

Utility Use of Advanced Leak Detection to Maximize Cost Effective Methane Reductions

New Jersey Clean Air Council

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N. Jonathan Peress

Mary Barber



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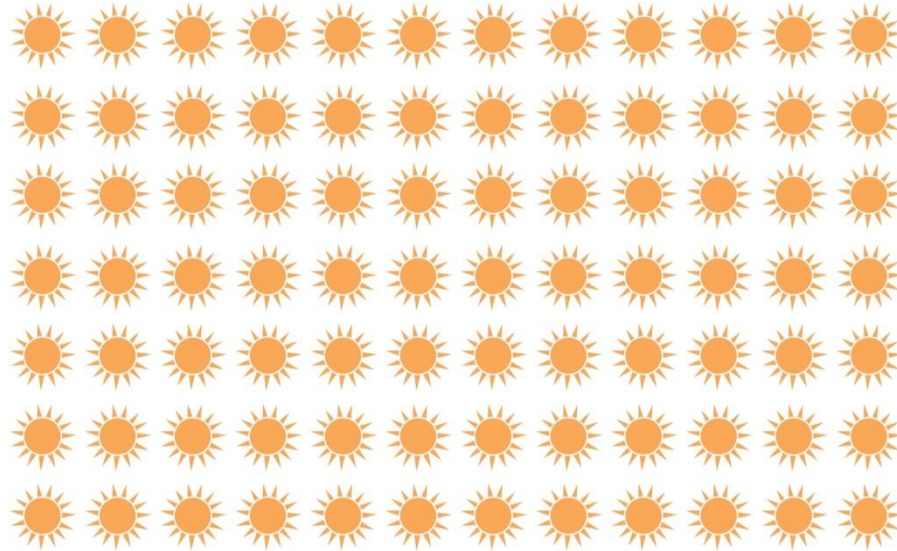
CH₄ traps more heat than CO₂...

