Understanding Particulate Matter Monitoring: Techniques and Considerations

Smoke and dust found in industrial emissions are both classified as particulate matter (PM), a key component in air quality and environmental monitoring. Accurately measuring PM levels is crucial for maintaining compliance with regulatory standards, protecting public health, and ensuring the efficient operation of industrial systems. Two widely used techniques for monitoring PM are opacity measurement and the triboelectric effect method. Each technique offers unique benefits and is suited to different operational conditions.

Opacity is a measure of the degree to which particulate matter in a gas stream blocks light. This method involves projecting a beam of light through a flue or stack and measuring the amount of light that is attenuated, lost due to scattering, absorption, or reflection. The greater the number and size of the particles, the more light is lost, which results in higher opacity readings. These readings can be used directly to express PM levels as a percentage, or they can be converted into a mass concentration, typically expressed as milligrams per normal cubic metre (mg/Nm^3), using a calibration factor specific to the installation.

In contrast, the triboelectric method relies on detecting charged particles as they collide with an electrically isolated metallic probe installed within the duct or stack. These interactions generate a small electric signal, the magnitude of which is proportional to the quantity of PM. As with the opacity method, a calibration factor is applied to correlate this signal with actual dust concentrations. This in-situ technique is valued for its sensitivity and ability to respond rapidly to changes in emission levels.

The choice of output units, either opacity (%) or dust concentration (mg/Nm^3) depends largely on the regulatory requirements that govern the specific installation. For example, most large industrial facilities are required to report PM emissions in terms of mass concentration, whereas smaller plants might be permitted to report using opacity levels. Deciding between the triboelectric and opacity techniques involves evaluating several important factors. These include the expected PM concentration range, cost constraints, duct or stack dimensions, process temperature, gas flow rate, moisture content (H_2O), and applicable environmental regulations. Each site presents its own challenges, and choosing the right technology requires a tailored approach.

At SHAPA (Solids Handling and Processing Association), our members specialise in providing expert guidance on PM monitoring. Each project is treated as a unique installation, and we offer professional advice to help determine the most suitable measurement method and analyser model for your specific requirements. SHAPA members can provide a full dust monitoring service, from system design and installation to testing and ongoing support. To find reliable, cost-effective solutions that inspire confidence throughout the lifetime of your installation, visit our equipment finder, browse our free to download technical resources, or contact us directly at louise@shapa.co.uk