COMPLIANCE TEST REPORT

ANR Storage Company
Rapid River Compressor Station
Kalkaska, MI
EURRCOMP-A
EURRCOMP-B

Prepared for:

TransCanada
In business to deliver

TransCanada's ANR Storage Company
Kalkaska, MI

Prepared by:

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June 2015

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY
AIR QUALITY DIVISION

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 Permit (ROP) 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 specified in Rule 213(3)(b)(ii), and be made available to the Department of Environmental Quality, Air Quality Division upon request.

Source Name: ANR Storage Company Rapid River Compressor Station — County: Kalkaska

Source Address: 2170 Rabourn Road — City: NE Kalkaska

AQD Source ID (SRN): B7197 — ROP No.: MI-ROP-B7197-2012 — ROP Section No.:

Please check the appropriate box(es):

☐ **Annual Compliance Certification (Pursuant to Rule 213(4)(c))**

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 ROP, 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 ROP.

☐ 2. During the entire reporting period this source was in compliance with all terms and conditions contained in the ROP, 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 ROP, unless otherwise indicated and described on the enclosed deviation report(s).

☐ **Semi-Annual (or More Frequent) Report Certification (Pursuant to Rule 213(3)(c))**

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

☐ 1. During the entire reporting period, **ALL** monitoring and associated recordkeeping requirements in the ROP 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 ROP 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 1/20/2012 To 1/20/2017

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

Emissions testing per operational permit, Part D, Section V.1 (R336.1213(3))

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

Randy Schmidgall	Vice Pres. US Pipeline Op.	832-320-5511
Name of Responsible Official (print or type)	Title	Phone Number

Signature of Responsible Official — Date

* Photocopy this form as needed.

EQP 5736 (Rev 11-04)

SUMMARY

The compliance testing was performed on the Engines EURRCOMP-A (Unit A) and EURRCOMP-B (Unit B), systems fulfillment of the Renewable Operating Permit requirements (ROP No. B7197-2012a, Section D.V.1) issued by the Michigan Department of Environmental Quality, Air Quality Division. The results of the testing are summarized in the following table.

NO_x Lb/Hr Results – Limit 99.2 Lbs/Hr				
Engine	Run 1	Run 2	Run 3	Average
Unit A	70.29	68.62	66.92	68.61
Unit B	72.69	71.97	73.46	72.71

1. INTRODUCTION

This report presents the results of the source emissions testing conducted by Environmental Quality Management, Inc. (EQ) for TransCanada's ANR Storage Company's (ANR) Rapid River Compressor Station, near Kalkaska, MI.

The primary purpose of this testing program was to conduct emissions testing to determine compliance on the internal combustion reciprocating engines, labeled EURRCOMP-A (Unit A) and EURRCOMP-B (Unit B) in fulfillment with the Renewable Operating Permit requirements (ROP No. B7197-2012a, Section D.V.1) issued by the Michigan Department of Environmental Quality, Air Quality Division.

EQ's responsibility was to conduct the compliance testing for the O2 and NO_x 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 Unit A was performed on Wednesday June 3, 2015, from 8:10 A.M. to11:30 A.M. The Compliance testing conducted on Unit B was performed on Wednesday June 3, 2015, from 8:40 A.M. to 11:50 A.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 and O2 test runs performed at the Unit A and Unit B 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 and O2 emissions determinations.

The testing program was approved by and/or coordinated with Pedro Amieva, TransCanada's ANR Storage Company. The emission testing was performed by Karl Mast, Manager, Air Emissions Measurement & Project Manager, EQ and Zach Hill, Test Technician, EQ. The emission testing was observed by Jeremy Howe, MDEQ.

2. TEST RESULTS SUMMARY

The compliance testing was performed on Unit A and Unit B in accordance with the requirements (ROP No. B7197-2012a, Section D.V.I) issued by the Michigan Department of Environmental Quality, Air Quality Division. A summary of the test results is given below:

Table 1. Test Results Summary

NO_x Lb/Hr Results – Limit 99.2 Lbs/Hr				
Engine	Run 1	Run 2	Run 3	Average
Unit A	70.29	68.62	66.92	68.61
Unit B	72.69	71.97	73.46	72.71

Based on the information provided above the Unit A and Unit B, and Combustion 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 2-11.

