COMPLIANCE TEST REPORT
ANR PIPELINE-EATON RAPIDS COMPRESSOR STATION
ENGINE EUETCOMP-C

Prepared for:

TransCanada
In business to deliver

TransCanada's ANR Pipeline Company
Eaton Rapids, Michigan

Prepared by:

EQM

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July 2016

DEQ

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY
AIR QUALITY DIVISION

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RENEWABLE OPERATING PERMIT REPORT CERTIFICATION

Authorized by 1994 P.A. 451, as amended. Failure to provide this information may result in civil and/or criminal penalties.

Reports submitted pursuant to R 336.1213 (Rule 213), subrules (3)(c) and/or (4)(c), of Michigan's Renewable Operating (RO) Permit program must be certified by a responsible official. Additional information regarding the reports and documentation listed below must be kept on file for at least 5 years, as described in General Condition No. 22 in the RO Permit and be made available to the Department of Environmental Quality, Air Quality Division upon request.

Source Name: ANR Pipeline Company, Eaton Rapids Comp. Sta. County: Eaton

Source Address: 3349 South Waverly Road City: Eaton Rapids

AQD Source ID (SRN): N3022 RO Permit No.: MI-ROP-N3022-2014 RO Permit Section No.: 1

Please check the appropriate box(es):

☐ **Annual Compliance Certification (General Condition No. 28 and No. 29 of the RO Permit)**

Reporting period (provide inclusive dates): From _____ To _____

☐ 1. During the entire reporting period, this source was in compliance with **ALL** terms and conditions contained in the RO Permit, each term and condition of which is identified and included by this reference. The method(s) used to determine compliance is/are the method(s) specified in the RO Permit.

☐ 2. During the entire reporting period this source was in compliance with all terms and conditions contained in the RO Permit, each term and condition of which is identified and included by this reference, **EXCEPT** for the deviations identified on the enclosed deviation report(s). The method used to determine compliance for each term and condition is the method specified in the RO Permit, unless otherwise indicated and described on the enclosed deviation report(s).

☐ **Semi-Annual (or More Frequent) Report Certification (General Condition No. 23 of the RO Permit)**

Reporting period (provide inclusive dates): From _____ To _____

☐ 1. During the entire reporting period, **ALL** monitoring and associated recordkeeping requirements in the RO Permit were met and no deviations from these requirements or any other terms or conditions occurred.

☐ 2. During the entire reporting period, all monitoring and associated recordkeeping requirements in the RO Permit were met and no deviations from these requirements or any other terms or conditions occurred, **EXCEPT** for the deviations identified on the enclosed deviation report(s).

☒ **Other Report Certification**

Reporting period (provide inclusive dates): From 12/23/2014 To 12/23/2019

Additional monitoring reports or other applicable documents required by the RO Permit are attached as described:

NOx, CO & VOC testing once per permit duration. (Permit condition D.V.)

I certify that, based on information and belief formed after reasonable inquiry, the statements and information in this report and the supporting enclosures are true, accurate and complete.

Randall Schmidgall	Vice President US Ops.	(832) 320-5511
Name of Responsible Official (print or type)	Title	Phone Number
[signature]		7/24/2016
Signature of Responsible Official		Date

* Photocopy this form as needed.

EQP 5736 (Rev 9/01)

PREFACE

I, Karl Mast, do hereby certify that the source emissions testing conducted at TransCanada in Eaton Rapids, MI was performed in accordance with the procedures set forth by the United States Environmental Protection Agency, and that the data and results submitted within this report are an exact representation of the testing.

Karl Mast
Test Supervisor

I, Karl Mast, do hereby attest that all work on this project was performed under my direct supervision, and that this report accurately and authentically presents the source emissions testing conducted at ANR Pipeline's Eaton Rapids Gas Storage System Compressor Station in Eaton Rapids, MI.

Karl Mast
Test Supervisor

SUMMARY

The compliance testing was performed on the Internal Combustion Reciprocating Engine EUETCOMP-C in accordance with the requirements of Permit MI-ROP-N3022-2014 in order to comply with Title 40, Code of Federal Regulations, Part 60, Appendix A. The results of the testing are detailed in the following tables.

