Project Newsletter

Welcome to the 2nd newsletter!

This newsletter contains an overview of the successful first Stakeholder Workshop held in early November 2023. There are also some project updates and introductions to more of the project consortium.

December 2023

Project updates and activities
Meet more partners

Date for the diary:

There will be a special session concerning the **QuantiAGREMI** project at the 14th **International Conference on Air Quality** held between the **14th and 17th May 2024** at Kumpula, Helsinki. Information can be found at the conference website: https://www.helsinki.fi/en/conferences/air-quality-2024.

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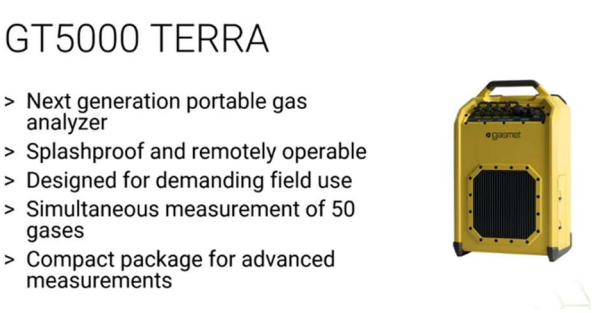
Project updates and activities

First Stakeholder Workshop (8th November 2023)

The first Stakeholder Workshop for the project took place online on the 8th November 2023. It was organized and hosted by Johannes Fritsche (METAS). The project partners are indebted to Johannes for his efforts in coordinating a successful event.

After a general introduction from project coordinator Axel Fouqueau (LNE) and some highlights from the previous MetNH3 project from Tobias Bühlmann (METAS), the workshop was divided into small sessions, each focused on one of the project's deliverables.

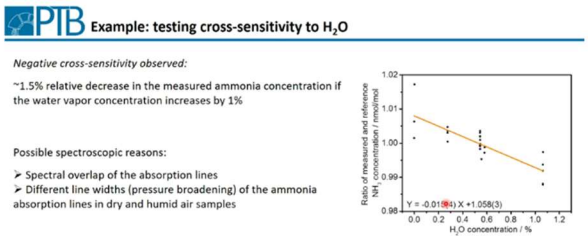
Talks within the mini-session on deliverable 1 (Traceable techniques for quantification of NH_3 and CH_4 emissions from selected livestock housings) included those from two manufacturers of relevant instrumentation Picarro Inc (on a single instrument solution for analysis of ammonia and greenhouse gases) and MBE/Gasmet (on a new portable gas analyser based on FTIR technology).

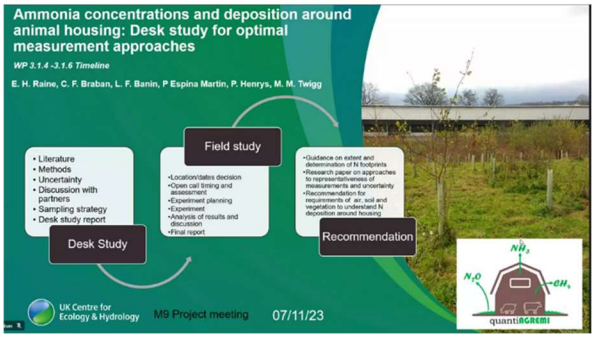


Project partner Sabine Schrade (Agroscope) presented on deliverable 2 (Emission monitoring techniques for CO_2, NH_3 and CH_4, considering atmospheric conditions as well as spatial and temporal coverage) and her talk concerned provision of guidelines and a decision matrix for determining which measurement techniques should be applied in specific instances.

The selection of approach depends on the livestock housing situation (mechanically or naturally vented), the measurement aims (are absolute emissions required for input into inventories, or are relative values acceptable?) and the scale of measurement (from particular areas within livestock housing, individual animals all the way up to a whole barn or entire farm.

