CHEMICAL ENGINEERING
December 2016
ESSENTIALS FOR THE CPI PROFESSIONAL
www.chemengonline.com

Bright Ideas for Cost Estimating

Air Emissions: Monitoring and Control

Facts at Your Fingertips: Solid-Liquid Separation

Focus on Rotating Equipment

Chemical Engineering 2017 Buyer's Guide

Parallel Pumping Safety

CPI Employment Landscape

Process Plant Layout

Pressure Measurement: Difficult Applications; and DP Device Selection

Access Intelligence

Air Emissions: Overcoming Monitoring & Control Challenges

Modern technology tackles CPI's air-emissions concerns

IN BRIEF

Air emissions monitoring and control is a major concern for all chemical processors, but the product being manufactured, the process used to make it, the resulting byproducts and pollutants, and the location of a facility and associated regulatory mandates all dictate the specific methods or technologies that must be employed to monitor and control air emissions at each facility. As a result, monitoring and control requirements vary greatly from processor to processor, and from location to location. However, there are several across-the-board challenges regarding air emissions monitoring and control in the chemical process industries (CPI). Here, monitoring and control technology experts discuss the issues of concern and the solutions they've designed to ease the burden of compliance.

Endress+Hauser

FIGURE 1. E+H's Promass 200 Coriolis mass flowmeters are used to monitor natural gas or other hydrocarbon feeds to furnaces and boilers for GHG emission monitoring and to provide certified integral and redundant calibration verification

Challenge: unreliable data

"In today's regulatory climate, just monitoring for air pollutants isn't enough," says Hank Braly, vice president of sales and marketing with Mocon-Baseline (Lyons, Colo.; www.baseline-mocon.com). "Processors have to be sure they're getting good data out of their instruments and, too often, we hear that there's a lack of confidence in the accuracy of the data."

Solution: Smarter instrumentation. "The onset of microprocessors going into instruments has allowed a lot of the analyzers to become more automated than they used to be," says Braly. "As a result, many instruments now include automatic calibration and self-diagnostics, which provide more reliable data."

Braly says Mocon-Baseline's Series 9000 total hydrocarbon analyzer and Series 9100 gas chromatograph are both designed for accurate and reliable analysis. Automatic calibration features provide long-term analytical stability of the instruments above and beyond what can be achieved via manual calibrations. "Microprocessors are allowing us to get into the diagnostics of instrumentation, as well, so that if anything appears to be getting

Emerson

FIGURE 2. The Rosemount CT5100 continuous gas analyzer is a Quantum Cascade Laser (QCL) for process gas analysis and emissions monitoring

CMC Solutions

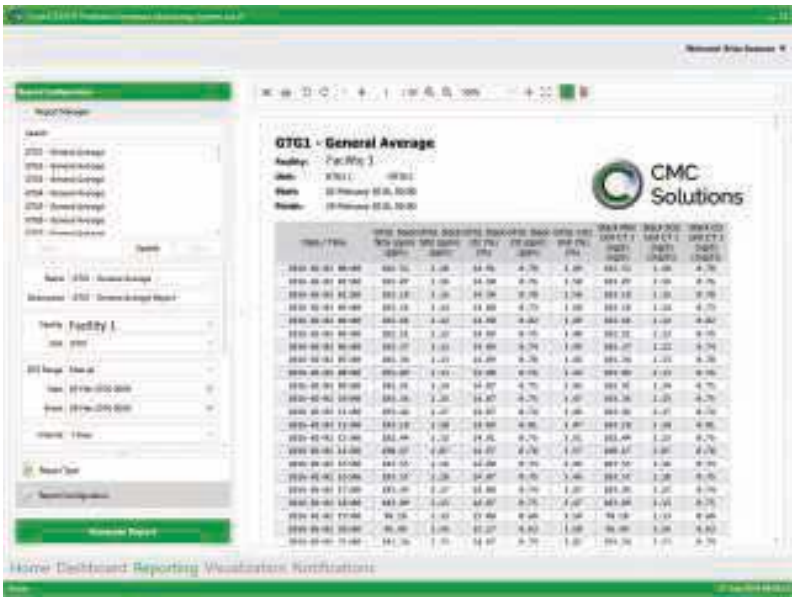

FIGURE 3. SmartCEMS-60 PEMS provides continuous data recording and report generation compliant with U.S. EPA 40 CFR Part 60 regulations and provides a secure and reliable means of collecting, storing and reporting compliance data. It can be used on most combustion sources that fire gaseous or liquid fuels and for most compliance parameters

out of line, users can be alerted that the instrument needs some attention before the data become skewed and before the instrument is out of compliance."

