2022 Natural Gas Leak Abatement (NGLA) Winter Workshop

9:00am-4:30pm

Tuesday, February 1, 2022

California Public Utilities Commission

Welcome, Introductions, and Review of the 2021 Joint Report

CPUC

California Public Utilities Commission

Housekeeping Notes

- Audio
  - Please mute your microphone unless you are speaking
  - Host will mute/ unmute people as needed

- Questions
  - Please hold questions for Q&A sessions at the end of presentations, unless otherwise noted by speaker
  - Click the hand next to your name in the participant list to raise hand → ✋
  - Alternatively, type questions in the chat
  - Staff will maintain a list of outstanding questions to resolve after the workshop

- Timing
  - We will try to stick to starting times for each presentation outlined in the agenda
  - We will reserve any additional time at the end of presentations for breaks

Overview of the Workshop

MORNING

- Welcome, Introductions, and Review of the 2021 Joint Report
- Appendix-Specific R&D and Updates

AFTERNOON

- Template and Reporting Updates and Baseline Adjustments
- Broader R&D Updates and Compliance Plan Efforts
- Closing and Next Steps

Detailed Agenda

PRESENTER	TOPIC	TIME
CPUC/CARB	*Introduction/Welcome; Brief Overview of 2021 Joint Report*	9:00-9:20am
	Appendix-Specific R&D and Updates	
PG&E	NYSEARCH T-786 Project Update — Transmission M&R Stations (Appendix 2)	9:20-9:45am
SoCalGas	Develop Leak-based EFs — Transmission M&R Stations (Appendix 2)	9:45-10:00am
SoCalGas	Compressor Rod Packing Emissions & Quarterly Measurements — Transmission Compressor Stations (Appendix 3)	10:00-10:30am
SoCalGas	Effects of Pipeline Material On Distribution Leak Rate & the Development of SDG&E Company-specific EFs — DM&S (Appendix 4)	10:30-11:00am
SoCalGas	Soap Bubble Emission Factors R&D — MSA Systems (Appendix 6)	11:00-11:30am
-	*Lunch*	*11:30-12:30pm*
	Template and Reporting Updates and Baseline Adjustments	
PG&E	Methodology & Baseline Adjustment (Appendix 5, 6, 3/7)	12:30-12:55pm
PG&E	Distribution System Emissions Baseline Adjustment (Appendix 4)	12:55-1:35pm
CPUC/CARB	Proposed Changes for 2022 Reporting Templates	1:35-2:00pm
CPUC	Baseline Adjustment Process and Tentative Timeline	2:00-2:30pm
-	*Break*	*2:30-2:45pm*
	Broader R&D Updates and Compliance Plan Efforts	
SoCalGas	Aerial Methane Mapping (AMM) Implementation Results	2:45-3:15pm
SoCalGas	Alternative Cost-Effective Reductions	3:15-3:35pm
PG&E	2022 Compliance Plan Measures	3:35-4:15pm
CPUC/CARB	*Closing and Next Steps, if needed*	4:15-4:25pm

Questions?

- Click the hand next to your name in the participant list
- The host will call on your name and unmute you when it is your turn to speak
- Or, type question into the chat

CALIFORNIA
AIR RESOURCES BOARD

Review of the 2021 Joint Report

2022 Natural Gas Leak Abatement Program
CPUC Winter Workshop
February 1, 2022

Background

- The 2021 Joint Report is the seventh Joint Report prepared by CPUC and CARB.
- CPUC issued data request and reporting template on March 31, 2021.
- All gas companies submitted 2020 data on June 15, 2021.
- The annual list of questions sent to utilities in July 2021 required minimal gas company data resubmittals this year.
- As required by SB 1371, the 2021 Joint Report presents total industry emissions and the systemwide leak rate.

Total Statewide Natural Gas Emissions in 2020

The total statewide 2020 estimated natural gas emissions was **5,674 million standard cubic feet**:

- **1% lower** than the 2019 adjusted natural gas emissions estimates.
- **14% lower** than the 2015 baseline natural gas emissions estimates.

Table 1: Total SB 1371 Sector Natural Gas Emissions

Sector Emissions	2015 Baseline	2019[b]	2020	2015 Baseline to 2020 Change[c]		2019 - 2020 YOY Change	
				MMscf, MMT CO2e	% Change	MMscf, MMT CO2e	% Change
Volume of Natural Gas (MMscf)	6,601[a]	5,710	5,674	(927)	(14%)	(36)	(1%)
Mass Equivalent, 100-Yr GWP, AR 4 (MMT CO2e)	2.96[a]	2.56	2.54	(0.42)	(14%)	(0.02)	(1%)
Mass Equivalent, 20-Yr GWP, AR 4 (MMT CO2e)	8.51[a]	7.36	7.32	(1.20)	(14%)	(0.05)	(1%)

Review of System Categories

Table 2: Total Natural Gas Emissions by System Category										
System Category	2015 Baseline		2019		2020		2015 Baseline to 2020 Change		2019 - 2020 YOY Change	
	MMscf	% Total	MMscf	% Total	MMscf	% Total	MMscf	% Change	MMscf	% Change
Transmission Pipeline	549	8%	294	5%	261	5%	(288)	(52%)	(33)	(11%)
Transmission M&R Station	1,007	15%	790	14%	760	13%	(247)	(25%)	(30)	(4%)
Compressor Station	163	2%	144	3%	143	3%	(20)	(12%)	(1)	(1%)
Distribution Mains & Services	1,703	26%	1,243	22%	1,178	21%	(525)	(31%)	(65)	(5%)
Distribution M&R Stations	1,348	20%	1,385	24%	1,482	26%	134	10%	97	7%
Customer Meter	1,638	25%	1,693	30%	1,704	30%	66	4%	11	1%
Underground Storage	193	3%	161	3%	146	3%	(47)	(24%)	(15)	(9%)
Total	**6,601**	**100%**	**5,710**	**100%**	**5,674**	**100%**	**(927)**	**(14%)**	**(36)**	**(1%)**

Systemwide Leak Rate

Shows the natural gas emissions relative to throughput for all respondents.

Table 4: System-wide Emissions – Throughput Categories, 2015 through 2020

Throughput Category	Natural Gas Volume (MMscf)					
	2015 Baseline	2016	2017	2018	2019	2020
Total Storage Annual Volume of Injections to Storage	199,522	116,579	155,272	137,122	213,772	182,841
Total Storage Annual Volume of Gas Used by the Gas Department	N/A	N/A	1,933	1,782	2,409	1,803
Total Transmission Annual Volume of Gas Used by the Gas Department	7,717	6,107	5,875	6,185	7,080	6,951
Total Transmission Volume of Annual Gas transported to or for Customers in state	1,832,676	1,736,336	1,842,669	1,621,332	1,751,440	1,745,839
Total Transmission Volume of Annual Gas transported for Customers out of state	16,775	18,002	11,241	11,665	12,553	12,567
Total Distribution Annual Volume of Gas Used by the Gas Department	261	156	315	320	369	362
Total Throughput	**2,056,950**	**1,877,179**	**2,017,306**	**1,778,406**	**1,987,623**	**1,950,363**
Total Emissions	**6,601**	**6,267**	**6,398**	**5,964**	**5,710**	**5,674**
System-wide Leak Rate ($\frac{Total\ Emissions}{Total\ Throughput}$)	**0.32%**	**0.33%**	**0.32%**	**0.34%**	**0.29%**	**0.29%**

The System-wide Leak Rate was **0.29%** for 2020.

Summary

- CPUC and CARB followed the process used in previous years to compile the 2021 Joint Report.
  - Following the March 2021 email with the reporting template, Staff sent reporting template revisions in April and May.
  - Respondents revised submitted data in July and August to address CPUC and CARB questions and comments.
- This year, Staff aim to finalize all template revisions by March 31 to avoid sending multiple reporting template updates.
- The proposed changes to the 2022 reporting template will be described in a later presentation.

Appendix-Specific R&D and Updates

PG&E and SoCalGas

9:20am-11:30am

PG&E	NYSEARCH T-786 Project Update — Transmission M&R Stations (Appendix 2)	9:20-9:45am
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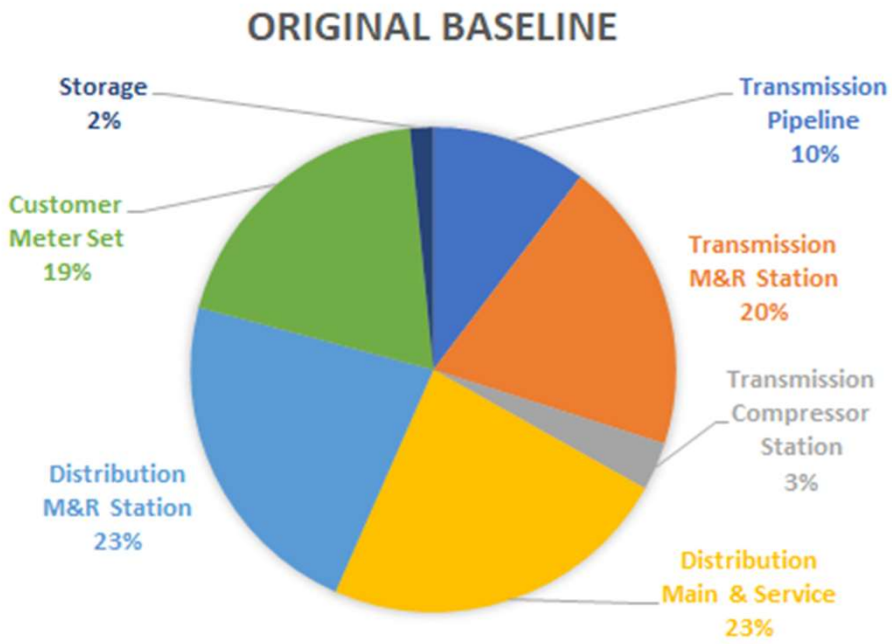
California Public Utilities Commission

T-786 Classification of Methane Emissions at Regulator Stations

Monique Montague

Background



- Transmission M&R stations make up approximately 20% of overall methane emissions in the original baseline
- M&R station emissions are currently calculated using a population-based emission factor based on a 1996 EPA study
- Using a population-based emission factor prevents the demonstration of improvement from methane abatement efforts and strategies

Project Overview

Framework:

Pneumatic devices are the main source of station emissions and can be categorized into low, intermittent, and high bleed categories

NYSEARCH and LTLT Consulting Services developed a classification tool to rank pressure regulating sites

- Class A - Continuous large emissions associated with high pressure systems
- Class B - Intermittent moderate emissions associated with high pressure systems
- Class C – Minor emissions associated with low pressure systems
- Class D – No or minimal emissions

NYSEARCH identified locations that met the Class A or B criteria. PG&E visited M&R stations to validate the framework from July through November 2021

Harkins Rd. Regulator Station (Salinas)

Station Classification

- Class A stations are high pressure systems with continuous bleed pneumatic devices

- Class B stations are high pressure systems with intermittent bleed pneumatic devices

Instantaneous Direct Measurements

- Instantaneous direct measurements were taken to validate the framework
- Several measurement methods were tested from July to November of 2021
- Measurement methods were selected based on specific component type and circumstance

Continuous Measurements

- Fixed Point Laser (FPL) Sensors were installed at 3 locations to further validate the framework through continuous measurements over time

Preliminary Results

- Stations were visited to conduct measurements and validate the ranking tool
- It's unclear whether the numbers are valid throughout the day, month, and year because the measurements are instantaneous

#	Station Name	Class	Method	Emissions
1	Los Medanos Station	A	Hi flow + RKI	V-703: 20-24 scfh V-704: 20-40 scfh V-705: 0.02 scfh V-706: 0.1 scfh V-716: 6-13 scfh
2	Fairway Ave Crossover Station	B	Anti-static Bag	V-15: 1 scfh V-16: 0.5 scfh V-18: 0.4 scfh
3	Hollister Station	B	Hi flow + RKI	V-128: 8 scfh for a few second then 0
4	Folley's Ranch Station	B	Anti-static Bag	V-11: 2 scfh V-12: 18 scfh
5	Martin Station	B	RKI only	None

Summary & Next Steps

Summary:

- NYSEARCH developed a classification tool to rank pressure regulating sites
- To verify the framework of the classification ranking tool, instantaneous measurements were taken, and FPL sensors were installed
- Preliminary results show good correlations between the ranking tool and station emissions

Next steps:

- Tool will be refined as we collect more information.
- Apply ranking criteria to all stations and to expand the sample size
- Analyze FPL data after one full year (July 2022)
- Propose a new method to better estimate, quantify, and report emissions
- Develop effective mitigative actions to reduce emissions at M&R stations

Continuous High Bleed Device (Los Medanos)

Thank You!

Monique Montague
Monique.montague@pge.com

SoCalGas A Sempra Energy utility®

APPENDIX 2 – DEVELOP LEAK-BASED EFS FOR TRANSMISSION M&R STATIONS

January 31st, 2022

Agenda ~ 15 mins

- Objective
- Method & Approach
- Project Timeline

Objective

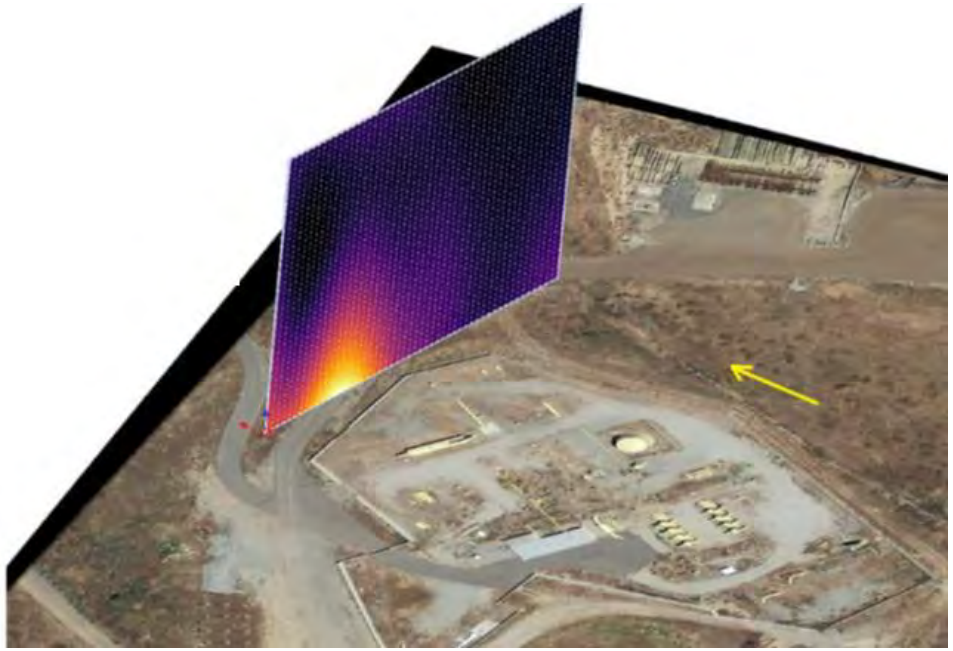
- Develop Company-Specific Leaker-Based Component Emission Factors for Transmission M&R Stations, validated by overall station emission profiles using both aerial and ground-based quantification technologies.
- This data can be used to:
  - Develop leaker-based emission factors for M&R Facility components
  - Verify thoroughness of facility emission source attribution using aerial technologies
  - Assess aerial quantification methods as a facility emissions screening tool

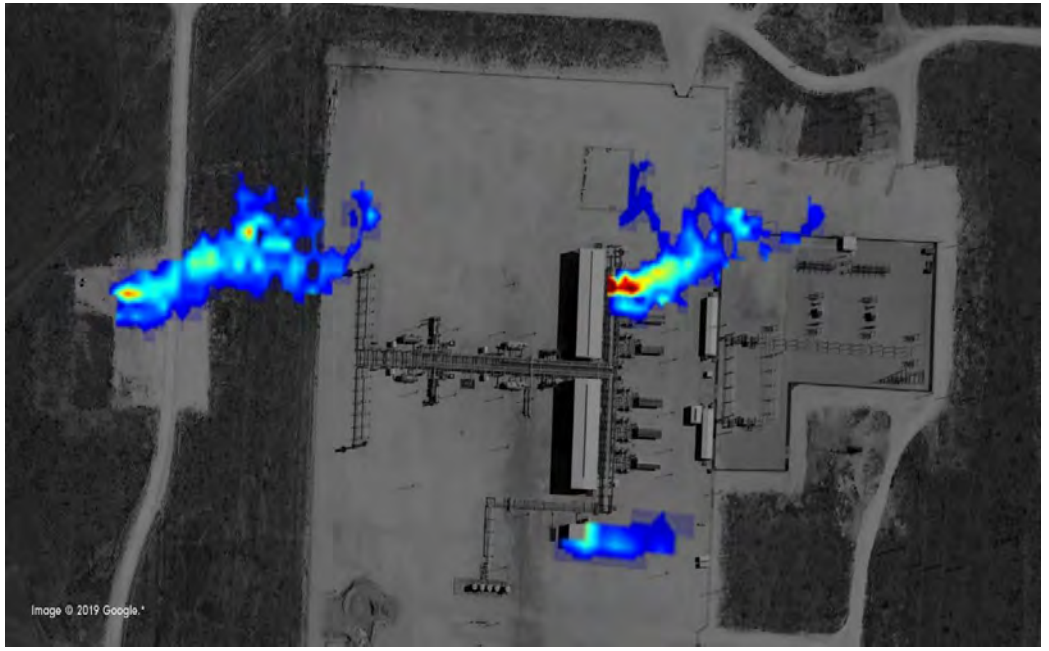
Method & Approach

- Survey 12 to 14 pressure limiting stations that capture a range of different equipment and station categories in both East and West territories
- Ground-based measurements
  - Survey all connection points and outlets within the facilities for potential emission points and quantify with Hi flow sampler.
  - Intermittent releases from pneumatic devices (e.g., valve actuators) will be measured via a meter installed at the exhaust point of the actuator.

Method & Approach

- Aerial measurements using OPLS technology
  - Survey at fence line (drone) and/or above the facility (manned aircraft) and compare quantification estimates with ground-based measurements.





Method & Approach

- Ground-based measurements (cont.)
  - Component screening for methane detection will be conducted using a TVA analyzer.
  - Aerial leak survey using TDLAS and Infrared (IR) thermal imaging camera will be used as a facility screening method to verify all emission sources are captured.

Project Timeline

Major Tasks and Milestones	2021				2022			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Project Initiation	1		2		3			
1) Develop project scope and plan								
2) Prelimary site visits								
3) Equipment acquisition								
Data Collection					1		2	
1) Perform ground and aerial surveys								
2) Quantify identified emission sources								
Statistical Analysis and Technical Reports							1	2 3
1) Perform statistical analysis								
2) Create draft report								
3) Peer review and publish final report								

Questions?

SoCalGas

APPENDIX 3 – COMPRESSOR ROD PACKING EMISSIONS & QUARTERLY MEASUREMENTS

January 31st, 2022

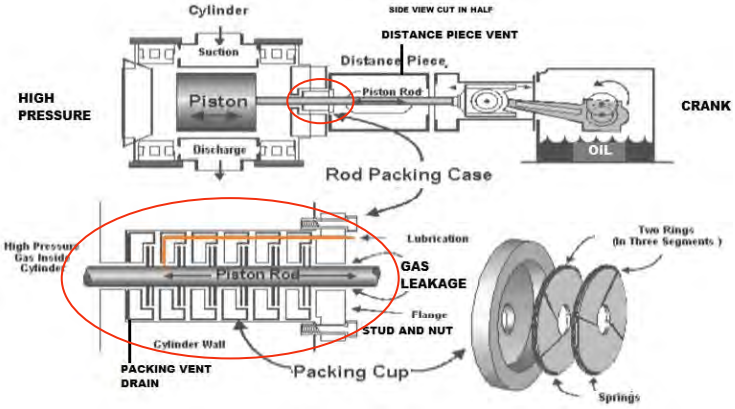
Topics

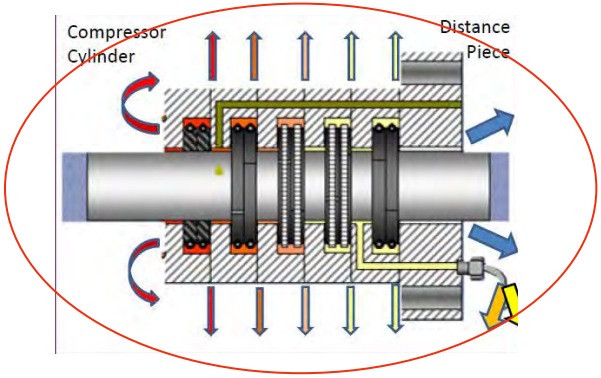
- Introduction
- Background & Highlights
- Quarterly Testing
- Rod Packing Study Project
- Quarterly Testing Alternatives
- Conclusion

Background

ROD PACKING

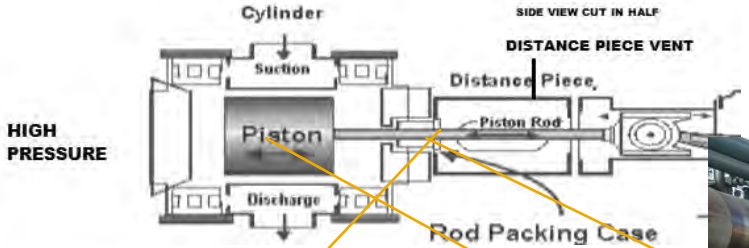
- In reciprocating compressors, the piston rod moves along a horizontal axis. This motion simultaneously draws in and compresses natural gas within a cylinder.
- Rod packing refers to the seal between the compressor cylinder and the compression rod.
- Rod packing is composed of a packing case and multiple sets of rings.
- By design, this is not a perfect seal. Every rod packing case has a vent line, which allows a small amount of natural gas to escape (vent). In addition, natural gas also vents along the piston rod surface.





Background

ROD PACKING



Background

2021 HIGHLIGHTS

- SoCalGas/SDG&E have reduced the total packing vent rate by 20% relative to the 2015 baseline.
- The Vapor Recovery Units (VRUs) at Blythe station were successfully commissioned.
- Major reduction were made at Honor Rancho station and Ventura station after working with manufactures.
  - Lubrication
- The Blythe station's slow speed compressors in plant 2 were retrofitted with Static Pak. This has resulted in as much as an 86% reduction in mode 2 rod packing venting rates.
- Successfully completed the quarterly testing pilot.

2021 TAKEAWAYS

- High Speed units continue to be identified as high emitters and at an increased need for maintenance.
- VRU not cost effective based on preliminary analysis.
- Many downstream capture systems are being investigated:
  - Venturi or inductor pump
  - Linear compressor
  - Slipstream
  - Thermal Oxidation
- Quarterly testing shows variations as normal and not a good predictor of failure.

Quarterly Testing

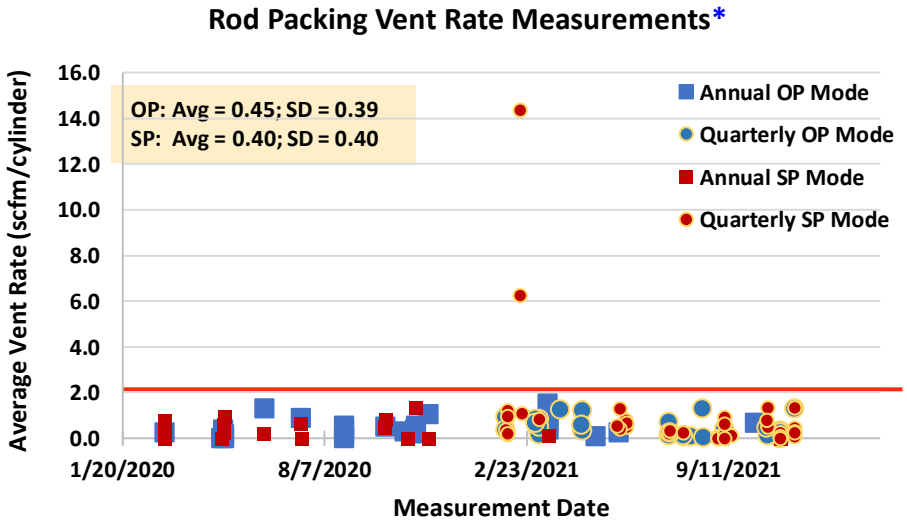
BACKGROUND

- During the 2021 Winter Workshop, questions arose about the variability of the data and about the rate at which out of compliance packing was identified. In response, it was agreed that SoCalGas/SDG&E would perform a pilot quarterly testing program, which would increase the testing rate thereby providing additional data points to help explain this variability, while also helping predict and identify failure sooner.
- 4 stations were selected to participate in the pilot study (Blythe, Moreno, South Needles, and Ventura), which encompassed a total of 24 compressors.
- As found measurements were taken for each compressor. Either operating pressurized, or standby pressurized (OP, SP).
- Pilot Goals:
  - Identify and/or characterize variability in measurements
  - Identify correlation between leak growth and packing age
    - Will increase testing predict failure?
  - Identify failures prior to annual testing
  - Collect corresponding parametric data along with vent rates.