Engine EUETCOMP-C				
Measured Unit	Rated Power (HP)	Permit Limit	Results	Pass/Fail
NOx Lb/Hr	2,650	52.6 Lb/Hr	13.02 Lb/Hr	Pass
NOx G/HP/Hr	2,650	3.0 G/HP/Hr	2.58 G/HP/Hr	Pass
CO Lb/Hr	2,650	49.1 Lb/Hr	7.74 Lb/Hr	Pass
CO G/HP/Hr	2,650	2.8 G/HP/Hr	1.53 G/HP/Hr	Pass
VOC Lb/Hr	2,650	21.03 Lb/Hr	0.37 Lb/Hr	Pass
VOC G/HP/Hr	2,650	1.2 G/HP/Hr	0.07 G/HP/Hr	Pass

1. INTRODUCTION

This report presents the results of the source emissions testing conducted by Environmental Quality Management, Inc. (EQM) for TransCanada's ANR Pipeline (ANR) at Eaton Rapids Gas Storage System compressor station, near Eaton Rapids, MI, which is located in Eaton County.

The primary purpose of this testing program was to conduct emissions testing to determine that the Combustion Engine EUERCOMP-C (Engine C) at ANR Pipeline's gas compressor facility is in compliance with permit No. MI-ROP-N3022-2014.

EQM's responsibility was to conduct the compliance testing for the O2, CO, VOC, and NOx emissions rates and perform data reduction for conformance evaluation. ANR Pipeline's responsibility was to maintain process operating parameters and to assist in providing process operating data per compliance test requirements.

The following report provides information pertaining to TransCanada's process operations, and Compliance testing. The Compliance testing conducted on Engine C was performed on Tuesday, June 21, 2016, from 11:45 A.M. to 3:10 P.M.

The following requirements were specific for the testing program:

1. Equipment calibrations performed and calibration data provided.
2. Three (3) sixty (60) -minute, minimum, O_2, CO, VOC and NOx test runs performed at Engine C at maximum achievable load and speed according to pipeline conditions pursuant to EPA, Title 40, Code of Federal Regulations, Part 60, Appendix A.
3. Process manufacturing operations maintained at 100% of capacities and production and fuel consumption rates recorded during the emissions testing periods.
4. All testing and analyses performed in accordance with current EPA test methodologies and analytical procedures for O_2, CO, VOC, and NOx emissions determinations.
5. Stratification was found to be less than 5% in the engine exhaust(s).

The testing program was approved by and/or coordinated with Roy Cannon, TransCanada's ANR Pipeline Company. The emission testing was performed by Karl Mast, Manager, Emission Measurement and Project Manager, EQM, Jeff Cavanaugh, Test Technician, EQM, and Zach Hill, Test Technician, EQM. Tom Gasloli, Michigan DEQ observed the testing event.

2. TEST RESULTS SUMMARY

The compliance testing was performed on the Internal Combustion Reciprocating Engine EUETCOMP-C in accordance with the requirements of Permit MI-ROP-N3022-2014 in order to comply with Title 40, Code of Federal Regulations, Part 60, Appendix A. A summary of the test results is given below:

Table 1. Test Results Summary-NO_x, CO, & VOC

Engine EUETCOMP-C				
Measured Unit	Rated Power (HP)	Permit Limit	Results	Pass/Fail
NOx Lb/Hr	2,650	52.6 Lb/Hr	13.02 Lb/Hr	Pass
NOx G/HP/Hr	2,650	3.0 G/HP/Hr	2.58 G/HP/Hr	Pass
CO Lb/Hr	2,650	49.1 Lb/Hr	7.74 Lb/Hr	Pass
CO G/HP/Hr	2,650	2.8 G/HP/Hr	1.53 G/HP/Hr	Pass
VOC Lb/Hr	2,650	21.03 Lb/Hr	0.37 Lb/Hr	Pass
VOC G/HP/Hr	2,650	1.2 G/HP/Hr	0.07 G/HP/Hr	Pass

Based on the information provided above, the Engine C met the acceptance criteria during the course of the testing. A complete list of performance parameters for each test run that was performed at the stack sampling locations can be found in Tables 2-6.

