EMERSON

A Guide to Taming NO_x Emissions Using New Gas Analyzer Technologies

1 Control NO_x Emissions to Meet Changing Regulations

Environmental regulations are changing at a rapid pace. Process plants need to do more than simply adapt. Not only must operators keep pace with these regulations, they need to seek proactive methods for reducing emissions.

FIGURE 1

The effects of NO_x can be seen, often hundreds of miles from the source.

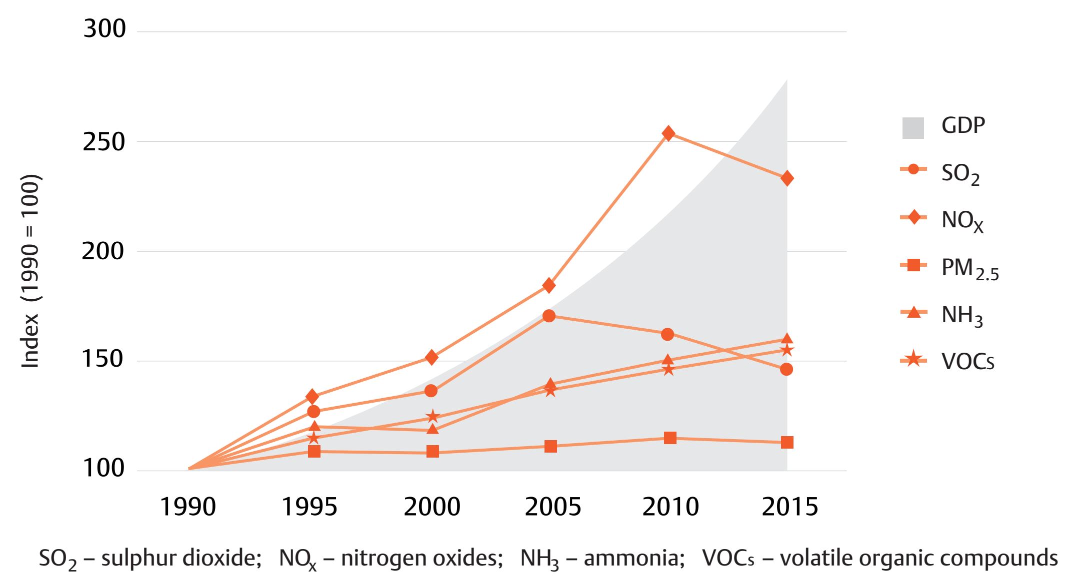
Taming Emissions

Throughout the wide range of air pollutants, one group remains particularly problematic and challenging for combustion processes: Nitrogen Oxides (NO_x), which comprises nitric oxide (NO) and nitrogen dioxide (NO_2). There are several characteristics contributing to the difficulties:

- It can be generated by burning any fossil fuel, even natural gas
- There are no specific fuel-borne precursors that users can avoid
- It is produced by large-scale installations (e.g., power plants)
- It is produced by small-scale installations (e.g., an individual truck engine)
- It produces wide-spread atmospheric photochemical reactions creating acid rain, ozone, and smog (Figure 1)
- It produces individualized respiratory problems in humans.

Fortunately, NO_x formation in combustion can be controlled to some extent, and certain processes are able to neutralize it in an exhaust stream. In a recent report published by the United Nations Environment Programme (UNEP) on air pollution in Asia Pacific countries, data shows large increases of nitrogen oxides emissions which closely followed the expansion of economic activities as measured by GDP (Figure 2). The report emphasizes NO_x emissions could be cut by 50% by 2030 in Asia Pacific compared to 2015 levels if energy policy measures and emissions controls are enforced.

On the other hand, NO_x emissions in the U.S. have declined by more than half over the last 20-plus years (Figure 3). This has been driven by the U.S. Environmental Protection Agency (EPA) cooperating with states and other bodies, imposing regulations over a growing range of sources and restricting the allowable levels generated by existing producers. Regulations have expanded over the years, now incorporating minimum specifications for emission monitoring, emission measurement methods, and performance specifications.



SO_2 – sulphur dioxide; NO_x – nitrogen oxides; NH_3 – ammonia; VOCs – volatile organic compounds

FIGURE 2

The evolution of gross domestic product and nitrogen oxides emissions in Asia Pacific. Increases in NO_x closely followed the economic expansion.[1]

[1] United Nations Environment Programme (UNEP). Air Pollution in Asia and the Pacific: Science-Based Solutions, 2019

For regulatory purposes, both NO_x components are treated equally and combined together during measurements. Both respond similarly to mitigation, so a facility with combustion processes that produce NO_x can implement a long list of possible solutions to reduce output by impeding its formation and/or removing it from the stream. (For the purposes of this eBook, we will focus on stationary industrial applications.)

Some solutions are major, capital-intensive undertakings, such as selective catalytic reduction (SCR), while others are more modest, such as adjusting the amount of combustion air preheating. Naturally, none of these are without their side-effects and costs, but it is incumbent on producers to be proactive and experiment with process modifications in an effort to reduce NO_x output. These actions assume a facility has appropriate instrumentation able to measure NO_x output to determine which changes are effective, practical, and economical, in addition to fulfilling the requirements of regulatory bodies.

