STANDARD OPERATING PROCEDURE – BER-37

COLLECTION OF SOIL VAPOR SAMPLES FOR ANALYSIS OF VOLATILE ORGANIC COMPOUNDS

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1.0 INTRODUCTION

The objective of this Standard Operating Procedure (SOP) is to describe the equipment and techniques for the collection of soil vapor samples to evaluate vapor intrusion with the ultimate goal of ensuring that similar methods and protocols are used when collecting such samples for analysis of volatile organic compounds (VOCs). This SOP specifically treats issues associated with the collection of soil vapor samples once temporary or permanent soil vapor sampling points have been installed in accord with KDHE's SOPs for Geoprobe Operations (BER-07) or Installation of Vapor Monitoring Wells to Assess Vapor Intrusion (BER-35). Procedures for the collection of sub-slab air samples are described in KDHE's SOP entitled Procedures for Sampling and Analysis of Subslab Air Samples (BER-34).

2.0 SAMPLE EQUIPMENT

Soil vapor samples can be collected in several ways depending on the analytical methodology selected for the project. Samples for onsite analysis may be collected with polyethylene or glass syringes equipped with a three-way valve or with a Tedlar bag. Samples for offsite analysis are collected in stainless-steel Summa canisters, typically with a volume of 1-liter or less.

Soil vapor samples may be collected as grab samples or as time-integrated samples. Time integrated samples are collected using a Summa canister equipped with a pre-calibrated flow controller and an in-line particulate filter. If an appropriate flow controller is not available from the laboratory, care must be taken to open the canister valve slowly and the sample is collected over several minutes to limit the chance of short-circuiting. Soil vapor samples should not be collected at a rate greater than 200 milliliters per minute (mL/min) (e.g., 1-liter sample should be collected over a period of 5 minutes). Duplicate samples may be collected is series or concurrently using a manifold. The frequency of duplicate sample collection should be specified in project planning documentation. Canisters will be cleaned and certified by the laboratory as per EPA Method TO-14A or TO-15 specifications.

Prior to sampling, a vacuum gauge is used to measure and record the initial Summa canister vacuum pressure. The initial canister pressure should be between -26 inches of mercury (”Hg) and -30”Hg. If the initial pressure is less than -26”Hg, the canister should be rejected and returned to the laboratory. A post-sampling vacuum measurement is also recorded to ensure that a full one liter of soil vapor is collected.

3.0 PROCEDURES FOR CONDUCTING LEAK TESTS

Prior to sample collection, leak tests may be performed to evaluate whether any leaks exist in the sampling train and/or within the boring/vapor monitoring point. Leak testing is most important when low permeability soils are present. There are two different types of leak tests that can be performed. Tracer testing involves the introduction of a gaseous tracer compound, such as helium, into a shroud covering the sampling apparatus. A portable gas monitoring device is used to maintain a reasonably steady concentration of tracer gas within the shroud. The tracer gas concentration in the shroud should be at least 10% or two orders of magnitude higher than the reporting limit of the field meter. Three tubing volumes are purged and then field screened with the meter. If high concentrations (e.g., >10% of the starting concentration within the shroud) of the tracer gas are observed in a sample, connections in the sampling train are checked. If tracer concentrations in the sample line still exceed the threshold and there are no other explanations for the detections, the boring or vapor monitoring well should be abandoned, reinstalled and the leak test repeated. A shut-in test may be used alone or in conjunction with the tracer test to check for leaks in the above ground fittings. This test involves assembling the sampling train and, leaving the canister valve in the closed position, applying a vacuum to the sampling line with a hand pump. A vacuum gauge, attached to the pump or connected to the line with a "T" fitting, is observed for at least one minute. If a loss of vacuum is observed, the fittings are adjusted until the vacuum does not noticeably dissipate.

