

Analysis of the Utilities' June 15, 2020, Natural Gas Leak and Emission Reports

SB 1371 (Leno) Natural Gas: Leakage Abatement
R.15-01-008/D.17-06-015/D.19-08-020

California Public Utilities Commission and California Air Resources Board Joint Staff Report

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Executive Summary

This is the sixth annual report compiled jointly by the California Public Utilities Commission (CPUC) and the California Air Resources Board (CARB) (2020 Joint Report) produced in compliance with SB 1371 (Leno – 2014) on natural gas emissions, as ordered by the CPUC Decision Approving Natural Gas Leak Abatement Program Consistent with Senate Bill 1371 (D.17-06-015).

The annual report analyzes and accounts for natural gas emissions from leaks and vented emissions in the natural gas transmission and distribution system in California.¹ This report estimates the annual methane emissions, the primary component of natural gas, from California's transmission, distribution and storage systems and discusses emissions by system categories, source categories and leak grades.²

California gas utilities and independent storage providers (ISPs), (respondents) filed their 2019 emissions data and information on or before June 15, 2020 pursuant to the data request issued by CPUC Staff in March of each year. The annual data request includes reporting templates and associated guidelines to respondents.

Staff used the report filings and any other relevant information to prepare the 2020 Joint Report.³ Respondents and Staff adjusted the 2018 data to correct misstatements as well as to present comparable category level emissions estimates and trends.⁴ A concerted effort will be made to update the 2015 Baseline figures in the 2021 Annual Report based on methodological changes and new information that affect the reported Baseline values.

The information in this report should be used by stakeholders to help determine where potential emission reductions can be achieved to meet the State's overall goal of reducing natural gas emissions 40% from 2015 Baseline levels by 2030,⁵ while

¹ Unless specified as a fugitive leak or vented emission, for the purposes of this report "emissions" include both fugitive leaks, and vented emissions of natural gas.

² "System Category" refers to the grouping of assets by function within the natural gas delivery system. "Source Category" refers to grouping emissions based on like source, e.g. pipelines emissions, or M&R station emissions, which was performed in the previous Joint Report. See page 9 of this report for definition of leak grades.

³ R. 15-01-008, *Order Instituting Rulemaking to Adopt Rules and Procedures Governing Commission-Regulated Natural Gas Pipelines and Facilities to Reduce Natural Gas Leakage Consistent with Senate Bill 1371*

⁴ No new 2015 Baseline adjustments correcting minor errors were made in this year's report. Only minor adjustments were made in prior Annual Reports to fix errors in the 2015 Baseline.

⁵ This goal was established by (SB 1383, Lara 2016).

maintaining the safe, reliable, and affordable operation of the regulated gas storage and delivery systems as stated in SB 1371.

Key Findings:

The total estimated emissions from leaks and vented emissions for the 2019 calendar year is 5,912 million standard cubic feet (MMscf) of natural gas, which is 138 MMscf or 2.4% higher than 2018 reported emissions, though it is 689 MMscf or 10.4% below the originally reported 2015 Baseline (See Table 1).⁶ The overall increase from 2018 to 2019 is the result of emission increases reported in Distribution Mains & Services (DM&S) graded pipeline leaks, and both Transmission and Distribution M&R Stations, which were partially offset by decreased Transmission Pipeline, Compressor Station and Underground Storage emissions (See Table 2: Total Emissions by System Category). A detailed analysis of emissions from individual categories is provided later in this report. Changes in methodology and corrections to M&R Station inventories that span both 2018 and 2019 contributed to the Year-Over-Year (YOY) increase in emissions.

The total 2019 reported natural gas emissions of 5.912 MMscf equates to 2.65 million metric tonnes of carbon dioxide (MMTCO_{2e}) using the Intergovernmental Panel on Climate Change (IPCC) Forth Assessment Report (AR4) 100-year methane Global Warming Potential (GWP) of 25, whereas using the 20-year methane GWP of 72 equates to 7.62 MMTCO_{2e}.

Table 1: Total SB 1371 Sector Emissions, 2015, 2018-2019

Sector Emissions	2015 Baseline	2018	2019	2015 Baseline to 2019 Change		2018 - 2019 YOY Change	
				MMscf, MMTCO _{2e}	%	MMscf, MMTCO _{2e}	%
Volume of Natural Gas (MMSCF)	6,601	5,774	5,912	(689)	(10.4%)	138	2.4%
Mass Equivalent, 100-Yr GWP, AR 4 (MMTCO _{2e})	2.96	2.59	2.65	(0.31)	(10.4%)	0.06	2.4%
Mass Equivalent, 20-Yr GWP, AR 4 (MMTCO _{2e})	8.51	7.45	7.62	(0.89)	(10.4%)	0.18	2.4%

This report further analyzes the total emissions by looking at individual categories and sub-categories that comprise the emissions for 2019. The following Table 2 shows emissions and trends by System Category, and Table 3 shows total emissions and trends grouped by Source Classification.

⁶ Methane is the primary component comprising approximately 93.4% of the volume of utility grade natural gas.

Table 2: Total Emissions by System Category, 2015, 2018-2019⁷

System Category	2015 Baseline		2018		2019		2015 Baseline to 2019 Change		2018 - 2019 YOY Change	
	MMscf	%	MMSCF	%	MMSCF	%	MMSCF	%	MMSCF	%
Transmission Pipeline	549	8%	345	6%	294	5%	(255)	(46%)	(51)	(15%)
Transmission M&R Station	1,007	15%	890	15%	924	16%	(83)	(8%)	34	4%
Compressor Station	163	2%	184	3%	144	2%	(19)	(12%)	(40)	(22%)
Distribution Mains & Services	1,703	26%	1,119	19%	1,315	22%	(388)	(23%)	195	17%
Distribution M&R Stations	1,348	20%	1,346	23%	1,385	23%	37	3%	40	3%
Customer Meter	1,638	25%	1,692	29%	1,688	29%	50	3%	(3)	(0%)
Underground Storage	193	3%	199	3%	161	3%	(32)	(17%)	(38)	(19%)
Unusual Large Leak	-	0%	-	0%	-	0%	-	N/A	0	N/A
Total	6,601	100%	5,774	100%	5,912	100%	(689)	(10.4%)	138	2.4%

In large part, this Joint Annual Report will focus on the Year-Over-Year (YOY) changes from 2018 to 2019 due to the pending adjustments to the 2015 Baseline. The current focus on YOY changes is due to the continued improvements in emissions estimation adopted since the 2015 Baseline year, such that in several categories the 2018 and 2019 emissions are not directly comparable to the 2015 Baseline.

Baseline Adjustments:

Because we anticipate making significant adjustments to some of the 2015 Baseline emissions, using the historic Baseline as a comparison for achieving emissions reductions at this time could lead to erroneous conclusions on the effectiveness of mitigation actions and potential opportunities for reductions.

The impacts of appropriate adjustments to the 2015 Baseline are being assessed and accumulated with the aim to make all the known adjustments at one time to minimize major changes to the Baseline on an ongoing YOY basis. Because not all the specifics have been finalized Staff prefer not showing exact figures for the eventual Baseline adjustments.

Over the intervening years, respondents and Staff learned new methods for estimating emissions as well as discoveries that show the 2015 Baseline emissions levels for some source categories are significantly over or understated. Several of the source categories' emissions are based on antiquated emission factors that fail to reflect

⁷ For more sub-category details see Table 7: Detailed Emissions by Category, Source, and Classification 2015-2019. In addition, in 2015 and 2016 the Aliso Canyon storage well leak was excluded from Unusual Large Leaks because it was accounted for by other state agencies.

reasonably accurate emissions, readers of this report should be aware that there have been no changes to the reported 2015 Baseline emissions levels used for comparison.

Staff include some prospective changes to 2015 Baseline emissions for information purposes only, and to alert readers to the significant nature of some of the Baseline changes anticipated. After a final review, Staff plan to make the 2015 Baseline adjustments in the 2021 Joint Annual Report.

Currently, Staff anticipate materially significant adjustments that would reduce the Baseline in the following areas:

- a. DM&S – Metering & Regulation (M&R) Stations
- b. Meter Sub-Assemblies (MSAs)
- c. Distribution Mains & Services (DM&S) Pipeline leaks
- d. Blowdowns

To a lesser degree, Staff anticipate adjustments to Compressor Station and Storage Facility Baseline emissions and other minor corrections. The total impact from all adjustments could be a net reduction in the range of 25%.

Emissions by System Category:

In general, there were no significant changes in total 2018 to 2019 YOY emissions, though there were offsetting YOY fluctuations, which given the category may be significant.

For example, the Transmission Pipelines category continues to account for about 5% of the total 2019 emissions but it experienced a 15% YOY decrease of 51 MMscf from 2018. The transmission pipeline blowdowns accounted for 45 MMscf (88%) of the decrease with damages and component emissions splitting the difference of the remaining 6 MMscf (See Table 7 – in the body of the report).⁸

The Transmission Metering & Regulation (M&R) Station's 16% proportional share of the total 2019 emissions remains unchanged from 2018. However, the YOY emissions increased 34 Mscf (4%) from 890 MMscf in 2018 to 924 MMscf in 2019. Most of the YOY change is due to two offsetting categories, first the M&R Station emissions decreased 6 MMscf due to adjusting stations counts, and secondly that was offset by an increase of 40 MMscf due to increased blowdown activity.

⁸ A blowdown is the release of gas from a pipeline to the atmosphere to relieve pressure in the pipe so that maintenance, testing or other activities can take place (PHMSA). The decrease is attributed to the implementation of best practices utilizing cross compression, lowering line pressure, and bundling maintenance.

The Compressors Stations' share of the 2019 total emissions fell to 2% from the 3% share of the 2018 total. The 2019 Compressor Station emissions decreased 40 MMscf (22%) YOY. The compressor vented emissions and components leaks contributed the largest decreases of 18 and 14 MMscf, respectively. The decreased compressor emissions resulted from a decrease in the pressurized operations EFs even though pressurized operating hours increased by 8% across all utilities. Compressor leaks decreased 14 MMscf for a 56% YOY reduction showing the net benefit of the quarterly survey and repair requirements of the 2018 the CARB Oil and Gas Rule (COGR).⁹ In addition, decreased blowdown activity reduced YOY emissions by 7 MMscf (12%).

The 2019 Distribution Mains & Services (DM&S) pipeline emissions increased 195 MMscf (17%) YOY. DM&S emissions increased to 22% of total emissions in 2019, which is up from 19% in 2018. Virtually all the increase came from 182 MMscf increase in pipeline leaks due to the large utilities implementing survey methods that emphasize finding more and larger leaks. PG&E continued its roll out of its "Super Emitter" survey protocol that identifies and fixes large leaks throughout their service territory and implemented a risk-based survey method to survey more leak prone areas.¹⁰ In 2019, SoCalGas and SDG&E continued their protocol to specifically identify leaks from vintage materials (e.g., plastic installed before 1986), and overall found more leaks. Also, emissions from DM&S pipeline damages increased YOY by 12 MMscf (10%) all the increase came from PG&E, which began to splitting out the 2019 main and service pipeline damages to account for differences in time to repair. It takes twice as long to repair main pipeline damages as service pipeline damages. The use of the mains and service average times to repair resulted in a 43% increase in emissions on damages to its larger main pipelines.¹¹

⁹ The CARB Oil and Gas Rule (OGR) is promulgated under 17 CCR, that took effect in 2018. The OGR requires quarterly surveys that helped update and account for components not previously listed, along with more stringent leak detection thresholds. Initially, this resulted in a slight increase in category emissions in the year initiated. We expect a new equilibrium of a lower level of emissions to result.

¹⁰ The PG&E "Super Emitter" protocol uses a complex set of algorithms that accounts for the removal of larger emitting leaks from the population and makes a proportional adjustment to the DM&S pipeline emissions. The Risk Based Survey predictive algorithm estimates the number of Unknown leaks from un-surveyed areas. PG&E notes "...the higher number of unknown leaks was due to a decrease in survey mileage from 2018 (24k miles) to 2019 (18k miles) and an increase in number of found leaks..."

¹¹ PG&E uses an average leak time to repair because it does not have an automated process to directly map the distribution damages reported in SAP (PG&E's official system of record used to report Appendix 4 data) to the more granular duration data in the Event Management Tool. PG&E anticipates having this automated functionality to link the distribution damages recorded in SAP to the EM Tool in the next two years.

The Distribution Metering & Regulating (M&R) Stations emissions increased 40 MMscf (3%) YOY to 1,385 MMscf, and this category of emissions has remained a constant 23% of total system emissions. The slight YOY increase was due to utilities' re-categorizing assets and improving the accuracy of records within their asset management systems.¹²

The emissions from Customer Meter Set Assemblies (MSAs) decreased 3 MMscf and is virtually the same as 2018 emissions levels. MSA emissions are population based and make up 29% of 2019 total emissions.

The Underground Storage emissions decreased 38 MMscf (19%) YOY from 199 MMscf to 161 MMscf, primarily due to component leaks decreasing 21.3 MMscf (56%) YOY from 38 MMscf to 17 MMscf in 2019. The remainder is a combination of decreases in storage well leaks (3 MMscf), compressor (5 MMscf) and component (8 MMscf) vented emissions. In general, the decrease can be largely attributed to the implementation of the COGR in 2018, which increased situational awareness and efforts to manage leaks and emissions better across the board. Most operators fall back on the compliance requirement that only requires measurement of compressor vented emissions once per year. Because these emissions fluctuate considerably over time, the reliability and integrity of the emission measurements based on a single measurement done arbitrarily at some point during the year is questionable.

Lastly, no unusual large leaks were reported in 2018 and 2019.

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¹² Distribution M&R stations are population based and will be subject to Baseline adjustments in the future. Both PG&E and Sempra utilities are developing leaker-based emissions protocols and in Sempra's case Staff are encouraged that they will be able to recalculate Baseline emissions using the leaker approach.

Emissions by Source Classification:

Table 3 shows the YOY changes by Source Classification.¹³

Table 3: Total Emissions Grouped by Source Classification, 2015, 2018-2019

Source Classification	2015 Baseline		2018		2019		2015 Baseline to 2019 Change		2018 - 2019 YOY Change	
	MMSCF	%	MMSCF	%	MMSCF	%	MMSCF	%	MMSCF	%
Population Based Emissions	3,931	60%	3,871	67%	3,916	66%	(15)	(0%)	45	1%
Graded Pipeline Leaks	1,458	22%	1,000	17%	1,182	20%	(276)	(19%)	182	18%
Blowdown	603	9%	425	7%	414	7%	(190)	(31%)	(11)	(3%)
Vented	258	4%	256	4%	220	4%	(37)	(14%)	(36)	(14%)
Damages	318	5%	154	3%	149	3%	(169)	(53%)	(5)	(3%)
Other Leaks	33	0.5%	69	1%	30	1%	(3)	(10%)	(39)	(56%)
Unusual Large Leaks	-	-	0	0%	-	0%	-	N/A	0	N/A
Total Sector Emissions	6,601	100%	5,774	100%	5,912	100%	(689)	(10.4%)	138	2.4%

Consistent with prior years’ the Population Based Emissions classification makes up the single largest source of emissions at 66% of the 2019 total emissions.¹⁴ Population Based Emissions, which are calculated based on the number of units within a category multiplied by an emission factor (EF), stay constant unless a change is made to how these emissions are estimated.¹⁵ Table 4 shows the 4-categories of population-based emissions sources. The two largest sources, MSA’s and Distribution M&R stations, will undergo significant reductions with the implementation of methodological changes being implemented for the 2020 inventory.

The largest YOY changes occurred in Graded Pipeline Leaks, Other, Vented emissions and Blowdowns as follows:

- Pipeline Leaks increased YOY by 182 MMscf (18%) due to a larger number of leaks found, fewer grade 3 leaks repaired, and the focus on locating larger leaks. For example, both PG&E and Sempra implemented changes that accelerate the identification of larger volume leaks, as well as account for the emissions impact of large emitters on the EFs used to calculate emissions.¹⁶ In addition, PG&E uses risk-based survey analysis to survey portions of its service territory expected to contain more leaks. In 2018 Sempra accelerated leak survey on more leak prone

¹³ See Table 7: Detailed Emissions (by Category, Source, and Classification) 2015, 2018-2019, in the body of the report.

¹⁴ The Population Based Emissions is comprised of Transmission and Distribution M&R Stations (58%), Customer Meter Sub-Assemblies (42%), and Transmission Pipeline Leaks (>0.1%).

¹⁵ See Table 4 in the report for a breakdown on the asset categories making up Population Based Emissions.

¹⁶ Large emitter programs employed by Sempra and PG&E identify and prioritize Code 2 and Code 3 leaks that have leak rates exceeding 10 cubic feet per hour (cfh).

vintage pipe from 5-year survey intervals to annual. Another significant driver of 2019 pipeline leaks count was the increase in the number of Un-surveyed Leaks estimated.

- Other Leaks decreased 39 MMscf (56%) YOY due to better survey and repair protocols resulting from the second year of COGR.
- Vented emissions decreased YOY by 36 MMscf (14%) due to maintenance of compressors that reduced rod packing emissions from 2018. The decreases occurred even though transmission compressor operating hours increased, and transmission component emissions were partially offset by decreased overall storage facility compressor operations and component emissions. Although implementing the COGR helped entities identify more components and emitting sources, it prompted better measurements and faster repairs with associated decreases in emissions.
- All blowdowns emissions combined decreased YOY by 11 MMscf (3%) due to type and nature of cyclical maintenance activity levels.
- Damages emissions decreased 5 MMscf (3%) YOY due to decreased number of damage events across the board.

