



**ANR Pipeline Company**

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**AIR QUALITY DIV.**

TransCanada US Pipelines  
Plant Reliability Department  
717 Texas Street  
Houston, Texas 77002

June 30, 2014  
Karen Kajiya-Mills  
Technical Programs Unit Supervisor MDEQ / AQD  
Constitution Hall, 525 W. Allegan Street  
3<sup>rd</sup> Floor North  
Lansing, MI 48933  
(517) 335-4874

**RE: 2012 Ozone Season Emissions Monitoring Report, ANR Woolfolk Compressor Station (SRN: B7220). R336.1818(4)(a)(ii)(A)(2)**

Dear Ms. Kajiya-Mills:

As operator of ANR Pipeline Company, TransCanada would like to submit the attached ozone season emissions monitoring report for the Michigan Department of Environmental Quality – Air Quality Division (MDEQ) review and approval.

The purpose of this monitoring was to demonstrate compliance with the applicable NOx standards in the NOx SIP Compliance Plan ANR submitted to comply with R336.1818(3)(a) on nine engines located at ANR Woolfolk compressor station, Mecosta County, Michigan. The monitoring was conducted in accordance to the ASTM DD6522-00 procedures as outlined in the protocol ANR submitted last April 4, 2014.

TransCanada respectfully requests the timely review and approval of this submittal. If you have any questions or concerns regarding this matter, please do not hesitate to contact me.

Thank You,

Pedro Amieva  
TransCanada US Pipelines  
Plant Reliability Department  
Office: (832) 320-5839  
Cell: (832) 819-9485  
[pedro\\_amieva@transcanada.com](mailto:pedro_amieva@transcanada.com)



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 (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, Woolfolk Compressor Station County Mecosta

Source Address 11750 150<sup>th</sup> Avenue City Big Rapids

AQD Source ID (SRN) B7220 RO Permit No. MI-ROP-B7220-2012a 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 5/1/2014 To 9/30/2014

Additional monitoring reports or other applicable documents required by the RO Permit are attached as described:  
Ozone Season Monitoring per R336.1818(4)(a)(ii)  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

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 Vicepresident Operations US (832) 320-5511  
Name of Responsible Official (print or type) Title Phone Number

Randall W. Schmidgall Signature of Responsible Official July 7, 2014 Date

## 1. Introduction

1.1. The Plant Reliability Department of TransCanada's US Pipelines Central conducted monitoring at ANR Woolfolk Compressor Station (SRN: B7220) pursuant to the Compliance Plan ANR submitted to comply with R336.1818(3)(a). The Compliance Plan has been approved by the MDEQ.

1.2. The purpose of the monitoring was to comply with the ozone season monitoring requirement in the ANR Compliance Plan and is in accordance with R336.1818(4)(a)(ii)(A)(2). The monitoring demonstrates compliance with the projected NOx emission rate in the ANR Compliance Plan. As such, the following parameter was determined:

1.2.1. Woolfolk Units #1 to #5: *20.5 g/bhp-hr of NOx*

### 1.3. Facilities Information:

ANR Woolfolk Compressor Station  
11750 150<sup>th</sup> Avenue  
Big Rapids, MI 49307

Environmental Contact  
Melinda Holdsworth  
717 Texas Street, Suite 24155B  
Houston, TX 77002  
(832) 320-5665

## 2. Process Description

2.1. Woolfolk compressor station operates nine NOx SIP affected engines; 2001 through 2005 are Ingersoll-Rand KVG-103, 1,000 HP each and 2006 through 2009 are Ingersoll-Rand KVG-123, 1,320 HP each. All engines are natural gas fired, reciprocating internal combustion engine used in Natural Gas Transmission. More specifically, the engine is used in the compression of natural gas from an initial "suction" pressure to a final "discharge" pressure, which creates the pressure gradient necessary to transport natural gas through ANR Pipeline's interstate pipeline system

## 3. Methodology

3.1. American Society of Testing and Materials test method D6522-00: Standard Test Method for Determination of Nitrogen Oxides, Carbon Monoxide, and Oxygen Concentrations in Emissions from Natural Gas-Fired Reciprocating Engines, Combustion Turbines, Boilers, and Process Heaters Using Portable Analyzers was employed for determination of compliance with Section 1.2.1.

