California Air Resources Board
Oil and Gas Methane Regulation
2022 Annual Leak Detection and Repair (LDAR) Summary

May 2025

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A. Key Findings

- During the fifth year of implementation of CARB's Greenhouse Gas Emission Standards for Crude Oil and Natural Gas Facilities[1] (Oil and Gas Methane Regulation, or Regulation), over 10,000 leaks were identified and repaired during quarterly leak detection and repair (LDAR) surveys of approximately 2.1 million unique components.
- The ratio of leaks to unique components surveyed was 0.48%.
- The natural gas processing plant sector had the largest ratio of leaks to components surveyed (3.7%), but the second fewest number of components surveyed, while the natural gas production sector had the smallest ratio of leaks to components surveyed (0.070%), but the second highest number of components surveyed. The remaining sectors (crude oil production, natural gas storage, natural gas transmission, and natural gas gathering and boosting stations) had ratios of leaks to components surveyed ranging from 0.21% to 0.96%.
- Approximately 10% of the leaks at or above the regulatory threshold of 1,000 parts per million volume (ppmv) accounted for 51% of the emissions.
- Total emission reductions resulting from corrections made due to LDAR surveys in 2022 were estimated to be approximately 1,600 metric tons methane, or approximately 40,000 metric tons CO2e.[2]
- LDAR surveys in 2022 resulted in an 18% reduction in emissions from components subject to LDAR in the Regulation.

Table 1 shows a summary comparison of 2022 LDAR data and 2021 LDAR data. A detailed comparison of 2022 and 2021 data is provided in Section D.

[1] California Code of Regulations, Title 17, Division 3, Chapter 1, Subchapter 10 Climate Change, Article 4. Subarticle 13: Greenhouse Gas Emission Standards for Crude Oil and Natural Gas Facilities.

[2] CO_2e was calculated throughout the report using the 100-year global warming potential (GWP) of methane of 25.

Table 1: Comparison of 2022 LDAR to 2021

	2021	2022
Annual Average Total Components in LDAR Program	2,373,178	2,105,729
Number of Leaks	10,489	10,082
Number of Leaks per Component Count in LDAR Program (%)		
Overall	0.44%	0.48%
Crude Oil Production Sector	0.46%	0.50%
Natural Gas Production Sector	0.08%	0.069%
Natural Gas Storage Sector	0.52%	0.53%
Natural Gas Transmission Sector	0.92%	0.96%
Natural Gas Gathering and Boosting Station Sector	0.38%	0.21%
Natural Gas Processing Plant Sector	1.0%	3.7%
% of Leaks that Accounted for 50% of Emissions	~10%	~10%
Total Estimated Emission Reductions (metric tons methane)	1,600	1,600
% Estimated Emission Reductions	16%	18%

B. Background

As an early action measure to achieve the emission reductions required by the California Global Warming Solutions Act of 2006, Assembly Bill 32, CARB adopted the Oil and Gas Methane Regulation to reduce methane emissions from oil and gas production, processing, storage, and transmission compressor stations. CARB's Oil and Gas Methane Regulation was adopted by the Board on March 23, 2017, and went into effect on January 1, 2018. Section 95669 requires owners/operators of oil and natural gas facilities[3] to conduct quarterly LDAR surveys to monitor components for leaks and repair detected leaks within a specified time frame. Quarterly LDAR inspections began on January 1, 2018, and operators are required to submit annual LDAR reports to CARB by July 1 of each calendar year. The following information must be included in operators' annual LDAR reports:

1. Total number of components inspected

[3] Including oil and gas production, processing, and storage; natural gas gathering and boosting stations; natural gas underground storage; and natural gas transmission compressor stations.

2. Total number of leaks identified per leak threshold category (1,000 to 9,999 ppmv, 10,000 to 49,999 ppmv, and 50,000 ppmv or greater)
3. For each leak:
    a. Inspection date
    b. US EPA Method 21 instrument used
    c. US EPA Method 21 instrument calibration date
    d. Component type
    e. Component ID, if applicable
    f. Equipment ID for the equipment the leaking component is on, if applicable
    g. Initial leak concentration
    h. Repair date
    i. Concentration after repair

This Annual LDAR Summary is based on annual reports CARB received from 100 operators for LDAR inspections at 451 facilities during 2022.

The LDAR requirements in CARB's Oil and Gas Methane Regulation do not apply to all components in California; there are two key exemptions. First, components that are subject to local air district LDAR requirements that were in place prior to January 1, 2018 are exempt from LDAR requirements in CARB's Oil and Gas Methane Regulation because the regulation was intended to cover components that were not already subject to district LDAR requirements.[4] Second, components handling crude oil with an API gravity less than 20 are not subject to LDAR requirements due to their very low emissions levels relative to other components found in gas or other liquid service (less than 1.0% of all emissions from components in the state).[5,6,7,8] Figure 1 shows the fraction of oil and gas components in California that are subject to CARB's regulation, are subject to local air district rules,[9] or handle heavy oil and are exempt from LDAR requirements.[10]

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[4] Oil and Gas Methane Regulation, Section 95669(b)(1).

[5] Oil and Gas Methane Regulation, Section 95669(b)(2).

[6] Air Resources Board, 2007 Oil and Gas Industry Survey Results. revised October, 2013.

[7] CAPCOA, California Implementation Guidelines for Estimating Mass Emissions of Fugitive Hydrocarbon Leaks at Petroleum Facilities. 1999.

[8] 15-Day Notice Attachment 2. *https://ww3.arb.ca.gov/regact/2016/oilandgas2016/oilgasatt2.pdf*.

[9] There are eight local air districts with LDAR requirements for oil and gas facilities, including Bay Area Air Quality Management District (AQMD), Monterey Bay Air Resources District (ARD), San Joaquin Valley Air Pollution Control District (APCD), San Luis Obispo County APCD, Santa Barbara County APCD, South Coast AQMD, Ventura County APCD, and Yolo-Solano AQMD.

[10] Heavy oil is defined differently in different district rules, e.g., by API gravity, by flash point, by vapor pressure, or by evaporation percentage. For the purposes of Figure 1, heavy oil was defined as < 20 API gravity.

