

2023 Natural Gas Leak Abatement (NGLA) Winter Workshop

9:00am-3:30pm

Wednesday, February 1, 2023



California Public
Utilities Commission

Welcome, Introductions, and Agenda

CPUC




California Public
Utilities Commission

Housekeeping Notes

- **Audio**

- Please mute your microphone unless you are speaking

- **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

- **Recording**

- A link to the recording will be made available on the CPUC NGLA webpage (<https://www.cpuc.ca.gov/about-cpuc/divisions/safety-policy-division/risk-assessment-and-safety-analytics/gas-leak-abatement-oir-r-15-01-008>)

Overview of the Workshop

MORNING

- Welcome and Introductions
- Review of the 2022 Joint Report
- Review of the NGLA Program 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
Introduction and Agency Reports		
CPUC/CARB	Introduction/Welcome	9:00-9:10am
CPUC/CARB	Overview of Joint Report	9:10-9:25am
CPUC/CARB	Overview of NGLA Program Report	9:25-9:40am
Appendix-Specific R&D and Updates		
Sempra	Appendix 2: Develop Leaker-Based Emission Factors for Transmission M&R Stations Transmission M&R Emissions Study	9:40-10:00am
Sempra	Appendix 3: Compressor Rod Packing Quarterly Measurements	10:00-10:15am
-	Break	10:15-10:30am
Sempra	Appendix 4: DM&S Emission Factors	10:30-10:50am
Sempra	Appendix 6: Company-Specific Leaker-Based Emission Factor Development for Customer Meters	10:50-11:10am
Template and Reporting Updates and Baseline Adjustments		
CPUC/CARB	Proposed Changes for 2023 Reporting Templates	11:10-11:35am
CPUC/CARB	Summary of Baseline Adjustments	11:35-11:50am
-	Lunch	11:50am-1:00pm
Broader R&D Updates and Compliance Plan Efforts		
Sempra	Aerial Methane Mapping Update	1:00-1:30pm
Sempra	R&D Project Update	1:30-1:45pm
PG&E	2022 Compliance Plan Update	1:45-2:00pm
PG&E	GHG Abatement for Planned Transmission Blowdowns	2:00-2:15pm
-	Break	2:15-2:30pm
PG&E	Distribution Main & Service Adjusted Baseline Proposal	2:30-2:50pm
PG&E	R&D Project Updates	2:50-3:05pm
PG&E	Other GHG Emission Reduction Strategies	3:05-3:20pm
CPUC/CARB	Closing and Next Steps	3:20-3:30pm

Questions?

- Click the hand next to your name in the participant list 
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- Or, type question into the chat





Review of the 2022 Joint Report

2023 Natural Gas Leak Abatement Program
CPUC Winter Workshop
February 1, 2023

Background

- The 2022 Joint Report is the eighth Joint Report prepared by CPUC and CARB.
- CPUC issued data request and reporting template on March 30, 2022.
- All gas companies submitted 2021 data on June 15, 2022.
- The annual list of questions sent to utilities in August 2022 required minimal gas company data resubmittals this year.
- As required by SB 1371, the 2022 Joint Report presents total industry emissions and the systemwide leak rate.

Total Statewide Natural Gas Emissions in 2021

The total statewide 2021 estimated natural gas emissions was **3,430 million standard cubic feet**:

- **5% lower** than the 2020 adjusted natural gas emissions estimates.
- **23% lower** than the 2015 baseline natural gas emissions estimates.

Table 1: Total Statewide Natural Gas Emissions Reported Under SB 1371							
Sector Emissions	2015 Baseline*	2020*	2021	2015 Baseline to 2021 Change		2020 - 2021 YOY Change	
				MMscf, MMT CO ₂ e	% Change	MMscf, MMT CO ₂ e	% Change
Volume of Natural Gas (MMscf)	4,437	3,608	3,430	(1,007)	(23%)	(178)	(5%)
Mass Equivalent, 100-Yr GWP, AR 4 (MMT CO ₂ e)	1.99	1.62	1.54	(0.45)	(23%)	(0.08)	(5%)
Mass Equivalent, 20-Yr GWP, AR 4 (MMT CO ₂ e)	5.72	4.65	4.42	(1.30)	(23%)	(0.23)	(5%)

* The adjustments to the 2015 baseline emissions approved by the CPUC on October 26, 2022 reduced the 2015 baseline emissions reported in the 2021 Joint Report by 2,164 MMscf (approximately 33%).

** The 2020 total has been modified from the 2021 Joint Report, which is described in the section, "2020 Data Adjustments and Corrections" of this 2022 Joint Report.

Review of System Categories

Table 2: Total Natural Gas Emissions by System Category⁵

System Category	2015 Baseline		2020		2021		2015 Baseline to 2021 Change		2020 - 2021 YOY Change	
	MMscf	% Total	MMscf	% Total	MMscf	% Total	MMscf	% Change	MMscf	% Change
Transmission Pipeline	557	13%	261	7%	174	5%	(383)	(69%)	(87)	(33%)
Transmission M&R Station	777	18%	760	21%	716	21%	(61)	(8%)	(44)	(6%)
Compressor Station	181	4%	143	4%	141	4%	(40)	(22%)	(2)	(1%)
Distribution Mains & Services	1,473	33%	1,184	33%	1,144	33%	(329)	(22%)	(40)	(3%)
Distribution Metering & Regulating Stations	284	6%	270	7%	267	8%	(17)	(6%)	(3)	(1%)
Customer Meter	823	19%	843	23%	851	25%	28	3%	8	0.9%
Underground Storage	342	8%	146	4%	137	4%	(205)	(60%)	(9)	(6%)
Total	4,437	100%	3,608	100%	3,430	100%	(1,007)	(23%)	(178)	(5%)

System-wide Leak Rate

Estimated as the natural gas emissions relative to throughput for all respondents.

Table 4: System-wide Throughput, Emissions, and Leak Rate - 2015, 2020, and 2021

Throughput Category	Natural Gas Volume (MMscf)		
	2015 Baseline	2020	2021
Total Storage Annual Volume of Injections to Storage	199,522	182,841	166,893
Total Storage Annual Volume of Gas Used by the Gas Department	N/A	1,803	1,732
Total Transmission Annual Volume of Gas Used by the Gas Department	7,717	6,951	7,018
Total Transmission Volume of Annual Gas transported to or for Customers in state	1,832,676	1,745,839	1,775,141
Total Transmission Volume of Annual Gas transported for Customers out of state	16,775	12,567	13,335
Total Distribution Annual Volume of Gas Used by the Gas Department	261	362	428
Total Throughput	2,056,950	1,950,363	1,964,547
Total Emissions	4,437	3,608	3,430
System-wide Leak Rate $\left(\frac{\text{Total Emissions}}{\text{Total Throughput}}\right)$	0.22%	0.18%	0.17%

Summary

- CPUC and CARB followed the process used in previous years to compile the 2022 Joint Report.
 - Following the March 2022 email with the reporting template, Staff sent reporting template revisions in June.
 - Respondents revised submitted data after the June due date to address CPUC and CARB questions and comments.
- Staff aim to finalize all template revisions by March 31, 2023 to avoid sending multiple reporting template updates.
- The proposed changes to the 2023 reporting template will be described in a later presentation.

NGLA Program Staff Evaluation

2023 NGLA Winter Workshop

Fred Hanes, Project and Program Supervisor

Safety Policy Division

February 1, 2023



California Public
Utilities Commission

Overview/Background

- Mid-course progress update with recommended modifications
- Deadline extended to end of 2022
- Based on SPD-approved methods and baseline changes

Program Results

- Based on the 2022 Joint Report:
 - 23 percent reduction from adjusted baseline for all companies
 - Exceeds the 2025 target of 20 percent for PG&E, SoCalGas
 - Sector emissions of 1.5 MMT CO₂(e) now at 0.4% of Statewide GHGs


Recommendations

- No hard target for 2030
 - Voluntary forecasting to meet 40 percent reduction goal
 - Statewide GHG impact from 20 percent to 40 percent is small
 - New CARB goal of 50 percent will not achieve much more for this sector
- Break-even cost for future ratepayer funded measures
 - Net cost effectiveness less Cap/Trade and Social Cost = zero
 - Social Cost of Methane must be adjusted for present value
 - CARB reports better than break-even cost for other methane sectors
- Emissions data verification audit
 - Details to be determined

Next Steps

- SPD plans to propose recommendations in a staff resolution
- SPD to develop data verification project
 - Coordinated with IOUs, CARB
 - May include field observations
 - May audit native leak records

Questions?

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APPENDIX 2: DEVELOP COMPANY- SPECIFIC EMISSION FACTORS FOR TRANSMISSION M&R STATIONS

February 1, 2023

Agenda

- » Objective
- » Method & Approach
- » Results

Objective

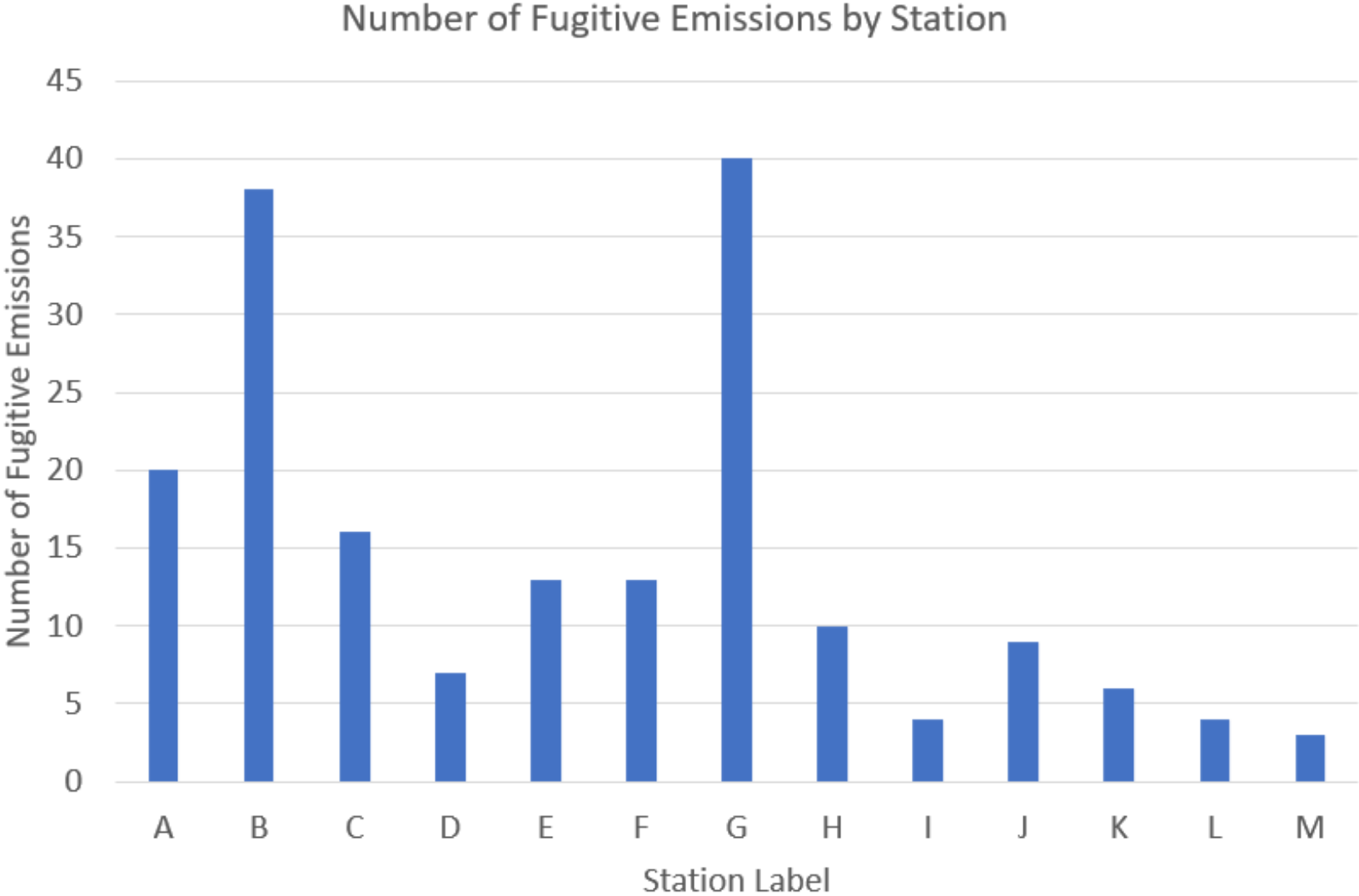
- » Develop Company-Specific Emission Factors for Transmission M&R Stations, validated by overall station emission profiles using both aerial and ground-based quantification technologies.
- » This data can be used to:
 - Develop emission factors for M&R Facility by station category
 - Verify thoroughness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

Method & Approach

- » Surveyed 13 pressure limiting stations in SoCalGas territory
- » Ground-based measurements
 - Surveyed w/ Toxic Vapor Analyzer (TVA) all connection points and outlets within the facilities for potential emissions and quantified flow rates using bagging method (Hi-Flow sampler)
 - Intermittent releases from pneumatic devices were measured with a meter installed at the exhaust point of the actuator
 - Compared Infrared (IR) thermal imaging camera and Aerial (Drone) Tunable-Diode Laser Spectrometer (TDLAS) as facility screening methods to verify all emission sources were captured

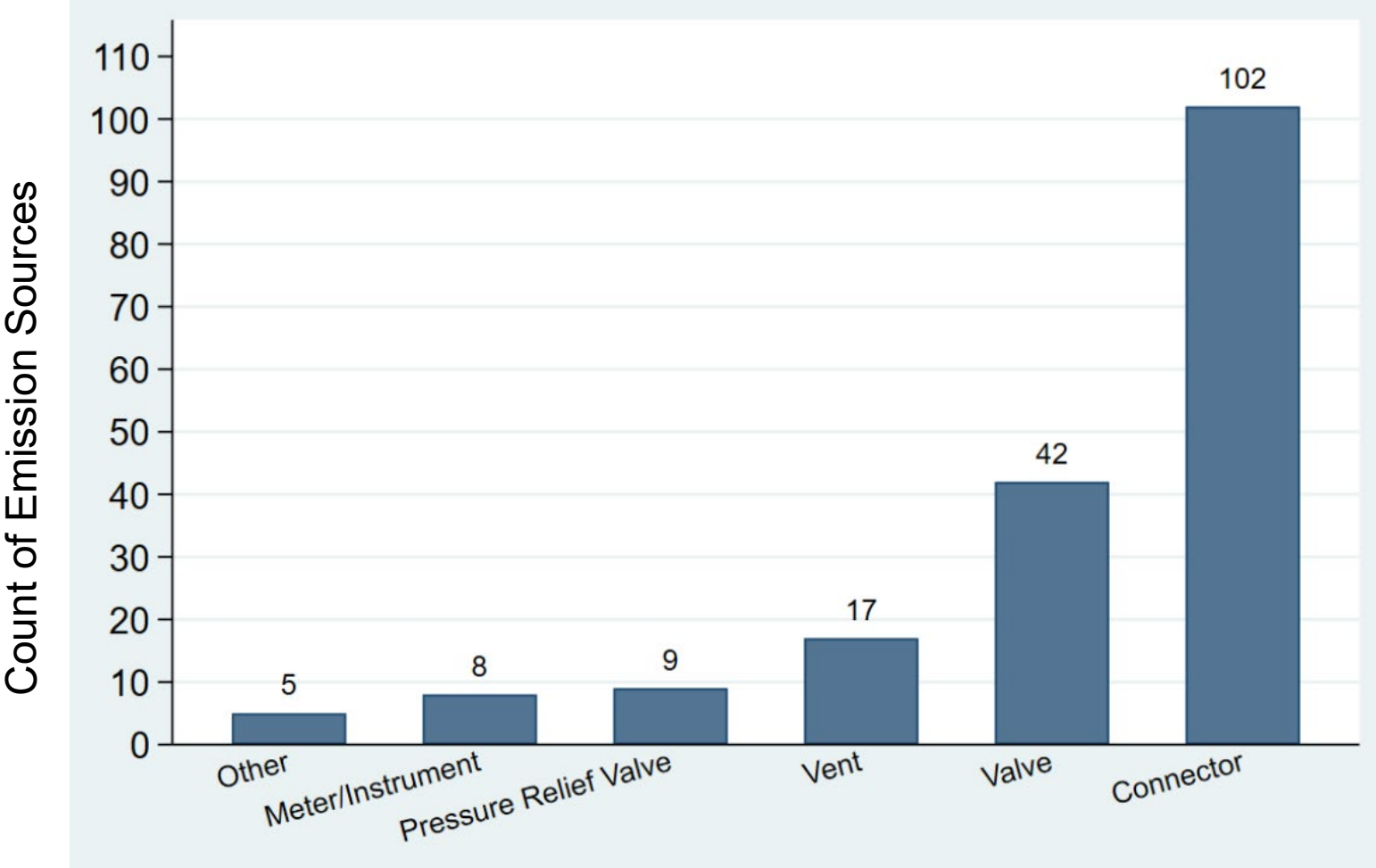


Results: Ground Measurements, Fugitive Emissions



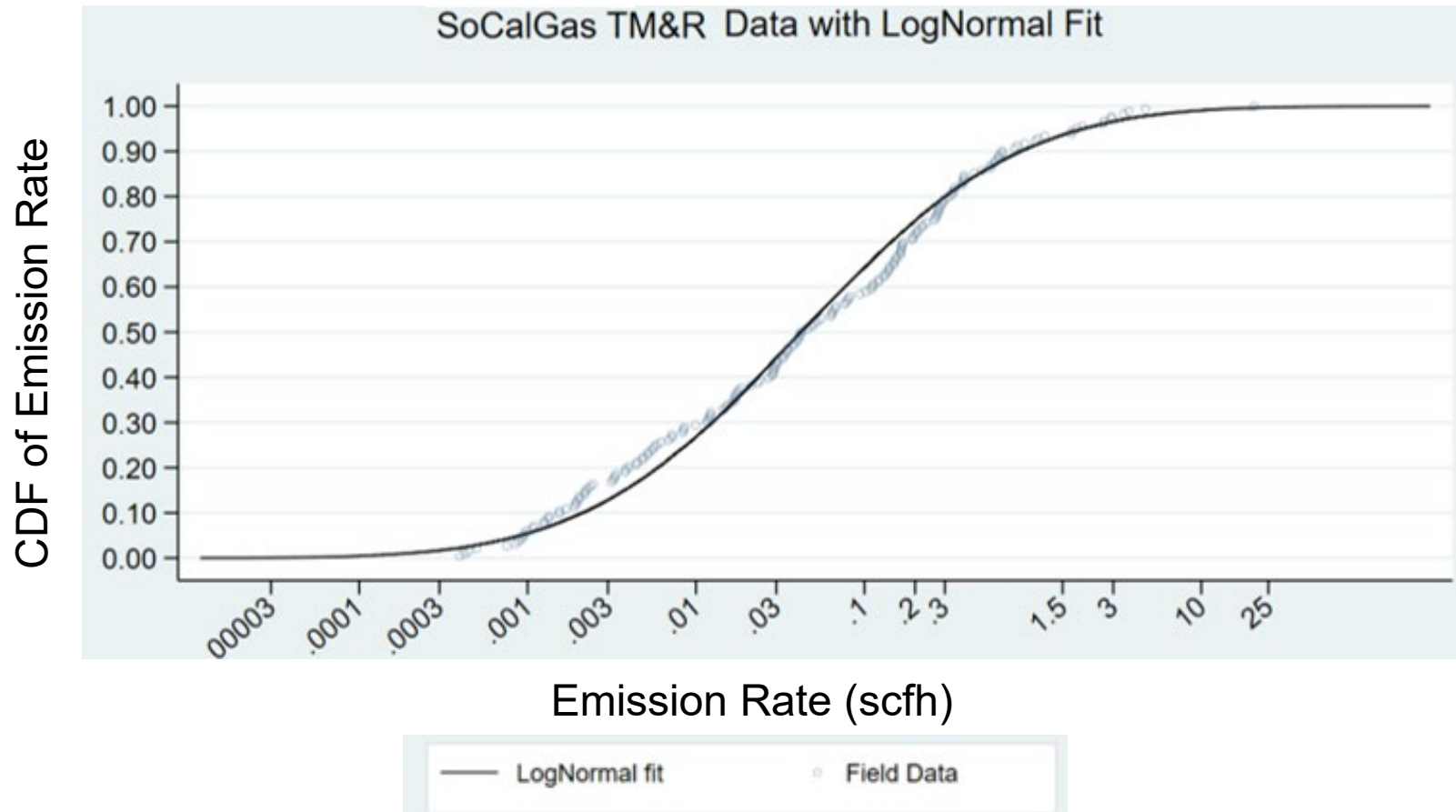
Results: Ground Measurements, Fugitive Emissions