Table 4: Population Based Emissions Sources, 2015, 2018-2019

Population Based Emissions	2015 Baseline		2018		2019		2015 Baseline to 2019 Change		2018 - 2019 YOY Change	
	MMSCF	%	MMSCF	%	MMSCF	%	MMSCF	%	MMSCF	%
Customer Meters, Meter Leaks	1,636	42%	1,659	43%	1,671	43%	35	2.1%	12	0.7%
Distribution M&R Stations, Station Leaks & Emissions	1,348	34%	1,345	35%	1,385	35%	37	2.7%	40	3.0%
Transmission M&R Stations, Station Leaks & Emissions	942	24%	862	22%	855	22%	(87)	(9.2%)	(6)	(0.7%)
Transmission Pipelines, Pipeline Leaks	5	0%	5	0%	5	0%	0.1	1.3%	(0)	(0.7%)
Total Population Based Emissions	3,931	100%	3,871	100%	3,916	100%	(15)	(0.4%)	45	1.2%

Conclusion:

1. The continued improvement in emissions estimate methodologies and updated emissions factors developed through the NGLA program has provided a clearer picture of the emissions estimate for the California Transmission and Distribution system.
2. The compressor vented emissions at the major utilities and some ISPs are based on a single annual EF measurement taken for each mode of operation to comply

with federal and state requirements.¹⁷ In addition, these operators follow the minimal requirement that allows maintaining rod packing for up to 26,000 hours of pressurized operations, regardless of condition or leakage.¹⁸ Many factors affect leak rates during each mode of operations, such that readings could vary significantly in a matter of hours or days resulting in significant variation in the EF. It appears that utilities may not take the necessary steps to increase their understanding of discrete compressor operations to optimize their performance. Timely maintenance has the corollary benefit of minimizing emissions as well as the economic benefit of not wasting lost gas. Whereas the ISPs have tighter margins, with a profit-based funding model that may incentivize cost effective emission reduction. Evidence suggests that more regular measurement should be required to ensure the integrity and reliability of compressor emissions estimates. In fact, given current technology, continuous monitoring of vented emissions should be considered.

3. The COGR reporting requirements improve Staff and operator understanding of transmission and storage compressor facility emissions. Component emissions and leak estimates appear to be improving with operators taking more granular and frequent component emissions and leak measurements as required.
4. In past years, the implementation of maintenance best practices, such as vacating gas from lines, bundling work, and better scheduling techniques, contributed to the significant reduction in blowdown emissions. However, in 2019 blowdown emissions increased showing that fluctuations based on activity drivers (e.g.,

¹⁷ The State Oil and Gas Rule requires rod packing to be replaced when the annual measured emissions exceed 2 cfm per compressor cylinder, however, due to the lack of measurement criteria, specifying when and how measurements should take place, operators have the latitude to choose when to measure the emissions. There are many factors that affect emissions rates significantly such that there are many questions surrounding the integrity of the annual measurements.

§ 60.5385 Paragraphs (a) through (d) apply to reciprocating compressor facilities

(a) You must replace the reciprocating compressor rod packing **according to either paragraph (a)(1) or (2) of this section or you must comply with paragraph (a)(3) of this section.** *(Because the statute uses "or" operators have opted to use the 26,000-hour threshold.)*

(1) **Before the compressor has operated for 26,000 hours.** After initial startup, October 15, 2012, or the date of most recent rod packing replacement, whichever is later.

(2) **Prior to 36 months from the date of the most recent rod packing replacement, or 36 months from the date of startup for a new reciprocating compressor** for which the rod packing has not yet been replaced.

(3) **Collect the emissions from the rod packing using a rod packing emissions collection system ...** through a closed vent system.

¹⁸ For example, SoCalGas replaces rod packing units after approximately 26,000 hours of use to prevent leakage, and SoCalGas's observations and experience indicate that the speed and magnitude of rod packing failure is not linear. The rod packing maintenance may go decades given some compressors log less than 1,000 hours a year.

number of repairs, pipe replacement, dig-ins, general O&M, etc.) is still a significant factor in YOY emissions and therefore, we should expect them to fluctuate YOY.

5. Additional adjustments to the 2015 Baseline were raised in this year's reporting cycle that are needed to reflect more accurate leak and emissions reporting methods. Currently, the total Baseline adjustment impact is anticipated to be in the range of 25%, which creates four issues: 1) the downward adjustment to the Baseline cannot be counted towards emissions reductions, 2) the overall reduction target becomes smaller in magnitude, 3) Baseline adjustments largely affect population-based emissions that are difficult to reduce without accurate emissions accounting, and 4) adjustments may shift the focus of reduction efforts. An accurate 2015 Baseline is important for all entities to have a firm idea what and where to reduce emissions. In particular, the Baseline adjustments affect PG&E's and SoCalGas's population-based emissions that conversely amplify the emissions reductions achieved in other categories.¹⁹ Because of the amplification effect, they may be in a better position to reach their 20% target reduction from 2015 Baseline by 2025.²⁰ If they fail to meet the 20% reduction by 2025, pursuant to PUC Decision D.19-08-020, their LUAF cost recovery will be restricted in 2025. Staff plan to make appropriate adjustments in time for inclusion in the 2021 annual report.

¹⁹ The amplification occurs because the total utility emissions as the denominator decreases but the net reductions to-date stay the same, which causes the percent of reduction to increase relative to the whole. For example, if PG&E's reductions since 2015 were 0.35 MMscf and its unadjusted Baseline is 2.0 MMscf the apparent reduction is 17.5%, and by updating the Baseline to 1.75 MMscf the 0.35 MMscf reduction increases to 20%.

²⁰ The three utilities PG&E and SoCalGas must reduce sector emissions 20% by 2025 to claim full cost recovery of their Lost and Un-Accounted for (LUAF) gas.

Introduction and Background

On September 14, 2014, Governor Jerry Brown signed into law SB 1371 that required reporting and verification of emissions of greenhouse gases (GHGs). The bill also requires gas corporations to file a report summarizing utility leak management practices, a list of new natural gas leaks by grade, a list of open leaks that are being monitored or are scheduled to be repaired, and a best estimate of gas loss due to leaks. In accordance with SB 1371, the California Public Utilities Commission (CPUC) and California Air Resources Board (ARB) prepared this annual report, which analyzes and accounts for natural gas from leaks and vented emissions from natural gas transmission, distribution, and storage in California.²¹

SB 1371 also requires the adoption of rules and procedures to minimize natural gas leakage from Commission regulated natural gas pipeline facilities consistent with Pub. Util. Code § 961(d), § 192.703(c) of Subpart M of Title 49 of the Code of Federal Regulation, the Commission's General Order (GO) 112-F, and the state's goal of reducing GHG emissions.

In January 2015, the Commission opened an Order Instituting Rulemaking (R.) 15-01-008 (OIR) to implement the provisions of SB 1371.

On June 15, 2017, the Commission in D.17-06-015 (Gas Leak Decision) approved the Natural Gas Leak Abatement (NGLA) Program consistent with SB 1371. This decision established Best Practices (BPs) and reporting requirements for the NGLA Program to be developed by the CPUC in consultation with CARB.²² The decision implements the following to support the state's goal of reducing 2015 Baseline natural gas emissions 40% by 2030:

1. Annual reporting for tracking natural gas emissions,
2. Twenty-six mandatory BPs for minimizing natural gas emissions pertaining to policies and procedures, recordkeeping, training, experienced trained personnel, leak detection, leak repair, and leak prevention,
3. Biennial Compliance Plan (CP) incorporated into the respondents' annual Gas Safety Plans, beginning in March 2018, and

²¹ Unless specified as a fugitive leak or vented emission, for the purposes of this report "emissions" include both fugitive leaks, and vented emissions of natural gas.

²² Leno, Chapter 525, Statutes of 2014; Pub. Util. Code §§ 975, 977, 978

4. Cost recovery process to facilitate Commission review and approval of incremental expenditures to implement BPs, Pilot Programs and Research & Development.

In the Gas Leak Decision, the Commission affirms that the 2015 Baseline emissions estimates will provide the starting point to measure future natural gas emissions reductions.²³

To culminate the second phase of OIR.15-01-008; on August 15, 2019, the Commission approved Decision D.19-08-020 establishing additional policies and mechanisms for the NGLA program pursuant to Senate Bills (SB) 1371 and 1383.²⁴

This decision requires:

- Utility Proposed Cost-Effectiveness Methodology and two Cost-Benefit Analyses for evaluating proposed methane reduction measures and the Biennial Methane Leaks Compliance Plans (Compliance Plans).
- Adopts a restriction on rate recovery beginning in 2025, for emissions greater than 20% below the 2015 Baseline levels for Pacific Gas and Electric Company (PG&E) and Southern California Gas Company (SoCalGas) to ensure they achieve their intended emissions reductions.
- Two workshops to refine the scope and detail of the Compliance Plans and Tier 3 Advice Letters pertaining to cost-effectiveness and cost-benefit analysis and other elements as directed in Decision (D.) 17-06-015.
- Develop a process that utilities can rely on, prior to submittal of the next Compliance Plans in March 2020, to adjust Emission Factors (EFs) used for annual reports to account for methane reduction measures in consultation with CARB.
- Extending the timeframe from 2020 to 2021 for the CPUC's Safety and Enforcement Division and Energy Division Staff to complete a written program evaluation of the NGLA program after Commission approval of the second set of Compliance Plans in late 2020.
- Commission direction of the NGLA program moving forward, following submission of the second set of Best Practices Biennial Compliance Plans due March 2020 and the NGLA program evaluation in 2021.

All directives of D.17-06-015 remain in effect unless they are superseded by directives and/or guidance provided by this decision. Lastly, in its decision D.19-08-020 the Commission closed R.15-01-008.

²³<http://docs.cpuc.ca.gov/SearchRes.aspx?DocFormat=ALL&DocID=190740714>, Finding of Fact #13, pg. 145.

²⁴ docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M309/K591/309591641.PDF

In addition, SB 32, which sets a 40% GHG reduction target from 2013 levels by 2030, was passed and signed into law in 2016.²⁵ SB 605 (Lara, Chapter 523, Statutes of 2014) directed CARB to develop plans to reduce statewide natural gas emissions, which it did in the Short-Lived Climate Pollutants strategy.

Purpose of the Natural Gas Leak Abatement Report:

The report estimates emissions from the gas storage and delivery systems in aggregate, by entity, by system categories, by source classification and by grade. The information should be used to help determine where emission reductions can be achieved while maintaining the safe and reliable operation of commission-regulated gas pipelines and other facilities. The metrics used to compile this report provide operators, the Commission, and the public with information about the type, number, and severity of emissions and the leaked quantity of gas emitted to the atmosphere over time.

This report provides a summary of the 2019 emissions inventory reports submitted by the respondents on June 15, 2020, and differs from prior year reports due to the following:²⁶

- The 2020 Joint Report includes year-over-year (YOY) comparisons to 2018 and the 2015 Baseline emissions.
- Continuing the practice from prior reports, Compressor Leaks and Component Leaks are combined across all years for both Compressor Stations and Underground Storage facilities. This was done to address comments from respondents that it is problematic to try to differentiate compressor leaks and components as in many cases they are integral systems.

In keeping with prior reports, in large part the data reported by gas companies in 2019 continued to require the use of 1996 GRI EFs.²⁷ However, Staff continue to evaluate improvements to the EFs and consider the CARB studies of DM&S pipeline and MSA leaks.

This report includes general discussions of changes to operational practices, new methods for leak and emission detection and mitigation programs. Lastly, Staff tried to include information on any improvements in the data capture (e.g., verification of asset

²⁵ California Global Warming Solutions Act of 2006: emissions limit. SB32, Pavley, Reg. Sess. 2015-2016. (2016).

²⁶ Respondents June 15, 2020 June 15, 2020 filings may be found on their respective websites.

²⁷ See Appendix 9 of the Data Request for specific EFs recommended by each System Category.

<http://www.cpuc.ca.gov/General.aspx?id=8829>

²⁸ docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M309/K591/309591641.PDF

inventory, integrating system databases, et al), changes to methodology for estimating emissions (e.g., calculating emissions for all blowdowns not just those above a specific threshold), and corrections to the classification of data or errors in the data that may provide greater accuracy in reporting.

Basis for the Annual Gas Leak Abatement Report:

On March 31, 2020, Staff issued a data request to CPUC jurisdictional utilities and independent storage providers (ISPs) in California to collect the information required by Article 3, Section 975 (c) and (e)(6), using templates jointly developed by CPUC and CARB Staff. (See Appendix C for detailed wording.)

The data were tabulated into the following seven systems categories (which included subgroupings by type):

1. Transmission Pipelines (leaks, damages, blowdowns, components, and odorizers),
2. Transmission Metering and Regulation (M&R) stations (station leaks and emissions, and blowdowns),
3. Compressor stations (compressor leaks and emissions, blowdowns, components leak and emissions, and storage tanks),
4. Distribution Pipeline Mains and Services (leaks, damages, and blowdowns),
5. Distribution M&R stations (station leaks and emissions, and blowdowns),
6. Customer Meters (leaks, and venting), and
7. Underground Storage Facilities (leaks, compressors leaks and emissions, blowdowns, and component leaks and emissions. Dehydrators are omitted in 2016).

The respondents provided contextual information and explanations for their data to help Staff understand the composition of the emissions, emission sources and related calculations underlying the emission estimates. The respondents summarized the data and provided their system-wide leak information. Appendix A explains methods used to estimate emissions.

Staff analyzed the data and requested supplementary information needed for clarification. The “Lessons Learned” section of this report identifies insights Staff acquired about potential improvements to the process and opportunities to enhance future data requests.

Basis for Adjusting the 2015 Baseline Values:

On August 15, 2019, the Commission approved Decision D.19-08-020 establishing additional policies and mechanisms for the Natural Gas Leakage Abatement (NGLA) program pursuant to Senate Bills (SB) 1371 and 1383.²⁸

Since the beginning of the NGLA reporting process Staff and respondents have identified opportunities for improving reporting methodology, emission factors and record keeping. Had some of these improved emissions data been known or used at the time of the 2015 reporting year they would have had a material impact on the level of 2015 Baseline emissions in the Joint Report. The June 2017 Commission decision (D.17-06-015) did not order a process for updating the 2015 Baseline, however, it ordered that:

“The Natural Gas Leak Abatement Program Annual Reporting Framework contained in Section 5.2 ... of this decision is adopted consistent with the process detailed below: The Commission’s Safety and Enforcement Division (SED), in consultation with the Air Resources Board (ARB), shall direct the annual report process...”²⁹

This is interpreted to include the consideration and evaluation of any changes to 2015 Baseline emissions based on new methods of emissions accounting, better record keeping and information as well as updated factors used for estimating emissions.

Decision D.19-08-020 modifies the approach to updating EFs by allowing utilities to propose EF changes that more accurately account for the emissions from their Compliance Plan emissions mitigation programs. In addition, changes to 2015 Baseline EFs may be warranted based on the supporting data and evidence used to develop EFs for emission mitigation programs included in their Compliance Plans.

The discussion within D.17-06-015 further clarifies the roles and responsibilities for managing the emissions reporting processes.

“...[T]he development of EFs and an official Baseline to manage this initiative in the long term is still in flux. Therefore, while, ARB is ultimately responsible for the development of EFs in collaboration with stakeholders, both ARB and CPUC should continue to collaborate to ensure that updates to EFs are completed in a timely fashion consistent with the Commission’s annual reporting process.

Following this year’s example, if changes are required to the annual reporting

²⁸ docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M309/K591/309591641.PDF

²⁹ D.17-06-015: Pg. 157

template, ARB and CPUC Staff will conduct a workshop to discuss EFs and ongoing changes to the reporting template. This workshop should take place during the first quarter of each year before SED issues the annual data request at the end of the first quarter.”³⁰

In the 2020 Winter workshop Staff discussed the impact of ongoing methodology and accounting changes and evaluated their impact on the 2015 Baseline balances. During the workshop additional Baseline adjustments were raised and discussed, and additional Baseline adjustments were raised during the review and evaluation of the respondents’ annual emissions filings. It is believed the majority of significant 2015 Baseline adjustments will be quantified and vetted for inclusion in the 2021 NGLA Joint Report. This will be one of the topics in the 2021 Winter workshop.

The larger sources of emissions identified for correction in the 2015 thru 2018 include:

- Revisions to the SoCalGas, SDG&E and PG&E Distribution M&R Station emissions, which have been reported on population-based EF, to a leak-based approach using historical leak detection and repair records. In PG&E’s case Staff are evaluating whether it is possible to approximate the emissions based current leak and emissions data that correlates to the 2015 timeframe. SoCalGas and SDG&E have maintenance records that substantiate leak occurrence and source that supports the level of estimated emissions consistent with subsequent years data and emissions.
- Updating the 1996 USEPA/Gas Research Institute (GRI) emission factors (EFs) for customer meter set assemblies, and pipelines.³¹ Staff proposes to use the findings of CARB’s meter set assemblies (MSAs) study, California-specific, to update the existing 1996 USEPA/Gas Research Institute (GRI) emission factors (EFs). The study was conducted in 2017-2018, a period where conditions and assets were assumed to be similar to those in the Baseline year of 2015. If staff’s proposal is approved, then the new EFs could significantly change the existing MSA emissions contribution with a downward adjustment to the 2015 emissions Baseline and subsequent reported emissions. In the meantime, utilities have been working on developing leaker-based EF’s, an extension of CARB’s study, utilizing MSA leak bubble size. The change from a population-based (CARB’s study) to leaker-based

³⁰ Ibid, Pg. 39

³¹ CARB EF study based on California specific leak profiles for customer MSAs indicates the current emissions factors are overstated by roughly 25%. Final quantification of the impact will ensue when the report is published.