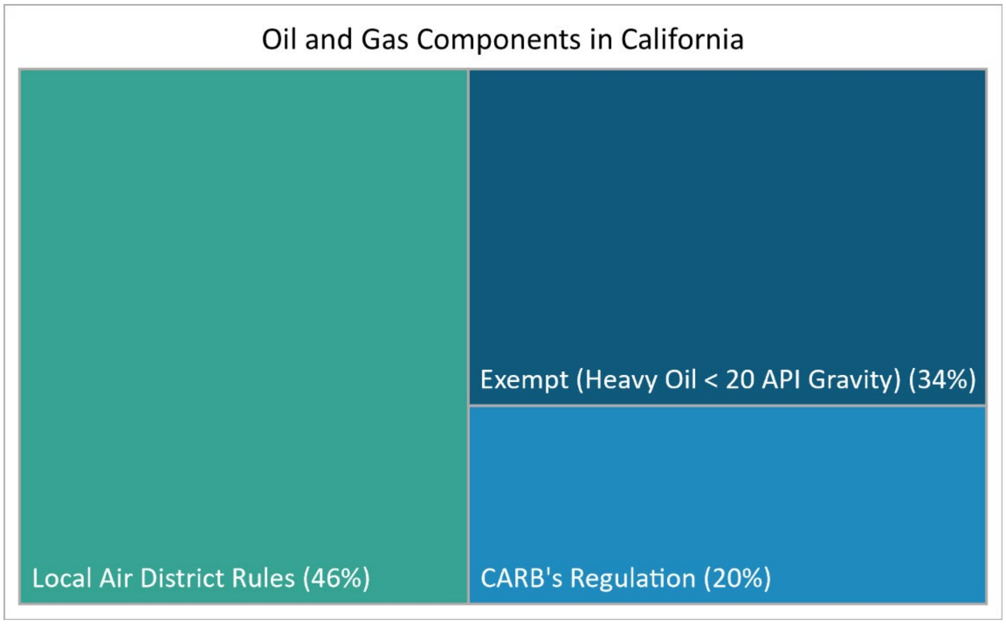

Figure 1: Breakdown of oil and gas components in California. Size of box corresponds to the percentage of components in each category (shown in parentheses) based on data from CARB's 2007 oil and gas industry survey and the Oil and Gas Methane Regulation rulemaking. [11,12]

C. Summary of LDAR Data

On average, 2,105,729 unique components were surveyed[13] during 2022 LDAR surveys each quarter, and in total throughout the year 10,082 leaks were identified as greater than or equal to 1,000 ppmv (the ratio of leaks to components surveyed was 0.48%).[14] Of the leaks found during inspections, 9,918 were repaired or a component was replaced, 26 were designated as critical components[15] and were repaired at the next scheduled shutdown or within 12 months, whichever was sooner, and 138 were approved for delays of repair at the time of reporting. Of the 138 approved delay of repair leaks, only one leak is still an approved delay of repair while the others were repaired or replaced within 30 calendar days from the allowed repair time period or by the anticipated repair date stated in the operator's approved delay of repair request. Delay of repair approvals are requested by operators who need to order specific parts or equipment to repair leaking components.

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[11] See footnote 6.

[12] See footnote 8.

[13] Component surveys were repeated quarterly for a total of approximately 8.4 million component inspections.

[14] Leak concentrations for four components were adjusted to 1,000,000 ppmv due to abnormally high readings that could not be accurately confirmed

[15] A critical component would require the shutdown of a critical process unit if that component was shutdown.

CARB staff tracks the delay of repair requests to confirm that repairs are completed according to the allowed timeline.[16]

The validity of the data presented in this report is dependent on the accuracy of the data reported by operators. CARB acknowledges that there are potential limitations with self-reported data; however, CARB staff conducted rigorous quality control checks to ensure the highest level of data integrity possible. CARB staff reviewed the data in the 2022 annual reports and found no widespread issues with operators' reported data. Issues encountered were all associated with data entry and include conflicting inspection dates, conflicting repair dates, conflicting instrument calibration dates, incorrect number of components inspected, incorrect number of leaks found, and incorrect repaired leak concentrations. All discrepancies were corrected by CARB staff after following up with operators. During 2022, 0.26% of the reported leaks had potential errors identified that affected the emissions and emissions reductions calculations and required CARB staff to follow up with operators and make necessary corrections. Of the facilities that reported LDAR data, 3.1% had discrepancies between the number of leaks recorded in the annual LDAR reports' two reporting tables, and 2.5% of all reported quarterly inspections listed incorrect inspection dates (i.e., dates were not in 2022). The number of facilities with reports that had discrepancies between the number of leaks reported in the two reporting tables as well as the number of incorrect inspection dates reported for quarterly inspections decreased compared to the 2021 reporting year.

Table 2 shows the LDAR survey leak distribution for 2022 according to oil and gas sector. The natural gas processing plant sector had the largest ratio of leaks to unique components surveyed, 3.7%, but the second fewest number of components surveyed (11,174). The natural gas production sector had the lowest ratio of leaks to components surveyed, 0.069%, but the second largest number of components surveyed (351,220). The remaining sectors (crude oil production, natural gas storage, natural gas transmission, and natural gas gathering and boosting stations) had ratios of leaks to components surveyed ranging from 0.21% to 0.96%, and crude oil production had the largest number of components surveyed (1,287,138).[17] The natural gas gathering and boosting station sector had the fewest number of components surveyed (4,290).

[16] The 164 critical component and delay of repair leaks were included in this report in Tables 1 and 2 as well as Figures 2 and 3, but not in estimates of emission reductions because those calculations require a concentration after repair that wasn't included at the time annual LDAR reports were submitted.

[17] In general, district LDAR rules cover crude oil production facilities; however, the Oil and Gas Methane Regulation addressed some components that are exempt from district rules, resulting in the large number of components in the crude oil production sector, as shown in Table 2.

Table 2: Components Found Leaking by Sector in 2022

Sector	Total Count of Components in LDAR Program[18]	Number of Leaks in Each Category[19] (Ratio of Leaks to Count of Components in LDAR Program by Sector)			Number of Leaks per Component Count in LDAR Program (%)
		1,000 to 9,999 ppmv	10,000 to 49,999 ppmv	50,000 ppmv or greater	
Crude Oil Production	1,287,138	4,909 (0.38%)	1,324 (0.10%)	255 (0.020%)	0.50%
Natural Gas Production	351,220	140 (0.040%)	90 (0.026%)	12 (0.0034%)	0.069%
Natural Gas Storage	325,456	1,237 (0.38%)	348 (0.11%)	137 (0.042%)	0.53%
Natural Gas Transmission	126,451	799 (0.63%)	281 (0.22%)	130 (0.10%)	0.96%
Natural Gas Gathering and Boosting Stations	4,290	6 (0.14%)	3 (0.070%)	0 (0.00%)	0.21%
Natural Gas Processing Plants	11,174	257 (2.3%)	154 (1.4%)	0 (0.00%)	3.7%
Total	2,105,729	7,348 (0.35%)	2,200 (0.10%)	534 (0.025%)	0.48%

Figure 2 shows the number of leaks identified in 2022 by component type; connectors and "other" had the most leaks of the component types, 4,018 and 2,905, respectively. The "other" component category includes gas regulators, pressure gauges, pressure relief devices, flow and pressure meter fittings, pneumatic devices, compressor vents, temperature controllers, stuffing boxes, and inactive flare pilots.

[18] Counts include the physical number of components that were surveyed four times throughout the year.

[19] A component could have been found to be leaking during a quarterly inspection and been repaired or replaced within the required time period, and also may have been measured as leaking again during a subsequent quarterly inspection, resulting in one component accounting for more than one leak.