EACH METHANE MOLECULE TRAPS **84x** MORE HEAT

CO₂



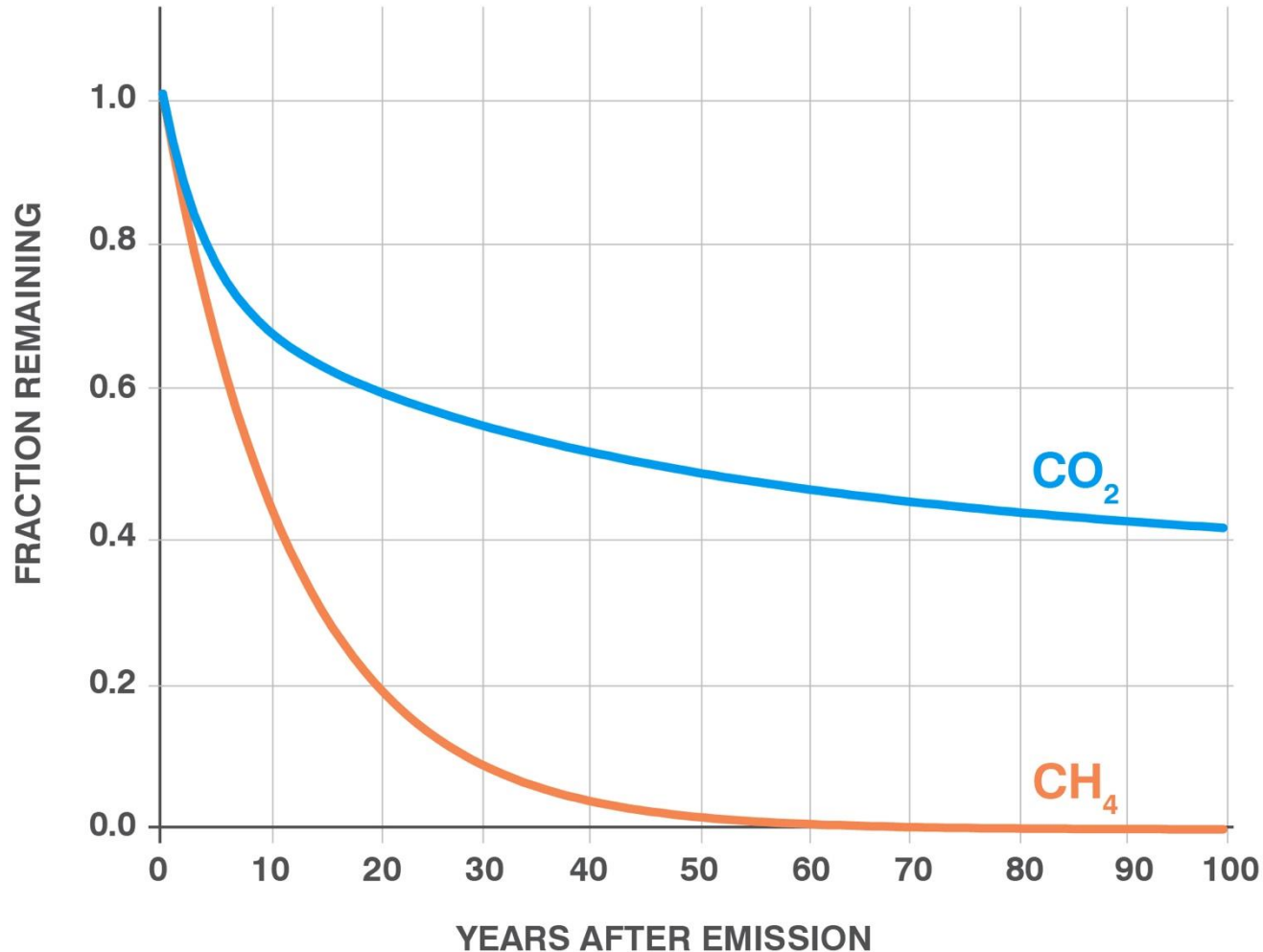
CH₄



Ratio of direct radiative efficiencies, W m⁻² ppb⁻¹ (IPCC AR5)