GHG regulations

Meeting current and potentially new and more-restrictive regulations from the U.S. Environmental Protection Agency (EPA; Washington, D.C.; www.epa.gov) and state regulators is one of the greatest emissions monitoring and control challenges for chemical processors, especially with today's focus on greenhouse gases (GHG). "In areas with already high concentrations of greenhouse gas emissions entrants, potential new emitters in areas that do not currently have significant GHG production may run up against local environmental opposition," explains Craig McIntyre, industry manager for Endress+Hauser (Greenwood, Ind.; www.us.endress.com). "For example, a company that is working to reduce coal consumption planned to build a world class methanol plant in Washington, but ran into enough environmental opposition that it cancelled its plans to build there."

Compounding the issue is that regulations require that GHG monitoring systems periodically verify that their calibrations are producing measurement accuracies within certain values. "Verification and documentation to prove the calibration is acceptable normally requires removal of the equipment," says McIntyre. "This exposes the system to damage during removal, transport and reinstallation and adds more costs."

He continues to say that some monitoring systems offer in-situ "push-button" calibration verification, but that these may not always be traceable or accredited to an international standard.

Solution: ISO-compliant instrumentation. McIntyre says that if an organization is ISO 9001:2008 certified, it needs to address Clause 7.6a Control of Monitoring and Measuring Devices, which states: "Where necessary to ensure valid results, measuring equipment shall…be calibrated or verified at specified intervals, or prior to use, against measurement standards traceable to international or national measurement standards."

New monitoring systems provide certified integral or redundant references that facilitate calibration verification via accredited and traceable means, and, thus, can have their measurement calibration regularly verified in situ, removing the risk and cost associated with taking the instruments out of service.

E+H's Promass 200 Coriolis mass flowmeters (Figure 1) are used to monitor natural gas or other hydrocarbon feeds to furnaces and boilers for GHG emission monitoring and to provide certified integral and redundant calibration verification. "These are calibrated and can be verified in situ via attested (TÜV) and traceable means, which addresses the ISO 9001:2008 Clause 7.6a trace-ability requirements," says McIntyre.

Declining skills base

"People that can read and look after analyzers are getting harder to find and more expensive to pay," says Shane Hale, director of product marketing for gas analysis with Emerson (St. Louis, Mo.; www.emerson.com).

Solution: Easier-to-use instrumentation. "Because we recognize that skilled [technicians] are hard to find, we are always developing our technology in an effort to make it easier to use," says Hale. This includes employing built-in diagnostics, as well as the inclusion of simplified sampling techniques.

The Rosemount CT5100 continuous gas analyzer is a quantum cascade laser (QCL) for process gas analysis and emissions monitoring

(Figure 2). "The quantum cascade lasers can measure multiple components in gas streams simultaneously, which is very unique, and allows us to measure these multiple components through a single sample chamber," says Hale.

Traditional analyzers require a separate chamber and analyzer bench for each component, he says. "But the quantum cascade laser adds significant ease of use because it is a single system, rather than having to have multiple technologies in a single box, which is quite a big advantage."

Other features include low long-term drift, which minimizes calibration intervals, low maintenance, continuous health-diagnostics reporting and an intuitive, simple front-panel user interface that allows access to all instrument functions, all of which help ease the burden on the workforce.

The costs of monitoring

"If you look at monitoring systems, there are costs associated with the initial purchase price, with maintenance and repair of each instrument and its support systems and with calibration and quality assurance, as well additional costs related to sample transport and handling," says Brian Swanson, president of CMC Solutions (Farmington Hills, Mich.; www.cmcpems.com).

