

EMISSION COMPLIANCE TEST
FOR THE
GENERAL ELECTRIC, 7FA.05, UNIT #EU-CTG1
PREPARED FOR
WOLVERINE POWER SUPPLY COOPERATIVE, INC.
AT THE
ALPINE POWER PLANT
ELMIRA, OTSEGO COUNTY, MICHIGAN
JULY 15, 2019

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certify that this testing was conducted and
this report was created in conformance
with the requirements of ASTM D7036

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**Emissions Compliance Test
General Electric, 7FA.05, Unit #EU-CTG1
Wolverine Power Supply Cooperative, Inc.
Alpine Power Plant
Elmira, Otsego County, Michigan
July 15, 2019**

1.0 INTRODUCTION

Air Hygiene International, Inc. (Air Hygiene) has completed the Emissions Compliance Test for nitrogen oxides (NO_x) and oxygen (O₂) from the exhaust of the General Electric, 7FA.05, Unit #EU-CTG1 for Wolverine Power Supply Cooperative, Inc. at the Alpine Power Plant in Elmira, Otsego County, Michigan. This report details the background, results, process description, and the sampling/analysis methodology of the stack sampling survey conducted on July 15, 2019.

1.1 TEST PURPOSE AND OBJECTIVES

The purpose of the test was to conduct a periodic compliance emission test to document levels of selected pollutants at four test loads (Low, Mid-Low, Mid, and High). The information will be used to confirm compliance with the operating permit issued by the Michigan Department of Environmental Quality (MDEQ). The specific objective was to determine the emission concentration of NO_x and O₂ from the exhaust of Wolverine Power Supply Cooperative, Inc.'s General Electric, 7FA.05, Unit #EU-CTG1 at Low, Mid-Low, Mid, and High loads.

1.2 SUMMARY OF TEST PROGRAM

The following list details pertinent information related to this specific project:

- 1.2.1 Participating Organizations
 - Michigan Department of Environmental Quality (MDEQ)
 - Wolverine Power Supply Cooperative, Inc. (WPC)
 - Fishbeck Thompson Carr & Huber, Inc. (FTCH)
 - Air Hygiene
- 1.2.2 Industry
 - Electric Utility / Electric Services
- 1.2.3 Air Permit and Federal Requirements
 - Permit Number: PTI 206-14
 - 40 CFR 75, Appendix E
- 1.2.4 Plant Location
 - Alpine Power Plant in Elmira, Otsego County, Michigan
 - GPS Coordinates [Latitude 45.06175, Longitude -84.84466]
 - 8343 M-32, Elmira, Michigan 49730
 - Federal Registry System / Facility Registry Service (FRS) No. – 110067539293
 - Source Classification Code (SCC) – 20100209
- 1.2.5 Equipment Tested
 - General Electric, 7FA.05, Unit #EU-CTG1

- 1.2.6 Emission Points
 - Exhaust from the General Electric, 7FA.05, Unit #EU-CTG1
 - For all gases, 12 sample points in the exhaust duct from the General Electric, 7FA.05, Unit #EU-CTG1
- 1.2.7 Emission Parameters Measured
 - NOx
 - O₂
- 1.2.8 Date of Emission Test
 - July 15, 2019
- 1.2.9 Federal Certifications
 - Stack Testing Accreditation Council AETB Certificate No. 3796.02
 - International Standard ISO/IEC 17025:2005 Certificate No. 3796.01

1.3 KEY PERSONNEL

WPC:	Laura Hoisington (lhoisington@wpsci.com)	231-775-5700 x3369
WPC:	Jesse Genther (jgenther@wpsci.com)	231-590-5769 x6659
WDEQ:	David Patterson (PattersonD2@michigan.gov)	517-256-4388
WDEQ:	William J. Rogers, Jr. (rogersw@michigan.gov)	989-705-3406
FTCH:	Stephanie A. Jarrett (sajarrett@ftch.com)	248-324-2146
Air Hygiene:	Matt McBride (mmcbride@airhygiene.com)	918-307-8865
Air Hygiene:	James Reynolds	918-307-8865

2.0 SUMMARY OF TEST RESULTS

Results from the sampling conducted on Wolverine Power Supply Cooperative, Inc.'s General Electric, 7FA.05, Unit #EU-CTG1 located at the Alpine Power Plant on July 15, 2019 are summarized in the following table and relate only to the items tested.

The results of all measured pollutant emissions were below the required limits. All testing was performed without any real or apparent errors. All testing was conducted according to the approved testing protocol.