There are many process gas analyzers available today able to measure NO_x and other pollutants on a continuous basis as regulators generally require continuous monitoring of emissions to air. If there is fuel being burned, the continuous emissions monitoring system (CEMS) should be working and recording data (Figure 4). Current technologies include many self-diagnostic functions and intuitive user interfaces to simplify operations and reduce costs. These make it an easy process to test and evaluate new reduction and remediation methods, supporting effective decision making.

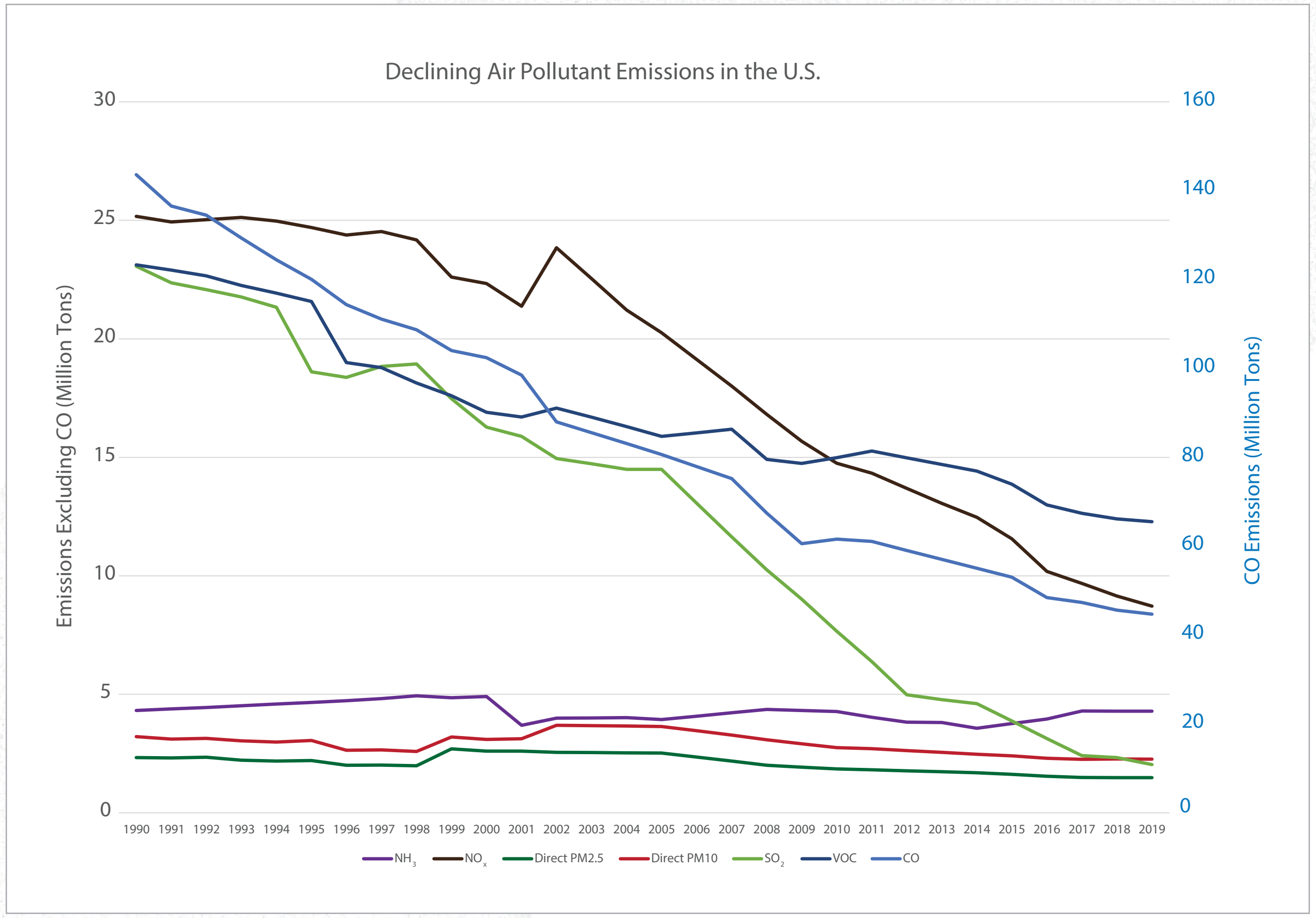


FIGURE 3

Overall output of NO_x in the U.S. has declined substantially over the last 20 years.[2]

[2]U.S. Environmental Protection Agency (EPA). 2020 Air Trends Report

FIGURE 4

Most continuous emissions monitoring systems take flue gas samples just before leaving the stack.

Continuous emissions monitoring systems with modern extractive technology help operators:

- **Minimize Safety Risks** by keeping personnel off the stacks.
- **Meet Emissions Targets** with new analyzer technologies that enable plants to stay ahead of environmental regulations.
- **Decrease Operating Costs** by lowering maintenance and equipment costs.

2 Use the Right Gas Analyzer to Optimize NO_x Monitoring

A significant percentage of plants still rely on obsolete or discontinued emissions monitoring systems. To achieve the mandated system availability, it is imperative for plant operators to implement reliable NO_x measurement technologies that can deliver the right information needed for compliance and prevention of system failure.

Technology Reliability: The Key to Less Reactive and More Proactive Environmental Compliance

Many facilities are still using older analyzer technologies to monitor emissions. According to a global market research study on emissions monitoring systems by the ARC Advisory Group, many plants are slow to adopt new technology because of implications for their workforce and work processes, and the need to establish new best practices. This leaves them struggling to maintain continuous operation with the degree of accuracy required by regulatory agencies.

