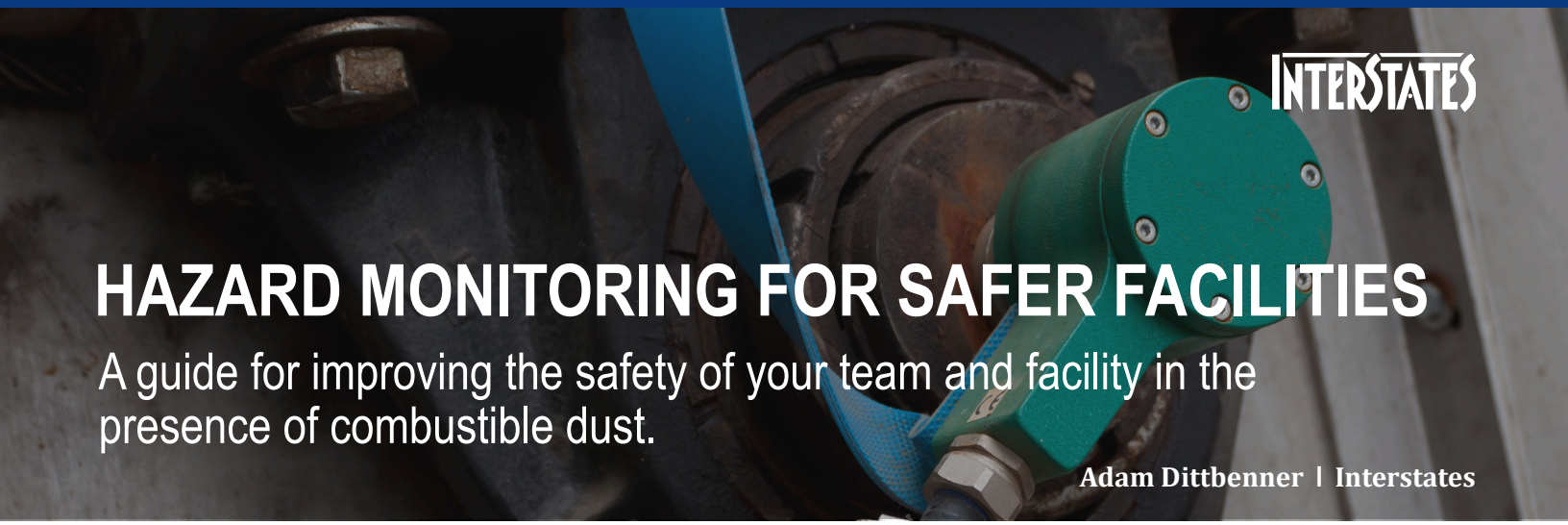

HAZARD MONITORING FOR SAFER FACILITIES

A guide for improving the safety of your team and facility in the presence of combustible dust.

Adam Dittbenner | Interstates

Combustible dust is a common, and potentially deadly, issue for a variety of industries and work environments. Companies need to take action to maintain the safety of their workers and facilities in the presence of combustible dust. The first step is to initiate and maintain proper housekeeping routines. It's equally important to install sensors that can identify hazardous conditions caused by ignition sources within the facility. These measures are not only essential to protect the safety of your facility and workers, but they are also required by OSHA and NFPA.

Mandatory regulations are only a starting point. To protect your people, safeguard your facility, and minimize false alarms and downtime, you need a comprehensive hazard monitoring program. In this paper, we will outline common installation techniques, industry requirements, and cost considerations, but keep in mind that partnering with an experienced company to install and maintain your hazard monitoring systems is the best way to maximize both safety and process efficiency.

Where Does Combustible Dust Come From?

Combustible dust is a by-product created from manufacturing processes that involve combustible raw materials. Some examples of industrial processes that may create combustible dust are blasting, crushing, cutting, grinding, milling, polishing, and sawing. Materials may include wood, light metals, several kinds of chemicals, as well as agricultural products such as grain, spices, and tobacco. Combustible dust particles may be difficult to see with the naked eye, allowing them to be hidden in plain sight.

