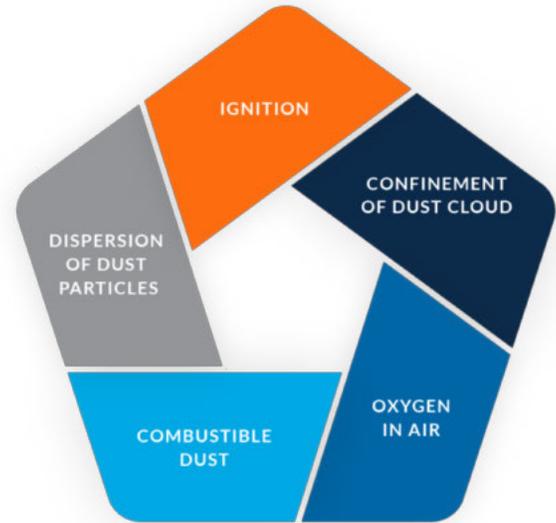




# Prevention Methods

For a dust explosion to occur, five elements must be present simultaneously: combustible dust as fuel, oxygen to sustain the combustion reaction, dispersion of the fuel particles, confinement of the dust/air mixture in a closed volume, and an ignition source.

While the risk of an explosion never can be completely removed, and explosion mitigation systems are always required, effectively removing one of these elements with preventative methods will significantly reduce the risk of a combustible dust explosion.



## SPARK DETECTION AND SUPPRESSION

Sparks or embers may be generated during a normal or malfunctioning production process due to: misaligned and colliding moving metal parts or foreign metal objects in fans, milling/shredding equipment or conveyors; overheating in dryers; or product self-heating over time. As spark energy typically exceeds the combustible dust's Minimum Ignition Energy (MIE) these are a common source for combustible dust explosions.

A spark detection and suppression system uses optical detectors installed on conveying lines which will detect minimal amounts of infrared radiation. A spark detection and suppression control system continuously monitors the spark detector readings and activates an extinguishment system when a spark is detected. A small amount of extinguishing water mist is injected into the conveying line downstream of the detectors to extinguish the spark. The production process continues running, the spark is removed and the extinguishing water is absorbed. When repetitive sparks are detected and extinguished, the process control system is signalled to shut down the process, and the ignition source may then be found and repaired.

## BENEFITS OF FIKE SPARK DETECTION

- Wide range of applications
- Can detect hot sparks as well as burning embers
- Proven in use in more than 30,000 field installations
- VdS and ATEX approved
- Comes with Fike field services for commissioning and maintenance



## IGNITION SOURCES

The Combustible Dust National Emphasis Program documents the proven ignition sources and their frequency of causing dust explosions:

- |                           |                             |
|---------------------------|-----------------------------|
| • Mechanical Sparks - 30% | • Hot Surfaces - 7%         |
| • Smoldering Nests - 9%   | • Self-Ignition - 6%        |
| • Static Discharge - 9%   | • Welding and Hot Work - 5% |
| • Friction - 9%           | • Electrical Equipment - 4% |
| • Fire - 8%               | • Other - 13%               |

## THERMAL IMAGING



Elevated surface temperatures are generated by malfunctioning process equipment often caused by: repetitive mechanical impact of misaligned moving metal parts; friction of misaligned moving metal parts; or overheated bearings. When the temperature of the hot spot exceeds the Minimum Ignition Temperature of the Dust Layer (MIT - Layer), dust accumulations start to smoulder and burn, and a fire can develop. When a combustible dust cloud comes into contact with a smouldering clump or burning dust layer, a dust explosion is ignited. Alternatively, when the temperature of the hot spot exceeds the Minimum Ignition Temperature of the Dust Cloud (MIT - Cloud), a dust

explosion is ignited as soon as the cloud comes into contact with the hot spot

Fike's thermal imaging solutions use a thermal camera to supervise areas at risk of overheating. When surface temperature threshold levels exceed a programmed threshold, a signal is sent to the process control system to shutdown the process. The malfunctioning equipment should be resolved before the production process can resume.

## BENEFITS OF FIKE THERMAL IMAGING

- Supervises smoldering nest formation, such as within storage piles and drying equipment
- Provides a wide supervision area
- Multiple equipment and hazard areas can be supervised with one camera
- Unforeseen hazard areas are supervised as long as in viewing area of thermal camera

## CONSIDERATIONS FOR EXPLOSION PREVENTION SYSTEMS

- Combustible dust explosion prevention limits the risk of a dust explosion; however...
  - it may not (fully) limit the risk for fire
  - while Fike explosion prevention systems eliminate certain types of ignition sources, other types may still occur
  - explosion protection systems are often still required
- Prevention systems in combination with protection systems reduce the risk and mitigate the hazard, which leads to lowest downtime and lowest-long term production exploitation cost
- Spark suppression systems use water as an extinguishing agent. This may not be acceptable in certain processes. Alternative methods with pinch valves or gate valves can be used - see Active Explosion Protection Solutions