

performed for

Board of Light and Power
J.B. Sims Generating Station
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I. INTRODUCTION

Network Environmental, Inc. was retained by the Grand Haven Board of Light and Power to conduct an emission study at the J.B. Sims Generating Station. The purpose of the study was to determine the particulate and hydrochloric acid (HCl) emissions from the boiler to document compliance with EPA MATS and Michigan ROP No. MI-ROP-B1976-2018.

The following emission limits have been established for this source:

Pollutant	Emission Limit
Particulate	0.03 Lbs/MMBTU
HCl	0.0020 Lbs/MMBTU

The following reference test methods were employed to conduct the emission sampling:

- Particulate (Filterable) – U.S. EPA Method 5 MATS
- HCl – U.S. EPA Method 26A MATS
- Exhaust Gas Parameters (air flow rate, temperature, moisture & density) – U.S. EPA Methods 1 through 4.

The sampling was performed over the period of June 11-12, 2019 by R. Scott Cargill and Richard D. Eerdmans of Network Environmental, Inc.. Assisting in the study were Mr. Paul Cederquist and Mr. Chris Morse of the Grand Haven Board of Light and Power. Mr. Jeremy Howe of the Michigan Department of Environment, Great Lakes and Energy (EGLE) – Air Quality Division was present to observe the sampling and source operation.

II. PRESENTATION OF RESULTS

**II.1 TABLE 1
PARTICULATE EMISSION RESULTS SUMMARY
BOILER 3
GRAND HAVEN BLP
GRAND HAVEN, MICHIGAN
JUNE 11, 2019**

Sample	Time	Air Flow Rate DSCFM ⁽¹⁾	% CO ₂ ⁽²⁾	Particulate Emission Rates	
				Lbs/Hr ⁽³⁾	Lbs/MMBTU ⁽⁴⁾
1	08:04-10:20	199,359	11.0	2.10	0.0029
2	10:58-13:16	206,026	11.0	1.69	0.0022
3	13:51-16:07	205,598	11.0	2.14	0.0028
Average		203,661	11.0	1.98	0.0027

- (1) DSCFM = Dry Standard Cubic Feet Per Minute (STP = 68 °F & 29.92 in. Hg)
 (2) %CO₂ = Percent Carbon Dioxide On A Dry Basis
 (3) Lbs/Hr = Pounds Of Particulate Per Hour
 (4) Lbs/MMBTU = Pounds Of Particulate Per Million BTU of Heat Input. Calculated Using Equation 19-6 Found In EPA Method 19 For CO₂ On A Dry Basis With An F Factor Of 1,800 DSCF/MMBTU.

**II.2 TABLE 2
HCl EMISSION RESULTS SUMMARY
BOILER 3
GRAND HAVEN BLP
GRAND HAVEN, MICHIGAN
JUNE 12, 2019**

Sample	Time	Air Flow Rate DSCFM ⁽¹⁾	% CO ₂ ⁽²⁾	HCl Concentration Mg/M ³ ⁽³⁾	HCl Emission Rates	
					Lbs/Hr ⁽⁴⁾	Lbs/MMBTU ⁽⁵⁾
1	07:58-09:58	196,002	10.8	0.060	0.044	6.27E-05
2	10:21-12:15	194,055	11.3	0.074	0.054	7.34E-05
3	12:31-14:18	192,905	11.0	0.054	0.039	5.53E-05
Average		194,321	11.0	0.063	0.046	6.38E-05

- (1) DSCFM = Dry Standard Cubic Feet Per Minute (STP = 68 °F & 29.92 in. Hg)
(2) %CO₂ = Percent Carbon Dioxide On A Dry Basis
(3) Mg/M³ = Milligrams Of HCl Per Dry Standard Cubic Meter
(4) Lbs/Hr = Pounds Of HCl Per Hour
(5) Lbs/MMBTU = Pounds Of HCl Per Million BTU of Heat Input. Calculated Using Equation 19-6 Found In EPA Method 19 For CO₂ On A Dry Basis With An F Factor Of 1,800 DSCF/MMBTU.

III. DISCUSSION OF RESULTS

The results of the emission sampling are summarized in Tables 1 and 2 (Section II.1 & II.2). The results are presented as follows:

III.1 Particulate Emission Results Summary (Table 1)

Table 1 summarizes the particulate emission results for the boiler as follows:

- Sample
- Time
- Air Flow Rate (DSCFM) – Dry Standard Cubic Feet Per Minute (STP = 68 °F & 29.92 in. Hg)
- Carbon Dioxide (CO₂) Concentration (%) – Percent Carbon Dioxide On A Dry Basis
- Particulate Mass Emission Rate (Lbs/Hr) – Pounds of Particulate Per Hour
- Particulate Mass Emission Rate (Lbs/MMBTU) – Pounds Of Particulate Per Million BTU of Heat Input. Calculated Using Equation 19-6 From EPA Method 19 For CO₂ On A Dry Basis With An F Factor Of 1,800 DSCF/MMBTU.

