Appendix J

MJB&A

Concord, MA - Washington, DC
47 Junction Square Drive
Concord, MA 01742
978-369-5533
www.mjbradley.com

To: Rosalie Winn, EDF

From: Dana Lowell, MJB&A

Date: December 13, 2018

Re: **Analysis of OOOOa Annual Air Emission Reports – Compressor Stations**

As requested, MJB&A conducted an analysis of Air Emission Reports (AERs) submitted to EPA by oil and gas production companies in compliance with the reporting requirements of the Code of Federal regulations, Part 60, Subpart OOOOa (40 CFR 60, OOOOa; New Source Performance Standards, Standards of Performance for Crude Oil and Natural Gas Facilities). These reports were accessed via EPA's WebFIRE website.[1] The reports analyzed, which are summarized here, are annual reports of fugitive emission sources detected at company-owned **natural gas compressor stations** during mandated Leak Detection and Repair (LDAR) surveys. The data includes reports from reporting year 2017 and reporting year 2018.

The data included in these reports indicated that:

- The average time to conduct an LDAR survey is approximately 2.8 hours per compressor station, not including travel time between sites. Based on this, EPA's estimate of the cost of semi-annual LDAR at natural gas gathering and boosting compressor stations is likely overstated by 7% - 24%.
- At least one fugitive emission source was detected during 88% of LDAR surveys at compressor stations. The average number of fugitive emission sources detected was 4.7 per compressor station.
- Flanges or connectors were the most common fugitive emission sources detected during LDAR surveys, comprising almost 42% of all detected sources. The second major source of fugitive emissions was leaking valves, totaling 31% of all detected sources.
- All detected fugitive emission sources had been repaired by the end of the reporting period at approximately 83% of sites.

Summary of Reports Analyzed

WebFIRE Reports

As of December 5, there were 189 unique OOOOa AERs included on the WebFIRE site (not including a handful of reports repeated more than once). Of these reports, 82 are "Well Sites," 50 are related to "Gas Plants," 15 are related to "Processing Facilities", 5 were submitted by "Production Facilities," 3 were submitted by "Pipeline Companies", and 2 were "Treating Facilities." These reports were not included in the analysis summarized here.

The remaining 32 reports (17% of total reports) each address one or more natural gas compressor station(s) owned by the reporting companies. All of these compressor stations are mid-stream gathering and boosting compressors and do not include compressor stations on intra-state or inter-state transmission pipelines. The analysis summarized here is based on data in these 32 reports. All 32 reports analyzed were submitted on Excel™

[1] https://cfpub.epa.gov/webfire/reports/eSearchResults.cfm; Accessed on December 5, 2018.

spreadsheet templates provided by EPA; however, some required data elements (per the EPA template) were missing or incomplete on some reports. In addition, the different companies did not use a consistent data format when completing other required data elements.

The site information sections of these 32 reports list 41 unique "compressor sites." These compressor sites are in 12 different states[2], but are most abundant (~40%) in Texas. Based on the descriptions provided, the majority of the companies reported data for a single facility in each report, but two companies reported data for two facilities and one company reported data for eight.

All of the "sites" listed in the site information section of a given report have corresponding data on "fugitive emission sources" at that site. Of these 41 sites, 48.8% have data on one LDAR survey, and 46.3% have data on more than one LDAR survey (i.e. there is data on 2 – 4 separate surveys of the same site conducted on different days, one site had 5 separate surveys, and one site had 13 separate surveys at the same site). The remaining 5%, or two reports, had no data.

Altogether there is at least partial data describing the results of 97 unique LDAR surveys (unique survey date at unique site). However, the data is not complete for all of these 97 unique surveys. Two reports did not include data on the type of fugitive sources detected at the site, and one contains fugitive data but does not include the start-end time for the LDAR survey.

Of 97 unique LDAR surveys for which the survey method was reported, all but one used Optical Gas Imaging to detect fugitive emission sources (the exception used a toxic vapor analyzer in conjunction with Method 21).

Of 97 unique LDAR surveys for which repair data was reported, 82.1% reported that all detected fugitive emission sources were repaired, 5.3% reported that less than 60% of detected sources were repaired, and 12.6% reported that less than 10% of detected sources were repaired.

Summary of LDAR Survey Data

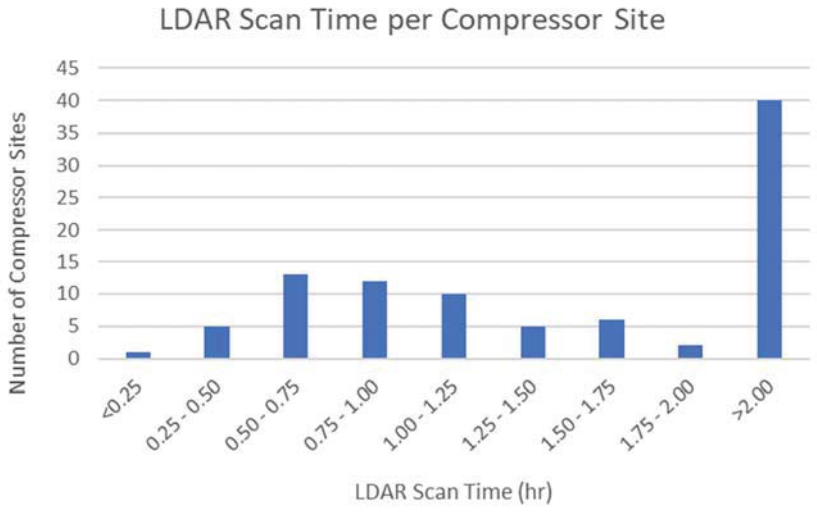
LDAR Survey Time per Compressor Site

See Figure 1 for a distribution of reported LDAR survey times at compressor sites. For the 94 compressor site LDAR surveys with reported start- and end-time data, 33% took less than one hour while 43% took more than 2 hours per compressor site. The average reported time to conduct the LDAR surveys was 2.8 hours per compressor site across the entire data set.

