

# Use of No-Purge Groundwater Sampling Techniques to Eliminate Health and Safety Concerns and Reduce Costs



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## ■ Bulk Petroleum Facility

- Semi-annual Groundwater Sampling
- 56 Acres
- In Operation Since the Late 1930s
- On the South Bank of the Ohio River
- Eight Aboveground Storage Tanks
  - 800,000 – 3,500,000 gallon capacity



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- Eight 10-inch Diameter Pipelines Run from the Tanks to a Lower Manifold Area along the East Property Line
  - Elevation change from 760 ft msl to 555 ft msl
  - Slope of 0.3 feet per foot
  
- Petroleum Products Stored/Handled:
  - Gasoline
  - Diesel Fuel
  - Kerosene
  - Jet A Fuel
  - Fuel Oil
  - Toluene

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- Petroleum Odors Reported in Basements of Residential Homes Directly East of the Facility in 1995
- LNAPL Discovered in a Sanitary Sewer in an Adjacent Street
- 40 Monitoring Wells Installed On and Adjacent to the Facility to Monitor Impacts
- Compounds of Concern:
  - Benzene
  - Toluene
  - Ethylbenzene
  - Total Xylenes
  - MTBE

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- General Safety Concerns Associated with Groundwater Sampling:
  - Slips, trips and falls
  - Back and muscle strains from improper lifting
  - Splashing and spills



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## ■ Near Miss:

- 325-gallon Polytank Used to Hold Purge Water
- Purge Water Emptied into the On-Site Oil/Water Separator
- Tank Slipped and Fell Almost Hitting a Technician

## ■ Root Cause Analysis Conducted

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## ■ Root Cause Analysis:

- For Every Serious Accident, a Larger Number of Incidents Result in Limited Impact and an Even Larger Number of Incidents Result in No Loss or Damage.





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## ■ Near Miss

- An event, which does not result in injury or damage, but had the potential to do so.
- Although the outcome is different, the causes that lead to a near miss incident are the same as those that result in injury or damage.
- By investigating and removing the cause(s) of the near miss, potential future incidents can be avoided.

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## ■ Discussion of Alternatives Focused on the Polytank:

- Install Handles on the polytank.
- Secure/strap down the polytank.
- Drilling a new opening in the polytank.
- Using a smaller polytank.
- Using a hand pump to empty the polytank.

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- Other Safety Concerns Noted During the Analysis:
  - Access to the polytank in the back of the truck.
  - Emptying the purge water into the polytank.
  - Splashing and spilling of purge water from the tank while driving to the wells.

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Solution:



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## ■ No-Purge Sampling Device Evaluation:

### ● Diffusion Samplers

- Compounds enter the sealed sampler through diffusion and the water quality inside the sampler reaches equilibrium with the water quality in the surrounding well.

### ● Grab Samplers

- The sampler is empty when deployed in the well, and following an equilibrium period, the sampler is closed to trap ambient groundwater or they are filled and sealed during the retrieval process.

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## ■ HydraSleeve™:

- MTBE cannot penetrate the diffusion samplers.
- Relatively small sample volume needed for the compounds of concern (i.e., one device per well).
- Ease of use.
- Low turbidity within the wells to be sampled.



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## ■ HydraSleeve™:

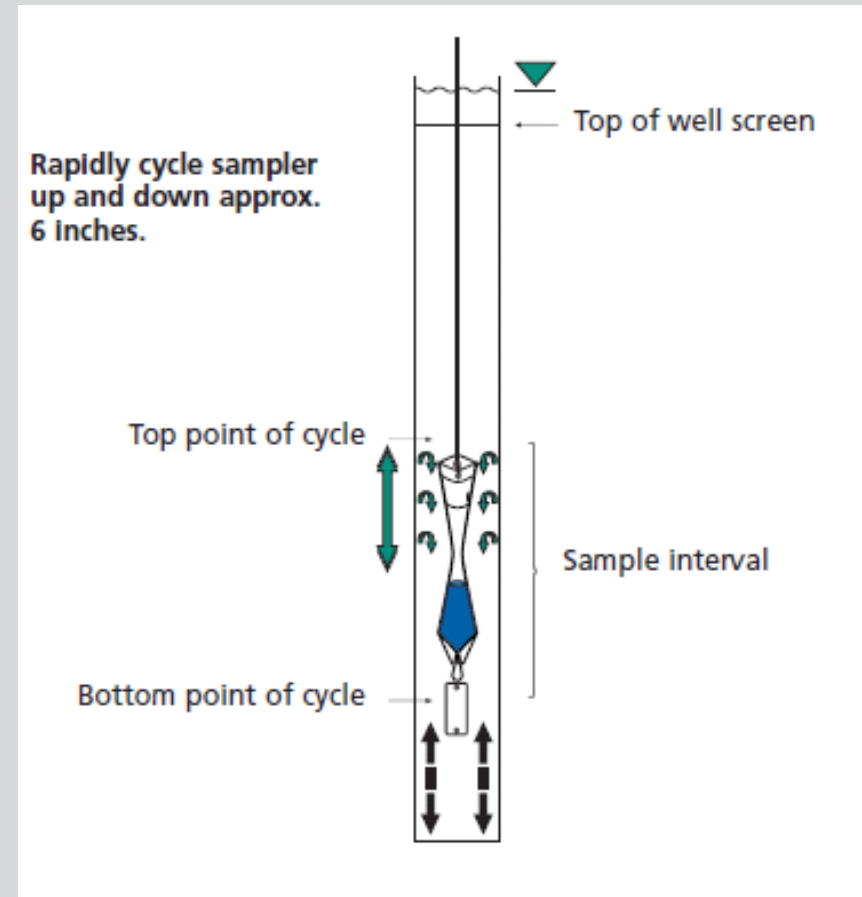
- Cylindrical, flexible, polyethylene bag, with a one-way reed valve.
- Suspended from a line with a stainless steel weight at the bottom.
- 500-mL sampler used at the site, although other sizes available.
- 24-hour equilibration period.



