Executive Summary

We present results from a case study examining the performance of two truck-based screening systems for detecting, attributing, and quantifying methane emissions at upstream oil and gas facilities, compared to baseline optical gas imaging (OGI)-based surveys.

The baseline OGI survey was completed with a handheld FLIR GF-320 camera coupled with a Providence Photonics QL-320 tablet for emissions quantification. The OGI survey collected component-level emissions detections and quantifications. The truck-based screening systems include the University of Calgary's PoMELO and Altus Geomatics' ExACT that each provide different information. The ExACT system detects, attributes, and quantifies facility-level emissions and the PoMELO system detects, attributes, and quantifies equipment and facility-level emissions. The ExACT system reported measurements on pad, and the PoMELO system reported measurements both on and off pad. Component-level detections and quantifications from the OGI survey were summed to the equipment and facility levels in order to compare with measurements from the truck systems. In total, 80 oil and gas facilities were surveyed in November 2018 and May 2019 using these three methods. At each facility, the methods were deployed at the same time to minimize potential differences due to temporal variations of emissions.

Results indicate strong agreement among the methods for facility-level detections. The relative accuracy of the truck systems in detecting facility-level emissions was between 86-100%. PoMELO detected emissions at 100% of facilities that were emitting according to OGI. ExACT detected emissions at 86-93% of facilities that were emitting according to OGI. In November 2018, PoMELO detected emissions at three facilities and ExACT detected emissions at one facility that OGI determined to be not emitting. ExACT and PoMELO detected similar emissions overall (86-89% agreement), but PoMELO detected emissions at three facilities in November 2018 and four facilities in May 2019 that ExACT determined were not emitting.

Equipment-level detections were compared only between OGI and PoMELO, as ExACT reported facility-level emissions. Results indicate that PoMELO identified 73-80% of the emitting and non-emitting equipment identified by OGI. PoMELO did not identify 20% of emitting equipment determined with OGI, but it identified emissions from 11-33% of the equipment OGI determined was not emitting. Part of the discrepancy may be the result of restricted downwind vehicle access and methane sources that are inherently harder to detect with OGI because of strong heat signatures interfering with methane emissions (e.g., catadyne heaters, engine exhausts).

There was overlap in estimates of facility-level emissions rates from all three methods, but there was limited statistical association between estimates from PoMELO and ExACT compared to estimates from quantitative OGI (QOGI) using the Providence Photonics QL-320. This may be problematic for work practices that rely on estimates of emissions rates to prioritize follow-up inspection.

There are several challenges comparing estimates of emissions rates among the three methods: wind conditions, atmospheric stability, on pad access downwind of equipment, and missing (out of scope) quantifications from QOGI. Approximately 50% of the facilities had full on pad access in which the trucks could drive downwind of all major equipment at close range. Similarly, off pad measurements were possible at approximately 50% of the facilities based on road access and wind direction in both campaigns. Furthermore, between 4% and 17% of emission sources could not be quantified by QOGI.

Key recommendations emerging from this research are:

1. The accuracy and reproducibility (precision) of emissions quantification with QOGI and truck-based methods requires further study.
2. Controlled release testing is recommended for evaluating detection and quantification performance.
3. Indices that qualify the completeness of screening measurements for each facility should be developed.