LAND

AMETEK®

COMBUSTIBLE MATERIALS MONITORING APPLICATION NOTE

Accurate measurement and control of operating conditions are key to safety and efficiency in modern power plants. Whether the fuel source is coal or an alternative type such as petcoke or biomass, there is a risk of unwanted combustion – potentially causing injury, damage, and downtime – wherever the fuel is handled, processed or stored.

The implementation of safe handling practices will ensure that the fuel remains stable throughout its journey from the source until the point at which it is ignited in the boiler, with monitoring taking place at key points:

- Storage piles
- Pulverisers
- Enclosed storage areas
- Transport via conveyors

With more than 25 years of experience in this application, AMETEK Land provides accurate and reliable solutions for measurements in the transport, storage and preparation of a wide range of combustible fuels.

THE RISKS POSED BY SELF-IGNITING COMBUSTIBLE MATERIALS

Power plants, and other facilities that rely on boilers or furnaces for heat generation, burn fuels in a combustion process to generate high temperatures.

Traditionally, coal has been one of the primary fuels used. However, as plants look to decarbonise by reducing their carbon dioxide (CO_2) emissions, alternative fuels such as biomass are becoming more prevalent.

Compared to coal, burning biomass results in significantly lower net CO_2 emissions, and can be used in existing power plants with some modifications. Provided the materials it is based on – such as forest products and agricultural waste – are replanted and managed sustainably, it is a renewable, carbon-neutral fuel.

Many common fuels are susceptible to self-heating which, left unchecked, can lead to spontaneous combustion. Coal and biomass are both prone to oxidation, while biomass heating may also be triggered by biological agents, such as bacteria or fungi.

This spontaneous heating may occur during storage or transport so, from fuel stockpile through to boiler, there are many transfer points and storage areas that must be monitored to detect these signs of the onset of spontaneous combustion.

If these areas are not properly monitored, the plant could risk unexpected physical and financial losses, along with possible shutdown.

Fortunately, several technologies are available to give an early warning of spontaneous heating before a hazardous condition is reached.

As the world's leading manufacturer of monitors and analysers for industrial infrared non-contact temperature measurement, combustion efficiency and environmental pollutant emissions, AMETEK Land provides solutions for all the key areas where there is a risk of spontaneous heating.

GRATE BOILERS

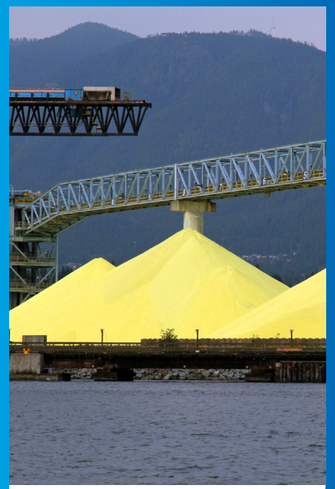
BULK MATERIAL STORAGE

While fuels are the primary use of combustible materials, many industrial processes also rely on them for important reactions.

For example, sulphur, which is highly combustible, is usually stored as a bulk solid in outdoor stockpiles ready for industrial use. To prevent any hot spots which may spark a fire or explosion, thermal imaging is used.

These outdoor stockpiles can be extremely large, so a solution with a versatile viewing range is required – typically, a thermal imager is required, and must be able to operate automatically and remotely, in outdoor conditions.

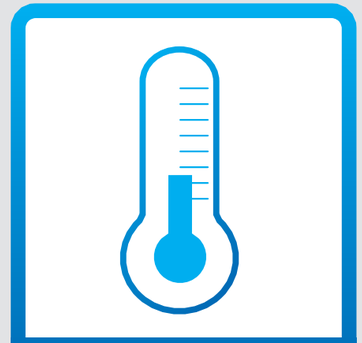
Additionally, in refineries where petcoke is produced, the carbon-rich combustible is often stored in large piles which could be reduced to worthless ash by a fire. Spontaneous combustion may occur several metres deep in the pile, so continuous thermal imaging is required to detect subtle rises in surface temperature.



SULPHUR STOCKPILES

THE SIGNS OF SPONTANEOUS HEATING

1. CARBON MONOXIDE



2. TEMPERATURE INCREASE

As oxidation occurs, carbon in the fuel is converted to carbon monoxide (CO). Even in an industrial environment, ambient air contains very little CO, so an increased concentration is a sure sign that oxidation is occurring.

CO monitoring is only effective in an enclosed space, because air movements in open areas will disperse the gas before a measurable concentration can build up.

