2024 Natural Gas Leak Abatement (NGLA) Winter Workshop

9:00am-4:00pm

Monday, February 5, 2024

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 me 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 2023 Joint Report
- Appendix-Specific R&D and Updates
- Template and Reporting Updates

AFTERNOON

- 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	9:10-9:20am
Appendix-Specific R&D and Updates		
PG&E/Sempra	Unknown Leak Calculations in Appendices 4 and 6	9:20-9:35am
Sempra	Appendix 4 Emission Factors for Annual Reporting	9:35-10:05am
-	Break	10:05-10:20am
PG&E	Transmission M&R Station Emission Factors	10:40-11:00am
Template and Reporting Updates		
CPUC/CARB	Proposed Changes for 2024 Reporting Templates	11:00-11:20am
CPUC/CARB	Draft Acceptance Criteria	11:20-11:40am
-	Lunch	11:40am-12:40pm
Broader R&D Updates and Compliance Plan Efforts		
Sempra	Blowdown Planning Tool Demo	12:40-1:00pm
Sempra	Emission Strategy Program Showcase	1:00-1:20pm
Sempra	R&D Overview	1:20-1:40pm
-	Break	1:40-1:50pm
PG&E	GHG Abatement from Enclosed Combustion Devices (ECDs)	1:50-2:10pm
PG&E	R&D Project Updates	2:10-2:40pm
-	Break	2:40-2:50pm
Southwest	Updates on Technology Implementations	2:50-3:20pm
CPUC/CARB	Closing and Next Steps	3:20-3:30pm

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

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Review of the 2023 Joint Report

2024 Natural Gas Leak Abatement Program
CPUC Winter Workshop
February 5, 2024

Background

- As required by SB 1371, the 2023 Joint Report presents total industry emissions and the systemwide leak rate.
- The 2023 Joint Report is the ninth Joint Report prepared by CPUC and CARB.
- CPUC issued data request and reporting template on March 30, 2023.
- All gas companies submitted 2022 data on June 15, 2023.
- The annual list of questions sent to utilities in July 2023 required gas company data resubmittals.

Total Statewide Natural Gas Emissions in 2022

The total statewide 2022 estimated natural gas emissions was **3,166 million standard cubic feet.**

Reported emission estimates are:

- **2% lower** than the 2021 natural gas emission estimates.
- **27% lower** than the 2015 baseline natural gas emission estimates.

Sector Emissions	2015 Baseline	2021	2022	2015 Baseline to 2022 Change		2021 - 2022 YOY Change	
				MMscf, MMT CO2e	% Change	MMscf, MMT CO2e	% Change
Volume of Natural Gas (MMscf)	4,324	3,238	3,166	(1,158)	(27%)	(72)	(2%)
Mass Equivalent, 100-Yr GWP, AR 4 (MMT CO2e)	1.94	1.45	1.42	(0.52)	(27%)	(0.03)	(2%)
Mass Equivalent, 20-Yr GWP, AR 4 (MMT CO2e)	5.58	4.18	4.08	(1.49)	(27%)	(0.09)	(2%)

Review of System Categories

System Category	2015 Baseline		2021		2022		2015 Baseline to 2022 Change		2021 - 2022 YOY Change	
	MMscf	% Total	MMscf	% Total	MMscf	% Total	MMscf	% Change	MMscf	% Change
Transmission Pipeline	589	14%	174	5%	208	7%	(381)	(65%)	34	20%
Trasmission M&R Station	777	18%	716	22%	705	22%	(72)	(9%)	(11)	(2%)
Transmission Compressor Station	181	4%	141	4%	93	3%	(88)	(49%)	(48)	(34%)
Distribution Mains & Services	1,328	31%	948	29%	919	29%	(409)	(31%)	(29)	(3%)
Distribution M&R Stations	284	7%	267	8%	269	8%	(15)	(5%)	2	1%
Customer Meter	823	19%	851	26%	848	27%	25	3%	(3)	(0%)
Underground Storage	342	8%	142	4%	125	4%	(217)	(63%)	(17)	(12%)
Total	**4,324**	**100%**	**3,238**	**100%**	**3,166**	**100%**	**(1,158)**	**(27%)**	**(72)**	**(2%)**

System-wide Leak Rate

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

Throughput Category	Natural Gas Volume (MMSCF)		
	2015 Baseline	2021	2022
Total Storage Annual Volume of Injections to Storage	199,522	166,893	144,321
Total Storage Annual Volume of Gas Used by the Gas Department	NA	1,732	1,687
Total Transmission Annual Volume of Gas Used by the Gas Department	7,717	7,018	6,185
Total Transmission Volume of Annual Gas transported to or for Customers in state	1,832,676	1,775,141	1,739,384
Total Transmission Volume of Annual Gas transported to or for Customers out of state	16,775	13,335	14,894
Total Distribution Annual Volume of Gas Used by the Gas Department	261	428	540
Total Throughput	**2,056,950**	**1,964,547**	**1,907,011**
Total Emissions	**4,324**	**3,238**	**3,166**
System-wide Leak Rate (Emissions/Throughput)	**0.21%**	**0.16%**	**0.17%**

Approved 2015 Baseline Adjustments

SPD approved the following adjusted 2015 baseline emissions	Natural Gas Volume (MSCF)	
	Original 2015 Baseline	Adjusted 2015 Baseline Emissions
West Coast Gas, Customer Meter Leaks	3	194
Pacific Gas and Electric, Component Vented Emissions in Transmission Pipelines	4,591	35,912
Pacific Gas and Electric, Distribution Mains and Services in Pipeline Leaks	626,590	481,638

Summary

- CPUC and CARB followed the process used in previous years to compile the 2023 Joint Report.
- Staff aim to finalize all template revisions by March 31, 2024.
- The proposed changes to the 2024 reporting template will be described in a later presentation.

PROPOSED MODIFICATIONS TO APPENDIX 4 & 6 UNKNOWN LEAKS FROM UNSURVEYED PORTION OF SYSTEM

February 5, 2024

PG&E

SOUTHWEST GAS

SDGE

SoCalGas

Introduction

- Background:
  - PG&E developed approach and white paper[1] for calculating number of estimated Unknown Leaks in the unsurveyed area of the system
    - This paper mentions "some leaks are detected immediately by workers or the public," but did not define these leaks or how to deal with them.
    - These leaks are referred to as "O&M" leaks in the CPUC reporting templates:
      - Defined in Appendix 4 as "M = O&M (E.G. O&M Activities, Third party reports, customer odor reports etc.)", and in the Unknown Leaks tab as "O&M leaks include any other pipeline leaks that are discovered during the year from operations and maintenance activity, third party and gas odor reports, etc. that are not accounted for in other categories of this worksheet."
      - Defined in Appendix 6 as "O&M activities, third party reports, customer odor reports, etc."

[1] *Model to calculate leak rate of distribution system_V2-1-clean.docx*

Introduction

- Joint IOU Perspective and Recent Activity:
  - Survey-Discovered leaks are used as the basis for the system leak rate and Unknown Leaks estimation
    - Compliance leak survey program provides for an on-going periodic sample of system performance
    - O&M Leaks are assumed to occur stochastically across the system and are detected by odorant soon after initiation. They, by definition, are not associated with the Unknown Leaks population.
  - A large variety of O&M operational activities result in the detection of system leaks.
    - System leak data not linked to leak survey schedule or date of last survey for facility asset involved.
  - Leaks initiated by report of leak by Customer are differentiated from leaks detected by operations during O&M activities other than leak survey.

Proposed Changes

- Modify definition for O&M *Leaks: leaks detected and reported by Customers*
  - O&M leaks are assumed to have started leaking on the day of discovery
- Apply "Survey" classification to all other leaks detected by operations during O&M operational activities
  - These leaks are added to the count of leaks detected by "survey" and assumed to be leaking since January 1 of the respective year.

APPENDIX 4 EMISSION FACTORS FOR ANNUAL REPORTING

February 5, 2024

SoCalGas™ SDGE™

Agenda

- Appendix 4 Continued Refinement of Emission Factors
- Appendix 4 Proposed 2015 Baseline Adjustment
- Effects of Aerial Methane Mapping on Appendix 4

Appendix 4 Continued Refinement of Emission Factors

- Quantification data has been collected through the years to develop Emission Factors (EFs) for belowground leaks:
  - National emission factor development studies (GRI, EPA, WSU, CARB)
  - SoCalGas R&D leak flow rate measurement samples (2015 thru 2018)
  - SoCalGas Decision Tree implementation leak flow rate measurement samples (2021 thru 2023)
- Plan to continue to refine EFs each year up until 2025
  - This will result in 5 years of Decision Tree implementation full system data upon which to base company specific EFs

Appendix 4 2015 Baseline

- Baseline emissions are currently estimated using the overall system average EF from recent years

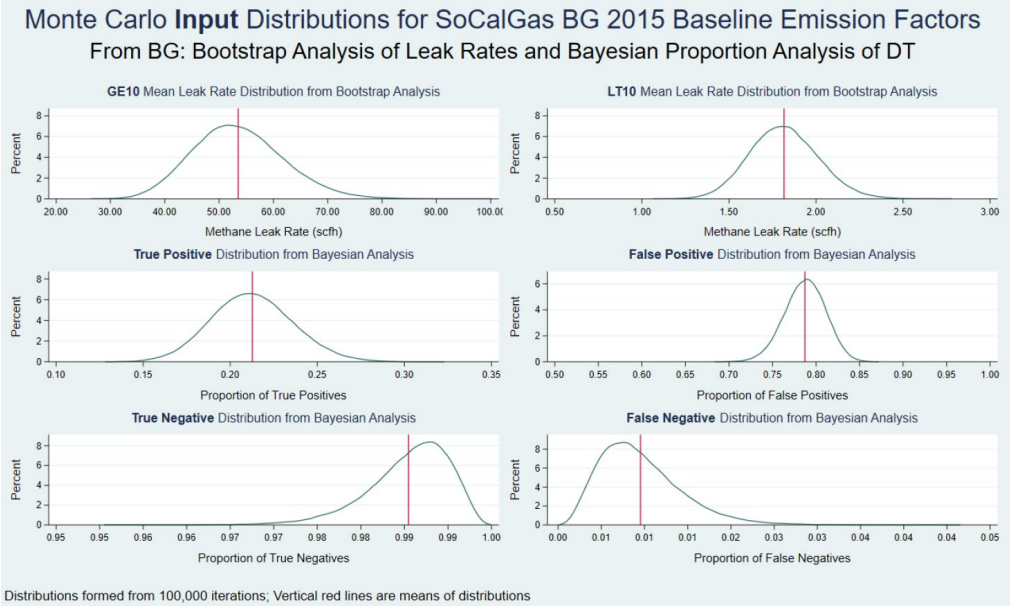
- Important to recognize the system leak inventory has changed between now and the 2015 baseline year due to repair of the leak backlog

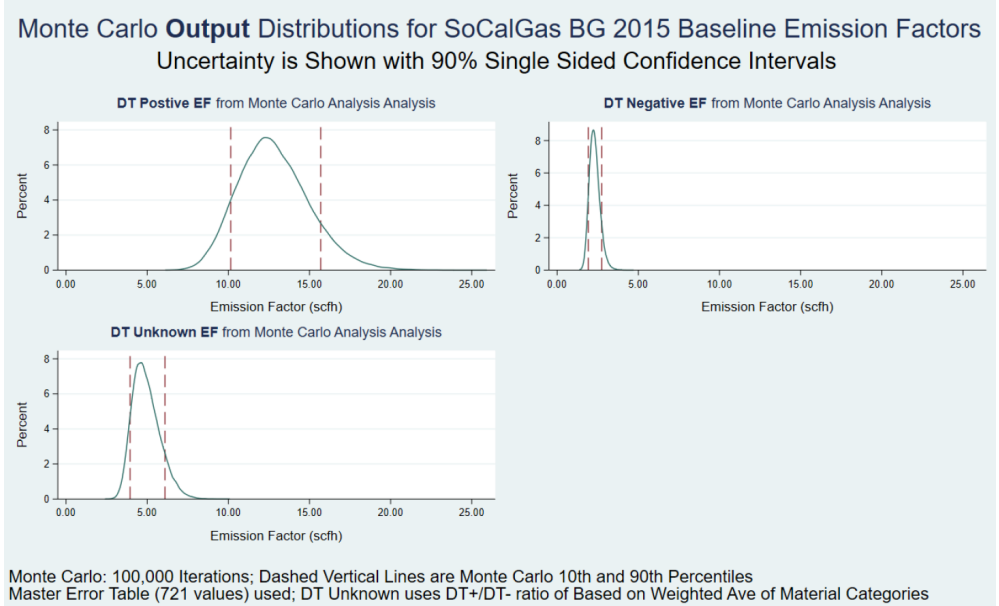
- Can leverage the change in leak frequency and associated average leak rates by pipeline material to calculate a more precise 2015 baseline estimate

Potential 2015 Baseline Emission Factor Derivation

1. Apply average Decision Tree output proportions from implementation to 2015 baseline year by material type
   - e.g., Protected Steel, Unprotected Steel, Modern Plastic, and Vintage Plastic

2. Use these proportions and corresponding EFs to derive Overall System Mean EF for 2015 baseline year



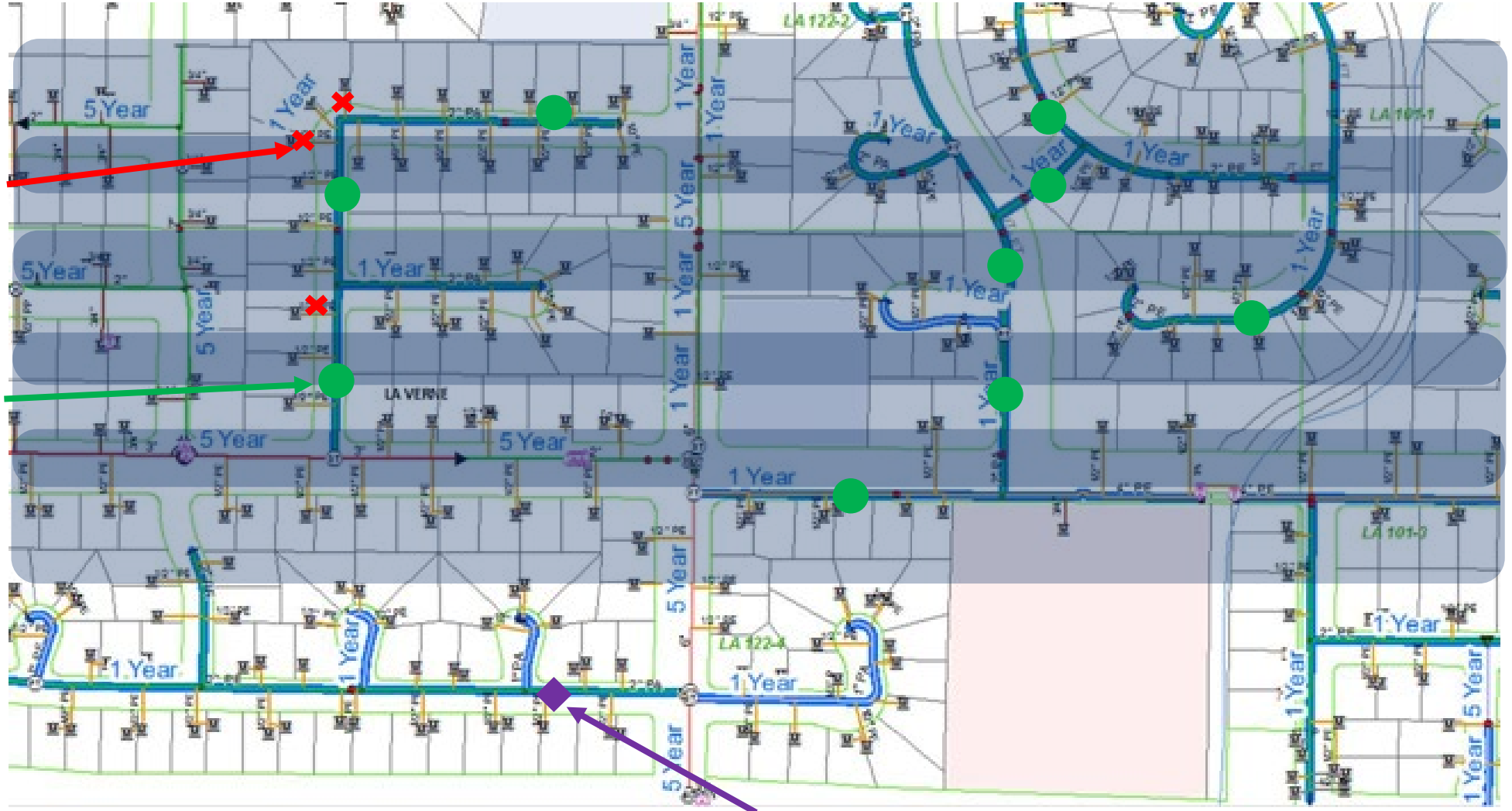


EFFECTS OF AERIAL METHANE MAPPING (AMM)
APPENDIX 4

Adjustment to Appendix 4 and 6 System EFs Based on AMM Surveys

2. System leaks not detected by AMM in Aerial survey area

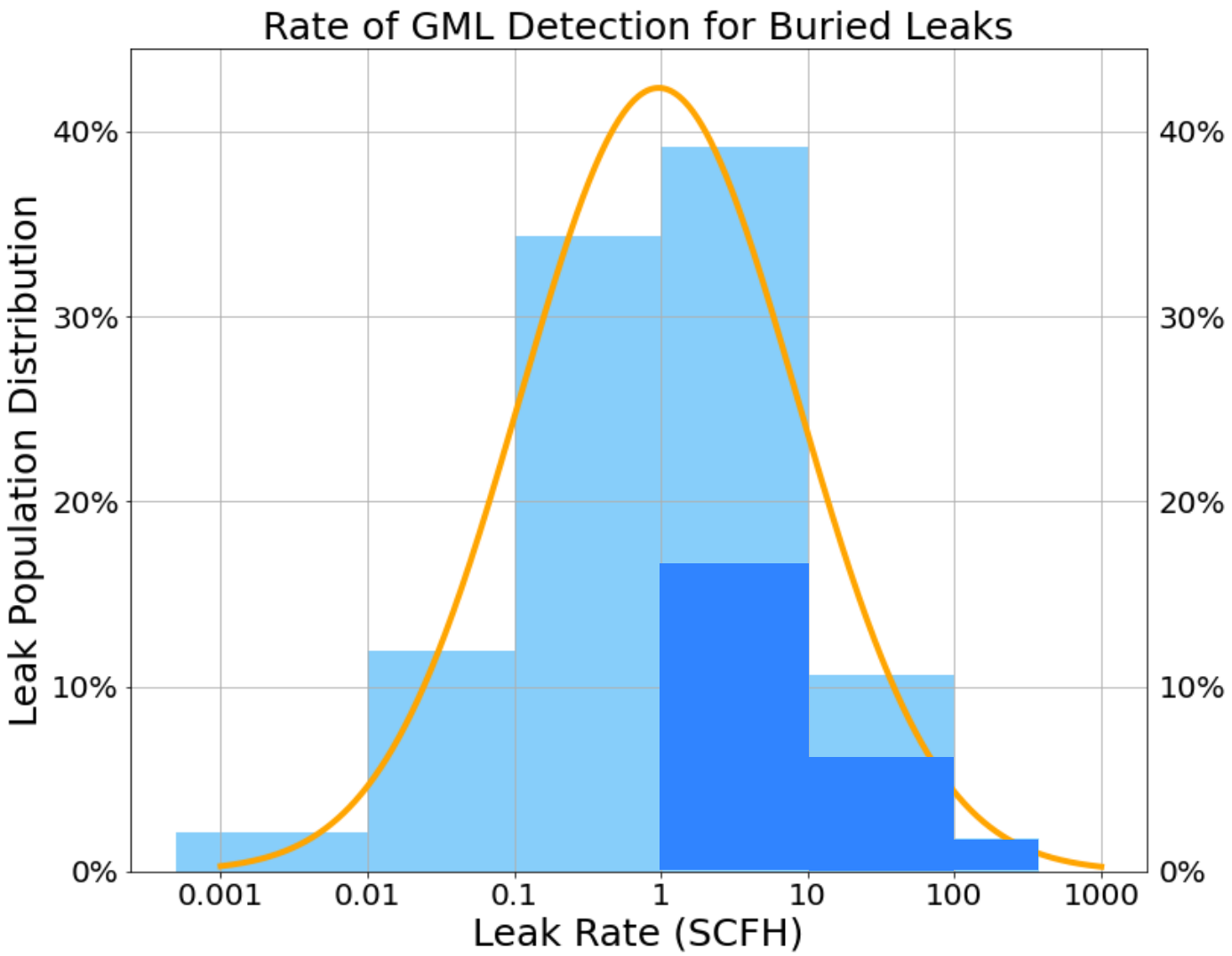
1. System leaks detected by AMM in Aerial survey area



