



# FACT SHEET

## Diffusion Multi-Layer Groundwater Sampling

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### **What is Diffusion Multi-Layer Ground Water Sampling?**

Diffusion sampling is a new groundwater sampling method for volatile organic compounds (VOCs). The Diffusion Multi-Layer Sampler (DMLS) is a passive multi-layer-sampling device based on dialysis cell technology. The device consists of a rod with openings at specific intervals to accommodate dialysis cells. Each dialysis cell is an independent sampling unit, essentially a propylene vial filled with distilled water and covered by permeable membranes at both ends

### **How does Diffusion Multi-Layer Groundwater Sampling work?**

When a dialysis cell is exposed to groundwater with concentrations of substances different from that inside the cell, a natural process of diffusion, where chemicals pass from higher concentrations to lower concentrations occurs. The method consists of suspending a weighted, polyethylene bag containing deionized/organic-free water in a well at a selected depth and left long enough to allow water in the sampler to come to equilibrium with concentrations of VOCs in the groundwater flowing through the well screen. After approximately two weeks of being exposed to the natural groundwater passing through a well, the sample rod is removed and the separate DMLS units are recovered. The groundwater captured through diffusion at various levels within the well is then prepared for laboratory analysis.

When the diffusion sampler is retrieved, the sample is transferred to the appropriate sampler container. Stainless steel weights that position the diffusion sampler in the well screen may either be dedicated to the well or decontaminated for use at another location. A new diffusion apparatus may be installed as the old one is removed. To provide a vertical profile of contaminant concentrations that may differ along the screened interval, diffusion sampler's lengths (e.g., one or two feet) may be "stacked" within the well screen.

### **Why use diffusion multi-layer groundwater sampling?**

Diffusion sampling is an efficient, viable alternative to conventional groundwater sampling techniques for VOCs. This new technology has been found to yield better quality analytical data at a lower cost.

The primary advantages of the passive diffusion sampling method are include:

- A more representative sample is collected because the groundwater is less disturbed.
- Lower labor and equipment costs due to shortened field time and little or not standard sampling method related equipment purchases/rentals.

- Less investigation derived waste since well purging prior to sample collection is unnecessary.
- Hard-to-reach wells become more accessible because very little equipment needs to be taken to a well in order to conduct sampling.
- The potential for cross-contamination is virtually eliminated because no decontamination procedures are necessary between wells.
- Improved quality of the resulting analytical data.
- Vertical profiling of contaminants by using short length diffusion samplers “stacked” within the screen interval of a well.

### **Where has the Navy implemented the diffusion multi-layer groundwater sampler?**

Passive diffusion sampling was first demonstrated in the Navy by the Naval Support Activity (NAS) Mid-South partnering team at NSA Mid-South, Southern Division. In August 1988, the Base Realignment and Closure (BRAC) Team decided to test this innovative sampling method as a means of reducing cost and time associated with long-term monitoring of VOCs in groundwater. The pilot-scale test was implemented to determine the accuracy and applicability of the method. The Navy found that the analytical data from the sampling at discrete depths provided representative sampling and was much less expensive than traditional sampling methods. Based on the success of the pilot test, the team proceeded to full-scale implementation of the diffusion sampling method.

### **Glossary:**

- Deionized** - To remove ions from (a solution) using an ion-exchange process.
- Dialysis** - Separation of substances in solution by means of their unequal diffusion through membranes, through which fluids can pass.
- Polyethylene** - A lightweight thermoplastic; used especially in packaging and insulation.

#### **References**

- Navy, 2000, *DON Environmental Restoration SMART Cleanup for Future Generations*.

#### **For Further information Visit:**

<http://www.clu-in.org>

<http://www.rtdf.org>

<http://www.denix.osd.mil>