## 4. Sample System

4.1. Sample system components, as outlined in Method D6522-00, were utilized for monitoring. These components include, but are not limited to, sample probe, heated sample line, sample transport lines, calibration assembly, moisture removal system, particulate filter, sample pump, sample flow rate control, gas analyzer, data recorder, and external interference gas scrubber.

## 5. Sample Location

5.1. Sampling location was selected as specified in sections 10.1.1 and 10.1.2 of Method D6522-00 at a location of five duct diameters downstream of any flow disturbance and three duct diameters upstream of the discharge to atmosphere.

5.2. All the stratification sampling for all the units showed a variance in concentration of less of 5%, therefore, as per section 10.1.4 of Method D6522-00, sampling was taken from a single point located in the center of the stack.

## 6. Sample Time

6.1. Monitoring was conducted during normal engine operation, i.e. not during periods of startup, shutdown, or malfunction. Each engine was monitored at the maximum load achievable based upon pipeline and ambient conditions.

6.2. Each engine was sampled at three 30-minute test runs. Samples were taken at a frequency of once per minute.

## 7. Results

7.1. Results of the monitoring demonstrated that all units tested below the permitted levels of 20.5 g/BHP-hr. Detailed emissions summaries and calibration records can be found in the following pages.

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# Test Summary

## General Information

Company: TransCanada US Pipelines  
 Station: ANR Woolfolk

## Unit Information

Unit No.: 2001 to 2005  
 Manufacturer: INGERSOLL RAND  
 Model: KVG-103  
 Rated BHP: 1,000  
 Rated RPM: 330

General Data					
Unit	2001	2002	2003	2004	2005
Test Date	6/17/14	6/17/14	6/17/14	6/18/14	6/18/14
Operating Data					
Horsepower	931	931	931	932	935
Speed	330	330	331	329	330
% Load	93.1%	93.1%	93.1%	93.2%	93.5%
% Torque	93.0%	93.0%	92.8%	93.4%	93.5%
Fuel Use (scfh)	8,873	9,433	8,920	9,318	8,525
Emissions Data					
NOx Limit	20.5 g/bhp-hr				
NOx (ppm)	1261.8	2462.0	1518.4	2945.9	1365.4
NO <sub>x</sub> (ppm@ 15% O <sub>2</sub> )	463.9	880.0	572.5	916.2	521.2
NO <sub>x</sub> (lb/hr)	16.7	31.6	19.5	32.4	16.8
NO <sub>x</sub> (g/bhp-hr)	7.6	15.4	9.5	15.7	8.2
NO <sub>x</sub> (TPY)	68.7	138.5	85.2	141.8	73.8
O <sub>2</sub> (%)	4.9	4.4	5.3	1.9	5.4

# Test Summary

## General Information

Company: TransCanada US Pipelines

Station: ANR Woolfolk

## Unit Information

Unit No.: 2006 to 2009

Manufacturer: UGERSOLL RAND

Model: KVG-123

Rated BHP: 1,320

Rated RPM: 330

### General Data

Unit	2006	2007	2008	2009
Test Date	6/18/14	6/19/14	6/19/14	6/20/14

### Operating Data

Horsepower	1,238	1,251	1,224	1,207
Speed	331	330	330	329
% Load	93.8%	94.8%	92.7%	91.4%
% Torque	93.6%	94.9%	92.8%	91.6%
Fuel Use (scfh)	12,123	11,376	11,254	11,282

### Emissions Data

NOx Limit	20.5 g/bhp-hr			
NOx (ppm)	877.6	1414.8	2557.1	2278.7
NO <sub>x</sub> (ppm@ 15% O <sub>2</sub> )	325.3	529.3	898.4	831.7
NO <sub>x</sub> (lb/hr)	15.0	22.9	38.5	36.0
NO <sub>x</sub> (g/bhp-hr)	5.5	8.3	14.3	13.5
NO <sub>x</sub> (TPY)	65.5	100.5	168.7	157.6
O <sub>2</sub> (%)	5.0	5.1	4.1	4.7

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# Unit 2001

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**Emissions Data Sheet Summary**