Temperatures	Pressures	Engine Operation	Ambient Conditions
Vent gas	Rod packing (inches H_2O)	Speed (rpm)	Sunny
Rod packing	Distance piece (inches H_2O)	Power (bhp)	Foggy
Ambient	Suction (psig)	Load step	
Engine crankcase	Discharge (psig)		
	Engine/Compressor crankcase (inches H_2O)		

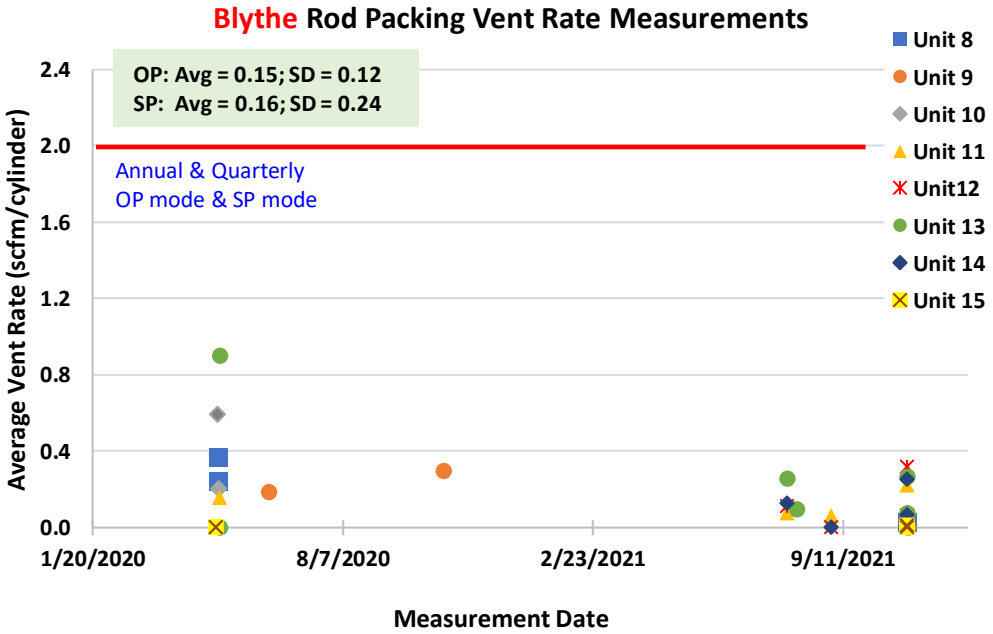
2020 & 2021 Annual + Quarterly Emission Measurements

- High emission rates (> 2 scfm/cylinder) investigated - caused by abnormal mode change made solely to conduct the measurements
- No units have trend of increasing RP emission rate with time leading to > 2 scfm/cylinder



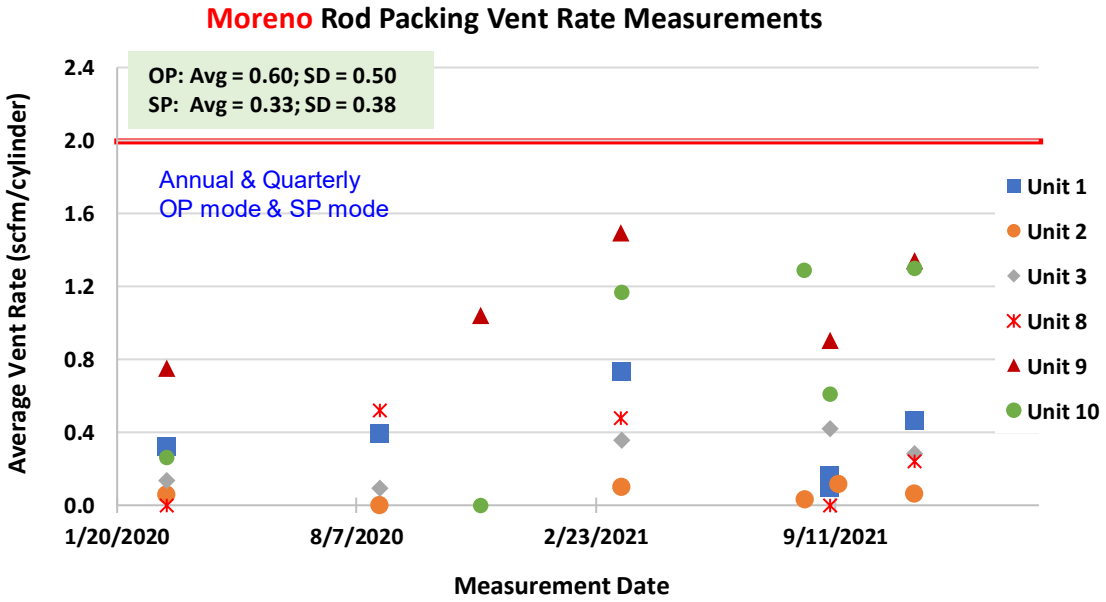
2020 & 2021 Annual + Quarterly Emission Measurements

- Blythe Clark Compressors – annual & quarterly OP mode & SP mode measurements
- No units have trend of increasing RP emission rate with time leading to > 2 scfm/cylinder



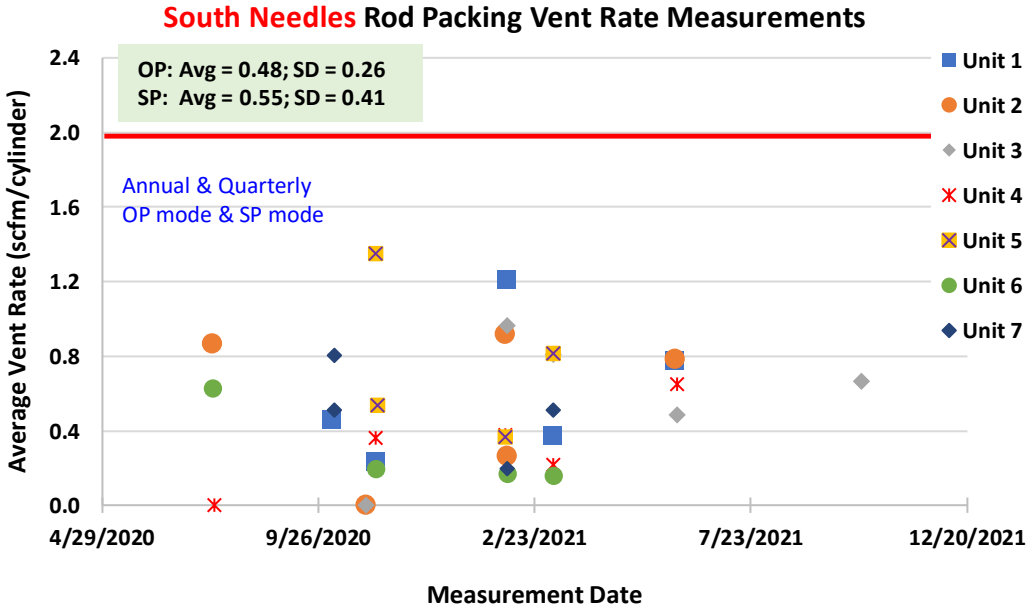
2020 & 2021 Annual + Quarterly Emission Measurements

- Moreno Compressors – annual & quarterly OP mode & SP mode measurements
- No units have trend of increasing RP emission rate with time leading to > 2 scfm/cylinder



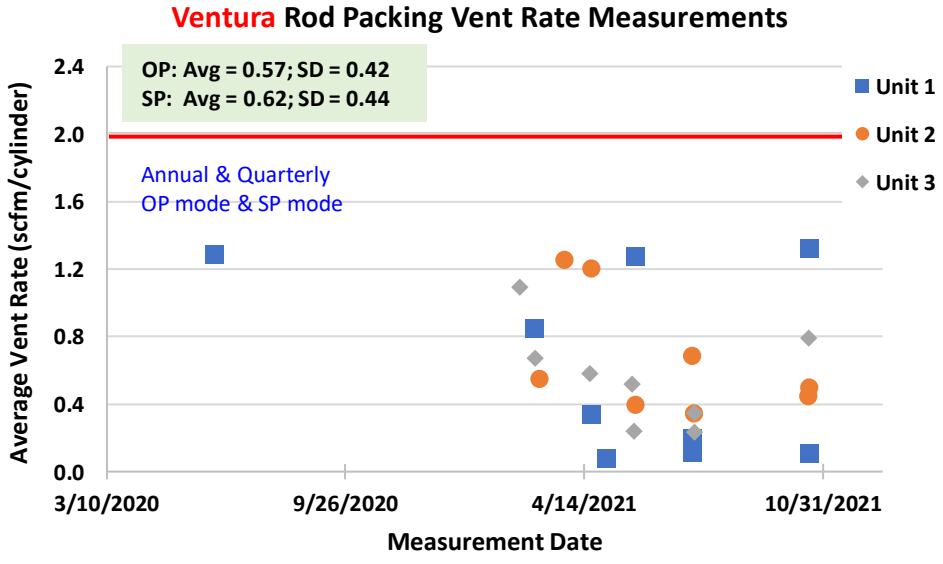
2020 & 2021 Annual + Quarterly Emission Measurements

- South Needles Compressors – annual & quarterly OP mode & SP mode measurements
- No units have trend of increasing RP emission rate with time leading to > 2 scfm/cylinder



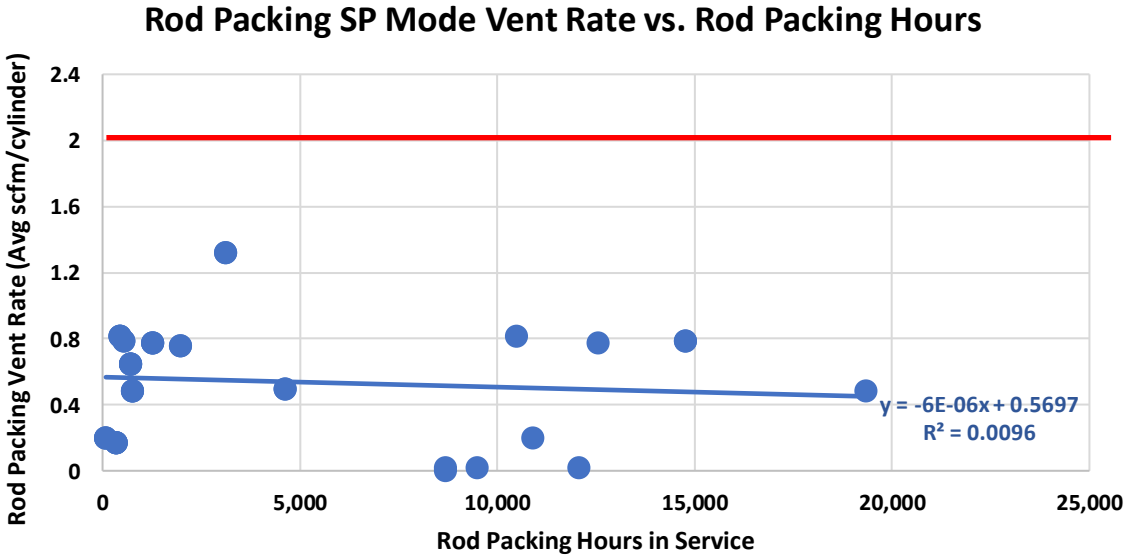
2020 & 2021 Annual + Quarterly Emission Measurements

- Ventura Compressors – annual & quarterly OP mode & SP mode measurements
  - Less anomalous SP mode high emissions measurements caused by abnormal mode change
- No units have trend of increasing RP emission rate with time leading to > 2 scfm/cylinder



Rod Packing Hours in Service

- No correlation between rod packing vent rate (SP Mode) and hours in service
  - S. Needles, N. Needles, and Ventura stations



Summary

2020 & 2021 Annual + Quarterly Emission Measurements

- Rod packing emission rates randomly vary with time
  - No trend of increasing RP emission rate with time leading to > 2 scfm/cylinder was observed
- Quarterly testing is not effective at predicting RP failures (vent rates > 2 scfm)
  - Engine start-up, operation, and blowdown for quarterly testing causes GHG emissions
  - Mode changes solely for testing can cause anomalous, non-representative, and unreliable measurements
  - Scheduling complications and personnel costs
- No correlations between vent rate and compressor and engine parameters were observed
  - RP gas temperature; RP pressure & temperature; distance piece pressure & temperature; engine horsepower, rpm, & load step; suction & discharge pressures; crankcase pressure & temperature; and ambient conditions
  - Consistent with literature review

Rod Packing Study Project

BACKGROUND

Many anecdotal factors are suspected to affect the rod packing venting rate, however there is no conclusive understanding of them within SoCal Gas/SDG&E and the industry. As such, there is an need to study these various factors in order to properly develop accurate measurement methods and respond to high emissions discoveries.

GENERAL ROADMAP

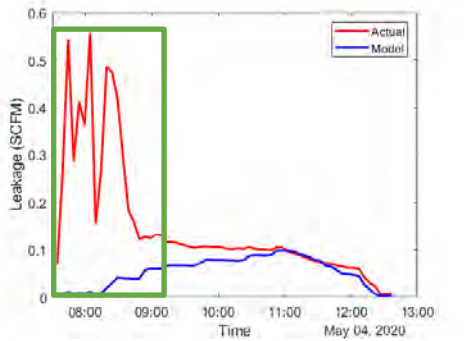
Rod Packing Study Project

OBJECTIVE 1

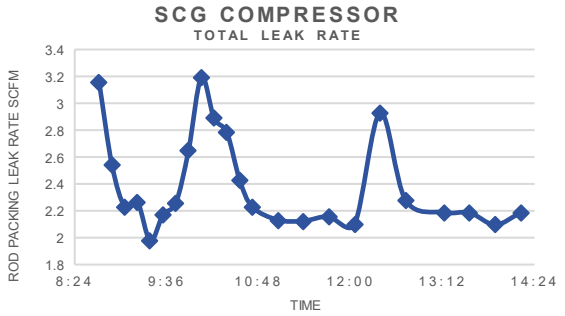
Improve measurement and accounting method for fugitive emissions from rod packing.

a. Short term: Develop a more accurate internal measurement procedure.
b. Long term: Publish study findings.

Rod packing venting rates have been shown to not behave consistently. This is especially true during start-up where rates can vary minute to minute by as much as 500%. This is attributed to several uncontrollable factors such as temperature, packing ring energization, lubrication, etc.. An anecdotal understanding as to when the packing vent rate obtains a steady state varies from hours to days. As a result, SCG & SDG&E see a need to investigate this further, but this initial instability is normal and only represents a small fraction of the total emissions.



Testing Rod Seal Leakage of a 700 HP Reciprocating Compressor, Jordan T. Nielson, SwRI, 2020



Rod Packing Study Project

OBJECTIVE 2

Identify cost effective reductions of packing emissions through standardized best practices and designs.

a. Short term: Develop a measurement piping requirement for Company compressor stations. Collect data for long term goal.
b. Long term: Develop a comprehensive recommendation for rod packing

Once further confidence is established in our testing method, we plan to investigate variables which we can control in order to further lower packing venting emissions. Current variables of focus are lubrication, manufacturer, and installation/maintenance. In addition we will continue to investigate downstream capture systems. These include:

- Electric Driven Vapor Recovery
- Linear Compression
- Intake Air Vapor Recovery

Rod Packing Study Project

Literature Review

As part of the initial efforts, a literature review was conducted by IES in order to provide testing guidance and narrow the scope of the project. The following were the major takeaways:

- "Cost Effective Leak Mitigation at NG Transmission Compressor Stations" (INDACO / PRCI, 1999)
  - RP vent rates measured at 13 compressor stations (71 recips), 10 stations had four quarterly surveys
  - Average SP mode RP vent rate about 1.5 times average OP mode RP vent rate
  - Based on limited data "there does not seem to be an observable trend in leak growth with packing age"
  - Maintenance practices recommended by RP distributor
    - Check compressor rods for alignment, taper/uneven wear, finish/roughness, and oversize
    - RP cups must be flat and smooth for packing rings to seal cup face (rework as needed), may require lapping
    - Packing case must allow cups to float vertically and horizontally within rod misalignment tolerances
    - Optimum packing materials depend on application (e.g., T, P, H_2S, HC liquids)
  - RP vent rates from stations with more rigorous RP maintenance practices (when RP changed, also removed & inspected the rod and inspected packing case) were ~ 1/3 of vent rates from stations with less rigorous maintenance (only changed RP, did not pull compressor rod)

Rod Packing Study Project

- "Compressor Seal Vent Rate Evaluation" (Accurata / Alberta Energy Regulator, 2018)
  - Analysis of existing reciprocating compressor RP vent measurements (2011 - 2017, ~ 4,000 units)
  - Additional study was recommended due to "unqualified" (e.g., incompletely documented) vent rate data, and
    - Insufficient data to compare vent rates with compressor parameters (e.g., RP age, rod speed) & maintenance practices
  - RP service providers indicated entrained debris and lubrication issues are primary causes of reduced RP life
  - "Normal" RP servicing includes replace rings, pull & refinish piston rod, and inspect & machine or replace cups
    - Some Operators limit RP servicing to ring replacement and field buffing of piston rod
  - Hoerbiger tight packing case data showed very low vent rates (< 0.1 scfm/seal) for RP life to ~ 28,000 hours
    - Slightly higher RP vent rates (~0.1 to 0.7 scfm/seal) measured during initial break-in period (normally 30 - 150 hours)
- "Compressor Seal Vent and Maintenance Study" (Advisian / Alberta Energy Regulator, 2019)
  - 156 rod packing vent rate measurements conducted on 98 reciprocating compressors in Alberta, and a very high-level analysis of vent rate as a function of rod packing maintenance practices was reported
    - Limited data suggests preventative maintenance practices (vs. condition-based) may reduce RP vent rates
  - No correlation observed between vent rate and years between packing changes, rod diameter, rpm, piston speed, throughput, time since last service, time to next service, years between major service

Quarterly Testing Alternatives

QUARTERLY TESTING CHALLENGES

Due to the nature of gas compression, rod packing is not always readily available for testing. It requires a notable amount of planning and coordination. Below are some of the challenges to consider:

Logistical

- Our compressors do not operate on a set schedule. They're use is dictated by Gas Control in response to real-time line pressures and demand. As a result it is not uncommon to have to reschedule testing the morning of.
- For safety and data quality reasons , trained personnel is required for any measurement or repair activity, which further complicates the logistics of scheduling.

Environmental

- Since our compressors do not operate on a set schedule and in many cases may not run for much of the year, we may be required to turn on units for the sole purpose of conducting a measurement.
  - As an example, a 3-hour test for a 1,760 Hp unit with 4 compression cylinders will consume about 47,000 scf of natural gas, resulting in combustion emissions of about 3.3 metric tons CO2e. If the same unit is blown down after testing because it is not being used, it will result in a venting event of about 20,000 scf, or 9.1 metric tons CO2e. In order to release the equivalent amount of GHG through the packing, you would need to continuously running the same unit for **2.4 days**.

Safety

- Compressor building are high risk areas of work, which require full PPE. An increase in the frequency of testing directly leads to an increased presence in this environment.

Quarterly Testing Alternatives

SUMMARY of POINTS

- Quarterly testing is not a reliable predictor of packing failure.
- An increase in testing will lead to counterproductive environmental effects.
- An increase in testing will also carries many logistical and safety challenges.
- Quarterly testing is a reactive approach to identifying packing failure.
- Studies show that proper installation and maintenance play a major role in packing performance by lowering the average leak rate.

Quarterly Testing Alternatives

PROPOSITION

- SCG would like to investigate a pro-active approach to lowering rod packing vent rates in lieu of quarterly testing.

- Material Specification (MSP)
  - A quality assurance (QA) document which would outline the minimum manufacturing/design requirements for rod packing for the entire Company . It would also include the creation and maintenance of a quality control inspection instructions (QCII) document, and an approved manufactures (AM) list.

  - Challenges and Benefits

- Gas Standard
  - A company operations standard for rod packing which would outline:
    - Minimum installation instructions and requirements.
    - Break-in requirements.
    - Maintenance practices and schedules.
    - Excessive venting rate inspection.

  - Challenges and Benefits

QUESTIONS?

SoCalGas

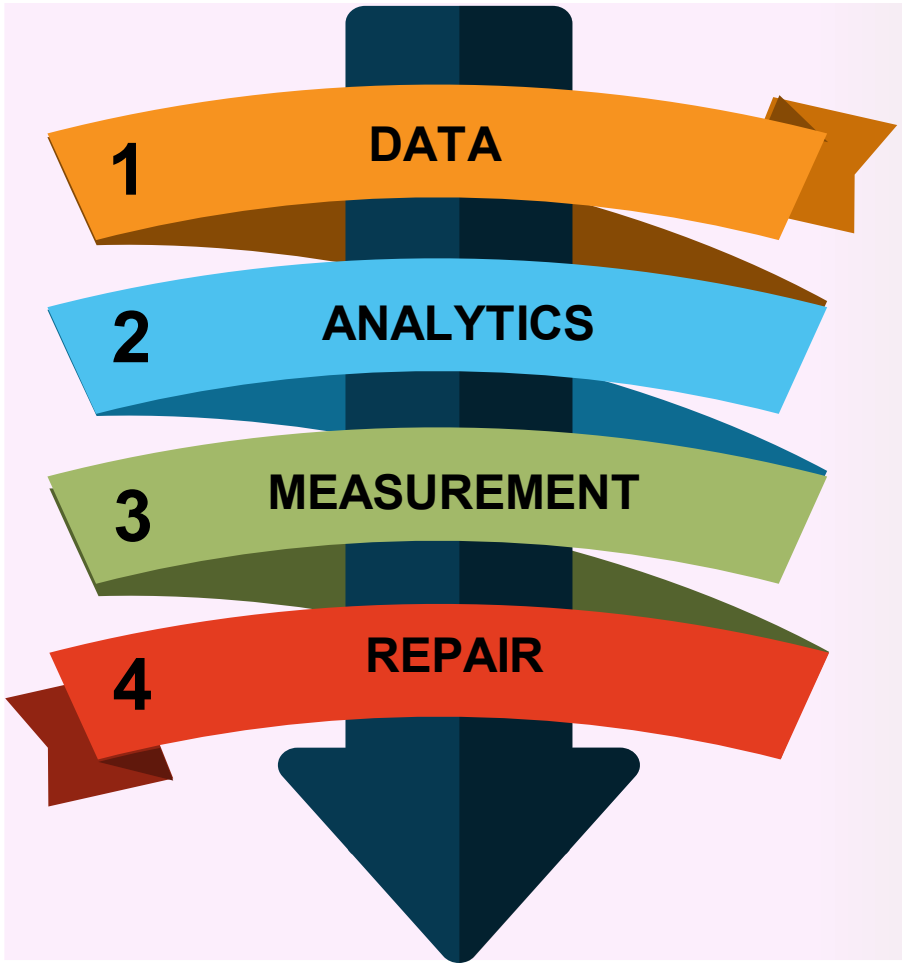
APPENDIX 4 - EFFECTS OF PIPELINE MATERIAL ON DISTRIBUTION LEAK RATE & THE DEVELOPMENT OF SDG&E COMPANY-SPECIFIC EMISSION FACTORS

January 31st, 2022

Agenda

- Overview
- Implementation Results
- Precision and Sample Size Sensitivity Analysis
- Verified Material Type and Era Analysis
- SDG&E Company-Specific Emission Factor Derivation

Large Leak Prioritization (LLP) Overview



COLLECT FIELD DATA

Leverage methane concentration data collected during routine Leak Survey & Leak Grading

DATA ANALYTICS

Algorithms identify leaks with highest probability to be "large" (10 CFH +)

MEASURE SUBSET OF LEAKS

Flux rate measured for ~8% of DM&S Non-Haz leaks detected by analytics

PRIORITIZE POTENTIAL HI-FLOW LEAKS FOR REPAIR

~18% of leaks detected by analytics are prioritized for repair

Note: DM&S – Distribution Main & Service

BENEFITS

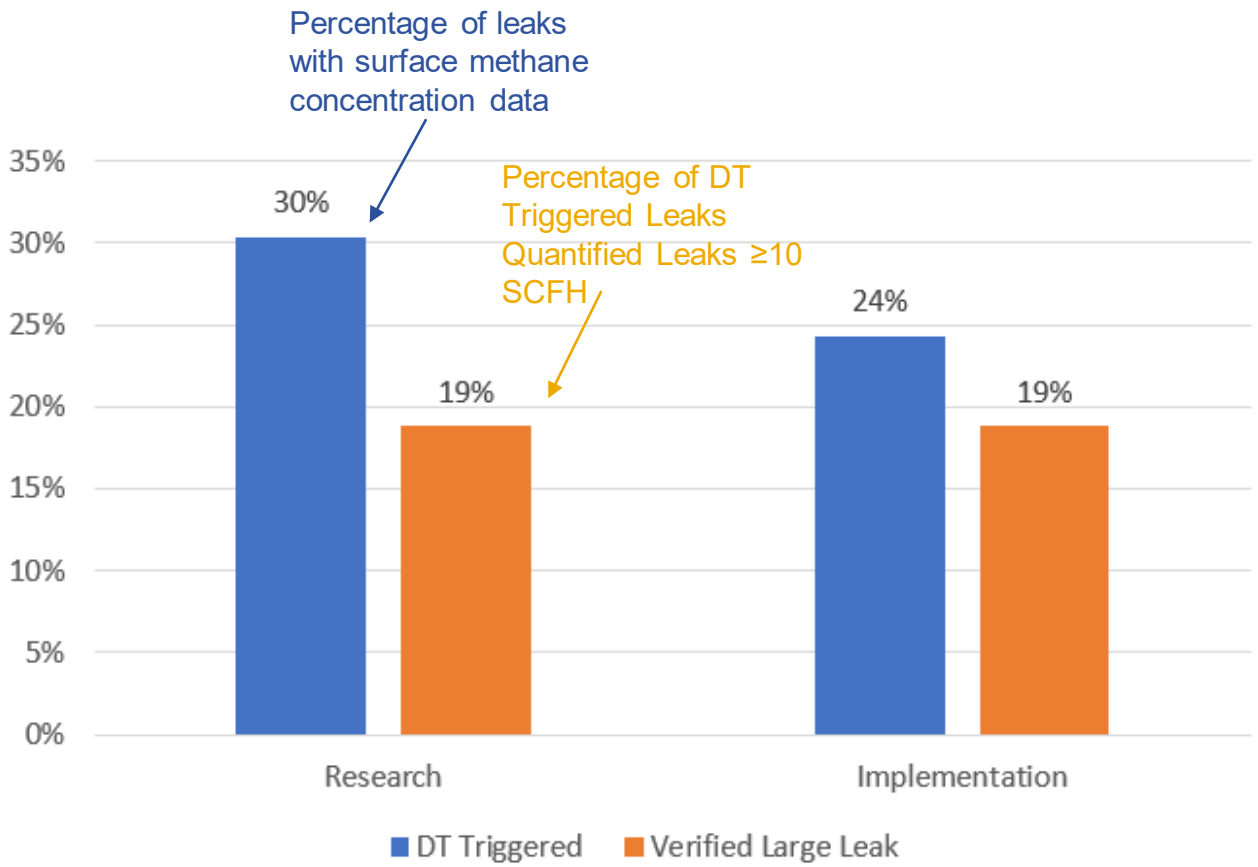
1. **Leverages routine O&M activities to minimize incremental field work**
2. **Improves cost-benefit over alternative methods**
3. **Improves Precision & Accuracy of DM&S Reported Emissions**

Company-Specific Distribution Leaker Emission Factors

- Emission Factors (EFs) derived using a combination of the appropriate bootstrap population leak rate means and the Bayesian Decision Tree error table percentiles (95% confidence)
- Result of robust methodology, data analysis, and quality data
- EFs are refined over time as more data is collected and layered on
- Methodology provides for detection of changes in system leak rates

Situation Number	Field Situation Description	Emission Factor (NG)	
1	Measured concentration triggers DT < 10 scfh category & leak rate is not measured (which would be the typical situation) - Use DT Not Triggered Ave EF	2.099 scfh	0.050 Mscf/day
2	Measured concentration DT ≥ 10 category & leak rate is not measured (used when leak rate cannot be measured, such as leaks quickly repaired or when leak is in a remote location) - Use DT Triggered Ave EF	8.298 scfh	0.199 Mscf/day
3	Leak repaired and no concentration or leak rate measurements - Use Combined All Case Ave EF	4.518 scfh	0.108 Mscf/day
4	Measured concentration(s) trigger DT >10 category & then leak rate measured and actual leak rate is < 10 scfh - Use the actual leak rate measurement for the emission factor	Use actual leak rate measurement	Convert actual leak rate measurement
5	Measured concentration(s) trigger DT >10 category & then leak rate measured and actual leak rate is ≥ 10 scfh - Use the actual leak rate measurement for the emission factor	Use actual leak rate measurement	Convert actual leak rate measurement

