Methane Emissions from Natural Gas Distribution Pipelines in CA

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Company Overview

- Independent, not-for-profit established by the natural gas industry
- GTI tackles tough energy challenges turning raw technology into practical solutions
- Downhole to the burner tip including energy conversion technologies

RESEARCH & DEVELOPMENT

PROGRAM MANAGEMENT

TECHNICAL/ ANALYTICAL

CONSULTING

TRAINING

Disclaimer

This presentation does not necessarily represent the views or policies of the California Air Resources Board.

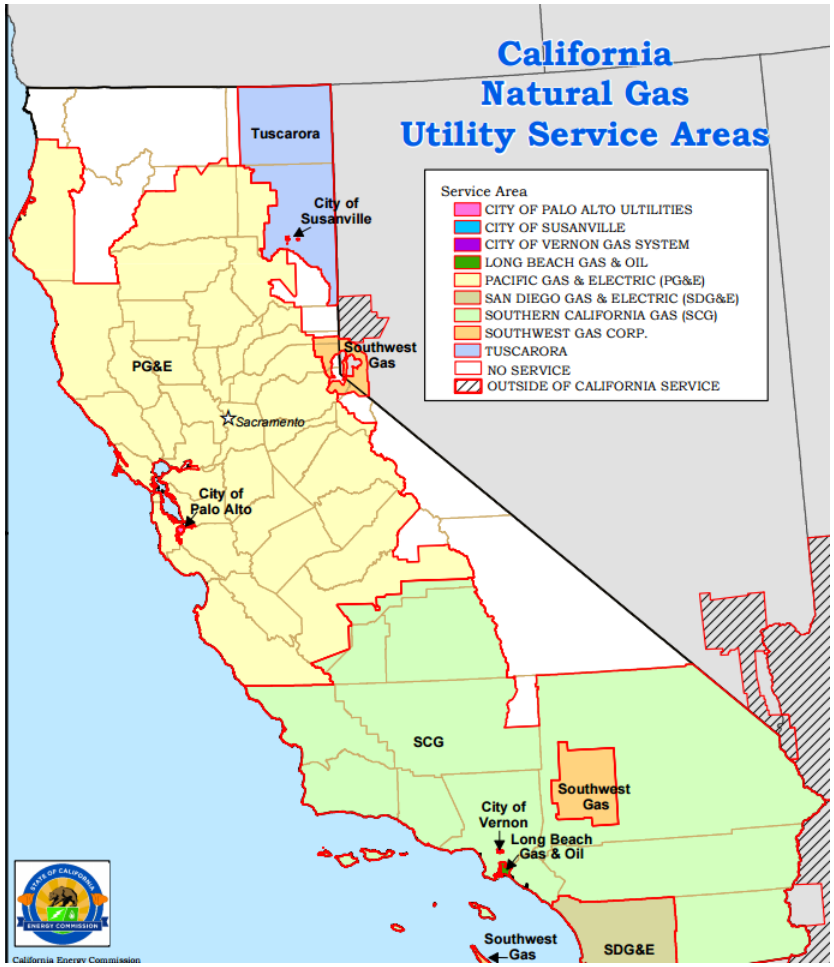
Project Overview

- Sponsored by California Air Resources Board
- Project duration of 24 months
- Participating Utility Partners: SoCal Gas, SDG&E, PG&E
- Objective: Quantify fugitive methane emissions from natural gas distribution pipelines in California
- Conducted field measurements to establish the emission factors at sites with known leaks from various types of belowground pipe materials used in the gas distribution system

Estimating Methane Emissions

- Total Emissions = Σ Emission Factors x Activity Data
- Emission Factors = Leak rate in scf/leak-year
- Activity Data = Number of annual equivalent leaks
- Until recently current US EPA GHGI used emission factors from 1996 GRI/US EPA study
- April 2016, US EPA revised their methane emission estimates based on the data from recent studies (EDF/WSU, GTI/OTD)

