**Cover Sheet**
**Standard Operating Procedure**

**Operation Title:** **Field Screening of Soil Samples Utilizing Photoionization and Flame-Ionization Detectors**

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## 1.0 Applicability

This Standard Operating Procedure (SOP) applies to all programs in the Maine Department of Environmental Protection's (MEDEP) Division of Remediation (DR). It may be utilized by other Divisions within MEDEP, as determined by the respective Division Directors or their designees.

This SOP is not a rule and is not intended to have the force of law, nor does it create or affect any legal rights of any individual, all of which are determined by applicable statutes and law. This SOP does not supersede statutes or rules.

## 2.0 Purpose

The purpose of this document is to describe the MEDEP/DR procedure for field screening volatile organic content of soils using a closed container and a photoionization detector (PID) or a flame ionization detector (FID). Please note that MEDEP has separate SOPs for the field screening of soils impacted by petroleum products (RWM-PP-004). The investigation and remediation of petroleum related impacts are typically overseen by the MEDEP Division of Petroleum Management or Division of Technical Services. Refer to the most recent version of MEDEP's Petroleum Remediation Guidelines and associated petroleum specific SOPs for additional guidance.

## 3.0 Key Definitions

**PID:** Photoionization detector

**FID:** Flame Ionization detector

## 4.0 Responsibilities

All MEDEP/DR Staff must follow this procedure when performing this task. All Managers and Supervisors are responsible for ensuring that their staff are familiar with and adhere to this SOP. MEDEP/DR staff reviewing data by outside parties should ensure that this SOP (or an equivalent) was followed, depending on the specific Data Quality Objectives (DQOs) of the task.

Other MEDEP SOPs may also apply when performing this task, including, but not limited to MEDEP/DR SOP *RWM-DR-014 - Development of a Sampling and Analysis Plan* (SAP). The SAP should consider quality assurance and quality control (QA/QC) samples and measures, the specifics of which will depend on the DQOs for the

task. Types of QA/QC samples are discussed in more detail in the DR Quality Assurance Plan (QAP). SAP development includes provisions for creating a Health and Safety Plan (HASP) associated with the activity, including compliance with Dig Safe notifications when disturbing soil with powered equipment or tools (i.e., not hand tools). Dig Safe notification does not include public utility clearance requests which must be completed separately (e.g., sewer and water lines). These utility marking requests typically do not extend onto marking private property (i.e., they may only mark lines in the public right of way), so hiring a private utility marking company may be necessary, depending on site specifics. Fieldwork and data collection tasks must be properly documented in accordance with applicable MEDEP SOPs and policies.

## 5.0 Guidelines and Procedures

### 5.1 Introduction

In conducting this procedure, a soil sample is placed in an approved container and sealed. Any volatile compounds in the soil then volatilize into the headspace of the container until a state of equilibrium is reached. The air in the jar headspace is then measured with a calibrated PID or FID, with a result expressed in parts per million (ppm), or parts per billion (ppb). Due to the different vapor pressures and ionization potentials of various volatile compounds that may be present in the soil, concentrations of individual compounds cannot be determined. However, this technique provides an effective means of screening soil for the presence of total volatile organic compounds (VOCs). It is also a helpful low-cost field technique that can be used to locate “hot spots”, identify the extent of hot-spots, and as a means of screening samples prior to submittal for laboratory analysis.

This methodology may not be sensitive enough to identify individual VOCs at or near the appropriate guidelines (with the possible exception of petroleum contaminants). The methodology is not a substitute for actual laboratory analysis. The method is a low cost field screening tool that is most effective when the number of site screening samples is proportional to the size of the area of concern and or/volume of contaminated soil. The methodology effectiveness is also based on the knowledge and experience of the environmental professional and the development of a complete conceptual site model.

