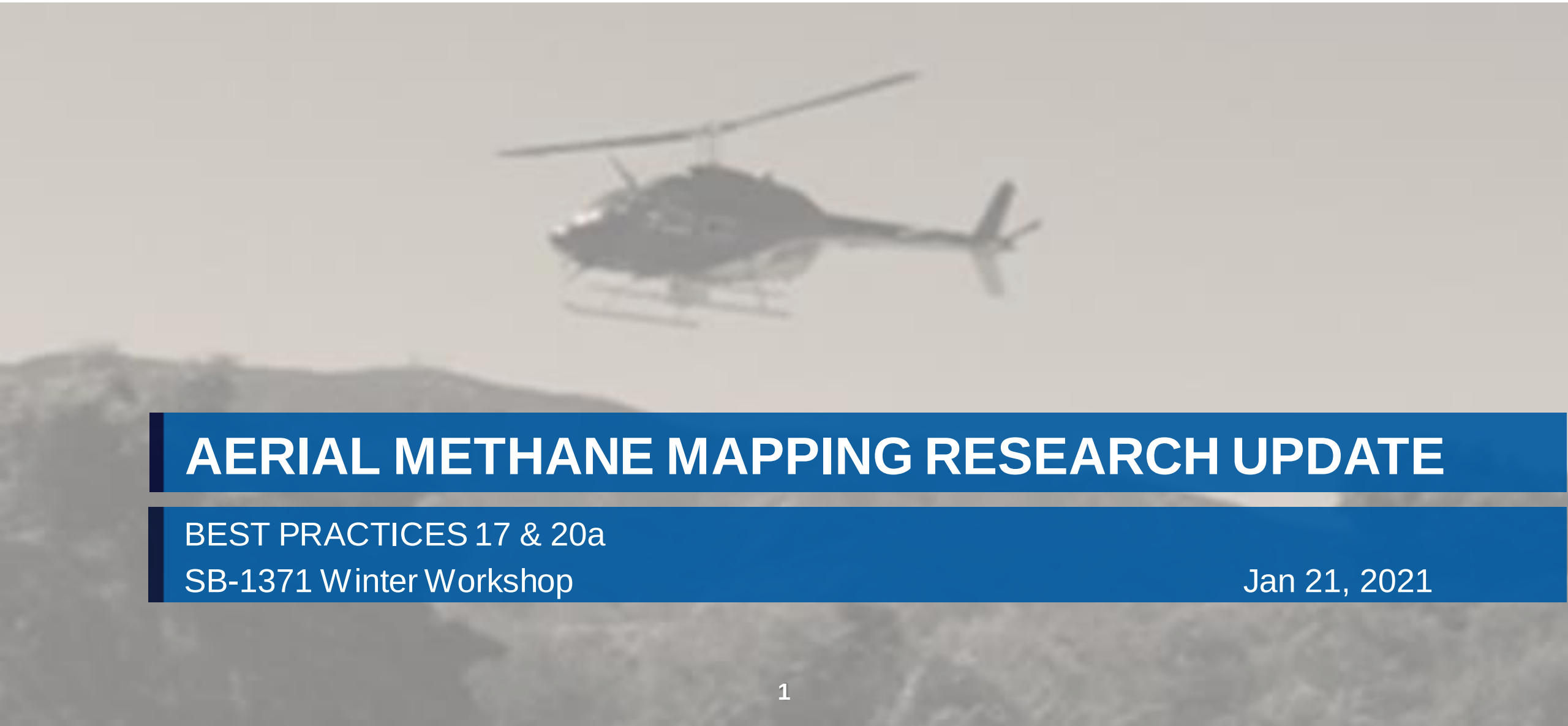

AERIAL METHANE MAPPING RESEARCH UPDATE

BEST PRACTICES 17 & 20a

SB-1371 Winter Workshop

Jan 21, 2021

Aerial Methane Mapping Research Update Best Practices 17&20a

- Agenda - Aerial Methane Mapping Research Update
  - Background
  - Project Overview & Objective
  - Research Evaluation Results
  - Next Steps
  - Implementation Flight Planning

Aerial Methane Mapping Research Update

» Background

- In 2019, SoCalGas identified Bridger Photonics Gas Mapping LiDAR (GML) as a potential Aerial Methane Mapping (AMM) technology viable for use in populated Distribution service areas; along with other potential use-cases.
- SoCalGas conducted two R&D studies of the technology, in 12 selected Distribution service areas. The technology was evaluated for use as an incremental technology to existing leak survey activities for the purpose of screening for large leaks.
- The R&D studies covered over 3,500 miles of Distribution Main and Service and over 229,000 customer meters. A series of blind controlled methane releases ranging from 0 to 45 SCFH were also conducted to evaluate the ability of the technology to detect and localize methane emission locations and to assess the precision of the flow rate estimates.