Although it takes longer to give an unambiguous indication of spontaneous heating, an increase in the temperature of the stored fuel indicates that spontaneous heating has taken place.

SUB-BITUMINOUS COAL

Sub-bituminous coals are used by many power plants because of their wide availability, low sulphur content and low cost. These coal types have a lower heating value and exhibit a higher tendency to react with oxygen in the air when compared to hard, bituminous coals.

The oxidation makes them self-heating, and so such coals have a reputation for spontaneous combustion, which has resulted in fires at facilities that previously had excellent safety records.

Many facilities that have switched to sub-bituminous coal are discovering that increased monitoring is required to assure safe and continuous operations.

MONITORING COAL STORAGE SILOS

Carbon monoxide (CO) monitoring is a fast and unambiguous indication of spontaneous combustion in an enclosed space such as a storage silo.

Ambient air has a very low concentration of CO, but a large amount of CO is produced as spontaneous combustion begins. A rapid rise in CO concentration is therefore a clear sign that preventative action is required.

Detection systems need to be designed to continuously monitor the atmosphere inside silos to quickly respond to any significant increase in CO levels. This is crucial to allow time for preventative action to avoid damage to plant or injury to personnel.

Detection systems typically extract sample gases from the silo headspace. Alarm threshold levels can be set to best suit the plant's individual operating conditions.

Oxygen (O_2) measurement is also an option for oxygen-limited silos which need to continuously monitor O_2 levels.

AMETEK LAND SOLUTION – LWIR-640

EARLY DETECTION OF HOT SPOTS IN STORAGE PILES

AMETEK Land's LWIR-640 long-wavelength thermal imager offers an ideal solution for monitoring storage piles, particularly when combined with the optional rugged EX housing to protect against explosive atmospheres and harsh weather conditions.

An Industry 4.0-ready imager with a range of built-in connectivity options, it builds on more than 20 years of thermal imaging experience, expanding the market-leading range of AMETEK Land temperature measurement solutions.

With a full temperature measurement range of 0 to 500 °C (32 to 932 °F), plus a choice of different optics, the LWIR-640 measures and streams live true-temperature images at up to 60 frames per second, with a 640x480 pixel resolution. Outputs are available in various formats.

An integrated webserver with multiple I/O options enables the camera to be used autonomously or easily integrated into new or existing process control systems. The webserver provides easy camera access, control, and setup, using a standard browser.

FEATURES

- High-resolution radiometric thermal images
- Variety of lens options
- Wide ambient temperature range
- Configurable areas of interest
- Viewer software as standard
- Embedded web server built in

BENEFITS

- Excellent temperature accuracy
- View any target, at any distance, with outstanding clarity
- Suitable for installation in just about any climate
- Rangeable target settings always keep the target in view
- User-friendly software control
- No separate image processor required

CONVEYOR SYSTEMS

Hot inclusions on fuel conveyors can go undetected, leading to substantial damage. Traditional methods such as visual inspections or single-point pyrometers often have difficulty detecting these hot spots on a moving conveyor.

A high-speed infrared scanning system provides the most reliable and accurate solution for continuous monitoring of emerging hot spots. This can reduce downtime and help eliminate costly conveyor belt repairs.

THERE ARE THREE KEY LOCATIONS FOR SCANNER PLACEMENT:

1. Above the conveyor belt to detect hot inclusions on or close to the surface
2. Looking at the curtain of solid fuel as it falls from one section of belt to another. This allows a scanner to see deeper into the fuel and detect hot inclusions
3. Under a belt just after a transfer point. The freshly uncovered belt will have a thermal fingerprint of any hot items that have been in contact with the surface

The systems need to be small enough to be positioned close to the belt just beyond the point where the material has been transferred. They need to measure the entire belt surface and alarm if any areas are above a designated temperature. Alarms can trigger water sprays or suppression systems. Alternatively, hot material can be diverted to a safe area so that it does not pass to the next stage of the process.

AMETEK LAND SOLUTION – HotSpotIR

HIGH-SPEED DETECTION OF HOT INCLUSIONS

HotSpotIR is a compact, fixed-focus, high-speed scanning system specifically developed to detect hot inclusions on conveyor belts.

Designed for industrial environments, it rapidly identifies hot material on a moving conveyor, preventing damage and avoiding costly shutdowns.

With high-resolution monitoring across 1000 temperature spots, user-adjustable scanning speeds up to 100 Hz, and repeatability of ±0.5 °C (±0.9 °F), HotSpotIR can detect hot spots as small as 25 mm (1 inch) in diameter.

