COLORADO
Air Pollution Control Division
Department of Public Health & Environment

2018 LDAR Annual Report Summary

September 30, 2019

Introduction

Statewide leak detection and repair (LDAR) requirements are outlined in Regulation No. 7, Section XVII.F, with additional LDAR requirements in Section XII.L for subject facilities located in the 8-hour ozone non-attainment area (NAA). Sections XII.L and XVII.F require owners/operators of well production facilities (WPF) and natural gas compressor stations (NGCS) to complete LDAR activities, which include periodic monitoring of components using an approved instrument monitoring method (AIMM), repairing detected leaks, and maintaining associated records. Monthly audio, visual, and olfactory (AVO) inspections are also required for WPFs under Section XVII.F.4. For NAA facilities subject to both Sections XII.L and XVII.F, owners/operators must complete AIMM inspections at the most stringent frequency of the two sections.

Changes to Regulation No. 7 in November 2017 expanded the LDAR reporting requirements, effective calendar year 2018, to ensure that the data submitted to the Division represents more detail and summarizes the activities and effectiveness of the LDAR program. Sections XII.L.7 and XVII.F.10 require owners/operators to submit to the Air Pollution Control Division (Division) an annual report by May 31st of each year with the following information regarding LDAR activities conducted during the previous calendar year:

a. the total number of WPFs and total number of NGCSs inspected;
b. the total number of inspections performed at subject facilities, separated by inspection frequency tier (and monitoring method for WPFs only);
c. the total number of identified leaks requiring repair at subject facilities separated by component type and inspection frequency tier (and monitoring method for WPFs only);
d. the total number of leaks repaired at subject facilities separated by inspection frequency tier (and monitoring method for WPFs only);
e. the total number of leaks at subject facilities on the delayed repair list as of December 31st separated by component type, inspection frequency tier (and monitoring method for WPFs only), and the basis for each delay of repair; and
f. the record of all reviews conducted for delayed repairs extending beyond 30 days due to unavailable parts.

For owners/operators of WPFs and NGCSs within the NAA, there are new requirements in Regulation No. 7, Section XVIII.F that are required to be reported for the first time for calendar year 2018 activities. These requirements include monitoring natural gas-driven pneumatic controllers and completing enhanced response actions to return to proper operation any pneumatic controllers that are identified as not functioning properly. Section XVIII.F.5 requires owners/operators to submit an annual report, as part of the annual reporting under Sections XII.L and XVII.F, with the following information regarding inspections of subject gas-driven pneumatic controllers:

a. the total number of pneumatic controllers returned to proper operation separated by facility type and inspection frequency tier;
b. the types of actions taken to return pneumatic controllers to proper operation separated by pneumatic type, facility type, and inspection frequency tier;
c. the number and type of pneumatic controllers on the delayed repair list as of December 31st and the basis for each delay separated by pneumatic type, facility type, and inspection frequency tier; and
d. the record of all reviews conducted for delayed repairs extending beyond 30 days due to unavailable parts.

This LDAR Annual Report Summary is based on data received from all owners/operators who submitted annual reports for LDAR monitoring activities that occurred during 2018. In all, 143 companies submitted annual reports for the reporting year summarized herein.

Summary of Monitoring Activities

All reporting companies provided the required information for the fields listed above in their 2018 annual reports. A summary of the reported information is provided in Tables 1 and 2 below, which combines data reported for WPFs and NGCSs. Figure 1 shows the distribution of component types for all leaks identified.

Table 1: LDAR inspections completed in 2018

Reporting companies	Facilities inspected	Inspections completed[A]
143	17,478	725,583

[A] Includes AIMM and AVO inspections

Table 2: Leaks identified and repaired

Component type	Leaks identified	Leaks repaired	Leaks on delayed repair
Valves	6,681		
Connectors	9,694		
Flanges	513		
Pump seals	520		
Pressure relief devices	6,458		
Total[B]	**23,866**	**23,651**	**280**

[B] The "Leaks repaired" and "Leaks on delayed repair" fields do not add up to the total of "Leaks identified" due to the timing of when leaks were first identified and then repaired or placed on delayed repair. Some leaks identified at the end of 2018 may not have been repaired by Dec. 31, 2018, nor needed to be placed on the delayed repair list. Additionally, leaks identified in late 2017 may have been repaired in 2018.

