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Compliance Emissions Test Report

Savoy Energy, L.P.
Moore Central Processing Facility
Two Caterpillar Compressor Engines
Brooklyn, Michigan
Project No. M194511
December 10, 2019

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Report Submittal Date
December 26, 2019

Project No. M194511

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630-993-2100

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1.0 EXECUTIVE SUMMARY

MOSTARDI PLATT conducted a Compliance test program for Savoy Energy, L.P. at the Moore Central Processing Facility on two Caterpillar Compressor Engines in Brooklyn, Michigan on December 10, 2019. This report summarizes the results of the test program and test methods.

The test locations, test date, and test parameters are summarized below.

TEST INFORMATION		
Test Locations	**Test Date**	**Test Parameters**
Two Caterpillar Compressor Engines	December 10, 2019	Nitrogen Oxides (NO_x), Carbon Monoxide (CO), Oxygen (O_2), Carbon Dioxide (CO_2)

The purpose of the test program was to demonstrate compliance with emission limits as required by the Michigan Department of Environment, Great lakes, and energy (EGLE) Permit to Install 188-18 and USEPA, Title 40, *Code of Federal Regulations*, Part 63 (40CFR63) Subpart ZZZZ (RICE NESHAP).

TEST RESULTS SUMMARY				
Test Location	**Parameter**	**Units**	**Emission Limit**	**Actual Test Result**
EUENG-1 Outlet	NO_X	tpy	6.0 (per engine)	5.1
	CO	ppmvd @ 15% O_2	270	267.3
		tpy	13.0 (per engine)	14.2
	O_2	%, dry basis	N/A	0.00
EUENG-3 Outlet	NO_X	tpy	6.0 (per engine)	4.4
	CO	ppmvd @ 15% O_2	270	45.8
		tpy	13.0 (per engine)	1.6
	O_2	%, dry basis	N/A	0.04

Emission Unit Description	Engine ID
CAT 398SA natural gas-fired 4SRB 625 hp compressor engine with oxidation catalyst	EUENG-1
	EUENG-3

The identifications of the individuals associated with the test program are summarized below.

TEST PERSONNEL INFORMATION		
Location	**Address**	**Contact**
Test Facility	Savoy Energy, L.P. 9703 Peterson Road Brooklyn, Michigan 49230	Mr. Dylan Foglesong Savoy Energy, LP (231) 941-9552 (phone) dylan@savoyexp.com
Testing Company Supervisor	Mostardi Platt 888 Industrial Drive Elmhurst, Illinois 60126	Mr. Timothy E. Russ Senior Project Manager (630) 993-2100 (phone) truss@mp-mail.com
Testing Company Personnel		Mr. Ryan Simon Test Engineer
		Mr. Matthew Keator Test Engineer

2.0 TEST METHODOLOGY

Emission testing was conducted following the United States Environmental Protection Agency (USEPA) methods specified in 40CFR60, Appendix A, in addition the Mostardi Platt Quality Manual. Schematics of the test section diagram and sampling train used are included in Appendix A and B respectively. Calculation nomenclature are included in Appendix C. Copies of analyzer print-outs for each test run are included in Appendix D. CEM data and process data as provided by Ardagh Glass Inc. are also included in Appendix E.

The following methodologies were used during the test program:

Method 3A Oxygen (O_2) Determination

Method 3A, 40CFR60, was used to determine O_2 concentrations at the inlet and outlet test locations. Gas samples were collected for the duration of the compliance gas runs. Readings were recorded with a data logging system. Linearity calibrations were performed prior to sample analysis, and mid-range calibration checks were performed after each sample was analyzed. Final O_2 concentrations were corrected for calibration error of the instrument. A list of calibration gases used and the results of all calibration and other required quality assurance checks are found in Appendix G. Copies of the gas cylinder certifications are found in Appendix H. This testing met the performance specifications as outlined in the Method.

Method 7E Nitrogen Oxides (NO_X) Determination

Method 7E, 40CFR60, was used for determining nitrogen oxides (NO_X) emissions from the inlet and outlet test locations. A gas sample was continuously extracted from the gas stream through a heated sample probe and gas conditioning system. A portion of the sample stream was conveyed via a sampling line to gas analyzers for determination of NO_X content. Prior to emissions sampling, the nitric oxide (NO)/NO_x analyzer was zeroed and calibrated. High-range, mid-range, and zero gases were introduced into the NO_x sampling system.