Count of Emission Sources by Component Type

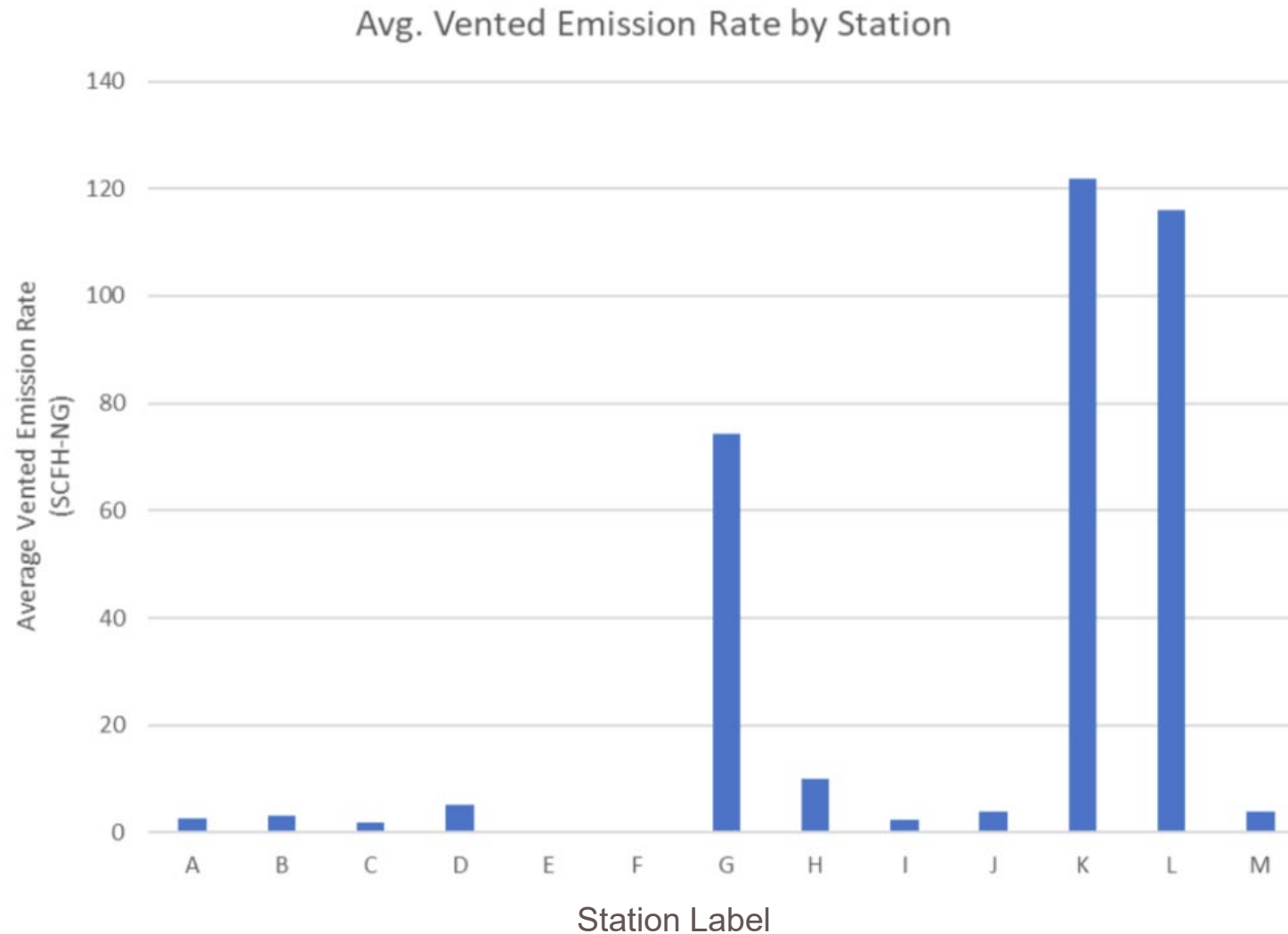


Results: Ground Measurements, Fugitive Emissions

Cumulative Fraction of Emission Rates

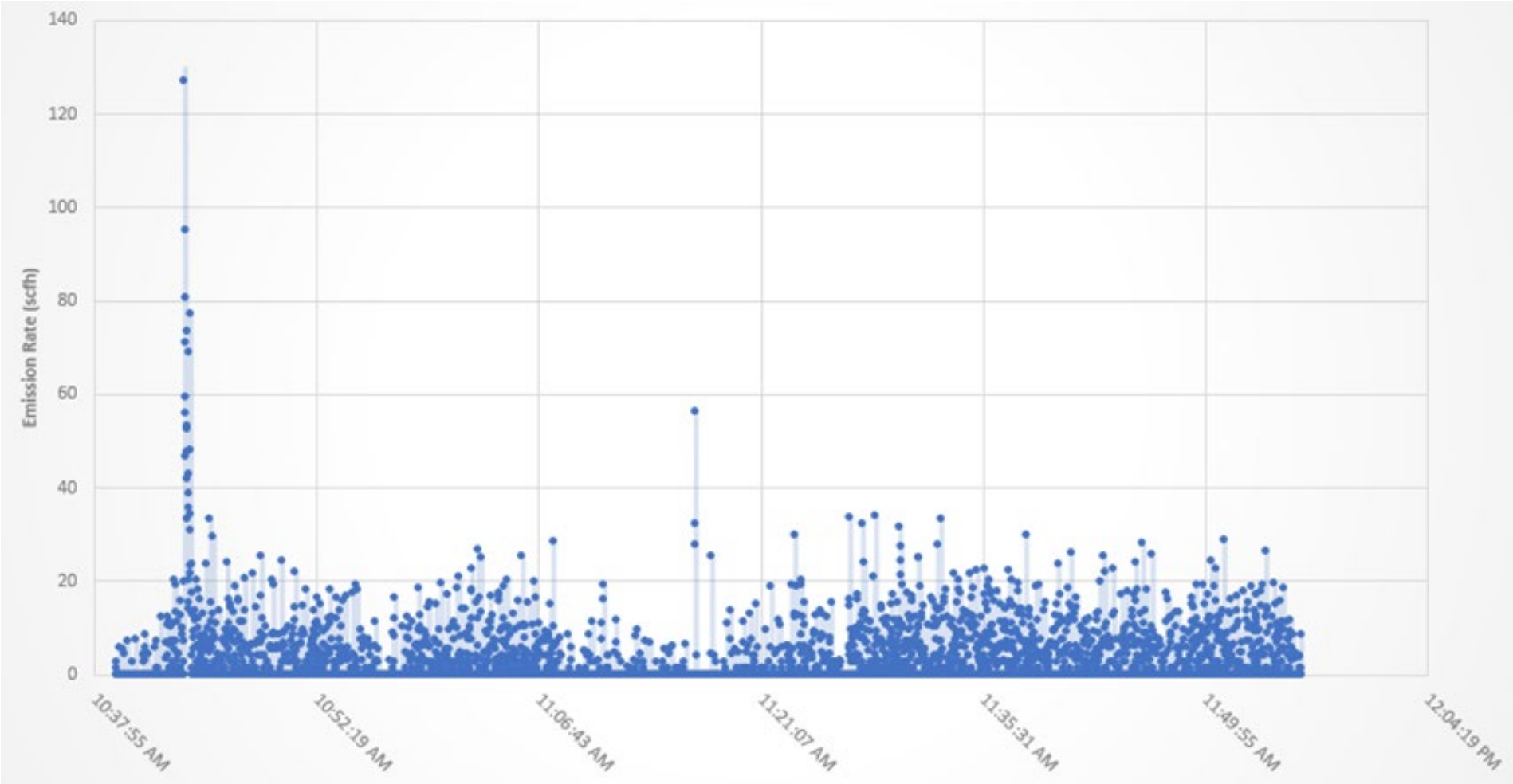


Results: Ground Measurements, Vented Emissions



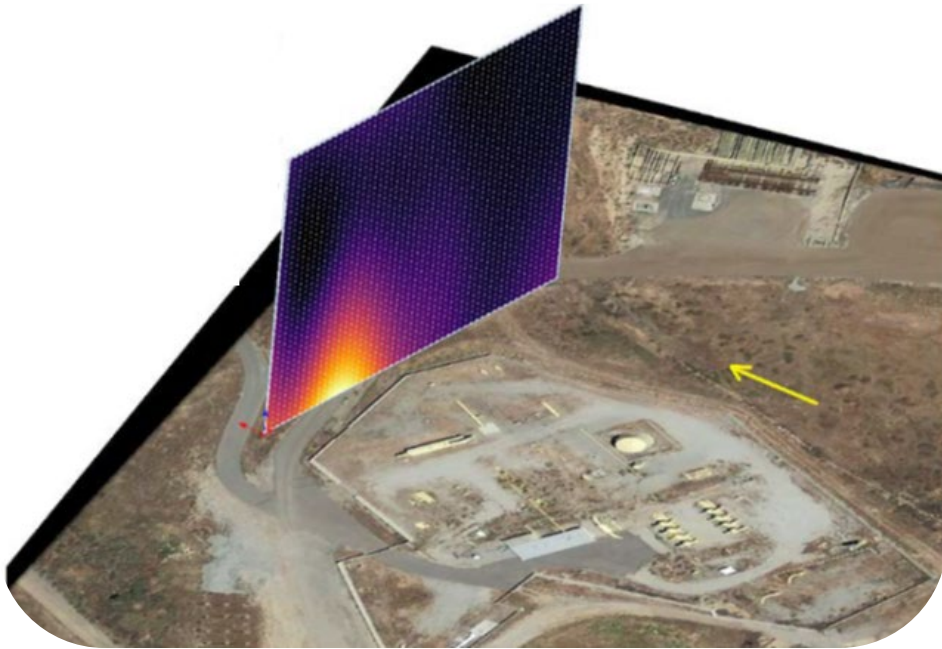
Results: Ground Measurements, Vented Emissions

Actuator Emission Rate Sample Over Time

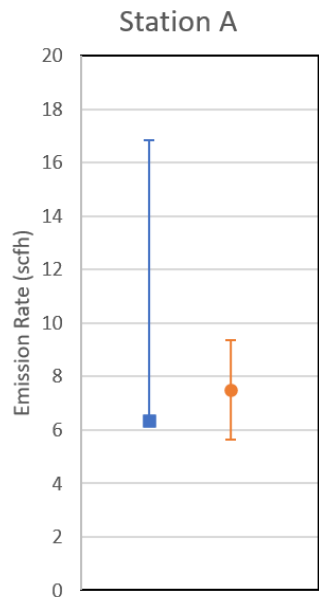


Results: Station Flux-Rate Verification Method & Approach

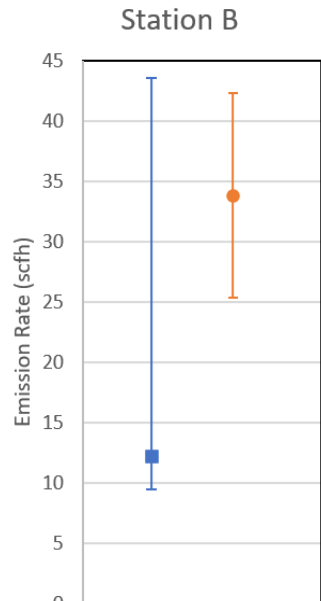
- » Aerial measurements using Open Path Laser Spectrometer (OPLS) technology
 - Performed fence line survey at 9 out of 13 stations using OPLS-equipped drones to compare emission detection and quantification estimates with ground-based measurements.



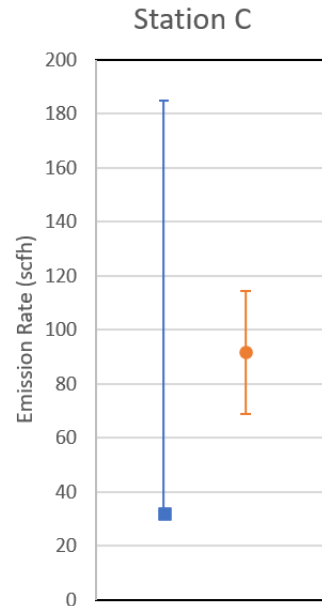
Results: Aerial Flux Measurements



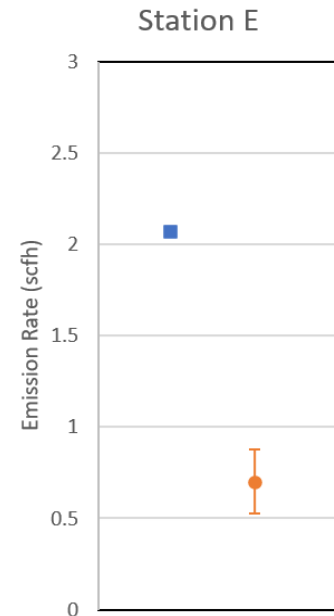
● Drone-based Overall (scfh)
■ Ground-based Fugitive & Vented (scfh)



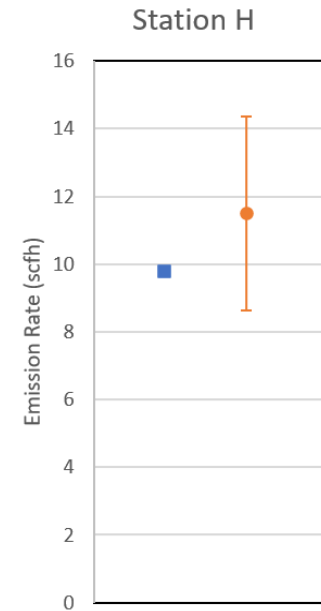
● Drone-based Overall (scfh)
■ Ground-based Fugitive & Vented (scfh)



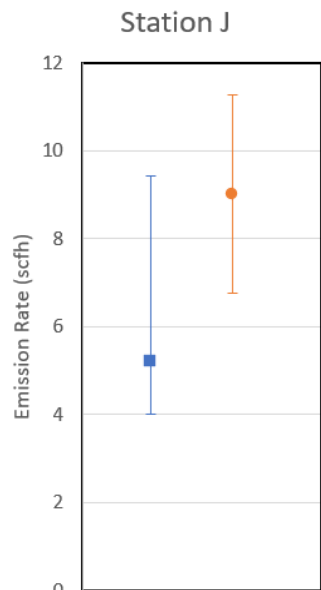
● Drone-based Overall (scfh)
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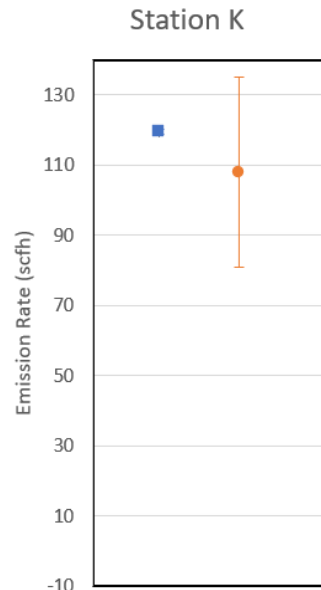
● Drone-based Overall (scfh)
■ Ground-based Fugitive & Vented (scfh)



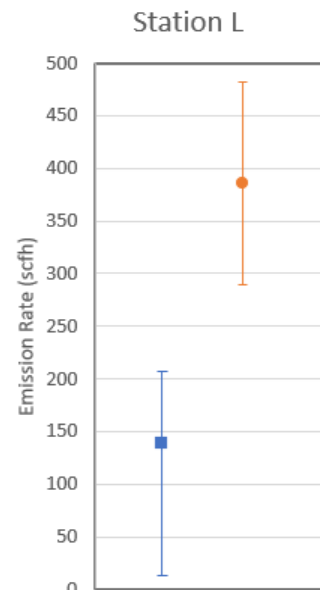
● Drone-based Overall (scfh)
■ Ground-based Fugitive & Vented (scfh)



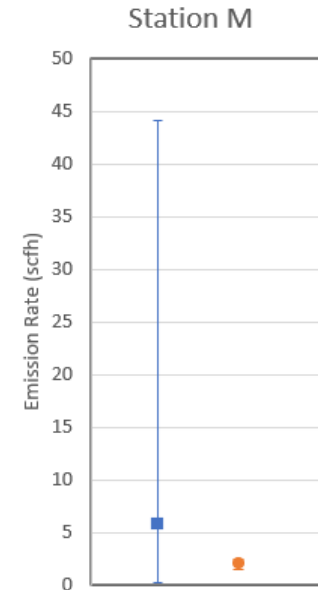
● Drone-based Overall (scfh)
■ Ground-based Fugitive & Vented (scfh)



● Drone-based Overall (scfh)
■ Ground-based Fugitive & Vented (scfh)



● Drone-based Overall (scfh)
■ Ground-based Fugitive & Vented (scfh)



● Drone-based Overall (scfh)
■ Ground-based Fugitive & Vented (scfh)



Next Steps

- » Continue data analysis and station categorization alongside next phase of NYSEARCH research project
- » Collect additional data samples for fugitive station emissions
- » Collect additional data samples for vented emissions
 - SoCalGas is developing a hardware package to quantify and record emissions from station actuators over a longer period of time
 - This data will be used to refine emission factors for pneumatic devices (vented emissions)

Questions?



APPENDIX 3: COMPRESSOR ROD PACKING QUARTERLY MEASUREMENTS

February 1, 2023



Agenda

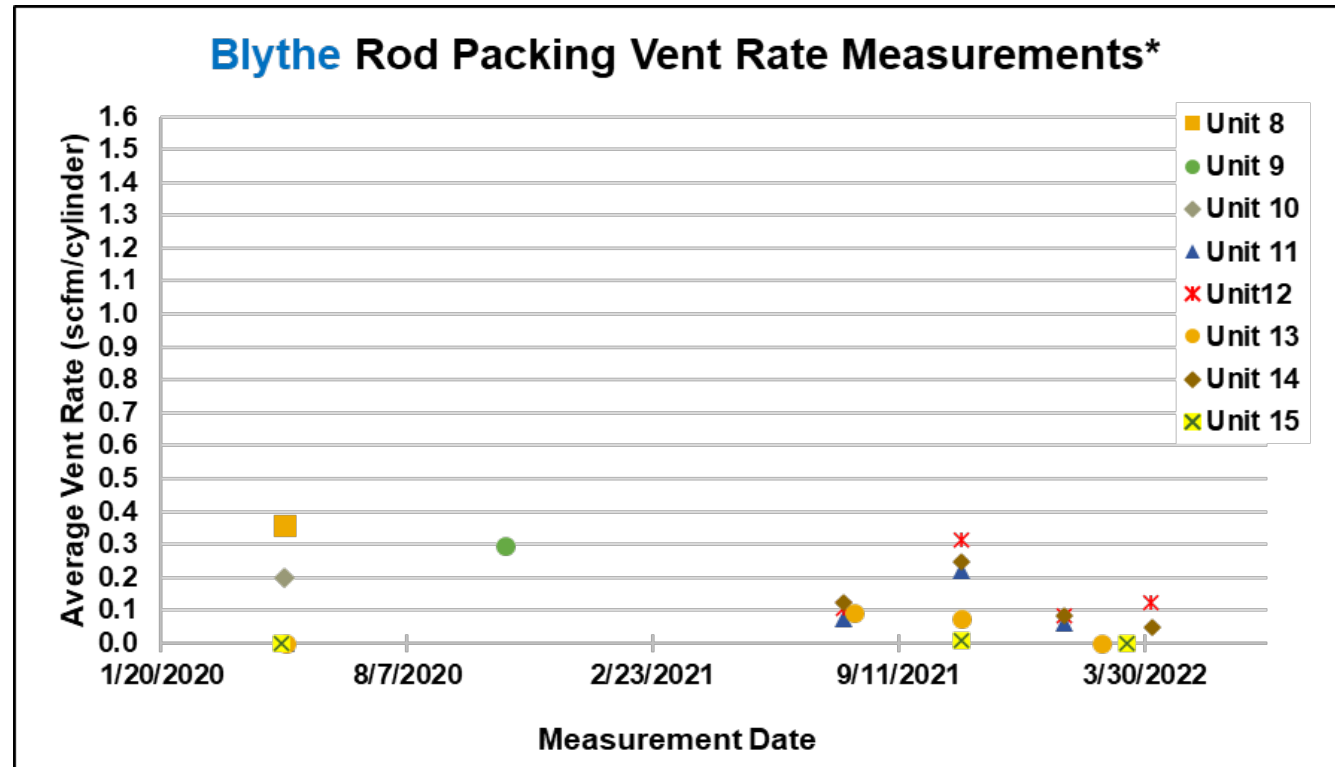
- » Background
- » Results
- » Summary
- » Conclusion

Background

- » During the 2021 Winter Workshop, questions arose regarding the variability of compressor emission flow rate data and the rate at which packing with flow rates >2 scfm/cylinder were identified. In response, it was agreed that SoCalGas/SDG&E would perform a quarterly testing pilot study.
- » 4 stations were selected to participate in the pilot study (Blythe, Moreno, South Needles, and Ventura), which encompassed 24 total compressors.
- » As-found measurements were taken quarterly for each compressor between 2020 and mid-2022
- » Pilot Goals:
 - Identify and/or characterize variability in measurements
 - Identify correlation between leak growth and packing age
 - Will increased testing help predict failure?
 - Identify failures prior to annual testing

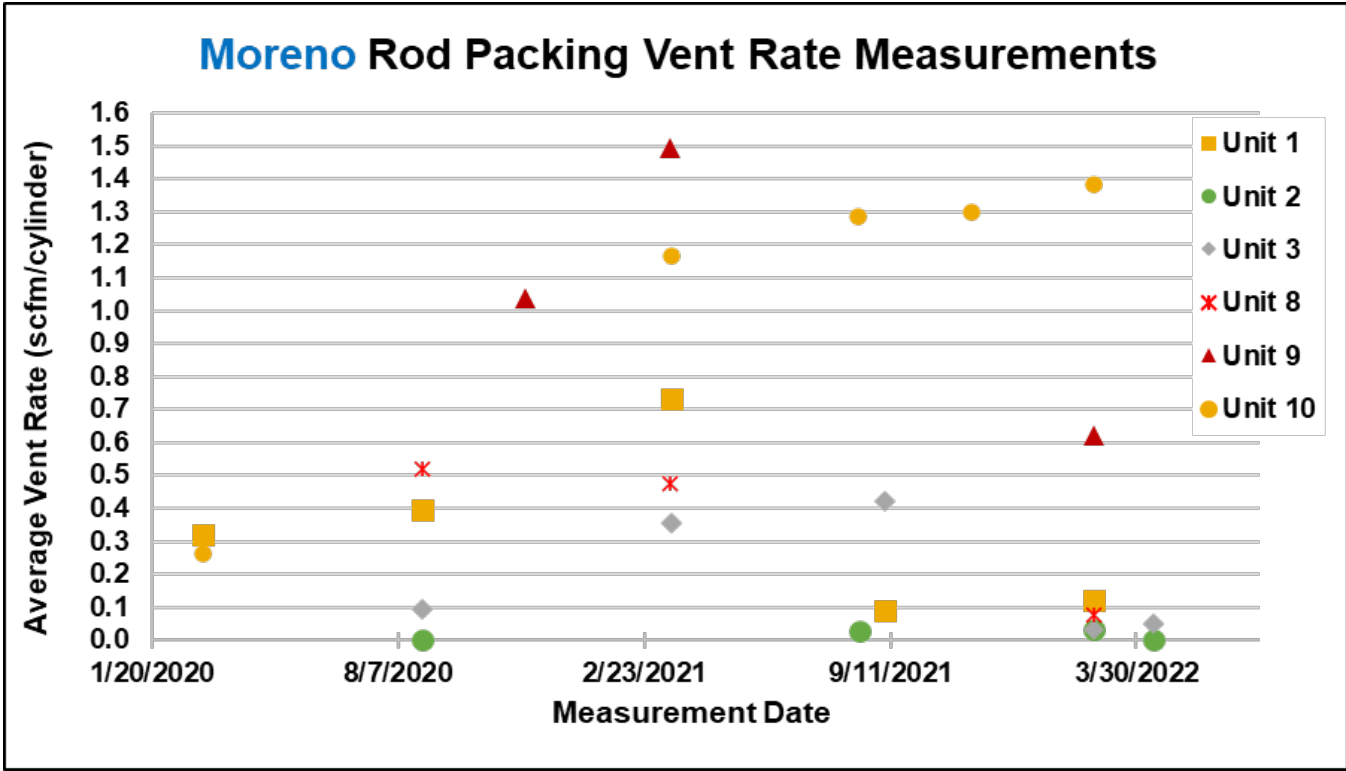
2020 – 2022 Annual + Quarterly Emission Measurements

- » **Blythe Clark Compressors** – annual and quarterly operating pressurized (OP) mode
 - *CATs not included in quarterly pilot because of vapor recovery exemption
- » No units have trend of increasing rod packing emission rate with time leading to > 2 scfm/cylinder



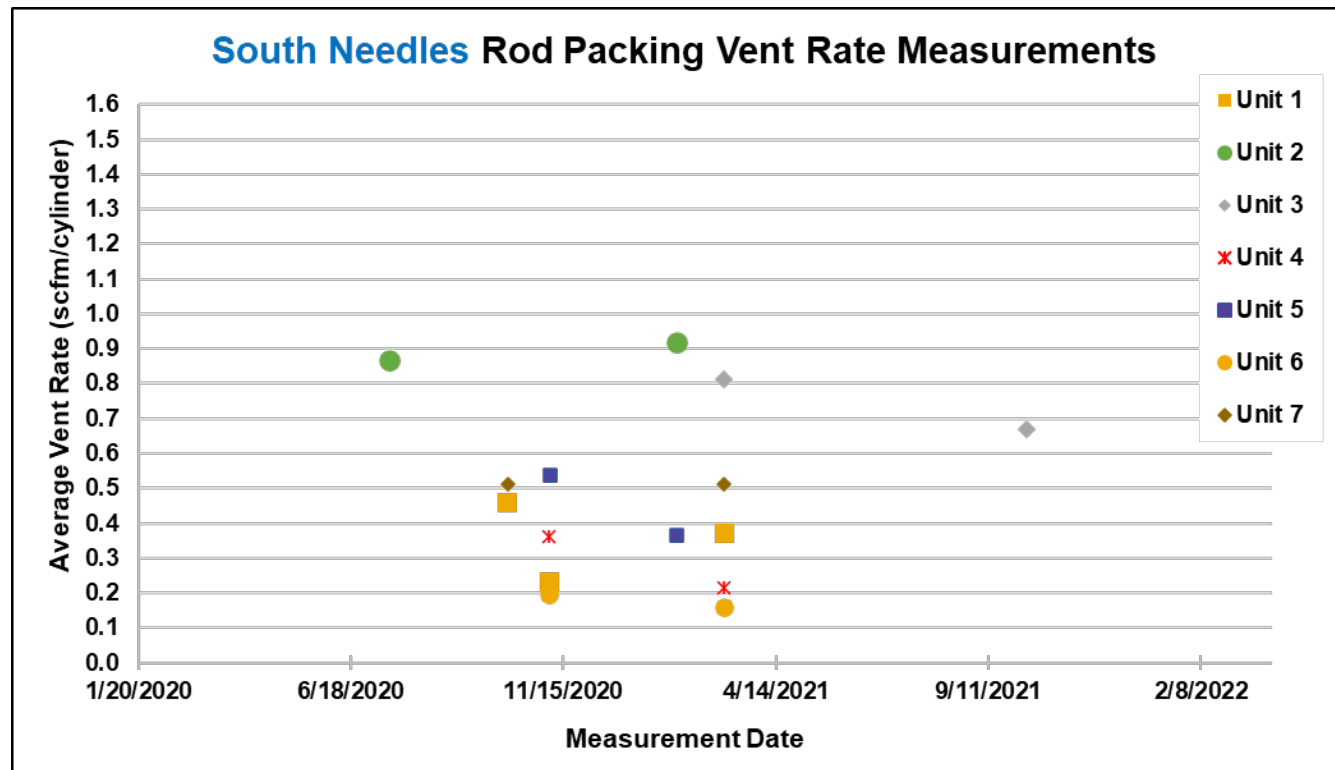
2020 – 2022 Annual + Quarterly Emission Measurements

- » **Moreno Compressors** – annual and quarterly OP mode
- » No units have trend of increasing rod packing emission rate with time leading to > 2 scfm/cylinder



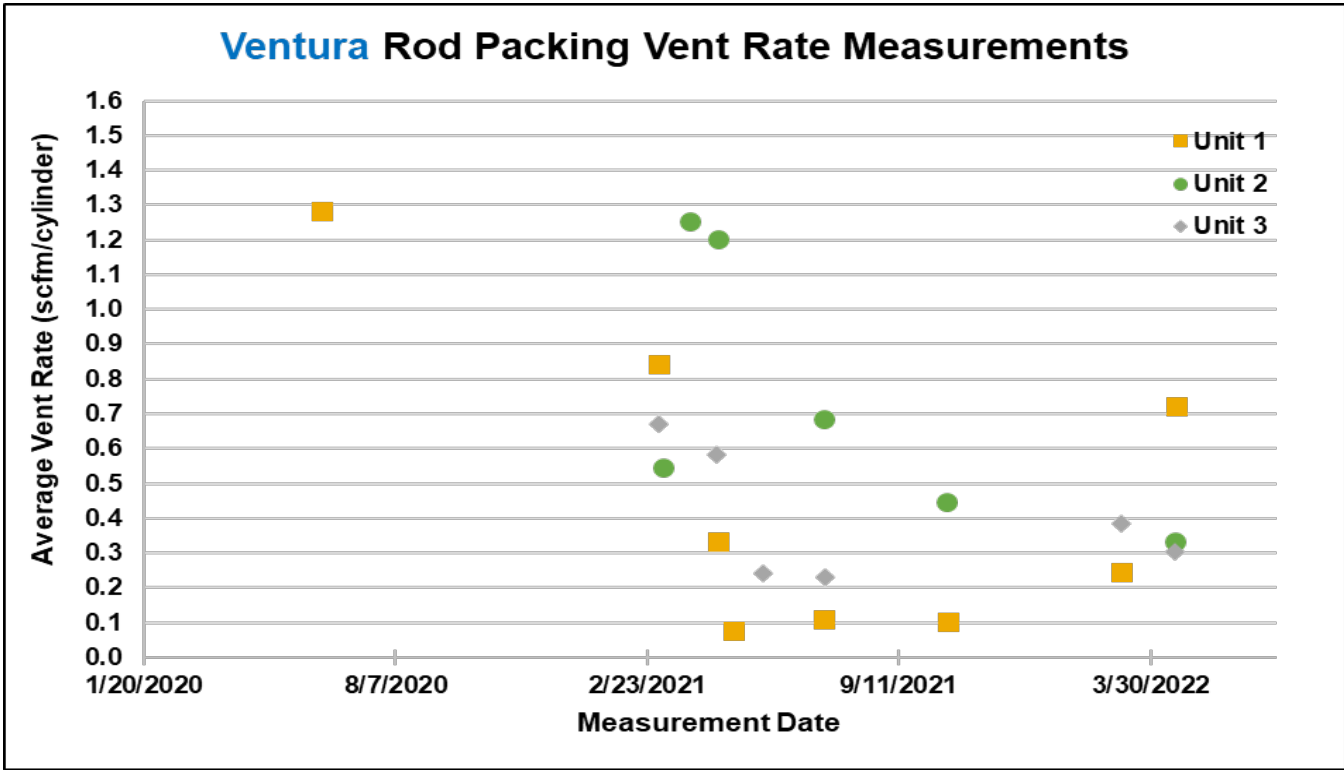
2020 – 2022 Annual + Quarterly Emission Measurements

- » **South Needles Compressors** – annual and quarterly OP mode
- » No units have trend of increasing rod packing emission rate with time leading to > 2 scfm/cylinder



2020 – 2022 Annual + Quarterly Emission Measurements

- » **Ventura Compressors** – annual & quarterly OP mode
- » No units have trend of increasing rod packing emission rate with time leading to > 2 scfm/cylinder



Summary and Conclusion

- » Rod packing emission rates vary randomly with time
 - No trend of increasing rod packing emission rate with time leading to > 2 scfm/cylinder was observed
- » Quarterly testing is not effective at predicting rod packing failures (vent rates > 2 scfm/cylinder)
 - 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
- » SoCalGas/SDG&E does not plan to proceed with quarterly rod packing emission measurements

Questions?



