

# METHANE FROM FLARING TOOLKIT



## Measure Efficiency: Drone equipped with single methane sensor

Can I measure flare efficiency? > Measure Efficiency: Drone equipped with single methane sensor

### Summary

A methane sensor is flown in to the emissions plume of the flare. Without measuring carbon dioxide, carbon monoxide or soot the combustion efficiency or destruction efficiency of the flare is not measured directly. The emission rate can be calculated by applying dispersion models and the combustion efficiency calculated by comparison to metered flow rates.

The technology is common to techniques also used for other methane measurement activities – such as leak detection and repair and can therefore be combined with these kinds of operations.

## How it Works

Several methane sensors are now commercially available. In the case study, an in-situ methane sensor based on tuneable diode laser absorption spectrometer TDLAS technology provides direct and real-time measurement of methane concentrations. TDLAS technology is deployed on small unmanned aerial systems (UAS) and coupled with wind speed is used to accurately detect, localise and quantify methane emission sources. The method is used to quantitatively assess all methane emission sources and can be used to determine combustion efficiency of energy-sector combustion equipment including flares. Calculation of destruction efficiency requires access to accurate flow data. Technology of this kind has the potential to work for flares of all sizes and locations, including offshore and be integrated into wider methane measurement activities including LDAR. Measurement is based upon a tuneable diode laser absorption spectrometer, measuring absorption of mid-wave light to obtain the relative concentrations of CH<sub>4</sub>. The sensor is placed in either an open or closed cavity to enable in-situ sampling of the local methane concentration.

A mass balance is performed by flying the aircraft in a raster pattern downwind of the flare or orbiting the flare. Using locally measured wind speed and direction the Methane emission rate is performed. The operator provides gas composition to flare, which is used to derive Combustion Efficiency and Destruction Efficiency.



*Image courtesy of SeekOps*

### Advantages

- ✔ Field-proven in both onshore and offshore environments
- ✔ Exploits automation capabilities for repeat surveys to determine temporal evolution of efficiency

- ✓ Full three-dimensional coverage of flare plume
- ✓ Survey can be made a few meters from flare to a few hundred due to high sensor sensitivity (ppb)
- ✓ Can be run night and day and in cloudy and light rain conditions
- ✓ Can survey emissions for all equipment groups as well as asset level cumulative emissions

#### Limitations

- ✗ Needs to be downwind of, or have ability to circumnavigate, the emission source
- ✗ Some limitations in severe weather conditions (e.g. heavy fog, heavy rain)
- ✗ Trained UAS Operator for set-up
- ✗ Specific to CE/DE - Need gas composition and flow-meter readings for CE and DE, because of inability to measure CO or CO<sub>2</sub>
- ✗ Permits required to fly close to flares
- ✗ Drones have a finite battery duration that determines the maximum area that can be flown when measuring upwind and downwind methane concentrations.

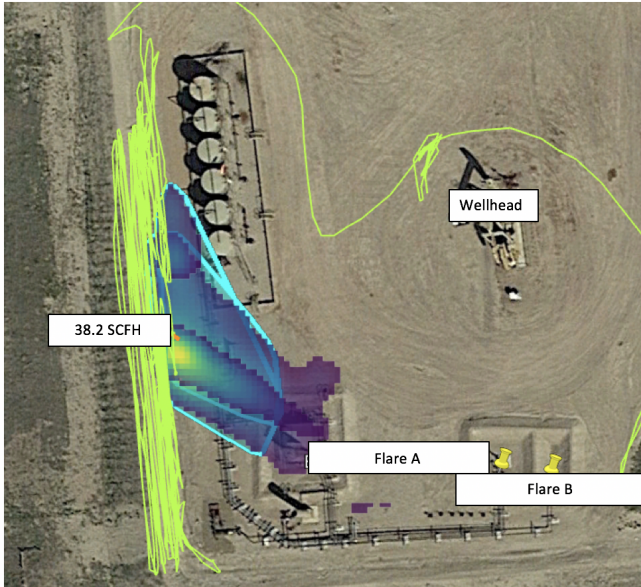
#### Go Deeper

- [Stanford University research presentation](#)
- [Vendor website: SeekOps](#)
- [Video: A short video of a typical operation](#)

## Case study

### Flight path of a drone measuring flare emissions from an onshore well-pad.

The example below highlights UAS flight paths and associated methane concentrations for a Rod-Lift Production Pad with associated flaring showing how the methane plume from the flare can be differentiated from other potential sources of the site and converted in to a emission rate.



## Can I measure flare efficiency?



Measure Efficiency: Predictive Feedback and Control



Measure Efficiency: Flare Simulations



Measure Efficiency: Aerial measurement of flare efficiency



Measure Efficiency: Drone equipped with dual CH4 and CO2 sensors



Measure Efficiency: Extractive method for determining flare efficiency