A more detailed breakdown of each individual particulate sample can be found in Appendix A.

III.2 HCl Emission Results Summary (Table 2)

Table 2 summarizes the HCl emission results for the boiler as follows:

- Sample
- Time
- Air Flow Rate (DSCFM) – Dry Standard Cubic Feet Per Minute (STP = 68 °F & 29.92 in. Hg)
- Carbon Dioxide (CO₂) Concentration (%) – Percent Carbon Dioxide On A Dry Basis
- HCl Concentration (Mg/M³) – Milligrams Of HCl Per Dry Standard Cubic Meter
- HCl Mass Emission Rate (Lbs/Hr) – Pounds of HCl Per Hour
- HCl Mass Emission Rate (Lbs/MMBTU) – Pounds Of HCl Per Million BTU of Heat Input. Calculated Using Equation 19-6 From EPA Method 19 For CO₂ On A Dry Basis With An F Factor Of 1,800 DSCF/MMBTU.

A more detailed breakdown of each individual HCl sample can be found in Appendix A.

III.3 Emission Limits

The following emission limits have been established for this source:

Pollutant	Emission Limit
Particulate	0.03 Lbs/MMBTU
HCl	0.0020 Lbs/MMBTU

The results of the particulate and HCl emission sampling are well below all of the established emission limits.

IV. SAMPLING AND ANALYTICAL PROTOCOL

The sampling location for the boiler exhaust is on the 160 inch diameter exhaust at a location that meets the minimum requirements of US. EPA Method 1. There are 4 sample ports. Twenty-Four (24) sampling points (6 per port) were used for the isokinetic sampling. The sampling point dimensions were as follows:

<u>Sample Point</u>	<u>Dimension (Inches)</u>
1	3.36
2	10.72
3	18.88
4	28.32
5	40.00
6	56.96

Prior to the emission testing, preliminary velocity/cyclonic (turbulent) flow measurements/checks were conducted. All the sampling locations and flows passed the requirements of Methods 1 and 2.

IV.1 Particulate – The particulate emission sampling was conducted in accordance with U.S. EPA Method 5 MATS. This is an out-stack filtration method using a heated filter and probe (heated at 320 °F plus or minus 25 °F). The samples were collected isokinetically on filters. Three (3) samples were collected from the boiler exhaust. Each sample was one hundred twenty (120) minutes in duration and had a minimum sample volume of two (2.0) dry standard cubic meters (DSCM).

The nozzle/probe rinses and filters were analyzed gravimetrically for particulate in accordance with Method 5 MATS. All the quality assurance and quality control procedures listed in the methods were incorporated in the sampling and analysis. The particulate sampling train is shown in Figure 1.

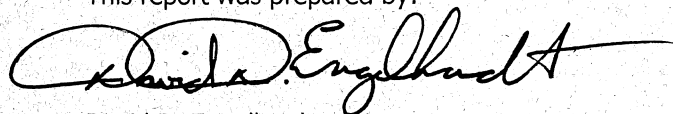
IV.2 Hydrochloric Acid – The HCl emission sampling was conducted in accordance with U.S. EPA Method 26A MATS. The sampling was performed isokinetically in accordance with the method. The filter and probe were heated to between 248 °F and 273 °F. The HCl was collected in the first two impingers of the sampling train, which contained 100 mls of 0.1 normal sulfuric acid. The probe rinse and the impinger catch from the impingers were combined and analyzed for HCl using Ion-chromatography as described in the method.

Three (3) samples were collected from the boiler exhaust. Each sample was ninety-six (96) minutes in duration and had a minimum sample volume of 1.5 dry standard cubic meters (DSCM). All the quality assurance and quality control requirements specified in the method were incorporated in the sampling and analysis. A diagram of the sampling train is shown in Figure 2.

IV.3 Exhaust Gas Parameters – The exhaust gas parameters (air flow rate, temperature, moisture and density) were determined in conjunction with the other sampling by employing U.S. EPA Methods 1 through 4.

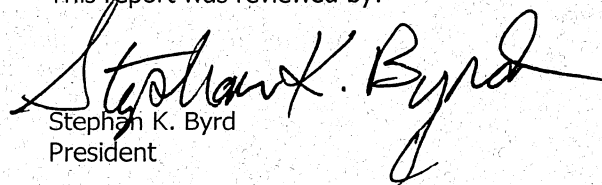
Air flow rates, temperatures and moistures were determined using the isokinetic sampling trains. Bag samples were collected from the exhaust of these trains and analyzed by ORSAT to determine the oxygen and carbon dioxide concentrations. All the quality assurance and quality control procedures listed in the methods were incorporated in the sampling and analysis.

