GLOBAL COAL POWER REVIEW

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All combustion plant operators are aware of the need to report emissions of particulate matter to environmental regulators, and opacity monitoring remains the preferred technique in much of North American and Asia. Although more sensitive techniques are available, opacity monitors have a number of features which make them especially attractive, including the ability to calibrate the analyser using a traceable neutral density filter. Opacity measurements can also be compared to a visual estimate made using the Ringelmann method or US APE Method 9, giving a simple remote check of the indicated value.

Although the details vary depending on the jurisdiction, quality standards apply to opacity monitors and other continuous emissions monitoring system (CEMS) equipment used worldwide. In Europe, all CEMS must be independently tested and certified to EN 15267. US Federal law requires opacity monitors to comply with ASTM D6216, though manufacturers are allowed to self-certify to this standard. In all cases, the aim is to ensure a minimum standard of quality and accuracy which all instruments must meet. This is not a trivial task as the monitor must consistently deliver accurate and reliable measurements for many years whilst it is exposed to severe conditions. Although an air purge system can protect the sensitive optics from hot, corrosive flue gases, the instrument is often installed high on a stack where it is exposed to widely varying weather conditions, including hot summer sunshine and driving rain and snow in winter.

An opacity monitor measures the amount of light lost through absorption and scattering, and converts it to a meaningful number: the stack opacity. This number is shown on the display and made available as an output in percent opacity. It is common for emission limit

values (ELVs) in North America to be expressed directly in units of percent opacity, with typical values of 10% or 20%. Europe and Asia generally set the ELV in mass units, such as 100 mg/m^3. If a mass concentration is needed, there is also a need to relate the optical properties of the dust particles to their mass. This requires an experimentally-determined calibration factor unique to that specific installation. An isokinetic sample is the standard reference method used to determine the actual mass concentration in a flue stack over a given time period and given set of stack conditions. This value is then used to set an instrument calibration factor which is used to determine the mass concentration

Most modern opacity monitors, including the AMETEK Land 4500 MkIII, have a double-pass design with an LED light source. This uses a transceiver to project a beam of light across the stack, hitting a reflector that returns the light to a detector mounted in the receiver. This design has several advantages over a simpler single-pass configuration. These include increased low-level sensitivity because the light passes through the stack gases twice and the ability to achieve a simulated zero condition by placing a reflector in the beam at the transceiver, effectively short-circuiting the stack.

An appropriate choice of accessories allows an opacity monitor to meet the end-user measurement needs and budget. A simple installation may require no more than a transceiver, retroreflector and air purge system. On a positive-pressure duct, fail-safe shutters protect against damage if the purge air should fail. They also allow the instrument to be isolated from stack gases for maintenance and calibration. A remote display allows access to diagnostic information without the need to climb the stack.

In addition to the opacity monitor's design, it is essential that it is installed and configured correctly. Although the analyser manufacturer generally offers commissioning and service, many plant operators prefer to use an independent CEMS service company that can work on a complete CEMS package, including equipment from several different manufacturers.

Air Tox Environmental, based in Connecticut, US, provides services including integration, commissioning and ongoing service.

In conclusion, a high-quality opacity monitor is an essential part of an emissions monitoring system. If it is correctly installed and maintained, it will provide accurate measurements for many years in spite of challenging environmental conditions.

Figure 1. AMETEK Land 4500 MkIII transceiver installed on a power plant duct.

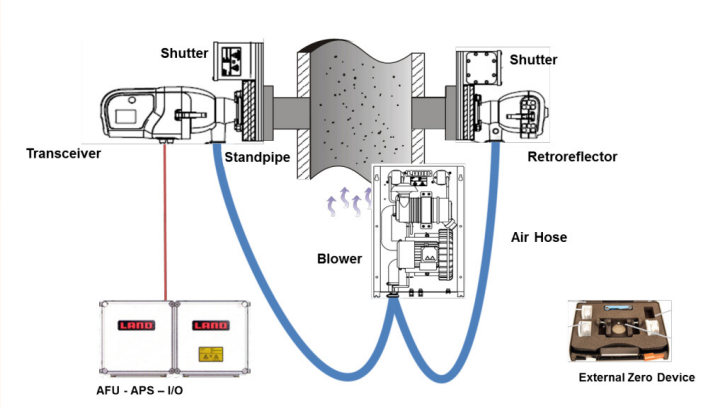

Figure 2. It is important to choose the correct configuration for a continuous opacity monitoring system.