BV
Titanium, Total	54.9		mg/kg	0.614	0.106	10	05/26/17 18:48	06/09/17 15:03	EPA 3050B	1,6020A	BV
Vanadium, Total	12.3		mg/kg	1.23	0.466	10	05/26/17 18:48	06/09/17 15:03	EPA 3050B	1,6020A	BV
Zinc, Total	42.9		mg/kg	12.3	3.19	10	05/26/17 18:48	06/09/17 15:03	EPA 3050B	1,6020A	BV



Project Name: WILLIAMS (1794)

Lab Number: L1717026

Project Number: 1794

Report Date: 06/14/17

SAMPLE RESULTS

Lab ID: L1717026-24

Date Collected: 05/20/17 13:58

Client ID: VC93-D3-6E

Date Received: 05/24/17

Sample Location: RARITAN BAY

Field Prep: Not Specified

Matrix: Sediment

Percent Solids: 82%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Aluminum, Total	1090		mg/kg	116	17.2	10	05/26/17 18:48	06/09/17 15:31	EPA 3050B	1,6020A	BV
Antimony, Total	ND		mg/kg	1.86	0.157	10	05/26/17 18:48	06/09/17 15:31	EPA 3050B	1,6020A	BV
Arsenic, Total	2.35		mg/kg	0.582	0.077	10	05/26/17 18:48	06/09/17 15:31	EPA 3050B	1,6020A	BV
Barium, Total	1.87	J	mg/kg	3.49	0.246	10	05/26/17 18:48	06/09/17 15:31	EPA 3050B	1,6020A	BV
Beryllium, Total	0.147	J	mg/kg	0.349	0.102	10	05/26/17 18:48	06/09/17 15:31	EPA 3050B	1,6020A	BV
Cadmium, Total	ND		mg/kg	0.233	0.031	10	05/26/17 18:48	06/09/17 15:31	EPA 3050B	1,6020A	BV
Calcium, Total	151	J	mg/kg	582	70.8	10	05/26/17 18:48	06/09/17 15:31	EPA 3050B	1,6020A	BV
Chromium, Total	4.58		mg/kg	2.33	0.545	10	05/26/17 18:48	06/09/17 15:31	EPA 3050B	1,6020A	BV
Cobalt, Total	0.912		mg/kg	0.582	0.062	10	05/26/17 18:48	06/09/17 15:31	EPA 3050B	1,6020A	BV
Copper, Total	0.995	J	mg/kg	2.33	0.226	10	05/26/17 18:48	06/09/17 15:31	EPA 3050B	1,6020A	BV
Iron, Total	5240		mg/kg	233	24.0	10	05/26/17 18:48	06/09/17 15:31	EPA 3050B	1,6020A	BV
Lead, Total	1.85		mg/kg	0.698	0.170	10	05/26/17 18:48	06/09/17 15:31	EPA 3050B	1,6020A	BV
Magnesium, Total	464		mg/kg	116	14.3	10	05/26/17 18:48	06/09/17 15:31	EPA 3050B	1,6020A	BV
Manganese, Total	21.2		mg/kg	2.33	0.517	10	05/26/17 18:48	06/09/17 15:31	EPA 3050B	1,6020A	BV
Mercury, Total	ND		mg/kg	0.018	0.002	5	06/02/17 11:40	06/07/17 16:09	EPA 7474	1,7474	LC
Molybdenum, Total	0.219	J	mg/kg	0.931	0.126	10	05/26/17 18:48	06/09/17 15:31	EPA 3050B	1,6020A	BV
Nickel, Total	1.45		mg/kg	1.16	0.311	10	05/26/17 18:48	06/09/17 15:31	EPA 3050B	1,6020A	BV
Potassium, Total	210		mg/kg	116	18.5	10	05/26/17 18:48	06/09/17 15:31	EPA 3050B	1,6020A	BV
Selenium, Total	1.62	J	mg/kg	2.33	0.880	10	05/26/17 18:48	06/09/17 15:31	EPA 3050B	1,6020A	BV
Silver, Total	ND		mg/kg	0.582	0.057	10	05/26/17 18:48	06/09/17 15:31	EPA 3050B	1,6020A	BV
Sodium, Total	2040		mg/kg	175	13.6	10	05/26/17 18:48	06/09/17 15:31	EPA 3050B	1,6020A	BV
Strontium, Total	3.71		mg/kg	1.16	0.285	10	05/26/17 18:48	06/09/17 15:31	EPA 3050B	1,6020A	BV
Thallium, Total	ND		mg/kg	0.233	0.060	10	05/26/17 18:48	06/09/17 15:31	EPA 3050B	1,6020A	BV
Tin, Total	0.964	J	mg/kg	1.40	0.144	10	05/26/17 18:48	06/09/17 15:31	EPA 3050B	1,6020A	BV
Titanium, Total	47.4		mg/kg	0.582	0.100	10	05/26/17 18:48	06/09/17 15:31	EPA 3050B	1,6020A	BV
Vanadium, Total	10.1		mg/kg	1.16	0.441	10	05/26/17 18:48	06/09/17 15:31	EPA 3050B	1,6020A	BV
Zinc, Total	5.80	J	mg/kg	11.6	3.03	10	05/26/17 18:48	06/09/17 15:31	EPA 3050B	1,6020A	BV



Project Name: WILLIAMS (1794)

Lab Number: L1717026

Project Number: 1794

Report Date: 06/14/17

SAMPLE RESULTS

Lab ID: L1717026-25

Date Collected: 05/20/17 13:58

Client ID: VC93-D6-9E

Date Received: 05/24/17

Sample Location: RARITAN BAY

Field Prep: Not Specified

Matrix: Sediment

Percent Solids: 77%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Aluminum, Total	85.9	J	mg/kg	124	18.3	10	05/26/17 18:48	06/09/17 15:34	EPA 3050B	1,6020A	BV
Antimony, Total	ND		mg/kg	1.98	0.167	10	05/26/17 18:48	06/09/17 15:34	EPA 3050B	1,6020A	BV
Arsenic, Total	0.220	J	mg/kg	0.618	0.082	10	05/26/17 18:48	06/09/17 15:34	EPA 3050B	1,6020A	BV
Barium, Total	0.965	J	mg/kg	3.71	0.261	10	05/26/17 18:48	06/09/17 15:34	EPA 3050B	1,6020A	BV
Beryllium, Total	ND		mg/kg	0.371	0.108	10	05/26/17 18:48	06/09/17 15:34	EPA 3050B	1,6020A	BV
Cadmium, Total	ND		mg/kg	0.247	0.033	10	05/26/17 18:48	06/09/17 15:34	EPA 3050B	1,6020A	BV
Calcium, Total	101	J	mg/kg	618	75.1	10	05/26/17 18:48	06/09/17 15:34	EPA 3050B	1,6020A	BV
Chromium, Total	1.22	J	mg/kg	2.47	0.578	10	05/26/17 18:48	06/09/17 15:34	EPA 3050B	1,6020A	BV
Cobalt, Total	ND		mg/kg	0.618	0.066	10	05/26/17 18:48	06/09/17 15:34	EPA 3050B	1,6020A	BV
Copper, Total	0.663	J	mg/kg	2.47	0.240	10	05/26/17 18:48	06/09/17 15:34	EPA 3050B	1,6020A	BV
Iron, Total	219	J	mg/kg	247	25.4	10	05/26/17 18:48	06/09/17 15:34	EPA 3050B	1,6020A	BV
Lead, Total	1.24		mg/kg	0.741	0.180	10	05/26/17 18:48	06/09/17 15:34	EPA 3050B	1,6020A	BV
Magnesium, Total	296		mg/kg	124	15.2	10	05/26/17 18:48	06/09/17 15:34	EPA 3050B	1,6020A	BV
Manganese, Total	1.42	J	mg/kg	2.47	0.549	10	05/26/17 18:48	06/09/17 15:34	EPA 3050B	1,6020A	BV
Mercury, Total	ND		mg/kg	0.018	0.002	5	06/02/17 11:40	06/07/17 16:11	EPA 7474	1,7474	LC
Molybdenum, Total	ND		mg/kg	0.988	0.133	10	05/26/17 18:48	06/09/17 15:34	EPA 3050B	1,6020A	BV
Nickel, Total	ND		mg/kg	1.24	0.330	10	05/26/17 18:48	06/09/17 15:34	EPA 3050B	1,6020A	BV
Potassium, Total	126		mg/kg	124	19.6	10	05/26/17 18:48	06/09/17 15:34	EPA 3050B	1,6020A	BV
Selenium, Total	ND		mg/kg	2.47	0.934	10	05/26/17 18:48	06/09/17 15:34	EPA 3050B	1,6020A	BV
Silver, Total	ND		mg/kg	0.618	0.060	10	05/26/17 18:48	06/09/17 15:34	EPA 3050B	1,6020A	BV
Sodium, Total	2510		mg/kg	185	14.5	10	05/26/17 18:48	06/09/17 15:34	EPA 3050B	1,6020A	BV
Strontium, Total	2.21		mg/kg	1.24	0.303	10	05/26/17 18:48	06/09/17 15:34	EPA 3050B	1,6020A	BV
Thallium, Total	ND		mg/kg	0.247	0.064	10	05/26/17 18:48	06/09/17 15:34	EPA 3050B	1,6020A	BV
Tin, Total	ND		mg/kg	1.48	0.153	10	05/26/17 18:48	06/09/17 15:34	EPA 3050B	1,6020A	BV
Titanium, Total	17.8		mg/kg	0.618	0.107	10	05/26/17 18:48	06/09/17 15:34	EPA 3050B	1,6020A	BV
Vanadium, Total	7.56		mg/kg	1.24	0.468	10	05/26/17 18:48	06/09/17 15:34	EPA 3050B	1,6020A	BV
Zinc, Total	ND		mg/kg	12.4	3.21	10	05/26/17 18:48	06/09/17 15:34	EPA 3050B	1,6020A	BV



Project Name: WILLIAMS (1794)

Lab Number: L1717026

Project Number: 1794

Report Date: 06/14/17

SAMPLE RESULTS

Lab ID: L1717026-26
 Client ID: VC93-D9-10E
 Sample Location: RARITAN BAY
 Matrix: Sediment
 Percent Solids: 78%

Date Collected: 05/20/17 13:58
 Date Received: 05/24/17
 Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Aluminum, Total	102	J	mg/kg	123	18.2	10	05/26/17 18:48	06/09/17 15:37	EPA 3050B	1,6020A	BV
Antimony, Total	ND		mg/kg	1.97	0.167	10	05/26/17 18:48	06/09/17 15:37	EPA 3050B	1,6020A	BV
Arsenic, Total	0.401	J	mg/kg	0.617	0.081	10	05/26/17 18:48	06/09/17 15:37	EPA 3050B	1,6020A	BV
Barium, Total	0.939	J	mg/kg	3.70	0.260	10	05/26/17 18:48	06/09/17 15:37	EPA 3050B	1,6020A	BV
Beryllium, Total	ND		mg/kg	0.370	0.108	10	05/26/17 18:48	06/09/17 15:37	EPA 3050B	1,6020A	BV
Cadmium, Total	0.034	J	mg/kg	0.247	0.033	10	05/26/17 18:48	06/09/17 15:37	EPA 3050B	1,6020A	BV
Calcium, Total	103	J	mg/kg	617	75.0	10	05/26/17 18:48	06/09/17 15:37	EPA 3050B	1,6020A	BV
Chromium, Total	2.56		mg/kg	2.47	0.577	10	05/26/17 18:48	06/09/17 15:37	EPA 3050B	1,6020A	BV
Cobalt, Total	ND		mg/kg	0.617	0.066	10	05/26/17 18:48	06/09/17 15:37	EPA 3050B	1,6020A	BV
Copper, Total	0.705	J	mg/kg	2.47	0.239	10	05/26/17 18:48	06/09/17 15:37	EPA 3050B	1,6020A	BV
Iron, Total	387		mg/kg	247	25.4	10	05/26/17 18:48	06/09/17 15:37	EPA 3050B	1,6020A	BV
Lead, Total	1.59		mg/kg	0.740	0.180	10	05/26/17 18:48	06/09/17 15:37	EPA 3050B	1,6020A	BV
Magnesium, Total	270		mg/kg	123	15.2	10	05/26/17 18:48	06/09/17 15:37	EPA 3050B	1,6020A	BV
Manganese, Total	1.49	J	mg/kg	2.47	0.548	10	05/26/17 18:48	06/09/17 15:37	EPA 3050B	1,6020A	BV
Mercury, Total	ND		mg/kg	0.018	0.002	5	06/02/17 11:40	06/07/17 16:19	EPA 7474	1,7474	LC
Molybdenum, Total	ND		mg/kg	0.987	0.133	10	05/26/17 18:48	06/09/17 15:37	EPA 3050B	1,6020A	BV
Nickel, Total	ND		mg/kg	1.23	0.330	10	05/26/17 18:48	06/09/17 15:37	EPA 3050B	1,6020A	BV
Potassium, Total	103	J	mg/kg	123	19.6	10	05/26/17 18:48	06/09/17 15:37	EPA 3050B	1,6020A	BV
Selenium, Total	ND		mg/kg	2.47	0.932	10	05/26/17 18:48	06/09/17 15:37	EPA 3050B	1,6020A	BV
Silver, Total	ND		mg/kg	0.617	0.060	10	05/26/17 18:48	06/09/17 15:37	EPA 3050B	1,6020A	BV
Sodium, Total	2250		mg/kg	185	14.4	10	05/26/17 18:48	06/09/17 15:37	EPA 3050B	1,6020A	BV
Strontium, Total	2.18		mg/kg	1.23	0.302	10	05/26/17 18:48	06/09/17 15:37	EPA 3050B	1,6020A	BV
Thallium, Total	ND		mg/kg	0.247	0.064	10	05/26/17 18:48	06/09/17 15:37	EPA 3050B	1,6020A	BV
Tin, Total	ND		mg/kg	1.48	0.153	10	05/26/17 18:48	06/09/17 15:37	EPA 3050B	1,6020A	BV
Titanium, Total	16.4		mg/kg	0.617	0.106	10	05/26/17 18:48	06/09/17 15:37	EPA 3050B	1,6020A	BV
Vanadium, Total	4.03		mg/kg	1.23	0.468	10	05/26/17 18:48	06/09/17 15:37	EPA 3050B	1,6020A	BV
Zinc, Total	ND		mg/kg	12.3	3.21	10	05/26/17 18:48	06/09/17 15:37	EPA 3050B	1,6020A	BV



Project Name: WILLIAMS (1794)

Lab Number: L1717026

Project Number: 1794

Report Date: 06/14/17

SAMPLE RESULTS

Lab ID: L1717026-27

Date Collected: 05/19/17 14:38

Client ID: DUP-D3-6E

Date Received: 05/24/17

Sample Location: RARITAN BAY

Field Prep: Not Specified

Matrix: Sediment

Percent Solids: 79%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Aluminum, Total	2800		mg/kg	126	18.6	10	05/26/17 18:48	06/09/17 15:40	EPA 3050B	1,6020A	BV
Antimony, Total	ND		mg/kg	2.01	0.170	10	05/26/17 18:48	06/09/17 15:40	EPA 3050B	1,6020A	BV
Arsenic, Total	4.51		mg/kg	0.628	0.083	10	05/26/17 18:48	06/09/17 15:40	EPA 3050B	1,6020A	BV
Barium, Total	4.50		mg/kg	3.77	0.265	10	05/26/17 18:48	06/09/17 15:40	EPA 3050B	1,6020A	BV
Beryllium, Total	0.236	J	mg/kg	0.377	0.110	10	05/26/17 18:48	06/09/17 15:40	EPA 3050B	1,6020A	BV
Cadmium, Total	0.055	J	mg/kg	0.251	0.033	10	05/26/17 18:48	06/09/17 15:40	EPA 3050B	1,6020A	BV
Calcium, Total	345	J	mg/kg	628	76.4	10	05/26/17 18:48	06/09/17 15:40	EPA 3050B	1,6020A	BV
Chromium, Total	11.1		mg/kg	2.51	0.588	10	05/26/17 18:48	06/09/17 15:40	EPA 3050B	1,6020A	BV
Cobalt, Total	1.57		mg/kg	0.628	0.067	10	05/26/17 18:48	06/09/17 15:40	EPA 3050B	1,6020A	BV
Copper, Total	2.97		mg/kg	2.51	0.244	10	05/26/17 18:48	06/09/17 15:40	EPA 3050B	1,6020A	BV
Iron, Total	12000		mg/kg	251	25.9	10	05/26/17 18:48	06/09/17 15:40	EPA 3050B	1,6020A	BV
Lead, Total	2.78		mg/kg	0.754	0.183	10	05/26/17 18:48	06/09/17 15:40	EPA 3050B	1,6020A	BV
Magnesium, Total	1190		mg/kg	126	15.5	10	05/26/17 18:48	06/09/17 15:40	EPA 3050B	1,6020A	BV
Manganese, Total	38.4		mg/kg	2.51	0.558	10	05/26/17 18:48	06/09/17 15:40	EPA 3050B	1,6020A	BV
Mercury, Total	ND		mg/kg	0.014	0.002	5	06/02/17 11:40	06/07/17 16:21	EPA 7474	1,7474	LC
Molybdenum, Total	0.796	J	mg/kg	1.00	0.136	10	05/26/17 18:48	06/09/17 15:40	EPA 3050B	1,6020A	BV
Nickel, Total	3.78		mg/kg	1.26	0.336	10	05/26/17 18:48	06/09/17 15:40	EPA 3050B	1,6020A	BV
Potassium, Total	624		mg/kg	126	20.0	10	05/26/17 18:48	06/09/17 15:40	EPA 3050B	1,6020A	BV
Selenium, Total	2.30	J	mg/kg	2.51	0.950	10	05/26/17 18:48	06/09/17 15:40	EPA 3050B	1,6020A	BV
Silver, Total	ND		mg/kg	0.628	0.061	10	05/26/17 18:48	06/09/17 15:40	EPA 3050B	1,6020A	BV
Sodium, Total	2200		mg/kg	188	14.7	10	05/26/17 18:48	06/09/17 15:40	EPA 3050B	1,6020A	BV
Strontium, Total	5.60		mg/kg	1.26	0.308	10	05/26/17 18:48	06/09/17 15:40	EPA 3050B	1,6020A	BV
Thallium, Total	ND		mg/kg	0.251	0.065	10	05/26/17 18:48	06/09/17 15:40	EPA 3050B	1,6020A	BV
Tin, Total	ND		mg/kg	1.51	0.156	10	05/26/17 18:48	06/09/17 15:40	EPA 3050B	1,6020A	BV
Titanium, Total	71.2		mg/kg	0.628	0.108	10	05/26/17 18:48	06/09/17 15:40	EPA 3050B	1,6020A	BV
Vanadium, Total	15.0		mg/kg	1.26	0.476	10	05/26/17 18:48	06/09/17 15:40	EPA 3050B	1,6020A	BV
Zinc, Total	14.6		mg/kg	12.6	3.27	10	05/26/17 18:48	06/09/17 15:40	EPA 3050B	1,6020A	BV



Project Name: WILLIAMS (1794)

Lab Number: L1717026

Project Number: 1794

Report Date: 06/14/17

SAMPLE RESULTS

Lab ID: L1717026-28

Date Collected: 05/24/17 12:00

Client ID: RINSE2

Date Received: 05/24/17

Sample Location: RARITAN BAY

Field Prep: Not Specified

Matrix: Water

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Aluminum, Total	0.00461	J	mg/l	0.0100	0.00327	1	06/01/17 06:15	06/07/17 10:24	EPA 3020A	1,6020A	AM
Antimony, Total	0.00076	J	mg/l	0.00400	0.00042	1	06/01/17 06:15	06/07/17 10:24	EPA 3020A	1,6020A	AM
Arsenic, Total	ND		mg/l	0.00050	0.00016	1	06/01/17 06:15	06/07/17 10:24	EPA 3020A	1,6020A	AM
Barium, Total	0.00092		mg/l	0.00050	0.00017	1	06/01/17 06:15	06/07/17 10:24	EPA 3020A	1,6020A	AM
Beryllium, Total	ND		mg/l	0.00030	0.00010	1	06/01/17 06:15	06/07/17 10:24	EPA 3020A	1,6020A	AM
Cadmium, Total	ND		mg/l	0.00020	0.00005	1	06/01/17 06:15	06/07/17 10:24	EPA 3020A	1,6020A	AM
Calcium, Total	ND		mg/l	0.100	0.0394	1	06/01/17 06:15	06/07/17 10:24	EPA 3020A	1,6020A	AM
Chromium, Total	ND		mg/l	0.00050	0.00017	1	06/01/17 06:15	06/07/17 10:24	EPA 3020A	1,6020A	AM
Cobalt, Total	ND		mg/l	0.00050	0.00016	1	06/01/17 06:15	06/07/17 10:24	EPA 3020A	1,6020A	AM
Copper, Total	0.00148		mg/l	0.00100	0.00038	1	06/01/17 06:15	06/07/17 10:24	EPA 3020A	1,6020A	AM
Iron, Total	ND		mg/l	0.0500	0.0191	1	06/01/17 06:15	06/07/17 10:24	EPA 3020A	1,6020A	AM
Lead, Total	ND		mg/l	0.00100	0.00034	1	06/01/17 06:15	06/07/17 10:24	EPA 3020A	1,6020A	AM
Magnesium, Total	ND		mg/l	0.0700	0.0242	1	06/01/17 06:15	06/07/17 10:24	EPA 3020A	1,6020A	AM
Manganese, Total	ND		mg/l	0.00100	0.00044	1	06/01/17 06:15	06/07/17 10:24	EPA 3020A	1,6020A	AM
Mercury, Total	0.00002	J	mg/l	0.00005	0.00001	1	06/09/17 11:26	06/12/17 09:01	EPA 7474	1,7474	LC
Molybdenum, Total	ND		mg/l	0.00200	0.00067	1	06/01/17 06:15	06/07/17 10:24	EPA 3020A	1,6020A	AM
Nickel, Total	ND		mg/l	0.00200	0.00055	1	06/01/17 06:15	06/07/17 10:24	EPA 3020A	1,6020A	AM
Potassium, Total	ND		mg/l	0.100	0.0309	1	06/01/17 06:15	06/07/17 10:24	EPA 3020A	1,6020A	AM
Selenium, Total	ND		mg/l	0.00500	0.00173	1	06/01/17 06:15	06/07/17 10:24	EPA 3020A	1,6020A	AM
Silver, Total	ND		mg/l	0.00040	0.00016	1	06/01/17 06:15	06/07/17 10:24	EPA 3020A	1,6020A	AM
Sodium, Total	0.0787	J	mg/l	0.200	0.0293	1	06/01/17 06:15	06/07/17 10:24	EPA 3020A	1,6020A	AM
Strontium, Total	0.00034	J	mg/l	0.00050	0.00003	1	06/01/17 06:15	06/07/17 10:24	EPA 3020A	1,6020A	AM
Thallium, Total	ND		mg/l	0.00050	0.00014	1	06/01/17 06:15	06/07/17 10:24	EPA 3020A	1,6020A	AM
Tin, Total	ND		mg/l	0.00300	0.00112	1	06/01/17 06:15	06/07/17 10:24	EPA 3020A	1,6020A	AM
Titanium, Total	0.00016	J	mg/l	0.00050	0.00007	1	06/01/17 06:15	06/07/17 10:24	EPA 3020A	1,6020A	AM
Vanadium, Total	ND		mg/l	0.00500	0.00157	1	06/01/17 06:15	06/07/17 10:24	EPA 3020A	1,6020A	AM
Zinc, Total	ND		mg/l	0.0100	0.00341	1	06/01/17 06:15	06/07/17 10:24	EPA 3020A	1,6020A	AM



Project Name: WILLIAMS (1794)

Lab Number: L1717026

Project Number: 1794

Report Date: 06/14/17

SAMPLE RESULTS

Lab ID: L1717026-29

Date Collected: 05/19/17 18:04

Client ID: RINSE1

Date Received: 05/24/17

Sample Location: RARITAN BAY

Field Prep: Not Specified

Matrix: Water

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Aluminum, Total	ND		mg/l	0.0100	0.00327	1	06/01/17 06:15	06/07/17 12:43	EPA 3020A	1,6020A	AM
Antimony, Total	ND		mg/l	0.00400	0.00042	1	06/01/17 06:15	06/07/17 12:43	EPA 3020A	1,6020A	AM
Arsenic, Total	ND		mg/l	0.00050	0.00016	1	06/01/17 06:15	06/07/17 12:43	EPA 3020A	1,6020A	AM
Barium, Total	0.00164		mg/l	0.00050	0.00017	1	06/01/17 06:15	06/07/17 12:43	EPA 3020A	1,6020A	AM
Beryllium, Total	ND		mg/l	0.00030	0.00010	1	06/01/17 06:15	06/07/17 12:43	EPA 3020A	1,6020A	AM
Cadmium, Total	ND		mg/l	0.00020	0.00005	1	06/01/17 06:15	06/07/17 12:43	EPA 3020A	1,6020A	AM
Calcium, Total	ND		mg/l	0.100	0.0394	1	06/01/17 06:15	06/07/17 12:43	EPA 3020A	1,6020A	AM
Chromium, Total	0.00022	J	mg/l	0.00050	0.00017	1	06/01/17 06:15	06/07/17 12:43	EPA 3020A	1,6020A	AM
Cobalt, Total	ND		mg/l	0.00050	0.00016	1	06/01/17 06:15	06/07/17 12:43	EPA 3020A	1,6020A	AM
Copper, Total	0.00339		mg/l	0.00100	0.00038	1	06/01/17 06:15	06/07/17 12:43	EPA 3020A	1,6020A	AM
Iron, Total	ND		mg/l	0.0500	0.0191	1	06/01/17 06:15	06/07/17 12:43	EPA 3020A	1,6020A	AM
Lead, Total	ND		mg/l	0.00100	0.00034	1	06/01/17 06:15	06/07/17 12:43	EPA 3020A	1,6020A	AM
Magnesium, Total	ND		mg/l	0.0700	0.0242	1	06/01/17 06:15	06/07/17 12:43	EPA 3020A	1,6020A	AM
Manganese, Total	0.00047	J	mg/l	0.00100	0.00044	1	06/01/17 06:15	06/07/17 12:43	EPA 3020A	1,6020A	AM
Mercury, Total	0.00002	J	mg/l	0.00005	0.00001	1	06/09/17 11:26	06/12/17 09:04	EPA 7474	1,7474	LC
Molybdenum, Total	ND		mg/l	0.00200	0.00067	1	06/01/17 06:15	06/07/17 12:43	EPA 3020A	1,6020A	AM
Nickel, Total	ND		mg/l	0.00200	0.00055	1	06/01/17 06:15	06/07/17 12:43	EPA 3020A	1,6020A	AM
Potassium, Total	ND		mg/l	0.100	0.0309	1	06/01/17 06:15	06/07/17 12:43	EPA 3020A	1,6020A	AM
Selenium, Total	ND		mg/l	0.00500	0.00173	1	06/01/17 06:15	06/07/17 12:43	EPA 3020A	1,6020A	AM
Silver, Total	ND		mg/l	0.00040	0.00016	1	06/01/17 06:15	06/07/17 12:43	EPA 3020A	1,6020A	AM
Sodium, Total	0.283		mg/l	0.100	0.0293	1	06/01/17 06:15	06/07/17 12:43	EPA 3020A	1,6020A	AM
Strontium, Total	0.00065		mg/l	0.00050	0.00003	1	06/01/17 06:15	06/07/17 12:43	EPA 3020A	1,6020A	AM
Thallium, Total	ND		mg/l	0.00050	0.00014	1	06/01/17 06:15	06/07/17 12:43	EPA 3020A	1,6020A	AM
Tin, Total	ND		mg/l	0.00300	0.00112	1	06/01/17 06:15	06/07/17 12:43	EPA 3020A	1,6020A	AM
Titanium, Total	0.00021	J	mg/l	0.00050	0.00007	1	06/01/17 06:15	06/07/17 12:43	EPA 3020A	1,6020A	AM
Vanadium, Total	ND		mg/l	0.00500	0.00157	1	06/01/17 06:15	06/07/17 12:43	EPA 3020A	1,6020A	AM
Zinc, Total	ND		mg/l	0.0100	0.00341	1	06/01/17 06:15	06/07/17 12:43	EPA 3020A	1,6020A	AM



Project Name: WILLIAMS (1794)

Lab Number: L1717026

Project Number: 1794

Report Date: 06/14/17

Method Blank Analysis Batch Quality Control

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Total Metals - Mansfield Lab for sample(s): 01-20 Batch: WG1007570-1										
Aluminum, Total	ND		mg/kg	100	14.8	10	05/26/17 18:48	06/09/17 13:23	1,6020A	BV
Antimony, Total	ND		mg/kg	1.60	0.135	10	05/26/17 18:48	06/09/17 13:23	1,6020A	BV
Arsenic, Total	ND		mg/kg	0.500	0.066	10	05/26/17 18:48	06/09/17 13:23	1,6020A	BV
Barium, Total	ND		mg/kg	3.00	0.211	10	05/26/17 18:48	06/09/17 13:23	1,6020A	BV
Beryllium, Total	ND		mg/kg	0.300	0.087	10	05/26/17 18:48	06/09/17 13:23	1,6020A	BV
Cadmium, Total	ND		mg/kg	0.200	0.026	10	05/26/17 18:48	06/09/17 13:23	1,6020A	BV
Calcium, Total	ND		mg/kg	500	60.8	10	05/26/17 18:48	06/09/17 13:23	1,6020A	BV
Chromium, Total	ND		mg/kg	2.00	0.468	10	05/26/17 18:48	06/09/17 13:23	1,6020A	BV
Cobalt, Total	ND		mg/kg	0.500	0.053	10	05/26/17 18:48	06/09/17 13:23	1,6020A	BV
Copper, Total	ND		mg/kg	2.00	0.194	10	05/26/17 18:48	06/09/17 13:23	1,6020A	BV
Iron, Total	ND		mg/kg	200	20.6	10	05/26/17 18:48	06/09/17 13:23	1,6020A	BV
Lead, Total	ND		mg/kg	0.600	0.146	10	05/26/17 18:48	06/09/17 13:23	1,6020A	BV
Magnesium, Total	ND		mg/kg	100	12.3	10	05/26/17 18:48	06/09/17 13:23	1,6020A	BV
Manganese, Total	ND		mg/kg	2.00	0.444	10	05/26/17 18:48	06/09/17 13:23	1,6020A	BV
Molybdenum, Total	ND		mg/kg	0.800	0.108	10	05/26/17 18:48	06/09/17 13:23	1,6020A	BV
Nickel, Total	ND		mg/kg	1.00	0.267	10	05/26/17 18:48	06/09/17 13:23	1,6020A	BV
Potassium, Total	ND		mg/kg	100	15.9	10	05/26/17 18:48	06/09/17 13:23	1,6020A	BV
Selenium, Total	ND		mg/kg	2.00	0.756	10	05/26/17 18:48	06/09/17 13:23	1,6020A	BV
Silver, Total	ND		mg/kg	0.500	0.049	10	05/26/17 18:48	06/09/17 13:23	1,6020A	BV
Sodium, Total	ND		mg/kg	150	11.7	10	05/26/17 18:48	06/09/17 13:23	1,6020A	BV
Strontium, Total	ND		mg/kg	1.00	0.245	10	05/26/17 18:48	06/09/17 13:23	1,6020A	BV
Thallium, Total	ND		mg/kg	0.200	0.052	10	05/26/17 18:48	06/09/17 13:23	1,6020A	BV
Tin, Total	ND		mg/kg	1.20	0.124	10	05/26/17 18:48	06/09/17 13:23	1,6020A	BV
Titanium, Total	ND		mg/kg	0.500	0.086	10	05/26/17 18:48	06/09/17 13:23	1,6020A	BV
Vanadium, Total	ND		mg/kg	1.00	0.379	10	05/26/17 18:48	06/09/17 13:23	1,6020A	BV
Zinc, Total	ND		mg/kg	10.0	2.60	10	05/26/17 18:48	06/09/17 13:23	1,6020A	BV

Prep Information

Digestion Method: EPA 3050B



Project Name: WILLIAMS (1794)

Lab Number: L1717026

Project Number: 1794

Report Date: 06/14/17

Method Blank Analysis Batch Quality Control

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Total Metals - Mansfield Lab for sample(s): 21-27 Batch: WG1007571-1										
Aluminum, Total	ND		mg/kg	100	14.8	10	05/26/17 18:48	06/09/17 14:38	1,6020A	BV
Antimony, Total	ND		mg/kg	1.60	0.135	10	05/26/17 18:48	06/09/17 14:38	1,6020A	BV
Arsenic, Total	ND		mg/kg	0.500	0.066	10	05/26/17 18:48	06/09/17 14:38	1,6020A	BV
Barium, Total	ND		mg/kg	3.00	0.211	10	05/26/17 18:48	06/09/17 14:38	1,6020A	BV
Beryllium, Total	ND		mg/kg	0.300	0.087	10	05/26/17 18:48	06/09/17 14:38	1,6020A	BV
Cadmium, Total	ND		mg/kg	0.200	0.026	10	05/26/17 18:48	06/09/17 14:38	1,6020A	BV
Calcium, Total	ND		mg/kg	500	60.8	10	05/26/17 18:48	06/09/17 14:38	1,6020A	BV
Chromium, Total	ND		mg/kg	2.00	0.468	10	05/26/17 18:48	06/09/17 14:38	1,6020A	BV
Cobalt, Total	ND		mg/kg	0.500	0.053	10	05/26/17 18:48	06/09/17 14:38	1,6020A	BV
Copper, Total	ND		mg/kg	2.00	0.194	10	05/26/17 18:48	06/09/17 14:38	1,6020A	BV
Iron, Total	ND		mg/kg	200	20.6	10	05/26/17 18:48	06/09/17 14:38	1,6020A	BV
Lead, Total	ND		mg/kg	0.600	0.146	10	05/26/17 18:48	06/09/17 14:38	1,6020A	BV
Magnesium, Total	ND		mg/kg	100	12.3	10	05/26/17 18:48	06/09/17 14:38	1,6020A	BV
Manganese, Total	ND		mg/kg	2.00	0.444	10	05/26/17 18:48	06/09/17 14:38	1,6020A	BV
Molybdenum, Total	ND		mg/kg	0.800	0.108	10	05/26/17 18:48	06/09/17 14:38	1,6020A	BV
Nickel, Total	ND		mg/kg	1.00	0.267	10	05/26/17 18:48	06/09/17 14:38	1,6020A	BV
Potassium, Total	ND		mg/kg	100	15.9	10	05/26/17 18:48	06/09/17 14:38	1,6020A	BV
Selenium, Total	ND		mg/kg	2.00	0.756	10	05/26/17 18:48	06/09/17 14:38	1,6020A	BV
Silver, Total	ND		mg/kg	0.500	0.049	10	05/26/17 18:48	06/09/17 14:38	1,6020A	BV
Sodium, Total	21.6	J	mg/kg	150	11.7	10	05/26/17 18:48	06/09/17 14:38	1,6020A	BV
Strontium, Total	ND		mg/kg	1.00	0.245	10	05/26/17 18:48	06/09/17 14:38	1,6020A	BV
Thallium, Total	ND		mg/kg	0.200	0.052	10	05/26/17 18:48	06/09/17 14:38	1,6020A	BV
Tin, Total	ND		mg/kg	1.20	0.124	10	05/26/17 18:48	06/09/17 14:38	1,6020A	BV
Titanium, Total	ND		mg/kg	0.500	0.086	10	05/26/17 18:48	06/09/17 14:38	1,6020A	BV
Vanadium, Total	ND		mg/kg	1.00	0.379	10	05/26/17 18:48	06/09/17 14:38	1,6020A	BV
Zinc, Total	ND		mg/kg	10.0	2.60	10	05/26/17 18:48	06/09/17 14:38	1,6020A	BV

Prep Information

Digestion Method: EPA 3050B



Project Name: WILLIAMS (1794)

Lab Number: L1717026

Project Number: 1794

Report Date: 06/14/17

Method Blank Analysis Batch Quality Control

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Total Metals - Mansfield Lab for sample(s): 01-19 Batch: WG1008096-1										
Mercury, Total	ND		mg/kg	0.013	0.002	5	05/30/17 13:50	06/06/17 10:22	1,7474	BV

Prep Information

Digestion Method: EPA 7474

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Total Metals - Mansfield Lab for sample(s): 28-29 Batch: WG1008707-1										
Aluminum, Total	ND		mg/l	0.0100	0.00327	1	06/01/17 06:15	06/07/17 09:54	1,6020A	AM
Antimony, Total	0.00118	J	mg/l	0.00400	0.00042	1	06/01/17 06:15	06/07/17 09:54	1,6020A	AM
Arsenic, Total	ND		mg/l	0.00050	0.00016	1	06/01/17 06:15	06/07/17 09:54	1,6020A	AM
Barium, Total	ND		mg/l	0.00050	0.00017	1	06/01/17 06:15	06/07/17 09:54	1,6020A	AM
Beryllium, Total	ND		mg/l	0.00030	0.00010	1	06/01/17 06:15	06/07/17 09:54	1,6020A	AM
Cadmium, Total	ND		mg/l	0.00020	0.00005	1	06/01/17 06:15	06/07/17 09:54	1,6020A	AM
Calcium, Total	ND		mg/l	0.100	0.0394	1	06/01/17 06:15	06/07/17 09:54	1,6020A	AM
Chromium, Total	ND		mg/l	0.00050	0.00017	1	06/01/17 06:15	06/07/17 09:54	1,6020A	AM
Cobalt, Total	ND		mg/l	0.00050	0.00016	1	06/01/17 06:15	06/07/17 09:54	1,6020A	AM
Copper, Total	ND		mg/l	0.00100	0.00038	1	06/01/17 06:15	06/07/17 09:54	1,6020A	AM
Iron, Total	ND		mg/l	0.0500	0.0191	1	06/01/17 06:15	06/07/17 09:54	1,6020A	AM
Lead, Total	ND		mg/l	0.00100	0.00034	1	06/01/17 06:15	06/07/17 09:54	1,6020A	AM
Magnesium, Total	ND		mg/l	0.0700	0.0242	1	06/01/17 06:15	06/07/17 09:54	1,6020A	AM
Manganese, Total	ND		mg/l	0.00100	0.00044	1	06/01/17 06:15	06/07/17 09:54	1,6020A	AM
Molybdenum, Total	ND		mg/l	0.00200	0.00067	1	06/01/17 06:15	06/07/17 09:54	1,6020A	AM
Nickel, Total	ND		mg/l	0.00200	0.00055	1	06/01/17 06:15	06/07/17 09:54	1,6020A	AM
Potassium, Total	ND		mg/l	0.100	0.0309	1	06/01/17 06:15	06/07/17 09:54	1,6020A	AM
Selenium, Total	ND		mg/l	0.00500	0.00173	1	06/01/17 06:15	06/07/17 09:54	1,6020A	AM
Silver, Total	ND		mg/l	0.00040	0.00016	1	06/01/17 06:15	06/07/17 09:54	1,6020A	AM
Sodium, Total	0.0419	J	mg/l	0.200	0.0293	1	06/01/17 06:15	06/07/17 09:54	1,6020A	AM
Strontium, Total	ND		mg/l	0.00050	0.00003	1	06/01/17 06:15	06/07/17 09:54	1,6020A	AM
Thallium, Total	ND		mg/l	0.00050	0.00014	1	06/01/17 06:15	06/07/17 09:54	1,6020A	AM
Tin, Total	ND		mg/l	0.00300	0.00112	1	06/01/17 06:15	06/07/17 09:54	1,6020A	AM
Titanium, Total	ND		mg/l	0.00050	0.00007	1	06/01/17 06:15	06/07/17 09:54	1,6020A	AM
Vanadium, Total	ND		mg/l	0.00500	0.00157	1	06/01/17 06:15	06/07/17 09:54	1,6020A	AM



Project Name: WILLIAMS (1794)
Project Number: 1794

Lab Number: L1717026
Report Date: 06/14/17

Method Blank Analysis Batch Quality Control

Zinc, Total	ND	mg/l	0.0100	0.00341	1	06/01/17 06:15	06/07/17 09:54	1,6020A	AM
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Prep Information

Digestion Method: EPA 3020A

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Total Metals - Mansfield Lab for sample(s): 20-27 Batch: WG1009290-1										
Mercury, Total	ND		mg/kg	0.013	0.002	5	06/02/17 11:40	06/07/17 15:49	1,7474	LC

Prep Information

Digestion Method: EPA 7474

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Total Metals - Mansfield Lab for sample(s): 28-29 Batch: WG1011473-1										
Mercury, Total	0.00003	J	mg/l	0.00005	0.00001	1	06/09/17 10:51	06/12/17 08:56	1,7474	LC

Prep Information

Digestion Method: EPA 7474

Lab Control Sample Analysis

Batch Quality Control

Project Name: WILLIAMS (1794)

Project Number: 1794

Lab Number: L1717026

Report Date: 06/14/17

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 01-20 Batch: WG1007570-2 SRM Lot Number: D091-540								
Aluminum, Total	88		-		52-148	-		20
Antimony, Total	112		-		1-200	-		20
Arsenic, Total	103		-		80-121	-		20
Barium, Total	100		-		84-117	-		20
Beryllium, Total	100		-		83-117	-		20
Cadmium, Total	100		-		83-117	-		20
Calcium, Total	104		-		81-118	-		20
Chromium, Total	100		-		80-119	-		20
Cobalt, Total	101		-		84-115	-		20
Copper, Total	103		-		82-117	-		20
Iron, Total	111		-		47-154	-		20
Lead, Total	99		-		82-118	-		20
Magnesium, Total	99		-		77-123	-		20
Manganese, Total	102		-		82-118	-		20
Molybdenum, Total	98		-		79-121	-		20
Nickel, Total	103		-		83-117	-		20
Potassium, Total	99		-		72-128	-		20
Selenium, Total	105		-		79-121	-		20
Silver, Total	105		-		76-124	-		20
Sodium, Total	106		-		73-126	-		20
Strontium, Total	101		-		81-120	-		20

Lab Control Sample Analysis

Batch Quality Control

Project Name: WILLIAMS (1794)

Project Number: 1794

Lab Number: L1717026

Report Date: 06/14/17

Parameter	LCS %Recovery	LCSD %Recovery	%Recovery Limits	RPD	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 01-20 Batch: WG1007570-2 SRM Lot Number: D091-540					
Thallium, Total	99	-	80-121	-	20
Tin, Total	102	-	77-122	-	20
Titanium, Total	94	-	31-169	-	20
Vanadium, Total	97	-	78-122	-	20
Zinc, Total	99	-	82-118	-	20

Lab Control Sample Analysis

Batch Quality Control

Project Name: WILLIAMS (1794)

Project Number: 1794

Lab Number: L1717026

Report Date: 06/14/17

Parameter	LCS %Recovery	LCSD %Recovery	%Recovery Limits	RPD	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 21-27 Batch: WG1007571-2 SRM Lot Number: D091-540					
Aluminum, Total	85	-	52-148	-	20
Antimony, Total	114	-	1-200	-	20
Arsenic, Total	102	-	80-121	-	20
Barium, Total	97	-	84-117	-	20
Beryllium, Total	100	-	83-117	-	20
Cadmium, Total	107	-	83-117	-	20
Calcium, Total	103	-	81-118	-	20
Chromium, Total	99	-	80-119	-	20
Cobalt, Total	101	-	84-115	-	20
Copper, Total	101	-	82-117	-	20
Iron, Total	109	-	47-154	-	20
Lead, Total	98	-	82-118	-	20
Magnesium, Total	95	-	77-123	-	20
Manganese, Total	102	-	82-118	-	20
Molybdenum, Total	98	-	79-121	-	20
Nickel, Total	101	-	83-117	-	20
Potassium, Total	95	-	72-128	-	20
Selenium, Total	104	-	79-121	-	20
Silver, Total	99	-	76-124	-	20
Sodium, Total	114	-	73-126	-	20
Strontium, Total	95	-	81-120	-	20

Lab Control Sample Analysis Batch Quality Control

Project Name: WILLIAMS (1794)

Project Number: 1794

Lab Number: L1717026

Report Date: 06/14/17

Parameter	LCS %Recovery	LCSD %Recovery	%Recovery Limits	RPD	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 21-27 Batch: WG1007571-2 SRM Lot Number: D091-540					
Thallium, Total	100	-	80-121	-	20
Tin, Total	98	-	77-122	-	20
Titanium, Total	88	-	31-169	-	20
Vanadium, Total	99	-	78-122	-	20
Zinc, Total	100	-	82-118	-	20
Total Metals - Mansfield Lab Associated sample(s): 01-19 Batch: WG1008096-2 SRM Lot Number: D091-540					
Mercury, Total	79	-	72-128	-	20

Lab Control Sample Analysis Batch Quality Control

Project Name: WILLIAMS (1794)

Project Number: 1794

Lab Number: L1717026

Report Date: 06/14/17

Parameter	LCS %Recovery	LCSD %Recovery	%Recovery Limits	RPD	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 28-29 Batch: WG1008707-2					
Aluminum, Total	117	-	80-120	-	20
Antimony, Total	107	-	80-120	-	20
Arsenic, Total	106	-	80-120	-	20
Barium, Total	105	-	80-120	-	20
Beryllium, Total	104	-	80-120	-	20
Cadmium, Total	104	-	80-120	-	20
Calcium, Total	109	-	80-120	-	20
Chromium, Total	102	-	80-120	-	20
Cobalt, Total	97	-	80-120	-	20
Copper, Total	98	-	80-120	-	20
Iron, Total	108	-	80-120	-	20
Lead, Total	109	-	80-120	-	20
Magnesium, Total	111	-	80-120	-	20
Manganese, Total	105	-	80-120	-	20
Molybdenum, Total	100	-	80-120	-	20
Nickel, Total	97	-	80-120	-	20
Potassium, Total	114	-	80-120	-	20
Selenium, Total	112	-	80-120	-	20
Silver, Total	101	-	80-120	-	20
Sodium, Total	120	-	80-120	-	20
Strontium, Total	108	-	80-120	-	20

Lab Control Sample Analysis Batch Quality Control

Project Name: WILLIAMS (1794)

Project Number: 1794

Lab Number: L1717026

Report Date: 06/14/17

Parameter	LCS %Recovery	LCSD %Recovery	%Recovery Limits	RPD	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 28-29 Batch: WG1008707-2					
Thallium, Total	103	-	80-120	-	20
Tin, Total	99	-	80-120	-	20
Titanium, Total	93	-	80-120	-	20
Vanadium, Total	102	-	80-120	-	20
Zinc, Total	100	-	80-120	-	20
Total Metals - Mansfield Lab Associated sample(s): 20-27 Batch: WG1009290-2 SRM Lot Number: D091-540					
Mercury, Total	83	-	72-128	-	20
Total Metals - Mansfield Lab Associated sample(s): 28-29 Batch: WG1011473-2 SRM Lot Number: HPHGAF					
Mercury, Total	99	-	80-120	-	20

Matrix Spike Analysis

Batch Quality Control

Project Name: WILLIAMS (1794)

Project Number: 1794

Lab Number: L1717026

Report Date: 06/14/17

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	Qual	MSD Found	MSD %Recovery	Qual	Recovery Limits	RPD	Qual	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 01-20 QC Batch ID: WG1007570-3 WG1007570-4 QC Sample: L1717026-05 Client ID: VC89-D0-3E												
Aluminum, Total	1590	198	2580	501	Q	2180	295	Q	75-125	17		20
Antimony, Total	ND	49.4	47.6	96		51.9	104		75-125	9		20
Arsenic, Total	4.62	11.8	16.6	101		16.5	99		75-125	1		20
Barium, Total	2.40J	198	208	105		216	108		75-125	4		20
Beryllium, Total	0.187J	4.94	5.25	106		5.42	108		75-125	3		20
Cadmium, Total	ND	5.04	5.37	106		5.70	112		75-125	6		20
Calcium, Total	747.	988	1770	104		1840	109		75-125	4		20
Chromium, Total	7.80	19.8	32.5	125		29.6	109		75-125	9		20
Cobalt, Total	1.82	49.4	51.0	100		52.8	102		75-125	3		20
Copper, Total	3.00	24.7	28.5	103		28.9	104		75-125	1		20
Iron, Total	13000	98.8	15400	2430	Q	12700	0	Q	75-125	19		20
Lead, Total	2.57	50.4	55.3	105		56.5	106		75-125	2		20
Magnesium, Total	880.	988	2020	115		1840	96		75-125	9		20
Manganese, Total	24.9	49.4	79.1	110		77.9	106		75-125	2		20
Molybdenum, Total	1.06	98.8	93.7	94		99.4	98		75-125	6		20
Nickel, Total	2.24	49.4	53.7	104		54.5	104		75-125	1		20
Potassium, Total	350.	988	1480	114		1450	110		75-125	2		20
Selenium, Total	1.86J	11.8	13.8	116		14.3	119		75-125	4		20
Silver, Total	ND	29.6	30.5	103		31.7	106		75-125	4		20
Sodium, Total	2180	988	3170	100		3270	109		75-125	3		20
Strontium, Total	5.97	98.8	107	102		111	105		75-125	4		20

Matrix Spike Analysis

Batch Quality Control

Project Name: WILLIAMS (1794)

Project Number: 1794

Lab Number: L1717026

Report Date: 06/14/17

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	MSD Found	MSD %Recovery	Recovery Limits	RPD	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 01-20 QC Batch ID: WG1007570-3 WG1007570-4 QC Sample: L1717026-05 Client ID: VC89-D0-3E									
Thallium, Total	0.188J	11.8	11.5	97	12.1	101	75-125	5	20
Tin, Total	ND	98.8	101	102	107	107	75-125	6	20
Titanium, Total	65.5	98.8	164	100	156	90	75-125	5	20
Vanadium, Total	20.3	49.4	78.1	117	71.5	102	75-125	9	20
Zinc, Total	9.74J	49.4	62.7	127	Q 62.0	124	75-125	1	20

Matrix Spike Analysis

Batch Quality Control

Project Name: WILLIAMS (1794)

Project Number: 1794

Lab Number: L1717026

Report Date: 06/14/17

Parameter	Native Sample	MS Added	MS Found	%Recovery		MSD Found	%Recovery		Recovery Limits		RPD	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 21-27			QC Batch ID: WG1007571-3			WG1007571-4	QC Sample: L1717026-23			Client ID: VC93-D0-3E		
Aluminum, Total	928.	189	1630	371	Q	1750	430	Q	75-125	7	20	
Antimony, Total	0.404J	47.2	48.4	102		49.5	104		75-125	2	20	
Arsenic, Total	3.71	11.3	17.0	117		16.5	112		75-125	3	20	
Barium, Total	2.36J	189	198	105		204	107		75-125	3	20	
Beryllium, Total	0.148J	4.72	4.89	103		5.11	107		75-125	4	20	
Cadmium, Total	0.108J	4.82	5.10	106		5.34	110		75-125	5	20	
Calcium, Total	252.J	945	1640	174	Q	2960	310	Q	75-125	57	Q 20	
Chromium, Total	7.70	18.9	26.0	97		27.6	104		75-125	6	20	
Cobalt, Total	1.92	47.2	48.8	99		50.2	101		75-125	3	20	
Copper, Total	12.9	23.6	36.5	100		37.1	101		75-125	2	20	
Iron, Total	6890	94.5	7700	857	Q	8490	1670	Q	75-125	10	20	
Lead, Total	11.9	48.2	58.9	98		62.4	104		75-125	6	20	
Magnesium, Total	485.	945	1510	108		1480	104		75-125	2	20	
Manganese, Total	31.3	47.2	79.5	102		88.3	119		75-125	10	20	
Molybdenum, Total	0.701J	94.5	88.8	94		91.0	95		75-125	2	20	
Nickel, Total	4.94	47.2	55.8	108		56.9	109		75-125	2	20	
Potassium, Total	219.	945	1230	107		1280	111		75-125	4	20	
Selenium, Total	0.948J	11.3	13.4	118		13.5	118		75-125	1	20	
Silver, Total	0.138J	28.3	28.9	102		29.7	104		75-125	3	20	
Sodium, Total	1840	945	2850	107		2830	104		75-125	1	20	
Strontium, Total	4.11	94.5	99.2	101		106	106		75-125	7	20	

Matrix Spike Analysis

Batch Quality Control

Project Name: WILLIAMS (1794)

Project Number: 1794

Lab Number: L1717026

Report Date: 06/14/17

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	MSD Found	MSD %Recovery	Recovery Limits	RPD	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 21-27 QC Batch ID: WG1007571-3 WG1007571-4 QC Sample: L1717026-23 Client ID: VC93-D0-3E									
Thallium, Total	ND	11.3	10.8	95	11.4	99	75-125	5	20
Tin, Total	1.29J	94.5	98.2	104	101	106	75-125	3	20
Titanium, Total	54.9	94.5	139	89	145	94	75-125	4	20
Vanadium, Total	12.3	47.2	61.1	103	63.4	107	75-125	4	20
Zinc, Total	42.9	47.2	95.6	112	94.3	108	75-125	1	20
Total Metals - Mansfield Lab Associated sample(s): 01-19 QC Batch ID: WG1008096-3 WG1008096-4 QC Sample: L1717026-05 Client ID: VC89-D0-3E									
Mercury, Total	ND	0.864	0.880	102	0.754	100	80-120	15	20

Matrix Spike Analysis

Batch Quality Control

Project Name: WILLIAMS (1794)
Project Number: 1794

Lab Number: L1717026
Report Date: 06/14/17

Parameter	Native Sample	MS Added	MS Found	MS %Recovery		MSD Found	MSD %Recovery	Recovery Limits	RPD	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 28-29			QC Batch ID: WG1008707-3			QC Sample: L1715898-01		Client ID: MS Sample		
Aluminum, Total	0.210	2	2.45	112		-	-	75-125	-	20
Antimony, Total	0.0015J	0.5	0.6422	128	Q	-	-	75-125	-	20
Arsenic, Total	0.0005J	0.12	0.1200	100		-	-	75-125	-	20
Barium, Total	0.0356	2	2.084	102		-	-	75-125	-	20
Beryllium, Total	ND	0.05	0.05280	106		-	-	75-125	-	20
Cadmium, Total	ND	0.051	0.05642	111		-	-	75-125	-	20
Calcium, Total	41.2	10	52.7	115		-	-	75-125	-	20
Chromium, Total	0.00110	0.2	0.200	99		-	-	75-125	-	20
Cobalt, Total	0.0005J	0.5	0.4851	97		-	-	75-125	-	20
Copper, Total	0.00484	0.25	0.255	100		-	-	75-125	-	20
Iron, Total	4.17	1	4.80	63	Q	-	-	75-125	-	20
Lead, Total	0.00133	0.51	0.558	109		-	-	75-125	-	20
Magnesium, Total	15.8	10	26.6	108		-	-	75-125	-	20
Manganese, Total	0.0675	0.5	0.5687	100		-	-	75-125	-	20
Molybdenum, Total	0.0007J	1	0.9979	100		-	-	75-125	-	20
Nickel, Total	0.00132J	0.5	0.4817	96		-	-	75-125	-	20
Potassium, Total	6.23	10	16.3	101		-	-	75-125	-	20
Selenium, Total	ND	0.12	0.128	107		-	-	75-125	-	20
Silver, Total	ND	0.05	0.05080	102		-	-	75-125	-	20
Sodium, Total	349.	10	380	310	Q	-	-	75-125	-	20
Strontium, Total	0.2736	1	1.339	106		-	-	75-125	-	20

Matrix Spike Analysis **Batch Quality Control**

Project Name: WILLIAMS (1794)

Project Number: 1794

Lab Number: L1717026

Report Date: 06/14/17

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	MSD Found	MSD %Recovery	Recovery Limits	RPD	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 28-29			QC Batch ID: WG1008707-3		QC Sample: L1715898-01		Client ID: MS Sample		
Thallium, Total	ND	0.12	0.1213	101	-	-	75-125	-	20
Tin, Total	ND	1	0.9973	100	-	-	75-125	-	20
Titanium, Total	0.0615	1	0.9667	90	-	-	75-125	-	20
Vanadium, Total	ND	0.5	0.484	97	-	-	75-125	-	20
Zinc, Total	0.00416J	0.5	0.514	103	-	-	75-125	-	20
Total Metals - Mansfield Lab Associated sample(s): 20-27			QC Batch ID: WG1009290-3		WG1009290-4		QC Sample: L1717026-23		Client ID: VC93-D0-3E
Mercury, Total	ND	0.934	0.954	102	0.796	89	80-120	18	20
Total Metals - Mansfield Lab Associated sample(s): 28-29			QC Batch ID: WG1011473-3		QC Sample: L1718989-02		Client ID: MS Sample		
Mercury, Total	0.00002J	0.0025	0.00277	111	-	-	80-120	-	20

Project Name: WILLIAMS (1794)
Project Number: 1794

Lab Duplicate Analysis

Batch Quality Control

Lab Number: L1717026
Report Date: 06/14/17

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 28-29 QC Batch ID: WG1008707-4 QC Sample: L1715898-01 Client ID: DUP Sample						
Cadmium, Total	ND	ND	mg/l	NC		20
Chromium, Total	0.00110	0.00111	mg/l	1		20
Copper, Total	0.00484	0.00426	mg/l	13		20
Iron, Total	4.17	4.10	mg/l	2		20
Lead, Total	0.00133	0.00132	mg/l	1		20
Nickel, Total	0.00132J	0.00128J	mg/l	NC		20
Zinc, Total	0.00416J	0.00391J	mg/l	NC		20
Total Metals - Mansfield Lab Associated sample(s): 28-29 QC Batch ID: WG1011473-4 QC Sample: L1718989-02 Client ID: DUP Sample						
Mercury, Total	0.00002J	0.00002J	mg/l	NC		20

INORGANICS & MISCELLANEOUS

Project Name: WILLIAMS (1794)**Project Number:** 1794**Lab Number:** L1717026**Report Date:** 06/14/17**SAMPLE RESULTS****Lab ID:** L1717026-01**Client ID:** VC88-D0-3E**Sample Location:** RARITAN BAY**Matrix:** Sediment**Date Collected:** 05/19/17 17:07**Date Received:** 05/24/17**Field Prep:** Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Mansfield Lab										
Solids, Total	78.2		%	0.100	0.100	1	-	05/31/17 11:29	121,2540G	SP



Project Name: WILLIAMS (1794)**Project Number:** 1794**Lab Number:** L1717026**Report Date:** 06/14/17**SAMPLE RESULTS****Lab ID:** L1717026-02**Client ID:** VC88-D3-6E**Sample Location:** RARITAN BAY**Matrix:** Sediment**Date Collected:** 05/19/17 17:07**Date Received:** 05/24/17**Field Prep:** Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Mansfield Lab										
Solids, Total	69.4		%	0.100	0.100	1	-	05/31/17 11:29	121,2540G	SP



Project Name: WILLIAMS (1794)**Project Number:** 1794**Lab Number:** L1717026**Report Date:** 06/14/17**SAMPLE RESULTS****Lab ID:** L1717026-03**Client ID:** VC88-D6-9E**Sample Location:** RARITAN BAY**Matrix:** Sediment**Date Collected:** 05/19/17 17:07**Date Received:** 05/24/17**Field Prep:** Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Mansfield Lab										
Solids, Total	54.2		%	0.100	0.100	1	-	05/31/17 11:29	121,2540G	SP



Project Name: WILLIAMS (1794)**Project Number:** 1794**Lab Number:** L1717026**Report Date:** 06/14/17**SAMPLE RESULTS****Lab ID:** L1717026-04**Client ID:** VC88-D9-10E**Sample Location:** RARITAN BAY**Matrix:** Sediment**Date Collected:** 05/19/17 17:07**Date Received:** 05/24/17**Field Prep:** Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Mansfield Lab										
Solids, Total	53.9		%	0.100	0.100	1	-	05/31/17 11:29	121,2540G	SP



Project Name: WILLIAMS (1794)**Project Number:** 1794**Lab Number:** L1717026**Report Date:** 06/14/17**SAMPLE RESULTS****Lab ID:** L1717026-05**Client ID:** VC89-D0-3E**Sample Location:** RARITAN BAY**Matrix:** Sediment**Date Collected:** 05/19/17 16:15**Date Received:** 05/24/17**Field Prep:** Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Mansfield Lab										
Solids, Total	78.4		%	0.100	0.100	1	-	05/31/17 11:29	121,2540G	SP



Project Name: WILLIAMS (1794)**Project Number:** 1794**Lab Number:** L1717026**Report Date:** 06/14/17**SAMPLE RESULTS****Lab ID:** L1717026-06**Client ID:** VC89-D3-6E**Sample Location:** RARITAN BAY**Matrix:** Sediment**Date Collected:** 05/19/17 16:15**Date Received:** 05/24/17**Field Prep:** Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Mansfield Lab										
Solids, Total	64.2		%	0.100	0.100	1	-	05/31/17 11:29	121,2540G	SP



Project Name: WILLIAMS (1794)**Project Number:** 1794**Lab Number:** L1717026**Report Date:** 06/14/17**SAMPLE RESULTS****Lab ID:** L1717026-07**Client ID:** VC89-D6-9E**Sample Location:** RARITAN BAY**Matrix:** Sediment**Date Collected:** 05/19/17 16:15**Date Received:** 05/24/17**Field Prep:** Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Mansfield Lab										
Solids, Total	56.7		%	0.100	0.100	1	-	05/31/17 11:29	121,2540G	SP



Project Name: WILLIAMS (1794)**Project Number:** 1794**Lab Number:** L1717026**Report Date:** 06/14/17**SAMPLE RESULTS****Lab ID:** L1717026-08**Client ID:** VC89-D9-10E**Sample Location:** RARITAN BAY**Matrix:** Sediment**Date Collected:** 05/19/17 16:15**Date Received:** 05/24/17**Field Prep:** Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Mansfield Lab										
Solids, Total	51.8		%	0.100	0.100	1	-	05/31/17 11:29	121,2540G	SP



Project Name: WILLIAMS (1794)**Project Number:** 1794**Lab Number:** L1717026**Report Date:** 06/14/17**SAMPLE RESULTS****Lab ID:** L1717026-09**Client ID:** DUP-D9-10E**Sample Location:** RARITAN BAY**Matrix:** Sediment**Date Collected:** 05/19/17 17:07**Date Received:** 05/24/17**Field Prep:** Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Mansfield Lab										
Solids, Total	53.8		%	0.100	0.100	1	-	05/31/17 11:29	121,2540G	SP



Project Name: WILLIAMS (1794)**Project Number:** 1794**Lab Number:** L1717026**Report Date:** 06/14/17**SAMPLE RESULTS****Lab ID:** L1717026-10**Client ID:** DUP-D0-3E**Sample Location:** RARITAN BAY**Matrix:** Sediment**Date Collected:** 05/19/17 16:15**Date Received:** 05/24/17**Field Prep:** Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Mansfield Lab										
Solids, Total	82.4		%	0.100	0.100	1	-	05/31/17 11:29	121,2540G	SP



Project Name: WILLIAMS (1794)**Project Number:** 1794**Lab Number:** L1717026**Report Date:** 06/14/17**SAMPLE RESULTS****Lab ID:** L1717026-11**Client ID:** VC90-D0-3E**Sample Location:** RARITAN BAY**Matrix:** Sediment**Date Collected:** 05/19/17 15:42**Date Received:** 05/24/17**Field Prep:** Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Mansfield Lab										
Solids, Total	81.3		%	0.100	0.100	1	-	05/31/17 11:29	121,2540G	SP



Project Name: WILLIAMS (1794)

Project Number: 1794

Lab Number: L1717026

Report Date: 06/14/17

SAMPLE RESULTS

Lab ID: L1717026-12

Client ID: VC90-D3-6E

Sample Location: RARITAN BAY

Matrix: Sediment

Date Collected: 05/19/17 15:42

Date Received: 05/24/17

Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Mansfield Lab										
Solids, Total	70.0		%	0.100	0.100	1	-	05/31/17 11:29	121,2540G	SP



Project Name: WILLIAMS (1794)**Project Number:** 1794**Lab Number:** L1717026**Report Date:** 06/14/17**SAMPLE RESULTS****Lab ID:** L1717026-13**Client ID:** VC90-D6-9E**Sample Location:** RARITAN BAY**Matrix:** Sediment**Date Collected:** 05/19/17 15:42**Date Received:** 05/24/17**Field Prep:** Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Mansfield Lab										
Solids, Total	55.6		%	0.100	0.100	1	-	05/31/17 11:29	121,2540G	SP



Project Name: WILLIAMS (1794)**Project Number:** 1794**Lab Number:** L1717026**Report Date:** 06/14/17**SAMPLE RESULTS****Lab ID:** L1717026-14**Client ID:** VC90-D9-10E**Sample Location:** RARITAN BAY**Matrix:** Sediment**Date Collected:** 05/19/17 15:42**Date Received:** 05/24/17**Field Prep:** Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Mansfield Lab										
Solids, Total	54.2		%	0.100	0.100	1	-	05/31/17 11:29	121,2540G	SP



Project Name: WILLIAMS (1794)**Project Number:** 1794**Lab Number:** L1717026**Report Date:** 06/14/17**SAMPLE RESULTS****Lab ID:** L1717026-15**Client ID:** VC91-D0-3E**Sample Location:** RARITAN BAY**Matrix:** Sediment**Date Collected:** 05/19/17 15:10**Date Received:** 05/24/17**Field Prep:** Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Mansfield Lab										
Solids, Total	83.5		%	0.100	0.100	1	-	05/31/17 11:29	121,2540G	SP



Project Name: WILLIAMS (1794)**Project Number:** 1794**Lab Number:** L1717026**Report Date:** 06/14/17**SAMPLE RESULTS****Lab ID:** L1717026-16**Client ID:** VC91-D3-6E**Sample Location:** RARITAN BAY**Matrix:** Sediment**Date Collected:** 05/19/17 15:10**Date Received:** 05/24/17**Field Prep:** Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Mansfield Lab										
Solids, Total	61.8		%	0.100	0.100	1	-	05/31/17 11:29	121,2540G	SP



Project Name: WILLIAMS (1794)**Project Number:** 1794**Lab Number:** L1717026**Report Date:** 06/14/17**SAMPLE RESULTS****Lab ID:** L1717026-17**Client ID:** VC91-D6-9.6E**Sample Location:** RARITAN BAY**Matrix:** Sediment**Date Collected:** 05/19/17 15:10**Date Received:** 05/24/17**Field Prep:** Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Mansfield Lab										
Solids, Total	57.2		%	0.100	0.100	1	-	05/31/17 11:29	121,2540G	SP



Project Name: WILLIAMS (1794)**Project Number:** 1794**Lab Number:** L1717026**Report Date:** 06/14/17**SAMPLE RESULTS****Lab ID:** L1717026-18**Client ID:** DUP-D6-9E**Sample Location:** RARITAN BAY**Matrix:** Sediment**Date Collected:** 05/19/17 15:42**Date Received:** 05/24/17**Field Prep:** Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Mansfield Lab										
Solids, Total	54.6		%	0.100	0.100	1	-	05/31/17 11:29	121,2540G	SP



Project Name: WILLIAMS (1794)**Project Number:** 1794**Lab Number:** L1717026**Report Date:** 06/14/17**SAMPLE RESULTS****Lab ID:** L1717026-19**Client ID:** VC92-D0-3E**Sample Location:** RARITAN BAY**Matrix:** Sediment**Date Collected:** 05/19/17 14:38**Date Received:** 05/24/17**Field Prep:** Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Mansfield Lab										
Solids, Total	74.9		%	0.100	0.100	1	-	05/31/17 11:29	121,2540G	SP



Project Name: WILLIAMS (1794)**Project Number:** 1794**Lab Number:** L1717026**Report Date:** 06/14/17**SAMPLE RESULTS****Lab ID:** L1717026-20**Client ID:** VC92-D3-6E**Sample Location:** RARITAN BAY**Matrix:** Sediment**Date Collected:** 05/19/17 14:38**Date Received:** 05/24/17**Field Prep:** Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Mansfield Lab										
Solids, Total	78.3		%	0.100	0.100	1	-	05/31/17 11:29	121,2540G	SP



Project Name: WILLIAMS (1794)**Project Number:** 1794**Lab Number:** L1717026**Report Date:** 06/14/17**SAMPLE RESULTS****Lab ID:** L1717026-21**Client ID:** VC92-D6-9E**Sample Location:** RARITAN BAY**Matrix:** Sediment**Date Collected:** 05/19/17 14:38**Date Received:** 05/24/17**Field Prep:** Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Mansfield Lab										
Solids, Total	73.4		%	0.100	0.100	1	-	05/31/17 11:44	121,2540G	SP



Project Name: WILLIAMS (1794)**Project Number:** 1794**Lab Number:** L1717026**Report Date:** 06/14/17**SAMPLE RESULTS****Lab ID:** L1717026-22**Client ID:** VC92-D9-10E**Sample Location:** RARITAN BAY**Matrix:** Sediment**Date Collected:** 05/19/17 14:38**Date Received:** 05/24/17**Field Prep:** Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Mansfield Lab										
Solids, Total	75.1		%	0.100	0.100	1	-	05/31/17 11:44	121,2540G	SP



Project Name: WILLIAMS (1794)**Project Number:** 1794**Lab Number:** L1717026**Report Date:** 06/14/17**SAMPLE RESULTS****Lab ID:** L1717026-23**Client ID:** VC93-D0-3E**Sample Location:** RARITAN BAY**Matrix:** Sediment**Date Collected:** 05/20/17 13:58**Date Received:** 05/24/17**Field Prep:** Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Mansfield Lab										
Solids, Total	80.6		%	0.100	0.100	1	-	05/31/17 11:44	121,2540G	SP



Project Name: WILLIAMS (1794)**Project Number:** 1794**Lab Number:** L1717026**Report Date:** 06/14/17**SAMPLE RESULTS****Lab ID:** L1717026-24**Client ID:** VC93-D3-6E**Sample Location:** RARITAN BAY**Matrix:** Sediment**Date Collected:** 05/20/17 13:58**Date Received:** 05/24/17**Field Prep:** Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Mansfield Lab										
Solids, Total	81.9		%	0.100	0.100	1	-	05/31/17 11:44	121,2540G	SP



Project Name: WILLIAMS (1794)**Project Number:** 1794**Lab Number:** L1717026**Report Date:** 06/14/17**SAMPLE RESULTS****Lab ID:** L1717026-25**Client ID:** VC93-D6-9E**Sample Location:** RARITAN BAY**Matrix:** Sediment**Date Collected:** 05/20/17 13:58**Date Received:** 05/24/17**Field Prep:** Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Mansfield Lab										
Solids, Total	77.4		%	0.100	0.100	1	-	05/31/17 11:44	121,2540G	SP



Project Name: WILLIAMS (1794)**Project Number:** 1794**Lab Number:** L1717026**Report Date:** 06/14/17**SAMPLE RESULTS****Lab ID:** L1717026-26**Client ID:** VC93-D9-10E**Sample Location:** RARITAN BAY**Matrix:** Sediment**Date Collected:** 05/20/17 13:58**Date Received:** 05/24/17**Field Prep:** Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Mansfield Lab										
Solids, Total	78.2		%	0.100	0.100	1	-	05/31/17 11:44	121,2540G	SP



Project Name: WILLIAMS (1794)**Project Number:** 1794**Lab Number:** L1717026**Report Date:** 06/14/17**SAMPLE RESULTS****Lab ID:** L1717026-27**Client ID:** DUP-D3-6E**Sample Location:** RARITAN BAY**Matrix:** Sediment**Date Collected:** 05/19/17 14:38**Date Received:** 05/24/17**Field Prep:** Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Mansfield Lab										
Solids, Total	79.4		%	0.100	0.100	1	-	05/31/17 11:44	121,2540G	SP



Lab Duplicate Analysis

Batch Quality Control

Project Name: WILLIAMS (1794)

Project Number: 1794

Lab Number: L1717026

Report Date: 06/14/17

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits
General Chemistry - Mansfield Lab Associated sample(s): 01-20 QC Batch ID: WG1008366-1 QC Sample: L1717026-01 Client ID: VC88-D0-3E						
Solids, Total	78.2	77.2	%	1		10
General Chemistry - Mansfield Lab Associated sample(s): 21-27 QC Batch ID: WG1008367-1 QC Sample: L1717286-04 Client ID: DUP Sample						
Solids, Total	53.6	51.8	%	3		10

Project Name: WILLIAMS (1794)
Project Number: 1794

Serial_No:06141717:02
Lab Number: L1717026
Report Date: 06/14/17

Sample Receipt and Container Information

Were project specific reporting limits specified?

YES

Cooler Information

Cooler	Custody Seal
A	Absent

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L1717026-01A	Glass 120ml/4oz unpreserved	A	N/A	N/A	3.2	Y	Absent		A2-FE-6020T(180),A2-MO-6020T(180),A2-PB-6020T(180),DPKG-FULL(),A2-BA-6020T(180),A2-NI-6020T(180),A2-SB-6020T(180),A2-ZN-6020T(180),A2-HG-7474T(28),A2-K-6020T(180),A2-CR-6020T(180),A2-TL-6020T(180),A2-TS(7),A2-AS-6020T(180),A2-CO-6020T(180),A2-MN-6020T(180),A2-SR-6020T(180),A2-BE-6020T(180),A2-CD-6020T(180),A2-HGPREP-AF(28),A2-V-6020T(180),A2-MG-6020T(180),A2-PREP-3050:2T(180),A2-SE-6020T(180),A2-AG-6020T(180),A2-AL-6020T(180),A2-CA-6020T(180),A2-CU-6020T(180),A2-NA-6020T(180),A2-PREP-3050:1T(180),A2-SN-6020T(180),A2-TI-6020T(180)
L1717026-02A	Glass 120ml/4oz unpreserved	A	N/A	N/A	3.2	Y	Absent		A2-FE-6020T(180),A2-MO-6020T(180),A2-PB-6020T(180),A2-BA-6020T(180),A2-NI-6020T(180),A2-SB-6020T(180),A2-ZN-6020T(180),A2-HG-7474T(28),A2-K-6020T(180),A2-CR-6020T(180),A2-TL-6020T(180),A2-TS(7),A2-AS-6020T(180),A2-CO-6020T(180),A2-MN-6020T(180),A2-SR-6020T(180),A2-BE-6020T(180),A2-CD-6020T(180),A2-HGPREP-AF(28),A2-V-6020T(180),A2-MG-6020T(180),A2-PREP-3050:2T(180),A2-SE-6020T(180),A2-AG-6020T(180),A2-AL-6020T(180),A2-CA-6020T(180),A2-CU-6020T(180),A2-NA-6020T(180),A2-PREP-3050:1T(180),A2-SN-6020T(180),A2-TI-6020T(180)

Project Name: WILLIAMS (1794)
Project Number: 1794

Serial_No:06141717:02
Lab Number: L1717026
Report Date: 06/14/17

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L1717026-03A	Glass 120ml/4oz unpreserved	A	N/A	N/A	3.2	Y	Absent		A2-FE-6020T(180),A2-MO-6020T(180),A2-PB-6020T(180),A2-BA-6020T(180),A2-NI-6020T(180),A2-SB-6020T(180),A2-ZN-6020T(180),A2-HG-7474T(28),A2-K-6020T(180),A2-CR-6020T(180),A2-TL-6020T(180),A2-TS(7),A2-AS-6020T(180),A2-CO-6020T(180),A2-MN-6020T(180),A2-SR-6020T(180),A2-BE-6020T(180),A2-CD-6020T(180),A2-HGPREP-AF(28),A2-V-6020T(180),A2-MG-6020T(180),A2-PREP-3050:2T(180),A2-SE-6020T(180),A2-AG-6020T(180),A2-AL-6020T(180),A2-CA-6020T(180),A2-CU-6020T(180),A2-NA-6020T(180),A2-PREP-3050:1T(180),A2-SN-6020T(180),A2-TI-6020T(180)
L1717026-04A	Glass 120ml/4oz unpreserved	A	N/A	N/A	3.2	Y	Absent		A2-FE-6020T(180),A2-MO-6020T(180),A2-PB-6020T(180),A2-BA-6020T(180),A2-NI-6020T(180),A2-SB-6020T(180),A2-ZN-6020T(180),A2-HG-7474T(28),A2-K-6020T(180),A2-CR-6020T(180),A2-TL-6020T(180),A2-TS(7),A2-AS-6020T(180),A2-CO-6020T(180),A2-MN-6020T(180),A2-SR-6020T(180),A2-BE-6020T(180),A2-CD-6020T(180),A2-HGPREP-AF(28),A2-V-6020T(180),A2-MG-6020T(180),A2-PREP-3050:2T(180),A2-SE-6020T(180),A2-AG-6020T(180),A2-AL-6020T(180),A2-CA-6020T(180),A2-CU-6020T(180),A2-NA-6020T(180),A2-PREP-3050:1T(180),A2-SN-6020T(180),A2-TI-6020T(180)
L1717026-05A	Glass 120ml/4oz unpreserved	A	N/A	N/A	3.2	Y	Absent		A2-FE-6020T(180),A2-MO-6020T(180),A2-PB-6020T(180),A2-BA-6020T(180),A2-NI-6020T(180),A2-SB-6020T(180),A2-ZN-6020T(180),A2-HG-7474T(28),A2-K-6020T(180),A2-CR-6020T(180),A2-TL-6020T(180),A2-TS(7),A2-AS-6020T(180),A2-CO-6020T(180),A2-MN-6020T(180),A2-SR-6020T(180),A2-BE-6020T(180),A2-CD-6020T(180),A2-HGPREP-AF(28),A2-V-6020T(180),A2-MG-6020T(180),A2-PREP-3050:2T(180),A2-SE-6020T(180),A2-AG-6020T(180),A2-AL-6020T(180),A2-CA-6020T(180),A2-CU-6020T(180),A2-NA-6020T(180),A2-PREP-3050:1T(180),A2-SN-6020T(180),A2-TI-6020T(180)

Project Name: WILLIAMS (1794)
Project Number: 1794

Serial_No:06141717:02
Lab Number: L1717026
Report Date: 06/14/17

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L1717026-06A	Glass 120ml/4oz unpreserved	A	N/A	N/A	3.2	Y	Absent		A2-FE-6020T(180),A2-MO-6020T(180),A2-PB-6020T(180),A2-BA-6020T(180),A2-NI-6020T(180),A2-SB-6020T(180),A2-ZN-6020T(180),A2-HG-7474T(28),A2-K-6020T(180),A2-CR-6020T(180),A2-TL-6020T(180),A2-TS(7),A2-AS-6020T(180),A2-CO-6020T(180),A2-MN-6020T(180),A2-SR-6020T(180),A2-BE-6020T(180),A2-CD-6020T(180),A2-HGPREP-AF(28),A2-V-6020T(180),A2-MG-6020T(180),A2-PREP-3050:2T(180),A2-SE-6020T(180),A2-AG-6020T(180),A2-AL-6020T(180),A2-CA-6020T(180),A2-CU-6020T(180),A2-NA-6020T(180),A2-PREP-3050:1T(180),A2-SN-6020T(180),A2-TI-6020T(180)
L1717026-07A	Glass 120ml/4oz unpreserved	A	N/A	N/A	3.2	Y	Absent		A2-FE-6020T(180),A2-MO-6020T(180),A2-PB-6020T(180),A2-BA-6020T(180),A2-NI-6020T(180),A2-SB-6020T(180),A2-ZN-6020T(180),A2-HG-7474T(28),A2-K-6020T(180),A2-CR-6020T(180),A2-TL-6020T(180),A2-TS(7),A2-AS-6020T(180),A2-CO-6020T(180),A2-MN-6020T(180),A2-SR-6020T(180),A2-BE-6020T(180),A2-CD-6020T(180),A2-HGPREP-AF(28),A2-V-6020T(180),A2-MG-6020T(180),A2-PREP-3050:2T(180),A2-SE-6020T(180),A2-AG-6020T(180),A2-AL-6020T(180),A2-CA-6020T(180),A2-CU-6020T(180),A2-NA-6020T(180),A2-PREP-3050:1T(180),A2-SN-6020T(180),A2-TI-6020T(180)
L1717026-08A	Glass 120ml/4oz unpreserved	A	N/A	N/A	3.2	Y	Absent		A2-FE-6020T(180),A2-MO-6020T(180),A2-PB-6020T(180),A2-BA-6020T(180),A2-NI-6020T(180),A2-SB-6020T(180),A2-ZN-6020T(180),A2-HG-7474T(28),A2-K-6020T(180),A2-CR-6020T(180),A2-TL-6020T(180),A2-TS(7),A2-AS-6020T(180),A2-CO-6020T(180),A2-MN-6020T(180),A2-SR-6020T(180),A2-BE-6020T(180),A2-CD-6020T(180),A2-HGPREP-AF(28),A2-V-6020T(180),A2-MG-6020T(180),A2-PREP-3050:2T(180),A2-SE-6020T(180),A2-AG-6020T(180),A2-AL-6020T(180),A2-CA-6020T(180),A2-CU-6020T(180),A2-NA-6020T(180),A2-PREP-3050:1T(180),A2-SN-6020T(180),A2-TI-6020T(180)

Project Name: WILLIAMS (1794)
Project Number: 1794

Serial_No:06141717:02
Lab Number: L1717026
Report Date: 06/14/17

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L1717026-09A	Glass 120ml/4oz unpreserved	A	N/A	N/A	3.2	Y	Absent		A2-FE-6020T(180),A2-MO-6020T(180),A2-PB-6020T(180),A2-BA-6020T(180),A2-NI-6020T(180),A2-SB-6020T(180),A2-ZN-6020T(180),A2-HG-7474T(28),A2-K-6020T(180),A2-CR-6020T(180),A2-TL-6020T(180),A2-TS(7),A2-AS-6020T(180),A2-CO-6020T(180),A2-MN-6020T(180),A2-SR-6020T(180),A2-BE-6020T(180),A2-CD-6020T(180),A2-HGPREP-AF(28),A2-V-6020T(180),A2-MG-6020T(180),A2-PREP-3050:2T(180),A2-SE-6020T(180),A2-AG-6020T(180),A2-AL-6020T(180),A2-CA-6020T(180),A2-CU-6020T(180),A2-NA-6020T(180),A2-PREP-3050:1T(180),A2-SN-6020T(180),A2-TI-6020T(180)
L1717026-10A	Glass 120ml/4oz unpreserved	A	N/A	N/A	3.2	Y	Absent		A2-FE-6020T(180),A2-MO-6020T(180),A2-PB-6020T(180),A2-BA-6020T(180),A2-NI-6020T(180),A2-SB-6020T(180),A2-ZN-6020T(180),A2-HG-7474T(28),A2-K-6020T(180),A2-CR-6020T(180),A2-TL-6020T(180),A2-TS(7),A2-AS-6020T(180),A2-CO-6020T(180),A2-MN-6020T(180),A2-SR-6020T(180),A2-BE-6020T(180),A2-CD-6020T(180),A2-HGPREP-AF(28),A2-V-6020T(180),A2-MG-6020T(180),A2-PREP-3050:2T(180),A2-SE-6020T(180),A2-AG-6020T(180),A2-AL-6020T(180),A2-CA-6020T(180),A2-CU-6020T(180),A2-NA-6020T(180),A2-PREP-3050:1T(180),A2-SN-6020T(180),A2-TI-6020T(180)
L1717026-11A	Glass 120ml/4oz unpreserved	A	N/A	N/A	3.2	Y	Absent		A2-FE-6020T(180),A2-MO-6020T(180),A2-PB-6020T(180),A2-BA-6020T(180),A2-NI-6020T(180),A2-SB-6020T(180),A2-ZN-6020T(180),A2-HG-7474T(28),A2-K-6020T(180),A2-CR-6020T(180),A2-TL-6020T(180),A2-TS(7),A2-AS-6020T(180),A2-CO-6020T(180),A2-MN-6020T(180),A2-SR-6020T(180),A2-BE-6020T(180),A2-CD-6020T(180),A2-HGPREP-AF(28),A2-V-6020T(180),A2-MG-6020T(180),A2-PREP-3050:2T(180),A2-SE-6020T(180),A2-AG-6020T(180),A2-AL-6020T(180),A2-CA-6020T(180),A2-CU-6020T(180),A2-NA-6020T(180),A2-PREP-3050:1T(180),A2-SN-6020T(180),A2-TI-6020T(180)

Project Name: WILLIAMS (1794)
Project Number: 1794

Serial_No:06141717:02
Lab Number: L1717026
Report Date: 06/14/17

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L1717026-12A	Glass 120ml/4oz unpreserved	A	N/A	N/A	3.2	Y	Absent		A2-FE-6020T(180),A2-MO-6020T(180),A2-PB-6020T(180),A2-BA-6020T(180),A2-NI-6020T(180),A2-SB-6020T(180),A2-ZN-6020T(180),A2-HG-7474T(28),A2-K-6020T(180),A2-CR-6020T(180),A2-TL-6020T(180),A2-TS(7),A2-AS-6020T(180),A2-CO-6020T(180),A2-MN-6020T(180),A2-SR-6020T(180),A2-BE-6020T(180),A2-CD-6020T(180),A2-HGPREP-AF(28),A2-V-6020T(180),A2-MG-6020T(180),A2-PREP-3050:2T(180),A2-SE-6020T(180),A2-AG-6020T(180),A2-AL-6020T(180),A2-CA-6020T(180),A2-CU-6020T(180),A2-NA-6020T(180),A2-PREP-3050:1T(180),A2-SN-6020T(180),A2-TI-6020T(180)
L1717026-13A	Glass 120ml/4oz unpreserved	A	N/A	N/A	3.2	Y	Absent		A2-FE-6020T(180),A2-MO-6020T(180),A2-PB-6020T(180),A2-BA-6020T(180),A2-NI-6020T(180),A2-SB-6020T(180),A2-ZN-6020T(180),A2-HG-7474T(28),A2-K-6020T(180),A2-CR-6020T(180),A2-TL-6020T(180),A2-TS(7),A2-AS-6020T(180),A2-CO-6020T(180),A2-MN-6020T(180),A2-SR-6020T(180),A2-BE-6020T(180),A2-CD-6020T(180),A2-HGPREP-AF(28),A2-V-6020T(180),A2-MG-6020T(180),A2-PREP-3050:2T(180),A2-SE-6020T(180),A2-AG-6020T(180),A2-AL-6020T(180),A2-CA-6020T(180),A2-CU-6020T(180),A2-NA-6020T(180),A2-PREP-3050:1T(180),A2-SN-6020T(180),A2-TI-6020T(180)
L1717026-14A	Glass 120ml/4oz unpreserved	A	N/A	N/A	3.2	Y	Absent		A2-FE-6020T(180),A2-MO-6020T(180),A2-PB-6020T(180),A2-BA-6020T(180),A2-NI-6020T(180),A2-SB-6020T(180),A2-ZN-6020T(180),A2-HG-7474T(28),A2-K-6020T(180),A2-CR-6020T(180),A2-TL-6020T(180),A2-TS(7),A2-AS-6020T(180),A2-CO-6020T(180),A2-MN-6020T(180),A2-SR-6020T(180),A2-BE-6020T(180),A2-CD-6020T(180),A2-HGPREP-AF(28),A2-V-6020T(180),A2-MG-6020T(180),A2-PREP-3050:2T(180),A2-SE-6020T(180),A2-AG-6020T(180),A2-AL-6020T(180),A2-CA-6020T(180),A2-CU-6020T(180),A2-NA-6020T(180),A2-PREP-3050:1T(180),A2-SN-6020T(180),A2-TI-6020T(180)

Project Name: WILLIAMS (1794)
Project Number: 1794

Serial_No: 06141717:02
Lab Number: L1717026
Report Date: 06/14/17

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L1717026-15A	Glass 120ml/4oz unpreserved	A	N/A	N/A	3.2	Y	Absent		A2-FE-6020T(180),A2-MO-6020T(180),A2-PB-6020T(180),A2-BA-6020T(180),A2-NI-6020T(180),A2-SB-6020T(180),A2-ZN-6020T(180),A2-HG-7474T(28),A2-K-6020T(180),A2-CR-6020T(180),A2-TL-6020T(180),A2-TS(7),A2-AS-6020T(180),A2-CO-6020T(180),A2-MN-6020T(180),A2-SR-6020T(180),A2-BE-6020T(180),A2-CD-6020T(180),A2-HGPREP-AF(28),A2-V-6020T(180),A2-MG-6020T(180),A2-PREP-3050:2T(180),A2-SE-6020T(180),A2-AG-6020T(180),A2-AL-6020T(180),A2-CA-6020T(180),A2-CU-6020T(180),A2-NA-6020T(180),A2-PREP-3050:1T(180),A2-SN-6020T(180),A2-TI-6020T(180)
L1717026-16A	Glass 120ml/4oz unpreserved	A	N/A	N/A	3.2	Y	Absent		A2-FE-6020T(180),A2-MO-6020T(180),A2-PB-6020T(180),A2-BA-6020T(180),A2-NI-6020T(180),A2-SB-6020T(180),A2-ZN-6020T(180),A2-HG-7474T(28),A2-K-6020T(180),A2-CR-6020T(180),A2-TL-6020T(180),A2-TS(7),A2-AS-6020T(180),A2-CO-6020T(180),A2-MN-6020T(180),A2-SR-6020T(180),A2-BE-6020T(180),A2-CD-6020T(180),A2-HGPREP-AF(28),A2-V-6020T(180),A2-MG-6020T(180),A2-PREP-3050:2T(180),A2-SE-6020T(180),A2-AG-6020T(180),A2-AL-6020T(180),A2-CA-6020T(180),A2-CU-6020T(180),A2-NA-6020T(180),A2-PREP-3050:1T(180),A2-SN-6020T(180),A2-TI-6020T(180)
L1717026-17A	Glass 120ml/4oz unpreserved	A	N/A	N/A	3.2	Y	Absent		A2-FE-6020T(180),A2-MO-6020T(180),A2-PB-6020T(180),A2-BA-6020T(180),A2-NI-6020T(180),A2-SB-6020T(180),A2-ZN-6020T(180),A2-HG-7474T(28),A2-K-6020T(180),A2-CR-6020T(180),A2-TL-6020T(180),A2-TS(7),A2-AS-6020T(180),A2-CO-6020T(180),A2-MN-6020T(180),A2-SR-6020T(180),A2-BE-6020T(180),A2-CD-6020T(180),A2-HGPREP-AF(28),A2-V-6020T(180),A2-MG-6020T(180),A2-PREP-3050:2T(180),A2-SE-6020T(180),A2-AG-6020T(180),A2-AL-6020T(180),A2-CA-6020T(180),A2-CU-6020T(180),A2-NA-6020T(180),A2-PREP-3050:1T(180),A2-SN-6020T(180),A2-TI-6020T(180)

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Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L1717026-18A	Glass 120ml/4oz unpreserved	A	N/A	N/A	3.2	Y	Absent		A2-FE-6020T(180),A2-MO-6020T(180),A2-PB-6020T(180),A2-BA-6020T(180),A2-NI-6020T(180),A2-SB-6020T(180),A2-ZN-6020T(180),A2-HG-7474T(28),A2-K-6020T(180),A2-CR-6020T(180),A2-TL-6020T(180),A2-TS(7),A2-AS-6020T(180),A2-CO-6020T(180),A2-MN-6020T(180),A2-SR-6020T(180),A2-BE-6020T(180),A2-CD-6020T(180),A2-HGPREP-AF(28),A2-V-6020T(180),A2-MG-6020T(180),A2-PREP-3050:2T(180),A2-SE-6020T(180),A2-AG-6020T(180),A2-AL-6020T(180),A2-CA-6020T(180),A2-CU-6020T(180),A2-NA-6020T(180),A2-PREP-3050:1T(180),A2-SN-6020T(180),A2-TI-6020T(180)
L1717026-19A	Glass 120ml/4oz unpreserved	A	N/A	N/A	3.2	Y	Absent		A2-FE-6020T(180),A2-MO-6020T(180),A2-PB-6020T(180),A2-BA-6020T(180),A2-NI-6020T(180),A2-SB-6020T(180),A2-ZN-6020T(180),A2-HG-7474T(28),A2-K-6020T(180),A2-CR-6020T(180),A2-TL-6020T(180),A2-TS(7),A2-AS-6020T(180),A2-CO-6020T(180),A2-MN-6020T(180),A2-SR-6020T(180),A2-BE-6020T(180),A2-CD-6020T(180),A2-HGPREP-AF(28),A2-V-6020T(180),A2-MG-6020T(180),A2-PREP-3050:2T(180),A2-SE-6020T(180),A2-AG-6020T(180),A2-AL-6020T(180),A2-CA-6020T(180),A2-CU-6020T(180),A2-NA-6020T(180),A2-PREP-3050:1T(180),A2-SN-6020T(180),A2-TI-6020T(180)
L1717026-20A	Glass 120ml/4oz unpreserved	A	N/A	N/A	3.2	Y	Absent		A2-FE-6020T(180),A2-MO-6020T(180),A2-PB-6020T(180),A2-BA-6020T(180),A2-NI-6020T(180),A2-SB-6020T(180),A2-ZN-6020T(180),A2-HG-7474T(28),A2-K-6020T(180),A2-CR-6020T(180),A2-TL-6020T(180),A2-TS(7),A2-AS-6020T(180),A2-CO-6020T(180),A2-MN-6020T(180),A2-SR-6020T(180),A2-BE-6020T(180),A2-CD-6020T(180),A2-HGPREP-AF(28),A2-V-6020T(180),A2-MG-6020T(180),A2-PREP-3050:2T(180),A2-SE-6020T(180),A2-AG-6020T(180),A2-AL-6020T(180),A2-CA-6020T(180),A2-CU-6020T(180),A2-NA-6020T(180),A2-PREP-3050:1T(180),A2-SN-6020T(180),A2-TI-6020T(180)

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Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L1717026-21A	Glass 120ml/4oz unpreserved	A	N/A	N/A	3.2	Y	Absent		A2-FE-6020T(180),A2-MO-6020T(180),A2-PB-6020T(180),A2-BA-6020T(180),A2-NI-6020T(180),A2-SB-6020T(180),A2-ZN-6020T(180),A2-HG-7474T(28),A2-K-6020T(180),A2-CR-6020T(180),A2-TL-6020T(180),A2-TS(7),A2-AS-6020T(180),A2-CO-6020T(180),A2-MN-6020T(180),A2-SR-6020T(180),A2-BE-6020T(180),A2-CD-6020T(180),A2-HGPREP-AF(28),A2-V-6020T(180),A2-MG-6020T(180),A2-PREP-3050:2T(180),A2-SE-6020T(180),A2-AG-6020T(180),A2-AL-6020T(180),A2-CA-6020T(180),A2-CU-6020T(180),A2-NA-6020T(180),A2-PREP-3050:1T(180),A2-SN-6020T(180),A2-TI-6020T(180)
L1717026-22A	Glass 120ml/4oz unpreserved	A	N/A	N/A	3.2	Y	Absent		A2-FE-6020T(180),A2-MO-6020T(180),A2-PB-6020T(180),A2-BA-6020T(180),A2-NI-6020T(180),A2-SB-6020T(180),A2-ZN-6020T(180),A2-HG-7474T(28),A2-K-6020T(180),A2-CR-6020T(180),A2-TL-6020T(180),A2-TS(7),A2-AS-6020T(180),A2-CO-6020T(180),A2-MN-6020T(180),A2-SR-6020T(180),A2-BE-6020T(180),A2-CD-6020T(180),A2-HGPREP-AF(28),A2-V-6020T(180),A2-MG-6020T(180),A2-PREP-3050:2T(180),A2-SE-6020T(180),A2-AG-6020T(180),A2-AL-6020T(180),A2-CA-6020T(180),A2-CU-6020T(180),A2-NA-6020T(180),A2-PREP-3050:1T(180),A2-SN-6020T(180),A2-TI-6020T(180)
L1717026-23A	Glass 120ml/4oz unpreserved	A	N/A	N/A	3.2	Y	Absent		A2-FE-6020T(180),A2-MO-6020T(180),A2-PB-6020T(180),A2-BA-6020T(180),A2-NI-6020T(180),A2-SB-6020T(180),A2-ZN-6020T(180),A2-HG-7474T(28),A2-K-6020T(180),A2-CR-6020T(180),A2-TL-6020T(180),A2-TS(7),A2-AS-6020T(180),A2-CO-6020T(180),A2-MN-6020T(180),A2-SR-6020T(180),A2-BE-6020T(180),A2-CD-6020T(180),A2-HGPREP-AF(28),A2-V-6020T(180),A2-MG-6020T(180),A2-PREP-3050:2T(180),A2-SE-6020T(180),A2-AG-6020T(180),A2-AL-6020T(180),A2-CA-6020T(180),A2-CU-6020T(180),A2-NA-6020T(180),A2-PREP-3050:1T(180),A2-SN-6020T(180),A2-TI-6020T(180)

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Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L1717026-24A	Glass 120ml/4oz unpreserved	A	N/A	N/A	3.2	Y	Absent		A2-FE-6020T(180),A2-MO-6020T(180),A2-PB-6020T(180),A2-BA-6020T(180),A2-NI-6020T(180),A2-SB-6020T(180),A2-ZN-6020T(180),A2-HG-7474T(28),A2-K-6020T(180),A2-CR-6020T(180),A2-TL-6020T(180),A2-TS(7),A2-AS-6020T(180),A2-CO-6020T(180),A2-MN-6020T(180),A2-SR-6020T(180),A2-BE-6020T(180),A2-CD-6020T(180),A2-HGPREP-AF(28),A2-V-6020T(180),A2-MG-6020T(180),A2-PREP-3050:2T(180),A2-SE-6020T(180),A2-AG-6020T(180),A2-AL-6020T(180),A2-CA-6020T(180),A2-CU-6020T(180),A2-NA-6020T(180),A2-PREP-3050:1T(180),A2-SN-6020T(180),A2-TI-6020T(180)
L1717026-25A	Glass 120ml/4oz unpreserved	A	N/A	N/A	3.2	Y	Absent		A2-FE-6020T(180),A2-MO-6020T(180),A2-PB-6020T(180),A2-BA-6020T(180),A2-NI-6020T(180),A2-SB-6020T(180),A2-ZN-6020T(180),A2-HG-7474T(28),A2-K-6020T(180),A2-CR-6020T(180),A2-TL-6020T(180),A2-TS(7),A2-AS-6020T(180),A2-CO-6020T(180),A2-MN-6020T(180),A2-SR-6020T(180),A2-BE-6020T(180),A2-CD-6020T(180),A2-HGPREP-AF(28),A2-V-6020T(180),A2-MG-6020T(180),A2-PREP-3050:2T(180),A2-SE-6020T(180),A2-AG-6020T(180),A2-AL-6020T(180),A2-CA-6020T(180),A2-CU-6020T(180),A2-NA-6020T(180),A2-PREP-3050:1T(180),A2-SN-6020T(180),A2-TI-6020T(180)
L1717026-26A	Glass 120ml/4oz unpreserved	A	N/A	N/A	3.2	Y	Absent		A2-FE-6020T(180),A2-MO-6020T(180),A2-PB-6020T(180),A2-BA-6020T(180),A2-NI-6020T(180),A2-SB-6020T(180),A2-ZN-6020T(180),A2-HG-7474T(28),A2-K-6020T(180),A2-CR-6020T(180),A2-TL-6020T(180),A2-TS(7),A2-AS-6020T(180),A2-CO-6020T(180),A2-MN-6020T(180),A2-SR-6020T(180),A2-BE-6020T(180),A2-CD-6020T(180),A2-HGPREP-AF(28),A2-V-6020T(180),A2-MG-6020T(180),A2-PREP-3050:2T(180),A2-SE-6020T(180),A2-AG-6020T(180),A2-AL-6020T(180),A2-CA-6020T(180),A2-CU-6020T(180),A2-NA-6020T(180),A2-PREP-3050:1T(180),A2-SN-6020T(180),A2-TI-6020T(180)

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Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L1717026-27A	Glass 120ml/4oz unpreserved	A	N/A	N/A	3.2	Y	Absent		A2-FE-6020T(180),A2-MO-6020T(180),A2-PB-6020T(180),A2-BA-6020T(180),A2-NI-6020T(180),A2-SB-6020T(180),A2-ZN-6020T(180),A2-HG-7474T(28),A2-K-6020T(180),A2-CR-6020T(180),A2-TL-6020T(180),A2-TS(7),A2-AS-6020T(180),A2-CO-6020T(180),A2-MN-6020T(180),A2-SR-6020T(180),A2-BE-6020T(180),A2-CD-6020T(180),A2-HGPREP-AF(28),A2-V-6020T(180),A2-MG-6020T(180),A2-PREP-3050:2T(180),A2-SE-6020T(180),A2-AG-6020T(180),A2-AL-6020T(180),A2-CA-6020T(180),A2-CU-6020T(180),A2-NA-6020T(180),A2-PREP-3050:1T(180),A2-SN-6020T(180),A2-TI-6020T(180)
L1717026-28A	Plastic 250ml HNO3 preserved	A	N/A	N/A	3.2	Y	Absent		A2-FE-6020T(180),A2-MO-6020T(180),A2-PB-6020T(180),A2-BA-6020T(180),A2-NI-6020T(180),A2-SB-6020T(180),A2-ZN-6020T(180),A2-HG-7474T(28),A2-K-6020T(180),A2-CR-6020T(180),A2-TL-6020T(180),A2-AS-6020T(180),A2-CO-6020T(180),A2-MN-6020T(180),A2-SR-6020T(180),A2-BE-6020T(180),A2-CD-6020T(180),A2-HGPREP-AF(28),A2-PREP-3020(180),A2-V-6020T(180),A2-MG-6020T(180),A2-SE-6020T(180),A2-AG-6020T(180),A2-AL-6020T(180),A2-CA-6020T(180),A2-CU-6020T(180),A2-NA-6020T(180),A2-SN-6020T(180),A2-TI-6020T(180)
L1717026-29A	Plastic 250ml HNO3 preserved	A	N/A	N/A	3.2	Y	Absent		A2-FE-6020T(180),A2-MO-6020T(180),A2-PB-6020T(180),A2-BA-6020T(180),A2-NI-6020T(180),A2-SB-6020T(180),A2-ZN-6020T(180),A2-HG-7474T(28),A2-K-6020T(180),A2-CR-6020T(180),A2-TL-6020T(180),A2-AS-6020T(180),A2-CO-6020T(180),A2-MN-6020T(180),A2-SR-6020T(180),A2-BE-6020T(180),A2-CD-6020T(180),A2-HGPREP-AF(28),A2-PREP-3020(180),A2-V-6020T(180),A2-MG-6020T(180),A2-SE-6020T(180),A2-AG-6020T(180),A2-AL-6020T(180),A2-CA-6020T(180),A2-CU-6020T(180),A2-NA-6020T(180),A2-SN-6020T(180),A2-TI-6020T(180)

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GLOSSARY

Acronyms

EDL	- Estimated Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The EDL includes any adjustments from dilutions, concentrations or moisture content, where applicable. The use of EDLs is specific to the analysis of PAHs using Solid-Phase Microextraction (SPME).
EPA	- Environmental Protection Agency.
LCS	- Laboratory Control Sample: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.
LCSD	- Laboratory Control Sample Duplicate: Refer to LCS.
LFB	- Laboratory Fortified Blank: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.
MDL	- Method Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The MDL includes any adjustments from dilutions, concentrations or moisture content, where applicable.
MS	- Matrix Spike Sample: A sample prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available.
MSD	- Matrix Spike Sample Duplicate: Refer to MS.
NA	- Not Applicable.
NC	- Not Calculated: Term is utilized when one or more of the results utilized in the calculation are non-detect at the parameter's reporting unit.
NDPA/DPA	- N-Nitrosodiphenylamine/Diphenylamine.
NI	- Not Ignitable.
NP	- Non-Plastic: Term is utilized for the analysis of Atterberg Limits in soil.
RL	- Reporting Limit: The value at which an instrument can accurately measure an analyte at a specific concentration. The RL includes any adjustments from dilutions, concentrations or moisture content, where applicable.
RPD	- Relative Percent Difference: The results from matrix and/or matrix spike duplicates are primarily designed to assess the precision of analytical results in a given matrix and are expressed as relative percent difference (RPD). Values which are less than five times the reporting limit for any individual parameter are evaluated by utilizing the absolute difference between the values; although the RPD value will be provided in the report.
SRM	- Standard Reference Material: A reference sample of a known or certified value that is of the same or similar matrix as the associated field samples.
STLP	- Semi-dynamic Tank Leaching Procedure per EPA Method 1315.
TIC	- Tentatively Identified Compound: A compound that has been identified to be present and is not part of the target compound list (TCL) for the method and/or program. All TICs are qualitatively identified and reported as estimated concentrations.

Footnotes

- 1 - The reference for this analyte should be considered modified since this analyte is absent from the target analyte list of the original method.

Terms

Analytical Method: Both the document from which the method originates and the analytical reference method. (Example: EPA 8260B is shown as 1,8260B.) The codes for the reference method documents are provided in the References section of the Addendum.

Final pH: As it pertains to Sample Receipt & Container Information section of the report, Final pH reflects pH of container determined after adjustment at the laboratory, if applicable. If no adjustment required, value reflects Initial pH.

Frozen Date/Time: With respect to Volatile Organics in soil, Frozen Date/Time reflects the date/time at which associated Reagent Water-preserved vials were initially frozen. Note: If frozen date/time is beyond 48 hours from sample collection, value will be reflected in 'bold'.

Initial pH: As it pertains to Sample Receipt & Container Information section of the report, Initial pH reflects pH of container determined upon receipt, if applicable.

Total: With respect to Organic analyses, a 'Total' result is defined as the summation of results for individual isomers or Aroclors. If a 'Total' result is requested, the results of its individual components will also be reported. This is applicable to 'Total' results for methods 8260, 8081 and 8082.

Data Qualifiers

- A** - Spectra identified as "Aldol Condensation Product".
- B** - The analyte was detected above the reporting limit in the associated method blank. Flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For MCP-related

Report Format: DU Report with 'J' Qualifiers



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projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For DOD-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank AND the analyte was detected above one-half the reporting limit (or above the reporting limit for common lab contaminants) in the associated method blank. For NJ-Air-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte above the reporting limit. For NJ-related projects (excluding Air), flag only applies to associated field samples that have detectable concentrations of the analyte, which was detected above the reporting limit in the associated method blank or above five times the reporting limit for common lab contaminants (Phthalates, Acetone, Methylene Chloride, 2-Butanone).

- C** - Co-elution: The target analyte co-elutes with a known lab standard (i.e. surrogate, internal standards, etc.) for co-extracted analyses.
- D** - Concentration of analyte was quantified from diluted analysis. Flag only applies to field samples that have detectable concentrations of the analyte.
- E** - Concentration of analyte exceeds the range of the calibration curve and/or linear range of the instrument.
- G** - The concentration may be biased high due to matrix interferences (i.e. co-elution) with non-target compound(s). The result should be considered estimated.
- H** - The analysis of pH was performed beyond the regulatory-required holding time of 15 minutes from the time of sample collection.
- I** - The lower value for the two columns has been reported due to obvious interference.
- M** - Reporting Limit (RL) exceeds the MCP CAM Reporting Limit for this analyte.
- NJ** - Presumptive evidence of compound. This represents an estimated concentration for Tentatively Identified Compounds (TICs), where the identification is based on a mass spectral library search.
- P** - The RPD between the results for the two columns exceeds the method-specified criteria.
- Q** - The quality control sample exceeds the associated acceptance criteria. For DOD-related projects, LCS and/or Continuing Calibration Standard exceedences are also qualified on all associated sample results. Note: This flag is not applicable for matrix spike recoveries when the sample concentration is greater than 4x the spike added or for batch duplicate RPD when the sample concentrations are less than 5x the RL. (Metals only.)
- R** - Analytical results are from sample re-analysis.
- RE** - Analytical results are from sample re-extraction.
- S** - Analytical results are from modified screening analysis.
- J** - Estimated value. The Target analyte concentration is below the quantitation limit (RL), but above the Method Detection Limit (MDL) or Estimated Detection Limit (EDL) for SPME-related analyses. This represents an estimated concentration for Tentatively Identified Compounds (TICs).
- ND** - Not detected at the method detection limit (MDL) for the sample, or estimated detection limit (EDL) for SPME-related analyses.

Report Format: DU Report with 'J' Qualifiers



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REFERENCES

- 1 Test Methods for Evaluating Solid Waste: Physical/Chemical Methods. EPA SW-846. Third Edition. Updates I - IV, 2007.
- 121 Standard Methods for the Examination of Water and Wastewater. APHA-AWWA-WEF. Standard Methods Online.

LIMITATION OF LIABILITIES

Alpha Analytical performs services with reasonable care and diligence normal to the analytical testing laboratory industry. In the event of an error, the sole and exclusive responsibility of Alpha Analytical shall be to re-perform the work at it's own expense. In no event shall Alpha Analytical be held liable for any incidental, consequential or special damages, including but not limited to, damages in any way connected with the use of, interpretation of, information or analysis provided by Alpha Analytical.

We strongly urge our clients to comply with EPA protocol regarding sample volume, preservation, cooling, containers, sampling procedures, holding time and splitting of samples in the field.



Alpha Analytical, Inc.

ID No.:17873

Facility: **Company-wide**

Revision 10

Department: **Quality Assurance**

Published Date: 1/16/2017 11:00:05 AM

Title: **Certificate/Approval Program Summary**

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Certification Information


The following analytes are not included in our Primary NELAP Scope of Accreditation:


Westborough Facility**EPA 624:** m/p-xylene, o-xylene**EPA 8260C:** NPW: 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene, Azobenzene; SCM: Iodomethane (methyl iodide), Methyl methacrylate, 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene.**EPA 8270D:** NPW: Dimethylnaphthalene, 1,4-Diphenylhydrazine; SCM: Dimethylnaphthalene, 1,4-Diphenylhydrazine.**EPA 300:** DW: Bromide**EPA 6860:** NPW and SCM: Perchlorate**EPA 9010:** NPW and SCM: Amenable Cyanide Distillation**EPA 9012B:** NPW: Total Cyanide**EPA 9050A:** NPW: Specific Conductance**SM3500:** NPW: Ferrous Iron**SM4500:** NPW: Amenable Cyanide, Dissolved Oxygen; SCM: Total Phosphorus, TKN, NO₂, NO₃.**SM5310C:** DW: Dissolved Organic Carbon**Mansfield Facility****SM 2540D:** TSS**EPA 3005A** NPW**EPA 8082A:** NPW: PCB: 1, 5, 31, 87, 101, 110, 141, 151, 153, 180, 183, 187.**EPA TO-15:** Halothane, 2,4,4-Trimethyl-2-pentene, 2,4,4-Trimethyl-1-pentene, Thiophene, 2-Methylthiophene, 3-Methylthiophene, 2-Ethylthiophene, 1,2,3-Trimethylbenzene, Indan, Indene, 1,2,4,5-Tetramethylbenzene, Benzothiophene, 1-Methylnaphthalene.**Biological Tissue Matrix:** EPA 3050B

The following analytes are included in our Massachusetts DEP Scope of Accreditation


Westborough Facility:**Drinking Water****EPA 300.0:** Nitrate-N, Fluoride, Sulfate; **EPA 353.2:** Nitrate-N, Nitrite-N; **SM4500NO3-F:** Nitrate-N, Nitrite-N; **SM4500F-C, SM4500CN-CE, EPA 180.1, SM2130B, SM4500CI-D, SM2320B, SM2540C, SM4500H-B****EPA 332:** Perchlorate; **EPA 524.2:** THMs and VOCs; **EPA 504.1:** EDB, DBCP.**Microbiology:** **SM9215B; SM9223-P/A, SM9223B-Colilert-QT, SM9222D.****Non-Potable Water****SM4500H,B, EPA 120.1, SM2510B, SM2540C, SM2320B, SM4500CL-E, SM4500F-BC, SM4500NH3-BH, EPA 350.1:** Ammonia-N, **LACHAT 10-107-06-1-B:** Ammonia-N, **SM4500NO3-F, EPA 353.2:** Nitrate-N, **EPA 351.1, SM4500P-E, SM4500P-B, E, SM4500SO4-E, SM5220D, EPA 410.4, SM5210B, SM5310C, SM4500CL-D, EPA 1664, EPA 420.1, SM4500-CN-CE, SM2540D.****EPA 624:** Volatile Halocarbons & Aromatics,**EPA 608:** Chlordane, Toxaphene, Aldrin, alpha-BHC, beta-BHC, gamma-BHC, delta-BHC, Dieldrin, DDD, DDE, DDT, Endosulfan I, Endosulfan II, Endosulfan sulfate, Endrin, Endrin Aldehyde, Heptachlor, Heptachlor Epoxide, PCBs**EPA 625:** SVOC (Acid/Base/Neutral Extractables), **EPA 600/4-81-045:** PCB-Oil.**Microbiology:** **SM9223B-Colilert-QT; Enterolert-QT, SM9221E.****Mansfield Facility:****Drinking Water****EPA 200.7:** Ba, Be, Cd, Cr, Cu, Ni, Na, Ca. **EPA 200.8:** Sb, As, Ba, Be, Cd, Cr, Cu, Pb, Ni, Se, TL. **EPA 245.1 Hg.****Non-Potable Water****EPA 200.7:** Al, Sb, As, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Mo, Ni, K, Se, Ag, Na, Sr, TL, Ti, V, Zn.**EPA 200.8:** Al, Sb, As, Be, Cd, Cr, Cu, Pb, Mn, Ni, Se, Ag, TL, Zn.**EPA 245.1 Hg.****SM2340B**

For a complete listing of analytes and methods, please contact your Alpha Project Manager.

 NEW JERSEY CHAIN OF CUSTODY Westborough, MA 01581 8 Walkup Dr. TEL: 508-898-9220 FAX: 508-898-9193 Mansfield, MA 02048 320 Forbes Blvd TEL: 508-822-9300 FAX: 508-822-3288		Service Centers Mahwah, NJ 07430: 35 Whitney Rd, Suite 5 Albany, NY 12205: 14 Walker Way Tonawanda, NY 14150: 275 Cooper Ave, Suite 105		Page <u>1</u> of <u> </u>		Date Rec'd in Lab <u>5/25/17</u>		ALPHA Job # <u>L1717026</u>			
		Project Information Project Name: <u>Williams (1794)</u> Project Location: <u>Raritan Bay</u> Project # <u>1794</u> (Use Project name as Project #) <input type="checkbox"/>				Deliverables <input type="checkbox"/> NJ Full / Reduced <input type="checkbox"/> EQUIS (1 File) <input type="checkbox"/> EQUIS (4 File) <input type="checkbox"/> Other				Billing Information <input type="checkbox"/> Same as Client Info PO #	
		Client Information Client: <u>Alpine Ocean</u> Address: <u>155 Hudson Ave</u> <u>Norwood NJ 07648</u> Phone: <u>(201)-768-8000</u> Fax: <u> </u> Email: <u>mikosakowski@alpineocean.com</u>				Regulatory Requirement <input type="checkbox"/> SRS Residential/Non Residential <input type="checkbox"/> SRS Impact to Groundwater <input type="checkbox"/> NJ Ground Water Quality Standards <input type="checkbox"/> NJ IGW SPLP Leachate Criteria <input type="checkbox"/> Other				Site Information Is this site impacted by Petroleum? Yes <input type="checkbox"/> Petroleum Product:	
Other project specific requirements/comments: Please specify <u>Metals</u> or TAL.		ANALYSIS		Sample Filtration <input type="checkbox"/> Done <input type="checkbox"/> Lab to do <input type="checkbox"/> Lab to do (Please Specify below)		Sample Specific Comments		Total Bottles			
For EPH, selection is REQUIRED: <input type="checkbox"/> Category 1 <input type="checkbox"/> Category 2		For VOC, selection is REQUIRED: <input type="checkbox"/> 1,4-Dioxane <input type="checkbox"/> 8011		These samples have been previously analyzed by Alpha <input type="checkbox"/>		Turn-Around Time Standard <input type="checkbox"/> Due Date: Rush (only if pre approved) <input type="checkbox"/> # of Days:					
ALPHA Lab ID (Lab Use Only)		Sample ID		Collection Date Time		Sample Matrix Sampler's Initials					
-01		VL88-00-3E		5/14/17 17:07		Sed RV			X		
-02		VL88-03-6E		5/14/17 17:07		Sed RV			X		
-03		VL88-06-9E		5/14/17 17:07		Sed RV			X		
-04		VL88-09-10E		5/14/17 17:07		Sed RV			X		
-05		VL89-00-3E		5/14/17 16:15		Sed RV			X		
-06		VL89-03-6E		5/14/17 16:15		Sed RV			X		
-07		VL89-06-9E		5/14/17 16:15		Sed RV			X		
-08		VL89-09-10E		5/14/17 16:15		Sed RV		X			
-09		Dup-09-10E		5/14/17 17:07		Sed RV		X			
-10		Dup-00-3E		5/14/17 16:15		Sed RV		X			
Preservative Code: A = None B = HCl C = HNO ₃ D = H ₂ SO ₄ E = NaOH F = MeOH G = NaHSO ₄ H = Na ₂ S ₂ O ₃ K/E = Zn Ac/NaOH O = Other		Container Code P = Plastic A = Amber Glass V = Vial G = Glass B = Bacteria Cup C = Cube O = Other E = Encore D = BOD Bottle		Westboro: Certification No: MA935 Mansfield: Certification No: MA015		Container Type Preservative		Please print clearly, legibly and completely. Samples can not be logged in and turnaround time clock will not start until any ambiguities are resolved. BY EXECUTING THIS COC, THE CLIENT HAS READ AND AGREES TO BE BOUND BY ALPHA'S TERMS & CONDITIONS. (See reverse side.)			
Relinquished By: <u>[Signature]</u>		Date/Time: <u>5/24/17 15:19</u>		Received By: <u>[Signature]</u>		Date/Time: <u>5/24/17 15:19</u>					
Relinquished By: <u>[Signature]</u>		Date/Time: <u>5/24/17 17:08</u>		Received By: <u>[Signature]</u>		Date/Time: <u>5/24/17 17:10</u>					
Relinquished By: <u>[Signature]</u>		Date/Time: <u>5/24/17 5:31</u>		Received By: <u>[Signature]</u>		Date/Time: <u>5/23/17 5:31</u>					

 NEW JERSEY CHAIN OF CUSTODY		Service Centers Mahwah, NJ 07430: 35 Whitney Rd, Suite 5 Albany, NY 12205: 14 Walker Way Tonawanda, NY 14150: 275 Cooper Ave, Suite 105		Page <u>2</u> of _____		Date Rec'd in Lab <u>5/25/17</u>		ALPHA Job # <u>L1717026</u>														
		Westborough, MA 01581 8 Walkup Dr. TEL: 508-898-9220 FAX: 508-898-9193		Mansfield, MA 02048 320 Forbes Blvd TEL: 508-822-9300 FAX: 508-822-3288		Project Information Project Name: <u>Williams</u> Project Location: <u>Raritan Bay</u> Project # <u>1794</u> (Use Project name as Project #) <input type="checkbox"/>		Deliverables <input type="checkbox"/> NJ Full / Reduced <input type="checkbox"/> EQulS (1 File) <input type="checkbox"/> EQulS (4 File) <input type="checkbox"/> Other		Billing Information <input type="checkbox"/> Same as Client Info PO # _____												
		Client Information Client: <u>Alpine Ocean</u> Address: <u>155 Hudson Ave</u> <u>Norwood NJ 07648</u> Phone: <u>(201)-768-8800</u> Fax: _____ Email: <u>m.kosakowski@alpine-ocean.com</u>		Project Manager: <u>Mark Kosakowski</u> ALPHAQuote #: _____ Turn-Around Time Standard <input type="checkbox"/> Due Date: _____ Rush (only if pre approved) <input type="checkbox"/> # of Days: _____		Regulatory Requirement <input type="checkbox"/> SRS Residential/Non Residential <input type="checkbox"/> SRS Impact to Groundwater <input type="checkbox"/> NJ Ground Water Quality Standards <input type="checkbox"/> NJ IGW SPLP Leachate Criteria <input type="checkbox"/> Other		Site Information Is this site impacted by Petroleum? Yes <input type="checkbox"/> Petroleum Product: _____														
For EPH, selection is REQUIRED: <input type="checkbox"/> Category 1 <input type="checkbox"/> Category 2		For VOC, selection is REQUIRED: <input type="checkbox"/> 1,4-Dioxane <input type="checkbox"/> 8011		Other project specific requirements/comments: Please specify <u>Metals</u> or TAL.		ANALYSIS <table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td style="width:10%;">TAL Metals + SN + SA + MD</td> <td style="width:10%;"></td> <td style="width:10%;"></td> <td style="width:10%;"></td> <td style="width:10%;"></td> <td style="width:10%;"></td> <td style="width:10%;"></td> <td style="width:10%;"></td> <td style="width:10%;"></td> <td style="width:10%;"></td> <td style="width:10%;"></td> <td style="width:10%;"></td> </tr> </table>		TAL Metals + SN + SA + MD												Sample Filtration <input type="checkbox"/> Done <input type="checkbox"/> Lab to do Preservation <input type="checkbox"/> Lab to do (Please Specify below)		Total Bottle
TAL Metals + SN + SA + MD																						
ALPHA Lab ID (Lab Use Only)		Sample ID		Collection Date Time		Sample Matrix		Sampler's Initials		Sample Specific Comments												
-11		VL90- D0- 3E		5/14/17 15:42		Sed		RV		X				Total Bottle								
-12		VL90- D3- 6E		5/14/17 15:42		Sed		RV		X												
-13		VL90- D6- 9E		5/14/17 15:42		Sed		RV		X												
-14		VL90- D9- 10E		5/14/17 15:42		Sed		RV		X												
-15		VL91- D0- 3E		5/14/17 15:10		Sed		RV		X												
-16		VL91- D8- 6E		5/14/17 15:10		Sed		RV		X												
-17		VL91- D6- 9.6E		5/14/17 15:10		Sed		RV		X												
		VL91- D6- 9.6E		5/14/17 15:10																		
-18		Dup - D6- 9E		5/14/17 15:42		Sed		RV		X												
Preservative Code: A = None B = HCl C = HNO ₃ D = H ₂ SO ₄ E = NaOH F = MeOH G = NaHSO ₄ H = Na ₂ S ₂ O ₃ K/E = Zn Ac/NaOH O = Other		Container Code P = Plastic A = Amber Glass V = Vial G = Glass B = Bacteria Cup C = Cube O = Other E = Encore D = BOD Bottle		Westboro: Certification No: MA935 Mansfield: Certification No: MA015		Container Type		Preservative				Please print clearly, legibly and completely. Samples can not be logged in and turnaround time clock will not start until any ambiguities are resolved. BY EXECUTING THIS COC, THE CLIENT HAS READ AND AGREES TO BE BOUND BY ALPHA'S TERMS & CONDITIONS. (See reverse side.)										
Relinquished By: <u>Bob Vito</u> <u>Jeremiah Vito</u> <u>Nmoya</u>		Date/Time <u>5/24/17 15:19</u> <u>5/24/17 17:08</u> <u>5/25/17 5:31</u>		Received By: <u>Jeremiah Vito</u> <u>Jeremiah Vito</u> <u>Belinda</u>		Date/Time <u>5/24/17 15:19</u> <u>5/24/17 17:10</u> <u>5/25/17 5:31</u>																

Form No: 01-14 HC (rev. 30-Sept-2013)

 NEW JERSEY CHAIN OF CUSTODY Westborough, MA 01581 8 Walkup Dr. TEL: 508-898-9220 FAX: 508-898-9193 Mansfield, MA 02048 320 Forbes Blvd TEL: 508-822-9300 FAX: 508-822-3288		Service Centers Mahwah, NJ 07430: 35 Whitney Rd, Suite 5 Albany, NY 12205: 14 Walker Way Tonawanda, NY 14150: 275 Cooper Ave, Suite 105		Page <u>3</u> of _____		Date Rec'd in Lab <u>5/25/17</u>		ALPHA Job # <u>L1717026</u>					
		Project Information Project Name: <u>Williams</u> Project Location: <u>Baritan Bay</u> Project # <u>1794</u> (Use Project name as Project #) <input type="checkbox"/>		Deliverables <input type="checkbox"/> NJ Full / Reduced <input type="checkbox"/> EQulS (1 File) <input type="checkbox"/> EQulS (4 File) <input type="checkbox"/> Other		Billing Information <input type="checkbox"/> Same as Client Info PO # _____							
Client Information Client: <u>Alpine Ocean</u> Address: <u>155 Hudson Ave</u> <u>Norman NJ 07064</u> Phone: <u>(201)-768-8000</u> Fax: _____ Email: <u>mikesakowski@alpineocean.com</u>		Project Manager: _____ ALPHAQuote #: _____ Turn-Around Time Standard <input type="checkbox"/> Due Date: _____ Rush (only if pre approved) <input type="checkbox"/> # of Days: _____		Regulatory Requirement <input type="checkbox"/> SRS Residential/Non Residential <input type="checkbox"/> SRS Impact to Groundwater <input type="checkbox"/> NJ Ground Water Quality Standards <input type="checkbox"/> NJ IGW SPLP Leachate Criteria <input type="checkbox"/> Other		Site Information Is this site impacted by Petroleum? Yes <input type="checkbox"/> Petroleum Product: _____							
These samples have been previously analyzed by Alpha <input type="checkbox"/>		ANALYSIS		Sample Filtration <input type="checkbox"/> Done <input type="checkbox"/> Lab to do Preservation <input type="checkbox"/> Lab to do (Please Specify below)		Total Bottles							
For EPH, selection is REQUIRED: <input type="checkbox"/> Category 1 <input type="checkbox"/> Category 2		For VOC, selection is REQUIRED: <input type="checkbox"/> 1,4-Dioxane <input type="checkbox"/> 8011		Other project specific requirements/comments: Please specify <u>Metals</u> or TAL.									
ALPHA Lab ID (Lab Use Only)		Sample ID		Collection Date Time		Sample Matrix		Sampler's Initials		TAL Metals + SN + SR + HD		Sample Specific Comments	
-19		V42-DO-3E		5/19/17 14:38		Sed		RV		X			
-20		V42-D3-6E		5/19/17 14:38		Sed		RV		X			
-21		V42-D6-9E		5/19/17 14:38		Sed		RV		X			
-22		V42-D9-10E		5/19/17 14:38		Sed		RV		X			
-23		V43-DO-3E		5/20/17 13:58		Sed		RV		X		MS/MSD	
-24		V43-D3-6E		5/20/17 13:58		Sed		RV		X			
-25		V43-D6-9E		5/20/17 13:58		Sed		RV		X			
-26		V43-D9-10E		5/20/17 13:58		Sed		RV		X			
-27		Dup-D3-6E		5/19/17 14:38		Sed		RV		X			
Preservative Code: A = None B = HCl C = HNO ₃ D = H ₂ SO ₄ E = NaOH F = MeOH G = NaHSO ₄ H = Na ₂ S ₂ O ₃ K/E = Zn Ac/NaOH O = Other		Container Code P = Plastic A = Amber Glass V = Vial G = Glass B = Bacteria Cup C = Cube O = Other E = Encore D = BOD Bottle		Westboro: Certification No: MA935 Mansfield: Certification No: MA015		Container Type		Preservative		Please print clearly, legibly and completely. Samples can not be logged in and turnaround time clock will not start until any ambiguities are resolved. BY EXECUTING THIS COC, THE CLIENT HAS READ AND AGREES TO BE BOUND BY ALPHA'S TERMS & CONDITIONS. (See reverse side.)			
Relinquished By: <u>Bob VLE</u>		Date/Time: <u>5/24/17 15:14</u>		Received By: <u>Debra Munn</u>		Date/Time: <u>5/24/17 15:14</u>							
<u>Debra Munn</u>		<u>5/24/17 17:08</u>		<u>Yun Munn</u>		<u>5/24/17 22:00</u>							
<u>Bob VLE</u>		<u>5/28/17 8:31</u>		<u>Bob VLE</u>		<u>5/25/17 5:31</u>							

Alpha Summary Forms



Inorganic Summary Forms

Form 1 METALS

Client : Alpine Ocean Seismic Survey Inc.
Project Name : WILLIAMS (1794)
Lab ID : L1717026-28
Client ID : RINSE2
Sample Location : RARITAN BAY
Sample Matrix : WATER
Analytical Method : 1,6020A
Lab File ID : WG1010576.pdf
Sample Amount : 50ml
Digestion Method : EPA 3020A

Lab Number : L1717026
Project Number : 1794
Date Collected : 05/24/17 12:00
Date Received : 05/24/17
Date Analyzed : 06/07/17 10:24
Dilution Factor : 1
Analyst : AM
Instrument ID : ICPMSQ
%Solids : N/A
Date Digested : 06/01/17

CAS NO.	Parameter	mg/l			Qualifier
		Results	RL	MDL	
7429-90-5	Aluminum, Total	0.00461	0.0100	0.00327	J
7440-36-0	Antimony, Total	0.00076	0.00400	0.00042	J
7440-38-2	Arsenic, Total	ND	0.00050	0.00016	U
7440-39-3	Barium, Total	0.00092	0.00050	0.00017	
7440-41-7	Beryllium, Total	ND	0.00030	0.00010	U
7440-43-9	Cadmium, Total	ND	0.00020	0.00005	U
7440-70-2	Calcium, Total	ND	0.100	0.0394	U
7440-47-3	Chromium, Total	ND	0.00050	0.00017	U
7440-48-4	Cobalt, Total	ND	0.00050	0.00016	U
7440-50-8	Copper, Total	0.00148	0.00100	0.00038	
7439-89-6	Iron, Total	ND	0.0500	0.0191	U
7439-92-1	Lead, Total	ND	0.00100	0.00034	U
7439-95-4	Magnesium, Total	ND	0.0700	0.0242	U
7439-96-5	Manganese, Total	ND	0.00100	0.00044	U
7439-98-7	Molybdenum, Total	ND	0.00200	0.00067	U
7440-02-0	Nickel, Total	ND	0.00200	0.00055	U
7440-09-7	Potassium, Total	ND	0.100	0.0309	U
7782-49-2	Selenium, Total	ND	0.00500	0.00173	U
7440-22-4	Silver, Total	ND	0.00040	0.00016	U
7440-23-5	Sodium, Total	0.0787	0.200	0.0293	J
7440-24-6	Strontium, Total	0.00034	0.00050	0.00003	J
7440-28-0	Thallium, Total	ND	0.00050	0.00014	U
7440-31-5	Tin, Total	ND	0.00300	0.00112	U
7440-32-6	Titanium, Total	0.00016	0.00050	0.00007	J
7440-62-2	Vanadium, Total	ND	0.00500	0.00157	U
7440-66-6	Zinc, Total	ND	0.0100	0.00341	U



Form 1 METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : WILLIAMS (1794)
 Lab ID : L1717026-29
 Client ID : RINSE1
 Sample Location : RARITAN BAY
 Sample Matrix : WATER
 Analytical Method : 1,6020A
 Lab File ID : WG1010576.pdf
 Sample Amount : 50ml
 Digestion Method : EPA 3020A

Lab Number : L1717026
 Project Number : 1794
 Date Collected : 05/19/17 18:04
 Date Received : 05/24/17
 Date Analyzed : 06/07/17 12:43
 Dilution Factor : 1
 Analyst : AM
 Instrument ID : ICPMSQ
 %Solids : N/A
 Date Digested : 06/01/17

CAS NO.	Parameter	mg/l			Qualifier
		Results	RL	MDL	
7429-90-5	Aluminum, Total	ND	0.0100	0.00327	U
7440-36-0	Antimony, Total	ND	0.00400	0.00042	U
7440-38-2	Arsenic, Total	ND	0.00050	0.00016	U
7440-39-3	Barium, Total	0.00164	0.00050	0.00017	
7440-41-7	Beryllium, Total	ND	0.00030	0.00010	U
7440-43-9	Cadmium, Total	ND	0.00020	0.00005	U
7440-70-2	Calcium, Total	ND	0.100	0.0394	U
7440-47-3	Chromium, Total	0.00022	0.00050	0.00017	J
7440-48-4	Cobalt, Total	ND	0.00050	0.00016	U
7440-50-8	Copper, Total	0.00339	0.00100	0.00038	
7439-89-6	Iron, Total	ND	0.0500	0.0191	U
7439-92-1	Lead, Total	ND	0.00100	0.00034	U
7439-95-4	Magnesium, Total	ND	0.0700	0.0242	U
7439-96-5	Manganese, Total	0.00047	0.00100	0.00044	J
7439-98-7	Molybdenum, Total	ND	0.00200	0.00067	U
7440-02-0	Nickel, Total	ND	0.00200	0.00055	U
7440-09-7	Potassium, Total	ND	0.100	0.0309	U
7782-49-2	Selenium, Total	ND	0.00500	0.00173	U
7440-22-4	Silver, Total	ND	0.00040	0.00016	U
7440-23-5	Sodium, Total	0.283	0.100	0.0293	
7440-24-6	Strontium, Total	0.00065	0.00050	0.00003	
7440-28-0	Thallium, Total	ND	0.00050	0.00014	U
7440-31-5	Tin, Total	ND	0.00300	0.00112	U
7440-32-6	Titanium, Total	0.00021	0.00050	0.00007	J
7440-62-2	Vanadium, Total	ND	0.00500	0.00157	U
7440-66-6	Zinc, Total	ND	0.0100	0.00341	U



Form 1 METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : WILLIAMS (1794)
 Lab ID : WG1008707-1
 Client ID : WG1008707-1BLANK
 Sample Location :
 Sample Matrix : WATER
 Analytical Method : 1,6020A
 Lab File ID : WG1010576.pdf
 Sample Amount : 50ml
 Digestion Method : EPA 3020A

Lab Number : L1717026
 Project Number : 1794
 Date Collected : NA
 Date Received : NA
 Date Analyzed : 06/07/17 09:54
 Dilution Factor : 1
 Analyst : AM
 Instrument ID : ICPMSQ
 %Solids : N/A
 Date Digested : 06/01/17

CAS NO.	Parameter	mg/l			Qualifier
		Results	RL	MDL	
7429-90-5	Aluminum, Total	ND	0.0100	0.00327	U
7440-36-0	Antimony, Total	0.00118	0.00400	0.00042	J
7440-38-2	Arsenic, Total	ND	0.00050	0.00016	U
7440-39-3	Barium, Total	ND	0.00050	0.00017	U
7440-41-7	Beryllium, Total	ND	0.00030	0.00010	U
7440-43-9	Cadmium, Total	ND	0.00020	0.00005	U
7440-70-2	Calcium, Total	ND	0.100	0.0394	U
7440-47-3	Chromium, Total	ND	0.00050	0.00017	U
7440-48-4	Cobalt, Total	ND	0.00050	0.00016	U
7440-50-8	Copper, Total	ND	0.00100	0.00038	U
7439-89-6	Iron, Total	ND	0.0500	0.0191	U
7439-92-1	Lead, Total	ND	0.00100	0.00034	U
7439-95-4	Magnesium, Total	ND	0.0700	0.0242	U
7439-96-5	Manganese, Total	ND	0.00100	0.00044	U
7439-98-7	Molybdenum, Total	ND	0.00200	0.00067	U
7440-02-0	Nickel, Total	ND	0.00200	0.00055	U
7440-09-7	Potassium, Total	ND	0.100	0.0309	U
7782-49-2	Selenium, Total	ND	0.00500	0.00173	U
7440-22-4	Silver, Total	ND	0.00040	0.00016	U
7440-23-5	Sodium, Total	0.0419	0.200	0.0293	J
7440-24-6	Strontium, Total	ND	0.00050	0.00003	U
7440-28-0	Thallium, Total	ND	0.00050	0.00014	U
7440-31-5	Tin, Total	ND	0.00300	0.00112	U
7440-32-6	Titanium, Total	ND	0.00050	0.00007	U
7440-62-2	Vanadium, Total	ND	0.00500	0.00157	U
7440-66-6	Zinc, Total	ND	0.0100	0.00341	U



Form 1 METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : WILLIAMS (1794)
 Lab ID : WG1008707-4
 Client ID : WG1008707-4 DUP
 Sample Location :
 Sample Matrix : WATER
 Analytical Method : 1,6020A
 Lab File ID : WG1010576.pdf
 Sample Amount : 50ml
 Digestion Method : EPA 3020A

Lab Number : L1717026
 Project Number : 1794
 Date Collected : 05/15/17 09:20
 Date Received : 05/16/17
 Date Analyzed : 06/07/17 10:17
 Dilution Factor : 1
 Analyst : AM
 Instrument ID : ICPMSQ
 %Solids : N/A
 Date Digested : 06/01/17

CAS NO.	Parameter	mg/l			Qualifier
		Results	RL	MDL	
7440-43-9	Cadmium, Total	ND	0.00020	0.0001	U
7440-47-3	Chromium, Total	0.00111	0.00050	0.0002	
7440-50-8	Copper, Total	0.00426	0.00100	0.0004	
7439-89-6	Iron, Total	4.10	0.0500	0.019	
7439-92-1	Lead, Total	0.00132	0.00100	0.0003	
7440-02-0	Nickel, Total	0.00128	0.00200	0.0006	J
7440-66-6	Zinc, Total	0.00391	0.0100	0.003	J



Form 2A

Initial and Continuing Calibration Verification

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : WILLIAMS (1794)
 Instrument ID : ICPMSQ

Lab Number : L1717026
 Project Number : 1794
 Units : ug/l

Parameter	Initial Calibration			Continuing Calibration(s)							
	Lab ID	: R973606-1		R973606-5			R973606-7		R973606-10		
	Date Analyzed	: 06/07/17 08:45		06/07/17 09:05			06/07/17 09:46		06/07/17 10:27		
	True	Found	%R	True	Found	%R	Found	%R	Found	%R	
Aluminum	100.0000	110.0000	110	100.0000	99.8000	100	96.0000	96	107.0000	107	
Antimony	100.0000	108.0000	108	100.0000	105.0000	105	106.0000	106	106.0000	106	
Arsenic	100.0000	100.0000	100	100.0000	98.3000	98	96.8000	97	97.6000	98	
Barium	100.0000	104.0000	104	100.0000	98.7000	99	99.1000	99	102.0000	102	
Beryllium	100.0000	97.3000	97	100.0000	101.0000	101	101.0000	101	100.0000	100	
Cadmium	100.0000	99.6000	100	100.0000	99.5000	100	100.0000	100	99.2000	99	
Calcium	10000.0000	10900.0000	109	10000.0000	10400.0000	104	10400.0000	104	10700.0000	107	
Chromium	100.0000	100.0000	100	100.0000	102.0000	102	97.2000	97	98.1000	98	
Cobalt	100.0000	100.0000	100	100.0000	101.0000	101	97.2000	97	94.6000	95	
Copper	100.0000	99.9000	100	100.0000	101.0000	101	96.5000	96	93.8000	94	
Iron	10000.0000	10300.0000	103	10000.0000	10200.0000	102	9740.0000	97	9820.0000	98	
Lead	100.0000	101.0000	101	100.0000	101.0000	101	102.0000	102	104.0000	104	
Magnesium	10000.0000	10600.0000	106	10000.0000	10200.0000	102	10200.0000	102	10600.0000	106	
Manganese	100.0000	105.0000	105	100.0000	102.0000	102	97.4000	97	102.0000	102	
Molybdenum	100.0000	101.0000	101	100.0000	103.0000	103	102.0000	102	103.0000	103	
Nickel	100.0000	99.2000	99	100.0000	100.0000	100	94.8000	95	94.2000	94	
Potassium	10000.0000	10800.0000	108	10000.0000	9820.0000	98	10200.0000	102	10600.0000	106	
Selenium	100.0000	102.0000	102	100.0000	100.0000	100	96.3000	96	108.0000	108	
Silver	100.0000	97.3000	97	100.0000	98.1000	98	98.0000	98	98.1000	98	
Sodium	10000.0000	10500.0000	105	10000.0000	10100.0000	101	10100.0000	101	10600.0000	106	
Strontium	100.0000	108.0000	108	100.0000	100.0000	100	103.0000	103	106.0000	106	
Thallium	100.0000	99.2000	99	100.0000	98.8000	99	99.3000	99	100.0000	100	
Titanium	100.0000	103.0000	103	100.0000	99.3000	99	101.0000	101	103.0000	103	
Tin	100.0000	100.0000	100	100.0000	101.0000	101	99.4000	99	100.0000	100	
Vanadium	100.0000	100.0000	100	100.0000	99.9000	100	97.1000	97	96.3000	96	
Zinc	100.0000	98.7000	99	100.0000	99.7000	100	97.0000	97	97.3000	97	

Acceptance Criteria:

ICV: 95-105% (Methods 200.7, 245.1)
 90-110% (Methods 200.8, 6010, 6020, 7470, 7471, 7474)
 85-115% (Method 1631)

CCV: 90-110% (Methods 200.7, 245.1, 6010, 6020, 7474)
 85-115% (Methods 200.8, 1631)
 80-120% (Methods 7470, 7471)



Form 2A

Initial and Continuing Calibration Verification

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : WILLIAMS (1794)
 Instrument ID : ICPMSQ

Lab Number : L1717026
 Project Number : 1794
 Units : ug/l

Parameter	Lab ID : Date Analyzed :	Initial Calibration			Continuing Calibration(s)						
		True	Found	%R	R973606-12 06/07/17 11:09			R973606-14 06/07/17 11:53		R973606-16 06/07/17 12:47	
					True	Found	%R	Found	%R	Found	%R
Aluminum					100.0000	103.0000	103	109.0000	109	102.0000	102
Antimony					100.0000	107.0000	107	104.0000	104	109.0000	109
Arsenic					100.0000	101.0000	101	99.2000	99	100.0000	100
Barium					100.0000	102.0000	102	103.0000	103	100.0000	100
Beryllium					100.0000	99.2000	99	101.0000	101	103.0000	103
Cadmium					100.0000	105.0000	105	99.1000	99	102.0000	102
Calcium					10000.0000	10400.0000	104	10700.0000	107	10300.0000	103
Chromium					100.0000	102.0000	102	96.6000	97	101.0000	101
Cobalt					100.0000	102.0000	102	95.9000	96	101.0000	101
Copper					100.0000	102.0000	102	95.7000	96	101.0000	101
Iron					10000.0000	10300.0000	103	9860.0000	99	10100.0000	101
Lead					100.0000	107.0000	107	106.0000	106	105.0000	105
Magnesium					10000.0000	10200.0000	102	10700.0000	107	10400.0000	104
Manganese					100.0000	108.0000	108	104.0000	104	99.6000	100
Molybdenum					100.0000	107.0000	107	104.0000	104	104.0000	104
Nickel					100.0000	100.0000	100	94.5000	94	99.2000	99
Potassium					10000.0000	10200.0000	102	10900.0000	109	10400.0000	104
Selenium					100.0000	105.0000	105	104.0000	104	102.0000	102
Silver					100.0000	102.0000	102	98.5000	98	101.0000	101
Sodium					10000.0000	10200.0000	102	10900.0000	109	10400.0000	104
Strontium					100.0000	106.0000	106	108.0000	108	103.0000	103
Thallium					100.0000	103.0000	103	103.0000	103	103.0000	103
Titanium					100.0000	104.0000	104	103.0000	103	104.0000	104
Tin					100.0000	102.0000	102	99.5000	100	102.0000	102
Vanadium					100.0000	102.0000	102	94.6000	95	96.4000	96
Zinc					100.0000	102.0000	102	96.3000	96	99.6000	100

Acceptance Criteria:

ICV: 95-105% (Methods 200.7, 245.1)
 90-110% (Methods 200.8, 6010, 6020, 7470, 7471, 7474)
 85-115% (Method 1631)

CCV: 90-110% (Methods 200.7, 245.1, 6010, 6020, 7474)
 85-115% (Methods 200.8, 1631)
 80-120% (Methods 7470, 7471)



Form 3 Blanks

Client : Alpine Ocean Seismic Survey Inc.
Project Name : WILLIAMS (1794)
Instrument ID : ICPMSQ

Lab Number : L1717026
Project Number : 1794

Parameter	Initial Calibration Blank		Continuing Calibration Blank(s)						Preparation Blank	
	ug/l	Q	ug/l	Q	ug/l	Q	ug/l	Q	mg/l	Q
Aluminum	3.27	U	3.27	U	3.27	U	3.27	U	0.00327	U
Antimony	3.26	J	2.49	J	2.90	J	2.73	J	0.00118	J
Arsenic	0.165	U	0.165	U	0.165	U	0.165	U	0.00016	U
Barium	0.173	U	0.173	U	0.173	U	0.173	U	0.00017	U
Beryllium	0.107	U	0.107	U	0.107	U	0.107	U	0.00010	U
Cadmium	0.0599	U	0.0599	U	0.0599	U	0.0599	U	0.00005	U
Calcium	39.4	U	39.4	U	39.4	U	39.4	U	0.0394	U
Chromium	0.178	U	0.178	U	0.178	U	0.178	U	0.00017	U
Cobalt	0.163	U	0.163	U	0.163	U	0.163	U	0.00016	U
Copper	0.384	U	0.384	U	0.384	U	0.384	U	0.00038	U
Iron	19.1	U	19.1	U	19.1	U	19.1	U	0.0191	U
Lead	0.343	U	0.343	U	0.343	U	0.343	U	0.00034	U
Magnesium	24.2	U	24.2	U	24.2	U	24.2	U	0.0242	U
Manganese	0.440	U	0.440	U	0.440	U	0.440	U	0.00044	U
Molybdenum	0.670	U	0.670	U	0.670	U	0.670	U	0.00067	U
Nickel	0.556	U	0.556	U	0.556	U	0.556	U	0.00055	U
Potassium	30.9	U	30.9	U	30.9	U	30.9	U	0.0309	U
Selenium	1.73	U	1.73	U	1.73	U	1.73	U	0.00173	U
Silver	0.163	U	0.163	U	0.163	U	0.242	J	0.00016	U
Sodium	29.3	U	29.3	U	29.3	U	29.3	U	0.0419	J
Strontium	0.0390	U	0.0390	U	0.0390	U	0.0390	U	0.00003	U
Thallium	0.143	U	0.143	U	0.143	U	0.143	U	0.00014	U
Tin	1.12	U	1.12	U	1.12	U	1.12	U	0.00112	U
Titanium	0.0750	U	0.0750	U	0.0750	U	0.0750	U	0.00007	U
Vanadium	1.57	U	1.57	U	1.57	U	1.57	U	0.00157	U
Zinc	3.41	U	3.41	U	3.41	U	3.41	U	0.00341	U



Form 3 Blanks

Client : Alpine Ocean Seismic Survey Inc.
Project Name : WILLIAMS (1794)
Instrument ID : ICPMSQ

Lab Number : L1717026
Project Number : 1794

Parameter	Initial Calibration Blank		Continuing Calibration Blank(s)						Preparation Blank
	ug/l	Q	ug/l	Q	ug/l	Q	ug/l	Q	Q
Aluminum			3.27	U	3.27	U	3.27	U	
Antimony			2.43	J	0.429	U	2.47	J	
Arsenic			0.165	U	0.165	U	0.165	U	
Barium			0.173	U	0.173	U	0.173	U	
Beryllium			0.107	U	0.107	U	0.107	U	
Cadmium			0.0599	U	0.0599	U	0.0599	U	
Calcium			39.4	U	39.4	U	39.4	U	
Chromium			0.178	U	0.178	U	0.178	U	
Cobalt			0.163	U	0.163	U	0.163	U	
Copper			0.384	U	0.384	U	0.384	U	
Iron			19.1	U	19.1	U	19.1	U	
Lead			0.343	U	0.343	U	0.343	U	
Magnesium			24.2	U	24.2	U	24.2	U	
Manganese			0.440	U	0.440	U	0.440	U	
Molybdenum			0.744	J	0.670	U	0.670	U	
Nickel			0.556	U	0.556	U	0.556	U	
Potassium			30.9	U	30.9	U	30.9	U	
Selenium			1.73	U	1.73	U	1.73	U	
Silver			0.163	U	0.163	U	0.163	U	
Sodium			76.4	J	90.8	J	72.1	J	
Strontium			0.0390	U	0.0390	U	0.0390	U	
Thallium			0.143	U	0.143	U	0.143	U	
Tin			1.12	U	1.12	U	1.12	U	
Titanium			0.197	J	0.0750	U	0.0750	U	
Vanadium			1.57	U	1.57	U	1.57	U	
Zinc			3.41	U	3.41	U	3.41	U	



Form 4a Interference Check Sample

Client : Alpine Ocean Seismic Survey Inc.
Project Name : WILLIAMS (1794)
Instrument ID : ICPMSQ

Lab Number : L1717026
Project Number : 1794
Concentration Units : ug/l

Analyte	True		Initial Found				Final Found			
	Lab ID : Analysis Date :		R973606-3 06/07/17 08:55				R973606-4 06/07/17 08:58			
	Sol. A	Sol. AB	Sol. A	%R	Sol. AB	%R	Sol. A	%R	Sol. AB	%R
Aluminum	20000	20000	21400	107	20300	102				
Antimony			1.18							
Arsenic		20	0.137		20.2	101				
Barium			1.42							
Beryllium			0.0107							
Cadmium		20	0.200		20.8	104				
Calcium	60000	60000	62400	104	62600	104				
Chromium		40	0.643		41.6	104				
Cobalt		40	0.592		39.6	99				
Copper		40	0.911		38.9	97				
Iron	50000	50000	51200	102	50800	102				
Lead			0.132							
Magnesium	20000	20000	21500	108	20600	103				
Manganese		40	1.06		41.3	103				
Molybdenum	400	400	410.	102	408.	102				
Nickel		40	1.25		39.6	99				
Potassium	20000	20000	20700	104	20600	103				
Selenium		20	0.390		21.1	106				
Silver		10	0.0896		9.67	97				
Sodium	50000	50000	51800	104	49600	99				
Strontium		40	0.899		42.0	105				
Thallium			0.0188							
Titanium	400	400	443.	111	448.	112				
Tin			1.02							
Vanadium		40	0.141		41.4	104				
Zinc		20	7.68		22.0	110				

Acceptance Criteria: Methods 200.7, 200.8, 6010, 6020

ICSA: 80-120%

ICSAB: 80-120%



Form 5a Matrix Spike

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : WILLIAMS (1794)
 Client Sample ID : NA
 Lab Sample ID : L1715898-01
 Matrix Spike : WG1008707-3
 Matrix Spike Dup :

Lab Number : L1717026
 Project Number : 1794
 Matrix : WATER
 MS Analysis Date : 06/07/17 10:11
 MSD Analysis Date :

Parameter	Sample Conc. (mg/l)	Matrix Spike Sample		%R	Matrix Spike Duplicate		%R	RPD	Recovery Limits	RPD Limit
		Spike Added (mg/l)	Spike Conc. (mg/l)		Spike Added (mg/l)	Spike Conc. (mg/l)				
Aluminum, Total	0.210	2	2.45	112					75-125	20
Antimony, Total	0.0015J	0.5	0.6422	128 Q					75-125	20
Arsenic, Total	0.0005J	0.12	0.1200	100					75-125	20
Barium, Total	0.0356	2	2.084	102					75-125	20
Beryllium, Total	ND	0.05	0.05280	106					75-125	20
Cadmium, Total	ND	0.051	0.05642	111					75-125	20
Calcium, Total	41.2	10	52.7	115					75-125	20
Chromium, Total	0.00110	0.2	0.200	99					75-125	20
Cobalt, Total	0.0005J	0.5	0.4851	97					75-125	20
Copper, Total	0.00484	0.25	0.255	100					75-125	20
Iron, Total	4.17	1	4.80	63 Q					75-125	20
Lead, Total	0.00133	0.51	0.558	109					75-125	20
Magnesium, Total	15.8	10	26.6	108					75-125	20
Manganese, Total	0.0675	0.5	0.5687	100					75-125	20
Molybdenum, Total	0.0007J	1	0.9979	100					75-125	20
Nickel, Total	0.00132J	0.5	0.4817	96					75-125	20
Potassium, Total	6.23	10	16.3	101					75-125	20
Selenium, Total	ND	0.12	0.128	107					75-125	20
Silver, Total	ND	0.05	0.05080	102					75-125	20
Sodium, Total	349.	10	380.	310 Q					75-125	20
Strontium, Total	0.2736	1	1.339	106					75-125	20
Thallium, Total	ND	0.12	0.1213	101					75-125	20
Tin, Total	ND	1	0.9973	100					75-125	20
Titanium, Total	0.0615	1	0.9667	90					75-125	20



Form 5a Matrix Spike

Client : Alpine Ocean Seismic Survey Inc.	Lab Number : L1717026
Project Name : WILLIAMS (1794)	Project Number : 1794
Client Sample ID : NA	Matrix : WATER
Lab Sample ID : L1715898-01	
Matrix Spike : L1715898-01	MS Analysis Date : 06/07/17 10:11
Matrix Spike Dup :	MSD Analysis Date :

Parameter	Sample Conc. (mg/l)	Matrix Spike Sample		%R	Matrix Spike Duplicate		%R	RPD	Recovery Limits	RPD Limit
		Spike Added (mg/l)	Spike Conc. (mg/l)		Spike Added (mg/l)	Spike Conc. (mg/l)				
Vanadium, Total	ND	0.5	0.484	97					75-125	20
Zinc, Total	0.00416J	0.5	0.514	103					75-125	20

Form 6 Lab Duplicates

Client	: Alpine Ocean Seismic Survey Inc.	Lab Number	: L1717026
Project Name	: WILLIAMS (1794)	Project Number	: 1794
Client Sample ID	: NA	Matrix	: WATER
Lab Sample ID	: NA	Analysis Date	: 06/07/17 10:21
Dup Sample ID	: WG1008707-4	DUP Analysis Date	: 06/07/17 10:17

Parameter	Sample Concentration (mg/l)	Duplicate Concentration (mg/l)	RPD	RPD Limit
Cadmium, Total	ND	ND	NC	20
Chromium, Total	0.00110	0.00111	1	20
Copper, Total	0.00484	0.00426	13	20
Iron, Total	4.17	4.10	2	20
Lead, Total	0.00133	0.00132	1	20
Nickel, Total	0.00132J	0.00128J	NC	20
Zinc, Total	0.00416J	0.00391J	NC	20

Form 7

Laboratory Control Sample

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : WILLIAMS (1794)
 Client Sample ID : NA
 Lab Sample ID : WG1008707-2
 Dup Sample ID :

Lab Number : L1717026
 Project Number : 1794
 Matrix : WATER
 LCS Analysis Date : 06/07/17 10:07
 LCSD Analysis Date :

Parameter	Laboratory Control Sample			Laboratory Control Duplicate			RPD	Recovery Limits	RPD Limit
	True (mg/l)	Found (mg/l)	%R	True (mg/l)	Found (mg/l)	%R			
Aluminum, Total	2.00	2.34	117.					80-120	20
Antimony, Total	0.500	0.535	107.					80-120	20
Arsenic, Total	0.120	0.127	106.					80-120	20
Barium, Total	2.00	2.10	105.					80-120	20
Beryllium, Total	0.0500	0.0518	104.					80-120	20
Cadmium, Total	0.0510	0.0531	104.					80-120	20
Calcium, Total	10.0	10.9	109.					80-120	20
Chromium, Total	0.200	0.203	102.					80-120	20
Cobalt, Total	0.500	0.486	97.					80-120	20
Copper, Total	0.250	0.245	98.					80-120	20
Iron, Total	1.00	1.08	108.					80-120	20
Lead, Total	0.510	0.558	109.					80-120	20
Magnesium, Total	10.0	11.1	111.					80-120	20
Manganese, Total	0.500	0.527	105.					80-120	20
Molybdenum, Total	1.00	1.00	100.					80-120	20
Nickel, Total	0.500	0.487	97.					80-120	20
Potassium, Total	10.0	11.4	114.					80-120	20
Selenium, Total	0.120	0.134	112.					80-120	20
Silver, Total	0.0500	0.0505	101.					80-120	20
Sodium, Total	10.0	12.0	120.					80-120	20
Strontium, Total	1.00	1.08	108.					80-120	20
Thallium, Total	0.120	0.124	103.					80-120	20
Tin, Total	1.00	0.988	99.					80-120	20
Titanium, Total	1.00	0.929	93.					80-120	20
Vanadium, Total	0.500	0.508	102.					80-120	20
Zinc, Total	0.500	0.498	100.					80-120	20



Form 12

Preparation Log

Client : Alpine Ocean Seismic Survey Inc. Lab Number : L1717026
Project Name : WILLIAMS (1794) Project Number : 1794
Matrix : WATER Prep Method : EPA 3020A

Sample Number	Preparation Date	Weight (gram)	Volume (mL)
L1717026-28	06/01/17 06:15	-	50
L1717026-29	06/01/17 06:15	-	50
WG1008707-1	06/01/17 06:15	-	50
WG1008707-2	06/01/17 06:15	-	50
WG1008707-3	06/01/17 06:15	-	50
WG1008707-4	06/01/17 06:15	-	50



Form 13 Analysis Run Log

Client : Alpine Ocean Seismic Survey Inc.
Project Name : WILLIAMS (1794)
Instrument ID : ICPMSQ
Start Date : 06/07/17 07:42

Lab Number : L1717026
Project Number : 1794
Analysis Method : 1,6020A
End Date : 06/07/17 12:50

Sample Number	Dilution Factor	Analysis Time	Aluminum, Total	Antimony, Total	Arsenic, Total	Barium, Total	Beryllium, Total	Cadmium, Total	Calcium, Total	Chromium, Total	Cobalt, Total	Copper, Total	Iron, Total	Lead, Total	Magnesium, Total	Manganese, Total	Molybdenum, Total	Nickel, Total	Potassium, Total	Selenium, Total	Silver, Total	Sodium, Total	Strontium, Total	Thallium, Total	Tin, Total	Titanium, Total	Vanadium, Total	Zinc, Total
R973606-9 TUNE		07:42:00																										
R973606-1 ICV	1	08:45:15	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
R973606-2 ICB	1	08:48:40	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
R973606-3 ICSA	1	08:55:31	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
R973606-4 ICSAB	1	08:58:57	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
R973606-5 CCV	1	09:05:43	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
R973606-6 CCB	1	09:09:08	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
R973606-7 CCV	1	09:46:05	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
R973606-8 CCB	1	09:49:30	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
WG1008707-1 BLANK	1	09:54:10	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
WG1008707-2 LCS	5	10:07:39	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
WG1008707-3 MS	10	10:11:02	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
WG1008707-4 DUP	1	10:17:44	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
L1717026-28	1	10:24:25	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
R973606-10 CCV	1	10:27:46	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
R973606-11 CCB	1	10:31:11	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
R973606-12 CCV	1	11:09:36	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
R973606-13 CCB	1	11:13:01	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
R973606-14 CCV	1	11:53:47	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
R973606-15 CCB	1	12:08:24	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
L1717026-29	1	12:43:40	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
R973606-16 CCV	1	12:47:01	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
R973606-17 CCB	1	12:50:27	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Form 14

ICP-MS Tune

Client : Alpine Ocean Seismic Survey Inc.
Project Name : WILLIAMS (1794)
Lab Sample ID : R973606-9
ICP-MS Instrument : iCAP Q

Lab Number : L1717026
Project Number : 1794
Analysis Date : 06/07/17 07:42

Mass Element	Avg Measured Mass (amu)	Avg. Peak Width at 10% Peak Height (amu)	%RSD
59 Co	58.9451	0.652	2.1
115 In	114.9079	0.654	1
7 Li	7.0038	0.706	1
238 U	238.0193	0.69	1.6



Form 15

ICP-MS Internal Standards Relative Intensity Summary

Client	: Alpine Ocean Seismic Survey Inc.	Lab Number	: L1717026
Project Name	: WILLIAMS (1794)	Project Number	: 1794
Instrument ID	: ICPMSQ	Analysis Method	: 1,6020A
Start Date	: 06/07/17	End Date	: 06/07/17

Sample #	Time	Internal Standards %RI For:				
		Lithium	Scandium	Ge	In	Bismuth
R973606-1 ICV	08:45:15	100	97	94	96	101
R973606-2 ICB	08:48:40	104	105	101	100	96
R973606-3 ICSA	08:55:31	87	88	86	85	95
R973606-4 ICSAB	08:58:57	84	83	83	82	92
R973606-5 CCV	09:05:43	92	84	83	82	94
R973606-6 CCB	09:09:08	96	89	85	85	89
R973606-7 CCV	09:46:05	97	98	94	92	100
R973606-8 CCB	09:49:30	96	92	91	89	89
WG1008707-1 BLANK	09:54:10	95	92	89	89	102
WG1008707-2 LCS	10:07:39	92	93	90	89	92
WG1008707-3 MS	10:11:02	91	91	87	83	90
WG1008707-4 DUP	10:17:44	87	83	83	80	96
L1717026-28	10:24:25	97	100	93	95	103
R973606-10 CCV	10:27:46	98	104	98	97	98
R973606-11 CCB	10:31:11	94	100	94	93	94
R973606-12 CCV	11:09:36	82	81	76	77	88
R973606-13 CCB	11:13:01	84	80	77	76	83
R973606-14 CCV	11:53:47	103	113	104	103	101
R973606-15 CCB	12:08:24	103	98	95	92	91
L1717026-29	12:43:40	90	85	82	83	94
R973606-16 CCV	12:47:01	88	83	79	79	90
R973606-17 CCB	12:50:27	91	81	83	83	86

Form 1 METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : WILLIAMS (1794)
 Lab ID : L1717026-01
 Client ID : VC88-D0-3E
 Sample Location : RARITAN BAY
 Sample Matrix : Sediment
 Analytical Method : 1,6020A
 Lab File ID : WG1011426.pdf
 Sample Amount : 1.262g
 Digestion Method : EPA 3050B

Lab Number : L1717026
 Project Number : 1794
 Date Collected : 05/19/17 17:07
 Date Received : 05/24/17
 Date Analyzed : 06/09/17 13:45
 Dilution Factor : 10
 Analyst : BV
 Instrument ID : ICPMSQ2
 %Solids : 78
 Date Digested : 05/26/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7429-90-5	Aluminum, Total	1150	127	18.7	
7440-36-0	Antimony, Total	ND	2.03	0.171	U
7440-38-2	Arsenic, Total	1.74	0.633	0.084	
7440-39-3	Barium, Total	2.12	3.80	0.268	J
7440-41-7	Beryllium, Total	0.112	0.380	0.110	J
7440-43-9	Cadmium, Total	ND	0.253	0.033	U
7440-70-2	Calcium, Total	4190	633	77.0	
7440-47-3	Chromium, Total	4.63	2.53	0.593	
7440-48-4	Cobalt, Total	0.785	0.633	0.067	
7440-50-8	Copper, Total	1.26	2.53	0.246	J
7439-89-6	Iron, Total	6530	253	26.1	
7439-92-1	Lead, Total	1.76	0.760	0.185	
7439-95-4	Magnesium, Total	882	127	15.6	
7439-96-5	Manganese, Total	25.4	2.53	0.562	
7439-98-7	Molybdenum, Total	0.900	1.01	0.137	J
7440-02-0	Nickel, Total	1.74	1.27	0.338	
7440-09-7	Potassium, Total	295	127	20.1	
7782-49-2	Selenium, Total	ND	2.53	0.958	U
7440-22-4	Silver, Total	ND	0.633	0.062	U
7440-23-5	Sodium, Total	2190	190	14.8	
7440-24-6	Strontium, Total	22.5	1.27	0.310	
7440-28-0	Thallium, Total	ND	0.253	0.065	U
7440-31-5	Tin, Total	ND	1.52	0.157	U
7440-32-6	Titanium, Total	60.9	0.633	0.109	
7440-62-2	Vanadium, Total	9.49	1.27	0.480	
7440-66-6	Zinc, Total	5.74	12.7	3.29	J



Form 1 METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : WILLIAMS (1794)
 Lab ID : L1717026-02
 Client ID : VC88-D3-6E
 Sample Location : RARITAN BAY
 Sample Matrix : Sediment
 Analytical Method : 1,6020A
 Lab File ID : WG1011426.pdf
 Sample Amount : 1.291g
 Digestion Method : EPA 3050B

Lab Number : L1717026
 Project Number : 1794
 Date Collected : 05/19/17 17:07
 Date Received : 05/24/17
 Date Analyzed : 06/09/17 13:48
 Dilution Factor : 10
 Analyst : BV
 Instrument ID : ICPMSQ2
 %Solids : 69
 Date Digested : 05/26/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7429-90-5	Aluminum, Total	3650	140	20.6	
7440-36-0	Antimony, Total	ND	2.23	0.189	U
7440-38-2	Arsenic, Total	3.84	0.698	0.092	
7440-39-3	Barium, Total	7.14	4.18	0.295	
7440-41-7	Beryllium, Total	0.260	0.418	0.122	J
7440-43-9	Cadmium, Total	0.055	0.279	0.037	J
7440-70-2	Calcium, Total	1660	698	84.8	
7440-47-3	Chromium, Total	10.5	2.79	0.653	
7440-48-4	Cobalt, Total	2.32	0.698	0.074	
7440-50-8	Copper, Total	3.43	2.79	0.271	
7439-89-6	Iron, Total	10600	279	28.7	
7439-92-1	Lead, Total	4.12	0.837	0.204	
7439-95-4	Magnesium, Total	1970	140	17.2	
7439-96-5	Manganese, Total	74.3	2.79	0.619	
7439-98-7	Molybdenum, Total	1.66	1.12	0.151	
7440-02-0	Nickel, Total	5.65	1.40	0.373	
7440-09-7	Potassium, Total	848	140	22.2	
7782-49-2	Selenium, Total	3.08	2.79	1.05	
7440-22-4	Silver, Total	ND	0.698	0.068	U
7440-23-5	Sodium, Total	2950	209	16.4	
7440-24-6	Strontium, Total	12.3	1.40	0.342	
7440-28-0	Thallium, Total	ND	0.279	0.072	U
7440-31-5	Tin, Total	ND	1.67	0.173	U
7440-32-6	Titanium, Total	118	0.698	0.120	
7440-62-2	Vanadium, Total	15.0	1.40	0.529	
7440-66-6	Zinc, Total	17.6	14.0	3.63	



Form 1 METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : WILLIAMS (1794)
 Lab ID : L1717026-03
 Client ID : VC88-D6-9E
 Sample Location : RARITAN BAY
 Sample Matrix : Sediment
 Analytical Method : 1,6020A
 Lab File ID : WG1011426.pdf
 Sample Amount : 1.263g
 Digestion Method : EPA 3050B

Lab Number : L1717026
 Project Number : 1794
 Date Collected : 05/19/17 17:07
 Date Received : 05/24/17
 Date Analyzed : 06/09/17 13:51
 Dilution Factor : 10
 Analyst : BV
 Instrument ID : ICPMSQ2
 %Solids : 54
 Date Digested : 05/26/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7429-90-5	Aluminum, Total	16100	183	27.0	
7440-36-0	Antimony, Total	ND	2.92	0.247	U
7440-38-2	Arsenic, Total	13.1	0.913	0.120	
7440-39-3	Barium, Total	26.4	5.48	0.386	
7440-41-7	Beryllium, Total	1.05	0.548	0.159	
7440-43-9	Cadmium, Total	0.121	0.365	0.048	J
7440-70-2	Calcium, Total	2480	913	111.	
7440-47-3	Chromium, Total	34.3	3.65	0.854	
7440-48-4	Cobalt, Total	9.72	0.913	0.097	
7440-50-8	Copper, Total	13.5	3.65	0.354	
7439-89-6	Iron, Total	37400	365	37.6	
7439-92-1	Lead, Total	13.2	1.10	0.267	
7439-95-4	Magnesium, Total	8160	183	22.5	
7439-96-5	Manganese, Total	269	3.65	0.811	
7439-98-7	Molybdenum, Total	2.55	1.46	0.197	
7440-02-0	Nickel, Total	24.4	1.83	0.488	
7440-09-7	Potassium, Total	3520	183	29.0	
7782-49-2	Selenium, Total	10.4	3.65	1.38	
7440-22-4	Silver, Total	ND	0.913	0.089	U
7440-23-5	Sodium, Total	7400	274	21.4	
7440-24-6	Strontium, Total	26.4	1.83	0.448	
7440-28-0	Thallium, Total	0.155	0.365	0.094	J
7440-31-5	Tin, Total	0.495	2.19	0.226	J
7440-32-6	Titanium, Total	278	0.913	0.158	
7440-62-2	Vanadium, Total	40.4	1.83	0.692	
7440-66-6	Zinc, Total	74.7	18.3	4.75	



Form 1 METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : WILLIAMS (1794)
 Lab ID : L1717026-04
 Client ID : VC88-D9-10E
 Sample Location : RARITAN BAY
 Sample Matrix : Sediment
 Analytical Method : 1,6020A
 Lab File ID : WG1011426.pdf
 Sample Amount : 1.297g
 Digestion Method : EPA 3050B

Lab Number : L1717026
 Project Number : 1794
 Date Collected : 05/19/17 17:07
 Date Received : 05/24/17
 Date Analyzed : 06/09/17 14:00
 Dilution Factor : 10
 Analyst : BV
 Instrument ID : ICPMSQ2
 %Solids : 54
 Date Digested : 05/26/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7429-90-5	Aluminum, Total	16600	179	26.5	
7440-36-0	Antimony, Total	0.322	2.86	0.242	J
7440-38-2	Arsenic, Total	14.5	0.894	0.118	
7440-39-3	Barium, Total	27.6	5.36	0.378	
7440-41-7	Beryllium, Total	1.05	0.536	0.156	
7440-43-9	Cadmium, Total	0.088	0.358	0.047	J
7440-70-2	Calcium, Total	3000	894	109.	
7440-47-3	Chromium, Total	36.1	3.58	0.837	
7440-48-4	Cobalt, Total	10.2	0.894	0.095	
7440-50-8	Copper, Total	14.3	3.58	0.347	
7439-89-6	Iron, Total	39100	358	36.8	
7439-92-1	Lead, Total	13.6	1.07	0.261	
7439-95-4	Magnesium, Total	8390	179	22.0	
7439-96-5	Manganese, Total	308	3.58	0.794	
7439-98-7	Molybdenum, Total	1.88	1.43	0.193	
7440-02-0	Nickel, Total	25.3	1.79	0.478	
7440-09-7	Potassium, Total	3710	179	28.4	
7782-49-2	Selenium, Total	12.3	3.58	1.35	
7440-22-4	Silver, Total	ND	0.894	0.087	U
7440-23-5	Sodium, Total	7530	268	21.0	
7440-24-6	Strontium, Total	29.7	1.79	0.438	
7440-28-0	Thallium, Total	0.157	0.358	0.092	J
7440-31-5	Tin, Total	0.568	2.14	0.222	J
7440-32-6	Titanium, Total	303	0.894	0.154	
7440-62-2	Vanadium, Total	39.9	1.79	0.678	
7440-66-6	Zinc, Total	76.4	17.9	4.65	



Form 1 METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : WILLIAMS (1794)
 Lab ID : L1717026-05
 Client ID : VC89-D0-3E
 Sample Location : RARITAN BAY
 Sample Matrix : Sediment
 Analytical Method : 1,6020A
 Lab File ID : WG1011426.pdf
 Sample Amount : 1.281g
 Digestion Method : EPA 3050B

