Report of...

Boiler MACT Emission Sampling

Performed for the...

Michigan Sugar Company

Sebewaing Michigan

on the

Wet ESP Exhaust

February 18-20, 2020

Project #: 022.52

By...

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I. INTRODUCTION

Network Environmental, Inc. was retained by the Michigan Sugar Company of Bay City, Michigan, to perform emission sampling at their Sebewaing, Michigan facility. The purpose of the sampling was to determine compliance with the National Emission Standard for Hazardous Air Pollutants (NESHAP) 40CFR Part 63 Subpart DDDDD (MACT for Industrial, Commercial, Institutional Boilers and Process Heaters). The following is a list of the compounds sampled and corresponding emission limits:

Compounds Sampled	Emission Limit
Mercury (Hg)	5.7 E-06 Lbs/MMBTU of Heat Input **or** 6.4 E-06 Lbs/MMBTU of Steam Output
Hydrochloric Acid (HCl)	2.2 E-02 Lbs/MMBTU of Heat Input **or** 2.5 E-02 Lbs/MMBTU of Steam Output

The test methods used were as follows:

- Mercury (Hg) – U.S. EPA Method 29
- Hydrochloric Acid (HCl)) – U.S. EPA Method 26A
- Oxygen (O_2) & Carbon Dioxide (CO_2) – U.S. EPA Method 3
- Exhaust Gas Parameters (air flow rate, temperature, moisture & density) – U.S. EPA Methods 1-4

The sampling was performed over the period of February 18-20, 2020 by Stephan K. Byrd, Richard D. Eerdmans and David D. Engelhardt of Network Environmental, Inc.. Assisting with the sampling were Mr. Steven Smock and the operating staff of the facility. Ms. Regina Angellotti and Mr. Ben Witkopp of the Michigan Department of Environment, Great Lakes and Energy (EGLE) - Air Quality Division were present to observe the sampling and source operation.

II. PRESENTATION OF RESULTS

II.1 TABLE 1
MERCURY (Hg)
EMISSION RESULTS SUMMARY
WET ESP EXHAUST
MICHIGAN SUGAR COMPANY
SEBEWAING, MICHIGAN
FEBRUARY 19-20, 2020

Sample	Date	Time	Air Flow Rate DSCFM (1)	Hg Mass Emission Rate		
				Lbs/Hr (2)	Lbs/MMBTU Heat Input (3)	Lbs/MMBTU Steam Output (4)
1	2/19/20	10:05-12:40	52,482	1.15E-04	8.29E-07	7.63E-07
2	2/19/20	15:08-17:43	53,621	1.35E-04	9.99E-07	8.72E-07
3	2/20/20	08:57-11:33	52,629	1.37E-04	9.64E-07	8.75E-07
Average			**52,911**	**1.29E-04**	**9.31E-07**	**8.37E-07**

(1) DSCFM = Dry Standard Cubic Feet Per Minute (STP = 68 °F & 29.92 in. Hg)
(2) Lbs/Hr = Pounds of Particulate Per Hour
(3) Lbs/MMBTU Heat Input = Pounds Per Million BTU of Heat Input (Calculated Using U.S. EPA Method 19 With An F-Factor of 9,780 DSCF/MMBTU)
(4) Lbs/MMBTU Steam Output = Pounds Per Million BTU of Steam Output (Calculated Using 150.73 MMBTU/Hr Of Steam Production For Sample One, 155.10 MMBTU/Hr Of Steam Production For Sample Two and 156.56 MMBTU/Hr Of Steam Production For Sample Three.)
(5) Hg Emission Limit From Part 63 Subpart DDDDD = 5.7E-06 Lbs/MMBTU Of Heat Input OR 6.4E-06 Lbs/MMBTU Of Steam Output

II.2 TABLE 2
HYDROCHLORIC ACID (HCl)
EMISSION RESULTS SUMMARY
WET ESP EXHAUST
MICHIGAN SUGAR COMPANY
SEBEWAING, MICHIGAN
FEBRUARY 18, 2020

