Project Recap

NPRM ALDP Performance Rule 5ppm at 5ft

OTD Project 7.24.b

Project Completed: May 2026 || Project PI: Abbie Corbet (acorbett@gti.energy)

Introduction

Accurately finding small leaks is essential for maintaining natural gas system safety and integrity but can be challenging. This project, funded by Operations Technology Development (OTD), analyzed real-world historical leak data and tested commercially available walking leak survey instruments and methods to clarify what levels of performance can realistically be achieved in day-to-day operations.

Historical Leak Data

Local distribution company leak survey data was analyzed to determine the range of leak sizes and surface spreads typically found during walking leak surveys under real-world conditions. This data showed that finding low-level methane leaks (around 5ppm) is relatively common under real-world conditions and found leaks typically exhibit surface spreads greater than 5ft.

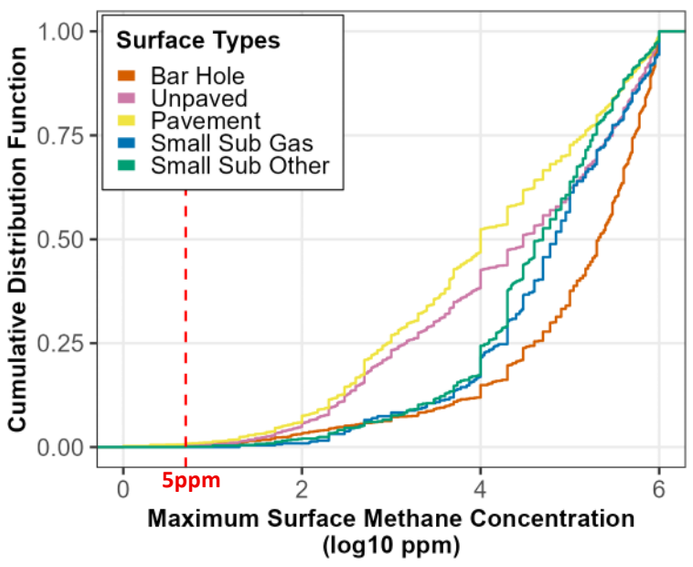

Figure 1: *Cumulative distribution functions (CDFs) of leak measurements across all five measurement categories (bar hole, unpaved, pavement, gas small substructures, and other small substructures).*

Underground Leak Simulation

A 5 inch deep test bed was constructed with sand and artificial turf to simulate underground leaks with controlled flow rates. Two scenarios were simulated 1) a single leak point (point-source) and 2) multiple leak points (dispersed). A string grid was created to allow consistent measurements relative to the leak points.

Controlled Release Testing

Controlled release testing was used to examine the relationship between leak flow rate, surface methane concentration, plume size, and probability of detection (POD). Typical walking leak survey methods and two types of handheld leak survey instruments were used in this experiment: a pump-based instrument and an open path laser instrument. The flow rate of simulated leaks was controlled using mass flow controllers for six flow rates: 0.03, 0.1, 0.3, 1.05, 3.15, and 10.5 scfh. Maximum concentration readings were recorded using the pump-based instrument at each intersection of the grid. Laser data was collected by scanning across the sandbox at each foot marker at 5, 10, and 15ft from the central leak point.

Experimental Results

Data analysis for the **pump-based instrument** demonstrates a clear, consistent positive association between leak size, maximum concentration, and spatial extent of the plume. POD decreased systematically for all flow rates as the distance from the leak center increased.

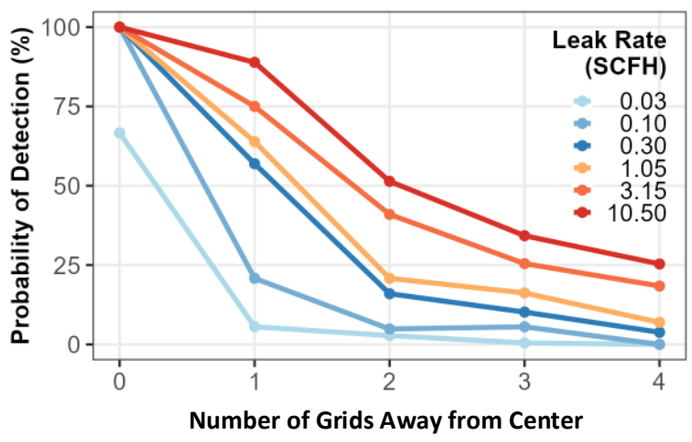

Figure 2: *Probability of detection for the pump-based instrument as a function of distance from leak center and leak flow rate.*

Conversely, measured surface expression and spatial spread varied substantially across flow rates and standoff distances when using the **laser-based instrument**. This is indicative of laser detection performance being influenced by environmental factors beyond leak flow rate alone.

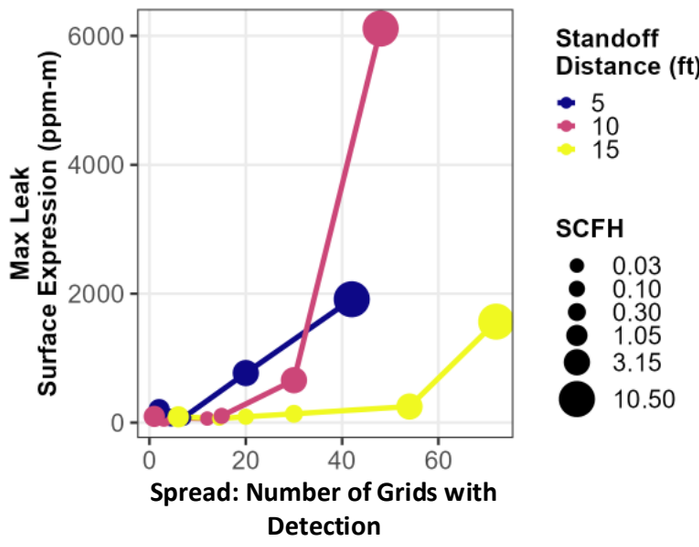

Figure 3: *Maximum measured ppm-m and corresponding surface spread for the handheld laser instrument across flow rates and standoff distances.*

Key Takeaways

A 5 ppm surface concentration does not correspond to a single leak size: Analysis of historical leak data and controlled release experiments indicates that a wide range of underground leak flow rates can produce similar surface methane concentrations.

Detection at very low concentrations is highly variable under field conditions: Controlled release data show that detection of low-level methane concentrations varies significantly depending on instrument type, survey method, operator technique, distance from the surface expression, and environmental conditions.

Probability of detection increases with leak size, but not uniformly: Higher leak flow rates generally result in higher probabilities of detection; however, the relationship is not consistent across different instruments or survey approaches, highlighting the importance of evaluating probability of detection rather than relying on a single threshold.