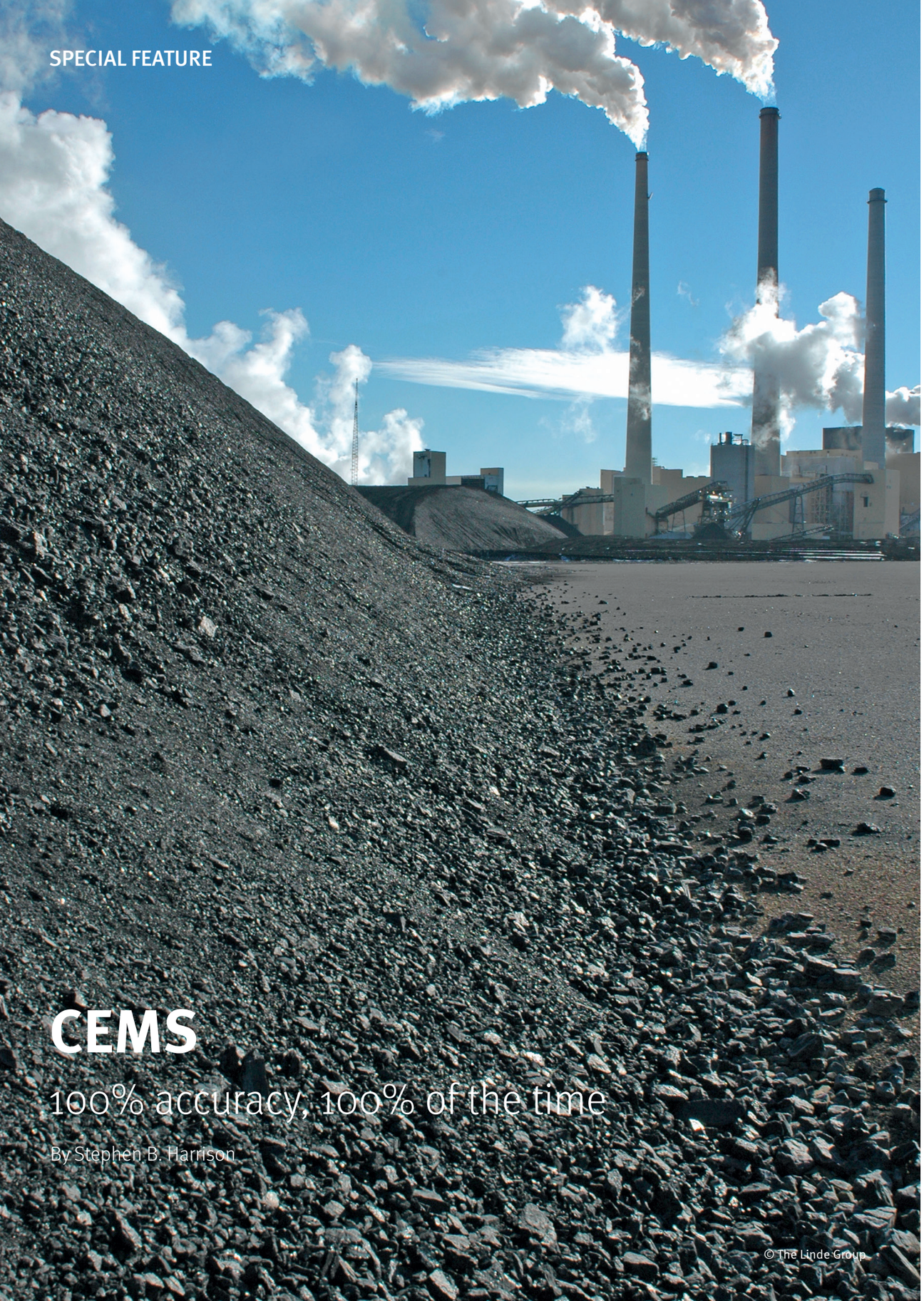

# CEMS

## 100% accuracy, 100% of the time

By Stephen B. Harrison



SPECIAL FEATURE

There are few acronyms as well known in the environmental management industry as CEMS. Also, few explain so clearly what they mean… 'Continuous Emissions Monitoring System'. The goal of each system is very simple: stack gas measurement with guaranteed precision and uninterrupted online availability.