2021 Implementation Results

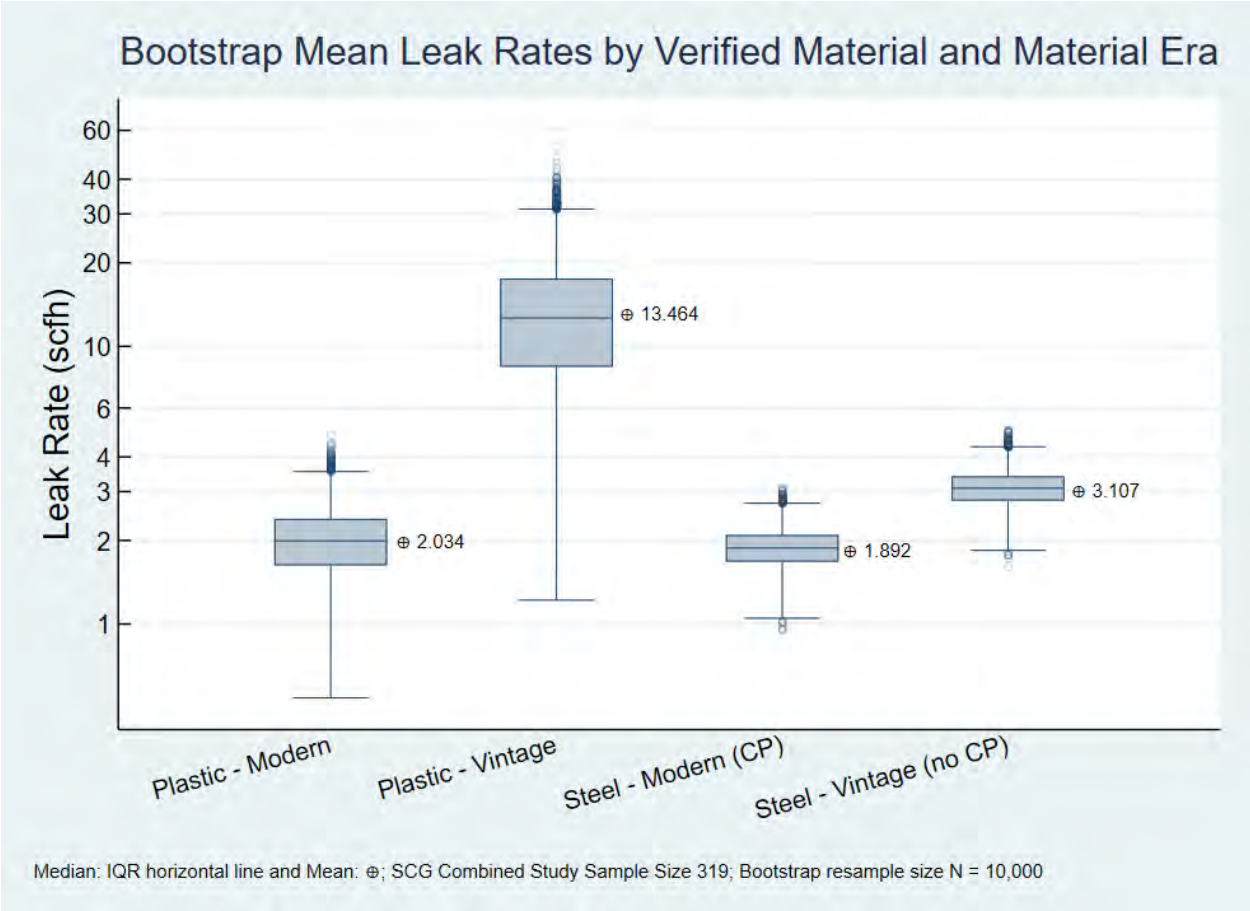


# of Leaks Prioritized for Repair	Approximate Emissions Abated (MSCF-NG)
195	27,008

Verified Material Type and Era Analysis

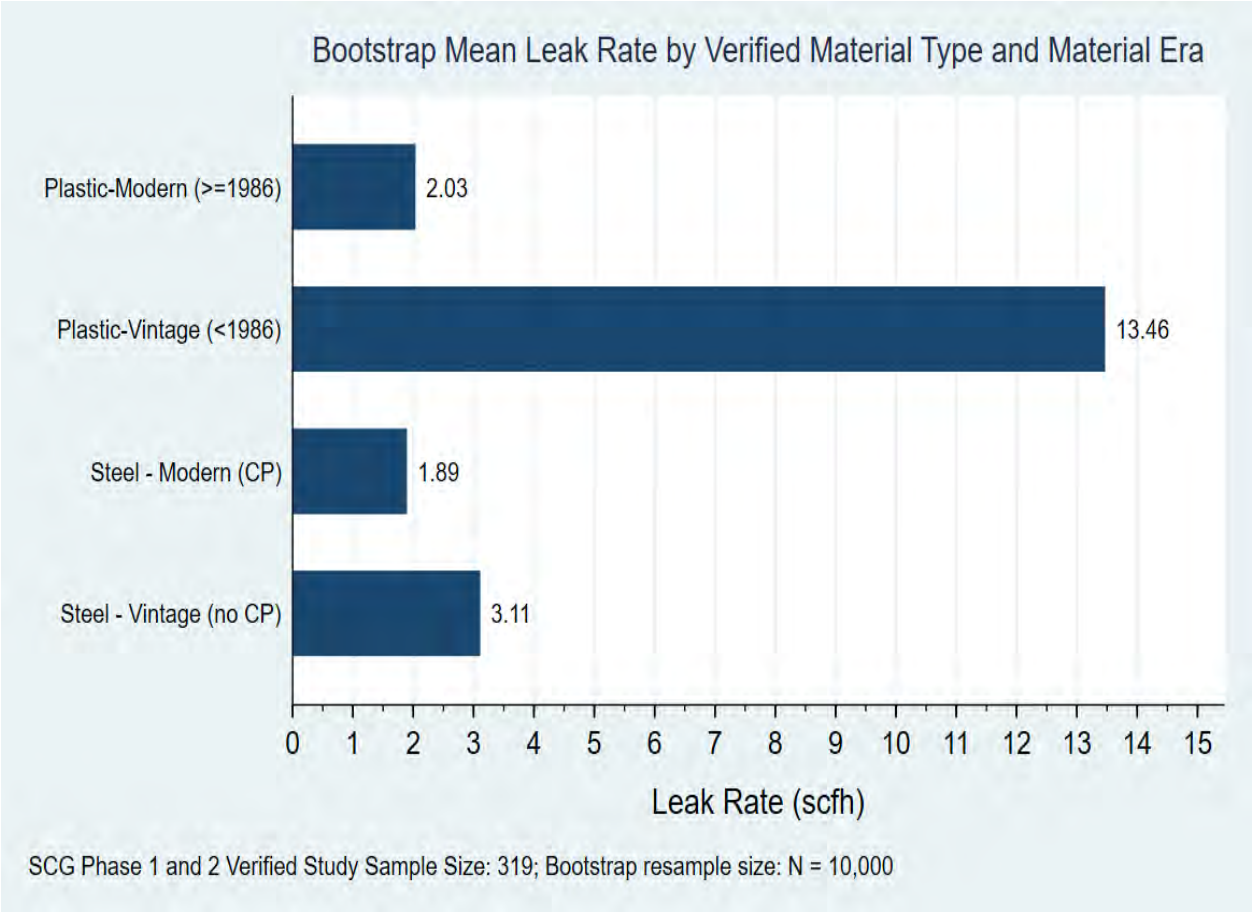
Verified Material Type and Era Analysis

- Using lessons learned from the CARB study, SoCalGas has taken the next step to evaluate the effect of pipeline material on leak flow rate
  - This analysis informs operations and management and is not intended to be used directly as emission factors.
  - Average leak rates were developed by verified material type (plastic or steel) and material era (vintage or modern).
  - Modern plastic pipe is defined as pipe manufactured on or after 1986, and vintage plastic pipe is defined as pipe manufactured before 1986.
  - Modern steel pipe is defined as pipe with cathodic protection (CP) systems installed, and vintage steel pipe is defined as pipe without a cathodic protection system installed.
  - Facility category (Main or Service) was not studied due to data quality issues and the operational challenges tied to determining the facility category. Also doing so would provide little if any true operational value.



Verified Material Type and Era Analysis

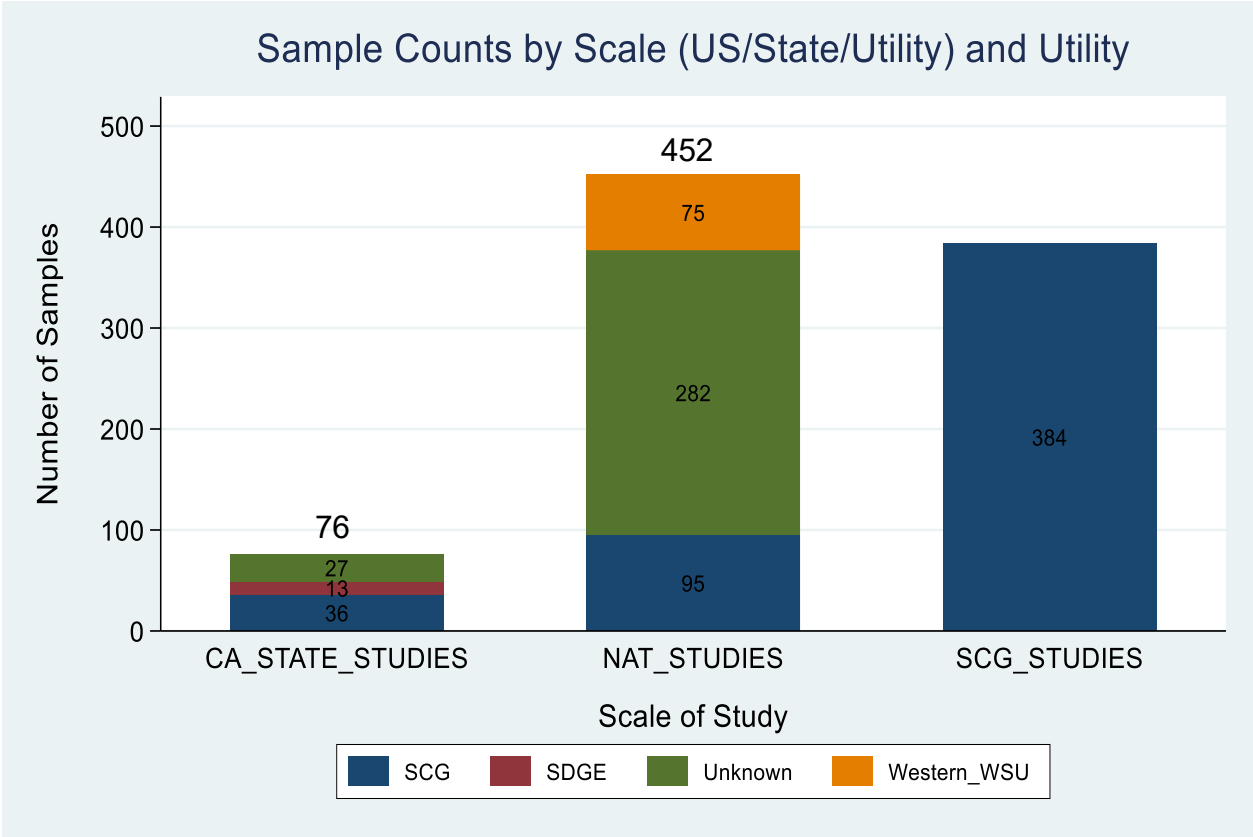
- The vintage plastic mean leak rate is significantly higher than the mean leak rate for all other material type and era categories.
- This aligns with and validates current operating practices for vintage PE:
  - Annual leak survey (i.e., 1yr instead of 3yr survey cycle)
  - Shorter scheduled time to repair for Non-Haz leaks (i.e., Code 3 – 15mo instead of 24mo)
  - Focusing the Aerial Methane Mapping program on annual coverage of Non-State-of-the-Art pipeline mileage
  - May provide another means of emissions reductions through more frequent leak survey of vintage PE pipelines, if cost effective
- Modern plastic and modern steel are very similar in mean leak rate, however there is potentially a significant difference in the frequency of leak occurrence for these two materials.
- Average leak emissions by Pipeline Materials will be refined and verified as more data becomes available.



Precision and Sample Size Sensitivity Analysis

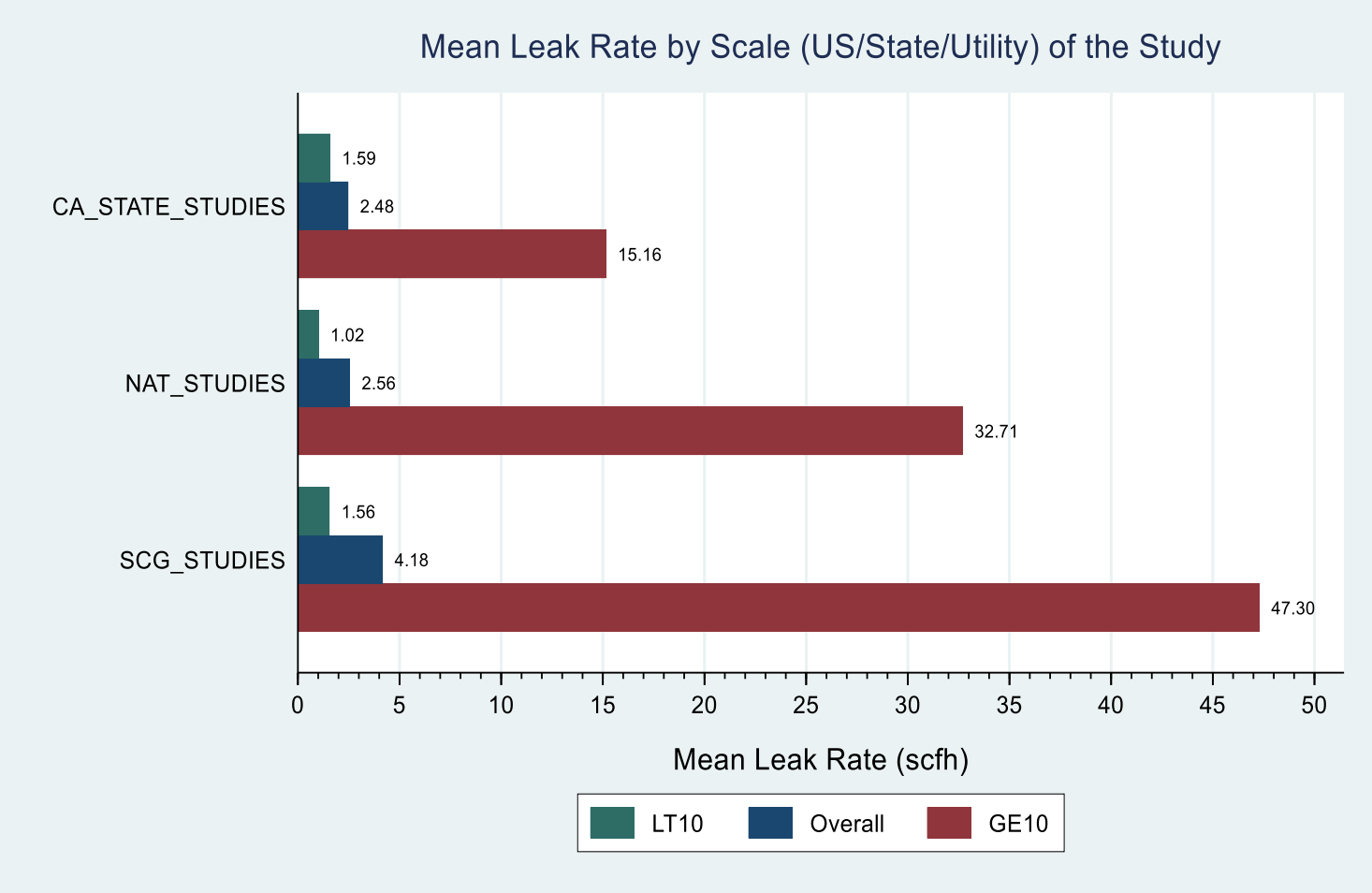
Precision and Sample Size Sensitivity Analysis

- SoCalGas is uniquely positioned to assess how data gathered from past industry studies can help develop EFs for Distribution buried leaks for the purpose of Company-Specific EFs.
  - Provided 144 samples out of 522 total samples nation-wide (28%).
  - Combined total number of system leaks measured is 528 compared to a combined total from other utilities of 384 samples nation-wide.



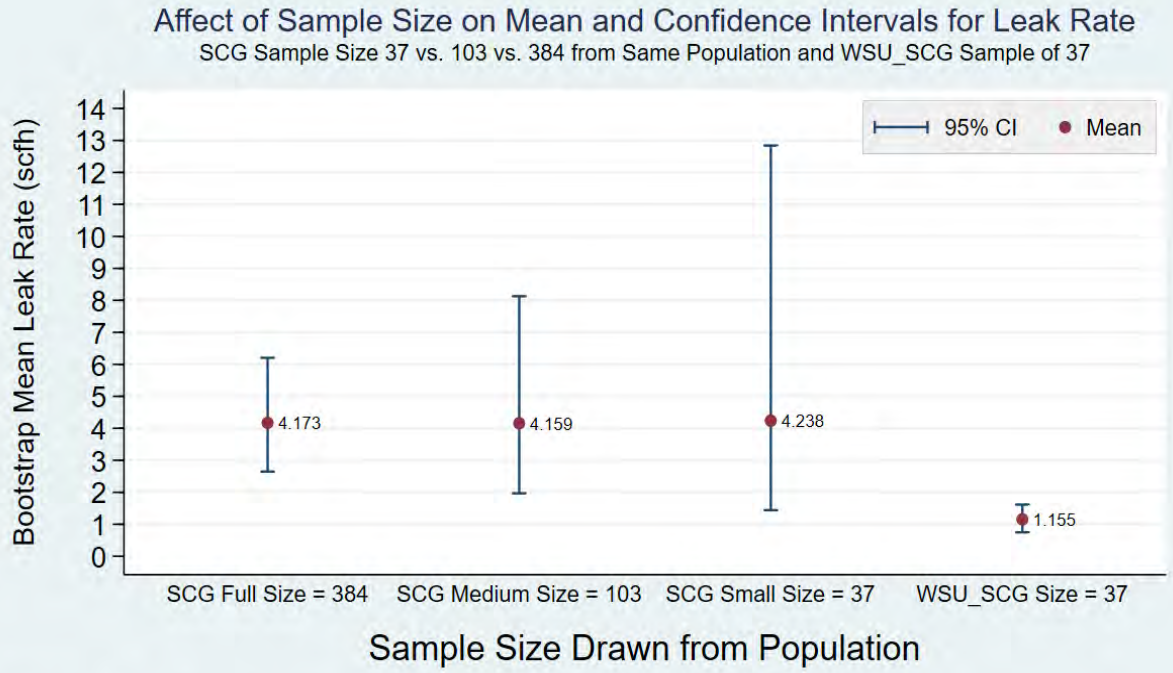
Precision and Sample Size Sensitivity Analysis

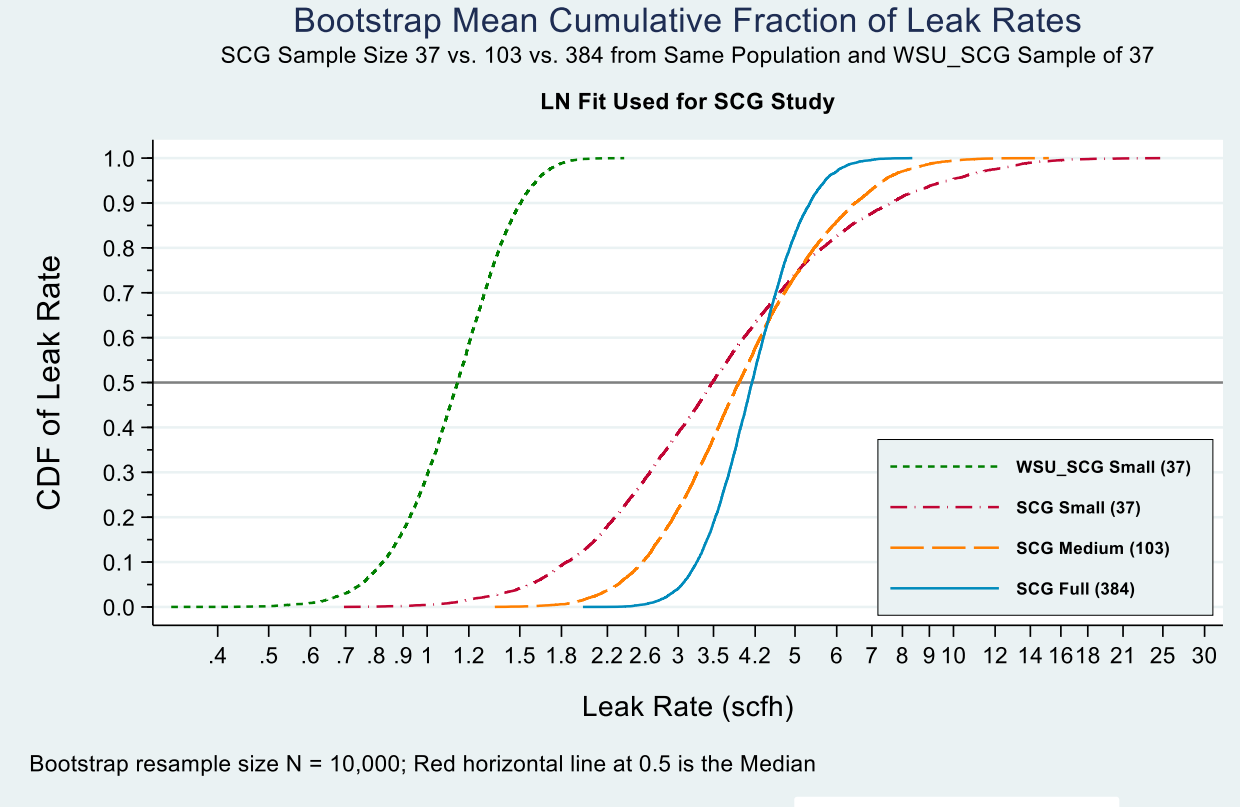
- Leveraging 10 years of SoCalGas & SDG&E involvement and support of industry studies the combined data was analyzed to explain the variation in emission factors.



Precision and Sample Size Sensitivity Analysis

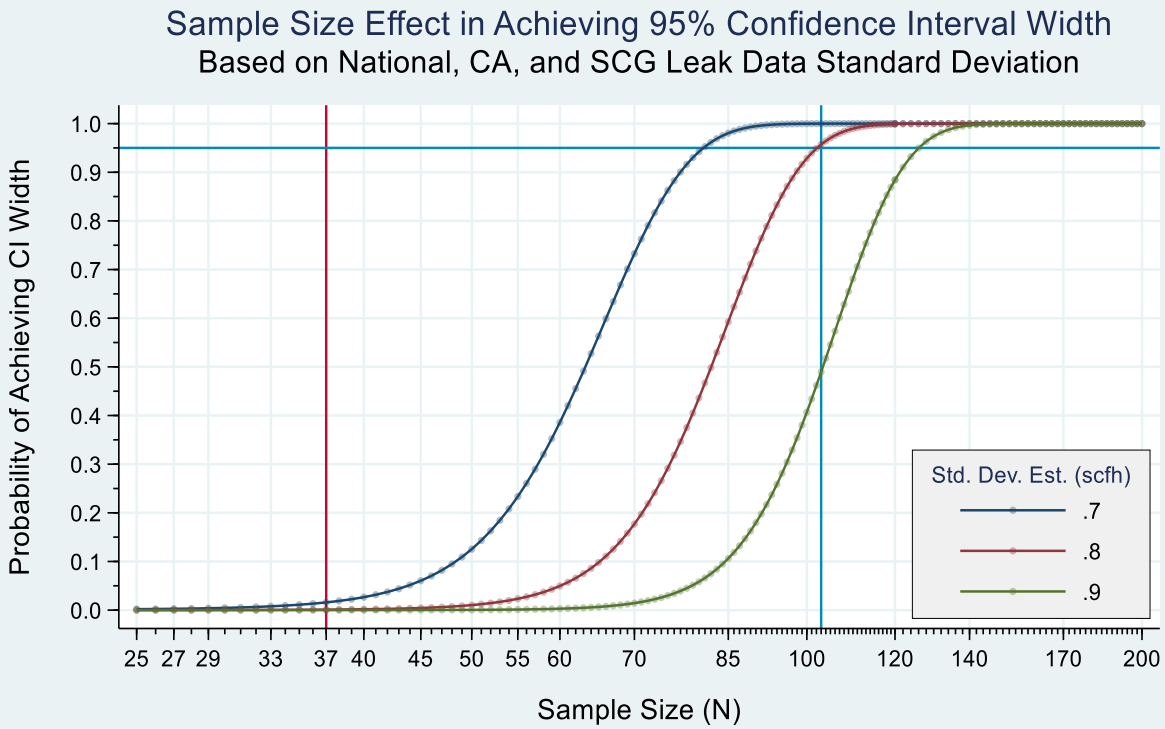
- The variation in confidence intervals due to sample size can be demonstrated by re-sampling the SoCalGas data.
- The bias in the WSU sample from the SoCalGas system could have been due to sample size or other study variables.





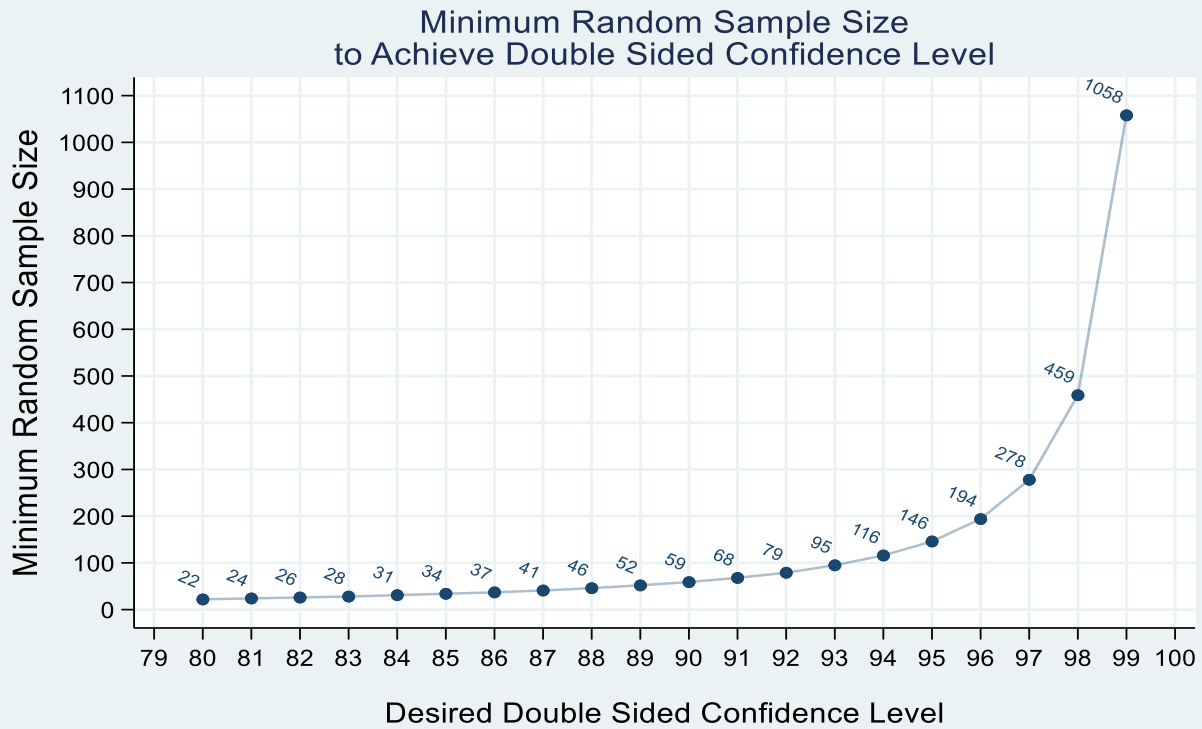
Precision and Sample Size Sensitivity Analysis

Sample Size Sensitivity Analysis



For 0.8 StdDev, a 95%/95% CL/CI Probability with a +/- 1.1 CI Width (scfh) need 103 samples (blue lines)

Sample Sizes for Bayesian Proportional Analysis



Calculation based on Bayes Theorem applied to a proportion analysis

*90% double sided confidence level equals 95% single sided confidence level

Precision and Sample Size Sensitivity Analysis

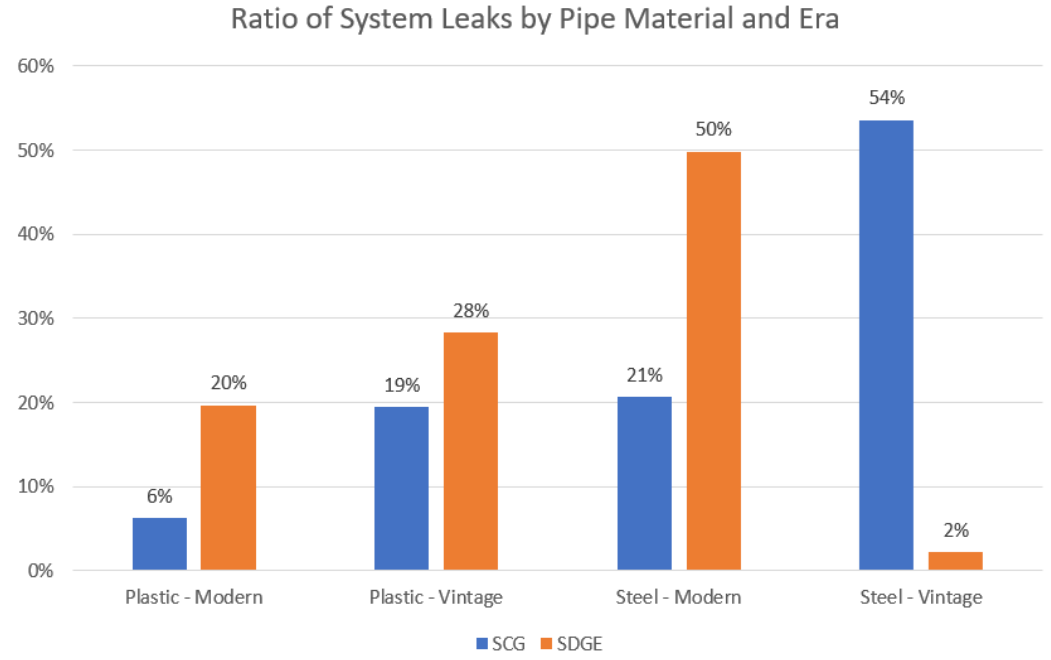
- Prior to conducting an Emission Factor study the sample size should be determined using a Precision and Sample Size analysis to achieve the desired precision and confidence interval.
- Sampling plan must be designed to achieve a statistically random sample.
- For lognormal skewed data distributions, sample sizes of inadequate size often leads to:
  - Under reported mean leak rate values for the population
  - Overly precise confidence intervals around a population mean; and
  - Non-representative confidence intervals that are too narrow and incorrectly symmetric around the mean
- The WSU study's small data set for the SoCalGas data and bootstrap analysis lead to a biased lower mean leak rate.
  - The SoCalGas WSU sample did not "encounter" any of the lower frequency, higher leak rates in the system and hence the bootstrap analysis did not have access to these via the sample
  - This resulted in a calculated population mean that was too low and did not accurately represent the entire SoCalGas leak population

