GE
Water & Process Technologies
Analytical Instruments

Application Note

Leak Detection by Groundwater Monitoring

Risks of Groundwater Contamination

Hydrocarbon leakage, from Underground Storage Tanks (USTs) and from the bottoms of above ground tanks, can seep into the groundwater, where it forms a floating oil sheen, or a thick oil layer. This layer, if left undetected, will eventually dissolve and cause severe damage. Health standards in some countries allow a maximum concentration of only a few PPBs of hydrocarbons and other organic solvents in drinking water. This translates to a quantity of 1-liter of hydrocarbon being able to contaminate several million liters of drinking water resources. Remediation of contaminated groundwater involves extremely high costs. It is therefore essential to use leak detection equipment that is capable of continuously and reliably detecting the smallest leaks in order to give an early warning, and thus reduce the damage as much as possible.

Leak Detection Methods

In order to prevent leakage from seeping undetected into the groundwater, regulations have been set that all new tanks should be double-walled.

Interstitial Monitoring

A detector installed between the walls should activate an alarm in the event of liquid penetration due to leakage from one of the walls. However, these regulations do not solve the leakage problems of the majority of the existing tanks, which are still single-walled. Environmental authorities have therefore approved several in-tank and out-tank leak detection methods.

Level Monitoring

Tank gauges are used in order to detect small changes in the level of the product. Changes which are not caused by temperature or inventory are interpreted as leaks. However, the best gauging systems are incapable of detecting leaks smaller than 0.4 liter/hour. On a yearly basis these undetected leaks may accumulate to a very large quantity of contamination (0.4 liter x 24 hours x 365 days = 3,500 liters of undetected hydrocarbons).

Vapor Monitoring

Vapor sensors installed around tanks may cause many costly false alarms, due to the existence of hydrocarbon vapor, resulting from non-leak events such as accidental spills, etc.

Liquid Monitoring

Liquid monitors, such as cable sensors, set off an alarm due to changes in conductivity or resistance, when contacted by hydrocarbons. These sensors must be installed in a special containment, making the installation rather expensive. After each alarm the sensor needs to be replaced. Vapor condensate may cause false alarms. Different sensors are required for different liquids.

Groundwater Monitoring

Leak detection by groundwater monitors may appear to be too late for an early detection, before the groundwater is contaminated. However, closer analysis of the risks (of non-detection and false alarms) by using the other methods, may reveal that especially in sites with shallow groundwater, this may be the only effective detection method. However, a pre-condition for using a groundwater monitor is that it is capable of detecting hydrocarbon seepage as soon as it occurs with no false alarm.

imagination at work

Manual sampling, which is done periodically in some sites, does not provide an ample solution since it may not detect the seepage as soon as it occurs. Also, displacement occurs when immersing a bailer into a monitoring well, and does not allow detection of very small oil layers. On-line capacitance and conductivity floating detectors are incapable of detecting hydrocarbon layers thinner than 3-4 mm (1/8 in). These sensors require extensive maintenance since dirt and hydrocarbon coating on their detection electrodes cause false alarms. Changes in water levels may result in reducing their detection capability to a minimal layer of 10 mm, and re-calibration is often required.

Leakwise* ID-221 Oil Sheen Detector

By using the principle of energy absorption, the Leakwise ID-221 Oil Sheen Detector supplies the best available solution to local and remote on-line groundwater monitoring. The ID-221 Sensor detects hydrocarbon layers as thin as 0.3 mm (1/80 in) and thus provides an early alarm of hydrocarbon seepage, earlier than any manual sampling or other floating detectors. Its capability to detect small layers is maintained regardless of water table fluctuations. Dirt and coating of hydrocarbons on the detection antenna can be out-calibrated without the need to clean the antenna. The ID-221 Oil Sheen Detector has a unique capability to monitor an increase in the thickness of the contaminating layer and can be calibrated to give low and high alarms. The Leakwise ID-225 Oil Thickness Monitor has a 4-20 mA linear output of oil layer thickness. Both the Leakwise ID-221 and ID-225 Sensors are suitable for installation in monitoring wells with a minimum diameter of 4 inches.

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