

Preliminary Results from Fugitive Emission Measurements of Selected Components at Compressor Stations

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ABSTRACT

This report summarizes the interim results of work completed by The University of Texas, *Center for Energy and Environmental Resources* for the U.S. Environmental Protection Agency (EPA). Initial measurements made of fugitive components at natural transmission compressor stations were measured and compared to previous published emission factors. This initial work will shape future phases of field measurement planned for this ongoing project.

INTRODUCTION

This project began in 2008 and reviewed existing published literature defining methane emission factors for natural gas industry sources. An initial project report in 2008 defined the emission source types of interest for this project as:

- Production: Well clean-ups, completion flaring, well workovers, pipelines leaks;
- Processing: fugitive emissions from reciprocating and centrifugal compressors;
- Transmission and Storage: fugitive emissions from reciprocating and centrifugal compressors, pneumatic devices, and M&R stations; and
- Distribution: Residential customer meters, plastic mains and services.

The ultimate goal for the project is to develop new emission factors for these sources that could be used to replace the existing emission factors, most of which were developed in the mid-1990's under the GRI/EPA program. An attached table to this summary report shows some of the data for those GRI/EPA sources.

This project was divided into Phases. The first target for Phase 1 was the Transmission and Storage segment. Phase 2 is planned to include E&P and distribution sources. Portions of Phase 1 have been completed and are discussed in this report. Project funding does not yet cover all of the planned work for Phase 1.

BODY

This summary will review the initial results of work done by The University of Texas at Austin for the EPA. The first goal of Phase 1 was to scope and develop sampling plans and conduct initial measurements. Phase 1 funding was not sufficient for completion of statistically significant sampling, but initial measurements were made to test the new proposed techniques.

The compressor station sampling techniques were as follows:

- Station Fugitive screening by FLIR camera (non-quantitative);
- Fugitive measurement on found leakers by High Volume Sampler device; and
- Vent Measurement by alternate methods (pitot tube, anemometer, or calibrated bag).

In Phase 1 of the project in 2009 and 2010, initial measurements were made for compressor related fugitive components at five compressor stations. Some pneumatic devices were also included.

Initial Results

During Phase 1, the project team canvassed companies and found volunteer sites for measurements. In Phase 1 of the project in 2009 and 2010, initial measurements were made for compressor related fugitive components at five compressor stations in the southern central U.S. Measurements included compressor related fugitive components (flanges, valves, open-ended-lines, pressure relief valves) as well as blowdown vent lines and compressor seal and rod packing emissions, the latter which were measured by anemometer and calibrated bag techniques.

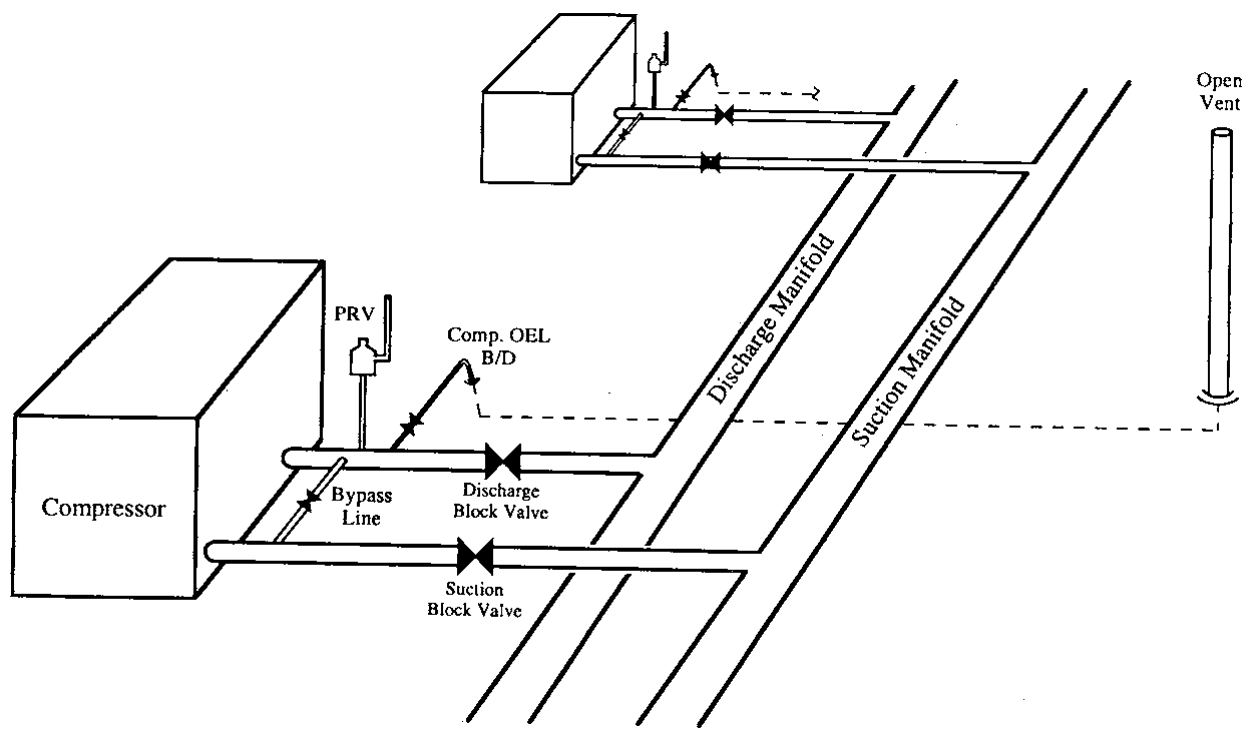
The following table describes the sites that were visited and measured during Phase 1.

