Honeywell

Aspiration Detection: When Early Isn't Soon Enough

Enhancing fire and life safety with the use of very early warning fire detection strengthens protection by enabling proactive response to a fire threat at the earliest possible stage.

Fire and life safety systems have come a long way, consisting of an adept mix of detectors and detection mechanisms integrated to safeguard life and property. Because data, computers, inventory and telecommunications systems drive almost every aspect of our economy, sometimes even higher levels of protection are necessary. High-sensitivity fire detectors that offer very early warning fire detection protect the most critical assets and business operations.

High-sensitivity detectors are often used to monitor critical and high-value infrastructure, equipment and processes where 24/7 continuity needs to be ensured. Providing a proactive approach to fire detection and prevention is crucial to these areas, especially in high-risk and specialty applications, such as clean rooms, hi-tech semiconductor and solar panel fabrication, laboratories, telephone switching centers and computer rooms, and facilities with irreplaceable assets, such as museums. This proactive approach can help facility managers identify and respond to a fire threat at the earliest possible stage, often preventing an actual fire and the associated damage.

Today, the most effective way of covering many of these applications is with highly sensitive Very Early Warning Fire Detection aspiration systems, which can detect potential fires before ignition.

Benefits at-a-glance

- Secures business continuity
- High sensitivity detection
- Easy access outside the monitored areas
- Nearly invisible design
- Fastest reaction time possible
- Suitable even for difficult environmental conditions
- Used in combination with suppression systems
- Easy planning and installation

Aspiration Technology

The primary role of an aspiration system is to give adequate warning of combustion particles, so that a fire can be extinguished before serious damage or lengthy interruption of service occurs. Because it provides very early detection, a potential fire emergency can become a simple maintenance task, thus helping to avoid fire damage, asset loss and business disruption.

Many aspirating smoke detectors are highly sensitive, and can detect smoke before it is even visible to the human eye. To elaborate the impact, consider the semiconductor industry, where clean rooms and photo bays have no tolerance for any particle generation. “Even a relatively small fire generates large quantities of particles that have the potential to cause significant damage to sensitive equipment and product,” says Beth Tshudy, Environmental Health and Safety Manager, Analog Devices, Inc., Wilmington, Mass. “If a fire takes place, it is critical that it is detected in its early stages by an aspiration system that measures particle counts and monitors at the delta. For example, an aspiration system can detect particles from a small fire on a circuit board before anyone can see or smell the smoke. The use of aspirating technologies is by far the best detection technology for the semiconductor industry.”

Some aspirating detectors are not recommended for use in unstable environments due to the wide range of particle sizes they detect. Other aspirating detectors can, however, be used in dusty/dirty environments.

One example of such a situation is an application in the oil and gas industry, where there might be a lot of particulates in the air. “Recently, aspiration detection technology was used in a 750,000 square foot building in the Middle East that included manufacturing areas and high rack storage areas,” explains Larry Owen, International Project Director, Dooley Tackaberry, Inc., Deer Park, Texas. “Many factors contributed to selecting aspiration detection, such as the exterior of the building. One side faces an ocean; the other side the desert, exposing it to extreme temperature fluctuations. Because of all these factors, 25 networked aspiration detection systems were used, as opposed to 850 spot detectors, providing a solution that resulted in a much safer environment for the technicians. It saved maintenance costs, and it worked.”

“The benefit is that the aspiration system can be adjusted to accommodate the environmental conditions,” Owen continues.

An aspiration system works by drawing in smoke through a network of plastic conduit piping via the aspirator (fan). The air sample is then passed through a filter and into the sensing chamber of the detector. Using advanced sensing technology, the detector analyzes the air sample and sends a signal of airborne smoke intensity to a remote or integrated display module, and a fire detection panel, when necessary, to raise an alarm.

The system, which typically has both pre-alarm particulate and alarm levels, is integrated with a fire detection panel. Airborne particulate information is presented through a bar graph display, alarm threshold indicators and graphic display. These detectors communicate information to a fire alarm control panel, a software management system or a building management system through relays or a high-level interface. E-mail status updates can be sent to appropriate personnel communicating alarm levels, urgent or minor faults or isolate inputs via relays.

The multiple warning levels of this system can be used to trigger different responses at different stages of a fire, from controlling air conditioning to suppression release. To accommodate specific codes or environments, alarm relays can be set from 0 to 60 seconds.

Not all aspirating smoke detectors are created equal and can be susceptible to nuisance alarms. That is why the System Sensor FAAST™ system uses dual source (blue LED and infrared laser) optical smoke detection with advanced algorithms to detect a wide range of fires while maintaining enhanced immunity to nuisance particulates. The blue LED detects extremely low concentrations of smoke. The infrared laser source is used to identify nuisances, such as dust, which can cause false alarms and downtime. Advanced algorithms interpret signals from both sources to meet a single purpose: the earliest and most accurate smoke detection available.

Regulatory Requirements
Although the design of fire protection systems has primarily been based on traditional prescriptive fire codes, there is an increasing emphasis on performance-based codes that address individual environmental requirements. Performance-based design determines the best fire protection system by assessing the function, risk factors and internal configuration and conditions of a specific environment (see "Codes Address Aspirating Smoke Detection").

Local codes and regulations can determine the size and spacing between the sample holes in a pipe network, making them a critical part to any pipe design. These requirements change depending on the type of environment being monitored.

The detection system must be designed for conditions when the air handling system is either operational or out of service. Periodic maintenance can include processes like changing the filter or occasional pipe maintenance — the frequency and necessity of specific maintenance would depend upon the application and the system. Other system checks may need to be performed in accordance with local or national codes and regulations.

Design
A variety of design configurations can be followed when including Very Early Warning Fire Detection. Although each application will have different airflow patterns, there are basic requirements that must be followed for a good site design. The more information that is obtained up front, the easier the process will be.

To aid the design process:
- Understand local codes and standards.
- Gather all relevant information about the site, including the floor plan for the protected space. The floor plan must also include existing or proposed fixtures, fittings, air handlers, vents and other equipment that requires special consideration.
- Determine the uses of the protected area to establish any special requirements.
- Verify the protection level required for the area: standard fire detection, Early Warning or Very Early Warning Fire Detection.

When designing a Very Early Warning Fire Detection system, consider:
1. The airflow characteristics and the air change rate within the room.
2. The coverage area per detector or sample point.
3. The sensitivity required per sampling point.
4. The room size and characteristics: raised floor, tall ceilings, etc.
5. The annunciation of emergency response systems.
6. The activation of mechanical control systems, such as air extraction and suppression systems.

When there is a concern for tampering, such as prisons and public spaces, consider systems that can be mounted in a secure area while air sampling points are located in the protected environment to greatly minimize the potential for tampering. Or perhaps the scenario is a large public area where evacuations can be difficult, like shopping malls, airports or stadiums. In this case, a highly accurate fire detection system that minimizes nuisance alarms and provides various levels of alert is needed to mount an appropriate, informed response to any situation.

Some areas, like cold storage facilities or spaces with high air flow, have environmental conditions outside the tolerance of typical fire detection technologies. Some Very Early Warning Fire Detection systems can be mounted at a temperate, easy-to-access location while sampling points can be located in the extreme environment — enabling reliable fire detection for spaces with challenging conditions.

Including Very Early Warning Fire Detection in the fire and life safety system can downgrade a potential fire emergency to a simple maintenance task. This proactive approach arms the security and fire and life safety personnel with a complete view of a fire event by identifying a threat at the earliest stage of a fire's progression.