Selection of Sites

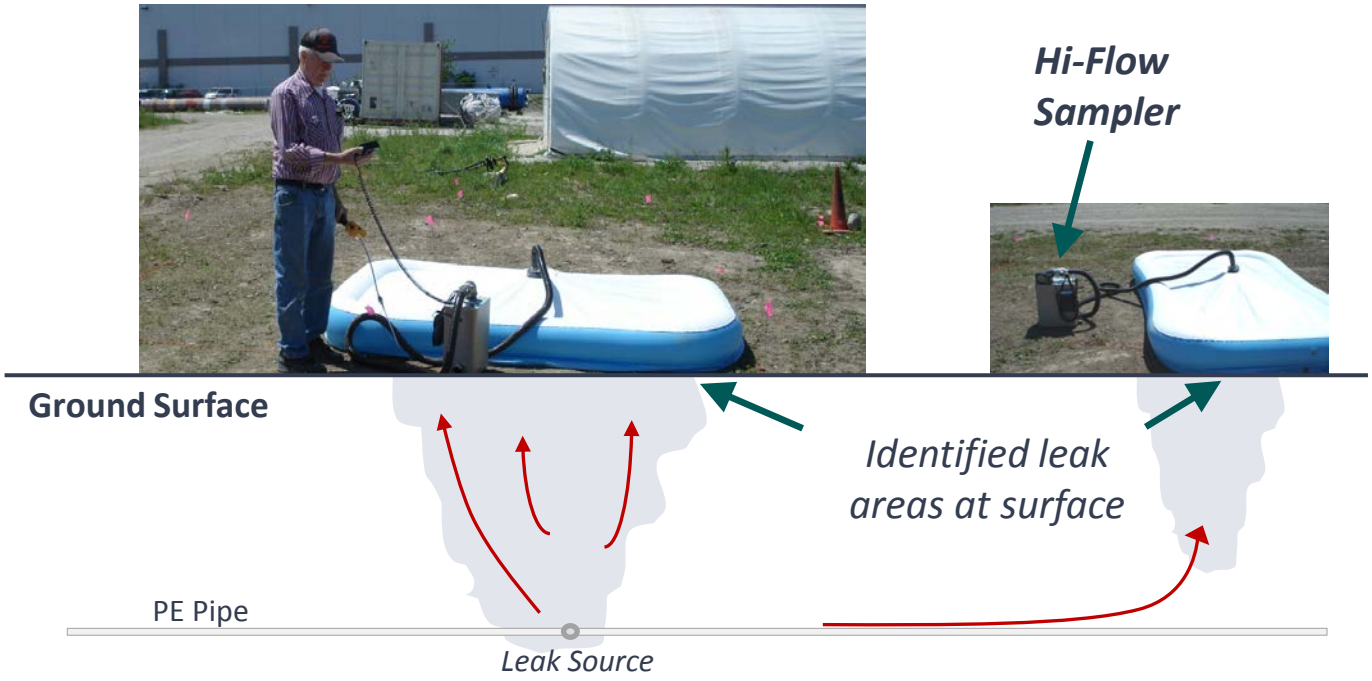


- Plastic mains and services (57% of samples)
- Unprotected steel mains and services (43% of samples)
- Measured non-hazardous leaks (Grades 2 & 3)
- Randomly selected sites based on leak records provided by each utility

