









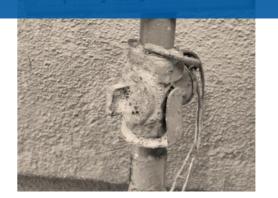


MSA STUDIES, CALCULATIONS PROPOSAL AND EF'S SOAP BUBBLE EMISSION FACTORS R&D

Company-Specific Leaker-Based Emission Factor Development for Customer Meters 2021 Winter Workshop (R.15-001-08)— Jan 21, 2021







Development of Soap Bubble Emission Factors

Proposed Methodology:

- » Replace Population-Based EFs with Leaker-Based EFs based on currently reported PHMSA "Hazardous" and "Non-Hazardous" above ground leak categories.
 - PHMSA Categories are currently based on Soap Test Criteria when soap is blown-off preventing formation of bubbles
- » Add Sub-Category of "Foam" type leaks to facilitate deferring repair of small leaks to bundle with future work.
 - Improves cost-effectiveness and helps to reduce vented emissions due to teardown and rebuild of Customer Meter facilities
- » Calculate emissions based on DM&S approach of calculating number of Unknown leaks based on "un-surveyed" Customer Meters
 - Define "Leak Survey" verses "O&M" leak record origination work types





R&D - Develop Customer Meter Leaker-Baser Emission Factors



- » Objective: evaluate a methodology of using soap test to estimate leak flow rate and develop Leak-Based Emission Factors for Distribution above-ground leaks (Pressures > 60 PSIG). Research Projects:
 - OTD 7.17.d Quantification of Small Leaks and Define Practical Lower Emission Threshold
 - OTD 7.19.e Study Framework for Developing Company-Specific Emission factors
 - CARB/GTI Residential MSA Study
 - DOE/OTD Industrial Meter Study
 - SoCalGas/SDG&E Develop Company-Specific Above Ground EFs based on Soap Test Categories

» Milestone Reached:

- OTD: Laboratory study and Field trial confirmed feasibility of the approach for quantifying leak rates based on soap test criteria. Public report submitted to CARB & CPUC. Phase 2 project proposed
- SoCalGas/SDG&E: Soap Test EF Field Study commenced in December 2020
- » Next Steps: Complete SoCalGas/SDG&E study to develop Company-Specific Emission Factors.



Miniscule (>0.02 SCFH)



Small to Medium (0.02-4.0 SCFH)



Large (>4+ SCFH)

Leak Category	Soap test description/criterion	Boundaries (scfh)
3	Soap solution produces foams with little or no bubbles	≤ 0.02
2	Soap solution produces a cluster of small bubbles up to medium bubbles	> 0.02 to ≤ 4
1	Soap solution is blown off	> 4

 $\it Table~7.~Alternative~set~of~3~leak~classification~categories$





1. Select which emission factors to develop

For example, above ground Customer meter sets, below ground Distribution Main & Service

2. Establish population characteristics and categories

- Identify historical population and leak data on target assets to establish expected mean and leak rate distribution
- Categorize assets according to available system information

3. Establish random sample methodology and sample size

- Utilize stratified random sampling for efficient, smaller sample size
- Determine sample size using precision and sample size (PrSS) analysis

4. Conduct pilot studies

Collect measurements and calculate statistical means and confidence bands for each category

5. Establish company-specific emission factors

Calculate uncertainty associated with emission factors

6. Continuous refinement of emission factors

Incorporate additional field data to lower uncertainty of emission factors

Note: based on project OTD 7.19.e. Developing a Framework for Company Specific Emission Factor Development