Additional testing information may be found in Appendix A.

Table 2. Operating Parameters and Ambient Conditions –EURRCOMP-A

Run	1	2	3	AVERAGES
Date	06/03/15	06/03/15	06/03/15	
Time	810-910	915-1015	1020-1130	
Condition	HS-HT	HS-HT	HS-HT	
Engine Operating Conditions				
Unit Horsepower from Control Panel	3,378.0	3,398.0	3,406.0	3,394.0
Unit Speed	351.0	349.0	351.0	350.3
Exhaust Temperature Average (^{O}F)	847.0	852.0	854.0	851.0
Air Manifold Temperature (^{O}F)	110.0	110.0	110.0	110.0
Jacket Water Inlet Temperature (^{O}F)	170.0	170.0	170.0	170.0
Lube Oil Outlet Temperature (^{O}F)	160.0	175.0	160.0	165.0
Lube Oil Pressure (PSIG)	50.0	50.0	49.0	49.7
Compressor Suction Pressure (PSIG)	731.0	727.0	731.0	729.7
Compressor Suction Temperature (^{o}F)	60.0	60.0	61.0	60.3
Compressor Discharge Pressure (PSIG)	1716.0	1719.0	1722.0	1,719.0
Compressor Discharge Temperature (^{o}F)	146.0	147.0	148.0	147.0
Fuel Torque (%)	93.0	94.0	93.0	93.3
% Load	90.1	90.6	90.8	90.5
% Torque	99.0	90.9	90.6	93.5
Heat Rate (BTU/HP-hr)	6,759.4	6,797.3	6,608.2	6,721.6
Heat Rate (KJ/Watt-Hr)	9.560	9.613	9.346	9.5
Ambient Conditions				
Ambient Temperature (^{o}F)	55.00	60.00	67.00	60.67
Barometric Pressure ("Hg)	28.90	28.90	28.90	28.90
Ambient Relative Humidity (%)	30.00	31.00	33.00	31.33

Table 3. Emissions Concentrations, Calculated Mass Emissions/Calculated & Fuel Flows EURRCOMP-A

Emissions Concentrations & Calculated Mass Emissions				
NO_x ppm (BIAS Corrected)	1391.33	1147.56	1302.97	1280.62
NO_X g/BHP-HR	9.439	9.161	8.912	9.17
NO_X LB/HR	70.29	68.62	66.92	68.61
NO_X (ppm @ 15% O_2)	755.18	728.81	719.13	734.37
NOx LB/MMBTU	2.78	2.69	2.65	2.71
CO ppm (BIAS Corrected)	299.16	316.58	291.67	302.47
CO g/BHP-HR	1.235	1.538	1.214	1.33
CO LB/HR	9.20	11.52	9.12	9.95
CO LB/MMBTU **	0.36	0.45	0.36	0.39
CO (ppm @ 15% O_2)	162.38	201.06	160.98	174.80
% CO_2 (BIAS Corrected)	6.00	6.00	6.00	6.00
% O_2 (BIAS Corrected)	10.03	11.61	10.21	11.50
Calculated Flows				
Fuel Flow - (SCFM)	406.6	411.3	406.5	408.2
Fuel Flow - (SCFH)	24,397.4	24,679.4	24,390.5	24,489.1
Fuel Flow (LB/HR)	1,106.7	1,119.5	1,106.4	1,110.9
Exhaust Flow (LB/HR)	31,572.8	37,434.6	32,126.9	33,711.4
Exhaust Flow (WSCFM)	8,647.3	8,747.3	8,644.9	8,679.8
Exhaust Flow (DSCFM)	7,038.2	8,330.5	7,154.7	7,507.8
Exhaust Gas Volume (ACFM)	22,496.2	22,843.3	22,610.3	22,649.9
Air Flow (WSCFM)	6,823.9	4,450.9	15,817.0	9,030.6
BSAC, #/BHP-hr	9.2	6.0	21.2	12.1
Fuel Flow Measurements				
Fuel Gas Differential Pressure ("H_2O)	39.0	40.0	39.0	39.33
Fuel Gas Static Pressure (PSIG)	64.0	64.0	64.0	64.00
Fuel Gas Temperature (°F)	93.0	94.0	93.0	93.33
** 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-EURRCOMP-A

