COMPLIANCE TEST REPORT
ANR PIPELINE-CENTRAL CHARLTON COMPRESSOR STATION
Unit EUCTCOMPENG0001

Prepared for:

TransCanada
In business to deliver

TransCanada's ANR Pipeline Company
Johannesburg, MI

Prepared by:

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August 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, Central Charlton Comp. Sta. County: Otsego

Source Address: 14490 Beckett Road City: Johannesburg

AQD Source ID (SRN): B7390 RO Permit No.: MI-ROP-B7390-2012 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 7/10/2012 To 7/10/2017

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

NOx testing once every five years. (Permit condition D.V.1)

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

Randall Schmidgall (signature)
Signature of Responsible Official

8/16/2016
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 Johannesburg, 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 Central Charlton's Compressor Station in Johannesburg, MI.

Karl Mast
Test Supervisor

SUMMARY

The compliance emissions testing was performed on Unit No. EUCTCOMPENG001 (Unit No. 1) in accordance with the requirements of Michigan Department of Environmental Quality, Air Quality Division, Permit No. MI-ROP-B7390-2012. The testing was performed utilizing USEPA Methods 3A and 7E at the Exhaust Stack sampling location. The results of the testing are detailed in the following tables.

Unit No. 1 Emission Test Results		
Run No.	**NO_x Emissions (g/bhp/hr)**	**NO_x (lb/hr)**
1	2.571	20.28
2	2.609	20.72
3	2.675	21.64
Average	2.618	20.88
Emission Limit	6 at 100 % Speed and Torque	53

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1. INTRODUCTION

This report presents the results of the source emissions testing conducted by Environmental Quality Management, Inc. (EQ) for Trans Canada's ANR Pipeline (ANR) Central Charlton Compressor Station, near Johannesburg, MI. The USGO Integrity Services Department of TransCanada's ANR Pipeline Company, contracted EQ which conducted the source emissions testing at the ANR Central Charlton Compressor Station in fulfillment of the Michigan Department of Environmental Quality, Air Quality Division (MDEQ), permit no. MI-ROP-B7390-2012.

The primary purpose of this testing program was to conduct emissions testing of the internal combustion reciprocating engine Unit No. EUCTCOMPENG001 (Unit 1), with an emission limit of 6 G/BHP-HR at 100 % Speed and Torque NO_x and 53 lb/hr of NO_x.

EQ's responsibility was to conduct the compliance testing for the NOx, CO, and O2 emissions rates and perform data reduction for conformance evaluation. ANR'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 the Unit No. 1 was performed on July 12, 2016, from 10:10 A.M. to 1:25 P.M.

The following requirements were specific for the testing program:

1. Equipment calibrations performed and calibration data provided.
2. Three (3) one (1) -hour, minimum, NOx, CO, and O2 test runs performed at the Unit 1 pursuant to EPA Reference methods as described in 40 CFR, 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 NOx, CO, and O2 emissions determinations.

The testing program was approved by and/or coordinated with Roy Cannon, TransCanada's ANR Pipeline Company. The emission testing was performed by Zach Hill, Test Manager, EQ and Jeff Cavanaugh, Test Technician, EQ. The emission testing was observed by MDEQ regulatory Air Division personnel.

2. TEST RESULTS SUMMARY

The compliance testing was performed on Unit No. 1 in accordance with the requirements (MI-ROP-B7390-2012) issued by MDEQ. A summary of the test results is given below:

Table 1. Test Results Summary

Unit No. 1 Emission Test Results		
Run No.	**NO_x Emissions (g/bhp/hr)**	**NO_x (lb/hr)**
1	2.571	20.28
2	2.609	20.72
3	2.675	21.64
Average	2.618	20.88
Emission Limit	6 at 100 % Speed and Torque	53

Based on the information provided above, the Unit No. 1 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 Table 1.