3. System leaks detected outside of Aerial survey

SoCalGas SDGE

Effects of AMM



Effects of AMM

Number of leaks detected by AMM: $$N_D = \sum_{i=1}^{I} N_i P_i$$

Mean leak rate for AMM detected leaks: $$\overline{R_D} = \frac{\sum_{n=1}^{N_T} R_n^i P_i}{\sum_{i=1}^{I} N_i P_i}$$

Number of leaks not detected by AMM: $$N_N = \sum_{i=1}^{I} N_i (1 - P_i)$$

Mean leak rate for AMM non-detected leaks: $$\overline{R_N} = \frac{\sum_{n=1}^{N_T} R_n^i (1 - P_i)}{\sum_{i=1}^{I} N_i (1 - P_i)}$$

where

i: Probability of Detection (PoD) leak rate category for AMM technology

I: Total number of PoD leak rate categories; contiguous across full leak rate range

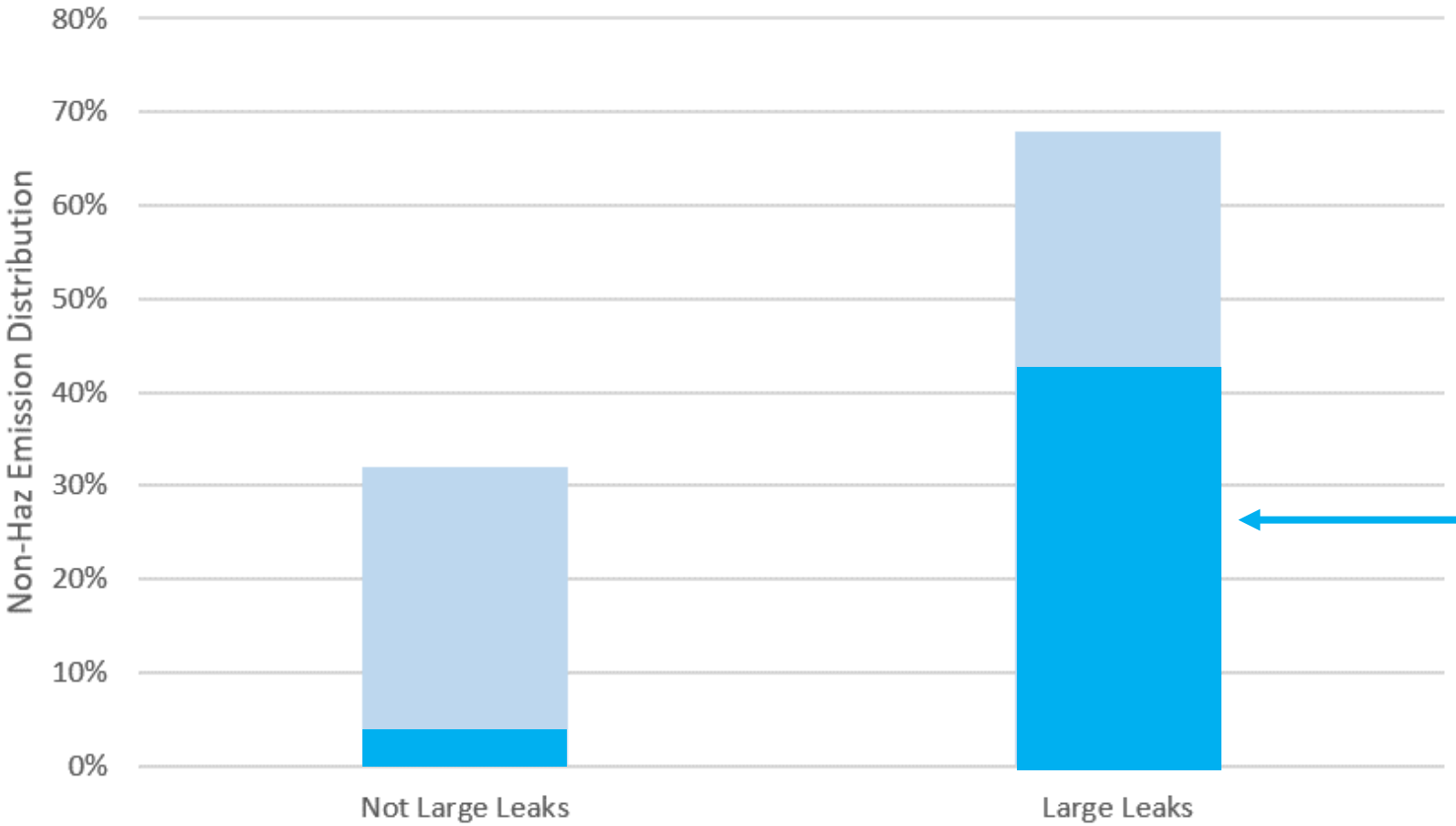
N_i: Number of leaks within leak rate category i

N_T: Total number of detected and non-detected leaks by AMM

P_i: PoD for category i

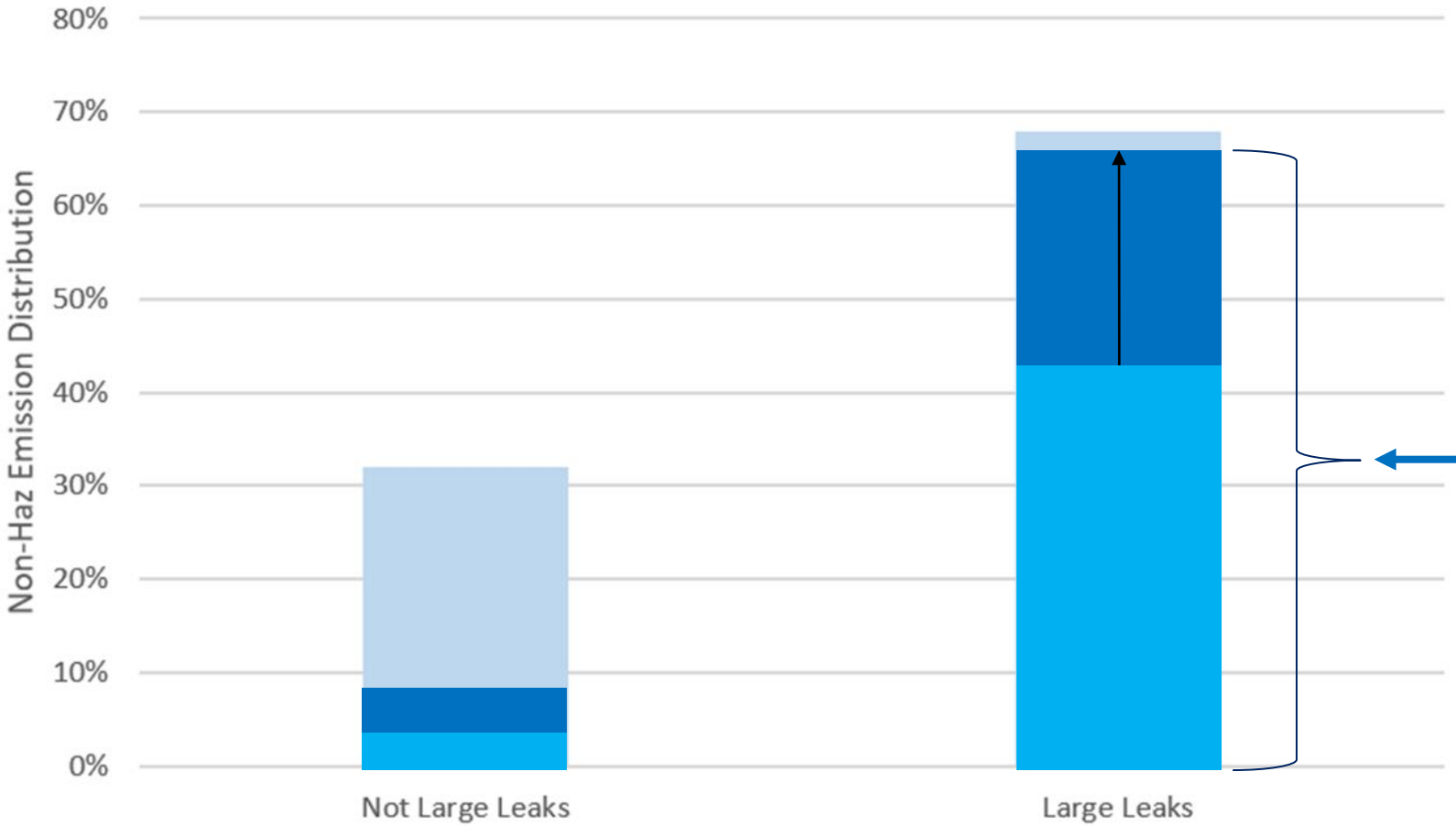
R_n^i: Leak rate (scfh) of a single leak n in AMM PoD category i

Combined Effects of Decision Tree (DT) Method and AMM



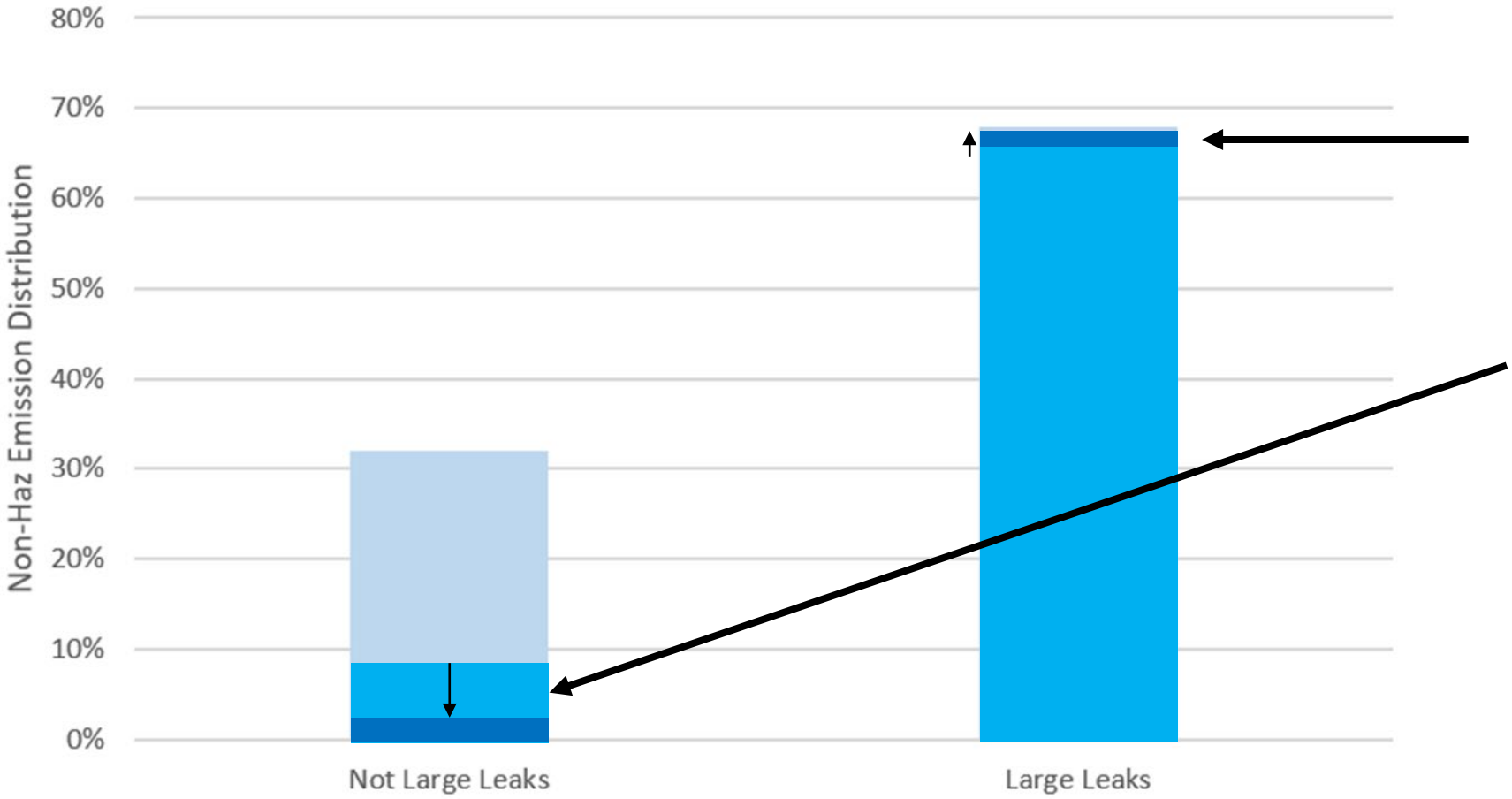
With the implemented DT process as part of the Large Leak Prioritization (LLP) program, we are mitigating ~61% of emissions from large leaks by prioritizing repair for 25% of non-Haz belowground system leaks

Combined Effects of Decision Tree (DT) Method and AMM



Combining the benefits of the GML technology used for the AMM program with the DT method of the LLP program, we detect and prioritize up to ~92.5% of large leaks

Combined Effects of Decision Tree (DT) Method and AMM



Improvements of both the GML technology and combined analytics of the LLP and AMM program data will facilitate increasing the % of emissions mitigated while simultaneously improving program cost-effectiveness and pipeline safety

- Fewer leaks will need to be prioritized for repair (i.e., secondary filter for small leaks)
- Hazardous leaks are detected more quickly and less reliant on detection by odor by customers and public

AMM program also facilitates similar improvements for post-meter Customer emissions

Potential Modifications

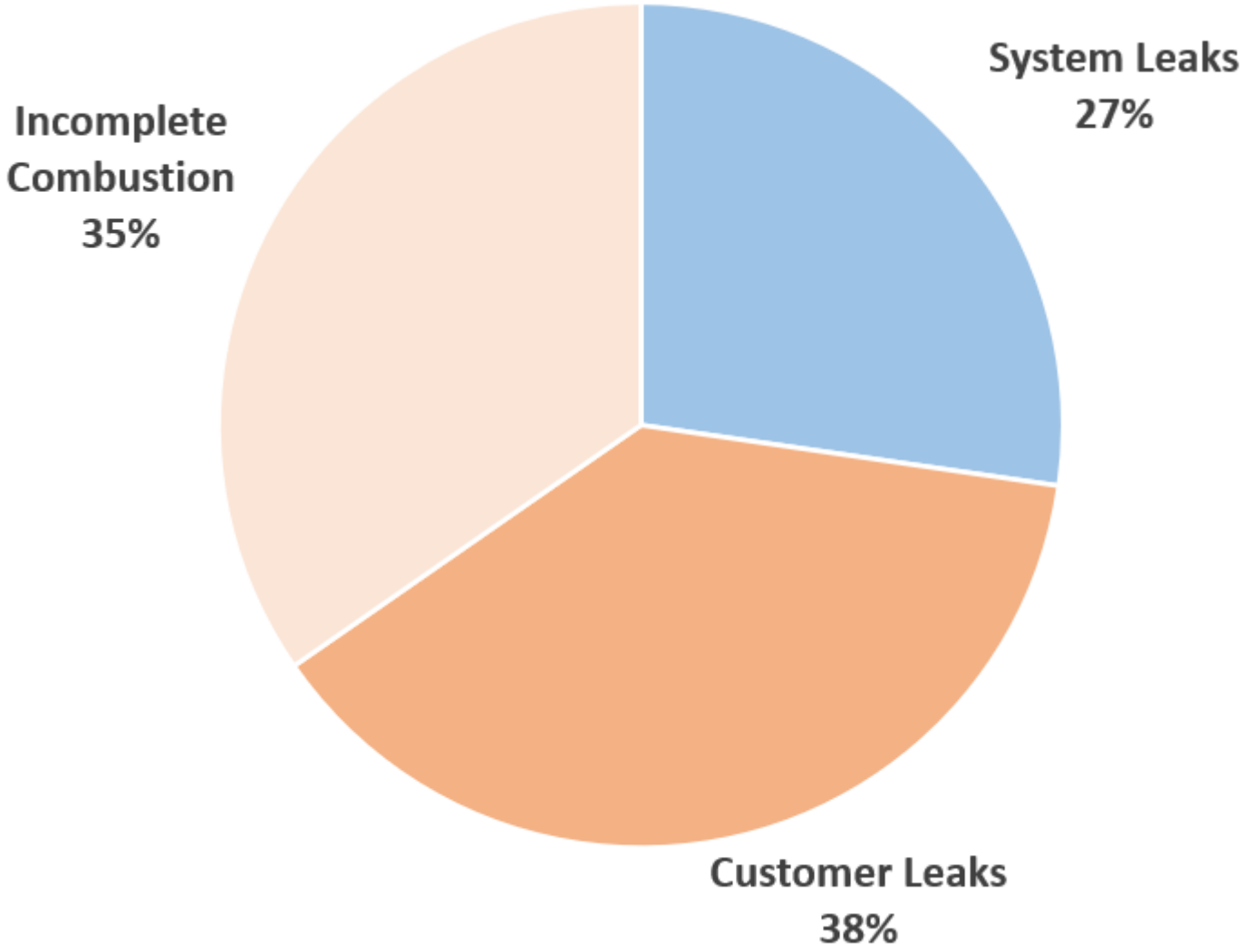
- EFs adjusted based on combination of AMM detection and Decision Tree flag
  - Apply similar Bayesian and probabilistic approach to PG&E's Super Emitter program
  - Validated by full system leak distribution knowledge and PoD leak rate bins using robust controlled release data
  - Unknown leaks in unsurveyed area flown by AMM will skew towards the lower end of the leak rate distribution

Appendix 4 EF			
DT Flag	AMM Detected	AMM Undetected	AMM Unsurveyed
DT+	R_{D+}	R_{N+}	Standard DT+
DT-	R_{D-}	R_{N-}	Standard DT-
DT Unknown	$\overline{R}_D$	$\overline{R}_N$	System Avg.

- Subtract leaks detected in unsurveyed portion of system from leak rate calculation and remove from unknown leak count

CUSTOMER-SIDE EMISSIONS

Leaks Discovered through AMM Detections



Potential Modifications

- Propose new Appendix to annual report for customer-side emission reductions
  - Separate worksheets for customer leaks and incomplete combustion
    - Quantity of emitters identified by emission source category
    - Apply EFs based on emission source category
  - To be discussed
    - Number of emitting days mitigated (i.e., “reduced days leaking”)
    - Program credit for customer-side emission reductions

Questions?