Andrea Pogany (PTB) presented on optical gas standards and on PTB's Picarro G2103 CDRS spectrometer within the mini-session on Deliverable 3 (Testing, calibration and validation of new and existing sensors for better estimation of livestock emissions).

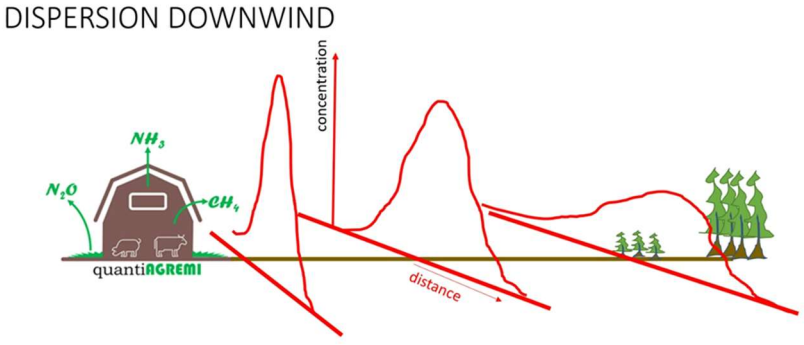




Christine Braban (UK CEH) presented within the Deliverable 4 (Key-indicators and improved emission models to increase representativeness of emission estimations and to determine their uncertainty; Management tools for farmers and farm-monitoring systems to evaluate efficiency of reduction measures) mini-session. This presentation concerned an ongoing desk study for optimal measurement approaches to determination of ammonia concentrations and deposition around livestock housing.

This session also included a talk from Kristiina Lång (LUKE) on the use of measurement data in reporting of agricultural green house gas and other air pollutant emissions. This included describing how measurement results are converted into emissions using emission factors and uncertainties.

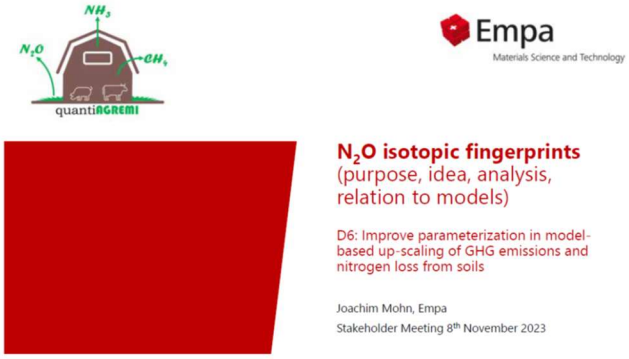
Within the Deliverable 5 mini-session (Quantification methods and their uncertainty for NH_3-deposition around livestock housings and tracing of nitrogen in managed soils), Arjan Hensen (TNO) presented on mobile measurements of ammonia, methane and nitrous oxide. Vehicle-mounted sensors provided real-time data showing the plumes of livestock emissions moving downwind.



There followed a couple of presentations from Christoph Häni (HAFL). The first concerned validation of a short-range dispersion and deposition model using parallel releases of ammonia and methane. Following application of 5% NH_3 in 95% CH4, both tracer gases were measured downwind. The difference in recovery (using dispersion modeling) of NH_3 versus CH_4 provided an indication of the magnitude of dry NH_3 deposition between source and sensor. They included this deposition in our extended dispersion model and can thus validate both the modeled dispersion and the modeled deposition.

Christoph's second talk concerned application of the inverse dispersion method to quantify whole-farm ammonia and methane emissions. Provided a summary of their NH_3 and CH_4 emission measurements at two sites (experimental emission barn Tänikon with in-house measurements as reference, and a dairy farm in Berner Seeland without reference), which were quantified by dispersion modeling.

The final mini-session of the workshop concerned Deliverable 6 (Improvement of model-based up-scaling of GHG emissions and nitrogen loss from soils). Joachim Mohn from EMPA presented a general introduction to the use of nitrogen and oxygen isotopic fingerprints of N_2O:



Joachim's presentation highlighted some of the outcomes of previous EURAMET-funded projects relevant to quantiAGREMI including production of N_2O reference materials and isotopic analysers as well as a comprehensive introduction to the role isotopic analyses will play in the current project.

