Actionable Science for Communities

The Effect Of Equilibration Time And Tubing Material On Soil Gas Measurements; SHC Task 3.61.4

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Purpose/Utility of Research

The collection of soil vapor samples representative of *in-situ* conditions presents challenges associated with the unavoidable disturbance of the subsurface and potential losses to the atmosphere. The time for three types of soil vapor probes (i.e., macro-purge, mini-purge, and post run tubing probes [PRT]) to equilibrate with subsurface conditions was assessed by installing probes (Figure 1) and collecting multiple samples over a 72 hour period. The effect of tubing material was evaluated by collocating soil vapor probes constructed with different tubing material and collecting samples over several months.

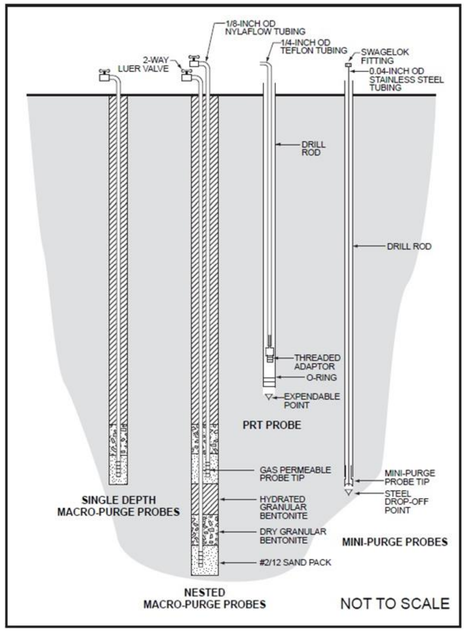

Figure 1. Schematic Diagram of Macro-purge, PRT and Mini-purge probes

Probe Tubing Diameters
Mini – 0.1 cm
Macro – 0.3 cm
PRT – 0.64 cm

Highlights

- Soil vapor data are widely used in site investigation and remediation projects to delineate VOC vapor plumes (1) as a screening tool to refine soil and groundwater sampling efforts, (2) to track the progress of soil remediation, and (3) to assess the vapor intrusion pathway.
- This research task evaluated the effects of two variables that influence the concentration of volatile organic compounds in soil vapor samples: equilibration time and tubing material.
- This research task showed that soil vapor probes constructed with a sand filter-pack and bentonite seal (i.e., macro-purge probe) needed to equilibrate for 24 to 48 hours prior to sample collection. PRT probes equilibrated within 1 to 2 hours while a new probe design, (i.e., mini-purge probe) equilibrated and could be sampled after only 30 minutes for screening assessments.
- Nylaflow, Teflon®, polyetheretherketone (PEEK), and stainless steel tubing had comparable trichloroethene (TCE) concentrations over all sampling time frames. Polyethylene tubing consistently yielded lower TCE concentrations than the other tubing materials except copper. Copper yielded significantly lower concentrations in the first days after installation, but performed similarly to other tubing after several months of exposure at the site. We recommend that copper tubing be avoided and polyethylene only be used for screening assessments.

Application & Translation

- The results have provided the Program Offices and Regions with vital information that has been directly incorporated into the latest vapor intrusion guidance document released in mid-2015 entitled, “OSWER Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air.”
- Further research into testing of the effect of equilibration time and tubing material on soil gas measurements is on-going in the vapor intrusion scientific community.

Intended End Users

The intended end users for this research project include: Office of Land and Emergency Management (OLEM), Regions, vapor intrusion researchers, regulators, universities, and the private sector who deal with vapor intrusion sampling issues. This research was identified and requested by OLEM during their annual research needs identification process. OLEM vapor intrusion personnel were intimately involved in this research effort through their review of products at all stages from initiation through completion.

Lessons Learned

- The results of this research suggests that installing vapor probes with a minimum amount of subsurface disturbance and dead volume within the sampling probe will result in decreased equilibration time.
- The result of this research recommends the use of Nylaflow, Teflon, PEEK and stainless steel as tubing material for collecting soil vapor samples and that copper tubing be avoided.
- This report helps fill in knowledge gaps identified by the Program Offices (e.g., Office of Land and Emergency Response) and the Regions in providing vapor intrusion guidance.

Brian A. Schumacher, John H. Zimmerman, R. James Elliot & Greg R. Swanson (2016) The Effect of Equilibration Time and Tubing Material on Soil Gas Measurements, Soil and Sediment Contamination: An International Journal, 25:2, 151-163, DOI:10.1080/15320383.2016.1111860