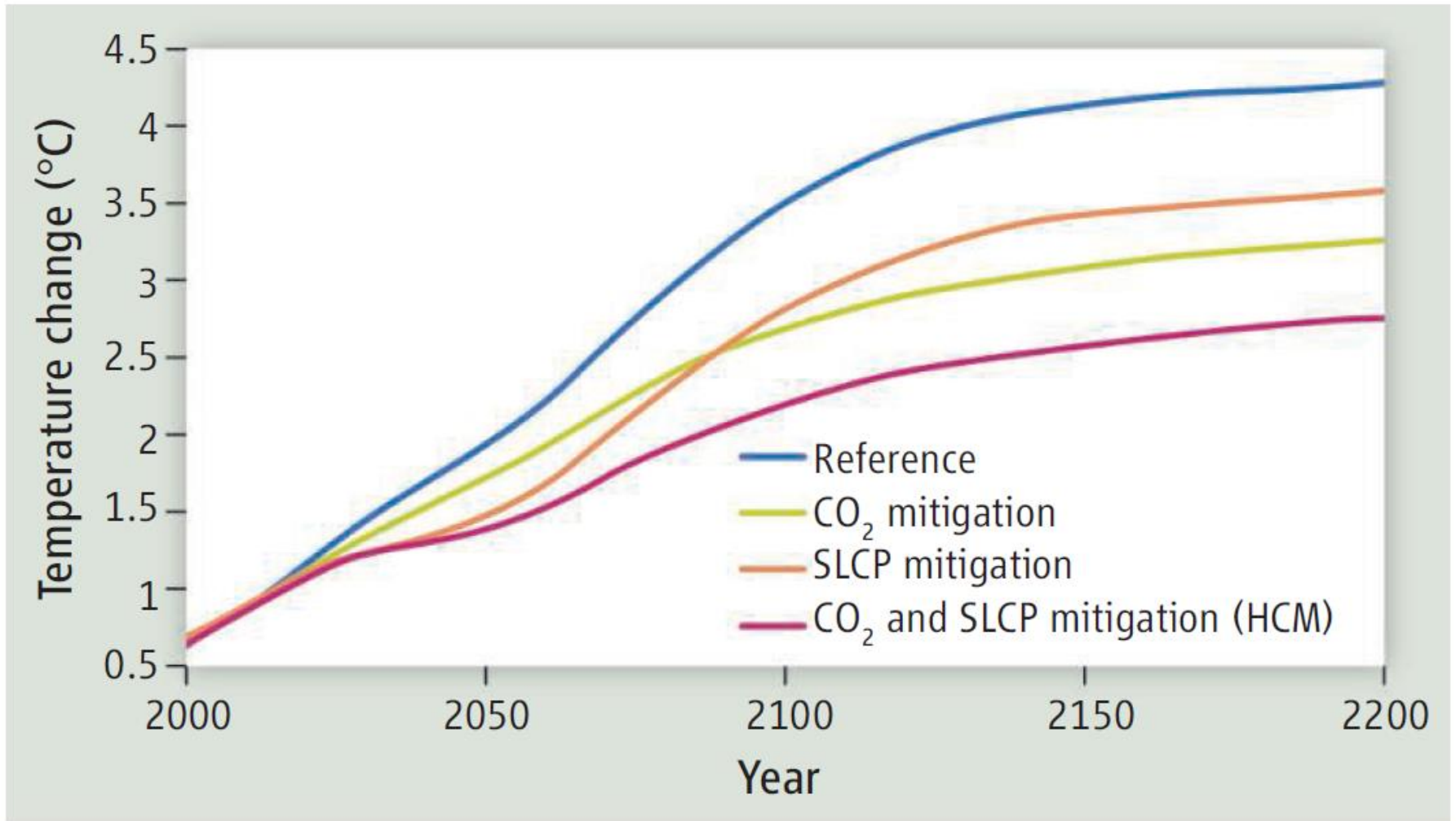
...but breaks down faster than CO₂

METHANE DISSIPATES FASTER THAN CARBON DIOXIDE



- CH₄ produces tropospheric ozone and stratospheric water vapor as it decays
- Increases the direct warming effect by 65% (IPCC AR5)

Methane and CO₂ reductions required



Large Number of Methane Leaks from Aging Urban Infrastructure

State	Miles of Leak-Prone Pipe	% of U.S. Leak-Prone Pipe
NY	16,442	17%
TX	10,652	11%
PA	10,313	11%
OH	10,282	11%
CA	8,358	9%
NJ	6,368	7%

PHMSA 2016 Data

New Jersey utilities have more cast iron distribution pipelines than any other state, 3911 miles as of 2019.

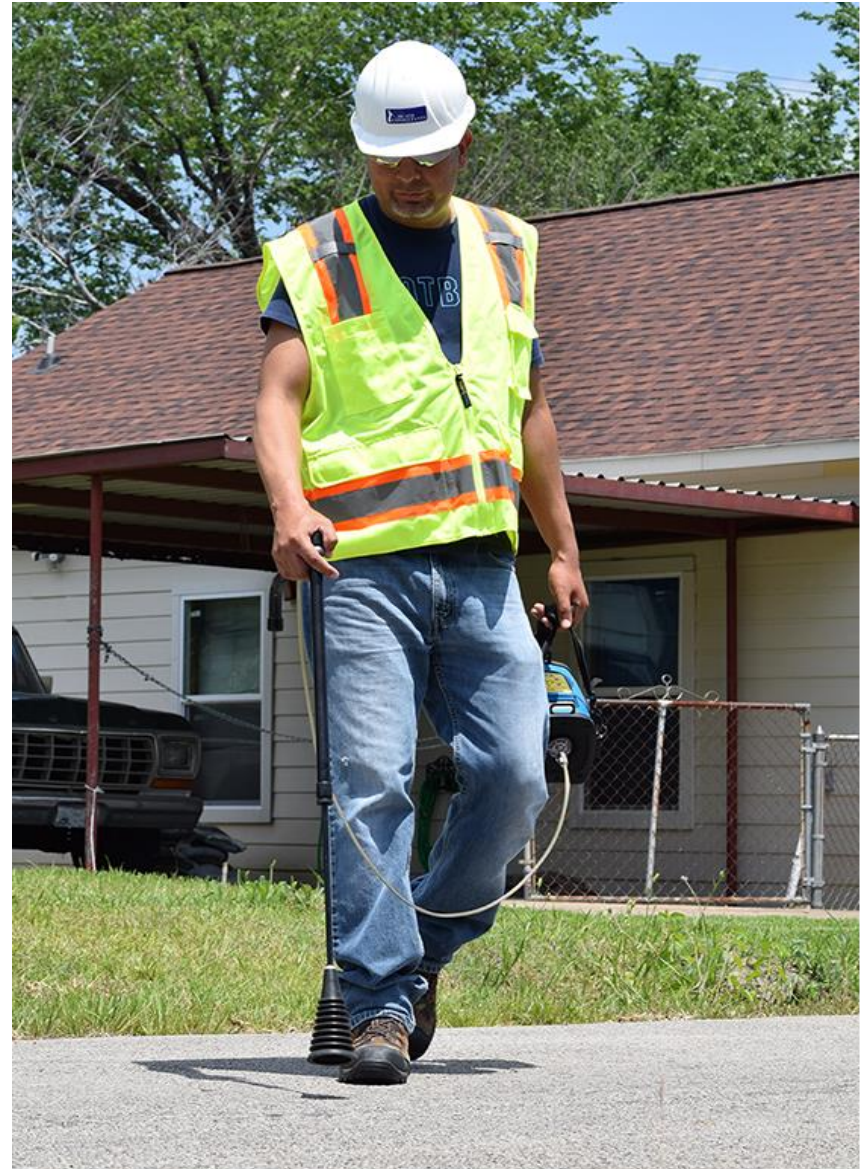
Nationally, **10.6 percent** of the safety incidents occurring on gas distribution mains involved cast iron mains. However, less than **2 percent** of distribution mains are cast iron.

