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INTEGRATED SOLUTIONS FOR GAS SAFETY

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Integrated Solutions for Plant and Process Gas Safety

By Natalie Iovino, FGFD Marketing Manager

MSA - The Safety Company

At your company, who is really responsible for safety? Many times the answer is, "Safety is everyone's job!" What often happens in some companies, unfortunately, is a kind of ad-hoc cross-functional approach to safety where different groups are responsible for different plant areas or activities, which can at times result in dangerous islands of safety with potentially hazardous gaps that can leave workers unprepared and unprotected at critical times.

The Challenge

No one disagrees that safety at their industrial facilities is the first priority. The problem is that safety is complicated, from simple wet floor spill signage for slip and trip hazards to the most complex manufacturing or refining processes with sophisticated gas and flame monitoring systems (Figure 1).

Fig. 1. Technician calibrating MSA ULTIMA X detector

Next comes the complicated array of local, provincial and federal agencies responsible for health, safety and environmental policies, regulations, reporting and accident reviews. Moreover, there are international safety standards from countries around the globe. On top of that there are professional safety and engineering organizations, which promote additional standards, codes and best practices adding to the regulatory environment.

Building Bridges

Building bridges between these islands of company safety and bringing the plant safety and process safety teams closer together offers many advantages. They include better hazard identification, coordinated plant safety procedures, joint equipment decisions, comprehensive training and cross-training, better spares management, vendor selection, incident reporting and cost management.

For example, plant and process safety managers should routinely discuss about where and when to use portable gas detectors versus fixed gas detectors. Many plants are so large or operations are so infrequent (e.g., tank cleaning) that isn't practical to install fixed gas detectors in certain locations. On the other hand, portable gas detectors only function where and when people are present and many pieces of equipment require continuous monitoring.

Integrated Solution

At MSA, we recommend an integrated approach to plant safety and process safety. We start by bringing together the plant operations and process engineering teams to review potential hazards across the entire plant. Next we review potential solutions, including fixed gas and flame monitoring systems, portable gas detectors, respiratory apparatus, fall protection and safety gear (e.g., hats, gloves, goggles and more)..

One of primary and biggest hazards or threats within industrial plants, especially in the petrochemical and other hazardous industries, is preventing toxic or combustible gas leaks, explosions and fires. Under the best circumstances and in the newest of plants, gas and flame safety is a real challenge in many industries.

There are large indoor and outdoor areas, as well as confined spaces, with an array of equipment, connecting pipes and tanks. No matter how many employees wear portable gas detectors and how many fixed gas detectors are installed if a leaking gas doesn't come into contact or view with a sensor then it isn't detected or alarmed.

When plant safety teams are not aware of the full effects of likely hazards, they need to make sure they are using the appropriate portable gas detector (Figure 2) or sensing technology for the potential threat. For example, some compounds can represent both a combustible and toxic threat. Although a combustible/LEL sensor may pick up explosive levels at the %LEL or % volume levels, toxicity may occur at much smaller levels measured in parts-per-million (ppm) and a different sensor or technology may be needed. Benzene is a good example.

Matching the right sensing technology to the specific hazard is critically important in placing fixed gas and flame detectors (Fig 3). Infrared (IR) detectors, for example, can't detect hydrogen gas because hydrogen doesn't absorb IR energy. Wind can prevent leaking gas from reaching combustible gas sensors. Optical flame detectors can be fooled by reflections or heat rising off tanks and other shiny surfaces on hot days.

Multi-Layer Model

It's not surprising with the many challenges to reliable gas and flame detection that a new strategy is emerging to improve safety in hazardous industries. What if you combined all of the portable and fixed hazard detection technologies together and then layered them where they fit best in terms of their reliability in each unique plant layout?

Gas and flame detection sensing technologies truly mimic the senses of the people who invented them. Catalytic bead sensors "sniff" gases for example, infrared and optical type sensors "see" gases and flames, and ultrasonic sensors hear "gases". What if these detectors behaved more like people, reacting based on their intelligence and retained past memories?

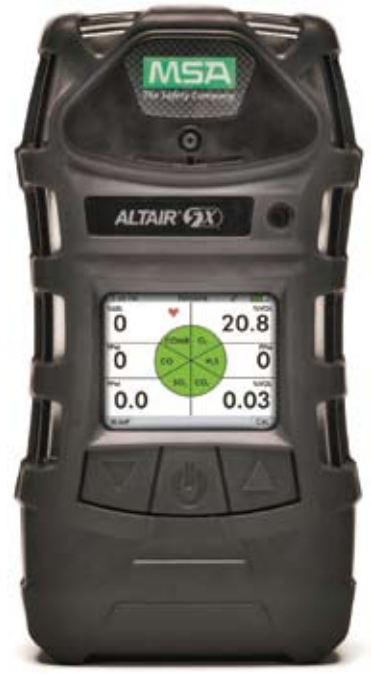

Figure 2. Altair 5x Portable Gas Detector

Layering portable and fixed sensor technologies throughout the plant where they fit best in terms of their reliability achieves a human sensory chain of plant defense against hazardous gases and flames. To better understand this new model of human sensory gas and flame detection, let's look at each type of sensing technology and then discuss how they work.

