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DEPARTMENT OF NATURAL RESOURCES & ENVIRONMENTAL CONTROL
DIVISION OF WASTE & HAZARDOUS SUBSTANCES
SITE INVESTIGATION & RESTORATION SECTION

STANDARD OPERATING PROCEDURE
Procedure for Indoor Air Sampling

GENERAL PROVISIONS:

DNREC-SIRS has created this standard operating procedure (SOP) as a default procedure to be followed for indoor air sampling. **Any deviation from this procedure will require DNREC-SIRS' approval prior to implementation.**

EQUIPMENT LIST:

- 1) Pre-cleaned and individually certified summa canister*
 - 2) Field Sampling Form
 - 3) Photo Ionization Detector (PID)
- * DNREC recommends, but does not require, that summa canister be pre-cleaned and individually certified.

CONSIDERATION FOR INDOOR AIR SAMPLING WHEN ALSO CONDUCTING SUB-SLAB:

- During sub-slab vapor probe installation, air from under the slab may be released into the indoor air. Time is required for this air to move out of the building prior to indoor air sampling. Based on indoor air exchange rates (indoor air being exchanged for outside air), EPA recommends waiting from one (1) to three (3) days after sub-slab probe installation to sample the indoor air. This requirement is not necessary if the HVAC is turned off prior to sampling. If the air exchange rate of the building is one (1) air exchange unit per hour, then collect the indoor air samples one (1) day after the sub-slab probe installation. If the air exchange rate of the building is 0.25 air exchanges per hour, then three (3) days after the sub-slab probe installation would be required before collecting the indoor air samples.

PREPARATIONS FOR INDOOR AIR SAMPLING:

Prior to the collection of indoor air samples, the following preparations should be made:

- a) De-activate HVAC systems in advance of sampling to more accurately determine natural migration of sub-slab air into the building.

- b) Contact the laboratory to confirm the required sample size necessary to obtain the desired reporting limit.
- c) Conduct a pre-sampling inspection (Fill in Attachment 1 – Parts I – V)
- 1) Prior to each sampling event, identify conditions that may affect or interfere with the proposed testing. Include the inspection checklist in the investigation report.
 - 2) The inspection should evaluate the type of structure, floor layout, physical conditions, and airflows of the building(s) being studied.
 - 3) Perform a product inventory to identify potential sources of interference. Use a photo ionization detector (PID) capable of screening to the low parts per billion (ppb) or a portable GC to screen containers for potential interference. If possible/available, record product name and manufacturer.
- d) Eliminate potential interference

Potential interference from products or activities releasing volatile chemicals may need to be controlled. Removing the sources from the indoor environment a minimum of 72 hours prior to testing (EPA 2015) is the most effective means of reducing the interference. In addition, for the 72-hour period preceding indoor air sampling, avoid the following activities:

- opening any windows, fireplace dampers, openings, or vents
- operating ventilation fans unless special arrangements are made
- smoking in the building
- painting
- operating wood stoves, fireplaces or other auxiliary heating equipment (e.g., kerosene heaters)
- operating or storing automobiles in an attached garage
- storing containers of gasoline or oil within the building,
- cleaning, waxing, or polishing furniture or floors with petroleum- or oil-based products
- using air fresheners or odor eliminators

SAMPLE COLLECTION (Fill in Attachment 2- Excluding the following information: Purge, sample depth, soil composition, other characteristics, and QA/QC Testing Results)

***NOTE:** Sampling personnel should avoid lingering in the immediate area of the sampling device while samples are being collected to avoid undue influence from sampling.

Location

- 1) Any indoor air samples collected should be co-located with a sub-slab sample for ease of comparison of the results.
- 2) Sample collection intakes should be located in the approximate breathing zone for building occupants (typically three feet above the floor level where occupants are normally seated or sleeping). Breathing zone level may vary depending on building use and should be modified accordingly for sampling.
- 3) Air samples should be collected from the basement (1 exposure unit), as applicable, and first floor (1 exposure unit).

Frequency

- 1) A minimum of one (1) indoor air sample per exposure unit should be collected to assess potential exposure of building occupants to volatile chemicals from a sub-surface source.
- 2) The number of ambient air samples collected should be based on Site-specific conditions (e.g., wind direction – is it changing?), but each air sampling event should include at least one (1) outdoor ambient air sample.
- 3) Please see the Active Soil SOP for more details on ambient air samples.

