COVERSHEET
STANDARD OPERATING PROCEDURE

Operational Title: **Soil Gas Sample Collection Method Utilizing Hand Tools**

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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 is also applicable to all parties that may submit data that will be used by the MEDEP/DR.

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 using hand tools to collect soil gas samples for the evaluation of contaminant vapor intrusion.

3.0 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 procedure. MEDEP/DR staff reviewing data by outside parties are responsible for assuring that the procedure (or an equivalent) was utilized appropriately.

4.0 GUIDANCE AND PROCEDURES

4.1 PREPARATION

4.1.1 SAMPLINGPLAN

A Conceptual Site Model (CSM) is important for effective soil gas sampling. Prior to conducting any sampling event, a Sampling and Analysis Plan (SAP) should be developed (see MEDEP/DR SOP# RWM-DR-014 - Development of a Sampling and Analysis Plan). Included in the sampling plan should be specifics regarding the anticipated substances of concern, data quality objectives, the laboratory conducting analysis, sample containers and tubing for collection, and Quality Assurance/Quality Control (QA/QC).

When evaluating vapor transport, it is important to identify preferential vapor pathways that are created by relatively permeable non-native fill associated with site development. Utility trenches are of particular importance because they can facilitate transport of both vapor and groundwater. At a minimum a CSM should identify potential site sources (e.g. current and former USTs, petroleum dispensers, dry cleaning machines, and ventilation hoods), preferential pathways (and interrelationships), surface water drainage patterns (both natural and man-made or influenced), and closest receptors in all directions from the site.

In certain situations, sewer utilities may be a secondary vapor sources as a result of chemical handling and disposal and the age of the sewer. Vapor samples from the utility corridor will provide information on the strength of the secondary source.

4.1.2 SCHEDULING

It should be noted that sampling during times when soil pores are water filled (spring thaw, extended rain events, or heavy short duration rain events greater than 0.25 inches over an 8-hour period) may negatively affect collection of soil gas samples. For this reason, rain dates should be planned in the proposed field work schedule. The exception may be when the site has limited exposed soils, or is covered with impervious surfaces, and has adequate storm water drainage that restricts soil pores from becoming saturated.

4.2 EQUIPMENT

4.2.1 EQUIPMENT LIST

The Equipment used for the collection of soil gas samples when following this this SOP may include:

- Pilot Hole Tool
  - Cordless or corded hand hammer rotary drill and 18-inch long drill bit with a 3/8 to 5/8-inch diameter; or
  - Tile Probe with slam bar;
- Pore water sampler or similar stainless-steel tube with screened interval at sampler tip;
- Peristaltic pump;
- Bentonite clay or modeling clay;
- Cold patch (for pavement penetrations);
- Portland cement (for concrete penetrations);
- Differential Pressure Gage (optional);
- Polyethylene tubing (see Section 4.2.2.3);
- Teflon lined tubing (see Section 4.2.2.3);
- Photo Ionization Detector (ppb level recommended);
- Multi-gas meter for oxygen and carbon dioxide;
- Soil gas sampling field sheet (updated as of Effective Date or newer);
- Digital camera;
- Sample containers and flow controllers (Summa Canister or Tedlar bags, see Section 4.2.2.1 or 4.2.2.2);
- Adjustable wrenches for connecting flow controller to Summa Canister
- Small sledgehammer

4.2.2 SPECIFIC CONTAINER AND TUBING CONCENTRATIONS FOR SOIL VAPOR SAMPLING

Due to the nature of soil gas sampling, additional planning must be undertaken in order to assure the appropriate sample collection/analysis methods and appropriate containers for a sampling event. Two types of sample containers are described in this SOP; Summa Canisters and Tedlar bags. When deciding which container to use, staff should consider the data quality objectives (DQOs) for the sample and the availability of a laboratory capable of analyzing the sample that is both State certified and capable of reaching required detection limits.

4.2.2.1 SUMMA CANISTERS

A Summa Canister is a clean, metal container sealed with a vacuum; this vacuum is then used to draw in the gas sample. Summa Canisters must be ordered from a laboratory in advance of the sampling event and are available from a limited number of labs. Samples from Summa Canisters are analyzed by certified labs only, by methods which have been approved by USEPA, and have detection limits that generally meet the ambient air guidelines.

Summa Canister samples can collect two types of samples; grab and time elapsed. Grab samples are collected utilizing the vacuum of the canister for a sample with a collection time of less than 30 minutes. Time elapsed are samples collected utilizing the vacuum of the canister over an extended period of time, up to and beyond 24 hours. Both sample types require a regulator between the tubing and canister to control the length of time the sample is collected. The regulator will be provided and calibrated by the laboratory conducting the analysis of the sample. The type and duration of sample should be indicated as part of the SAP.

The laboratory certifies the Summa Canister has been appropriately cleaned prior to shipment. Laboratory certification can be done on individual canisters or from one representative can in a batch. **For soil gas sample collection personnel may use either individually certified clean canisters or batch certified clean canisters depending on the DQOs for the project.**

Clean Summa Canisters must be obtained from the laboratory providing the analysis for each sampling event. Unused Canisters will be sent back to the laboratory. The laboratory will need to be informed as to the sample collection method used and the duration of collection time prior to shipping the Summa Canisters and regulators for the sampling event.

