Mobile and Walking Survey Method using OMD and RMLD

Alberta Methane Field Challenge

Heath Consultants Final Report

Recipient Agreement 19-AMFC-04

James Rutherford, Chris Gretencord

8/12/19

Objective

Heath Consultants conducted leak survey of Oil & Gas production sites as part of the Alberta Methane Field Challenge (AMFC) in order to learn, evaluate and demonstrate the feasibility of using alternative methods and instrument technologies. Currently, the accepted work practice is to conduct walking survey's using either Optical Gas Imaging (OGI) or Method 21.

Heath Consultants is a leading provider of leak survey instruments used throughout the gas distribution system. Heath proposed to demonstrate that current instrument technologies used worldwide may be just as affective with significant time and cost savings could be used. The technologies demonstrated in this study offer significantly lower cost, improved efficiencies and greater performance than accepted work practice and other "advanced" instrumentation.

Our main objective and expected results are:

1) Demonstrate that the Remote Methane Leak Detector (RMLD) is equal or greater than OGI in leak detection performance, efficiency and cost
2) Demonstrate that the Optical Methane Detector (OMD) detection performance is as good as the "Advance Mobile" systems for detection of leaks but at a far superior reliability, ruggedness and cost.
3) Demonstrate that the Remote Methane Leak Detector – Quantitative Gas Imaging (a new emerging technology) can directly measure the methane emission rate at a component.

Technology Description

Remote Methane Leak Detector (RMLD):

The RMLD is based on open path Tunable Diode Laser Absorption Spectroscopy (TDLAS). The initial instrument technology was introduced in 2005 and is used throughout the gas distribution industry for compliance leak survey. Being a portable, hand-held open path laser, the operator can quickly and accurately scan an area or components with out physically walking the entire area or into the plume. Making a leak survey highly more safe, quicker and improved detection. Pinpoints the exact leak source (ex. component) is quickly done. It quantifies the gas plume concentration in units of part per million – meter (ppm-m). Based on peak ppm-m concentrations, a rough estimate of flow rate can be done[i].

Two models were used as part of this study:

- RMLD-IS. Current production original version rated for hazard areas (Class 1, Div. 1). This model does not have direct data/GPS recording. This model was used for the leak survey since it is the industry benchmark and was officially submitted for the study.
- RMLD-CS. Just released second generation model with full data/GPS recording, visual display, photo capture, small single unit.

RMLD-IS (left); RMLD-CS (right two): The RMLD-IS and CS are high sensitivity open path lasers capable of detecting small methane plumes from a distance.

Optical Methane Detector (OMD):

The OMD is based on a fixed open path optical infrared Etalon. The initial instrument was introduced in the late '90s. It is the primary mobile search instrument used to conduct mobile leak survey within the gas distribution industry. It is hardened for use under sever weather, road conditions and off-road applications. Sensitivity is not as low as recent "advance mobile" instruments but is enough (sub ppm) for mobile surveys of production sites were larger leaks are expected. The instrument data is recorded through a pc interface and the software application ATLaS. ATLaS captures route, readings, wind and GPS. An improved detection algorithm is also implemented. Currently, the ATLaS does not compute emission flow rate. Heath does offer a "Advance Mobile" solutions which will estimate flow, but was not selected for this study.

OMD Mobile survey: The OMD is an open path methane specific sensor capable of detection of small plumes. It is specifically designed to survey under harsh conditions.

Remote Methane Leak Detector – Quantitative Gas Imaging (RMLD-QGI):
The RMLD-QGI is an experimental instrument based on the same RMLD laser technology which can image the gas plume in real time and quantify emission flow rate in real time. For the study, a "semi-portable" instrument was made. Final concept will be for it to be available in a small hand-held unit, similar to the RMLD-CS.

Eye-C-Gas:
The Eye-C-Gas from Opgal was used in addition to document leaks. This instrument is rated also for use in hazardously rated areas.