GAS COMPOSITION	(Based on AGA standard conditions of 14.73 psia and 60 F)					
Constituent	**Mol. Fraction**	**MW**	**weighted MW**	**DENSITY**	**Weighted Density**	
NITROGEN	0.0059010	28.0134	0.1653	0.07399	0.00044	
CARBON DIOX.	0.0111260	44.01	0.4897	0.11624	0.00129	
METHANE	0.9400320	16.04315	15.0811	0.04237	0.03983	
ETHANE	0.0341140	30.0703	1.0258	0.07942	0.00271	
PROPANE	0.0073740	44.0975	0.3252	0.11647	0.00086	
I-BUTANE	0.0005000	58.1246	0.0291	0.15352	0.00008	
N-BUTANE	0.0006690	58.1246	0.0389	0.15352	0.00010	
I-PENTANE	0.0001640	72.1518	0.0118	0.19057	0.00003	
N-PENTANE	0.0000000	72.1518	0.0000	0.19057	0.00000	
HEXANE +	0.0000790	95.958	0.0076	0.32000	0.00003	
	1.0000	17.1744	17.1744		0.04536	
Upper Dry Heat Value	1038	btu/dscf				
Low Dry Heat Value	936	btu/dscf				
Specific Gravity	0.5941					
DENSITY	0.0454	lb/cf				
Total Carbons	1.047533075	Total H	4.038568			

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	856.84	858.75	1012	951.312384	953.43
ETHANE	1622.4	55.35	55.47	1773.7	60.5080018	60.64
PROPANE	2320.3	17.11	17.15	2522.1	18.5979654	18.64
I-BUTANE	3007.3	1.50	1.51	3260.5	1.63025	1.63
N-BUTANE	3017.8	2.02	2.02	3270.1	2.1876969	2.19
I-PENTANE	3707.6	0.61	0.61	4011.1	0.6578204	0.66
N-PENTANE	3715.5	0.00	0.00	4018.2	0	0.00
HEXANE +	4900.5	0.39	0.39	5288.8	0.4178152	0.42
		LHV real	935.90		HHV real	1037.62

Constituent	SG	SG(i) ideal	b	b(i)	
NITROGEN	0.96723	0.005707624	0.0044	2.59644E-05	
CARBON DIOX.	1.51955	0.016906513	0.0197	0.000219182	Compressibility
METHANE	0.55392	0.520702525	0.0116	0.010904371	0.997775392
ETHANE	1.03824	0.035418519	0.0239	0.000815325	
PROPANE	1.52256	0.011227357	0.0344	0.000253666	
I-BUTANE	2.00684	0.00100342	0.0458	0.0000229	
N-BUTANE	2.00684	0.001342576	0.0478	3.19782E-05	
I-PENTANE	2.49115	0.000408549	0.0581	9.5284E-06	
N-PENTANE	2.49115	0	0.0631	0	
HEXANE +	3.3127	0.000261703	0.0802	6.3358E-06	
	SG real	0.594057211		0.01228925	

Table 5. Gas Composition-EPA Standard Conditions- EURRCOMP-A

GAS COMPOSITION	(Based onEPA standard conditions of 14.696 psia and 68 F)					
Constituent	Mol. Fraction	MW	weighted MW			
NITROGEN	0.0059	28.0134	0.1653			
CARBON DIOX.	0.0111	44.01	0.4897			
METHANE	0.9400	16.04315	15.0811	Carbon Wt. % :	0.732607	
ETHANE	0.0341	30.0703	1.0258	Hydrogen Wt. % :	0.237038	
PROPANE	0.0074	44.0975	0.3252	Oxygen Wt. % :	0.020730	
I-BUTANE	0.0005	58.1246	0.0291	Nitrogen Wt. % :	0.009625	
N-BUTANE	0.0007	58.1246	0.0389		1.0000	
I-PENTANE	0.0002	72.1518	0.0118			
N-PENTANE	0.0000	72.1518	0.0000			
HEXANE +	0.0001	95.958	0.0076			
	1.0000	MW	17.1744			
Upper Dry Heat Value	1036	btu/dscf	Mole Weight	17.1744	btu/dscf	
Low Dry Heat Value	937	btu/dscf	A F-Factor (calc)	8693	dscf/MMbtu	
Specific Gravity	0.5941					
Density	0.0456	lb/scf				
Total Carbons	1.0475	Total H	4.0387			

