Stack Testing Manual Overview

May 3, 2023

Emission Measurement Section (EMS)

Stack Testing Program

Technical Manual 1004 Overview

Presented by Michael Klein, EMS Section Chief

EMISSION MEASUREMENT SECTION

OUR MISSION:

Ensure that the DEP/Public/Industry have accurate and reliable stack emissions data for the purposes of assessing Permit compliance and for making decisions.

Data quality is our primary objective. Compliance is secondary. Issues uncovered in the course of our work just as often prevent emissions results from being biased high as being biased low.

Our Mission

(CONTINUED)

- **The Emission Measurement Section (EMS) is responsible for the quality assurance/quality control of air emissions measurements in New Jersey. The Section's two primary programs include:**
  - Oversight and review of all single event stack emission tests conducted by source facilities.
  - Certification of the accuracy and reliability of continuous emissions monitoring systems (CEMS) and continuous opacity monitoring systems (COMS).

EMS Technical Manual for Stack Testing
Technical Manual 1004 (TM1004)

- **“Guidelines for Compliance Stack Emission Test Programs”**
- **www.state.nj.gov/dep/bts (Look under Consultant Services)**
- **Revision approved September 2009.**
  - New protocol templates.
  - Updated protocol templates.
  - Safety.
  - NJ Certified Labs required.
  - Basis and Operation during testing.
- **Plan to revise again to incorporate electronic submittals (and add more templates).**
- **Supplemented through Listservs:** www.nj.gov/dep/bts/subscribe.html

Stack Test Quality Assurance Steps

Protocol Review – Initial step. Ensures that not only the proper methods are selected, but that they are tailored to the source specific conditions. 100% of protocol are reviewed by EMS.

Test Observation – The most critical step. Testing is complicated and often conducted in harsh conditions. Errors affecting the data quality could not be documented without direct observation. > 95% of test programs are observed by EMS.

Report Review – The final step. Includes calculation confirmation and review of laboratory data. Validated results can then be compared to Permit limits or other standards. 100% of reports are reviewed by EMS.

Stack Testing Process

- **Test required (Permit, Regulation, Enforcement Action)**
- **Protocol submitted:**
  - Often without pre-test site survey.
- **Reviewed / comments issued:**
  - Notice of Deficiency (NOD) for method choices or procedures.
- **Protocol eventually approved.**
- **Mutually acceptable test date(s) established:**
  - Generally, only after protocol approval.
- **Testing conducted:**
  - Problems often discovered.
- **Report submitted for review:**
  - At times, incomplete or calculation errors discovered.

Stack Testing Process (Additional Comments)

- **Each protocol is source specific:**
  - Applicable methods vary source to source.
- **Protocol spells out the procedures to be followed by tuning the methods:**
  - Testing procedures must be approved by EMS.
- **Testing must be conducted in accordance with the approved protocol and methods:**
  - Deviations from the protocol and/or methods require specific approval.
- **Report must provide sufficient raw field and laboratory data for EMS to reproduce the results, including QA/QC.**

Stack Testing Process
(Additional Comments continued)

Testing must be conducted at worst-case permitted operating conditions with regard to meeting the applicable emission standards, but without creating an unsafe condition.

Report must include Operating Data to document this:

- Reflect regulations and Permit requirements.
- Raw material information.
- Control equipment parameters.
- Fuel usage rates (if applicable).
- Production input/output (if applicable).
- Other pertinent information.

Typical Protocol Deficiencies

Note: We recommend using available Technical Manual 1004 Protocol Templates to speed our review. Using Templates can prevent many of the issues that follow:

- Not including a stack diagram with the port locations, stack diameter, the distances from disturbances, and the number and location of traverse points.
- Proposing an inappropriate method.
- Not including an adequate description of the sampling train, including materials of construction and reagents used.
- Not including an adequate description of sample train operation, including leak checks, required temperatures, sample rates/volumes, sample times, and other method-specific requirements.

Typical Protocol Deficiencies
(cont.)

- Not calculating in-stack detection limits and/or proposing sample train operation that will not provide an adequate detection limit to demonstrate compliance.
- Not including an adequate description of sample train recovery, including reagents and recovery equipment.
- Not providing an adequate description of the analytical methods or procedures, including calibration and QA/QC procedures (ie: replicate analysis, blanks, spikes, audits, etc.)
- Not providing analyzer operating ranges and/or calibration gases, or proposing an inappropriate range (ie: 0 – 1000 ppm for a 10 ppm allowable).

Typical Protocol Deficiencies
(cont.)

