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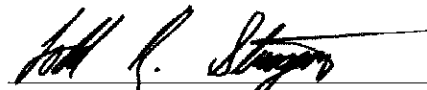
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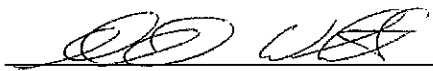
AIR QUALITY DIVISION

EMISSION COMPLIANCE TEST  
EPA 40 CFR PART 75 APPENDIX E  
FOR THE  
GENERAL ELECTRIC (GE), FRAME 7FA.05, UNIT #2  
PREPARED FOR  
WOLVERINE POWER SUPPLY COOPERATIVE, INC.  
AT THE  
ALPINE POWER PLANT  
ELMIRA, OTSEGO COUNTY, MICHIGAN  
AUGUST 3, 2017

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

**Emissions Compliance Test  
General Electric (GE), Frame 7FA.05, Unit #2  
Wolverine Power Supply Cooperative, Inc.  
Alpine Power Plant  
Elmira, Otsego County, Michigan  
August 3, 2017**

## **1.0 INTRODUCTION**

Air Hygiene International, Inc. (Air Hygiene) has completed the Emissions Compliance Test for nitrogen oxides (NO<sub>x</sub>) and oxygen (O<sub>2</sub>) from the exhaust of the General Electric (GE), Frame 7FA.05, Unit #2 for Wolverine Power Supply Cooperative, Inc. at the Alpine Power Plant near Elmira, Otsego County, Michigan. This report details the background, results, process description, and the sampling/analysis methodology of the stack sampling survey conducted on August 3, 2017.

## **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 (50%, 70%, 85%, and 100%). 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<sub>x</sub> and O<sub>2</sub> from the exhaust of Wolverine Power Supply Cooperative, Inc.'s General Electric (GE), Frame 7FA.05, Unit #2 at 50%, 70%, 85%, and 100% of total capacity.

## **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.
  - 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 near 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. – 110070082175
    - Source Classification Code (SCC) – 20100201
- 1.2.5 Equipment Tested
  - General Electric (GE), Frame 7FA.05, Unit #2
- 1.2.6 Emission Points
  - Exhaust from the General Electric (GE), Frame 7FA.05, Unit #2

- For all gases, twelve sample points in the exhaust stack from the General Electric (GE), Frame 7FA.05, Unit #2, at 16.7, 50.0, and 83.3 percent of the diameter
- 1.2.7 Emission Parameters Measured
- NOx
  - O<sub>2</sub>
- 1.2.8 Date of Emission Test
- August 3, 2017
- 1.2.9 Federal and State Certifications
- Stack Testing Accreditation Council AETB Certificate No. 3796.02
  - International Standard ISO/IEC 17025:2005 Certificate No. 3796.01

### 1.3 KEY PERSONNEL

Wolverine:	Laura Hoisington (lhoisington@wpsci.com)	231-775-5700x3369
MDEQ:	Jeremy Howe (howej1@michigan.gov)	231-876-4416
Air Hygiene:	Michael Whisenhunt (mwhisenhunt@airhygiene.com)	918-307-8865
Air Hygiene:	Dustin Hopson	918-307-8865

### 2.0 SUMMARY OF TEST RESULTS

Results from the sampling conducted on Wolverine Power Supply Cooperative, Inc.'s General Electric (GE), Frame 7FA.05, Unit #2 located at the Alpine Power Plant on August 3, 2017 are summarized in the following table and relate only to the items tested.

**TABLE 2.1  
SUMMARY OF GENERAL ELECTRIC, 7FA.05, UNIT #EU-CTG2 RESULTS**

Parameter	High Load	Mid-High Load	Mid Load	Low Load	Permit Limits
Start Time (hh:mm:ss)	7:28:09	9:40:12	12:33:15	14:50:18	--
End Time (hh:mm:ss)	9:25:41	11:38:44	14:31:47	16:48:50	--
Run Duration (min / run)	34	34	34	34	--
Bar. Pressure (in. Hg)	28.80	28.80	28.75	28.70	--
Amb. Temp. (°F)	62	65	69	69	--
Rel. Humidity (%)	92	92	80	79	--
Spec. Humidity (lb water / lb air)	0.011526	0.012574	0.012619	0.012542	--
Load Designator	High	Mid-High	Mid	Low	--
Turbine Fuel Flow (SCFH)	2,018,546	1,737,034	1,520,311	1,256,670	--
Total Fuel Flow (SCFH)	2,018,546	1,737,034	1,520,311	1,256,670	--
Stack Flow (RM19) (SCFH)	47,688,326	41,646,300	35,801,883	30,584,136	--
Power Output (megawatts)	208.2	176.2	145.2	104.9	--
NOx (ppmvd)	7.19	6.51	7.48	9.24	--
NOx (lb/hr)	40.96	32.40	32.00	33.75	66.8
NOx (lb/MMBtu)	0.020	0.019	0.021	0.027	0.03
O <sub>2</sub> (%)	13.26	13.37	13.24	13.49	--

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.

### 3.0 SOURCE OPERATION

#### 3.1 PROCESS DESCRIPTION

Wolverine Power Supply Cooperative (Wolverine Power) owns and operates the Alpine Power Plant. The Alpine Power Plant includes two simple-cycle, 203 megawatt (MW), General Electric (GE) Frame 7FA.05 combustion turbine generators (CTGs), fired on natural gas, and designated as EU-CTG1 and EU-CTG2. Each turbine is rated with a nominal maximum peak heat input of 2,045 million British thermal units per hour (MMBtu/hr). Each unit is capable of operating at multiple test loads, but operations are continuous, not cyclical or batch, pending approval from dispatchers controlling the local electrical grid. The turbines use Dry-Low NOx burners and good combustion practices as controls.

#### 3.2 SAMPLING LOCATION

The Turbine 2 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. All exhaust samples for gaseous emissions were continuously drawn from 12 points located throughout the stack.

### 4.0 SAMPLING AND ANALYTICAL PROCEDURES

#### 4.1 TEST METHODS

The emission test on the General Electric (GE), Frame 7FA.05, Unit #2 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 August 3, 2017.

**TABLE 4.1  
SUMMARY OF SAMPLING METHODS**

<b>Pollutant or Parameter</b>	<b>Sampling Method</b>	<b>Analysis Method</b>
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, then 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 an air-conditioned, 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. NO<sub>x</sub> 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. Data records can be found in Appendix A and B of this report.

Three test runs of approximately 35 minutes each were conducted on the General Electric (GE), Frame 7FA.05, Unit #2 at each of the multiple test loads for NO<sub>x</sub> and O<sub>2</sub>.

The stack gas analysis for O<sub>2</sub> concentrations was performed in accordance with procedures set forth in EPA Method 3A. The O<sub>2</sub> analyzer uses a paramagnetic cell detector.

EPA Method 7E was used to determine concentrations of NO<sub>x</sub>. A chemiluminescent analyzer was used to determine the nitrogen oxides concentration in the gas stream. A NO<sub>2</sub> in nitrogen certified gas cylinder was used to verify at least a 90 percent NO<sub>2</sub> conversion on the day of the test.

**TABLE 4.2  
ANALYTICAL INSTRUMENTATION**

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