Solution: Software-based systems. "Our solutions, the SmartCEMS-60 PEMS (predictive emissions monitoring system) and the SmartCEMS VPA (virtual process analytics), are software solutions," says Swanson. "There's no hardware other than the computer it runs on, so right there, our customers see initial investment costs that are one-half to one-third the price of a physical analyzer. On top of that, there is no installation cost, no associated access platforms or test ports and there is no necessary maintenance and no sample transport issues."

SmartCEMS-60 PEMS provides continuous data recording and report generation compliant under U.S. EPA 40 CFR Part 60 regulations and provides a secure and reliable means of collecting, storing and reporting compliance data (Figure 3). It can be used on most combustion sources that fire gaseous or liquid fuels and for most compliance parameters. The VPA product is a set of tools and software to be used in a process plant environment to model process inputs in realtime and run plant-operating scenarios.

"These products, by far, offer the lowest total cost of ownership of any monitoring system for process control or stack monitoring," he says. However, he adds, there is sometimes skepticism regarding use of a virtual system. "Many process engineers really like to hold onto those instruments," he says. "We understand this and often propose our solution as a redundancy to a physical analyzer or suggest initial trials where the measurement isn't as critical and, after a while, they see that our models

Dürr Systems

FIGURE 4. Shown here is a catalytic hot-gas filtration system installed in the glass industry by Dürr

are very robust and that they provide readings that are 100% reliable without the additional costs. We also like to remind people who are arguing safety and reliability that traditional instruments drip, plug and fail, but a virtual instrument never has these issues."

Controlling fugitive emissions

"The greatest control challenges we see often surround fugitive emissions," says Kari Kohonen, strategic account manager for oil and gas with Valin Corp. (San Jose, Calif.; www.valin.com) "And, the challenges encountered in this area are directly related to the reliability of existing equipment, as well as the use of outdated valve technologies and correct installation procedures to ensure that they are remaining compliant with EPA standards."

Solution: Mitigating valve leaks and increasing reliability. "It is important to provide solutions with technologies that contain and reduce fugitive emissions by mitigating leak potential and providing greater reliability," says Kohonen. Valin offers three solutions to assist here: rotary globe control valves, transmitter manifold valves and instrument tubing connections.

While conventional globe control valves use a linear rising stem that inherently pulls process fluids or gases up through the valve stem packing, increasing the risk and probability of introducing emissions into the environment, the Metso/Neles rotary globe valve, Series ZX, reduces that risk because the valve stem rotates within the packing, thus reducing the risk of emission leaks as the stem is not trying to pull process fluids or gases up through the packing.

Parker's PGI transmitter manifold valves feature the company's Pressure-Core stem-seal system for reliability and a virtually leak-free bonnet, which requires no maintenance. The leak-free design means no fugitive emissions in process level, flow, pressure and differential-pressure transmitter locations. And, the Phastite tubing connection system from Parker eliminates the requirement of welding and combines quick installation with a single-assembly process, achieving a tube connector that can be used in applications with pressures up to 20,000 psi (1,380 bars).

Multiple contaminants

The most challenging aspect of emissions control today is that chemical processors and other industrial manufacturers are required to address the capture of not only volatile organic compounds (VOCs) and gaseous contaminants, but there are also restrictions on particulate matter, acid gases, oxides of nitrogen (NOx) emissions and more. "Today's emissions regulations cover all sorts of pollutants and there is not necessarily one piece of equipment that can address all of the emissions in one shot," says Steven George, key account manager with Dürr Systems (Southfield, Mich.; www.durr-northamerica.com).

Solution: Integrated control systems. "To overcome this issue, we've been providing integrated system solutions," he says. According to George, traditional integrated systems might look like this: a bag house technology on the front end to address the particulate matter, followed by a regenerative thermal oxidizer (RTO) for the thermal destruction of VOCs, followed by a wet scrubber to remove acid gases generated by the thermal destruction process. "You end up with a staged approach to emission control, rather than one piece of equipment," he explains. The newest technology to be incorporated into this line of defense is catalytic hot gas filtration (Figure 4), says George, because it addresses multiple needs. "Not only can you use it to remove particulate matter, but it can also address NOx issues," he says. "And when this is combined with dry sorbent injection, it can also address acid gas removal, SOx and NOx all in one piece of equipment."

So, no matter the chemical being produced, the location of the facility or the greatest emissions challenge, there is likely a solution available to meet the need. ■

Joy LePree