Methodology:
The following leak survey method was conducted:

1) Survey the site using the mobile OMD. Depending on the site, lap the site multiple times. Often the site was not configured for a complete encircling. In this case, the vehicle drove were it could. Leak detections were noted, and peak readings recorded. In addition, the RMLD-IS was used to side scan the area (for areas upwind, the side scan laser would pick up emissions)
2) Survey the site with the RMLD-IS. After mobile, the surveyor would walk the site, scanning for leaks. All equipment and structures (Piping, vents, walls, windows, door frames, ground, etc.) were scanned. Leak detections were noted, and peak readings recorded
3) Using the RMLD-CS and the Opgal Eye-C-Gas OGI camera, the leaks were further investigated and recorded. Using the RMLD-CS, concentration readings and photos were digitally captured. Gas plume images were also digitally captured.

The results were then loaded into our Leak Survey Analytics application for GIS presentation and survey record keeping (See below).

AMFC Participation

Overview summary of the study are:

- Heath Consultants conducted site surveys from June 11th through June 21, 2019.
- Safety orientation and survey planning session was attended on June 10th.
- 55 sites were surveyed. 35 by mobile, 52 by walking
    - Mobile sites were limited due to the vehicle not being 4-wheel drive and pc malfunction
- All but 3 sites had detectable emissions
- Average time to perform walking survey with the RMLD-IS was 23 minutes with a standard deviation of 15 minutes. Just minutes to mobile.
- Mobile survey resulted in 30 of 35 sites with detections. 2 sites with no mobile detections, leaks were found via walking survey. 10 leaks were ranked as medium to Large.
- Walking survey resulted in 122 individual leak sources located. Two leaks were missed (found on post survey). 8 leaks were ranked large to very large, 21 leaks were ranked as medium to very large. 73 leaks were ranked small. 20 leaks were rank as Non-Actionable (well below detection limit of OGI).
- OGI could not image the leak on 55 out of 113 confirmed leak sources.
- The RMLD-QGI demonstrated that it could, in real time, capture the leak plume and flow rate. However, it was restricted from providing a large amount of data due to delivery and logistical issues.

Learnings from Participation

- The RMLD walking survey demonstrated significant less time to survey and significantly improved leak detection than OGI. The OMD mobile survey demonstrated effective leak detection.
- This study is the first to directly compare alternative technologies and methods to OGI. In addition, Heath was able to real time compare methane specific technology (i.e. RMLD) to OGI.
- There was very little planning time available to prepare and transport equipment. Delays and expense were encountered to get equipment through customs.