But by understanding constraints and available solutions, plant operators are in a unique position to evaluate existing technologies and manage emissions in a more timely, safe, and cost-effective manner. Today's analyzers are not only easy to use, they are also easy to deploy, offering the ability to be:

- Retrofitted into existing infrastructure to minimize installation costs
- Easily configured to avoid service disruptions when replacing legacy analyzers
- Installed and commissioned quickly due to pre-configured features.

When evaluating new designs, two options should be considered, depending on the specific application requirements.

Emerson offers two NO_x measuring technologies. Each approaches the task differently and gives prospective users options for optimizing their processes. The first and more comprehensive technology is direct absorption spectroscopy. The second and more specialized approach uses a chemical effect called chemiluminescence.

DIRECT ABSORPTION SPECTROSCOPY

Direct absorption spectroscopy takes advantage of a given compound's capability to absorb specific wavelengths of electromagnetic (EM) radiation. This spectral fingerprint can be identified electronically allowing an analyzer to detect and quantify the presence of various compounds of interest. This way, a single analyzer can monitor a range of pollutants in a gas stream rather than just NO_x.

The tell-tale spectral fingerprints for many polluting flue gas components can be observed in near- and mid-infrared sections of the EM spectrum. The ability to create radiation with wavelengths ranging from 800 to 12,000 nanometers (nm) depends on using a mix of different lasers which can be optimized and combined, generating an output with specific segments of that larger range.

Emerson's Rosemount CT4400 Continuous Gas Analyzer (Figure 7) can be configured with multiple tunable diode lasers and quantum cascade lasers to cover a wide wavelength band and measure multiple pollutants (Figure 6). All of these working together permit measurement of a long list of specific chemical components.

Quantum Cascade Laser (QCL) technology offers fast, high-resolution spectroscopy to detect and identify a range of molecules in the mid-infrared wavelength range. Coupled with Tunable Diode Laser (TDL) spectroscopy to cover the near-infrared band, a single instrument is now able to provide greater insight and monitoring in both the near- and mid-infrared range of spectroscopic light. QCL and TDL's narrow line width (Figure 5) allows scanning of individual peaks of identified components with minimum interference and without the need for optical filters, reference cells, or chemometric manipulations. No consumables are necessary, ensuring low lifecycle costs.

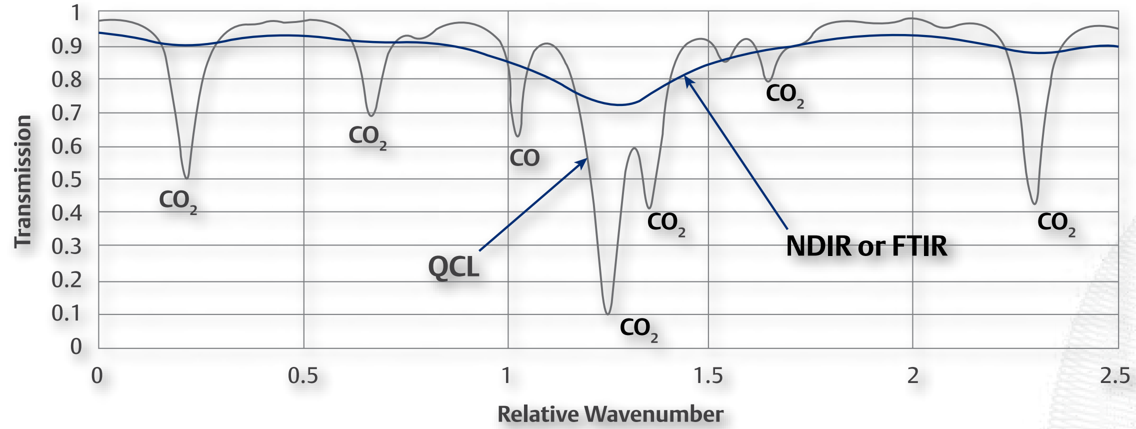


FIGURE 5

This graph compares QCL detection to a conventional nondispersive infrared (NDIR) and Fourier-transform infrared (FTIR) analyzer. In this example using CO_2, peaks are more pronounced and easier to see with QCL detection.

