COVERSHEET
STANDARD OPERATING PROCEDURE

Operation Title: **PROTOCOL FOR COLLECTING SUB SLAB SOIL GAS SAMPLES**

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Five Year Review No Changes Needed:

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1.0 PURPOSE

The purpose of this document is to describe the Maine Department of Environmental Protection (DEP) Bureau of Remediation and Waste Management, Division of Remediation's (MEDEP/DR) procedure for collecting soil vapor samples from the interstitial spaces beneath the concrete floors of buildings.

2.0 APPLICABILITY

MEDEP/DR is responsible for the investigation and remediation of uncontrolled hazardous substance sites throughout Maine. In the course of the investigation and subsequent remediation, samples must be collected to determine the geographical extent, chemical characteristics, and relative levels of contaminants at each site and surrounding area. For this reason soil gas samples are often collected near sites where volatile chemicals are contaminants of concern. Collection of soil gas samples from beneath the concrete floor of buildings can determine the potential for impact to the indoor air of a building from volatile chemicals, without the issue of cross contamination from chemicals that may exist within the building itself. This standard operating procedure (SOP) is designed to be a guideline for the collection of building sub soil gas samples.

3.0 RESPONSIBILITIES

All Uncontrolled Sites Program Staff must follow this procedure when collecting sub slab soil gas samples. All managers and supervisors within MEDEP/DR are responsible for ensuring that their staff are familiar with and adhere to this procedure.

4.0 PREPARATION

4.1 SAMPLING PLAN

A well developed Site conceptual model is imperative for effective soil gas sampling. Prior to conducting any sampling event, a sampling plan should be developed (see SOP DR#014 - Development of a Sampling and Analysis Plan). Special considerations should be made to determine the presence of preferential pathways for contamination into the building, and appropriate locations and methodology to assure proper sampling locations are selected. 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.

It should be noted that sub slab sampling will involve the drilling of a hole in the basement floor of the building. The owner of the property of the sampling must made fully aware and approve of the sampling event, and any follow up monitoring planned. Additionally, the owner/ operator of the building should identify any sub slab utilities, foundation/column footings, vapor barriers, radon sub slab depressurization systems, and any other foundation structures that might impact the results or collection of sub slab gas samples.

If collection of soil gas will become part of a routine monitoring program, it is recommended that permanent monitoring points, such as Geoprobe systems soil gas implant system.

4.2 SCHEDULING

It should be noted that sampling during heavy precipitation and saturated soil conditions may negatively effect collection of soil gas samples. A provision to have alternate days for conducting field work if scheduled days are raining, or immediately proceeding heavy rains, should be made.

5.0 EQUIPMENT

5.1 EQUIPMENT LIST

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

- Hammer rotary drill
- Extension cord(s)
- Masonry drill bit, 3/8 inch diameter x 10 inches long
- Filter sand (for backfill)
- Appropriate tubing (see Section 5.2.3)
- Geoprobe Soil Gas Implant system (Optional if placing a permanent monitoring point),
- Vacuum pump, such as peristaltic;
- Bentonite clay or modeling clay;
- Quick mix concrete (optional, for permanent monitoring point)
- Containers (Summa Canister or Tedlar Bags, see Section 5.2.1 and 5.2.2)

5.2 Specific Container and Tubing Considerations for Soil Vapor Sampling

Due to the nature of sub slab 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 for the sample and the availability of a laboratory capable of analyzing the sample.

5.2.1 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. Samples from Summa canisters are analyzed by certified labs only, and by methods which have been approved by EPA 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 length of time of sample should be indicated as part of the sample plan.

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.

5.2.2 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 limited and the holding time for tedlar bag samples is 48 hours. Tedlar bag sampless can be analyzed in the field with the appropriate mobile laboratory equipment and can provide real time data analyses. 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 are no USEPA approved methods for tedlar bag samples. Samplers utilizing tedlar bags must communicate with the laboratory conducting the analysis prior to sampling to assure data quality objectives for the project are met.

5.2.3 Tubing Selection

Certain volatile chemicals (especially those found in petroleum products) may interact with certain types of tubing used for collecting samples. Tubing used for vapor sampling is usually a flexible, PVC based tubing. These interactions will affect the quality of sample results, and may require a contaminant specific tubing, such as a Teflon lined tubing. Therefore, contaminants of concern for the site should be determined before collecting samples (refer to the Sites conceptual site model). 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. Type of tubing used should be noted in the field notes of the samplers.

6.0 SAMPLE COLLECTION

If the sampling point is for one time use, utilizing tubing inserted into the hole drilled in the slab will be sufficient. However, if the sampling is to be part of a long term monitoring program, a more robust sampler, such as Geoprobe Systems permanent soil gas implant, is recommended.

1) Drill hole into concrete slab floor. Using the hammer rotary drill and 3/8 inch drill bit, drill a hole through the cement floor slab of the building. If dust prevention is necessary, cover the location with a towel/ cloth and drill through a pre cut hole in the cloth.

