Methane Mitigation Requires Accurate Measurement and Quantification

Author information – Dr. Peter A. Roos
Affiliation – Co-Founder and CEO, Bridger Photonics Inc.

Summary

The oil and gas industry is at an inflection point. It must balance meeting increased demand for cleaner fuels, like natural gas, in addition to reducing emissions and greenhouse gases to achieve corporate and global climate objectives. Emission quantification is increasingly important for all stakeholders within the oil and gas ecosystem. For orphaned or abandoned wells, for instance, such quantification will likely guide the prioritization and valuation of repair efforts based on carbon credits.

To meet these challenges and opportunities, new technologies are required that will efficiently and accurately measure methane emissions across all oil and gas touchpoints. Technology innovations are essential to establish accurate methane emission measurements along with a reliable baseline. This is necessary to:

1) create inputs into predictive climate models using real data versus projections,
2) ground federal and state policy on emissions reduction targets,
3) provide incorruptible and transparent supply chain visibility to serve customers concerned with natural gas generated greenhouse gases, and
4) measure the impact of mitigation efforts and improvements across the oil and gas ecosystem that could also result in validation for carbon credits.

One such technology, Gas Mapping LiDAR™, was developed by Bridger Photonics that precisely images, pinpoints, and quantifies methane emissions (see sample imagery in Figure 1). The solution uses sensitive state-of-the-art aerial laser technology combined with proprietary data processing and analytics techniques to detect more than 90 percent of emissions within typical production sector basins. Once a leak is detected, Bridger provides its clients with actionable data to guide ground crews directly to the source of the leak. Additionally, this data can be used by the operator to

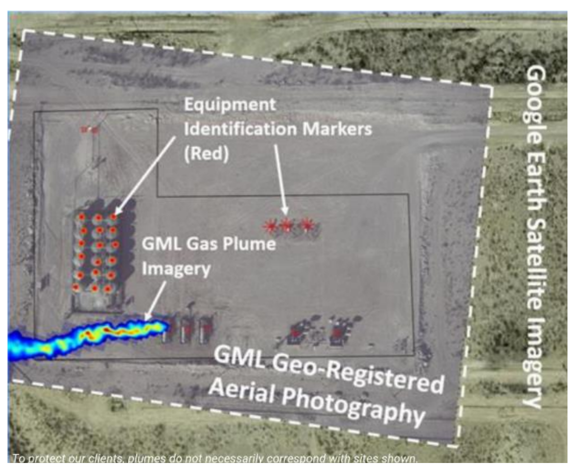

Figure 1 – Example data provided to clients
**Plumes do not necissarily correspond with sites shown.*

accurately baseline its emissions inventory and to measure itself against internal emissions reduction targets, regulatory requirements, and industry and sustainability benchmarks.

Method / Workflow

To help validate the quantification capabilities of Gas Mapping LiDAR, Bridger recently conducted blind quantification studies of controlled released methane gas. The releases for this study were very large and configured to allow flow rates of up to 560 kg CH_4/hr (30,000 scfh). Bridger personnel used a master valve to control the emission rate for four different nominal flow rates [93 kg/hr (5,000 scfh), 187 kg/hr (10,000 scfh), 373 kg/hr (20,000 scfh), and 560 kg/hr (30,000 scfh)]. Ten flight passes were performed for each emission rate except for the highest rate, for which five passes were performed. The wind speed for these studies was determined using two separate on-site anemometers: LCJ Capteurs SONIC-ANEMO-DZP ("Sonic") and Davis S-WCF-M003 ("Davis").

Results, Observations, Conclusions

Results and Observations

Results of the blind controlled release testing are shown in **Error! Reference source not found.** representing Davis (left) and Sonic (right) wind data in the processing and determination of emission rates. The testing conditions are considered favorable because only a single emitter was used with no interference emissions or obstructions, and plenty of gas was available for analysis. Nevertheless, these conditions are reasonably representative of the conditions found in the Permian basin of the US, where the tests were performed.