Transmission Metering & Regulating Station Emission Factors

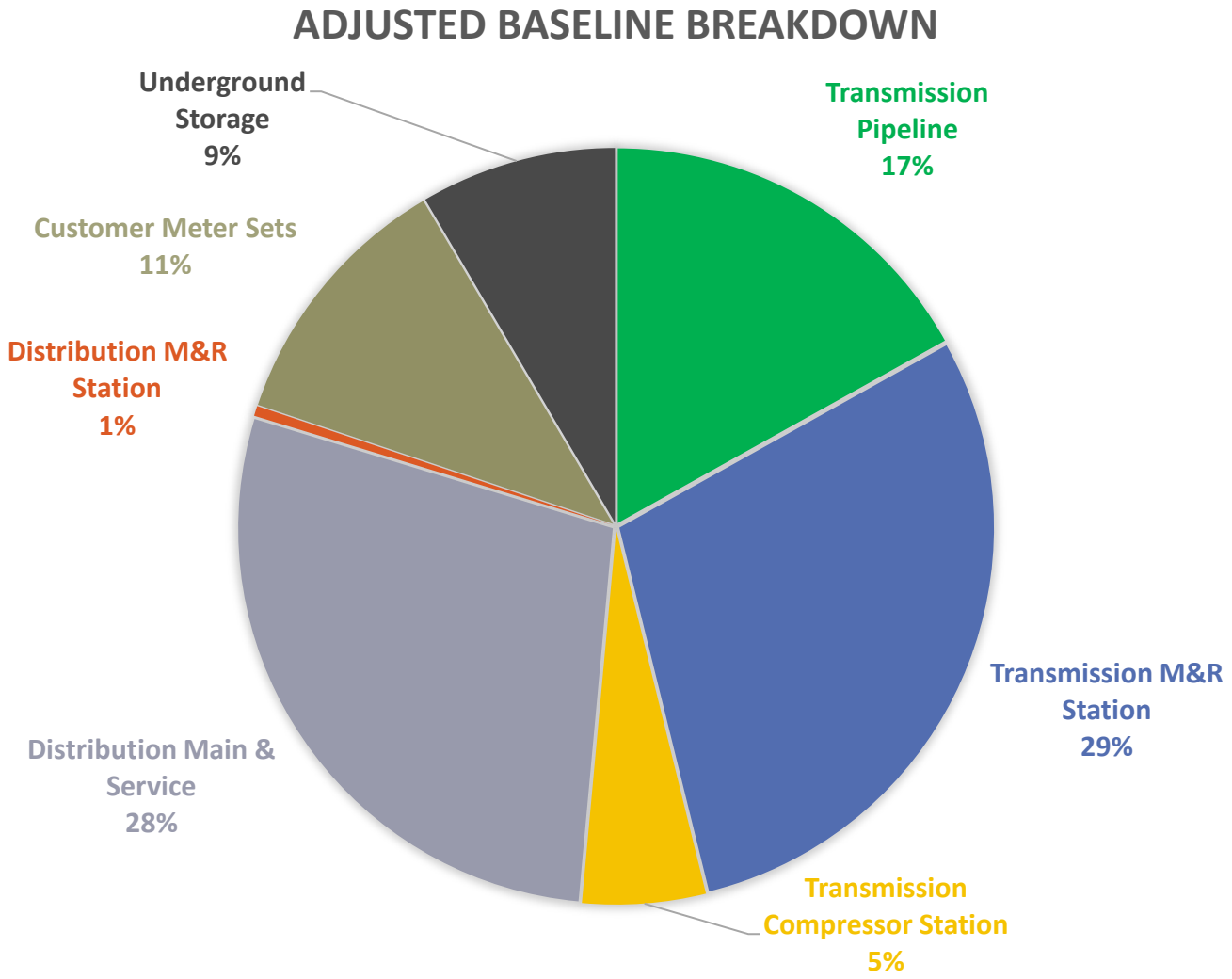
Gas Research & Development

January 2024

Background

Current calculation methodology and reporting framework

- Transmission M&R stations are of the top methane emitters in PG&E's overall baseline emissions
- The current reporting framework and calculation methodology uses an outdated population-based emission factor that overestimates emissions
- This prevents the demonstration of emission reduction through methane abatement efforts and strategies like component replacement programs



Introduction

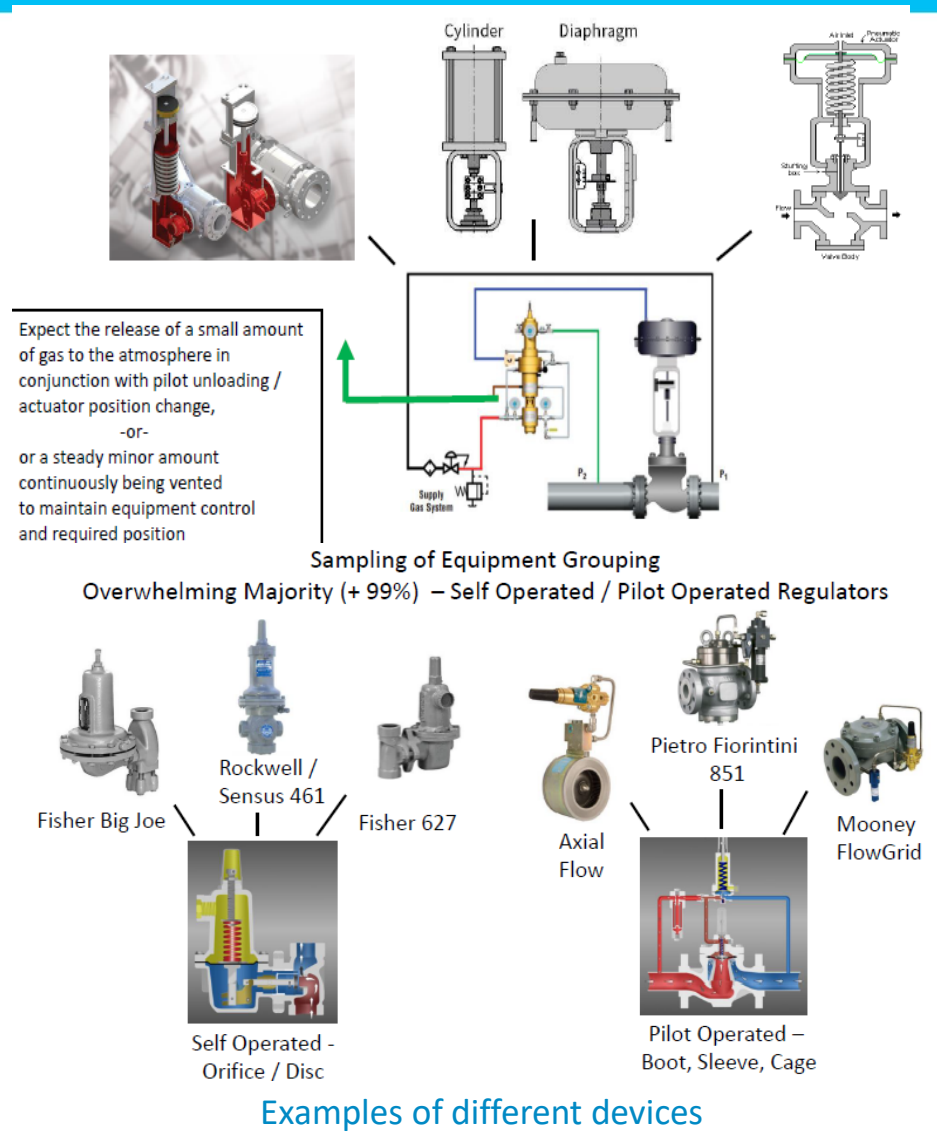
The need for a measurement-based Methodology

- Transmission M&R stations are vastly unique and include a variety of complex components
- The main source of methane emissions are gas powered pneumatics used to adjust and maintain pipeline pressures
- Gas-powered pneumatics often emit natural gas to the atmosphere by design, which is referred to as the “bleed” rate
- To more accurately estimate methane emissions, a new measurement-based methodology must be proposed

NYSEARCH Project T-786

Qualitatively categorizing stations

- The goal of this project was to identify the highest emitting stations and components so strategic mitigation efforts could be taken to maximize abatement
- The project intended to create a framework to quantitatively classify emissions from transmission M&R stations
- NYSEARCH developed a ranking tool to assist with identifying and grouping various types of pressure regulating stations based off bleed rates
- Four classes were created based on various impact factors with class A being the highest emitting stations with continuous bleed devices, class B being moderate bleed stations with intermittent bleed devices, class C being low bleed, and class D being no-bleed devices



Examples of different devices

PG&E Internal Study

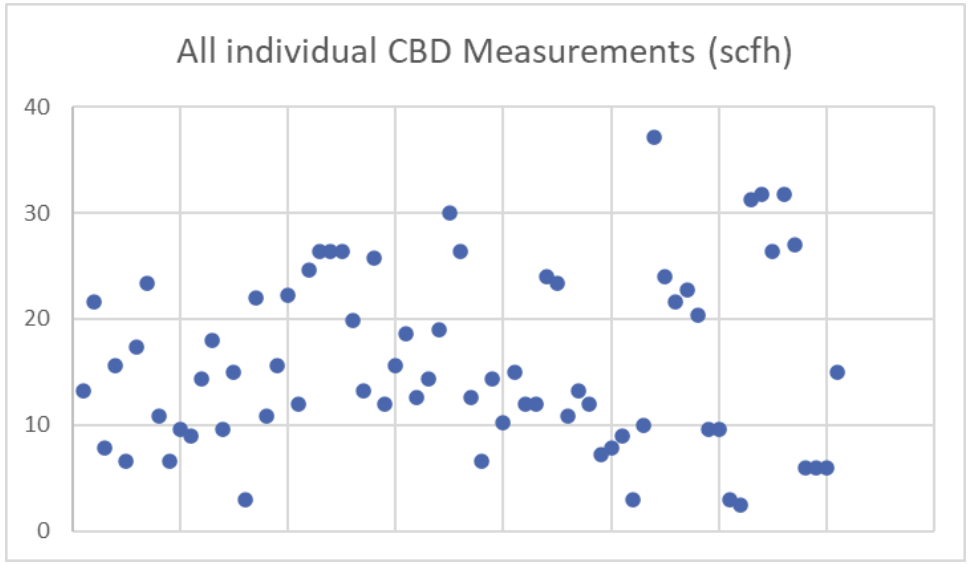
Evaluating emissions at TM&R stations

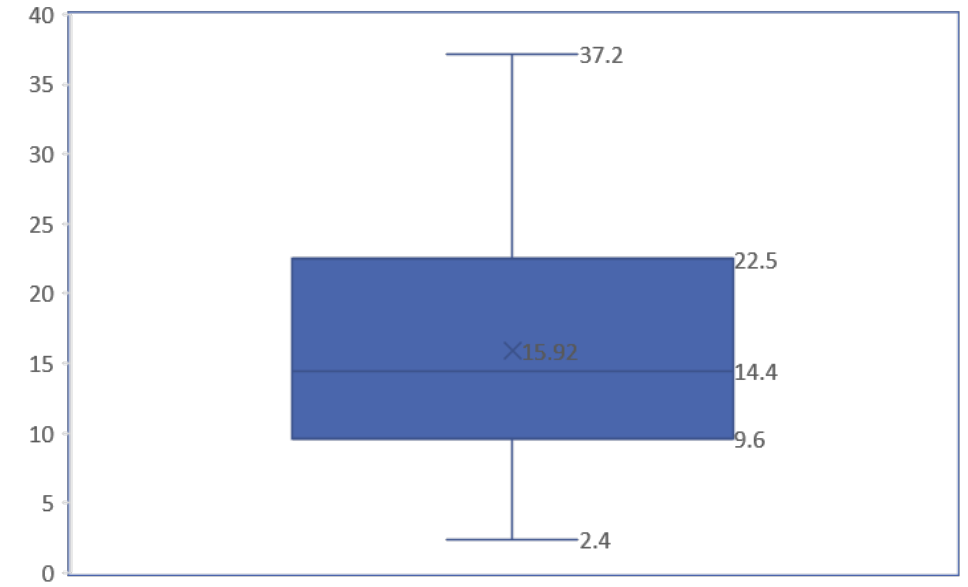
- Following the development of the ranking tool and qualitative classes, PG&E R&D began to validate the framework
- Several stations were selected for site visits with a focus on the large emitting Class A locations for field testing and direct measurements
- Multiple tools were used since each station has unique components and various venting schematics
    - hi-flow sampler - instantaneous flow measurements
    - anti-static bag method - continuous monitoring over short periods of time
    - Sensit fixed point laser (FPL) and QLM camera - continuous monitoring over longer periods of time

Continuous Bleed Station Analysis

Instantaneous Measurements

- PG&E prioritized collecting data from continuous bleed stations in 2023 as they are the highest emitters
- There are currently only 3 stations left with continuous bleed devices (CBD) remaining in PG&E's territory
- R&D measured emissions from 14 devices using the hi-flow sampler
- A total of 71 direct measurements were taken with the high flow sampler. Some devices were measured more frequently than others due to station location and ease of access
- Emission rates per device ranged between to 2.4 to 37.2 scfh with an average emission rate of 15.92 scfh per CBD

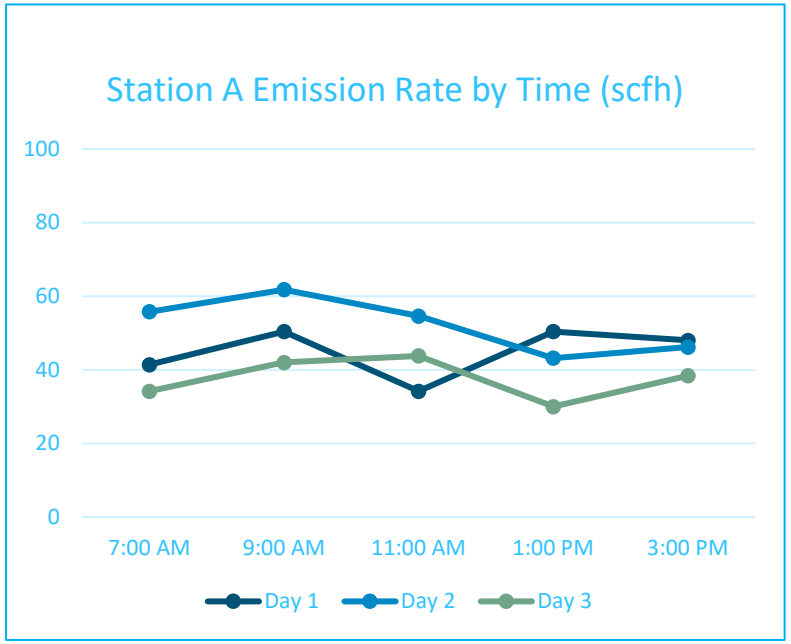


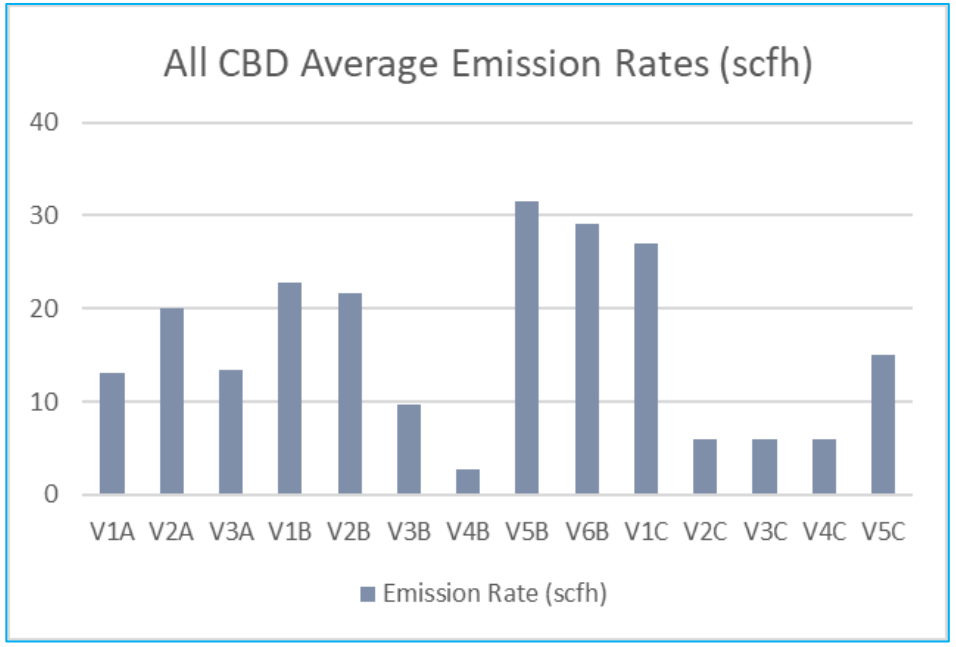


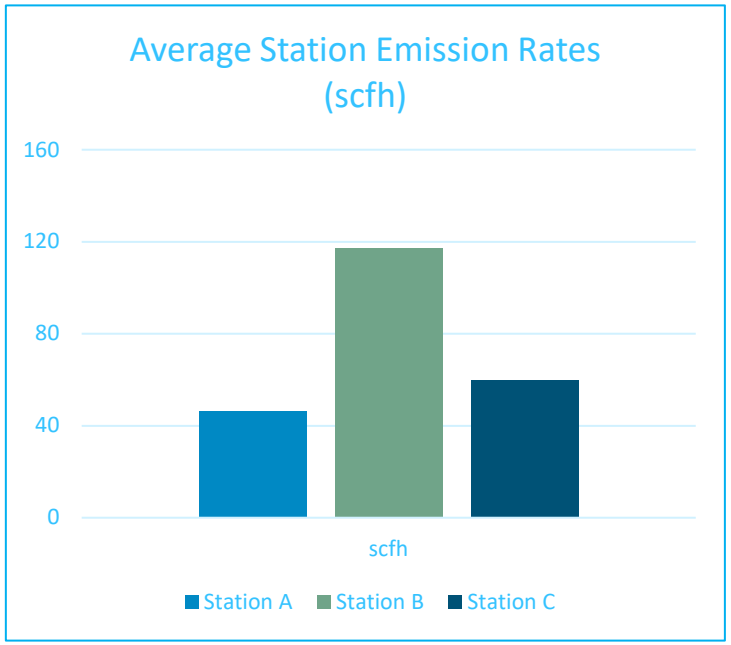
Continuous Bleed Station Analysis

Main Take Aways

- Time of day did not substantially affect the bleed rate
- Varying pipeline pressure did not substantially affect the bleed rate
- Time of year, seasons, and weather did not substantially affect the bleed rate
- Bleed rates generally stay within the same order of magnitude, despite fluctuations in operating conditions



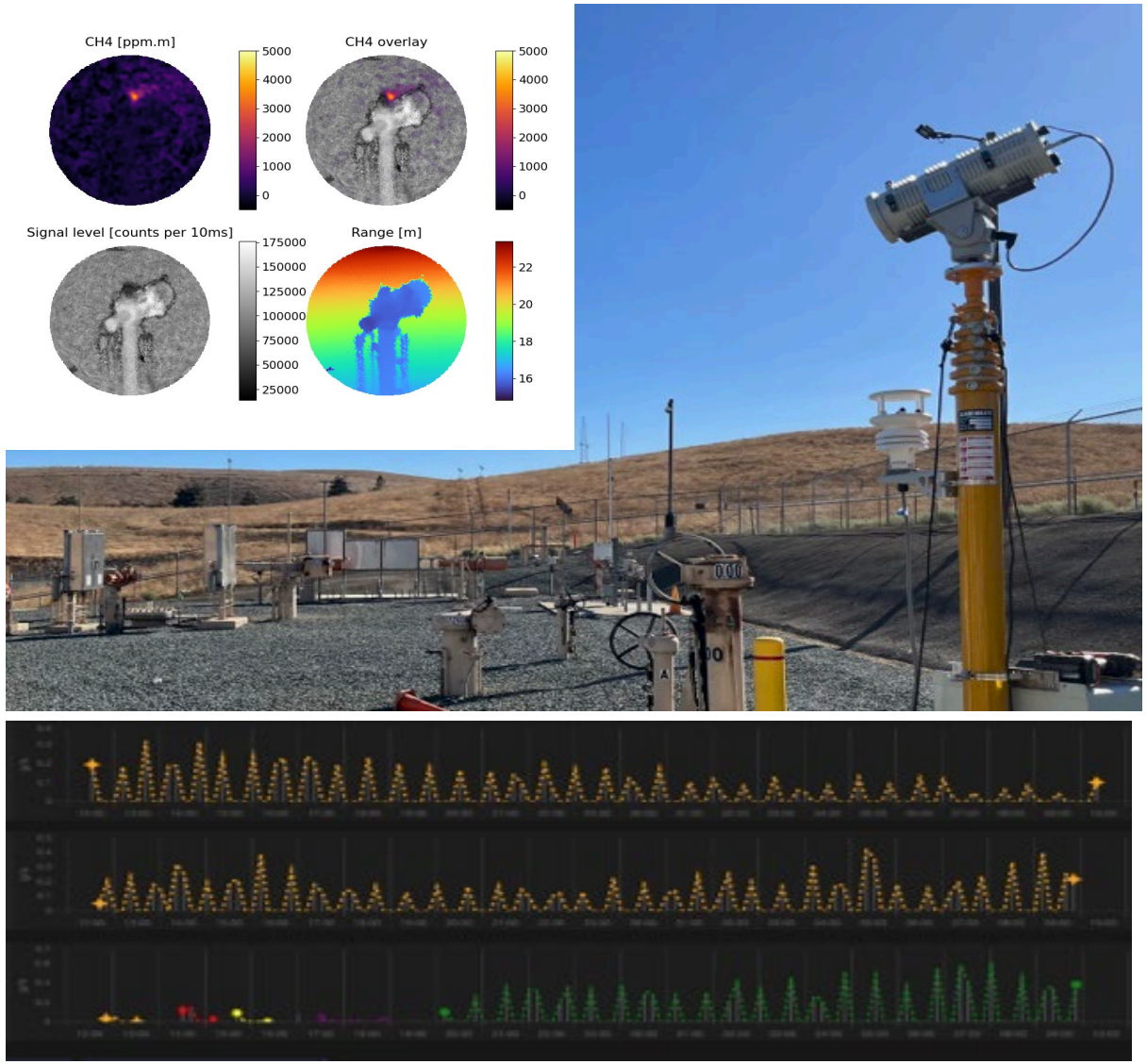




Continuous Bleed Station Analysis

Continuous Measurements

- To validate the hi flow measurements PG&E conducted supplemental continuous monitoring using the QLM camera
- The camera was installed at Station A to monitor emissions for 24 hours to capture data overnight, through varying temperatures and to supplement the hi flow data.
- Results from the QLM camera were on average 1.5-1.75 times higher than that of the hi flow but coincided well overall with the instantaneous measurements