Electrochemical Cells (EC)

Portable and fixed gas detectors are designed with highly effective electrochemical cells, which measure the concentration of a specific gas by oxidizing it with an electrode and measuring the resulting current. Different types of cells have been developed for specific toxic gases, such as carbon monoxide, chlorine, ammonia, etc., and combustible gases. The technology keeps evolving such as with the MSA XCell Sensors offering a breakthrough in sensor design, enabling faster response and shorter span calibrations, saving users time and money. ASIC (application-specific integrated circuit) technology inside of each sensor provides greater control and higher performance than other EC sensors on the market,

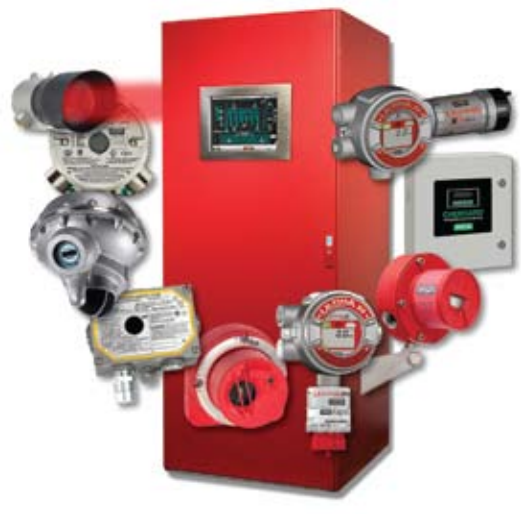

Figure 3. Gas & Flame Safety System With Sensors

Catalytic Bead (CB)

Catalytic bead gas detectors employ catalytic combustion to measure combustible gases in air at fine concentrations. As combustible gas oxidizes in the presence of a catalyst, it produces heat and the sensor converts the temperature rise to a change in electrical resistance, which is linearly proportional to gas concentration. A standard Wheatstone bridge circuit transforms the raw temperature change into a sensor signal.

Point Infrared (PIR)

Two wavelengths are used in PIR detection: One is at the gas absorbing "active" wavelength and the other at a "reference" wavelength not absorbed by the gas; neither wavelength is absorbed by other common atmospheric components such as water vapor, nitrogen, oxygen, or carbon dioxide. In point IR detectors, the concentration of hydrocarbon gas is measured via the infrared absorption of an optical beam known as the active beam. A second optical beam, known as the reference, follows the same optical path as the active but contains radiation at a wavelength not absorbed by the gas.

Open Path Infrared (OPIR)

In OPIR detection, the path of the IR beam is expanded from less than 10 centimeters, typical of point IR detectors, to greater than 100 meters. These devices

can be either laser-based or use separate IR transmitters and receivers housed in different enclosures. There are OPIR detectors available that monitor in both the LEL-m and ppm-m ranges to detect both small and large leaks. They cover large open areas, along a line of several potential leak sources such as a row of valves or pumps and also for perimeter monitoring of leaks.

Ultrasonic (UGLD)
When considered in comparison to conventional gas detectors that measure % LEL, advanced ultrasonic gas leak detectors with neural network technology (NNT) include pattern recognition capability that responds to the ultrasonic noise created by a pressurized gas leak. This ultrasonic noise provides a measurement of the leak rate and establishes warning and alarm thresholds. Gas does not need to reach the sensing element as the detector "hears" the gas leak. They are best suited for outdoor installations and indoor spaces with high ventilation rates.

Ultraviolet/Infrared (UV/IR)
By integrating a UV sensor with an infrared (IR) sensor, a dual band optical flame detector is created that is sensitive to the UV and IR radiation emitted by a flame. The resulting UV/IR flame detector offers increased immunity over a UV-only detector, operates at moderate speeds of response, and is suited for both indoor and outdoor use.

Multispectral Infrared (MSIR)
The advanced design of MSIR flame detectors operates with an IR based sensing array combined with neural network technology (NNT) intelligence. This neural network intelligence provides pattern recognition capabilities that help train the detector to differentiate between real threats and normal events thus reducing false alarms. MSIR technology allows area coverage up to six times greater than that of more conventional UV/IR flame detectors.

Conclusions

Spanning the islands of plant and process safety with integrated solutions offers many advantages that better protect people, equipment and plants. The safety industry is well aware of these advantages and is working toward creating such integrated solutions. They are pursuing strategies to provide a single-point of responsibility to address plant and process safety with comprehensive product lines that include portable gas detectors and fixed gas and flame detectors, protective gear, fall safety, respiratory equipment and more. They know the result can be improved safety, which benefits everyone.

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