Table 2. Test Results-Engine Operating and Ambient Conditions-Unit No. 1

Run	1	2	3	AVERAGES
Date	7.12.2016	7.12.2016	7.12.2016	
Time	10:10	11:15	12:25	
Condition	HS-HT	HS-HT	HS-HT	
Engine Operating Conditions				
Unit Horsepower from Control Panel	3,578.0	3,602.0	3,669.0	3,616.3
Unit Speed	452.0	449.0	450.0	450.3
Wastegate Open (%)	16.9	21.6	14.0	17.5
Turbo RPM	8,904.0	8,910.0	9,033.0	8,949.0
Exhaust Temperature Average (°F)	353.5	354.9	360.8	356.4
Air Manifold Pressure (PSIG)	19.1	19.0	19.6	19.2
Air Manifold Temperature (°F)	88.4	89.8	92.7	90.3
Jacket Water Inlet Temperature (°F)	148.8	148.9	149.7	149.1
Jacket Water Outlet Temperature (°F)	159.7	160.1	161.0	160.3
Lube Oil Inlet Temperature (°F)	145.4	145.9	146.9	146.1
Lube Oil Outlet Temperature (°F)	160.7	161.4	162.5	161.5
Compressor Suction Pressure (PSIG)	781.0	784.0	805.0	790.0
Compressor Suction Temperature (°F)	61.8	61.8	62.0	61.9
Compressor Discharge Pressure (PSIG)	3079.0	3081.0	3085.0	3,081.7
Compressor Discharge Temperature (°F)	256.7	252.7	251.1	253.5
Compressor Flow (MMSCF/D)	34.3	34.6	36.7	35.2
Fuel Torque (%)	78.3	77.9	79.6	78.6
% Load	77.8	78.3	79.8	78.6
% Torque	81.7	82.8	84.2	82.9
Heat Rate (BTU/HP-hr)	5,668.1	5,576.3	5,711.8	5,652.1
Heat Rate (KJ/Watt-Hr)	8.016	7.886	8.078	8.0
Ambient Conditions				
Ambient Temperature (°F)	82.00	84.00	86.00	84.00
Barometric Pressure ("Hg)	28.28	28.26	28.24	28.26
Ambient Relative Humidity (%)	61.00	59.00	55.00	58.33

*Due to the injection mode being two stages, the most accurate Suction numbers would come from Stage #1 since it is the "front" half of the 2 stages. The same was said to be true for the Discharge and Stage #2 being the "back" half.

Table 3. Test Results- Emission Concentrations/Calculated Mass Emissions & Flows/Fuel Flow Measurements-Unit No. 1

Run	1	2	3	AVERAGES
Date	7.12.2016	7.12.2016	7.12.2016	
Time	10:10	11:15	12:25	
Condition	HS-HT	HS-HT	HS-HT	
Emissions Concentrations & Calculated Mass Emissions				
NO_x ppm (BIAS Corrected)	263.99	272.33	276.68	271.00
NO_X g/BHP-HR	2.571	2.609	2.675	2.618
NO_X LB/HR	20.28	20.72	21.64	20.88
NO_X (ppm @ 15% O_2)	245.28	253.03	257.88	252.07
Nox Tons/Year	88.82	90.75	94.78	91.45
Nox lbs/scf fuel	0.000906	0.000935	0.000953	0.00093
NOx LB/MMBTU	0.90	0.93	0.95	0.93
CO ppm (BIAS Corrected) Outlet	270.30	260.82	244.35	258.49
CO g/BHP-HR	1.602	1.521	1.438	1.52
CO LB/HR	12.64	12.08	11.63	12.12
CO LB/MMBTU **	0.56	0.54	0.51	0.54
CO (ppm @ 15% O_2)	251.14	242.34	227.75	240.41
% O_2 (BIAS Corrected)	14.55	14.55	14.57	14.56
Calculated Flows				
Fuel Flow - (SCFM)	373.0	369.4	378.5	373.6
Fuel Flow - (SCFH)	22,377.4	22,162.8	22,710.0	22,416.7
Fuel Flow (LB/HR)	975.9	966.5	990.4	977.6
Exhaust Flow (LB/HR)	49,015.3	48,498.3	49,760.8	49,091.5
Exhaust Flow (WSCFM)	7,688.9	7,615.2	7,803.2	7,702.4
Exhaust Flow (DSCFM)	10,701.6	10,598.9	10,895.0	10,731.8
Exhaust Gas Volume (ACFM)	12,721.1	12,629.7	13,042.7	12,797.9
Air Flow (WSCFM)	10,304.7	10,205.9	10,490.7	10,333.8
BSAC, #/BHP-hr	13.1	12.9	13.0	13.0
Fuel Flow Measurements				
Fuel Gas Differential Pressure ("H_2O)	48.2	47.4	50.0	48.53
Fuel Gas Static Pressure (PSIG)	95.0	95.0	94.8	94.93
Fuel Gas Temperature (°F)	85.7	86.9	88.0	86.87
** BASED ON FUEL SPECIFIC DRY F-FACTOR CALCULATION * BASED ON CARBON BALANCE (STOICH. + O2) - A/F IS TOTAL MASS RATIO				