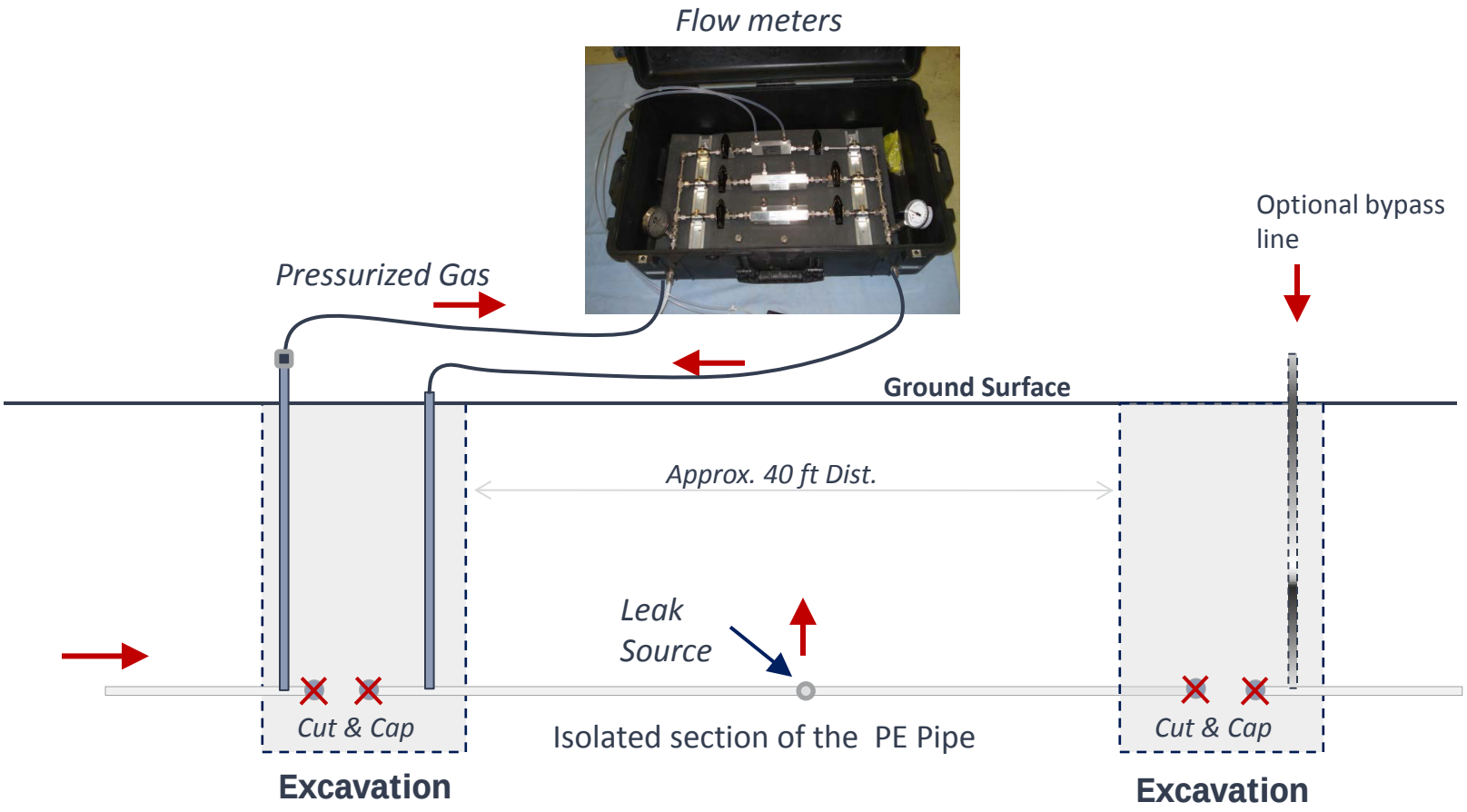
Measuring Methane Emissions

- Survey and map leak area using a CGI
- Enclose leak area and use the Hi-Flow Sampler to measure emissions
- Correlate subset of surface measurements using the Hi-Flow Sampler with below ground measurements using a Laminar Flow Element

