Evaluation of Extractable Petroleum Hydrocarbons in Soil Technical Guidance

July 23, 2019







• In-Person Attendees

• Webinar Attendees





Continuing Education Credits (CECs)

SRP Licensing Board has not yet approved 3 Technical CEC for this Training Class

 Certificate process will occur after course has been approved by the SRPL Board

• Attendance Requirements:

- In-person attendance: must sign-in / sign-out and may not miss more than 20 minutes of the training
- Webinar participants: must be logged-in for entire session and answer 3 out of 4 test questions (randomly inserted in the presentation)



CECs: What's the Process?

Upon SRPL Board approval of CEC application:

- DEP compiles a list of "in-person" and "webinar" participants eligible for CECs
- DEP will email eligible participants a "Link" to a LSRPA webpage with certificate access instructions
- Certificates are issued by the LSRPA after paying \$25 processing fee





Test Your Knowledge

Is the Lynne Mitchell the new Acting Assistant Director of the Remediation Review Element (BIR and BRAP)?

A. Yes

B. No



Test Your Knowledge

Is the Lynne Mitchell the new Acting Assistant Director of the Remediation Review Element (BIR and BRAP)?

A. Yes



Important Reminders

- Please mute cell phones
- Phone calls / conversations
 - Please take outside of the meeting room
- Question / Answers
 - At times specified during the presentation
 - Please wait for the microphone
 - Webinar participants, wait for question period to "open up" and can then type in question







Remember!

Remember to sign in <u>and</u> out for credit

Please fill out the Course Evaluation Form







NJDEP Evaluation of Extractable Petroleum Hydrocarbons in Soil Technical Guidance Training 401 East State Street Trenton, New Jersey July 23, 2019













Upcoming Events

August 1, 2019 - Trenton Thunder Baseball Game September 17, 2019 - LSRPA Member Breakfast October 7, 2019 - Professional Ethics 2018-082 MGP Conference, Philadelphia, PA

LSRPA

October 15, 2019 - LSRPA Member Breakfast October 29, 2019 - Prevention of Adverse Community Exposure During Hazardous Waste Site Clean-ups 2018-062, Florham Park, NJ October 30, 2019 - Due Diligence in New Jersey, Princeton, NJ November 19, 2019 - LSRPA Member Breakfast December 17, 2019 - LSRPA Member Breakfast

Click here to register: https://www.lsrpa.org/events



LSRPA Initiatives

- Member Breakfasts, held throughout the state: Check lsrpa.org for locations.
- LSRPA Participated in NRD and the Environmental Justice Task Force groups.
- > LSRPA was a Stakeholder in the SRRA 2.0 revisions.
- LSRPA met with NJDEP Commissioner and NJEDA Chief Director on brownfield issues
- Dispute Resolution, LSRPA Sounding Board & CE Tracking Spreadsheet Tool





SOCIAL MEDIA IS NOT JUST FOR KIDS...

It is an important way to connect our membership with the community



@NJLSRPA

GET INVOLVED !

 LSRPA Committees **Governance (incl. Bylaws) Continuing Education Membership/Next Generation Risk Management/Loss Prevention** Mentoring **Regulatory Outreach Sponsorship Sounding Board**

Communications College Outreach Finance Legal/Legislative Nominating SRRA 2.0 Conference

WANTED - VOLUNTEERS





Thank You!

Evaluation of EPH in Soil Technical Guidance

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Committee Members

- David Barskey, Co-Chair, Department (retired)
- John Ruhl, Co-Chair, Department
- Kathleen Kunze, Department Guidance Coordinator (retired)

- Ronald Baker, USGS New Jersey
 Water Science Center (retired)
- Michel Boufadel, New Jersey Institute of Technology (NJIT)
- Geoffrey Clark, LSRP, GHD Services, Inc.
- John Donohue, Fuel Merchants Association of New Jersey
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Additional Contributions Rendered

- Paul Sanders, NJDEP, BEERA
- Jacob Oehrig, NewFields

- Paul Bauer, NJDEP, BIS
- Lynne Mitchell, NJDEP, SRWMP Training Chair
- Christina Page, NJDEP, SRWMP Ass't Training Chair
- Nicole Kozlowski, NJDEP, SRWMP Ass't Training Chair





List of Abbreviations

- AOC Area of Concern
- Cat 1/Cat 2 Category 1/Category 2
- Conc. concentration
- EPH Extractable Petroleum Hydrocarbons
- EPH Protocol *Protocol For Addressing Extractable Petroleum Hydrocarbons* (August 2010)
- FAQs Frequently Asked Questions in August 2010 EPH Protocol
- Ing-D Exp. Path. Ingestion-Dermal Exposure Pathway
- NRDCSRC Non-Residential Direct Contact Soil Remediation Criterion
- RDCSRC Residential Direct Contact Soil Remediation Criterion
- SRC Soil Remediation Criterion
- SRS Soil Remediation Standards in REMEDIATION STANDARDS (<u>N.J.A.C.</u> 7:26D)
- Technical Rules TECHNICAL REQUIREMENTS FOR SITE REMEDIATION (N.J.A.C. 7:26E)

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TPH - Total Petroleum Hydrocarbons



Petroleum Products in Table 2-1 of Technical Rules

Petroleum products this guidance applies to: **Cat 1 Defined** (Section 4.1.1 of this guidance)

- No. 2 Heating Oil
- Diesel Fuel





Petroleum Products in Table 2-1 (cont'd)

Cat 2 Defined (section 4.1.2 of this guidance)

- Nos. 4 & 6 Heating Oil
- Hydraulic Oil, Cutting Oil, Lubricating Oil
- Crude Oil
- Waste Oil, *Unknown Petroleum Hydrocarbons

- Waste Vehicular Crankcase Oil
- *Mineral Oil
- *Dielectric Fluid, *Dielectric Mineral Oil, *Transformer Oil
- *Manufactured Gas Plant (MGP) Sites



* Petroleum products added to Table 2-1 that post-date the EPH Protocol

Stimulus For Developing EPH Technical Guidance

- Consider alternative EPH product limits for other soil textures
 - Medium sand-based EPH default product limits to all soil types (App. 3.1 of this guidance):

- 8,000 mg/kg EPH for Cat 1
- 17,000 mg/kg EPH for Cat 2
- Update EPH SRC with pending revisions to SRS



Main Differences Between 2010 and Now

- Addition of six EPH petroleum products in Table 2-1 of Technical Rule
- Allow for development EPH alternative product limits
- 8,000 mg/kg default product limit assigned to some Cat 2 petroleum products
- Establishment of 30,000 mg/kg EPH ceiling
- Compliance averaging for EPH Cat 1 SRC
- Petroleum product mixtures clarification for EPH product limits and applicable SRC



Additional Changes

- Updated EPH evaluation steps (Sect. 5.0), plus
 - order rearranged to the investigator's perspective
 - streamlined
- Updated EPH Cat 2 SRC calculator
 - no longer compares EPH conc. to default product limit
 - displays equation and parameter default values for Ing-D Exp. Path.

Pertinent aspects of FAQs and EPH Protocol Implementation Phase-In (August 2010) retained in EPH Technical Guidance Appendix 3





Historical Perspective: TPH to EPH Freon/Method 418.1 Phase-Out

- TPH via EPA Method 418.1 used Freon extraction
 - Freon depletes ozone layer
- Freon phased-out
 - Method 418.1 unavailable
- Replacement method necessary
- Department employed several methods to bridge the gap

 USEPA SW846 Methods 8015B and 8015B/C,
 NJDEP OQA-QAM-025 and OQA-QAM-025 rev. 7, and
 NJDEP EPH Method Revision 2





Historical Perspective: TPH Transition to EPH (Legislative Mandate)

- TPH based on "field capacity" and was not health-based
- Department legislatively mandated to establish human health-based remediation standards per Brownfield and Contaminated Site Remediation Act (<u>N.J.S.A.</u> 58:10B-12)
- EPH METHODOLOGY (Version 3.0) [August 2010] is health-based



Historical Perspective: TPH transition to EPH (NJDEP EPH Method Version 3.0)

- **RESULT:** Provides more accurate assessment of potential human health risk
- Determines collective concentrations for specific carbon number ranges of extractable <u>aliphatic</u> and <u>aromatic</u> petroleum hydrocarbons
- EPH method analyzes for 4 aromatic + 4 aliphatic fractions
- Representative toxicity factors assigned to each fraction range



EPH Category 1: Human Health-Based SRC Derivation

- 2007 EPH-TPH Field Study (No. 2 heating oil tank removals)
- EPH Direct Contact SRC based on Ing-D Exp. Path.
- Applying 95% Lower Confidence Limit of the mean and 2010 Remediation Standards Rule update:
 - 5,100 mg/kg EPH RDCSRC
 - 54,000 mg/kg EPH NRDCSRC

Appendix 3.3





EPH Cat 1 – Inhalation SRS and IGW Soil Screening Level

- How are the inhalation and impact to ground water exposure pathways evaluated?
- >1,000 mg/kg EPH triggers contingency analyses for:
 - Naphthalene: evaluates inhalation exposure pathway [FAQ#5]
 - 2-methylnaphthalene: evaluates impact to ground water exposure pathway [FAQ#9]





Petroleum Product Mixtures

Mixtures of Table 2-1 Petroleum Products

Hand-Out: EPH Category, SRC, and Default Product Limit by Petroleum Product







N.J.A.C. 7:26E Table 2-1	EPH Category	EPH SRC:	
Potroloum	(1 or 2)	Defined or	EPH default product limit (mg/kg)
Petroleum	(1012)	Sample-specific	
Product			
No. 2 heating oil	1	Defined	8,000
Diesel fuel	1	Defined	8,000
No. 4 heating oil	2	Sample-specific	17,000
No. 6 heating oil	2	Sample-specific	17,000
Hydraulic oil	2	Sample-specific	17,000
Cutting oil	2	Sample-specific	8,000
Lubricating oil	2	Sample-specific	17,000
Crude oil	2	Sample-specific	8,000
Waste oil	2	Sample-specific	Parent product dependent
Unknown petroleum hydrocarbons	2	Sample-specific	8,000
Waste vehicular crankcase oil	2	Sample-specific	17,000
Mineral oil	2	Sample-specific	17,000
Dielectric fluid	2	Sample-specific	17,000
Dielectric mineral oil	2	Sample-specific	17,000
Transformer oil	2	Sample-specific	17,000
Manufactured Gas Plant	2	Sample-specific	8,000
Mixtures			
Mixture of Categories 1 and 2		Sample-specific	8,000
Waste Oil comprised of Categories 1 and 2		Sample-specific	8,000
Mixture of petroleum product with 8,000 mg/kg default product limit and petroleum product with 17,000 mg/kg default product limit			
		Sample-specific	8,000
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Commingled NAPL Plumes Scenario



Plan View: Not-to-scale

AOC #2 #4 Heating Oil

V

EPH SRC = TBD Sample Specific EPH Default Product Limit Concentration = 17,000 mg/kg

Comingled Plume Mixture of #2 and #4

EPH SRC = TBD Sample Specific **EPH Default Product Limit** Concentration = 8,000 mg/kg

Two separate and unique NAPL plumes

- Each plume is investigated individually
- Any commingled area utilizes the most conservative remedial criteria



V Typical Grain Size Sample

QUESTIONS?





Conceptual Approach for Petroleum Hydrocarbons in Soils

Ronald J. Baker

U.S. Geological Survey (retired)

Michel C. Boufadel, Ph.D., PE, BCEE, P.Hydro.

Professor, Department of Civil and Environmental Engineering Professor, Department of Chemical and Materials Engineering Director, Center for Natural Resources New Jersey Institute of Technology, Newark NJ


Objectives for Presentation

- Basic understanding of NAPL distribution in soils
- Complex system involving three phases
 - -Hydrocarbons; water; air
- Movement of hydrocarbons is highly irregular
- Hysteresis
- Need for a simplification using





Hydrocarbon in Aquifers

Problem Statement

Three phases exist in the pore space:

- Hydrocarbon
- Water
- Air



Red= Oil Green= Air Blue= Water White= Soil

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Scanziani et al. (2018), Advances in Water Resources

Hysteresis

The movement of hydrocarbons depends on the content and hydrodynamics of the three phases and the soil wettability



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Morrow and Harris (1965), Soc. Pet. Eng. Jour. 15–24

EPH Committee Approach

- Accurately predicting the hydrocarbon content requires complicated models and a significant amount of soil and hydrocarbon data
- Adopt the approach used for unsaturated water flow in soils
- •Conceptually, replace oil for water in the equations —Account for oil viscosity





EPH Committee Approach

Solve the Darcy equation for hydrocarbon flow in porous media (i.e., in soils)

Darcy flux= hydraulic conductivity*(Head drop)

$$q = \frac{g}{v} k_{\text{intrinsic}} * k_r * (\text{Head drop})$$

Where: v = oil viscosity.

 $k_{intrinsic}$ = Intrinsic soil permeability -Depends on porosity and d_{10}

(If you know porosity and d_{10} , you obtain $k_{intrinsic}$)

 k_r = Relative permeability (0 to 1) **Depends on hydrocarbon content**





EPH Committee Approach

For vertical flow, (head drop)=1.0; Also let q = 1 foot/(100 years) per NJDEP

Thus, given oil viscosity, and k_{int} , one solves for k_r : $k_r = \frac{1}{\sigma}$

After finding k_r , one finds the hydrocarbon content (i.e., volume fraction)





Questions?





Equation Variables used in the Calculator, Sensitivity Analysis, and Sample Collection for Particle-Size Distribution

Ronald J. Baker

U.S. Geological Survey (retired)





Factors that Determine Petroleum Hydrocarbon Product Mobility

- Site characteristics
 - Size, shape
 - Slope, structures, disturbance
- Product properties
 - Viscosity & density
 - Temperature, degree of weathering
- Soil properties
 - Porosity
 - Grain size distribution



Equations and Variables

- Appendix 2.3 describes derivation of the equation in detail
- Variable Names handout lists all variables used in the equation (in red)
- The following slides show the equations used in the calculator





Derivation of the Equation used to Calculate the Alternative EPH Product Limit in Soil





Final Equation used to Calculate the Alternative EPH Product Limit in Soil

Input the parameter default values and convert the units to mg/kg. The remaining parameters

are specific to the type of petroleum product and the site's soil-specific properties.

$$C = \frac{\left[\left(1 - 0.02\right)1.1349 * \left(\frac{10^{-9} * \mu}{k * \rho_0 * 9.81}\right)^{\circ} 0.3095 + 0.02\right] * 0.41 * \rho_o}{(1 - 0.41) 2.54} * 10^6 \frac{mg}{kg}$$





Product Related Variables

• **µ** = Dynamic Viscosity

- Lower viscosity \rightarrow greater mobility
- p_o = Product Density
 - Lower density \rightarrow lower mobility





Properties of Products Specified in the Calculator

Petroleum Product Name	Density (g/cm^3)	Dynamic Viscosity (poise)
Cutting Oil, Diesel Fuel		
No. 2 Heating Oil		
Unknown Petroleum Hydrocarbons	0.8245 @ 15°C	0.02 @ 15°C
Dielectric Fluid		
Mineral Oil		
Transformer Oil	0.8673	0.19
No. 4 Heating Oil	0.9250 @ 20°C	0.23@ 20°C
Hydraulic Oil	0.8727 @ 15°C	1.02 @ 15°C
Lubricating Oil	0.8498@ 15°C	1.4217 @ 15°C
Waste Vehicular Crankcase Oil	0.8848@ 15°C	1.75@ 15°C
No. 6 Heating Oil	0.9879 @ 15°C	403.4 @ 15°C



Soil Properties that Determine Product Mobility

- **Φ** =Total porosity of soil
- θ_o = Product-filled porosity
- i = Flow Gradient
 - Worst case: vertical gradient (1.0 feet/foot)
- **D**₁₀ = grain effective diameter
 - Sieve size through which 10% passes





Values Determined by the Calculator

• **D**₁₀

- **C** = AOC-specific alternative product limit
 - Defined as the product concentration at which product moves at 0.01 ft/yr
- **Ceiling limit** = 30,000 mg/kg (Appendix 3.2)
- And is C greater than or less than the ceiling limit?
 - Only use **C** if it is less than the ceiling limit





Default Variables Imbedded in the Calculator

- i = Vertical Groundwater Gradient dimensionless (1.0)
- **q** = Darcy Flux value feet/year (0.01 feet/year)
- S_r = Residual petroleum HC saturation percent (2%)
- ρ_s = Grain density of the soil grams/cm³ (2.54 g/cm³)
- Temperature of NAPL in soil (15 degrees C)
- **n** = Van Genuchten uniformity coefficient n (4)
- \mathbf{T} = tortuosity to flow (0.5)
- F = particle shape factor (2.5)
- **Φ** = porosity (0.41)



Variables Determined by the Calculator

- \mathbf{K} = Hydraulic conductivity K=q/I = 0.01 ft/year
- \mathbf{k} = Intrinsic permeability of the medium
- $\mathbf{k}_{\mathbf{r}}$ = Relative permeability of the medium
- S = NAPL saturation ratio, the fraction of porosity occupied by product
- $S_e = Effective saturation$, the relative fraction of product available for flow
- θ_o = Product-filled porosity



Sensitivity Analysis of Variables in the Calculator

• Alternative EPH Product Limit has different degrees of sensitivity to these variables:

Product properties

- Density
- Dynamic viscosity

Soil properties

- Porosity
- D₁₀





Minimal Effect of Product Density on C-Value



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Substantial Effect of Product Viscosity on C-Value



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Minimal Effect of Porosity on C-Value





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-

Why use D₁₀?