Areas of Technology Improvement

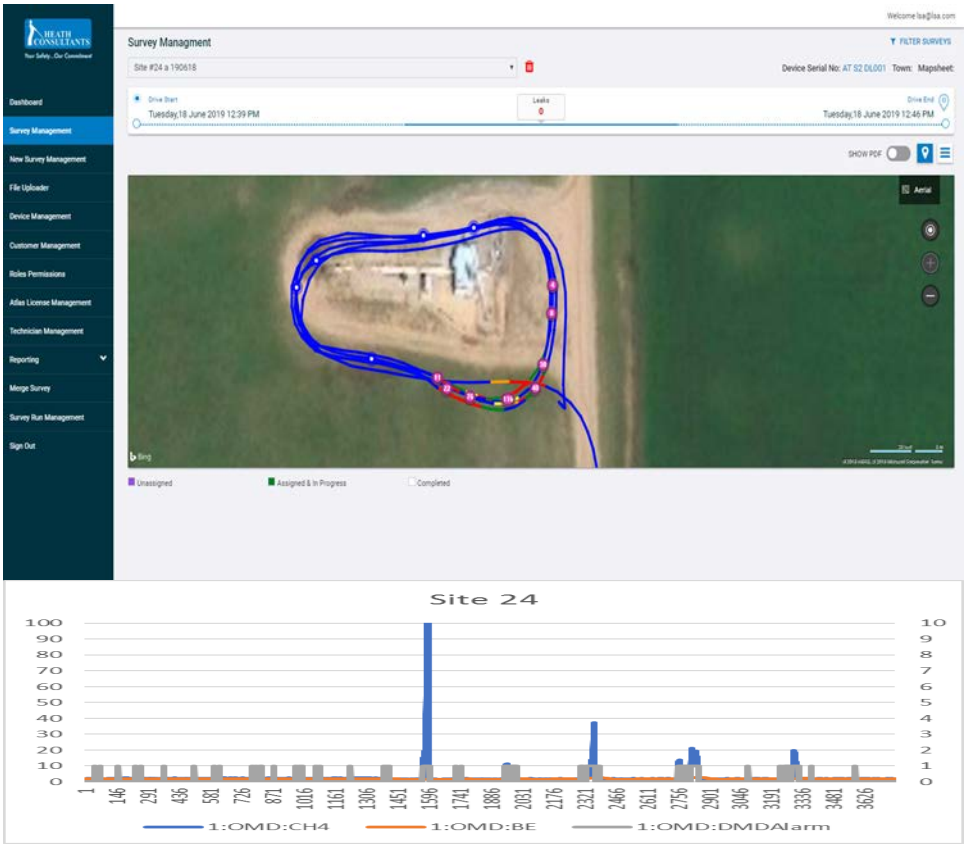
- The principal technologies used in the study (OMD, RMLD) are mature, well established instruments design for rugged field conditions and worked without issue and had high detection performance results. Real time flow rate calculation was not part of the instruments, however, raw data produced by the instruments would be capable of doing so (at least to the ability to rank leak size).
- Continued development of RMLD-QGI into a simple hand-held instrument would greatly improve the ease and time to take direct flow measurements.

Cost Implications

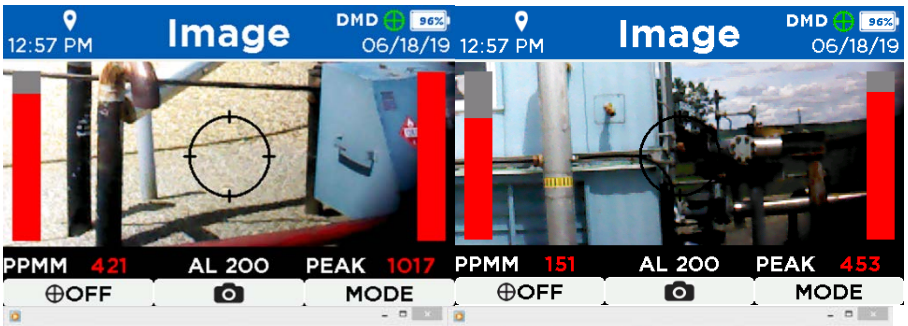
The primary instruments (OMD, RMLD) are significantly less expensive than OGI or “Advanced” new technology. The study confirmed that they are comparable to performance in detection and localization of leaks.

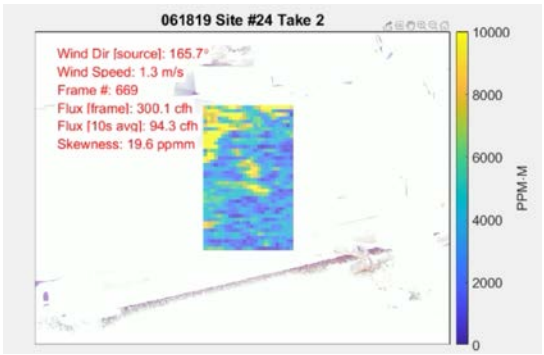
Data Product Example

Mobile survey with OMD, ATLaS software;
GPS position with ppm and wind data is collected. Data is loaded into the Leak Survey Analytics (LSA) cloud portal which stores and provides further survey management and analysis.



Walking survey with RMLD-IS;
The RMLD-IS does not record digital data directly. The next generation, RMLD-CS records GPS position, ppm-m readings and photos. Initial leak survey was conducted with RMLD-IS, then the RMLD-CS was used to data capture leak readings and photos.





[i] This is currently being evaluated in a couple of independent studies and is not yet a released validated feature.