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	858.25	860.16	1010	949.43232	951.55
ETHANE	1624	55.40	55.52	1769.6	60.3681344	60.50
PROPANE	2322	17.12	17.16	2516.1	18.5537214	18.60
I-BUTANE	3010	1.51	1.51	3251.9	1.62595	1.63
N-BUTANE	3020	2.02	2.02	3262.3	2.1824787	2.19
I-PENTANE	3711	0.61	0.61	4000.9	0.6561476	0.66
N-PENTANE	3718	0.00	0.00	4008.9	0	0.00
HEXANE +	4904	0.39	0.39	5278	0.416962	0.42
		LHV real	937.38		HHV real	1035.54

Constituent	SG	SG(i) ideal	b	b(i)		
NITROGEN	0.96723	0.005707624	0.0044	2.59644E-05		
CARBON DIOX.	1.51955	0.016906513	0.0197	0.000219182	Compressibility	
METHANE	0.55392	0.520702525	0.0116	0.010904371	0.997775392	
ETHANE	1.03824	0.035418519	0.0239	0.000815325		
PROPANE	1.52256	0.011227357	0.0344	0.000253666		
I-BUTANE	2.00684	0.00100342	0.0458	0.0000229		
N-BUTANE	2.00684	0.001342576	0.0478	3.19782E-05		
I-PENTANE	2.49115	0.000408549	0.0581	9.5284E-06		
N-PENTANE	2.49115	0	0.0631	0		
HEXANE +	3.3127	0.000261703	0.0802	6.3358E-06		
	SG real	0.594057211		0.01228925		

Table 6. Orifice Flow Calculations- EURRCOMP-A

ORIFICE FLOW CALCULATIONS				
Run Number	1	2	3	AVERAGES
Supply Pressure	64.0	64.0	64.0	64.0
Differential	39.0	40.0	39.0	39.3
Temperature	93.0	94.0	93.0	93.3
Fuel Flow (scfh)	24397	24679	24390	24490
Fuel Flow (scfm)	406.6	411.3	406.5	408.2
PIPE I.D.	2.067	2.067	2.067	2.067
ORIFICE I.D.	1.25	1.25	1.25	1.25
PRESS TAP? (1-UP,2-DN)	2	2	2	2
SP. GRAVITY	0.583817634	0.5838176	0.5838176	0.583817634
BETA	0.604741171	0.6047412	0.6047412	0.604741171
K	0.658439831	0.6584398	0.6584398	0.658439831
K1	0.658439831	0.6584398	0.6584398	0.658439831
Bc	368.6426941	368.64269	368.64269	368.6426941
E	671.8343196	671.83432	671.83432	671.8343196
kflang	0.648675828	0.6486758	0.6486758	0.648675828
Ko	0.653173935	0.6531739	0.6531739	0.653173935
Fb	345.1391483	345.13915	345.13915	345.1391483
BB	0.064554807	0.0645548	0.0645548	0.064554807
Fr	1.00116902	1.0011546	1.0011694	1.001164275
Fpb	1	1	1	1
Ftb	1	1	1	1
Ftf	0.969685447	0.9688094	0.9696854	0.969393154
FG	1.308764167	1.3087642	1.3087642	1.308764167
Fpv	1.004789891	1.0047543	1.0047872	1.004777086
R	0.018002225	0.0184743	0.0180124	0.018162936
QY	1.002691291	1.0027623	1.0026928	1.002715457
C	441.8108719	441.42097	441.8105	441.6806202
Qfh	24397	24679	24390	24490
Qfm	406.6	411.3	406.5	408.2