The sample gas manifold was then be adjusted for emissions sampling. After each test run, the zeroes were checked and mid-range NO_x gas was introduced into the sampling system to check calibration.

The chemiluminescent reaction of NO and ozone (O_3) provides the basis for this instrument operation. Specifically:

$$NO + O_3 \rightarrow NO_2 + O_2 + h_\upsilon$$
$$\text{where } h_\upsilon = \text{light}$$

Light emission results when electronically excited nitrogen dioxide (NO_2) molecules revert to their ground state. To measure NO concentrations, the gas sample to be analyzed was blended with O_3 in a reaction chamber. The resulting chemiluminescence was monitored through an optical filter by a high-sensitivity photomultiplier positioned at one end of the chamber. The filter/photomultiplier combination responds to light in a narrow-wavelength band unique to the above reaction (hence, no interference). The output from the photomultiplier is linearly proportional to the NO concentration.

To measure NO_X concentrations (i.e., NO plus NO_2), the sample gas flow was diverted through a NO_2-to-NO converter. The chemiluminescent response in the reaction chamber to the converted effluent is linearly proportional to the NO_X concentration entering the converter. The instrument was operated in the NO_X mode during all tests and calibrations.

A list of calibration gases used and the results of all calibration and other required quality assurance checks can be found in the Appendix. Copies of calibration gas certifications can be found in the Appendix.

Method 10 Carbon Monoxide (CO) Determination

Method 10, 40CFR60, test procedure was used to determine the CO concentrations from the inlet and outlet test locations. A gas sample was continuously extracted from the gas stream through a heated sample probe and gas conditioning system and analyzed for CO content using a nondispersive infrared analyzer (NDIR). This instrument employs an internal gas correlation filter wheel which eliminates potential detector interference. Instruments so equipped do not require the use of an interference removal trap.

After an appropriate warm-up time, and prior to emissions sampling, the CO analyzer was zeroed and calibrated. High-range, mid-range, and zero gases were introduced into the CO sampling system.

The sample gas manifold was then be adjusted for emissions sampling. After each test run, the zeroes were checked and mid-range CO gas was introduced into the sampling system to verify calibration.

A list of calibration gases used and the results of all calibration and other required quality assurance checks can be found in the Appendix. Copies of calibration gas certifications can be found in the Appendix.

3.0 TEST RESULT SUMMARIES

Savoy Energy, L.P.
Moore Central Processing Facility
EUENG-1 Outlet and Inlet
Gaseous Summary

Test No.	Date	Start Time	End Time	Fuel Usage scf/day	Fuel Analysis Btu/scf	Fuel Factor lb/dscf	Heat Input, MMBtu/hr	NO_x Inlet ppmvd	CO Inlet ppmvd	O_2 Inlet % (dry)	NO_x Outlet ppmvd	CO Outlet ppmvd	O_2 Outlet % (dry)	CO Inlet ppmvd @ 15% O_2	CO Outlet ppmvd @ 15% O_2	CO Removal Efficiency	NO_x Outlet lb/mmBtu	NO_x lb/hr	NO_x ton/year	CO Outlet lb/mmBtu	CO lb/hr	CO ton/year
1	12/10/19	18:00	18:59	130000	984.6	8847.59	5.333	2101.0	4183.8	0.22	169.9	1251.8	0.00	1193.6	353.4	70.4%	0.179	0.96	4.2	0.805	4.29	18.8
2	12/10/19	19:18	20:17	130000	984.6	8847.59	5.333	2153.2	3936.7	0.20	219.4	797.2	0.00	1122.1	225.0	79.9%	0.232	1.24	5.4	0.512	2.73	12.0
3	12/10/19	20:30	21:29	130000	984.6	8847.59	5.333	2131.6	3877.6	0.19	226.6	791.4	0.00	1104.7	223.4	79.8%	0.239	1.28	5.6	0.509	2.71	11.9
Average							5.333	2128.6	3999.4	0.20	205.3	946.8	0.00	1,140.1	267.3	76.7%	0.217	1.16	5.1	0.609	3.25	14.2

Emission Limits		
NOx	tpy	6.0 (per engine)
CO	ppmvd @ 15% O_2	270
	tpy	13.0 (per engine)
O2	% (dry)	N/A

Savoy Energy, L.P.
Moore Central Processing Facility
EUENG-3 Outlet and Inlet
Gaseous Summary