APPENDIX 4: DISTRIBUTION MAINS & SERVICE EMISSION FACTORS

February 1, 2023

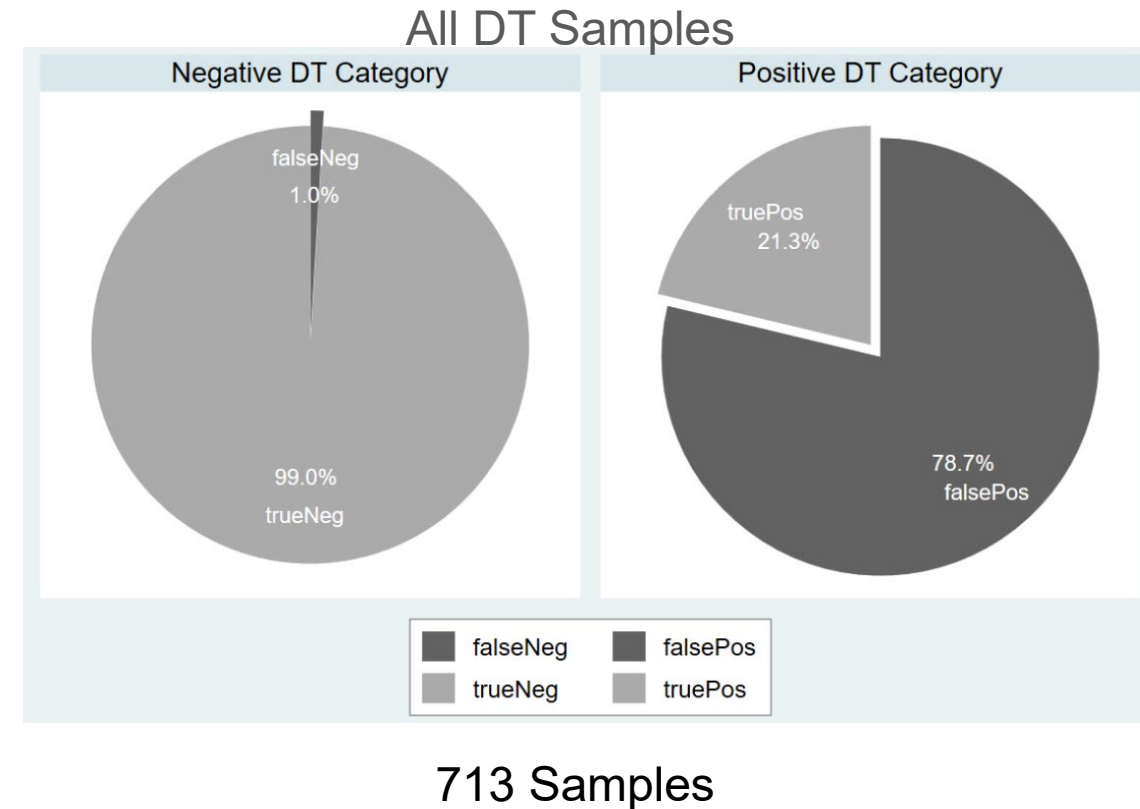
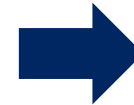
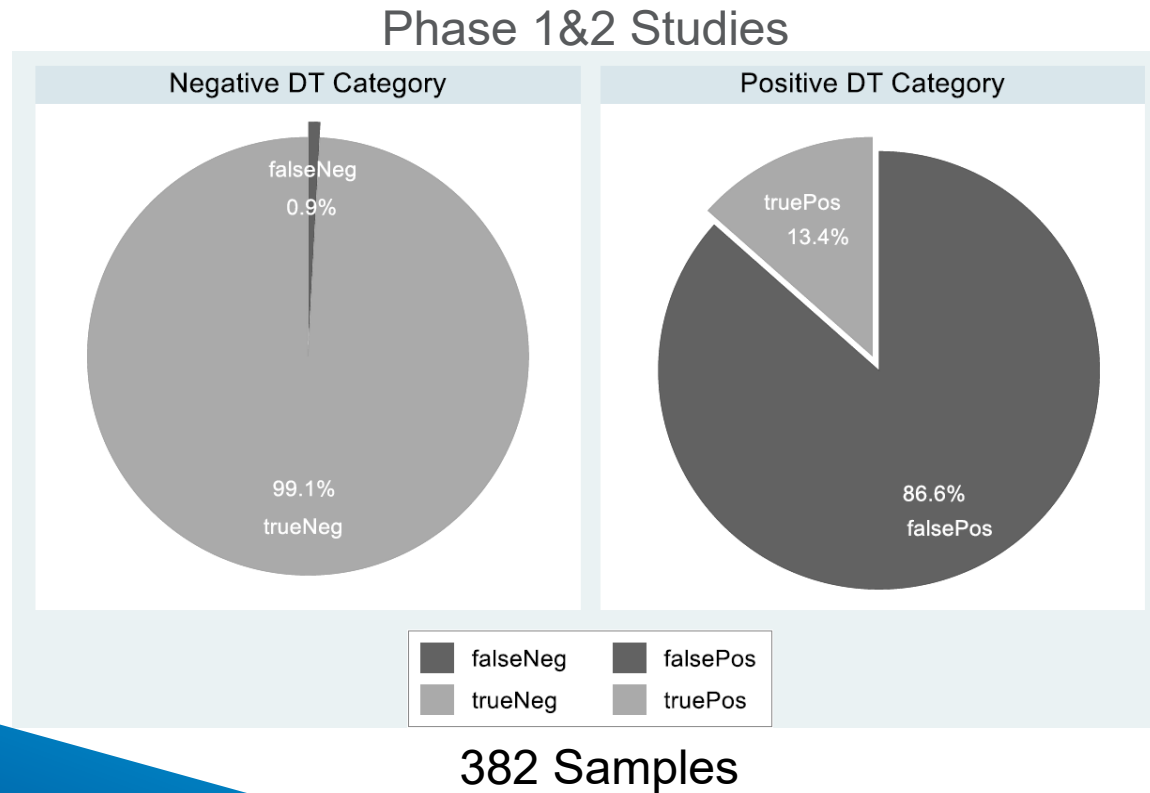


Agenda

- 2022 SoCalGas "Decision Tree" Implementation Results
- Refinement of Emission Factors and Confidence Intervals
- SoCalGas System Trends
- SDG&E Sampling

Decision Tree Implementation (DTI) Sampling (2021-2022)

- Quantified 148 DT_{pos} and 183 DT_{neg} additional belowground samples (increasing total sample count from 382 to 713)



PRELIMINARY

SoCalGas Emission Factor Adjustments

- The Bayesian analysis leveraged the larger sample to further refine the EF and tighten the Confidence Intervals for DT_{pos} and DT_{neg}

For example, DT_{pos} (≥ 10 scfh prediction):

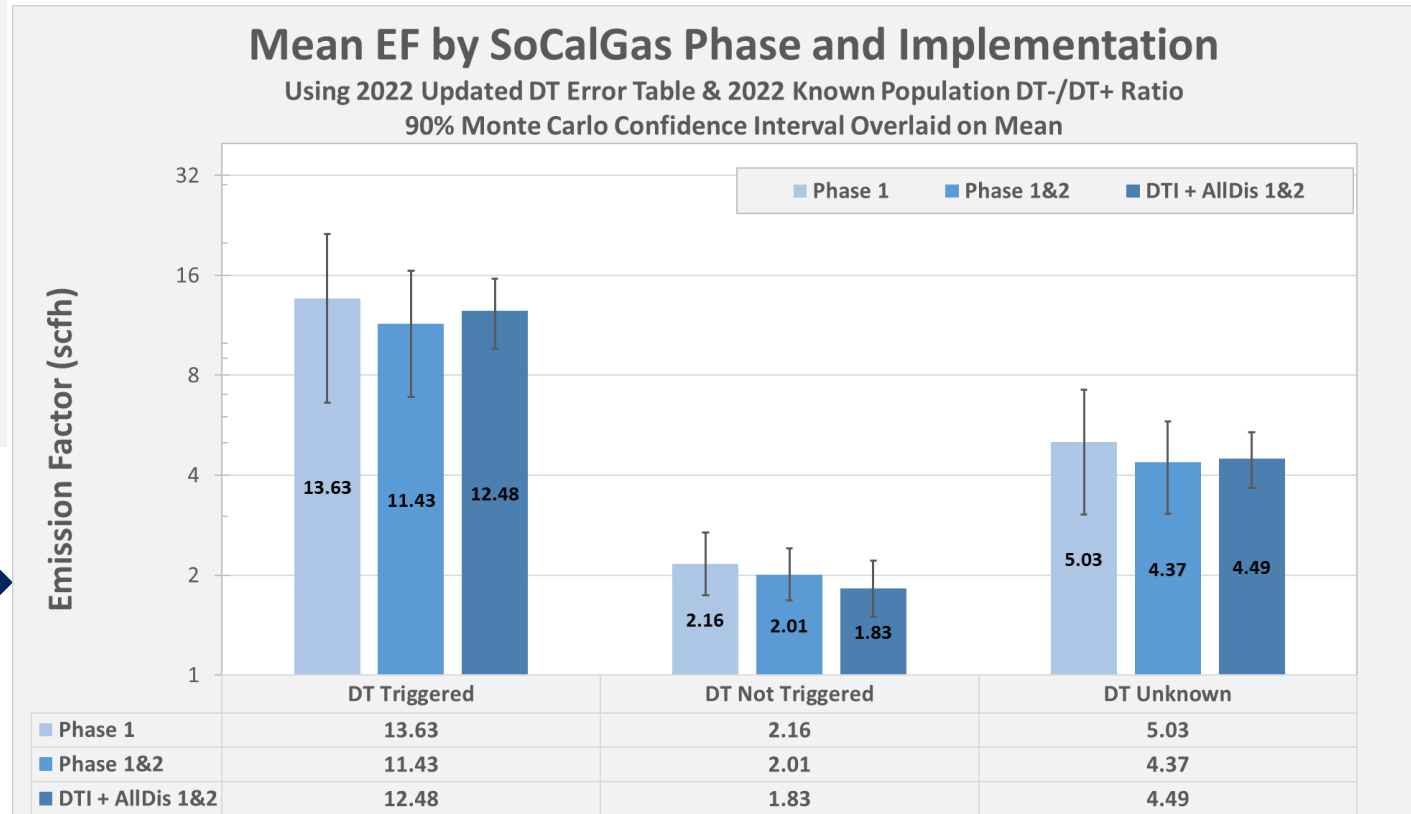
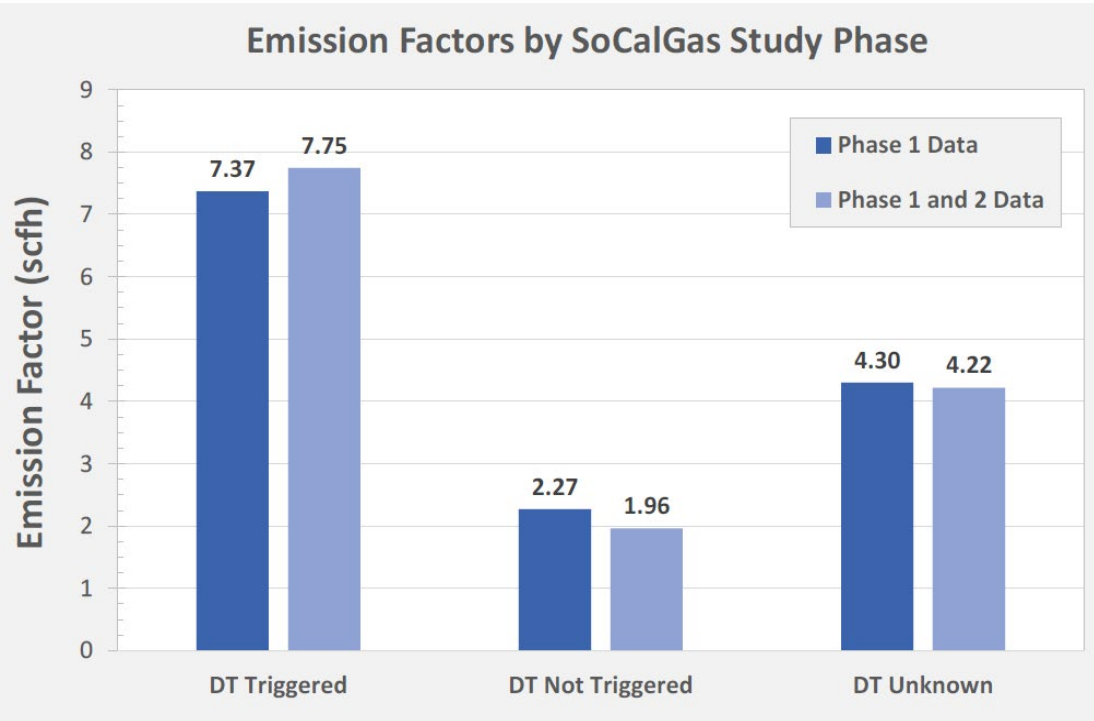
$$= [\text{True Positive MLV\% (TP)}] \times [\text{Mean Leak Rate for } \geq 10 \text{ scfh (GE10)}] + [\text{False Positive MLV\% (FP)}] \times [\text{Mean Leak Rate for } < 10 \text{ scfh (LT10)}]$$

- The 2022 full population proportions obtained from the DT implementation can now be used with the Bayesian analysis to refine the EF for DT Unknown (System Average)

$$\text{DT Unknown} = (\text{DT}_{\text{pos}} \text{ EF} \times \text{DT}_{\text{pos}} \text{ Rate}) + (\text{DT}_{\text{neg}} \text{ EF} \times \text{DT}_{\text{neg}} \text{ Rate})$$

Data Source	DT _{pos} rate	DT _{neg} rate
Research (382 DT measurements)	39%	61%
Implementation (6,473 DT measurements)	25%	75%

Emission Factor Adjustments & Confidence Intervals

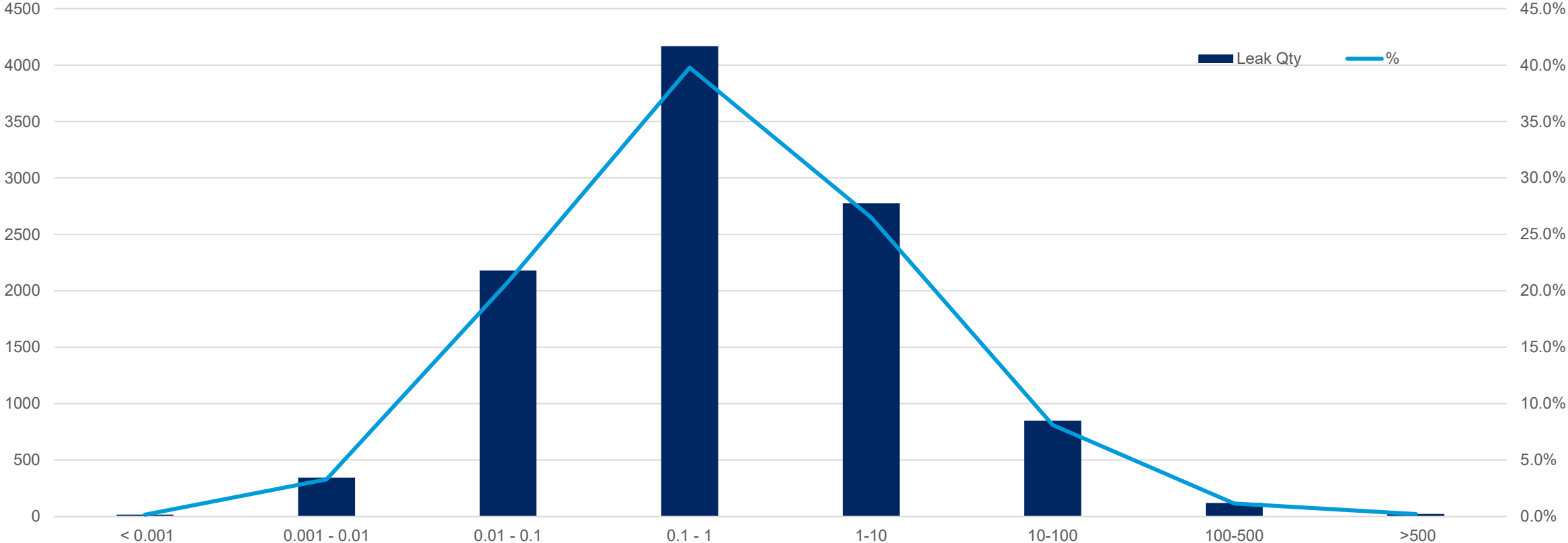


SoCalGas Emission Factor Adjustments

Emission Factors	2015 Baseline (MSCF/year)	2021 (MSCF/year)
Population-based EFs	797,426	
Previous Leaker-based EFs	576,261	465,687
Updated Leaker-based EFs	615,623	486,173

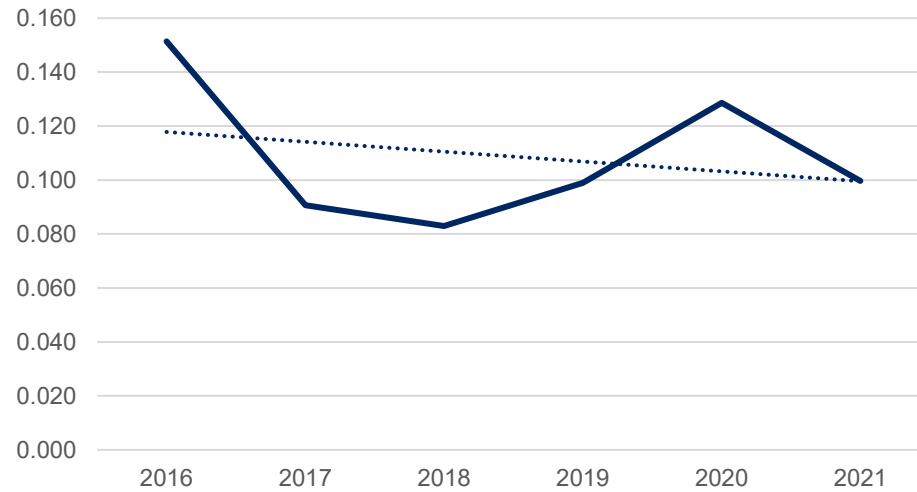
SoCalGas Leak Flow Rate Population Distribution

2022 SoCalGas Belowground (BG) Leak Qty & Percentage by Order-of-Magnitude Flow Rate Ranges (scfh)

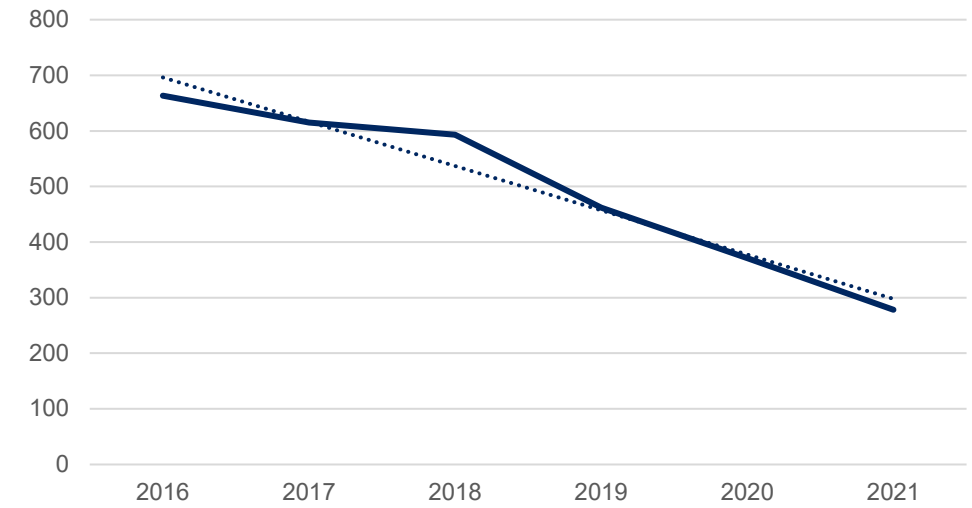


SoCalGas System Trends

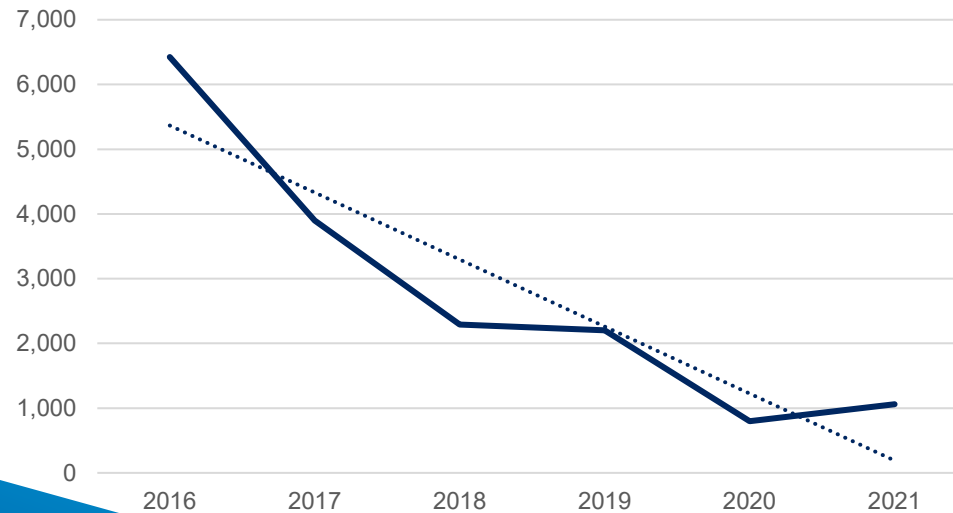
Survey Leaks per Mile



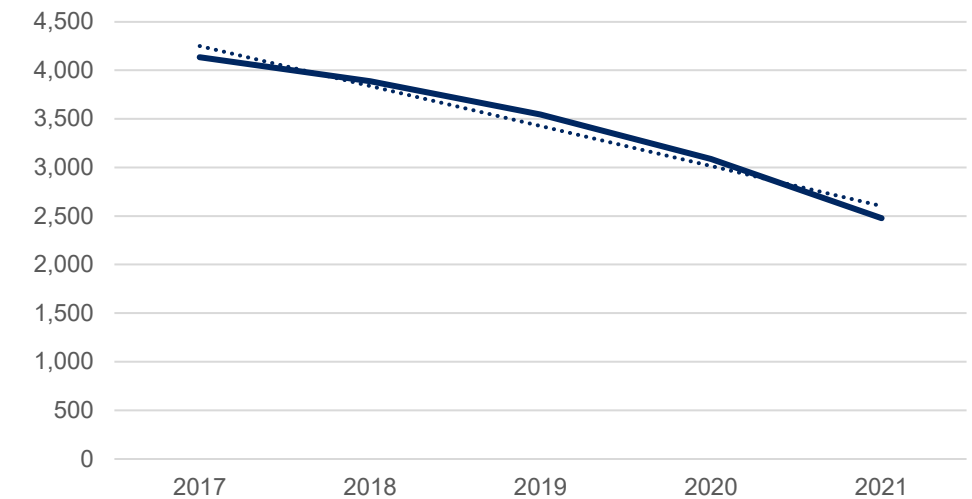
Average Leak Age (Days)