**Sample Calculations**

**General Information**

**Linearity Check**

**NO Stability Check**

**NO<sub>2</sub> Stability Check**

**Calibration Error**

**Engine Operating Data**

**Run 1 – 3**

# Data Summary

## General Information

Start Date: 6/17/2014

Company: ANR

Station: Woolfolk

## Unit Information

Unit No.: 2001

Manufacturer: I/R

Model: KVG 103

Rated BHP: 1000

Rated RPM: 330

## Gas Analysis

Nitrogen: 1.1608      I - Butane: 0.011

Carbon Dioxide: 0.8223      N - Butane: 0.0166

Methane: 93.1086      I - Pentane: 0.0012

Ethane: 4.6235      N - Pentane: 0.0008

Propane: 0.2478      Hexane +: 0.007

**Total: 100.000**

## Test Data

General Data				
Run	1	2	3	Averages
Date	6/17/14	6/17/14	6/17/14	
Time	08:19:36	08:59:38	09:40:58	
Operating Data				
Horsepower	938	925	929	931
Speed	333	329	330	330
% Load	93.8%	92.5%	92.9%	93.1%
% Torque	93.0%	92.8%	93.0%	93.0%
Fuel Use (scfh)	8,860	8,885	8,875	8,873
UDHV (BTU/dscf)	1,034.1	1,034.1	1,034.1	1,034.1
Curve	1	1	1	1
AMP (psig)				
AMT (°F)				
Suct. Press. (psig)	573	559	561	564
Suct. Temp. (°F)	53.6	55.2	55.1	54.6
Disc. Press. (psig)	794	809	808	804
Disc. Temp. (°F)	92.6	92.6	92.6	92.6
Emissions Data				
NO (ppm)	1129.03	1164.94	1215.52	1169.83
NO <small>Bias corrected</small> (ppm)	1123.67	1160.02	1211.22	1164.97
NO <sub>2</sub> (ppm)	94.55	96.42	97.10	96.02
NO <sub>2</sub> <small>Bias corrected</small> (ppm)	95.49	97.24	97.92	96.88
NO <sub>x</sub> (ppm)	1219.16	1257.26	1309.14	1261.85
NO <sub>x</sub> (ppm@15% O <sub>2</sub> )	448.03	462.59	481.10	463.91
NO <sub>x</sub> (lb/hr)	15.12	15.66	16.27	15.68
NO <sub>x</sub> (g/bhp-hr)	7.3	7.7	7.9	7.6
NO <sub>x</sub> (TPY)	66.2	68.6	71.2	68.7
O <sub>2</sub> (%)	4.85	4.86	4.85	4.85

# Data Summary

## General Information

Start Date: 6/17/2014  
 Company: ANR  
 Station: Woolfolk

## Unit Information

Unit No.: 2002  
 Manufacturer: I/R  
 Model: KVG 103  
 Rated BHP: 1000  
 Rated RPM: 330

## Gas Analysis

Nitrogen: 1.1608    I - Butane: 0.011  
 Carbon Dioxide: 0.8223    N - Butane: 0.0166  
 Methane: 93.1086    I - Pentane: 0.0012  
 Ethane: 4.6235    N - Pentane: 0.0008  
 Propane: 0.2478    Hexane +: 0.007  
**Total: 100.000**

## Test Data

General Data				
Run	1	2	3	Averages
Date	6/17/14	6/17/14	6/17/14	
Time	11:18:50	11:57:48	12:33:49	
Operating Data				
Horsepower	931	931	930	931
Speed	330	331	330	330
% Load	93.1%	93.1%	93.0%	93.1%
% Torque	93.1%	92.8%	93.1%	93.0%
Fuel Use (scfh)	9,463	9,440	9,395	9,433
UDHV (BTU/dscf)	1,034.1	1,034.1	1,034.1	1,034.1
Curve				
AMP (psig)				
AMT (°F)				
Suct. Press. (psig)	563	566	567	565
Suct. Temp. (°F)	56.0	59.1	60.7	58.6
Disc. Press. (psig)	814	815	815	814
Disc. Temp. (°F)	92.6	92.6	92.6	92.6
Emissions Data				
NO (ppm)	2531.19	2174.03	2197.00	2300.74
NO <small>Bias corrected</small> (ppm)	2556.08	2185.67	2214.28	2318.67
NO <sub>2</sub> (ppm)	148.77	138.81	133.90	140.49
NO <sub>2</sub> <small>Bias corrected</small> (ppm)	151.76	141.59	136.59	143.31
NO <sub>x</sub> (ppm)	2707.84	2327.26	2350.87	2461.99
NO <sub>x</sub> (ppm@ 15% O <sub>2</sub> )	956.71	840.29	842.94	879.98
NO <sub>x</sub> (lb/hr)	34.49	30.22	30.17	31.63
NO <sub>x</sub> (g/bhp-hr)	16.8	14.7	14.7	15.4
NO <sub>x</sub> (TPY)	151.1	132.4	132.1	138.5
O <sub>2</sub> (%)	4.20	4.56	4.45	4.40



