Ammonia Emissions Monitoring

Products: Tiger-i 2000

Tiger Optics Overview

Tiger Optics introduced the world's first commercial "Continuous Wave Cavity Ring-Down Spectroscopy" (CW-CRDS) analyzer in 2001. Today, our instruments monitor thousands of critical points for industrial and scientific applications. They also serve the world's national metrology institutes, where they function as transfer standards for the qualification of calibration and zero gases, as well as research tools for such critical issues as global warming and urban air quality.

Tiger-i 2000 NH_3

CW-CRDS is ideally suited to the requirements of numerous environmental measurement applications, including emissions monitoring, where factors such as accuracy, sensitivity, low detection limits, speed of response, long-term stability, low maintenance, and low gas throughput are all essential. This application note details the use of our Tiger-i 2000 NH_3 unit for emissions monitoring applications.

Atmospheric Ammonia

Ammonia in the atmosphere results from a number of anthropogenic activities primarily associated with intensive agriculture. This includes the rearing of livestock, such as poultry and pigs, and processes relating to arable farming. In addition to causing problems at the local level, bad odors and adverse effects on animal health, ammonia contributes to the formation of airborne particulate matter. The transport of this secondary pollution, as well as ammonia itself, can have a negative impact on air quality many miles from the source.

Ammonia is produced via the decomposition of animal waste. For example, waste from poultry contains an amount of unused feed nitrogen in the form of uric acid, the microbial breakdown of which results in the formation of ammonia. Increased amounts of ammonia will be formed if conditions favor microbial growth, e.g. high humidity and warm temperatures.

The presence of ammonia at ppm levels has an injurious effect on contained animals and raises concerns with respect to animal welfare and negative effects on production. Atmospheric ammonia causes respiratory problems in healthy animals, resulting in illness and potential deaths.

In arable farming, ammonia emissions result from the application of nitrogen-containing fertilizers to the soil.

It is critical that scientists responsible for optimizing animal feeds, animal enclosures, fertilizer design, and fertilizer application methods, as examples, are able to make accurate, real-time measurements of ammonia emissions to develop strategies to reduce its effects.

By contrast, the current technique for measurement of ammonia provides an average measurement over a specified time period. This method relies upon a two-step process, starting with passive sampling, followed by traditional wet chemical analysis. Thus, ammonia is captured on a sorbent material that is exposed to ambient air for a set time period -- up to weeks depending on the application. Thereafter, the amount of absorbed ammonia is determined by a wet chemical analysis.

In contrast, CW-CRDS offers a continuous, time-resolved measurement that allows users to accurately measure the atmospheric concentration of ammonia at a rate of 1 Hz. Combined with relevant meteorological data, this allows the accurate calculation of ammonia flux.

CW-CRDS for Ammonia Emissions Monitoring

Tiger Optics Tiger-i range has been developed for the measurement of trace level gases in samples at ambient pressure, via the use of a vacuum pump to introduce the sample to the analyzer. All Tiger Optics instruments are based on CW-CRDS, as shown in Figure 1 below.

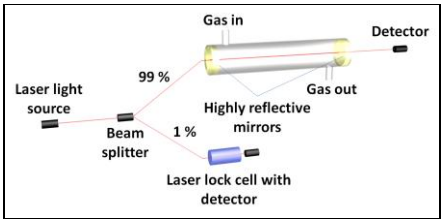

Figure 1. Schematic of CW-CRDS Analyzer

CW-CRDS works by tuning light rays to a unique molecular fingerprint of the sample species. By measuring the time it takes the light to fade or "ring-down", you receive an accurate molecular count in milliseconds.

The time of light decay, in essence, provides an exact, non-invasive, and rapid means to detect contaminants.

The Tiger-i 2000 NH_3 for emissions monitoring offers a detection limit of 8 ppb, with a dynamic range up to 40 ppm. It accurately measures close to an emission source, but is sensitive enough to locate emissions at a distance.

The unit is compact – ½ rack-width, 5U high -and relatively lightweight at just 33 lbs (15 kg) -- making it transportable and suitable for integration into a mobile facility. This is further enhanced by its low power consumption of just 40 Watts maximum.

The touch-screen interface, including integrated trending features, plus on-board data logging – five days @ 15 second logging interval, three weeks @ 1 minute logging interval – provides additional benefits for operation at remote locations. Data is retrievable via an RS232 or Ethernet interface. Real-time data collection to an external data logger or PC is available via the same two options, or the 4-20 mA signal output.

Tiger Optics CW-CRDS analyzers bring significant benefits to emissions monitoring, including:

- Accuracy traceable to the world's major national reference labs
- Sub-ppb detection capability
- No zero or span required
- No periodic sensor replacement/maintenance
- Nano-second speed of response
- Wide dynamic range

The maintenance-free and calibration-free nature of CW-CRDS also affords low cost of ownership and allows users to operate with confidence and ease in the field. And, despite the sophistication and performance associated with this technology; it remains extremely easy to use.

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