New Jersey Methane Emissions

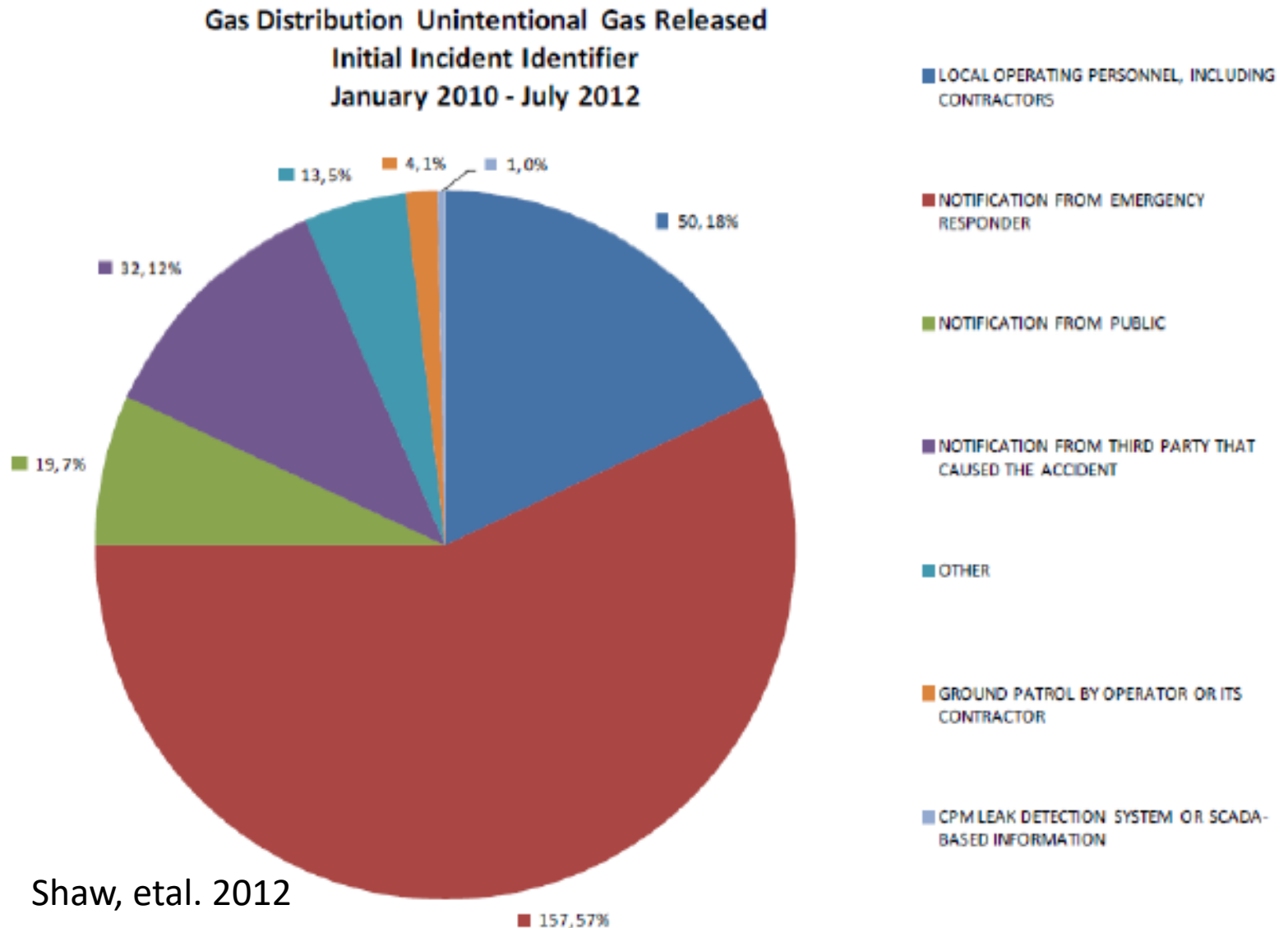
- Local distribution companies (LDCs) are responsible for 850,912 metric tons, or 40.3% of NJ methane emissions.
- Self-reported data from New Jersey's four LDCs (Elizabethtown Gas, NJ Resources, PSE&G and South Jersey gas) reveal that 79% of their emissions come from leaks in their distribution system gas mains.
- Thus, the EPA data indicate that 32% of New Jersey's CH₄ emissions come from leaks in the mains that distribute natural gas to homes and businesses.