Field Measurements – Hi Flow Sampler



Field Measurements – Laminar Flow Element

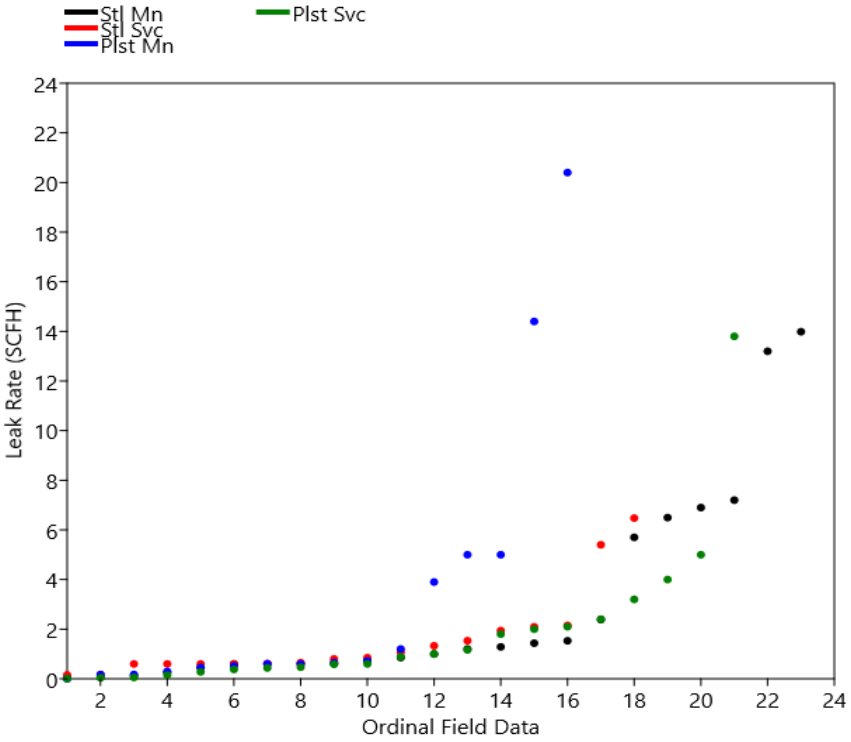


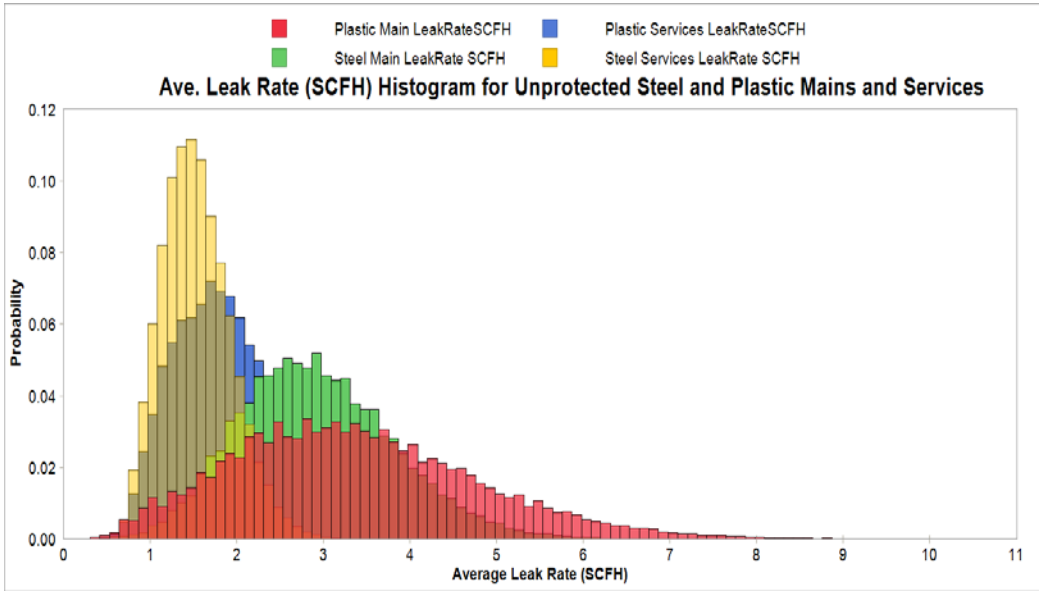
Average Leak Rates

- Measured mains & services underground pipeline leaks:
  - Pipeline materials: unprotected steel & plastic
  - Samples size: 78 above and 9 below-ground measurements from across geographic and socio-economic areas in California
  - Bootstrap analysis of above-ground measurements to determine average leak rates and 90% UCL

	Unprotected Steel Main Leak Rate (scfh)	Unprotected Steel Services Leak Rate (scfh)	Plastic Main Leak Rate (scfh)	Plastic Services Leak Rate (scfh)
Mean	2.925	1.536	3.369	1.923
90% UCL	4.102	2.061	5.265	2.806