- D_{10} = measure of the finer particle fraction
 - Finer particles control permeability
- D₁₀ is the basis of the Hazen formula used in geotechnical engineering and the Kozeny-Carmen equation (which we use in the calculator)
- D₂₀ or D₆₀/D₁₀ were rejected as alternatives
 - D_{20} gives less information about the finer particles
 - D_{60}/D_{10} informs about soil grading, but gives no additional information about the finer fraction



USDA Soil Classification System (SCS)



Soil Permeability



Sieves for Determining Particle (grain) Size Distribution







Sieves for Determining Particle (grain) Size Distribution







Additional Information about Sieve Analysis

- Chain of Custody must follow samples from collection through results reporting
- Specify method used
- Appropriate QA/QC measures must be applied
- If D₁₀ is supplied by the lab, calculation method must be specified



Example of Particle Size Distribution Data

Project: 493 North Arlington, NJ Collected: 10/19/16 Lab Method: ASTM D422-63

Sieve	size (mm)	Percent	passed through
0.75 Inch	19.05	100.0	
0.375 Inch	9.575	99.4	
No.4 Sieve	4.75	96.2	
No.10 Sieve	2.00	92.3	
No.30 Sieve	0.60	87.1	
No.50 Sieve	0.30	82.8	
No.100 Sieve	0.15	74.3	
No.200 Sieve	0.075 🛛 🗖	10 65.1	
Hydrometer	0.030	50.0	
Hydrometer	0.005 🖌	10.0	
Hydrometer	0.0015	3.0	

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Substantial Effect of D₁₀ on C value





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EPH Grain Size Sample Notes - Horizontal





Typical Cross Sections- Grain Size Sample Locations



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Commingled NAPL Plumes Scenario



Plan View: Not-to-scale

AOC #2 #4 Heating Oil

EPH SRC = TBD Sample Specific **EPH Default Product Limit** Concentration = 17,000 mg/kg

Comingled Plume Mixture of #2 and #4

EPH SRC = TBD Sample Specific **EPH Default Product Limit** Concentration = 8,000 mg/kg

Two separate and unique NAPL plumes

- Each plume is investigated individually
- Any commingled area utilizes the most conservative remedial criteria

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V Typical Grain Size Sample

Sharing of Grain Size Samples - 3 AOCs Scenario





Questions? Comments? Need coffee or other stimulants?





EPH Investigation Overview

John F. Donohue

Fuel Merchants Association of New Jersey




Determine EPH of Concern

• Cat 1 EPH

- Number 2 (#2) fuel oil and/or diesel fuel

• Cat 2 EPH

 Number 4 (#4) fuel oil, Number 6 fuel oil, hydraulic oils, cutting oils, crude oil, lubricating oil, waste oil, waste vehicular crankcase oil, and waste mineral oil

• Both: Current #2 Fuel Oil, Former #4 Oil Use

– Mixtures: MGP, crude oil, cutting oil, unknown EPH





Determine Health Based Limits

- **Cat 1 EPH** = 5,100 mg/kg RDCSRC
 - 54,000 mg/kg NRDCSRC
- Cat 2 EPH → Site Specific
 - >2,300 mg/kg fractionated analysis needed
 - Use SRC calculator
- **Mixtures** \rightarrow Most Stringent





Determine Contingency Driver Limits

- <u>N.J.A.C.</u> 7:26E, Table 2-1
- Cat 1 EPH: 1,000 mg/kg
 - Evaluate for naphthalene and 2-methylnaphthalene
- Cat 2 EPH, Heating Oils: 100 mg/kg
 PAHs
- Cat 2 EPH, Other: >ND or Required
 - Product specific





Determine Default Product Limits

- Cat 1 EPH: 8,000 mg/kg
- Cat 2 EPH: 17,000 mg/kg
- Mixtures: 8,000 mg/kg
- What if EPH concentrations are:
 - Greater than default product limit?
 - Consider 'Alternative Product Limit'
 - Greater than 30,000 mg/kg?





What's New?

- Guidance includes greater reference to Attainment Compliance Technical Guidance
- Guidance provides a method to develop a site-specific, <u>alternative</u> product limit
- Alternate product limit calculator
- Textural analysis of soil is needed to generate a value for use in the `calculator'





What's New? Depends on the Project Type

Residential HOT

-No substantive change -Cat 1 EPH standard -Cat 2 EPH calculated

> Compliance Averaging (>5,100/<8,000 mg/kg)

Standard Industrial

-Small changes -Cat 1 EPH standard -Cat 2 EPH calculated -Product ceiling limit -Option for Alternative **Product Limit** Concentration -Additional Grain Size analysis

Complex Industrial

-More changes

- -Cat 1 EPH standard
- -Cat 2 EPH calculated -Product ceiling limit

-Option for Alternative Product Limit Concentration

-Grain Size analysis

- -Added products and mixtures
 - -Technical Consultation

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What is <u>Not</u> New

- Cat 1 Soil Remediation Criterion (RDCSRC)
 - Established in Remediation Standard, N.J.A.C. 7:26D
 - Established in Heating Oil Tank System Rule, <u>N.J.A.C.</u> 7:26 F (HOTSR Rule)
- Cat 2 Composition Specific EPH Soil Criterion Remediation Calculator (which has been updated)
- Contingency Analysis Requirements
- Default Product Limits
- Unrestricted Use Criterion/Institutional Control Requirements
- Product Indicator Concentrations require Single-Point Compliance

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Residential Use Remediation Goal

• Existing Residential Site with Unrestricted Use as goal

- EPH 2019 does not offer a 'silver bullet'
- Compliance averaging or 75%/10X can be used for Cat 1 fuels and specific compounds of concern
- Alternative product limit calculator, along with compliance averaging or 75%/10X can be used at sites regulated by <u>N.J.A.C.</u>
 7:26F (HOTSR Rule) if EPH > 8,000 mg/kg is present
- Cat 2 fuel AOC attainment compliance options do not include averaging



Non-Residential Use Remediation Goal

- Non-Residential Site with an <u>Unrestricted</u> Use as goal
 - EPH 2019 does not offer a 'silver bullet' for Cat 1 fuels due to RDCSRC
 - Alternative product limit calculator, along with compliance averaging or 75%/10X can be used at sites regulated by <u>N.J.A.C.</u> 7:26F (HOTSR Rule) if EPH > 8,000 mg/kg is present
 - Cat 2 fuels and use of alternative product limit can be quite effective for meeting remediation goal
 - Compliance averaging or 75%/10X can be used for Cat 1 fuels and specific compounds of concern





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Restricted Use

• Restricted Use is acceptable to the PRCR

- Institutional control required
- Engineering control use may be reduced
- Long term monitoring requirements can apply
- Requires Remedial Action Permit (see HOTSR exclusions)





Why Default Product Limits?

• 7:26E-5.1 Remedial action requirements

(e) The person responsible for conducting the remediation shall treat or remove free product and residual product to the extent practicable or contain **free product** and **residual product** when treatment or removal is not practicable.
 Monitored natural attenuation of free product and residual product is prohibited.

• Question: How does the LSRP determine...

- What is 'Free product'? What is 'Residual product'?
- What is 'Residual contamination'?
- What is `NAPL'?
- Answer: Department established 'Product Limits' for EPH





The Work of the Committee

- Evaluate the appropriateness of established default product limits
- Seek out methods to support development of 'site specific' limits
 - Centrifuge analysis
 - Testing of EPH impacted soils
- Consider a field classification of soil and use corresponding default limits from prior studies
- Provide the regulated community the option to calculate a product limit



Brost and DeVaull, 2000

- The Title: NAPL Mobility Limits in Soil
- The title may have been better stated as:
 - When is product in soil residual (or presumed to be immobile)?
 - When is product in soil NAPL (or potentially mobile)?
- Demonstrated <u>soil</u> <u>texture</u> is the predominant factor





What did Brost and DeVaull Say?

- "Conservative screening concentrations for NAPL that could be considered immobile in unsaturated soils."
- "Mobile NAPL deplete as immobile residual chemical is left behind through the soil column in which the NAPL is descending."
- "Our intent...is to determine conservative NAPL concentration below which NAPL will be immobile."
- "By '<u>conservative</u>' we mean underpredicting the concentration at which mobility would actually occur."
- "These screening values are intended to be worst-case estimates for mobility. Higher values may be applicable on a site-specific basis. For example, with an adequate distance in unsaturated soil between the lowest depth of a mobile NAPL and groundwater. ...account for potential NAPL redistribution in unsaturated soil layer. Redistribution decreases concentration..."



Brost and DeVaull: Table 2

	NAPL		Soil Type	Residual NAPL Concentration (mg/kg)
	Middle Distillates		Coarse Gravel	2,286
	Middle Distillates		Coarse Sand & Gravel	3,879
	Middle Distillates	(Cat 1)	Medium to Coarse Sand	<mark>7,742</mark>
Evistina	Middle Distillates		Fine to Medium sand	13,333
default product limits	Middle Distillates		Silt to Fine sand	22,856
	Fuel Oils		Coarse Gravel	5,143
	Fuel Oils		Coarse Sand & Gravel	8,727
	Fuel Oils	(Cat 2)	Medium to Coarse Sand	<mark>17,419</mark>
	Fuel Oils		Fine to Medium sand	30,000
	Fuel Oils		Silt to Fine sand	51,429 87

Challenges to Determining Soil Type

- Appendix 3.1 states: "Sand was selected by the NJDEP as a reasonably conservative soil texture for determination of a default upper limit concentration for No. 2 fuel oil and diesel based on the residual saturation point."
- Sand
 - Coarse, fine, sand with fines?
 - Silty sand? Sandy silt? Clay?
- Soil Classification
 - Could the investigator use USDA Soil Classification, as with VI?
 - How did Brost and DeVaull measure or classify soil type? Could the investigator go to their chart?



USDA Soil Classification System



Generic Soil Types Can Pose Issues

- Use of any generic soil classification is generally too broad
- Sieve analysis was conducted on samples submitted to EPH committee for use evaluating viability of centrifuge analysis
- For 7 of 11 sites, sand content 70% or less
 - Sites with 90% sand, EPH calculated to 22,000 mg/kg to 31,000 mg/kg
 - Sites with 70% sand, EPH calculated to 23,000 mg/kg to 88,000 mg/kg
 - Sites with 50% sand, EPH calculated to 83,000 mg/kg
 - Sites with 30% sand, EPH calculated to 23,000 mg/kg to 177,000 mg/kg



EPH Guidance-Criterion and Limits

- Health Based Criterion
 - <u>N.J.A.C.</u> 7:26D, <u>N.J.A.C.</u> 7:26F
- Contingency Analysis
 - <u>N.J.A.C.</u> 7:26E
 - Health Based Criterion
- Ecologic Assessment
 - ECO Guidance 1,700 mg/kg
- Product Limits
 - Default Product Limits- 8,000 mg/kg, 17,000 mg/kg
 - Site-specific Product Limits: established via soil testing up to Product Ceiling



Product Ceiling Limit

- Committee discussions:
 - When is a soil not a soil?
 - At what concentration of residual product do the characteristics of the soil change?
- Cat 1 Fuel NRDCSRC = 54,000 mg/kg
- Cat 2 Fuel criterion can range over 100,000 mg/kg
- Alternative product limit calculation can exceed 100,000 mg/kg

What is appropriate? 30,000 mg/kg





EPH Guidance 2019 - Effect

- EPH Product Limits for Cat 1 and Cat 2 Fuel can be up to 30,000 mg/kg
- Institutional Controls are required if EPH is to remain on-site at concentrations over RDCSRC (except for the limited provisions of the HOTSR Rule)
- Derivation of Alternative EPH Product Limit does not eliminate the need to remediate compounds of concern identified by contingency analysis
- Derivation of an Alternative Product Limit does not eliminate the need to evaluate ground water investigation requirements for compounds of concern identified by contingency analysis



Summary

- Define product type as soon as possible
- Product indicator concentrations are capped by the Default Ceiling Limit
- Product indicator compliance is determined on a point-by-point basis
- Soil samples for grain size analysis can be collected at any time
- A 'Calculator' is used to develop a Site-Specific Alternative Product Limit Concentration
- EPH samples are referenced to a free or residual product level, 'residual contamination' is not defined



Questions?





BREAK





Using The EPH Alternative Product Limit Calculator

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NewFields Princeton, LLC

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EPH Alternative Product Limit Concentration Calculator for Soil

Goals of this Section

- Introduce the calculator format
- Describe the data entry process
- Identify the input variables and calculator output
- Provide insight into the calculations
- Identify some eccentricities in the calculator
- Describe a recommended documentation and submittal process



Using the Product Limit Calculator

- Read the instructions & become comfortable with the calculator
- Preparing your data
- Working with the calculator
- Data submittal
- **READ THE INSTRUCTIONS**





Preparing Your Data

Necessary information

1. Site specific information, including the PI# for the site and the AOC # for the investigation

link to data miner

- 2. Grain Size soil analysis laboratory reports
- 3. Definition of the Type of Petroleum Product discharged at the AOC
- 4. Site Plan of the AOC and sample locations
- 5. Download the NJDEP Excel Calculator





EPH Alternative Product Limit Concentration Calculator for Soil

Simple

One Page

No interpretation

Instruction guide follows

the input process

A1 Ŧ F G H I A B D Е 1 2 New Jersey Department of Environmental Protection 3 Site Remediation and Waste Management Program 4 5 Extractable Petroleum Hydrocarbon (EPH) Alternative Product Limit Concentration Calculator for Soil 6 Version 1.0, December 1, 2018 Release Date 7 8 Site Name Program Interest (PI) Num э Area of Concern Name 10 AOC NO. (murt correspond with CID) Investigator's Name 11 12 Default Product Type of Petroleum Product mg/kg EPH #N/A Indicator Concentration 13 Dynamic Viscosity of the Petroleum Product (poise) ŧN/A poise 14 Density of the Petroleum Product (gram/cm^3) **#N/A** aram/cm^3 15 16 JEIEGG THE HUMBER OF GRAM JILE JAMPIES THAT were C 4 Grain Size Samples were analyzed analuzed for this AOC. 3 Grain Size Samples were analysis Click the quantity of grain size samples: 3 samples or 4 17 complex Sample 1 Sample 2 Sample 3 Sample 4 19 Sample Identification Name/Number 20 Direct D10 input Direct D10 input Direct D10 input Direct D10 input from lab report. from lab report from lab report. from lab report. For each sample, click the bullet corresponding 21 to source of D₁₁ value. Input sieve D10 da Innet sizes D10 dat Input sieve D10 da Innatiaieae D10 da and determine and determine and determine and determine through calculator through calculator through calculator through calculator. 22 COMPLETE GRAIN SIZE DATA SHEET 23 D₁₀ Grain Size with 10% of Soil Passing through the Sieve (mm) 0.000 0.000 0.000 0.000 24 k – Intrinsic Permeability (m²) -calculated based on D₁₁ 1.10E-11 1.10E-11 1.10E-11 1.10E-11 25 26 Calculated EPH Product mg/kg of EPH Limit Concentration for #N₽A #N⊮A #N₽A 27 each grain size sample. Maximum Allowable EPH Concentration in Soil fi.e., mg/kg of EPH #N∦A #N₽A #N₽A NJDEP Ceiling Limit) 28 Alternative EPH Product Limit Concentration mg/kg #N/A for Soil in this AOC EPH 29 30 31 32 33 34 35 **PRINT EPH Report** RESET CALCULATOR INSTRUCTIONS 36 37 38 39 40



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Task 1- Op	ening		r	G	Н
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Cite News et			Drogram Interact	(DI) Num	
Site Name:			Program interest	(PI) Nulli.	
Area of Concern Name			AOC No. (must corres	pond with CID)	
Area of Concern Name Investigator's Name			AOC No. (must corres	pond with CID)	
Area of Concern Name Investigator's Name Type of Petroleum Product	No. 2 Heating Oil		AOC No. (must corres	(PT) NuTT. pond with CID) 8,000	mg/kg EPH
Site Name: Area of Concern Name Investigator's Name Type of Petroleum Product μ _o Dynamic Viscosity of the Petroleum Product	No. 2 Heating Oil	0.02	AOC No. (must corres Default Product Indicator Concentration poise	8,000	mg/kg EPH
Site Name: Area of Concern Name Investigator's Name Type of Petroleum Product μ₀ Dynamic Viscosity of the Petroleum Product ♀₀ Density of the Petroleum Product (gram/cm²)	No. 2 Heating Oil (poise) ^3)	0.02	AOC No. (must corres Default Product Indicator Concentration poise gram/cm^3	8,000	mg/kg EPH
Site Name: Area of Concern Name Investigator's Name Type of Petroleum Product μ _o Dynamic Viscosity of the Petroleum Product p _o Density of the Petroleum Product (gram/cm ²) Select the number of Grain Size Samples the analyzed for this AOC. Click the quantity of grain size samples: 3 s	No. 2 Heating Oil (poise) ^3) at were mples or 4 samples.	0.02 0.8245	AOC No. (must corres Default Product Indicator Concentration poise gram/cm^3 ples were analyzed	(PT) Num. pond with CID) 8,000 > 4 Grain Size Samples	mg/kg EPH