SDG&E Company-Specific Emission Factors

SDG&E Company-Specific Emission Factors

Company-Specific Emission Factors were derived for SDG&E by using data from the SoCalGas study, SDG&E verified leak repair data, and pipeline inventory proportions by utility and material type

- Technical approach is founded on the statistical confidence and sample size of the SoCalGas study and similarity between the two utilities (piping systems, operating environment, operating processes and procedures)
- It would take many years to perform a similar data collection effort at SDG&E
  - SDG&E has a much lower frequency of leak occurrence when compared to SoCalGas (about 1/40th the number of annual leaks)
  - SDG&E repairs leaks as they are detected, reducing opportunity for sampling leak inventory for flow measurement

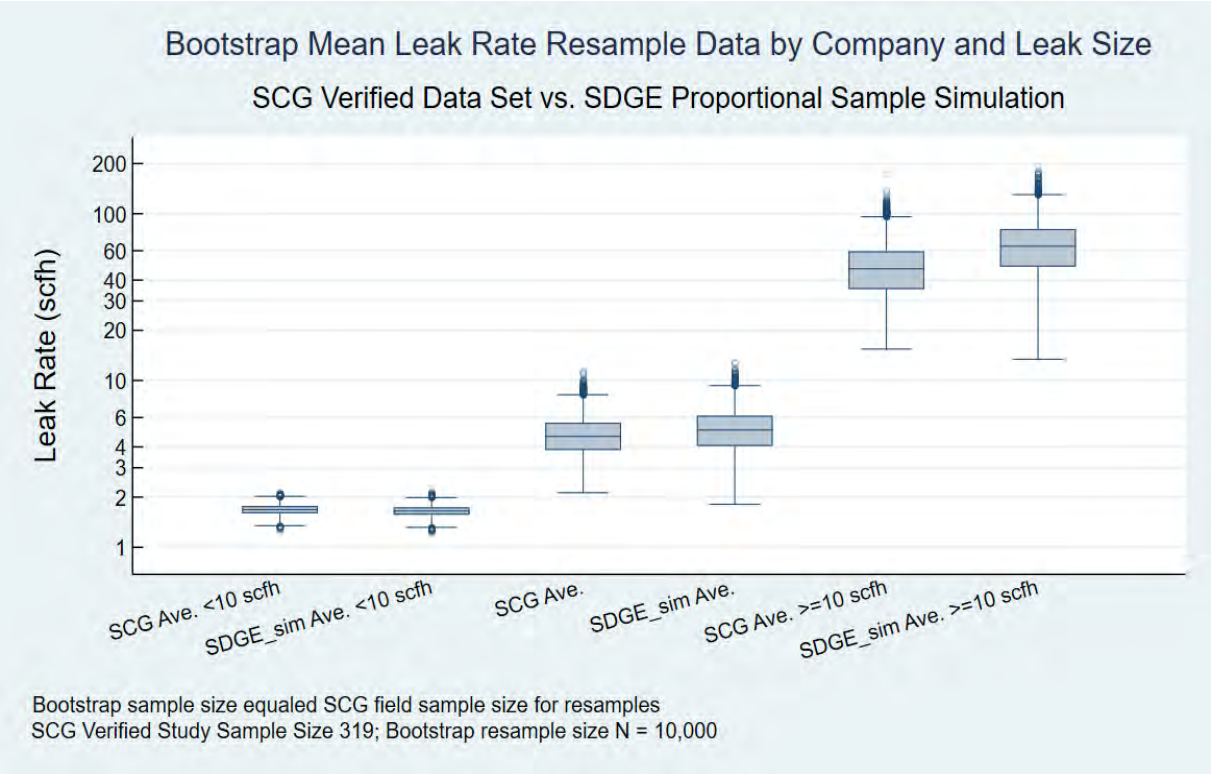


Methane Leak Rates by Company (SCFH)

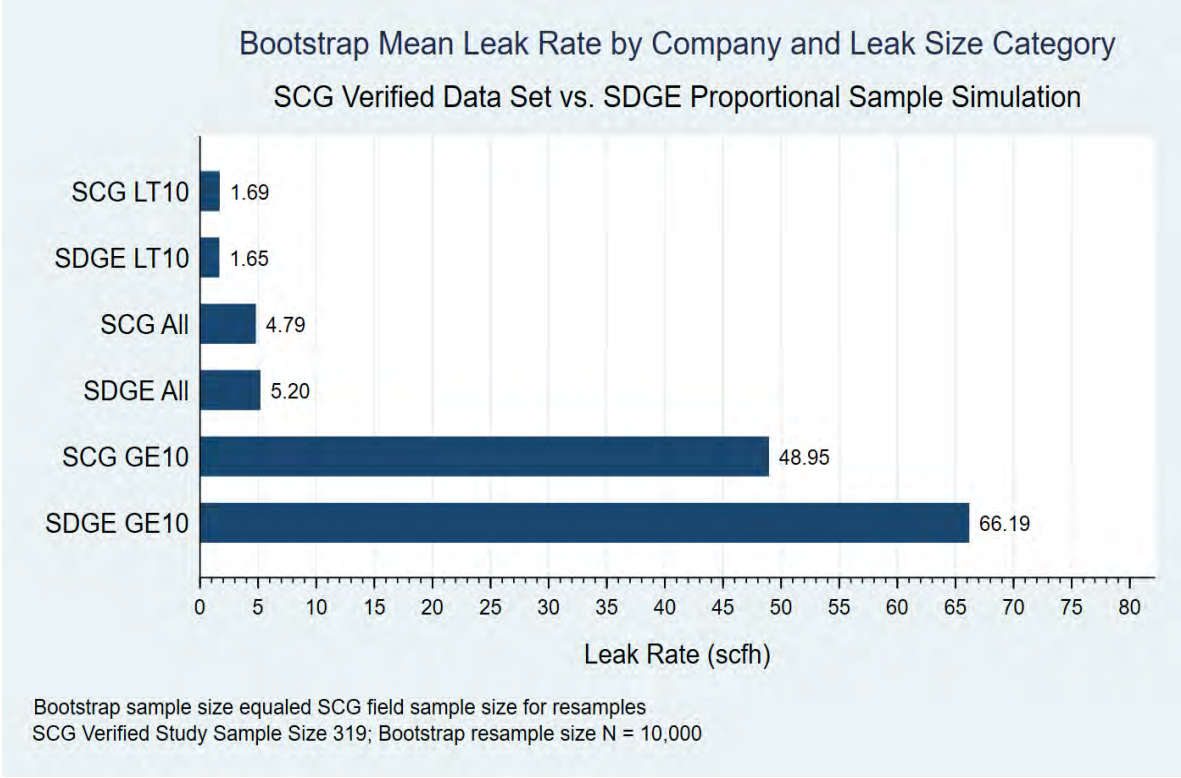
Material/Era	SoCalGas			SDG&E (95% Confidence Limits)		
	Mean	Min	Max	Mean	LCL	UCL
Modern Plastic	2.0	0.5	4.8	2.0	1.2	3.0
Vintage Plastic	3.5	1.2	52.4	13.5	4.2	25.6
Modern Steel	1.9	0.9	3.1	1.9	1.4	2.4
Vintage Steel	3.1	0.5	5.0	3.1	2.4	3.9

SDG&E Company-Specific Emission Factors

- A weighted Bootstrap analysis was completed for the SDG&E system data to establish Company-Specific average leak rate and by leak size categories and compared to SoCalGas



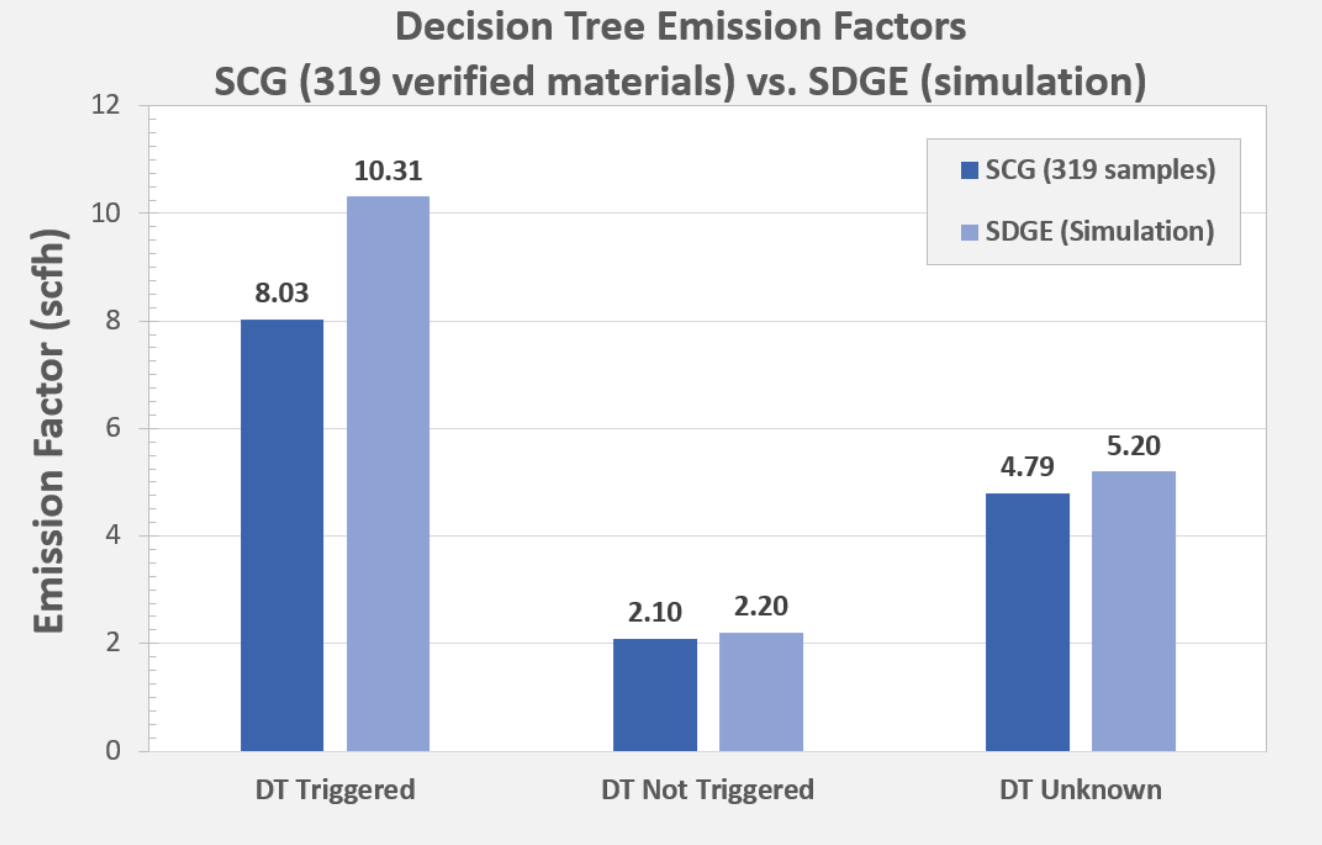
Bootstrap sample size equaled SCG field sample size for resamples
SCG Verified Study Sample Size 319; Bootstrap resample size N = 10,000



Bootstrap sample size equaled SCG field sample size for resamples
SCG Verified Study Sample Size 319; Bootstrap resample size N = 10,000

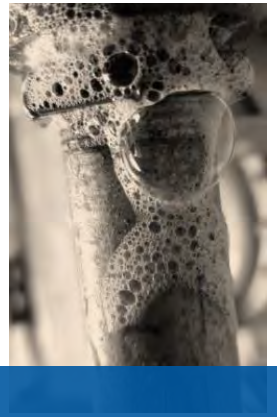
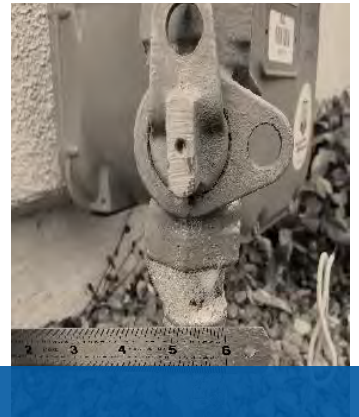
SDG&E Company-Specific Emission Factors

- The data from the SoCalGas Bootstrap analysis and Decision Tree (DT) Error Table were combined with the SDG&E simulated mean leak rates to calculate a synthetic set of Company-Specific Emission Factors for SDG&E.
  - This allows SDG&E to provide a more accurate emissions inventory and therefore a more accurate method to demonstrate emissions reductions
  - SDG&E simulated EFs benefit from the extensive scope, statistical confidence, and sample size of the SoCalGas study
  - The material-based average leak rates by themselves can also be used by SDG&E for operational, risk-based, and system integrity decision making



Questions?

Ed Newton
Gas Engineering Programs Manager
Tel: 213.244.4238
Cell: 213.219.0373
E-Mail: ENewton@SoCalGas.com

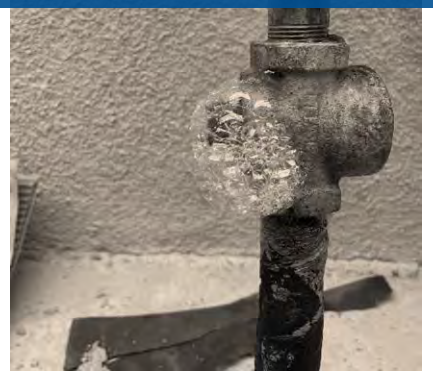



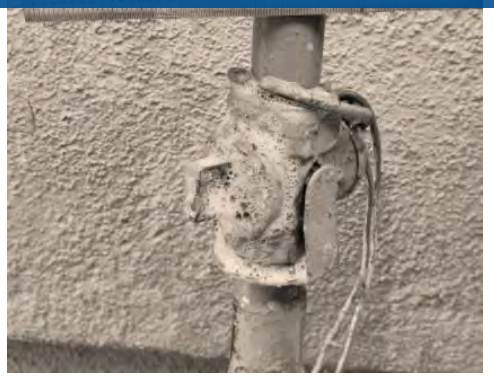
SOAP BUBBLE EMISSION FACTORS R&D

Company-Specific Leaker-Based Emission Factor Development for Customer Meters

2022 Technical Working group (R.15-001-08)

January 31, 2022





Agenda

- Overview
- Sampling Methodology
- Results
- Proposed Emission Factors

Overview

Objective

- For Customer Meter emissions replace Population-Based emission factors (EFs) with Leaker-Based EFs based on currently reported PHMSA “Hazardous” and “Non-Hazardous” Above Ground (AG) leak categories.
  - PHMSA Safety Leak categories are currently based partly on Soap Test Criteria when soap is blown-off preventing formation of bubbles
- Split “Non-Hazardous” category into two sub-categories: “Bubbles” and “Foam”
  - May facilitate deferring repair of very small leaks to bundle leak repairs with future work
  - May improve cost-effectiveness and help to reduce vented emissions due to tear-down and rebuild of Customer Meter facilities
- Develop EF for CARB "No-Bubble EF" to account for non-leaker Customer Meters
- Calculate emissions based on DM&S approach of calculating number of Unknown leaks based on “un-surveyed” Customer Meters and apply to baseline if possible
  - Define “Leak Survey” verses “O&M” leak records based on origination work-types

Overview

» R&D Project designed for five (5) Above Ground (AG) Leak categories

1. Soap Blown-Off

2. Bubbles

3. Foam

4. Indeterminate – when soap test does not work
5. Non-Leaker EF for undetected emissions
    - MSA emissions below detection limits of survey process
    - ≥100ppm w/CGI per CARB/GTI study protocol

» Also evaluate current AG Haz and AG Non-Haz categories

Sampling Methodology - Leakers

Coordinate with Gas Operations Leak Survey

- Determine leak location(s) via leak survey
- Grade the Leak (AG-Haz, Non-Haz, Minor-TLA)
- Provide concentration reading at leak point to R&D team to record
- Soap test the leak

R&D Team

- Determine soap bubble category
- Record picture/video with ruler for each leak location
- Record concentration reading at leak point with CGI
- Connect appropriate adapter to leak location for Hi Flow Sampler
- Quantify leak rate with Hi Flow Sampler

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Sampling Methodology – Non-Leakers

R&D Team

- Identify areas that had been recently surveyed
- Take CGI Measurement at all threaded joints and components (similar to Method 21)
- Perform Soap Test
- Determine soap bubble category
- Record picture/video with ruler for each leak location
- Record concentration reading at leak point with CGI
- Connect appropriate adapter to leak location for Hi Flow Sampler
- Quantify leak rate with Hi Flow Sampler

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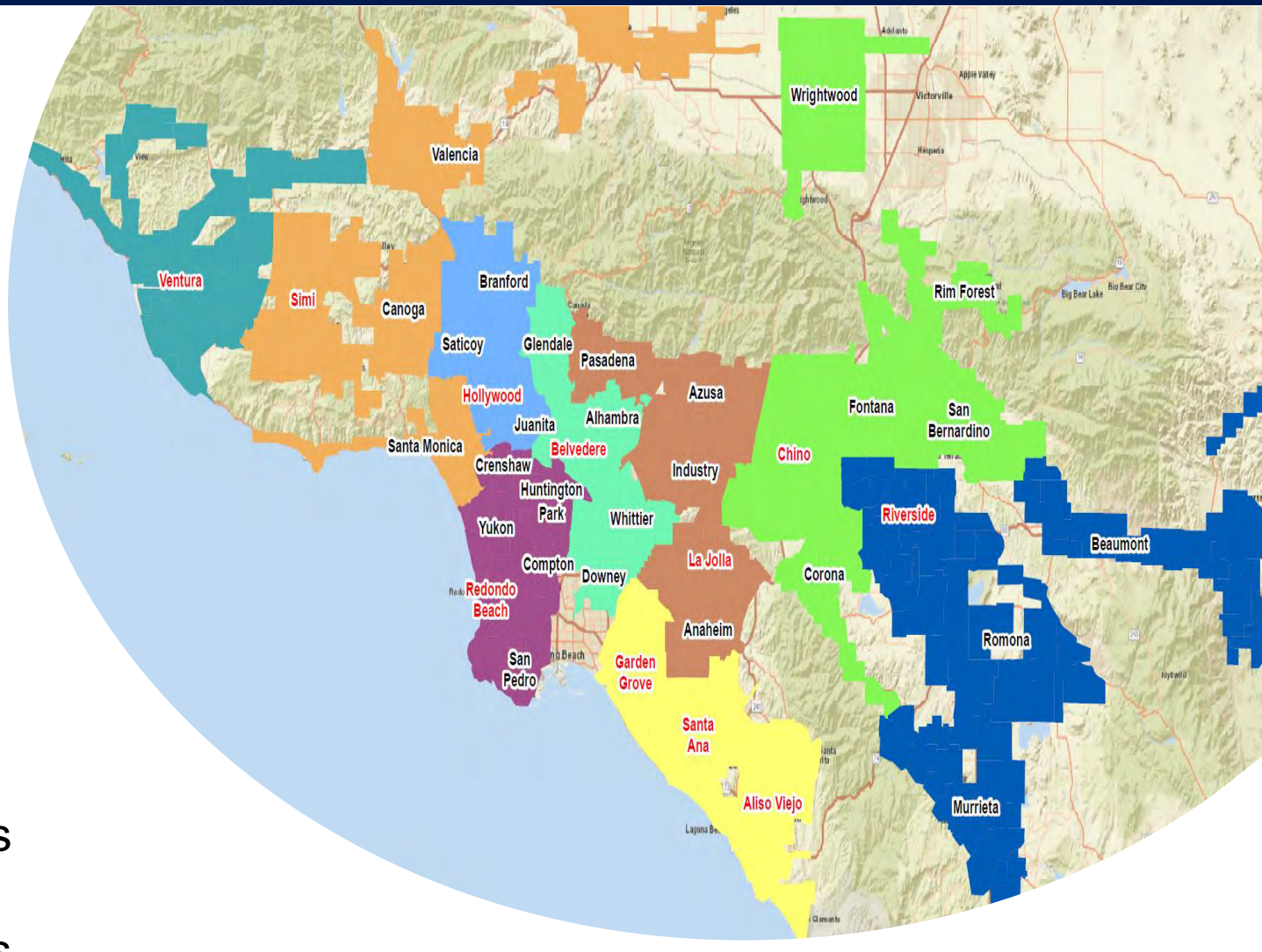
Random Sampling Plan

System-wide random sampling across SoCalGas territory

- Geographically grouped districts into nine meta districts with roughly equivalent meter counts
- Randomly selected one district within each meta district for sampling
- Collected 458 Leaker MSA bubble categories and flow rate measurements
- Collected 79 Non-leaker MSA bubble categories and flow rate measurements across 203 non-leaking meters sampled



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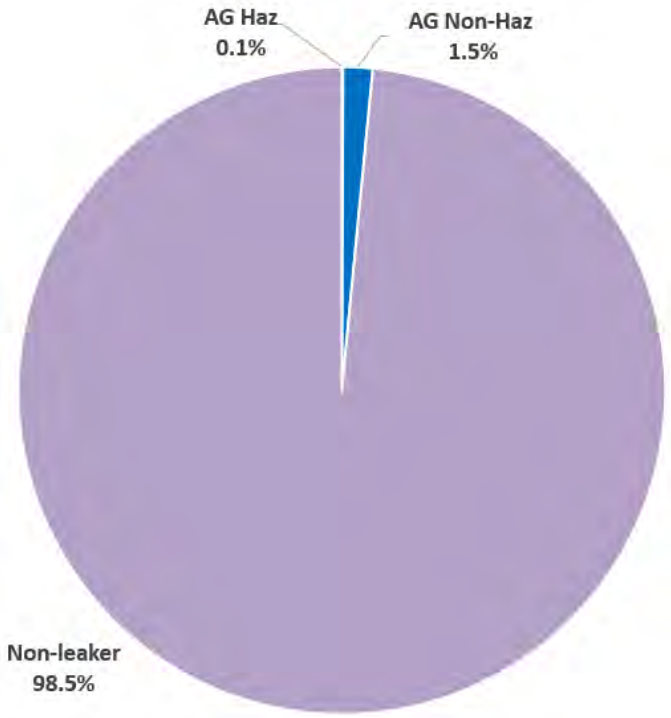
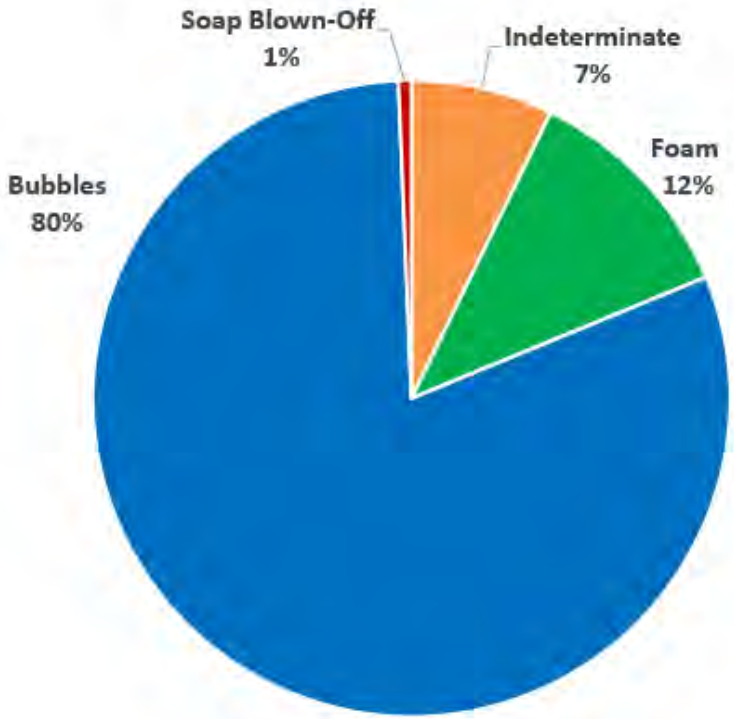
SoCalGas Customer Meter (MSA) Data

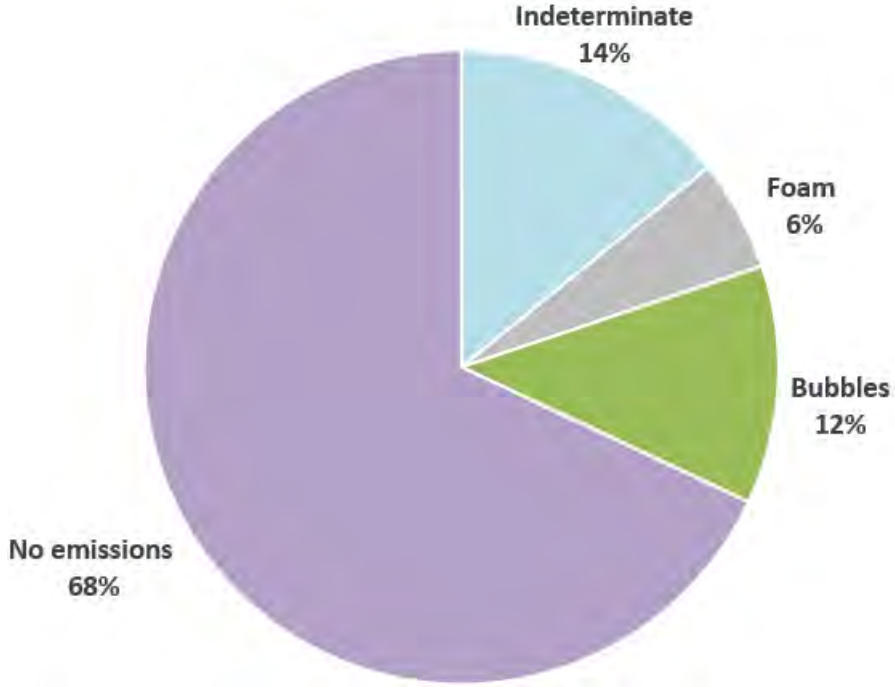
AG Leaks from All MSAs Surveyed Annually (59.5% of MSAs)



MSA Leak Soap Test (458 samples)



Non-leaker MSAs Un-Detected Emissions (203 samples)



