

PASSIVE SAMPLING Installation VaporZorb by VSOL Group

General Guidelines

Passive sampling relies on the use of sorbent materials positioned in the subsurface to adsorb volatile and select semi-volatile organic compounds partitioning from soil and groundwater into the vapor phase.



VaporZorb Sampler

One of the major advantages of passive sampling is that there is no need for pumps or sample media that create a vacuum resulting in the advective movement of contaminants making the passive sample more representative of ambient conditions in the undisturbed environment. Additionally, when using passive sampling, variations in concentration due to temporal factors are minimized since this type of sampling can last for days or weeks, thus providing a more representative sample than those collected in a limited timeframe using active sampling techniques.

Passive sampling involves the absorption of volatile and select semi-volatile contaminants onto the surface and pores of the sorbent material. Sorbents are designed and typically synthesized to have surface area, surface type, and pores selected based on the compounds intended to be adsorbed onto the surface. It is crucial that the selection of the sorbent or sorbent mixture is appropriate for the target compounds.

Passive Sampling for Soil Gas - Equipment

All procedures recommended follow D7758. The list of materials necessary for passive sampling includes:

- Sampler sealed in a box with numbered seal
- Passive samplers
- Individual zip bags for storing each sampler
- Chain of custody
- Return custody numbered seal
- Aluminum sleeve (1.5-inch diameter). (For sites with low gas exchange at depth a PVC water well screen could be used instead of an aluminum sleeve. Backfilling around the screen and the bottom of the hole with sand is not necessary but helpful).
- Aluminum foil
- Paper towels
- Nitrile gloves
- Hammer drill
- Drill bit at least 1.5 inch
- Drill bit at least 0.5 – 1.0 inches

PVC water well screen



The procedure is illustrated in steps for two situations: for installation in solid surface (asphalt or concrete) or soft surface (soil).

Passive Sampling for Soil Gas - Procedure

Step 1

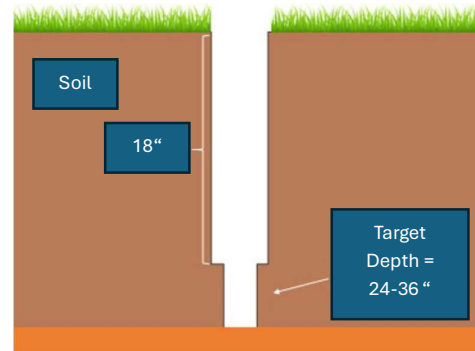
Drill to 12-inch depth with a drill bit 1.5-inches in diameter.

Step 2

Ream hole another 12- to 24-inches with a drill bit at least ½ inch in diameter.

Step 3

Place the aluminum sleeve approximately 12 to 14- inches into the hole. (Alternately a PVC screen could be used if there isn't sufficient gas exchange due to soil type)



Step 4

Remove the VaporZorb Passive sampler from the mylar bag and clear shipping vial. Attach nylon line to sampler and secure to the aluminum foil "plug".

Step 5

Position the sampler inside the liner and seal it with aluminum foil "plug" pressing the foil 1- to 2-inches into the liner

Step 6A

Replace the surface soil ensuring it does not get into the PVC or aluminum liner.

Step 6B

Place 1- to 2-inches of Quickcrete over the top of the foil plug ensuring it does not get into the PVC or aluminum liner.

Step 7 (sampler retrieval)

Remove the soil or concrete from over the sampler liner, carefully remove the aluminum foil and VaporZorb Passive sampler from the liner, clean the sampler body with paper towels, and place within the original clear glass vial. Store the glass vial in an individual mylar bag. Record all sampling data including the location, start and end dates and times on the sample label as well as the electronic chain-of-custody.

Storage

After sampling is completed using the samplers provided, the samples should be stored at room temperature ($\leq 25^{\circ}\text{C}$) and have a holding time of 30 days from the date the samplers are removed from the sample point (ASTM D6196-15).

Although passive sampling is simple, several precautions must be taken to ensure representative data. These include:

- It is generally recommended that the sampling lasts at least seven days.
- Drill bits must be cleaned with water free of volatile or semi-volatile compounds between sampling locations.
- Samplers must be stored away from potential contaminants such as fuels and cleaning products.
- Removing samplers from shipping vials should occur away from any other contamination sources (car exhaust, cleaning solutions, hand sanitizers, etc).
- Do not mark sample locations with volatile or semi-volatile compounds such as spray paints.
- Do not use Sharpie markers when filling out sample labels or chain of custody documents.



Passive Sampling for Indoor and Outdoor Air

All procedures recommended follow ISO 16017-2. The materials required for passive sampling are:

- Sampler sealed in a box with numbered seal
 - Passive samplers
 - Individual zip bags for storing each sampler
 - Chain of custody
 - Return custody numbered seal
 - Nitrile gloves
 - A stand for positioning the sampler
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Step 1

Remove the sampler from the mylar bag and clear shipping vial. Attach nylon line to sampler.