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	New Jersey Departmen Site Remediation and War Extractable Petroleum Hydroca Version 1.0, May 1, 2019 Release Date	nt of Environmen aste Management rbon (EPH) Alternative	tal Protection t Program Product Limit C	ON Concentration C	alculator for Soil
Site Name:		P	rogram Interest ((PI) Num.	
Area of Concern Name		A	OC No. (must corresp	pond with CID)	
Investigator's Name					
Investigator's Name					
Investigator's Name Type of Petroleum Product	No. 2 Heating Oil	De In	efault Product dicator Concentration	8,000	mg/kg EPH
Investigator's Name Type of Petroleum Product μ _σ Dynamic Viscosity of the Petroleum Prod	No. 2 Heating Oil	De In: 0.02 pc	efault Product dicator Concentration Dise	8,000	mg/kg EPH
Investigator's NameType of Petroleum Product μ_o Dynamic Viscosity of the Petroleum Product ρ_o Density of the Petroleum Product (gram,	No. 2 Heating Oil luct (poise) /cm^3)	0.02 pc 0.8245 gr	efault Product dicator Concentration Dise ram/cm^3	8,000	mg/kg EPH
Investigator's NameType of Petroleum Product μ_o Dynamic Viscosity of the Petroleum Product ρ_o Density of the Petroleum Product (gram,Select the number of Grain Size Sample analyzed for this AOC. Click the quantity of grain size samples: 3	No. 2 Heating Oil Juct (poise) /cm^3) Is that were 3 samples or 4 samples.	De Ind 0.02 pc 0.8245 gr	efault Product dicator Concentration oise ram/cm^3	8,000) 4 Grain Size Samples w	mg/kg EPH
Investigator's Name Type of Petroleum Product μ₀ Dynamic Viscosity of the Petroleum Product ρ₀ Density of the Petroleum Product (gram, Select the number of Grain Size Sample analyzed for this AOC. Click the quantity of grain size samples: 3	No. 2 Heating Oil duct (poise) /cm^3) is that were 3 samples or 4 samples.	De Inc 0.02 pc 0.8245 gr	efault Product dicator Concentration oise ram/cm^3 re analyzed	8,000) 4 Grain Size Samples w	mg/kg EPH



New Jersey Department of Environmental Protection Site Remediation and Waste Management Program

Extractable Petroleum Hydrocarbon (EPH) Alternative Product Limit Concentration Calculator for Soil

Version 1.0, May 1, 2019 Release Date

Site Name:	ABC Site		Program Interest (PI) Num.		0012345
Area of Concern Name	Former Oil Tank Ar	ea	AOC No. (must correspond with CID)		10
Investigator's Name	LSRP O'DeYear				
Type of Petroleum Product	No. 2 Heating Oil		Default Product Indicator Concentration	8,000	mg/kg EPH
μ_o Dynamic Viscosity of the Petroleum Product (poise)		0.02	poise		
$ ho_{\circ}$ Density of the Petroleum Product (gram/cm^3)		0.8245	gram/cm^3		
Select the number of Grain Size Samples that were analyzed for this AOC.) 3 Grain Size Sample	s were analyzed	re analyzed	

New Jersey Department of Environmental Protection Site Remediation and Waste Management Program Extractable Petroleum Hydrocarbon (EPH) Alternative Product Limit Concentration Calculator for Soil Version 1.0, May 1, 2019 Release Date					
ABC Site		Program Interest	(PI) Num.	0012345	
Former Oil Tank Are	а	AOC No. (must correspond with CID)		10	
LSRP O'DeYear					
No. 2 Heating Oil		Default Product Indicator Concentration	8,000	mg/kg EPH	
No. 2 Heating Oil A	0.02	poise			
No. 4 Heating Oil No. 6 Heating Oil Hydraulic Oil	0.8245 gram/cm^3				
Select the number of Grain Size amples the Lubricating Oil Analyzed for this AOC. Click the quantity of grain size samples: 3 samples or 4 samples.		les were analyzed	○ 4 Grain Size Samples we	re analyzed	
	New Jersey Department of Site Remediation and Wast Extractable Petroleum Hydrocarbo Version 1.0, May 1, 2019 Release Date ABC Site Former Oil Tank Are No. 2 Heating Oil No. 4 Heating Oil No. 4 Heating Oil No. 6 Heating Oil No. 6 Heating Oil Hydraulic Oil Cutting Oil Unbricating Oil Waste Oil- Known Source Material	New Jersey Department of Environm Site Remediation and Waste Managem Extractable Petroleum Hydrocarbon (EPH) Alterna Version 1.0, May 1, 2019 Release Date ABC Site Former Oil Tank Area LSRP O'DeYear	New Jersey Department of Environmental Protection Site Remediation and Waste Management Program Extractable Petroleum Hydrocarbon (EPH) Alternative Product Limit (Product Limi (Product Limi (Product Limit (Product Limit (Product Li	New Jersey Department of Environmental Protection Site Remediation and Waste Management Program Extractable Petroleum Hydrocarbon (EPH) Alternative Product Limit Concentration Ca Version 1.0, May 1, 2019 Release Date ABC Site Program Interest (PI) Num. Former Oil Tank Area AOC No. (must correspond with CID) LSRP O'DeYear Default Product Indicator Concentration 8,000 No. 2 Heating Oil O.02 poise No. 4 Heating Oil O.02 poise Radia Concentration 8,000 No. 4 Heating Oil O.02 poise Concentration Concentration	

Step 2 Type of Petroleum Product Pull Down Options List

Type of Petroleum Product Source Material

No. 2 Heating Oil

Diesel Fuel

No. 4 Heating Oil

No. 6 Heating Oil

Hydraulic Oil

Cutting Oil

Lubricating Oil

Waste Oil

Unknown Petroleum Hydrocarbon

Waste Vehicular Crankcase Oil

Mineral Oil

Dielectric Fluid, Dielectric Mineral Oil, Transformer Oil

Crude Oil

Manufactured Gas Plant (MGP)







Type of Petroleum Product

No. 2 Heating Oil

Step 3 – Define the number of grain size samples (either 3 or 4 grain size samples)

Sample Identification Name/Number

For each sample, click the bullet corresponding to source of D₁₀ value.

COMPLETE GRAIN SIZE DATA SHEET

D₁₀ Grain Size with 10% of Soil Passing through the Sieve (mm)

k Intrinsic Permeability (m²) -calculated based on D₁₀



0.000	0.000	0.000	0.000
1.10E-11	1.10E-11	1.10E-11	1.10E-11 108
Step 5a –Define the Data Structure of your D10 Grain Size Samples & Input Sample Names

Sample Identification Name/Number

For each sample, click the bullet corresponding to source of D₁₀ value.

COMPLETE GRAIN SIZE DATA SHEET

D10 Grain Size with 10% of Soil Passing through the Sieve (mm)

k Intrinsic Permeability (m²) -calculated based on D₁₀



1.10E-11

1.10E-11 109

1.10E-11

1.10E-11



New Jersey Department of Environm Site Remediation and Waste Manageme Extractable Petroleum Hydrocarbon (EPH) Alternativ Version 1.0, May 1, 2019 Release Date	ental Protection ht Program Product Limit Concentration	Calculator for S	oil					Ret Summ	urn to ary Sheet	
Sample 1 Lab ample Name 0	Sa Lab Sample Name	mple 2 0		Sa .ab Sample Name	mple 3 O		La	Sam ab Sample Name	ple 4 O	
Lab D ₁₀ = mm	Grain Size from Sieve (mm of Sieve)	Percent of soil mass passing through the sieve	Percent of material mass retained on the sieve	Grain Size from Sieve (mm of Sieve)	Percent of soil mass passing through the sieve	Percent of material mass retained on the sieve		Lab D ₁₀ =		mm
			100% 100% 100% 100% 100% 100% 100% 100%			100% 100% 100% 100% 100% 100% 100% 100%				
-	Calc. D ₁₀ =	0.0000	mm	Calc. D ₁₀ =	0.0000	mm				

New Jersey Department of Environmental Site Remediation and Waste Management Pr Extractable Petroleum Hydrocarbon (EPH) Alternative Version 10, May 1, 2019 Release Date	Il Protection rogram e Product Limit Concentra	tion Calculator	for Soil				Retu Summa	rn to ry Sheet	
Sample 1 Lab Sample Name GS-A Lab D ₁₀ = 0.4659 mm	Sa Lab Sample Name	mple 2 GS-B2		Lab Sample Nam	iample 3 e GS-03		Samp Lab Sample Name Lab D ₁₀ =	ole 4 GS-D 0.1100	mm
	Grain Size from Sieve (mm of Sieve)	Percent of soil mass passing through the sieve	Percent of material mass retained on the sieve	Grain Size from Sieve (mm of Sieve)	Percent of soil mass passing through the sieve	Percent of material mass retained on the sieve			c
	75	100.0%	0%	75	100.0%	0%			F
	37.5	10.0%	0%	37.5	100.0%	0%			-
	19	10.0%	0%	19	100.0%	0%			-
	9.5	100.0%	0%	9.5	100.0%	0%			
	4.75	98.0%	2%	4.75	100.0%	0%			
	2.36	94.0%	6%	2.36	100.0%	0%			
	2	92.5%	8%	2	100.0%	0%			
	1.18	80.0%	20%	1.18	82.0%	18%			
	0.6	30.0%	70%	0.6	20.0%	80%			
	0.3	7.8%	92%	0.3	4.0%	96%			
	0.15	5.5%	95%	0.15	3.8%	96%			
	0.075	2.5%	98%	0.075	3.8%	96%			
	0.03	2.5%	98%	0.03	1.2%	99%			
	0.005	2.0%	98%	0.005	1.0%	99%			
	0.0015	12%	99%	0.0015	0.0%	100%			
	Calc. D ₁₀ =	0.3297	mm	Calc. D ₁₀ =	0.4125	mm			

Close-up view of GS-03, sieve data input.

The calculator interpolates between the two % passing values that bound 10%.

GS-03, $D_{10} = 0.4125$ mm Direct read from the calculator.

	Sa	mple 3		
La	b Sample Name	GS-03		
	Grain Size from Sieve (mm of Sieve)	Percent of soil mass passing through the sieve	Percent of material mass retained on the sieve	
	75	100.0%	0%	
	37.5	100.0%	0%	
	19	100.0%	0%	
	9.5	100.0%	0%	
	4.75	100.0%	0%	
	2.36	100.0%	0%	
	2	100.0%	0%	
	1.18	82.0%	18%	
	0.6	20.0%	80%	
	0.3	4.0%	96%	
	0.15	3.8%	96%	
	0.075	3.8%	96%	
	0.03	1.2%	99%	
	0.005	1.0%	99%	
	0.0015	0.0%	100%	
	Calc. D ₁₀ =	0.4125	mm	3

	New Jersey Department of Environment Site Remediation and Waste Management Extractable Petroleum Hydrocarbon (EPH) Alternati Version 10, May 1, 2019 Release Date	t al Protec Program ve Product I	tion Limit Concentra	ation Calculator	for Soil					Re Sumn	turn to nary Sheet		
	Sample 1 Lab Sample Name GS-A	Lai	S i b Sample Name	ample 2 GS-B2		Sa ab Sample Name	mple 3 GS-03		Ŀ	Sa ab Sample Name Lab Dwe	mple 4 GS-D 0.1100	mm	
			Grain Size from Sieve (mm of Sieve)	Percent of soil mass passing through the sieve	Percent of material mass retained on the sieve	Grain Size from Sieve (mm of Sieve)	Percent of soil mass passing through the sieve	Percent of material mass retained on the sieve					
			75	100.0%	0%	75	100.0%	0%					ŀ
			37.5	100.0%	0%	37.5	100.0%	0%					ľ
			19	100.0%	0%	19	100.0%	0%					Ľ
			9.5	100.0%	0%	9.5	100.0%	0%					
		_	4.75	98.0%	2%	4.75	100.0%	0%					L
			2.36	94.0%	6%	2.36	100.0%	0%					l
			2	92.5%	8%	2	100.0%	0%					l
			1.18	80.0%	20%	118	82.0%	18%					l
_			0.6	30.0%	70%	0.6	20.0%	80%					ŀ
_			0.3	7.8%	92%	0.3	4.0%	96%					ŀ
			0.15	5.5%	95%	0.15	3.8%	96%					ŀ
-		L	0.075	25%	58%	0.075	3.8%	95%					ŀ
-			0.03	25%	38%	 0.005	12%	95%					ŀ
-			0.005	2.0%	36%	0.005	0.0%	33%					ŀ
	Li		0.00.0	12%	33%	 0.00.0	0.0%	100%					ŀ
			Calc. D ₁₀ =	0.3297	mm	Calc. D ₁₀ =	0.4125	mm					

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Step 8 – The EPH Product Limit for this AOC is the median of the 4 Grain Size samples.

For this AOC, the EPH Alternative Product Limit is 8,552 mg/kg.

D10 Grain Size with 10% of Soil Passing through the Sieve (mm)	0.466	0.330	0.413	0.110
k Intrinsic Permeability (m ²) -calculated based on D ₁₀	2.39E-10	1.20E-10	1.87E-10	1.33E-11
Calculated EPH Product Limit Concentration for each grain size mg/kg of EPH sample.	8,000	8,832	8,273	13,036
Maximum Allowable EPH Concentration in Soil (i.e., NJDEP Ceiling Limit) mg/kg of EPH				
EPH Alternative Product Limit Concentration for Soil in this AOC	8,552	mg/kg EPH		

Step 9 – Save Product Limit Calculator with a *Unique Name*

Reminder:

The calculator is a Macro Enabled file, with a *.xlsm extension.





Step 10a - Print the EPH Report









Step 10b – Active Printer Screen Notice

U	E	F	G	н	1	J
the bullet corresponding to source of D ₁₀ value. MPLETE GRAIN SIZE DATA SHEET	 Direct D10 input from lab report. Input sieve D10 data and determine through calculator. 	 □ Direct D10 input from lab report. Input sieve D10 data e and determine through calculator. 	 Direct D10 input from lab report. Input sieve D10 data and determine through calculator. 	 Direct D10 input from lab report. Input sieve D10 data and determine through calculator. 		
Soil Passing through the Sieve (mm)	0.466	0.330	0.413	0.110		
(m^2) -calculated based on D ₁₀	2.39E-10	Active Printer		×		
t Limit 1 grain size mg/kg of EPH	8,000	You are going t \\Nfjersey\RICC	to print the summary OH MP C6004 PCL 6	r to this printer: on Ne10:		
PH Concentration ing Limit) mg/kg of EPH			OK	Cancel		
Product Limit Concentration for Soil in this	8,552	mg/kg EPH		Canter		
port RESET CA	LCULATOR		INS	TRUCTIONS		



