



Open-path UV Air Monitoring of BTEX and SO₂ Compounds

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In May 2003, a petroleum refinery in the South African harbor city of Durban spilled nearly 5 million liters of gasoline when an underground pipeline between the refinery and its loading facility ruptured. Throughout the refinery's recovery effort, residents near the remediation site filed complaints concerning strong chemical odors from the site. The refinery set up a UVSentry Open-path UV Air Monitoring System between the remediation site and the community to detect atmospheric toxics and to identify the actual source of the irritants.

The UVSentry is a portable air monitoring system that can instantly detect, identify and quantify multiple atmospheric toxic compounds including BTEX (benzene, toluene, ethylbenzene, and xylene), which is found in petroleum hydrocarbons such as gasoline, and sulfur dioxide (SO₂), a foul-smelling acidic gas that is produced by the burning of fossil fuels. The UVSentry monitors these compounds using UV absorption spectroscopy.

The UVSentry system includes a deuterium optical transmitter unit that projects a continuous collimated beam of UV light to an optical receiver. The receiver collects the UV beam and sends it to an integrated Ocean Optics HR2000 High-resolution Spectrometer for analysis. Configured to detect light from 180–320 nm, the HR2000 provides 0.1-nm optical resolution (fwhm) and can resolve the fine UV spectral features of atmospheric toxics. The HR2000 enables the UVSentry to detect chemical compounds to parts-per-trillion along the system's 10–1000 m pathlength. A release of a chemical anywhere along this pathlength is immediately detected by the system.

Experimental Conditions

In this application, the UVSentry was deployed along a fenceline between the remediation site and the local community to monitor for multiple atmospheric compounds including BTEX and SO₂. Controlled by a monitoring operator, the system continuously acquired UV absorption spectra from contaminants released along a 200-m pathlength. Additionally, the operator observed data from an on-site meteorological station to correlate wind direction with the release of contaminants.

Results

When community members contacted the refinery to complain about noxious gas odors from the remediation site, the monitoring operator would immediately generate a complaint window. The operator would then plot a graph of the real-time atmos-

pheric gas measurements from the UVSentry and the current wind direction.

In Figure 1, an odor complaint window for May 9, 2003 is shown. The 15-min window indicates that peak 0.12 mg/m³ of toluene and SO₂ was detected by the UVSentry between 8:09 and 8:24 p.m. Correlated with wind direction data, shown in degrees to the remediation site, the operator could ascertain the actual source of the irritant. High concentrations of SO₂ indicate that combustion sources are the cause of complaints, not emissions from the remediation site.

Using this method, the refinery was able to demonstrate to regulators and community groups that one-third of complaints were attributed to the remediation site. The remaining two-thirds of complaints filed were correlated to other sources including shipping traffic in the harbor, a competing refinery, automobile traffic and a spray-painting business.

The ability of the UVSentry System to monitor for multiple atmospheric compounds has allowed the refinery to differentiate between emissions that they are responsible for and those that are produced by other sources. Additionally, the refinery was able to take appropriate and decisive action in response incidents attributed to its remediation site.

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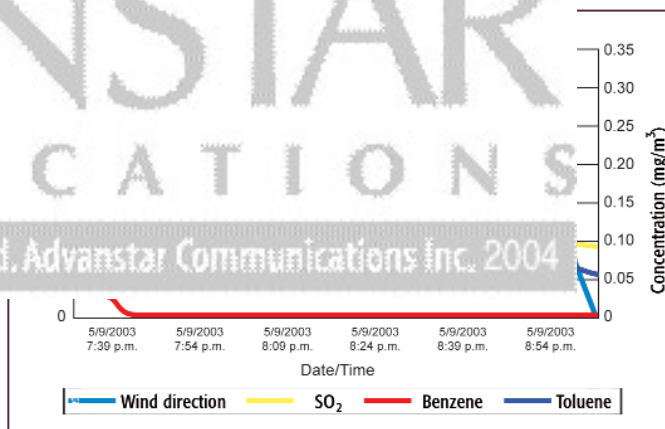


Figure 1

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