- Not specifying the source and control device operation during testing and / or the monitoring to verify the operation during testing. (Permits require operation at worst-case with respect to meeting the emission limits without creating an unsafe condition.)

- Not specifying sample location acceptability verification procedures (ie: cyclonic flow check and stratification check, as applicable).

- Not specifying what will be included in the test report, including required certifications, and/or specifying a report submittal date that is contrary to the Permit requirements.

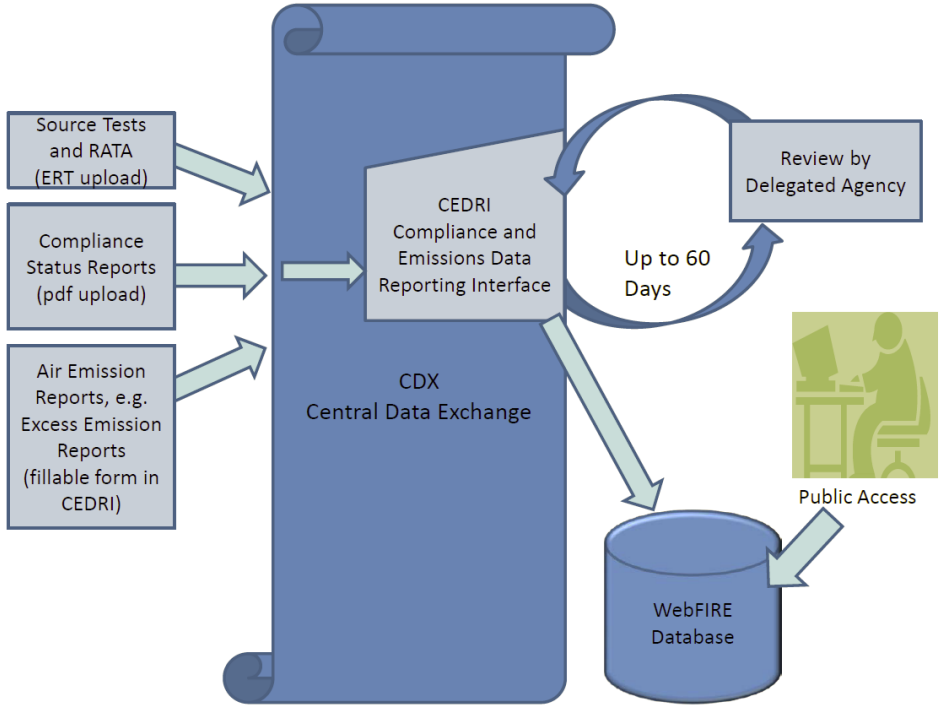
- Not filling out all required fields when using the Electronic Reporting Tool (ERT) to prepare the protocol.

EPA's Electronic Reporting Tool (ERT)

- EPA Software to Standardize Source Test Planning, Reporting and Assessment.
- EMS started exploring electronic reporting in 2006. The Air Permitting Program began to include language in Permits approved on or after July 1, 2014 that required stack test protocols and stack test reports be submitted to the Emission Measurement Section using ERT (**unless otherwise approved by EMS**).
- Some EPA regulations require the use of ERT to prepare stack test reports for submission to EPA.

Proposed Rule – Electronic Reporting for NSPS

- Required use of ERT for nearly all NSPS test report submittals (amongst other things).
- Proposal published March 20, 2015. 96 Public Comments.
- Promulgated on December 21, 2016. Stack test reporting using ERT to EPA required 90 days after promulgation.
- On January 20, 2017, new regulation implementations frozen pending review. EPA subsequently withdrew the Electronic Reporting for New Source Performance Standards Final Rule from the Office of the Federal Register.