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## ■ HydraSleeve™:

- To collect a sample, the device is raised and lowered approximately six inches twenty times.
- Once the bag is full, the internal pressure keeps the valve closed as the device is recovered from the well.



(From Cordry, 2003)



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## ■ Regulatory Approval:

- Kentucky Department of Environmental Protection, Division of Waste Management
- Compared a subset of four wells using traditional purge and no-purge methods during one sampling event.
- Four wells selected since the majority of the wells (16 of 23) do not have detectable concentrations of the compounds of concern.

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## ■ Regulatory Approval:

### ● Four wells:

- One location that has among the highest detected concentrations;
- One location with low to moderate levels of contamination;
- One location with low levels of contamination; and
- One location with non-detectable levels.

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## Comparison of Results for HydraSleeve and Three-Volume Traditional Purge Methods

Well Location	Benzene Concentration (ug/L)	Toluene Concentration (ug/L)	Ethylbenzene Concentration (ug/L)	Xylenes Concentration (ug/L)	MTBE Concentration (ug/L)
MW-2					
HydraSleeve	4400	770	2300	10000	3700
3-Vol. Purge	4600	840	2100	9600	3300
MW-4D					
HydraSleeve	150	8.3	<5	8.6	62
3-Vol. Purge	36	6	<5	11	33
MW-7					
HydraSleeve	<1	<5	<5	<5	<4
3-Vol. Purge	<1	<5	<5	<5	<4
MW-17					
HydraSleeve	1.6	<5	<5	<5	18
3-Vol. Purge	2.6	<5	<5	<5	22
Parker & Clark Study (2002)					
HydraSleeve	513	Not Analyzed	Not Analyzed	169	Not Analyzed
3-Vol. Purge	521			177	
Parker & Clark Study (2002)					
HydraSleeve	136,000	Not Analyzed	Not Analyzed	140,000	Not Analyzed
3-Vol. Purge	137,000			145,000	

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## ■ Implementation Results:

- HydraSleeves have been used to collect samples at the site without incident since 2007.



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## ■ Implementation Results:

- No-purge sampling results may be more accurate since only the dissolved fraction in water is collected and not some of the sheen that may be on the water surface.
- Monitoring well depths range from approximately 15 – 150 feet, with most wells having a total depth of approximately 30 – 40 feet.
- Results have been consistent with historical data collected at the site.

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## ■ Implementation Results:

- Low-water levels require the placement of additional top weights in order to collapse the sampler below the water table and obtain the necessary sample volume.



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## ■ Implementation Results:

- Sample collection time has been reduced from approximately five days for two technicians to approximately two days for two technicians.
- Annual labor savings of approximately \$3200 per year.
- Equipment costs have remained approximately the same at about \$1250.

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## ■ Implementation Results:

- Assuming 30 years of additional monitoring, a savings of approximately \$108,000 will be realized over the life of the project.
- With fewer pieces of equipment needed (such as generators and pumps), the potential for muscle strains and other injuries associated with lifting and hauling large equipment has also been reduced.



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## ■ Conclusions

- Use of no-purge sampling devices has made it safer for technicians to collect the necessary samples with no impact to the quality of the data.
- In addition, an increased concern for safety does not have to lead to increased cost.

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**QUESTIONS?**