Lab Number : L1717026
 Project Number : 1794
 Date Collected : 05/19/17 16:15
 Date Received : 05/24/17
 Date Analyzed : 06/09/17 13:29
 Dilution Factor : 10
 Analyst : BV
 Instrument ID : ICPMSQ2
 %Solids : 78
 Date Digested : 05/26/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7429-90-5	Aluminum, Total	1590	124	18.4	
7440-36-0	Antimony, Total	ND	1.99	0.168	U
7440-38-2	Arsenic, Total	4.62	0.622	0.082	
7440-39-3	Barium, Total	2.40	3.73	0.263	J
7440-41-7	Beryllium, Total	0.187	0.373	0.108	J
7440-43-9	Cadmium, Total	ND	0.249	0.033	U
7440-70-2	Calcium, Total	747	622	75.7	
7440-47-3	Chromium, Total	7.80	2.49	0.582	
7440-48-4	Cobalt, Total	1.82	0.622	0.066	
7440-50-8	Copper, Total	3.00	2.49	0.241	
7439-89-6	Iron, Total	13000	249	25.6	
7439-92-1	Lead, Total	2.57	0.747	0.182	
7439-95-4	Magnesium, Total	880	124	15.3	
7439-96-5	Manganese, Total	24.9	2.49	0.553	
7439-98-7	Molybdenum, Total	1.06	0.996	0.134	
7440-02-0	Nickel, Total	2.24	1.24	0.332	
7440-09-7	Potassium, Total	350	124	19.8	
7782-49-2	Selenium, Total	1.86	2.49	0.941	J
7440-22-4	Silver, Total	ND	0.622	0.061	U
7440-23-5	Sodium, Total	2180	187	14.6	
7440-24-6	Strontium, Total	5.97	1.24	0.305	
7440-28-0	Thallium, Total	0.188	0.249	0.064	J
7440-31-5	Tin, Total	ND	1.49	0.154	U
7440-32-6	Titanium, Total	65.5	0.622	0.108	
7440-62-2	Vanadium, Total	20.3	1.24	0.472	
7440-66-6	Zinc, Total	9.74	12.4	3.24	J



Form 1 METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : WILLIAMS (1794)
 Lab ID : L1717026-06
 Client ID : VC89-D3-6E
 Sample Location : RARITAN BAY
 Sample Matrix : Sediment
 Analytical Method : 1,6020A
 Lab File ID : WG1011426.pdf
 Sample Amount : 1.25g
 Digestion Method : EPA 3050B

Lab Number : L1717026
 Project Number : 1794
 Date Collected : 05/19/17 16:15
 Date Received : 05/24/17
 Date Analyzed : 06/09/17 14:03
 Dilution Factor : 10
 Analyst : BV
 Instrument ID : ICPMSQ2
 %Solids : 64
 Date Digested : 05/26/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7429-90-5	Aluminum, Total	7700	156	23.0	
7440-36-0	Antimony, Total	ND	2.49	0.210	U
7440-38-2	Arsenic, Total	6.63	0.779	0.103	
7440-39-3	Barium, Total	17.7	4.67	0.329	
7440-41-7	Beryllium, Total	0.575	0.467	0.136	
7440-43-9	Cadmium, Total	0.085	0.312	0.041	J
7440-70-2	Calcium, Total	1330	779	94.7	
7440-47-3	Chromium, Total	18.2	3.12	0.729	
7440-48-4	Cobalt, Total	5.30	0.779	0.083	
7440-50-8	Copper, Total	9.07	3.12	0.302	
7439-89-6	Iron, Total	21600	312	32.1	
7439-92-1	Lead, Total	9.83	0.934	0.227	
7439-95-4	Magnesium, Total	3980	156	19.2	
7439-96-5	Manganese, Total	139	3.12	0.692	
7439-98-7	Molybdenum, Total	1.34	1.25	0.168	
7440-02-0	Nickel, Total	12.4	1.56	0.416	
7440-09-7	Potassium, Total	1730	156	24.7	
7782-49-2	Selenium, Total	9.02	3.12	1.18	
7440-22-4	Silver, Total	ND	0.779	0.076	U
7440-23-5	Sodium, Total	3880	234	18.2	
7440-24-6	Strontium, Total	16.1	1.56	0.382	
7440-28-0	Thallium, Total	0.082	0.312	0.080	J
7440-31-5	Tin, Total	0.493	1.87	0.193	J
7440-32-6	Titanium, Total	160	0.779	0.134	
7440-62-2	Vanadium, Total	27.4	1.56	0.591	
7440-66-6	Zinc, Total	39.9	15.6	4.05	



Form 1 METALS

Client : Alpine Ocean Seismic Survey Inc.
Project Name : WILLIAMS (1794)
Lab ID : L1717026-07
Client ID : VC89-D6-9E
Sample Location : RARITAN BAY
Sample Matrix : Sediment
Analytical Method : 1,6020A
Lab File ID : WG1011426.pdf
Sample Amount : 1.303g
Digestion Method : EPA 3050B

Lab Number : L1717026
Project Number : 1794
Date Collected : 05/19/17 16:15
Date Received : 05/24/17
Date Analyzed : 06/09/17 14:06
Dilution Factor : 10
Analyst : BV
Instrument ID : ICPMSQ2
%Solids : 57
Date Digested : 05/26/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7429-90-5	Aluminum, Total	15900	169	25.0	
7440-36-0	Antimony, Total	ND	2.71	0.229	U
7440-38-2	Arsenic, Total	14.8	0.846	0.112	
7440-39-3	Barium, Total	28.1	5.08	0.357	
7440-41-7	Beryllium, Total	0.997	0.508	0.148	
7440-43-9	Cadmium, Total	0.101	0.338	0.045	J
7440-70-2	Calcium, Total	4000	846	103.	
7440-47-3	Chromium, Total	34.7	3.38	0.792	
7440-48-4	Cobalt, Total	9.73	0.846	0.090	
7440-50-8	Copper, Total	14.2	3.38	0.328	
7439-89-6	Iron, Total	41500	338	34.8	
7439-92-1	Lead, Total	13.4	1.02	0.247	
7439-95-4	Magnesium, Total	7830	169	20.8	
7439-96-5	Manganese, Total	276	3.38	0.751	
7439-98-7	Molybdenum, Total	1.46	1.35	0.183	
7440-02-0	Nickel, Total	24.6	1.69	0.452	
7440-09-7	Potassium, Total	3410	169	26.9	
7782-49-2	Selenium, Total	11.8	3.38	1.28	
7440-22-4	Silver, Total	ND	0.846	0.083	U
7440-23-5	Sodium, Total	5460	254	19.8	
7440-24-6	Strontium, Total	32.2	1.69	0.415	
7440-28-0	Thallium, Total	0.141	0.338	0.087	J
7440-31-5	Tin, Total	0.548	2.03	0.210	J
7440-32-6	Titanium, Total	290	0.846	0.146	
7440-62-2	Vanadium, Total	39.7	1.69	0.642	
7440-66-6	Zinc, Total	75.7	16.9	4.40	



Form 1 METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : WILLIAMS (1794)
 Lab ID : L1717026-08
 Client ID : VC89-D9-10E
 Sample Location : RARITAN BAY
 Sample Matrix : Sediment
 Analytical Method : 1,6020A
 Lab File ID : WG1011426.pdf
 Sample Amount : 1.307g
 Digestion Method : EPA 3050B

Lab Number : L1717026
 Project Number : 1794
 Date Collected : 05/19/17 16:15
 Date Received : 05/24/17
 Date Analyzed : 06/09/17 14:10
 Dilution Factor : 10
 Analyst : BV
 Instrument ID : ICPMSQ2
 %Solids : 52
 Date Digested : 05/26/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7429-90-5	Aluminum, Total	17000	185	27.3	
7440-36-0	Antimony, Total	ND	2.95	0.250	U
7440-38-2	Arsenic, Total	14.0	0.923	0.122	
7440-39-3	Barium, Total	33.4	5.54	0.390	
7440-41-7	Beryllium, Total	1.02	0.554	0.161	
7440-43-9	Cadmium, Total	0.174	0.369	0.049	J
7440-70-2	Calcium, Total	3980	923	112.	
7440-47-3	Chromium, Total	37.4	3.69	0.864	
7440-48-4	Cobalt, Total	10.1	0.923	0.098	
7440-50-8	Copper, Total	15.4	3.69	0.358	
7439-89-6	Iron, Total	52500	369	38.0	
7439-92-1	Lead, Total	13.2	1.11	0.270	
7439-95-4	Magnesium, Total	7620	185	22.7	
7439-96-5	Manganese, Total	291	3.69	0.820	
7439-98-7	Molybdenum, Total	1.91	1.48	0.199	
7440-02-0	Nickel, Total	27.2	1.85	0.493	
7440-09-7	Potassium, Total	3700	185	29.3	
7782-49-2	Selenium, Total	11.3	3.69	1.40	
7440-22-4	Silver, Total	ND	0.923	0.090	U
7440-23-5	Sodium, Total	5570	277	21.6	
7440-24-6	Strontium, Total	31.2	1.85	0.453	
7440-28-0	Thallium, Total	0.165	0.369	0.095	J
7440-31-5	Tin, Total	0.493	2.22	0.229	J
7440-32-6	Titanium, Total	328	0.923	0.160	
7440-62-2	Vanadium, Total	41.6	1.85	0.700	
7440-66-6	Zinc, Total	82.0	18.5	4.80	



Form 1 METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : WILLIAMS (1794)
 Lab ID : L1717026-09
 Client ID : DUP-D9-10E
 Sample Location : RARITAN BAY
 Sample Matrix : Sediment
 Analytical Method : 1,6020A
 Lab File ID : WG1011426.pdf
 Sample Amount : 1.268g
 Digestion Method : EPA 3050B

Lab Number : L1717026
 Project Number : 1794
 Date Collected : 05/19/17 17:07
 Date Received : 05/24/17
 Date Analyzed : 06/09/17 14:13
 Dilution Factor : 10
 Analyst : BV
 Instrument ID : ICPMSQ2
 %Solids : 54
 Date Digested : 05/26/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7429-90-5	Aluminum, Total	15700	183	27.1	
7440-36-0	Antimony, Total	ND	2.93	0.248	U
7440-38-2	Arsenic, Total	14.0	0.916	0.121	
7440-39-3	Barium, Total	26.9	5.50	0.387	
7440-41-7	Beryllium, Total	0.974	0.550	0.160	
7440-43-9	Cadmium, Total	0.132	0.366	0.048	J
7440-70-2	Calcium, Total	3070	916	111.	
7440-47-3	Chromium, Total	33.6	3.66	0.858	
7440-48-4	Cobalt, Total	9.40	0.916	0.098	
7440-50-8	Copper, Total	13.3	3.66	0.355	
7439-89-6	Iron, Total	36100	366	37.7	
7439-92-1	Lead, Total	13.1	1.10	0.268	
7439-95-4	Magnesium, Total	7950	183	22.6	
7439-96-5	Manganese, Total	277	3.66	0.814	
7439-98-7	Molybdenum, Total	2.01	1.46	0.198	
7440-02-0	Nickel, Total	24.4	1.83	0.490	
7440-09-7	Potassium, Total	3530	183	29.1	
7782-49-2	Selenium, Total	11.2	3.66	1.38	
7440-22-4	Silver, Total	ND	0.916	0.089	U
7440-23-5	Sodium, Total	7660	275	21.5	
7440-24-6	Strontium, Total	29.0	1.83	0.449	
7440-28-0	Thallium, Total	0.142	0.366	0.095	J
7440-31-5	Tin, Total	0.515	2.20	0.227	J
7440-32-6	Titanium, Total	290	0.916	0.158	
7440-62-2	Vanadium, Total	38.9	1.83	0.695	
7440-66-6	Zinc, Total	72.1	18.3	4.76	



Form 1 METALS

Client : Alpine Ocean Seismic Survey Inc.
Project Name : WILLIAMS (1794)
Lab ID : L1717026-10
Client ID : DUP-D0-3E
Sample Location : RARITAN BAY
Sample Matrix : Sediment
Analytical Method : 1,6020A
Lab File ID : WG1011426.pdf
Sample Amount : 1.252g
Digestion Method : EPA 3050B

Lab Number : L1717026
Project Number : 1794
Date Collected : 05/19/17 16:15
Date Received : 05/24/17
Date Analyzed : 06/09/17 14:16
Dilution Factor : 10
Analyst : BV
Instrument ID : ICPMSQ2
%Solids : 82
Date Digested : 05/26/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7429-90-5	Aluminum, Total	1500	121	17.9	
7440-36-0	Antimony, Total	ND	1.94	0.164	U
7440-38-2	Arsenic, Total	6.20	0.606	0.080	
7440-39-3	Barium, Total	1.75	3.63	0.256	J
7440-41-7	Beryllium, Total	0.216	0.363	0.106	J
7440-43-9	Cadmium, Total	ND	0.242	0.032	U
7440-70-2	Calcium, Total	773	606	73.7	
7440-47-3	Chromium, Total	11.3	2.42	0.567	
7440-48-4	Cobalt, Total	0.943	0.606	0.064	
7440-50-8	Copper, Total	3.38	2.42	0.235	
7439-89-6	Iron, Total	13600	242	25.0	
7439-92-1	Lead, Total	2.15	0.727	0.177	
7439-95-4	Magnesium, Total	776	121	14.9	
7439-96-5	Manganese, Total	22.4	2.42	0.538	
7439-98-7	Molybdenum, Total	0.983	0.969	0.131	
7440-02-0	Nickel, Total	2.76	1.21	0.324	
7440-09-7	Potassium, Total	293	121	19.2	
7782-49-2	Selenium, Total	1.58	2.42	0.916	J
7440-22-4	Silver, Total	ND	0.606	0.059	U
7440-23-5	Sodium, Total	2130	182	14.2	
7440-24-6	Strontium, Total	6.01	1.21	0.297	
7440-28-0	Thallium, Total	ND	0.242	0.063	U
7440-31-5	Tin, Total	ND	1.45	0.150	U
7440-32-6	Titanium, Total	44.0	0.606	0.105	
7440-62-2	Vanadium, Total	19.0	1.21	0.459	
7440-66-6	Zinc, Total	10.3	12.1	3.15	J



Form 1 METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : WILLIAMS (1794)
 Lab ID : L1717026-11
 Client ID : VC90-D0-3E
 Sample Location : RARITAN BAY
 Sample Matrix : Sediment
 Analytical Method : 1,6020A
 Lab File ID : WG1011426.pdf
 Sample Amount : 1.299g
 Digestion Method : EPA 3050B

Lab Number : L1717026
 Project Number : 1794
 Date Collected : 05/19/17 15:42
 Date Received : 05/24/17
 Date Analyzed : 06/09/17 14:19
 Dilution Factor : 10
 Analyst : BV
 Instrument ID : ICPMSQ2
 %Solids : 81
 Date Digested : 05/26/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7429-90-5	Aluminum, Total	3730	118	17.5	
7440-36-0	Antimony, Total	ND	1.89	0.160	U
7440-38-2	Arsenic, Total	3.66	0.592	0.078	
7440-39-3	Barium, Total	7.69	3.55	0.250	
7440-41-7	Beryllium, Total	0.289	0.355	0.103	J
7440-43-9	Cadmium, Total	0.041	0.237	0.031	J
7440-70-2	Calcium, Total	11200	592	72.0	
7440-47-3	Chromium, Total	9.58	2.37	0.554	
7440-48-4	Cobalt, Total	2.82	0.592	0.063	
7440-50-8	Copper, Total	4.32	2.37	0.230	
7439-89-6	Iron, Total	11200	237	24.4	
7439-92-1	Lead, Total	6.21	0.710	0.173	
7439-95-4	Magnesium, Total	1830	118	14.6	
7439-96-5	Manganese, Total	102	2.37	0.526	
7439-98-7	Molybdenum, Total	0.587	0.947	0.128	J
7440-02-0	Nickel, Total	5.73	1.18	0.316	
7440-09-7	Potassium, Total	771	118	18.8	
7782-49-2	Selenium, Total	2.65	2.37	0.895	
7440-22-4	Silver, Total	ND	0.592	0.058	U
7440-23-5	Sodium, Total	2610	178	13.9	
7440-24-6	Strontium, Total	53.2	1.18	0.290	
7440-28-0	Thallium, Total	ND	0.237	0.061	U
7440-31-5	Tin, Total	0.202	1.42	0.147	J
7440-32-6	Titanium, Total	101	0.592	0.102	
7440-62-2	Vanadium, Total	14.3	1.18	0.449	
7440-66-6	Zinc, Total	18.5	11.8	3.08	



Form 1 METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : WILLIAMS (1794)
 Lab ID : L1717026-12
 Client ID : VC90-D3-6E
 Sample Location : RARITAN BAY
 Sample Matrix : Sediment
 Analytical Method : 1,6020A
 Lab File ID : WG1011426.pdf
 Sample Amount : 1.301g
 Digestion Method : EPA 3050B

Lab Number : L1717026
 Project Number : 1794
 Date Collected : 05/19/17 15:42
 Date Received : 05/24/17
 Date Analyzed : 06/09/17 14:22
 Dilution Factor : 10
 Analyst : BV
 Instrument ID : ICPMSQ2
 %Solids : 70
 Date Digested : 05/26/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7429-90-5	Aluminum, Total	8420	137	20.3	
7440-36-0	Antimony, Total	ND	2.20	0.186	U
7440-38-2	Arsenic, Total	9.33	0.686	0.091	
7440-39-3	Barium, Total	16.5	4.12	0.290	
7440-41-7	Beryllium, Total	0.636	0.412	0.120	
7440-43-9	Cadmium, Total	0.071	0.274	0.036	J
7440-70-2	Calcium, Total	2950	686	83.4	
7440-47-3	Chromium, Total	21.2	2.74	0.642	
7440-48-4	Cobalt, Total	5.59	0.686	0.073	
7440-50-8	Copper, Total	9.11	2.74	0.266	
7439-89-6	Iron, Total	27300	274	28.3	
7439-92-1	Lead, Total	8.87	0.824	0.200	
7439-95-4	Magnesium, Total	4880	137	16.9	
7439-96-5	Manganese, Total	158	2.74	0.609	
7439-98-7	Molybdenum, Total	2.63	1.10	0.148	
7440-02-0	Nickel, Total	13.7	1.37	0.367	
7440-09-7	Potassium, Total	1960	137	21.8	
7782-49-2	Selenium, Total	8.94	2.74	1.04	
7440-22-4	Silver, Total	ND	0.686	0.067	U
7440-23-5	Sodium, Total	4560	206	16.1	
7440-24-6	Strontium, Total	24.0	1.37	0.336	
7440-28-0	Thallium, Total	0.086	0.274	0.071	J
7440-31-5	Tin, Total	0.317	1.65	0.170	J
7440-32-6	Titanium, Total	183	0.686	0.118	
7440-62-2	Vanadium, Total	34.8	1.37	0.520	
7440-66-6	Zinc, Total	47.1	13.7	3.57	



Form 1 METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : WILLIAMS (1794)
 Lab ID : L1717026-13
 Client ID : VC90-D6-9E
 Sample Location : RARITAN BAY
 Sample Matrix : Sediment
 Analytical Method : 1,6020A
 Lab File ID : WG1011426.pdf
 Sample Amount : 1.276g
 Digestion Method : EPA 3050B

Lab Number : L1717026
 Project Number : 1794
 Date Collected : 05/19/17 15:42
 Date Received : 05/24/17
 Date Analyzed : 06/09/17 14:25
 Dilution Factor : 10
 Analyst : BV
 Instrument ID : ICPMSQ2
 %Solids : 56
 Date Digested : 05/26/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7429-90-5	Aluminum, Total	15800	176	26.1	
7440-36-0	Antimony, Total	ND	2.82	0.238	U
7440-38-2	Arsenic, Total	14.6	0.881	0.116	
7440-39-3	Barium, Total	26.6	5.28	0.372	
7440-41-7	Beryllium, Total	1.00	0.528	0.154	
7440-43-9	Cadmium, Total	0.079	0.352	0.047	J
7440-70-2	Calcium, Total	2740	881	107.	
7440-47-3	Chromium, Total	34.1	3.52	0.824	
7440-48-4	Cobalt, Total	9.42	0.881	0.094	
7440-50-8	Copper, Total	14.5	3.52	0.342	
7439-89-6	Iron, Total	38500	352	36.3	
7439-92-1	Lead, Total	13.5	1.06	0.257	
7439-95-4	Magnesium, Total	7860	176	21.7	
7439-96-5	Manganese, Total	275	3.52	0.782	
7439-98-7	Molybdenum, Total	1.30	1.41	0.190	J
7440-02-0	Nickel, Total	24.7	1.76	0.471	
7440-09-7	Potassium, Total	3500	176	28.0	
7782-49-2	Selenium, Total	11.4	3.52	1.33	
7440-22-4	Silver, Total	ND	0.881	0.086	U
7440-23-5	Sodium, Total	6100	264	20.6	
7440-24-6	Strontium, Total	26.5	1.76	0.432	
7440-28-0	Thallium, Total	0.138	0.352	0.091	J
7440-31-5	Tin, Total	0.470	2.11	0.218	J
7440-32-6	Titanium, Total	272	0.881	0.152	
7440-62-2	Vanadium, Total	38.2	1.76	0.668	
7440-66-6	Zinc, Total	76.0	17.6	4.58	



Form 1 METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : WILLIAMS (1794)
 Lab ID : L1717026-14
 Client ID : VC90-D9-10E
 Sample Location : RARITAN BAY
 Sample Matrix : Sediment
 Analytical Method : 1,6020A
 Lab File ID : WG1011426.pdf
 Sample Amount : 1.281g
 Digestion Method : EPA 3050B

Lab Number : L1717026
 Project Number : 1794
 Date Collected : 05/19/17 15:42
 Date Received : 05/24/17
 Date Analyzed : 06/09/17 14:28
 Dilution Factor : 10
 Analyst : BV
 Instrument ID : ICPMSQ2
 %Solids : 54
 Date Digested : 05/26/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7429-90-5	Aluminum, Total	17000	180	26.6	
7440-36-0	Antimony, Total	ND	2.88	0.243	U
7440-38-2	Arsenic, Total	16.2	0.900	0.119	
7440-39-3	Barium, Total	30.5	5.40	0.380	
7440-41-7	Beryllium, Total	1.04	0.540	0.157	
7440-43-9	Cadmium, Total	0.260	0.360	0.048	J
7440-70-2	Calcium, Total	16500	900	109.	
7440-47-3	Chromium, Total	38.1	3.60	0.842	
7440-48-4	Cobalt, Total	10.1	0.900	0.096	
7440-50-8	Copper, Total	15.3	3.60	0.349	
7439-89-6	Iron, Total	44200	360	37.1	
7439-92-1	Lead, Total	13.7	1.08	0.263	
7439-95-4	Magnesium, Total	7880	180	22.2	
7439-96-5	Manganese, Total	375	3.60	0.799	
7439-98-7	Molybdenum, Total	3.81	1.44	0.194	
7440-02-0	Nickel, Total	27.4	1.80	0.481	
7440-09-7	Potassium, Total	3760	180	28.6	
7782-49-2	Selenium, Total	11.3	3.60	1.36	
7440-22-4	Silver, Total	ND	0.900	0.088	U
7440-23-5	Sodium, Total	6650	270	21.1	
7440-24-6	Strontium, Total	79.6	1.80	0.441	
7440-28-0	Thallium, Total	0.185	0.360	0.093	J
7440-31-5	Tin, Total	0.518	2.16	0.223	J
7440-32-6	Titanium, Total	335	0.900	0.156	
7440-62-2	Vanadium, Total	41.0	1.80	0.683	
7440-66-6	Zinc, Total	77.1	18.0	4.68	



Form 1 METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : WILLIAMS (1794)
 Lab ID : L1717026-15
 Client ID : VC91-D0-3E
 Sample Location : RARITAN BAY
 Sample Matrix : Sediment
 Analytical Method : 1,6020A
 Lab File ID : WG1011426.pdf
 Sample Amount : 1.312g
 Digestion Method : EPA 3050B

Lab Number : L1717026
 Project Number : 1794
 Date Collected : 05/19/17 15:10
 Date Received : 05/24/17
 Date Analyzed : 06/09/17 14:44
 Dilution Factor : 10
 Analyst : BV
 Instrument ID : ICPMSQ2
 %Solids : 84
 Date Digested : 05/26/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7429-90-5	Aluminum, Total	2050	114	16.9	
7440-36-0	Antimony, Total	ND	1.82	0.154	U
7440-38-2	Arsenic, Total	2.06	0.570	0.075	
7440-39-3	Barium, Total	6.15	3.42	0.241	
7440-41-7	Beryllium, Total	0.201	0.342	0.100	J
7440-43-9	Cadmium, Total	0.146	0.228	0.030	J
7440-70-2	Calcium, Total	260	570	69.4	J
7440-47-3	Chromium, Total	8.18	2.28	0.534	
7440-48-4	Cobalt, Total	1.41	0.570	0.061	
7440-50-8	Copper, Total	10.7	2.28	0.221	
7439-89-6	Iron, Total	7760	228	23.5	
7439-92-1	Lead, Total	5.77	0.685	0.166	
7439-95-4	Magnesium, Total	797	114	14.0	
7439-96-5	Manganese, Total	25.7	2.28	0.507	
7439-98-7	Molybdenum, Total	0.243	0.913	0.123	J
7440-02-0	Nickel, Total	3.50	1.14	0.305	
7440-09-7	Potassium, Total	372	114	18.1	
7782-49-2	Selenium, Total	2.54	2.28	0.863	
7440-22-4	Silver, Total	ND	0.570	0.056	U
7440-23-5	Sodium, Total	1760	171	13.4	
7440-24-6	Strontium, Total	4.77	1.14	0.280	
7440-28-0	Thallium, Total	0.177	0.228	0.059	J
7440-31-5	Tin, Total	ND	1.37	0.141	U
7440-32-6	Titanium, Total	43.9	0.570	0.099	
7440-62-2	Vanadium, Total	17.1	1.14	0.433	
7440-66-6	Zinc, Total	13.3	11.4	2.97	



Form 1 METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : WILLIAMS (1794)
 Lab ID : L1717026-16
 Client ID : VC91-D3-6E
 Sample Location : RARITAN BAY
 Sample Matrix : Sediment
 Analytical Method : 1,6020A
 Lab File ID : WG1011426.pdf
 Sample Amount : 1.271g
 Digestion Method : EPA 3050B

Lab Number : L1717026
 Project Number : 1794
 Date Collected : 05/19/17 15:10
 Date Received : 05/24/17
 Date Analyzed : 06/09/17 14:47
 Dilution Factor : 10
 Analyst : BV
 Instrument ID : ICPMSQ2
 %Solids : 62
 Date Digested : 05/26/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7429-90-5	Aluminum, Total	12500	159	23.6	
7440-36-0	Antimony, Total	ND	2.55	0.215	U
7440-38-2	Arsenic, Total	11.2	0.796	0.105	
7440-39-3	Barium, Total	25.1	4.77	0.336	
7440-41-7	Beryllium, Total	0.840	0.477	0.139	
7440-43-9	Cadmium, Total	0.114	0.318	0.042	J
7440-70-2	Calcium, Total	11000	796	96.8	
7440-47-3	Chromium, Total	27.7	3.18	0.745	
7440-48-4	Cobalt, Total	7.60	0.796	0.085	
7440-50-8	Copper, Total	11.8	3.18	0.309	
7439-89-6	Iron, Total	31700	318	32.8	
7439-92-1	Lead, Total	11.4	0.955	0.232	
7439-95-4	Magnesium, Total	6310	159	19.6	
7439-96-5	Manganese, Total	227	3.18	0.706	
7439-98-7	Molybdenum, Total	1.56	1.27	0.172	
7440-02-0	Nickel, Total	18.9	1.59	0.425	
7440-09-7	Potassium, Total	2800	159	25.3	
7782-49-2	Selenium, Total	9.21	3.18	1.20	
7440-22-4	Silver, Total	ND	0.796	0.078	U
7440-23-5	Sodium, Total	5440	239	18.6	
7440-24-6	Strontium, Total	62.8	1.59	0.390	
7440-28-0	Thallium, Total	0.170	0.318	0.082	J
7440-31-5	Tin, Total	0.433	1.91	0.197	J
7440-32-6	Titanium, Total	233	0.796	0.137	
7440-62-2	Vanadium, Total	31.4	1.59	0.603	
7440-66-6	Zinc, Total	58.7	15.9	4.14	



Form 1 METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : WILLIAMS (1794)
 Lab ID : L1717026-17
 Client ID : VC91-D6-9.6E
 Sample Location : RARITAN BAY
 Sample Matrix : Sediment
 Analytical Method : 1,6020A
 Lab File ID : WG1011426.pdf
 Sample Amount : 1.258g
 Digestion Method : EPA 3050B

Lab Number : L1717026
 Project Number : 1794
 Date Collected : 05/19/17 15:10
 Date Received : 05/24/17
 Date Analyzed : 06/09/17 14:50
 Dilution Factor : 10
 Analyst : BV
 Instrument ID : ICPMSQ2
 %Solids : 57
 Date Digested : 05/26/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7429-90-5	Aluminum, Total	16000	174	25.7	
7440-36-0	Antimony, Total	ND	2.78	0.235	U
7440-38-2	Arsenic, Total	12.8	0.868	0.115	
7440-39-3	Barium, Total	28.9	5.21	0.367	
7440-41-7	Beryllium, Total	1.04	0.521	0.151	
7440-43-9	Cadmium, Total	0.152	0.347	0.046	J
7440-70-2	Calcium, Total	3410	868	106.	
7440-47-3	Chromium, Total	35.1	3.47	0.813	
7440-48-4	Cobalt, Total	9.79	0.868	0.092	
7440-50-8	Copper, Total	15.0	3.47	0.337	
7439-89-6	Iron, Total	39900	347	35.8	
7439-92-1	Lead, Total	13.2	1.04	0.254	
7439-95-4	Magnesium, Total	7540	174	21.4	
7439-96-5	Manganese, Total	260	3.47	0.771	
7439-98-7	Molybdenum, Total	1.88	1.39	0.188	
7440-02-0	Nickel, Total	26.5	1.74	0.464	
7440-09-7	Potassium, Total	3530	174	27.6	
7782-49-2	Selenium, Total	12.7	3.47	1.31	
7440-22-4	Silver, Total	ND	0.868	0.085	U
7440-23-5	Sodium, Total	6370	260	20.4	
7440-24-6	Strontium, Total	29.8	1.74	0.426	
7440-28-0	Thallium, Total	0.182	0.347	0.090	J
7440-31-5	Tin, Total	0.546	2.08	0.215	J
7440-32-6	Titanium, Total	290	0.868	0.150	
7440-62-2	Vanadium, Total	39.8	1.74	0.659	
7440-66-6	Zinc, Total	74.7	17.4	4.52	



Form 1 METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : WILLIAMS (1794)
 Lab ID : L1717026-18
 Client ID : DUP-D6-9E
 Sample Location : RARITAN BAY
 Sample Matrix : Sediment
 Analytical Method : 1,6020A
 Lab File ID : WG1011426.pdf
 Sample Amount : 1.313g
 Digestion Method : EPA 3050B

Lab Number : L1717026
 Project Number : 1794
 Date Collected : 05/19/17 15:42
 Date Received : 05/24/17
 Date Analyzed : 06/09/17 14:53
 Dilution Factor : 10
 Analyst : BV
 Instrument ID : ICPMSQ2
 %Solids : 55
 Date Digested : 05/26/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7429-90-5	Aluminum, Total	15300	174	25.8	
7440-36-0	Antimony, Total	ND	2.79	0.236	U
7440-38-2	Arsenic, Total	12.9	0.872	0.115	
7440-39-3	Barium, Total	29.1	5.23	0.368	
7440-41-7	Beryllium, Total	0.990	0.523	0.152	
7440-43-9	Cadmium, Total	0.149	0.349	0.046	J
7440-70-2	Calcium, Total	34100	872	106.	
7440-47-3	Chromium, Total	34.2	3.49	0.816	
7440-48-4	Cobalt, Total	8.94	0.872	0.093	
7440-50-8	Copper, Total	13.6	3.49	0.338	
7439-89-6	Iron, Total	37200	349	35.9	
7439-92-1	Lead, Total	12.3	1.05	0.254	
7439-95-4	Magnesium, Total	7320	174	21.5	
7439-96-5	Manganese, Total	282	3.49	0.774	
7439-98-7	Molybdenum, Total	2.29	1.39	0.188	
7440-02-0	Nickel, Total	23.8	1.74	0.466	
7440-09-7	Potassium, Total	3490	174	27.7	
7782-49-2	Selenium, Total	10.8	3.49	1.32	
7440-22-4	Silver, Total	ND	0.872	0.085	U
7440-23-5	Sodium, Total	6410	262	20.4	
7440-24-6	Strontium, Total	213	1.74	0.428	
7440-28-0	Thallium, Total	0.171	0.349	0.090	J
7440-31-5	Tin, Total	0.477	2.09	0.216	J
7440-32-6	Titanium, Total	343	0.872	0.151	
7440-62-2	Vanadium, Total	38.3	1.74	0.661	
7440-66-6	Zinc, Total	69.8	17.4	4.53	



Form 1 METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : WILLIAMS (1794)
 Lab ID : L1717026-19
 Client ID : VC92-D0-3E
 Sample Location : RARITAN BAY
 Sample Matrix : Sediment
 Analytical Method : 1,6020A
 Lab File ID : WG1011426.pdf
 Sample Amount : 1.274g
 Digestion Method : EPA 3050B

Lab Number : L1717026
 Project Number : 1794
 Date Collected : 05/19/17 14:38
 Date Received : 05/24/17
 Date Analyzed : 06/09/17 14:56
 Dilution Factor : 10
 Analyst : BV
 Instrument ID : ICPMSQ2
 %Solids : 75
 Date Digested : 05/26/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7429-90-5	Aluminum, Total	1290	131	19.4	
7440-36-0	Antimony, Total	ND	2.10	0.177	U
7440-38-2	Arsenic, Total	1.57	0.655	0.086	
7440-39-3	Barium, Total	3.17	3.93	0.277	J
7440-41-7	Beryllium, Total	ND	0.393	0.114	U
7440-43-9	Cadmium, Total	ND	0.262	0.035	U
7440-70-2	Calcium, Total	1510	655	79.6	
7440-47-3	Chromium, Total	4.36	2.62	0.613	
7440-48-4	Cobalt, Total	1.13	0.655	0.070	
7440-50-8	Copper, Total	1.44	2.62	0.254	J
7439-89-6	Iron, Total	4890	262	27.0	
7439-92-1	Lead, Total	3.22	0.786	0.191	
7439-95-4	Magnesium, Total	878	131	16.1	
7439-96-5	Manganese, Total	44.3	2.62	0.582	
7439-98-7	Molybdenum, Total	0.198	1.05	0.141	J
7440-02-0	Nickel, Total	1.97	1.31	0.350	
7440-09-7	Potassium, Total	367	131	20.8	
7782-49-2	Selenium, Total	1.67	2.62	0.990	J
7440-22-4	Silver, Total	ND	0.655	0.064	U
7440-23-5	Sodium, Total	2430	196	15.4	
7440-24-6	Strontium, Total	11.5	1.31	0.321	
7440-28-0	Thallium, Total	ND	0.262	0.068	U
7440-31-5	Tin, Total	ND	1.57	0.162	U
7440-32-6	Titanium, Total	65.6	0.655	0.113	
7440-62-2	Vanadium, Total	5.99	1.31	0.497	
7440-66-6	Zinc, Total	7.80	13.1	3.40	J



Form 1 METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : WILLIAMS (1794)
 Lab ID : L1717026-20
 Client ID : VC92-D3-6E
 Sample Location : RARITAN BAY
 Sample Matrix : Sediment
 Analytical Method : 1,6020A
 Lab File ID : WG1011426.pdf
 Sample Amount : 1.275g
 Digestion Method : EPA 3050B

Lab Number : L1717026
 Project Number : 1794
 Date Collected : 05/19/17 14:38
 Date Received : 05/24/17
 Date Analyzed : 06/09/17 14:59
 Dilution Factor : 10
 Analyst : BV
 Instrument ID : ICPMSQ2
 %Solids : 78
 Date Digested : 05/26/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7429-90-5	Aluminum, Total	3950	125	18.5	
7440-36-0	Antimony, Total	ND	2.00	0.169	U
7440-38-2	Arsenic, Total	7.81	0.626	0.083	
7440-39-3	Barium, Total	6.38	3.76	0.264	
7440-41-7	Beryllium, Total	0.374	0.376	0.109	J
7440-43-9	Cadmium, Total	0.039	0.250	0.033	J
7440-70-2	Calcium, Total	916	626	76.1	
7440-47-3	Chromium, Total	12.0	2.50	0.586	
7440-48-4	Cobalt, Total	2.78	0.626	0.067	
7440-50-8	Copper, Total	5.00	2.50	0.243	
7439-89-6	Iron, Total	15900	250	25.8	
7439-92-1	Lead, Total	4.57	0.751	0.183	
7439-95-4	Magnesium, Total	1970	125	15.4	
7439-96-5	Manganese, Total	72.9	2.50	0.556	
7439-98-7	Molybdenum, Total	1.01	1.00	0.135	
7440-02-0	Nickel, Total	6.39	1.25	0.334	
7440-09-7	Potassium, Total	835	125	19.9	
7782-49-2	Selenium, Total	3.29	2.50	0.946	
7440-22-4	Silver, Total	ND	0.626	0.061	U
7440-23-5	Sodium, Total	2740	188	14.7	
7440-24-6	Strontium, Total	9.64	1.25	0.307	
7440-28-0	Thallium, Total	ND	0.250	0.065	U
7440-31-5	Tin, Total	ND	1.50	0.155	U
7440-32-6	Titanium, Total	101	0.626	0.108	
7440-62-2	Vanadium, Total	20.3	1.25	0.475	
7440-66-6	Zinc, Total	25.2	12.5	3.26	



Form 1 METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : WILLIAMS (1794)
 Lab ID : L1717026-21
 Client ID : VC92-D6-9E
 Sample Location : RARITAN BAY
 Sample Matrix : Sediment
 Analytical Method : 1,6020A
 Lab File ID : WG1011426.pdf
 Sample Amount : 1.266g
 Digestion Method : EPA 3050B

Lab Number : L1717026
 Project Number : 1794
 Date Collected : 05/19/17 14:38
 Date Received : 05/24/17
 Date Analyzed : 06/09/17 15:25
 Dilution Factor : 10
 Analyst : BV
 Instrument ID : ICPMSQ2
 %Solids : 73
 Date Digested : 05/26/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7429-90-5	Aluminum, Total	4620	134	19.9	
7440-36-0	Antimony, Total	0.264	2.15	0.182	J
7440-38-2	Arsenic, Total	5.22	0.672	0.089	
7440-39-3	Barium, Total	9.34	4.04	0.284	
7440-41-7	Beryllium, Total	0.343	0.404	0.117	J
7440-43-9	Cadmium, Total	0.075	0.269	0.036	J
7440-70-2	Calcium, Total	794	672	81.8	
7440-47-3	Chromium, Total	12.9	2.69	0.630	
7440-48-4	Cobalt, Total	2.61	0.672	0.072	
7440-50-8	Copper, Total	5.10	2.69	0.261	
7439-89-6	Iron, Total	14400	269	27.7	
7439-92-1	Lead, Total	5.20	0.807	0.196	
7439-95-4	Magnesium, Total	1800	134	16.6	
7439-96-5	Manganese, Total	95.1	2.69	0.597	
7439-98-7	Molybdenum, Total	1.28	1.08	0.145	
7440-02-0	Nickel, Total	6.65	1.34	0.359	
7440-09-7	Potassium, Total	964	134	21.4	
7782-49-2	Selenium, Total	4.14	2.69	1.02	
7440-22-4	Silver, Total	ND	0.672	0.066	U
7440-23-5	Sodium, Total	2520	202	15.8	
7440-24-6	Strontium, Total	9.76	1.34	0.330	
7440-28-0	Thallium, Total	0.102	0.269	0.069	J
7440-31-5	Tin, Total	0.265	1.61	0.167	J
7440-32-6	Titanium, Total	109	0.672	0.116	
7440-62-2	Vanadium, Total	17.6	1.34	0.510	
7440-66-6	Zinc, Total	20.5	13.4	3.50	



Form 1 METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : WILLIAMS (1794)
 Lab ID : L1717026-22
 Client ID : VC92-D9-10E
 Sample Location : RARITAN BAY
 Sample Matrix : Sediment
 Analytical Method : 1,6020A
 Lab File ID : WG1011426.pdf
 Sample Amount : 1.281g
 Digestion Method : EPA 3050B

Lab Number : L1717026
 Project Number : 1794
 Date Collected : 05/19/17 14:38
 Date Received : 05/24/17
 Date Analyzed : 06/09/17 15:28
 Dilution Factor : 10
 Analyst : BV
 Instrument ID : ICPMSQ2
 %Solids : 75
 Date Digested : 05/26/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7429-90-5	Aluminum, Total	2430	130	19.2	
7440-36-0	Antimony, Total	ND	2.08	0.176	U
7440-38-2	Arsenic, Total	3.05	0.650	0.086	
7440-39-3	Barium, Total	6.22	3.90	0.274	
7440-41-7	Beryllium, Total	0.214	0.390	0.113	J
7440-43-9	Cadmium, Total	0.053	0.260	0.034	J
7440-70-2	Calcium, Total	324	650	79.0	J
7440-47-3	Chromium, Total	7.27	2.60	0.608	
7440-48-4	Cobalt, Total	1.34	0.650	0.069	
7440-50-8	Copper, Total	3.25	2.60	0.252	
7439-89-6	Iron, Total	9800	260	26.8	
7439-92-1	Lead, Total	3.66	0.780	0.190	
7439-95-4	Magnesium, Total	965	130	16.0	
7439-96-5	Manganese, Total	85.7	2.60	0.577	
7439-98-7	Molybdenum, Total	1.02	1.04	0.140	J
7440-02-0	Nickel, Total	3.34	1.30	0.347	
7440-09-7	Potassium, Total	548	130	20.6	
7782-49-2	Selenium, Total	2.55	2.60	0.982	J
7440-22-4	Silver, Total	ND	0.650	0.063	U
7440-23-5	Sodium, Total	2360	195	15.2	
7440-24-6	Strontium, Total	5.92	1.30	0.318	
7440-28-0	Thallium, Total	ND	0.260	0.067	U
7440-31-5	Tin, Total	ND	1.56	0.161	U
7440-32-6	Titanium, Total	75.0	0.650	0.112	
7440-62-2	Vanadium, Total	10.2	1.30	0.493	
7440-66-6	Zinc, Total	11.5	13.0	3.38	J



Form 1 METALS

Client : Alpine Ocean Seismic Survey Inc.
Project Name : WILLIAMS (1794)
Lab ID : L1717026-23
Client ID : VC93-D0-3E
Sample Location : RARITAN BAY
Sample Matrix : Sediment
Analytical Method : 1,6020A
Lab File ID : WG1011426.pdf
Sample Amount : 1.263g
Digestion Method : EPA 3050B

Lab Number : L1717026
Project Number : 1794
Date Collected : 05/20/17 13:58
Date Received : 05/24/17
Date Analyzed : 06/09/17 15:03
Dilution Factor : 10
Analyst : BV
Instrument ID : ICPMSQ2
%Solids : 81
Date Digested : 05/26/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7429-90-5	Aluminum, Total	928	123	18.2	
7440-36-0	Antimony, Total	0.404	1.96	0.166	J
7440-38-2	Arsenic, Total	3.71	0.614	0.081	
7440-39-3	Barium, Total	2.36	3.68	0.259	J
7440-41-7	Beryllium, Total	0.148	0.368	0.107	J
7440-43-9	Cadmium, Total	0.108	0.246	0.032	J
7440-70-2	Calcium, Total	252	614	74.6	J
7440-47-3	Chromium, Total	7.70	2.46	0.575	
7440-48-4	Cobalt, Total	1.92	0.614	0.065	
7440-50-8	Copper, Total	12.9	2.46	0.238	
7439-89-6	Iron, Total	6890	246	25.3	
7439-92-1	Lead, Total	11.9	0.737	0.179	
7439-95-4	Magnesium, Total	485	123	15.1	
7439-96-5	Manganese, Total	31.3	2.46	0.545	
7439-98-7	Molybdenum, Total	0.701	0.982	0.133	J
7440-02-0	Nickel, Total	4.94	1.23	0.328	
7440-09-7	Potassium, Total	219	123	19.5	
7782-49-2	Selenium, Total	0.948	2.46	0.928	J
7440-22-4	Silver, Total	0.138	0.614	0.060	J
7440-23-5	Sodium, Total	1840	184	14.4	
7440-24-6	Strontium, Total	4.11	1.23	0.301	
7440-28-0	Thallium, Total	ND	0.246	0.063	U
7440-31-5	Tin, Total	1.29	1.47	0.152	J
7440-32-6	Titanium, Total	54.9	0.614	0.106	
7440-62-2	Vanadium, Total	12.3	1.23	0.466	
7440-66-6	Zinc, Total	42.9	12.3	3.19	



Form 1 METALS

Client : Alpine Ocean Seismic Survey Inc.
Project Name : WILLIAMS (1794)
Lab ID : L1717026-24
Client ID : VC93-D3-6E
Sample Location : RARITAN BAY
Sample Matrix : Sediment
Analytical Method : 1,6020A
Lab File ID : WG1011426.pdf
Sample Amount : 1.311g
Digestion Method : EPA 3050B

Lab Number : L1717026
Project Number : 1794
Date Collected : 05/20/17 13:58
Date Received : 05/24/17
Date Analyzed : 06/09/17 15:31
Dilution Factor : 10
Analyst : BV
Instrument ID : ICPMSQ2
%Solids : 82
Date Digested : 05/26/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7429-90-5	Aluminum, Total	1090	116	17.2	
7440-36-0	Antimony, Total	ND	1.86	0.157	U
7440-38-2	Arsenic, Total	2.35	0.582	0.077	
7440-39-3	Barium, Total	1.87	3.49	0.246	J
7440-41-7	Beryllium, Total	0.147	0.349	0.102	J
7440-43-9	Cadmium, Total	ND	0.233	0.031	U
7440-70-2	Calcium, Total	151	582	70.8	J
7440-47-3	Chromium, Total	4.58	2.33	0.545	
7440-48-4	Cobalt, Total	0.912	0.582	0.062	
7440-50-8	Copper, Total	0.995	2.33	0.226	J
7439-89-6	Iron, Total	5240	233	24.0	
7439-92-1	Lead, Total	1.85	0.698	0.170	
7439-95-4	Magnesium, Total	464	116	14.3	
7439-96-5	Manganese, Total	21.2	2.33	0.517	
7439-98-7	Molybdenum, Total	0.219	0.931	0.126	J
7440-02-0	Nickel, Total	1.45	1.16	0.311	
7440-09-7	Potassium, Total	210	116	18.5	
7782-49-2	Selenium, Total	1.62	2.33	0.880	J
7440-22-4	Silver, Total	ND	0.582	0.057	U
7440-23-5	Sodium, Total	2040	175	13.6	
7440-24-6	Strontium, Total	3.71	1.16	0.285	
7440-28-0	Thallium, Total	ND	0.233	0.060	U
7440-31-5	Tin, Total	0.964	1.40	0.144	J
7440-32-6	Titanium, Total	47.4	0.582	0.100	
7440-62-2	Vanadium, Total	10.1	1.16	0.441	
7440-66-6	Zinc, Total	5.80	11.6	3.03	J



Form 1 METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : WILLIAMS (1794)
 Lab ID : L1717026-25
 Client ID : VC93-D6-9E
 Sample Location : RARITAN BAY
 Sample Matrix : Sediment
 Analytical Method : 1,6020A
 Lab File ID : WG1011426.pdf
 Sample Amount : 1.307g
 Digestion Method : EPA 3050B

Lab Number : L1717026
 Project Number : 1794
 Date Collected : 05/20/17 13:58
 Date Received : 05/24/17
 Date Analyzed : 06/09/17 15:34
 Dilution Factor : 10
 Analyst : BV
 Instrument ID : ICPMSQ2
 %Solids : 77
 Date Digested : 05/26/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7429-90-5	Aluminum, Total	85.9	124	18.3	J
7440-36-0	Antimony, Total	ND	1.98	0.167	U
7440-38-2	Arsenic, Total	0.220	0.618	0.082	J
7440-39-3	Barium, Total	0.965	3.71	0.261	J
7440-41-7	Beryllium, Total	ND	0.371	0.108	U
7440-43-9	Cadmium, Total	ND	0.247	0.033	U
7440-70-2	Calcium, Total	101	618	75.1	J
7440-47-3	Chromium, Total	1.22	2.47	0.578	J
7440-48-4	Cobalt, Total	ND	0.618	0.066	U
7440-50-8	Copper, Total	0.663	2.47	0.240	J
7439-89-6	Iron, Total	219	247	25.4	J
7439-92-1	Lead, Total	1.24	0.741	0.180	
7439-95-4	Magnesium, Total	296	124	15.2	
7439-96-5	Manganese, Total	1.42	2.47	0.549	J
7439-98-7	Molybdenum, Total	ND	0.988	0.133	U
7440-02-0	Nickel, Total	ND	1.24	0.330	U
7440-09-7	Potassium, Total	126	124	19.6	
7782-49-2	Selenium, Total	ND	2.47	0.934	U
7440-22-4	Silver, Total	ND	0.618	0.060	U
7440-23-5	Sodium, Total	2510	185	14.5	
7440-24-6	Strontium, Total	2.21	1.24	0.303	
7440-28-0	Thallium, Total	ND	0.247	0.064	U
7440-31-5	Tin, Total	ND	1.48	0.153	U
7440-32-6	Titanium, Total	17.8	0.618	0.107	
7440-62-2	Vanadium, Total	7.56	1.24	0.468	
7440-66-6	Zinc, Total	ND	12.4	3.21	U



Form 1 METALS

Client : Alpine Ocean Seismic Survey Inc.
Project Name : WILLIAMS (1794)
Lab ID : L1717026-26
Client ID : VC93-D9-10E
Sample Location : RARITAN BAY
Sample Matrix : Sediment
Analytical Method : 1,6020A
Lab File ID : WG1011426.pdf
Sample Amount : 1.296g
Digestion Method : EPA 3050B

Lab Number : L1717026
Project Number : 1794
Date Collected : 05/20/17 13:58
Date Received : 05/24/17
Date Analyzed : 06/09/17 15:37
Dilution Factor : 10
Analyst : BV
Instrument ID : ICPMSQ2
%Solids : 78
Date Digested : 05/26/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7429-90-5	Aluminum, Total	102	123	18.2	J
7440-36-0	Antimony, Total	ND	1.97	0.167	U
7440-38-2	Arsenic, Total	0.401	0.617	0.081	J
7440-39-3	Barium, Total	0.939	3.70	0.260	J
7440-41-7	Beryllium, Total	ND	0.370	0.108	U
7440-43-9	Cadmium, Total	0.034	0.247	0.033	J
7440-70-2	Calcium, Total	103	617	75.0	J
7440-47-3	Chromium, Total	2.56	2.47	0.577	
7440-48-4	Cobalt, Total	ND	0.617	0.066	U
7440-50-8	Copper, Total	0.705	2.47	0.239	J
7439-89-6	Iron, Total	387	247	25.4	
7439-92-1	Lead, Total	1.59	0.740	0.180	
7439-95-4	Magnesium, Total	270	123	15.2	
7439-96-5	Manganese, Total	1.49	2.47	0.548	J
7439-98-7	Molybdenum, Total	ND	0.987	0.133	U
7440-02-0	Nickel, Total	ND	1.23	0.330	U
7440-09-7	Potassium, Total	103	123	19.6	J
7782-49-2	Selenium, Total	ND	2.47	0.932	U
7440-22-4	Silver, Total	ND	0.617	0.060	U
7440-23-5	Sodium, Total	2250	185	14.4	
7440-24-6	Strontium, Total	2.18	1.23	0.302	
7440-28-0	Thallium, Total	ND	0.247	0.064	U
7440-31-5	Tin, Total	ND	1.48	0.153	U
7440-32-6	Titanium, Total	16.4	0.617	0.106	
7440-62-2	Vanadium, Total	4.03	1.23	0.468	
7440-66-6	Zinc, Total	ND	12.3	3.21	U



Form 1 METALS

Client : Alpine Ocean Seismic Survey Inc.
Project Name : WILLIAMS (1794)
Lab ID : L1717026-27
Client ID : DUP-D3-6E
Sample Location : RARITAN BAY
Sample Matrix : Sediment
Analytical Method : 1,6020A
Lab File ID : WG1011426.pdf
Sample Amount : 1.253g
Digestion Method : EPA 3050B

Lab Number : L1717026
Project Number : 1794
Date Collected : 05/19/17 14:38
Date Received : 05/24/17
Date Analyzed : 06/09/17 15:40
Dilution Factor : 10
Analyst : BV
Instrument ID : ICPMSQ2
%Solids : 79
Date Digested : 05/26/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7429-90-5	Aluminum, Total	2800	126	18.6	
7440-36-0	Antimony, Total	ND	2.01	0.170	U
7440-38-2	Arsenic, Total	4.51	0.628	0.083	
7440-39-3	Barium, Total	4.50	3.77	0.265	
7440-41-7	Beryllium, Total	0.236	0.377	0.110	J
7440-43-9	Cadmium, Total	0.055	0.251	0.033	J
7440-70-2	Calcium, Total	345	628	76.4	J
7440-47-3	Chromium, Total	11.1	2.51	0.588	
7440-48-4	Cobalt, Total	1.57	0.628	0.067	
7440-50-8	Copper, Total	2.97	2.51	0.244	
7439-89-6	Iron, Total	12000	251	25.9	
7439-92-1	Lead, Total	2.78	0.754	0.183	
7439-95-4	Magnesium, Total	1190	126	15.5	
7439-96-5	Manganese, Total	38.4	2.51	0.558	
7439-98-7	Molybdenum, Total	0.796	1.00	0.136	J
7440-02-0	Nickel, Total	3.78	1.26	0.336	
7440-09-7	Potassium, Total	624	126	20.0	
7782-49-2	Selenium, Total	2.30	2.51	0.950	J
7440-22-4	Silver, Total	ND	0.628	0.061	U
7440-23-5	Sodium, Total	2200	188	14.7	
7440-24-6	Strontium, Total	5.60	1.26	0.308	
7440-28-0	Thallium, Total	ND	0.251	0.065	U
7440-31-5	Tin, Total	ND	1.51	0.156	U
7440-32-6	Titanium, Total	71.2	0.628	0.108	
7440-62-2	Vanadium, Total	15.0	1.26	0.476	
7440-66-6	Zinc, Total	14.6	12.6	3.27	



Form 1 METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : WILLIAMS (1794)
 Lab ID : WG1007570-1
 Client ID : WG1007570-1BLANK
 Sample Location :
 Sample Matrix : SOIL
 Analytical Method : 1,6020A
 Lab File ID : WG1011426.pdf
 Sample Amount : 1.25g
 Digestion Method : EPA 3050B

Lab Number : L1717026
 Project Number : 1794
 Date Collected : NA
 Date Received : NA
 Date Analyzed : 06/09/17 13:23
 Dilution Factor : 10
 Analyst : BV
 Instrument ID : ICPMSQ2
 %Solids : NA
 Date Digested : 05/26/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7429-90-5	Aluminum, Total	ND	100	14.8	U
7440-36-0	Antimony, Total	ND	1.60	0.135	U
7440-38-2	Arsenic, Total	ND	0.500	0.066	U
7440-39-3	Barium, Total	ND	3.00	0.211	U
7440-41-7	Beryllium, Total	ND	0.300	0.087	U
7440-43-9	Cadmium, Total	ND	0.200	0.026	U
7440-70-2	Calcium, Total	ND	500	60.8	U
7440-47-3	Chromium, Total	ND	2.00	0.468	U
7440-48-4	Cobalt, Total	ND	0.500	0.053	U
7440-50-8	Copper, Total	ND	2.00	0.194	U
7439-89-6	Iron, Total	ND	200	20.6	U
7439-92-1	Lead, Total	ND	0.600	0.146	U
7439-95-4	Magnesium, Total	ND	100	12.3	U
7439-96-5	Manganese, Total	ND	2.00	0.444	U
7439-98-7	Molybdenum, Total	ND	0.800	0.108	U
7440-02-0	Nickel, Total	ND	1.00	0.267	U
7440-09-7	Potassium, Total	ND	100	15.9	U
7782-49-2	Selenium, Total	ND	2.00	0.756	U
7440-22-4	Silver, Total	ND	0.500	0.049	U
7440-23-5	Sodium, Total	ND	150	11.7	U
7440-24-6	Strontium, Total	ND	1.00	0.245	U
7440-28-0	Thallium, Total	ND	0.200	0.052	U
7440-31-5	Tin, Total	ND	1.20	0.124	U
7440-32-6	Titanium, Total	ND	0.500	0.086	U
7440-62-2	Vanadium, Total	ND	1.00	0.379	U
7440-66-6	Zinc, Total	ND	10.0	2.60	U



Form 1 METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : WILLIAMS (1794)
 Lab ID : WG1007571-1
 Client ID : WG1007571-1BLANK
 Sample Location :
 Sample Matrix : SOIL
 Analytical Method : 1,6020A
 Lab File ID : WG1011426.pdf
 Sample Amount : 1.25g
 Digestion Method : EPA 3050B

Lab Number : L1717026
 Project Number : 1794
 Date Collected : NA
 Date Received : NA
 Date Analyzed : 06/09/17 14:38
 Dilution Factor : 10
 Analyst : BV
 Instrument ID : ICPMSQ2
 %Solids : NA
 Date Digested : 05/26/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7429-90-5	Aluminum, Total	ND	100	14.8	U
7440-36-0	Antimony, Total	ND	1.60	0.135	U
7440-38-2	Arsenic, Total	ND	0.500	0.066	U
7440-39-3	Barium, Total	ND	3.00	0.211	U
7440-41-7	Beryllium, Total	ND	0.300	0.087	U
7440-43-9	Cadmium, Total	ND	0.200	0.026	U
7440-70-2	Calcium, Total	ND	500	60.8	U
7440-47-3	Chromium, Total	ND	2.00	0.468	U
7440-48-4	Cobalt, Total	ND	0.500	0.053	U
7440-50-8	Copper, Total	ND	2.00	0.194	U
7439-89-6	Iron, Total	ND	200	20.6	U
7439-92-1	Lead, Total	ND	0.600	0.146	U
7439-95-4	Magnesium, Total	ND	100	12.3	U
7439-96-5	Manganese, Total	ND	2.00	0.444	U
7439-98-7	Molybdenum, Total	ND	0.800	0.108	U
7440-02-0	Nickel, Total	ND	1.00	0.267	U
7440-09-7	Potassium, Total	ND	100	15.9	U
7782-49-2	Selenium, Total	ND	2.00	0.756	U
7440-22-4	Silver, Total	ND	0.500	0.049	U
7440-23-5	Sodium, Total	21.6	150	11.7	J
7440-24-6	Strontium, Total	ND	1.00	0.245	U
7440-28-0	Thallium, Total	ND	0.200	0.052	U
7440-31-5	Tin, Total	ND	1.20	0.124	U
7440-32-6	Titanium, Total	ND	0.500	0.086	U
7440-62-2	Vanadium, Total	ND	1.00	0.379	U
7440-66-6	Zinc, Total	ND	10.0	2.60	U



Form 2A

Initial and Continuing Calibration Verification

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : WILLIAMS (1794)
 Instrument ID : ICPMSQ2

Lab Number : L1717026
 Project Number : 1794
 Units : ug/l

Parameter	Initial Calibration			Continuing Calibration(s)							
	Lab ID	: R974427-1		R974427-5			R974427-7		R974427-9		
	Date Analyzed:	06/09/17 07:33		06/09/17 08:07			06/09/17 08:47		06/09/17 09:25		
	True	Found	%R	True	Found	%R	Found	%R	Found	%R	
Aluminum	100.0000	102.0000	102	100.0000	107.0000	107	100.0000	100	101.0000	101	
Antimony	100.0000	100.0000	100	100.0000	102.0000	102	90.4000	90	92.4000	92	
Arsenic	100.0000	97.0000	97	100.0000	98.1000	98	94.7000	95	95.0000	95	
Barium	100.0000	99.1000	99	100.0000	102.0000	102	98.0000	98	97.5000	98	
Beryllium	100.0000	97.7000	98	100.0000	96.1000	96	97.5000	98	99.5000	100	
Cadmium	100.0000	103.0000	103	100.0000	104.0000	104	101.0000	101	99.3000	99	
Calcium	10000.0000	10400.0000	104	10000.0000	10800.0000	108	10200.0000	102	10200.0000	102	
Chromium	100.0000	102.0000	102	100.0000	104.0000	104	98.1000	98	99.2000	99	
Cobalt	100.0000	103.0000	103	100.0000	107.0000	107	101.0000	101	101.0000	101	
Copper	100.0000	104.0000	104	100.0000	107.0000	107	102.0000	102	102.0000	102	
Iron	10000.0000	10300.0000	103	10000.0000	10700.0000	107	10000.0000	100	10200.0000	102	
Lead	100.0000	97.9000	98	100.0000	102.0000	102	99.4000	99	97.5000	98	
Magnesium	10000.0000	10000.0000	100	10000.0000	10400.0000	104	9640.0000	96	9810.0000	98	
Manganese	100.0000	101.0000	101	100.0000	106.0000	106	99.7000	100	100.0000	100	
Molybdenum	100.0000	103.0000	103	100.0000	106.0000	106	102.0000	102	102.0000	102	
Nickel	100.0000	105.0000	105	100.0000	108.0000	108	102.0000	102	102.0000	102	
Potassium	10000.0000	10400.0000	104	10000.0000	10900.0000	109	10200.0000	102	10200.0000	102	
Selenium	100.0000	99.0000	99	100.0000	102.0000	102	93.5000	94	98.1000	98	
Silver	100.0000	101.0000	101	100.0000	104.0000	104	99.4000	99	98.4000	98	
Sodium	10000.0000	10800.0000	108	10000.0000	11000.0000	110	10400.0000	104	10500.0000	105	
Strontium	100.0000	99.0000	99	100.0000	105.0000	105	101.0000	101	100.0000	100	
Thallium	100.0000	98.4000	98	100.0000	102.0000	102	99.7000	100	98.2000	98	
Titanium	100.0000	102.0000	102	100.0000	106.0000	106	102.0000	102	101.0000	101	
Tin	100.0000	104.0000	104	100.0000	107.0000	107	103.0000	103	103.0000	103	
Vanadium	100.0000	100.0000	100	100.0000	104.0000	104	97.4000	97	98.8000	99	
Zinc	100.0000	98.9000	99	100.0000	103.0000	103	95.4000	95	98.0000	98	

Acceptance Criteria:

ICV: 95-105% (Methods 200.7, 245.1)
 90-110% (Methods 200.8, 6010, 6020, 7470, 7471, 7474)
 85-115% (Method 1631)

CCV: 90-110% (Methods 200.7, 245.1, 6010, 6020, 7474)
 85-115% (Methods 200.8, 1631)
 80-120% (Methods 7470, 7471)



Form 2A

Initial and Continuing Calibration Verification

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : WILLIAMS (1794)
 Instrument ID : ICPMSQ2

Lab Number : L1717026
 Project Number : 1794
 Units : ug/l

Parameter	Lab ID : Date Analyzed :	Initial Calibration			Continuing Calibration(s)						
		True	Found	%R	R974427-11 06/09/17 10:02			R974427-14 06/09/17 10:42		R974427-16 06/09/17 11:24	
					True	Found	%R	Found	%R	Found	%R
Aluminum					100.0000	104.0000	104	103.0000	103	107.0000	107
Antimony					100.0000	92.4000	92	93.7000	94	93.0000	93
Arsenic					100.0000	95.3000	95	95.1000	95	94.8000	95
Barium					100.0000	98.6000	99	96.6000	97	100.0000	100
Beryllium					100.0000	99.9000	100	98.0000	98	98.8000	99
Cadmium					100.0000	101.0000	101	96.2000	96	102.0000	102
Calcium					10000.0000	10200.0000	102	10200.0000	102	10700.0000	107
Chromium					100.0000	97.3000	97	95.3000	95	100.0000	100
Cobalt					100.0000	101.0000	101	97.8000	98	103.0000	103
Copper					100.0000	100.0000	100	98.1000	98	102.0000	102
Iron					10000.0000	10000.0000	100	9820.0000	98	10200.0000	102
Lead					100.0000	98.3000	98	95.7000	96	101.0000	101
Magnesium					10000.0000	9800.0000	98	9650.0000	96	10100.0000	101
Manganese					100.0000	101.0000	101	98.8000	99	102.0000	102
Molybdenum					100.0000	102.0000	102	99.6000	100	103.0000	103
Nickel					100.0000	100.0000	100	98.4000	98	102.0000	102
Potassium					10000.0000	10300.0000	103	10200.0000	102	10600.0000	106
Selenium					100.0000	98.8000	99	96.4000	96	102.0000	102
Silver					100.0000	99.2000	99	95.8000	96	99.8000	100
Sodium					10000.0000	10600.0000	106	10400.0000	104	10900.0000	109
Strontium					100.0000	103.0000	103	101.0000	101	104.0000	104
Thallium					100.0000	97.5000	98	96.6000	97	100.0000	100
Titanium					100.0000	102.0000	102	99.3000	99	104.0000	104
Tin					100.0000	102.0000	102	99.8000	100	103.0000	103
Vanadium					100.0000	97.1000	97	96.5000	96	100.0000	100
Zinc					100.0000	97.0000	97	95.1000	95	98.4000	98

Acceptance Criteria:

ICV: 95-105% (Methods 200.7, 245.1)
 90-110% (Methods 200.8, 6010, 6020, 7470, 7471, 7474)
 85-115% (Method 1631)

CCV: 90-110% (Methods 200.7, 245.1, 6010, 6020, 7474)
 85-115% (Methods 200.8, 1631)
 80-120% (Methods 7470, 7471)



Form 2A

Initial and Continuing Calibration Verification

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : WILLIAMS (1794)
 Instrument ID : ICPMSQ2

Lab Number : L1717026
 Project Number : 1794
 Units : ug/l

Parameter	Lab ID : Date Analyzed :	Initial Calibration			Continuing Calibration(s)						
		True	Found	%R	R974427-18 06/09/17 11:55			R974427-20 06/09/17 12:35		R974427-22 06/09/17 13:12	
					True	Found	%R	Found	%R	Found	%R
Aluminum					100.0000	105.0000	105	110.0000	110	106.0000	106
Antimony					100.0000	91.3000	91	94.4000	94	92.0000	92
Arsenic					100.0000	93.3000	93	98.6000	99	97.0000	97
Barium					100.0000	96.7000	97	103.0000	103	98.8000	99
Beryllium					100.0000	102.0000	102	98.9000	99	99.2000	99
Cadmium					100.0000	97.4000	97	103.0000	103	100.0000	100
Calcium					10000.0000	10200.0000	102	10900.0000	109	10600.0000	106
Chromium					100.0000	95.2000	95	101.0000	101	98.5000	98
Cobalt					100.0000	97.3000	97	102.0000	102	100.0000	100
Copper					100.0000	95.3000	95	101.0000	101	100.0000	100
Iron					10000.0000	9870.0000	99	10400.0000	104	10100.0000	101
Lead					100.0000	92.5000	92	102.0000	102	96.4000	96
Magnesium					10000.0000	9710.0000	97	10200.0000	102	9940.0000	99
Manganese					100.0000	97.8000	98	105.0000	105	100.0000	100
Molybdenum					100.0000	97.4000	97	106.0000	106	100.0000	100
Nickel					100.0000	96.9000	97	103.0000	103	99.4000	99
Potassium					10000.0000	10400.0000	104	11000.0000	110	10700.0000	107
Selenium					100.0000	95.9000	96	99.4000	99	101.0000	101
Silver					100.0000	95.4000	95	101.0000	101	97.0000	97
Sodium					10000.0000	10600.0000	106	10900.0000	109	10800.0000	108
Strontium					100.0000	101.0000	101	106.0000	106	103.0000	103
Thallium					100.0000	93.6000	94	102.0000	102	96.7000	97
Titanium					100.0000	98.8000	99	105.0000	105	104.0000	104
Tin					100.0000	98.4000	98	106.0000	106	102.0000	102
Vanadium					100.0000	95.8000	96	102.0000	102	99.5000	100
Zinc					100.0000	94.2000	94	100.0000	100	97.0000	97

Acceptance Criteria:

ICV: 95-105% (Methods 200.7, 245.1)
 90-110% (Methods 200.8, 6010, 6020, 7470, 7471, 7474)
 85-115% (Method 1631)

CCV: 90-110% (Methods 200.7, 245.1, 6010, 6020, 7474)
 85-115% (Methods 200.8, 1631)
 80-120% (Methods 7470, 7471)



Form 2A

Initial and Continuing Calibration Verification

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : WILLIAMS (1794)
 Instrument ID : ICPMSQ2

Lab Number : L1717026
 Project Number : 1794
 Units : ug/l

Parameter	Lab ID : Date Analyzed :	Initial Calibration			Continuing Calibration(s)						
		True	Found	%R	R974427-24 06/09/17 13:54			R974427-26 06/09/17 14:31		R974427-28 06/09/17 15:09	
					True	Found	%R	Found	%R	Found	%R
Aluminum					100.0000	110.0000	110	109.0000	109	107.0000	107
Antimony					100.0000	96.1000	96	98.7000	99	102.0000	102
Arsenic					100.0000	99.5000	100	98.3000	98	101.0000	101
Barium					100.0000	103.0000	103	104.0000	104	105.0000	105
Beryllium					100.0000	98.8000	99	98.4000	98	100.0000	100
Cadmium					100.0000	101.0000	101	102.0000	102	102.0000	102
Calcium					10000.0000	10600.0000	106	10800.0000	108	10700.0000	107
Chromium					100.0000	98.6000	99	101.0000	101	101.0000	101
Cobalt					100.0000	101.0000	101	104.0000	104	104.0000	104
Copper					100.0000	98.6000	99	102.0000	102	102.0000	102
Iron					10000.0000	10100.0000	101	10200.0000	102	10400.0000	104
Lead					100.0000	97.4000	97	101.0000	101	101.0000	101
Magnesium					10000.0000	10100.0000	101	10300.0000	103	10200.0000	102
Manganese					100.0000	102.0000	102	103.0000	103	102.0000	102
Molybdenum					100.0000	102.0000	102	104.0000	104	105.0000	105
Nickel					100.0000	102.0000	102	103.0000	103	104.0000	104
Potassium					10000.0000	10700.0000	107	11000.0000	110	10900.0000	109
Selenium					100.0000	102.0000	102	102.0000	102	100.0000	100
Silver					100.0000	97.6000	98	99.1000	99	99.9000	100
Sodium					10000.0000	10600.0000	106	10800.0000	108	10900.0000	109
Strontium					100.0000	103.0000	103	102.0000	102	104.0000	104
Thallium					100.0000	98.4000	98	100.0000	100	102.0000	102
Titanium					100.0000	104.0000	104	103.0000	103	105.0000	105
Tin					100.0000	104.0000	104	106.0000	106	107.0000	107
Vanadium					100.0000	98.8000	99	102.0000	102	102.0000	102
Zinc					100.0000	99.9000	100	100.0000	100	100.0000	100

Acceptance Criteria:

ICV: 95-105% (Methods 200.7, 245.1)
 90-110% (Methods 200.8, 6010, 6020, 7470, 7471, 7474)
 85-115% (Method 1631)

CCV: 90-110% (Methods 200.7, 245.1, 6010, 6020, 7474)
 85-115% (Methods 200.8, 1631)
 80-120% (Methods 7470, 7471)



Form 2A

Initial and Continuing Calibration Verification

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : WILLIAMS (1794)
 Instrument ID : ICPMSQ2

Lab Number : L1717026
 Project Number : 1794
 Units : ug/l

Parameter	Initial Calibration			Continuing Calibration(s)						
	True	Found	%R	True	Found	%R	Found	%R	Found	%R
Aluminum				100.0000	110.0000	110				
Antimony				100.0000	101.0000	101				
Arsenic				100.0000	102.0000	102				
Barium				100.0000	104.0000	104				
Beryllium				100.0000	99.8000	100				
Cadmium				100.0000	103.0000	103				
Calcium				10000.0000	10800.0000	108				
Chromium				100.0000	102.0000	102				
Cobalt				100.0000	104.0000	104				
Copper				100.0000	104.0000	104				
Iron				10000.0000	10500.0000	105				
Lead				100.0000	101.0000	101				
Magnesium				10000.0000	10300.0000	103				
Manganese				100.0000	103.0000	103				
Molybdenum				100.0000	107.0000	107				
Nickel				100.0000	106.0000	106				
Potassium				10000.0000	11000.0000	110				
Selenium				100.0000	104.0000	104				
Silver				100.0000	100.0000	100				
Sodium				10000.0000	10800.0000	108				
Strontium				100.0000	106.0000	106				
Thallium				100.0000	102.0000	102				
Titanium				100.0000	107.0000	107				
Tin				100.0000	107.0000	107				
Vanadium				100.0000	103.0000	103				
Zinc				100.0000	102.0000	102				

Acceptance Criteria:

ICV:	95-105%	(Methods 200.7, 245.1)
	90-110%	(Methods 200.8, 6010, 6020, 7470, 7471, 7474)
	85-115%	(Method 1631)
CCV:	90-110%	(Methods 200.7, 245.1, 6010, 6020, 7474)
	85-115%	(Methods 200.8, 1631)
	80-120%	(Methods 7470, 7471)



Form 3 Blanks

Client : Alpine Ocean Seismic Survey Inc.
Project Name : WILLIAMS (1794)
Instrument ID : ICPMSQ2

Lab Number : L1717026
Project Number : 1794

Parameter	Initial Calibration Blank		Continuing Calibration Blank(s)						Preparation Blank	
	ug/l	Q	ug/l	Q	ug/l	Q	ug/l	Q	mg/kg	Q
Aluminum	37.0	U	37.0	U	37.0	U	37.0	U	14.8	U
Antimony	0.759	J	0.947	J	0.805	J	0.805	J	0.135	U
Arsenic	0.165	U	0.165	U	0.165	U	0.165	U	0.066	U
Barium	0.528	U	0.528	U	0.528	U	0.528	U	0.211	U
Beryllium	0.218	U	0.218	U	0.218	U	0.218	U	0.087	U
Cadmium	0.0660	U	0.0660	U	0.0660	U	0.0660	U	0.026	U
Calcium	152.	U	152.	U	152.	U	152.	U	60.8	U
Chromium	1.17	U	1.17	U	1.17	U	1.17	U	0.468	U
Cobalt	0.133	U	0.133	U	0.133	U	0.133	U	0.053	U
Copper	0.485	U	0.485	U	0.485	U	0.485	U	0.194	U
Iron	51.5	U	51.5	U	51.5	U	51.5	U	20.6	U
Lead	0.365	U	0.365	U	0.365	U	0.365	U	0.146	U
Magnesium	30.8	U	30.8	U	30.8	U	30.8	U	12.3	U
Manganese	1.11	U	1.11	U	1.11	U	1.11	U	0.444	U
Molybdenum	0.270	U	0.270	U	0.270	U	0.270	U	0.108	U
Nickel	0.668	U	0.668	U	0.668	U	0.668	U	0.267	U
Potassium	39.7	U	39.7	U	39.7	U	39.7	U	15.9	U
Selenium	1.89	U	1.89	U	1.89	U	1.89	U	0.756	U
Silver	0.122	U	0.122	U	0.122	U	0.122	U	0.049	U
Sodium	29.3	U	29.3	U	29.3	U	29.3	U	11.7	U
Strontium	0.613	U	0.613	U	0.613	U	0.613	U	0.245	U
Thallium	0.129	U	0.129	U	0.129	U	0.129	U	0.052	U
Tin	0.310	U	0.310	U	0.310	U	0.310	U	0.124	U
Titanium	0.216	U	0.216	U	0.216	U	0.216	U	0.086	U
Vanadium	0.948	U	0.948	U	0.948	U	0.948	U	0.379	U
Zinc	6.50	U	6.50	U	6.50	U	6.50	U	2.60	U



Form 3 Blanks

Client : Alpine Ocean Seismic Survey Inc.
Project Name : WILLIAMS (1794)
Instrument ID : ICPMSQ2

Lab Number : L1717026
Project Number : 1794

Parameter	Initial Calibration Blank		Continuing Calibration Blank(s)						Preparation Blank	
	ug/l	Q	ug/l	Q	ug/l	Q	ug/l	Q	mg/kg	Q
Aluminum			37.0	U	37.0	U	37.0	U	14.8	U
Antimony			0.782	J	0.925	J	0.796	J	0.135	U
Arsenic			0.165	U	0.165	U	0.165	U	0.066	U
Barium			0.528	U	0.528	U	0.528	U	0.211	U
Beryllium			0.218	U	0.218	U	0.218	U	0.087	U
Cadmium			0.0660	U	0.0660	U	0.0660	U	0.026	U
Calcium			152.	U	152.	U	152.	U	60.8	U
Chromium			1.17	U	1.17	U	1.17	U	0.468	U
Cobalt			0.133	U	0.133	U	0.133	U	0.053	U
Copper			0.485	U	0.485	U	0.485	U	0.194	U
Iron			51.5	U	51.5	U	51.5	U	20.6	U
Lead			0.365	U	0.365	U	0.365	U	0.146	U
Magnesium			30.8	U	30.8	U	30.8	U	12.3	U
Manganese			1.11	U	1.11	U	1.11	U	0.444	U
Molybdenum			0.270	U	0.270	U	0.270	U	0.108	U
Nickel			0.668	U	0.668	U	0.668	U	0.267	U
Potassium			39.7	U	39.7	U	39.7	U	15.9	U
Selenium			1.89	U	1.89	U	1.89	U	0.756	U
Silver			0.122	U	0.122	U	0.122	U	0.049	U
Sodium			54.0	J	29.3	U	29.3	U	21.6	J
Strontium			0.613	U	0.613	U	0.613	U	0.245	U
Thallium			0.129	U	0.129	U	0.129	U	0.052	U
Tin			0.310	U	0.310	U	0.310	U	0.124	U
Titanium			0.216	U	0.216	U	0.216	U	0.086	U
Vanadium			0.948	U	0.948	U	0.948	U	0.379	U
Zinc			6.50	U	6.50	U	6.50	U	2.60	U



Form 3 Blanks

Client : Alpine Ocean Seismic Survey Inc.
Project Name : WILLIAMS (1794)
Instrument ID : ICPMSQ2

Lab Number : L1717026
Project Number : 1794

Parameter	Initial Calibration		Continuing Calibration						Preparation
	Blank		Blank(s)						Blank
	Lab ID	Date Analyzed	R974427-19	06/09/17 11:58	R974427-21	06/09/17 12:39	R974427-23	06/09/17 13:15	
	ug/l	Q	ug/l	Q	ug/l	Q	ug/l	Q	Q
Aluminum			37.0	U	37.0	U	37.0	U	
Antimony			0.780	J	0.824	J	0.758	J	
Arsenic			0.165	U	0.165	U	0.165	U	
Barium			0.528	U	0.528	U	0.528	U	
Beryllium			0.218	U	0.218	U	0.218	U	
Cadmium			0.0660	U	0.0660	U	0.0660	U	
Calcium			152.	U	152.	U	152.	U	
Chromium			1.17	U	1.17	U	1.17	U	
Cobalt			0.133	U	0.133	U	0.133	U	
Copper			0.485	U	0.485	U	0.485	U	
Iron			51.5	U	51.5	U	51.5	U	
Lead			0.365	U	0.365	U	0.365	U	
Magnesium			30.8	U	30.8	U	30.8	U	
Manganese			1.11	U	1.11	U	1.11	U	
Molybdenum			0.270	U	0.270	U	0.270	U	
Nickel			0.668	U	0.668	U	0.668	U	
Potassium			39.7	U	39.7	U	39.7	U	
Selenium			1.89	U	1.89	U	1.89	U	
Silver			0.122	U	0.122	U	0.122	U	
Sodium			66.7	J	29.3	U	29.3	U	
Strontium			0.613	U	0.613	U	0.613	U	
Thallium			0.129	U	0.129	U	0.129	U	
Tin			0.310	U	0.310	U	0.310	U	
Titanium			0.216	U	0.216	U	0.216	U	
Vanadium			0.948	U	0.948	U	0.948	U	
Zinc			6.50	U	6.50	U	6.50	U	



Form 3 Blanks

Client : Alpine Ocean Seismic Survey Inc.
Project Name : WILLIAMS (1794)
Instrument ID : ICPMSQ2

Lab Number : L1717026
Project Number : 1794

Parameter	Initial Calibration Blank		Continuing Calibration Blank(s)						Preparation Blank	
	ug/l	Q	ug/l	Q	ug/l	Q	ug/l	Q		Q
Aluminum			37.0	U	37.0	U	37.0	U		
Antimony			0.814	J	0.758	J	0.799	J		
Arsenic			0.165	U	0.165	U	0.165	U		
Barium			0.528	U	0.528	U	0.528	U		
Beryllium			0.218	U	0.218	U	0.218	U		
Cadmium			0.0660	U	0.0660	U	0.0660	U		
Calcium			152.	U	152.	U	152.	U		
Chromium			1.17	U	1.17	U	1.17	U		
Cobalt			0.133	U	0.133	U	0.133	U		
Copper			0.485	U	0.485	U	0.485	U		
Iron			51.5	U	51.5	U	51.5	U		
Lead			0.365	U	0.365	U	0.365	U		
Magnesium			30.8	U	30.8	U	30.8	U		
Manganese			1.11	U	1.11	U	1.11	U		
Molybdenum			0.270	U	0.270	U	0.270	U		
Nickel			0.668	U	0.668	U	0.668	U		
Potassium			39.7	U	39.7	U	39.7	U		
Selenium			1.89	U	1.89	U	1.89	U		
Silver			0.122	U	0.122	U	0.122	U		
Sodium			29.3	U	43.4	J	55.8	J		
Strontium			0.613	U	0.613	U	0.613	U		
Thallium			0.129	U	0.129	U	0.129	U		
Tin			0.310	U	0.310	U	0.310	U		
Titanium			0.216	U	0.216	U	0.216	U		
Vanadium			0.948	U	0.948	U	0.948	U		
Zinc			6.50	U	6.50	U	6.50	U		



Form 3 Blanks

Client : Alpine Ocean Seismic Survey Inc.
Project Name : WILLIAMS (1794)
Instrument ID : ICPMSQ2

Lab Number : L1717026
Project Number : 1794

Parameter	Initial Calibration Blank		Continuing Calibration Blank(s)				Preparation Blank	
	ug/l	Q	ug/l	Q	ug/l	Q	ug/l	Q
Aluminum			37.0	U				
Antimony			0.719	J				
Arsenic			0.165	U				
Barium			0.528	U				
Beryllium			0.218	U				
Cadmium			0.0660	U				
Calcium			152.	U				
Chromium			1.17	U				
Cobalt			0.133	U				
Copper			0.485	U				
Iron			51.5	U				
Lead			0.365	U				
Magnesium			30.8	U				
Manganese			1.11	U				
Molybdenum			0.270	U				
Nickel			0.668	U				
Potassium			39.7	U				
Selenium			1.89	U				
Silver			0.122	U				
Sodium			38.7	J				
Strontium			0.613	U				
Thallium			0.129	U				
Tin			0.310	U				
Titanium			0.216	U				
Vanadium			0.948	U				
Zinc			6.50	U				



Form 4a Interference Check Sample

Client : Alpine Ocean Seismic Survey Inc.
Project Name : WILLIAMS (1794)
Instrument ID : ICPMSQ2

Lab Number : L1717026
Project Number : 1794
Concentration Units : ug/l

Analyte	True		Initial Found				Final Found			
	Lab ID : Analysis Date :		R974427-3 06/09/17 07:49				R974427-4 06/09/17 07:52			
	Sol. A	Sol. AB	Sol. A	%R	Sol. AB	%R	Sol. A	%R	Sol. AB	%R
Aluminum	20000	20000	21800	109	21700	108				
Antimony			0.398							
Arsenic		20	0.157		20.8	104				
Barium			2.91							
Beryllium			0.0118							
Cadmium		20	0.132		21.3	106				
Calcium	60000	60000	67300	112	66500	111				
Chromium		40	0.868		42.4	106				
Cobalt		40	0.713		41.5	104				
Copper		40	1.20		41.8	104				
Iron	50000	50000	54600	109	52900	106				
Lead			0.126							
Magnesium	20000	20000	21700	108	21100	106				
Manganese		40	0.844		43.1	108				
Molybdenum	400	400	434.	108	424.	106				
Nickel		40	1.13		41.8	104				
Potassium	20000	20000	22800	114	22900	114				
Selenium		20	0.152		20.9	104				
Silver		10	0.0916		10.0	100				
Sodium	50000	50000	54800	110	53300	107				
Strontium		40	1.01		43.6	109				
Thallium			0.0101							
Titanium	400	400	487.	122	477.	119				
Tin			0.385							
Vanadium		40	0.124		42.4	106				
Zinc		20	6.87		23.0	115				

Acceptance Criteria: Methods 200.7, 200.8, 6010, 6020

ICSA: 80-120%

ICSAB: 80-120%



Form 5a Matrix Spike

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : WILLIAMS (1794)
 Client Sample ID : VC89-D0-3E
 Lab Sample ID : L1717026-05
 Matrix Spike : WG1007570-3
 Matrix Spike Dup : WG1007570-4

Lab Number : L1717026
 Project Number : 1794
 Matrix : SOIL
 MS Analysis Date : 06/09/17 13:32
 MSD Analysis Date : 06/09/17 13:35

Parameter	Sample Conc. (mg/kg)	Matrix Spike Sample			Matrix Spike Duplicate			RPD	Recovery Limits	RPD Limit
		Spike Added (mg/kg)	Spike Conc. (mg/kg)	%R	Spike Added (mg/kg)	Spike Conc. (mg/kg)	%R			
Aluminum, Total	1590	198	2580	501 Q	200	2180	295 Q	17	75-125	20
Antimony, Total	ND	49.4	47.6	96	50	51.9	104	9	75-125	20
Arsenic, Total	4.62	11.8	16.6	101	12	16.5	99	1	75-125	20
Barium, Total	2.40J	198	208.	105	200	216.	108	4	75-125	20
Beryllium, Total	0.187J	4.94	5.25	106	5	5.42	108	3	75-125	20
Cadmium, Total	ND	5.04	5.37	106	5.1	5.70	112	6	75-125	20
Calcium, Total	747.	988	1770	104	1000	1840	109	4	75-125	20
Chromium, Total	7.80	19.8	32.5	125	20	29.6	109	9	75-125	20
Cobalt, Total	1.82	49.4	51.0	100	50	52.8	102	3	75-125	20
Copper, Total	3.00	24.7	28.5	103	25	28.9	104	1	75-125	20
Iron, Total	13000	98.8	15400	2430Q	100	12700	0 Q	19	75-125	20
Lead, Total	2.57	50.4	55.3	105	51	56.5	106	2	75-125	20
Magnesium, Total	880.	988	2020	115	1000	1840	96	9	75-125	20
Manganese, Total	24.9	49.4	79.1	110	50	77.9	106	2	75-125	20
Molybdenum, Total	1.06	98.8	93.7	94	100	99.4	98	6	75-125	20
Nickel, Total	2.24	49.4	53.7	104	50	54.5	104	1	75-125	20
Potassium, Total	350.	988	1480	114	1000	1450	110	2	75-125	20
Selenium, Total	1.86J	11.8	13.8	116	12	14.3	119	4	75-125	20
Silver, Total	ND	29.6	30.5	103	30	31.7	106	4	75-125	20
Sodium, Total	2180	988	3170	100	1000	3270	109	3	75-125	20
Strontium, Total	5.97	98.8	107.	102	100	111.	105	4	75-125	20
Thallium, Total	0.188J	11.8	11.5	97	12	12.1	101	5	75-125	20
Tin, Total	ND	98.8	101.	102	100	107.	107	6	75-125	20
Titanium, Total	65.5	98.8	164.	100	100	156.	90	5	75-125	20



Form 5a Matrix Spike

Client : Alpine Ocean Seismic Survey Inc.	Lab Number : L1717026
Project Name : WILLIAMS (1794)	Project Number : 1794
Client Sample ID : VC89-D0-3E	Matrix : SOIL
Lab Sample ID : L1717026-05	
Matrix Spike : L1717026-05	MS Analysis Date : 06/09/17 13:32
Matrix Spike Dup : WG1007570-4	MSD Analysis Date : 06/09/17 13:35

Parameter	Sample Conc. (mg/kg)	Matrix Spike Sample			Matrix Spike Duplicate			RPD	Recovery Limits	RPD Limit
		Spike Added (mg/kg)	Spike Conc. (mg/kg)	%R	Spike Added (mg/kg)	Spike Conc. (mg/kg)	%R			
Vanadium, Total	20.3	49.4	78.1	117	50	71.5	102	9	75-125	20
Zinc, Total	9.74J	49.4	62.7	127 Q	50	62.0	124	1	75-125	20



Form 5a Matrix Spike

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : WILLIAMS (1794)
 Client Sample ID : VC93-D0-3E
 Lab Sample ID : L1717026-23
 Matrix Spike : WG1007571-3
 Matrix Spike Dup : WG1007571-4

Lab Number : L1717026
 Project Number : 1794
 Matrix : SOIL
 MS Analysis Date : 06/09/17 15:15
 MSD Analysis Date : 06/09/17 15:18

Parameter	Sample Conc. (mg/kg)	Matrix Spike Sample			Matrix Spike Duplicate			RPD	Recovery Limits	RPD Limit
		Spike Added (mg/kg)	Spike Conc. (mg/kg)	%R	Spike Added (mg/kg)	Spike Conc. (mg/kg)	%R			
Aluminum, Total	928.	189	1630	371 Q	191	1750	430 Q	7	75-125	20
Antimony, Total	0.404J	47.2	48.4	102	47.8	49.5	104	2	75-125	20
Arsenic, Total	3.71	11.3	17.0	117	11.5	16.5	112	3	75-125	20
Barium, Total	2.36J	189	198.	105	191	204.	107	3	75-125	20
Beryllium, Total	0.148J	4.72	4.89	103	4.78	5.11	107	4	75-125	20
Cadmium, Total	0.108J	4.82	5.10	106	4.87	5.34	110	5	75-125	20
Calcium, Total	252.J	945	1640	174 Q	956	2960	310 Q	57 Q	75-125	20
Chromium, Total	7.70	18.9	26.0	97	19.1	27.6	104	6	75-125	20
Cobalt, Total	1.92	47.2	48.8	99	47.8	50.2	101	3	75-125	20
Copper, Total	12.9	23.6	36.5	100	23.9	37.1	101	2	75-125	20
Iron, Total	6890	94.5	7700	857 Q	95.6	8490	1670 Q	10	75-125	20
Lead, Total	11.9	48.2	58.9	98	48.7	62.4	104	6	75-125	20
Magnesium, Total	485.	945	1510	108	956	1480	104	2	75-125	20
Manganese, Total	31.3	47.2	79.5	102	47.8	88.3	119	10	75-125	20
Molybdenum, Total	0.701J	94.5	88.8	94	95.6	91.0	95	2	75-125	20
Nickel, Total	4.94	47.2	55.8	108	47.8	56.9	109	2	75-125	20
Potassium, Total	219.	945	1230	107	956	1280	111	4	75-125	20
Selenium, Total	0.948J	11.3	13.4	118	11.5	13.5	118	1	75-125	20
Silver, Total	0.138J	28.3	28.9	102	28.7	29.7	104	3	75-125	20
Sodium, Total	1840	945	2850	107	956	2830	104	1	75-125	20
Strontium, Total	4.11	94.5	99.2	101	95.6	106.	106	7	75-125	20
Thallium, Total	ND	11.3	10.8	95	11.5	11.4	99	5	75-125	20
Tin, Total	1.29J	94.5	98.2	104	95.6	101.	106	3	75-125	20
Titanium, Total	54.9	94.5	139.	89	95.6	145.	94	4	75-125	20



Form 5a Matrix Spike

Client : Alpine Ocean Seismic Survey Inc.	Lab Number : L1717026
Project Name : WILLIAMS (1794)	Project Number : 1794
Client Sample ID : VC93-D0-3E	Matrix : SOIL
Lab Sample ID : L1717026-23	
Matrix Spike : L1717026-23	MS Analysis Date : 06/09/17 15:15
Matrix Spike Dup : WG1007571-4	MSD Analysis Date : 06/09/17 15:18

Parameter	Sample Conc. (mg/kg)	Matrix Spike Sample		%R	Matrix Spike Duplicate		%R	RPD	Recovery Limits	RPD Limit
		Spike Added (mg/kg)	Spike Conc. (mg/kg)		Spike Added (mg/kg)	Spike Conc. (mg/kg)				
Vanadium, Total	12.3	47.2	61.1	103	47.8	63.4	107	4	75-125	20
Zinc, Total	42.9	47.2	95.6	112	47.8	94.3	108	1	75-125	20

Form 5b Post Digest Spike Recovery

Client	: Alpine Ocean Seismic Survey Inc.	Lab Number	: L1717026
Project Name	: WILLIAMS (1794)	Project Number	: 1794
Client Sample ID	: VC89-D0-3E	Matrix	: SOIL
Lab Sample ID	: L1717026-05		
Post Spike	: WG1007570-5	PS Analysis Date	: 06/09/17 13:38

Parameter	Sample Conc. (mg/kg)	Post Spike Sample		%R	Recovery Limits
		Spike Added (mg/kg)	Spike Conc. (mg/kg)		
Aluminum, Total	1590	24.9	1600	40	75-125
Iron, Total	13000	2490	15200	88	75-125
Zinc, Total	9.74J	24.9	34.0	136	75-125

Form 5b Post Digest Spike Recovery

Client	: Alpine Ocean Seismic Survey Inc.	Lab Number	: L1717026
Project Name	: WILLIAMS (1794)	Project Number	: 1794
Client Sample ID	: VC93-D0-3E	Matrix	: SOIL
Lab Sample ID	: L1717026-23		
Post Spike	: WG1007571-5	PS Analysis Date	: 06/09/17 15:21

Parameter	Sample Conc. (mg/kg)	Post Spike Sample		%R	Recovery Limits
		Spike Added (mg/kg)	Spike Conc. (mg/kg)		
Aluminum, Total	928	24.6	926.	0	75-125
Calcium, Total	252J	2460	2680	109	75-125
Iron, Total	6890	2460	8950	84	75-125

Form 7

Laboratory Control Sample

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : WILLIAMS (1794)
 Client Sample ID : NA
 Lab Sample ID : WG1007570-2
 Dup Sample ID :

Lab Number : L1717026
 Project Number : 1794
 Matrix : SOIL
 LCS Analysis Date : 06/09/17 13:26
 LCSD Analysis Date :

Parameter	Laboratory Control Sample			Laboratory Control Duplicate			RPD	Recovery Limits	RPD Limit
	True (mg/kg)	Found (mg/kg)	%R	True (mg/kg)	Found (mg/kg)	%R			
Aluminum, Total	8080	7110	88.					52-148	20
Antimony, Total	123.	138.	112.					1-200	20
Arsenic, Total	145.	150.	103.					80-121	20
Barium, Total	209.	210.	100.					84-117	20
Beryllium, Total	97.3	97.1	100.					83-117	20
Cadmium, Total	87.6	87.8	100.					83-117	20
Calcium, Total	5690	5930	104.					81-118	20
Chromium, Total	143.	143.	100.					80-119	20
Cobalt, Total	154.	156.	101.					84-115	20
Copper, Total	173.	179.	103.					82-117	20
Iron, Total	15000	16700	111.					47-154	20
Lead, Total	146.	144.	99.					82-118	20
Magnesium, Total	2640	2620	99.					77-123	20
Manganese, Total	309.	314.	102.					82-118	20
Molybdenum, Total	116.	114.	98.					79-121	20
Nickel, Total	129.	133.	103.					83-117	20
Potassium, Total	2400	2370	99.					72-128	20
Selenium, Total	178.	187.	105.					79-121	20
Silver, Total	31.3	33.0	105.					76-124	20
Sodium, Total	869.	923.	106.					73-126	20
Strontium, Total	105.	106.	101.					81-120	20
Thallium, Total	141.	140.	99.					80-121	20
Tin, Total	144.	147.	102.					77-122	20
Titanium, Total	316.	296.	94.					31-169	20
Vanadium, Total	115.	112.	97.					78-122	20
Zinc, Total	194.	193.	99.					82-118	20



Form 7

Laboratory Control Sample

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : WILLIAMS (1794)
 Client Sample ID : NA
 Lab Sample ID : WG1007571-2
 Dup Sample ID :

Lab Number : L1717026
 Project Number : 1794
 Matrix : SOIL
 LCS Analysis Date : 06/09/17 14:41
 LCSD Analysis Date :

Parameter	Laboratory Control Sample			Laboratory Control Duplicate			RPD	Recovery Limits	RPD Limit
	True (mg/kg)	Found (mg/kg)	%R	True (mg/kg)	Found (mg/kg)	%R			
Aluminum, Total	8080	6840	85.					52-148	20
Antimony, Total	123.	140.	114.					1-200	20
Arsenic, Total	145.	148.	102.					80-121	20
Barium, Total	209.	203.	97.					84-117	20
Beryllium, Total	97.3	96.9	100.					83-117	20
Cadmium, Total	87.6	93.5	107.					83-117	20
Calcium, Total	5690	5860	103.					81-118	20
Chromium, Total	143.	142.	99.					80-119	20
Cobalt, Total	154.	155.	101.					84-115	20
Copper, Total	173.	175.	101.					82-117	20
Iron, Total	15000	16400	109.					47-154	20
Lead, Total	146.	143.	98.					82-118	20
Magnesium, Total	2640	2500	95.					77-123	20
Manganese, Total	309.	314.	102.					82-118	20
Molybdenum, Total	116.	114.	98.					79-121	20
Nickel, Total	129.	130.	101.					83-117	20
Potassium, Total	2400	2280	95.					72-128	20
Selenium, Total	178.	185.	104.					79-121	20
Silver, Total	31.3	31.0	99.					76-124	20
Sodium, Total	869.	987.	114.					73-126	20
Strontium, Total	105.	99.8	95.					81-120	20
Thallium, Total	141.	141.	100.					80-121	20
Tin, Total	144.	141.	98.					77-122	20
Titanium, Total	316.	279.	88.					31-169	20
Vanadium, Total	115.	114.	99.					78-122	20
Zinc, Total	194.	194.	100.					82-118	20



Form 8 Serial Dilutions

Client : Alpine Ocean Seismic Survey Inc.
Project Name : WILLIAMS (1794)
Client Sample ID : VC89-D0-3E
Lab Sample ID : L1717026-05
Serial Dilution ID : WG1007570-6

Lab Number : L1717026
Project Number : 1794
Matrix : SOIL
Analysis Date : 06/09/17 13:29
Analysis Date : 06/09/17 13:41

Parameter	Initial Sample Result (mg/kg)	Serial Dilution Result (mg/kg)	% Difference	%D Limit
Iron, Total	13000	12900	1	10
Titanium, Total	65.5	67.0	2	10



Form 8 Serial Dilutions

Client	: Alpine Ocean Seismic Survey Inc.	Lab Number	: L1717026
Project Name	: WILLIAMS (1794)	Project Number	: 1794
Client Sample ID	: VC93-D0-3E	Matrix	: SOIL
Lab Sample ID	: L1717026-23	Analysis Date	: 06/09/17 15:03
Serial Dilution ID	: WG1007571-6	Analysis Date	: 06/09/17 15:06

Parameter	Initial Sample Result (mg/kg)	Serial Dilution Result (mg/kg)	% Difference	%D Limit
Titanium, Total	54.9	54.7	0	10

Form 12 Preparation Log

Client	: Alpine Ocean Seismic Survey Inc.	Lab Number	: L1717026
Project Name	: WILLIAMS (1794)	Project Number	: 1794
Matrix	: SOIL	Prep Method	: EPA 3050B

Sample Number	Preparation Date	Weight (gram)	Volume (mL)
L1717026-01	05/26/17 18:48	1.26	-
L1717026-02	05/26/17 18:48	1.29	-
L1717026-03	05/26/17 18:48	1.26	-
L1717026-04	05/26/17 18:48	1.30	-
L1717026-05	05/26/17 18:48	1.28	-
L1717026-06	05/26/17 18:48	1.25	-
L1717026-07	05/26/17 18:48	1.30	-
L1717026-08	05/26/17 18:48	1.31	-
L1717026-09	05/26/17 18:48	1.27	-
L1717026-10	05/26/17 18:48	1.25	-
L1717026-11	05/26/17 18:48	1.30	-
L1717026-12	05/26/17 18:48	1.30	-
L1717026-13	05/26/17 18:48	1.28	-
L1717026-14	05/26/17 18:48	1.28	-
L1717026-15	05/26/17 18:48	1.31	-
L1717026-16	05/26/17 18:48	1.27	-
L1717026-17	05/26/17 18:48	1.26	-
L1717026-18	05/26/17 18:48	1.31	-
L1717026-19	05/26/17 18:48	1.27	-
L1717026-20	05/26/17 18:48	1.28	-
WG1007570-1	05/26/17 18:48	1.25	-
WG1007570-2	05/26/17 18:48	0.39	-
WG1007570-3	05/26/17 18:48	1.29	-
WG1007570-4	05/26/17 18:48	1.28	-
WG1007570-5	05/26/17 18:48	1.28	-
WG1007570-6	05/26/17 18:48	1.28	-

Form 12 Preparation Log

Client	: Alpine Ocean Seismic Survey Inc.	Lab Number	: L1717026
Project Name	: WILLIAMS (1794)	Project Number	: 1794
Matrix	: SOIL	Prep Method	: EPA 3050B

Sample Number	Preparation Date	Weight (gram)	Volume (mL)
L1717026-21	05/26/17 18:48	1.27	-
L1717026-22	05/26/17 18:48	1.28	-
L1717026-23	05/26/17 18:48	1.26	-
L1717026-24	05/26/17 18:48	1.31	-
L1717026-25	05/26/17 18:48	1.31	-
L1717026-26	05/26/17 18:48	1.30	-
L1717026-27	05/26/17 18:48	1.25	-
WG1007571-1	05/26/17 18:48	1.25	-
WG1007571-2	05/26/17 18:48	0.39	-
WG1007571-3	05/26/17 18:48	1.31	-
WG1007571-4	05/26/17 18:48	1.30	-
WG1007571-5	05/26/17 18:48	1.26	-
WG1007571-6	05/26/17 18:48	1.26	-

Form 13

Analysis Run Log

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : WILLIAMS (1794)
 Instrument ID : ICPMSQ2
 Start Date : 06/09/17 06:45

Lab Number : L1717026
 Project Number : 1794
 Analysis Method : 1,6020A
 End Date : 06/09/17 15:46

Sample Number	Dilution Factor	Analysis Time	Aluminum, Total	Antimony, Total	Arsenic, Total	Barium, Total	Beryllium, Total	Cadmium, Total	Calcium, Total	Chromium, Total	Cobalt, Total	Copper, Total	Iron, Total	Lead, Total	Magnesium, Total	Manganese, Total	Molybdenum, Total	Nickel, Total	Potassium, Total	Selenium, Total	Silver, Total	Sodium, Total	Strontium, Total	Thallium, Total	Tin, Total	Titanium, Total	Vanadium, Total	Zinc, Total
R974427-13 TUNE		06:45:00																										
R974427-1 ICV	1	07:33:39	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
R974427-2 ICB	1	07:40:14	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
R974427-3 ICSA	1	07:49:43	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
R974427-4 ICSAB	1	07:52:53	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
R974427-5 CCV	1	08:07:38	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
R974427-6 CCB	1	08:10:48	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
R974427-7 CCV	1	08:47:17	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
R974427-8 CCB	1	08:50:26	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
R974427-9 CCV	1	09:25:39	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
R974427-10 CCB	1	09:28:48	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
R974427-11 CCV	1	10:02:58	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
R974427-12 CCB	1	10:06:07	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
R974427-14 CCV	1	10:42:43	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
R974427-15 CCB	1	10:45:53	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
R974427-16 CCV	1	11:24:36	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
R974427-17 CCB	1	11:27:46	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
R974427-18 CCV	1	11:55:49	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
R974427-19 CCB	1	11:58:59	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
R974427-20 CCV	1	12:35:52	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
R974427-21 CCB	1	12:39:02	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
R974427-22 CCV	1	13:12:32	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
R974427-23 CCB	1	13:15:42	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
WG1007570-1 BLANK	10	13:23:16	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
WG1007570-2 LCS	10	13:26:22	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
L1717026-05	10	13:29:28	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
WG1007570-3 MS	10	13:32:34	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	

Form 13 Analysis Run Log

Client : Alpine Ocean Seismic Survey Inc.
Project Name : WILLIAMS (1794)
Instrument ID : ICPMSQ2
Start Date : 06/09/17 06:45

Lab Number : L1717026
Project Number : 1794
Analysis Method : 1,6020A
End Date : 06/09/17 15:46

Sample Number	Dilution Factor	Analysis Time	Aluminum, Total	Antimony, Total	Arsenic, Total	Barium, Total	Beryllium, Total	Cadmium, Total	Calcium, Total	Chromium, Total	Cobalt, Total	Copper, Total	Iron, Total	Lead, Total	Magnesium, Total	Manganese, Total	Molybdenum, Total	Nickel, Total	Potassium, Total	Selenium, Total	Silver, Total	Sodium, Total	Strontium, Total	Thallium, Total	Tin, Total	Titanium, Total	Vanadium, Total	Zinc, Total
WG1007570-4 MSD	10	13:35:41	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
WG1007570-5 PS	10	13:38:47	X										X														X	
WG1007570-6 SERDIL	50	13:41:54											X												X			
L1717026-01	10	13:45:01	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
L1717026-02	10	13:48:08	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
L1717026-03	10	13:51:16	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
R974427-24 CCV	1	13:54:22	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
R974427-25 CCB	1	13:57:32	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
L1717026-04	10	14:00:42	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
L1717026-06	10	14:03:49	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
L1717026-07	10	14:06:55	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
L1717026-08	10	14:10:02	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
L1717026-09	10	14:13:08	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
L1717026-10	10	14:16:15	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
L1717026-11	10	14:19:21	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
L1717026-12	10	14:22:28	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
L1717026-13	10	14:25:35	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
L1717026-14	10	14:28:42	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
R974427-26 CCV	1	14:31:49	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
R974427-27 CCB	1	14:34:59	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
WG1007571-1 BLANK	10	14:38:09	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
WG1007571-2 LCS	10	14:41:15	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
L1717026-15	10	14:44:22	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
L1717026-16	10	14:47:30	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
L1717026-17	10	14:50:37	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
L1717026-18	10	14:53:44	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
L1717026-19	10	14:56:51	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Form 13 Analysis Run Log

Client : Alpine Ocean Seismic Survey Inc.
Project Name : WILLIAMS (1794)
Instrument ID : ICPMSQ2
Start Date : 06/09/17 06:45

Lab Number : L1717026
Project Number : 1794
Analysis Method : 1,6020A
End Date : 06/09/17 15:46

Sample Number	Dilution Factor	Analysis Time	Aluminum, Total	Antimony, Total	Arsenic, Total	Barium, Total	Beryllium, Total	Cadmium, Total	Calcium, Total	Chromium, Total	Cobalt, Total	Copper, Total	Iron, Total	Lead, Total	Magnesium, Total	Manganese, Total	Molybdenum, Total	Nickel, Total	Potassium, Total	Selenium, Total	Silver, Total	Sodium, Total	Strontium, Total	Thallium, Total	Tin, Total	Titanium, Total	Vanadium, Total	Zinc, Total
L1717026-20	10	14:59:58	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
L1717026-23	10	15:03:04	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
WG1007571-6 SERDIL	50	15:06:12																								X		
R974427-28 CCV	1	15:09:19	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
R974427-29 CCB	1	15:12:29	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
WG1007571-3 MS	10	15:15:39	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
WG1007571-4 MSD	10	15:18:46	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
WG1007571-5 PS	10	15:21:53	X					X				X																
L1717026-21	10	15:25:00	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
L1717026-22	10	15:28:07	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
L1717026-24	10	15:31:14	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
L1717026-25	10	15:34:21	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
L1717026-26	10	15:37:29	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
L1717026-27	10	15:40:36	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
R974427-30 CCV	1	15:43:43	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
R974427-31 CCB	1	15:46:53	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Form 14

ICP-MS Tune

Client : Alpine Ocean Seismic Survey Inc.
Project Name : WILLIAMS (1794)
Lab Sample ID : R974427-13
ICP-MS Instrument : iCAP Q

Lab Number : L1717026
Project Number : 1794
Analysis Date : 06/09/17 06:45

Mass Element	Avg Measured Mass (amu)	Avg. Peak Width at 10% Peak Height (amu)	%RSD
59 Co	58.9256	0.692	0.5
115 In	114.8965	0.712	1.3
7 Li	7.0019	0.709	1
238 U	238.0245	0.715	0.8



Form 15

ICP-MS Internal Standards Relative Intensity Summary

Client	: Alpine Ocean Seismic Survey Inc.	Lab Number	: L1717026
Project Name	: WILLIAMS (1794)	Project Number	: 1794
Instrument ID	: ICPMSQ2	Analysis Method	: 1,6020A
Start Date	: 06/09/17	End Date	: 06/09/17

Sample #	Time	Internal Standards %RI For:				
		Lithium	Scandium	Ge	In	Bismuth
R974427-1 ICV	07:33:39	97	102	101	102	105
R974427-2 ICB	07:40:14	97	101	102	100	107
R974427-3 ICSA	07:49:43	95	101	103	104	100
R974427-4 ICSAB	07:52:53	92	102	103	105	98
R974427-5 CCV	08:07:38	97	106	102	103	100
R974427-6 CCB	08:10:48	94	101	99	97	96
R974427-7 CCV	08:47:17	96	106	102	102	102
R974427-8 CCB	08:50:26	97	105	106	106	107
R974427-9 CCV	09:25:39	96	107	106	108	109
R974427-10 CCB	09:28:48	95	103	102	105	107
R974427-11 CCV	10:02:58	94	109	108	108	114
R974427-12 CCB	10:06:07	94	100	102	105	108
R974427-14 CCV	10:42:43	96	112	107	110	111
R974427-15 CCB	10:45:53	97	114	110	114	113
R974427-16 CCV	11:24:36	98	107	105	109	106
R974427-17 CCB	11:27:46	100	108	107	111	111
R974427-18 CCV	11:55:49	98	114	112	115	116
R974427-19 CCB	11:58:59	98	116	114	118	117
R974427-20 CCV	12:35:52	102	112	110	114	110
R974427-21 CCB	12:39:02	102	112	114	116	114
R974427-22 CCV	13:12:32	102	116	113	116	111
R974427-23 CCB	13:15:42	104	117	114	118	112
WG1007570-1 BLANK	13:23:16	104	115	113	116	111
WG1007570-2 LCS	13:26:22	101	118	112	116	112
L1717026-05	13:29:28	100	112	108	111	108
WG1007570-3 MS	13:32:34	99	115	111	114	110
WG1007570-4 MSD	13:35:41	98	113	111	113	108



Form 15

ICP-MS Internal Standards Relative Intensity Summary

Client	: Alpine Ocean Seismic Survey Inc.	Lab Number	: L1717026
Project Name	: WILLIAMS (1794)	Project Number	: 1794
Instrument ID	: ICPMSQ2	Analysis Method	: 1,6020A
Start Date	: 06/09/17	End Date	: 06/09/17

Sample #	Time	Internal Standards %RI For:				
		Lithium	Scandium	Ge	In	Bismuth
WG1007570-5 PS	13:38:47	99	113	111	112	104
WG1007570-6 SERDIL	13:41:54	102	117	114	116	107
L1717026-01	13:45:01	98	113	113	113	106
L1717026-02	13:48:08	100	113	109	111	106
L1717026-03	13:51:16	104	119	115	113	104
R974427-24 CCV	13:54:22	103	121	116	116	103
R974427-25 CCB	13:57:32	103	120	118	118	104
L1717026-04	14:00:42	104	119	112	112	101
L1717026-06	14:03:49	101	115	109	109	98
L1717026-07	14:06:55	103	119	112	110	99
L1717026-08	14:10:02	104	120	114	113	98
L1717026-09	14:13:08	103	119	113	110	96
L1717026-10	14:16:15	101	119	116	113	103
L1717026-11	14:19:21	101	118	114	112	97
L1717026-12	14:22:28	103	120	113	112	96
L1717026-13	14:25:35	103	118	112	111	95
L1717026-14	14:28:42	105	115	109	110	94
R974427-26 CCV	14:31:49	103	121	119	115	95
R974427-27 CCB	14:34:59	104	125	120	121	104
WG1007571-1 BLANK	14:38:09	103	117	114	113	97
WG1007571-2 LCS	14:41:15	102	117	114	114	98
L1717026-15	14:44:22	102	120	115	113	102
L1717026-16	14:47:30	101	120	113	114	99
L1717026-17	14:50:37	102	117	112	112	98
L1717026-18	14:53:44	100	114	111	111	95
L1717026-19	14:56:51	100	114	112	108	94
L1717026-20	14:59:58	101	118	111	112	98



Form 15

ICP-MS Internal Standards Relative Intensity Summary

Client	: Alpine Ocean Seismic Survey Inc.	Lab Number	: L1717026
Project Name	: WILLIAMS (1794)	Project Number	: 1794
Instrument ID	: ICPMSQ2	Analysis Method	: 1,6020A
Start Date	: 06/09/17	End Date	: 06/09/17

Sample #	Time	Internal Standards %RI For:				
		Lithium	Scandium	Ge	In	Bismuth
L1717026-23	15:03:04	102	115	111	111	101
WG1007571-6 SERDIL	15:06:12	101	117	113	114	98
R974427-28 CCV	15:09:19	103	119	114	115	97
R974427-29 CCB	15:12:29	102	114	114	113	98
WG1007571-3 MS	15:15:39	100	116	112	113	102
WG1007571-4 MSD	15:18:46	98	114	111	112	101
WG1007571-5 PS	15:21:53	98	116	111	115	103
L1717026-21	15:25:00	102	118	112	115	104
L1717026-22	15:28:07	100	118	113	115	102
L1717026-24	15:31:14	100	112	110	111	98
L1717026-25	15:34:21	100	116	112	114	101
L1717026-26	15:37:29	101	118	114	113	104
L1717026-27	15:40:36	101	116	112	115	103
R974427-30 CCV	15:43:43	102	116	110	114	100
R974427-31 CCB	15:46:53	100	115	114	116	102

Form 1

METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : WILLIAMS (1794)
 Lab ID : L1717026-01
 Client ID : VC88-D0-3E
 Sample Location : RARITAN BAY
 Sample Matrix : Sediment
 Analytical Method : 1,7474
 Lab File ID : WG1010166.pcl
 Sample Amount : 0.92g
 Digestion Method : EPA 7474

Lab Number : L1717026
 Project Number : 1794
 Date Collected : 05/19/17 17:07
 Date Received : 05/24/17
 Date Analyzed : 06/06/17 10:40
 Dilution Factor : 5
 Analyst : BV
 Instrument ID : MERCURYAF
 %Solids : 78
 Date Digested : 05/30/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7439-97-6	Mercury, Total	ND	0.017	0.002	U



Form 1

METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : WILLIAMS (1794)
 Lab ID : L1717026-02
 Client ID : VC88-D3-6E
 Sample Location : RARITAN BAY
 Sample Matrix : Sediment
 Analytical Method : 1,7474
 Lab File ID : WG1010166.pcl
 Sample Amount : 1.14g
 Digestion Method : EPA 7474

Lab Number : L1717026
 Project Number : 1794
 Date Collected : 05/19/17 17:07
 Date Received : 05/24/17
 Date Analyzed : 06/06/17 10:42
 Dilution Factor : 5
 Analyst : BV
 Instrument ID : MERCURYAF
 %Solids : 69
 Date Digested : 05/30/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7439-97-6	Mercury, Total	0.005	0.016	0.002	J



Form 1 METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : WILLIAMS (1794)
 Lab ID : L1717026-03
 Client ID : VC88-D6-9E
 Sample Location : RARITAN BAY
 Sample Matrix : Sediment
 Analytical Method : 1,7474
 Lab File ID : WG1010166.pcl
 Sample Amount : 1.06g
 Digestion Method : EPA 7474

Lab Number : L1717026
 Project Number : 1794
 Date Collected : 05/19/17 17:07
 Date Received : 05/24/17
 Date Analyzed : 06/06/17 10:45
 Dilution Factor : 5
 Analyst : BV
 Instrument ID : MERCURYAF
 %Solids : 54
 Date Digested : 05/30/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7439-97-6	Mercury, Total	0.015	0.022	0.003	J



Form 1

METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : WILLIAMS (1794)
 Lab ID : L1717026-04
 Client ID : VC88-D9-10E
 Sample Location : RARITAN BAY
 Sample Matrix : Sediment
 Analytical Method : 1,7474
 Lab File ID : WG1010166.pcl
 Sample Amount : 0.91g
 Digestion Method : EPA 7474

Lab Number : L1717026
 Project Number : 1794
 Date Collected : 05/19/17 17:07
 Date Received : 05/24/17
 Date Analyzed : 06/06/17 10:47
 Dilution Factor : 5
 Analyst : BV
 Instrument ID : MERCURYAF
 %Solids : 54
 Date Digested : 05/30/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7439-97-6	Mercury, Total	0.014	0.026	0.003	J



Form 1

METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : WILLIAMS (1794)
 Lab ID : L1717026-05
 Client ID : VC89-D0-3E
 Sample Location : RARITAN BAY
 Sample Matrix : Sediment
 Analytical Method : 1,7474
 Lab File ID : WG1010166.pcl
 Sample Amount : 0.92g
 Digestion Method : EPA 7474

Lab Number : L1717026
 Project Number : 1794
 Date Collected : 05/19/17 16:15
 Date Received : 05/24/17
 Date Analyzed : 06/06/17 10:27
 Dilution Factor : 5
 Analyst : BV
 Instrument ID : MERCURYAF
 %Solids : 78
 Date Digested : 05/30/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7439-97-6	Mercury, Total	ND	0.017	0.002	U



Form 1

METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : WILLIAMS (1794)
 Lab ID : L1717026-06
 Client ID : VC89-D3-6E
 Sample Location : RARITAN BAY
 Sample Matrix : Sediment
 Analytical Method : 1,7474
 Lab File ID : WG1010166.pcl
 Sample Amount : 1.026g
 Digestion Method : EPA 7474

Lab Number : L1717026
 Project Number : 1794
 Date Collected : 05/19/17 16:15
 Date Received : 05/24/17
 Date Analyzed : 06/06/17 10:50
 Dilution Factor : 5
 Analyst : BV
 Instrument ID : MERCURYAF
 %Solids : 64
 Date Digested : 05/30/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7439-97-6	Mercury, Total	0.010	0.019	0.002	J



Form 1

METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : WILLIAMS (1794)
 Lab ID : L1717026-07
 Client ID : VC89-D6-9E
 Sample Location : RARITAN BAY
 Sample Matrix : Sediment
 Analytical Method : 1,7474
 Lab File ID : WG1010166.pcl
 Sample Amount : 0.878g
 Digestion Method : EPA 7474

Lab Number : L1717026
 Project Number : 1794
 Date Collected : 05/19/17 16:15
 Date Received : 05/24/17
 Date Analyzed : 06/06/17 10:52
 Dilution Factor : 5
 Analyst : BV
 Instrument ID : MERCURYAF
 %Solids : 57
 Date Digested : 05/30/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7439-97-6	Mercury, Total	0.013	0.025	0.003	J



Form 1

METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : WILLIAMS (1794)
 Lab ID : L1717026-08
 Client ID : VC89-D9-10E
 Sample Location : RARITAN BAY
 Sample Matrix : Sediment
 Analytical Method : 1,7474
 Lab File ID : WG1010166.pcl
 Sample Amount : 0.959g
 Digestion Method : EPA 7474

Lab Number : L1717026
 Project Number : 1794
 Date Collected : 05/19/17 16:15
 Date Received : 05/24/17
 Date Analyzed : 06/06/17 10:55
 Dilution Factor : 5
 Analyst : BV
 Instrument ID : MERCURYAF
 %Solids : 52
 Date Digested : 05/30/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7439-97-6	Mercury, Total	0.013	0.025	0.003	J



Form 1

METALS

Client : Alpine Ocean Seismic Survey Inc.
Project Name : WILLIAMS (1794)
Lab ID : L1717026-09
Client ID : DUP-D9-10E
Sample Location : RARITAN BAY
Sample Matrix : Sediment
Analytical Method : 1,7474
Lab File ID : WG1010166.pcl
Sample Amount : 0.894g
Digestion Method : EPA 7474

Lab Number : L1717026
Project Number : 1794
Date Collected : 05/19/17 17:07
Date Received : 05/24/17
Date Analyzed : 06/06/17 10:57
Dilution Factor : 5
Analyst : BV
Instrument ID : MERCURYAF
%Solids : 54
Date Digested : 05/30/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7439-97-6	Mercury, Total	0.012	0.026	0.003	J



Form 1

METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : WILLIAMS (1794)
 Lab ID : L1717026-10
 Client ID : DUP-D0-3E
 Sample Location : RARITAN BAY
 Sample Matrix : Sediment
 Analytical Method : 1,7474
 Lab File ID : WG1010166.pcl
 Sample Amount : 1.088g
 Digestion Method : EPA 7474

Lab Number : L1717026
 Project Number : 1794
 Date Collected : 05/19/17 16:15
 Date Received : 05/24/17
 Date Analyzed : 06/06/17 11:00
 Dilution Factor : 5
 Analyst : BV
 Instrument ID : MERCURYAF
 %Solids : 82
 Date Digested : 05/30/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7439-97-6	Mercury, Total	ND	0.014	0.002	U



Form 1

METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : WILLIAMS (1794)
 Lab ID : L1717026-11
 Client ID : VC90-D0-3E
 Sample Location : RARITAN BAY
 Sample Matrix : Sediment
 Analytical Method : 1,7474
 Lab File ID : WG1010166.pcl
 Sample Amount : 1.184g
 Digestion Method : EPA 7474

Lab Number : L1717026
 Project Number : 1794
 Date Collected : 05/19/17 15:42
 Date Received : 05/24/17
 Date Analyzed : 06/06/17 11:02
 Dilution Factor : 5
 Analyst : BV
 Instrument ID : MERCURYAF
 %Solids : 81
 Date Digested : 05/30/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7439-97-6	Mercury, Total	0.002	0.013	0.002	J



Form 1

METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : WILLIAMS (1794)
 Lab ID : L1717026-12
 Client ID : VC90-D3-6E
 Sample Location : RARITAN BAY
 Sample Matrix : Sediment
 Analytical Method : 1,7474
 Lab File ID : WG1010166.pcl
 Sample Amount : 0.915g
 Digestion Method : EPA 7474

Lab Number : L1717026
 Project Number : 1794
 Date Collected : 05/19/17 15:42
 Date Received : 05/24/17
 Date Analyzed : 06/06/17 11:11
 Dilution Factor : 5
 Analyst : BV
 Instrument ID : MERCURYAF
 %Solids : 70
 Date Digested : 05/30/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7439-97-6	Mercury, Total	0.007	0.020	0.003	J



Form 1 METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : WILLIAMS (1794)
 Lab ID : L1717026-13
 Client ID : VC90-D6-9E
 Sample Location : RARITAN BAY
 Sample Matrix : Sediment
 Analytical Method : 1,7474
 Lab File ID : WG1010166.pcl
 Sample Amount : 0.997g
 Digestion Method : EPA 7474

Lab Number : L1717026
 Project Number : 1794
 Date Collected : 05/19/17 15:42
 Date Received : 05/24/17
 Date Analyzed : 06/06/17 11:13
 Dilution Factor : 5
 Analyst : BV
 Instrument ID : MERCURYAF
 %Solids : 56
 Date Digested : 05/30/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7439-97-6	Mercury, Total	0.013	0.023	0.003	J



Form 1

METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : WILLIAMS (1794)
 Lab ID : L1717026-14
 Client ID : VC90-D9-10E
 Sample Location : RARITAN BAY
 Sample Matrix : Sediment
 Analytical Method : 1,7474
 Lab File ID : WG1010166.pcl
 Sample Amount : 0.898g
 Digestion Method : EPA 7474

Lab Number : L1717026
 Project Number : 1794
 Date Collected : 05/19/17 15:42
 Date Received : 05/24/17
 Date Analyzed : 06/06/17 11:16
 Dilution Factor : 5
 Analyst : BV
 Instrument ID : MERCURYAF
 %Solids : 54
 Date Digested : 05/30/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7439-97-6	Mercury, Total	0.015	0.026	0.003	J



Form 1

METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : WILLIAMS (1794)
 Lab ID : L1717026-15
 Client ID : VC91-D0-3E
 Sample Location : RARITAN BAY
 Sample Matrix : Sediment
 Analytical Method : 1,7474
 Lab File ID : WG1010166.pcl
 Sample Amount : 0.97g
 Digestion Method : EPA 7474

Lab Number : L1717026
 Project Number : 1794
 Date Collected : 05/19/17 15:10
 Date Received : 05/24/17
 Date Analyzed : 06/06/17 11:18
 Dilution Factor : 5
 Analyst : BV
 Instrument ID : MERCURYAF
 %Solids : 84
 Date Digested : 05/30/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7439-97-6	Mercury, Total	ND	0.015	0.002	U



Form 1

METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : WILLIAMS (1794)
 Lab ID : L1717026-16
 Client ID : VC91-D3-6E
 Sample Location : RARITAN BAY
 Sample Matrix : Sediment
 Analytical Method : 1,7474
 Lab File ID : WG1010166.pcl
 Sample Amount : 1.15g
 Digestion Method : EPA 7474

Lab Number : L1717026
 Project Number : 1794
 Date Collected : 05/19/17 15:10
 Date Received : 05/24/17
 Date Analyzed : 06/06/17 11:21
 Dilution Factor : 5
 Analyst : BV
 Instrument ID : MERCURYAF
 %Solids : 62
 Date Digested : 05/30/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7439-97-6	Mercury, Total	0.011	0.018	0.002	J



Form 1

METALS

Client : Alpine Ocean Seismic Survey Inc.
Project Name : WILLIAMS (1794)
Lab ID : L1717026-17
Client ID : VC91-D6-9.6E
Sample Location : RARITAN BAY
Sample Matrix : Sediment
Analytical Method : 1,7474
Lab File ID : WG1010166.pcl
Sample Amount : 1.134g
Digestion Method : EPA 7474

Lab Number : L1717026
Project Number : 1794
Date Collected : 05/19/17 15:10
Date Received : 05/24/17
Date Analyzed : 06/06/17 11:23
Dilution Factor : 5
Analyst : BV
Instrument ID : MERCURYAF
%Solids : 57
Date Digested : 05/30/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7439-97-6	Mercury, Total	0.013	0.019	0.002	J



Form 1

METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : WILLIAMS (1794)
 Lab ID : L1717026-18
 Client ID : DUP-D6-9E
 Sample Location : RARITAN BAY
 Sample Matrix : Sediment
 Analytical Method : 1,7474
 Lab File ID : WG1010166.pcl
 Sample Amount : 0.942g
 Digestion Method : EPA 7474

Lab Number : L1717026
 Project Number : 1794
 Date Collected : 05/19/17 15:42
 Date Received : 05/24/17
 Date Analyzed : 06/06/17 11:26
 Dilution Factor : 5
 Analyst : BV
 Instrument ID : MERCURYAF
 %Solids : 55
 Date Digested : 05/30/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7439-97-6	Mercury, Total	0.013	0.024	0.003	J



Form 1

METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : WILLIAMS (1794)
 Lab ID : L1717026-19
 Client ID : VC92-D0-3E
 Sample Location : RARITAN BAY
 Sample Matrix : Sediment
 Analytical Method : 1,7474
 Lab File ID : WG1010166.pcl
 Sample Amount : 0.997g
 Digestion Method : EPA 7474

Lab Number : L1717026
 Project Number : 1794
 Date Collected : 05/19/17 14:38
 Date Received : 05/24/17
 Date Analyzed : 06/06/17 11:28
 Dilution Factor : 5
 Analyst : BV
 Instrument ID : MERCURYAF
 %Solids : 75
 Date Digested : 05/30/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7439-97-6	Mercury, Total	ND	0.017	0.002	U



Form 1

METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : WILLIAMS (1794)
 Lab ID : WG1008096-1
 Client ID : WG1008096-1BLANK
 Sample Location :
 Sample Matrix : SOIL
 Analytical Method : 1,7474
 Lab File ID : WG1010166.pcl
 Sample Amount : 1g
 Digestion Method : EPA 7474

Lab Number : L1717026
 Project Number : 1794
 Date Collected : NA
 Date Received : NA
 Date Analyzed : 06/06/17 10:22
 Dilution Factor : 5
 Analyst : BV
 Instrument ID : MERCURYAF
 %Solids : NA
 Date Digested : 05/30/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7439-97-6	Mercury, Total	ND	0.013	0.002	U



Form 2A

Initial and Continuing Calibration Verification

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : WILLIAMS (1794)
 Instrument ID : MERCURYAF

Lab Number : L1717026
 Project Number : 1794
 Units : mg/l

Parameter	Initial Calibration			Continuing Calibration(s)							
	Lab ID	Date Analyzed		Lab ID	Date Analyzed						
	R973255-7	06/06/17 10:03		R973255-9	06/06/17 10:34		R973255-11	06/06/17 11:05		R973255-13	06/06/17 11:30
	True	Found	%R	True	Found	%R	Found	%R	Found	%R	
Mercury	0.0025	0.0024	96.	0.0025	0.0025	99.	0.0023	93.	0.0023	93.	

Acceptance Criteria:

ICV: 95-105% (Methods 200.7, 245.1)
 90-110% (Methods 200.8, 6010, 6020, 7470, 7471, 7474)
 85-115% (Method 1631)

CCV: 90-110% (Methods 200.7, 245.1, 6010, 6020, 7474)
 85-115% (Methods 200.8, 1631)
 80-120% (Methods 7470, 7471)



Form 3 Blanks

Client	: Alpine Ocean Seismic Survey Inc.	Lab Number	: L1717026
Project Name	: WILLIAMS (1794)	Project Number	: 1794
Instrument ID	: MERCURYAF		

	Initial Calibration		Continuing Calibration				Preparation	
	Blank		Blank(s)				Blank	
Lab ID	: R973255-8		R973255-10	R973255-12	R973255-14		WG1008096-1	
Date Analyzed	: 06/06/17 10:05		06/06/17 10:37	06/06/17 11:08	06/06/17 11:35		06/06/17 10:22	
Parameter	mg/l	Q	mg/l	Q	mg/l	Q	mg/kg	Q
Mercury	0.00000640 U		0.00000640 U	0.00000640 U	0.00000640 U		0.002	U



Form 5a Matrix Spike

Client : Alpine Ocean Seismic Survey Inc.	Lab Number : L1717026
Project Name : WILLIAMS (1794)	Project Number : 1794
Client Sample ID : VC89-D0-3E	Matrix : SOIL
Lab Sample ID : L1717026-05	
Matrix Spike : WG1008096-3	MS Analysis Date : 06/06/17 10:29
Matrix Spike Dup : WG1008096-4	MSD Analysis Date : 06/06/17 10:32

Parameter	Sample Conc. (mg/kg)	Matrix Spike Sample			Matrix Spike Duplicate			RPD	Recovery Limits	RPD Limit
		Spike Added (mg/kg)	Spike Conc. (mg/kg)	%R	Spike Added (mg/kg)	Spike Conc. (mg/kg)	%R			
Mercury, Total	ND	0.864	0.880	102	0.753	0.754	100	15	80-120	20



Form 7

Laboratory Control Sample

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : WILLIAMS (1794)
 Client Sample ID : NA
 Lab Sample ID : WG1008096-2
 Dup Sample ID :

Lab Number : L1717026
 Project Number : 1794
 Matrix : SOIL
 LCS Analysis Date : 06/06/17 10:24
 LCSD Analysis Date :

Parameter	Laboratory Control Sample			Laboratory Control Duplicate			RPD	Recovery Limits	RPD Limit
	True (mg/kg)	Found (mg/kg)	%R	True (mg/kg)	Found (mg/kg)	%R			
Mercury, Total	12.3	9.70	79.					72-128	20



Form 12

Preparation Log

Client	: Alpine Ocean Seismic Survey Inc.	Lab Number	: L1717026
Project Name	: WILLIAMS (1794)	Project Number	: 1794
Matrix	: SOIL	Prep Method	: EPA 7474

Sample Number	Preparation Date	Weight (gram)	Volume (mL)
L1717026-01	05/30/17 13:50	0.92	-
L1717026-02	05/30/17 13:50	1.14	-
L1717026-03	05/30/17 13:50	1.06	-
L1717026-04	05/30/17 13:50	0.91	-
L1717026-05	05/30/17 13:50	0.92	-
L1717026-06	05/30/17 13:50	1.03	-
L1717026-07	05/30/17 13:50	0.88	-
L1717026-08	05/30/17 13:50	0.96	-
L1717026-09	05/30/17 13:50	0.89	-
L1717026-10	05/30/17 13:50	1.09	-
L1717026-11	05/30/17 13:50	1.18	-
L1717026-12	05/30/17 13:50	0.92	-
L1717026-13	05/30/17 13:50	1.00	-
L1717026-14	05/30/17 13:50	0.90	-
L1717026-15	05/30/17 13:50	0.97	-
L1717026-16	05/30/17 13:50	1.15	-
L1717026-17	05/30/17 13:50	1.13	-
L1717026-18	05/30/17 13:50	0.94	-
L1717026-19	05/30/17 13:50	1.00	-
WG1008096-1	05/30/17 13:50	1.00	-
WG1008096-2	05/30/17 13:50	0.16	-
WG1008096-3	05/30/17 13:50	0.92	-
WG1008096-4	05/30/17 13:50	1.06	-



Form 13

Analysis Run Log

Client : Alpine Ocean Seismic Survey Inc.
Project Name : WILLIAMS (1794)
Instrument ID : MERCURYAF
Start Date : 06/06/17 09:48

Lab Number : L1717026
Project Number : 1794
Analysis Method : 1,7474
End Date : 06/06/17 11:35

[illegible]

Form 13

Analysis Run Log

Client : Alpine Ocean Seismic Survey Inc.
Project Name : WILLIAMS (1794)
Instrument ID : MERCURYAF
Start Date : 06/06/17 09:48

Lab Number : L1717026
Project Number : 1794
Analysis Method : 1,7474
End Date : 06/06/17 11:35

[illegible]

Form 1

METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : WILLIAMS (1794)
 Lab ID : L1717026-20
 Client ID : VC92-D3-6E
 Sample Location : RARITAN BAY
 Sample Matrix : Sediment
 Analytical Method : 1,7474
 Lab File ID : WG1010776.pcl
 Sample Amount : 0.94g
 Digestion Method : EPA 7474

Lab Number : L1717026
 Project Number : 1794
 Date Collected : 05/19/17 14:38
 Date Received : 05/24/17
 Date Analyzed : 06/07/17 15:54
 Dilution Factor : 5
 Analyst : LC
 Instrument ID : MERCURYAF
 %Solids : 78
 Date Digested : 06/02/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7439-97-6	Mercury, Total	ND	0.017	0.002	U



Form 1

METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : WILLIAMS (1794)
 Lab ID : L1717026-21
 Client ID : VC92-D6-9E
 Sample Location : RARITAN BAY
 Sample Matrix : Sediment
 Analytical Method : 1,7474
 Lab File ID : WG1010776.pcl
 Sample Amount : 0.98g
 Digestion Method : EPA 7474

Lab Number : L1717026
 Project Number : 1794
 Date Collected : 05/19/17 14:38
 Date Received : 05/24/17
 Date Analyzed : 06/07/17 15:56
 Dilution Factor : 5
 Analyst : LC
 Instrument ID : MERCURYAF
 %Solids : 73
 Date Digested : 06/02/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7439-97-6	Mercury, Total	ND	0.017	0.002	U



Form 1

METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : WILLIAMS (1794)
 Lab ID : L1717026-22
 Client ID : VC92-D9-10E
 Sample Location : RARITAN BAY
 Sample Matrix : Sediment
 Analytical Method : 1,7474
 Lab File ID : WG1010776.pcl
 Sample Amount : 0.88g
 Digestion Method : EPA 7474

Lab Number : L1717026
 Project Number : 1794
 Date Collected : 05/19/17 14:38
 Date Received : 05/24/17
 Date Analyzed : 06/07/17 15:59
 Dilution Factor : 5
 Analyst : LC
 Instrument ID : MERCURYAF
 %Solids : 75
 Date Digested : 06/02/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7439-97-6	Mercury, Total	ND	0.019	0.002	U



Form 1

METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : WILLIAMS (1794)
 Lab ID : L1717026-23
 Client ID : VC93-D0-3E
 Sample Location : RARITAN BAY
 Sample Matrix : Sediment
 Analytical Method : 1,7474
 Lab File ID : WG1010776.pcl
 Sample Amount : 0.85g
 Digestion Method : EPA 7474

Lab Number : L1717026
 Project Number : 1794
 Date Collected : 05/20/17 13:58
 Date Received : 05/24/17
 Date Analyzed : 06/07/17 16:01
 Dilution Factor : 5
 Analyst : LC
 Instrument ID : MERCURYAF
 %Solids : 81
 Date Digested : 06/02/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7439-97-6	Mercury, Total	ND	0.018	0.002	U



Form 1

METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : WILLIAMS (1794)
 Lab ID : L1717026-24
 Client ID : VC93-D3-6E
 Sample Location : RARITAN BAY
 Sample Matrix : Sediment
 Analytical Method : 1,7474
 Lab File ID : WG1010776.pcl
 Sample Amount : 0.86g
 Digestion Method : EPA 7474

Lab Number : L1717026
 Project Number : 1794
 Date Collected : 05/20/17 13:58
 Date Received : 05/24/17
 Date Analyzed : 06/07/17 16:09
 Dilution Factor : 5
 Analyst : LC
 Instrument ID : MERCURYAF
 %Solids : 82
 Date Digested : 06/02/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7439-97-6	Mercury, Total	ND	0.018	0.002	U



Form 1

METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : WILLIAMS (1794)
 Lab ID : L1717026-25
 Client ID : VC93-D6-9E
 Sample Location : RARITAN BAY
 Sample Matrix : Sediment
 Analytical Method : 1,7474
 Lab File ID : WG1010776.pcl
 Sample Amount : 0.91g
 Digestion Method : EPA 7474

Lab Number : L1717026
 Project Number : 1794
 Date Collected : 05/20/17 13:58
 Date Received : 05/24/17
 Date Analyzed : 06/07/17 16:11
 Dilution Factor : 5
 Analyst : LC
 Instrument ID : MERCURYAF
 %Solids : 77
 Date Digested : 06/02/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7439-97-6	Mercury, Total	ND	0.018	0.002	U



Form 1

METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : WILLIAMS (1794)
 Lab ID : L1717026-26
 Client ID : VC93-D9-10E
 Sample Location : RARITAN BAY
 Sample Matrix : Sediment
 Analytical Method : 1,7474
 Lab File ID : WG1010776.pcl
 Sample Amount : 0.91g
 Digestion Method : EPA 7474

Lab Number : L1717026
 Project Number : 1794
 Date Collected : 05/20/17 13:58
 Date Received : 05/24/17
 Date Analyzed : 06/07/17 16:19
 Dilution Factor : 5
 Analyst : LC
 Instrument ID : MERCURYAF
 %Solids : 78
 Date Digested : 06/02/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7439-97-6	Mercury, Total	ND	0.018	0.002	U



Form 1

METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : WILLIAMS (1794)
 Lab ID : L1717026-27
 Client ID : DUP-D3-6E
 Sample Location : RARITAN BAY
 Sample Matrix : Sediment
 Analytical Method : 1,7474
 Lab File ID : WG1010776.pcl
 Sample Amount : 1.15g
 Digestion Method : EPA 7474

Lab Number : L1717026
 Project Number : 1794
 Date Collected : 05/19/17 14:38
 Date Received : 05/24/17
 Date Analyzed : 06/07/17 16:21
 Dilution Factor : 5
 Analyst : LC
 Instrument ID : MERCURYAF
 %Solids : 79
 Date Digested : 06/02/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7439-97-6	Mercury, Total	ND	0.014	0.002	U



Form 1 METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : WILLIAMS (1794)
 Lab ID : WG1009290-1
 Client ID : WG1009290-1BLANK
 Sample Location :
 Sample Matrix : SOIL
 Analytical Method : 1,7474
 Lab File ID : WG1010776.pcl
 Sample Amount : 1g
 Digestion Method : EPA 7474

Lab Number : L1717026
 Project Number : 1794
 Date Collected : NA
 Date Received : NA
 Date Analyzed : 06/07/17 15:49
 Dilution Factor : 5
 Analyst : LC
 Instrument ID : MERCURYAF
 %Solids : NA
 Date Digested : 06/02/17

CAS NO.	Parameter	mg/kg			Qualifier
		Results	RL	MDL	
7439-97-6	Mercury, Total	ND	0.013	0.002	U



Form 2A

Initial and Continuing Calibration Verification

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : WILLIAMS (1794)
 Instrument ID : MERCURYAF

Lab Number : L1717026
 Project Number : 1794
 Units : mg/l

Parameter	Initial Calibration			Continuing Calibration(s)							
	Lab ID	: R973984-7			R973984-9			R973984-11		R973984-13	
	Date Analyzed	: 06/07/17 14:46			06/07/17 15:04			06/07/17 15:44		06/07/17 16:14	
	True	Found	%R	True	Found	%R	Found	%R	Found	%R	
Mercury	0.0025	0.0025	102.	0.0025	0.0025	98.	0.0024	97.	0.0025	98.	

Acceptance Criteria:

ICV: 95-105% (Methods 200.7, 245.1)
 90-110% (Methods 200.8, 6010, 6020, 7470, 7471, 7474)
 85-115% (Method 1631)

CCV: 90-110% (Methods 200.7, 245.1, 6010, 6020, 7474)
 85-115% (Methods 200.8, 1631)
 80-120% (Methods 7470, 7471)



Form 2A

Initial and Continuing Calibration Verification

Client	: Alpine Ocean Seismic Survey Inc.	Lab Number	: L1717026
Project Name	: WILLIAMS (1794)	Project Number	: 1794
Instrument ID	: MERCURYAF	Units	: mg/l

	Initial Calibration			Continuing Calibration(s)							
	Lab ID :				R973984-15						
	Date Analyzed :				06/07/17 16:24						
Parameter		True	Found	%R	True	Found	%R	Found	%R	Found	%R
Mercury					0.0025	0.0024	97.				

Acceptance Criteria:

ICV:	95-105%	(Methods 200.7, 245.1)
	90-110%	(Methods 200.8, 6010, 6020, 7470, 7471, 7474)
	85-115%	(Method 1631)
CCV:	90-110%	(Methods 200.7, 245.1, 6010, 6020, 7474)
	85-115%	(Methods 200.8, 1631)
	80-120%	(Methods 7470, 7471)



Form 3 Blanks

Client	: Alpine Ocean Seismic Survey Inc.	Lab Number	: L1717026
Project Name	: WILLIAMS (1794)	Project Number	: 1794
Instrument ID	: MERCURYAF		

	Initial Calibration Blank		Continuing Calibration Blank(s)				Preparation Blank	
Lab ID	: R973984-8		R973984-10	R973984-12	R973984-14		WG1009290-1	
Date Analyzed	: 06/07/17 14:49		06/07/17 15:06	06/07/17 15:46	06/07/17 16:16		06/07/17 15:49	
Parameter	mg/l	Q	mg/l	Q	mg/l	Q	mg/kg	Q
Mercury	0.00000640	U	0.00000640	U	0.00000640	U	0.002	U

Form 3 Blanks

Client	: Alpine Ocean Seismic Survey Inc.	Lab Number	: L1717026
Project Name	: WILLIAMS (1794)	Project Number	: 1794
Instrument ID	: MERCURYAF		

Parameter	Initial Calibration		Continuing Calibration				Preparation	
	Blank		Blank(s)				Blank	
Lab ID :			R973984-16					
Date Analyzed :			06/07/17 16:26					
	mg/l	Q	mg/l	Q	mg/l	Q	mg/l	Q
Mercury			0.00000640 U					

Form 5a Matrix Spike

Client : Alpine Ocean Seismic Survey Inc.	Lab Number : L1717026
Project Name : WILLIAMS (1794)	Project Number : 1794
Client Sample ID : VC93-D0-3E	Matrix : SOIL
Lab Sample ID : L1717026-23	
Matrix Spike : WG1009290-3	MS Analysis Date : 06/07/17 16:04
Matrix Spike Dup : WG1009290-4	MSD Analysis Date : 06/07/17 16:06

Parameter	Sample Conc. (mg/kg)	Matrix Spike Sample			Matrix Spike Duplicate			RPD	Recovery Limits	RPD Limit
		Spike Added (mg/kg)	Spike Conc. (mg/kg)	%R	Spike Added (mg/kg)	Spike Conc. (mg/kg)	%R			
Mercury, Total	ND	0.934	0.954	102	0.891	0.796	89	18	80-120	20

Form 7

Laboratory Control Sample

Client : Alpine Ocean Seismic Survey Inc. Lab Number : L1717026
 Project Name : WILLIAMS (1794) Project Number : 1794
 Client Sample ID : NA Matrix : SOIL
 Lab Sample ID : WG1009290-2 LCS Analysis Date : 06/07/17 15:51
 Dup Sample ID : LCSD Analysis Date:

Parameter	Laboratory Control Sample			Laboratory Control Duplicate			RPD	Recovery Limits	RPD Limit
	True (mg/kg)	Found (mg/kg)	%R	True (mg/kg)	Found (mg/kg)	%R			
Mercury, Total	12.3	10.2	83.					72-128	20



Form 12

Preparation Log

Client : Alpine Ocean Seismic Survey Inc. Lab Number : L1717026
Project Name : WILLIAMS (1794) Project Number : 1794
Matrix : SOIL Prep Method : EPA 7474

Sample Number	Preparation Date	Weight (gram)	Volume (mL)
L1717026-20	06/02/17 11:40	0.94	-
L1717026-21	06/02/17 11:40	0.98	-
L1717026-22	06/02/17 11:40	0.88	-
L1717026-23	06/02/17 11:40	0.85	-
L1717026-24	06/02/17 11:40	0.86	-
L1717026-25	06/02/17 11:40	0.91	-
L1717026-26	06/02/17 11:40	0.91	-
L1717026-27	06/02/17 11:40	1.15	-
WG1009290-1	06/02/17 11:40	1.00	-
WG1009290-2	06/02/17 11:40	0.16	-
WG1009290-3	06/02/17 11:40	0.83	-
WG1009290-4	06/02/17 11:40	0.87	-

Form 13

Analysis Run Log

Client : Alpine Ocean Seismic Survey Inc.
Project Name : WILLIAMS (1794)
Instrument ID : MERCURYAF
Start Date : 06/07/17 14:31

Lab Number : L1717026
Project Number : 1794
Analysis Method : 1,7474
End Date : 06/07/17 16:26

[illegible]

Form 1

METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : WILLIAMS (1794)
 Lab ID : L1717026-28
 Client ID : RINSE2
 Sample Location : RARITAN BAY
 Sample Matrix : WATER
 Analytical Method : 1,7474
 Lab File ID : WG1012106.pcl
 Sample Amount : 50ml
 Digestion Method : EPA 7474

Lab Number : L1717026
 Project Number : 1794
 Date Collected : 05/24/17 12:00
 Date Received : 05/24/17
 Date Analyzed : 06/12/17 09:01
 Dilution Factor : 1
 Analyst : LC
 Instrument ID : MERCURYAF
 %Solids : N/A
 Date Digested : 06/09/17

CAS NO.	Parameter	mg/l			Qualifier
		Results	RL	MDL	
7439-97-6	Mercury, Total	0.00002	0.00005	0.00001	J



Form 1

METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : WILLIAMS (1794)
 Lab ID : L1717026-29
 Client ID : RINSE1
 Sample Location : RARITAN BAY
 Sample Matrix : WATER
 Analytical Method : 1,7474
 Lab File ID : WG1012106.pcl
 Sample Amount : 50ml
 Digestion Method : EPA 7474

Lab Number : L1717026
 Project Number : 1794
 Date Collected : 05/19/17 18:04
 Date Received : 05/24/17
 Date Analyzed : 06/12/17 09:04
 Dilution Factor : 1
 Analyst : LC
 Instrument ID : MERCURYAF
 %Solids : N/A
 Date Digested : 06/09/17

CAS NO.	Parameter	mg/l			Qualifier
		Results	RL	MDL	
7439-97-6	Mercury, Total	0.00002	0.00005	0.00001	J



Form 1 METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : WILLIAMS (1794)
 Lab ID : WG1011473-1
 Client ID : WG1011473-1BLANK
 Sample Location :
 Sample Matrix : WATER
 Analytical Method : 1,7474
 Lab File ID : WG1012106.pcl
 Sample Amount : 50ml
 Digestion Method : EPA 7474

Lab Number : L1717026
 Project Number : 1794
 Date Collected : NA
 Date Received : NA
 Date Analyzed : 06/12/17 08:56
 Dilution Factor : 1
 Analyst : LC
 Instrument ID : MERCURYAF
 %Solids : N/A
 Date Digested : 06/09/17

CAS NO.	Parameter	mg/l			Qualifier
		Results	RL	MDL	
7439-97-6	Mercury, Total	0.00003	0.00005	0.00001	J



Form 1

METALS

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : WILLIAMS (1794)
 Lab ID : WG1011473-4
 Client ID : WG1011473-4 DUP
 Sample Location :
 Sample Matrix : WATER
 Analytical Method : 1,7474
 Lab File ID : WG1012106.pcl
 Sample Amount : 50ml
 Digestion Method : EPA 7474

Lab Number : L1717026
 Project Number : 1794
 Date Collected : 06/07/17 12:35
 Date Received : 06/07/17
 Date Analyzed : 06/12/17 09:14
 Dilution Factor : 1
 Analyst : LC
 Instrument ID : MERCURYAF
 %Solids : N/A
 Date Digested : 06/09/17

CAS NO.	Parameter	mg/l			Qualifier
		Results	RL	MDL	
7439-97-6	Mercury, Total	0.00002	0.00005	0.00001	J



Form 2A

Initial and Continuing Calibration Verification

Client : Alpine Ocean Seismic Survey Inc. Lab Number : L1717026
 Project Name : WILLIAMS (1794) Project Number : 1794
 Instrument ID : MERCURYAF Units : mg/l

Parameter	Initial Calibration			Continuing Calibration(s)						
	True	Found	%R	True	Found	%R	Found	%R	Found	%R
Lab ID	: R974995-7			R974995-9						
Date Analyzed	: 06/12/17 08:48			06/12/17 09:21						
Mercury	0.0025	0.0025	102.	0.0025	0.0026	104.				

Acceptance Criteria:

ICV: 95-105% (Methods 200.7, 245.1)
 90-110% (Methods 200.8, 6010, 6020, 7470, 7471, 7474)
 85-115% (Method 1631)

CCV: 90-110% (Methods 200.7, 245.1, 6010, 6020, 7474)
 85-115% (Methods 200.8, 1631)
 80-120% (Methods 7470, 7471)



Form 3 Blanks

Client	: Alpine Ocean Seismic Survey Inc.	Lab Number	: L1717026
Project Name	: WILLIAMS (1794)	Project Number	: 1794
Instrument ID	: MERCURYAF		

Parameter	Initial Calibration		Continuing Calibration				Preparation	
	Blank		Blank(s)				Blank	
Lab ID	: R974995-8		R974995-10				WG1011473-1	
Date Analyzed	: 06/12/17 08:51		06/12/17 09:24				06/12/17 08:56	
	mg/l	Q	mg/l	Q	mg/l	Q	mg/l	Q
Mercury	0.0000343	J	0.0000173	J			0.00003	J



Form 5a Matrix Spike

Client : Alpine Ocean Seismic Survey Inc.	Lab Number : L1717026
Project Name : WILLIAMS (1794)	Project Number : 1794
Client Sample ID : NA	Matrix : WATER
Lab Sample ID : L1718989-02	
Matrix Spike : WG1011473-3	MS Analysis Date : 06/12/17 09:16
Matrix Spike Dup :	MSD Analysis Date :

Parameter	Sample Conc. (mg/l)	Matrix Spike Sample		%R	Matrix Spike Duplicate		%R	RPD	Recovery Limits	RPD Limit
		Spike Added (mg/l)	Spike Conc. (mg/l)		Spike Added (mg/l)	Spike Conc. (mg/l)				
Mercury, Total	0.00002J	0.0025	0.00277	111					80-120	20



Form 6 Lab Duplicates

Client	: Alpine Ocean Seismic Survey Inc.	Lab Number	: L1717026
Project Name	: WILLIAMS (1794)	Project Number	: 1794
Client Sample ID	: NA	Matrix	: WATER
Lab Sample ID	: NA	Analysis Date	: 06/12/17 09:11
Dup Sample ID	: WG1011473-4	DUP Analysis Date	: 06/12/17 09:14

Parameter	Sample Concentration (mg/l)	Duplicate Concentration (mg/l)	RPD	RPD Limit
Mercury, Total	0.00002J	0.00002J	NC	20



Form 7

Laboratory Control Sample

Client : Alpine Ocean Seismic Survey Inc.
 Project Name : WILLIAMS (1794)
 Client Sample ID : NA
 Lab Sample ID : WG1011473-2
 Dup Sample ID :

Lab Number : L1717026
 Project Number : 1794
 Matrix : WATER
 LCS Analysis Date : 06/12/17 08:59
 LCSD Analysis Date :

Parameter	Laboratory Control Sample			Laboratory Control Duplicate			RPD	Recovery Limits	RPD Limit
	True (mg/l)	Found (mg/l)	%R	True (mg/l)	Found (mg/l)	%R			
Mercury, Total	0.00250	0.00247	99.					80-120	20



Form 12

Preparation Log

Client : Alpine Ocean Seismic Survey Inc. Lab Number : L1717026
Project Name : WILLIAMS (1794) Project Number : 1794
Matrix : WATER Prep Method : EPA 7474

Sample Number	Preparation Date	Weight (gram)	Volume (mL)
L1717026-28	06/09/17 11:26	-	50
L1717026-29	06/09/17 11:26	-	50
WG1011473-1	06/09/17 10:51	-	50
WG1011473-2	06/09/17 10:51	-	50
WG1011473-3	06/09/17 10:51	-	50
WG1011473-4	06/09/17 10:51	-	50



Form 13

Analysis Run Log

Client : Alpine Ocean Seismic Survey Inc.
Project Name : WILLIAMS (1794)
Instrument ID : MERCURYAF
Start Date : 06/12/17 08:34

Lab Number : L1717026
Project Number : 1794
Analysis Method : 1,7474
End Date : 06/12/17 09:24

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Data Usability Summary Reports

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Data Usability Summary Report	Project: NESE Offshore Sampling
Date Completed: 10 April 2017	Completed by: Lynne Parker

The analytical data provided by the laboratory were reviewed for precision, accuracy, and completeness based on applicable sections of the following guidance:

- EPA Region 2 Data Validation Standard Operating Procedures.
 - SOP NO. HW-3B, Rev. 0, ICP-MS Data Validation

Specific criteria for QC limits were obtained from the site specific QAPP: *Offshore Sampling and Analysis Plan / Quality Assurance Project Plan, Version 1.1, Northeast Supply Enhancement Project*. Compliance with the project QA program is indicated in the checklist and tables below. Any major or minor concerns affecting data usability are listed below. The checklist and tables also indicate whether data qualification is required and/or the type of qualifier assigned.

Reference:

Project ID	Lab Work Order	Laboratory
1000891.0020.05	L1710301	Alpha Analytical

Table 1: Sample List

SDG	Matrix	Sample Name	Lab ID	Sample Date	Sample Type	ID Correction
L1710301	SE	BHA-7 SS1 0-2	L1710301-01	10/8/2016	N	
L1710301	SE	BHA-7 SS2 2-4	L1710301-02	10/8/2016	N	
L1710301	SE	BHA-7 SS3 4-6	L1710301-03	10/8/2016	N	
L1710301	SE	BHA-7 SS4 6-8	L1710301-04	10/8/2016	N	
L1710301	SE	BHA-7 SS5 8-10	L1710301-05	10/8/2016	N	
L1710301	SE	BHA-7 SS6 10-12	L1710301-06	10/8/2016	N	
L1710301	SE	BHA-7 SS7 15-17	L1710301-07	10/8/2016	N	
L1710301	SE	BHA-9 SS2 2-4	L1710301-08	10/8/2016	N	
L1710301	SE	BHA-9 SS3 4-6	L1710301-09	10/8/2016	N	
L1710301	SE	BHA-9 SS4 6-8	L1710301-10	10/8/2016	N	
L1710301	SE	BHA-9 SS5 8-10	L1710301-11	10/8/2016	N	
L1710301	SE	BHA-9 SS6 10-12	L1710301-12	10/8/2016	N	
L1710301	SE	BHA-9 SS7 15-17	L1710301-13	10/8/2016	N	

Table 1A: Sample Test Summary

SDG	Matrix	Test Method	Prep Method	Number of Samples	Sample Type
L1710301	SE	SW6020A	EPA 3050B	13	N
L1710301	SE	SW7474	EPA 7474	13	N

Data Usability Summary Report	Project: NESE Offshore Sampling
Date Completed: 10 April 2017	Completed by: Lynne Parker

General Sample Information	
Do Samples and Analyses on COC check against Lab Sample Tracking Form?	No. The samples were marked as collected on 10/9/16 on the COC; however, the case narrative noted that Alpha contacted Alpine and they confirmed via email that the collection date was 10/8/16. The sample collection forms indicate that Boring Number BHA-7 was started on 10/9/16 and completed 10/9/16, and Boring Number BHA-9 was started on 10/8/16 and completed 10/9/16. The COC did not request mercury analysis; however, the laboratory analyzed for the analyte.
Did coolers arrive at lab between 2 and 6°C and in good condition as indicated on COC and Cooler Receipt Form?	No. The samples arrived at the laboratory at 14.9°C and were stored at ambient conditions prior to shipment to the laboratory. Thermal preservation is not required for solid samples for metals analysis.
Frequency of Field QC Samples Correct? Field Duplicate - 1/20 samples MS/MSD – 1/20 samples Trip Blank - Every cooler with VOCs waters only Equipment Blank - 1/ set of samples per day?	Field QC samples were not required. These samples were analyzed for confirmation of the chemical vibracore results. The laboratory used sample BHA-7-SS1 0-2 for laboratory QC – MS and DUP for both Methods SW-846 6020 and 7474.
Case narrative present and complete?	Yes.
Any holding time violations?	Yes. All of the results for mercury were outside of holding time and R/UR qualified as rejected.

The following tables are presented at the end of this DUSR and provided summaries of results outside QC criteria:

- Method Blanks Results (Table 2 and 2A)
- Surrogates Outside Limits (Table 3)
- MS/MSD/LR Outside Limits (Table 4 and 4A)
- LCS Outside Limits (Table 5 and 5A)
- Re-analysis Results (Table 6)
- Field Duplicate Results (Table 7)

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Data Usability Summary Report	Project: NESE Offshore Sampling
Date Completed: 10 April 2017	Completed by: Lynne Parker

Metals & Mercury by ICP/MS and CVAA	
Description	Notes and Qualifiers
Are any compounds present in method blank as noted on Table 2?	Antimony was detected below the PQL in method blank WG991289-1. There were several detections for antimony, molybdenum, tin, sodium, arsenic, and/or silver in the initial calibration blank (ICB) and continuing calibration blank (CCB).
For samples, if results are <5 times the blank then "U" flag data (See Table 2A)	Eight sample results for antimony were less than 5X the blank detection and were U qualified as non-detect due to method blank contamination. Eleven sample results for molybdenum and nine sample results for tin were U qualified as non-detect due to ICB and/or CCB detections.
Is laboratory QC frequency one blank and LCS with each batch and one set of MS/MSD per 20 samples?	Yes.
Are MS/MSD within QC criteria (see Table 4)? If not, was a post digestion spike analyzed? QC limits are not applicable to sample results greater than 4 times spike amount.	No. Arsenic, calcium, manganese, selenium, and titanium were recovered outside of laboratory control limits. The case narrative noted that the recoveries in the post digestion spike were acceptable; therefore, the results in the parent sample were J qualified as estimated. The native concentration of aluminum and iron was greater than 4 times the spiking concentration; therefore, no qualification of the data was required.
Were elements recovered $\leq 30\%$? If so, "R" flag associated NDs.	Yes. Antimony was recovered at 20% in LCS WG991289-2. The laboratory limits for the reference material are 1-200%. No qualification of the data was made.
Is LCS within QC criteria (see Table 5 and 5A)? If out, and the recovery is high with no positive values, then no data qualification is required.	Yes.
Is there one serial dilution per 20 samples? Flag all data reported with an "E" as "J".	Yes.
Spot check ICS recoveries 80-120%. Contact lab if unacceptable.	The ICS recoveries were acceptable
Spot check ICV 90-110%. Contact lab if unacceptable.	The ICV recoveries were acceptable.
Spot check CCV 90-110%. Contact lab if unacceptable.	The CCV recoveries were acceptable.
Spot check ICB/CCB +/- RL. Contact lab if unacceptable.	The ICB/CCB detections were all less than the PQL.
Are laboratory replicates within limits (see Table 4A)?	No. Antimony, arsenic, barium, calcium, chromium, and titanium were outside of control limits in the laboratory duplicate of sample BHA-7 SS1 0-2. The results in the parent sample were J qualified as estimated.
Were any samples re-analyzed or diluted (see Table 6)? For any sample re-analysis and dilutions is only one reportable result by flagged?	Samples BHA-7 SS1 0-2 and BHA-7 SS1 2-4 were analyzed at 10X to bring the mercury concentration within the calibration curve. No data usability issues.
Do field duplicate results show good precision for all compounds (see Table 7)?	Not applicable.

Data Usability Summary Report	Project: NESE Offshore Sampling
Date Completed: 10 April 2017	Completed by: Lynne Parker

Summary of Findings
<ul style="list-style-type: none"> • Arsenic, calcium, manganese, selenium, and titanium were recovered outside of laboratory control limits for the MS/MSD. The case narrative noted that the recoveries in the post digestion spike were acceptable; therefore, the results in sample BHA-7 SS1 0-2 were J qualified as estimated. • Antimony, arsenic, barium, calcium, chromium, and titanium were outside of control limits in the laboratory duplicate of sample BHA-7 SS1 0-2. The results in the parent sample were J qualified as estimated. • Eight sample results for antimony were less than 5X the blank detection and were U qualified as non-detect. • Eleven sample results for molybdenum and nine sample results for tin were U qualified as non-detect due to ICB and/or CCB detections.

Data Usability Summary Report	Project: NESE Offshore Sampling
Date Completed: 10 April 2017	Completed by: Lynne Parker

Table 2 – List of Positive Results for Blank Samples

Method	Sample ID	Sample Type	Analyte	Result	Qualifier	Units	MDL	PQL
SW6020	WG991289-1	MB	ANTIMONY	0.645	J	mg/kg	0.169	2.00
SW6020	R955527-2	ICB	ANTIMONY	2.33	J	µg/L	0.338	4.0
SW6020	R955527-2	ICB	MOLYBDENUM	0.327	J	µg/L	0.27	2.0
SW6020	R955527-2	ICB	TIN	0.382	J	µg/L	0.31	3.0
SW6020	R955527-23	CCB	ANTIMONY	3.22	J	µg/L	0.338	4.0
SW6020	R955527-23	CCB	MOLYBDENUM	0.647	J	µg/L	0.27	2.0
SW6020	R955527-23	CCB	TIN	0.784	J	µg/L	0.31	3.0
SW6020	R955527-25	CCB	ANTIMONY	3.13	J	µg/L	0.338	4.0
SW6020	R955527-25	CCB	MOLYBDENUM	0.582	J	µg/L	0.27	2.0
SW6020	R955527-25	CCB	TIN	0.810	J	µg/L	0.31	3.0
SW6020	R955527-27	CCB	ANTIMONY	3.67	J	µg/L	0.338	4.0
SW6020	R955527-27	CCB	MOLYBDENUM	0.567	J	µg/L	0.27	2.0
SW6020	R955527-27	CCB	TIN	0.793	J	µg/L	0.31	3.0
SW6020	R955527-29	CCB	ANTIMONY	3.52	J	µg/L	0.338	4.0
SW6020	R955527-29	CCB	MOLYBDENUM	0.618	J	µg/L	0.27	2.0
SW6020	R955527-29	CCB	SODIUM	51.5	J	µg/L	29.3	375
SW6020	R955527-29	CCB	TIN	0.790	J	µg/L	0.31	3.0
SW6020	R955527-31	CCB	ANTIMONY	3.55	J	µg/L	0.338	4.0
SW6020	R955527-31	CCB	ARSENIC	0.203	J	µg/L	0.165	1.25
SW6020	R955527-31	CCB	MOLYBDENUM	0.601	J	µg/L	0.27	2.0
SW6020	R955527-31	CCB	SILVER	0.132	J	µg/L	0.122	1.25
SW6020	R955527-31	CCB	SODIUM	31.2	J	µg/L	29.3	375
SW6020	R955527-31	CCB	TIN	0.753	J	µg/L	0.31	3.0

Table 2A – List of Samples Qualified for Blank Contamination

Method	Method Blank	Matrix	Analyte	Blank Result	Sample Result	Lab Qualifier	PQL	Affected Samples	Sample Flag
SW6020A	WG991289-1	SQ	Antimony, Total	0.645	6.8		3.1	BHA-7 SS1 0-2	None
SW6020A	WG991289-1	SQ	Antimony, Total	0.645	8.32		2.99	BHA-7 SS2 2-4	None
SW6020A	WG991289-1	SQ	Antimony, Total	0.645	7.15		2.85	BHA-7 SS3 4-6	None
SW6020A	WG991289-1	SQ	Antimony, Total	0.645	6.19		2.72	BHA-7 SS4 6-8	None

Data Usability Summary Report	Project: NESE Offshore Sampling
Date Completed: 10 April 2017	Completed by: Lynne Parker

Method	Method Blank	Matrix	Analyte	Blank Result	Sample Result	Lab Qualifier	PQL	Affected Samples	Sample Flag
SW6020A	WG991289-1	SQ	Antimony, Total	0.645	1.06	J	2.36	BHA-7 SS5 8-10	U Flag
SW6020A	WG991289-1	SQ	Antimony, Total	0.645	0.475	J	2.03	BHA-7 SS6 10-12	U Flag
SW6020A	WG991289-1	SQ	Antimony, Total	0.645	0.458	J	2.96	BHA-7 SS7 15-17	U Flag
SW6020A	WG991289-1	SQ	Antimony, Total	0.645	0.396	J	2.18	BHA-9 SS2 2-4	U Flag
SW6020A	WG991289-1	SQ	Antimony, Total	0.645	0.403	J	1.96	BHA-9 SS3 4-6	U Flag
SW6020A	WG991289-1	SQ	Antimony, Total	0.645	0.226	J	1.85	BHA-9 SS4 6-8	U Flag
SW6020A	WG991289-1	SQ	Antimony, Total	0.645	0.256	J	1.82	BHA-9 SS5 8-10	U Flag
SW6020A	WG991289-1	SQ	Antimony, Total	0.645	0.29	J	1.79	BHA-9 SS6 10-12	U Flag
SW6020A	WG991289-1	SQ	Antimony, Total	0.645	ND	U	1.98	BHA-9 SS7 15-17	None
SW6020A	R955527-23	SQ	MOLYBDENUM, TOTAL	0.647	2.683		2.0	BHA-7 SS1 0-2	U Flag
SW6020A	R955527-23	SQ	MOLYBDENUM, TOTAL	0.647	2.838		2.0	BHA-7 SS2 2-4	U Flag
SW6020A	R955527-23	SQ	MOLYBDENUM, TOTAL	0.647	2.557		2.0	BHA-7 SS3 4-6	U Flag
SW6020A	R955527-23	SQ	MOLYBDENUM, TOTAL	0.647	2.927		2.0	BHA-7 SS4 6-8	U Flag
SW6020A	R955527-25	SQ	TIN, TOTAL	0.810	3.874		3.0	BHA-7 SS5 8-10	U Flag
SW6020A	R955527-25	SQ	MOLYBDENUM, TOTAL	0.582	1.306		2.0	BHA-7 SS6 10-12	U Flag
SW6020A	R955527-25	SQ	TIN, TOTAL	0.810	1.731		3.0	BHA-7 SS6 10-12	U Flag
SW6020A	R955527-25	SQ	TIN, TOTAL	0.810	2.099	J	3.0	BHA-7 SS7 15-17	U Flag
SW6020A	R955527-25	SQ	MOLYBDENUM, TOTAL	0.582	1.912	J	2.0	BHA-9 SS2 2-4	U Flag
SW6020A	R955527-25	SQ	TIN, TOTAL	0.810	1.860	J	3.0	BHA-9 SS2 2-4	U Flag
SW6020A	R955527-25	SQ	TIN, TOTAL	0.810	1.792	J	3.0	BHA-9 SS3 4-6	U Flag
SW6020A	R955527-25	SQ	MOLYBDENUM, TOTAL	0.582	2.407		2.0	BHA-9 SS3 4-6	U Flag
SW6020A	R955527-25	SQ	TIN, TOTAL	0.810	1.350	J	3.0	BHA-9 SS4 6-8	U Flag
SW6020A	R955527-25	SQ	MOLYBDENUM, TOTAL	0.582	0.413	J	2.0	BHA-9 SS4 6-8	U Flag
SW6020A	R955527-25	SQ	TIN, TOTAL	0.810	0.653	J	3.0	BHA-9 SS7 15-17	U Flag
SW6020A	R955527-25	SQ	MOLYBDENUM, TOTAL	0.582	0.564	J	2.0	BHA-9 SS7 15-17	U Flag
SW6020A	R955527-29	SQ	TIN, TOTAL	0.790	1.051	J	3.0	BHA-9 SS5 8-10	U Flag
SW6020A	R955527-29	SQ	MOLYBDENUM, TOTAL	0.618	0.696	J	2.0	BHA-9 SS5 8-10	U Flag
SW6020A	R955527-29	SQ	TIN, TOTAL	0.790	1.301	J	3.0	BHA-9 SS6 10-12	U Flag
SW6020A	R955527-29	SQ	MOLYBDENUM, TOTAL	0.618	0.404	J	2.0	BHA-9 SS6 10-12	U Flag

Data Usability Summary Report	Project: NESE Offshore Sampling
Date Completed: 10 April 2017	Completed by: Lynne Parker

Table 3 – List of Samples with Surrogates outside Control Limits

N/A

Table 4A - List MS/MSD Recoveries outside Control Limits

Method	Sample ID	Sample Type	Analyte	Orig. Result	Spike Amount	MS	Dil Fac	Low Limit	High Limit	Sample Qualifier
SW6020A	WG991289-3-MS	SQ	Aluminum, Total	10200	303	594	10	75	125	4X
SW6020A	WG991289-3-MS	SQ	Arsenic, Total	39.1	18.2	134	10	75	125	J Flag
SW6020A	WG991289-3-MS	SQ	Calcium, Total	5040	1510	0	10	75	125	J Flag
SW6020A	WG991289-3-MS	SQ	Iron, Total	32400	151	0	10	75	125	4X
SW6020A	WG991289-3-MS	SQ	Manganese, Total	274	75.7	13	10	75	125	J Flag
SW6020A	WG991289-3-MS	SQ	Selenium, Total	3.36	18.2	126	10	75	125	J Flag
SW6020A	WG991289-3-MS	SQ	Titanium, Total	362	151	167	10	75	125	J Flag

Table 4B – List RPDs outside Control Limits

Method	Sample ID	Analyte	RPD	RPD Limit	Sample Qualifier
SW6020A	WG991289-4-DUP	Antimony, Total	28	20	J Flag
SW6020A	WG991289-4-DUP	Arsenic, Total	40	20	J Flag
SW6020A	WG991289-4-DUP	Barium, Total	25	20	J Flag
SW6020A	WG991289-4-DUP	Calcium, Total	22	20	J Flag
SW6020A	WG991289-4-DUP	Chromium, Total	21	20	J Flag
SW6020A	WG991289-4-DUP	Titanium, Total	32	20	J Flag

Table 5A - List LCS Recoveries outside Control Limits

None

Table 5B – List RPDs outside Control Limits

None

Table 6 –Samples that were Reanalyzed/Diluted

Sample ID	Lab ID	Method	Sample Type	Action
BHA-7 SS1 0-2	L1710301-01	SW7474	N	10X – Sample was diluted to bring the concentration within the calibration curve.
BHA-7 SS2 2-4	L1710301-02	SW7474	N	10X – Sample was diluted to bring the concentration within the calibration curve.