Table 7. Operating Parameters and Ambient Conditions - EURRCOMP-B

Run	1	2	3	AVERAGES
Date	06/03/15	06/03/15	06/03/15	
Time	840-940	945-1045	1050-1150	
Condition	HS-HT	HS-HT	HS-HT	
Engine Operating Conditions				
Unit Horsepower from Control Panel	3,398.0	3,373.0	3,378.0	3,383.0
Unit Speed	352.0	349.0	350.0	350.3
Exhaust Temperature Average (°F)	799.0	801.0	800.0	800.0
Air Manifold Temperature (°F)	110.0	115.0	118.0	114.3
Jacket Water Inlet Temperature (°F)	170.0	172.0	173.0	171.7
Lube Oil Outlet Temperature (°F)	160.0	162.0	179.0	167.0
Lube Oil Pressure (PSIG)	53.0	53.0	52.0	52.7
Compressor Suction Pressure (PSIG)	727.0	727.0	726.0	726.7
Compressor Suction Temperature (°F)	60.0	60.0	61.0	60.3
Compressor Discharge Pressure (PSIG)	1721.0	1724.0	1726.0	1,723.7
Compressor Discharge Temperature (°F)	151.0	152.0	152.0	151.7
Fuel Torque (%)	102.0	102.0	102.0	102.0
% Load	90.6	89.9	90.1	90.2
% Torque	99.0	90.2	90.1	93.1
Heat Rate (BTU/HP-hr)	7,396.5	7,338.1	7,224.7	7,319.7
Heat Rate (KJ/Watt-Hr)	10.461	10.378	10.218	10.4
Ambient Conditions				
Ambient Temperature (°F)	55.00	60.00	67.00	60.67
Barometric Pressure ("Hg)	28.90	28.90	28.90	28.90
Ambient Relative Humidity (%)	30.00	31.00	33.00	31.33

Table 8. Emissions Concentrations, Calculated Mass Emissions/Calculated & Fuel Flows EURRCOMP-B

Emissions Concentrations & Calculated Mass Emissions				
NO_x ppm (BIAS Corrected)	1262.60	1259.69	1268.57	1263.62
NO_X g/BHP-HR	9.703	9.678	9.865	9.75
NO_X LB/HR	72.69	71.97	73.46	72.71
NO_X (ppm @ 15% O_2)	709.46	713.26	728.07	716.93
NOx LB/MMBTU	2.61	2.63	2.68	2.64
CO ppm (BIAS Corrected)	299.16	316.58	291.67	302.47
CO g/BHP-HR	1.400	1.481	1.381	1.42
CO LB/HR	10.48	11.01	10.28	10.59
CO LB/MMBTU **	0.38	0.40	0.38	0.38
CO (ppm @ 15% O_2)	168.10	179.25	167.40	171.58
% CO_2 (BIAS Corrected)	6.00	6.00	6.00	6.00
% O_2 (BIAS Corrected)	10.40	10.48	10.62	11.50
Calculated Flows				
Fuel Flow - (SCFM)	447.6	440.8	440.8	443.0
Fuel Flow - (SCFH)	26,854.7	26,446.7	26,446.7	26,582.7
Fuel Flow (LB/HR)	1,218.2	1,199.7	1,199.7	1,205.9
Exhaust Flow (LB/HR)	35,988.0	35,726.0	36,238.2	35,984.1
Exhaust Flow (WSCFM)	9,518.3	9,373.7	9,373.7	9,421.9
Exhaust Flow (DSCFM)	8,020.1	7,958.9	8,067.3	8,015.5
Exhaust Gas Volume (ACFM)	23,852.4	23,527.3	23,508.7	23,629.5
Air Flow (WSCFM)	7,774.5	4,255.4	17,830.9	9,953.6
BSAC, #/BHP-hr	10.4	5.7	24.1	13.4
Fuel Flow Measurements				
Fuel Gas Differential Pressure ("H_2O)	48.0	46.0	46.0	46.67
Fuel Gas Static Pressure (PSIG)	64.0	65.0	65.0	64.67
Fuel Gas Temperature (°F)	102.0	102.0	102.0	102.00
** BASED ON FUEL SPECIFIC DRY F-FACTOR CALCULATION				
* BASED ON CARBON BALANCE (STOICH. + O2)				
- A/F IS TOTAL MASS RATIO				