Quantity of Unknown Leaks

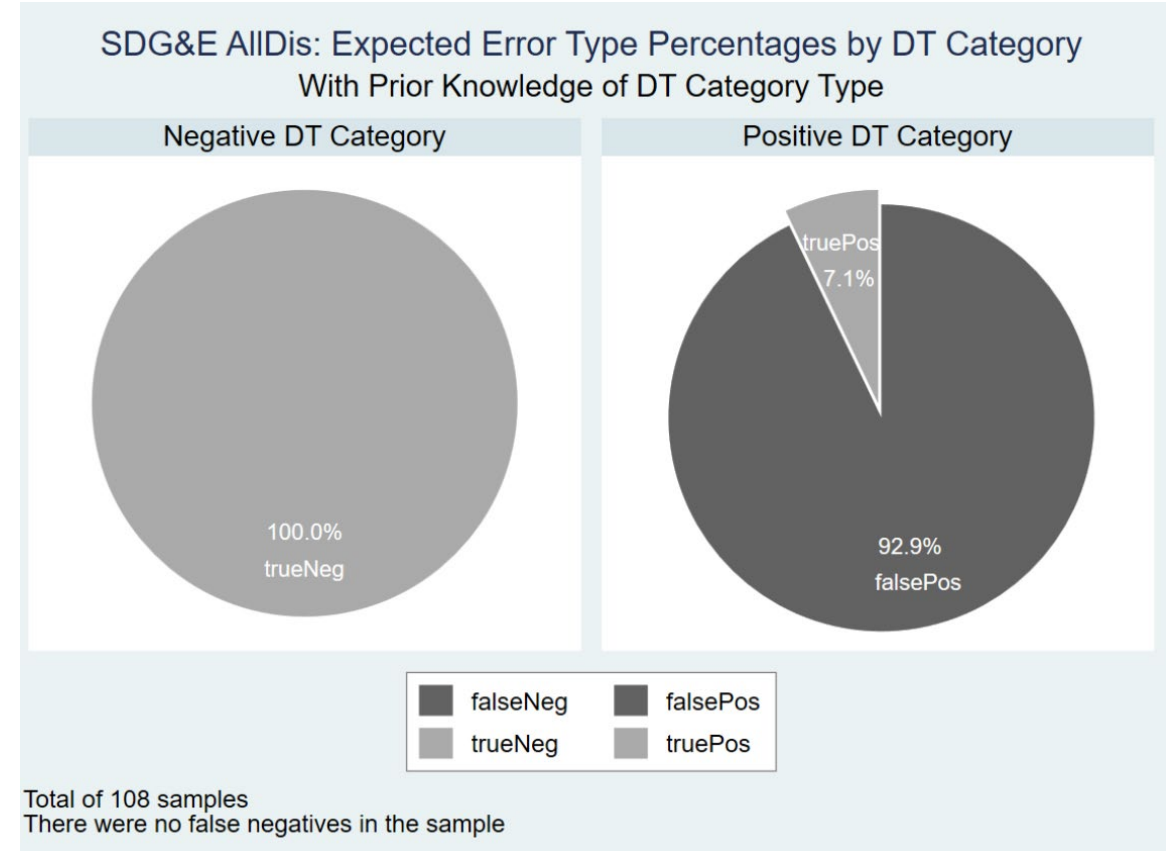


Quantity of O&M Leaks



SDG&E Sampling

- Quantified 14 DT_{pos} and 94 DT_{neg} belowground samples
- DT Implementation planned for 2023
- Additional quantification samples needed to calculate SDG&E Company-Specific EFs



Next Steps

- » Develop method to account for emissions associated with leaks found through AMM separately from other below-ground leaks in the population
 - Adjust DT Unknown emission factor based on the removal of these large AMM leaks
- » Estimate number of leaks found through AMM over unsurveyed pipeline in the given year and remove from Unknown leak count
- » Continue DT data collection efforts at SDG&E

Questions?



APPENDIX 6: COMPANY-SPECIFIC LEAKER-BASED EMISSION FACTOR DEVELOPMENT FOR CUSTOMER METERS

February 1, 2023



Agenda

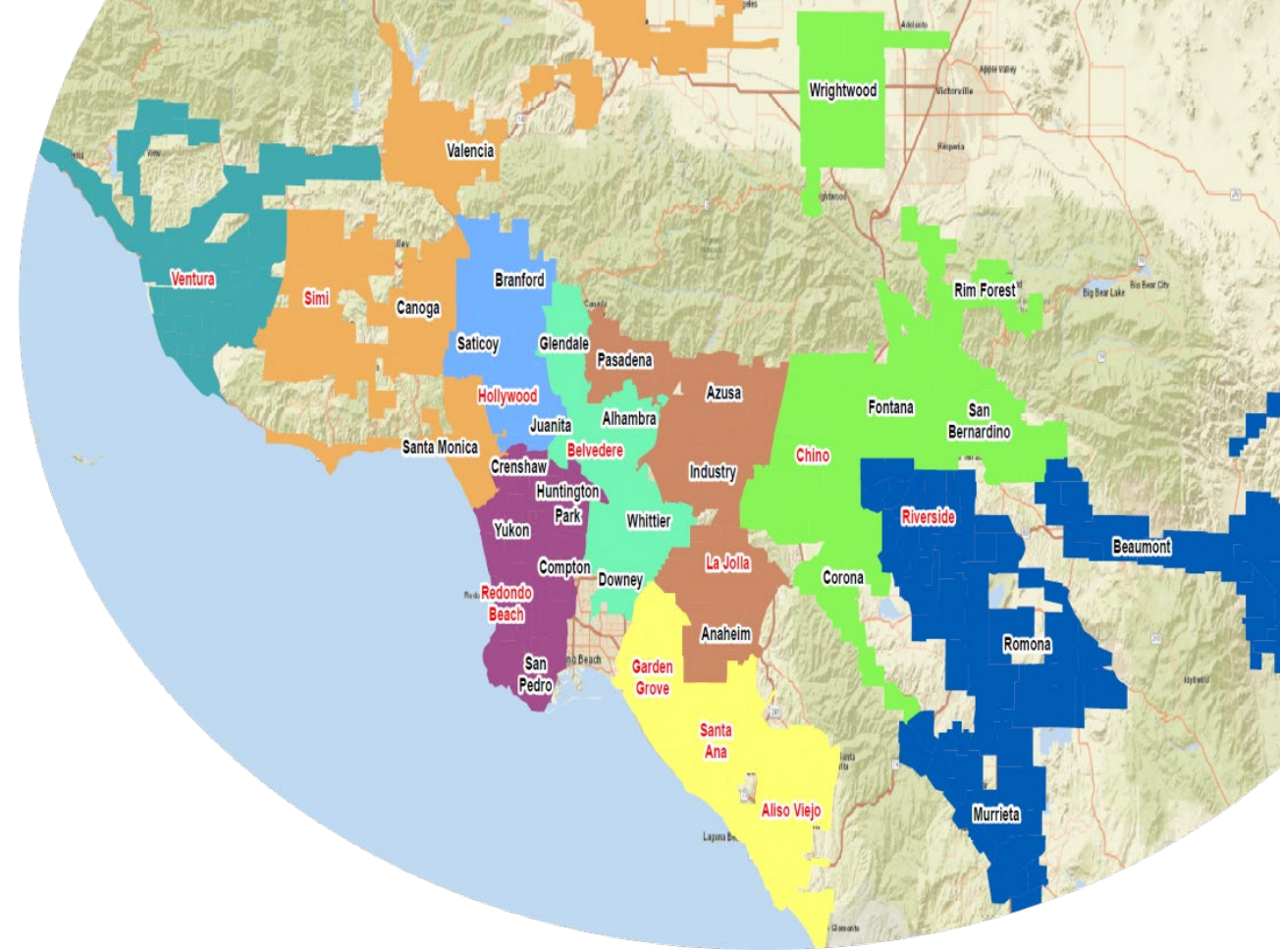
- Overview
- SoCalGas & SDG&E Sampling Methodology
- SoCalGas & SDG&E Results
- SoCalGas & SDG&E Proposed Emission Factors

Objective

- » Apply SoCalGas Customer Meter Emission Factor (EF) approach to SDG&E
 - For Customer Meter emissions, replace Facility-Based with Leaker-Based EFs.
 - EFs based on currently reported PHMSA “Hazardous” (Haz) and “Non-Hazardous” (Non-Haz) Above Ground (AG) leak categories.
 - Develop EF for Non-Detected leaks to account for emissions from Customer Meters not captured by the current Leak Survey process.
 - Calculate emissions for Unknown Leaks based on approach currently used for Distribution Main & Service (DM&S) based on “un-surveyed” Customer Meters and apply to 2015 Baseline.

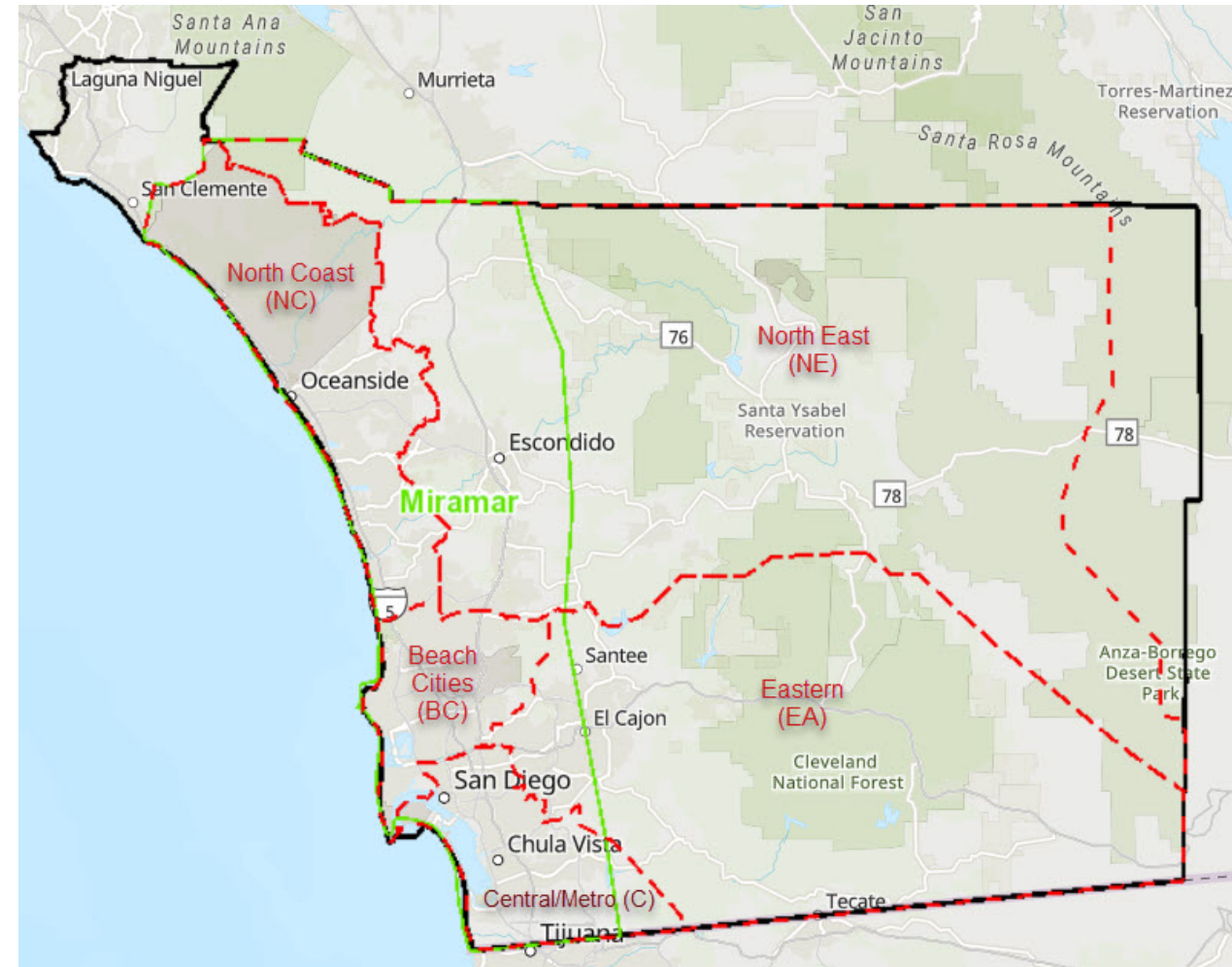
SoCalGas Random Sampling Plan

- » 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 60 Non-leaker MSA bubble categories and flow rate measurements across 203 non-leaking meters sampled



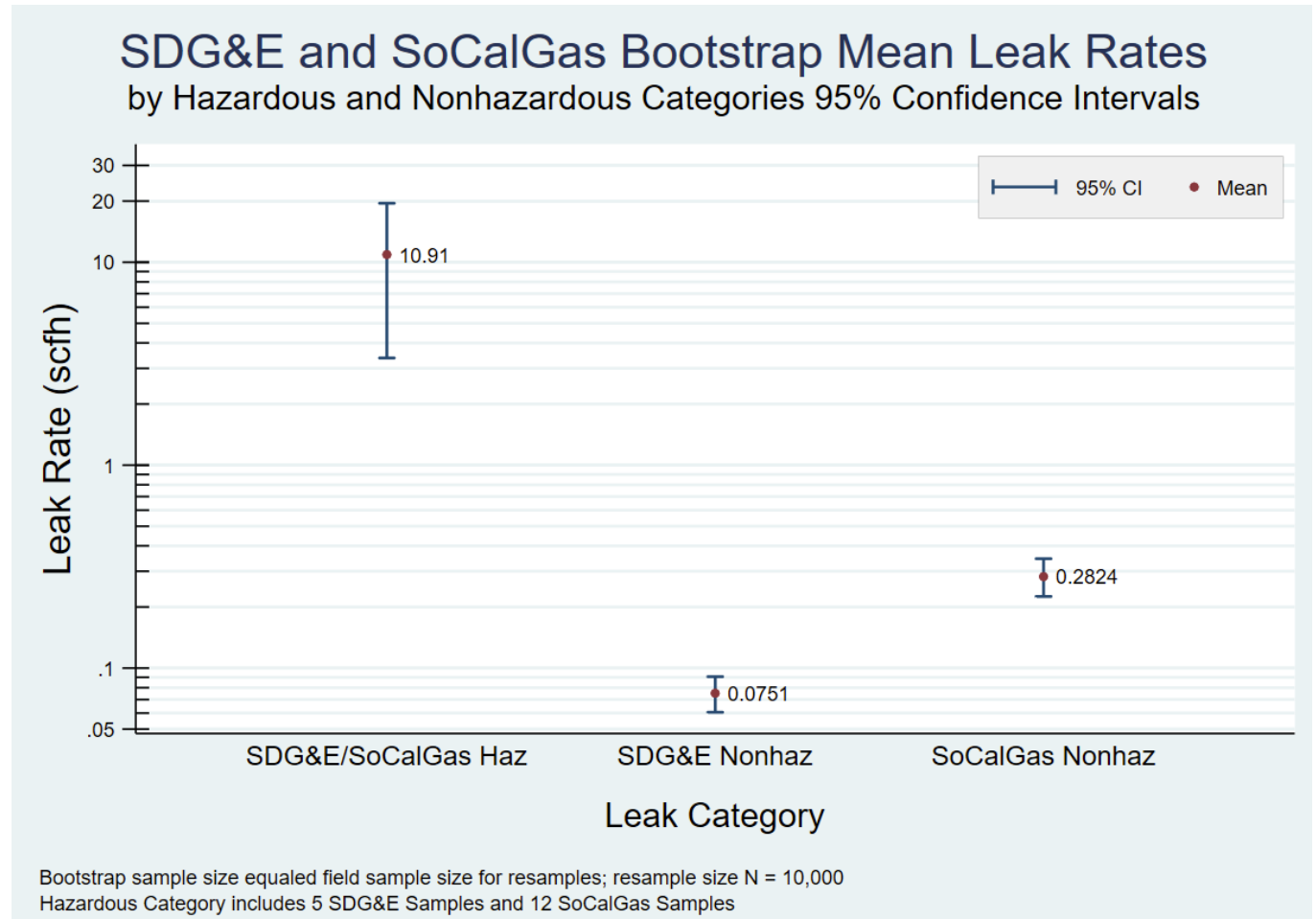
SDG&E Random Sampling Plan

- » System-wide random sampling across SDG&E territory
 - Collected samples from all 5 SDG&E Operating Districts
 - Collected flow rate measurements from 150 MSA leaks
 - Inspected 454 "Non-Leaking" MSAs. Found and measured the flow rate from 37 "Non-Detected" leaks.

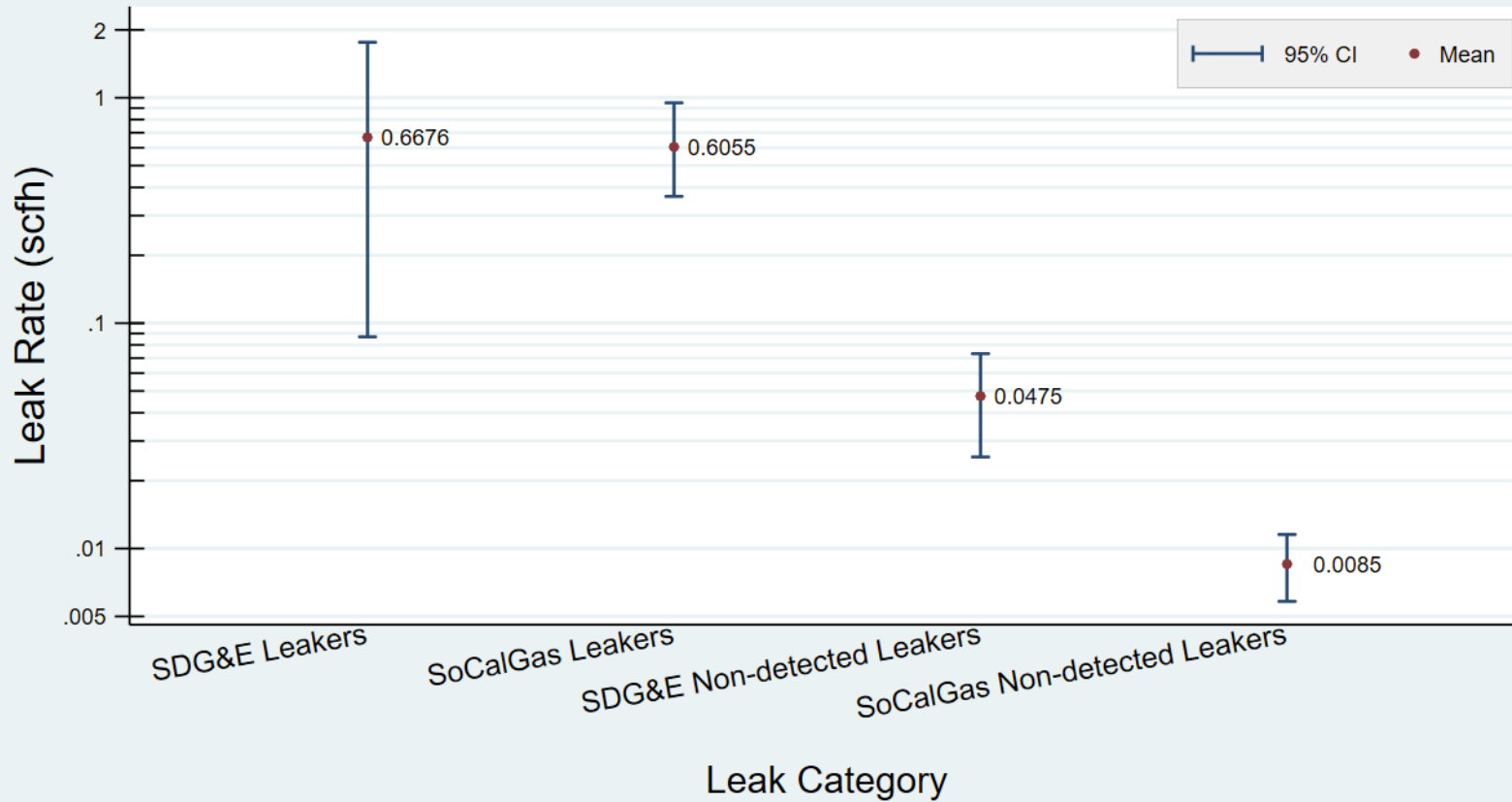


Customer Meter Leak-Based Emission Factors

- » AG-Haz leak data combined for both utilities
- » SDG&E AG Non-Haz EF lower than SoCalGas, likely due to combined 3-year Leak Survey with Atmospheric Corrosion Survey procedures



SDG&E and SoCalGas Bootstrap Mean Leak Rates by Leakers and Non-Detected Leakers with 95% Confidence Intervals



Bootstrap sample size equaled field sample size for resamples; resample size N = 10,000

Company	Meters Surveyed	Non-Detected Leaks Found	%
SoCalGas	206	60	29%
SDG&E	454	37	8%

» Operational Difference: SDG&E inspects meters during corrosion survey on a 3-year cycle

Example SoCalGas Emission Factors

Leak Class	Leak Rate	Emission Factor	
		SCFH-NG	MSCF-NG/day
AG Non-Haz	Mean of All Non-Haz Leaks	0.3024	0.0073
AG Haz	Mean of AG-Haz Leaks	11.6809	0.2803
Unknown Leaks	Proportional Mean of All Leaker Categories	0.8060	0.0193
Non-detected Emissions	Mean of Undetected Leaks (Non-Leakers)	0.0091	0.0002

Example SDG&E Emission Factors

Leak Class	Leak Rate	Emission Factor	
		SCFH-NG	MSCF-NG/day
AG Non-Haz	Mean of All Non-Haz Leaks	0.0804	0.0019
AG Haz	Mean of AG-Haz Leaks	11.6809	0.2803
Unknown Leaks	Proportional Mean of All Leaker Categories	0.8249	0.0198
Non-detected Emissions	Mean of Undetected Leaks (Non-Leakers)	0.0509	0.0012

Next Steps

- » Continue gathering leak rate data for AG Haz leak category to tighten the confidence interval for the emission factor (23 more leak measurements needed)
- » Verify SoCalGas EFs after completion of data verification
- » Identify operational reasons for differences in emission factors and "Non-Leakers" leak flow rates
- » Develop cost-effective options for further reducing system emissions

Questions?