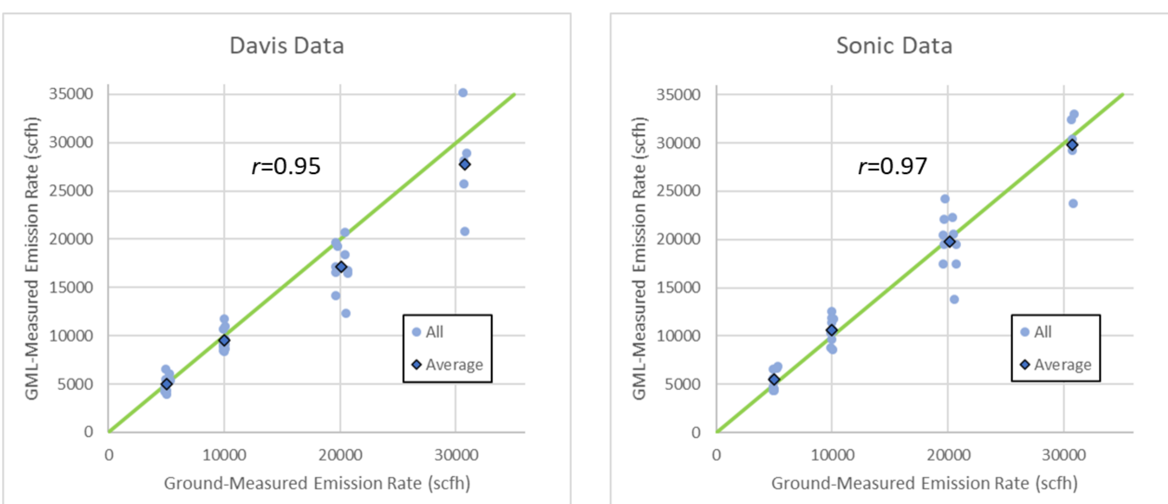

Figure 2 – Results of internal emissions detection testing

Each light blue circle data point in the figures represents Bridger's Gas Mapping LiDAR-measured emission rate estimate for a flight pass, while the darker blue diamonds represent the average emission rate for each nominal emission rate, both shown as functions of ground-measured emission rate (assumed "truth"). The green line in each plot represents the "ideal" 1:1 ratio. For each wind data source, the Pearson correlation coefficient was calculated and is also shown on each plot. Both coefficients were very near unity, indicating strong correlation between the Gas Mapping LiDAR-measured and ground-measured emission rates, but the Sonic wind data resulted in the highest coefficient (r=0.97).

The average (dark blue diamond data points) for each nominal emission is very important because when multiple emitters are measured (e.g. to obtain an aggregate emission for inventory purposes), the uncertainty in the aggregate emission rate effectively approaches the average values, very similar to that shown in the figure. This makes the measurement of aggregate emissions inventories with Gas Mapping LiDAR more accurate than a single measurement. In the limit of large number of emitters measured, the uncertainty on the aggregate measurement will approach the measurement bias, which in this case was less than ±5% for each anemometer.

Conclusions

To effectively reduce methane emissions from natural gas operations, accurate location, measurement, and quantification of leaks is required. New technologies, such as Gas Mapping LiDAR, meet all these requirements. The solution will help the oil and gas industry and policy makers establish a reliable baseline derived from actual and verifiable data. For abandoned or orphaned wells, the problem must be better understood. Gas Mapping LiDAR represents a solution that can efficiently, quickly, and accurately quantify the extent of the problem, both on an aggregate level and to guide/prioritize repair of individual wells.

Novel/Additive Information

Gas Mapping LiDAR is approved and compliant (for the transmission sector) with PHMSA in the US and the Canadian Standards Association in Canada, submitted by oil and gas operators as an Alt-FEMP under Directive 060 (Alberta Energy Regulator). Bridger's Gas Mapping LiDAR was included in ExxonMobil's application to the EPA for an AMEL under OOOOa.

Acknowledgements

Bridger Photonics' developed Gas Mapping LiDAR™ with funding from the US Department of Energy's advanced research arm, ARPA-E, and won an R&D 100 award in 2019 recognizing the top 100 innovations worldwide for that year.