DET-TRONICS
United Technologies

TIP SHEET

Best Practices for Fire Protection in Hazardous Locations

Fire is one of the most critical hazards in any facility, and industrial processes that involve volatile and potentially flammable materials present challenges for fire protection.

Hazardous locations and operations call for a fire and gas (F&G) safety system designed to detect the presence of smoke, flames and combustible and toxic gases, and then take executive actions regarding notification and fire suppression. While the design and specification of an F&G safety system requires experts, knowledge regarding best practices can help facility owners and operators contribute to and maintain the robustness of their facility's F&G safety system. Read on for an overview of 10 best practices related to life safety fire protection in hazardous locations.

1 Identify fire hazards

The first step is to identify any fire hazards within the area to be protected by conducting a fire hazard analysis (FHA). An FHA determines the expected outcome triggered by a specific set of conditions called a fire scenario, which includes the arrangement of rooms/areas in a building, as well as room dimensions, contents, construction materials and potential sources of combustion. The FHA is often conducted with the help of a consulting fire protection engineer (FPE).

2 Be aware of standards and certifications

In the U.S., the most widely used fire standards come from the National Fire Protection Association (NFPA). In particular, plant operators should review NFPA 70® (also known as the National Electrical Code, or NEC) and NFPA 72®. The NEC defines Class I areas as those in which flammable gases, flammable liquid-produced vapors, or combustible liquid-produced vapors are or may be present in the air in quantities sufficient to produce explosive or ignitable mixtures. The surest way to know that detectors meet the required hazardous location and performance standards is to specify equipment with third-party approval certifications.

3 Start with gas detection

Combustible gas detectors are considered the first line of defense against fire since they can alert plant personnel of a gas leak before the gas ignites. A gas detection system should be capable of giving an early warning of both the presence and the general location of an accumulation of flammable gas or vapor.

Common gas leak detection technologies include point detectors, line of sight (LOS) detectors and acoustic/ultrasonic detectors which detect leaks based on gases' unique sound signatures. Each detection technology has its strengths and weaknesses. For example, infrared (IR) point detectors require less frequent calibration but cannot detect hydrogen gas, while some catalytic gas detectors can detect hydrogen gas, but are susceptible to poisoning. Although LOS detectors are not capable of providing gas concentration measurements, they can continuously monitor gas levels between two points over long distances. Acoustic leak detectors can respond almost immediately to a pressurized gas leak, but they cannot distinguish between combustible and non-combustible gas leaks.

4 Locate gas detectors carefully

Point detection technologies require gas to travel to the detector, which means the gas sensor should be placed near the most probable sources of leaks. Point detectors should be installed in accordance with the properties of the target gas. For example, detectors should be installed close to the ceiling if the target gas is lighter than air, or near the floor if the target gas is heavier than air. Air movement within the facility should be studied to determine best placement of the detectors. LOS detectors require an unobstructed line of sight between the transmitter and receiver as well as mounting to a rigid and stable surface. To prevent gas detectors from being damaged during pressure-washing of floors, detectors should be mounted at least two or three feet off the floor. Also bear in mind that gas detectors require periodic cleaning so ease of access should be considered.

5 Combine gas detection technologies

Since each of the gas detection technologies has benefits and limitations, a common strategy is combining the technologies and placing them in locations that maximize their effectiveness. For example, LOS detectors work with point detectors to provide optimal protection. In situations like this, the point detectors should be installed at or near high-risk gas leakage points or accumulation areas to provide gas-level information. LOS detectors are often installed at plant or process-area boundaries, where they can monitor the perimeter and track gas cloud movement in and out of an area.

6 Calibrate and maintain gas detectors

Once in use, all gas detectors require periodic calibration using the appropriate method. Some gas detectors are subject to degradation caused by dust, solvents and other contaminants in the air. Ongoing maintenance is essential for proper operation.

7 Use appropriate smoke detectors

While combustible gas detectors can provide warning of an increased fire risk, smoke detectors provide indication that a fire has actually started. Hazardous areas require smoke detectors that are hazardous location rated (explosion-proof or intrinsically safe). To be effective, smoke detectors should be located and spaced in anticipation of airflow from sources likely to present fire risks.

8 Add optical flame detectors

Flame detectors detect the radiant energy emitted by a flame. They can employ several sensing technologies: ultraviolet (UV), IR, UV/IR and multi-spectrum IR (MSIR). When making a selection from these options, it is critical to match the spectral response of the detector to the spectral emissions of the fires to be detected. Performance testing can determine a flame detector's coverage area or field of view (FOV).

9 Plan for minimizing unwanted fire alarms

UV and IR energy is emitted from fire as well as non-fire sources. It is important that flame detection systems do not misinterpret non-fire sources as fire — causing a system to signal nuisance or potentially costly false alarms. Many flame detectors are able to differentiate fire from non-fire sources by using optical filters and algorithms that analyze the characteristics of the energy they detect. Another way to minimize false alarms is to use multiple detectors to monitor the same area. This type of system includes algorithms capable of handling voting logic circuits (with each detector's interpretation of an event counting as one vote) and taking action based on input from multiple detectors.

10 Manage detection and response with a fire and gas safety controller

In addition to gas, smoke and flame detectors, a fire protection system includes a safety system controller (SSC) that receives and interprets input from multiple detectors and takes executive actions regarding notification and fire suppression. The SSC also provides information about detection device status to the facility's process control system so personnel in charge of the process are informed about important fire-related events.

Final thoughts

Understanding the best practices above can help facility owners and operators make informed decisions regarding the purchase, installation and maintenance of a fire and gas safety system.

About Det-Tronics

Det-Tronics is a global leader in fire and gas safety systems, providing flame and gas detection and hazard mitigation systems for high-risk processes and industrial operations. The company designs, manufactures and commissions certified SIL 2-capable flame and gas safety products, including the X3301 Multispectrum Infrared Flame Detector and the Eagle Quantum Premier® (EQP) Fire and Gas Safety Controller.

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