What You Should Know About Gas Detection

SCOTT/BACHARACH
Gas Detection Products

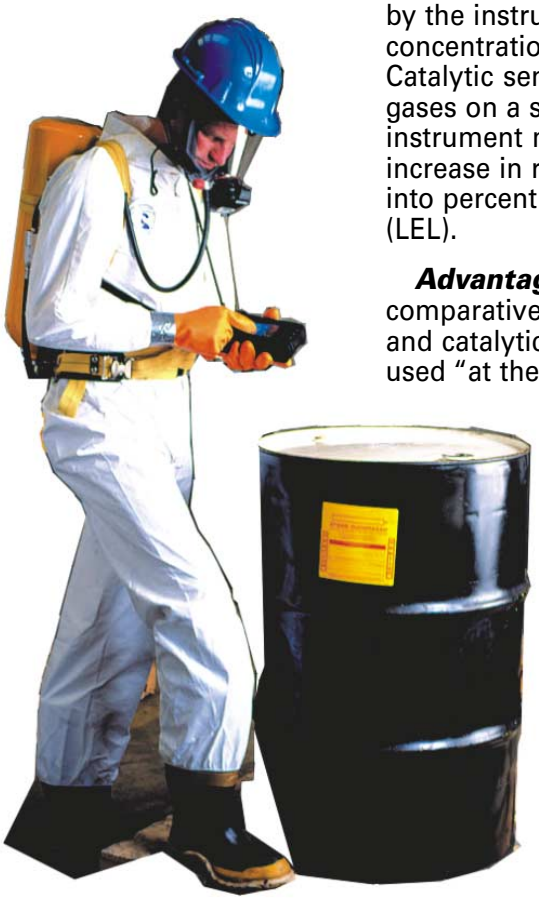
Protecting your plant's people, process, and the surrounding environment is your gas detection system's primary function - *but knowing which method to use can help improve your facility's bottom line.*

Many different gas detection technologies exist to help today's industry meet building and fire code requirements; each of these technologies has advantages and disadvantages. After reading the following overview of the most popular technologies, we think you'll agree that there is no "one best way" — rather, the best gas detection system generally is a hybrid tailored to your company's specific situation.

Electrochemical and Catalytic Instruments

Electrochemical gas sensors contain various components designed to react with a specific toxic gas; the reaction generates a current which is measured by the instrument and translated into a concentration value (PPM or PPB). Catalytic sensors "burn" combustible gases on a small catalytic bead; the instrument measures the resulting increase in resistance and translates it into percent of lower explosive limit (LEL).

Advantages. Because of their comparatively low cost, electrochemical and catalytic instruments typically are used "at the source" (i.e., wherever leaks are likely to occur). Response to leaks is therefore quick and monitoring is continuous (i.e., leaks cannot be "overlooked" due to sequence sampling). In addition, there are no moving parts that can cause mechanical failure.



Disadvantages. Some sensors respond to gases other than those they are designed to measure ("interferents"), so care is necessary during design and installation to avoid using these sensors in areas where interferents could be present. Sensors typically require quarterly calibration, and generally need to be replaced after one to two years. In addition, several brands of sensors use a liquid electrolyte that must be refilled at regular intervals.

Paper Tape Instruments

Paper tape instruments use chemically-impregnated tape to detect toxic gases. Much like a piece of litmus paper, the tape changes color when exposed to a given gas; the color change is detected by a photocell, analyzed, and translated into a concentration value.

Advantages. As a result of the color change reaction, paper tape instruments provide physical evidence of a gas leak (versus electrochemical, catalytic, solid state, and FTIR instruments, which only send out a 4-20 mA signal). Typically, they are also somewhat less prone to interferences than electrochemical and solid state instruments, providing slightly more specificity. In addition, paper tape devices typically can detect more gases than electrochemical instruments.

Disadvantages. Paper tape instruments can only be used for toxics — they cannot detect combustible gases such as hydrogen. Because of their high cost, paper tape instruments are typically kept in a central location and connected to multiple detection points through sample tubing; samples are pumped from each individual point in sequence. As a result, significant lag

times can exist between a leak and its detection, and sequencing can cause the instrument to overlook some leaks. In addition, reactive gases (such as HF, Cl_2, HCl, and NH_3) are easily adsorbed on tubing, which can prevent the instrument from "seeing" a leak. Mechanical failure is always an issue with paper tape detectors (the cassette drive can jam, the optics can foul, pumps can fail, filters can plug, and flows can become unbalanced), and regular preventative maintenance is required. Regular calibration of the optics is also necessary. Manufacturers recommend that tapes be replaced every 2-4 weeks — although this is a simple process, the cost of purchasing and disposing of tapes can be high.

Solid State Instruments

Solid state sensors are made of a metal oxide (typically tin-oxide) material that changes resistance in response to the presence of a gas; the instrument measures this resistance change and translates it into concentration.

Advantages. Solid state sensors have a very long lifetime, typically 10 years. They can detect a wide range of gases, including many that electrochemical and paper tape instruments are unable to see. Because they are fairly inexpensive, solid-state instruments typically are used to detect gas at the source, so response to leaks is quick and monitoring is continuous. In addition, they have no moving parts that can cause mechanical failure.

Disadvantages. While solid state sensors can detect a wide range of gases, they have very low selectivity — so the possibility of "false alarms" is significantly higher than with other technologies. In addition, when they have not been exposed to gas for some time, some solid state sensors oxidize and "go to sleep," meaning that they will not respond to real gas leak. Solid state sensors also provide a non-linear output, so calibration is more difficult and time-consuming than it is with electrochemical sensors (which have a linear output).

FTIR Instruments

Fourier-transform infra-red instruments use spectrophotometric techniques to detect gas. Infra-red light is shined through a sample, and the resulting absorbance spectrum is analyzed to determine its constituents.

Advantages. FTIR is the most accurate gas technique commonly used, providing good sensitivity and low risk of false alarms. No consumables are involved, so ongoing maintenance costs are less than with other technologies.

Disadvantages. Because of their high cost, FTIR instruments are typically kept in a central location and connected to multiple detection points through sample tubing; samples are pumped from each individual point. As a result, significant lag times can exist between a leak and its detection. In addition, reactive gases (such as HF, Cl_2, HCl, and NH_3) are easily adsorbed on tubing, which can prevent the instrument from "seeing" a leak. Mechanical failure is also an issue with FTIR instruments — the rotating shutter can wear and/or jam, and the pump can fail.