Data Usability Summary Report	Project: NESE Offshore Sampling
Date Completed: 10 April 2017	Completed by: Lynne Parker

Table 7 – Summary of Field Duplicate Results

N/A

Acronym List and Table Key:

BD	=	blank spike duplicate
BS	=	blank spike
COC	=	chain of custody
CVAA	=	cold vapor atomic absorption
DUSR	=	data usability summary report
FD	=	field duplicate sample
ICP/MS	=	Inductively coupled / mass spectrometry
LB	=	laboratory blank
LCS	=	laboratory control sample
LCSD	=	laboratory control sample duplicate
LR	=	laboratory replicate
MB	=	method blank
MS	=	matrix spike
MSD	=	matrix spike duplicate
N	=	normal field sample
NC	=	not calculated
ND	=	not detected
NJDEP	=	New Jersey Department of Environmental Protection
NYSDEC	=	New York State Department of Environmental Conservation
PQL	=	practical quantitation limit
QA	=	quality assurance
QAPP	=	quality assurance project plan
QC	=	quality control
RB	=	rinsate blank sample
RPD	=	relative percent difference
SDG	=	sample delivery group

Data Usability Summary Report	Project: NESE Offshore Sampling
Date Completed: June 20, 2017	Completed by: Eridania Marte; Lynne Parker

The analytical data provided by the laboratory were reviewed for precision, accuracy, and completeness based on applicable sections of the following guidance:

- EPA Region 2 Data Validation Standard Operating Procedures.
 - SOP NO. HW-3B, Rev. 0, ICP-MS Data Validation
 - SOP NO. HW-3C, Rev. 0, Mercury and Cyanide Data Validation

Specific criteria for QC limits were obtained from the site specific QAPP: *Offshore Sampling and Analysis Plan / Quality Assurance Project Plan, Version 1.1, Northeast Supply Enhancement Project*. Compliance with the project QA program is indicated in the checklist and tables below. Any major or minor concerns affecting data usability are listed below. The checklist and tables also indicate whether data qualification is required and/or the type of qualifier assigned.

Reference:

Project ID	Lab Work Order	Laboratory
100891.0020.05	L1717026	Alpha Analytical

Table 1: Sample List

SDG	Sample Name	Matrix	Lab ID	Sample Date	Sample Type	ID Correction
L1717026	DUP-D0-3E	SE	L1717026-10	5/19/2017 4:15:00 PM	FD	
L1717026	DUP-D3-6E	SE	L1717026-27	5/19/2017 2:38:00 PM	FD	
L1717026	DUP-D6-9E	SE	L1717026-18	5/19/2017 3:42:00 PM	FD	
L1717026	DUP-D9-10E	SE	L1717026-09	5/19/2017 5:07:00 PM	FD	
L1717026	VC88-D0-3E	SE	L1717026-01	5/19/2017 5:07:00 PM	N	
L1717026	VC88-D3-6E	SE	L1717026-02	5/19/2017 5:07:00 PM	N	
L1717026	VC88-D6-9E	SE	L1717026-03	5/19/2017 5:07:00 PM	N	
L1717026	VC88-D9-10E	SE	L1717026-04	5/19/2017 5:07:00 PM	N	
L1717026	VC89-D0-3E	SE	L1717026-05	5/19/2017 4:15:00 PM	N	
L1717026	VC89-D3-6E	SE	L1717026-06	5/19/2017 4:15:00 PM	N	
L1717026	VC89-D6-9E	SE	L1717026-07	5/19/2017 4:15:00 PM	N	
L1717026	VC89-D9-10E	SE	L1717026-08	5/19/2017 4:15:00 PM	N	
L1717026	VC90-D0-3E	SE	L1717026-11	5/19/2017 3:42:00 PM	N	
L1717026	VC90-D3-6E	SE	L1717026-12	5/19/2017 3:42:00 PM	N	
L1717026	VC90-D6-9E	SE	L1717026-13	5/19/2017 3:42:00 PM	N	
L1717026	VC90-D9-10E	SE	L1717026-14	5/19/2017 3:42:00 PM	N	
L1717026	VC91-D0-3E	SE	L1717026-15	5/19/2017 3:10:00 PM	N	
L1717026	VC91-D3-6E	SE	L1717026-16	5/19/2017 3:10:00 PM	N	
L1717026	VC91-D6-9.6E	SE	L1717026-17	5/19/2017 3:10:00 PM	N	
L1717026	VC92-D0-3E	SE	L1717026-19	5/19/2017 2:38:00 PM	N	
L1717026	VC92-D3-6E	SE	L1717026-20	5/19/2017 2:38:00 PM	N	
L1717026	VC92-D6-9E	SE	L1717026-21	5/19/2017 2:38:00 PM	N	
L1717026	VC92-D9-10E	SE	L1717026-22	5/19/2017 2:38:00 PM	N	
L1717026	VC93-D0-3E	SE	L1717026-23	5/20/2017 1:58:00 PM	N	

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SDG	Sample Name	Matrix	Lab ID	Sample Date	Sample Type	ID Correction
L1717026	VC93-D3-6E	SE	L1717026-24	5/20/2017 1:58:00 PM	N	
L1717026	VC93-D6-9E	SE	L1717026-25	5/20/2017 1:58:00 PM	N	
L1717026	VC93-D9-10E	SE	L1717026-26	5/20/2017 1:58:00 PM	N	
L1717026	VC89-D0-3E-MS	SQ	WG1007570-3	5/19/2017 4:15:00 PM	MS	
L1717026	VC89-D0-3E-MS	SQ	WG1008096-3	5/19/2017 4:15:00 PM	MS	
L1717026	VC89-D0-3E-MSD	SQ	WG1007570-4	5/19/2017 4:15:00 PM	MSD	
L1717026	VC89-D0-3E-MSD	SQ	WG1008096-4	5/19/2017 4:15:00 PM	MSD	
L1717026	VC93-D0-3E-MS	SQ	WG1007571-3	5/20/2017 1:58:00 PM	MS	
L1717026	VC93-D0-3E-MS	SQ	WG1009290-3	5/20/2017 1:58:00 PM	MS	
L1717026	VC93-D0-3E-MSD	SQ	WG1007571-4	5/20/2017 1:58:00 PM	MSD	
L1717026	VC93-D0-3E-MSD	SQ	WG1009290-4	5/20/2017 1:58:00 PM	MSD	
L1717026	RINSE1	WH	L1717026-29	5/19/2017 6:04:00 PM	RB	RINSE1_20171905
L1717026	RINSE2	WH	L1717026-28	5/24/2017 12:00:00 PM	RB	RINSE2_20172405

Table 1A: Sample Test Summary

SDG	Matrix	Test Method	Prep Method	Number of Samples	Sample Type
L1717026	SE	6020A	3050B	23	N
L1717026	SE	6020A	3050B	4	FD
L1717026	WH	6020A	SW3020A	2	RB
L1717026	SE	E7474/SW846	METHOD	23	N
L1717026	SE	E7474/SW846	METHOD	4	FD
L1717026	WH	E7474/SW846	METHOD	2	RB

Table 1B: Holding Time Exceedances

None.

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General Sample Information	
Do Samples and Analyses on COC check against Lab Sample Tracking Form?	Yes. The rinsate sample names were updated to include the collection date as noted in Table 1.
Did coolers arrive at lab between 2 and 6°C and in good condition as indicated on COC and Cooler Receipt Form?	Yes.
Frequency of Field QC Samples Correct? Field Duplicate - 1/20 samples MS/MSD – 1/20 samples Trip Blank - Every cooler with VOCs waters only Equipment Blank - 1/ set of samples per day?	Yes. 4 FD per 27 samples. 1 MS/MSD per 27 samples. VOCs not collected, trip blank not required. 2 equipment blanks, one per day.
Case narrative present and complete?	Yes.
Any holding time violations?	No.

The following tables are presented at the end of this DUSR and provided summaries of results outside QC criteria:

- Method Blanks Results (Table 2)
- Surrogates Outside Limits (Table 3)
- MS/MSD/LR Outside Limits (Table 4)
- LCS/SRM Outside Limits (Table 5)
- Re-analysis Results (Table 6)
- Field Duplicate Results (Table 7)

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Metals & Mercury by ICP/MS and CVAA	
Description	Notes and Qualifiers
Are any compounds present in method and field blanks as noted on Table 2?	Yes.
For samples, if results are <5 times the blank then "U" flag data.	<p>Sodium was detected in method blank WG1007571-1. Associated sample results were greater than 5X the blank detection; therefore, no qualifications were made.</p> <p>Antimony and sodium were detected in method blank WG1008707-1. Associated sample results in RINSE2 were less than 5X the blank detection; therefore, the results were U qualified as non-detect and the MDL were elevated to the sample result.</p> <p>Mercury was detected in method blank WG1011473-1. Associated sample results in RINSE1 and RINSE2 were less than 5X the blank detection; therefore, the results were U qualified as non-detect and the MDL were elevated to the sample result.</p> <p>Barium, chromium, copper, manganese, sodium, strontium, and titanium were detected in RINSE1. All associated results for chromium, manganese, sodium, strontium, and titanium were greater than</p>

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	<p>5X the blank detection; therefore, no qualifications were made. Copper was detected less than 5X the rinsate blank detection in twelve samples and barium was detected less than 5X the rinsate blank detection in four samples. In instances where the blank detection was greater than the PQL, the PQL was elevated to the sample result. In instances where the blank detection was less than the PQL, the MDL was elevated to the sample result.</p> <p>Aluminum, barium, copper, strontium, and titanium were detected in RINSE2. All associated samples for aluminum, strontium, and titanium were greater than 5X the blank detection; therefore, no qualifications were made. Copper and barium were detected less than 5X the rinsate blank detection in three samples. The results were U qualified as non-detect and the MDL was elevated to sample result.</p>
Is laboratory QC frequency one blank and LCS with each batch and one set of MS/MSD per 20 samples?	Yes.
Are MS/MSD within QC criteria (see Table 3)? If not, was a post digestion spike analyzed? QC limits are not applicable to sample results greater than 4 times spike amount.	<p>No.</p> <p>The MS/MSD for sample VC89-D0-3E was recovered outside of acceptance limits for aluminum, iron, and zinc. The native concentration of aluminum and iron were greater than 4X the spike amount; therefore, no qualification was made. Zinc was recovered high in the MS and exceeded the acceptance criteria in the post digestion spike. The results in the parent sample were J qualified as estimated.</p> <p>The MS/MSD for sample VC93-D0-3E was recovered outside of acceptance limits for aluminum, iron, and calcium. The native concentration of aluminum and iron were greater than 4X the spike amount; therefore, no qualification was made. Calcium was recovered high in the MS and MSD; however, the post digestion spike recovery was acceptable. The MS and MSD exhibited poor precision for calcium. The results in the parent sample were J qualified as estimated.</p>
Were elements recovered $\leq 30\%$? If so, "R" flag associated NDs.	The MS/MSD for sample VC89-D0-3E exhibited 0% recovery for iron, as noted above. No qualification was made.
Is LCS within QC criteria (see Table 4)? If out, and the recovery is high with no positive values, then no data qualification is required.	Yes.
Is there one serial dilution per 20 samples? Flag all data reported with an "E" as "J".	Yes.
Spot check ICS recoveries 80-120%. Contact lab if unacceptable.	<p>Yes.</p> <p>The ICS exhibited recovery at 122% for titanium. All sediment sample results for titanium were J qualified as estimated.</p>
Spot check ICV 90-110%. Contact lab if unacceptable.	Yes.

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Spot check CCV 90-110%. Contact lab if unacceptable.	Yes.
Spot check ICB/CCB +/- RL. Contact lab if unacceptable.	<p>Yes.</p> <p>ICB R974427-2 exhibited detection for antimony at 0.759 µg/L. Associated samples VC92-D6-9E (0.492 µg/L), VC88-D9-10E (0.451 µg/L), and VC93-D0-3E (0.823 µg/L) were less than 5X the blank detection. The results were U qualified as non-detect and the MDL was elevated to the sample result. CCBs throughout the analytical batch also exhibited detections for antimony, which indicates instrument contamination.</p> <p>CCB's R974427-25, R974427-27, and R974427-29 exhibited detections for antimony at 0.814, 0.758, and 0.799 µg/L respectively. Thirteen samples associated with CCB R974427-25, fifteen samples with CCB R974427-27, and eleven samples with CCB R974427-29 were greater than 5X the blank detection. No qualification was made.</p> <p>CCB R974427-23 and CCB R974427-31 exhibited detection for antimony at 0.758 and 0.719 µg/L respectively. Four samples associated with CCB R974427-23 and six with CCB R974427-31 were greater than 5X the blank detection. No qualification was made.</p> <p>CCB's R974427-27, R974427-29, and R974427-31 exhibited detections for sodium at 43.4, 55.8, and 38.7 µg/L respectively. Seventeen samples associated with CCB R974427-27, thirteen with CCB R974427-29, and six with CCB R974427-31 were greater than 5X the blank detection. No qualification was made.</p> <p>CCB's R973606-15 and R973606-17 exhibited detections for sodium at 90.8 and 72.1 µg/L respectively. Associated sample RINSE1 (283 µg/L) was less than 5X the blank detection. The result was U qualified as non-detect and the PQL was elevated to the sample result.</p> <p>ICB R973606-2 and CCB's R973606-8, R973606-11, and R973606-17 exhibited detections for antimony at 2.36, 2.90, 2.73, and 2.47 µg/L respectively. The sample results were U qualified due to instrument contamination. No further qualification made.</p> <p>CCB R973606-11 exhibited detection for silver at 0.242 µg/L. Associated samples were non-detected; therefore, no qualification was made.</p>
Are laboratory replicates within limits?	Yes.
Were any samples re-analyzed or diluted (see Table 6)? For any sample re-analysis and	All sediment samples were analyzed at a 5X dilution for mercury analysis.

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dilutions is only one reportable result by flagged?	All sediment samples were analyzed at a 10X dilution for metals analysis. All of the detection limits were less than the screening criteria; therefore, there is not impact to data usability.
Do field duplicate results show good precision for all compounds (see Table 6)?	Overall, the field duplicate results show good precision. Only few metals were qualified as follows: Sample VC92-D3-6E and field duplicate DUP-D3-6E exhibited poor precision for calcium. The sample results were J qualified as estimated. Sample VC90-D6-9E and field duplicate DUP-D6-9E exhibited poor precision for calcium and strontium. The sample results were J qualified as estimated.

Summary of Findings	
<ul style="list-style-type: none"> 6020A: Antimony and sodium were detected in method blank WG1008707-1. Associated sample was U qualified as non-detect and the MDL was elevated to the sample result. 6020A: Barium and copper were detected in rinse blank RINSE1. Sample results were less than 5X the blank detection and were U qualified as non-detect. Sample results in which were less than the PQL, the MDL was elevated to the sample result and sample results in which were greater than the PQL, the PQL was elevated to the sample result. 6020A: Barium and copper were detected in rinse blank RINSE2. Sample results were less than 5X the blank detection and were U qualified as non-detect. The MDL was elevated to sample result. E7474: Mercury was detected in method blank WG1011473-1. Sample results were less than 5X the blank detection and were U qualified as non-detect. The MDL was elevated to the sample result. 6020A: ICB R974427-2 exhibited detection for antimony. Associated sample results were less than 5X the blank detection and were U qualified as non-detect. The MDL was elevated to the sample result. 6020A: CCB's R973606-15 and R973606-17 exhibited detections for sodium. Associated sample results were less than 5X the blank detection and were U qualified as non-detect. The PQL was elevated to the sample result. 6020A: Sample VC92-D3-6E and field duplicate DUP-D3-6E exhibited poor precision for calcium. Sample VC90-D6-9E and field duplicate DUP-D6-9E exhibited poor precision for calcium and strontium. The sample results were J qualified as estimated in the field duplicate pair. 	

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Table 2 List of Positive Results for Blank Samples

Method	Sample Name	Matrix	Analyte	Result	Qualifier	Units	MDL	QL
6020A	WG1007571-1	LB	SODIUM, TOTAL	21.6	J	mg/kg	11.7	150
6020A	WG1008707-1	LB	ANTIMONY, TOTAL	0.00118	J	mg/l	0.00042	0.004
6020A	WG1008707-1	LB	SODIUM, TOTAL	0.0419	J	mg/l	0.0293	0.2
E7474/SW846	WG1011473-1	LB	MERCURY, TOTAL	0.00003	J	mg/l	0.00001	0.00005
6020A	RINSE1	RB	BARIUM, TOTAL	0.00164		mg/l	0.00017	0.0005
6020A	RINSE1	RB	CHROMIUM, TOTAL	0.00022	J	mg/l	0.00017	0.0005
6020A	RINSE1	RB	COPPER, TOTAL	0.00339		mg/l	0.00038	0.001
6020A	RINSE1	RB	MANGANESE, TOTAL	0.00047	J	mg/l	0.00044	0.001
6020A	RINSE1	RB	SODIUM, TOTAL	0.283		mg/l	0.0293	0.1
6020A	RINSE1	RB	STRONTIUM, TOTAL	0.00065		mg/l	0.00003	0.0005
6020A	RINSE1	RB	TITANIUM, TOTAL	0.00021	J	mg/l	0.00007	0.0005
6020A	RINSE2	RB	ALUMINUM, TOTAL	0.00461	J	mg/l	0.00327	0.01
6020A	RINSE2	RB	BARIUM, TOTAL	0.00092		mg/l	0.00017	0.0005
6020A	RINSE2	RB	COPPER, TOTAL	0.00148		mg/l	0.00038	0.001
6020A	RINSE2	RB	STRONTIUM, TOTAL	0.00034	J	mg/l	0.00003	0.0005
6020A	RINSE2	RB	TITANIUM, TOTAL	0.00016	J	mg/l	0.00007	0.0005

Table 2A List of Samples Qualified for Blank Contamination

Method	Method Blank	Matrix	Analyte	Blank Result	Sample Result	Lab Qualifier	Units	MDL	QL	Affected Sample	Sample Flag
6020A	WG1008707-1	WH	ANTIMONY, TOTAL	0.00118	0.00076	J	mg/l	0.00042	0.004	RINSE2	U Flag
6020A	WG1008707-1	WH	SODIUM, TOTAL	0.0419	0.0787	J	mg/l	0.0293	0.2	RINSE2	U Flag
E7474/SW846	WG1011473-1	WH	MERCURY, TOTAL	0.00003	0.00002	J	mg/l	0.00001	0.00005	RINSE1	U Flag
E7474/SW846	WG1011473-1	WH	MERCURY, TOTAL	0.00003	0.00002	J	mg/l	0.00001	0.00005	RINSE2	U Flag
6020A	RINSE1	RB	Copper	3.39	2.49	J	ug/L	0.246	2.53	VC88-D0-3E	U Flag

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Table 2A List of Samples Qualified for Blank Contamination

Method	Method Blank	Matrix	Analyte	Blank Result	Sample Result	Lab Qualifier	Units	MDL	QL	Affected Sample	Sample Flag
6020A	RINSE1	RB	Copper	3.39	6.15		ug/L	0.271	2.79	VC88-D3-6E	U Flag
6020A	RINSE1	RB	Copper	3.39	6.0		ug/L	0.241	2.49	VC89-D0-3E	U Flag
6020A	RINSE1	RB	Copper	3.39	14.6		ug/L	0.302	3.12	VC89-D3-6E	U Flag
6020A	RINSE1	RB	Copper	3.39	6.98		ug/L	0.235	2.42	DUP-D0-3E	U Flag
6020A	RINSE1	RB	Copper	3.39	9.132		ug/L	0.23	2.37	VC90-D0-3E	U Flag
6020A	RINSE1	RB	Copper	3.39	16.6		ug/L	0.266	2.74	VC90-D3-6E	U Flag
6020A	RINSE1	RB	Copper	3.39	2.8	J	ug/L	0.254	2.62	VC92-D0-3E	U Flag
6020A	RINSE1	RB	Copper	3.39	10.0		ug/L	0.243	2.5	VC92-D3-6E	U Flag
6020A	RINSE1	RB	Copper	3.39	9.47		ug/L	0.261	2.69	VC92-D6-9E	U Flag
6020A	RINSE1	RB	Copper	3.39	6.25		ug/L	0.252	2.6	VC92-D9-10E	U Flag
6020A	RINSE1	RB	Copper	3.39	5.9		ug/L	0.244	2.51	DUP-D3-6E	U Flag
6020A	RINSE1	RB	Barium	1.64	4.17	J	ug/L	0.268	3.8	VC88-D0-3E	U Flag
6020A	RINSE1	RB	Barium	1.64	4.813	J	ug/L	0.263	3.73	VC89-D0-3E	U Flag
6020A	RINSE1	RB	Barium	1.64	3.6	J	ug/L	0.256	3.63	DUP-D0-3E	U Flag
6020A	RINSE1	RB	Barium	1.64	6.047	J	ug/L	0.277	3.93	VC92-D0-3E	U Flag
6020A	RINSE2	RB	Copper	1.48	2.137	J	ug/L	0.226	2.33	VC93-D3-6E	U Flag
6020A	RINSE2	RB	Copper	1.48	1.34	J	ug/L	0.24	2.47	VC93-D6-9E	U Flag
6020A	RINSE2	RB	Copper	1.48	1.429	J	ug/L	0.239	2.47	VC93-D9-10E	U Flag
6020A	RINSE2	RB	Barium	0.92	4.01	J	ug/L	0.246	3.49	VC93-D3-6E	U Flag
6020A	RINSE2	RB	Barium	0.92	1.95	J	ug/L	0.261	3.71	VC93-D6-9E	U Flag
6020A	RINSE2	RB	Barium	0.92	1.903	J	ug/L	0.26	3.7	VC93-D9-10E	U Flag

Table 3 – List of Samples with Surrogates outside Control Limits

None.

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Table 4 List MS/MSD Recoveries outside Control Limits

Method	Parent Sample	Analyte	Dil Fac	Unit	MS	MSD	Low Limit	High Limit	Qualifier
6020A	VC89-D0-3E	ALUMINUM, TOTAL	10	mg/kg	501	295	75	125	None- 4X
6020A	VC89-D0-3E	IRON, TOTAL	10	mg/kg	2430	0	75	125	None - 4X
6020A	VC89-D0-3E	ZINC, TOTAL	10	mg/kg	127		75	125	Diluted Out
6020A	VC93-D0-3E	ALUMINUM, TOTAL	10	mg/kg	371	430	75	125	None - 4X
6020A	VC93-D0-3E	CALCIUM, TOTAL	10	mg/kg	174	310	75	125	Diluted Out
6020A	VC93-D0-3E	IRON, TOTAL	10	mg/kg	857	1670	75	125	None - 4X

Table 4A List RPDs outside Control Limits

Method	Parent Sample	Analyte	Dil Fac	Unit	RPD	RPD Limit	Qualifier	Sample Type
6020A	VC93-D0-3E	CALCIUM, TOTAL	10	mg/kg	57	20	Diluted Out	MSD

Table 4B – List of Laboratory Replicate outside Control Limits

None.

Table 5 – List LCS Recoveries outside Control Limits

None.

Table 5A – List RPDs outside Control Limits

None.

Table 5B – List SRM Recoveries outside Control Limits

N/A

Table 6 Samples that were Reanalyzed/Diluted

Sample Name	Matrix	Method	Sample Type	Detect Flag	Number of Chemicals	Dilution Factor	Test Type	Notes
DUP-D0-3E	SE	6020A	FD	N	5	10	INITIAL	Sample initially diluted at 10X for antimony, cadmium, silver, thallium, and tin

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Table 6 Samples that were Reanalyzed/Diluted

Sample Name	Matrix	Method	Sample Type	Detect Flag	Number of Chemicals	Dilution Factor	Test Type	Notes
DUP-D0-3E	SE	6020A	FD	Y	21	10	INITIAL	Sample initially diluted at 10X
DUP-D0-3E	SE	E7474/SW846	FD	N	1	5	INITIAL	Sample initially diluted at 5X
DUP-D3-6E	SE	6020A	FD	N	4	10	INITIAL	Sample initially diluted at 10X for antimony, silver, thallium, and tin
DUP-D3-6E	SE	6020A	FD	Y	22	10	INITIAL	Sample initially diluted at 10X
DUP-D3-6E	SE	E7474/SW846	FD	N	1	5	INITIAL	Sample initially diluted at 5X
DUP-D6-9E	SE	6020A	FD	N	2	10	INITIAL	Sample initially diluted at 10X for antimony and silver
DUP-D6-9E	SE	6020A	FD	Y	24	10	INITIAL	Sample initially diluted at 10X
DUP-D6-9E	SE	E7474/SW846	FD	Y	1	5	INITIAL	Sample initially diluted at 5X
DUP-D9-10E	SE	6020A	FD	N	2	10	INITIAL	Sample initially diluted at 10X for antimony and silver
DUP-D9-10E	SE	6020A	FD	Y	24	10	INITIAL	Sample initially diluted at 10X
DUP-D9-10E	SE	E7474/SW846	FD	Y	1	5	INITIAL	Sample initially diluted at 5X
VC88-D0-3E	SE	6020A	N	N	6	10	INITIAL	Sample initially diluted at 10X for antimony, cadmium, selenium, silver, thallium, and tin
VC88-D0-3E	SE	6020A	N	Y	20	10	INITIAL	Sample initially diluted at 10X
VC88-D0-3E	SE	E7474/SW846	N	N	1	5	INITIAL	Sample initially diluted at 5X
VC88-D3-6E	SE	6020A	N	N	4	10	INITIAL	Sample initially diluted at 10X for antimony, silver, thallium, and tin
VC88-D3-6E	SE	6020A	N	Y	22	10	INITIAL	Sample initially diluted at 10X
VC88-D3-6E	SE	E7474/SW846	N	Y	1	5	INITIAL	Sample initially diluted at 5X
VC88-D6-9E	SE	6020A	N	N	2	10	INITIAL	Sample initially diluted at 10X for antimony and silver
VC88-D6-9E	SE	6020A	N	Y	24	10	INITIAL	Sample initially diluted at 10X
VC88-D6-9E	SE	E7474/SW846	N	Y	1	5	INITIAL	Sample initially diluted at 5X
VC88-D9-10E	SE	6020A	N	N	1	10	INITIAL	Sample initially diluted at 10X for silver
VC88-D9-10E	SE	6020A	N	Y	25	10	INITIAL	Sample initially diluted at 10X

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Table 6 Samples that were Reanalyzed/Diluted

Sample Name	Matrix	Method	Sample Type	Detect Flag	Number of Chemicals	Dilution Factor	Test Type	Notes
VC88-D9-10E	SE	E7474/SW846	N	Y	1	5	INITIAL	Sample initially diluted at 5X
VC89-D0-3E	SE	6020A	N	N	4	10	INITIAL	Sample initially diluted at 10X for antimony, silver, cadmium, and tin
VC89-D0-3E	SE	6020A	N	Y	22	10	INITIAL	Sample initially diluted at 10X
VC89-D0-3E	SE	E7474/SW846	N	N	1	5	INITIAL	Sample initially diluted at 5X
VC89-D3-6E	SE	6020A	N	N	2	10	INITIAL	Sample initially diluted at 10X for antimony and silver
VC89-D3-6E	SE	6020A	N	Y	24	10	INITIAL	Sample initially diluted at 10X
VC89-D3-6E	SE	E7474/SW846	N	Y	1	5	INITIAL	Sample initially diluted at 5X
VC89-D6-9E	SE	6020A	N	N	2	10	INITIAL	Sample initially diluted at 10X for antimony and silver
VC89-D6-9E	SE	6020A	N	Y	24	10	INITIAL	Sample initially diluted at 10X
VC89-D6-9E	SE	E7474/SW846	N	Y	1	5	INITIAL	Sample initially diluted at 5X
VC89-D9-10E	SE	6020A	N	N	2	10	INITIAL	Sample initially diluted at 10X for antimony and silver
VC89-D9-10E	SE	6020A	N	Y	24	10	INITIAL	Sample initially diluted at 10X
VC89-D9-10E	SE	E7474/SW846	N	Y	1	5	INITIAL	Sample initially diluted at 5X
VC90-D0-3E	SE	6020A	N	N	3	10	INITIAL	Sample initially diluted at 10X for antimony, silver, and thallium
VC90-D0-3E	SE	6020A	N	Y	23	10	INITIAL	Sample initially diluted at 10X
VC90-D0-3E	SE	E7474/SW846	N	Y	1	5	INITIAL	Sample initially diluted at 5X
VC90-D3-6E	SE	6020A	N	N	2	10	INITIAL	Sample initially diluted at 10X for antimony and silver
VC90-D3-6E	SE	6020A	N	Y	24	10	INITIAL	Sample initially diluted at 10X
VC90-D3-6E	SE	E7474/SW846	N	Y	1	5	INITIAL	Sample initially diluted at 5X
VC90-D6-9E	SE	6020A	N	N	2	10	INITIAL	Sample initially diluted at 10X for antimony and silver
VC90-D6-9E	SE	6020A	N	Y	24	10	INITIAL	Sample initially diluted at 10X
VC90-D6-9E	SE	E7474/SW846	N	Y	1	5	INITIAL	Sample initially diluted at 5X

Data Usability Summary Report	Project: NESE Offshore Sampling
Date Completed: June 20, 2017	Completed by: Eridania Marte; Lynne Parker

Table 6 Samples that were Reanalyzed/Diluted

Sample Name	Matrix	Method	Sample Type	Detect Flag	Number of Chemicals	Dilution Factor	Test Type	Notes
VC90-D9-10E	SE	6020A	N	N	2	10	INITIAL	Sample initially diluted at 10X for antimony and silver
VC90-D9-10E	SE	6020A	N	Y	24	10	INITIAL	Sample initially diluted at 10X
VC90-D9-10E	SE	E7474/SW846	N	Y	1	5	INITIAL	Sample initially diluted at 5X
VC91-D0-3E	SE	6020A	N	N	3	10	INITIAL	Sample initially diluted at 10X for antimony, silver, and tin
VC91-D0-3E	SE	6020A	N	Y	23	10	INITIAL	Sample initially diluted at 10X
VC91-D0-3E	SE	E7474/SW846	N	N	1	5	INITIAL	Sample initially diluted at 5X
VC91-D3-6E	SE	6020A	N	N	2	10	INITIAL	Sample initially diluted at 10X for antimony and silver
VC91-D3-6E	SE	6020A	N	Y	24	10	INITIAL	Sample initially diluted at 10X
VC91-D3-6E	SE	E7474/SW846	N	Y	1	5	INITIAL	Sample initially diluted at 5X
VC91-D6-9.6E	SE	6020A	N	N	2	10	INITIAL	Sample initially diluted at 10X for antimony and silver
VC91-D6-9.6E	SE	6020A	N	Y	24	10	INITIAL	Sample initially diluted at 10X
VC91-D6-9.6E	SE	E7474/SW846	N	Y	1	5	INITIAL	Sample initially diluted at 5X
VC92-D0-3E	SE	6020A	N	N	6	10	INITIAL	Sample initially diluted at 10X for antimony, cadmium, beryllium, silver, thallium, and tin
VC92-D0-3E	SE	6020A	N	Y	20	10	INITIAL	Sample initially diluted at 10X
VC92-D0-3E	SE	E7474/SW846	N	N	1	5	INITIAL	Sample initially diluted at 5X
VC92-D3-6E	SE	6020A	N	N	4	10	INITIAL	Sample initially diluted at 10X for antimony, silver, thallium, and tin
VC92-D3-6E	SE	6020A	N	Y	22	10	INITIAL	Sample initially diluted at 10X
VC92-D3-6E	SE	E7474/SW846	N	N	1	5	INITIAL	Sample initially diluted at 5X
VC92-D6-9E	SE	6020A	N	N	1	10	INITIAL	Sample initially diluted at 10X for silver
VC92-D6-9E	SE	6020A	N	Y	25	10	INITIAL	Sample initially diluted at 10X
VC92-D6-9E	SE	E7474/SW846	N	N	1	5	INITIAL	Sample initially diluted at 5X
VC92-D9-10E	SE	6020A	N	N	4	10	INITIAL	Sample initially diluted at 10X for antimony, silver, thallium, and tin

Data Usability Summary Report	Project: NESE Offshore Sampling
Date Completed: June 20, 2017	Completed by: Eridania Marte; Lynne Parker

Table 6 Samples that were Reanalyzed/Diluted

Sample Name	Matrix	Method	Sample Type	Detect Flag	Number of Chemicals	Dilution Factor	Test Type	Notes
VC92-D9-10E	SE	6020A	N	Y	22	10	INITIAL	Sample initially diluted at 10X
VC92-D9-10E	SE	E7474/SW846	N	N	1	5	INITIAL	Sample initially diluted at 5X
VC93-D0-3E	SE	6020A	N	N	1	10	INITIAL	Sample initially diluted at 10X for thallium
VC93-D0-3E	SE	6020A	N	Y	25	10	INITIAL	Sample initially diluted at 10X
VC93-D0-3E	SE	E7474/SW846	N	N	1	5	INITIAL	Sample initially diluted at 5X
VC93-D3-6E	SE	6020A	N	N	4	10	INITIAL	Sample initially diluted at 10X for antimony, silver, thallium, and cadmium
VC93-D3-6E	SE	6020A	N	Y	22	10	INITIAL	Sample initially diluted at 10X
VC93-D3-6E	SE	E7474/SW846	N	N	1	5	INITIAL	Sample initially diluted at 5X
VC93-D6-9E	SE	6020A	N	N	11	10	INITIAL	Sample initially diluted at 10X for antimony, cadmium, selenium, silver, thallium, tin, beryllium, cobalt, molybdenum, nickel, and zinc
VC93-D6-9E	SE	6020A	N	Y	15	10	INITIAL	Sample initially diluted at 10X
VC93-D6-9E	SE	E7474/SW846	N	N	1	5	INITIAL	Sample initially diluted at 5X
VC93-D9-10E	SE	6020A	N	N	10	10	INITIAL	Sample initially diluted at 10X for antimony, selenium, silver, thallium, tin, beryllium, cobalt, molybdenum, nickel, and zinc
VC93-D9-10E	SE	6020A	N	Y	16	10	INITIAL	Sample initially diluted at 10X
VC93-D9-10E	SE	E7474/SW846	N	N	1	5	INITIAL	Sample initially diluted at 5X

Table 7 – Summary of Field Duplicate Results

Method	Analyte	Unit	Matrix	PQL	VC89-D0-3E	DUP-D0-3E	RPD	RPD Rating	Sample Qual
6020A	ALUMINUM, TOTAL	mg/kg	SE	124	1590	1500	5.8%	Good	None
6020A	ARSENIC, TOTAL	mg/kg	SE	0.622	4.62	6.2	29.2%	Good	None
6020A	BERYLLIUM, TOTAL	mg/kg	SE	0.373	0.187	0.216	14.4%	Good	None

Data Usability Summary Report	Project: NESE Offshore Sampling
Date Completed: June 20, 2017	Completed by: Eridania Marte; Lynne Parker

Method	Analyte	Unit	Matrix	PQL	VC89-D0-3E	DUP-D0-3E	RPD	RPD Rating	Sample Qual
6020A	CALCIUM, TOTAL	mg/kg	SE	622	747	773	3.4%	Good	None
6020A	CHROMIUM, TOTAL	mg/kg	SE	2.49	7.8	11.3	36.6%	Good	None
6020A	COBALT, TOTAL	mg/kg	SE	0.622	1.82	0.943	63.5%	Good	None
6020A	IRON, TOTAL	mg/kg	SE	249	13000	13600	4.5%	Good	None
6020A	LEAD, TOTAL	mg/kg	SE	0.747	2.57	2.15	17.8%	Good	None
6020A	MAGNESIUM, TOTAL	mg/kg	SE	124	880	776	12.6%	Good	None
6020A	MANGANESE, TOTAL	mg/kg	SE	2.49	24.9	22.4	10.6%	Good	None
6020A	MOLYBDENUM, TOTAL	mg/kg	SE	0.996	1.06	0.983	7.5%	Good	None
6020A	NICKEL, TOTAL	mg/kg	SE	1.24	2.24	2.76	20.8%	Good	None
6020A	POTASSIUM, TOTAL	mg/kg	SE	124	350	293	17.7%	Good	None
6020A	SELENIUM, TOTAL	mg/kg	SE	2.49	1.86	1.58	16.3%	Good	None
6020A	SODIUM, TOTAL	mg/kg	SE	187	2180	2130	2.3%	Good	None
6020A	STRONTIUM, TOTAL	mg/kg	SE	1.24	5.97	6.01	0.7%	Good	None
6020A	THALLIUM, TOTAL	mg/kg	SE	0.249	0.188	ND	NC	--	--
6020A	TITANIUM, TOTAL	mg/kg	SE	0.622	65.5	44	39.3%	Good	None
6020A	VANADIUM, TOTAL	mg/kg	SE	1.24	20.3	19	6.6%	Good	None
6020A	ZINC, TOTAL	mg/kg	SE	12.4	9.74	10.3	5.6%	Good	None

Method	Analyte	Unit	Matrix	PQL	VC92-D3-6E	DUP-D3-6E	RPD	RPD Rating	Samp Qual
6020A	ALUMINUM, TOTAL	mg/kg	SE	125	3950	2800	34.1%	Good	None
6020A	ARSENIC, TOTAL	mg/kg	SE	0.626	7.81	4.51	53.6%	Good	None
6020A	BARIUM, TOTAL	mg/kg	SE	3.76	6.38	4.5	34.6%	Good	None
6020A	BERYLLIUM, TOTAL	mg/kg	SE	0.376	0.374	0.236	45.2%	Good	None
6020A	CADMIUM, TOTAL	mg/kg	SE	0.25	0.039	0.055	34.0%	Good	None
6020A	CALCIUM, TOTAL	mg/kg	SE	626	916	345	90.6%	Poor	J Flag
6020A	CHROMIUM, TOTAL	mg/kg	SE	2.5	12	11.1	7.8%	Good	None
6020A	COBALT, TOTAL	mg/kg	SE	0.626	2.78	1.57	55.6%	Good	None
6020A	IRON, TOTAL	mg/kg	SE	250	15900	12000	28.0%	Good	None
6020A	LEAD, TOTAL	mg/kg	SE	0.751	4.57	2.78	48.7%	Good	None
6020A	MAGNESIUM, TOTAL	mg/kg	SE	125	1970	1190	49.4%	Good	None

Data Usability Summary Report	Project: NESE Offshore Sampling
Date Completed: June 20, 2017	Completed by: Eridania Marte; Lynne Parker

Method	Analyte	Unit	Matrix	PQL	VC92-D3-6E	DUP-D3-6E	RPD	RPD Rating	Samp Qual
6020A	MANGANESE, TOTAL	mg/kg	SE	2.5	72.9	38.4	62.0%	Good	None
6020A	MOLYBDENUM, TOTAL	mg/kg	SE	1	1.01	0.796	23.7%	Good	None
6020A	NICKEL, TOTAL	mg/kg	SE	1.25	6.39	3.78	51.3%	Good	None
6020A	POTASSIUM, TOTAL	mg/kg	SE	125	835	624	28.9%	Good	None
6020A	SELENIUM, TOTAL	mg/kg	SE	2.5	3.29	2.3	35.4%	Good	None
6020A	SODIUM, TOTAL	mg/kg	SE	188	2740	2200	21.9%	Good	None
6020A	STRONTIUM, TOTAL	mg/kg	SE	1.25	9.64	5.6	53.0%	Good	None
6020A	TITANIUM, TOTAL	mg/kg	SE	0.626	101	71.2	34.6%	Good	None
6020A	VANADIUM, TOTAL	mg/kg	SE	1.25	20.3	15	30.0%	Good	None
6020A	ZINC, TOTAL	mg/kg	SE	12.5	25.2	14.6	53.3%	Good	None

Method	Analyte	Unit	Matrix	PQL	VC90-D6-9E	DUP-D6-9E	RPD	RPD Rating	Samp Qual
6020A	ALUMINUM, TOTAL	mg/kg	SE	176	15800	15300	3.2%	Good	None
6020A	ARSENIC, TOTAL	mg/kg	SE	0.881	14.6	12.9	12.4%	Good	None
6020A	BARIUM, TOTAL	mg/kg	SE	5.28	26.6	29.1	9.0%	Good	None
6020A	BERYLLIUM, TOTAL	mg/kg	SE	0.528	1	0.99	1.0%	Good	None
6020A	CADMIUM, TOTAL	mg/kg	SE	0.352	0.079	0.149	61.4%	Good	None
6020A	CALCIUM, TOTAL	mg/kg	SE	881	2740	34100	170.2%	Poor	J Flag
6020A	CHROMIUM, TOTAL	mg/kg	SE	3.52	34.1	34.2	0.3%	Good	None
6020A	COBALT, TOTAL	mg/kg	SE	0.881	9.42	8.94	5.2%	Good	None
6020A	COPPER, TOTAL	mg/kg	SE	3.52	14.5	13.6	6.4%	Good	None
6020A	IRON, TOTAL	mg/kg	SE	352	38500	37200	3.4%	Good	None
6020A	LEAD, TOTAL	mg/kg	SE	1.06	13.5	12.3	9.3%	Good	None
6020A	MAGNESIUM, TOTAL	mg/kg	SE	176	7860	7320	7.1%	Good	None
6020A	MANGANESE, TOTAL	mg/kg	SE	3.52	275	282	2.5%	Good	None
E7474	MERCURY, TOTAL	mg/kg	SE	0.023	0.013	0.013	0.0%	Good	None
6020A	MOLYBDENUM, TOTAL	mg/kg	SE	1.41	1.3	2.29	55.2%	Good	None
6020A	NICKEL, TOTAL	mg/kg	SE	1.76	24.7	23.8	3.7%	Good	None
6020A	POTASSIUM, TOTAL	mg/kg	SE	176	3500	3490	0.3%	Good	None
6020A	SELENIUM, TOTAL	mg/kg	SE	3.52	11.4	10.8	5.4%	Good	None

Data Usability Summary Report	Project: NESE Offshore Sampling
Date Completed: June 20, 2017	Completed by: Eridania Marte; Lynne Parker

Method	Analyte	Unit	Matrix	PQL	VC90-D6-9E	DUP-D6-9E	RPD	RPD Rating	Samp Qual
6020A	SODIUM, TOTAL	mg/kg	SE	264	6100	6410	5.0%	Good	None
6020A	STRONTIUM, TOTAL	mg/kg	SE	1.76	26.5	213	155.7%	Poor	J Flag
6020A	THALLIUM, TOTAL	mg/kg	SE	0.352	0.138	0.171	21.4%	Good	None
6020A	TIN, TOTAL	mg/kg	SE	2.11	0.47	0.477	1.5%	Good	None
6020A	TITANIUM, TOTAL	mg/kg	SE	0.881	272	343	23.1%	Good	None
6020A	VANADIUM, TOTAL	mg/kg	SE	1.76	38.2	38.3	0.3%	Good	None
6020A	ZINC, TOTAL	mg/kg	SE	17.6	76	69.8	8.5%	Good	None

Method	Analyte	Unit	Matrix	PQL	VC88-D9-10E	DUP-D9-10E	RPD	RPD Rating	Samp Qual
6020A	ALUMINUM, TOTAL	mg/kg	SE	179	16600	15700	5.6%	Good	None
6020A	ARSENIC, TOTAL	mg/kg	SE	0.894	14.5	14	3.5%	Good	None
6020A	BARIUM, TOTAL	mg/kg	SE	5.36	27.6	26.9	2.6%	Good	None
6020A	BERYLLIUM, TOTAL	mg/kg	SE	0.536	1.05	0.974	7.5%	Good	None
6020A	CADMIUM, TOTAL	mg/kg	SE	0.358	0.088	0.132	40.0%	Good	None
6020A	CALCIUM, TOTAL	mg/kg	SE	894	3000	3070	2.3%	Good	None
6020A	CHROMIUM, TOTAL	mg/kg	SE	3.58	36.1	33.6	7.2%	Good	None
6020A	COBALT, TOTAL	mg/kg	SE	0.894	10.2	9.4	8.2%	Good	None
6020A	COPPER, TOTAL	mg/kg	SE	3.58	14.3	13.3	7.2%	Good	None
6020A	IRON, TOTAL	mg/kg	SE	358	39100	36100	8.0%	Good	None
6020A	LEAD, TOTAL	mg/kg	SE	1.07	13.6	13.1	3.7%	Good	None
6020A	MAGNESIUM, TOTAL	mg/kg	SE	179	8390	7950	5.4%	Good	None
6020A	MANGANESE, TOTAL	mg/kg	SE	3.58	308	277	10.6%	Good	None
E7474	MERCURY, TOTAL	mg/kg	SE	0.026	0.014	0.012	15.4%	Good	None
6020A	MOLYBDENUM, TOTAL	mg/kg	SE	1.43	1.88	2.01	6.7%	Good	None
6020A	NICKEL, TOTAL	mg/kg	SE	1.79	25.3	24.4	3.6%	Good	None
6020A	POTASSIUM, TOTAL	mg/kg	SE	179	3710	3530	5.0%	Good	None
6020A	SELENIUM, TOTAL	mg/kg	SE	3.58	12.3	11.2	9.4%	Good	None
6020A	SODIUM, TOTAL	mg/kg	SE	268	7530	7660	1.7%	Good	None
6020A	STRONTIUM, TOTAL	mg/kg	SE	1.79	29.7	29	2.4%	Good	None
6020A	THALLIUM, TOTAL	mg/kg	SE	0.358	0.157	0.142	10.0%	Good	None
6020A	TIN, TOTAL	mg/kg	SE	2.14	0.568	0.515	9.8%	Good	None

Data Usability Summary Report	Project: NESE Offshore Sampling
Date Completed: June 20, 2017	Completed by: Eridania Marte; Lynne Parker

Method	Analyte	Unit	Matrix	PQL	VC88-D9-10E	DUP-D9-10E	RPD	RPD Rating	Samp Qual
6020A	TITANIUM, TOTAL	mg/kg	SE	0.894	303	290	4.4%	Good	None
6020A	VANADIUM, TOTAL	mg/kg	SE	1.79	39.9	38.9	2.5%	Good	None
6020A	ZINC, TOTAL	mg/kg	SE	17.9	76.4	72.1	5.8%	Good	None

Acronym List and Table Key:

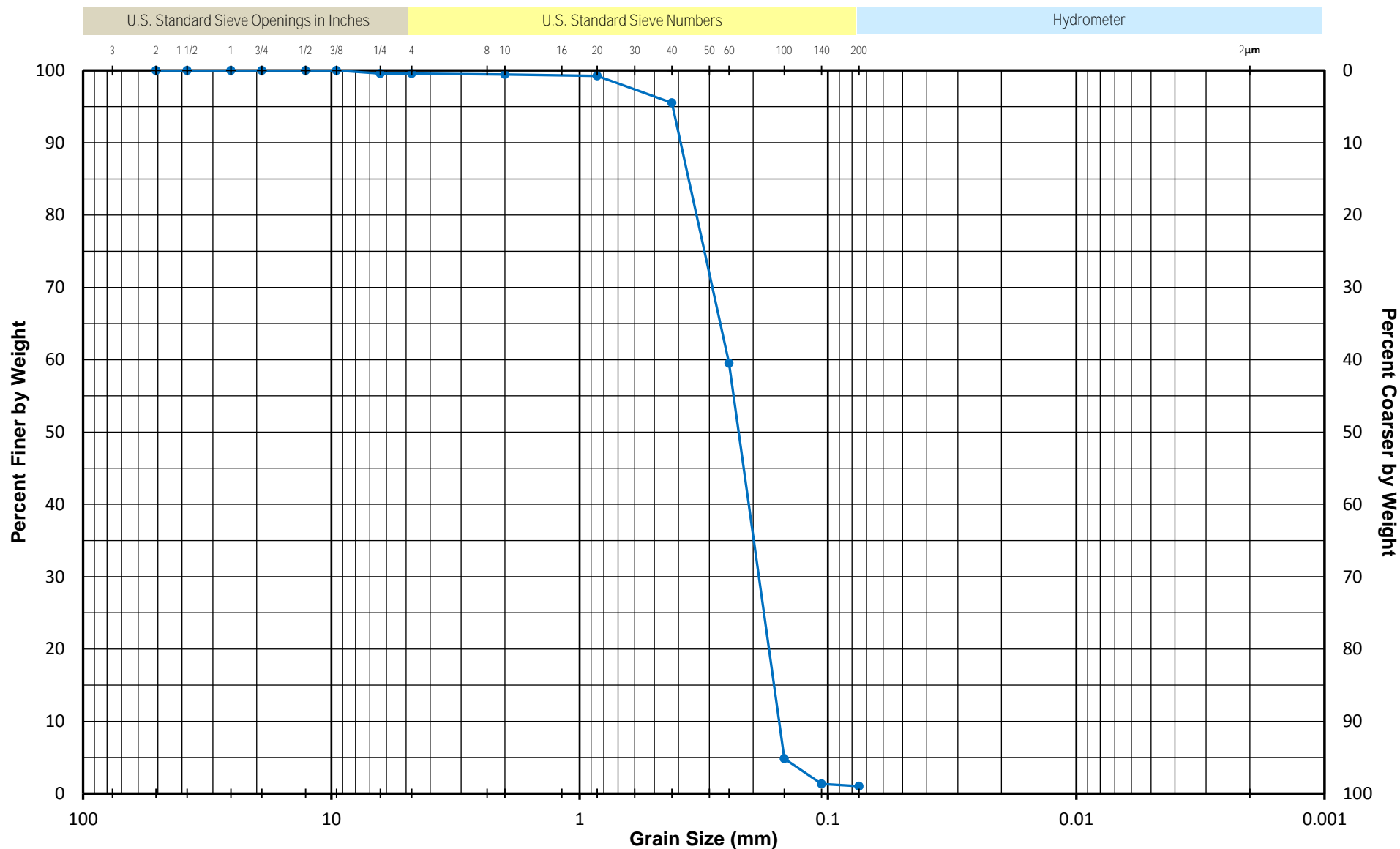
BD	=	blank spike duplicate
BS	=	blank spike
COC	=	chain of custody
CVAA	=	cold vapor atomic absorption
DUSR	=	data usability summary report
FD	=	field duplicate sample
ICP/MS	=	Inductively coupled / mass spectrometry
LB	=	laboratory blank
LCS	=	laboratory control sample
LCSD	=	laboratory control sample duplicate
LR	=	laboratory replicate
MB	=	method blank
MS	=	matrix spike
MSD	=	matrix spike duplicate
N	=	normal field sample
NC	=	not calculated
ND	=	not detected
NJDEP	=	New Jersey Department of Environmental Protection
NYSDEC	=	New York State Department of Environmental Conservation
PQL	=	practical quantitation limit
QA	=	quality assurance
QAPP	=	quality assurance project plan
QC	=	quality control
RB	=	rinsate blank sample
RPD	=	relative percent difference
SDG	=	sample delivery group

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E

Grain Size Curves

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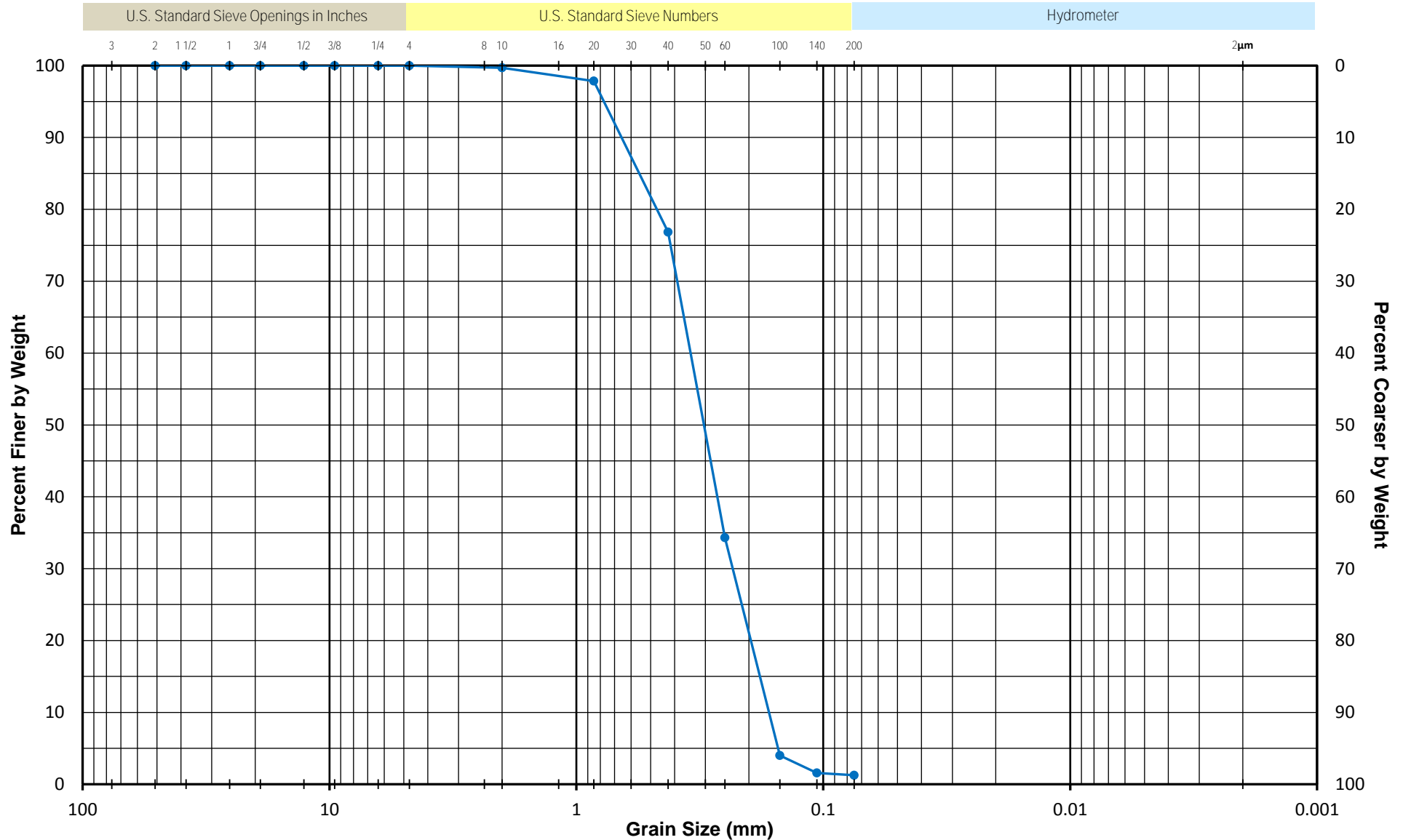


Test Depth	Core ID Section/Sample	Material Description
0.08 ft	VC93 0-2	Dark Grayish Brown and Very Dark Gray Fine Sand

GRADATION CURVES

ASTM D-422, D-6913

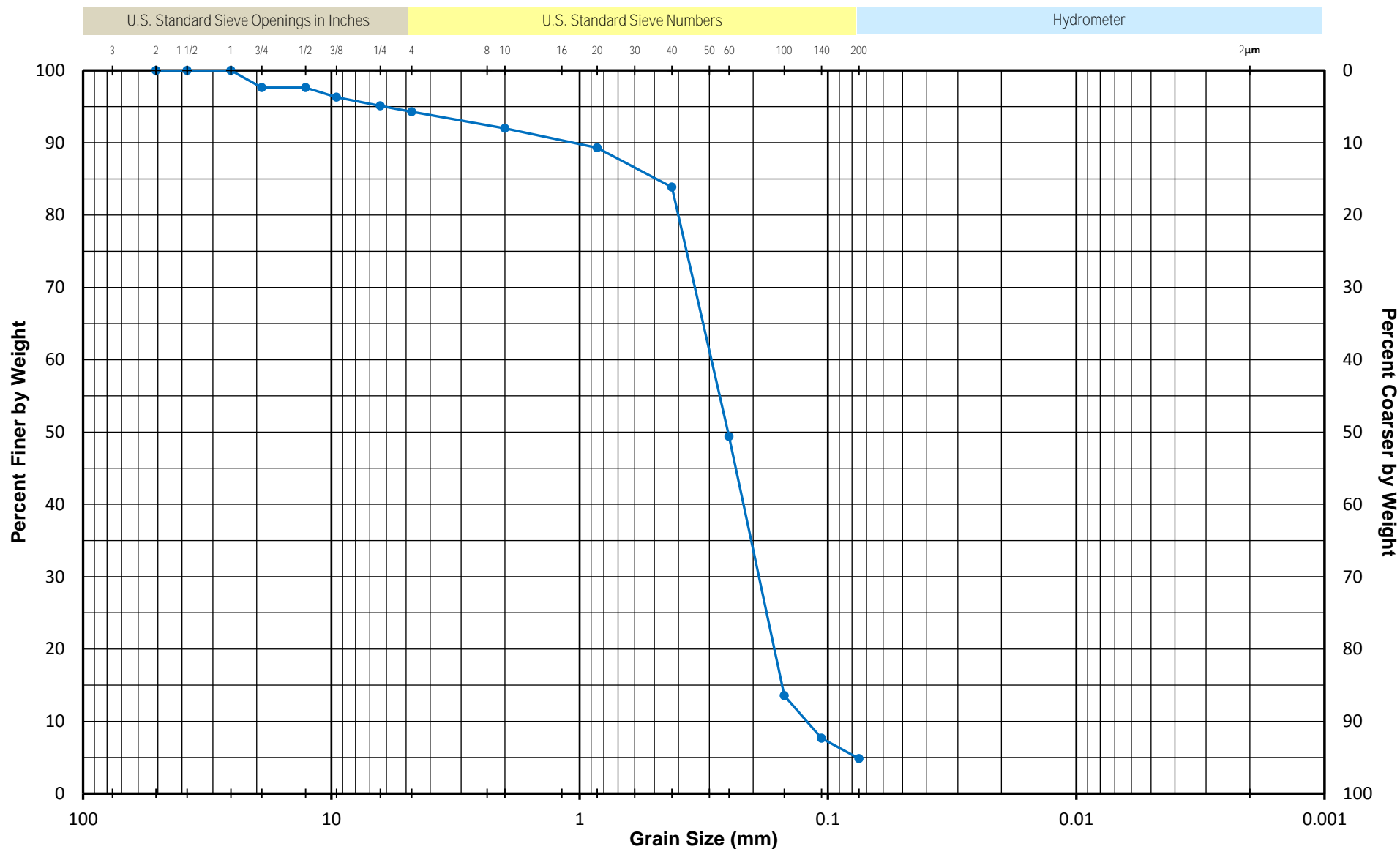
Alpine - NESE II



Test Depth	Core ID Section/Sample	Material Description
1.0 ft	VC93 0-2	Dark Olive Gray Fine Sand

GRADATION CURVES
 ASTM D-422, D-6913
 Alpine - NESE II

Alpine - NESE II

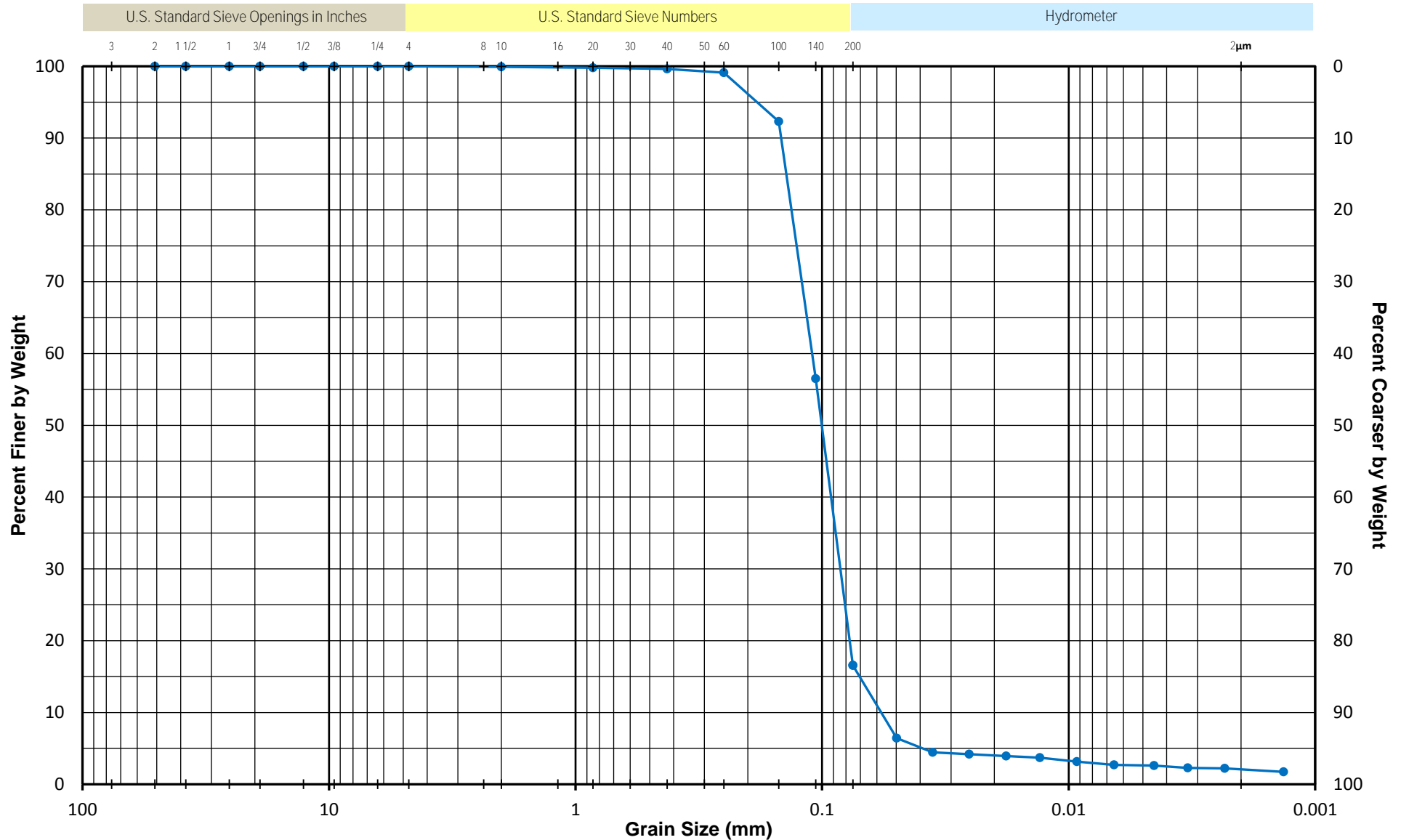


Test Depth	Core ID Section/Sample	Material Description
•—• 3.0 ft	VC93 2-4	Dark Grayish Brown Fine to Medium Sand

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

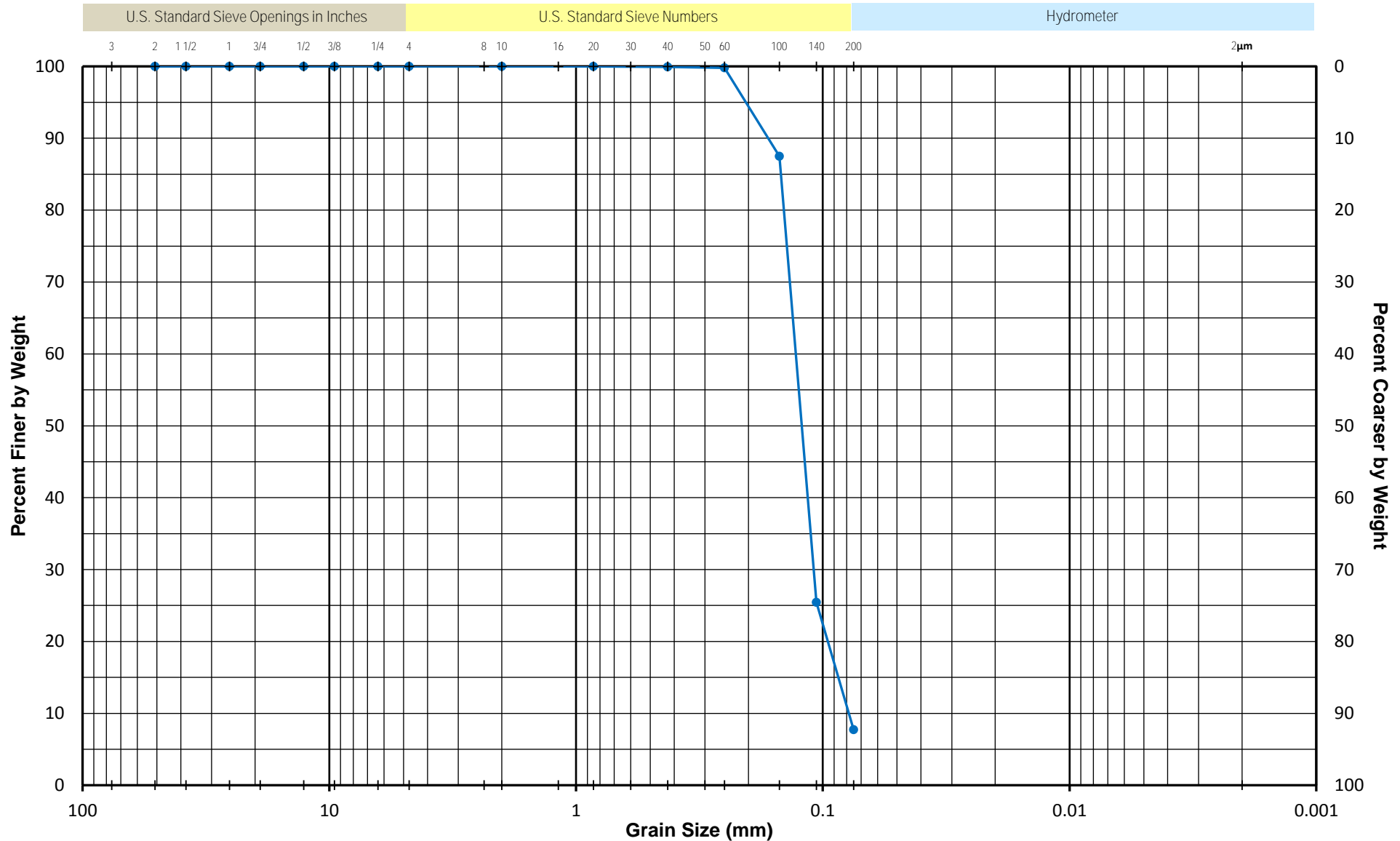


Test Depth	Core ID Section/Sample	Material Description
4.0 ft	VC93 2-4	Light Brownish Gray Silty Fine Sand with dark yellowish brown seams

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

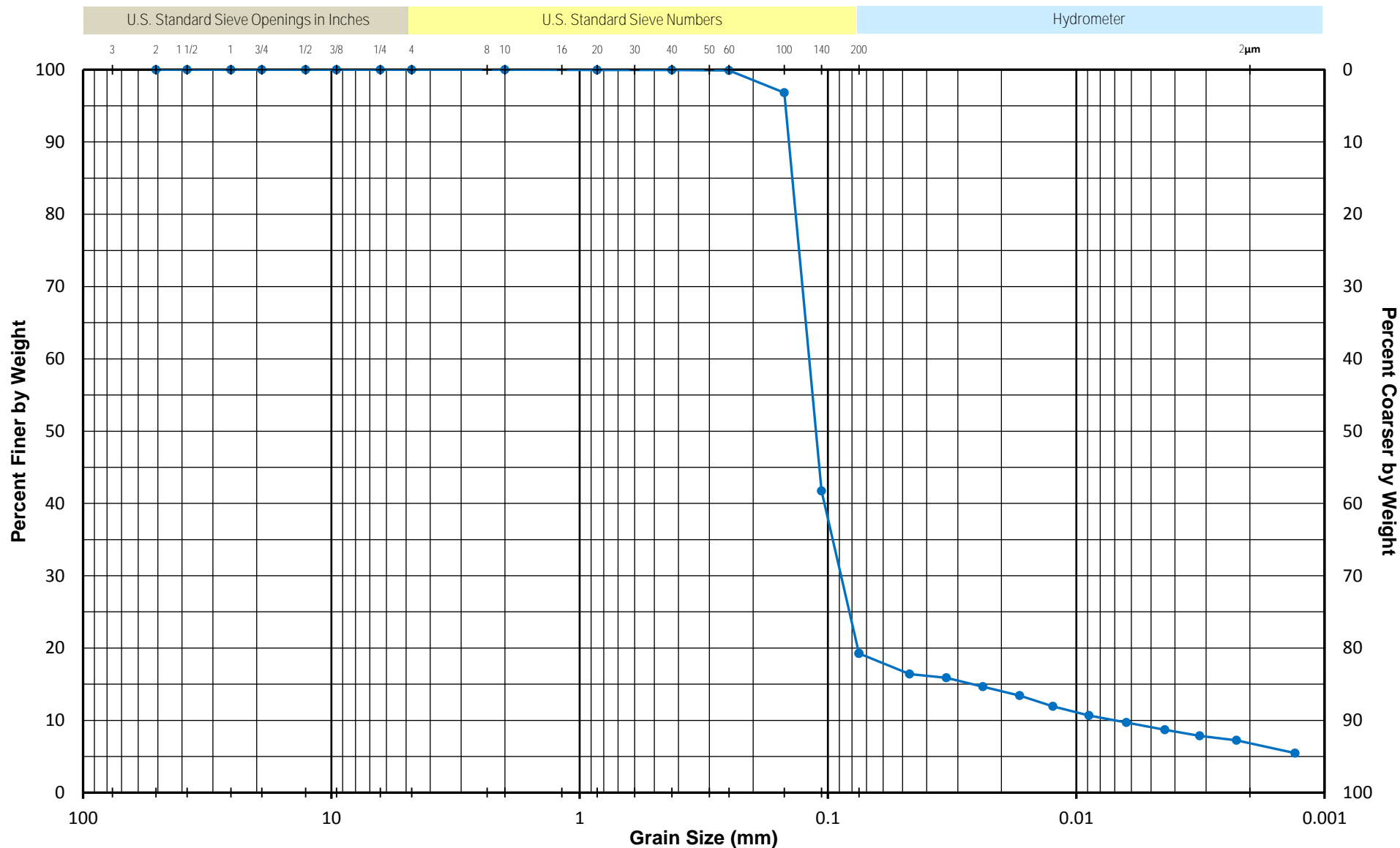


Test Depth	Core ID Section/Sample	Material Description
5.0 ft	VC93 4-6	Light Brownish Gray Fine Sand with silt

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

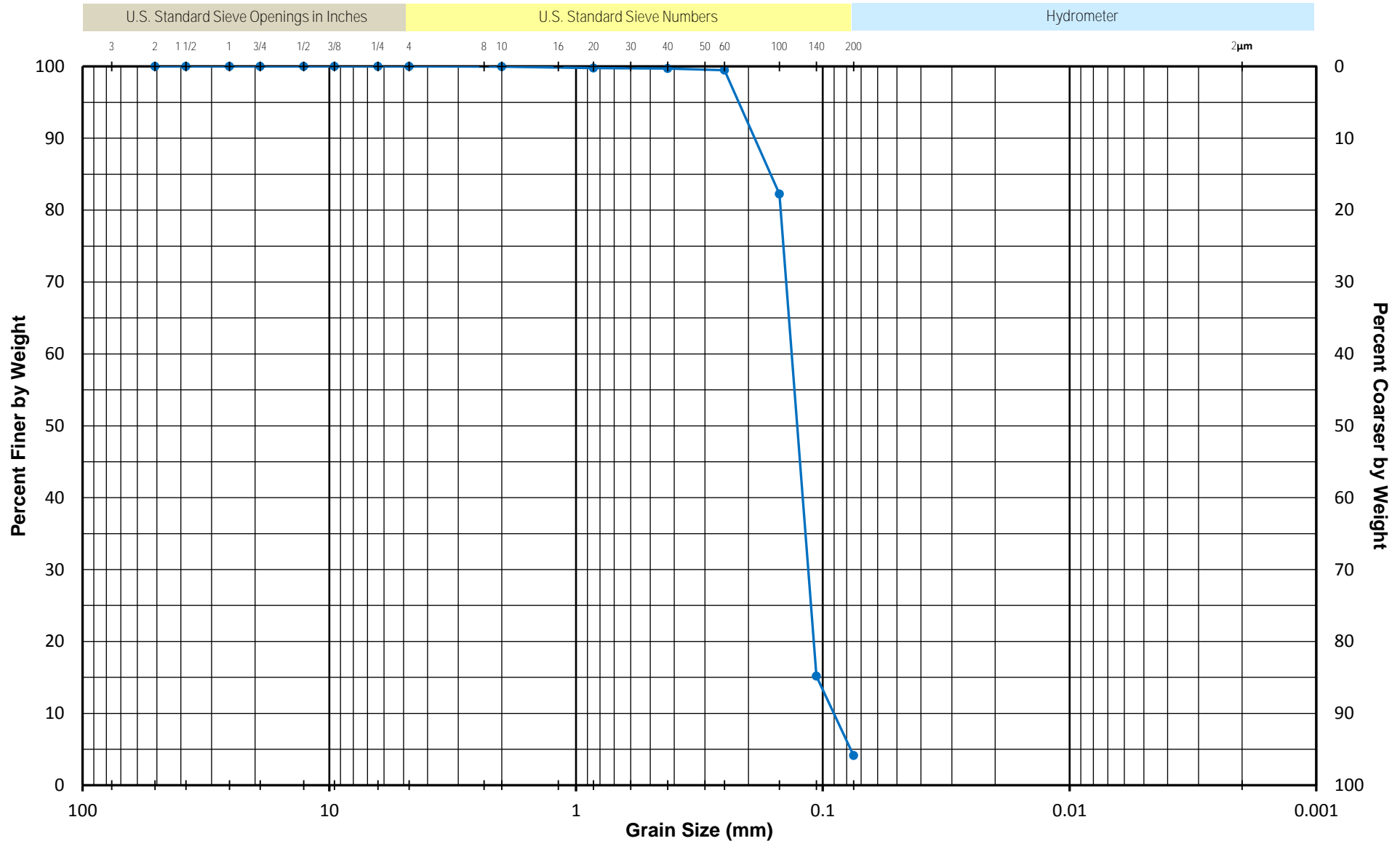


Test Depth	Core ID Section/Sample	Material Description
6.0 ft	VC93 4-6	Light Brownish Gray Silty Fine Sand with clay seam and dark yellowish brown seams

GRADATION CURVES

ASTM D-422, D-6913

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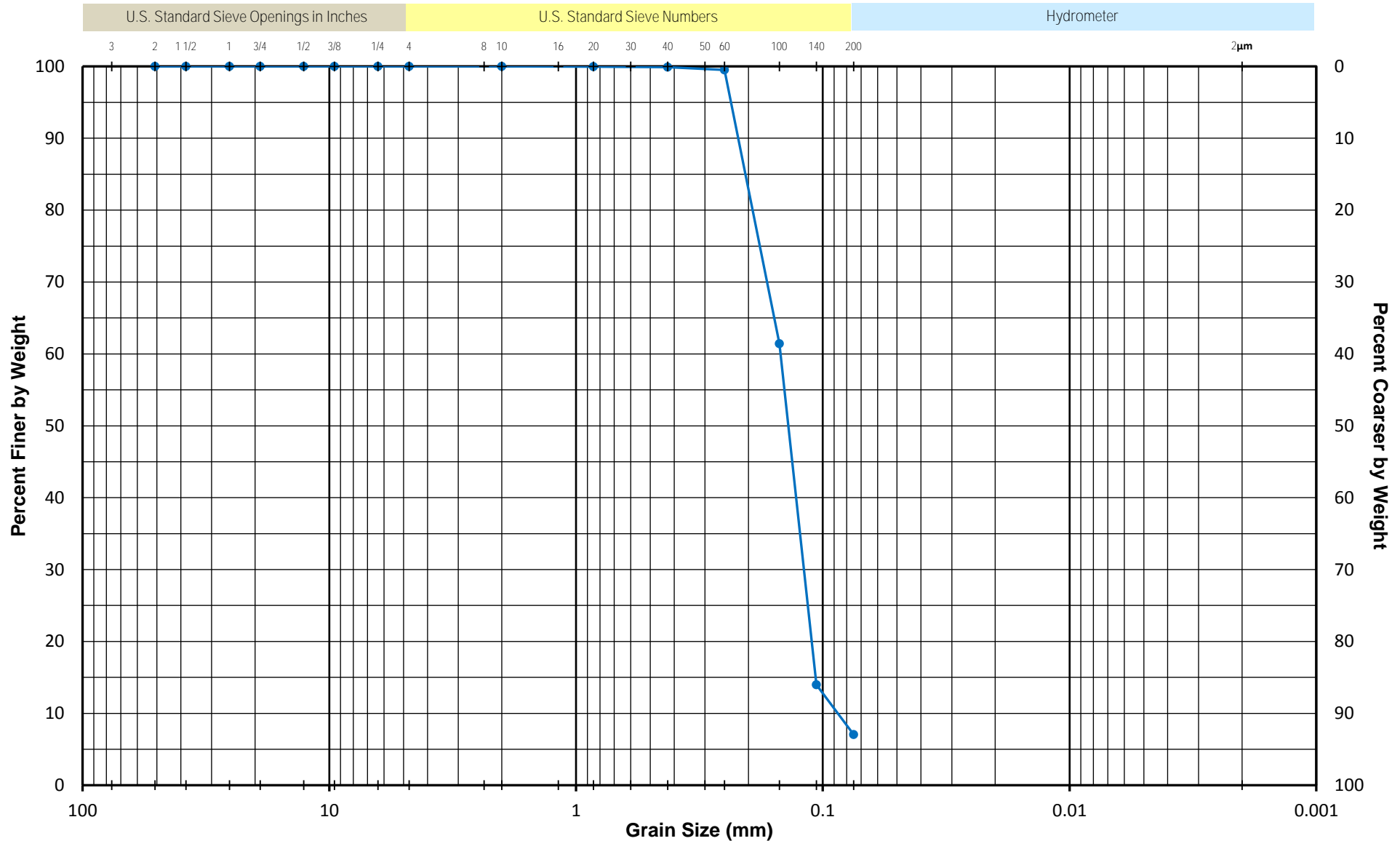


Test Depth	Core ID Section/Sample	Material Description
7.0 ft	VC93 6-8	Light Brownish Gray Fine Sand with gray seam with mica

GRADATION CURVES

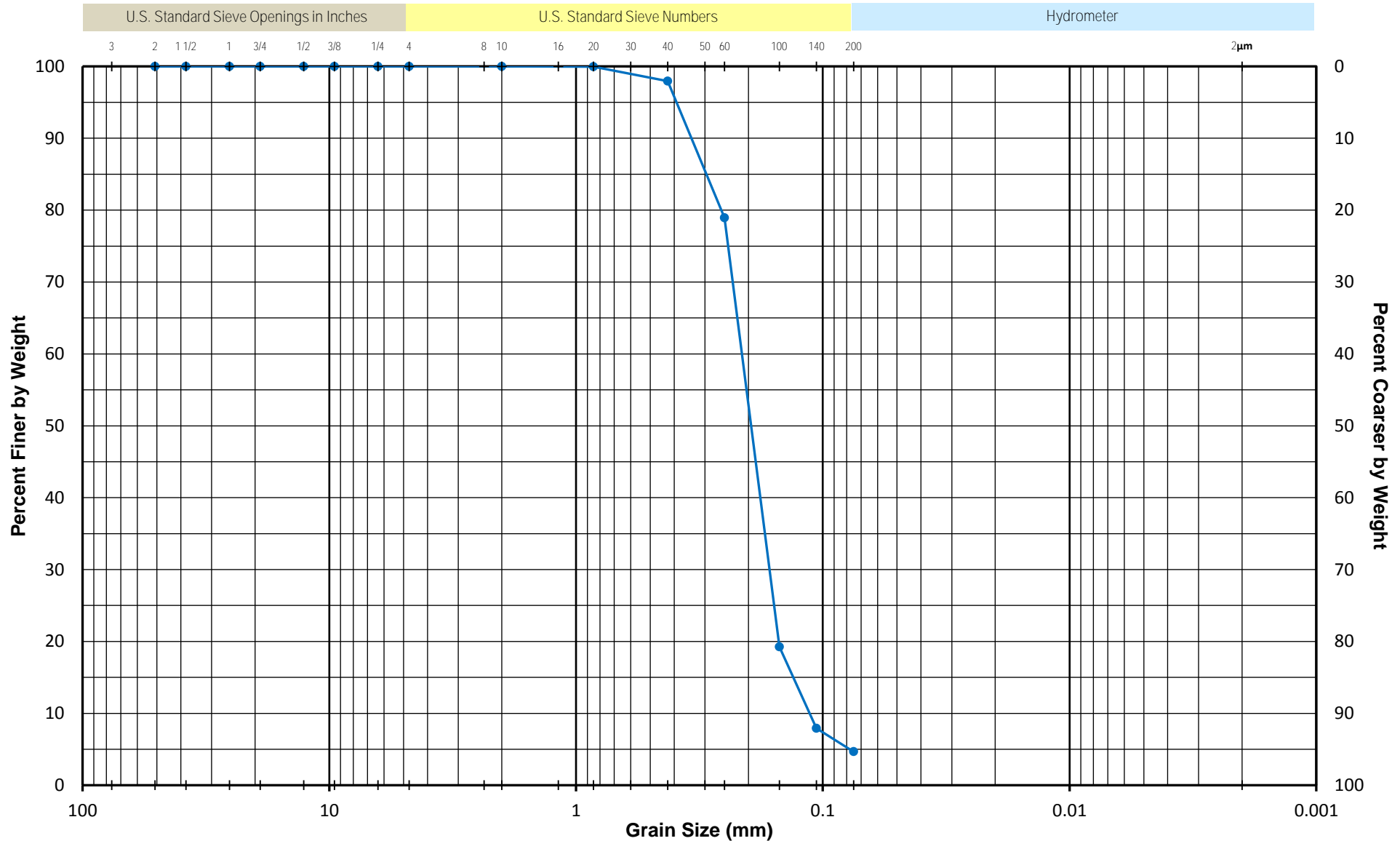
ASTM D-422, D-6913

Alpine - NESE II



Test Depth	Core ID Section/Sample	Material Description
8.0 ft	VC93 6-8	Light Brownish Gray Fine Sand with silt and gray seams with mica

GRADATION CURVES
 ASTM D-422, D-6913
 Alpine - NESE II



Test Depth	Core ID Section/Sample	Material Description
10.0 ft	VC93 8-10	Light Brownish Gray Fine Sand with gray seams with mica

GRADATION CURVES
 ASTM D-422, D-6913
 Alpine - NESE II

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F

Core Logs

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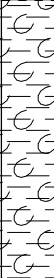


Alpine Ocean Seismic Survey, Inc
155 Hudson Avenue
Norwood, NJ 07648
Telephone: 201-768-8000

BORING NUMBER VC 01 Alt

PAGE 1 OF 1

CLIENT	Williams	PROJECT NAME	NESE Pipeline				
PROJECT NUMBER	1794	PROJECT LOCATION	Raritan Bay and Lower New York Harbor				
DATE STARTED	12/14/16	COMPLETED	12/14/16	WATER DEPTH	-8.71 ft MLLW	HOLE SIZE	3.5 in inches
DRILLING CONTRACTOR	Alpine Ocean Seismic	CORE PENETRATION:	19.48				
DRILLING METHOD	Vibracore	CORE RECOVERY:	15.92				
LOGGED BY	CM	CHECKED BY	CD	CORE LOCATION:	X:912889.51	Y:110112.09	
NOTES	NAD 83, NY Long Island Lambert, ft						

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	PENETRATION SECONDS PER FOOT	POCKET PEN. (tsf)	TORVANE (tsf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲						
									20 40 60 80						
									PL	MC	LL				
									20 40 60 80						
									□ FINES CONTENT (%) □						
									20 40 60 80						
0		(CH) Unsplit	VC 1	100	1.2	0	0	115	▲		●		▲		
		(CH) Very soft black Clay;non plastic													
		(CH) Black Clay with odor and organics	VC 2	100	1.2						▲				●
5		(CH) Soft brown silty Clay; thinly bedded with black silty Clay; non plastic													
		(CH) Unsplit	VC 3	100	1.7					20	▲				●
		(CH) Soft gray Clay; non plastic													
		(CH) Unsplit	VC 4	100	1.1					28	▲				●
10		(CH) Soft gray Clay with trace shell fragments; non plastic													
		(CH) Unsplit	VC 5	100	1.1					26	▲				●
		(OLSH) Soft gray-brown Clay with trace shell fragments; non plastic													
		(OLSH) Soft grayish brown Clay with few whole shells; non plastic													
15															
Bottom of borehole at 19.5 feet.															

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BORING NUMBER VC 02

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CLIENT	Williams	PROJECT NAME	NESE Pipeline
PROJECT NUMBER	1794	PROJECT LOCATION	Raritan Bay and Lower New York Harbor
DATE STARTED	12/5/16	COMPLETED	12/5/16
DRILLING CONTRACTOR	Alpine Ocean Seismic	WATER DEPTH	-8.23 ft MLLW
DRILLING METHOD	Vibracore	HOLE SIZE	3.5 in inches
LOGGED BY	CM	CHECKED BY	CD
NOTES	CORE PENETRATION: 13.08		
	CORE RECOVERY: 9.29		
	CORE LOCATION: X:914612.32 Y:110957.65		
	NAD 83, NY Long Island Lambert, ft		

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	PENETRATION SECONDS PER FOOT	POCKET PEN. (tsf)	TORVANE (tsf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲			
									20 40 60 80			
									PL MC LL			
0									20 40 60 80			
									□ FINES CONTENT (%) □			
									20 40 60 80			
		(CL) Very soft, gray Clay, nonplastic and noncohesive	VC 1	100	1.4			99	▲	—	—	●
		(SC) Very soft, light brown silty Clay with trace fine sand	VC 2	100	1.0	0.75	0.05	102	▲	□	●	
		(SW) Very loose, light brown medium Sand and cobbles, well graded	VC 3	100	1.8	0.25	0		▲			
		(SC) Loose, dark gray fine Sand with trace silt	VC 4	100	1.1	0.65	0	125	▲	●	□	
		(CH) Very stiff, dry, very light gray Clay; Cohesive and high plasticity.				1.25	0.4					
						1.4	0.3					
			VC 5	100	1.7	2.25	5.25	122	▲	●		□
10												

Bottom of borehole at 13.1 feet.

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BORING NUMBER VC 03 Alt

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CLIENT	Williams	PROJECT NAME	NESE Pipeline
PROJECT NUMBER	1794	PROJECT LOCATION	Raritan Bay and Lower New York Harbor
DATE STARTED	12/5/16	COMPLETED	12/5/16
DRILLING CONTRACTOR	Alpine Ocean Seismic	WATER DEPTH	-8.86 ft MLLW
DRILLING METHOD	Vibracore	HOLE SIZE	3.5 in inches
LOGGED BY	CM	CHECKED BY	CD
NOTES	CORE PENETRATION: 19.49		
	CORE RECOVERY: 11.83		
	CORE LOCATION: X:916536.59 Y:112053.47		
	NAD 83, NY Long Island Lambert, ft		

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	PENETRATION SECONDS PER FOOT	POCKET PEN. (tsf)	TORVANE (tsf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲			
									20	40	60	80
									PL	MC	LL	
0									20	40	60	80
									☐ FINES CONTENT (%) ☐			
									20	40	60	80
		(CH) Soft, gray Clay; noncohesive, nonplastic	VC 1	100	1.9			91				☐ ●
		(CH) Dark greenish gray Clay	VC 2	100	1.5			91				●
5		(CL) Soft, gray Clay; noncohesive, nonplastic										
		(CL) Dark greenish gray Clay, trace shell fragments	VC 3	100	1.2			92				●
		(CL) Soft, gray Clay; noncohesive, nonplastic										
10		(CH) Dark greenish gray Clay, trace shell fragments	VC 4	100	1.5			92				●
		(CL) Soft, gray Clay; noncohesive, nonplastic										
		(CL) Dark greenish gray Clay, trace shell fragments	VC 5	100	1.0			92				●
15												

Bottom of borehole at 19.5 feet.



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CLIENT	Williams	PROJECT NAME	NESE Pipeline
PROJECT NUMBER	1794	PROJECT LOCATION	Raritan Bay and Lower New York Harbor
DATE STARTED	12/4/16	COMPLETED	12/4/16
DRILLING CONTRACTOR	Alpine Ocean Seismic	WATER DEPTH	-7.62 ft MLLW
DRILLING METHOD	Vibracore	HOLE SIZE	3.5 in inches
LOGGED BY	CM	CORE PENETRATION:	17.95
CHECKED BY	CD	CORE RECOVERY:	11.83
NOTES		CORE LOCATION:	X:918089.31 Y:112938.49
		NAD 83, NY Long Island Lambert, ft	

[illegible]

Bottom of borehole at 18.0 feet.



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CLIENT	Williams	PROJECT NAME	NESE Pipeline
PROJECT NUMBER	1794	PROJECT LOCATION	Raritan Bay and Lower New York Harbor
DATE STARTED	12/2/16	COMPLETED	12/2/16
DRILLING CONTRACTOR	Alpine Ocean Seismic	WATER DEPTH	-11.3 ft MLLW
DRILLING METHOD	Vibracore	HOLE SIZE	3.5 in inches
LOGGED BY	CM	CORE PENETRATION:	17.15
CHECKED BY	CD	CORE RECOVERY:	11.17
NOTES		CORE LOCATION:	X:919825.29 Y:113928.17
			NAD 83, NY Long Island Lambert, ft

[illegible]

Bottom of borehole at 17.2 feet.






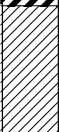




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CLIENT	Williams	PROJECT NAME	NESE Pipeline
PROJECT NUMBER	1794	PROJECT LOCATION	Raritan Bay and Lower New York Harbor
DATE STARTED	11/28/16	COMPLETED	11/28/16
DRILLING CONTRACTOR	Alpine Ocean Seismic	WATER DEPTH	-13.93 ft MLLW
DRILLING METHOD	Vibracore	HOLE SIZE	3.5 in inches
LOGGED BY	CM	CORE PENETRATION:	19.49
CHECKED BY	CD	CORE RECOVERY:	11.08
NOTES		CORE LOCATION:	X:921564.31 Y:114918.1
			NAD 83, NY Long Island Lambert, ft

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	PENETRATION SECONDS PER FOOT	POCKET PEN. (tsf)	TORVANE (tsf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲		
									<div> <div>20 40 60 80</div> <div>PL MC LL</div> <div>20 40 60 80</div> </div>		
									□ FINES CONTENT (%) □		
0											
		(CH) Unsplit	VC 1	100	2.1			82	▲		● 4
		(CL) Very soft, black Clay; noncohesive, nonplastic									
		(CH) Unsplit	VC 2	100	1.6			85	▲		■ 3
5		(CL) Very soft, light gray Clay with few shells; noncohesive, nonplastic									
		(CH) Unsplit	VC 3	100	1.4			89	▲		● 0
		(CL) Very soft, light gray Clay with few shells; noncohesive, nonplastic									
10		(CH) Unsplit	VC 4	100	1.4			90	▲		■
		(CH) Unsplit	VC 5	100	1.4				▲		
15											
Bottom of borehole at 19.5 feet.											



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CLIENT	Williams	PROJECT NAME	NESE Pipeline
PROJECT NUMBER	1794	PROJECT LOCATION	Raritan Bay and Lower New York Harbor
DATE STARTED	11/28/16	COMPLETED	11/28/16
DRILLING CONTRACTOR	Alpine Ocean Seismic	WATER DEPTH	-13.93 ft MLLW
DRILLING METHOD	Vibracore	HOLE SIZE	3.5 in inches
LOGGED BY	CM	CORE PENETRATION:	19.48
CHECKED BY	CD	CORE RECOVERY:	10.75
NOTES		CORE LOCATION:	X:923299.9 Y:115910.19
			NAD 83, NY Long Island Lambert, ft

[illegible]



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CLIENT	Williams	PROJECT NAME	NESE Pipeline
PROJECT NUMBER	1794	PROJECT LOCATION	Raritan Bay and Lower New York Harbor
DATE STARTED	12/2/16	COMPLETED	12/2/16
DRILLING CONTRACTOR	Alpine Ocean Seismic	WATER DEPTH	-15.44 ft MLLW
DRILLING METHOD	Vibracore	HOLE SIZE	3.5 in inches
LOGGED BY	CM	CORE PENETRATION:	19.5
CHECKED BY	CD	CORE RECOVERY:	10.67
NOTES		CORE LOCATION:	X:925038.28 Y:116897.95
			NAD 83, NY Long Island Lambert, ft

[illegible]



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CLIENT	Williams	PROJECT NAME	NESE Pipeline
PROJECT NUMBER	1794	PROJECT LOCATION	Raritan Bay and Lower New York Harbor
DATE STARTED	12/1/16	COMPLETED	12/1/16
DRILLING CONTRACTOR	Alpine Ocean Seismic	WATER DEPTH	-12.43 ft MLLW
DRILLING METHOD	Vibracore	HOLE SIZE	3.5 in inches
LOGGED BY	CM	CORE PENETRATION:	17
CHECKED BY	CD	CORE RECOVERY:	11.79
NOTES		CORE LOCATION:	X:926774.97 Y:117889.99
			NAD 83, NY Long Island Lambert, ft

[illegible]

Bottom of borehole at 17.0 feet.



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CLIENT	Williams	PROJECT NAME	NESE Pipeline				
PROJECT NUMBER	1794	PROJECT LOCATION	Raritan Bay and Lower New York Harbor				
DATE STARTED	12/1/16	COMPLETED	12/1/16	WATER DEPTH	-8.81 ft MLLW	HOLE SIZE	3.5 in inches
DRILLING CONTRACTOR	Alpine Ocean Seismic	CORE PENETRATION:	16.3				
DRILLING METHOD	Vibracore	CORE RECOVERY:	11.63				
LOGGED BY	CM	CHECKED BY	CD	CORE LOCATION:	X:928514.39	Y:118877.43	
NOTES				NAD 83, NY Long Island Lambert, ft			

[illegible]

Bottom of borehole at 16.3 feet.



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CLIENT <u>Williams</u>	PROJECT NAME <u>NESE Pipeline</u>
PROJECT NUMBER <u>1794</u>	PROJECT LOCATION <u>Raritan Bay and Lower New York Harbor</u>
DATE STARTED <u>11/25/16</u> COMPLETED <u>11/25/16</u>	WATER DEPTH <u>-11.53 ft MLLW</u> HOLE SIZE <u>3.5 in inches</u>
DRILLING CONTRACTOR <u>Alpine Ocean Seismic</u>	CORE PENETRATION: <u>16.58</u>
DRILLING METHOD <u>Vibracore</u>	CORE RECOVERY: <u>10.58</u>
LOGGED BY <u>CM</u> CHECKED BY <u>CD</u>	CORE LOCATION: <u>X:930250.82</u> <u>Y:119866.2</u>
NOTES	NAD 83, NY Long Island Lambert, ft

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	PENETRATION SECONDS PER FOOT	POCKET PEN. (tsf)	TORVANE (tsf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲			
									20 40 60 80			
									PL	MC	LL	
									20	40	60	80
									☐ FINES CONTENT (%) ☐			
									20	40	60	80
0		(SP-SM) Very loose, dark brown medium Sand with trace shell fragments and pebbles (SP-SM) Very loose, dark gray clayey Sand with trace pebbles; noncohesive, nonplastic (SPG) Loose, brown medium Sand with trace pebbles	VC 1	100	2.1			106	▲	●		
		(SP) Medium dense, light gray, medium to coarse Sand with trace cobbles	VC 2	100	1.7			113	●			
5		(SW) Loose, very coarse Sand and gravel in a red silty matrix; poorly sorted										
		(SW) Loose coarse Sand and gravel in a red sandy silt matrix	VC 3	100	3.2			120	●			
		(SP) Loose, light grayish brown medium Sand	VC 4	100	4.7			104	▲	●		
10												
15												

Bottom of borehole at 16.6 feet.

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CLIENT	Williams	PROJECT NAME	NESE Pipeline
PROJECT NUMBER	1794	PROJECT LOCATION	Raritan Bay and Lower New York Harbor
DATE STARTED	11/25/16	COMPLETED	11/25/16
DRILLING CONTRACTOR	Alpine Ocean Seismic	WATER DEPTH	-14.43 ft MLLW
DRILLING METHOD	Vibracore	HOLE SIZE	3.5 in inches
LOGGED BY	CM	CHECKED BY	CD
NOTES	CORE PENETRATION: 15.9		
	CORE RECOVERY: 12.33		
	CORE LOCATION: X:931990.72 Y:120858.99		
	NAD 83, NY Long Island Lambert, ft		

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	PENETRATION SECONDS PER FOOT	POCKET PEN. (tsf)	TORVANE (tsf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲			
									20 40 60 80			
									PL MC LL			
0									20 40 60 80			
									□ FINES CONTENT (%) □			
									20 40 60 80			
		(CH) Very soft, greenish gray Clay with trace shell fragments and coarse sand; nonplastic, noncohesive	VC 1	100	1.4			98	▲		●	■
		(SP-SM) Loose, dark gray Silt with some gravel; noncohesive, nonplastic	VC 2	100	1.4			119	▲	□	●	
		(GW-GM) Loose, dark gray Gravel in a black silty sand matrix; poorly sorted										
5		(SP) Medium dense, yellowish red coarse Sand with some gravel; poorly sorted	VC 3	100	4.5			118	▲			
		Large Rock										
		(SP) Medium dense, reddish brown medium Sand; well sorted	VC 4	100	9.9			111	▲	●		
10		(SW-SC) Medium dense, fine brown Sand; few light brown clay laminations	VC 5	100	4.3			119	▲		●	
15												

Bottom of borehole at 15.9 feet.

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CLIENT	Williams	PROJECT NAME	NESE Pipeline
PROJECT NUMBER	1794	PROJECT LOCATION	Raritan Bay and Lower New York Harbor
DATE STARTED	11/25/16	COMPLETED	11/25/16
DRILLING CONTRACTOR	Alpine Ocean Seismic	WATER DEPTH	-15.76 ft MLLW
DRILLING METHOD	Vibracore	HOLE SIZE	3.5 in inches
LOGGED BY	CM	CHECKED BY	CD
NOTES			
	CORE PENETRATION:	16.21	
	CORE RECOVERY:	12.33	
	CORE LOCATION:	X:933727.16	Y:121847.92
	NAD 83, NY Long Island Lambert, ft		

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	PENETRATION SECONDS PER FOOT	POCKET PEN. (tsf)	TORVANE (tsf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲			
									20 40 60 80			
									PL MC LL			
0									20 40 60 80			
									☐ FINES CONTENT (%) ☐			
									20 40 60 80			
		(CH) Unsplit	VC 1	100	1.6			91				
		(CH) Very soft, greenish gray Clay with trace shell fragments; nonplastic, noncohesive										
		(CH) Unsplit	VC 2	100	1.6			92				
5		(CL) Very soft, greenish gray Clay; noncohesive, nonplastic										
		(CH) Unsplit	VC 3	100	1.7			94				
		(CL) Soft, light gray Clay; cohesive, nonplastic										
10		(CH) Unsplit	VC 4	100	1.7			91				
		(CL) Soft, light gray Clay; cohesive, nonplastic										
		(CH) Unsplit	VC 5	100	1.4			91				
15												

Bottom of borehole at 16.2 feet.

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CLIENT	Williams	PROJECT NAME	NESE Pipeline
PROJECT NUMBER	1794	PROJECT LOCATION	Raritan Bay and Lower New York Harbor
DATE STARTED	11/25/16	COMPLETED	11/25/16
DRILLING CONTRACTOR	Alpine Ocean Seismic	WATER DEPTH	-16.69 ft MLLW
DRILLING METHOD	Vibracore	HOLE SIZE	3.5 in inches
LOGGED BY	CM	CHECKED BY	CD
NOTES			
	CORE PENETRATION:	19.5	
	CORE RECOVERY:	14.38	
	CORE LOCATION:	X:934710.63 Y:122409.57	
	NAD 83, NY Long Island Lambert, ft		

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	PENETRATION SECONDS PER FOOT	POCKET PEN. (tsf)	TORVANE (tsf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲			
									20	40	60	80
									PL	MC	LL	
0									20	40	60	80
									☐ FINES CONTENT (%) ☐			
									20	40	60	80
		(CH) Unsplit	VC 1	100	2.8			91	▲			●
		(CH) Very soft, greenish gray Clay with trace shell fragments; nonplastic, noncohesive										
			VC 2	100	2.0			89	▲			●
5												
			VC 3	100	2.4			86	▲			●
			VC 4	100	3.6				▲			
		(CH) Very soft, greenish gray Clay with trace shell fragments; nonplastic, noncohesive	VC 5	100	2.3				▲			
10		(CH) Very soft, greenish gray Clay with trace shell fragments; nonplastic, noncohesive										
		(CH) Very soft, greenish gray Clay with trace shell fragments; nonplastic, noncohesive	VC 6	100	1.9				▲			
		(CH) Very soft, greenish gray Clay with trace shell fragments; nonplastic, noncohesive										
15												

Bottom of borehole at 19.5 feet.

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CLIENT	Williams	PROJECT NAME	NESE Pipeline
PROJECT NUMBER	1794	PROJECT LOCATION	Raritan Bay and Lower New York Harbor
DATE STARTED	11/26/16	COMPLETED	11/26/16
DRILLING CONTRACTOR	Alpine Ocean Seismic	WATER DEPTH	-18.01 ft MLLW
DRILLING METHOD	Vibracore	HOLE SIZE	3.5 in inches
LOGGED BY	CM	CHECKED BY	CD
NOTES			
	CORE PENETRATION:	19.5	
	CORE RECOVERY:	15.96	
	CORE LOCATION:	X:935230.75 Y:122705.16	
	NAD 83, NY Long Island Lambert, ft		

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	PENETRATION SECONDS PER FOOT	POCKET PEN. (tsf)	TORVANE (tsf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲			
									20	40	60	80
									PL	MC	LL	
0									20	40	60	80
		(OL) Organic Shell hash	VC 1	100	0.2							
		(CH) Unsplit	VC 2	100	1.8			92				
		(CL) Very soft, greenish gray Clay with trace shell fragments; nonplastic, noncohesive										
		(CL) Very soft dark gray Clay; noncohesive, nonplastic										
		(CH) Dark greenish gray Clay, with shell fragments	VC 3	100	1.4			93				
		(CH) Very soft dark gray Clay; noncohesive, nonplastic										
5		(CH) Dark greenish gray Clay, with shell fragments	VC 4	100	1.2			91				
		(CH) Very soft dark gray Clay; noncohesive, nonplastic										
		(CL) Dark greenish gray Clay	VC 5	100	1.2			92				
		(CL) Dark greenish gray Clay										
		(CH) Dark greenish gray Clay	VC 6	100	1.4			93				
		(CL) Dark greenish gray Clay	VC 7	100	1.2			95				
		(CL) Very soft dark gray Clay; noncohesive, nonplastic										
15						0	0.075					
						0	0.05					

Bottom of borehole at 19.5 feet.

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CLIENT	Williams	PROJECT NAME	NESE Pipeline
PROJECT NUMBER	1794	PROJECT LOCATION	Raritan Bay and Lower New York Harbor
DATE STARTED	11/26/16	COMPLETED	11/26/16
DRILLING CONTRACTOR	Alpine Ocean Seismic	WATER DEPTH	-29.81 ft MLLW
DRILLING METHOD	Vibracore	HOLE SIZE	3.5 in inches
LOGGED BY	CM	CHECKED BY	CD
NOTES			
	CORE PENETRATION:	19.5	
	CORE RECOVERY:	16.42	
	CORE LOCATION:	X:935719.46 Y:122985.05	
	NAD 83, NY Long Island Lambert, ft		

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	PENETRATION SECONDS PER FOOT	POCKET PEN. (tsf)	TORVANE (tsf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲			
									20 40 60 80			
									PL	MC	LL	
									20	40	60	80
									□ FINES CONTENT (%) □			
									20 40 60 80			
0		(CH) Unsplit	VC 1	100	2.1			76		I		4
		(CL) Very soft black Clay; nonplastic, noncohesive										
		(CL) Black Clay with odor	VC 2	100	1.8			84		I		3
		(CH) Very soft black Clay thinly bedded with grayish green clay; nonplastic, noncohesive										
		(CL) Black Clay with odor	VC 3	100	1.4			86		I		1
		(CH) Very soft black Clay thinly bedded with grayish green clay; nonplastic, noncohesive										
		(CH) Black Clay with odor	VC 4	100	2.0			81		I		2
		(CH) Very soft black Clay thinly bedded with grayish green clay; nonplastic, noncohesive										
		(CH) Black Clay	VC 5	100	2.2			83		I		0
		(CH) Very soft black Clay thinly bedded with grayish green clay; nonplastic, noncohesive										
		(CH) Black Clay with odor	VC 6	100	1.6			80				3
		(CH) Very soft black Clay thinly bedded with grayish green clay; nonplastic, noncohesive										

Bottom of borehole at 19.5 feet.

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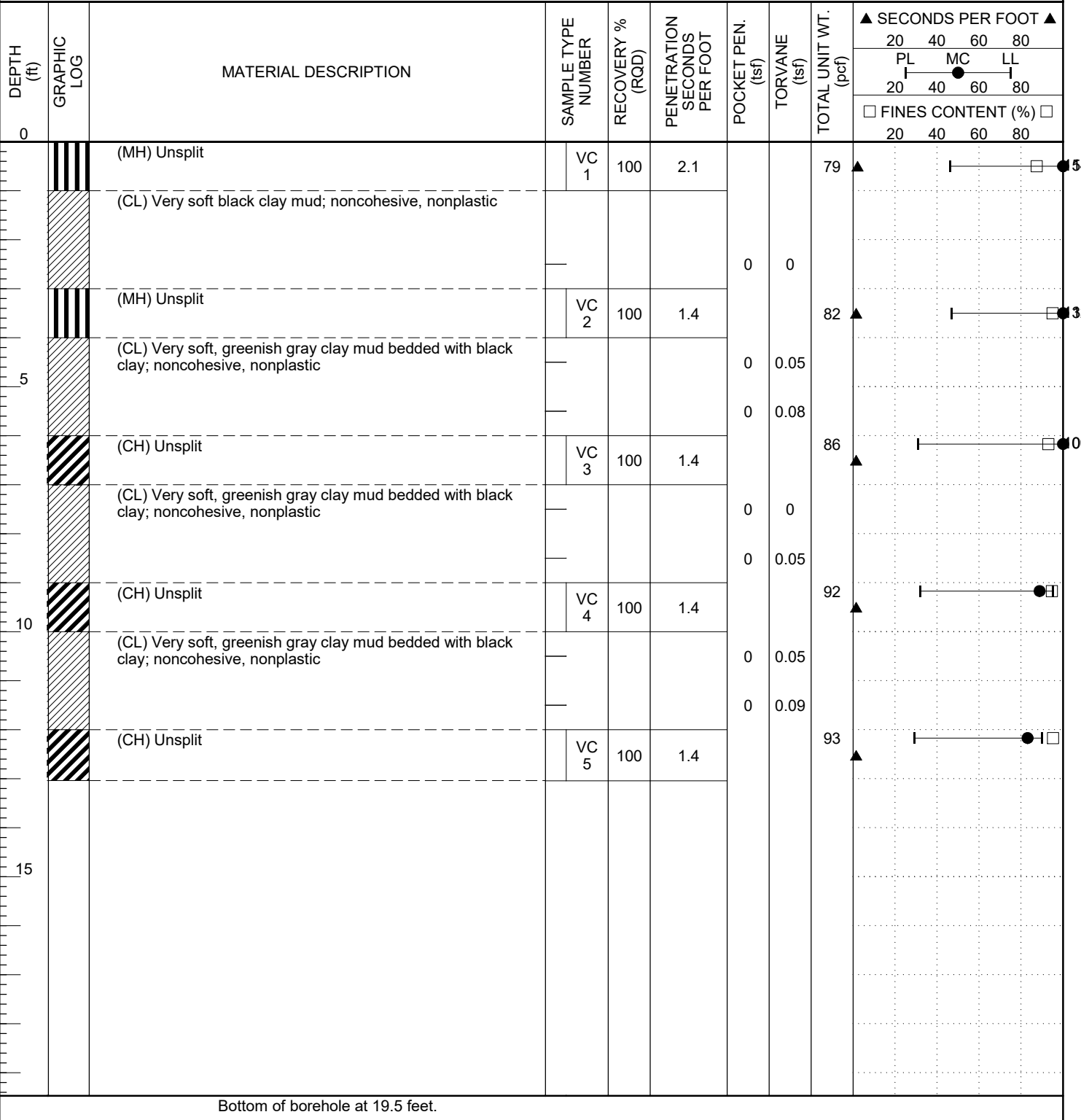


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CLIENT	Williams	PROJECT NAME	NESE Pipeline
PROJECT NUMBER	1794	PROJECT LOCATION	Raritan Bay and Lower New York Harbor
DATE STARTED	11/26/16	COMPLETED	11/26/16
DRILLING CONTRACTOR	Alpine Ocean Seismic	WATER DEPTH	-32.74 ft MLLW
DRILLING METHOD	Vibracore	HOLE SIZE	3.5 in inches
LOGGED BY	CM	CHECKED BY	CD
NOTES			
	CORE PENETRATION:	19.47	
	CORE RECOVERY:	13.04	
	CORE LOCATION:	X:936446.7 Y:123397.59	
	NAD 83, NY Long Island Lambert, ft		



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CLIENT	Williams	PROJECT NAME	NESE Pipeline
PROJECT NUMBER	1794	PROJECT LOCATION	Raritan Bay and Lower New York Harbor
DATE STARTED	11/26/16	COMPLETED	11/26/16
DRILLING CONTRACTOR	Alpine Ocean Seismic	WATER DEPTH	-17.28 ft MLLW
DRILLING METHOD	Vibracore	HOLE SIZE	3.5 in inches
LOGGED BY	CM	CHECKED BY	CD
NOTES			
	CORE PENETRATION:	19.5	
	CORE RECOVERY:	16.58	
	CORE LOCATION:	X:936944.92 Y:123677.54	
	NAD 83, NY Long Island Lambert, ft		

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	PENETRATION SECONDS PER FOOT	POCKET PEN. (tsf)	TORVANE (tsf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲			
									20	40	60	80
									PL	MC	LL	
0									20	40	60	80
									□ FINES CONTENT (%) □			
									20	40	60	80
		(CH) Unsplit	VC 1	100	1.9			90	▲	I	●	
		(CH) Very soft, greenish gray Clay with trace shell fragments; cohesive, low plasticity										
		(CH) Very soft, greenish gray Clay with trace shell fragments; cohesive, low plasticity	VC 2	100	2.0			90	▲	I	●	
		(CH) Very soft, dark gray clay laminated with brown clay; noncohesive, nonplastic				0	0.03					
5		(CH) Very soft, dark gray clay with trace peat; noncohesive, nonplastic	VC 3	100	1.5	0	0.09		▲	I		
		(CH) Very soft, dark gray clay with trace peat; noncohesive, nonplastic				0	0.07					
		(CH) Very soft, dark gray clay with trace peat; noncohesive, nonplastic	VC 4	100	2.3	0	0.10		▲	I		
10		(CH) Very soft, dark gray clay with trace peat; noncohesive, nonplastic				0	0.06					
		(CH) Very soft, dark gray clay with trace peat; noncohesive, nonplastic	VC 5	100	2.6	0	0.12		▲	I		
		(CH) Very soft, dark gray clay with trace peat; noncohesive, nonplastic				0	0.10					
		(CH) Very soft, dark gray clay with trace peat; noncohesive, nonplastic	VC 6	100	1.5				▲	I		
15		(CH) Very soft, dark gray clay with trace peat; noncohesive, nonplastic				0	0.13					
						0	0.13					

Bottom of borehole at 19.5 feet.



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CLIENT	Williams	PROJECT NAME	NESE Pipeline
PROJECT NUMBER	1794	PROJECT LOCATION	Raritan Bay and Lower New York Harbor
DATE STARTED	11/26/16	COMPLETED	11/26/16
DRILLING CONTRACTOR	Alpine Ocean Seismic	WATER DEPTH	-18.94 ft MLLW
DRILLING METHOD	Vibracore	HOLE SIZE	3.5 in inches
LOGGED BY	CM	CORE PENETRATION:	19.48
CHECKED BY	CD	CORE RECOVERY:	11.67
NOTES		CORE LOCATION:	X:937794.14 Y:124069.86
			NAD 83, NY Long Island Lambert, ft

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	PENETRATION SECONDS PER FOOT	POCKET PEN. (tsf)	TORVANE (tsf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲				
									<div> <div>20 40 60 80</div> <div>PL MC LL</div> <div>20 40 60 80</div> </div>				
									□ FINES CONTENT (%) □				
0													
		(CH) Dark greenish gray Clay with trace shell fragments	VC 1	100	1.6			95	▲	----- ●	□		
(CH) Very soft greenish gray Clay with trace shell fragments; noncohesive, nonplastic													
(CH) Very soft greenish gray Clay with trace shell fragments; noncohesive, nonplastic		VC 2	100	2.4			88	▲	----- ●	□			
(CH) Very soft greenish gray Clay with trace shell fragments; noncohesive, nonplastic													
(CH) Dark greenish gray Clay with trace shell fragments		VC 3	100	2.2			96	▲	----- ●	□			
(CH) Dark greenish gray Clay with trace shell fragments													
(CH) Dark greenish gray Clay with trace fine sand partings		VC 4	100	2.4			97	▲	----- ●				
(CH) Dark greenish gray Clay with trace shell fragments													
(CH) Dark greenish gray Clay with trace shell fragments		VC 5	100	1.5			93	▲	----- ●				
Bottom of borehole at 19.5 feet.													



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CLIENT	Williams	PROJECT NAME	NESE Pipeline
PROJECT NUMBER	1794	PROJECT LOCATION	Raritan Bay and Lower New York Harbor
DATE STARTED	11/27/16	COMPLETED	11/27/16
DRILLING CONTRACTOR	Alpine Ocean Seismic	WATER DEPTH	-17.8 ft MLLW
DRILLING METHOD	Vibracore	HOLE SIZE	3.5 in inches
LOGGED BY	CM	CORE PENETRATION:	19.49
CHECKED BY	CD	CORE RECOVERY:	14.50
NOTES		CORE LOCATION:	X:939104.16 Y:124461.33
			NAD 83, NY Long Island Lambert, ft

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	PENETRATION SECONDS PER FOOT	POCKET PEN. (tsf)	TORVANE (tsf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲			
									20 40 60 80			
									PL	MC	LL	
									20 40 60 80			
									☐ FINES CONTENT (%) ☐			
									20 40 60 80			
0		(OL) Shell hash	VC 1	100	0.2				106			
		(CL) Lean Clay with Sand, shell content and 2.8% organic material	VC 2	100	2.2							
		(CL-ML) Very soft, dark gray silty clay with trace shell hash; cohesive, low plasticity				0	0					
		(CH) Dark greenish gray Clay	VC 3	100	1.7				100			
		(CH) Very soft, dark gray clay with trace shell hash; cohesive, nonplastic				0	0.05					
5						0	0.08					
		(CH) Dark greenish gray Clay	VC 4	100	2.3				96			
		(CH) Very soft, dark gray clay with trace shell hash; cohesive, nonplastic				0	0.12					
						0	0.10					
		(CH) Dark greenish gray Clay with shell fragments	VC 5	100	2.0				97			
10		(CH) Very soft, dark gray clay with trace shell hash; cohesive, nonplastic				0	0.06					
		(CH) Dark greenish gray Clay	VC 6	100	1.6				91			
		(CH) Very soft, dark gray clay with trace shell hash; cohesive, nonplastic				0	0.11					
						0	0.13					
						0	0.02					
15												
Bottom of borehole at 19.5 feet.												



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CLIENT Williams		PROJECT NAME NESE Pipeline	
PROJECT NUMBER 1794		PROJECT LOCATION Raritan Bay and Lower New York Harbor	
DATE STARTED 11/27/16	COMPLETED 11/27/16	WATER DEPTH -16.31 ft MLLW	HOLE SIZE 3.5 in inches
DRILLING CONTRACTOR Alpine Ocean Seismic		CORE PENETRATION: 19.09	
DRILLING METHOD Vibracore		CORE RECOVERY: 11.58	
LOGGED BY CM	CHECKED BY CD	CORE LOCATION: X:941097.33 Y:124619.57	
NOTES		NAD 83, NY Long Island Lambert, ft	

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	PENETRATION SECONDS PER FOOT	POCKET PEN. (tsf)	TORVANE (tsf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲				
									☐ FINES CONTENT (%) ☐				
0													
		(OL) Shell hash layer	VC 1	100	0.5								
		(SM) Dark gray silty Sand with large shells and shell hash; noncohesive	VC 2	100	2.2	0.1	0.09	121					
		(SM) Dark gray silty Sand with trace shell hash; very soft; noncohesive											
		(CL-ML) Dark gray silty Clay, trace shell hash; very soft; very low plasticity				0	0.09						
		(SC) Dark gray silty clay, trace shell hash; soft, cohesive; nonplastic	VC 3	100	2.6	0.25	0.09	106					
		(CL) Dark gray silty clay, trace shell hash and trace peat; soft, cohesive; nonplastic				0	0.06						
5						0	0.05						
			VC 4	100	2.2	0	0.075	92					
						0	0.1						
		(SC) Dark gray silty clay with trace fine sand and shells and few lenses of dense shell hash; soft, cohesive; nonplastic				0.15	0.08						
			VC 5	100	2.1	0	0.06	99					
10						0.15	0.1						
			VC 6	100	1.5	0.35	0.11	109					

Bottom of borehole at 19.1 feet.



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CLIENT <u>Williams</u>	PROJECT NAME <u>NESE Pipeline</u>
PROJECT NUMBER <u>1794</u>	PROJECT LOCATION <u>Raritan Bay and Lower New York Harbor</u>
DATE STARTED <u>11/27/16</u> COMPLETED <u>11/27/16</u>	WATER DEPTH <u>-17.66 ft MLLW</u> HOLE SIZE <u>3.5 in inches</u>
DRILLING CONTRACTOR <u>Alpine Ocean Seismic</u>	CORE PENETRATION: <u>15.87</u>
DRILLING METHOD <u>Vibracore</u>	CORE RECOVERY: <u>14.00</u>
LOGGED BY <u>CM</u> CHECKED BY <u>CD</u>	CORE LOCATION: <u>X:943095.96</u> <u>Y:124553.81</u>
NOTES	NAD 83, NY Long Island Lambert, ft

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	PENETRATION SECONDS PER FOOT	POCKET PEN. (tsf)	TORVANE (tsf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲			
									20	40	60	80
									PL	MC	LL	
									20	40	60	80
									☐ FINES CONTENT (%) ☐			
									20	40	60	80
0												
		(SC) Dark gray Clayey Sand with little shell hash; soft, cohesive, non-plastic	VC 1	100	1.4			111		●	☐	
		(SC) Dark gray Clayey Sand with trace shell fragments; one large shell at 1.25 ft. Very soft, slightly cohesive, non plastic; rare pebbles; pp- 0.1 kg/cm2 at 1.5 ft				0.1	0					
		(SM) Soft, dark gray clayey Silt with trace pebbles; noncohesive, nonplastic										
		(SM) Medium dense, dark gray Silt with some pebbles; noncohesive, nonplastic	VC 2	100	0.9			127	▲	☐	●	
5		(SP) Medium dense, reddish brown medium Sand	VC 3	100	3.0					▲	●	
		(SP) Medium dense, light brown medium Sand with trace pebbles	VC 4	100	4.2			118	☐			
		(SP) Medium dense, reddish brown medium to coarse Sand with little pebbles										
10			VC 5	100	9.5			125	●	▲		
			VC 6	100	10.1			115	●	▲		
15												

Bottom of borehole at 15.9 feet.



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CLIENT Williams		PROJECT NAME NESE Pipeline	
PROJECT NUMBER 1794		PROJECT LOCATION Raritan Bay and Lower New York Harbor	
DATE STARTED 11/27/16	COMPLETED 11/27/16	WATER DEPTH -18.05 ft MLLW	HOLE SIZE 3.5 in inches
DRILLING CONTRACTOR Alpine Ocean Seismic		CORE PENETRATION: 16.91	
DRILLING METHOD Vibracore		CORE RECOVERY: 11.50	
LOGGED BY CM	CHECKED BY CD	CORE LOCATION: X:945096.62 Y:124485.31	
NOTES		NAD 83, NY Long Island Lambert, ft	

[illegible]

Bottom of borehole at 16.9 feet.



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CLIENT	Williams	PROJECT NAME	NESE Pipeline
PROJECT NUMBER	1794	PROJECT LOCATION	Raritan Bay and Lower New York Harbor
DATE STARTED	11/27/16	COMPLETED	11/27/16
DRILLING CONTRACTOR	Alpine Ocean Seismic	WATER DEPTH	-18.18 ft MLLW
DRILLING METHOD	Vibracore	HOLE SIZE	3.5 in inches
LOGGED BY	CM	CORE PENETRATION:	15.59
CHECKED BY	CD	CORE RECOVERY:	11.46
NOTES		CORE LOCATION:	X:947094.03 Y:124418.2
			NAD 83, NY Long Island Lambert, ft

[illegible]

Bottom of borehole at 15.6 feet.

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CLIENT Williams	PROJECT NAME NESE Pipeline
PROJECT NUMBER 1794	PROJECT LOCATION Raritan Bay and Lower New York Harbor
DATE STARTED 11/27/16 COMPLETED 11/27/16	WATER DEPTH -17.84 ft MLLW HOLE SIZE 3.5 in inches
DRILLING CONTRACTOR Alpine Ocean Seismic	CORE PENETRATION: 14.35
DRILLING METHOD Vibracore	CORE RECOVERY: 11.38
LOGGED BY CM CHECKED BY CD	CORE LOCATION: X:949091.06 Y:124351.15
NOTES	NAD 83, NY Long Island Lambert, ft

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	PENETRATION SECONDS PER FOOT	POCKET PEN. (tsf)	TORVANE (tsf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲				
									20	40	60	80	
									PL	MC	LL		
0									20	40	60	80	
										□ FINES CONTENT (%) □			
										20	40	60	80
		(SP-SM) Dark gray to light gray poorly graded Sand with silt, little shell hash, trace pebbles; noncohesive, nonplastic	VC 1	100	2.1			109	▲	●			
		(SP) Light gray-brown fine to medium Sand, trace coarse sand and pebbles											
		(SP) Light brown fine to medium Sand, trace coarse sand and few pebbles											
		(SP) Medium dense, dark brown medium Sand with trace pebbles	VC 2	100	2.3			121	▲	●			
5		(SP-SM) Medium dense, brownish red medium Sand with trace pebbles											
			VC 3	100	19.2			123	■	●	▲		
		(SP) Medium dense, grayish brown coarse Sand with trace pebbles	VC 4	100	29.7					●		▲	
		(SP) Dense, reddish brown coarse Sand with trace pebbles											
			VC 5	100	14.2			133	●	▲			
10		(SP) Dense, reddish gray coarse Sand with trace pebbles	VC 6	100	28.4			137	□	●		▲	

Bottom of borehole at 14.4 feet.



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CLIENT Williams

PROJECT NAME NESE Pipeline

PROJECT NUMBER 1794

PROJECT LOCATION Raritan Bay and Lower New York Harbor

DATE STARTED 12/4/16 **COMPLETED** 12/4/16

WATER DEPTH -14.72 ft MLLW **HOLE SIZE** 3.5 in inches

DRILLING CONTRACTOR Alpine Ocean Seismic

CORE PENETRATION: 19.5

DRILLING METHOD Vibracore

CORE RECOVERY: 11.67

LOGGED BY CM CHECKED BY CD

CORE LOCATION: X:951089.14 Y:124409.84

NOTES

NAD 83, NY Long Island Lambert, ft

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	PENETRATION SECONDS PER FOOT	POCKET PEN. (tsf)	TORVANE (tsf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲				
									20 40 60 80				
									PL	MC	LL		
									20 40 60 80				
										□ FINES CONTENT (%) □			
										20 40 60 80			
0		(SP) Light brown poorly graded Sand; trace shell hash	VC 1	100	0.2	2.75	0.48	106	▲	●			
		(SP-SM) Dark gray fine to medium Sand with silt and trace shell hash and pebbles; very soft	VC 2	100	1.6						▲	●	
		(SW) Medium dense, dark reddish gray medium Sand with trace gravel and coarse sand	VC 3	100	0.9					126	▲	●	
5		(CL) Stiff, light gray sandy Clay with trace gravel, thinly bedded with red sandy clay; lenses of highly plastic and cohesive light gray clay at 5.04 ft and 5.17 ft											
		(SW-SM) Stiff, dark red silty fine Sand with some gravel Unsplit	VC 4	100	2.3					139	▲	●	
		(SW) Medium dense, brown medium Sand with little gravel											
		(SW) Brown, fine to medium Sand											
		Unsplit	VC 5	100	15.6					113	●	▲	
10		(SP) Dense, gray fine Sand											
		(SW) Dense, gray fine to medium Sand with trace coarse sand	VC 6	100	16.2					125	●	▲	
15													
Bottom of borehole at 19.5 feet.													

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CLIENT	Williams	PROJECT NAME	NESE Pipeline
PROJECT NUMBER	1794	PROJECT LOCATION	Raritan Bay and Lower New York Harbor
DATE STARTED	12/5/16	COMPLETED	12/5/16
DRILLING CONTRACTOR	Alpine Ocean Seismic	WATER DEPTH	-17.8 ft MLLW
DRILLING METHOD	Vibracore	HOLE SIZE	3.5 in inches
LOGGED BY	CM	CHECKED BY	CD
NOTES	CORE PENETRATION: 15.31		
	CORE RECOVERY: 11.50		
	CORE LOCATION: X:953005.77 Y:124939.45		
	NAD 83, NY Long Island Lambert, ft		

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	PENETRATION SECONDS PER FOOT	POCKET PEN. (tsf)	TORVANE (tsf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲			
									20 40 60 80			
									PL	MC	LL	
									20 40 60 80			
□ FINES CONTENT (%) □												
20 40 60 80												
0		(SP-SM) Very loose, dark gray fine to medium Sand with silt, trace shell hash and pebbles; one pebble 1.5 diameter at 0.75 feet	VC 1	100	1.4			130	▲ □ ●			
		(SP) Very loose, dark red-brown fine Sand, trace coarse Sand										
		(SP) Very loose, dark brown medium to coarse Sand										
		(SP-SM) Loose, dry, gray coarse Sand	VC 2	100	2.9			118	▲ □ ●			
		(SP-SM) Medium dense, red fine silty Sand										
5		(SC) Medium dense, red clayey fine Sand										
		(SP) Loose, fine to medium brownish red Sand										
			VC 3	100	3.9			116	▲ ●			
			VC 4	100	8.7				▲ ●			
			VC 5	100	6.5			111	▲ ●			
			VC 6	100	4.6			118	▲ ●			
		</										

Bottom of borehole at 15.3 feet.



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CLIENT <u>Williams</u>	PROJECT NAME <u>NESE Pipeline</u>
PROJECT NUMBER <u>1794</u>	PROJECT LOCATION <u>Raritan Bay and Lower New York Harbor</u>
DATE STARTED <u>12/5/16</u> COMPLETED <u>12/5/16</u>	WATER DEPTH <u>-18.83 ft MLLW</u> HOLE SIZE <u>3.5 in inches</u>
DRILLING CONTRACTOR <u>Alpine Ocean Seismic</u>	CORE PENETRATION: <u>16.27</u>
DRILLING METHOD <u>Vibracore</u>	CORE RECOVERY: <u>10.92</u>
LOGGED BY <u>CM</u> CHECKED BY <u>CD</u>	CORE LOCATION: <u>X:954766.91 Y:125875.8</u>
NOTES	NAD 83, NY Long Island Lambert, ft

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	PENETRATION SECONDS PER FOOT	POCKET PEN. (tsf)	TORVANE (tsf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲			
									20 40 60 80			
									PL	MC	LL	
									20	40	60	80
									☐ FINES CONTENT (%) ☐			
									20	40	60	80
0		(SM) Dark gray silty fine Sand; trace shell hash	VC 1	100	1.9			124	▲	●		
		(SP) Dark gray medium Sand, trace pebbles and shell hash										
		(SP) Light gray medium Sand										
		(SM) Silty, gray medium Sand	VC 2	100	1.9			128	▲	●		
5		(SP) Loose, coarse gray Sand with gravel; well graded										
		(SP) Very loose, gray and red Gravel with coarse sand; well graded	VC 3	100	2.3			126	▲	●		
			VC 4	100	6.3							
10		(SP) Loose, fine to medium dark gray Sand	VC 5	100	3.5			130	▲	●		
		(SP) Loose, Gravel and coarse Sand; well graded	VC 6	100	2.76			130	▲	●		
15												

Bottom of borehole at 16.3 feet.

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CLIENT Williams	PROJECT NAME NESE Pipeline
PROJECT NUMBER 1794	PROJECT LOCATION Raritan Bay and Lower New York Harbor
DATE STARTED 12/5/16 COMPLETED 12/5/16	WATER DEPTH -17.83 ft MLLW HOLE SIZE 3.5 in inches
DRILLING CONTRACTOR Alpine Ocean Seismic	CORE PENETRATION: 15.58
DRILLING METHOD Vibracore	CORE RECOVERY: 11.29
LOGGED BY CM CHECKED BY CD	CORE LOCATION: X:956498.35 Y:126873.51
NOTES	NAD 83, NY Long Island Lambert, ft

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	PENETRATION SECONDS PER FOOT	POCKET PEN. (tsf)	TORVANE (tsf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲			
									20 40 60 80			
									PL	MC	LL	
									20	40	60	80
									□ FINES CONTENT (%) □			
20 40 60 80												
0												
		(SM) Very loose, dark gray silty Sand with red silty clay lamination at surface; cohesive, nonplastic	VC 1	100	1.6			114	▲	□	●	
		(SW) Very loose, dark gray fine Sand with trace pebbles and shells; noncohesive, nonplastic										
		(SW) Loose, dark red medium Sand with trace pebbles; thin clay lamination at 2.17 ft										
		(SP) Loose, reddish brown fine to coarse Sand; well graded	VC 2	100	2.6			114	▲	●		
5												
			VC 3	100	3.0			116	▲	●		
			VC 4	100	6.1				▲	●		
10		(SP) Medium dense coarse Sand and gravel; well graded	VC 5	100	2.6			125	▲	●		
			VC 6	100	4.4			134	▲	●		
15												

Bottom of borehole at 15.6 feet.

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CLIENT	Williams	PROJECT NAME	NESE Pipeline
PROJECT NUMBER	1794	PROJECT LOCATION	Raritan Bay and Lower New York Harbor
DATE STARTED	12/5/16	COMPLETED	12/5/16
DRILLING CONTRACTOR	Alpine Ocean Seismic	WATER DEPTH	-17.92 ft MLLW
DRILLING METHOD	Vibracore	HOLE SIZE	3.5 in inches
LOGGED BY	CM	CHECKED BY	CD
NOTES	CORE PENETRATION: 15.86		
	CORE RECOVERY: 11.04		
	CORE LOCATION: X:958231.75 Y:127870.52		
	NAD 83, NY Long Island Lambert, ft		

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	PENETRATION SECONDS PER FOOT	POCKET PEN. (tsf)	TORVANE (tsf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲			
									20 40 60 80			
									PL MC LL			
0									20 40 60 80			
		(SW-SM) Loose, dark gray silty fine Sand with trace shell fragments and coarse sand; noncohesive, nonplastic	VC 1	100	2.1			131	▲	●		
		(SW) Loose, red and black silty medium Sand; poorly graded										
		(SW) Loose, red coarse gravelly Sand; Well graded	VC 2	100	0.9			125	▲	●		
5		(SW) Medium dense, reddish gray medium Sand with trace gravel; well graded										
		(SP) Loose, yellow brown medium Sand; poorly graded	VC 3	100	4.1			116	▲	●		
10			VC 4	100	6.7			123	▲	●		
			VC 5	100	6.2			114	▲	●		
15												

Bottom of borehole at 15.9 feet.

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CLIENT	Williams	PROJECT NAME	NESE Pipeline
PROJECT NUMBER	1794	PROJECT LOCATION	Raritan Bay and Lower New York Harbor
DATE STARTED	12/6/16	COMPLETED	12/6/16
DRILLING CONTRACTOR	Alpine Ocean Seismic	WATER DEPTH	-16.85 ft MLLW
DRILLING METHOD	Vibracore	HOLE SIZE	3.5 in inches
LOGGED BY	CM	CHECKED BY	CD
NOTES			
	CORE PENETRATION:	16.7	
	CORE RECOVERY:	11.63	
	CORE LOCATION:	X:960083.55 Y:128941.61	
	NAD 83, NY Long Island Lambert, ft		

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	PENETRATION SECONDS PER FOOT	POCKET PEN. (tsf)	TORVANE (tsf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲			
									20	40	60	80
									PL	MC	LL	
									20	40	60	80
									□ FINES CONTENT (%) □			
									20	40	60	80
0		(SP-SM) Loose, brown to gray poorly Sand with silt; trace shell fragments	VC 1	100	1.6			108	▲	●		
			VC 2	100	2.1							
		(SP) Very loose, yellowish gray medium Sand; poorly graded	VC 3	100	1.9			105	▲	●		
		(SM) Loose, light gray silty fine Sand with trace shell fragments; noncohesive, nonplastic										
5												
		(CL) Soft, gray silty Clay; noncohesive, nonplastic	VC 4	100	3.8			101	▲		■	
			VC 5	100	2.1							
		(SP) Loose, gray very coarse Sand with some gravel; well graded	VC 6	100	0.5			124	▲	●		
10												
			VC 7	100	3.9			131	▲	●		
15												

Bottom of borehole at 16.7 feet.

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CLIENT	Williams	PROJECT NAME	NESE Pipeline
PROJECT NUMBER	1794	PROJECT LOCATION	Raritan Bay and Lower New York Harbor
DATE STARTED	12/6/16	COMPLETED	12/6/16
DRILLING CONTRACTOR	Alpine Ocean Seismic	WATER DEPTH	-17.79 ft MLLW
DRILLING METHOD	Vibracore	HOLE SIZE	3.5 in inches
LOGGED BY	CM	CHECKED BY	CD
NOTES			
		CORE PENETRATION:	16.95
		CORE RECOVERY:	11.08
		CORE LOCATION:	X:961695.3 Y:129870.51
		NAD 83, NY Long Island Lambert, ft	

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	PENETRATION SECONDS PER FOOT	POCKET PEN. (tsf)	TORVANE (tsf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲				
									20 40 60 80				
									PL	MC	LL		
									20 40 60 80				
										□ FINES CONTENT (%) □			
										20 40 60 80			
0													
		(SP) Loose, brown medium Sand with trace shells; poorly graded	VC 1	100	2.1			124	▲	●			
		(SP-SM) Loose, dark gray medium Sand with silt; poorly graded											
		(SW) Loose, brown fine to coarse Sand with some gravel; well graded											
		(SP) Medium dense, reddish brown fine to coarse Sand with trace gravel; well graded	VC 2	100	1.9			113	▲	●			
5			VC 3	100	4.4				▲	●			
			VC 4	100	4.2			117	▲	●			
10			VC 5	100	2.3			116	▲	●			
			VC 6	100	2.5			122	▲	□	●		
15													

Bottom of borehole at 17.0 feet.



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CLIENT	Williams	PROJECT NAME	NESE Pipeline
PROJECT NUMBER	1794	PROJECT LOCATION	Raritan Bay and Lower New York Harbor
DATE STARTED	12/6/16	COMPLETED	12/6/16
DRILLING CONTRACTOR	Alpine Ocean Seismic	WATER DEPTH	-17.2 ft MLLW
DRILLING METHOD	Vibracore	HOLE SIZE	3.5 in inches
LOGGED BY	CM	CORE PENETRATION:	17.3
CHECKED BY	CD	CORE RECOVERY:	11.46
NOTES		CORE LOCATION:	X:963516.61 Y:130916.02
			NAD 83, NY Long Island Lambert, ft

[illegible]

Bottom of borehole at 17.3 feet.



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CLIENT Williams		PROJECT NAME NESE Pipeline	
PROJECT NUMBER 1794		PROJECT LOCATION Raritan Bay and Lower New York Harbor	
DATE STARTED 12/6/16	COMPLETED 12/6/16	WATER DEPTH -17.6 ft MLLW	HOLE SIZE 3.5 in inches
DRILLING CONTRACTOR Alpine Ocean Seismic		CORE PENETRATION: 15.7	
DRILLING METHOD Vibracore		CORE RECOVERY: 10.83	
LOGGED BY CM	CHECKED BY CD	CORE LOCATION: X:965273.19 Y:131643.93	
NOTES		NAD 83, NY Long Island Lambert, ft	

[illegible]

Bottom of borehole at 15.7 feet.



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CLIENT <u>Williams</u>	PROJECT NAME <u>NESE Pipeline</u>
PROJECT NUMBER <u>1794</u>	PROJECT LOCATION <u>Raritan Bay and Lower New York Harbor</u>
DATE STARTED <u>12/6/16</u> COMPLETED <u>12/6/16</u>	WATER DEPTH <u>-18.98 ft MLLW</u> HOLE SIZE <u>3.5 in inches</u>
DRILLING CONTRACTOR <u>Alpine Ocean Seismic</u>	CORE PENETRATION: <u>16.24</u>
DRILLING METHOD <u>Vibracore</u>	CORE RECOVERY: <u>11.21</u>
LOGGED BY <u>CM</u> CHECKED BY <u>CD</u>	CORE LOCATION: <u>X:967242.9 Y:131994.9</u>
NOTES	NAD 83, NY Long Island Lambert, ft

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	PENETRATION SECONDS PER FOOT	POCKET PEN. (tsf)	TORVANE (tsf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲			
									20 40 60 80			
									PL	MC	LL	
									20	40	60	80
									□ FINES CONTENT (%) □			
									20	40	60	80
0		(SP-SM) Loose, gray medium Sand with silt; trace gravel; poorly graded	VC 1	100	1.2			125	▲	●		
		(SP-SM) Loose, reddish brown fine to coarse Sand with some gravel										
		(SW-SM) Medium dense, reddish brown very fine Sand with silt; noncohesive, nonplastic										
		(SP) Dense, reddish brown fine Sand	VC 2	100	1.4			128	▲	□	●	
5		(SW) Very loose, brown medium Sand thinly bedded with coarse sand	VC 3	100	3.0							
		(SP) Loose, brown, medium Sand with trace thin beds of coarse sand	VC 4	100	2.6			118	▲	●		
10		(SW) Medium dense, gray medium Sand with trace gravel	VC 5	100	4.4			111	▲	●		
			VC 6	100	8.3			123	▲	●		
15												

Bottom of borehole at 16.2 feet.

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CLIENT <u>Williams</u>	PROJECT NAME <u>NESE Pipeline</u>
PROJECT NUMBER <u>1794</u>	PROJECT LOCATION <u>Raritan Bay and Lower New York Harbor</u>
DATE STARTED <u>12/6/16</u> COMPLETED <u>12/6/16</u>	WATER DEPTH <u>-20.33 ft MLLW</u> HOLE SIZE <u>3.5 in inches</u>
DRILLING CONTRACTOR <u>Alpine Ocean Seismic</u>	CORE PENETRATION: <u>19.51</u>
DRILLING METHOD <u>Vibracore</u>	CORE RECOVERY: <u>17.17</u>
LOGGED BY <u>CM</u> CHECKED BY <u>CD</u>	CORE LOCATION: <u>X:969241</u> <u>Y:131903.44</u>
NOTES	NAD 83, NY Long Island Lambert, ft

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	PENETRATION SECONDS PER FOOT	POCKET PEN. (tsf)	TORVANE (tsf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲			
									20 40 60 80			
									PL	MC	LL	□ FINES CONTENT (%) □
									20	40	60	80
0		(SC) Soft, black clayey Sand; trace shells; organic material noted	VC 1	100	1.9	0.1	0.025	105				
		(SC) Loose, medium yellow Sand with trace shells										
		(ML) Soft, dark brown sandy Silt with little shell fragments; noncohesive, nonplastic										
		(SM) Medium dense, dark gray silty Sand with trace shell fragments	VC 2	100	1.4			110				
		(SW-SM) Loose, dark grayish brown fine Sand with trace pebbles and gray silt										
5		(SP) Loose, dark grayish brown medium Sand with trace pebbles	VC 3	100	4.2							
		(SP) Loose, grayish brown fine Sand										
		(SP) Medium dense, reddish gray brown coarse Sand with trace pebbles	VC 4	100	1.6			118				
		(SP) Medium dense, brown medium Sand										
10			VC 5	100	4.2			111				
			VC 6	100	9.7							
		(SP) Loose, gray medium Sand										
		(SP) Medium dense, orangish brown medium to coarse Sand; lens of fine sand from 16.08 - 16.21	VC 7	100	5.3			118				
15			VC 8	100	7.4			104				
		(SP) Very loose, orangish brown coarse Sand with trace pebbles										

Bottom of borehole at 19.5 feet.

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CLIENT <u>Williams</u>	PROJECT NAME <u>NESE Pipeline</u>
PROJECT NUMBER <u>1794</u>	PROJECT LOCATION <u>Raritan Bay and Lower New York Harbor</u>
DATE STARTED <u>12/8/16</u> COMPLETED <u>12/8/16</u>	WATER DEPTH <u>-21.78 ft MLLW</u> HOLE SIZE <u>3.5 in inches</u>
DRILLING CONTRACTOR <u>Alpine Ocean Seismic</u>	CORE PENETRATION: <u>19.51</u>
DRILLING METHOD <u>Vibracore</u>	CORE RECOVERY: <u>15.42</u>
LOGGED BY <u>CM</u> CHECKED BY <u>CD</u>	CORE LOCATION: <u>X:971194.11</u> <u>Y:971194.11</u>
NOTES	NAD 83, NY Long Island Lambert, ft

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	PENETRATION SECONDS PER FOOT	POCKET PEN. (tsf)	TORVANE (tsf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲			
									20 40 60 80			
									PL	MC	LL	FINES CONTENT (%) □
0									20	40	60	80
		(CH) Dark gray Clay; high plasticity	VC 1	100	2.1			92				
		(CL-ML) Soft, black silty Clay; noncohesive, nonplastic; cobble at 4.42ft										
		(CL-ML) Soft, black silty Clay with some fine sand and shell fragments; noncohesive, nonplastic										
		(MH) Very soft, dark gray clayey Silt with little shell fragments; noncohesive, nonplastic	VC 2	100	2.8			114				
		(SP-SM) Medium dense, gray fine Sand with trace shell fragments and thin beds of gray clay										
5												
		(SP-SM) Medium dense, dark gray silty Sand with little shell fragments	VC 3	100	2.3			128				
		(SP) Medium dense, dark orange medium Sand thinly bedded with coarse sand										
10			VC 4	100	2.3			122				
		(SP) Medium dense, orange fine Sand with trace beds of dark brown fine sand, and a lens of coarse sand from 12.25 - 12.5 ft	VC 5	100	8.4							
		(SP) Medium dense, light reddish brown fine to medium Sand	VC 6	100	5.6			126				
15		(SP-SM) Medium dense, dark reddish brown fine Sand	VC 7	100	12.1			121				

Bottom of borehole at 19.5 feet.

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CLIENT Williams	PROJECT NAME NESE Pipeline
PROJECT NUMBER 1794	PROJECT LOCATION Raritan Bay and Lower New York Harbor
DATE STARTED 12/8/16 COMPLETED 12/8/16	WATER DEPTH -25.4 ft MLLW HOLE SIZE 3.5 in inches
DRILLING CONTRACTOR Alpine Ocean Seismic	CORE PENETRATION: 19.51
DRILLING METHOD Vibracore	CORE RECOVERY: 16.38
LOGGED BY CM CHECKED BY CD	CORE LOCATION: X:972198.55 Y:131238.87
NOTES	NAD 83, NY Long Island Lambert, ft

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	PENETRATION SECONDS PER FOOT	POCKET PEN. (tsf)	TORVANE (tsf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲			
									20	40	60	80
									PL	MC	LL	
									20	40	60	80
									□ FINES CONTENT (%) □			
									20	40	60	80
0		(OH) Soft, wet, black sandy Organic Clay; noncohesive	VC 1	100	2.6			94				
		(SM) Soft, moist, dark brown silty Clay; noncohesive, nonplastic										
		(SM) Soft, wet, dark gray silty Clay; noncohesive, nonplastic	VC 2	100	3.2			105				
5		(SP-SM) Soft, wet, dark gray silty Sand with trace shells										
			VC 3	100	2.3			129				
		(SP) Dense, moist, dark brown fine Sand										
		(SP) Medium dense, reddish gray medium Sand thinly bedded with coarse sand										
10			VC 4	100	3.7			108				
		(SP) Medium dense, dark orangish brown medium to coarse Sand										
		(SP) Medium dense, orangish brown medium to coarse Sand with brown laminations										
			VC 5	100	9.3			115				
		(SP) Medium dense, dark brown medium Sand with dark brown laminations										
			VC 6	100	9.5							
15		(SP) Loose, dark orange-brown coarse Sand with clay lens from 15.5 - 15.67 ft, and trace pebbles										
			VC 7	100	7.3			112				

Bottom of borehole at 19.5 feet.



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CLIENT <u>Williams</u>	PROJECT NAME <u>NESE Pipeline</u>
PROJECT NUMBER <u>1794</u>	PROJECT LOCATION <u>Raritan Bay and Lower New York Harbor</u>
DATE STARTED <u>12/8/16</u> COMPLETED <u>12/8/16</u>	WATER DEPTH <u>-34.78 ft MLLW</u> HOLE SIZE <u>3.5 in inches</u>
DRILLING CONTRACTOR <u>Alpine Ocean Seismic</u>	CORE PENETRATION: <u>19.5</u>
DRILLING METHOD <u>Vibracore</u>	CORE RECOVERY: <u>18.83</u>
LOGGED BY <u>CM</u> CHECKED BY <u>CD</u>	CORE LOCATION: <u>X:972811.56</u> <u>Y:131099</u>
NOTES	NAD 83, NY Long Island Lambert, ft

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	PENETRATION SECONDS PER FOOT	POCKET PEN. (tsf)	TORVANE (tsf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲			
									20	40	60	80
									PL	MC	LL	
									20	40	60	80
									☐ FINES CONTENT (%) ☐			
									20	40	60	80
0		(SM) Soft, black silty Clay; noncohesive, nonplastic	VC 1	100	2.3			109	▲	●		
		(SM) Loose, gray, wet silty fine Sand with trace shells; poorly graded										
		(SP-SM) Loose, gray fine Sand with silt and coarse shell hash										
		(CL) Very stiff, dark brown Clay thinly bedded with gray clay and trace peat; nonplastic, noncohesive	VC 2	100	4.7	1.5	0.14	104	▲		●	
5		(ML) Very soft, wet, black sandy Silt				0.9	0.15					
		(SM) Stiff, wet, dark gray fine sand with trace coarse Sand										
		(SP) Stiff, moist, reddish gray medium Sand with trace coarse sand	VC 3	100	2.1			121	▲	■		
		(SP) Medium dense, moist, gray medium Sand with trace pebbles	VC 4	100	2.1				▲	●		
10		(SP) Stiff, moist, dark grayish red medium Sand with trace coarse sand	VC 5	100	1.6			131	▲	●		
		(SC) Stiff, moist, grayish green silty Clay; cohesive, low plasticity				2.1	0.35					
			VC 6	100	4.9			126	▲	●	☐	
		(ML) Medium dense, moist, reddish green sandy Silt										
15		(SM) Medium dense, moist, orange fine Sand	VC 7	100	9.2			118	▲	■	☐	
		(SM) Dense, moist, dark brownish-red fine Sand										
		(SP) Dense, moist, dark brown medium Sand with trace coarse sand										
		(SW) Medium dense, dry, yellow brown medium Sand with some coarse sand and gravel										
		(CH) Dense, dry, light blue Clay; cohesive, highly plastic				1.1	0.35					

Bottom of borehole at 19.5 feet.

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CLIENT <u>Williams</u>	PROJECT NAME <u>NESE Pipeline</u>
PROJECT NUMBER <u>1794</u>	PROJECT LOCATION <u>Raritan Bay and Lower New York Harbor</u>
DATE STARTED <u>12/8/16</u> COMPLETED <u>12/8/16</u>	WATER DEPTH <u>-32.48 ft MLLW</u> HOLE SIZE <u>3.5 in inches</u>
DRILLING CONTRACTOR <u>Alpine Ocean Seismic</u>	CORE PENETRATION: <u>19.5</u>
DRILLING METHOD <u>Vibracore</u>	CORE RECOVERY: <u>15.42</u>
LOGGED BY <u>CM</u> CHECKED BY <u>CD</u>	CORE LOCATION: <u>X:973309.06 Y:130978.87</u>
NOTES	NAD 83, NY Long Island Lambert, ft

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	PENETRATION SECONDS PER FOOT	POCKET PEN. (tsf)	TORVANE (tsf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲			
									20	40	60	80
									PL	MC	LL	
									20	40	60	80
									□ FINES CONTENT (%) □			
									20	40	60	80
0		(SP-SM) Very loose, yellow, fine to medium Sand	VC 1	100	2.6			111	▲	●		
		(SP-SM) Loose, black, fine Sand lamination										
		(SP-SM) Loose, yellowish brown medium Sand; 1 inch diameter shell at 2.33 feet										
		(SP-SM) Medium dense, brown fine Sand; trace shell hash	VC 2	100	2.8			120	▲	□	●	
		(SP-SM) Medium dense, dark gray fine Sand with coarse sand thin beds at 5.08 and 5.33 feet										
5		(SP-SM) Medium dense, dark brownish red fine Sand with some coarse sand from 7.25 - 7.75 ft	VC 3	100	1.6			128	▲	□	●	
			VC 4	100	4.0				▲	●		
		(SP) Medium dense, light brown coarse Sand with trace pebbles	VC 5	100	1.4			118	●			
10		(SC) Loose, wet, dark gray fine Sand	VC 6	100	22.1			122		□	●	
		(SP-SM) Medium dense, dark reddish brown medium Sand with trace coarse sand	VC 7	100	7.0			118	●			

Bottom of borehole at 19.5 feet.



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CLIENT Williams	PROJECT NAME NESE Pipeline
PROJECT NUMBER 1794	PROJECT LOCATION Raritan Bay and Lower New York Harbor
DATE STARTED 12/10/16 COMPLETED 12/10/16	WATER DEPTH -24.3 ft MLLW HOLE SIZE 3.5 in inches
DRILLING CONTRACTOR Alpine Ocean Seismic	CORE PENETRATION: 19.49
DRILLING METHOD Vibracore	CORE RECOVERY: 15.5
LOGGED BY CM CHECKED BY CD	CORE LOCATION: X:974209.67 Y:130733.23
NOTES	NAD 83, NY Long Island Lambert, ft

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	PENETRATION SECONDS PER FOOT	POCKET PEN. (tsf)	TORVANE (tsf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲			
									20	40	60	80
									PL	MC	LL	
									20	40	60	80
									□ FINES CONTENT (%) □			
									20	40	60	80
0		(OL) Shell hash sample	VC 1	100	0.3							
		(SP-SM) Very loose, yellow medium Sand with some shell fragments	VC 2	100	1.4			108	□	●		
		(ML) Very soft, black sandy Silt with trace shell fragments										
		(SM) Loose, black very fine silty Sand with trace shell fragments										
		(SP-SM) Medium dense, dark brown fine Sand thinly bedded with dark gray silty clay; trace shell fragments	VC 3	100	1.2			108	▲	□	●	
		(SP) Dense, gray fine Sand										
5												
			VC 4	100	2.1			121	▲	●		
			VC 5	100	3.7			122	▲	●		
			VC 6	100	11.1			115	□	▲	●	
		(SP-SM) Dense, dark gray fine Sand with trace shells										
			VC 7	100	48.7			120	□	●	▲	
15												

Bottom of borehole at 19.5 feet.



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CLIENT	Williams	PROJECT NAME	NESE Pipeline				
PROJECT NUMBER	1794	PROJECT LOCATION	Raritan Bay and Lower New York Harbor				
DATE STARTED	12/10/16	COMPLETED	12/10/16	WATER DEPTH	-16.5 ft MLLW	HOLE SIZE	3.5 in inches
DRILLING CONTRACTOR	Alpine Ocean Seismic	CORE PENETRATION:	16.03				
DRILLING METHOD	Vibracore	CORE RECOVERY:	11.33				
LOGGED BY	CM	CHECKED BY	CD	CORE LOCATION:	X:975045.49	Y:130398.95	
NOTES				NAD 83, NY Long Island Lambert, ft			

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	PENETRATION SECONDS PER FOOT	POCKET PEN. (tsf)	TORVANE (tsf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲		
									<div> <div>20 40 60 80</div> <div>PL MC LL</div> <div>20 40 60 80</div> </div>		
									□ FINES CONTENT (%) □		
			20 40 60 80								
0											
		(SP) Shell hash in yellow medium Sand	VC 1	100	0.2						
		(SP-SM) Very loose, brown medium Sand with shells	VC 1	100	1.3						
		(SP-SM) Loose, light gray medium Sand with clay lens from 5" to 6.5"	VC 2								
		(SP) Very loose, dark gray medium Sand with trace shells									
		(SP) Very loose, black medium Sand with trace shells									
		(CH) Loose, brown fine Sand with some clay									
		(CH) Medium dense, black sandy Silt with trace shells	VC 3	100	1.0						
		(CH) Very soft, moist, dark greenish gray Clay with trace shells; cohesive, nonplastic									
		(SP-SM) Loose, dark gray fine Sand with trace shells and some silt									
		(SP-SC) Medium dense, light gray fine Sand with some shells thinly bedded with dark gray clayey sand									
		(SM) Very soft, wet, dark gray clayey Sand with little shells	VC 4	100	1.2						
		(SP) Medium dense, gray fine Sand with trace shells	VC 5	100	2.5						
			VC 6	100	7.4						
			VC 7	100	35.6						

Bottom of borehole at 16.0 feet.

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CLIENT	Williams	PROJECT NAME	NESE Pipeline
PROJECT NUMBER	1794	PROJECT LOCATION	Raritan Bay and Lower New York Harbor
DATE STARTED	12/10/16	COMPLETED	12/10/16
DRILLING CONTRACTOR	Alpine Ocean Seismic	WATER DEPTH	-16.8 ft MLLW
DRILLING METHOD	Vibracore	HOLE SIZE	3.5 in inches
LOGGED BY	CM	CHECKED BY	CD
NOTES			
	CORE PENETRATION:	15.21	
	CORE RECOVERY:	11.92	
	CORE LOCATION:	X:976737.25 Y:129339.01	
	NAD 83, NY Long Island Lambert, ft		

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	PENETRATION SECONDS PER FOOT	POCKET PEN. (tsf)	TORVANE (tsf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲			
									20 40 60 80			
									PL MC LL			
0									20 40 60 80			
		(SP) Loose, light grayish brown medium Sand, and large shells in upper 2 inches	VC 1	100	2.8			98				
		(SP) Medium dense, dark gray medium Sand										
		(SP) Loose, dry, yellow fine to medium Sand	VC 2	100	6.5			110				
5		(SP) Loose, moist, light gray medium Sand										
		(SP) Loose, yellow, medium Sand	VC 3	100	32.1			105				
		(SP) Medium dense, light gray medium Sand with trace shell fragments										
10		(SP) Medium dense, dry, yellow fine Sand	VC 4	100	22.9			104				
		(SP) Medium dense, moist, dark gray fine to medium Sand with trace shell fragments	VC 5	100	11.3			128				
15												

Bottom of borehole at 15.2 feet.



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CLIENT <u>Williams</u>	PROJECT NAME <u>NESE Pipeline</u>
PROJECT NUMBER <u>1794</u>	PROJECT LOCATION <u>Raritan Bay and Lower New York Harbor</u>
DATE STARTED <u>12/10/16</u> COMPLETED <u>12/10/16</u>	WATER DEPTH <u>-16.69 ft MLLW</u> HOLE SIZE <u>3.5 in inches</u>
DRILLING CONTRACTOR <u>Alpine Ocean Seismic</u>	CORE PENETRATION: <u>14.52</u>
DRILLING METHOD <u>Vibracore</u>	CORE RECOVERY: <u>12.00</u>
LOGGED BY <u>CM</u> CHECKED BY <u>CD</u>	CORE LOCATION: <u>X:978307.36 Y:127774.37</u>
NOTES	NAD 83, NY Long Island Lambert, ft

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	PENETRATION SECONDS PER FOOT	POCKET PEN. (tsf)	TORVANE (tsf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲			
									20	40	60	80
									PL	MC	LL	
									20	40	60	80
									□ FINES CONTENT (%) □			
									20	40	60	80
0		(SP) Very loose, light grayish brown medium Sand with trace shells	VC 1	100	1.6			104	●			
		(SP) Medium dense, moist, dark gray medium Sand with 1" cobble at 2 ft	VC 2	100	1.9			123	▲	●		
			VC 3	100	2.5			128	▲	●		
		(SP) Medium dense, moist, light to dark gray fine Sand	VC 4	100	8.2			109	●	▲		
5			VC 5	100	24.9					●	▲	
			VC 6	100	40.3			106	●		▲	
10			VC 7	100	92.1			106	●			▲
			VC 8	100	69.4			125	□	●		▲

Bottom of borehole at 14.5 feet.

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CLIENT	Williams	PROJECT NAME	NESE Pipeline
PROJECT NUMBER	1794	PROJECT LOCATION	Raritan Bay and Lower New York Harbor
DATE STARTED	12/11/16	COMPLETED	12/11/16
DRILLING CONTRACTOR	Alpine Ocean Seismic	WATER DEPTH	-14.23 ft MLLW
DRILLING METHOD	Vibracore	HOLE SIZE	3.5 in inches
LOGGED BY	CM	CHECKED BY	CD
NOTES			
	CORE PENETRATION:	14.27	
	CORE RECOVERY:	11.83	
	CORE LOCATION:	X:979791.2	Y:126210
	NAD 83, NY Long Island Lambert, ft		

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	PENETRATION SECONDS PER FOOT	POCKET PEN. (tsf)	TORVANE (tsf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲			
									20	40	60	80
									PL	MC	LL	
0									20	40	60	80
		(SP) Very loose, light gray medium Sand with trace shells	VC 1	100	1.6			106				
		(SP) Loose, light brown medium Sand with some large shells										
		(SP) Loose, light gray medium Sand with some large shells	VC 2	100	2.7							
		(SP) Medium dense, gray medium Sand with trace shell fragments										
		(SP) Loose, dry, yellow medium Sand	VC 3	100	6.7			109				
5		(SP) Medium dense, moist, dark gray medium Sand										
		(SP) Loose, dry, yellow medium Sand	VC 4	100	26.4			109				
		(SP) Medium dense, moist, dark gray medium Sand										
10		(SP) Loose, dry, yellow medium Sand	VC 5	100	31.1			107				
		(SP) Loose, moist, dark gray medium Sand	VC 6	100	15.1			123				

Bottom of borehole at 14.3 feet.

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CLIENT	Williams	PROJECT NAME	NESE Pipeline
PROJECT NUMBER	1794	PROJECT LOCATION	Raritan Bay and Lower New York Harbor
DATE STARTED	12/11/16	COMPLETED	12/11/16
DRILLING CONTRACTOR	Alpine Ocean Seismic	WATER DEPTH	-17.45 ft MLLW
DRILLING METHOD	Vibracore	HOLE SIZE	3.5 in inches
LOGGED BY	CM	CHECKED BY	CD
NOTES	CORE PENETRATION: 13.74		
	CORE RECOVERY: 12.17		
	CORE LOCATION: X:980931.07 Y:125005.02		
	NAD 83, NY Long Island Lambert, ft		

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	PENETRATION SECONDS PER FOOT	POCKET PEN. (tsf)	TORVANE (tsf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲				
									20 40 60 80				
									PL MC LL				
									20 40 60 80				
									□ FINES CONTENT (%) □				
									20 40 60 80				
0													
		(SM) Very loose, moist, dark brown medium Sand with trace clay and shells	VC 1	100	1.4			94	▲	□	●		
		(SP) Medium dense, light gray medium Sand	VC 2	100	0.9			110	▲	●			
			VC 3	100	2.4			134	▲		●		
		(SP) Loose, dry, yellow medium Sand with trace shells	VC 4	100	6.9			105	□	▲			
5		(SP) Loose, moist, dark gray medium Sand with trace shells	VC 5	100	27.0						●	▲	
		(SP) Loose, dry, yellow medium Sand with trace shells	VC 6	100	18.8			104	□	●	▲		
		(SP) Loose, moist, dark gray medium Sand with trace shells											
10		(SP) Loose, dry, yellow medium Sand with trace shells	VC 7	100	22.3			103	□	●		▲	
		(SP) Loose, moist, dark gray medium Sand with trace shells	VC 8	100	20.5			124	□		●		

Bottom of borehole at 13.7 feet.

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CLIENT	Williams	PROJECT NAME	NESE Pipeline
PROJECT NUMBER	1794	PROJECT LOCATION	Raritan Bay and Lower New York Harbor
DATE STARTED	12/11/16	COMPLETED	12/11/16
DRILLING CONTRACTOR	Alpine Ocean Seismic	WATER DEPTH	-17.74 ft MLLW
DRILLING METHOD	Vibracore	HOLE SIZE	3.5 in inches
LOGGED BY	CM	CHECKED BY	CD
NOTES			
	CORE PENETRATION:	15.18	
	CORE RECOVERY:	11.71	
	CORE LOCATION:	X:982379.96	Y:123660.9
	NAD 83, NY Long Island Lambert, ft		

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	PENETRATION SECONDS PER FOOT	POCKET PEN. (tsf)	TORVANE (tsf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲								
									20 40 60 80								
									PL MC LL								
									20 40 60 80								
□ FINES CONTENT (%) □																	
20 40 60 80																	
0																	
5		(SP) Very loose, brown medium Sand	VC 1	100	1.4			112									
		(SP) Very loose, black fine to medium Sand with trace shell fragments and large shells															
		(CL-ML) Very loose, wet, black silty Clay with some shells															
		Unsplit	VC 2	100	0.9												
		(SM) Loose, moist, black fine silty Sand with few shells															
		(SP) Loose, moist, dark gray medium Sand															
		(SP) Loose, dry, yellow medium Sand	VC 3	100	5.8												
		(SP) Loose, moist, yellow medium Sand thinly bedded with moist, loose, gray medium sand															
		(SP) Medium dense, moist, light gray medium Sand															
		(SP) Loose, dry, medium yellow Sand; clay lamination from 9.0 - 9.21 ft	VC 4	100	11.7												
(SP) Very loose, dry, coarse brown Sand																	
10		(SP) Loose, moist, black fine Sand with some shells	VC 5	100	7.9												
		(SP) Loose, moist, gray coarse Sand															
15																	

Bottom of borehole at 15.2 feet.

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CLIENT	Williams	PROJECT NAME	NESE Pipeline
PROJECT NUMBER	1794	PROJECT LOCATION	Raritan Bay and Lower New York Harbor
DATE STARTED	12/19/16	COMPLETED	12/19/16
DRILLING CONTRACTOR	Alpine Ocean Seismic	WATER DEPTH	-14.12 ft MLLW
DRILLING METHOD	Vibracore	HOLE SIZE	3.5 in inches
LOGGED BY	CM	CHECKED BY	CD
NOTES			
	CORE PENETRATION:	14.92	
	CORE RECOVERY:	11.58	
	CORE LOCATION:	X:984202.76	Y:122534.78
	NAD 83, NY Long Island Lambert, ft		

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	PENETRATION SECONDS PER FOOT	POCKET PEN. (tsf)	TORVANE (tsf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲			
									20	40	60	80
									PL	MC	LL	
									20	40	60	80
									□ FINES CONTENT (%) □			
									20	40	60	80
0		(SP) Very loose, light brown medium Sand with trace shell hash	VC 1	100	2.3			101	●			
		(SP-SM) Loose, gray medium sand with trace black sandy Silt	VC 2	100	2.1			124	▲	●		
		(SP) Loose, dry, pale yellow fine Sand										
		(SP) Loose, moist, medium yellow Sand	VC 3	100	2.1			110	●			
5		(SP) Medium dense, moist, black medium Sand with shells	VC 4	100	36.3					●	▲	
		(SP) Loose, dry, pale yellow fine Sand with shells	VC 5	100	36.2			111	●		▲	
		(SP) Medium dense, moist, light gray medium Sand										
		(SP) Loose, dry, pale yellow medium Sand	VC 6	100	63.3			113	●			▲
10		(SP) Medium dense, moist, dark gray medium Sand	VC 7	100	65.7			123	●			▲

Bottom of borehole at 14.9 feet.

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CLIENT	Williams	PROJECT NAME	NESE Pipeline
PROJECT NUMBER	1794	PROJECT LOCATION	Raritan Bay and Lower New York Harbor
DATE STARTED	12/13/16	COMPLETED	12/13/16
DRILLING CONTRACTOR	Alpine Ocean Seismic	WATER DEPTH	-11.7 ft MLLW
DRILLING METHOD	Vibracore	HOLE SIZE	3.5 in inches
LOGGED BY	CM	CHECKED BY	CD
NOTES			
	CORE PENETRATION:	13.78	
	CORE RECOVERY:	12.08	
	CORE LOCATION:	X:985638.86	Y:122017.58
	NAD 83, NY Long Island Lambert, ft		

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	PENETRATION SECONDS PER FOOT	POCKET PEN. (tsf)	TORVANE (tsf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲			
									20 40 60 80			
									PL MC LL			
0									20 40 60 80			
		(SP) Loose, brown fine Sand	VC 1	100	2.1			98		●		
		(SP) Medium dense, gray fine to medium Sand										
		(SP) Loose, moist, light yellow medium Sand	VC 2	100	17.4			105		●	▲	
		(SP) Loose, moist, gray medium Sand	VC 3	100	11.7			102		●	▲	
		(SP) Loose, dry, very light yellow medium Sand	VC 4	100	20.5			102		●	▲	
		(SP) Medium dense, moist, very dark gray medium Sand	VC 5	100	28.7					●	▲	
			VC 6	100	30.3			128		□	●	▲

Bottom of borehole at 13.8 feet.

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CLIENT Williams	PROJECT NAME NESE Pipeline
PROJECT NUMBER 1794	PROJECT LOCATION Raritan Bay and Lower New York Harbor
DATE STARTED 12/11/16 COMPLETED 12/11/16	WATER DEPTH -17.91 ft MLLW HOLE SIZE 3.5 in inches
DRILLING CONTRACTOR Alpine Ocean Seismic	CORE PENETRATION: 13.38
DRILLING METHOD Vibracore	CORE RECOVERY: 12.04
LOGGED BY CM CHECKED BY CD	CORE LOCATION: X:987403.33 Y:121670.34
NOTES	NAD 83, NY Long Island Lambert, ft

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER		RECOVERY % (RQD)	PENETRATION SECONDS PER FOOT	POCKET PEN. (tsf)	TORVANE (tsf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲			
										20 40 60 80			
										PL MC LL			
										20 40 60 80			
□ FINES CONTENT (%) □													
20 40 60 80													
0		(SP) Very loose, light brown medium Sand with trace shells		VC 1	100	1.2			117	▲	●		
		(SP) Loose, gray medium Sand with trace shells		VC 2	100	1.4			119	▲	●		
		(SP) Loose, dark gray medium Sand		VC 3	100	3.7			98	□	●		
		(SP) Loose, dry, light brown fine Sand		VC 4	100	8.9			99	□	●	▲	
		(SP) Loose, dry, light brown medium Sand											
5		(SP) Medium dense, dry, black medium Sand											
		(SP) Medium dense, dry, light brown, medium Sand		VC 5	100	15.2			111	□	●	▲	
		(SP) Medium dense, dry, black medium Sand with few gravel											
		(SP) Medium dense, dry, pale yellow fine Sand		VC 6	100	24.1			107	□	●	▲	
10		(SP) Medium dense, dry, dark grayish black medium Sand		VC 7	100	24.8			125		●	▲	

Bottom of borehole at 13.4 feet.

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CLIENT	Williams	PROJECT NAME	NESE Pipeline
PROJECT NUMBER	1794	PROJECT LOCATION	Raritan Bay and Lower New York Harbor
DATE STARTED	12/11/16	COMPLETED	12/11/16
DRILLING CONTRACTOR	Alpine Ocean Seismic	WATER DEPTH	-23.24 ft MLLW
DRILLING METHOD	Vibracore	HOLE SIZE	3.5 in inches
LOGGED BY	CM	CHECKED BY	CD
NOTES			
	CORE PENETRATION:	13.19	
	CORE RECOVERY:	12.17	
	CORE LOCATION:	X:989335.67 Y:121657.44	
	NAD 83, NY Long Island Lambert, ft		

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	PENETRATION SECONDS PER FOOT	POCKET PEN. (tsf)	TORVANE (tsf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲			
									20	40	60	80
									PL	MC	LL	
0									20	40	60	80
		(SP) Very loose, light brown medium Sand with trace shell fragments	VC 1	100	1.9			98				
		(SP) Loose, dark gray medium Sand										
		(SP) Medium dense, dry, yellow fine to medium Sand	VC 2	100	10.7			120				
5		(SP) Loose, dry, fine black Sand with trace shell fragments	VC 3	100	52.4							
		(SP) Medium dense, dry, medium light gray Sand with some shell fragments	VC 4	100	30.3			124				
10		(SP) Loose, dry, fine yellow Sand with few shells	VC 5	100	31.7			115				
		(SP) Medium dense, dry, light gray medium Sand	VC 6	100	36.4			128				

Bottom of borehole at 13.2 feet.