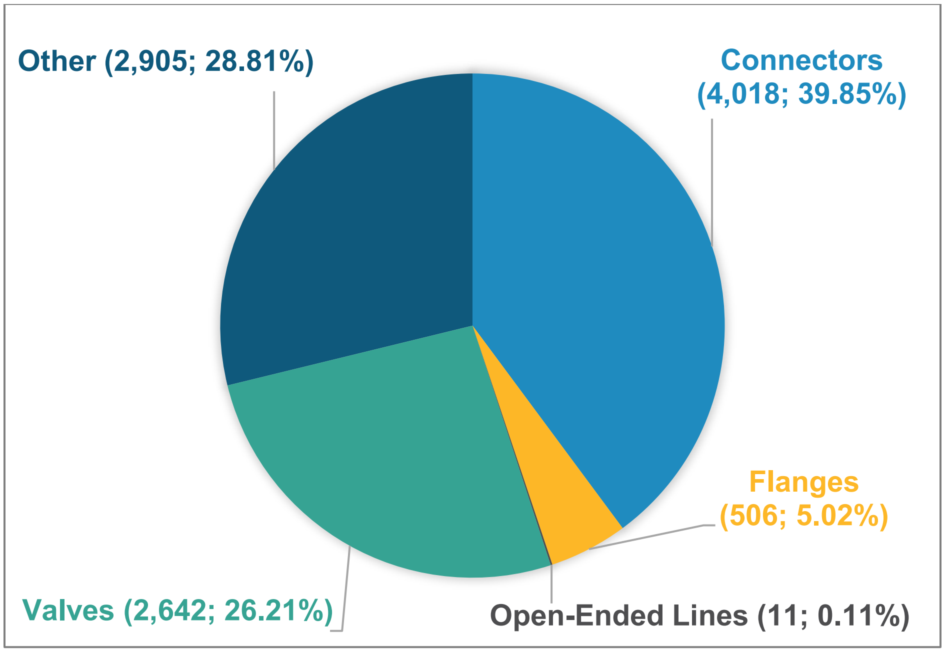

Figure 2: Number of leaks and percentage of overall leaks Identified in 2022 by component type.

CARB staff estimated emissions from the reported leaks using correlation equations developed in the *Enhanced Inspection & Maintenance for GHG & VOCs at Upstream Facilities* study.[20] Estimated methane leak rate statistics by component type are shown in Table 3. On average, open-ended lines had the highest leak rate, but only accounted for 11 total leaks. The mean leak rate of all components was 0.019 kg CH_4/hr.

[20] Sage ATC Environmental Consulting LLC, Air Resources Board IFB No. 13-414: Enhanced Inspection & Maintenance for GHG & VOCs at Upstream Facilities. revised November, 2019.

Table 3: Methane Leak Rate Statistics by Component Type[21]

	All Components	Connector	Flange	Open-Ended Line	Valve	Other
Min (kg CH_4/hr)	0.002	0.002	0.002	0.090	0.003	0.005
Max (kg CH_4/hr)	1.108	0.178	0.037	0.172	0.864	1.108
Mean (kg CH_4/hr)	0.019	0.007	0.007	0.146	0.027	0.030
Median (kg CH_4/hr)	0.008	0.004	0.004	0.148	0.015	0.013

Figure 3 shows the cumulative leak emission distribution from 2022 LDAR data. The distribution shows that approximately 10% of leaks accounted for 51% of estimated emissions from leaking components. The results continue to show that a relatively small number of sources contributed to a significant portion of the emissions, as has been demonstrated in previous studies of oil and gas facilities.[22,23]

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[21] Leak rates were converted from total hydrocarbons assuming a methane composition of 89.2% based on data from a CARB-funded 2019 study (see footnote 20).

[22] Allen, D. (2016). Emissions from oil and gas operations in the United States and their air quality implications. *Journal of the Air & Waste Management Association*, 66:6, 549-575. DOI: 10.1080/10962247.2016.1171263.

[23] Brandt et al. 2016. Methane Leaks from Natural Gas Systems Follow Extreme Distributions. *Environmental Science & Technology*, 50:22, 12512-12520. DOI: 10.1021/acs.est.6b04303.

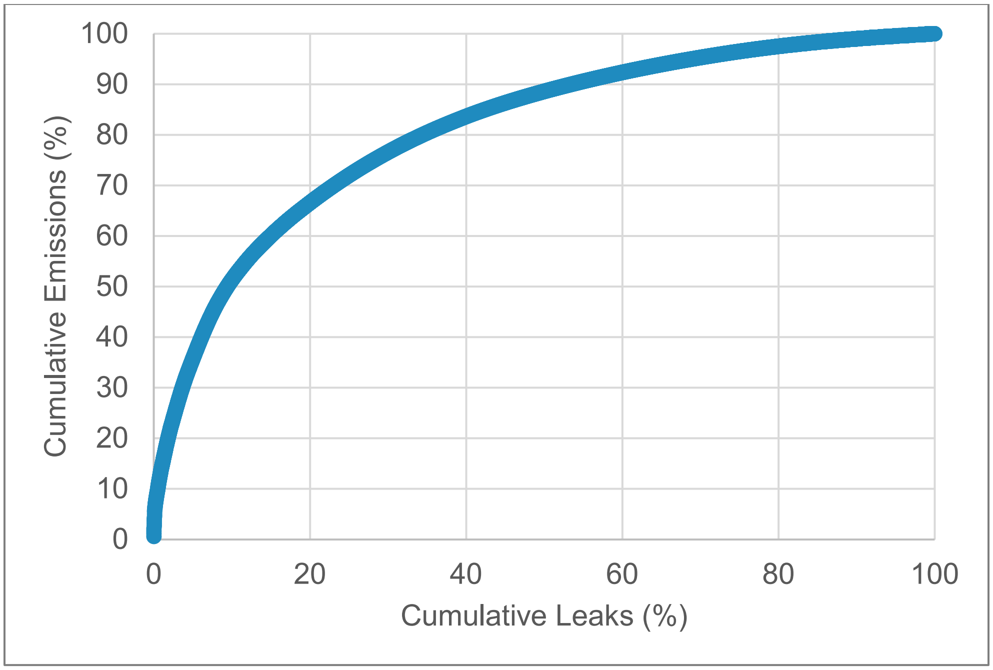

Figure 3: Fraction of cumulative emissions versus cumulative leaks based on LDAR data for 2022.

Emission reductions were estimated by assuming that a leak would have continued unabated for a year without the LDAR program. Total emission reductions from the 2022 LDAR surveys were estimated to be approximately 1,600 metric tons methane, or approximately 40,000 metric tons CO_2e.[24] CARB staff also estimated baseline 2022 emissions from all components subject to LDAR in the regulation to evaluate the percent emission reductions from 2022 LDAR surveys. Operators are not required to report concentration data for components measured below the leak threshold (1,000 ppmv); therefore, emissions from these "non-leaking" components were estimated by assuming a leak rate equal to the average post-repair leak rate of all leaking components. Similar to an estimate of emission reductions, baseline emissions from leaks were estimated by assuming that leaks would have persisted for a year without the LDAR program. The combined total baseline emissions from leaking and "non-leaking" components subject to quarterly LDAR surveys for CARB's Oil and Gas Methane Regulation during 2022 was estimated to be approximately 8,700 metric tons methane,[25,26] or approximately 217,000 metric tons CO_2e.[27]

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[24] Approximately 120,000 metric tons CO_2e using the 20-year GWP of methane of 72.

