

**TEST REPORT  
ANNUAL COMPLIANCE DEMONSTRATION  
BLUEWATER GAS STORAGE LLC  
BOOSTER STATION  
ST. CLAIR COUNTY, MICHIGAN**

Prepared For:

**Bluewater Gas Storage, LLC**  
333 S. Wales Center  
Columbus, MI 48063

**RECEIVED**

**NOV 13 2018**

**AIR QUALITY DIVISION**

Prepared By:

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1371 Brummel Avenue  
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Test Date: September 20, 2018  
Document Date: November 5, 2018



### REVIEW AND CERTIFICATION

All work, calculations, and other activities and tasks performed and presented in this document were carried out by me or under my direction and supervision. I hereby certify that, to the best of my knowledge, Montrose operated in conformance with the requirements of the Montrose Quality Management System and ASTM D7036-04 during this test project.

Signature:  Date: 10/30/18

Name: Brandon Check Title: Client Project Manager

I have reviewed, technically and editorially, details, calculations, results, conclusions, and other appropriate written materials contained herein. I hereby certify that, to the best of my knowledge, the presented material is authentic, accurate, and conforms to the requirements of the Montrose Quality Management System and ASTM D7036-04.

Signature:  Date: 10/30/18

Name: Roy Slick Title: QA/QC Manager

NOV 13 2018

**PROJECT OVERVIEW**

**AIR QUALITY DIVISION**

**1.1 GENERAL**

Montrose Air Quality Services, LLC (Montrose) formerly known as Airtech Environmental Services Inc. (Airtech) located at 1371 Brummel Avenue, Elk Grove Village, Illinois was contracted by Wisconsin Public Service perform an air emission test program at the Bluewater Booster Station located in Ray Township, Michigan. Testing was performed to satisfy the requirements of the United States Environmental Protection Agency (U.S. EPA), 40 CFR 63.6640 (c), Subpart ZZZZ, as applicable.

The specific objective of the test program is as follows:

- Determine the carbon monoxide (CO) emissions from one (1) natural gas fired, compressor engine at the Bluewater Booster Station

Testing was performed on September 20, 2018. Coordinating the field aspects of the test program were:

Shelly Heston - Wisconsin Public Service - (920)433-1294  
Sean Cronin – Montrose Air Quality Services, LLC – (630) 860-4740

**1.2 EXECUTIVE SUMMARY**

The results of the carbon monoxide testing are summarized in the following table.

**TABLE 1-1  
EXECUTIVE SUMMARY**

Location	CO (ppm@15%)	
	Limit	Result
EU-COMP	47	3.29

**1.3 ASTM D7036-04(2011)**

All applicable Montrose field personnel used on-site for this test program were compliant with ASTM D7036-04(2011) "Standard Practice for Competence of Air Emissions Testing Bodies" for all tests performed. This includes having the appropriate QSTI directly supervise the testing.

The following table summarizes the key personnel that were involved with this project:

**TABLE 1-2  
PROJECT PERSONNEL**

Personnel	Position on Project	Date of QSTI Exam
Brandon Check, Q.S.T.I.	Client Project Manager	03/31/2016
Sean Cronin, Q.S.T.I.	Field Project Manager	11/22/2017

#### 1.4 METHODOLOGY

The concentrations of oxygen (O<sub>2</sub>), and CO at the exhaust of the engine were determined using EPA Methods 3A, and 10. The sample gas was withdrawn from the outlet at a constant rate through a stainless steel probe, a glass fiber filter and a Teflon sample line. The probe, filter and sample line were operated at a minimum temperature of 250 °F to prevent the condensation of moisture. The sample gas passed through a gas cooler system. The gas cooler consists of two separate stages designed to lower the dew point of the sample gas to 35 °F, thus removing the moisture. Each stage of the gas cooler is designed to minimize contact of condensed moisture with the dry sample gas. The dry gas is then delivered to the O<sub>2</sub> and CO analyzer.

Three (3) fifteen (15) minute test runs were performed at the outlet of each engine. Results from the analyzers will be determined on a “dry” basis. Results are in parts per million dry volume (ppmdv), ppmdv at fifteen (15) percent (%) O<sub>2</sub> (ppmdv@15%).

#### 1.5 PARAMETERS

The following specific parameters were determined at each engine at the Bluewater Booster Station test locations during each test run:

- oxygen concentration
- carbon monoxide

#### 1.6 RESULTS

A complete summary of test results is presented in Table 1<sup>1</sup>.

##### <sup>1</sup> MEASUREMENT UNCERTAINTY STATEMENT

Both qualitative and quantitative factors contribute to field measurement uncertainty and should be taken into consideration when interpreting the results contained within this report. Whenever possible, Montrose personnel reduce the impact of these uncertainty factors through the use of approved and validated test methods. In addition, Montrose personnel perform routine instrument and equipment calibrations and ensure that the calibration standards, instruments, and equipment used during test events meet, at a minimum, test method specifications as well as the specifications of the Montrose Quality Manual and ASTM D7036-04. The limitations of the various methods, instruments, equipment, and materials utilized during this test have been reasonably considered, but the ultimate impact of the cumulative uncertainty of this project is not fully identified within the results of this report.