Sample	Time	Air Flow Rate DSCFM (1)	HCl Concentration Mg/M³ (2)	HCl Mass Emission Rate		
				Lbs/Hr (3)	Lbs/MMBTU Heat Input (4)	Lbs/MMBTU Steam Output (5)
1	09:33-10:36	53,537	0.542	0.1086	7.43E-04	7.14E-04
2	11:05-12:10	53,863	0.080	0.0161	1.08E-04	1.05E-04
3	12:40-13:45	54,228	0.219	0.0444	3.03E-04	2.94E-04
Average		**53,876**	**0.280**	**0.0563**	**3.85E-04**	**3.71E-04**

(1) DSCFM = Dry Standard Cubic Feet Per Minute (STP = 68 °F & 29.92 in. Hg)
(2) Mg/M³ = Milligrams Per Dry Standard Cubic Meter
(3) Lbs/Hr = Pounds of HCl Per Hour
(4) Lbs/MMBTU Heat Input = Pounds Per Million BTU of Heat Input (Calculated Using U.S. EPA Method 19 With An F-Factor of 9,780 DSCF/MMBTU)
(5) Lbs/MMBTU Steam Output = Pounds Per Million BTU of Steam Output (Calculated Using 152.08 MMBTU/Hr Of Steam Production For Sample One, 152.49 MMBTU Of Steam Production For Sample Two and 151.21 MMBTU Of Steam Production For Sample Three.)
(6) HCl Emission Limit From Part 63 Subpart DDDDD) = 2.2E-02 Lbs/MMBTU Of Heat Input OR 2.5E-02 Lbs/MMBTU Of Steam Output

III. DISCUSSION OF RESULTS

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

III.1 Hg

Table 1 – Mercury (Hg) Emission Results Summary

- Sample
- Date
- Time
- Air Flow Rate (DSCFM) – Dry Standard Cubic Feet Per Minute (STP = 68 °F & 29.92 in. Hg)
- Hg Mass Emission Rate (Lbs/Hr) – Pounds of Hg Per Hour
- Hg Mass Emission Rate (Lbs/MMBTU Heat Input) – Pounds of Hg Per Million BTU of Heat Input (Calculated using Equation 19-1 from U.S. EPA Method 19. The F Factor used for the Lbs/MMBTU calculations was 9,780 DSCF/MMBTU.)
- Hg Mass Emission Rate (Lbs/MMBTU Steam Output) – Pounds of Hg Per Million BTU of Steam Output. The BTU/Lb of steam value used (1200 BTU/Lb of Steam) in these calculations was obtained from a Steam Table using steam operating data supplied by Michigan Sugar. The steam table used can be found in Appendix D. Boiler operating data during the testing can be found in Appendix F.

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

III.2 HCl

Table 2 – Hydrochloric Acid (HCl) Emission Results Summary

- Sample
- Time
- Air Flow Rate (DSCFM) - Dry Standard Cubic Feet Per Minute (STP = 68 °F & 29.92 in. Hg)
- HCl Concentration (Mg/M^3) - Milligrams Per Dry Standard Cubic Meter
- HCl Mass Emission Rate (Lbs/Hr) - Pounds of HCl Per Hour
- HCl Mass Emission Rate (Lbs/MMBTU Heat Input) - Pounds of HCl Per Million BTU of Heat Input (Calculated using Equation 19-1 from U.S. EPA Method 19. The F Factor used for the Lbs/MMBTU calculations was 9,780 DSCF/MMBTU.)
- HCl Mass Emission Rate (Lbs/MMBTU Steam Output) – Pounds of HCl Per Million BTU of Steam Output. The BTU/Lb of steam value used (1200 BTU/Lb of Steam) in these calculations was

obtained from a Steam Table using steam operating data supplied by Michigan Sugar. The steam table used can be found in Appendix D. Boiler operating data during the testing can be found in Appendix F.