[25] Converted from total hydrocarbons assuming a methane composition of 89.2% based on data from a CARB-funded 2019 study (see footnote 20).

[26] Leaking and "non-leaking" components accounted for approximately 1,600 and approximately 7,000 metric tons methane, respectively.

[27] Approximately 620,000 metric tons CO_2e using the 20-year GWP of methane of 72.

Based on these calculations, 2022 LDAR surveys resulted in an estimated 18% reduction in emissions from components subject to LDAR in the Oil and Gas Methane Regulation.

Leak data broken down by local air district and owner/operator are shown in Appendix A: LDAR Data by Local Air District and Owner/Operator. Figures A-1 and A-3 show emission reductions from each sector (crude oil production, natural gas production, natural gas transmission, natural gas storage, natural gas gathering and boosting stations, and natural gas processing plants), and Figures A-2 and A-4 show the ratios of leaks to components surveyed for each sector.[28] San Joaquin Valley Air Pollution Control District (APCD) had the highest emission reductions, with the majority coming from the crude oil production sector (Figure A-1). Excluding Bay Area AQMD, San Joaquin Valley APCD, and Tehama APCD, the transmission sector had the highest ratios of leaks to components surveyed of the six sectors for all local air districts with natural gas transmission facilities (Figure A-2). For Bay Area AQMD, San Joaquin Valley APCD, and Tehama APCD, the highest ratios of leaks to components surveyed came from the crude oil production, natural gas processing plant, and natural gas production sectors, respectively. The three highest ratios of leaks to components surveyed based on sector were San Joaquin Valley APCD's (6.1%; natural gas processing plant), Lassen County APCD's (3.9%; natural gas transmission), and Mojave Desert AQMD's (1.2%; natural gas transmission). The owner/operators with the highest emission reductions were Aera, Southern California Gas Company, and California Resources Corporation (Figure A-3). The owners/operators with the highest ratios of leaks to components surveyed based on sector were California Resources Corporation (25%; natural gas processing), CalNRG Operating (23%; crude oil production), and Glendale Oil (13%; crude oil production); no clear trends were observed across sectors (Figure A-4).

D. Comparison to 2021 Data and Conclusions

In 2022, CARB received annual reports for inspections from 100 operators at 451 facilities, whereas in 2021, 94 operators submitted annual reports for inspections at 438 facilities. During 2022 LDAR surveys, on average, operators inspected fewer unique components (2,105,729 compared to 2,373,178 in 2021) each quarter. Some of the factors leading to fewer unique components compared to the previous year include plugging and abandoning wells, equipment consolidation and shutdowns, and re-evaluation of facilities being subject to local rules instead of CARB's Regulation. Although fewer leaks were identified in 2022 (10,082 leaks) compared to 2021 (10,489 leaks), the overall ratio of leaks to unique components surveyed still increased from 0.44% to 0.48%. Table 4 shows the LDAR survey leak distribution comparison between 2022 and 2021. Compared to the 2021 LDAR leak ratios by sector, four sectors saw increased leak ratios. The sectors with the

[28] The ratio metric in this report should not be compared to the "% of total inspected" metric in Tables 1 and 2 of CARB's Oil and Gas Methane Regulation. Tables 1 and 2 pertain to single inspections of a group of components during district or CARB inspections; the ratios in this report represent four inspections of a group of components during operator inspections. The ratio metric also should not be compared to the loss rate used in Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation (GREET).

largest increase in leak ratio were natural gas processing plants, which increased from 1.0% to 3.7%, followed by the crude oil production and natural gas transmission sectors, which increased from 0.46% to 0.50% and 0.92% to 0.96%, respectively. For the remaining three sectors, natural gas storage increased from 0.52% to 0.53%, natural gas gathering and boosting stations decreased from 0.38% to 0.21%, and natural gas production decreased from 0.080% to 0.069%. The larger increase in leak ratio for the natural gas processing plant sector was due to the decrease in number of components surveyed along with an increase in the number of leaks identified.[29]

[29] The decrease in number of components surveyed for the natural gas processing plant sector was from a facility removing a system and decommissioning some equipment.

Table 4: Components Found Leaking by Sector in 2022 and 2021

Sector	Total Count of Components in LDAR Program[30] (2022|2021)	Number of Leaks in Each Category[31] (Ratio of Leaks to Count of Components in LDAR Program by Sector)			Number of Leaks per Component Count in LDAR Program (%) (2022|2021)
		1,000 to 9,999 ppmv (2022|2021)	10,000 to 49,999 ppmv (2022|2021)	50,000 ppmv or greater (2022|2021)	
Crude Oil Production	1,287,138| 1,519,578[32]	4,909 (0.38%) | 5,171 (0.34%)	1,324 (0.10%) | 1,559 (0.10%)	255 (0.020%) | 300 (0.020%)	0.50% | 0.46%
Natural Gas Production	351,220 | 361,068	140 (0.040%) | 217 (0.060%)	90 (0.026%) | 63 (0.020%)	12 (0.0034%) | 19 (0.010%)	0.069% | 0.080%
Natural Gas Storage	325,456 | 344,543	1,237 (0.38%) | 1,176 (0.34%)	348 (0.11%) | 449 (0.13%)	137 (0.040%) | 172 (0.050%)	0.53% | 0.52%
Natural Gas Transmission	126,451 | 126,279	799 (0.63%) | 789 (0.62%)	281 (0.22%) | 269 (0.21%)	130 (0.10%) | 107 (0.080%)	0.96% | 0.92%
Natural Gas Gathering and Boosting Stations	4,290 | 3,691	6 (0.14%) | 2 (0.050%)	3 (0.070%) | 9 (0.24%)	0 (0.00%) | 3 (0.080%)	0.21% | 0.38%
Natural Gas Processing Plants	11,174 | 18,019[33]	257 (2.3%) | 115 (0.64%)	154 (1.4%) | 69 (0.38%)	0 (0.00%) | 0 (0.00%)	3.7% | 1.0%
Total	2,105,729 | 2,373,178	7,348 (0.35%) | 7,470 (0.31%)	2,200 (0.10%) | 2,418 (0.10%)	534 (0.025%) | 601 (0.030%)	0.48% | 0.44%

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[30] Counts include the physical number of components that were surveyed four times throughout the year.

