Region 4
U.S. Environmental Protection Agency
Science and Ecosystem Support Division
Athens, Georgia

OPERATING PROCEDURE

Title: **Soil Gas Sampling**

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Revision History

This table shows changes to this controlled document over time. The most recent version is presented in the top row of the table. Previous versions of the document are maintained by the SESD Field Quality Manager.

History	Effective Date
SESDPROC-307-R1, *Soil Gas Sampling*, replaces SESDPROC-307-R0 **General** Updated referenced operating procedures due to changes in title names and/or to reflect most recent version. **Title Page** Changed title for Antonio Quinones from Environmental Investigations Branch to Enforcement and Investigations Branch **Section 1.3** Updated information to reflect that the procedure is located on the H: drive of the LAN. Clarified Field Quality Manager (FQM) responsibilities. **Section 1.4** Alphabetized and revised the referencing style for consistency. **Section 1.5.1** Corrected the title of the Safety, Health, and Environmental Management Program Procedures and Policy Manual.	November 1, 2007
SESDPROC-307-R0, Soil Gas Sampling, Original Issue	February 05, 2007

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1 General Information

1.1 Purpose

This document describes general and specific procedures, methods and considerations to be used and observed when collecting soil gas samples for field screening or laboratory analysis.

1.2 Scope/Application

The procedures contained in this document are to be used by field personnel when collecting and handling soil gas samples in the field. On the occasion that SESD field personnel determine that any of the procedures described in this section are either inappropriate, inadequate or impractical and that another procedure must be used to obtain a soil gas sample, the variant procedure will be documented in the field log book, along with a description of the circumstances requiring its use.

1.3 Documentation/Verification

This procedure was prepared by persons deemed technically competent by SESD management, based on their knowledge, skills and abilities and has been tested in practice and reviewed in print by a subject matter expert. The official copy of this procedure resides on the H: drive of the SESD local area network. The Field Quality Manager (FQM) is responsible for ensuring the most recent version of the procedure is placed on the H: drive and for maintaining records of review conducted prior to its issuance.

1.4 References

Geoprobe® Systems Tools and Equipment Catalog, Kejr Engineering, Inc., Salinas, Kansas, 1997.

International Air Transport Authority (IATA). Dangerous Goods Regulations, Most Recent Version

SESD Operating Procedure for Control of Records, SESDPROC-002, Most Recent Version

SESD Operating Procedure for Equipment Inventory and Management (SESDPROC-104, Most Recent Version)
SESD Operating Procedure for Field Equipment Cleaning and Decontamination, SESDPROC-205, Most Recent Version

SESD Operating Procedure for Field Sampling Quality Control, SESDPROC-011, Most Recent Version

SESD Operating Procedure for Logbooks, SESDPROC-010, Most Recent Version

SESD Operating Procedure for Packaging, Marking, Labeling and Shipping of Environmental and Waste Samples, SESDPROC-209, Most Recent Version

SESD Operating Procedure for Sample and Evidence Management, SESDPROC-005, Most Recent Version

The Yellow Field Book©, Kejr Engineering, Inc., Salinas, Kansas, 2000.

US EPA. 1999. Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, Second Edition, Compendium Method TO-15, Determination of Volatile Organic Compounds (VOCs) in Air Collected in Specially Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS); Center for Environmental Research Information, Office of Research and Development, Cincinnati, OH; EPA/625/R-96/010b

US EPA. 2001. Environmental Investigations Standard Operating Procedures and Quality Assurance Manual. Region 4 Science and Ecosystem Support Division (SESD), Athens, GA

US EPA. Analytical Support Branch Laboratory Operations and Quality Assurance Manual. Region 4 SESD, Athens, GA, Most Recent Version

US EPA. April 13, 1981. Final Regulation Package for Compliance with DOT Regulations in the Shipment of Environmental Laboratory Samples. Memo from David Weitzman, Work Group Chairman, Office of Occupational Health and Safety (PM-273)

US EPA. Safety, Health and Environmental Management Program Procedures and Policy Manual. Region 4 SESD, Athens, GA, Most Recent Version

1.5 General Precautions

1.5.1 Safety

Proper safety precautions must be observed when collecting soil gas samples. Refer to the SESD Safety, Health and Environmental Management Program (SHEMP) Procedures and Policy Manual and any pertinent site-specific Health and Safety Plans (HASP) for guidelines on safety precautions. These guidelines should be used to complement the judgment of an experienced professional. Address chemicals that pose specific toxicity or safety concerns and follow any other relevant requirements, as appropriate.

1.5.2 Procedural Precautions

The following precautions should be considered when collecting soil gas samples.