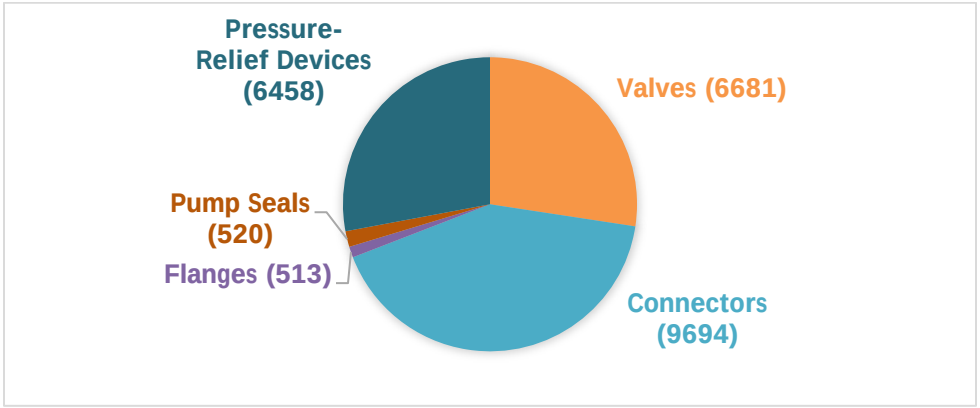

Figure 1: Number of leaks identified, by component type

Of the total number of component leaks identified during the 2018 calendar year, 99% were repaired and 1% remained on the delayed repair list as of December 31, 2018. As seen in Figure 1 above, leaks were most commonly identified emanating from connectors, valves, and pressure-relief devices. The proportion of leaking pressure-relief devices was about 27% of the total number of leaking components in 2018, compared to roughly 16% over the previous three years. This coincides with the November 2017 change in the definition of "component" to include thief hatches or other openings on controlled storage tanks as pressure-relief devices (Regulation No. 7, Section XVII.A.5).

LDAR activities at well production facilities

Of the 17,478 total facilities inspected, 17,238 were identified as well production facilities. A breakdown of the method and number of inspections conducted per frequency tier and the resulting number of leaks identified can be found in the Table 3 below. Regulation No. 7, Section XVII.F.4 requires AVO inspections at WPFs on a monthly basis except during months when an AIMM inspection was completed, in which case the AIMM inspection can take the place of the monthly AVO inspection. However, many owners/operators reported conducting AVO inspections on a more frequent basis, evidenced by the total number of AVO inspections. Additionally, where owners/operators completed AIMM inspections at a frequency greater than that required by Regulation No. 7, the Division instructed owners/operators to report those inspections under the frequency tier(s) at which inspections were actually completed and not under the tier(s) that would otherwise be required by the regulation.

Table 3: WPF inspections and leaks identified

Frequency tier	Method	Inspections	Leaks identified
Monthly	AVO	702,274	2,163
One-time	AIMM	277	263
Annual	AIMM	2,270	1,796
Semi-annual	AIMM	4,872	3,278
Quarterly	AIMM	3,823	3,692
Monthly	AIMM	11,406	11,693
Total		**724,922**	**22,885**

LDAR activities at natural gas compressor stations

The remaining 240 facilities inspected were identified as compressor stations. A breakdown of the number of inspections conducted per frequency tier and the resulting number of leaks identified can be found in Table 4 below. There is no requirement to complete AVO inspections at NGCSs. As with WPF reporting above, owners/operators were instructed to report AIMM inspections at the frequency at which they were completed.

Table 4: NGCS inspections and leaks identified

AIMM frequency tier	Inspections	Leaks identified
Annual	130	194
Quarterly	397	642
Monthly	134	145
Total	**661**	**981**

Comparison of leaks identified through AIMM and AVO inspections

One result of the LDAR program regulatory changes that took effect in 2018 is that annual data is now reported by monitoring method, which allows a comparison of AVO and AIMM inspections conducted at WPFs. (Recall that there is no AVO requirement for NGCS.) Figure 3 shows the number of inspections completed at WPFs, separated by monitoring method, and Figure 4 shows the number of leaks identified at WPFs by each type of monitoring method.