How Utilities Find Leaks, Before:

- The “state of the art” is handheld methane detectors DIMP surveys or responding to odor calls.
- The vast majority of leaks are found by first responders or customers smelling gas.
- Is there a better way?

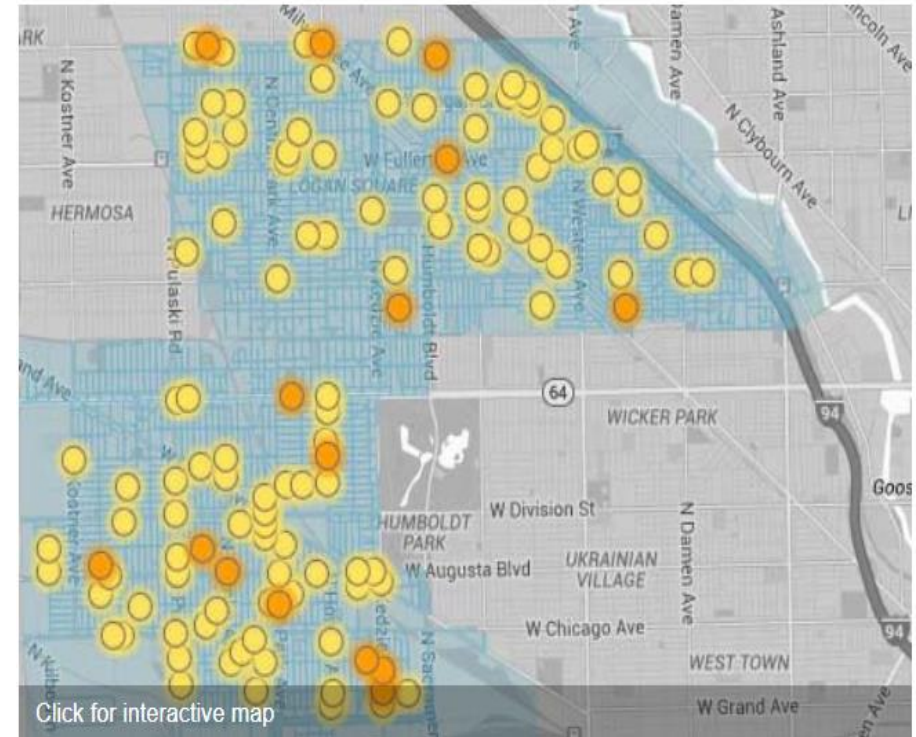


2012: First Responders Find Most Leaks



EDF/Google Leak Mapping Project

Explore Chicago map data



What began as an EDF science and methane public awareness campaign in 2014 is shaping gas utility business practices in 2019.

