CONSTRUCTION AND INSTALLATION OF PERMANENT SUB-SLAB SOIL GAS WELLS

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1.0 SCOPE AND APPLICATION

This standard operating procedure (SOP) outlines the procedure used for the construction and installation of permanent sub-slab soil gas wells. The wells are used to sample the gas contained in the interstitial spaces beneath the concrete floor slab of dwellings and other structures.

Soil gas monitoring provides a quick means of detecting volatile organic compounds (VOCs) in the soil subsurface. Using this method, underground VOC contamination can be identified and the source, extent and movement of pollutants can be traced.

2.0 METHOD SUMMARY

Using an electric Hammer Drill or Rotary Hammer, an inner or pilot hole is drilled into the concrete slab to a depth of approximately 2" with the d" diameter drill bit. Using the pilot hole as the center, an outer hole is drilled to an approximate depth of 1d" using the 1" diameter drill bit. The 1" diameter drill bit is then replaced with the d" drill bit. The pilot hole is drilled through the slab and several inches into the sub-slab material. Once drilling is completed, a stainless steel probe is assembled and inserted into the pre-drilled hole. The probe is mounted flush with the surrounding slab so it will not interfere with pedestrian or vehicular traffic and cemented into place. A length of Teflon tubing is attached to the probe assembly and to a sample container or system.

3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE

3.1 SUMMA Canister Sampling

After the sub-slab soil gas sample is collected, the canister valve is closed, an identification tag is attached to the canister and the canister is transported to a laboratory under chain of custody for analysis. Upon receipt at the laboratory, the data documented on the canister tag is recorded. Sample holding times are compound dependent, but most VOCs can be recovered from the canister under normal conditions near the original concentration for up to 30 days. Refer to SERAS SOP #1704, *SUMMA Canister Sampling* for more details.

3.2 Tedlar Bag Sampling

Tedlar bags most commonly used for sampling have a 1-liter volume capacity. After sampling, the Tedlar bags are stored in either a clean cooler or an opaque plastic bag at ambient temperature to prevent photodegradation. It is essential that sample analysis be undertaken within 24 to 48 hours following sample collection since VOCs may escape or become altered. Refer to SERAS SOP #2102, *Tedlar Bag Sampling* for more details.

4.0 INTERFERENCES AND POTENTIAL PROBLEMS

The thickness of a concrete slab may vary from structure to structure. A structure may also have a single slab where the thickness varies. A slab may contain steel reinforcement (REBAR). Drill bits of various sizes and cutting ability will be required to penetrate slabs of varying thicknesses or those that are steel-reinforced.

5.0 EQUIPMENT/APPARATUS

- Hammer Drill or Rotary Hammer
- Alternating current (AC) extension cord
- AC generator, if AC power is not available on site
- Hammer or Rotary Hammer drill bit, d" diameter
- Hammer or Rotary Hammer drill bit, 1"diameter
- Portable vacuum cleaner
- 1 - ¾" open end wrench or 1-medium adjustable wrench
- 2 - 9/16" open end wrenches or 2-small adjustable wrenches
- Hex head wrench, ¼"
- Tubing cutter
- Disposable cups, 5 ounce (oz)
- Disposable mixing device (i.e., popsicle stick, tongue depressor, etc.)
- Swagelok SS-400-7-4 Female Connector, ¼" National Pipe Thread (NPT) to ¼" Swagelok connector
- Swagelok SS-400-1-4 Male Connector, ¼"NPT to ¼" Swagelok connector
- ¼" NPT flush mount hex socket plug, Teflon-coated
- ¼" outer diameter (OD) stainless steel tubing, pre-cleaned, instrument grade
- ¼" OD Teflon tubing
- Teflon thread tape
- 1/8 ” OD stainless steel rod, 12” to 24” length
- Swagelok Tee, optional (SS-400-3-4TMT or SS-400-3-4TTM)

6.0 REAGENTS

- Tap water, for mixing anchoring cement
- Anchoring cement
- Modeling clay

7.0 PROCEDURES

7.1 Probe Assembly and Installation

1. Drill a d" diameter inner or pilot hole to a depth of 2" (Figure 1, Appendix A).

2. Using the d" pilot hole as your center, drill a 1" diameter outer hole to a depth of 1d". Vacuum out any cuttings from the hole (Figure 2, Appendix A).

3. Continue drilling the d inner or pilot hole through the slab and a few inches into the sub-slab material (Figure 3, Appendix A). Vacuum out any cuttings from the outer hole.