Table 4. AGA Gas Composition-Unit No. 1

GAS COMPOSITION (Based on AGA standard conditions of 14.73 psia and 60 F)

Constituent	Mol. Fraction	MW	weighted MW	DENSITY	Weighted Density
NITROGEN	0.0100580	28.0134	0.2818	0.07399	0.00074
CARBON DIOX.	0.0065550	44.01	0.2885	0.11624	0.00076
METHANE	0.9653930	16.04315	15.4879	0.04237	0.04090
ETHANE	0.0141700	30.0703	0.4261	0.07942	0.00113
PROPANE	0.0005960	44.0975	0.0263	0.11647	0.00007
I-BUTANE	0.0000303	58.1246	0.0018	0.15352	0.00000
N-BUTANE	0.0000099	58.1246	0.0006	0.15352	0.00000
I-PENTANE	0.0000000	72.1518	0.0000	0.19057	0.00000
N-PENTANE	0.0000000	72.1518	0.0000	0.19057	0.00000
HEXANE +	0.0000000	95.958	0.0000	0.32000	0.00000
	0.9968	16.5129	16.5129		0.04361

Upper Dry Heat Value	1005.78	btu/dscf
Low Dry Heat Value	906	btu/dscf
Specific Gravity	0.5711	
DENSITY	0.0436	lb/cf

Total Carbons	1.00223692	Total H	3.9517623

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	879.96	881.74	1012	976.977716	978.96
ETHANE	1622.4	22.99	23.04	1773.7	25.133329	25.18
PROPANE	2320.3	1.38	1.39	2522.1	1.5031716	1.51
I-BUTANE	3007.3	0.09	0.09	3260.5	0.09879315	0.10
N-BUTANE	3017.8	0.03	0.03	3270.1	0.032472093	0.03
I-PENTANE	3707.6	0.00	0.00	4011.1	0	0.00
N-PENTANE	3715.5	0.00	0.00	4018.2	0	0.00
HEXANE +	4900.5	0.00	0.00	5288.8	0	0.00
		LHV real	906.29		HHV real	1005.78

Constituent	SG	SG(i) ideal	b	b(i)	
NITROGEN	0.96723	0.009728399	0.0044	4.42552E-05	
CARBON DIOX.	1.51955	0.00996065	0.0197	0.000129134	Compressibility
METHANE	0.55392	0.534750491	0.0116	0.011198559	0.997972228
ETHANE	1.03824	0.014711861	0.0239	0.000338663	
PROPANE	1.52256	0.000907446	0.0344	2.05024E-05	
I-BUTANE	2.00684	6.08073E-05	0.0458	1.38774E-06	
N-BUTANE	2.00684	1.99279E-05	0.0478	4.74654E-07	
I-PENTANE	2.49115	0	0.0581	0	
N-PENTANE	2.49115	0	0.0631	0	
HEXANE +	3.3127	0	0.0802	0	
	SG real	0.571063812		0.011732975	
					8.46546E-07

Table 5. EPA Gas Composition-Unit No. 1

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

Constituent	Mol. Fraction	MW	weighted MW
NITROGEN	0.0101	28.0134	0.2818
CARBON DIOX.	0.0066	44.01	0.2885
METHANE	0.9654	16.04315	15.4879
ETHANE	0.0142	30.0703	0.4261
PROPANE	0.0006	44.0975	0.0263
I-BUTANE	0.0000	58.1246	0.0018
N-BUTANE	0.0000	58.1246	0.0006
I-PENTANE	0.0000	72.1518	0.0000
N-PENTANE	0.0000	72.1518	0.0000
HEXANE +	0.0000	95.958	0.0000
	0.9968	MW	16.5129