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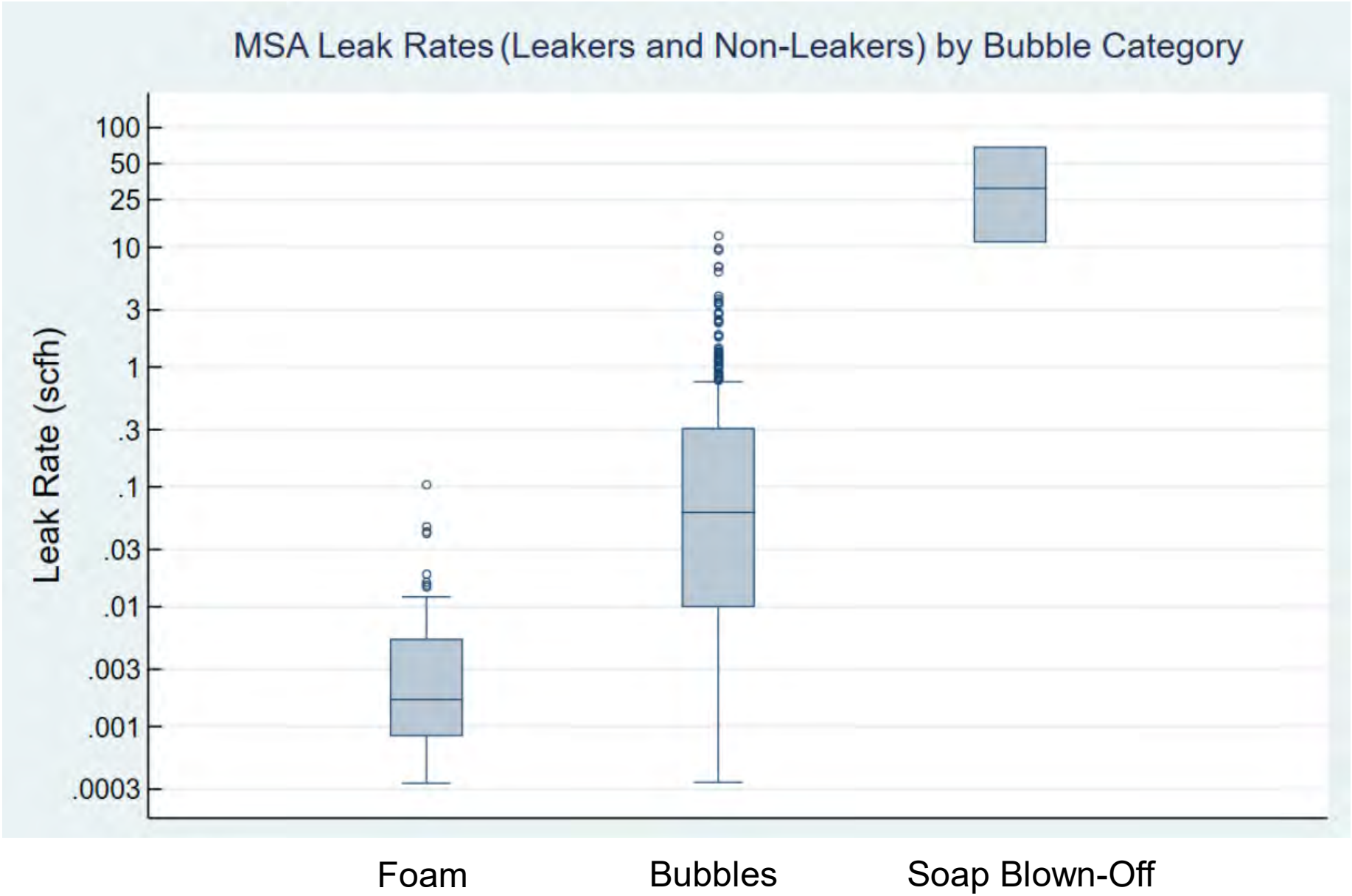
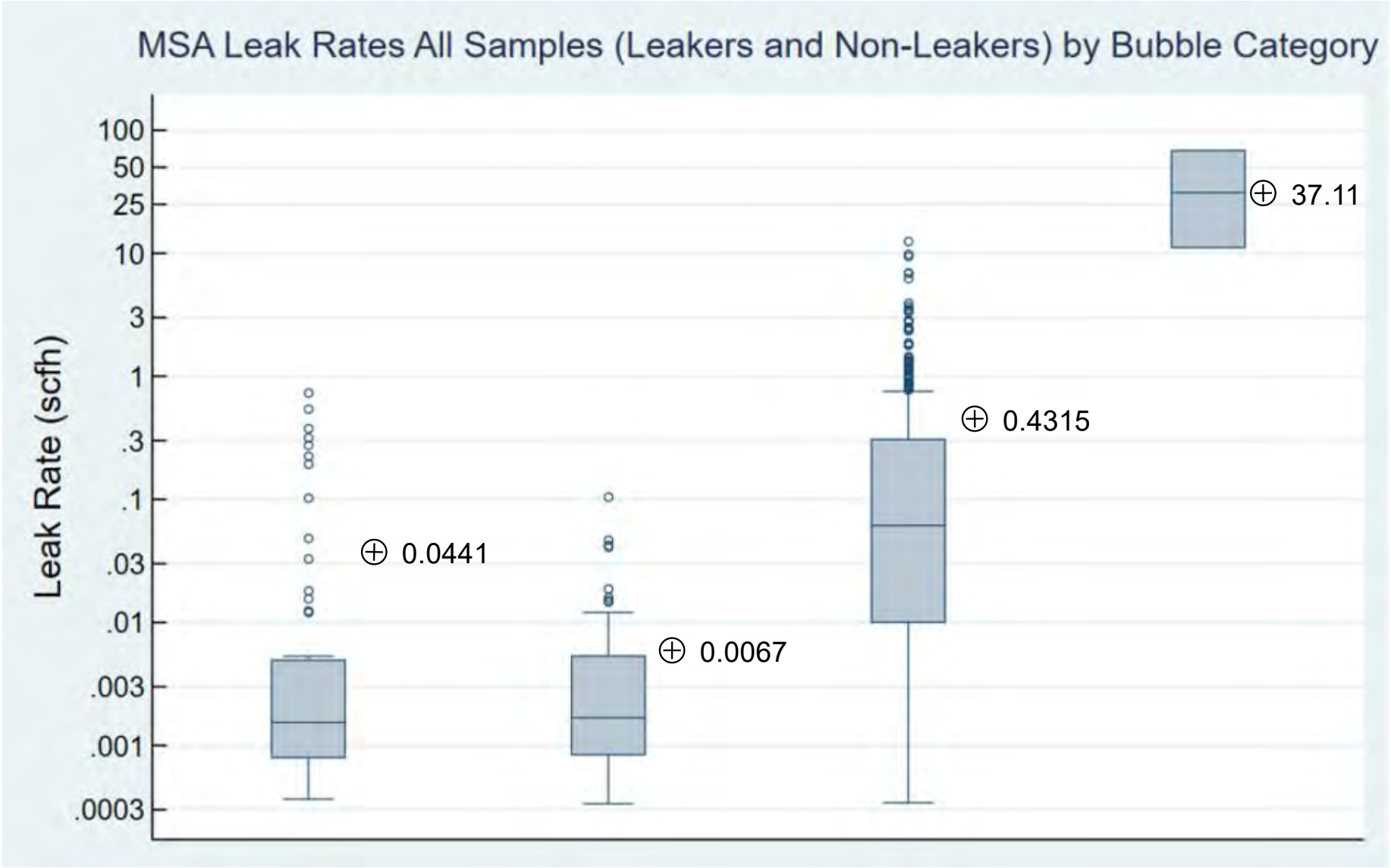
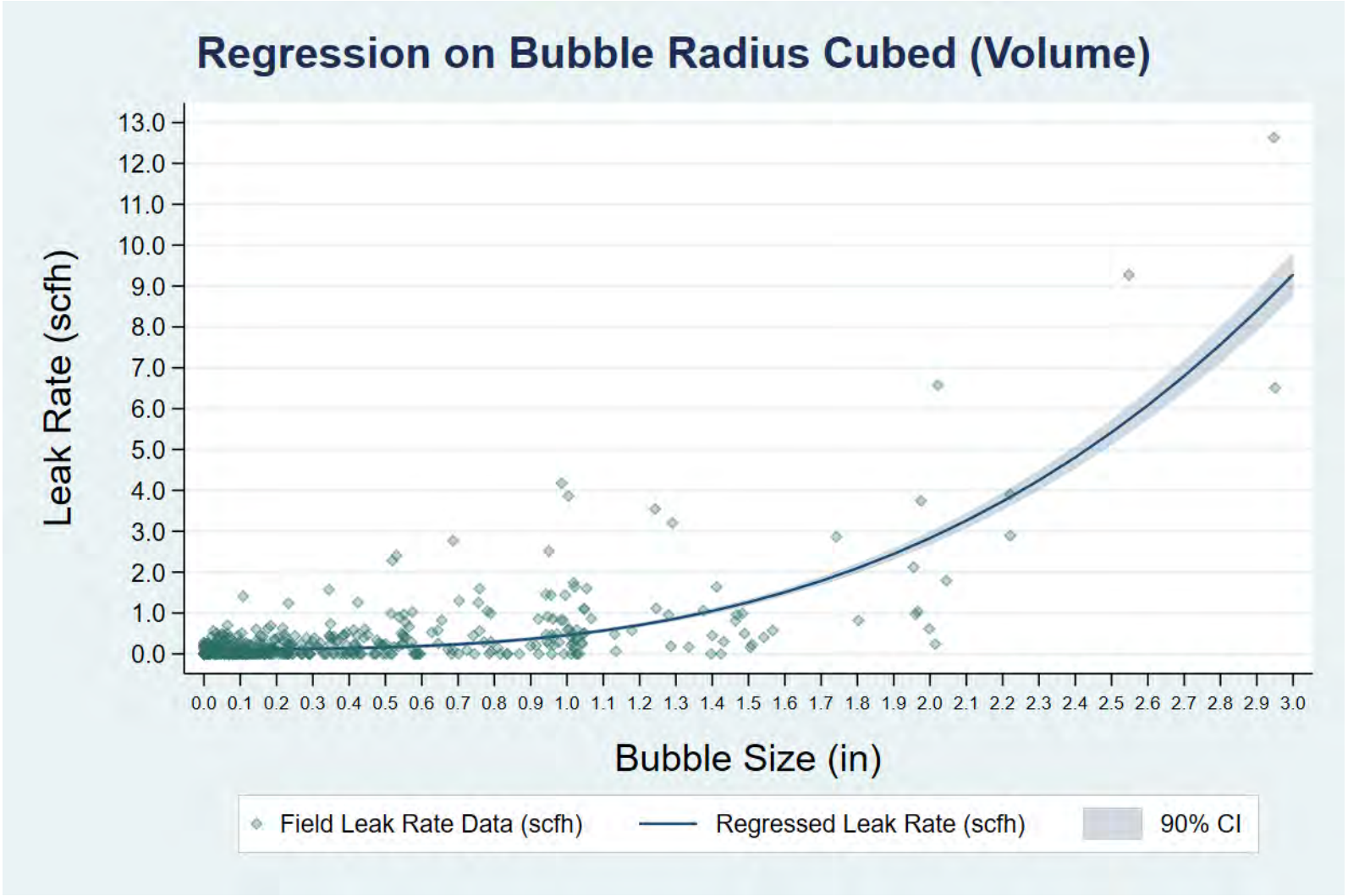
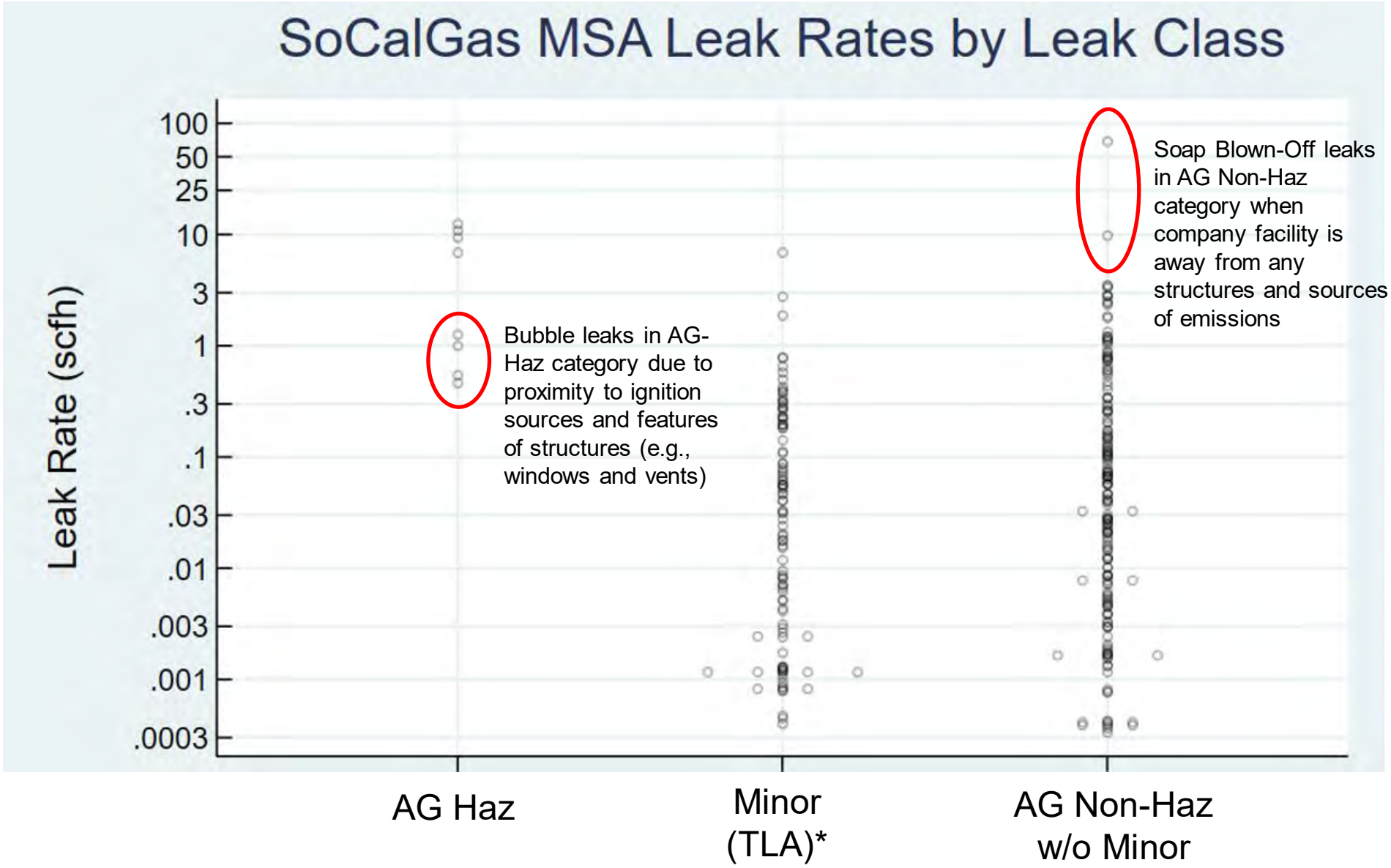

MSA Leak Rates (Leakers and Non-Leakers) by Bubble Category
Leak Rate (scfh)
100
50
25
10
3
1
.3
.1
.03
.01
.003
.001
.0003
Foam
Bubbles
Soap Blown-Off


MSA Leak Rates All Samples (Leakers and Non-Leakers) by Bubble Category
Leak Rate (scfh)
100
50
25
10
3
1
.3
.1
.03
.01
.003
.001
.0003
⊕ 0.0441
⊕ 0.0067
⊕ 0.4315
⊕ 37.11
Indeterminate
Foam
Bubbles
Soap Blown-Off

Soap Test Correlation to Leak Flow Rate

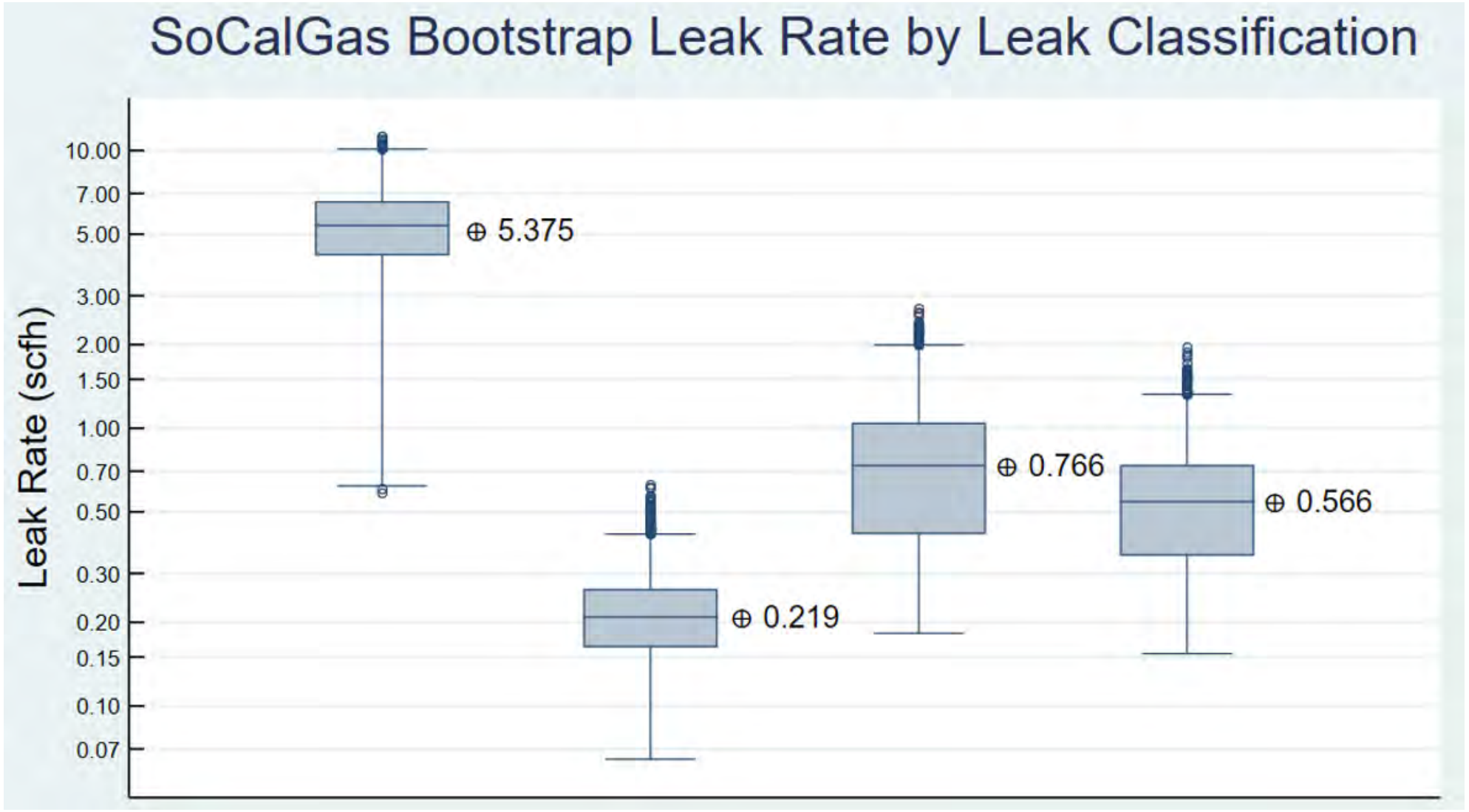


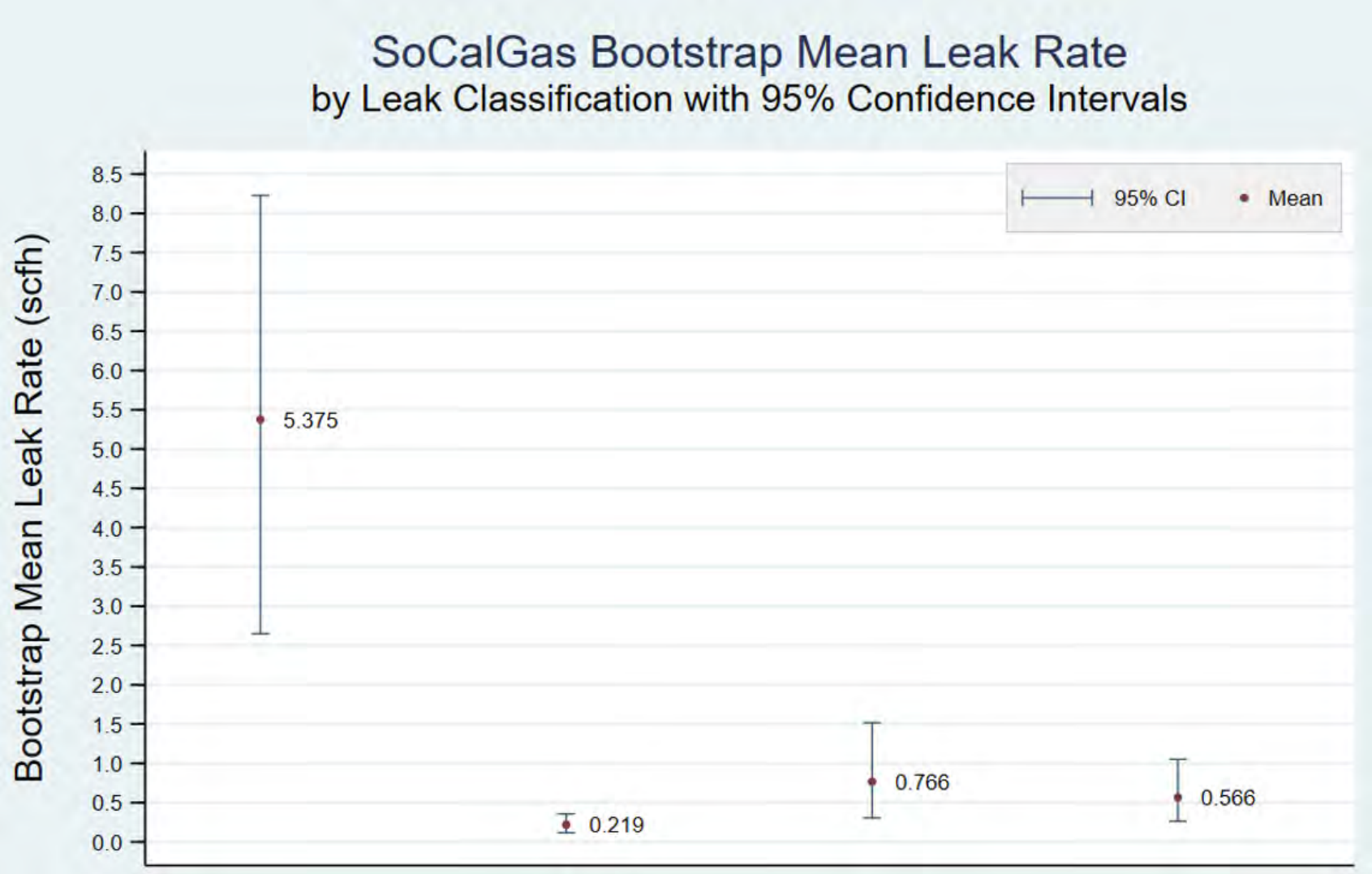
SoCalGas MSA Leak Rates by Leak Class



*Leaks repaired by tightening, lubrication, or adjustment

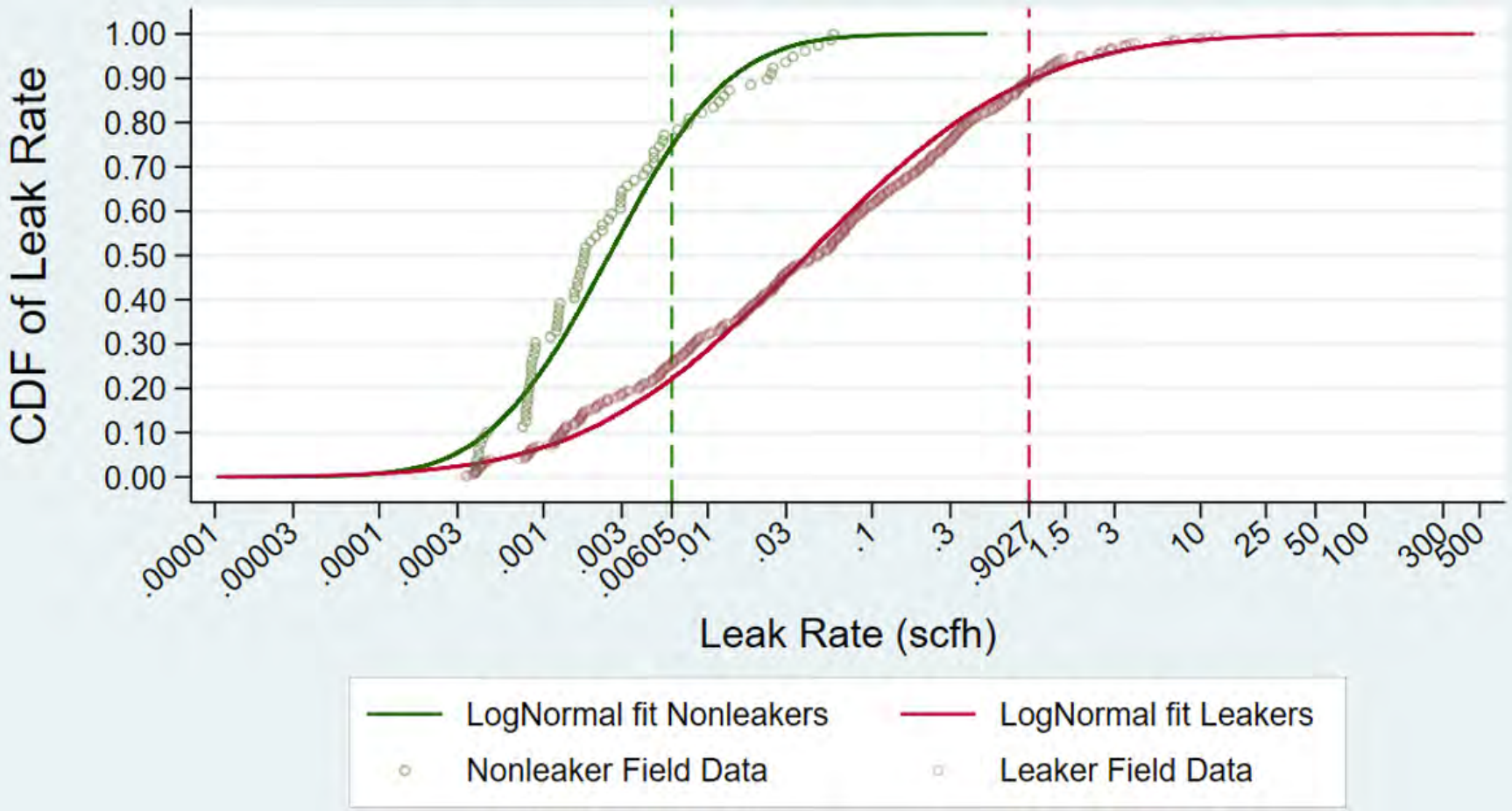
SoCalGas Bootstrap Leak Rate by Leak Classification




SoCalGas Bootstrap Mean Leak Rate
by Leak Classification with 95% Confidence Intervals
Bootstrap Mean Leak Rate (scfh)
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
95% CI
Mean
5.375
0.219
0.766
0.566
AG Haz
Minor (TLA)
AG Non-Haz w/o Minor
All AG Non-Haz

Cumulative Fraction of Leak Rates

SoCalGas MSA Nonleakers vs. Leakers Data with LogNormal Fit



Number of samples for leakers: 458; nonleakers: 79; Vertical dashed lines are lognormal distribution averages.
Nonleaker lognormal fit (μ=0.00605, σ=.01320); Leaker lognormal fit (μ=0.9027, σ=20.1484)

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Mean Leak Rates by Non-Haz Bubble Category

Category	Leak Rate	
	SCFH-NG	SCF-NG/leak/year
Foam	0.0075	66
Indeterminate	0.0471	413
Bubbles	0.4615	4,042
Soap Blown-Off	39.73**	348,035
All AG Non-Haz	0.6060	5,308
AG Haz	5.755**	50,412

**1st approximation. Additional data samples are needed for adequate statistical confidence.

- There is little benefit to separating AG Non-Haz leaks by bubble categories
  - If deferred for repair, foam bubble category leaks will emit about 66 SCF-NG per leak per year.
  - Rebuilding MSA to repair a leak releases between approximately 2 to 10 SCF-NG
  - Repairing Foam leaks as they are found provides more emission reductions than deferring repair and bundling with other work
- Detection & Repair of hi-flow leaks (i.e., Soap-Blown-Off) is key to achieving significant emissions reductions
- Currently being achieved by more frequent inspections, and will continue to be realized by inspecting a larger portion of the system annually using Aerial Methane Mapping

Proposed Emission Factors
(*95% Statistical Confidence)

Leak Class	Leak Rate	Emission Factor	
		SCFH-NG	MSCF-NG/day
AG Non-Haz	Mean of All Non-Haz Leaks	0.6060*	0.0145*
AG Haz	Mean of AG-Haz Leaks	5.7550	0.1381
Unknown Leaks	Proportional Mean of All Leaker Categories	0.8114	0.0195
Undetected Emissions	Mean of Undetected Leaks (Non-Leakers)	0.0023*	0.00006*

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Emissions Inventory

Methodology	Leak Class	SoCalGas Leak Inventory		SoCalGas Emissions (MSCF-NG)	
		2016	2020	2016	2020
Company-Specific Leaker-Based EF	AG Non-Haz	65,009	53,049	**326,313**	**138,606**
	AG Haz	3,025	2,204	**74,385***	**57,644***
	Unknown Leaks	33,596	16,946	**238,788**	**120,444**
	Undetected Emissions	5,827,833	5,993,679	**120,277**	**123,700**
	Total	5,929,463	6,065,878	**759,763****	**440,394****
Population-Based EF	Total	5,929,463	6,065,878	**851,086**	**871,235**

*1st approximation. Additional data samples are needed for adequate statistical confidence.
**Preliminary estimate of system-wide total provided for comparison purposes.