4. Determine the length of stainless steel tubing required to reach from the bottom of the outer hole, through the slab and into the open cavity below the slab. To avoid obstruction of the probe tube, ensure that it does not contact the sub-slab material. Using a tube cutter, cut the tubing to the desired length.

5. Attach the measured length (typically 12O) of ¼" OD stainless tubing to the female connector

(SS-400-7-4) with the Swagelok nut. Tighten the nut.

6. Insert the ¼" hex socket plug into the female connector. Tighten the plug. **Do not over tighten**. If excessive force is required to remove the plug during the sample set up phase, the probe may break loose from the anchoring cement.

7. Place a small amount of modeling clay around the stainless steel tubing adjacent to the Swagelok nut, which connects the stainless steel tubing to the female connector. Use a sufficient amount of modeling clay so that the completed probe, when placed in the outer hole, will create a seal between the outer hole and the inner hole. The clay seal will prevent any anchoring cement from flowing into the inner hole during the final step of probe installation.

8. Place the completed probe into the outer hole. The probe tubing should not contact the sub-slab material and the top of the female connector should be flush with the surface of the slab and centered in the outer hole (Figure 4, Appendix A). If the top of the completed probe is not flush with the surface of the slab, due to the outer hole depth being greater than 1d", additional modeling clay may be placed around the stainless steel tubing adjacent to the Swagelok nut, which connects the stainless steel tubing to the female connector. Use a sufficient amount of clay to raise the probe until it is flush with the surface of the slab while ensuring that a portion of the clay will still contact and seal the inner hole.

9. Mix a small amount of the anchoring cement. Fill the space between the probe and the outside of the outer hole. Allow the cement to cure according to manufacturers instructions before sampling.

7.2 Sampling Set-Up

1. Wrap one layer of Teflon thread tape onto the NPT end of the male connector (SS-400-1-4). Refer to Figure 5, Appendix A.

2. Remove the ¼" hex socket plug from the female connector (SS-400-7-4). Refer to Section 7.3 if the probe breaks loose from the anchoring cement during this step.

3. To ensure that the well has not been blocked by the collapse of the inner hole below the end of the stainless steel tubing, a stainless steel rod, 1/8” diameter, may be passed through the female connector and the stainless steel tubing. The rod should pass freely to a depth greater than the length of the stainless steel tubing, indicating an open space or loosely packed soil below the end of the stainless steel tubing. Either condition should allow a soil gas sample to be collected.

   If the well appears blocked, the stainless steel rod may be used as a ramrod in an attempt to open the well. If the well cannot be opened, the probe should be reinstalled or a new probe installed in an alternate location.

4. Screw and tighten the male connector (SS-400-1-4) into the female connector (SS-400-7-4). **Do not over tighten**. This may cause the probe to break loose from the anchoring cement during this step or when the male connector is removed upon completion of the sampling

event. Refer to Section 7.3 if the probe breaks loose from the anchoring cement during this step.

5. If a collocated sub-slab sample or split sample is desired, a stainless steel Swagelok Tee (SS-400-3-4TMT or SS-400-3-4TTM) may be used in place of the Swagelok male connector (SS-400-1-4).

6. Attach a length of ¼"OD Teflon tubing to the male connector with a Swagelok nut. The Teflon tubing is then connected to the sampling container or system to be used for sample collection.

7. After sample collection remove the male connector from the probe and reinstall the hex socket plug. **Do not over tighten** the hex socket plug. If excessive force is required to remove the plug during the next sampling event the probe may break loose from the anchoring cement. Refer to Section 7.3 if the probe breaks loose from the anchoring cement during this step.

7.3 Repairing a Loose Probe

1. If the probe breaks loose from the anchoring cement while removing or installing the hex head plug or the male connector (SS-400-1-4), lift the probe slightly above the surface of the concrete slab.

2. Hold the female connector (SS-400-7-4) with the ¾" open end wrench.

3. Complete the step being taken during which the probe broke loose, following the instructions contained in this SOP (i.e., **Do not over tighten** the hex socket plug or male connector).

4. Push the probe back down into place and reapply the anchoring cement.

5. Modeling clay may be used as a temporary patch to effect a seal around the probe until the anchoring cement can be reapplied.

8.0 CALCULATIONS

This section is not applicable to this SOP.