Upper Dry Heat Value	1004	btu/dscf	Mole Weight	16.5129	btu/dscf
Low Dry Heat Value	908	btu/dscf	A F-Factor (calc)	8685	dscf/MMbtu
Specific Gravity	0.5711				
Density	0.0438	lb/scf			
Total Carbons	1.0022	Total H	3.9518		

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	881.40	883.19	1010	975.04693	977.03
ETHANE	1624	23.01	23.06	1769.6	25.075232	25.13
PROPANE	2322	1.38	1.39	2516.1	1.4995956	1.50
I-BUTANE	3010	0.09	0.09	3251.9	0.09853257	0.10
N-BUTANE	3020	0.03	0.03	3262.3	0.032394639	0.03
I-PENTANE	3711	0.00	0.00	4000.9	0	0.00
N-PENTANE	3718	0.00	0.00	4008.9	0	0.00
HEXANE +	4904	0.00	0.00	5278	0	0.00
		LHV real	907.76		HHV real	1003.79

Constituent	SG	SG(i) ideal	b	b(i)	
NITROGEN	0.96723	0.009728399	0.0044	4.42552E-05	
CARBON DIOX.	1.51955	0.00996065	0.0197	0.000129134	Compressibility
METHANE	0.55392	0.534750491	0.0116	0.011198559	0.997972228
ETHANE	1.03824	0.014711861	0.0239	0.000338663	
PROPANE	1.52256	0.000907446	0.0344	2.05024E-05	
I-BUTANE	2.00684	6.08073E-05	0.0458	1.38774E-06	
N-BUTANE	2.00684	1.99279E-05	0.0478	4.74654E-07	
I-PENTANE	2.49115	0	0.0581	0	
N-PENTANE	2.49115	0	0.0631	0	
HEXANE +	3.3127	0	0.0802	0	
	SG real	0.571063812		0.011732975	

Table 6. Fuel Orifice Flow Calculations-Unit No. 1

ORIFICE FLOW CALCULATIONS				
Run Number	1	2	3	AVERAGES
Supply Pressure	95.0	95.0	94.8	94.9
Differential	48.2	47.4	50.0	48.5
Temperature	85.7	86.9	88.0	86.9
Fuel Flow (scfh)	22377	22163	22710	22418
Fuel Flow (scfm)	373.0	369.4	378.5	373.6
PIPE I.D.	2.067	2.067	2.067	2.067
ORIFICE I.D.	1.065	1.065	1.065	1.065
PRESS TAP? (1-UP,2-DN)	1	1	1	1
SP. GRAVITY	0.583817634	0.5838176	0.5838176	0.583817634
BETA	0.515239478	0.5152395	0.5152395	0.515239478
K	0.632064995	0.632065	0.632065	0.632064995
K1	0.632064995	0.632065	0.632065	0.632064995
Bc	368.6426941	368.64269	368.64269	368.6426941
E	465.6269861	465.62699	465.62699	465.6269861
kflang	0.626388481	0.6263885	0.6263885	0.626388481
Ko	0.627946841	0.6279468	0.6279468	0.627946841
Fb	240.8615332	240.86153	240.86153	240.8615332
BB	0.054381214	0.0543812	0.0543812	0.054381214
Fr	1.000749609	1.0007561	1.0007368	1.000747359
Fpb	1	1	1	1
Ftb	1	1	1	1
Ftf	0.976153691	0.9750815	0.9741018	0.97511126
FG	1.308764167	1.3087642	1.3087642	1.308764167
Fpv	1.007030091	1.0069686	1.0069028	1.006966943
R	0.015932221	0.0156741	0.0165642	0.016056539
QY	0.994672923	0.9947592	0.9944616	0.994631356
C	308.457416	308.12853	307.70081	308.095125
Qfh	22377	22163	22710	22418
Qfm	373.0	369.4	378.5	373.6

3. FACILITY AND PROCESS DESCRIPTION

TransCanada's ANR Pipeline Company Central Charlton Compressor Station (ANR) is located in Johannesburg, MI and operates a natural gas fired compressor station. The plant is located at 14490 Beckett Road, Johannesburg, MI. The facility has two Cooper Bessemer model 12Q145-HM natural gas fired internal combustion reciprocating engines labeled EUCTCOMPENG001 (Unit 1) and EUCTCOMPENG002 (Unit 2). Unit 1 was the source for this testing event.