Table 9. Gas Composition-AGA Standard Conditions- EURRCOMP-B

GAS COMPOSITION	(Based on AGA standard conditions of 14.73 psia and 60 F)					
Constituent	Mol. Fraction	MW	weighted MW	DENSITY	Weighted Density	
NITROGEN	0.0059010	28.0134	0.1653	0.07399	0.00044	
CARBON DIOX.	0.0111260	44.01	0.4897	0.11624	0.00129	
METHANE	0.9400320	16.04315	15.0811	0.04237	0.03983	
ETHANE	0.0341140	30.0703	1.0258	0.07942	0.00271	
PROPANE	0.0073740	44.0975	0.3252	0.11647	0.00086	
I-BUTANE	0.0005900	58.1246	0.0291	0.15352	0.00008	
N-BUTANE	0.0006690	58.1246	0.0389	0.15352	0.00010	
I-PENTANE	0.0001640	72.1518	0.0118	0.19057	0.00003	
N-PENTANE	0.0000000	72.1518	0.0000	0.19057	0.00000	
HEXANE +	0.0000790	95.958	0.0076	0.32000	0.00003	
	1.0000	17.1744	17.1744		0.04536	
Upper Dry Heat Value	1038	btu/dscf				
Low Dry Heat Value	936	btu/dscf				
Specific Gravity	0.5941					
DENSITY	0.0454	lb/cf				
Total Carbons	1.047533075	Total H	4.038568			

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	856.84	858.75	1012	951.312384	953.43
ETHANE	1622.4	55.35	55.47	1773.7	60.5080018	60.64
PROPANE	2320.3	17.11	17.15	2522.1	18.5979654	18.64
I-BUTANE	3007.3	1.50	1.51	3260.5	1.63025	1.63
N-BUTANE	3017.8	2.02	2.02	3270.1	2.1876969	2.19
I-PENTANE	3707.6	0.61	0.61	4011.1	0.6578204	0.66
N-PENTANE	3715.5	0.00	0.00	4018.2	0	0.00
HEXANE +	4900.5	0.39	0.39	5288.8	0.4178152	0.42
		LHV real	935.90		HHV real	1037.62

Constituent	SG	SG(i) ideal	b	b(i)	
NITROGEN	0.96723	0.005707624	0.0044	2.59644E-05	
CARBON DIOX.	1.51955	0.016906513	0.0197	0.000219182	Compressibility
METHANE	0.55392	0.520702525	0.0116	0.010904371	0.997775392
ETHANE	1.03824	0.035418519	0.0239	0.000815325	
PROPANE	1.52256	0.011227357	0.0344	0.000253666	
I-BUTANE	2.00684	0.00100342	0.0458	0.0000229	
N-BUTANE	2.00684	0.001342576	0.0478	3.19782E-05	
I-PENTANE	2.49115	0.000408549	0.0581	9.5284E-06	
N-PENTANE	2.49115	0	0.0631	0	
HEXANE +	3.3127	0.000261703	0.0802	6.3358E-06	
	SG real	0.594057211		0.01228925	
					8.46546E-07

Table 10. Gas Composition-EPA Standard Conditions- EURRCOMP-B

GAS COMPOSITION	(Based onEPA standard conditions of 14.696 psia and 68 F)					
Constituent	Mol. Fraction	MW	weighted MW			
NITROGEN	0.0059	28.0134	0.1653			
CARBON DIOX.	0.0111	44.01	0.4897			
METHANE	0.9400	16.04315	15.0811	Carbon Wt. % :	0.732607	
ETHANE	0.0341	30.0703	1.0258	Hydrogen Wt. % :	0.237038	
PROPANE	0.0074	44.0975	0.3252	Oxygen Wt. % :	0.020730	
I-BUTANE	0.0005	58.1246	0.0291	Nitrogen Wt. % :	0.009625	
N-BUTANE	0.0007	58.1246	0.0389		1.0000	
I-PENTANE	0.0002	72.1518	0.0118			
N-PENTANE	0.0000	72.1518	0.0000			
HEXANE +	0.0001	95.958	0.0076			
	1.0000	MW	17.1744			
Upper Dry Heat Value	1036	btu/dscf	Mole Weight	17.1744	btu/dscf	
Low Dry Heat Value	937	btu/dscf	A F-Factor (calc)	8693	dscf/MMbtu	
Specific Gravity	0.5941					
Density	0.0456	lb/scf				
Total Carbons	1.0475	Total H	4.0387			

