

Emissions Test Report

Unit EUBG009:

(1) Clark TCVC-20M Natural Gas Fired Internal Combustion Reciprocating Engine

RO Permit No.: MI-ROP-N5575-2013

**ANR Pipeline Company
Bridgman Compressor Station
Bridgman, Michigan.**

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Date: August 26, 2014
Prepared for: Michigan Department of Environmental
Quality. Air Quality Division
Prepared by: Pedro Amieva.
Plant Reliability (832) 320-5839



MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY
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RENEWABLE OPERATING PERMIT
REPORT CERTIFICATION

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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 Pipeline Company, Bridgman Compressor Station County Berrien

Source Address 3372 Browntown Road City Bridgman

AQD Source ID (SRN) N5575 ROP No. MI-ROP-N5575-2013 ROP Section No. 1

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 5/1/2014 To 9/30/2014

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

<u>Randall Schmidgall</u>	<u>Vice Pres. US Pipelines Op.</u>	<u>832-320-5301</u>
Name of Responsible Official (print or type)	Title	Phone Number
		<u>08/27/2014</u>
Signature of Responsible Official		Date

* Photocopy this form as needed.

1. Introduction

- 1.1. The Plant Reliability Department of TransCanada's US Pipelines Central (ANR) conducted emissions monitoring at the ANR Bridgman Compressor Station 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 NO_x emission rate in the ANR Compliance Plan. As such, the following parameter was determined:
 - 1.2.1. Bridgman unit 9 – Emissions limit 6.6 g/bhp-hr of NO_x
- 1.3. Notification of intent to test was provided through letter to Ms. Karen Kajiya-Mills and the MDEQ Kalamazoo district office on April 4, 2014. James Winger from TransCanada ANR conducted the monitoring on August 11, 2014.
- 1.4. Facility Location
ANR BRIDGMAN COMPRESSOR
STATION
3372 BROWNTOWN ROAD
BRIDGMAN, MI 49106

2. Process Description

- 2.1. The affected engine at Bridgman is a Clark TCVC-20M rated at 12,000 horsepower, a natural gas fired reciprocating internal combustion compressor engine.
- 2.2. 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 of this test plan.

- 3.2. Method D6522-00 prescribes the use of an appropriate portable emission analyzer, utilizing electrochemical cells, which can meet the documented calibration and preparation requirements. The make and model of analyzer employed are documented in the test report.

- 3.3. Electrochemical cell operational theory is based on chemical reactions that produce electricity. Each cell utilizes diffusion limited oxidation and reduction reactions to produce an electrical potential between a sensing electrode and a counter electrode. The chemical reaction that occurs produces electricity and the amount of electricity produced is directly related to the concentration of the constituent in the exhaust gas. The electricity is thus measured to give a concentration of the constituent. The relationship between the concentration of the constituent and the amount of electricity that is produced is linear and thus it is easily converted to engineering units.

4. Sample System

- 4.1. Sample system components, as outlined in Method D6522-00, were utilized for testing. 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. Instrument Preparation

- 5.1. This emission performance test program was followed procedures prescribed in ASTM test method D6522-00. Being that the intent of this test program is NO_x determination, the following requirements, outlined in Method D6522-00, were disregarded:
 - All specifications regarding CO determination, including CO interference checks and calculations, and CO stability checks and calculations.

6. Sample Location

- 6.1. Due to the complexity of the test ports, a single sample test point was selected. Two stainless steel probes were inserted into the middle of the exhaust stream of the dual exhaust pipes. These probes then joined to form a single flow to the heated sample line. This procedure was approved by the MDEQ

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personnel while on site during the 2007 Ozone Season emissions monitoring.

7. Sample Time

- 7.1. Testing was conducted during normal engine operation, i.e. not during periods of startup, shutdown, or malfunction
- 7.2. The relevant standard, Method D6522-00, stipulates that, during each test run, pollutant concentrations must be recorded at a frequency of no greater than once per minute; however, does not specify a standard duration for each test run.
- 7.3. For the purposes of this emission performance test, and considering the specifications outlined above, a total of three test runs were employed for compliance determination. Each test run lasted for a period of 30-minutes. The data was recorded at the frequency of once per minute.

8. Report Details

- 8.1. The engine was tested at the maximum load achievable based upon pipeline and ambient condition. As a result, the engine was tested at the average of 92.7 % of engine rated load condition.

9. Results of Monitoring

- 9.1. A summary of test results can be seen in the table below. Detailed summaries of the unit's results are included in the Appendices.

Average Tested Horsepower (HP)	10,600
Average Tested Speed (RPM)	331
NOx (g/bhp-hr) permitted limit	6.6
Average measured NOx (g/bhp-hr)	5.5

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Appendix A

Section 1: EUBG009 Detailed Emission Summary

- Emissions Data Sheet Summary**
- Sample Calculations**

Section 2: EUBG009 Instrument Checks and Calibration

- General Information**
- Linearity Check**
- NO Stability Check**
- NO₂ Stability Check**
- Calibration Error**

Section 3: EUBG009 Raw Test Run Data

- Engine Operating Data**
- Fuel Gas Analysis**
- Run 1 - 3**
- Stack Drawing**

Section 1: EUBG009 Detailed Emission Summary

Data Summary

General Information

Start Date: 8/11/2014
 Company: TransCanada - ANR Pipeline
 Station: Bridgman

Unit Information

Unit No.: 1209
 Manufacturer: Clark
 Model: TCVC-20M
 Rated BHP: 12000
 Rated RPM: 345

Gas Analysis

Nitrogen: 1.2427 I - Butane: 0.0076
 Carbon Dioxide: 0.6699 N - Butane: 0.011
 Methane: 91.8577 I - Pentane: 0.0027
 Ethane: 5.9254 N - Pentane: 0.0017
 Propane: 0.2782 Hexane +: 0.0032
Total: 100.000

Test Data

General Data

Run	1	2	3	Averages
Date	6/14/11	6/14/11	6/14/11	
Time	11:48:27	13:02:26	14:09:48	

Operating Data

Horsepower	10,649	10,586	10,564	10,600
Speed (rpm)	331	331	331	331
% Load	88.7%	88.2%	88.0%	88.3%
% Torque	92.4%	92.0%	91.7%	92.0%
Fuel Use (scfh)	72,200	71,913	71,493	71,868
UDHV (BTU/dscf)	1,045.0	1,045.0	1,045.0	1,045.0
Curve	0	0	0	0
AMP (psig)	20.68	20.70	20.58	20.65
AMT (°F)	110.2	110.1	110.2	110.2
Suct. Press. (psig)	614	610	606	610
Suct. Temp. (°F)	68.1	68.4	68.5	68.3
Disc. Press. (psig)	770	765	761	765
Disc. Temp. (°F)	113.5	114.2	114.3	114.0

Emissions Data

NO (ppm)	460.89	432.61	437.66	443.72
NO _{Bias corrected} (ppm)	462.32	433.90	438.97	445.06
NO ₂ (ppm)	50.49	49.07	47.39	48.98
NO _{2 Bias corrected} (ppm)	51.90	50.43	48.72	50.35
NO _x (ppm)	514.22	484.33	487.69	495.41
NO _x (ppm@ 15% O ₂)	486.77	450.18	447.52	461.49
NO _x (lb/hr)	135.30	124.63	123.17	127.70
NO _x (g/bhp-hr)	5.8	5.3	5.3	5.5
NO _x (TPY)	592.6	545.9	539.5	559.3
O ₂ (%)	14.67	14.55	14.47	14.56