Unit No. 1 is a two 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 table provide a summary of the production rates for the Unit No. 1 during the test:

Table 7. Unit No. 1 Production Data (Horse Power)

Unit No. 1 Production Data (HP)	
Run No.	Horse Power
1	3,578
2	3,602
3	3,669
Average	3,616

Figure 1. Unit 1-Flow Schematic

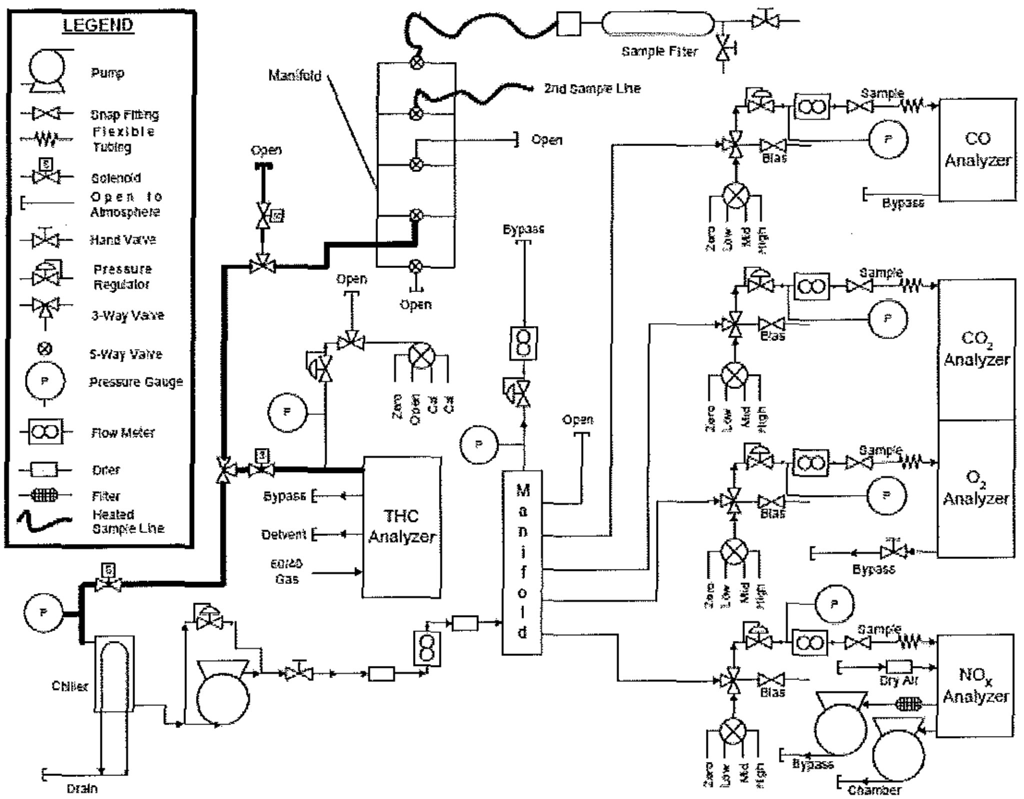
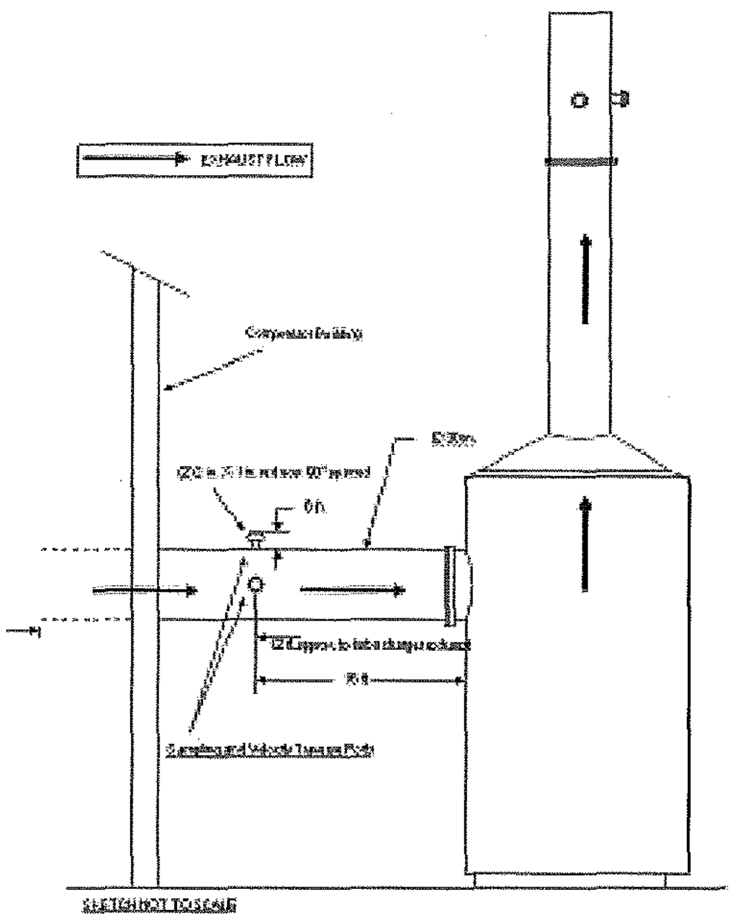