- Special care must be taken not to contaminate samples. This includes storing samples in a secure location to preclude conditions which could alter the properties of the sample. Samples shall be custody sealed during long-term storage or shipment.
- Collected samples are in the custody of the sampler or sample custodian until the samples are relinquished to another party.
- If samples are transported by the sampler, they will remain under his/her custody or be secured until they are relinquished.
- Shipped samples shall conform to all U.S. Department of Transportation (DOT) and/or International Air Transportation Association (IATA) hazardous materials shipping requirements.
- Documentation of field sampling is done in a bound logbook.
- Chain-of-custody documents shall be filled out and remain with the samples until custody is relinquished.
- All shipping documents, such as air bills, bills of lading, etc., shall be retained by the project leader and stored in a secure place.

2 Special Sampling Considerations

2.1 Special Considerations for Sampling

The tubing used as part of either of the described sampling systems should be Teflon® or stainless steel. As most soil gas sampling will be conducted to investigate the presence or extent of organic compounds, Teflon® tubing is required to ensure the integrity of the sample.

2.2 Special Precautions for Soil Gas Sampling

- A clean pair of new, non-powdered, disposable gloves will be worn each time a different location is sampled and the gloves should be donned immediately prior to sampling. The gloves should be changed any time during sample collection when their cleanliness is compromised.
- If possible, one member of the field sampling team should take all the notes and photographs, fill out tags, etc., while the other members collect the samples.

2.3 Sample Handling Requirements

1. Soil gas samples will typically be collected by directly filling evacuated, specially-prepared stainless steel canisters (SUMMA® or SilcoSteel™ canisters), after sample delivery line purging.

2. The SUMMA® canister will be labeled and identified according to SESD Operating Procedure for Packaging, Marking, Labeling and Shipping of Environmental and Waste Samples (SESDPROC-209).

2.4 Quality Control

If applicable to the study or investigation, a control sample should be collected from a location not affected by the possible contaminants of concern and submitted with the other samples. A canister field blank, prepared prior to the investigation by ASB personnel, should also be submitted with the sample set during the investigation. Equipment rinsate blanks should be collected if equipment, such as PRT adapters, probe rod or other sampling equipment is field cleaned and re-used to document that low-level contaminants were not introduced into the sample by the decontaminated equipment.

2.5 Records

Information generated or obtained by SESD personnel will be organized and accounted for in accordance with SESD records management procedures found in the SESD Operating Procedure for Control of Records (SESDPROC-002). Field notes, recorded in a bound field logbook, will be generated, as well as chain-of-custody documentation

according to the procedures found in SESD Operating Procedure Logbooks (SESDPROC-010) and SESD Operating Procedure for Sample and Evidence Management (SESDPROC-005).

3 Grab Sampling Using the Geoprobe® PRT System

3.1 General

Single event or grab sampling may be conducted using the Post-Run Tubing System (PRT). Using this system, soil gas samples can be collected quickly and with a high degree of assurance that the samples are representative of the targeted depth, i.e., using this method, there is no leakage at probe rod joints that will compromise the integrity of the sample.

The downhole components of the PRT system include:

- Sample delivery tubing
- Probe rods
- PRT Adapter
- Expendable point holder
- Expendable point

O-ring seals are used on the PRT Adapter and the expendable point holder to provide a leak-proof system that assures sample integrity.

3.2 PRT System Installation Procedures

The following procedures are used to collect soil gas samples using the Geoprobe® PRT system. The PRT system can be used with either the 1.0-inch or 1.25-inch diameter probe rod. All parts or accessories used in the PRT system must be selected with the appropriate diameter probe rod in mind to ensure compatibility of all components.

1. Place O-ring on PRT expendable point holder and attach to initial section of probe rod.

2. Place O-ring on expendable point and press into expendable point holder.

3. Add drive cap to probe rod and push PRT system into ground. Add additional probe rods, as needed, to push system to the desired sampling depth.

4. At the desired sampling depth, attach pull cap to probe rod and pull the rod back to disengage the expendable point and expose the soil interval for sampling. Remove the pull cap when this step is completed.

5. Secure the PRT adapter to a length of tubing sufficient to reach from the sampling interval to the surface, with several feet of excess tubing extending beyond the top of the probe rod to facilitate sampling. The adapter is secured tightly to the tubing using electrical tape. This will not compromise the integrity of the sample to be collected, as the sample is pulled directly through the adapter and is never

exposed to the tape.

6. Run the tubing and adapter into the probe rod and, using steady downward pressure, turn the tubing counter-clockwise to dock the adapter into the top of the expendable point holder. Tug gently on the tubing to ensure that the adapter docked firmly into the expendable point holder. Failure to dock could indicate that soil intruded during the push or that the expendable point was lost during the push.

7. At this point, the PRT system has been installed and is ready for sampling. If the sample can not be collected immediately, the end of the tubing should be capped with a stainless steel Swagelok® cap.