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Next Steps

- Perform laboratory studies to pinpoint transition flow rate between Soap Bubbles and Soap Blown-Off
- R&D project to develop a simple flow meter for leaks where soap is blown-off
- Continue gathering leak rate data for AG Haz leak category to tighten the confidence interval for the Emission Factor

Questions?

Erik Rodriguez
Gas Emissions R&D Team Lead
Cell: 562.708.2568
E-Mail: ERodrig1@SoCalGas.com

SoCalGas

SDGE

LUNCH

Until 12:30pm

California Public Utilities Commission

Template and Reporting Updates and Baseline Adjustments

CARB, CPUC, PG&E, and SoCalGas

12:30-2:30pm

PG&E	Methodology & Baseline Adjustment (Appendix 5, 6, 3/7)	12:30-12:55pm
PG&E	Distribution System Emissions Baseline Adjustment (Appendix 4)	12:55-1:35pm
CPUC/CARB	Proposed Changes for 2022 Reporting Templates	1:35-2:00pm
CPUC	Baseline Adjustment Process and Tentative Timeline	2:00-2:30pm

California Public Utilities Commission

Methodology & Baseline Adjustments

Andres Beltran

Distribution M&R Stations – Station Leaks & Emissions

Background:

- Distribution Regulation Stations do not include pneumatic devices such as controllers and actuators.
- Except for relief valve, all emissions are related to unintentional leaks.
- RY2020 Leak Abatement OIR Report Appendix 5 calculated using leak-based approach

Leak-Based Methodology:

- SAP Leak Data – Apply filters for facility type to regulation & distribution
- Assign SAP leak source to CARB MRR Component
- Apply CARB MRR Component Leaker EFs
- Calculate known emissions where we consider the leak open from the first of the year until repair or end of the year, whichever is earliest
- Calculate unknown emissions due to 3-year interval survey

Baseline Proposal: Utilize RY 2020 Appendix 5 as the baseline to compare against moving forward

Future action: Distribution M&R station leak repairs follow the grading criteria

- Gr 1 = repair immediately
- Gr 2 = scheduled repair within 1 year
- Gr 3 = monitor

Component leaker EFs from CARB MRR (Appendix A Table 7)

Component	Emission Factor (scf CH_4/hour/component)	scf CH_4/ scf NG[A]	Emission Factor (Mscf NG/component-day)
Connector	1.69	0.95	0.0427
Block Valve	0.557	0.95	0.0141
Control Valve	9.34	0.95	0.2360
Pressure Relief Valve	0.27	0.95	0.0068
Orifice Meter	0.212	0.95	0.0054
Regulator	0.772	0.95	0.0195
Open-ended Line	26.131	0.95	0.6602

A. Subpart W default value for CH_4 in NG [§ 98.233(u)(2)]

Customer Meter Sets – Meter Leaks

Background:

- Meter set assembly (MSA) emissions are calculated using a population-based emission factor developed by GRI in 1996.
- The population-based emission factor does not allow for future improvement in reducing MSA emissions.
- Implementing a new meter set tracking standard can improve the accuracy of meter set emission accounting and aid PG&E in prioritizing repairs to reduce methane emissions.

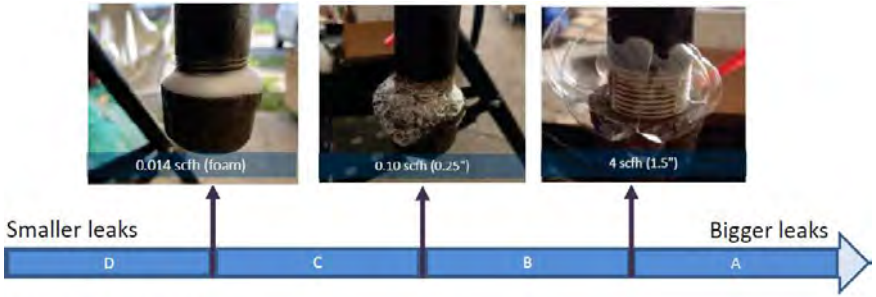
Leak-Based Methodology:

- Leak Surveyor performs traditional soap test on meter set leaks and documents bubble classification on mobile application
- Meter set leaks are bucketed based on bubble size and determine bubble classification distribution
- Include "No Bubble Leaks" per CARB study
- Calculate known emissions where we consider the leak open from the first of the year until repair or end of the year, whichever is earliest
- Calculate unknown emissions due to 3-year survey interval

Baseline Proposal: Utilize RY 2020 Appendix 6 as the baseline to compare against moving forward

Future action: Repair Class A leaks immediately. Prioritize Class B leak repairs.

Classification	Description	Thresholds (scfh)	Mean Emission Rate (scfh)
A	Soap solution is blown off the facility providing no opportunity for bubbles to form and "hold"	> 4	9.5
B	Soap solution can hold a cluster of bubbles	>0.1 to ≤ 4	0.53
C	Soap solution forms a cluster of small bubbles	>0.014 to ≤0.1	0.041
D	Soap solution creates foam with few or no visible bubbles	≤0.014	0.0032



Representative flow rates:

Underground Storage – Component Emissions & Leaks

Background:

- In 2017, the California Air Resource Board issued **Greenhouse Gas Emission Standards for Crude Oil and Natural Gas Facilities**.
- The regulation-imposed emission controls on equipment located at onshore and offshore production and processing facilities, as well as natural gas compressor stations, underground storage facilities, and gathering and boosting stations.
- The standards included a quarterly survey of all components and applied a repair timeline based on concentration measurement.
- In 2017, PG&E completed an inventory of all the components and completed the survey, which was used to calculate Component Emissions and Component Leaks category for Storage that led to an increase in storage reported emissions.
- In 2020, the leak threshold was decreased from 10k to 1k ppm in the CARB O&G regulation. This resulted in more leaks identified.

Baseline Proposal: With the increased visibility of these emissions which provides a more accurate estimate, PG&E proposes to utilize 2017 as the baseline to compare against moving forward.

Consider adjusting the baseline to include leaks >1k ppm, or keep the 2017 baseline, and report moving forward, only leaks >10k ppm.

Future action: Continue quarterly surveys and perform repairs in accordance with the CARB O&G rule.

FINAL REGULATION ORDER

California Code of Regulations, Title 17, Division 3, Chapter 1, Subchapter 10 Climate Change, Article 4

(Note: The entire text of sections 95665, 95666, 95667, 95668, 95669, 95670, 95671, 95672, 95673, 95674, 95675, 95676, and 95677 set forth below is new language in "normal type" proposed to be added to title 17, California Code of Regulations.)

Adopt new Subarticle 13, and sections 95665, 95666, 95667, 95668, 95669, 95670, 95671, 95672, 95673, 95674, 95675, 95676, 95677, Appendix A, Appendix B, and Appendix C, title 17, California Code of Regulations, to read as follows:

Subarticle 13: Greenhouse Gas Emission Standards for Crude Oil and Natural Gas Facilities

Thank you

Andres Beltran
Andres.beltran@pge.com

Distribution Mains and Services

Baseline and Emission Factors

François Rongere
Senior Manager R&D and Innovation

2015 baseline for DM&S leak distribution

Background

Emissions of the Distribution Mains and Services are calculated using the Emission Factors established by GRI in 1992. They represent almost 25% of PG&E's reported methane emissions.

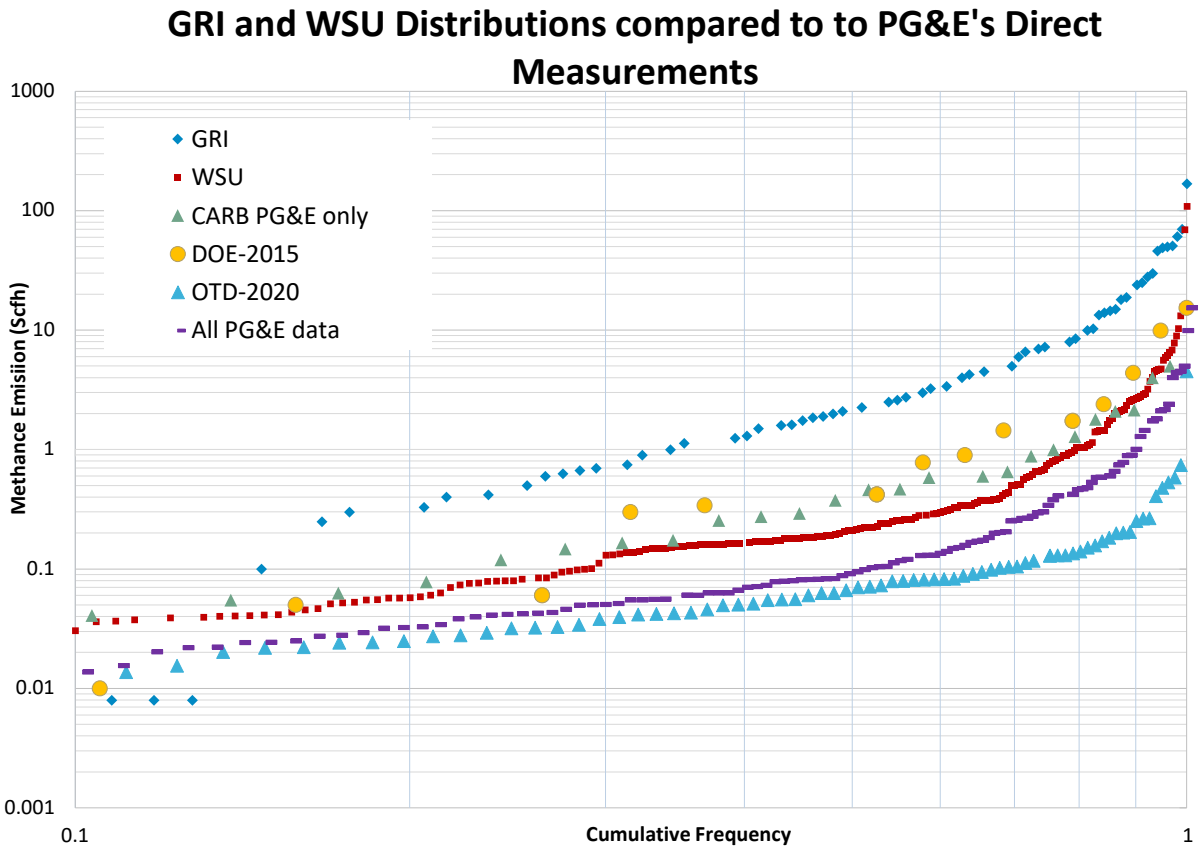
Proposal

To use the distribution of Washington State University as representative of PG&E's system in 2015 with a unique emission factor across materials and assets.

Rationale

1. Data collected from PG&E's system between 2014 and 2020 do not align with GRI leak distribution but align well with WSU leak distribution data.
2. Using WSU would be consistent with our Super Emitter program.
3. Data show that leak size does not depend on material and asset. In addition, assignment before repair is uncertain creating possible variations.
4. Using a unique emission factor across materials and assets would be consistent with our current methodology implemented since 2018.
5. An adjusted baseline will better capture PG&E's asset conditions and leak survey practices.

Direct measurements and leak size distributions

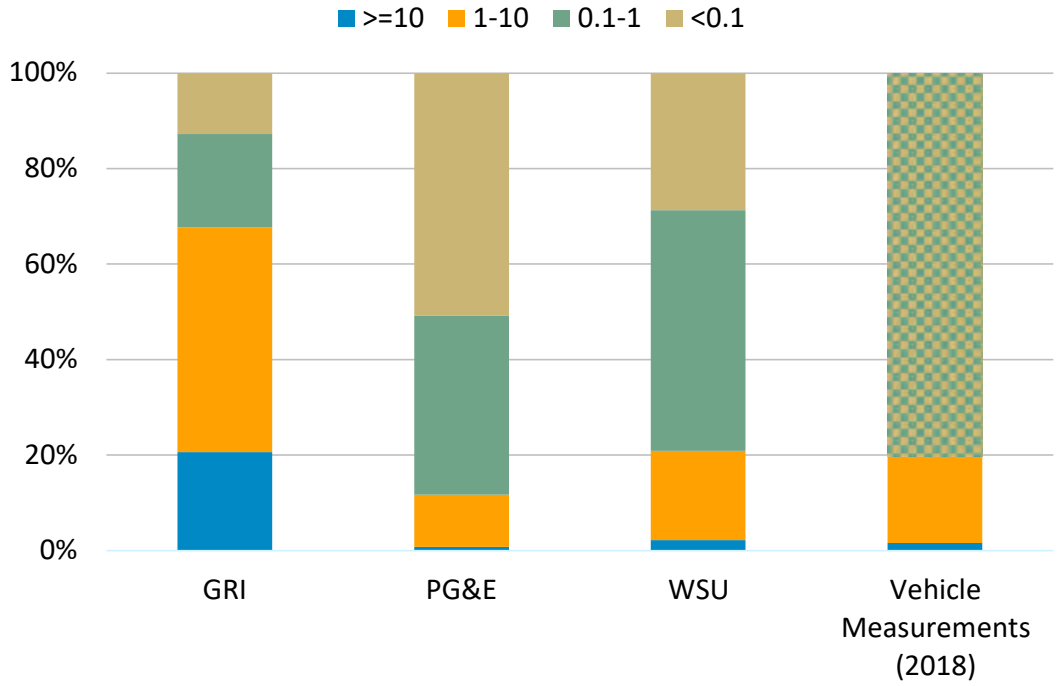


- Measurements form three different studies
  - CARB 2014
  - DOE 2015
  - OTD 2020
- Direct measurements are very different from GRI
- Variability due to sample size because of rare large leaks
- WSU distribution is closer to direct measurements

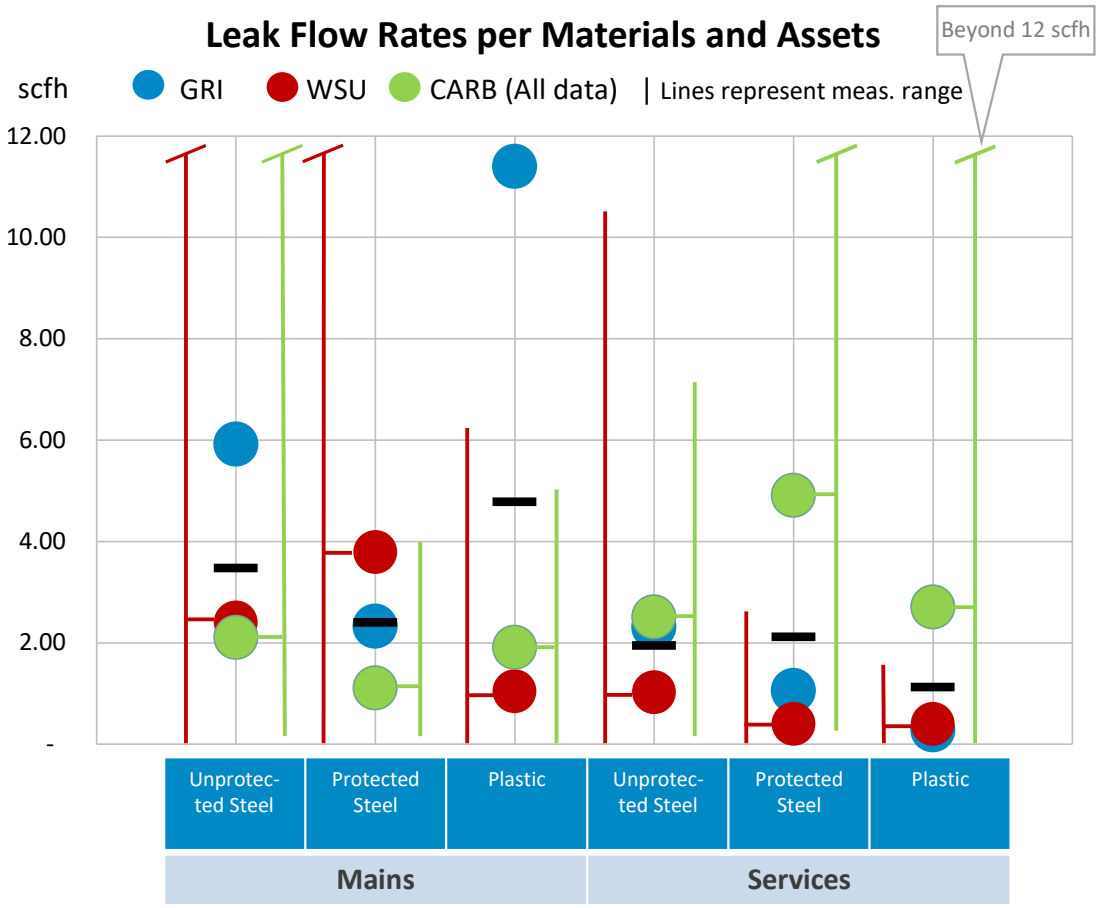
Adding Vehicle Measurements

- Through the Super Emitter program and Compliance surveys, PG&E estimates the size of **all leaks** using a vehicle mounted system.
- It supplements direct measurements that are limited by their sampling size.
- 2018 Vehicle Measurements show very good alignment with WSU distribution.

Leak size	GRI	PG&E	WSU	Vehicle Measurements (2018)
>=10	21%	1%	2%	2%
1-10	47%	11%	19%	18%
0.1-1	20%	38%	50%	80%
<0.1	13%	51%	29%	



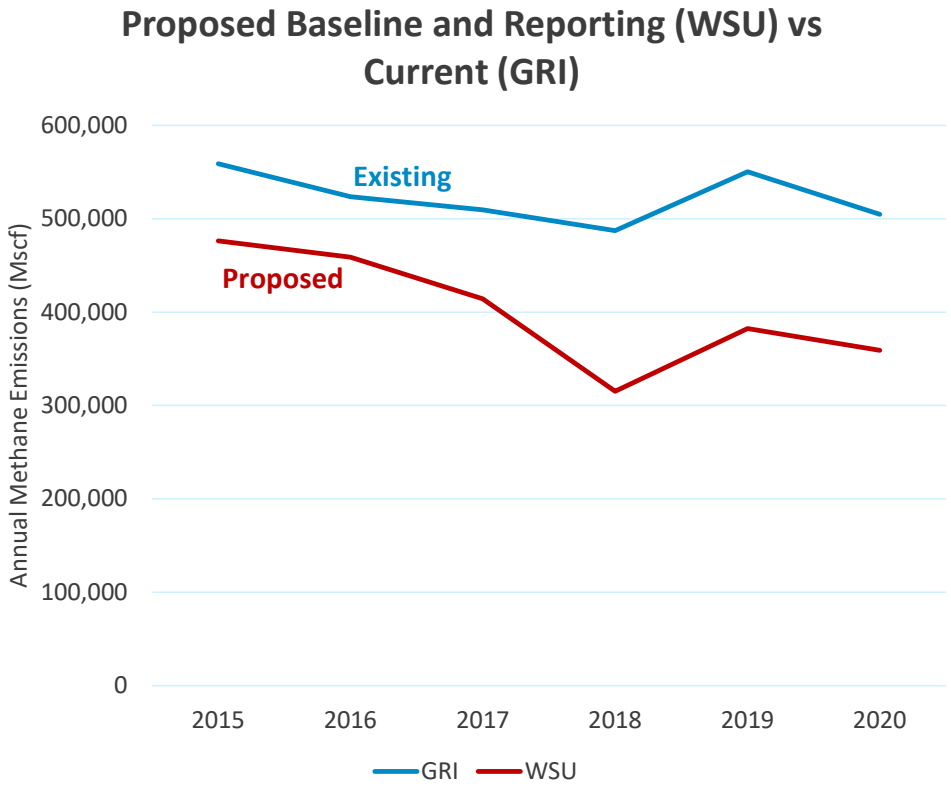
Leak Flow Rates per Assets and Materials



- Differences between studies within same A/M category are greater than differences between A/M categories with the same study
- Variability within A/M categories and studies is large
- Errors from limited sampling size are worsened when dividing by A/M categories
- A/M category attributions are uncertain.

A/M : Asset and Material

Conclusion



Use WSU distribution with a unique EF across assets and materials

- Offers the simplest and most representative baseline for PG&E's assets
- Assures consistency over time with quantification approaches such as Super Emitter program
- Reduces errors due to mischaracterization of assets and materials

Thank You

François Rongere
Francois.Rongere@pge.com

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AIR RESOURCES BOARD

Proposed Changes to the 2022 Reporting Template and Procedures

2022 Natural Gas Leak Abatement Winter Workshop
February 1, 2022

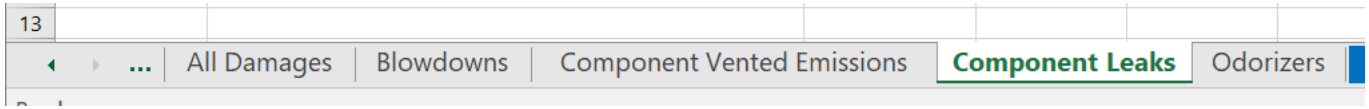
Overview of Proposed Changes to Reporting Template and Procedures

1. Appendices 1, 3, 4, 5 & 7: Revise tab name
2. Appendix 5: Add classifications for farm taps
3. Appendices 5 and 6: Report emissions using population-based and leaker-based emission factors
4. Appendix 8: Round estimated emissions to nearest Mscf

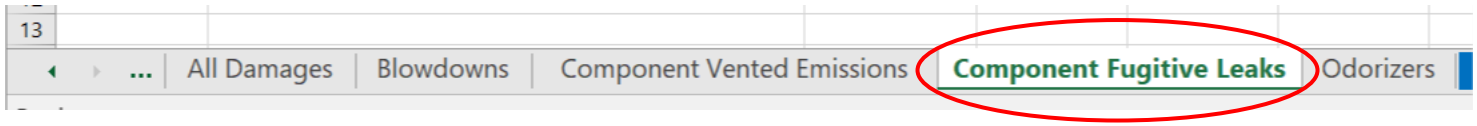
Proposed Change to Appendices 1, 3, 4, 5 & 7

- Revise name of tab “Component Leaks” to “Component Fugitive Leaks”

  Prior Appendix 1:



  Proposed Appendix 1:

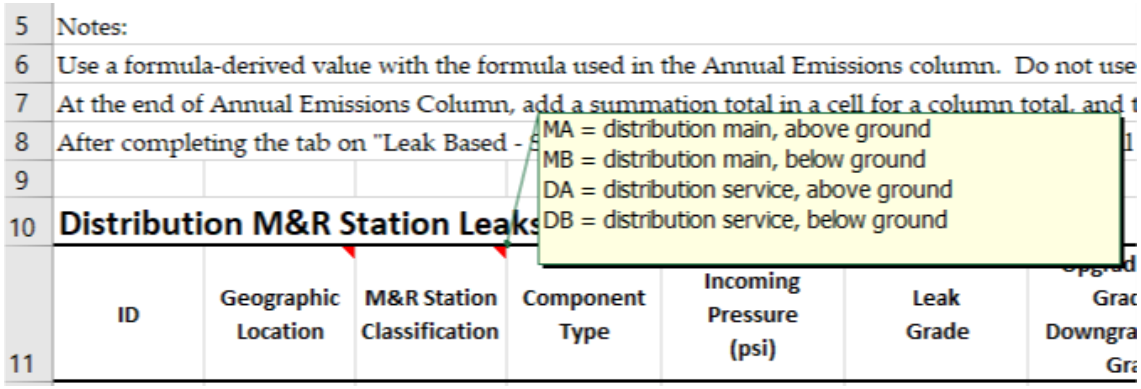


- Revise terminology in Joint Report
  - “Component Leaks” → “Component Fugitive Leaks”
  - “Component Emissions” → “Component Vented Emissions”

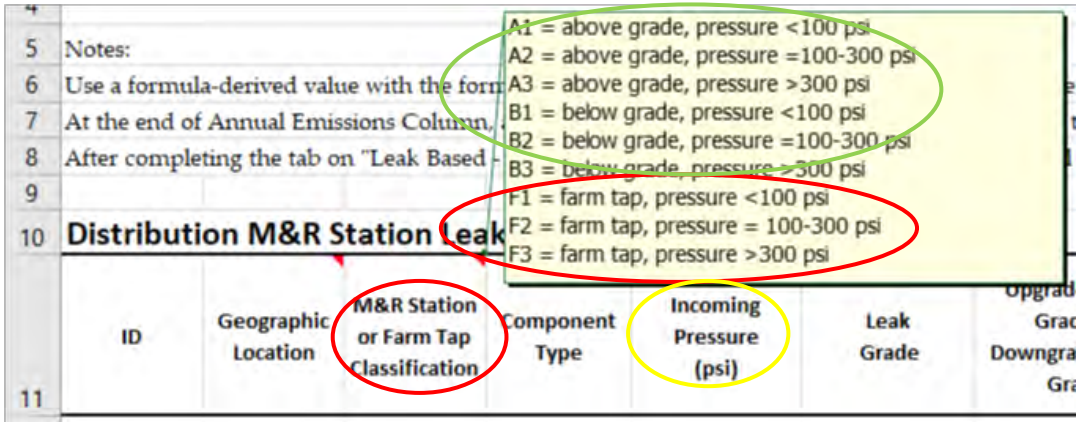
Proposed Changes to Appendix 5 (Leaker-Based)

- Add new classifications to identify farm taps
  - What pressure range(s) are appropriate?
  - Are "Incoming Pressure" data necessary?

Prior:



Proposed:



Proposed Changes to Appendix 5 (Population-Based):

- Add new classifications to identify farm taps
  - What pressure ranges are appropriate?

Appendix 5 - Rev. 03/31/2022

Notes:

Use a formula-derived value with the formula used in the Annual Emissions column. Do not use a copy and paste-as-value.

At the end of Annual Emissions Column, add a summation total in a cell for a column total, and then highlight orange.

As revised in 2021, add F1, F2, and F3 for Farm Taps

Distribution M&R Station Leaks and Emissions

Number of Stations	Station Classification	Emission Factor (Mscf/yr)	Annual Emissions (Mscf)	Explanatory Notes / Comments
1	A1	40.600	40.600	Appendix 9 Emission Factors
1	A2	896.500	896.500	Appendix 9 Emission Factors
1	A3	1684.500	1684.500	Appendix 9 Emission Factors
1	B1	0.964	0.964	Appendix 9 Emission Factors
1	B2	1.840	1.840	Appendix 9 Emission Factors
1	B3	12.176	12.176	Appendix 9 Emission Factors
1	F1	12.200	12.200	Appendix 9 Emission Factors
1	F2	12.200	12.200	Appendix 9 Emission Factors
1	F3	12.200	12.200	Appendix 9 Emission Factors
		Total	2648.780	

Proposed Reporting Change for Appendices 5 & 6

- For gas companies reporting leaker-based emissions for Distribution Metering & Regulation Stations (Appendix 5) and/or Customer Meters (Appendix 6), continue to report population-based emissions estimates for these system categories until Baseline adjustments approved.