9.0 QUALITY ASSURANCE/QUALITY CONTROL

An additional collocated soil gas well is installed with the frequency of 10 percent (%) or as specified in the site-specific Quality Assurance Project Plan (QAPP). The following general Quality Assurance (QA) procedures apply:

1. A rough sketch of the area is drawn where the ports are installed with the major areas noted on the sketch. This information may be transferred to graphing software for incorporation into the final deliverable.

2. A global positioning system (GPS) unit may be used to document coordinates outside of a structure as

a reference point.

3. Equipment used for the installation of sampling ports should be cleaned by heating, inspected and tested prior to deployment.

10.0 DATA VALIDATION

This section is not applicable to this SOP.

11.0 HEALTH AND SAFETY

When working with potentially hazardous materials, follow Environmental Protection Agency (EPA), Occupational Safety and Health Administration (OSHA) and Lockheed Martin corporate health and safety procedures. All site activities should be documented in the site-specific health and safety plan (HASP).

12.0 REFERENCES

This section is not applicable to this SOP.

13.0 APPENDICES

A - Figures

APPENDIX A
Soil Gas Installation Figures
SOP #2082
March 2007

FIGURE 1

INNER or PILOT HOLE

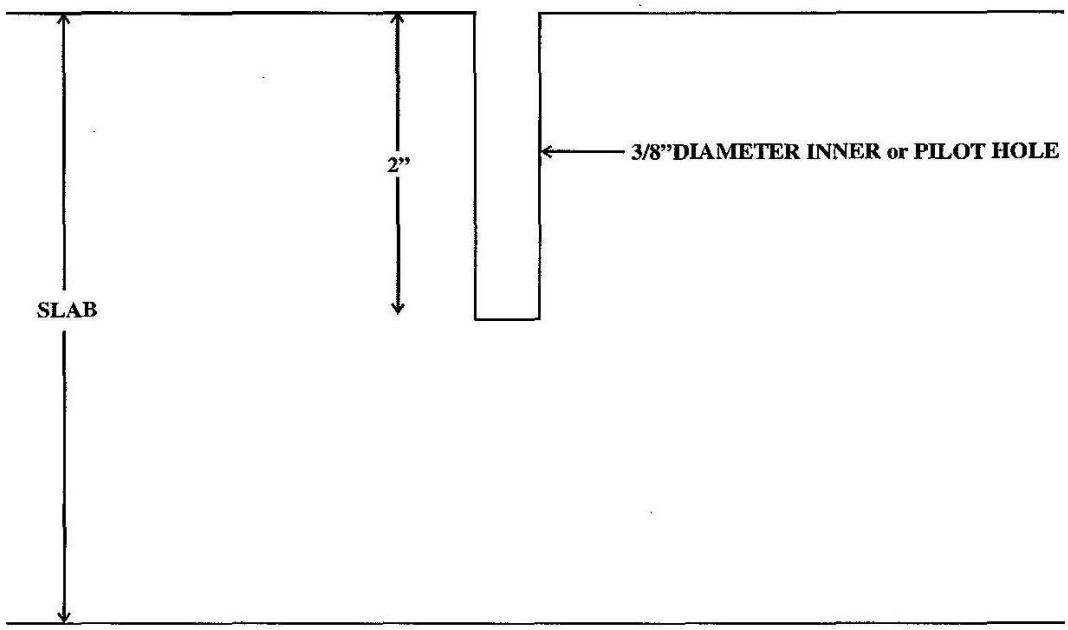


FIGURE 2

OUTER HOLE

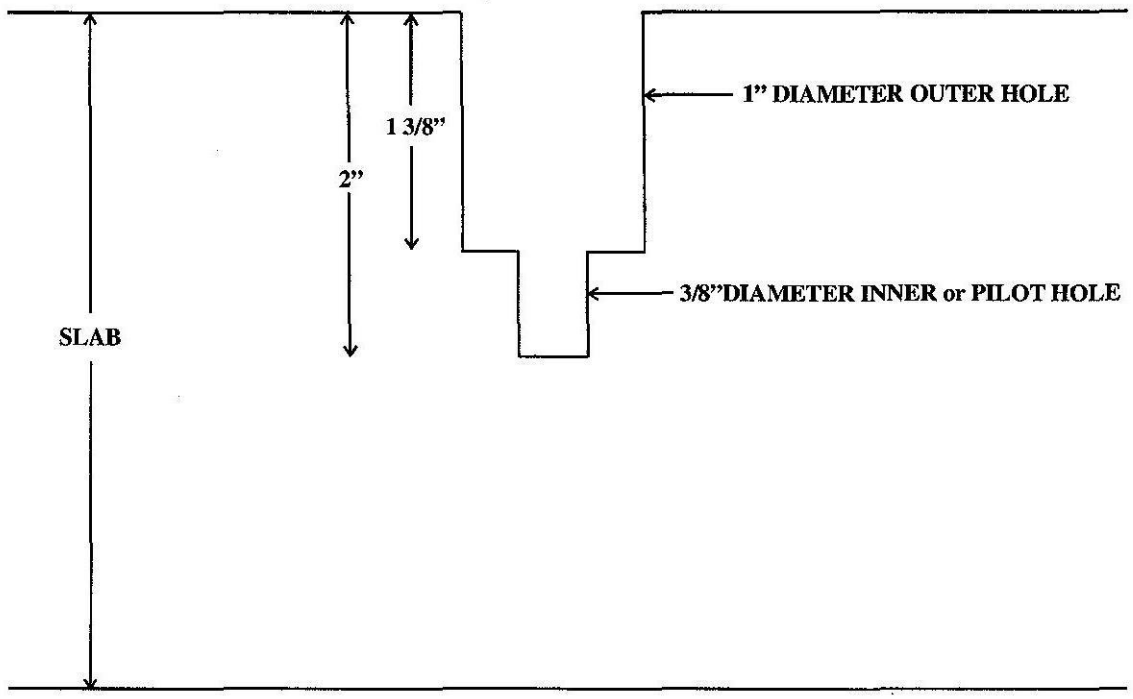
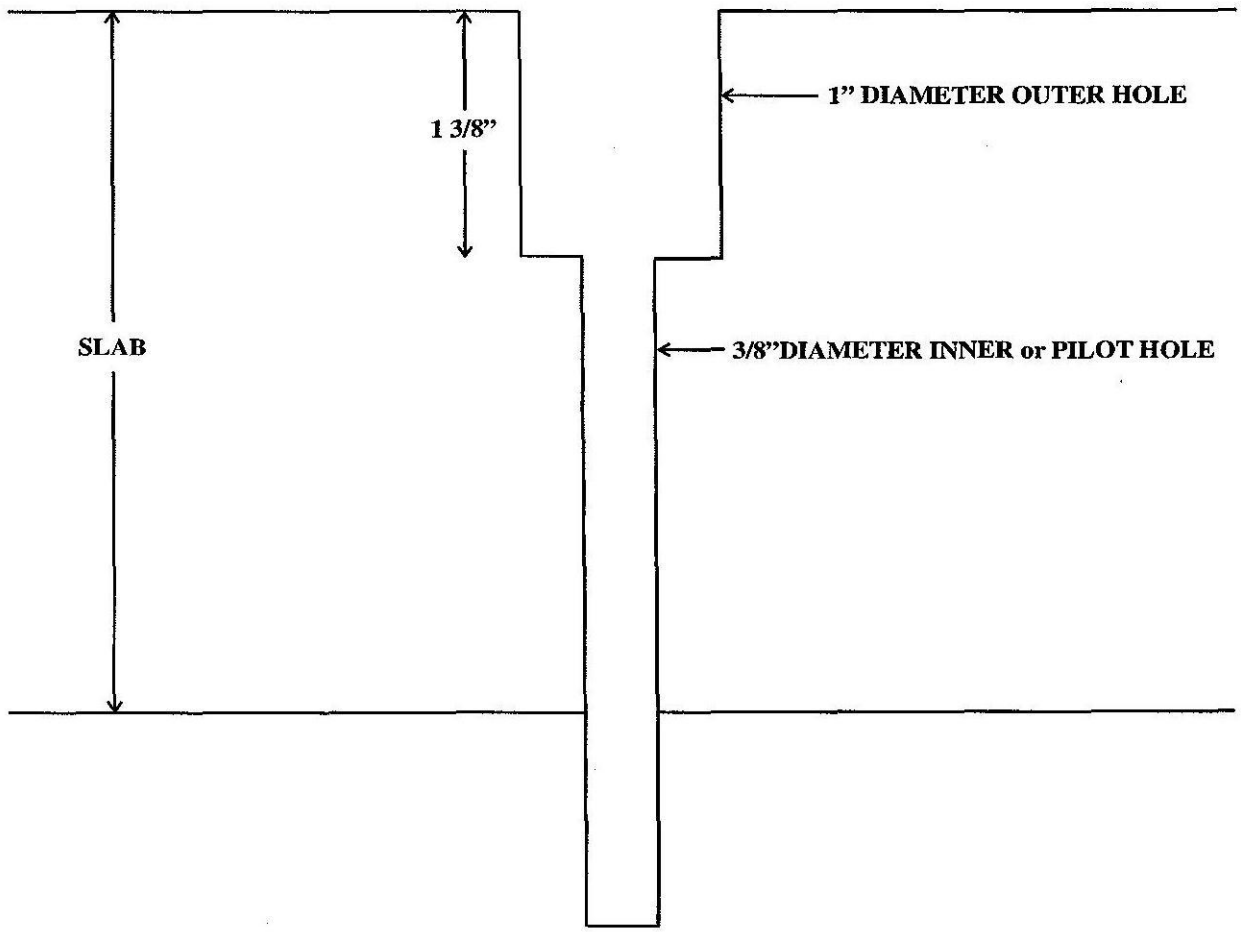