To achieve the continuous 100% uptime goal is a big ask and legislation around the world allows for only very short periods of outage for calibration or other maintenance activities. However, the best CEMS systems will achieve more than 97% uptime throughout the year and that, indeed, is the stretching target that environmental regulators require. For this up time to be valid, not only must the analytical instrument be functional, it must also be properly calibrated.

Calibration for CEMS instrumentation is achieved with high precision specialty gases mixtures. It is often the case that legislation will demand mixtures which are traceable to international reference materials and have suitable accreditation to back up the traceability claim. This is the domain of US EPA protocol gas mixtures and ISO17025 accredited calibration standards, some of the most sophisticated products in the world of industrial gases.

**100% uptime…easy as ABC?**

FTIR is a common choice for CEMS instrumentation in combustion applications where a broad range of pollutants are emitted, for example waste incineration or co-incineration of fuel and waste, which is often the case for cement kilns. The FTIR will require relevant specialty gases calibration mixtures, according to the chemical species to be measured, and high purity nitrogen to purge the instrument. Measurement of the flue gas oxygen concentration is required to compensate the FTIR measurement of the pollutant species. For this, a zirconia oxygen analyser is often used which will also require a calibration gas mixture, typically 8% oxygen in a balance of nitrogen.

The industry benchmark FTIR for CEMS is arguably the ACF5000 from ABB. With more than 1,700 installed units worldwide and an average availability exceeding 98%, this technology has been proven to be highly robust. Marjus Seubert, Head of Product Management for Continuous Gas Analysers at ABB Automation GmbH explains, "Our FTIR runs on the 'hot / wet' principle, meaning that the sample is brought to the instrument in a similar condition to how it exists in the stack. We can therefore avoid the problems of reactive, sticky species such as ammonia, hydrogen chloride or hydrogen fluoride condensing out or adsorbing onto the sample line walls."

"Combined with a high resolution FTIR spectrometer, we can measure all of these water soluble components simultaneously."

With regard to flexibility, Seubert adds that "up to 15 components can be measured in the FTIR and it can, in principle, measure any component which is IR-active. Limitations only exist if there is overlap of spectra, which may have an impact of the measurement. However, most typical and exotic combustion pollutants are within scope." And, on the topic of 100% uptime he continues, "To pull the sample through the FTIR, we use a gas ejector pump running on instrument air. So, inside the cabinet there are no moving parts. This is one of the secrets behind our extremely high uptime record. In fact, we now have so much data on reliability that we plan to stretch the service interval for our ACF5000 FTIR from 6 to 12 months. In doing so, it will require even less downtime for maintenance and calibration each year and come ever closer to the holy grail of 100% uptime."

**"The implication of this new MCP legislation will also bring smaller power generation facilities under the eyes of the regulators..."**

**Size matters**

For many years, in European legislation, it has been the case that only the largest power generation facilities with burners of more than 50MW thermal input capacity have been addressed in the scope of CEMS requirements through the IED (Industrial Emissions Directive).

This will change in December 2018 when the new medium combustion plants directive (MCP Directive 2015/2193) will come into force for emissions from newly built combustion plants with a thermal input of more than 1MW. There will be a further phase of implementation in 2025 to regulate the emissions from all existing combustion plants rated at more than 5MW thermal input and then finally, in 2030 the scope will extend to existing combustion facilities rated at more than 1MW thermal input.

Dr. Roberto Parola, Global Product Manager for Specialty Gases at Linde in Munich, further explains the impact of the European legislation. "Through the IED, it is already the case that small waste incinerators must implement CEMS to comply with reporting requirements for their stack emissions. The implication of this new MCP legislation will also bring smaller power generation facilities under the eyes of the regulators and we anticipate that there might be an additional 140,000 medium combustion plants coming into the scope of the legislation. Many of those will chose to employ CEMS to assist with monitoring, reporting and environmental compliance."

