APPENDIX E

SUB-SLAB SOIL VAPOR SAMPLING GUIDE

Sub-Slab Soil Vapor Sampling Guide

Montana Department of Environmental Quality
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Purpose: This sampling guide is intended to assist DEQ and other Environmental Professionals with the collection of sub-slab soil vapor samples. This guide presents one method to collect soil vapor samples. Slight variations on the method presented may also be appropriate and effective sampling methods.

General Equipment

- Measuring tape to measure building dimensions and sample location
- Nitrile gloves
- 1 Environmental Field Book
- Pre-printed sample log forms
- Pre-printed Inhabited Structure Questionnaire sheets and metal clipboard
- 4 indelible ink ball-point pens (NOTE: no solvent-based markers or Sharpie pens will be used for labeling samples, taking field notes, or otherwise used during sampling)
- Clear plastic trash bags
- Digital camera and batteries
- Tool box with wrenches, tubing cutters, mixers for concrete, etc.
- Sample receipts

Sub-slab Soil Vapor Sampling Equipment

- Individually cleaned and certified Summa® canisters with individual 200 mL/min flow controllers and individual pressure gauges (supplied by laboratory)
- ¼" Teflon tubing (supplied by laboratory)
- Summa canister fittings and ferules (supplied by laboratory)
- Roto-hammer drill and drill bits (3/4" or 7/8", 6" and 12" lengths)
- Small dustpan and broom for cleaning
- Small "garbage" container for drill cuttings and other refuse
- Clean silica sand for bottom of probe point
- Bentonite (sand or powder) for sealing hole annulus while sampling
- Modeling clay for leak sealing (if necessary)
- Low-voc quick-setting cement for sealing top of probe
- DI Water for sealing bentonite and mixing concrete
- Quikcrete, water, and trowel to patch hole after sampling
- Fittings for tubing (supplied by laboratory)
- Plastic zip-lock bags , scissors to snip end to direct concete into hole
- 60 cc Syringes for purging and evacuating air from tubing
- Helium (ultra high purity or high purity)
- Helium meter
- PID meter
- Plastic bags or plastic sheeting for leak detection shroud
- Hose filled with sand for sealing plastic bags to floor
- Decon brush, spray bottle of Liquinox, spray bottle of deionized water
- Flexible tubing in various sizes for connecting meters to Teflon tubing

Identify your sub-slab sampling location. The sampling location should be a minimum of 5 feet from exterior walls. Note the presence of underground utilities such as electric, gas, sewer lines, or radiant heat. The building owner or their representative should approve the sampling location. Take care to avoid tile, wood flooring, carpet, etc. to the extent practicable. It can be extremely helpful to identify sub-slab sampling locations and any potential underground utilities during pre-sampling building inspections. Take out the roto-hammer, drill bits, and extension cord if necessary.

Begin drilling into the slab with the 6" drill bit. Most slabs are 3-4". You should feel the drill punch through the slab and into the sub-slab material. Ream out the hole with the 6" drill bit.

Switch to the 12" drill bit and continue to ream out the hole in the slab in order to create a preferential pathway in the sub-slab material that will allow soil vapor to accumulate.

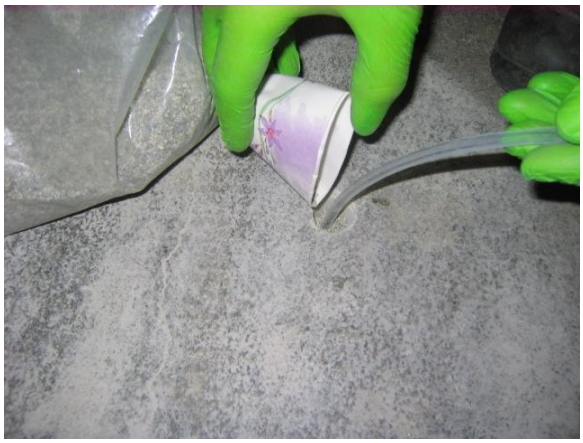
Clean up the drill cuttings with a dustpan and brush or vacuum. Take care to avoid spilling the cuttings back into the hole that you've created in the slab.

Measure the depth of the hole created beneath the slab and record the slab thickness. A small flashlight is helpful for measuring slab thickness.

Take out the clean silica sand, bentonite, deionized water, and Teflon tubing.

Remove the end cap from the Teflon tubing, straighten by hand, and insert the tubing to the bottom of the hole in the slab. Set the tubing approximately 1/2" above the bottom of the hole in the slab.

Begin adding the silica sand. A small paper cup can be helpful. Fill the hole until sand is visible slightly above the bottom of the concrete slab. A flashlight can be helpful to verify this. Add sand slowly to avoid "bridging" and overfilling.



Put away the sand and begin adding the bentonite. At this point sand already should be above the bottom of the slab so there should only be 2-3" of void space in the hole, unless the slab is unusually thick. Add bentonite to approximately 1" below the top of the slab.