Successful project partner training at INRAE

INRAE in Rennes, France, operates experimental farmhouses and controlled test chambers to investigate emissions from livestock farming. As part of Work Package 1, a researcher of METAS, Switzerland, visited INRAE to study measurement interferences between trace gases that are commonly emitted from farmhouses.

The researchers of METAS and INRAE added controlled volumes of CH_4-, CO2 and N_2O-enriched nitrogen gases from cylinders as well as water from a humidifier to a N_2 gas stream containing 5 µmol/mol NH_3. Different gas combinations were then fed to a Picarro CRDS analyzer and the detected NH_3 signals recorded.

First measurement results indicate that water vapor at 9 g/m³ and CO_2 at 500 µmol/mol do interfere with NH_3 detection at the given amount fraction, while CH_4 and N_2O do not seem to have an effect. Although the magnitude of the interferences are unlikely to be of concern they need to be followed up in the coming measurement campaigns to properly account for their effect.

Meet the Consortium

In this newsletter, we introduce more of the project partners within the quantiAGREMI project – this time it's the remaining national metrology insitutes or designated institutes.

CMI

CMI (Český metrologický institut) is the national metrology institute for The Czech Republic. The Institute provides services in all basic fields of metrology: fundamental metrology, maintenance and development of national standards, research and development in metrology transfer of units, calibration of standards and measuring instruments, legal metrology, type approvals of legal metrology instruments, initial and subsequent verification of measuring instruments, metrological supervision, conformity assessment in metrology. CMI also provides certification of reference materials, provides state metrology assessment of measuring instruments and other services too.

Their laboratory is equipped with a variety of instruments including GC-MS, TOF or GC-PDD. They prepare more than hundred gas mixture cylinders per year on a routine basis and these mixtures are used as reference materials for verification of breath analysers and process gas chromatographs.

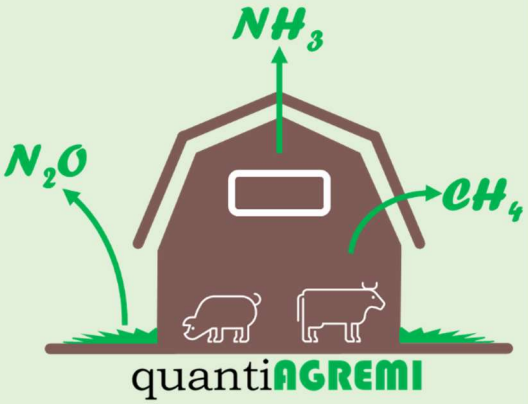
Within this project, CMI are participating in WP1 where they will prepare static CH_4 and N_2O reference gas mixtures that are then used further in WP2 for testing of sensors.

PTB

The Physikalisch-Technische Bundesanstalt (PTB) is the national institute for science and technology and the highest technical authority of the Federal Republic of Germany for the field of metrology and certain sectors of safety engineering. PTB comes under the auspices of the Federal Ministry of Economics and Technology. It meets the requirements for calibration and testing laboratories as defined in the EN ISO/IEC 17025. It is a fundamental task of PTB to realise and maintain the legal units in compliance with the International System of Units (SI) and to disseminate them. PTB is also coordinating the national network for Metrology in Chemistry. With respect to gas analysis, this network is the framework for a close collaboration with the Federal Agency for Environmental Protection (UBA) and the Federal Institute for Materials Research and (BAM).

The working group on Spectrometric Gas Analysis in PTB is concerned with research and development of laser-based spectrometer systems based on near-infrared tunable diode lasers and mid-infrared quantum cascade lasers. These setups were used with the traceable infrared laser-spectrometric amount fraction measurement (TILSAM) method.