Additional testing information may be found in Appendix A.

Table 2. Operating Parameters and Ambient Conditions-Engine C

Run	1	2	3	AVERAGES
Date	6.21.2016	6.21.2016	6.21.2016	
Time	11:45	13:01	14:10	
Condition	HS-HT	HS-HT	HS-HT	
Engine Operating Conditions				
Unit Horsepower from Control Panel	2,298.0	2,257.0	2,323.0	2,292.7
Unit Speed	898.0	896.0	902.0	898.7
Turbo RPM	14,415.0	14,406.0	14,558.0	14,459.7
Exhaust Temperature Average (°F)	996.0	1,001.0	1,002.0	999.7
Air Manifold Pressure (PSIG)	12.0	12.0	12.0	12.0
Air Manifold Temperature (°F)	113.0	114.0	114.0	113.7
Jacket Water Inlet Temperature (°F)	166.0	169.0	170.0	168.3
Jacket Water Outlet Temperature (°F)	181.0	184.0	185.0	183.3
Lube Oil Inlet Temperature (°F)	149.0	149.0	150.0	149.3
Lube Oil Outlet Temperature (°F)	180.0	181.0	181.0	180.7
Compressor Suction Pressure (PSIG)	601.0	614.0	621.0	612.0
Compressor Suction Temperature (°F)	64.0	64.0	64.0	64.0
Compressor Discharge Pressure (PSIG)	1381.0	1382.0	1382.0	1,381.7
Compressor Discharge Temperature (°F)	94.0	96.0	96.0	95.3
Compressor Flow (MMSCF/D)	1.6	1.6	1.6	1.6
Fuel Torque (%)	86.0	87.0	88.0	87.0
% Load	86.7	85.2	87.7	86.5
% Torque	86.9	85.6	87.5	86.6
Heat Rate (BTU/HP-hr)	6,716.0	6,832.8	6,893.9	6,814.3
Heat Rate (KJ/Watt-Hr)	9.498	9.664	9.750	9.6
Ambient Conditions				
Ambient Temperature (°F)	79.00	79.00	79.00	79.00
Barometric Pressure ("Hg)	30.00	30.00	30.00	30.00
Ambient Relative Humidity (%)	33.00	33.00	33.00	33.00

Table 3. Emissions Concentrations & Calculated Mass Emissions/Calculated Emissions Concentrations/Calculated Flows/Fuel Flows-Engine C