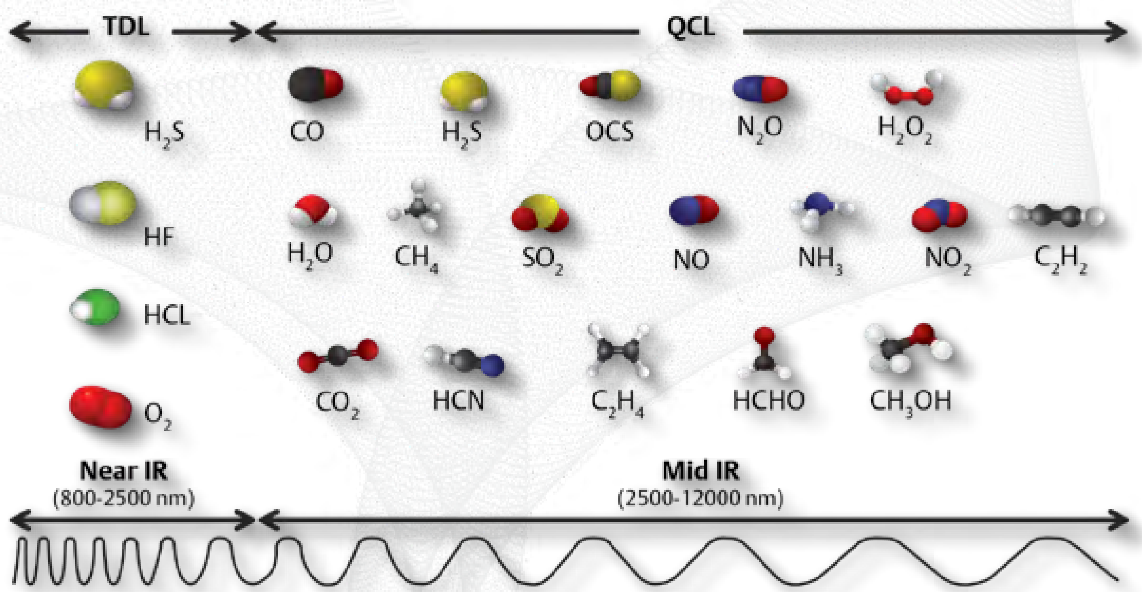


FIGURE 6

Emerson's Rosemount QCL/TDL systems include up to six high-resolution lasers to measure both the near- and mid-infrared spectral regions for real-time, optimal gas measurement and analysis down to sub ppm concentrations.

Advanced signal processing of the Rosemount QCL technology enables real-time validation of measurements and reduces the need for calibrations. This technology is capable of very high sensitivity, able to detect into the parts-per-billion ranges in certain applications.

This approach offers many advantages for CEMS in refineries and petrochemical plants (See Sidebar 1). NO_x is certainly a major area of concern, but additional gases (Figure 6) may be added to the list, including:

- CO (carbon monoxide)
- CO_2 (carbon dioxide)
- NH_3 (ammonia)
- SO_2 (sulfur dioxide)
- H_2O (water vapor)
- O_2 (oxygen)

Where regulations require monitoring many components in a gas stream, the Rosemount CT4400 Continuous Gas Analyzer might be able to handle them all (Figure 6). Sophisticated models, such as the CT5000 Series of Rosemount Quantum Cascade Laser Gas Analyzers can detect and quantify up to 8 gases, so just one analyzer may be able to replace multiple analyzers in many applications. More frequently, three to five components might require monitoring, so a user can choose the model able to cover those measurements without over specifying the analyzer.

QCL/TDL-based analyzers can take a variety of forms making them easy to install in plant environments. Some are now robust enough be mounted in the field without a traditional analyzer shelter. These field-mountable enclosures minimize the distance between the analyzer and the duct sampling point, so lag time to capture a measurement can be very short. Some enclosures are even certified for hazardous areas, eliminating the need for a purged shelter. Internal components are often highly modular, allowing field replacement of major subsystems, including the actual laser module. This ensures high availability, keeping regulatory inspectors happy.

FIGURE 7

Emerson's Rosemount CT4400 Continuous Gas Analyzer is a purpose-built hybrid QCL/TDL process gas analyzer designed to enhance performance and reduce costs specifically in NO_x measurement and continuous emissions monitoring applications.

View Customer Success: Relative Accuracy Test Audit (RATA) of Emerson's Rosemount QCL/TDL Analyzer >>

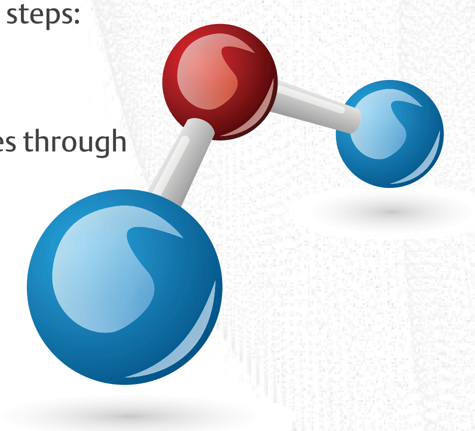
CHEMILUMINESCENCE DETECTION

Chemiluminescence detection (CLD) is the emission of light as the result of a chemical reaction. In a chemical reaction, intermediates form and one molecule emerges in an excited state. By emitting an extra photon during the excited state, the molecule returns to its ground state.

Emerson's Rosemount X-STREAM *Enhanced* XECLD Continuous Gas Analyzer (Figure 9) detects and measures light emission—the chemiluminescence—and uses it to determine the number of molecules counted.

Applying this principle to measure NO_x sounds complex, but the process is highly reliable. None of the NO_x molecules carried by a combustion gas stream are expected to be in an excited state, so this condition has to be induced in the sample being analyzed, which requires several steps:

1. The sample stream must be cooled and all water vapor must be removed.
2. All NO_2 in the sample must first be converted to NO. The sample gas stream passes through a heated bed of vitreous carbon causing a reaction turning more than 98% of NO_2 into NO and CO.
3. A high-voltage corona discharge generator module in the analyzer creates ozone (O_3) from atmospheric oxygen. A pure oxygen supply is not necessary.
4. The O_3 and NO are fed continuously into a chamber where they react, creating NO_2 molecules. Approximately 10% of those molecules emerge from the reaction in the excited state.
5. The molecules emit their photon in the chamber and revert to the ground state. The spent reacted gases exit with the exhaust stream.