- (Utilities' study) paradigm could facilitate utilities to make better estimates of emission reductions resulting from MSA leak repairs.
- Reductions to Appendix 4 - DM&S pipeline emissions are primarily due to modifications in the estimate of the SoCalGas and SDG&E un-surveyed leaks that resulted from changes in methodology categorizing O&M leaks.
 - In one case the method used to estimate blowdowns evolved since 2015.
 - COGR survey results indicate operating emission profiles at some compressor and storage facilities are significantly different than reported using prior methodology. The COGR information is largely based on direct measurement, which, unless there are identifiable changes in facility assets, operations, or practices, could closely match the emissions profiles in prior years and will be the basis for adjusting some compressor and component emissions or leaks.

There are various smaller adjustments related to methodology improvements, measurement protocols, and asset identification and re-categorization that may warrant retroactive application to the 2015 Baseline balances. The total impact from all adjustments is expected to be a net reduction in the range 25% from 2015 reported emissions.

Findings and Discussion

Leaks and Emissions:

Based on the respondents' data, 2019 emissions totaled approximately 5,912 MMscf, which equates to 2.65 MMTCO₂e using the Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report (AR4) 100- year methane Global Warming Potential (GWP) of 25, or 7.62 MMTCO₂e using the 20-year methane GWP of 72 (see Table 1). This is a 2.4% YOY increase from 2018 estimated emissions of 5,774 MMscf or 2.59 MMTCO₂e.³² The 2019 emissions are 10.4% lower than the 2015 Baseline of 2.96 MMTCO₂e.

System-wide Leak Rate

The System-wide Leak Rate is an important metric that shows the relative emissions to throughput from all respondents. SB 1371 requires annual monitoring of a System-wide Leak Rate for the transmission and distribution system.^{33 34}

The 2015 System-wide Leak Rate was 0.32%, notably less than the 2019 system wide leak rate of 0.39% that reflects the decreased throughput in 2019 rather than any increase in emissions. In 2019 the throughput volume was the lowest across the five years being tracked at 1,515,289 MMscf, which is 26% lower than 2015 throughput of 2,056,950 MMscf. The decrease was due to a 30% reduction in the amount of gas transported in state through the transmission system. The 2019 total emission volume was virtually the same 2018, which is the lowest level of the five years since tracking began. Before 2019 the leak rate remained relatively constant at around a third of a percent.

Table 5: System-wide Emissions – Throughput Categories, 2015 thru 2019

Throughput Category	Natural Gas Volume (MMSCF)				
	2015 Baseline	2016	2017	2018	2019
Total Storage Annual Volume of Injections to Storage	199,522	116,579	155,272	137,122	218,771
Total Storage Annual Volume of Gas Used by the Gas Department	NA	NA	1,933	1,782	2,409
Total Transmission Annual Volume of Gas Used by the Gas Department	7,717	6,107	5,875	6,185	7,080
Total Transmission Volume of Annual Gas transported to or for Customers in state	1,832,676	1,736,336	1,842,669	1,621,332	1,274,107
Total Transmission Volume of Annual Gas transported to or for Customers out of state	16,775	18,002	11,241	11,665	12,553
Total Distribution Annual Volume of Gas Used by the Gas Department	261	156	315	320	369
Total Throughput	2,056,950	1,877,179	2,017,305	1,778,406	1,515,289
Total Emissions	6,601	6,267	6,398	5,774	5,912
System-wide Leak Rate (Emissions/Throughput)	0.32%	0.33%	0.32%	0.32%	0.39%

The total throughput showed a decrease in 2019 compared to 2018 with 21% less gas transported to customers in the State that was partially offset by a 60% increase in gas injected into storage. The amount of gas used by the gas department changed insignificantly.³⁵ The fluctuations in injections into storage could correlate with the changes in storage facility emissions. For example, storage injections and withdrawals could correspond to emissions associated with the number of compressor hours, but

³³ For the purposes of SB 1371, the definitions of “leak” and “gas -loss” and the formula for calculating a “system-wide gas leak rate” were defined in a different manner than elsewhere. For the purposes of calculating the System-Wide Leak Rate, a “leak” was defined as any breach, whether intentional or unintentional, whether hazardous or non-hazardous, of the pressure boundary of the gas system that allows natural gas to leak into the atmosphere. Any vented or fugitive emission to the atmosphere is considered a “leak”. See Appendix B.

³⁴ Refer to Appendix C for PUC Code Section 975(e)(6), Article 3

³⁵ This category refers to natural gas that may be used by the utility itself, such as providing fuel to start-up a compressor or run an HVAC system for an occupied building at the storage site.

there are other emissions drivers, such as maintenance cycles, compressor mode EFs and leak detection protocols that positively and negatively affect storage emissions.

2020 Adjustments and Corrections

This report reflects a few minor adjustments to the data reported in the 2020 Joint Report. The errors, changes in methodology or change in emissions accounting in the 2018 respondent filings were updated to the 2018 values for consistency and comparability with the 2019 respondent filings. Staff reviewed and approved all the items that were adjusted in the 2020 Annual Joint Report.

Staff compared and adjusted the total based on respondents' proposed adjustments and corrections in this year's June 15th emissions report. A total of 197 MMscf adjustments reduced the previous published total of 5,971 MMscf to the adjusted total of 5,774 MMscf in this report. Four utilities proposed one-two corrections, while SoCalGas proposed eight corrections.

The corrections made to 2018 values include:

- Southwest Gas (SWG) increased the Transmission M&R Station, Leaks & Emissions from 10,884 Mscf to 15,548 Mscf, and decreased Distribution M&R Station, Leaks & Emissions from 174,933 Mscf to 169,879 Mscf by reclassifying M&R Stations between them.
- Central Valley Gas Storage (CVGS) corrected the Transmission M&R Station, Leaks and Emissions from zero to 21 Mscf to recognize a M&R station inadvertently omitted.
- Gill Ranch Gas Storage (GRGS) halved the Underground Storage, Component Leaks from 675 Mscf to 319 Mscf to reflect methodology updates.
- San Diego Gas & Electric (SDG&E) corrected the Transmission Pipeline, Odorizer emissions from 2 to 143 Mscf.
- Southern California Gas changed the following 2018 values:
 - Transmission M&R Stations, Leaks & Emissions decreased by 88,624 Mscf from 335,401 Mscf to 246,777 Mscf. This significant change resulted from SoCalGas's project to update its M&R station data and confirm the data with Asset Field Verification. The project found 41 stations omitted from the inventory, and 98 that were double counted.
 - Transmission Compressor, Compressor Emissions decreased by 12,068 Mscf from 55,581 Mscf to 43,513 Mscf due to incorrectly reported values based on data from an incorrect period.

- Transmission Compressor, Blowdowns decreased by 2,269 Mscf from 13,053 Mscf to 10,874 Mscf due to incorrectly reported values based on data from an incorrect period.
- DM&S, Pipeline leaks decreased significantly by 88,442 Mscf from 586,680 Mscf reported in 2018 to 498,238 Mscf. The reduction is due to a 2019 change in the company specific EFs, which were back cast to 2018 for comparability. In addition, the mileage used for main vintage plastic pipeline mistakenly included 1986 in the Vintage Plastic category for emission estimation correcting an error. In addition, the 2018 DM&S, Component Leaks of 2,934 Mscf were reclassified to DM&S, pipeline leak emissions to report these emissions consistently with all other respondents and improve comparability of emissions.
- The DM&S, Blowdowns decreased by 184 Mscf from 488 Mscf to 304 Mscf because the length pipeline used to calculate two of the 2018 blowdowns were in error and corrected.
- Underground Storage, Storage Leaks & Emissions (e.g., wellheads) decreased by 1,898 Mscf from 2,637 Mscf to 739 Mscf because the values originally reported were inadvertently based on EFs for pipe leaks as opposed to well leaks.

Data Management and Reporting

The top three utilities all describe continuing improvement and completing updates of programming software in 2019 to better record and analyze the data in their system. The quarterly surveys mandated by the COGR culminated in more details about the number of leaks down to 10,000 parts per million (ppm). The impact on emissions results is becoming more apparent and it is clear the more frequent surveys are ultimately more accurate than the prior method of estimation based on population based EFs.

In addition, utilities need to acquire and provide more complete emissions information, which is driving systems integration projects within the utilities to align maintenance, survey, and historical leak data to obtain better information on system emissions.

Impacts of CARB's Oil and Gas Rule (COGR)

In the 2019 Annual Joint report Staff provided an assessment of the COGR survey data and the SB 1371 leak data reported. The Staff observations of the COGR and SB 1371 reports are summarized as follows:

1. The reported data per the COGR and SB 1371 filings are similar but not necessarily the same in all respects, and not as much overlap occurs between the reports as was previously thought because of the different objectives of each report.
2. Both SB 1371 and COGR require descriptive entries, such as compressor facility name, type of compressor and facility address. For example, SB 1371 collects data to determine total annual emissions, whereas the COGR collects and evaluates quarterly reports of compressor component leaks to determine whether the reported leaks exceed the volumetric thresholds.
3. COGR also requires annual emissions flow rate measurements from reciprocating compressor rod packing and centrifugal compressor wet seals to verify emissions are below allowed leak rates.
4. Both reports rely on the same surveys conducted by the gas companies, as evidenced by the matching date of inspection of leaks and date of repair of leaks.

The following summary lists Staff observations of impacts of the OGR on the SB 1371 Annual Report:

1. The quarterly surveys initially result in a greater overall count of component leaks, but we are seeing indications over time leaks count are decreasing. The overall increase in the number of discrete leaks is largely due to the more stringent leak survey protocols and lower leak detection thresholds. An increase in number of leaks, initially result in an increase in emissions and as leaks are repaired quickly and decrease over time, overall emissions have held steady or started to decrease.
2. The COGR imposed new leak repair requirements effectively reducing the average number of days to repair. It was expected that the number of leaks detected would increase initially, and that the associated emissions would decrease. This appears to happen for the most part due to two factors: 1) leaks get repaired faster; and 2) the leak duration assumes that the leak started after the last survey date or January 1st, which ever was more recent, and emitted through the day of repair. However, the relationship between the number of leaks found and the correlative emissions is not clear.

- a. For example, in 2018 PG&E reported 1,279 component leaks at transmission compressor stations, whereas in 2019, 457 component leaks were reported though this is a 64% decrease YOY, the component emissions only decreased 340 Mscf (2%) from 18,852 Mscf in 2018 to 18,512 Mscf in 2019.
- b. Another example indicates that the situation that shows a higher correlation to leak detection and faster repairs, where in 2019 PG&E's storage facilities experienced a YOY 37% decrease in the number of "Storage Leaks & Emissions" leaks from 1,057 leaks in 2018 to 671 leaks in 2019. The emissions for the compressor "Storage Leaks & Emissions" decreased 60% from 4,636 Mscf in 2018 to 1,824 Mscf in 2019. Though the leaks decreased by 37% the average days to repair had a bigger impact falling 54% from 48 days to 22 days on average.
3. Component leaks are now based on Leaker EFs rather than Population EFs.
4. Inconsistency between reported compressor and storage emissions reported by the various respondents exist, with some reporting higher emissions and some lower. The more frequent surveys and direct measurements provide more situational information to help understand the factors driving these disparate changes.
 - a. In some cases, more frequent surveys helped identify increased emissions from compressor's rod packing prompting rod packing replacement. As expected, compressor activity levels appear to be a significant factor in leak generation and emissions levels.
 - b. Other respondents have relied on a single annual compressor emission measurement, and do not benefit from situational awareness that alerts them to rod packing failure.
 - c. The component leak detection surveys were successful in identifying more granular leaks, and the repair protocols instituted helped reduce emissions from leaks.³⁶
 - d. Respondents observed that the surveys resulted in quick identification and repair of more leaks and thus reduction of methane emissions.
5. Operators should continue to improve reporting of event and activity details.
6. Operators need to continue upgrading data management systems and implement operator best practices in response to SB1371 and COGR reporting requirements that could enable them to disaggregate data and include additional

³⁶ Transmission Compressor Station leaks increased slightly due to an overall increase in operating hours which increase the opportunity for leaks, and challenge O&M scheduling to minimize disruptions to operations. The converse was seen in Storage facilities where overall decreased compressor operations had a corresponding decrease in both emissions and leaks.

components and assets not previously reported that results in improved quality of information.

Summary of Gas Company Emissions

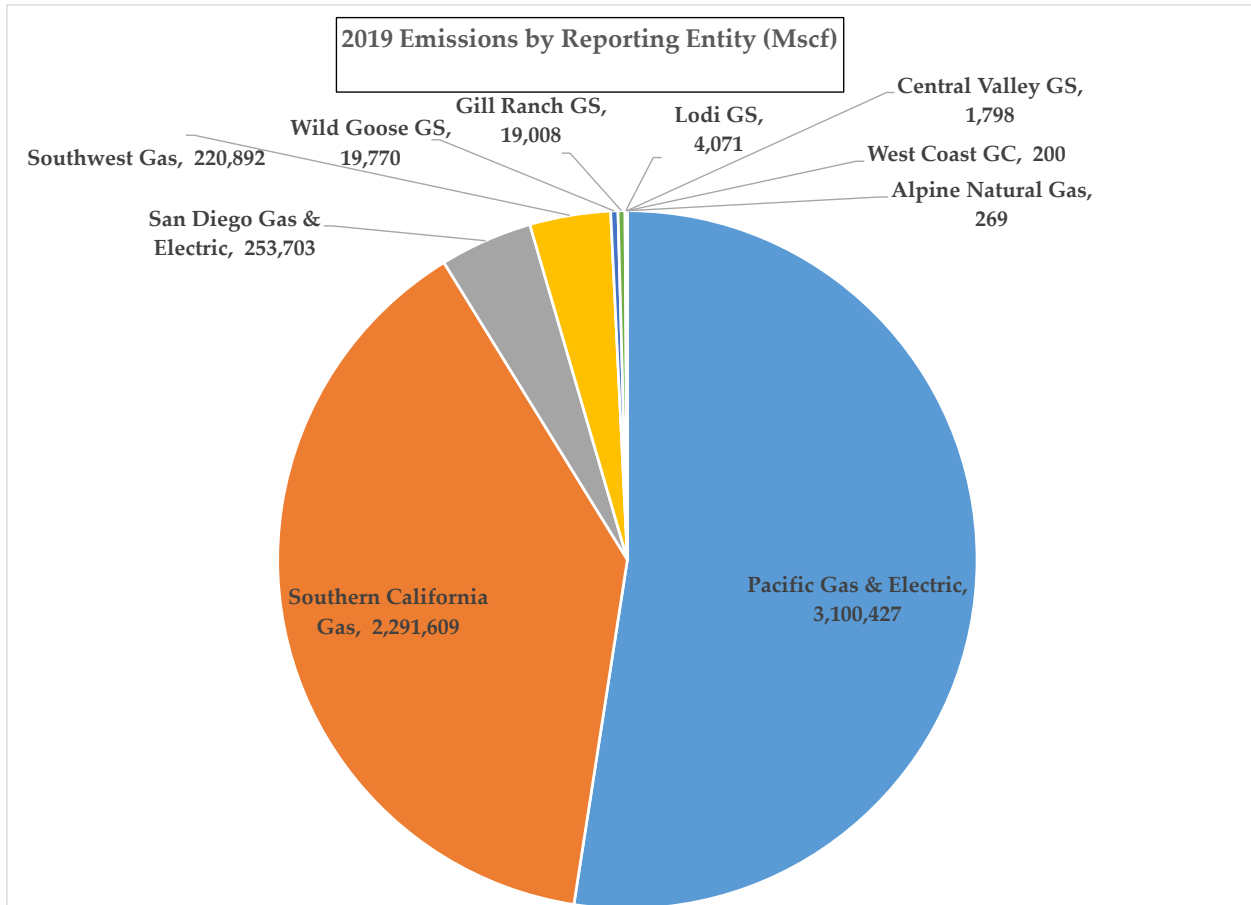
In 2019, the overall emissions decreased 1% from 2018. Table 6 shows respondents' YOY changes from 2018 to 2019. Importantly, Figure 1: 2019 Emissions Reported by Entity also highlights that the top four utilities make up approximately 99.2% of the emissions inventory while the remaining six utilities and ISPs make up the remaining 0.8% of the total system emissions. The circumstances and explanations for changes in gas company emissions should be referred to when questions arise when reviewing the emissions presented by system category.