Run	1	2	3	AVERAGES
Date	6.21.2016	6.21.2016	6.21.2016	
Time	11:45	13:01	14:10	
Condition	HS-HT	HS-HT	HS-HT	
Emissions Concentrations & Calculated Mass Emissions				
NO_x ppm (BIAS Corrected)	388.87	423.32	424.66	412.28
NO_X g/BHP-HR	2.406	2.661	2.663	2.58
NO_X LB/HR	12.19	13.24	13.64	13.02
NO_X (ppm @ 15% O_2)	193.45	210.23	210.90	204.86
Nox Tons/Year	53.40	57.99	59.72	57.04
Nox lbs/scf fuel	0.000721	0.000783	0.000786	0.00076
NOx LB/MMBTU	0.71	0.78	0.78	0.76
CO ppm (BIAS Corrected) Outlet	441.09	380.99	386.20	402.76
CO g/BHP-HR	1.662	1.458	1.474	1.53
CO LB/HR	8.42	7.25	7.55	7.74
CO LB/MMBTU **	0.49	0.42	0.43	0.45
CO (ppm @ 15% O_2)	219.43	189.21	191.80	200.15
Post-Catalyst Emissions Concentrations				
THC ppmvw (As Propane) - Method 25A	416.50	416.33	412.62	415.15
Methane ppmvw Method 25A	1197.00	1224.00	1215.00	1212.00
Non-Methane/Non-Ethane VOCs ppmvd (As Propane)	19.47	9.25	8.46	12.40
THC g/BHP-HR **	0.89	0.91	0.90	0.90
VOC LB/HR (As Propane) ** - Using Method 25A Measured THC	0.59	0.28	0.26	0.37
VOC g/BHP-hr (As Propane) ** - Using Method 25A Measured THC	0.115	0.056	0.051	0.07
% O_2 (BIAS Corrected)	9.04	9.02	9.02	9.03
Calculated Emissions Concentrations				
% CO_2 (Wet) *	4.82	4.83	4.83	4.83
%CO_2 (Dry) *	5.36	5.37	5.37	5.37
% H_2O *	10.12	9.96	9.96	10.02
% O_2 (Wet) *	8.12	8.12	8.12	8.12
Calculated Flows				
Fuel Flow - (SCFM)	281.9	281.7	289.2	284.3
Fuel Flow - (SCFH)	16,916.0	16,903.0	17,354.4	17,057.8
Fuel Flow (LB/HR)	0.0	0.0	0.0	0.0
Exhaust Flow (LB/HR)	18,300.0	18,276.9	18,765.0	18,447.3
Exhaust Flow (WSCFM)	5,847.5	5,843.0	5,999.0	5,896.5
Exhaust Flow (DSCFM)	4,367.4	4,356.7	4,473.1	4,399.1
Exhaust Gas Volume (ACFM)	16,325.6	16,369.1	16,817.8	16,504.2
Air Flow (WSCFM)	4,227.9	4,217.6	4,330.2	4,258.6
BSAC, #/BHP-hr	8.4	8.5	8.5	8.5
Fuel Flow Measurements				
Fuel Gas Static Pressure (PSIG)	21.0	21.0	21.0	21.00
Fuel Gas Temperature (°F)	64.0	68.0	67.0	66.33

** BASED ON FUEL SPECIFIC DRY F-FACTOR CALCULATION
* BASED ON CARBON BALANCE (STOICH. + O2)
- A/F IS TOTAL MASS RATIO

Table 4. Gas Composition-AGA Standard Conditions-Engine C

GAS COMPOSITION	(Based on AGA standard conditions of 14.73 psia and 60 F)					
Constituent	Mol. Fraction	MW	weighted MW	DENSITY	Weighted Density	
NITROGEN	0.0157660	28.0134	0.4417	0.07399	0.00117	1.5766
CARBON DIOX.	0.0128150	44.01	0.5640	0.11624	0.00149	1.2815
METHANE	0.9430770	16.04315	15.1299	0.04237	0.03996	94.3077
ETHANE	0.0234870	30.0703	0.7063	0.07942	0.00187	2.3487
PROPANE	0.0035760	44.0975	0.1577	0.11647	0.00042	0.3576
I-BUTANE	0.0003380	58.1246	0.0196	0.15352	0.00005	0.0338
N-BUTANE	0.0005000	58.1246	0.0291	0.15352	0.00008	0.05
I-PENTANE	0.0001310	72.1518	0.0095	0.19057	0.00002	0.0131
N-PENTANE	0.0001080	72.1518	0.0078	0.19057	0.00002	0.0108
HEXANE +	0.0002020	95.958	0.0194	0.32000	0.00006	0.0202
	1.0000	17.0849	17.0849		0.04513	100.00000
Upper Dry Heat Value	1011.99	btu/dscf				
Low Dry Heat Value	912	btu/dscf				
Specific Gravity	0.5909					
DENSITY	0.0451	lb/cf				
Total Carbons	1.019493825	Total H	3.955914			

Constituent	LHV ideal	LHV(i) ideal	LHV(i) real	HHV ideal	HHV(i) ideal	HHV(i) real
NITROGEN		0.00	0.00		0	0
CARBON DIOX.		0.00	0.00		0	0
METHANE	911.5	859.61	861.45	1012	954.393924	956.43
ETHANE	1622.4	38.11	38.19	1773.7	41.6588919	41.75
PROPANE	2320.3	8.30	8.32	2522.1	9.0190296	9.04
I-BUTANE	3007.3	1.02	1.02	3260.5	1.102049	1.10
N-BUTANE	3017.8	1.51	1.51	3270.1	1.63505	1.64
I-PENTANE	3707.6	0.49	0.49	4011.1	0.5254541	0.53
N-PENTANE	3715.5	0.40	0.40	4018.2	0.4339656	0.43
HEXANE +	4900.5	0.99	0.99	5288.8	1.0683376	1.07
		LHV real	912.36		HHV real	1011.99