Next Steps

2024 Planned Agenda

- While the CBD station study has concluded and an emission factor has been established for continuous bleed devices, further validation is necessary for other station classifications
- Nysearch project T-786 is continuing
- PG&E plans to continue its independent efforts to validate the framework
- PG&E also plans to expand its internal study to intermittent and no bleed stations, to establish emission factors for both intermittent and no bleed devices
- The QLM trial for continuous monitoring is expected to be expanded to intermittent bleed stations in 2024
- Sensit FPLs and FMDs are expected to be relocated to no/low bleed stations

Expected Future Proposal

Expected future proposal for calculation methodology and reporting framework

- Once data is collected and analyzed for intermittent and no bleed stations, PG&E plans to submit a formal proposal for a new methodology for Appendix 2
- In the planned proposed adjustment, as part of the reporting, it is expected that all stations will be broken up at the component/device level (devices that continuously bleed, devices that bleed moderate amounts of gas intermittently, devices that bleed small amounts of gas intermittently, devices that don't bleed)
- It is expected that based off collected measurement data, each device type receive a specific emission factor depending on the suspected bleed rate
- It is expected that there will be 4 different emission factors; 1 for continuous bleed devices, 1 for intermittent-moderate devices, 1 for intermittent-low devices, and one for no/low bleed devices that can be multiplied by the number of days per year

Thank you

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Proposed Changes to the 2024 Reporting Template and Procedures

2024 Natural Gas Leak Abatement Winter Workshop
February 5, 2024

Overview of Proposed Changes to Reporting Template and Procedures

- Provide a timeline for proposals, review meetings, and final decision procedures for the 2015 baseline adjustments and for emission factor changes
- Provide more guidance on the June 15th data submittal process, such as sending all files to the CPUC E-Filed Supporting Documents, including the resubmittals
- Appendices 3 and 7: Evaluate consistency across utilities
- Appendices 4 and 6: Definitions, Reporting of Survey miles
- Appendix 6: Leaker-based specific requirements
- Appendix 8: Reminders

2015 Baseline Adjustments

Provide a timeline for proposals, review meetings, and final decision procedures for the 2015 baseline adjustments and for emission factor changes

- Solicit Baseline Proposals: February 5 through April 30, 2024
- Baseline adjustments or methodology change request must also be included in supplemental questionnaire to be submitted on June 15, 2024
- Agency Review Meetings: April 30 through July 31, 2024
- Final Decision by August 31, 2024

CPUC and CARB will provide more guidance on procedural requirements as needed

June 15th Data Submittal Process

- All June 15 data must be submitted to the CPUC E-Filed Supporting Documents per the March 31 filing instructions.
- Additionally, please submit the June 15 data to the review staff: Gary Ermann, Andrew Mrowka, and Christian Fehrenbacher. Please refrain from sending June 15 data to the list serve.
- Utilities must review previous annual reporting, make necessary corrections, and file revisions to the CPUC E-Filed Supporting Documents per the March 31 filing instructions. Please send any resubmittal data, such as August submittals, to the CPUC E-Filed Supporting Documents.
- CPUC and CARB staff have an internal deadline to have a finalized set of reported data by August 31, 2024.

Additional Filing Instructions

- All utilities reporting emissions with a leaker-based methodology must review all previous year's submissions.
  - Correct for any leaks reported in all previous years that are not accounted for as repaired or continuing in the current reporting year.
  - If previously reported leaks had been removed from the reporting year data set for any reason other than leak repair as recorded in subsequent filing, the affected years' data sets must be revised .
    - Erroneous data/leaks must be removed.
    - Removed data/leaks must be accounted for in a separate tab of the data file.
  - This includes years such as 2015 that were used to calculate a baseline adjustment.

Appendices 3 and 7
Consistency with Reporting Compressor Leaks

- Evaluate consistency in reporting across utilities.
- Compressor leaks found with concentrations below 10,000 ppm should have associated emissions.
- Existing emissions factors should be used to estimate emissions from leaks below 10,000 ppm.

Appendices 4 and 6
Distribution Mains and Services and Meter Set Assemblies

- The number of miles surveyed should be the number of unique miles surveyed, and should not include any repeated mileage surveyed multiple times per year.
  - Mileage surveyed multiple times per year should be recorded in the appendix.
- Clarify definition of O&M and Survey Leaks:
  - O&M Leaks:
    - Occur stochastically across the whole territory
    - Leaks reported by customers
    - Found quickly after occurring
    - Found independently of surveying activities but would have been found later by surveyors
    - Considered a small number of leaks
  - Survey Leaks are leaks found from company employees (or contractors) actively searching for leaks, including (but not limited to): compliance survey leaks and non-compliance survey leaks (e.g. Super Emitter programs, Aerial Methane Mapping, Corrosion Surveying).

Appendix 6
Meter Set Assemblies: Leaker-Based Reporting Methods

For leaker-based reporting methods, provide:

- Number of MSAs which were within the surveyed areas but were not able to be surveyed (Cannot-Get-Ins)
- Number of MSAs which were inaccessible to surveyors
- The portion of survey mileage that is surveyed multiple times per year.
- Leaking MSA identification number
- Bubble-size classification for all collected leaks

Reminder

- Reminder to use the latest version of the Summary Appendix 8.
- Staff will add additional language to the email that is sent on March 31, 2024.
- Staff will include a note in Appendix 8.

Key Dates for the 2024 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
- August 31: CPUC and CARB Staff have an internal deadline to finalize data.
- November 15: CPUC will send Draft Joint Report to gas companies for review
- December 31: CPUC will publish Final Joint Report

Questions?

Draft Acceptance Criteria for 2024 Annual Emission Data Reporting

2024 Natural Gas Leak Abatement Winter Workshop
February 5, 2024

Opportunities to Improve Data Quality

- CARB, CPUC, and IOUs have worked together for 9 years within the NGLA program
- Significant progress has been made in data collection, reporting, coordination, and process
- Program growth necessitates implementing measures to improve efficiency and transparency
- Future improvements to data quality require CARB/CPUC set acceptance criteria for annual reporting
- CPUC and CARB will continue to review of reported data, baseline adjustment proposals, methodology change requests, and changes in emission factors (Submissions)

Overarching Acceptance Criteria (1)

- *Acceptance criteria will be a living document and may evolve as new information is received*
- All leak data must be submitted as E-filed Supporting Documents per the March 31 filing instructions, including the following:
  - Revised or corrected previous annual reporting.
  - Any data responses related to the annual reporting, baseline adjustment proposals, or methodology change requests
  - Utilities must review previous annual reporting, and revise necessary corrections, and also file these revisions to the docket
- Submissions to CPUC and CARB must consist of data supported by clear and comprehensive documentation and should be as accurate as possible
  - Example: Changes in device counts which result in significant emission reductions, including those already reported, will require documentation
- Reminder: data request responses adhere to CPUC Rules of Practice and Procedure.

Overarching Acceptance Criteria (2)

- Submissions may be subject to verification including but not limited to documentation of leaks and field inspections.
- Approval of reported data or other submission may be rescinded if data are deemed inaccurate, or methodologies for estimating emissions are not followed accordingly.
- Emission estimation methods (e.g., leaker-based methodologies) should be as consistent as possible across utilities.
- Significant changes in reporting may trigger a review of the approved baseline adjustments or methodology. *"Significant" to be defined.*
- Note: Acceptance criteria are specific to reported data but may apply to baseline and emission factor proposals. The following slide presents examples of draft acceptance criteria specific to leaker-based methodologies.

Criteria Associated with Leaker-Based Methodology

- Data submitted under current and new emission estimation methodologies are subject to further documentation request or verification.
- Revisions to annual reporting data which result in significant emission reductions are subject to further review through documentation and/or underlying data sets.
- All leaks reported to CPUC and CARB should include an associated emission estimate when a leaker-based methodology is used; no leaks shall be reported for informational purposes only.
- Integrity of historical datasets must be maintained.
- Any changes in a company's leak detection procedures may result in rescinding approval of reporting data or other submission
  - Examples (including but limited to): changing threshold of leak detection methods; cessation of any leak discovery programs or decrease in frequency of non-compliance programs activities; changes to internal company procedures of detecting leaks

Discussion?

Blowdown Planning Tool Demo

Blowdown Planning Tool

» Purpose

- In compliance with SB 1371 requirements, SoCalGas is compelled to maintain records of methane emissions, leakage activity, and blowdown measurement calculations and assumptions used to determine the amount of gas released to atmosphere

- Implementation of digital input forms record blowdown activity and improve data accuracy

- Digital forms restructure and simplify the existing business process workflow to meet procedural standards in pipeline equipment maintenance, storage operations, and transmission operations

Blowdown Planning Tool

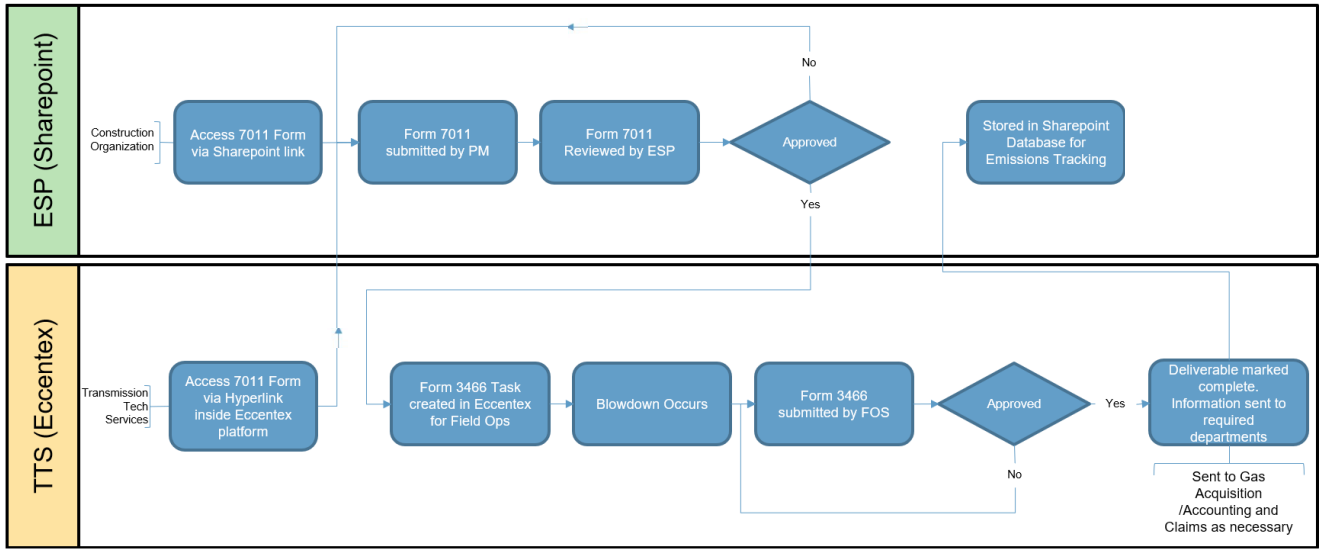
BPs Addressed: 3-7, 9, 23

Project Description

- Automated system for submitting, reviewing, and approving blowdown reduction plans, and gas vented to atmosphere reports. Objective is to create a seamless process that will improve accuracy, accountability, and reduce labor hours

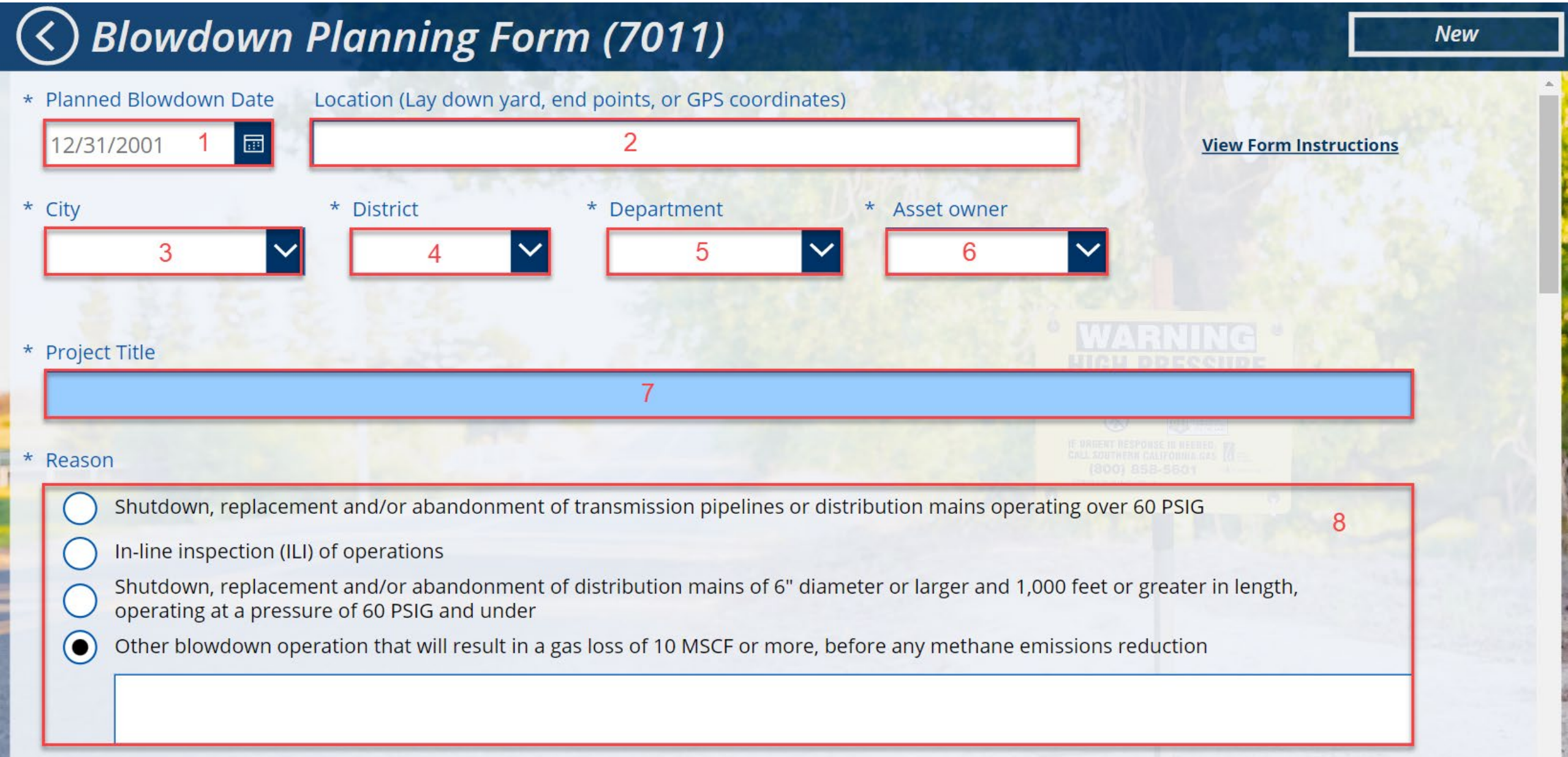
Benefits

- More efficient for reviewing, approving and tracking forms and reports
- Helps to reduce potential errors
- Better tracking of blowdown with tasks and deliverables
- Streamlined process for Annual Emissions Report development
- Real time reporting on methane emissions goals

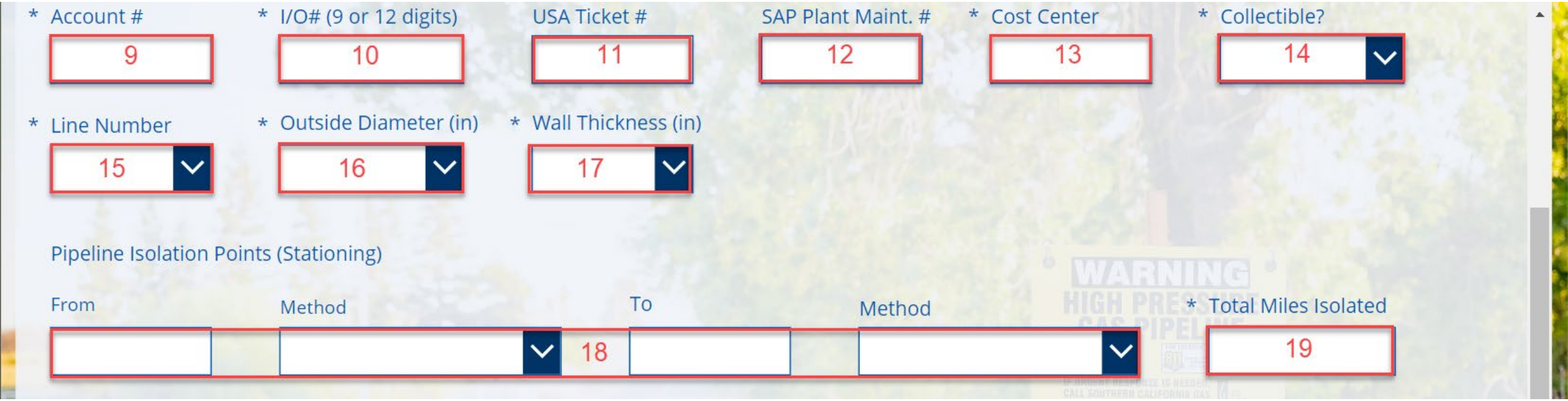


Blowdown Planning Tool Guide

Blowdown Planning Tool Guide



Blowdown Planning Tool Guide



Blowdown Planning Tool Guide

How will the pipeline pressure be reduced prior to blowdown?

20

- [ ] Cross Compression
- [ ] CNG Capture (tanking)
- [ ] Draw Down Pressure
- [ ] Diverting to Other Local Lines
- [ ] Volume Reduction Via Stopple Fittings
- [ ] Thermal Oxidizers
- [ ] Other

Provide verification: Check all Supporting Documentation

21

- [ ] Reserve or ZEVAC Quotes for Cross Compression
- [ ] Communication Records of Gas Control Confirming availability of time for extended outage
- [ ] RER Identifying Taps for Drawdown
- [ ] Requests for CNG capture service
- [ ] Other

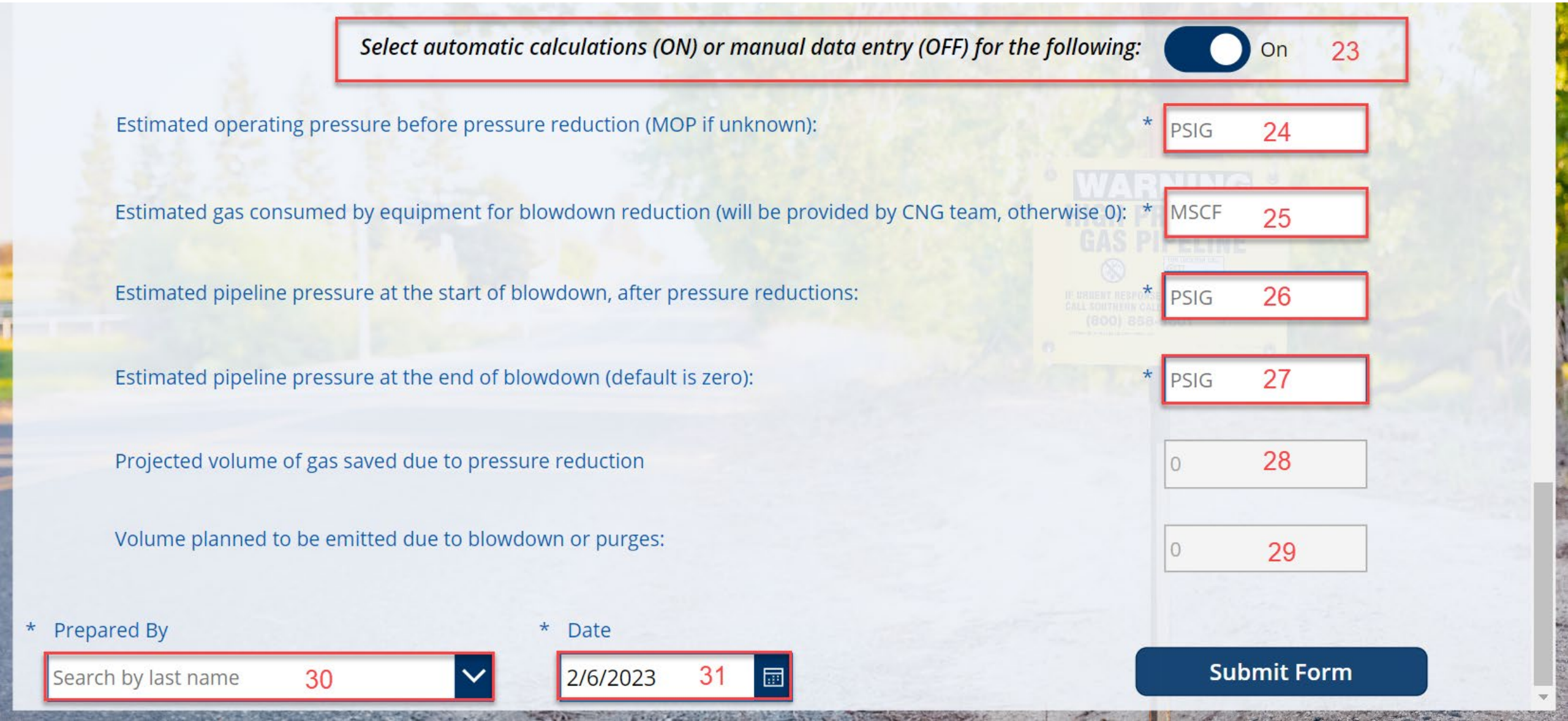
Attachments

None.