Table 1: Sites Visited in Phase 1

Ownership	Date Visited	Description	IR screening?	Hi Flow on component leaks	Vent Pipes Measured
Co #1	11/3/09	6 Recips (1965)	√	√	√
Co #1	11/4/09	5 Recips ('92 – '09)	√	√	√
Co #1	11/3/09	3 Centrif (1982)	√	√	√
Co #2	2/23/10	15 Recips	√	√	√
Co #2	2/24/10	8 Recips (1950's)	√	√	√

The following figure shows a representation of a typical compressor blowdown line configuration. When compressors are idle and pressurized, the small (often 2 inch size) valve to the open vent is the only open-ended line (OEL) leak point. However, if the compressor is isolated from the suction and discharge lines and blown-down, the OEL leak points are the very large suction and discharge block vales, which can leak at a much higher rate.

Figure 1: Compressor Blowdown Line Configuration



The following tables show some of the initial results. Comparisons were made to the existing emission data generated in the 1990's for The Gas Research Institute and the U.S. EPA. The resulting data is as follows:

Table 2: Vent Measurements (First 2 Stations)

	New Measurement Mscfy	Previous GRI/EPA Mscfy per compr.
Average BD vent for IDLE (recip)	14347	3683
Avg BD vent for RUNNING (recip)	8807	
Avg Packing Vent RUNNING	13798	396

Table 3: Vent Measurements (Last 3 Stations)

	Mscfy	Previous GRI/EPA Mscfy per compr.
Average BD vent for IDLE, recip	699	3683
Avg BD vent for IDLE+RUN, centrif	15787	
Avg Packing Vent IDLE	8379	396

Table 4: Compressor Miscellaneous Fugitives (valves, flanges, etc: all stations)

	Mscfy per compr.	GRI/EPA Mscfy per Recip compr.
Pressurized idle	60	180 per Recip compr;
Operating	48	
Average	52	

CONCLUSIONS

As was found in the previous GRI/EPA study, the largest single emission sources at a compressor station site are the compressor blowdown (BD) vent lines and the compressor seal vents. These remain the largest sources in the sampling for this project. For compressor vent lines, measurements at the first two stations exceeded the values previously reported for the GRI/EPA study. However, measurements at the last three stations had lower values for idle reciprocating compressors. At the last three stations, the practice for idle compressors was to leave the compressor pressurized. This reduces leakage through the compressor BD line versus other practices.

While no statistical analysis have yet been made, it is unlikely that this data is statistically sufficient to replace the previous GRI/EPA data, which made direct measurements of the high emission components at 15 stations, and which gathered other activity data on a much larger sample set. More stations would have to be visited across a broader geographic area to cover a representative sample of U.S. transmission compressor stations. Also, data on operating practices for compressors might be gathered from a larger sample than visited for direct measurements; volunteer companies could participate in a survey that would gather the needed data.

New Regulatory Changes that Affect This Research

This study may be of special interest now, since the measurement techniques used were nearly identical to those that the EPA recently outlined in the April 12, 2010 proposed Subpart W of the greenhouse gas (GHG) Mandatory Reporting Rule (MRR). This rule also required measurements by natural gas industry for many of the same sources that were targeted by this University of Texas research project.

The EPA proposed Subpart W rule is due to be issued as a final rule by September or October of 2010. While EPA may make changes to the version proposed in April 2010, the currently proposed version of the rule would require measurement of all these individual sources by practically every US operator. In that scenario, the regulatory measurement data collected may replace the need to collect data under this research project.

Industry associations and individual companies have commented on the proposed rule, and it is possible that EPA will make changes to eliminate the regulatory measurements, and rely upon emission factors. In that scenario, this University of Texas research project to update the emission factors becomes more important.

Future Work

It is clear that the project team must closely monitor the outcome of the final published MRR Subpart W. It is possible that there is benefit to additional compressor station work under any outcome of the rule.

If the project continues in Phase 1 with compressor stations, more sampling is needed to establish a statistically significant number of measurements. The specific recommendations are:

- Gather more direct measurement data (Measure more compressor station sites and gas plant sites) Target: 6-10 more stations geographically diverse;
- Survey INGAA members for company practices on compressor operating practices that affect leak rate; and
- Produce and publish updated compressor emission factors.

REFERENCES

Hummel, Kirk E, Campbell, Lisa M., Harrison, Matthew R., *Methane Emissions from the Natural Gas Industry, Volume 8: Equipment Leaks*, Gas Research Institute and the United States Environmental Protection Agency, June 1996

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