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BORING NUMBER VC 52

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CLIENT	Williams	PROJECT NAME	NESE Pipeline
PROJECT NUMBER	1794	PROJECT LOCATION	Raritan Bay and Lower New York Harbor
DATE STARTED	12/11/16	COMPLETED	12/11/16
DRILLING CONTRACTOR	Alpine Ocean Seismic	WATER DEPTH	-19.04 ft MLLW
DRILLING METHOD	Vibracore	HOLE SIZE	3.5 in inches
LOGGED BY	CM	CHECKED BY	CD
NOTES			
	CORE PENETRATION:	13.82	
	CORE RECOVERY:	11.92	
	CORE LOCATION:	X:991493.28 Y:122094.84	
	NAD 83, NY Long Island Lambert, ft		

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER		RECOVERY % (RQD)	PENETRATION SECONDS PER FOOT	POCKET PEN. (tsf)	TORVANE (tsf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲																		
										20 40 60 80																		
										PL MC LL																		
										20 40 60 80																		
0											□ FINES CONTENT (%) □				20 40 60 80													
5		(SP) Very loose, light brown medium Sand	VC 1	100	2.3	7	1	106	□	●	130	▲	●	130	▲	●	111	□	●	▲								
		(SP) Very loose, light gray medium Sand																										
		(SP) Loose, gray medium Sand	VC 2	100	1.4				VC 3	100		4.4	VC 4		100	16.8		VC 5	100	109.4	VC 6	100	130.4	VC 7	100	49.7		
		(SP) Medium dense, dry, fine to medium yellow Sand																										
10																												
		(SP) Medium dense, dry, fine to medium black Sand with some shell fragments	VC 8	100	17.2	131	□	●	131	□	●	131	□	●	131	□	●	131	□	●								

Bottom of borehole at 13.8 feet.

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CLIENT	Williams	PROJECT NAME	NESE Pipeline
PROJECT NUMBER	1794	PROJECT LOCATION	Raritan Bay and Lower New York Harbor
DATE STARTED	12/19/16	COMPLETED	12/19/16
DRILLING CONTRACTOR	Alpine Ocean Seismic	WATER DEPTH	-22.13 ft MLLW
DRILLING METHOD	Vibracore	HOLE SIZE	3.5 in inches
LOGGED BY	CM	CHECKED BY	CD
NOTES			
	CORE PENETRATION:	13.57	
	CORE RECOVERY:	12.08	
	CORE LOCATION:	X:992466.79 Y:122464.21	
	NAD 83, NY Long Island Lambert, ft		

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER		RECOVERY % (RQD)	PENETRATION SECONDS PER FOOT	POCKET PEN. (tsf)	TORVANE (tsf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲			
										20 40 60 80			
										PL MC LL			
										20 40 60 80			
□ FINES CONTENT (%) □													
20 40 60 80													
0		(SP) Very loose, light brown fine to medium Sand	VC	1	100	2.8			105	□	●		
		(SP) Medium dense, dark brown medium Sand with trace shell hash	VC	2	100	9.5			126		▲	●	
		(SP) Dense, black fine Sand	VC	3	100	14.3			124		▲	●	
		(SP) Loose, dry, yellow medium Sand	VC	4	100	24.0			111	□	●	▲	
5		(SP) Medium dense, dry, yellow coarse Sand and some gravel ~1"		VC	5	100	133.2				●		>>▲
		(SP) Very loose, dry, black coarse Sand and some gravel ~1"											
		(SP) Loose, moist, yellow medium to coarse Sand with few small gravel ~0.25"	VC	6	100	81.3			121	●		▲	
		(SP) Medium dense, dry, black medium Sand											
10		(SP) Loose, dry, medium yellow Sand	VC	7	100	172.9			118	■			>>▲
		(SP) Black, dry, loose medium Sand and some white gravel ~0.25"											
		(SP) Loose, moist, light gray, medium Sand	VC	8	100	161.0			128	□	●		>>▲

Bottom of borehole at 13.6 feet.



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CLIENT	Williams	PROJECT NAME	NESE Pipeline
PROJECT NUMBER	1794	PROJECT LOCATION	Raritan Bay and Lower New York Harbor
DATE STARTED	12/13/16	COMPLETED	12/13/16
DRILLING CONTRACTOR	Alpine Ocean Seismic	WATER DEPTH	-39.18 ft MLLW
DRILLING METHOD	Vibracore	HOLE SIZE	3.5 in inches
LOGGED BY	CM	CORE PENETRATION:	19.48
CHECKED BY	CD	CORE RECOVERY:	14.67
NOTES		CORE LOCATION:	X:993370.46 Y:122845.22
			NAD 83, NY Long Island Lambert, ft

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	PENETRATION SECONDS PER FOOT	POCKET PEN. (tsf)	TORVANE (tsf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲		
									20 40 60 80		
									PL	MC	LL
									□ FINES CONTENT (%) □		
									20 40 60 80		
0		(SP) Very loose, light brown medium Sand	VC 1	100	1.6			101	▲	●	
		(SP) Loose, alternating laminations of light gray and black fine Sand; Clay lens @ 6.5", Peat lens @1.5'	VC 2	100	3.0			121	▲	●	
		(SW-SM) Loose, alternating laminations of dark gray fine Sand and black sandy Silt	VC 3	100	3.0			120	▲	●	
		(SC) Medium dense, light gray fine Sand thinly bedded with black silty Clay	VC 4	100	2.6			106	▲	□	●
5		(SP-SM) Medium dense, dark gray fine Sand thinly bedded with black Silt									
		(SP-SM) Medium dense, light brown Sand thinly bedded with black sandy Silt; trace shell fragments	VC 5	100	2.9			106	▲	□	●
10			VC 6	100	4.9			121	▲	□	●
		(SC) Soft, dark gray sandy Silt thinly bedded with black Clay									
			VC 7	100	3.9				▲	□	●
		(SP-SC) Loose, light brown fine Sand thinly bedded with dark gray soft Clay; trace shell fragments									
		(SP-SM) Loose, dark gray fine Sand with trace Silt and trace shell fragments									
15											
Bottom of borehole at 19.5 feet.											



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CLIENT <u>Williams</u>	PROJECT NAME <u>NESE Pipeline</u>
PROJECT NUMBER <u>1794</u>	PROJECT LOCATION <u>Raritan Bay and Lower New York Harbor</u>
DATE STARTED <u>12/20/16</u> COMPLETED <u>12/20/16</u>	WATER DEPTH <u>-15.69 ft MLLW</u> HOLE SIZE <u>3.5 in inches</u>
DRILLING CONTRACTOR <u>Alpine Ocean Seismic</u>	CORE PENETRATION: <u>29.33</u>
DRILLING METHOD <u>Vibracore</u>	CORE RECOVERY: <u>29.33</u>
LOGGED BY <u>CM</u> CHECKED BY <u>CD</u>	CORE LOCATION: <u>X:997095.45 Y:124366.91</u>
NOTES	NAD 83, NY Long Island Lambert, ft

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	PENETRATION SECONDS PER FOOT	POCKET PEN. (tsf)	TORVANE (tsf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲			
									20	40	60	80
									PL	MC	LL	
									20	40	60	80
									☐ FINES CONTENT (%) ☐			
									20	40	60	80
0		(SP) Very loose, moist, brown medium Sand. Well sorted.	VC 1	100	1.1			102				
			VC 2	100	1.6			116				
		(SP) Loose, moist, dark gray medium Sand. Well sorted.	VC 3	100	4.3			126				
		(SP) Medium dense, moist, light brown fine Sand with trace pebbles.	VC 4	100	6.1			115				
5		(SP) Medium dense, moist, dark gray medium Sand with little coarse sand										
		(SP) Loose, moist, yellow-brown medium Sand with trace pebbles. Well-graded	VC 5	100	11.9			120				
			VC 6	100	19.4							
		(SP) Medium dense, moist, dark gray medium sand with trace coarse Sand and pebbles. Well graded										
10		(SP) Unsplit sample sent to lab	VC 7	100	28.2			124				
		(SP) Loose, moist, very light brown fine to medium Sand with trace laminations of greenish gray sand	VC 8	100	11.0			116				
		(SP) Loose, moist, brown coarse Sand with little pebbles and trace laminations of gray sand										
15		(SP) Loose, moist, grayish green coarse Sand with trace pebbles and dark gray laminations	VC 9	100	57.2			122				
		(SP) Unsplit sample sent to lab										
20			VC									

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CLIENT Williams PROJECT NAME NESE Pipeline
PROJECT NUMBER 1794 PROJECT LOCATION Raritan Bay and Lower New York Harbor

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	PENETRATION SECONDS PER FOOT	POCKET PEN. (tsf)	TORVANE (tsf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲			
									20	40	60	80
									PL	MC	LL	
									20	40	60	80
									□ FINES CONTENT (%) □			
									20	40	60	80
20		(SP) Unsplit sample sent to lab (<i>continued</i>)	10	100	169.5			117	●			→
		(SP) Loose, moist, light yellowish brown coarse Sand	VC 11	100	43.3			119	■		▲	
		(SP) Medium dense, moist, light yellow medium Sand with trace pebbles thinly bedded with dark greenish brown medium sand										
		(SP) Medium dense, moist, dark gray coarse Sand with some pebbles and trace light brown sand laminations	VC 12	100					●			
25		(SP) Medium dense, moist, light brown medium Sand with trace coarse sand and pebbles thinly bedded with dark greenish brown sand	VC 13	100				131	■			
		(SP) Medium dense, moist, dark gray coarse Sand with trace pebbles										
		(SP) Loose, moist, light greenish brown medium Sand with trace coarse sand	VC 14	100				104	■			
		(SP) Medium dense, moist, dark greenish brown medium to coarse Sand with trace pebbles	VC 15	100				119	●			

Bottom of borehole at 29.3 feet.

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CLIENT	Williams	PROJECT NAME	NESE Pipeline
PROJECT NUMBER	1794	PROJECT LOCATION	Raritan Bay and Lower New York Harbor
DATE STARTED	12/13/16	COMPLETED	12/13/16
DRILLING CONTRACTOR	Alpine Ocean Seismic	WATER DEPTH	-21.42 ft MLLW
DRILLING METHOD	Vibracore	HOLE SIZE	3.5 in inches
LOGGED BY	CM	CHECKED BY	CD
NOTES			
	CORE PENETRATION:	13.6	
	CORE RECOVERY:	11.79	
	CORE LOCATION:	X:998801.58 Y:125079.29	
	NAD 83, NY Long Island Lambert, ft		

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER		RECOVERY % (RQD)	PENETRATION SECONDS PER FOOT	POCKET PEN. (tsf)	TORVANE (tsf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲			
										20 40 60 80			
										PL MC LL			
										20 40 60 80			
□ FINES CONTENT (%) □													
				20 40 60 80									
0		(SP) Very loose, light gray medium to coarse Sand	VC	1	100	1.6			114	●			
		(SP) Loose, light brown medium to coarse Sand with some gravel	VC	2	100	1.6			116	▲ ●			
		(SP) Medium dense, light gray medium Sand with trace coarse sand	VC	3	100	3.5			118	▲ ●			
		(SP) Loose, light greenish brown fine Sand	VC	4	100	13.5			107	● ▲			
5		(SP) Medium dense, light brown medium Sand thinly bedded with gray sand	VC	5	100	41.0				●		▲	
		(SM) Loose, light brown fine to medium Sand with few coarse sand beds	VC	6	100	20.2			108	●	▲	□	
		(SP) Loose, light brown coarse Sand											
		(SP) Medium dense, light greenish gray fine Sand											
10		(SP) Loose, light greenish brown medium to coarse Sand with trace pebbles	VC	7	100	17.4			108	●	▲		
			VC	8	100	6.3			108	□	▲	●	

Bottom of borehole at 13.6 feet.



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CLIENT <u>Williams</u>	PROJECT NAME <u>NESE Pipeline</u>
PROJECT NUMBER <u>1794</u>	PROJECT LOCATION <u>Raritan Bay and Lower New York Harbor</u>
DATE STARTED <u>12/13/16</u> COMPLETED <u>12/13/16</u>	WATER DEPTH <u>-25.64 ft MLLW</u> HOLE SIZE <u>3.5 in inches</u>
DRILLING CONTRACTOR <u>Alpine Ocean Seismic</u>	CORE PENETRATION: <u>12.24</u>
DRILLING METHOD <u>Vibracore</u>	CORE RECOVERY: <u>12.13</u>
LOGGED BY <u>CM</u> CHECKED BY <u>CD</u>	CORE LOCATION: X:1000031.5 Y:125585.26
NOTES	NAD 83, NY Long Island Lambert, ft

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	PENETRATION SECONDS PER FOOT	POCKET PEN. (tsf)	TORVANE (tsf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲			
									20 40 60 80			
									PL	MC	LL	
									20	40	60	80
									□ FINES CONTENT (%) □			
									20	40	60	80
0		(SP) Very loose, brown, fine to coarse Sand with little gravel	VC 1	100	1.4			114	●			
		(SP) Loose, light brown fine Sand with trace gravel interbedded with light gray fine sand	VC 2	100	30.4			114	●	▲		
5												
			VC 3	100	43.4			123	●		▲	
			VC 4	100	59.5				●		▲	
10			VC 5	100	24.8			111	●	▲		
			VC 6	100	61.9			126	□	●		▲

Bottom of borehole at 12.2 feet.



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CLIENT <u>Williams</u>	PROJECT NAME <u>NESE Pipeline</u>
PROJECT NUMBER <u>1794</u>	PROJECT LOCATION <u>Raritan Bay and Lower New York Harbor</u>
DATE STARTED <u>12/13/16</u> COMPLETED <u>12/13/16</u>	WATER DEPTH <u>-33.87 ft MLLW</u> HOLE SIZE <u>3.5 in inches</u>
DRILLING CONTRACTOR <u>Alpine Ocean Seismic</u>	CORE PENETRATION: <u>13.04</u>
DRILLING METHOD <u>Vibracore</u>	CORE RECOVERY: <u>12.79</u>
LOGGED BY <u>CM</u> CHECKED BY <u>CD</u>	CORE LOCATION: X:1002381.71 Y:126342.57
NOTES	NAD 83, NY Long Island Lambert, ft

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	PENETRATION SECONDS PER FOOT	POCKET PEN. (tsf)	TORVANE (tsf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲			
									20 40 60 80			
									PL	MC	LL	
									20	40	60	80
									□ FINES CONTENT (%) □			
									20	40	60	80
0		(SP) Very loose, dark brown medium Sand with trace shell fragments and trace gravel	VC 1	100	2.6			112	●			
			VC 2	100	2.1			122	▲ ●			
		(SP) Loose, gray medium Sand	VC 3	100	4.2			128	▲ ●			
		(SP) Loose, moist, brown fine Sand interbedded with black fine sand	VC 4	100	23.8			106	● ▲			
5			VC 5	100	108.4				●			>>▲
			VC 6	100	62.7			105	● ▲			
10			VC 7	100	103.6			110	●			>>▲
			VC 8	100	56.6			117	□ ● ▲			

Bottom of borehole at 13.0 feet.



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CLIENT <u>Williams</u>	PROJECT NAME <u>NESE Pipeline</u>
PROJECT NUMBER <u>1794</u>	PROJECT LOCATION <u>Raritan Bay and Lower New York Harbor</u>
DATE STARTED <u>12/14/16</u> COMPLETED <u>12/14/16</u>	WATER DEPTH <u>-28.45 ft MLLW</u> HOLE SIZE <u>3.5 in inches</u>
DRILLING CONTRACTOR <u>Alpine Ocean Seismic</u>	CORE PENETRATION: <u>9.88</u>
DRILLING METHOD <u>Vibracore</u>	CORE RECOVERY: <u>8.83</u>
LOGGED BY <u>CM</u> CHECKED BY <u>CD</u>	CORE LOCATION: X: <u>1004344.28</u> Y: <u>127083.47</u>
NOTES	NAD 83, NY Long Island Lambert, ft

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	PENETRATION SECONDS PER FOOT	POCKET PEN. (tsf)	TORVANE (tsf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲			
									20	40	60	80
									PL	MC	LL	
0									20	40	60	80
									☐ FINES CONTENT (%) ☐			
									20	40	60	80
		(SP) Very loose, light brown medium Sand with trace shells. Large rock at 8 in and large shell at 1ft 5in	VC 1	100	11.8			111	☐	▲		
		(SP) Loose, dark gray fine to medium Sand with trace shell fragments										
		(SP-SM) Loose, moist, gray fine Sand	VC 2	100	29.0			114	☐	●	▲	
		(SP) Loose, moist, dark gray fine Sand	VC 3	100	96.2							
		(SP) Loose, moist, dark gray medium Sand										
		(SP) Very loose, moist, light brown medium Sand with trace gravel	VC 4	100	120.1			107	●			>>▲
		(SW) Loose, moist, dark gray medium Sand with some gravel	VC 5	100	36.1			125	●	▲		

Bottom of borehole at 9.9 feet.



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CLIENT <u>Williams</u>	PROJECT NAME <u>NESE Pipeline</u>
PROJECT NUMBER <u>1794</u>	PROJECT LOCATION <u>Raritan Bay and Lower New York Harbor</u>
DATE STARTED <u>12/16/16</u> COMPLETED <u>12/16/16</u>	WATER DEPTH <u>-28.32 ft MLLW</u> HOLE SIZE <u>3.5 in inches</u>
DRILLING CONTRACTOR <u>Alpine Ocean Seismic</u>	CORE PENETRATION: <u>9.81</u>
DRILLING METHOD <u>Vibracore</u>	CORE RECOVERY: <u>8.88</u>
LOGGED BY <u>CM</u> CHECKED BY <u>CD</u>	CORE LOCATION: X: <u>1006157.33</u> Y: <u>127789.93</u>
NOTES _____	NAD 83, NY Long Island Lambert, ft _____

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	PENETRATION SECONDS PER FOOT	POCKET PEN. (tsf)	TORVANE (tsf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲			
									20 40 60 80			
									PL	MC	LL	
									20	40	60	80
									□ FINES CONTENT (%) □			
									20	40	60	80
0		(SP) Very soft, moist, shell hash in brown fine Sand	VC 1	100	1.4			106	●			
		(SP) Very soft, moist, dark brown coarse Sand with some pebbles and gravel; piece of ceramic and glass found	VC 2	100	1.2			118	▲	●		
		Very hard charcoal and slag; piece of anthropogenic glass found at 0.92 ft	VC 3	100	4.5			130	▲	●		
		(SP) Loose, gray fine Sand with trace shell fragments; charcoal found from 0.25 - 0.42 ft	VC 4	100	7.8			112	□	▲		
		(SP) Dense, grey medium Sand with trace shell hash; large shell bed found from 1.83 - 2.17ft										
		(SP) Loose, brown coarse Sand with trace shell fragments										
		(SP) Loose, moist, brown fine Sand										
5		(SP) Loose, moist, black fine Sand with trace shells fragments	VC 5	100	68.1					●		▲
		(SP) Loose, moist, brown medium Sand	VC 6	100	51.1			110	□	●		▲
		(SP) Loose, moist, black medium Sand	VC 7	100	30.6			121		●	▲	

Bottom of borehole at 9.8 feet.



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CLIENT <u>Williams</u>	PROJECT NAME <u>NESE Pipeline</u>
PROJECT NUMBER <u>1794</u>	PROJECT LOCATION <u>Raritan Bay and Lower New York Harbor</u>
DATE STARTED <u>12/16/16</u> COMPLETED <u>12/16/16</u>	WATER DEPTH <u>-30 ft MLLW</u> HOLE SIZE <u>3.5 in inches</u>
DRILLING CONTRACTOR <u>Alpine Ocean Seismic</u>	CORE PENETRATION: <u>6.81</u>
DRILLING METHOD <u>Vibracore</u>	CORE RECOVERY: <u>4.92</u>
LOGGED BY <u>CM</u> CHECKED BY <u>CD</u>	CORE LOCATION: X:1007456.99 Y:128301.93
NOTES	NAD 83, NY Long Island Lambert, ft

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	PENETRATION SECONDS PER FOOT	POCKET PEN. (tsf)	TORVANE (tsf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲			
									20 40 60 80			
									PL	MC	LL	
									20	40	60	80
									☐ FINES CONTENT (%) ☐			
									20	40	60	80
0		(SP) Very loose, light brown fine Sand with trace shell fragments	VC 1	100	1.9			88	▲	●		
		(SP) Loose, moist, brown medium Sand with shell fragments and trace pebbles; pieces of anthropogenic glass and brick found at 1 ft	VC 2	100	12.0			126		▲		
		Granular charcoal with trace shells and pebbles										
		(SP) Loose, dark gray medium Sand with trace shells										
		(SP) Loose, brown fine Sand										
		(SP) Medium dense, black fine Sand thinly bedded with brown sand	VC 3	100	15.1			123	☐	▲		
			VC 4	100	24.1			118		▲		

Bottom of borehole at 6.8 feet.

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CLIENT	Williams	PROJECT NAME	NESE Pipeline
PROJECT NUMBER	1794	PROJECT LOCATION	Raritan Bay and Lower New York Harbor
DATE STARTED	12/17/16	COMPLETED	12/17/16
DRILLING CONTRACTOR	Alpine Ocean Seismic	WATER DEPTH	-31.01 ft MLLW
DRILLING METHOD	Vibracore	HOLE SIZE	3.5 in inches
LOGGED BY	CM	CHECKED BY	CD
NOTES	CORE PENETRATION: 6.45		
	CORE RECOVERY: 4.17		
	CORE LOCATION: X:1009834.96 Y:129210.8		
	NAD 83, NY Long Island Lambert, ft		

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	PENETRATION SECONDS PER FOOT	POCKET PEN. (tsf)	TORVANE (tsf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲			
									20 40 60 80			
									PL MC LL			
0									20	40	60	80
		(SP) Very loose, light brown fine Sand with trace shell fragments	VC 1	100	3.5			98				
		(SP-SM) Loose, gray fine Sand with trace shell fragments and trace silt	VC 2	100	4.0			111				
			VC 3	100	7.9			119				
		(SP) Medium dense, dark brown and gray medium Sand with few shell hash and few silt beds	VC 4	100	28.9			128				
5												

Bottom of borehole at 6.5 feet.



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BORING NUMBER VC 63

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CLIENT	Williams	PROJECT NAME	NESE Pipeline
PROJECT NUMBER	1794	PROJECT LOCATION	Raritan Bay and Lower New York Harbor
DATE STARTED	12/17/16	COMPLETED	12/17/16
DRILLING CONTRACTOR	Alpine Ocean Seismic	WATER DEPTH	-32.65 ft MLLW
DRILLING METHOD	Vibracore	HOLE SIZE	3.5 in inches
LOGGED BY	CM	CORE PENETRATION:	9.76
CHECKED BY	CD	CORE RECOVERY:	7.04
NOTES		CORE LOCATION:	X:1011696.93 Y:129929.48
		NAD 83, NY Long Island Lambert, ft	

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	PENETRATION SECONDS PER FOOT	POCKET PEN. (tsf)	TORVANE (tsf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲				
									20 40 60 80 PL MC LL 20 40 60 80				
									□ FINES CONTENT (%) □				
									20 40 60 80				
0													
5		(SP-SM) Medium dense, brown and black silty fine Sand; lens of shells at 0.33 ft	VC 1	100	3.3			115	▲ □	●			
		(SP-SM) Medium dense, black silty fine Sand with with trace shell fragments; shell bed at 1.33 ft	VC 2	100	5.7				▲	●			
		(SP-SM) Medium dense, black fine Sand with trace silt											
		VC 3	100	6.3	124				▲	●			
			VC 4	100	12.7			118	□ ▲	●			

Bottom of borehole at 9.8 feet.

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CLIENT Williams		PROJECT NAME NESE Pipeline	
PROJECT NUMBER 1794		PROJECT LOCATION Raritan Bay and Lower New York Harbor	
DATE STARTED 12/17/16	COMPLETED 12/17/16	WATER DEPTH -33.71 ft MLLW	HOLE SIZE 3.5 in inches
DRILLING CONTRACTOR Alpine Ocean Seismic		CORE PENETRATION: 7.6	
DRILLING METHOD Vibracore		CORE RECOVERY: 6.04	
LOGGED BY CM	CHECKED BY CD	CORE LOCATION: X:1013550.49 Y:130644.04	
NOTES		NAD 83, NY Long Island Lambert, ft	

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	PENETRATION SECONDS PER FOOT	POCKET PEN. (tsf)	TORVANE (tsf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲			
									<div>20406080</div> <div>PLMCLL</div> <div>20406080</div>			
									☐ FINES CONTENT (%) ☐			
0		(SP) Loose, brown fine Sand (SP) Medium dense, dark gray fine Sand	VC 1	100	6.3			112	<div>☐▲●</div>			
			VC 2	100	6.8			122	<div>▲●</div>			
		(SP-SM) Medium dense, moist, black fine Sand with some silt										
			VC 3	100	6.7			120	<div>☐▲●</div>			
			VC 4	100	9.7				<div>▲●</div>			
5		(SP) Loose, medium to coarse black Sand thinly bedded with brown Sand; trace shell fragments	VC 5	100	18.0			116	<div>☐●▲</div>			

Bottom of borehole at 7.6 feet.

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CLIENT	Williams	PROJECT NAME	NESE Pipeline
PROJECT NUMBER	1794	PROJECT LOCATION	Raritan Bay and Lower New York Harbor
DATE STARTED	12/17/16	COMPLETED	12/17/16
DRILLING CONTRACTOR	Alpine Ocean Seismic	WATER DEPTH	-38.12 ft MLLW
DRILLING METHOD	Vibracore	HOLE SIZE	3.5 in inches
LOGGED BY	CM	CHECKED BY	CD
NOTES			
		CORE PENETRATION:	6.4
		CORE RECOVERY:	4.21
		CORE LOCATION:	X:1015604.57 Y:131158.15
		NAD 83, NY Long Island Lambert, ft	

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	PENETRATION SECONDS PER FOOT	POCKET PEN. (tsf)	TORVANE (tsf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲			
									20	40	60	80
									PL	MC	LL	
0									20	40	60	80
		(SP) Shell hash with large shells in a medium -fine yellow Sandy matrix	VC 1	100	3.5			102				
		(SP) Loose, fine yellow Sand										
		(SP) Medium dense, moist, dark gray fine Sand with large shell fragment at 2.5 ft and coarse sand lamination between 2.67 - 2.83 ft										
		(SP) Loose, coarse yellow Sand	VC 2	100	24.3			128				
5												

Bottom of borehole at 6.4 feet.



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CLIENT	Williams	PROJECT NAME	NESE Pipeline
PROJECT NUMBER	1794	PROJECT LOCATION	Raritan Bay and Lower New York Harbor
DATE STARTED	12/17/16	COMPLETED	12/17/16
DRILLING CONTRACTOR	Alpine Ocean Seismic	WATER DEPTH	-35.34 ft MLLW
DRILLING METHOD	Vibracore	HOLE SIZE	3.5 in inches
LOGGED BY	CM	CORE PENETRATION:	7.93
CHECKED BY	CD	CORE RECOVERY:	5.67
NOTES		CORE LOCATION:	X:1017720.25 Y:131268.02
			NAD 83, NY Long Island Lambert, ft

[illegible]

Bottom of borehole at 7.9 feet.



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CLIENT <u>Williams</u>	PROJECT NAME <u>NESE Pipeline</u>
PROJECT NUMBER <u>1794</u>	PROJECT LOCATION <u>Raritan Bay and Lower New York Harbor</u>
DATE STARTED <u>12/17/16</u> COMPLETED <u>12/17/16</u>	WATER DEPTH <u>-36.5 ft MLLW</u> HOLE SIZE <u>3.5 in inches</u>
DRILLING CONTRACTOR <u>Alpine Ocean Seismic</u>	CORE PENETRATION: <u>6.45</u>
DRILLING METHOD <u>Vibracore</u>	CORE RECOVERY: <u>4.92</u>
LOGGED BY <u>CM</u> CHECKED BY <u>CD</u>	CORE LOCATION: X:1019741.35 Y:130898.4
NOTES	NAD 83, NY Long Island Lambert, ft

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	PENETRATION SECONDS PER FOOT	POCKET PEN. (tsf)	TORVANE (tsf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲			
									20	40	60	80
									PL	MC	LL	
									20	40	60	80
									☐ FINES CONTENT (%) ☐			
									20	40	60	80
0		(SP-SM) Loose, moist, yellow fine Sand with some shells (SP) Loose, moist, light gray fine Sand with trace shells	VC 1	100	3.3			112	▲	●		
			VC 2	100	6.0			128	▲	●		
			VC 3	100	9.1			120	▲	●		
			VC 4	100	19.4			120		●		
			VC 5	100	30.8			127	☐	●	▲	
5												

Bottom of borehole at 6.5 feet.



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CLIENT	Williams	PROJECT NAME	NESE Pipeline
PROJECT NUMBER	1794	PROJECT LOCATION	Raritan Bay and Lower New York Harbor
DATE STARTED	12/19/16	COMPLETED	12/19/16
DRILLING CONTRACTOR	Alpine Ocean Seismic	WATER DEPTH	-40 ft MLLW
DRILLING METHOD	Vibracore	HOLE SIZE	3.5 in inches
LOGGED BY	CM	CORE PENETRATION:	8.51
CHECKED BY	CD	CORE RECOVERY:	6.25
NOTES		CORE LOCATION:	X:1021671.36 Y:130404.59
		NAD 83, NY Long Island Lambert, ft	

[illegible]

Bottom of borehole at 8.5 feet.

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CLIENT	Williams	PROJECT NAME	NESE Pipeline
PROJECT NUMBER	1794	PROJECT LOCATION	Raritan Bay and Lower New York Harbor
DATE STARTED	12/19/16	COMPLETED	12/19/16
DRILLING CONTRACTOR	Alpine Ocean Seismic	WATER DEPTH	-41.51 ft MLLW
DRILLING METHOD	Vibracore	HOLE SIZE	3.5 in inches
LOGGED BY	CM	CHECKED BY	CD
NOTES			
		CORE PENETRATION:	11.25
		CORE RECOVERY:	9.92
		CORE LOCATION:	X:1022403.95 Y:130263.15
		NAD 83, NY Long Island Lambert, ft	

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	PENETRATION SECONDS PER FOOT	POCKET PEN. (tsf)	TORVANE (tsf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲			
									20 40 60 80			
									PL	MC	LL	
									20 40 60 80			
									☐ FINES CONTENT (%) ☐			
									20 40 60 80			
0		(SP) Loose, yellow fine to medium Sand with some large shells	VC 1	100	3.0			115	▲	●		
		(SP) Loose, moist, gray fine Sand with few shell fragments and one large shell at 2.83 ft	VC 2	100	5.1			126	▲	●		
			VC 3	100	8.7			121	▲	●		
		(SP) Loose, moist, light brown fine Sand with few shells	VC 4	100	18.4			116	☐	▲	●	
		(SP) Medium dense, dry, yellow medium Sand interbedded with fine to medium black sand										
5		(SP) Loose, dry, medium gray Sand with few shell fragments and a large shell at 5.75 ft										
		(SP-SM) Medium dense, moist, fine gray Sand with shell fragments, bedded with loose, dry, yellow medium sand	VC 5	100	94.6			123	☐		●	▲
		(SP-SM) Loose, moist, light gray fine silty sand with few thin shell fragment beds	VC 6	100	108.3					●		>>▲
			VC 7	100	96.8			126			●	▲
10												

Bottom of borehole at 11.3 feet.



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CLIENT	Williams	PROJECT NAME	NESE Pipeline
PROJECT NUMBER	1794	PROJECT LOCATION	Raritan Bay and Lower New York Harbor
DATE STARTED	11/28/16	COMPLETED	11/28/16
DRILLING CONTRACTOR	Alpine Ocean Seismic	WATER DEPTH	-13.15 ft MLLW
DRILLING METHOD	Vibracore	HOLE SIZE	3.5 in inches
LOGGED BY	CM	CORE PENETRATION:	19.5
CHECKED BY	CD	CORE RECOVERY:	11.04
NOTES		CORE LOCATION:	X:923401.33 Y:115464.1
			NAD 83, NY Long Island Lambert, ft

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	PENETRATION SECONDS PER FOOT	POCKET PEN. (tsf)	TORVANE (tsf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲		
									20 40 60 80 PL MC LL 20 40 60 80		
									□ FINES CONTENT (%) □		
0											
		(CH) Very soft, black, wet Clay with some silt and a few shells; noncohesive, nonplastic	VC 1	100	2.6			82	▲		●
						0	0				
		(CH) Very soft, greenish gray Clay with silt and trace shells; noncohesive, nonplastic	VC 2	100	1.9			92	▲		● □
						0	0				
						0	0.02				
			VC 3	100	1.9			89	▲		● □
						0	0				
						0	0.04				
			VC 4	100	1.6			88	▲		● □
			VC 5	100	2.0			89	▲		● □
15											
Bottom of borehole at 19.5 feet.											





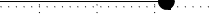










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CLIENT Williams		PROJECT NAME NESE Pipeline	
PROJECT NUMBER 1794		PROJECT LOCATION Raritan Bay and Lower New York Harbor	
DATE STARTED 11/28/16	COMPLETED 11/28/16	WATER DEPTH -13.16 ft MLLW	HOLE SIZE 3.5 in inches
DRILLING CONTRACTOR Alpine Ocean Seismic		CORE PENETRATION: 19.5	
DRILLING METHOD Vibracore		CORE RECOVERY: 11.63	
LOGGED BY CM	CHECKED BY CD	CORE LOCATION: X:925373.73 Y:115806.05	
NOTES		NAD 83, NY Long Island Lambert, ft	

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER		RECOVERY % (RQD)	PENETRATION SECONDS PER FOOT	POCKET PEN. (tsf)	TORVANE (tsf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲			
										20 40 60 80			
										PL	MC	LL	
										20	40	60	80
										□ FINES CONTENT (%) □			
										20	40	60	80
0		(CH) Unsplit	VC 1	100	1.5	0	0.03	87		0			
		(CL-ML) Soft, wet, greenish black Clay with silt and trace shells; noncohesive, nonplastic											
		(CH) Unsplit	VC 2	100	2.0			90		0			
5		(CL) Very soft, bluish gray Clay; noncohesive, nonplastic											
		(CH) Unsplit	VC 3	100	2.0			88		1			
		(CL) Soft, bluish gray Clay; noncohesive, nonplastic											
		(CH) Unsplit	VC 4	100	2.2	0	0.06	89		0			
10			VC 5	100	2.1			88		0			
15													
Bottom of borehole at 19.5 feet.													



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CLIENT	Williams	PROJECT NAME	NESE Pipeline
PROJECT NUMBER	1794	PROJECT LOCATION	Raritan Bay and Lower New York Harbor
DATE STARTED	12/1/16	COMPLETED	12/1/16
DRILLING CONTRACTOR	Alpine Ocean Seismic	WATER DEPTH	-13.09 ft MLLW
DRILLING METHOD	Vibracore	HOLE SIZE	3.5 in inches
LOGGED BY	CM	CORE PENETRATION:	18.11
CHECKED BY	CD	CORE RECOVERY:	11.58
NOTES		CORE LOCATION:	X:927345.93 Y:116145.85
			NAD 83, NY Long Island Lambert, ft

[illegible]

Bottom of borehole at 18.1 feet.

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CLIENT <u>Williams</u>	PROJECT NAME <u>NESE Pipeline</u>
PROJECT NUMBER <u>1794</u>	PROJECT LOCATION <u>Raritan Bay and Lower New York Harbor</u>
DATE STARTED <u>11/24/16</u> COMPLETED <u>11/24/16</u>	WATER DEPTH <u>-9.94 ft MLLW</u> HOLE SIZE <u>3.5 in inches</u>
DRILLING CONTRACTOR <u>Alpine Ocean Seismic</u>	CORE PENETRATION: <u>15.23</u>
DRILLING METHOD <u>Vibracore</u>	CORE RECOVERY: <u>13.25</u>
LOGGED BY <u>CM</u> CHECKED BY <u>CD</u>	CORE LOCATION: <u>X:929447.14 Y:116490.81</u>
NOTES	NAD 83, NY Long Island Lambert, ft

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	PENETRATION SECONDS PER FOOT	POCKET PEN. (tsf)	TORVANE (tsf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲			
									20 40 60 80			
									PL	MC	LL	
									20	40	60	80
									☐ FINES CONTENT (%) ☐			
									20	40	60	80
0		(SP) Loose, moist black Silt with trace shells and yellow fine sand with trace shells; well graded	VC 1	100	1.9			100	▲	●		
		(SP) Loose, yellow fine to medium Sand with some shell fragments										
		(SP) Loose, wet, black fine Sand				0.25	0					
		(SM) Loose, wet, gray fine Sand with silt and some shell fragments										
		(SM) Medium dense, dark gray Silty sand thinly bedded with red fine sand and trace pebbles										
		(GP) Loose Gravel with light gray and orange coarse sand matrix	VC 2	100	1.4			131	▲	●		
5		(SP) Dense, orange and dark red fine to medium Sand										
		(SP) Loose, light brown medium Sand with little pebbles										
		(SP) Dense, light brown medium to coarse Sand with trace pebbles	VC 3	100	4.0			118		●		
		(SW) Medium dense, dark brown fine Sand with coarse sand and pebbles; well graded										
		(SP) Loose, light orange-brown medium to coarse Sand with little pebbles	VC 4	100	3.5			125		●		
10		(SP) Medium dense, dark brown medium Sand with trace pebbles and coarse sand										
		(SP) Loose, dark brown medium Sand with some pebbles and coarse sand	VC 5	100	11.1					●		
		(SP) Loose, dark red medium Sand with little coarse sand and pebbles up to 1 inch	VC 6	100	13.5			119	●	▲		
		(SP) Very loose, dark reddish brown fine Sand with trace coarse sand and pebbles										
15												

Bottom of borehole at 15.2 feet.



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CLIENT	Williams	PROJECT NAME	NESE Pipeline
PROJECT NUMBER	1794	PROJECT LOCATION	Raritan Bay and Lower New York Harbor
DATE STARTED	11/23/16	COMPLETED	11/23/16
DRILLING CONTRACTOR	Alpine Ocean Seismic	WATER DEPTH	-12.64 ft MLLW
DRILLING METHOD	Vibracore	HOLE SIZE	3.5 in inches
LOGGED BY	CM	CORE PENETRATION:	16.83
CHECKED BY	CD	CORE RECOVERY:	11.13
NOTES		CORE LOCATION:	X:931284.39 Y:116828.72
			NAD 83, NY Long Island Lambert, ft

[illegible]

Bottom of borehole at 16.8 feet.

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CLIENT	Williams	PROJECT NAME	NESE Pipeline
PROJECT NUMBER	1794	PROJECT LOCATION	Raritan Bay and Lower New York Harbor
DATE STARTED	11/24/16	COMPLETED	11/24/16
DRILLING CONTRACTOR	Alpine Ocean Seismic	WATER DEPTH	-18.6 ft MLLW
DRILLING METHOD	Vibracore	HOLE SIZE	3.5 in inches
LOGGED BY	CM	CHECKED BY	CD
NOTES			
	CORE PENETRATION:	19.01	
	CORE RECOVERY:	11.00	
	CORE LOCATION:	X:933255.63 Y:117167.89	
	NAD 83, NY Long Island Lambert, ft		

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	PENETRATION SECONDS PER FOOT	POCKET PEN. (tsf)	TORVANE (tsf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲			
									20	40	60	80
									PL	MC	LL	
									20	40	60	80
									□ FINES CONTENT (%) □			
									20	40	60	80
0		(CH) Very soft, wet, black Clay with silt and some shells; noncohesive, nonplastic	VC 1	100	1.6			89				●
		(CL) Soft, wet, brown silty Clay with some shells and trace sand; noncohesive, nonplastic	VC 2	100	2.0							
		(SC) Dense shell hash in a silty Clay matrix, gray soft, noncohesive and nonplastic	VC 3	100	2.2			114				
5		(SP) Loose, yellowish brown silty Sand	VC 4	100	1.6			118				
		(SP) Medium dense, yellowish brown silty coarse Sand with trace shells										
			VC 5	100	3.7			115				
10			VC 6	100	6.5			123				
15												

Bottom of borehole at 19.0 feet.

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CLIENT	Williams	PROJECT NAME	NESE Pipeline
PROJECT NUMBER	1794	PROJECT LOCATION	Raritan Bay and Lower New York Harbor
DATE STARTED	11/24/16	COMPLETED	11/24/16
DRILLING CONTRACTOR	Alpine Ocean Seismic	WATER DEPTH	-17.23 ft MLLW
DRILLING METHOD	Vibracore	HOLE SIZE	3.5 in inches
LOGGED BY	CM	CHECKED BY	CD
NOTES			
	CORE PENETRATION:	18.36	
	CORE RECOVERY:	13.63	
	CORE LOCATION:	X:935223.96	Y:117508.55
	NAD 83, NY Long Island Lambert, ft		

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	PENETRATION SECONDS PER FOOT	POCKET PEN. (tsf)	TORVANE (tsf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲							
									20 40 60 80							
									PL	MC	LL					
									20 40 60 80							
									□ FINES CONTENT (%) □							
									20 40 60 80							
0		(CH) Unsplit	VC 1	100	2.3			86	▲	-----●-----			●			
		(CL) Soft, moist, black Clay; noncohesive, nonplastic														
		(CH) Unsplit	VC 2	100	3.0						94	▲	-----●-----			●
		(CL) Very soft, gray brown Clay; noncohesive, nonplastic				0	0									
5		(CH) Unsplit	VC 3	100	2.1						91	▲	-----			●
		(CL) Very soft, gray brown Clay; noncohesive, nonplastic														
		(CH) Unsplit	VC 4	100	1.4	0	0.04	90	▲	-----			●			
		(CH) Unsplit	VC 5	100	2.8						87	▲	-----			●
		(CL) Soft, gray Clay with trace shells; noncohesive, nonplastic														
						0	0.07									
																
																
15																

Bottom of borehole at 18.4 feet.



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BORING NUMBER VC 77

PAGE 1 OF 1

CLIENT Williams

PROJECT NAME NESE Pipeline

PROJECT NUMBER 1794

PROJECT LOCATION Raritan Bay and Lower New York Harbor

DATE STARTED 11/24/16 **COMPLETED** 11/24/16

WATER DEPTH -21.62 ft MLLW **HOLE SIZE** 3.5 in inches

DRILLING CONTRACTOR Alpine Ocean Seismic

CORE PENETRATION: 19.49

DRILLING METHOD Vibracore

CORE RECOVERY: 16.83

LOGGED BY CM CHECKED BY CD

CORE LOCATION: X:937139.18 Y:118062.09

NOTES

NAD 83, NY Long Island Lambert, ft

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	PENETRATION SECONDS PER FOOT	POCKET PEN. (tsf)	TORVANE (tsf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲		
									20 40 60 80		
									PL	MC	LL
									20 40 60 80		
										□ FINES CONTENT (%) □	
										20 40 60 80	
0		(CH) Unsplit	VC 1	100	2.8			82	▲		●
		(CL) Soft, wet, black Clay with coarse and and shells; noncohesive, nonplastic									
		(CL) Soft, wet, greenish black Clay with trace shells; noncohesive, nonplastic									
		(CH) Unsplit	VC 2	100	1.8			93	▲		●
		(CL) Soft, wet, greenish black Clay with trace shells; cohesive, nonplastic				0	0.05				
						0	0.04				
		(CH) Unsplit	VC 3	100	1.9			95	▲		●
		(CL) Soft, wet, greenish black Clay with trace shells; cohesive, nonplastic				0	0.05				
						0	0.07				
		(CH) Unsplit	VC 4	100	2.3			90	▲		●
		(CL) Soft, wet, greenish black Clay with trace shells; cohesive, nonplastic				0	0.1				
						0	0.13				
		(CH) Unsplit	VC 5	100	2.3			93	▲		●
		(CL) Soft, wet, greenish black Clay with trace shells; cohesive, nonplastic				0	0.1				
		(CH) Unsplit	VC 6	100	1.8			91	▲		●
		(CL) Soft, wet, greenish black Clay with trace shells; cohesive, nonplastic				0	0.12				
Bottom of borehole at 19.5 feet.											



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BORING NUMBER VC 78

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CLIENT	Williams	PROJECT NAME	NESE Pipeline
PROJECT NUMBER	1794	PROJECT LOCATION	Raritan Bay and Lower New York Harbor
DATE STARTED	11/19/16	COMPLETED	11/19/16
DRILLING CONTRACTOR	Alpine Ocean Seismic	WATER DEPTH	-11.79 ft MLLW
DRILLING METHOD	Vibracore	HOLE SIZE	3.5 in inches
LOGGED BY	CM	CORE PENETRATION:	19.47
CHECKED BY	CD	CORE RECOVERY:	17.83
NOTES		CORE LOCATION:	X:938887.92 Y:119027.08
			NAD 83, NY Long Island Lambert, ft

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	PENETRATION SECONDS PER FOOT	POCKET PEN. (tsf)	TORVANE (tsf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲		
									20 40 60 80		
									PL	MC	LL
0		(CH) Unsplit	VC 1	100	2.3			84			
		(CL) Soft, wet, black Clay with some shells; noncohesive, nonplastic (CL) Soft, gray, Clay; noncohesive, nonplastic									
		(CH) Unsplit	VC 2	100	2.7			90			
		(CL) Very soft, wet, gray Clay; cohesive, nonplastic				0	0.05				
						0	0.06				
		(CH) Unsplit	VC 3	100	1.9			91			
		(CL) Very soft, wet, gray Clay; cohesive, nonplastic				0	0.04				
		(CH) Unsplit	VC 4	100	2.1			91			
		(CL) Soft, wet, gray Clay; cohesive, nonplastic				0	0.15				
		(CH) Unsplit	VC 5	100	2.1			93			
		(CL) Soft, wet, gray Clay; cohesive, nonplastic				0	0.12				
		(CH) Unsplit	VC 6	100	1.7			90			
		(CL) Soft, wet, gray Clay; cohesive, nonplastic									
Bottom of borehole at 19.5 feet.											



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BORING NUMBER VC 79 Alt

PAGE 1 OF 1

CLIENT	Williams	PROJECT NAME	NESE Pipeline
PROJECT NUMBER	1794	PROJECT LOCATION	Raritan Bay and Lower New York Harbor
DATE STARTED	11/19/16	COMPLETED	11/19/16
DRILLING CONTRACTOR	Alpine Ocean Seismic	WATER DEPTH	-25.85 ft MLLW
DRILLING METHOD	Vibracore	HOLE SIZE	3.5 in inches
LOGGED BY	CM	CORE PENETRATION:	19.48
CHECKED BY	CD	CORE RECOVERY:	18.54
NOTES		CORE LOCATION:	X:940475.34 Y:120460.69
			NAD 83, NY Long Island Lambert, ft

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER		RECOVERY % (RQD)	PENETRATION SECONDS PER FOOT	POCKET PEN. (tsf)	TORVANE (tsf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲		
										20 40 60 80		
										PL	MC	LL
										20 40 60 80		
										□ FINES CONTENT (%) □		
										20 40 60 80		
0		(CH) Unsplit	VC 1	100	3.7			88	▲	I	●	
		(CL) Soft, dark gray Clay; cohesive, nonplastic										
		(CH) Unsplit	VC 2	100	3.3			92	▲	I	●	
		(CL) Very soft, wet, gray Clay with trace shells				0	0.05					
5						0	0.1					
		(CH) Unsplit	VC 3	100	2.6			93	▲	I	●	
		(CL) Very soft, wet, gray Clay with trace shells				0	0.04					
		(CH) Unsplit	VC 4	100	2.9			87	▲	I	●	
10		(CL) Very soft, wet, gray Clay with trace shells				0	0.1					
		(CH) Unsplit	VC 5	100	1.9			90	▲	I	●	
		(CL) Very soft, wet, gray Clay with trace shells				0	0.02					
						0	0.07					
15						0	0.15					
						0	0.14					
						0	0.05					
						0	0.12					
Bottom of borehole at 19.5 feet.												



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BORING NUMBER VC 80

PAGE 1 OF 1

CLIENT <u>Williams</u>		PROJECT NAME <u>NESE Pipeline</u>	
PROJECT NUMBER <u>1794</u>		PROJECT LOCATION <u>Raritan Bay and Lower New York Harbor</u>	
DATE STARTED <u>11/19/16</u>	COMPLETED <u>11/19/16</u>	WATER DEPTH <u>-36.89 ft MLLW</u>	HOLE SIZE <u>3.5 in inches</u>
DRILLING CONTRACTOR <u>Alpine Ocean Seismic</u>		CORE PENETRATION: <u>19.47</u>	
DRILLING METHOD <u>Vibracore</u>		CORE RECOVERY: <u>16.75</u>	
LOGGED BY <u>CM</u>	CHECKED BY <u>CD</u>	CORE LOCATION: <u>X:941296.37</u> <u>Y:121365.07</u>	
NOTES		NAD 83, NY Long Island Lambert, ft	

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	PENETRATION SECONDS PER FOOT	POCKET PEN. (tsf)	TORVANE (tsf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲			
									20 40 60 80			
									PL	MC	LL	
									20 40 60 80			
									□ FINES CONTENT (%) □			
									20 40 60 80			
0		(CH) Unsplit	VC 1	100	2.8			78	▲		●	81
		(CL) Very soft, wet, black Clay; noncohesive, nonplastic										
		(CH) Unsplit	VC 2	100	2.4			82	▲		●	85
		(CL) Very soft, wet, black Clay thinly bedded with green-gray clay; noncohesive, nonplastic				0	0.02					
5						0	0.05					
		(CH) Unsplit	VC 3	100	1.6			88	▲		●	90
		(CL) Very soft, moist, black Clay; cohesive, nonplastic				0	0.07					
		(CL) Soft, moist, greenish- gray Clay; cohesive, nonplastic				0	0.10					
						0	0.10					
10		(CH) Unsplit	VC 4	100	2.6			89	▲		●	90
		(CL) Soft, moist, greenish- gray Clay; cohesive, nonplastic				0	0.13					
						0	0.14					
		(CH) Unsplit	VC 5	100	2.3			89	▲		●	100
		(CL) Soft, moist, greenish- gray Clay; cohesive, nonplastic				0	0.16					
15		(CH) Unsplit	VC 6	100	2.5			91	▲		●	100
		(CL) Soft, moist, greenish gray Clay thinly bedded with black clay; cohesive, nonplastic				0	0.15					
						0	0.09					
Bottom of borehole at 19.5 feet.												



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BORING NUMBER VC 81

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CLIENT	Williams	PROJECT NAME	NESE Pipeline
PROJECT NUMBER	1794	PROJECT LOCATION	Raritan Bay and Lower New York Harbor
DATE STARTED	11/23/16	COMPLETED	11/23/16
DRILLING CONTRACTOR	Alpine Ocean Seismic	WATER DEPTH	-32.6 ft MLLW
DRILLING METHOD	Vibracore	HOLE SIZE	3.5 in inches
LOGGED BY	CM	CORE PENETRATION:	19.48
CHECKED BY	CD	CORE RECOVERY:	16.08
NOTES		CORE LOCATION:	X:941726.69 Y:121847.07
			NAD 83, NY Long Island Lambert, ft

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	PENETRATION SECONDS PER FOOT	POCKET PEN. (tsf)	TORVANE (tsf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲			
									20 40 60 80			
									PL	MC	LL	
									20 40 60 80			
									□ FINES CONTENT (%) □			
									20 40 60 80			
0		(CH) Unsplit	VC 1	100	2.3			78	▲		□	●
		(CL) Very soft, wet, dark gray, Clay with trace shells; noncohesive, nonplastic	VC 2	100	3.2				▲			
		(CL) Very soft, wet, black Clay; noncohesive, nonplastic				0	0.01					
		(CH) Unsplit	VC 3	100	2.3			81	▲			●
		(CL) Very soft, wet, black Clay with trace thin beds of greenish gray clay; noncohesive, nonplastic				0	0.01					
						0	0.01					
		(CH) Unsplit	VC 4	100	1.9			83	▲		□	●
		(CL) Very soft, moist, black Clay thinlybedded with greenish gray clay; noncohesive, nonplastic				0	0.03					
						0	0.07					
		(CH) Unsplit	VC 5	100	1.6			88	▲			●
		(CL) Very soft, moist, black Clay thinly bedded with greenish gray clay; noncohesive, nonplastic				0	0.07					
						0	0.05					
		(CH) Unsplit	VC 6	100	1.6			89	▲		●	□
		(CL) Very soft, moist, black Clay thinly bedded with greenish gray clay; cohesive, nonplastic				0	0.15					
						0	0.13					
		(CH) Unsplit	VC 7	100	1.6			95	▲		●	□
		(CL) Very soft, moist, black Clay thinly bedded with greenish gray clay; cohesive, nonplastic				0	0.16					
Bottom of borehole at 19.5 feet.												



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BORING NUMBER VC 82

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CLIENT	Williams	PROJECT NAME	NESE Pipeline
PROJECT NUMBER	1794	PROJECT LOCATION	Raritan Bay and Lower New York Harbor
DATE STARTED	11/23/16	COMPLETED	11/23/16
DRILLING CONTRACTOR	Alpine Ocean Seismic	WATER DEPTH	-20.26 ft MLLW
DRILLING METHOD	Vibracore	HOLE SIZE	3.5 in inches
LOGGED BY	CM	CORE PENETRATION:	19.48
CHECKED BY	CD	CORE RECOVERY:	15.46
NOTES		CORE LOCATION:	X:943049.96 Y:123310.85
			NAD 83, NY Long Island Lambert, ft

[illegible]



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BORING NUMBER VC 83-ALT

PAGE 1 OF 1

CLIENT	Williams	PROJECT NAME	NESE Pipeline
PROJECT NUMBER	1794	PROJECT LOCATION	Raritan Bay and Lower New York Harbor
DATE STARTED	11/28/16	COMPLETED	11/28/16
DRILLING CONTRACTOR	Alpine Ocean Seismic	WATER DEPTH	-14.65 ft MLLW
DRILLING METHOD	Vibracore	HOLE SIZE	3.5 in inches
LOGGED BY	CM	CORE PENETRATION:	15.58
CHECKED BY	CD	CORE RECOVERY:	10.83
NOTES		CORE LOCATION:	X:946366.51 Y:125549.63
			NAD 83, NY Long Island Lambert, ft

[illegible]

Bottom of borehole at 15.6 feet.



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BORING NUMBER VC 84-ALT

PAGE 1 OF 1

CLIENT	Williams	PROJECT NAME	NESE Pipeline
PROJECT NUMBER	1794	PROJECT LOCATION	Raritan Bay and Lower New York Harbor
DATE STARTED	11/28/16	COMPLETED	11/28/16
DRILLING CONTRACTOR	Alpine Ocean Seismic	WATER DEPTH	-15.89 ft MLLW
DRILLING METHOD	Vibracore	HOLE SIZE	3.5 in inches
LOGGED BY	CM	CORE PENETRATION:	15.25
CHECKED BY	CD	CORE RECOVERY:	11.08
NOTES		CORE LOCATION:	X:948452.09 Y:125884.58
		NAD 83, NY Long Island Lambert, ft	

[illegible]

Bottom of borehole at 15.3 feet.



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BORING NUMBER VC 85

PAGE 1 OF 1

CLIENT	Williams	PROJECT NAME	NESE Pipeline
PROJECT NUMBER	1794	PROJECT LOCATION	Raritan Bay and Lower New York Harbor
DATE STARTED	12/4/16	COMPLETED	12/4/16
DRILLING CONTRACTOR	Alpine Ocean Seismic	WATER DEPTH	-15.53 ft MLLW
DRILLING METHOD	Vibracore	HOLE SIZE	3.5 in inches
LOGGED BY	CM	CORE PENETRATION:	15.53
CHECKED BY	CD	CORE RECOVERY:	10.46
NOTES		CORE LOCATION:	X:950325.01 Y:125844.85
		NAD 83, NY Long Island Lambert, ft	

[illegible]

Bottom of borehole at 15.5 feet.

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BORING NUMBER VC 86 ALT

PAGE 1 OF 1

CLIENT	Williams	PROJECT NAME	NESE Pipeline
PROJECT NUMBER	1794	PROJECT LOCATION	Raritan Bay and Lower New York Harbor
DATE STARTED	12/4/16	COMPLETED	12/4/16
DRILLING CONTRACTOR	Alpine Ocean Seismic	WATER DEPTH	-17.24 ft MLLW
DRILLING METHOD	Vibracore	HOLE SIZE	3.5 in inches
LOGGED BY	CM	CHECKED BY	CD
NOTES			
		CORE PENETRATION:	15.4
		CORE RECOVERY:	11.04
		CORE LOCATION:	X:952172.68 Y:125756.07
		NAD 83, NY Long Island Lambert, ft	

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER		RECOVERY % (RQD)	PENETRATION SECONDS PER FOOT	POCKET PEN. (tsf)	TORVANE (tsf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
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Bottom of borehole at 15.4 feet.

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CLIENT	Williams	PROJECT NAME	NESE Pipeline
PROJECT NUMBER	1794	PROJECT LOCATION	Raritan Bay and Lower New York Harbor
DATE STARTED	12/4/16	COMPLETED	12/4/16
DRILLING CONTRACTOR	Alpine Ocean Seismic	WATER DEPTH	-21.45 ft MLLW
DRILLING METHOD	Vibracore	HOLE SIZE	3.5 in inches
LOGGED BY	CM	CHECKED BY	CD
NOTES			
	CORE PENETRATION:	15.41	
	CORE RECOVERY:	12.00	
	CORE LOCATION:	X:954297.38	Y:126036.15
	NAD 83, NY Long Island Lambert, ft		

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	PENETRATION SECONDS PER FOOT	POCKET PEN. (tsf)	TORVANE (tsf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲			
									20	40	60	80
									PL	MC	LL	
0									20	40	60	80
		(SM) Dark gray fine Sand, trace shell hash, trace silt	VC 1	100	3.0			114				
		(SM) Dark gray fine Sand with trace silt; large amount of shell hash										
		(SM) Dark gray fine Sand, trace shell hash, trace silt										
		(SC) Unsplit	VC 2	100	1.4	0.1	0.075	114				
		(CL-CH) Dark gray Clay; moderate plasticity				0.75	0.25					
		(SP) Dark gray fine to medium Sand, trace pebbles										
		(SP) Red to light gray fine to medium Sand with trace pebbles	VC 3	100	4.4			122				
		(SP) Dark red fine Sand, trace coarse sand and pebbles										
		(SP) Red-gray medium to coarse Sand with trace pebbles	VC 4	100	12.3			121				
			VC 5	100	10.2							
15												

Bottom of borehole at 15.4 feet.



TRANSCONTINENTAL GAS PIPE LINE COMPANY, LLC

APPENDIX D-3 – ERRATA AND ADDENDUM OCTOBER 2017

NORTHEAST SUPPLY ENHANCEMENT PROJECT

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**Fall/Winter 2016 Offshore
Environmental Sampling Report
for the Northeast Supply Enhancement
Project
New Jersey, New York**

Errata Sheets

October 2017


Prepared for:

Transcontinental Gas Pipe Line Company, LLC

Prepared by:


ECOLOGY AND ENVIRONMENT, INC.

368 Pleasant View Drive
Lancaster, New York 14086



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1

Introduction

Transcontinental Gas Pipe Line Company, LLC. (Transco), an indirect wholly owned subsidiary of Williams Partners L.P. (Williams), is proposing the Northeast Supply Enhancement (NESE) Project (Project) to expand its existing interstate natural gas pipeline system in Pennsylvania and New Jersey and its existing offshore natural gas pipeline system in New Jersey and New York waters. The Project capacity is fully subscribed by two entities of National Grid: Brooklyn Union Gas Company (d/b/a [doing business as] National Grid NY) and KeySpan Gas East Corporation (d/b/a National Grid), collectively referred to herein as “National Grid.”

To provide the incremental 400,000 dekatherms per day (Dth/d) of capacity, Transco plans to expand portions of its system from the existing Compressor Station 195 in York County, Pennsylvania, to the Rockaway Transfer Point in New York State waters. As defined in executed precedent agreements with National Grid, the Rockaway Transfer Point is the interconnection point between Transco’s existing Lower New York Bay Lateral (LNYBL) and existing offshore Rockaway Delivery Lateral (RDL).

Transco filed its application for a Certificate of Public Convenience and Necessity with the Federal Energy Regulatory Commission (FERC) on March 27, 2017 (Certificate Application), and FERC assigned the Project Docket No. CP17-101. Transco submitted its Offshore Environmental Sampling Report as Appendix J of Transco’s Joint Permit Application to the U.S. Army Corp of Engineers (USACE) and New York State Department of Environmental Conservation on June 27, 2017. Transco submitted its first Errata and Addendum to its Offshore Environmental Sampling Report as Appendix J to the Supplemental Information Filing for Transco’s Joint Permit Application to the USACE on September 15, 2017. Transco submitted its Offshore Environmental Sampling Report to FERC on June 30, 2017, and its first Errata and Addendum to its Offshore Environmental Sampling report to FERC on September 7, 2017.

The following information consists of corrections to information initially presented in the Offshore Environmental Sampling Report. Please refer to the Offshore Environmental Sampling Report for the unchanged information. All revised information is listed in **red bold text** and removed features marked as ~~strike through text~~. Corrections to the Offshore Environmental Sampling Report

are the result of transcription and formatting errors. Additionally, for consistency any use of “VC1-ALT-B” in the Offshore Environmental Sampling Report should be updated to “VC1B-ALT”.

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Sediment Chemistry

Results

Group A – New Jersey

Pesticides

Each sediment sample was analyzed for 27 pesticides (see Appendix C for a complete list of these pesticides). A total of seven pesticides (Dieldrin, O,P'-DDD, O,P'-DDE, O,P'-DDT, P,P'-DDD, P,P'-DDE, and P,P'-DDT) were detected in at least one sample in Group A. (Table 2-2 lists the sample sites where pesticides were detected.) Eleven pesticides tested for have available ER-L and/or ER-M thresholds and four of these (including the sum of three pesticides [DDD + DDE + DDT] exceeded ~~only~~ the ER-L **and/or ER-M** thresholds.

P,P'-DDD exceeded the ER-L threshold at the 0- to 3-foot and 3- to 6-foot depth intervals at VC1-ALT and VC1~~B~~-ALT-~~B~~ and at the 6- to 9-foot depth interval at VC1~~B~~-ALT-~~B~~, with concentrations ranging from 4.48 to 14.7 micrograms per kilogram ($\mu\text{g}/\text{kg}$). P,P'-DDE exceeded the ER-L threshold at the ~~0- to 3-foot and 3- to 6-foot depth intervals at VC1-ALT and VC1-ALT-B~~ and at the 6- to 9-foot depth interval at VC1~~B~~-ALT-~~B~~ with ~~a~~ concentrations ~~of~~ ranging from 5.5 to 56.5 $\mu\text{g}/\text{kg}$. **P,P'-DDE exceeded the ER-M threshold at the 0- to 3-foot and 3- to 6-foot depth intervals at VC1-ALT and VC1B-ALT with concentrations ranging from 27.2 to 56.5 $\mu\text{g}/\text{kg}$.** P,P'-DDT exceeded the ER-L threshold at the 0- to 3-foot and 3- to 6 foot depth intervals at VC1-ALT and VC1~~B~~-ALT-~~B~~ with concentrations ranging from 2.39 to 5.37 $\mu\text{g}/\text{kg}$.

The sum of DDD + DDE + DDT exceeded the ER-L threshold value within the 0- ~~to 3-foot and 3-6 ft~~ depth intervals at VC1-ALT and VC1~~ALT-B~~ and the 6- ~~to 9-foot~~ depth interval at VC1~~B~~-ALT-~~B~~ with concentrations ranging from 14.21 to 92.57 $\mu\text{g}/\text{kg}$. **The sum of DDD + DDE + DDT exceeded the ER-M threshold at the 0- to 3-foot depth interval at VC1B-ALT and the 3- to 6-foot depth interval at VC1-ALT and VC1B-ALT with concentrations ranging from 73.50 to 92.57 $\mu\text{g}/\text{kg}$.**

Polychlorinated Biphenyls (PCBs)

Aroclor 1254 and Aroclor 1260 exceeded the ER-L in the following samples: 0- to 3 feet and 3- to 6 feet at VC1-ALT; and 0- to 3 feet, 3- to 6 feet, and 6- to 9 feet at VC1B-ALT. The concentrations of Aroclor 1254 that exceeded the ER-L threshold ranged from ~~47.6~~ **439.0** µg/kg to 714.0 µg/kg. The concentrations of Aroclor 1254~~60~~ that exceeded the ER-L threshold ranged from 149 µg/kg to 340 µg/kg. The sum of Aroclors exceeded the ER-M threshold in the following samples: 0- to 3 feet and 3- to 6 feet at VC1-ALT; and 0- to 3 feet, 3- to 6 feet, and 6- to 9 feet at VC1B-ALT. The concentrations of the sum of Aroclors that exceeded the ER-M threshold ranged from 291.6 µg/kg to 1,140.0 µg/kg.

Dioxins/Furans

For these sample sites, the total toxicity equivalency factor exceeded the ER-M threshold in the following samples: the 0- to 3 feet, 3- to 6 feet, and 6- to 9 feet depth intervals at VC1-ALT and VC1B-ALT; the 12- to 15 foot depth interval at VC1-ALT; the 6- to 9 foot depth interval at VC2; and the 0- to 3 feet, **and** 3- to 6 feet, ~~and 6- to 9 feet~~ depth intervals at VC4. Concentrations in these samples ranged from 3.81 pg/g to 81.5 pg/g.

2.3.2 Group B – New York**Metals**

Each sediment sample was analyzed for 27 metals, including mercury (see Appendix C for a complete list of these metals). Each of the 27 metals was detected in at least one sample in Group B (see Table B-7 for the sample sites where they were detected; due to the number of sample sites in Group B, this table is included in Appendix B). ~~Seven~~ **Nine** of the detected metals exceeded Class A thresholds. Of these metals, nine have available Class A and/or Class C thresholds and all nine of these metals exceeded available NYSDEC thresholds. The metals detected within this segment that exceeded Class A and/or Class C thresholds are presented in Table B-8.

Cyanide

Total cyanide was detected in the following samples: 0- to 3 feet at VC7 and 9- to 12 feet at VC16 and VC17; 3- to 6 feet at VC3**5**; and 3- to 6 feet and 9- to 12 feet at VC36. Detected concentrations ranged from 0.25 mg/kg to 0.97 mg/kg.

PesticidesNon-Clamshell Dredge Sample Sites

Of the 11 pesticides tested for in samples from sample sites where clamshell dredging would not occur, Class A and/or Class C thresholds are available for three pesticides and the sum of DDT+DDE+DDD. No pesticides tested for were detected in samples from these sample sites.

Possible Clamshell Dredge Sample Sites

Of the pesticides tested for in samples from sample sites where clamshell dredging may occur, 11 have available Class A and/or Class C thresholds. A total of 8 pesticides (aldrin, endosulfan sulfate, endrin, O,P'-DDD, O,P'-DDE, P,P'-DDD, P,P'-DDE, and P,P'-DDT) were detected in at least one sample in Group B. (See Table B-7 for a list of the sample sites where pesticides were detected.) Of the detected pesticides, only endrin and the sum of DDT + DDE + DDD have available Class A and Class C thresholds, and only the sum of DDT + DDE + DDD exceeded the Class A threshold. The sum of DDT + DDE + DDD exceeded the Class A threshold in the 0- to 3-foot samples at VC6 and VC7; all samples from VC16 and VC17; and 0- to 3 foot sample at VC41-ALT. Concentrations that exceeded the Class A threshold ranged from 8.6 µg/kg to **with a concentration of 99.0 µg/kg.**

Polycyclic Aromatic Hydrocarbons (PAHs)

Total PAHs detected only exceed the Class A criteria in the following samples: 0- **to 3 feet**, 3- to 6 feet, 6- to 9 feet, 9- to 12 feet at VC16 and VC17; and 0- to 3 feet at VC37 and VC38; **and 3- to 6 feet and 6- to 9 feet at VC42.** The concentrations that exceeded the Class A threshold ranged from 4,540.0 µg/kg to 21,860.5 µg/kg.

Dioxins/Furans

Possible Clamshell Dredge Sample Sites

The total toxicity equivalency factor only exceeded the Class A threshold in samples from sites where clamshell dredging may occur. 2,3,7,8-tetrachlorodibenzo-P-Dioxin ~~did not exceed~~ the Class A threshold **in the 0- to 3 feet samples at VC6, VC7, and VC41-ALT; and the 0- to 3 feet, 3- to 6 feet, 6- to 9 feet, 9- to 12 feet, and 12- to 15 feet samples at VC16 and VC17. The concentrations that exceeded the Class A threshold ranged from 0.53 pg/g to 13.2 pg/g.** The samples where the total toxicity equivalency factor exceeded the Class A threshold were **0- to 3 feet, and 3- to 6 feet at VC6; 3- to 6 feet at VC7; 9- to 12 feet at VC8; 0- to 3 feet and 6- to 9 feet at VC15; 3- to 6 feet, 6- to 9 feet, and 9- to 12 feet at VC16 and VC17; 12- to 15 feet at VC16; 0- to 3 feet and 6- to 9 feet at VC18; 0- to 3 feet at VC37; and 3- to 6 feet at VC39.** The concentrations that exceeded the Class A threshold ranged from 4.6 pg/g to **8.04-39.7 pg/g.**

2.3.3 Group C – New Jersey

Metals

Each sediment sample was analyzed for 27 metals, including mercury (see Appendix C for a complete list of these metals). Of these metals, 16 ER-L and/or ER-M thresholds are available. Within this sample segment, 25 metals tested for were detected in at least one sample in Group C (see Table 2-6 for the sample sites where metals were detected). The only two metals not detected were

antimony and ~~silver~~-molybdenum. ~~Three~~**Four** of the metals detected exceeded available NJDEP thresholds.

Selenium exceeded the ER-M threshold in the following samples: 0- to 3 feet at VC46; 9- to 12 feet at VC47; 0- to 3 feet, 3- to 6 feet, 6- to 9 feet, 9- to 12 feet at VC50, 0- to 3 feet, 3- to 6 feet, 6- to 9 feet, 9- to 12 feet at VC51; 3- to 6 feet, and 6- to 9 feet at VC52; 0- to 3 feet, 3- to 6 feet, **and** 6- to 9 feet, ~~9- to 12 feet~~ at VC53; 0- to 3 feet, 3- to 6 feet, 6- to 9 feet, 9- to 12 feet, 12- to 15 feet, and 15- to 17.63 feet at VC54; 0- to 3 feet, 3- to 6 feet, 6- to 9 feet, ~~and 9- to 12~~, **12- to 15 feet, and 15- to 16 feet** at VC54B; and 9- to 12 feet at VC55. Concentrations that exceeded the ER-M threshold ranged from 1.00 mg/kg to 4.13 mg/kg.

Cyanide

Samples from all sample sites in New Jersey were tested for cyanide. Cyanide was measured as total and amenable concentrations. There are no standard or guidance values available for total or amenable cyanide. Total cyanide was detected in three of the sample sites. Detections occurred at the 6- to 9.7-foot interval at location VC48-ALT, the 9- to 12-foot interval at location VC51, and the **0- to 3-foot**, 3- to 6-foot and 6- to 9-foot intervals at location VC55 with concentrations ranging from 0.21 to 0.62 mg/kg.

Polychlorinated Biphenyls (PCBs)

Each sediment sample was analyzed for PCBs expressed as seven Aroclor compounds. Testing for ~~22~~**31** PCB congeners was also performed for samples from all sample sites in New Jersey. A complete list of the Aroclor compounds and PCB congeners included in the analysis is provided in Appendix C. ER-L thresholds are available for four Aroclor compounds and for the sum of Aroclor compounds, and an ER-M threshold is also available for the sum of Aroclor compounds. While there are no available thresholds for individual PCB congeners, there are ER-L and ER-M thresholds for total PCB congeners.

Polycyclic Aromatic Hydrocarbons (PAHs)

Each sediment sample was analyzed for 18 PAH compounds and 17 PAHs were detected (see Table 2-8 for a list of detected ~~SVOCs~~ **PAHs** and Table 2-6 for the sample sites where they were detected). The total toxicity equivalency factor exceeded the ER-M threshold in the 6- to 9 foot sample from sample site VC54 with a concentration of 5.83 pg/g.

Semi-Volatile Organic Compounds (SVOCs)

An additional 46 SVOCs were tested in samples from all sample sites in New Jersey (see Appendix C for a complete list of these SVOCs). ~~Five~~ **Six** of the 46 SVOCs were detected (4-chloroaniline, 4-methylphenol, benzyl butyl phthalate, **carbazole**, dibenzofuran, and phenol). ER-L and/or ER-M thresholds for 16 SVOCs are available. No SVOCs exceeded the ER-L and/or ER-M thresholds.

2.3.4 Group D – New York

Dioxins/Furans

Three dioxins (1,2,3,4,6,7,8-heptachlorodibenzo-p-dioxin, 2,3,7,8-tetrachlorodibenzo-p-dioxin, and octachlorodibenzo-p-dioxin) and two furans (1,2,3,4,6,7,8-heptachlorodibenzofuran and 2,3,7,8-tetrachlorodibenzofuran) were detected in at least one sample in Group D (see Table 2.10 for the sample sites where they were detected). No detected dioxins or furans exceeded the Class A thresholds. The total toxicity equivalency factor did not exceed the Class A threshold.

2.3.5 Alternative Route

Metals

Table 2-11 Number of Detections at Sample Sites Along Alternative Route

Sample Site ¹	Number of Detections							
	VOCs	PAHs	Other SVOCs	Dioxins/Furans	Pesticides	PCB Congener	PCB Aroclor	Metals
VC70	0	17	0	17	5	0	2	27
VC71	0	8	0	2	0	0	0	26
VC72	0	12	0	3	0	0	0	23
VC73-ALT	0	16	0	2	4 3	0	3 0	24
VC74	0	14	0	2	0	0	1 0	22
VC75	0	17	0	2	1 0	0	0	26
VC76	5	17	0	7	5 4	0	3 2	26
VC77	0	17	1 5	7	4 3	29	3 2	26
VC78	0	17	5 6	14	2 1	28	0	27
VC79-ALT	0	16	2 5	15	2 1	27	0	26
VC80	0	16	0 2	16	11 10	30	2	27
VC81	0	17	0 7	17	5	31	2	26
VC82	0	17	0	2	0	0	1 0	25
VC83-ALT	0	0	0	2	0	0	0	24
VC84-ALT	0	0	0	2	0	0	0	24
VC85	0	11	0	2	0	0	0	24
VC86-ALT	0	11	0	1	0	0	0	24
VC87	0	2	0	2	0	0	0	24

Key:

¹ Dioxins and furans were analyzed only in the samples taken from 0- to 3 feet at sites in New York where clamshell dredging is not anticipated to occur. Dioxin/furan samples for additional depths at these sites were archived. PCB congeners were not tested at sites in New York where clamshell dredging is not anticipated to occur.

Cyanide

Samples from sampling sites in New York where clamshell dredging may occur were tested for cyanide (see Table B-1 for these locations). See above for discussion of analytes included in the analysis of samples at clamshell sites. Cyanide was measured as total and amenable concentrations. No standard or

guidance values are available for total or amenable cyanide. Total cyanide was detected in ~~three~~-two of the sample sites. Total cyanide was detected in the following samples: 0- to 3 feet, 3- to 6 feet, and 6- to 9 feet at VC80; and 0- to 3 feet, 6- to 9 feet, 9- to 12 feet, and 12- to 14.75 feet at VC81. Concentrations in these samples ranged from 0.38 mg/kg to 0.66 mg/kg.

Polychlorinated Biphenyls (PCBs)

Non-Clamshell Dredge Sample Sites

Three Aroclor compounds (Aroclor 1016, Aroclor 1254, and Aroclor 1260) were detected in at least one sample from the alternative route (see Table 2-11 for the sample sites where PCBs were detected). Class A thresholds were exceeded only for the sum of Aroclor compounds in the following samples: 0- to 3 feet at VC70 and VC76 and 9- to 12 feet at VC73 and VC74. Concentrations that exceeded the Class A threshold ranged from 300 µg/kg to 554 µg/kg.

Possible Clamshell Dredge Sample Sites

~~Three~~-Two Aroclor compounds (~~Aroclor 1016~~, Aroclor 1254, and Aroclor 1260) and all 31 PCB congeners were detected in at least one sample in the alternative route (see Table 2.11 for the sample sites where they were detected). Class A thresholds were exceeded for both the sum of Aroclor compounds and total PCB congeners. The Class C threshold for total PCB congeners was also exceeded.

Semi-Volatile Organic Compounds (SVOCs)

Samples from sample sites in New York where clamshell dredging may occur (see Table B-1 for these locations) were tested for an additional 46 SVOCs. See above for discussion of analytes included in the analysis of samples at clamshell sites. See Appendix C for a complete list of these SVOCs. Six SVOCs have available Class A and/or Class C thresholds. Of those samples tested, ~~five~~-nine SVOCs were detected (**1,2,4-trichlorobenzene**, 4-methylphenol, **benzyl butyl phthalate**, bis(2-ethylhexyl) phthalate, carbazole, **dibenzofuran**, **diethyl phthalate**, **di-n-butyl phthalate**, ~~hexachlorocyclopentadiene~~, and phenol) in at least one sample in the alternative route (see Table 2-11 for the sample sites where SVOCs were detected). None exceeded Class A thresholds.

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Tables

Table B-3 Summary of Sediment Sample Analytical Results that Exceeded Available Thresholds for the Proposed Route

Analyte	No. of Sites (and Samples) Included in Analysis	No. of Sites (and Samples) Where Analyte was Detected	Maximum Result	Location of Maximum Result	No. of Exceedances (and Range of Values in Exceedance) ³			
					NJDEP ER-L	NJDEP ER-M	NYSDEC Class A	NYSDEC Class C
Total BTEX (µg/kg)	69(314)	6(12)	9.81	VC16-D9-12E	N/A	N/A	0	0
Total PAHs (µg/kg)	69(313)	56(155)	21860.5	VC38-D0-3E	24(4230-21860.5)	0	24(4230-21860.5)	0
Dioxins and Furans Total Toxicity Equivalency Factor ¹ (pg/g)	69(219)	66(202)	81.499	VC1-ALT-D0-3E	N/A	45(3.70104-81.499)	26(4.60107-81.499)	1(81.499-81.499)
P,P'-DDE (µg/kg)	69(313)	7(21)	56.5	VC1B-ALT-D3-6E	19(4.1-56.5)	N/A	0	N/A
Sum of DDT + DDE + DDD (µg/kg)	69(313)	7(21)	99.003	VC6-D0-3E	21(3.393-99.003)	N/A 4(73.497-99.003)	0 4(8.672-99.003)	0
Total PCB Congeners ² (pg/g)	37(177)	28(135)	2000000	VC16-D9-12E	19(28800-2000000)	N/A 15(233000-2000000)	0 16(149000-2000000)	3(1160000-2000000)
Total PCB Aroclors (µg/kg)	69(313)	6(19)	1140	VC1B-ALT-D0-3E	19(93.9-1140)	0 17(239.8-1140)	0 18(161.6-1140)	1(1140-1140)
Aluminum (mg/kg)	69(314)	69(314)	18000	VC16-D0-3E	N/A	N/A 0	0 N/A	N/A
Antimony (mg/kg)	69(314)	8(23)	15.8	VC6-D0-3E	N/A	4(73.497-99.003) 1(15.8-15.8)	4(8.672-99.003) N/A	N/A
Arsenic (mg/kg)	69(314)	69(314)	108	VC1-ALT-D3-6E	86(8.27-108)	15(233000-2000000) 3(87.8-108)	16(149000-2000000) 86(8.27-108)	3(87.8-108)
Barium (mg/kg)	69(314)	68(300)	135	VC1B-ALT-D0-3E	N/A	17(239.8-1140) 17(48.8-135)	18(161.6-1140) N/A	N/A
Cadmium (mg/kg)	69(314)	43(146)	3.49	VC16-D6-9E	12(1.3-3.49)	0	N/A 12(1.3-3.49)	0
Chromium, Total (mg/kg)	69(314)	65(296)	202	VC16-D6-9E	14(86.5-202)	1(15.8-15.8) 0	N/A 14(86.5-202)	0
Cobalt (mg/kg)	69(314)	69(313)	16.3	VC16-D6-9E	N/A	3(87.8-108) 45(10.1-16.3)	86(8.27-108) N/A	N/A
Copper (mg/kg)	69(314)	65(281)	504	VC1B-ALT-D0-3E	22(37.3-504)	17(48.8-135) 2(307-504)	N/A 22(37.3-504)	2(307-504)

Table B-3 Summary of Sediment Sample Analytical Results that Exceeded Available Thresholds for the Proposed Route

Analyte	No. of Sites (and Samples) Included in Analysis	No. of Sites (and Samples) Where Analyte was Detected	Maximum Result	Location of Maximum Result	No. of Exceedances (and Range of Values in Exceedance) ³			
					NJDEP ER-L	NJDEP ER-M	NYSDEC Class A	NYSDEC Class C
Lead (mg/kg)	69(314)	69(314)	285	VC16-D6-9E	24(47.4-285)	0 4(235-285)	12(1.3-3.49) 24(47.4-285)	4(235-285)
Manganese (mg/kg)	69(314)	69(314)	906	VC16-D6-9E	N/A	0 94(263-906)	14(86.5-202) N/A	N/A
Nickel (mg/kg)	69(314)	68(301)	53.5	VC16-D6-9E	86(21.4-53.5)	45(10.1-16.3) 1(53.5-53.5)	N/A 86(21.4-53.5)	1(53.5-53.5)
Selenium (mg/kg)	69(314)	46(167)	18.6	VC1-ALT-D3-6E	N/A	2(307-504) 156(1.01-18.6)	22(37.3-504) N/A	N/A
Silver (mg/kg)	69(314)	13(34)	8.52	VC16-D9-12E	18(1.06-8.52)	4(235-285) 8(3.92-8.52)	24(47.4-285) 18(1.06-8.52)	8(3.92-8.52)
Vanadium (mg/kg)	69(314)	64(279)	94.4	VC22-D9-12E	N/A	94(263-906) 6(61.7-94.4)	N/A	N/A
Zinc (mg/kg)	69(314)	66(270)	494	VC16-D6-9E	18(154-494)	1(53.5-53.5) 3(427-494)	86(21.4-53.5) 18(154-494)	3(427-494)
Mercury (mg/kg)	69(314)	53(196)	5.28	VC1B-ALT-D0-3E	36(0.169-5.28)	156(1.01-18.6) 21(0.904-5.28)	N/A 36(0.169-5.28)	21(0.904-5.28)

Sources: NJDEP 2009, NYSDEC 2004, 2014c.

Notes:

1 Dioxins/Furans only analyzed in top 3 feet in NY non-clamshell.

2 Not analyzed in NY non-clamshell.

3 N/A indicates that there is no guidance value for that analyte, 0 indicates no exceedances of the guidance value. All measured concentrations of analytes detected in samples from New Jersey and New York were compared to both the SGVs and ESC.

Key:

DDD = dichloro-diphenyl-dichloroethane

DDE = dichloro-diphenyl-dichloroethylene

DDT = dichloro-diphenyl-trichloroethane

µg/kg = micrograms per kilogram

mg/kg = milligrams per kilogram

PCBs = polychlorinated biphenyls

PCBs = polychlorinated biphenyls

pg/g = picogram/gram

Table B-4 Count of Exceedances in New York and New Jersey per Number of Available SGVs and ESCs

Analyte Group	VC1-ALT ¹		VC1B-ALT ¹		VC2		VC3-ALT		VC4		VC5		VC6		VC7		VC8		VC9		VC10		VC11 ²		VC12 ²	
	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY
VOCs ³	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5
SVOCs (excluding PAHs) ³	4/15	0/6	3/15	0/6	0/15	0/6	0/15	0/6	0/15	0/6	0/15	0/6	1/15	0/6	2/15	0/6	0/15	0/6	0/15	0/6	0/15	0/6	0/15	0/0	0/15	0/0
PAHs ³	16/18	1/1	13/18	1/1	0/18	0/1	0/18	0/1	1/18	0/1	0/18	0/1	7/18	0/1	8/18	0/1	0/18	0/1	0/18	0/1	0/18	0/1	0/18	0/1	0/18	0/1
Dioxins/ Furans ³	1/1	2/2	1/1	2/2	1/1	1/2	0/1	0/2	1/1	1/2	1/1	0/2	1/1	2/2	1/1	2/2	1/1	1/2	1/1	0/2	0/1	0/2	1/1	0/2	1/1	0/2
Pesticides ³	4/11	1/11	4/11	1/11	0/11	0/11	0/11	0/11	0/11	0/11	0/11	0/11	4/11	1/11	4/11	10/11	0/11	0/11	0/11	0/11	0/11	0/11	0/11	0/11	0/4	0/11
PCB Congener ³	1/1	1/1	1/1	1/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	1/1	1/1	1/1	1/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/0	0/1	0/0
PCB Aroclor ³	3/5	1/1	3/5	1/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	3/5	1/1	3/5	1/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1
Metals ³	14/16	9/9	14/16	9/9	2/16	1/9	5/16	2/9	7/16	4/9	5/16	2/9	15/16	9/9	13/16	9/9	5/16	2/9	4/16	2/9	0/16	0/9	0/16	0/9	2/16	1/9
Total	43/71	15/36	39/71	15/36	3/71	2/36	5/71	2/36	9/71	5/36	6/71	2/36	32/71	14/36	32/71	14/36	6/71	3/36	5/71	2/36	0/71	0/36	1/71	0/22	3/71	1/22

Analyte Group	VC13 ²		VC14 ²		VC15		VC16		VC17		VC18		VC19 ²		VC20 ²		VC21 ²		VC22 ²		VC23 ²		VC24 ²		VC25 ²	
	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY
VOCs ³	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5
SVOCs (excluding PAHs) ³	0/15	0/0	0/15	0/0	0/15	0/6	3/15	0/6	4/15	0/6	0/15	0/6	0/15	0/0	0/15	0/0	0/15	0/0	0/15	0/0	0/15	0/0	0/15	0/0	0/15	0/0
PAHs ³	0/18	0/1	0/18	0/1	0/18	0/1	17/18	1/1	17/18	1/1	0/18	0/1	0/18	0/1	0/18	0/1	0/18	0/1	0/18	0/1	0/18	0/1	0/18	0/1	0/18	0/1
Dioxins/ Furans ³	0/1	0/2	1/1	0/2	1/1	1/2	1/1	2/2	1/1	2/2	1/1	1/2	0/1	0/2	0/1	0/2	0/1	0/2	0/1	0/2	0/1	0/2	0/1	0/2	0/1	0/2
Pesticides ³	0/11	0/4	0/11	0/4	0/11	0/11	4/11	10/11	4/11	1/11	10/11	0/11	0/11	0/4	0/11	0/4	0/11	0/4	0/11	0/4	0/11	0/4	0/11	0/4	0/11	0/4
PCB Congener ³	0/1	0/0	0/1	0/0	0/1	0/1	1/1	1/1	1/1	1/1	0/1	0/1	0/1	0/0	0/1	0/0	0/1	0/0	0/1	0/0	0/1	0/0	0/1	0/0	0/1	0/0
PCB Aroclor ³	0/5	0/1	0/5	0/1	0/5	0/1	3/5	1/1	3/5	1/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1
Metals ³	3/16	2/9	3/16	2/9	4/16	2/9	14/16	9/9	13/16	9/9	4/16	2/9	4/16	2/9	4/16	2/9	0/16	0/9	3/16	1/9	3/16	2/9	0/16	0/9	1/16	1/9
Total	3/71	2/22	4/71	2/22	5/71	3/36	43/71	15/36	43/71	15/36	5/71	3/36	4/71	2/22	4/71	2/22	0/71	0/22	3/71	1/22	3/71	2/22	0/71	0/22	1/71	1/22

Analyte Group	VC26 ²		VC27 ²		VC28 ²		VC29 ²		VC30 ²		VC31-ALT ²		VC32 ²		VC33-ALT ²		VC34 ²		VC35		VC36		VC37		VC38	
	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY
VOCs ³	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5
SVOCs (excluding PAHs) ³	0/15	0/0	0/15	0/0	0/15	0/0	0/15	0/0	0/15	0/0	0/15	0/0	0/15	0/0	0/15	0/0	0/15	0/0	0/15	0/6	0/15	0/6	0/15	0/6	0/15	0/6
PAHs ³	0/18	0/1	0/18	0/1	0/18	0/1	0/18	0/1	0/18	0/1	0/18	0/1	0/18	0/1	0/18	0/1	0/18	0/1	0/18	0/1	0/18	0/1	17/18	1/1	18/18	1/1
Dioxins/ Furans ³	0/1	0/2	1/1	0/2	0/1	0/2	0/1	0/2	0/1	0/2	0/1	0/2	0/1	0/2	0/1	0/2	0/1	0/2	0/1	0/2	0/1	0/2	1/1	1/2	1/1	0/2
Pesticides ³	0/11	0/4	0/11	0/4	0/11	0/4	0/11	0/4	0/11	0/4	0/11	0/4	0/11	0/4	0/11	0/4	0/11	0/4	0/11	0/11	0/11	0/11	0/11	0/11	0/11	0/11
PCB Congener ³	0/1	0/0	0/1	0/0	0/1	0/0	0/1	0/0	0/1	0/0	0/1	0/0	0/1	0/0	0/1	0/0	0/1	0/0	0/1	0/1	0/1	0/1	0/1	0/1	1/1	0/1
PCB Aroclor ³	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1
Metals ³	1/16	0/9	2/16	1/9	1/16	0/9	3/16	1/9	1/16	0/9	2/16	0/9	1/16	0/9	1/16	0/9	1/16	0/9	1/16	0/9	1/16	0/9	5/16	4/9	11/16	7/9
Total	1/71	0/22	3/71	1/22	1/71	0/22	3/71	1/22	1/71	0/22	2/71	0/22	1/71	0/22	1/71	0/22	1/71	0/22	1/71	0/36	1/71	0/36	23/71	6/36	31/71	8/36

Analyte Group	VC39		VC40		VC41-ALT		VC42 ²		VC43 ²		VC44 ²		VC45-ALT		VC46		VC47		VC48-ALT		VC49		VC50		VC51	
	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY
VOCs ³	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5
SVOCs (excluding PAHs) ³	0/15	0/6	0/15	0/6	0/15	0/6	0/15	0/0	0/15	0/0	0/15	0/0	0/15	0/6	0/15	0/6	0/15	0/6	0/15	0/6	0/15	0/6	0/15	0/6	0/15	0/6
PAHs ³	0/18	0/1	0/18	0/1	0/18	0/1	17/18	1/1	0/18	0/1	0/18	0/1	0/18	0/1	0/18	0/1	0/18	0/1	0/18	0/1	0/18	0/1	0/18	0/1	0/18	0/1
Dioxins/ Furans ³	1/1	1/2	0/1	0/2	1/1	1/2	0/1	0/2	0/1	0/2	0/1	0/2	0/1	0/2	0/1	0/2	0/1	0/2	0/1	0/2	0/1	0/2	0/1	0/2	0/1	0/2
Pesticides ³	0/11	0/11	0/11	0/11	2/11	10/11	0/11	0/4	0/11	0/4	0/11	0/4	0/11	0/11	0/11	0/11	0/11	0/11	0/11	0/11	0/11	0/11	0/11	0/11	0/11	0/11
PCB Congener ³	0/1	0/1	0/1	0/1	1/1	0/1	0/1	0/0	0/1	0/0	0/1	0/0	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
PCB Aroclor ³	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1
Metals ³	1/16	0/9	1/16	0/9	2/16	1/9	8/16	6/9	1/16	0/9	0/16	0/9	0/16	0/9	1/16	0/9	3/16	2/9	1/16	0/9	1/16	0/9	1/16	0/9	1/16	0/9
Total	2/71	1/36	1/71	0/36	6/71	3/36	25/71	7/22	1/71	0/22	0/71	0/22	0/71	0/36	1/71	0/36	3/71	2/36	1/71	0/36	1/71	0/36	1/71	0/36	1/71	0/36

Table B-4 Count of Exceedances in New York and New Jersey per Number of Available SGVs and ESCs

Analyte Group	VC52		VC53		VC54 ¹		VC54B ¹		VC55 ¹		VC55B ¹		VC56 ²		VC57 ²		VC58 ²		VC59 ²		VC60 ²		VC61-ALT ²		VC62 ²	
	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY
VOCs ³	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5
SVOCs (excluding PAHs) ³	0/15	0/6	0/15	0/6	0/15	0/6	0/15	0/6	0/15	0/6	0/15	0/6	0/15	0/0	0/15	0/0	0/15	0/0	0/15	0/0	0/15	0/0	0/15	0/0	0/15	0/0
PAHs ³	0/18	0/1	0/18	0/1	15/18	1/1	15/18	1/1	0/18	0/1	0/18	0/1	0/18	0/1	0/18	0/1	0/18	0/1	0/18	0/1	1/18	1/1	0/18	0/1	9/18	1/1
Dioxins/ Furans ³	0/1	0/2	0/1	0/2	1/1	1/2	1/1	0/2	0/1	0/2	0/1	0/2	0/1	0/2	0/1	0/2	0/1	0/2	0/1	0/2	0/1	0/2	0/1	0/2	0/1	0/2
Pesticides ³	0/11	0/11	0/11	0/11	0/11	0/11	0/11	0/11	0/11	0/11	0/11	0/11	0/11	0/4	0/11	0/4	0/11	0/4	0/11	0/4	0/11	0/4	0/11	0/4	0/11	0/4
PCB Congener ³	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/0	0/1	0/0	0/1	0/0	0/1	0/0	0/1	0/0	0/1	0/0	0/1	0/0
PCB Aroclor ³	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1
Metals ³	1/16	0/9	1/16	0/9	2/16	1/9	2/16	1/9	1/16	0/9	0/16	0/9	1/16	0/9	1/16	0/9	1/16	0/9	1/16	0/9	5/16	4/9	2/16	1/9	2/16	2/9
Total	1/71	0/36	1/71	0/36	18/71	3/36	18/71	2/36	1/71	0/36	0/71	0/36	1/71	0/22	1/71	0/22	1/71	0/22	1/71	0/22	6/71	5/22	2/71	1/22	11/71	3/22

Analyte Group	VC63 ²		VC64 ²		VC65 ²		VC66 ²		VC67 ²		VC68 ²		VC69-ALT ²	
	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY	NJ	NY
VOCs ³	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5	0/4	0/5
SVOCs (excluding PAHs) ³	0/15	0/0	0/15	0/0	0/15	0/0	0/15	0/0	0/15	0/0	0/15	0/0	0/15	0/0
PAHs ³	11/18	1/1	15/18	1/1	0/18	0/1	0/18	0/1	0/18	0/1	0/18	0/1	0/18	0/1
Dioxins/ Furans ³	0/1	0/2	0/1	0/2	0/1	0/2	0/1	0/2	0/1	0/2	0/1	0/2	0/1	0/2
Pesticides ³	1/11	0/4	0/11	0/4	0/11	0/4	0/11	0/4	0/11	0/4	0/11	0/4	0/11	0/4
PCB Congener ³	0/1	0/0	0/1	0/0	0/1	0/0	0/1	0/0	0/1	0/0	0/1	0/0	0/1	0/0
PCB Aroclor ³	2/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1	0/5	0/1
Metals ³	0/16	0/9	1/16	1/9	1/16	1/9	0/16	0/9	0/16	0/9	1/16	0/9	1/16	0/9
Total	14/71	1/22	16/71	2/22	1/71	1/22	0/71	0/22	0/71	0/22	1/71	0/22	1/71	0/22

Key

¹ Both samples of each set (VC1-ALT/VC1B-ALT, VC54/VC54B, and VC55/VC55B) were collected in the same location.

² Dioxins and furans were tested for only in the samples taken from 0-3 feet at sites in New York where clamshell dredging is not anticipated to occur. Dioxin/furan samples for additional depths at these sites were archived. PCB Congeners were not tested for at sites in New York where clamshell dredging is not anticipated to occur.

³ Highlighted cells indicate that ER-M or Class C thresholds were also exceeded.

Table B-7 Number of Detections at Sample Sites in Group B

Sample Site	Number of Detections							
	VOCs	PAHs	Other SVOCs	Dioxins/Furans	Pesticides	PCB Congener	PCB Aroclor	Metals
VC5	0	7	2	2	0	24	0	26
VC6	0	17	7	14	5	30	2	27
VC7	0	17	9	14	5	29	2	27
VC8	0	0	2	4	0	5	0	25
VC9	0	2	1	2	0	13	0	23
VC10	0	7	1	1	0	2	0	21
VC11 ¹	0	14	0	2	0	0	0	23
VC12 ¹	0	16	0	2	0	0	0	25
VC13	0	17	0	2	0	0	0	24
VC14 ¹	0	15	0	2	0	0	0	23
VC15	0	12	2	3	0	14	0	24
VC16	5	17	6	16	5	30	2	26
VC17	1	17	7	16	7-6	30	2	26
VC18	0	11	2	3	0	20	0	24
VC19 ¹	0	16	0	2	0	0	0	24
VC20 ¹	0	17	0	2	0	0	0	24
VC21 ¹	0	15	0	2	0	0	0	23
VC22 ¹	0	15	0	3	0	0	0	23
VC23 ¹	0	14	0	3	0	0	0	24
VC24 ¹	0	15	0	2	0	0	0	24
VC25 ¹	0	18	0	1	0	0	0	22
VC26	0	1	0	2	0	0	0	23
VC27 ¹	0	6	0	2	0	0	0	25
VC28 ¹	0	10	0	2	0	0	0	24
VC29 ¹	0	4	0	2	0	0	0	24
VC30 ¹	0	5	0	1	0	0	0	23
VC31-ALT ¹	0	1	0	1	0	0	0	24
VC32 ¹	0	0	0	2	0	0	0	23
VC33-ALT ¹	0	1	0	1	0	0	0	23
VC34 ¹	0	0	0	2	0	0	0	23
VC35	0	0	0	2	0	3	0	24
VC36	0	11	0	2	0	4	0	26
VC37	0	17	5	5	0	14	0	27
VC38	0	17	4	5	2	28	0	27
VC39	NY-0	9	1	2	0	24	0	26
VC40	NY-0	1	1	3	0	2	0	25
VC41-ALT	NY-0	17	3	6	3	27	0	25
VC42 ¹	NY-0	18	0	3	0	0	0	25
VC43 ¹	NY-0	3	0	1	0	0	0	19
VC44 ¹	NY-0	3	0	1	0	0	0	19

Key:

1 - Dioxins and furans were only analyzed in the samples taken from 0-3 feet at sites in New York where clamshell dredging is not anticipated to occur. Dioxin/furan samples for additional depths at these sites were archived. PCB Congeners were not tested at sites in New York where clamshell dredging is not anticipated to occur.

Table B-8 Sample Sites and Samples in Group B Exceeding Class A and/or Class C Thresholds for Metals

Analyte	Concentrations that Exceeded Thresholds		Sample Site	Sample Depth(s)*
	Exceeded Class A (mg/kg)	Exceeded Class C (mg/kg)		
Arsenic	8.61-37.54	87.8	VC5	0-3 ft, 3-6ft, 6-9 ft, 9-12 ft
			VC6	0-3 ft , 3-6ft, 6-9 ft, 9-12 ft
			VC7	0-3 ft, 3-6ft, 6-9 ft, 9-12 ft
			VC8	0-3 ft, 3-6ft, 6-9 ft, 9-12 ft
			VC9	0-3 ft, 3-6ft, 6-9 ft, 9-12 ft
			VC12	0-3 ft
			VC13	0-3 ft, 3-6ft, 6-9 ft, 9-12 ft
			VC14	3-6 ft, 6-9 ft
			VC15	0-3 ft, 3-6ft, 6-9 ft, 9-12 ft, 12-15 ft, 15-16.5 ft
			VC16	0-3 ft, 3-6ft, 6-9 ft, 9-12 ft, 12-15 ft
			VC17	0-3 ft, 3-6ft, 6-9 ft, 9-12 ft, 12-15 ft, 15-17.5 ft
			VC18	3-6 ft, 6-9 ft, 9-12 ft, 12-15 ft, 15-16.2 ft
			VC19	3-6 ft, 6-9 ft, 9-12 ft
			VC20	6-9 ft, 9-12 ft
			VC22	9-12 ft
			VC23	9-12 ft
			VC25	9-11.5 ft
			VC37	0-3 ft
			VC38	0-3 ft
			VC42	3-6 ft
Cadmium	1.3-3.5	N/A	VC6	0-3 ft
			VC7	0-3 ft
			VC16	3-6 ft, 6-9 ft, 9-12 ft
			VC17	6-9 ft, 9-12 ft, 12-15 ft
Chromium	86.5-202.0	N/A	VC6	0-3 ft
			VC7	0-3 ft
			VC16	0-3 ft, f-6 ft, 6-9 ft, 9-12 ft
			VC17	3-6 ft, 6-9 ft, 9-12 ft, 12-15 ft
Copper	37.3-265.0	N/A	VC6	0-3 ft
			VC7	0-3 ft, 3-6 ft
			VC16	0-3 ft, 3-6ft, 6-9 ft, 9-12 ft, 12-15 ft
			VC17	0-3 ft, 3-6ft, 6-9 ft, 9-12 ft, 12-15 ft, 15-17.5 ft
			VC37	0-3 ft
			VC38	0-3 ft
			VC42	3-6 ft
Lead	51.0-198.0	235.0-285.0	VC6	0-3 ft
			VC7	0-3 ft, 3-6 ft
			VC16	0-3 ft, 3-6ft, 6-9 ft , 9-12 ft , 12-15 ft
			VC17	0-3 ft, 3-6ft, 6-9 ft , 9-12 ft , 12-15 ft, 15-17.5 ft
			VC37	0-3 ft
			VC38	0-3 ft
			VC42	3-6 ft
Nickel	21.4-48.7	53.5	VC5	0-3 ft, 3-6ft, 6-9 ft, 9-12 ft
			VC6	0-3 ft, 3-6ft, 6-9 ft, 9-12 ft
			VC7	0-3 ft, f-6 ft, 6-9 ft, 9-12 ft
			VC8	0-3 ft, f-6 ft, 6-9 ft, 9-12 ft
			VC9	0-3 ft, f-6 ft, 6-9 ft, 9-12 ft
			VC13	0-3 ft, f-6 ft, 6-9 ft, 9-12 ft
			VC14	0-3 ft, f-6 ft, 6-9 ft, 9-12 ft
			VC15	0-3 ft, f-6 ft, 6-9 ft, 9-12 ft, 12-15 ft, 15-16.5 ft

Table B-8 Sample Sites and Samples in Group B Exceeding Class A and/or Class C Thresholds for Metals

Analyte	Concentrations that Exceeded Thresholds		Sample Site	Sample Depth(s)*
	Exceeded Class A (mg/kg)	Exceeded Class C (mg/kg)		
			VC16	0-3 ft, 3-6ft, <i>6-9 ft</i> , 9-12 ft, 12-15 ft
			VC17	0-3 ft, 3-6ft, 6-9 ft, 9-12 ft, 12-15 ft, 15-17.5 ft
			VC18	<i>0-3 ft</i> , 3-6 ft, 6-9 ft, 9-12 ft, 12-15 ft, 15-16.2 ft
			VC19	3-6 ft, 6-9 ft, 9-12 ft
			VC20	3-6 ft, 6-9 ft, 9-12 ft
			VC23	6-9 ft
			VC27	0-3 ft, 3-6 ft
			VC29	9-12 ft
			VC38	0-3 ft
			VC42	3-6 ft
Silver	1.06-3.55	4.78-8.52	VC6	0-3 ft
			VC7	<i>0-3 ft</i>
			VC16	0-3 ft, <i>3-6 ft</i> , <i>6-9 ft</i> , <i>9-12 ft</i> , 12-15 ft
			VC17	0-3 ft, 3-6 ft, <i>6-12 ft</i> , 12-17.5 ft
			VC38	0-3 ft
Zinc	154-390	427-494	VC6	0-3 ft
			VC7	0-3 ft, 3-6 ft
			VC16	0-3 ft, 3-6 ft, <i>6-9 ft</i> , <i>9-12 ft</i>
			VC17	<i>0-3 ft</i> , 3-6 ft, 6-9 ft, <i>9-12 ft</i> , 12-17.5 <i>15 ft</i>
			VC38	0-3 ft
			<i>VC42</i>	<i>3-6 ft</i>
Mercury	0.265-0.515	0.904-4.22	VC6	<i>0-3 ft</i> , 3-6 ft
			VC7	<i>0-3 ft</i> , <i>3-6 ft</i>
			VC16	<i>0-3 ft</i> , <i>3-6 ft</i> , <i>6-9 ft</i> , <i>9-12 ft</i> , 12-15 ft
			VC17	<i>0-3 ft</i> , <i>3-6 ft</i> , <i>6-9 ft</i> , <i>9-12 ft</i> , <i>12-15 ft</i> , <i>15-17.5 ft</i>
			VC37	<i>0-3 ft</i>
			VC38	<i>0-3 ft</i>
			VC41-ALT	0-3 ft
			VC42	<i>3-6 ft</i> , <i>6-9 ft</i>

Key:

* Sample depths where Class C thresholds were exceeded are in bold and italics.

Table B-9 Sample Sites and Samples in Group C Exceeding ER-L and/or ER-M Thresholds for PAHs

Analyte	Concentrations that Exceeded Thresholds		Sample Site	Sample Depth(s)*
	Exceeded ER-L (µg/kg)	Exceeded ER-M (µg/kg)		
Acenaphthene	39.4-172	N/A	VC54	0-3 ft, 3-6 ft, 6-9 ft
			VC54B	0-3 ft, 3-6 ft, 6-9 ft
Acenaphthylene	46.3-131	N/A	VC54	0-3 ft, 3-6 ft, 6-9 ft
			VC54B	3-6 ft, 6-9 ft
Anthracene	122-989	N/A	VC54	0-3 ft, 3-6 ft, 6-9 ft
			VC54B	0-3 ft, 3-6 ft, 6-9 ft
Benzo(A)Anthracene	282-1580	1670	VC54	0-3 ft, 3-6 ft, 6-9 ft
			VC54B	0-3 ft, 3-6 ft, 6-9 ft
Benzo(A)Pyrene	861-1330	N/A	VC54	0-3 ft, 3-6 ft, 6-9 ft
			VC54B	3-6 ft, 6-9 ft
Benzo(G,H,I)Perylene	440-708	N/A	VC54	0-3 ft, 3-6 ft, 6-9 ft
			VC54B	3-6 ft, 6-9 ft
Benzo(K)Fluoranthene	369-488	N/A	VC54	0-3 ft, 3-6 ft, 6-9 ft
			VC54B	3-6 ft, 6-9 ft
Chrysene	733-1160	N/A	VC54	0-3 ft, 3-6 ft, 6-9 ft
			VC54B	3-6 ft, 6-9 ft
Dibenz(A,H)Anthracene	134-211	N/A	VC54	0-3 ft, 3-6 ft, 6-9 ft
			VC54B	3-6 ft, 6-9 ft
Fluoranthene	1680-2490	N/A	VC54	0-3 ft, 3-6 ft, 6-9 ft
			VC54B	3-6 ft, 6-9 ft
Fluorene	46-263	N/A	VC54	0-3 ft, 3-6 ft, 6-9 ft
			VC54B	0-3 ft , 3-6 ft, 6-9 ft
Indeno(1,2,3-C,D)Pyrene	457-753	N/A	VC54	0-3 ft, 3-6 ft, 6-9 ft
			VC54B	3-6 ft, 6-9 ft
Phenanthrene	324-1440	1540-1570	VC54	0-3 ft, 3-6 ft , 6-9 ft
			VC54B	0-3 ft , 3-6 ft, 6-9 ft
Pyrene	1530-2270	N/A	VC54	0-3 ft, 3-6 ft, 6-9 ft
			VC54B	3-6 ft, 6-9 ft
Total PAHs	10400-15400	N/A	VC54	0-3 ft, 3-6 ft, 6-9 ft
			VC54B	3-6 ft, 6-9 ft

Key:

* Sample depths where ER-M thresholds were exceeded are in bold and italics.

N/A = Detected concentrations did not exceed the ER-M thresholds.

**Addendum to the
Fall/Winter 2016 Offshore
Environmental Sampling Report
for the Northeast Supply Enhancement
Project
New Jersey, New York**

October 2017

Prepared for:

Transcontinental Gas Pipe Line Company, LLC

Prepared by:

ECOLOGY AND ENVIRONMENT, INC.

368 Pleasant View Drive
Lancaster, New York 14086

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List of Abbreviations and Acronyms

E & E	Ecology and Environment, Inc.
ETRA	Environmental Toxicology and Risk Assessment
FERC	Federal Energy Regulatory Commission
Project	Northeast Supply Enhancement Project
SAP/QAPP	Sampling and Analysis Plan/Quality Assurance Project Plan
Transco	Transcontinental Gas Pipe Line Company, LLC
USACE	U.S. Army Corps of Engineers

1

Introduction

1.1 Project Description

Transcontinental Gas Pipe Line Company, LLC (Transco), has filed an application with the Federal Energy Regulatory Commission (FERC) for a Certificate of Public Convenience and Necessity (Certificate) for the Northeast Supply Enhancement Project (Project) (Docket No. CP17-101-000). The Offshore Environmental Sampling Report was prepared to facilitate FERC's review and development of an environmental impact statement for the Project and to support the corresponding state-level environmental evaluation of the Project. On June 27, 2017, Transco submitted its Offshore Environmental Sampling Report as Appendix J of Transco's application for a U.S. Army Corps of Engineers (USACE) permit. On June 30, 2017, Transco submitted its Offshore Environmental Sampling Report to FERC. See the Offshore Environmental Sampling Report for a Project Description. On September 7, 2017, Transco submitted an initial Addendum to the sampling report as Attachment 6 to Volume 1 of Supplemental Information Filing 3 to Transco's application for a FERC Certificate.

1.2 Scope of Work

Transco conducted a supplemental field survey and laboratory analysis in May 2017 to evaluate the physical and chemical characteristics of sediment at the proposed anode sled installation and to further evaluate chemical data along the Raritan Bay Loop route. The survey was conducted to support evaluation of the route for both engineering design and environmental review purposes. Supplementary vibracore samples were collected from sample sites in the 2016 survey where recovery to depth was incomplete. Laboratory analysis was completed for a focused list of contaminants, specifically metals, based on historical contamination documented in the area. Transco contracted Ecology and Environment, Inc. (E & E) to support the environmental permitting effort for the Project. The Sampling and Analysis Plan/Quality Assurance Project Plan (SAP/QAPP) developed by E & E and reviewed by regulatory agencies for the previous offshore survey was used for this supplemental field survey. The SAP/QAPP prepared for the offshore component of the Project is provided in Appendix C of the Offshore Environmental Sampling Report. Agency comments on initial versions of the SAP/QAPP are provided in Appendix D of the Offshore Environmental Sampling Report. Transco contracted Alpine Ocean (a Gardline company) to conduct the survey and arrange for sediment testing at onshore laboratories.

1.3 Spring 2017 Survey Results

Attached to this report are grain size statistics (see Appendix A), and the previously unsubmitted core logs for samples collected in the 2017 survey (see Appendix B).

A

Grain Size Results

Summary of Sieve Results

Project Number: 17-1052

Alpine - NESE II



Boring or Core Number		VC11	VC11	VC11	VC11	VC11	VC11	VC11	VC25	VC25	VC25	VC25
Sample or Section No		0-2	0-2	2-4	4-6	6-8	8-10	10-12	0-2	0-2	2-4	4-6
Depth in ft		0.45	1.90	4.00	6.00	8.00	10.00	12.00	0.50	2.00	4.00	6.00
Sieve Size/No.	Sieve Size (mm)	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing
2 inch	50.8	100	100.0	100	100	100	100.0	100	100.0	100	100	100
1 1/2 inch	38.1	100	100.0	100	100	100	100.0	100	100.0	100	100	100
1 inch	25.4	100	100.0	99	100	100	100.0	100	100.0	100	100	100
3/4 inch	19.05	100	100.0	95	100	100	100.0	100	100.0	100	100	100
1/2 inch	12.7	100	100.0	91	98	95	100.0	100	100.0	100	96	100
3/8 inch	9.525	100	100.0	87	93	92	100.0	99	100.0	97	84	98
1/4 inch	6.35	97	100.0	83	88	86	100.0	96	99.5	93	79	96
4	4.75	96	100.0	79	85	84	99.7	95	99.2	87	74	96
10	2.00	89	99.6	68	65	77	98.8	88	97.0	70	65	93
20	0.85	69	98.5	54	29	48	95.5	71	82.7	55	56	81
40	0.425	40	81.4	38	6	7	60.9	37	50.8	32	35	63
60	0.250	18	30.3	12	2	2	16.6	10	36.3	15	16	35
100	0.150	12	5.3	3	1	1	3.1	2	23.9	7	6	7
140	0.106	11	2.0	2	1	1	2.4	2	14.2	5	4	3
200	0.075	10	1.5	2	1	1	2.1	1	10.6	4	4	2

Summary of Sieve Results

Project Number: 17-1052

Alpine - NESE II



Boring or Core Number		VC25	VC25	VC25	VC26	VC26	VC26	VC26	VC26	VC26	VC26	VC28
Sample or Section No		6-8	8-10	10-12	0-2	0-2	2-4	4-6	6-8	8-10	10-12	0-2
Depth in ft		8.00	10.00	12.00	0.50	2.00	4.00	6.00	8.00	10.00	12.00	0.60
Sieve Size/No.	Sieve Size (mm)	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing
2 inch	50.8	100	100	100	100.0	100	100	100	100	100.0	100.0	100.0
1 1/2 inch	38.1	100	100	100	100.0	100	100	100	100	100.0	100.0	100.0
1 inch	25.4	100	100	100	100.0	100	100	100	100	100.0	100.0	100.0
3/4 inch	19.05	100	100	100	100.0	100	94	100	100	100.0	100.0	100.0
1/2 inch	12.7	97	100	98	100.0	100	80	100	100	100.0	100.0	100.0
3/8 inch	9.525	95	95	98	99.8	97	72	99	95	99.2	100.0	100.0
1/4 inch	6.35	92	92	97	99.8	89	67	98	92	99.2	100.0	99.5
4	4.75	89	90	96	99.8	87	64	96	87	99.1	99.4	99.0
10	2.00	76	85	92	99.6	82	54	92	70	97.8	97.3	97.6
20	0.85	57	68	78	98.8	75	41	86	53	93.5	86.0	92.2
40	0.425	27	27	34	89.9	58	24	73	31	70.6	43.6	72.0
60	0.250	6	4	5	36.1	35	10	57	17	19.2	8.0	50.8
100	0.150	3	2	3	4.7	13	5	46	8	4.9	1.9	34.3
140	0.106	3	1	3	2.6	8	4	42	6	3.6	1.3	22.1
200	0.075	3	1	3	1.9	7	4	39	5	3.2	1.2	16.9

Summary of Sieve Results

Project Number: 17-1052

Alpine - NESE II



Boring or Core Number		VC28	VC28	VC28	VC28	VC28	VC28	VC30	VC30	VC30	VC30	VC30
Sample or Section No		0-2	2-4	4-6	6-8	8-10	10-12	0-2	0-2	2-4	4-6	6-8
Depth in ft		2.00	4.00	6.00	8.00	10.00	12.00	0.60	2.00	4.00	6.00	8.00
Sieve Size/No.	Sieve Size (mm)	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing
2 inch	50.8	100	100.0	100	100	100	100	100.0	100	100	100	100.0
1 1/2 inch	38.1	100	100.0	100	100	100	100	100.0	100	100	100	100.0
1 inch	25.4	100	100.0	100	100	100	100	100.0	100	100	100	100.0
3/4 inch	19.05	100	100.0	100	100	100	100	100.0	100	100	100	100.0
1/2 inch	12.7	100	100.0	97	100	100	100	100.0	100	100	100	100.0
3/8 inch	9.525	98	100.0	97	99	100	100	100.0	98	100	87	100.0
1/4 inch	6.35	97	100.0	97	94	99	100	100.0	96	95	78	100.0
4	4.75	95	99.6	97	91	97	98	99.5	96	94	74	100.0
10	2.00	91	98.6	93	83	88	96	97.8	90	86	67	99.9
20	0.85	85	93.9	78	72	69	95	92.5	85	65	58	99.0
40	0.425	71	82.3	53	59	24	89	85.7	78	36	32	91.8
60	0.250	53	33.6	27	24	9	61	77.4	71	22	11	52.1
100	0.150	33	20.6	16	9	4	8	56.7	53	11	3	10.2
140	0.106	19	18.7	14	7	3	3	17.2	20	7	2	4.3
200	0.075	14	17.6	13	6	3	2	10.5	11	6	2	3.1

Summary of Sieve Results

Project Number: 17-1052

Alpine - NESE II



Boring or Core Number		VC30	VC30	VC33	VC33	VC33	VC33	VC33	VC33	VC33	VC34	VC34
Sample or Section No		8-10	10-12	0-2	0-2	2-4	4-6	6-8	8-10	10-12	0-2	0-2
Depth in ft		10.00	12.00	0.70	2.00	4.00	6.00	8.00	10.00	11.70	0.70	2.00
Sieve Size/No.	Sieve Size (mm)	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing
2 inch	50.8	100.0	100	100.0	100.0	100.0	100	100	100	100	100	100.0
1 1/2 inch	38.1	100.0	100	100.0	100.0	100.0	100	100	100	100	100	100.0
1 inch	25.4	100.0	100	100.0	100.0	100.0	100	100	100	100	100	100.0
3/4 inch	19.05	100.0	100	100.0	100.0	100.0	100	100	100	100	100	100.0
1/2 inch	12.7	100.0	100	100.0	100.0	100.0	100	100	100	100	100	100.0
3/8 inch	9.525	100.0	100	100.0	100.0	100.0	98	94	98	98	99	100.0
1/4 inch	6.35	100.0	98	100.0	99.4	100.0	95	87	97	94	99	100.0
4	4.75	99.9	96	100.0	99.1	99.8	94	83	95	91	98	100.0
10	2.00	99.6	90	99.9	96.2	99.1	92	76	91	82	97	98.4
20	0.85	97.4	77	99.0	86.6	97.2	85	67	85	75	88	90.2
40	0.425	53.7	51	71.5	72.3	90.2	50	32	64	42	48	67.1
60	0.250	12.8	22	17.0	56.5	66.3	17	9	39	11	17	26.5
100	0.150	3.6	6	3.5	28.4	26.9	6	2	9	4	4	3.6
140	0.106	1.6	3	2.5	7.3	18.5	5	2	4	3	3	2.1
200	0.075	1.3	3	1.9	5.3	14.9	4	2	3	3	2	1.8

Summary of Sieve Results

Project Number: 17-1052

Alpine - NESE II



Boring or Core Number		VC34	VC34	VC34	VC34	VC34	VC42	VC42	VC42	VC42	VC42	VC42
Sample or Section No		2-4	4-6	6-8	8-10	10-12	0-2	0-2	2-4	4-6	6-8	8-10
Depth in ft		4.00	6.00	8.00	10.00	12.00	0.50	2.00	4.00	5.90	8.00	10.00
Sieve Size/No.	Sieve Size (mm)	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing
2 inch	50.8	100.0	100.0	100.0	100	100.0	100	100.0	100	100	100	100.0
1 1/2 inch	38.1	100.0	100.0	100.0	100	100.0	100	100.0	100	100	100	100.0
1 inch	25.4	100.0	100.0	100.0	100	100.0	100	100.0	100	100	100	100.0
3/4 inch	19.05	100.0	100.0	100.0	100	100.0	100	100.0	100	100	100	100.0
1/2 inch	12.7	100.0	100.0	100.0	100	100.0	99	100.0	99	99	99	100.0
3/8 inch	9.525	100.0	100.0	100.0	100	100.0	98	100.0	99	97	98	100.0
1/4 inch	6.35	100.0	100.0	99.9	99	99.6	97	100.0	97	92	95	100.0
4	4.75	100.0	100.0	99.7	98	99.3	97	99.9	97	91	93	99.9
10	2.00	99.8	99.9	97.7	96	97.5	95	99.7	95	90	89	99.6
20	0.85	97.2	99.2	78.5	92	84.5	95	99.6	94	90	89	99.4
40	0.425	52.5	83.6	26.7	79	41.5	88	93.8	92	90	88	98.8
60	0.250	15.6	49.2	7.9	25	7.9	46	51.0	81	89	84	96.4
100	0.150	5.2	22.2	5.0	4	3.2	4	4.4	20	84	38	24.6
140	0.106	2.3	12.8	3.7	2	2.1	2	2.2	15	83	27	6.0
200	0.075	1.9	8.1	3.2	2	1.8	2	1.9	14	82	22	4.3

Summary of Sieve Results

Project Number: 17-1052

Alpine - NESE II



Boring or Core Number		VC42	VC43	VC43	VC43	VC43	VC43	VC43	VC43	VC46	VC46	VC46
Sample or Section No		10-12	0-2	0-2	2-4	4-6	6-8	8-10	10-12	0-2	0-2	2-4
Depth in ft		12.00	0.50	2.00	4.00	6.00	8.00	10.00	12.00	0.50	2.00	4.00
Sieve Size/No.	Sieve Size (mm)	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing
2 inch	50.8	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100	100.0	100.0
1 1/2 inch	38.1	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100	100.0	100.0
1 inch	25.4	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	96	100.0	100.0
3/4 inch	19.05	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	91	100.0	100.0
1/2 inch	12.7	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	88	100.0	100.0
3/8 inch	9.525	100.0	100.0	100.0	100.0	100.0	99.9	100.0	100.0	84	100.0	100.0
1/4 inch	6.35	100.0	100.0	100.0	100.0	100.0	99.9	99.9	99.6	83	100.0	100.0
4	4.75	100.0	100.0	100.0	100.0	99.9	99.8	99.4	99.5	82	99.9	100.0
10	2.00	99.6	100.0	100.0	100.0	99.9	99.4	98.5	97.8	80	99.8	99.9
20	0.85	99.2	100.0	99.9	99.9	99.9	99.1	98.0	94.2	79	99.6	99.8
40	0.425	97.1	96.2	97.0	95.1	97.0	92.6	97.2	82.1	68	84.1	88.1
60	0.250	89.3	50.0	54.4	49.5	60.5	52.4	91.7	43.7	47	21.6	23.8
100	0.150	21.0	2.6	3.3	2.7	5.2	4.6	16.1	9.8	21	2.0	2.3
140	0.106	4.7	1.4	1.1	1.3	1.4	1.8	2.6	4.0	17	1.0	1.3
200	0.075	3.1	1.3	1.0	1.1	1.1	1.4	1.8	3.3	15	0.9	1.1

Summary of Sieve Results

Project Number: 17-1052

Alpine - NESE II



Boring or Core Number		VC46	VC46	VC46	VC46	VC47	VC47	VC47	VC47	VC47	VC47	VC47
Sample or Section No		4-6	6-8	8-10	10-12	0-2	0-2	2-4	4-6	6-8	8-10	10-12
Depth in ft		6.00	8.00	10.00	12.00	0.70	2.00	4.00	6.00	8.00	10.00	12.00
Sieve Size/No.	Sieve Size (mm)	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing
2 inch	50.8	100.0	100.0	100.0	100.0	100.0	100	100	100.0	100.0	100	100.0
1 1/2 inch	38.1	100.0	100.0	100.0	100.0	100.0	100	100	100.0	100.0	100	100.0
1 inch	25.4	100.0	100.0	100.0	100.0	100.0	100	100	100.0	100.0	100	100.0
3/4 inch	19.05	100.0	100.0	100.0	100.0	100.0	100	100	100.0	100.0	100	100.0
1/2 inch	12.7	100.0	100.0	100.0	100.0	98.5	98	96	100.0	100.0	100	100.0
3/8 inch	9.525	100.0	100.0	100.0	100.0	98.5	98	93	100.0	100.0	100	100.0
1/4 inch	6.35	100.0	100.0	100.0	100.0	97.9	97	89	100.0	100.0	99	100.0
4	4.75	99.9	100.0	100.0	100.0	97.9	96	86	100.0	100.0	99	99.9
10	2.00	99.8	99.4	100.0	99.8	97.7	94	81	99.6	99.6	95	99.2
20	0.85	99.7	98.6	99.8	98.1	97.2	92	79	99.3	98.7	88	91.4
40	0.425	94.4	93.9	93.7	52.5	78.7	76	74	89.6	87.3	64	84.1
60	0.250	35.9	48.5	44.5	12.0	25.4	26	69	31.6	35.4	28	46.5
100	0.150	3.6	6.6	2.8	2.2	2.6	4	57	4.2	4.1	4	4.6
140	0.106	1.3	2.3	1.4	1.5	1.7	3	54	2.3	2.0	2	3.3
200	0.075	1.1	1.9	1.2	1.3	1.6	3	50	2.0	1.7	2	3.1

Summary of Sieve Results

Project Number: 17-1052

Alpine - NESE II



Boring or Core Number		VC49	VC49	VC49	VC49	VC49	VC49	VC49	VC50	VC50	VC50	VC50
Sample or Section No		0-2	0-2	2-4	4-6	6-8	8-10	10-12	0-2	0-2	2-4	4-6
Depth in ft		0.10	2.00	4.00	6.00	8.00	10.00	12.00	0.70	2.00	4.00	6.00
Sieve Size/No.	Sieve Size (mm)	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing
2 inch	50.8	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1 1/2 inch	38.1	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1 inch	25.4	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
3/4 inch	19.05	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1/2 inch	12.7	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
3/8 inch	9.525	100.0	100.0	100.0	100.0	100.0	100.0	100.0	99.3	100.0	100.0	100.0
1/4 inch	6.35	100.0	100.0	100.0	100.0	100.0	100.0	100.0	97.3	100.0	100.0	100.0
4	4.75	100.0	100.0	100.0	100.0	100.0	100.0	100.0	96.7	100.0	100.0	100.0
10	2.00	99.7	100.0	100.0	100.0	100.0	100.0	100.0	95.3	100.0	99.7	99.5
20	0.85	99.6	99.9	99.9	99.9	100.0	99.9	100.0	90.2	99.8	97.1	93.9
40	0.425	99.5	99.8	99.5	97.8	99.7	99.5	99.9	68.2	98.6	71.2	57.1
60	0.250	82.0	65.7	58.7	17.5	90.2	78.5	89.2	37.0	85.6	30.8	14.7
100	0.150	1.9	1.4	1.5	0.8	3.7	3.7	5.8	2.9	5.4	4.0	3.7
140	0.106	0.6	0.6	0.5	0.6	1.1	1.2	1.3	1.7	1.1	1.8	2.3
200	0.075	0.5	0.6	0.5	0.5	1.0	1.0	1.1	1.5	0.9	1.5	2.1

Summary of Sieve Results

Project Number: 17-1052

Alpine - NESE II



Boring or Core Number		VC50	VC50	VC50	VC51	VC51	VC51	VC51	VC51	VC51	VC52	VC52
Sample or Section No		6-8	8-10	10-12	0-2	0-2	2-4	4-6	6-8	8-10	0-2	0-2
Depth in ft		8.00	10.00	12.00	0.70	2.00	4.00	6.00	8.00	9.30	0.70	2.00
Sieve Size/No.	Sieve Size (mm)	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing
2 inch	50.8	100.0	100.0	100.0	100.0	100.0	100.0	100	100.0	100.0	100.0	100.0
1 1/2 inch	38.1	100.0	100.0	100.0	100.0	100.0	100.0	100	100.0	100.0	100.0	100.0
1 inch	25.4	100.0	100.0	100.0	100.0	100.0	100.0	100	100.0	100.0	100.0	100.0
3/4 inch	19.05	100.0	100.0	100.0	100.0	100.0	100.0	100	100.0	100.0	100.0	100.0
1/2 inch	12.7	100.0	100.0	100.0	99.6	100.0	100.0	100	100.0	100.0	100.0	100.0
3/8 inch	9.525	100.0	100.0	100.0	99.6	100.0	100.0	99	100.0	100.0	100.0	100.0
1/4 inch	6.35	100.0	100.0	100.0	99.4	100.0	100.0	99	100.0	100.0	99.7	100.0
4	4.75	100.0	100.0	100.0	99.3	100.0	100.0	99	99.9	100.0	99.7	99.9
10	2.00	99.9	99.9	100.0	99.0	99.9	99.9	97	99.7	99.6	99.3	99.8
20	0.85	99.6	99.6	99.8	97.4	98.6	99.8	90	99.0	97.8	97.4	99.7
40	0.425	93.9	96.1	97.1	73.9	91.8	97.5	63	66.3	80.8	87.5	98.5
60	0.250	63.9	72.6	80.9	21.9	53.2	75.6	27	20.3	35.1	45.0	88.4
100	0.150	5.5	8.6	11.3	1.6	6.9	13.5	17	2.1	4.5	1.8	11.2
140	0.106	1.7	2.4	2.0	1.0	1.8	5.0	9	1.4	2.6	1.0	1.8
200	0.075	1.4	1.8	1.3	0.9	1.6	4.2	7	1.3	2.4	1.0	1.2

Summary of Sieve Results

Project Number: 17-1052

Alpine - NESE II



Boring or Core Number		VC52	VC52	VC52	VC52	VC52	VC53	VC53	VC53	VC53	VC53	VC53
Sample or Section No		2-4	4-6	6-8	8-10	10-12	0-2	0-2	2-4	4-6	6-8	8-10
Depth in ft		4.00	6.00	8.00	10.00	12.00	0.70	2.00	4.00	6.00	8.00	10.00
Sieve Size/No.	Sieve Size (mm)	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing
2 inch	50.8	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1 1/2 inch	38.1	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1 inch	25.4	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
3/4 inch	19.05	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1/2 inch	12.7	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
3/8 inch	9.525	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1/4 inch	6.35	100.0	100.0	100.0	100.0	99.9	99.1	100.0	100.0	100.0	100.0	100.0
4	4.75	100.0	100.0	100.0	99.9	99.7	99.1	100.0	100.0	100.0	100.0	100.0
10	2.00	99.9	100.0	100.0	99.9	95.7	98.8	99.9	100.0	100.0	100.0	99.9
20	0.85	98.5	99.9	100.0	99.8	85.1	97.9	99.8	100.0	100.0	100.0	99.8
40	0.425	95.6	99.8	99.8	96.7	62.1	92.6	94.2	99.0	99.5	99.4	99.1
60	0.250	91.3	98.6	99.0	92.2	32.3	56.5	49.6	69.4	74.9	87.4	89.2
100	0.150	22.1	21.8	26.8	19.5	15.4	1.7	3.2	4.9	6.4	11.6	16.4
140	0.106	3.4	2.5	2.9	3.2	10.8	0.9	1.1	2.1	2.0	3.8	6.1
200	0.075	2.5	1.6	2.0	2.2	9.7	0.9	0.8	1.6	1.5	2.0	3.6

Summary of Sieve Results

Project Number: 17-1052

Alpine - NESE II



Boring or Core Number		VC55	VC55	VC55	VC55	VC55	VC55	VC55	VC56	VC56	VC56	VC56
Sample or Section No		0-2	0-2	2-4	4-6	6-8	8-10	10-12	0-2	0-2	2-4	4-6
Depth in ft		0.70	2.00	4.00	6.00	8.00	10.00	11.90	0.70	2.00	4.00	6.00
Sieve Size/No.	Sieve Size (mm)	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing
2 inch	50.8	100	100.0	100.0	100	100	100	100	100.0	100	100.0	100.0
1 1/2 inch	38.1	100	100.0	100.0	100	100	100	100	100.0	100	100.0	100.0
1 inch	25.4	100	100.0	100.0	100	100	100	100	100.0	100	100.0	100.0
3/4 inch	19.05	100	100.0	100.0	100	100	100	100	100.0	98	100.0	100.0
1/2 inch	12.7	100	100.0	100.0	100	100	98	100	100.0	98	100.0	100.0
3/8 inch	9.525	100	100.0	100.0	100	100	96	100	98.7	95	100.0	100.0
1/4 inch	6.35	99	100.0	100.0	98	99	92	98	98.7	86	99.7	100.0
4	4.75	99	100.0	100.0	96	98	86	94	98.2	77	99.7	99.6
10	2.00	96	99.2	99.9	94	92	70	80	97.4	61	98.4	97.6
20	0.85	78	85.0	94.0	92	77	48	64	92.8	45	94.6	93.8
40	0.425	33	29.2	54.6	63	36	17	28	23.5	24	64.9	72.4
60	0.250	8	6.7	13.3	20	9	4	5	3.3	10	17.0	14.1
100	0.150	1	1.5	2.2	3	4	1	1	1.2	1	2.2	1.4
140	0.106	1	0.9	1.0	1	4	1	1	0.9	1	1.0	1.1
200	0.075	1	0.8	0.8	1	3	1	1	0.8	1	0.9	1.1

Summary of Sieve Results

Project Number: 17-1052

Alpine - NESE II



Boring or Core Number		VC56	VC56	VC56	VC58	VC58	VC58	VC58	VC58	VC58	VC58	VC59
Sample or Section No		6-8	8-10	10-12	0-2	0-2	2-4	4-6	6-8	8-10	10-12	0-2
Depth in ft		8.00	10.00	12.00	0.20	2.00	4.00	6.00	8.00	10.00	12.00	0.70
Sieve Size/No.	Sieve Size (mm)	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing
2 inch	50.8	100.0	100	100.0	100	100.0	100	100	100	100.0	100.0	100
1 1/2 inch	38.1	100.0	100	100.0	100	100.0	100	100	100	100.0	100.0	100
1 inch	25.4	100.0	100	100.0	100	100.0	100	100	100	100.0	100.0	100
3/4 inch	19.05	100.0	100	100.0	100	100.0	100	100	100	100.0	100.0	100
1/2 inch	12.7	100.0	100	100.0	100	100.0	100	96	100	100.0	100.0	95
3/8 inch	9.525	100.0	100	100.0	97	100.0	100	87	100	100.0	100.0	94
1/4 inch	6.35	100.0	99	100.0	92	99.2	95	72	100	100.0	99.8	91
4	4.75	100.0	96	100.0	90	99.2	90	64	98	99.8	99.4	89
10	2.00	99.2	82	99.1	85	99.2	75	55	92	98.8	98.9	86
20	0.85	95.2	61	94.8	82	98.6	64	49	80	94.9	98.7	83
40	0.425	52.4	21	43.7	73	83.7	43	28	38	44.9	86.2	73
60	0.250	20.5	5	9.7	51	18.9	4	5	9	8.8	26.0	34
100	0.150	1.4	1	1.7	16	1.2	1	1	1	1.1	5.7	5
140	0.106	1.0	1	1.0	3	0.8	1	1	1	0.9	3.9	2
200	0.075	0.9	1	1.0	1	0.8	1	1	1	0.9	3.2	2

Summary of Sieve Results

Project Number: 17-1052

Alpine - NESE II



Boring or Core Number		VC59	VC59	VC59	VC59	VC59	VC59	VC60	VC60	VC60	VC60	VC60
Sample or Section No		0-2	2-4	4-6	6-8	8-10	10-12	0-2	0-2	2-4	4-6	6-8
Depth in ft		2.00	4.00	6.00	8.00	10.00	12.00	0.30	2.00	4.00	6.00	8.00
Sieve Size/No.	Sieve Size (mm)	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing
2 inch	50.8	100.0	100.0	100.0	100	100	100	100	100	100	100.0	100.0
1 1/2 inch	38.1	100.0	100.0	100.0	100	100	100	100	100	100	100.0	100.0
1 inch	25.4	100.0	100.0	100.0	100	100	100	100	100	100	100.0	100.0
3/4 inch	19.05	100.0	100.0	100.0	100	100	100	100	100	100	100.0	100.0
1/2 inch	12.7	100.0	100.0	100.0	100	100	100	98	92	100	100.0	100.0
3/8 inch	9.525	100.0	100.0	100.0	100	100	100	98	87	100	100.0	100.0
1/4 inch	6.35	99.7	99.9	100.0	99	84	100	97	79	97	99.9	100.0
4	4.75	99.4	99.9	99.8	98	66	99	96	76	97	99.8	100.0
10	2.00	97.7	99.4	99.1	93	44	97	93	69	96	99.7	99.9
20	0.85	90.1	98.8	96.3	75	34	93	90	64	78	99.4	99.3
40	0.425	66.5	94.5	82.6	33	12	80	73	50	39	87.2	80.6
60	0.250	43.0	71.5	23.3	17	3	14	32	32	15	38.2	17.0
100	0.150	9.4	12.6	2.7	1	1	2	3	3	2	3.8	2.1
140	0.106	2.2	2.2	1.5	1	1	1	1	1	1	2.8	1.7
200	0.075	1.2	1.4	1.3	1	1	1	1	1	1	2.5	1.6

Summary of Sieve Results

Project Number: 17-1052

Alpine - NESE II



Boring or Core Number		VC60	VC61	VC61	VC61	VC61	VC61	VC61	VC61	VC62	VC62	VC62
Sample or Section No		8-10	0-2	0-2	2-4	4-6	6-8	8-10	10-12	0-2	0-2	2-4
Depth in ft		10.00	0.70	2.00	4.00	6.00	8.00	10.00	12.00	0.70	2.00	4.00
Sieve Size/No.	Sieve Size (mm)	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing
2 inch	50.8	100.0	97	100	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100
1 1/2 inch	38.1	100.0	97	100	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100
1 inch	25.4	100.0	96	100	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100
3/4 inch	19.05	100.0	93	99	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100
1/2 inch	12.7	100.0	89	87	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100
3/8 inch	9.525	100.0	87	78	99.6	100.0	100.0	100.0	100.0	100.0	100.0	100
1/4 inch	6.35	100.0	84	66	99.6	100.0	100.0	100.0	100.0	100.0	99.9	99
4	4.75	100.0	84	61	99.3	100.0	100.0	100.0	100.0	100.0	99.8	98
10	2.00	99.6	81	51	98.8	100.0	100.0	100.0	99.9	99.9	99.2	96
20	0.85	99.6	80	40	97.8	99.9	99.4	99.3	99.8	99.8	98.8	95
40	0.425	94.8	71	26	70.2	98.8	69.2	32.5	71.4	99.7	98.5	81
60	0.250	22.2	48	14	31.0	66.8	9.5	4.3	8.0	98.7	97.2	54
100	0.150	3.3	4	4	4.7	3.1	1.9	0.9	1.0	46.8	41.9	13
140	0.106	2.6	1	3	1.6	1.2	1.8	0.7	0.7	8.6	11.1	3
200	0.075	2.5	1	2	1.1	1.1	1.7	0.6	0.7	2.1	2.7	1

Summary of Sieve Results

Project Number: 17-1052

Alpine - NESE II



Boring or Core Number		VC62	VC62	VC62	VC62	VC64	VC64	VC64	VC64	VC64	VC64	VC64
Sample or Section No		4-6	6-8	8-10	10-12	0-2	0-2	2-4	4-6	6-8	8-10	10-12
Depth in ft		6.00	8.00	10.00	12.00	0.70	2.00	4.00	6.00	8.00	10.00	11.50
Sieve Size/No.	Sieve Size (mm)	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing
2 inch	50.8	100	100.0	100.0	100.0	100.0	100.0	100.0	100	100	100.0	100.0
1 1/2 inch	38.1	100	100.0	100.0	100.0	100.0	100.0	100.0	100	100	100.0	100.0
1 inch	25.4	100	100.0	100.0	100.0	100.0	100.0	100.0	100	100	100.0	100.0
3/4 inch	19.05	100	100.0	100.0	100.0	100.0	100.0	100.0	100	100	100.0	100.0
1/2 inch	12.7	100	100.0	100.0	100.0	100.0	100.0	100.0	100	100	100.0	100.0
3/8 inch	9.525	100	100.0	100.0	100.0	100.0	100.0	100.0	100	100	100.0	100.0
1/4 inch	6.35	99	100.0	100.0	100.0	99.8	100.0	100.0	98	100	100.0	100.0
4	4.75	99	100.0	100.0	100.0	99.8	100.0	100.0	97	99	99.8	100.0
10	2.00	98	100.0	99.5	99.1	98.6	99.9	99.8	89	91	98.9	99.9
20	0.85	93	99.9	98.3	94.4	97.9	99.7	99.3	54	72	93.8	95.8
40	0.425	42	83.8	73.3	29.7	96.9	99.5	95.4	19	25	54.5	50.4
60	0.250	5	22.0	18.9	8.1	95.5	99.2	84.8	5	4	10.7	9.0
100	0.150	2	5.3	5.2	1.4	78.8	94.2	61.2	3	2	3.9	3.2
140	0.106	1	3.1	2.6	1.0	26.5	34.2	20.5	1	1	2.8	2.5
200	0.075	1	2.1	2.2	0.9	6.2	4.6	3.7	1	1	2.4	2.3

Summary of Sieve Results

Project Number: 17-1052

Alpine - NESE II



Boring or Core Number		VC66	VC66	VC66	VC66	VC66	VC66	VC66	VC67	VC67	VC67	VC67
Sample or Section No		0-2	0-2	2-4	4-6	6-8	8-10	10-12	0-2	0-2	2-4	4-6
Depth in ft		0.70	2.00	4.00	6.00	8.00	10.00	12.00	0.70	2.00	4.00	6.00
Sieve Size/No.	Sieve Size (mm)	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing
2 inch	50.8	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1 1/2 inch	38.1	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1 inch	25.4	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
3/4 inch	19.05	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1/2 inch	12.7	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	98.5
3/8 inch	9.525	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	98.5
1/4 inch	6.35	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	98.5
4	4.75	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	99.9	100.0	98.2
10	2.00	100.0	99.3	99.1	99.2	99.8	99.8	99.9	99.9	99.5	100.0	97.7
20	0.85	99.7	81.9	83.0	80.7	86.6	94.7	98.4	99.8	98.9	99.8	97.4
40	0.425	99.0	37.6	35.9	37.8	45.4	59.6	77.5	99.4	98.5	99.4	97.0
60	0.250	98.0	6.8	4.8	8.9	8.4	14.8	22.2	98.0	97.0	98.1	95.1
100	0.150	86.4	1.7	1.1	1.9	1.4	2.5	1.9	81.1	70.3	69.2	69.9
140	0.106	32.3	0.9	0.8	1.0	1.0	1.3	1.2	31.4	19.7	20.0	20.2
200	0.075	5.0	0.7	0.7	0.8	0.9	1.0	1.0	5.0	2.1	3.7	4.2

Summary of Sieve Results

Project Number: 17-1052

Alpine - NESE II



Boring or Core Number		VC67	VC67	VC67	VC68	VC68	VC68	VC68	VC68	VC68	VC68	VC93
Sample or Section No		6-8	8-10	10-12	0-2	0-2	2-4	4-6	6-8	8-10	10-12	0-2
Depth in ft		7.80	10.00	12.00	0.70	2.00	4.00	6.00	8.00	10.00	12.00	0.08
Sieve Size/No.	Sieve Size (mm)	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing
2 inch	50.8	100.0	100.0	100.0	100	100.0	100.0	100.0	100	100.0	100.0	100.0
1 1/2 inch	38.1	100.0	100.0	100.0	100	100.0	100.0	100.0	100	100.0	100.0	100.0
1 inch	25.4	100.0	100.0	100.0	100	100.0	100.0	100.0	99	100.0	100.0	100.0
3/4 inch	19.05	100.0	100.0	100.0	100	100.0	100.0	100.0	98	100.0	100.0	100.0
1/2 inch	12.7	100.0	100.0	100.0	99	100.0	100.0	100.0	96	100.0	100.0	100.0
3/8 inch	9.525	100.0	100.0	100.0	95	100.0	100.0	100.0	95	100.0	100.0	100.0
1/4 inch	6.35	100.0	100.0	99.0	93	99.9	99.6	100.0	92	100.0	99.5	99.6
4	4.75	100.0	99.9	99.0	92	99.7	99.6	100.0	90	100.0	99.2	99.6
10	2.00	99.9	99.0	98.3	90	99.0	98.8	99.9	81	99.7	98.4	99.4
20	0.85	99.6	97.5	97.6	88	98.0	98.4	99.6	74	99.3	97.4	99.3
40	0.425	98.8	76.0	96.7	87	96.8	98.2	97.9	70	98.8	96.6	95.5
60	0.250	95.0	19.0	95.3	81	93.2	96.2	61.0	59	98.1	95.8	59.5
100	0.150	80.9	6.5	75.4	44	53.6	55.6	31.7	17	90.5	92.6	4.8
140	0.106	31.6	3.3	19.6	12	12.2	14.2	10.9	6	30.2	37.9	1.4
200	0.075	7.7	1.9	5.3	3	2.6	2.8	2.8	3	8.8	8.9	1.0

Summary of Sieve Results

Project Number: 17-1052

Alpine - NESE II



Boring or Core Number		VC93	VC93	VC93	VC93	VC93	VC93	VC93	VC93
Sample or Section No		0-2	0-2	2-4	4-6	6-8	6-8	8-10	8-10
Depth in ft		1.00	2.00	3.00	5.00	7.00	8.00	9.00	10.00
Sieve Size/No.	Sieve Size (mm)	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing	% Passing
2 inch	50.8	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1 1/2 inch	38.1	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1 inch	25.4	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
3/4 inch	19.05	100.0	100.0	97.6	100.0	100.0	100.0	100.0	100.0
1/2 inch	12.7	100.0	100.0	97.6	100.0	100.0	100.0	100.0	100.0
3/8 inch	9.525	100.0	100.0	96.3	100.0	100.0	100.0	100.0	100.0
1/4 inch	6.35	100.0	100.0	95.1	100.0	100.0	100.0	100.0	100.0
4	4.75	100.0	100.0	94.3	100.0	100.0	100.0	100.0	100.0
10	2.00	99.7	99.1	92.0	100.0	100.0	100.0	100.0	100.0
20	0.85	97.8	96.7	89.3	100.0	99.8	99.9	100.0	100.0
40	0.425	76.8	85.0	83.9	99.9	99.7	99.9	99.9	98.0
60	0.250	34.3	46.8	49.4	99.8	99.5	99.5	97.9	78.9
100	0.150	4.0	5.1	13.5	87.5	82.2	61.4	33.7	19.3
140	0.106	1.6	3.0	7.7	25.4	15.2	14.0	12.5	7.9
200	0.075	1.3	2.5	4.9	7.7	4.1	7.1	5.6	4.7

Summary Of Hydrometer and Sieve Results

Project Number: 17-1052

Alpine - NESE II

Boring or Core Number		VC93
Sample or Section No		2-4
Depth in ft		4.00
Sieve Size/No.	Sieve Size (mm)	% Passing
2 inch	50.8	100.0
1 1/2 inch	38.1	100.0
1 inch	25.4	100.0
3/4 inch	19.05	100.0
1/2 inch	12.7	100.0
3/8 inch	9.525	100.0
1/4 inch	6.35	100.0
4	4.75	100.0
10	2.00	99.9
20	0.85	99.8
40	0.425	99.6
60	0.250	99.1
100	0.150	92.3
140	0.106	56.5
200	0.075	16.6
Hyd.	0.04981	6.4
Hyd.	0.03562	4.4
Hyd.	0.02533	4.2
Hyd.	0.01791	3.9
Hyd.	0.01308	3.7
Hyd.	0.00925	3.2
Hyd.	0.00654	2.7
Hyd.	0.00450	2.6
Hyd.	0.00329	2.3
Hyd.	0.00233	2.2
Hyd.	0.00134	1.7

% passing 2 μ	2.1
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D ₁₀₀ (mm)	4.750
D ₆₀ (mm)	0.110
D ₃₀ (mm)	0.085

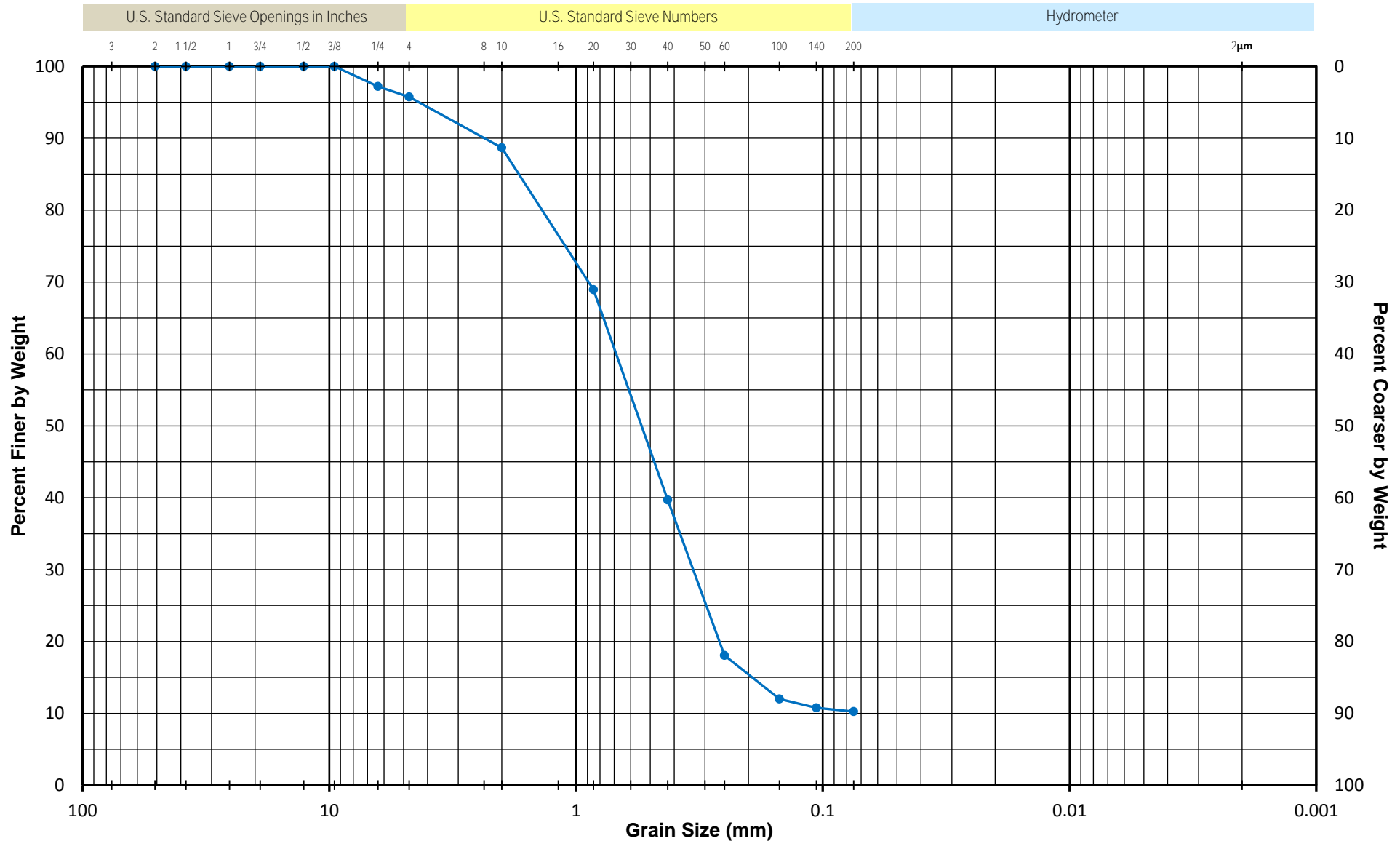
Boring or Core Number		VC93
Sample or Section No		4-6
Depth in ft		6.00
Sieve Size/No.	Sieve Size (mm)	% Passing
2 inch	50.8	100.0
1 1/2 inch	38.1	100.0
1 inch	25.4	100.0
3/4 inch	19.05	100.0
1/2 inch	12.7	100.0
3/8 inch	9.525	100.0
1/4 inch	6.35	100.0
4	4.75	100.0
10	2.00	100.0
20	0.85	100.0
40	0.425	99.9
60	0.250	99.9
100	0.150	96.8
140	0.106	41.7
200	0.075	19.3
Hyd.	0.04687	16.4
Hyd.	0.03336	15.9
Hyd.	0.02374	14.6
Hyd.	0.01689	13.4
Hyd.	0.01241	11.9
Hyd.	0.00888	10.7
Hyd.	0.00628	9.7
Hyd.	0.00440	8.7
Hyd.	0.00318	7.8
Hyd.	0.00226	7.2
Hyd.	0.00131	5.5

% passing 2 μ	6.8
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D ₁₀₀ (mm)	0.850
D ₆₀ (mm)	0.121
D ₃₀ (mm)	0.090

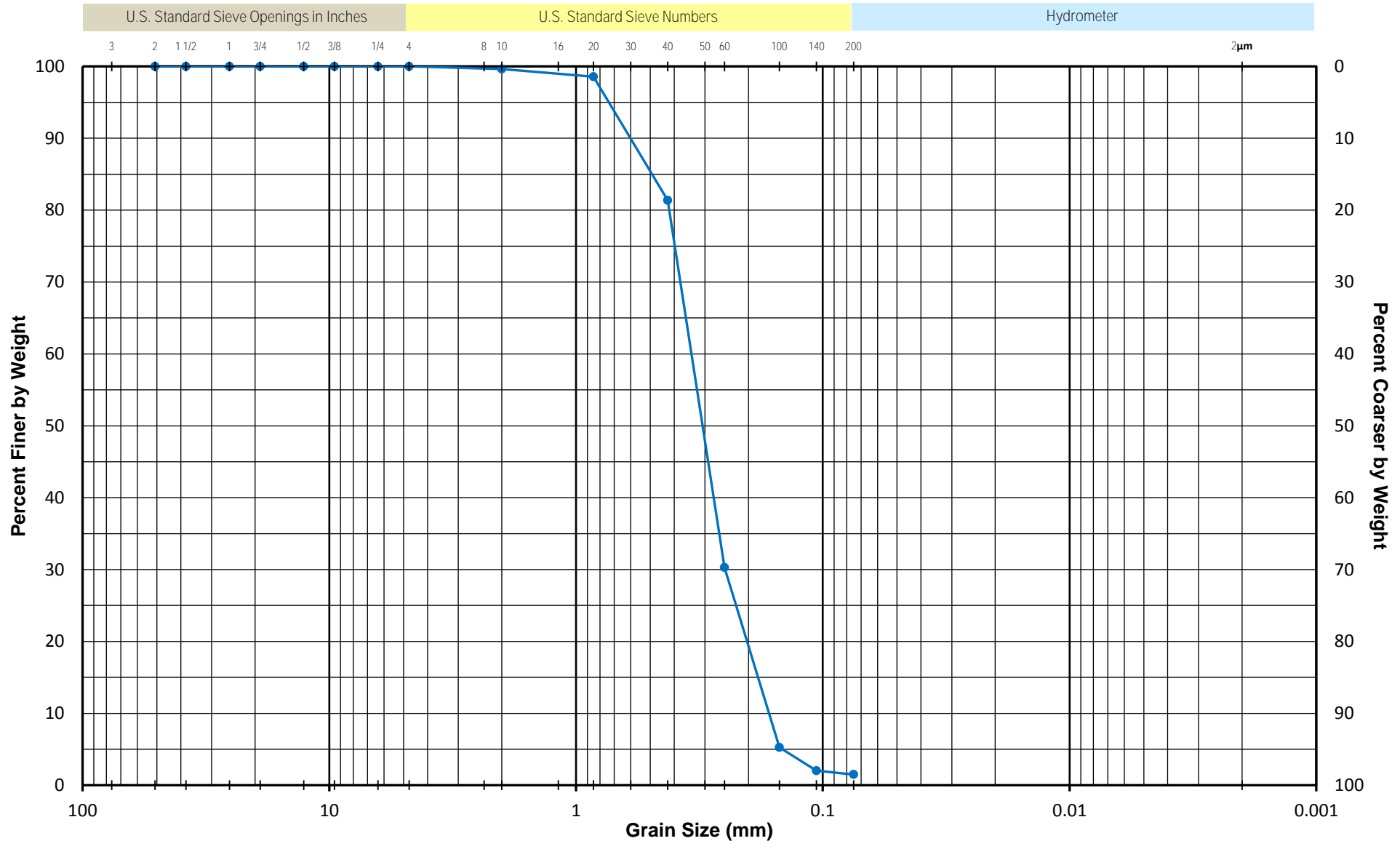
D_{10} (mm)	0.059
C_c	-
C_u	-

D_{10} (mm)	0.007
C_c	-
C_u	-



Test Depth	Core ID Section/Sample	Material Description
0.45 ft	VC11 0-2	Very Dark Gray Medium to Fine Sand with silt

GRADATION CURVES
 ASTM D-422, D-6913
 Alpine - NESE II

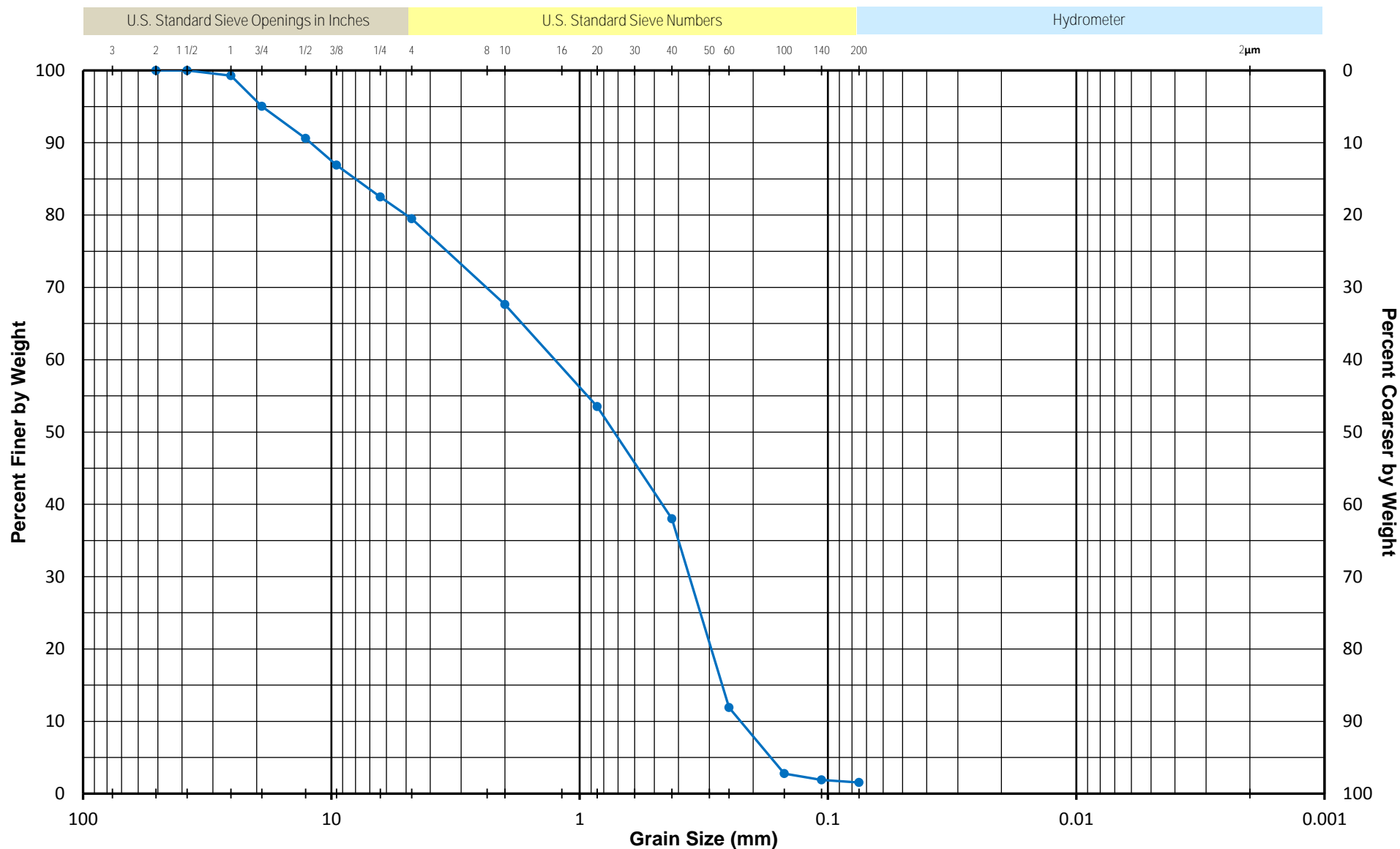


Test Depth	Core ID Section/Sample	Material Description
1.9 ft	VC11 0-2	Dark Brown Medium to Fine Sand

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

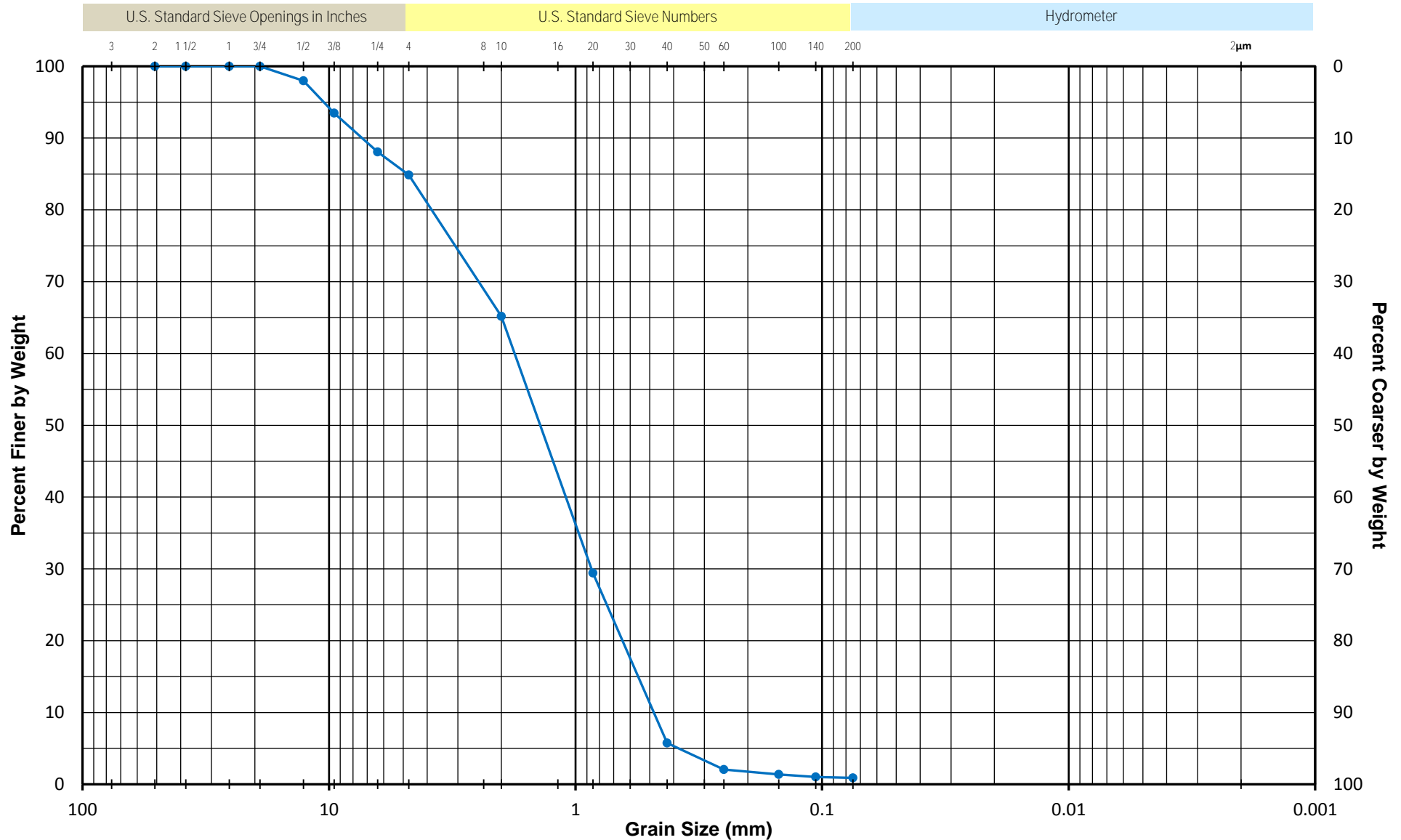


Test Depth	Core ID Section/Sample	Material Description
4.0 ft	VC11 2-4	Dark Brown Fine to Coarse Sand with gravel

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

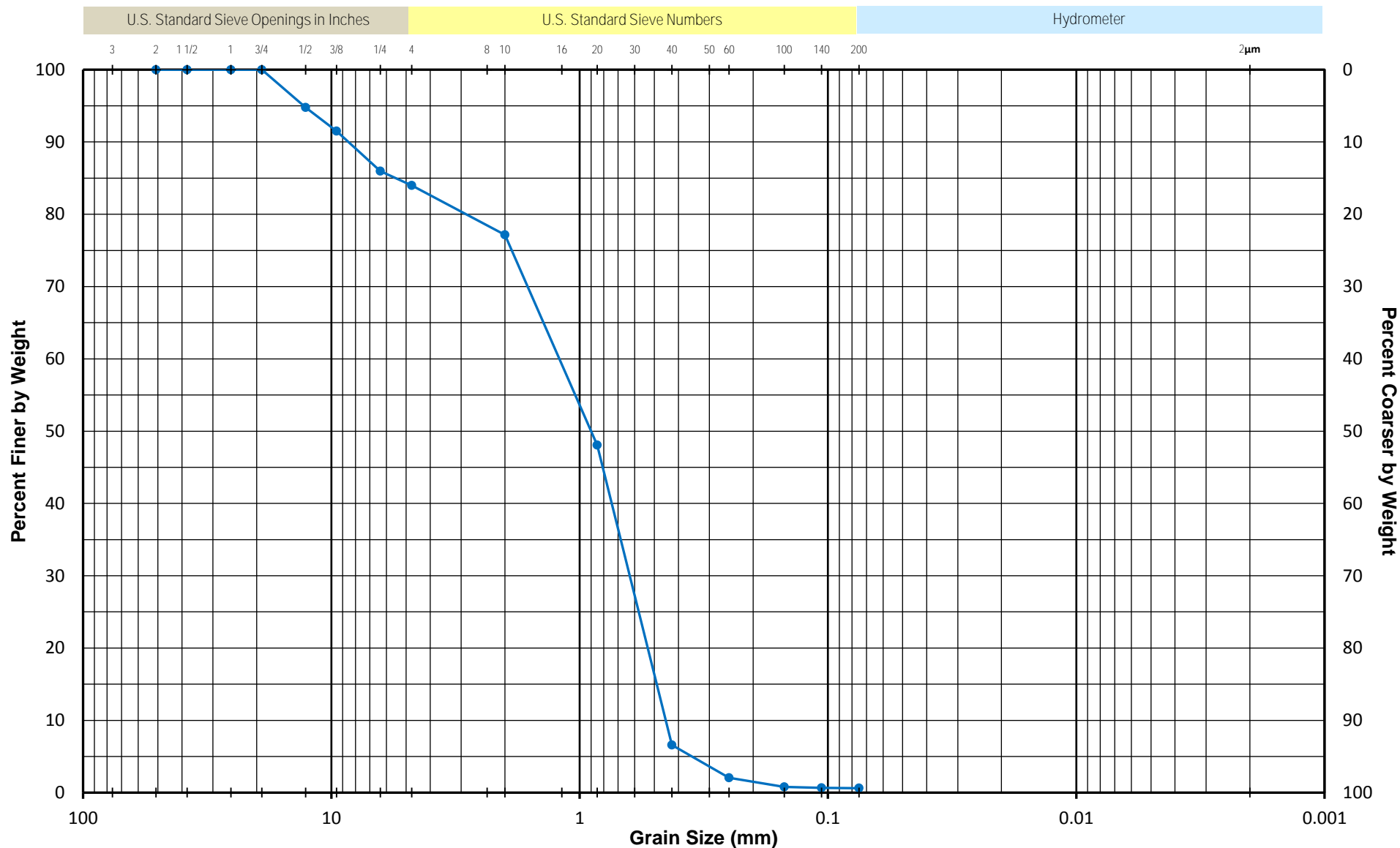


Test Depth	Core ID Section/Sample	Material Description
6.0 ft	VC11 4-6	Dark Brown Coarse to Medium Sand with gravel

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

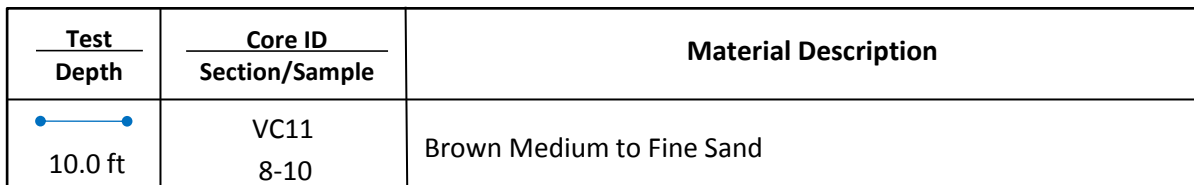


Test Depth	Core ID Section/Sample	Material Description
8.0 ft	VC11 6-8	Brown Coarse to Medium Sand

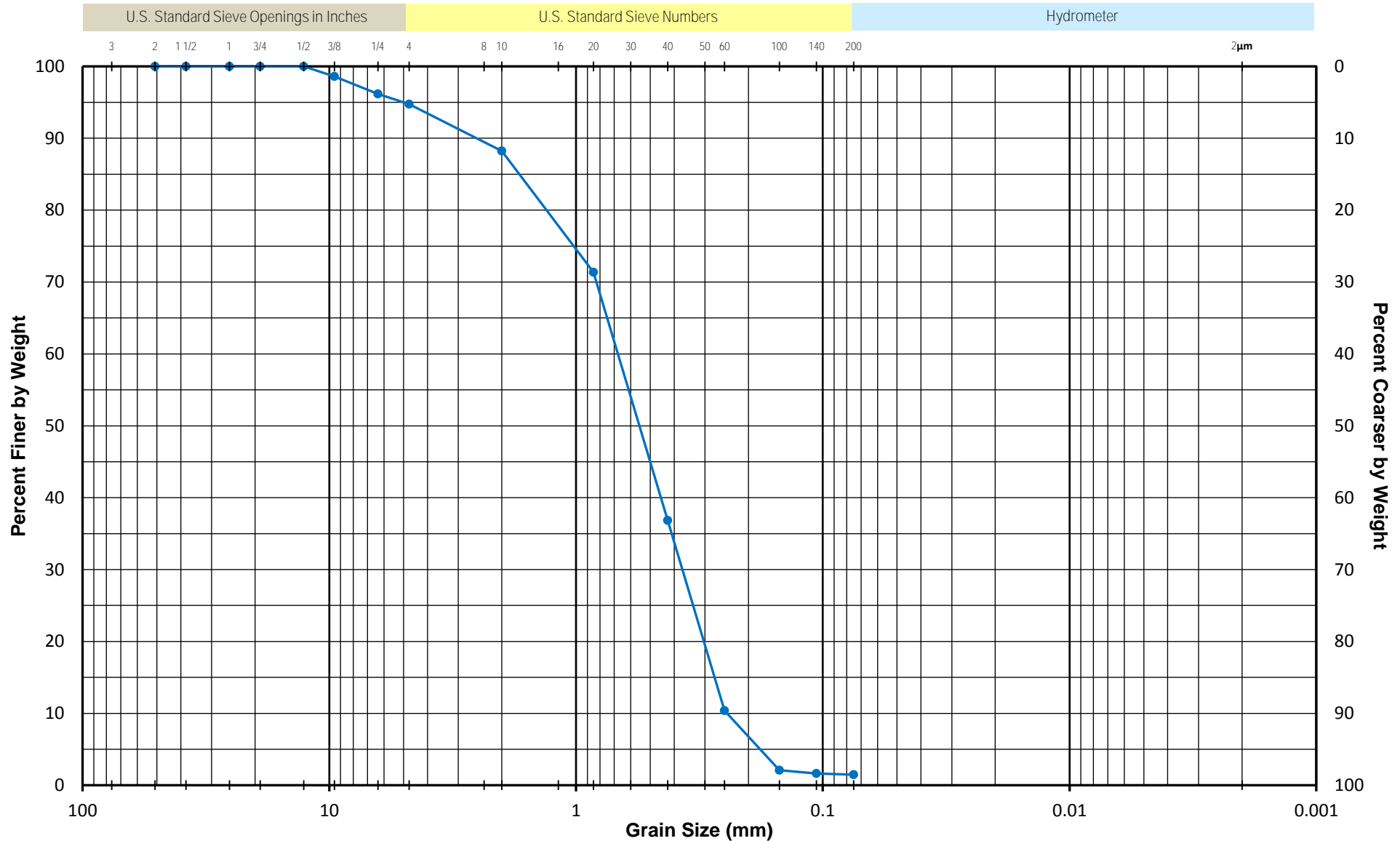
GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II