Aerial Methane Mapping

Helicopter-based aerial methane detection and 3D plume modeling technology identifies methane emissions from a variety of sources in the vicinity of the Distribution pipeline system. This enables SoCalGas to find leaks faster, increase safety, reduce methane emissions, and improve energy efficiency at customer facilities.

3D Methane Plume Modeling

The Gas Mapping LiDAR™ technology detects and localizes methane emission sources within proximity to Company pipelines. Robust spatial and temporal plume data combined with aerial imagery provides insight as to the likely source of emissions, which aides Company operations in identifying and mitigating emission sources.

EFFICIENCY GAINS

In only 12 flight days, the technology identified leaks on over 1,900 miles of Main, 184,000 Services and 229,000 Meters. It would take 70 employees to cover this scope of work in the same amount of time using traditional walking survey*.

GHG REDUCTIONS

This technology is a key piece of SoCalGas' strategy to reduce methane missions by 40% by 2025. By detecting leaks faster, SoCalGas can reduce emissions not only on our pipelines, but also on customer facilities. SoCalGas estimates annual methane emission reductions at 22,000 MCF from our distribution system and an additional 63,000 MCF from downstream emissions.

ENERGY EFFICIENCY

This technology detects not only leaks, but also incomplete combustion associated with gas-fired equipment. These detections give our Customer Services teams an opportunity to partner with customers to improve their energy efficiency.

*For illustration purposes only as the two programs are not directly comparable

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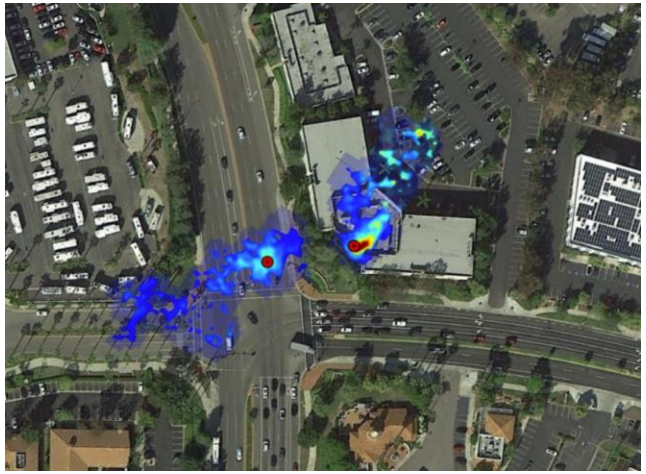
Emission Source Discrimination

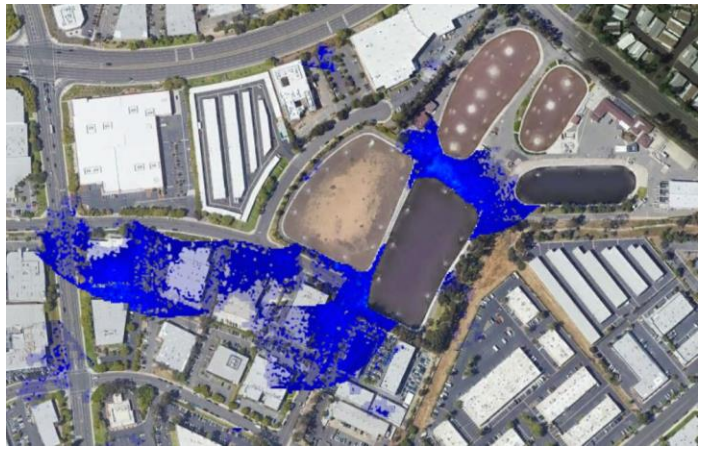
Service Line Leak

Customer Yard Line Leak



Incomplete Combustion*

Natural Methane Seep



Water Treatment Plant

Vehicle Plume

*The two plumes depicted were captured at different times and relate to a single intermittent source on top of the structure. Location and height of plume "source" location demonstrates complexity of modeling intermittent combustion sources and effects of wind.

