FAQs from the NWGLDE

...All you ever wanted to know about leak detection, but were afraid to ask.

Questions About Sensors, Part II

In Part I of our FAQs about sensors, the following questions were answered:

- *How can I find interstitial sensors on the National Work Group on Leak Detection Evaluations (NWGLDE) website?*
- *Why are some sensors listed with consoles and some listed without consoles, while others appear to be listed as part of a complete system?*
- *Are sensors and probes the same?*
- *How do the different interstitial monitoring methods shown on the NWGLDE List work?*

This FAQ is broader in scope than the previous one. Because of the Energy Act of 2005, the previous FAQ addressed interstitial monitoring exclusively. In addition to addressing sensors related to monitoring UST-system interstitial spaces, this FAQ also discusses sensors used in vapor and groundwater monitoring applications. Although on the decline, as indicated by the rating in the "Estimate of Current Use" column in Table 1 (on page 17), many older systems are still in use today. These systems remain a concern to UST inspectors because they are still being used to comply with regulatory leak-detection requirements.

The NWGLDE recommends that you read the answers to the questions contained in LUSTLine *Bulletin 59, (November 2008) before reading this FAQ because the answers contain information about sensors that will be helpful in understanding the information presented below. Also, USEPA's Office of Underground Storage Tanks is developing a "Leak Detection Sensors Manual" to assist UST operators and state inspectors with information on the operation, maintenance, and inspection of sensors. The manual is expected to be available in fall 2009. (Please Note: the views expressed in this column represent those of the work group and not necessarily those of any implementing agency.)*

Q. What are the different ways that sensors work to detect pressure/vacuum changes, liquids, and vapors?

A. Sensors come in many different shapes and sizes and function under a number of different operating principles. Table 1 provides the operating principles used by the specified Test Method (sensor category), as listed by NWGLDE, a brief description of the operating principle, and a rough estimate of the likelihood of encountering the device being used in the field. (See Table 1.)

Q. What information is included in the NWGLDE sensor listings, and how can this information be used?

A. NWGLDE sensor listings provide beneficial evaluation results that can aid users of the list in determining whether sensors are suitable for use in a particular leak-detection application. These listings include the operating principle discussed above and, depending on the protocol under which the sensor has been evaluated, the listing might include the output type of the sensor, such as **quantitative** or **qualitative, discriminating** or **nondiscriminating**. **Quantitative** sensors provide an indication of the concentration of liquid or vapor; **qualitative** sensors simply tell you whether or not a liquid or vapor is present. **Discriminating** sensors distinguish between different liquids and actuate for only one specific liquid; **nondiscriminating** sensors activate in response to contact with any liquid.

The sampling frequency of the sensor is also indicated. Sampling frequency can either be **continuous,** where the sensor routinely performs leak detection on an uninterrupted basis, or **intermittent,** where the sensor is used to periodically test for the presence of product.

Listings include other results from the third-party evaluation such as the **lower-detection limit, detection time,** and **fall time** of the sensor. The **lower-detection limit** is the smallest liquid concentration or level that a detector can reliably detect. The **detection time** is the time the sensor took to sense the liquid or vapor and send a signal. **Fall time** is the time it takes for the sensor to recover before it can again respond to a liquid or vapor. For detailed definitions of these terms, refer to the "Glossary of Terms" on the NWGLDE website at *http://www.nwglde.org/glossary.html* Finally, these listings provide the types of liquids, and vapors that the sensor was able to detect during the evaluation.

About the NWGLDE

The NWGLDE is an independent work group comprising 10 members, including 9 state and 1 USEPA member. This column provides answers to frequently asked questions (FAQs) the NWGLDE receives from regulators and people in the industry on leak detection. If you have questions for the group, please contact NWGLDE at *questions@nwglde.org.*

NWGLDE's Mission:

- Review leak-detection system evaluations to determine if each evaluation was performed in accordance with an acceptable leak-detection test method protocol and ensure that the leak-detection system meets USEPA and/or other applicable regulatory performance standards.
- Review only draft and final leak-detection test-method protocols submitted to the work group by a peer review committee to ensure they meet equivalency standards stated in the USEPA standard test procedures.
- Make the results of such reviews available to interested parties.