# Data Summary

## General Information

Start Date: 6/17/2014  
 Company: ANR  
 Station: Woolfolk

## Unit Information

Unit No.: 2003  
 Manufacturer: I/R  
 Model: KVG 103  
 Rated BHP: 1000  
 Rated RPM: 330

## Gas Analysis

Nitrogen: 1.1608    I - Butane: 0.011  
 Carbon Dioxide: 0.8223    N - Butane: 0.0166  
 Methane: 93.1086    I - Pentane: 0.0012  
 Ethane: 4.6235    N - Pentane: 0.0008  
 Propane: 0.2478    Hexane +: 0.007  
**Total: 100.000**

## Test Data

General Data				
Run	1	2	3	Averages
Date	6/17/14	6/17/14	6/17/14	
Time	13:41:32	14:17:59	15:00:48	
Operating Data				
Horsepower	927	930	935	931
Speed	332	332	329	331
% Load	92.7%	93.0%	93.5%	93.1%
% Torque	92.1%	92.5%	93.7%	92.8%
Fuel Use (scfh)	8,963	8,908	8,890	8,920
UDHV (BTU/dscf)	1,034.1	1,034.1	1,034.1	1,034.1
Curve	1	1	1	1
AMP (psig)				
AMT (°F)				
Suct. Press. (psig)	568	565	567	567
Suct. Temp. (°F)	63.9	64.3	63.1	63.8
Disc. Press. (psig)	814	814	818	815
Disc. Temp. (°F)	93.5	93.5	93.5	93.5
Emissions Data				
NO (ppm)	1323.23	1468.39	1468.19	1419.94
NO Bias corrected (ppm)	1322.48	1471.38	1471.19	1421.68
NO <sub>2</sub> (ppm)	101.29	94.74	87.55	94.53
NO <sub>2</sub> Bias corrected (ppm)	103.32	97.20	89.82	96.78
NO <sub>x</sub> (ppm)	1425.80	1568.58	1561.00	1518.46
NO <sub>x</sub> (ppm@ 15% O <sub>2</sub> )	539.75	591.60	586.19	572.51
NO <sub>x</sub> (lb/hr)	18.43	20.08	19.85	19.45
NO <sub>x</sub> (g/bhp-hr)	9.0	9.8	9.6	9.5
NO <sub>x</sub> (TPY)	80.7	87.9	87.0	85.2
O <sub>2</sub> (%)	5.31	5.26	5.19	5.25

# Data Summary

## General Information

Start Date: 6/18/2014  
 Company: ANR  
 Station: Woolfolk

## Unit Information

Unit No.: 2004  
 Manufacturer: I/R  
 Model: KVG 103  
 Rated BHP: 1000  
 Rated RPM: 330

## Gas Analysis

Nitrogen: 1.5137    I - Butane: 0.0321  
 Carbon Dioxide: 0.7016    N - Butane: 0.0559  
 Methane: 93.5912    I - Pentane: 0.0128  
 Ethane: 3.687    N - Pentane: 0.0116  
 Propane: 0.3776    Hexane +: 0.0164  
**Total: 100.000**

## Test Data

General Data				
Run	1	2	3	Averages
Date	6/18/14	6/18/14	6/18/14	
Time	07:39:59	08:19:07	08:54:31	
Operating Data				
Horsepower	923	933	941	932
Speed	329	331	329	329
% Load	92.3%	93.3%	94.1%	93.2%
% Torque	92.7%	93.2%	94.4%	93.4%
Fuel Use (scfh)	9,278	9,285	9,390	9,318
UDHV (BTU/dscf)	1,029.0	1,029.0	1,029.0	1,029.0
Curve	1	1	1	1
AMP (psig)				
AMT (°F)				
Suct. Press. (psig)	558	557	559	558
Suct. Temp. (°F)	65.4	66.9	64.6	65.6
Disc. Press. (psig)	806	807	815	809
Disc. Temp. (°F)	94.3	94.3	94.3	94.3
Emissions Data				
NO (ppm)	2757.52	2804.52	2872.81	2811.61
NO Bias corrected (ppm)	2771.96	2819.48	2886.17	2825.87
NO <sub>2</sub> (ppm)	119.90	121.23	120.87	120.67
NO <sub>2</sub> Bias corrected (ppm)	119.23	120.55	120.20	119.99
NO <sub>x</sub> (ppm)	2891.19	2940.03	3006.36	2945.86
NO <sub>x</sub> (ppm@ 15% O <sub>2</sub> )	899.29	915.13	934.29	916.24
NO <sub>x</sub> (lb/hr)	31.63	32.21	33.26	32.37
NO <sub>x</sub> (g/bhp-hr)	15.6	15.7	16.0	15.7
NO <sub>x</sub> (TPY)	138.5	141.1	145.7	141.8
O <sub>2</sub> (%)	1.93	1.95	1.91	1.93