22

Attach file

Blowdown Planning Tool Guide



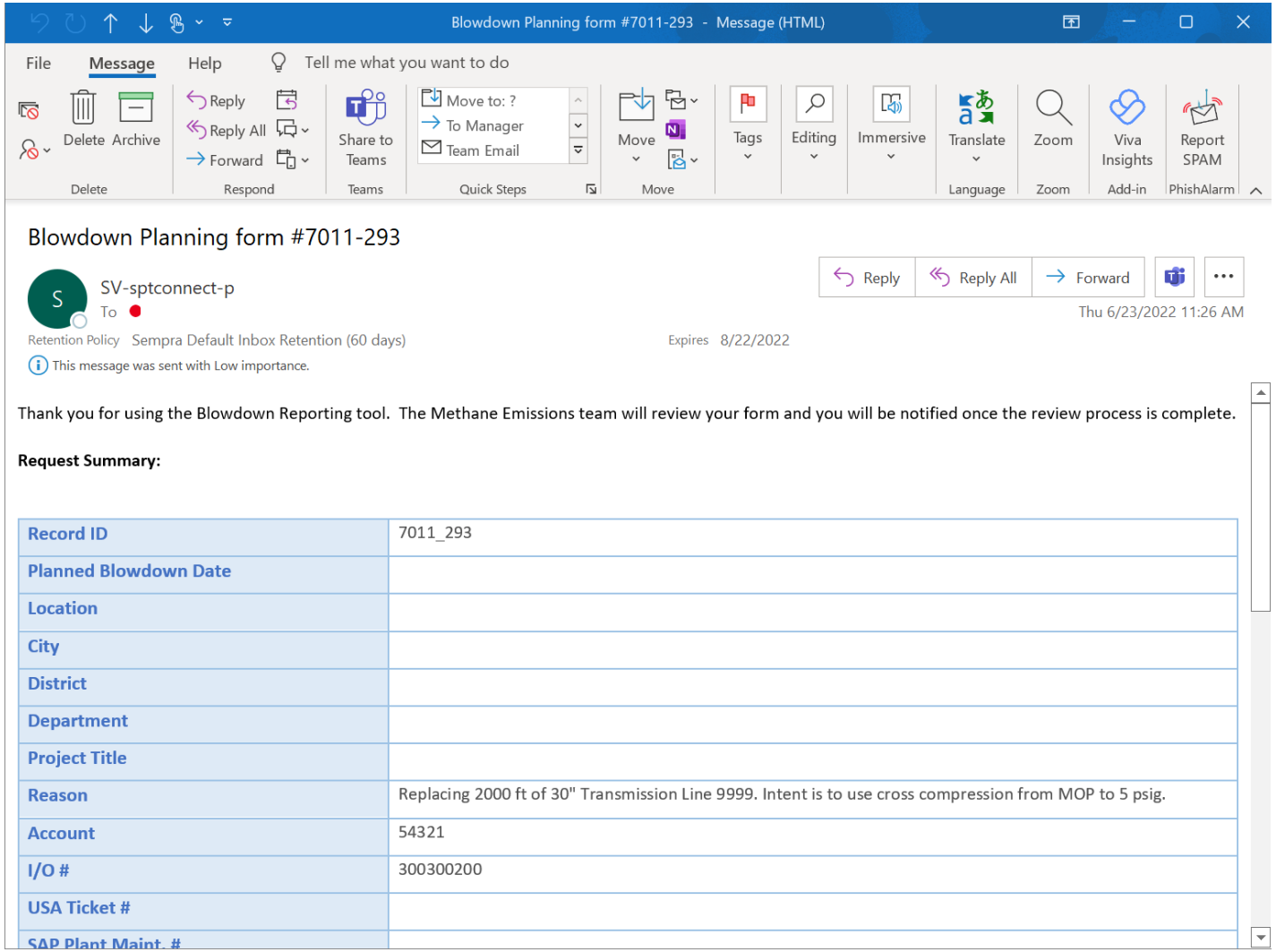
SoCalGas Blowdown Planning and Reporting Tool

Plan for a Blowdown Event (Form 7011)

Report a Blowdown Event — Planned (Form 3466)

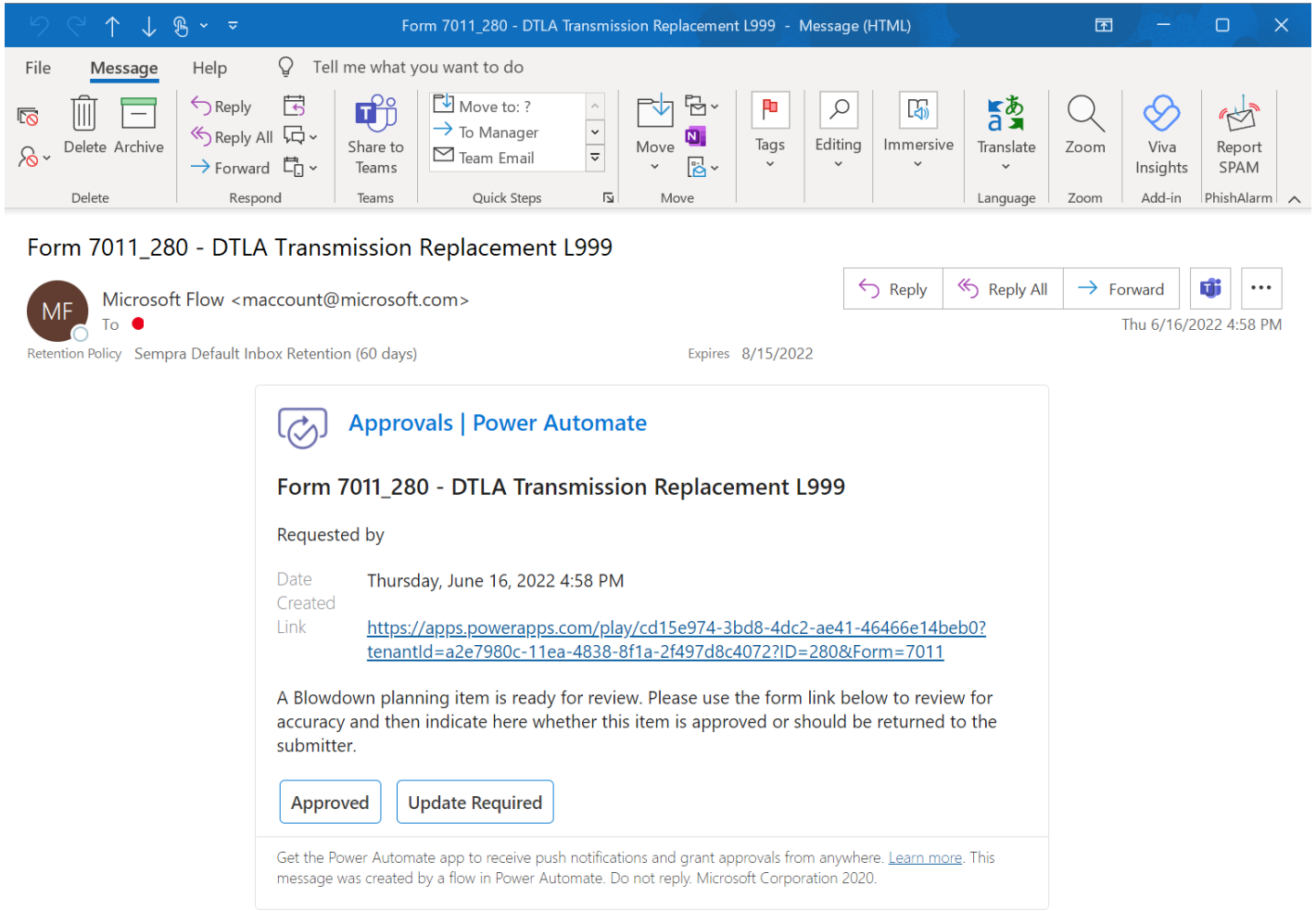
Blowdown Planning Tool

- Submittal Notification via Email



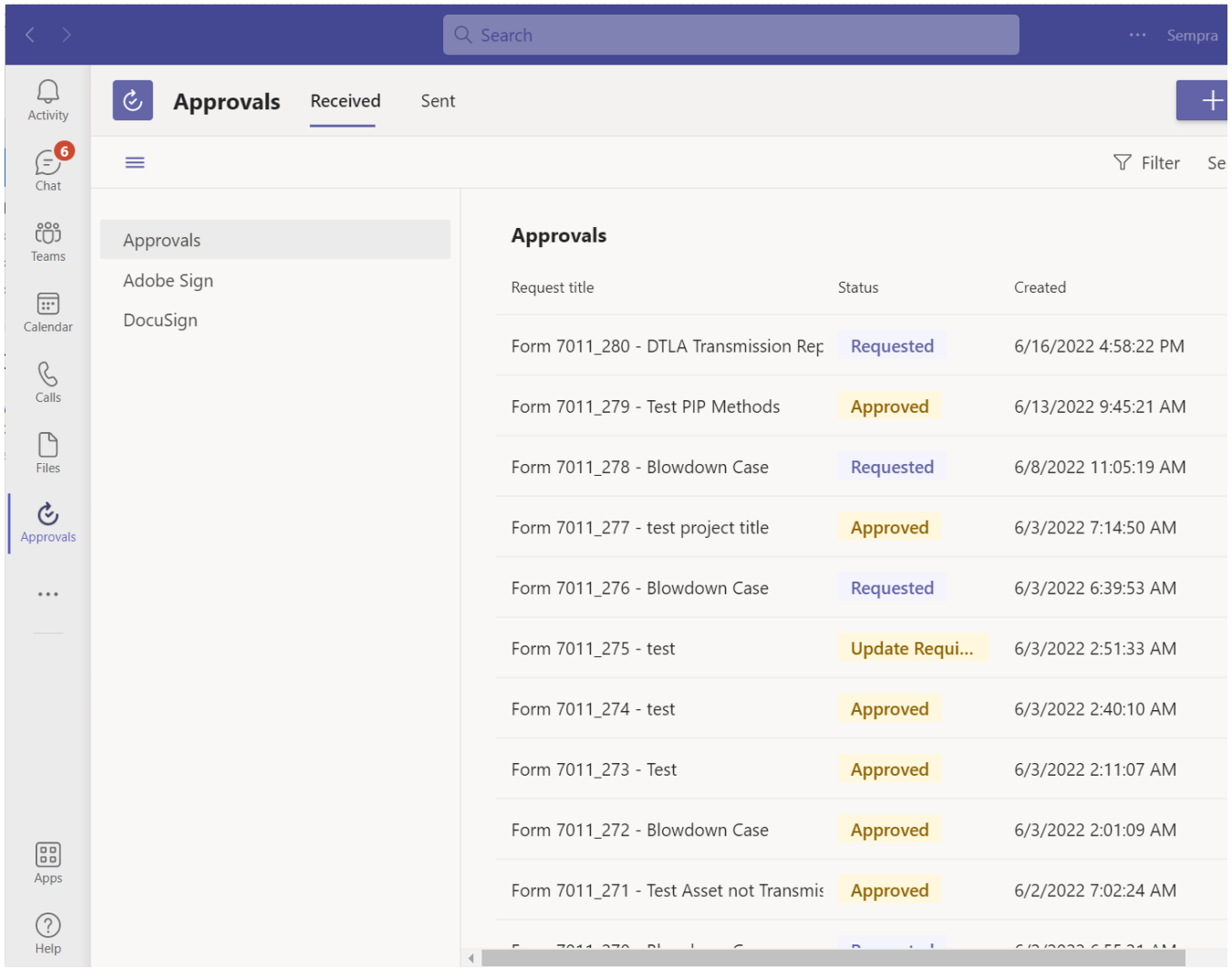
Blowdown Planning Tool

» Request for Review via Email



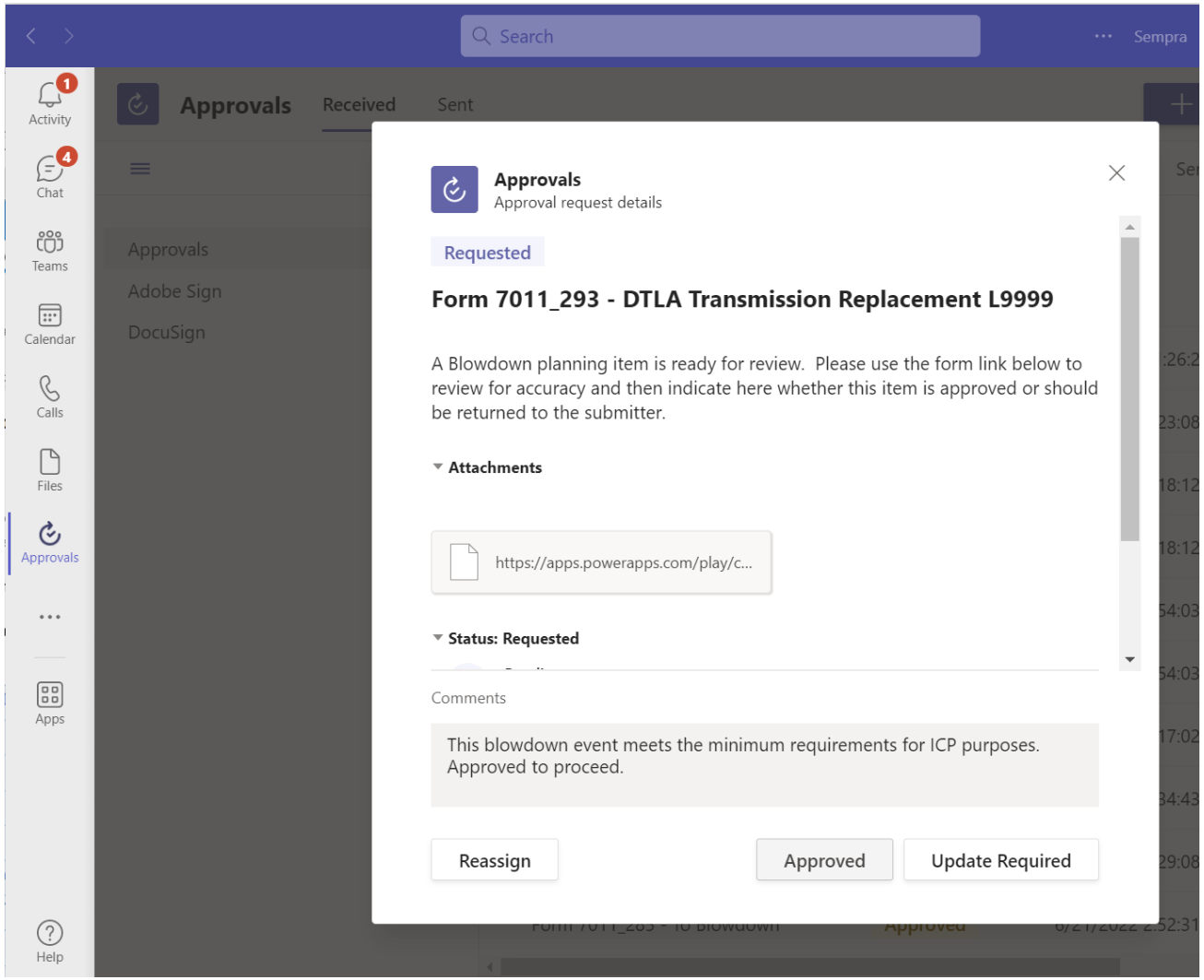
Blowdown Planning Tool

» Request for Review via Teams



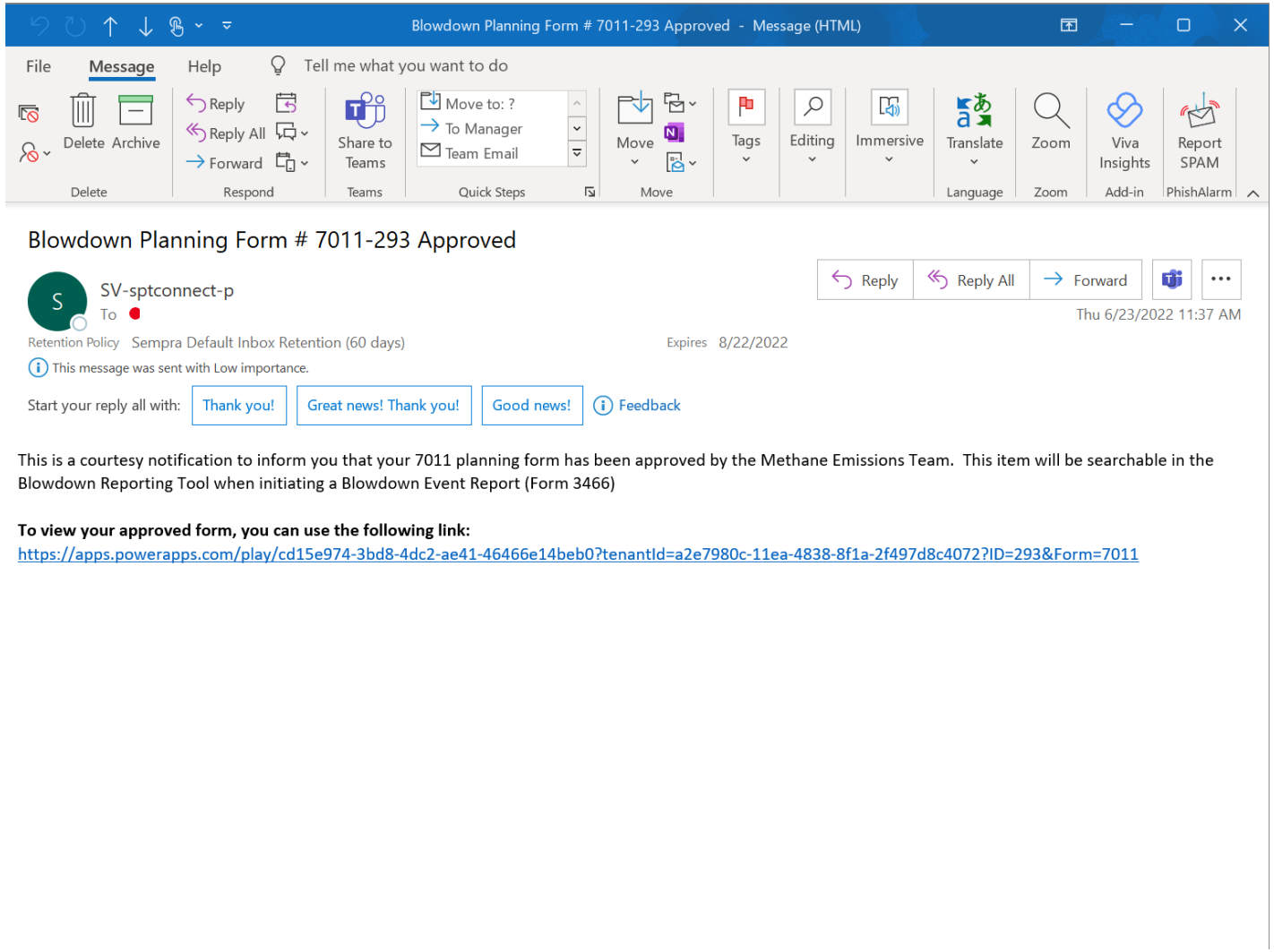
Blowdown Planning & Reporting Tool

» Approval Process via Teams



Blowdown Planning & Reporting Tool

- Approval Notification to Submitter via Email



Blowdown Planning & Reporting Tool

- Approved Form 7011 is pushed to Company work management system
- District Operation Manager and Field Operation Supervisor (FOS) of District are notified
- Task for Form 3466 to be submitted is created for FOS
- Once Blowdown occurs, FOS submits Form 3466 through Company work management system

Blowdown Planning & Reporting Tool

- Final Form 3466 is pushed to SharePoint for tracking and emissions reporting
- Dashboard to present data in real time is in development
- Plan is to connect data to SB 1371 Data Lake and automate annual emissions reporting

Questions?