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	858.25	860.16	1010	949.43232	951.55
ETHANE	1624	55.40	55.52	1769.6	60.3681344	60.50
PROPANE	2322	17.12	17.16	2516.1	18.5537214	18.60
I-BUTANE	3010	1.51	1.51	3251.9	1.62595	1.63
N-BUTANE	3020	2.02	2.02	3262.3	2.1824787	2.19
I-PENTANE	3711	0.61	0.61	4000.9	0.6561476	0.66
N-PENTANE	3718	0.00	0.00	4008.9	0	0.00
HEXANE +	4904	0.39	0.39	5278	0.416962	0.42
		LHV real	937.38		HHV real	1035.54

Constituent	SG	SG(i) Ideal	b	b(i)		
NITROGEN	0.96723	0.005707624	0.0044	2.59644E-05		
CARBON DIOX.	1.51955	0.016906513	0.0197	0.000219182	Compressibility	
METHANE	0.55392	0.520702525	0.0116	0.010904371	0.997775392	
ETHANE	1.03824	0.035418519	0.0239	0.000815325		
PROPANE	1.52256	0.011227357	0.0344	0.000253666		
I-BUTANE	2.00684	0.00100342	0.0458	0.0000229		
N-BUTANE	2.00684	0.001342576	0.0478	3.19782E-05		
I-PENTANE	2.49115	0.000408549	0.0581	9.5284E-06		
N-PENTANE	2.49115	0	0.0631	0		
HEXANE +	3.3127	0.000261703	0.0802	6.3358E-06		
	SG real	0.594057211		0.01228925		

Table 11. Orifice Flow Calculations- EURRCOMP-B

ORIFICE FLOW CALCULATIONS				
Run Number	1	2	3	AVERAGES
Supply Pressure	64.0	65.0	65.0	64.7
Differential	48.0	46.0	46.0	46.7
Temperature	102.0	102.0	102.0	102.0
Fuel Flow (scfh)	26855	26447	26447	26585
Fuel Flow (scfm)	447.6	440.8	440.8	443.1
PIPE I.D.	2.067	2.067	2.067	2.067
ORIFICE I.D.	1.25	1.25	1.25	1.25
PRESS TAP? (1-UP,2-DN)	2	2	2	2
SP. GRAVITY	0.583817634	0.5838176	0.5838176	0.583817634
BETA	0.604741171	0.6047412	0.6047412	0.604741171
K	0.658439831	0.6584398	0.6584398	0.658439831
K1	0.658439831	0.6584398	0.6584398	0.658439831
Bc	368.6426941	368.64269	368.64269	368.6426941
E	671.8343196	671.83432	671.83432	671.8343196
kflang	0.648675828	0.6486758	0.6486758	0.648675828
Ko	0.653173935	0.6531739	0.6531739	0.653173935
Fb	345.1391483	345.13915	345.13915	345.1391483
BB	0.064554807	0.0645548	0.0645548	0.064554807
Fr	1.00105374	1.0010699	1.0010699	1.001064359
Fpb	1	1	1	1
Ftb	1	1	1	1
Ftf	0.961885126	0.9618851	0.9618851	0.961885126
FG	1.308764167	1.3087642	1.3087642	1.308764167
Fpv	1.00450354	1.0045585	1.0045585	1.004540158
R	0.022156584	0.020977	0.020977	0.021366996
QY	1.003316776	1.003139	1.003139	1.003197771
C	438.3547995	438.30817	438.30817	438.3234331
Qfh	26855	26447	26447	26585
Qfm	447.6	440.8	440.8	443.1

3. PROCESS DESCRIPTION

TransCanada's ANR Storage Company's Rapid River Compressor Station is located in Kalkaska, Michigan and operates two affected engines. Units EURRCOMP-A and EURRCOMP-B (serial numbers 410KVR152A and 410KVR153A respectively) are Ingersoll Rand 410-KVR-TE natural gas fired internal combustion reciprocating engines rated at 3,750 hp and 350 rpm.

The Ingersoll Rand KVR-410-TE 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 move it toward another compressor gas station, into or out of the gas storage facility, or the final user.