Example Calculator Printout Sheet for this AOC

23 34 34 5 35 6 36 6 36 6 36 6 36 6 36 6 36 6 36 6 36 6 36 6 36 6 37 7 38 6 39 6 30 7 30 7 31 7 32 7 33 7 34 7 35 8 36 7 36 7 37 7 38 7 39 7 30 7 31 10 32 7 34 10 35 8 36 10 37 10 36 10 37 10 36	В	с	D	E	F	G	н	1
Extractable Petroleum Hydrocarbon (EPH) Alternative Product Limit Concentration Calculator for Soil Description of the Petroleum Product Description of the Petroleum Product No. 2 Heating Oil Operation of the Petroleum Product Operation of the Petroleum Product (galoe) Operation of the Petroleum Product (galoe) P Operating Oil Operating Oil Operating Oil Operating Oil Setect the number of Grain Size Samples that wee analyzed for this AOC. Operating Oil Operating Oil Operating Oil Operating Oil Operating Oil Operating Oil Operating Oil Operating Oil Operating Oil Operating Oil Operating Oil Operating Oil Operating Oil Operating Oil Operating Oil Operating Oil Operating Oil Operating Oil Operating Oil Operating Oil Operating Oil Operating Oil Operating Oil Operating Oil Operating Oil <th colspan="</td> <td>2 3 4 5</td> <td></td> <td>New Jersey Department of Site Remediation and Waste</td> <td>f Environment e Management</td> <td>al Protection Program</td> <td></td> <td></td> <td></td>	2 3 4 5		New Jersey Department of Site Remediation and Waste	f Environment e Management	al Protection Program			
9 Site Name: ABC Site Program Interest (PI) Num. 0012345 10 Area of Concern Name Former Oil Tank Area AOC No. (must correspond with CD) 10 11 Investigator's Name LSRP O'DeYear 10 12 Type of Petroleum Product No. 2 Heating Oil Default Product Indicator Concentration 8,000 mg/kg EPH 13 Iv. Dynamic Viscosity of the Petroleum Product (poise) 0.02 poise gran/cm ³ 14 Iv. Dynamic Viscosity of the Petroleum Product (poise) 0.02 poise gran/cm ³ 15 P Bensity of the Petroleum Product (gran/cm ³) 0.8245 gran/cm ³ 16 Select the number of Grain Size Samples that were analyzed I Grain Size Samples were analyzed I Grain Size Samples were analyzed 17 Sample I dentification Name/Number Sample 1 Sample 2 Sample 3 Sample 4 19 For each sample, click the bullet corresponding to source of D ₁₀ value. Offenct D0 input from lab report.	5 7 8		Extractable Petroleum Hydrocarbo Version 1.0, May 1, 2019 Release Date	on (EPH) Alternativ	ulator for Soil			
International concern Name Former Oil Tank Area AOC No. (must correspond with CD) 10 Investigator's Name LSRP O'DeYear Investigator's Name LSRP O'DeYear Investigator's Name LSRP O'DeYear Investigator's Name No. 2 Heating Oil Default Product Indicator Concentration 8,000 mg/kg EPH Investigator's Name 0.02 poixe Investigator's Name 0.02 0.02	9	Site Name:	ABC Site		Program Interest (PI) Num.	0012345	
Investigator's Name LSRP O'DeYear Investigator's Name LSRP O'DeYear Investigator's Name Investigator's Name Investigator Name Investigator's Name	0	Area of Concern Name	Former Oil Tank Ar	ea	AOC No. (must corresp	ond with CID)	10	
12 Vipe of Petroleum Product No. 2 Heating Oil Default Product Indicator 8,000 mg/kg EPH 13 µ₀ Dynamic Viscosity of the Petroleum Product (poise) 0.02 poise 0.82245 gram/cm ³ 3 15 P₀ Density of the Petroleum Product (gram/cm ⁴ 3) 0.82245 gram/cm ³ 3 16 0.82245 gram/cm ³ 3 0.82245 gram/cm ³ 3 17 Click the quantity of grain size samples that were analyzed for this AOC. 0.82245 gram/cm ³ 3 17 Click the quantity of grain size samples: 3 samples or 4 samples. Sample 1 Sample 2 Sample 3 Sample 4 19 Sample Identification Name/Number For each sample, dick the bullet corresponding to source of D ₁₀ value. Olivet D10 input from lab report. Olivet D10 data Olivet D10 input from lab report. Olivet D10 data Olivet D10 input from lab report. Olivet D10 data Olivet D10 input from lab report. Olivet size D10 data	1	Investigator's Name		LSRP O'DeYear				
Image: Noise of Petroleum Product No. 2 Heating Oil Default Product Indicator Concentration 8,000 mg/kg EPH Image: Noise Streps of the Petroleum Product (gram/cm^3) 0.02 poise 0.02 poise Image: Petroleum Product (gram/cm^3) 0.8245 gram/cm^3 Image: Petroleum Product (gram/cm^3) Image: Select the number of Grain Size Samples that were analyzed for this AOC. Click the quantity of grain size samples: 3 samples or 4 samples. Image: Petroleum Product (gram/cm^3) Image: Petroleum Product (gram/cm^3) Image: Petroleum Product (gram/cm^3) Sample 1 Sample 2 Sample 3 Sample 4 Image: Petroleum Product (gram/cm^3) Sample 1 Sample 2 Sample 3 Sample 4 Image: Petroleum Product Indicator Point Size Samples were analyzed Image: Petroleum Product Indicator Image: Petroleum Product Indicator Image: Petroleum Product Indicator Image: Petroleum Product Indicator Point Product Indicator Image: Petroleum Product Indicator Image: Petroleum Product Indicator Image: Petroleum Product Indicator Image: Petroleum Product Indicator Point Product Indicator Point Product Indicator Image: Petroleum Product Indicator Image: Petroleum Product Indicator Image: Petroleum Product Indicator Image: Petroleum Product Indicator <td< td=""><td>2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></td<>	2							
14 µ₀ Dynamic Viscosity of the Petroleum Product (poise) 0.02 poise 15 ρ₀ Density of the Petroleum Product (gram/cm^3) 0.8245 gram/cm^3 16 0.8245 gram/cm^3 17 0.8245 gram/cm^3 18 Sample for this AOC. Click the quantity of grain size samples or 4 samples. 19 Sample I dentification Name/Number Sample 1 Sample 2 Sample 3 Sample 4 11 For each sample, click the bullet corresponding to source of D ₁₀ value. Oliect D10 input from lab report. Olient D10 input from lab report. Input sive D10 data 0 and determine through calculator. Oliect D10 input from lab report. Input sive D10 data 0 and determine through calculator. Oliect D10 input from lab report. Input sive D10 data 0 and determine through calculator. Oliect D10 input from lab report. Input sive D10 data 0 and determine through calculator. Oliect D10 input from lab report. Input s	3	Type of Petroleum Product	No. 2 Heating Oil		Default Product Indicator Concentration	8,000	mg/kg EPH	
15 ρ. Density of the Petroleum Product (gram/cm^3) 0.8245 gram/cm^3 16 Select the number of Grain Size Samples that were analyzed for this AOC. Click the quantity of grain size samples: 3 samples or 4 samples. Image: Click the quantity of grain size samples: 3 samples or 4 samples. 17 19 Sample Identification Name/Number Image: Click the bullet corresponding to source of D ₁₀ value. Sample 1 Sample 2 Sample 3 Sample 4 11 For each sample, click the bullet corresponding to source of D ₁₀ value. Other D10 input from la report. Input sieve D10 data and determine through calculator. Other D10 input from la report. Input sieve D10 data and determine through calculator. Other D10 input from la report. Input sieve D10 data and determine through calculator. Other D10 input from la report. Input sieve D10 data and determine through calculator. Other D10 input from la report. Input sieve D10 data and determine through calculator. Other D10 input from la report. Input sieve D10 data and determine through calculator. Other D10 input from la report. Input sieve D10 data and determine through calculator. Other D10 input from la report. Input sieve D10 data and determine through calculator. Other D10 input from la report. Input sieve D10 data and determine through calculator. Other D10 input from la report. Input sieve D10 data and determine through calculator. Other D10 input from la report. Input sieve D10 data and determine through calculator. Otheret D10 input from la report. Input sieve D10	4 μ _o	Dynamic Viscosity of the Petroleum Product	t (poise)	0.02	poise			
6 Select the number of Grain Size Samples that were analyzed for this AOC Click the quantity of grain size samples: 3 samples or 4 samples. 17 19 19 Sample Identification Name/Number 19 Sample Identification Name/Number 19 For each sample, dick the bullet corresponding to source of D ₁₀ value. 12 COMPLETE GRAIN SIZE DATA SHEET 13 D ₁₀ Grain Size with 10% of Soil Passing through the Sieve (mm) 14 Intrinsic Permeability (m ²) -calculated based on D ₁₀ 15 Calculated EPH Product Llimit Concentration for each grain size sample, mg/kg of EPH	5 <i>ρ</i> ₀	Density of the Petroleum Product (gram/cm/	^3)	0.8245	gram/cm^3			
19 Sample 1 Sample 2 Sample 2 Sample 3 Sample 4 20 Sample Identification Name/Number Sample 1 Sample 1 Sample 2 Sample 3 Sample 4 21 For each sample, click the bullet corresponding to source of D10 value. Direct D10 input from lab report. Direct D10 input from lab report. Direct D10 input from lab report. Input sieve D10 data and determine through calculator. COMPLETE GRAIN SIZE DATA SHEET Complete GRAIN SIZE DATA SHEET Output sieve D10 data and determine through calculator. Output sieve D10 data and deter	7	Select the number of Grain Size Samples th analyzed for this AOC. Click the quantity of grain size samples: 3 sa	nat were mples or 4 samples.	O 3 Grain Size Samples	were analyzed	4 Grain Size Samples were	e analyzed	
20 Sample Identification Name/Number 21 For each sample, dick the bullet corresponding to source of D ₁₀ value. 22 Direct D10 input from lab report. 22 COMPLETE GRAIN SIZE DATA SHEET 23 Of ain Size with 10% of Soil Passing through the Sieve (mm) 44 Intrinsic Permeability (m ²) -calculated based on D ₁₀ 25 Calculated EPH Product Limit Concentration for each grain size sample, mg/kg of EPH	9			Sample 1	Sample 2	Sample 3	Sample 4	
A1 For each sample, dick the bullet corresponding to source of D ₁₀ value. Direct D10 input from lab report. Input sieve D10 data on determine through calculator. Direct D10 input from lab report. Input sieve D10 data on determine through calculator. Direct D10 input from lab report. Input sieve D10 data on determine through calculator. © Direct D10 input from lab report. Input sieve D10 data on determine through calculator. © Direct D10 input from lab report. Input sieve D10 data on determine through calculator. © Direct D10 input from lab report. Input sieve D10 data on determine through calculator. © Direct D10 input from lab report. Input sieve D10 data on determine through calculator. © Direct D10 input from lab report. Input sieve D10 data on determine through calculator. © Direct D10 input from lab report. Input sieve D10 data on determine through calculator. 24 D ₁₀ Grain Size with 10% of Soil Passing through the Sieve (mm) 0.466 0.330 0.413 0.110 15 k Intrinsic Permeability (m ²) -calculated based on D ₁₀ 2.39E-10 1.20E-10 1.87E-10 1.33E-11 0 Calculated EPH Product Limit Concentration for each grain size sample. mg/kg of EPH 8,000 8,832 8,273 13,036	0	Sample Identification Name/Number						
23 0.0 Grain Size with 10% of Soil Passing through the Sieve (mm) 0.466 0.330 0.413 0.110 15 k Intrinsic Permeability (m ²) -calculated based on D ₁₀ 2.39E-10 1.20E-10 1.87E-10 1.33E-11 16 Calculated EPH Product Limit Concentration for each grain size sample. mg/kg of EPH 8,000 8,832 8,273 13,036	1	For each sample, click the bullet correspon	ding to source of D ₁₀ value.	 Direct D10 input from lab report. Input sieve D10 data and determine through calculator. 	 Direct D10 input from lab report. Input sieve D10 data and determine through calculator. 	O Direct D10 input from lab report. Input sieve D10 data and determine through calculator.	 Direct D10 input from lab report. Input sieve D10 data and determine through calculator. 	
24 D10 Grain Size with 10% of Soil Passing through the Sieve (mm) 0.466 0.330 0.413 0.110 15 k Intrinsic Permeability (m²) -calculated based on D10 2.39E-10 1.20E-10 1.87E-10 1.33E-11 16 Calculated EPH Product Limit Concentration for each grain size sample. mg/kg of EPH 8,000 8,832 8,273 13,036	3							
k Intrinsic Permeability (m²) -calculated based on D10 2.39E-10 1.20E-10 1.87E-10 1.33E-11 26 Calculated EPH Product Limit Concentration for each grain size sample. mg/kg of EPH 8,000 8,832 8,273 13,036	4 D ₁₀	Grain Size with 10% of Soil Passing through t	the Sieve (mm)	0.466	0.330	0.413	0.110	
Calculated EPH Product Limit mg/kg of EPH 8,000 8,832 8,273 13,036	5 k	Intrinsic Permeability (m ²) -calculated based or	n D ₁₀	2.39E-10	1.20E-10	1.87E-10	1.33E-11	
Calculated EPH Product Limit mg/kg of EPH 8,000 8,832 8,273 13,036	6							
	7	Calculated EPH Product Limit Concentration for each grain size sample.	mg/kg of EPH	8,000	8,832	8,273	13,036	
Maximum Allowable EPH Concentration in Soil (i.e., NJDEP Ceiling Limit)		Maximum Allowable EPH Concentration in Soil (i.e., NJDEP Ceiling Limit)	mg/kg of EPH					
EPH Alternative Product Limit Concentration for Soil in this AOC 8,552 mg/kg EPH	8		Concentration for Soil in this	0.550	ma/ka EDH			
	9	EPH Alternative Product Limit AOC		8,552	mg/kg EPH			



Created: 5/13/2019

Calculator Printout Reference

uct Limit Concentration for Soil in this

mg/kg EPH

8,552

File Version: NJDEP EPH Alternative Product Limit Calculator - FINAL TRAINING

Created: 5/13/2019

The calculator print setup includes the name of the calculator file in Excel format and The date the Calculator was printed



Step 11 – Reset Calculator for Next AOC

D ₁₀	Grain Size with 10% of Soil Passing through	n the Sieve (mm)	0.466	0.330	0.413	0.110
k	Intrinsic Permeability (m ²) -calculated based	on D ₁₀	2.39E-10	1.20E-10	1.87E-10	1.33E-11
	Calculated EDU Droduct Limit					
	Concentration for each grain size sample.	mg/kg of EPH	8,000	8,832	8,273	13,036
	Maximum Allowable EPH Concentration in Soil (i.e., NJDEP Ceiling Limit)	mg/kg of EPH				
	EPH Alternative Product Limit AOC	Concentration for Soil in this	8,552	mg/kg EPH		





I.



A Reset Calculator Screen

No site data No Petroleum type No D₁₀ values No EPH values Identical Intrinsic Permeability values



в	L C	U	L E	F	6	н	
		Extractable Petroleum Hydrocar Soil Version 1.0, May 1, 2019 Release Date	bon (EPH) Alterna	tive Product Limi	t Concentration (Calculator for	
	Site Name:			Program Interest	(PI) Num.		
	Area of Concern Name			AOC No. (must corre	espond with CID)		
	Investigator's Name				· · ·		
	Type of Petroleum Product			Default Product Indicator Concentration	#N₽A	mg/kg EPH	
μ,	Dynamic Viscosity of the Petrole	eum Product (poise)	#N#A	poise			
ρ.	, Density of the Petroleum Produc	ct (gram/cm^3)	#N/A	gram/cm^3			
	Select the number of Grain analyzed for this ADC. Click the quantity of grain size s	Size Samples that were amples: 3 samples or 4 samples.	🍘 3 Grain Size Samples	were analyzed	🗘 4 Grain Size Samples wer	e analyzed	
			Sample 1	Sample 2	Sample 3	Sample 4	
	Sample Identification Name	Number					
	For each sample, click the	bullet corresponding to source of	 Direct D10 input from lab report. 	 Direct D10 input from lab report. 	Cirect D10 input from lab report.	Direct D10 input from lab report.	
	D ₁₀ value.		Input sieve D10 data	Input sieve D10 data	Input sieve D10 data C and determine	Input sieve D10 data	
	COMPLETE GRAI	N SIZE DATA SHEET	through calculator.	through calculator.	through calculator.	through calculator.	
D ₁₀	, Grain Size with 10% of Soil Pass	ing through the Sieve (mm)	0.000	0.000	0.000	0.000	
k	Intrinsic Permeability (m²)-calcul	ated based on D_{10}	1.10E-11	1.10E-11	1.10E-11	1.10E-11	
	Calculated EPH Product Liv	mit					
	Concentration for each grai size sample.	n mg/kg of EPH	#N/A	#N/A	#N/A		
	Maximum Allowable EPH Concentration in Soil (i.e., NJDEP Ceiling Limit)	mg/kg of EPH	#N/A	#N/A	#N/A		
	EPH Alternative Product this AOC	Limit Concentration for Soil in	#N/A	mg/kg EPH			
				-			

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Instructions Fly-Out Sheet

$D_{10}~$ Grain Size with 10% of Soil Passing through the Sieve (mm)	0.466	0.330	0.413	0.110
k Intrinsic Permeability (m ²) -calculated based on D ₁₀	2.39E-10	1.20E-10	1.87E-10	1.33E-11
Calculated EPH Product Limit Concentration for each grain size mg/kg of EPH sample.	8,000	8,832	8,273	13,036
Maximum Allowable EPH Concentration in Soil (i.e., NJDEP Ceiling Limit) mg/kg of EPH				
EPH Alternative Product Limit Concentration for Soil in this AOC	8,552	mg/kg EPH		