Table 6: Emissions by Respondent, 2015, 2018-2019

Entity	2015 Baseline		2018		2019		2015 Baseline to 2019 Change		2018-2019 YOY Change	
	Mscf	%	Mscf	%	Mscf	%	Mscf	%	Mscf	%
Pacific Gas & Electric	3,294,368	50%	2,913,208	50%	3,100,427	52%	(193,942)	(6%)	187,219	6%
Southern California Gas	2,779,853	42%	2,348,101	41%	2,291,609	39%	(488,243)	(18%)	(56,491)	(2%)
San Diego Gas & Electric	282,041	4%	253,536	4%	253,703	4%	(28,338)	(10%)	167	0%
Southwest Gas	214,309	3%	217,151	4%	220,892	4%	6,583	3%	3,741	2%
Wild Goose GS	24,003	0.36%	21,248	0.37%	19,770	0.33%	(4,233)	(18%)	(1,478)	(7%)
Gill Ranch GS	3,636	0.06%	15,727	0.27%	19,008	0.32%	15,372	423%	3,281	21%
Lodi GS	1,638	0.02%	2,814	0.05%	4,071	0.07%	2,433	149%	1,257	45%
Central Valley GS	806	0.01%	1,929	0.03%	1,798	0.03%	992	123%	(131)	(7%)
West Coast GC	509	0.01%	252	0.00%	200	0.00%	(309)	(61%)	(51)	(20%)
Alpine Natural Gas	6	0.00%	241	0.00%	269	0.00%	264	4,707%	28	12%
Total	6,601,169	100%	5,774,205	100%	5,911,748	100%	(689,422)	(10.4%)	137,543	2.4%

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Figure 1: 2019 Emissions by Respondent (Mscf)



Pacific Gas & Electric

PG&E's has the largest geographical service territory in the state and the second largest gas utility in terms of throughput, with the highest level of emissions reported under SB1371. In 2019 PG&E reported emissions of 3,100,427 Mscf increasing by 187,219 Mscf (6%) from the 2018 emissions of 2,913,208 Mscf. The YOY emissions increase was largely driven by a greater number of DM&S pipeline leaks (130,463 Mscf), Transmission M&R Station blowdowns (41,625 Mscf), DM&S M&R Station emissions (36,531 Mscf), and Transmission Compressor emissions (21,502 Mscf), which were slightly offset by several smaller reductions in other source categories.

The YOY DM&S pipeline leaks increased due to a combination of more leaks carried over from 2018 and more discovered in 2019 with fewer leaks repaired than in 2018. The contributing causes for the increase DM&S pipeline emissions in 2019 include:

- 2,359 more leaks carried over to 2019 than carried over to 2018.

- 7 fewer grade 1,
- 16 fewer grade 2, and
- 2,382 more grade 3 leaks carried over from the prior year.
- 1,844 net fewer leaks repaired in 2019 than in 2018.
 - 434 more grade 1,
 - 375 fewer grade 2, and
 - 1,903 fewer grade 3 leaks were repaired in 2019 than in 2018.
- 881 net more leaks found in 2019 than 2018.
 - 449 more grade 1,
 - 161 fewer grade 2, and
 - 593 more grade 3 leaks found in 2019 than in 2018.

PG&E's compliance plan included an approach that was approved by the Commission that focused on identifying and repairing the Super-Emitters in the distribution pipeline system that are expected to reduce emissions over time. They also were approved to focus on fixing a greater number of larger leaks rather than devote those resources to fixing low emitting grade 3 leaks. In addition, the implementation of the approved Risk-Based Survey (RBS) method that identifies survey plats in more leak prone areas results in a greater number of leaks found. The RBS is a predictive algorithm that is also used to estimate the number of unknown leaks from un-surveyed areas. "PG&E notes that the higher number of unknown leaks was due to a decrease in survey mileage from 2018 (24k miles) to 2019 (18k miles) and an increase in number of found leaks... that resulted from an issue with the detection method.³⁷

The YOY increase of 2,382 grade 3 leaks carried over from the prior years was offset by decreases in grade 1 and 2 leaks carried over that netted to 2,359 leaks carried over from 2018. In addition, 881 more leaks were discovered during the compliance and Super-Emitter surveys, with the increase comprised of 449 grade 1 (8.7%) and 593 grade 3 leaks (8.0%), which were offset by a decrease of 161 grade 2 leaks (5.4%) found in 2019.

Staff approved PG&E's new Risk-Based approach for 2019 surveys that uses historical leak data to focus surveys on plats that have higher leak densities or prevalence of leaks. PG&E surveys the plats with lower predicted leak rates within the 5-year survey compliance requirement. In addition, PG&E continued to utilize its Picarro survey techniques to identify and fix Super-Emitters. The adoption of the Risk-

³⁷ PG&E detected leaks in covered vaults where methane from microscopic leaks accumulated and when exposed during the leak survey, these resulted in a leak indication. However, once the accumulated natural gas dissipates, the leak is undetectable with its equipment. However, once a leak indication is noted it must be reported.

Based survey and the Super-Emitter approaches contributed to the increase in YOY leaks found.

As part of the Risk-Based approach PG&E used the predictive model to estimate the Unknown leaks in the un-surveyed portion of its territory. The Risk-Based model predicted a significantly larger number of Unknown leaks than estimated in prior years. The model predicted 20,667 Unknown leaks, which when combined with the Super-Emitter and adjusted pipeline leaker EF, resulted in an increase to pipeline emissions of 113,245 Mscf. The increase in Unknown leaks makes up the largest component of the YOY increase in DM&S pipeline emissions.

In 2019 PG&E found 16,464 distribution pipeline leaks, whereas in 2018, they found 15,583 leaks for a YOY increase of 881 leaks. In 2019, 10,656 leaks were carried over from prior years, for an increase of 2,359 leaks (28%), where in 2018 there were 8,297 leaks carried over. Conversely, PG&E repaired a total of 8,084 grades 1-3 leaks in 2019, which was 1,844 fewer than the total of 9,928 grades 1-3 leaks repaired in 2018.

These factors contributed to the net increase of 130,493 Mscf of DM&S pipelines emissions. It is hoped that continued emission abatement efforts, including the Risk-Based survey, the annual leak survey on select vintage pipe, and the continuation of Super-Emitter leak survey and a repair program that fixes Super-Emitters, will contribute to accelerated leak discovery and repair that brings down DM&S pipeline emissions overtime.

In 2019 for its DM&S damages emissions PG&E calculated the average main repair times separately from its services repair times, where it previously used a combined average, which resulted in a YOY increase of 12,175 Mscf.

In 2019 PG&E increased its maintenance activities at its Transmission M&R Stations, which resulted in increased blowdown emissions of 41,625 Mscf. Even though PG&E employs cross compression, project bundling, and evacuation in preparation for its maintenance activities, blowdowns are still a fact that cannot always be avoided. The type of projects, the number of projects, and the ability to bundle projects and perform cross compression are expected to vary YOY and are difficult to predict or trend.

The DM&S Metering & Regulation (M&R) Stations YOY increase of 36,531 Mscf is a result of adding 24 Type A3 M&R stations.³⁸ Because these emissions are based on a

³⁸ Distribution M&R Stations types and design vary based on station operating pressure and system design. Currently utilities following the emissions estimate methodology, categorize Distributions M&R Stations into six different categories: A1 = above grade, pressure <100 psi; A2 = above grade, pressure =100-300 psi; A3 = above

population EF where each Type A3 station is charged with emitting 1,684.5 Mscf per year the additional 24 M&R stations increased emissions by 40,428 Mscf, that was slightly offset by a decrease of 4-Type A2 M&R stations. Staff have been working with PG&E and Sempra to develop and implement a leaker EF emissions accounting protocol for DM&S M&R stations that should be implemented for 2020 and included in the 2021 Joint Report.

The PG&E efforts to identify M&R Station emissions includes going through their M&R station survey and O&M records to parse the number and types of leaks identified at each of their Distribution M&R stations from 2015 through 2019. Initially, it appears that identifying the leaking component coupled with the component leaker EFs from CARB's Mandatory Reporting Regulation (MRR) (Table 7) as well as including the pneumatic device EFs from manufacturer data or CARB's MRR (Table 3) will improve M&R station emissions estimates. The initial estimate of reduction to reported Distribution M&R station emissions is in the range of 740-790 MMscf.³⁹ This level of emissions reduction indicates that valuable resources would be deployed in other areas of the gas delivery system that would net greater overall reductions towards the 40% reduction target set forth in SB 1371.

In 2019 PG&E reduced its YOY blowdown emissions on its Transmission Pipeline and Transmission Compressor station facilities by a combined 25,400 Mscf. In addition, it reduced the Storage facility emissions for wellhead, component emissions, and component leak sources by a combined 20,600 Mscf, attributed to a greater awareness of leaks and emission associated with the implementation of COGR that identified leaks and emissions prompting timely repairs.

The storage facility and transmission station - compressor emissions are affected by several factors. The major factors affecting emissions are the number of hours in each operating mode, and the associated EF/hr. In 2019 for PG&E, the operating modes with the most impact on its storage compressors were pressurized operation and depressurized idle. Both modes had significant YOY changes in both hours and EFs. In 2019 the storage facility compressor emissions decreased by 3,235 Mscf or 40% YOY, where the pressurized operating hours increased 5,400 hours YOY (35%) and an offsetting decrease in the weighted average pressurized operating EF decreased from

grade, pressure >300 psi; B1 = below grade, pressure <100 psi; B2 = below grade, pressure =100-300 psi; and B3 = below grade, pressure >300 psi.

³⁹ CARB MRR component leaker EFs are aligned with Table W-7 to Subpart W of Part 98.

291 Scf/hr to 199 Scf/hr (31%). The depressurized idle hours decreased 7,400 hours or 21%, and the associated weighted average depressurized idle EF decreased 81% from 98 Scf/hr to 18 Scf/hr. The 40% decrease in YOY emissions was driven by the decrease in the measured EF's and the decrease in depressurized idle hours though the overall decrease was offset by increased pressurized operating hours.

The Transmission Compressor station compressor emissions increased 21,502 Mscf (78%) YOY to 49,204 Mscf. These compressor emissions were driven by a 29% increase in the weighted average pressurized EF that is applied to 44% of compressor hours, a 31,847 hour or 32% increase in pressurized operations, and a 654% increase in the weighted average EF for the combined pressurized idle, and depressurized idle modes that is applied to 56% of compressor hours.

Noting that one compressor accounted for 19,862 Mscf or 40% of the total transmission compressor emissions. This unit (HIN-K-12) also experienced a 7,911 Mscf (66%) increase in YOY emissions due to a combination of a 28% increase in both its operating EF and hours. Another example of compressor emission is the "TOP-K-5" unit with a YOY increase in its pressurized operating EF from 34 Scf/hr to 1,084 Scf/hr, an increase of 1,050 Scf/hr or 3,055%. That coupled with a 17% increase in associated pressurized operating hours drove the unit's total emissions increase of 4,522 Mscf or 2,740% YOY.⁴⁰ This single compressor's emissions change should raise attention to the importance of monitoring compressor performance (e.g., rod packing emissions) because it accounted for 21% of the YOY increased transmission compressor emissions.

PG&E continued to conduct quarterly comprehensive leak surveys in underground storage facilities pursuant to the requirements in the COGR, which became effective January 1, 2018. In mid-2019, PG&E also began grading all leaks identified through the quarterly surveys in compliance with the COGR. PG&E's compliance with COGR resulted in significantly fewer leaks discovered in 2019 compared to 2018. In addition, PG&E significantly reduced the wellhead leaks average repair time from 48.5 days in 2018 to 12.6 days in 2019. In 2019 PG&E modified its leak reporting system to correct double counting of some wellhead leaks in both "component leaks" and "storage leaks and emissions" classifications that occurred in 2018.

Note that in 2019, PG&E increased its down-hole safety valve (DHSV) testing at McDonald Island and Los Medanos storage facilities. The increase in testing is required

⁴⁰ The compressor TOP-K-5 had 2019 emissions of 4,687 Mscf up from 165 Mscf in 2018.

by a new California Department of Conservation Geologic Energy Management regulation requiring DHSV testing at least every six months. The DHSV testing is designed to detect safety and integrity issues with operator wells. PG&E did not report any significant emissions associated with this new activity in its report.

Southern California Gas

Southern California Gas Company (SoCalGas) is the state's second largest gas utility and reported emissions totaling 2,291,609 Mscf in 2019, a decrease of 56,491 Mscf (2%) from the 2,348,101 Mscf reported in 2018. Some of the reduction in 2019 emissions are attributed to implementation of the COGR, and blowdown best practices. Other reductions occurred in compressor emissions due to cyclical maintenance that offset increases that occurred in DM&S pipeline emissions, and MSA units.

For example, the compressor cyclical rod packing replacement at Transmission Compressor Stations and Storage facilities reduced the weighted average pressurized operating EFs by 92% and 86% respectively. This is an estimate based on a single measurement of the compressor emissions during the year, and it is not clear whether the actual emissions were sustained at these EF levels of emissions throughout the entire year. According to federal EPA regulations 40 CFR Section 60.5410 More frequent periodic measurements during the year would validate this level of emissions and provide more reliable emission estimates. The significant decreases noted in 2019 compressor EFs are directly attributed to SoCalGas's replacing rod packing in nineteen units at Transmission Compressor Stations and at nine units at Storage facilities. The percentage reduction in pressurized operating EFs correlates to the 39,598 Mscf or 91% and 8,080 Mscf or 84% reduction in compressor emissions at transmission and storage facilities, respectively. SoCalGas indicates it plans to increase the frequency of rod packing replacement, whereby increasing the frequency of rod packing replacement will reduce methane emissions attributed to worn or damaged rod packings that allow elevated levels of natural gas to escape.

The best practices of bundling blowdowns and reducing line pressure before blowdowns contributed to the 30,750 Mscf (19%) reduction of Transmission Pipeline blowdown emissions. Noting that blowdowns at transmission compressor stations increased 2,846 Mscf (26%) due to modernization and COGR related repair activity.

The MSA damages emission reduction is attributed to increased spending on media for awareness campaigns aimed at individuals that promotes calling 811 before

digging that is believed to have contributed to the reduction in the 2019 YOY total number of MSA excavation damages by 10,787 Mscf (49%).

The largest increase in emission occurred in DM&S pipeline leaks with an increase 48,965 Mscf (10%). The increase is likely a result of more frequent leak surveys implemented by the utility. The YOY DM&S pipeline leaks increased due to a combination of more leaks discovered and repaired in 2019 with fewer leaks carried over from 2018. The contributing causes for the increase DM&S pipeline emissions in 2019 include:

- 1,147 net more leaks found in 2019 than 2018.
 - 542 more grade 1,
 - 704 more grade 2, and
 - 99 fewer grade 3 leaks found in 2019 than in 2018.
- 208 net more leaks repaired in 2019 than in 2018.
 - 541 more grade 1,
 - 97 more grade 2, and
 - 430 fewer grade 3 leaks were repaired in 2019 than in 2018.
- 574 fewer leaks carried over to 2019 than carried over to 2018.
 - 1 fewer grade 1,
 - 88 more grade 2, and
 - 661 fewer grade 3 leaks carried over from the prior year.

SoCalGas reported that it replaced 74 miles of non-state-of-the-art pipe, including 28 miles of unprotected steel and 46 miles of early vintage plastic pipe. Using the leak rate per mile per year for these categories of materials, these replacements are estimated to provide an annual emissions reduction of 463 Mscf, which at 0.02% of SoCalGas's total 2019 emissions appears to be relatively insignificant. The cost benefit of pipeline replacement pursuant to SB 1371 emissions mitigation needs to be evaluated considering all the natural gas mitigation benefits, and safety benefits as well as the improved reliability benefits. In comments provided to the draft report

SoCalGas clarified that it "...has a GRC-funded Bare Steel Replacement Program (BSRP) that focuses on the replacement of poor performing bare steel. SoCalGas targets replacing 29 miles of main and associated services annually above and beyond routine replacements in accordance with the Distribution Integrity Management Program (DIMP) regulations. SoCalGas has a GRC-funded Vintage Integrity Plastic Plan (VIPP) that focuses on the replacement of poor performing early vintage plastic for all pre-1986 plastic pipe. SoCalGas targets replacing 78 miles of main and associated services annually above and beyond routine replacements in accordance with DIMP regulations.

DIMP is an ongoing program that was developed in accordance with the requirements of the DOT and PHMSA, specifically 49 CFR Part 192, Subpart P (Gas Distribution Pipeline Integrity Management). The program's purpose is to improve pipeline safety by having operators identify and reduce pipeline integrity risks on distribution pipelines. DIMP focuses on potential threats and measures designed to reduce the likelihood and consequences of pipeline failures, with the secondary benefit of methane emission reduction. More information about SoCalGas' Integrity Management Programs can be found in the 2020 Gas Safety Plan."⁴¹

SoCalGas explained that for Transmission M&R Stations, the decrease in facility count and associated emissions resulted from a field verification project. In prior years, the values were overstated primarily due to the misclassification of assets and the inclusion of previously abandoned or decommissioned facilities. The updated station count was back adjusted to the 2018 emissions for comparability with 2019 emissions. The 2015 Baseline needs to be adjusted for the updated station counts.

There were several small projects approved through the compliance plan process were continued or completed in 2019 that individually did not have a material impact on the utilities' emissions. However, the cumulative impact of these projects should contribute to SoCalGas progress towards meeting the reduction goals. These projects include:

- Replaced five high-bleed pneumatic devices with one remaining device scheduled to be replaced in 2020. High bleed pneumatics can emit up to 100 times more emissions per device during operation compared to low bleed pneumatics.
- Enhanced prioritization and optimization of non-state-of-the art pipeline replacement programs by identifying leak clusters using eGIS.
- Implemented several projects at Storage facilities to reduce vented and fugitive emissions as outlined below:
 - Rebuilt a set of orifice meters with a history of high leak rates.
 - Improved measurement of the main unit packer leakage of rod packing at compressor facilities. This project enables collection of individual packer measurements to identify and replace leaking packers.
 - Removed several flow meters used to measure the flow of gas to various storage facilities that were out-of-service and a source of emissions.