4.2.2.2 TEDLAR BAG

A Tedlar bag is a bag manufactured from Tedlar (Polyvinyl fluoride) with a two-way valve. Tedlar bag samples require less time for planning because they can be ordered in advance and kept on hand until they are needed. However, the bags must be stored in a clean location. Laboratories capable of analyzing these samples are even more limited than laboratories that supply Summa Canisters. Hold time for a Tedlar bag sample is 48 hours. However, Tedlar bags can be analyzed in the field with a mobile laboratory (that is capable of providing the analysis), providing real time data. Due to detection limits for this analytical method (generally 10 times the indoor air standard for most compounds), **Tedlar bag collection is most often used for screening purposes**. There is not an USEPA approved method; samplers using

Tedlar bag collection must communicate with the laboratory conducting the analysis, prior to sampling, to be sure DQOs will be met. Due to the potential for cross-contamination, each group of Tedlar bags that are stored together for more than 1-hour should be accompanied with a zero-VOC field blank and at least one field duplicate. The field blank and duplicate should be analyzed after all the other environmental samples in the group.

4.2.2.3 TUBING SELECTION

Tubing used for vapor sampling is usually a flexible, low density polyethylene plastic tubing (LDPE). Certain volatile chemicals (especially those found in petroleum products) may interact with certain types of tubing used for collecting samples. These interactions will affect the quality of sample results, and may require a contaminant specific tubing, such as Teflon lined tubing (e.g. when sampling for petroleum vapors). Therefore, contaminants of concern for the site should be determined before collecting samples (refer to the Site's CSM). If tubing interaction is a concern, the laboratory and/or the DEP Chemist in the DEP's Division of Technical Services should be consulted prior to sample collection to assure appropriate tubing is used.
The type of tubing used should be documented in field notes or on sample collection forms.

4.2.2.4 SAMPLE COLLECTION DURATION/RATE

The sample collection duration and rate will depend on the DQO for the project. Sub-slab soil gas sample rates should not exceed 200 mL/min. In general, the collection of sub-slab samples usually takes less than 30-minutes.

4.3 SAMPLE COLLECTION

The drill or tile probe is used to create a pilot hole between 18 and 48 inches below the ground surface. The thin wall screened stainless steel or aluminum tube is inserted into the pilot hole and advanced to an optimum depth of 3-4 feet. The sample tube is sealed at the surface with clay and at least one sample tube volume should be purged with a peristaltic pump. To help assure that a representative sample will be collected, atmospheric CO_2 and O_2 can be compared to subsurface CO_2 and O_2 measurements using a multi meter 4-gas field instrument. Atmospheric O_2 concentrations are usually much higher than subsurface O_2 levels. Atmospheric CO_2 concentrations are usually much lower than subsurface CO_2 levels. To collect a sample for analysis, tubing is connected to the top of the sampling tube and a soil gas sample is either pumped or collected under vacuum directly into the sample container. If utilizing a Summa Canister be sure to record both the starting and ending pressures on the Canister as well as their individual ID tag #'s.

5.0 QUALITY CONTROL

Due to cross contamination issues inherent with soil gas sample collection, more rigorous quality control sampling may be required then the sampling of other media. DQOs should be stated in the SAP. Quality Assurance/Quality Control (QA/QC) samples may be collected if needed to meet your DQOs. The following typical types of QA/QC samples should be collected

as part of the QA/QC program for soil gas sample collection. For additional discussion of QA/QC, please refer to the MEDEP/DR Quality Assurance Plan.

5.1 EQUIPMENT BLANKS

When using Tedlar bags, equipment blanks should be collected at a rate of 5%, which is equivalent to one equipment blank for every twenty (20) samples collected. The equipment blank will consist of purging a stainless-steel sample tube (pore water) sampler with laboratory supplied zero air and collecting the equipment blank air in a Tedlar bag for analysis.

5.2 DUPLICATE SAMPLES

It is recommended that field duplicate samples be collected at a rate of 10% to assess sample location variability.

5.3 BACKGROUND / AMBIENT AIR SAMPLES

Depending on data quality objectives, one to two ambient air samples per day can be collected at representative sampling locations with sample containers selected for the site investigation to assess ambient air conditions.

5.4 TRIP BLANK

A trip blank should be collected when utilizing Tedlar bags as sample containers. The trip blank will consist of a Tedlar bag filled from a canister of zero air that is kept with the sample containers at the start of the day and travels with the containers to the laboratory.

5.5 TRACER GAS DISPERSION

This SOP relies on the use of carbon dioxide, and to a lesser degree, oxygen, as tracer gases for surface leakage. Under normal situations, ambient air concentrations of carbon dioxide are an order of magnitude less (~500 ppm) than soil gas carbon dioxide concentrations (5,000+ ppm). The contrast between ambient air concentrations and soil gas concentrations in addition to pre-sample and post-sample soil gas concentrations provides sufficient information on leakage from the surface into the soil gas. Under certain situations, a helium shroud may be used to in lieu of carbon dioxide to determine the level of leakage.

5.6 SYSTEM DECONTAMINATION

In an effort to provide the most representative soil vapor samples possible, all tooling and materials in contact with the site soils will be cleaned with a detergent wash and potable water rinse prior to re-use, as outlined in MEDEP/DR SOP# RWM-DR-017 – Equipment Decontamination Protocol. Additional cleaning of the tooling with steam cleaning may be warranted depending on the site contamination.

New, flexible tubing (i.e. dedicated) will be used at each different sample location, regardless as to the type of tubing used.

6.0 DOCUMENTATION / CHAIN OF CUSTODY

All sampling activities must be documented as outlined in MEDEP/DR SOP# RWM-DR-013 - Documentation of Field Activities and Development of a Trip Report. Sample custody must be followed as outlined in MEDEP/DR SOP# RWM-DR-012 – Chain of Custody Protocol. Due to the nature of soil gas sampling, attention should be made to the following:

1) Weather conditions particularly precipitation within past 3 days.

2) Depth of sample collection.

3) Possible sources of off-site contamination (gas stations, dry cleaners, automotive body shops, etc.) in the vicinity of the investigation field work.

4) Possible sources of cross contamination (fueling vehicles/equipment, etc.).

5) Length of time of sample collection.

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