ALD+ = Sensors and data analytics



High sensitivity, mobile
Mounted methane detectors

Available to utilities via
Picarro, Heath/LGR

Faster, more sensitive than
optical imaging or hand held
flame ionization

Can quantify leak flow volume

Validation of false positives & leak size estimation

Weller *et al.*

EnvSci&Tech 2018

Vehicle-Based Methane Surveys for Finding Natural Gas Leaks and Estimating Their Size: Validation and Uncertainty

Zachary D. Weller,^{1,2,3,4} Joseph R. Roscillo,¹ M. Connor Dachs,¹ Brian K. Lamb,^{5,6} Thomas W. Ferrara,¹ Paul E. Brower,⁷ and Joseph C. von Fischer⁷

¹Department of Biology, Colorado State University, Fort Collins, Colorado 80523, United States

²Department of Statistics, Colorado State University, Fort Collins, Colorado 80523, United States

³Academy Research Incorporated, Billerica, Massachusetts 01821, United States

⁴Laboratory for Atmospheric Research, Department of Civil & Environmental Engineering, Washington State University, Pullman, Washington 99164, United States

⁵GH2 Services Incorporated, Niagara Falls, New York 14304, United States

⁶Southwestern Environmental Research Center, Edgewood, Maryland 21027, United States

⁷Supporting Information

ABSTRACT: Detecting leaks in urban natural gas (NG) distribution systems is important for reducing methane emissions and safety risks. Mobile sensing technology has emerged as a new tool for monitoring system integrity, but the new technology has not yet been widely adopted. Here, we establish the efficacy of mobile methane sensors for measuring local NG distribution systems by conducting their ability to detect and locate NG leaks and quantify their emissions. In two cities, three quarters of leak indications from mobile sensors corresponded to NG leaks, but local distribution companies' field crews did not find most of these leaks, indicating that the standard CO₂ activity ratios for leaks in local NG distribution pipelines is underestimated by a factor of 2.4. We found the median distance between mobile-sensored leak locations and actual leak locations was 18 m. A comparison of sensitive quantitative methods (vehicle-based, surface emissions, and tracer release) found that the mobile method underestimated leak magnitudes for the smallest leaks but accurately estimated size for the largest leaks that are responsible for the majority of total emissions. Across both cities, mobile methods adequately track relative emission rates for repair prioritization, and they are easily deployed and offer efficient spatial coverage.



1. INTRODUCTION

Detecting natural gas (NG) leaks in urban distribution systems is for significant environmental, economic, and public safety benefits. Methane (CH₄) is the primary component of NG and is the second most important anthropogenic greenhouse gas; it is a large gas because it has a global warming potential 28 times greater than CO₂ over a 100-year period.¹ The economic benefits of not air from distribution systems are limited

overall, or "leaking."² Data from these mobile sensors can be used to detect and map locations with elevated CH₄ concentrations, often called leak indications.^{3,4}

Data from mobile platforms have also been used to estimate NG leak rates,^{5,6} and their ease of deployment and ability to detect leaks and quantify provides large spatial coverage makes them an attractive approach for prioritizing leak repair and to provide information to allow CH₄ emissions. Mobile

ALD finds leaks that other methods miss: PG&E, Centerpoint Energy, CSU analysis finds 3 to 5 times more leaks than standard utility survey methods

Prioritizing Pipe Replacement Using ALD+

- Public Utilities
Fortnightly white paper and article (May 2017) describe methodology and benefits.
- Improving decision-making by using ALD+.
- EDF collaborations with PSE&G (NJ), PGL (Chicago), Con Ed (NY), PG&E (CA) and Peoples (Pittsburgh)

