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Application Note

Power Plant Emissions and SCR Monitoring with MultiGas™ 2030 Analyzers

Note #02/02

CUSTOMER CHALLENGES

- Cost of exhaust gas monitoring for stationary power sources
- Support and calibration of numerous analyzers required to monitor the exhaust
- Maintenance of sample conditioning equipment
- Speciation of organics such as formaldehyde, formic acid, ethylene, propylene, etc. to meet new regulations
- Direct measurement of NH_3 and NOx at single digit ppm levels for added SCR systems

BACKGROUND

Historically, combustion exhaust is analyzed for species such as O_2, SO_2, CO_2, CO, total hydrocarbons, NO, and NO_2 using multiple single gas analyzers. These individual analyzers have a high initial cost, continuing maintenance cost and cannot measure wet sample streams, so sample condition systems must be installed to remove moisture. The conditioning process can affect the measurement quality and remove compounds of interest. In addition, current combustion analyzers cannot monitor all combustion by-products suggested or required by changes in environmental regulations, including formaldehyde, which has traditionally been difficult to monitor in real time.

Tightening regulations on NOx emissions from stationary combustion sources has brought about the development of Selective Catalytic Reduction (SCR) technologies. These technologies are driving NOx emissions to low single digit ppm levels or below. This reduction is not without some drawbacks to emissions in that ammonia is commonly used by the SCR. Normally, ammonia levels can vary from tens of ppm to tens of ppb, but if not balanced correctly the process results in significant ammonia slip. One current method to monitor ammonia relies on catalytic conversion of NH_3 to NO, which is then analyzed using traditional chemiluminescence NOx analyzers. This indirect measurement of ammonia adds a significant level of complexity and uncertainty, and current analyzers have limited accuracy below a ppm. New technology needs to be provided that will provide 100 ppb NH_3 monitoring directly and in real-time.

SOLUTION

The MultiGas 2030 is an FTIR-based analyzer capable of directly measuring ppm to ppb levels of CO, NO, NO_2, CH_2O (formaldehyde), NH_3, SO_2, N_2O, methane and other hydrocarbons, in sample streams containing up to 30% H_2O and CO_2. This enables complete exhaust gas measurement on wet streams with minimal sample conditioning. The 2030 provides simultaneous analysis and display of more than 30 gases in real-time that include ppm to sub-ppm levels of both formaldehyde and ammonia. For example, the MultiGas 2030 can detect 100 ppb ammonia from SCR scrubbers, even in gas streams with high % levels of H_2O and CO_2. The ability to simultaneously detect most combustion byproducts, allows for the replacement of several single gas analyzers racks into a single compact instrument. Also, the permanently stored spectral calibration data, for each gas species, reduces the need for continuous calibration checks and the quantity of gas cylinders.

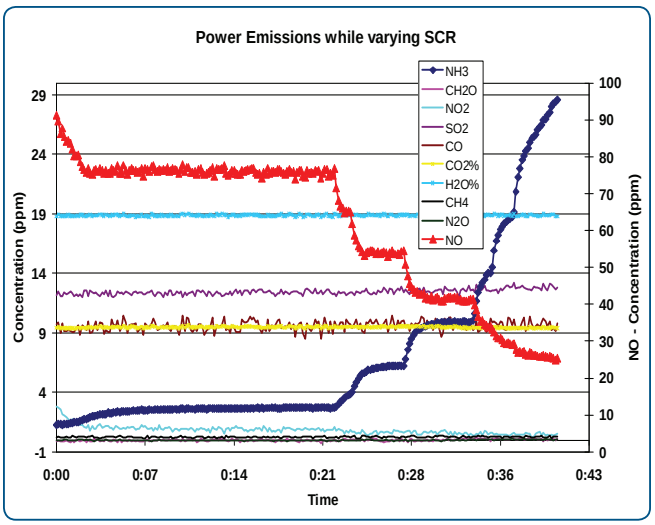
Maintenance engineers and technicians will find the robust, fully automated 2030 easy to operate and maintain. The analyzer incorporates a patented small volume, corrosion-resistant gas cell that enables percent to ppb-level detection of combustion by-products with fast response times. Since the multipass gas cell mirrors require no alignment, they are easily removed for cleaning or replaced and therefore are ideal for industrial applications. Also, the 2030 reduces the space and facilities required for combustion analyzers further reducing continued operational costs such as air conditioning and electricity.

MultiGas™ 2030 Gas Analyzer

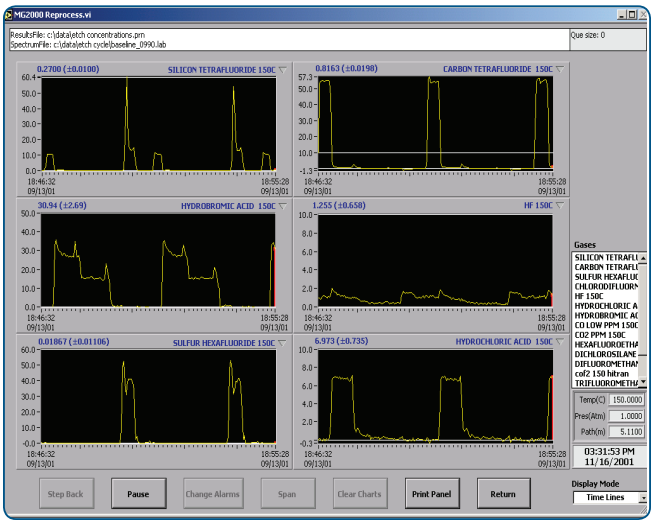
BENEFITS

The MultiGas 2030 analyzer provides benefits to emissions monitoring professionals including:

- A low cost, state-of-the-art solution for continuous emissions monitoring
- The ability to analyze and display over 30 gas species (including FAA and EPA-specified criteria pollutants), substantially eliminating the space requirements and cost of conventional single gas rack systems
- Up to 60% reduction in costs and up to 80% reduction in space over traditional continuous emissions monitors (CEM) may be realized
- The ability to monitor pollutants, such as formaldehyde and ammonia, which are not typically monitored by traditional CEMs
- Continuous on-line feedback for combustion tuning, resulting in lower energy use and improved control of SCR ammonia injection
- The 2030 can handle hot – wet samples and as such does not require moisture removal from the sample stream, eliminating the need for sample conditioning and the corresponding maintenance.



Plot of concentrations verses time for 10 compounds showing the reduction in NOx with higher levels of NH_3. H_2O and CO_2 are in percent levels.



Timeline from MultiGas 2030 analyzer showing the concentrations of six compounds and their calculated measurement uncertainty.

REFERENCE MATERIALS

MKS Publications:

1. Datasheet MultiGas 2030 - 1/08
2. "The Application of FT-IR Spectroscopy to Turbine Engine Exhaust Measurement", D. Marran et al Advanced Fuel Research, P. Jalbert et al Arnold Engineering Development Center, 21st AIAA Advanced Measurement Technology Conference and Ground Testing Conference, June 2000
3. Combustion Project Fact Sheet, J. Markham, Advanced Fuel Research, February 2001
4. "Make Way for Smaller, Cheaper MultiGas Analyzers", J. Markham, Advanced Fuel Research, BMDO Update, Winter 2000/2001

For further information, call your local MKS Sales Engineer or contact the MKS Applications Engineering Group at 800.227.8766.
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