The chamber where nitrogen oxide and ozone react is fitted with a photodiode (Figure 8) able to read emissions with wavelengths between 500 to 2500 nm. This chemiluminescence here has its highest intensity around 1100 nm. Software analyzes the excited molecule count and extrapolates to project the NO_x content percentage for the entire gas stream by comparing the process gas signal to a signal from a calibration gas with known NO_x concentration.

A CLD analyzer (Figure 9) needs a cold/dry sample gas stream since water vapor can quench the chemiluminescence effect before it can be captured, therefore causing an underreporting of the true NO_x level.

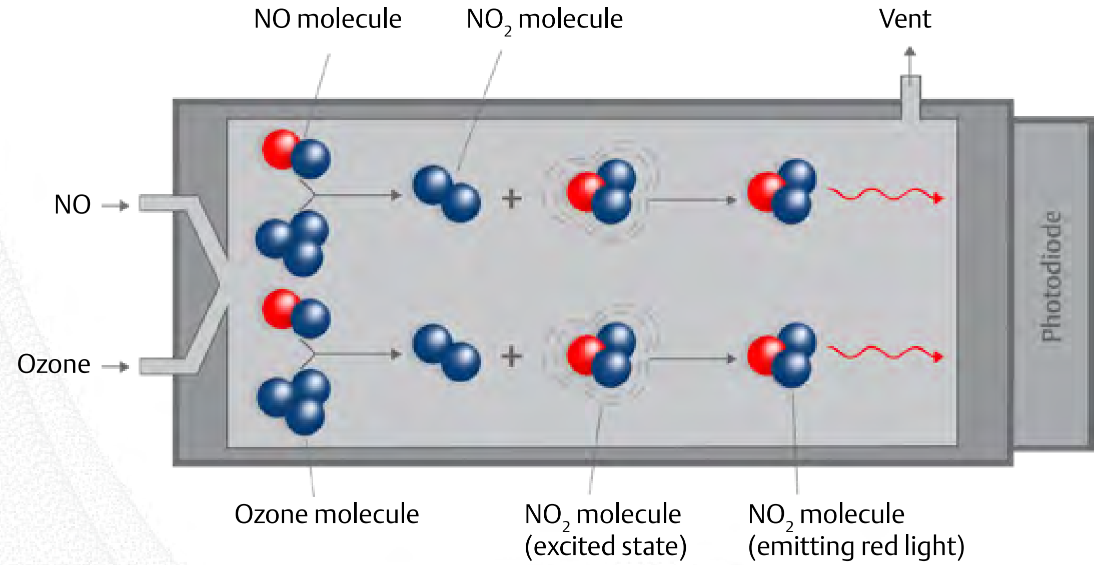


FIGURE 8

A CLD analyzer determines the amount of NO_x in a sample by measuring the light given off by excited molecules.

FIGURE 9

New CLD analyzers, such as Emerson's Rosemount X-STREAM *Enhanced* XECLD Continuous Gas Analyzer, offer high precision and durability with a low lifecycle cost.

CLD analyzers have been available for many years, and the technology has long been accepted as the Standard Reference Method (SRM) for NO_x monitoring by the EPA (See Sidebar 2) (Method 7E procedure) and other regulatory agencies, including the European Standard EN 14792:2017. Over the years, the overall performance, stability, and durability of commercial CLD analyzers has improved dramatically.

Among the various NO_x measurement technology alternatives, CLD analyzers have low purchase and operational costs since there are no consumables, with only the converter material requiring periodic replacement at intervals of one to three years depending on NO_2 content in the process. The atmospheric pressure operation of Emerson's Rosemount CLD technology in particular eliminates vacuum pumps, reducing a potential source of vibration which can add maintenance requirements, or compromise measurement integrity. It also offers very wide user-selectable NO_x measurement ranges from 0 ppm–5 ppm up to 10,000 ppm and can operate without pure oxygen supply requirements, eliminating that expense.

On the other hand, a CLD analyzer performs just this one NO_x measurement function. It can't look for any other components in the gas stream. If this measurement is all that's required for the application, it can be a very economical and practical choice.

When measurement of multiple components is required for CEMS—in addition to NO_x, CLD can be packaged together with a second analyzer equipped with traditional detection technologies, including paramagnetic sensors for O_2 measurement and dispersive infrared (NDIR) and/or nondispersive ultraviolet (NDUV) photometers for the measurement of other pollutants, such as SO_2, CO, CO_2, N_2O.

To reduce the number of analyzers, footprint and cost in multi-component CEMS measurement applications that include NOx, NDIR and NDUV photometers can be leveraged to measure NO_x instead of using CLD technology. By measuring NO using NDIR and NO_2 using NDUV, a multi-component CEMS measurement can be achieved using one-analyzer solution since the NDIR/NDUV detection methods can also monitor other gas components beyond NO_x.

View Customer Success:
Relative Accuracy Test Audit (RATA) of Emerson's Rosemount CLD Analyzer >>

3 Ensure CEMS Mandated Availability and Quality

A NO_x CEMS system must meet a range of performance specifications and quality assurance requirements to determine ongoing compliance. A percent monitor availability (PMA) is a key component in determining how well a CEMS system is performing. If the PMA is below 95%, plants may face consequences like additional reporting requirements and more punitive data substitution values.

Delivering Continuous Performance

Environment regulations in many countries and regions around the world require a continuous emissions monitoring system to measure NO_x. So, how is “continuous” defined in this context?