The Dangers of Combustible Dust

Whenever combustible dust is present, there is the risk it may catch fire, create a flash fire, or cause an explosion. The first two risks require fuel, oxygen, and an ignition source. If the dust particles are dispersed in the right direction, and the dust cloud is confined, there is an elevated risk of a dust explosion. The quick combustion process, known as deflagration, creates an airwave that can explode out of a confined space, dislodging or agitating dust elsewhere in the facility. When mixed with more oxygen, the explosion can quickly grow, placing personnel and equipment in danger.

Industry Standards for Combustible Dust

Dust explosions can be deadly, so keeping hazard monitoring systems functioning is paramount. In the U.S., some laws and regulations are mandatory, but they provide only the minimum requirement for each piece of equipment. Individuals working on grain handling and related equipment should always be aware of instances or machinery that could cause heat or ignition of dust explosions.

Putting hazard monitoring equipment on legs on the exterior of facilities, in addition to the interior, is an example of going beyond regulations to achieve a safer facility.

Hazard monitoring audits and dust collection system checks should be ongoing to minimize the risk of explosions. OSHA mandates regularly scheduled inspections of at least the mechanical and safety control equipment associated with dryers, grain stream processing equipment, bucket elevators, and dust collection equipment including filter collectors. Inspections must be documented, and any issues discovered must be fixed.

NFPA and OSHA both require belt misalignment bearing sensors and speed sensors with shutdown interlocks of various types of legs and conveyors. For reference, here are some OSHA and NFPA regulations to use as a starting point:

Belt Slip

- OSHA 1910.272(q)(5): Shut down bucket elevator when belt speed is reduced by 20% (inside legs).
- NFPA 61 (2020) 9.3.14.1.5: Shut down bucket elevator when belt speed is reduced by 20%.
- NFPA 652 (2019) 9.3.14.3.1: Shut down bucket elevator when belt speed is reduced by 20%.
- NFPA 654 (2020) 9.3.10.4.1: Shut down bucket elevator when belt speed is reduced by 20%.

Bearing Temperature

- OSHA 1910.272(q)(4)(ii): Monitor vibration or temperature of bearings inside the leg casing (inside legs).
- NFPA 61 (2020) 9.3.14.1.12.1, 9.3.14.1.12.3, 9.3.15.2: Alarm when bucket elevator head, tail, or knee bearings get hot or through vibration (inside legs). Monitor belt conveyor head and tail bearings.
- NFPA 652 (2019) 9.3.14.4.3, 9.3.14.6.1-3: No bearings allowed in leg casing. Alert the operator when bucket elevator head or tail bearings get hot.
- NFPA 654 (2020) 9.3.10.6, 9.3.10.9.1-3: No bearings allowed in leg casing. Alert the operator when Bucket Elevator head or tail bearings get hot.

Belt Alignment

- OSHA 1910.272(q)(6)(i), 1910.272(q)(6)(ii): Alarm when the belt in a bucket elevator misaligns (inside legs).
- NFPA 61 (2020) 9.3.14.1.12.2-3, 9.3.15.2: Alarm when the belt in a bucket elevator misaligns or a head, tail, or knee pulley misaligns (inside legs). Monitor belt conveyor head and tail belt alignment.
- NFPA 652 (2019) 9.3.14.6.1-3: Alert the operator when a bucket elevator belt or pulley misaligns at the head or tail.
- NFPA 654 (2020) 9.3.10.9.1-3: Alert the operator when the belt or head/tail pulley in a bucket elevator misaligns.

Plug/Overflow Condition

- NFPA 61 (2020) 9.3.15.1, 9.3.15.3, 9.3.21.1.5, 9.3.14.1.13: Shut down bucket elevators and conveyors when plugged.
- NFPA 652 (2019) 9.3.14.7.1, 9.3.15.2.1: Shut down bucket elevators and conveyors when plugged.
- NFPA 654 (2020) 9.3.10.10.1, 9.3.11.2.1: Shut down bucket elevators and conveyors when plugged.