⁴¹ 2020 Gas Safety Plan:

<https://www.socalgas.com/sites/default/files/2020%20SCG%20Gas%20Safety%20Plan%20Final.pdf>

- Replace chemical injection pumps powered by pressurized natural gas that is emitted after powering the pumps, with electric motor driven pumps to reduce gas venting to atmosphere.
- Installed a facility drawdown system to reduce emissions during maintenance and construction work.
- Installed several small compressors at strategic field locations to compress gas between systems to capture gas that would otherwise be emitted as a blowdown during maintenance and construction work.
- Adding pipes to shunt wellhead venting from wellhead annuli that emit gas at certain pressure thresholds to send these emissions into nearby lines.
- Replacing pressure transmitter needle valves with quarter turn ball valves to promote complete isolation and reduce leakage.
- Hired additional Staff to mitigate the inventory of above ground minor leaks and updated the leak repair policy to repair of above-ground minor leaks on the Distribution system within 10 days of discovery.
- Created a Blowdown Emission Reduction Plan Form and updated the Blowdown Reporting Form to improve the accuracy and tracking of blowdown methods, reduction effectiveness and efficiency.
- Purchased Remote Methane Leak Detectors (RMLDs) to perform instrumented above ground survey on high pressure M&R facilities.

San Diego Gas and Electric

San Diego Gas & Electric (SDG&E) is the state's third largest utility and reported 2019 emissions totaling 253,703 Mscf, a slight increase of 167 Mscf (0.1%) from the 253,536 Mscf reported in 2018. As SDG&E and SoCalGas operate under Sempra Energy, both utilities share similar practices and efforts in reducing emissions.

For 2019, SDG&E reported relatively significant YOY emissions reductions from components leaks in transmission compressor stations, customer MSA damages and transmission compressor emissions. The emission reductions were offset by YOY increases in DM&S pipeline leaks and overall blowdown emissions. The transmission compressor station component leaks decrease of 2,535 Mscf (87%) is the result of continued leak mitigation resulting from the COGR. The MSA damage reduction of 1,565 Mscf (52%) is due to outreach and awareness programs instituted by SDG&E gaining traction. / The transmission compressor emissions decrease of 267 Mscf (21%) is attributed to a 14% decrease in pressurized operating hours offset by a 147% increase in pressurized operating EF. The YOY increases in DM&S pipeline leaks of 2,032 Mscf (51%) due to surveys of more leak prone areas increasing the number of leaks used to calculate emissions. The YOY increase in overall blowdown emissions of 1,990 Mscf (94%) are a function of type and number of activities performed that fluctuate annually.

Southwest Gas

Southwest Gas (SWG) is the state's fourth largest utility and reported emissions totaling 220,892 Mscf for 2019, which increased YOY by 3,741 Mscf (2%) from the 217,151 Mscf in 2018. The increase in emissions was mainly due to changes in the number of Distribution M&R Stations for station retirements, additions, and reclassifications. SWG reclassified 3 distribution M&R stations to transmission M&R stations since components within the stations were determined to meet the transmission requirements, however this transfer did not result in a YOY change because the 2018 data was revised to reflect these reclassifications per Staff direction.

In addition, DM&S pipeline leak emissions increased 832 Mscf (53%) due to discovering more leaks in 2019 than 2018. The MSA emissions increased due to increased number of customer meters installed. The YOY DM&S damages decreased 606 Mscf (52%) due outreach and awareness programs.

SWG does not have many leaks on its pipeline network and surveys its distribution system over a 3-year cycle, while some portions of its system are surveyed annually (e.g. business districts and PVC pipe). In addition, SWG has not experienced large YOY fluctuations in emissions. In 2019, the utility also:

- Implemented a 3-year repair cycle for grade 3 leaks
- Reduced YOY DM&S blowdown emissions 32% even though activity levels increased 10%.

Wild Goose Gas Storage

Wild Goose Storage (WGGS) reported emissions of 19,770 Mscf in 2019, which decreased by 1,478 Mscf (7%) from the 21,248 Mscf reported in 2018. The implementation of the COGR reduce YOY component leaks by 3,115 Mscf (78%) which was offset by an increase in blowdowns emissions of 1,469 Mscf (13%) due to an increase in the number and type of O&M projects.

Wild Goose undertook several new and on-going emission abatement efforts (described in its bi-annual compliance plan) that reduced total emissions. The company implemented daily leak checks at underground storage well pads with portable gas detection equipment, continued quarterly leak detection surveys of above ground equipment per COGR, installed new stationary methane monitoring equipment onsite, and placed a greater awareness on bundling, pressure reduction before blowdowns and methane evacuation procedures.

Gill Ranch Gas Storage

Gill Ranch Gas Storage (GRGS) reported emissions of 19,008 Mscf for 2019, which increased by 3,281 Mscf (21%) from the 2018 emissions of the 15,727 Mscf. In 2019 the compressor emissions increased 5,009 Mscf (89%) YOY from 2018 due to a 1,564 increase in pressurized operating hours (48%) offset by a 10% decrease in the pressurized operating EF. GRGS's 2019 weighted average pressurized operating EF is 39% larger than the Offline EF so that when the operating hours increase the emissions increase disproportionately to the increase in operating hours. A YOY decrease in 2019 facility blowdowns of 1,924 Mscf offset the increase in the compressor emissions.

Staff note that starting in 2018 GRGS implemented direct measurement of compressor emissions. However, GRGS discovered on June 1, 2020 that due to the installation of packing leak detection equipment in March of 2019, its internal SCADA recordkeeping system failed to record leak rates after the installation. To accurately estimate compressor emissions for all of 2019 for the SB 1371 emissions filing, GRGS used the leak rate readings taken on June 1st, 2020 for both pressurized idle and pressurized operating modes to estimate emissions for 2019.

Implementing the COGR was instrumental in improving GRGS's estimation of 2019 emissions as well as providing a better understanding and determining under reporting of prior year emissions.

Lodi Gas Service

Lodi Gas Service (LGS) reported emissions of 4,071 Mscf for 2019. The utility experienced increased YOY emissions of 1,257 Mscf (45%) from the 2,814 Mscf reported in 2018. The relatively large increase resulted from a 79% increase in compressor operating hours from 6,435 pressurized operating hours in 2018 to 11,491 pressurized operating hours in 2019. The weighted average pressurized operating EF increased slightly YOY by 6%.

LGS continues to implement a variety of BPs in its operations to reduce emissions, such as bundling, pressure reduction before blowdowns, operating equipment in longer intervals before starting/stopping/venting natural gas, increased pro-active inspections and repairs of both compressors and components, using gas detection devices to identify and confirm leaks and repairs, and performing regular aerial surveys of pipelines in order to identify and minimize potential dig-ins or accidental damages.

LGS installed stationary methane monitoring equipment, which became operational in August 2019, performs daily leak checks at well pad with a portable gas detector, and continues its compliance with the COGR quarterly leak detection surveys.

Central Valley Gas Storage

Central Valley Gas Storage (CVGS) reported emissions of 1,798 Mscf for 2019, a decrease of 131 Mscf from the 1,929 Mscf reported in 2018. While blowdowns emissions increased by 318 Mscf (130%) YOY, the installation of vent line meters on its compressors 2 and 3 helped CVGS monitor and reduce methane emissions by 438 Mscf (27%) YOY. CVGS had a 27% increase in pressurized operating hours from 5,232 hours in 2018 to 6,618 hours in 2019. The weighted average pressurized operating EF decreased 18% YOY from 105 Scf/hr in 2018 to 86 Scf/hr in 2019.

Since adopting direct measurement of the compressor emissions, it appears that prior year emissions were understated since there has not been any change in operations or assets before installing the meters. Staff will evaluate the 2018 and 2019 data to determine whether it warrants a change to CVGS's baseline.

West Coast Gas

West Coast Gas (WCG) is a small natural gas supplier and distribution utility with 200 Mscf in 2019 reported emissions and reported a 51 Mscf or 20% reduction from the 252 Mscf 2018 emissions. The reduction in YOY emissions is the direct result of a reduction in pipeline leaks between the two calendar years.

Alpine

Alpine gas storage reported emissions of 269 Mscf in 2019, an increase of 28 Mscf from the 240 Mscf reported in 2018. The utility's emissions remain relatively constant YOY with fluctuations due to a few additional pipeline leaks, and pipeline damages due to accidental dig-ins. In 2019 the increase in YOY emissions was the result of 8 dig-ins that drove the YOY increase of 20 Mscf in damages and the 7 Mscf in associated blowdowns to repair the dig-ins.

Detailed Emissions by Category, Source and Classification

The next section discusses the emissions by system categories, emission source, and source classification. Table 7 provides a comprehensive and detailed emission inventory for 2015, 2018, and 2019 calendar years.

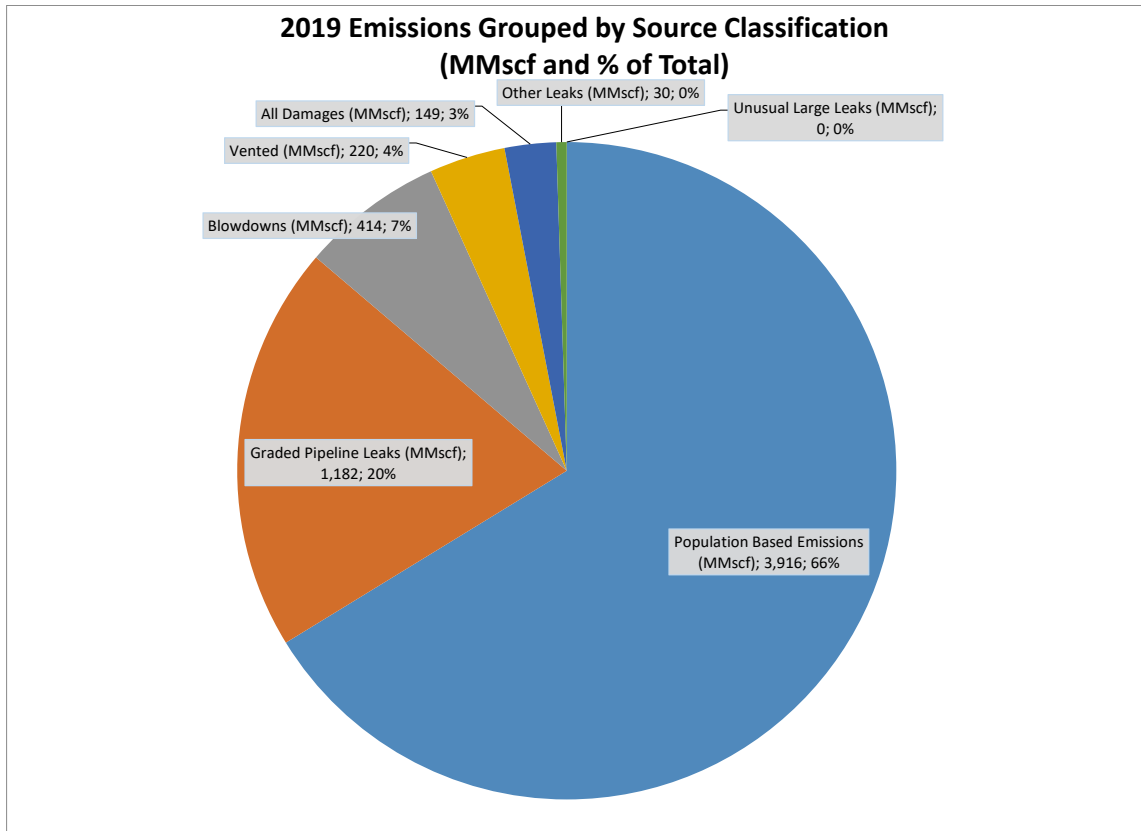
CALIFORNIA PUBLIC UTILITIES COMMISSION AND CALIFORNIA AIR RESOURCES BOARD-ANALYSIS OF THE UTILITIES' JUNE 15, 2020, NATURAL GAS LEAK AND EMISSION REPORTS

Table 7 summarizes information from the templates, where common items may be combined or regrouped as done in 2018. Because the reporting templates also include items reported for informal purposes, Table 7 does not report all line item categories as reported in the templates. For example, the M&R Station template captures Component Leaks in the EF used to report M&R Station emissions, and therefore, they are not shown separately to prevent duplicating emissions. The Transmission Compressor and Component Leaks are combined in the inventory report.

Table 7: Detailed Emissions (Category, Source, and Classification) 2015, 2018-2019

System Category	Emission Source	Source Classification	2015 Baseline	2018	2019	2015 Baseline to 2019 Change		2018 - 2019 YOY Change	
			Mscf	Mscf	Mscf	Mscf	%	Mscf	%
Transmission Pipelines	Pipeline Leaks	Population Based	5,238	5,102	5,067	(171)	(3%)	(35)	(1%)
	All Damages	Damages	81,793	4,171	1,420	(80,373)	(98%)	(2,750)	(66%)
	Blowdowns	Blowdown	455,055	297,494	252,716	(202,339)	(44%)	(44,777)	(15%)
	Component Emissions	Vented	4,592	35,433	32,178	27,586	601%	(3,255)	(9%)
	Odorizers	Vented	2,570	2,814	2,942	372	14%	128	5%
Transmission M&R Stations	Station Leaks & Emissions	Vented	941,622	861,647	855,364	(86,258)	(9.2%)	(6,283)	(1%)
	Blowdowns	Blowdown	65,583	28,432	68,594	3,011	5%	40,162	141%
	Component Emissions	Vented	21			(21)	(100%)	-	N/A
Transmission Compressor Stations	Compressor Emissions	Vented	106,257	72,520	54,156	(52,101)	(49%)	(18,363)	(25%)
	Blowdowns	Blowdown	31,088	62,616	55,232	24,144	78%	(7,383)	(12%)
	Component Emissions	Vented	7,186	24,039	23,661	16,475	229%	(378)	(2%)
	Component Leaks	Other Leaks	18,153	24,252	10,617	(7,536)	(42%)	(13,635)	(56%)
	Storage Tank Leaks & Emissions	Other Leaks	3	332	183	180	6,013%	(149)	(45%)
Distribution Mains & Services	Pipeline Leaks	Pipeline Leaks	1,458,399	1,000,156	1,182,396	(276,003)	(19%)	182,240	18%
	All Damages	Damages	236,145	118,242	130,483	(105,662)	(45%)	12,241	10%
	Blowdowns	Blowdown	5,046	1,036	1,861	(3,185)	(63%)	824	80%
	Component Emissions	Vented	3,281	-	-	(3,281)	(100%)	-	N/A
Distribution M&R Stations	Station Leaks & Emissions	Population	1,347,773	1,345,116	1,384,965	37,192	2.8%	39,849	3.0%
	Blowdowns	Blowdown	295	6	50	(245)	(83%)	45	785%
	All Damages	Damages	-	395	362	362	N/A	(34)	(9%)
Customer Meters	Meter Leaks	Population Based	1,635,911	1,658,638	1,670,537	34,626	2.1%	11,899	0.7%
	All Damages	Damages	-	31,683	16,880	16,880	N/A	(14,803)	(47%)
	Vented Emissions	Vented	2,363	1,278	1,056	(1,307)	(55%)	(222)	(17%)
Underground Storage	Storage Leaks & Emissions	Other Leaks	15,016	5,572	2,160	(12,856)	(86%)	(3,412)	(61.2%)
	Compressor Emissions	Vented	96,313	32,517	27,432	(68,881)	(72%)	(5,085)	(16%)
	Blowdowns	Blowdown	46,358	34,918	35,420	(10,938)	(24%)	502	1%
	Component Emissions	Vented	14,947	87,399	78,957	64,010	428%	(8,442)	(10%)
	Compressor & Component Leak Dehydrator Vent Emissions	Other Leaks	-	38,384	17,046	17,046	N/A	(21,338)	(56%)
Unusual Large Leaks/Emissions	Leaks and Emissions		-	-	-	-	N/A	0	N/A
	Total		6,601,171	5,774,205	5,911,748	(689,423)	(10.4%)	137,543	2.4%

Figure 2: Emissions Grouped by Source Classification, 2019



Grouping the system emissions by source classification resulted in the following observations:

1. The Population Based Leaks make up 66% of the total 2019 emissions as shown in Figure 2.⁴²
2. The 2019 Graded Pipeline Leak emissions make up 20% or about of total emissions and had a significant 18% increase from 2018 of 182 MMscf.⁴³
3. Though Blowdowns make up 7% of 2019 total emissions at 414 MMscf, they experienced a YOY decrease of 11 MMscf or 3%. Because Blowdown emissions are correlated with O&M activity, we expect YOY fluctuations, however, over time we should see a decreasing trend due to implementation of best practices.
4. The Vented emissions category had the second largest YOY decrease on both a volume and percentage basis at 36 MMscf and 14%, in large part attributed to the COGR implementation, improved rod packing maintenance that reduced the EFs used to calculate emissions which were significant enough to

⁴² See Table 3: Total Emissions by Source Classification, 2015 – 2019.