Duration

- 1) EPA recommends collecting ambient air samples 1-2 hours prior to collecting indoor air samples (EPA 2015).
- 2) Collect samples for either 8 hours (commercial exposure scenario) or for 24 hours (residential exposure scenario) depending on the current or anticipated building use to ensure that an air sample is representative of the conditions being tested.
- 3) In non-residential buildings, samples should be collected during normally-occupied periods to be representative of typical exposure. Canister should be

retrieved within 10% of the total sample time. NOTE: Longer duration sampling periods may be appropriate depending on the goals of the investigation.

Procedure

1. The summa canister should be used within 24 hours of shipment to avoid cross-contamination. Canister can be stored longer with DNREC-SIRS permission. Record the vacuum pressure in each summa canister. If the value you just recorded is not within ± 2 psi of the value recorded by the lab prior to shipment, it cannot be used (EPA, 1992).
2. Place a summa canister on a flat surface in the building in the approximate breathing zone of occupants.
3. Prior to completing the sampling, personnel will complete a sampling form by filling in the appropriate sections (Attachment 2) noting pertinent weather conditions, vacuum present in the canister when the sampling began, whether it passed QA/QC testing, etc.
4. A Summa® canister sample valve will be opened to collect the sample for either 8 hour or 24 hour sample time depending on the appropriate exposure scenario.
5. The canister must be shut off while vacuum still remains the canister. Note the remaining vacuum from the vacuum gauge on the sampling form. Summa canisters length of actual sample collection time must be within 10% of the required sampling time interval in order to be considered a valid sample and have a minimum of 1 in of vacuum remaining in the canister (Eurofins). For example, 7 hours for 8 hour sample time or 22 hours for a 24 hour sample. Please contact DNREC as soon as possible regarding any sampling issues to discuss the data usability.

ATTACHMENT 1



**STATE OF DELAWARE
DEPARTMENT OF NATURAL RESOURCES AND ENVIRONMENTAL
CONTROL**

INDOOR AIR BUILDING SURVEY

Survey Completed by: _____ Date: _____

Site Name: _____

DE#: _____

Part I - Occupants

Building Address:

Property Contact: _____
Owner/Renter/Other: _____

Contact's Phone: home () _____ work () _____
cell () _____

Contact's Email: _____

Building occupants: Children under age 13 _____ Children age 13-18 _____ Adults _____

Special Health Conditions (respiratory, cardiovascular; partially able or homebound?)

Allergies _____ Other (describe) _____

Part II - Building Characteristics

Building type: single-family residential / trailer or mobile / multi-family residential (duplex, row, apartment?) / office / strip mall / commercial / industrial

If air, when were filters changed last?

Type of ventilation system (circle all that apply):

- central air conditioning
- bathroom ventilation fans
- range hood fan
- mechanical fans
- individual air conditioning units
- other (specify): _____
- kitchen

Type of fuel utilized (circle all that apply):

Natural gas / electric / fuel oil / wood-wood pellets / coal / solar / kerosene / waste oil/
outside (fresh) air intake

Septic system? *Yes / Yes (but not used) / No* Irrigation/private well?
Yes / Yes (but not used) / No

Public or private well *Yes / No* If public, name of company _____

Existing subsurface depressurization (radon) system in place? *Yes / No*
and running? *Yes / No*

Part III - Outside Contaminant Sources

DNREC DEN/Marplot/Brownfields lists (1000-ft. radius):

Previous land use in area:

Other stationary sources nearby:

- Gas stations
- Waste disposal facilities (LFS & WWTPs)
- Dry cleaners
- Emission stacks
- Beauty shops
- Refineries/chemical plants
- Hot-mix plants
- Auto repair/body shops
- Fuel oil tanks
- Road or roof
- Repair w/hot tar

Wetlands nearby? (distance and direction)

Heavy vehicular traffic nearby (or other mobile sources):

Known groundwater or soil contamination within 1000 feet

Physical parameters of unsaturated zone (summarize or attach)

Sinkholes or Debris Pits

Part IV – Indoor Contaminant Sources

Identify all potential indoor sources found in the building (including attached garages), the location of the source (floor & room), and whether the item was removed from the building 48 hours prior to indoor air sampling event.

