Advanced Energy

Application Note

EMISSION MONITORING IN ANIMAL HUSBANDRY

Pollutant gas emissions from husbandry activities are often measured in studies. Beyond the environmental impact on the neighborhood, excessive concentration of a pollutant like ammonia (NH3) also has a direct negative effect on the growth rate of animals.

The Challenge

For determining best environmental practices, advanced multi-gas monitoring systems are used to quantify the gaseous emissions from animal husbandries.

Agriculture activity is a major contributor of greenhouse gas (GHG) emissions, representing an estimated 13% of global anthropogenic (resulting from human activities) emissions. Animal husbandries also impact the environment from their large ammonia (NH_3) emissions.

Important research programs are carried out all over the globe to better characterize the emission rates in animal husbandries and to populate the large databases that are subsequently used in the modeling of its environmental footprint and to identify and promote the best environmental practices (eg. for feeding diets, waste management).

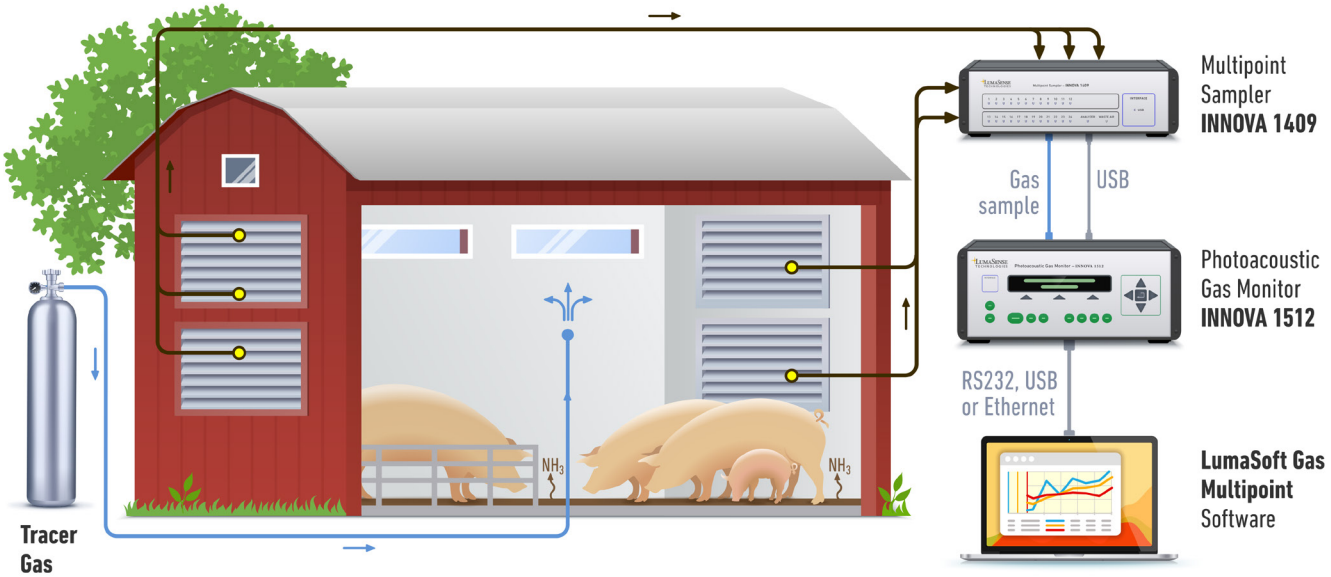
Our INNOVA photoacoustic multi-gas monitors offer a unique combination of measurement performance and operational features to meet gas monitoring needs.

Monitoring Needs

The most important gases to monitor when studying livestock emissions are NH_3 (ammonia), CO_2 (carbon dioxide), CH_4 (methane), and N_2O (nitrous oxide).

NH_3 is largely produced in animal husbandries by the mixture of feces and urine.

CO_2 and CH_4 production occurs from normal respiration and digestion processes (ruminants), as well as from various biologically-induced degradation processes within the manure or the slurry.



Typical setup used to monitor gas emission in husbandry buildings: A tracer gas is used to quantify the dilution effect of natural (or forced) ventilation on a gas source located in the building. Multi-point sampling is set on the inlets and outlets of the same control volume. Mass balance calculation with gas concentration values then leads to actual emission rates of pollutants of interest.

INNOVA 1512
Photoacoustic Gas Monitor.

Our Solution

It is a standard practice to characterize emission rates inside a control volume from a mass balance calculation for the gases of interest. In our case, the control volume is either a whole building or a dynamic flux chamber.

The Photoacoustic Gas Monitor INNOVA 1512 can monitor up to 5 different gases at trace concentration. Therefore, it is often possible to configure and calibrate the instrument for an additional specific compound to be used as tracer gas (typically SF_6 - sulfur hexafluoride - or Freon R134a). The measurement method then consists of a controlled injection rate inside the husbandry building envelope with measurement at the ventilation inlets and outlets (up to 24 channels can be configured with the INNOVA 1409 multi-point sampler). The tracer gas monitoring is used to estimate the dilution effect from the ventilation on emission sources inside the building. One can then deduce the actual emission rates for the gases of interest.

When the use of dynamic flux chambers is preferred, the multi-point sampler enables the monitoring of multiple chambers in parallel.

The INNOVA 1512 can be configured with 5 optical filters. A good calibration procedure then enables measurement of 5 different gases: interferometric interferences are actively compensated within the sensing module to achieve low detection limit and measurement accuracy (see Table 1 with a list of representative gases).

LumaSoft 7880 provides a user-friendly interface to the end-user who can easily set up the system, access the database, export the measurement logs into a spreadsheet format, and post-process them as needed.

Depending on the experimental setup, the monitor and sampler can either run as a standalone system or it can be remotely controlled by the LumaSoft 7880 software for full online monitoring.

Compound	Detection limit (ppm)
CO_2	1.5
CH_4	0.4
N_2O	0.03
NH_3	0.2
SF_6	0.006

Table 1: Detection limits for 5 gases of interests in animal husbandry research. Calibration requires accounting for interferometric interferences, then enabling active compensation within the sensing module for superior sensitivity and accuracy.

Your Benefits

- ✓ **Field deployable INNOVA 1512 monitor**
- ✓ **In-situ direct multi-gas monitoring**
- ✓ **Multi-channel (up to 24) sampling with INNOVA 1409**
- ✓ **Easy and convenient data export/processing from SQL Server database with the LumaSoft 7880 software**
- ✓ **Stable, reliable, no consumables, "zero" maintenance over long multi-month measurement period**

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