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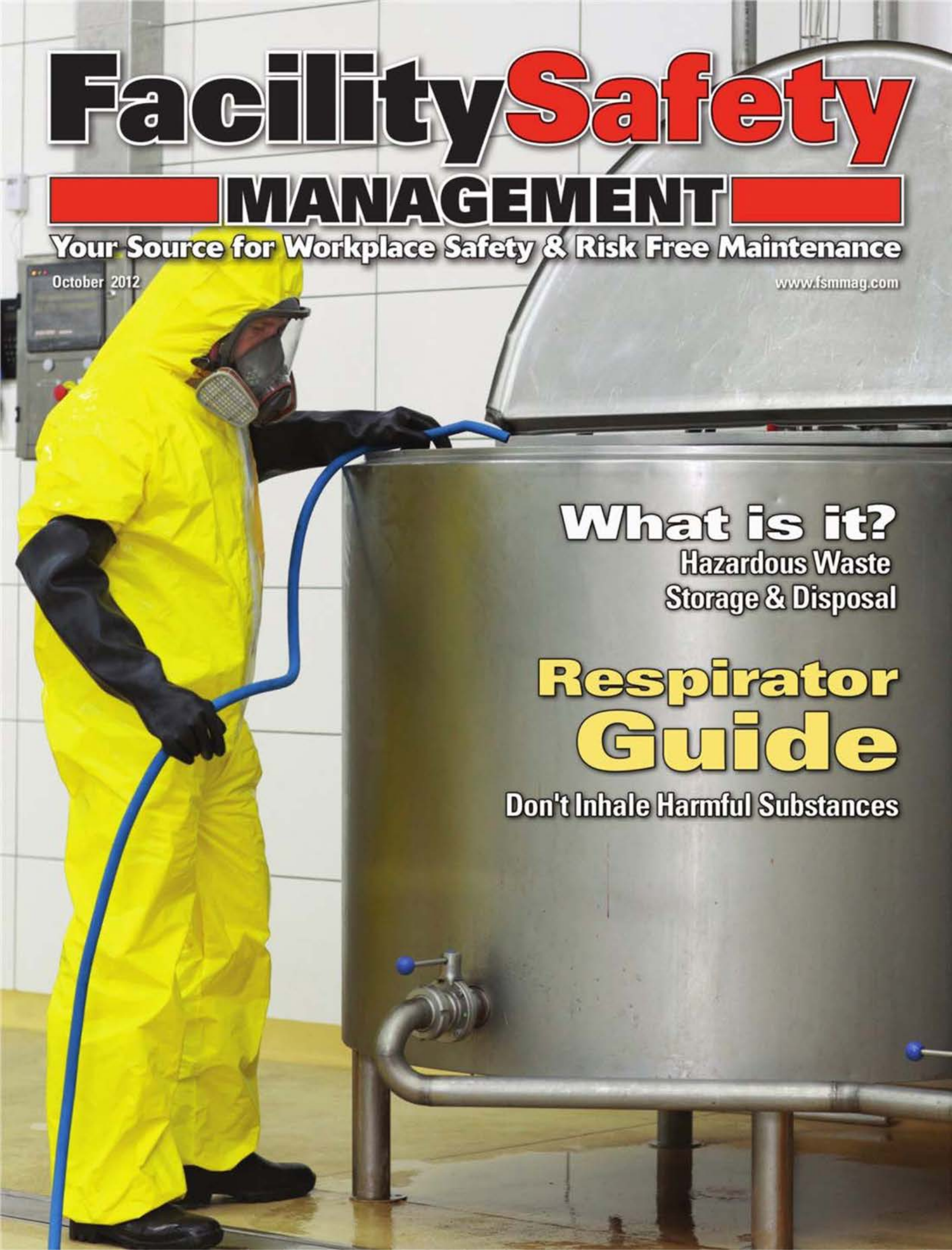

What is it?

Hazardous Waste Storage & Disposal

Respirator Guide

Don't Inhale Harmful Substances

Three Levels of Detection

Safety Monitoring: Combining Technologies for Reliable Results

By Jonathan Saint

At any industrial plant, detection of dangerous flammable and/or toxic gases and vapors and their potential ignition is a critical activity. But navigating the evolution of detection technology, finding the optimum system to protect people and property, isn't a simple task, particularly since no single system or technology is the solution to every plant's problems.

The following addresses the fundamental choices available in detection and possible combinations of technologies that may solve problems while saving dollars, property and lives. The vulnerabilities of any one detection solution are offset by the strengths of the others when utilizing a comprehensive approach to coverage.