# Data Summary

## General Information

Start Date: 6/18/2014  
 Company: ANR  
 Station: Woolfolk

## Unit Information

Unit No.: 2005  
 Manufacturer: I/R  
 Model: KVG 103  
 Rated BHP: 1000  
 Rated RPM: 330

## Gas Analysis

Nitrogen: 1.5137    I - Butane: 0.0321  
 Carbon Dioxide: 0.7016    N - Butane: 0.0559  
 Methane: 93.5912    I - Pentane: 0.0128  
 Ethane: 3.687    N - Pentane: 0.0116  
 Propane: 0.3776    Hexane +: 0.0164  
**Total: 100.000**

## Test Data

General Data				
Run	1	2	3	Averages
Date	6/18/14	6/18/14	6/18/14	
Time	10:08:33	10:51:12	11:37:01	
Operating Data				
Horsepower	936	934	935	935
Speed	331	330	329	330
% Load	93.6%	93.4%	93.5%	93.5%
% Torque	93.2%	93.4%	93.8%	93.5%
Fuel Use (scfh)	8,680	8,453	8,443	8,525
UDHV (BTU/dscf)	1,029.0	1,029.0	1,029.0	1,029.0
Curve	1	1	1	1
AMP (psig)				
AMT (°F)				
Suct. Press. (psig)	559	557	556	557
Suct. Temp. (°F)	59.7	60.2	59.4	59.7
Disc. Press. (psig)	809	807	809	808
Disc. Temp. (°F)	94.3	94.3	94.3	94.3
Emissions Data				
NO (ppm)	1284.06	1320.32	1277.55	1293.98
NO <sub>Bias corrected</sub> (ppm)	1280.07	1317.11	1273.42	1290.20
NO <sub>2</sub> (ppm)	76.55	75.35	76.10	76.00
NO <sub>2 Bias corrected</sub> (ppm)	75.70	74.52	75.25	75.16
NO <sub>x</sub> (ppm)	1355.77	1391.63	1348.67	1365.36
NO <sub>x</sub> (ppm@ 15% O <sub>2</sub> )	520.56	529.12	513.96	521.21
NO <sub>x</sub> (lb/hr)	17.13	16.95	16.45	16.84
NO <sub>x</sub> (g/bhp-hr)	8.3	8.2	8.0	8.2
NO <sub>x</sub> (TPY)	75.0	74.3	72.0	73.8
O <sub>2</sub> (%)	5.53	5.38	5.42	5.44

# Data Summary

## General Information

Start Date: 6/18/2014  
 Company: ANR  
 Station: Woolfolk

## Unit Information

Unit No.: 2006  
 Manufacturer: I/R  
 Model: KVG 103  
 Rated BHP: 1320  
 Rated RPM: 330

## Gas Analysis

Nitrogen: 1.5137    I - Butane: 0.0321  
 Carbon Dioxide: 0.7016    N - Butane: 0.0559  
 Methane: 93.5912    I - Pentane: 0.0128  
 Ethane: 3.687    N - Pentane: 0.0116  
 Propane: 0.3776    Hexane +: 0.0164  
**Total: 100.000**

