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Net Zero Technology Centre
Technology Driving Transition

INDUSTRY GUIDANCE NOTE

Offshore Aerial Methane Measurement

Recommended Practice for Site-Level Methane Measurement on Offshore Installations



Informed by
The OEUK Technical Note (2024) and NZTC Methane Measurement JIP (2025–2026)

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At a glance

Site-level (top-down) methane measurement is foundational to OGMP 2.0 Level 5 reporting, but offshore methods have remained unregulated and inconsistently applied. Informed by the recommendations of the 2024 OEUK Technical Note, the **NZTC Methane Measurement JIP (BP, CNOOC, Harbour Energy, Ithaca Energy, Serica, Shell; Aeromon, Flylogix, SINTEF Ocean; November 2025)** generated field-based evidence and practical lessons to support the ongoing development of industry guidance. This guidance note distils those lessons into seven practical recommendations for offshore aerial methane measurement.

Background and Purpose

Accurate site-level methane measurement is foundational to any credible emissions reduction strategy. Methane carries a global warming potential 28 times that of CO_2 over a 100-year period, and the oil and gas sector's ability to make targeted, defensible reductions depends on the quality of the data it generates. OGMP 2.0 Level 5 reporting now requires operators to supplement bottom-up emissions inventories with independent top-down, site-level measurements. In 2024, OEUK identified that offshore aerial methane measurement remains a developing and non-standardised practice, with further work needed to improve consistency and understanding of measurement uncertainty.[1]

To improve industry understanding of offshore methane measurement and contribute to the ongoing development of industry guidance, the Net Zero Technology Centre (NZTC) convened a Joint Innovation Programme (JIP) bringing together six UKCS operators (BP, CNOOC, Harbour Energy, Ithaca Energy, Serica and Shell), and three measurement providers (Flylogix, Aeromon, and SINTEF Ocean). The JIP generated field data and shared learning through a multi-vendor field trial at Ithaca Energy's Captain assets (a wellhead protection platform and bridge-linked platform (WPP/BLP), and an FPSO) in November 2025.[2]

This guidance note presents the key lessons learned from that campaign to support the planning, execution and interpretation of offshore aerial methane measurements.

Why Existing Practice Falls Short

In 2024, an OEUK task finish group reviewed offshore aerial methane measurement deployment across the UK Continental Shelf and identified several areas where industry understanding and practice could be improved:[1]

- **Bottom-up uncertainty** estimation needs to be improved. Quantifying uncertainty for a bottom-up emissions inventory remains challenging, making comparison with top-down measurements more difficult.
- **Top-down repeatability** is not yet well understood. Measurements taken under ostensibly similar conditions yield variable.
- **Vendor uncertainty estimates** are largely "one-size-fits-all" values often derived from controlled releases, with limited transparency on how environmental conditions affect them.
- **No minimum standards** exist for method selection, data acquisition or reporting. Further guidance is needed on issues such as wind effects, stand-off distance, uncertainty reporting and operational support.

The NZTC Methane Measurement JIP was undertaken within this broader industry context. The project explored several practical aspects of offshore methane measurement, with a particular focus on wind wake effects, stand-off distance and repeat measurements within a survey campaign. The recommendations that follow draw on the lessons learned from that work.



Core Recommendations from the NZTC Methane Measurement JIP

1 Understand the asset before you fly

No measurement campaign should begin without a thorough understanding of the asset's emissions profile. The dominant source at the Captain FPSO was cold venting from the cargo tank vent mast riser, which accounted for **approximately 98.9% of total site-level methane emissions when cargo tanks were near full**. This source varies with crude oil fill rate, temperature, and offloading activities.

Across the JIP, site-level emission estimates for the Captain WPP/BLP varied within a relatively narrow range (≈0.4–2.6 kg/h), while emissions at the Captain FPSO ranged from ≈1–70 kg/h as cargo tank filling and offloading activities changed operating conditions.[2]

Operators should ensure measurement vendors are aware of relevant operating conditions, planned activities and any deviations from routine operations that may influence emissions, while preserving the independence of the site-level assessment. A d**edicated process support representative** with detailed knowledge of facility operations should be available during the measurement campaign to support result interpretation and reconciliation with bottom-up inventories.

