A measured approach

by Siemens, Germany

Under the NESHAP guidelines, manual stack testing is now required, replacing the use of particulate matter continuous-emission monitoring systems such as gas analysers. The new particulate standards are 0.07lb/t of clinker based on manual stack testing and 0.02lb/t of clinker for new or reconstructed sources.

As an alternative to the THC emissions standard, the US Environmental Protection Agency (EPA) is also amending the alternative organic hazardous air pollutants (HAP) to increase from 9ppm to 12ppm for existing and new sources. No changes have been proposed to the standards for mercury, total hydrocarbons (THC), or hydrochloride (HCl) for existing cement kilns.

In terms of work practices, the EPA has also added standards for open clinker storage piles to reduce dust emissions from these sources. The final rule contains a definition of open clinker storage piles and requires that a source’s operation and maintenance plan include steps take to minimise dust emissions from such piles.

According to the EPA, reduction of these substances from the environment will help reduce cardiovascular and respiratory illnesses. Failure to comply with continuous monitoring requirements will be considered a violation.

Clinker production monitoring requirements

To determine hourly clinker production, one of two methods must be used:

1. Install, calibrate, maintain and operate a permanent belt scale system to measure and record weight rates, in tons per hour, of the amount of clinker produced. The system of measuring hourly clinker production must be maintained within ±5 per cent accuracy.

2. Install, calibrate, maintain and operate a permanent belt scale system to measure and record weight rates, in tons per hour, of the amount of material fed into the kiln. The system of measuring hourly clinker production must be maintained within ±5 per cent accuracy.

The clinker production rate must be calculated using a kiln-specific feed-to-clinker ratio. This value must be maintained and verified monthly.

The role of instrumentation

To measure clinker production and storage, the process instrumentation under consideration in this article includes:

- clinker cooler radars level measurement
- belt scales for pan and belt conveyors

Radar level measurement in clinker coolers

Sitrans LR560 is the world’s first 78GHz Frequency-Modulated Continuous Wave non-contact, two-wire radar level transmitter. It features a narrow four-degree beam, which allows for accurate level measurement in applications with obstructions. It also enables the unit to be mounted on a high nozzle or stand-off.

With a range of up to 100m (328ft), the device is extremely versatile for inventory monitoring as well as process measurement.

The clinker exits the kiln at temperatures in excess of 1000°C (1800°F) and must be cooled before moving to the clinker silos. The clinker is pushed with a metallic grate and air is directed from below to cool the clinker. During this process, the depth of...
the clinker on the cooler grate affects not only the production rate of the facility but also the quality and consistency of the final product. Traditionally, the bed depth on the cooler is inferred by measuring a secondary effect.

The two most common secondary measurements are the:
- hydraulic pressure on the grate drive (ie, the higher the pressure, the more material the grate is moving)
- cooling air pressure – the higher the back pressure, the more material is present.

The problem with using secondary measurements for clinker bed depth control is that the response rate is slow, as there is an inherent time lag between the inferred measurement and the control device.

In addition, accuracy is compromised, as the measured secondary effect is rarely linear or even repeatable. Direct measurement of the clinker depth has traditionally been fraught with problems, especially due to the extremely high temperature of the product and the ambient environment directly in front of the kiln.

Belt scales for pan and belt conveyors

Sitran WB300, for example, is a specialised belt scale for use on pan conveyors or apron feeders. It is designed to operate at elevated temperatures, as the clinker leaving the kiln can have a temperature up to 400˚C (752˚F).

Pan conveyors do not use rubber belting, but feature steel pans that are hinged and travel on rails. Sitran WB300 can support these rails to measure the continuous flow of clinker in tons per hour.
The heavy-duty shear beam load cells are mounted directly to the rail supports for fast reaction time and accurate weighing. Self-aligning spherical rod ends are mounted perpendicular to each other to ensure that the dynamic frame of the scale maintains its position for maintenance-free conveying and alignment.

Sitrans WB300 is accurate to ±2 per cent over a 33-100 per cent rate range. That means that the scale is as accurate at 33 per cent of the nominal flow rate as it is at 100 per cent of that rate. The scale can monitor the flow rate of clinker production after the material is discharged from the kiln and before it is stored in the silo to support option one above for clinker production monitoring.

The Siemens Milltronics MSI belt scale is designed for use in the cement industry, and has been in use in production facilities for more than 30 years. Materials in the form of limestone, clay or shale feed into the kiln via a belt conveyor.

Belt scales can also be added to conveyors that feed fuel into the kiln. The MSI features a single idler design with two triple-beam stainless steel parallelogram load cells.

The load cells of the MSI do not react against horizontal forces from the belt, a proven feature of the MSI. This unique design ensures optimum performance in harsh conditions and dusty environments.

Flow rates up to 12,000tph can be monitored at ±0.5 per cent accuracy over a 20-100 per cent rate range. The combination of two MSI belt scales in tandem can achieve ±0.25 per cent accuracy for critical application monitoring. The Milltronics MSI can monitor the flow rate of material into the kiln to support option two above for clinker production monitoring.

**Stories from the field**

**St Marys Cement, Canada**

For level measurement in a clinker bed, St Marys Cement in Ontario, Canada, has employed radar technology to enhance control and lower operating costs. Directly measuring the level of the clinker means that measurements are immediate and there is no lag time. Moreover, it is more accurate, as measurements are not inferred from a secondary source. Lastly, since there is only one instrument that is measuring the level, it costs less than using a secondary measurement device. The extreme temperature inside the kiln is reduced to nominal levels at the radar transmitter by using a one-metre long pipe extension. The very narrow beam is ideal for this extension pipe.

**Longyuan Construction Anhui Cement, China**

Further afield, Longyuan Construction Anhui Cement Co (China) found that decreased stability and durability of its belt scales was a growing problem. Operators would calibrate the belt scales, but after just a few days, measurement accuracy decreased to a point outside of Longyuan’s mandated range. After careful consideration, Longyuan selected a Milltronics MMI belt scale with a Milltronics BW500 integrator and a Sitrans WS5300 speed sensor. After successful completion of belt scale calibration, accuracy results are now in line with Longyuan’s requirements of ±0.25 per cent. These belt scales reduce the need for ongoing maintenance and also help the producer operate more efficiently. Downtime is reduced, therefore keeping Longyuan up and running for longer periods of time.

**Changing times, changing standards**

The new EPA regulations are a reality for the US cement industry. Process instrumentation helps cement producers to control the production process more accurately and help ensure a healthier environment for future generations.