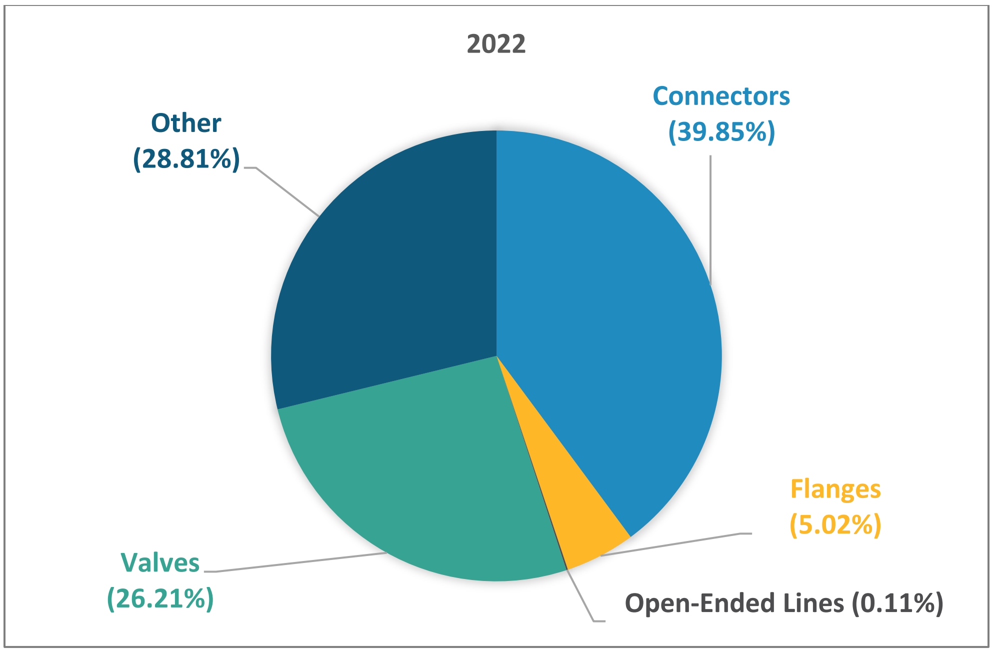
[31] A component could have been found to be leaking during a quarterly inspection and been repaired or replaced within the required time period, and also may have been measured as leaking again during a subsequent quarterly inspection, resulting in one component accounting for more than one leak.

[32] Reduced component counts stem from plugging and abandonment of wells, equipment consolidation and shutdowns, and re-evaluation of facilities being subject to local rules instead of CARB's Regulation.

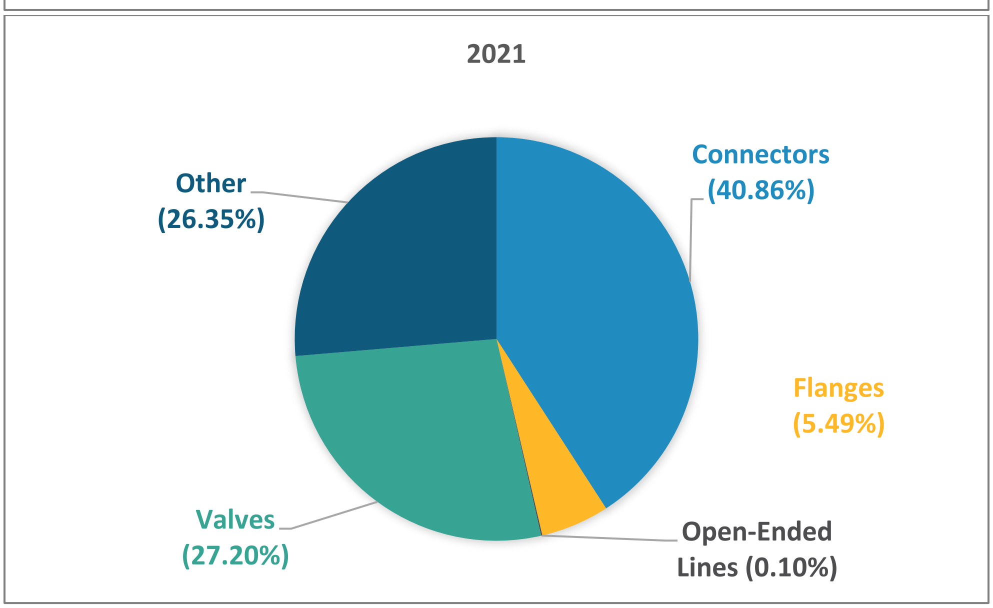
[33] See footnote 28

Leak counts by component type were similar for 2022 and 2021 with connectors having the most leaks. A difference between the number of leaks between 2022 and 2021 is that in 2022 the "other" category had the second most number of leaks and in 2021 this occurred in valves.

Figure 4 shows the percentage of overall leaks found by component type in 2022 and 2021. The percentage of leaks found on connectors decreased from 40.86% to 39.85%, leaks found on components in the "other" category increased from 26.35% to 28.81%, leaks found on valves decreased from 27.20% to 26.21%, leaks found on flanges decreased from 5.49% to 5.02%, and leaks found on open-ended lines increased from 0.10% to 0.11%.



(a)



(b)

Figure 4: Percentages of leaks identified in 2022 (a) and 2021 (b) by component type.

Table 5 displays the methane leak statistics for leaks in 2022 and 2021. In both years, on average, leaks found on open-ended lines had the highest leak rates but accounted for the fewest leaks total. The mean leak rate from all components increased from 0.018 kg CH_4/hr to 0.019 CH_4/hr.

Table 5: Methane Leak Rate Statistics by Component Type for Leaks 2022 and 2021[34]

	All Components (2022 | 2021)	Connector (2022 | 2021)	Flange (2022 | 2021)	Open-Ended Line (2022 | 2021)	Valve (2022 | 2021)	Other (2022 | 2021)
Min (kg CH_4/hr)	0.002 | 0.002	0.002 | 0.002	0.002 | 0.002	0.090 | 0.013	0.003 | 0.003	0.005 | 0.005
Max (kg CH_4/hr)	1.108 | 0.877	0.178 | 0.048	0.037 | 0.037	0.172 | 0.186	0.864 | 0.877	1.108 | 0.267
Mean (kg CH_4/hr)	0.019 | 0.018	0.007 | 0.007	0.007 | 0.007	0.146 | 0.088	0.027 | 0.027	0.030 | 0.028
Median (kg CH_4/hr)	0.008 | 0.008	0.004 | 0.004	0.004 | 0.005	0.148 | 0.081	0.015 | 0.014	0.013 | 0.014

Figure 5 shows the cumulative leak distribution in 2022 and 2021. There were fewer leaks identified in 2022 compared to 2021 (10,082 compared to 10,489 in 2021), however, the distribution of leaks to emissions remains similar. The distribution of leaks and resulting emissions in 2022 follows a similar trend to the distribution of leaks in 2021. In 2022, approximately 10% of leaks accounted for 51% of total emissions, compared to approximately 10% of leaks accounting for 50% of total emissions in 2021.

[34] Leak rates were converted from total hydrocarbons assuming a methane composition of 89.2% based on data from a CARB-funded 2019 study (see footnote 20).