- Presentation of emissions estimates in future Joint Reports will be similar to 2021 Joint Report until Baseline adjustments approved
  - Main body of report → population-based estimates
  - Report appendix → leaker-based estimates

- If Baseline adjustments are approved before September 2022, the leaker-based estimates will be presented in the main body of the 2022 Joint Report

Proposed Change to Appendix 8

- Round estimated emissions to nearest Mscf

Prior:

Summary Tables:

System Categories	Emission Source Categories	Fugitive or Vented	For Reference Only: 2015 Baseline Emissions (Mscf)	2019 Total Annual Volume of Leaks & Emissions (Mscf)	2019 Total Annual Count of Leak & Emission Items	2020 Total Annual Volume of Leaks & Emissions (Mscf)
Transmission Pipelines	Pipeline Leaks	Fugitive	87	84.55	Leak count: 0 Total System Mileage: 441	83.1

Proposed:

Notes:

Round all estimated natural gas emissions to nearest Mscf.

Summary Tables:

System Categories	Emission Source Categories	Fugitive or Vented	For Reference Only: 2015 Baseline Emissions (Mscf)	2019 Total Annual Volume of Leaks & Emissions (Mscf)	2019 Total Annual Count of Leak & Emission Items	2020 Total Annual Volume of Leaks & Emissions (Mscf)
Transmission Pipelines	Pipeline Leaks	Fugitive	87	85	Leak count: 0 Total System Mileage: 441	83

Key Dates for 2022 NGLA Reporting

- **March 31**: CPUC will send reporting template to gas companies
- **June 15**: Emissions reports due from gas companies
- **July**: CPUC and CARB will send a list of follow-up questions and comments to gas companies
- **November 15**: CPUC will send Draft Joint Report to gas companies for review
- **December 31**: CPUC will publish Final Joint Report

Baseline Adjustment Process and Tentative Timeline

2022 Natural Gas Leak Abatement Program Winter Workshop

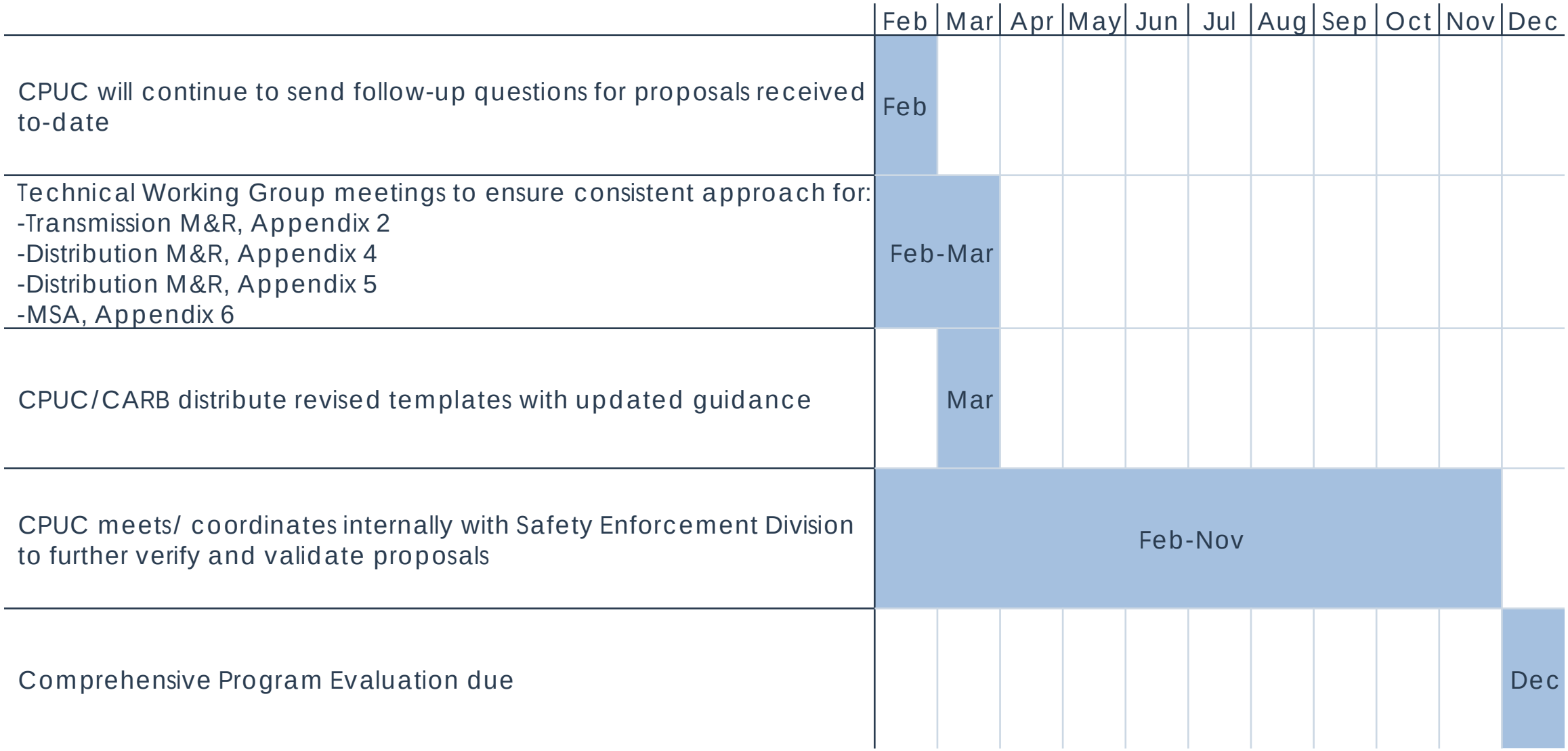
California Public Utilities Commission

Baseline Adjustment Process

- To ensure that proposed changes are well supported and reasonable, CPUC will:
  1. Issue data requests to utilities for further information and clarification
  2. Continue to meet and work with engineers from CPUC's Safety Enforcement Division Gas Safety Branch to help confirm and validate proposed adjustments and review compliance with Best Practices
  3. Review documents as they are received

- As baseline updates are approved, expect that subsequent templates and reporting will use the updated baseline figures

Baseline Adjustment 2022 Timeline



Questions?

- Click the hand next to your name in the participant list
- The host will call on your name and unmute you when it is your turn to speak
- Or, type question into the chat

BREAK

Until 2:45pm

California Public Utilities Commission

Broader R&D Updates and Compliance Plan Efforts

PG&E and SoCalGas

2:45-4:15pm

SoCalGas	Aerial Methane Mapping (AMM) Implementation Results	2:45-3:15pm
SoCalGas	Alternative Cost-Effective Reductions	3:15-3:35pm
PG&E	2022 Compliance Plan Measures	3:35-4:15pm

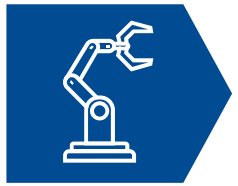
California Public Utilities Commission

AERIAL METHANE MAPPING IMPLEMENTATION RESULTS

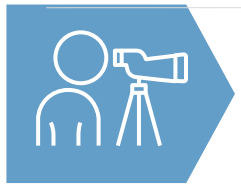
Emission Strategy Program - SoCalGas

Mori Farid
Emissions Strategy Program Policy Manager
Ed Newton
Gas Engineering Programs Manager

Agenda



Background



Aerial Methane Mapping Program Overview

Implementation Results

Implementation Strategy

Challenges and Next Steps

Company Stats and SB 1371 Requirements

Utility	Transmission - Miles	Distribution Mains – Miles	Distribution Services – Miles	Number of Customers
SoCalGas	3,385	51,249	50,237	21.8 M

Legislative and Regulatory Background

- Senate Bill 1371 (2014) requires utilities to reduce emissions of natural gas to the maximum extent feasible, while giving priority to safety, reliability, and affordability.
- In 2015, the CPUC implemented SB 1371 through Decision 17-06-015, which requires Class A Utilities to:
  - Submit biennial compliance plans and annual emissions reports
  - Implement best practices to reduce methane emissions
  - Achieve a reduction of at least 20% from 2015 levels by 2025

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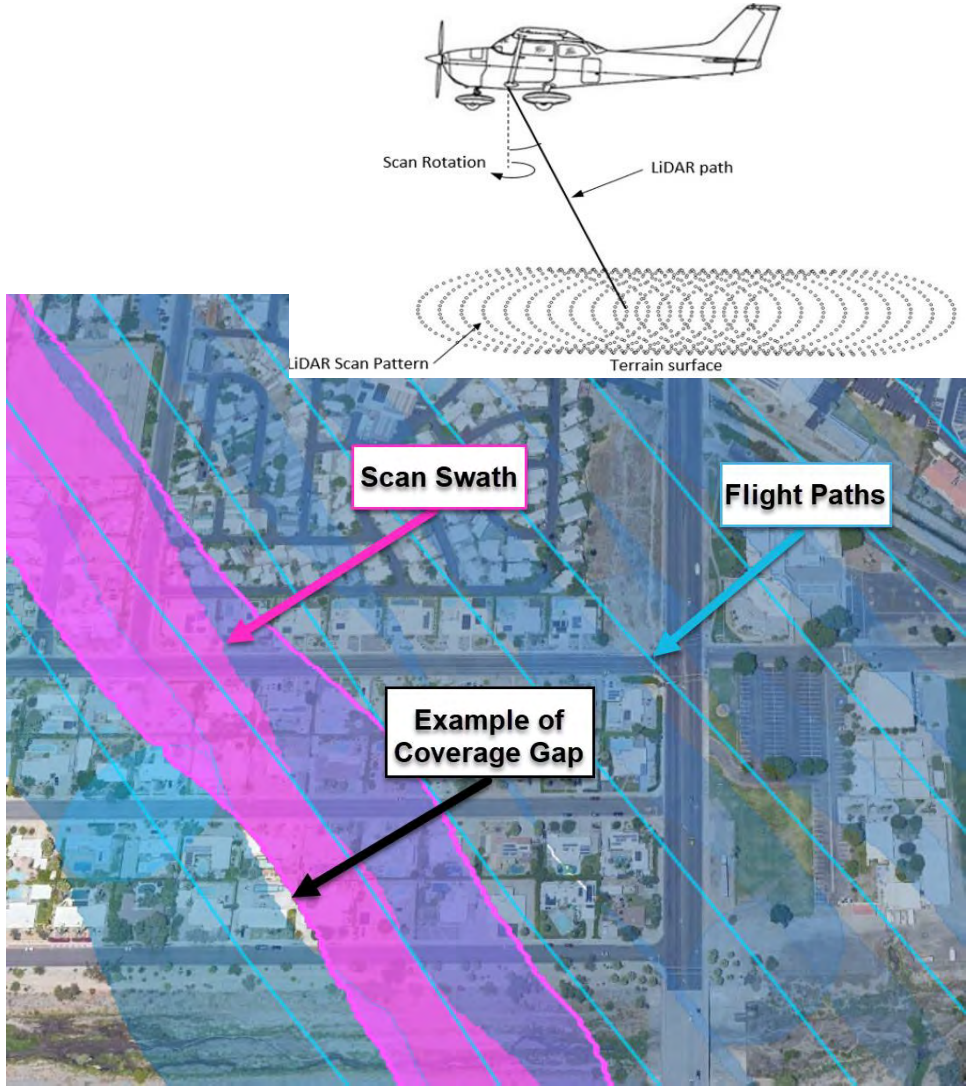
Video

Aerial Methane Mapping 30 FC Master REVISION (vimeo.com)

Gas Mapping LiDAR™ Technology & Area Coverage

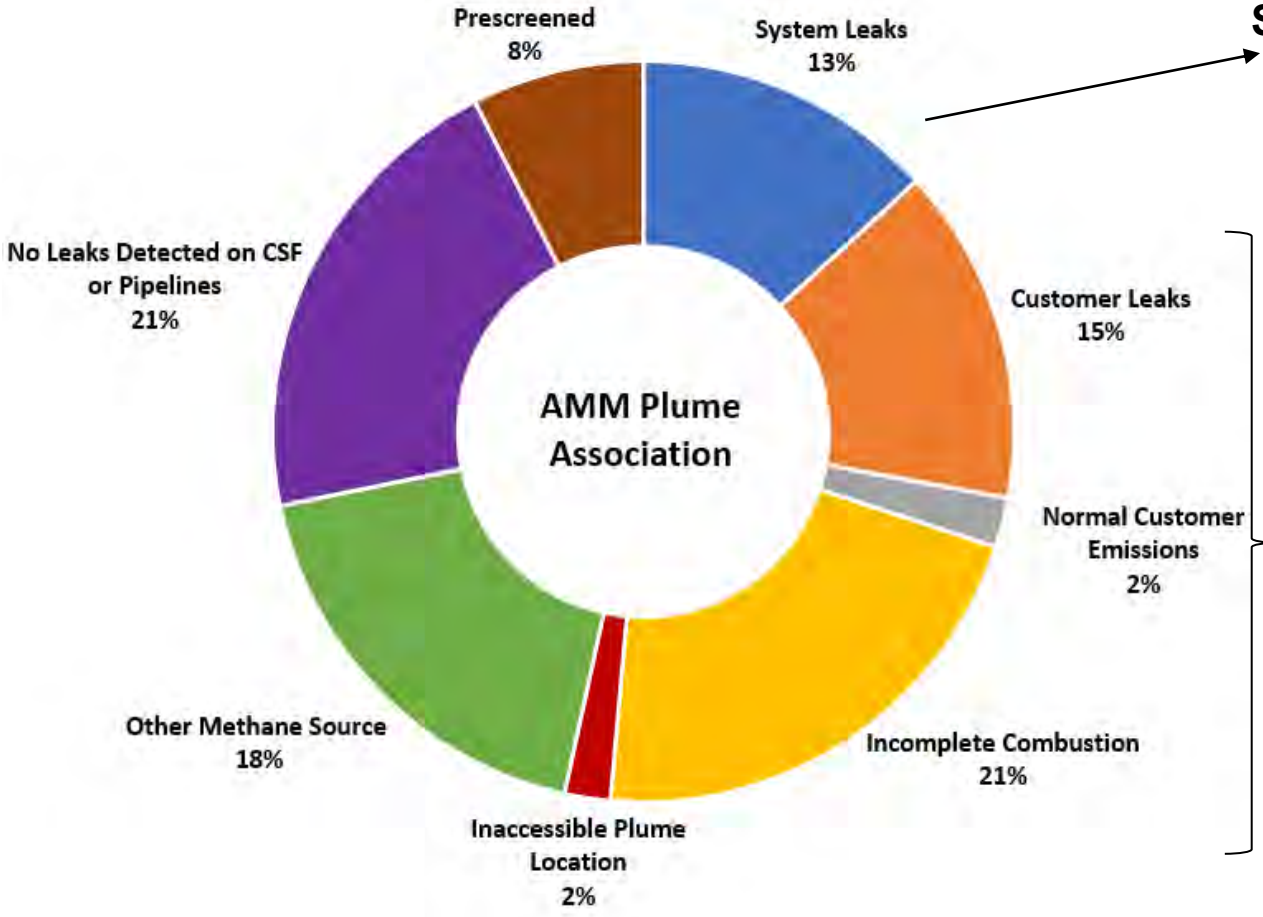
- Methane-Absorbing LiDAR combined with Topographic LiDAR plus Real-Time Aerial Imagery

- Flight Pattern and Area Coverage
  - Aircraft flies long-straight flight lines
  - 280’ Swath with 20% overlap
  - Area coverage within defined AMM area is auditable

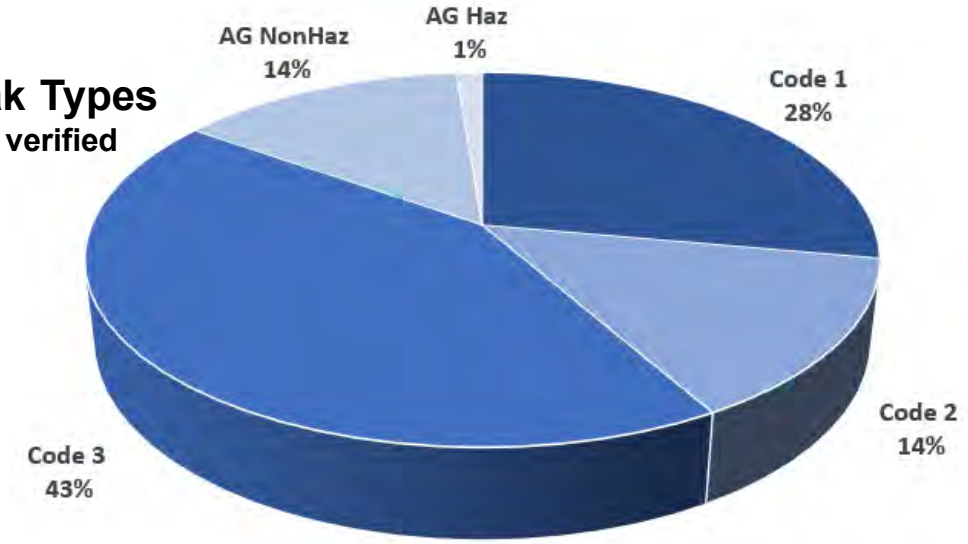


AMM Implementation Results

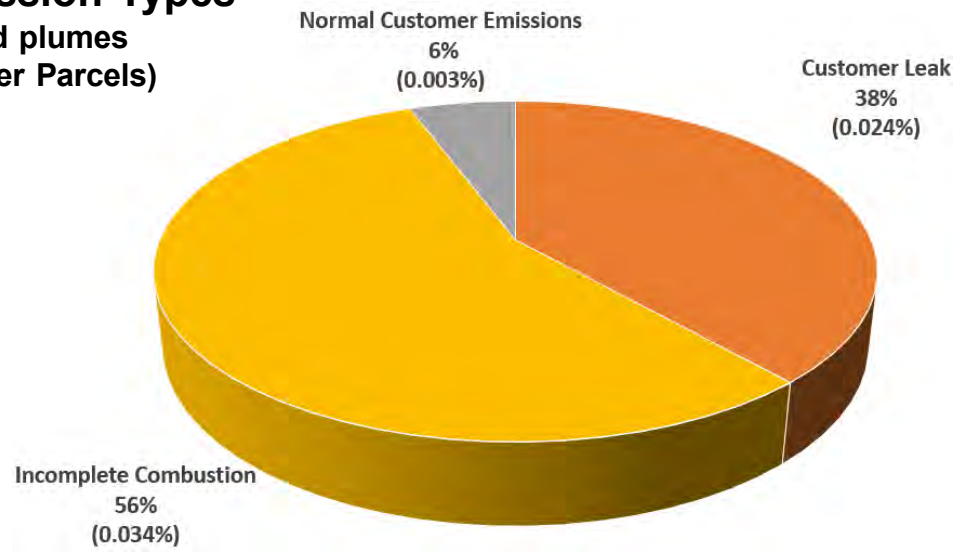
(First 5 months)



System Leak Types
% of plumes verified



Customer Emission Types
% of verified plumes
(% of Customer Parcels)



Note: This data represents the number of emission sources detected in the immediate vicinity of distribution pipelines and should not be confused with state-wide methane emission source types.

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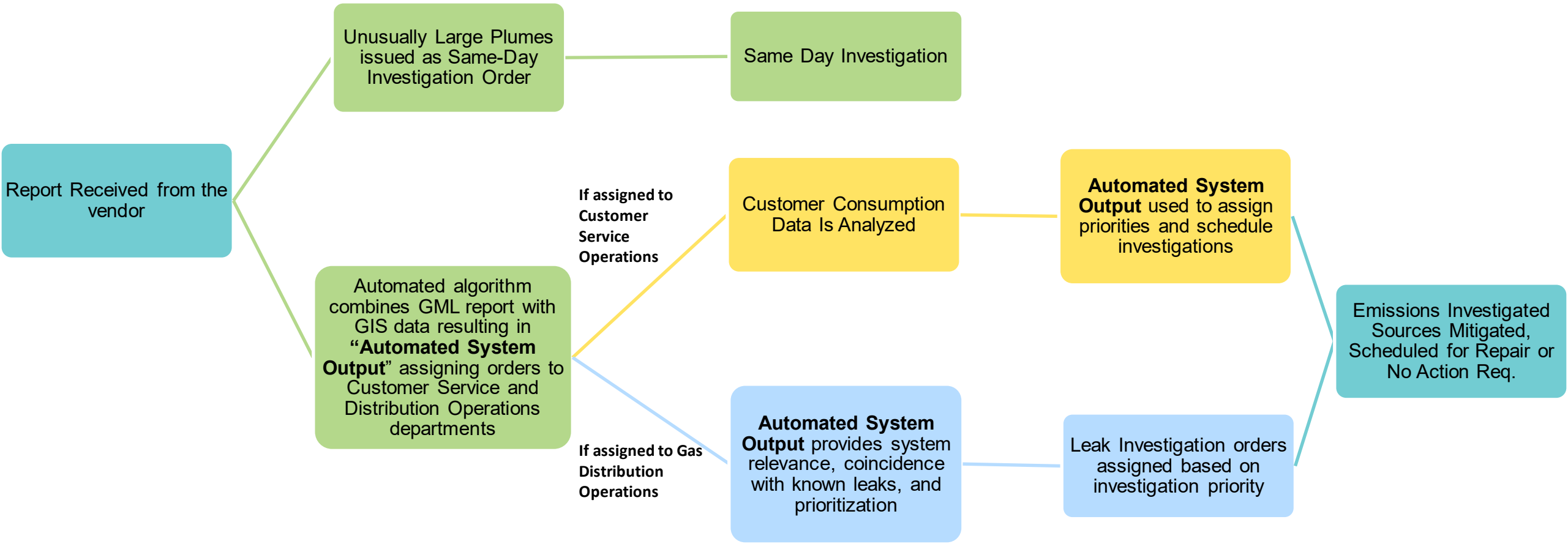
Program Workflow



Implementation Plan

Transition from pilot study
- Project Management Team
- Incremental multi-departmental staffing
- Training of impacted company departments
- Communications plan

Process
- End to end process flow
- Process improvements & Automation
- Leak investigation prioritization strategy

Automation and System Enhancements
- Improve and automate process
- System enhancements to track data for both costs and emissions reductions

Ramp up Plan
- From 1 to 6 areas per week
- 10 square miles to 60 square miles per week

Data Management
- Storage and data Security
- Pre-flight & post-flight data
- System enhancements
- Program Dashboard

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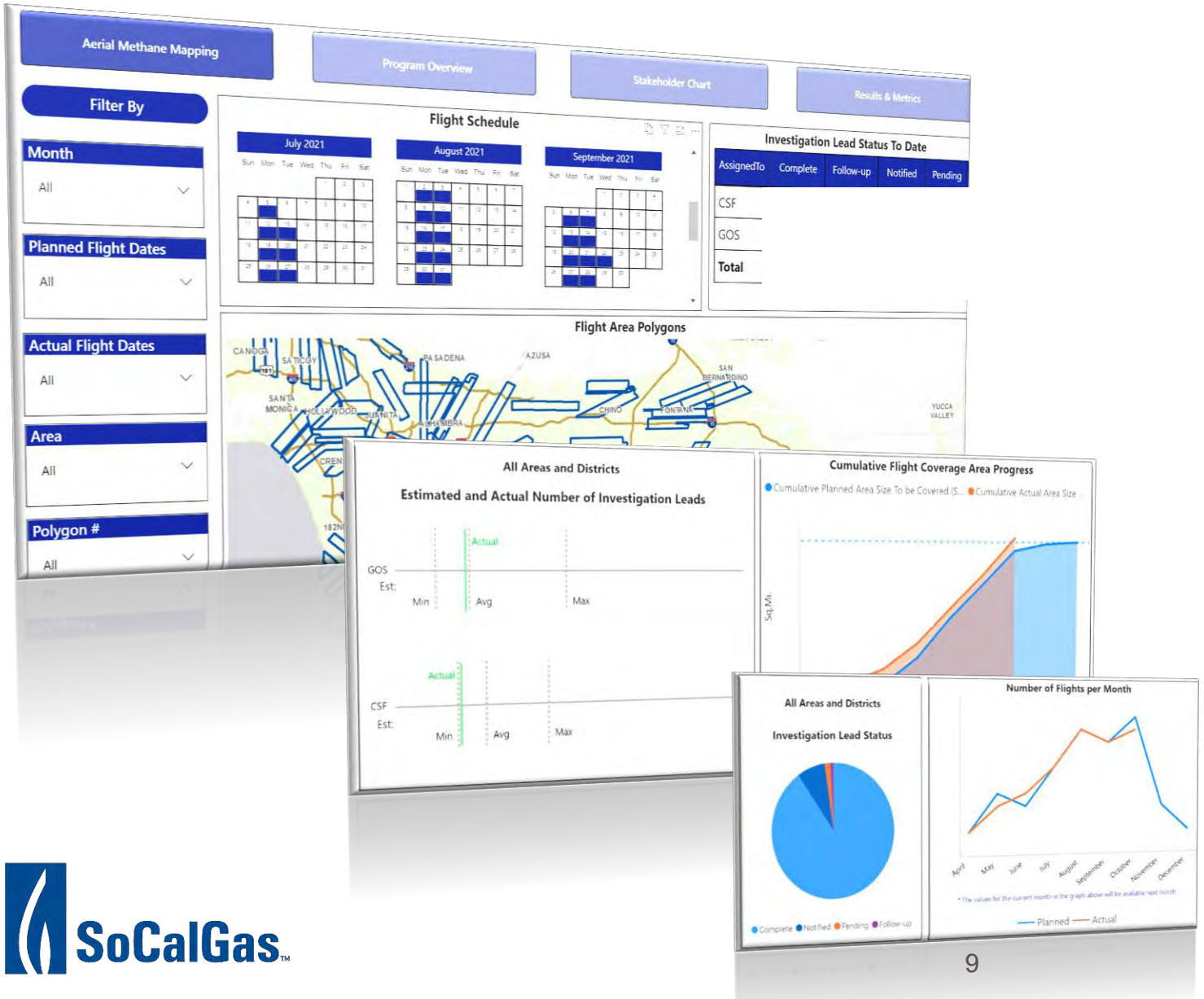
Program Dashboard



- Program overview
  - Stakeholder chart
- Flight Schedules
  - Calendar
  - Maps
- Cumulative flight coverage area progress
  - Planned vs. actual size
- Number of flights per month
  - Planned vs. actual
  - Leak investigation status
    - Pending
    - Complete
    - Notified
    - Follow up
- Estimated and actual number of leak investigations
  - Estimates (Min, Ave, Max)
  - Actuals (Min, Ave, Max)