Step 2

Position the sampler, preferably near the breathing zone, approximately 4-5 feet high, as recommended by ASTM D7663-12.

Step 3

Record all sampling data, such as start and end times, start and end dates, and complete all required chain-of-custody information.

Although passive sampling is simple, several precautions must be taken to ensure representative data. These include:

- It is generally recommended that the sampling lasts at least seven days.
- Samplers must be stored away from potential contaminants, such as fuels and cleaning products.
- Removing samplers from shipping vials should occur away from running generators or any other contamination sources, whenever possible.
- Monitor and record local conditions to highlight any interference during sampling.
- Check and record the use or storage of products containing volatile or semi-volatile compounds. This step is critical for vapor intrusion investigations to ensure that the presence of a compound in indoor air is truly linked to vapor migration from the soil.
- Do not use Sharpie markers when filling out sample labels or chain of custody documents.

Storage

After sampling is completed using the samplers provided to the customer, the samples should be stored at room temperature ($\leq 25^{\circ}\text{C}$) and have a holding time of 30 days from the date the samplers are removed from the soil (ASTM D6196-15)

	1 Week	2 Weeks
	MRL	MRL
	(µg/m3)	(µg/m3)
1,1,1,2-Tetrachloroethane	6	3
1,1,1-Trichloroethane	2.8	1.4
1,1,2,2-Tetrachloroethane	7	3.5
1,1,2-Trichloroethane	5.8	2.9
1,1-Dichloroethane	5.4	2.7
1,1-Dichloroethene	5	2.5
1,2,3-Trichlorobenzene	3.6	1.8
1,2,3-Trichloropropane	3.1	1.5
1,2,4-Trichlorobenzene	3.5	1.8
1,2,4-Trimethylbenzene	3.4	1.7
1,2-Dibromo-3-chloropropane	6.4	3.2
1,2-Dibromoethane	2.4	1.2
1,2-Dichlorobenzene	3.1	1.6
1,2-Dichloroethane	5.6	2.8
1,2-Dichloropropane	2.7	1.4
1,3,5-Trimethylbenzene	3	1.5
1,3-Dichloropropane	5.5	2.8
1,4-Dichlorobenzene	3.1	1.6
1-Chlorobutane	2.7	1.3
2-Chlorotoluene	3.1	1.6
2-Hexanone	8.2	4.1
4-Chlorotoluene	3.3	1.6
Benzene	15.4	7.7
Bromobenzene	5.9	2.9
Bromochloromethane	2.2	1.1
Bromodichloromethane	2.5	1.3
Carbon tetrachloride	3	1.5
Chlorobenzene	2.2	1.1
Chloroethane	8.1	4

	1 Week	2 Weeks
	MRL	MRL
	(µg/m3)	(µg/m3)
Chloroform	2.4	1.2
Chloromethane	6.6	3.3
cis-1,2-Dichloroethene	4.6	2.3
Dibromochloromethane	2.6	1.3
Dibromomethane	2.6	1.3
Diethyl Ether	4.9	2.5
Ethylbenzene	2.4	1.2
Hexachloroethane	3.5	1.8
Isopropylbenzene	3	1.5
m,p-Xylene	5	2.5
Methyl Ethyl Ketone	5.8	2.9
Methyl Isobutyl Ketone	6	3
Methyl methacrylate	2.8	1.4
Methyl tert Butyl Ether	6.8	3.4
Naphthalene	7.2	3.6
n-butylbenzene	3.6	1.8
n-Propylbenzene	2.6	1.3
o-Xylene	2.8	1.4
sec-butylbenzene	3.6	1.8
tert-butylbenzene	3.6	1.8
Tetrachloroethene	2.8	1.4
Tetrahydrofuran	2.3	1.2
Toluene	3	1.5
trans-1,2-Dichloroethene	2.4	1.2
trans-1,4-Dichloro-2-butene	6	3
Tribromomethane	2.7	1.3
Trichloroethene	2.6	1.3
Vinyl Chloride	11.4	5.7

References

1. Vapor Intrusion Pathway: A Practical Guideline, The Interstate Technology and Regulatory Council (ITRC), 2007.
2. U.S. Environmental Protection Agency (USEPA). "Determination of Volatile Organic Compounds in Ambient Air Using Active Sampling Onto Sorbent Tubes", 1999.
3. ASTM D7558. "Passive Soil Gas Sampling in the Vadose Zone for Source Identification, Spatial Variability Assessment, Monitoring, and Vapor Intrusion Evaluations", ASTM, 2011.
4. ASTM D6196-15 – "Standard Practice for Choosing Sorbents, Sampling Parameters and Thermal Desorption Analytical Conditions for Monitoring Volatile Organic Chemicals in Air", ASTM, 2015.
5. CETESB Directorate Decision No. 038/2017/C, dated 07 February 2017, CETESB, 2017.