Potential Sources	Location(s)	Removed Prior to Sampling? (Yes / No / NA)
Gasoline storage cans		
Gas-powered equipment		
Kerosene storage cans		
Paints / thinners / strippers / glues / caulks		
Cleaning solvents		
Oven cleaners		
Carpet / upholstery cleaners		
Other house cleaning products/laundry products		
Moth balls		
Polishes / waxes		
Insecticides		
Furniture / floor polish		
Nail polish / polish remover		
Hairspray		
Cologne / perfume / after-shave, etc.		
Air fresheners		
Fuel tank (inside building) (outside)		NA
Wood stove or fireplace		NA
New furniture / upholstery		
New carpeting / flooring /paneling		NA

Recent painting in building? Roof repair?		NA
Hobbies - glues, paints, etc.		
Toilet or septic additives		
Dry drain traps, plugged drains, toilets won't flush		
Garbage/spoiled food		
Standing water/tire piles/recent flooding		
Sewage/septage		
Dead animals (including unusual numbers of insects)?		
Mold/mildew		
Wet sheetrock/paneling/flooring		
Neighbors making drugs/Explosives		
Mercury-containing switches or instruments		
Alcohol/bleach/disinfectants		
Recent concrete/masonry work		
Flowers		
Pets (specify); scented kitty litter		
Compost/manure		

Part V – Miscellaneous Items

Do any occupants of the building smoke? *Yes / No* How often? _____

Any chronic health problems? *Yes / No*

Has anyone smoked within the building within the last 48 hours? *Yes / No*

Does the building have an attached garage? *Yes / No*

If yes, does garage have heat/ventilation? _____

Connected to house or separate? _____ Windows? *Yes / No*

If so, is a car usually parked in the garage? *Yes / No*

Do the occupants of the building have their clothes dry-cleaned? *Yes / No*

If yes, name of dry cleaner _____

When were dry-cleaned clothes last brought into the building?

Have the occupants ever noticed any unusual odors in the building? *Yes / No*

Describe (with location): Date _____ Amount

Any known spills of a chemical, fuel or sewage immediately outside or inside the building?

Yes / No Fires? *Yes / No*

Describe (with location): _____

Have any pesticides/herbicides been applied around the building foundation or in the yard/gardens? *Yes / No*

Have any pesticides been applied regionally, e.g. by Mosquito Control or DSWC? *Yes / No*

If so, when and which chemicals?

Are odors more noticeable under certain weather conditions? Describe (wind direction/speed/precipitation/temperature/humidity):

Attachment 2- DNREC-SIRS Sampling Form

**DNREC SIRS Vapor Intrusion Policy
Field Sampling Form**

(Attach Sample Map)

Project #: _____ Sample #: _____
Project Name: _____
Sampled By: _____
Date Sampled: _____ Time: _____

General Site Conditions:

Atmospheric Data:

_____ Source of Data
_____ Precipitation during sampling
_____ Amount of Precipitation
_____ Barometric Press.(Outside/Inside)
_____ Temp(Outside/Inside)
_____ Wind Speed
_____ Wind Direction

Sampling System

(check one)

- () Whole-Air active approach (summa)
- () Whole-Air passive approach
- () Sorbed contaminants-active approach
- () Sorbed contaminants-passive approach
- () Headspace or extraction approach
- () soil pore liquid headspace approach

Sample Type

- () Field Blank
- () TravelBlank

- () Sample Replicate

System Purge Volume (0.086 L/ft) * Depth (ft): _____ Volumes Purged (3): _____ Sample Volume: _____

Sorbent

Device: Installed: _____ Date/time
Recovered: _____ Date/time

Sample Container Type: _____ Sample Container #: _____

Analytical Method: _____ (Chain of Custody Attached)

Analyzer Result: _____

Surface cover: _____

Concrete Thickness: _____

Condition Of Concrete Floor near Sample: _____

Sample Depth: _____ Sampling rate: _____

Soil Composition:	Clay	_____	%
	Soil Organic matter	_____	%
	Fine Granular Material	_____	%
	Coarse Granular Material	_____	%

Moisture Content: _____

Other characteristics:	_____	free water present	_____	indurated
	_____	Free product	_____	soil discoloration
	_____	contaminant odors	_____	probable connection to surface macropores

QA/QC Testing Results

Note- Each vapor point must pass all the QA\QC Tests below before sampling. Reseal and Retest until the vapor point passes the test.