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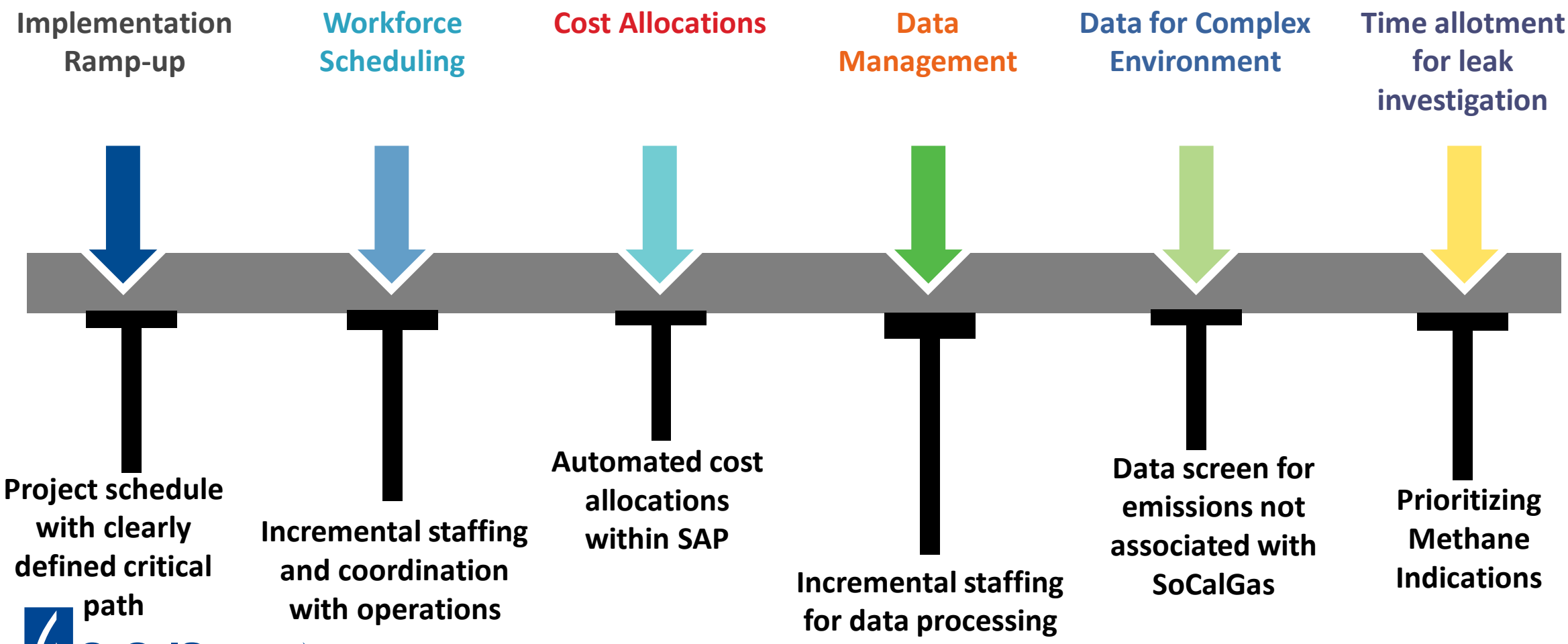
Program Benefits

1. Find Large leaks faster & Accelerated repair
2. Complementary approach to Large Emitting Leak Prioritization strategy
3. Assessment of emissions from pending leaks in current inventory
4. Detects emissions downstream of Customer meter
5. Complements ground-based leak survey program & Advanced Meter technology
6. Maximize Emission Reductions & Improve Safety of the natural gas system

Project Implementation Challenges & Solutions



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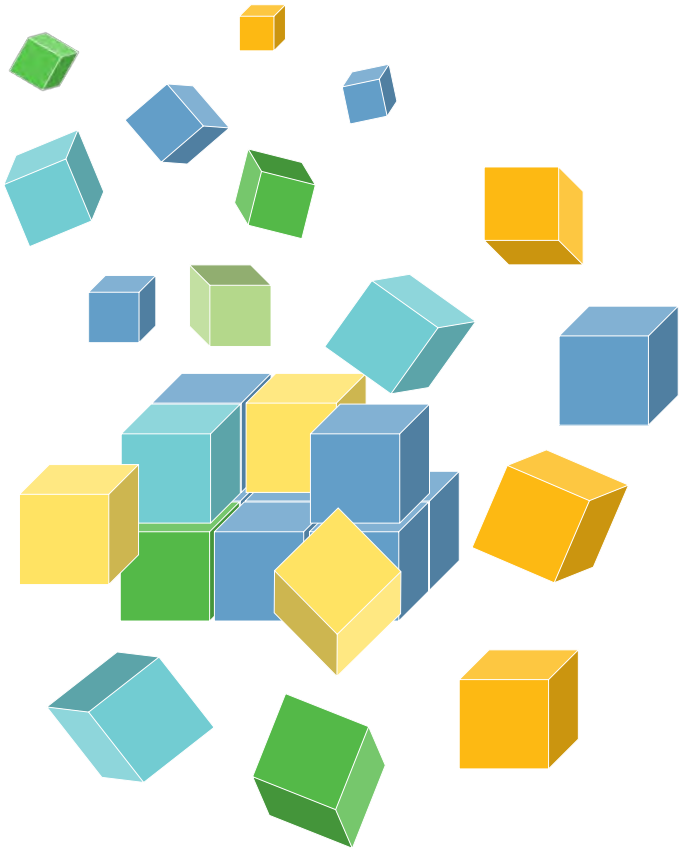
Next Steps & Conclusion



01 Complete ramp-up for current scope

02 Forecasted 12% reduction in annual methane emissions

03 System enhancements

04 Improve Cost-effectiveness

05 Expanded scope

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SoCalGas

ALTERNATIVE COST-EFFECTIVE REDUCTIONS

January 31st, 2022

Agenda

- ❖ Emissions Reduction Goals – California's Goal
- ❖ Alternative Cost-Effective Reduction Efforts
- ❖ Post-Meter Emission Reductions Best Practices
- ❖ Next Steps

Agenda

1. EMISSION REDUCTION GOALS – CALIFORNIA'S GOALS
2. ALTERNATIVE COST-EFFECTIVE REDUCTION EFFORTS
3. POST-METER EMISSION REDUCTIONS BEST PRACTICES
4. NEXT STEPS

Emission Reduction Goals – California's Goals

Evolution of California Methane Emission Reduction Policies

- Various policies focused on setting methane emission reduction goals to meet California's aggressive goals [AB32 (CARB Oil & Gas), SB605, SB887, SB1371, SB1383]
- SB1371 has two emission reduction goals:
  - Requires Class A utilities to reduce methane emissions 20% by 2025 from 2015 Baseline
  - Sets target to reduce methane emissions 40% by 2030 from 2015 Baseline to mirror statewide goal
- Integrated strategy and implementation of methane reduction projects are essential to realize California's environmental, economic and health goals.
- SB1371 program (Compliance Plan) must be cost-effective to implement
- As the program progresses the cost to maintain implemented mitigation measures should track inflation to maintain lower-level emissions; however, costs to further implement new reduction measures is likely to continue to increase due to less opportunity for emissions reductions.
- Utilities and the CPUC can work together to innovate to uncover other areas for reducing natural gas or methane emissions to meet California Goals

Alternative Emission Reduction Efforts

- **Reductions achieved through changes in natural gas composition from blending RNG and H2**
  - SoCalGas is investigating the effects on natural gas emissions from blending renewable natural gas (RNG) and Hydrogen (H2).
  - Net emissions reduction depends heavily on the source and method of alternative fuel generation.

- **Post-Meter (Customer) Natural Gas Emissions Reductions**
  - SoCalGas is already implementing emissions reductions practices not being accounted for via SB1371 Compliance Plan measures nor Annual Emissions Reports.
  - Many existing Compliance Plan measures identify post-meter emissions sources
    - Aerial Methane Mapping
    - Advance Meter Analytics Algorithm
    - Leak Surveys

Initiatives Providing Post-Meter Emission Reductions

- **Aerial Methane Mapping Program:**
  - **Post-Meter (Customer) Leaks:**
    - o In an event of identifying leaks associated with customer's side
    - o Further Investigation is performed
    - o Company personnel replaces/tightens components connected to the MSA
    - o If the leak requires further repair:
      - Company isolates the leak or shuts off service to maintain safety
      - Issues a Hazardous or Unsatisfactory Condition Form to repair the leak with a licensed contractor. The form is signed by company personnel and the customer.
      - Once repaired, trained Company personnel assesses the repair and ensures it is up to safety standards before resuming the service.
  - **Emission Reductions Estimates:**
    - o Estimation of 1,284 downstream leaks detected via first year of implementation
    - o Estimated 240,898 MSCF reductions

Initiatives Providing Post-Meter Emission Reductions

- **Aerial Methane Mapping Program:**
  - Natural Gas Appliance Inspection and Incomplete Combustion:
    - Further Investigation is performed
    - Trained Company personnel perform appliance survey with methane detection equipment or visual test to ensure proper combustion
      - if the leak does not require parts replacement, company personnel tune/tighten the appliances' connections at no fee
      - if the leak requires parts replacement, company personnel offers replacements with a fee included in the next billing cycle
  - **Emission Reductions Estimates:**
    - Estimation of 1,853 downstream leaks detected via first year of implementation
    - Estimated 347,624 MSCF reductions

Initiatives Providing Post-Meter Emission Reductions

- **Advanced Meter Analytics Algorithm:**
  - Consumption reports generated monthly
  - Customers are notified when data indicates unusual consumption rate
  - Leak investigation is performed
    - Company personnel replaces/tightens components connected to the MSA
    - If the leak is on Customer-owned system
      - Company isolates the leak or shuts off service to maintain safety
      - Issues a Hazardous or Unsatisfactory Condition Form to repair the leak with a licensed contractor. The form is signed by company personnel and the customer
      - Once repaired, trained Company personnel assesses the repair and ensure it is up to safety standards before resuming the service

- **R&D Pilot Project for Residential Meters Methane Sensors.**

Recommended Next Steps

- Stakeholder collaboration to establish a process to allow reduction credits for post-meter emission reductions achieved through SB-1371 mitigation measures.
- Stakeholder collaboration to develop estimation methods through demonstrated emission reductions from post-meter mitigation practices and changes in gas composition
- Stakeholder collaboration to integrate reporting of emission reductions from post-meter and gas composition changes into the Annual Emissions Report

Questions?

2022 Compliance Plan Measures

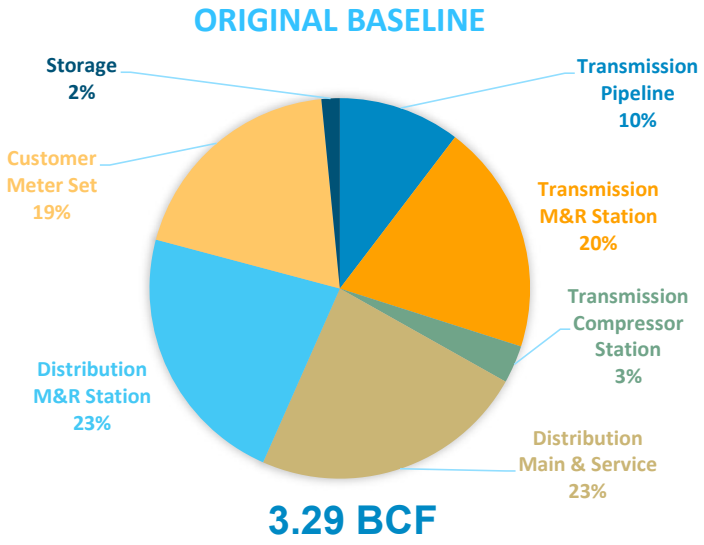
Stephen Ramos

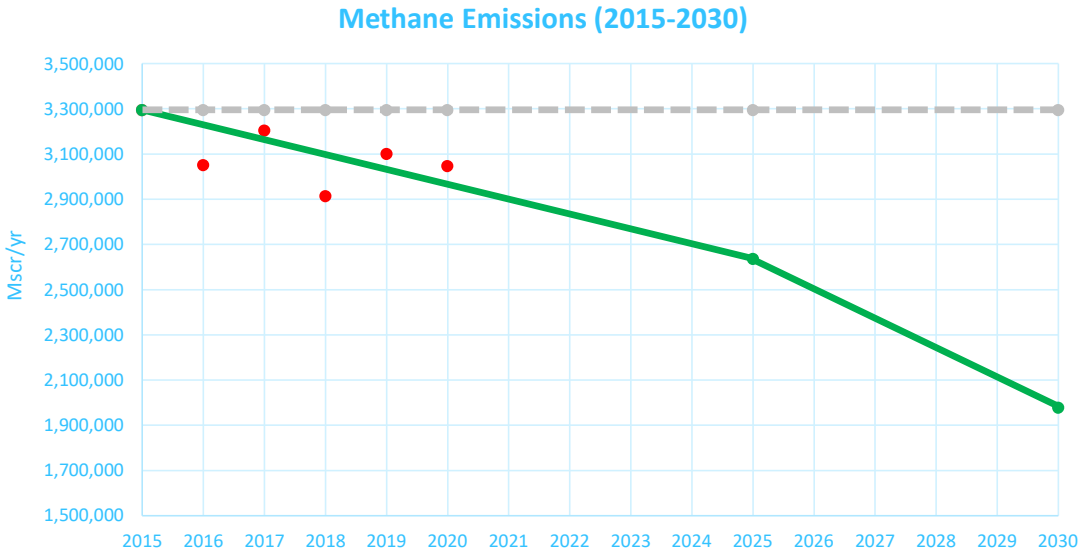
Background

Overview

As part of SB 1371, every 2 years, PG&E submits the Compliance Plan (as an attachment to the Gas Safety Plan) to the CPUC & CARB. The Compliance plan summarizes actions taken and proposed measures to reduce emissions in order to meet the reduction goals.

The goal is to reduce methane emissions 20% by 2025 and 40% by 2030 (CARB Short Lived Climate Pollutant), compared to 2015 baseline.

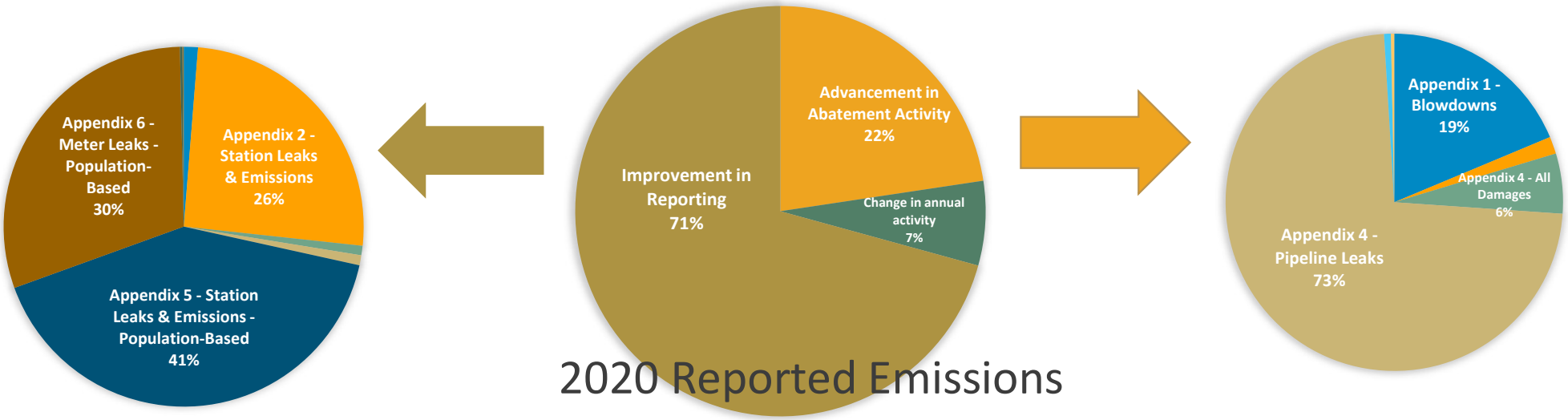




Leak Abatement OIR Reporting

Starting 2018, as part of Appendix 8 and the narrative, PG&E bucketed each emission change based on 3 categories:

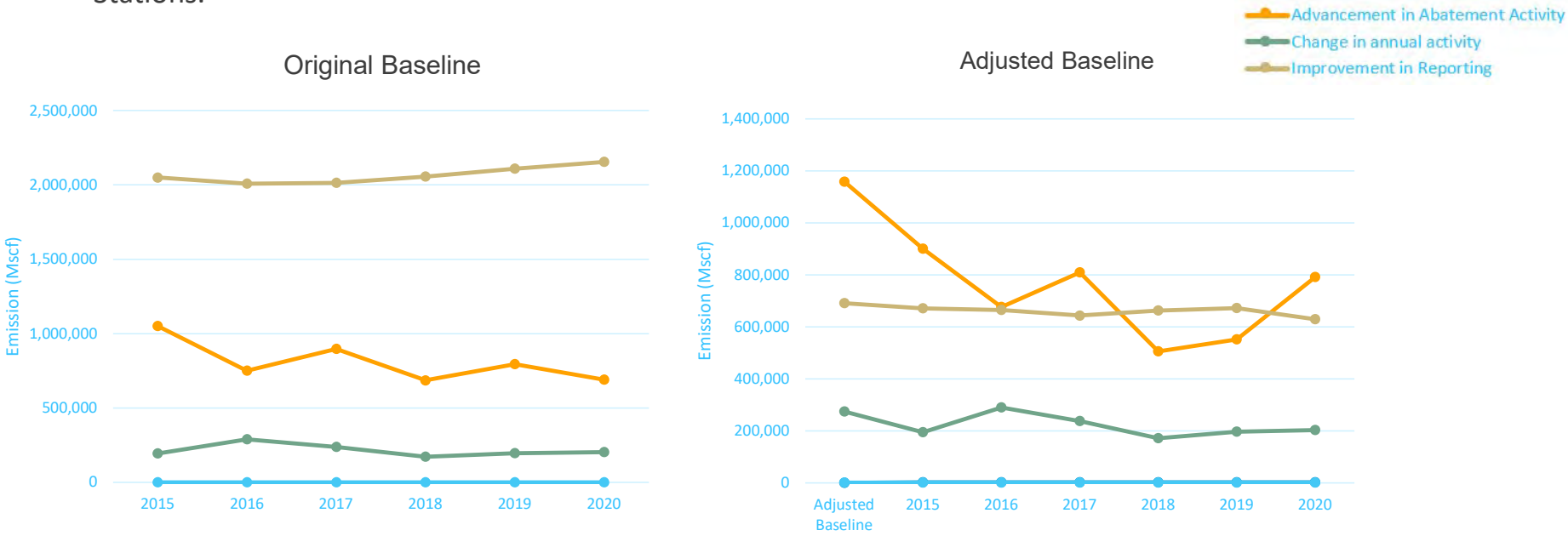
- **Improvement in Reporting:**
  - Population-based emission factor approaches.
  - Areas that can be improved to better characterize and understand emissions.
  - Improved inventory of assets
- **Advancement in Abatement Activity**
  - Actual reduction activities that can be measured, such as the Super Emitter Program and Transmission blowdown reduction strategies
- **Changes in annual activity**
  - Maintenance and/or damage activities that vary from year-to-year.
  - Activities that have little to no reduction activities.



2020 Reported Emissions

Leak Abatement OIR Reporting

- **Improvement in reporting** (i.e. population-based reporting) represents 2/3 of the overall emissions.
- Actual emission reductions through **advancements in abatement activities** are not well represented in the overall emissions.
- The baseline needs to be adjusted to better account for the Operator's emission reduction activities.
- This includes moving to the leak-based approaches for Meter Set Assemblies and Distribution M&R Stations.



Ch 3: Non-Emergency Gas Transmission Blowdown Reduction

Current Practices:

- PG&E complies through standard & procedure TD-5601S and TD-5601P-01
- Standard provides direction to:
  - Assess planned gas transmission system construction projects to incorporate methane abatement strategies
  - Drafting
  - Calculate transmission blowdown and reduction amounts
  - Complete post-blowdown evaluation and analysis after blowdown events
- Systematically deployed methane abatement activities for backbone and large transmission blowdown events.

Best Practices:

- BP 3 – Pressure Reduction Policy
- BP 4 - Project Scheduling Policy
- BP 5 – Methane Evacuation Procedure
- BP 6 – Methane Evacuation Work Order Policy
- BP 7 – Bundling Work Policy
- BP 23 – Minimize Emissions from Operations, Maintenance, and Other Activities

Effectiveness:

Pipeline Activity Type	Total Gas Volume (Mscf)
Drafting	99,756
Cross-Compression	666,686
Flaring	14,020
Bundling	20,949
Total Diverted (Drafting, Cross-Compression, Flaring)	801,411
Blowdown	150,613
% Abatement (Total Diverted/(Total Diverted + Blowdown)	84%

2021 Pipeline and Regulator Station Abatement Activities

Ch 3: Non-Emergency Gas Transmission Blowdown Reduction

Proposed New or Continuing Measure:

#	Chapter	Measure Description
1	3	Purchased gas driven mobile fill compressors, tube trailers, 2 enclosed combustion devices and 2 thermal oxidizers
2	3	Lower the pipeline pressure to near zero for scheduled backbone transmission blowdowns
3	3	Expand methane abatement strategies to stations
4	3	Evaluate degasssing technologies for ILI projects
5	3	Apply volume threshold to require a methane abatement strategy for scheduled transmission pipeline blowdowns
6	3	Review and analyze pipeline repair projects that utilized PCFs & sleeves for methane abatement
7	3	Incorporate project bundling as an abatement technique and promote/enhance the project bundling process to better capture activities & drive decisions to bundle more

Ch 7: Gas Distribution Leak Surveys, Ch 11: Find It/Fix It

Current Practices:

- Ch 7 - Accelerated leak survey, from a 5-yr to a 3-yr cycle
- Ch 7 - DIMP leak survey on vintage distribution pipelines
- Ch 7,11 – Super Emitter Program
- Ch 11 – Grade 3 Leak Repair

Best Practices:

- BP 15 – Gas Distribution Leak Survey
- BP 16 – Special Leak Surveys
- BP 21 – Find It/Fix It

Effectiveness:

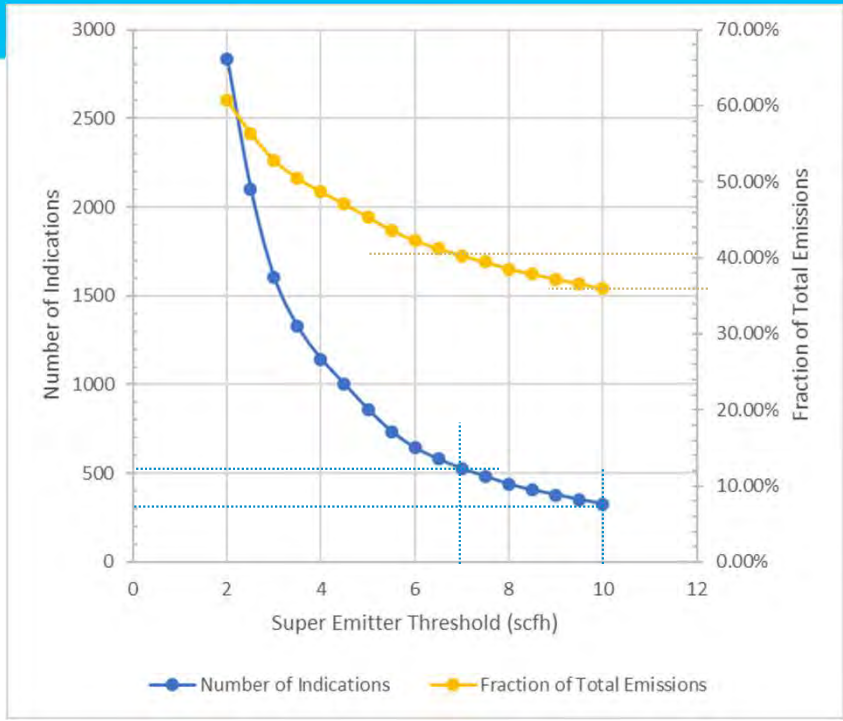
- Enables PG&E to detect and fix leaks faster than the previous cycle.
- Grade 3 Leak Repair
- Super Emitter results (see below)
- Meter Set leak management

Super Emitter Program		2018	2019	2020
Compliance Survey	Coverage	15,800 miles	12,800 miles	23,600 miles
	Number of BG SE	86	44	34
	Grade 1	42	21	18
	Grade 2	21	6	9
	Grade 3	23	17	7
	Number of repairs	54	23	26
SE Survey	Coverage	41,700 miles	56,800 miles	45,700 miles
	Number of BG SE	134	148	90
	Grade 1	35	58	42
	Grade 2	55	41	38
	Grade 3	44	49	10
	Number of repairs	74	102	58
Total	Coverage	57,500 miles	69,600 miles	69,300 miles
	Number of BG SE	220	192	124
	Actual number of repairs	128	125	84
	Number of repairs driven by the SE program	157	165	97
	Actual number of repairs under the SE program	74	102	58
	Abatement	88 MMscf	192 MMscf	186 MMscf

Ch 7: Gas Distribution Leak Surveys, Ch 11: Find It/Fix It

Proposed New or Continuing Measure:

#	Ch	Measure Description
8	3	Integrate Vintage Leak Survey into Risk Based Survey
9	7	Continue to evaluate Risk-Based Leak Survey for Operations
10	7, 11	Lower SE threshold to 7 scfh
11	11	Replace "repair of 2000 bg 3 leaks" to "repair larger leaks via lowering the SE threshold, regardless of grade"



Scenario	Net Annual Cost	Cost Notes	Abatement (Mscf)	Cost Effectiveness ($/Mscf)
For 2,064 belowground grade 3 leak repairs	$ 15,312,389	2021 bg gr 3 leak repairs	76,224	$ 200.89
SE program (>10 scfh)	$ 2,118,549	SE survey at 1.4M, assuming 123 leak repairs at $7.5k	84,692	$ 25.01
SE program (>7 scfh)	$ 4,637,850	SE survey at 1.4M, assuming 500 leak repairs at $7.5k each	213,319	$ 21.74

Ch 11: Find It/Fix It

Proposed New or Continuing Measure:

#	Measure Description
12	Prioritize Class A and B meter set leaks for repair/remediation

Classification	Description	Thresholds (scfh)	Mean Emission Rate (scfh)
A	Soap solution is blown off the facility providing no opportunity for bubbles to form and "hold"	> 4	9.5
B	Soap solution can hold a cluster of bubbles	>0.1 to ≤ 4	0.53
C	Soap solution forms a cluster of small bubbles	>0.014 to ≤0.1	0.041
D	Soap solution creates foam with few or no visible bubbles	≤0.014	0.0032

Ch 13: High-Bleed Pneumatic Device Replacements

Current Practices:

- Addressed all high bleed devices at Compressor and Underground Storage facilities (CARB O&G Rule)
- Converted the power gas at 2 intermittent valves from natural gas to instrument air in Topock
- Continue to replace high bleed devices at Measurement & Control Station Facilities (2 replaced at 1 station in 2021)

Best Practices:

- BP 23 – Minimize Emissions from Operations, Maintenance and Other Activities

Proposed New or Continuing Measure:

#	Measure Description
13	High bleed pneumatic replacements. For 2022-2023, plan to replace 10 high bleed controllers at 2 M&C Stations and convert the power gas at 18 intermittent bleed valves from natural gas to air in Hinkley.
14	Feasibility study to reduce methane emissions at Compressor Station/Storage Facility

Effectiveness:

- Appendix 9 EFs: High bleed controllers (18.6 scfh), Intermittent Bleed controllers (2.4 scfh), low bleed controllers (1.4 scfh).
- For the 2 intermittent valves converted to instrument air in Topock, assuming 20 years, the emissions savings is 841 Mscf.
- For the 2 high bleed controller replacements at the one M&C station, assuming 20 years, the emission savings is 6,507 Mscf.

Ch 15: R&D Projects

Current Practices:

- N/A – forward looking

Best Practices:

- BP 20a – Quantification & Geographic Tracking
- BP 23 – Minimize Emissions from Operations, Maintenance and Other Activities

Effectiveness:

- 15/16 will not directly abate methane emissions, but rather provide PG&E with the ability to directly calculate emissions from its regulator stations.
- 17 will evaluate an alternative to further reduce emissions during flaring activities.
- 18/19 will research alternative methods to estimate emissions in the distribution M&S category.
- 20 will evaluate other technologies to better characterize compressor emissions in Compressor Station and Underground Storage Facilities.

Proposed New or Continuing Measure:

#	Measure Description
15	Transmission M&R Station Emission Framework
16	Evaluate the feasibility of using the bubble classification method on station facilities
17	Flaring Alternative
18	Vehicle-Based Measurements and Emissions
19	High Sensitivity Methane Detector for Estimating Flow Rate
20	Vented Emission Measurements





Thank You

Stephen Ramos
Stephen.ramos@pge.com

Closing and Next Steps

CARB and CPUC

4:15-4:25pm

California Public
Utilities Commission

Questions?

- Click the hand next to your name in the participant list
- The host will call on your name and unmute you when it is your turn to speak
- Or, type question into the chat

THANK YOU

For more information and today's slides:

https://www.cpuc.ca.gov/about-cpuc/divisions/safety-policy-division/risk-assessment-and-safety-analytics/methane-leaks

California Public Utilities Commission