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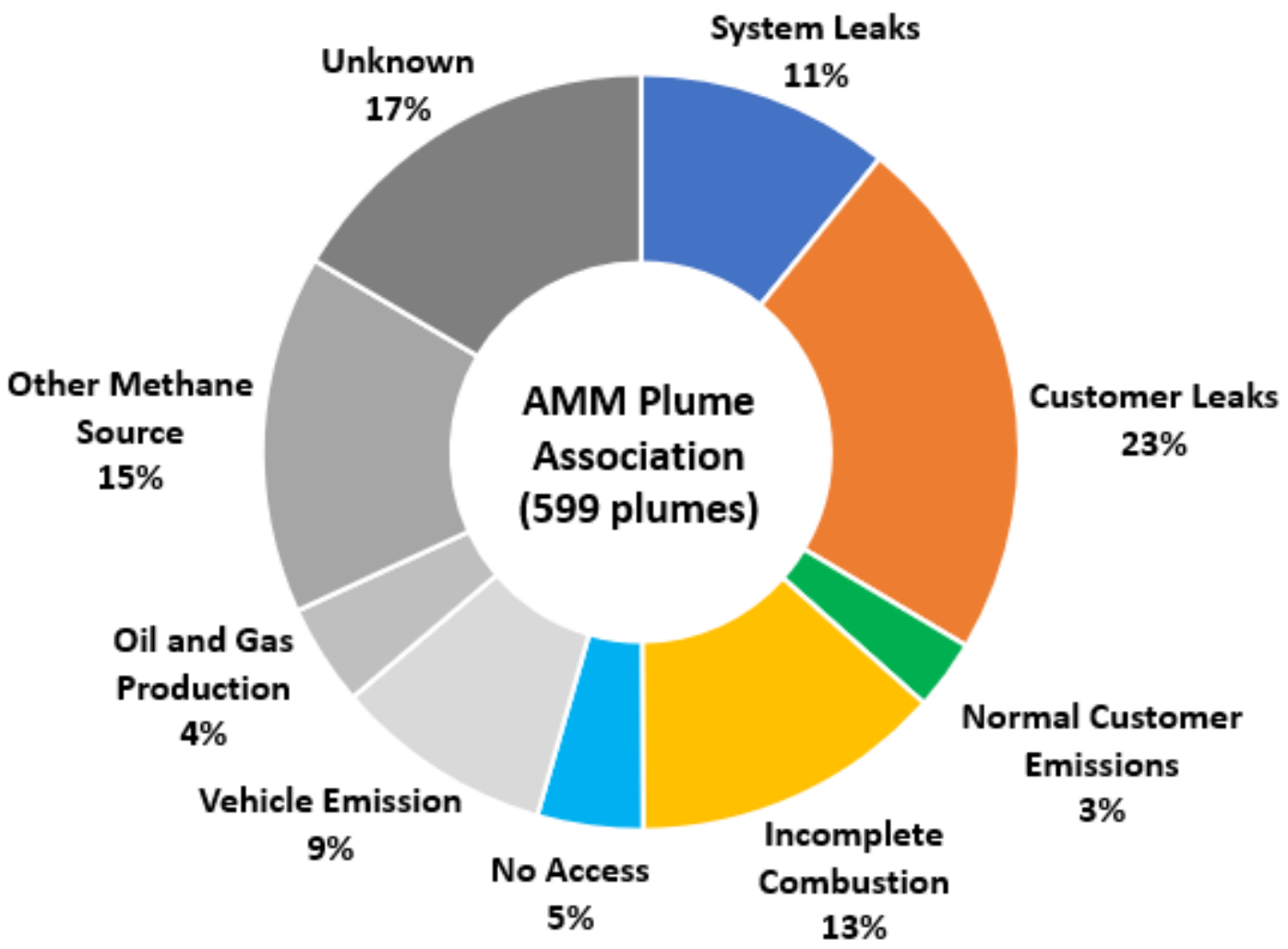
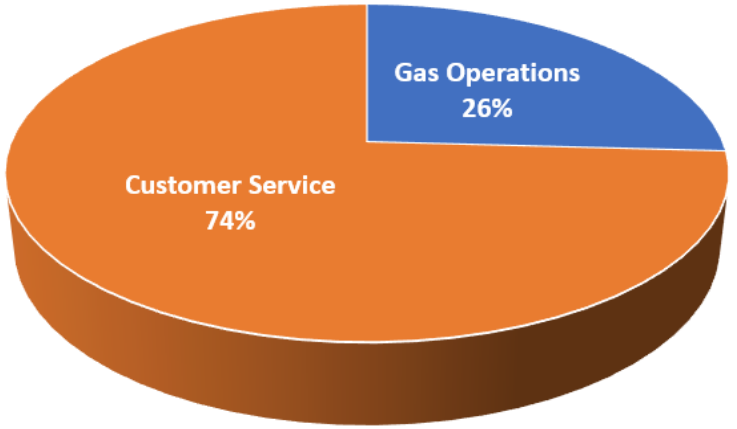
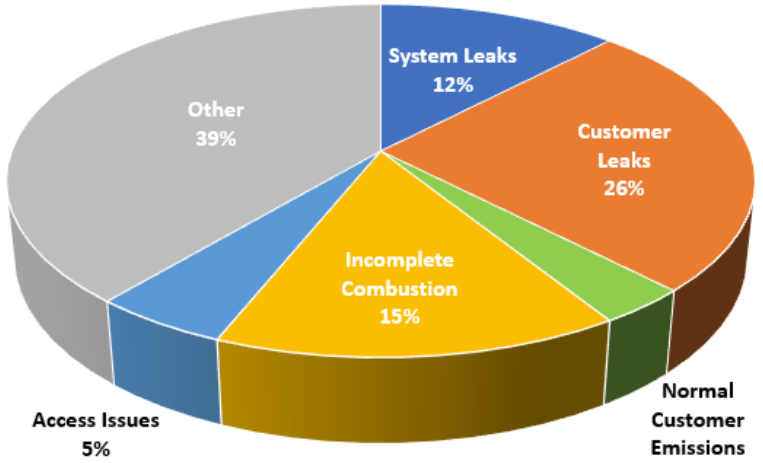
Aerial Methane Mapping Research Results