Ideally, there must be valid measurement data for every hour the facility is burning fuel. However, the EPA, for instance, is willing to accept 90% of the time during the first year an analyzer is in operation. After the first year this increases to 95%, which means if a process is running 24/7 for an entire year at that point, the analyzer can only miss a total of 438 hours. Similar EPA procedures that define continuous monitoring are also outlined by regulatory bodies in the EU and other world regions.

There are no allowances beyond that figure for malfunctions, calibration problems, unavailability of consumables, or other interruptions. At the same time, a solid analyzer installation using today’s technologies should have no trouble reaching the 95% figure. Even over a year of operation, 438 hours of downtime should be more than enough for maintenance, verifications, and calibrations.

Modern internal analyzer mechanisms are simpler and more robust than older designs so there is less to go wrong. When combined with internal diagnostic capabilities available, unscheduled outages should be rare (Figure 10). Moreover, the need for consumables with today’s designs is often eliminated. The list of critical components is very short so achieving long periods of uninterrupted operation is not a challenge.

Availability is important for compliance reporting, but it is also critical for any facility involved in NO_x trading as multiple facilities must have directly comparable data.

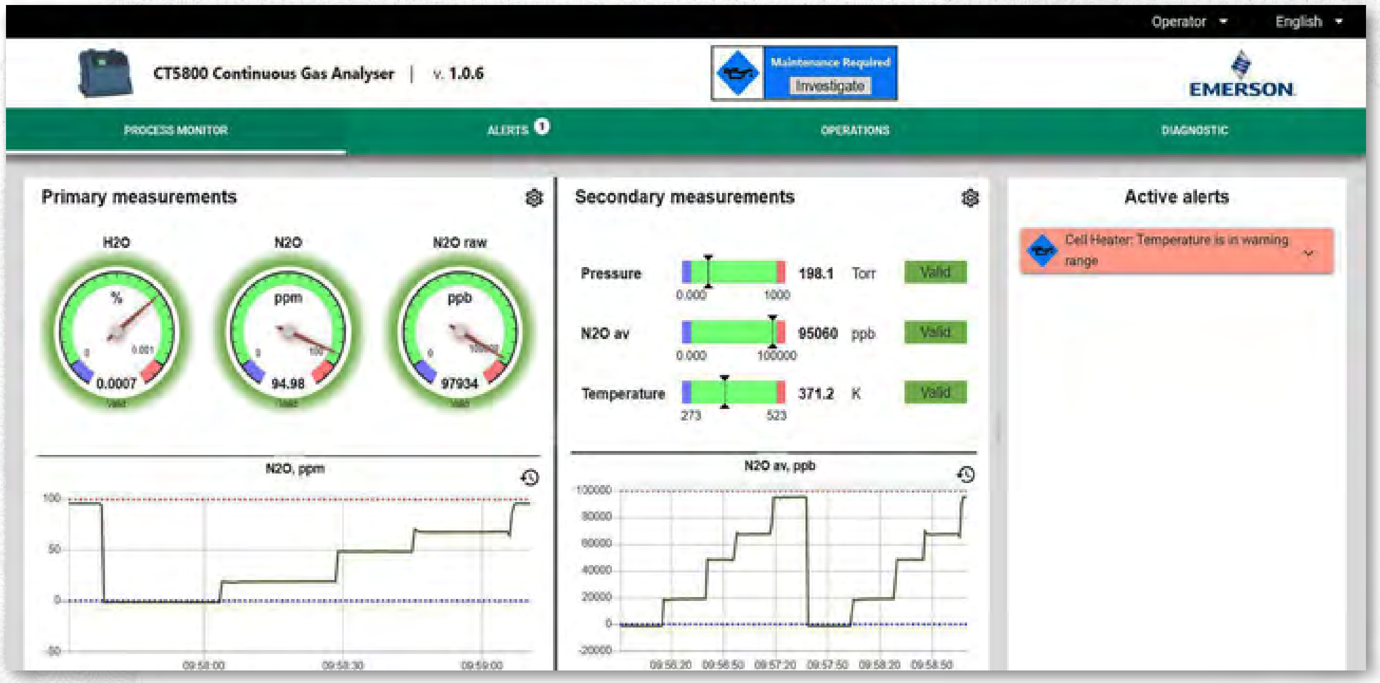


FIGURE 10

The integrated diagnostic capabilities and web interface of Rosemount gas analyzers enable continuous monitoring of analyzer health and measurement to help operators stay ahead of environmental excursions and meet the mandated CEMS availability and quality.

> “The QA procedures consist of two distinct and equally important functions. One function is the assessment of the quality of the CEMS data by estimating accuracy. The other function is the control and improvement of the quality of the CEMS data by implementing QC policies and corrective actions. These two functions form a control loop: When the assessment function indicates that the data quality is inadequate, the control effort must be increased until the data quality is acceptable. In order to provide uniformity in the assessment and reporting of data quality, this procedure explicitly specifies the assessment methods for response drift and accuracy.” [3]

[3] U.S. Environmental Protection Agency (EPA). Air Emission Measurement Center. EPA.GOV

TEST, REPORT, REPEAT

Environment regulation agencies take nothing for granted when it comes to testing and verifying CEMS performance. Quality assurance procedures are used to evaluate the effectiveness of quality and control of data produced by any CEMS used for determining compliance with the emission standards on a continuous basis.

