Air Quality Monitor

Highlighting spinoff examples in the field of computer technology is a system for analyzing smokestack emissions

Increasingly stringent government regulations for control of the environment require industrial firms to install increasingly sophisticated monitoring equipment for full compliance with smokestack emission standards. One such advanced system is the Stak-Tracker™ CEM (Continuous Emission Monitor) Gas Analyzer, an air quality monitor capable of separating the various gases in a bulk exhaust stream and determining the amounts of individual gases present within the stream.

The Stak-Tracker is produced by GE Reuter-Stokes, Twinsburg, Ohio, a subsidiary of General Electric Company, and is supported by the GE Corporate Research & Development Center (GE CR&D), Schenectady, New York. An important element of the Stak-Tracker is a NASA-developed software package that made possible the system's advanced analytical technique. This technique is the key to accurate measurement of minute quantities of certain gases, such as nitric oxide, carbon monoxide and sulphur dioxide, generated in new, low-emission combustors.

Developed by Langley Research Center, the method of analysis is a gas filter correlation technique; it measures the concentration of an individual target gas within the bulk stream by determining the degree to which molecules of that gas absorb an infrared beam.

The Stak-Tracker directs an infrared beam across a smokestack exhaust to a reflector and collects the reflected beam. The instrument sends the beam through a dual filter assembly. The first filter operates in the general wavelength range of the target gas. The other filter, which oscillates in and out of the infrared beam, is the target gas cell. When the cell filter is in the beam, the beam is absorbed by the cell at the target gas' specific wavelength before it goes through the smokestack exhaust. A detector measures the ratio of the two signals, which serves as the basic input that enables the patented analysis technique to provide a measurement of the target gas concentration. The Stak-Tracker can measure up to six gas components within three seconds.

In the early 1990s, when the GE CR&D was helping GE Reuter-Stokes develop the system, it became apparent that there were no commercially-available software tools for modeling

Right: A pair of industrial smokestacks equipped with GE Reuter-Stokes Stak-Tracker gas analyzers; the Stak-Tracker equipment is shown in closeup (far right). Offering highly accurate measurements of pollutants for improved compliance with environmental regulations, the system incorporates software technology that originated at Langley Research Center.

the performance of sensitive pollution monitors of this type. The developers, however, were aware that Langley Research Center had designed a software system for a Gas Filter Correlation Radiometer (GFCR) that seemed the answer to the need.

Two GE CR&D scientists—Dr. Emily Shu of the Industrial Electronics Laboratory and Dr. M. K. Cueman of the Manufacturing Technology Laboratory—visited Langley's Atmospheric Research Division and received detailed information on the GFCR software, which is capable of calculating gas absorption even when the gas is present in minute amounts, and which additionally can separate the interference from a number of coexisting gases in a stream. The visit led to a GE-NASA Space Act Agreement for exchange of technical information relative to trace gas measurement. Langley scientists shared their expertise in atmospheric research and helped GE apply the GFCR code. The GFCR software was incorporated into the calibration of the Stak-Tracker, and the software has found additional use at GE CR&D for evaluating changes in the instrument's design and solving other industrial problems.

Besides its utility as an aid to full compliance with environmental regulations, the Stak-Tracker offers fast response for process control applications and relatively low installation and maintenance costs. It is applicable to gas turbines, gas, oil, or coal-fired boilers, incinerators, dryers, scrubber controls, kilns and process heaters used by the power, oil, pulp and paper, iron and steel, non-ferrous metals, cement, glass and other industries.

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