Fail to danger

Most toxic and flammable gas detectors feature the fundamental flaw of failing to danger. Dr Tom Shelley looks at the problem and some useful solutions

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Whereas a dead canary let miners know at a glance that it was time to get out as quickly as possible, a dead sensor in a toxic or flammable gas detector will, in most cases, do no such thing. Worse: it may well indicate that no problem exists, even when gas concentrations are dangerously high.

The only obvious solution to the risk of a fatality is to test sensors to ensure that they respond to the gases they are supposed to detect, before they are used. To be safe, this ought to be done frequently – such as whenever portable detectors are recharged. That is also the time when information on whether units have detected gases, how much and whether the detectors should be serviced or replaced, should be downloaded.

How does this potentially very serious problem arise? In fact, it has nothing to with a design fault, but everything to do with the sensor technologies themselves – usually gas absorption, solid state electrochemical cell or catalytic bead. The exception is infrared sensing devices, which depend on atmospheric absorption peaks. With these gas detectors, a malfunction normally displays when no signal is detected as the unit is switched on. However, these, too, require periodic testing and calibration.

Bump testing

Hansjoerg Schwartz, of gas detection specialist Draeger, insists that personal gas detectors must be subjected to frequent 'bump' tests, using the gases they are intended to detect. And he adds that, in fixed distributed gas detection systems, it is essential "to build in as much redundancy as possible".

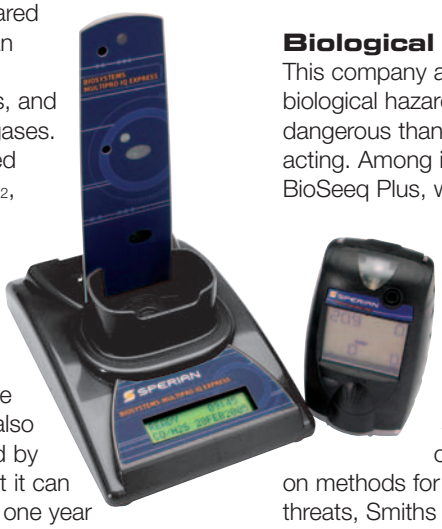
Meanwhile, Gary Collins, director of international instrumentation operations with Sperian Protection, recommends his company's docking station, which allows each detector to be bump tested with the relevant gas or gases every day. He makes the point that there is no legislation either in Europe or the US that requires this approach, but indicates that OSHA (the US Occupational Safety and Health Administration) and the International Safety Equipment Association both recommend it.

Sperian's test also shows whether a sensor needs to be recalibrated. If it does, recalibration takes place automatically in the docking station, which also gives an indication of remaining sensor life. Since this is an inexact science, Collins

From left, main image, clockwise: the classic canary, as used by miners for decades; Draeger sensors in a range of applications Centre: Sperian test docking station

suggests that, if the test shows 20% life left, best practice is to replace the sensor.

As for the time involved, bump tests, he says, take less than 30 seconds for a single gas and one minute for full calibration. The docking station also downloads details of any alert situations, which it files in a read-only database. This allows managers to identify trends or problems on site that might need remedial action. Larger users may have as many as 50 docking stations, connected to networks. Individual docking stations can stand alone, communicating by infrared port, USB or Ethernet. Sperian offers single and multiple gas detectors for up to four gases, and an engineer's version for six gases. Gases detected and measured include: O_2, CO, H_2S, SO_2, Cl_2, NO_2, NH_3, HCN and PH_3.



Moving on to infrared gas sensors, Sperian also offers a unit for methane detection, which is not only inherently proof against poisoning, but also unaffected by interference from other gases. Infrared is also the technology recommended by Draeger, which points out that it can extend calibration intervals to one year and offer a life expectancy of more than 15 years. Further, if used for site monitoring, infrared beams can cover up to 200m, which significantly reduces cabling and installation costs.

The newest product from Draeger is the X-zone 5000, which is a Zone 0 ATEX hazardous area certified portable wireless monitoring unit. Using a variety of alarms to warn of different gases, up to 25 can operate together, acting as wireless monitors around a zone. They have been designed for use alongside X-am portable gas detection instruments. When used with the X-am 5000, they can each be fitted with up to four sensors to detect as many as five gases at once by using a catalytic Ex-sensor, together with two electrochemical sensors and a combination double sensor for CO and H2S.

As for ease of use, a green LED band round the circumference of each unit indicates that air is clean. Then, as soon as it detects a gas, the unit transmits an alarm to all the others and the LED band unit changes to red – with the others showing green and red signals, and sounding an evacuation alarm. A patented 360° amplifier ensures that the alarm signal is heard with the same intensity in all directions.

So far, so good, but, if the gas threat is likely to be something unusual, or simply unknown or especially dangerous, Draeger says there is really only one company to engage, and that is Smiths Detection in Watford. This company offers systems based on technologies such as Fourier Transform infrared spectroscopy, Fourier Transform Raman spectroscopy and ion mobility spectroscopy.

Biological hazards

This company also has technologies for identifying biological hazards, which can be even more dangerous than chemical gases, if slightly slower acting. Among its available detection units is BioSeeq Plus, which is a hand-held instrument that uses a LATE-PCR (linear after the exponential polymerase chain reaction) approach to identify bacterial and viral pathogens down to only 100 organisms in 65 minutes.

In fact, despite billions of dollars spent in the US by a host of other companies and research institutions on methods for detecting chemical and bioweapon threats, Smiths Detection is in a league of its own. Indeed, the firm claims that "multiple local and national security agencies" used its threat detection systems and training to help secure the Super Bowl, in addition to other events and venues associated with the football championship.

"Leading up to the event and on game day, teams of law enforcement and counter-terrorism officials had a variety of Smiths Detection tools for air monitoring, entrance screening and response to any potential unknown chemical threat or biological substance," says a spokesperson.

Systems used included: the company's LCD, HGVI and GasID for gas and vapour detection and identification; the HazMatID, HazMatID Ranger and ResponderR RCI, for the identification of suspicious liquids, powders and gels; the Prime Alert and BioSeeq Plus, for biological threat assessment; and a system for radiation assessment. The company has also provided threat detection and security screening systems for the Olympic Games, FIFA World Cup, Pan American Games, G-20 Summit and the United Nations Congress. PE

Pointers

Most gas sensor fail to danger, leaving the detector appearing to be working

- Personal gas detector units should be regularly bump tested with the gases they are to detect
- Area detection sensors should be tested often, and redundancy built into the monitoring system
- Infrared sensors for methane and infrared beam sensing are more reliable than alternatives
- For terrorist threats and unknown hazards, Smiths Detection offers the widest range of devices for all known hazards