Test No.	Date	Start Time	End Time	Fuel Usage scf/day	Fuel Analysis Btu/scf	Fuel Factor lb/dscf	Heat Input, MMBtu/hr	NO_x Inlet ppmvd	CO Inlet ppmvd	O_2 Inlet % (dry)	NO_x Outlet ppmvd	CO Outlet ppmvd	O_2 Outlet % (dry)	CO Inlet ppmvd @ 15% O_2	CO Outlet ppmvd @ 15% O_2	CO Removal Efficiency	NO_x Outlet lb/mmBtu	NO_x lb/hr	NO_x ton/year	CO Outlet lb/mmBtu	CO lb/hr	CO ton/year
1	12/10/19	13:59	14:58	84000	984.6	8847.59	3.446	1409.4	8719.6	0.93	261.0	168.2	0.03	2576.1	47.6	98.2%	0.276	0.95	4.2	0.108	0.37	1.6
2	12/10/19	15:15	16:14	84000	984.6	8847.59	3.446	1380.7	8811.7	0.84	282.1	133.0	0.04	2591.7	37.6	98.5%	0.299	1.03	4.5	0.086	0.30	1.3
3	12/10/19	16:30	17:29	84000	984.6	8847.59	3.446	1448.3	9558.4	0.86	278.1	184.0	0.05	2814.1	52.1	98.1%	0.294	1.01	4.4	0.119	0.41	1.8
Average							3.446	1412.8	9029.9	0.88	273.7	161.7	0.04	2660.6	45.8	98.3%	0.290	1.00	4.4	0.104	0.36	1.6

Emission Limits		
Nox	tpy	6.0 (per engine)
CO	ppmvd @ 15% O_2	270
	tpy	13.0 (per engine)
O2	% (dry)	N/A

4.0 CERTIFICATION

MOSTARDI PLATT is pleased to have been of service to Savoy Energy, L.P. If you have any questions regarding this test report, please do not hesitate to contact us at 630-993-2100.

CERTIFICATION

As the program manager, I hereby certify that this test report represents a true and accurate summary of emissions test results and the methodologies employed to obtain those results. The test program was performed in accordance with the test methods and the Mostardi Platt Quality Manual, as applicable.

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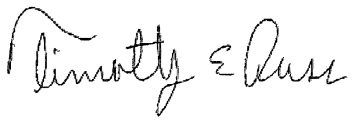
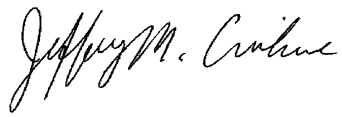