Methane Plumes Investigated (533)



Leak Investigation Results

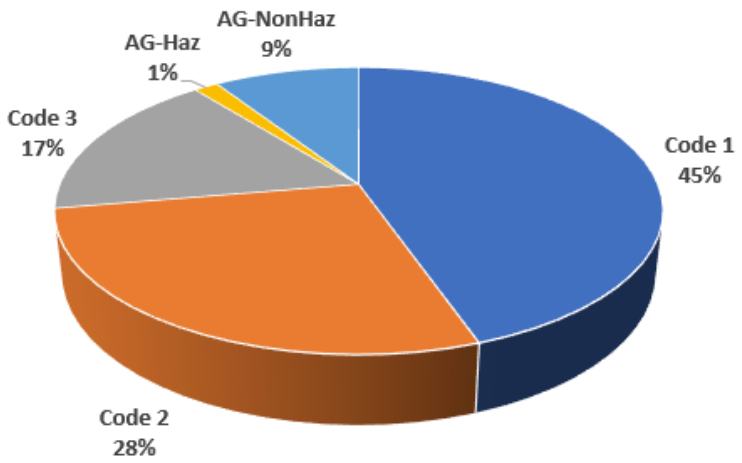


Note: this information is intended to provide a first approximation of the performance of the overall process based on results of the R&D Pilot Study