In Europe, the quality criteria for permanently installed CEMS are governed by four levels of tests outlined by the EN 14181 standards. These tests assess the measurement procedure (QAL1), proper installation (QAL2), ongoing monitoring (QAL3) and include Annual Surveillance Tests (AST). In the US, similar procedures are outlined by the EPA and include at least nine tests and as many as 12 that must be performed to validate a CEMS, plus ongoing testing that consists of:

- Initial performance testing
  - Calibration drift test
  - Linearity test
  - Response time test
  - Interference check
  - Calibration error test
  - Relative accuracy test audit
- Routine testing
  - Relative accuracy test audit
  - Cylinder gas audit

Testing involves two techniques. The first is a validation of a system by feeding the analyzer a certified concentration of the target gas to ensure it is capable of reading the value correctly. If the reading is not correct, the analyzer must be calibrated. Any such adjustments must be logged, with the history made available to inspectors.

These validations can be performed manually, but with newer analyzers, this task can be automatic at specified intervals. There is also a growing list of other analyzer parameters which are internally self-checked on a continuous basis, with results reported to operators via the analyzer’s diagnostics. If anything is out of limit, the analyzer can report an out of specification reading or an outright failure. It can also call for a specific maintenance action or check function.

The second test is a direct comparison of two systems operating in parallel. This is a relative accuracy test audit (RATA) and calls for an independent third-party to temporarily install a second certified system to provide a series of directly comparable measurements to the facility’s installed CEMS analyzer (See Sidebars 1 and 2). Parallel results must fall into a narrow range.

Customer Success: Relative Accuracy Test Audit (RATA) of Emerson's Rosemount QCL/TDL Analyzer

THE TEST

A major refinery in North America undertook a long-term stability trial of Emerson's Rosemount CT5400 Continuous Gas Analyzer with hybrid quantum cascade laser (QCL) and tunable diode laser (TDL) technology. It was installed to characterize the flue gas from its calciner hearth for environmental reporting.

The analyzer draws flue gas after the chiller in the stack's vacuum eductor and performs all EPA tests alongside the refinery's legacy analyzers. The site's CEMS was configured using multiple analyzers, each measuring specific gas components. NO_x measured with chemiluminescent analyzers, O_2 with paramagnetic, and CO_2, CO, SO_2 with non-dispersive infrared (NDIR) analyzers. The Rosemount CT5400 Continuous Gas Analyzer measured all gas components. Data collected from the Rosemount analyzer and plant analyzers were compared to a certified, third-party EPA test reference analyzer.

The refinery processes 250,000 bpd of crude oil. It can manufacture diesel fuel from biomass-based feedstocks.

The testing program included daily validation of analyzers with check gas, quarterly stability testing against check gases, and yearly relative accuracy test audit (RATA) of stack gases.

The facility was testing Emerson's analyzer in hopes of replacing less stable existing analyzers using older technologies dependent on broad-spectrum light sources and filter wheels with moving parts. The expectation was that new laser spectroscopy technologies would yield more stable analysis and more precise emissions measurements to support regulatory compliance.

The refinery selected the QCL/TDL technology based on fast measurements and stability. The plant was counting on drift-free performance and no need for calibrations, even after 10 or more years in operation. The facility had good experience with earlier-model TDL analyzers and had every expectation that using hybrid QCL/TDL technology would add more capabilities and functions into a single analyzer while providing high availability.

During the actual RATA procedure, both the plant's analyzers and the certified reference analyzer compared samples taken simultaneously. The procedure called for nine runs at 21 minutes per run, with data recorded at one-minute averages. The tester performed analyzer bias checks between each run, and the stack diameter was traversed by moving the probe every seven minutes to eliminate any stratification concerns.

THE RESULTS

The plant's environmental compliance team needed to match the performance of the EPA's existing testing method before fully adopting the QCL/TDL technology. After 10 runs, Emerson's analyzer passed for all gases — O_2, CO_2, CO, SO_2, and NO_x. During the 50-day trial, Emerson's QCL/TDL analyzer showed it was stable, met the EPA's performance requirements, and had lower maintenance requirements than existing solutions. The Rosemount analyzer has already been approved for two additional fired-heater applications.

Customer Success: Relative Accuracy Test Audit (RATA) of Emerson's Rosemount CLD Analyzer

THE TEST

A Midwestern grain processing plant operates two 271 million BTU/hour natural gas or alcohol fired boilers, each equipped with one low-NO_x burner and a flue gas recirculation system. Both boilers send their emissions to a single common stack. The plant installed Emerson's Rosemount CLD Continuous Gas Analyzer to measure NO_x emissions for both boilers.

The relative accuracy test audit (RATA) procedure recounted here followed U.S. EPA Method 7E for NO_x emissions. With both boilers running, gas samples were drawn from the stack continuously, with a portion sent to the Rosemount CLD analyzer and a portion to the reference analyzer. After the wet flue gas was dried, it went through the actual analysis process with both analyzers. EPA protocol 1 gases were used to validate both analyzers as well as to run system bias and drift checks.

Nine times, testers used the same steps. First, both the reference analyzer (FTIR spectrometry continuous gas analyzer) and the plant CEMS analyzer were calibrated using calibration gas. Next, there was an operational run lasting about 21 minutes, where the facility's CLD analyzer and the reference analyzer supplied by the testing company collected data simultaneously, averaging each minute and then averaging these for the run. This provided directly comparable data (See Table 1) using two measurement calculation methods: NO_x in parts per million (ppm) and NO_x in pounds per million BTU (lb/mmBTU). With each run, boiler output was kept within a narrow range.