Test #1A- Short Circuit Test

Oxygen reading in % O₂: _____ Did the vapor points pass the test (<=18.8%): Y/N (circle one)

Notes: _____

Test #1B- Short Circuit Test

Oxygen reading in % O₂: _____ Did the vapor points pass the test (<=18.8%): Y/N (circle one)

Notes: _____

Test #2- Helium Test (Please see Attachment 3- Active Soil Gas or Sub-Slab Air Sampling SOP for details)

Test #2A- Helium Concentration within the Shroud: _____

Helium Concentration within tubing: _____
 Did the vapor points pass the test (tubing<10% of the shroud): Y/N (circle one)
 Test #2B- Helium Concentration within the Shroud: _____
 Helium Concentration within tubing: _____
 Did the vapor points pass the test (tubing<10% of the shroud): Y/N (circle one)
 Notes:

Test #3- Shut-in Test (Please see Attachment 3- Active Soil Gas or Sub-Slab Air Sampling SOP for details)

Test 3A# Pass Shut in test by maintaining -7 in. Hg in tubing from the shroud to the summa canister for 5 minutes: Y/N (circle one)
 Notes:

Test 3B# Pass Shut in test by maintaining -7 in. Hg in tubing from the shroud to the summa canister for 5 minutes: Y/N (circle one)
 Notes:

Test 3C# Pass Shut in test by maintaining -7 in. Hg in tubing from the shroud to the summa canister for 5 minutes: Y/N (circle one)
 Notes:

Sampling Information

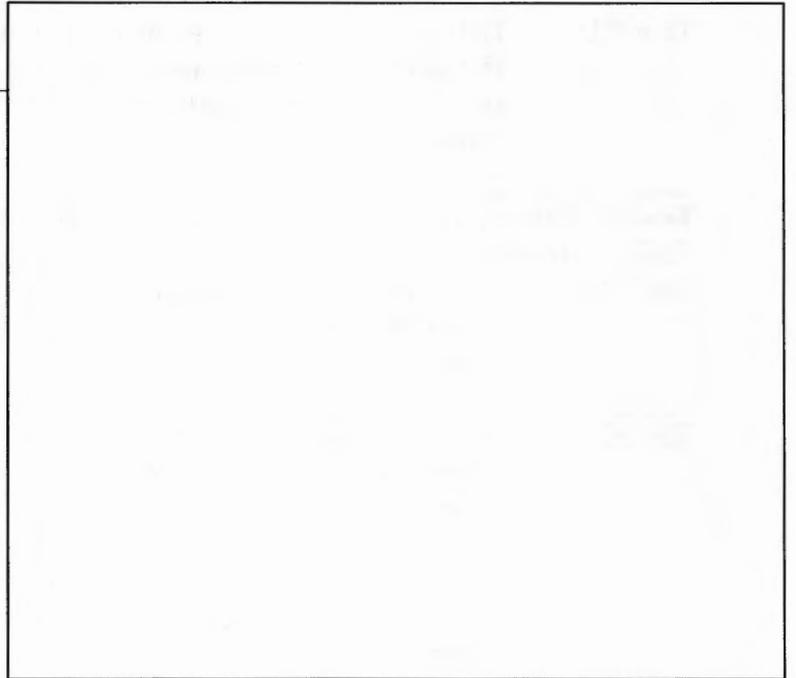
Laboratory: _____

Sample #	Floor	Room	Canister / Tube #	Pump ID # (if applicable)	Sample Start Date / Time	Sample End Date / Time

Sample location(s):

Provide Drawing of Sample Location(s) in Building

Sample # _____ - _____



Did the occupants not follow any of the "Instructions for Residents" directions? *Yes / No*

If so, describe modifications: _____

General Observations

Provide any information that may be pertinent to the sampling event and may assist in the data interpretation process.