⁴³ Ibid

- offset the overall 20% increase in compressor operating hours. For example, the overall weighted average pressurized operating EF for all operators' storage and transmission compressors decreased 42% YOY from 472 Scf/hr in 2018 to 274 Scf/hr in 2019, which offset the 20% increase in pressurized operating hours.
5. The Damages classification had a small YOY decrease of 3% or 5 MMscf decrease attributed to expanded public outreach to call "811" before digging.
 6. The Other Leaks category, which includes component and compressor leaks in the Transmission Pipeline, Transmission Compressor and Underground Storage facilities experienced the largest YOY change on both a volume and percentage basis at 39 MMscf and 56%, in large part due to the COGR gaining traction to reduce leaks and emissions.
 7. There were no Unusual Large Leaks in 2019, or 2018.

Table 8 shows the detail composition of Blowdowns. The 2019 Blowdowns classifications experienced a 3% decrease of 10,628 Mscf from 2018. The decrease from the 2015 Baseline emissions of 189,551 Mscf or 31% are primarily due to project bundling and cross pressurization practices.

Table 8: Blowdown by Systems Category, 2015, 2018-2019

System Category	2015 Baseline [Mscf]	2018 [Mscf]	2019 [Mscf]	2015 Baseline to 2019 Change		2018 - 2019 YOY Change	
				Mscf	%	Mscf	%
Blowdowns							
Transmission Pipeline	455,055	297,494	252,716	(202,339)	(44%)	(44,777)	(15%)
Transmission M&R Stations	65,583	28,432	68,594	3,011	5%	40,162	141%
Transmission Compressor Stations	31,088	62,616	55,232	24,144	78%	(7,383)	(12%)
Distribution Mains and Services	5,046	1,036	1,861	(3,185)	(63%)	824	80%
Distribution M&R Stations	295	6	50	(245)	(83%)	45	785%
Underground Storage	46,358	34,918	35,420	(10,938)	(24%)	502	1%
Total-Blowdowns	603,425	424,501	413,874	(189,551)	(31%)	(10,628)	(3%)

Table 9 shows the detail composition of vented emissions. There is some variability between the vented emissions in the Transmission Compressor Stations and Underground Storage Facilities, where the implementation of the COGR affected each respondent differently, though in general COGR resulted in decreased YOY reported emissions. The reasons are complicated and specific to each respondent (see the section: Summary of Gas Company Emissions). Though the overall transmission compressor operations increased 8% from 89,600 in 2018 to 96,900 operating hours

during 2019 the pressurized operating EF decreased 37% resulting in a net decrease of 18,363 Mscf in YOY emissions. Overall injections into Underground Storage facilities also increased significantly YOY from 104,750 in 2018 to 135,750 operating hours in 2019 for a 31,000-hour increase or 30%. However, the overall Underground Storage compressor emissions decreased 5,085 Mscf or 16% due to the significant offsetting decrease of 44% in the overall weighted average pressurized operating EF from 223 Scf/hr in 2018 to 125 Scf/hr in 2019.

The Underground Storage component leaks also experienced a significant YOY decrease of 8,442 Mscf (10%) due to the continued benefits more frequent leak surveys required by COGR resulting in reduced leak counts and shorter leak durations from the rapid repair protocols.

Table 9: Vented Emissions by Systems Category, 2015, 2018-2019

System Category	2015 Baseline [Mscf]	2018 [Mscf]	2019 [Mscf]	2015 Baseline to 2019 Change		2018 - 2019 YOY Change	
				Mscf	%	Mscf	%
Vented Emissions							
Transmission Pipelines, Components	4,592	35,433	32,178	27,586	601%	(3,255)	(9%)
Transmission Pipelines, Odorizers	2,570	2,814	2,942	372	14%	128	5%
Transmission M&R Stations , Components	21	-	-	(21)	(100%)	-	-
Transmission Compressors Stations, Compressors	106,257	72,520	54,156	(52,101)	(49%)	(18,363)	(25%)
Transmission Compressors Stations, Components	7,186	24,039	23,661	16,475	229%	(378)	(2%)
Distribution Mains & Services, Components	3,281	-	-	(3,281)	(100%)	-	-
Customer Meters, Vented	2,363	1,278	1,056	(1,307)	(55%)	(222)	(17%)
Underground Storage, Compressors	96,313	32,517	27,432	(68,881)	(72%)	(5,085)	(16%)
Underground Storage, Components	14,947	87,399	78,957	64,010	428%	(8,442)	(10%)
Underground Storage, Dehydrator Vent	20,163	14	12	(20,151)	(100%)	(2)	(12%)
Total-Vented Emissions	257,693	256,012	220,393	(37,300)	(14%)	(35,619)	(14%)

Detailed Discussion for Each of the Seven Systems Categories

Transmission Pipeline:

PG&E, SoCalGas, SDG&E, Lodi Gas Storage (LGS), and Central Valley Gas Storage (CVGS) reported Transmission Pipeline Emissions; the transmission system category has shown significant emission reductions YOY in Blowdowns. As shown in Table 9 below, emissions decreased by 50,690 Mscf (15%) from the 345,013 Mscf reported in 2018 to 294,323 Mscf in 2019. This YOY reduction is made up almost entirely by the 44,777 Mscf YOY reduction in Blowdowns. Blowdowns are cyclical in nature

where we expect variability due to maintenance activity levels. Transmission pipeline damages are also highly variable, and event driven, where it is difficult to show causation, because one dig-in on a transmission pipeline could reap significant emissions. Utilities report that their out-reach, public and contractor education efforts correlate to the decreased damage events and emissions. (See company summaries above for more detail.)

Table 10: Transmission Pipeline Emissions, 2015, 2018-2019

Source	2015 Baseline		2018		2019		2018 - 2019 YOY Change	
	Mscf	%	Mscf	%	Mscf	%	Mscf	%
Pipeline Leaks	5,238	1%	5,102	1%	5,067	2%	(35)	(1%)
All Damages	81,793	15%	4,171	1%	1,420	0%	(2,750)	(66%)
Blowdowns	455,055	83%	297,494	86%	252,716	86%	(44,777)	(15%)
Component Emissions	4,592	1%	35,433	10%	32,178	11%	(3,255)	(9%)
Odorizers	2,570	0%	2,814	1%	2,942	1%	128	5%
Total	549,248	100%	345,013	100%	294,323	100%	(50,690)	(15%)

- The Transmission Pipeline Leaks category decreased 35 Mscf (1%) from 5,102 Mscf in 2018 to 5,067 Mscf in 2019. Typically, emissions for this category have remained constant because the emissions are based on the miles of transmission pipeline, which does not vary much YOY.
- In 2019 All Damages decreased by 2,750(Mscf (66%) to 1,420 Mscf. These emissions are event based and can fluctuate significantly from year-to-year. Notably, Southern California Gas’s emissions decreased from 3,913 Mscf in 2018 to zero in 2019, as there were no reported damages in 2019. Though utilities implemented best practices to reduce pipeline dig-ins (Best Practice 24), the efficacy of their programs will become evident over time.
- Blowdowns showed significant YOY reductions of 44,777 Mscf (15%) from 297,494 Mscf in 2018 to 252,716 Mscf in 2019. There are several factors affecting blowdowns and the potential for YOY fluctuations (e.g. the cyclical nature of O&M, ability to bundle projects, the amount of pipeline replacement, the size, length and pressure of the pipelines affected, and number of safety events.)
- Component Emissions category decreased 3,255 Mscf (9%) from 35,433 Mscf to 32,178 Mscf in 2019.
- The Odorizer emissions remained relatively constant with 2,814 Mscf in 2018 and 2,942 Mscf in 2019.

Transmission M&R Stations:

PG&E, SoCalGas, SDG&E, SWG, and Central Valley Gas Storage reported total Transmission M&R Station Emissions of 923,958 Mscf in 2019. This category of emissions is largely population based, except for the blowdowns, which are activity based.⁴⁴ As a result M&R station emissions will be relatively constant over time unless the population changes significantly or changes to the EF. In 2019 SoCalGas’s YOY decrease of 429 stations resulted in an decrease of 4,538 Mscf.⁴⁵ SWG’s YOY increase of stations and Mscf due to reclassification from distribution M&R stations. (See company summaries above for more detail.)

As noted in Table 11 below, the 2019 Blowdowns contributed 7% to the emissions in this category and increased by 40,162 Mscf (141%) YOY. Specifically, PG&E reported an increase in local transmission projects that lead to an increase in blowdowns in this category from 25,476 Mscf in 2018 to 67,101 Mscf in 2019.⁴⁶

Table 11: Transmission M&R Station Emissions, 2015, 2018-2019

Source	2015 Baseline		2018		2019		2018 - 2019 YOY Change	
	Mscf	%	Mscf	%	Mscf	%	Mscf	%
Station Leaks & Emissions	941,622	93%	861,647	97%	855,364	93%	(6,283)	(1%)
Blowdowns	65,583	7%	28,432	3%	68,594	7%	40,162	141%
Component Emissions	21	0%	-	0%	-	0%	-	NA
Total	1,007,226	100%	890,079	100%	923,958	100%	33,879	4%

There were no reportable component emissions in 2018 or 2019 because M&R station EF already takes this source of emissions into account. This line item is an

⁴⁴ Population based emissions in this category are calculated based on the number of M&R stations multiplied by an EF to obtain the emission estimate.

⁴⁵ In 2018 SoCalGas embarked on an asset verification of its M&R stations that resulted in adjusting downward its population of M&R stations. The verification was not completed in time for reporting 2018 Transmission M&R Station emissions, and these were updated in the 2020 Annual Report to reflect the verified station counts for comparability with 2019 figures.

⁴⁶ The 2018 emission estimates utilize a technique, which accounts for the chamber volume, pressure, and temperature of the gas at the time of the gas release pursuant to the requirements for 40 CFR Part 98, Subpart W greenhouse gas (GHG) reporting. Note that blowdowns where the chamber volume is less than 50 scf were not included, as discussed on page 12 of the narrative report. This technique allows PG&E to be more specific about blowdown volumes and utilize tracked data that was, for the first time in the 2018 emission year, granular enough to interpret, which gas release events happened at transmission M&R stations as opposed to relying on an industry-wide emission factor. Staff reviewed and approved this methodological change based on actual measurement.

artifact of inadvertently including component emissions that were reported for informational purposes in 2015. The 21 Mscf included in 2015 will be omitted at the same time that the 2015 Baseline adjustments are made.

Transmission Compressors:

PG&E, SoCalGas, and SDG&E reported 2019 total Transmission Compressor Station Emissions of 143,851 Mscf, which is a 39,908 Mscf (22%) decrease from 2018 emissions of 183,759 Mscf (see Table 12 below). (See company summaries above for more detail.)

Table 12: Transmission Compressor Station Emissions, 2015, 2018-2019

Source	2015 Baseline		2018		2019		2018 - 2019 YOY Change	
	Mscf	%	Mscf	%	Mscf	%	Mscf	%
Compressor Emissions	106,257	65%	72,520	39%	54,156	38%	(18,363)	(25%)
Blowdowns	31,088	19%	62,616	34%	55,232	38%	(7,383)	(12%)
Component Emissions	7,186	4%	24,039	13%	23,661	16%	(378)	(2%)
Compressor and Component Leaks	18,153	11%	24,252	13%	10,617	7%	(13,635)	(56%)
Storage Tank Leaks & Emissions	3	0.0%	332	0.2%	183	0.1%	(149)	(45%)
Total	162,687	100%	183,759	100%	143,851	100%	(39,908)	(22%)

The sub-category Compressor Emissions decreased 18,363 Mscf (25%) from 72,520 Mscf in 2018 to 54,156 Mscf in 2019. The decreased emissions come from SoCalGas of 39,598 Mscf (91%) was partially offset by a YOY increase from PG&E of 21,502 Mscf (78%). The net decrease is due significantly lower YOY compressor emissions EF's that decreased 37% that were offset by an 8% YOY increase of pressurized run hours to transport gas to storage facilities. SoCalGas's decrease was largely due to their O&M rod packing replacement efforts to mitigate the increased emissions from worn compressor rod packing that drove 2018 emissions at one facility.

Blowdowns decreased 7,383 Mscf (12%) from 62,616 Mscf in 2018 to 55,232 Mscf in 2019.

Component Emissions decreased by 378 Mscf (2%) from 24,039 Mscf in 2018 to 23,661 Mscf in 2019.

Component Leaks decreased by 13,635 Mscf (56%) from 24,252 Mscf reported in 2018 to of 10,617 Mscf reported in 2019. Both PG&E and SoCalGas showed YOY

decreases of around 5,000 Mscf. Both utilities mentioned that the COGR leak survey and repair schedules were responsible for the reduced emissions.

Lastly, Storage Tank Leaks and Emissions decreased by 149 Mscf YOY from the 332 Mscf reported in 2018 to 183 Mscf reported in 2019.

Distribution Mains and Services (DM&S):

PG&E, SoCalGas, SDG&E, SWG, West Coast Gas Company (WCGC) and Alpine reported total DM&S Emissions of 1,314,739 Mscf in 2019, which is an increase of 195,305 Mscf (17%) from the 1,119,434 Mscf in 2018 (see Table 13). (See company summaries above for more detail.)

Table 13: Distribution Mains and Services (DM&S) Emissions, 2015, 2018-2019

Source	2015 Baseline		2018		2019		2018 - 2019 YOY Change	
	Mscf	%	Mscf	%	Mscf	%	Mscf	%
Pipeline Leaks	1,458,399	86%	1,000,156	89%	1,182,396	90%	182,240	18%
All Damages	236,145	14%	118,242	11%	130,483	10%	12,241	10%
Blowdowns	5,046	0.3%	1,036	0.1%	1,861	0.1%	824	80%
Component Emissions	3,281	0.2%	-	0%	-	0%	-	NA
Total	1,702,871	100%	1,119,434	100%	1,314,739	100%	195,305	17%

The emissions from DM&S Pipeline Leaks showed a decrease of 182,240 Mscf (18%) from 2018 to 2019. The increase is primarily due to increased number of leaks found, carried over and estimated in the un-surveyed portions the service territory. Specifically, both PG&E and SoCalGas implemented changes that identify larger leaks. In addition, PG&E uses a risk-based model to identify the plats with the highest expected number of leaks for surveying in during the year.⁴⁷

Most of the increase in DM&S pipeline leaks came from PG&E. PG&E's large YOY increase of 130,463 Mscf and SoCalGas contributing the remainder with a YOY increase of 48,965 Mscf. Both PG&E and SoCalGas implemented new survey protocols and EF estimation methods that increased the emissions. (See company summaries above for more detail.)

⁴⁷ PG&E surveys all plats within 5-years in accordance with GO 112f which meets statutory requirements.

All Damages increased by 12,241 Mscf (10%) from 118,242 Mscf in 2018 to 130,483 Mscf in 2019. Virtually all the increase comes from PG&E, which split and updated its average repair times for mains and services.⁴⁸

Blowdowns showed an increase of 824 Mscf (80%) YOY from 1,036 Mscf reported in 2018 to 1,861 Mscf reported in 2019.

There were 3,281 Mscf of Component Emissions reported in 2015, while none have been reported since.⁴⁹

The Component leaks showed a decrease from 751 Mscf in 2018 to no reported emissions in 2019.

Detailed Discussion of DM&S Leaks and Emissions:

The data provided by respondents include leak discovery date, repair date, leak grade, pipeline classification as either main or service, pipeline material, method of discovery, and emissions calculation. Respondents also provided other parameters for informational purposes that were not used in any calculations, such as zip code location of leak, pipe size, pressure, and scheduled date of repair.

Table 14 shows the count of each leak grades 1 – 3, Un-surveyed leaks, and Above Ground (AG) Non-Hazardous leaks. The number of Un-surveyed (a.k.a. Unknown) leaks are estimated based on respondent's leak rate, and as such, Staff does not proportionately allocate the un-surveyed leaks by the proportion of graded leaks found in respondent's service territory.

Grade 3 leaks make up most of the DM&S leaks (49%). A significant amount of the grade 3 leaks carryover from previous years. In addition, PG&E uses an approved protocol where it prioritizes the repair of its "Super Emitters" to maximize the emissions reduction and as a result more grade 3 leaks are carried over to subsequent years. While the estimated un-surveyed leaks cannot be graded, these leaks make-up 45% of the leak inventory by count.

⁴⁸ The above ground damages associated with MSA's that was included in the 2018 balance totaling 23,901 Mscf was deducted from the 2018 DM&S damages and transferred to 2018 MSA damages to match up with the 2019 damages.

⁴⁹ The 2015 balance of DM&S Component Emissions is an artifact of inadvertently including Component emissions provided for informational purposes and represents duplicating emissions either included in Distribution M&R Station EFs, or MSA EFs. The 2015 balance will be evaluated for adjustment at the same time we make the of 2015 Baseline adjustments.

Table 15 shows that grade 1 leaks are repaired quickly, taking a weighted average of 2.6 days to fix which is an improvement of 22.7% from the 2018 weighted average of 3.3 days to fix. This trend to reduce average repair times extends to grade 2 and 3 where each experienced weighted average repair time decreases of 22.3% and 24.5% respectively. There is more variability in the average time to repair grade 2 and 3 leaks where smaller utilities, such as SDG&E, SWG, WCGC, have shorter average repair times than the major utilities due to the volume of leaks in their inventories.

