

Excerpts from the Advisory Opinion by the six New England States, EPA Region I - New England, the Northeast Waste Management Officials' Association (NEWMOA) Technology Review Committee in January, 2002, regarding the use of Polyethylene Diffusion Bag (PDB) samplers.

Advantages:

- Eliminates or substantially reduces the amount of purge water associated with sampling that has to be managed.
- Inexpensive method to obtain groundwater samples.
- Relatively easy to deploy and recover – a minimal amount of labor and field equipment are required. Practical for use where access is a problem and where discretion is desirable.
- Samplers are disposable, so there is little downhole equipment to decontaminate between wells and minimal decontamination waste to manage.
- The use of multiple samplers can be helpful in delineating contaminant stratification in the open or screened intervals of monitoring wells. This is difficult to accomplish using conventional methods.
- The pore size of LDPE is about 10 angstroms or less, so sediment does not pass through the membrane into the bag. Therefore, the samplers are not subject to interferences from turbidity. However, turbidity by itself does not affect the concentration of VOCs in a sample.
- Alkalinity-contributing solutes do not pass through the membrane, allowing for collection of VOCs in a non-alkaline matrix, and thereby eliminating the VOC losses associated with the foaming that occurs when using acid to preserve the sample in highly alkaline water.
- Integrates over time - would be a limitation in an aquifer where VOC concentrations change more rapidly than the samplers equilibrate and the goal of sampling is to collect a representative sample of a particular point in time.
- Water-filled LDPE PDB samplers are not applicable for all compounds. The samplers are not appropriate for inorganic compounds. They also have a limited applicability for the very soluble and the very insoluble organic compounds, such as acetone, MTBE, most semi-volatiles, and most ions.
- PDB samplers cannot be used to measure parameters such as pH, temperature, and redox potential. However, these parameters are typically not necessary to meet the goals of a sampling event where the use of PDB samplers is appropriate. The purpose of measuring pH, temperature, and redox potential is typically to document that the well has been adequately purged before sample collection, or for use in evaluating natural attenuation. Well purging is not an issue when PDB samplers are used, and PDB samplers are not recommended for natural attenuation monitoring.
- PDB samplers rely on the free movement of water through the well screen. If the well screen is occluded or if the aquifer or the sandpack surrounding the well screen is more transmissive than the well screen, then VOC concentrations in the well might not represent concentrations in the adjacent aquifer.
- VOC concentrations in PDB samplers usually represent concentrations found at the elevation of the sampler within the well screen or open interval. This is often not a

limitation, but might be in a situation where the groundwater contamination is above or below the screen, or not in the interrogated sample interval.

- In well screens transecting zones of different hydraulic head, VOC concentrations in water from PDB samplers could represent concentrations in a part of the aquifer not adjacent to the PDB sampler. However, multiple PDB samplers may be used in conjunction with borehole flow meter testing to gain insight on the movement of contaminants into and out of the well screen.
- In well screens transecting zones of different chemical concentrations or constituents, the use of a single PDB sampler may not adequately target nor provide accurate concentration values for the most contaminated zone. However, multiple PDB samplers can be used to locate the zone of highest concentration in the screen. Multiple PDB samplers may be needed in wells where flow patterns through the screen change as a result of groundwater pumping or seasonal fluctuations. Analytical costs when using multiple PDB samplers can be reduced by selecting a limited number of the samplers for laboratory analysis based on field screening using gas chromatography at the time of sample collection.

Applicable Contaminants

PDB samplers are appropriate for many, *but not all*, VOCs. Therefore, PDB samplers are appropriate for use at well-characterized sites where the target chemicals are known and have been determined appropriate for PDB samplers. PDB samplers are not appropriate for inorganic compounds. They also have a limited applicability for the very soluble and the very insoluble organic compounds, such as acetone, MTBE, most semi-volatiles, and most ions. Hydrophobic compounds can have an affinity to the LPDE plastic and do not diffuse into the water inside the bag.

The VOCs that have been tested and shown good correlation between the results from PDB sampler water and test-vessel water (11 percent or less difference) are listed below:

benzene	DBC chloromethane	trans-1,2-dichloroethene	1,1,2-trichloroethane
BDCmethane	dibromomethane	1,2-dichloropropane	trichloroethene
bromoform	1,2-DCbenzene	cis -dichloropropene	TCFmethane
chlorobenzene	1,3 – DCbenzene	EDB	1,2,3-TCPA
carbon tetrachloride	1,4-DCbenzene	trans-1,3-DCPE	1,1,2,2-PCD
chloroethane	DCFmethane	ethyl benzene	tetrachloroethene
chloroform	1,2-dichloroethane	naphthalene	vinyl chloride
chloromethane	1,1-dichloroethene	toluene	xylene
2-chlorovinylether	cis -1,2-dichloroethene	1,1,1-trichloroethane	

The tested compounds showing poor correlation (>20 percent difference) are:

acetone	MTBE	styrene	MIBK
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In addition, PDB samplers are not appropriate for sampling iron, sulfate, nitrate, and manganese, and therefore PDB samplers are not recommended for use to evaluate the natural attenuation process unless the necessary natural attenuation parameters can be collected in another manner. ***(EON Products note: use the Hydrasleeve for this application)***

Other recommendations included in the Advisory to improve or insure product performance are:

1. PDB samplers are appropriate for use at well-characterized sites where the target chemicals are known and have been determined appropriate for PDB samplers.
2. Before PDB samplers replace low flow or purge groundwater sampling techniques, a side by side comparison should be completed.
3. PDB samplers should equilibrate for a minimum of 2-weeks in monitoring wells constructed in sandy soils. The user must demonstrate that the chosen equilibrium time used is appropriate when applying PDB samplers in less permeable formations; in waters colder than have been previously well tested (10°C); or for target chemicals without sufficient corroborating data from prior studies.
4. For the initial sampling event, multiple PDBs should be deployed in all monitoring wells with screens greater than 5 feet in length, as discussed previously. Once contaminant stratification, or other complicating factors are determined NOT to be present, then a single PDB sampler in a well might be appropriate.
5. Replicate samples should be collected from a single PDB sampler at a rate of 1 set of replicates from 1 in every 10 PDB samplers deployed (10 percent).
6. For PDB samplers that are not purchased pre-filled, a sample of the water used to fill the PDB samplers should be collected when the bags are being filled and analyzed to detect any possible introduction of VOCs by the water used.
7. For pre-filled PDB samplers, water from an extra sampler that is not deployed should be collected as a trip blank to determine whether contaminants have affected the samplers prior to deployment. This type of trip blank should be collected at the time of deployment.
8. A traditional trip blank should also be used to assess whether external VOCs contaminate the sample due to the sample handling and/or analytical processes. These trip blanks are water filled VOA vials that are transported with the sample collection equipment and are collected at the time of sample collection.
9. Users must accurately measure the sampler's position within the well. "As-built" well diagrams are important.
10. PDB samplers should not contact non-aqueous phase liquid (NAPL) during deployment or retrieval to prevent cross contamination.
11. When PDB samplers are retrieved, they should be visually inspected and observations recorded in the field book, including deposits or coatings. Any irregularities noted should be reported to the project manager. Samplers that have a heavy build-up of organic coating or a tear in the membrane should be rejected. *(EON Products note: immediate collection of sample into vials is recommended to prevent VOC diffusion into the air.)*