Top-Down Methane Emissions Quantification for the Oil and Gas Industry using the SeekIR® Sensor

SeekOps

Environmental concerns, regulation, gas certification, investor and customer pressure and corporate commitments mean that is increasingly important for oil and gas operators to be able to both detect and importantly quantify methane emissions from their facilities.

SeekOps Leak Detection and Quantification (LDAQ™) approach starts with a highly sensitive Tunable Diode Laser sensor mounted on a drone (UAV or RPAS) to precisely measure methane concentrations around facilities to as low as ten parts per billion. Standardised flight paths capture the entirety of methane plumes, including those well above deck level that are missed by fixed sensors. Proprietary algorithms are used to integrate methane concentration, position and wind vector data to quantify the emissions, localised to the source. This allows an accurate understanding of methane emissions and focused prioritisation of remedial work. A SeekOps survey meets the requirements for OGMP 2.0 Level 5 top-down measurements.

Technology

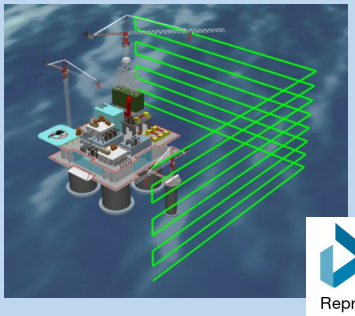
Originally developed by NASA for ultra-sensitive methane measurement on Mars as part of the Curiosity Mars Rover mission, the SeekIR Tunable Diode Laser Absorption Spectrometer (TDLAS) sensor is lightweight enough to be carried by a drone and sensitive to less than ten parts per billion of methane at +/- 1% accuracy. Measuring methane concentration in the air passing through the sensor ten times per second allows a detailed concentration profile along the flight path to be obtained and transmitted to a ground station in real time. The drone-agnostic system is fully self-contained and can be deployed by most enterprise-grade UAVs.

Sensor assembly includes TDLAS sensor, electronics, telemetry, batteries, GPS and LIDAR altimeter

SeekIR mounted on drone

Data Acquisition

Using carefully developed standardised flight paths the sensor is flown downwind of the target equipment to capture a complete cross-section of the methane plume(s). High resolution wind speed and direction data is simultaneously captured with an ultrasonic anemometer placed close to the site. The direct measurement works equally well onshore and offshore and can be deployed from the ground, deck or a boat and many facilities can be surveyed in a matter of minutes.

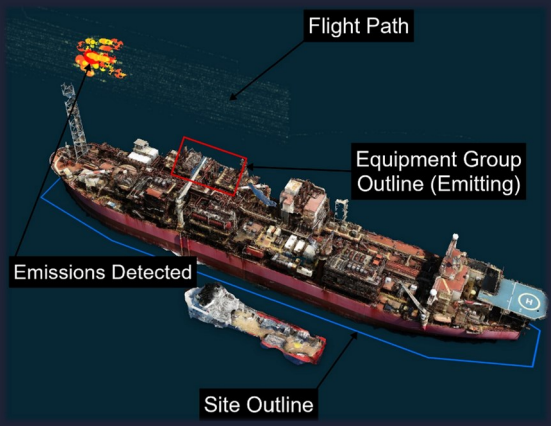


Idealised flight path around an offshore facility, green lines show drone flight path flown downwind of the facility. A minimum windspeed of 1 m/sec is preferred for accurate quantification.

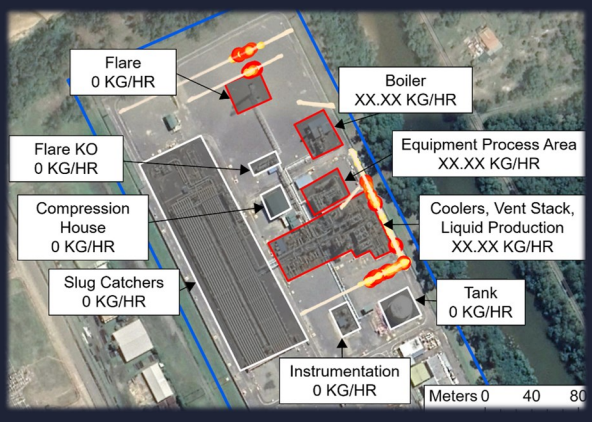
Analysis: Quantification and Localisation

Measuring concentration on its own does not tell the entire story, there can be a wide range of concentration values measured depending on the wind speed, wind direction variability, and atmospheric stability. The only true measure of methane impact is to quantify mass flow rate of emissions. SeekOps Flux Plane method integrates concentration data across the plume cross-section with wind and position data to derive the mass flow rate. It has been demonstrated in independent testing that mass flow rates as low as 0.02kg/hour can be quantified.

A next step that can be performed with the recorded data is to identify the source of the emission. By modelling particle trajectories in the instantaneous wind condition recorded it is possible to localise the source to the equipment group level or better. This allows more targeted leak detection efforts and faster remediation.



This example is an FPSO, the flight path and methane enhancements are seen along the starboard side of the vessel. The methane plume from the vent stack is clearly visible.



In this example of an onshore gas plant the and the detected methane enhancements by dots along the flightpath, colour coded by intensity. Quantified emissions from individual equipment groups are shown.

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