Mill fires and explosions can occur at any coal mill, so precautions need to be taken to minimise the risks. Of all the techniques available for early detection of dangerous conditions, carbon monoxide (CO) monitoring is among the most attractive because it is fast, sensitive and very specific. For over 2 years, AMETEK Land CO monitors installed at Hoosier Energy’s Merom power plant in the US have operated reliably, with no mill explosions. Successive experience has allowed the site to determine alarm levels that are sensitive, while minimising the occurrence of false alarms.

Hoosier Energy’s Merom power plant, in southern Indiana, US, is a coal-fired baseload generator, which comprises two 505 MW generating units. It went into commercial operation in 1982 and provides power to electric distribution cooperatives in southern Indiana and southeastern Illinois. At full load, it uses 10,000 tpd of coal. Coal is supplied by road and rail from mines in southwestern Indiana. Hoosier Energy has a strong commitment to safety and maintains a robust safety programme, endeavouring to operate with the utmost regard for the health and safety of its employees and the public.

Safe coal handling practices are designed to ensure that the fuel remains intact throughout its journey from the mine until the point at which it is ignited in the boiler. Risks of unwanted combustion occur wherever the coal is handled, processed or stored, including railcars.
Rugged sample probes with Twin-stream analysers allow automatic calibration verifies any residual coal left within the mill will be exposed to the air. Even when a mill is shut down under load, as this allows for an unexpected shutdown to occur or when there is a high risk of a coal fire.

### Safety methods
Several methods are available to detect the presence of oxidation within the mill. Temperature monitoring can detect the heat buildup, but it has limited sensitivity and discrete sensors are difficult to monitor the whole volume of the mill. This method was used at Merom before 2011, but experience showed that it did not provide a reliable indication that a hazardous condition was developing within the mill. CO gas detection offers a fast and sensitive means to detect the presence of oxidising coal, as the oxidation inevitably produces large amounts of CO. There are a number of reasons for choosing CO measurement for this application, but the most important are the availability of sensitive CO sensors, the ability to detect a few parts per million of CO and to sample a large portion of the mill using a probe mounted at the classifier outlet.

### Installation
Having decided to monitor CO within the mills, Hoosier Energy and Riley Power determined that coal dust and protect the filters. Blowback controllers were installed close to the classifiers, but outside the hazardous area. A CO monitor was installed on each classifier, to determine the oxygen concentration while the mills are inerted using steam. The CO analysers were installed at the same level as the classifiers. This meant the sample lines could be kept short and the response time minimised. The chosen location also gave easy access for maintenance. Commissioning took place during an outage in May 2011.

### Enhanced safety
In the two years since the Millwatch analysers were installed at Merom, there have been a number of high CO alarms, but there have been no mill explosions. This is an impressive achievement for a baseline power plant. During that time, the Millwatch analysers have proven to be reliable, requiring no more than routine maintenance and providing enhanced safety. On 8 December 2013, the Millwatch analysers demonstrated their value. With Unit 2 running at full load, one of the mills tripped and the operators observed a rapid increase in the CO readings, even though there was no indication of a temperature rise. Within a few minutes, the CO level was above the alarm threshold and the operators made the decision to activate the deluge system. The boiler continued to operate using coal from the remaining mills, with output dropping to 60% of its rated value. The CO level in the mill started dropping after 15 min and within 45 min the CO level was below 10 ppm. The mill was restarted 2 hours after the high CO alarm was detected and was returned to full operation in 3.5 hours. The Millwatch CO analysers detected a potentially dangerous condition and allowed it to be dealt with quickly with no damage to plant or personnel.

### Summary
In conclusion, CO monitoring provides a rapid and reliable method for detecting potentially dangerous coal oxidation within a mill so that action can be taken to reduce the risk of a fire or explosion. At the Hoosier Energy Merom power plant, 12 twin-stream Millwatch analysers from AMETEK Land have provided good reliability and a high level of safety coverage with no explosions in the mill since they were installed more than two years ago.