## Test Data

General Data				
Run	1	2	3	Averages
Date	6/18/14	6/18/14	6/18/14	
Time	13:01:24	13:42:22	14:18:32	
Operating Data				
Horsepower	1,246	1,235	1,233	1,238
Speed	328	329	335	331
% Load	94.4%	93.5%	93.4%	93.8%
% Torque	95.1%	93.8%	91.9%	93.6%
Fuel Use (scfh)	12,083	12,115	12,173	12,123
UDHV (BTU/dscf)	1,029.0	1,029.0	1,029.0	1,029.0
Curve	7	7	7	7
AMP (psig)				
AMT (°F)				
Suct. Press. (psig)	574	570	570	571
Suct. Temp. (°F)	58.8	59.7	60.1	59.5
Disc. Press. (psig)	816	813	805	811
Disc. Temp. (°F)	94.3	94.3	94.3	94.3
Emissions Data				
NO (ppm)	1014.16	785.10	777.00	858.75
NO <small>Bias corrected</small> (ppm)	1004.22	771.43	763.14	846.27
NO <sub>2</sub> (ppm)	45.23	25.55	23.23	31.33
NO <sub>2</sub> <small>Bias corrected</small> (ppm)	44.97	25.62	23.29	31.29
NO <sub>x</sub> (ppm)	1049.19	797.05	786.44	877.56
NO <sub>x</sub> (ppm@ 15% O <sub>2</sub> )	383.46	298.27	294.18	325.30
NO <sub>x</sub> (lb/hr)	17.56	13.70	13.57	14.95
NO <sub>x</sub> (g/bhp-hr)	6.4	5.0	5.0	5.5
NO <sub>x</sub> (TPY)	76.9	60.0	59.5	65.5
O <sub>2</sub> (%)	4.76	5.13	5.13	5.01

# Data Summary

## General Information

Start Date: 6/19/2014  
 Company: ANR  
 Station: Woolfolk

## Unit Information

Unit No.: 2007  
 Manufacturer: I/R  
 Model: KVG 103  
 Rated BHP: 1320  
 Rated RPM: 330

## Gas Analysis

Nitrogen: 0.9939 I - Butane: 0.008  
 Carbon Dioxide: 0.8904 N - Butane: 0.0094  
 Methane: 93.7208 I - Pentane: 0  
 Ethane: 4.1904 N - Pentane: 0  
 Propane: 0.1864 Hexane +: 0.001  
 Total: 100.000

## Test Data

General Data				
Run	1	2	3	Averages
Date	6/19/14	6/19/14	6/19/14	
Time	08:21:03	09:16:30	10:42:02	
Operating Data				
Horsepower	1,234	1,264	1,256	1,251
Speed	330	331	328	330
% Load	93.5%	95.7%	95.2%	94.8%
% Torque	93.5%	95.4%	95.7%	94.9%
Fuel Use (scfh)	11,265	11,415	11,448	11,376
UDHV (BTU/dscf)	1,030.3	1,030.3	1,030.3	1,030.3
Curve	1	1	1	1
AMP (psig)				
AMT (°F)				
Suct. Press. (psig)	581	577	582	580
Suct. Temp. (°F)	68.7	64.3	64.5	65.8
Disc. Press. (psig)	822	825	831	826
Disc. Temp. (°F)	94.3	94.3	94.3	94.3
Emissions Data				
NO (ppm)	1377.90	1356.45	1296.61	1343.66
NO <sub>Bias corrected</sub> (ppm)	1375.41	1353.71	1293.19	1340.77
NO <sub>2</sub> (ppm)	70.03	76.45	74.94	73.81
NO <sub>2 Bias corrected</sub> (ppm)	70.23	76.67	75.15	74.01
NO <sub>x</sub> (ppm)	1445.64	1430.38	1368.34	1414.78
NO <sub>x</sub> (ppm@ 15% O <sub>2</sub> )	536.35	530.37	521.23	529.32
NO <sub>x</sub> (lb/hr)	22.93	22.98	22.65	22.85
NO <sub>x</sub> (g/bhp-hr)	8.4	8.2	8.2	8.3
NO <sub>x</sub> (TPY)	100.5	100.7	99.2	100.1
O <sub>2</sub> (%)	5.00	4.99	5.41	5.13

# Data Summary

## General Information

Start Date: 6/19/2014  
 Company: ANR  
 Station: Woolfolk

## Unit Information

Unit No.: 2008  
 Manufacturer: I/R  
 Model: KVG 103  
 Rated BHP: 1320  
 Rated RPM: 330

## Gas Analysis

Nitrogen: 1.159      I - Butane: 0.0113  
 Carbon Dioxide: 0.7684      N - Butane: 0.018  
 Methane: 93.2676      I - Pentane: 0.0013  
 Ethane: 4.5225      N - Pentane: 0.001  
 Propane: 0.2426      Hexane +: 0.008  
**Total: 100.000**

