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Use of Multicomponent Infrared Gas Analyzers at Waste-to-Energy Facilities

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ABSTRACT

Multicomponent Infrared Gas analyzers have been a workhorse as Continuous Emissions Monitoring Systems (CEMS) in the waste-to-energy (WTE) application for the past two decades. It is the technique of choice for many facilities. With obsolescence for electronics, instrumentation and data acquisition systems (DAS) averaging less than 10 years, the earlier multicomponent CEMS are being upgraded to what is now a third generation of that technology.

This paper describes the evolution of the three generations of multicomponent CEMS. The evaluation of this technology in the WTE application encompasses the operating histories of nearly two dozen facilities demonstrating compliance with this type of CEMS. Specific details explaining the sampling systems, analyzer optics & controls, interface and communication with plant distributed control systems, and DAS systems are presented. Relative accuracy test audit (RATA) results, CEMS availability histories and annual maintenance costs are reviewed presenting a unique insight into both initial capital costs and operating costs. Actual annual man-hour totals for preventive maintenance (PM), unscheduled maintenance, and annual consumable parts costs are provided.

Advances in computer capabilities have provided an opportunity for CEMS functions to not only become more comprehensive but also more robust. Key among these advances is the ability for factory-support services to be provided not only for the software platform but now even down to the basic auditing parameters of the analyzers themselves. Third generation CEMS now feature remote access of the analyzers from the instrumentation repair shop, the vendor's factory or from the company's technical service center.

TECHNOLOGY BACKGROUND

In 1989, the first multi-component infrared analyzer was introduced for both CEMS and process control monitoring. The underlying advantages were as obvious then as they are today. If just a single instrument could measure all of the gases, using just one source lamp, sample cell and detector, then it could replace a room full of analyzers and attendant complexity. Indeed, if one has four gas analyzers, each must have its own sample cell, sources, detectors, electronics, and ancillary equipment. Then, if it could be an infrared photometer, it could greatly reduce the components in contact with flue gas, perhaps to less complexity than any one of the four it replaced. Figures 1 and 2 illustrate the comparative differences in complexity of the traditional discrete analyzer approach versus the hot-wet multicomponent Infrared (IR) analyzer approach.

Prior to its introduction in 1989 many were skeptical about the ability of any IR based photometer to accurately measure NO_x and SO_2 in the infrared region. Interference with other common gases such as CO_2 and H_2O abound in the infrared region and it was thought to be an insurmountable problem. The first generation of these analyzers brought several innovations that could be deemed breakthroughs. First, it was able to use Gas Filter Correlation [1], that is a technique that allows much greater selectivity and interference rejection, and at the same time Single Beam Dual Wavelength that has advantages in some gas measurements. This is all done simultaneously to measure up to 8 different gases, including the interfering gases. It thus opened the door for continuous real time corrections to internal analyzer signals.

The ultimate result of this multicomponent infrared approach was an amazingly sensitive and accurate device with some significant advantages.

The fact is that all gas analyzers suffer interference from other common stack gas constituents. This is as true for Chemiluminescence NO_x and Pulsed Fluorescence SO_2 analyzers as it is for Infrared devices. In most cases the effect is manageable but still, it detracts from the overall accuracy and none of those discrete devices are capable of performing dynamic corrections for interferences. Given that a