

Field Measurement of Total Organic Vapors

SSFL SOP 6
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1.0 Objective

The objective of this technical standard operating procedure (SOP) is to define the techniques and the requirements for the measurement of total organic vapors in the breathing zone and in field samples at the Santa Susana Field Laboratory (SSFL) site.

2.0 Background**2.1 Definitions**

Photoionization detector (PID) – A portable, hand-held instrument that measures the concentration of gaseous organic compounds through the photoionization of organic vapors.

2.2 Associated Procedures

- SSFL SOP 1, *Procedures for Locating and Clearing Phase 3 Samples*
- SSFL SOP 2, *Surface Soil Sampling*
- SSFL SOP 3, *Subsurface Soil Sampling with Hand Auger*
- SSFL SOP 4, *Direct Push Technology (DPT) Sampling*
- SSFL SOP 5, *Backhoe Trenching/Test Pits for Sample Collection*
- SSFL SOP 9, *Lithologic Logging*

2.3 Discussion

The measurement of organic vapors is a required step during numerous field activities. The measurement of organic vapors is being performed for two purposes. The first objective is to address health and safety concerns to determine if the breathing zone in a work area is acceptable or if personal protective equipment such as a respirator or a supplied air device is necessary for field personnel. The second objective is to assist in the identification of contamination and possible sample intervals for field judgment decisions on where samples for volatile organic compounds (VOCs) should be collected.

Samples to be screened include excavation spoils, hand auger cuttings, sample material from an acetate liner or stainless steel sleeve, as well as in situ screening. All sample material will be screened for the presence of volatile organic chemicals.

2.3.1 PID Operation

The PID is preferred when the compounds of interest are aromatics or halogenated VOCs. The PID ionizes the sampled vapors using an ultraviolet lamp that emits light energy at a specific electron voltage (eV - labeled on the lamp). Every organic compound has a specific ionization potential (measured in electron volts). The energy emitted by the lamp must be higher than the ionization potential of the compound for the compound to become ionized and emit an electron. If the ionization potential of the compound is higher than the eV of the lamp, there will be no response on the instrument. Therefore, the ionization potential of the known or suspected compounds shall be checked against the energy of the ultraviolet lamp (i.e., typically 10.2 eV, 10.7 eV, or 11.7 eV) to verify that the energy provided by the lamp is greater. Consult the manufacturer's manual to determine the appropriate ultraviolet lamp to be used and obtain the appropriate correction factors for known or suspected contaminants.

Water vapor associated with samples can interfere with the PID detector and cause the instrument to stop responding. This can be caused by using the PID on a rainy day or when sampling headspace samples that have been in the sun. If moisture is suspected, use the calibration gas to check the instrument response by inserting the gas as a check sample,

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not by recalibrating. If the response is lower than the gas level, then dry out the probe and the ionization chamber before reusing the instrument.

Do not insert the sampling probe directly into soil samples or dusty areas, as the instrument vacuum will pull dirt into the ionization chamber. Under particularly dirty or dusty conditions, the lamp may become covered with a layer of dust. If dirty conditions are encountered, or if the instrument response seems to have decreased, then clean the lamp. The instrument comes with an inlet filter that can be used to control dust and moisture. The instrument manual provides instructions on removing the instrument cover to access the lamp, and cleaning the screen in the ionization chamber as well as the surface of the lamp. In addition, the ultraviolet lamp in the PID is sensitive to shock, especially when using the higher eV lamps. Therefore, handle and transport the equipment carefully.

Finally, make sure the battery is fully charged before use. The average battery life is on the order of 8 to 12 hours of continuous use. Also, make sure the unit is allowed to equilibrate to ambient outdoor temperatures.

3.0 Responsibilities

Field Team Leader– The field team leader (FTL) is responsible for ensuring that field personnel conduct field activities in accordance with this SOP and the Field Sampling Plan (FSP) Addendum.

Site Geologist – The person responsible for overseeing soil sample collection, documentation, and lithologic logging.

Sampling Personnel – Field team members responsible for physically collecting samples and decontamination of equipment.

Site Health and Safety Technician – The person who will use field screening instruments to monitor all field activities for VOCs and radiological contaminants and pre-shipment sample coolers.

4.0 Required Equipment

- Site-specific plans (i.e., FSP Addendum)
- Health and safety plan
- Field logbook
- Photoionization detector with appropriate lamp rating
- Calibration gases in a range appropriate for the expected use
- Pint- to quart-sized zip-top plastic bags
- Waterproof black ink pen
- Personal protective clothing and equipment

5.0 Procedures

5.1 Direct Reading Measurement

1. Charge the instrument overnight.
2. Connect the measurement probe to the instrument (if necessary), turn on the probe, and make necessary operational checks (e.g., battery check) as outlined in the manufacturer's manual.
3. Calibrate the instrument using appropriate calibration gas and following the applicable manufacturer's manual.
4. Make sure the instrument is reading zero and all function and range switches are set appropriately.
5. Insert the end of the probe directly into the atmosphere to be measured (e.g., breathing zone, soil sampler liner) and read the total organic vapor concentration in parts per million (ppm) from the instrument display. Apply the appropriate correction factor if necessary. Record the highest instrument response.
6. Immediately document the reading in the field logbook or on the appropriate field form.

5.2 Headspace Measurement

1. Once on and operational, calibrate the instrument (as needed) following the appropriate manufacturer's manual.

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2. Make sure the instrument is reading zero and all function and range switches are set appropriately.
3. Fill one zip-top plastic bag approximately one-half full of the sample to be measured. Quickly seal the bag minimizing volume of air in bag.
4. Allow headspace to develop for approximately 10 minutes. It is generally preferable to knead the bag for 10 to 15 seconds to break apart the sample and maximize sample surface area.

Note: When the ambient temperature is below 0 degrees Celsius (32 degrees Fahrenheit), perform the headspace development and subsequent measurement within a heated vehicle or building.

5. Quickly puncture the bag wall and insert the probe, wrapping the bag wall around the probe stem to minimize loss of vapors. Insert the instrument probe to a point approximately one-half of the headspace depth. Do not let the probe contact the soil, and ensure the probe does not get plugged by the plastic during puncturing. If using a PID and there is condensation on the inside of the bag, only leave the probe in the jar or bag long enough to obtain a reading. Remove the probe and allow fresh air to flow through the instrument to avoid excess water vapor build-up.
6. Read the total organic vapor concentration in ppm from the instrument display. Apply the appropriate correction factor if necessary. Record the highest instrument response.
7. Immediately record the reading in the field logbook or on the appropriate field form.

6.0 Restrictions/Limitations

The PID provides quantitative measurement of total organic vapors, but generally is not compound-specific. The typical measurement range of the PID is 0 to 2,000 ppm. In addition, the instrument will not detect/measure VOCs with an associated ionization potential (in eVs) above the rating of the lamp, so lamp rating is critical to monitoring for selected VOCs.

Note: The presence of methane will cause erratic PID measurements.

7.0 References

No references were used in development of this SOP.