Instructions Fly-Out Sheet

С D E F G H I J K L M N O P Q R S T U V AB 2 Close Instructions New Jersey Department of Environmental Protection 3 Instructions for using the EPH Alternative Product Limit Concentration Calculator. Site Remediation and Waste Management Program Use this calculator in accordance with the Department's Technical Guidance for Evaluation of Extractable Petroleum Hydrocarbons in Soil. This calculator provides a tool for the investigator to calculate an AOC-specific Extractable Petroleum Hydrocarbon (EPH) Alternative Product Limit Concentration Calculator for alternative EPH product limit concentration. To use the calculator, the investigator must identity the petroleum Soil product as listed in Table 2-1 at N.J.A.C. 7:26E-2.1(d) and have the laboratory report of the grain size 6 7 8 Version 1.0, May 1, 2019 Release Date distribution analyses. The investigator can input the effective diameter (D₁₀) reported by the laboratory, or the investigator can input the grain size distribution values and the calculator will generate the D₁₀ value. Site Name: э ABC Site Program Interest (PI) Num. 0012345 Complete the following actions: Area of Concern Name 10 Former Oil Tank Area ADC NO. (must correspond with CID) 10 1. Input the general information including the Site Name, PI number for the Site, AOC Name and AOC Investigator's Name Number from the CID as applicable, and the investigator's name in the corresponding blue fields. LSRP O'DeYear 12 2. To the right of "Type of Petroleum Product", click in the blue field, and then select the applicable Default Product petroleum product from the dropdown list (identical to Table 2-1 at N.J.A.C. 7:26E-2.1(d)). If the Type of Petroleum Product No. 2 Heating Oil Indicator 8,000 mg/kg EPH petroleum product is Waste Oil with known source(s), select instead the source petroleum product Concentration 13 from the dropdown list; or if the source petroleum product is not identified on the dropdown list or is Dynamic Viscosity of the Petroleum Product (poise) unknown, select Unknown Petroleum Hydrocarbon. This ensures the correct dynamic viscosity and 0.02 poise density values are incorporated into the calculation. . Density of the Petroleum Product (gram/cm^3) 0.8245 gram/cm^3 Contact the Department if the petroleum product is MGP or Crude Oil. Select the number of Grain Size Samples that were 3. Choose the selector button corresponding to the number of grain size samples that were analyzed. The 3 Grain Size Samples were analyzed 4 Grain Size Samples were analyzed analyzed for this AOC. selection options are 3 and 4 samples. Click the quantity of grain size samples: 3 samples or 4 samples. 4. In the blue fields to the right of Sample Identification Name/Number, input the Sample ID for each sample analyzed for grain size. Sample 1 Sample 2 Sample 3 Sample 4 19 5. For each sample, click the radio button corresponding to source of the D₁₀ value. Sample Identification Name/Number 20 The default option is "Direct D₁₀ input from lab report" when D₁₀ has been calculated and reported by Direct D10 input Direct D10 input Direct D10 input Direct D10 input from lab report. from lab report. the laboratory. If this option is chosen, click on the blue box: COMPLETE GRAIN SIZE DATA SHEET, from lab report from lab report For each sample, click the bullet corresponding to source of 21 which opens the sheet Grain Size Data Entry. Click in the gray field to the right of Lab D₁₀ and enter the Input sieve D10 data Input sieve D10 data Input sieve D10 da Input sieve D10 dat D₁₀ value. and determine and determine and determine and determine D10 value. Do this for each sample. When finished, click Return to Summary. through calculator. through calculator through calculator through calculator. 22 COMPLETE GRAIN SIZE DATA SHEET If D₁₀ is not provided by the laboratory, the investigator selects "Input sieve D₁₀ data and determine through this calculator". Next, click on the blue box: COMPLETE GRAIN SIZE DATA SHEET, which opens 23 the sheet Grain Size Data Entry. In the column titled "Grain Size from Sieve (mm of Sieve)", starting at D₁₀ Grain Size with 10% of Soil Passing through the Sieve (mm) 0.466 0.330 0.413 0.110 the bottom, enter the corresponding sieve size in mm from finest upward to coarsest for each sieve size reported by the laboratory. In the column directly to the right titled "Percent of soil mass passing k Intrinsic Permeability (m²) -calculated based on D₁₁ 2.39E-10 1.20E-10 1.87E-10 1.33E-11 25 through the sieve", enter the percent passing corresponding to each sieve size. The D₁₀ value for the 26 sample is displayed in the gray field to the right of "Calc D10". Continue the data entry process for the **Calculated EPH Product Limit** remainder of the samples. When finished, click: Return to Summary Concentration for each grain mg/kg of EPH 8.000 8.832 8.273 13.036 27 size samnle 6. The Summary Sheet displays the D₁₀ value for each sample and computes the intrinsic permeability (k), Maximum Allovable EPH displaying both parameters below the corresponding sample in the green fields. Concentration in Soil (i.e., mg/kg of EPH 28 NJDEP Ceiling Limit) 7. The Calculated EPH Product Limit Concentration for each sample is displayed on Line 27. If a displayed Calculated EPH Product Limit Concentration has a strikethrough, then the concentration for that EPH Alternative Product Limit Concentration for Soil in sample exceeds the 30,000 mg/kg EPH Ceiling Limit. mg/kg EPH 8.552 this AOC 29 8. Line 29 provides the Alternative EPH Product Limit Concentration for Soil in this AOC (cell E29). The 30 concentration is the lesser of the median value for the Calculated EPH Product Limit Concentrations 31 32 from Line 27 -OR- the 30,000 mg/kg EPH ceiling limit. 33 9. Save the spreadsheet with a unique file name and date within the project file. 10. Print the Summary Sheet by selecting "PRINT EPH Report". Return to the Grain Size Data Entry sheet **PRINT EPH Report** and print it separately. 11. To run another set of samples or to calculate an Alternative EPH Product Limit Concentration for a second petroleum product stored/discharged at the AOC, click "RESET CALCULATOR" and return to Step

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Instructions – Intro & Action 1 to 4

Instructions for using the EPH Alternative Product Limit Concentration Calculator.

Use this calculator in accordance with the Department's *Technical Guidance for Evaluation of Extractable Petroleum Hydrocarbons in Soil*. This calculator provides a tool for the investigator to calculate an AOC-specific alternative EPH product limit concentration. To use the calculator, the investigator must identity the petroleum product as listed in Table 2-1 at N.J.A.C. 7:26E-2.1(d) and have the laboratory report of the grain size distribution analyses. The investigator can input the effective diameter (D_{10}) reported by the laboratory, or the investigator can input the grain size distribution values and the calculator will generate the D_{10} value.

Complete the following actions:

- 1. Input the general information including the Site Name, PI number for the Site, AOC Name and AOC Number from the CID as applicable, and the investigator's name in the corresponding blue fields.
- 2. To the right of "Type of Petroleum Product", click in the blue field, and then select the applicable petroleum product from the dropdown list (identical to Table 2-1 at N.J.A.C. 7:26E-2.1(d)). If the petroleum product is Waste Oil with known source(s), select instead the source petroleum product from the dropdown list; or if the source petroleum product is not identified on the dropdown list or is unknown, select Unknown Petroleum Hydrocarbon. This ensures the correct dynamic viscosity and density values are incorporated into the calculation.

Contact the Department if the petroleum product is MGP or Crude Oil.

- 3. Choose the selector button corresponding to the number of grain size samples that were analyzed. The selection options are 3 and 4 samples.
- 4. In the blue fields to the right of **Sample Identification Name/Number**, input the Sample ID for each sample analyzed for grain size.



Instructions – Action 5 to 8

5. For each sample, click the radio button corresponding to source of the D_{10} value.

The default option is "Direct D_{10} input from lab report" when D_{10} has been calculated and reported by the laboratory. If this option is chosen, click on the blue box: **COMPLETE GRAIN SIZE DATA SHEET**, which opens the sheet **Grain Size Data Entry**. Click in the gray field to the right of Lab D_{10} and enter the D_{10} value. Do this for each sample. When finished, click **Return to Summary**.

If D_{10} is not provided by the laboratory, the investigator selects "Input sieve D_{10} data and determine through this calculator". Next, click on the blue box: **COMPLETE GRAIN SIZE DATA SHEET**, which opens the sheet **Grain Size Data Entry**. In the column titled "Grain Size from Sieve (mm of Sieve)", starting at the <u>bottom</u>, enter the corresponding sieve size in mm from <u>finest upward to coarsest</u> for each sieve size reported by the laboratory. In the column directly to the right titled "Percent of soil mass passing through the sieve", enter the percent passing corresponding to each sieve size. The D_{10} value for the sample is displayed in the gray field to the right of "Calc D_{10} ". Continue the data entry process for the remainder of the samples. When finished, click: **Return to Summary**

- 6. The **Summary Sheet** displays the D₁₀ value for each sample and computes the intrinsic permeability (k), displaying both parameters below the corresponding sample in the green fields.
- 7. The Calculated EPH Product Limit Concentration for each sample is displayed on Line 27. If a displayed Calculated EPH Product Limit Concentration has a strikethrough, then the concentration for that sample exceeds the 30,000 mg/kg EPH Ceiling Limit.
- 8. Line 29 provides the <u>Alternative EPH Product Limit Concentration for Soil in this AOC</u> (cell E29). The concentration is the lesser of the median value for the Calculated EPH Product Limit Concentrations from Line 27 -OR- the 30,000 mg/kg EPH ceiling limit.

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Instructions – Action 9 to 11

- 9. Save the spreadsheet with a unique file name and date within the project file.
- 10. Print the **Summary Sheet** by selecting "**PRINT EPH Report**". Return to the **Grain Size Data Entry** sheet and print it separately.
- 11. To run another set of samples or to calculate an Alternative EPH Product Limit Concentration for a second petroleum product stored/discharged at the AOC, click "RESET CALCULATOR" and return to Step 1.

Close Instructions – Selection button.

а а в	C C	DE	FG	H	
		New Jersey Department of Enviro Site Remediation and Waste Manage Extractable Petroleum Hydrocarbon (EPH) / Soil	Close instructions Instructions for using the EPH Alternative Product Limit Concentration Calculator. Use this calculator in accordance with the Department's Technical Guidance or Evaluation of Extractable Petroleum Hydrocarbons in Soil. This calculator provides a tool for the investigator must identity the petroleum product limit concentration. To use the calculator, the investigator must identity the petroleum product as listed in Table 2-1 at N.J.A.C. 7:26F-2.1(d) and have the laboratory report of the grain size distribution paperson.		
	Site Name:		Decision laboration (DI) Marca	0010045	distribution analyses. The investigator can input the effective diameter (v_{10}) reported by the laboratory, or the investigator can input the grain size distribution values and the calculator will generate the D_{10} value.
	Area of Concern Name	ABL Site	Program Interest (PI) Num.	10	Complete the following actions:
-		Former Uit Tank Area	AUL NO. (must correspond with CID)	IU	 Input the general information including the Site Name, PI number for the Site, AOC Name and AOC



Eccentricities in the Calculator

- 1. Quantity of Grain Size Samples Radio selector buttons
- 2. Same grain sizes Different Petroleum Product Type
- 3.Grain Size Samples Yielding Alternate Product Limit Concentrations Above and Below the Ceiling Limit
- 4.Grain Size Samples are below the Default Product Limit Concentration



Quantity of Grain Size Samples Must be Confirmed See "Radio" Selector Buttons



Same Grain Sizes – Different Petroleum Product Type

<u>#2 Fuel Oil</u> = 8,552 mg/kg

No. 2 Heating Oil	•	Default Product Indicator Concentration	8,000	mg/kg EPH
roduct (poise)	0.02	poise		
am/cm^3)	0.8245	gram/cm^3		
les that were 25: 3 samples or 4 samples.	3 Grain Size Samples	; were analyzed	4 Grain Size Samples were	e analyzed
	Sample 1	Sample 2	Sample 3	Sample 4
sponding to source of D ₁₀ value.	 Direct D10 input from lab report. Input sieve D10 data and determine through calculator. 	 □ Direct D10 input from lab report. Input sieve D10 data € and determine through calculator. 	C Direct D10 input from lab report. Input sieve D10 data and determine through calculator.	 Direct D10 input from lab report. Input sieve D10 data and determine through calculator.
rough the Sieve (mm)	0.466	0.330	0.413	0.110
pased on D ₁₀	2.39E-10	1.20E-10	1.87E-10	1.33E-11
mg/kg of EPH	8,000	8,832	8,273	13,036
on mg/kg of EPH				
mit Concentration for Soil n th	is 8,552	mg/kg EPH		

<u>Hydraulic Oil</u> = 18,966 mg/kg

Hydraulic Oil	¥	Default Product Indicator Concentration	17,000	mg/kg EPH
roduct (poise)	1.02	poise		
am/cm^3)	0.8727	gram/cm^3		
oles that were es: 3 samples or 4 samples.	O 3 Grain Size Samples were analyzed			e analyzed
	Sample 1	Sample 2	Sample 3	Sample 4
esponding to source of D ₁₀ value.	 Direct D10 input from lab report. Input sieve D10 data and determine through calculator. 0.466	 Direct D10 input from lab report. Input sieve D10 data and determine through calculator. 	C Direct D10 input from lab report. Input sieve D10 data and determine through calculator. 0.413	 Direct D10 input from lab report. Input sieve D10 data Cand determine through calculator.
based on D ₁₀	2.39E-10	1.20E-10	1.87E-10	1.33E-11
mg/kg of EPH	17,025	19,948	17,984	34,710
on mg/kg of EPH				30,000
mit Concentration for Soil in this	18,966	mg/kg EPH		
				4

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Grain Size Samples Yielding Alternate Product Limit Concentrations Above and Below the Ceiling Limit

Hydraulic Oil example

- 2 Samples calculate > 30,000
- 2 Samples calculate < 30,000
- Result = Median using the calculated values (31,038 and 34,710 mg/kg)





Grain Size Samples are below the Default Product Limit Concentration

#4 Fuel Oil Examples

4 Samples calculate > 17,000 mg/kg

"C" Result = 14,378 mg/kg

LSRP is allowed to use the Cat 2 Default Product Indicator Concentration = 17,000 mg/kg





Questions?





What to Include in Report Submissions

John Ruhl, Technical Coordinator Bureau of Environmental Evaluation and Risk Assessment







- EPH Alternative Product Limit Calculation Report content
- Conclusions
- EPH Technical Questions / Dept. Contact





What to Submit -EPH Alternative Product Limit

Technical Rules

- Applicable phase documentation/discussion
- Information pursuant to N.J.A.C. 7:26E-1.6





What to Submit -EPH Alternative Product Limit (cont'd)

AOC-specific info:

- Petroleum product identity
- Source Description (e.g., UST, AST, etc.)/Cause of discharge
- EPH product limits (defaults and alternative)
- Figures & vertical soil profiles across EPH product zone demonstrating delineation (include boring logs) [refer to Figure 2.1-1 in the guidance]
- All printouts from EPH Alternative Product Limit Calculator
- Complete lab data deliverables for all grain size distribution analysis(es): how D₁₀ calculated





EPH Grain Size Sample Notes - Horizontal





Typical Cross Sections- Grain Size Sample Locations



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How to Use pre-September 2010 TPH Data

Cat 1 EPH only

• TPH data can be used

TPH/EPH data considered comparable (1:1 ratio)

• TPH or EPH > 1,000 mg/kg

• Resample 25% for naphthalene & 2-methylnaphthalene

Bias locations to highest TPH/EPH detections

• Remediate TPH > 10,000 mg/kg







How to Use pre-September 2010 TPH Data

Cat 2 EPH only

- TPH >2,300 mg/kg and \leq 10,000 mg/kg
 - Resample 25% of TPH samples for EPH (determines health-based criteria)
 Bias locations to highest TPH

If EPH results are above health-based criteria, delineation required

- TPH results > 10,000 mg/kg:
 - Remediate, OR
 - Resample, analyze using EPH Method, and use SRC Calculator







Conclusions

- Majority of the Evaluation of EPH in Soil Technical Guidance is <u>not</u> new information
- One new important tool the EPH Alternative Product Limit Calculator




Helpful Links

Link to Evaluation of Extractable Petroleum Hydrocarbons (EPH) in Soil Technical Guidance: https://www.nj.gov/dep/srp/guidance/

Link to SRRA Contacts: <u>https://www.nj.gov/dep/srp/srra/srra_contacts.htm</u>









QUESTIONS?

EPH Category 2 Ingestion/ Dermal Calculator Soil Remediation Criteria for Residential & Non-Residential Standards Training Section

Dave Puchalski, LSRP, PE

- NewFields Princeton, LLC
- dpuchalski@newfields.com



EPH Category 2 Health-based Soil Remediation Criterion Calculator

Goals of the Section

- Introduce the calculator format
- Describe the data entry process
- Identify the input variables and calculator output
 - Present Two Samples with the same EPH Concentration, but different chemical characteristics
 - Provide limited overview of the calculations





EPH Category 2 Chemical Speciation What are Aliphatics and Aromatics?

Aliphatics

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- Contains Carbon and Hydrogen joined together as straight chains, branched chains, or cyclic non-aromatic hydrocarbons
- May contain single, double, and triple bonds
- Include Petroleum Constituents
- Examples: Alkanes, Alkenes, Alkynes, Cycloalkanes

Aromatics

- Cyclic Compounds with Carbon joined together in alternating single and double bonds.
- Contains one or more aromatic rings (Benzene rings)
- Generally more volatile, more toxic, variable solubility
- Examples: Monoaromatics, Polyaromatic Hydrocarbons
- Benzene, Toluene, Phenol, Benzo(a)pyrene

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Aliphatic Ranges & Indicator Compounds

Carbon Range	AL 9-12	AL 12-16	AL 16-21	AL 21-40
Indicator Compound	Nonane	Dodecane	Hexadecane	Docosane
Chemical Formula	C9H20	C12H26	C16H34	C22H46
Molecular Weight, g/mol	128.3 g/mol	170.3 g/mol	226.4 g/mol	310.6 g/mol
Water Solubility, ug/L @25 deg C	220 ug/l	3.7 ug/l	0.021 ug/l	0.00078 ug/l
Vapor Pressure, Pa	593.3 Pa /	18.0 Pa /	0.20 Pa /	0.0002 Pa /
@25 deg C	0.086 psi	0.001 psi	2.95 x10 ⁻⁵ psi	2.95 x10 ⁻⁸ psi
Structure	H H H H H H H H H H-C-C-C-C-C-C-C-C-C-H H H H H H H H H H	ң нң нң нң нң нң н ^ң с ^{, с} с ^{, с} с ^{, с} с ^{, с} с с с с с с с с с с с с с с с с с с	Straight Chain n- Alkane	Straight Chain n- Alkane
			Too large to present	Too large to present

Aromatic Ranges & Indicator Compounds

Carbon Range	AR 10-12	AR 12-16	AR 16-21	AR 21-36
Indicator Compound	<u>Naphthalene</u>	Acenaphthene	Fluorene	Fluoranthene
Chemical Formula	C10H8	C12H10	C13H10	C16H10
Molecular Weight, g/mol	128.2 g/mol	154.2 g/mol	166.2 g/mol	202.3 g/mol
Water Solubility, ug/L @25 deg C	31,000 ug/l	3,900 ug/l	1,690 ug/l	230 ug/l
Vapor Pressure, Pa @25 deg C	11.3 Pa / 0.0016 psi	0.3 Pa / 4.3 x10 ⁻⁵ psi	0.08 Pa / 1.16 x10 ⁻⁵ psi	0.001 Pa / 1.45 x10 ⁻⁷ psi
Structure				

