Hydrocarbon Monitoring Technologies

by Geoff Hewitt

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The oil spill in the Gulf of Mexico has increased the interest in technology in oil spills, cleanups and remediation.

The Gulf of Mexico oil spill is expected to present challenges to every person in the region whose livelihood or operations depend on access to clean water and air. While the obvious presence of crude oil floating on the surface appears to have diminished, the concern that the bulk of the oil is still lurking beneath the surface, perhaps dispersed into tiny droplets, introduces new challenges. Reports of water sheens and the apparent presence of toxic decomposition products do not bode well for the future of the area.

Every user of the Gulf's water, be it for aquiculture, cooling, aquariums, etc., must now be prepared for the potential problems brought on by the sudden onset of contamination. At the same time, the breakdown of the oil and its dissolution may introduce toxic chemicals and aromatics such as benzene, toluene, ethylbenzene, xylene (BTEX) and other volatile compounds that have the potential to pollute both the water and the air. Oil-contaminated sand dumped in landfills has the potential to break down and pollute groundwater.

The PhoCheck Tiger VOC detector is pictured to the left. Photograph courtesy of ION Science.

While the Gulf Spill may be the largest on record, it is not an isolated incident, as a recent pipeline rupture in Michigan demonstrated, and the soil and groundwater in and around many tank farms, gas stations, airports and military bases are potentially contaminated with petroleum fuels of many types.

Most regulated sites are subject to periodic monitoring, but Murphy's Law often comes into play.

What to do?

The key to addressing most of these issues is real-time monitoring. Recent introductions of *in-situ* continuous monitoring technology allows for early warning of potential problems. New technology using continuous and portable instruments are available to provide real-time detection of dissolved and airborne contaminants.

The CMS-100 pictured above can provide continuous *monitoring as needed. Photograph courtesy of ION Science.*

Dissolved total petroleum hydrocarbons (TPH) and BTEX compounds can be monitored *in-situ*, utilizing a patented, fiber optic chemical sensor technology from FCI Environmental, which also gives instantaneous response to the onset of oil sheens. This technology provides 99.9 percent correlation for BTEX with EPA Method 8020 for fresh or salt water, making it equally applicable for water intakes for desalination plants and groundwater beneath landfills or tank farms. It is available in portable and continuous configurations. This technology has a long and successful history monitoring storage tanks for leaks across the state of Florida.

Fiber optic chemical sensors utilize changes in the refractive index caused by petroleum hydrocarbons present on the surface of a treated fiber. The process is fast, instantaneous in the case of oil sheen, and reversible. The fiber sensor is stable and has a long service life. When used to detect dissolved hydrocarbons from petroleum, usually the soluble BTEX fraction, sub ppm detection limits can be achieved and there is excellent linearity over the range of interest.

The EPA's published *Water Quality Benchmarks for Aquatic Life* acute benchmarks for dissolved BTEX compounds are 27 ppm for benzene and 3.6 ppm for total xylenes. Independent data* from KWA Inc., Midland, Texas, on the fiber optic sensor indicates lower detection limits in the range of 0.1 to 0.37 ppm.

Advances in recent years have also made such technology portable. Such monitors allow the detection of BTEX compounds directly in groundwater monitoring wells, while continuous CMS 100 provides real time tracking – and Web-based reporting – of the onset of sheen or dissolved BTEX.

Newly introduced technology incorporated into photo-ionization detection (PID) devices include fence electrode technology and anti-contamination features, which can extend the utility of these devices in extreme humidity (such as that often experienced in the Gulf region), and in the presence of particulates from combustion of oil residue. These two technologies allow the routine use of such units' dynamic range and ppb sensitivity, even under harsh conditions. Benzene selectivity is often offered as an option and lithium ion battery technology extend the field use of such gear.

While continuous monitors for VOCs have been available for some time, the capability to continuously monitor *in situ* in a monitoring well is relative new. Heretofore, monitoring wells, be they on a landfill or at a gas station, were almost always periodically monitored using portable detectors. The introduction of continuous landfill analyzers and monitors meets the promise of real time vapor-phase data for the first time. Originally designed for monitoring ground gasses at landfill and brownfield sites, continuous monitoring systems can provide constant data for up to three months for the usual suspects of concern: methane, CO_2 and

O_2, and atmospheric and bore hole pressure.

Proven technology is available to assist in monitoring spill sites for the presence and onset of petroleum hydrocarbons as sheen, dissolved or as vapor. The combination of *in-situ* continuous vapor and water monitoring provides a level of protection not previously available or affordable. ***PE***

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