Proposed Changes to the 2023 Reporting Template and Procedures

2023 Natural Gas Leak Abatement Winter Workshop
February 1, 2023

Overview of Proposed Changes to Reporting Template and Procedures

1. Appendices 1 – 7: Update tab “Column Description&Explanations”
2. Appendix 1: Revise to include additional columns for reporting related to blowdown emissions
3. Appendix 6: Revise to include additional column for reporting of leak determination method
4. Appendix 7: Revise tab names for consistency with Appendix 8 and Appendix 9
5. Appendix 7: Remove unnecessary columns
6. Appendix 8: Revise tab names and add additional column
7. Appendix 9: Add notes to link emission factors with corresponding tabs in Appendix 7
8. Supplemental Questionnaire: Revise question 1
9. Supplemental Questionnaire: Delete questions 2 - 6

Proposed Changes to Appendices 1 – 7

- Update tab “Column Description&Explanations” for each appendix

Prior tab

Appendix 7 - Rev. 03/29/19	
Header column "Comment" boxes displayed below for reference.	
Column Heading	Description and Definition of Required Contents (IF not self-explanatory)
Storage Leaks & Emissions	
ID	
Geographic Location	GIS, zip code, or equivalent
Source	W/C = wellhead connector W/V = wellhead valve W/PRV = wellhead pressure relief valve W/OEL = wellhead open-ended line
Number of Sources	
Discovery Date	Report Discovery Date if calculating wellhead component emissions using Leaker EFs
Repair Date	Report Discovery Date if calculating wellhead component emissions using Leaker EFs
Number of Days Leaking	Calculate Number of Days Leaking using the formula: Repair Date minus Discovery Date + 1 day
Emission Factor (Mscf/yr)	
Annual Emissions (Mscf)	
Explanatory Notes / Comments	

Proposed Changes to Appendix 1

- Add two columns for reporting of the reason and Emission Reduction Strategy Used (i.e., gas capture, cross-compressor, other, or none) for Transmission Pipeline Blowdowns

Prior Appendix 1

Transmission Pipeline Blowdowns:			
ID	Geographic Location	Number of Blowdown Events	Annual Emissions (Mscf)

Proposed Appendix 1

Transmission Pipeline Blowdowns:					
ID	Geographic Location	Number of Blowdown Events	Reason	Emission Reduction Strategy Used	Annual Emissions (Mscf)
			For example, M = Maintenance R = Repair	GC = Gas Capture CC = Cross-Compression O = Other N = None	

Proposed Change to Appendix 6

- Add column for reporting of Leak Discovery Method (i.e., routine leak survey or O&M), similar to reporting in Appendix 4

Prior Appendix 6

Customer Meter Fugitive Leaks:					
ID	Geographic Location	Meter Classification (Commercial/Industrial or Residential)	Leak Classification (Grade)	Discovery Date (DD/MM/YY)	Leak R Dat (MM/D

Proposed Appendix 6

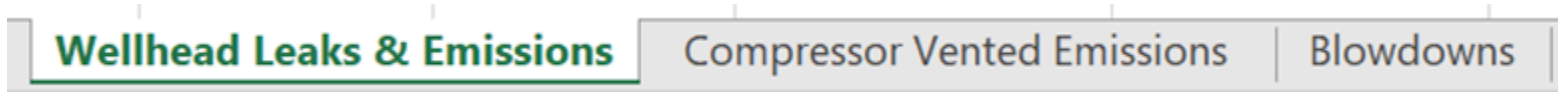
Customer Meter Fugitive Leaks:					
ID	Geographic Location	Meter Classification (Commercial/Industrial or Residential)	Leak Classification (Grade)	Leak Discovery Method	(MM/D

S = Routine Leak Survey
 M = O&M (E.G. O&M Activities, Third party reports, customer odor reports, etc.)

Proposed Changes to Appendices 7 and 8

- Revise tab names for consistency

Prior Appendix 7



Proposed Appendix 7



Proposed Changes to Appendices 7 and 8

- Revise tab names for consistency

Prior Appendix 8

Underground Storage	Storage Leaks & Emissions
	Compressor Emissions
	Compressor Leaks
	Blowdowns
	Component Emissions
	Component Leaks
	Dehydrator Vent Emissions

Proposed Appendix 8

Storage Leaks & Emissions
Compressor Vented Emissions
Blowdowns
Component Vented Emissions
Compressor and Component Fugitive Leaks
Dehydrator Vent Emissions

Proposed Changes to Appendix 7

- Remove unnecessary columns in the “Compressor Vented Emissions” tab

Prior Appendix 7

Emission Factor: Offline (scf/hr)	Emission Factor: Pressurized Operating - Wet Seal Oil Degassing Vent (scf/hr)	Emission Factor: Pressurized Operating - Wet Seal (scf/hr)
Emission Factor: Pressurized Operating - Dry Seal (scf/hr)	Emission Factor: Pressurized Idle - Wet Seal Oil Degassing Vent (scf/hr)	Emission Factor: Pressurized Idle - Wet Seal (scf/hr)
Emission Factor: Pressurized Idle - Dry Seal (scf/hr)	Emission Factor: Pressurized Idle - Isolation Valve (scf/hr)	

Proposed Changes to Appendix 8

- Revise name of tab “Component Leaks” to “Component Fugitive Leaks”
- Revise name of tab “Component Emissions” to “Component Vented Emissions.”

Prior Appendix 8

7			
8	Transmission Pipelines	Pipeline Leaks	Fugitive
9		All Damages	Fugitive
10		Blowdowns	Vented
11		Component Emissions	Vented
12		Component Leaks	Fugitive
13		Odorizers	Vented

Proposed Appendix 8

Summary Tables:

System Categories	Emission Source Categories	Fugitive or Vented
Transmission Pipelines	Pipeline Leaks	Fugitive
	All Damages	Fugitive
	Blowdowns	Vented
	Component Vented Emissions	Vented
	Component Fugitive Leaks	Fugitive
	Odorizers	Vented

Proposed Change to Appendix 8

- Revise column heading to clarify that the adjusted 2015 baseline emissions approved by CPUC on October 26, 2022 should be entered in this column
- Include an additional column for Proposed Adjusted 2015 Baseline Emissions (i.e., gas companies' new proposal(s) for adjusted 2015 baseline emissions)

Prior Appendix 8

For Informational and Reference Purposes only: Original 2015 Baseline Emissions (Mscf)	Adjusted 2015 Baseline Emissions (Mscf)
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Proposed Appendix 8

For Informational and Reference Purposes only: Original 2015 Baseline Emissions (Mscf)	Adjusted 2015 Baseline Emissions [Mscf] approved on October 26, 2022	Proposed Adjusted 2015 Baseline Emissions
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Proposed Change to Appendix 9

- Add a note in red text that links each emission factor in Appendix 9 to the corresponding tab in Appendix 7 where the emission factor is used

Prior Appendix 9

4	Dehydrator Vents - Storage
	Storage - piping leakage
	Storage - surface casing leakage
5	
6	Underground Storage

7	Storage - Wellhead leakage
	Storage - Compressor & blowdowns
	Storage - Wellhead Rework blowdown and bring-in
	Pressure Relief Valves
	Pneumatic Devices - Pneumatic/Hydraulic Valve Operators, and Turbine Valve Operators

Proposed Change to Appendix 9

- Add a note in red text that links each emission factor in Appendix 9 to the corresponding tab in Appendix 7 where the emission factor is used

Proposed Appendix 9

Underground Storage	Dehydrator Vents - Storage <i>(dehydrator vent emissions tab)</i>
	Storage - piping leakage <i>(compressor and component fugitive leaks tab)</i>
	Storage - surface casing leakage <i>(storage leaks and emissions tab)</i>

Storage - Wellhead leakage <i>(storage leaks and emissions tab)</i>
Storage - Compressor & blowdowns <i>(Blowdowns tab)</i>
Storage - Wellhead Rework blowdown and bring-in <i>(Blowdowns tab)</i>
Pressure Relief Valves <i>(Component Vented Emissions tab)</i>
Pneumatic Devices - Pneumatic/Hydraulic Valve Operators, and Turbine Valve Operators <i>(Component Vented Emissions tab)</i>

Proposed Change to the Supplemental Questionnaire

- Revise Question 1 to facilitate a more complete response

Prior Supplemental Questionnaire Question 1:

- 1. A summary of changes to utility leak and emission management practices from January 1, 2021 to December 31, 2021. The report must include a detailed summary of changes, including the reasoning behind each change and an explanation of how each change will reduce methane leaks and emissions.**

Proposed Changes to the Supplemental Questionnaire

Proposed Question 1 in the Supplemental Questionnaire:

1. Please provide the following for the period from January 1, 2022 to December 31, 2022:
 - a. Describe any current projects or studies related to SB 1371.
 - b. Describe the activity changes between the previous year's reporting and the current year's reporting that affected the change in the total emissions. For example, changes in maintenance activities may have changed blowdown emissions from previous years and resulted in changes to total emissions.
 - c. Describe advances in abatement efforts, similar to the executive summary in the best practices reporting.
 - d. Describe improvements in reporting that are not discernable by reviewing the reporting data. For example, report the installation of a new data management or leak tracking system.
 - e. For smaller utilities, confirm if there were no leaks in distribution mains and services pipelines.
 - f. Identify any additional tables to be included in the Joint Report. Staff will place these tables in an appendix.

Proposed Change to the Supplemental Questionnaire

- Delete Question 2

Prior Supplemental Questionnaire Question 2:

- 2. A list of new graded and ungraded gas leaks discovered, tracked by geographic location in a Geographic Information System (GIS) or best equivalent, by grade, component or equipment, pipe size, schedule and material, pressure, age, date discovered and annual volume of gas leaked for each, by month, from January 1, 2021 through December 31, 2021.**

Response:

See Appendices

Proposed Change to the Supplemental Questionnaire

- Delete Question 3

Prior Supplemental Questionnaire Question 3:

- 3. A list of graded and ungraded gas leaks repaired, tracked by geographic location in a Geographic Information System (GIS) or best equivalent, by month, from January 1, 2021 through December 31, 2021. Include the grade, component or equipment, pipe size, schedule and material, pressure, age, date discovered, date of repair, annual volume of gas leaked for each and the number of days from the time the leak was discovered until the date of repair.**

Response:

See Appendices

Proposed Change to the Supplemental Questionnaire

- Delete Question 4

Prior Supplemental Questionnaire Question 4:

- 4. A list of ALL open graded and ungraded leaks, regardless of when they were found, tracked by geographic location in a Geographic Information System (GIS) or best equivalent that are being monitored, or are scheduled to be repaired, by month, from January 1, 2021 through December 31, 2021. Include the grade, component or equipment, pipe size, schedule and material, pressure, age, date discovered, scheduled date of repair, and annual volume of gas leaked for each.**

Proposed Change to the Supplemental Questionnaire

- Delete Question 5

Prior Supplemental Questionnaire

- 5. System-wide gas leak and emission rate data, along with any data and computer models used in making that calculation, for the 12 months from January 1, 2021 through December 31, 2021.**

Response:

See Appendices

Proposed Change to the Supplemental Questionnaire

- Delete Question 6

Prior Supplemental Questionnaire Question 6:

- 6. Calculable or estimated emissions and non-graded gas leaks, as defined in Data Request [Company Name] R15-01-008 2018 Annual Report for the 12 months from January 1, 2021 through December 31, 2021.**

Response:

See Appendices

Key Dates for 2023 NGLA Reporting

- **March 31:** CPUC will send reporting template to gas companies
- **June 15:** Emissions reports from gas companies due to CPUC
- **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

Summary of Baseline Adjustments

2023 NGLA Winter Workshop

Gary Ermann, Utilities Engineer

Safety Policy Division

February 1, 2023



California Public
Utilities Commission

Background

- Natural gas emissions initially estimated using population-based methodologies
 - Generally unable to capture results of emissions reduction efforts
- June 2022: CPUC approved new leaker-based estimation methods for PG&E and SoCalGas
 - 2020 and 2021 data
- Concern of disparity between new leaker-based estimations and initial baselines determined using population-based methodologies
- October 2022: CPUC/CARB approved several adjustments to the original baseline values established for PG&E and SoCalGas

Summary of PG&E Baseline Adjustments

Appendix #	System Category	Emission Source Category	Original Baseline Emissions (Mscf)	Adjusted Baseline Emissions (Mscf)
3	Transmission Compressor Stations	Component Vented Emissions	N/A	10,172
		Component Fugitive Leaks	15,823	16,928
4	Distribution Mains and Services Pipelines	All Damages (Fugitives)	146,335	141,102
5	Distribution Metering and Regulating Stations	Station Leaks & Emissions (Fugitives)	741,986	9,440
6	Meter Set Assemblies	Meter Leaks (Fugitives)	636,034	245,907
		All Damages (Fugitives)	N/A	5,233
7	Underground Storage	Storage Leaks & Emissions (Fugitives)	11,870	2,036
		Component Vented Emissions	N/A	86,681
		Component Fugitive Leaks	10,574	75,957
		Dehydrator Vent Emissions (Fugitives)	6,761	13


Summary of SoCalGas Baseline Adjustments

Appendix #	System Category	Emission Source Category	Original Baseline Emissions (Mscf)	Adjusted Baseline Emissions (Mscf)
1	Transmission Pipelines	Component Vented Emissions	0	8,182
		Component Fugitive Leaks	N/A	0
2	Transmission Metering and Regulating Stations	Station Leaks & Emissions (Fugitives)	340,142	110,296
3	Transmission Compressor Stations	Component Vented Emissions	N/A	4,301
		Component Fugitive Leaks	8,430	10,784
		Storage Tank Leaks & Emissions (Vented)	0	275
4	Distribution Mains and Services Pipelines	Pipeline Fugitive Leaks	797,426	576,261
		Component Fugitive Leaks	3,282	0
5	Distribution Metering and Regulating Stations	Station Leaks & Emissions (Fugitives)	340,729	0
		Component Vented Emissions	N/A	295
		Component Fugitive Leaks	N/A	8,898
6	Meter Set Assemblies	Meter Leaks (Fugitives)	846,235	415,362
7	Underground Storage	Component Vented Emissions	N/A	5,281
		Component Fugitive Leaks	107	21,989
		Dehydrator Vent Emissions (Fugitives)	13,402	0

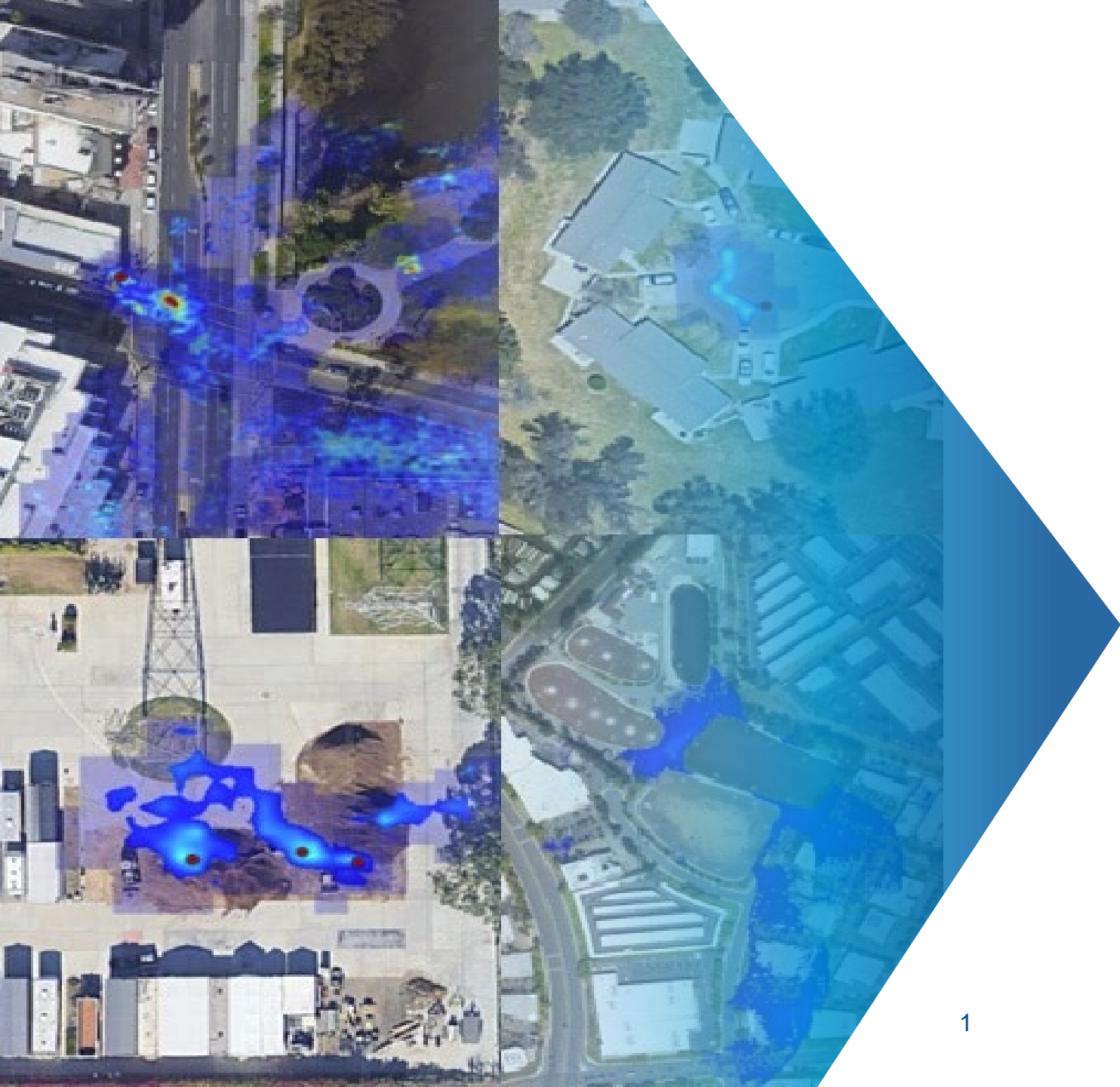
Impact on Baseline Totals

Utility	Adjusted Total Baseline (Mscf)	Original Total Baseline (Mscf)	Total Baseline Change (Mscf)
PG&E	2,318,454	3,294,368	(975,914)
SoCalGas	1,592,024	2,779,853	(1,187,829)

Questions?

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



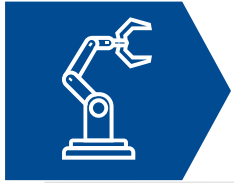


AERIAL METHANE MAPPING UPDATE

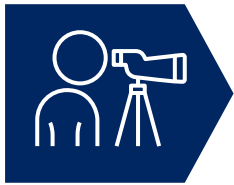
February 1, 2023



Agenda



SoCalGas Implementation Results



R&D – SDG&E Pilot Study



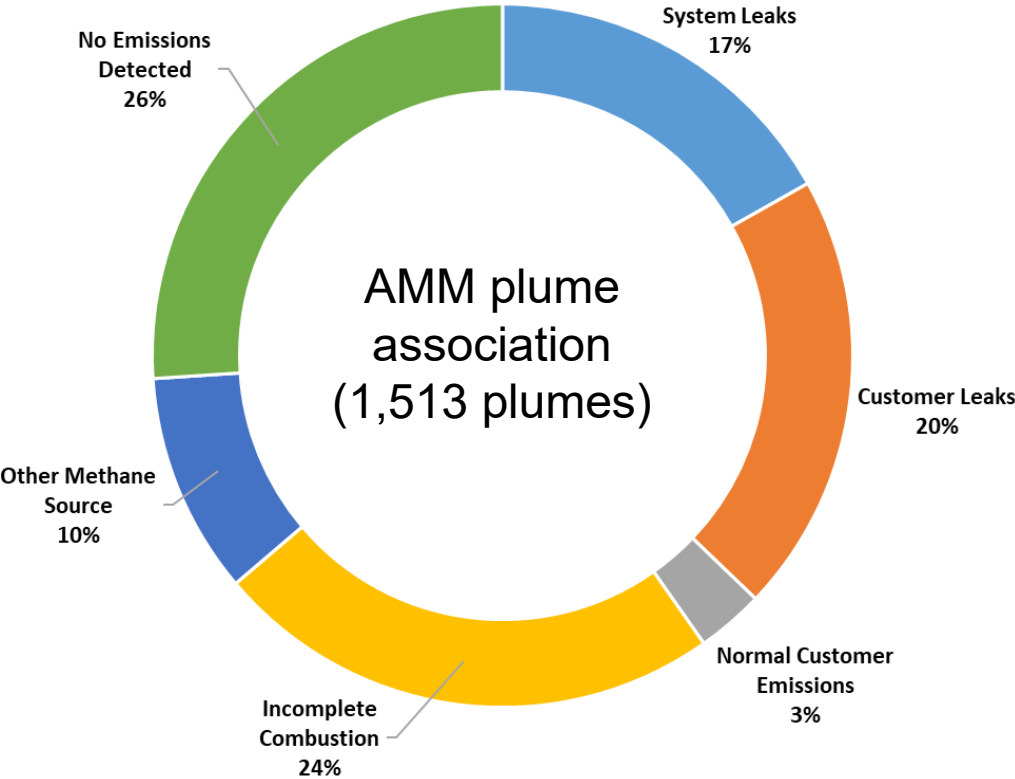
AMM and Appendix Emissions



Customer Emissions

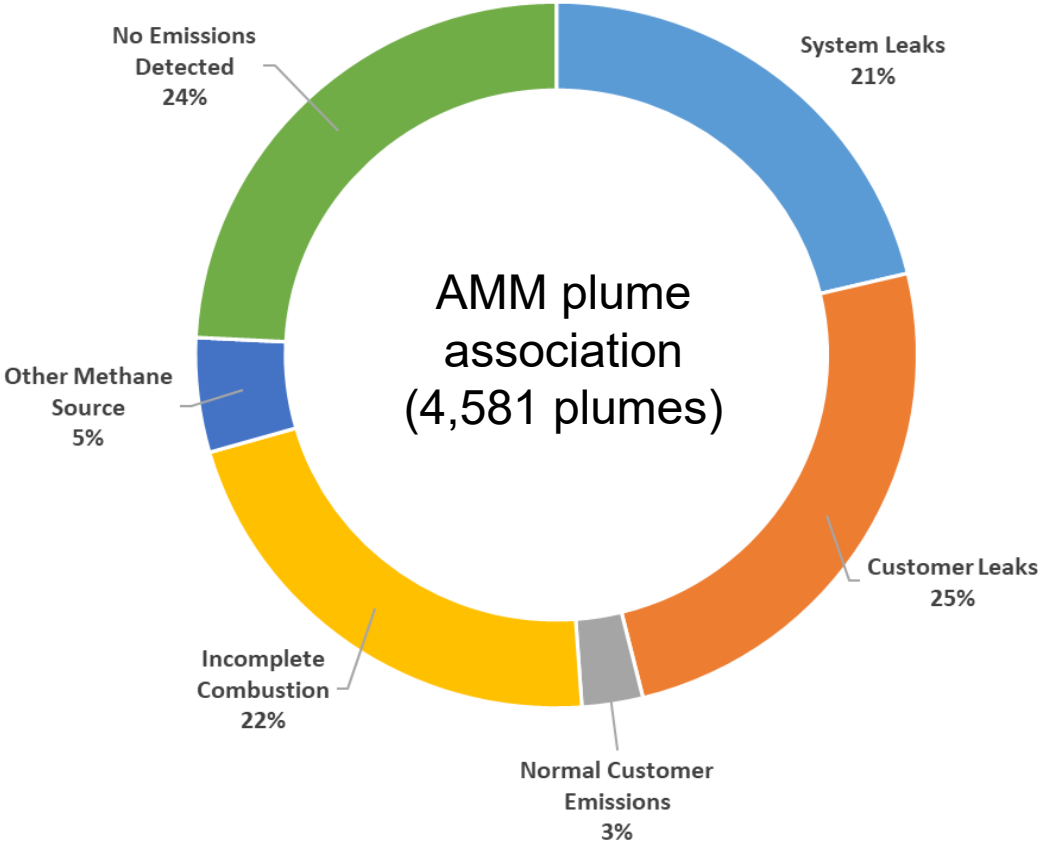
SoCalGas Implementation Results

2021



18% of System Meters Scanned

2022

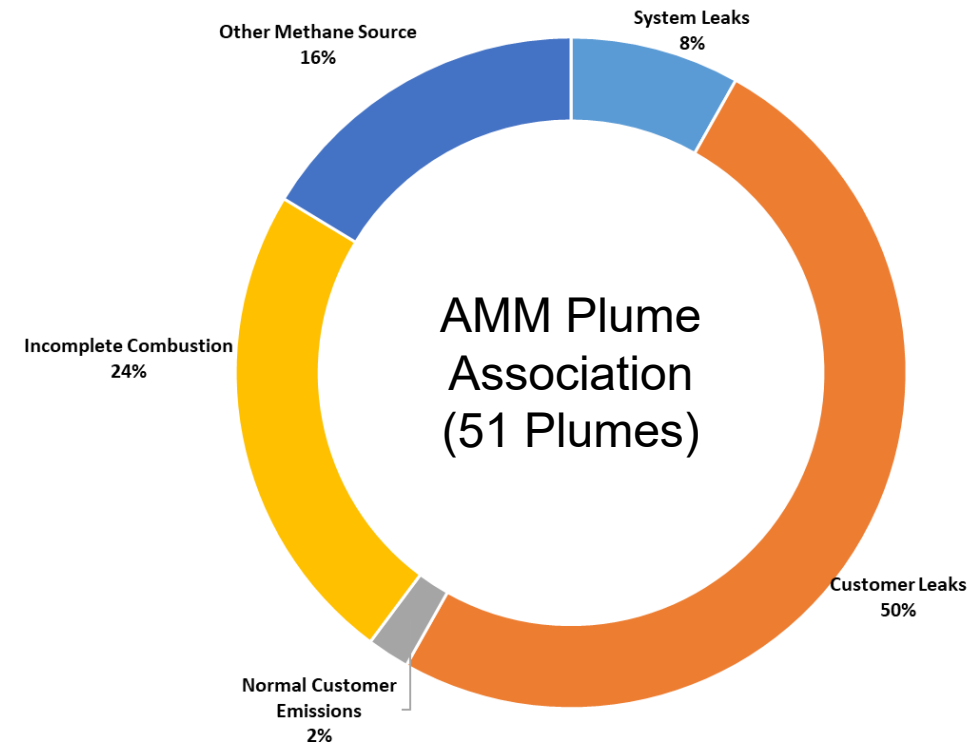


73% of System Meters Scanned

SDG&E AMM Pilot Study

- Pilot study conducted over 38 sq miles of service territory
- Flights covered 39,751 Customer Meters and 889 miles of pipeline (~6% of SDG&E system)