## 2.0 SUMMARY OF RESULTS

**TABLE 2-1  
CLINTON-BLUEWATER BOOSTER STATION**

Test Parameters	Run 1	Run 2	Run 3	Average
Date	9/20/2018	9/20/2018	9/20/2018	
Start Time	20:25	20:49	21:12	
Stop Time	20:39	21:03	21:26	
<b>Gas Conditions</b>				
Oxygen (% dry)	6.70	6.82	6.86	<b>6.79</b>
Fuel BTU	1071	1071	1071	1071
Heat Input (MMBTU/hr)	6.51	6.51	6.57	
<b>Pollutant Results</b>				
Carbon Monoxide Concentration (ppmdv)	8.06	7.71	7.82	<b>7.86</b>
Carbon Monoxide Concentration, C (ppmdv@15% O2)	3.35	3.23	3.29	<b>3.29</b>

**TABLE 2-2  
PROCESS DATA**

Run	RMP/BHP	% Load	Catalyst Pressure drop	Catalyst inlet temperature	Fuel Flow (SCFH)	Fuel Consumed (MSCF)
1	1250.9/640.2	53.5	0.2	843.6	6085	1.52
2	1249.9/639	53.4	0.2	845.1	6075	1.52
3	1253.5/640.5	53.4	0.2	845.1	6131	1.53

### 3.0 TEST PROCEDURES

#### 3.1 METHOD LISTING

The following EPA test methods were referenced for the test program. These methods can be found in 40 CFR Part 60 Appendix A and 40 CFR Part 63, Appendix A.

- Method 3A Determination of Oxygen and Carbon Dioxide Concentrations in Emissions from Stationary Sources (Instrumental Analyzer Procedure)
- Method 10 Determination of carbon monoxide emissions from stationary sources (Instrumental Analyzer Procedure)
- Method 19 Determination of sulfur dioxide removal efficiency and particulate matter, sulfur dioxide, and nitrogen oxides emission rates

#### 3.2 METHOD DESCRIPTIONS

##### 3.2.1. Methods 3A and 10

The oxygen, and carbon monoxide concentrations at the test location were determined using EPA Methods 3A, and 10. A schematic of the sample system is shown in Figure 1 in the Appendix.

The sample gas was withdrawn from the test location at a constant rate through an in-situ 0.3 micron stainless steel cindered frit, a stainless steel probe and Teflon sample line. The sample line was operated at a temperature of 250 °F to prevent the condensation of moisture. The sample gas passed through an M & C Type EC gas cooler system. The gas cooler is designed to unobtrusively lower the dewpoint of the sample gas to 35 °F, thus removing the moisture. The dry gas was then vented to the oxygen and carbon monoxide analyzers. Results from these analyzers were determined on a dry basis.

The analyzers that were used for this project are listed in the table below.

**TABLE 3-1  
ANALYZERS**

Parameter	Manufacturer	Model Number	Operating Principle	Units Reported	Range to be used
Oxygen	Teledyne	T803	Paramagnetic	(%)	0-21.21
Carbon Monoxide	Thermo Environmental	48i-tle	Infrared, Gas Filter Correlation	(ppm)	0-49.41

Prior to sampling, a calibration error test was performed on each analyzer using EPA Protocol 1 gases. The zero and high-range calibration gases for each constituent was introduced directly into each analyzer. Each analyzer was then adjusted to the

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appropriate values. The mid-range and low-range gases were introduced to each analyzer and the measured values were then recorded. The measured values for each calibration gas were compared to the calibration gas values and the differences were less than the method requirement of two percent of the span value.

A sample system bias check was performed, by introducing the zero and mid-range calibration gases into the sampling system at the base of the probe. The gas was drawn through the entire sampling system. The measured responses were compared to the calibration error test values to determine the bias in response due to the sampling system. In all cases, the sampling system bias was less than the method requirement of five percent of the span value. In addition, the system response time was determined by measuring the time required for each analyzer to reach 95 percent of its' high-range calibration gas value.

After each test run the instrument drift for each analyzer was determined by introducing the zero and mid-range calibration gases into the sampling system at the base of the probe. The gas was drawn through the entire sampling system. The measured responses were compared to the values from the previous test run to determine the analyzer drift. For all test runs, the analyzer drift was less than the method requirement of three percent of the span value.

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#### **4.0 DESCRIPTION OF INSTALLATION**

EU-COMP is a 10.1 MMBtu/hr heat input Caterpillar G3516 natural gas fired 4-stroke lean burn reciprocating internal combustion engine driving a compressor. It is controlled with a catalytic oxidation system.