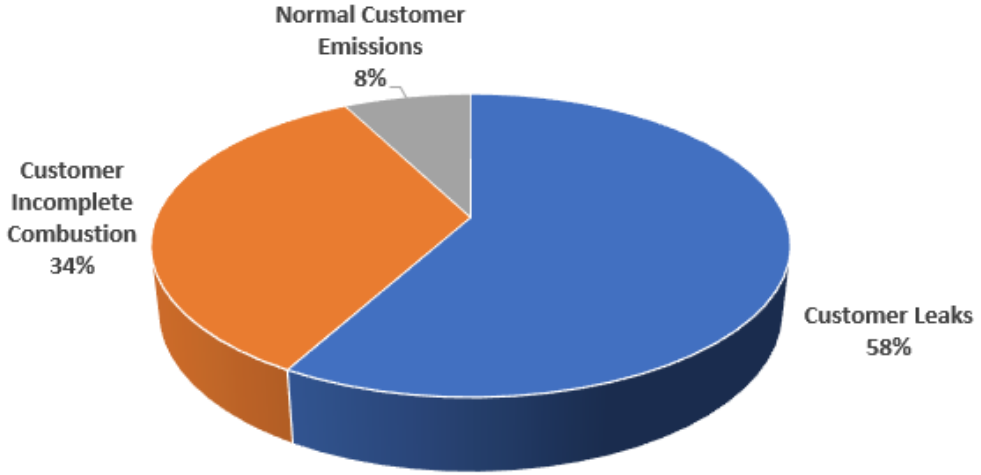
Aerial Methane Mapping Research Results

AMM Detected Emissions

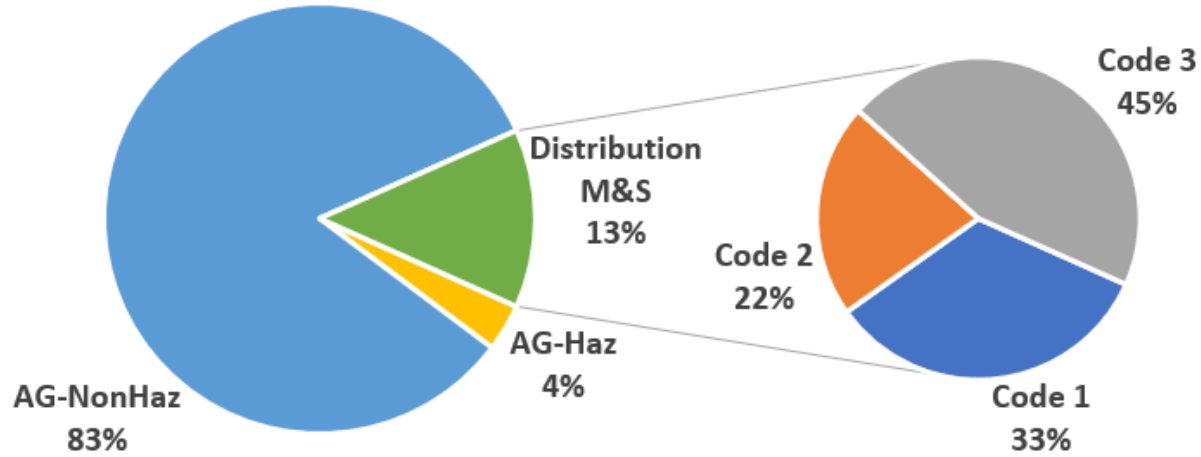
Verified Pipeline Leaks



Verified Customer Emissions



2019 System Leak Data (for comparison)



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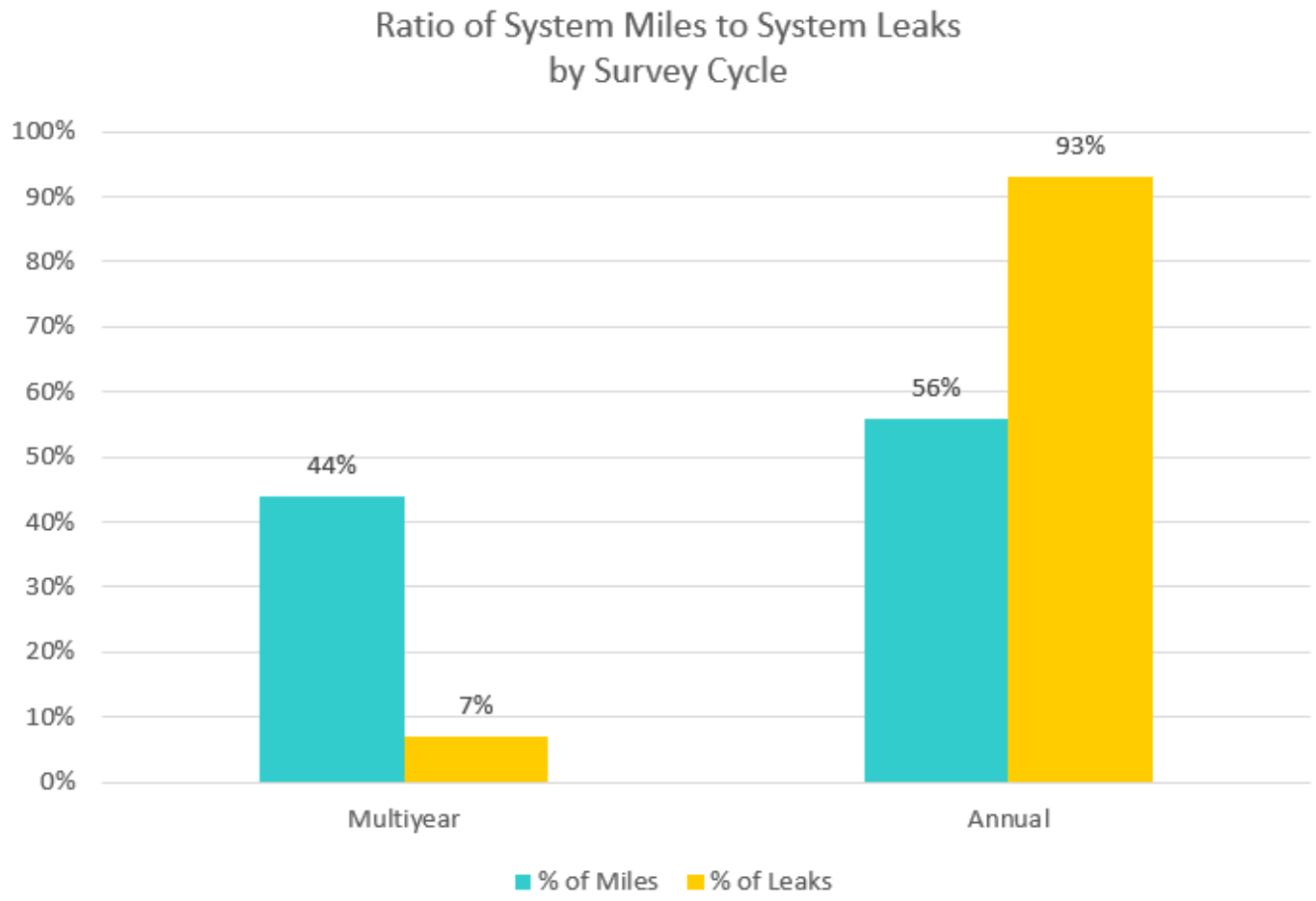
