USING GAS ANALYSIS TO SUPPORT CLEAN AIR INITIATIVES IN PLANTS AND REFINERIES

Operators of hydrocarbon processing plants and refineries are increasingly conscious of their contribution towards harmful emissions. Many of these plants are looking to gas analysis systems to help them reduce greenhouse gases and operate in the most ecologically responsible way. To support these efforts, Servomex, the global expert in gas analysis, provides a three-stage strategy for clean air, focusing on combustion efficiency, gas clean-up, and emissions monitoring.
This not only helps ensure cleaner air, but also optimizes processes to deliver reduced fuel consumption and higher yields.

Plant operators have become more sensitive to their contribution towards greenhouse gas emissions

Stage one: combustion efficiency

Combustion mixes fuel with oxygen (traditionally from air) in a fired heater, creating heat energy for use in the process. This reaction typically requires a significant amount of fuel, creates potential safety hazards, and generates harmful emissions.

Before gas analyzer technology developed, fired heaters were typically run in inefficient, high excess air conditions. This increased the level of fuel consumption, but avoided the creation of unsafe, explosive conditions.

Excess oxygen (O_2) also combines with nitrogen and sulfur from the fuel to produce unwanted emissions such as oxides of nitrogen (NOx) and sulfur (SOx).

Accurate measurements of oxygen and combustibles, principally carbon monoxide (CO), allows the air-to-fuel ratio to be balanced, controlling the combustion reaction and reducing fuel consumption. Emissions of NOx, SOx, CO and the greenhouse gas carbon dioxide (CO_2) are also reduced.

The long-established solution for O_2 monitoring in combustion is Zirconia-based sensing technology. This provides reliable, accurate results, and has a fast response to changing conditions.

A combustibles sensor can be added easily, at modest cost, for an all-in-one combustion control solution – for example in Servomex's SERVOTOUGH FluegasExact 2700 combustion analyzer.

A newer, alternative technology for this application is Tunable Diode Laser (TDL) sensing. This delivers an even faster measurement than Zirconia, particularly for carbon monoxide. It also gives an average path measurement across the heater, rather than the result at a single point, and is a non-contact measurement which reduces degradation and maintenance over the life of the product.

TDL sensing is highly specific to the gas being measured, so separate analyzers are required for O_2 and CO.

Servomex's SERVOTOUGH Laser 3 Plus Combustion TDL analyzer can be configured to measure either O_2 or CO. It can also be set for a joint measurement of CO and CH_4, providing a rapid-response measurement for safety in natural gas-fired heaters and boilers to detect CH_4 breakthrough during burner flame-out conditions.

While combustion is the primary focus of this stage, it's important to note that gas analysis is used in many applications to increase process efficiency. The more efficient the process reaction is, the fewer harmful emissions are likely to be generated, playing an important role in cleaner air.

Stage two: gas clean-up

This phase involves the removal of harmful substances from process gases that might otherwise be emitted by the plant. Typical applications include DeNOx (ammonia slip) treatment and flue gas desulfurization, as well as dust abatement if required.

Gas analysis solutions support plants in their clean air goals

A FluegasExact 2700 installation – this provides measurements to control combustion reactions

In ammonia slip, ammonia (NH_3) or urea is used in either a Selective Catalytic Reduction (SCR) or Selective Non-Catalytic Reduction (SNCR) process to suppress harmful NOx emissions from combustion.

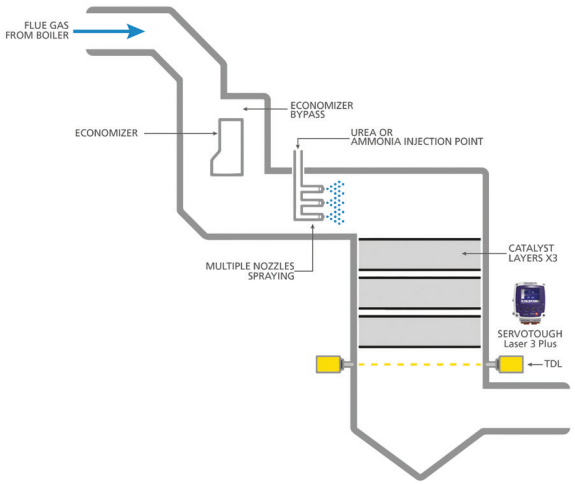
Accuracy is vital to both methods. Insufficient NH_3 means that NOx emissions are not sufficiently suppressed, while an excess of only a few parts per million (ppm) leads to ammonium bisulfate (ABS) formation. ABS can plug the catalyst in SCR processes, damaging equipment and reducing the value of the fly ash by-product.

A TDL analyzer – such as the SERVOTOUGH Laser 3 Plus Environmental – installed directly into the process ducts, is the most effective analysis solution. It provides a highly sensitive, average measurement across the duct, so the NH_3 reading is accurate even when flow conditions are inconsistent.

Similarly, flue gas desulfurization (FGD) systems remove sulfur compounds (SOx, mainly SO_2) from exhaust gases. Fossil-fuel power plants and waste incinerators often use this process.

Typically, the flue gas is sprayed with a wet slurry of lime, which reacts with SOx and scrubs up to 95% of the SO_2 content from the gas. Measuring the SO_2 content before and after treatment ensures that any remaining sulfur compounds fall within regulatory limits, and allows dosing to be accurately controlled.

Gases containing SOx can be corrosive, so non-contact, photometric sensing technology provides the most effective and accurate measurement.



Using the Laser 3 Plus TDL analyzer in ammonia slip applications

Servomex's SERVOPRO 4900 Multigas uses Infrared Gas Filter Correlation (GFC) technology to measure SO_2 in this application. GFC allows real-time measurements accurate to very low levels, without interference from background gases, and can also support sulfur recovery units (SRUs) which recover sulfur from streams containing H_2S.

Stage three: emissions monitoring

Monitoring flue gas emissions not only helps determine the process efficiency and protect the environment, it also ensures – and demonstrates – that plant operators are complying with the necessary regulations.

A continuous emissions monitoring system (CEMS) is required to measure all the necessary components of the flue gas to ensure compliance.

The solution employed must be capable of offering the highest sensitivity and accuracy when dealing with multiple measurements for pollutants and greenhouse gases.

Multi-component gas analyzers, such as the 4900 Multigas, are ideal for this application, and depending on the process can either deliver all the necessary measurements in one device or form a key part of an integrated, comprehensive CEMS.

For example, a single 4900 Multigas can monitor four gases simultaneously, measuring from a choice of O_2, CO_2, CO, SO_2, NO, CH_4 and nitrous oxide (N_2O). It also meets MCERTS and QAL1 certifications for compliance with regulatory criteria.

Solutions for a cleaner future

Gas analysis is essential to cleaner plant and refinery operations. Beyond the three stages covered here, it can also support carbon capture and storage operations, and the production of cleaner fuels such as hydrogen.

The SERVOPRO 4900 Multigas provides CEMS analysis for emissions monitoring

It is at the heart of emerging trends in the industry including greater process optimization, the move to cleaner fuels, and achieving higher product yields.

Partnering with an expert gas analysis supplier is key. By offering a diverse selection of technologies, backed by service support and applications expertise, Servomex is able to ensure the best-fit and most cost-effective solution for each application, playing a major role in creating a world with cleaner air.

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