Quantifying Methane Emissions from Natural Gas Residential Customer Meters in California

CPUC Winter Workshop
January 21-22, 2021

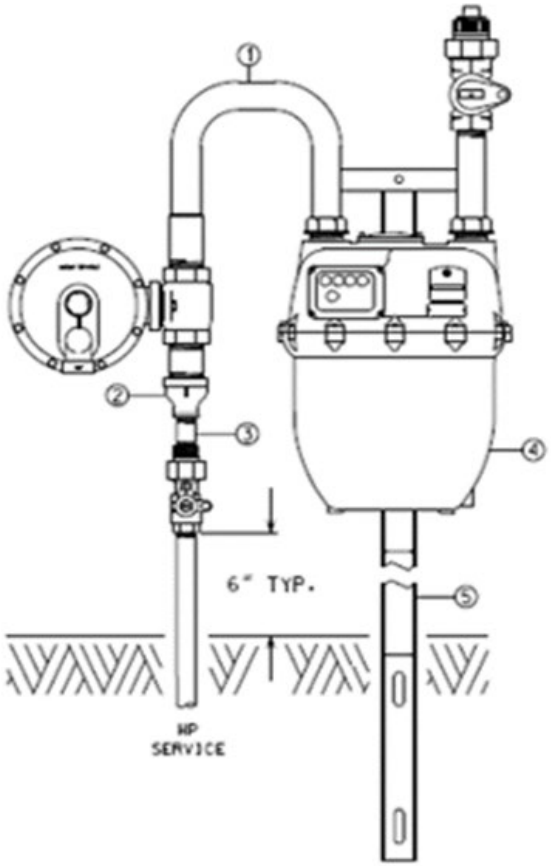
Study Rationale

- Currently emission factors in the SB 1371 program are from 1996 US EPA/GRI Studies
- Emission factors need updating and should be California-specific
- Use higher tier methodology
  - Estimates are more accurate
  - Requires disaggregate input data (e.g., categorize leaks by flowrate)

California MSA Study

- Objectives
  - Update existing emission factors
  - Identify leak prone components
  - Compare inland to coastal region leak rates
- 500 MSAs stratified by:
  - Utility company
    - 200 MSAs each in SoCal Gas and PG&E service territory
    - 100 MSAs in SDG&E territory
  - Location
    - 63 of 500 MSAs in coastal region
    - 10 coastal MSAs in SoCal Gas, 11 in SDG&E, 42 in PG&E
  - Demographic factor
    - Various ZIP codes

MSA Diagram



Legend:

1. Elbows
2. Flange
3. Treaded connections
4. Gas meter box
5. Support

Methods Used to Identify and Measure Emissions

- Identification
  - Handheld CGI
  - Soap test
- Measurement
  - Hi-flow sampler
  - LGT methane analyzer

