AALBORG PORTLAND

NON-CONTACT LASER GAS ANALYSIS TECHNOLOGY HELPS INCREASE SAFETY LIMIT

BACKGROUND

AALBORG PORTLAND IS A CEMENT MANUFACTURING COMPANY THAT WAS FOUNDED IN DENMARK IN THE LATE 1800S WHEN MANY CEMENT PLANTS STARTED OPERATING IN THE REGION. TODAY, IT IS THE ONLY CEMENT PLANT STILL OPERATING IN AALBORG. THE COMPANY EXPORTS CEMENT TO MANY COUNTRIES WORLDWIDE AND IS CURRENTLY.

CHALLENGE

The plant's electrostatic precipitators (ESP) were being operated based on a safety interlocking limit of 0.8 Vol% carbon monoxide (CO). Using Refuse-Derived Fuel (RDF) as a combustible, this limit caused numerous costly shut-downs of the ESP as well as increased emissions.

RDF is often preferred in industrial combustion processes due to its lower cost and contribution to reducing carbon dioxide emissions. However, because the waste material used to make RFD is not completely homogeneous, burn-ability and caloric values can vary significantly. Such varia-tions affect the burning process and outcomes, including the amount of energy released and differing values of oxygen gas (O_2) and CO in the process gas.

Adding too much RDF can cause incomplete combustion and potentially explosive levels of CO, causing costly shutdowns of, for example, ESPs using safety interlocking technology. The potential process value of CO is crucial for two main reasons:

1. Saving costs – as a measurement together with O_2 to optimise how much RDF can be added to the process in place of traditional, more expensive combustibles like coal, oil and gas.

2. Reducing explosion risk – as a measurement to protect the plant against excessive levels of explosive CO in the process gas.

APPROACH

To increase the safety limit at Aalborg Portland, the project team agreed to test FLO_2R's Hybrid 600™ laser gas analysis system in one of its kilns – a semi-dry 5500 tonnes-per-day production line. The kiln was selected for testing due to its high use of RDF combustibles. On-site testing of the Hybrid 600™ is the best way to see if the technology will work as intended with the actual equipment in combustion pro-cesses.

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Getting as close as possible to the origin of where the CO is produced is the optimum measuring point for accurate gas analysis. For the kiln at Aalborg Portland, this was in the preheater system after the de-dusting cyclones. The temperature at this location is usually around 150°C and the dust load can vary between 75-200 g/m^3.

A conventional extractive gas analysis system was already installed at that point of measurement, which provided a direct and ideal comparison between the two systems.

The objectives for the test were to:

· Conduct a feasibility study of using the Hybrid 600™
· Increase the safety status of the interlocking equipment for CO
· Increase the safety interlocking limit for CO
· Evaluate operations and maintenance compared to conventional extractive equipment.

THE TECHNOLOGY

The Hybrid 600™ from FLO$_2$R is a progressive laser gas analysis technology that works fast in high-dust industrial combustion processes. It offers the unique combination of an 'air knife' and a high-speed bypass loop.

The patent pending air knife is state-of-the-art technology that keeps the optic lenses clear of contamination from process gases. Quick and clean bursts of air flow past the lenses in a bypass loop system offering precise fast gas analysis.

The bypass loop creates a fixed and controlled environment to analyse a sample of the gas, making ideal conditions for the laser to operate. It removes any uncertainties for an accurate reading with deviations of less than ± 2 percent. A custom-made probe filter allows the bypass loop to operate in high-dust processes, tolerating dust loads up to 200g/m^3 with a response time of less than five seconds.

SAFETY INTERLOCKING

The use of RDF as a main combustible at Aalborg Portland leads to unpredictable CO levels released during combustion. The Lower Explosive Limit (LEL) for CO is 12.5 Vol%, which is a guiding principle for setting safety limits to prevent explosions. Using safety interlocking technology at the plant, every time the safety limit is exceeded, the ESP is turned off as a precautionary measure. When this occurs, the dust in the process gas coming out of the preheater is not cleaned. Instead, it is released into the ambient air and recorded by the emission reporting system.

During the test period, the Hybrid 600™ triggered safety interlocking once, which was caused by an uncontrolled additional feed of coal in to the calciner.

RESULTS

Hybrid 600™ was commissioned at Aalborg Portland in May 2018 and took less than one day to complete. A two-month validation period helped the team decide if the technology would suit its needs. In that validation period, no failures were reported, and no maintenance was required.

At evaluation, a zero and span calibration was performed with a zero-test result of 10-15 parts per million (ppm) and a CO span calibration of less than ± 1% deviation. Finally, a test of response time at 5-6 seconds was concluded, which provided assurance that the safety limit can be increased. The system was approved by the Aalborg Portland project team, saving costs because there was no need to invest in a costly new filter installation. Dust emissions decreased greatly following installation of the Hybrid 600™.

Raising the safety limit to 2 Vol% allows Aalborg Portland to stretch its use of RDF further as the process operation can now tolerate larger variations in burnability and caloric value. It also means that shutdown of the ESP occurs less frequently because the safety limit is a bit more forgiving.

Since its commissioning, the Hybrid 600™ at the Aalborg Portland site has required no servicing or preventative maintenance. Further, no signs of wear or contamination of the optical lenses have been observed. The technology has been in place and running for six months and the project team is extremely happy with the results so far.

CONTACT
Contact FLO$_2$R Products to enable your TDLS lasers to work in high dust applications.

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