Alpine - NESE II

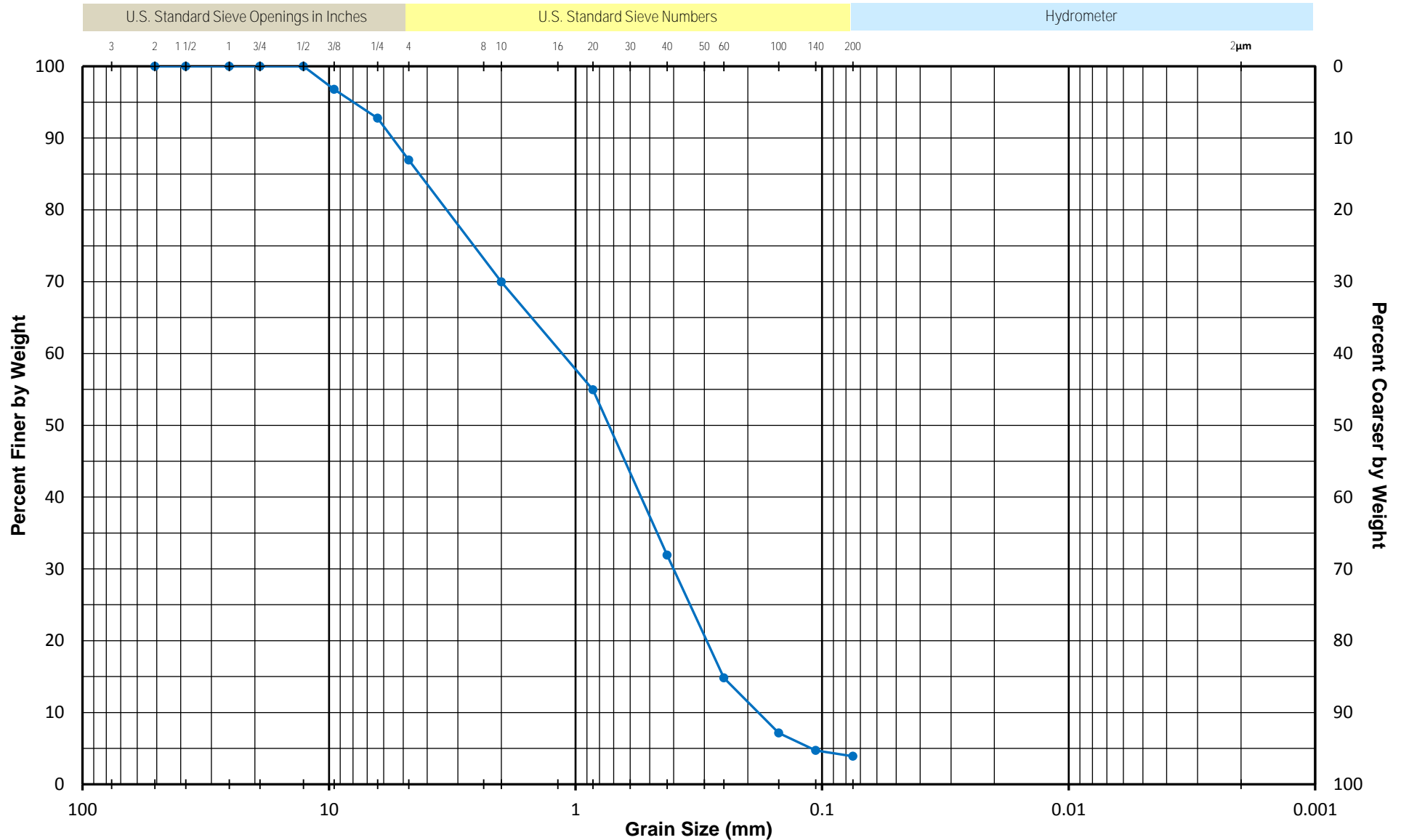


Test Depth	Core ID Section/Sample	Material Description
12.0 ft	VC11 10-12	Dark Brown Coarse to Medium Sand

GRADATION CURVES

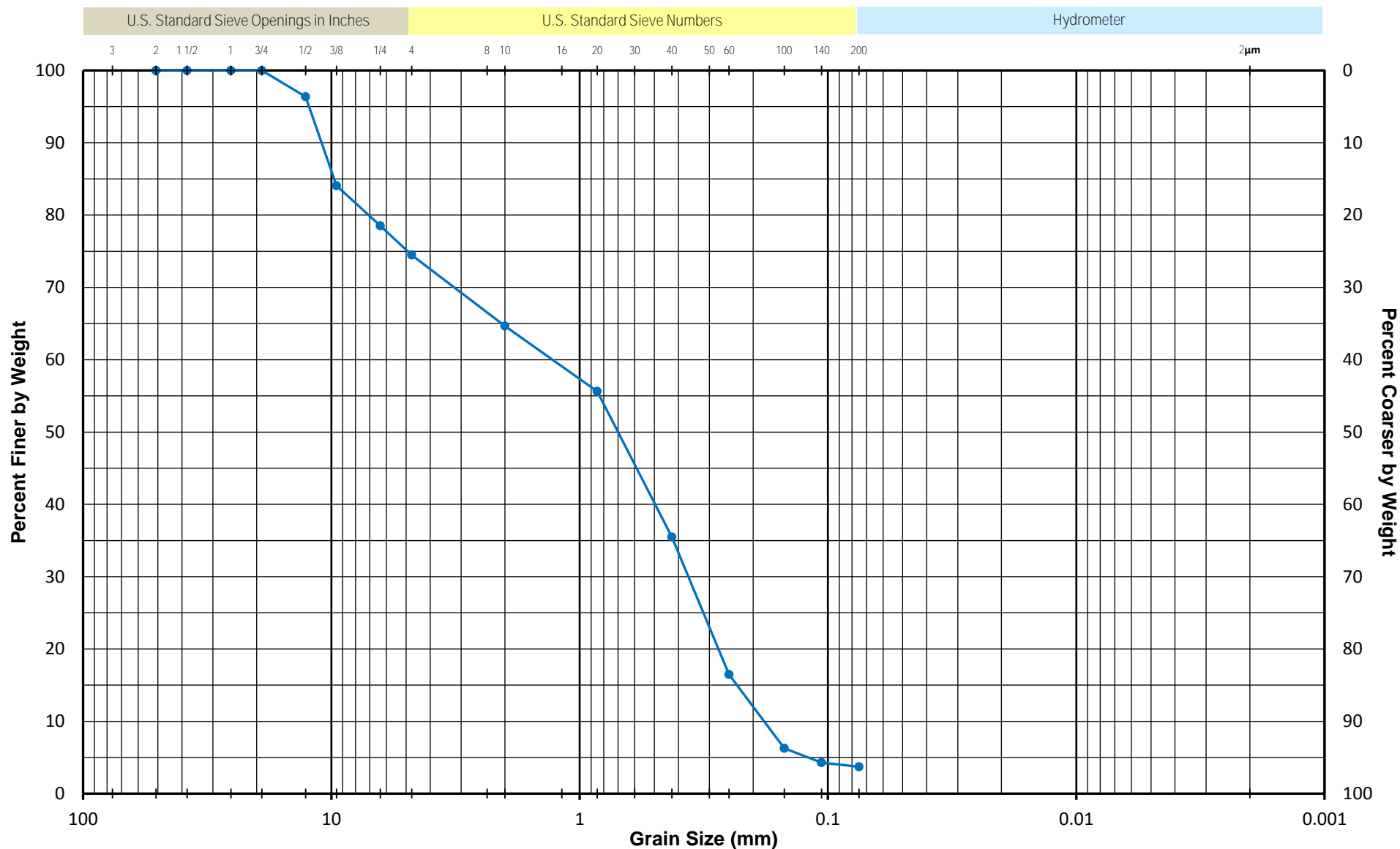
ASTM D-422, D-6913

Alpine - NESE II



Test Depth	Core ID Section/Sample	Material Description
• — • 2.0 ft	VC25 0-2	Brown Coarse to Medium Sand

GRADATION CURVES
 ASTM D-422, D-6913
 Alpine - NESE II

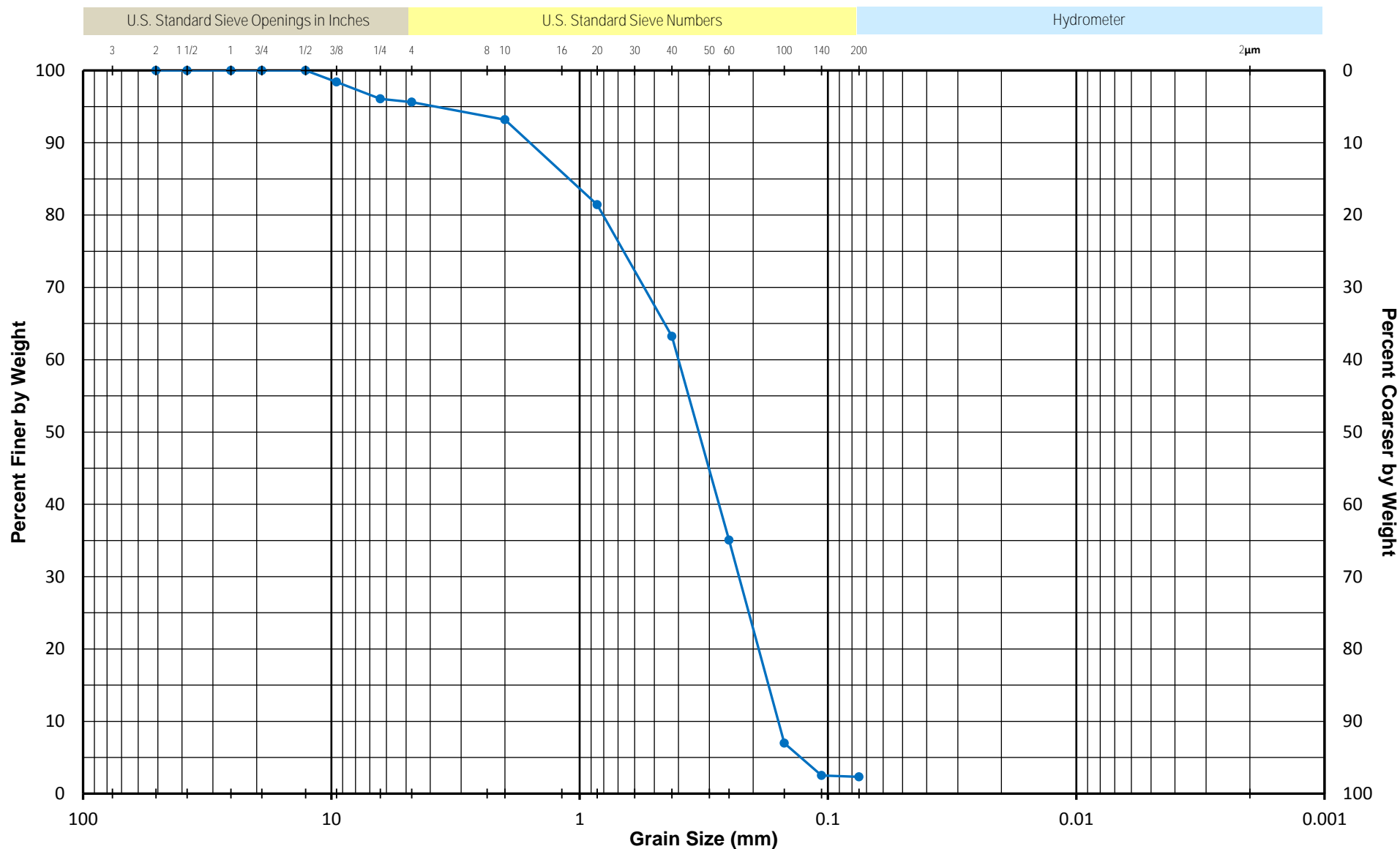


Test Depth	Core ID Section/Sample	Material Description
4.0 ft	VC25 2-4	Dark Brown Coarse to Medium Sand with gravel

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

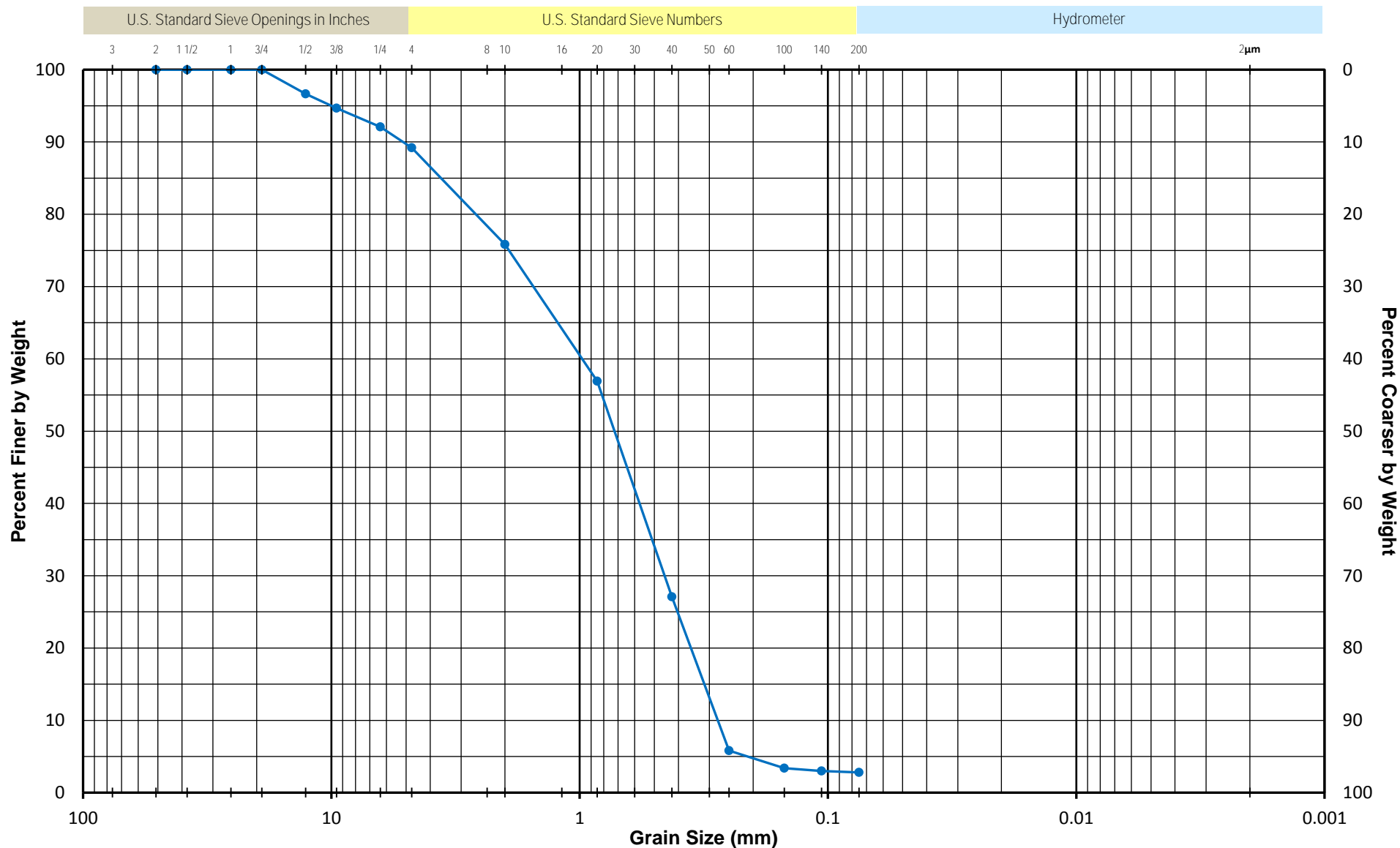


Test Depth	Core ID Section/Sample	Material Description
6.0 ft	VC25 4-6	Dark Brown Fine to Medium Sand

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

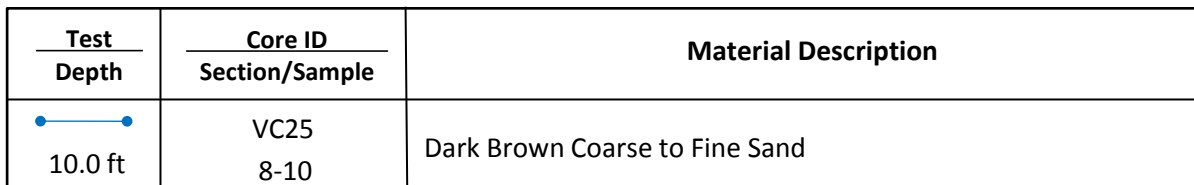


Test Depth	Core ID Section/Sample	Material Description
8.0 ft	VC25 6-8	Dark Brown Medium to Coarse Sand

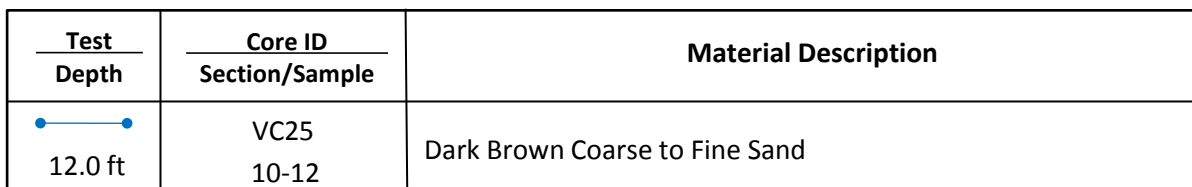
GRADATION CURVES

ASTM D-422, D-6913

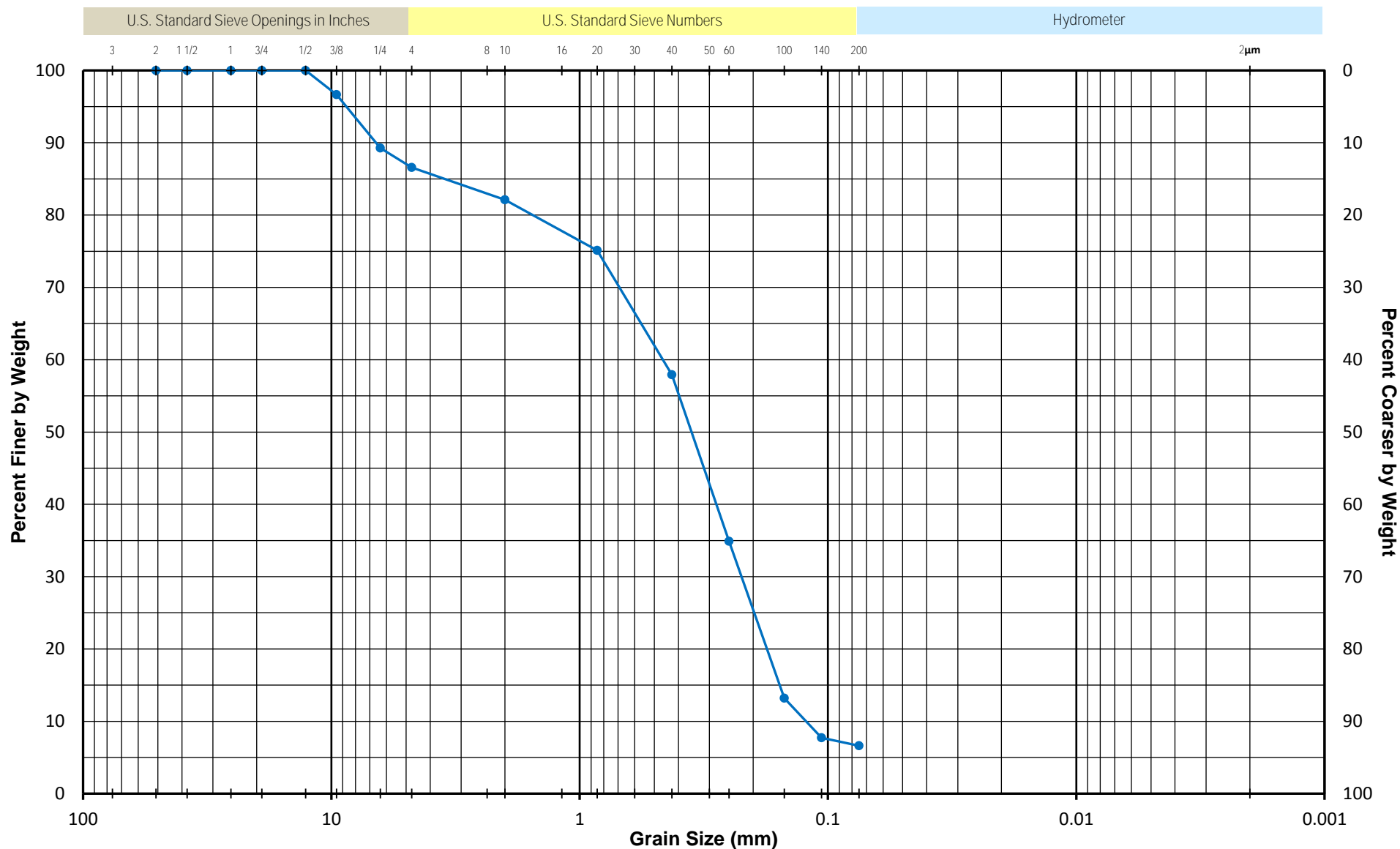
Alpine - NESE II



Alpine - NESE II



Alpine - NESE II

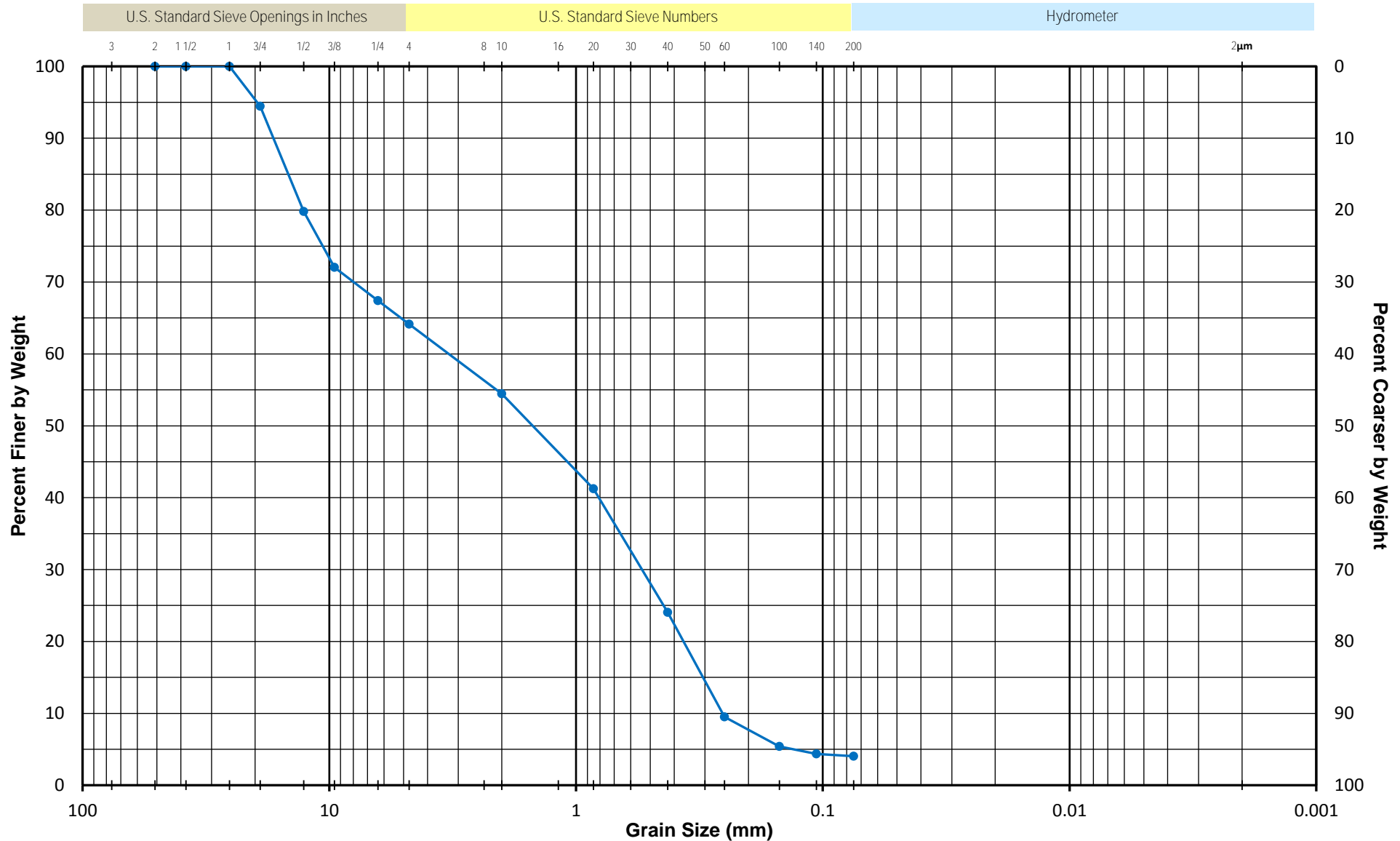


Test Depth	Core ID Section/Sample	Material Description
2.0 ft	VC26 0-2	Very Dark Gray Coarse to Fine Sand with clay

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

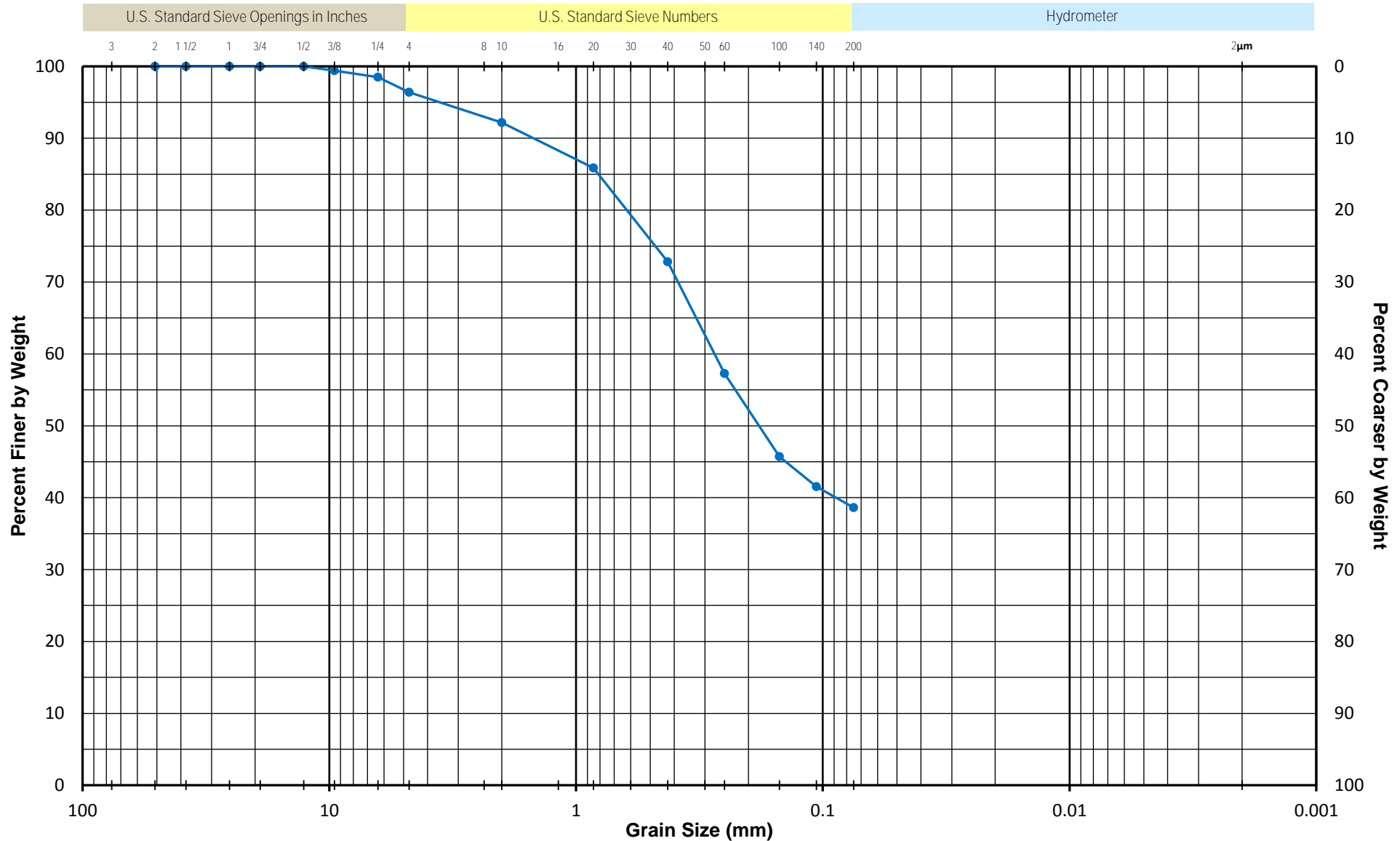


Test Depth	Core ID Section/Sample	Material Description
4.0 ft	VC26 2-4	Very Dark Gray Fine to Coarse Sand with gravel

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

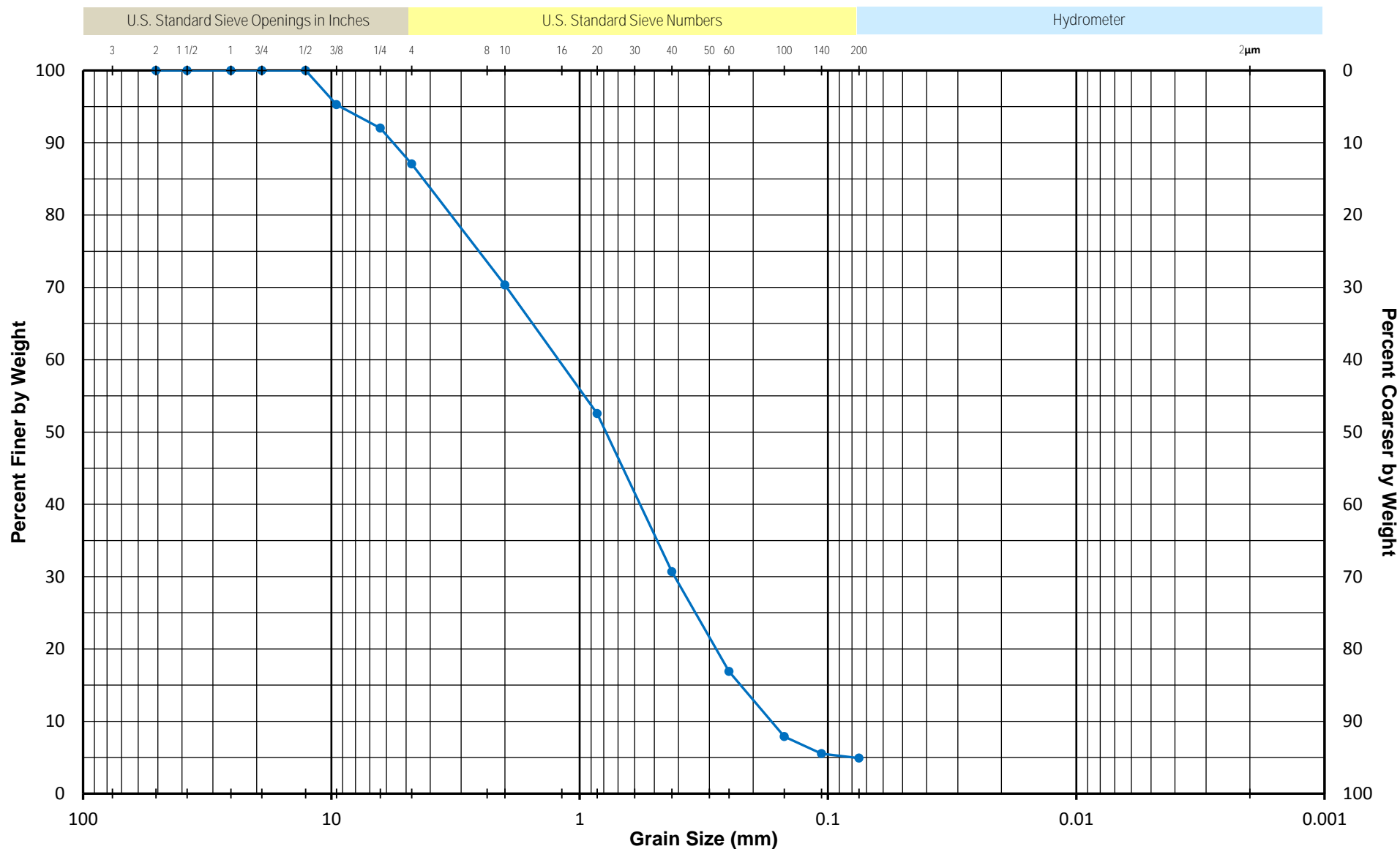


Test Depth	Core ID Section/Sample	Material Description
6.0 ft	VC26 4-6	Strong Brown Silty Sand

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

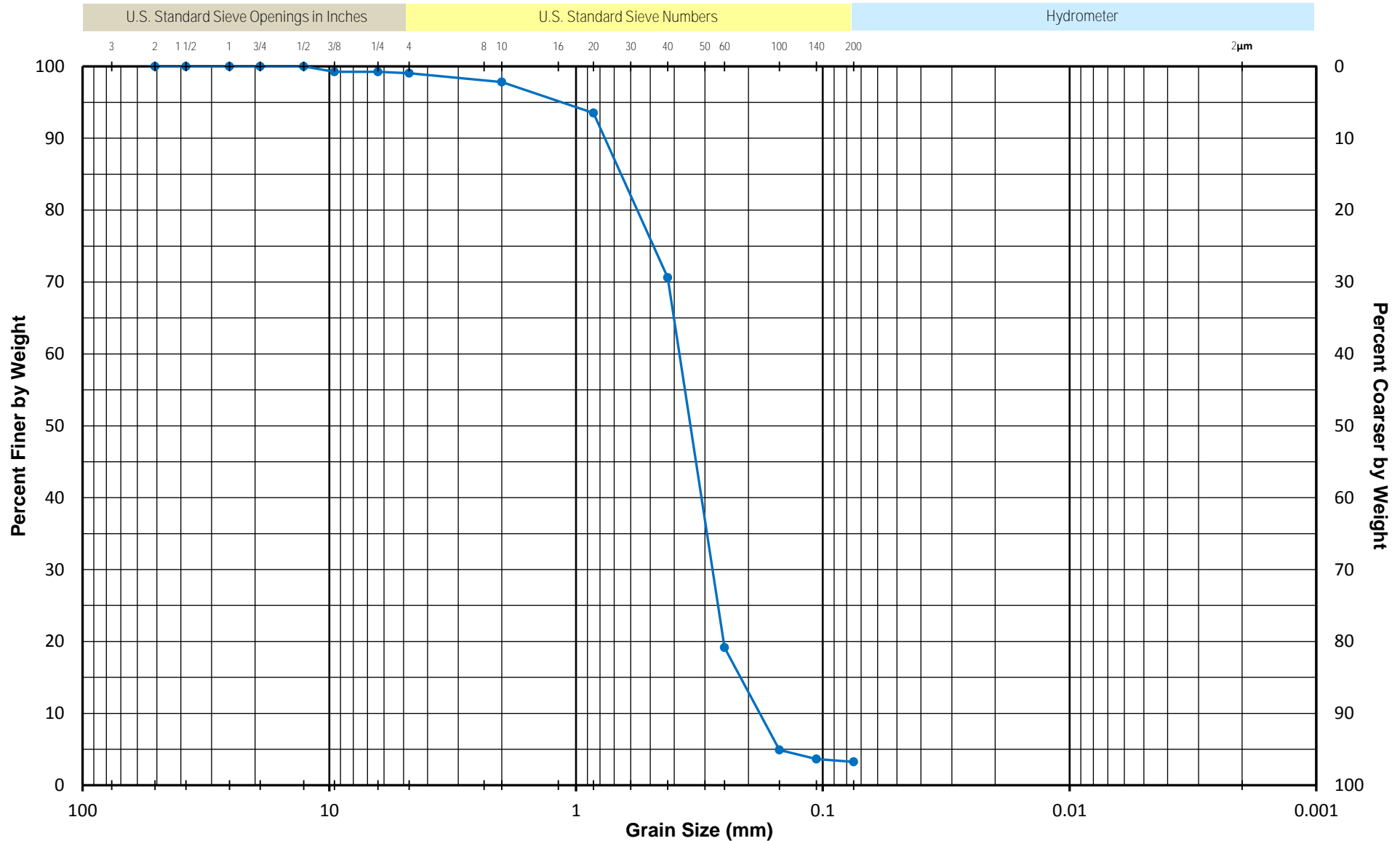


Test Depth	Core ID Section/Sample	Material Description
8.0 ft	VC26 6-8	Strong Brown Coarse to Fine Sand

GRADATION CURVES

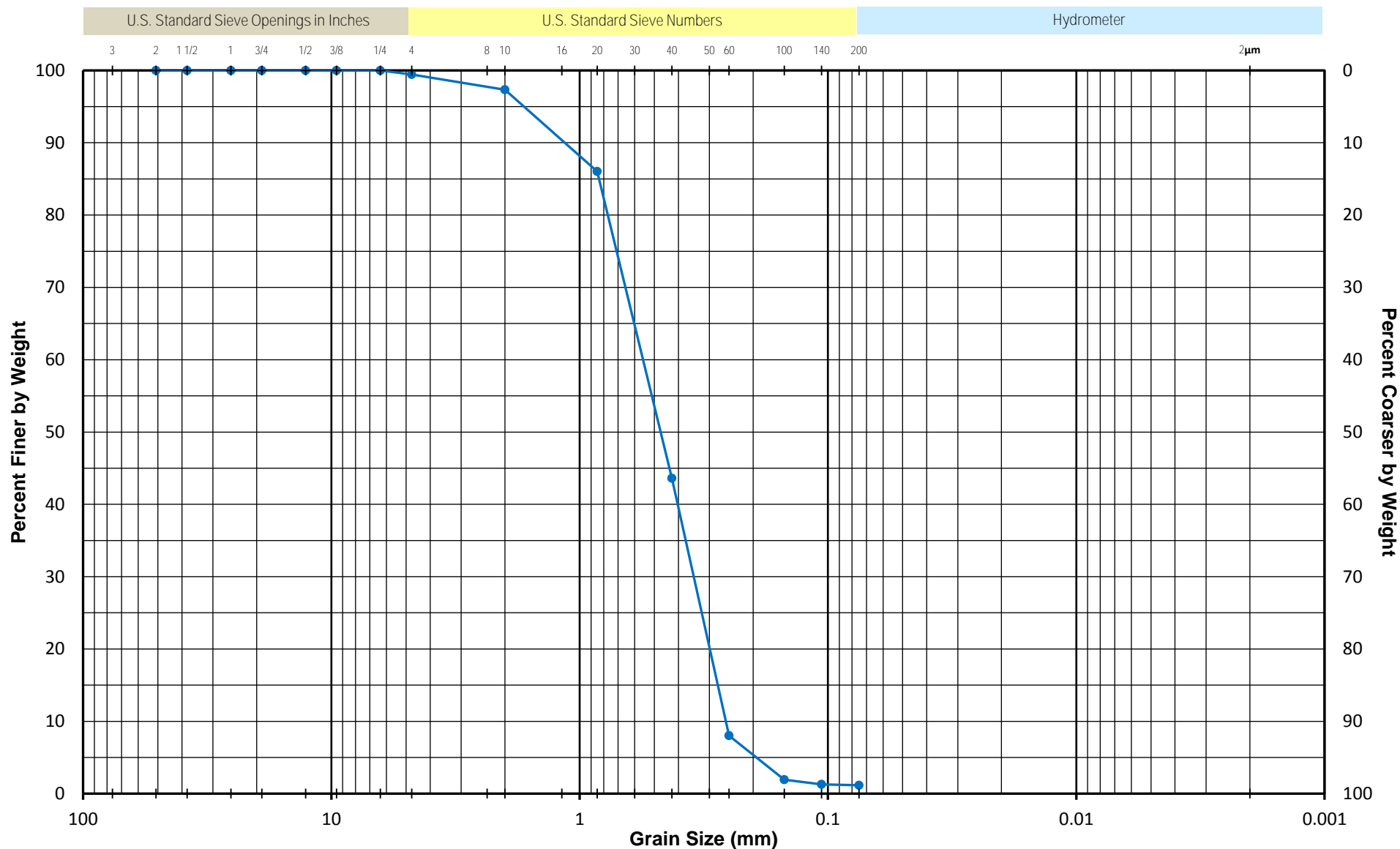
ASTM D-422, D-6913

Alpine - NESE II



Test Depth	Core ID Section/Sample	Material Description
10.0 ft	VC26 8-10	Dark Brown Fine to Medium Sand

GRADATION CURVES
 ASTM D-422, D-6913
 Alpine - NESE II

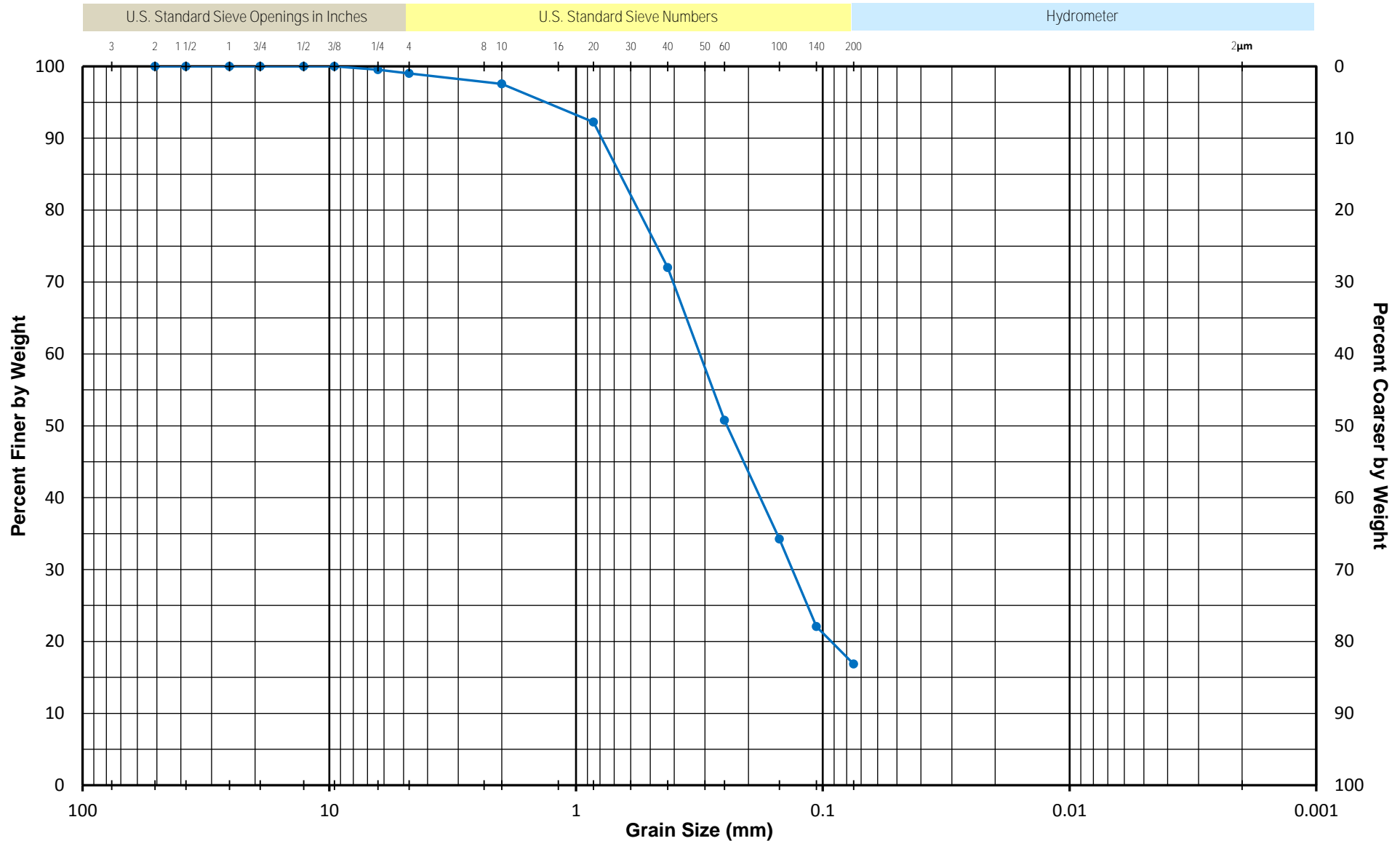


Test Depth	Core ID Section/Sample	Material Description
12.0 ft	VC26 10-12	Dark Brown Medium to Fine Sand

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

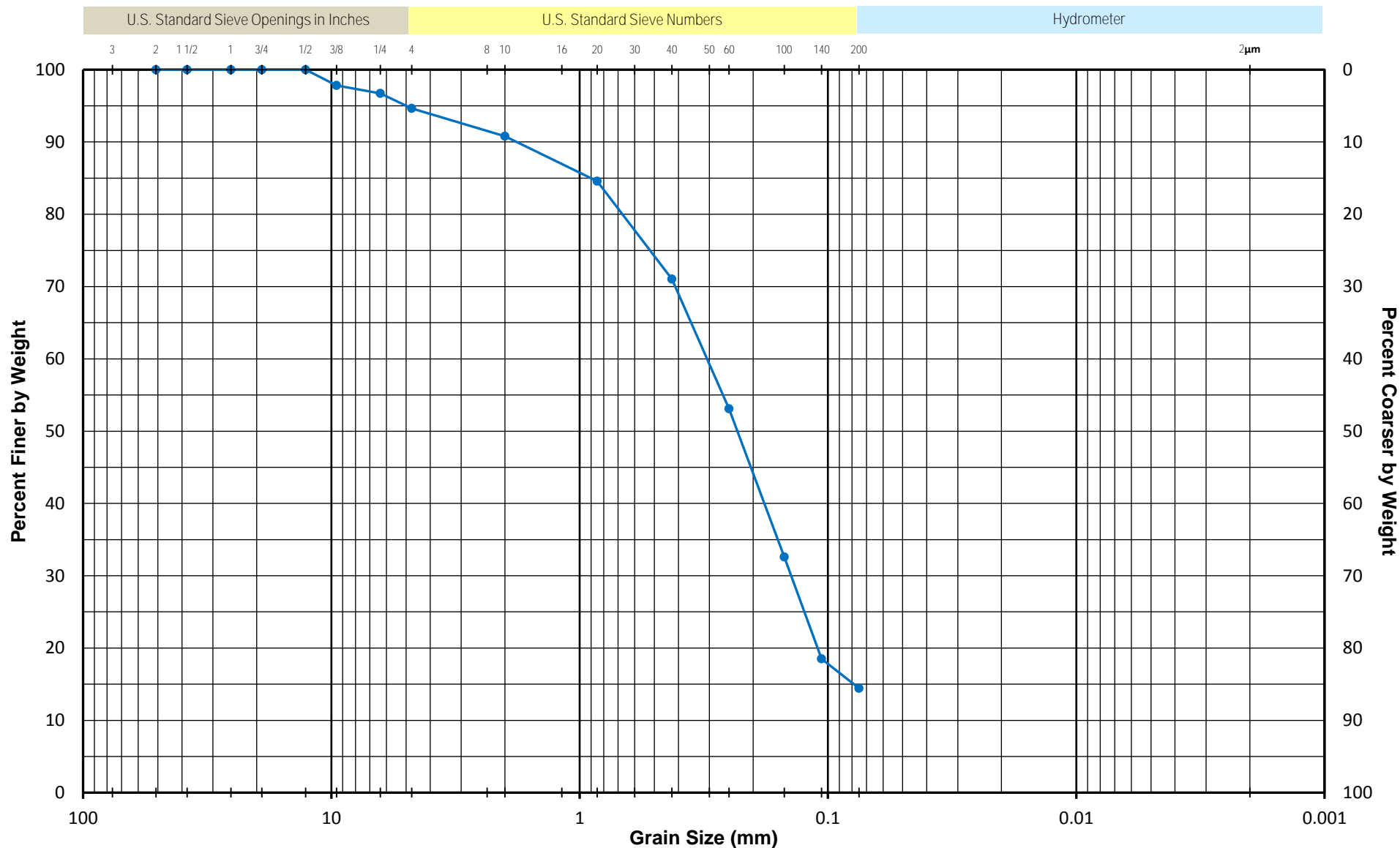


Test Depth	Core ID Section/Sample	Material Description
0.6 ft	VC28 0-2	Black Clayey Sand with shell fragments

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

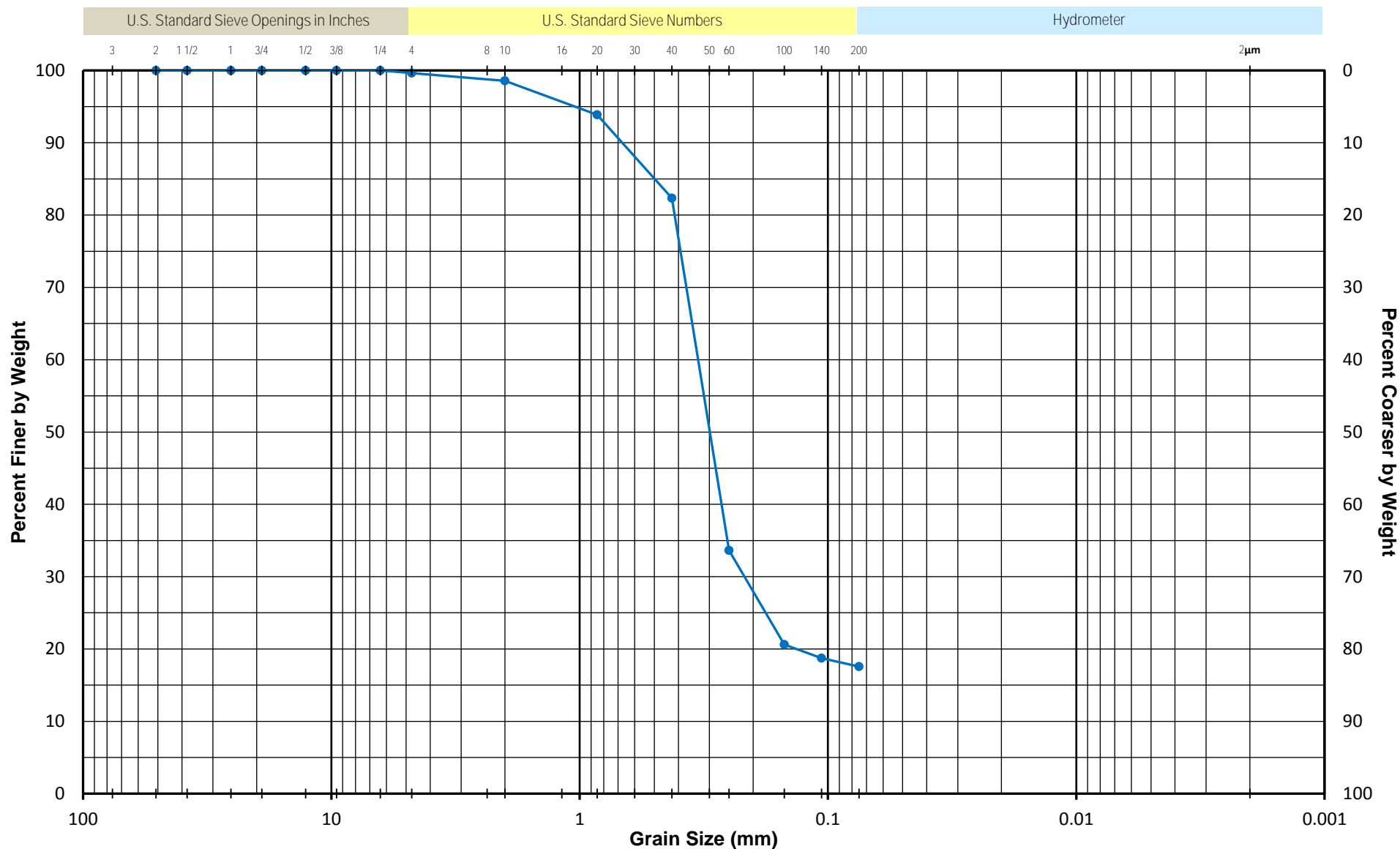


Test Depth	Core ID Section/Sample	Material Description
<div>● — ●</div> 2.0 ft	VC28 0-2	Very Dark Gray Clayey Sand with shell fragments

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

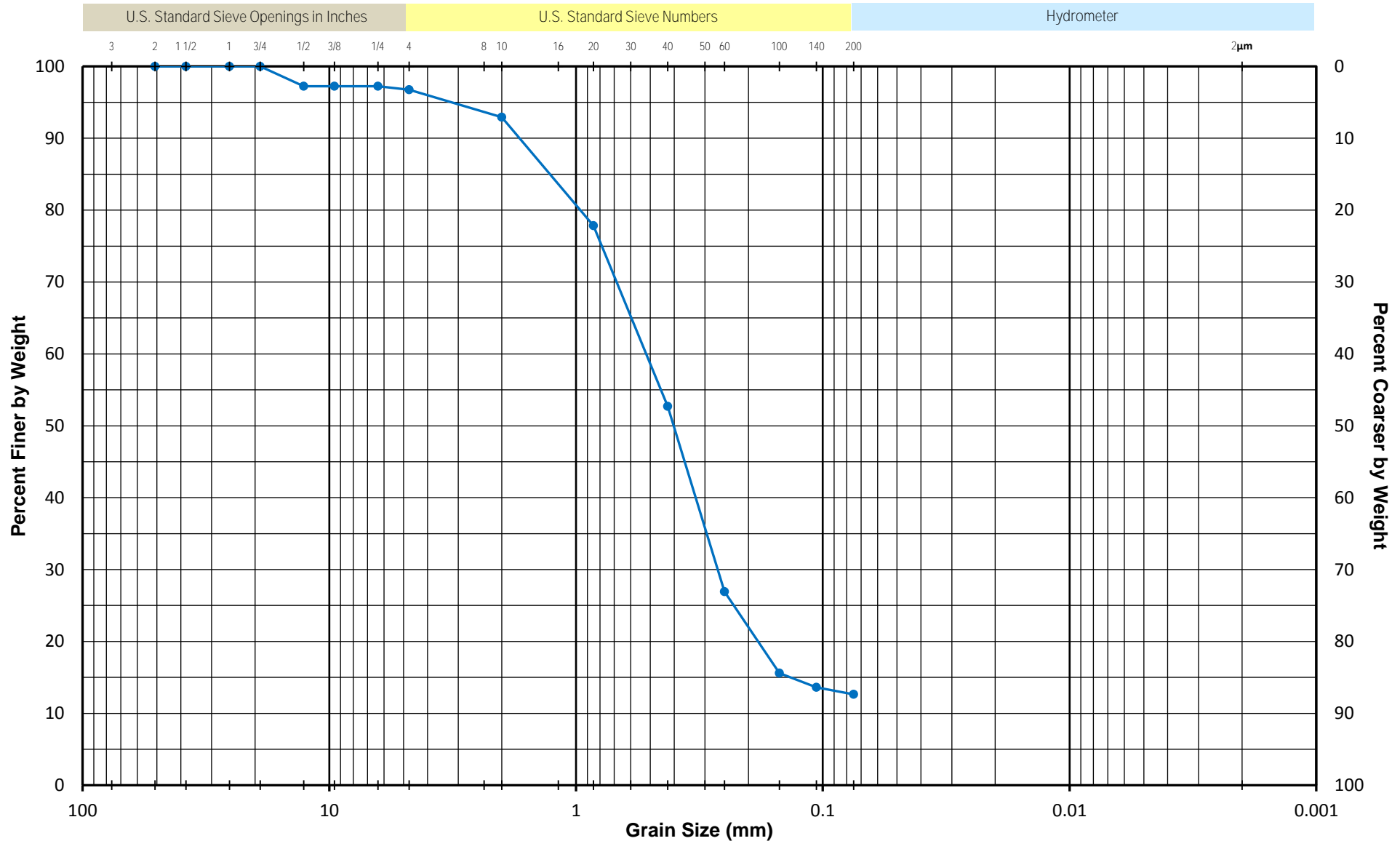


Test Depth	Core ID Section/Sample	Material Description
4.0 ft	VC28 2-4	Dark Gray Silty Fine to Medium Sand

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

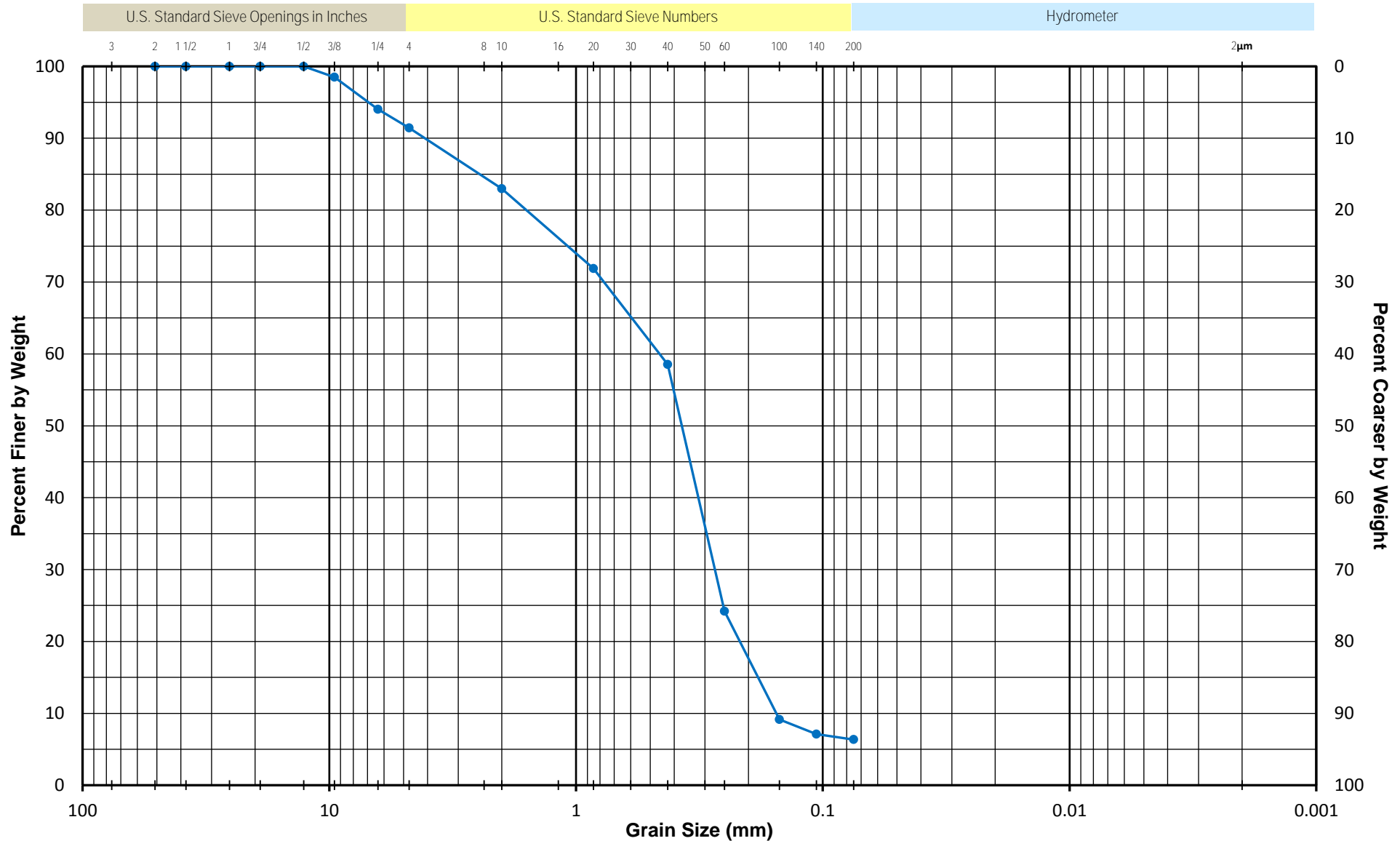


Test Depth	Core ID Section/Sample	Material Description
6.0 ft	VC28 4-6	Dark Gray Silty Medium to Fine Sand

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

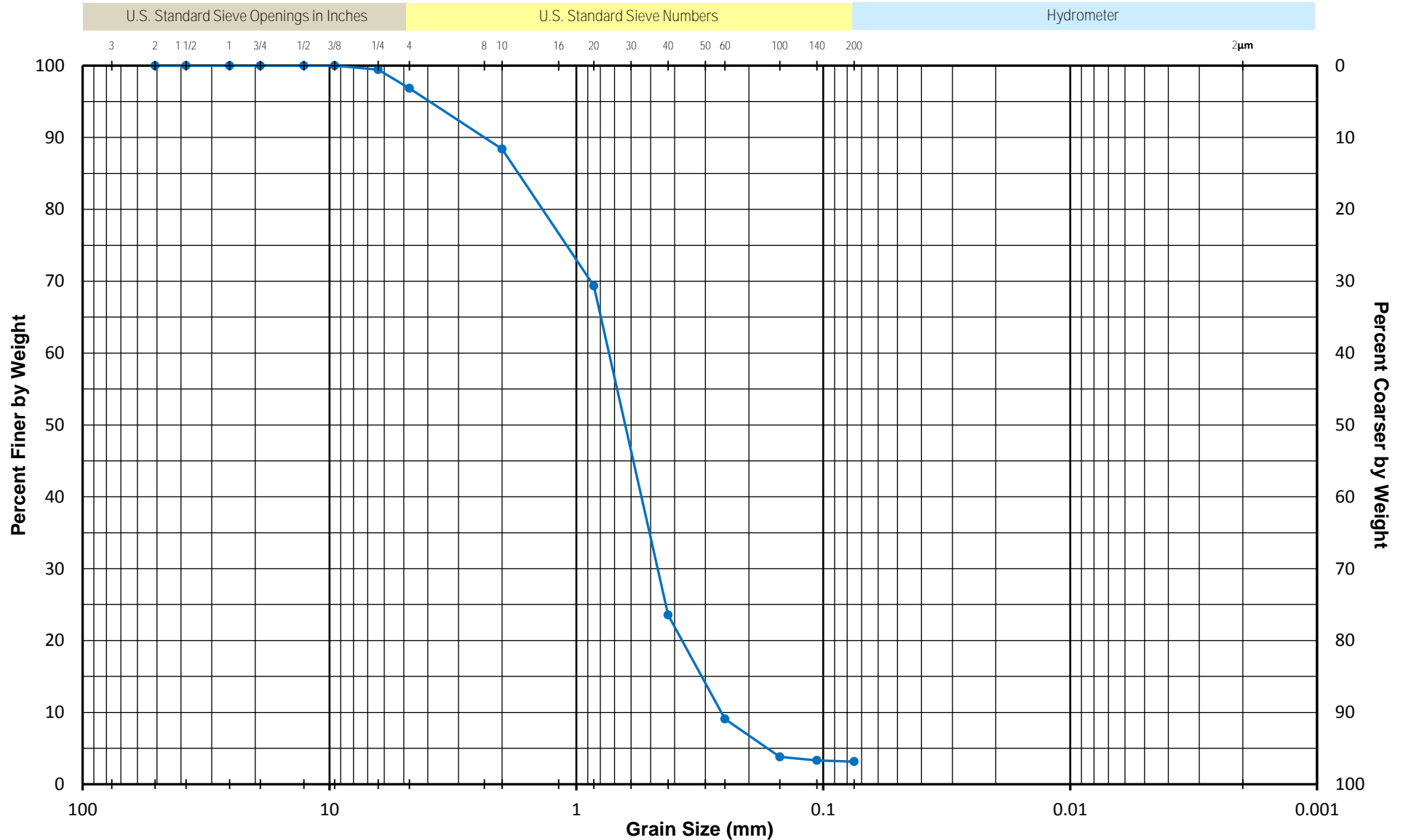


Test Depth	Core ID Section/Sample	Material Description
8.0 ft	VC28 6-8	Dark Gray Fine to Coarse Sand with silt

GRADATION CURVES

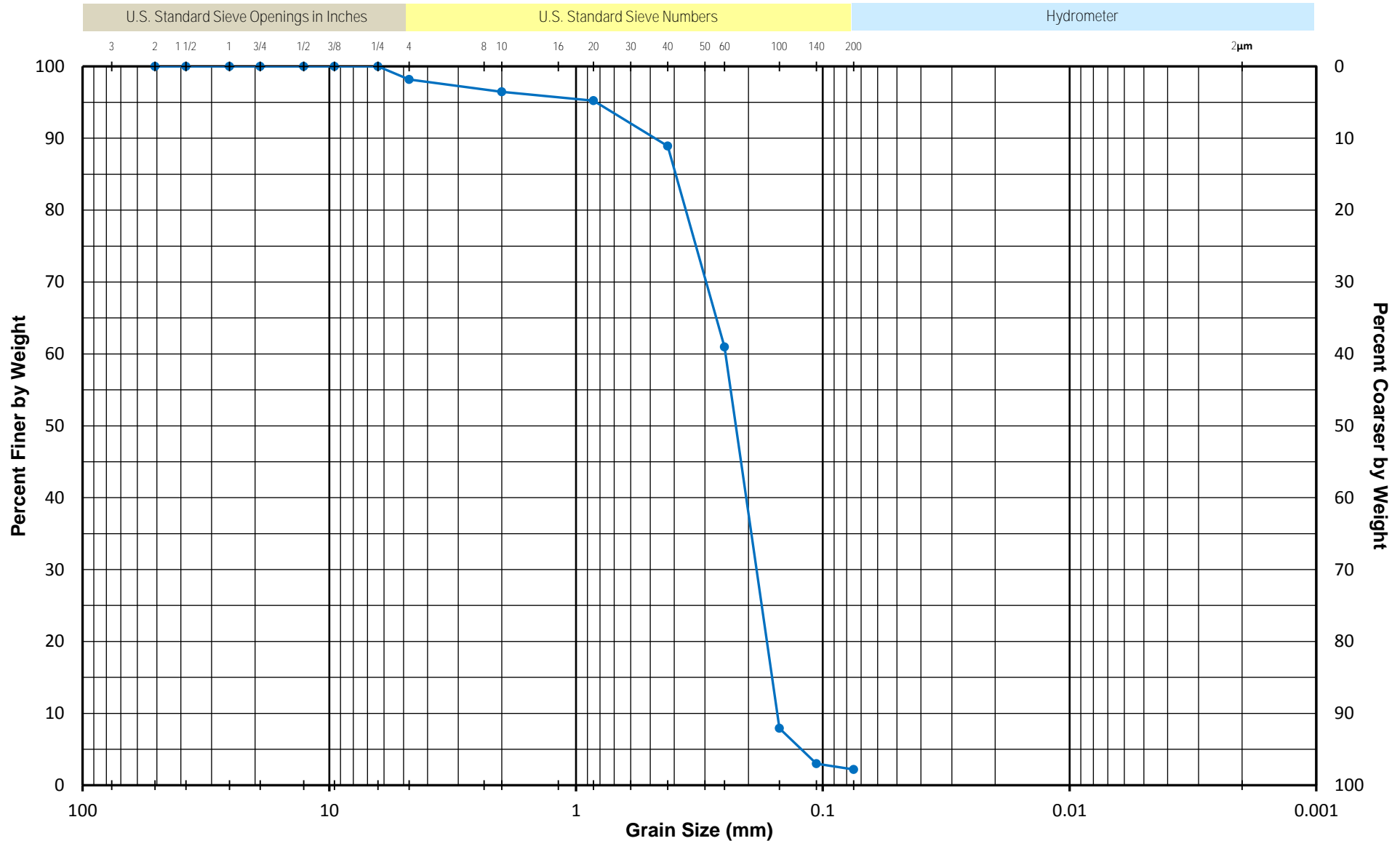
ASTM D-422, D-6913

Alpine - NESE II



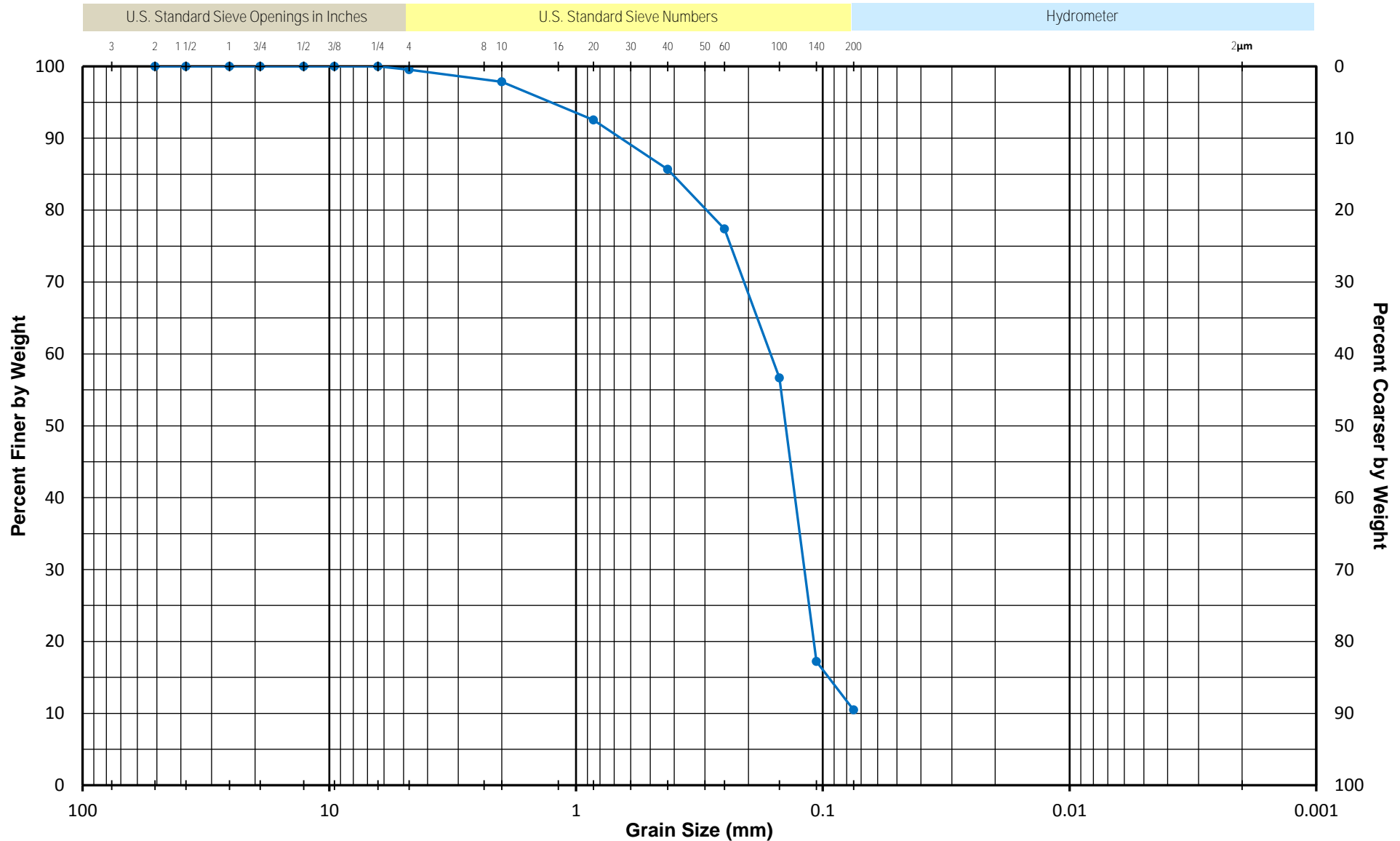
Test Depth	Core ID Section/Sample	Material Description
•—• 10.0 ft	VC28 8-10	Dark Brown Medium to Coarse Sand

GRADATION CURVES
 ASTM D-422, D-6913
 Alpine - NESE II



Test Depth	Core ID Section/Sample	Material Description
•—• 12.0 ft	VC28 10-12	Dark Brown Fine to Medium Sand

GRADATION CURVES
 ASTM D-422, D-6913
 Alpine - NESE II

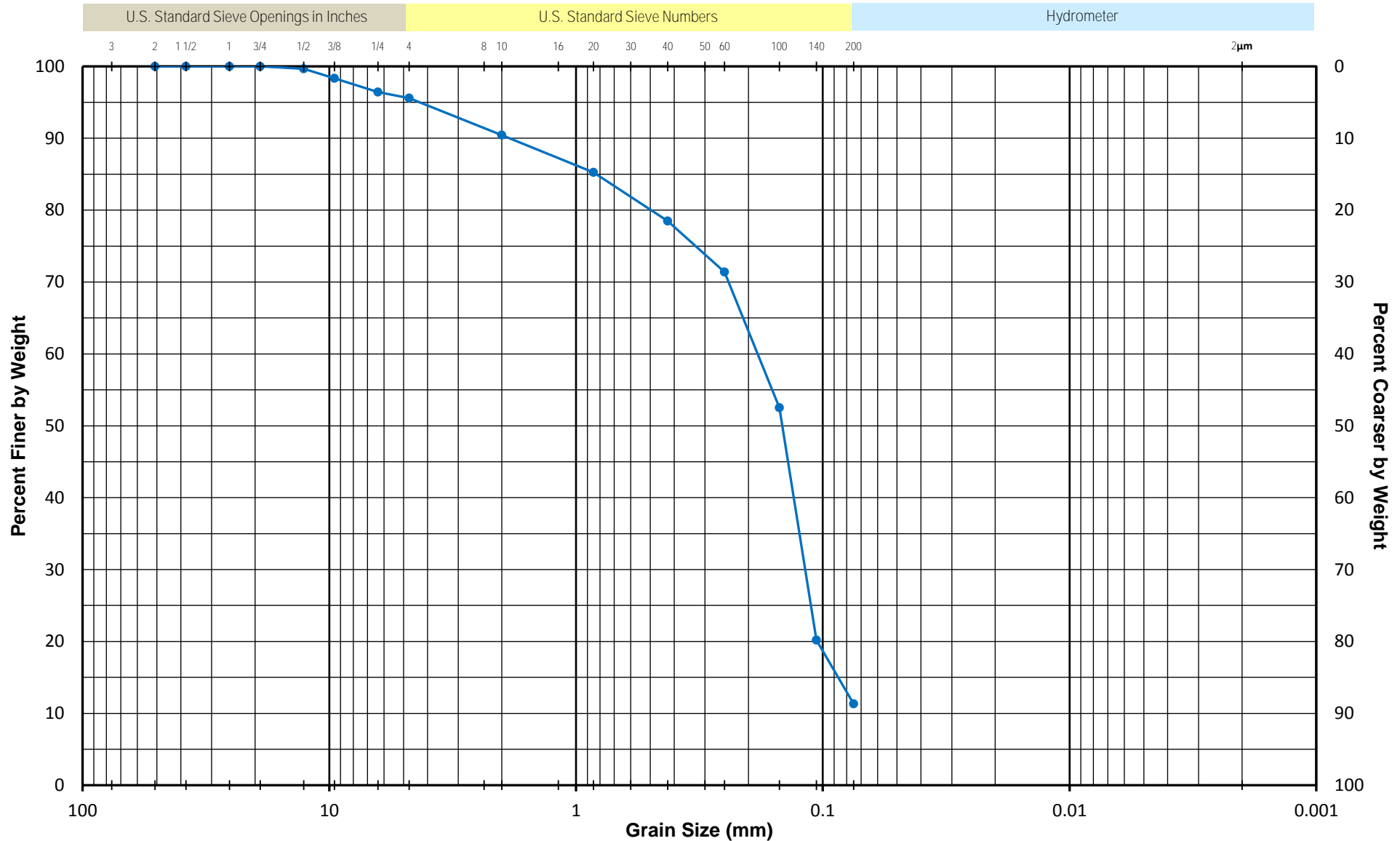


Test Depth	Core ID Section/Sample	Material Description
0.6 ft	VC30 0-2	Very Dark Gray Sand with silt and shell fragments

GRADATION CURVES

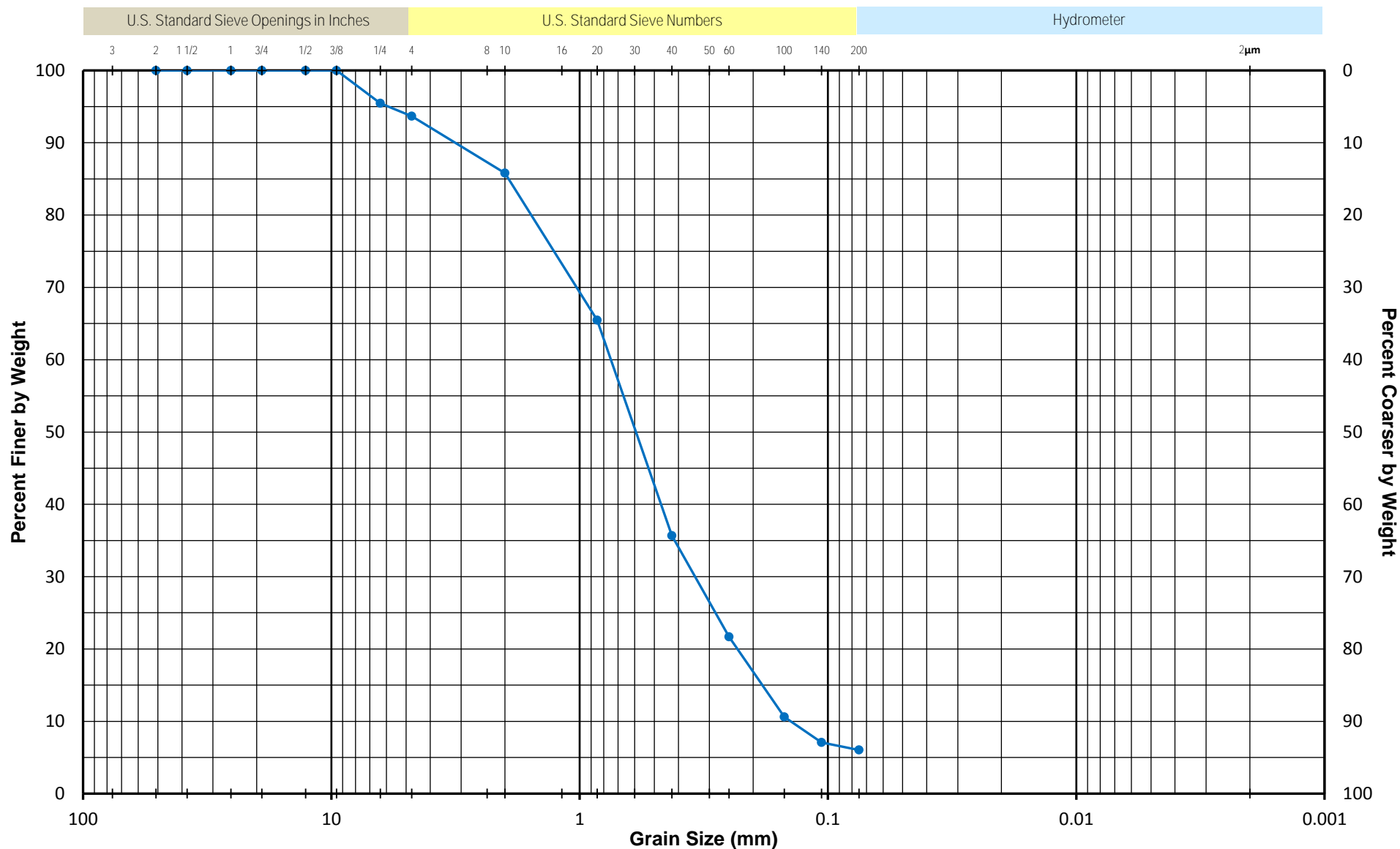
ASTM D-422, D-6913

Alpine - NESE II



Test Depth	Core ID Section/Sample	Material Description
• — • 2.0 ft	VC30 0-2	Very Dark Gray Fine to Medium Sand with silt and shell fragments

GRADATION CURVES
 ASTM D-422, D-6913
 Alpine - NESE II

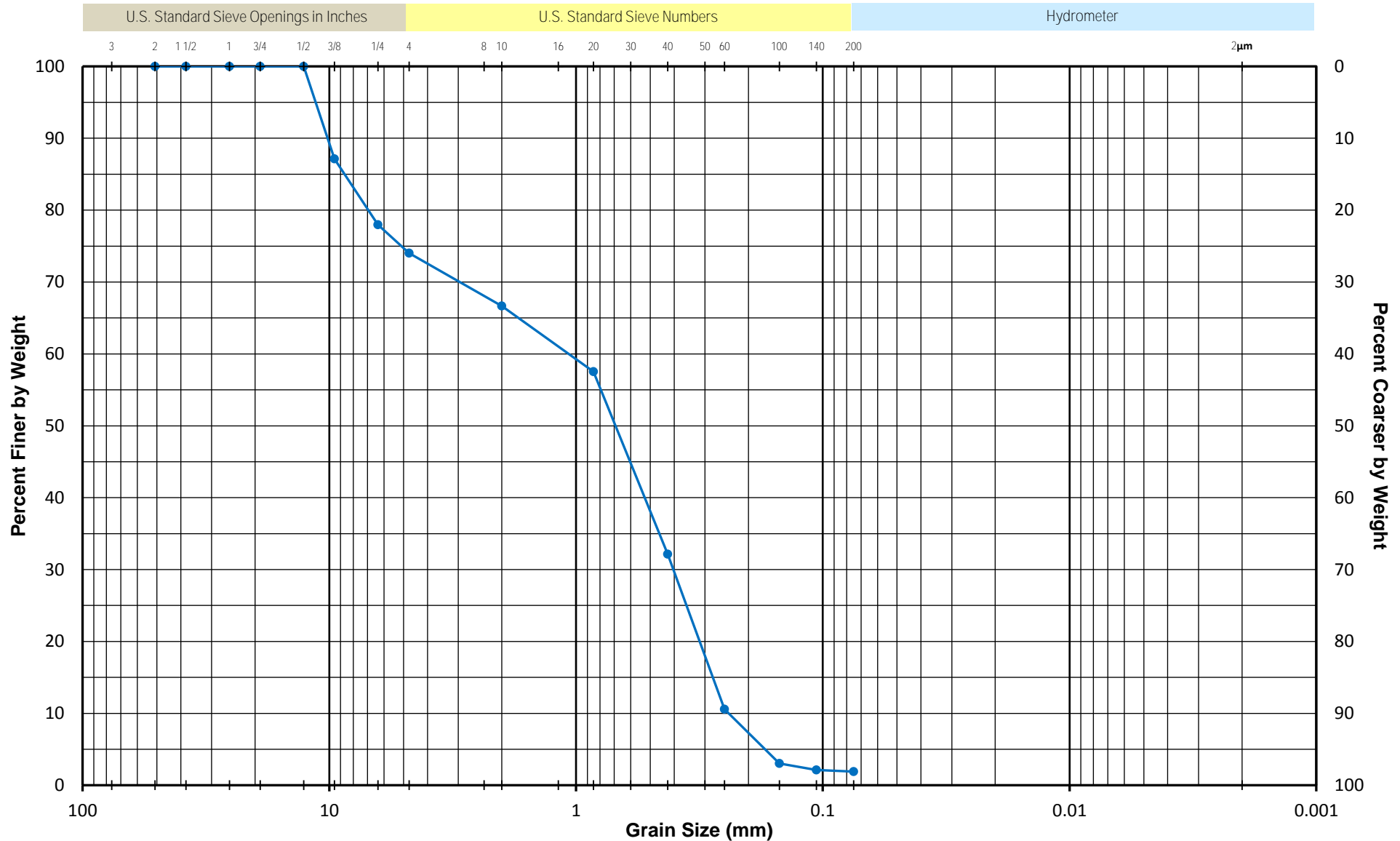


Test Depth	Core ID Section/Sample	Material Description
4.0 ft	VC30 2-4	Very Dark Gray Medium to Fine Sand with silt

GRADATION CURVES

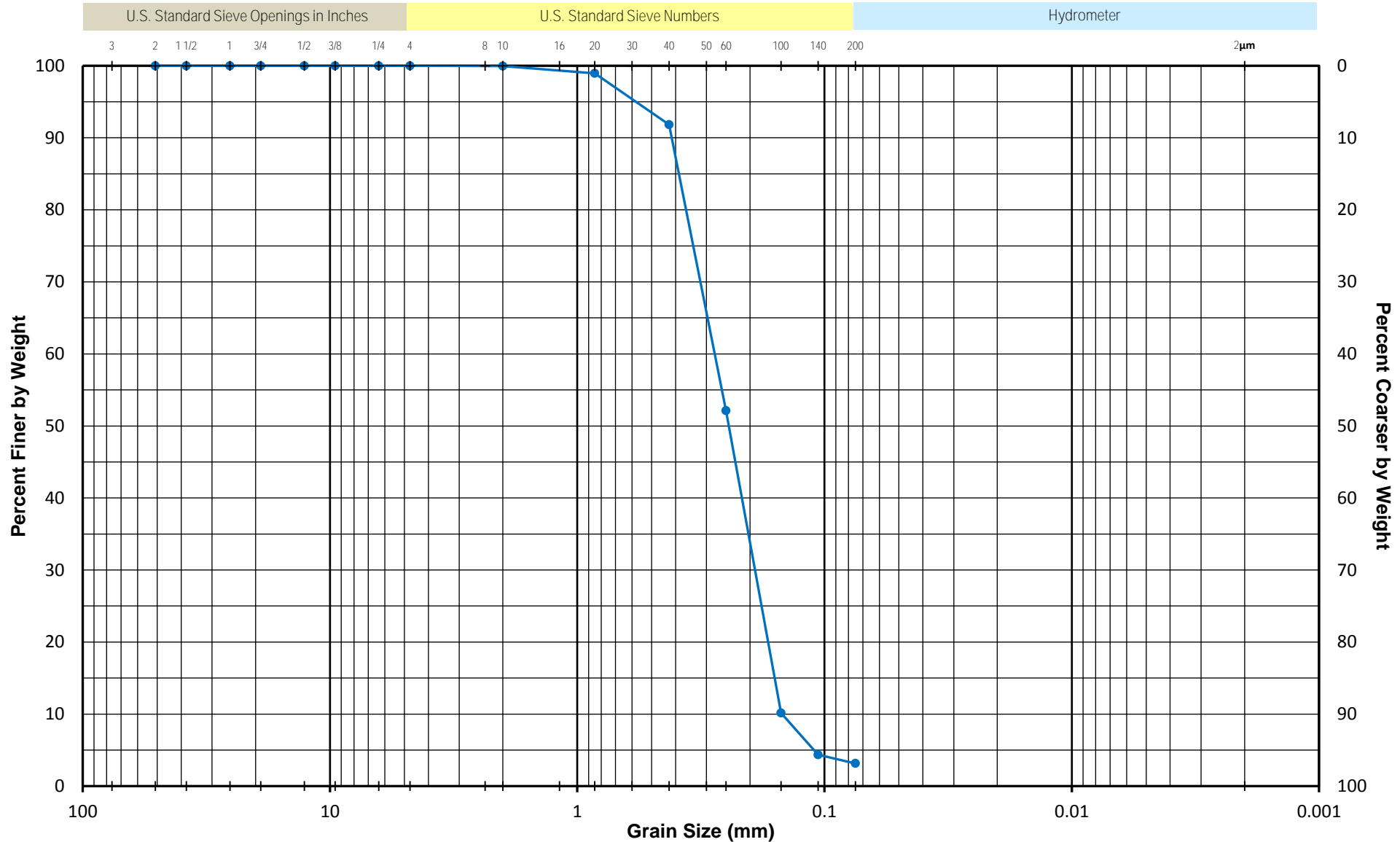
ASTM D-422, D-6913

Alpine - NESE II



Test Depth	Core ID Section/Sample	Material Description
6.0 ft	VC30 4-6	Brown Fine to Coarse Sand with gravel

GRADATION CURVES
 ASTM D-422, D-6913
 Alpine - NESE II

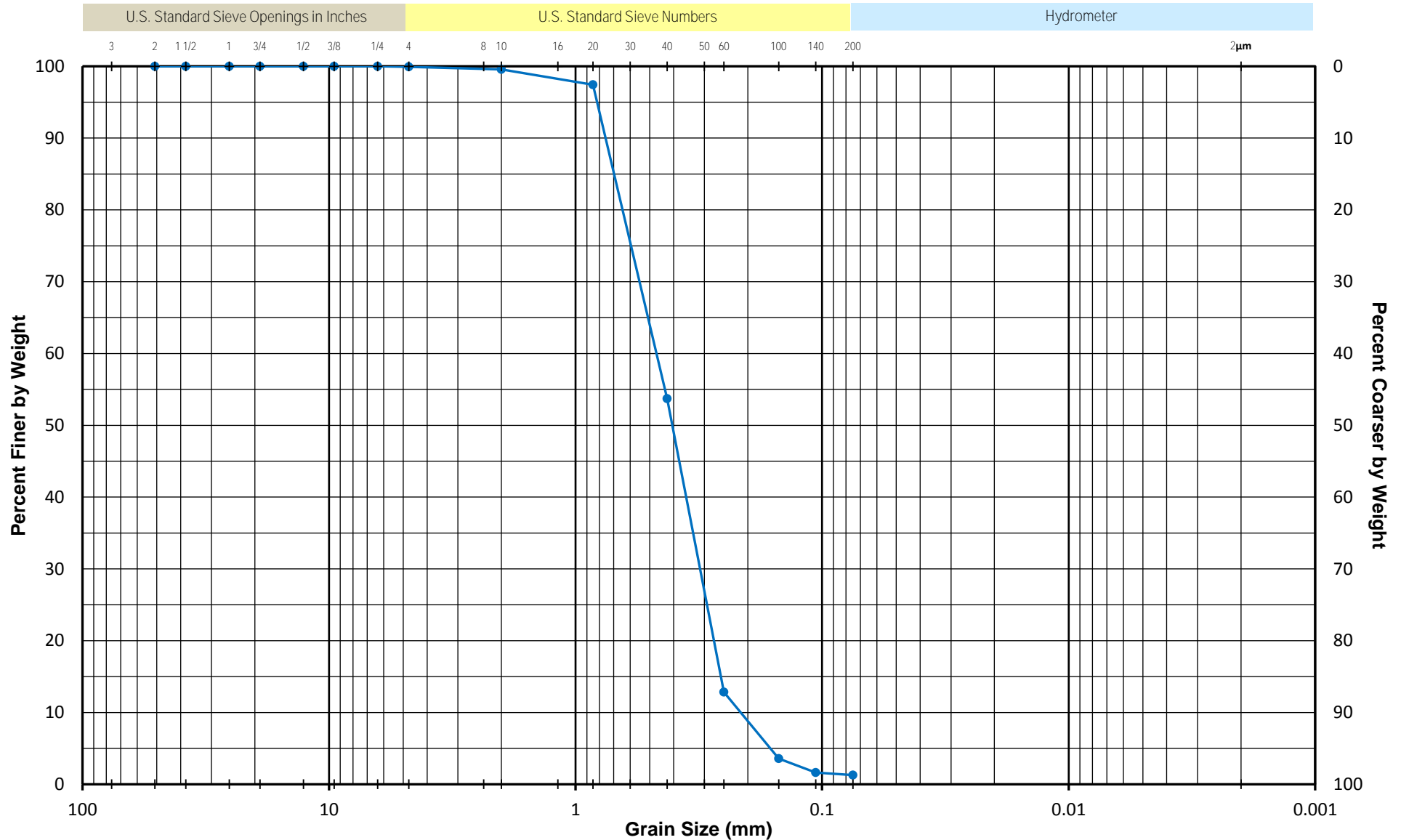


Test Depth	Core ID Section/Sample	Material Description
8.0 ft	VC30 6-8	Strong Brown Fine to Medium Sand

GRADATION CURVES

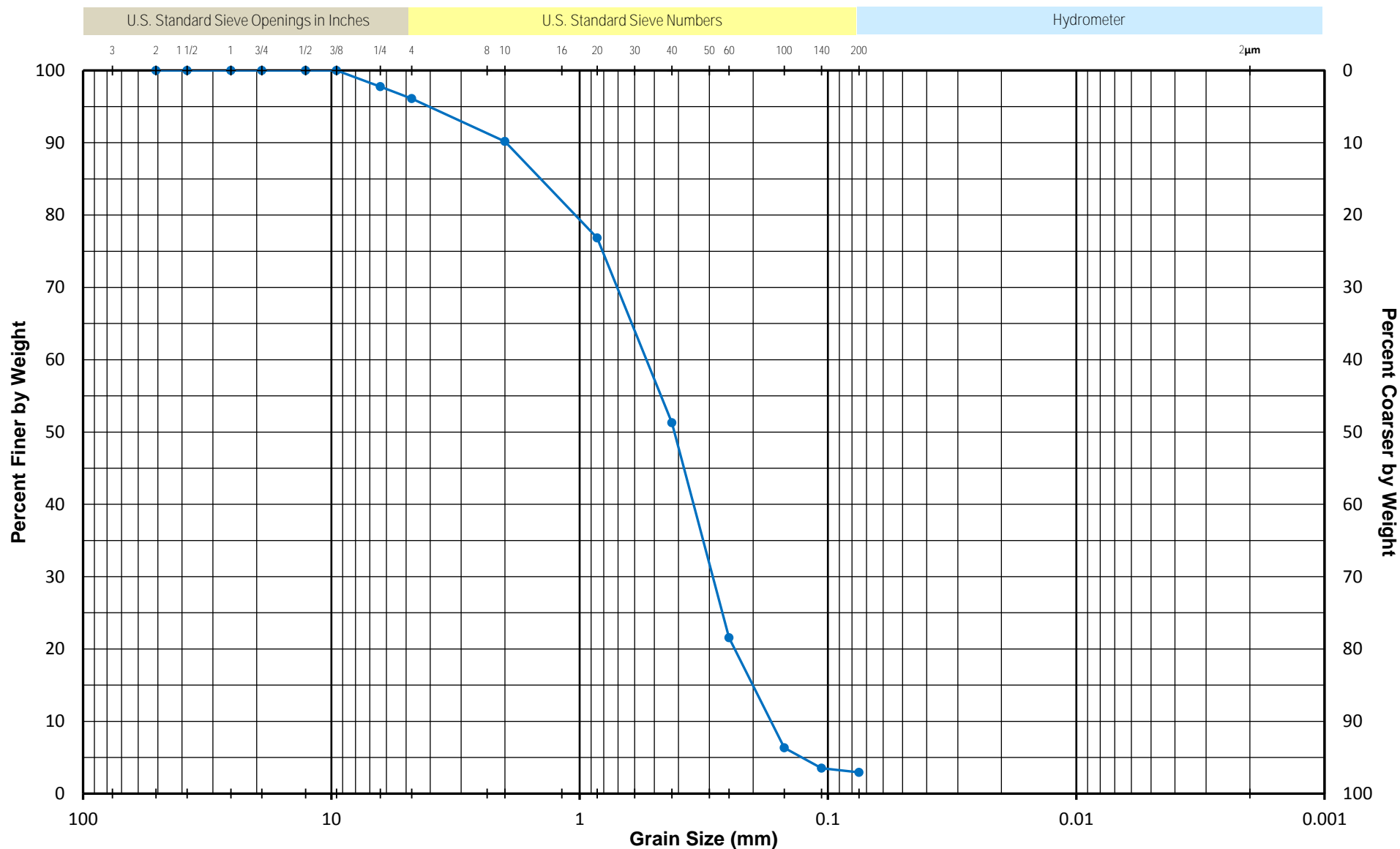
ASTM D-422, D-6913

Alpine - NESE II



Test Depth	Core ID Section/Sample	Material Description
10.0 ft	VC30 8-10	Brown Fine to Medium Sand

GRADATION CURVES
 ASTM D-422, D-6913
 Alpine - NESE II

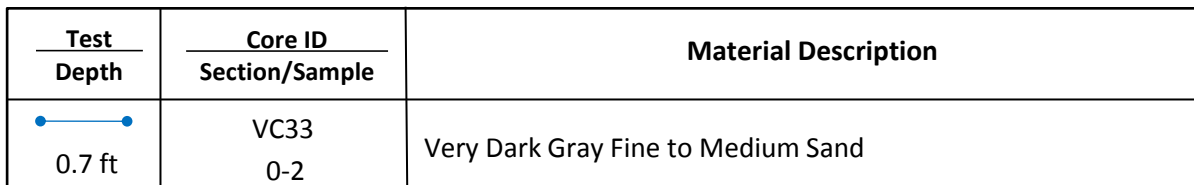


Test Depth	Core ID Section/Sample	Material Description
12.0 ft	VC30 10-12	Dark Brown Fine to Medium Sand

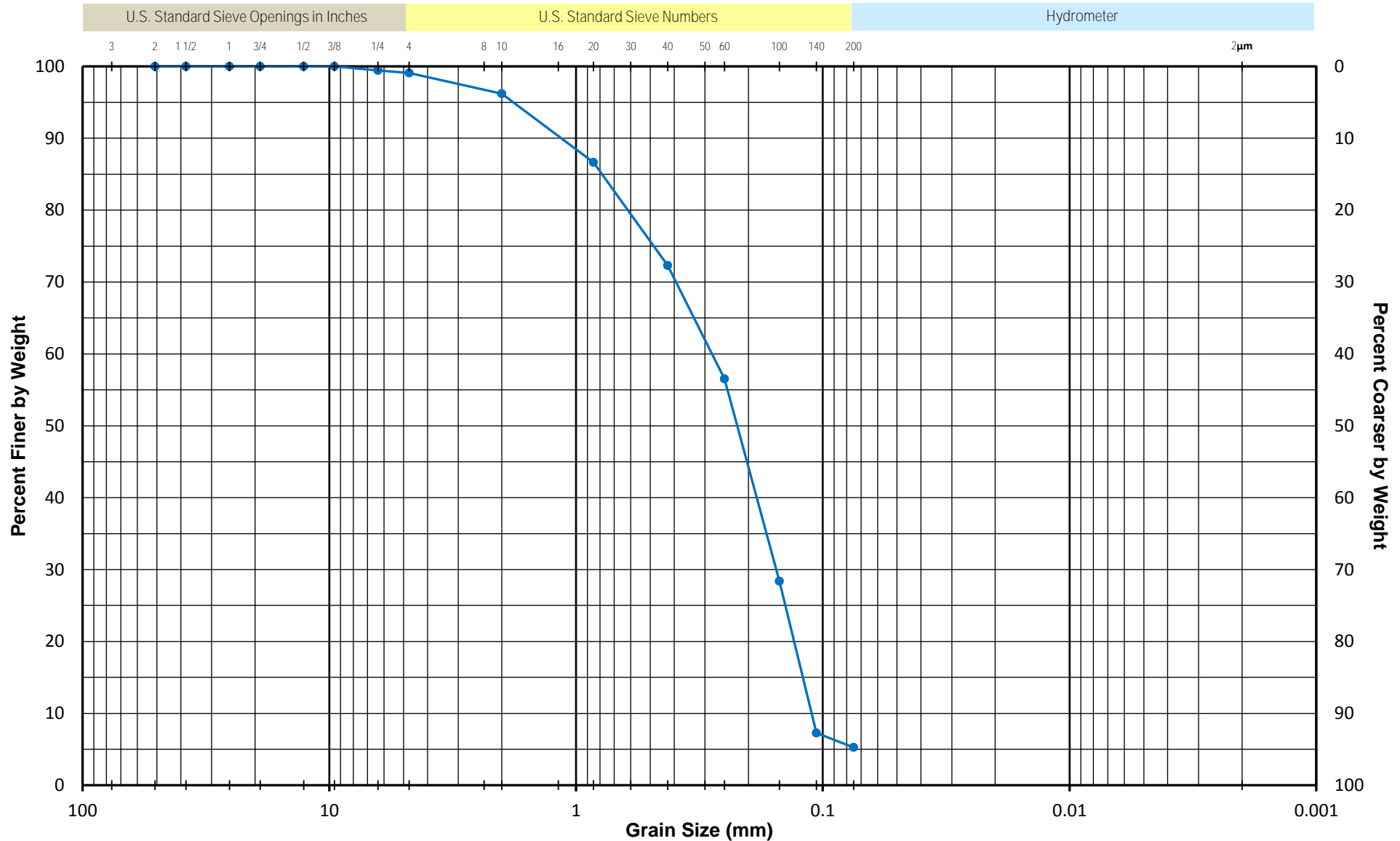
GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II



Alpine - NESE II

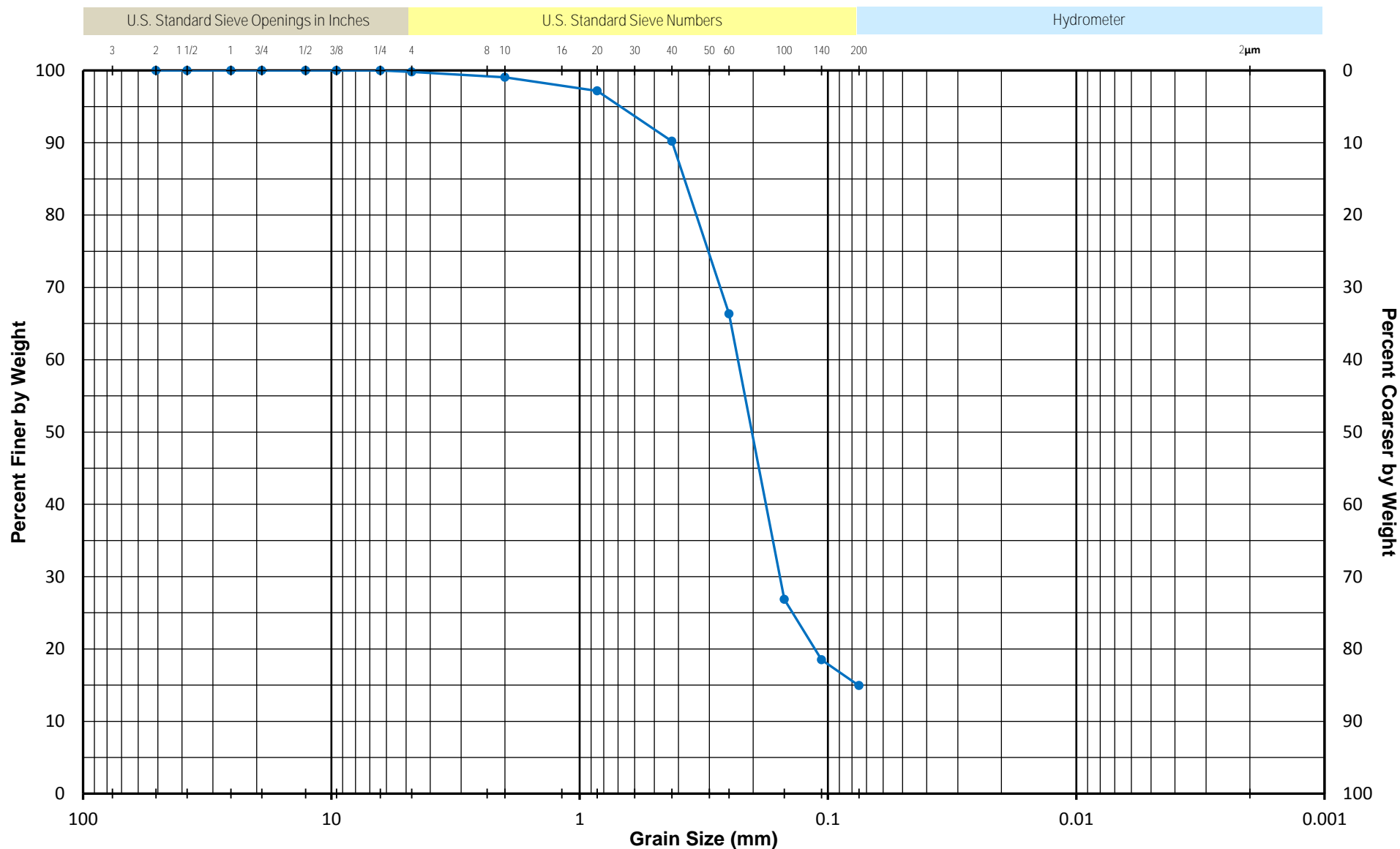


Test Depth	Core ID Section/Sample	Material Description
2.0 ft	VC33 0-2	Very Dark Gray Medium to Fine Sand with silt and shell fragments

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

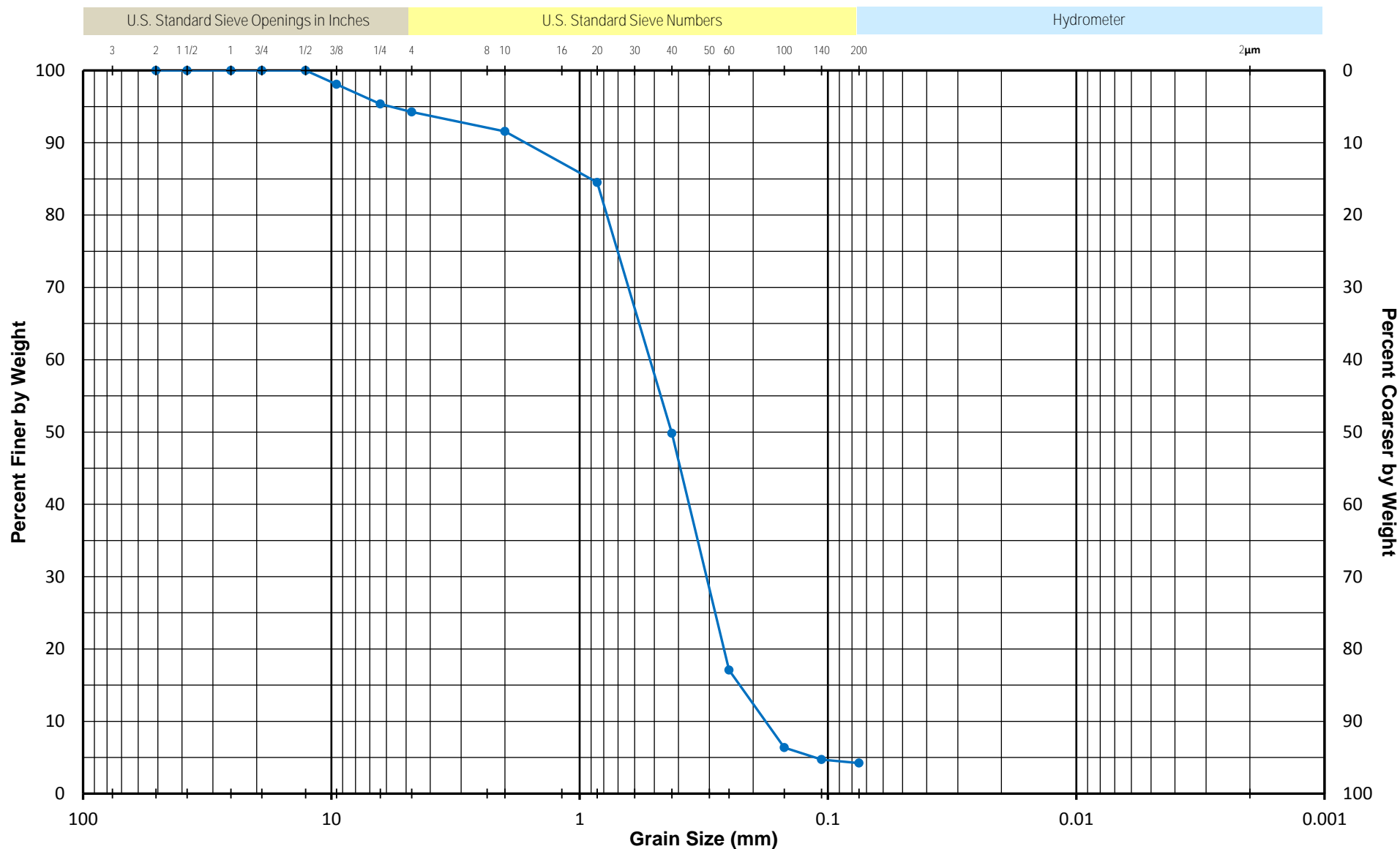


Test Depth	Core ID Section/Sample	Material Description
4.0 ft	VC33 2-4	Brown and Gray Silty Fine Sand

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

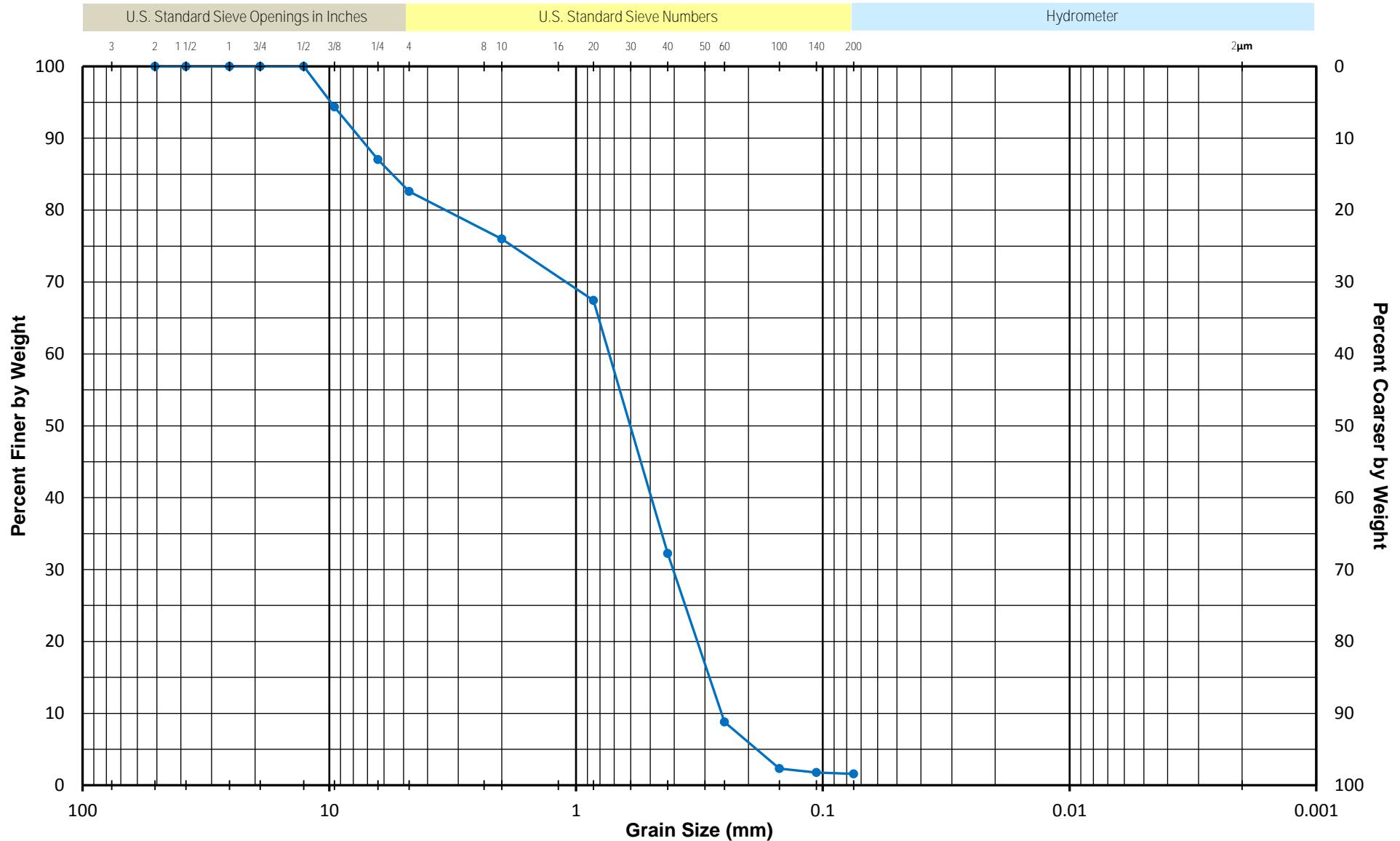


Test Depth	Core ID Section/Sample	Material Description
• — • 6.0 ft	VC33 4-6	Brown Fine to Medium Sand

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

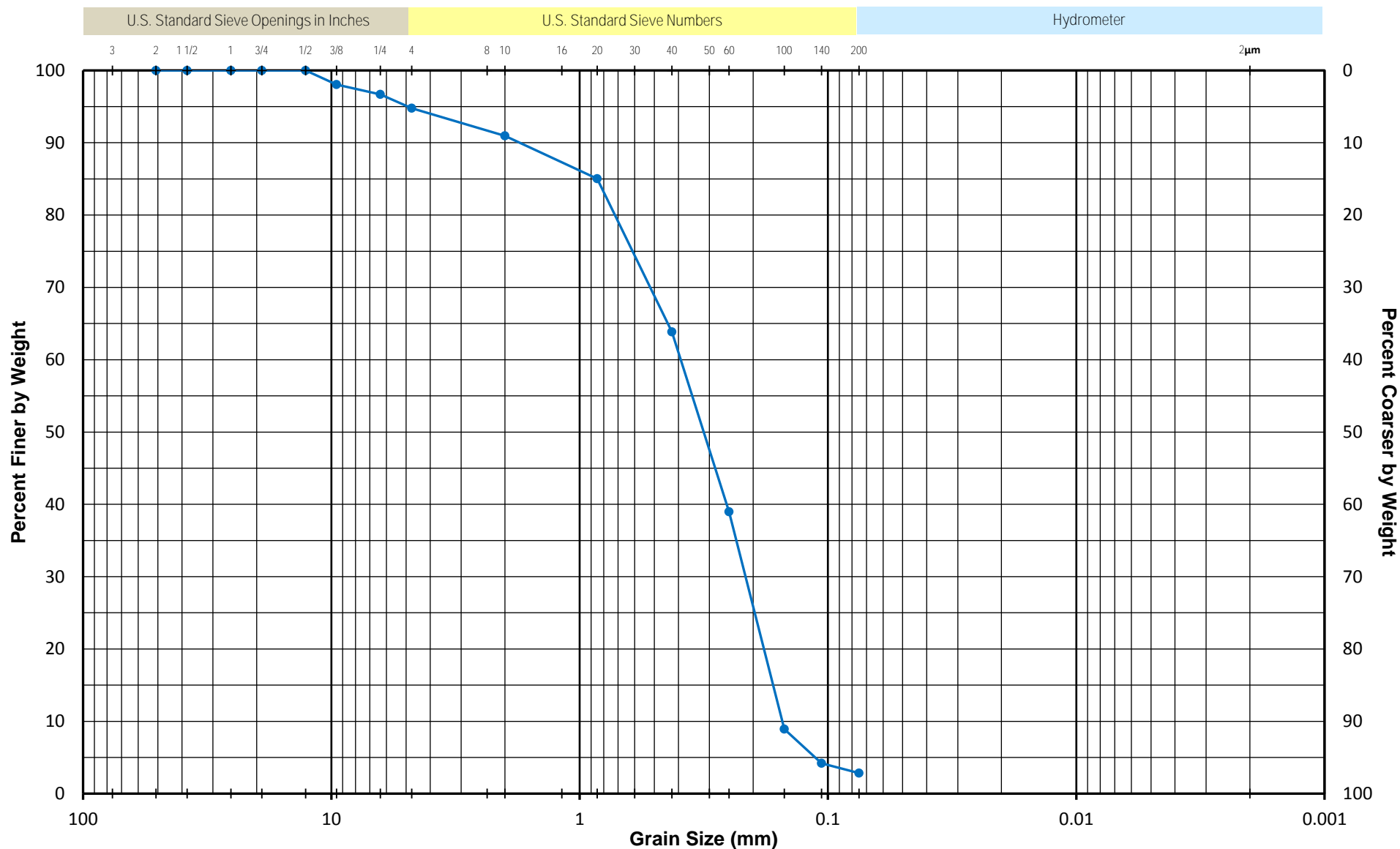


Test Depth	Core ID Section/Sample	Material Description
8.0 ft	VC33 6-8	Brown Medium to Coarse Sand with gravel

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

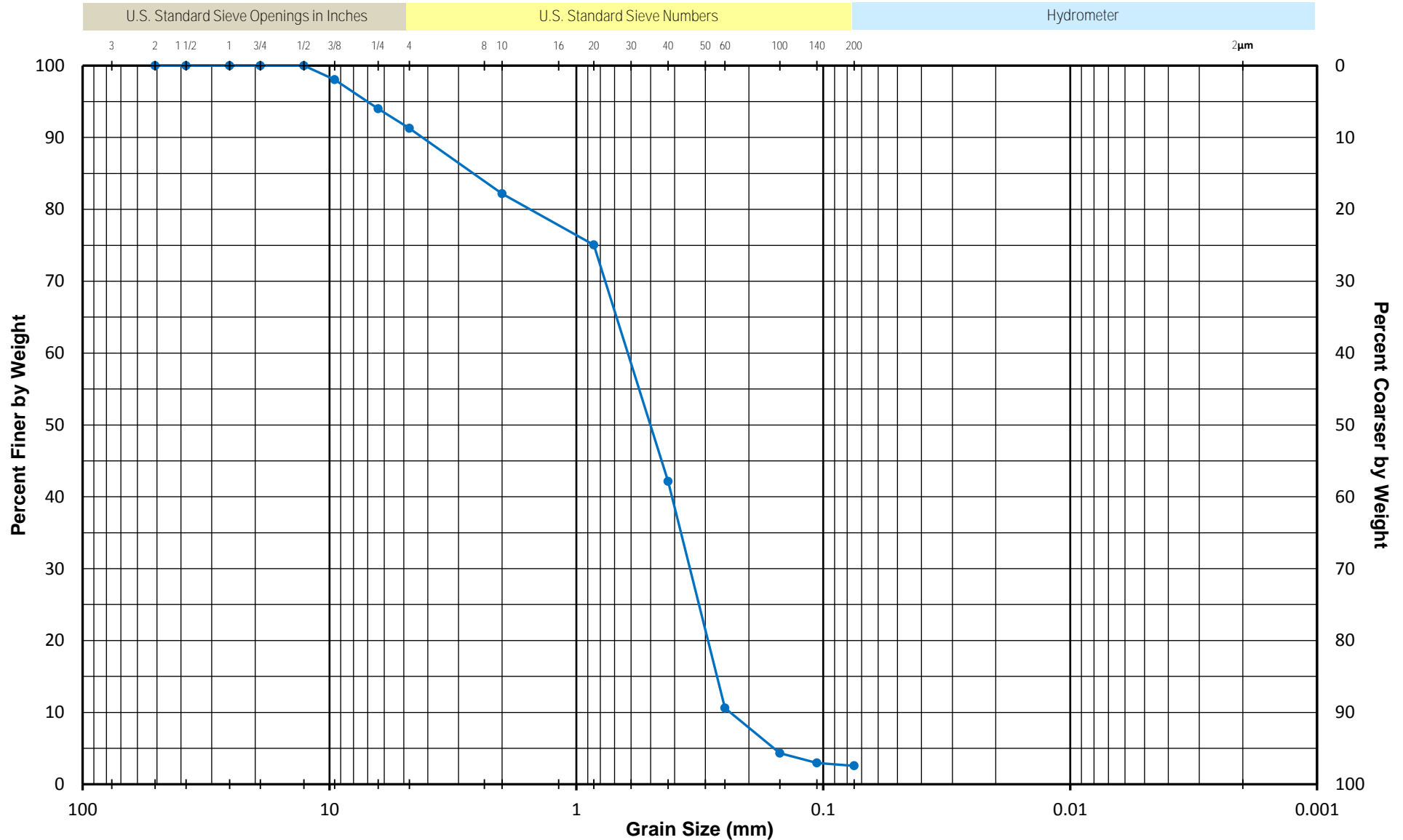


Test Depth	Core ID Section/Sample	Material Description
10.0 ft	VC33 8-10	Very Dark Grayish Brown Fine to Medium Sand

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

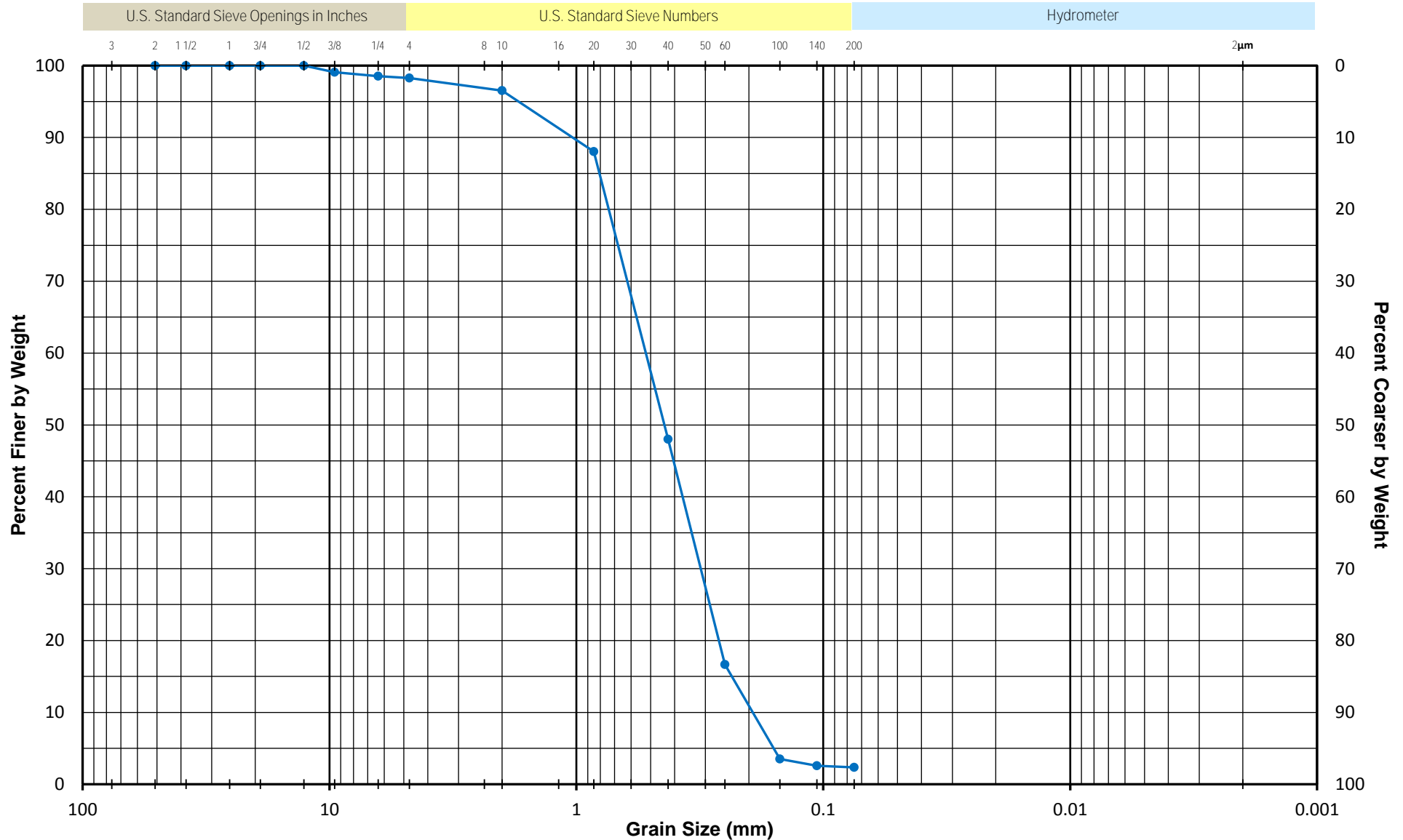


Test Depth	Core ID Section/Sample	Material Description
<div> <div></div> <div>11.7 ft</div> </div>	VC33 10-12	Very Dark Grayish Brown Fine to Coarse Sand

GRADATION CURVES

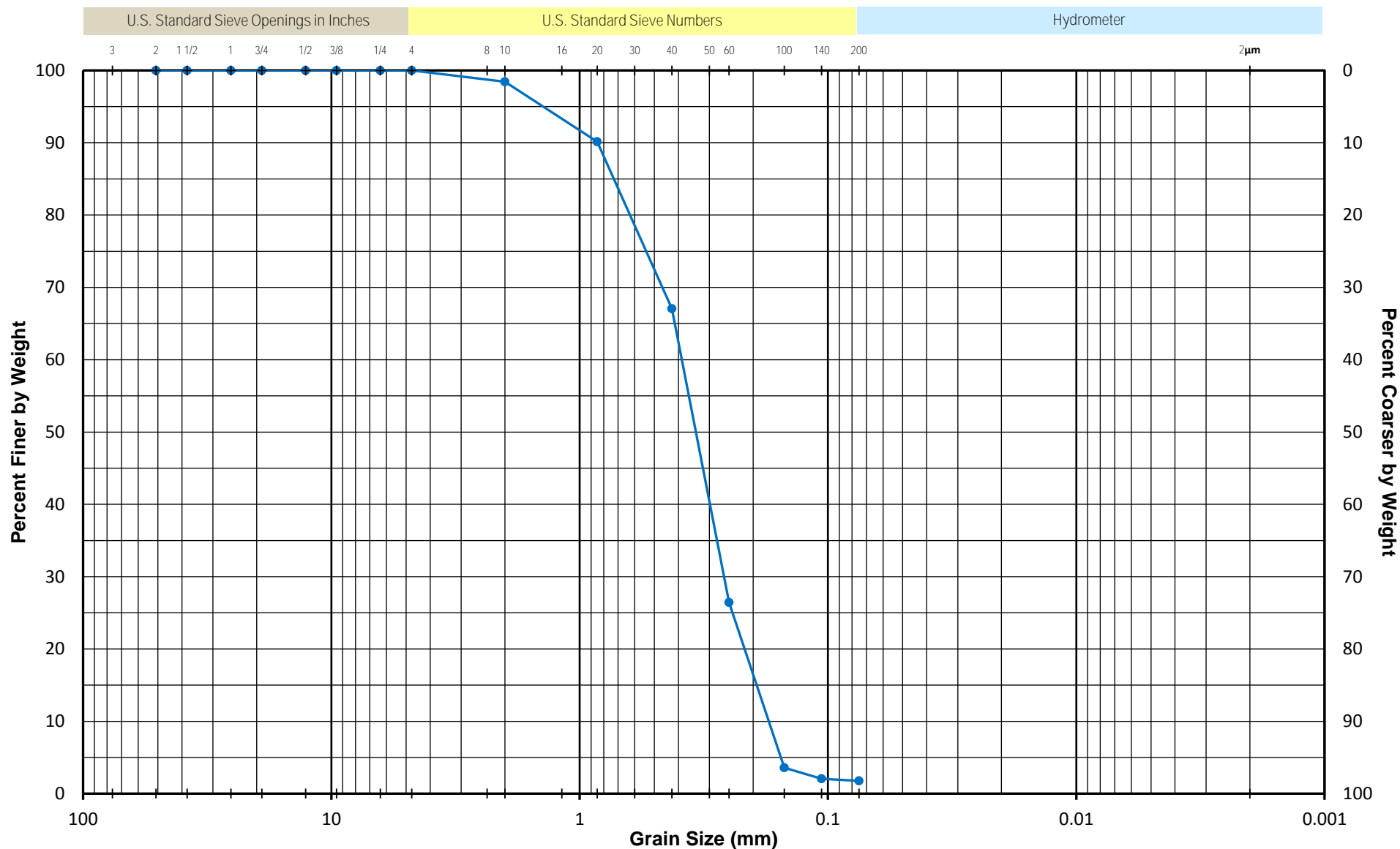
ASTM D-422, D-6913

Alpine - NESE II



Test Depth	Core ID Section/Sample	Material Description
0.7 ft	VC34 0-2	Gray Fine to Medium Sand with shells

GRADATION CURVES
 ASTM D-422, D-6913
 Alpine - NESE II

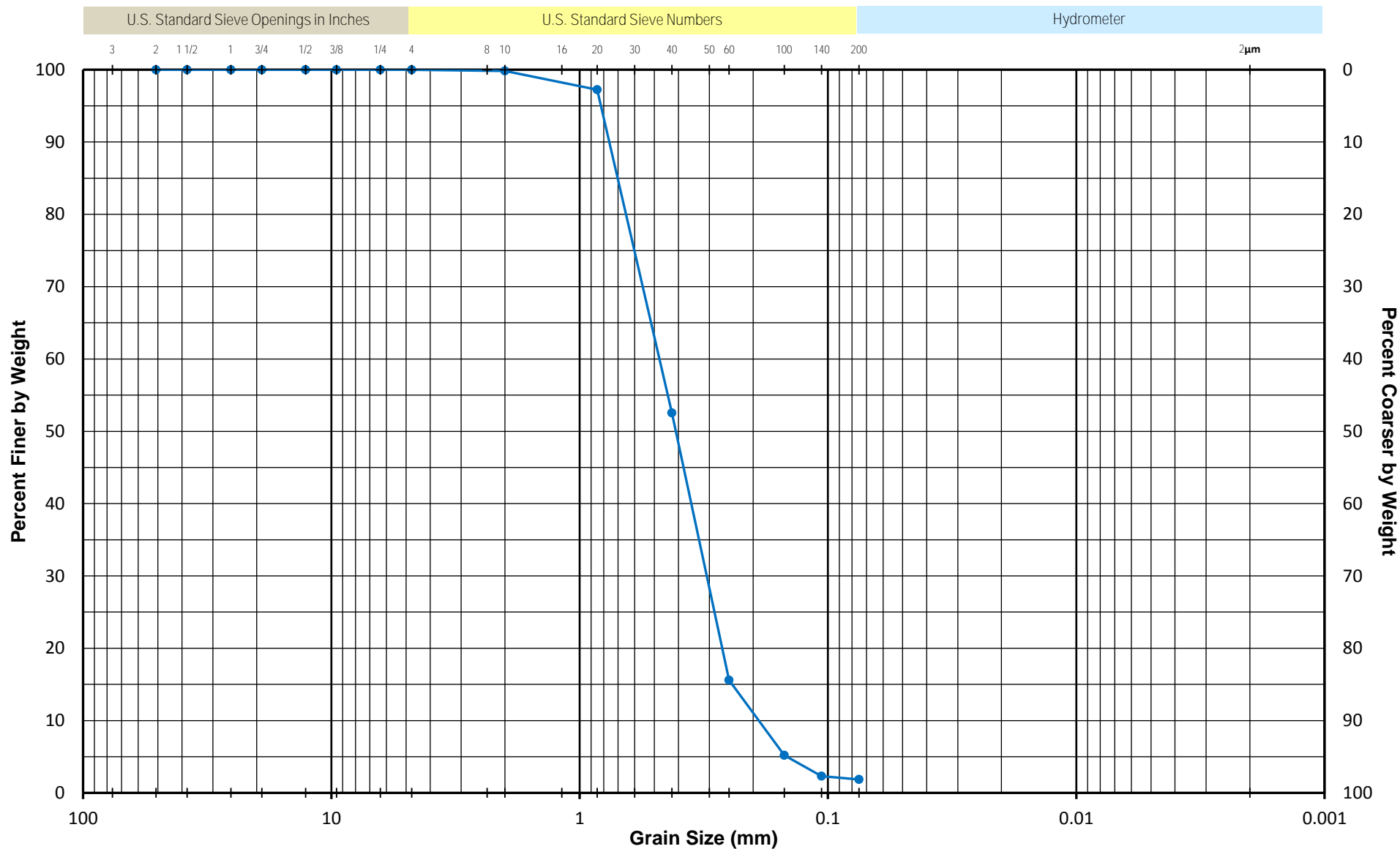


Test Depth	Core ID Section/Sample	Material Description
•—• 2.0 ft	VC34 0-2	Very Dark Grayish Brown Fine to Medium Sand

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

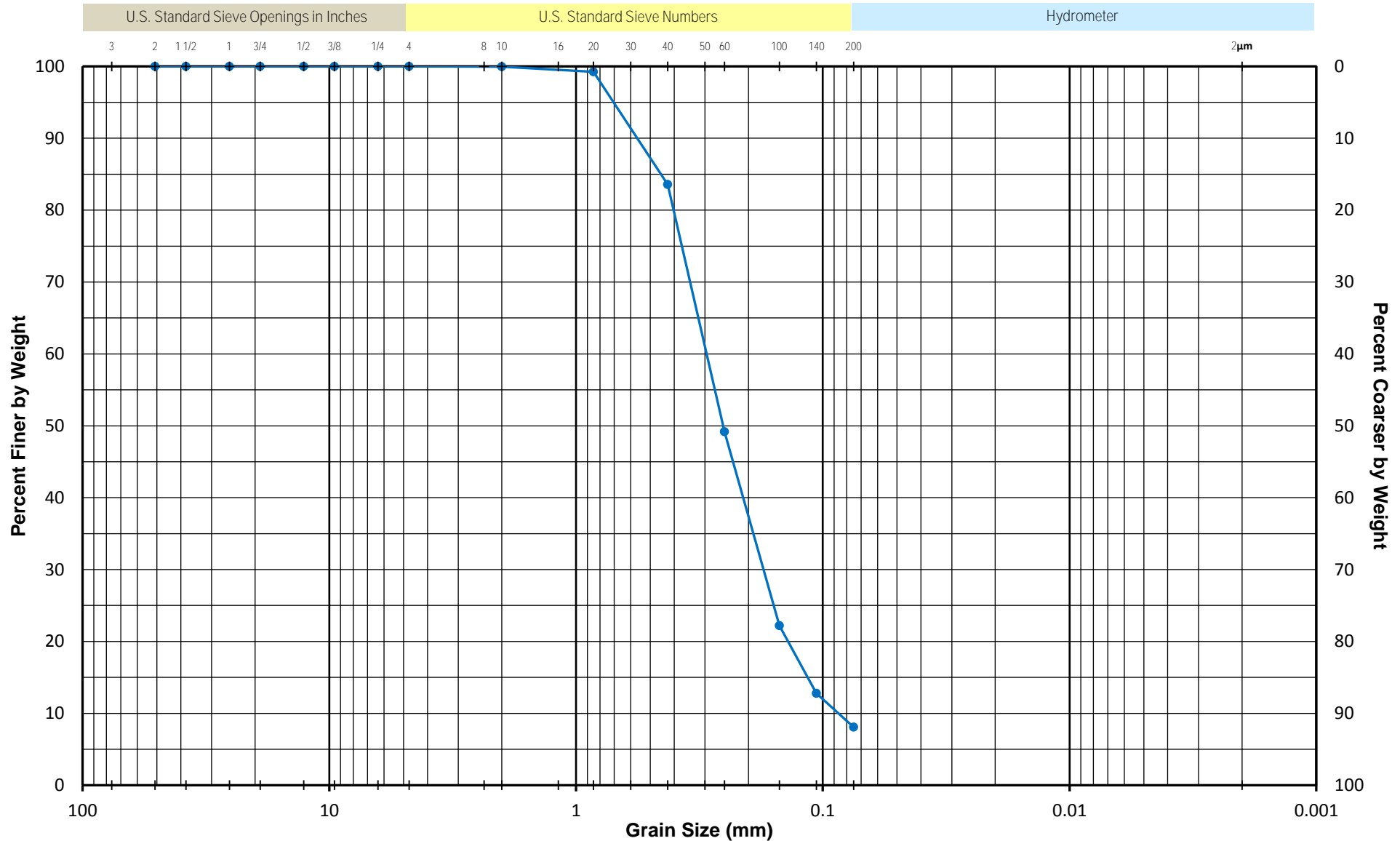


Test Depth	Core ID Section/Sample	Material Description
4.0 ft	VC34 2-4	Gray Fine to Medium Sand

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

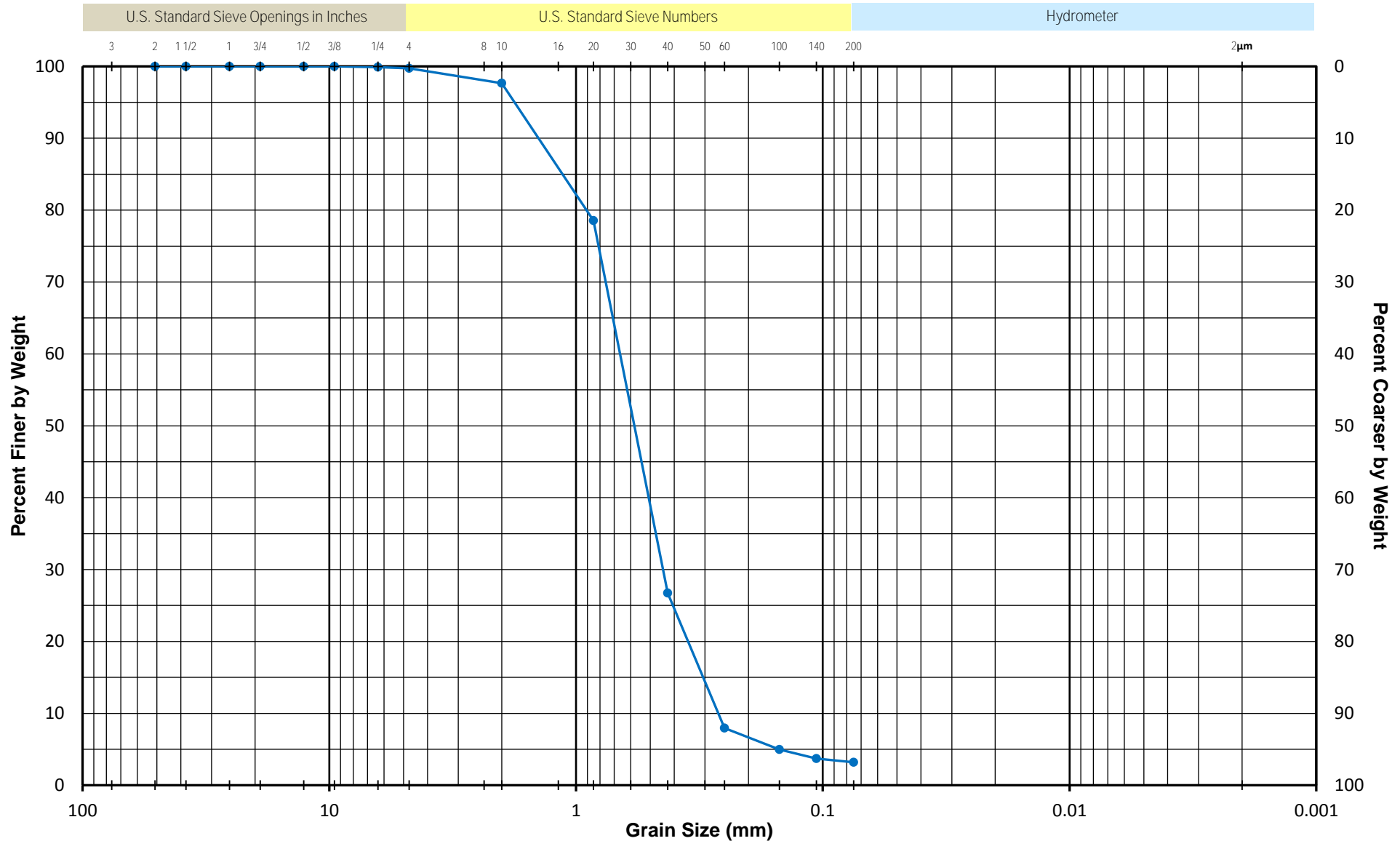


Test Depth	Core ID Section/Sample	Material Description
6.0 ft	VC34 4-6	Dark Gray Fine to Medium Sand with silt

GRADATION CURVES

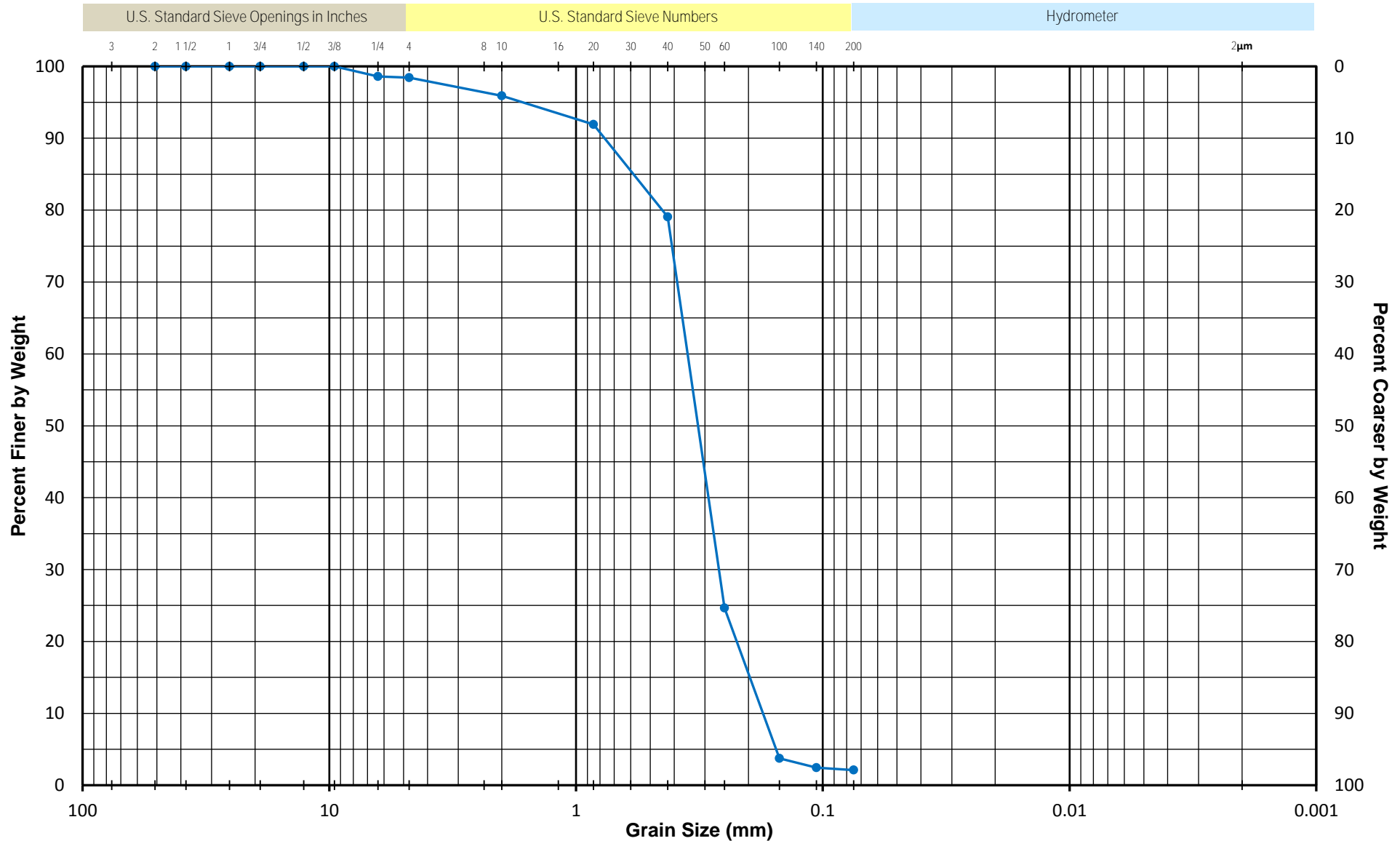
ASTM D-422, D-6913

Alpine - NESE II



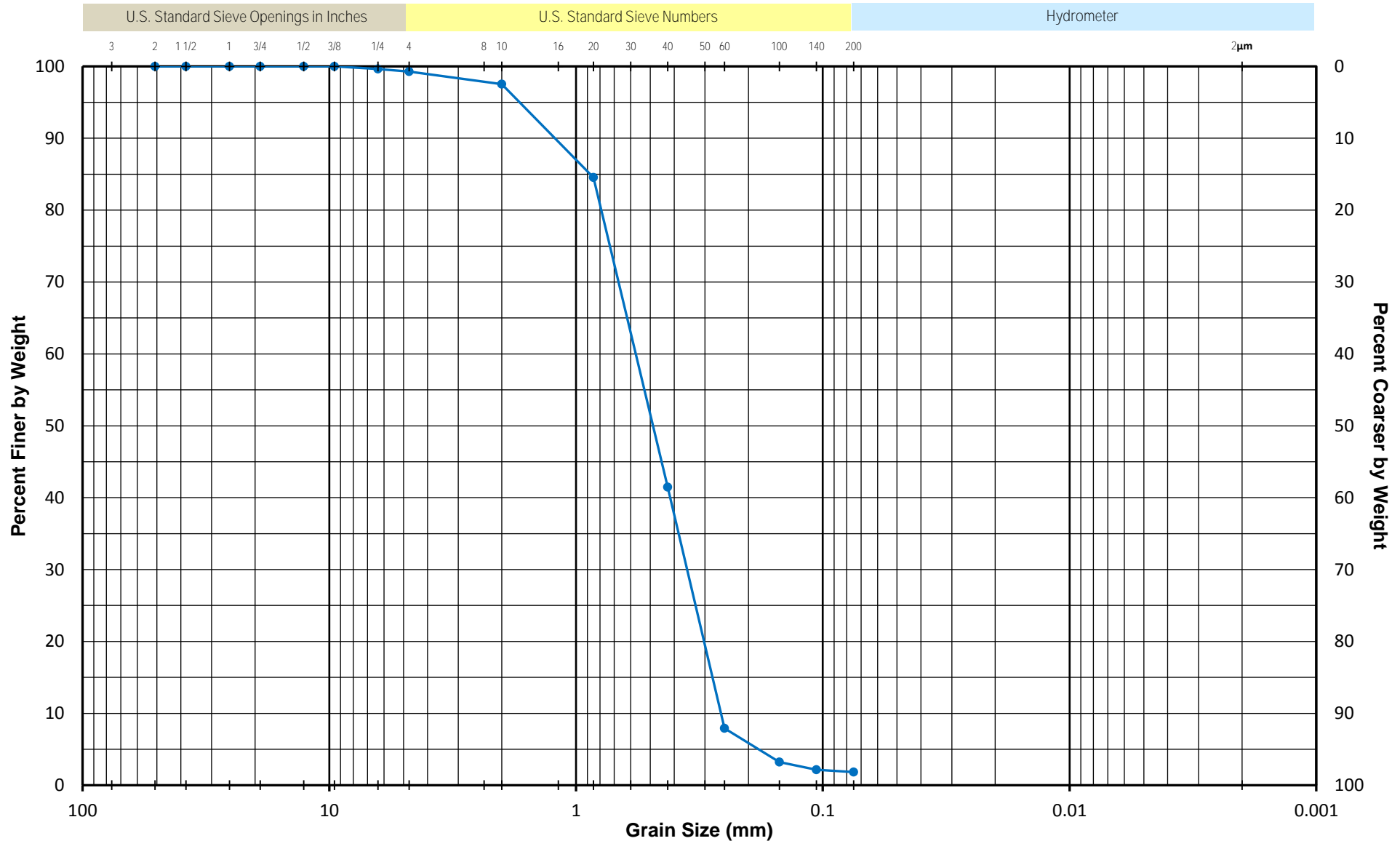
Test Depth	Core ID Section/Sample	Material Description
8.0 ft	VC34 6-8	Very Dark Gray Medium to Fine Sand with shell fragments

GRADATION CURVES
 ASTM D-422, D-6913
 Alpine - NESE II



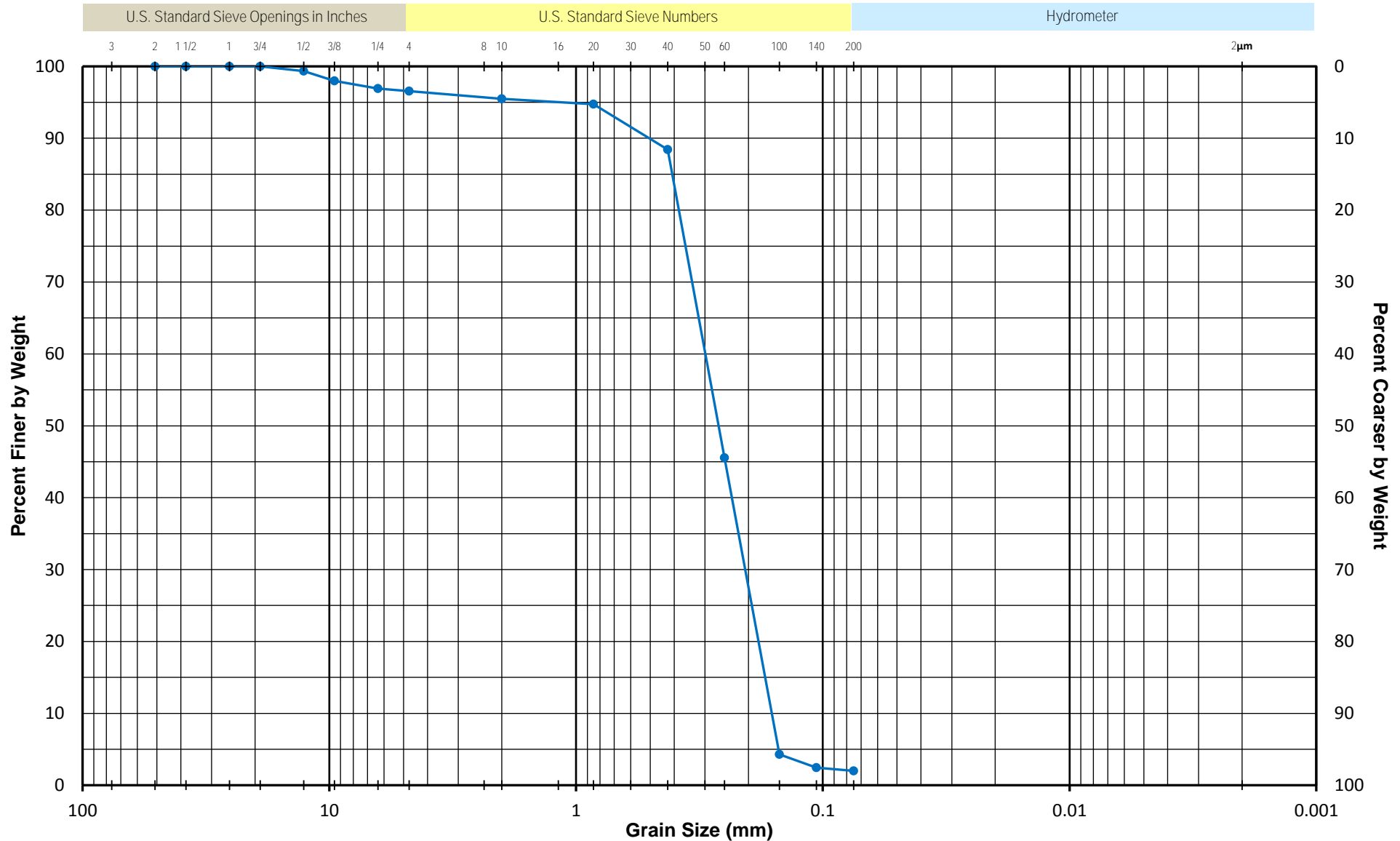
Test Depth	Core ID Section/Sample	Material Description
10.0 ft	VC34 8-10	Black Fine to Medium Sand

GRADATION CURVES
 ASTM D-422, D-6913
 Alpine - NESE II



Test Depth	Core ID Section/Sample	Material Description
•—• 12.0 ft	VC34 10-12	Dark Grayish Brown Medium to Fine Sand

GRADATION CURVES
 ASTM D-422, D-6913
 Alpine - NESE II

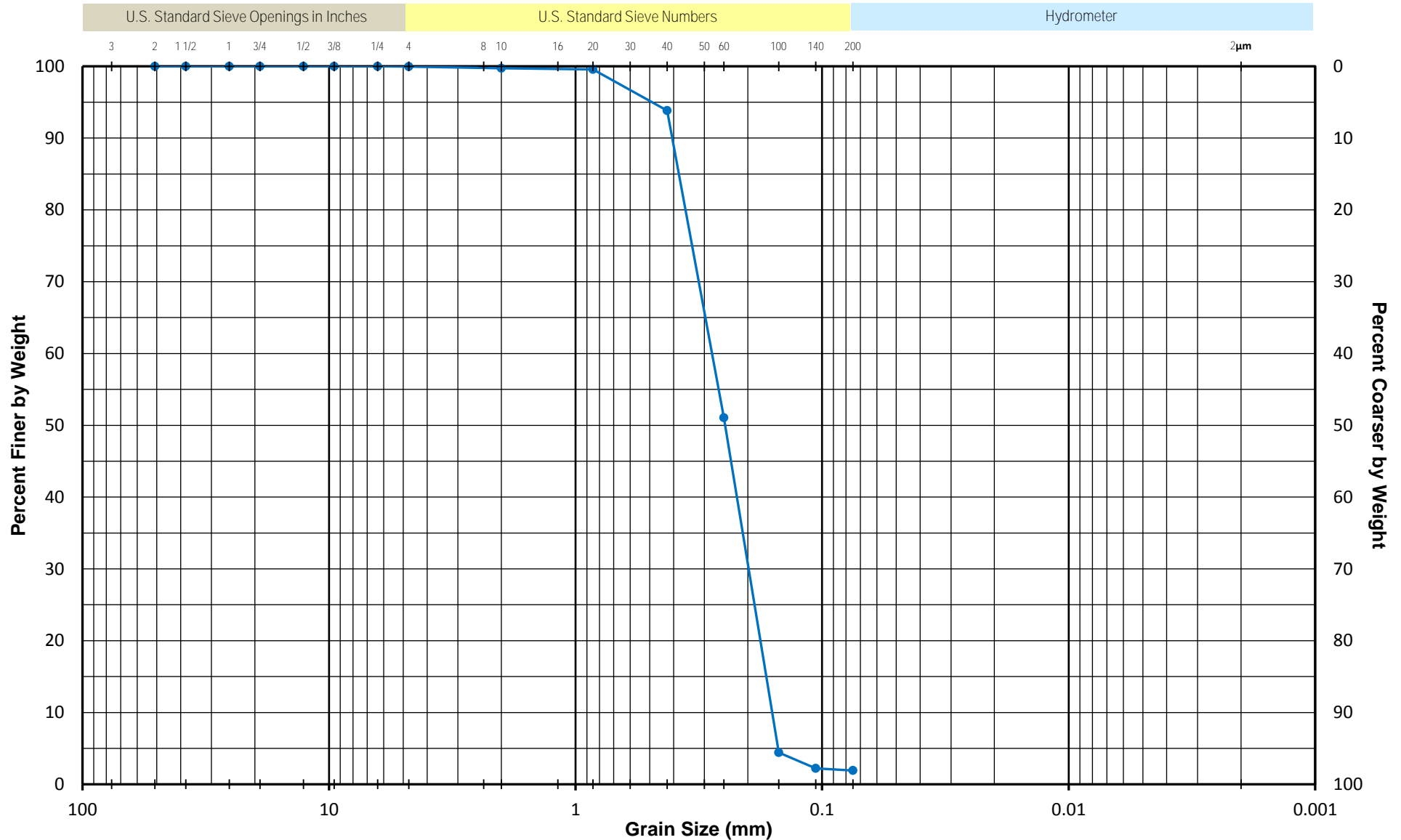


Test Depth	Core ID Section/Sample	Material Description
0.5 ft	VC42 0-2	Dark Gray Fine to Medium Sand with shells

GRADATION CURVES

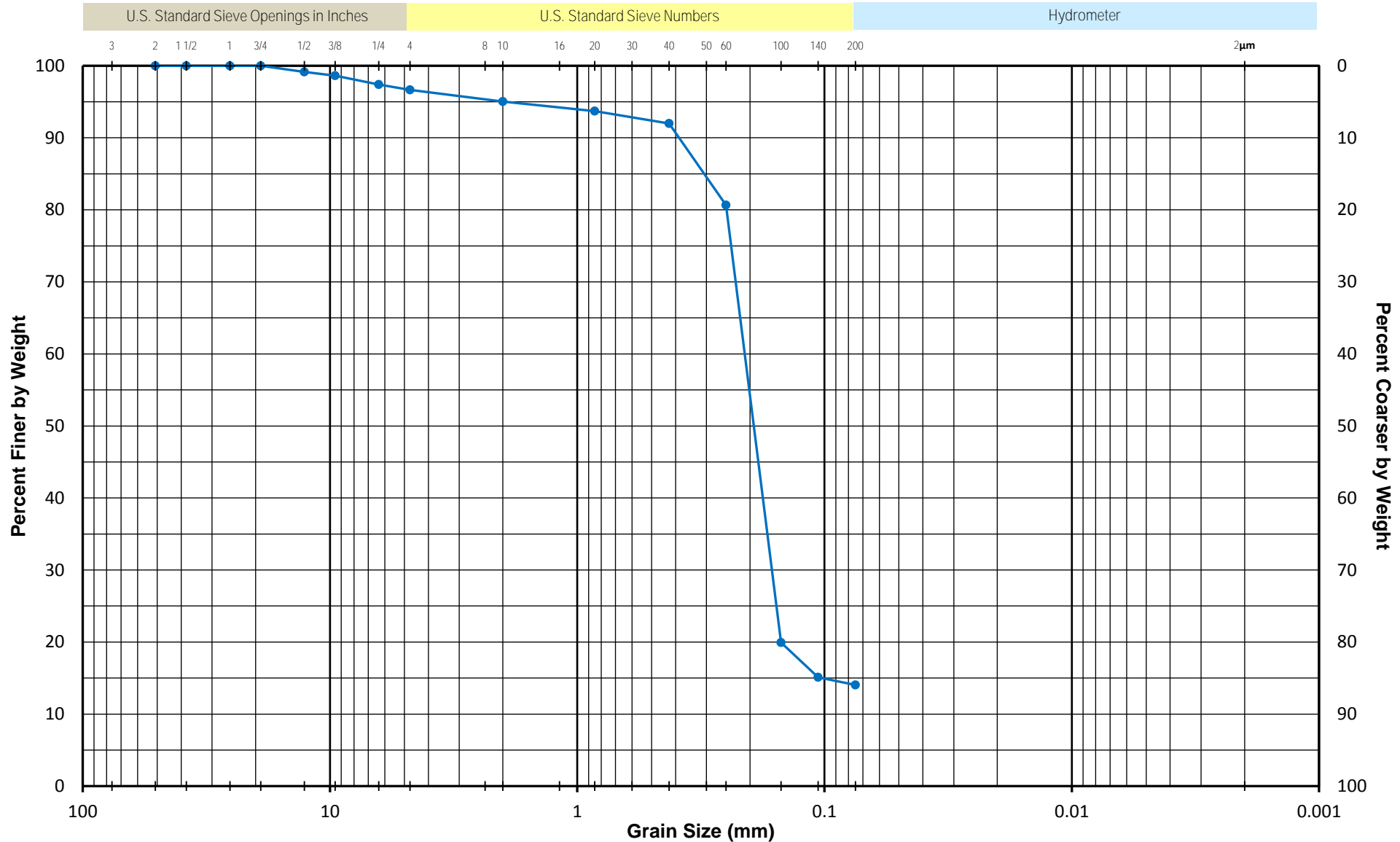
ASTM D-422, D-6913

Alpine - NESE II



Test Depth	Core ID Section/Sample	Material Description
•—• 2.0 ft	VC42 0-2	Gray Fine to Medium Sand

GRADATION CURVES
 ASTM D-422, D-6913
 Alpine - NESE II

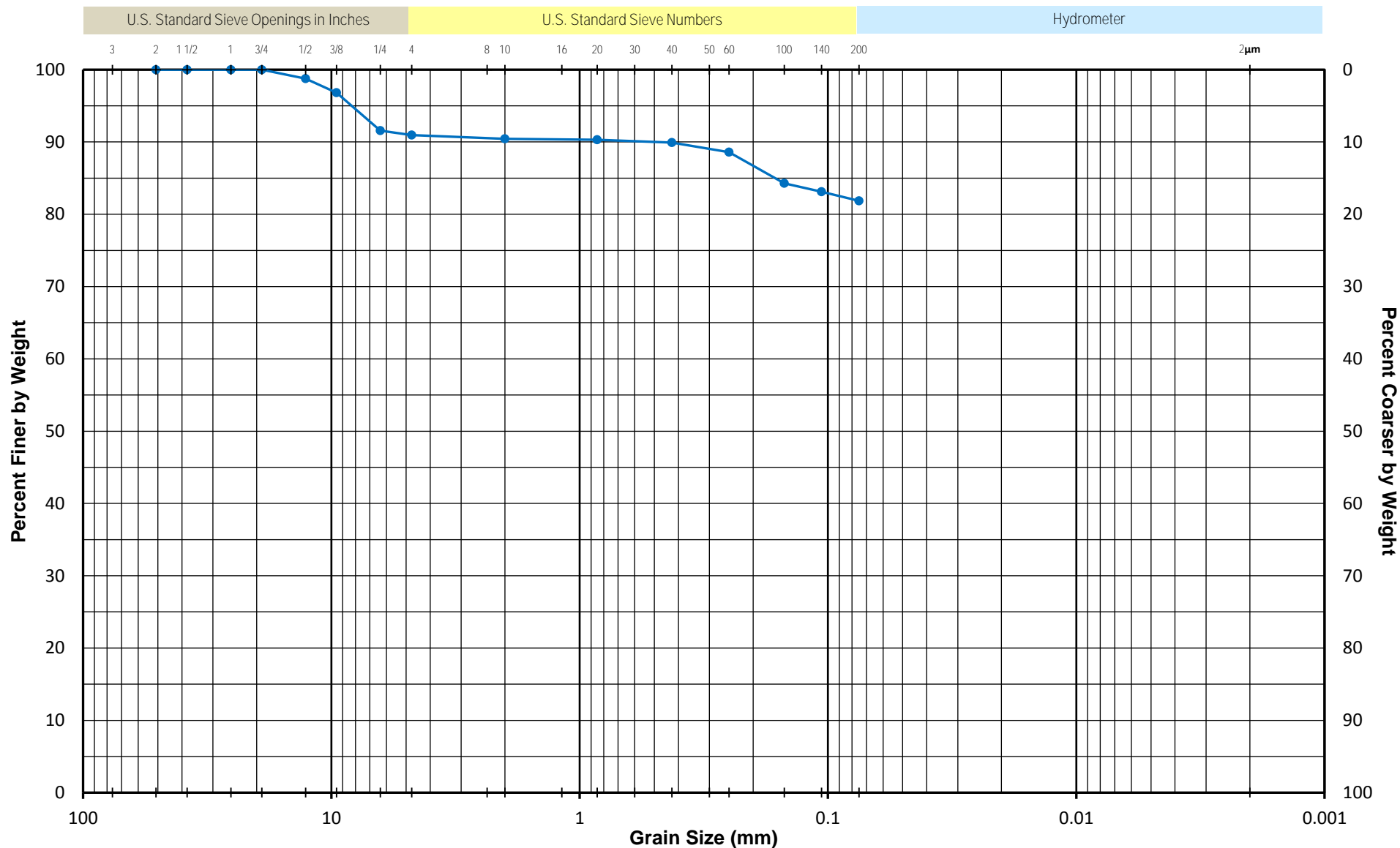


Test Depth	Core ID Section/Sample	Material Description
4.0 ft	VC42 2-4	Black Fine to Medium Sand with clay seams and shell fragments

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

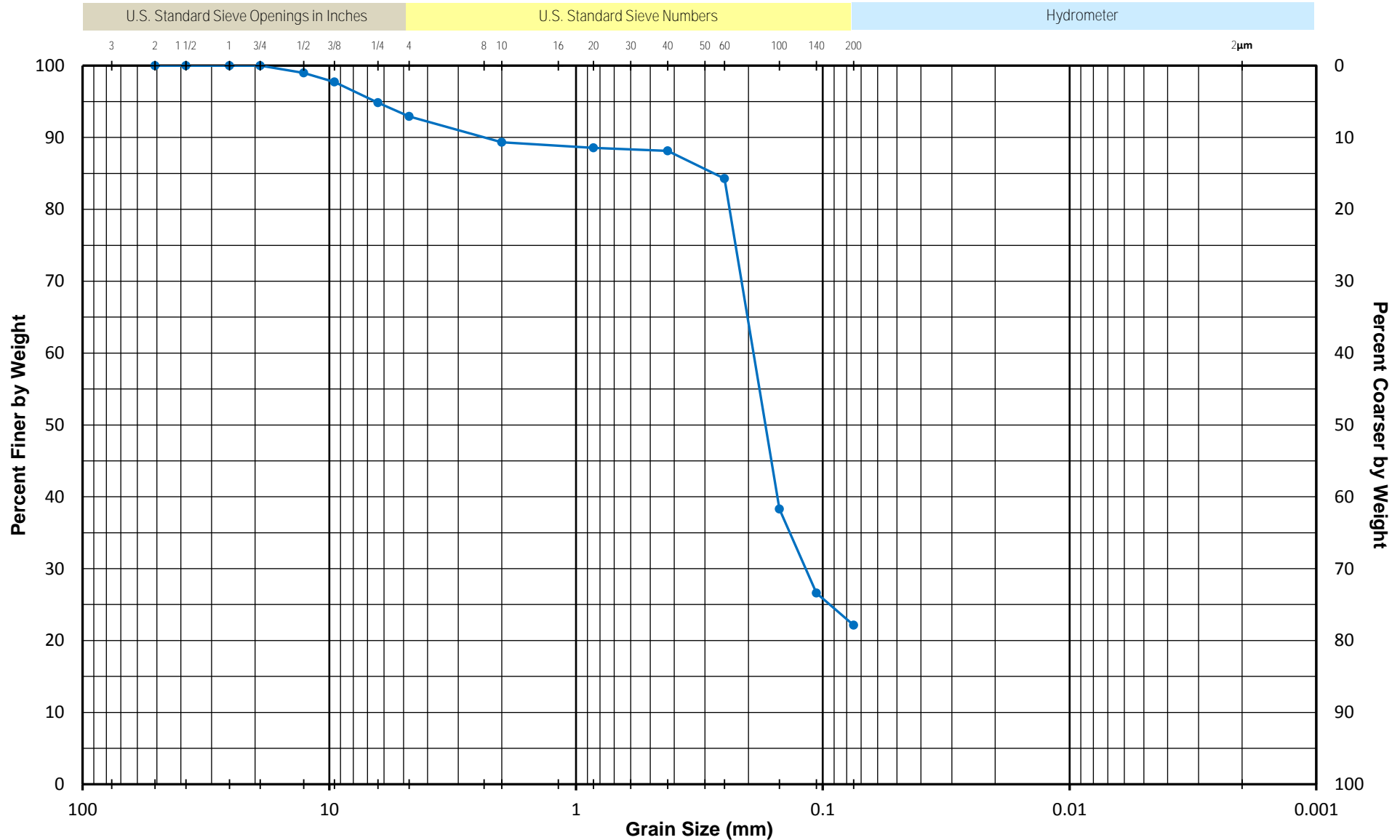


Test Depth	Core ID Section/Sample	Material Description
5.9 ft	VC42 4-6	Black Clay with sand and shells

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

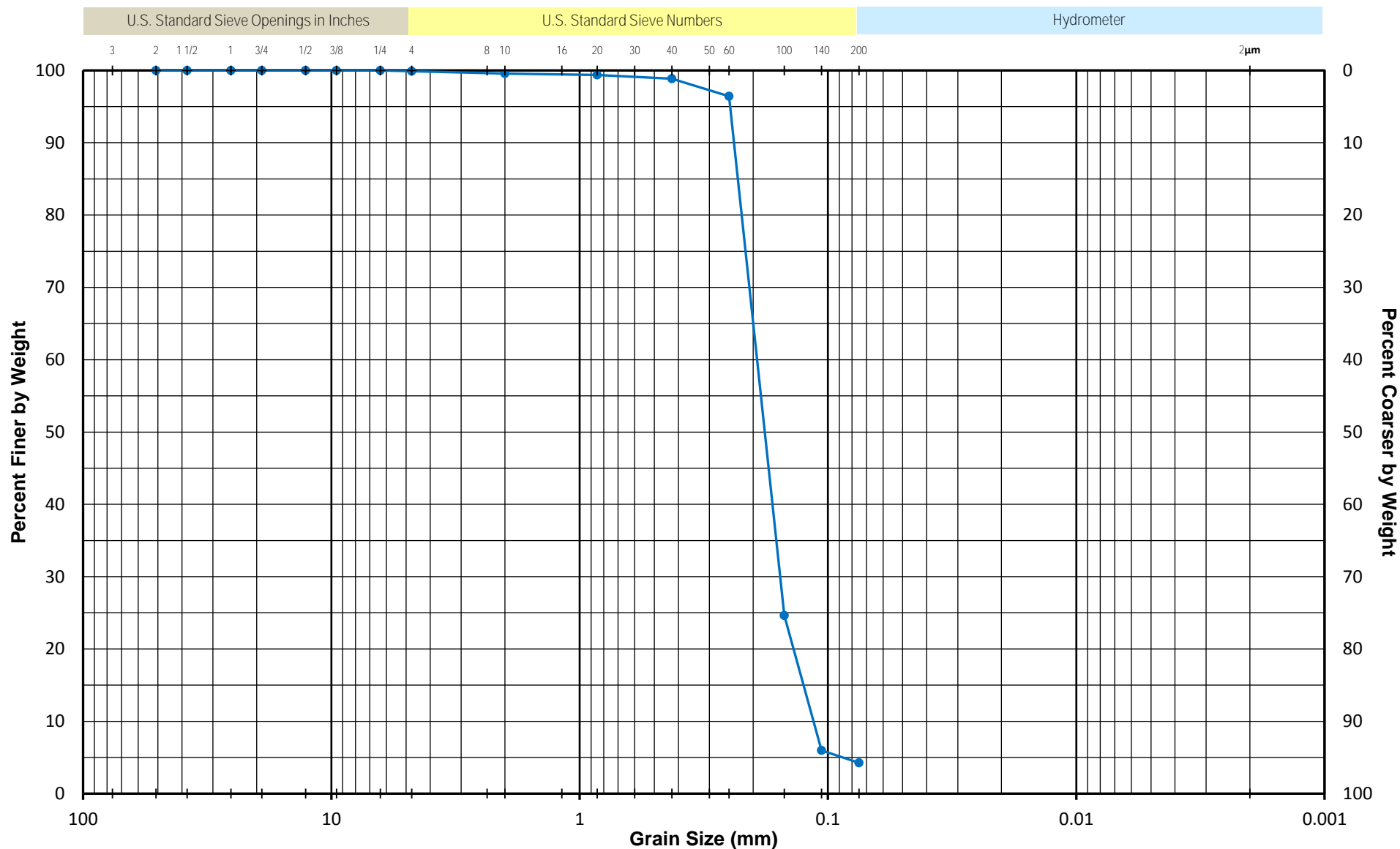


Test Depth	Core ID Section/Sample	Material Description
8.0 ft	VC42 6-8	Black Fine Sand with clay pockets and shells

