
**PERFORMANCE TEST REPORT
ANR PIPELINE COMPANY
BRIDGMAN COMPRESSOR STATION
AND EUBG014 (1211)**

May 19, 2023

Prepared for:



ANR Pipeline Company
3372 Browntown Road
Bridgman, MI

PTI No. 92-20
SRN No. N5575

Prepared by:



Environmental Quality Management, Inc.
1280 Arrowhead Court
Suite 2
Crown Point, IN 46307
(219) 661-9900
www.eqm.com

PN: 050816.0011

June 2023

RECEIVED

JUL 18 2023

AIR QUALITY DIVISION

PREFACE

I, Karl Mast, do hereby certify that the source emissions testing conducted at ANR Pipeline Company in Bridgman, MI was performed in accordance with the procedures set forth by the United States Environmental Protection Agency, and that the data and results submitted within this report are an exact representation of the testing.



Karl Mast
Test Supervisor

I, Karl Mast, do hereby attest that all work on this project was performed under my direct supervision, and that this report accurately and authentically presents the source emissions testing conducted at ANR Pipeline Company's Bridgman Compressor Station in Bridgman, MI.



Karl Mast
Test Supervisor

SUMMARY

The compliance testing was performed on the Stationary Turbine system in accordance with the requirements of the Title 40, Code of Federal Regulations, Part 60 (40 CFR 60, Subpart KKKK). The results of the testing are detailed in the following table. More information may be found in Section 2.0.

EUBG014 (Unit 1211)- Test Results						
Parameter	Run 1	Run 2	Run 3	Average	Limit	Pass/Fail
NO _x ppmvd @ 15% O ₂	12.7349	12.5258	12.5362	12.5990	25	Pass
NO _x Lbs/Hr	4.0553	3.9887	3.9920	4.0120	3.1	Fail
CO Lbs/Hr	0.6705	0.5527	0.5346	0.5859	3.2	Pass

CONTENTS

Preface ii

Summary iii

1 Introduction 1

2 Test Results Summary 3

3 Facility and Process Conditions 6

4 Test Procedures 19

5 Quality Assurance Procedures 13

6 Conclusions 14

TABLES

1 Test Results Summary 3

2 Operating Parameters/Ambient Conditions 4

4 Emission Concentrations/Calculated Mass Emissions
 & Concentrations/Calculated Flows 5

7 Production Data 6

9 General Information 7

FIGURES

1 Flow Schematic 8

APPENDICES

- A – Field Test Data
- B – Process Operating Data
- C – Gas Certifications
- D – Sample Calculation
- E – Correspondence

RECEIVED

JUL 18 2023

1. INTRODUCTION

This report presents the results of the source emissions testing conducted by Environmental Quality Management, Inc. (EQM) for ANR Pipeline Company (ANR) at Bridgman Compressor Station, Bridgman, MI, in Berrien County.

The primary purpose of this testing program was to conduct emissions testing that is required by Permit to Install 92-20 and [40 CFR 60, Subpart KKKK] for the Turbine EUBG014 at ANR's gas compressor facility.

EQM's responsibility was to conduct the compliance testing for the O₂, CO and NO_x emissions rates and perform data reduction for conformance evaluation. ANR Pipeline Company'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 ANR's process operations, and compliance testing. The compliance testing conducted on the stationary turbine EUBG014 (Unit 1211) was performed on May 19, 2023, from 1:31 P.M. to 2:35 P.M.

The following requirements were specific for the testing program:

1. Equipment calibrations performed and calibration data provided.
2. Three (3) twenty-one (21) minute, minimum, O₂, CO, and NO_x test runs performed at the turbines at maximum achievable load and speed according to pipeline conditions pursuant to EPA, Title 40, Code of Federal Regulations, Part 60, Appendix A.
3. Process manufacturing operations maintained at 100% +/- 5% 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 O₂, CO and NO_x emissions determinations.
5. Stratification was found to be less than 5% in the turbine exhaust(s).
6. Diluent corrected stratification test was performed in accordance with Subpart KKKK.

The testing program was approved by and/or coordinated with Pedro Amieva, ANR Pipeline Company. The emission testing was Performed by Karl Mast, Manager, Emission Measurement and Project Manager, EQM. The emission testing was observed by Trevor Drost, Environmental Quality Analyst, Michigan EGLE.