Keeping up with regulations and performing audits can place a burden on your staff. Many companies choose a third party to audit their systems. Experienced hazard monitoring providers will send a technician to your site at least once a year to perform checks on every sensor and interlock. They will understand how to maintain your system, fix any problems, and go above and beyond government requirements.

Planning the Hazard Monitoring System in Your Facility

Installation Options

Advances in technology have transformed the installation of hazard-monitoring equipment in the past 30 years. Traditional manual devices required long lengths of wire and conduit to connect the control room to the sensors. Now, the sensor only needs to be wired to the local controller or PLC, utilizing a common signal cable to bring data to the control room.

With this method, the cable no longer needs to be inside a conduit because it's protected via intrinsic safety. Eliminating conduit installation saves time and money by reducing the amount of materials, equipment, and labor needed to run conduit up the side of the feed mill or silo.

It's understandable why more and more providers are moving toward the non-conduit method. Not having to produce an elaborate conduit system throughout an entire facility is attractive when projects are expected to be completed faster and faster. The amount of time and labor saved with this method fluctuates depending on the plant, but using the non-conduit method could use roughly half the time, half the labor, and half the materials when compared to a traditional conduit installation.

New technology like wireless hazard monitoring systems can be exciting and will likely be the wave of the future, but those systems still require line of sight, so the installation requires a fair number of cables and mounting antennas to ensure communication throughout a facility.

Costs & Considerations

Every hazard monitoring system will require bearing sensors, misalignment sensors, and speed sensors for legs across all systems. While most sensors cost about the same, you will also need a control unit that receives the signals from the sensors, and those prices are more variable. Some systems offer a standalone unit that all the sensors go back to which is purchased directly from the manufacturer. Other systems have all the sensors go back to a PLC, which is brand dependent. For instance, if you have an Allen Bradley control system on-site, you'll need to purchase an Allen Bradley PLC and program the HMI screen. It might cost more to go this route.

Budget constraints are always a factor, but the benefits of hazard monitoring far outweigh the investment. Prices for hazard monitoring equipment are generally reasonable, and a properly installed system should be easy enough to maintain. Different systems have different installation techniques and, therefore, different installation costs.

In addition to preventing a catastrophic event, a properly maintained system will not be plagued by false alarms that disrupt production and destroy trust in the system. A regular inspection of the system's health helps ensure that sensors only provide warnings when they should.

When you're planning your hazard monitoring installation or maintenance program and formulating a budget, consider:

- Non-conduit installation. This method reduces crew size, speeds up the process, and saves on costs because it uses much less material.
- Third-party inspections. If you hire an outside company to do your regular checks, they will likely be more experienced and more thorough than an internal employee with other tasks to accomplish.

Moving Forward with Confidence

It's prudent to find a partner who will dialogue with you to determine the most appropriate system to fit both your budget and plant installation requirements. If the installer is only familiar with one or two systems or only works with one manufacturer, you might not end up with a hazard monitoring system tailored to meet your needs. Your integrator should understand how the sensors communicate to give you helpful hazard-monitoring support. Some sensors put out a 4-20 milliamp signal, so you would need a provider who could measure that signal and also know how the PLC receives the signal. Other sensors put out bus communication signals, so your provider would need the tools and knowledge to read those signals as well. It's also crucial to choose a professional who understands motor interlocks and how a motor runs and shuts down.

Ultimately, you want to keep your personnel and facilities safely and productively operating. A properly installed and maintained hazard monitoring system can help. Routine inspections and maintenance by a provider versed in regulatory requirements and industry best practices can help avoid costly fines, damage, and even loss of personnel. When you have a well-running, intentionally maintained system that's not ignored or constantly sending out nuisance alarms, you can trust the signals are legitimate.

About the Author

Adam Dittbenner is an Instrumentation Manager at Interstates. Reach him at **adam.dittbenner@interstates.com**, or visit **www.interstates.com** for more information.

For More Information on Hazard Monitoring

To read more about the rules and regulations surrounding hazard monitoring systems, visit **www.nfpa.org** or **www.osha.gov**.

To learn more about combustible dust incidents and how your facility can operate more safely, **www.dustsafetyscience.com** is a great resource.