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

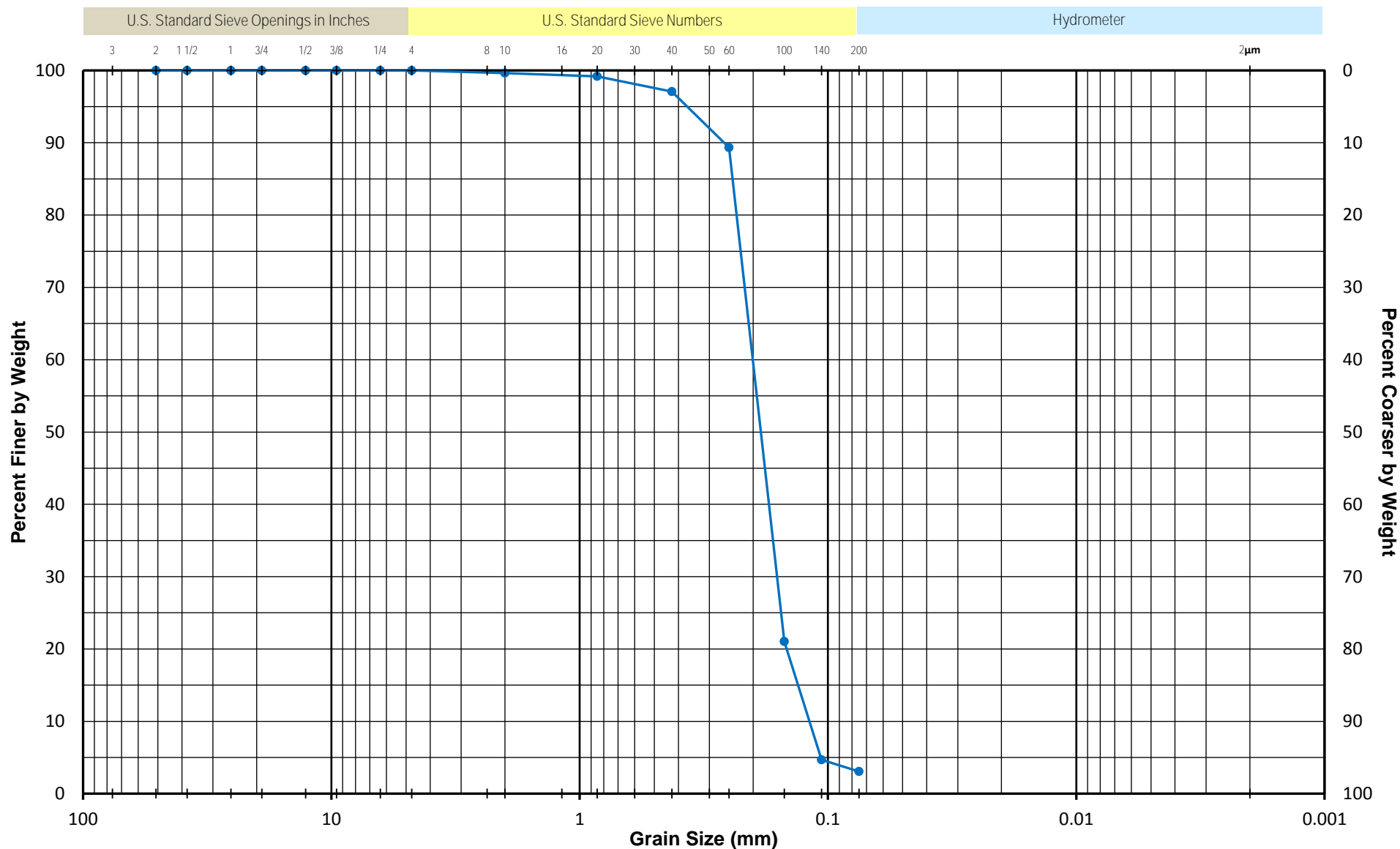


Test Depth	Core ID Section/Sample	Material Description
10.0 ft	VC42 8-10	Gray Fine Sand with shell fragments

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

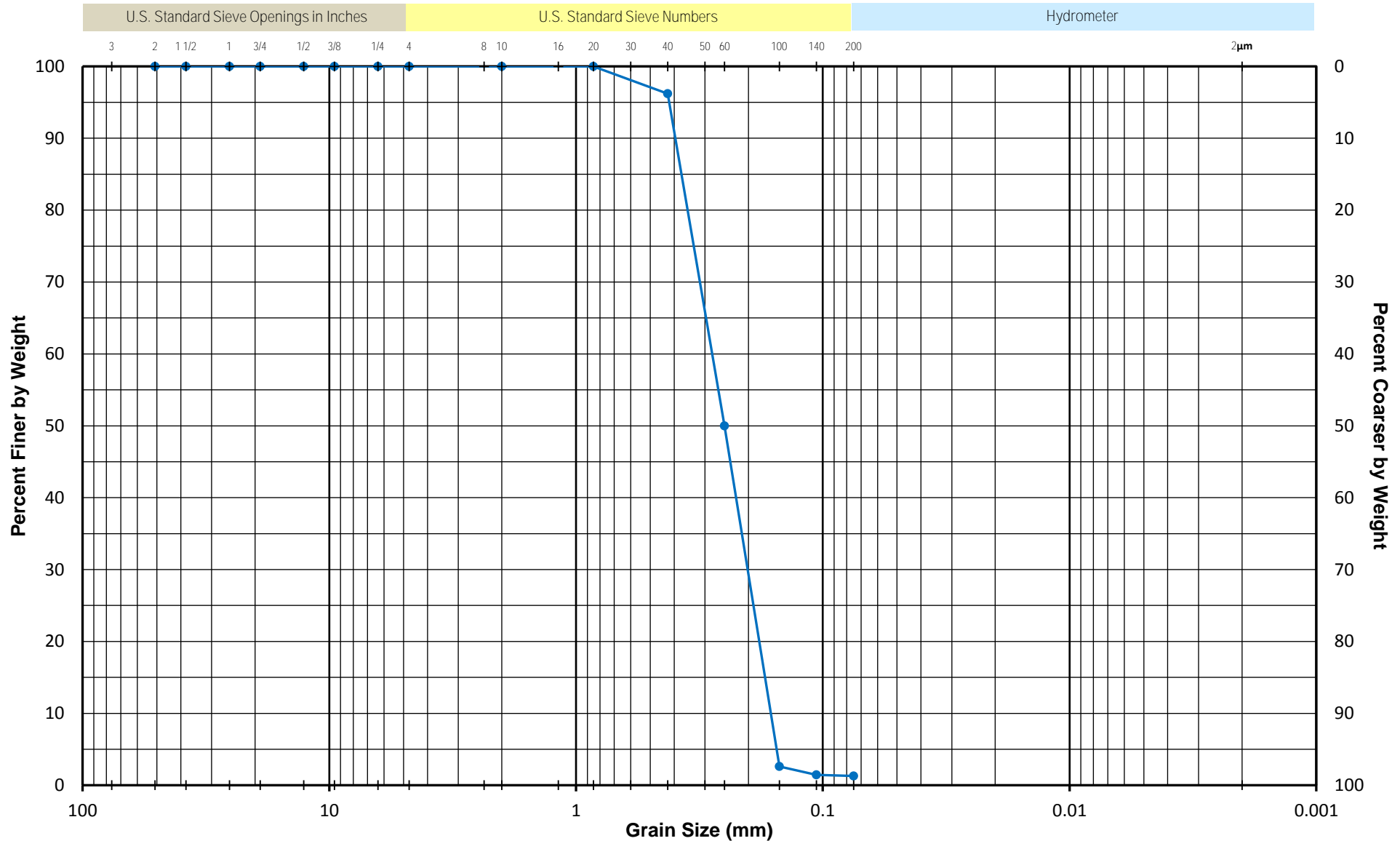


Test Depth	Core ID Section/Sample	Material Description
12.0 ft	VC42 10-12	Gray Fine Sand with shell fragments

GRADATION CURVES

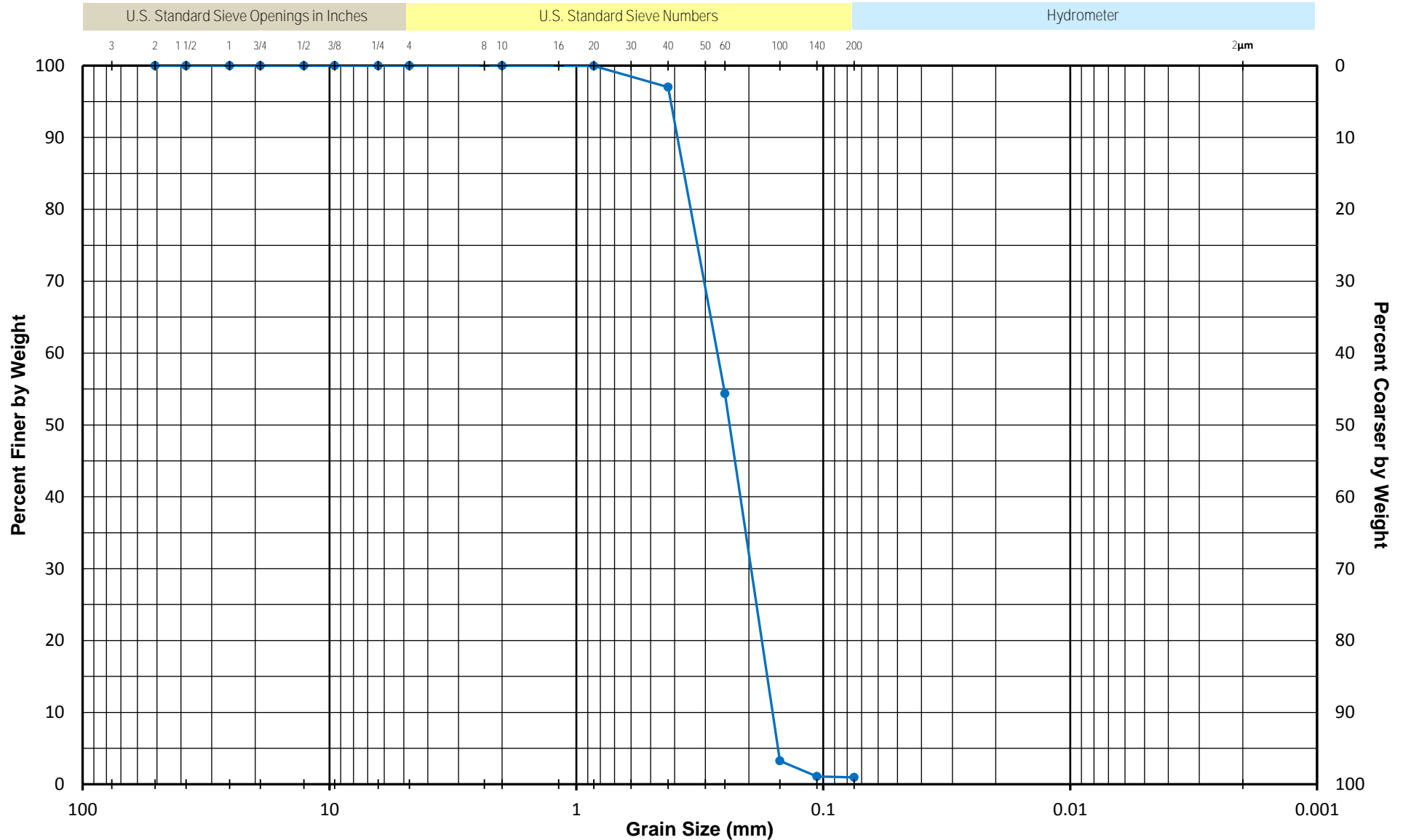
ASTM D-422, D-6913

Alpine - NESE II



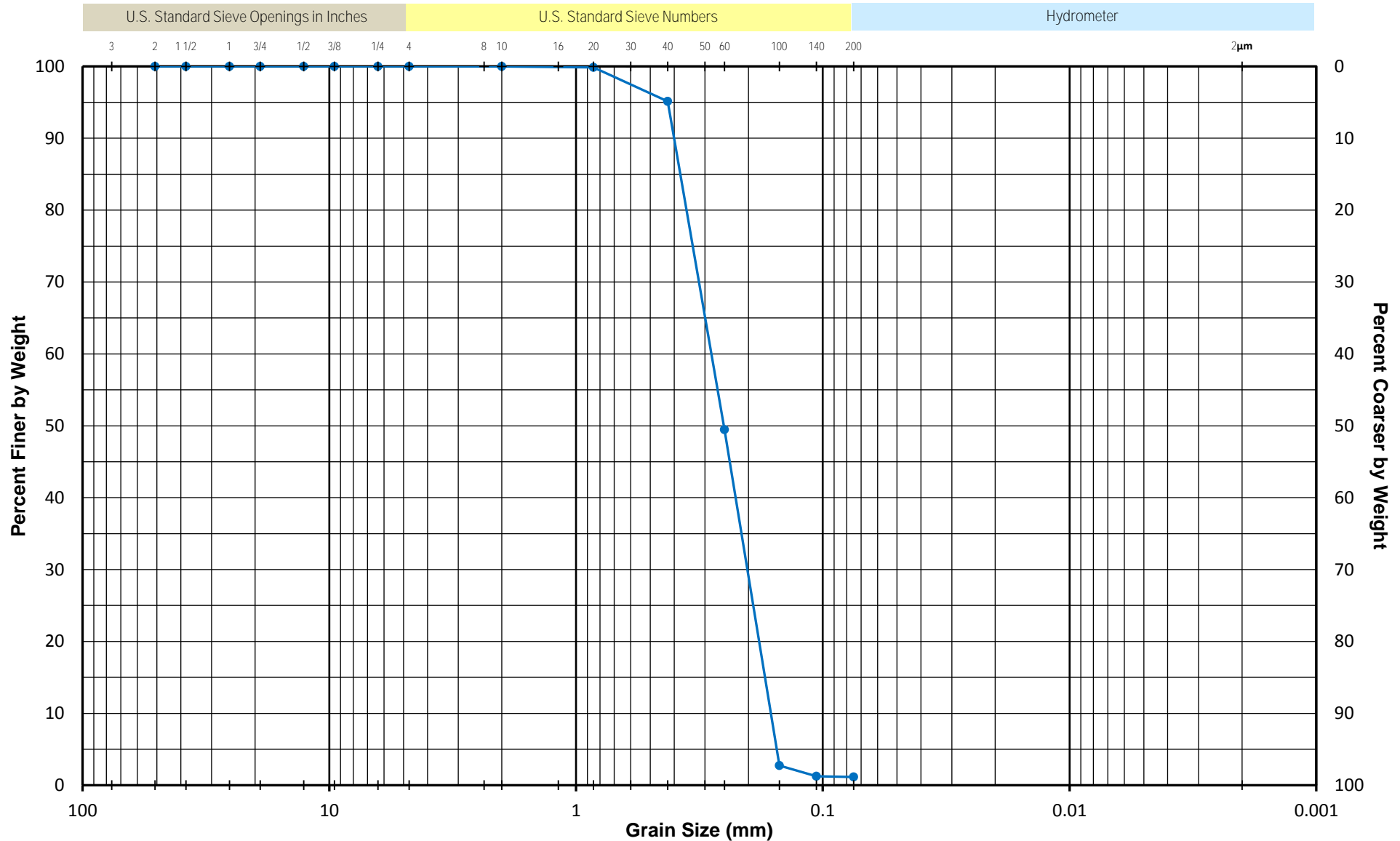
Test Depth	Core ID Section/Sample	Material Description
0.5 ft	VC43 0-2	Gray Fine Sand

GRADATION CURVES
 ASTM D-422, D-6913
 Alpine - NESE II



Test Depth	Core ID Section/Sample	Material Description
•—• 2.0 ft	VC43 0-2	Gray Fine Sand

GRADATION CURVES
 ASTM D-422, D-6913
 Alpine - NESE II

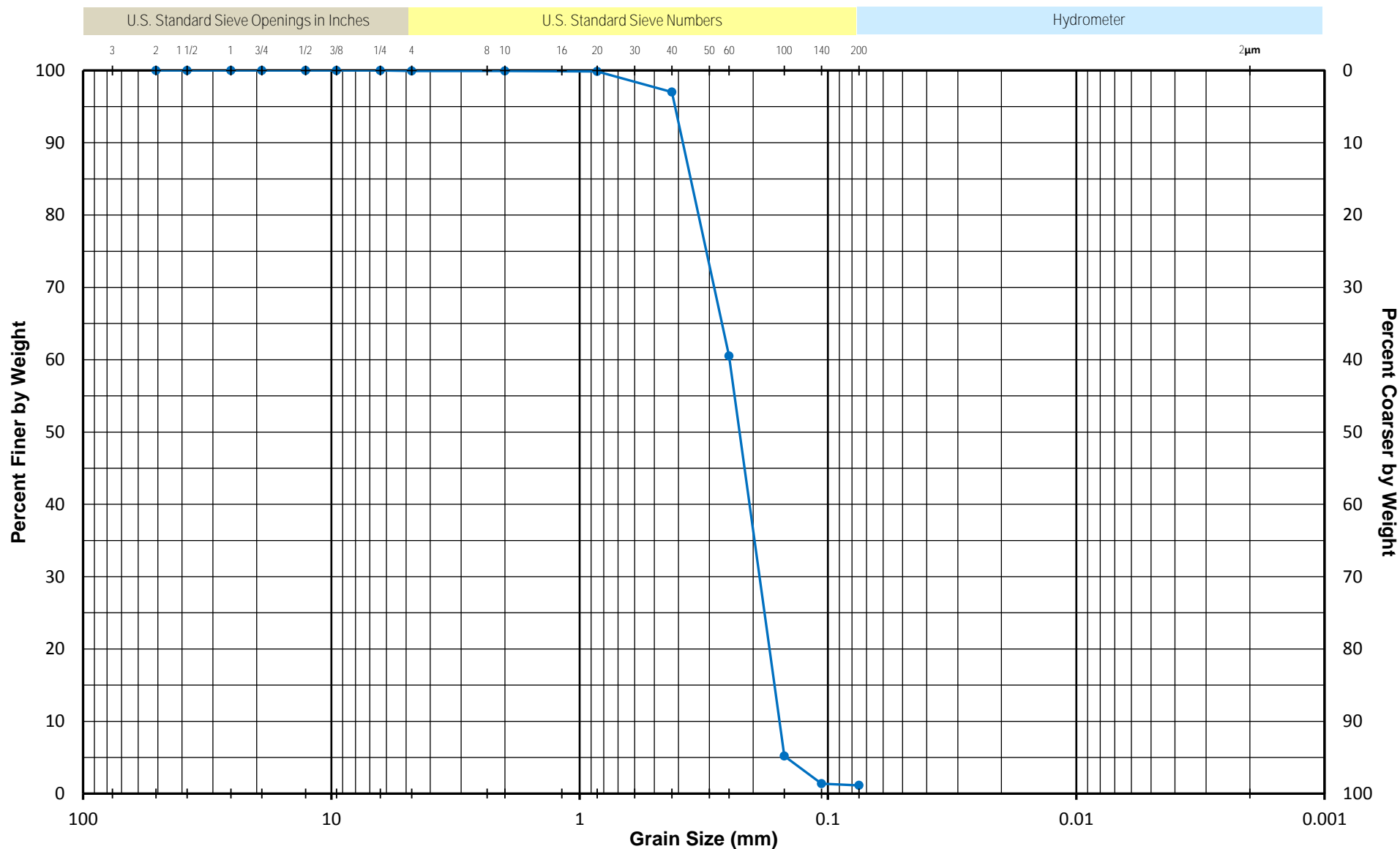


Test Depth	Core ID Section/Sample	Material Description
4.0 ft	VC43 2-4	Gray Fine Sand

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

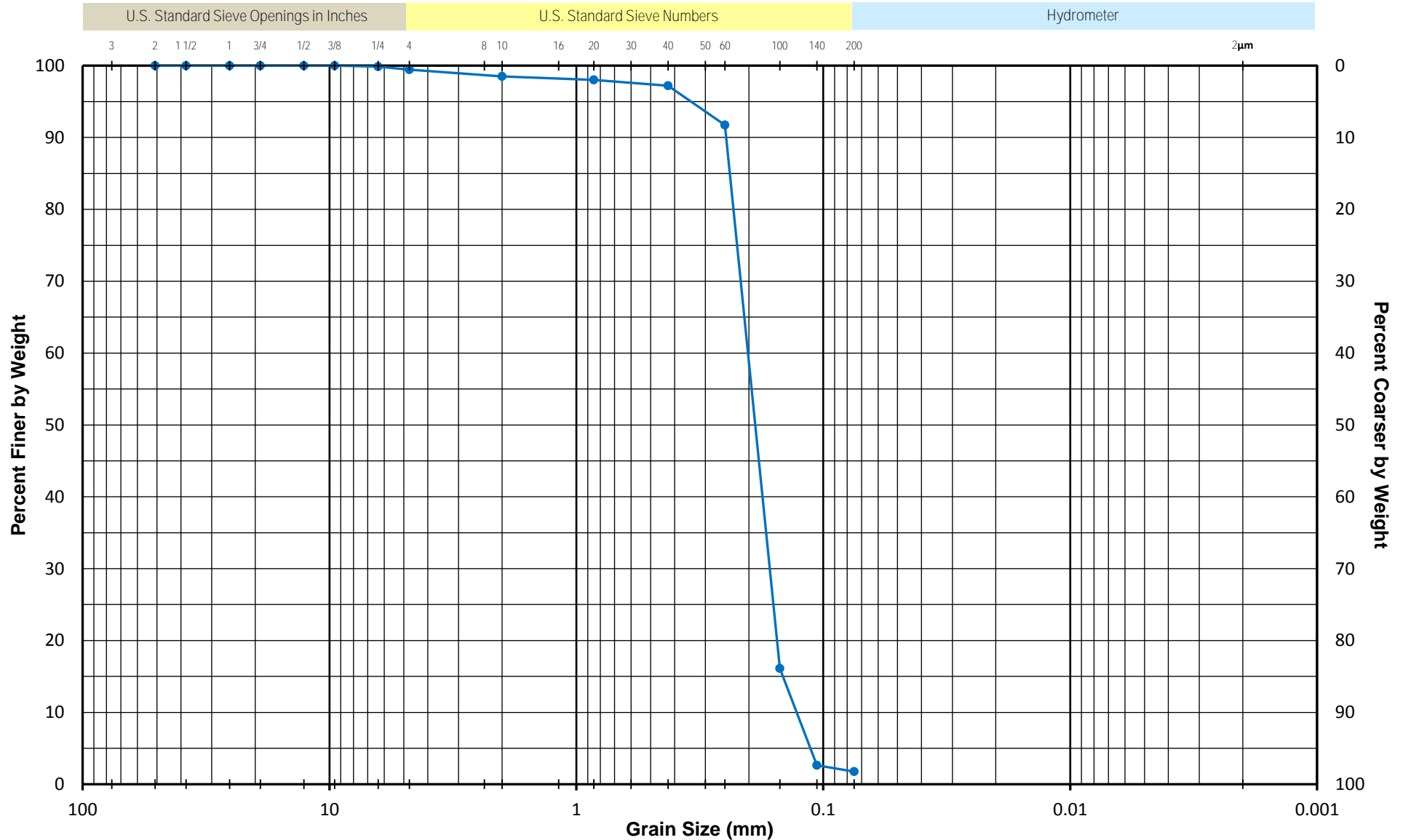


Test Depth	Core ID Section/Sample	Material Description
6.0 ft	VC43 4-6	Gray Fine Sand

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

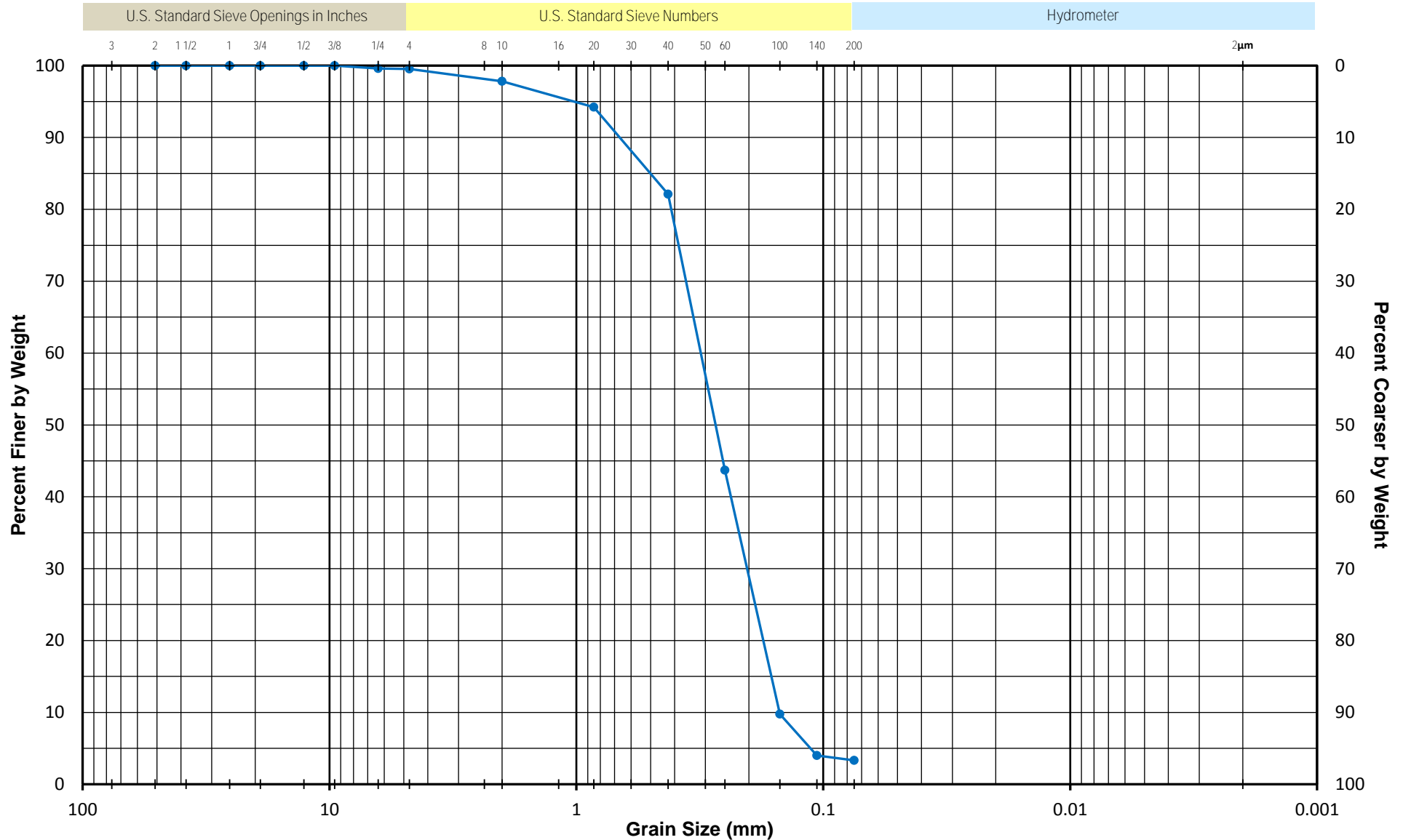


Test Depth	Core ID Section/Sample	Material Description
10.0 ft	VC43 8-10	Gray Fine Sand with shell fragments

GRADATION CURVES

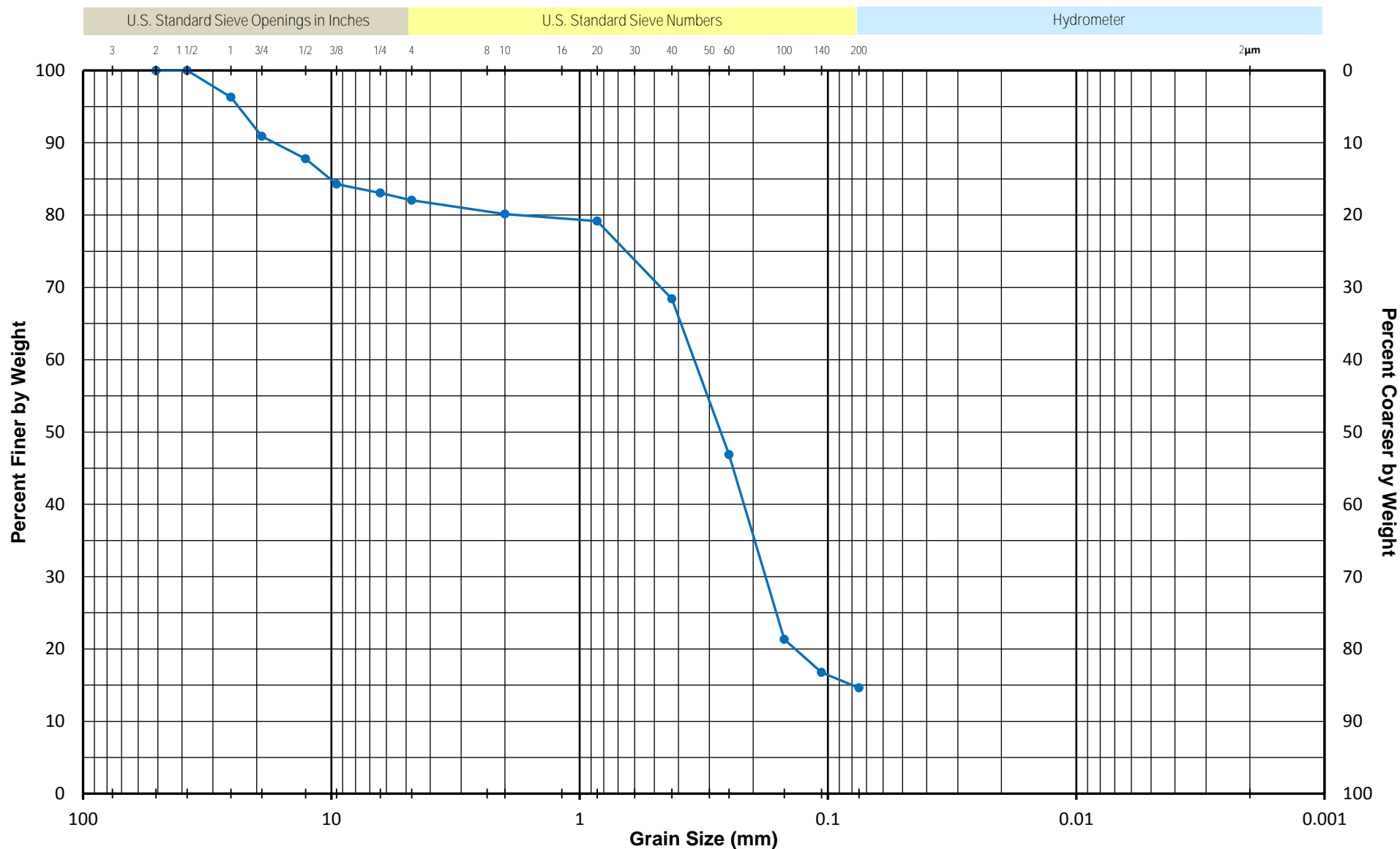
ASTM D-422, D-6913

Alpine - NESE II



Test Depth	Core ID Section/Sample	Material Description
12.0 ft	VC43 10-12	Gray Fine to Medium Sand with shell fragments

GRADATION CURVES
 ASTM D-422, D-6913
 Alpine - NESE II

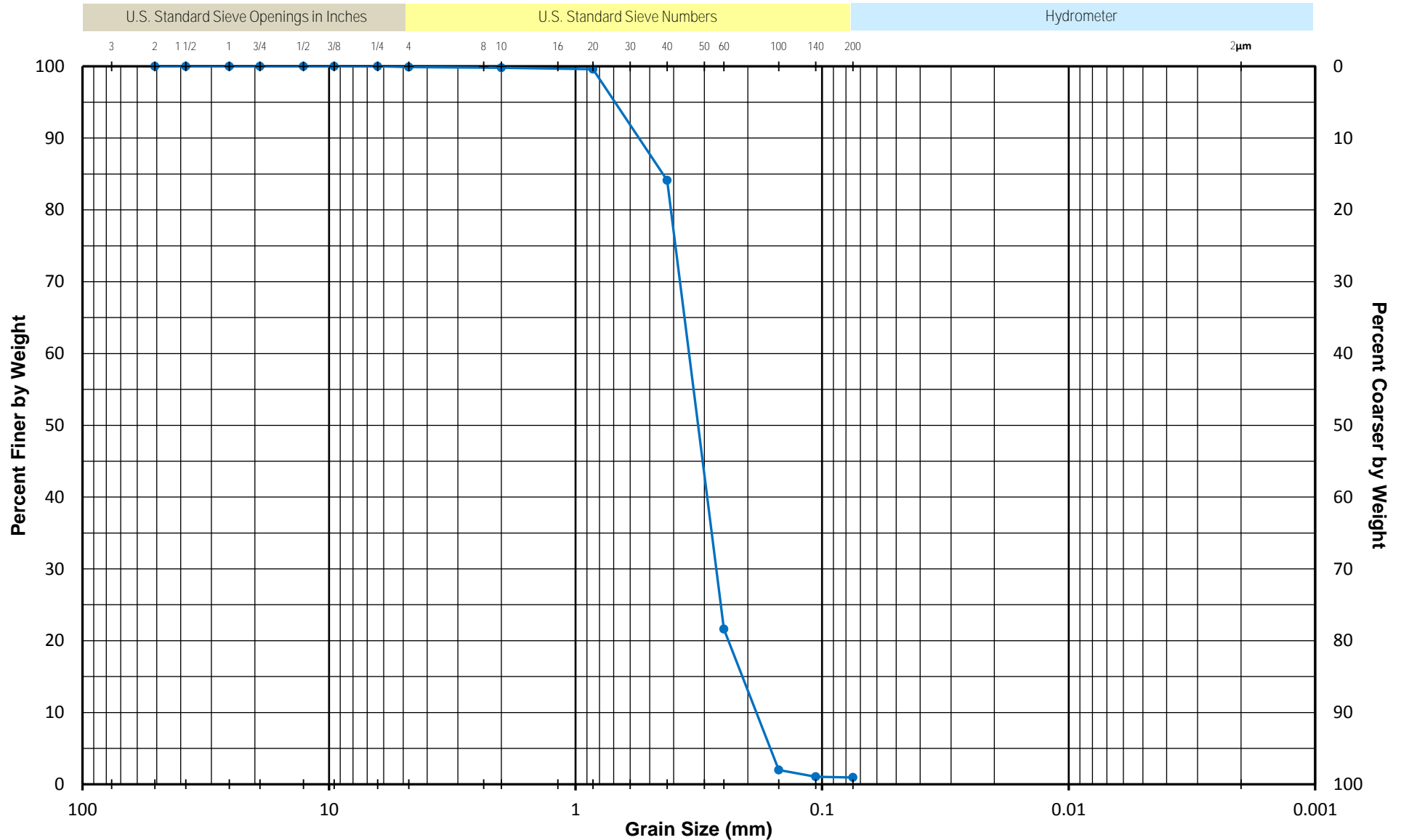


Test Depth	Core ID Section/Sample	Material Description
0.5 ft	VC46 0-2	Dark Olive Gray Clayey Sand with large shells

GRADATION CURVES

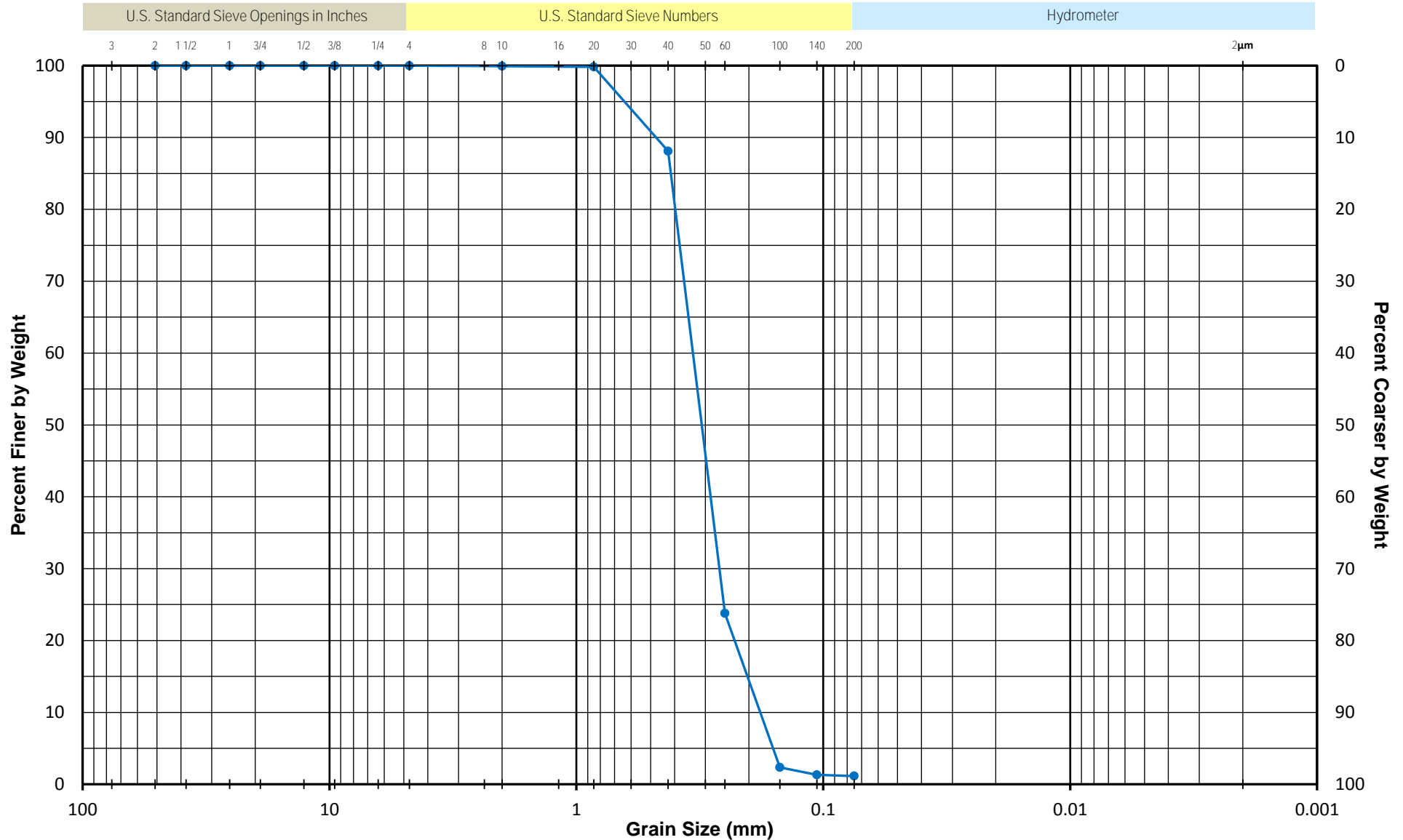
ASTM D-422, D-6913

Alpine - NESE II



Test Depth	Core ID Section/Sample	Material Description
2.0 ft	VC46 0-2	Gray Fine to Medium Sand with shell fragments

GRADATION CURVES
 ASTM D-422, D-6913
 Alpine - NESE II

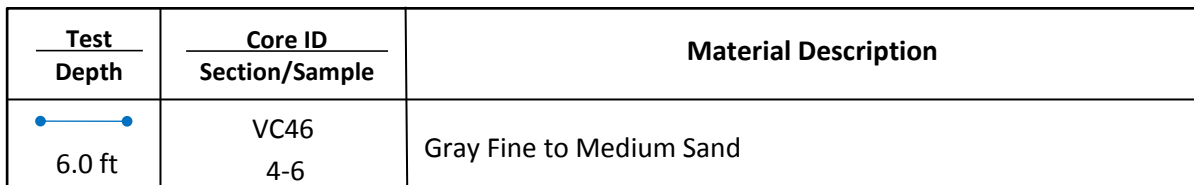


Test Depth	Core ID Section/Sample	Material Description
4.0 ft	VC46 2-4	Gray Fine to Medium Sand

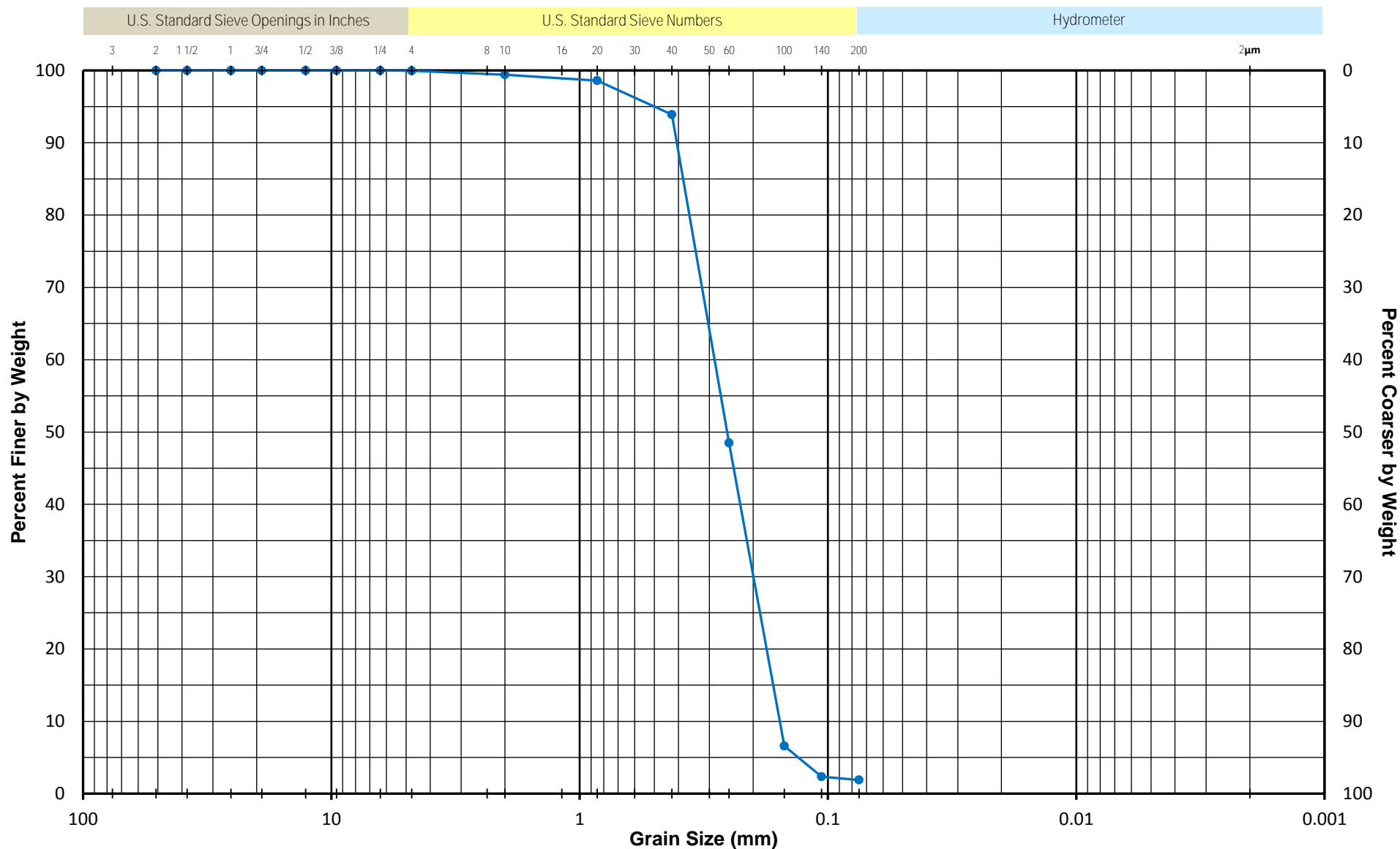
GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II



Alpine - NESE II

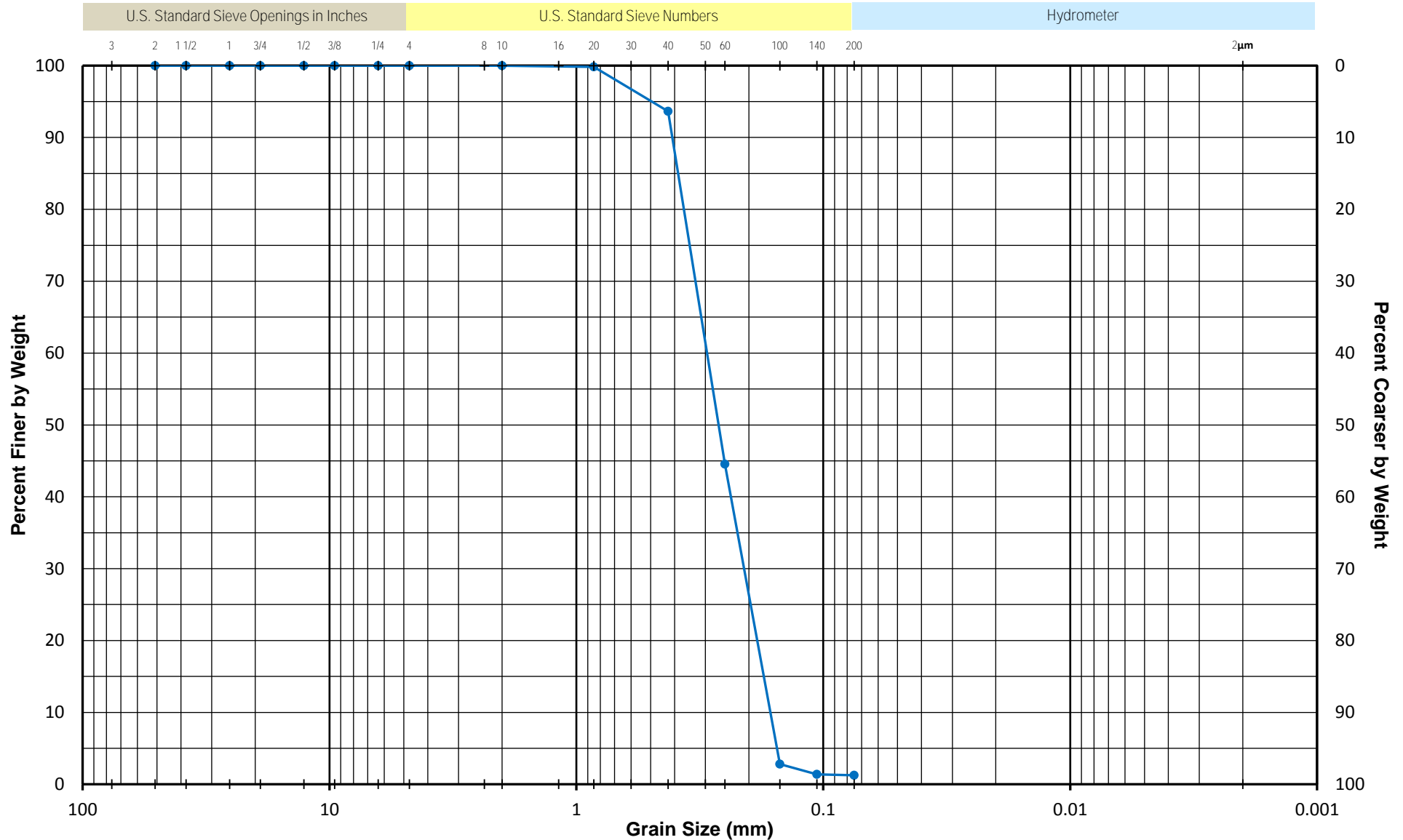


Test Depth	Core ID Section/Sample	Material Description
8.0 ft	VC46 6-8	Gray Fine to Medium Sand

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

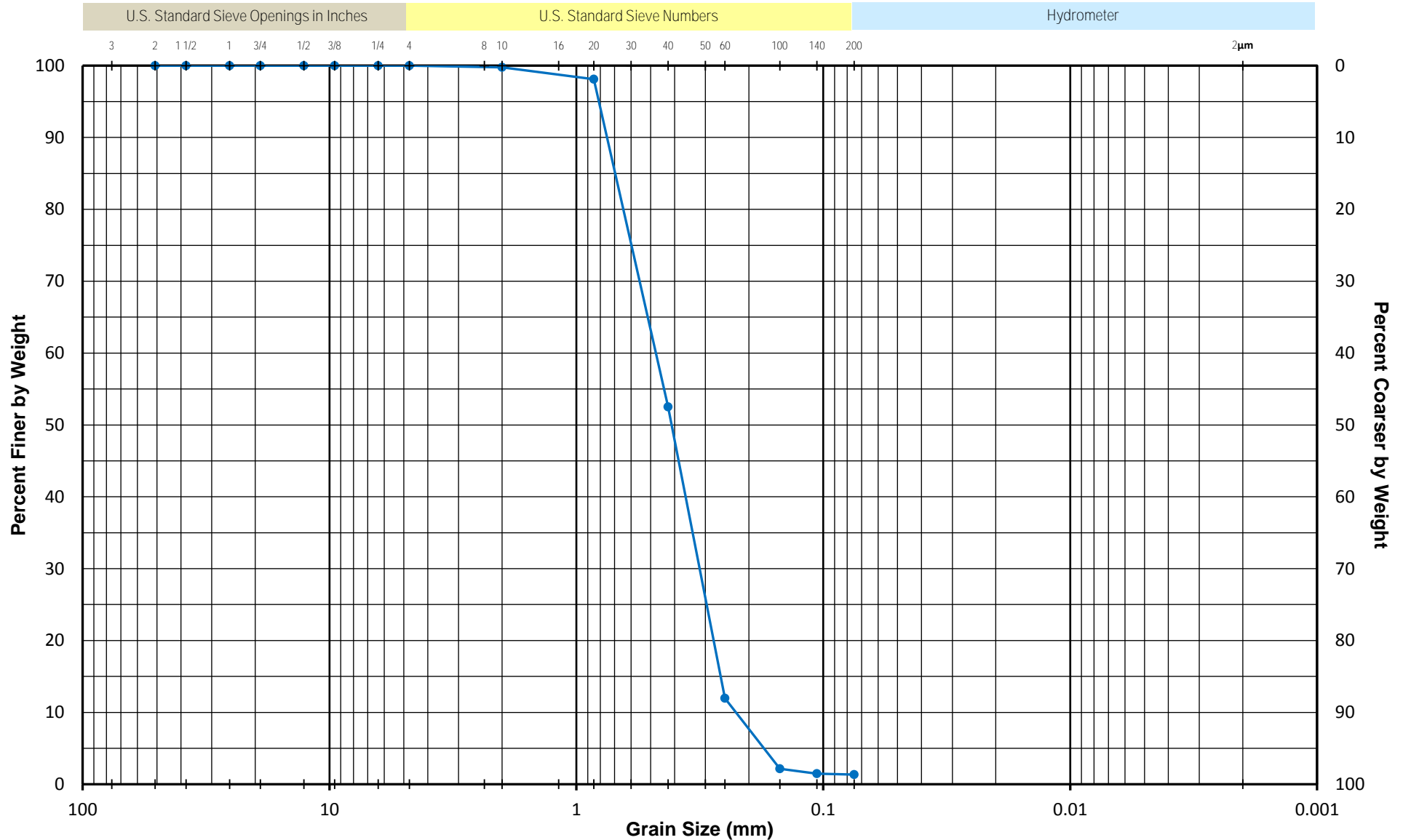


Test Depth	Core ID Section/Sample	Material Description
10.0 ft	VC46 8-10	Gray Fine to Medium Sand

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

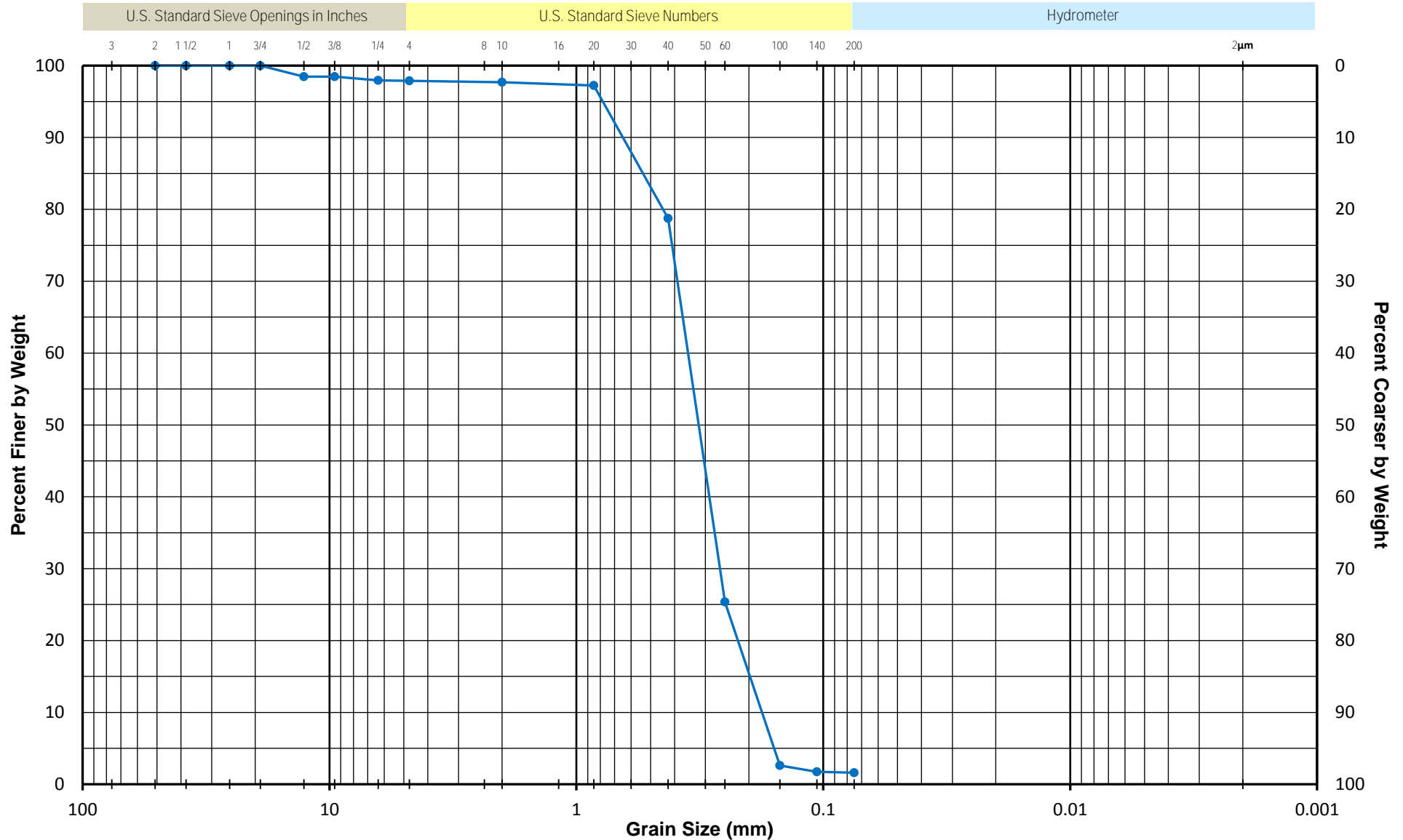


Test Depth	Core ID Section/Sample	Material Description
12.0 ft	VC46 10-12	Dark Gray Fine to Medium Sand

GRADATION CURVES

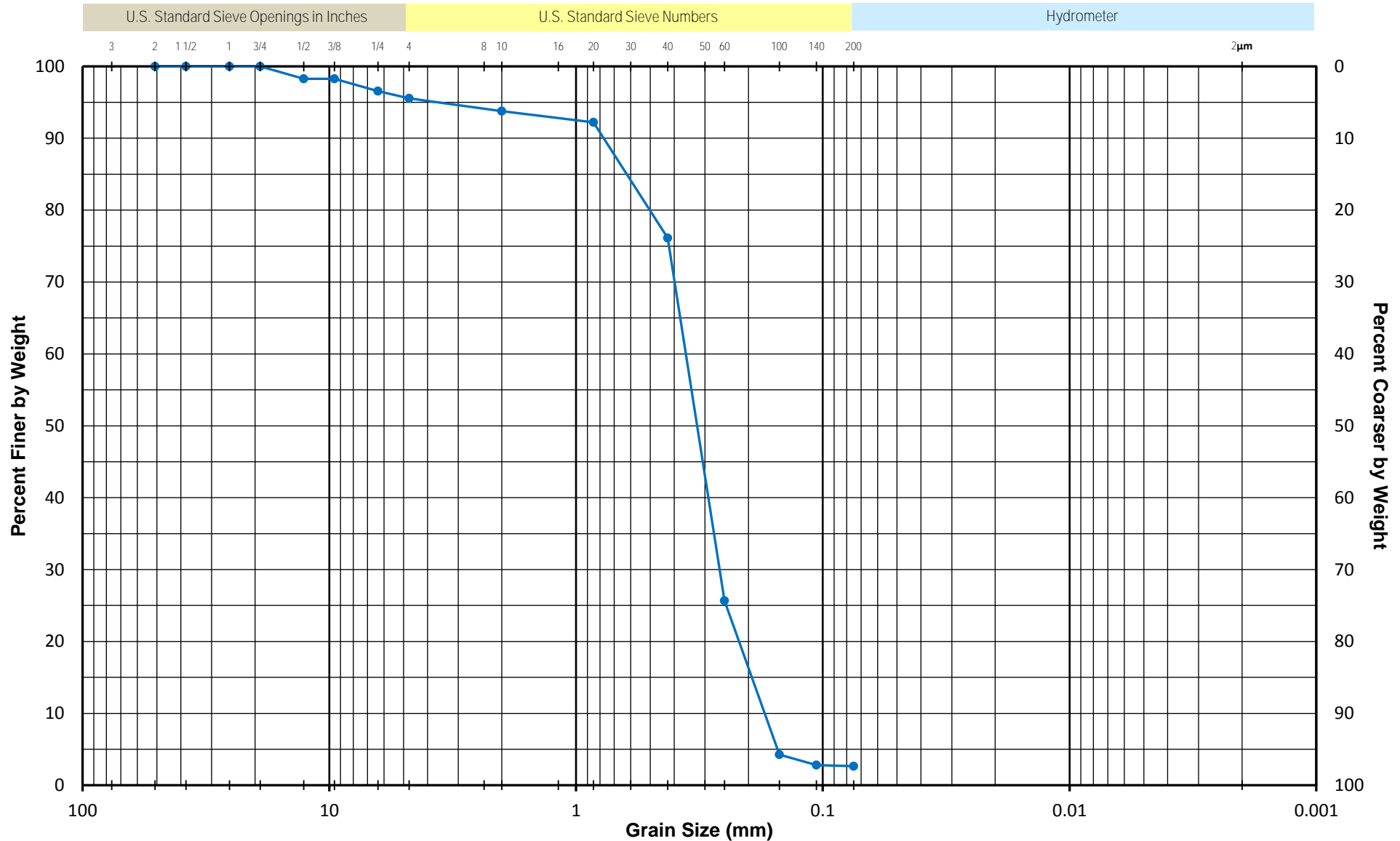
ASTM D-422, D-6913

Alpine - NESE II



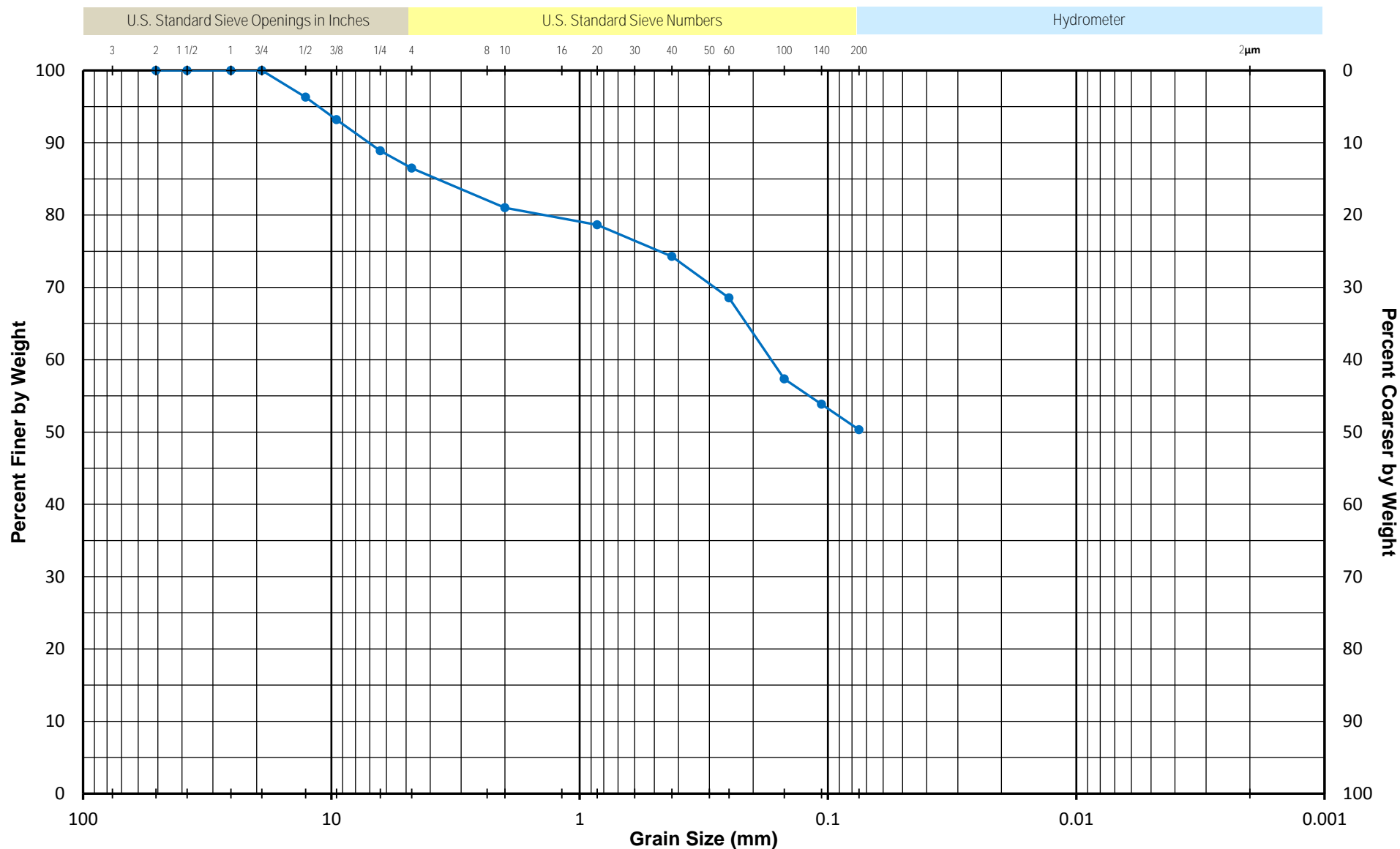
Test Depth	Core ID Section/Sample	Material Description
0.7 ft	VC47 0-2	Black Fine to Medium Sand with shell fragments

GRADATION CURVES
 ASTM D-422, D-6913
 Alpine - NESE II



Test Depth	Core ID Section/Sample	Material Description
•—• 2.0 ft	VC47 0-2	Dark Gray Fine to Medium Sand with shell fragments

GRADATION CURVES
 ASTM D-422, D-6913
 Alpine - NESE II

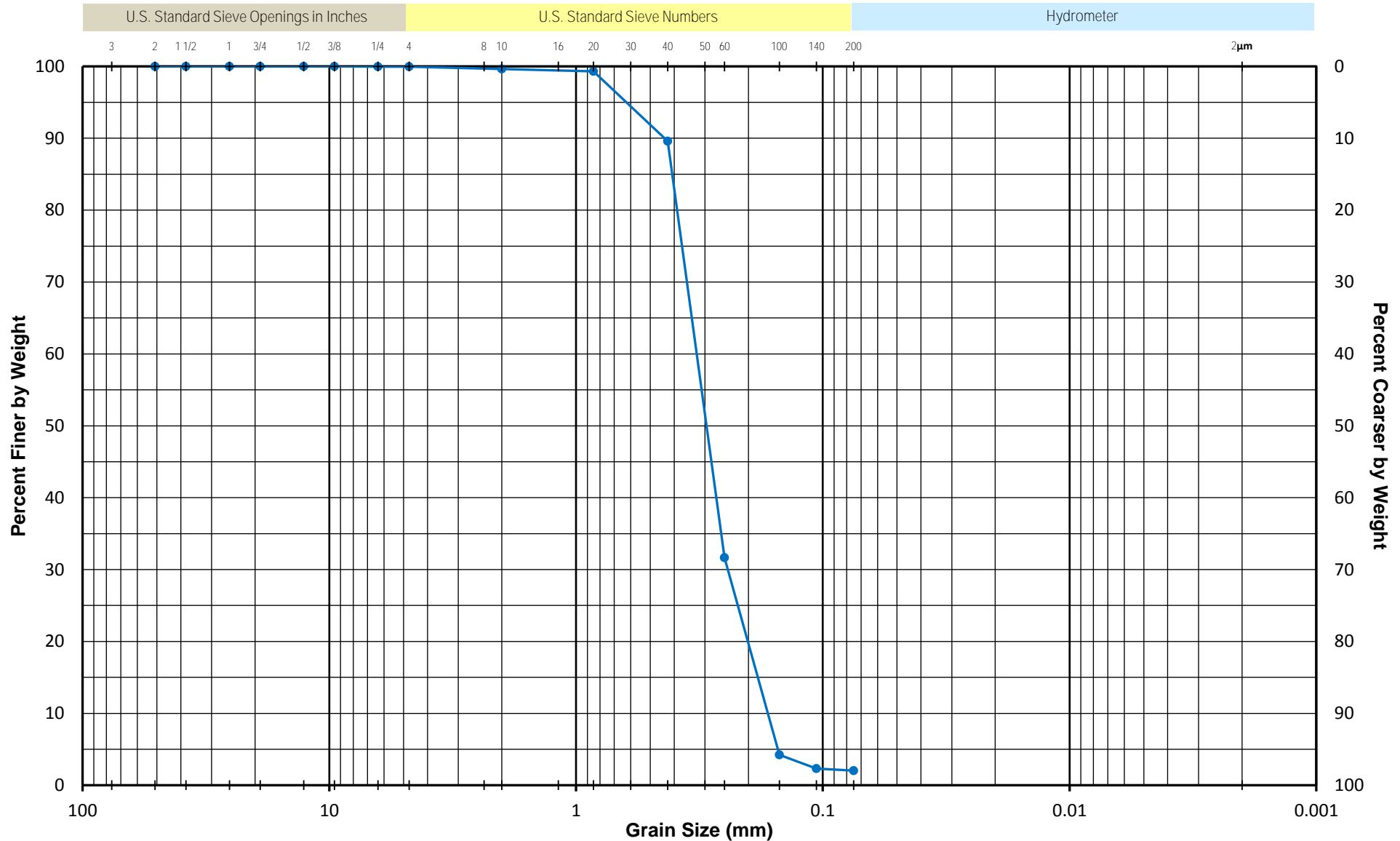


Test Depth	Core ID Section/Sample	Material Description
VC47 2-4 4.0 ft		Black Sandy Clay with shell, shell fragments, and organics

GRADATION CURVES

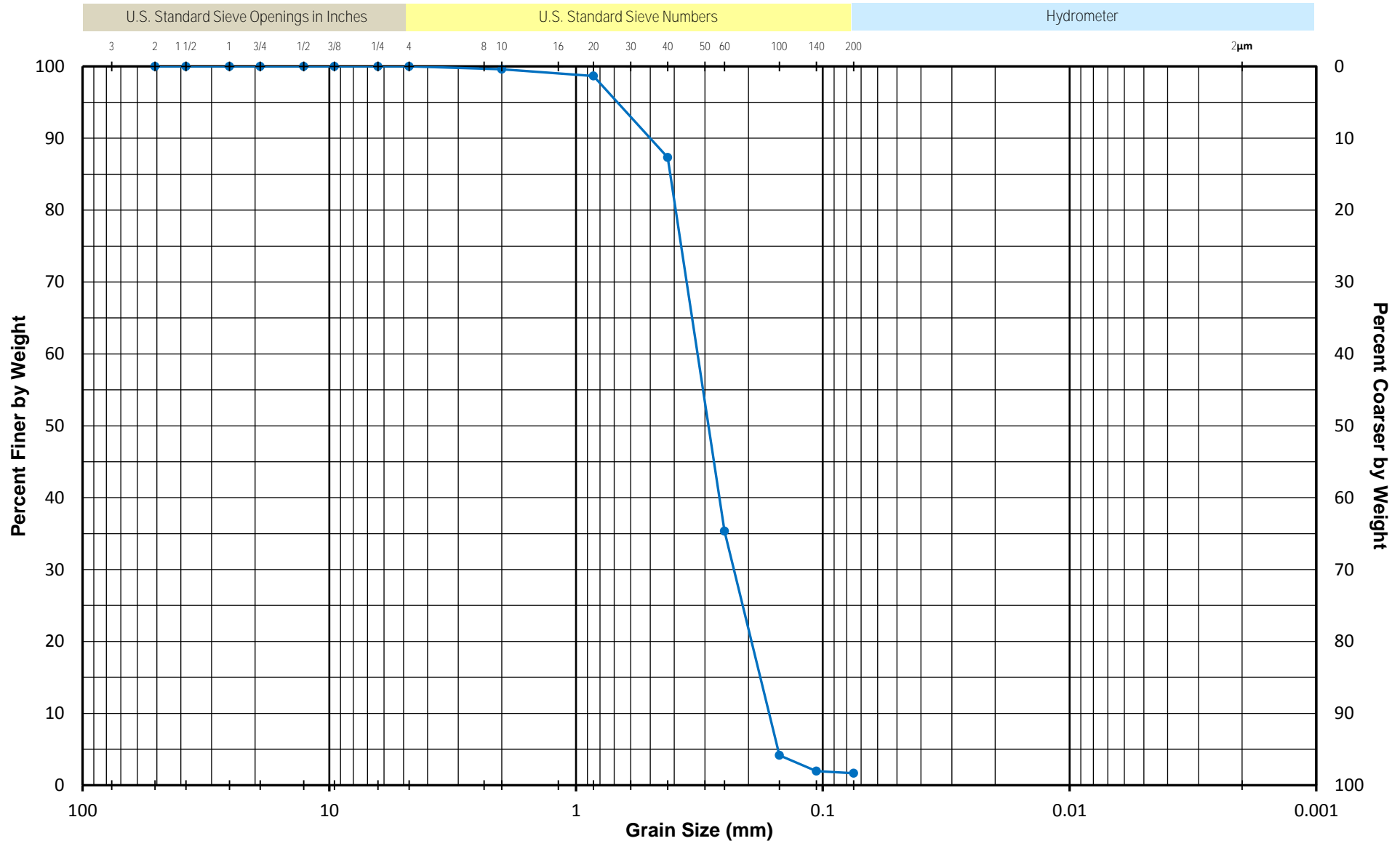
ASTM D-422, D-6913

Alpine - NESE II



Test Depth	Core ID Section/Sample	Material Description
6.0 ft	VC47 4-6	Gray Fine to Medium Sand with shell fragments

GRADATION CURVES
 ASTM D-422, D-6913
 Alpine - NESE II

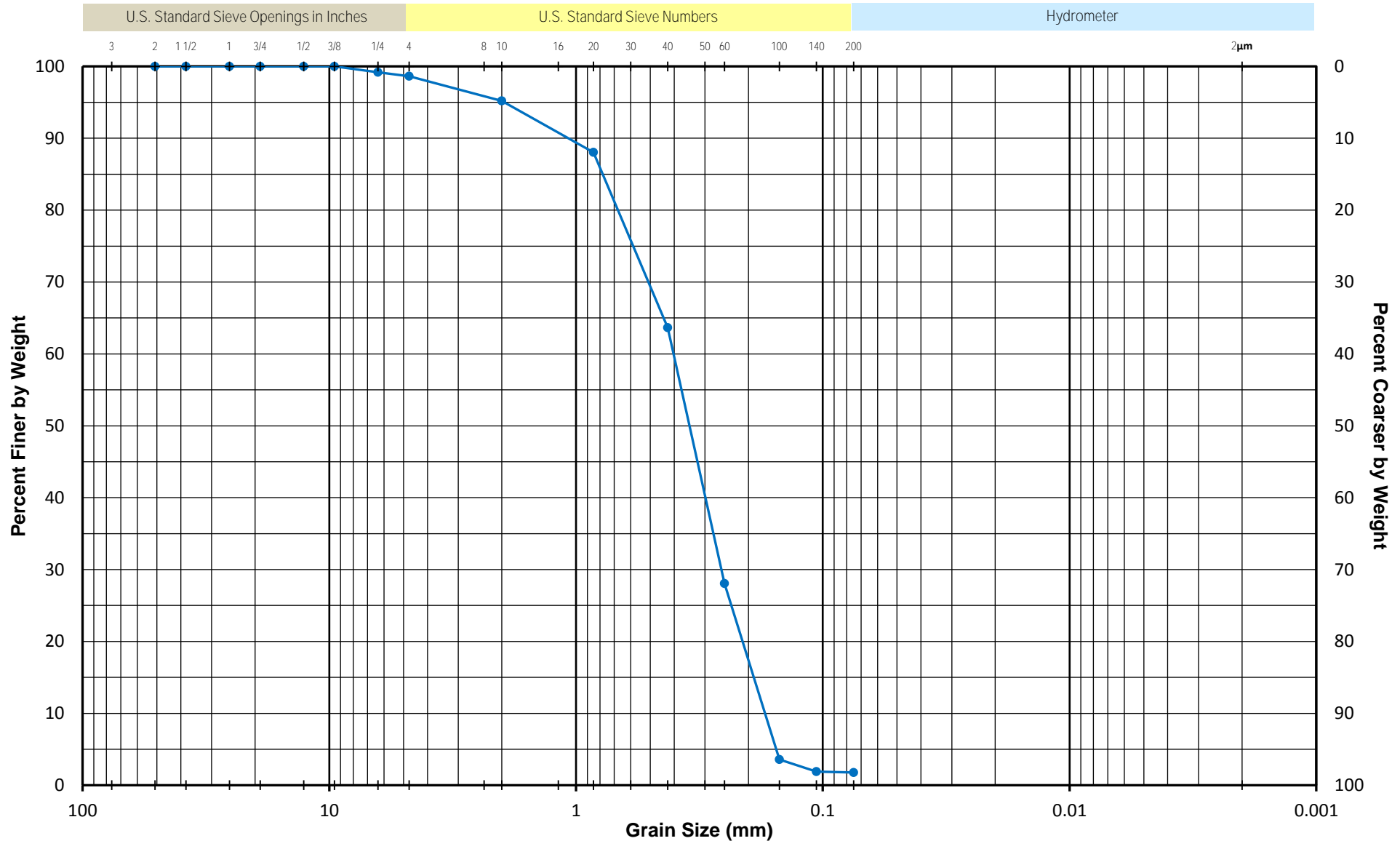


Test Depth	Core ID Section/Sample	Material Description
8.0 ft	VC47 6-8	Gray Fine to Medium Sand with shell fragments

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

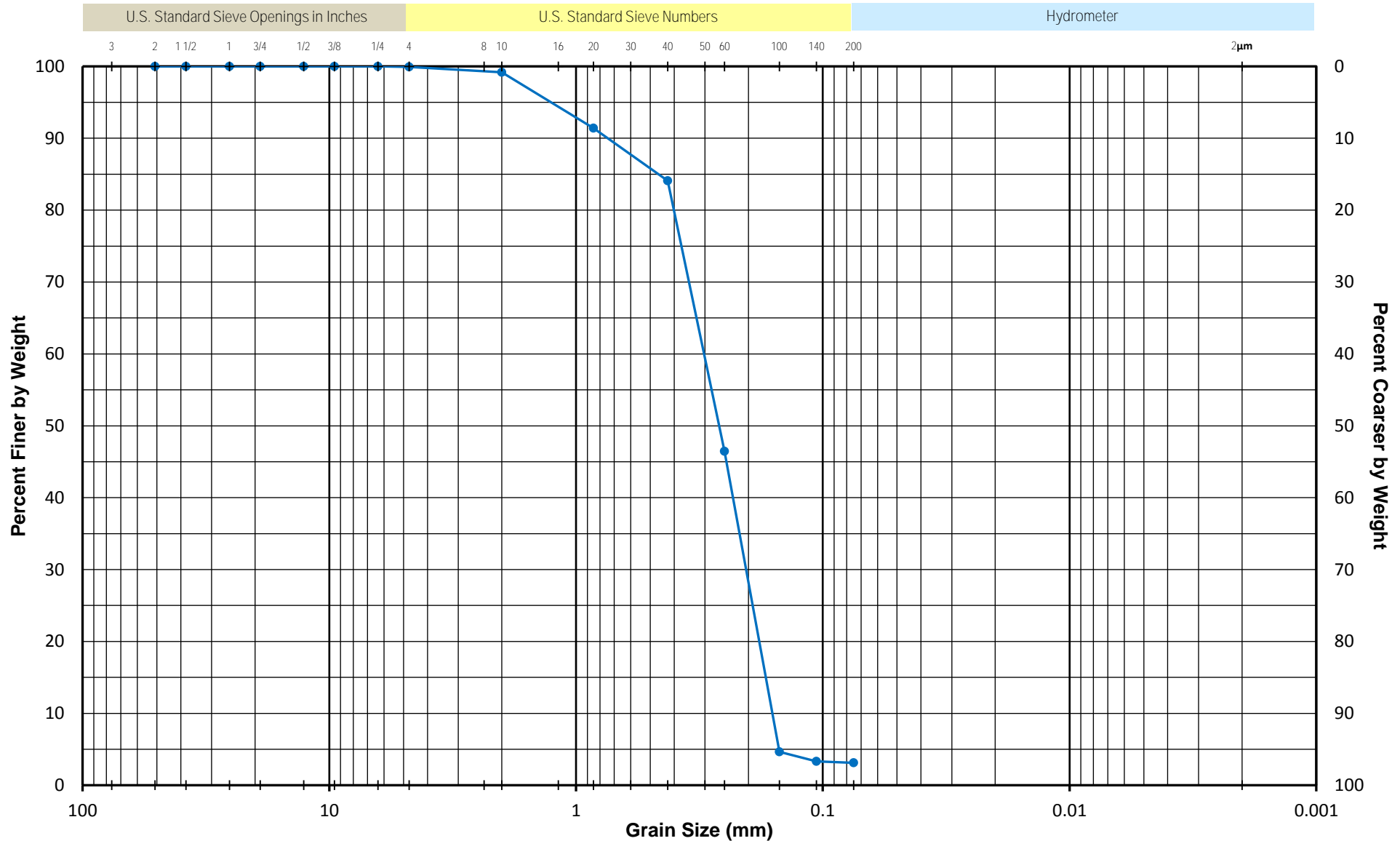


Test Depth	Core ID Section/Sample	Material Description
10.0 ft	VC47 8-10	Dark Gray Fine to Medium Sand with shell fragments

GRADATION CURVES

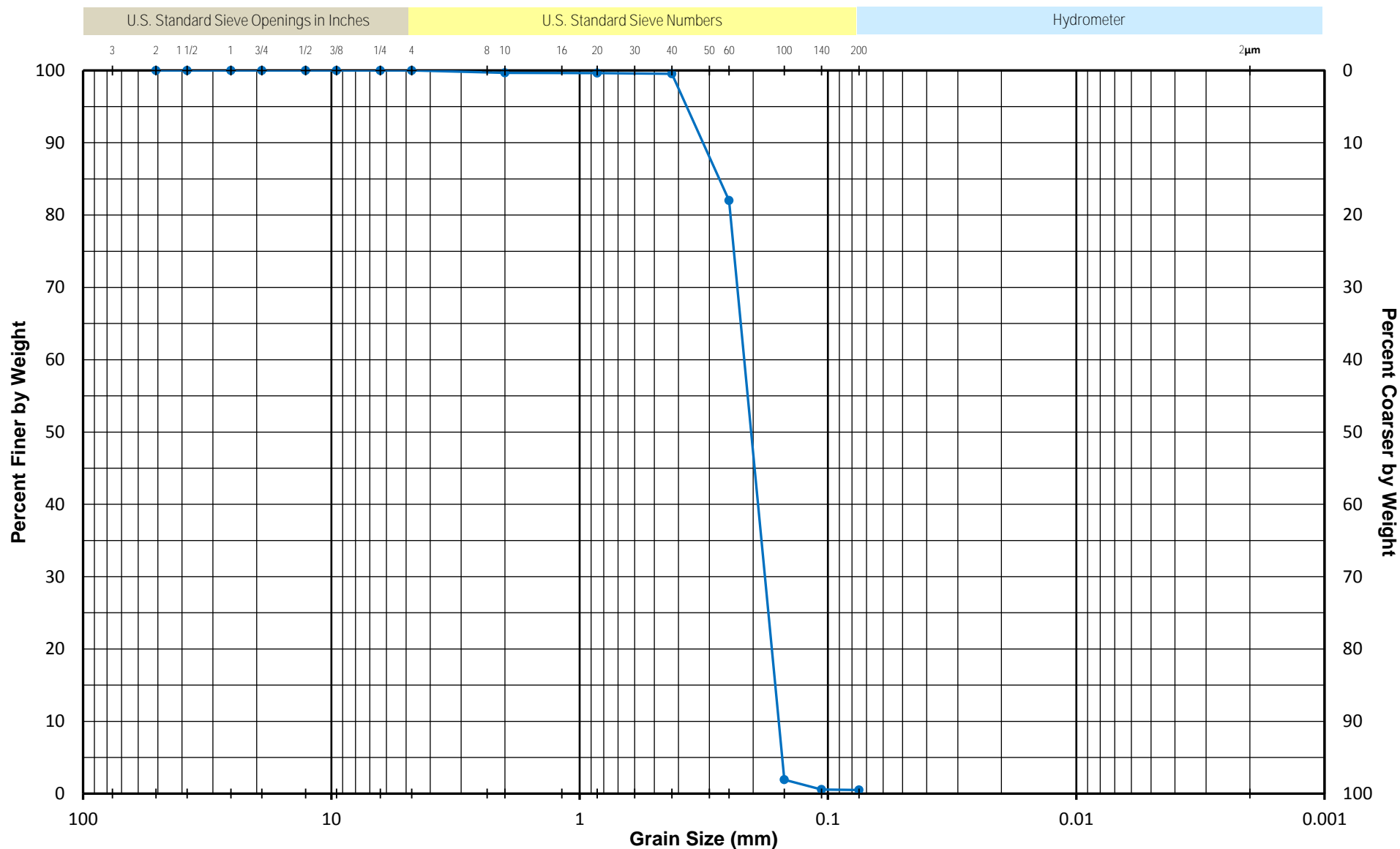
ASTM D-422, D-6913

Alpine - NESE II



Test Depth	Core ID Section/Sample	Material Description
12.0 ft	VC47 10-12	Dark Gray Fine to Medium Sand with shell fragments

GRADATION CURVES
 ASTM D-422, D-6913
 Alpine - NESE II

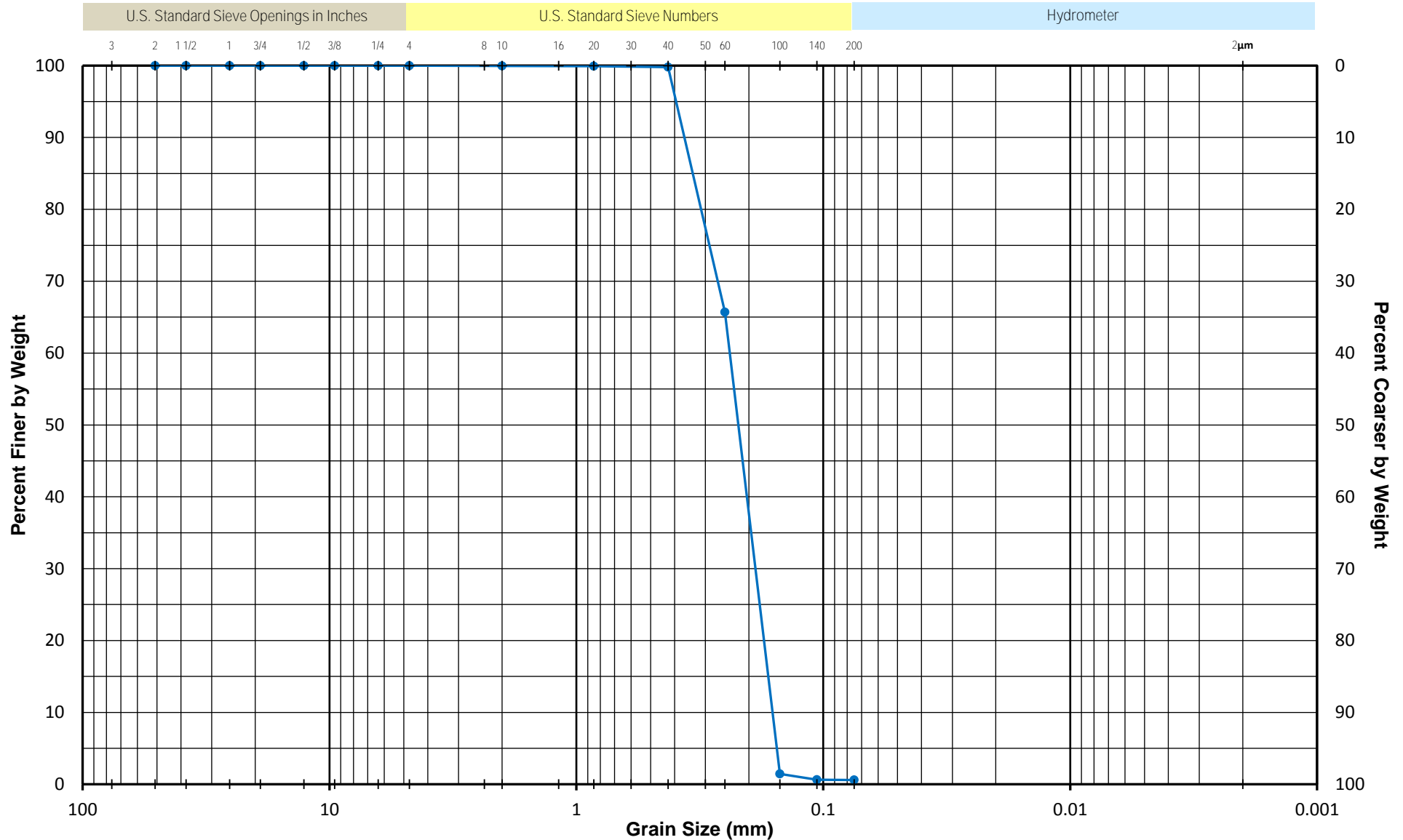


Test Depth	Core ID Section/Sample	Material Description
0.10 ft	VC49 0-2	Light Olive Brown Fine Sand with trace shell fragments

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

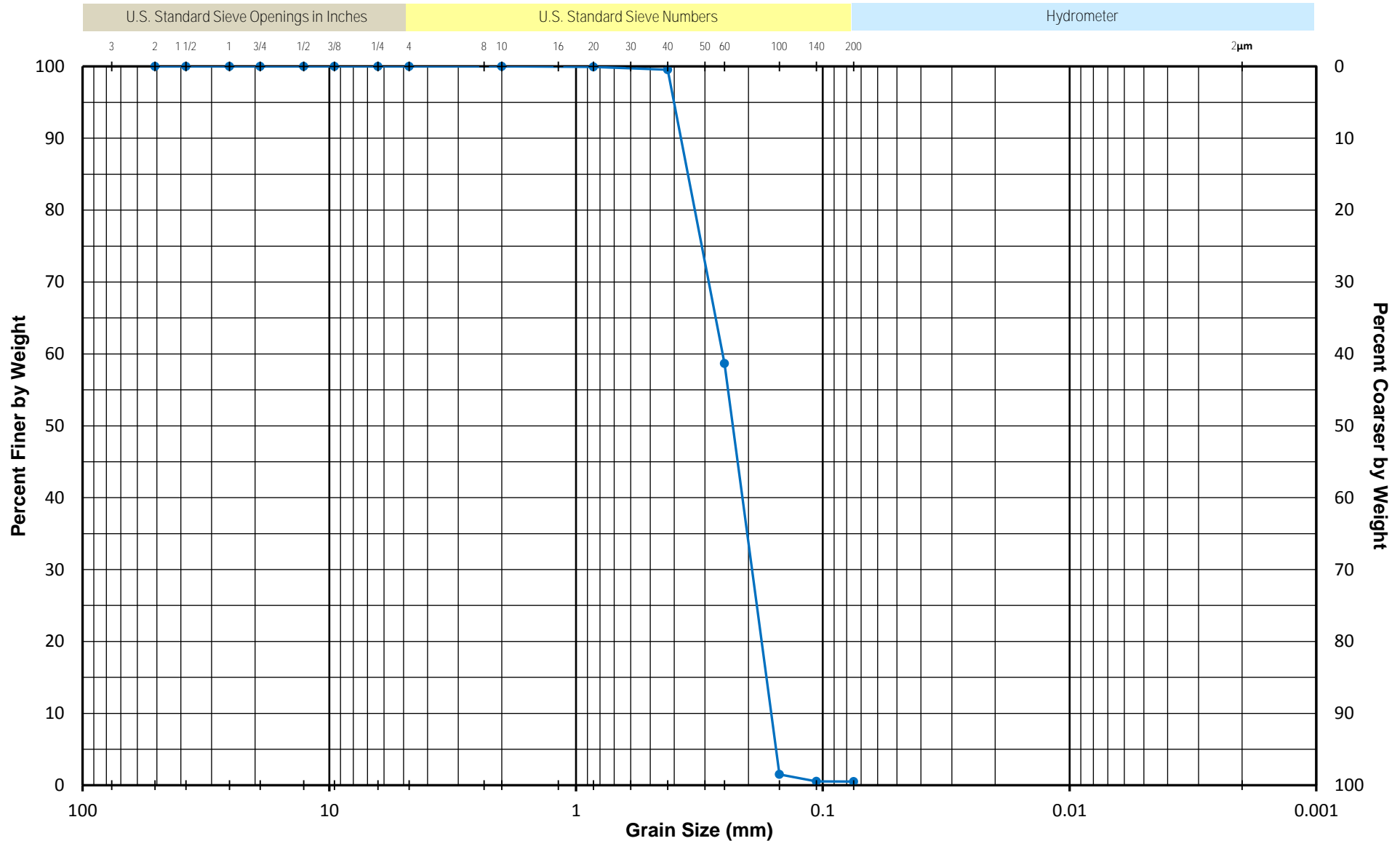


Test Depth	Core ID Section/Sample	Material Description
2.0 ft	VC49 0-2	Grayish Brown Fine Sand

GRADATION CURVES

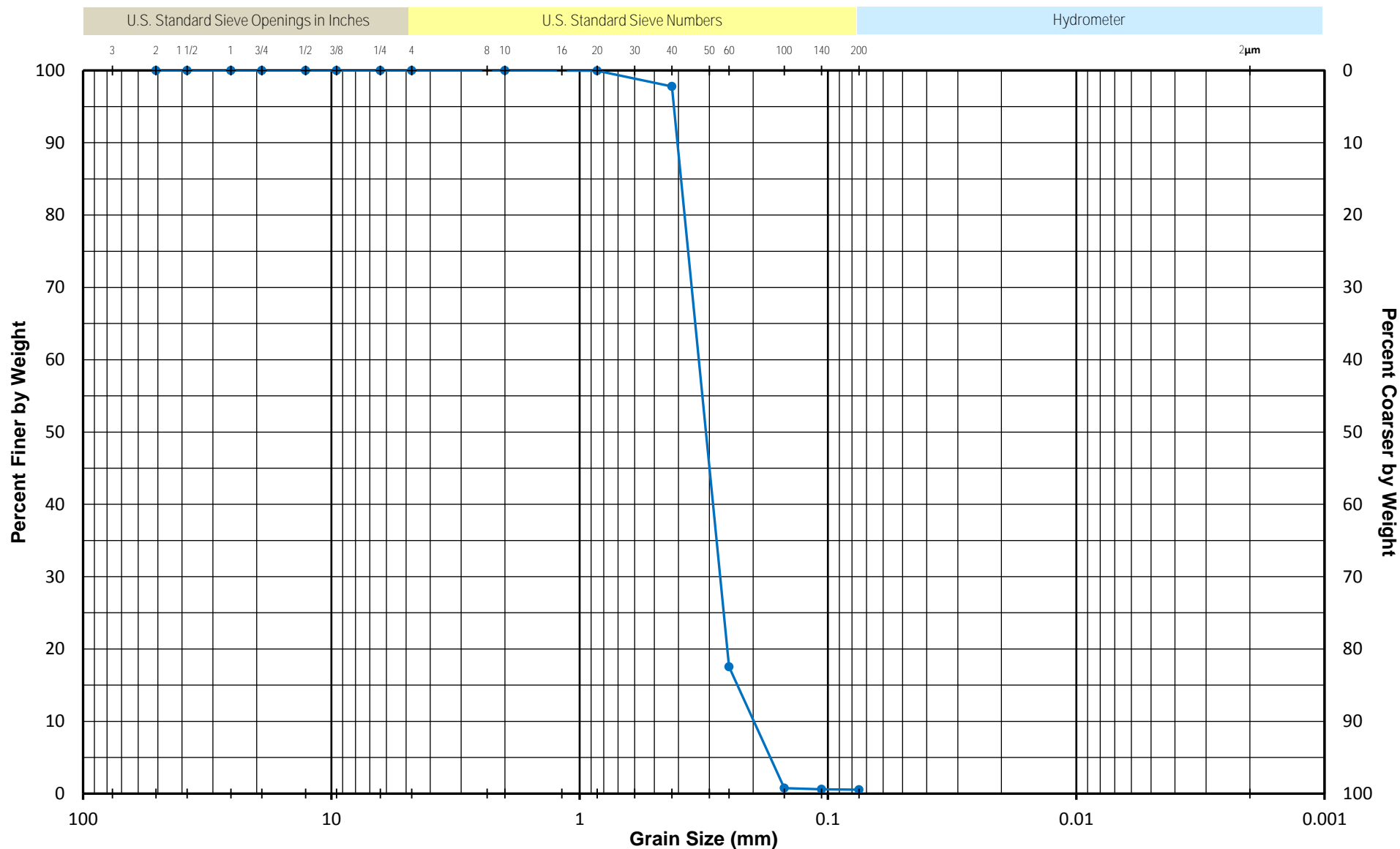
ASTM D-422, D-6913

Alpine - NESE II



Test Depth	Core ID Section/Sample	Material Description
4.0 ft	VC49 2-4	Grayish Brown Fine Sand

GRADATION CURVES
 ASTM D-422, D-6913
 Alpine - NESE II

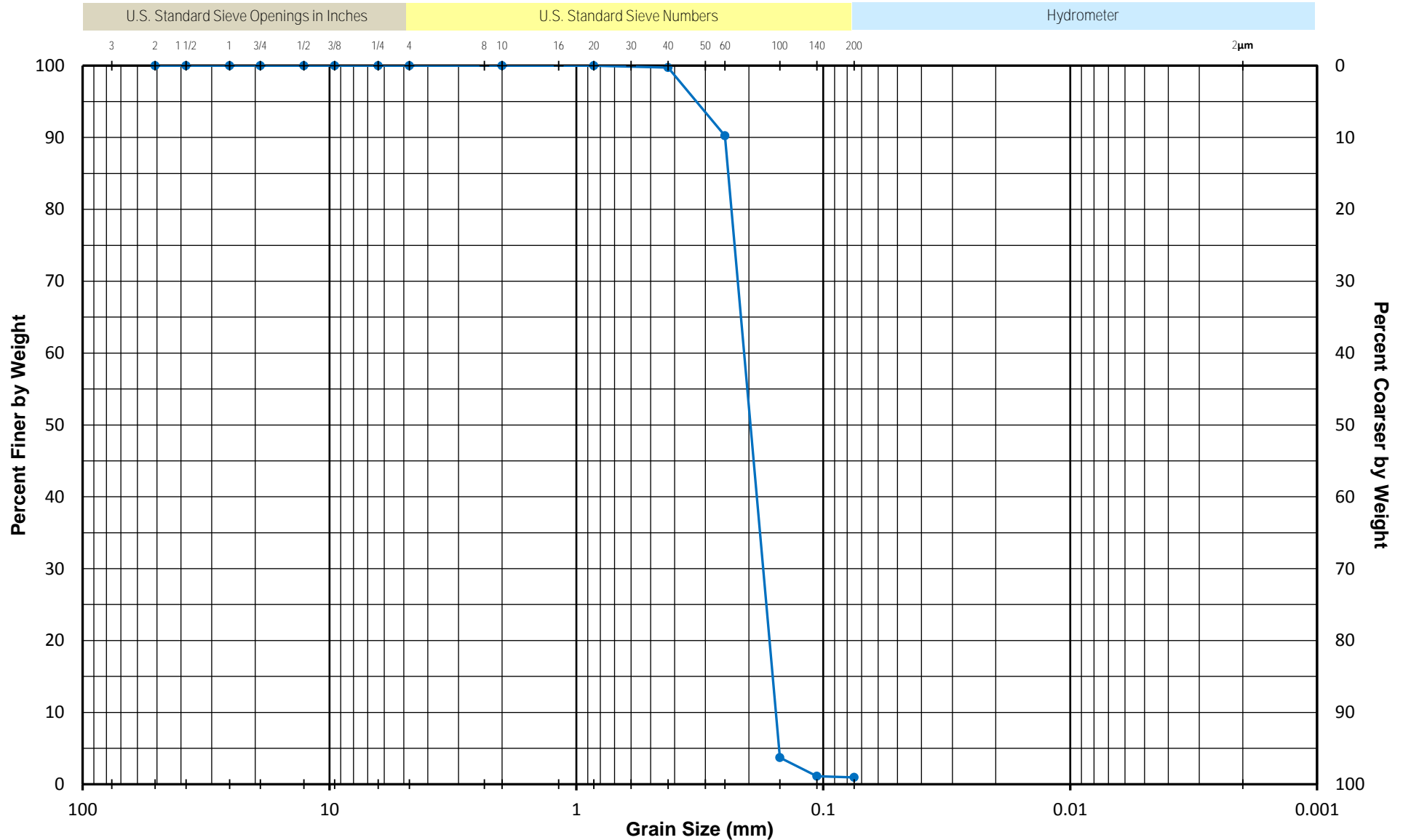


Test Depth	Core ID Section/Sample	Material Description
6.0 ft	VC49 4-6	Grayish Brown Fine Sand

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

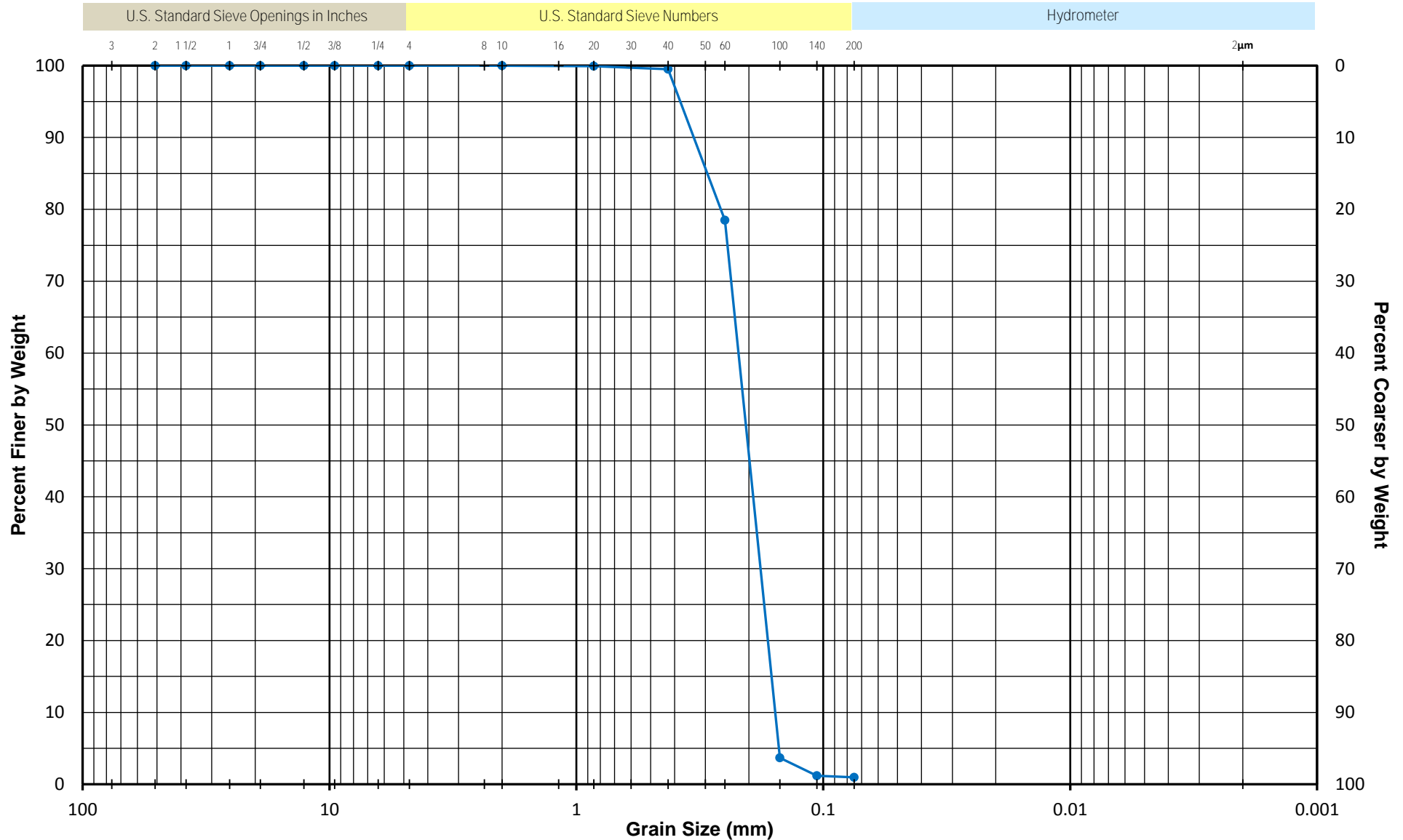


Test Depth	Core ID Section/Sample	Material Description
8.0 ft	VC49 6-8	Grayish Brown Fine Sand

GRADATION CURVES

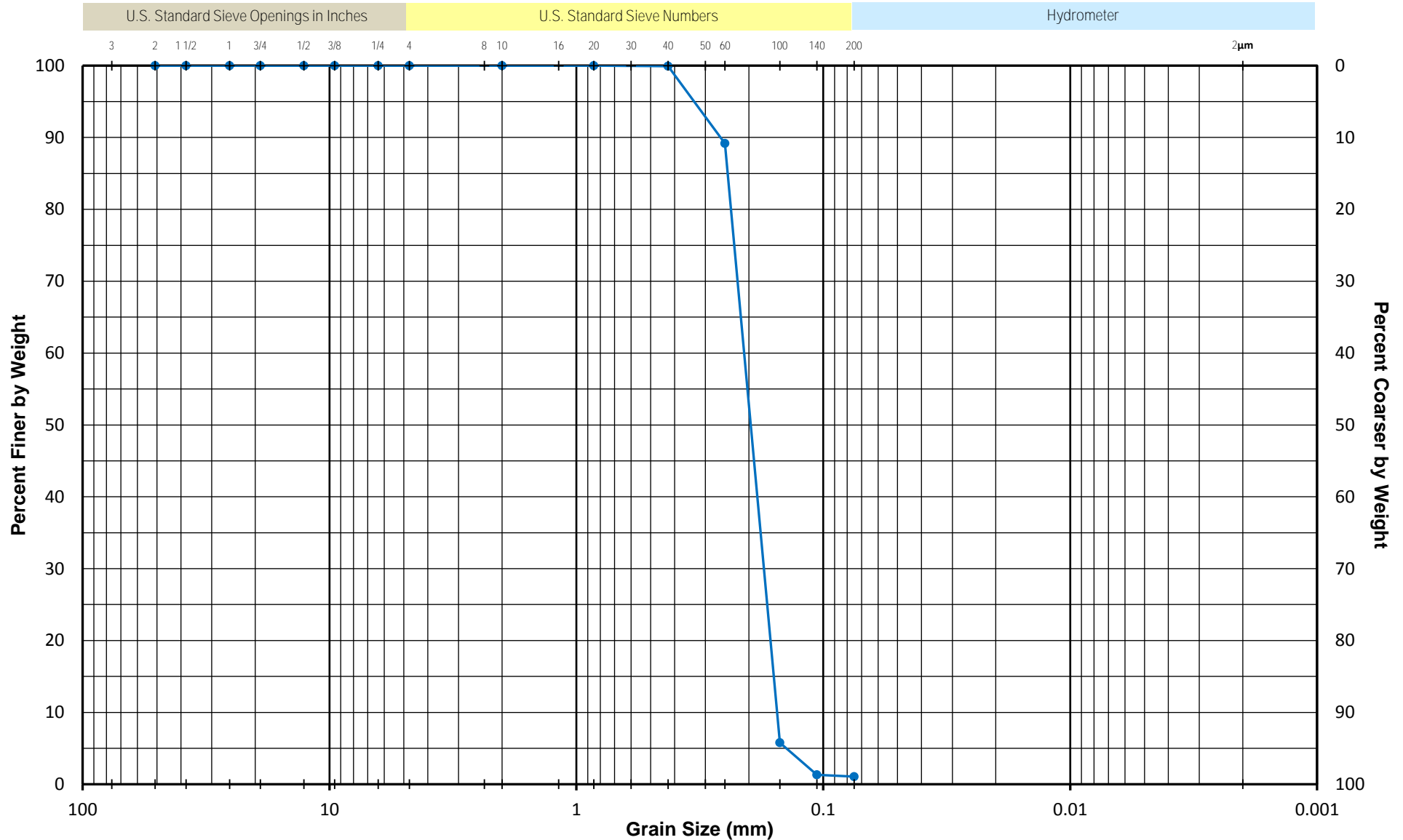
ASTM D-422, D-6913

Alpine - NESE II



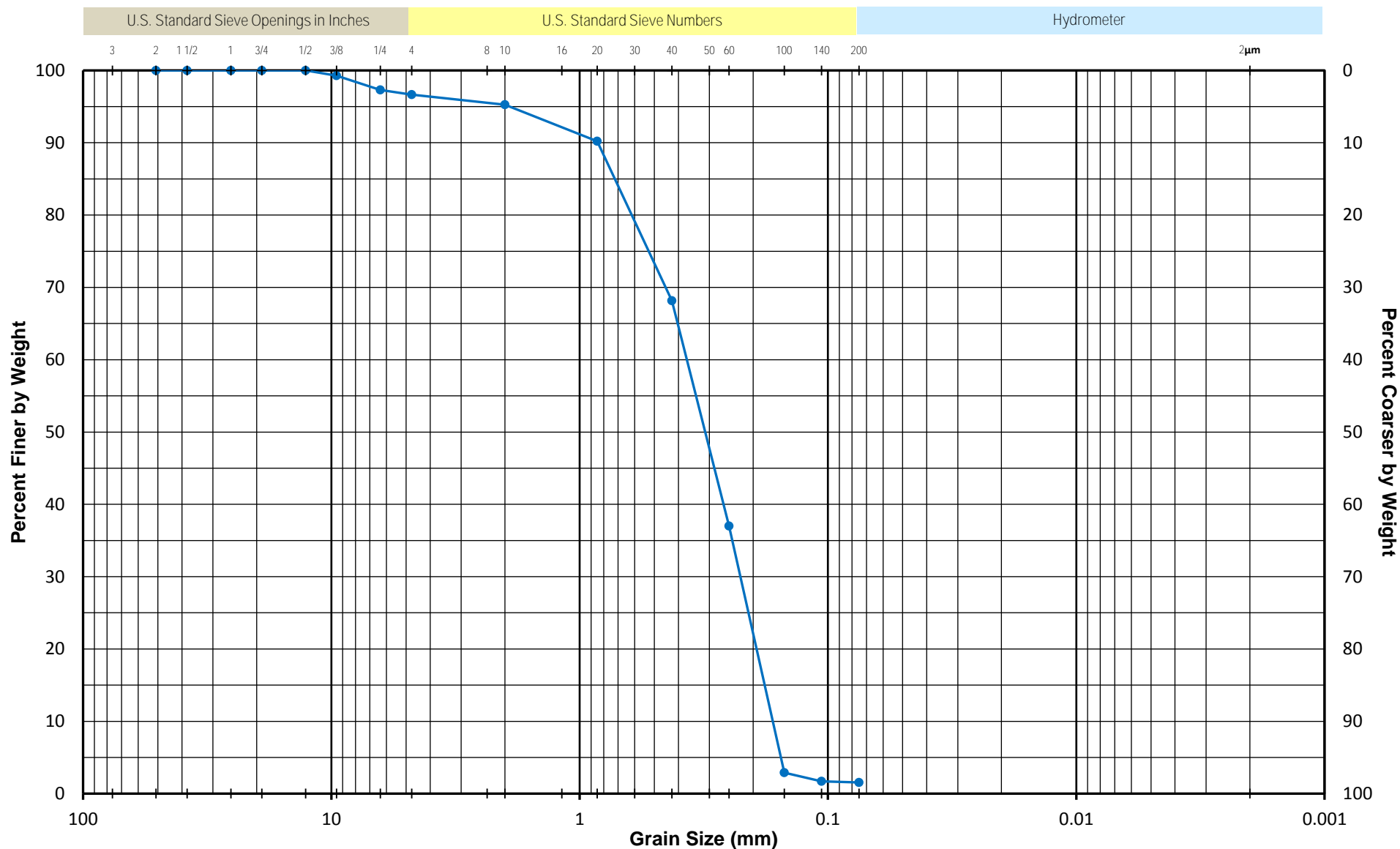
Test Depth	Core ID Section/Sample	Material Description
10.0 ft	VC49 8-10	Gray Fine Sand

GRADATION CURVES
 ASTM D-422, D-6913
 Alpine - NESE II



Test Depth	Core ID Section/Sample	Material Description
12.0 ft	VC49 10-12	Gray Fine Sand

GRADATION CURVES
 ASTM D-422, D-6913
 Alpine - NESE II

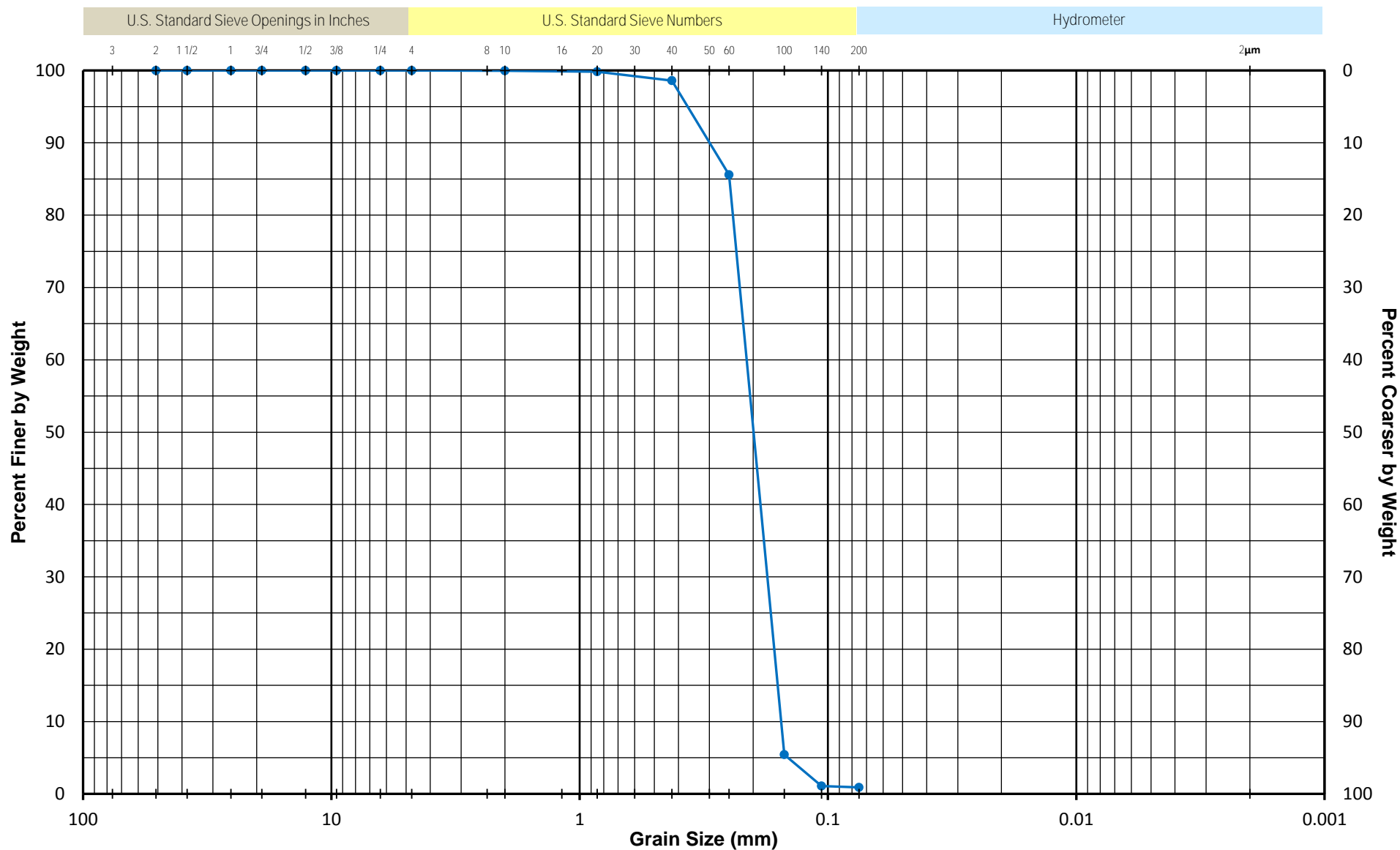


Test Depth	Core ID Section/Sample	Material Description
0.7 ft	VC50 0-2	Grayish Brown Fine to Medium Sand with shell fragments

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

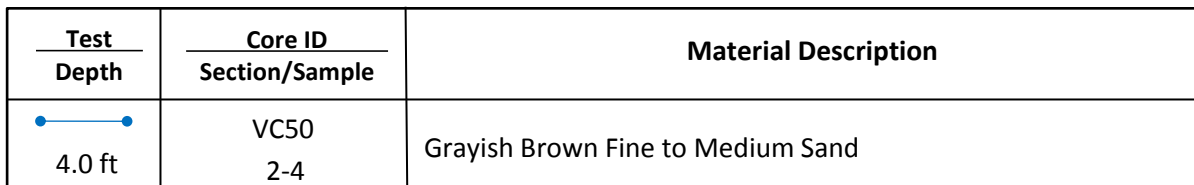


Test Depth	Core ID Section/Sample	Material Description
<div><div></div><div></div></div> <div>2.0 ft</div>	VC50 0-2	Gray Fine Sand

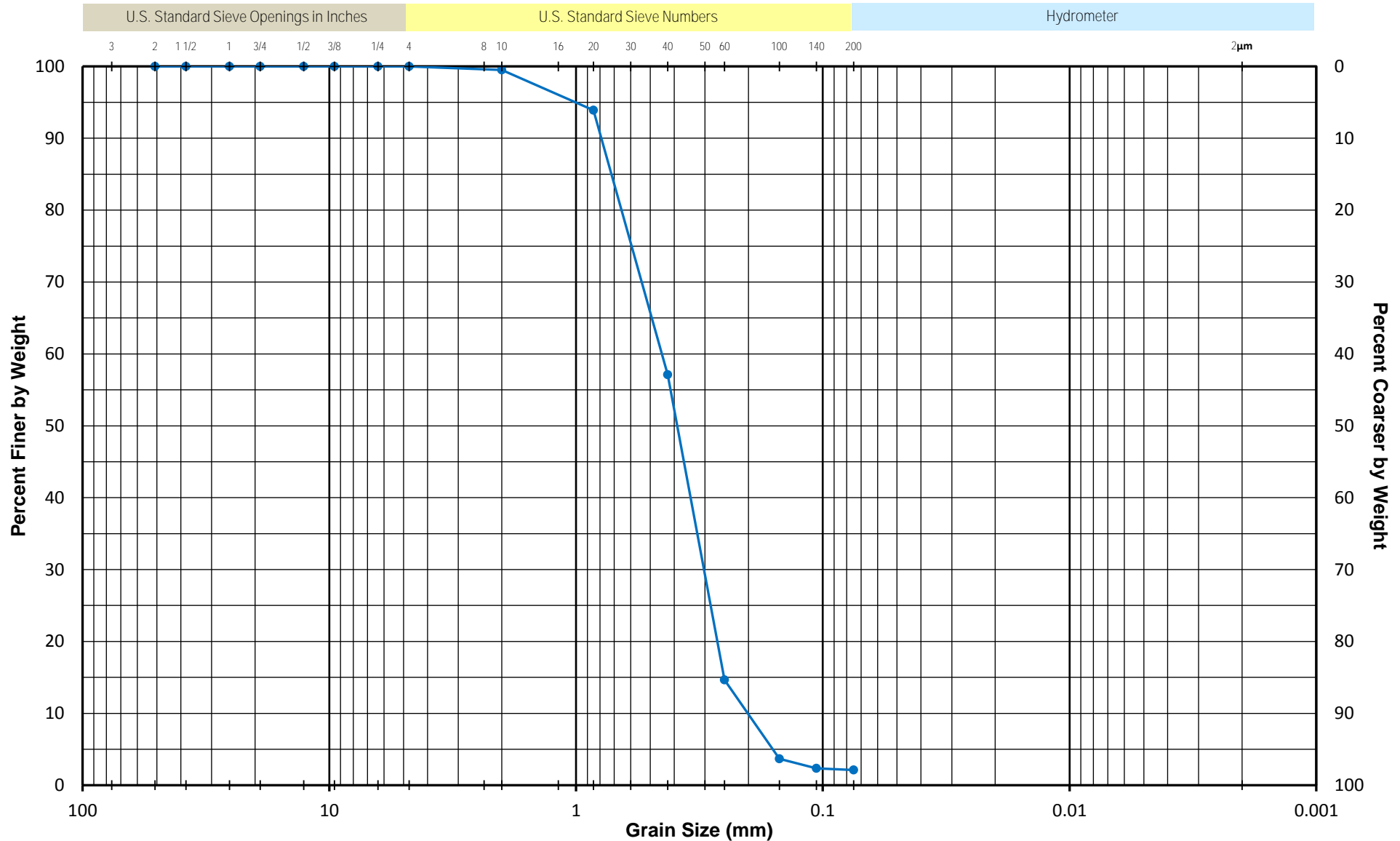
GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

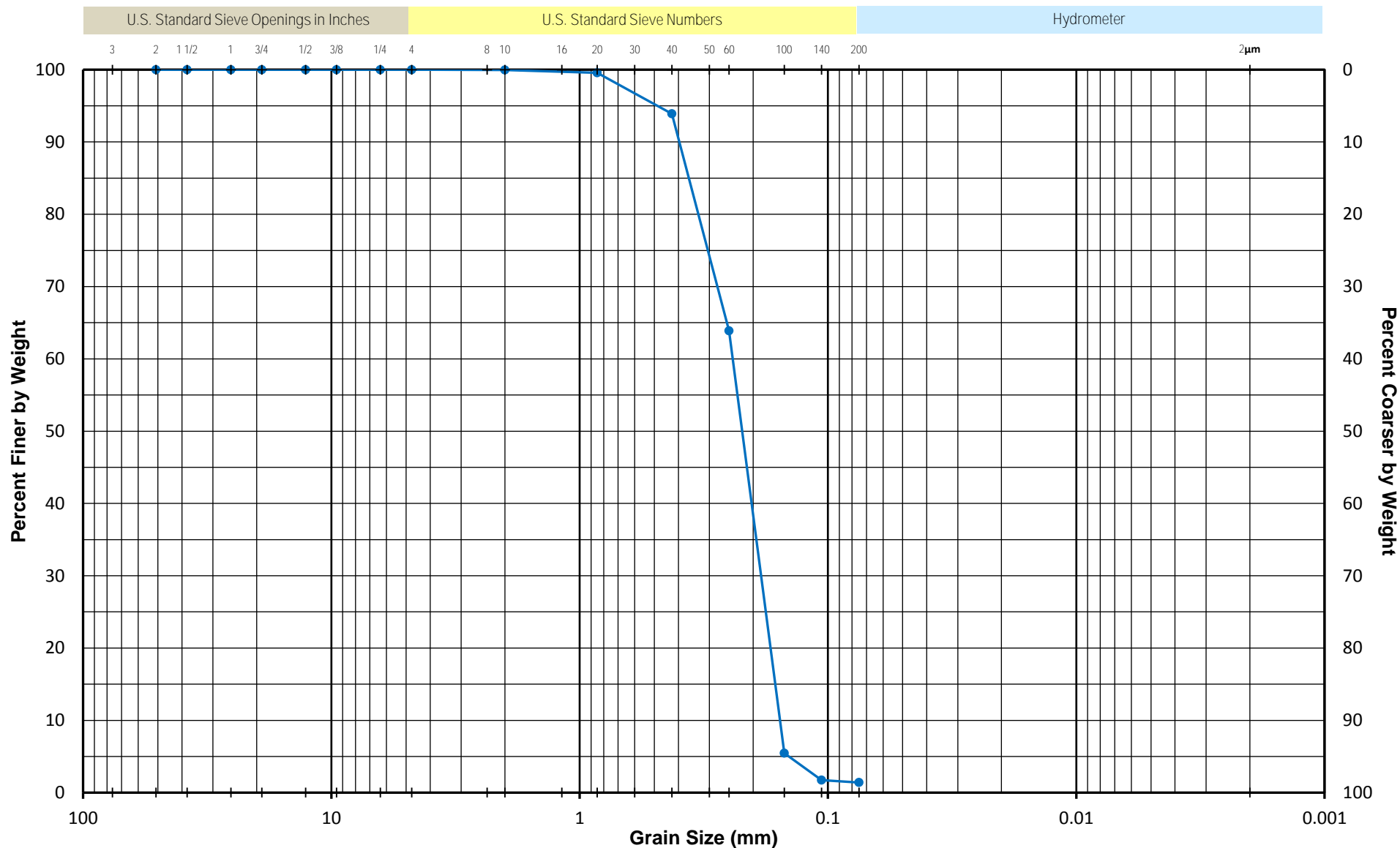


Alpine - NESE II



Test Depth	Core ID Section/Sample	Material Description
6.0 ft	VC50 4-6	Grayish Brown Fine to Medium Sand

GRADATION CURVES
 ASTM D-422, D-6913
 Alpine - NESE II

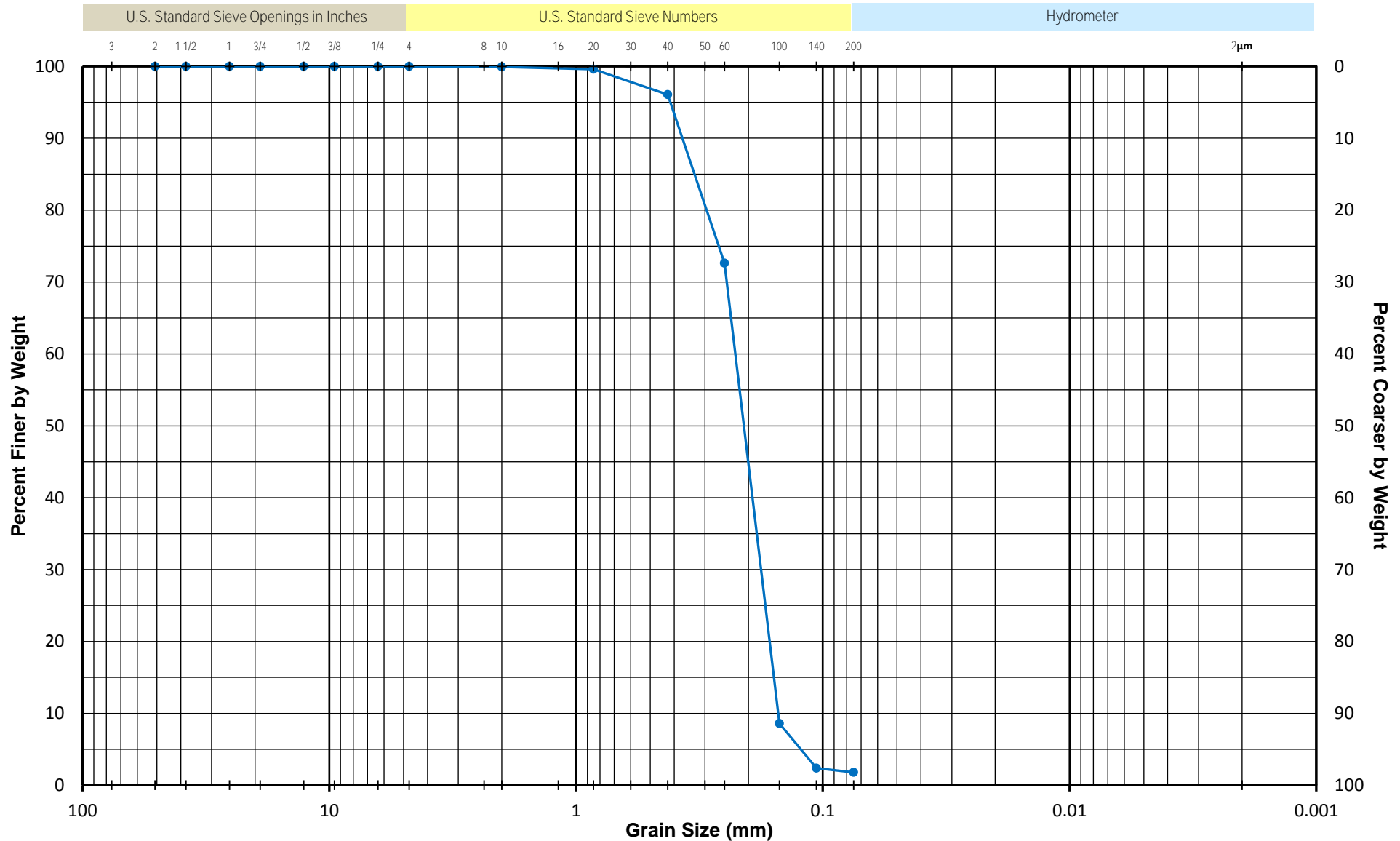


Test Depth	Core ID Section/Sample	Material Description
8.0 ft	VC50 6-8	Gray Fine to Medium Sand

GRADATION CURVES

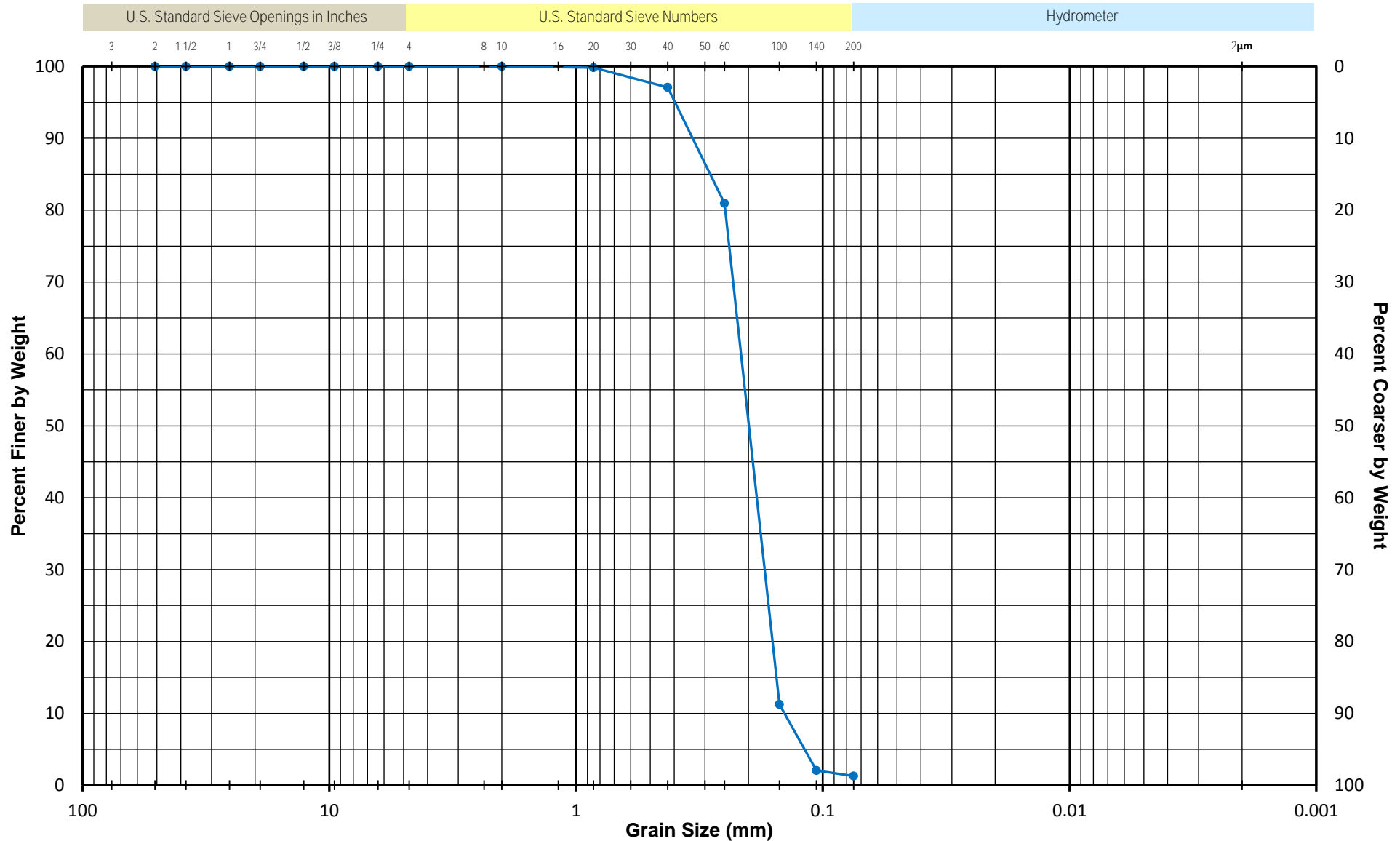
ASTM D-422, D-6913

Alpine - NESE II



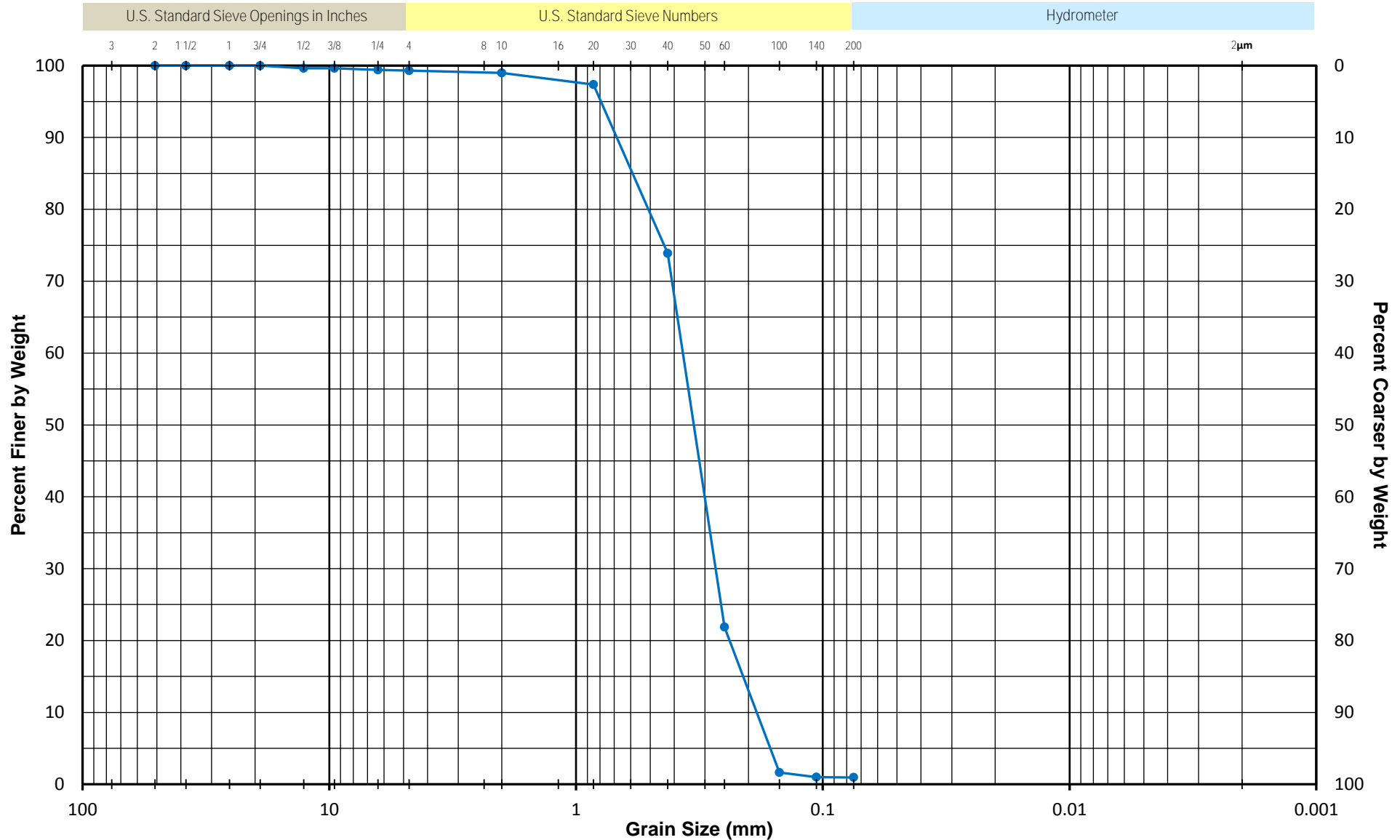
Test Depth	Core ID Section/Sample	Material Description
10.0 ft	VC50 8-10	Dark Gray Fine Sand

GRADATION CURVES
 ASTM D-422, D-6913
 Alpine - NESE II



Test Depth	Core ID Section/Sample	Material Description
12.0 ft	VC50 10-12	Dark Gray Fine Sand with shell fragments

GRADATION CURVES
 ASTM D-422, D-6913
 Alpine - NESE II

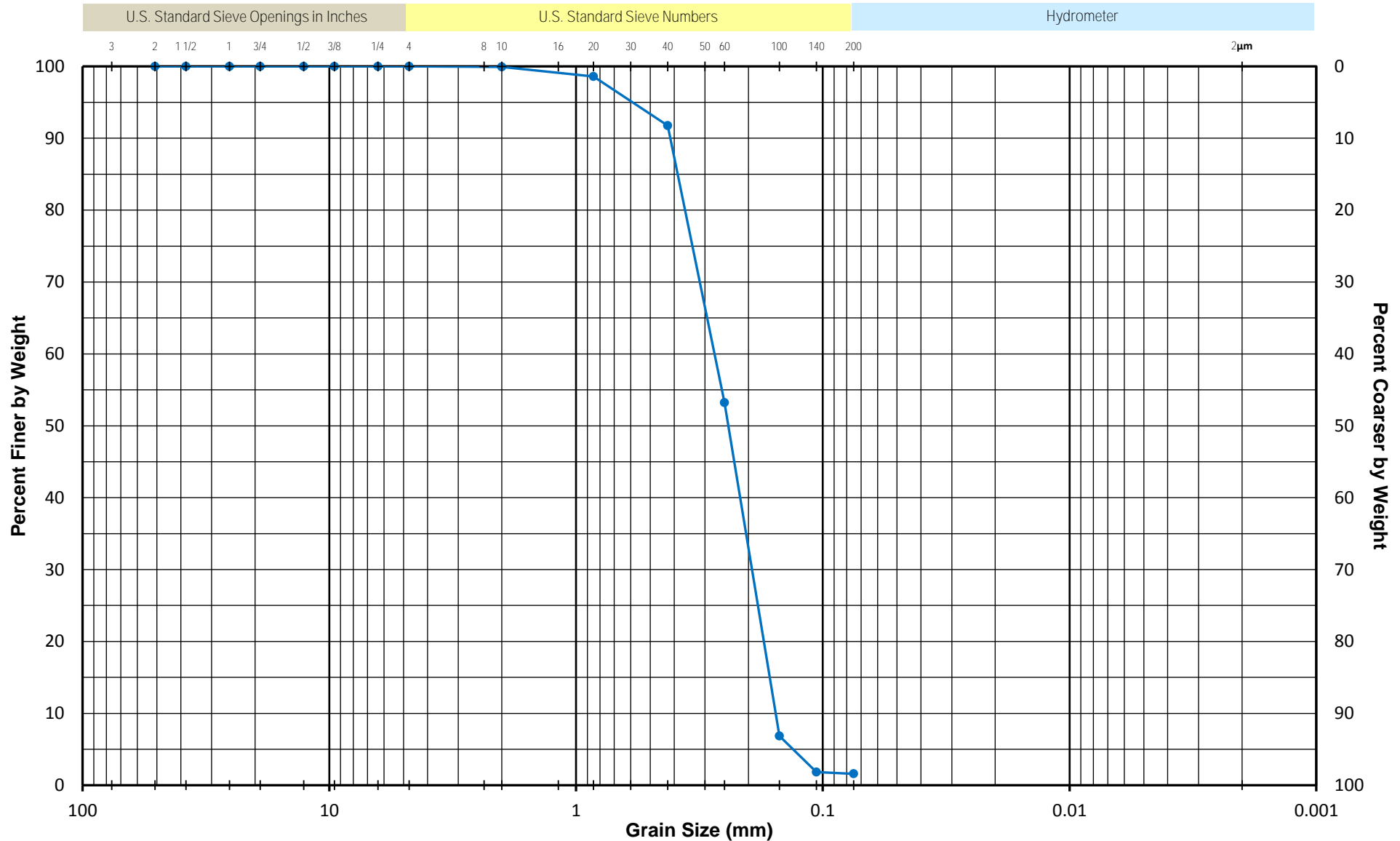


Test Depth	Core ID Section/Sample	Material Description
0.7 ft	VC51 0-2	Dark Gray Fine to Medium Sand with shell fragments

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

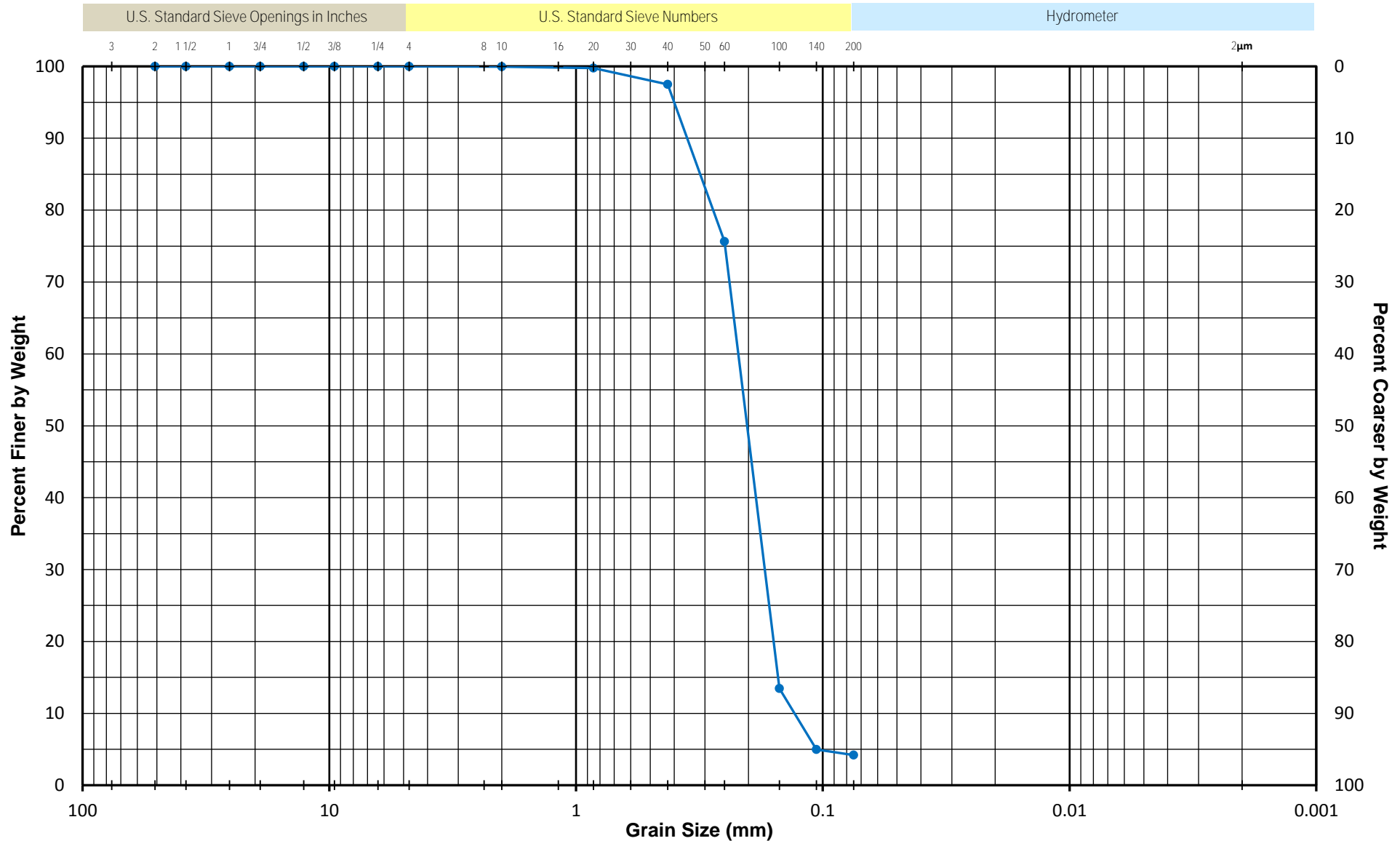


Test Depth	Core ID Section/Sample	Material Description
•—• 2.0 ft	VC51 0-2	Dark Gray Fine to Medium Sand

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

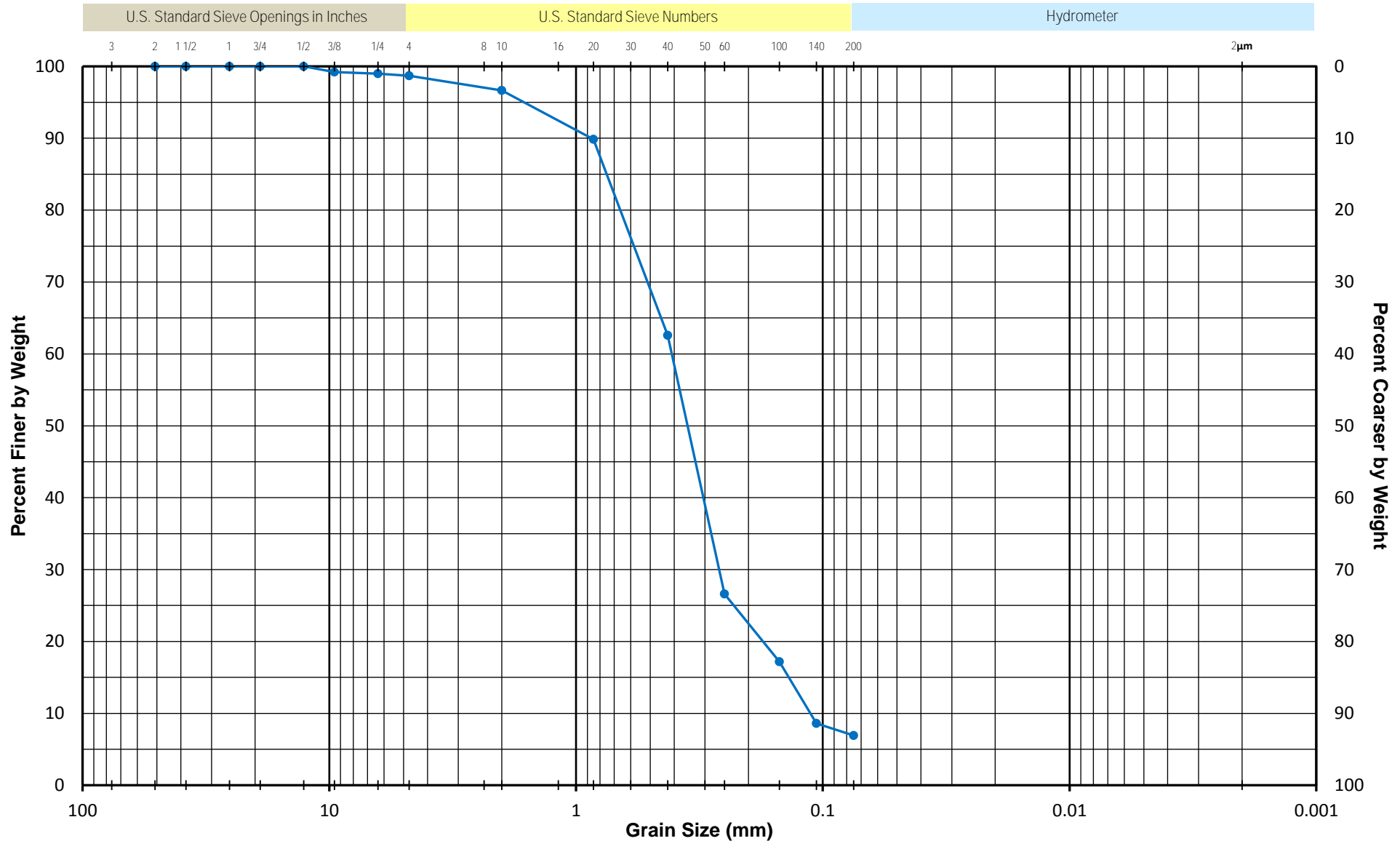


Test Depth	Core ID Section/Sample	Material Description
4.0 ft	VC51 2-4	Very Dark Gray Fine Sand

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

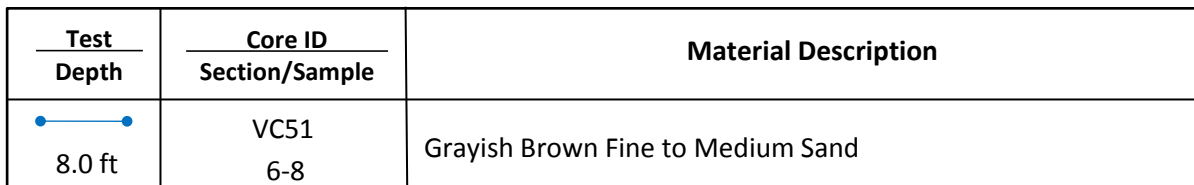


Test Depth	Core ID Section/Sample	Material Description
• — • 6.0 ft	VC51 4-6	Very Dark Gray Fine to Medium Sand with silt and shell fragments

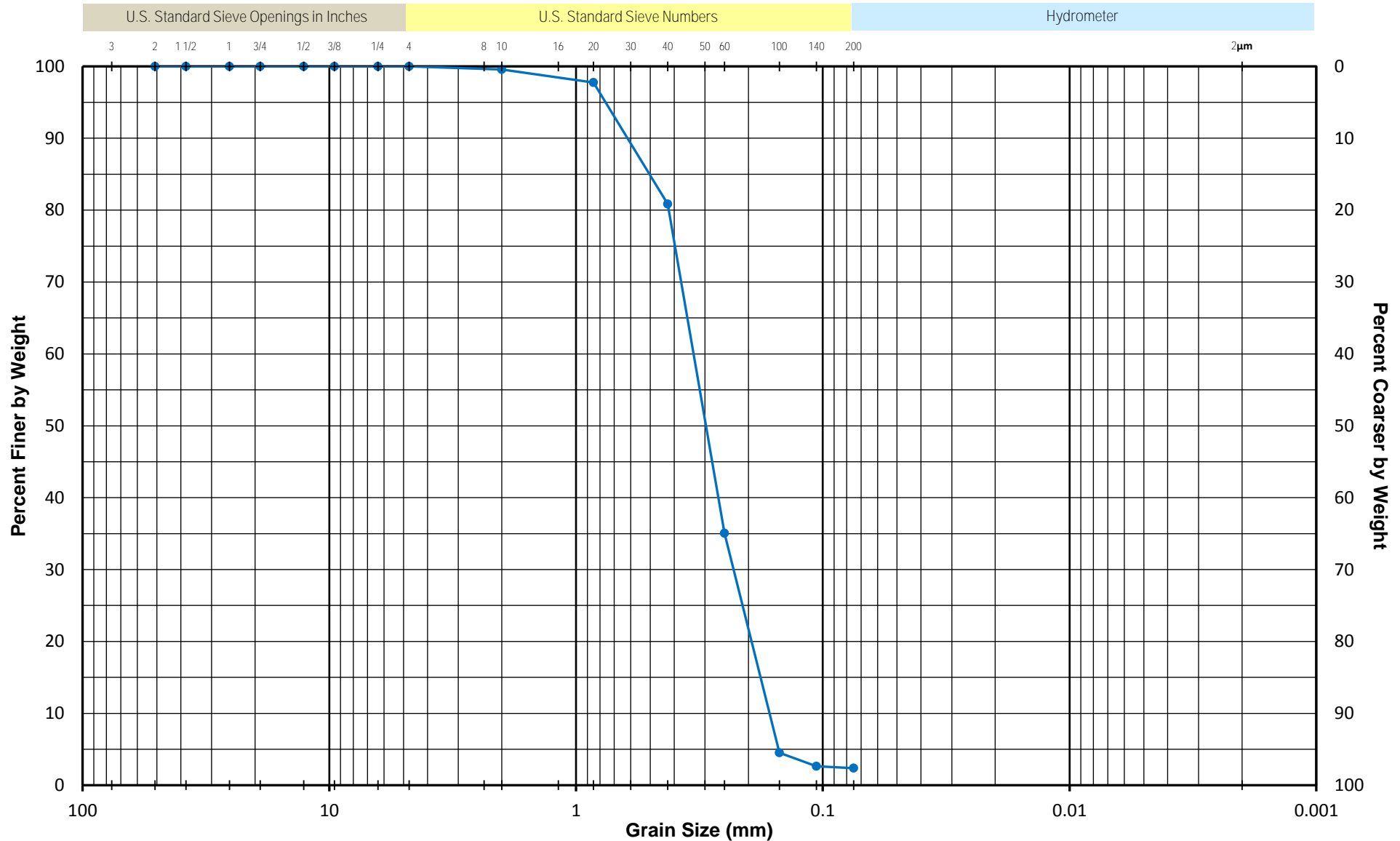
GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

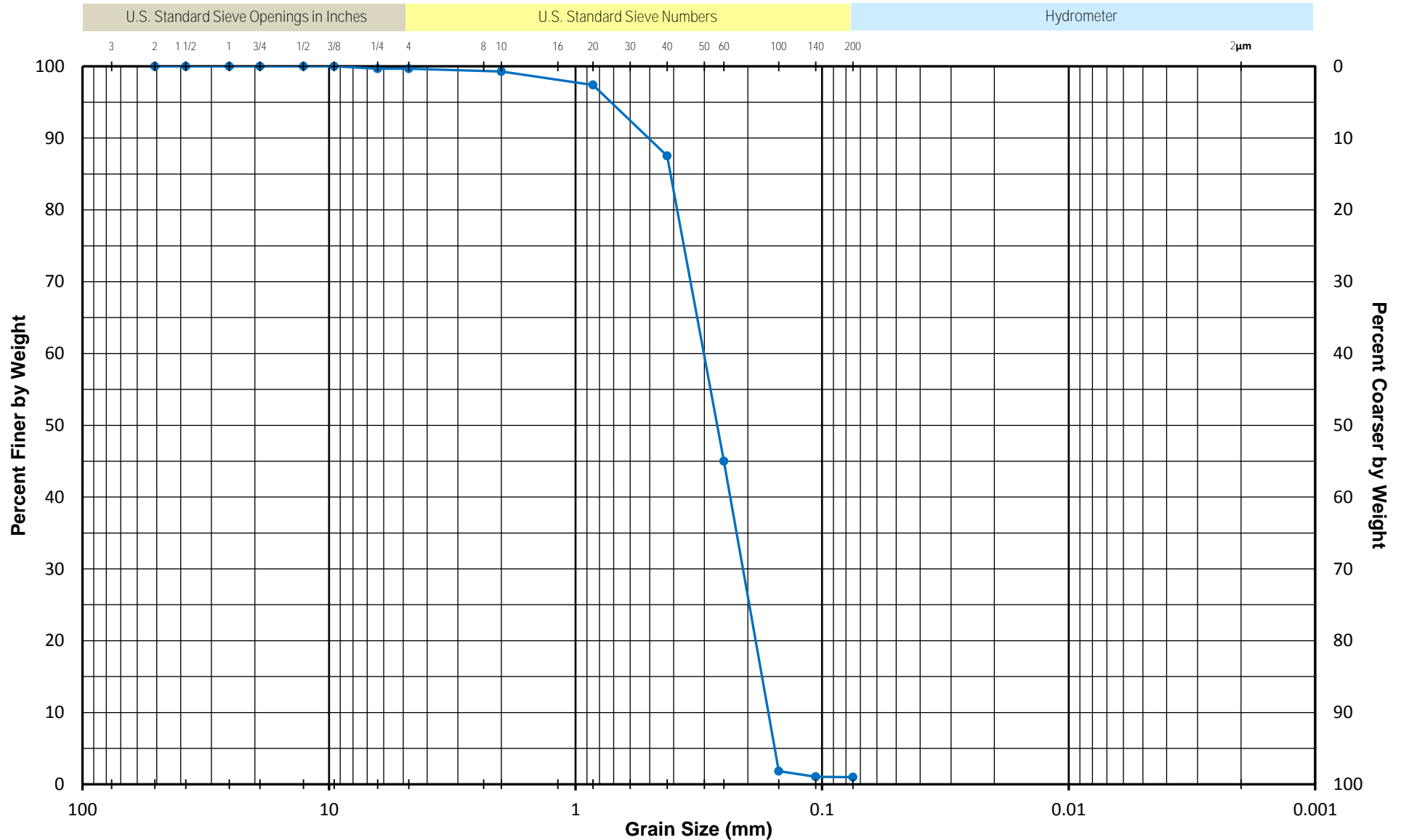


Alpine - NESE II



Test Depth	Core ID Section/Sample	Material Description
9.3 ft	VC51 8-10	Grayish Brown Fine to Medium Sand

GRADATION CURVES
 ASTM D-422, D-6913
 Alpine - NESE II

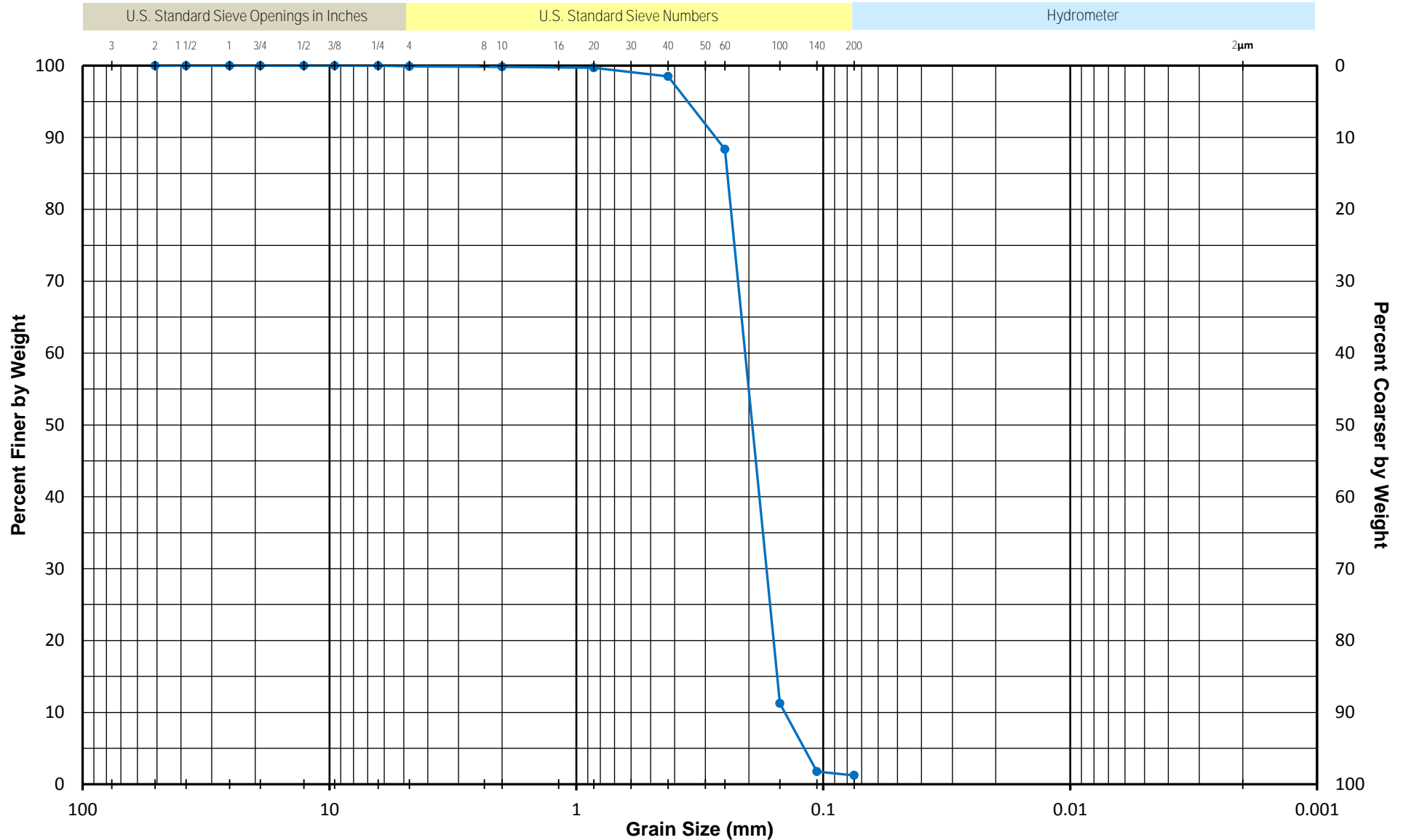


Test Depth	Core ID Section/Sample	Material Description
0.7 ft	VC52 0-2	Dark Gray Fine to Medium Sand with shell fragments

GRADATION CURVES

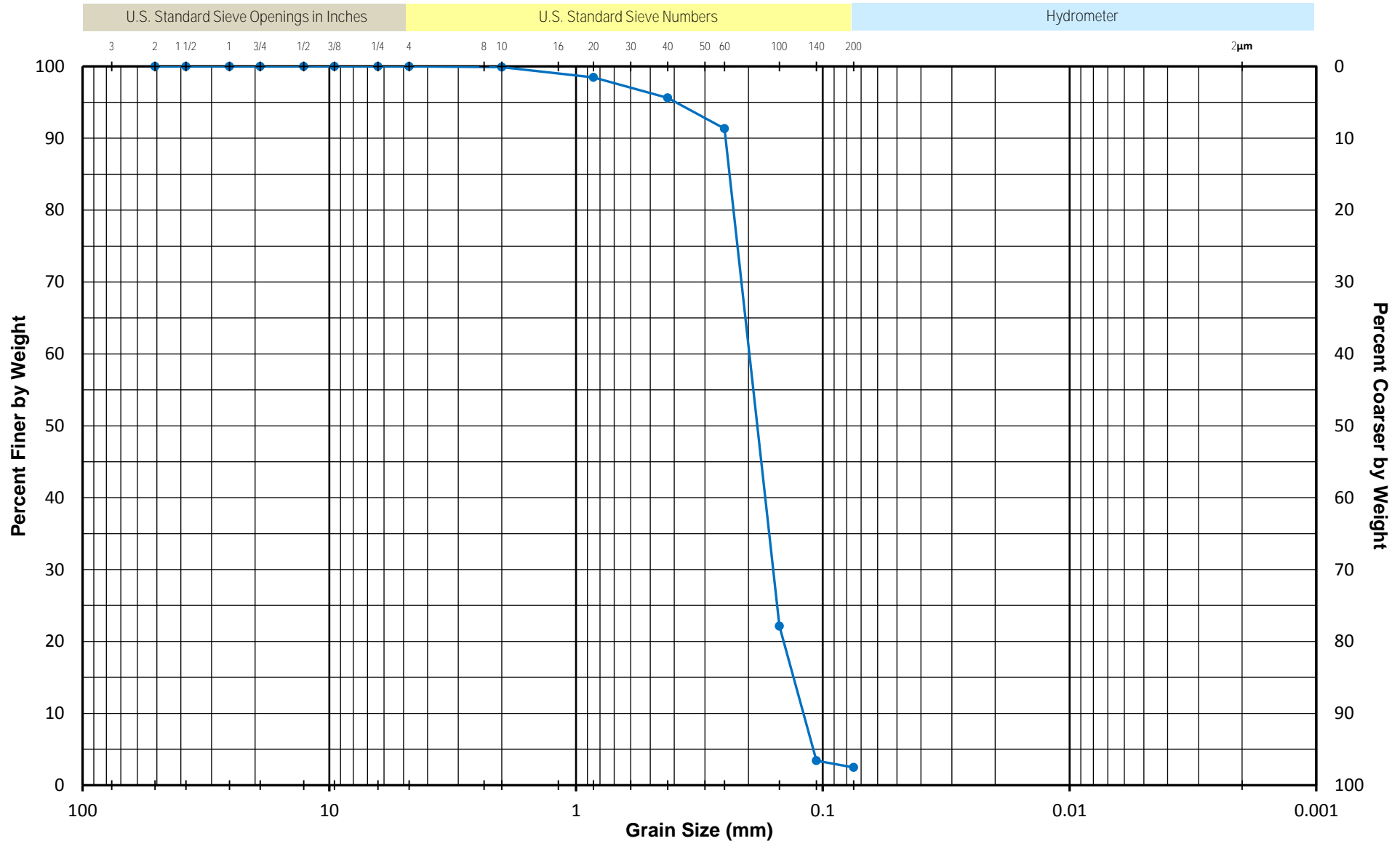
ASTM D-422, D-6913

Alpine - NESE II



Test Depth	Core ID Section/Sample	Material Description
2.0 ft	VC52 0-2	Dark Gray Fine Sand with shell fragments

GRADATION CURVES
 ASTM D-422, D-6913
 Alpine - NESE II

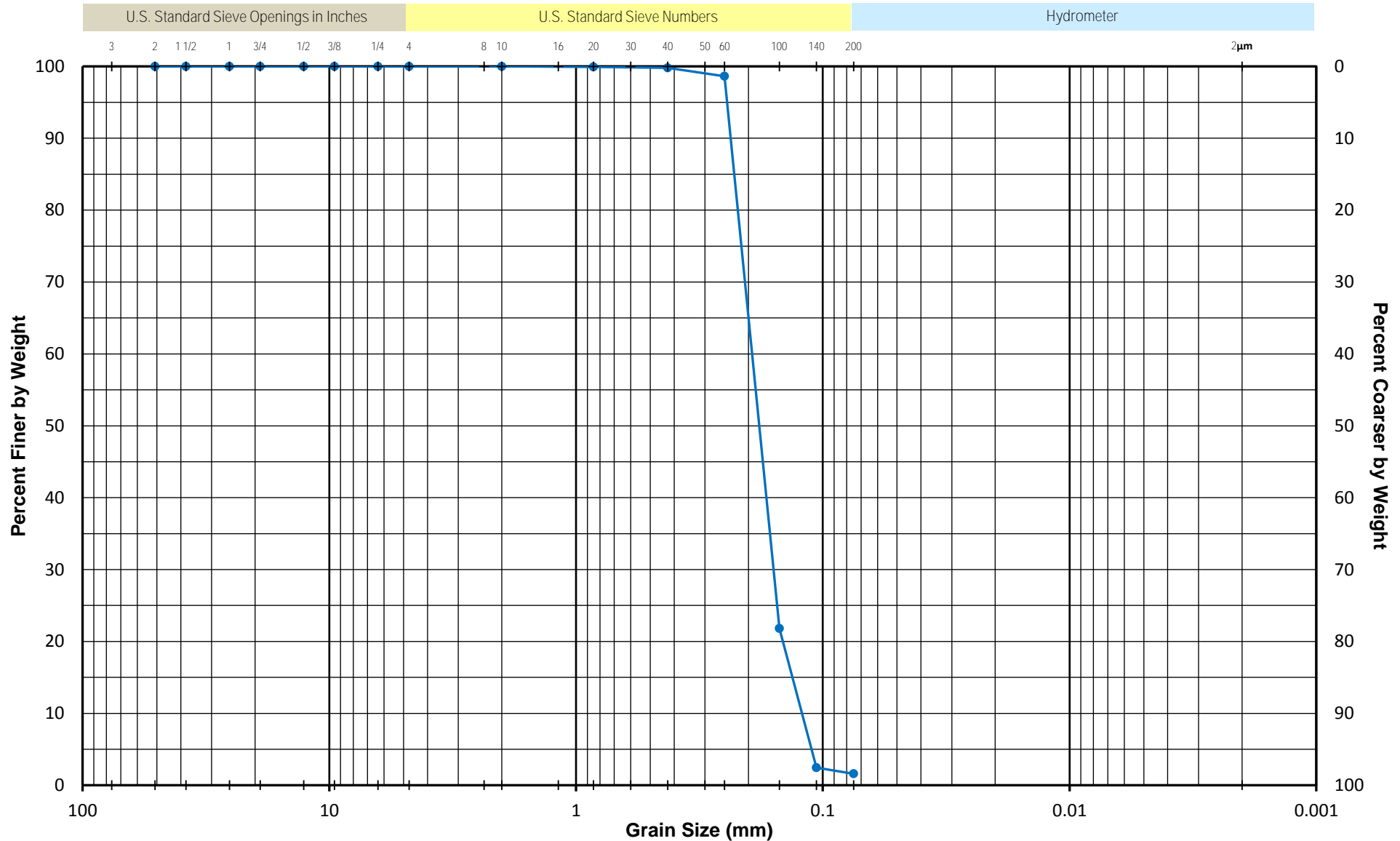


Test Depth	Core ID Section/Sample	Material Description
4.0 ft	VC52 2-4	Gray Fine Sand

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

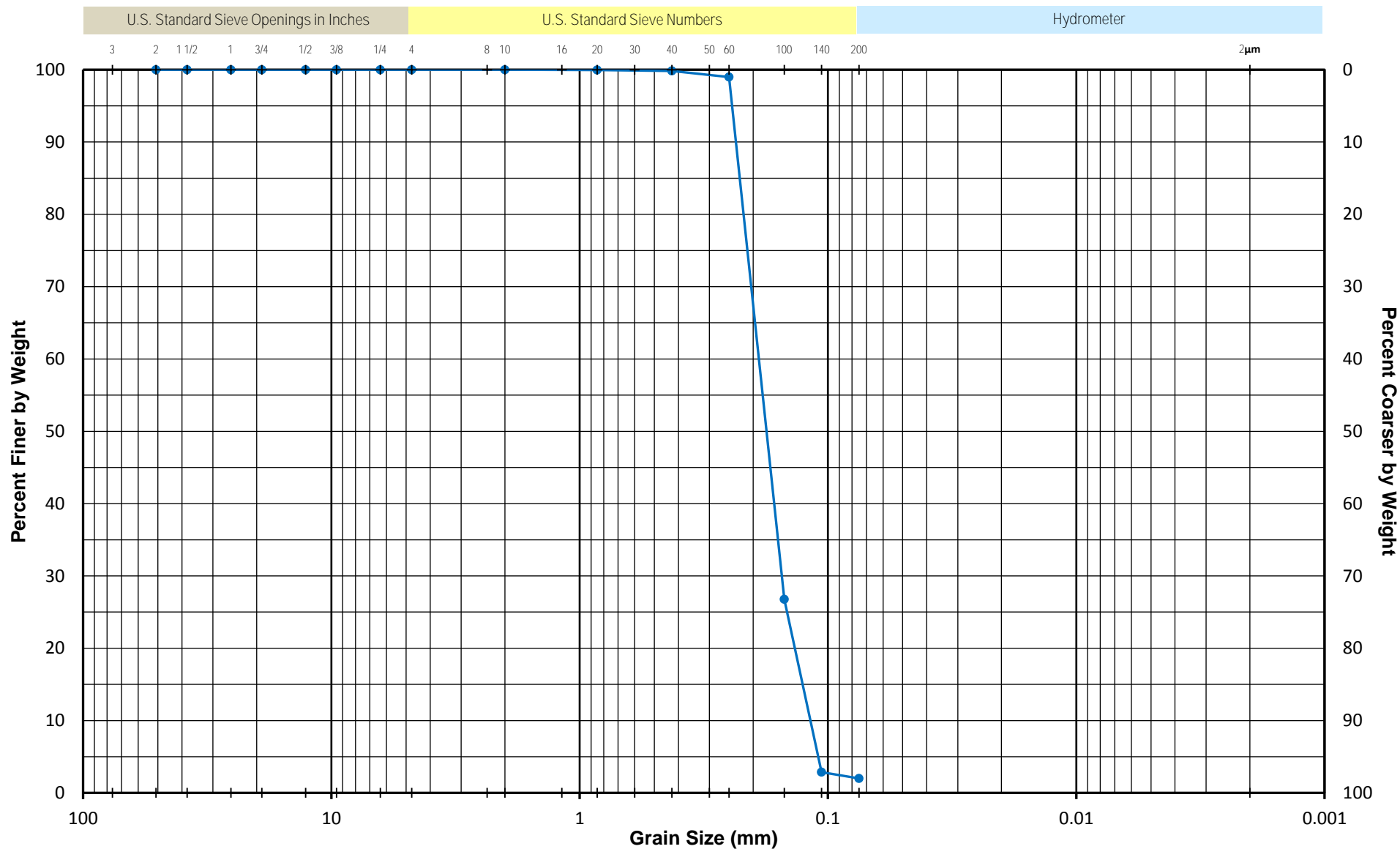


Test Depth	Core ID Section/Sample	Material Description
6.0 ft	VC52 4-6	Gray Fine Sand