2. TEST RESULTS SUMMARY

The compliance testing was performed on the stationary EUBG014 system in accordance with the requirements of the Title 40, Code of Federal Regulations, Part 60 (40 CFR 60, Appendix A). A summary of the test results is given below:

Table 1. EUBG014 (Unit 1211)-Test Results						
Parameter	Run 1	Run 2	Run 3	Average	Limit	Pass/Fail
NO _x ppmvd @ 15% O ₂	12.7349	12.5258	12.5362	12.5990	25	Pass
NO _x Lbs/Hr	4.0553	3.9887	3.9920	4.0120	3.1	Fail
CO Lbs/Hr	0.6705	0.5527	0.5346	0.5859	3.2	Pass

Based on the information provided above, the stationary turbines EUBG014 met the acceptance criteria during the course of the testing for Nox ppmvd@15% O2 and CO Lbs/Hr. Due to the emission rate for NOx Lbs/Hr, ANR Pipeline is in the process of investigating the operational rates. A complete list of performance parameters for each test run that was performed at the stack sampling locations can be found in Table 2-5.

Additional testing information may be found in Appendix A and B.

Table 2. Operating Parameters and Ambient Conditions-EUBG014 (1211)

Run	1	2	3	
Date	05/19/23	05/19/23	05/19/23	
Time	13:31	13:52	14:15	
Engine Operating Conditions	High 1102	High 1102	High 1102	Averages
Unit Horsepower from Control Panel	10,901.0	10,823.0	10,767.0	10,830.3
% HP Load	99.5	98.8	98.3	98.9
Unit Speed (rpm) CT/GG/GP/Jet	15,200.0	15,184.8	15,200.0	15,194.9
% CT Speed	100.0	99.9	100.0	100.0
Gas Compressor Speed (rpm) PT/Booster	10,572.0	10,569.0	10,586.0	10,575.7
% PT Speed	88.1	88.1	88.2	88.1
Turbine Exhaust Temp T5	1,400.0	1,399.0	1,400.0	1,399.7
Compressor Suction Pressure (PSIG)	663.0	665.0	666.0	664.7
Compressor Suction Temperature (°F)	60.0	60.0	60.0	60.0
Compressor Discharge Pressure (PSIG)	825.0	825.0	825.0	825.0
Compressor Discharge Temperature (°F)	92.0	92.0	92.0	92.0
Compressor Flow (MMSCFD)	964.0	967.0	968.0	966.3
Heat Rate (BTU(LHV)/HP-hr)	7,177.2	7,228.9	7,266.5	7,224.2
Ambient Conditions				
Ambient Temperature (°F)	65.00	65.00	65.00	65.00
Barometric Pressure (psi)	14.36	14.35	14.36	14.35
Ambient Relative Humidity (%)	77.00	80.00	77.00	78.00
Absolute Humidity (grains/LB)	72.69	75.58	72.69	73.65

Table 3. Emissions Concentrations & Calculated Mass Emissions/Calculated Emissions Concentrations/Calculated Flows-EUBG014 (1211)

