Executive Views

Gases & Instrumentation (G&I) had the opportunity to speak with Dr. Graham Leggett, Tiger Optics' newly appointed product manager of its environmental division. Over the past decade, Tiger Optics has pioneered the technology known as Continuous Wave Cavity Ring-Down Spectroscopy (CW CRDS).

Gases & Instrumentation: When we think "environment" we think greenhouse gases (GHG). What are the challenges in GHG detection, measurement and analysis?

Dr. Graham Leggett: The problems are well defined as well as the applications, but the commercially available analyzers are not yet optimized for every one. So there is still plenty of room for what we plan to offer, with products designed to be more affordable and reliable. Also, our CW-CRDS instruments provide reduced maintenance schedules and lower running costs, with easier use in the field. This would be a great plus for users.

G&I: In terms of the measurements themselves, is there still work to be done?

GL: Oh, yes. With respect to long-term background GHG measurements and source emission measurements, there is certainly a requirement for more measurement points, a wider network of measurement stations, and the replacement of less-efficient equipment. In each case, CW-CRDS is gaining ground because it is accurate, robust and better suited for field use than technologies that require service and calibration gases.

G&I: Is there a need for even higher detection levels?

GL: For key GHG species, such as carbon dioxide and methane, detection limits associated with our CW-CRDS technology are suited for the purpose. What we need to do now is to go out and identify sources, such as agricultural facilities and landfill sites, and see what they are actually outputting into the atmosphere and if that coincides with estimated emissions.

G&I: A kind of verification?

GL: That is correct. Often, the estimated emissions from such sources vary widely from the genuine figure when emissions are actually measured. For this work, the need is not necessarily for high levels of sensitivity or precision, but for a suitably compact and robust instrument for field use, coupled with economy. Our Tiger-i device ably meets these criteria.

G&I: You must then look at the different vertical markets to see what each industry needs.

GL: We've long focused on the industrial side. The instruments we have developed have broad application across a range of environmental measurements, both beyond our current client base, but also within our existing industrial market where we have always worked with our customers to optimize manufacturing processes, thus reducing waste and emissions. A natural progression to these activities is then to help our customers use our monitors to assess how well they are doing in terms of emission reductions.

G&I: So it's both their emissions and also ambient measurements?

GL: Yes and no. Our first order of business is to use our standard process analyzers, which are inherently clean, by the way, to help our customers operate with greater efficiency and less emissions. Part two is to then use our Tiger-i monitors in a feedback loop, if you will, to measure how well our customers are doing, thereby giving them the information they need to make on-going improvements.

G&I: Is Tiger's CRDS technology portable?

GL: No, not in the sense that it can be hand-carried. But our Tiger-i is mobile, and in most instances, that is the key requirement. We can operate these instruments from a truck or mobile facility. All you need is a pump to pull in ambient air, along with sample pre-conditioning and/or environment control, if required. We also have configurations for testing pressurized samples from cylinders. The analyzer can be started up and shut down very quickly, so it's ideal for field work.

G&I: This is really the distinction between mobile and portable, and you may not necessarily need portable.

GL: This is correct. In addition, our instruments do not require the collection of gas cylinders required for the operation of some competing technologies – gas chromatography, for example -- which requires a sample carrier gas, hydrogen (for FID), and calibration gases.

G&I: I assume your responsibilities are global?

GL: Yes. While local regulations differ from country to country and region to region, the species of interest remain the same. For example, with respect to air quality in urban environments, NOx (nitric oxide and nitrogen dioxide) is an issue regardless of the location. We are considering specific legislative requirements, however, and developing instrumentation based on these, with a view to ensuring that our offering for each application can be used universally, independent of region. There will obviously be accreditation issues depending on the location, but the technical specification should be universal if possible.

G&I: Does stack emissions monitoring require ruggedized equipment?

GL: The nature of the sample certainly has to be considered. Humidity levels, temperature, the presence of high levels of hydrocarbons, or the presence of corrosive species, will affect the choice of construction materials, sample preconditioning requirements and environmental control.

G&I: You have to protect the optics.

GL: Yes, both for particulates and oil droplets, which call for proper sample conditioning.

G&I: In terms of in situ measurement, I understand, for example, that with FTIR, moisture levels can give inaccurate readings. Is the same true for CRDS?

GL: Moisture levels certainly have to be considered with respect to condensation within the instrument, but that can be resolved. In addition, high levels of hydrocarbons and the very broad absorption associated with these species can obscure the relevant region of the spectrum for the analyte of interest. That said, we see the field expanding rapidly as wider spectrums become more accessible and affordable, allowing ready access to many more analytes in the very near future.

G&I: To summarize, we need ease of use, sensitivity, and I suppose speed. Can you say something about speed?

GL: One of the hallmarks of CW-CRDS is the very long path-lengths – 1,000 times that of a spectrometer you may have used in college. This allows for both sensitivity and great speed of response. In terms of measurement rate, our current products are able to run at up to 4 Hz, with developments underway to improve this to tens of Hz.

G&I: How important is speed in certain applications?

GL: Speed of measurement is critical for the determination of small changes in concentration and also for responding quickly to major concentration changes with an accurate measurement. Significant changes in concentration over a short time frame could be missed if the measurement is not sufficiently fast. So, for the determination of an output rate for a particular species from an emission source, the rate of measurement is extremely important.

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