Distribution of Measured Leaks



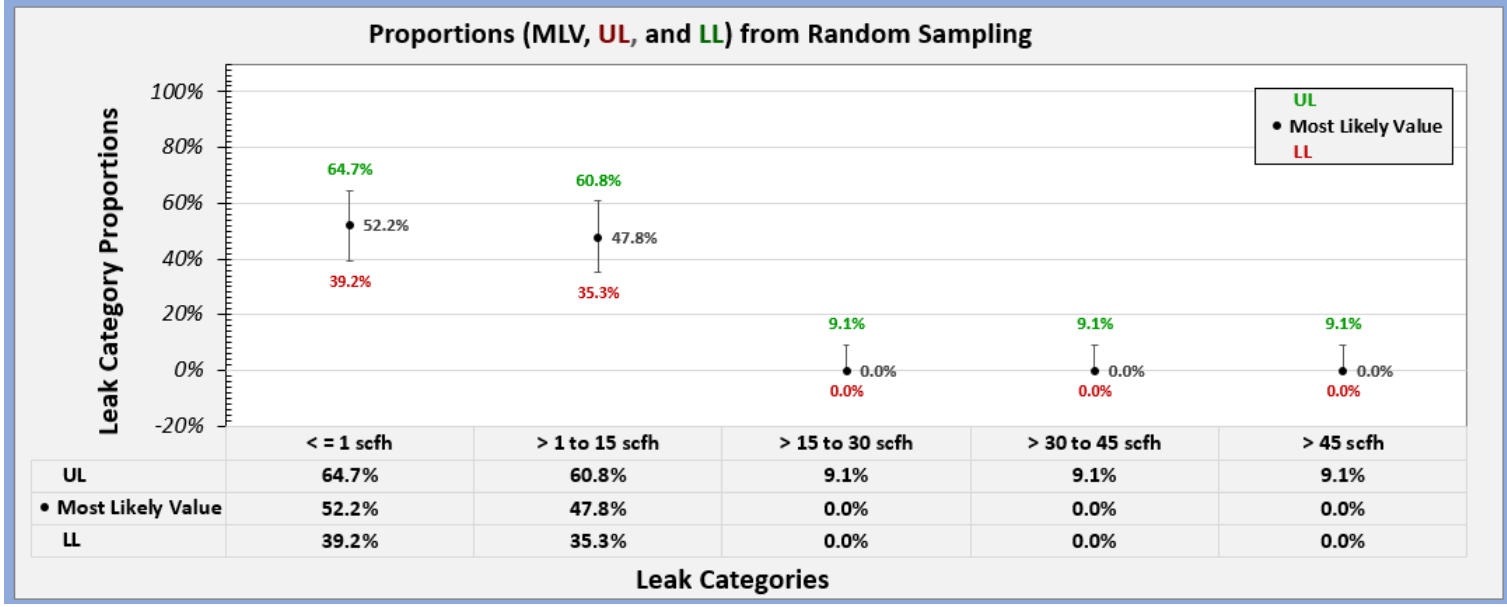


Likelihood of Large Leaks for Unprot. Steel Mains and Services?