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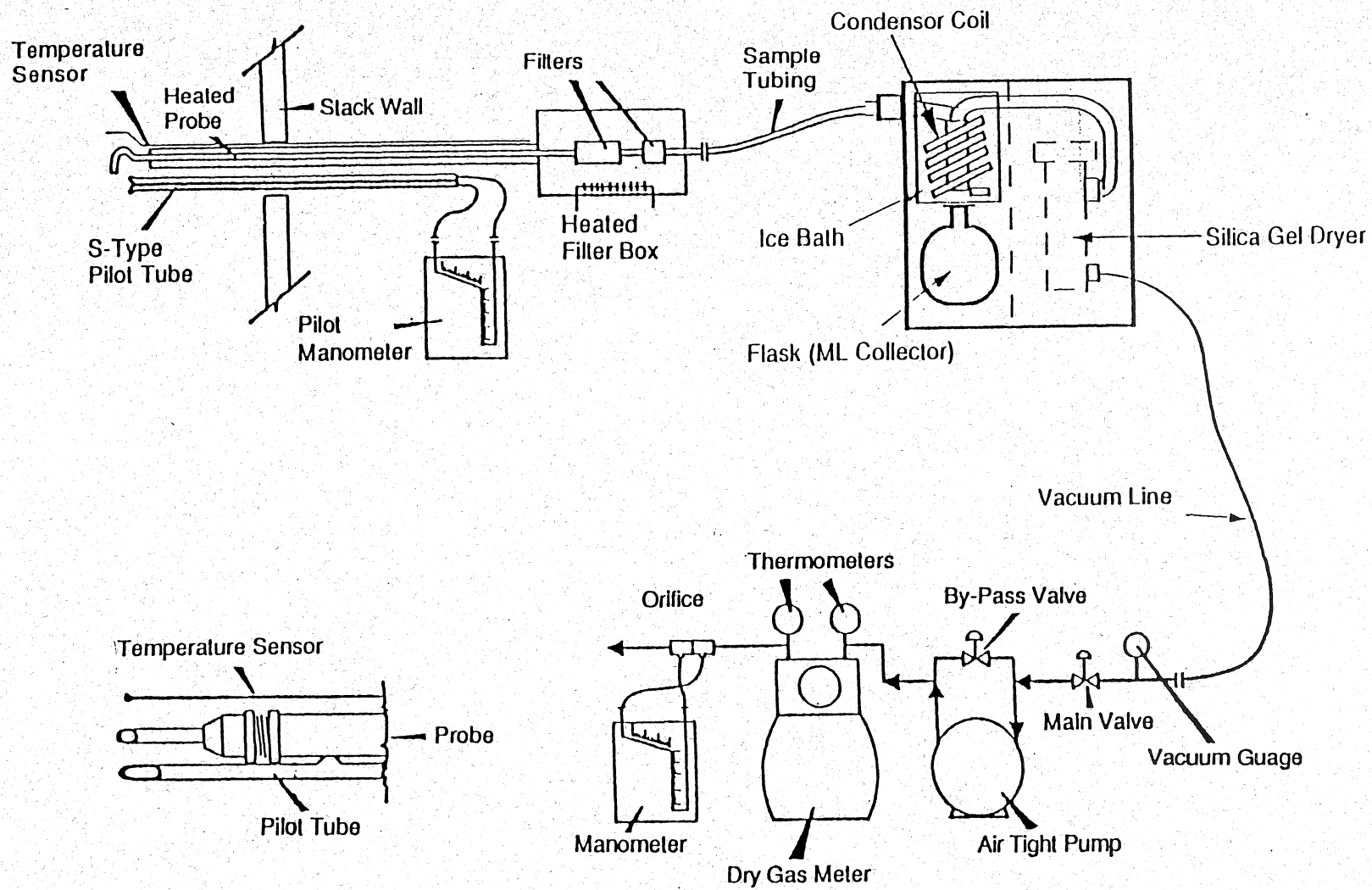


Figure 1
Particulate
Sampling Train

Temperature
Sensor

Probe

Stack Wall

Nozzle

Filter

Sample
Tubing

Heated
Filter Box

Impinger Train

Silica Gel Dryer

Impingers

Ice Bath

Vacuum line

Thermometers

Orifice

By-Pass Valve

Main Valve

Vacuum Gauge

Manometer

Dry Gas Meter

Air Tight Pump

Figure 2

HCl
Sampling Train

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