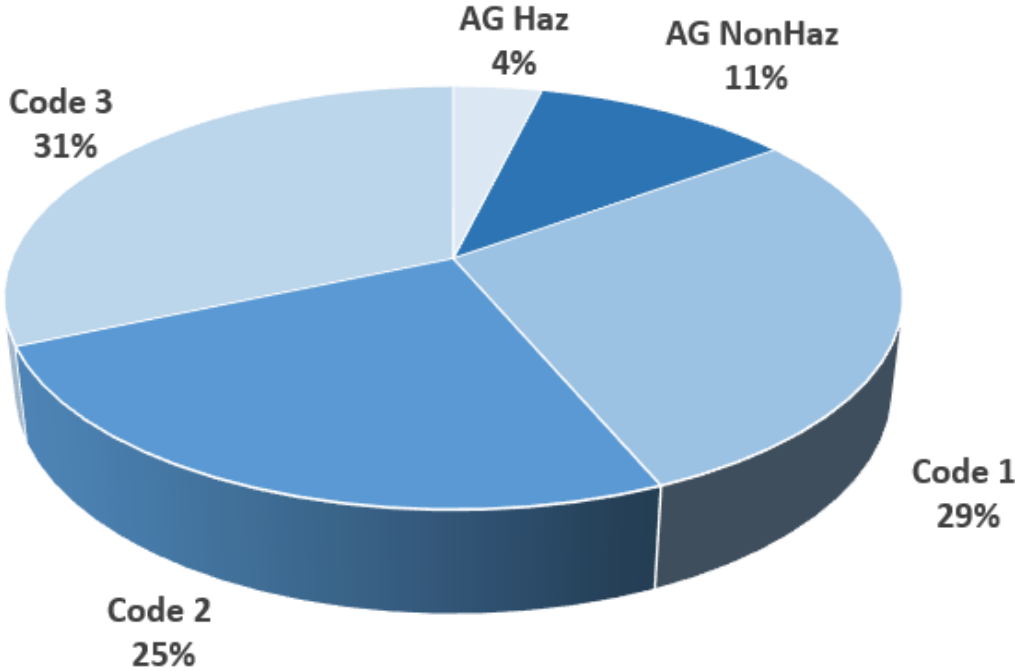
Preliminary Investigation Results



SoCalGas Implementation Results

2021

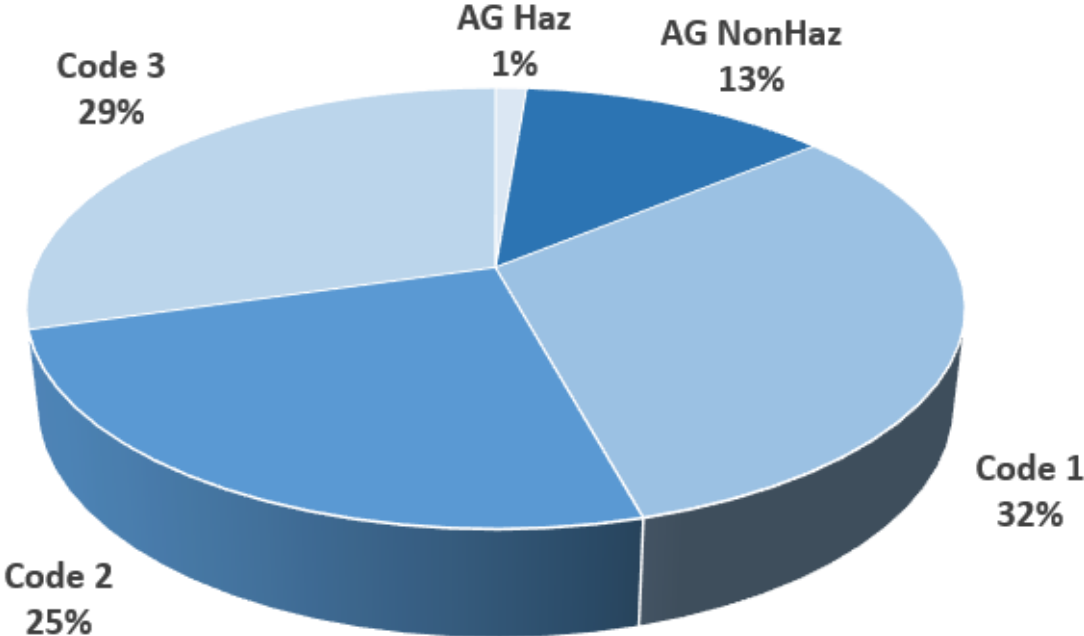
314 System Leaks



23,181 Miles of Distribution Scanned

2022

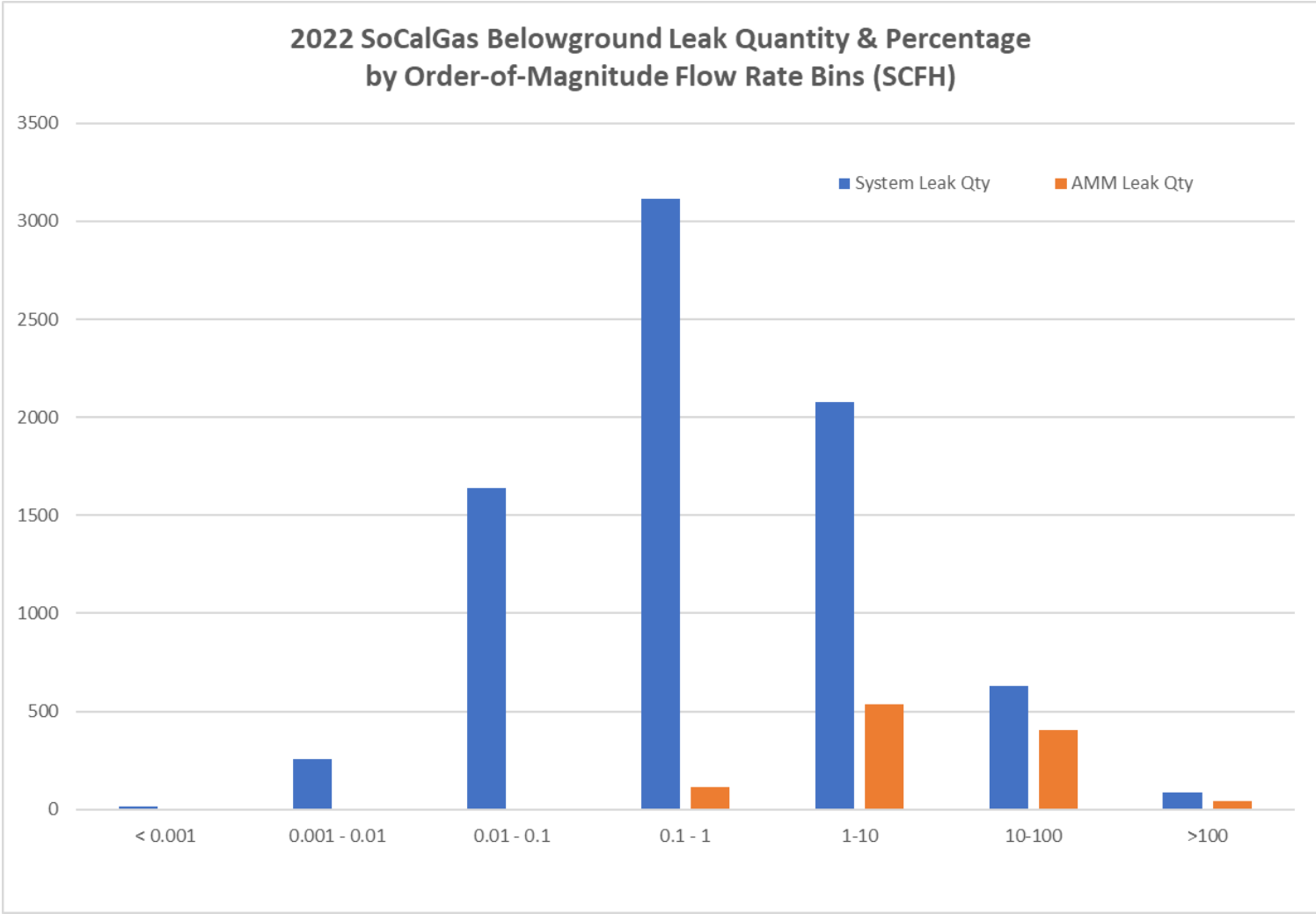
1,099 System Leaks



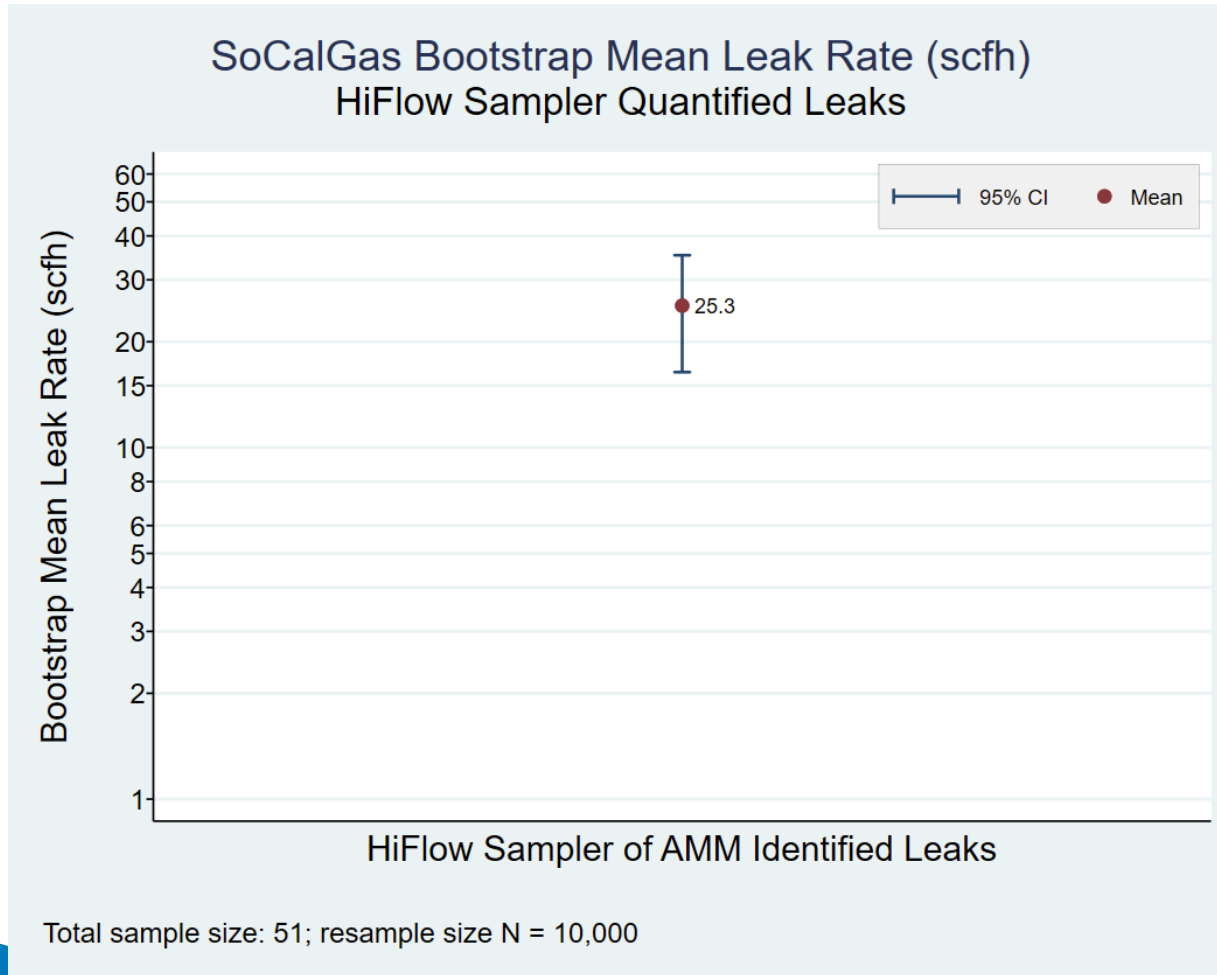
78,761 Miles of Distribution Scanned

SoCalGas Implementation Results

AMM detected Belowground System leaks accounts for ~10% of leaks but more than 40% of leak emissions



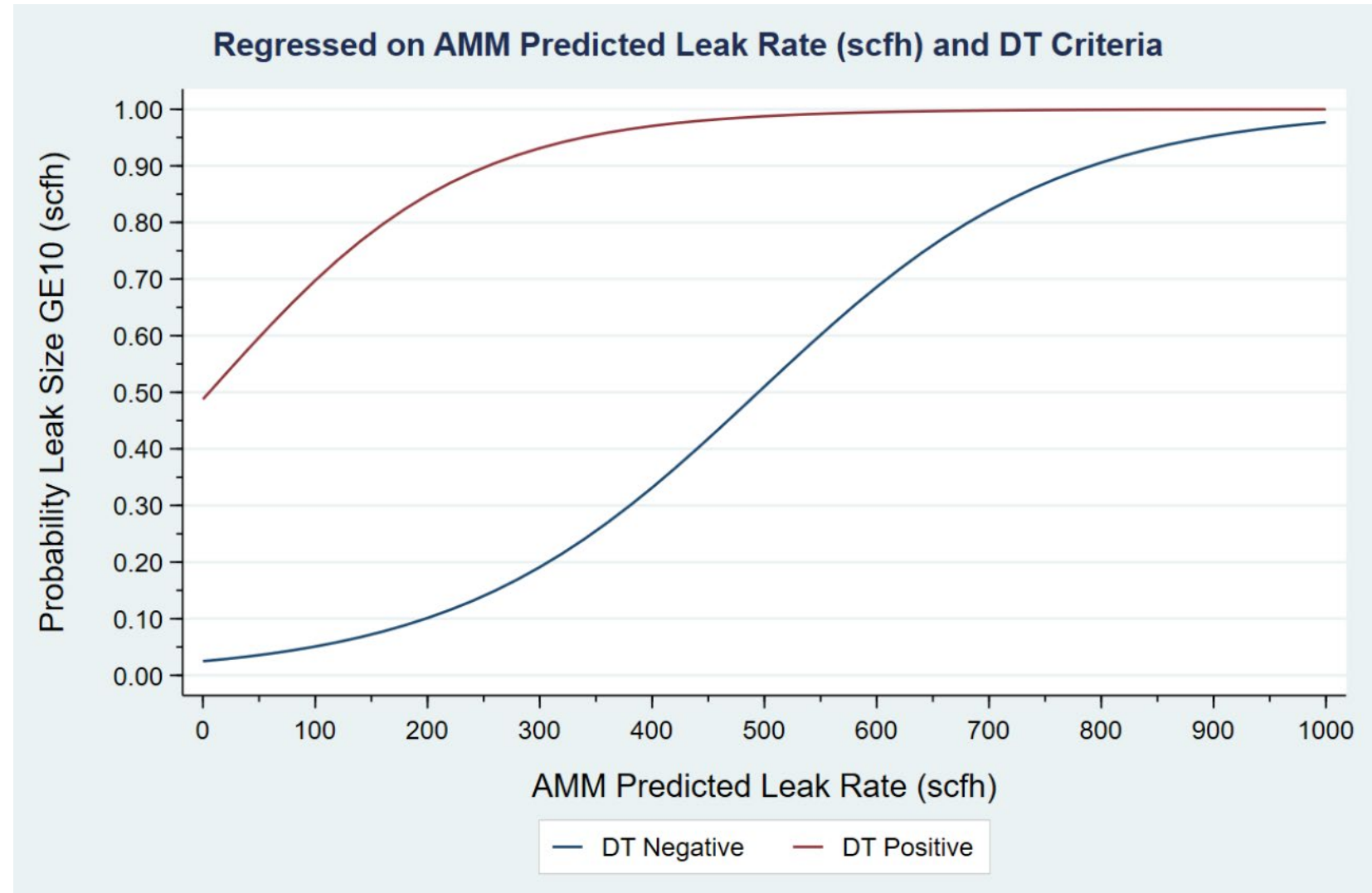
AMM Emission Factor



- Measured leak flow rate from 51 belowground (BG) leaks detected by AMM using surface expression method
- ~40% of BG leaks detected by AMM are ≥ 10 SCFH (~27 SCFH-NG mean leak rate)
- Estimate 197,600 MCF-NG emissions mitigation potential associated with AMM-detected BG leaks

Predictive Power of Combining AMM and DT Data

AMM data can be combined with DT data to improve prediction of leaks ≥ 10 scfh



AMM and Appendix Reporting

- » For leaks detected during Survey and O&M, there is no change to emission factors or calculation method.
- » Utilize AMM EF data to adjust emission factor for Unknown Leaks on the unsurveyed portion of the system due to the removal of large leaks found by AMM:

$$\text{Unknown Leak EF} = \frac{\text{System Leak Emissions} - \text{AMM Leak Qty} * \text{AMM EF} * \text{Avg Days Leaking}}{\text{Survey and O\&M Leak Qty} * \text{Avg Days Leaking}}$$

where,

$$\text{Survey and O\&M Leak Qty} = \text{Total Known System Leak Qty} - \text{AMM Leak Qty from scanned portion of system}$$

- » Adjust the Quantity of Unknown Leaks and associated EF:
 - Determine number of leaks found through AMM over unsurveyed pipeline in the given year and remove from Unknown leak count.
 - Calculate Unknown Leak Emissions using adjusted Unknown Leak quantity and Unknown Leak EF:

$$\text{Adjusted Unknown Leak Qty} = \text{Unknown Leak Qty} - \text{AMM Leak Qty from unsurveyed portion of system}$$

$$\text{Unknown Leak Emissions} = \text{Adjusted Unknown Leak Qty} * \text{Unknown Leak EF} * 365 \text{ Days Leaking}$$

Co-Benefits of AMM Program

- Significant pipeline safety benefits (regardless of emission source)
 - AMM-detected leaks resulted in 22 customer evacuation events
- Customer leaks
 - Complements Advanced Meter Consumption-Data Analytics and Registration Check programs for finding Customer (Post-Meter) leaks
 - Emission rates can be estimated by using a combination of AMM quantification data and Advanced Meter analytics data from verified customer leaks found by the AMM program
- Incomplete Combustion
 - Emission rates can be estimated by using the proportional analysis relative to customer leaks using AMM quantification data
 - Improved efficiency of End-Use equipment will result in additional reductions in combustion emissions
- Adding Post-Meter emissions mitigation meets cost-effectiveness objective
 - Estimated 300,000 MCF-NG emissions mitigation potential associated with AMM-detected customer emissions

Questions?



R&D PROJECT UPDATE

February 1, 2023



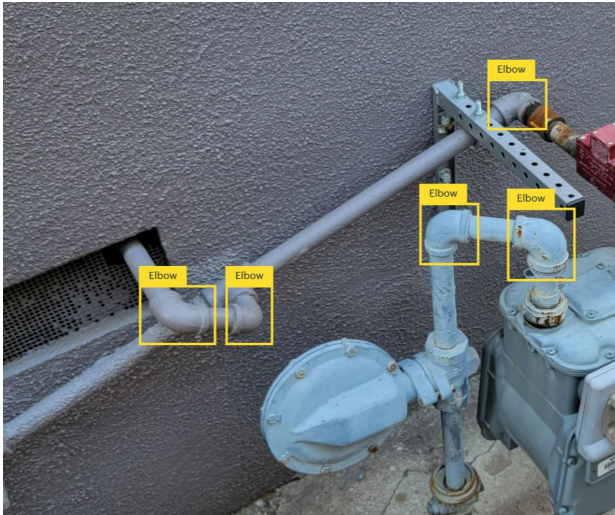
Agenda

- » BP16 – Special Leak Surveys
- » BP17 – Enhanced Methane Detection
- » BP18 – Stationary Methane Detectors for Early Detection of Leaks
- » BP20a – Quantification
- » BP20b – Geographic Tracking
- » BP22 – Pipe Fitting Specification and Tolerances
- » BP23 – Emissions from Operations, Maintenance and other Activities

BP16 – Special Leak Surveys

Unmanned Aerial Vehicles (UAVs) for Bridge and Span Inspection and Can't Get In (CGI) Inspection

- Improve operational costs associated with Bridge and Span survey using remotely controlled Aerial vehicles
- Reduce costs associated with repeat visits to customer site by performing aerial survey for CGIs
- Initial pilot study completed in 2022
- Process refinement continued in 2023



Intelligent Image Recognition for Customer Meters

- Perform Meter Set Assembly (MSA) component inventory and detection of Abnormal Operating Conditions (AOCs) using image recognition AI algorithms
- 2022 Accomplishments
 - Created image repository and collected 8,200+ images
 - Developed models to detect 20 distinct MSA components
- 2023 Goals
 - Develop models for AOC detection of corrosion and vegetation encroachment

BP17 – Enhanced Methane Detection

Next Generation Walking Leak Survey

- Evaluate and develop the use of portable ppb-detection capable instruments to enhance walking leak survey detection
- Completed laboratory and simulated field testing of four different devices in 2022
- Controlled field testing planned for 2023



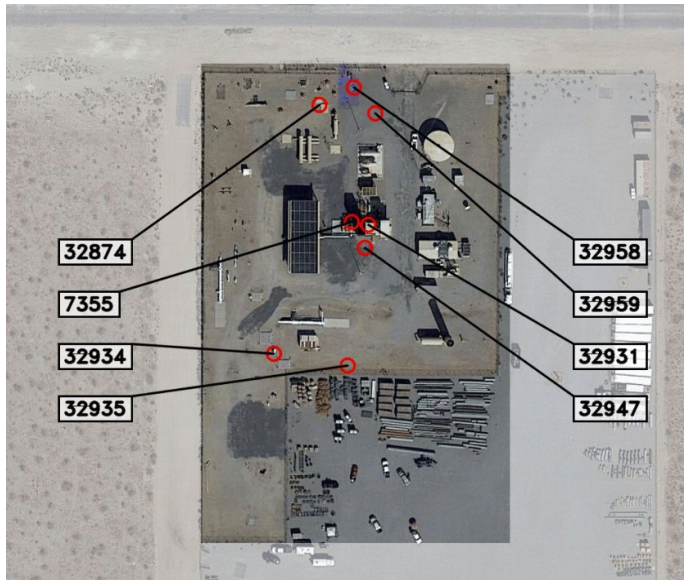
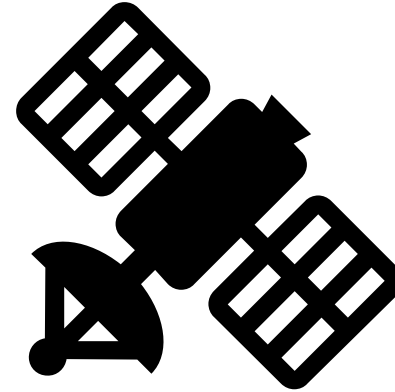
Fleet-based Passive Mobile Methane Detection

- Passively detect methane emissions from normal fleet vehicle operations
- Utilize data analytics to compile methane readings and potentially identify leak sources
- Pilot study planned for 2023

BP17 – Enhanced Methane Detection

Satellite-based Methane Detection

- Allows for frequent emissions scanning
- Detection data available within hours of scan
- Detects leaks as small as 9 kg/hr (~470 SCFH)
- Pilot study planned for 2023



Compressor Station and High-Pressure Distribution Aerial Leak Survey

- Leverage technological developments from Aerial Methane Mapping project in compressor station and distribution high pressure pipeline survey applications
- Compressor station flights performed in late 2022 and results analysis is currently ongoing
- High pressure distribution study planned for 2023

BP18 – Stationary Methane Detectors for Early Detection of Leaks

Stationary Methane Sensor Pilot

- Install methane detectors at service Points of Entry for meter rooms and crawl spaces
- Improve safety while reducing emissions by detecting methane in these high consequence locations
- Based on successful implementation results at fellow utility
- Project planning and equipment acquisition completed in 2022
- Pilot installation and monitoring planned for 2023-2024



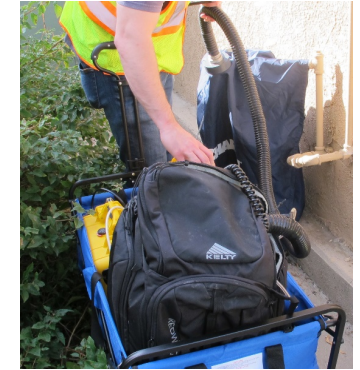
Quantification of Emissions from Vented Equipment

- Assemble device package for real-time quantification of emissions from actuators over long periods of time
- Use this data to develop emission factors for vented emissions associated with these devices to replace population-based emission factors
- Initial field data collection effort performed in 2022
- Measurement device development, installation, and data collection planned for 2023-2024

BP20a – Quantification

Company-Specific Emission Factor Development

- Objective is to develop leaker-based emission factors for the various emission reporting Appendices to replace population-based and facility-based emission factors
 - Allows for the realization of emission reductions associated with system and process improvements
- » Transmission M&R Stations
- 2022
- Performed aerial and ground-based sampling of 13 stations
- 2023-2024
- Finalize analysis and development of fugitive emission factors
 - Continue data gathering for analysis and development of intermittent emission factors
- » Distribution Main & Service Pipelines
- 2015-2022
- Performed system wide random sampling of leaks and developed preliminary emission factors
 - Developed and implemented Decision Tree method for identification of potentially large leaks to accelerate for repair
- 2023
- Finalize data collection, analysis, and development of aboveground emission factors
 - Finalize schema for annual sampling and upkeep of belowground and aboveground emission factors
- » Transmission Pipelines
- 2024
- Develop leaker-based emission factors to replace mileage-based emission factors
 - Allows the realization of emission reduction efforts associated with this infrastructure



BP20b – Geographic Tracking

Geographic Leak Data Environmental Justice Analysis

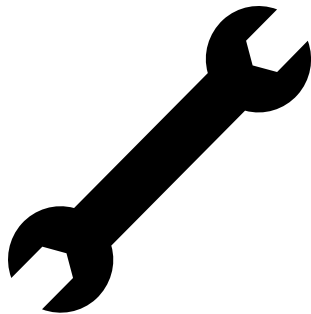
- » Determine if correlations exist between different populations in the SoCalGas service area (i.e., demographic parameters such as residential location, income, minority populations, or age) with quantity and magnitude of leaks, leak durations, and overall methane emissions
- » Collected and aggregated leak and demographic data in 2022
- » Performing robust, statistical analysis using this data in 2023



BP22 – Pipe Fitting Specification and Tolerances

Pipe Thread Sealant Performance in Storage Applications

- Objective: evaluate various thread sealants for application in storage system (pressure up to 3700 psi)
- Project planning, sealant selection, and component acquisition completed in 2022
- Laboratory testing planned for 2023-2024



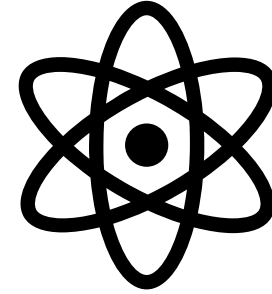
Reducing Methane Emissions at Threaded Connections – Sealant Application, Torque, and Workmanship (NYSEARCH)

- Objective: evaluate mitigation techniques to prevent and reduce emissions at threaded connections
- Phases I through III of the project focused on studying the effect of thread quality. Completed as of 2022.
- Phase IV (2023) will study the effects of sealant application technique, applied torque, and overall workmanship

BP23 – Emissions from Operations, Maintenance and other Activities

Alternative Fuel Substitution Analysis

- Objective: Estimate the impact on total methane emissions from the incorporation of renewable natural gas and hydrogen blending into the natural gas system
- H2 blending GHG analysis completed in 2021-2022
- RNG preliminary analysis completed in 2022
- Review analysis and complete reports in 2023



Compressor Rod Packing Fugitive Emissions Capture System

- Objective: Evaluate the effectiveness of a compressor rod packing fugitive emissions capture system
- Engineering process hazard analysis completed in 2022
- Pilot implementation at SoCalGas compressor station planned for 2023-2024

Questions?