Confidence Level 80.0 %
Upper Level of 90.0 %

GTI Unprotected Steel Mains

Sample Size 23

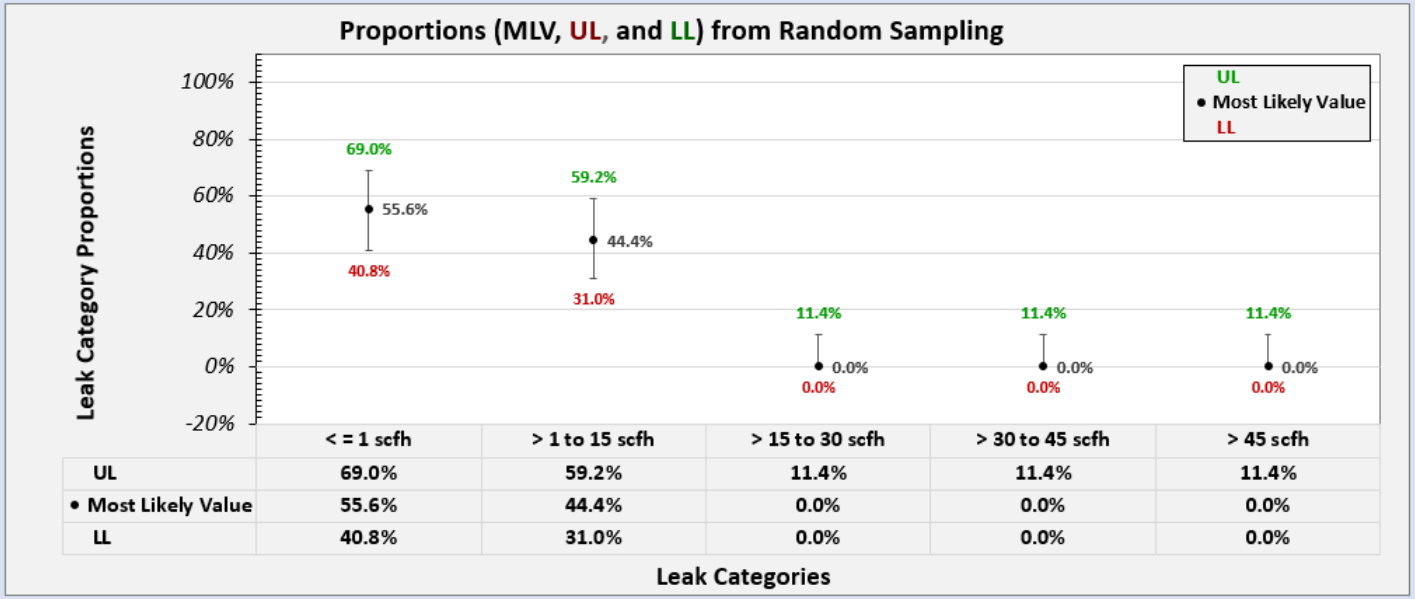


	< = 1 scfh	> 1 to 15 scfh	> 15 to 30 scfh	> 30 to 45 scfh	> 45 scfh
UL	64.7%	60.8%	9.1%	9.1%	9.1%
• Most Likely Value	52.2%	47.8%	0.0%	0.0%	0.0%
LL	39.2%	35.3%	0.0%	0.0%	0.0%

Confidence Level 80.0 %
Upper Level of 90.0 %

GTI Unprotected Steel Services

Sample Size 18



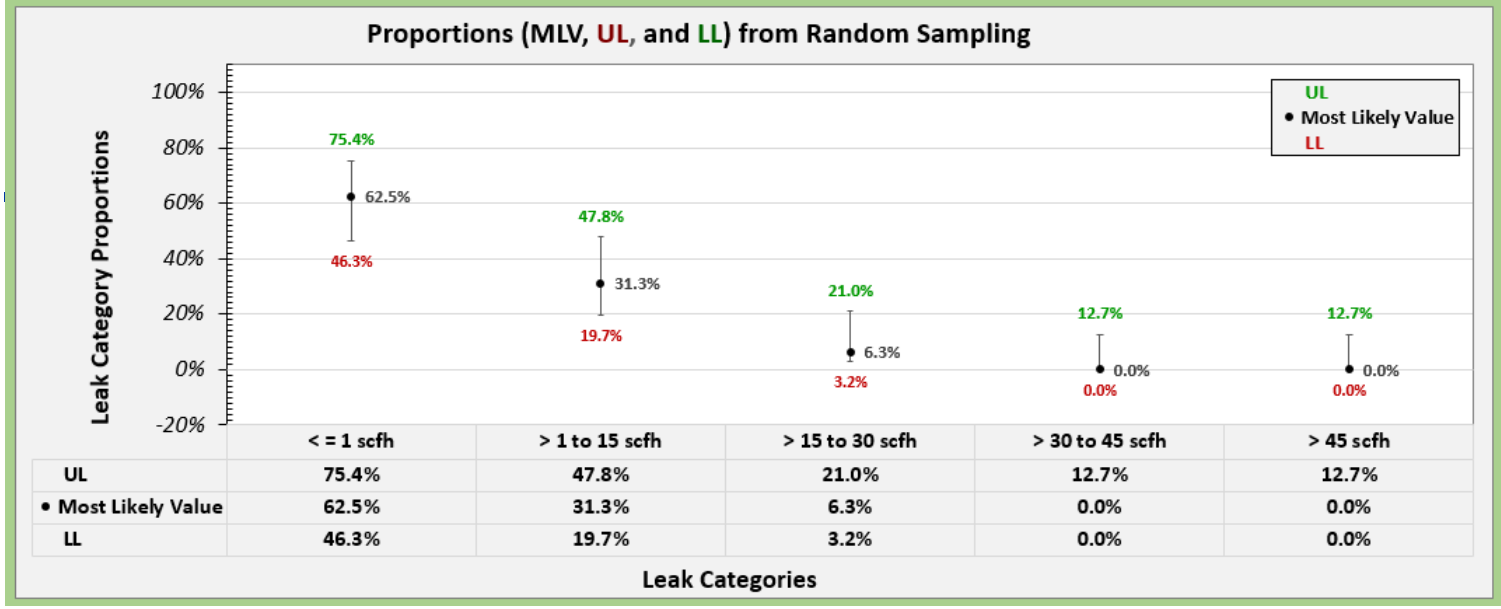
	< = 1 scfh	> 1 to 15 scfh	> 15 to 30 scfh	> 30 to 45 scfh	> 45 scfh
UL	69.0%	59.2%	11.4%	11.4%	11.4%
• Most Likely Value	55.6%	44.4%	0.0%	0.0%	0.0%
LL	40.8%	31.0%	0.0%	0.0%	0.0%