Table 14: Leak Count by Grade in 2019

Leak Grade	Natural Gas Leaks				Total	%
	Carried Over from 2018	Discovered in 2019	Repaired in 2019	Estimated Unsurveyed		
Grade 1	23	9,232	(8,985)	-	270	1%
Grade 2	1,153	5,098	(3,529)	-	2,722	5%
Grade 3	17,389	12,331	(4,640)	-	25,080	49%
Unsurveyed - No grade	-	-	-	22,888	22,888	45%
Above Ground - Hazardous	-	-	-	-	-	0%
Above Ground - Non-Hazardous	-	-	-	-	-	0%
Total	18,565	26,661	(17,154)	22,888	50,960	100%

Table 15: Average Days to Repair by Entity in 2019⁵⁰

Entity	Average Repair Days		
	Grade 1	Grade 2	Grade 3
PG&E	3.5	93.3	842.7
SCG	1.1	207.3	721.5
SDG&E	1.2	22.2	16.2
SWG	1.0	2.0	45.4
WCGC	NA	NA	111.0
2019 - Weighted Average	2.6	129.0	730.6
2018 - Weighted Average	3.3	166.0	968.0
System Wide - YOY Change	(0.7)	(37.0)	(237.4)
System Wide - YOY Percent Change	(22.7%)	(22.3%)	(24.5%)

⁵⁰ PG&E calculates its Average Repair Days based on the original discovery date, where leaks initial grade may not require immediate repair such as a Grade 3 leak, when it gets subsequently regraded to a higher grade the repair prioritization changes per the requirements for the new grade. However, the average number of days to repair does not account for the leak regrade date. Therefore, it does not take many regraded old Grade 3 leaks to skew the overall average time to repair.

Distribution M&R Stations:

PG&E, SoCalGas, SDG&E, SWG and Alpine reported 2019 total emissions in this category of 1,385,377 Mscf, which increased by 39,860 Mscf (3%) from the 1,345,518 Mscf reported in 2018 (see Table 15). Except for Blowdowns and All Damages, the emissions in this category are based on the number of M&R stations multiplied by an EF.

Small adjustments in the reported data are due to improvements in the reporting of individual facility types, as well as closures and additions of new M&R stations. As a result of the improved asset reporting, PG&E had a YOY increase in emissions for Station Leaks & Emissions of 36,531 Mscf from 754,014 Mscf in 2018 to 790,545 Mscf in 2019. Still, PG&E mentions that the increase in emissions is directly attributed to improved reporting and the total will undergo typical fluctuations YOY.

Staff note that Distribution M&R station emissions estimation is going through dramatic changes as both major utilities are proposing to use leaker-based emissions reporting in 2020. The proposals are based on actual leak detection multiplied by EFs from CARB’s Mandatory Reporting Regulation (MRR) (Table 7) as well as including the pneumatic device EFs from manufacturer data or CARB MRR (Table 3). (See 2015 Baseline adjustments and company summaries above for more detail.)

Table 16: Distribution M&R Stations Emissions, 2015, 2018-2019

Source	2015 Baseline		2018		2019		2018 - 2019 YOY Change	
	Mscf	%	Mscf	%	Mscf	%	Mscf	%
Station Leaks & Emissions	1,347,773	100%	1,345,116	100%	1,384,965	100%	39,849	3.0%
Blowdowns	295	0%	6	0%	50	0%	45	785%
All Damages	0	0%	395	0%	362	0%	-34	(9%)
Total	1,348,068	100%	1,345,518	100%	1,385,377	100%	39,860	3.0%

Customer Meters:

PG&E, SoCalGas, SDG&E, SWG, WGGs, and Alpine reported Customer Meter emissions totaling 1,688,473 Mscf which decreased by 3,126 Mscf (0.2%) from 1,691,598 Mscf reported in 2018, see Table 17. (See company summaries above for more detail.)

Table 17: Customer Meter Emissions, 2015, 2018-2019

Source	2015 Baseline		2018		2019		2018 - 2019 YOY Change	
	Mscf	%	Mscf	%	Mscf	%	Mscf	%
Meter Leaks	1,635,911	100%	1,658,638	98%	1,670,537	99%	11,899	0.7%
All Damages	N/A	N/A	31,683	1.9%	16,880	1.0%	(14,803)	(47%)
Vented Emissions	2,363	0.1%	1,278	0.0%	1,056	0.1%	(222)	(17%)
Total	1,638,274	100%	1,691,598	100%	1,688,473	100%	(3,126)	(0.2%)

Overall, the customer meters category has the largest share of the total emissions at 28%, and once again comprises the largest share (43%) of population-based emissions for the 2019. MSA emissions are not expected to fluctuate widely YOY because they are based on an EF applied to the number of meter sets.⁵¹

The All Damages category was not part of the 2015 reporting but was added in 2018. The YOY decrease in 2019 of 14,803 Mscf (47%) from 31,683 Mscf in 2018 to 16,880 Mscf in 2019 primarily resulted from SoCalGas’s reduction of 10,787 Mscf (49%) from 22,192 Mscf in 2018 to 11,405 Mscf in 2019. SoCalGas reported the reduction in meter damages can be attributed to the Gas Infrastructure Protection Program.

Although Vented Emissions of 1,056 Mscf in 2019 are relatively insignificant, this emission source decreased by 222 Mscf (17%) from 2018. These blowdown emissions are a function of O&M activity levels and vary YOY due to a variety of repair work and maintenance performed on the MSAs.

Underground Storage:

PG&E, SoCalGas, CVGS, GRGS, LGS, and Wild Goose Storage (WGGGS) reported Underground Storage systems emissions for 2019. As seen in Table 18 below, Underground Storage emissions decreased 37,777 Mscf (19%) from 198,804 Mscf in 2018 to 161,027 Mscf in 2019.

⁵¹ Currently, the gas companies provide their actual MSA leaks found on their systems in their annual filings on an information only basis. The major utilities are currently working on projects to develop leaker EFs and bubble leak indications to evolve the MSA leak category and to estimate MSA emissions by extrapolating MSA survey leaks on the same basis as that used for DM&S pipeline leaks. The progress of the projects and utility proposals will be taken up in the 2021 winter workshop.

Table 18: Underground Storage Emissions, 2015, 2018-2019

Source	2015 Baseline		2018		2019		2018 - 2019 YOY Change	
	Mscf	%	Mscf	%	Mscf	%	Mscf	%
Storage Leaks & Emissions	15,016	8%	5,572	2.8%	2,160	1.3%	(3,412)	(61%)
Compressor Emissions	96,313	50%	32,517	16%	27,432	17%	(5,085)	(16%)
Blowdowns	46,358	24%	34,918	18%	35,420	22%	502	1%
Component Emissions	14,947	8%	87,399	44%	78,957	49%	(8,442)	(10%)
Compressor and Component Leaks	-	0%	38,384	19%	17,046	11%	(21,338)	(56%)
Dehydrator Vent Emissions	20,163	10%	14	0.0%	12	0.0%	(2)	(12%)
Total	192,797	100%	198,804	100%	161,027	100%	(37,777)	(19%)

The Storage Leaks and Emissions decreased 3,412 Mscf (61%) YOY from 5,572 Mscf in 2018 to 2,160 Mscf in 2019. This is largely due to PG&E reducing emissions by 2,812 Mscf (61%) from 4,636 Mscf in 2018 to 1,824 Mscf in 2019 where they focused efforts on additional leak grading starting in August 2019 and compliance to the requirements of the COGR. (See company summaries above for more detail.)

Compressor Emissions decreased by 5,085 Mscf (16%), which are attributed to the positive effects from replacement of compressor rod packing offset by the 30% increase in compressor run hours for injections into storage. The net decrease is due significantly lower YOY compressor emissions EF's that decreased 44% offset by a 30% YOY increase of pressurized run hours. SoCalGas's experienced the largest net YOY decrease of 86% in its weighted average pressurized operating EF though partially offset by a 12% increase in run hours, which resulted in an 8,080 Mscf (84%) YOY decrease in storage compressor emissions. PG&E and CVGS also experienced YOY decreases of 3,234 (40%) and 438 (27%) Mscf, respectively. Whereas GRGS, LGS, and WGGs experienced increases in YOY emissions of 5,009, 1,395, and 264 Mscf, respectively, except for LGS the increases were a result of significantly higher compressor run times that overshadowed the offsetting decrease in their weighted average pressurized operating EFs. LGS experienced higher run hours and a higher weighted average EF.

Blowdown emissions remained relatively constant YOY. This source category increased by only 502 Mscf (1%) from 34,918 Mscf in 2018 to 35,420 Mscf in 2018.

Component Emissions decreased by 8,442 Mscf (10%) YOY from 87,399 Mscf reported in 2018 to 78,957 Mscf reported in 2019.

Compressor and Component Leaks also experienced a decrease of 21,338 Mscf (56%) YOY from 38,384 Mscf in 2018 to 17,046 Mscf reported in 2019. This significant decrease directly resulted from PG&E's reduction from 11,190 Mscf in 2018 to 769 Mscf in 2019. The reduction is attributed to improvements in leak repairs and repair of leaks from increased surveys resulting from the COGR requirements. In addition, the 2019 data corrected prior year's double counting of some wellhead emissions included in both the component leaks and storage leaks and emissions.

In the dehydrator source category, PG&E is the sole source of emissions, which decreased by 2 Mscf YOY. All other dehydrator facilities use either a vapor recovery unit to reinject gas into the pipeline and/or thermally oxidize the glycol/methane mixture after dehydration and therefore have no reported emissions.

Unusual Large Leaks:

There were no unusual large leaks reported in 2019. The 2019 Winter Workshop included a review of the definition for categorizing this type of emission and it was determined that each discrete event depends on situational factors that should be reviewed and evaluated for inclusion in Unusual Large Leaks. The determination should not be based solely on an emission threshold level, nor should it be left to the utility's discretion. Staff will continue to analyze the annual filings for leaks that might warrant inclusion in this category and work with respondents to help identify discrete events that may qualify as an Unusual Large leak.

Lessons Learned

In 2019 the data collection and review process did not change significantly from 2018 with the usual interaction between Staff and respondents to refine the annual data and understand YOY fluctuations. Staff continued to work with gas companies to evolve emissions estimation methods in step with gas company implementation of their Compliance Plans. As in prior years there continue to be lessons learned from this year's submittal and review process. The most significant Lessons Learned to be shared are:

- We continue to find inadvertent and unforeseen improvements in reporting once the data comes in, which poses challenges in evaluating and modifying the reporting templates during the summer review cycle.

- Staff continue to see different interpretations of reporting requirements. A greater effort is needed in future reporting workshops to ensure a standard understanding that is shared by all respondents to minimize differences in reporting. In part, this observation stems from the differences in how entities chose to report the COGR component leaks in their templates. Some summarized the leaks of each asset type and others listed each discrete leak, and in one case an ISP did not include the leaks they found in their filing. This points to Staff doing a better job communicating what is required during the annual template workshop.
- The ongoing issue of solidifying the extent and magnitude of Baseline and prior year adjustments. The importance of developing and communicating the process for prior year adjustments has not lessened and becomes more critical to assess the relative benefit of mitigation projects. Baseline adjustments were discussed during the 2020 Winter Reporting Workshop and it was determined that significant adjustments are warranted in MSA and Distribution M&R Stations, which have not been fully quantified at this time. Time will be set aside in the next winter workshop to this complicated area given the financial ramification associated with meeting emissions reduction goals in 2025. At this time Staff plan to adjust Baseline values for known discrepancies, changes in methodology, new information and updated EFs in the 2021 Annual Report.

Conclusion:

1. The continued improvement in emissions estimate methodologies and updated emissions factors developed through the NGLA program has provided a clearer picture of the emissions estimate for the California Transmission and Distribution system.
2. The compressor vented emissions at the major utilities and some ISPs are based on a single annual EF measurement taken for each mode of operation to comply with federal and state requirements.⁵² In addition, these operators follow the

⁵² The State Oil and Gas Rule requires rod packing to be replaced when the annual measured emissions exceed 2 cfm per compressor cylinder, however, due to the lack of measurement criteria, specifying when and how measurements should take place, operators have the latitude to choose when to measure the emissions. There are many factors that affect emissions rates significantly such that there are many questions surrounding the integrity of the annual measurements. § 60.5385 Paragraphs (a) through (d) apply to reciprocating compressor facilities

minimal requirement that allows maintaining rod packing for up to 26,000 hours of pressurized operations, regardless of condition or leakage.⁵³ Many factors affect leak rates during each mode of operations, such that readings could vary significantly in a matter of hours or days resulting in significant variation in the EF. It appears that utilities may not take the necessary steps to increase their understanding of discrete compressor operations to optimize their performance. Timely maintenance has the corollary benefit of minimizing emissions as well as the economic benefit of not wasting lost gas. Whereas the ISPs have tighter margins, with a profit-based funding model that may incentivize cost effective emission reduction. Evidence suggests that more regular measurement should be required to ensure the integrity and reliability of compressor emissions estimates. In fact, given current technology, continuous monitoring of vented emissions should be considered.

3. The COGR reporting requirements improve Staff and operator understanding of transmission and storage compressor facility emissions. Component emissions and leak estimates appear to be improving with operators taking more granular and frequent component emissions and leak measurements as required.
4. In past years, the implementation of maintenance best practices, such as vacating gas from lines, bundling work, and better scheduling techniques, contributed to the significant reduction in blowdown emissions. However, in 2019 blowdown emissions increased showing that fluctuations based on activity drivers (e.g. number of repairs, pipe replacement, dig-ins, general O&M, etc.) is still a significant factor in YOY emissions and therefore, we should expect them to fluctuate YOY.

(a) You must replace the reciprocating compressor rod packing **according to either paragraph (a)(1) or (2) of this section or you must comply with paragraph (a)(3) of this section.** (Because the statute uses “or” operators have opted to use the 26,000-hour threshold.)

(1) **Before the compressor has operated for 26,000 hours.** After initial startup, October 15, 2012, or the date of most recent rod packing replacement, whichever is later.

(2) **Prior to 36 months from the date of the most recent rod packing replacement, or 36 months from the date of startup for a new reciprocating compressor** for which the rod packing has not yet been replaced.

(3) **Collect the emissions from the rod packing using a rod packing emissions collection system ...** through a closed vent system.

⁵³ For example, SoCalGas replaces rod packing units after approximately 26,000 hours of use to prevent leakage, and SoCalGas’s observations and experience indicate that the speed and magnitude of rod packing failure is not linear. The rod packing maintenance may go decades given some compressors log less than 1,000 hours a year.

5. Additional adjustments to the 2015 Baseline were raised in this year's reporting cycle that are needed to reflect more accurate leak and emissions reporting methods. Currently, the total Baseline adjustment impact is anticipated to be in the range of 25%, which creates four issues: 1) the downward adjustment to the Baseline cannot be counted towards emissions reductions, 2) the overall reduction target becomes smaller in magnitude, 3) Baseline adjustments largely affect population-based emissions that are difficult to reduce without accurate emissions accounting, and 4) adjustments may shift the focus of reduction efforts. An accurate 2015 Baseline is important for all entities to have a firm idea what and where to reduce emissions. In particular, the Baseline adjustments affect PG&E's and SoCalGas's population-based emissions that conversely amplify the emissions reductions achieved in other categories.⁵⁴ Because of the amplification effect, they may be in a better position to reach their 20% target reduction from 2015 Baseline by 2025.⁵⁵ If they fail to meet the 20% reduction by 2025, pursuant to PUC Decision D.19-08-020, their LUAF cost recovery will be restricted in 2025. Staff plan to make appropriate adjustments in time for inclusion in the 2021 annual report.

⁵⁴ The amplification occurs because the total utility emissions as the denominator decreases but the net reductions to-date stay the same, which causes the percent of reduction to increase relative to the whole. For example, if PG&E's reductions since 2015 were 0.35 MMscf and its unadjusted Baseline is 2.0 MMscf the apparent reduction is 17.5%, and by updating the Baseline to 1.75 MMscf the 0.35 MMscf reduction increases to 20%.

⁵⁵ The three utilities PG&E and SoCalGas must reduce sector emissions 20% by 2025 to claim full cost recovery of their Lost and Un-Accounted for (LUAF) gas.

Appendix A: Methods for Estimating Emissions

Explanation of methods used for reporting and estimating leaks and emissions in the Joint Report.		
System Categories	Emission Source Categories	Description
Transmission Pipeline	Pipeline Leaks	Pipeline operators were instructed to provide emissions using the approved EF by number of miles of pipeline. It was determined that use of the EF from INGAA Greenhouse Gas Emission Estimation Guidelines for Natural Gas Transmission and Storage - Volume 1 GHG Emission Estimation Methodologies and Procedures (September 28, 2005 - Revision 2) - Table 44 study would be the best available for Transmission Pipeline emissions at this time.
	All damages (as defined by PHMSA)	Event specific emissions data reported where emissions were estimated either from modelling or size of breach using pressure and duration to calculate the emissions.
	Pipeline Blowdowns	The blowdown emissions are calculated based on unique equipment attributes and measured with engineering calculations on an individual basis.
	Component Emissions:	The emissions from components associated with transmission pipeline operations are based on the recommended EFs outlined in Appendix 9 of the Data Request. In some cases, the components did not meet the definition for the EFs and discrete approximations based on manufacturer provided leak rates, direct measurement of the different operating states as well as the for specific values recommended for use in calculating component specific leaks times number of units of equipment.
	Pneumatic Devices	
	Pressure Relief Valves	
	Component Leaks:	This new category was added to the reporting templates for RY 2016. The purpose is to capture fugitive component leaks in this category. This differentiates them from emissions from components that result from normal operations or by design. No emissions were reported in this category for RY 2016.
	Odorizer (Odorizer and Gas Sampling Vents)	The EFs recommended in Appendix 9 were used where directly applicable, however where transmission pipeline dehydrator equipment did not match the pipeline operators used the discrete equipment attributes and operations profile to estimate emissions. The methods used appeared to provide the best estimate of emissions given the variety and operating context of these facilities.
Transmission M&R	M&R Stations	The emission estimates for M&R stations are based on the EFs recommended in Appendix 9 multiplied by the population of each type of M&R station.