2) Place tubing or implant into hole. After drilling the hole through the concrete slab, evaluate and note the subslab conditions. The conditions and data quality objectives will determine the appropriate intake depth(s) for the subslab sample(s). Conditions to be noted include the presence of bedrock, groundwater, pipes, underdrain, void spaces, soil conditions (native, backfill), and general soil type (silt, clay, sand, gravel) Sample tubing can be placed directly into

the subslab environment or tubing can be attached to an anchor (implant) to hold the tube in place beneath the cement slab.

Care should be taken to reduce cross contaminating subslab soil vapor and indoor air vapors. This may be done by backfilling the intake with filter sand below the slab and sealing the sample point with modeling clay or hydrated bentonite clay to the top of the cement slab. If using bentonite, wait 15 to 30 minutes prior to sampling for bentonite to congeal.

2a) Special considerations regarding implants:

Geoprobe Systems and other manufacturers of direct push drilling equipment manufacture soil gas implant systems designed for use with their boring equipment. These implants can also be deployed by hand in sub slab monitoring. The samplers should refer to the manufacturer's instructions for specific assembly and deployment instructions.

The entire implant should be place below the concrete slab, with tubing attached to the barbed end of the implant.

3) Connect tubing to a vacuum or peristaltic pump and purge tubing. Use a peristaltic pump to evacuate at least one sample tube volume prior sample collection. The volume of ¼" OD x 3/16" ID tubing is approximately 5.5 mL per ft. A minimum of 1 tube volume of gas should be removed prior to sampling.

4) Collect sample in Tedlar Bag or Summa Canister. If using a tedlar bag for sample collection, connect the exhaust end of the tube from the vacuum or peristaltic pump and directly fill the tedlar bag. Tedlar bags should be filled at a rate of approximately 5 minutes per liter, or 15 minutes for a three liter bag. If using Summa canisters for sample collection, remove pump from tubing, and attach canister/ regulator to end of tubing, and allow the canister to fill using the vacuum of the canister. To avoid connection problems at time of sampling, connection fittings should be checked for fit prior to sampling. .

5) Sealing permanent sample points If sample points are going to be used as monitoring points over a long period of time then it may be desirable to secure the sample point with concrete instead of modeling clay. Bentonite clay or modeling clay should be used at the bottom of the slab to seal the sample point. Portland cement should be used above the seal to the top of the slab.

6) Protect implant sample collection tubing. If the implant is designed for long term monitoring, placement and/or construction of some type of protective device is recommended. Be sure to provide some means of marking/locating the implant for future monitoring.

7.0 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. Data quality objectives should be stated in the sampling plan. Quality Assurance/Quality Control (QA/QC) samples may be collected if needed to meet your data quality objectives. The following typical types of QA/QC samples should be collected as part of the QA/QC program for soil gas sample

collection. For an additional discussion of QA/QC, please refer to the MEDEP/DR Quality Assurance Plan, Section 5 and Section 10.

7.1 EQUIPMENT BLANKS

Equipment blanks should be collected at a rate of 5%, one equipment blank every twenty samples collected. The equipment blank will consist of purging a complete drive rod and closed point system with zero air.

7.2 DUPLICATE SAMPLES

It is recommended that duplicate samples be collected at a rate of 5% to assess sample location variability.

7.3 BACKGROUND/AMBIENT AIR SAMPLES

Depending on data quality objectives, one to two ambient air samples per day may be collected at the sampling locations to assess ambient air conditions.

7.4 TRIP BLANK

A trip blank should be collected particularly when utilizing tedlar bags as sample containers. The trip blank will consist of a tedlar bag filled at the Site area from a canister of zero air or an inert gas such as nitrogen.

7.5 TRACER GAS DISPERSION

Ambient air may intrude into the soil formation, and not provide a true sample of the gas below the slab. In situations where this is suspect, a tracer gas such as sulfur hexafluoride can be dispersed around the penetration point to determine if ambient air contamination of the sample may be present. If analysis indicates sulfur hexafluoride is present in the sample, re-sampling of the location may be warranted.

8.0 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# 017, Decontamination Procedures. 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.

9.0 DOCUMENTATION/CHAIN OF CUSTODY

All sampling activities must be documented as outlined in MEDEP/DR SOP DR#013 - Documentation of Field Notes and Development of a Sampling Event Trip Report. Sample

custody must be followed as outlined in MEDEP/DR SOP#012 – Chain of Custody Protocol. Due to the nature of soil gas sampling, attention should be made to the following:

- Weather conditions particularly precipitation within past 3 days;
- Depth of sample collection;
- Subslab conditions;
- Modifications to the procedure;
- Possible sources of off site contamination (gas stations, dry cleaners, automotive body shops, etc.) in the vicinity of the investigation field work;
- Possible sources of cross contamination (fueling vehicles/equipment, etc);
- Length of time of sample collection.

As with all sampling events, any deviations from the sampling plan or SOPs must be documented in field staffs field notes.

10.0 REFERENCES

1. Geoprobe Soil Vapor Sampling, Standard Operating Procedure, Technical Bulletin No. 93-660, 9/21/93.
2. USEPA, Environmental Response Team, Soil Gas Sampling, SOP #2042, 6/1/96.
3. Geoprobe Systems, Direct Push Installation of Devices for Active Soil Gas Sampling and Monitoring. Technical Bulletin NO. MK3098. Prepared May, 2006.