**TABLE 2.1
SUMMARY OF GENERAL ELECTRIC, 7FA.05, UNIT #EU-CTG1 RESULTS**

Parameter	Low Load	Mid-Low Load	Mid Load	High Load	Permit Limits
Start Time (hh:mm:ss)	6:14:08	8:33:08	12:17:08	14:59:08	--
End Time (hh:mm:ss)	8:21:38	12:06:08	14:40:08	17:29:08	--
Run Duration (min / run)	38	41	43	44	--
Bar. Pressure (in. Hg)	28.72	28.71	28.65	28.59	--
Amb. Temp. (°F)	63	64	66	75	--
Rel. Humidity (%)	71	86	99	85	--
Spec. Humidity (lb water / lb air)	0.008993	0.011065	0.014298	0.016654	--
Load Designator	LOW	MID-LOW	MID	HIGH	--
Comb. Inlet Pres. (psig)	1.4	1.7	2.2	2.7	--
Turbine Fuel Flow (lb/min)	1,081	1,184	1,300	1,485	--
Total Fuel Flow (SCFH)	1,464,326	1,604,054	1,760,957	2,011,264	--
Stack Flow (RM19) (SCFH)	35,992,475	39,526,403	43,719,233	48,645,874	--
Heat Input (MMBtu/hr)	1,496.1	1,638.9	1,799.2	2,054.9	--
Power Output (megawatts)	140.0	159.9	180.3	206.5	--
CD Temp (°F)	704.40	721.98	757.09	1,034.45	--
NOx (ppmvd)	9.51	9.29	9.01	10.92	--
NOx (ppm@15%O ₂)	7.47	7.31	7.15	8.43	--
NOx (ppm@15%O ₂ &ISO)	7.90	8.04	8.29	9.97	--
NOx (lb/hr)	40.88	43.86	47.04	63.42	66.8
NOx (lb/MMBtu)	0.0273	0.0268	0.0261	0.0309	0.0327
O ₂ (%)	13.39	13.40	13.46	13.26	--

3.0 SOURCE OPERATION

3.1 PROCESS DESCRIPTION

Wolverine Power Supply Cooperative, Inc. (WPC) owns and operates the Alpine Power Plant located in Elmira, Otsego County, Michigan. The station consists of two General Electric (GE) Frame 7FA.05 simple cycle combustion turbines, designated as EU-CTG1 and EU-CTG2. Each CTG has a nominal rating of 203 MW, with a peak heat input of 2,045 MMBtu/hr, an exhaust flow rate of ~800,000 scfm (at 100% load), and an exhaust gas temperature of ~1,100 °F. The interest of this report is EU-CTG1.

3.2 SAMPLING LOCATION

The EU-CTG1 stack is vertical, circular and measures 22 feet (ft) (264 inches) in diameter at the test ports which are approximately 110 ft above grade level with an exit elevation of approximately 130 ft above grade level. The test ports are located approximately 39.2 ft (470.5 inches) downstream and approximately 11 ft (132 inches) upstream from the nearest disturbances. The stacks were sampled from a minimum of twelve sampling points during each run with the sampling time at each point in compliance with Appendix E Section 2.1.2.3. Prior to the first run for Appendix E testing, the system response time was determined to ensure sufficient sampling time for each sample point.

4.0 SAMPLING AND ANALYTICAL PROCEDURES

4.1 TEST METHODS

The emission test on the General Electric, 7FA.05, Unit #EU-CTG1 at the Alpine Power Plant was performed following United States Environmental Protection Agency (EPA) methods described by the Code of Federal Regulations (CFR). Table 4.1 outlines the specific methods performed on July 15, 2019.

**TABLE 4.1
SUMMARY OF SAMPLING METHODS**

Pollutant or Parameter	Sampling Method	Analysis Method
Sample Point Location	EPA Method 1	Equal Area Method
Oxygen	EPA Method 3A	Paramagnetic Cell
Nitrogen Oxides	EPA Method 7E	Chemiluminescent Analyzer
Stack Flow Rate	EPA Method 19	Dry Oxygen F Factor

4.2 INSTRUMENT CONFIGURATION AND OPERATIONS FOR GAS ANALYSIS

The sampling and analysis procedures used during these tests conform with the methods outlined in the Code of Federal Regulations (CFR), Title 40, Part 60, Appendix A, Methods 1, 3A, 7E, and 19.

Figure 4.1 depicts the sample system used for the real-time gas analyzer tests. The gas sample was continuously pulled through the probe and transported, via heat-traced Teflon® tubing, to a stainless steel minimum-contact condenser designed to dry the sample. Transportation of the sample, through Teflon® tubing, continued into the sample manifold within the mobile laboratory via a stainless steel/Teflon® diaphragm pump. From the manifold, the sample was partitioned to the real-time analyzers through rotameters that controlled the flow rate of the sample.

Figure 4.1 shows that the sample system was also equipped with a separate path through which a calibration gas could be delivered to the probe and back through the entire sampling system. This allowed for convenient performance of system bias checks as required by the testing methods.

All instruments were housed in a climate controlled, trailer-mounted mobile laboratory. Gaseous calibration standards were provided in aluminum cylinders with the concentrations certified by the vendor. EPA Protocol No. 1 was used to determine the cylinder concentrations where applicable (i.e. NOx calibration gases).

Table 4.2 provides a description of the analyzers used for the instrument portion of the tests. All data from the continuous monitoring instruments were recorded on a Logic Beach Portable Data Logging System which retrieves calibrated electronic data from each instrument every one second and reports an average of the collected data every 30 seconds.