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

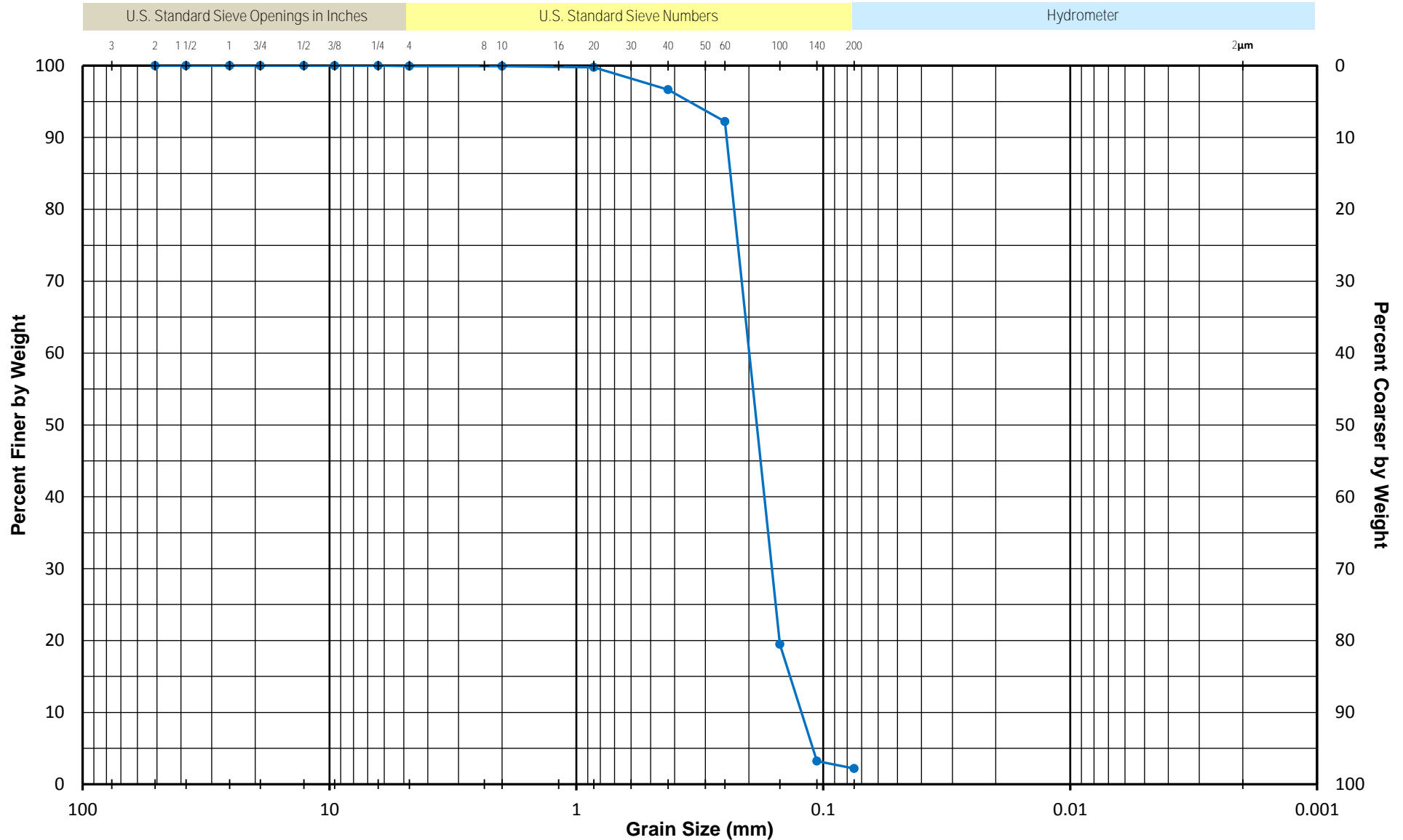


Test Depth	Core ID Section/Sample	Material Description
8.0 ft	VC52 6-8	Gray Fine Sand

GRADATION CURVES

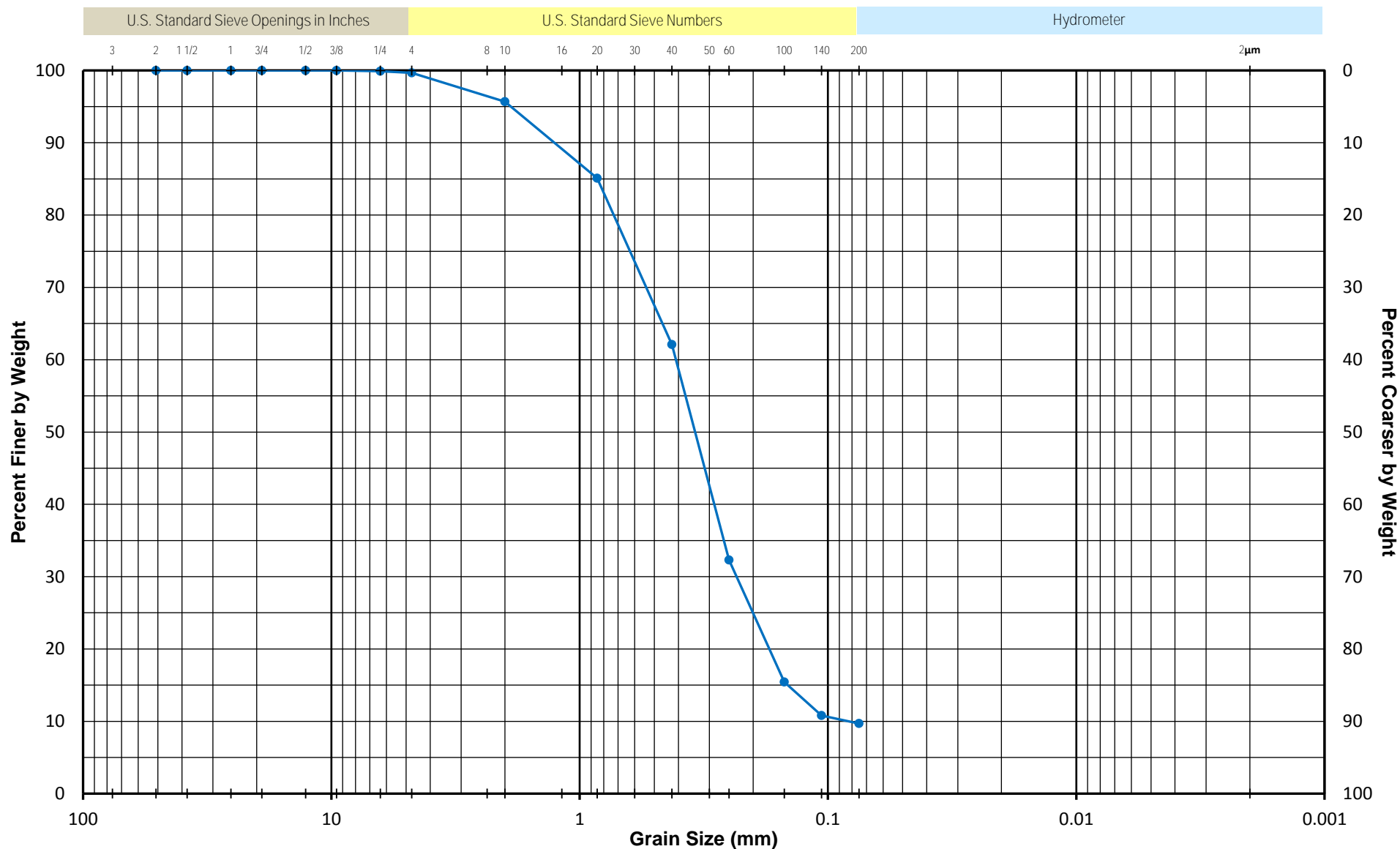
ASTM D-422, D-6913

Alpine - NESE II



Test Depth	Core ID Section/Sample	Material Description
10.0 ft	VC52 8-10	Gray Fine Sand

GRADATION CURVES
 ASTM D-422, D-6913
 Alpine - NESE II

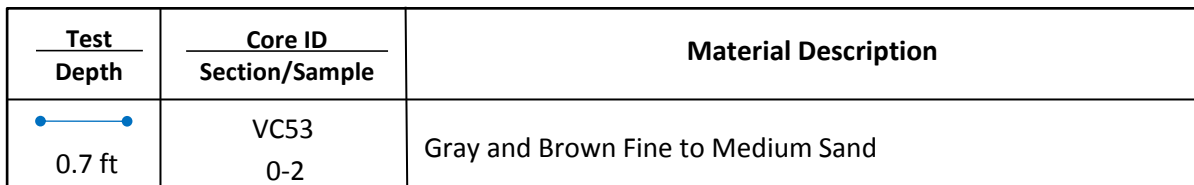


Test Depth	Core ID Section/Sample	Material Description
12.0 ft	VC52 10-12	Gray Fine to Medium Sand with black silty fine sand seam

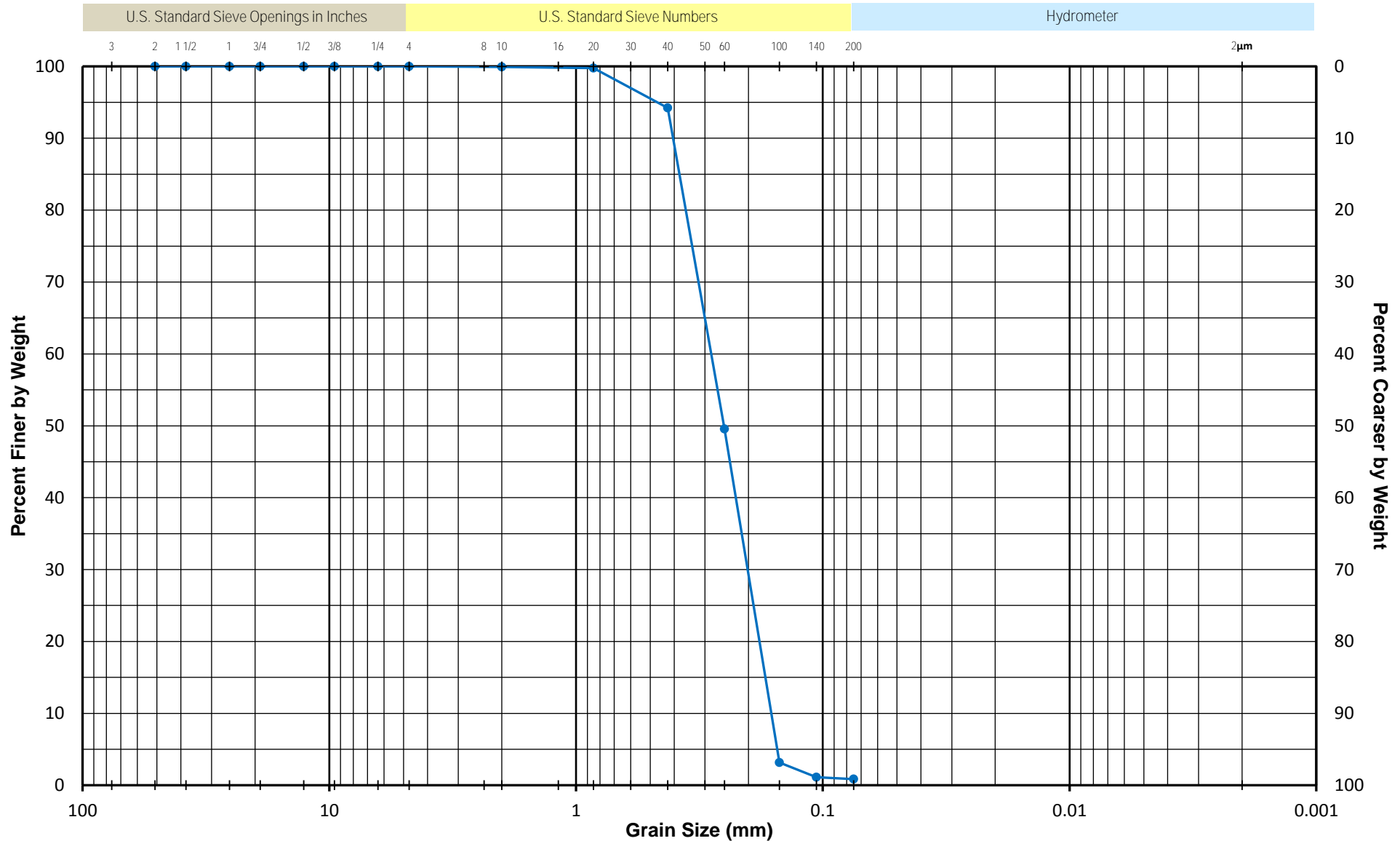
GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II



Alpine - NESE II

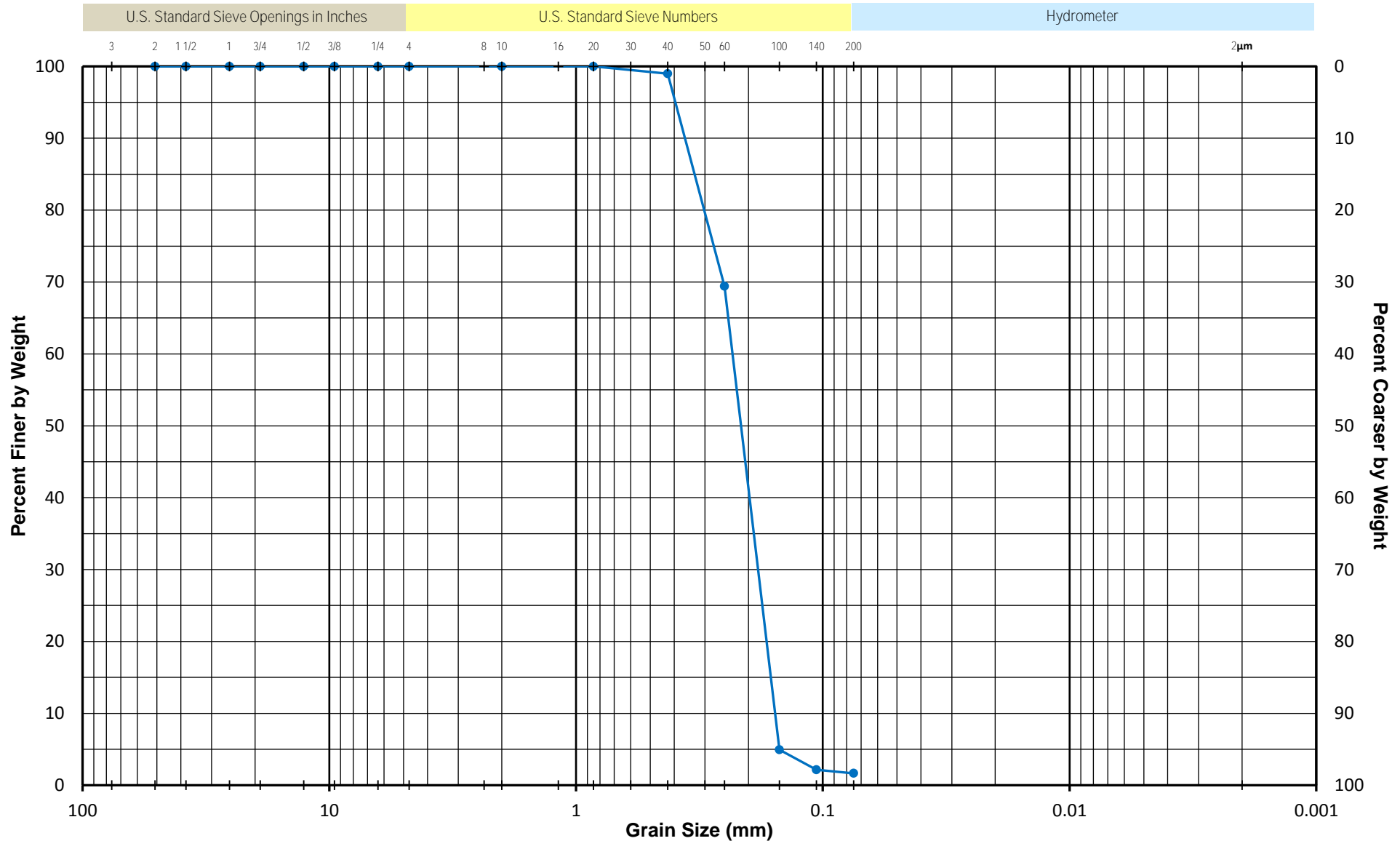


Test Depth	Core ID Section/Sample	Material Description
2.0 ft	VC53 0-2	Very Dark Gray Fine to Medium Sand with shell fragments

GRADATION CURVES

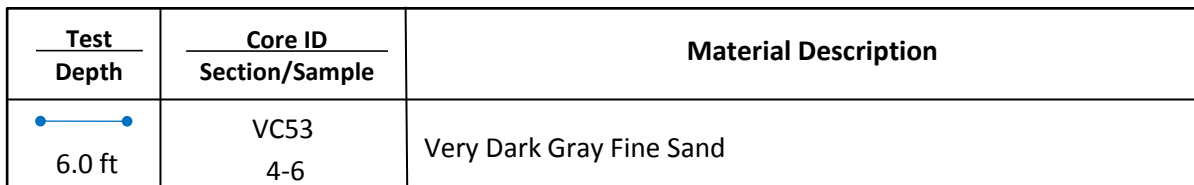
ASTM D-422, D-6913

Alpine - NESE II

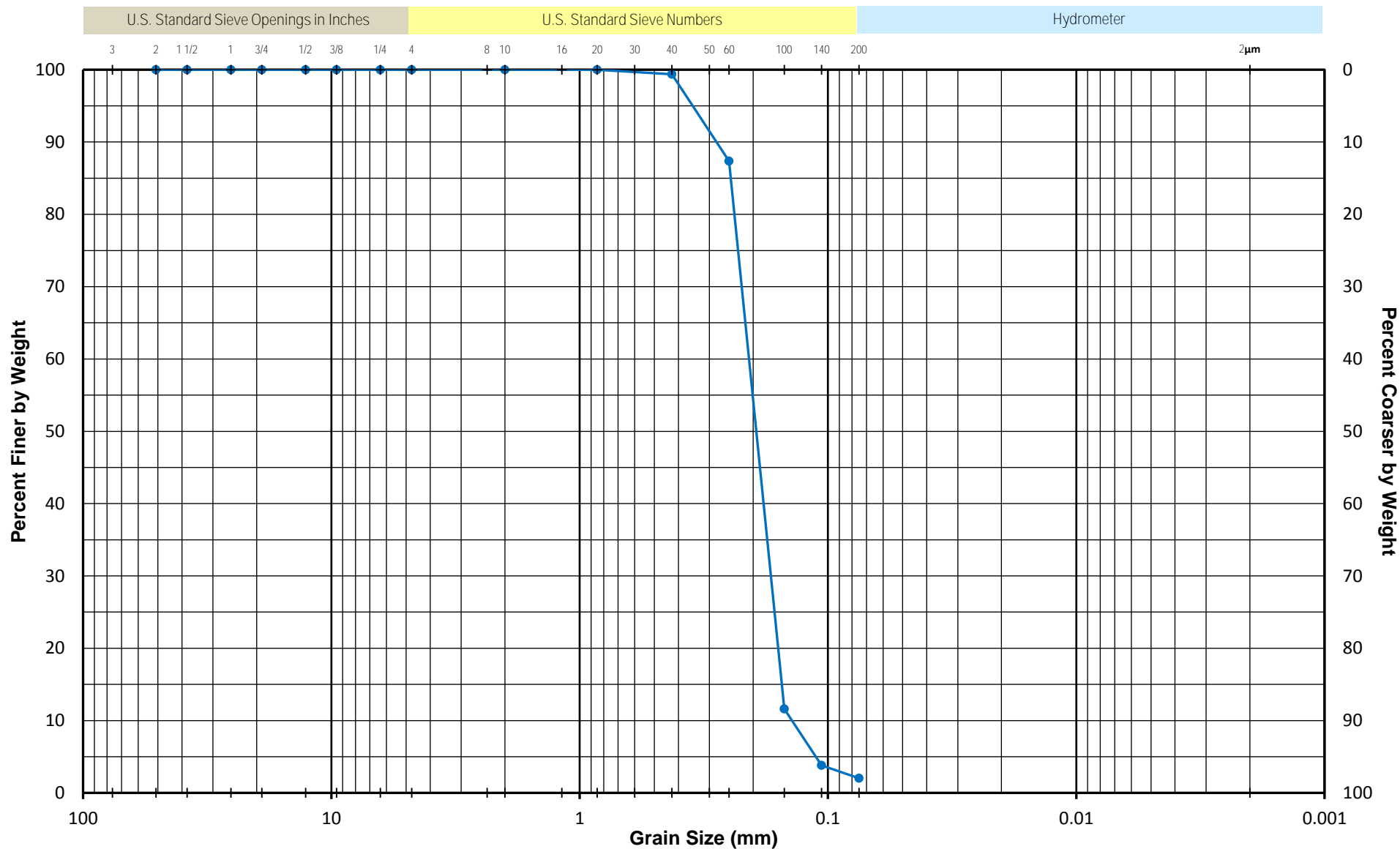


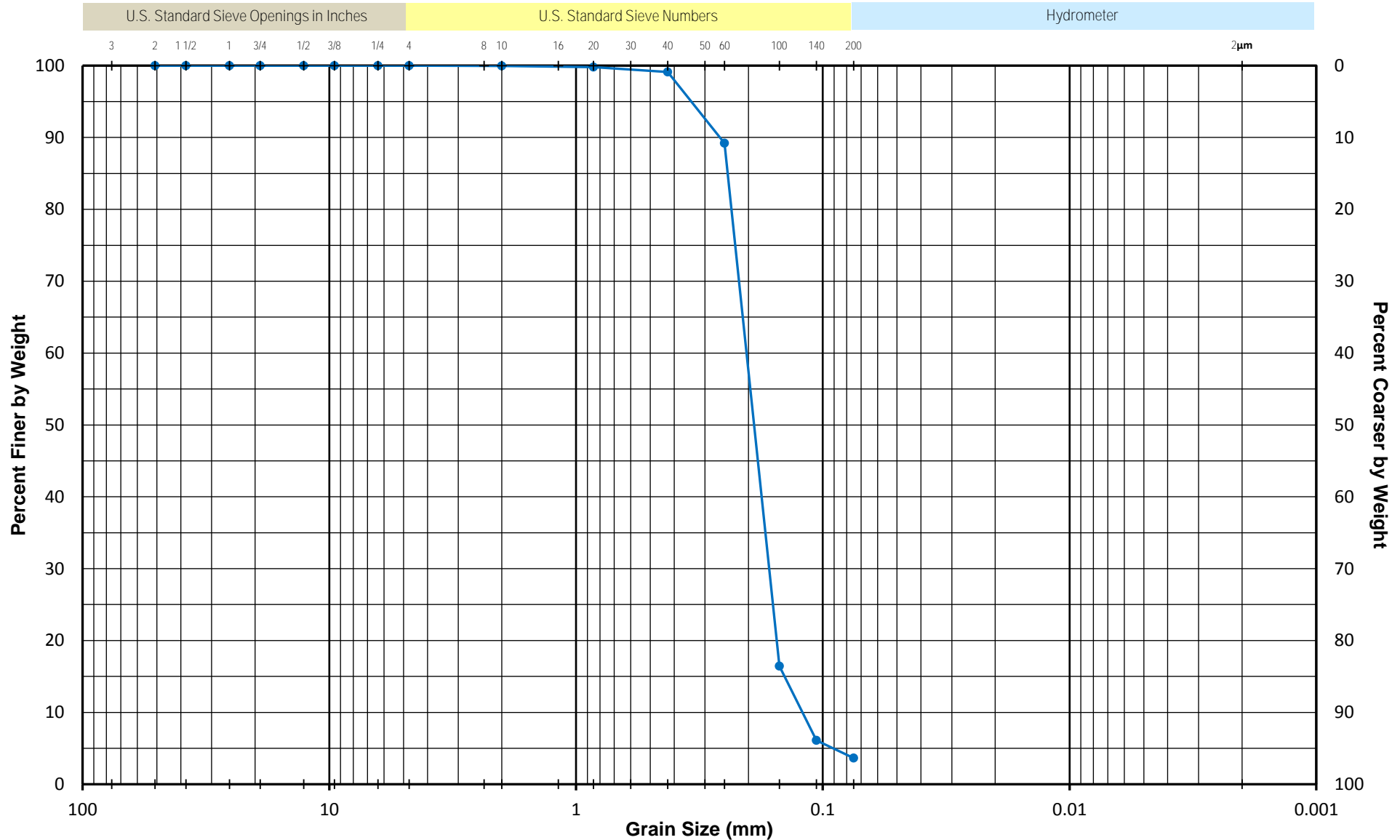
Test Depth	Core ID Section/Sample	Material Description
4.0 ft	VC53 2-4	Very Dark Gray Fine Sand

GRADATION CURVES
 ASTM D-422, D-6913
 Alpine - NESE II



Alpine - NESE II



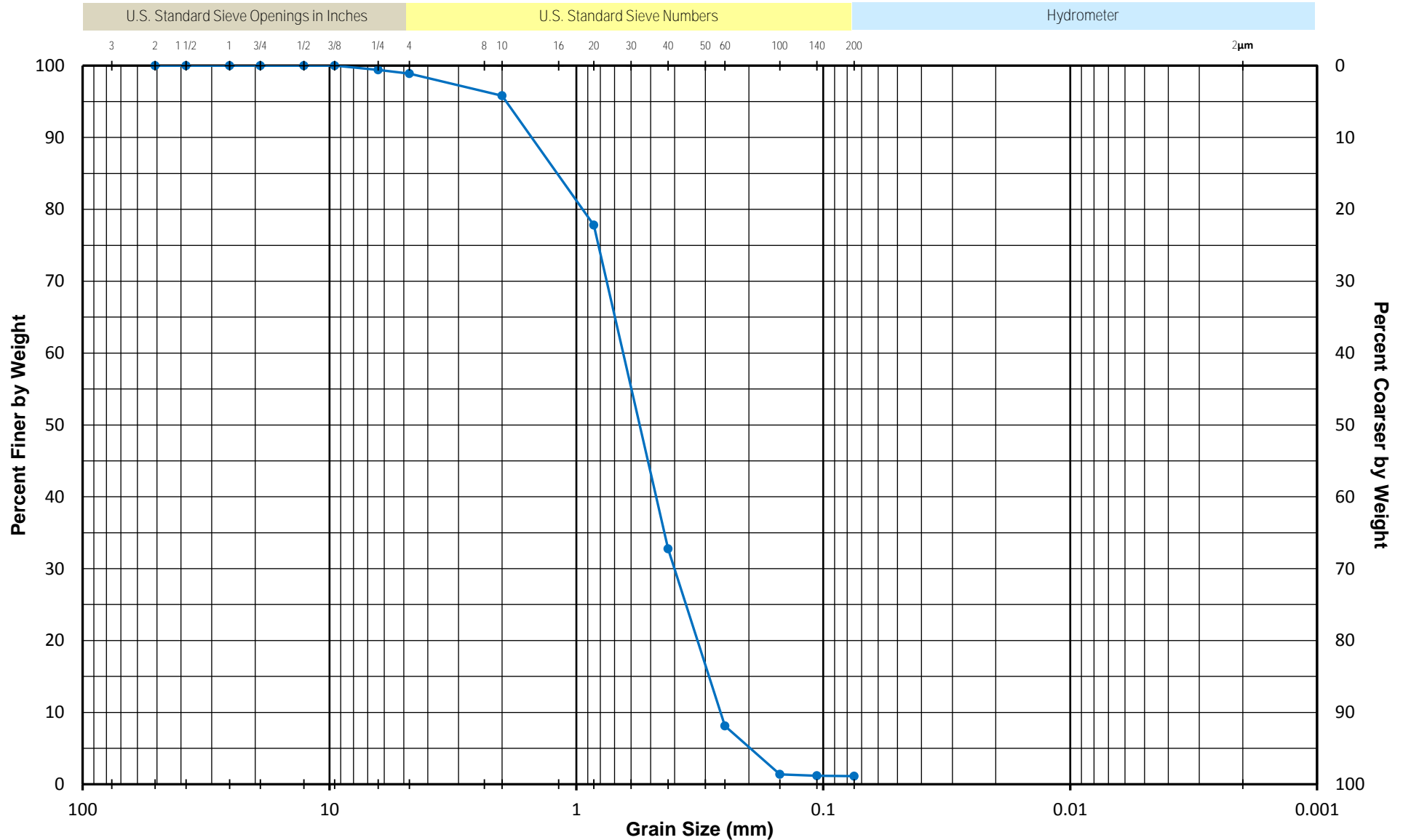


Test Depth	Core ID Section/Sample	Material Description
10.0 ft	VC53 8-10	Very Dark Gray Fine Sand

GRADATION CURVES

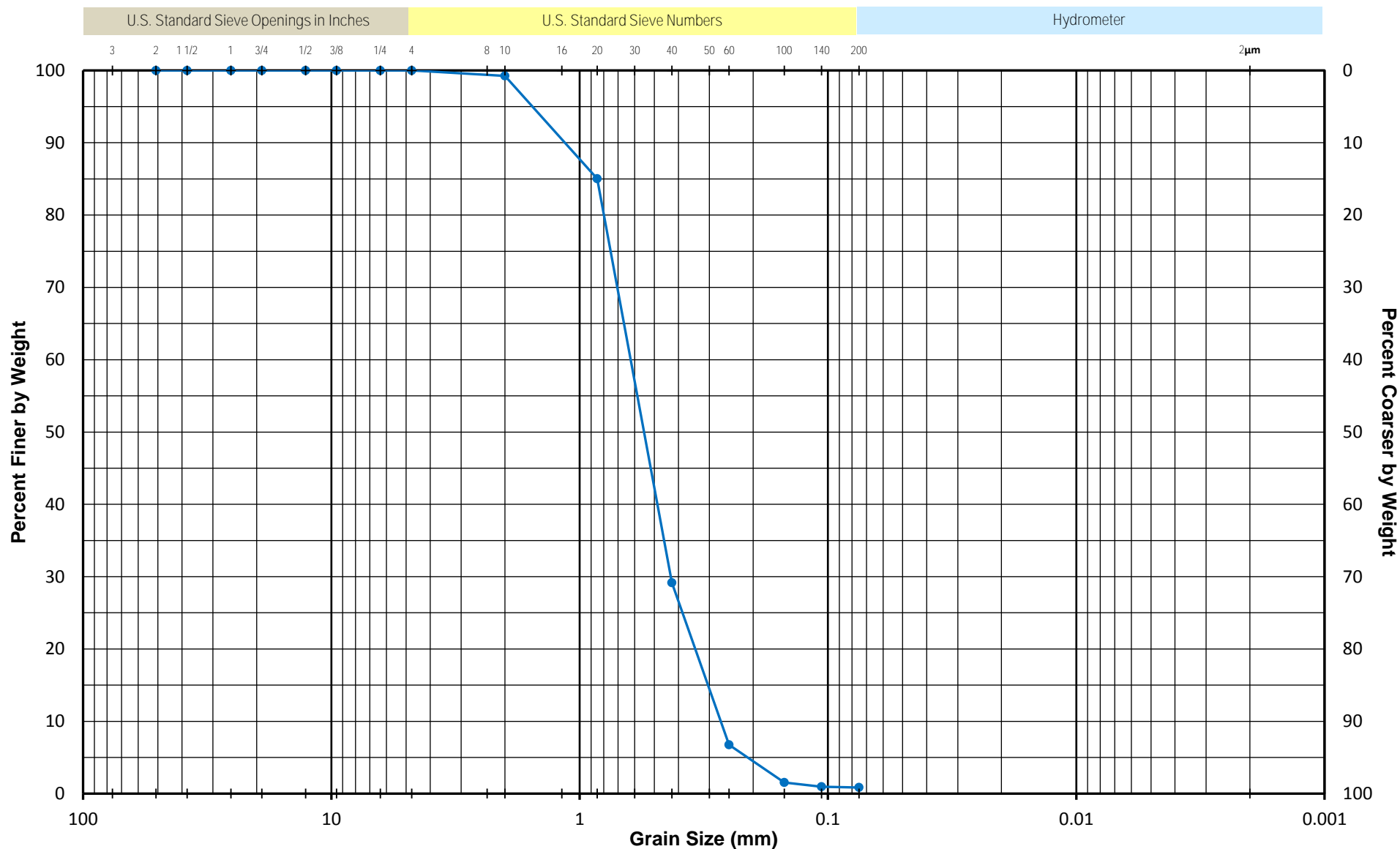
ASTM D-422, D-6913

Alpine - NESE II



Test Depth	Core ID Section/Sample	Material Description
0.7 ft	VC55 0-2	Grayish Brown Medium to Fine Sand

GRADATION CURVES
 ASTM D-422, D-6913
 Alpine - NESE II

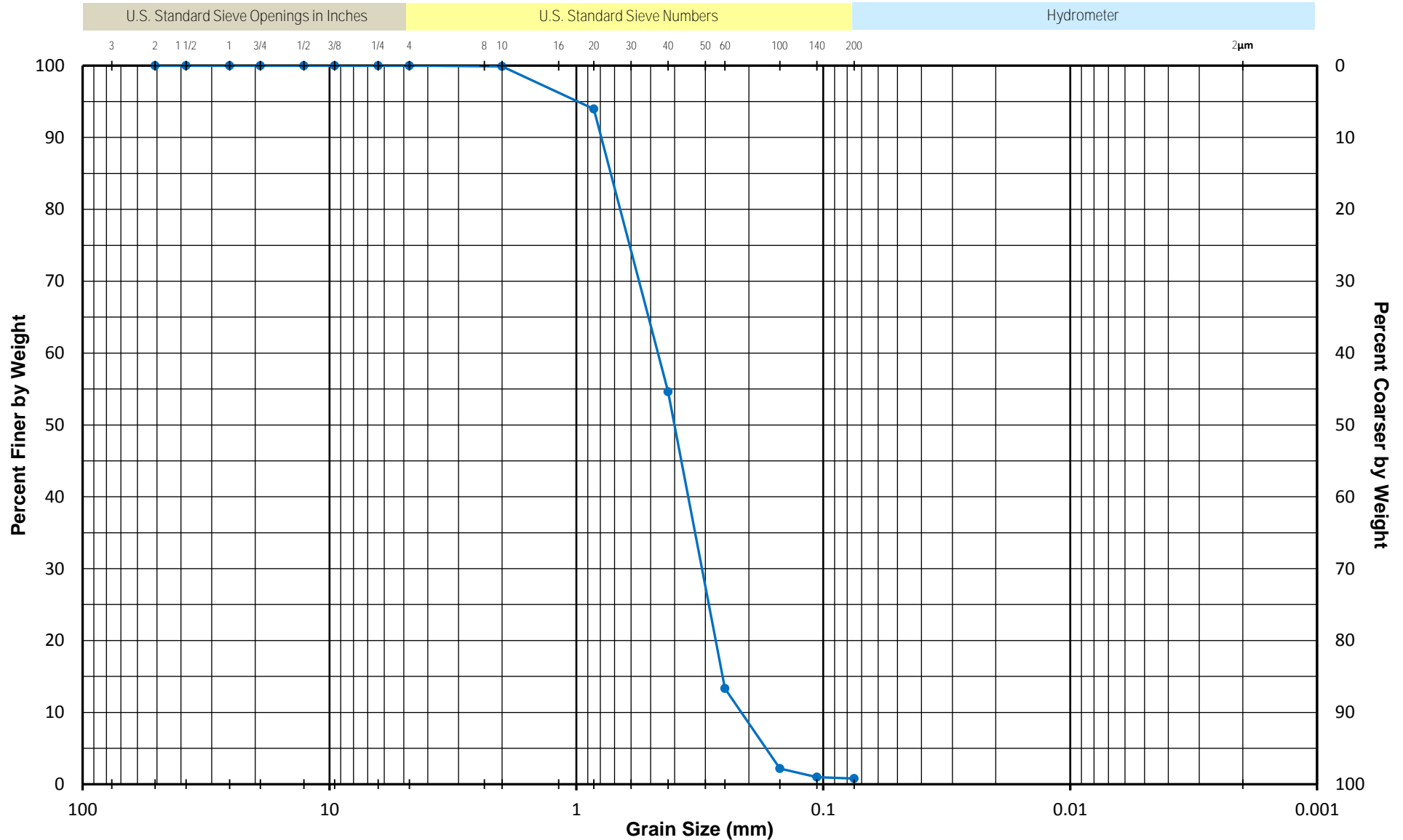


Test Depth	Core ID Section/Sample	Material Description
2.0 ft	VC55 0-2	Gray Medium to Fine Sand

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

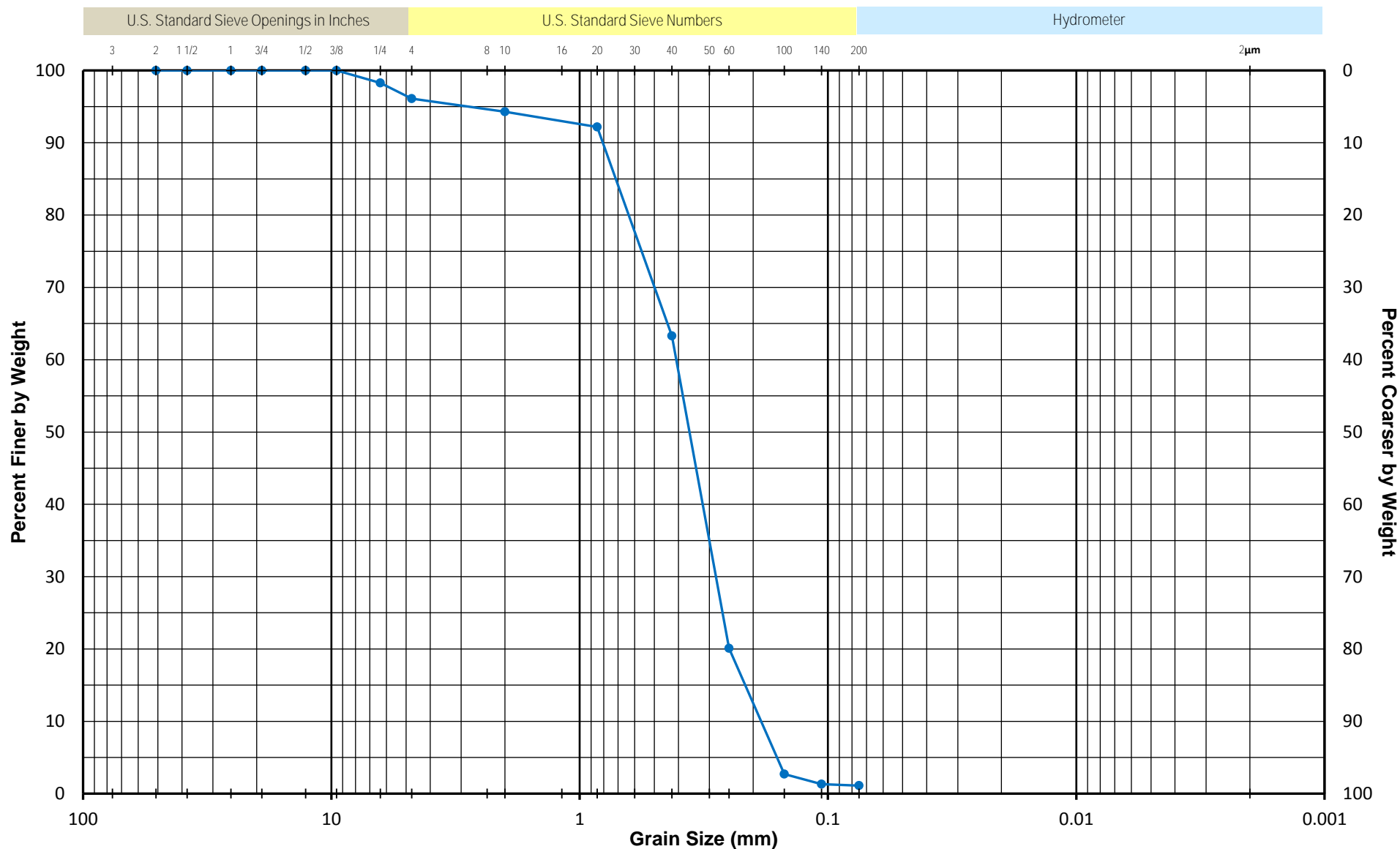


Test Depth	Core ID Section/Sample	Material Description
4.0 ft	VC55 2-4	Gray Fine to Medium Sand

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

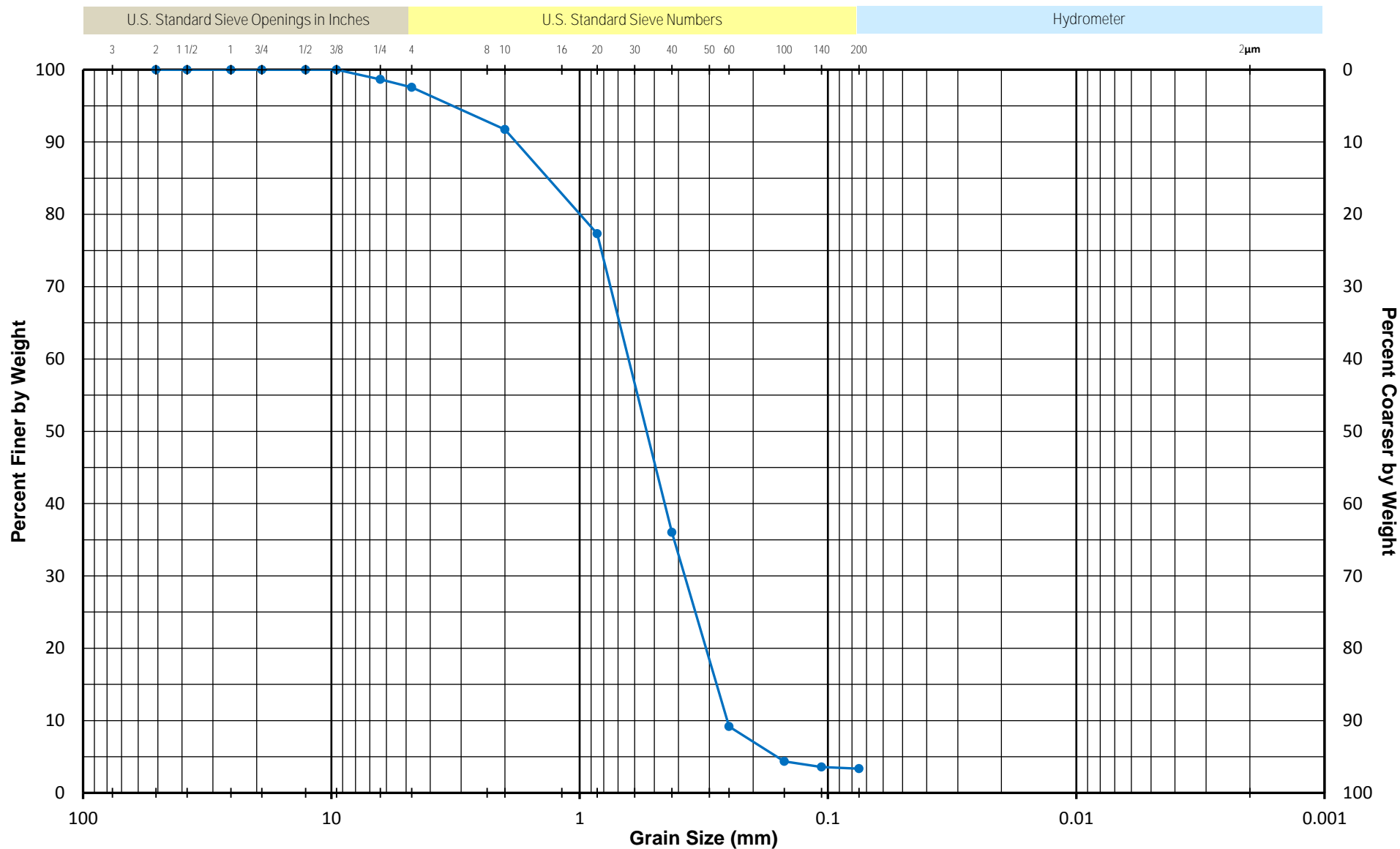


Test Depth	Core ID Section/Sample	Material Description
6.0 ft	VC55 4-6	Gray Fine to Medium Sand

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

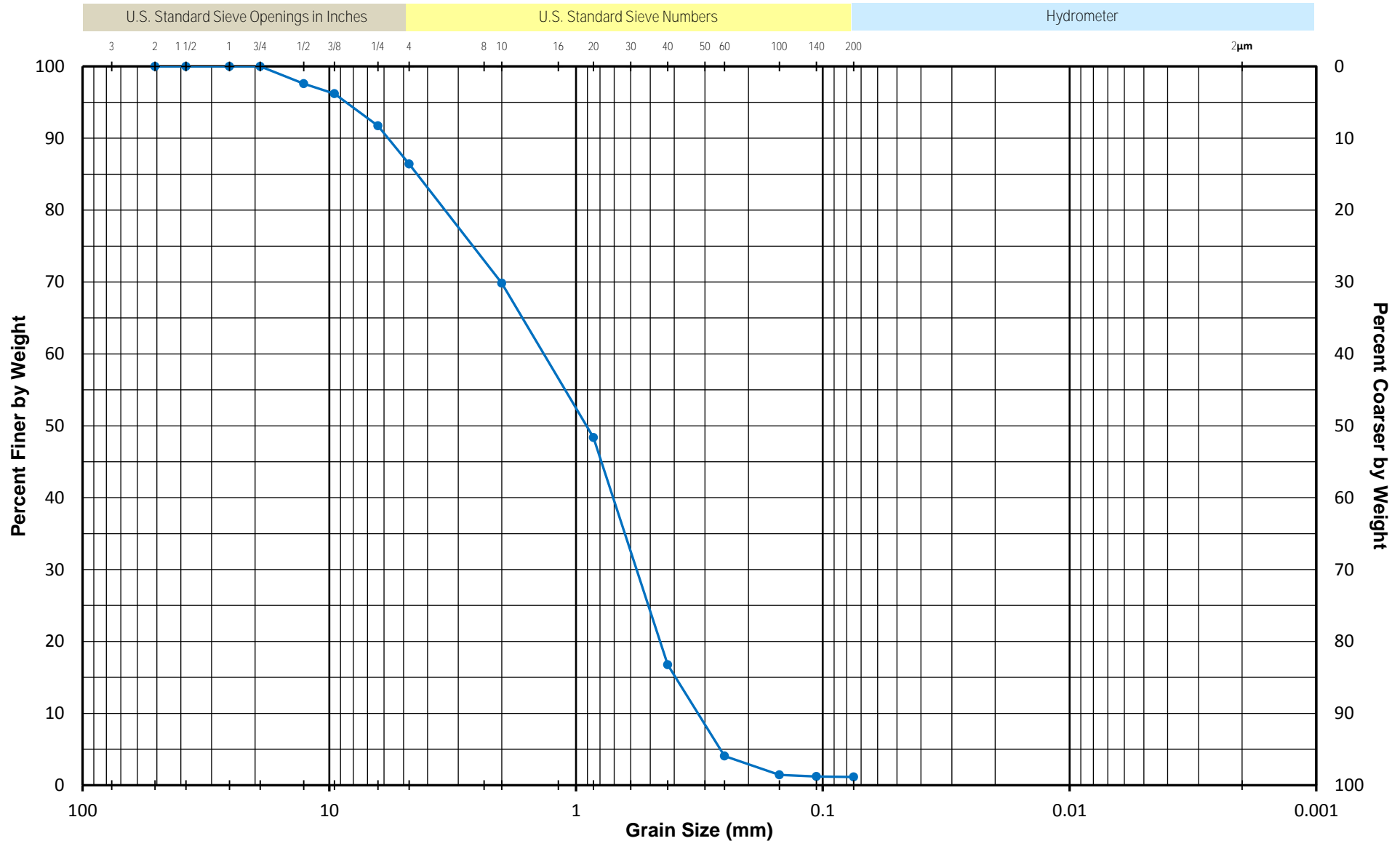


Test Depth	Core ID Section/Sample	Material Description
8.0 ft	VC55 6-8	Pale Olive Medium to Fine Sand

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

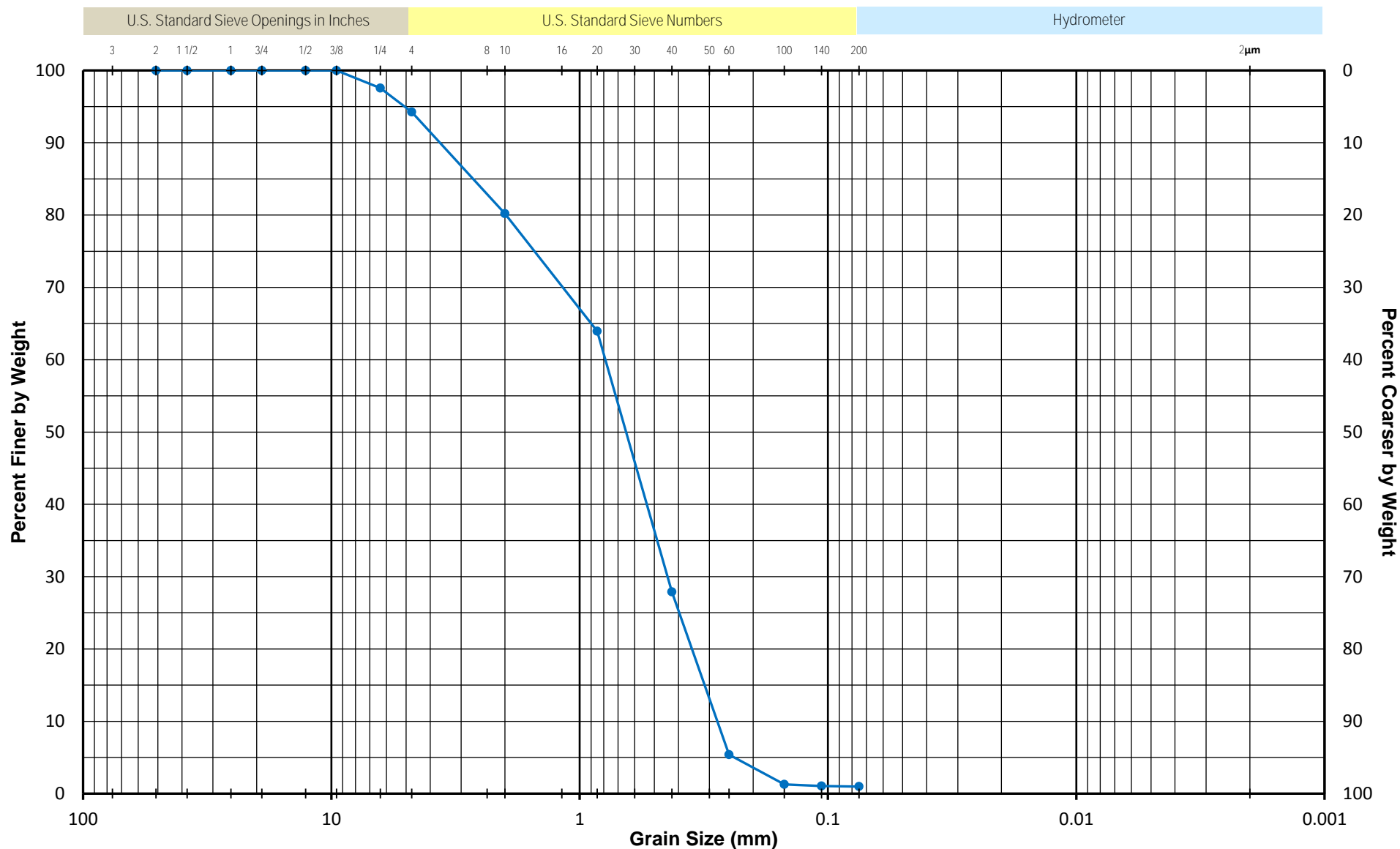


Test Depth	Core ID Section/Sample	Material Description
10.0 ft	VC55 8-10	Pale Olive Medium to Coarse Sand

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

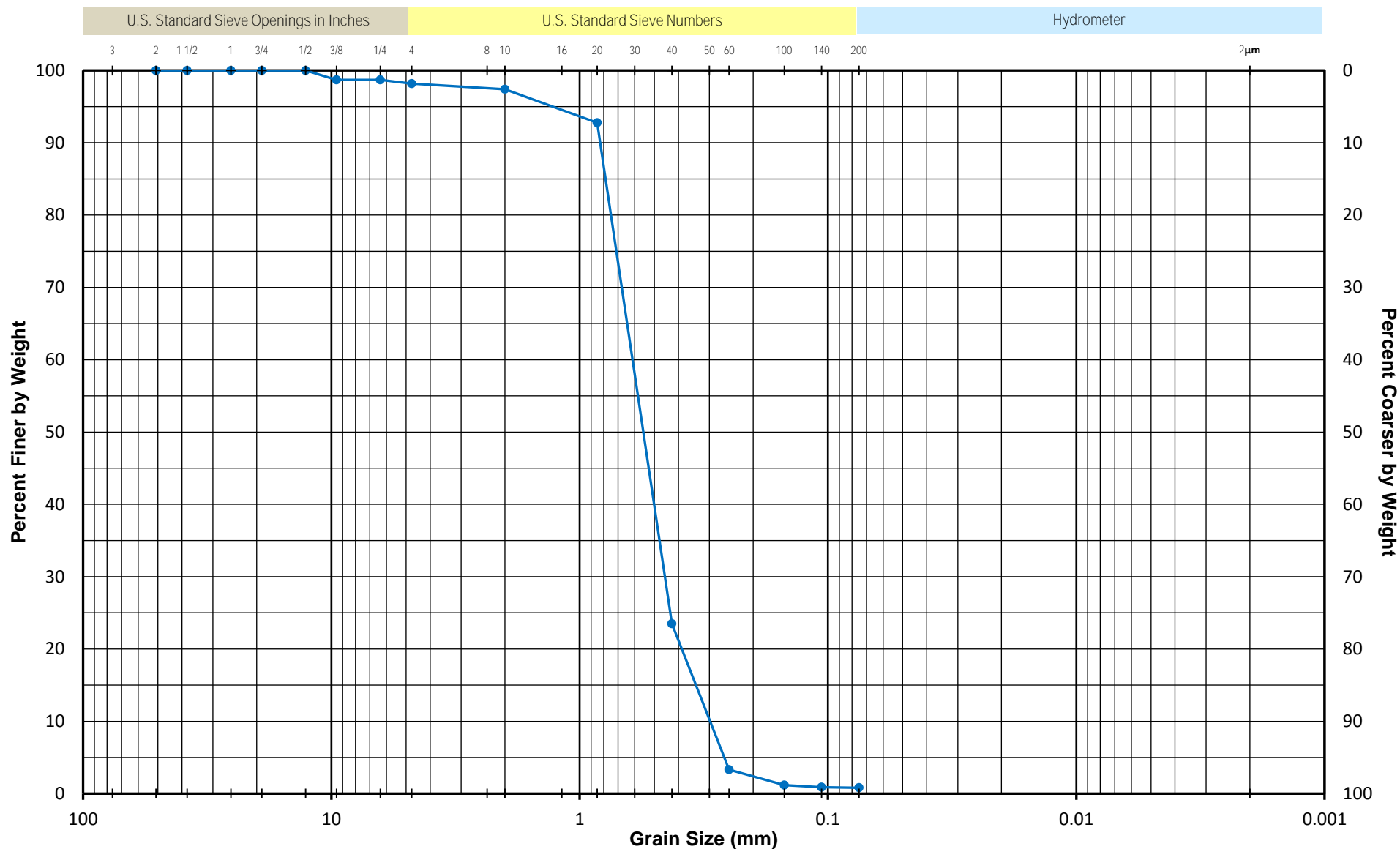


Test Depth	Core ID Section/Sample	Material Description
<div> <div></div> <div>11.9 ft</div> </div>	VC55 10-12	Pale Olive Medium to Fine Sand

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

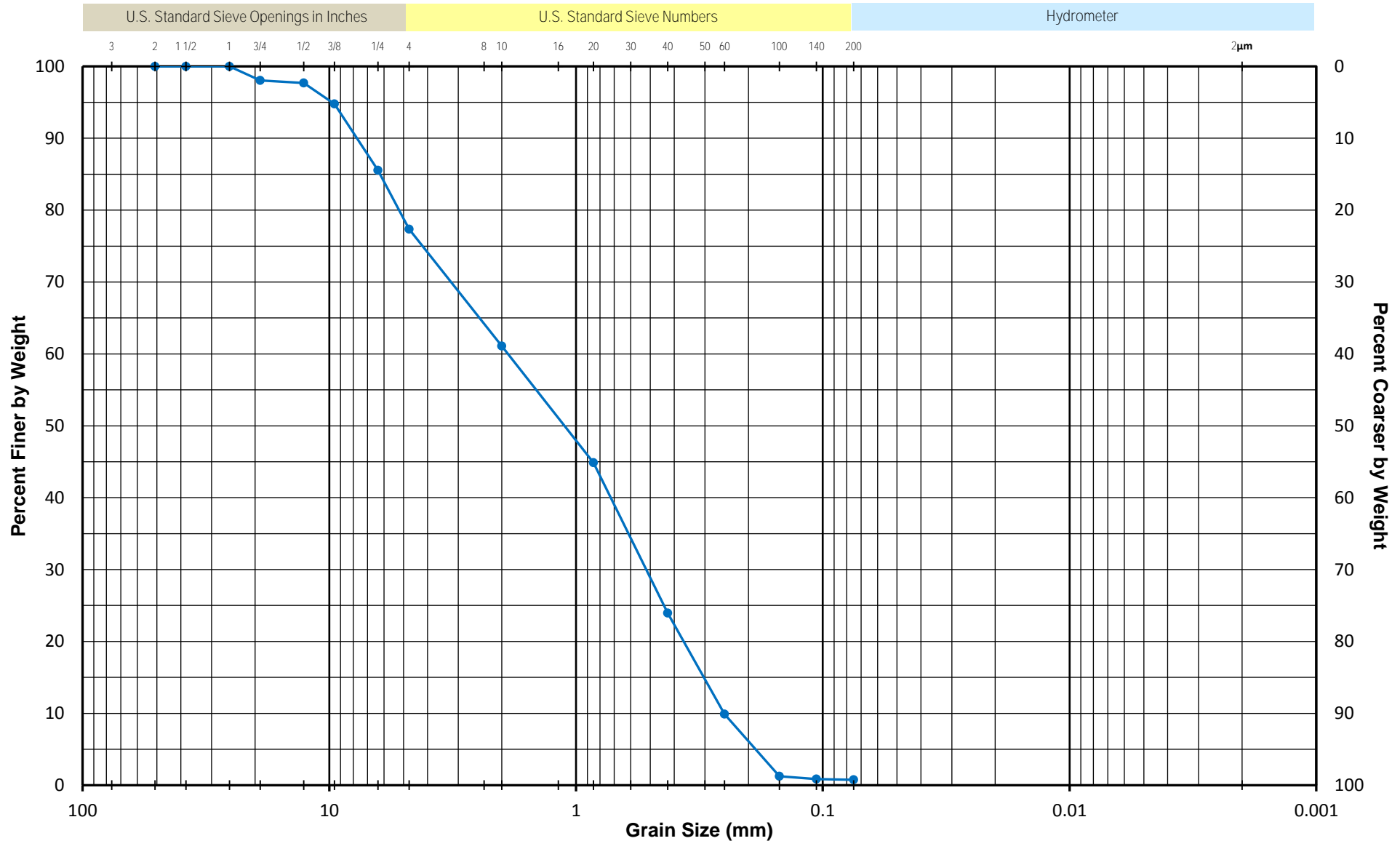


Test Depth	Core ID Section/Sample	Material Description
0.7 ft	VC56 0-2	Brown and Gray Medium to Fine Sand with shell fragments

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

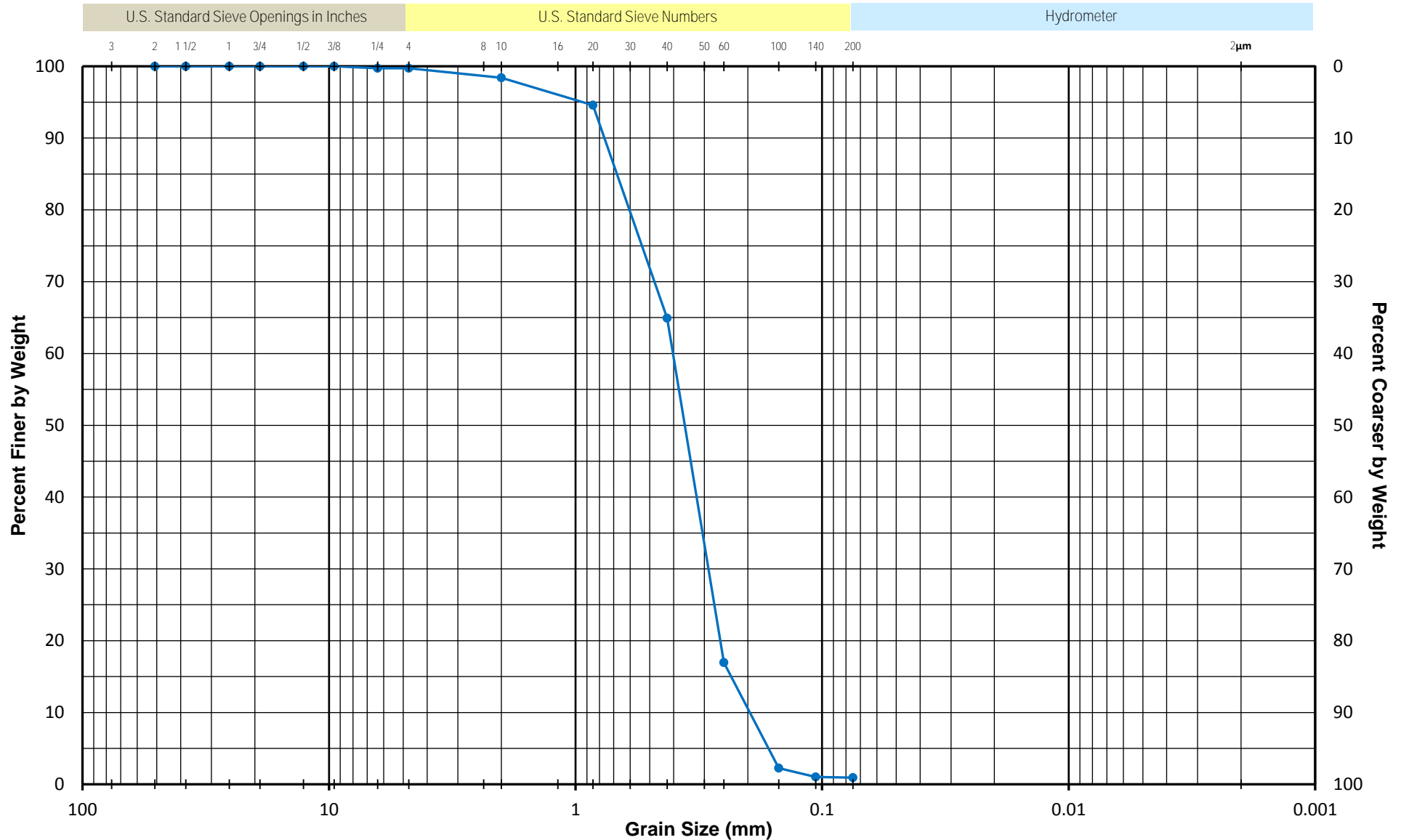


Test Depth	Core ID Section/Sample	Material Description
•—• 2.0 ft	VC56 0-2	Light Yellowish Brown Medium to Fine Sand with gravel

GRADATION CURVES

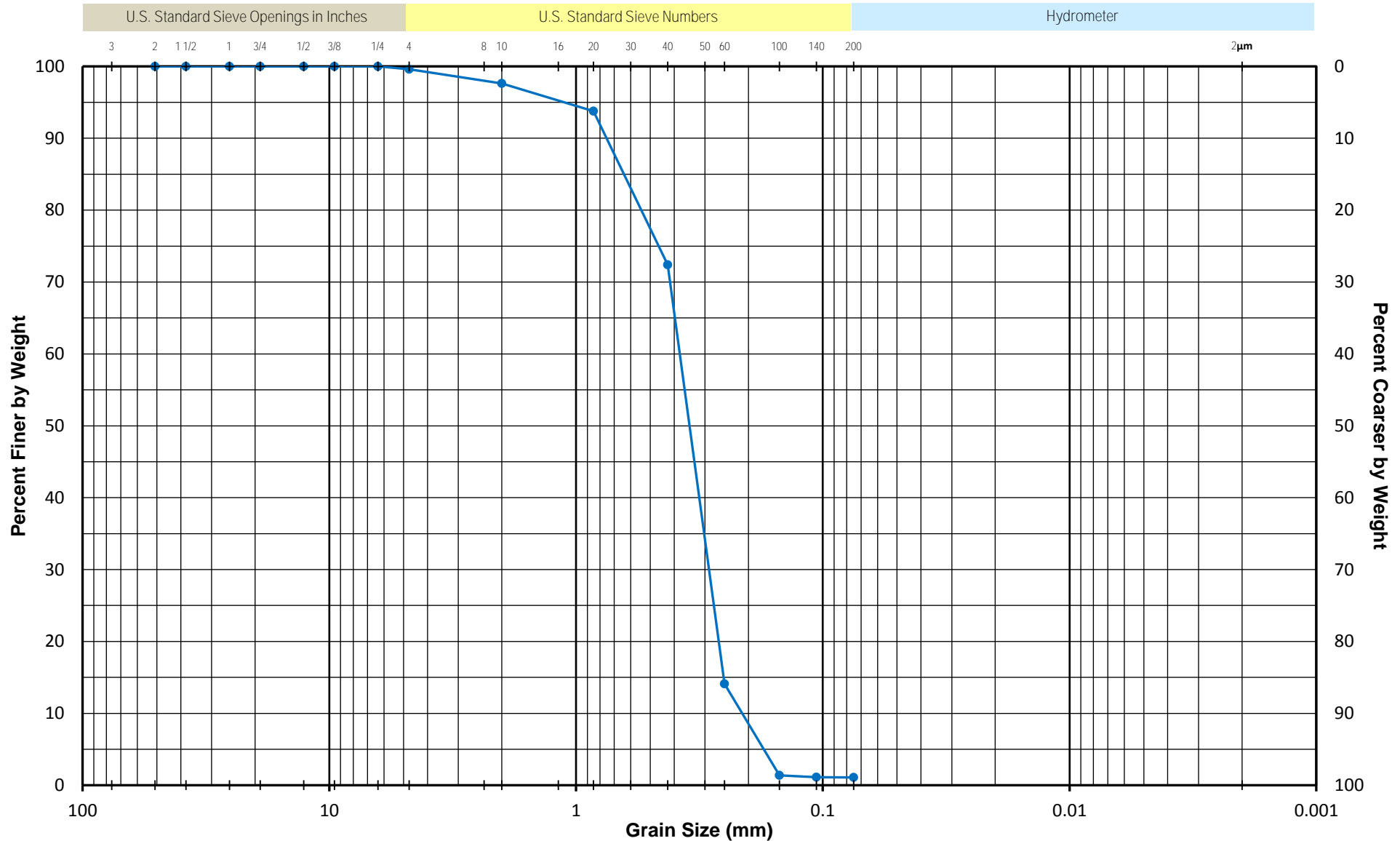
ASTM D-422, D-6913

Alpine - NESE II



Test Depth	Core ID Section/Sample	Material Description
4.0 ft	VC56 2-4	Light Brownish Gray Fine to Medium Sand

GRADATION CURVES
 ASTM D-422, D-6913
 Alpine - NESE II

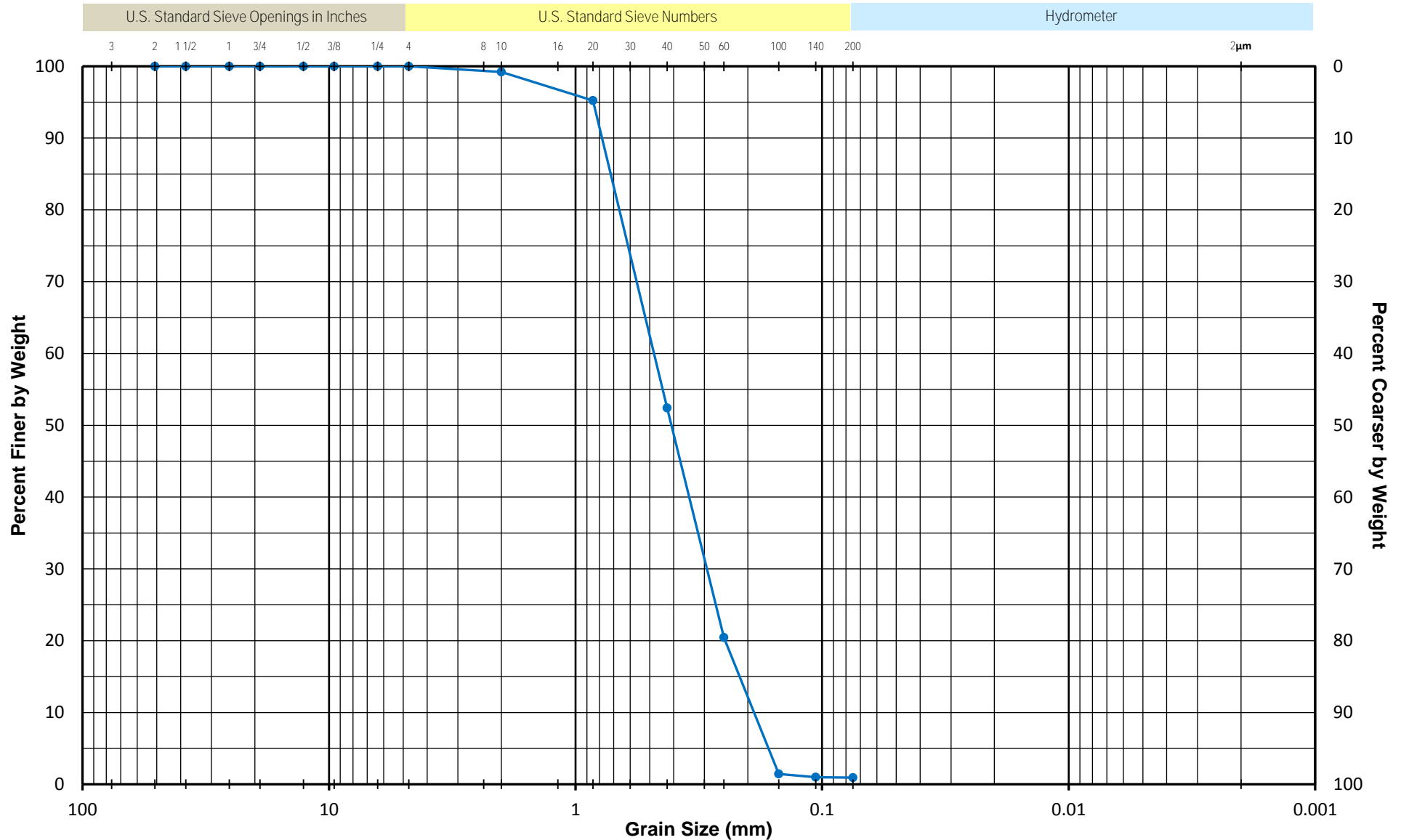


Test Depth	Core ID Section/Sample	Material Description
6.0 ft	VC56 4-6	Light Brownish Gray Fine to Medium Sand

GRADATION CURVES

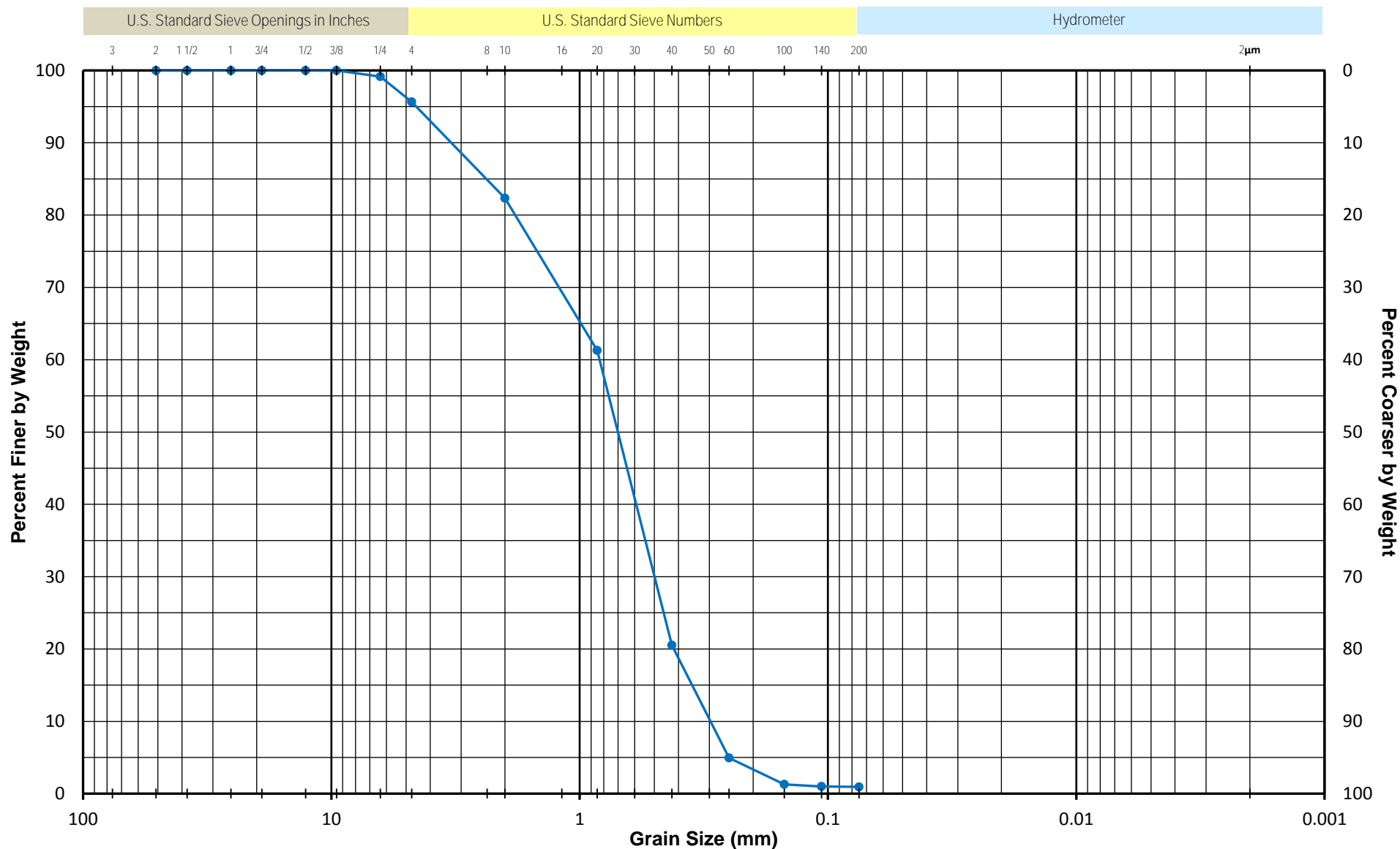
ASTM D-422, D-6913

Alpine - NESE II



Test Depth	Core ID Section/Sample	Material Description
8.0 ft	VC56 6-8	Gray and Brownish Gray Fine to Medium Sand

GRADATION CURVES
 ASTM D-422, D-6913
 Alpine - NESE II

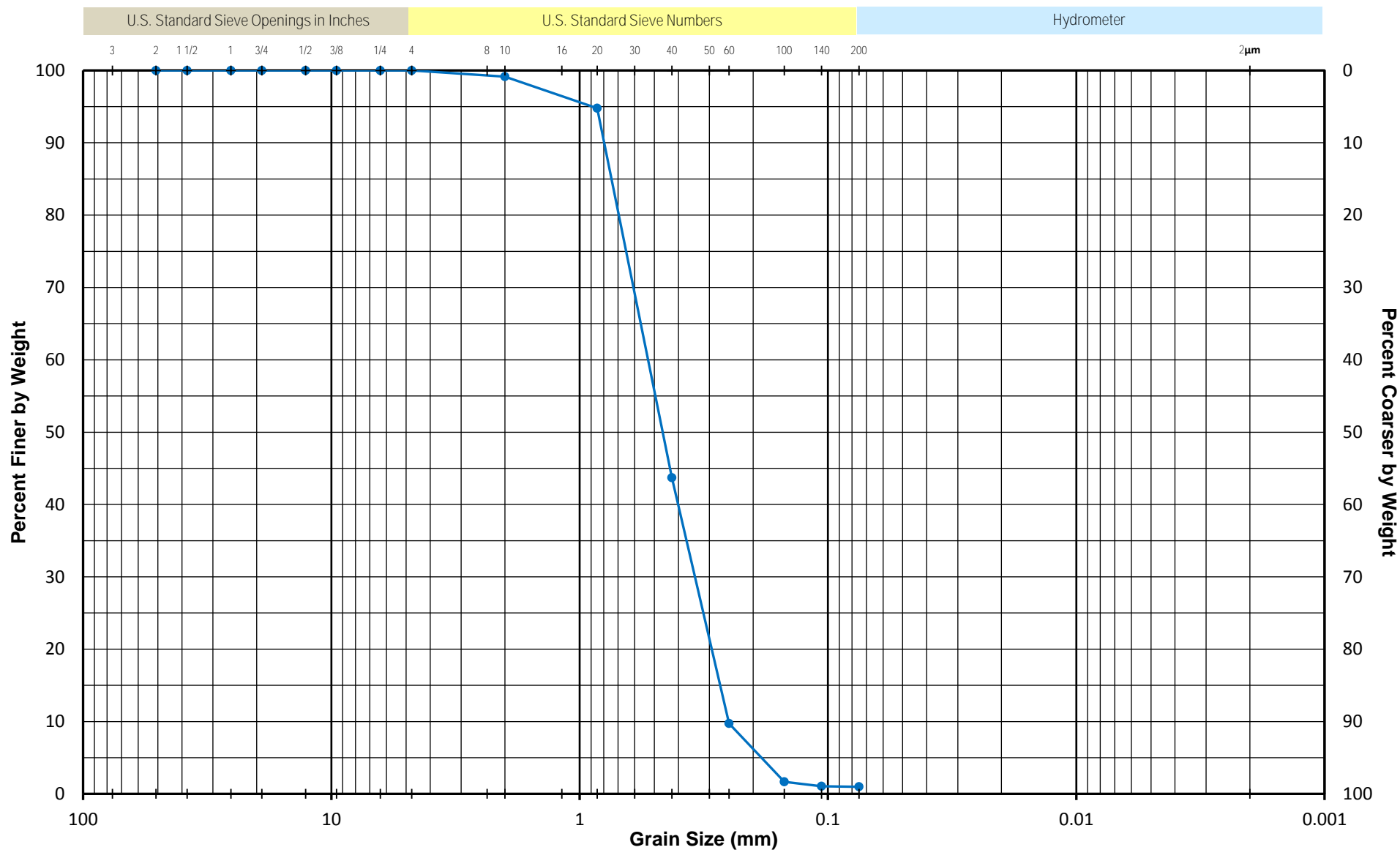


Test Depth	Core ID Section/Sample	Material Description
10.0 ft	VC56 8-10	Brownish Gray Fine to Coarse Sand

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

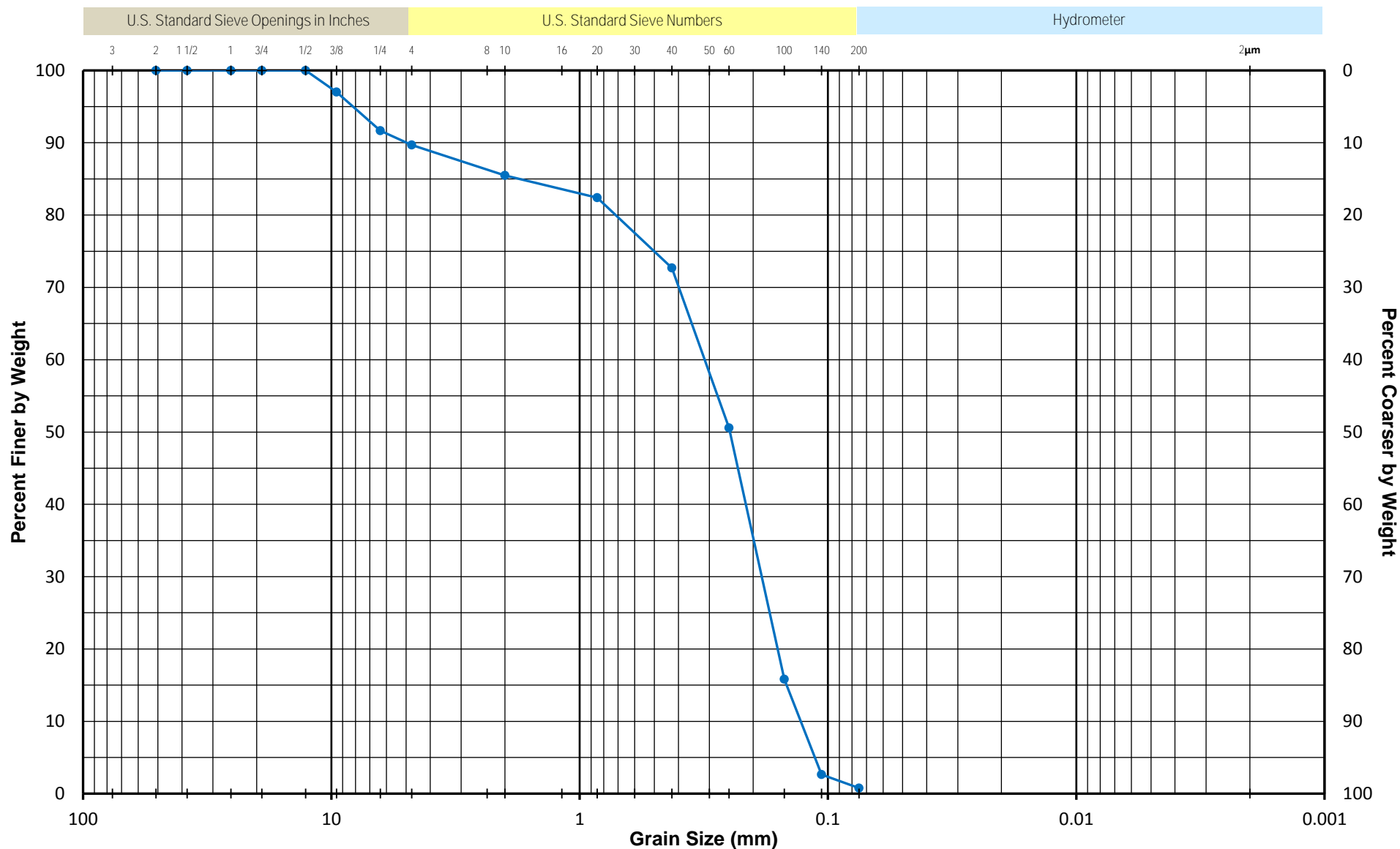


Test Depth	Core ID Section/Sample	Material Description
12.0 ft	VC56 10-12	Brownish Gray Medium to Fine Sand

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

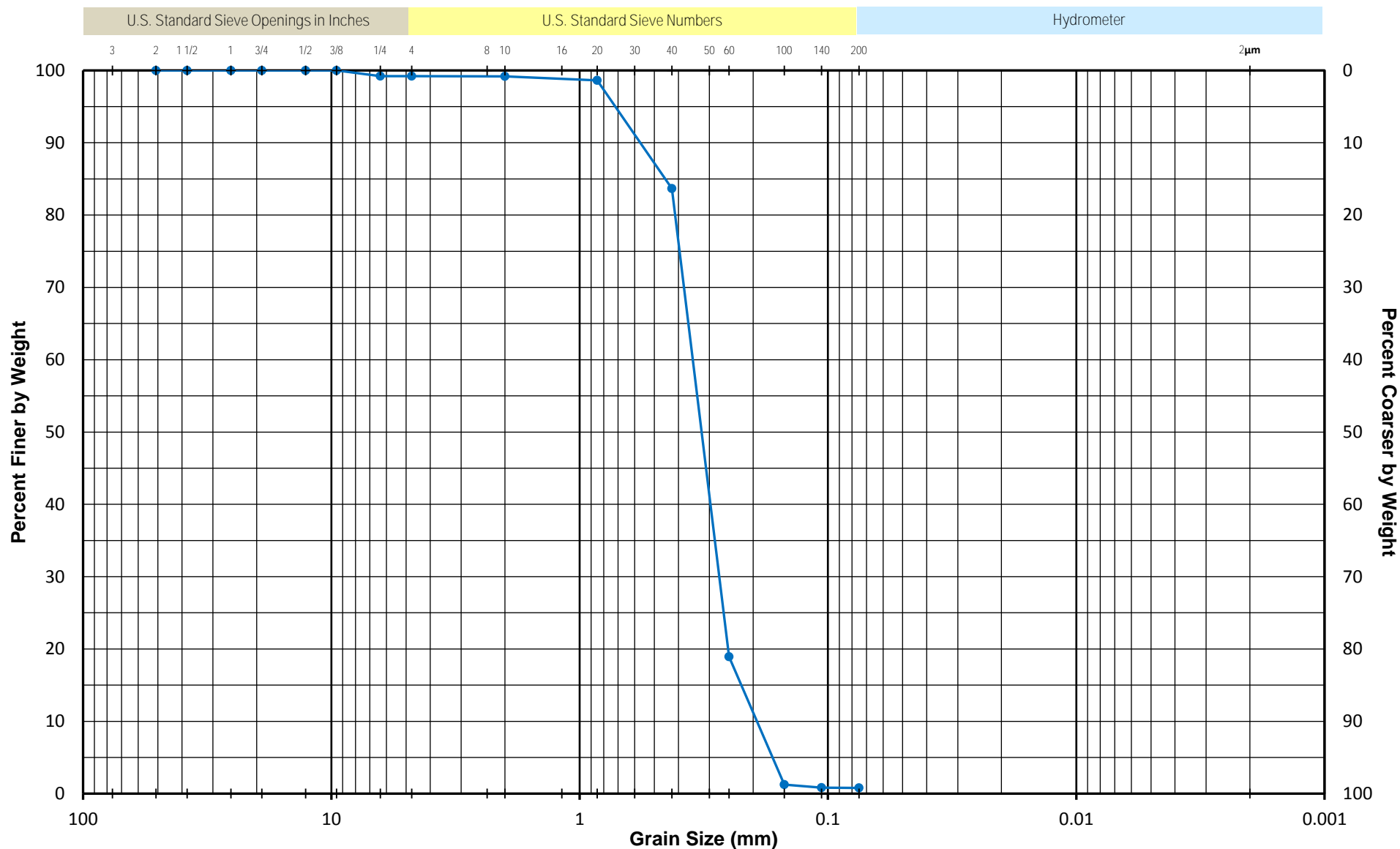


Test Depth	Core ID Section/Sample	Material Description
0.2 ft	VC58 0-2	Black and Olive Brown Fine to Medium Sand with shell fragments

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

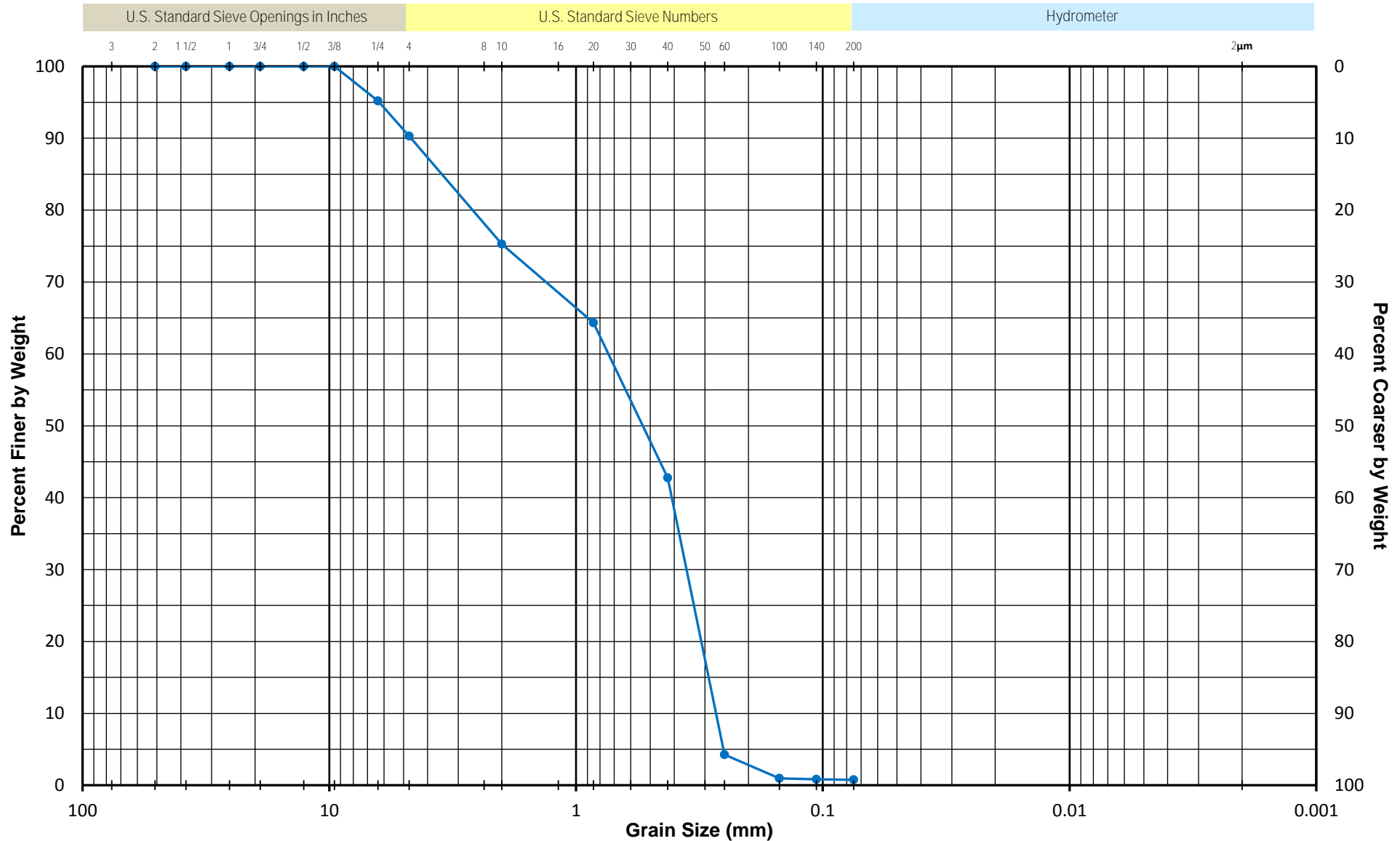


Test Depth	Core ID Section/Sample	Material Description
•—• 2.0 ft	VC58 0-2	Dark Gray Fine to Medium Sand

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

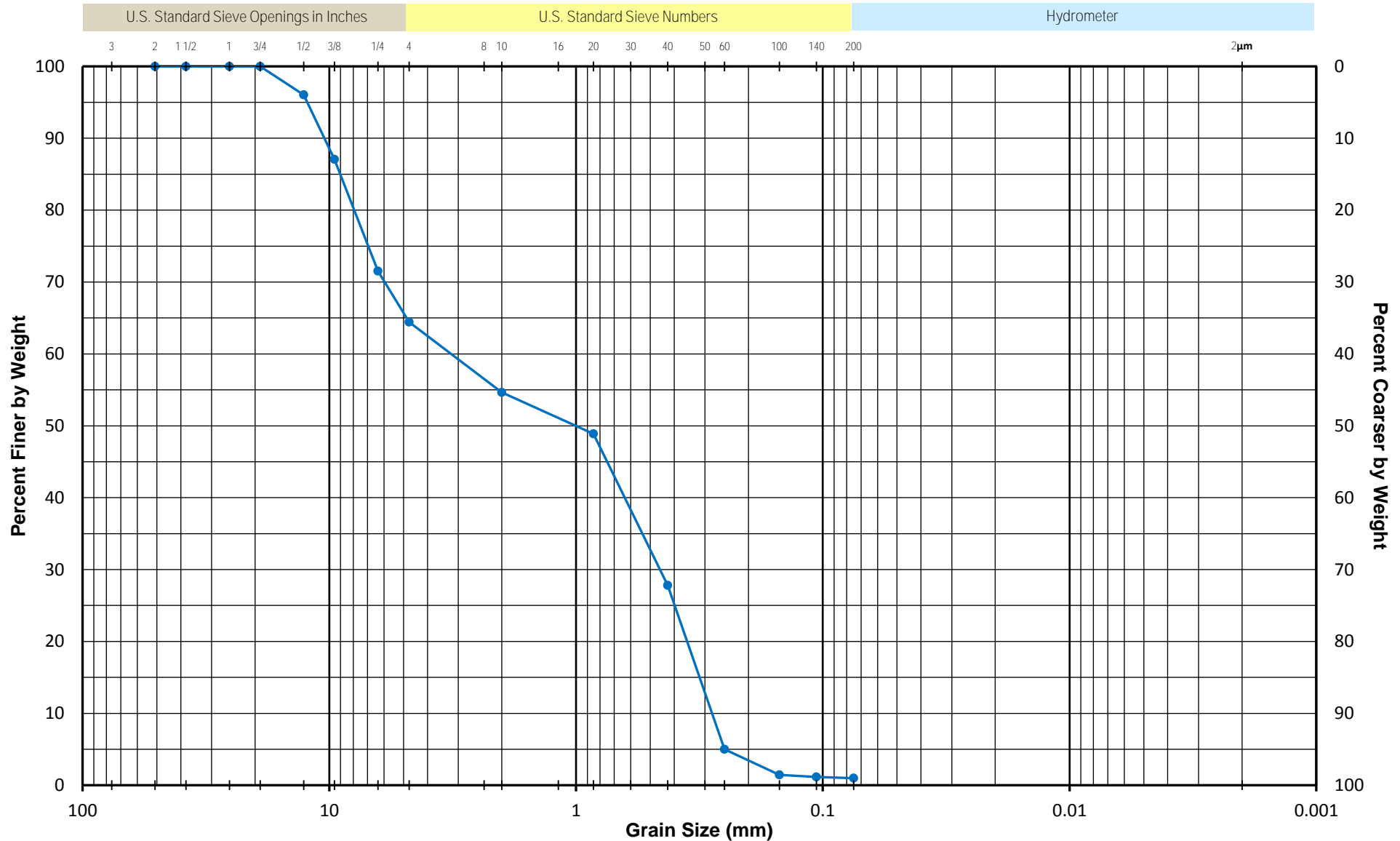


Test Depth	Core ID Section/Sample	Material Description
• — • 4.0 ft	VC58 2-4	Dark Gray Fine to Coarse Sand

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

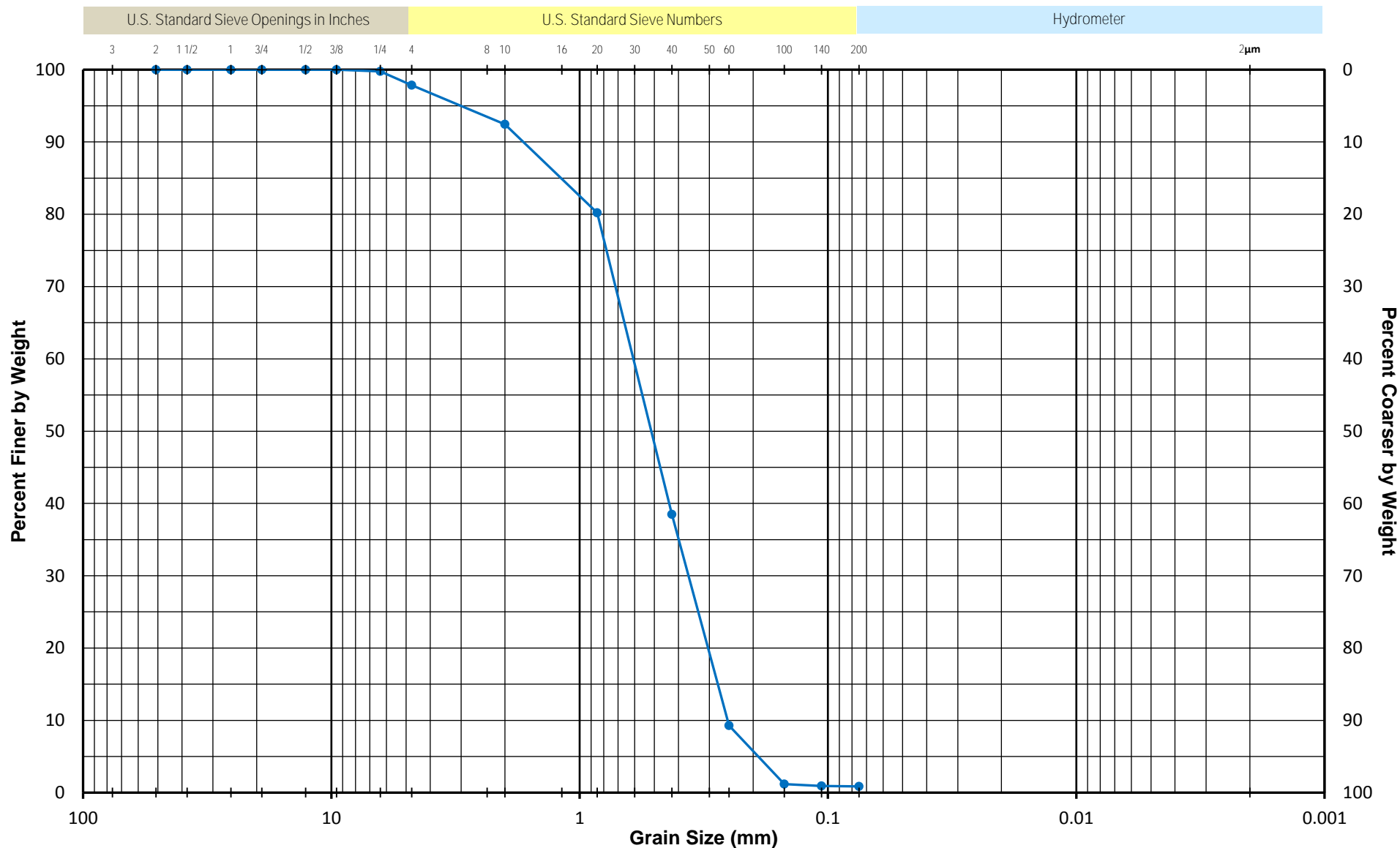


Test Depth	Core ID Section/Sample	Material Description
6.0 ft	VC58 4-6	Dark Gray Fine to Coarse Sand with gravel

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

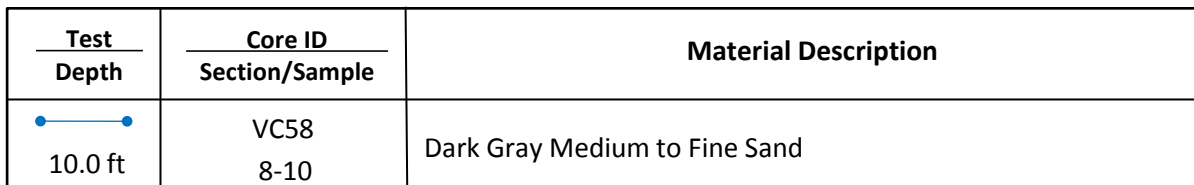


Test Depth	Core ID Section/Sample	Material Description
8.0 ft	VC58 6-8	Dark Gray Medium to Fine Sand

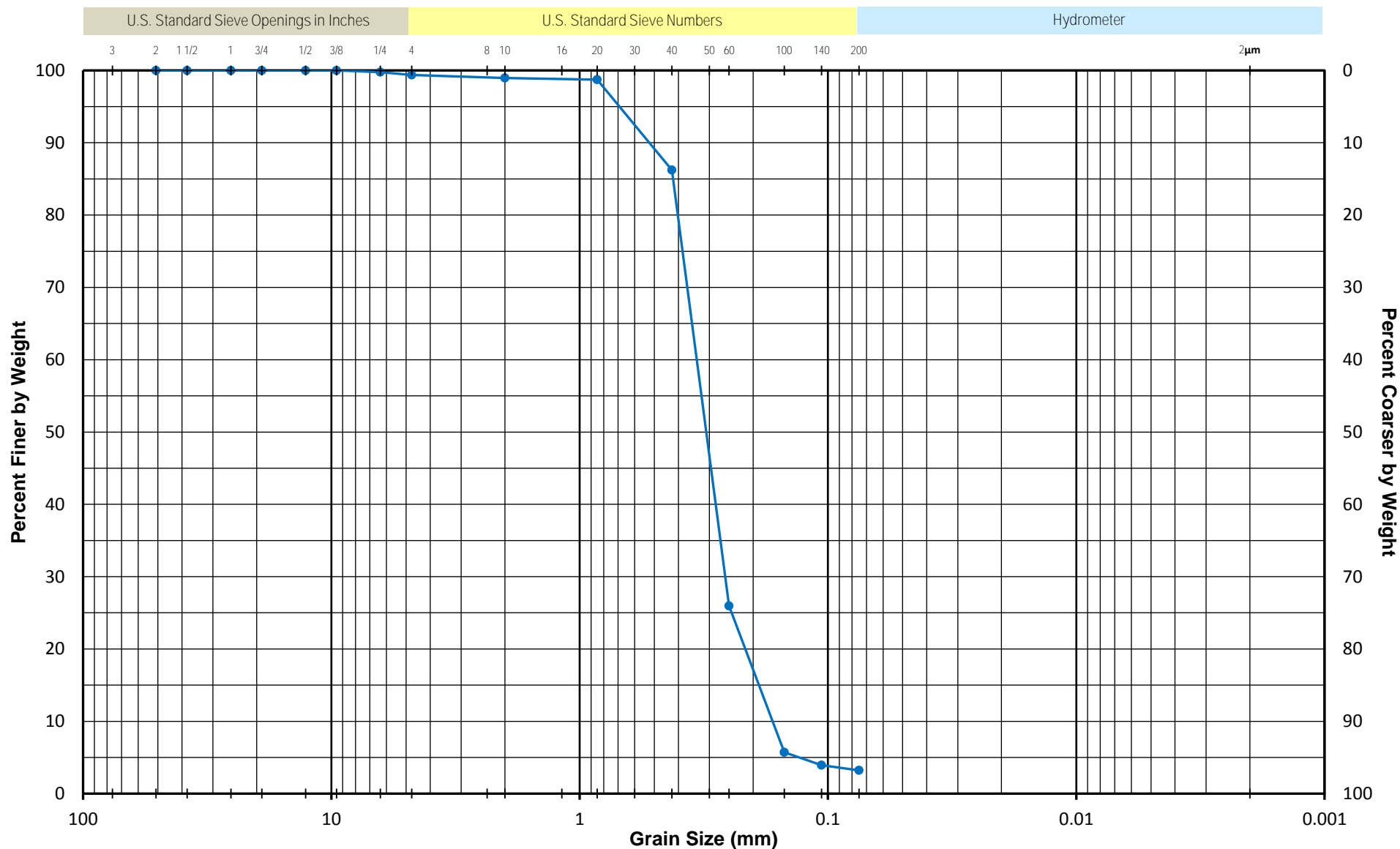
GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II



Alpine - NESE II

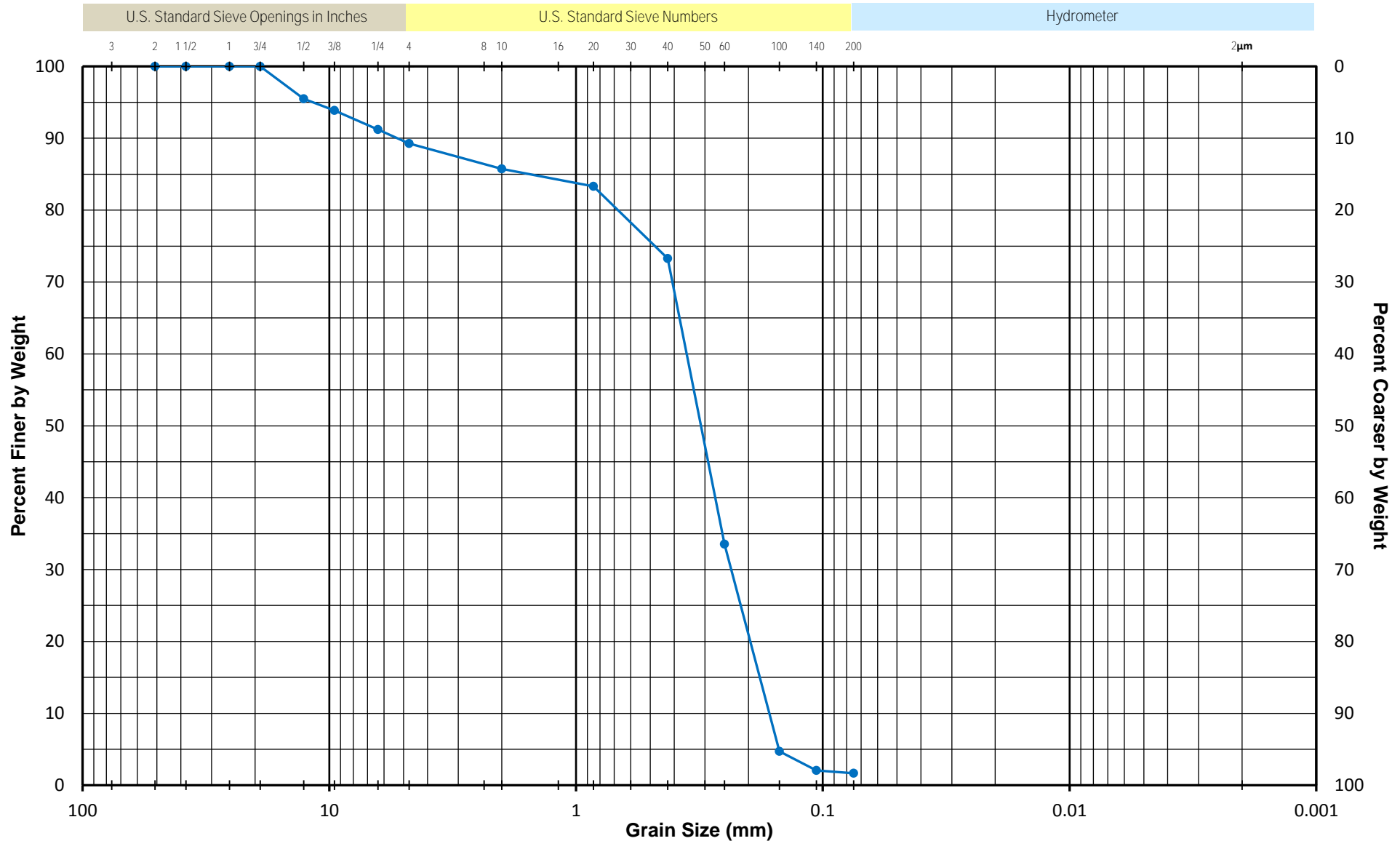


Test Depth	Core ID Section/Sample	Material Description
12.0 ft	VC58 10-12	Dark Gray Fine to Medium Sand

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

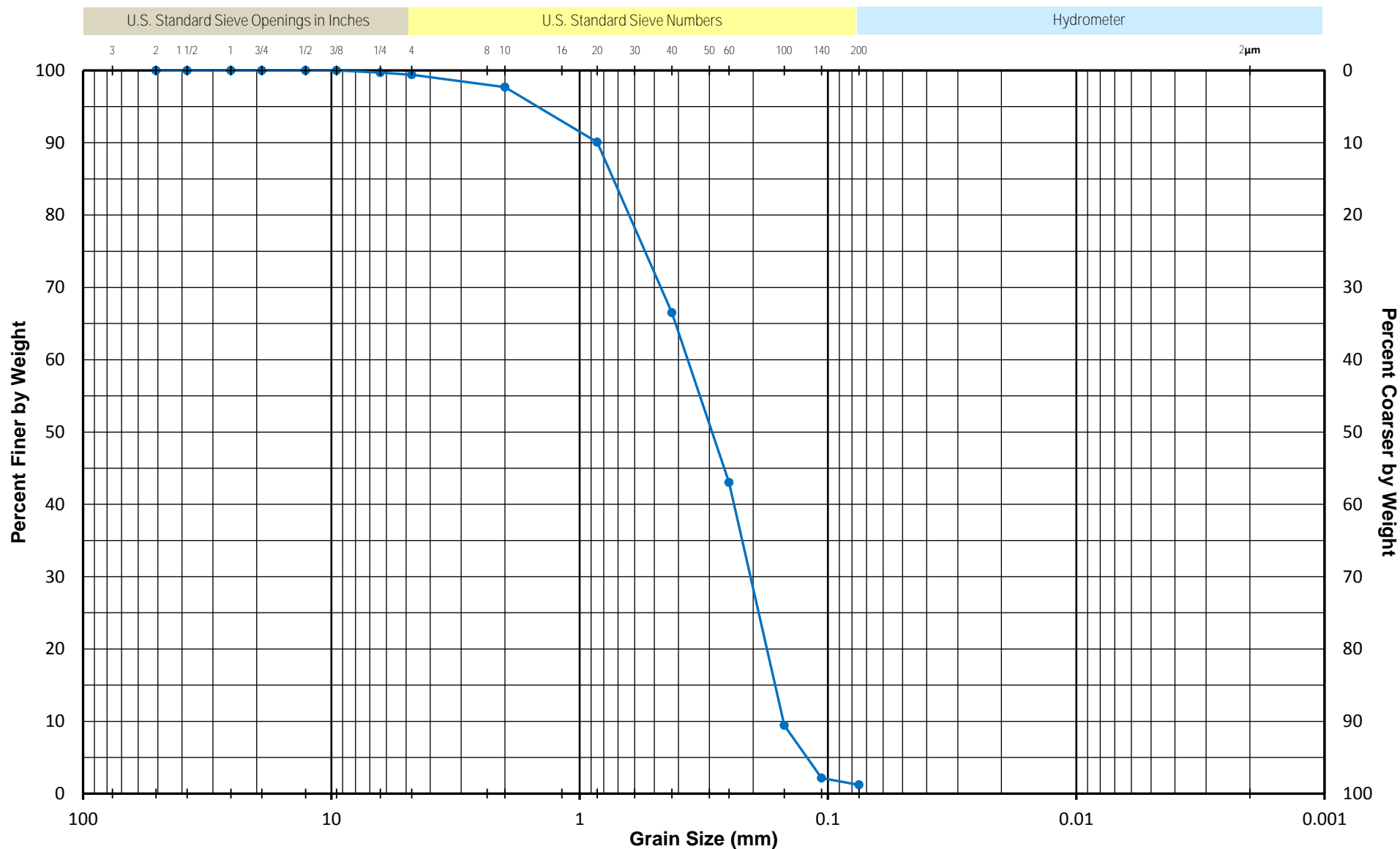


Test Depth	Core ID Section/Sample	Material Description
• — • 0.7 ft	VC59 0-2	Dark Brownish Gray Fine to Coarse Sand with shell, shell fragments, and organics

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

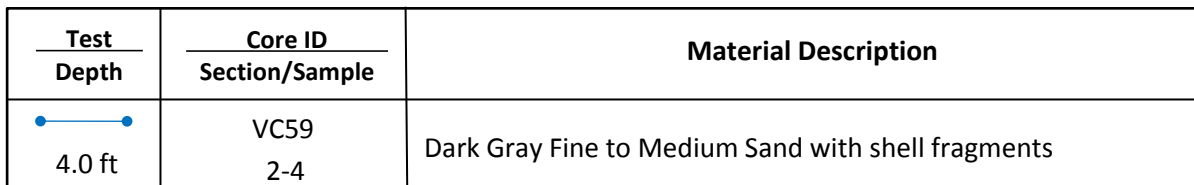


Test Depth	Core ID Section/Sample	Material Description
2.0 ft	VC59 0-2	Dark Gray Fine to Medium Sand with shell fragments

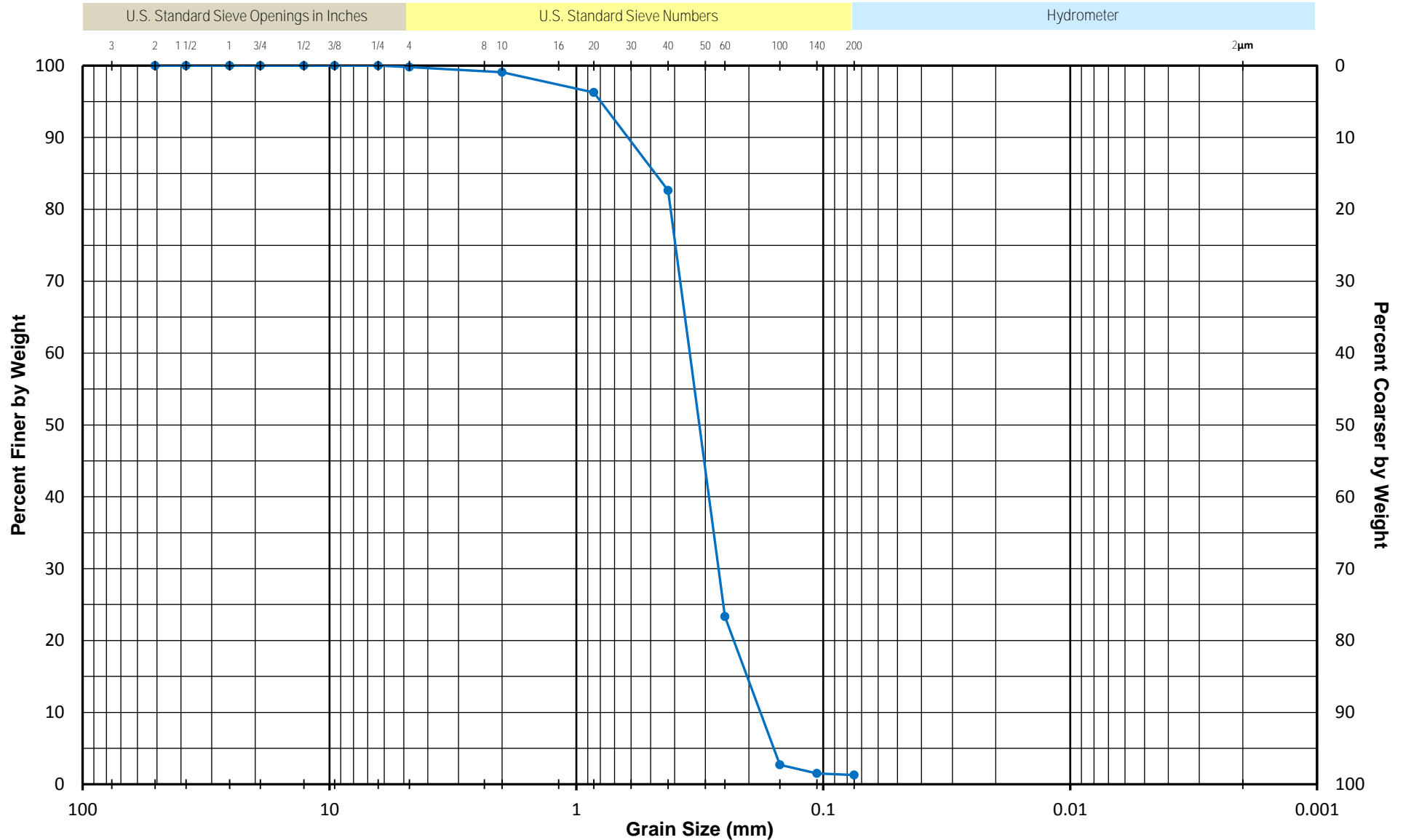
GRADATION CURVES

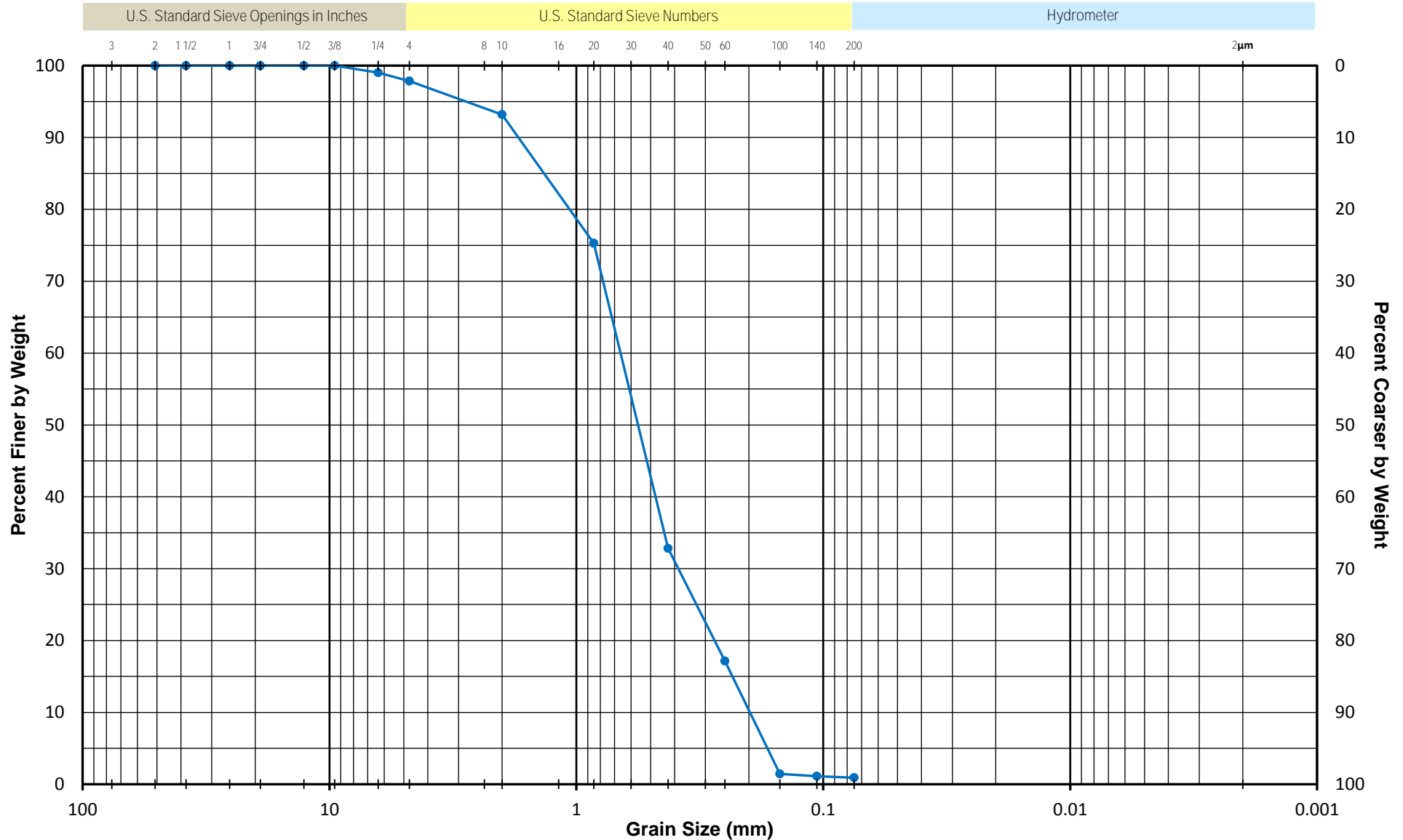
ASTM D-422, D-6913

Alpine - NESE II



Alpine - NESE II



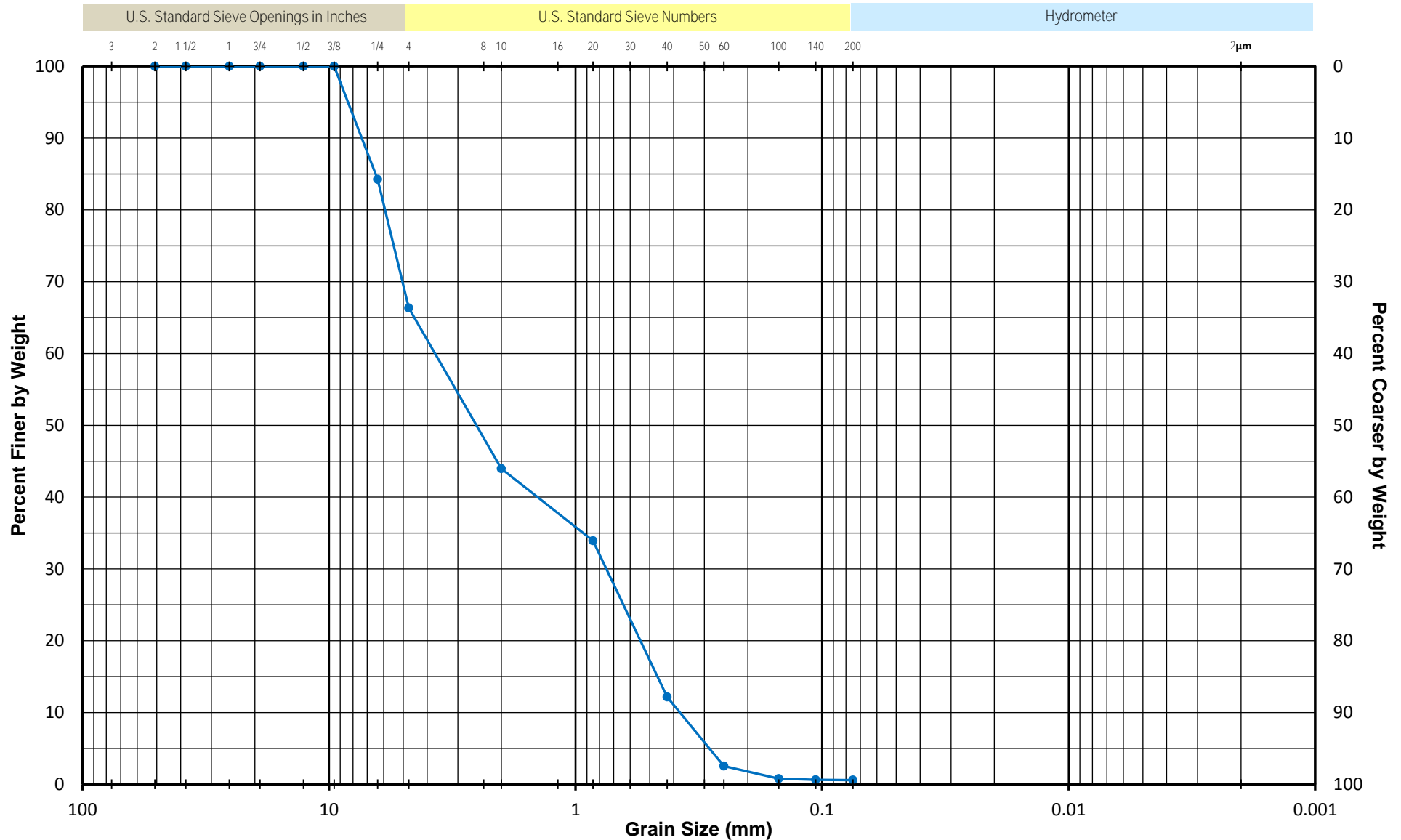


Test Depth	Core ID Section/Sample	Material Description
8.0 ft	VC59 6-8	Very Dark Gray Medium to Fine Sand

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

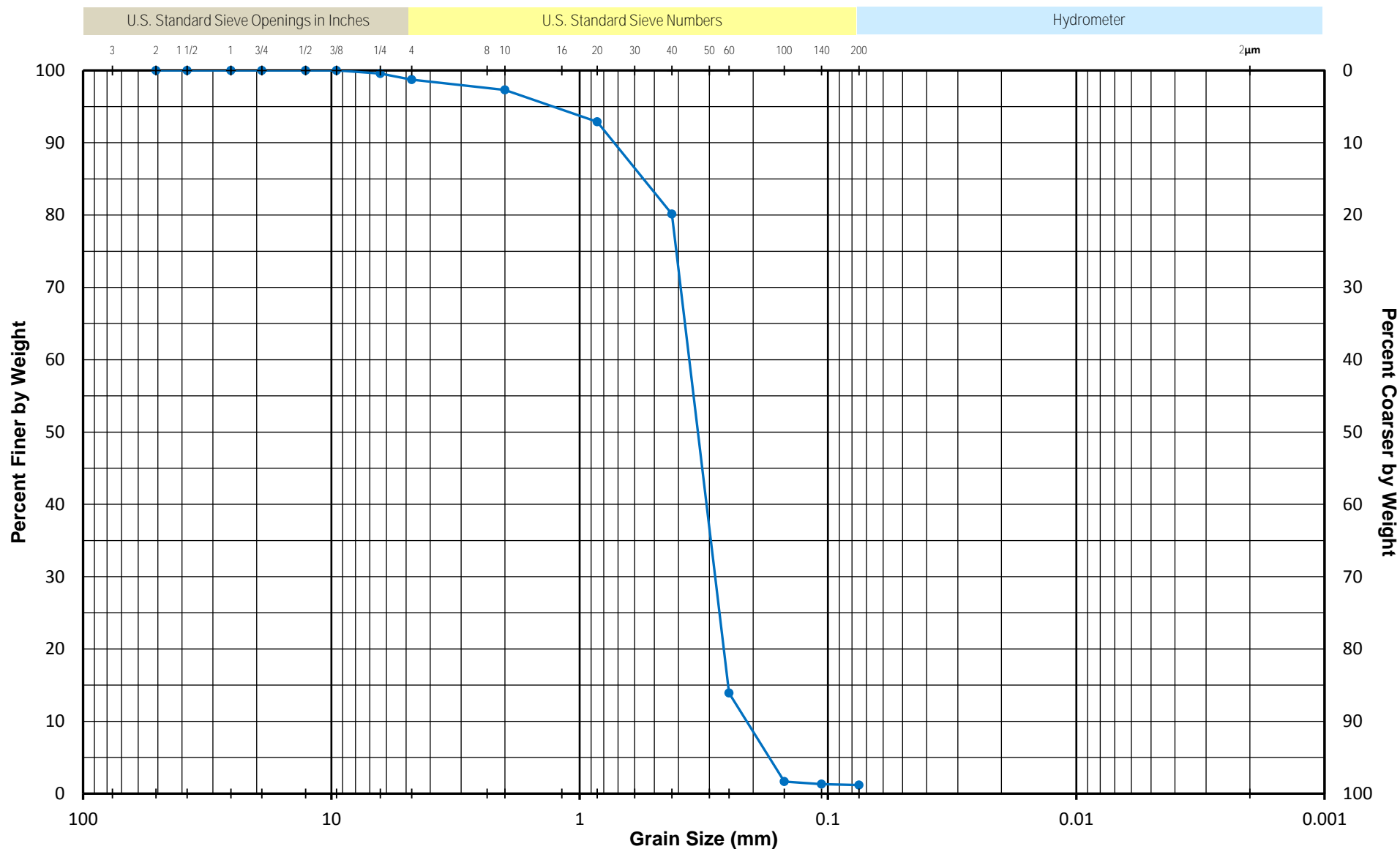


Test Depth	Core ID Section/Sample	Material Description
10.0 ft	VC59 8-10	Very Dark Gray Medium to Coarse Sand with gravel

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

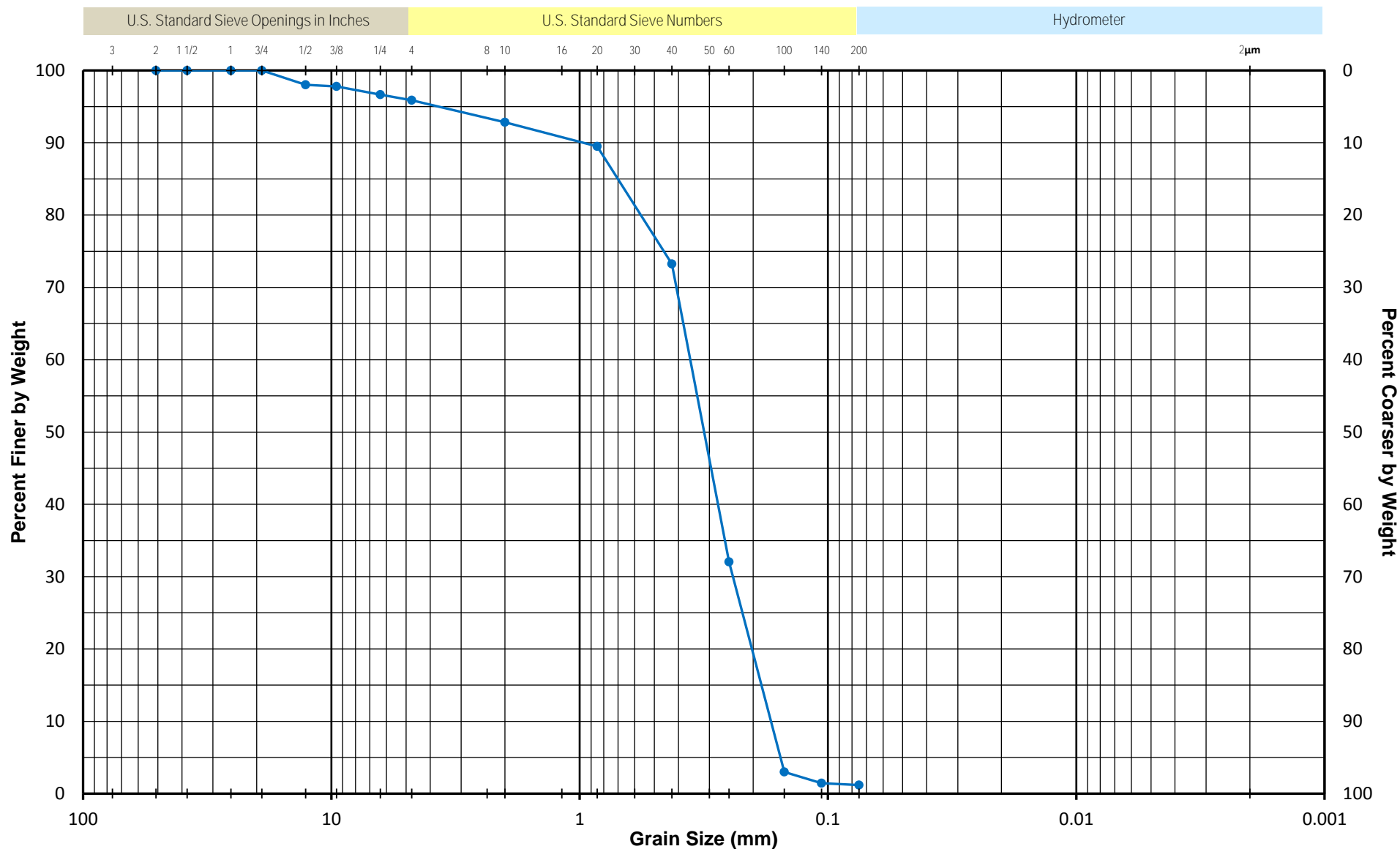


Test Depth	Core ID Section/Sample	Material Description
•—• 12.0 ft	VC59 10-12	Dark Gray Fine to Medium Sand

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

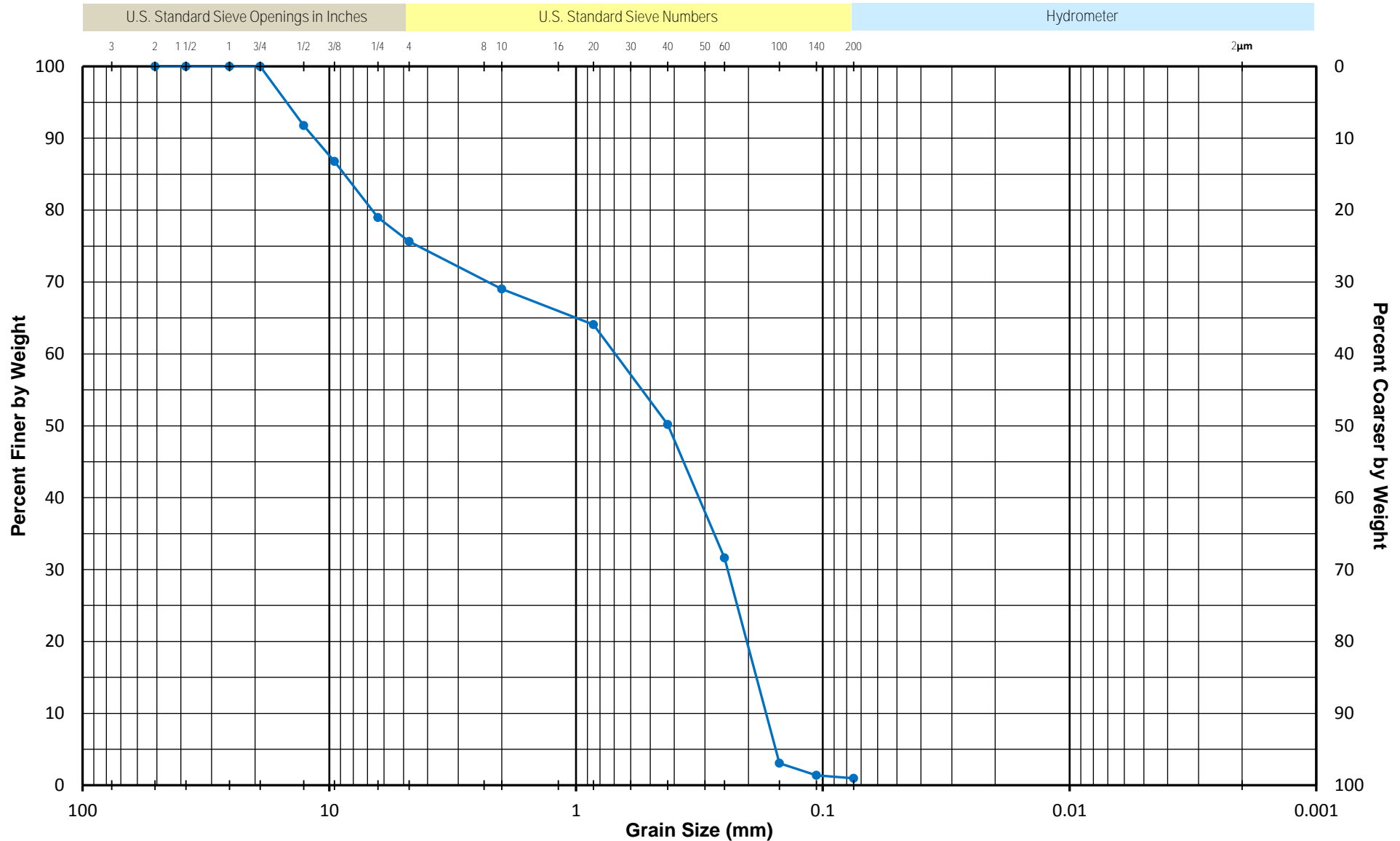


Test Depth	Core ID Section/Sample	Material Description
0.3 ft	VC60 0-2	Black and Brown Fine to Medium Sand with shell fragments

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

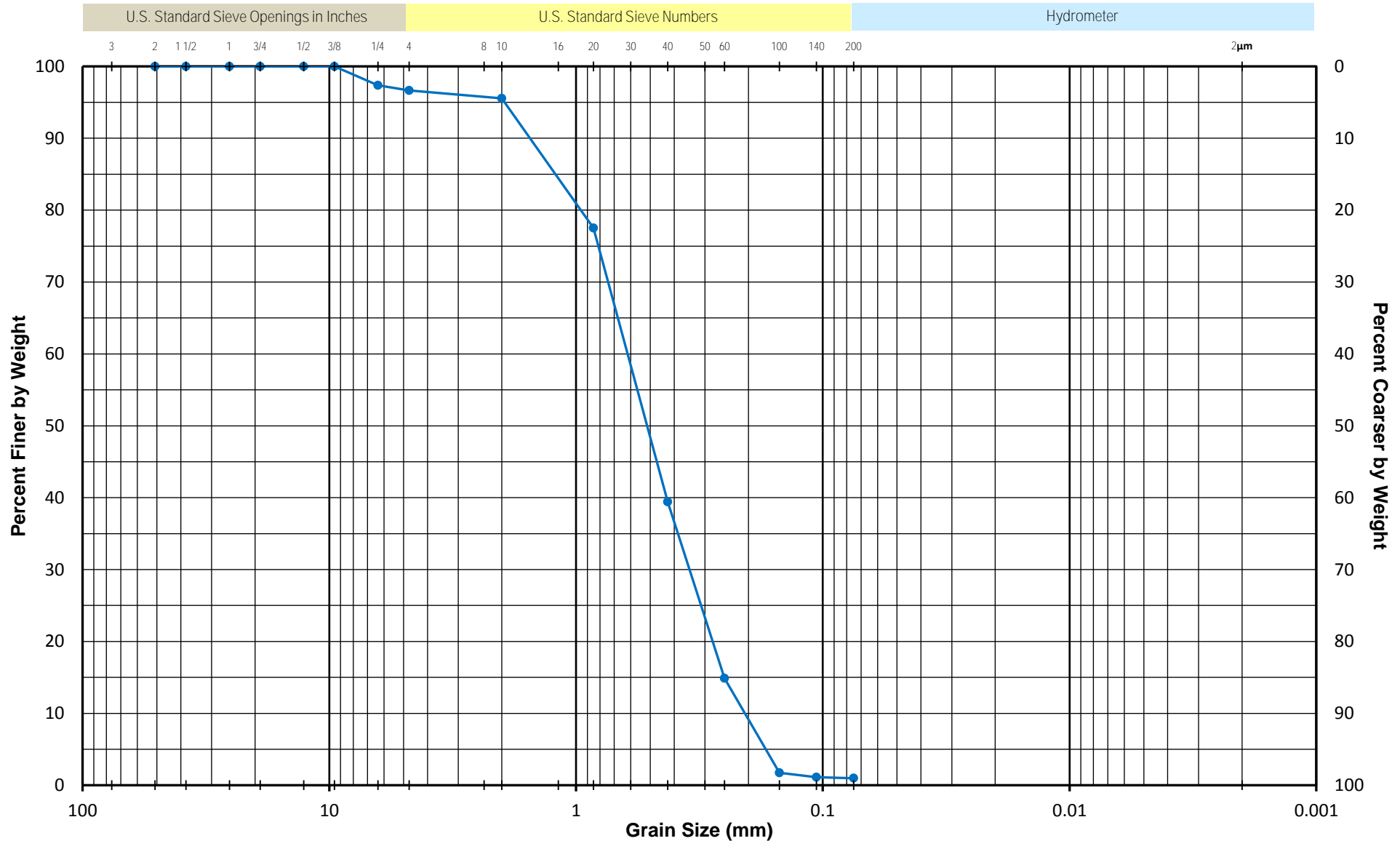


Test Depth	Core ID Section/Sample	Material Description
• — • 2.0 ft	VC60 0-2	Black Fine to Medium Sand with gravel and glass debris

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

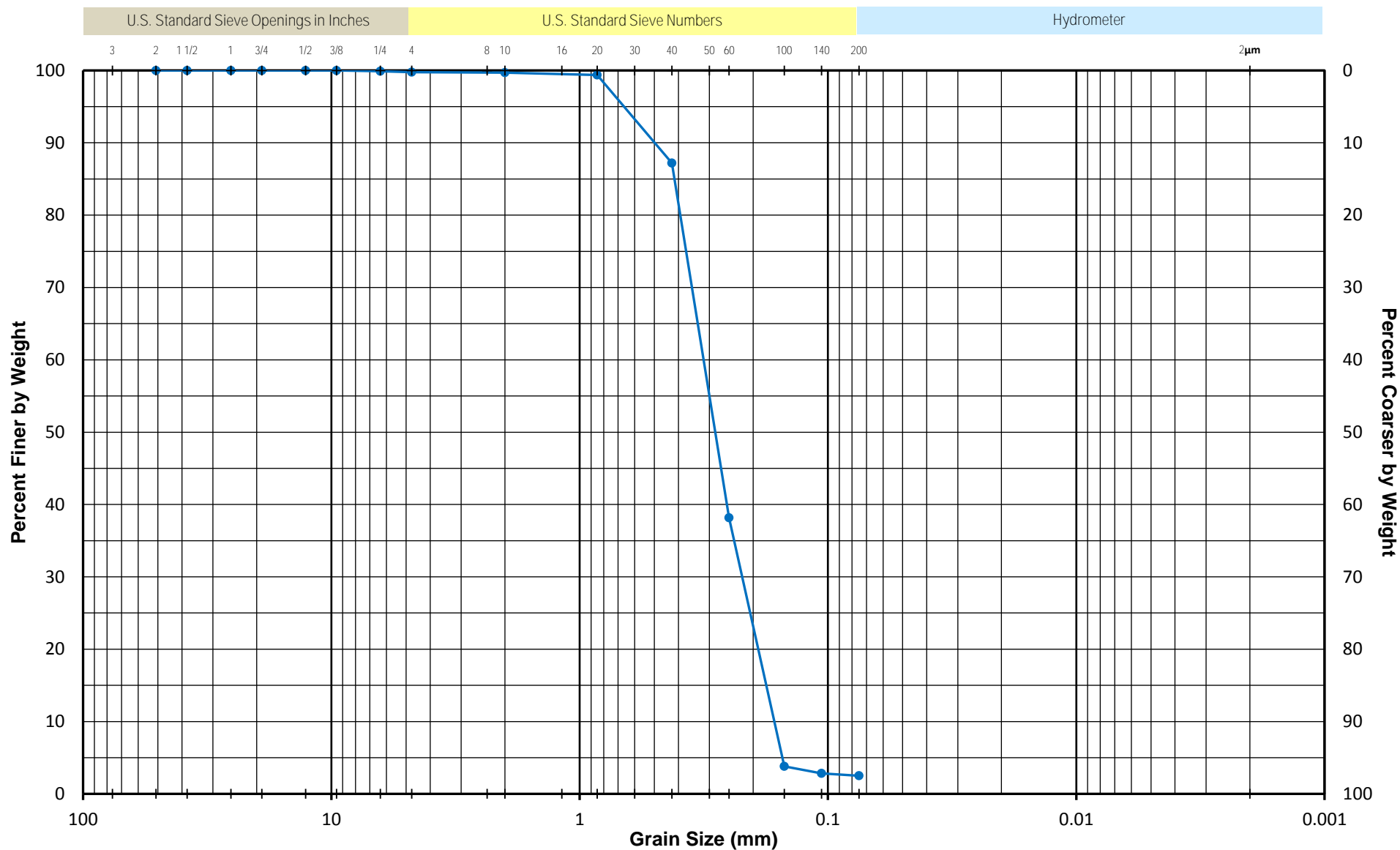


Test Depth	Core ID Section/Sample	Material Description
4.0 ft	VC60 2-4	Grayish Brown Medium to Fine Sand with shell fragments

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

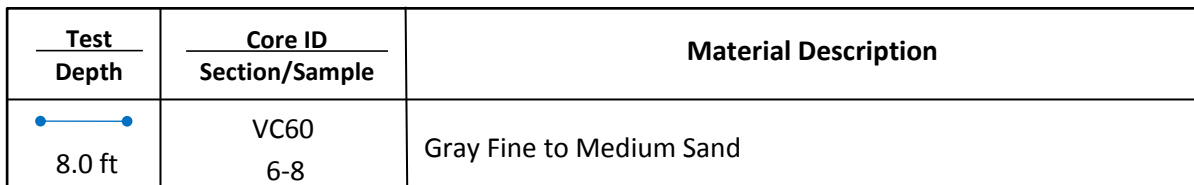


Test Depth	Core ID Section/Sample	Material Description
6.0 ft	VC60 4-6	Gray Fine to Medium Sand

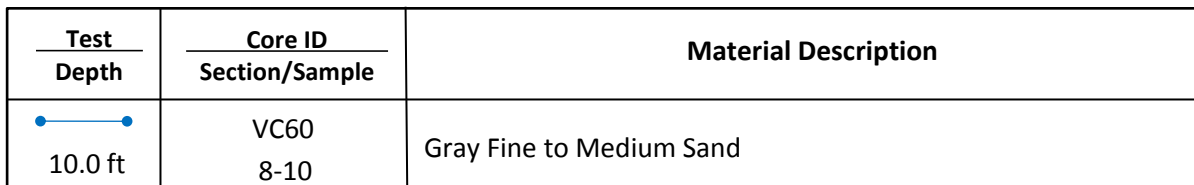
GRADATION CURVES

ASTM D-422, D-6913

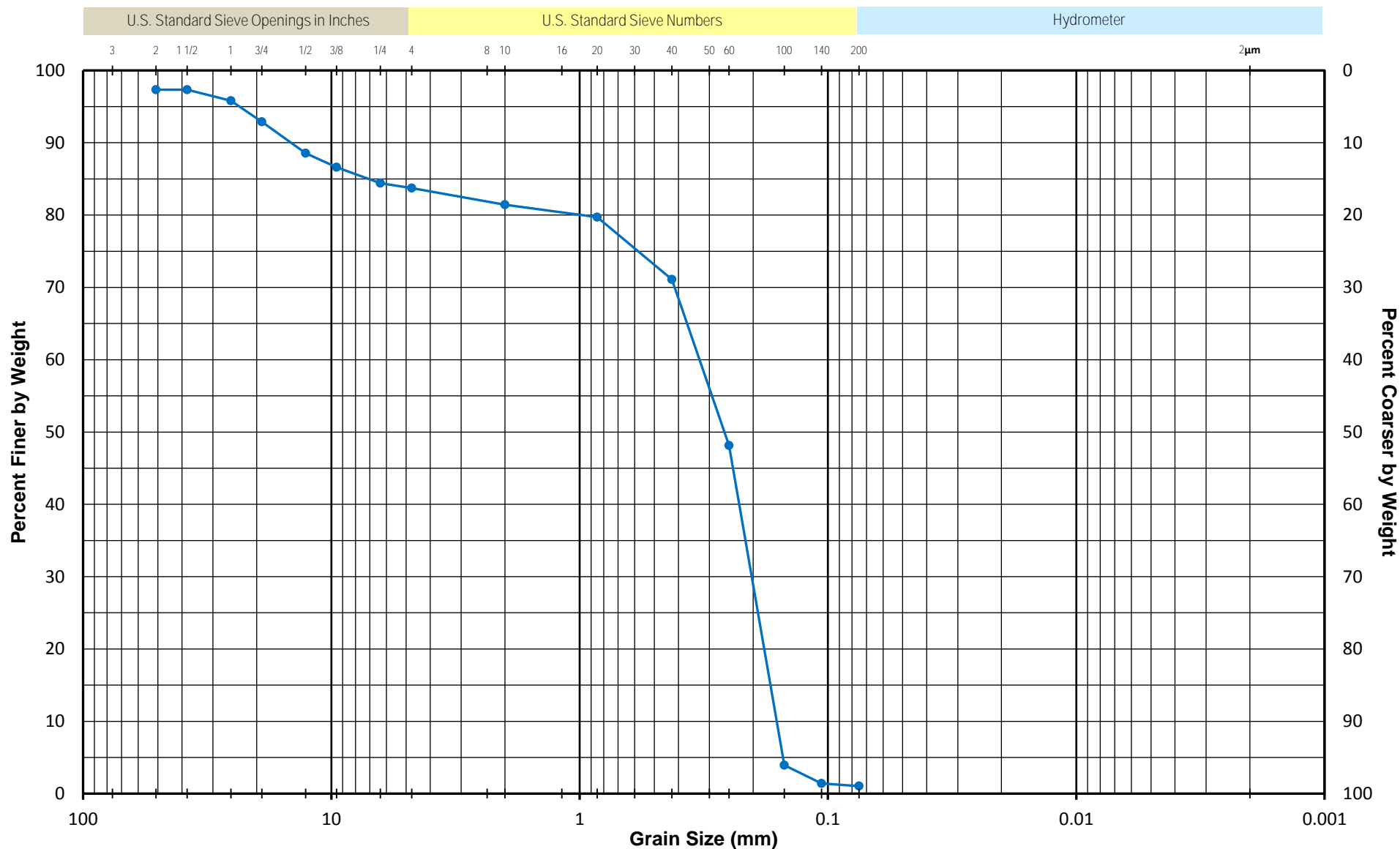
Alpine - NESE II



Alpine - NESE II



Alpine - NESE II

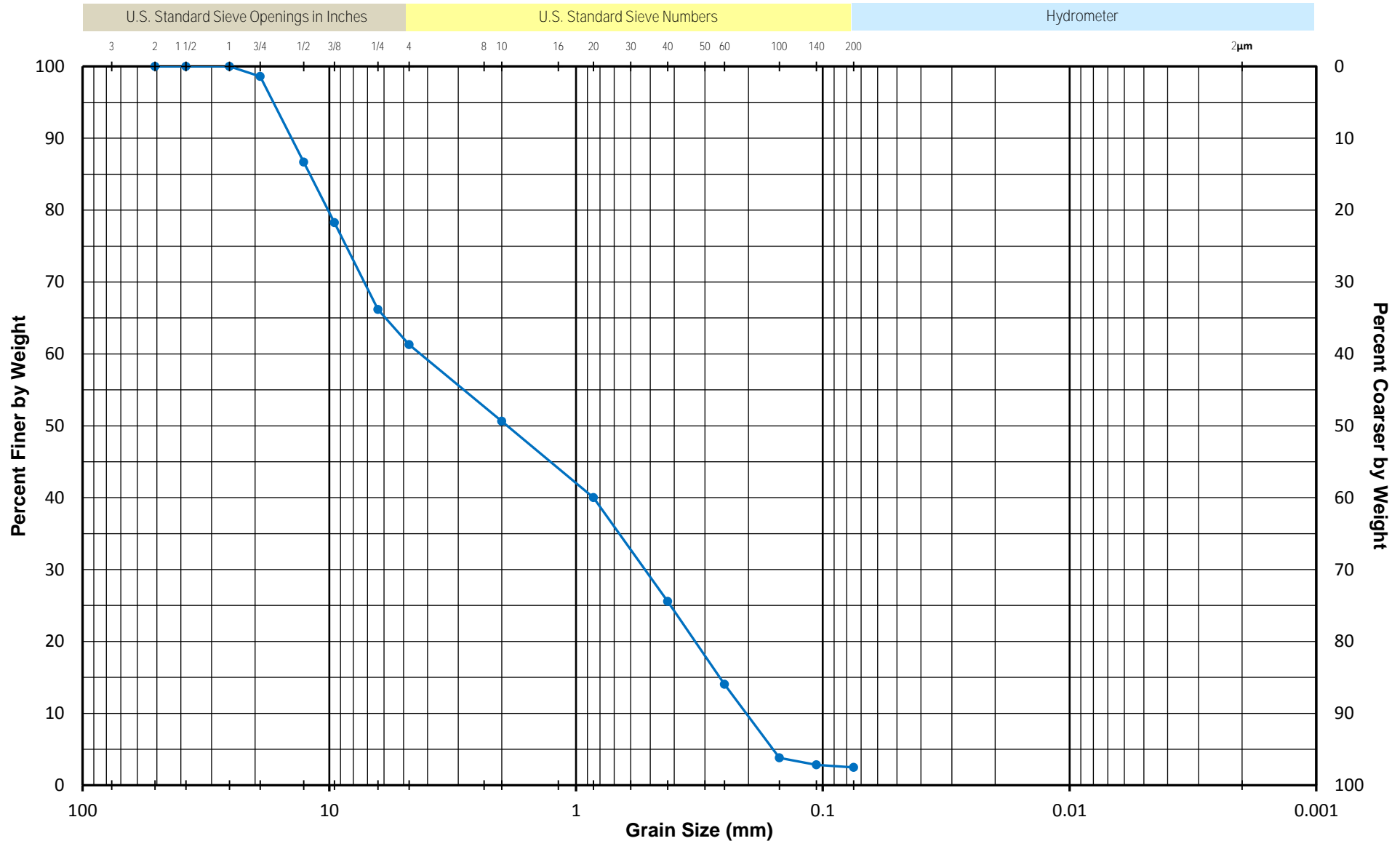


Test Depth	Core ID Section/Sample	Material Description
0.7 ft	VC61 0-2	Very Dark Gray Fine to Medium Sand with gravel

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

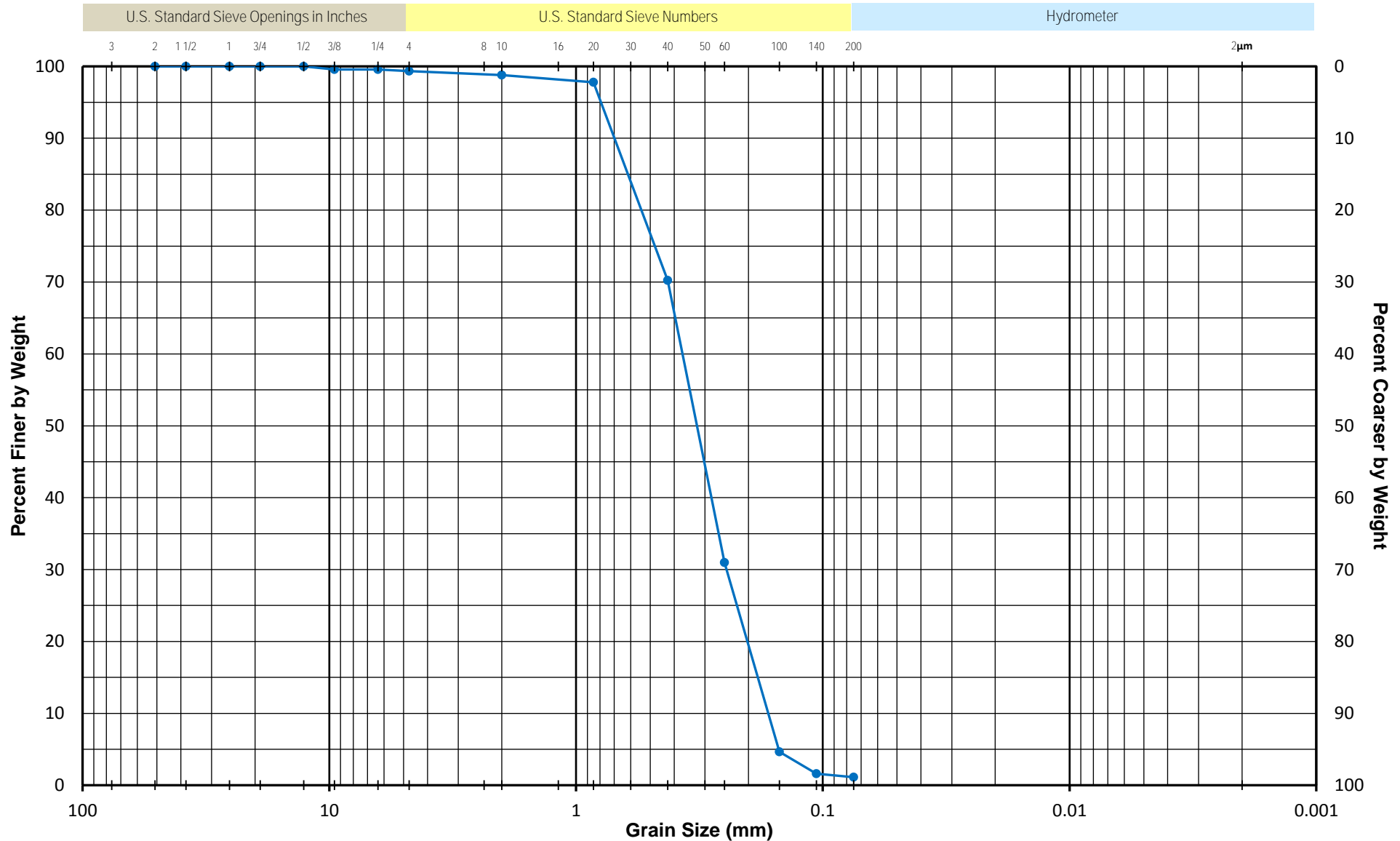


Test Depth	Core ID Section/Sample	Material Description
•—• 2.0 ft	VC61 0-2	Black Fine to Coarse Sand with gravel and glass and metal debris

GRADATION CURVES

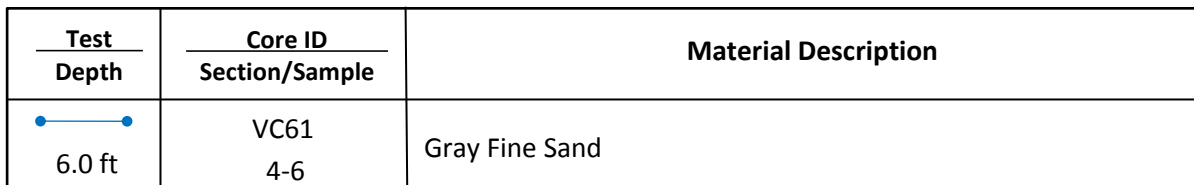
ASTM D-422, D-6913

Alpine - NESE II

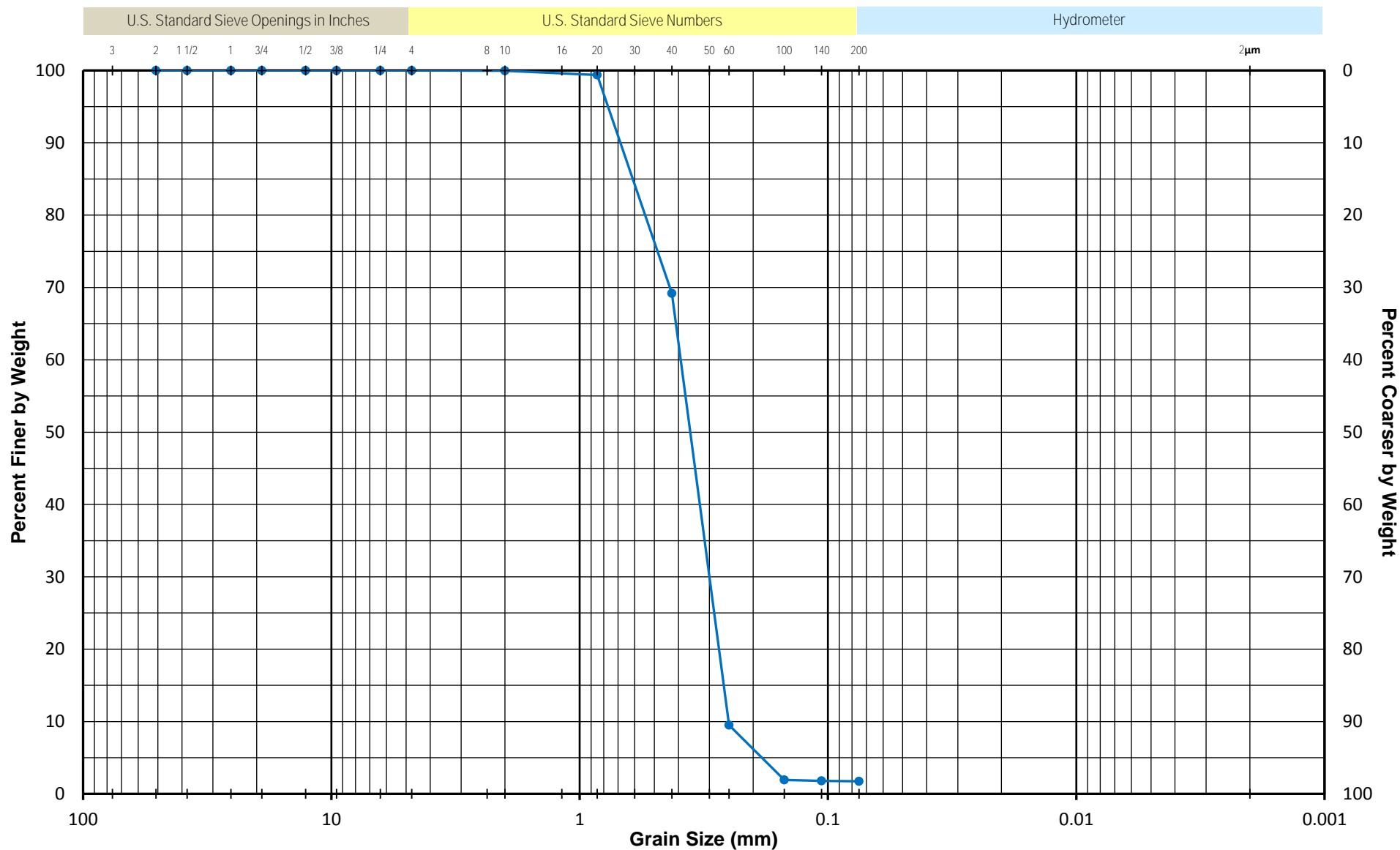



Test Depth	Core ID Section/Sample	Material Description
4.0 ft	VC61 2-4	Very Dark Gray Fine to Medium Sand

GRADATION CURVES
 ASTM D-422, D-6913
 Alpine - NESE II



Alpine - NESE II

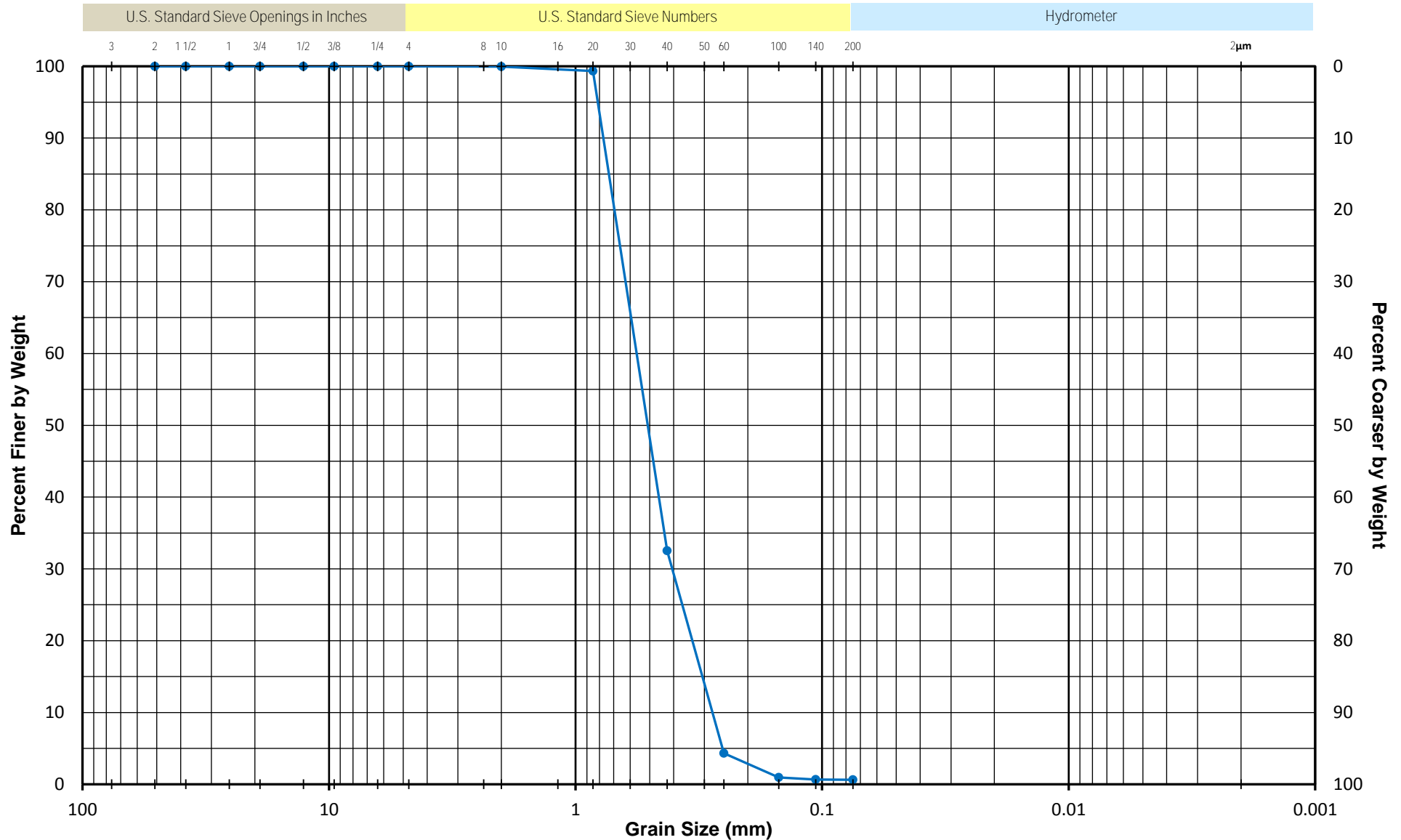


Test Depth	Core ID Section/Sample	Material Description
 8.0 ft	VC61 6-8	Gray Fine to Medium Sand

GRADATION CURVES

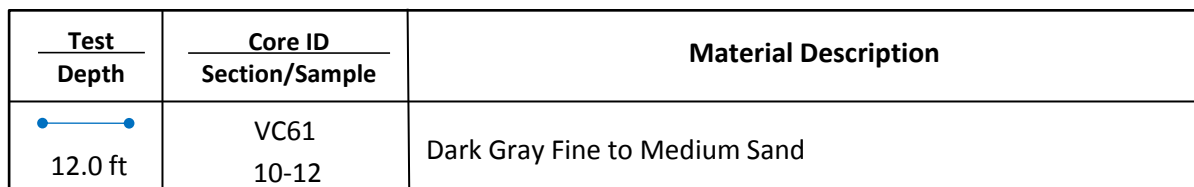
ASTM D-422, D-6913

Alpine - NESE II

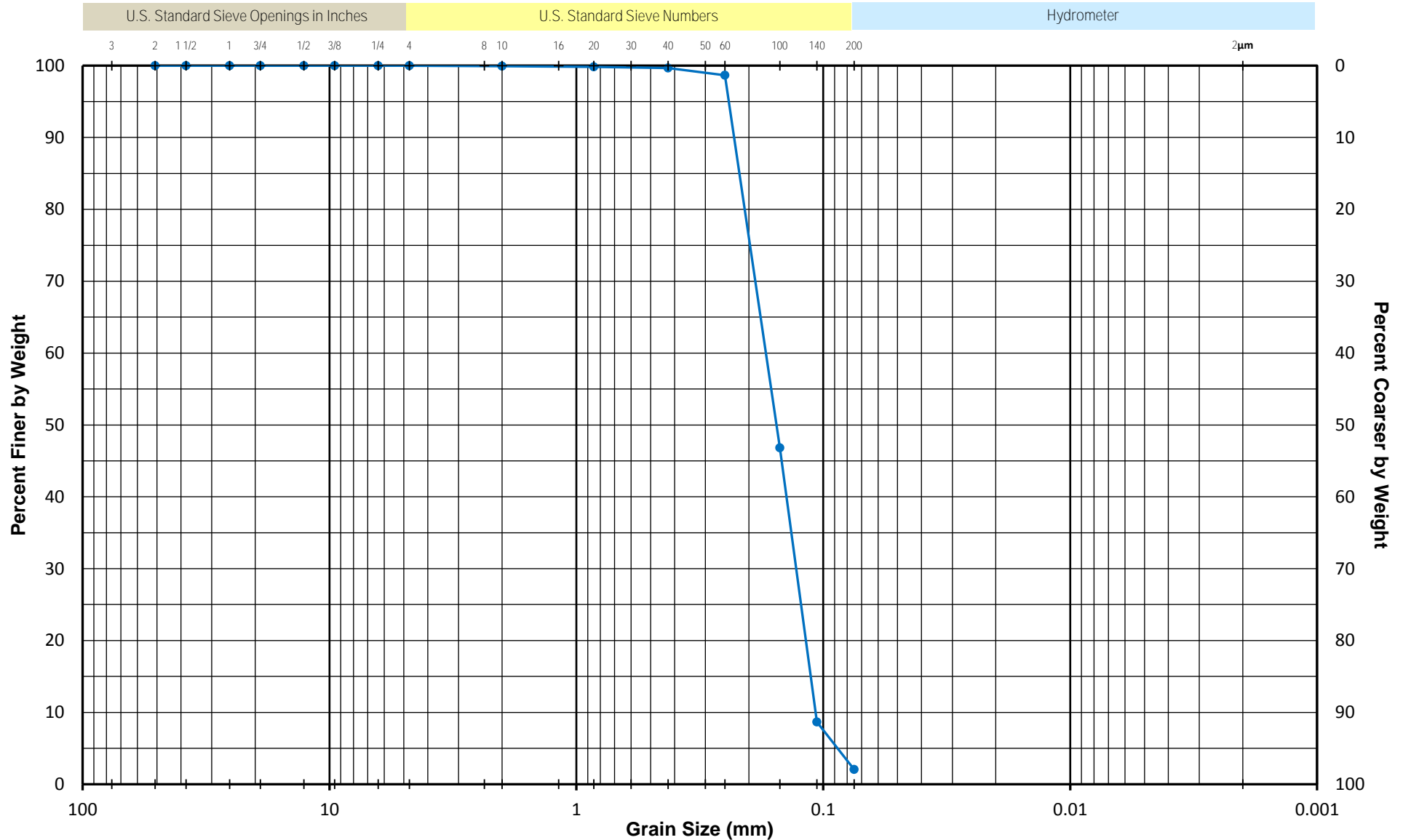


Test Depth	Core ID Section/Sample	Material Description
•—• 10.0 ft	VC61 8-10	Gray Medium to Fine Sand

GRADATION CURVES
 ASTM D-422, D-6913
 Alpine - NESE II



Alpine - NESE II

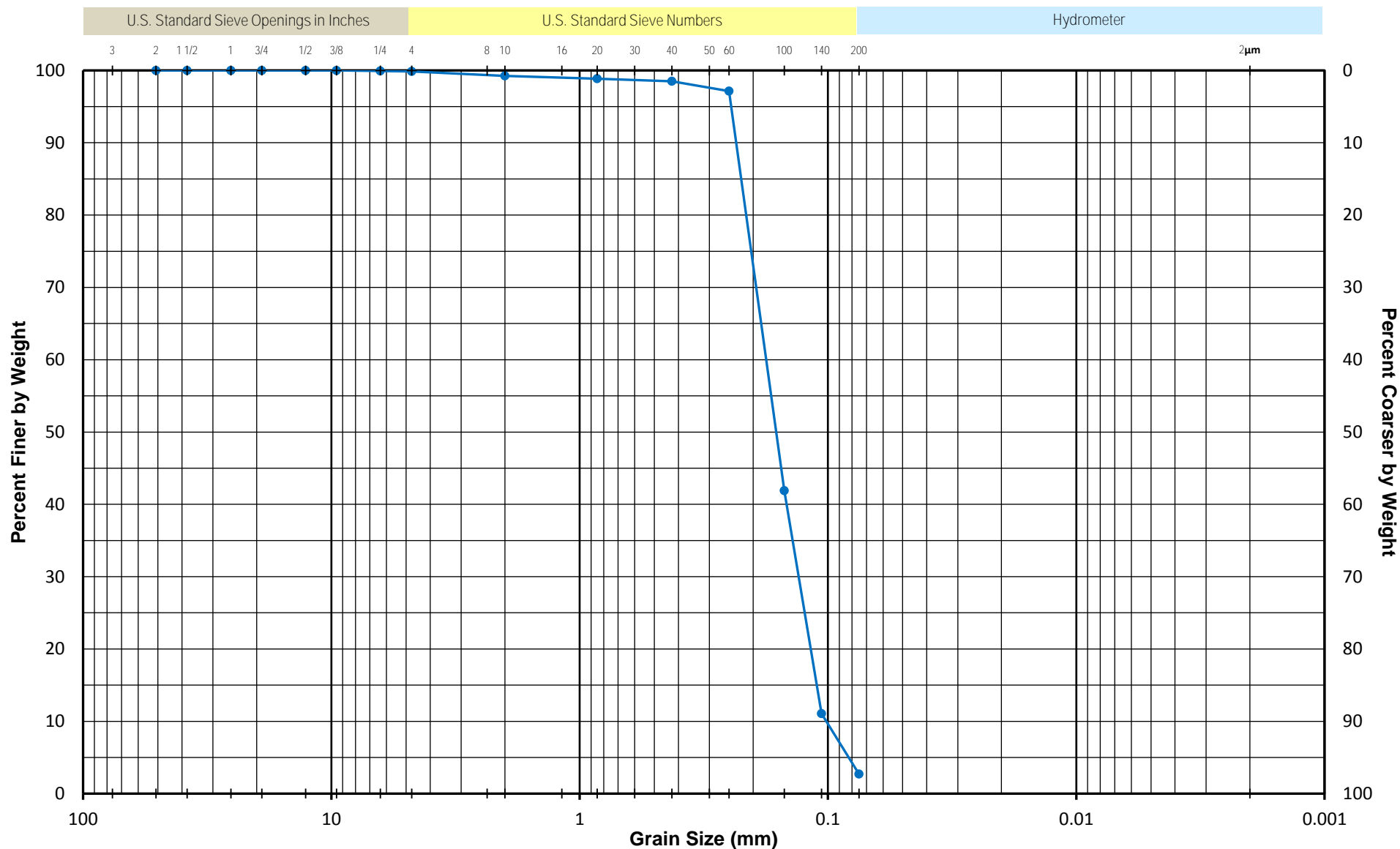


Test Depth	Core ID Section/Sample	Material Description
0.7 ft	VC62 0-2	Very Dark Gray Fine Sand