FIGURE 3

COMPLETED HOLE PRIOR to PROBE INSTALLATION



SUB-SLAB MATERIAL

FIGURE 4

SOIL GAS PROBE INSTALLED

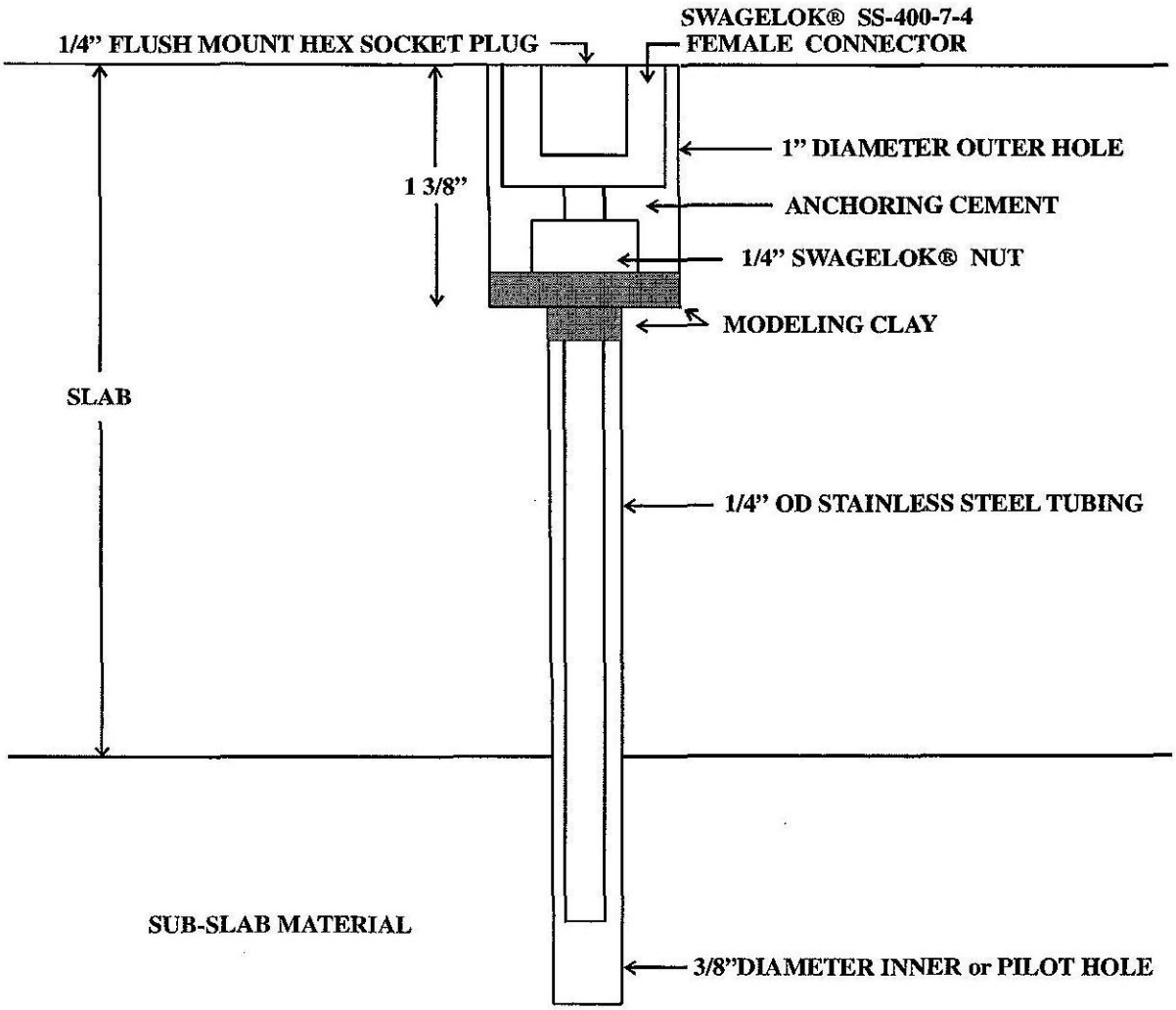


FIGURE 5
SOIL GAS PROBE PREPARED FOR SAMPLING