Handheld CGI

Soap Bubble Test

Emission Measurement

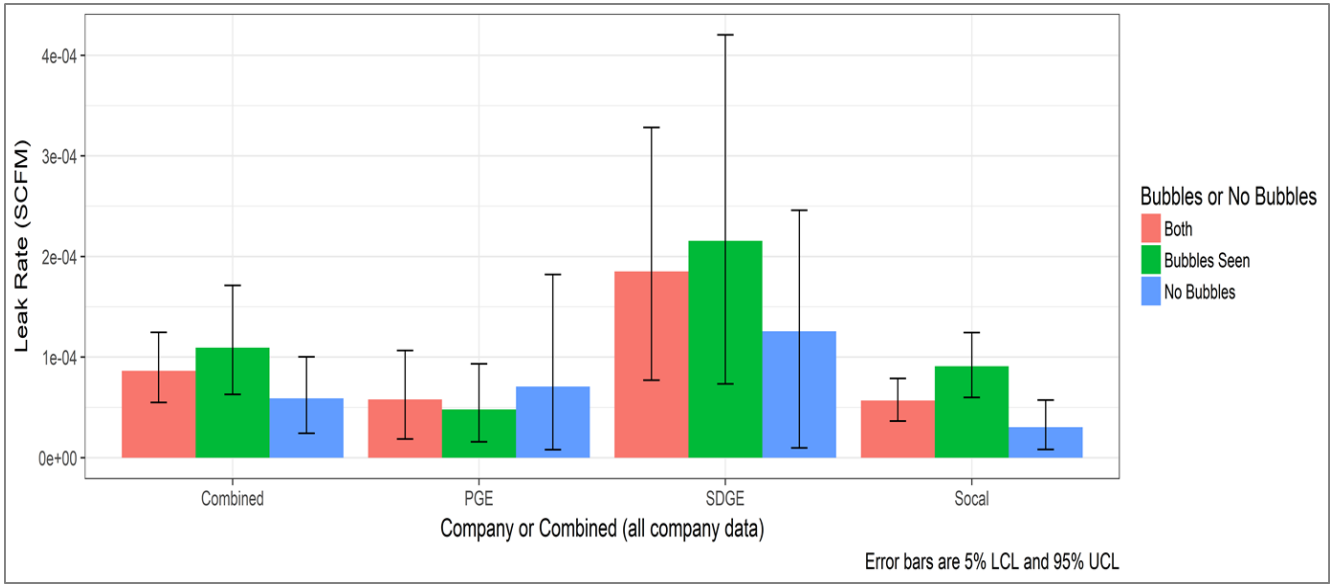
Summary of MSA Leak Indications

- CGI identified 166 leaking MSAs out of 500 (33%)
  - 77 MSAs confirmed by soap test (15%)
  - 89 MSAs showed no bubbles (18%)
- 334 MSAs had no leak indications

Leak Type/ Indication	SoCal Gas	SDG&E	PG&E	Combined	% of Total MSAs Surveyed
Bubbles	33	15	29	77	15%
No Bubbles	57	6	26	89	18%
No Indications	110	79	145	334	67%
Total	**200**	**100**	**200**	**500**	**100%**

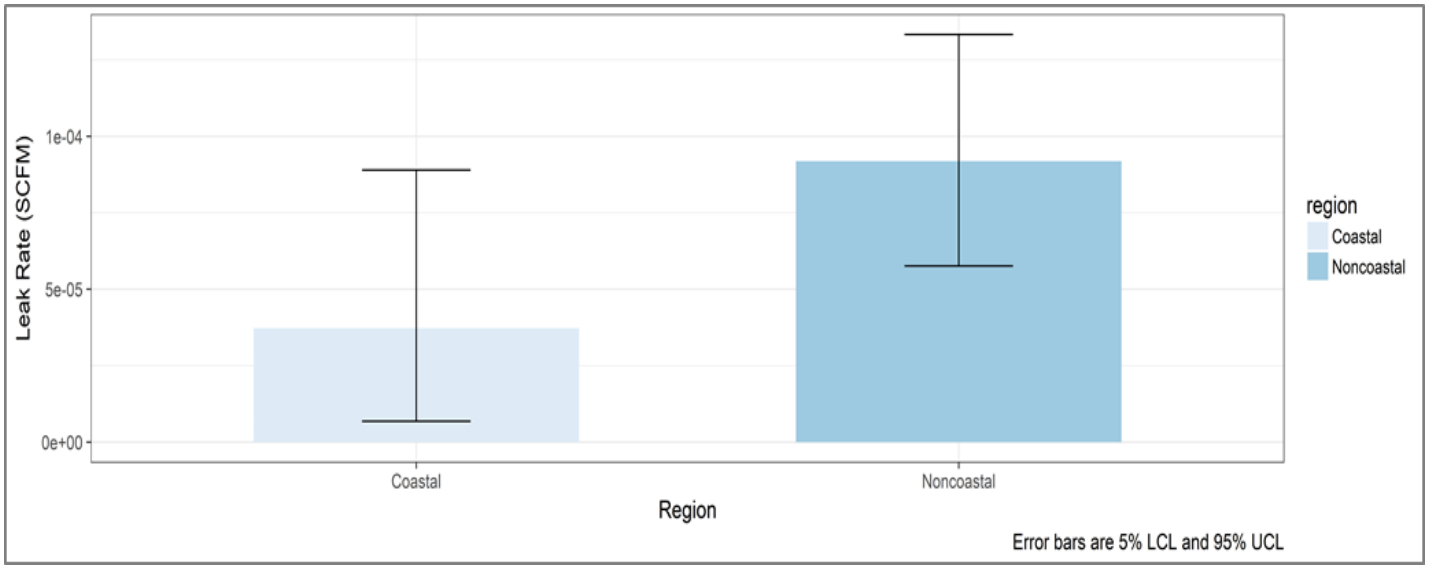
MSA Leak Rate by Company

- Emissions measured in SDG&E territory show higher average leak rates and a wider confidence interval compared to SoCal Gas and PG&E territories
- While leak rates vary by utility, differences are not statistically significant