Likelihood of Large Leaks for Plastic Mains and Services?

Confidence Level 80.0 %
Upper Level of 90.0 %

GTI Plastic Mains

Sample Size 16

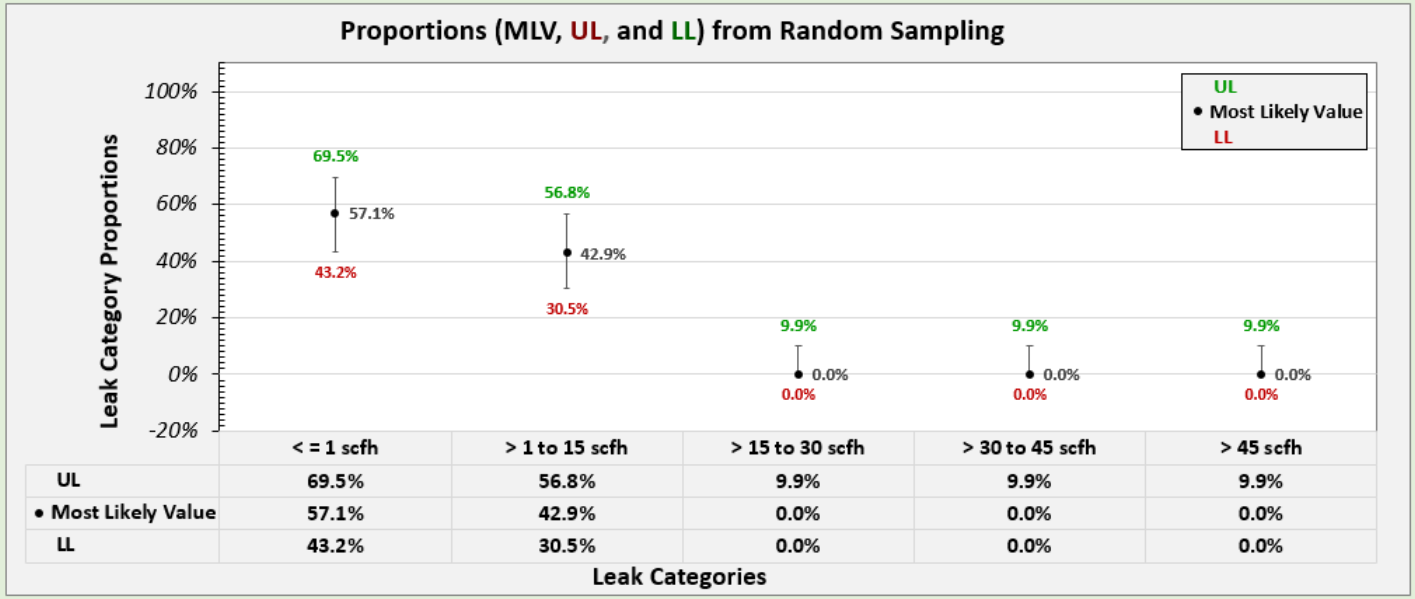


	< = 1 scfh	> 1 to 15 scfh	> 15 to 30 scfh	> 30 to 45 scfh	> 45 scfh
UL	75.4%	47.8%	21.0%	12.7%	12.7%
• Most Likely Value	62.5%	31.3%	6.3%	0.0%	0.0%
LL	46.3%	19.7%	3.2%	0.0%	0.0%