Constituent	SG	SG(i) ideal	b	b(i)		
NITROGEN	0.96723	0.015249348	0.0044	6.93704E-05		
CARBON DIOX.	1.51955	0.019473033	0.0197	0.000252456	Compressibility	
METHANE	0.55392	0.522389212	0.0116	0.010939693	0.997873263	
ETHANE	1.03824	0.024385143	0.0239	0.000561339		
PROPANE	1.52256	0.005444675	0.0344	0.000123014		
I-BUTANE	2.00684	0.000678312	0.0458	1.54804E-05		
N-BUTANE	2.00684	0.00100342	0.0478	0.0000239		
I-PENTANE	2.49115	0.000326341	0.0581	7.6111E-06		
N-PENTANE	2.49115	0.000269044	0.0631	6.8148E-06		
HEXANE +	3.3127	0.000669165	0.0802	1.62004E-05		
	SG real	0.590902533		0.01201588		
					8.46546E-07	

Table 5. Gas Composition-EPA Standard Conditions-Engine C

GAS COMPOSITION (Based onEPA standard conditions of 14.696 psia and 68 F)

Constituent	Mol. Fraction	MW	weighted MW
NITROGEN	0.0158	28.0134	0.4417
CARBON DIOX.	0.0128	44.01	0.5640
METHANE	0.9431	16.04315	15.1299
ETHANE	0.0235	30.0703	0.7063
PROPANE	0.0036	44.0975	0.1577
I-BUTANE	0.0003	58.1246	0.0196
N-BUTANE	0.0005	58.1246	0.0291
I-PENTANE	0.0001	72.1518	0.0095
N-PENTANE	0.0001	72.1518	0.0078
HEXANE +	0.0002	95.958	0.0194
	1.0000	MW	17.0849

			arbon Wt. % :	0.716733	
			rogen Wt. % :	0.233414	
			xygen Wt. % :	0.024002	
			rogen Wt. % :	0.025851	
				1.0000	
Upper Dry Heat Value	1010	btu/dscf	Mole Weight	17.0849	btu/dscf
Low Dry Heat Value	914	btu/dscf	A F-Factor (calc)	8704	dscf/MMbtu
Specific Gravity	0.5909				
Density	0.0453	lb/scf			
Total Carbons	1.0195	Total H	3.9562		

Constituent	LHV ideal	LHV(i) ideal	LHV(i) real	HHV ideal	HHV(i) ideal	HHV(i) real
NITROGEN		0.00	0.00		0	0
CARBON DIOX.		0.00	0.00		0	0
METHANE	913	861.03	862.86	1010	952.50777	954.54
ETHANE	1624	38.14	38.22	1769.6	41.5625952	41.65
PROPANE	2322	8.30	8.32	2516.1	8.9975736	9.02
I-BUTANE	3010	1.02	1.02	3251.9	1.0991422	1.10
N-BUTANE	3020	1.51	1.51	3262.3	1.63115	1.63
I-PENTANE	3711	0.49	0.49	4000.9	0.5241179	0.53
N-PENTANE	3718	0.40	0.40	4008.9	0.4329612	0.43
HEXANE +	4904	0.99	0.99	5278	1.066156	1.07
		LHV real	913.82		HHV real	1009.97