MSA Leak Rate by Region

- Although inland MSAs exhibit higher average leak rates than those in coastal regions, the difference is not statistically significant



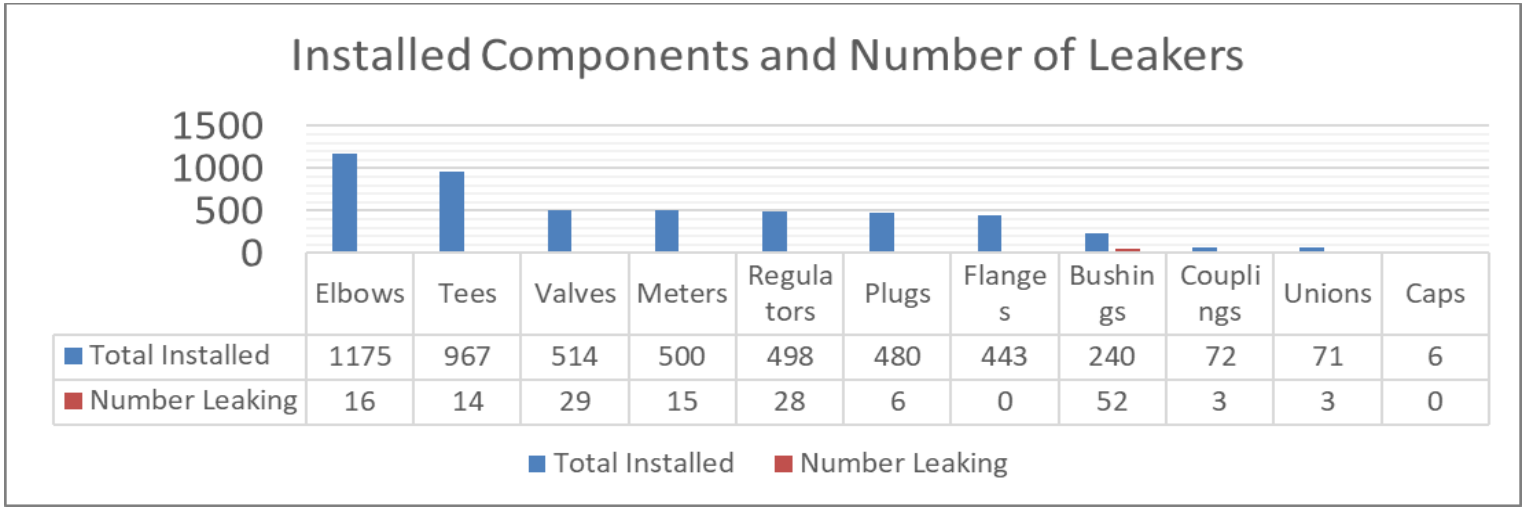
Leak Rate by Soap Bubble Indication

- 46% of leaking MSAs formed soap bubbles
- The MSAs that formed soap bubbles contributed about 62% of the emissions
- Not all leaks can be detected using soap bubble method

Leak Type/Indication	Number of Leaks/Indications	% of Total Leaks/Indications	Bootstrapped Mean Leak Rate (scfm)	Emissions Per Year (lb CH_4/year)	% of Total Emissions Contribution
Bubbles	77	46%	1.10E-04	199	62%
No Bubbles	89	54%	5.89E-05	123	38%