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

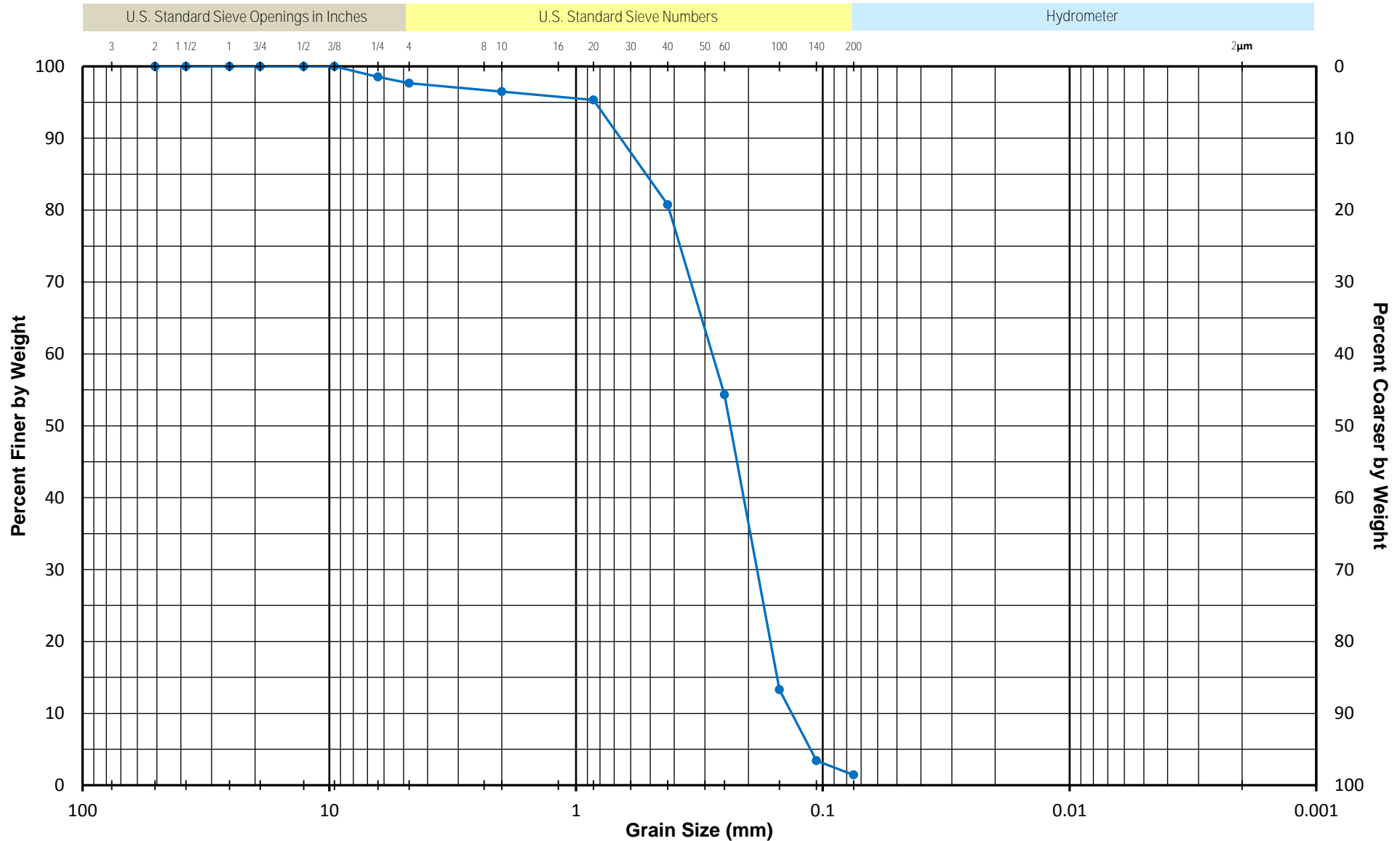


Test Depth	Core ID Section/Sample	Material Description
•—• 2.0 ft	VC62 0-2	Black Fine Sand with shell fragments

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

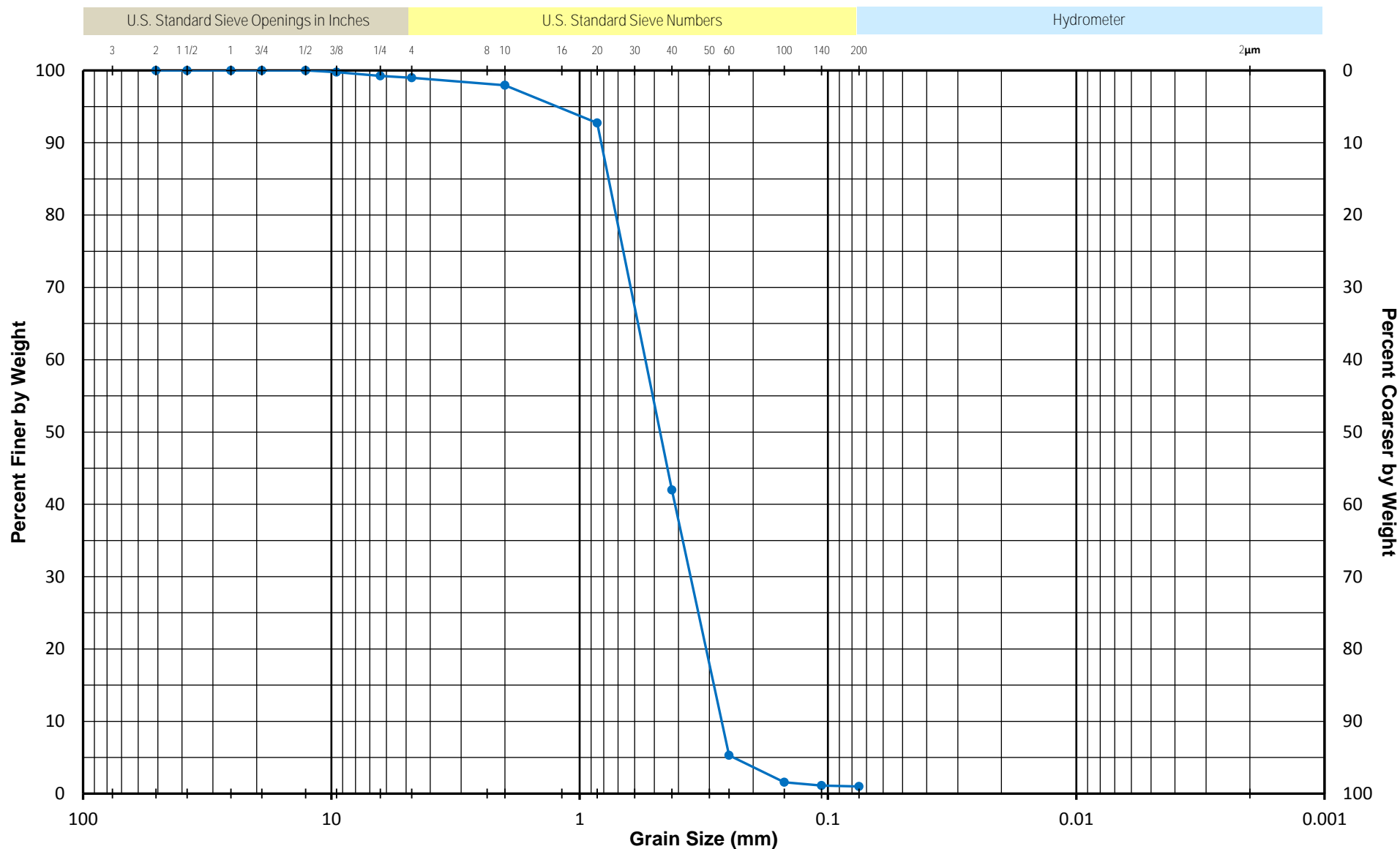


Test Depth	Core ID Section/Sample	Material Description
4.0 ft	VC62 2-4	Very Dark Gray Fine to Medium Sand with shell fragments

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

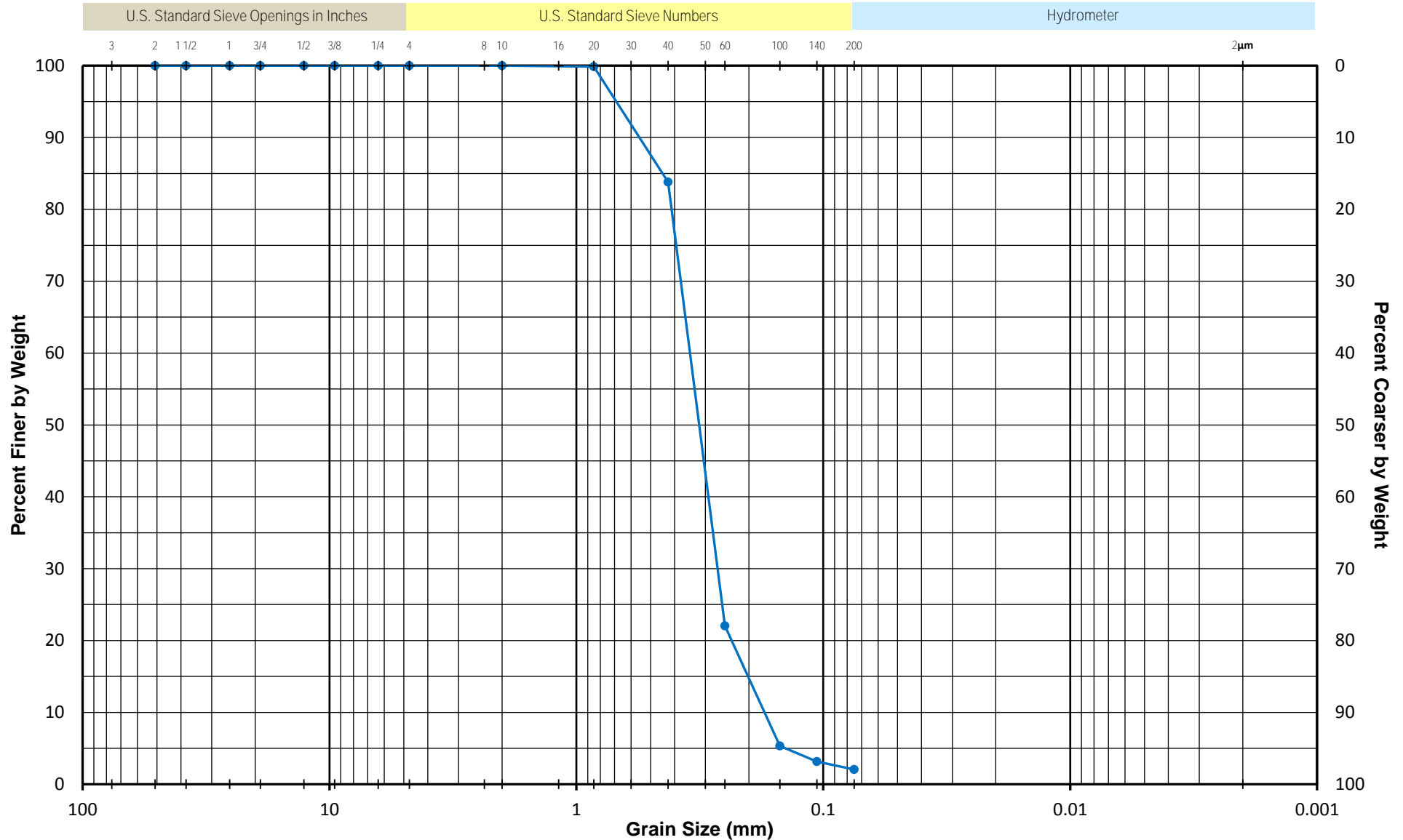


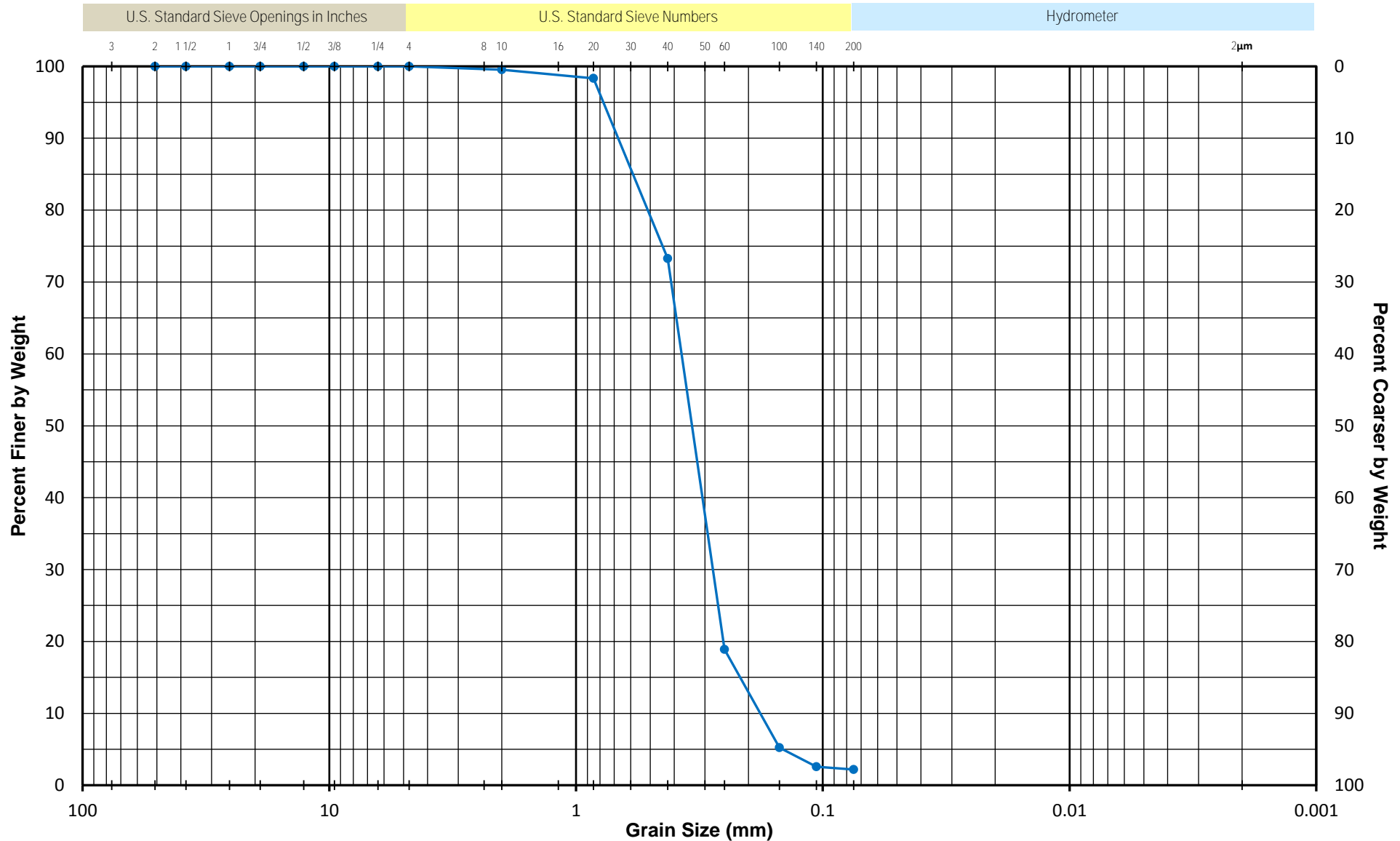
Test Depth	Core ID Section/Sample	Material Description
6.0 ft	VC62 4-6	Grayish Brown Medium to Fine Sand with shell fragments

GRADATION CURVES

ASTM D-422, D-6913

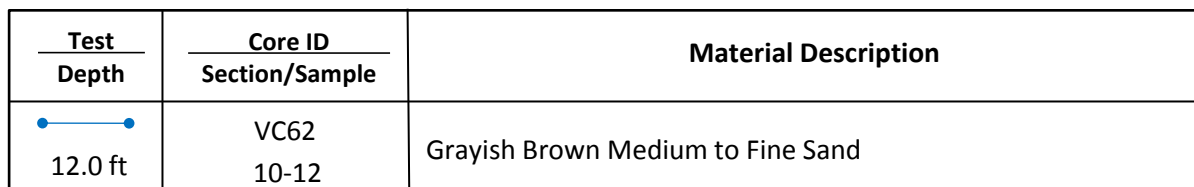
Alpine - NESE II



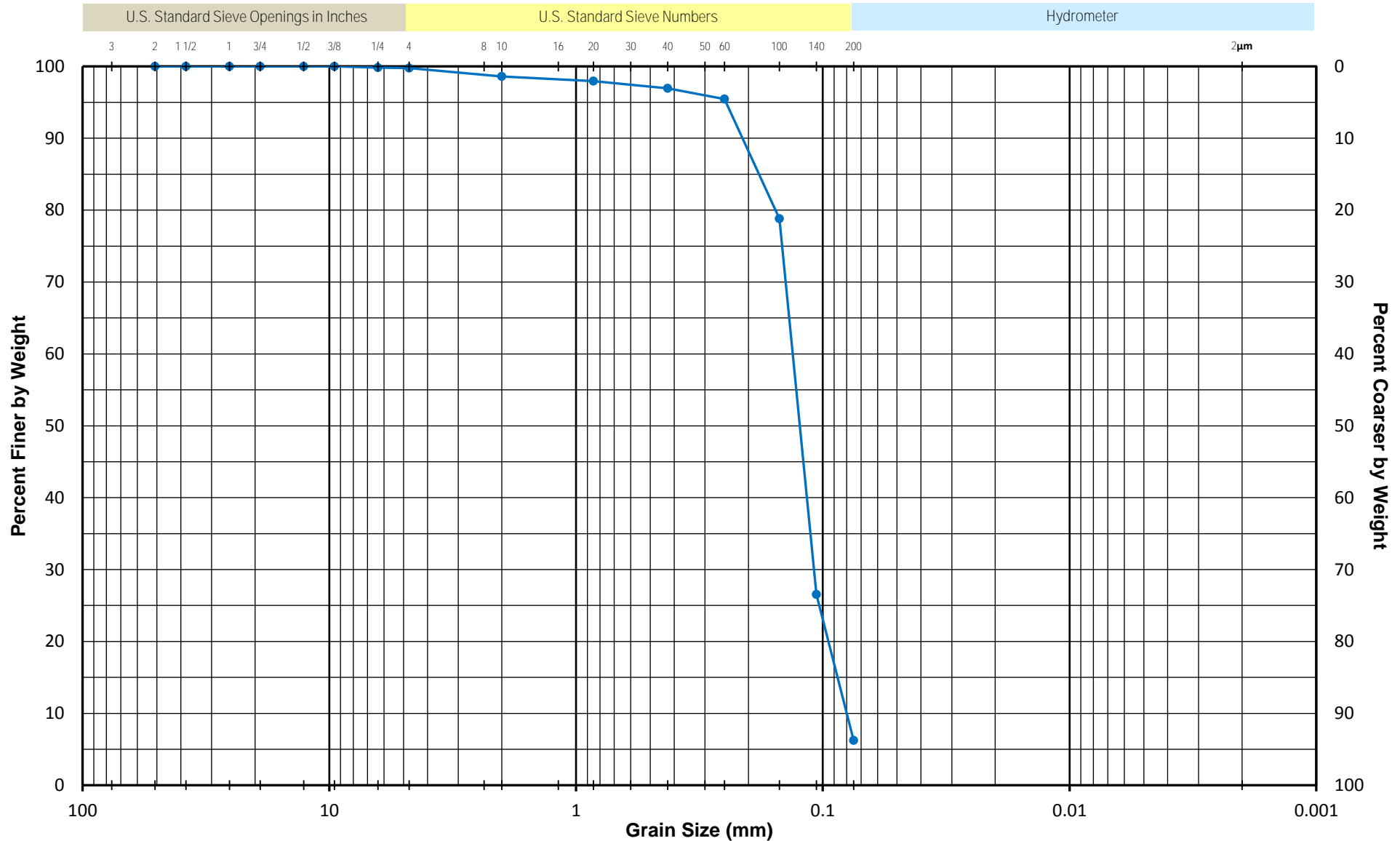


Test Depth	Core ID Section/Sample	Material Description
10.0 ft	VC62 8-10	Dark Gray Fine to Medium Sand with shell fragments

GRADATION CURVES
 ASTM D-422, D-6913
 Alpine - NESE II

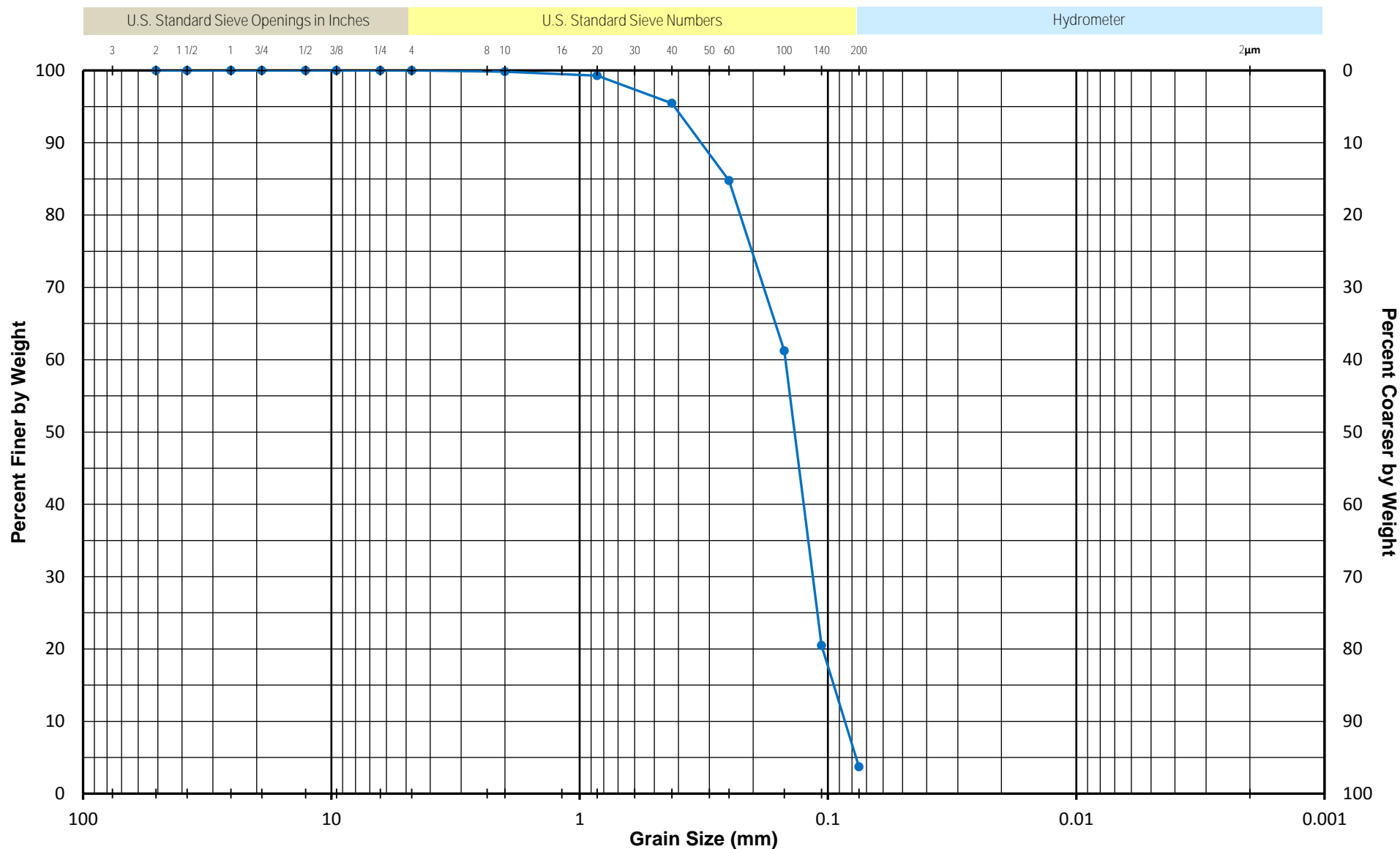


Alpine - NESE II



Test Depth	Core ID Section/Sample	Material Description
0.7 ft	VC64 0-2	Black Very Fine Sand with shell fragments

GRADATION CURVES
 ASTM D-422, D-6913
 Alpine - NESE II

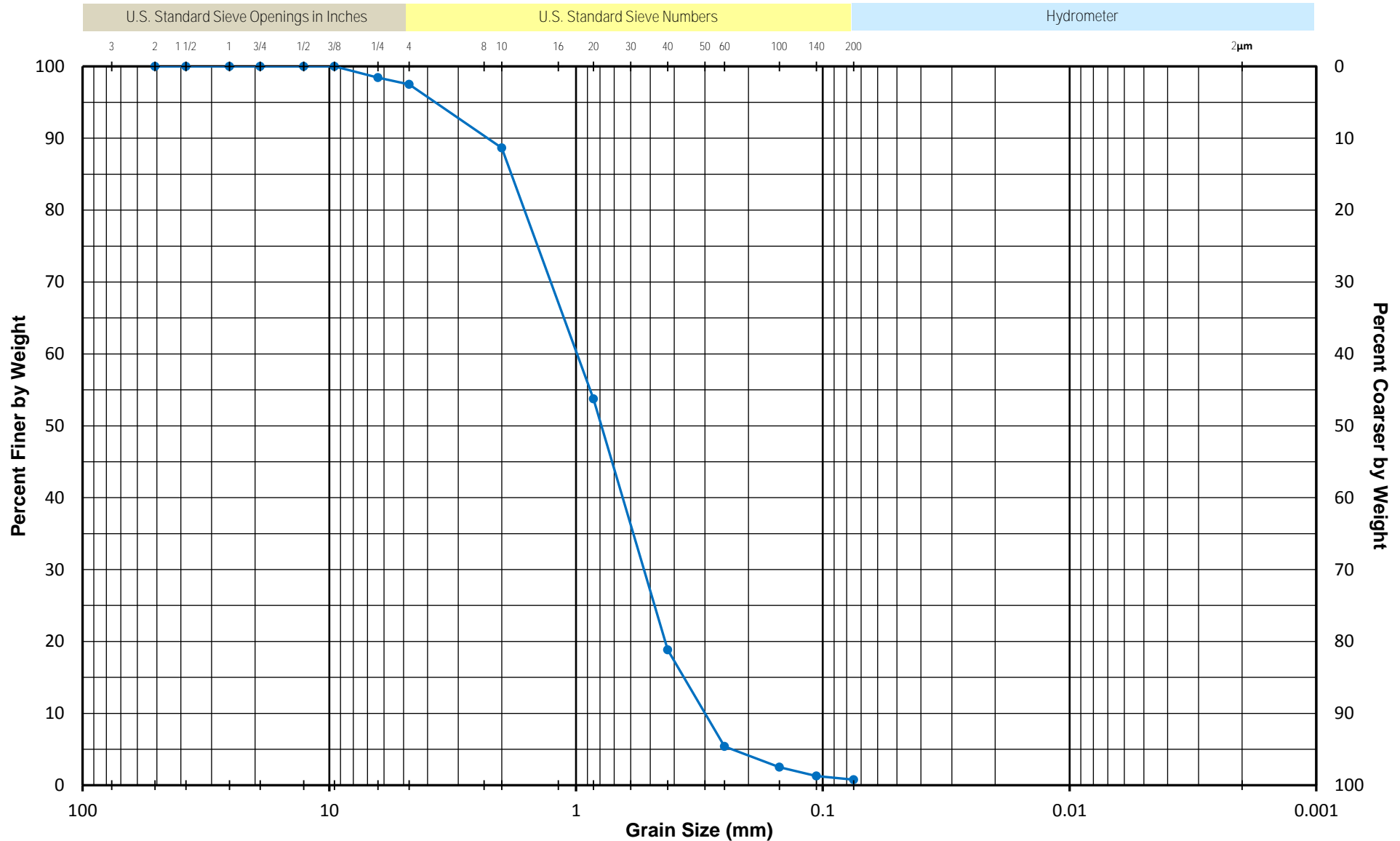


Test Depth	Core ID Section/Sample	Material Description
4.0 ft	VC64 2-4	Very Dark Gray Fine Sand with shell fragments

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

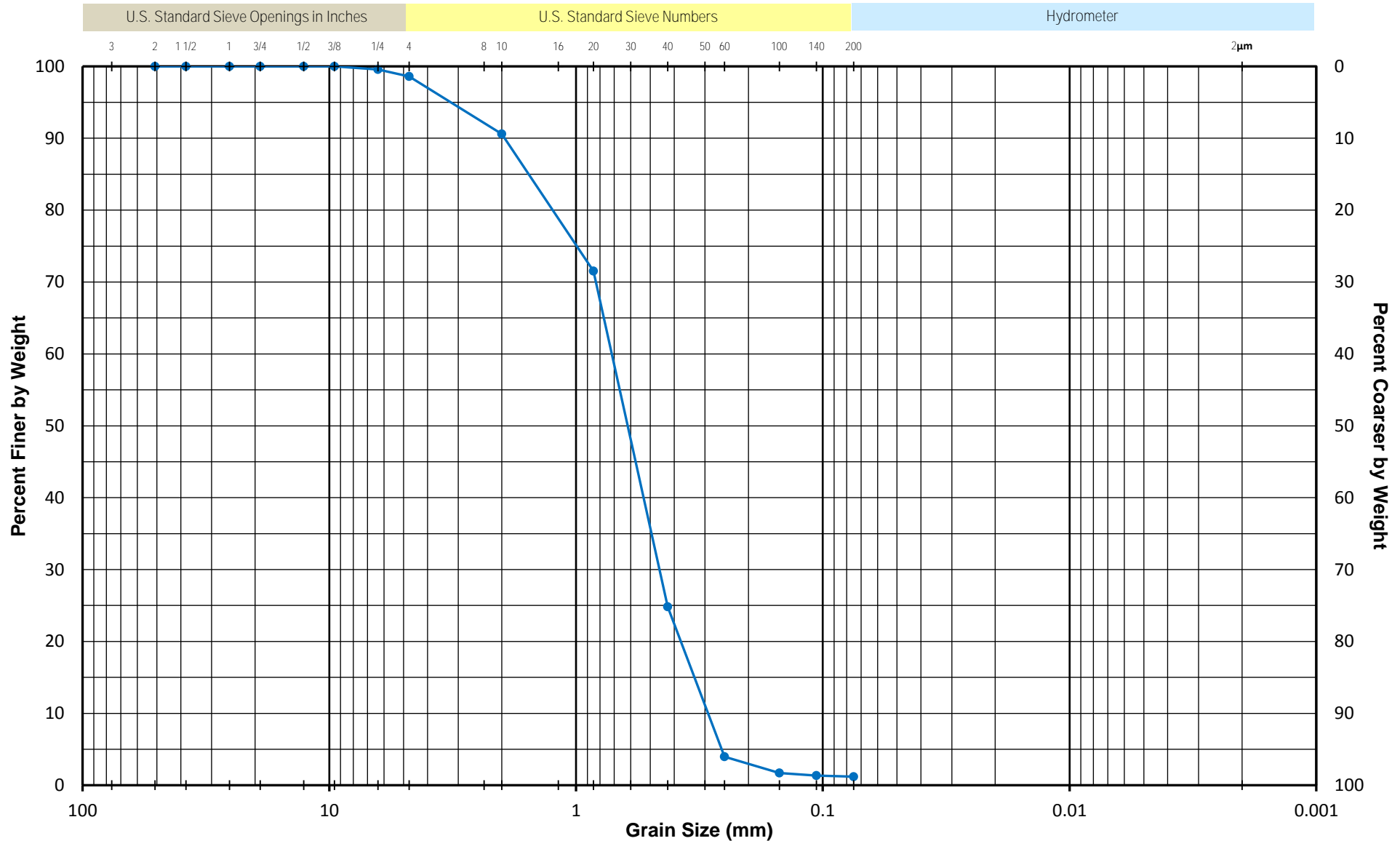


Test Depth	Core ID Section/Sample	Material Description
6.0 ft	VC64 4-6	Brown Fine to Coarse Sand with shell fragments

GRADATION CURVES

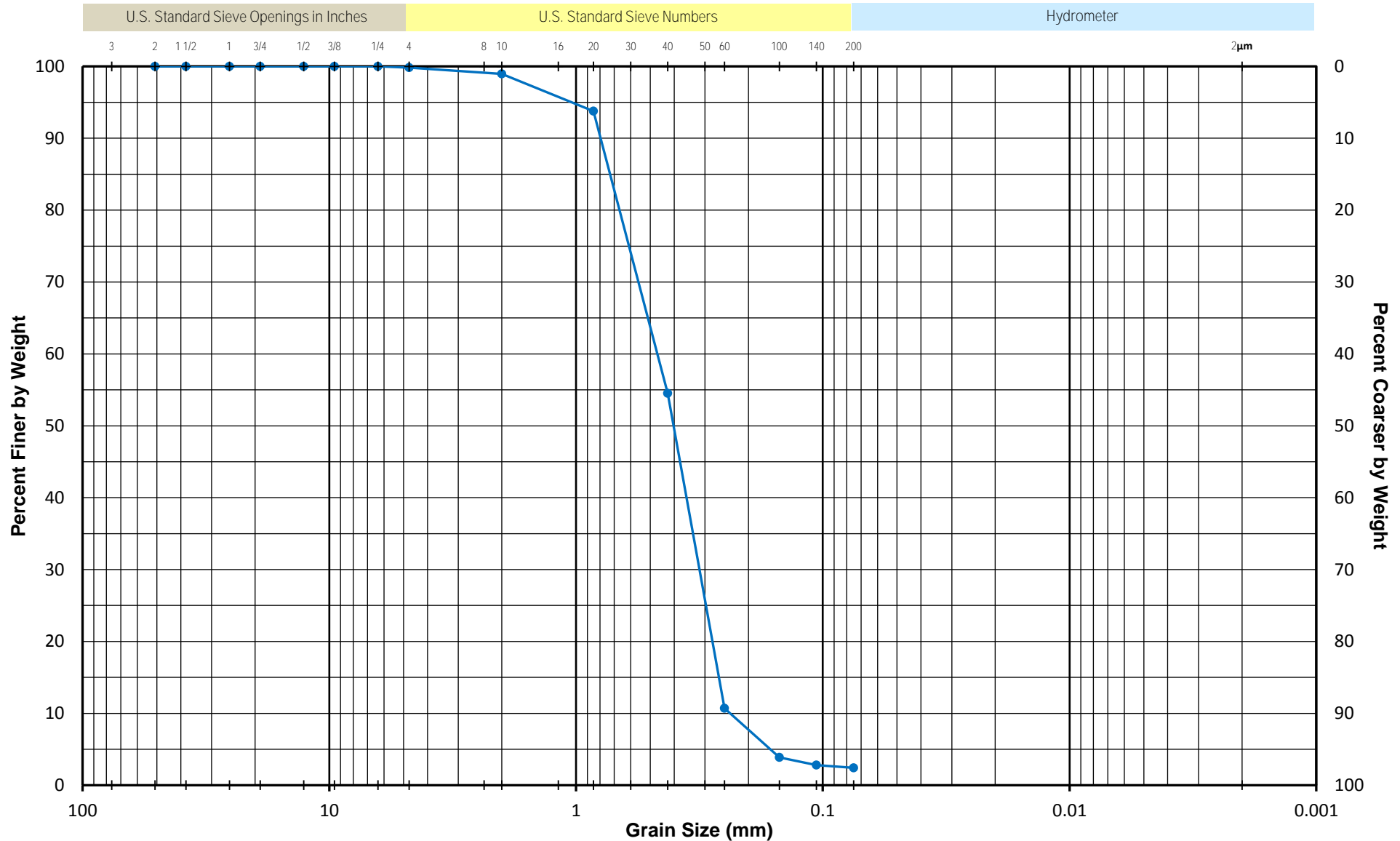
ASTM D-422, D-6913

Alpine - NESE II



Test Depth	Core ID Section/Sample	Material Description
8.0 ft	VC64 6-8	Brown Fine to Coarse Sand with shell fragments

GRADATION CURVES
 ASTM D-422, D-6913
 Alpine - NESE II

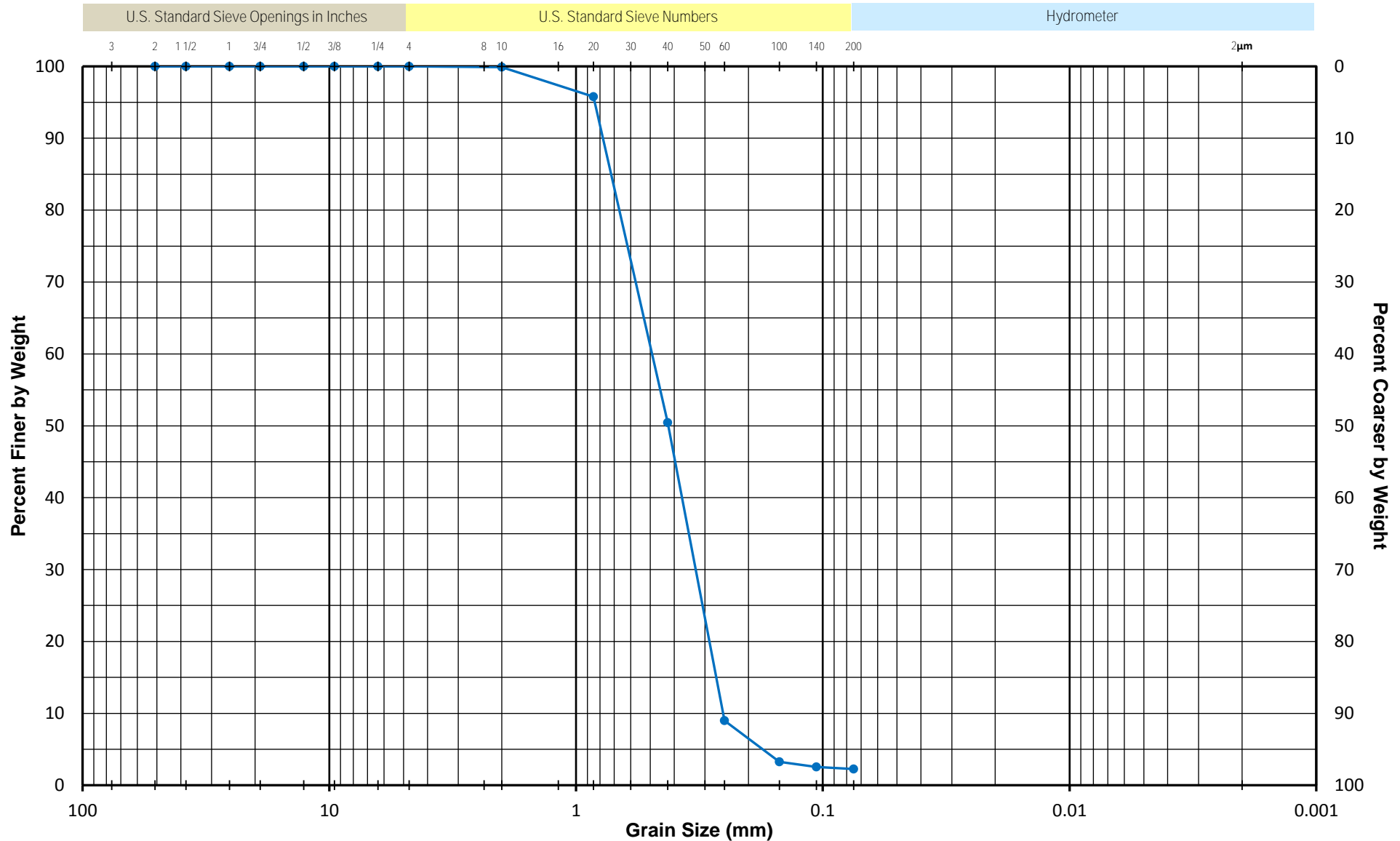


Test Depth	Core ID Section/Sample	Material Description
10.0 ft	VC64 8-10	Dark Grayish Brown Fine to Medium Sand with shell fragments

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

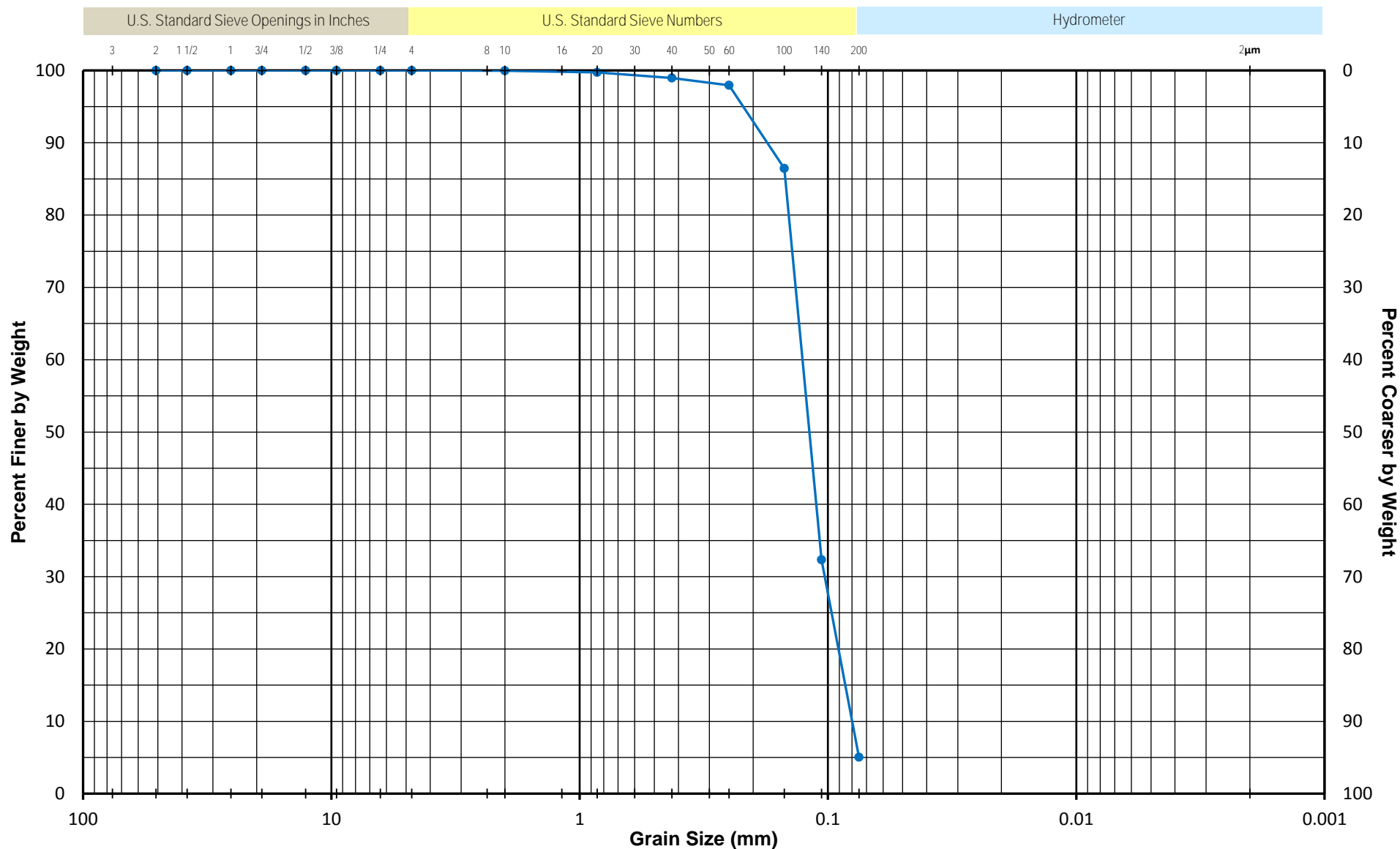


Test Depth	Core ID Section/Sample	Material Description
11.5 ft	VC64 10-12	Dark Grayish Brown Medium to Fine Sand with shell fragments

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

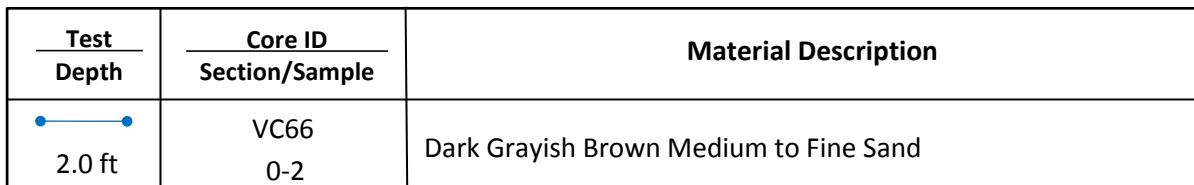


Test Depth	Core ID Section/Sample	Material Description
0.7 ft	VC66 0-2	Very Dark Gray Fine Sand

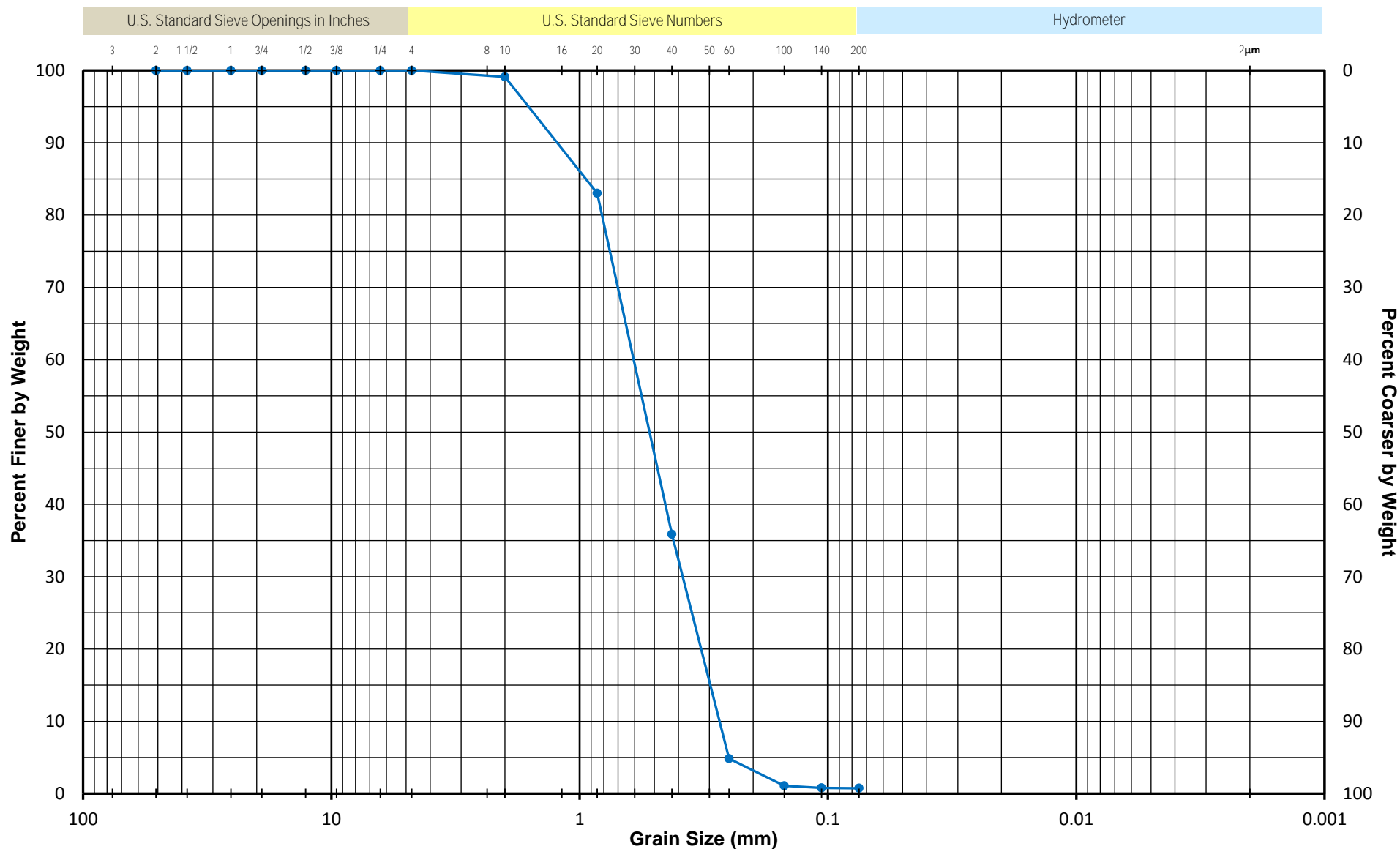
GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II



Alpine - NESE II

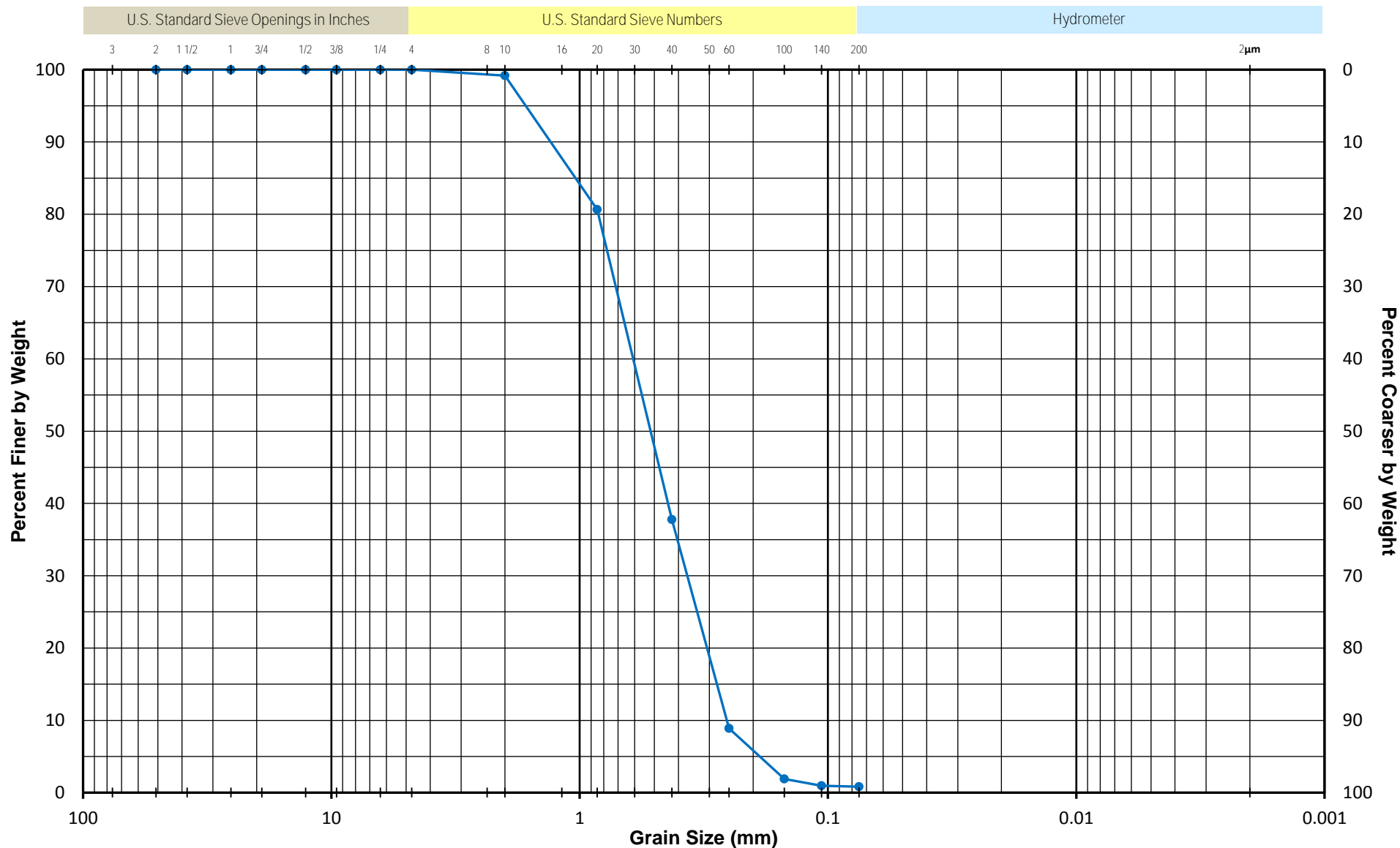


Test Depth	Core ID Section/Sample	Material Description
4.0 ft	VC66 2-4	Dark Grayish Brown Medium to Fine Sand

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

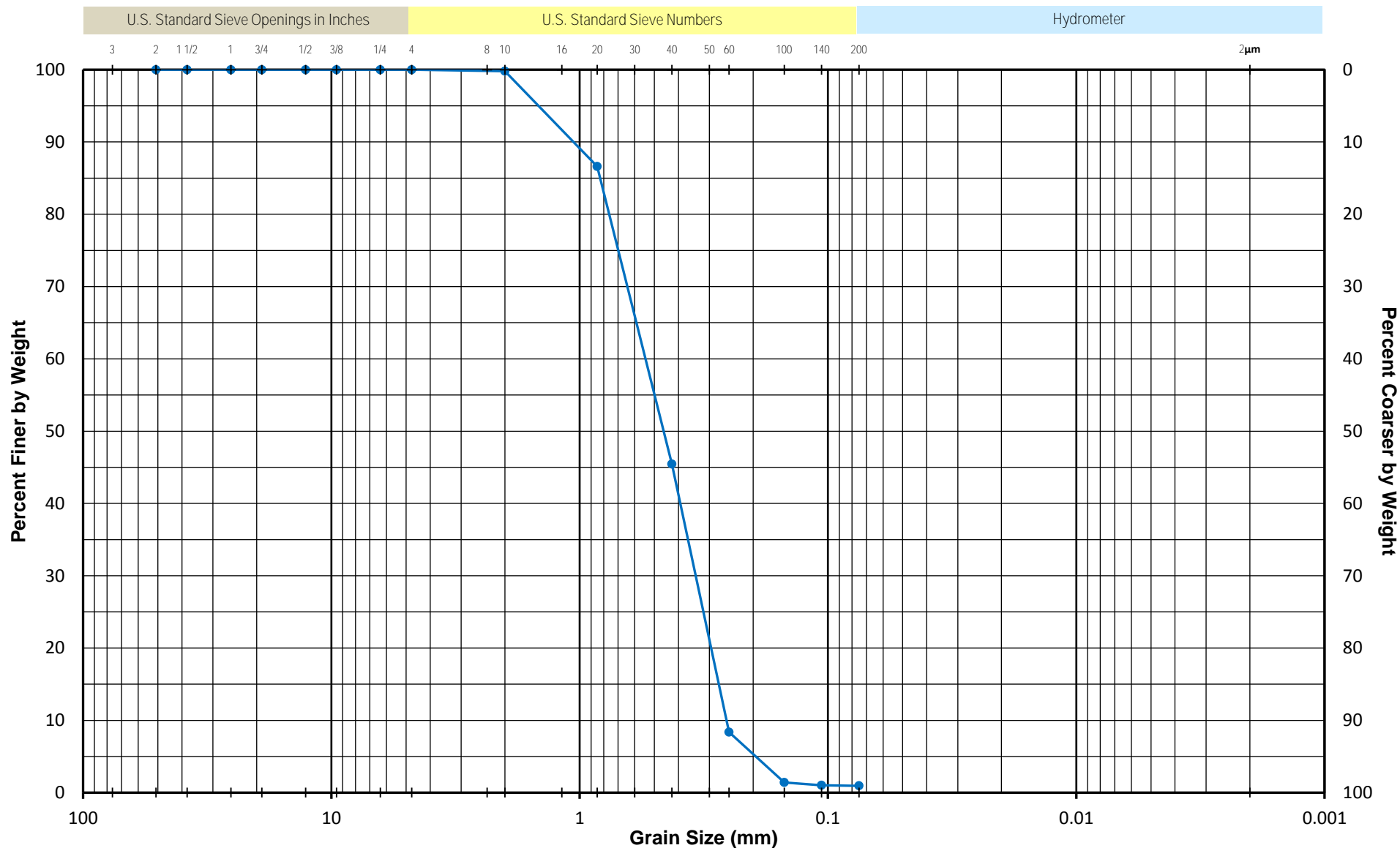


Test Depth	Core ID Section/Sample	Material Description
6.0 ft	VC66 4-6	Dark Grayish Brown Medium to Fine Sand

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

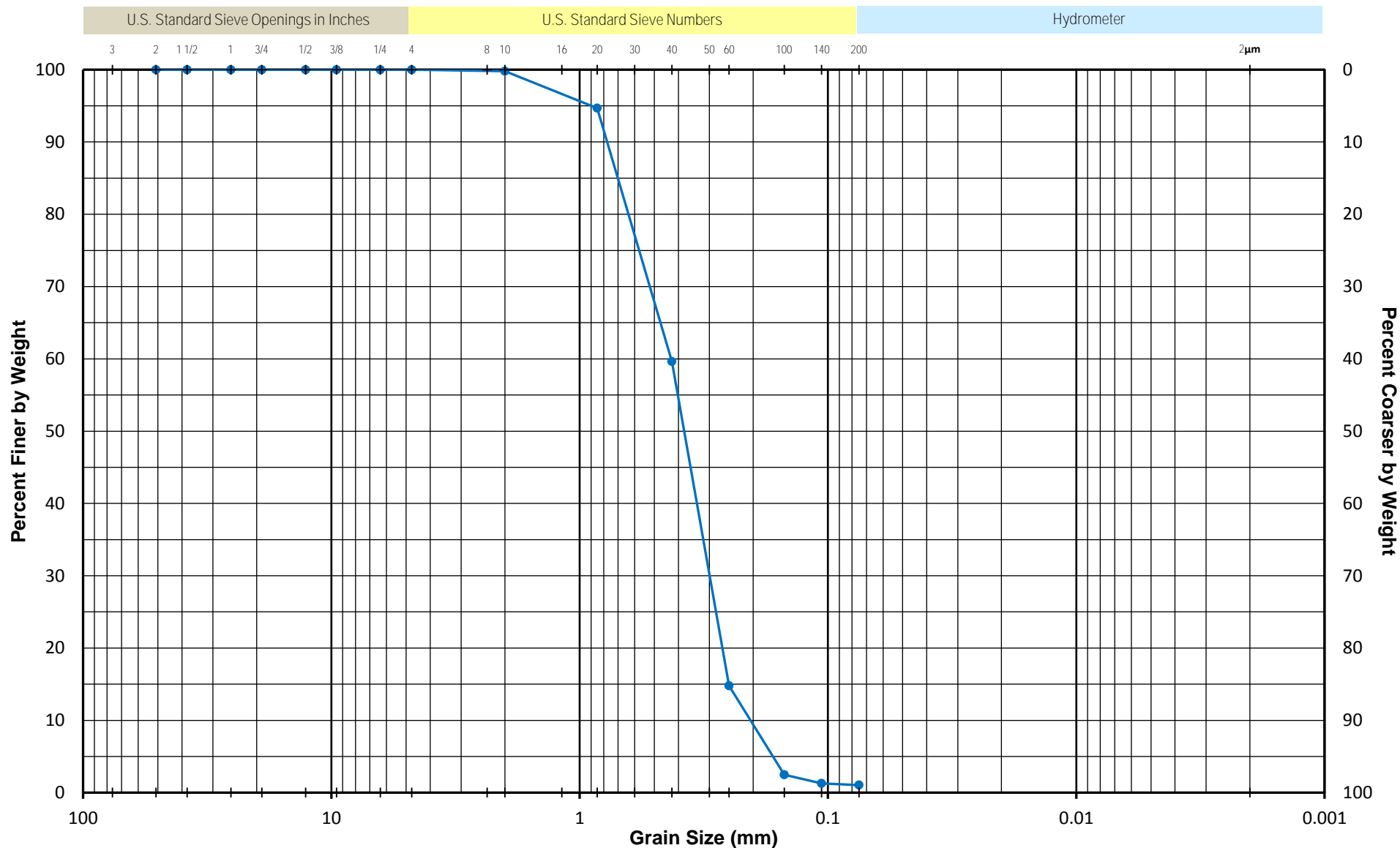


Test Depth	Core ID Section/Sample	Material Description
8.0 ft	VC66 6-8	Dark Brownish Gray Medium to Fine Sand

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

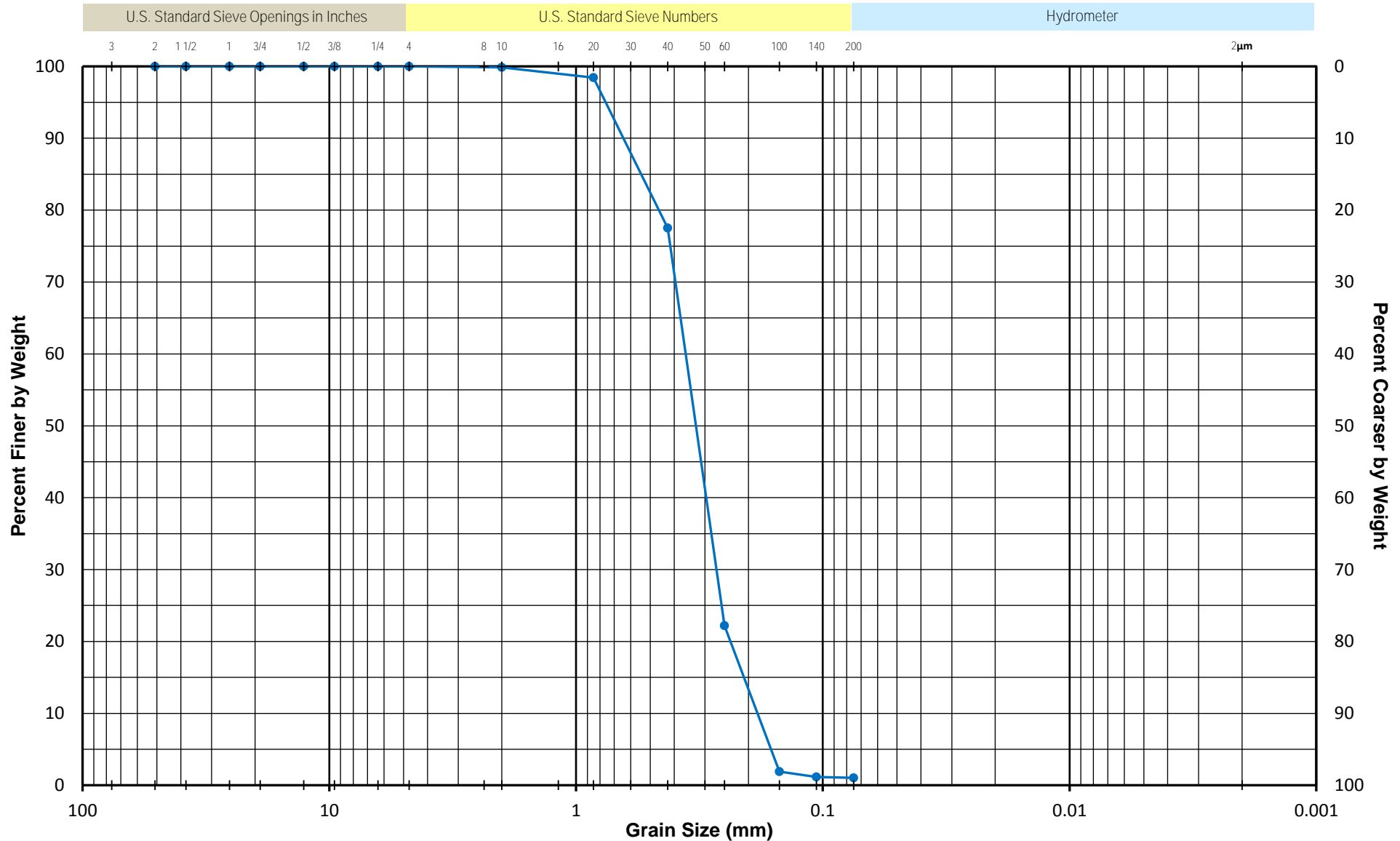


Test Depth	Core ID Section/Sample	Material Description
10.0 ft	VC66 8-10	Dark Brownish Gray Fine to Medium Sand with shell fragments

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

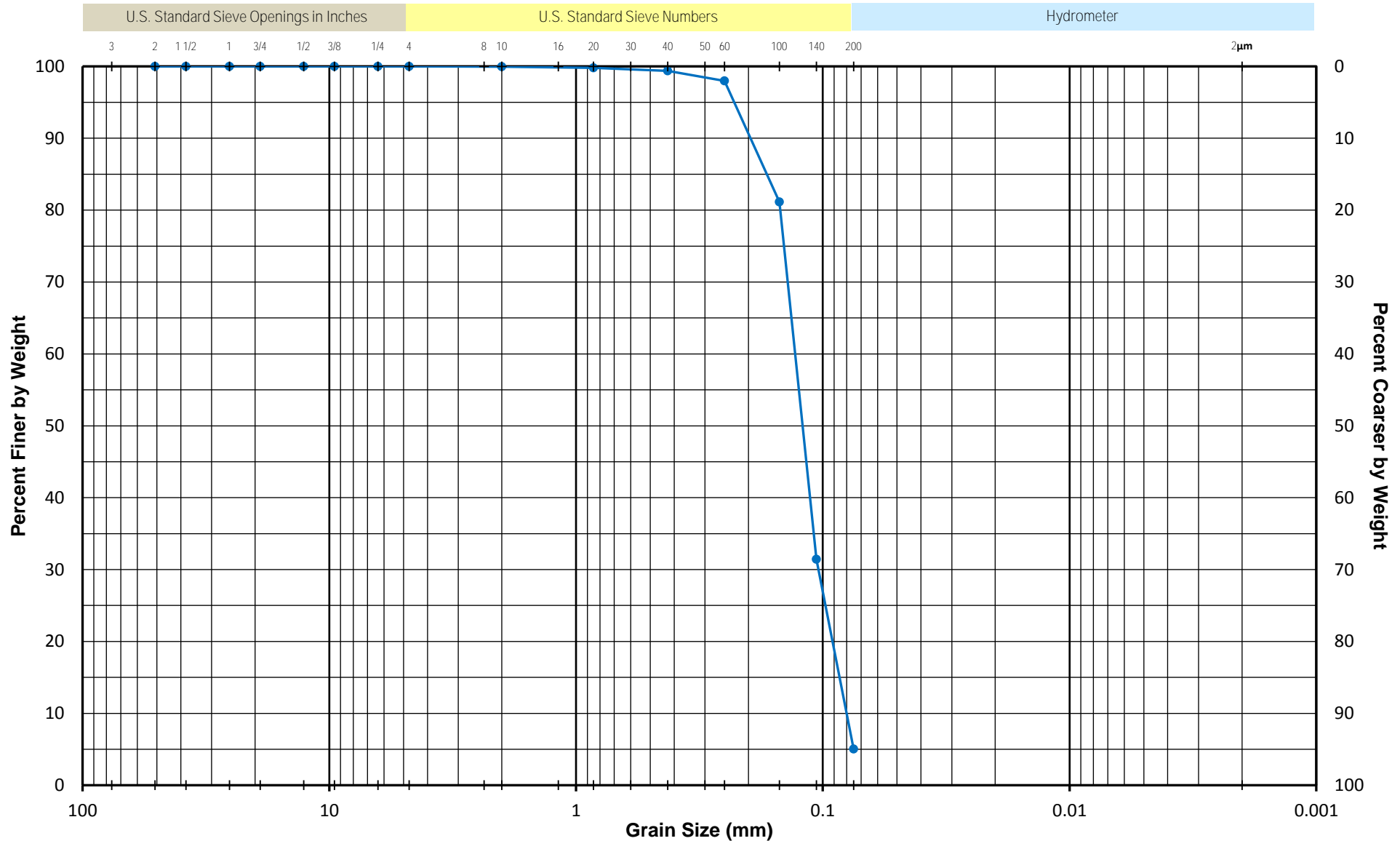


Test Depth	Core ID Section/Sample	Material Description
12.0 ft	VC66 10-12	Very Dark Grayish Brown Fine to Medium Sand with shell fragments

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

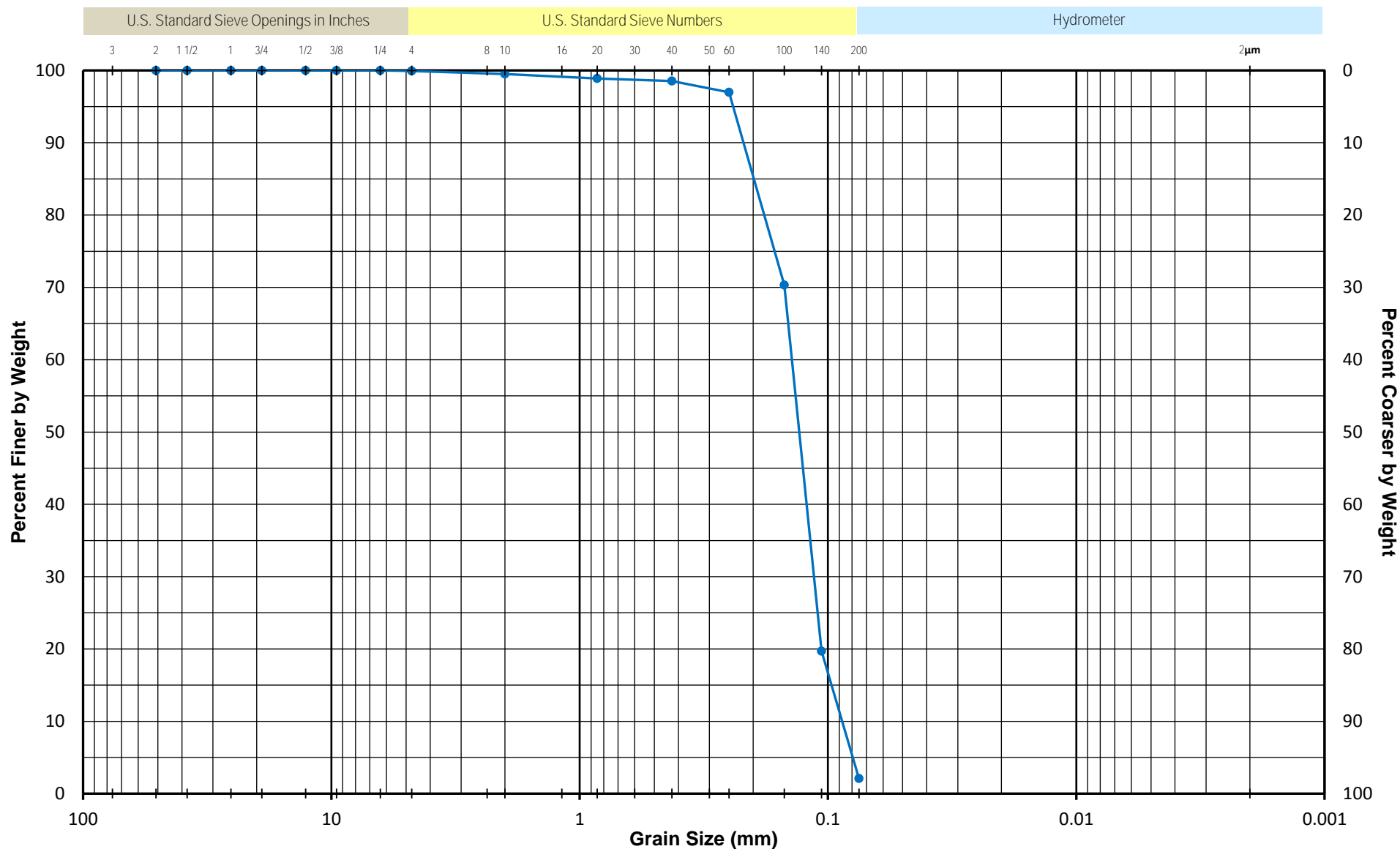


Test Depth	Core ID Section/Sample	Material Description
0.7 ft	VC67 0-2	Very Dark Gray Fine Sand with silt, shell fragments, and organics

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

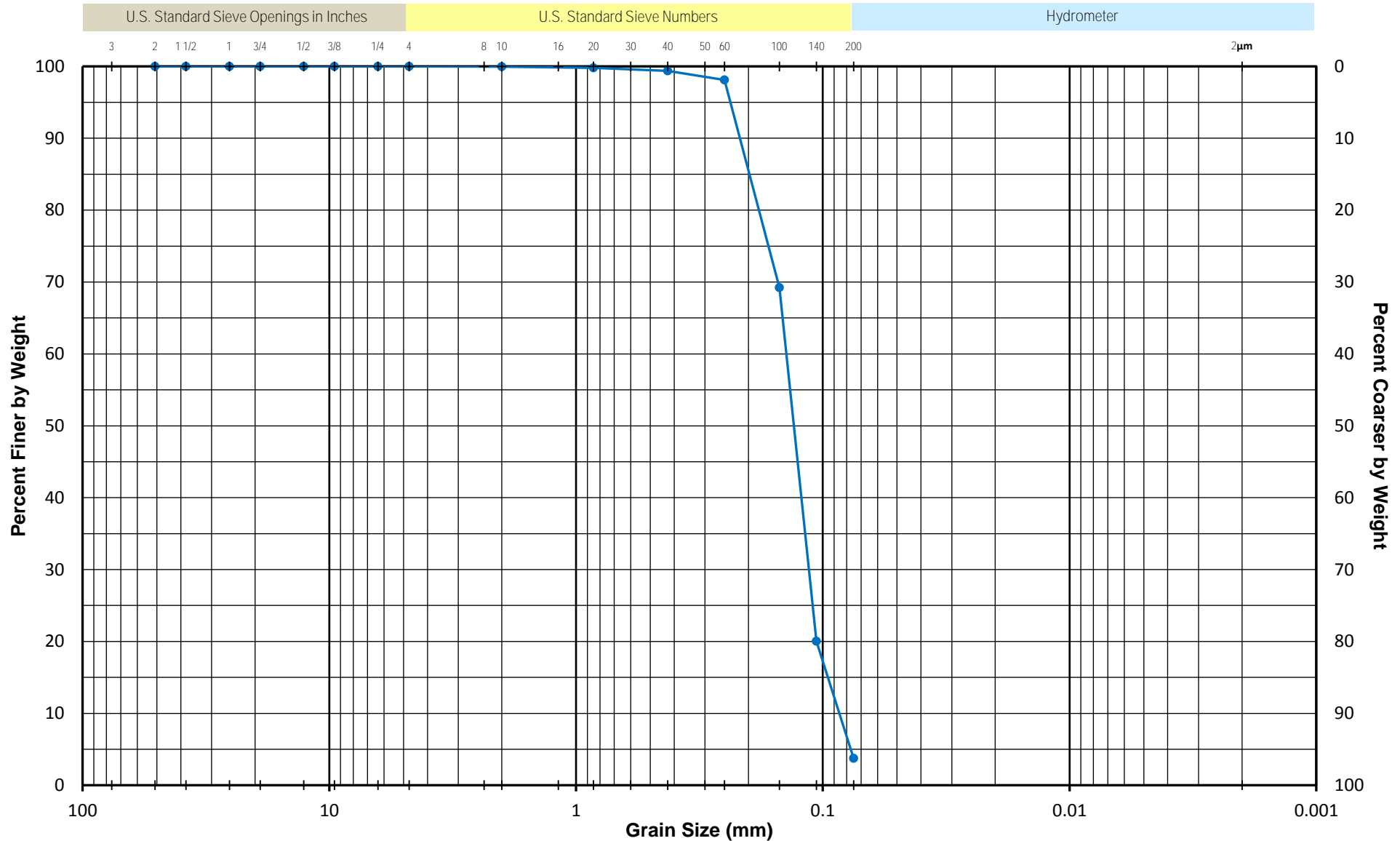


Test Depth	Core ID Section/Sample	Material Description
2.0 ft	VC67 0-2	Dark Gray Fine Sand with shell fragments

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

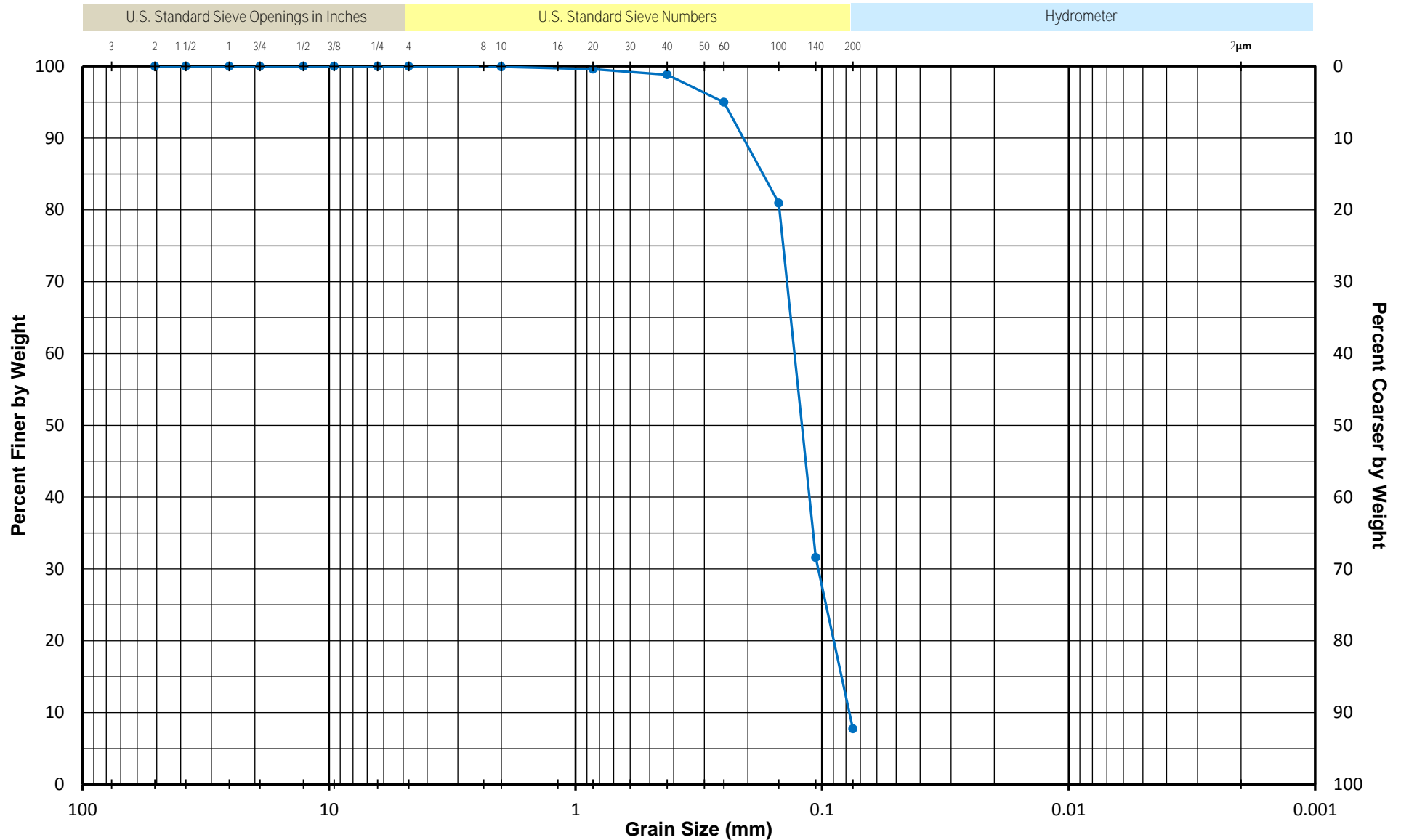


Test Depth	Core ID Section/Sample	Material Description
4.0 ft	VC67 2-4	Dark Gray Fine Sand with shell fragments

GRADATION CURVES

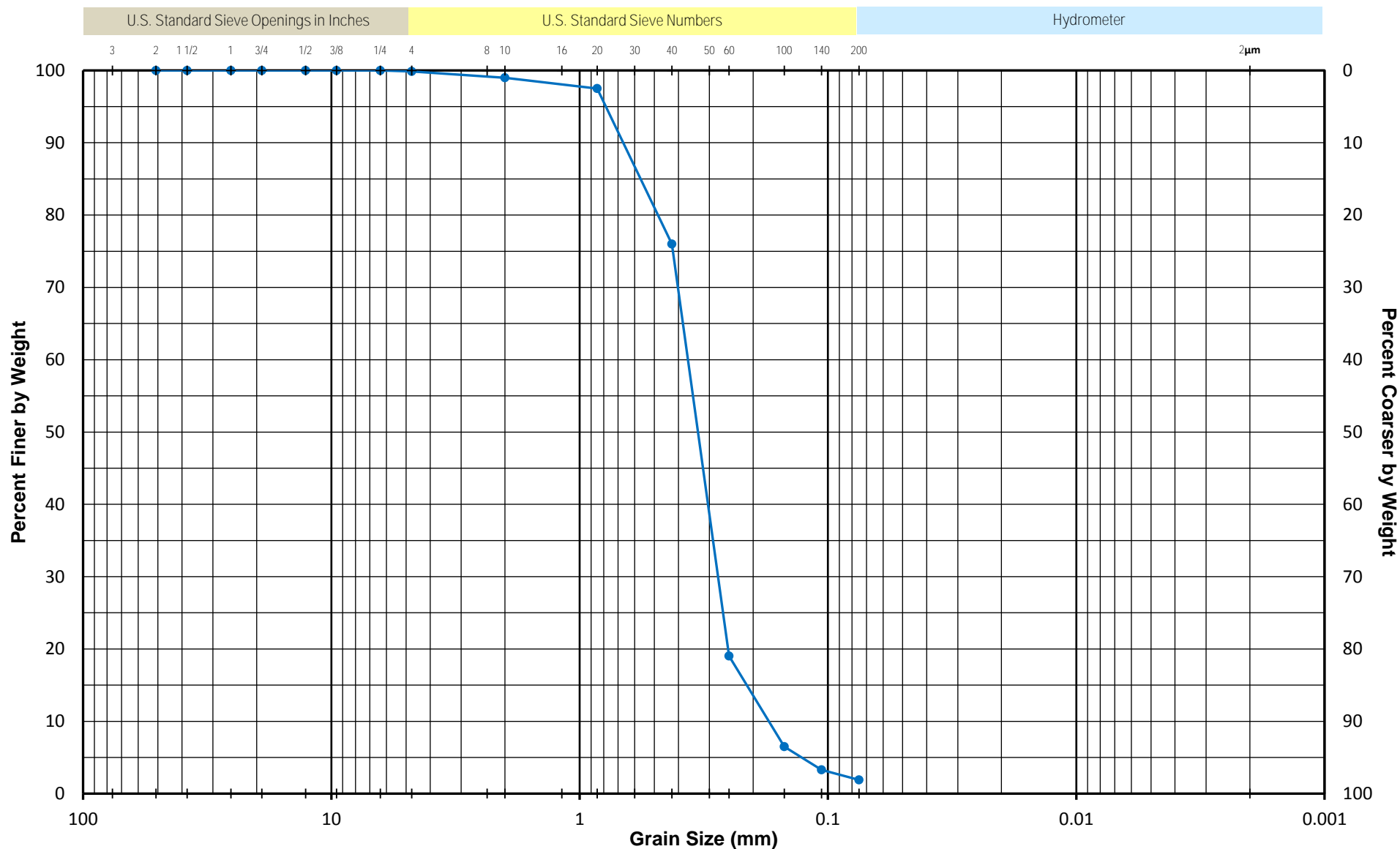
ASTM D-422, D-6913

Alpine - NESE II



Test Depth	Core ID Section/Sample	Material Description
7.8 ft	VC67 6-8	Very Dark Gray Fine Sand with silt and shell fragments

GRADATION CURVES
 ASTM D-422, D-6913
 Alpine - NESE II

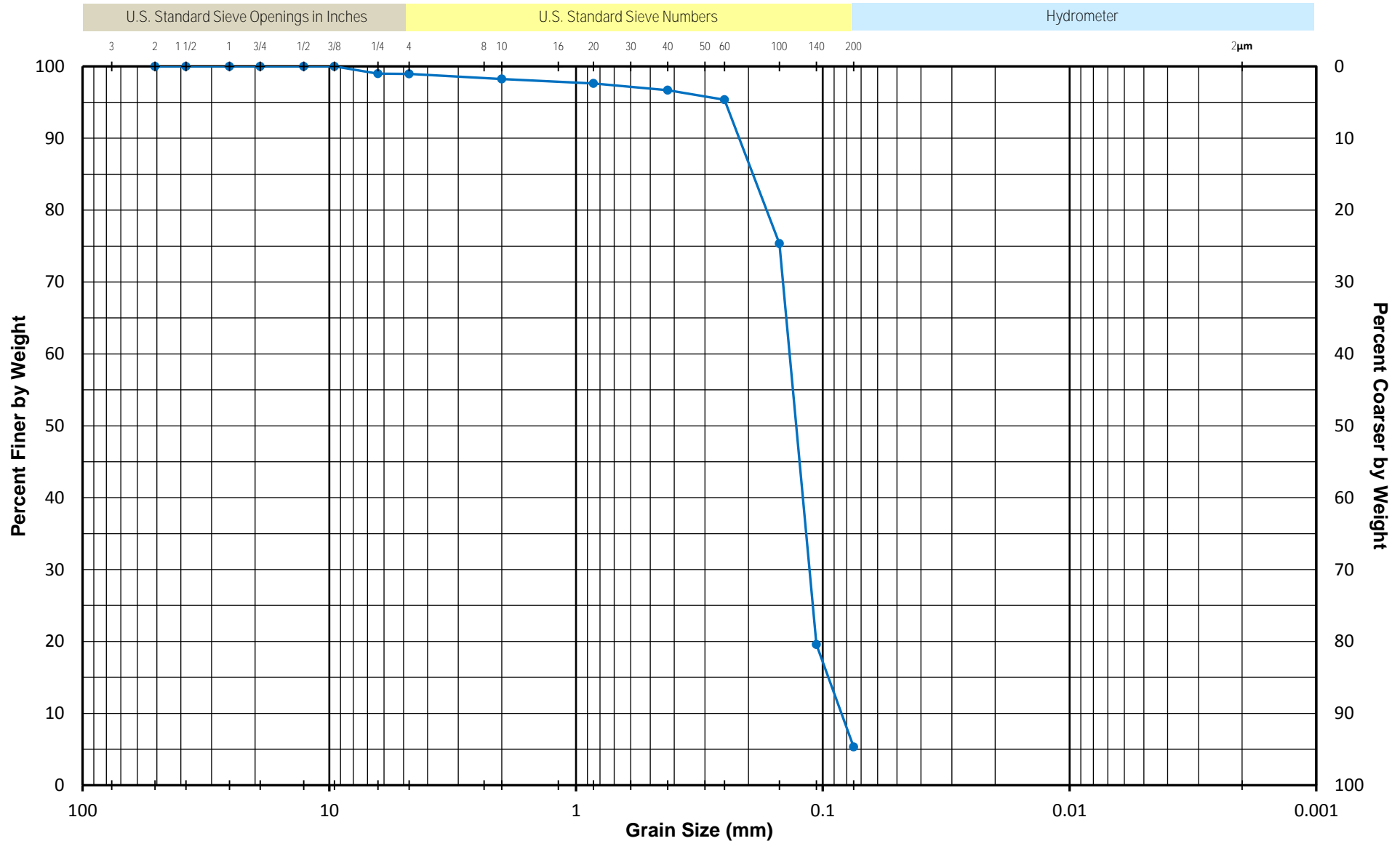


Test Depth	Core ID Section/Sample	Material Description
10.0 ft	VC67 8-10	Very Dark Gray Fine to Medium Sand with shell fragments

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

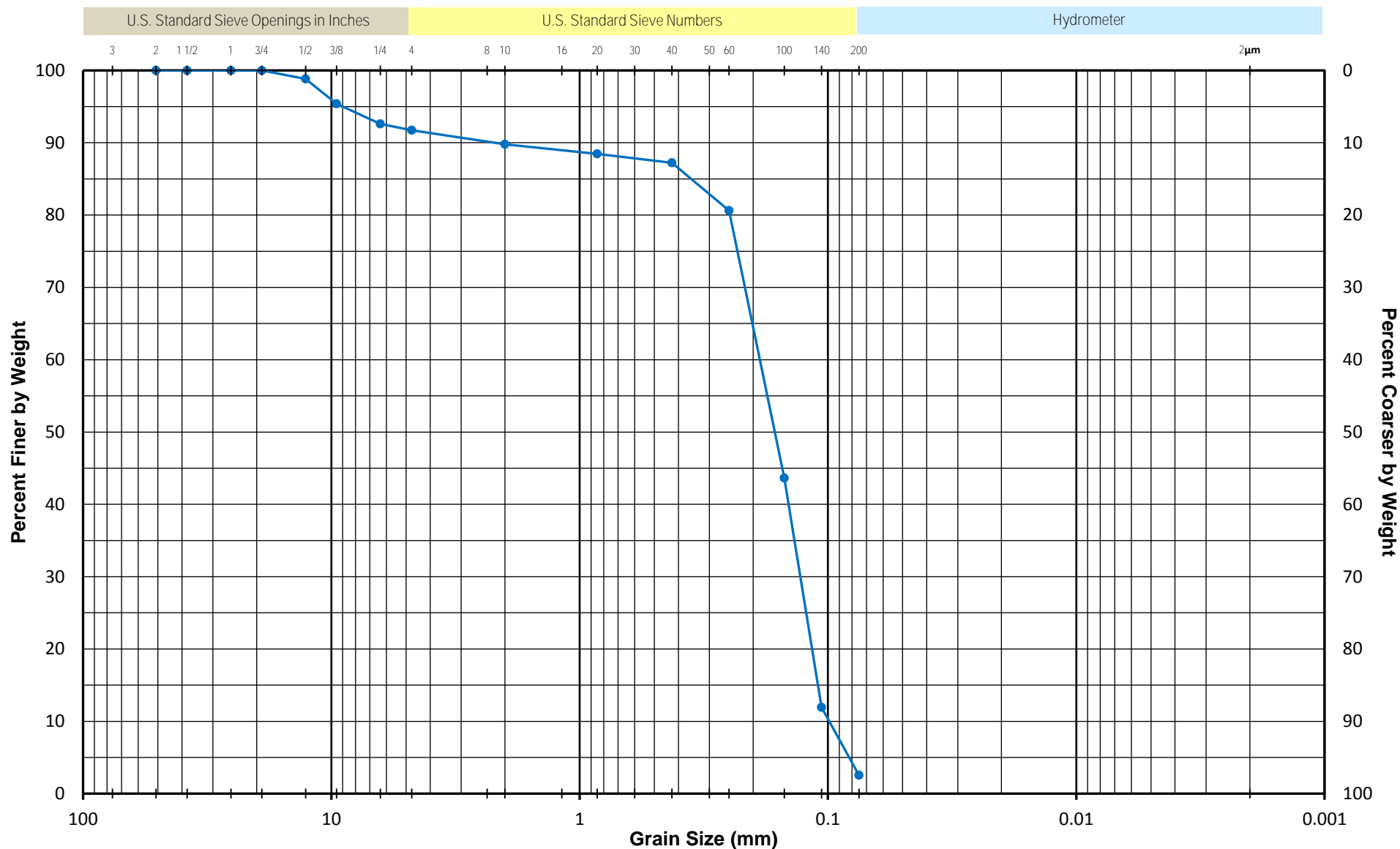


Test Depth	Core ID Section/Sample	Material Description
12.0 ft	VC67 10-12	Very Dark Gray Fine Sand with silt and shell fragments

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

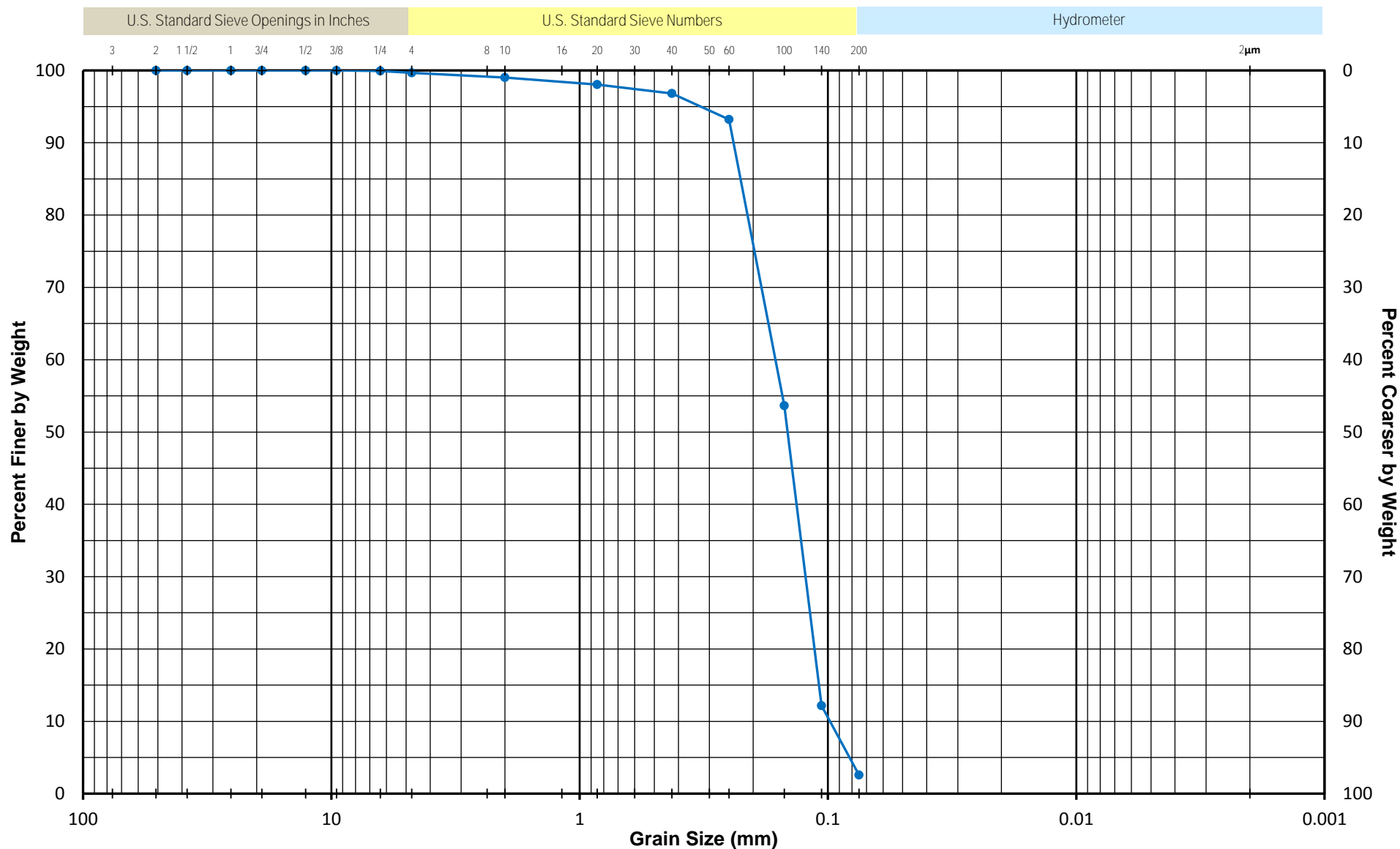


Test Depth	Core ID Section/Sample	Material Description
0.7 ft	VC68 0-2	Very Dark Gray Fine Sand with shell fragments

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

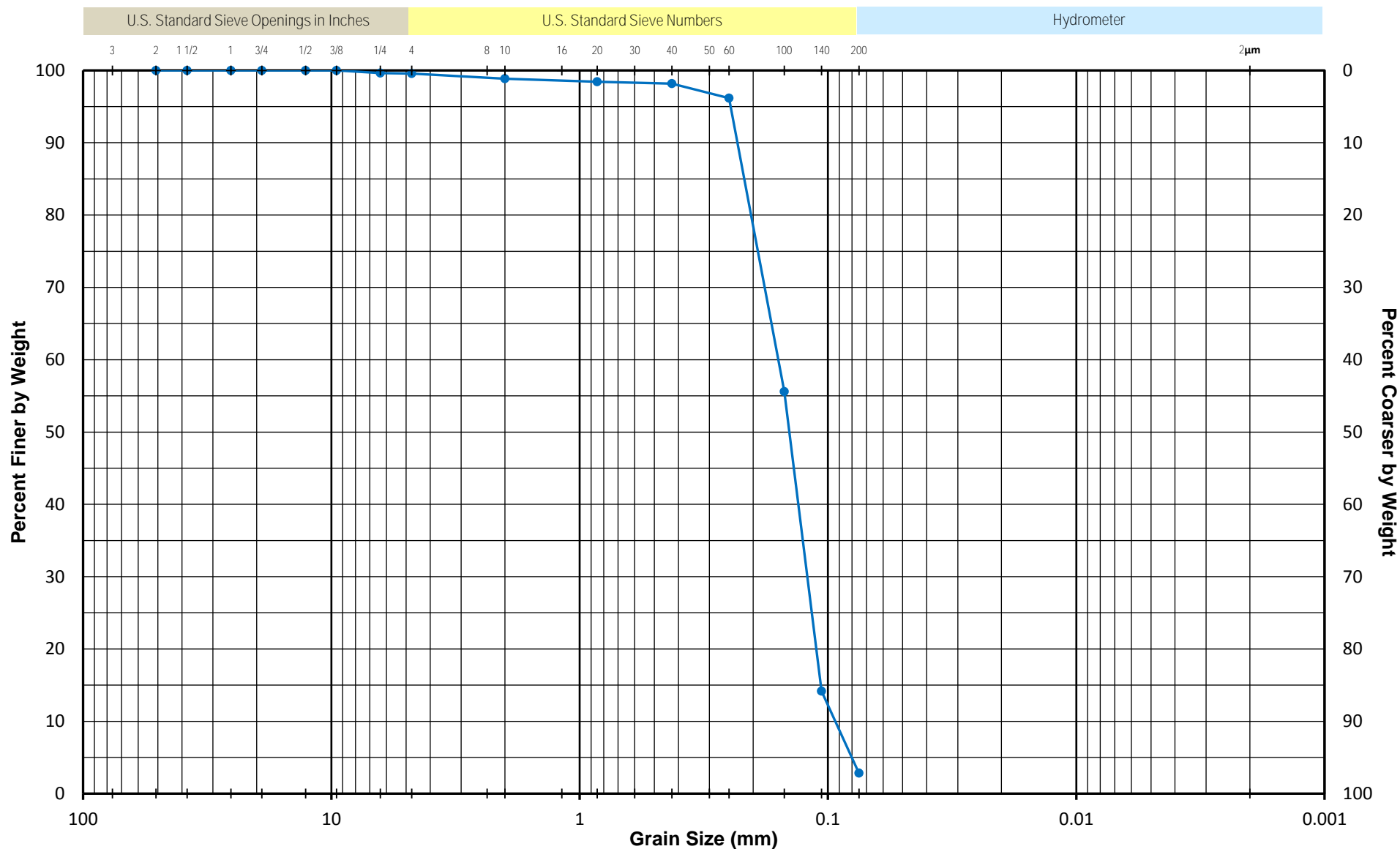


Test Depth	Core ID Section/Sample	Material Description
2.0 ft	VC68 0-2	Very Dark Gray Fine Sand with shell fragments

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

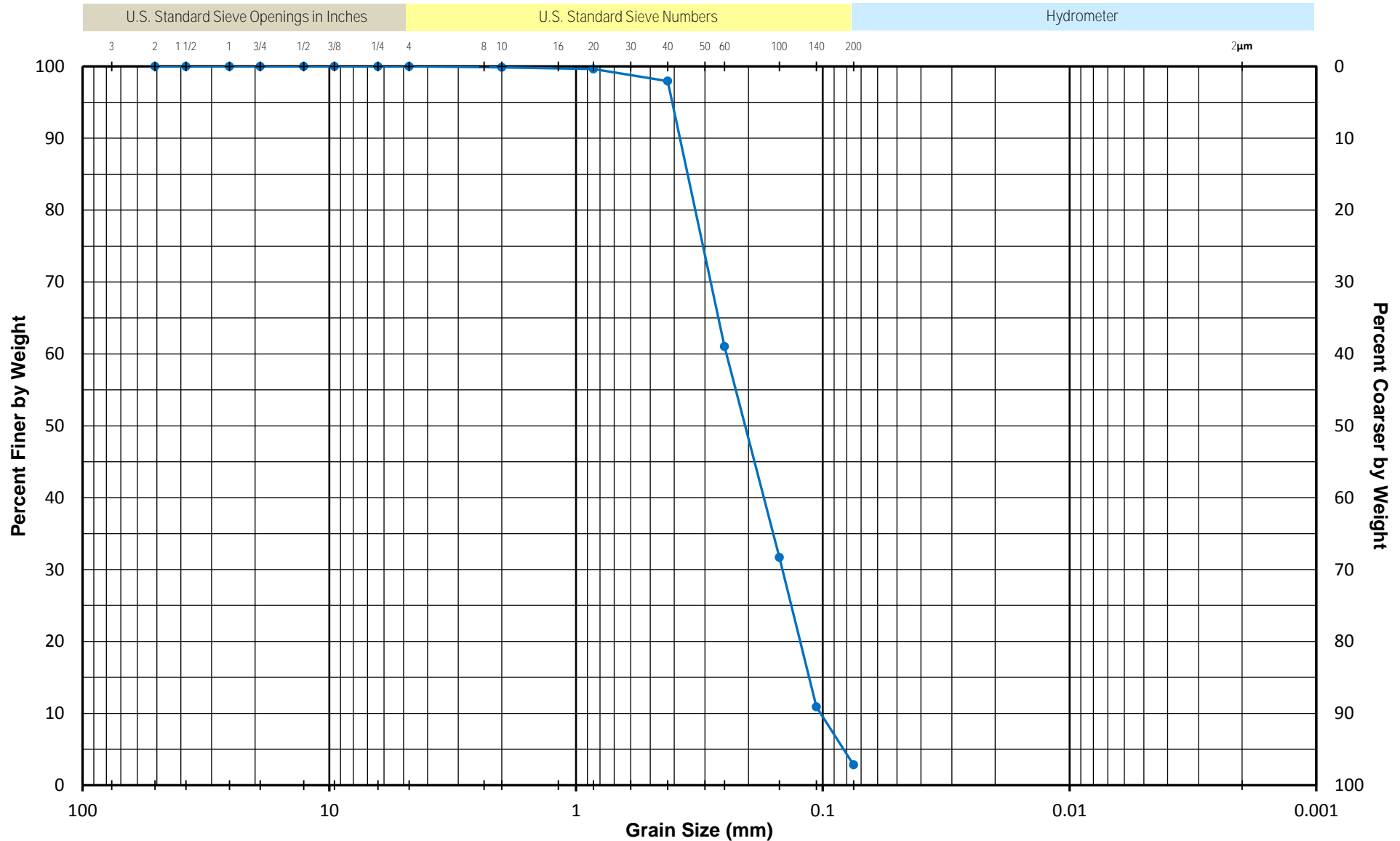


Test Depth	Core ID Section/Sample	Material Description
4.0 ft	VC68 2-4	Dark Gray Fine Sand with shell fragments

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

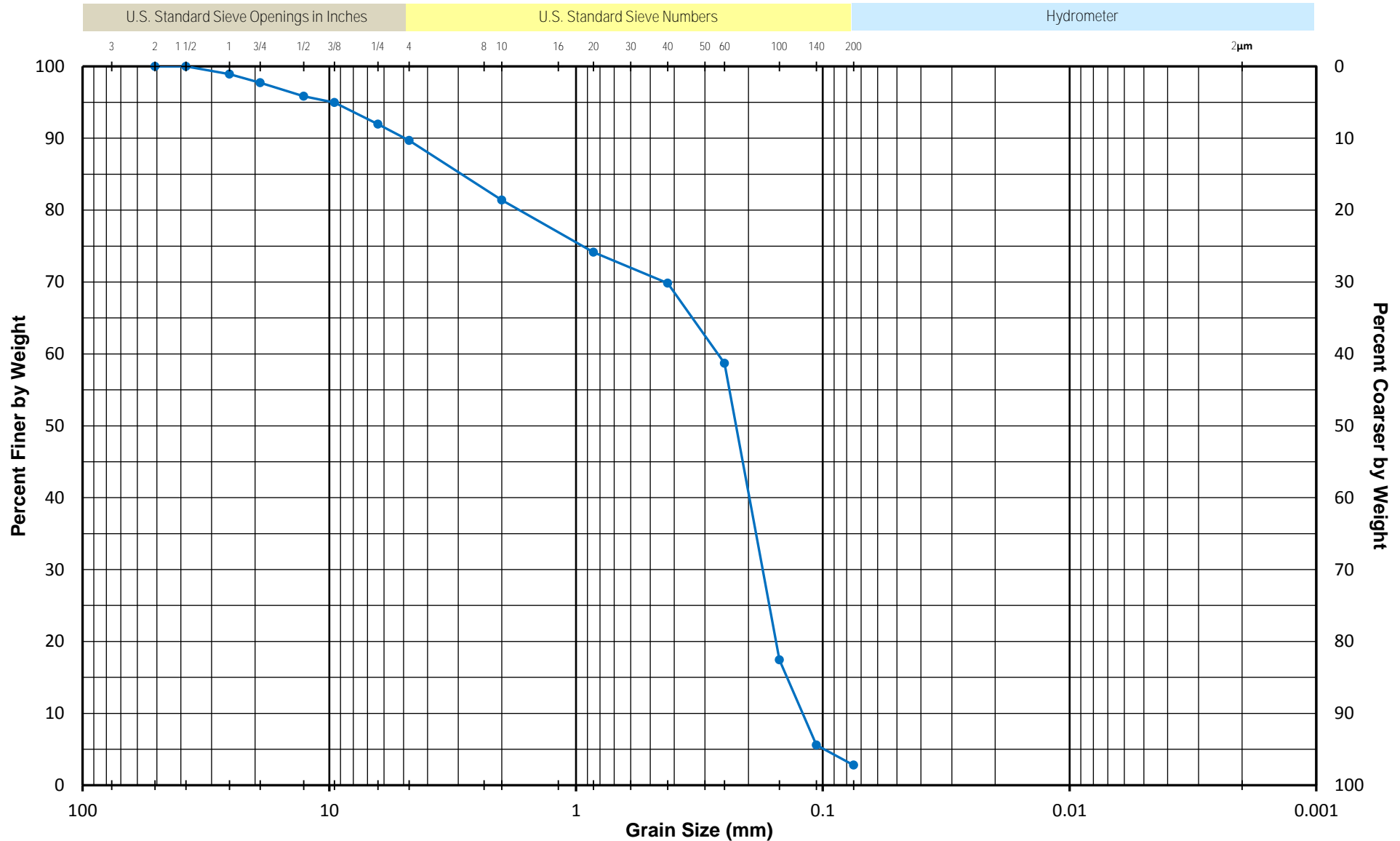


Test Depth	Core ID Section/Sample	Material Description
6.0 ft	VC68 4-6	Very Dark Gray Fine Sand with shell fragments

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

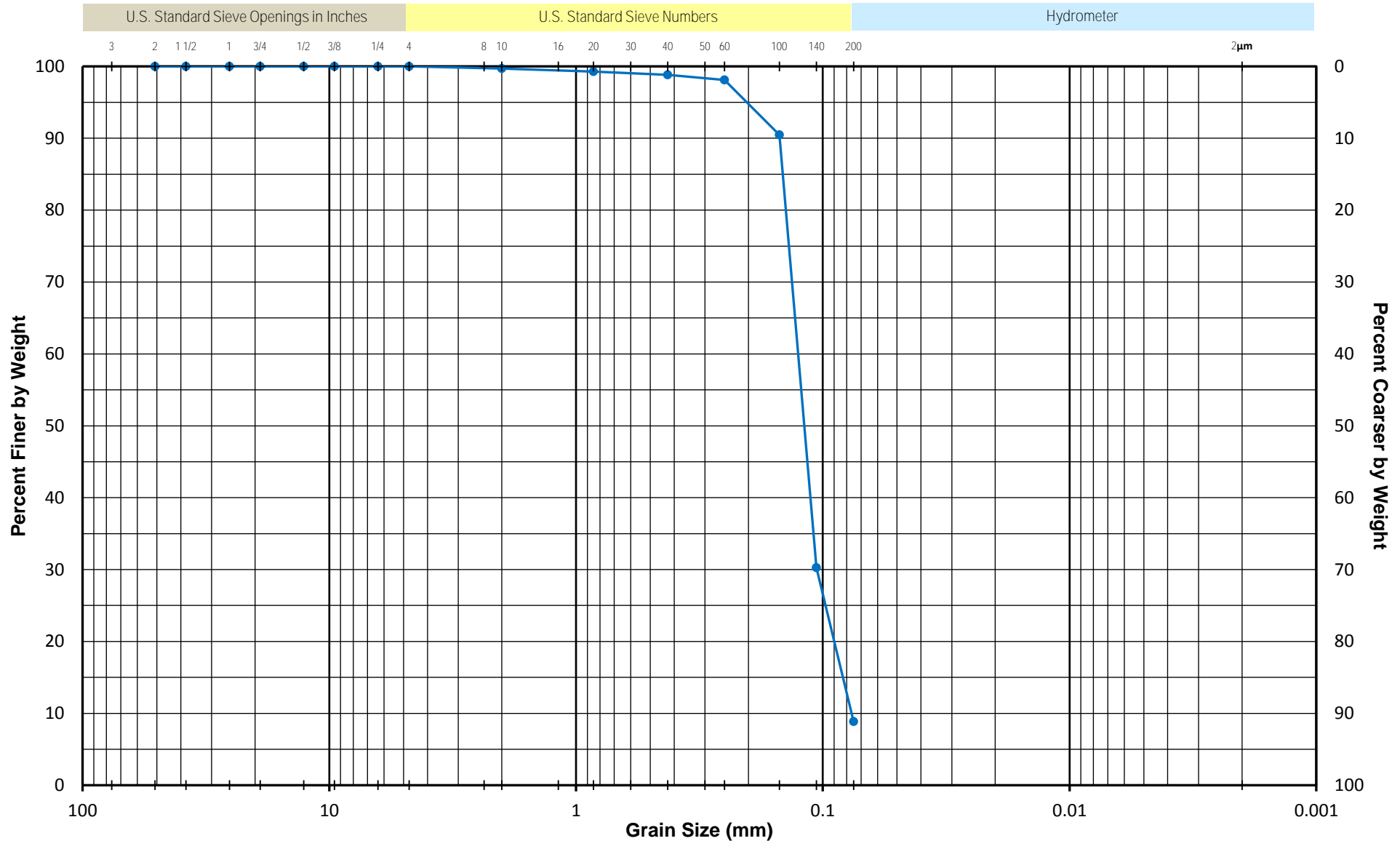


Test Depth	Core ID Section/Sample	Material Description
8.0 ft	VC68 6-8	Very Dark Gray Fine to Medium Sand with shell fragments

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

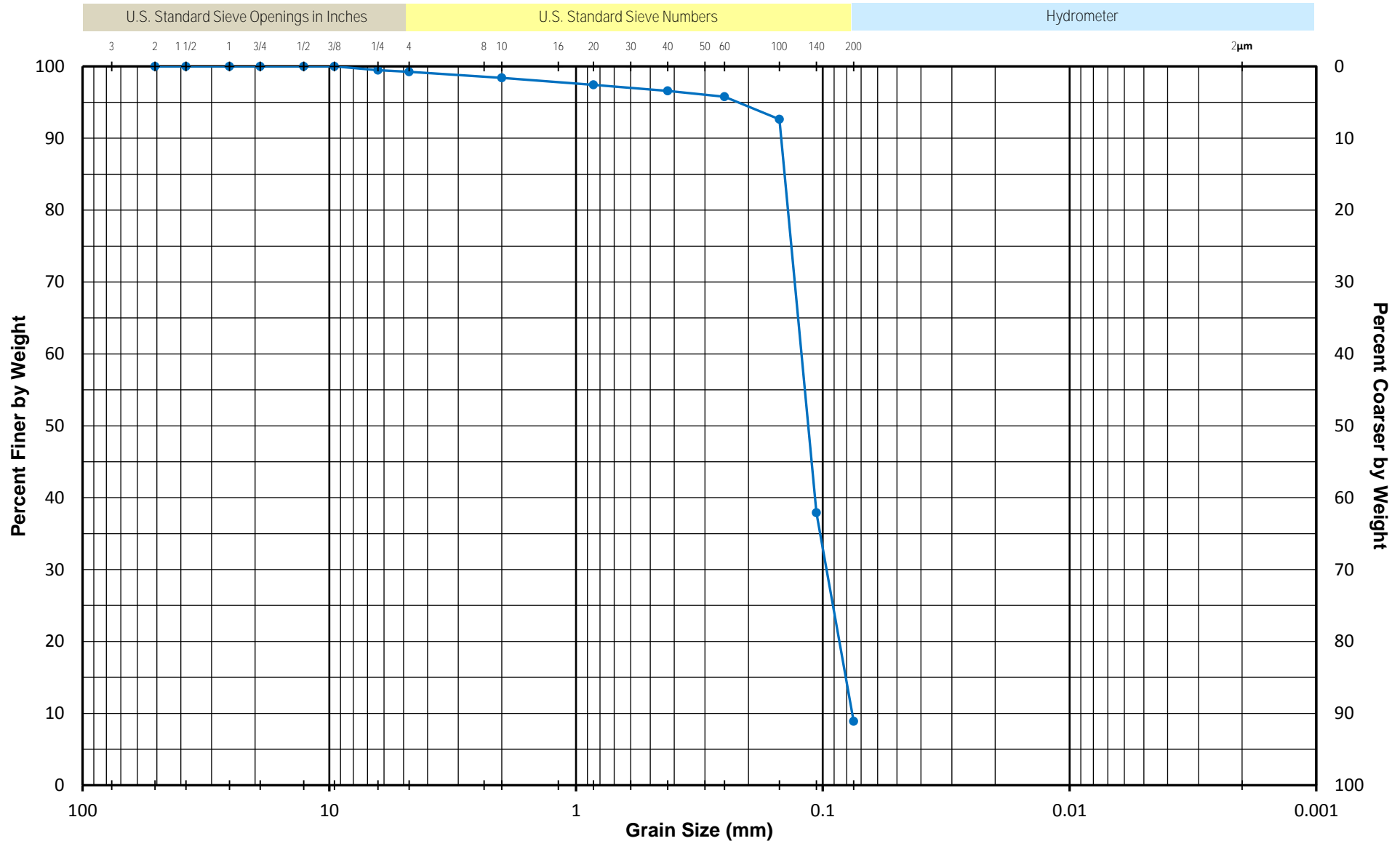


Test Depth	Core ID Section/Sample	Material Description
10.0 ft	VC68 8-10	Dark Gray Fine Sand with silt and shell fragments

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II



Test Depth	Core ID Section/Sample	Material Description
12.0 ft	VC68 10-12	Dark Gray Fine Sand with silt and shell fragments

GRADATION CURVES

ASTM D-422, D-6913

Alpine - NESE II

B

Core Logs



CLIENT <u>Williams</u>	PROJECT NAME <u>NESE Pipeline</u>
PROJECT NUMBER <u>1794</u>	PROJECT LOCATION <u>Raritan Bay and Lower New York Harbor</u>
DATE STARTED <u>5/19/17</u> COMPLETED <u>5/19/17</u>	WATER DEPTH <u>Not Recorded</u> HOLE SIZE <u>3.5 inches</u>
DRILLING CONTRACTOR <u>Alpine Ocean Seismic</u>	CORE PENETRATION: <u>16.34</u>
DRILLING METHOD <u>Vibracore</u>	CORE RECOVERY: <u>12.00</u>
LOGGED BY <u>MK</u> CHECKED BY <u>CD</u>	CORE LOCATION: <u>X:930281.95</u> <u>Y:119832.47</u>
NOTES _____	NAD 83, NY Long Island Lambert, ft _____

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE NUMBER	SAMPLE RECOVERY %	PENETRATION SECONDS PER FOOT	DRY UNIT WT. (pcf)	SUBMERGED UNIT WT. (pcf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲			
									20	40	60	80
									PL	MC	LL	
									20	40	60	80
									☐ FINES CONTENT (%) ☐			
									20	40	60	80
0		(SP-SM) Very dark gray medium to fine Sand with Silt	1	100	0.9	112	71	135	▲	●		
		(SP) Dark brown coarse to fine Sand	2		1.4	105	63	127	▲	●		
		(SP) Dark brown medium to fine Sand	3		1.4	99	57	121	▲	●		
		(SP) Dark brown coarse to fine Sand	4		1.2	106	65	129	▲	●		
5		(SW) Dark brown fine to coarse Sand with Gravel	5		1.7	118	72	136	▲	●		
		(SP) Dark brown coarse to medium Sand with Gravel	6		3.3				▲			
		(SW) Brown coarse to medium Sand with Gravel	7		4.5	122	68	132	▲	●		
		(SW) Brown coarse to medium Sand with Gravel			5.7				▲			
10		(SP) Brown medium to fine Sand	8		4.7	121	68	132	▲	●		
		(SP) Dark brown coarse to medium Sand	9		5				▲			
					3.3	112	71	135	▲	●		
					2.8				▲			
						111	64	128	▲	●		

Bottom of borehole at 16.3 feet.



CLIENT <u>Williams</u>	PROJECT NAME <u>NESE Pipeline</u>
PROJECT NUMBER <u>1794</u>	PROJECT LOCATION <u>Raritan Bay and Lower New York Harbor</u>
DATE STARTED <u>5/19/17</u> COMPLETED <u>5/19/17</u>	WATER DEPTH <u>Not Recorded</u> HOLE SIZE <u>3.5 inches</u>
DRILLING CONTRACTOR <u>Alpine Ocean Seismic</u>	CORE PENETRATION: <u>16.30</u>
DRILLING METHOD <u>Vibracore</u>	CORE RECOVERY: <u>12.00</u>
LOGGED BY <u>MK</u> CHECKED BY <u>CD</u>	CORE LOCATION: <u>X:949132.07</u> <u>Y:124379.23</u>
NOTES _____	NAD 83, NY Long Island Lambert, ft _____

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE NUMBER	SAMPLE RECOVERY %	PENETRATION SECONDS PER FOOT	DRY UNIT WT. (pcf)	SUBMERGED UNIT WT. (pcf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲				
									20 40 60 80				
									PL	MC	LL		
									20 40 60 80				
									☐ FINES CONTENT (%) ☐	20 40 60 80			
0													
0 <													

Bottom of borehole at 16.3 feet.



CLIENT <u>Williams</u>	PROJECT NAME <u>NESE Pipeline</u>
PROJECT NUMBER <u>1794</u>	PROJECT LOCATION <u>Raritan Bay and Lower New York Harbor</u>
DATE STARTED <u>5/19/17</u> COMPLETED <u>5/19/17</u>	WATER DEPTH <u>Not Recorded</u> HOLE SIZE <u>3.5 inches</u>
DRILLING CONTRACTOR <u>Alpine Ocean Seismic</u>	CORE PENETRATION: <u>16.44</u>
DRILLING METHOD <u>Vibracore</u>	CORE RECOVERY: <u>12.00</u>
LOGGED BY <u>MK</u> CHECKED BY <u>CD</u>	CORE LOCATION: <u>X:951144.82 Y:124410.16</u>
NOTES	NAD 83, NY Long Island Lambert, ft

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE NUMBER	SAMPLE RECOVERY %	PENETRATION SECONDS PER FOOT	DRY UNIT WT. (pcf)	SUBMERGED UNIT WT. (pcf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲		
									20 40 60 80		
									PL	MC	LL
									20 40 60 80		
									□ FINES CONTENT (%) □		
									20 40 60 80		
0		(SP) Very dark gray fine Sand with shell fragments	1	100	0.1	106	64	128	▲	□	●
		(SW-SM) Very dark gray coarse to fine Sand with Silt	2		0.7	107	65	129	▲		●
		(SW-SC) Very dark gray coarse to fine Sand with Clay	3		0.7	114	69	133	▲	□	●
		(SW-SM) Very dark gray fine to coarse Sand with Silt	4		1.4	112	68	132	▲		●
5		(SP) Very dark gray fine to coarse Sand with Gravel; Lense of strong brown Silty Sand with greenish gray Silt from 5.7-5.9'	5		0.7	122	73	137	▲	□	●
			6		1.2				▲		
		(SM) Strong brown Silty Sand	7		2.3	120	72	136	▲		●
					5.4				▲		
		(SP) Strong brown coarse to fine Sand	8		15.4	121	73	137	▲	□	●
10					25						▲
		(SP) Dark brown fine to medium Sand	9		14.7	105	63	127	▲	□	●
		(SP) Dark brown medium to fine Sand	10		13.8				▲		
						109	65	129	▲	□	●
15											

Bottom of borehole at 16.4 feet.



CLIENT <u>Williams</u>	PROJECT NAME <u>NESE Pipeline</u>
PROJECT NUMBER <u>1794</u>	PROJECT LOCATION <u>Raritan Bay and Lower New York Harbor</u>
DATE STARTED <u>5/19/17</u> COMPLETED <u>5/19/17</u>	WATER DEPTH <u>Not Recorded</u> HOLE SIZE <u>3.5 inches</u>
DRILLING CONTRACTOR <u>Alpine Ocean Seismic</u>	CORE PENETRATION: <u>15.95</u>
DRILLING METHOD <u>Vibracore</u>	CORE RECOVERY: <u>14.30</u>
LOGGED BY <u>MK</u> CHECKED BY <u>CD</u>	CORE LOCATION: <u>X:954827.41</u> <u>Y:125889.14</u>
NOTES _____	NAD 83, NY Long Island Lambert, ft _____

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE NUMBER	SAMPLE RECOVERY %	PENETRATION SECONDS PER FOOT	DRY UNIT WT. (pcf)	SUBMERGED UNIT WT. (pcf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲				
									20 40 60 80				
									PL MC LL				
									20 40 60 80				
									□ FINES CONTENT (%) □				
									20 40 60 80				
0													
		(SC) Black Clayey Sand with shell fragments		100	3.3					▲			
			1			98	58	122		□	●		
		(SC) Very dark gray Clayey Sand with shell fragments	2			98	59	123			●		
			3										
						1.9				▲			
			3										
						1.6							
			3				99	59	123		□	●	
						1.6				▲			
		(SP-SC) Very dark gray Gravelly Sand with Clay and shell fragments	4		1.6	107	64	128			●		
									▲				
		(SM) Dark gray Silty fine to medium Sand	5		3.7	113	67	131			●	□	
									▲				
5					2.1					▲			
		(SP) Dark gray Silty medium to fine Sand	6		1.9	115	69	133			□	●	
									▲				
					5.1					▲			
		(SP-SM) Dark gray fine to coarse Sand with Silt	7		4.4	112	67	131		□	●		
									▲				
					7					▲			
10		(SP) Dark brown medium to coarse Sand	8		5.4	114	71	135		□	●		
									▲				
		(SW) Dark brown fine to medium Sand	9		4.7					▲			
							105	65	129	□	●		
		No Analysis											
15													

Bottom of borehole at 16.0 feet.



CLIENT <u>Williams</u> PROJECT NUMBER <u>1794</u> DATE STARTED <u>5/18/17</u> COMPLETED <u>5/18/17</u> DRILLING CONTRACTOR <u>Alpine Ocean Seismic</u> DRILLING METHOD <u>Vibracore</u> LOGGED BY <u>MK</u> CHECKED BY <u>CD</u> NOTES _____	PROJECT NAME <u>NESE Pipeline</u> PROJECT LOCATION <u>Raritan Bay and Lower New York Harbor</u> WATER DEPTH <u>Not Recorded</u> HOLE SIZE <u>3.5 inches</u> CORE PENETRATION: <u>15.76</u> CORE RECOVERY: <u>12.00</u> CORE LOCATION: X:958257.98 Y:127881.29 NAD 83, NY Long Island Lambert, ft _____
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DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE NUMBER	SAMPLE RECOVERY %	PENETRATION SECONDS PER FOOT	DRY UNIT WT. (pcf)	SUBMERGED UNIT WT. (pcf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲			
									20 40 60 80			
									PL	MC	LL	□ FINES CONTENT (%) □
0									20	40	60	80
		(SP-SM) Very dark gray Sand with Silt and shell fragments	1	100	1	101	62	126				
		(SM) Very dark gray Silty fine Sand with coarse Sand and shell fragments	2		1.8	100	61	125				
		(SP-SM) Very dark gray fine to medium Sand with Silt and shell fragments	3		1.8	107	64	128				
		(SM) Very dark gray Silty Sand with shell fragments	4		1.4	104	64	128				
5		(SP-SM) Very dark gray medium to fine Sand with Silt	5		0.9	117	71	135				
		(SP) Brown fine to coarse Sand with Gravel	6		2.3	118	71	135				
		(SP) Strong brown fine to medium Sand	7		6.1	102	62	126				
10		(SP) Brown fine to medium Sand	8		11.8	105	63	127				
		(SP) Dark brown fine to medium Sand	9		9.1	107	63	127				
15												

Bottom of borehole at 15.8 feet.



CLIENT <u>Williams</u>	PROJECT NAME <u>NESE Pipeline</u>
PROJECT NUMBER <u>1794</u>	PROJECT LOCATION <u>Raritan Bay and Lower New York Harbor</u>
DATE STARTED <u>5/18/17</u> COMPLETED <u>5/18/17</u>	WATER DEPTH <u>Not Recorded</u> HOLE SIZE <u>3.5 inches</u>
DRILLING CONTRACTOR <u>Alpine Ocean Seismic</u>	CORE PENETRATION: <u>15.21</u>
DRILLING METHOD <u>Vibracore</u>	CORE RECOVERY: <u>12.10</u>
LOGGED BY <u>MK</u> CHECKED BY <u>CD</u>	CORE LOCATION: <u>X:963512.39</u> <u>Y:130860.41</u>
NOTES _____	NAD 83, NY Long Island Lambert, ft _____

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE NUMBER	SAMPLE RECOVERY %	PENETRATION SECONDS PER FOOT	DRY UNIT WT. (pcf)	SUBMERGED UNIT WT. (pcf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲				
									20 40 60 80				
									PL	MC	LL		
									20 40 60 80				
									☐ FINES CONTENT (%) ☐	20 40 60 80			
0		(SP) Very dark gray fine to medium Sand		100	2.6								
		(SP) Dark brown fine Sand	1		101	58	122						
			2		4	105	63	127					
		(SP-SM) Very dark gray medium to fine Sand with Silt and shell fragments	3		7	111	68	132					
		(SP) Dark gray medium to coarse Sand with Gravel	4		1.6	117	72	136					
		(SM) Brown and gray Silty fine Sand	5		1.4	107	64	128					
5		(SP) Brown fine to medium Sand	6		1.9								
					1.6	109	65	129					
		(SP) Brown medium to coarse Sand with Gravel	7		3.9								
					4.9	112	65	129					
		(SP) Very dark grayish brown fine to medium Sand	8		4.4								
10					2.3	110	67	131					
		(SP) Very dark grayish brown fine to coarse Sand	9		3.9								
						113	68	132					
15													

Bottom of borehole at 15.2 feet.



CLIENT <u>Williams</u> PROJECT NUMBER <u>1794</u> DATE STARTED <u>5/19/17</u> COMPLETED <u>5/19/17</u> DRILLING CONTRACTOR <u>Alpine Ocean Seismic</u> DRILLING METHOD <u>Vibracore</u> LOGGED BY <u>MK</u> CHECKED BY <u>CD</u> NOTES _____	PROJECT NAME <u>NESE Pipeline</u> PROJECT LOCATION <u>Raritan Bay and Lower New York Harbor</u> WATER DEPTH <u>Not Recorded</u> HOLE SIZE <u>3.5 inches</u> CORE PENETRATION: <u>16.77</u> CORE RECOVERY: <u>14.40</u> CORE LOCATION: <u>X:965236.05</u> <u>Y:131624.39</u> NAD 83, NY Long Island Lambert, ft _____
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DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE NUMBER	SAMPLE RECOVERY %	PENETRATION SECONDS PER FOOT	DRY UNIT WT. (pcf)	SUBMERGED UNIT WT. (pcf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲		
									20 40 60 80		
									PL	MC	LL
									20 40 60 80		
									□ FINES CONTENT (%) □		
									20 40 60 80		
0		(SP) Gray fine to medium Sand with shells; disturbed		100	1.1				▲	●	
		(SW) Very dark grayish brown fine to medium Sand with Gravel	1		1.4	95	50	114	□	●	
		(SP) Very dark grayish brown fine to medium Sand	2			110	66	130	▲	●	
		(SP) Very dark grayish brown fine to medium Sand	3		1.6	108	65	129	□	●	
		(SP) Gray fine to medium Sand with shell fragments	4		3.3	103	64	128	▲	●	
		(SP) Gray fine to medium Sand	5		2.1	109	65	129	□	●	
5					2.6				▲		
		(SP-SM) Dark gray fine to medium Sand with Silt	6		2.3	108	64	128	□	●	
					3				▲		
		(SP) Very dark gray medium to fine Sand with shell fragments	7		6	109	62	126	□	●	
					10				▲		
10		(SP) Black fine to medium Sand	8		8.8	109	67	131	□	●	
					9.1				▲		
		(SP) Dark grayish brown medium to fine Sand	9			108	64	128	□	●	
		No Analysis									
15											

Bottom of borehole at 16.8 feet.



CLIENT Williams PROJECT NAME NESE Pipeline
PROJECT NUMBER 1794 PROJECT LOCATION Raritan Bay and Lower New York Harbor
DATE STARTED 5/18/17 COMPLETED 5/18/17 WATER DEPTH Not Recorded HOLE SIZE 3.5 inches
DRILLING CONTRACTOR Alpine Ocean Seismic CORE PENETRATION: 16.37
DRILLING METHOD Vibracore CORE RECOVERY: 15.20
LOGGED BY MK CHECKED BY CD CORE LOCATION: X:974998.52 Y:130401.19
NOTES NAD 83, NY Long Island Lambert, ft

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE NUMBER	SAMPLE RECOVERY %	PENETRATION SECONDS PER FOOT	DRY UNIT WT. (pcf)	SUBMERGED UNIT WT. (pcf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲			
									20 40 60 80			
									PL MC LL			
									20 40 60 80			
									□ FINES CONTENT (%) □			
									20 40 60 80			
0		(SP) Dark gray fine to medium Sand with shells	1	100	0.01	100	59	123	□	●		
			2			104	62	126		●		
		(SP) Gray fine to medium Sand	3		0.1	101	59	123	□	●		
		(SP-SC) Black fine Sand with Clay seams and shell fragments, petrol odor	4		0.5	73	43	107			●	
		(SP-SC) Black fine to medium Sand with Clay seams and shell fragments, petrol odor	5		1.4	94	58	122	□	●		
5		(CH) Black Clay with Sand and shells	6		0.7	48	25	89				●
		(SP-SC) Black fine Sand with Clay pockets and shells	7		0.9	89	53	117	□	●		
10		(SP) Gray fine Sand with shell fragments	8		0.9	102	61	125	□	●		
			9		3.9				▲			
		No Analysis			9.5	104	62	126	□	●		
15												

Bottom of borehole at 16.4 feet.



CLIENT Williams PROJECT NAME NESE Pipeline
PROJECT NUMBER 1794 PROJECT LOCATION Raritan Bay and Lower New York Harbor
DATE STARTED 5/18/17 COMPLETED 5/18/17 WATER DEPTH Not Recorded HOLE SIZE 3.5 inches
DRILLING CONTRACTOR Alpine Ocean Seismic CORE PENETRATION: 16.02
DRILLING METHOD Vibracore CORE RECOVERY: 17.00
LOGGED BY MK CHECKED BY CD CORE LOCATION: X:976721.34 Y:129338.52
NOTES NAD 83, NY Long Island Lambert, ft

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE NUMBER	SAMPLE RECOVERY %	PENETRATION SECONDS PER FOOT	DRY UNIT WT. (pcf)	SUBMERGED UNIT WT. (pcf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲					
									20 40 60 80					
									PL	MC	LL			
									20	40	60	80		
									□ FINES CONTENT (%) □	20	40	60	80	
0		(SP) Gray fine Sand		100										
			1		1.1	105	64	128	▲	□	●			
			2		2	105	63	127	▲		●			
			3		2	105	63	127	▲	□	●			
			4		3	105	64	128	▲		●			
			5		8.4	103	62	126	▲	□	●			
5			6		12.7	103	62	126	▲		●			
			7		16.6	104	63	127	▲	□	●			
		(SP) Gray fine to medium Sand with shell fragments			15.9						●			
			8		18.7	102	62	126	▲	□	●			
10		(SP) Gray fine Sand with shell fragments			20						●			
		(SP) Gray fine to medium Sand with shell fragments	9		16.4	108	63	127	▲	□	●			
		No Analysis												
15														

Bottom of borehole at 17.0 feet.



CLIENT Williams PROJECT NAME NESE Pipeline
PROJECT NUMBER 1794 PROJECT LOCATION Raritan Bay and Lower New York Harbor
DATE STARTED 5/19/17 COMPLETED 5/19/17 WATER DEPTH Not Recorded HOLE SIZE 3.5 inches
DRILLING CONTRACTOR Alpine Ocean Seismic CORE PENETRATION: 16.23
DRILLING METHOD Vibracore CORE RECOVERY: 12.00
LOGGED BY MK CHECKED BY CD CORE LOCATION: X:980912.67 Y:124964.13
NOTES NAD 83, NY Long Island Lambert, ft

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE NUMBER	SAMPLE RECOVERY %	PENETRATION SECONDS PER FOOT	DRY UNIT WT. (pcf)	SUBMERGED UNIT WT. (pcf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲			
									20	40	60	80
									PL	MC	LL	
									20	40	60	80
									□ FINES CONTENT (%) □			
									20	40	60	80
0		(SC) Dark olive gray Clayey Sand with large shells, air voids		100	1	94	57	121	▲	●		
		(SP-SC) Dark olive gray Sand with Clay and large shell fragments; air voids	1		1.3	92	54	118	▲	●		
		(SP) Gray fine to medium Sand with shell fragments	2		1.6	106	65	129	▲	●		
		(SP) Gray fine to medium Sand	3		2.7	107	64	128	▲	●		
			4		10.7	104	62	126	▲	●		
5			5		13.9				▲			
			6		13.4	105	63	127	▲	●		
			7		13.9				▲			
			8		13.6	103	61	125	▲	●		
10			9		16.4				▲			
		(SP) Dark gray fine to medium Sand	8		19.1	105	63	127	▲	●		
			9		29.8				▲			
						111	66	130	▲	●		
15												

Bottom of borehole at 16.2 feet.

CLIENT <u>Williams</u> PROJECT NUMBER <u>1794</u> DATE STARTED <u>5/19/17</u> COMPLETED <u>5/19/17</u> DRILLING CONTRACTOR <u>Alpine Ocean Seismic</u> DRILLING METHOD <u>Vibracore</u> LOGGED BY <u>MK</u> CHECKED BY <u>CD</u> NOTES _____	PROJECT NAME <u>NESE Pipeline</u> PROJECT LOCATION <u>Raritan Bay and Lower New York Harbor</u> WATER DEPTH <u>Not Recorded</u> HOLE SIZE <u>3.5 inches</u> CORE PENETRATION: <u>16.74</u> CORE RECOVERY: <u>12.00</u> CORE LOCATION: X:982399 Y:123622.76 NAD 83, NY Long Island Lambert, ft _____
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DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE NUMBER	SAMPLE RECOVERY %	PENETRATION SECONDS PER FOOT	DRY UNIT WT. (pcf)	SUBMERGED UNIT WT. (pcf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲			
									20	40	60	80
									PL	MC	LL	
									20	40	60	80
									□ FINES CONTENT (%) □			
									20	40	60	80
0		(SP) Black fine to medium Sand with shell fragments	1	100	1	105	63	127				
		(SP-SC) Black Sand with Clay and shell fragments	2		1.1	87	52	116				
		(SP) Dark gray fine to medium Sand with shell fragments	3		1.4	109	68	132				
		(SP) Dark gray medium to fine Sand	4		1.4	103	64	128				
5		(CL) Black Sandy Clay with shell, shell fragments, and organics	5		2	49	31	95				
		(SP) Gray fine to medium Sand with shell fragments	6		1.1	103	62	126				
			7		6.6	104	62	126				
10		(SP) Dark gray fine to medium Sand with shell fragments	8		16.1	110	65	129				
		(SP) Dark gray fine to medium Sand with shell fragments and medium Sand partings at 11.9 feet	9		11.1	103	63	127				

Bottom of borehole at 16.7 feet.

CLIENT <u>Williams</u> PROJECT NUMBER <u>1794</u> DATE STARTED <u>5/27/17</u> COMPLETED <u>5/27/17</u> DRILLING CONTRACTOR <u>Alpine Ocean Seismic</u> DRILLING METHOD <u>Vibracore</u> LOGGED BY <u>MK</u> CHECKED BY <u>CD</u> NOTES _____	PROJECT NAME <u>NESE Pipeline</u> PROJECT LOCATION <u>Raritan Bay and Lower New York Harbor</u> WATER DEPTH <u>Not Recorded</u> HOLE SIZE <u>3.5 inches</u> CORE PENETRATION: <u>14.65</u> CORE RECOVERY: <u>12.00</u> CORE LOCATION: X:985603.77 Y:122065.18 NAD 83, NY Long Island Lambert, ft _____
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DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE NUMBER	SAMPLE RECOVERY %	PENETRATION SECONDS PER FOOT	DRY UNIT WT. (pcf)	SUBMERGED UNIT WT. (pcf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲				FINES CONTENT (%) □
									20	40	60	80	
									PL	MC	LL	20	
0									20	40	60	80	
		(SP) Light olive brown fine Sand with trace shell fragments; large vertical void 0-0.7 '	1	100	1								
		(SP) Grayish brown fine Sand	2		1	102	61	125					
			3		1.2	105	59	123					
			4		1.6	101	61	125					
			5		3	108	57	121					
5			6		5.8	106	58	122					
			7		6.1	105	55	119					
					8.4								
					8.7								
10		(SP) Gray fine Sand	8		7	104	59	123					
			9		10.8								
						100	60	124					

Bottom of borehole at 14.7 feet.



CLIENT <u>Williams</u>	PROJECT NAME <u>NESE Pipeline</u>
PROJECT NUMBER <u>1794</u>	PROJECT LOCATION <u>Raritan Bay and Lower New York Harbor</u>
DATE STARTED <u>6/4/17</u> COMPLETED <u>6/4/17</u>	WATER DEPTH <u>Not Recorded</u> HOLE SIZE <u>3.5 inches</u>
DRILLING CONTRACTOR <u>Alpine Ocean Seismic</u>	CORE PENETRATION: <u>13.64</u>
DRILLING METHOD <u>Vibracore</u>	CORE RECOVERY: <u>13.40</u>
LOGGED BY <u>MK</u> CHECKED BY <u>CD</u>	CORE LOCATION: <u>X:987393.88 Y:121657.18</u>
NOTES	NAD 83, NY Long Island Lambert, ft

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE NUMBER	SAMPLE RECOVERY %	PENETRATION SECONDS PER FOOT	DRY UNIT WT. (pcf)	SUBMERGED UNIT WT. (pcf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲			
									20 40 60 80			
									PL MC LL			
									20 40 60 80			
									☐ FINES CONTENT (%) ☐			
									20 40 60 80			
0		(SP) Grayish brown fine to medium Sand with shell fragments	1	100	0.5	108	65	129	▲	●		
		(SP) Gray fine Sand	2		5.4	105	65	129	▲	●		
			3		4.9	103	62	126	▲	●		
		(SP) Grayish brown fine to medium Sand	4		9.6	103	62	126		●		
			5		24.6	110	66	130	▲	●	▲	
5			6		25					▲		
			7		19.9	110	66	130	▲	●		
		(SP) Gray fine to medium Sand	8		17.8					▲		
					24.1	105	63	127	▲	●	▲	
		(SP) Dark gray fine Sand	9		42.1						▲	
10					40.5	105	64	128	▲	●		
		(SP) Dark gray fine Sand with shell fragments			47.5						▲	
		No Analysis				105	63	127	▲	●		

Bottom of borehole at 13.6 feet.



CLIENT Williams PROJECT NAME NESE Pipeline
PROJECT NUMBER 1794 PROJECT LOCATION Raritan Bay and Lower New York Harbor
DATE STARTED 6/4/17 COMPLETED 6/4/17 WATER DEPTH Not Recorded HOLE SIZE 3.5 inches
DRILLING CONTRACTOR Alpine Ocean Seismic CORE PENETRATION: 12.06
DRILLING METHOD Vibracore CORE RECOVERY: 9.51
LOGGED BY MK CHECKED BY CD CORE LOCATION: X:989313.17 Y:121658.87
NOTES NAD 83, NY Long Island Lambert, ft

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE NUMBER	SAMPLE RECOVERY %	PENETRATION SECONDS PER FOOT	DRY UNIT WT. (pcf)	SUBMERGED UNIT WT. (pcf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲			
									20	40	60	80
									PL	MC	LL	
0									20	40	60	80
									□ FINES CONTENT (%) □			
									20	40	60	80
		(SP) Dark gray fine to medium Sand with shell fragments		100	1.2							
		(SP) Dark gray medium to fine Sand with shell fragments	1		106	63	127					
			2		108	64	128					
		(SP) Dark gray fine to medium Sand	3		107	65	129					
		(SP) Dark gray medium to fine Sand	4		109	65	129					
		(SP) Very dark gray fine Sand	5		109	67	131					
5					21.1							
		(SP-SM) Very dark gray fine to medium Sand with Silt and shell fragments	6		116	71	135					
					24.8							
		(SP) Grayish brown fine to medium Sand	7		110	67	131					
			8		106	62	126					
10					30.3							

Bottom of borehole at 12.1 feet.



CLIENT <u>Williams</u>	PROJECT NAME <u>NESE Pipeline</u>
PROJECT NUMBER <u>1794</u>	PROJECT LOCATION <u>Raritan Bay and Lower New York Harbor</u>
DATE STARTED <u>6/4/17</u> COMPLETED <u>6/4/17</u>	WATER DEPTH <u>Not Recorded</u> HOLE SIZE <u>3.5 inches</u>
DRILLING CONTRACTOR <u>Alpine Ocean Seismic</u>	CORE PENETRATION: <u>13.52</u>
DRILLING METHOD <u>Vibracore</u>	CORE RECOVERY: <u>13.50</u>
LOGGED BY <u>MK</u> CHECKED BY <u>CD</u>	CORE LOCATION: X:991488.56 Y:122099.78
NOTES _____	NAD 83, NY Long Island Lambert, ft _____

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE NUMBER	SAMPLE RECOVERY %	PENETRATION SECONDS PER FOOT	DRY UNIT WT. (pcf)	SUBMERGED UNIT WT. (pcf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲			
									20 40 60 80			
									PL MC LL			
									20 40 60 80			
									□ FINES CONTENT (%) □			
									20 40 60 80			
0		(SP) Dark gray fine to medium Sand with shell fragments		100	2.6							
			1			107	65	129				
			2		3	105	63	127				
		(SP) Dark gray fine Sand with shell fragments	3		3.7	104	63	127				
		(SP) Gray fine to medium Sand with shell fragments	4		10.8	102	62	126				
		(SP) Gray fine Sand	5		24.6	100	59	123				
5					50.3							
			6		36.3	102	62	126				
					28.5							
			7		24.1	102	62	126				
					20.4							
10			8		11.5	104	63	127				
		(SP-SM) Gray fine to medium Sand with black Silty fine Sand seam	9		11.2							
		No Analysis				111	68	132				

Bottom of borehole at 13.5 feet.



CLIENT Williams PROJECT NAME NESE Pipeline
PROJECT NUMBER 1794 PROJECT LOCATION Raritan Bay and Lower New York Harbor
DATE STARTED 6/4/17 COMPLETED 6/4/17 WATER DEPTH Not Recorded HOLE SIZE 3.5 inches
DRILLING CONTRACTOR Alpine Ocean Seismic CORE PENETRATION: 10.91
DRILLING METHOD Vibracore CORE RECOVERY: 11.00
LOGGED BY MK CHECKED BY CD CORE LOCATION: X:992454.13 Y:122430.14
NOTES _____ NAD 83, NY Long Island Lambert, ft _____

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE NUMBER	SAMPLE RECOVERY %	PENETRATION SECONDS PER FOOT	DRY UNIT WT. (pcf)	SUBMERGED UNIT WT. (pcf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲				
									20 40 60 80				
									PL MC LL				
									20 40 60 80				
									□ FINES CONTENT (%) □				
									20 40 60 80				
0		(SP) Gray and brown fine to medium Sand		100	1.5								
		(SP) Grayish brown medium Sand with shell fragments	1		2.3	107	64	128					
		(SP) Very dark gray fine to medium Sand with shell fragments	2		4.7	103	63	127					
		(SP) Very dark gray fine to medium Sand	3		11.7	103	62	126					
		(SP) Very dark gray fine Sand	4		29	105	64	128					
5			5		30.4								
			6		33.2	105	64	128					
			7		31.6								
			8		34.9	102	62	126					
10			9		29.3								
			10		72.3	102	62	126					

Bottom of borehole at 11.0 feet.



CLIENT <u>Williams</u>	PROJECT NAME <u>NESE Pipeline</u>
PROJECT NUMBER <u>1794</u>	PROJECT LOCATION <u>Raritan Bay and Lower New York Harbor</u>
DATE STARTED <u>6/4/17</u> COMPLETED <u>6/4/17</u>	WATER DEPTH <u>Not Recorded</u> HOLE SIZE <u>3.5 inches</u>
DRILLING CONTRACTOR <u>Alpine Ocean Seismic</u>	CORE PENETRATION: <u>13.33</u>
DRILLING METHOD <u>Vibracore</u>	CORE RECOVERY: <u>14.30</u>
LOGGED BY <u>MK</u> CHECKED BY <u>CD</u>	CORE LOCATION: <u>X:997068.41 Y:124377.4</u>
NOTES	NAD 83, NY Long Island Lambert, ft

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE NUMBER	SAMPLE RECOVERY %	PENETRATION SECONDS PER FOOT	DRY UNIT WT. (pcf)	SUBMERGED UNIT WT. (pcf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲		
									20 40 60 80		
									PL	MC	LL
									20 40 60 80		
☐ FINES CONTENT (%) ☐											
20 40 60 80											
0		(SP) Grayish brown medium to fine Sand		100	2.1				▲	●	
		(SP) Gray medium Sand	1		115	69	133	☐	▲	●	
			2		113	68	132		▲	●	
		(SP) Gray medium to fine Sand	3		111	66	130	☐	▲	●	
			4		112	68	132		▲	●	
		(SP) Gray fine to medium Sand	5		110	66	130	☐	▲	●	
5			6		14.3				▲		
			7		17.3	111	67	131	☐	▲	
		(SP) Pale olive medium to fine Sand	8		25.5					▲	
			9		27.4	118	71	135	☐	●	
					20.6					▲	
10		(SP) Pale olive medium to coarse Sand	8		16.4	124	74	138	☐	●	
					14.7					▲	
		(SP) Pale olive medium to fine Sand	9			117	68	132	☐	●	
		No Analysis									

Bottom of borehole at 14.3 feet.

CLIENT <u>Williams</u> PROJECT NUMBER <u>1794</u> DATE STARTED <u>5/27/17</u> COMPLETED <u>5/27/17</u> DRILLING CONTRACTOR <u>Alpine Ocean Seismic</u> DRILLING METHOD <u>Vibracore</u> LOGGED BY <u>MK</u> CHECKED BY <u>CD</u> NOTES _____	PROJECT NAME <u>NESE Pipeline</u> PROJECT LOCATION <u>Raritan Bay and Lower New York Harbor</u> WATER DEPTH <u>Not Recorded</u> HOLE SIZE <u>3.5 inches</u> CORE PENETRATION: <u>9.27</u> CORE RECOVERY: <u>12.00</u> CORE LOCATION: <u>X:998806.28 Y:125100.13</u> NAD 83, NY Long Island Lambert, ft _____
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DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE NUMBER	SAMPLE RECOVERY %	PENETRATION SECONDS PER FOOT	DRY UNIT WT. (pcf)	SUBMERGED UNIT WT. (pcf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲		
									20 40 60 80 PL MC LL		
									20 40 60 80 □ FINES CONTENT (%) □		
0		(SP) Brown and gray medium to fine Sand with shell fragments	1	100	0.9	93	44	108	▲		
		(SP) Light yellowish brown medium Sand	2		0.9	105	60	124	▲		
		(SP) Light yellowish brown medium to fine Sand with Gravel	3		2.3	123	71	135	▲		
		(SP) Light brownish gray medium to coarse Sand with single 2" Gravel	4		17.8	111	68	132	▲		
5		(SP) Light brownish gray fine to medium Sand with single 2.5" Gravel	5		22.5	114	70	134	▲		
		(SP) Light brownish gray fine to medium Sand	6		9.4				▲		
		(SP) Light brownish gray fine to medium Sand			31.6	108	64	128	▲		
		(SP) Gray and brownish gray fine to medium Sand	7		25.5				▲		
		(SP) Gray and brownish gray fine to medium Sand			26.2	110	66	130	▲		
10		(SP) Brownish gray fine to coarse Sand	8		184.9				▲		
		(SP) Brownish gray fine to coarse Sand				115	65	129	▲		
		(SP) Brownish gray medium to fine Sand	9			112	67	131	▲		

Bottom of borehole at 12.0 feet.



CLIENT <u>Williams</u>	PROJECT NAME <u>NESE Pipeline</u>
PROJECT NUMBER <u>1794</u>	PROJECT LOCATION <u>Raritan Bay and Lower New York Harbor</u>
DATE STARTED <u>6/5/17</u> COMPLETED <u>6/5/17</u>	WATER DEPTH <u>Not Recorded</u> HOLE SIZE <u>3.5 inches</u>
DRILLING CONTRACTOR <u>Alpine Ocean Seismic</u>	CORE PENETRATION: <u>12.01</u>
DRILLING METHOD <u>Vibracore</u>	CORE RECOVERY: <u>13.50</u>
LOGGED BY <u>MK</u> CHECKED BY <u>CD</u>	CORE LOCATION: X:1002375.54 Y:126300.99
NOTES _____	NAD 83, NY Long Island Lambert, ft _____

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE NUMBER	SAMPLE RECOVERY %	PENETRATION SECONDS PER FOOT	DRY UNIT WT. (pcf)	SUBMERGED UNIT WT. (pcf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲						
									20 40 60 80						
									PL MC LL						
									20 40 60 80						
									☐ FINES CONTENT (%) ☐						
									20 40 60 80						
0															
		(SP) Black and olive brown fine to medium Sand with shell fragments	<div><div></div>1</div>	100	2.3				<div><div></div></div>	<div><div></div></div>					
		(SP) Gray medium to coarse Sand with Gravel	<div><div></div>2</div>		3.3	113	66	130	<div><div></div></div>	<div><div></div></div>					
		(SP) Dark gray fine to medium Sand	<div><div></div>3</div>		4.7	106	64	128	<div><div></div></div>	<div><div></div></div>					
		(SP) Dark gray medium to fine Sand	<div><div></div>4</div>		18	106	63	127	<div><div></div></div>	<div><div></div></div>					
		(SP) Dark gray fine to coarse Sand	<div><div></div>5</div>		19.7	116	68	132	<div><div></div></div>	<div><div></div></div>					
5						15					<div><div></div></div>				
		(SW) Dark gray fine to coarse Sand with Gravel	<div><div></div>6</div>			12.2	127	76	140	<div><div></div></div>	<div><div></div></div>				
						13.6					<div><div></div></div>				
		(SP) Dark gray medium to fine Sand	<div><div></div>7</div>			13.3	115	70	134	<div><div></div></div>	<div><div></div></div>				
						19.2					<div><div></div></div>				
10				<div><div></div>8</div>		72.5	111	68	132	<div><div></div></div>	<div><div></div></div>				
		(SP) Dark gray fine to medium Sand	<div><div></div>9</div>	83.5						<div><div></div></div>	<div><div></div></div>				
		No Analysis				112	68	132	<div><div></div></div>	<div><div></div></div>					

Bottom of borehole at 13.5 feet.

CLIENT <u>Williams</u> PROJECT NUMBER <u>1794</u> DATE STARTED <u>5/27/17</u> COMPLETED <u>5/27/17</u> DRILLING CONTRACTOR <u>Alpine Ocean Seismic</u> DRILLING METHOD <u>Vibracore</u> LOGGED BY <u>MK</u> CHECKED BY <u>CD</u> NOTES _____	PROJECT NAME <u>NESE Pipeline</u> PROJECT LOCATION <u>Raritan Bay and Lower New York Harbor</u> WATER DEPTH <u>Not Recorded</u> HOLE SIZE <u>3.5 inches</u> CORE PENETRATION: <u>14.20</u> CORE RECOVERY: <u>12.00</u> CORE LOCATION: X:1004351.94 Y:127031.76 NAD 83, NY Long Island Lambert, ft _____
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DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE NUMBER	SAMPLE RECOVERY %	PENETRATION SECONDS PER FOOT	DRY UNIT WT. (pcf)	SUBMERGED UNIT WT. (pcf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲			
									20 40 60 80			
									PL MC LL			
									20 40 60 80			
									□ FINES CONTENT (%) □			
									20 40 60 80			
0		(GP) Black coarse Gravel, cemented Sand and shell	1	100	2.2	109	66	130	▲	●		
		(SP) Dark brownish gray fine to coarse Sand with shell, shell fragments, and organics	2			106	63	127		●		
		(SP) Dark gray medium to fine Sand with shell fragments	3		5.9				▲			
		(SP) Dark gray fine to medium Sand with shell fragments	4		8.7	111	67	131	▲	●		
			5		13.1	107	65	129	▲	●		
			6		20.4	106	66	130	▲	●		
5					22.7					▲		
		(SP) Dark gray fine to medium Sand	7		23.9	108	66	130	▲	●		
					25.3					▲		
		(SP) Very dark gray medium to fine Sand	8		24.8	117	71	135	▲	●		
					32.7					▲		
10		(SP) Very dark gray medium to coarse Sand with Gravel	9		34.4	130	75	139	▲	●		
					40.3					▲		
		(SP) Dark gray fine to medium Sand	10			109	66	130	▲	●		

Bottom of borehole at 14.2 feet.



CLIENT Williams PROJECT NAME NESE Pipeline
PROJECT NUMBER 1794 PROJECT LOCATION Raritan Bay and Lower New York Harbor
DATE STARTED 6/5/17 COMPLETED 6/5/17 WATER DEPTH Not Recorded HOLE SIZE 3.5 inches
DRILLING CONTRACTOR Alpine Ocean Seismic CORE PENETRATION: 12.52
DRILLING METHOD Vibracore CORE RECOVERY: 11.80
LOGGED BY MK CHECKED BY CD CORE LOCATION: X:1006143.21 Y:127792.69
NOTES _____ NAD 83, NY Long Island Lambert, ft _____

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE NUMBER	SAMPLE RECOVERY %	PENETRATION SECONDS PER FOOT	DRY UNIT WT. (pcf)	SUBMERGED UNIT WT. (pcf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲			
									20	40	60	80
									PL	MC	LL	
0									20	40	60	80
									□ FINES CONTENT (%) □			
									20	40	60	80
		(SP) Black and brown fine to medium Sand with shell fragments	1	100	0.2				▲	●		
		(SW) Black and brown fine to medium Sand with Gravel and ceramic and glass debris	2		2.6	108	62	126	▲	●		
		(SW) Black fine to medium Sand with Gravel and glass debris	3		3.5	98	53	117	▲	●		
		(SP) Grayish brown medium to fine Sand with shell fragments	4		9.6	112	68	132	▲	●		
			5		14.3	116	71	135	▲	●		
5					15.9				▲			
		(SP) Gray fine to medium Sand	6		35.1	110	67	131	▲	●		
			7		57.1						▲	
					52.4	111	68	132	▲	●		
			8		56.6						▲	
10					46.6	109	67	131	▲	●		
					66.7						▲	

Bottom of borehole at 12.5 feet.



CLIENT <u>Williams</u>	PROJECT NAME <u>NESE Pipeline</u>
PROJECT NUMBER <u>1794</u>	PROJECT LOCATION <u>Raritan Bay and Lower New York Harbor</u>
DATE STARTED <u>6/5/17</u> COMPLETED <u>6/5/17</u>	WATER DEPTH <u>Not Recorded</u> HOLE SIZE <u>3.5 inches</u>
DRILLING CONTRACTOR <u>Alpine Ocean Seismic</u>	CORE PENETRATION: <u>13.60</u>
DRILLING METHOD <u>Vibracore</u>	CORE RECOVERY: <u>15.50</u>
LOGGED BY <u>MK</u> CHECKED BY <u>CD</u>	CORE LOCATION: X:1007440.11 Y:128281.66
NOTES	NAD 83, NY Long Island Lambert, ft

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE NUMBER	SAMPLE RECOVERY %	PENETRATION SECONDS PER FOOT	DRY UNIT WT. (pcf)	SUBMERGED UNIT WT. (pcf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲		
									20 40 60 80		
									PL	MC	LL
									20 40 60 80		
									☐ FINES CONTENT (%) ☐		
									20 40 60 80		
0		(SW) Very dark gray fine to medium Sand with Gravel		100	3						
			1			100	57	121	▲	●	
		(SP) Very dark gray fine to medium Sand	2			94	53	117	☐	●	
		(SP) Black medium to coarse Sand with Gravel and glass debris	3		3	95	45	109	▲	●	
			4			99	52	116	☐	●	
		(SW) Black fine to coarse Sand with Gravel, glass and metal debris, and piece of concrete 0.5' long			3				▲		
		(SP) Black medium Sand with Gravel	5			107	63	127		●	
					13.1					▲	
		(SP) Very dark gray fine to medium Sand	6			107	63	127	☐	●	▲
5					40.7						
					15					▲	
		(SP) Gray fine Sand	7			104	63	127	☐	●	
					14					▲	
					15.7					▲	
		(SP) Gray fine to medium Sand	8			108	66	130	☐	●	
					15.4					▲	
10					15.2					▲	
		(SP) Gray medium to fine Sand	9			110	65	129	☐	●	
					19.4					▲	
		(SP) Dark gray fine to medium Sand	10							▲	
					17.8						
		No Analysis				105	63	127	☐	●	
15											

Bottom of borehole at 15.5 feet.



CLIENT Williams PROJECT NAME NESE Pipeline
PROJECT NUMBER 1794 PROJECT LOCATION Raritan Bay and Lower New York Harbor
DATE STARTED 6/5/17 COMPLETED 6/5/17 WATER DEPTH Not Recorded HOLE SIZE 3.5 inches
DRILLING CONTRACTOR Alpine Ocean Seismic CORE PENETRATION: 13.40
DRILLING METHOD Vibracore CORE RECOVERY: 14.50
LOGGED BY MK CHECKED BY CD CORE LOCATION: X:1009876.68 Y:129212.16
NOTES _____ NAD 83, NY Long Island Lambert, ft _____

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE NUMBER	SAMPLE RECOVERY %	PENETRATION SECONDS PER FOOT	DRY UNIT WT. (pcf)	SUBMERGED UNIT WT. (pcf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲			
									20	40	60	80
									PL	MC	LL	
0									20	40	60	80
									□ FINES CONTENT (%) □			
									20	40	60	80
		(SP) Very dark gray fine Sand	1	100	2.6	100	60	124	▲	●		
			2		3.9	101	61	125	▲	●		
		(SP) Black fine Sand with shell fragments	3		4.2	102	62	126	▲	●		
		(SP) Very dark gray fine Sand with trace shell fragments	4		8.4	103	63	127	▲	●		
5		(SP) Very dark gray fine to medium Sand with shell fragments	5		17.1	104	62	126	▲	●		
					17.3				▲			
		(SP) Grayish brown medium to fine Sand with shell fragments	6		16.8	110	67	131	▲	●		
					29.5					▲		
		(SP) Gray fine to medium Sand	7		32.3	111	68	132	▲	●		
10					18				▲			
		(SP) Dark gray fine to medium Sand with shell fragments	8		32.8	110	64	128	▲	●		
					27.8					▲		
		(SP) Grayish brown medium to fine Sand	9			112	68	132	▲	●		
		No Analysis										

Bottom of borehole at 14.5 feet.



CLIENT <u>Williams</u>	PROJECT NAME <u>NESE Pipeline</u>
PROJECT NUMBER <u>1794</u>	PROJECT LOCATION <u>Raritan Bay and Lower New York Harbor</u>
DATE STARTED <u>6/5/17</u> COMPLETED <u>6/5/17</u>	WATER DEPTH <u>Not Recorded</u> HOLE SIZE <u>3.5 inches</u>
DRILLING CONTRACTOR <u>Alpine Ocean Seismic</u>	CORE PENETRATION: <u>13.32</u>
DRILLING METHOD <u>Vibracore</u>	CORE RECOVERY: <u>12.60</u>
LOGGED BY <u>MK</u> CHECKED BY <u>CD</u>	CORE LOCATION: X:1013567.2 Y:130638.38
NOTES _____	NAD 83, NY Long Island Lambert, ft _____

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE NUMBER	SAMPLE RECOVERY %	PENETRATION SECONDS PER FOOT	DRY UNIT WT. (pcf)	SUBMERGED UNIT WT. (pcf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲			
									20 40 60 80			
									PL MC LL			
									20 40 60 80			
									□ FINES CONTENT (%) □			
									20 40 60 80			
0		(SP) Black very fine Sand with shell fragments		100	2.5							
		(SP) Black very fine Sand	1			96	57	121				
			2		3.5	97	56	120				
		(SP) Black very fine Sand with shell fragments	3		4	101	62	126				
		(SP) Dark gray very fine Sand with shell fragments	4		5.1	100	61	125				
		(SP) Very dark gray fine Sand with shell fragments	5		7.3	105	64	128				
5					9.4							
		(SP) Brown fine to coarse Sand with shell fragments	6		9.8	119	69	133				
					12.2							
			7		25	117	71	135				
					30.9							
10		(SP) Dark grayish brown fine to medium Sand with shell fragments	8		40	112	67	131				
					53.6							
		(SP) Dark grayish brown medium to fine Sand with shell fragments	9			109	66	130				

Bottom of borehole at 13.3 feet.



CLIENT <u>Williams</u>	PROJECT NAME <u>NESE Pipeline</u>
PROJECT NUMBER <u>1794</u>	PROJECT LOCATION <u>Raritan Bay and Lower New York Harbor</u>
DATE STARTED <u>6/5/17</u> COMPLETED <u>6/5/17</u>	WATER DEPTH <u>Not Recorded</u> HOLE SIZE <u>3.5 inches</u>
DRILLING CONTRACTOR <u>Alpine Ocean Seismic</u>	CORE PENETRATION: <u>13.25</u>
DRILLING METHOD <u>Vibracore</u>	CORE RECOVERY: <u>13.40</u>
LOGGED BY <u>MK</u> CHECKED BY <u>CD</u>	CORE LOCATION: X:1017706.23 Y:131248.68
NOTES _____	NAD 83, NY Long Island Lambert, ft _____

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE NUMBER	SAMPLE RECOVERY %	PENETRATION SECONDS PER FOOT	DRY UNIT WT. (pcf)	SUBMERGED UNIT WT. (pcf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲			
									20	40	60	80
									PL	MC	LL	
0									20	40	60	80
									□ FINES CONTENT (%) □			
									20	40	60	80
		(SP) Very dark gray fine Sand		100	2.9							
		(SP) Very dark gray and dark gray fine Sand with shell fragments	1		3.1	101	62	126				
		(SP) Dark grayish brown medium to fine Sand	2		4	103	64	128				
			3		6.8	110	67	131				
			4		8.4	112	66	130				
			5		8.2	110	67	131				
5			6		7.7	111	67	131				
		(SP) Dark brownish gray medium to fine Sand	7		9.1	108	65	129				
		(SP) Dark brownish gray fine to medium Sand with shell fragments	8		17.1	109	66	130				
10		(SP) Very dark grayish brown fine to medium Sand with shell fragments	9		19.4							
		No Analysis			19	105	64	128				

Bottom of borehole at 13.4 feet.

CLIENT <u>Williams</u> PROJECT NUMBER <u>1794</u> DATE STARTED <u>6/5/17</u> COMPLETED <u>6/5/17</u> DRILLING CONTRACTOR <u>Alpine Ocean Seismic</u> DRILLING METHOD <u>Vibracore</u> LOGGED BY <u>MK</u> CHECKED BY <u>CD</u> NOTES _____	PROJECT NAME <u>NESE Pipeline</u> PROJECT LOCATION <u>Raritan Bay and Lower New York Harbor</u> WATER DEPTH <u>Not Recorded</u> HOLE SIZE <u>3.5 inches</u> CORE PENETRATION: <u>13.61</u> CORE RECOVERY: <u>14.50</u> CORE LOCATION: X:1019751.72 Y:130933.32 NAD 83, NY Long Island Lambert, ft _____
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DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE NUMBER	SAMPLE RECOVERY %	PENETRATION SECONDS PER FOOT	DRY UNIT WT. (pcf)	SUBMERGED UNIT WT. (pcf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲			
									20 40 60 80			
									PL MC LL			
									20 40 60 80			
□ FINES CONTENT (%) □												
20 40 60 80												
0												
		(SP-SM) Very dark gray fine Sand with Silt, shell fragments, and organics	1	100	2.6	96	57	121	▲	●		
		(SP) Very dark gray fine Sand	2		3.7	103	63	127	▲	●		
		(SP) Dark gray fine Sand with shell fragments	3		5.8	106	66	130	▲	●		
			4		9.4	94	53	117	▲	●		
			5		14.5	102	63	127	▲	●		
5					18				▲			
		(SP) Very dark gray fine Sand with shell fragments	6		17.3	102	61	125	▲	●		
					14.7				▲			
		(SP-SM) Very dark gray fine Sand with Silt and shell fragments	7		12.9	100	62	126	▲	●		
					18.5				▲			
10		(SP) Very dark gray fine to medium Sand with shell fragments	8		20.1	105	63	127	▲	●		
		(SP-SM) Very dark gray fine Sand with Silt and shell fragments	9		18.7				▲			
		No Analysis				104	65	129	▲	●		

Bottom of borehole at 14.5 feet.

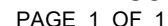


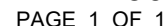
CLIENT <u>Williams</u>	PROJECT NAME <u>NESE Pipeline</u>
PROJECT NUMBER <u>1794</u>	PROJECT LOCATION <u>Raritan Bay and Lower New York Harbor</u>
DATE STARTED <u>6/5/17</u> COMPLETED <u>6/5/17</u>	WATER DEPTH <u>Not Recorded</u> HOLE SIZE <u>3.5 inches</u>
DRILLING CONTRACTOR <u>Alpine Ocean Seismic</u>	CORE PENETRATION: <u>13.62</u>
DRILLING METHOD <u>Vibracore</u>	CORE RECOVERY: <u>14.80</u>
LOGGED BY <u>MK</u> CHECKED BY <u>CD</u>	CORE LOCATION: X:1021691.55 Y:130413.2
NOTES	NAD 83, NY Long Island Lambert, ft

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE NUMBER	SAMPLE RECOVERY %	PENETRATION SECONDS PER FOOT	DRY UNIT WT. (pcf)	SUBMERGED UNIT WT. (pcf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲				
									20 40 60 80				
									PL MC LL				
									20 40 60 80				
									☐ FINES CONTENT (%) ☐				
									20 40 60 80				
0		(SP) Very dark gray fine Sand with shell fragments		100	2.4					▲	●		
			1			104	63	127	☐		●		
			2		3.5	103	63	127		▲			
			3		5.4	103	63	127	☐	▲	●		
		(SP) Dark gray fine Sand with shell fragments	4		9.4	101	61	125			▲	●	
			5		13.3	104	63	127	☐		●		
5					14.5						▲		
		(SP) Very dark gray fine Sand with shell fragments	6		10.5	105	64	128	☐		▲	●	
					8.4						▲		
		(SP) Very dark gray fine to medium Sand with shell fragments	7		13.3	109	66	130	☐		▲	●	
					15.2						▲		
10		(SP-SM) Dark gray fine Sand with Silt and shell fragments	8		17.8	103	63	127	☐		▲	●	
					16.9						▲		
		No Analysis	9			102	63	127	☐		▲	●	

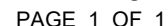
Bottom of borehole at 14.8 feet.

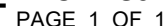














BORING NUMBER VC93_Physical

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CLIENT <u>Williams</u>	PROJECT NAME <u>NESE Pipeline</u>
PROJECT NUMBER <u>1794</u>	PROJECT LOCATION <u>Raritan Bay and Lower New York Harbor</u>
DATE STARTED <u>5/20/17</u> COMPLETED <u>5/20/17</u>	WATER DEPTH <u>Not Recorded</u> HOLE SIZE <u>3.5 inches</u>
DRILLING CONTRACTOR <u>Alpine Ocean Seismic</u>	CORE PENETRATION: <u>13.59</u>
DRILLING METHOD <u>Vibracore</u>	CORE RECOVERY: <u>11.50</u>
LOGGED BY <u>MK</u> CHECKED BY <u>CD</u>	CORE LOCATION: <u>X:911469.61 Y:110567.68</u>
NOTES	NAD 83, NY Long Island Lambert, ft

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE NUMBER	SAMPLE RECOVERY %	PENETRATION SECONDS PER FOOT	DRY UNIT WT. (pcf)	SUBMERGED UNIT WT. (pcf)	TOTAL UNIT WT. (pcf)	▲ SECONDS PER FOOT ▲			
									20 40 60 80			
									PL	MC	LL	□ FINES CONTENT (%) □
0									20	40	60	80
		(SP) Dark grayish brown and very dark gray fine Sand	1	100	0.2							
		(SP) Dark olive gray fine Sand	2		1	97	55	119				
		(SP) Dark olive gray and gray medium to fine Sand	3		1.9	95	51	115				
		(SP) Dark grayish brown fine to medium Sand	4		0.9	106	64	128				
5		(SM) Light brownish gray Silty fine Sand with dark yellowish brown seams	5		2.6	91	50	114				
		(SP-SM) Light brownish gray fine Sand with Silt	6		10.9	91	49	113				
		(SM) Light brownish gray Silty fine Sand with Clay seam and dark yellowish brown seams	7		9.1	101	61	125				
		(SP) Light brownish gray fine Sand with gray seam with mica	8		6.5	93	54	118				
		(SP-SM) Light brownish gray fine Sand with Silt and gray seams with mica	9		5.6	96	55	119				
		(SP-SM) Light brownish gray fine Sand with gray Silt seams with mica and dark yellowish brown seams	10		6	97	56	120				
10		(SP) Light brownish gray fine Sand with gray seams with mica	11			98	55	119				
		No Analysis										

Bottom of borehole at 13.6 feet.