4.0 PURGING REQUIREMENTS AND PROCEDURES FOR CONDUCTING PURGE VOLUME TESTS

For vapor intrusion investigations, minimum purge volumes (e.g., three times the volume of the sampling train and the annular space around the sample tip) and low sample volumes are preferred to lessen the potential for breakthrough from the surface or between collocated sample intervals. However, in some cases it may be appropriate to conduct purge volume tests to help ensure that stagnant air has been removed and that samples are representative of subsurface conditions. The tubing volume is dependent on the length and inside diameter of the tubing. The approximate volume of the $^{1}/_{4}$-inch and $^{1}/_{8}$-inch outside diameter (or $^{1}/_{8}$-inch or $^{1}/_{16}$-inch inside diameter) tubing commonly used for vapor intrusion investigations are 2.41 milliliters per foot (mL/ft) and 0.60 mL/ft, respectively. When conducting a purge volume test, samples for chemical analysis are collected following removal of various purge volumes (e.g., 1 volume, 3 volumes, and 7 volumes). The samples are analyzed and the purge volume with the highest concentration of site contaminants of concern is used for other sample locations.

5.0 PROCEDURES FOR COLLECTING SAMPLES USING THE POST-RUN TUBING METHOD

Protocols for installation of Post Run Tubing (PRT) sample probes are described in BER-SOP-07. Once the probes rods have been installed to the desired sampling interval, the rods are retracted approximately 0.25 - 3 inches and a metal rod is then used to push out the expendable drive point. Tubing fitted with a PRT adaptor and an o-ring is inserted into the probe rods and rotated counterclockwise to engage the adapter threads with the expendable point holder. Pull up lightly on the tubing to test engagement of the threads. Failure of the adaptor to thread could mean that intrusion of soil may have occurred during probe installation or disengagement of the drive point. Once the tubing is secured to the point holder, the sampling train is connected and the system is purged and leak tested (as appropriate) as described above. Soil vapor samples can then be collected with a syringe and/or a Tedlar bag for onsite analysis or with a Summa canister for offsite analysis.

Attach an identification tag that indicates the canister serial number, sample number, location, collection time and date to the canister for transport to the laboratory. The canisters must be shipped under proper chain-of-custody protocol to the laboratory from which they were rented for analysis.

6.0 PROCEDURES FOR COLLECTING SAMPLES FROM TEMPORARY OR PERMANENT VAPOR MONITORING WELLS

Protocols for installing vapor monitoring wells are described in BER-SOP-35. Once the well has been installed, the sampling train is connected directly to the vapor monitoring well tubing. As multiple monitoring points may be installed within a single boring, care must be taken to ensure that the proper interval(s) are sampled and that samples are appropriately labeled. Once the sampling train is connected, the system is purged and leak tested (as appropriate) before samples are collected for laboratory analysis. As above, samples can be collected with a syringe and/or Tedlar bag for onsite analysis or with a Summa canister for offsite analysis.

Attach an identification tag that indicates the canister serial number, sample number, location, and date to the canister for transport to the laboratory. The canisters must be shipped under proper chain-of-custody protocol to the laboratory from which they were rented for analysis.

7.0 SAMPLE ANALYSIS

Field analysis will be performed according to SOP BER-25 Mobile Laboratory. Detection limits for most compounds will be low enough to make decisions regarding vapor intrusion exposure estimates.

A number of analytical methods are available for analyzing vapor samples for VOCs. In general, the preferred laboratory analytical method is EPA Method TO-15 which uses gas chromatography/mass spectrometry (GC/MS) to identify and quantify target VOCs. The GC/MS utilized for EPA Method TO-15 is a more scientifically defensible detector scheme and is more desirable than the use of single or multiple specific detectors utilized in EPA Method TO-14A. In some cases it may be necessary to analyze samples using EPA Method TO-15 Selective Ion Monitoring (SIM) to obtain lower detection limits for some contaminants of concern, although this is unlikely for soil vapor samples. The laboratory should be consulted prior to sampling to determine which analytical method is most appropriate to satisfy project data needs.

8.0 REFERENCES

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