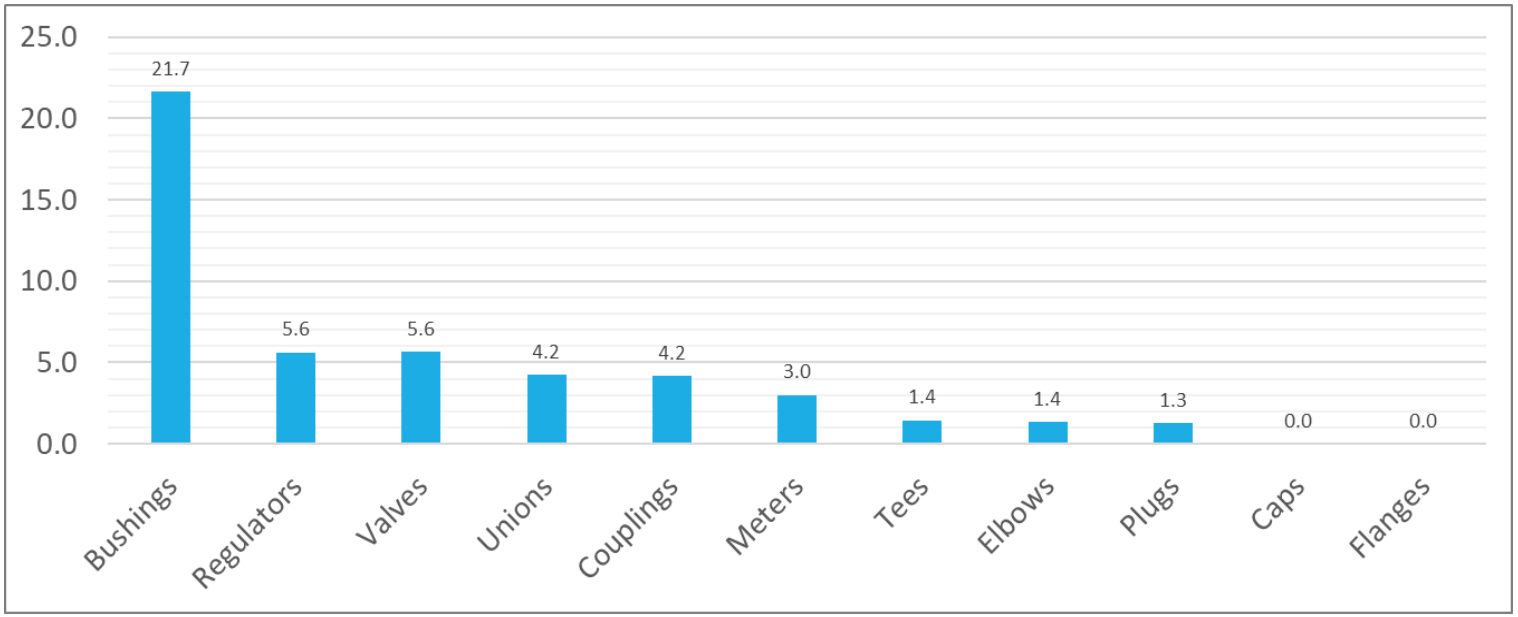
Percent of Leaking Components

- Elbows are the most common components, followed by tees
- Bushings are the leakiest component category



Percent of Leaking Components

- 22% of bushings leaked, 52 out of 240 installed
- Bushing leaks are at least three times more frequent than leaks from other components



Overall Leak Rate

- Natural gas residential customer meters in California emit on average about 90% less than in the US

Number of Leaks Identified	Bootstrap Mean (scfm)	Total Methane (ft^3/year)	Total Methane Emissions (lb CH_4/year)	Number of Residential Meters Surveyed	Residential Meter Emission Factor (lb CH_4/meter-yr)
166	8.65E-05	7547	319	500	0.64

Study Limitations

- Small sample size studied
- Due to small sample size, MSAs with larger emissions likely not included
- An adjustment to emission factors may be necessary to account for larger leaks

Next Steps

- Compare results with utility MSA study
- Form Technical Working Group
- Discuss new emission factors for:
  - 2015 baseline emissions adjustment
  - Emissions reduction estimate from MSA repairs (2020 onward)

Proposed New Emission Factor

- Use CARB study results
- Supplement with utility data for larger leaks

$$TE = ((p_1 * EF_1) + (p_2 * EF_2)) * NM$$

where:

TE = total emissions

p_i = fraction i of total MSA population

i = 1 (smaller leaks) and 2 (larger leaks)

EF_i = weighted average emission factor i

NM = total MSA population

Discussion

Questions?