Parola goes on to explain the significance to specialty gases producers, "Within the rules for large combustion plants and waste incinerators, a wide range of pollutant species must be measured, each one requiring calibration gas mixtures, or other technologies, for calibration. For the medium combustion plants, on the other hand, emissions limit values only apply to NOx, $SO_2$ and particulates. Additionally, CO levels must be monitored. So, with the MCP legislation, the quantity of specialty gases mixtures required in the industry will grow, although the complexity is unlikely to change."

SPECIAL FEATURE

**Europe and her neighbours**

European Union legislation applies to all member states and additionally to candidate countries, such as Turkey. This has been a major driver of CEMS growth in Turkey and has stimulated growth in specialty gases calibration mixtures usage.

Turkey is a country that straddles the Bosporus water way, with part of the nation on the European land mass and the rest of the country in the Middle East. This geographical diversity has meant that specialty gases supply to end-users in Turkey has been through a combination of local production, exports from Europe and sourcing from the Middle East.

Gulf Cryo is one such Middle Eastern industrial gases company with interests in Turkey. Historically, exports to Turkey have been from their specialty gases hub location in Dubai. However, according to Suresh Justo, Group Product Manager for Helium and Special Gases at Gulf Cryo, this will soon change. He informs us that "Since June 2018 we have been producing specialty gases at our new facility in Dammam in Saudi Arabia."

This change represents more than just a new location. Justo adds, "Our substantial investment in Dammam is designed to put us into a pivotal role for specialty gases supply across the Gulf region and beyond. Our technical capability, product quality and ISO17025 accreditation will build on our existing expertise in Dubai. This will mean that we are fully equipped to serve the needs of CEMS and air quality monitoring applications with ppm (parts-per-million) and ppb (parts-per-billion) level mixtures of $NO_X$, $SO_2$, CO and other pollutants. From Dammam, our proximity to many markets will improve and when combined with our increased production capacity, this will ensure that our international customers will be able to receive specialty gases with faster delivery lead times."

**ISO – international by definition**

Air in the Earth's atmosphere is highly mobile and airborne pollutants will effortlessly traverse international borders. This is one reason that a key requirement of CEMS calibration gas mixtures is that they are traceable to a common international reference point.

Waste incineration in Oberhausen, Germany; waste incineration is an example of CEMS instrumentation application.

**"Our substantial investment in Dammam is designed to put us into a pivotal role for specialty gases supply across the Gulf region and beyond"**

Borrowing some phrases from the EU MCP directive, "Sampling and analysis shall be based on methods enabling reliable, representative and comparable results. EN standards (ISO 17025, for example) shall be presumed to satisfy this requirement." Put another way, the use of internationally traceable, ISO17025 accredited calibration gas mixtures ensures that a 200 mg/Nm$^3$ $NO_x$ emission limit value in Arabia is the same actual concentration of $NO_X$ that would be measured in Asia, Africa, America, or Australia using similar instrumentation.

So, taking a trip around the world, let's turn to Steve Abbott, the National Operations Manager at Coregas Pty Ltd in Australia. He comments that "Our specialty gases accreditation journey began in 1997 when we achieved ISO17025 accreditation as a calibration laboratory for gas mixtures."

"The accreditation authority responsible for Coregas production and testing operations is NATA, the National Association of Testing Authorities Australia. Their reputation is global and they currently hold the secretariat for the International Laboratory Accreditation Cooperation (ILAC). Through our accreditation from NATA, users of specialty gases calibration mixtures for CEMS applications here in Australia can be sure that they are measuring on a level playing field with analysts in other continents. This helps to keep worldwide air pollution in check and supports fair enforcement of regulations around the globe."

Abbott continues, "At Coregas, our pedigree has grown from serving CEMS customers in Australia. In recent years, both our reputation and our specialty gas cylinders have been travelling abroad and we are now proud to be a supplier to multi-national companies as far away as Brazil." GW


**ABOUT THE AUTHOR**

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