EMISSION STRATEGY PROGRAM SHOWCASE

Winter Workshop – February 2024

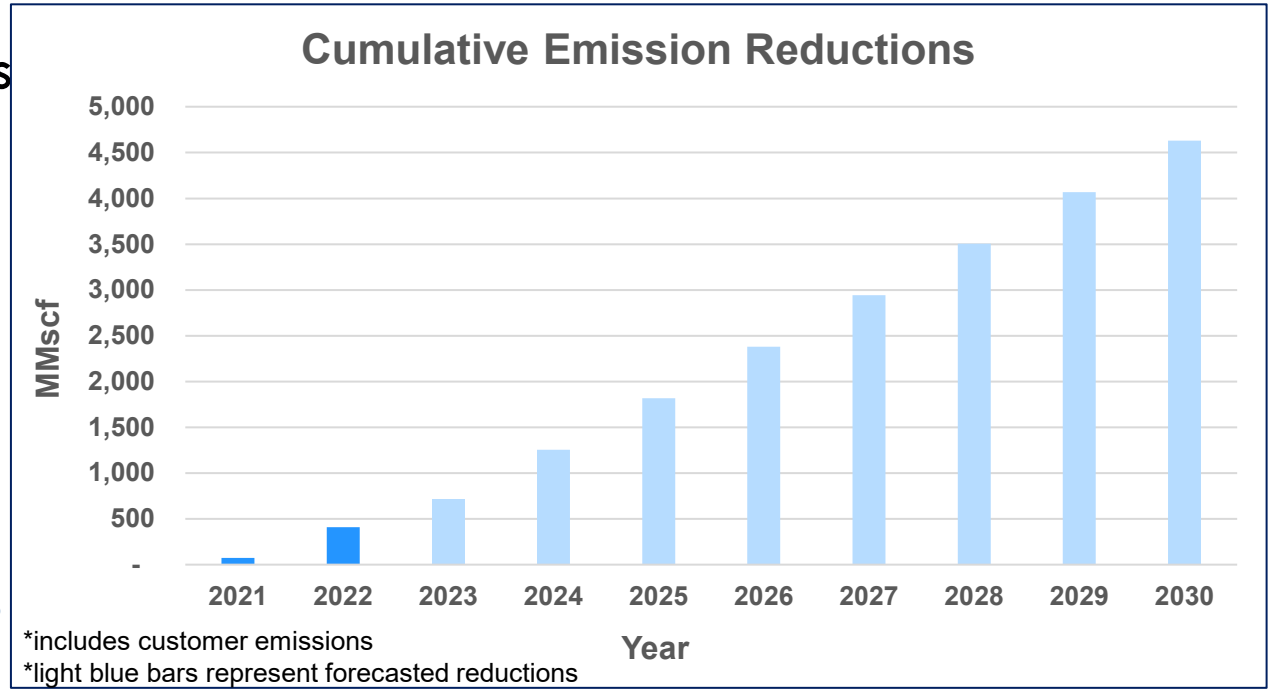
SDGE™ SoCalGas™

Summary

- Project Showcases
  - SoCalGas and SDG&E Aerial Methane Mapping
  - SoCalGas Advanced Meter Analytics Algorithm
  - SoCalGas Leak Inventory Reduction
  - SoCalGas Large Leak Prioritization
  - SoCalGas and SDG&E Blowdown Reduction Activities
  - SDG&E Electronic Leak Survey
- Cost Effectiveness in the 2024 Compliance Plans

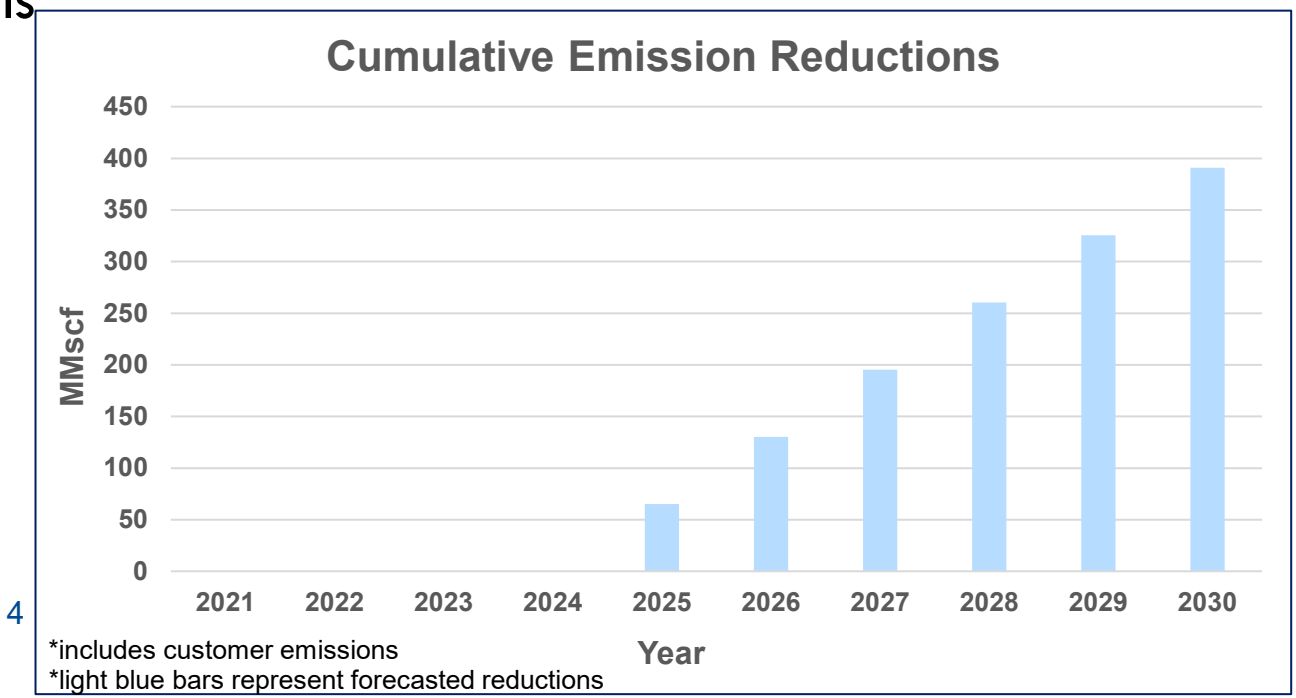
SoCalGas – Aerial Methane Mapping (AMM)

- 410 MMscf of reductions during 2021 and 2022
- Forecasting 4.6 Bscf of cumulative reductions from 2021 through 2030
- Program is positioned to benefit from past 3 years of investments to lower cost effectiveness
- Project compliments other existing programs
  - Eliminates hazardous conditions in customer parcels
  - Provides potential Energy Efficiency projects



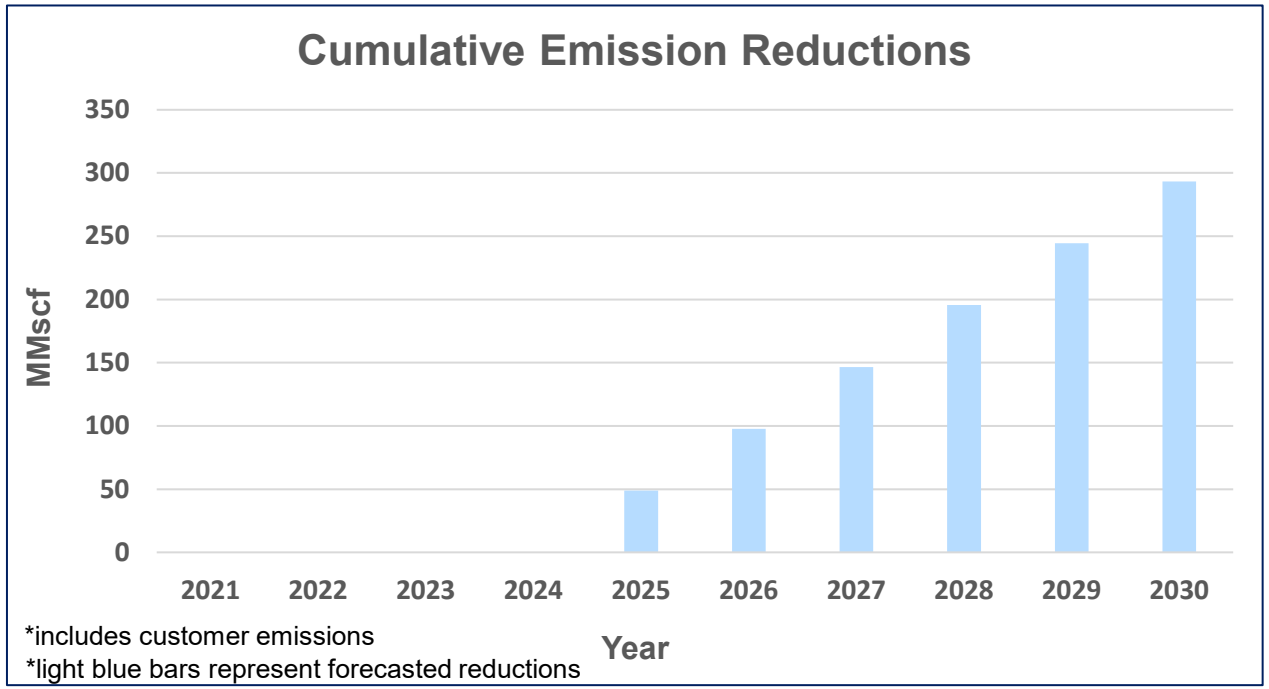
SDG&E – Aerial Methane Mapping (AMM)

- Project in RD&D phase until 2024 end
- Forecasting 391 MMscf of cumulative reductions from 2025 through 2030
- Significant learnings from SoCalGas program will help keep costs low
- Project compliments other existing programs
  - Eliminates hazardous conditions in customer parcels
  - Provides potential Energy Efficiency projects



SoCalGas – Advanced Meter Analytics Algorithm (AMA)

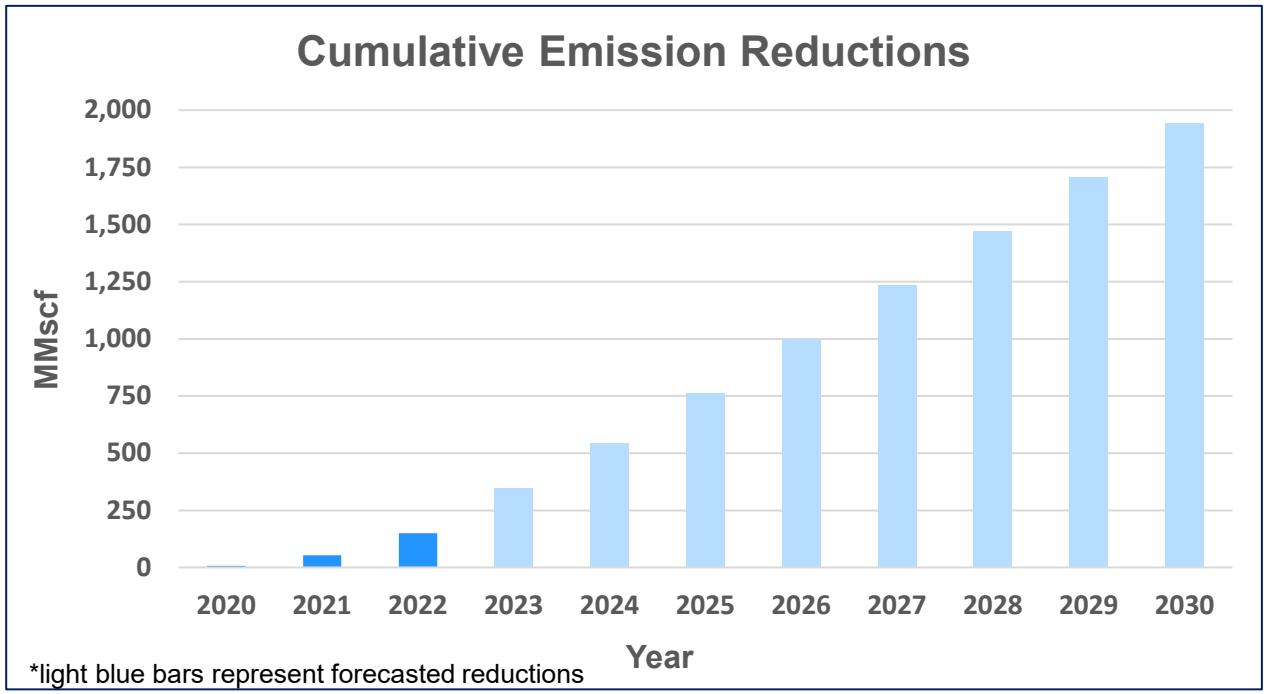
- Continue to develop new recognition algorithms to detect customer leaks that existing algorithms cannot detect
- AMM and AMA will be complimentary
- AMM is finding leaks that existing algorithms do not detect
- Estimating 342 MMscf of cumulative reductions from 2025 through 2030



SoCalGas – Leak Inventory Reduction

2020:	2021:	2022:	2023:	2024:
32-month inventory	24-month inventory	13-month inventory	8-month average	7-month average

- Continuing to reduce distribution main and service leak durations year-over-year
- 150 MMscf of reductions from 2020 through 2022
- Estimating 1.9 Bscf of cumulative reductions by 2030



SoCalGas

SoCalGas – Large Leak Prioritization

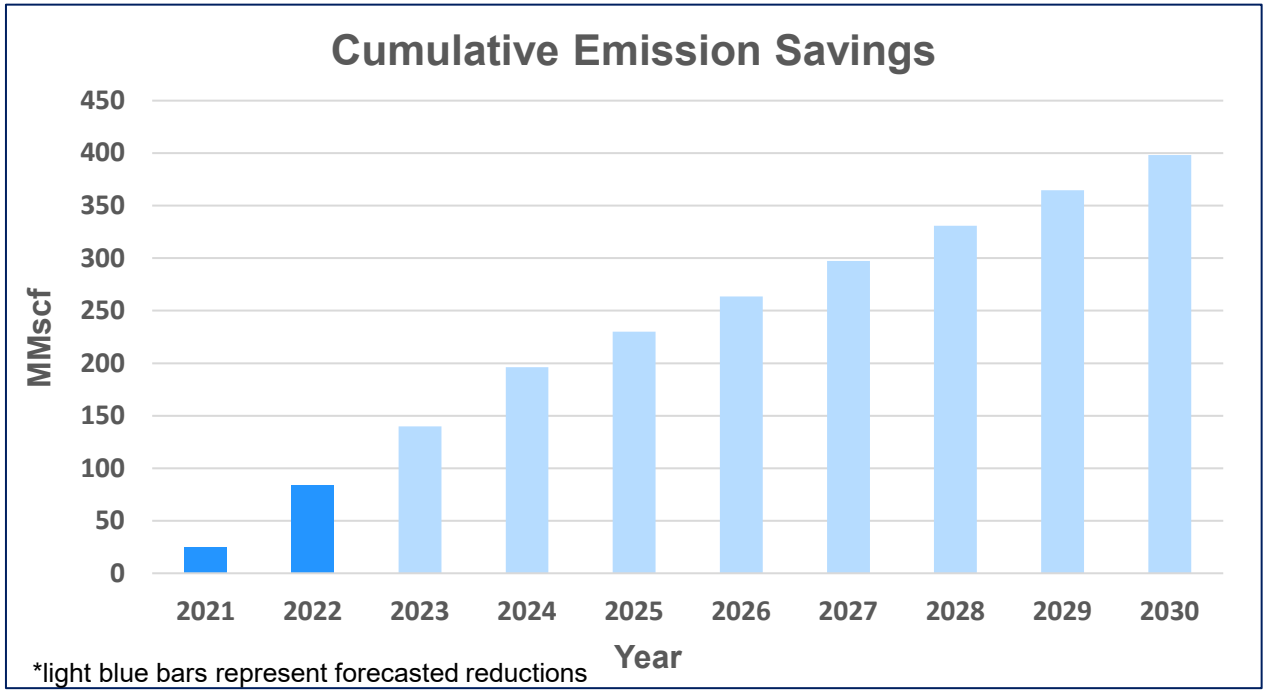
- Methods:
  - Utilize Decision Tree to identify high-volume leaks on distribution mains and services
  - Prioritize these high-volume leaks for repair on expedited timelines
- 83 MMscf of reductions during 2021 and 2022
- Estimating 398 MMscf of cumulative reductions by 2030