Easy to install, it uses non-contact infrared scanning to measure from 20 to 250 °C (68 to 482 °F).

HotSpotIR utilises a dedicated processor to monitor the entire belt surface, activating an alarm which can be linked to fire suppression systems.

The continuous monitoring means hot spots can be detected and the alarm triggered in a hundredth of a second, allowing the operator to respond quickly.

The results are safer employees, reduced risk of damage and downtime, and lower insurance costs.

FEATURES

- Wide, 80° scan angle
- Fast, 100 Hz scanning speed
- Robust high ambient temperature performance
- Direct control system integration

BENEFITS

- Continuous automatic monitoring
- Rapid-response alarm system
- Helps reduce insurance costs
- Prevents damage and downtime

PULVERISERS

Carbon monoxide (CO) monitoring provides an excellent early warning of a possible mill fire.

A fast response to an increase in CO concentration is especially important in pulverisers, where there is a risk that burning material may be introduced, and a hazardous condition can develop in less than a minute.

The risk is highest during mill start-up and shut down as the concentration of combustible dust passes through the explosive range. If burning material is present at this time, ignition is highly likely.

Typically, these types of systems extract a sample from the classifier outlet. If the CO level reaches a user-set limit, the instrument alarms to enable preventative action to be taken before a fire starts or an explosion occurs, increasing plant safety and reducing downtime.

AMETEK LAND SOLUTION – Millwatch

RAPID CO BUILD-UP DETECTION IN A MILL

Millwatch detects the rapid build-up of CO in a horizontal or vertical-axis mill, giving a continuous indication of the CO concentration.

User-selectable alarm relays give an additional warning that a hazardous condition is developing.

FEATURES

- Specifically designed for fuel mills
- Sensitive 2 ppm detection limit
- Automatic calibration verification
- Rugged sample probe with abrasion shield, large-area filter, and blowback
- Freeze-protected sample line

BENEFITS

- Fast response – T90 less than 50 s
- Minimised false alarms
- Dual-stream option monitors one or two locations
- Uninterrupted on-line maintenance with external sample filter
- Suitable for installations down to -20 °C (-4 °F)

STORAGE SILOS

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Detection systems need to be designed to continuously monitor the atmosphere inside silos to quickly respond to any significant increase in CO levels. This is crucial to allow time for preventative action to avoid damage to plant or injury to personnel.

Detection systems typically extract sample gases from the silo headspace. Alarm threshold levels can be set to best suit the plant's individual operating conditions.

Oxygen (O_2) measurement is also an option for oxygen-limited silos.

AMETEK LAND SOLUTION – Silowatch

DETECT CO RELEASED BY SMOULDERING MATERIAL IN ENCLOSED STORAGE

AMETEK Land's Silowatch rapidly detects the build-up of carbon monoxide (CO) in storage silos for coal and biomass fuels, providing a continuous indication of the CO concentration.

If the CO level reaches a user-set limit, the instrument alarms to allow preventative action to be taken before a fire starts or an explosion occurs, increasing plant safety and reducing downtime.

FEATURES

- Specifically designed for storage silos
- Sensitive, 2 ppm detection limit
- Automatic calibration verification
- Optional O_2 measurement
- Simple sample probe with dust filter and blowback
- Z-purge available for hazardous areas

BENEFITS

- Rapid indication of onset of spontaneous heating
- Protects expensive equipment and prevents downtime
- Integrates with plant operating system
- Dual-stream option monitors one or two locations
- Highly reliable in aggressive environments

COMBUSTIBLE MATERIALS MONITORING

AMECARE® PERFORMANCE SERVICES

Our global service centres provide after-sales services to ensure you get the best performance from your system. This includes technical support, certification, calibration, commissioning, repairs, servicing, preventative maintenance and training. Our highly trained technicians/engineers can also attend your site to cover planned maintenance schedules and repair emergency breakdowns.

LWIR-640

A long-wavelength thermal imager providing a full temperature measurement range of 0 to 1000 °C (32 to 1832 °F) in two ranges with a choice of different optics and fields of view.

FIXED THERMAL IMAGERS

HotSpotIR

An extremely compact, fast-response infrared scanning system designed to detect emerging hot spots on conveyor belt materials.

LINE SCANNERS

Millwatch

An advanced carbon monoxide detector designed to provide early warning of spontaneous combustion in pulverisers for coal and biomass.

CARBON MONOXIDE DETECTORS

Silowatch

Designed to monitor coal and biomass storage silos, this advanced carbon monoxide detector delivers an early warning of spontaneous combustion.

CARBON MONOXIDE DETECTORS

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