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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AIR QUALITY DIVISION

Date: June 22, 2018
Prepared for: Michigan Department of Environmental Quality - Air Quality Division
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1. Introduction

1.1. The Air Compliance Team 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 NOx 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 NOx

1.3. Notification of intent to test was provided through a letter to Ms. Karen Kajiya-Mills and the MDEQ Kalamazoo district office dated February 16, 2018. James Winger from TransCanada ANR conducted the monitoring on June 7, 2018.

1.4. Facility Location:

ANR BRIDGMAN COMPRESSOR STATION
3372 BROWNTOWN ROAD
BRIDGMAN, MI 49106

Facility Contact:
Chris Waltman
700 Louisiana Street
Houston, TX 77002
(715) 758-3341

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 followed procedures prescribed in ASTM test method D6522-00. Being that the intent of this test program is NOx 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 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 91.2 % 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)	10,947
Average Tested Speed (RPM)	331
NOx (g/bhp-hr) permitted limit	6.6
Average measured NOx (g/bhp-hr)	4.6