Put away the bentonite. LIGHTLY hydrate the bentonite with the de-ionized water. A pipet or similar may be helpful to avoid adding too much water. The idea is to add just enough water to allow the bentonite to expand and seal the hole, but not so much that it percolates through the bentonite and into the sand below. If water is pulled through the sampling train, it will ruin the sample.

Add low VOC, quick setting hydraulic cement to a plastic zip-lock bag. Hydrate with the de-ionized water until the proper consistency is reached. The cement can be mixed in other vessels, but zip-lock bags are recommended due to ease of mixing, cleanup, and disposal.

Cut the corner of the ziplock bag and squeeze cement into the final 1" of void space in the hole. Mound cement above the top of the slab and tightly around the tubing.

Cut the Teflon tubing, leaving approximately 3-4’ of tubing above the top of the slab (enough for easy connection to the Summa canister). Place the end cap on the tubing. Allow the hydraulic cement to set for approximately 20 minutes or until hard to the touch.

While the cement is setting, connect the flow controller to the Summa canister. Place the brass cap from the top of the Summa canister on top of the flow controller and tighten. Briefly open the Summa canister valve (no more than 5 seconds) and then close it to verify the negative pressure in the canister (between -23” Hg and -30”Hg, depending on elevation). If the pressure does not hold, tighten the valve and fittings and try again. If you cannot get the pressure to hold, you may have a leak between the flow controller and the canister, and you will need to use a different canister. Leave the brass cap on.

Turn on the Helium meter, the PID meter (calibrated), and connect the helium canister to its flow regulator and hose.

Place the helium meter tubing and hose from the helium canister adjacent to the sub-slab sampling point.

Place the clear plastic shroud (the garbage bag) around the sub-slab sampling point, encompassing the helium canister hose and the helium meter tubing. The end of the sub-slab sampling train Teflon tubing should remain outside of the shroud. Throughout the leak check and sample collection, try not to disturb the seal between the cement mound and the probe tubing in order to maintain the integrity of the seal.

Place the sand filled hose around the edges of the shroud, weighting it down. The sealed sub-slab sampling point, helium meter tubing and helium gas hose should be contained inside the shroud with only the end of the Teflon sampling tubing extending outside of the shroud (held in hand in photo). Turn on the helium gas and slowly inflate the shroud to a minimum of 20% helium gas content (as measured by the helium meter). Record high and low helium gas concentration beneath shroud on sampling form.

Calculate the volume of soil vapor necessary to purge from the sampling train (a ¼" inside diameter tube has 9.65 ml/ft). A minimum of three times the volume of the sampling train should be purged. Take the 60ml syringe and connect to the Teflon tubing with flexible tubing. Purge 60ml over 20 second intervals to avoid purging at too great a rate (0.2L/min is standard).

Remove the end of the helium meter tubing from beneath the shroud carefully so as to avoid losing helium from the shroud, allow to "zero", and connect to the Teflon probe tubing. Allow the meter to run until it reaches a stable reading. The concentration of helium in the sampling train should be a maximum of 10% of the minimum concentration beneath the shroud. If your concentration is above 10%, remove the shroud, reseal the sampling point with additional hydraulic cement or modeling clay and redo the purge and leak test.

Connect the PID meter to the Teflon tubing sampling train. Allow meter to reach a stable reading and record on the sampling form.

Remove the shroud. Put away the PID meter, but keep the helium meter running. Place the laboratory supplied hardware (ferrule and hex nut) on the Teflon tubing as shown.

Connect the tubing to the top of the flow controller and tighten firmly using 9/16” and 1/2” wrenches.

Place the tubing for the helium meter and helium hose next to the Summa canister and surround with the shroud. Weight the shroud down with the sand and refill the shroud with helium to a minimum concentration of 20%. Open the Summa canister by twisting it open through the shroud and record initial vacuum again on the field form. Watch the helium concentrations beneath the shroud and add additional helium if necessary. Also watch the vacuum readings for the Summa canister. Close the canister once the vacuum is approximately -5”Hg, so as to maintain negative pressure in the canister.

Double check that the Summa canister is tightly closed and remove the shroud. Use the wrenches to remove the flow controller from the canister and replace the brass nut on top of the Summa canister. Remove tubing from the slab by simply pulling it out. Make sure that all relevant information has been documented on the tags on the Summa canister, and that it matches the information on the field forms.

Put away all the equipment. Remove the concrete surface seal with a hammer and chisel. Using a finger or the end of a tool, compact the sand and bentonite in the sub-slab hole so as to avoid settling later.

Mix quickcrete cement or hydraulic cement and add to the sub-slab sampling point. Smooth with trowel. Take a photo to document the condition of the slab upon completion. If the building owner or representative is present, ask them to verify that the slab has been repaired to their satisfaction.