3.3 PRT System Sampling Methodology

Soil gas samples may be collected from the installed PRT system using several methods, listed below:

- Canister Sampling for Laboratory Analysis - After purging the PRT system tubing to introduce representative soil gas into the sampling system, an evacuated SUMMA® canister is attached using a Swagelok® or other suitable secure connection. After connection, the valve on the SUMMA® canister is opened, pulling soil gas from the exposed soil interval into the canister.

- Real-time Field Analytical Methods – Real-time analytical measurements may be obtained using appropriate instrumentation. Typically, a low flow rate pump is used to pull soil gas from the screened interval and through a properly calibrated instrument, such as the B and K Photoacoustic Analyzer, normally placed in-line between the implant tubing and the pump. Soil gas concentrations for selected compounds are read directly from the instrument and recorded.

4 Sampling Using Geoprobe® Permanent Soil Gas Implants

4.1 General

Long-term soil gas sampling may be conducted using permanent soil gas sampling implants installed with the Geoprobe®. Stainless steel implants may be installed at any depth achievable by the Geoprobe® and may be installed in 1.0-inch and 1.25-inch diameter probe rod in custom lengths, using 6-inch (152 mm) or 21-inch (533 mm) screens, which can be connected in any combination. The screens are double-woven stainless steel mesh with 0.0057-inch (0.15 mm) pore openings. A 14-inch long screen is available for use only with the 1.25-inch diameter probe rod.

4.2 Installation of Permanent Soil Gas Sampling Implants

The following procedures are used by to install a permanent soil gas sampling implant using the Geoprobe®. These are general procedures which are used with either 1.0-inch or 1.25-inch diameter probe rod. Attention should be given to rod diameter when ordering points and point holders.

1. Attach O-ring to implant point anchor.

2. Press implant point anchor into point holder and attach to first section of probe rod.

3. Push implant point anchor to the desired depth for implant installation.

4. When the desired depth has been reached, attach the implant to the sample delivery tubing. This is accomplished by loosening or removing the Swagelok® fitting and pressing the tubing into the implant. When the end of the tubing is sufficiently engaged in the end of the implant, the Swagelok® fitting is tightened to secure the tubing in the implant. It is critical that the tubing be securely attached to the implant so that it does not pull off during subsequent steps of the installation.

5. Feed the tubing into the probe rod until the implant reaches the implant point anchor. At this point, cut the tubing to allow enough tubing to remain for sampling, usually three to four feet.

6. Rotate the tubing and implant counter-clockwise, threading the implant into the anchor. If there was any soil intrusion during the push, the implant may not dock. If the implant does not dock, it is possible to salvage the installation by removing the implant and sealing the small hole on the bottom of the implant, if present, with foil or with a small sheet metal screw then returning the implant to the hole.

7. After the implant has been docked, use a pull cap and pull the probe rod

approximately one foot, exposing the implant. Observe the tubing to make sure that anchor remained in place and is not being pulled with the rod.

8. If the implant remained in place, slowly pour a measured amount of 60-100 mesh glass beads down the inside of the probe rod. The glass beads are used as a filter pack around the implant. Ideally, the implant should be covered with beads with approximately six inches of beads above the top of the implant. The volume of beads should be calculated based on the length of implant used. While pouring the beads, it is advisable to gently shake the tubing to prevent the beads from bridging inside the probe rod.

9. After placing the beads, the implant is sealed using a flowable mixture of the glass beads and fine-powdered bentonite. To accomplish this, two to three feet of rod is pulled and the mixture is slowly poured into the rod above the bead-packed implant. As with the bead placement, similar care should be taken to avoid bridging of this mixture.

10. If it is appropriate to grout the installation, grouting may be accomplished either through pressure grouting through the probe rod as the rods are pulled after placement of the seal or, if the hole remains open, the grout may be mixed and poured down the open hole after retrieval of the rods.

11. For permanent or long-term installations, efforts should be taken to protect the tubing at the surface using some type of surface completion and protective casing.

4.3 Sampling of Permanent Soil Gas Sampling Implants

Soil gas samples may be collected from the installed permanent soil gas implant using several methods. These are listed below:

- Canister Sampling for Laboratory Analysis - After purging implant tubing to introduce representative soil gas into the system, an evacuated SUMMA® canister is attached using a Swagelok® or other suitable secure connection. After connection, the valve on the SUMMA® canister is opened, pulling soil gas from the implant into the canister.
- Real-time Field Analytical Methods – Real-time analytical measurements may be obtained using appropriate instrumentation. Typically, a low flow rate pump is used to pull soil gas from the screened interval and through a properly calibrated instrument, such as the B and K Photoacoustic Analyzer, normally placed in-line between the implant tubing and the pump. Soil gas concentrations for selected compounds are read directly from the instrument and recorded.