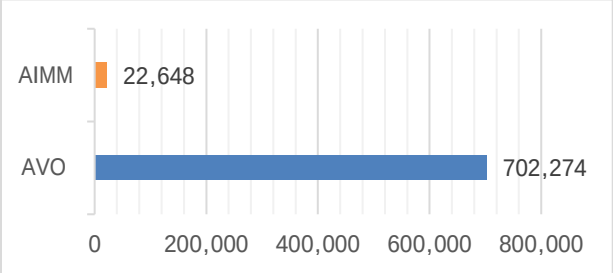

Figure 2: Inspections completed, by monitoring method (WPF only)

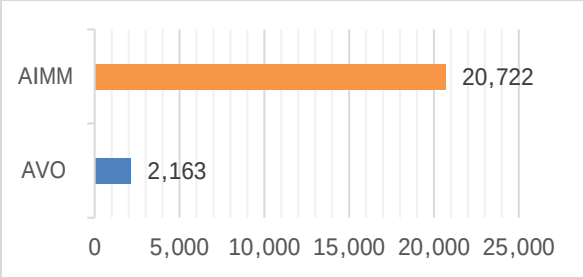

Figure 4: Leaks identified, by monitoring method (WPF only)

Based on the data reported by owners/operators, more than 90% of leaks were identified through AIMM inspections despite AIMM inspections constituting only 3% of the total number of inspections at WPFs. While AVO inspections are valuable for operations and maintenance purposes, as well as being required by other sections of Regulation No. 7, the data from this year's LDAR annual reporting indicate that AIMM is a more effective monitoring method than AVO for detecting leaks.

Pneumatic controller inspection and enhanced response

As of June 30, 2018, owners/operators are required to inspect gas-driven pneumatic controllers at WPFs and NGCSs located within the NAA using AIMM, as required in Section XVIII.F. The inspection frequencies for subject pneumatic controllers, as outlined in Sections XVIII.F.2.a-b, are aligned with the most stringent AIMM inspection frequencies for WPFs and NGCSs as required in Sections XII.L and XVII.F. As such, AIMM inspections performed to comply with Sections XII.L and XVII.F also fulfill inspection requirements for the purposes of Section XVIII.F.

The numbers of enhanced response actions performed and pneumatics returned to proper operation, separated by facility type and tier category, are included in Table 5 below. For the purposes of annual reporting, owners/operators were instructed to identify *all* enhanced response actions taken to return a given pneumatic controller to proper operation. Therefore the number of enhanced response actions performed and the number of pneumatic controllers returned to proper operation are not the same, since more than one action may have been applied to return a single pneumatic controlled to proper operation.

Table 5: Enhanced response actions and pneumatic controllers returned to proper operation

AIMM inspection frequency tier	Enhanced response actions performed	Pneumatic controllers returned to proper operation
NGCS		
Quarterly	2	2
Monthly	5	4
Subtotal - NGCS	7	6

AIMM inspection frequency tier	Enhanced response actions performed	Pneumatic controllers returned to proper operation
WPF		
Annual	233	231
Semi-annual	735	735
Quarterly	892	879
Monthly	2,193	2,170
Subtotal - WPF	4,053	4,015
Total – all facilities	**4,060**	**4,021**

At the request of the Air Quality Control Commission the Division developed a list of standardized enhanced response actions with input from the oil and gas industry to be used for recordkeeping and annual reporting purposes. These include the following options to return a gas-driven pneumatic controller to proper operation:

a. adjusted/tuned;
b. cleaned/removed debris;
c. tightened;
d. heated/insulated;
e. replaced part(s) of controller;
f. rebuilt controller with repair kit;
g. replaced controller; and
h. other.

Figure 2 below shows the distribution of each type of response action, with a total of 4,060 actions reported. The two most common types of response action were to clean/remove debris, and to rebuild the pneumatic controller with a repair kit.