Questions About Sensors, Part II *continued*

Table 1. SENSOR DESCRIPTIONS

Operating Principle	Test Method (Sensor Category)	Description of Operating Principle	Estimate of Current Use (High/Med/Low)
Liquid-filled interstitial monitoring	Continuous interstitial-monitoring method (liquid-filled)	A fluid reservoir containing brine, water, or propylene glycol is attached at the top of the tank and opens to the interstice. The reservoir is equipped with a dual-point float switch to provide for low-level and high-level alarms.	Low/Med (Varies with geography. Low in the mid-continent. Med in states where secondary containment is required.)
Pressure-filled interstitial monitoring	Continuous interstitial-line-monitoring method (pressure/vacuum)	Uses a pump to pressurize an inert gas to continuously maintain an overpressure using a pressure sensor within the interstitial space of double-walled piping. System is designed to activate a visual and acoustic alarm before stored product can escape to the environment and is capable of detecting breaches in both the inner and outer walls.	Low (Mainly found on newer installations in CA.)
Pressure-voided interstitial monitoring	Continuous interstitial-tank-monitoring method (pressure/vacuum)	Uses an integral vacuum pump and a vacuum sensor to continuously maintain a partial vacuum within the interstitial space of double-walled tanks. System is designed to activate a visual and acoustic alarm before stored product can escape to the environment and is capable of detecting breaches in both the inner and outer walls.	Low (Mainly found on newer installations in CA.)
Metal-oxide semiconductor	Interstitial liquid-phase & vapor-phase	Detects petroleum hydrocarbon vapors by monitoring for a change in electrical current in a cell inside the sensor.	Very Low
Float switch/ Reed switch/ Magnetic switch	Interstitial liquid-phase & out-of-tank liquid-phase	A device that monitors for a change in the level of a liquid. A float switch is made up of a reed switch activated by a magnet inserted in a float. These devices are generally specified as "normally open" or "normally closed," depending on how they are oriented. The switch completes a circuit or interrupts a circuit.	High (The most commonly used interstitial sensor.)
Polymer sensitive/Product solubility	Interstitial liquid-phase, out-of-tank liquid-phase, & vapor-phase	Uses a material that allows penetration of petroleum hydrocarbons but not water.	Low (Most often associated with discriminating sensors. More common in CA.)
Optical sensor/Refraction	Interstitial liquid-phase	Monitors a continuous light source such as an LED. A liquid (petroleum or water) will decrease the amount of light the detector receives and a signal is sent to the console.	Low
Electrical conductivity	Interstitial liquid & out-of-tank liquid-phase	Uses hydrocarbon-permeable coated wire that indicates a change in the resistance of the wire when the coating degrades as a result of contact with petroleum hydrocarbons.	Very Low (Old technology – late '80s to early '90s.)
Capacitance change/RF-attenuation/Proximity sensors (capacitive)	Interstitial liquid-phase, out-of-tank liquid-phase	Monitors for changes in capacitance.	Very Low
Thermal conductivity	Interstitial liquid-phase	Designed to respond to heat differences between air, water, and hydrocarbons. The temperature inside the sensor element rises and triggers a response at the console.	Very Low
Fiber-optic chemical sensor	Out-of-tank liquid-phase	Characterized by a chemically sensitive film deposited on the end of an optical fiber. Any change to the film results in a decrease of light being emitted, sending a signal to the console.	Extremely Low
Adsistor/adsorption sampling	Vapor-phase	Changes electrical resistance in the presence of petroleum hydrocarbon vapors.	Very Low (Old technology.)
Photo-ionization	Vapor-phase	Uses ultraviolet radiation to ionize and detect small concentrations of volatile organic compounds in ambient air.	Very Low
Chromatograhic (i.e., color change)	Vapor-phase	A granular material that changes color in the presence of hydrocarbon vapors.	Low

USEPA's New Guide for Developing a Third-Party UST Inspection Program

USEPA has provided state and regional UST programs with an electronic version of its new publication, *Developing a Third-Party Underground Storage Tank Inspection Program: A Guide to Assist States* (EPA-510-K-08-001, September 2008). The guide provides states with information on how to develop a third-party inspection program or enhance an existing one. It summarizes USEPA's inspection grant guidelines and outlines steps states should follow in developing a third-party inspection program. It also includes examples of existing state programs. To access the guide, go to: *http://www.epa.gov/oust/pubs/thirdpartyinspection.htm.*