Potential methane sources upwind of the asset should also be considered, as these may influence site-level measurements.[2]

2 Plan measurements to minimise wind wake effects

Wind shadowing is one of the most significant sources of uncertainty in offshore site-level measurement. Within the downwind wake of a large offshore structure, wind may be blocked entirely, form complex vortices, or even reverse direction. These effects can increase measurement uncertainty, particularly for flux plane methods that rely on accurate wind characterisation. At the Captain FPSO, cold-vented methane emissions from the cargo tank vent mast riser were driven to near sea level by wind effects, with elevated methane concentrations observed at altitudes of 5-10m ASL.[2]

Measurements should be conducted sufficiently far downwind of a facility to minimise wake effects while maintaining a detectable and representative methane plume. Extending the measurement location further downwind may reduce wake-related uncertainty but can also increase plume dilution and widening, making suitable sensor sensitivity and spatial coverage increasingly important.

Where measurements are conducted within or near the wake, the potential impact on measurement uncertainty should be considered in the analysis.

3 Fully bound the emission plume

Failure to fully bound an emission plume can lead to underestimation of site-level emissions. Measurements should be designed to capture the full plume extent, including above, below and across the plume.

Plume position should not be assumed based solely on source location. At the Captain FPSO, elevated methane concentrations associated with cold-vented emissions were observed at altitudes of 5–10 m ASL. Other sources, such as flares, may generate plume behaviour that extends beyond the expected measurement envelope.[2]

Where elevated methane concentrations are observed on outermost transects, additional assessment may be required to determine whether plume boundaries have been adequately captured. Attention should be paid where plume limits cannot be demonstrated, as this may increase uncertainty in the resulting emission estimate.

4

Use the right instrument

Sensor selection is not a procurement detail — it is a technical consideration that can influence measurement outcomes. Differences in sensor sensitivity influenced measurement performance during the campaign, as reported methane limits of detection (LOD) ranged from 10–250 ppb across participating technologies. At the low emission rates typically encountered on North Sea platforms, higher-LOD instruments may be less able to detect and quantify low-concentration methane plumes.[2]

Use a methane sensor with sufficiently low detection limits and a fast response time for the expected measurement conditions and emissions profile. Instrument capability should also be considered alongside expected emission rates, measurement distance and atmospheric dilution, particularly where measurements are conducted further downwind of a facility.[2]

Where feasible, measure CO_2 alongside methane. CO_2 data can support flare destruction and removal efficiency (DRE) calculations, help distinguish combustion-related emissions from cold-vented and fugitive methane sources, and provide additional opportunities to validate site-level measurements.[2]

5

One flight, one flux plane

Due to shifting wind direction offshore, a site-level flux plane measurement is highly recommended to be completed within **a single continuous flight** where possible. However, we recognise that operational and technical constraints may not always make this achievable. Piecing together multiple flight segments risks missing migrating plume segments or double-counting emissions as the plume shifts. Where multiple flights are operationally necessary, each flight should aim to fully bound a discrete plume rather than contribute partial transects to a combined calculation.[2]

Collect all required ancillary data within the measurement area — including methane concentration, wind speed and direction, GPS position, temperature, and atmospheric pressure. **Wind data taken from the helideck or a fixed anemometer on the asset could reflect a substantially different wind profile from the measurement zone and should be used with appropriate caution**.[2]

6

Prioritise quality over quantity

There is an industry tendency to average multiple measurement passes to arrive at a site-level figure. The JIP suggests that data quality should take precedence over data quantity. **A single well-bounded, fit-for-purpose measurement provides greater confidence than the average of several measurements of varying quality**.