Program Manager

Timothy E. Russ



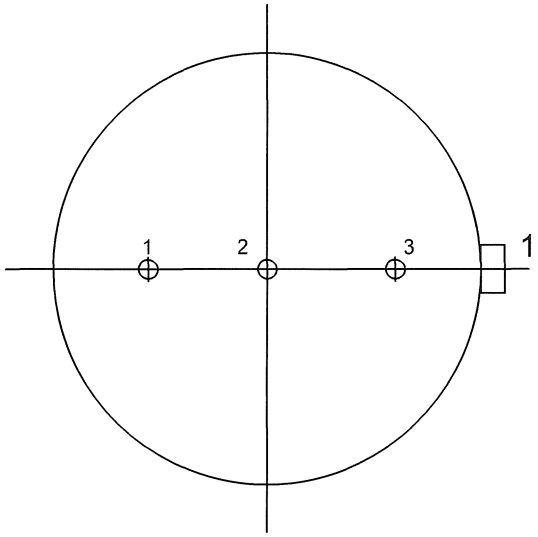
Quality Assurance

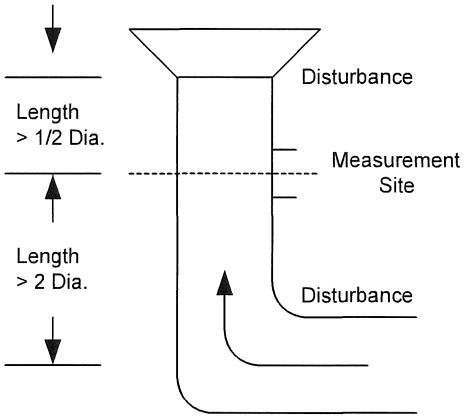
Jeffrey M. Crivlare

APPENDICES

Appendix A - Test Section Diagram

GASEOUS TRAVERSE FOR ROUND DUCTS





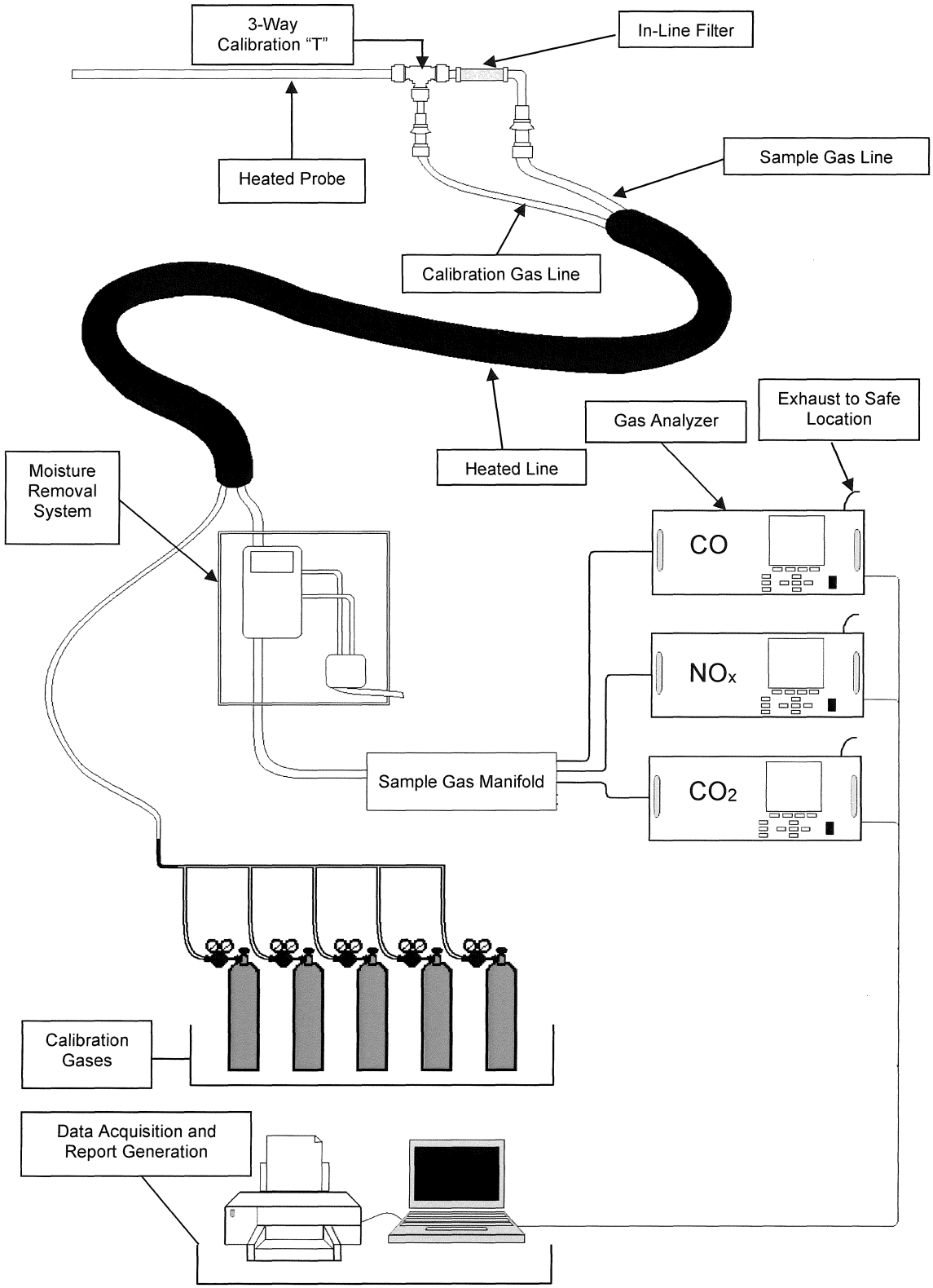
Job:	Savoy Energy, L.P. Brooklyn, Michigan
Date:	December 10, 2019
Test Location:	EUENG-1 and EUENG-3 Inlets and Exhausts
Stack Diameter:	0.833 Feet
Stack Area:	0.54 Square Feet
No. Sample Points:	3

Distance from Inside Wall
To Traverse Point:

1. 83.3 % of diameter
2. 50.0 % of diameter
3. 16.7 % of diameter

Appendix B - Sample Train Diagram

USEPA Methods 3A, 7E, and 10 Extractive Gaseous Sampling Diagram



Appendix C - Calculation Nomenclature and Formulas