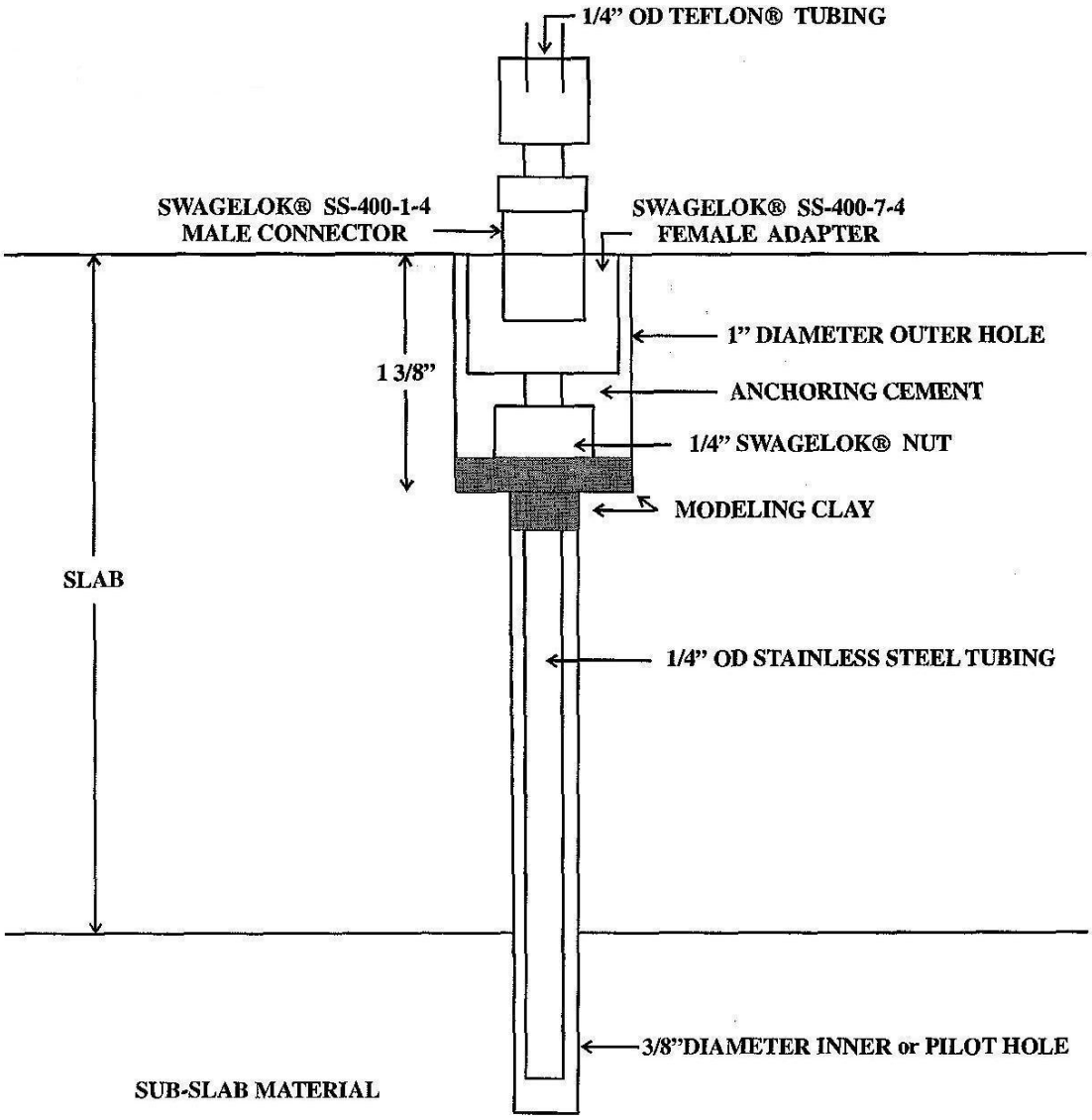
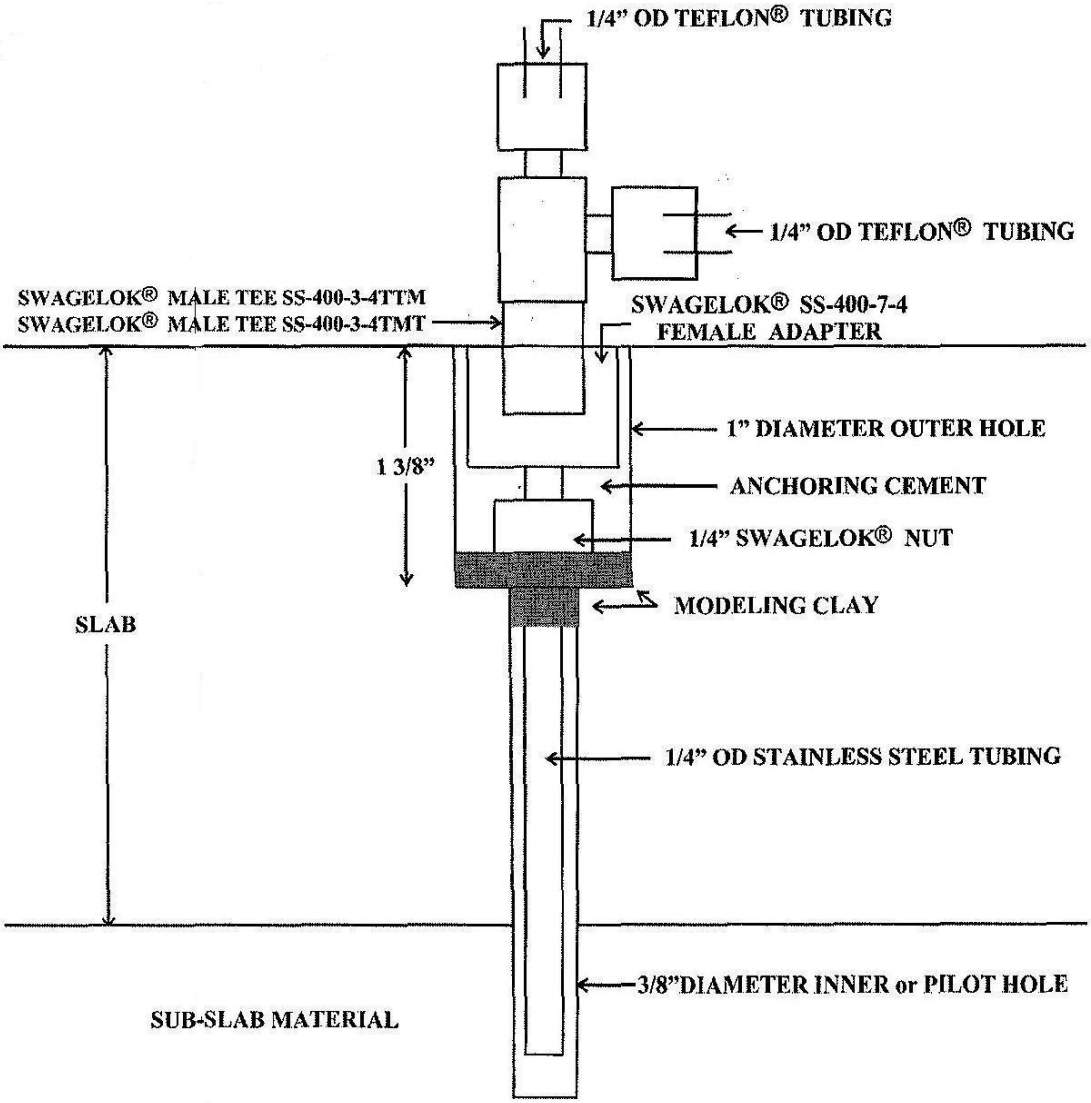



FIGURE 6
SOIL GAS PROBE PREPARED FOR SAMPLING