ERT – Pollutants Quantified

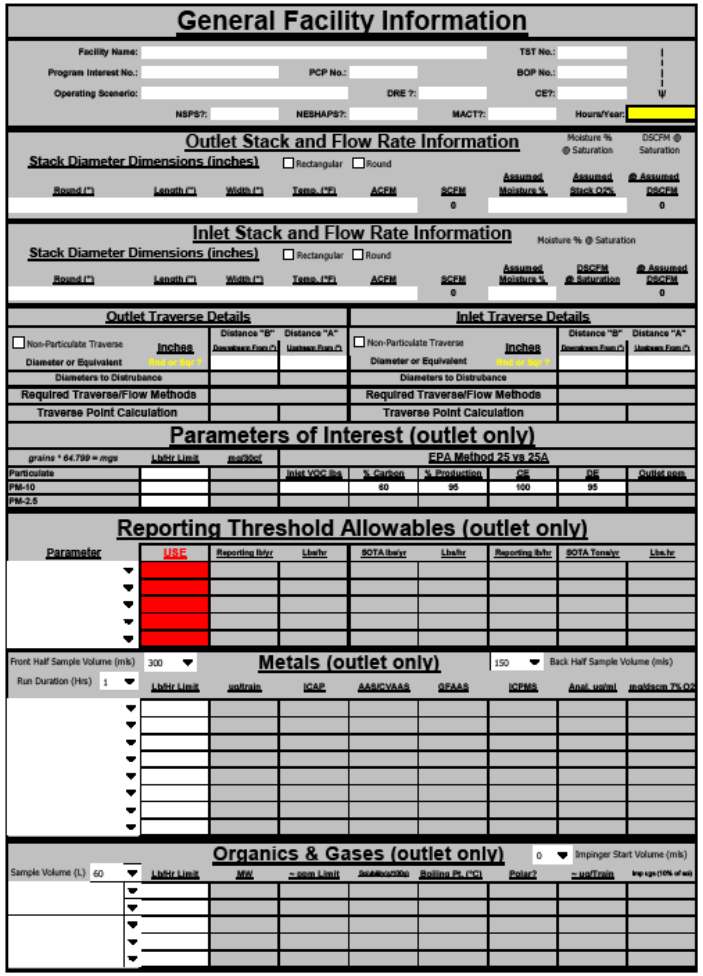
- Filterable Particulate Matter
- Condensable Particulate Matter
- Filterable PM10
- Filterable PM2.5
- Acetaldehyde
- Formaldehyde
- Carbon Monoxide
- Chlorine, Chloride, Hydrogen Chloride, Total Chloride
- Nitrogen Oxides (NOx)
- Sulfur Dioxide
- Sulfuric Acid
- Sulfur Trioxide
- Metals including Antimony, Arsenic, Barium, Beryllium, Cadmium, Chromium, Cobalt, Copper, Hexavalent Chromium, Lead, Manganese, Mercury, Nickel, Phosphorus (yellow or white), Selenium, Silver, Thallium and Zinc

- Total Fluoride
- Hydrogen Fluoride
- Hydrogen Bromide
- Total organic compounds (TOC) (as Carbon, Ethane, Methane, Propane)
- Dioxin/Furan Congeners
- Co-planer PCB's
- PAH Compounds
- Dioxins / Furans

The CEMS Relative Accuracy Test Audits which can be documented include:

- Carbon Monoxide - Carbon Dioxide
- Nitrogen Oxides - Sulfur Dioxide
- Oxygen

Protocol Preparation Tool



- Calculates many of the items needed for a protocol submittal.
- Currently available from EMS website:

https://www.nj.gov/dep/bts/consult.html

The functions of this spreadsheet have been incorporated into ERT.

Updated in 2018 to reflect the new deminimus reporting threshold values, now found in Subchapter 17.

Typical Issues in the Field

- Pre-test site survey errors (failure to perform one):

  - unacceptable sample location, equipment/electrical needs, clearances, safety issues, etc.

- Sample recovery & handling errors:

  - recovery location (not clean), improper reagents/equipment, improper procedures, etc.

- Equipment errors:

  - operating ranges/calibrations, materials of construction, incorrect equipment, etc.

- Procedural errors:

  - cyclonic flow, leak checks, traverse points, isokinetics, temperatures, etc.

- Tuning instead of testing. The test date is not the time to tune!

Typical Issues in the Field (cont.)

- Errors caused by inexperienced testers (in general or with testing in NJ).

"But that's how we do it in [Insert State name here]."

- Preparedness

Backup equipment and glassware, additional calibration gases for unexpected concentrations, insufficient ice, etc. Person(s) performing the test did not write or read the protocol, including correspondences.

- Coordination between Testers and Facility

Proper source operation, collection of process data, etc.

- "End of Day Syndrome"

Like the proverbial tree in the forest, if a leak check fails after a long day when it is 20^{o}F outside and an observer doesn't witness it, will the failure be recorded and the test repeated?

Safety - Our #1 Field Priority

- Stack sampling and source evaluation exposes DEP officials and consultants to potential safety hazards in the field. Ensuring the safety of all field personnel at facilities is an issue that the EMS takes very seriously.

- To ensure the safety of all field personnel, stack sampling platforms, both permanent and temporary, and access ways leading to and from the platforms or testing locations, must be designed and erected in such a manner as to conform to published safety laws and regulations.

- If the EMS observer identifies an unsafe condition that poses an undue risk to EMS, test consultant or facility field staff, the test will be postponed at his/her discretion.