Step 1- Opening the Excel File

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FIL	E HON	ME INSERT	PAGE LAYOUT	FORMULAS	DATA	REVIEW VIE	EW ACROB	.T					
Ð	PROTECTE	D VIEW Be care	ful—files from the I	nternet can cont	tain viruses. Unle	ess you need to e	dit, it's safer to s	ay in Protected \	/iew. Enabl	le Editing			
C2		: X	s fx										
	А	В	С	D	E	F	G	Н	I	J	K	L	
1		EPH Ca	tegory 2 Ing	estion/Der	mal Resid	ential Calci	ulator - Ver	sion 2018					
2	Site	Name:						Date:				Calculated or I	
3 4	Sam	iple ID:					Evaluated by:					Required data Optional data	
		ECEV -		THQ *	AT * BW * 36	5 d/yr							
5			(EF * ED * 10 ⁻⁶)	$(kg/mg) * \left[\left(\frac{R}{R} \right) \right]$	$\frac{1}{fD_o} * IR + ($	$\frac{1}{RfD_D} * SA * A$	F * ABS _d * EV	<u>·)]</u>			Reset		
		ID -		Т	НQ								
		$\frac{ID_{ne}}{FCF}$	$\frac{f_{(2)}}{V} + \frac{f_{(2)}}{FCFV} + \frac{f_{(2)}}{FC}$	$\frac{f_{(3)}}{FV} + \frac{f_{(4)}}{FCFV}$	$+\frac{f_{(5)}}{FCFV}+\frac{f}{FC}$	$\frac{f_{(6)}}{FV} + \frac{f_{(7)}}{FCFV} + \frac{f_{(7)}}{FCFV}$	$\frac{f_{(8)}}{FCFV}$			E	Back to EPH	Menu	
6		LUT	V(1) LCFV(2) LC	r V ₍₃₎ L Cr V ₍₄₎	LUTV ₍₅₎ LU.	rv ₍₆₎ LCrv ₍₇₎	LC1 V (8)			_			
		AL9-12	AL12-16	AL16-21	AL21-40	AR10-12	(Acenaphthen	AR16-21	AR21-36				
7		(PHC Mixture)	(PHC Mixture)	(Mineral Oil)	(Mineral Oil)	(Naphthalene)	e)	(Fluorene)	(Fluoranthene)		Evit		
8	RfD₀	0.1	0.1	2	2	0.041	0.06	0.04	0.04		EXIL		
9	RfD _D	0.1	0.1	2	2	0.041	0.06	0.04	0.04				
10	ABSd	0.1	0.1	0.1	0.1	0.13	0.13	0.13	0.13				

Step 2- Enable Macros & Enable Content

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FI	LE HOI	ME INSERT	PAGE LAYOUT	FORMULAS	S DATA	REVIEW VI	EW ACROBA	т						
!	SECURITY	WARNING Som	e active content ha	s been disabled.	Click for more d	letails. Enal	ble Content							
C2		• : 🗙	$\checkmark f_x$											
	А	В	С	D	E	F	G	Н	I	J	K	L	М	
1		EPH Ca	tegory 2 Ing	estion/Der	mal Resid	ential Calc	ulator - Ver	sion 2018						
2	Site	Name:						Date:				Calculat	ed or lock	ed ce
3 4	San	nple ID:					Evaluated by:					Required Optional	l data enti data entry	ry //moo
		ECEV -		THQ *	AT * BW * 36	i5 d/yr								
5		ECTV =	(EF * ED * 10 ⁻⁶⁾	$kg/mg) * \left[\left(\overline{R} \right) \right]$	$\frac{1}{fD_o} * IR + ($	$\frac{1}{RfD_D} * SA * A$	F * ABS _d * EV	·)]			Reset			
		$ID_{nc} = \frac{f_{cc}}{\frac{f_{cc}}{ECF}}$	$\frac{f_{(2)}}{V_{(2)}} + \frac{f_{(2)}}{ECFV_{(2)}} + \frac{f_{(2)}}{EC}$	$\frac{f_{(3)}}{FV_{(3)}} + \frac{f_{(4)}}{ECFV_{(4)}}$	$\frac{HQ}{+\frac{f_{(5)}}{ECFV_{(5)}}+\frac{J}{EC}}$	$f_{(6)} + \frac{f_{(7)}}{ECFV_{(7)}} + \frac{f_{(7)}}{ECFV_{(7)}}$	$+\frac{f_{(s)}}{ECFV_{(s)}}$			В	ack to EPH Mer	ıu		
6									170100	_				
7		AL9-12 (PHC Mixture)	AL12-16 (PHC Mixture)	AL16-21 (Mineral Oil)	AL21-40 (Mineral Oil)	(Naphthalene)	(Acenaphthen e)	(Fluorene)	AR21-36 (Fluoranthene)					
8	RfD₀	0.1	0.1	2	2	0.041	0.06	0.04	0.04		Exit			
9	RfD _D	0.1	0.1	2	2	0.041	0.06	0.04	0.04	_				
10	ABS _d	0.1	0.1	0.1	0.1	0.13	0.13	0.13	0.13					
11	COULD FUEL	6110	6110	122210	122210	2261	2//1	2204	2204					

Step 3 – Select Residential/ Nonresidential Standard for the Calculator







Step 4 – Define the Site and Sample Name

4	Α	В	С	D	Е	F	G	Η		J	K	L		М	
1		EPH Cat	tegory 2 Ing	estion/Der	mal Resid	ential Calc	ulator - Ver	rsion 2018							
2	Site I	Name:	ABC Site					Date:	5/1/2019			Calcula	ted or I	locked c	ell
3 4	Sam	ple ID:		EPH	-A		Evaluated by:	LSRP 0	'DeYear			Require Optiona)d data I data (entry entry/mo)dif
5		ECFV = - ($(EF * ED * 10^{-6})$	$THQ *$ $kg/mg) * \left[\left(\frac{R}{R} \right) + \frac{f_{(4)}}{R} \right]$	$\frac{AT * BW * 36}{fD_o} * IR + \left(\frac{1}{fD_o} + \frac{1}{fD_o} + \frac{1}{fD_o} + \frac{1}{fD_o} + \frac{1}{fD_o} + \frac{1}{fD_o} + \frac{1}{DD_o} $	$\frac{1}{RfD_D} * SA * A$	$F * ABS_d * EV$	<u>·)]</u>		B	Reset	:011			
6		ECF	$V_{(1)} ECFV_{(2)} EC$	FV ₍₃₎ ECFV ₍₄₎	ECFV ₍₅₎ EC	FV ₍₆₎ ECFV ₍₇₎	ECFV ₍₈₎			_					
7		AL9-12 (PHC Mixture)	AL12-16 (PHC Mixture)	AL16-21 (Mineral Oil)	AL21-40 (Mineral Oil)	AR10-12 (Naphthalene)	(Acenaphthen e)	AR16-21 (Fluorene)	AR21-36 (Fluoranthene)						
8	RfD₀	0.1	0.1	2	2	0.041	0.06	0.04	0.04		Exit				
9	RfD _D	0.1	0.1	2	2	0.041	0.06	0.04	0.04	_					
10	ABSd	0.1	0.1	0.1	0.1	0.13	0.13	0.13	0.13						
а а 🛛	OBULEOEV	0440	0440	100010	100010	0054	0.4.44	0004	0004						

Step 5 – Define EPH Fractionation Total EPH = 16,900 mg/kg; Majority is Aliphatic

_	~ ~ ~	D	<u> </u>			· · · ·			•	· · ·	15	L (V)	1.4
3 1	Sam	ple ID:		EPH	I-A		Evaluated by:	LSRP 0	'DeYear		Rec Opti	quired data entry ional data entry/modi	ficatior
5		ECFV = -	(EF * ED * 10 ⁻⁶⁾			Reset							
6		$\frac{ID_{sc} - \frac{f_{cl}}{ECF}}{AI 9-12}$	$\frac{f_{(2)}}{V_{(1)}} + \frac{f_{(2)}}{ECFV_{(2)}} + \frac{f_{(2)}}{EC}$	$\frac{f_{(3)}}{FV_{(3)}} + \frac{f_{(4)}}{ECFV_{(4)}}$	$+\frac{f_{(5)}}{ECFV_{(5)}}+\frac{f}{EC}$	$\frac{f_{(6)}}{FV_{(6)}} + \frac{f_{(7)}}{ECFV_{(7)}} + \frac{f_{(7)}}{ECFV_{(7)}$	$\frac{f_{(8)}}{ECFV_{(8)}}$	AR16-21	AR21-36		Back to EPH Menu		
7		(PHC Mixture)	(PHC Mixture)	(Mineral Oil)	(Mineral Oil)	(Naphthalene)	e)	(Fluorene)	(Fluoranthene)		-		
3	RfD₀	0.1	0.1	2	2	0.041	0.06	0.04	0.04		Exit		
9	RfD₀	0.1	0.1	2	2	0.041	0.06	0.04	0.04				
0	/ 000	0.1	0.1	0.1	0.1	0.15	0.15	0.15	0.13				
1	Chil ECFV	6110	6110	122210	122210	2351	3441	2294	2294				
2	Concentratio n of fraction (n g/kg)	2000	1000	6500	6500	200	100	300	300	←	Enter EP for each	H Concentration fraction. ND=0	n)
3	f	0.440040405	0.050474500	0.004045005	0.004045005	0.01102122	0.00504746	0.047754470	0.047754470				
4													
5	Parameter	Dei	finition	Units	Residential Scenario								
6	EV	Event	Frequency	events/day	1			Total EPH in s	ample:				
7	THQ	Target Ha	zard Quotient	unitless	1			16900	mg/kg				

Step 6 – View Calculated Standard for Residential Use Evaluation

	A	В	С	D	E	F	G	H		J	K L M	
10	ABS₀	0.1	0.1	0.1	0.1	0.13	0.13	0.13	0.13			
11	Child ECFV	6110	6110	122210	122210	2351	3441	2294	2294			
12	Concentratio n of fraction (mg/kg)	2000	1000	6500	6500	200	100	300	300		Enter EPH Concentration for each fraction. ND=0	n
13	f	0.118343195	0.059171598	0.384615385	0.384615385	0.01183432	0.00591716	0.017751479	0.017751479			
14 15	Parameter	Dei	finition	Units	Residential Scenario							
16	FV	Event F	requency	events/day	1			Total EPH in s	ample:) I		
17	THQ	Target Ha	zard Quotient	unitless	1			16900	ma/ka			
18		Convers	sion Factor	davs/vear	365			Allowable EPH	in sample:			
19	EF	Exposure Fr	equency - child	davs/vear	350			17000	ma/ka			
20	ED _c and AT _c	Exposure Averaging	Duration and Time - child	years	6			PA	SS			
21	RfD₀	Oral Refe	erence Dose	mg/kg-day	see above							
22	RfD₀	Dermal Re	ference Dose	mg/kg-day	see above	These pa the defa	arameters a ult resident	re fixed at ial values.				
23	ABS₀	Dermal Abs	orption Fraction	unitless	see above							
24	BWc	Body We	eight - child	kg	15							
25	IR _c	Soil Ingesti	on Rate - child	mg/day	200							
26	SAc	Skin Surfa	ce Area - child	cm²/day	2800							
27	AFc	Soil Adheren	ce Factor - child	mg/cm ²	0.2							
28	ECFV	Equivalent car	bon fraction value	mg/kg-day	see above							
29	f	EC Weight fra concentration/t	action = fraction otal concentration	unitless	see above							
30	ID _{nc}	Residential N Health-Base (ingesti	on-carcinogenic d Soil Criterion on/dermal)	mg/kg	17000							
14												
2 33	EPH Cate	egory 2 Inge	stion/Dermal 17000	Residential mg/kg	Soil Remed	diation Stan	dard:				RESULT DOWN HERE	
85												

Step 7 – Compare Total EPH with Allowable EPH Sample may PASS or FAIL ?

_	A	В	C	D	E	F	G	H		J	ĸ	L		IVI
0	ABS₀	0.1	0.1	0.1	0.1	0.13	0.13	0.13	0.13					
1	Child ECFV	6110	6110	122210	122210	2351	3441	2294	2294	1				
	Concentratio										Entor		_	stration
	n of fraction	2000	1000	6500	6500	200	100	300	300		Enter	EPH U	oncer	itration
2	(mg/kg)										for ea	ach frac	ction.	ND=0
3	f	0.118343195	0.059171598	0.384615385	0.384615385	0.01183432	0.0059171	6 0.017751479	0.017751479					
4														
	Decemeter	0.0	Enition	L la ita	Residential									
5	Parameter	Der	imuon	Units	Scenario									
6	EV	Event F	Frequency	events/day	1			Total EPH in s	ample:					
7	THQ	Target Ha	zard Quotient	unitless	1		_	16900	mg/kg					
8		Convers	sion Factor	days/year	365		_	Allowable EPH	l in sample:	1				
9	EFc	Exposure Fr	requency - child	days/year	350		_	17000	mg/kg					
	ED and AT	Exposure	Duration and	VOOR	e		_		00	1				
0	ED _c and Ar _c	Averaging	g Time - child	years	· ·		_		33					
1	RfD _o	Oral Refe	erence Dose	mg/kg-day	see above									
		Dermel De	forence Dece	malka day	ana ahawa	These pa	arameters	are fixed at						
2	RfDp	Definal Re	elefence Dose	mg/kg-uay	See above	the defa	ult rosido	ntial values						
3	ABS₀	Dermal Abs	orption Fraction	unitless	see above	the dela	unereside	nual values.						
4	BWc	Body W	eight - child	kg	15									
5	IR _c	Soil Ingesti	ion Rate - child	mg/day	200									
6	SA _c	Skin Surfa	ce Area - child	cm ² /day	2800									
7	AFc	Soil Adheren	ice Factor - child	mg/cm ²	0.2									
8	ECFV	Equivalent car	bon fraction value	mg/kg-day	see above									
	f	EC Weight fra	action = fraction	unitless	see above									
9		concentration/t	total concentration	unitess	000 00000									
		Residential N	on-carcinogenic	malka	17000									
0	ID _{nc}	(ingesti	ion/dermal)	mg/kg	17000									
4		(ingeoti	ondormany											
								_						
2	EPH Cate	agory 2 Inge	stion/Dermal	Residential	Soil Remer	liation Stan	dard:							
2	- I Cate	gory zinge	47000		contenee		uulu.							
3			17000	mg/kg							RECI			IFRE
4											ILS(VVIN I	
5														

Step 8 – Save SRC Calculator Result for Each Sample with a Unique Name

Category 2 EPH Health-based SRC calculator - 2018 FINAL

Info

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Step 9 – Reset Inputs for Additional Samples (only resets concentrations)



Step 4.b – Enter Data for Sample B



Step 5.b. – Define EPH Fractionation Total EPH = 16,900 mg/kg; Majority Aromatic

A	D		U	C	Г	6	П		J	n	L IVI I
Sam	nalo ID:		EDH	B							Required data entry
San	ipie iD.		LEI			Evaluated by:	LSRP 0	'DeYear			Optional data entry/modificati
			THO *	AT * BW * 36	5 d/vr	-					
	ECFV = -		· • §	1 \ /	1		11				
	($(EF * ED * 10^{-6})$	kg/mg) * (_	$\frac{1}{4D} * IR + ($	$\frac{1}{R f D} * SA * A$	$F * ABS_d * EV$	·)			Reset	
_			[/K	<i>j D_o</i>) (rj D _D		/]				
	1D -		T.	НQ							
	$f_{\mu e} = f_{(1)}$	$f_{(2)} + f_{(2)} +$	$f_{(3)} + f_{(4)}$	+ f(5) + J	$f_{(6)} + f_{(7)} +$	$f_{(s)}$					
	ECF	$V_{(1)}$ ' $ECFV_{(2)}$ ' EC	$EFV_{(3)}$ $ECFV_{(4)}$	ECFV ₍₅₎ EC	$FV_{(6)}$ $ECFV_{(7)}$	ECFV(8)				васк то ЕРН ме	nu
_			1								
	AL9-12	AL12-16	AL16-21	AL21-40	AR10-12	(Acenaphthen	AR16-21	AR21-36			
	(PHC Mixture)	(PHC Mixture)	(Mineral Oil)	(Mineral Oil)	(Naphthalene)	e)	(Fluorene)	(Fluoranthene)			
RfD₀	0.1	0.1	2	2	0.041	0.06	0.04	0.04		Exit	
RfDp	0.1	0.1	2	2	0.041	0.06	0.04	0.04	-		
ABS	0.1	0.1	0.1	0.1	0.13	0.13	0.13	0.13			
Child ECFV	6110	6110	122210	122210	2351	3441	2294	2294			
Concentratio											EDU C
n of fraction	200	100	300	300	2000	1000	6500	6500		Ente	r EPH Concentration
(mg/kg)										for e	ach fraction. ND=0
f	0.01183432	0.00591716	0.017751479	0.017751479	0.118343195	0.059171598	0.384615385	0.384615385			
			•	•	•	•	•	•			
	_			Residential]						
Parameter	Dei	tinition	Units	Scenario							
EV THQ	Event	Frequency	events/dav	1	Total EPH in sample:				u I		
	Target Hazard Quotient unitless 1 1600 mg/l							mg/kg			

Step 6.b. – View Calculated Standard

4	A	В	C	D	E	F	G	Н		J	K L M N
2	Concentratio n of fraction (mg/kg)	200	100	300	300	2000	1000	6500	6500		Enter EPH Concentration for each fraction. ND=0
3	f	0.01183432	0.00591716	0.017751479	0.017751479	0.118343195	0.059171598	0.384615385	0.384615385		
4											
5	Parameter	De	finition	Units	Residential Scenario						
6	EV	Event	Frequency	events/day	1			Total EPH in sa	ample:		
7	THQ	Target Ha	zard Quotient	unitless	1			16900	mg/kg		
8		Conver	sion Factor	days/year	365			Allowable EPH	in sample:		
9	EFc	Exposure Fi	requency - child	days/year	350			2500	mg/kg		
0	ED_{c} and AT_{c}	Exposure Averaging	Duration and g Time - child	years	6			FA			
1	RfD₀	Oral Refe	erence Dose	mg/kg-day	see above						
2	RfD₀	Dermal Re	eference Dose	mg/kg-day	see above	These pa the defa	arameters a ult resident	re fixed at ial values.			
3	ABS₀	Dermal Abs	orption Fraction	unitless	see above						
4	BWc	Body W	eight - child	kg	15						
5	IR。	Soil Ingesti	ion Rate - child	mg/day	200						
6	SAc	Skin Surfa	ce Area - child	cm²/day	2800						
7	AFc	Soil Adheren	nce Factor - child	mg/cm ²	0.2						
8	ECFV	Equivalent car	bon fraction value	mg/kg-day	see above						
9	f	EC Weight fr concentration/t	action = fraction total concentration	unitless	see above						
0	ID _{nc}	Residential N Health-Base (ingesti	lon-carcinogenic ed Soil Criterion ion/dermal)	mg/kg	2500						
1											
2 3 4	EPH Cate	egory 2 Inge	estion/Dermal 2500	Residential mg/kg	Soil Remed	diation Stan	dard:				RESULT DOWN HERE
5											

Step 7.b. – Compare Total EPH with Allowable EPH Sample may PASS or FAIL ?