Run	1	2	3	
Date	05/19/23	05/19/23	05/19/23	
Time	13:31	13:52	14:15	
Emissions Concentrations & Calculated Mass Emissions				
NO _x ppm (BIAS Corrected)	12.260	12.080	12.090	12.1433
NO _x g/BHP-HR	0.1687	0.1672	0.1682	0.1680
NO _x LB/HR	4.0553	3.9887	3.9920	4.0120
NO _x (ppm @ 15% O ₂)	12.7349	12.5258	12.5362	12.5990
NO _x (ppm @ 15% O ₂ , ISO)	13.6623	13.5446	13.4485	13.5518
NO _x LB/MMBTU	0.0469	0.0461	0.0461	0.0464
NO _x Tons/Year	17.7621	17.4705	17.4850	17.5725
NO _x LB/SCF Fuel	5.02E-05	4.93E-05	4.94E-05	4.96E-05
NO _x LB/MMSCF Fuel	50.1664	49.3430	49.3839	49.6311
CO ppm (BIAS Corrected)	3.330	2.750	2.660	2.9133
CO g/BHP-HR	0.0279	0.0232	0.0225	0.0245
CO LB/HR	0.6705	0.5527	0.5346	0.5859
CO LB/MMBTU **	0.0078	0.0064	0.0062	0.0068
CO (ppm @ 15% O ₂)	3.4590	2.8515	2.7582	3.0229
CO (ppm @ 15% O ₂ , ISO)	3.7109	3.0834	2.9589	3.2511
CO Tons/Year	2.9367	2.4209	2.3417	2.5664
CO LB/SCF Fuel	8.29E-06	6.84E-06	6.61E-06	7.25E-06
CO LB/MMSCF Fuel	8.2943	6.8376	6.6138	7.2485
% O ₂ (BIAS Corrected)	15.220	15.210	15.210	15.2133
Calculated Flows				
Fuel Flow - (SCFM)	1350.00	1350.00	1350.00	1350.00
Fuel Flow - (SCFH)	81000.00	81000.00	81000.00	81000.0000
Exhaust Flow Method 19 (scfm)	46078.1798	45997.1988	45997.1988	46024.1925
Exhaust Flow Method 19 (lbm/min)	2115.1972	2111.9266	2111.4791	2112.8676
Exhaust Flow Carbon Balance (lbm/min)	3537.8829	3531.9076	3531.9076	3533.8993
Air flow Beshouri (scfm)	46029.8904	45952.1483	45952.1483	45978.0622
BSAC, #/BHP-hr	18.5410	18.6421	18.7390	18.6407
Fuel Flow Measurements				
Fuel Flow From Screen(MSCFH)	81.00	81.00	81.00	81.00
** BASED ON FUEL SPECIFIC DRY F-FACTOR CALCULATION	Run 1	Run 2	Run 3	
* BASED ON CARBON BALANCE (STOICH. + O ₂)				
- A/F IS TOTAL MASS RATIO				

3. PROCESS DESCRIPTION

ANR Bridgman Compressor Station is located in Bridgman, MI and operates two natural gas fired simple cycle combustion turbines. Each turbine drives a natural gas compressor. The plant is located at 3372 Browntown Road, Bridgman, MI.

The following tables provide a summary of the production rates for the EUBG014 during the test:

Table 4. EUBG014 (Unit 1211) Production Data					
Parameter	Run 1	Run 2	Run 3	Average	Rated
CT RPM	15,200.0	15,184.8	15,200.0	15,194.9	15,200
CT Speed %	100.0	99.9	100.0	100.0	N/A
PT RPM	10,572.0	10,569.0	10,586.0	10,575.7	12,000
PT Speed %	88.1	88.1	88.2	88.1	N/A
Horsepower	10,901.0	10,823.0	10,767.0	10,830.3	10,953
HP Load %	99.5	98.8	98.3	98.9	N/A

Additional information may be found in Appendix B.

