EGU25-14858 Poster in session AS3.41 - Quantification and attribution of anthropogenic methane sources through measurement: Where to target for mitigation?
Thursday, 1 May 2025, 14:00-18:00, Hall X5 board number X5.116

Advancing methane emission quantification: a robust methodology for site-level measurements

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This study introduces a robust methodology to meet OGMP Level 5 requirements, which call for site-level methane measurements integrated with specific Emission Factors (EF) and Activity Factors (AF) for individual sources.

Background

The Oil and Gas Methane Partnership 2.0 (OGMP 2.0), led by the United Nations Environment Programme (UNEP) and supported by the European Commission, is a measurement-based international reporting framework for the oil and gas sector. OGMP 2.0 aims to standardize and enhance the accuracy of CH_4 emission reporting, enabling the industry to systematically quantify and reduce emissions. Previously, emissions reporting relied solely on inventory data, but independent site-level measurements now reconcile source-level inventories (Level 4), enhancing confidence in reported emissions.

The Dutch oil and gas sector serves as a case study. In 2023, the Dutch Emission Registration reported 639 kton of CH_4 emissions nationally, which 17 kton (2.7%) attributed to the oil & gas sector. As part of this study, we measured emissions at over hundred oil and gas production and distribution sites.

Tracer Dispersion Method (TDM)

We demonstrate the application of the Tracer Dispersion Method (TDM) to quantify site-level methane emissions.
→ releasing a tracer gas with a known emission rate
→ measuring its concentration, along with methane, downwind of the facility with a specially equipped measurement truck.

Multiple transects downwind of the site to reduce associated uncertainties of the plumes.
Differentiate emissions of various types of sources, via concentration measurements of:
- methane (CH_4)
- ethane (C_2H_6)
- nitrous oxide (N_2O)
- carbon dioxide (CO_2)
- carbon monoxide (CO)

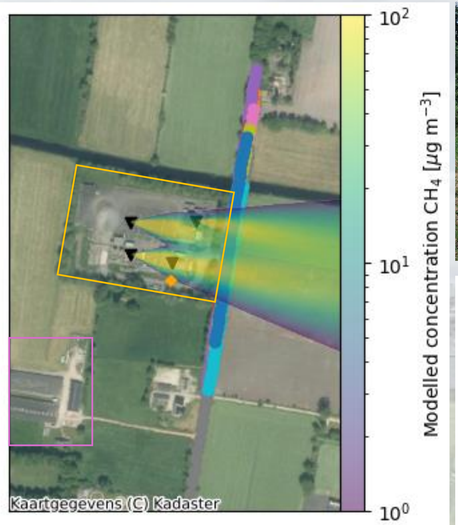
Requirements

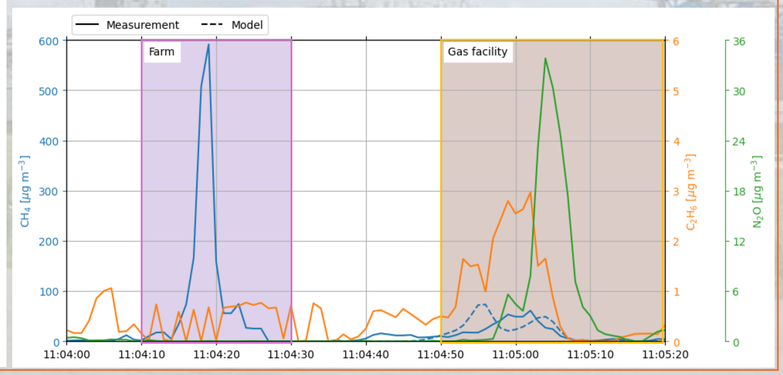
Wind speed: > 2m/s
Wind direction: transect downwind of source
Tracer: released from location with comparable dispersion as source

Results

Advantages:
- Site-level emission measurements
- Possibility to distinguish sources
- Tracer will reduce uncertainties
- Multiple sites at the same day

Limitations:
- Meteorological conditions
- Multiple measurements in time are advised for annual averages
- Downwind road needed (or tube measurements)





Emission quantification

Tracer

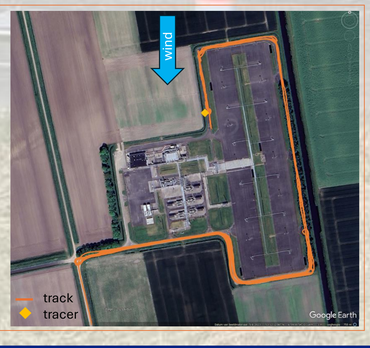
$$Q_{source} = Q_{tracer} \cdot \frac{M_{source}}{M_{tracer}} \cdot \frac{\int s_{source}}{\int s_{tracer}}$$

Gaussian plume model

$$Q_{meas} = Q_{model} \cdot \frac{\int s_{meas}}{\int s_{model}}$$

Q_{source}	= emission rate measured source gas (g/s)
Q_{tracer}	= known emission rate tracer gas (g/s)
M_{source}	= molar weight target gas (g/mol)
M_{tracer}	= molar weight tracer gas (g/mol)
$\int s_{source}$	= integrated signal source conc. plume (ppbv)
$\int s_{tracer}$	= integrated signal tracer conc. plume (ppbv)

Q_{meas}	= emission rate measured source gas (g/s)
Q_{model}	= model emission rate, here 1 g/s,
$\int s_{meas}$	= integrated signal measured conc. plume (ppbv)
$\int s_{model}$	= integrated signal modelled conc. plume (ppbv)



Conclusions

This methodology not only complements source-level measurements but also improves the detection of previously unidentified emission sources, enhancing the overall reliability of emission inventories. Using a tracer will reduce the uncertainty significantly.

Take home message

Every source needs a customized solution for emission quantification.
→ TDM is one of the methods that can quantify site-level emissions
→ If driving downwind of the source is impossible, tube measurements can be used.
→ Applicable for offshore measurements of platforms (level 5) (Hensen *etal*, 2019)

TNO innovation for life

Hensen, A., Velzeboer, I., Frumau, K.F.A., Bulk, W.C.M. van den, Dinther, D. van, 2019. *Methane emission measurements of offshore oil and gas platforms*. TNO report R10895, TNO Petten.

Go to: **EGU25-8267** Poster
Ship-based methodologies to investigate methane emissions from abandoned wells and natural sources: a case study from the Dutch North Sea
Wednesday, 30 April 2025, 14:00-18:00, Hall X1, number X1.113

Go to: **EGU25-12579** Oral In situ monitoring reveals episodic water column methane anomalies at abandoned wells in the Dutch North Sea
Thursday, 1 May 2025, 17:20, Session BG7.1 - Methane dynamics in aquatic systems, room 2.95