Step 8.b. – Back to Main Menu to Switch to Nonresidential Evaluation



Step 9.b. – Switch from Residential to Nonresidential Standard Calculation - Sample A







Step 10 – Re-Enter EPH Fractionation for Sample A

	EPH Cated	orv 2 Indes	tion/Derma	al Nonresio	ential Cal	culator - Ve	rsion 201	8	Ť	IX.	
Site	Name:	ABC Site					Date:	5/1/2019			Calculated or locked cell
Sam	Sample ID:		EPH	-A							Required data entry
						Evaluated by:	LSRP C)'DeYear			Optional data entry/modifica
			THO * AT	* BW * 365 d	/vr]				
	ECFV = (EF	" * ED * 10 ⁻⁶ kg/	$(mg) * \left[\left(\frac{1}{RfD_{d}} \right) \right]$	$\frac{1}{p} * IR + \left(\frac{1}{Rf}\right)$	$\overline{D_D} * SA * AF$	$*ABS_d * EV$				Reset	
	$ID_{nc} = \frac{f_{(1)}}{\frac{f_{(2)}}{r - c r}}$	$+\frac{f_{(2)}}{F_{(2)}}+\frac{f_{(2)}}{F_{(2)}}$				1					
	$ECFV_{(1)} = ECFV_{(2)} = ECFV_{(3)} = ECFV_{(4)} = ECFV_{(5)} = ECFV_{(6)} = ECFV_{(7)} = ECFV_{(8)}$									Back to EPH Ment	
	AL9-12 (PHC Mixture)	AL12-16 (PHC Mixture)	AL16-21 (Mineral Oil)	AL21-40 (Mineral Oil)	AR10-12 (Nanhthalene)	(Acenaphthene	AR16-21 (Eluorene)	(Fluoranthene			
DfD		(1110 mixture)				,	(110010110)	,			
RID ₀	0.1	0.1	2	2	0.041	0.06	0.04	0.04		Exit	
RIDD	0.1	0.1	2	2	0.041	0.06	0.04	0.04			
	0.1	0.1	4000400	4000400	0.13	0.13	013	013			
Adult ECFV	6840 <i>1</i>	6840 <i>1</i>	1368139	1368139	25058	36670	24447	24447		Entor	EDU Concontration
n of fraction	2000	1000	6500	6500	200	100	300	300		for ea	ch fraction. ND=0
f	0.118343195	0.059171598	0.384615385	0.384615385	0.01183432	0.00591716	0.017751479	0.017751479			
Parameter	Dei	finition	Units	Nonresidentia I Scenario							
EV	/ Event Frequency		events/day	1	Total EPH in sample:						
THQ	Target Hazard Quotient		unitless	1		16900 mg/kg					

Step 11 – View Calculated Standard and Compare Total/Allowable EPH for Non-Red

IN

A	D	U U	U	E	Г	G	П		J	r. L IVI
ABSd	0.1	0.1	0.1	0.1	0.13	0.13	0.13	0.13	1	
Adult ECFV	68407	68407	1368139	1368139	25058	36670	24447	24447		
Concentratio n of fraction (mg/kg)	2000	1000	6500	6500	200	100	300	300		Enter EPH Concentration for each fraction. ND=0
f	0.118343195	0.059171598	0.384615385	0.384615385	0.01183432	0.00591716	0.017751479	0.017751479		
Parameter EV THQ	Del Event I Target Ha Convers	finition Frequency zard Quotient sion Factor	Units events/day unitless days/year	Nonresidentia I Scenario 1 1 365			Total EPH in 16900 Allowable EP	sample: mg/kg H in sample:		
EFa	Exposure Fr	requency - adult	days/year	225			190000	mg/kg		
ED _a and AT _a	Exposure Dura Time	tion and Averaging e - adult	years	25	PASS					
RfD₀	Oral Refe	erence Dose	mg/kg-day	see above	These personators are fixed				1	
RfD _D	Dermal Re	eference Dose	mg/kg-day	see above	at the	at the default nonresidential				
ABSd	Dermal Abs	orption Fraction	unitless	see above	values				1	
BWa	Body W	eight - adult	kg	70					1	
IR _a	Soil Ingesti	on Rate - adult	mg/day	100					1	
SAa	Skin Surfa	ce Area - adult	cm²/day	3300					1	
AFa	Soil Adheren	ce Factor - adult	mg/cm ²	0.2					1	
ECFV	Equivalent car	bon fraction value	mg/kg-day	see above					1	
f	EC Weight fra concentration/t	action = fraction total concentration	unitless	see above						
ID _{nc}	Nonresidential Health-Base (ingesti	Non-carcinogenic d Soil Criterion ion/dermal)	mg/kg	190000						
EPH Category 2 Ingestion/Dermal Nonresidential Soil Remediation Standard: 190000 mg/kg										RESULT DOWN HERE

Step 10.b. – Re-Enter EPH Fractionation for Sample B

	А	D	U	U	L		6			J	K	L M N
	E	EPH Categ	ory 2 Ingest	tion/Derma	al Nonresio	dential Cal	culator - Ve	ersion 201	8			
	Site	Name:	ABC Site					Date:	5/1/2019		С	alculated or locked cell
	Sam	ple ID [.]		FPH	EPH-B			•			R	equired data entry
oumpie io.			Evaluated				LSRP C)'DeYear		0	ptional data entry/modificatio	
		ECEV -		THQ * AT	* BW * 365 d	!/yr]				
		$(EF * ED * 10^{-6} kg/mg) * \left[\left(\frac{1}{RfD_o} * IR \right) + \left(\frac{1}{RfD_D} * SA * AF * ABS_d * EV \right) \right]$									Reset	
		$ID_{ne} = -\frac{1}{f_{ne}}$	f _{en} t				1					
		$\frac{J_{(1)}}{ECFV_{(1)}} + \frac{J_{(2)}}{ECFV_{(2)}} + \frac{J_{(3)}}{ECFV_{(3)}} + \frac{J_{(4)}}{ECFV_{(4)}} + \frac{J_{(5)}}{ECFV_{(5)}} + \frac{J_{(6)}}{ECFV_{(6)}} + \frac{J_{(7)}}{ECFV_{(7)}} + \frac{J_{(8)}}{ECFV_{(8)}}$										
,		AL9-12 (PHC Mixture)	AL12-16 (PHC Mixture)	AL16-21 (Mineral Oil)	AL21-40 (Mineral Oil)	AR10-12 (Naphthalene)	(Acenaphthene)	AR16-21 (Fluorene)	(Fluoranthene)			-
-	RfD₀	0.1	0.1	2	2	0.041	0.06	0.04	0.04		Exit	
	RfD _D	0.1	0.1	2	2	0.041	0.06	0.04	0.04			
)	ABS₄	0.1	0.1	0.1	0.1	0.13	0.13	0.13	0.13			
1	Adult ECFV	68407	68407	1368139	1368139	25058	36670	24447	24447			
2	Concentratio n of fraction (mg/kg)	200	100	300	300	2000	1000	6500	6500	+	Enter E for eac	PH Concentration h fraction. ND=0
3	f	0.01183432	0.00591716	0.017751479	0.017751479	0.118343195	0.059171598	0.384615385	0.384615385			
4												
5	Parameter	Dei	finition	Units	Nonresidentia I Scenario							
6	EV	Event	Frequency	events/day	1]	Total EPH in s					
7	THQ	Target Ha	Hazard Quotient unitless 1 1 16900 mg/kg			mg/kg						

Step 11.b. – View Calculated Standard and Compare Total/Allowable EPH

đ,	A	В	С	D	E	F	G	Н		J		K	L		M	
	ABS₀	0.1	0.1	0.1	0.1	0.13	0.13	0.13	0.13							
	Adult ECFV	68407	68407	1368139	1368139	25058	36670	24447	24447							
	Concentratio n of fraction (mg/kg)	200	100	300	300	2000	1000	6500	6500			Enter for ea	EPH (ach fra	Conce actior	entrat . ND	ior =0
;	f	0.01183432	0.00591716	0.017751479	0.017751479	0.118343195	0.059171598	0.384615385	0.384615385							
	Parameter EV	De Event l	finition Frequency	<i>Units</i> events/day	Nonresidentia I Scenario 1				sampre.							
<u></u>	THQ	Target Ha	zard Quotient	unitless	1			16900	mg/kg							
•		Conver	sion Factor	days/year	365			Allowable EPI	H in sample:							
	EFa	Exposure F	requency - adult	days/year	225			26000	mg/kg							
)	ED_a and AT_a	Exposure Dura Time	tion and Averaging e - adult	years	25		PASS									
	RfD₀	Oral Refe	erence Dose	mg/kg-day	see above	These nerometer										
2	RfD _D	RfD _D Dermal Reference Dose mg/kg-day			see above	at the	default non	are fixed residential								
•	ABS₫	Dermal Abs	orption Fraction	unitless	see above	values										
	BWa	Body W	eight - adult	kg	70											
	IR _a	Soil Ingesti	ion Rate - adult	mg/day	100											
5	SAa	Skin Surfa	ce Area - adult	cm²/day	3300											
	AFa	Soil Adheren	ce Factor - adult	mg/cm ²	0.2											
•	ECFV	Equivalent car	bon fraction value	mg/kg-day	see above											
•	f	concentration/	action = fraction total concentration	unitless	see above											
1	ID _{nc}	Nonresidential Health-Base (ingesti	Non-carcinogenic d Soil Criterion ion/dermal)	mg/kg	26000											
	EPH Cate	gory 2 Inge	estion/Dermal 26000	Nonresider mg/kg	ntial Soil Rei	mediation S	tandard:				I	RESU	JLT D	own	HERE	

Step 12 1 Printout for EACH sample

Example Calculator Printout Sheet

	EPH Cat	egory 2 Inges	stion/Derma	al Nonresid	ential Calc	ulator - Ver	sion 2018				
Site I	Name:	ABC Site					Date:	5/1/2019			
Sam	nle ID:		EP H	.в							
				-		Evaluated by:	LSRP O	'DeYear			
	ECEV -		THQ * AT * I	BW * 365 d/ yı	r						
	ECFV = (FF	• ED • 10 ⁻⁶ kα/m	(1)	(12) + (-1)	• 5 4 • 4 F • 4 F	25					
	(51	*ED * 10 kg/h	$(\overline{RfD_o})^*$	(RfD_p)	* 5 A * AF * AL	^{за} * ^с ^г Л					
	//D =		77	чQ							
	- for	$\frac{f_{(2)}}{f_{(2)}} + \frac{f_{(2)}}{f_{(2)}} $	$f_{(2)} + f_{(2)}$	$+ \frac{f_{00}}{f_{00}} + \frac{f_{0}}{f_{0}}$	(a) + f(m)	+					
	ECF	$V_{(1)} = ECFV_{(2)} = EC$	$FV_{(2)} = ECFV_{(4)}$	ECFV(2) ECI	$FV_{(0)} = ECFV_{(7)}$	$ECFV_{(2)}$					
1	AL9-12	AL12-16	AL16-21	AL21-40	AR10-12	AR12-16	AR16-21	AR21-36			
	(PHC Mixture)	(PHC Mixture)	(Mineral Oil)	(Mineral Oil)	(Naphthalene)	(Acenaphthene)	(Fluorene)	(Fluoranthene)			
RÐ,	0.1	0.1	2	2	0.041	0.06	0.04	0.04			
RfD _p	0.1	0.1	2	2	0.041	0.06	0.04	0.04			
ABS _d	0.1	0.1	0.1	0.1	0.13	0.13	0.13	0.13			
dult ECFV	68407	68407	1368139	1368139	25058	36670	24447	24447			
Concentratio											
(marka)	200	100	300	300	2000	1000	6500	6500			
(mg/ng) f	0.01183432	0.00591716	0.017751479	0.017751479	0 118343195	0.059171598	0.384815385	0.384615385			
	0.01100102	0.00001110	0.011101110	0.011101110	0.110010100	0.000111000	0.00 10 10000	0.001010000			
	Nonresidential										
Parameter	De	notina	Units	Scenario							
EV	Event	Frequency	e vents/day	1			Total EPH in s	sample:			
THQ	Target Ha	zard Quotient	unitess	1			16900	mg/kg			
	Conver	sion Factor	days/year	365	Allowable EPH in sa 28000 mg/kg						
EF,	Exposure F	requency-adult	days/year	225							
ED, and AT,	Exposure Dura	tion and Averaging	years	25	PASS						
PD.	Oral Bat	e-auur	and the days	and alterna							
RD ₀	Ulai Nei	elence bose	mg/kg-day	see above	These parameters are fixed						
RD _n	Dermal Re	eference Dose	mg/kg-day	see above	at the default nonresidential						
ABS∉	Dermal Abs	orption Fraction	unitess	see above	values.						
BW	Body W	leight-adult	kg	70							
R.	Soil Ingest	ion Rate - adult	mg/day	100	1						
SA,	Skin Surfa	ce Area - adult	cm²/day	3300]						
AF,	Soil Adheren	ice Factor - adult	mg/cm ²	0.2							
ECFV	Equivalent car	rbon fraction value	mg/kg-day	see above							
f	EC Weight fr	action = fraction	unitess	see above							
	Nonres identite	Non-caminonania			1						
ID	Health-Base	ad Soll Criterion	ma/ka	28000							
	(inges t	ion/dermai)									
I					•						
PH Cate	gory 2 Inges	tion/Dermal N	onresidentia	al Soil Reme	diation Stan	idard:					
		26000	ma/ka								
								ł			





Comparison of Two EPH Data Sets

Sample	``A″	``B″	EPH Cat 2 Fractionation Data				
Total EPH	16,900 mg/kg	16,900 mg/kg	— EPH Sample A — EPH Sample B AL 9-12				
Sum of Aliphatics	16,000 mg/kg	900 mg/kg	7000 6000 AR 21-36 5000 4000				
Sum of Aromatics	900 mg/kg	16,000 mg/kg	3000 2000 1000				
Calculated Residential Standard	17,000 mg/kg Pass Res.	2,500 mg/kg Fail Res.	AR 16-21 0 AL 26-21				
Calculated Non-Residential Standard	190,000 mg/kg Pass NonRes	26,000 mg/kg Pass NonRes	AR 12-16 AL21-40 AR 10-12				

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Questions?





EPH Guidance & Scenarios

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Baseline Characteristics for all Scenarios

- Each Scenario was developed to present specific points
 - All information is conceptual and may be abbreviated for training
 - Generally the same site, but different AOCs
 - Same surface covering & same surface water percolation rate
 - Same depth to water
 - Access is available for each of the AOCs unless indicated
- Variations exist in the mass of petroleum that was released
 - Variations in degradation characteristics





SCENARIO 1

#2 FUEL OIL WITH A PLANNED RESIDENTIAL/ UNRESTRICTED PROPERTY USE





Scenario 1 / #2 Fuel Oil Cat 1 – Residential Use

- 1. Are more samples required?
- 2. Is a ground water investigation required?

Sample Name	SS-1	SS-2	SS-3	SS-4	SS-5			
EPH Concentration (mg/kg)	800	3,785	7,675	3,650	2,100			
2 Methyl-Naphthalene (8 mg/kg RDCSRS)	NA	NA	7.85	NA	NA			
Naphthalene (6 mg/kg RDCSRS)	NA	NA	4.25	NA	NA			
EPH Product Limit Concentration	8,000 mg/kg							
RAO Goal?	Residential – Unrestricted Use							
Remedial Action?	To Be Determined							



Plan View: Not-to-scale

Scenario 1 / #2 Fuel Oil Cat 1 – Residential Use

- 1. SS-6 & 7 are required to delineate the EPH exceedance
- 2. SS-3 deep is required for vertical delineation
- 3. No GW investigation is required
 - 2 MeN is below criteria

Sample Name	SS-1	SS-2	SS-3	SS-4	SS-5	SS-6	SS-7	SS-3d	
EPH Concentration (mg/kg)	800	3,785	7,675	3,650	2,100	4,150	2,105	650	
2 Methyl-Naphthalene (8 mg/kg RDCSRS)	NA	NA	7.85	NA	NA	NA	NA	NA	
Naphthalene (6 mg/kg RDCSRS)	NA	NA	4.25	NA	NA	NA	NA	NA	
EPH Product Limit Concentration		8,000 mg/kg							
Remedial Action?			Comp	bliance A	Average	e - EPH			



SCENARIO 2A AND 2B

3,000 GALLON #2 FUEL OIL WITH A PLANNED NON RESIDENTIAL PROPERTY USE





Scenario 2 / Cat 1, 3,000-gal Non-Residential Use

- 1. Are more samples required?
- 2. Is a ground water investigation required?
 - SPLP samples are collected by the field team
- 3. What remedial actions are available?