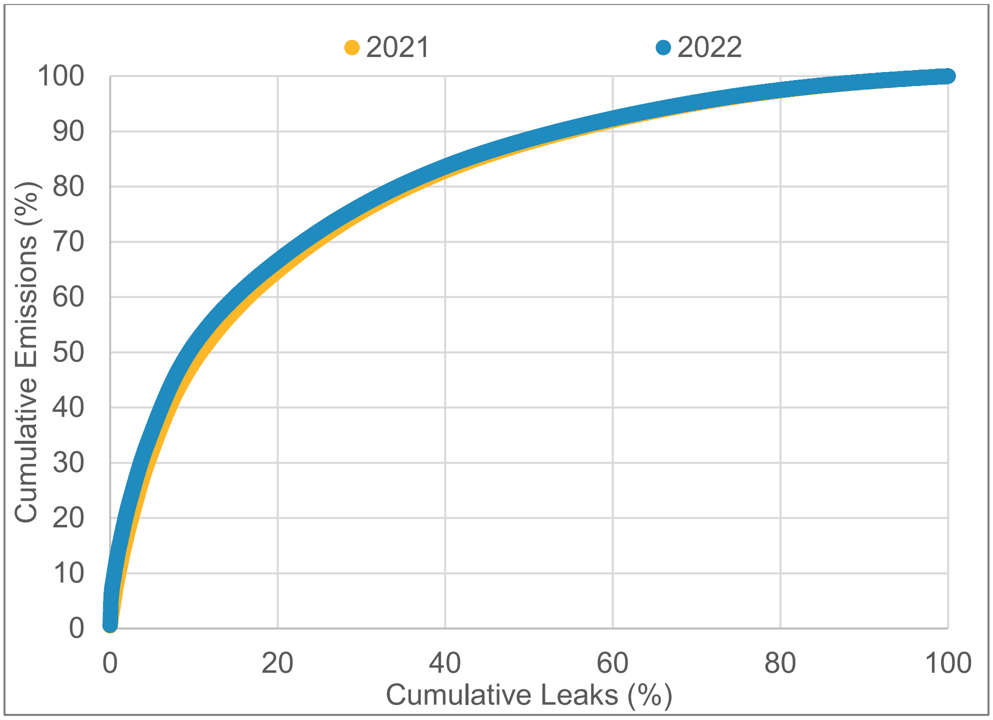


Figure 5: Fraction of cumulative emissions versus cumulative leaks for 2022 and 2021.

Table 6 shows a comparison of LDAR emissions and emission reductions between 2022 and 2021. Emission reductions were comparable in 2022 and 2021, with reductions of approximately 1,600 metric tons methane in both years. The comparable values could be due to the similar number of leaks identified between 2022 and 2021. The baseline emissions from components subject to quarterly LDAR surveys were smaller in 2022 relative to 2021 due to the fewer components surveyed in 2022. This, along with the similar number of leaks identified between the two years result in a smaller number of "non-leaking" components in 2022. LDAR surveys in 2022 resulted in an 18% reduction in emissions from components subject to LDAR in the regulation compared to 16% in 2021. The higher percent reduction was caused by the decrease in baseline emissions while maintaining similar emission reductions values.

Table 6: Comparison of LDAR Emissions and Emission Reductions between 2022 and 2021

	2022	2021
Baseline Emissions (metric tons methane; “non-leaking” components)	7,000	8,300
Baseline Emissions (metric tons methane; “leaking” components)	1,600	1,600
Total Baseline Emissions (metric tons methane)	8,700	10,000
Total Emission Reductions (metric tons methane)	1,600	1,600
% Emission Reductions	18%	16%

Although the ratio of leaks to unique components surveyed increased from 2021 to 2022, the number of overall leaks continue to decrease, indicating that implementation of the LDAR program is helpful in reducing the number of leaks over time.

Appendix A: LDAR Data by Local Air District and Owner/Operator

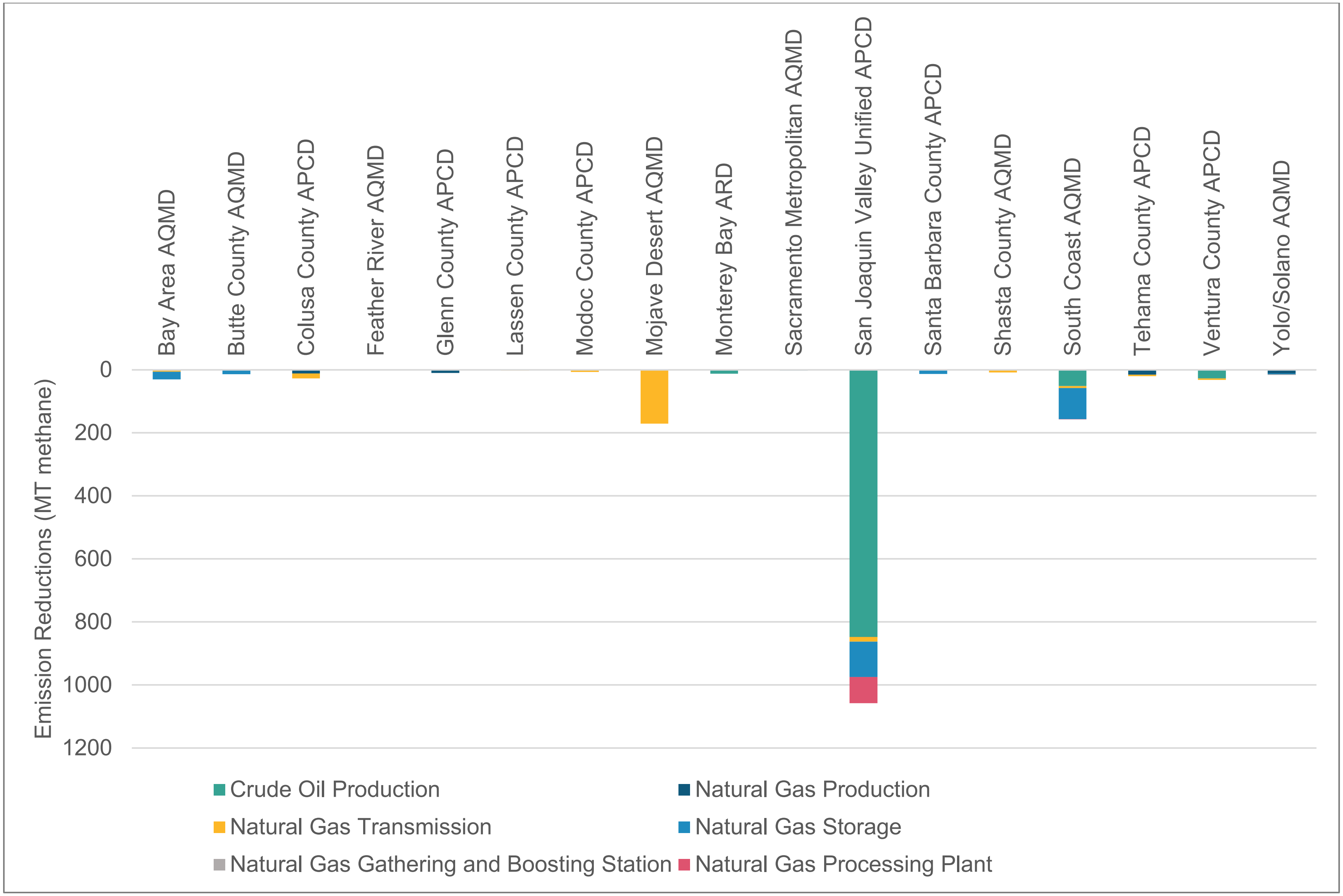


Figure A-1: Emission reductions from each sector by local air district during 2022. No leaks at or above 1,000 ppmv were discovered at the North Coast Unified AQMD in 2022. San Luis Obispo County APCD does not have facilities subject to CARB's Oil and Gas Methane Regulation's LDAR provisions; those facilities report their LDAR data to the District.