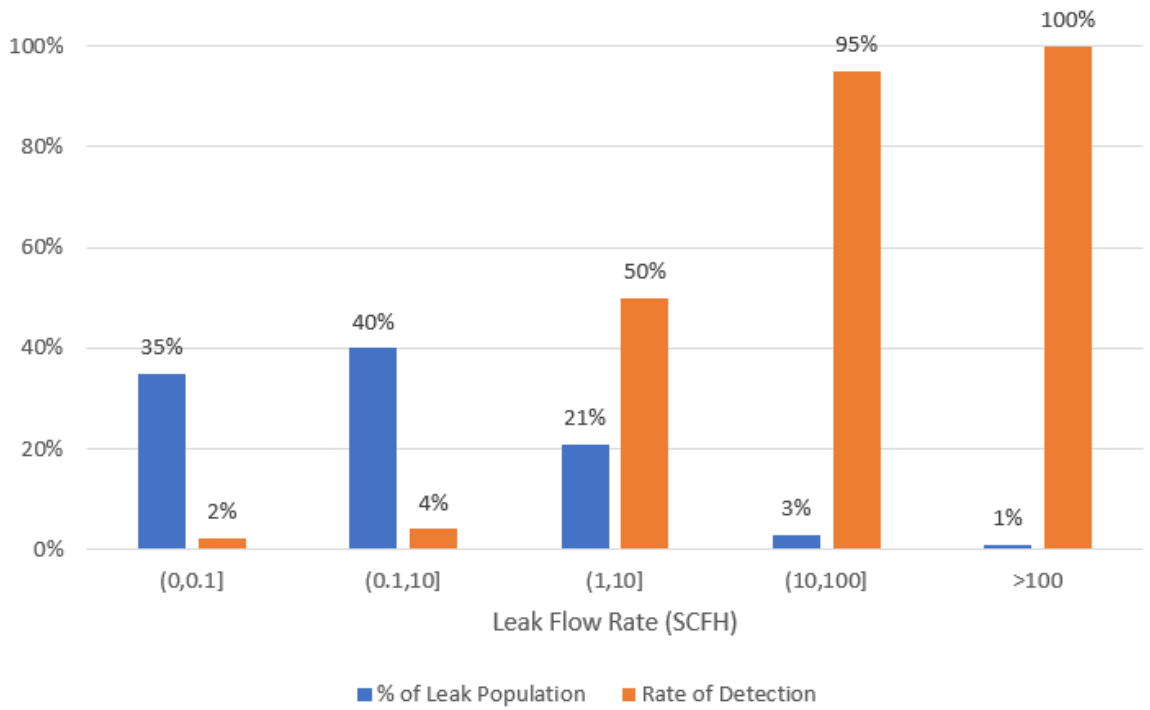
Aerial Methane Mapping Research Results

- Pipelines on multi-year leak survey schedule represent 44% of pipeline miles in AMM flight areas with 7% of buried leaks found.
- Pipelines on annual leak survey schedule represent 56% of pipeline miles in AMM flight area with 93% of buried leaks found.