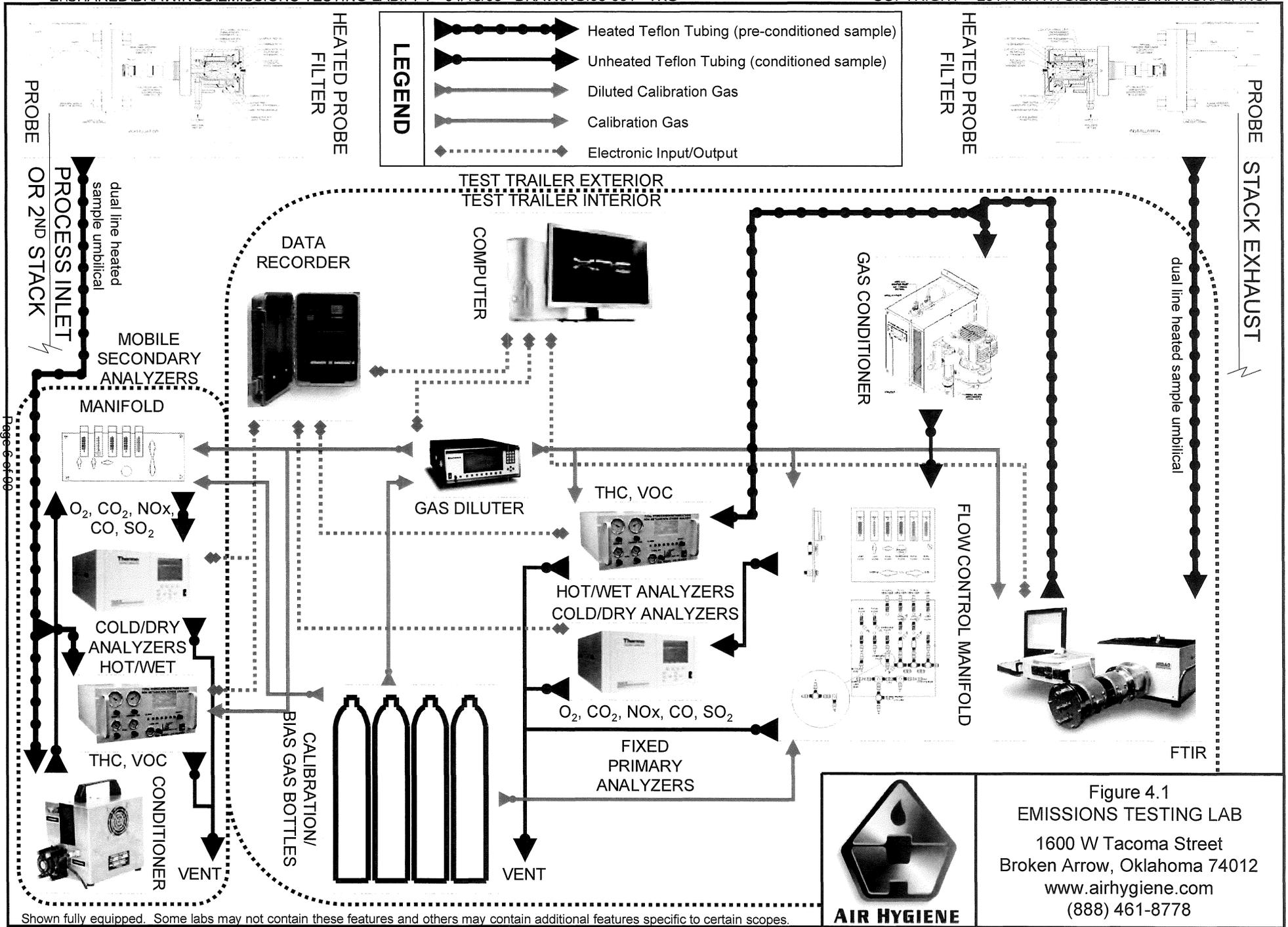
Three test runs of approximately 40 minutes each were conducted on the General Electric, 7FA.05, Unit #EU-CTG1 at each of the multiple test loads for NOx and O₂.

The stack gas analysis for O₂ concentrations was performed in accordance with procedures set forth in EPA Method 3A. The O₂ analyzer uses a paramagnetic cell detector.

EPA Method 7E was used to determine concentrations of NO_x. A chemiluminescent analyzer was used to determine the nitrogen oxides concentration in the gas stream. A NO₂ in nitrogen certified gas cylinder was used to verify at least a 90 percent NO₂ conversion on the day of the test.

**TABLE 4.2
ANALYTICAL INSTRUMENTATION**

Parameter	Manufacturer and Model	Range	Sensitivity	Detection Principle
NO _x	THERMO 42 series	User may select up to 5,000 ppm	0.1 ppm	Thermal reduction of NO ₂ to NO. Chemiluminescence of reaction of NO with O ₃ . Detection by PMT. Inherently linear for listed ranges.
O ₂	SERVOMEX 1440	0-25%	0.1%	Paramagnetic cell, inherently linear.



Shown fully equipped. Some labs may not contain these features and others may contain additional features specific to certain scopes.



Figure 4.1
EMISSIONS TESTING LAB
 1600 W Tacoma Street
 Broken Arrow, Oklahoma 74012
 www.airhygiene.com
 (888) 461-8778