Before including any measurement in a site-level calculation, apply the following QA assessment:

Fitness criterion	Check before inclusion
Plume bounding	Has the plume been fully captured above, below and across its full extent?
Attributed data	Were the required parameters (CH_4, wind, position, temperature, pressure) collected within the measurement area?
LOD application in analysis	Has the methane LOD been appropriately applied when analysing elevated concentrations above ambient background?
Operating state	Were operating conditions understood and documented when the measurement was taken?

Collecting multiple measurements can increase the opportunity to obtain a representative dataset, but more data is not automatically better data. A smaller number of high-quality, fit-for-purpose measurements may provide greater confidence than a larger number of measurements collected under differing conditions, with incomplete supporting data, or where data quality does not meet minimum requirements.[2]

7

Reconcile top-down with bottom-up

Site-level (top-down) measurements should not be interpreted in isolation. Consistent with the principles of OGMP 2.0 Level 5 reporting, top-down results should be considered alongside bottom-up inventory data and source-level measurements.

The JIP demonstrated the value of pairing top-down results with source-level sampling — **including flare DRE measurement (99.99% DRE confirmed at Captain BLP under field conditions)**, targeted LDAR surveys, turbine exhaust sampling, and produced water assessments. This multi-layer approach enabled source attribution and helped identify previously unquantified fugitive emissions, including localised methane concentrations of 7–24 ppm above ambient at the Captain BLP mezzanine deck.[2]

Top-down and bottom-up estimates should be compared alongside transparent uncertainty information. Without a transparent ± value that accounts for environmental conditions, emission rate, and instrument performance, top-down and bottom-up values cannot be meaningfully compared.[1]

The JIP however recognises the logistical challenges associated with conducting source-level sampling in a timely manner to align with on-going top-down aerial measurements.

Key Takeaways

Recommendation	Key Takeaway
Understand the Asset	Know the emissions profile and operating state before you fly.
Minimise Wind Wake Effects	Minimise wake effects while maintaining a detectable and representative methane plume.
Bound the Plume	Capture the plume above, below and across its full extent.
Use the Right Instrument	Match instrument capability to the measurement challenge.
One Flight, One Flux Plane	Complete a flux plane measurement within a single continuous flight wherever practicable.
Prioritise Quality Over Quantity	Use fit-for-purpose measurements rather than simply increasing measurement count.
Reconcile Top-Down with Bottom-Up	Interpret measurements alongside inventories and source-level data.

Next Steps for the Industry

This guidance reflects the current state of knowledge and should be treated as a living document. The findings from the JIP point to several areas for further work:[2]



Further investigation of stand-off distance across different offshore asset types, including the trade-offs between wind wake effects, plume detectability and plume bounding.



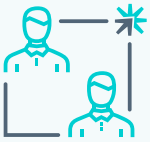
Additional work on measurement repeatability and frequency to improve understanding of how many site-level measurements are needed to characterise emissions under varying operating conditions.



Controlled-release experiments in offshore conditions to better characterise wind wake behaviour and validate flux plane methods.



Wider dissemination of JIP findings through OGMP 2.0 channels and incorporation into the OEUK Aerial Methane Measurement Guideline.



Continued multi-vendor collaboration to develop approved methods, improve inter-vendor comparability, and promote transparent reporting of measurement methodologies and performance.[2]

The JIP generated comprehensive datasets on offshore aerial methane measurement spanning two asset types, three measurement vendors, and multiple operating conditions on the UK Continental Shelf. The lessons captured in this guidance are intended to support more consistent planning, execution and interpretation of offshore methane measurements, while informing the continued development of industry guidance and OGMP 2.0 Level 5 reporting.

References

[1] OEUK (2024). Site Level Measurement of Methane: Technology Readiness for North Sea Operators. Technical Note, Issue 1, September 2024. Offshore Energies UK.

[2] NZTC (2026). Net Zero Technology Centre JIP — Ithaca Captain: Performance and Validation Report (OC2026 F-004). Author: Daniel F. Krause, SINTEF Ocean. Funded by BP, CNOOC, Harbour Energy, Ithaca Energy, Serica Energy, and Shell. May 2026. [Internal report, restricted distribution to JIP participants].

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