Table 5. EUBG014 (Unit 1211) General Information

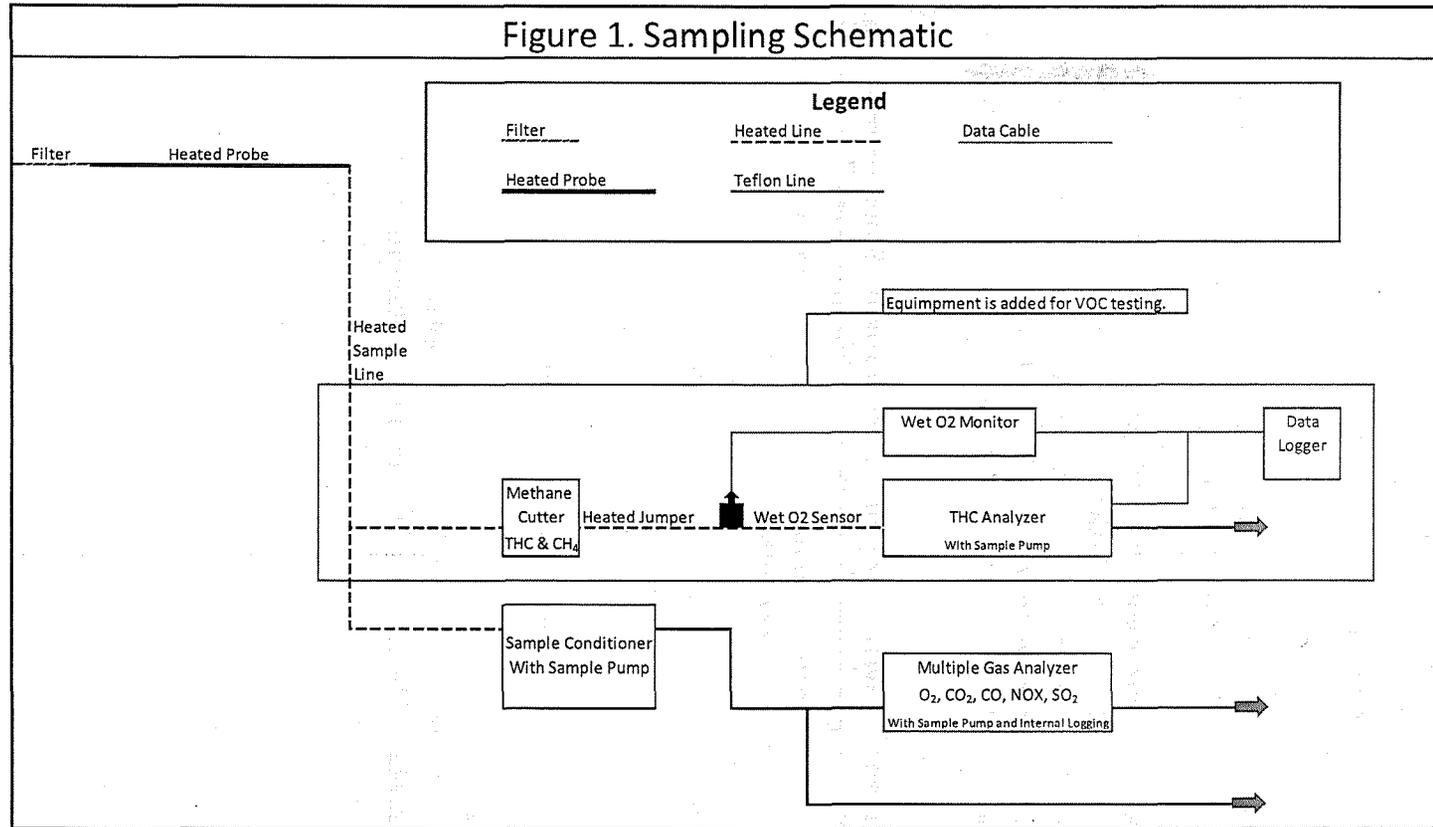
General Information	
Date:	19-May-23
Company:	TC Energy
Station:	Bridgeman MI
Unit:	14
Engine Type:	TAURUS 70
CT Rated RPM:	15200 RPM
PT Rated RPM:	12000 RPM
Rated BHP:	10953 BHP

Permit Limits				
	ppm @ 15%	g/Bhp-Hr	lb/hr	TPY
NOx:	25		3.1	
CO:			3.2	
VOC:				
H2CO:				

Limits are actually listed as average values

Fuel Gas Analysis	
Constituent	Mole Percent
Nitrogen	0.373
Carbon Dioxide	0.188
Methane	91.699
Ethane	7.461
Propane	0.238
I-Butane	0.018
N-Butane	0.017
I-Pentane	0.003
N-Pentane	0.000
Hexane +	0.002
Total	100.00

Fuel Meter Type	
Enter Type from List Below	2
Orifice Meter (upstream pressure tap):	1
Orifice Meter (downstream pressure tap):	2
Electronic Flow Meter (EFM):	3
Venturi (Nozzle) Meter:	4
Roots Meter w/ Accumulator:	5
Pipe I.D.:	3.068
Orifice I.D.:	1.5



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

4. TEST PROCEDURES

EQM and EQM'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)
- U.S. EPA Method 10 – Determination of Carbon Monoxide Emissions From Stationary Sources (Instrumental Analyzer Procedure)
- U.S. EPA Method 19 – Determination of Volumetric Flow Rate from Stationary Sources

USEPA Methods 3A, 7E and 19 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.