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	M&R Components Emissions.	The purpose of this category is to capture emissions that occur in M&R station components that result from normal operations or by design of the component. The emissions from components are captured in the EF used on a station by station basis and the discrete information on a subset of components in the facility would duplicate emissions and present misleading count information. Until further work can be done with more comprehensive survey techniques relying on the recommended EFs on a station by station basis is considered the best estimate of emissions at this time.
	M&R Leaks	This new category was added to the reporting templates for RY 2016. The purpose of this category is to capture fugitive leaks on components within the M&R station and create a record as a basis for evaluating using actual measured leaks rather than an M&R station EF for estimating emissions. Currently the discrete leaks for M&R stations would be captured in the recommended EFs used to estimate the M&R station emissions and only where it could be determined that inclusion of discrete M&R leaks were not duplicated would they be included in the count of emissions for this category.
	M&R blowdown	Blowdown emissions were estimated based on the calculation of the unique equipment volume being vented corrected for pressure and temperature at the time of the release. The estimates for blowdown events in general provide reliable emission estimates.
Transmission Compressor Stations	Compressor Equipment - Centrifugal and Reciprocating.	The emissions calculated based on the direct measurement of each compressor unit given its operating state and pressure, and then the emissions are based on number of operating hours in each operating state.
	Compressor Leaks:	This new category was added to the reporting templates for RY 2016. The purpose is to capture fugitive leaks in this category and differentiate them from emissions from compressors that result from normal operations or by design. There were no discrete compressor leaks in RY 2016.
	Equipment and pipeline blowdowns	Blowdown emissions were estimated based on the calculation of the unique equipment volume being vented corrected for pressure and temperature at the time of the release. The estimates for blowdown events in general provide reliable emission estimates.
	Components Emissions.	The equipment and component emissions are based on the leaks detected at the compressor stations times the recommended EF for that type of equipment per Appendix 9. The purpose of this tab is to capture emissions that result from normal operations or by design.
	Component Leaks:	This new category was added to the reporting templates for RY 2016. The purpose is to capture fugitive component leaks in this category. This differentiates them from emissions from components that result from normal operations or by design. No emissions were reported in this category for RY 2016.

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	Compressor Station Storage Tanks	These emissions are based on discrete tank pressure fluctuations due to exterior temperature fluctuations. The initial volume of gas release calculation is based on the starting and ending pressures assuming a constant temperature.
Distribution Mains and Services Pipelines	Pipeline Leaks - Below Ground	The emissions from leaks detected in 2016 in Distribution Mains and Service pipelines are calculated assuming that the leak was emitting from the first day of the calendar year through date of repair, or the entire year if not repaired in 2016, times the recommended EF. For identified leaks carried over from prior years the emissions are calculated from the beginning of the year through repair date (if repaired in 2016) or end of year times the recommended EF. In addition, leaks occurring in un-surveyed parts of operator's service territory were estimated based on the leak occurrence rate in the surveyed portion of the territory extrapolated based on number of years in the survey cycle to come up with the number of expected leaks in the un-surveyed territory times the recommended EF. This method of estimating the emissions from leaks occurring in un-surveyed portions of the service territory is considered a reasonable way of approximating the emissions and considers the frequency of leak detection surveys.
	Pipeline Leaks - Above Ground	See above for below ground leaks. Above ground leaks associated with MSAs are not counted in the volume or the numbers of leaks to prevent misleading representation of emissions as well as potential for duplication of emissions volumes.
	Blowdowns and Venting	Blowdown emissions were estimated based on the calculation of the unique equipment volume corrected for pressure and temperature at the time of the release. The estimates for blowdown events in general provide reliable emission estimates.
	All damages (as defined by PHMSA)	<p>Emissions from damages for Above Ground (AG) Non-hazardous and MSA damages are calculated based on company EF for above ground facilities times the number of days leaking unless an engineering estimate could be performed to measure the emissions. For AG Hazardous and Below Ground Code 1 damages, emission was estimated based on engineering calculation using pipe size, damage opening size, and duration. For Code 2 and Code 3 damages, the EF for Distribution pipeline leaks was used.</p> <p>In 2015 and 2016 all damages for DM&S above and below ground as well as MSA above ground damages are aggregated in this category.</p> <p>Where an estimate was not made at the time of the event, the emission was estimated from population of similar events with respective pipe material and pipe size.</p>

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	Components - Pneumatic Devices	Emissions from components such as pneumatic devices are based on manufacturer specifications for bleed rate given the pressure.
	Component Leaks:	This new category was added to the reporting templates for RY 2016. The purpose is to capture fugitive component leaks in this category. This differentiates them from emissions from components that result from normal operations or by design. No emissions were reported in this category for RY 2016.
	Odorizer (Odorizer and Gas Sampling Vents)	Not applicable for this category.
Distribution M&R Stations	M&R Stations	The emission estimates for M&R stations are based on the EFs recommended in Appendix 9 multiplied by the population of each type of M&R station.
	Blowdowns	Blowdown emissions were estimated based on the calculation of the unique equipment volume corrected for pressure and temperature at the time of the release. The estimates for blowdown events in general provide reliable emission estimates.
	Component Emissions	The purpose of this category is to capture emissions that occur in M&R station components that result from normal operations or by design of the component. The emissions from components are captured in the EF used on a station by station basis, and any discrete leak information from components in the facility would duplicate emissions and present misleading count information. Until further work can be done with more comprehensive survey techniques, continued reliance on the recommended EFs on a station by station basis is considered the best estimate of emissions at this time.
	Component Leaks:	This new category was added to the reporting templates for RY 2016. The purpose of this category is to capture fugitive leaks on components within the M&R station and create a record as a basis for evaluating using actual measured leaks rather than an M&R station EF for estimating emissions. Currently the discrete leaks for M&R stations would be captured in the recommended EFs used to estimate the M&R station emissions and only where it could be determined that inclusion of discrete M&R leaks were not duplicated would they be included in the count of emissions for this category.
Commercial, Industrial and Residential Meters	Residential and Commercial Meters	The emissions for this category are based on the MSA population count times the recommended EF per Appendix 9. There is substantial work currently being done to update EFs for MSAs and in future any updated EFs could be backward applied to 2015.

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	Actual MSA Leaks	This new category was added to the reporting templates for RY 2016. The purpose of this category is to capture fugitive leaks on MSAs and create a record in order to form a basis for evaluating using actual measured leaks rather the number of meters in the population times an EF to estimate emissions. Currently the discrete MSA leaks would be captured in the current method using EFs time the population of meters.
	All damages (as defined by PHMSA)	Emissions from damages for Above Ground (AG) Non-hazardous MSA damages should be calculated based on company EF for above ground facilities times the number of days leaking. For AG Hazardous damages, emission should be estimated based on based on engineering calculation using pipe size, damage opening size, and duration. The reported damages in this category were re-categorized and included with DM&S pipeline damages because not all respondents could separate out their AG - MSA related damages with their AG - DM&S damages. Grouping them all together in this year's report is consistent with the grouping used in 2015. However, in the future separating the respective AG damages will help differentiate the source of damages and emissions.
	Component Emissions:	This new category was added to the reporting templates for RY 2016. The purpose of this category is to capture fugitive leaks on components other than MSAs in the MSA systems to determine whether such leaks existed. In addition, if such leaks existed this could form a basis for evaluating using actual measured leaks rather than an EF for estimating emissions. No component leaks were identified or reported in 2016.
	Vented Emission from MSA	Emissions from venting MSAs are based on the number of events times the estimated volume release by MSA and/or the type of activity.
Underground Storage	Facility Leaks	Emissions in this category are based on EPA GHG Subpart W data EFs multiplied by the number of units of each equipment type. Or respondents may use EFs from MRR Leaker Emission Factor Table W4, or they may choose to use Leaker-based EFs, which means that if a survey is conducted, those components found not to be leaking would be recorded with zero emissions as opposed to applying a population-based EF. Just as those components found to be leaking would use a "Leaker EF" with a proscribed value.
	Compressor Emissions	Emissions from storage facility compressors are calculated in the same manner as for compressors in other categories. See the description in the Compressor Station category.
	Compressor Leaks:	This new category was added to the reporting templates for RY 2016. The purpose is to capture fugitive leaks in this category and differentiate them from emissions from compressors that result from normal operations or by design. The emissions from components associated with compressor operations are based on the recommended EFs outlined in Appendix 9 of the Data Request.

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	Blowdown and Venting	Blowdown emissions were estimated based on the calculation of the unique equipment volume corrected for pressure and temperature at the time of the release. The estimates for blowdown events in general provide reliable emission estimates.
	Components Emissions:	Component emissions are based on the emissions that occur because of normal operation of the component or its design. The emissions detected during GHG leak survey pursuant to the GHG Mandatory Reporting Regulation and each component's EF times the population count. All leak and component emission estimates assume that the leak is leaking the entire year or during its identified hours of operation.
	Component Leaks:	This new category was added to the reporting templates for RY 2016. The purpose is to capture fugitive leaks in this category and differentiate them from emissions from components that result from normal operations or by design. The emissions from components associated with transmission pipeline operations are based on the recommended EFs outlined in Appendix 9 of the Data Request.
	Dehydrator Emissions	Because there are several different types and configurations of dehydrators and it was determined that most respondent's dehydrators use a control device to eliminate natural gas emissions. Therefore, only those dehydrators which vent natural gas are included in this category. The dehydrator emission estimates are based on the engineering estimate, manufacturer's data, or MRR prescribed method of calculating natural gas emissions.

Appendix B: Definitions

For the purposes of SB 1371, the definitions of “leak” and “gas -loss” and the formula for calculating a “system-wide gas leak rate” were defined in a different manner than elsewhere. A “leak” was defined as any breach, whether intentional or unintentional, whether hazardous or non-hazardous, of the pressure boundary of the gas system that allows natural gas to leak into the atmosphere. Any vented or fugitive emission to the atmosphere is considered a “leak”. Examples of leaking components include defective gaskets, seals, valve packing, relief valves, pumps, compressors, etc. Gas blowdowns during operations, maintenance, and testing (including hydro-testing) were also included as leaks. Consequently, this leak definition is broader than the Pipeline Hazardous Material and Safety Administration’s (PHMSA) definition.

The gas respondents are required by Federal Law, 49 CFR 192, to survey their systems for leaks, which could be hazardous to public safety or property. To accomplish this, the gas utility companies developed graded leak programs to detect, prioritize and repair the safety related types of leaks. The same definitions are used within this report and are as follows:

- Graded Leaks – hazardous leaks or, which could potentially become hazardous as described below:
 - A "grade 1 leak" is a leak that represents an existing or probable hazard to persons or property and requiring prompt action, immediate repair, or continuous action until the conditions are no longer hazardous.⁵⁶
 - A "grade 2 leak" is recognized as being non-hazardous at the time of detection but justifies scheduled repair based on the potential for creating a future hazard.⁵⁷
 - A "grade 3 leak" is a leak that is not hazardous at the time of detection and can reasonably be expected to remain not hazardous.⁵⁸
- Vented Emissions are releases of gas to the atmosphere, which occur during operations or maintenance, for a safety reason. Some examples are:
 - Purging (a.k.a. “blowdown”) gas prior to hydro-testing a line.
 - Gas releases designed into the equipment function, such as gas emitting from relief valve vents or pneumatic equipment.
 - Gas releases caused by operations, maintenance, testing, training, etc.
 - Ungraded Leaks are the remaining leaks, which are not hazardous to persons and/or property.

⁵⁶ Refer to GO 112-F for more information.

⁴² Ibid.

⁵⁸ Ibid.

For further information please see CPUC GO 112-F.

Lastly, in 2014 the system-wide gas leak rate was calculated as a percent of total input for the 12 months ending June 30 of the reporting year. However, Staff determined that there were problems with this calculation and opted not to report a leak rate using this formula. The formula for calculating a system-wide gas leak was written as follows:

Pipeline Hazardous Material and Safety Administration (PHMSA)
Modified Equation for Lost and Unaccounted for (LAUF) Gas:

$$\frac{[(\text{Purchased gas} + \text{produced gas} + \text{transported gas entering the gas system}) - (\text{customer use} + \text{company use} + \text{appropriate adjustments} + \text{gas injected into storage} + \text{transported gas leaving the gas system})]}{(\text{Purchased gas} + \text{produced gas} + \text{transported gas entering the gas system})} = \text{System Wide Gas Leak Rate.}$$

Note: transported gas includes gas purchased by customers and transported in common carrier pipelines.

In section 5 of the 2015 Joint Report, "Baseline System-Wide Emissions Rate," Staff determined the value for 2015 to be 0.32% by using the total emissions from all source categories (6,601.2 MMscf) divided by the Total Annual Volume of Gas Transported (2,056,950 MMscf). The five sources for Total Annual Volume of Gas Transported include:

- Gas Injected into Storage
- Storage – Gas Used by the Gas Department
- Gas Transported to Customers in the State
- Gas Transported to Customers out of State
- Distribution – Gas Used by the Gas Department

Appendix C: Article 3, Section 975 (c) and (e)(6)

Article 3. Section 975

(c) As soon as practicable, the commission shall require gas corporations to file a report that includes, but is not limited to, all the following:

- (1) A summary of utility leak management practices.
- (2) A list of new natural gas leaks in 2013 by grade.
- (3) A list of open leaks that are being monitored or are scheduled to be repaired.
- (4) A best estimate of gas loss due to leaks.

(e) The rules and procedures adopted pursuant to subdivision (d) shall accomplish all the following:

- (6) to the extent feasible, require the owner of each commission-regulated gas pipeline facility that is an intrastate transmission or distribution line to calculate and report to the commission and the State Air Resources Board a Baseline system-wide leak rate, to periodically update that system-wide leak rate calculation, and to annually report measures that will be taken in the following year to reduce the system-wide leak rate to achieve the goals of the bill.

Appendix D: Conversion of Natural Gas to Carbon Dioxide Equivalents

The conversion of natural gas volume to carbon dioxide equivalent mass requires the use of a GWP value. CARB used the GWP value of 25 (100-year value) from the IPCC, AR4, for previous GHG emissions inventory. The following calculations show the conversion of the total emissions from this report. The conversion was done in two steps. In the first step, the calculation shows the volumetric natural gas that contains exactly one metric ton of methane.

$$1 \text{ MT CH}_4 * \frac{2,204.62 \text{ lbs CH}_4}{1 \text{ MT CH}_4} * \frac{1 \text{ lb mole}}{16.04246 \text{ lb CH}_4} * \frac{379.48 \text{ scf of CH}_4 \text{ gas}}{1 \text{ lb mole}} * \frac{1.0 \text{ scf of natural gas}}{0.934 \text{ scf of CH}_4 \text{ gas}} * \frac{1 \text{ Mscf}}{1,000 \text{ scf}} = 55.835 \text{ Mscf of natural gas}$$

Using this volumetric unit, the 2019 total emissions, 5,912 MMscf, is equivalent to about 2.65 MMTCO₂e, as shown below:

$$5,911,748 \text{ Mscf natural gas} * \frac{1 \text{ MT CH}_4}{55.835 \text{ Mscf of natural gas}} * \frac{25 \text{ CO}_2e}{1 \text{ CH}_4} = 2,646,972 \text{ MT CO}_2e$$

CARB has also used the GWP value of 72 (AR4, 20-year) in the Short-Lived Climate Pollutant Plan and Oil and Gas Regulation. Based on the higher GWP, the 2019 total emissions, 5,912 MMscf is about 7.62 MMTCO₂e, as follows:

$$5,911,748 \text{ Mscf natural gas} * \frac{1 \text{ MT CH}_4}{55.835 \text{ Mscf of natural gas}} * \frac{72 \text{ CO}_2e}{1 \text{ CH}_4} = 7,623,280 \text{ MT CO}_2e$$

The use of 1.0 scf of natural gas per 0.934 scf of CH₄ gas accounts for composition of natural gas being not 100% methane. The American Gas Association published a value of 93.4% to be used as a default methane concentration that is comparable to what respondents reported.⁵⁹ The standard cubic foot “scf” for measuring gas is based on 60 degrees Fahrenheit at atmosphere pressure.

In addition, respondents reported trace amounts of concentration for ethane, inert gases, and other elements and compounds. There was not an entry for carbon dioxide explicitly, and so it cannot be assumed that all the inert gas was carbon dioxide. A calculation was performed that showed CO₂ emissions from the inert gases would be less than 0.1% of the total and is excluded in this report.

⁵⁹ AGA, GHG Guidelines, page 39, April 18, 2008, http://s3.amazonaws.com/zanran_storage/www.aga.org/ContentPages/18068841.pdf