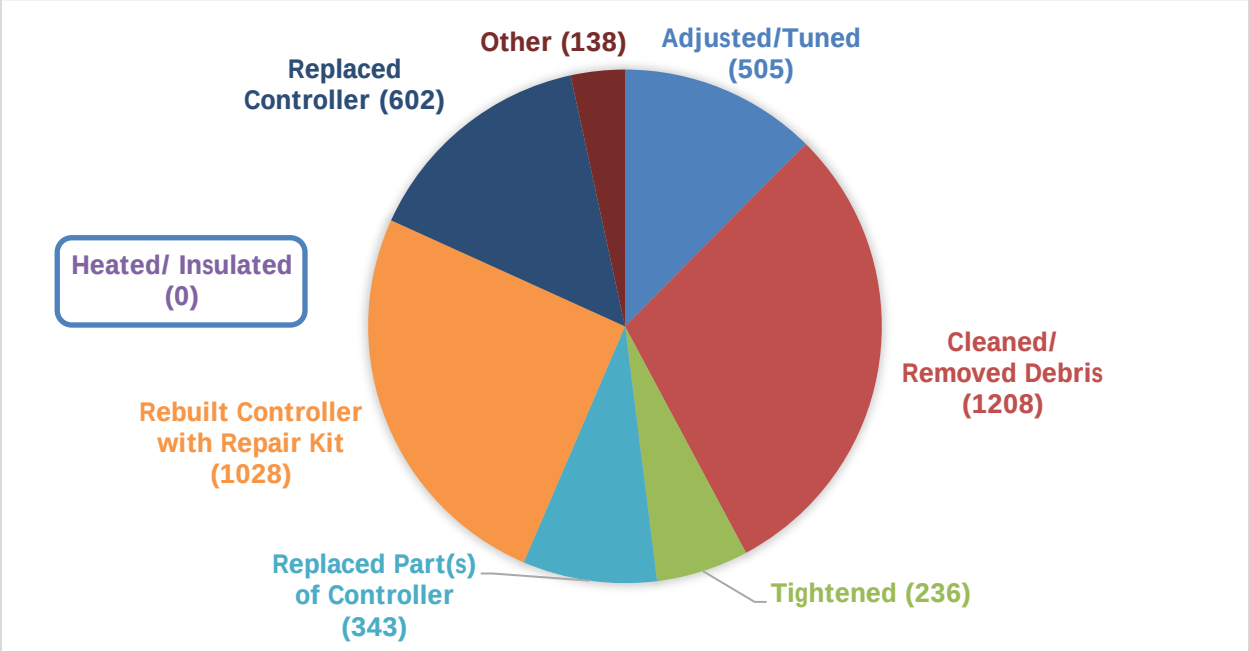

Figure 2: Enhanced response actions taken to return pneumatic controllers to proper operation, by enhanced response action category

The annual reporting provisions of Section XVIII.F require owners/operators to report enhanced response actions separated by pneumatic controller type: low-bleed, high-bleed, and intermittent-bleed. The three types are defined by Regulation No. 7, Section XVIII.B.5-7. Any pneumatic controller that is designed to bleed continuously at a rate of more than 6 standard cubic feet per hour (scfh) of natural gas is categorized as high-bleed, while low-bleed controllers are designed to bleed less than or equal to 6 scfh of natural gas. Any pneumatic controller that vents non-continuously is designated as intermittent bleed. Of the 4,060 response actions taken to bring pneumatic controllers back to proper operation, 3,964 were performed on intermittent bleed pneumatic controllers.

Conclusion

The state-wide LDAR program described in Regulation No. 7, Section XVII.F began in 2014 and has now been fully implemented for four calendar years. Table 6 below provides a summary of the data reported by owners/operators from 2015 through 2018. The reported data indicate that after a continued year-over-year reduction in the number of leaking components identified from 2015 through 2017, the number of leaks identified in 2018 increased, as shown in the table below. This coincides with an increased number of overall inspections reported, the required increase AIMM inspection frequencies for some facilities in the NAA required under Section XII.L, additional AIMM inspections required at NAA WPFs related to enforcement and settlements with multiple owners/operators, and the change in definition of "component" to include thief hatches and other opening on controlled storage tanks.

It is unclear from the information reported by owners/operator whether the increase in the number of leaks reported in 2018 indicates that more components are leaking at facilities or due to the regulatory and other changes impacting LDAR activities at affected facilities. Key changes targeted at further reducing volatile organic compound (VOC) and methane emissions in the NAA that took effect during the 2018 monitoring year include increased AIMM inspection frequencies at WPFs with storage tank emissions less than 12 tons per year of VOC, standard quarterly AIMM inspections at NGCSs, and the addition of monitoring gas-driven pneumatic controllers.

The Division expects that continued collection of more detailed LDAR reporting data, which began with 2018, will help provide further insight to the efficacy of the LDAR program at reducing emissions from Colorado's oil and gas sector.

Table 6: Summary of LDAR annual data reported 2015 through 2018

Reporting year	Companies reporting	Facilities inspected	Inspections completed[C]	Leaking components reported
2015	135	18,759	493,814	36,044
2016	127	18,683	432,701	20,435
2017	139	20,719	562,021	17,254
2018	143	17,478	725,583	23,866

[C] Includes AIMM and AVO inspections