	Test Run Number									
	1	2	3	4	5	6	7	8	9	Average
Reference Analyzer										
Reference Analyzer NO_x ppm	17.57	18.23	18.54	18.38	19.23	18.59	19.24	19.45	20.29	18.84
Reference Analyzer NO_x lb/mm BTU	0.0228	0.0242	0.0246	0.0243	0.0254	0.0245	0.0252	0.0255	0.0266	0.0248
Facility CEMS with Rosemount CLD Analyzer										
Facility CEMS NO_x ppm	20.2	19.9	20	20.2	20.1	20.6	21.3	21.5	22.3	20.7
Facility CEMS NO_x lb/mm BTU	0.0261	0.0256	0.0258	0.0259	0.0259	0.0266	0.0274	0.0278	0.0310	0.0269

Table 1: The RATA test procedure calls for 9 test runs to validate both the Rosemount analyzer and reference analyzer and verify system bias and drift.

THE RESULTS

The facility's Rosemount CLD Continuous Gas Analyzer passed the calibration, system bias error check, and NO_x measurement every time. These positive results provided the plant with the required data to verify operation.

4 Leverage Modern Gas Analyzers to Manage Energy Usage & Emissions

Deploying the right technology enabler can help plants not only meet regulatory compliance, but also minimize energy losses, reduce costs, automate workflows and leverage analytics to improve availability and decision making.

FIGURE 11

Analyzer data can be securely viewed worldwide by plant personnel after verifying login credentials.

Practical Advantages of Today's Analyzers

While the availability and accuracy of today's analyzers is proven, here are four other factors which can be important for plants seeking to minimize emissions and risk of fines.

REDUCE OPERATIONAL COSTS

Advanced analyzers, such as the CT4000 or CT5000 Series of Emerson's Rosemount Continuous Gas Analyzers using hybrid QCL/TDL technology, can monitor a wide range of target gases in addition to NO_x. When using traditional technologies, monitoring multiple components could have called for two, three, or even four analyzers. Each analyzer would require its own consumables, calibration, maintenance, operator training, and space on the plant floor. Those multiple analyzers can often be replaced with one analyzer and its associated sampling system—requiring no consumables, providing automated verification, and delivering an intuitive operator interface with extensive internal diagnostics. All these make it much easier for one operator to oversee multiple analyzers, as is frequently required.

AUTOMATE WORKFLOWS

Connectivity extends to automation host systems and other corporate networks, including programmable logic controllers, distributed control systems and enterprise networks. Whatever the communication protocol, Emerson's analyzers can deliver the data.

IMPROVE DECISION MAKING

Connectivity of advanced analyzers also makes data available to authorized personnel in any location via plant networks or the web. Those working to optimize combustion processes or pollutant removal systems can easily see the effects of their efforts. Performance data for regulatory inspectors can be reported quickly and painlessly. Maintenance personnel can see at a glance when the most recent verification check was performed (Figure 11). More information delivered quickly with thorough analysis means better decision making for plant operation and emissions control.

IMPROVE RELIABILITY

Advanced analyzers are designed from the ground up for problem-free performance over the long term. Compared to older systems, there are fewer critical parts, less that can go wrong, and no consumables. The lifetime cost picture has changed.

DECREASE ENERGY USAGE AND BUILD VALUE CREATION INTO COMPLIANCE

NO_x is a critical pollutant, and fighting it is not a simple matter. But whatever the plan for abatement, it has to begin with measurement, which calls for an accurate and reliable analyzer. For many companies, this is driven by regulation. The EU Industrial Emissions Directive (IED) and the U.S. EPA are there to keep an eye on things and make sure emissions stay within limits. A top-notch analyzer is basic to any CEMS.

Some companies are intent on doing even more to find better ways to reduce NO_x output while optimizing processes and reducing operational costs. Of course, regulations must be met, but are there ways to be proactive at the same time and reduce emissions in an effort to be a better global citizen?

Gas analyzer emission measurement data can be leveraged for optimizing energy consumption. For example, monitoring NO_x content and excess oxygen and CO levels in flue gas can be used to adjust the fuel and airflow ratio and by that optimizing fuel consumption in a combustion process. Furthermore, these measurements can be used as a performance indicator of an engine or boiler's combustion which enables the detection of faulty operation at an early stage.

In many process plants and facilities, energy use has been cut by making more extensive use of analyzer data. This has in turn reduced emissions, while dramatically improving the bottom line since energy consumption is the second largest operating cost in many process plants.

Whatever the motivation, Emerson's analyzers can handle the task, whether performing a simple single NO_x reading, or sensing a full spectrum of flue gas components.

Emerson's Solutions for Emissions Monitoring, Control and Optimization

CEMS Regulatory Measurements. Pollutants analysis to control emissions and meet environmental regulations.

Flue Gas Process Control. Process control to optimize flue gas treatment ($DeNO_x$ and $DeSO_x$).

Combustion Efficiency Control. O_2, CO and CO_2 measurement to optimize combustion process and reduce fuel consumption.

Reliable monitoring and control of NO_x emissions requires precise and repeatable measurements. Your choice of technology is critical to meeting emissions regulations.

Partner with application experts at Emerson to help you with the right solution to reduce non-compliance risks and costs.

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