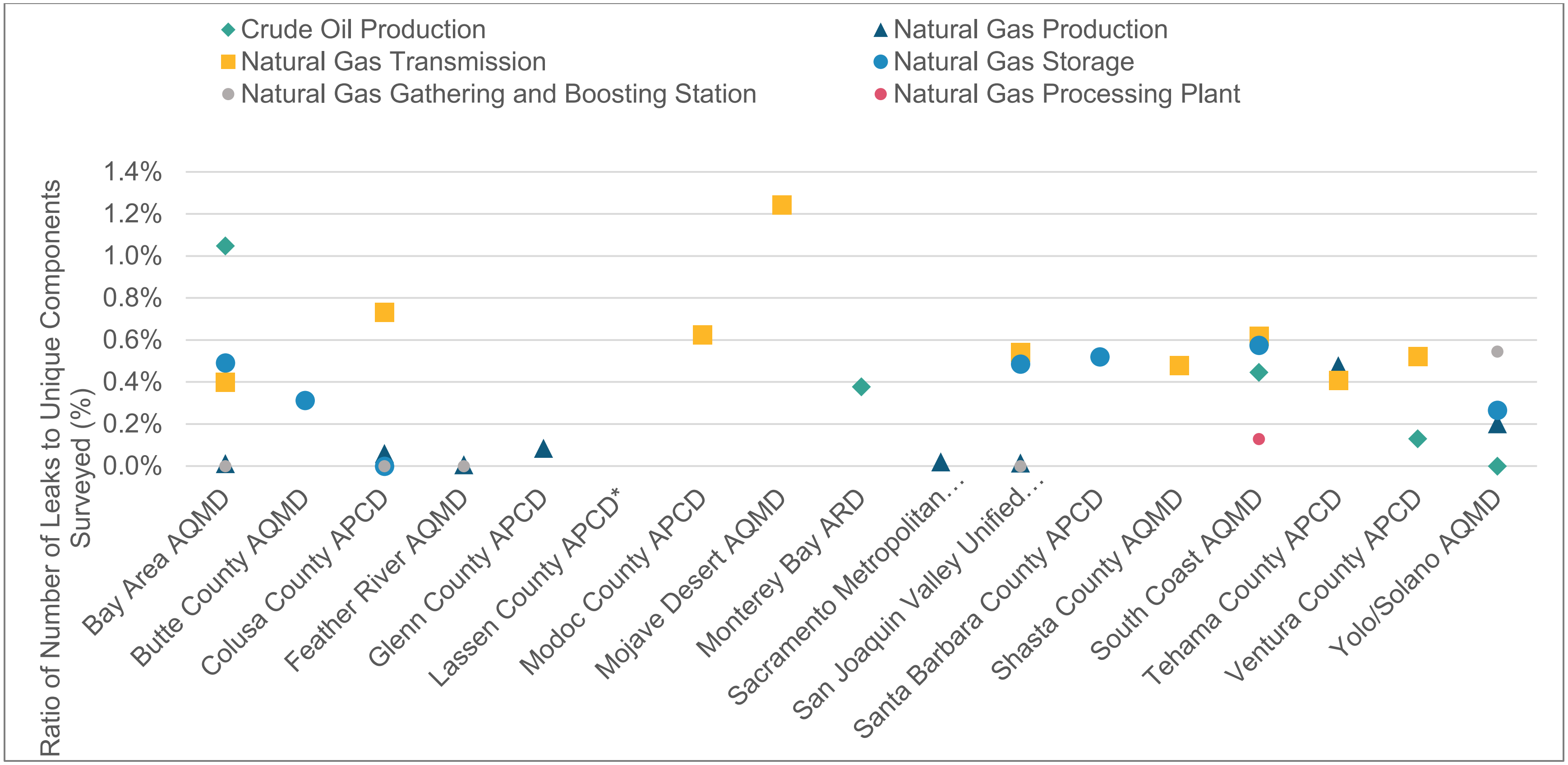


Figure A-2: Ratios of numbers of leaks to numbers of unique components surveyed for each sector by local air district during 2022. Note there are overlapping values: Bay Area AQMD had ratios of 0.012% and 0.00% for natural gas production and natural gas gathering and boosting stations, respectively; Colusa County APCD had ratios of 0.00% for both natural gas production and natural gas storage; Feather River AQMD had ratios of 0.007% and 0.00% for natural gas production and natural gas gathering and boosting stations, respectively, and San Joaquin Valley Unified APCD had ratios of 0.014%, 0.00%, 0.54% and 0.54% for natural gas production, natural gas gathering and boosting stations, natural gas transmission, and crude oil production, respectively. No leaks at or above 1,000 ppmv were discovered at the North Coast Unified AQMD in 2021. San Luis Obispo County APCD does not have facilities subject to CARB's Oil and Gas Methane Regulation's LDAR provisions; those facilities report their LDAR data to the District. *Lassen APCD had a ratio of 3.94% for natural gas transmission and San Joaquin Valley APCD had a ratio of 6.082% for natural gas processing plants, but the y-axis in this figure was limited to 1.4% to better illustrate the variation between the vast majority of operators.