Today, five main types of fixed detectors are available: Point-type detectors; line-of-sight detectors; ultrasonic detectors; sampling detectors; and flame detectors.

Point detectors monitor a specific area or point for the presence of toxic or flammable gas. These systems must be carefully placed to be effective, are calibrated for the type of gas to be detected, and require regular maintenance and inspection for optimum performance.

Also requiring strategic placement and careful alignment, line-of-sight (or open-path) detectors monitor for gas occurring within the zone of a beam of infrared light projected between two points. These detectors are calibrated for specific gases.

Ultrasonic gas leak detection employs acoustic sensors that constantly monitor wide areas for ultrasound generated from the release of pressurized gas. Ideally suited for monitoring well-ventilated outdoor environments, these detectors are engineered to withstand the most extreme conditions and are a non-consumptive sensing technology that doesn't require calibration, reducing maintenance and cost-of-ownership.

Sampling detection systems are available for many fixed-point instruments, a technique that extracts an air sample from an enclosed area like a duct, sends the sample to a sensor, and then returns the sample to a safe location. Sampling systems are relatively complex, including a vacuum pump, sensors, flow meters, filters and flow control, and are installed in an enclosure.

The most common flame detectors identify flames through optical methods like ultraviolet (UV) and infrared (IR) spectroscopy. Flames are typically fueled by hydrocarbons supplied with oxygen and an ignition source, which generates emissions of UV and IR radiation as part of this reaction. Flame detectors are designed to detect this energy at specific wavelengths, which allows them to discriminate between flames and false alarm sources. When selecting a flame detector, performance criteria includes: hazard to be detected (i.e., fuel type); intended environment (potential false alarm sources or attenuation sources); response time of the detector; and self-diagnostics.

Detection systems alert users when a fault condition has occurred and typically initiate a corrective action automatically. Since it's critical that alarm settings be sensitive enough to detect unsafe conditions, false alarms are a problem.

False alarms can be triggered by other gases or vapors in the area, background gases, sensor drift, or in the case of flame detectors, background UV or IR energy sources. One possible solution is to employ a voting system where two or more detectors must both indicate an alert condition for the system to trigger an alarm.

The factors to consider when determining alarm settings include: the inherent risk of the gases being measured; the typical background level of gases; the proximity of people; time required for alarm response; what must be done to correct the hazardous condition; and the particular code requirements at the installation site.

Combining Technologies for Optimum Effectiveness

Safety systems that deploy a diverse range of detection technologies can counteract the serious impacts of gas leaks and potential for fire and explosions. A combination of ultrasonic leak detectors, fixed gas monitors and flame detectors is particularly effective because they're complementary and cover the three detection defense levels.

The first stage is the immediate leak stage, which has the greatest opportunity for fast and effective mitigation; the second is during the gas cloud formation or accumulation stage, which is a very serious safety condition; and the third is during the ignition stage, which can be catastrophic.

Ultrasonic detectors are often installed outdoors to cover wide areas with challenging detection conditions. Point detectors should be installed at or near known high-risk gas leakage points or accumulation areas to provide information on the level of gas present in these areas. Open-path gas detection systems are most effective at plant or process area boundaries. They monitor the plant perimeter and provide an indication of overall gas cloud movement in and out of the facility.

The movement of gas clouds throughout the facility is tracked by monitoring the output signals of all the gas detectors within the safety system. Optical flame detectors monitor wide areas for IR or UV energy related to the ignition of a gas source and provide instant alarm condition back to notification and mitigation systems.

A variety of challenging factors affect the performance of these technologies: location (indoors/outdoors); air flow; gas properties (type, density, buoyancy); environmental conditions like temperature and humidity; background conditions (false alarm sources); and obstruction. Best practices for each application will be different, but it's critical to perform proper HAZOP analysis and identify the sequence of events leading up to an incident.

Every safety engineer that is committed to safeguarding personnel, plant and productivity, and employing a system that provides comprehensive, tiered coverage can yield optimal results before an escalated incident occurs.

For years now, detecting gas leaks has been accomplished through the use of various point detectors along with open path infrared perimeter detectors. While no single sensing technology solves every situation, users can now greatly extend the coverage provided by those solutions, as well as overcome some of their serious limitations, through the use of ultrasonic gas leak sensing technology. At the same time, no single sensing technology solves the entire problem.

With a combination of detection technologies, hazards have fewer chances of propagating undetected. Such diverse safety systems, combined with a design that mitigates leakage and eliminates possible ignition sources, provides a sound approach for delivering reliable coverage in any hazardous industrial environment. **FSM**

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