Constituent	SG	SG(i) ideal	b	b(i)	
NITROGEN	0.96723	0.015249348	0.0044	6.93704E-05	
CARBON DIOX.	1.51955	0.019473033	0.0197	0.000252456	Compressibility
METHANE	0.55392	0.522389212	0.0116	0.010939693	0.997873263
ETHANE	1.03824	0.024385143	0.0239	0.000561339	
PROPANE	1.52256	0.005444675	0.0344	0.000123014	
I-BUTANE	2.00684	0.000678312	0.0458	1.54804E-05	
N-BUTANE	2.00684	0.00100342	0.0478	0.0000239	
I-PENTANE	2.49115	0.000326341	0.0581	7.6111E-06	
N-PENTANE	2.49115	0.000269044	0.0631	6.8148E-06	
HEXANE +	3.3127	0.000669165	0.0802	1.62004E-05	
	SG real	0.590902533		0.01201588	

Table 6. Fuel Orifice- Engine C

ORIFICE FLOW CALCULATIONS				
Run Number	1	2	3	AVERAGES
Supply Pressure	21.0	21.0	21.0	21.0
Differential	0.0	0.0	0.0	0.0
Temperature	64.0	68.0	67.0	66.3
PIPE I.D.	2	2	2	2
ORIFICE I.D.	1	1	1	1
PRESS TAP? (1-UP,2-DN)	1	1	1	1
SP. GRAVITY	0.583817634	0.5838176	0.5838176	0.583817634
BETA	0.5	0.5	0.5	0.5
K	0.628908757	0.6289088	0.6289088	0.628908757
K1	0.628908757	0.6289088	0.6289088	0.628908757
Bc	374.766594	374.76659	374.76659	374.766594
E	429.766594	429.76659	429.76659	429.766594
kflang	0.623787738	0.6237877	0.6237877	0.623787738
Ko	0.624880466	0.6248805	0.6248805	0.624880466
Fb	211.3208262	211.32083	211.32083	211.3208262
BB	0.053678448	0.0536784	0.0536784	0.053678448
Fpb	1	1	1	1
Ftb	1	1	1	1
Ftf	0.99617348	0.9923906	0.9933322	0.993961528
FG	1.308764167	1.3087642	1.3087642	1.308764167
Fpv	1.002652104	1.0025729	1.0025916	1.002605263
QY	1	1	1	1
Qfh				
Qfm				

3. PROCESS DESCRIPTION

TransCanada's ANR Eaton Rapids Compressor Station is located at 3349 S Waverly, Eaton Rapids, Michigan. The plant operates three Superior model no. 16SGTB, 2650 HP natural gas fired internal combustion reciprocating engines. The engines are labeled EUERCOMP-A, EUERCOMP-B, and EUERCOMP-C. Unit EUERCOMP-C was tested for this event.

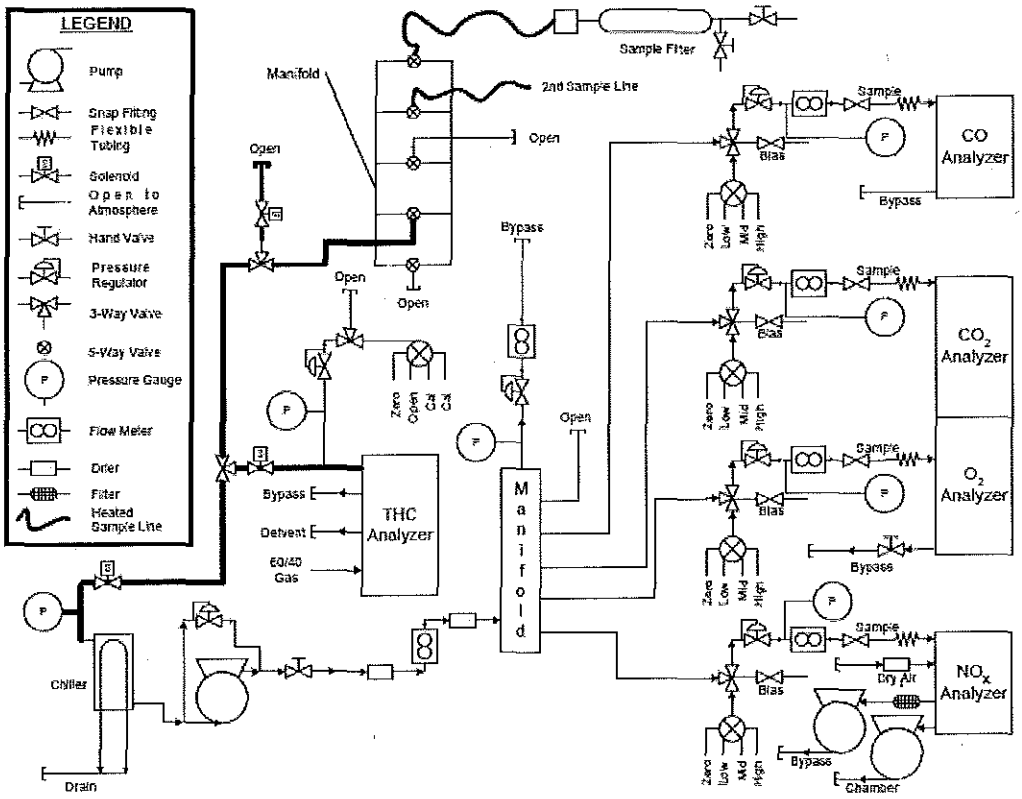
The Superior 16SGTB is a four stroke lean burn natural gas fired internal combustion reciprocating engine driving gas compressors. The energy released during the combustion process drives integral reciprocating gas compressors, thus raising the pressure of the incoming natural gas to inject or withdraw natural gas from a natural gas storage field.