Bar-Hole

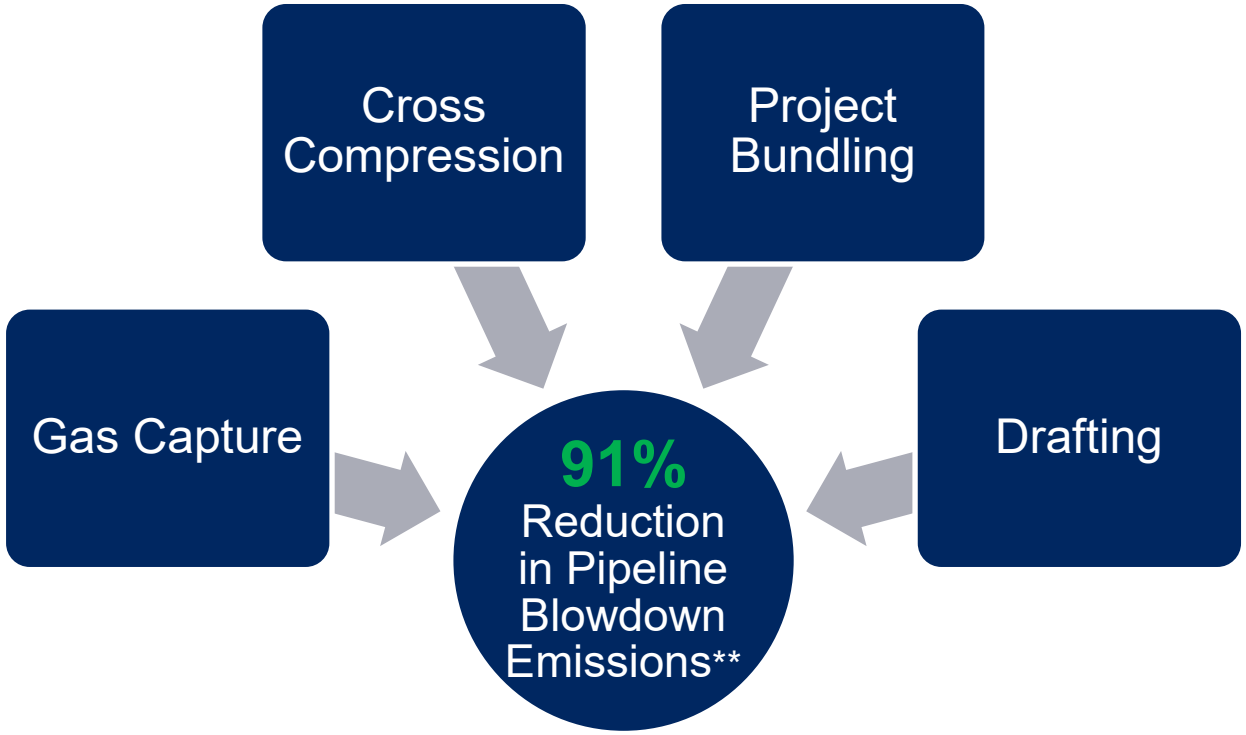

Sub-Structures


Unpaved

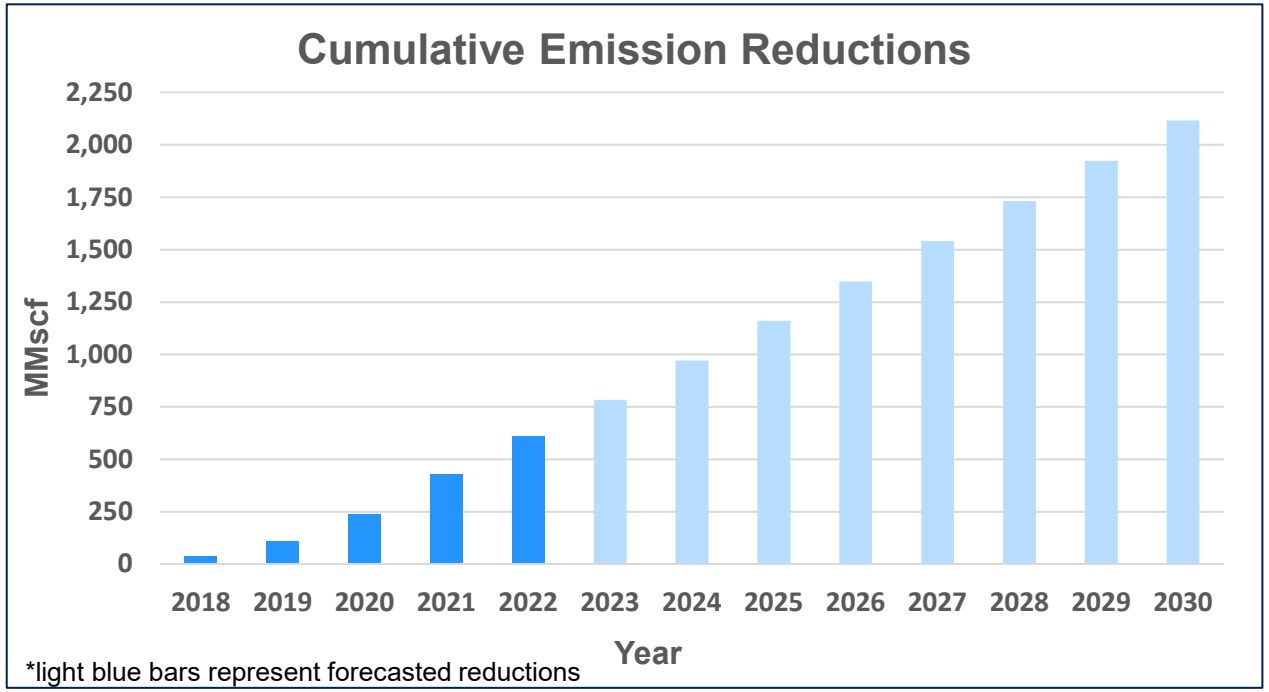

Paved (Crack)



SoCalGas – Blowdown Reduction Activities



- 612 MMscf of emission reductions from blowdowns from 2018 through 2022
- Estimating 2.1 Bscf of cumulative reductions by 2030



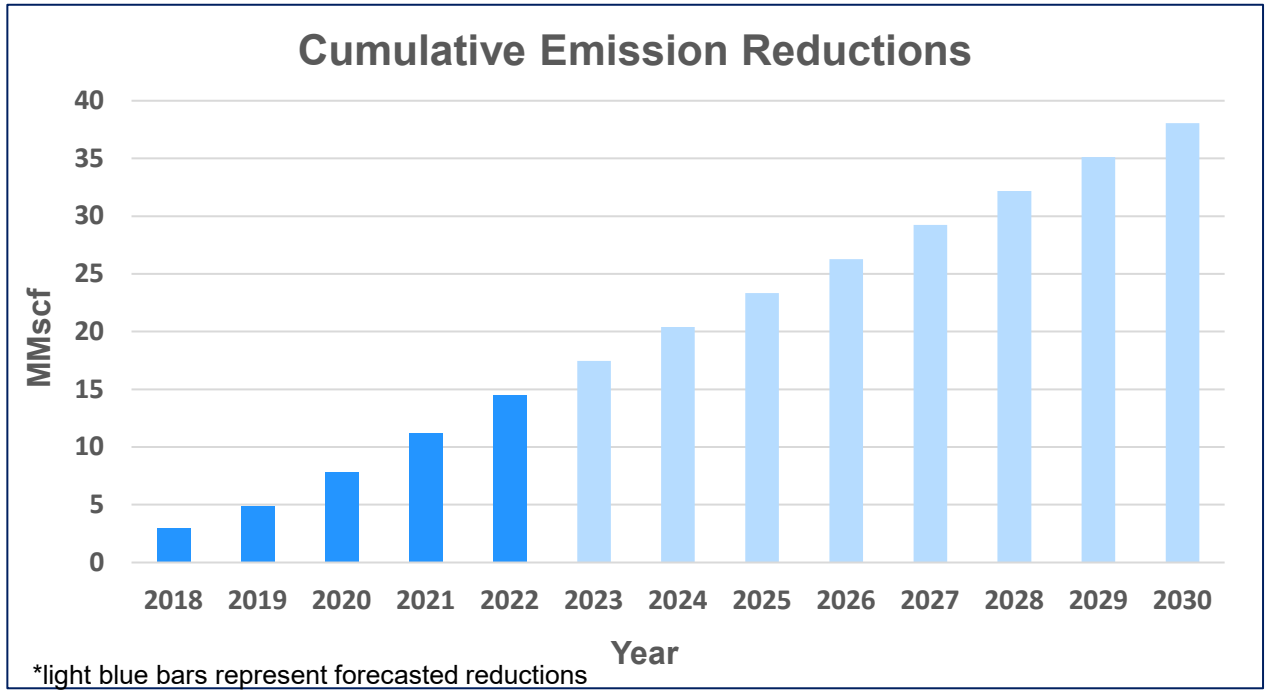
*light blue bars represent forecasted reductions

SoCalGas

**Per 2023 Annual Emissions Report

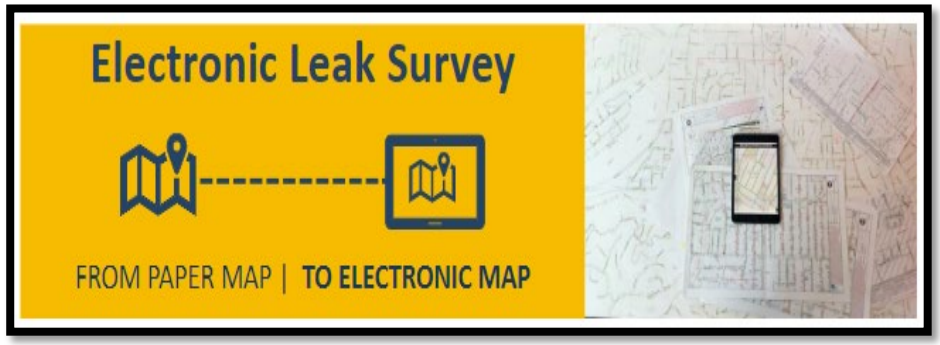
SDG&E – Blowdown Reduction Activities

- 95% reduction in pipeline blowdown emissions during 2022 per 2023 Annual Emissions Report
- 15 MMscf of reductions from blowdowns during 2018 through 2022
- Estimating 38 MMscf of cumulative reductions by 2030



*light blue bars represent forecasted reductions

SDG&E – Electronic Leak Survey



- Mobile application with GIS-generated leak survey routes
- Advantages/Features
  - Integration with work management systems
  - Enables quicker response during significant events (e.g., floods, earthquakes, etc.)
  - Improves geographic location data
  - Increases efficiency by eliminating manual tracking processes
- For **SoCalGas**, ELS implementation was fully deployed for distribution routine leak surveys in November 2022. Since deployment,
  - ELS has saved about 3,519 hours (147 days) in leak response time

Cost Effectiveness in the 2024 Compliance Plans

Cost-Effectiveness Variables

- **RRR:** Realized Revenue Requirement
- **AARR:** Average Annual Revenue Requirement
- **Cost Benefits:** Reduced cost of gas at forecasted average annual Weighted Average Cost of Gas (WACOG)
- **Avoided Cap & Trade Costs:** Assuming December 2025 vintage prices, based on 5-day average of trading in January 2024
- **Social Cost of Methane:** Adjusted variable from D.19-08-020 using the California Consumer Price Index
- **Safety Benefits:** Calculated using PHMSA incident data and Company leak data
- **Emissions Reductions:** Emission reductions of program or project

Historical Cost Effectiveness

» Historical Standard Cost Effectiveness:

$$\frac{(RRR - Cost\ Benefits)_{2018-2022}}{Emissions\ Reductions_{2018-2022}}$$

» Historical Cost Effectiveness with Cost Benefits, Safety Benefits*, Avoided Social Cost of Methane, and Avoided Cap & Trade Costs:

$$\frac{(RRR - Cost\ Benefits - Avoided\ Cap\ \&\ Trade\ Costs - Social\ Cost\ of\ Methane - Safety\ Benefits\ )_{2018-2022}}{Emissions\ Reductions_{2018-2022}}$$

*Only included when applicable. Not all projects have calculated safety benefits.

Future Cost Effectiveness

» Future Standard Cost Effectiveness:

$$\frac{(AARR - Cost\ Benefits)_{2025-2030}}{Emissions\ Reductions_{2025-2030}}$$

» Future Cost Effectiveness with Cost Benefits, Safety Benefits*, Avoided Social Cost of Methane, and Avoided Cap & Trade Costs:

$$\frac{(AARR - Cost\ Benefits - Avoided\ Cap\ \&\ Trade\ Costs - Social\ Cost\ of\ Methane - Safety\ Benefits\ )_{2025-2030}}{Emissions\ Reductions_{2025-2030}}$$

*Only included when applicable. Not all projects have calculated safety benefits.

Questions?

R&D OVERVIEW

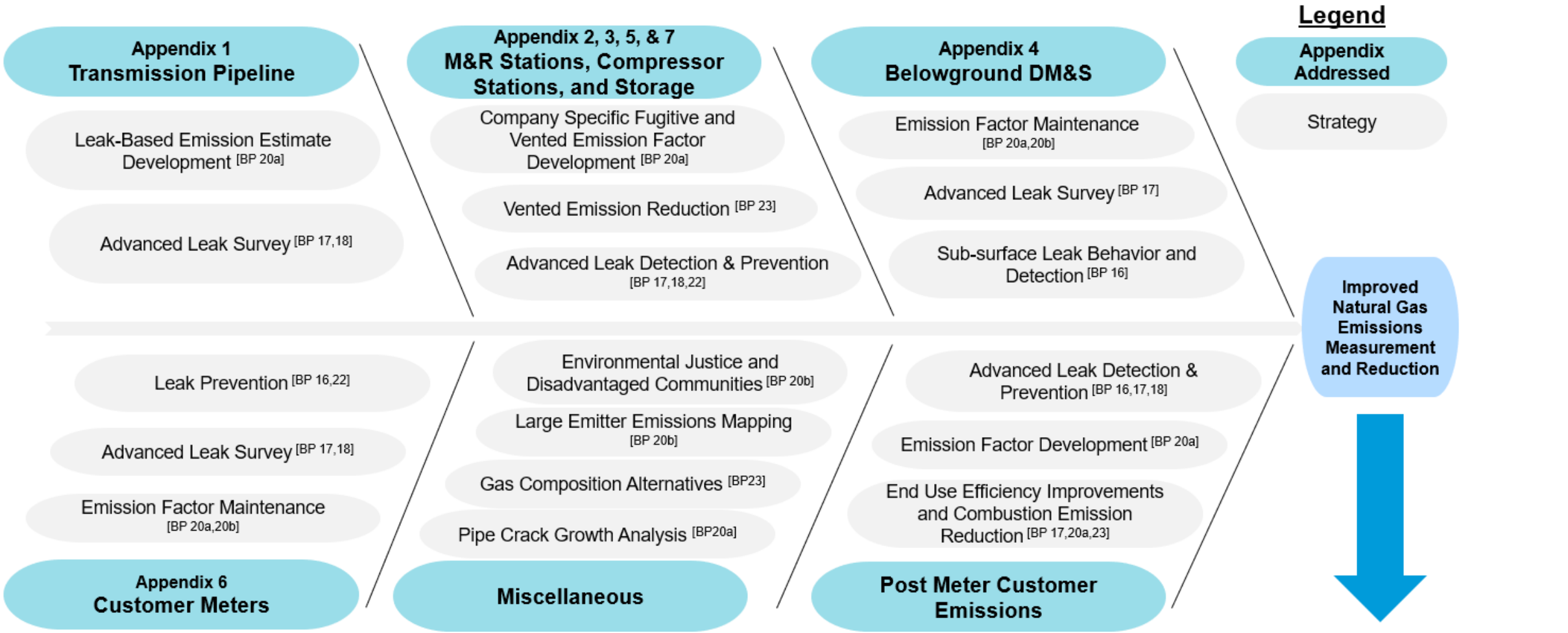
February 5, 2024

SoCalGas™ SDGE™

Agenda

- Research Roadmap
- Project Milestones
- Future Work

Research Roadmap



1) Improve Baseline Emissions Inventory Estimate

2) Advance Emissions Detection, Localization, and Quantification Technologies

3) Improve Cost-Effectiveness, incl: Operational Efficiency, Safety, Sys Emissions, Other Co-Benefits

Project Milestones - 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 controlled field testing in 2023
- Additional testing for enhanced detection of small leaks (e.g., MSA leaks) planned in 2024

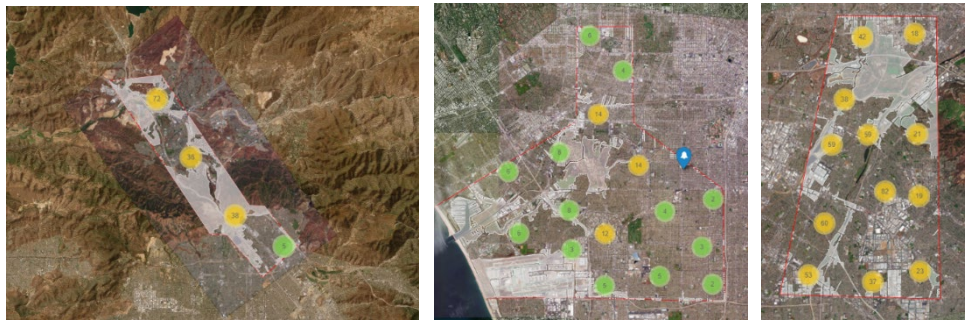
Fleet-based Passive Mobile Methane Detection

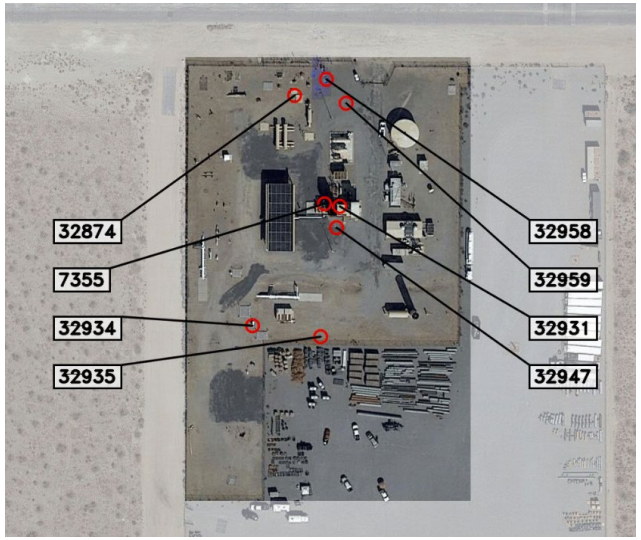
- Passively detect methane emissions from normal fleet vehicle operations and utilize data analytics to compile methane readings and potentially identify leak sources
- Installed units on 6 vehicles in 2023
- Installation of 30+ additional units planned for early 2024
- Data collection and analysis planned throughout 2024

Project Milestones - Enhanced Methane Detection

Satellite-based Methane Detection

- Performed two scans of three polygons in SoCalGas territory
  - Very difficult to schedule scans with satellite company
  - Multiple attempts over multiple weeks were required to scan polygons in entirety
- No leaks found on follow-up walking investigations
- SoCalGas performed two controlled releases during these scans
  - 100 CFH release was detected
  - 500 CFH release was not detected
- Two additional scans with refined/tuned algorithm planned for 2024





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
- Performed additional pilot flights over compressor stations and high-pressure distribution pipeline in 2023
- GML technology was capable of clearly identifying emission sources for both the compressor station and high-pressure distribution applications

Project Milestones – Stationary Methane Detectors

Stationary Methane Sensor Pilot

- Install methane detectors at service Points of Entry for meter rooms and crawl spaces to improve safety while reducing emissions by detecting methane in these high consequence locations
- Installed 167 units in 2023
- Installation of 200-250 additional units in Q2 2024 with data monitoring and analysis throughout 2024

Project Milestones – 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

» Distribution Main & Service Pipelines

2015-2023

- 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 (3 years worth of implementation data)

Quantification of Emissions from Vented Equipment

- Designed, developed, and assembled device package for quantification of emissions from actuators over long periods of time (joint project with NYSEARCH)
- Tested devices at two Transmission M&R stations and collected one week's worth of data at each facility
- Construction of additional quantification assemblies and station data collection planned for 2024

Future Efforts

- Continue Company-Specific Emission Factor and 2015 baseline adjustment research efforts (e.g., transmission facilities and customer-side emissions)
  - Prior work has already provided ~1,200,000 MCF correction to baseline and current annual emissions reporting (original baseline ~2,800,000 MCF)
  - Allows accurate identification of areas with the highest emission reduction potential

- Large focus on mitigating leaks from threaded connections through failure mode analysis or alternative assemblies
  - Meter set assembly leaks account for 35% of total system emissions
  - Leaks are already repaired quickly (1 to 3 days)
  - Increased survey frequency and/or more leak-tight assemblies required to reduce emissions

- Must reduce emissions while meeting cost-effectiveness metrics for all researched technologies and processes

Questions?

GHG Abatement from Enclosed Combustion Devices (ECDs)

Feb 2024

Enclosed Combustor Use Cases

Scenario 1: ECD use for Odor Fade Conditioning

- Gas is either blowdown or combusted via ECD until gas odor spec is maintained

Scenario 2: ECD use for In-Line Inspection (ILI) Operations

- Downstream gas is combusted to increase demand on hydraulically “unpiggable” pipelines (method of last resort)

Question: Is abatement achieved in Scenario 2?

ILI Hydraulic Considerations

Pipelines with extreme (very low or very high) flow conditions are traditionally deemed "unpiggable" as they can lead to stuck or damaged inspection tools. Inspection tools need to operate at specified speed ranges to obtain reliable data.

Not feasible to blowdown gas to atmosphere to increase gas flow

Alternatives to ECD on low flow pipe:

a. Adjust in-line flow – throttle up and downstream in-line valves
b. Create a "bottle" – increase pressure on an intersecting line via station regulation
c. Portable Compressor – move gas into adjacent pipeline
d. Bi-directional pigging – given pipeline has compatible features, use CNG to push pig in "reverse"
e. Change Inspection Season – wait for optimal flow as demand changes with seasons
f. Non-Traditional Inspection or Other Assessment Method

Low-flow, radial feed pipelines eliminate most options for traditional and non-traditional inspection

Avoided GHG Potential from pulling ILI Tool?