2022 Compliance Plan Updates

GHG Emission Strategies

February 2023





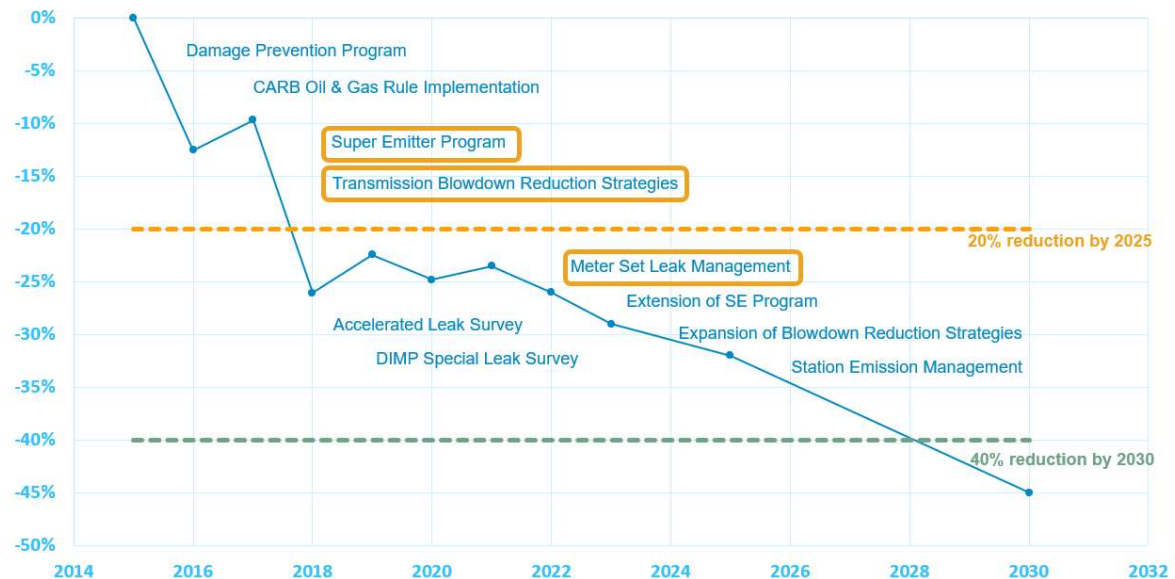
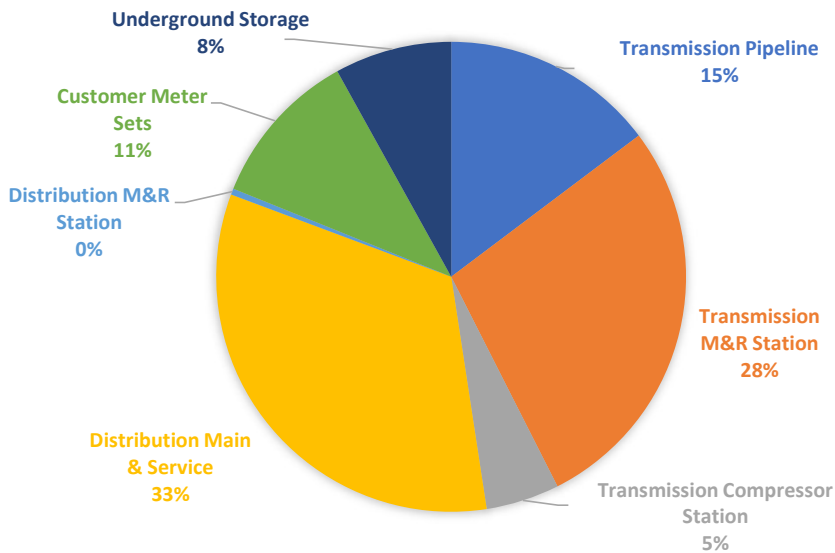
Background

Overview

As part of SB1371, every 2 years, PG&E submits the Compliance Plan (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.

Reduce methane emissions 20% by 2025 and 40% by 2030 (CARB Short Lived Climate Pollutant), compared to 2015 baseline. Climate Strategy Report has a goal to reduce emissions by 45% by 2030.

2015 ADJUSTED BASELINE % BREAKDOWN



Internal



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.



Effectiveness:

Isaac to present on 2022 highlights in his presentation

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



Ch 3: Non-Emergency Gas Transmission Blowdown Reduction

Proposed New or Continuing Measure:

#	Chapter	Measure Description	Status Update
1	3	Purchased gas driven mobile fill compressors, tube trailers, 2 enclosed combustion devices and 2 thermal oxidizers	COMPLETE – received units in 2022
2	3	Lower the pipeline pressure to near zero as feasible for scheduled backbone transmission blowdowns. “PG&E is targeting an annual abatement of 90 percent of potential gas releases from backbone pipeline clearances and 50 percent of potential gas releases from local transmission pipeline clearances.”	PENDING – Revised goal to 90% backbone, 75% local transmission, and 60% facilities.
3	3	Expand methane abatement strategies to stations	PENDING – As mentioned above, we have a target for facilities abatement. We’re close to updating Unifier to include GHG feasibility reviews to consider station projects.
4	3	Evaluate degassing technologies for ILI projects	COMPLETE – Piloted GOVAC as a degassing technology for ILI projects. Isaac to provide overview.
5	3	Apply volume threshold to require a methane abatement strategy for scheduled transmission pipeline blowdowns	COMPLETE
6	3	Review and analyze pipeline repair projects that utilized PCFs & sleeves for methane abatement	PENDING – Isaac to provide overview.
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	COMPLETE

Internal



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

Current Practices:

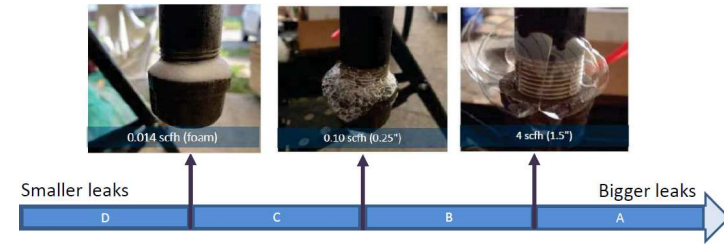
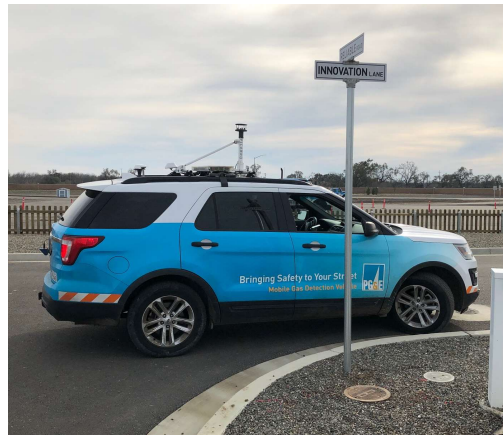
- Ch 7 - Accelerated leak survey, from a 5-yr to a 3-yr cycle
- Ch 7 - DIMP leak survey on vintage distribution pipelines
- Ch 7,11 – Super Emitter Program
- Ch 11 – Grade 3 Leak Repair

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
- Meter Set leak management



Super Emitter Program		2018	2019	2020	2021
Compliance Survey	Coverage	15,800 miles	12,800 miles	23,600 miles	22,700 miles
	Number of BG SE	86	44	34	30
	Grade 1	42	21	18	13
	Grade 2	21	6	9	10
	Grade 3	23	17	7	7
	Number of repairs	54	23	26	23
SE Survey	Coverage	41,700 miles	56,800 miles	45,700 miles	51,400 miles
	Number of BG SE	134	148	90	164
	Grade 1	35	58	42	74
	Grade 2	55	41	38	65
	Grade 3	44	49	10	25
	Number of repairs	74	102	58	110
Total	Coverage	57,500 miles	69,600 miles	69,300 miles	74,100 miles
	Number of BG SE	220	192	124	194
	Actual number of repairs	128	125	84	133
	Actual number of repairs under the SE program	74	102	58	110
	Abatement	88 MMscf	192 MMscf	186 MMscf	198 MMscf



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

Proposed New or Continuing Measure:

#	Ch	Measure Description	Status Update
8	3	Integrate Vintage Leak Survey into Optimized Leak Survey	REVISED – Leverage Super Emitter Drives for Vintage Leak Survey
9	7	Continue to evaluate Optimized Leak Survey for Operations	PENDING
10	7, 11	Lower SE threshold to 7 scfh	COMPLETE – Started in 2023
11	11	Revised the belowground grade 3 repair target from 2,000 to 1,000.	COMPLETE
12	11	Prioritize Class A and B meter set leaks for repair/remediation	PENDING – Doing well with Class A leaks. Class B leaks, we need to update our procedure to repair these in priority before those self-imposed 3-year MSL repairs.

Internal



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:

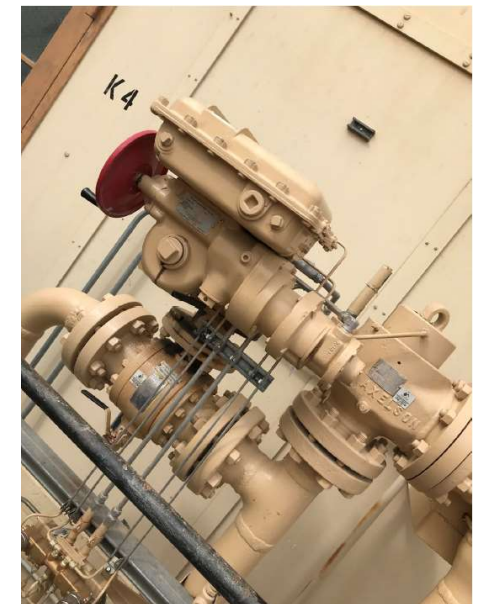
- BP 23 – Minimize Emissions from Operations, Maintenance and Other Activities

Proposed New or Continuing Measure:

#	Measure Description	Status Update
13	High bleed pneumatic replacement	PENDING – Replaced 8 high bleed pneumatic devices at Transmission M&R stations in 2022.
14	Feasibility study to reduce methane emissions at Compressor Station/Storage Facility	PENDING - Converted 18 intermittent bleed valves from natural gas to instrument air in Hinkley in 2022.

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:

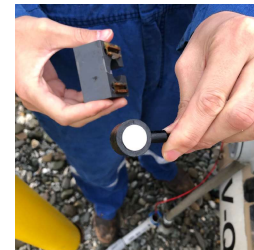
- BP 20a – Quantification & Geographic Tracking
- BP 23 – Minimize Emissions from Operations, Maintenance and Other Activities

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	Status Update
15	Transmission M&R Station Emission Framework	Monique to provide update during her presentation
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

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GHG Abatement for Planned Transmission Blowdown

Feb 2023

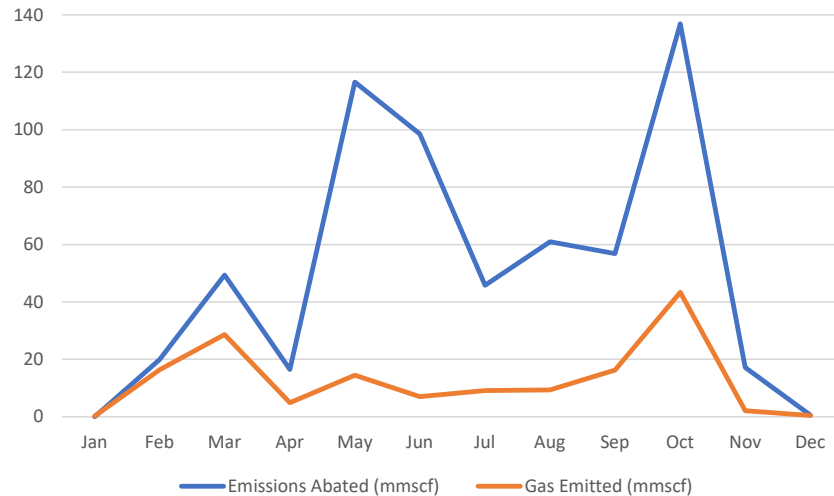




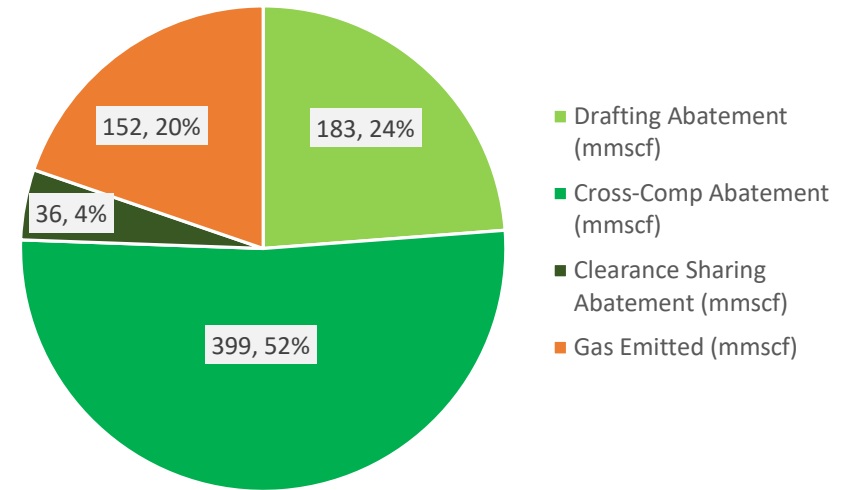
2022 Abatement Results

Most GHG Abatement is from Cross Compression

Gas Emitted & Abated by Month (MMscf), 2022



Gas Emitted & Abated (MMscf), 2022



152	MMSCF Gas Emitted
619	MMSCF Gas Abated
80%	Gas Abated
21%	Clearances that used Reduction Strategies

Internal



GOVAC Pilot

Mid-to-Small Scale Compressor Application



Left: Connection to the Launcher Right: GOVAC unit being prepared for demo

- **5 Total clearances** (1 test, 4 ILI) for a total abatement of **114 Mscf**
- Applied 1 GOVAC unit with an average degas time of **4 hours**
- GOVAC lessons learned, use cases and future application

Internal

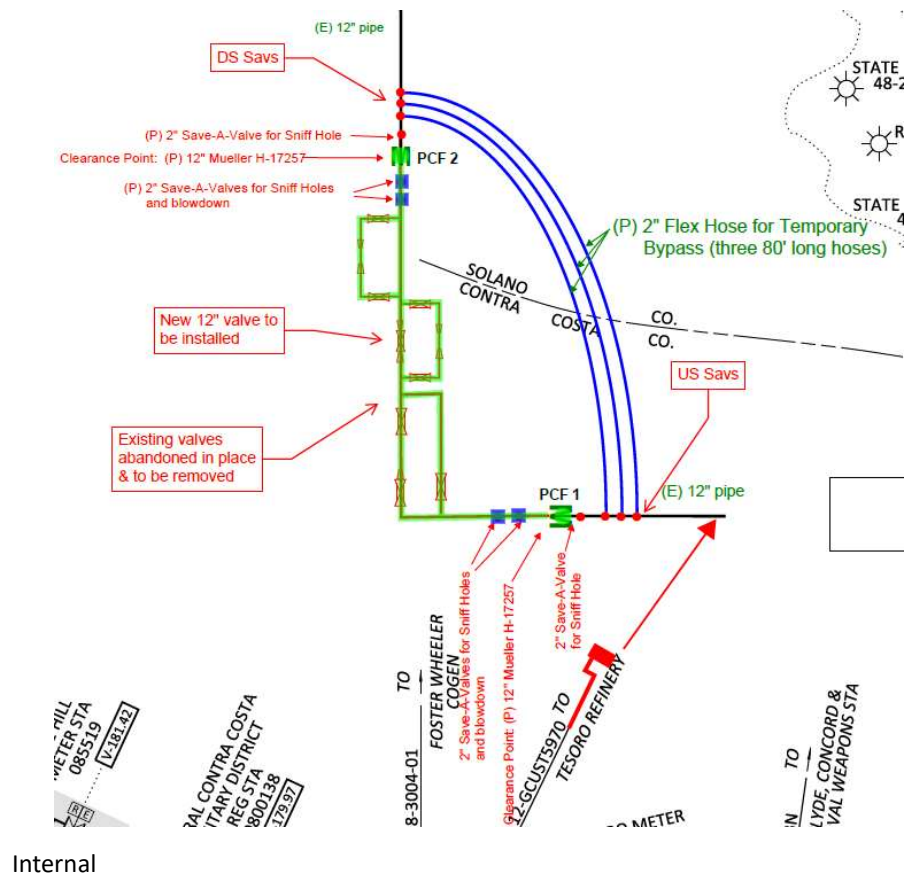


Avoid GHG Emissions from Utilizing Hot Tapping

Using PCFs to reduce emissions

Example: V-874, Valve Replacement

- With PCFs installed
 - 48 cf of isolated pipe
 - 1.1 mscf of gas emissions
- Without PCFs installed (hypothetical)
 - 4400 cf of isolated pipe
 - 103 mscf of gas emissions





Questions & Open Discussion



Distribution Mains and Services

Baseline and Emission Factors

Andres Beltran
Gas Engineer for GHG Emission Strategies





2015 baseline for DM&S leak distribution

Background:

Distribution Main and Service Emissions are calculated using the Emission Factors established by GRI in 1992. This represents approximately 25% of PG&E's reported methane emissions.

Proposal:

Apply the Washington State University (WSU) leak distribution OR an adjusted WSU distribution (based on Super Emitter measurements) as representative of PG&E's system in **2015** with a unique emission factor across materials and assets.

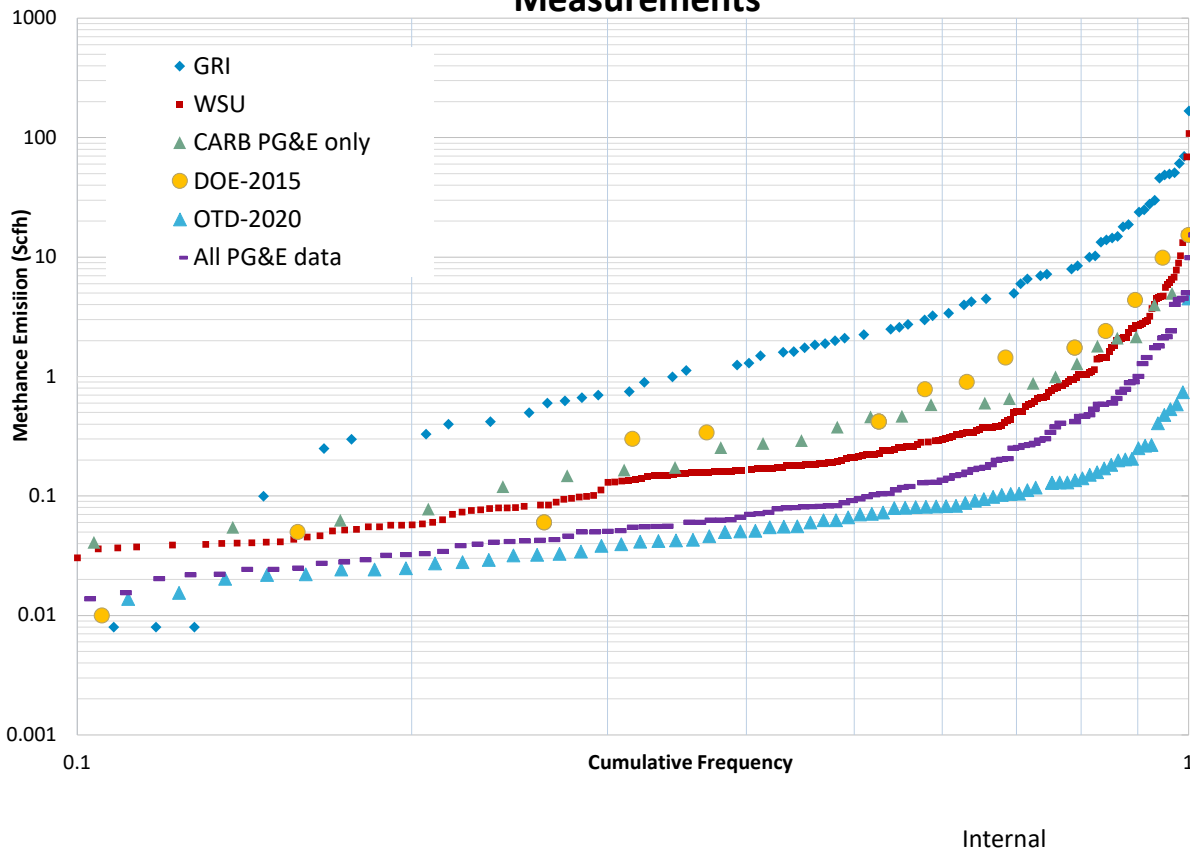
Rationale:

1. Data collected from PG&E's system between 2014 and 2021 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

GRI and WSU Distributions compared to to PG&E's Direct Measurements



- 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 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 data show **very good alignment with WSU distribution.**

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

**Average WSU EF for Non-SE and SE*

Unique EF (SCFH)	SE (SCFH)
1.705	43.7



WSU Adjusted Emission Factor

Results

- Observed that the **results of the vehicle measurements were in line with the WSU** proposed leak size distribution
- **Applied WSU distribution as the baseline** for establishing the **emission factors to apply to leaks** in PG&E's systems
- In September 2022, CPUC and CARB commented that the **straight average of the leak rate for leaks above 10 SCFH from the WSU data set is higher than the straight average from PG&E's Super Emitter measurements.**
- PG&E has reviewed all super emitter data from 2018 – 2021 and calculated a similar **super emitter average emission factor of 35.27 scfh**

Readjusted WSU average EF using average PG&E SE data

	Unique EF (SCFH)	SE (SCFH)
WSU Avg.	1.705	43.7
WSU Adj.	1.521	35.27



R Y2015 Recalculation & Unknown Emissions

Process

- Reviewed distribution main and service leak data from 2011 – 2014
- Performed quality control on leaks reported in RY2015
- Unknown leak emissions were calculated similarly to 2015, since there is no available survey mileage data for the unsurveyed territory (see calculation below)

Unknown Leaks

- Extracted total leaks found (TLF) in the year of interest between 2011 – 2014
- Applied a tiered approach to estimate *Unknown Emissions*

$$\text{Unk. Emissions} = (2011_{TLF} * 80\% + 2012_{TLF} * 60\% + 2013_{TLF} * 40\% + 2014_{TLF} * 20\%) * EF * 365 \text{ days} * 24 \text{ hour}$$