The following tables provide a summary of the production rates for the Engine C during the test:

Table 7. Production Data- Horse Power (HP)

Engine C	
Run No.	**Turbine No. TR01**
1	2,298
2	2,257
3	2,323
Average	2,292
Rated HP	2,650

Figure 1. Flow Schematic



Additional Information pertaining to the Fuel Flows may be found in Appendix B.

4. TEST PROCEDURES

EQM and EQM's affiliates and subcontractors use current U.S. EPA accepted testing methodologies in their Air Quality Programs as listed in the U.S. Code of Federal Regulations, Title 40, Part 60, Appendix A. For this testing program, the following specific methodologies were utilized:

- U.S. EPA Method 3A – Determination of Oxygen and Carbon Dioxide Concentrations in Emissions From Stationary Sources (Instrumental Analyzer Procedure)
- U.S. EPA Method 7E – Determination of Nitrogen Oxides Emissions From Stationary Sources (Instrumental Analyzer Procedure)
- U.S. EPA Method 10 – Determination of Carbon Monoxide Emissions From Stationary Sources (Instrumental Analyzer Procedure)
- U.S. EPA Method 25A – Determination of VOC Emissions From Stationary Sources (Instrumental Analyzer Procedure)

USEPA Methods 3A, 7E, 10, and 25A were performed at the Exhaust Stack sampling location by continuously extracting a gas sample from the stack through a single point stainless steel sample probe. The extracted sample was pulled through a series of filters to remove any particulate matter. Directly after the probe, the sample was conditioned by a series of refrigeration dryers to remove moisture from the gas stream. After the refrigeration dryers, the sample was transported through a Teflon® line to the analyzers. The flow of the stack gas sample was regulated at a constant rate to minimize drift.

At the start of the day, each monitor was checked for calibration error by introducing zero, mid-range and high-range EPA Protocol 1 gases to the measurement system at a point upstream of the analyzers. In this report, the calibration error test is referred to as instrument calibration. The gas was injected into the sampling valve located at the outlet of the sampling probe. The bias test was conducted before and after each consecutive test run by introducing zero and upscale calibration gases for each monitor. The upscale calibration gases used for each monitor were the high calibration gases.

Measurement System Performance Specifications were as follows:

- Analyzer Calibration Error - Less than +/- 2% of the span of the zero, mid-range and high-range calibration gases.
- Sampling System Bias - Less than +/-5% of the span for the zero, mid-range and high-range calibration gases.

- Zero Drift - Less than +/-3% of the span over the period of each test run.
- Calibration Drift - Less than +/-3% of the span over the period of each set of runs.