The following tables provide a summary of the production rates for the Unit A and Unit B during the test:

Table 12. EURRCOMP-A - Rated Information

		# of Cylinders:	10	
		Stroke:	4	
		Fuel Orifice ID.:	1.25	in.
		Fuel Pipe ID.:	2.067	in.
		AGA UDHV :	1,026	btu/dscf
		AGA LDHV :	927	btu/dscf
Company:	ANR	Rated RPM:	350	RPM
Station:	Rapid River	Bore:		inches
Unit:	410VR152A	Stroke:	15.5	inches
Engine Type	Ingersoll Rand	Rated BHP:	3,750	BHP
Date:	3-Jun-15			

Table 13. Production Data-Horse Power (HP)

EURRCOMP-A Horse Power (HP)	
Run No.	**EURRCOMP-A**
1	3,378
2	3,398
3	3,406
Average	3,394
Rated HP	3,750

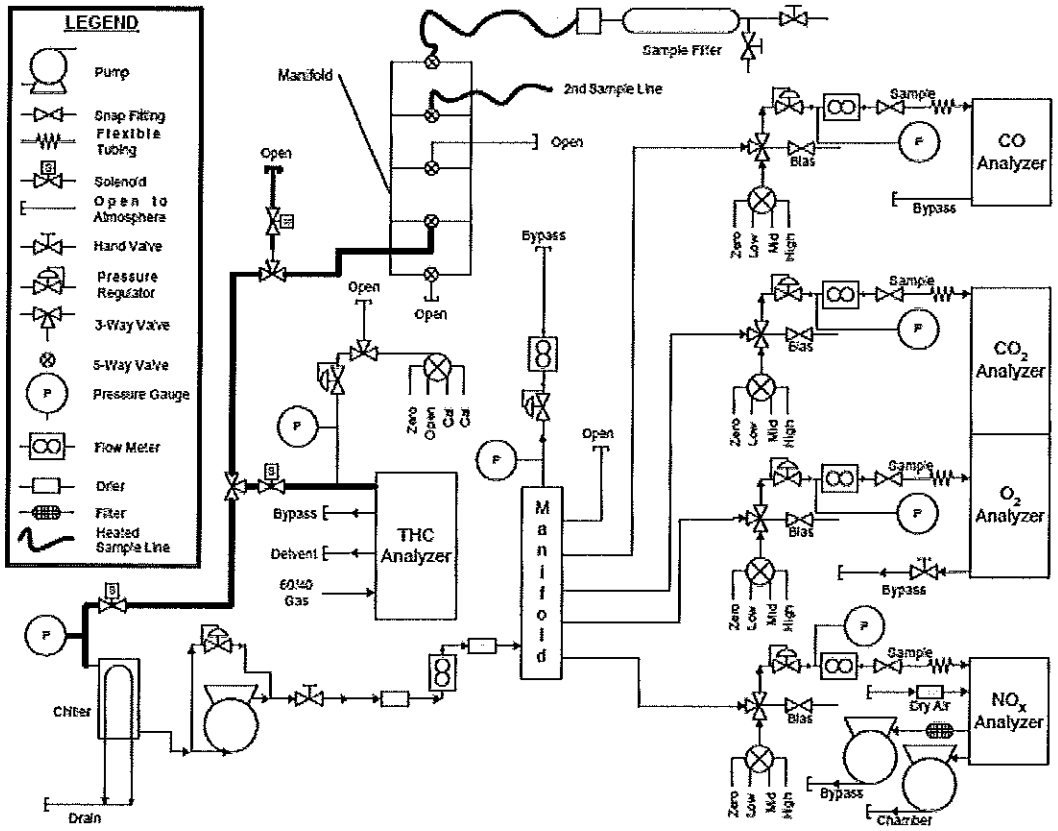
Table 14 EURRCOMP-B - Rated Information

		# of Cylinders:	10	
		Stroke:	4	
		Fuel Orifice ID.:	1.25	in.
		Fuel Pipe ID.:	2.067	in.
		AGA UDHV :	1,026	btu/dscf
		AGA LDHV :	927	btu/dscf
Company:	ANR	Rated RPM:	350	RPM
Station:	Rapid River	Bore:	17	inches
Unit:	410VR152B	Stroke:	15.5	inches
Engine Type	Ingersoll Rand	Rated BHP:	3,750	BHP
Date:	3-Jun-15			

Table 15. Production Data-Horse Power (HP)

EURRCOMP-B Horse Power (HP)	
Run No.	**EURRCOMP-B**
1	3,398
2	3,373
3	3,378
Average	3,383
Rated HP	3,750

Figure 1. Flow Schematic



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

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)

USEPA Methods 3A and 7E 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.