Confidence Level 80.0 %
Upper Level of 90.0 %

GTI Plastic Services

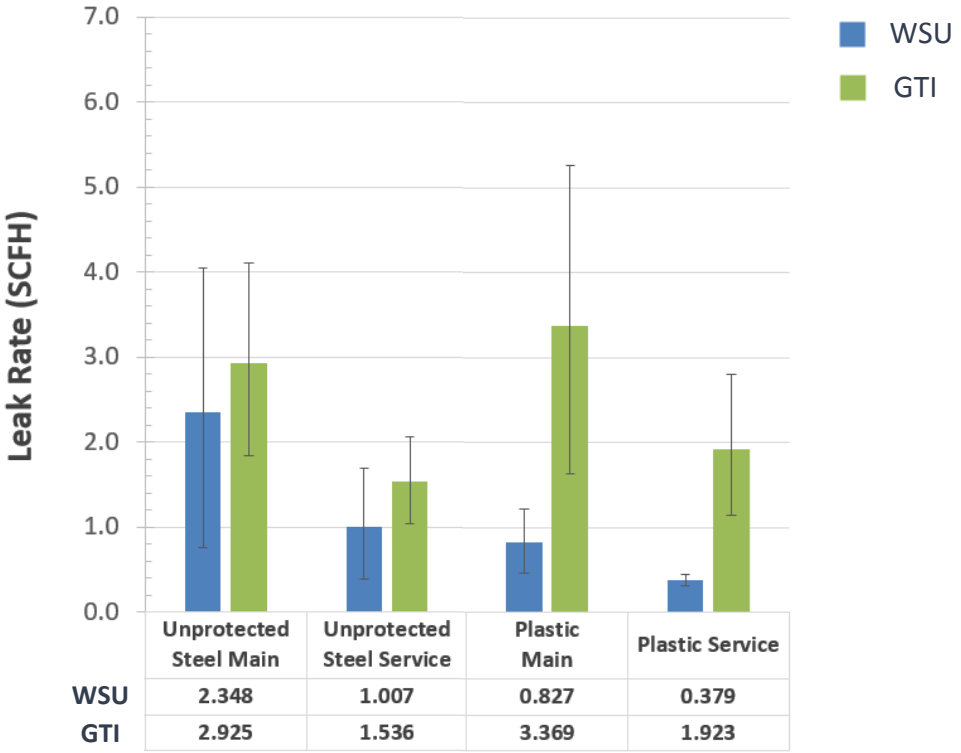
Sample Size 21



	< = 1 scfh	> 1 to 15 scfh	> 15 to 30 scfh	> 30 to 45 scfh	> 45 scfh
UL	69.5%	56.8%	9.9%	9.9%	9.9%
• Most Likely Value	57.1%	42.9%	0.0%	0.0%	0.0%
LL	43.2%	30.5%	0.0%	0.0%	0.0%

Emission Factors: CA vs National (WSU)

WSU and GTI 2015 Average Leak Rate (SCFH) with 90% Upper and 10% Lower Confidence Limits



	Unprotected Steel Main	Unprotected Steel Service	Plastic Main	Plastic Service
WSU	2.348	1.007	0.827	0.379
GTI	2.925	1.536	3.369	1.923

Summary and Potential Additional Research

- In General, leak rates from this study are lower than GRI/EPA 1996 study (with the exception of plastic services), but higher than the WSU national study
- Better characterization of emissions from other distribution sources, such as residential meters in CA ($150K proposal is in process)
- Research programs through DOE-NETL will be addressing mitigation and quantification of methane emissions from the gas industry

CEC Project: Quantifying Emissions from Commercial Buildings

- PON-14-507 Regional Climate Impacts and Adaptation Studies For the Natural Gas System and Other Environmental Related Issues
- Develop and pilot test a method to measure fugitive emissions in commercial buildings
  - Sources include piping and joining components downstream of meter, sewer and waste water vent stacks, commercial appliances
- LBNL key subcontractor
- Project initiated in Jan 2016
- Funding $599k

Questions

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