Figure 2. Unit 1 - Stack Configuration



4. TEST PROCEDURES

EQ and EQ'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

USEPA Methods 3A, 7E, and 10 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 for the Unit No. 2 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

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

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

Mass emission rate (g/bhp-hr)

$$NOx_{\frac{g}{bhp\text{-}hr}} = C_d \times F_d \times \frac{20.9}{20.9 - \%O_2} \times Q_h \times \frac{GCV}{10^6} \times \frac{453.6}{Bhp}$$

Where:

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, measured on a dry basis
GCV:	Upper dry heating value of fuel, Btu/dscf

Mass emission rate (lb/hr)

$$NOx_{\frac{lb}{hr}} = C_d \times F_d \times \frac{20.9}{20.9 - \%O_2} \times Q_h \times \frac{GCV}{10^6}$$

Where:

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, measured on a dry basis
GCV:	Upper dry heating value of fuel, Btu/dscf

For the emissions concentration correction required in 40CFR60, Appendix A, Method 7E concentration corrections will be calculated by using the bias check zero and span values from before and after the test. The equation is as follows:

$$C_{gas} = (\overline{C} - C_o) \quad \frac{C_{ma}}{C_m - C_o}$$

Nomenclature:

C_{gas}: Effluent gas concentration (ppmv)

$\bar{C}$: Average gas concentration indicated by analyzer (ppmv)

C_o: Average of initial & final system calibration bias check responses for the zero gas (ppmv)

Cm: Average of initial & final system calibration bias check responses for the span gas (ppmv)

C_{ma}: Actual concentration of the upscale calibration gas (ppmv)

Cm: Average of initial & final system calibration bias check responses for the span gas (ppmv)

C_{ma}: Actual concentration of the upscale calibration gas (ppmv)

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. EQ and EQ'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 internal combustion reciprocating engine, Unit No. 1 at TransCanada's ANR Pipeline Company's Central Charlton compressor station located in Johannesburg, Michigan. The testing was conducted on July 12, 2016.

During the course of the testing, the Engine Unit No. 1 conformed to the requirements of Code Of Federal Regulations, Title 40, Part 60, Appendix A, National Emission Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines.

The usefulness and/or significance of the emissions values presented in this document as they relate to the compliance status of the Engine Unit No. 1 emissions shall be determined by others.

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

A. FIELD TEST DATA