<u>SENSING DISASTER</u>

How Infrared Heat Detectors Can
Reduce Mill Fire and Explosion Risks

by Bill Stevenson

Plant managers and facilities engineers are beginning to take note of sophisticated new infrared technology for detecting explosion and fire risks in plants that process fibers and bulk powders. The increased accuracy and reliability of these infrared devices more than recoups their initial expense, as even one false alarm can cost a company $50,000 or more per day in lost revenue. Mix in reduced maintenance expenses and even improvements in process controls that increase productivity, and fire protection suddenly becomes of prime importance to the bottom line.

By some estimates, two to three fires—and in some cases explosions—occur in manufacturing facilities in the U.S. on any given day. Any company that handles powders and bulk solids is susceptible, but plants that process solid wood or woodchips, such as OSB, particleboard and medium density fiberboard mills, are particularly at risk.

While all plant managers and facilities engineers are well aware of these risks and plan accordingly by installing protective systems, increased expectations for all aspects of operation are giving rise to protective systems that provide a larger margin of safety and greater return on investment.

Safety has to go hand in hand with and be supported by corporate culture and personnel management. If you run a plant with a certain management style and install a safety system that is counter to that style, it will never work. Everyone has to see benefit in what is done.

Corporate leaders are becoming less forgiving of fire protection systems that meet minimum requirements but cause problems of their own in the form of malfunctions that leave a plant vulnerable, or false alarms that halt the production process.

In the past, many wood, paper and bulk powder plants utilized fire protection systems that relied on the detection of a visible flame or spark. However, these devices operate by detecting light, not heat, which can pose several drawbacks, including false positives from normal light sources. More importantly, the ignition temperature for dust clouds of pulp is 500° C, and for wood, 480° C. That's too low for spark detectors to pick up, since visible sparks and embers are not detectable at temperatures below 700° C. By the time there is a visible flame that the spark detector can see, the sawdust or other wood particles have already caught fire.

On the other hand, spark detectors are very sensitive to any light in the facility, increasing the chance of causing false positives. If you get a light leak in a process line, and you have a spark detector, it's very common to have the spark device detect the light and then activate the suppression system. All of a sudden an alarm sounds, water starts spraying, and the process shuts down unnecessarily. Income is not ordinarily insured, so when processes are suddenly stopped, substantial losses can quickly mount.

The latest breed of fire and explosion protection systems are anchored around infrared detectors that seek heat. Infrared detectors are now available that react to temperatures as low as 400° C, 250° C, or even 175° C. The detector measures both the number of glowing particles and the highest registered energy value. The self-cleaning hemispherical lens of the detector scans a 180° field of view. This means that a single detector is normally sufficient to cover the entire cross-section of a process conveyor, for example.

The intelligence needed for signal processing and calculation is built into the detector and a simple cable connects as many as eight detectors to a control unit that can activate as many as two explosive release mechanisms and eight solenoid valves for water or gas spraying. Combined, the system works to detect a hot body before it can ignite any particles, and if necessary, take action to remove the heat or hot body from the rest of the process product.

True infrared operates in the sub-light spectrum at lower energy levels and picks up heat signatures that can be dialed in. This allows preemptive action because the heat can be detected before it is high enough to ignite the material.

The systems can detect and neutralize all ignition sources within 100-300 milliseconds. Water, being the most common extinguishing agent, is sprayed under high pressure through full-cone nozzles that distribute the water particles uniformly throughout the extinguishing zone. Carbon dioxide and nitrogen extinguishing agents, when indicated, are regulated using high-speed actuators with closure times varying from 50-300 milliseconds. Mechanical diversion involves a switching valve that rapidly routes any abnormally hot material off the process conveyor into an isolated container. The process itself need not be stopped.

It is essential to adapt the extinguishing action to suit the size and risk of the ignition source. Hot particles have greater energy content and last longer than sparks, and hence pose greater danger. Infrared systems can detect these more quickly and correct the situation faster.

Infrared technology also helps ensure that the extinguishing system will halt the production process only in real emergencies. An infrared detector only looks for heat; it doesn't care if there is a light leak somewhere. It's not going to trigger unless there is a heat signature in the range that has been programmed. This further minimizes the possibility of interrupting production unnecessarily.

Fully integrated electronic controls allow today's infrared detection systems to interface with process systems to serve as a monitor of component performance. If the energy content of the product rises, it could indicate that a component is in need of service or that a control system needs calibration.

Let's say you have a cutting machine with a certain feed speed. When the machine exceeds a certain limit, fire risk is increased. An infrared system can be installed to prevent that. A second infrared detector that reads even lower temperatures can be used to monitor the flow of chips or dust being generated by the machine. When a certain threshold temperature is exceeded, you know that the cutting tool is starting to dull. Until that point, you can actually push the machine to a higher production capacity than you would do otherwise. Given this safety net, you can go 20-25 percent over maximum speed. That's really where you can make your money. You get a return on your safety investment because it increases the production output.

The fact that some of the more modern infrared systems require less and easier maintenance and inspection frees up personnel to concentrate on productivity issues. Some systems can perform their own self-diagnosis. It is even possible to download system data via a modem, analyze it, and determine what is happening without having to personally inspect the installation.

Additionally, extinguishing equipment—such as detachable water nozzles—can be designed so that the testing procedure does not interrupt the process. With conventional hook-ups, you get water into the process during testing, which means you have five minutes of testing but two hours of cleaning. The temptation is for maintenance engineers to just skip the testing. Then you skip the next month, and suddenly you only test once a year.

Much of the advancement in today's fire and explosion protection installations stem from a customized approach. Each system should be designed from the ground up and be specific to the individual requirements of the process being protected. For example, wood particles burn at a different temperature than paper particles. There is no single generic solution for every problem, so careful consideration must be given to the location of the detectors and reaction components, as well as to their integration with existing control systems.

Attention to detail pays off through more comprehensive protection, decreased maintenance, and improved production output. Additional savings can accrue from the leverage gained with insurance carriers. For these reasons, modern protection systems are viewed increasingly as a valuable productivity tool that adds income to the bottom line. ■

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