Safety, Safety, Safety……and Safety!

OSHA regulations for a ladderway floor opening or platform opening: “Every ladderway floor opening or platform shall be guarded by a standard railing with standard toeboard on all exposed sides (except at entrance to opening), with the passage through the railing either provided with a swinging gate or so offset that a person cannot walk directly into the opening.”

.....and Safety!

Monorail system to support Sample Trains

Monorail literally held in place with baling wire…supporting the weight of a sample train box over 100 feet above ground.

Look out below!

Why the focus on safety? To the right is a photo (not in NJ) of where a corroded platform collapsed, and a tester fell 130 feet to his death.

Simple Examples of Errors Observed in the Field – Pitot Tubes

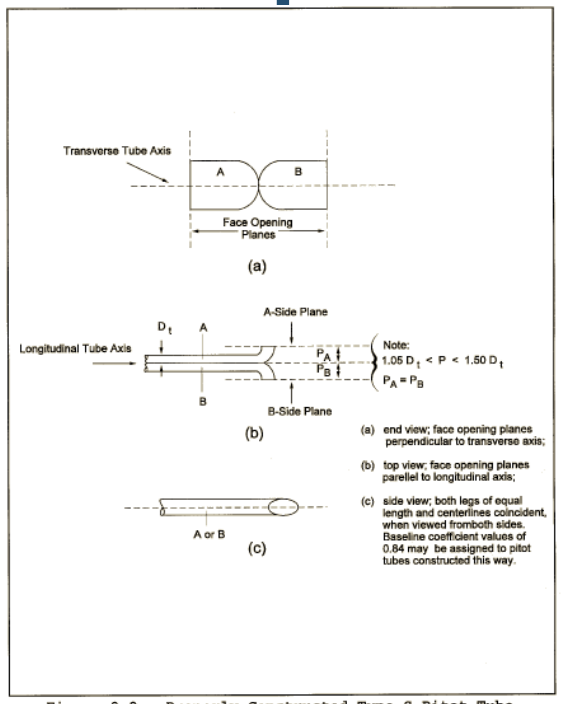


Figure 2-2. Properly Constructed Type S Pitot Tube.