This data set does not contain any information that would allow us to calculate average travel time to/from these compressor sites when conducting LDAR surveys (i.e. there is no data on successive surveys at different sites by the same person on the same day).

[2] The states include: CO, GA, ID, ND, NM, NY, OH, OK, TX, UT, WV, and WY.

Figure 1 Distribution of LDAR Survey Times at Compressor Sites



Implied LDAR Costs

In their supporting documentation for the background Technical Support Document for the proposed reconsideration of OOOOa [3] EPA estimates that:

- The cost of quarterly LDAR at natural gas boosting and gathering compressor stations using optical gas imaging is $20,983 (2016$) per site (net of the value of natural gas savings) based on the use of third-party contractors to conduct the OGI surveys,
- OGI camera surveys will cost $2,300 per survey, and will take 10.6 hours per site, implying a contract cost for OGI services of $217/hour, and
- Average labor costs for in-house personnel are $61.21/hr

As noted above, the data submitted by oil and gas companies on their annual emission reports indicates that the average LDAR survey time was approximately 2.8 hours/site/survey, not including travel time, for surveys of gathering and boosting compressor stations.

Even if travel time averages 2 hours per site per survey (80 - 100 miles between sites), the AER data therefore indicates that EPA's estimate of LDAR costs may overstate the labor effort for LDAR surveys at compressor stations by at least 23.2 hours per site per year, for quarterly LDAR. Assuming average labor cost of $61.21/hr - $217/hr (covering the range of surveys conducted by in-house personnel and contracted services), EPA's estimate of LDAR costs for boosting and gathering compressor stations may therefore be overstated by 7% - 24% ($1,420 - $5,034/site/year).

Number of Detected Fugitive Emission Sources per Compressor Site

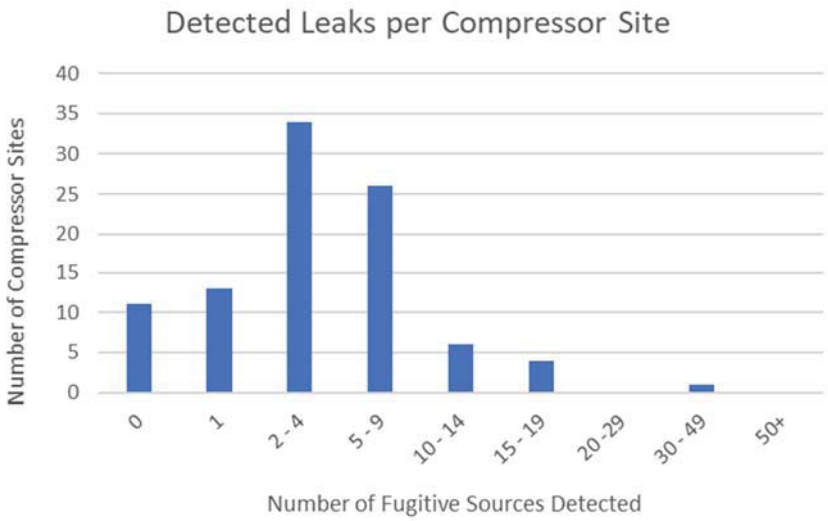
See Figure 2 for a distribution of the number of fugitive emission sources detected at compressor sites during the LDAR surveys. Of the 95 unique LDAR surveys with reported fugitive data, 88% detected at least one fugitive emissions source at the surveyed compressor site. There were 11 compressor site scans that did not detect any leaks.

[3] https://www.regulations.gov/document?D=EPA-HQ-OAR-2017-0483-0040

Of the unique surveys with detected fugitive sources, 13.7% detected one source, 35.8% detected 2 – 4 different sources, 27.4% detected 5 – 9 different sources, and 11.6% detected 10 or more different sources at the compressor site. The average number of fugitive sources detected during LDAR surveys was 4.73 fugitive sources per site.

There were 17 unique compressor stations that had one or more repeat scans at least two months after the initial scan. Of the 58 total repeat scans, 83% detected new leaks.

Figure 2 Distribution of Fugitive Emission Sources Detected at Compressor Sites During LDAR Surveys



Types of Fugitive Emission Sources Detected

See Figure 3 for a summary of the types of fugitive emission sources detected during the LDAR surveys. Out of 449 fugitive emission sources identified by type in the reports, 41.6% were leaking flanges or controllers and 31% were leaking valves or regulators. Leaking pressure relief valves (5.3%), compressors (3.8%) and controllers (3.3%) made up a smaller share of fugitive emissions. The remaining 15% of fugitive emission sources were various component types for which no single type accounted for more than 1% of detected fugitive sources.

Figure 3 Types of Fugitive Emission Sources Detected During LDAR Surveys