A. Combustion achieves no abatement

Abatement = avoided methane emissions

B. Combustion achieves incidental abatement

Abatement = volume of gas combusted

Questions & Open Discussion

R&D Project Updates

Gas Research & Development

January 2024

2023 and 2024 Priorities

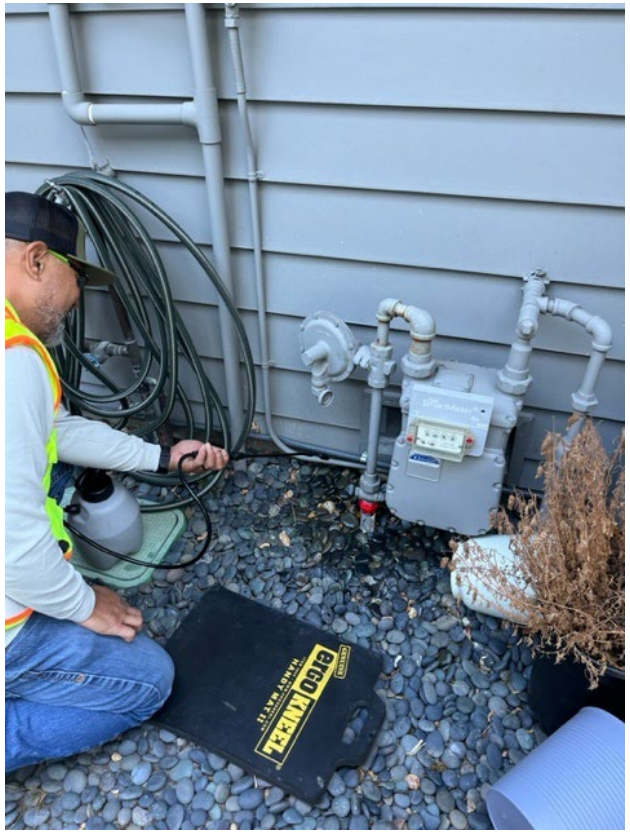
LLFA Tape for Meter Set Leaks

2023

- Meter set leaks are among the top emitters in PG&E's service territory
- LLFA tape would allow for quick repairs without breaking down the meter set
- Began a small-scale pilot in conjunction with field services throughout the bay area performing monthly rechecks

2024

- A larger scale pilot is expected to be launched in 2024 to encompass the different geographic regions in PG&E's service territory



2023 and 2024 Priorities

Continuous Bleed Data Collection

2023

- Emissions are calculated using a population-based emission factor that overestimates emissions
- Transmission M&R stations are of the top 3 emitters in PG&E's territory
- In 2023, R&D prioritized collecting data from stations with CBD devices
- Instantaneous measurements of all continuous bleed devices were taken multiple times throughout the year using the hi-flow sampler
- The data was analyzed, and results were summarized for CBD stations

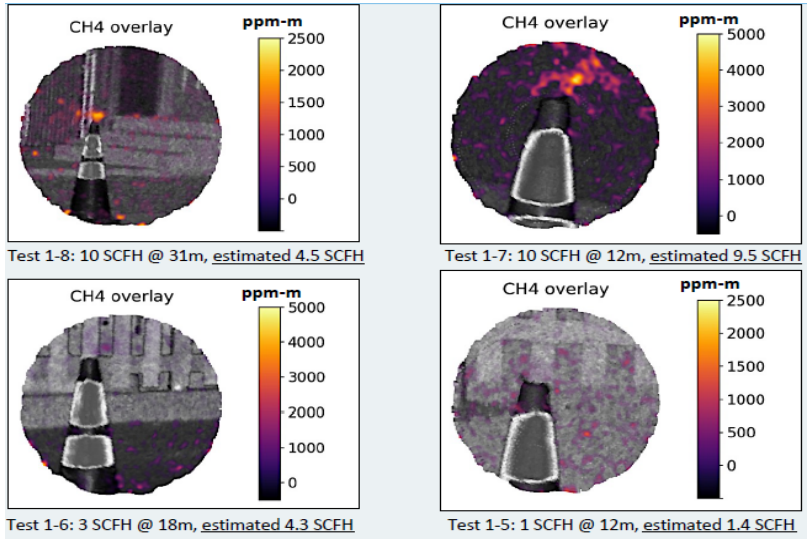
2023 and 2024 Priorities

SRRR/CH4IQ Demo of QLM lidar based-camera for DM&S Leaks

2023

- In Q3, PG&E hosted a demo of the QLM lidar based camera at the request of methane emissions nonprofits (SRRR and CH4IQ) at the PG&E Gas Safety Academy. Representatives from the California Public Utilities Commission (CPUC), California Air Resources Board (CARB), and the Department of Energy (DOE) attended
- The proposed use case for distribution mains and services will take further R&D in the coming years but the results of the demo were promising


Gas released at top of the cone emulates above ground leaks



2023 and 2024 Priorities

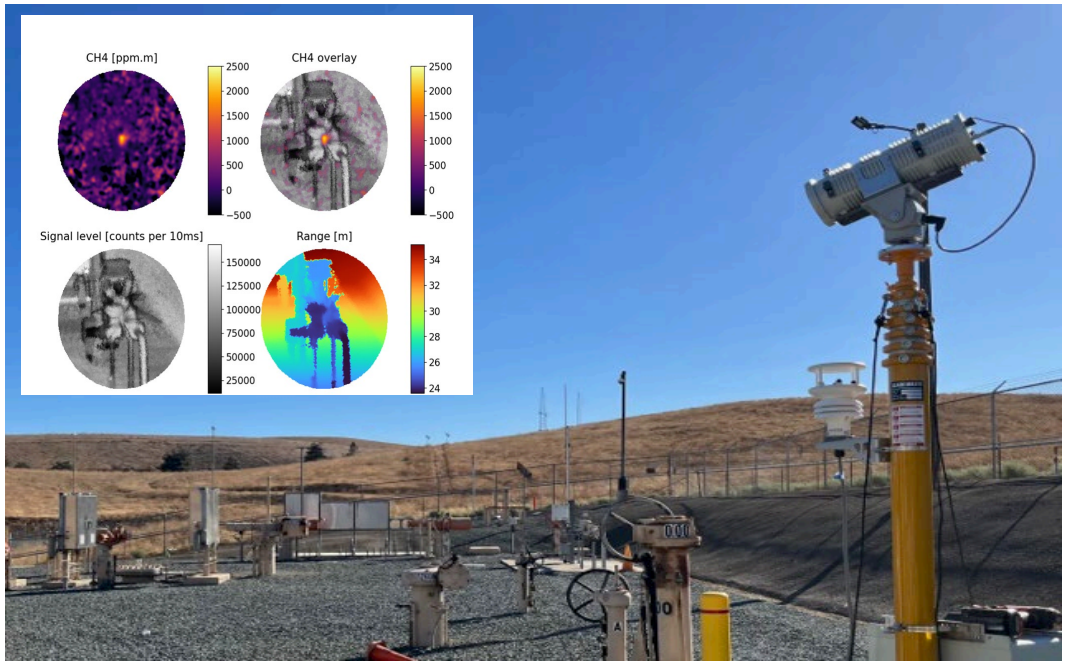
Continuous Monitoring at M&R Stations

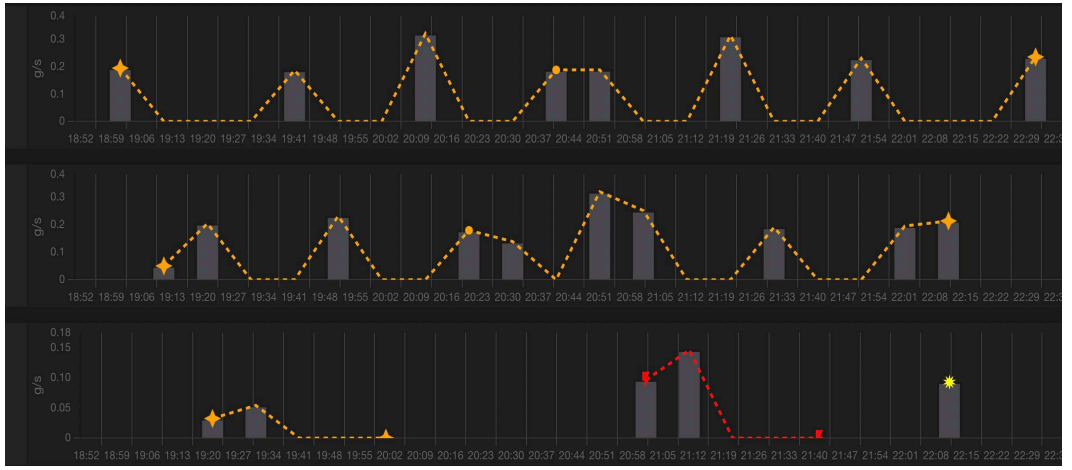
2023

- Continuous monitoring is needed for an accurate representation of intermittent bleed station emissions since instantaneous measurement tools such as the hi-flow sampler can't capture intermittent releases
- In 2023, PG&E conducted a single-station trial with the QLM lidar based camera for continuous monitoring. Results coincided well with instantaneous measurements taken using the hi-flow

2024

- The QLM trial is expected to be expanded to intermittent bleed stations in 2024 for further data collection





2023 and 2024 Priorities

Continuous Monitoring of Wellheads

2023

- Created a phased approach pilot project for continuous monitoring at wellheads in lieu of daily wellhead leak surveys
- Site visit and benchmarking session Q2 2023 with a utility that has implemented continuous monitoring

2024

- Phase 1 plans to consist of a 2-month field trial of 3 different devices on a single wellhead to validate the technical specs of the sensors per COGR requirements
- Phase 2 plans to consist of a larger scale project to evaluate IT integration, alarm systems, etc.

2023 and 2024 Priorities

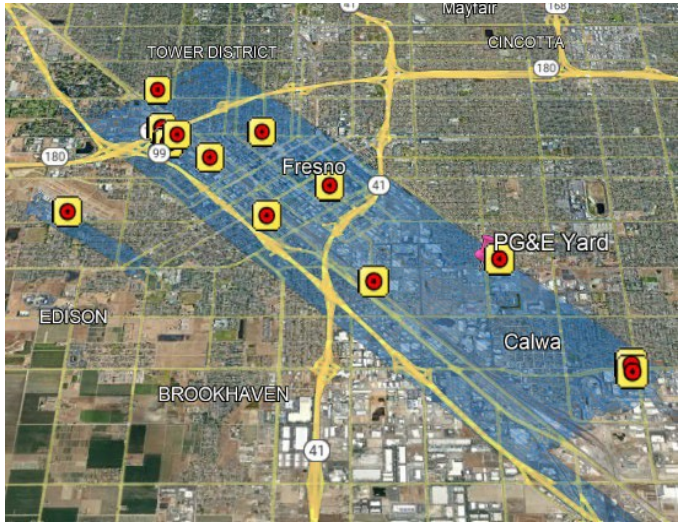
Aerial Leak Detection via Helicopter

2023

- Evaluated Bridger Photonics Gas Mapping LiDAR for methane leak detection and quantification
- Report provides plume height to assist in determining pipeline gas
- Confirmed leaks on existing open leaks, Class B meter set and a house gas line

2024

- Continued R&D evaluation of promising technology focused on emission quantification and probability of detection (PoD) performance



2023 and 2024 Priorities

Aerial Leak Detection via Drones

2023

- Tested methane LiDAR sensors on PG&E's drones using controlled gas releases to survey hard-to-access areas and for emergencies
- Gazoscan – remote methane detector beta build that will need an integrator
- U10 – positive user experience/interface

2024

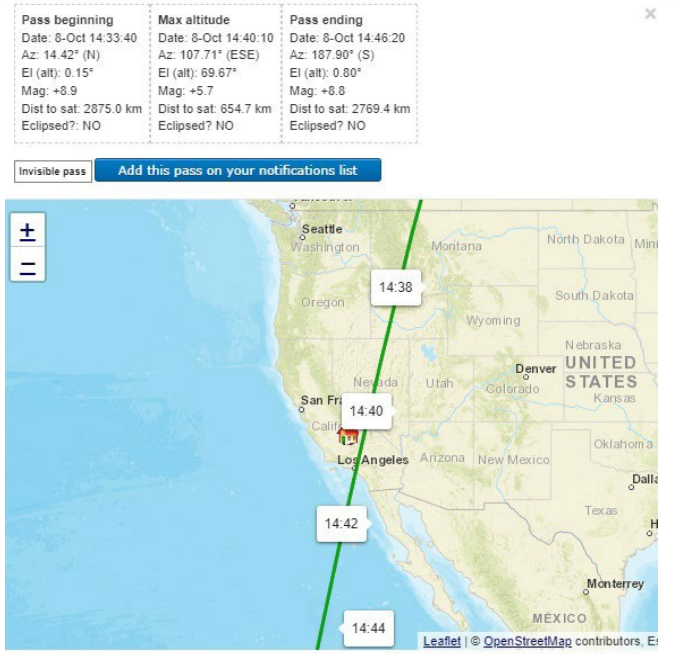
- Pergam Falcon – Plans to evaluate in 2024

2023 and 2024 Priorities

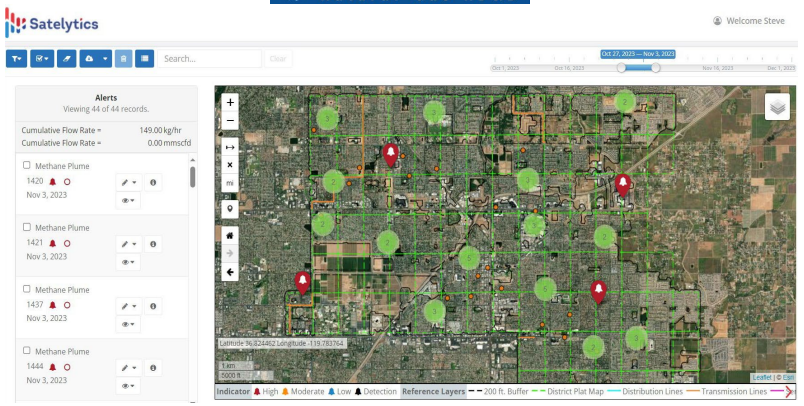
Aerial Leak Detection via Satellite

2023

- Faster, safer, can be used for multiple applications
- NYSEARCH T-796 - LDC Validation of Satelytics' Aerial System for Methane Detection and Emission Quantification
- Technology limitations include too much cloud coverage and satellite angle restraints
- Planning 15 controlled releases for the 4th scan ranging from 0.5 - 50 scfh



NYSEARCH Natural Gas RD&D



Thank you

Southwest Gas SB 1371 Emissions Abatement Winter Workshop

February 5, 2024

Presented by:
Aaron Quilici, Manager/Gas Operations Support Staff
Joe Romo, Manager/Construction/Southern Nevada Division
Myrle Heki, Supervisor/Construction/Southern Nevada Division

SOUTHWEST GAS CORPORATION

Agenda

- Southwest Gas Overview
- New Technologies at Southwest Gas
  - AMLD Technology
  - Methane Capture Equipment

Southwest Gas Corporation – Utility Overview

Decentralized
Leak Survey

57,000+
Miles of Main and Service

3 Year DOT Cycle

5
Division Ops Centers

Southwest Gas HOLDINGS

SOUTHWEST GAS

Customers
2.2 Million

41,000+
Customers added in 2022

Corporate
Las Vegas

3,500
Field Contractor Partners

Southwest Gas AMLD Long-Term Future

2023–2025

- ***Implement AMLD as a Special Patrol Leak Survey Tool***
  - Continue to work with each State Commission as we implement AMLD for special leak surveys and patrol leak survey types
  - Survey 100% of applicable special leak surveys with AMLD by the end of 2025
  - Shift all states to leverage emissions qualification data for leak management programs
  - Develop and implement procedures to prioritize areas with a significant leak density for replacement
  - Develop and implement a procedure for large-volume leaks (>10 SCFH)

2025–2027

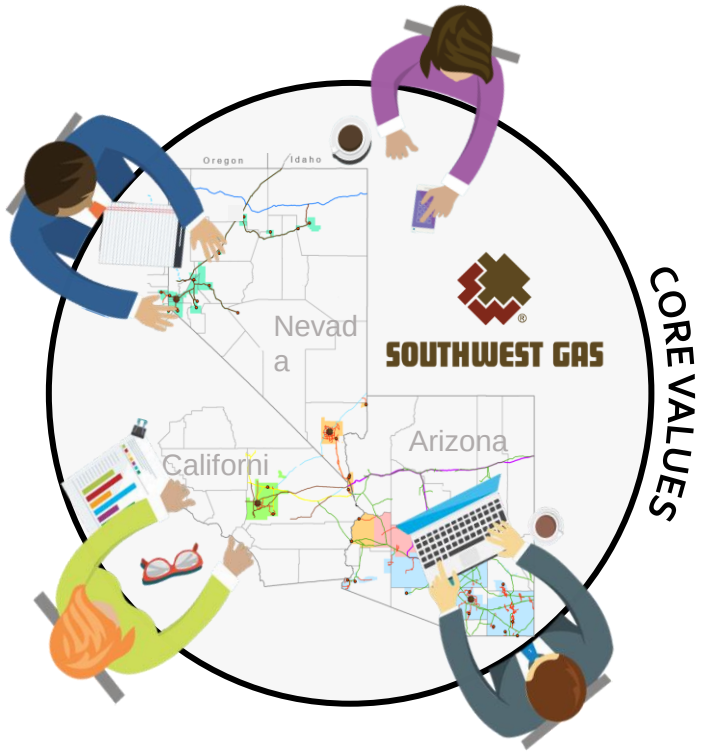
- ***Enhance the AMLD Program to drive emissions reduction***
  - Evaluate emissions quantification benefits and survey schedules
  - Incorporate AMLD data to support DIMP assessments
  - Compliance Leak Survey and Leak Management process improvements

AMLD Technology

Safety
We take the time to do it right and protect our communities. Our employees are family – they need to come home safe, every day.

Quality
We are committed to providing reliable service and a best-in-class customer experience. It's about doing things right, every time.

Excellence
We continuously improve through investment in employee development, system integrity, and technology. We constantly ask, "How can we do it better?"



Methane Capture

Relates to Best Practice 23 of the Company's California Emissions Compliance Plan

Topics

- Why do we capture methane?
- Methods of methane capture.

- Identify and implement effective methodologies to further reduce methane emissions in pipeline operations

- Expand environmental stewardship and decarbonization initiatives

Methods of Methane Capture

- System Draft Down
- Methane Capturing Equipment
  - ZEVAC
  - GoVAC

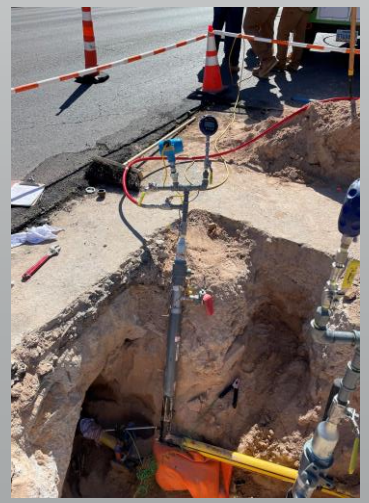
ZEVAC Quad Unit

- 0-1,480 psig
- Requires an additional air compressor to operate
- Mitigates/eliminates venting (blowdowns)
- The QUAD is 100% mechanically driven with no on-board electronics

GoVAC Flex Unit

Can draw a pipeline from 1250 psig (higher pressures optional) to near 0 psig and transfer into an adjoining pipeline or a tube trailer at pressures up to 3600 psig

- No outside fuel or power is required, and it is fully self-sustaining
- Remote Monitoring Full access by Onboard Dynamics professionals to remotely monitor system performance



Mini-ZEVAC Unit

- Assists with reducing Environmental Footprint
- Simplistic & Easy to use
- Unit requires a 90 CFM Compressor to Operate
- Unit can take line pressure to a negative ensuring zero methane is released to the atmosphere

Mini-ZEVAC Unit

- After methane is transferred ZEVAC provides an Environmental Report
- Environmental Reports can be tracked throughout the year to provide methane savings to Utility Commission's

COMPANY	Southwest Gas		
LOCATION	Henderson, NV		
SYSTEM	5126ft of 2.375 inch pipe Drawn down from 38.3 psig To 0 psig	To minimize environmental and social impact, Southwest Gas utilized ZEVAC® technology for depressurization of the pipelines. Instead of releasing the gas into the atmosphere, ZEVAC® equipment moves the gas out of the pipeline being depressurized into another section of the system. This way, Southwest Gas can perform a "blowdown" while minimizing the amount of methane gas blown into the atmosphere.	
SAVINGS	192.4 scf Natural Gas (Methane) NOT VENTED	0.0 Cars off the road for 1 year	271.1 Miles not driven
ENVIRONMENTAL IMPACT	0.1 Metric Tonnes CO2e SAVED	120.4 Pounds of coal not burned	0.0 Tons of waste recycled instead of landfilled
		0.1 Acres of forest grown for 1 year	1.8 Seedlings grown for 10 years

Example from a 2023 Southern Nevada Project

If there are any questions after the workshop, please contact Southwest Gas Engineering Services/Compliance Administrator Laurie Brown at laurie.brown@swgas.com

SOUTHWEST GAS CORPORATION

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/natural-gas-leak-abatement

California Public Utilities Commission