PTB is also active in spectral molecular line parameter measurements based



on a high-resolution Fourier-Transform Infrared (FTIR) Spectrometer, as well as laser spectroscopy. The group has expertise in spectroscopic line parameter measurements, spectrometric facilities for atmospheric sensing, multi component line data evaluation, and spectrometric method development.

PTB's activity shall be focused on WP1, aiming at the validation of an optical transfer standard for ambient ammonia measurements in and around farms, based on a state-of-the-art spectroscopic measurement technique. The developed optical transfer standard will be used in WP2 and WP3 in inter-comparison measurements, as well as for the validation of newly developed measurements systems.

TUBITAK UME

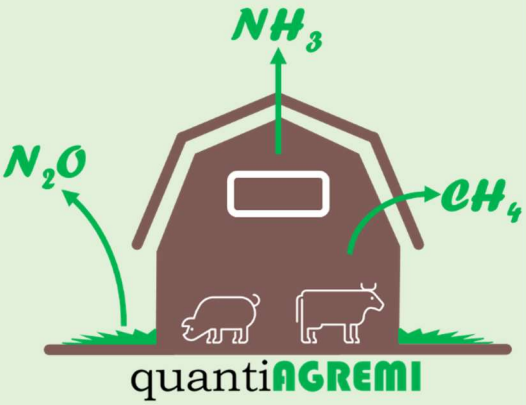
Ulusal Metroloji Enstitusu (UME) is the Turkish National Metrology Institute and is part of the legal entity Turkiye Bilimsel ve Teknolojik Arastirma Kurumu (TUBITAK).

TUBITAK UME operates with the mission to establish and maintain national measurements standards in accordance with the SI Units for providing traceability to the secondary laboratories. UME Chemical Metrology laboratories are equipped with many instruments amongst which particularly in Gas Metrology Laboratory are gas filling station for preparation of static gas mixtures, turbo molecular vacuum pump station for the evacuation of cylinders, mixture roller to homogenise the mixture prepared by rolling the cylinders, weighing system with special cabinet and a comparator to weigh the gas mixture cylinders, three gas chromatography (GC) for gas analyses, auto samplers for GCs, a cavity ringdown spectrometry (CRDS) analyser for ambient CO_2/CO/CH_4/H_2O gas measurements and trace water, several mass flow and pressure control systems and precise molbloc/molbox flow measurement systems for dynamic gas mixture generations available.

Within quantiAGREMI, TUBITAK will prepare a static CO_2 reference gas mixture within WP1 which will then be used within WP to test the newly developed sensors.

VSL

VSL is the Dutch National Metrology Institute. It disseminates metrological traceability to industry through calibrations and reference materials for a wide range of quantities in various fields, including but not limited to mass, pressure, amount–of–substance (chemistry), flow, temperature and humidity. It has a vast track record in applied research and development focused on developing new measurement standards and novel paths of disseminating metrological traceability to the industry, laboratories, government agencies and other parties in need of accurate and reliable measurements. These activities are supplemented by consultancy, training, and proficiency testing services.



The Chemistry Group has over 30 years of experience in developing gaseous reference materials and calibration gas mixtures using a variety of static and dynamic preparation techniques. It has a vast array of state-of-the-art analytical chemical techniques to compare and verify measurement standards for both the composition of gas mixtures and for trace components. The analytical techniques comprise, among others, gas chromatography with different detectors (thermal conductivity, flame ionisation, mass spectrometry, atomic emission), various spectroscopic techniques (non-dispersive, chemiluminescence, laser-based).

VSL are heavily involved in WP1 in building a 2-step device that can dilute up to 1:10^4 to generate traceable NH_3 levels down to the low nmol/mol level starting from RGMs in cylinders at µmol/mol level. This system will also allow addition of humidity at relevant ambient levels. The device will be provided for laboratory and field use in WP2 as well as preparation of various refernce gas mixtures. VSL are also providing the alternatives to SF_6 and SF_5CF_3 that aare used as external tracer gases amongst other activities in WP1. Within WP2, VSL will help with the remote measurements of NH_3