Statistics and the Environment: Detecting Natural Gas Leaks

Statistics informs optimal survey practices and algorithm development

There are an estimated 650,000 leaks in the United States natural gas distribution system. These leaks emit the potent greenhouse gas methane (CH_4), a contributor to climate change. Additionally, leaks are an economic loss, emit a foul odor, kill vegetation and occasionally develop into explosion hazards.

ADVANCED LEAK DETECTION TECHNOLOGY

Highly sensitive, portable methane instruments have recently been developed and deployed on vehicles. Advanced leak detection (ALD) combines the massive data sets produced by these sensors with sophisticated analytics to detect and find leaks faster than traditional methods. ALD has been deployed using Google Street View cars and is now commercially available. Rapid leak detection with these platforms is important for infrastructure repair and replacement efforts, pipeline safety, and greenhouse gas emission quantification.

How to optimally deploy these technologies for detecting leaks?

We use statistical and data mining methods to interpret the data streams, reveal meaningful insights, and improve ALD surveys. We developed models to quantify the probability of detecting leaks and how detection is influenced by factors such as pipeline materials and housing characteristics. The results of our analyses inform optimal survey practices. For example, our analysis indicates that driving an area six times will detect most leaks. We also quantified the uncertainty and variability of ALD emissions estimates.

SOCIETAL IMPACT

ALD technology provides the ability to rapidly detect and locate large leaks, allowing for timely repair or replacement. Optimal surveying practices and advanced data processing algorithms, informed by statistics, enable utility companies to maintain the safety and integrity of their infrastructure and reduce greenhouse gas emissions.