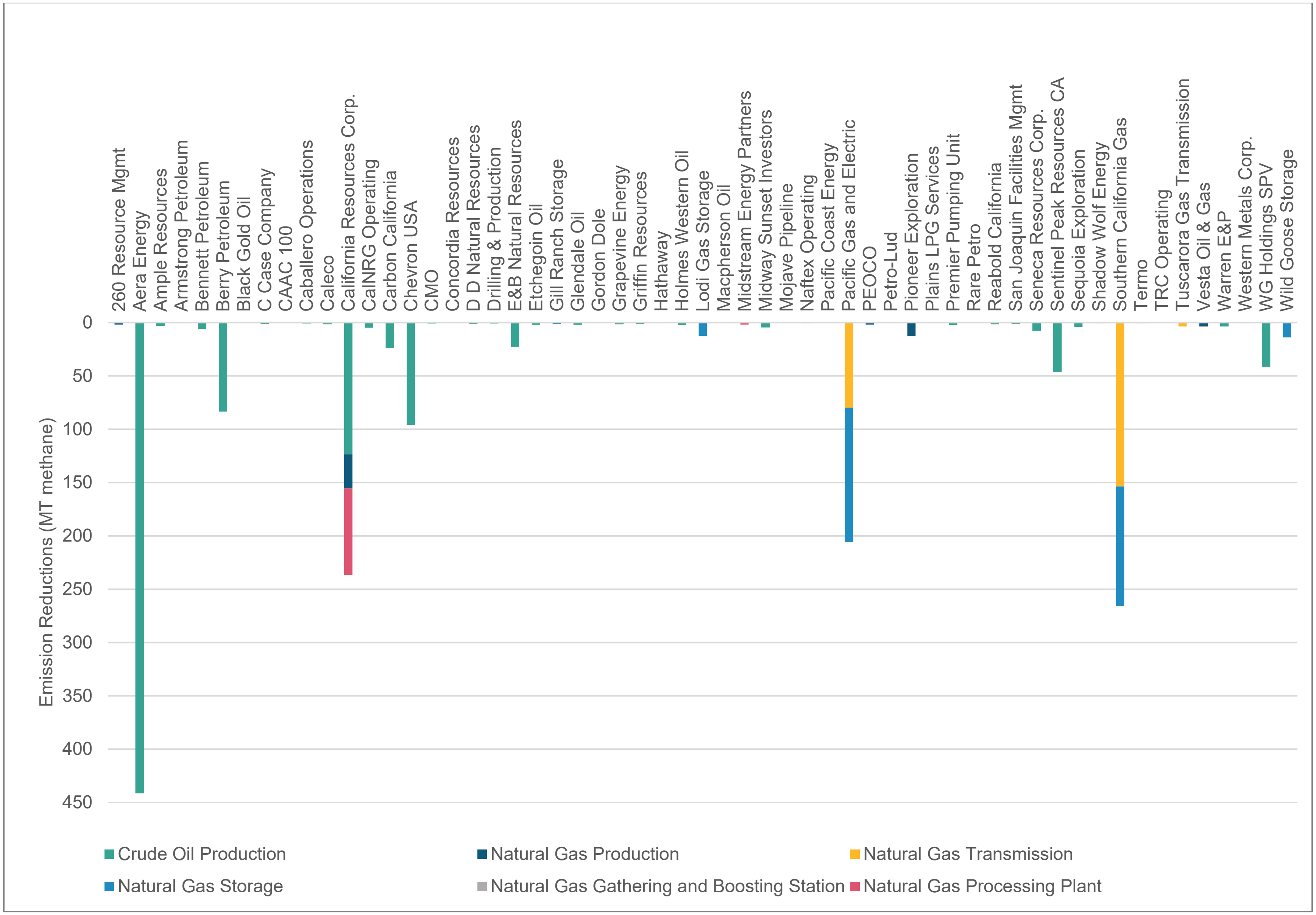


Figure A-3: Emission reductions from each sector by owner/operator during 2022. Of the 100 operators who conducted quarterly LDAR surveys, 43 did not measure any leaks at or above 1,000 ppmv and are therefore not shown here.

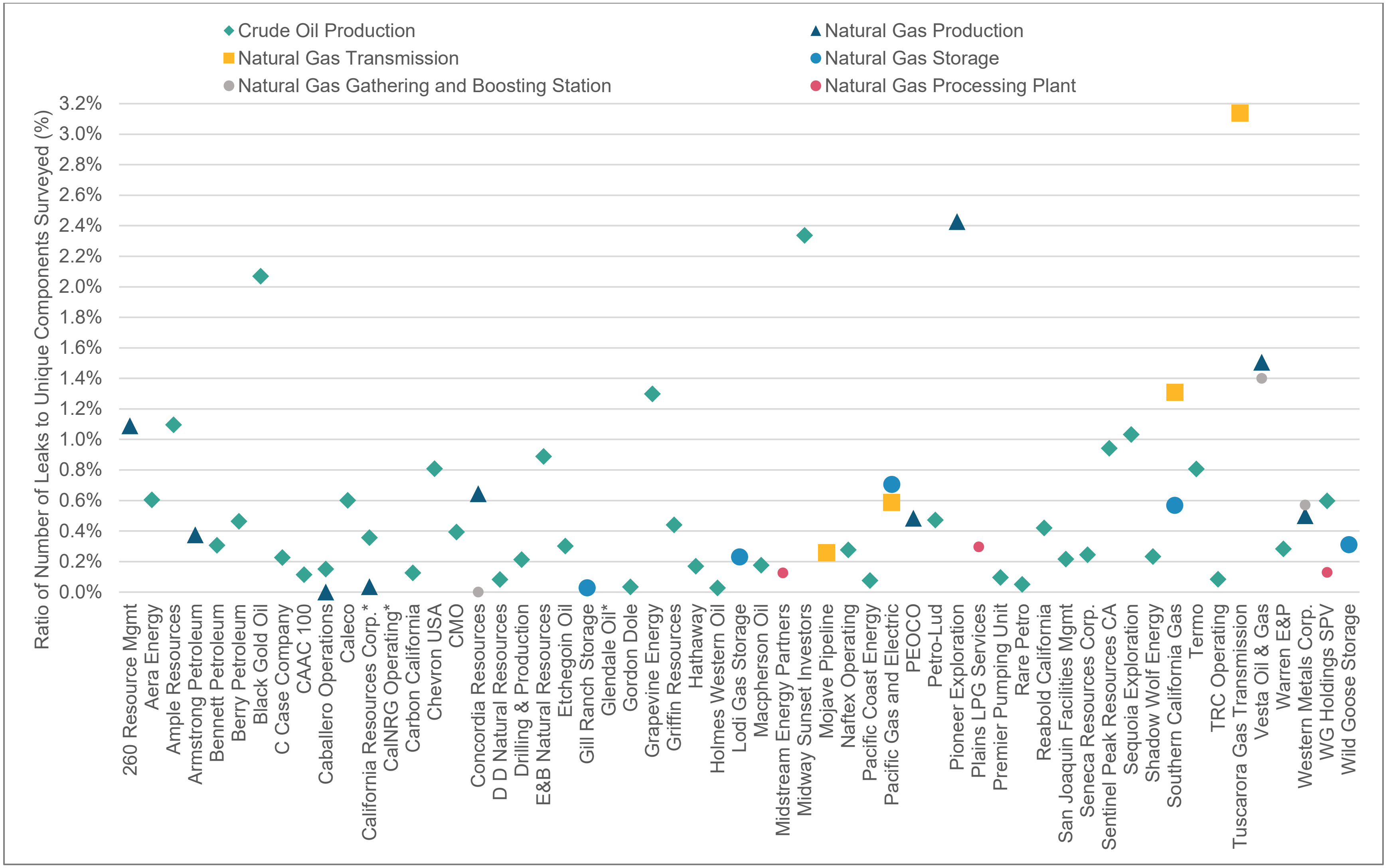


Figure A-4: Ratios of numbers of leaks to numbers of unique components surveyed for each sector by owner/operator during 2022. Of the 100 operators who conducted quarterly LDAR surveys, 43 did not measure any leaks at or above 1,000 ppmv and are therefore not shown here. *California Resources Corporation had a ratio of 25.43% for natural gas processing plants, CalNRG and Glendale Oil had ratios of 23.077% and 12.5% for crude oil production, respectively, but the y-axis in this figure was limited to 3.2% to better illustrate the variation between the vast majority of operators.