## Test Data

General Data				
Run	1	2	3	Averages
Date	6/19/14	6/19/14	6/19/14	
Time	12:09:09	12:43:49	13:18:04	
Operating Data				
Horsepower	1,228	1,225	1,219	1,224
Speed	330	329	331	330
% Load	93.0%	92.8%	92.3%	92.7%
% Torque	93.2%	93.0%	92.1%	92.8%
Fuel Use (scfh)	11,310	11,235	11,218	11,254
UDHV (BTU/dscf)	1,033.9	1,033.9	1,033.9	1,033.9
Curve	1	1	1	1
AMP (psig)				
AMT (°F)				
Suct. Press. (psig)	584	585	588	586
Suct. Temp. (°F)	62.7	62.7	62.6	62.7
Disc. Press. (psig)	822	821	821	821
Disc. Temp. (°F)	94.3	94.3	94.3	94.3
Emissions Data				
NO (ppm)	2414.00	2447.19	2454.29	2438.49
NO <sub>2</sub> Bias corrected (ppm)	2423.31	2468.13	2475.37	2455.60
NO <sub>2</sub> (ppm)	99.71	99.58	103.10	100.80
NO <sub>2</sub> Bias corrected (ppm)	99.99	100.43	103.97	101.46
NO <sub>x</sub> (ppm)	2523.31	2568.55	2579.34	2557.07
NO <sub>x</sub> (ppm@ 15% O <sub>2</sub> )	887.00	903.08	905.11	898.40
NO <sub>x</sub> (lb/hr)	38.21	38.65	38.67	38.51
NO <sub>x</sub> (g/bhp-hr)	14.1	14.3	14.4	14.3
NO <sub>x</sub> (TPY)	167.4	169.3	169.4	168.7
O <sub>2</sub> (%)	4.12	4.12	4.09	4.11

# Data Summary

## General Information

Start Date: 6/20/2014  
 Company: ANR  
 Station: Woolfolk

## Unit Information

Unit No.: 2009  
 Manufacturer: I/R  
 Model: KVG 103  
 Rated BHP: 1320  
 Rated RPM: 330

## Gas Analysis

Nitrogen: 1.5129    I - Butane: 0.0323  
 Carbon Dioxide: 0.7037    N - Butane: 0.0557  
 Methane: 93.5943    I - Pentane: 0.0136  
 Ethane: 3.6863    N - Pentane: 0.0116  
 Propane: 0.3762    Hexane +: 0.013  
**Total: 100.000**

## Test Data

General Data				
Run	1	2	3	Averages
Date	6/20/14	6/20/14	6/20/14	
Time	07:43:18	08:18:52	08:54:53	
Operating Data				
Horsepower	1,204	1,204	1,212	1,207
Speed	329	329	330	329
% Load	91.2%	91.2%	91.8%	91.4%
% Torque	91.5%	91.5%	91.9%	91.6%
Fuel Use (scfh)	11,220	11,248	11,378	11,282
UDHV (BTU/dscf)	1,028.9	1,028.9	1,028.9	1,028.9
Curve	7	7	7	7
AMP (psig)				
AMT (°F)				
Suct. Press. (psig)	529	521	516	522
Suct. Temp. (°F)	47.6	48.0	48.6	48.0
Disc. Press. (psig)	761	760	759	760
Disc. Temp. (°F)	92.0	92.1	92.0	92.0
Emissions Data				
NO (ppm)	2101.65	2181.71	2155.06	2146.14
NO <sub>2</sub> Bias corrected (ppm)	2102.09	2192.02	2173.77	2155.96
NO <sub>2</sub> (ppm)	123.52	117.00	104.65	115.05
NO <sub>2</sub> Bias corrected (ppm)	124.92	137.81	105.53	122.75
NO <sub>x</sub> (ppm)	2227.01	2329.82	2279.31	2278.71
NO <sub>x</sub> (ppm@15% O <sub>2</sub> )	812.01	850.01	832.92	831.65
NO <sub>x</sub> (lb/hr)	34.53	36.24	35.92	35.56
NO <sub>x</sub> (g/bhp-hr)	13.0	13.7	13.4	13.4
NO <sub>x</sub> (TPY)	151.3	158.7	157.3	155.8
O <sub>2</sub> (%)	4.72	4.73	4.75	4.73