### 5.2 Equipment

The following equipment is required for conducting the procedure:

- Soil sampling equipment (e.g., shovel, bucket auger, soil boring tools)
- Approved containers (recommend using a metalized aluminum bag or glass jar, see section 5.4)
- A PID or FID
- Calibration equipment and user manual for the particular PID or FID to be used

### 5.3 Operating a PID/FID

1. Warm up and calibrate the PID and FID instrument(s) to be used according to the manufacturers' recommended procedure. See also MEDEP/DR SOP# RWM-DR-019 – Protocol for the Use of Portable Vapor Monitors. The PID and/or FID should be ready for use prior to collection of the first sample. The PID/FID should be operated in accordance with MEDEP/DR SOP# RWM-DR-019 – Protocol for the Use of Portable Vapor Monitors.

2. Collect the soil sample. As outlined in the site-specific SAP, collect the sample utilizing appropriate soil sampling equipment.

3. Place approximately 200 grams of the soil sample into an approved container as stated in the SAP. The same type of container should be consistently used at the site for comparison purposes; do not mix or reuse headspace containers (unless the approved container is reusable and cleaned appropriately between uses). In so far as possible, samples should be mineral soil free of vegetation and stones larger than a ½ inch in diameter. The type of soil being screened should be recorded and that description reported with the results. If a duplicate sample is to be submitted for laboratory analysis, this sample should **immediately** be containerized and preserved as appropriate. Care should be taken to co-locate field screening and laboratory samples from the same soils. Laboratory VOC samples should not be taken from the field screening sample after it is screened, unless approved in the SAP and documented in the field notes and subsequent report. If using jars, the jars should be immediately sealed by placing a square of foil over the mouth and screwing on the lid. If using a metalized bag, the gusset at the bottom should be opened to allow development of the headspace within the entire bag.

4. Knead and break up any soil clods and shake the container for 30 seconds to thoroughly mix the contents.

5. Let sample equilibrate for 10 minutes and shake again. Allow at least ten minutes, but not more than 60minutes, for VOCs to reach headspace equilibrium. A reasonable attempt should be made to allow the same amount of equilibration time for each sample. When ambient temperatures are greater than 70 ºF, samples should be stored in the shade. When temperatures are below 70 ºF, samples should be warmed in the sunlight or in a running vehicle.

6. Measure and record the sample headspace concentration with the instrument by recording the highest PID/FID response. Collect a sample of the headspace by inserting the PID/FID probe into the appropriate opening for the container you are using. It is important to insert the probe as quickly as possible after the seal to the container has been broken. If the highest reading is related to a spike in the instrument response, then both the spike response and the highest response should be recorded and noted. Documentation of headspace results should be outlined in the SAP.

### 5.4 Special Considerations Regarding Containers

The most commonly used (and recommended) containers are one-quart sized metalized aluminum bags (various manufacturers make these types of bags). Also used are wide mouthed, metal screw top 16-oz. glass jars, with a ¼ inch hole drilled through the center, with foil placed over the top to provide the seal.

## 6.0 Additional Considerations with Use of a PID/FID

There are limitations of PIDs and FIDs. A PID or FID cannot detect all VOCs, nor do they detect all VOCs equally. Factors that influence the response of the particular compound include the ionization potential of the compound, the energy rating of the PID lamp used, the calibration standard used, the response factor, the response curve, etc. In some instances, such as when the contaminant of concern is a single known compound it is possible to calibrate the instrument so that a relatively accurate measurement, when compared to laboratory analysis, can be obtained. Because of this, it is recommended that the operator of the particular instrument that will be conducting this procedure take the time prior to the sampling event to familiarize themselves with the particular instrument that will be

used. This includes reviewing the specific user manual calibration procedure and practicing with the instrument prior to the sampling event. Typically, if petroleum constituents are the primary contaminants of concern, then MEDEP petroleum specific SOPs should be followed, as generally described in Section 2 of this SOP, unless otherwise stated in the SAP.

## 7.0 Recalibration During Use

During the course of the workday, the PID/FID should be bump tested with the appropriate calibration gas every two hours or after screening samples with headspaces greater than 1,000-ppm. If the bump test reading is more than 10% different from the calibration gas, then the instrument should be recalibrated in accordance with the manufacturer's specifications. All bump test and recalibration readings must be documented in the field notebook.

## 8.0 References

None