Calculations that were used in this testing event are as follows:

Calibration Correction

$$C_{GAS} = (C_R - C_O)\frac{C_{MA}}{C_M - C_O}$$

Where:

C_{GAS}:	Corrected flue gas concentration (ppmvd)
C_R:	Flue gas concentration (ppmvd)
C_O:	Average of initial and final zero checks (ppmvd)
C_M:	Average of initial and final span checks (ppmvd)
C_{MA}:	Actual concentration of span gas (ppmvd)

EPA F-Factor

$$F_d = \frac{\left[(3.64 \cdot H_{Wt\%} \cdot 100) + (1.53 \cdot C_{Wt\%} \cdot 100)\right]}{\frac{GCV}{\rho_{FuelGas}}} \cdot 10^6 + \frac{\left[(0.14 \cdot N_{2Wt\%} \cdot 100) - (0.46 \cdot O_{2Wt\%} \cdot 100)\right]}{\frac{GCV}{\rho_{FuelGas}}} \cdot 10^6$$

Where:

F_d:	Fuel specific F-factor, dscf/MMBtu
$H_{Wt\%}$:	Hydrogen weight percent
$C_{Wt\%}$:	Carbon weight percent
$N_{2Wt\%}$:	Nitrogen weight percent
$O_{2Wt\%}$:	Oxygen weight percent
GCV:	Heating value of the fuel, BTU/dscf
$\rho_{Fuel\ Gas}$:	Density of the fuel gas, lb/scf

VOC ppmvd

$$VOC_{ppmvd} = \frac{THC_{ppmvw} - \frac{1}{3}CH_{4\,ppmvd} - \frac{2}{3}C_2H_{6\,ppmvd}}{1-\left(\frac{\%H_2O}{100}\right)}$$

Mass Emission Calculations Lbs/Hr
Mass Emission Calculations

The F-factor method will be used to calculate mass emission rates for NO_x, CO, and VOC. The fuel specific F_d factor will be used as described in equation 3 of EPA Method 19.

Where:

EM:	Pollutant emission rate, lb/hr
C_d:	Pollutant concentration, lb/scf
F_d:	Fuel specific F-Factor, dscf/MMBtu
Q_h:	Fuel flow, scf/hr
$\%O_2$:	Oxygen concentration in percent, measure on a dry basis
GCV:	Upper dry heating value of fuel, Btu/dscf

Mass Emission Calculations g/bhp-hr

$$EM_{\frac{g}{bhp\text{-}hr}} = EM_{\frac{lbs}{hr}} \times F_d \times \frac{4536g}{BHP}$$

To Convert from:	To	Multiply by:
ppmvd NO_x	lb/scf	1.194×10^{-7}
ppmvd CO		7.268×10^{-8}
ppmvd VOC		1.1444×10^{-8}

5. QUALITY ASSURANCE PROCEDURES

Each reference method presented in the U.S. Code of Federal Regulations details the instrument calibration requirements, sample recovery and analysis, data reduction and verification, types of equipment required, and the appropriate sampling and analytical procedures to ensure maximum performance and accuracy. EQM and EQM's affiliates and subcontractors adhere to the guidelines for quality control set forth by the United States Environmental Protection Agency. These procedures are outlined in the following documents:

- Code of Federal Regulations, Title 40, Part 51
- Code of Federal Regulations, Title 40, Part 60
- Quality Assurance Handbook, Volume 1, EPA 600/9-76-005
- Quality Assurance Handbook, Volume 2, EPA 600/4-77-027a
- Quality Assurance Handbook, Volume 3, EPA 600/4-77-027b

6. CONCLUSIONS

An Emissions Test was conducted on the Engine C located at TransCanada's ANR Pipeline Company's Eaton Rapids Compressor Station located in Eaton Rapids, MI. The testing was conducted on June 21, 2016.

During the course of the testing, the Engine C conformed to the requirements of Code of Federal Regulations, Title 40, Part 60, Appendix A.

The usefulness and/or significance of the emissions values presented in this document as they relate to the compliance status of the Engine C emissions shall be determined by others.

For additional information pertaining to the testing program see Appendix E of this report.