Sample Name	SS-1	SS-2	SS-3	SS-4	SS-5			
EPH Concentration (mg/kg)	1,020	3,785	8,551	3,650	2,100			
2 Methyl-Naphthalene (8 mg/kg NRDCSRS)	NA	4.10	9.25	NA	NA			
Naphthalene (17 mg/kg NRDCSRS)	NA	0.85	5.15	NA	NA			
EPH Product Limit Concentration	8,000 mg/kg (Default value)							
RAO Goal?	Non-Residential							



Plan View: Not-to-scale
Scenario 2A / Cat 1, 3,000-gal Non-Residential Use

- 1. 5 Borings Completed- 2 Horizontal, 1 Vertical, 2 Grain Size
- 2. SS-6 & 7 are required for horizontal delineation
- 3. 2MeN exceedance triggers further investigation
 - a. SPLP is analyzed on SS-2, SS-3 and SS-6 & **PASSES**
- 4. SS-3 deep is required for vertical delineation EPH & 2MeN

Sample Name	SS-1	SS-2	SS-3	SS-4	SS-5	SS-6	SS-7	SS-3d		
EPH Concentration (mg/kg)	1,020	3,785	8,551	3,650	2,100	4,150	2,105	650		
2 Methyl-Naphthalene (8 mg/kg NRDCSRS)	NA	4.10	9.25	NA	NA	4.15	NA	6.05		
Naphthalene (17 mg/kg NRDCSRS)	NA	0.85	5.15	NA	NA	1.35	NA	NA		
EPH Product Limit Concentration		8,000 mg/kg (Default value)								
RAO Goal?	Non-	Residen	tial – Lii	mited-Re	estricted	l Use or	Unrestr	icted		



Scenario 2A / Cat 1, 3,000-gal Non-Residential Use

Grain size yields – D_{10} Larger than 0.110 mm

Alternate Product Indicator Concentration = 8,552 mg/kg

Remedial Alternatives

Compliance Average EPH and 2MeN in soils

Alternate product indicator concentration for EPH

Sample Name	SS-1	SS-2	SS-3	SS-4	SS-5	SS-6	SS-7	SS-3d		
EPH Concentration (mg/kg)	1,020	3,785	8,551	3,650	2,100	4,150	2,105	650		
2 Methyl-Naphthalene (8 mg/kg NRDCSRS)	NA	4.10	9.25	NA	NA	4.15	NA	6.05		
Naphthalene (17 mg/kg NRDCSRS)	NA	0.85	5.15	NA	NA	1.35	NA	NA		
EPH Product Limit Concentration		8,552 mg/kg (Site Specific "C" Value)								
RAO Goal?	Non-	-Residen	tial – Lir	nited-Re	stricted	Use or l	Jnrestrio	ted		



Scenario 2B / Cat 1, 3,000-gal Non-Residential Use

WHAT IF, SPLP was not collected?

- 1. Site specific EPH product indicator concentration <u>remains valid</u>.
- 2. 2 Methyl-Naphthalene <u>MUST</u> be addressed.
 - a. A groundwater investigation may be conducted for 2 MeN
 - **b. OR** –Evaluate 2 MeN impact to GW with SPLP samples or F_{oc} Soil-Water Partition Equation

Sample Name	SS-1	SS-2	SS-3	SS-4	SS-5	SS-6	SS-7	SS-3d		
EPH Concentration (mg/kg)	1,020	3,785	8,551	3,650	2,100	4,150	2,105	650		
2 Methyl-Naphthalene (8 mg/kg RDCSRS)	NA	4.10	9.25	2.15	1.15	4.15	NA	6.05		
Naphthalene (6 mg/kg RDCSRS)	NA	0.85	5.15	0.6	<0.10	1.35	NA	NA		
EPH Product Limit Concentration		8,552 mg/kg (Site Specific "C" Value)								
RAO Goal?		Unre	estricted	Resider	ntial Use	e is avail	able			



SCENARIO 3A AND 3B

8,000 GALLON #2 FUEL OIL WITH A PLANNED RESIDENTIAL PROPERTY USE





Scenario 3 / 8,000 gal. Cat 1 – Residential Use

- 1. Are more samples required?
 - a. Where to take samples and how many?
- 2. Is a ground water investigation required?
- 3. What additional work is required?

Sample Name	SS-1	SS-2	SS-3	SS-4	SS-5
EPH Concentration (mg/kg)	800	3,185	8,675	3,950	16,875
2 Methyl-Naphthalene (8 mg/kg RDCSRS)	NA	NA	9.65	2.15	11.75
Naphthalene (6 mg/kg RDCSRS)	NA	NA	4.25	13.2	<0.15
EPH Product Limit Concentration		8,000 mg	y/kg (Defa	ult value)	
RAO Goal?		Residentia	I – Unrest	ricted Use	2



Scenario 3A / #2 Fuel Oil Cat 1 – Residential Use

SPLP at SS-5 and SS-3 PASSES. No ground water trigger

SS-5 must be remediated in order to reach residential standards. SS-4 Naphthalene may be compliance averaged after delineating Do we need vertical delineation of SS-4? **YES**

Sample Name	SS-1	SS-2	SS-3	SS-4	SS-5	SS-6	SS-7	SS-8	SS-3d
EPH Concentration (mg/kg)	400	3,185	8,675	3,950	16,875	4,150	2,105	2,005	650
2 Methyl- Naphthalene (8 mg/kg RDCSRS)	NA	NA	9.65	2.15	11.75	4.15	0.21	0.19	7.95
Naphthalene (6 mg/kg RDCSRS)	NA	NA	4.25	13.2	<0.15	1.35	0.21	<0.19	<0.22
EPH Product Limit Conc.	9,160 mg/kg (Site Specific "C" Value)								
RAO Goal?			Res	sidential	– Unrest	ricted L	Jse		



Scenario 3B / #2 Fuel Oil Cat 1 – Residential Use

SPLP SS-5 Fails. A ground water investigation is required

SS-5 must be remediated in order to reach residential standards

SS-4 Naphthalene may be compliance averaged after delineating

Sample Name	SS-1	SS-2	SS-3	SS-4	SS-5	SS-6	SS-7	SS-8	SS-3d
EPH Concentration (mg/kg)	400	3,185	8,675	3,950	16,875	4,150	2,105	2,005	650
2 Methyl- Naphthalene (8 mg/kg RDCSRS)	NA	NA	9.65	2.15	11.75	4.15	0.21	0.19	7.95
Naphthalene (6 mg/kg RDCSRS)	NA	NA	4.25	13.2	<0.15	1.35	0.21	<0.19	<0.22
EPH Product Limit Conc.	9,160 mg/kg (Site Specific "C" Value)								
RAO Goal?			Res	sidential	– Unrest	ricted L	Jse		



SCENARIO 4

2,000 GALLON DIESEL OIL WITH A PLANNED RESIDENTIAL PROPERTY USE





Scenario 4 / Diesel Fuel Oil 2000 gal. UST

- 1. The LSRP collected Grain Size samples during the investigation
- 2. What remedial actions are available? **SS-4 is at a footing**
- 3. Are more samples required?
 - Where to take samples and how many?

Sample Name	GS & SS-1	GS & SS-2	SS-3	SS-4	GS & SS-5					
EPH Concentration (mg/kg)	ND	ND	ND	17,000	ND					
2 Methyl-Naphthalene (8 mg/kg RDCSRS)	NA	NA	NA	5.15	NA					
Naphthalene (6 mg/kg RDCSRS)	NA	NA	NA	13.2	NA					
EPH Product Limit Conc.	8,000 mg/kg (Default Limit)									
RAO Goal?	F	Residentia	al – Unre	stricted Us	se					



Scenario 4 / Diesel Fuel Oil 2000 gal. UST

- 1. Site specific product indicator concentration = **22,000 mg/kg**.
- 2. What delineation is required?
- 3. How does Naphthalene in SS-4 affect the site?



Sample Name	SS-1	SS-2	SS-3	SS-4	SS-5	SS-4D	SS-4A	SS-4B	SS-4	•
EPH Concentration (mg/kg)	ND	ND	ND	17,000	ND	5,050	4,100	3,800	SS-4b	GS & SS-5
2 Methyl-Naphthalene (8 mg/kg RDCSRS)	NA	NA	NA	5.15	NA	4.7	3.6	3.21		_
Naphthalene (6 mg/kg RDCSRS)	NA	NA	NA	13.2	NA	4.4	3.2	1.8	ilding	SS-3
EPH Product Limit Conc.		22,	000 mg/	kg (Site	Specific `	°C" Valu	le)	e e e e e e e e e e e e e e e e e e e	ng Pla	an View: No
RAO Goal?			Reside	ential – U	nrestricted					

SCENARIO 5

LUBRICATING OIL WITH A PLANNED RESIDENTIAL PROPERTY USE





Scenario 5 / Lubricating Oil Cat 2 – Residential use

- 1. What remedial actions are available?
- 2. Are more samples required?
 - Where to take samples and how many?
- 3. Is a groundwater investigation required?
- 4. What additional work is required?

Sample Name	SS-1	SS-2	SS-3	SS-4	SS-5	SS-6			
EPH Concentration (mg/kg)	80	3,785	22,000	3,650	1,150	4,250			
EPH Cat 2 Risk Calculator Results (mg/kg)	NA	Pass	Pass	Pass	Pass	Pass			
Individual PAH Exceedances of Residential	NA	No exceed.	No exceed.	No exceed.	No exceed.	No exceed.			
EPH Product Limit Conc.	17,000 mg/kg (Default Limit)								
RAO Goal?		Resid	dential - U	nrestricte	d Use				



Plan View: Not-to-scale

Scenario 5 / Lubricating Oil Cat 2 – Residential use



SCENARIO 6A & 6B

CUTTING OIL WITH AN INDUSTRIAL PROPERTY USE





Scenario 6A / Cutting Oil– Industrial Use

- 1. What remedial actions are available?
- 2. Are more samples required?
 - Where to take samples and how many?
- 3. Is a ground water investigation required?
- 4. What additional work is required?

Sample Name	SS-1	SS-2	SS-3	SS-4	SS-5	SS-6			
EPH Concentration (mg/kg)	85	4,785	23,250	3,650	1,150	4,250			
EPH Cat 2 Risk Calculator Results	NA	Pass	Pass	Pass	Pass	Pass			
Indivi. PAH Exceedance of Residential Criteria	NA	No exceed.	No exceed.	No exceed.	No exceed.	No exceed.			
EPH Product Limit Concentration	8,000 mg/kg (Unique Petroleum Product)								
RAO Goal?		Indust	rial – Limite	ed Restric	ted Use				



Scenario 6A / Cutting Oil– Industrial Use

- Whys is the default Product Limit concentration = 8,000 mg/kg?
- 2. Alternate Product Indicator Concentration = 25,755 mg/kg



Sample Name	SS-1	SS-2	SS-3	SS-4	SS-5	SS-6	SS-7	SS-8	SS-9		
EPH Concentration (mg/kg)	85	4,785	23,250	3,650	1,150	4,250	1,020	5,010	3.950		
EPH Cat 2 Risk Calculator Results	NA	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass		
Indiv PAH Exceedance of Residential Criteria	NA	No exceed	No exceed	No exceed	No exceed	No exceed	No exceed	No exceed	No exceed		
EPH Product Limit Concentration		25,755 mg/kg (Site Specific "C" Value)									
RAO Goal?				Unre	stricted	RAO					

Scenario 6B / Crude Oil– Industrial Use

- EPH and Cat 2 concentrations are the same, however the petroleum product was a <u>CRUDE</u> <u>OIL</u> release
- 2. Why is the default Product Limit concentration = **UNKNOWN?**

Sample Name	SS-1	SS-2	SS-3	SS-4	SS-5	SS-6				
EPH Concentration (mg/kg)	85	4,785	23,250	3,650	1,150	4,250				
EPH Cat 2 Risk Calculator Results	NA	Pass	Pass	Pass	Pass	Pass				
Indivi. PAH Exceedance of Residential Criteria	NA	No exceed.	No exceed.	No exceed.	No exceed.	No exceed.				
EPH Product Limit Concentration	UNKNOWN									
RAO Goal?		Indust	rial – Limite	ed Restric	ted Use					



Scenario 6B / Crude Oil– Industrial Use

<u>Crude Oil & MGP & Waste Oil with an unknown</u> <u>**source**</u> are considered unique mixtures of chemicals

The LSRP & PRCR can contact the NJDEP to evaluate the source material and determine a project specific EPH criteria for the product indicator concentration

Sample Name	SS-1	SS-2	SS-3	SS-4	SS-5	SS-6	
EPH Concentration (mg/kg)	85	4,785	23,250	3,650	1,150	4,250	
EPH Cat 2 Risk Calculator Results	NA	Pass	Pass	Pass	Pass	Pass	
Indivi. PAH Exceedance of Residential Criteria	NA	No exceed.	No exceed.	No exceed.	No exceed.	No exceed.	
EPH Product Limit Concentration	UNKNOWN						
RAO Goal?	Industrial – Limited Restricted Use						



SCENARIO 7

#4 FUEL OIL WITH AN INDUSTRIAL PROPERTY USE





Scenario 7 / #4 Fuel Oil Cat 2 – Industrial Use

- 1. What remedial actions are available?
- 2. Are more samples required?
 - Where to take samples and how many?
- 3. Is a ground water investigation required?
- 4. What additional work is required?

Sample Name	SS-1	SS-2	SS- 3	SS-4	SS-5	SS-6
EPH Concentration (mg/kg)	80	3,785	26,250	3,650	1,150	4,250
EPH Cat 2 Risk Calculator Results (mg/kg)	NA	Pass	Fail	Pass	Pass	Pass
Individual PAH Exceedances of Residential D	NA	No exceed.	YES	No exceed.	No exceed.	No exceed.
EPH Product Limit Conc.	17,000 mg/kg (Default Limit)					
RAO Goal?	Industrial – Limited Restricted or Unrestricted Use					





Scenario 7 / #4 Fuel Oil Cat 2 – Industrial Use

Alternate Product Indicator Concentration = 14,378 mg/kg

Remedial Alternatives

- **EPH Product Indicator**
- EPH Cat 2 Risk analysis
- Individual PAH Compounds

Indiv	laaal			unus					
Sample Name	SS-1	SS-2	SS-3	SS-4	SS-5	SS-6	SS-8	SS-9	SS-12
EPH Concentration (mg/kg)	80	3,785	26,250	3,650	1,150	4,250	21,250	16,200	13,150
EPH Cat 2 Risk Calculator Results (mg/kg)	NA	Pass	Fail	Pass	Pass	Pass	Fail	Fail	Fail
Individual PAH Exceedances of Residential D	NA	No exceed	YES	No exceed	No exceed	No exceed	YES	YES	No exceed
EPH Product Limit Conc.	17,000 mg/kg (Default Limit)								
RAO Goal?	Industrial – Limited Restricted or Unrestricted Use								



Not all results are presented.

Scenario 7 / #4 Fuel Oil Cat 2 – Industrial Use

Remedial Alternatives

EPH Product Indicator - Active Remediation - No Compliance Avg EPH Cat 2 Risk analysis - Active Remediation - No Compliance Avg Individual PAH Compounds – Compliance Averaging is available

Consider 75%/10X & Spatially Weighted Average Technique

									-
Sample Name	SS-1	SS-2	SS-3	SS-4	SS-5	SS-6	SS-8	SS-9	SS-12
EPH Concentration (mg/kg)	80	3,785	26,250	3,650	1,150	4,250	21,250	16,200	13,150
EPH Cat 2 Risk Calculator Results (mg/kg)	NA	Pass	Fail	Pass	Pass	Pass	Fail	Fail	Fail
Individual PAH Exceedances of Residential D	NA	No exceed	YES	No exceed	No exceed	No exceed	YES	YES	No exceed
EPH Product Limit Conc.	17,000 mg/kg (Default Limit)								
RAO Goal?	Industrial – Limited Restricted or Unrestricted Use								



Not all results are presented

Comparison of Calculated Product Indicator Concentrations – Varying Petroleum Type

Calculated EPH Product Indicator Concentration Based on Petroleum Type Identical Grain Size Data - Only Varying Petroleum Product



Category 1	Category 2 Petroleum Products

Summary

- EPH concentrations provide <u>three pieces of data</u>:
 - 1. Indication of the potential for free or residual petroleum product
 - 2. Indication of a direct contact human health exposure
 - 3. A screening point to determine if additional actions/analytical is required
- The LSRP must focus on compliance with all chemicals/ compounds in accordance with <u>N.J.A.C.</u> 7:26D and <u>N.J.A.C.</u> 7:26E
- The LSRP may use the Attainment & Compliance Technical Guidance





Questions?





Thank you! Please sign out