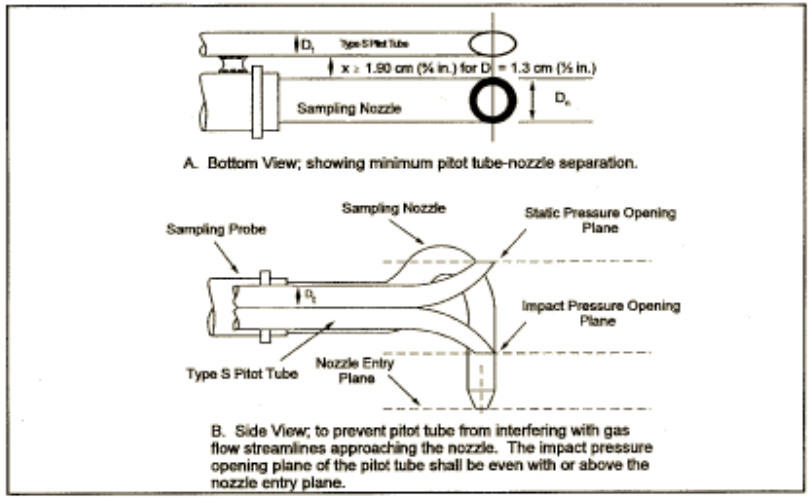
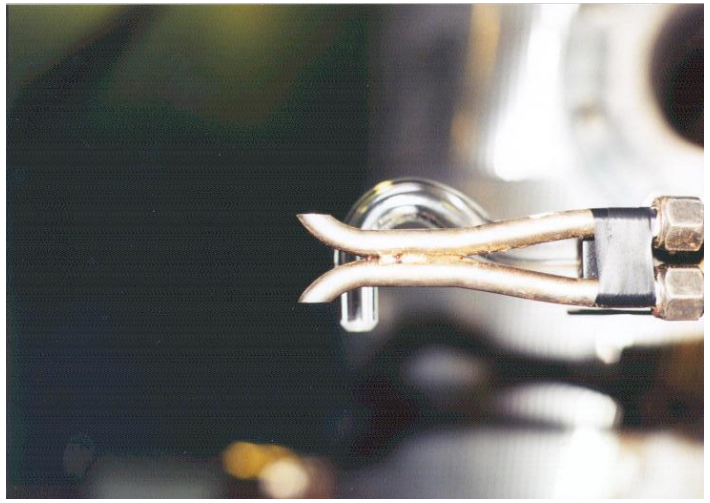
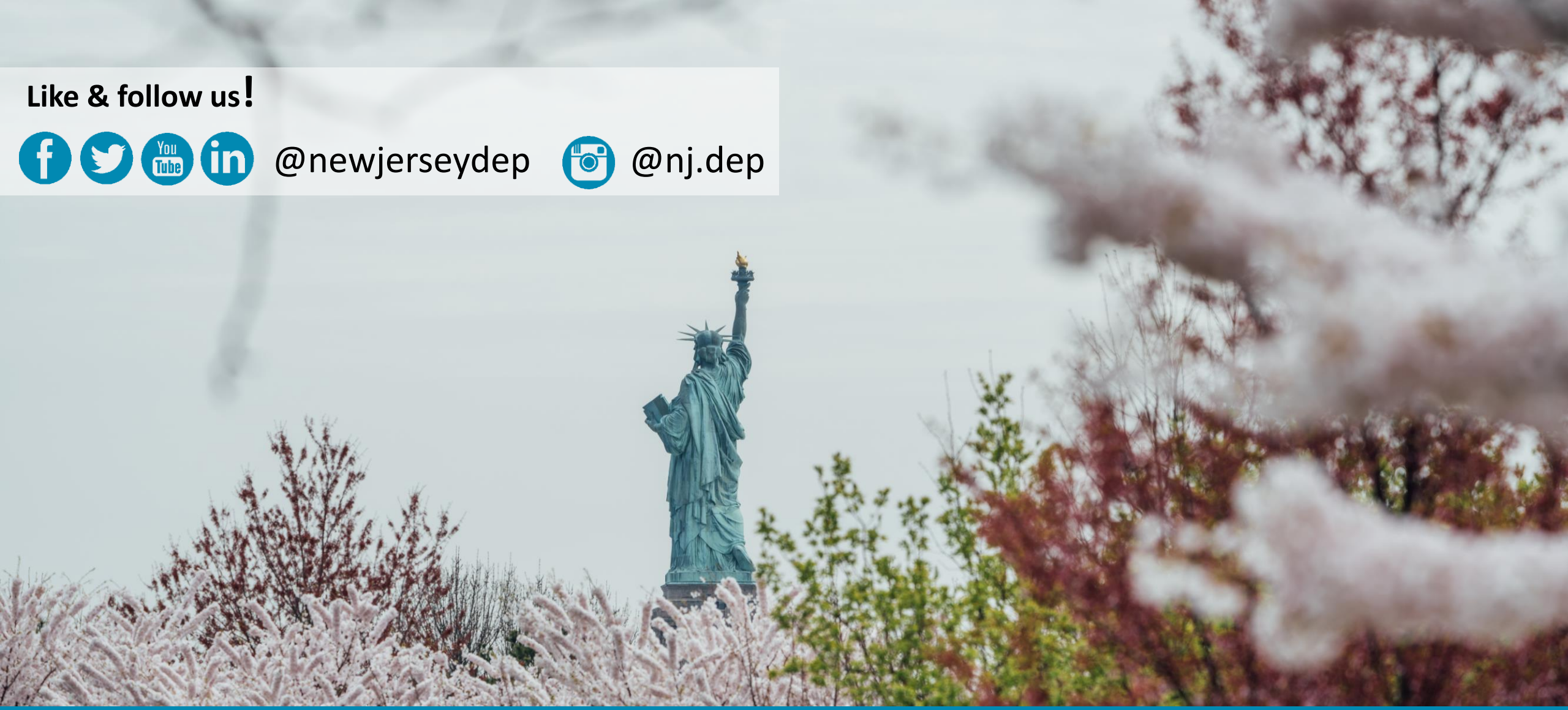


Figure 2-7. Proper pitot tube-sampling nozzle configuration.



Typical Issues with Reports

- Test report does not include all the required certification statements (N.J.A.C. 7:27-1.39) and signatures (Tester, Responsible Official and PE/CIH).
- Raw field data sheets missing or incomplete.
- Full laboratory report(s) missing (summaries are not acceptable).
- Certified laboratory not utilized for analysis.
- Calibration data and/or QA/QC data missing or incomplete.
- Hold-times exceeded, excessive blank values, audit failures, other criteria not met.
- Calculations not included or incorrect.
- Process data missing or incomplete.
- Testing not conducted at worst-case production levels.
- Report not organized in a logical fashion.



Like & follow us!

@newjerseydep @nj.dep

Thank you!

Emission Measurement Section

michael.klein@dep.nj.gov
609-984-3443

NJ.GOV/DEP/BTS