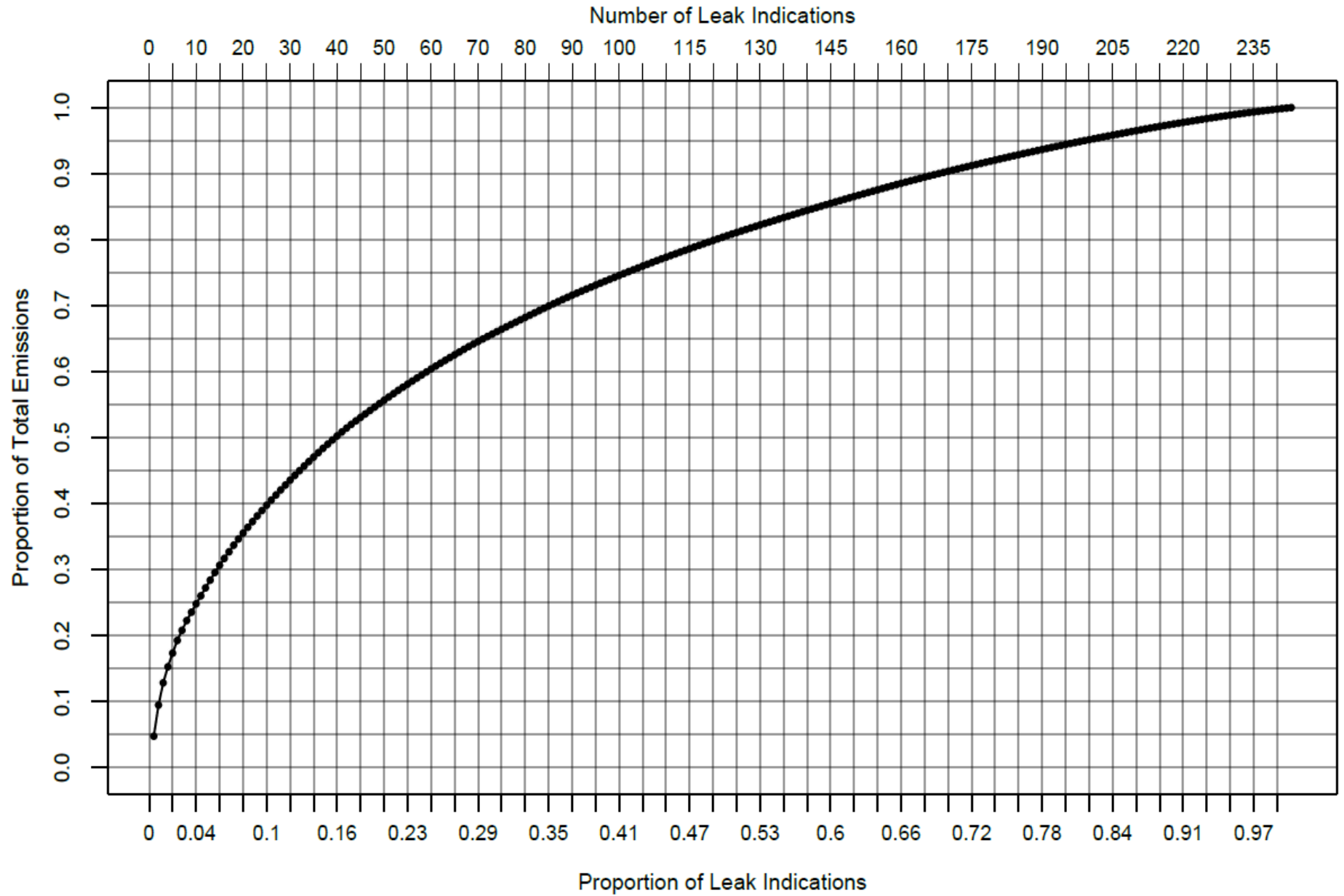


Leak Detection/ Measurement Saves Money

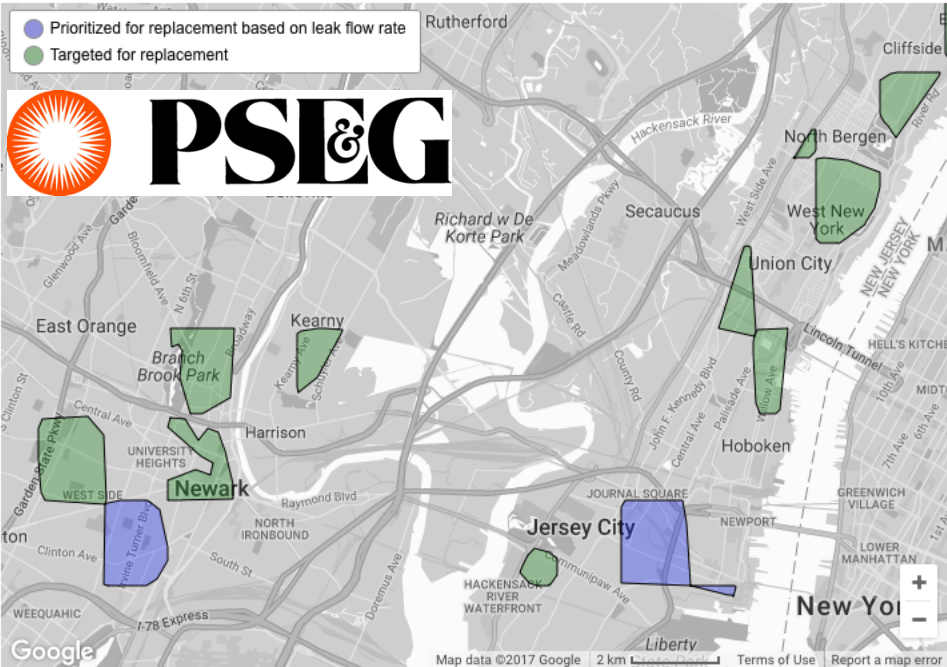
Market Based Solutions

BY VIRGINIA PALACIOS

E-town Cumulative Emissions Curve



PSE&G: ALD+ methods helped prioritize \$900M in pipeline replacement



Result: 83% reduction of methane emissions by replacing one-third fewer miles of gas lines than under a business as usual scenario.

in Support of the Methane Leak Surveying Report for the PSE&G GSMP II Program

Prepared by Picarro, Inc.

December 14, 2018

roduction

arro has completed mobile methane emissions measurements for use in the r
ase of PSE&G's Gas System Modernization Program (GSMP II). Methane data v
hered along approximately 280 miles of Utilization Pressure Cast Iron ("UPCI
mains contained in 44 map grids. The replacement of mains within GSMP II v
ow the prioritization based on the grid-based Leak Hazard Indices developed
E&G, and the Picarro methane emissions results will be used as a sub-
oritization metric within that framework. Including methane emission rate
lometric flow rate) as part of the replacement prioritization process may res
he reduction of natural gas emissions and reduce the environmental impacts
h emissions. This document describes the measurement campaign results, da

PSEG Findings:

With methane maps and their aggregated emissions data, however, it is possible to make accurate, surgical construction decisions at the grid or individual pipeline section level as desired.

Although the total grid emissions trends essentially with the per-mile emission rate, there are exceptions to that trend, also evidenced by visual comparison of the methane maps – there are large variations in both per-mile leak density as well as variability of over two orders of magnitude in leak rates.

This variability shows **the power of the methane mapping technique for providing additional granularity that can be used to maximize methane emissions reductions and/or maximize remediation of the maximum number of belowground leaks through changes to construction priorities based on these methane maps and associated data.**

Today's Best Practice: Emissions Quantification & Leak Density Estimation Analytics

- Mobile mounted high sensitivity leak detectors find and quantify leaks
- Using methane data, analytics estimate leak density and measure emissions of pipe segments rather than identifying individual leaks
- Pipe segments with highest leak density are identified for repair or capital replacement
- Emissions, costs and safety risk are reduced



Finding and Recommendations

- Advanced leak detection methods would reduce more than 50% of methane emissions by repairing only the largest 20% of leaks.
- Recommendations
 - Require use of ALD to establish inventory
 - Mandate abatement of environmentally significant non-hazardous leaks (by leak flow volume)
 - Track emissions
 - Partner with BPU to address LDC costs and incentives