Framework to

develop and

refine emission

factors



EF Development Methodology Summary Flowchart

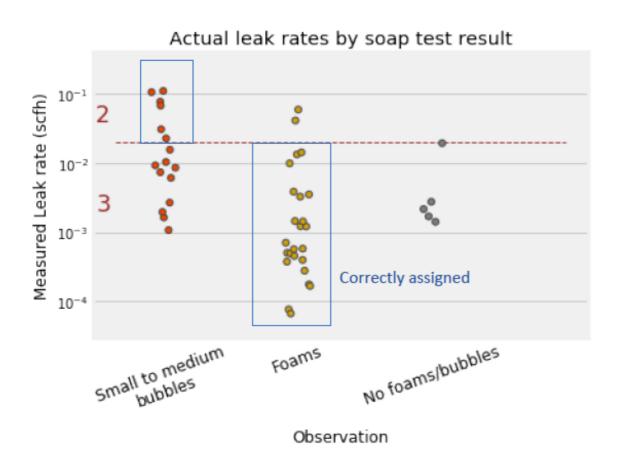
CARB MSA Study Data, OTD Industrial Meter Study Data, SoCalGas Preliminary MSA Data Sampling Plan System-Wide System-Wide SoCalGas Historical Stratified Random Sample Set sample size to achieve CARB Project Stratified Random Sample Haz. vs. Non-Haz **Emissions Data for** of Leakers as Defined By statistically robust EFs of Non-Leaking MSA's as Reported Leak Data Non-Leaking MSAs Operations (95% Confidence) **Defined By Operations** (Soap Test Done in Field) Measure CH₄ ppm, Confirm Bubble Category, Measure Emission Flow Rate Confirm Bubble Category and Measure CH₄ ppm and Leak Rate (scfh) Provides Emission Flow Rate Population and Percentile of Emitting MSA's **Provides Leak Flow Rates Populations and Bubble Category Percentiles** Non-Leaking MSA's per Operations with Detectable Emissions No Foam or No Foam **Bubbles** Soap Blown per CARB protocol (> 100ppm w/CGI) (Non-Haz) (Non-Haz) Off (Haz) Bubbles (Non-Haz) Statistical and Probabilistic Analysis Leak Flow Rates, Bubble Categories, Metadata, etc. Descriptive Statistics of: Sensitivity Analysis of: **Bootstrap Leak Lognormal Distribution Fits** Logistic Regression Bubble Categories Geographic Regions Averages and Leak Averages and **Probability Margins Between** Leak Flow Rates MSA/Meter Categories Confidence Intervals Confidence Intervals Flow Rate and EF Categories · Leaking Components CH4 Concentrations **Emission Factors** 1) Soap Solution Blown Off (Haz) 2) Bubbles (Non-Haz) 3) Foam (Non-Haz) 4) No Bubbles (Non-Haz) Non-leaking MSA Emissions (CH4 > 100 ppm)

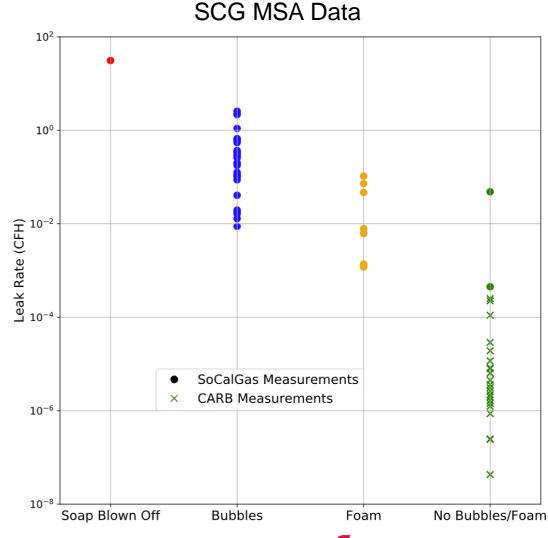




Note: for prior Non-Haz data combine EFs for 2, 3, and 4

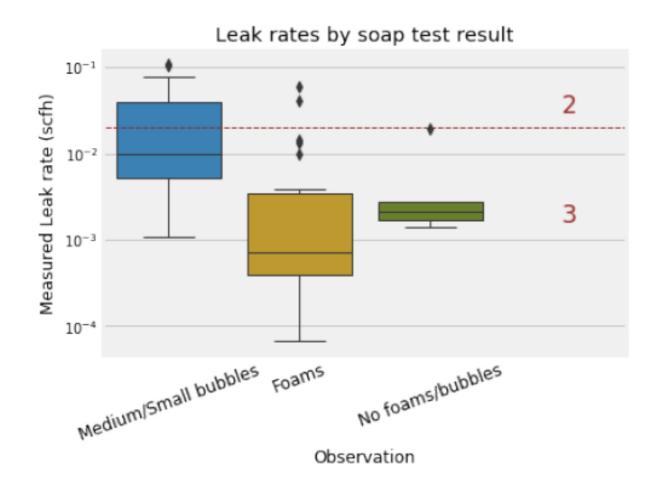
SoCalGas Preliminary MSA Leak Data compared to OTD 7.17.d Study

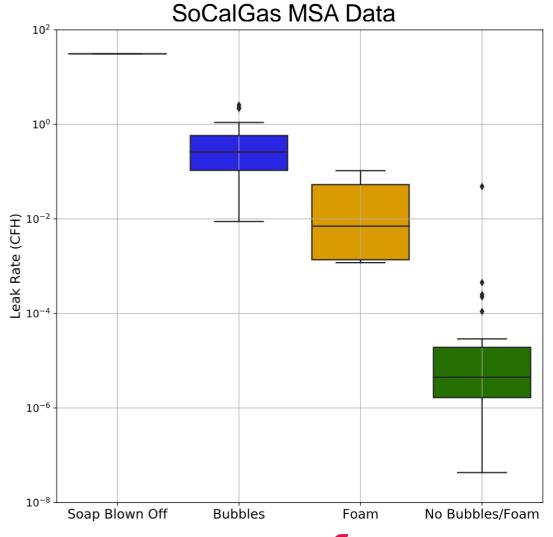






SoCalGas Preliminary MSA Leak Data compared to OTD 7.17.d Study







Questions?

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