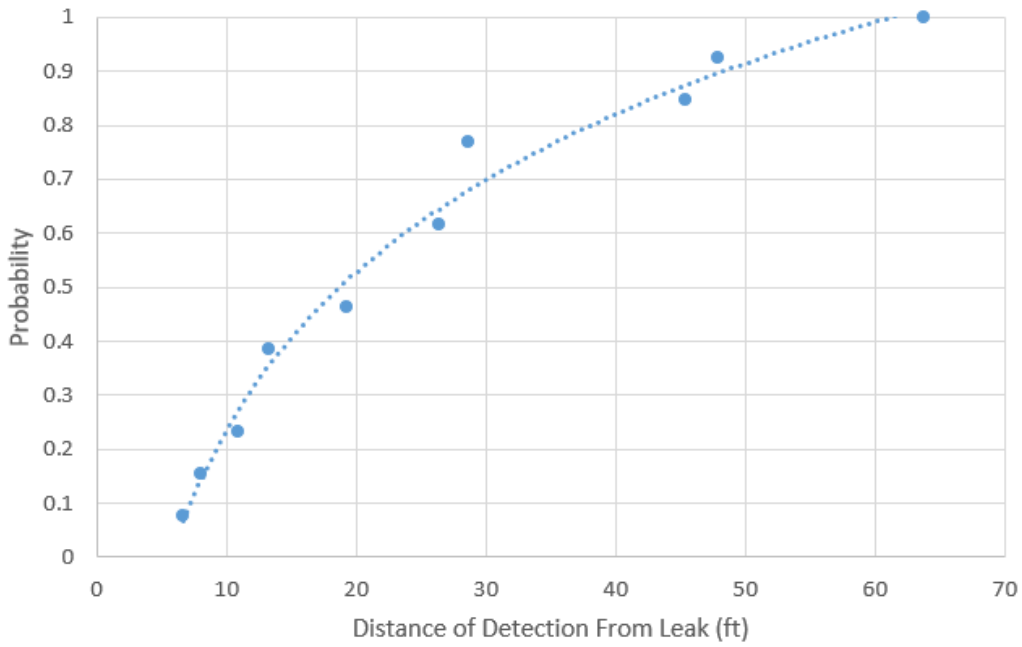
Aerial Methane Mapping Research Results

System Leak Rate Proportions to Estimated Rate of Detection



Provides for detection of ~17% of System Leaks, weighted toward high flow rate

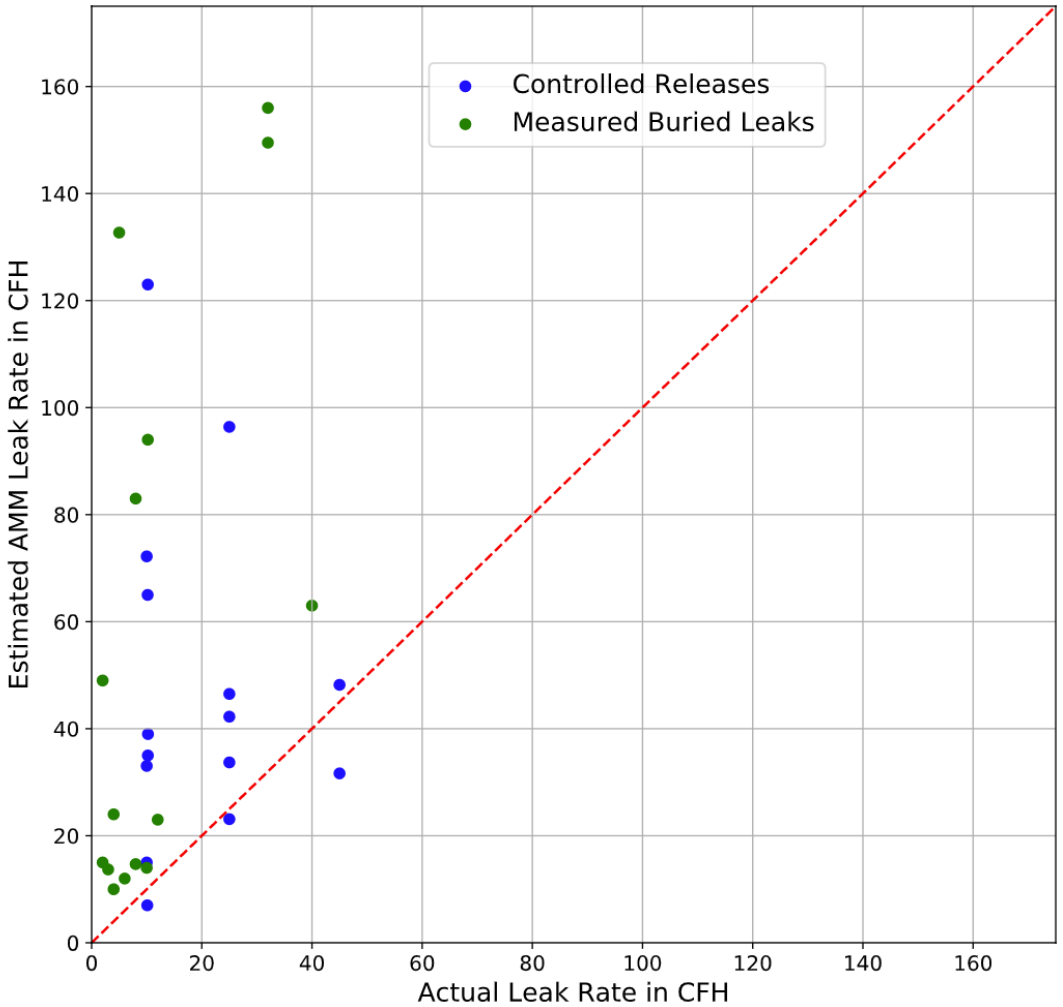
Emission Source Localization

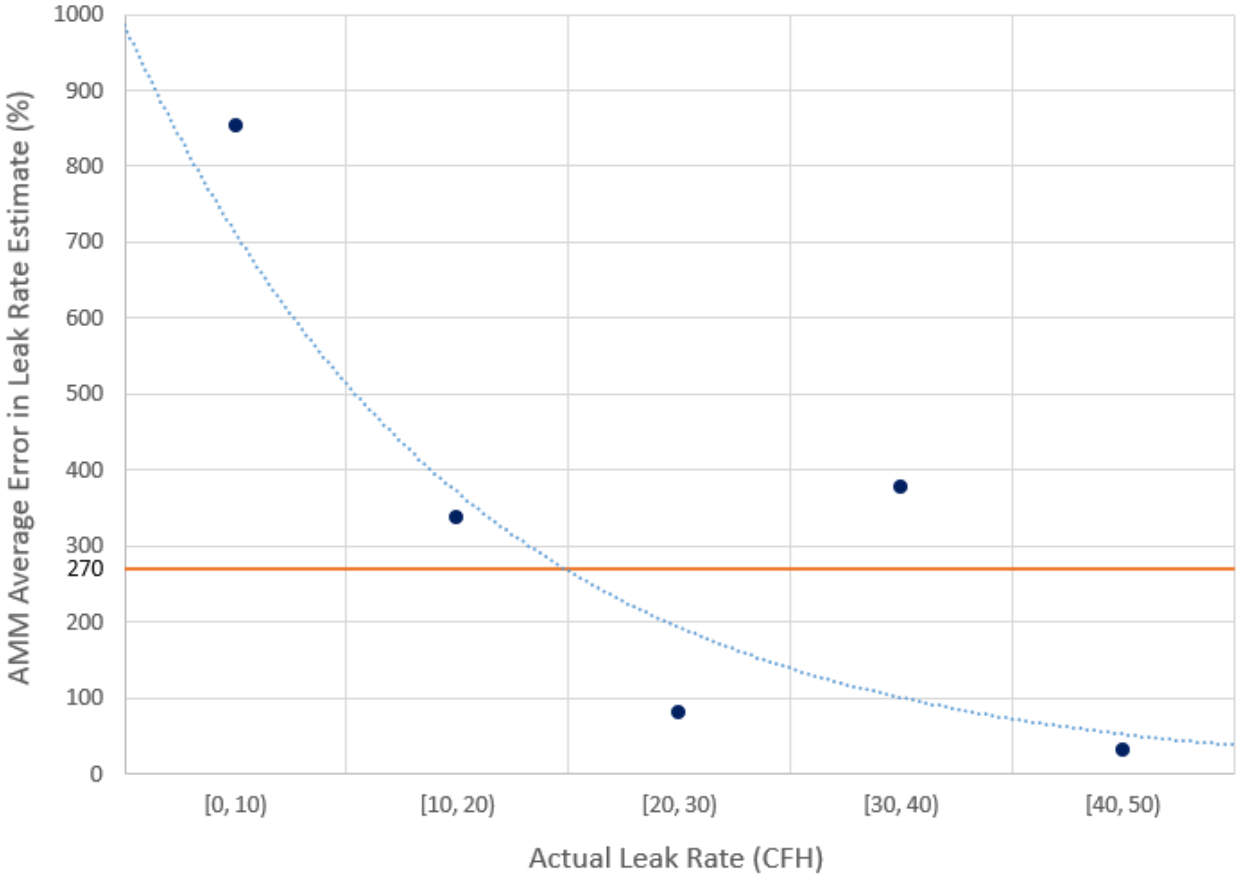


Provides geospatial localization of leak source within 40ft 80% of the time

Note: this information is intended to provide a first approximation of the performance of the overall process based on results of the R&D Pilot Study

Aerial Methane Mapping Research Update
Quantification Accuracy





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Aerial Methane Mapping

» **Next Steps:**

- System-wide implementation starting January 2021
  - Finalizing business process workflows, system enhancements and staffing to support the program.
- R&D will continue to promulgate and evaluate advancements to various aerial technologies

Questions?

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