	GRI (Mscf)	WSU Avg. (Mscf)	WSU Adj. (Mscf)
Unknown Emissions	389,233	330,386	294,816



Conclusion – New Baseline

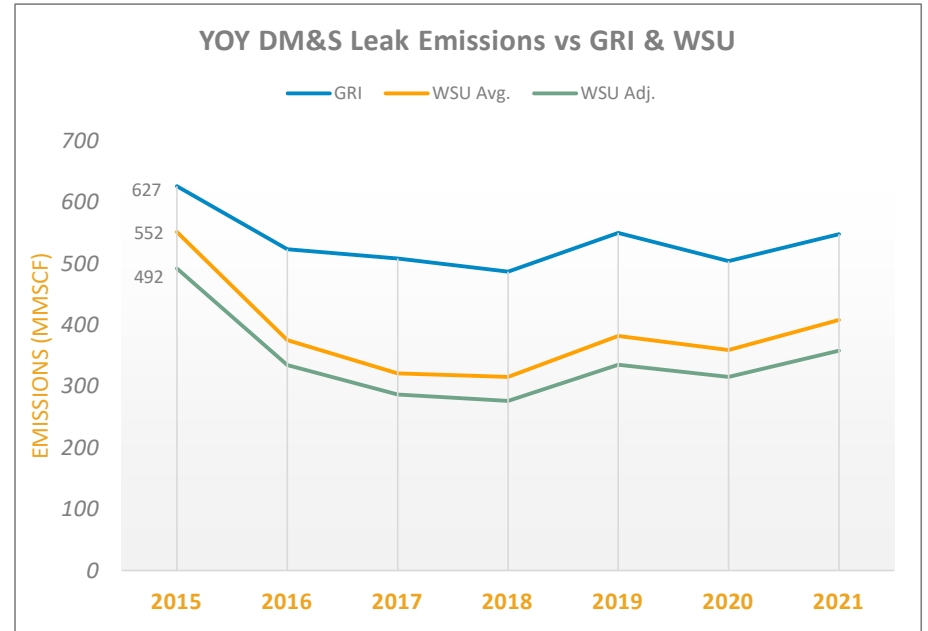
Using WSU distribution with a unique EF across assets and materials

- 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

2015 Baseline using the WSU emission Factors

- *Option 1* – WSU Average w/ WSU SEs
- *Option 2* – WSU Adjusted w/ PG&E SEs

Year	GRI (Mscf)	WSU Avg. (Mscf)	WSU Adj. (Mscf)
2015	626,590	551,842	492,430



Thank You

Andres Beltran

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R&D Project Updates

GRID Gas R&D

February 2023





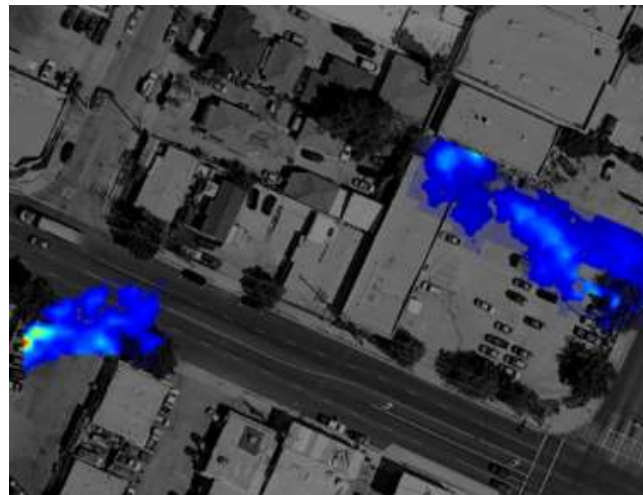
Aerial Leak Detection

2022

- Seek Ops - Piloted drone-based system for leak detection and emission quantification at 6 compressor stations and 1 storage facility

2023

- Satelytics - uses satellite technology to detect leaks
- Bridger Photonics - helicopter mounted lidar sensor for leak detection and quantification
- GHG Sat - satellite or fixed wing leak detection



From left to right: SeekOps Drone System, Bridger Photonics Imagery, Satelytics Methane Map



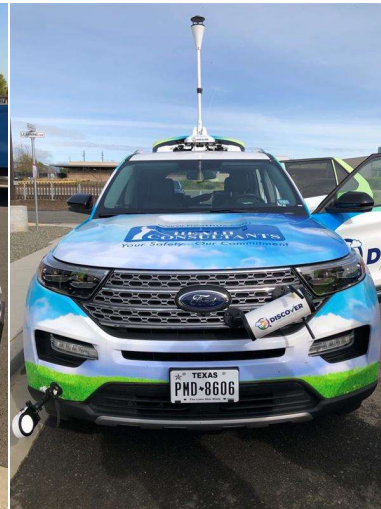
Advanced Mobile Leak Detection

2022

- Aclima Pro
- Heath Advanced Mobile Leak Detection
- Southern Cross Advanced Mobile Leak Detection

2023

- Aeris Technologies



From left to right: Aclima AMLD, Heath AMLD, controlled leak setup example, Southern Cross AMLD. Upper right: Aeris Sensor



Continuous and Instantaneous Monitoring Equipment

2022

- Analyzed Sensit FPL Data for transmission M&R stations
- Tested the Semtech hi-flow 2 sampler at our Dublin Lab Facility
- Tested the Ceco EPV for emissions measurements at wellhead casings

2023

- Relocate Sensit FPL sensors and perform direct measurements at M&R stations
- Continuous monitoring device for storage facilities



From left to right: Sensit FPL at Panoche Station, Hi-flow 2 Sampler at Dublin Lab, Ceco EPV testing at McDonald Island, Aeris continuous monitoring device



Research Consortia Partnership Projects

2022

- Development of a Decision-making Algorithm for Detection and Quantification of Leaks (M2020-009)
- Reducing Methane Emissions at Threaded Connections (M2018-001 Ph3)

2023

- Reducing Methane Emissions at Threaded Connections (M2018-001 Ph4)
- Methane Sniffer Small Unmanned Aerial System (ms-sUAV) (M2014-001 Ph 3)
- NYSEARCH project T-786 monitoring emissions at Transmission M&R stations



From left to right: Data collection using a network of sensors for project M2020-009, threaded connection testing, NYSEARCH T-786 Field Visit

Thank you

Monique Montague

Monique.Montague@pge.com



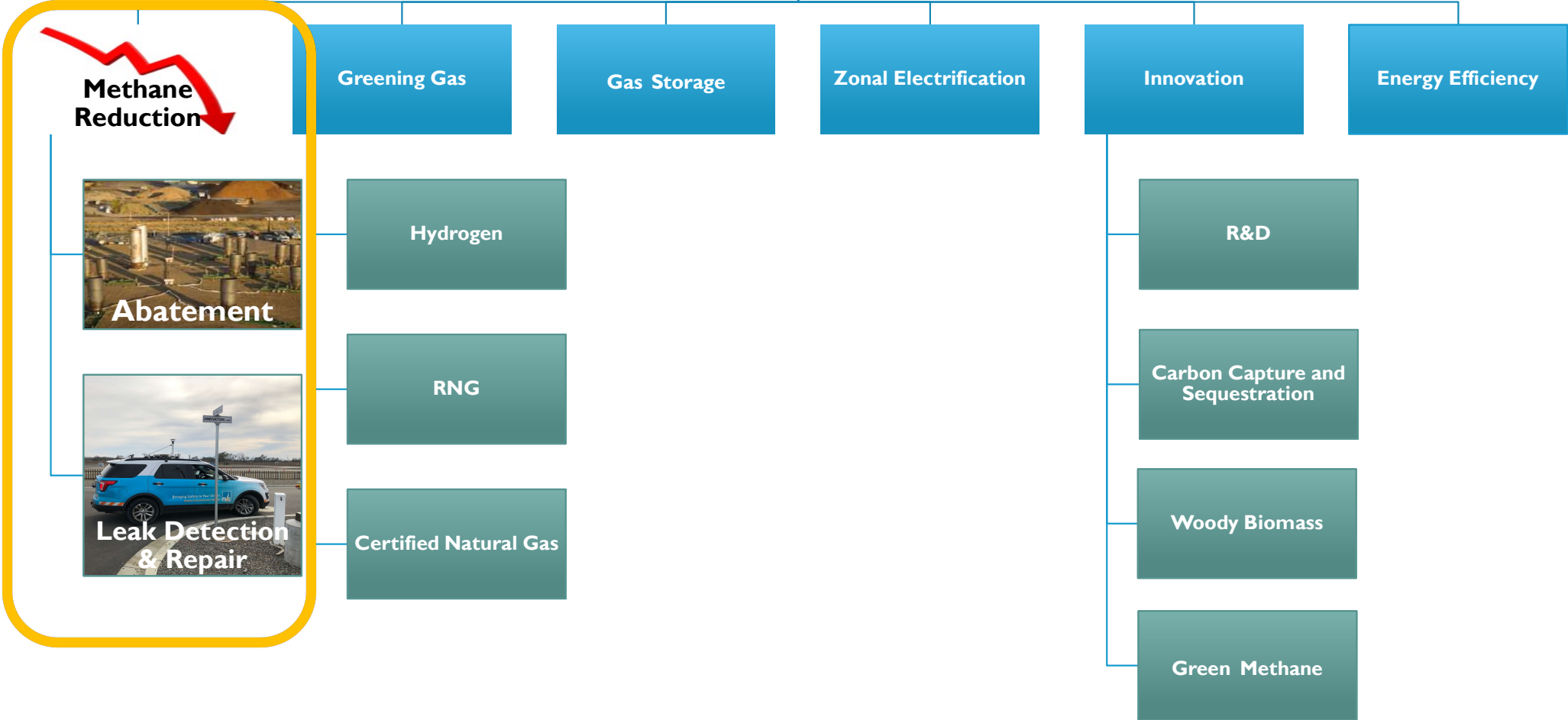
Other GHG Emission Reduction Strategies

GHG Emission Strategies

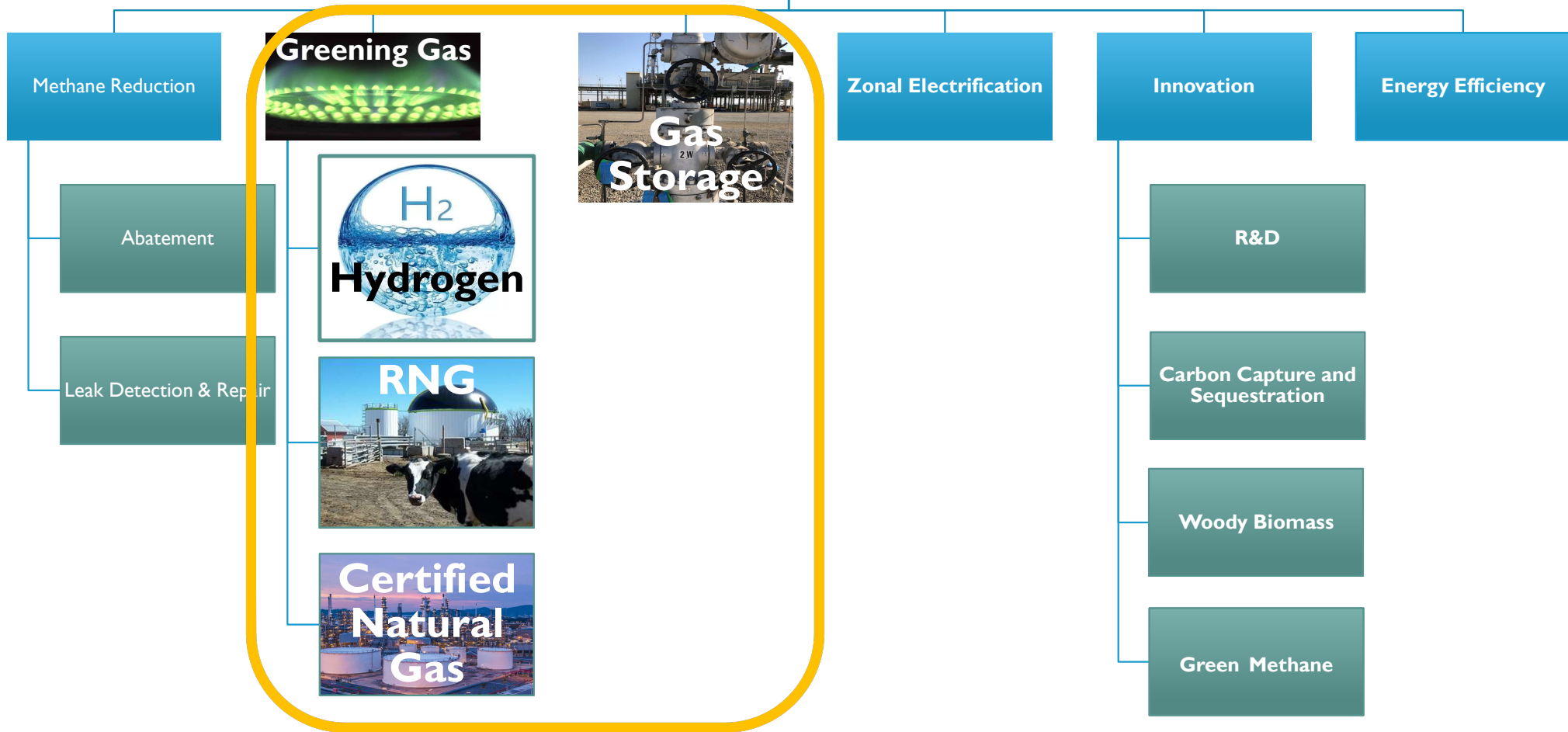
February 2023



Reduce GHG Emissions

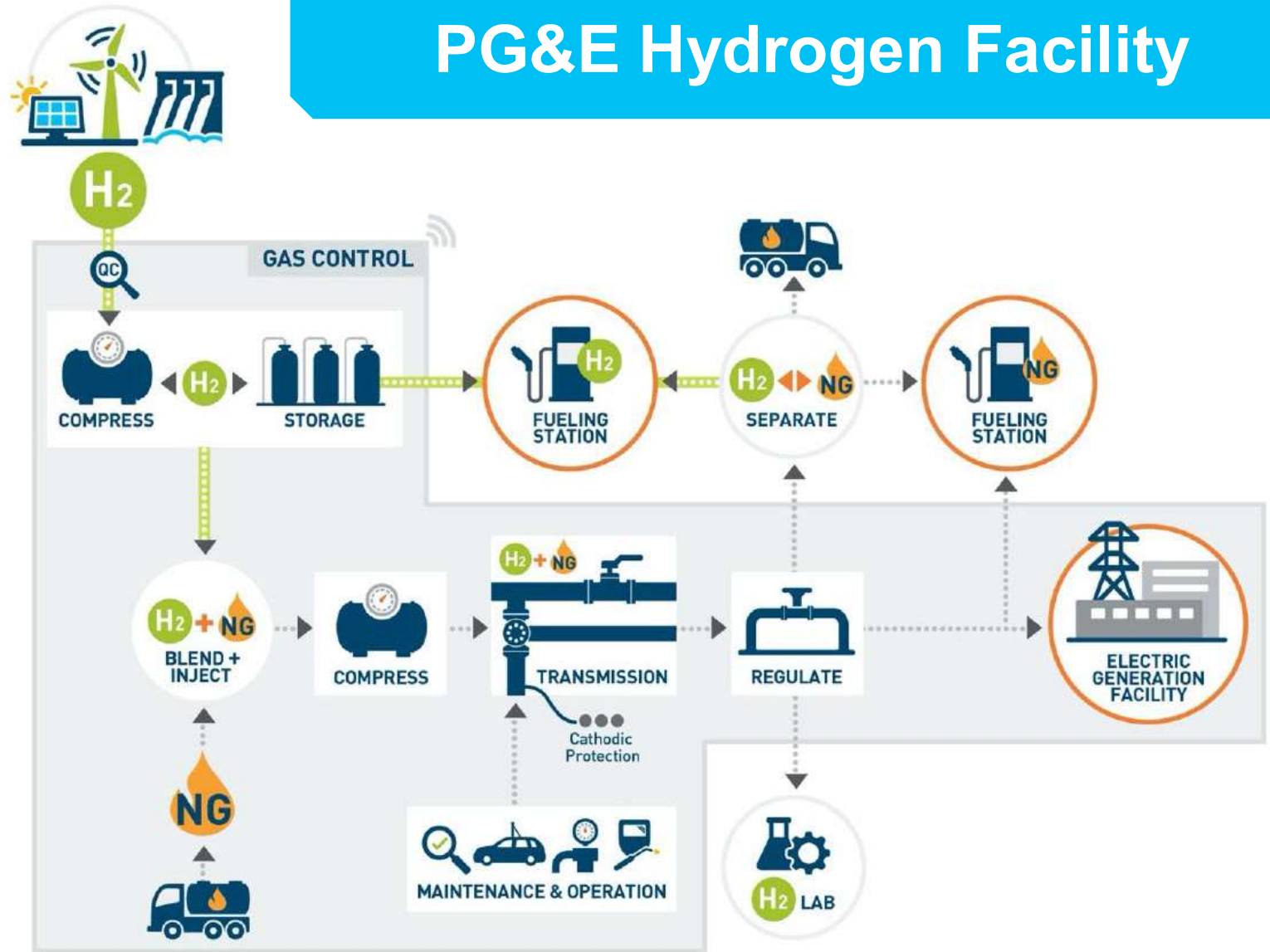


Reduce GHG Emissions





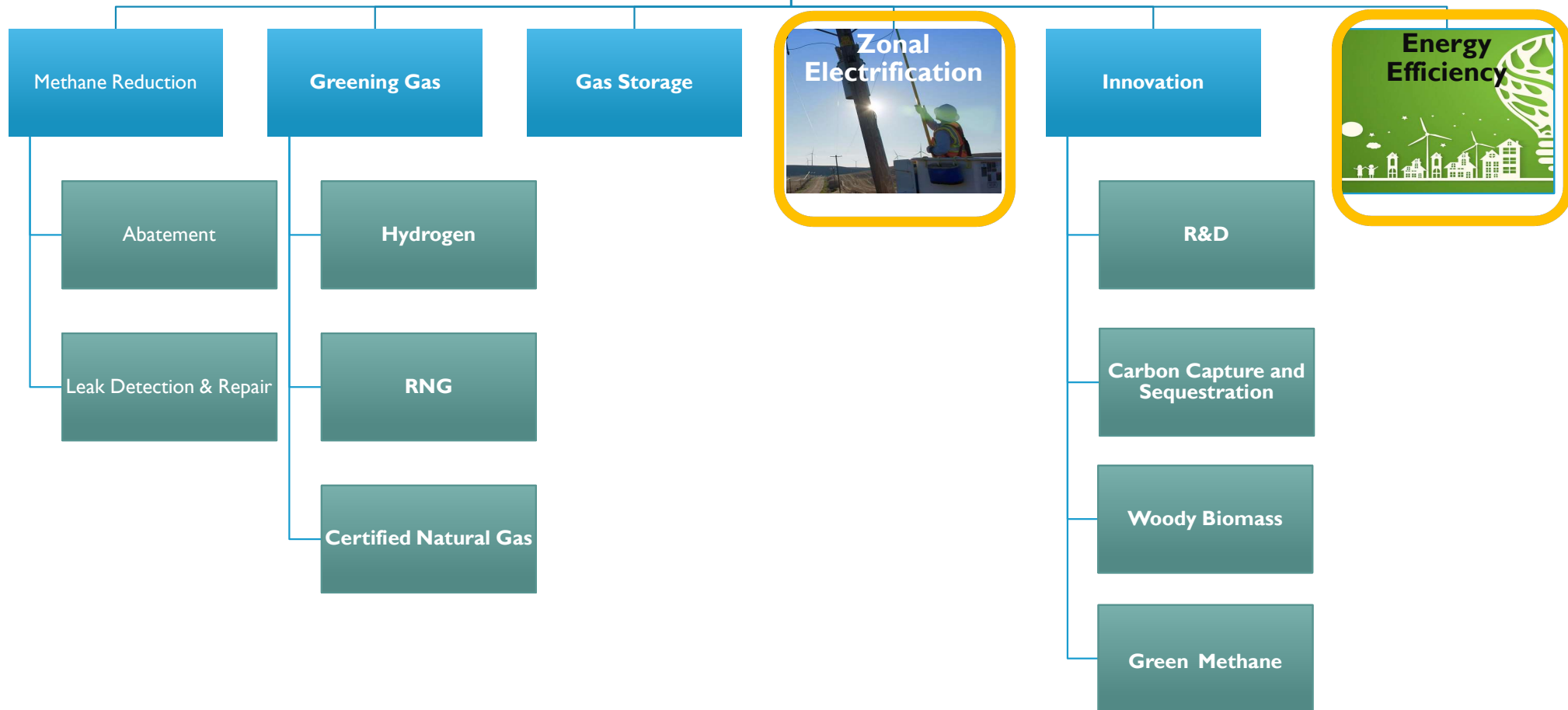
PG&E Hydrogen Facility



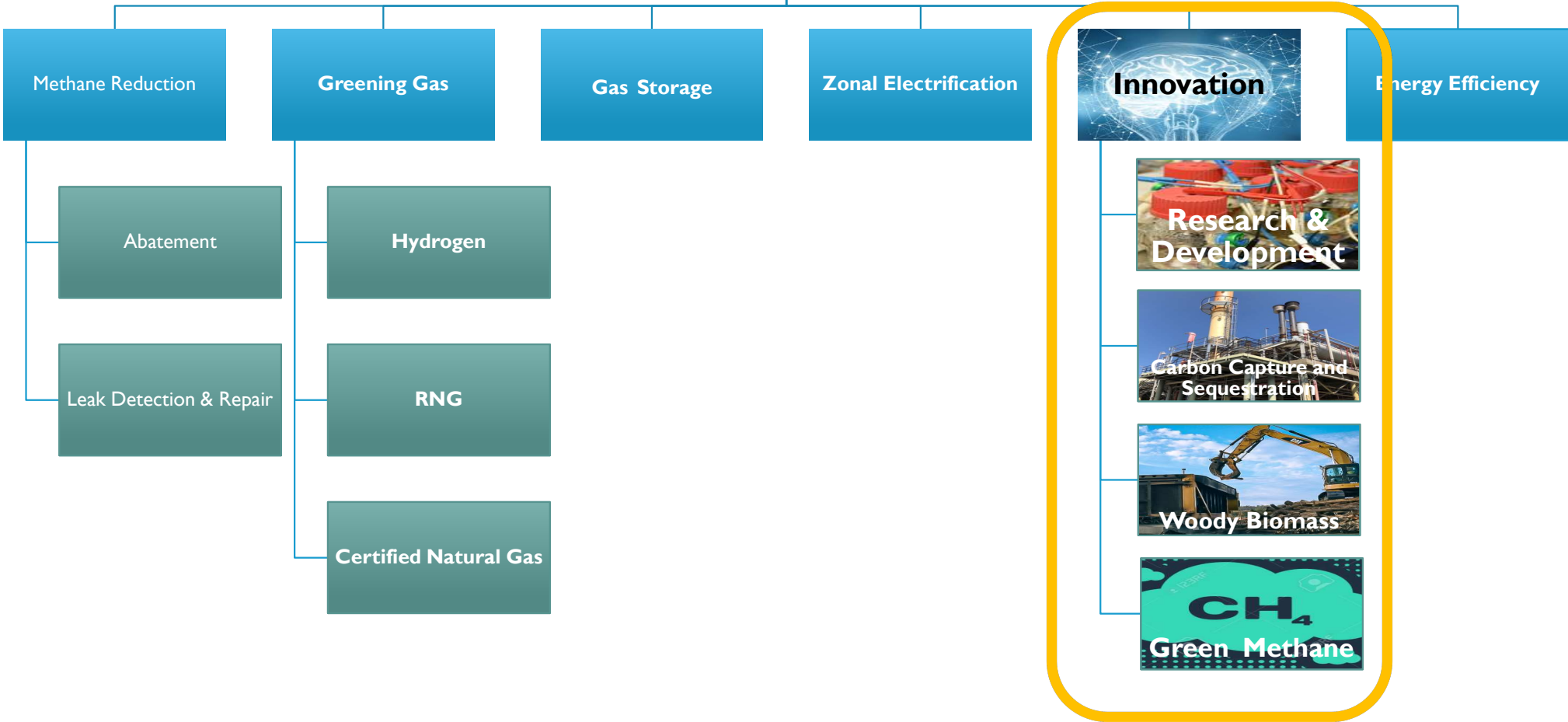
RNG (Biogas)



Reduce GHG Emissions



Reduce GHG Emissions



Thank you

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INTERNAL


Closing and Next Steps

CARB and CPUC



California Public
Utilities Commission

Final Questions?

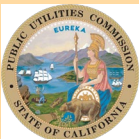
- Click the hand next to your name in the participant list 
- The host will call on your name when it is your turn to speak
- Or, type question into the chat



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/gas-leak-abatement-oir-r-15-01-008>



California Public
Utilities Commission