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

III.3 Emission Limits

National Emission Standard for Hazardous Air Pollutants (NESHAP) 40CFR Part 63 Subpart DDDDD (MACT for Industrial, Commercial, Institutional Boilers and Process Heaters) has established the following emission limits for this source:

Compound	Emission Limit
Mercury (Hg)	5.7 E-06 Lbs/MMBTU of Heat Input **or** 6.4 E-06 Lbs/MMBTU of Steam Output
Hydrochloric Acid (HCl)	2.2 E-02 Lbs/MMBTU of Heat Input **or** 2.5 E-02 Lbs/MMBTU of Steam Output

IV. SOURCE DESCRIPTION

There are two (2) boilers at the Sebewaing facility. Both boilers are Wicks "A" frame coal fired stokers. These boilers are as follows:

- Boiler #2 (EUICKESEASTBOIL) - Built in 1940. Designed heat input of approximately 87 MMBTU/Hr
- Boiler #3 (EUICKESWESTBOIL) - Built in 1939. Designed heat input of approximately 87 MMBTU/Hr

These boilers are used for generating process steam. The exhaust gases from these boilers have a common exhaust duct that leads to a wet scrubber followed by a Wet ESP before being emitted to atmosphere. Source operating data during the sampling can be found in Appendix F.

V. SAMPLING AND ANALYTICAL PROTOCOL

The sampling location was on the 60 inch I.D. stack with 2 sample ports in a location that exceeded the 8 duct diameters downstream and 2 duct diameters upstream from the nearest disturbances requirement of U.S. EPA Method 1. Twelve (12) sampling points were used for this source.

V.1 Mercury (Hg) - The Hg emission sampling was conducted by employing U.S. EPA Method 29. This is an out of stack filtration method, where the sampling probe and filter are heated at 250 °F (plus or minus 25 °F). Three (3) samples were collected. The samples were one hundred fifty (150) minutes in duration and each had a minimum sample volume of three (3) dry standard cubic meters (DSCM). The samples were collected isokinetically on quartz filters, in a nitric acid/hydrogen peroxide solution and in a acidic potassium permanganate solution.

The front half, the nitric acid/hydrogen peroxide solutions and the acidic potassium permanganate solutions were analyzed for mercury by cold vapor atomic absorption spectrophotometry (CVAAS). All the quality assurance and quality control procedures listed in the methods were incorporated in the sampling and analysis. A diagram of the Hg sampling train is shown in Figure 1.

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

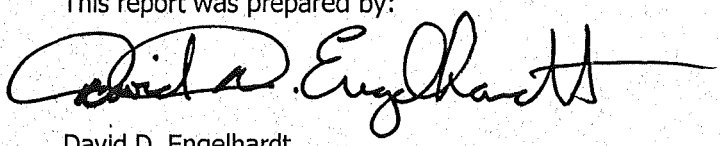
Three (3) samples were collected from the Wet ESP exhaust. Each sample was sixty (60) minutes in duration and had a minimum sample volume of one (1) dry standard cubic meter (DSCM). All the quality assurance and quality control requirements specified in the method were incorporated in the sampling and analysis. A diagram of the sampling train is shown in Figure 2.

V.3 Oxygen & Carbon Dioxide - The O_2 & CO_2 sampling was performed by employing U.S. EPA Method 3. Bag samples were collected from the back of the isokinetic sampling trains and analyzed by Orsat analysis. All the quality assurance and quality control requirements specified in the method were incorporated in the sampling and analysis.

V.4 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. All the quality assurance and quality control procedures listed in the methods were incorporated in the sampling and analysis.

This report was prepared by:



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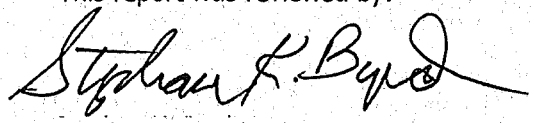

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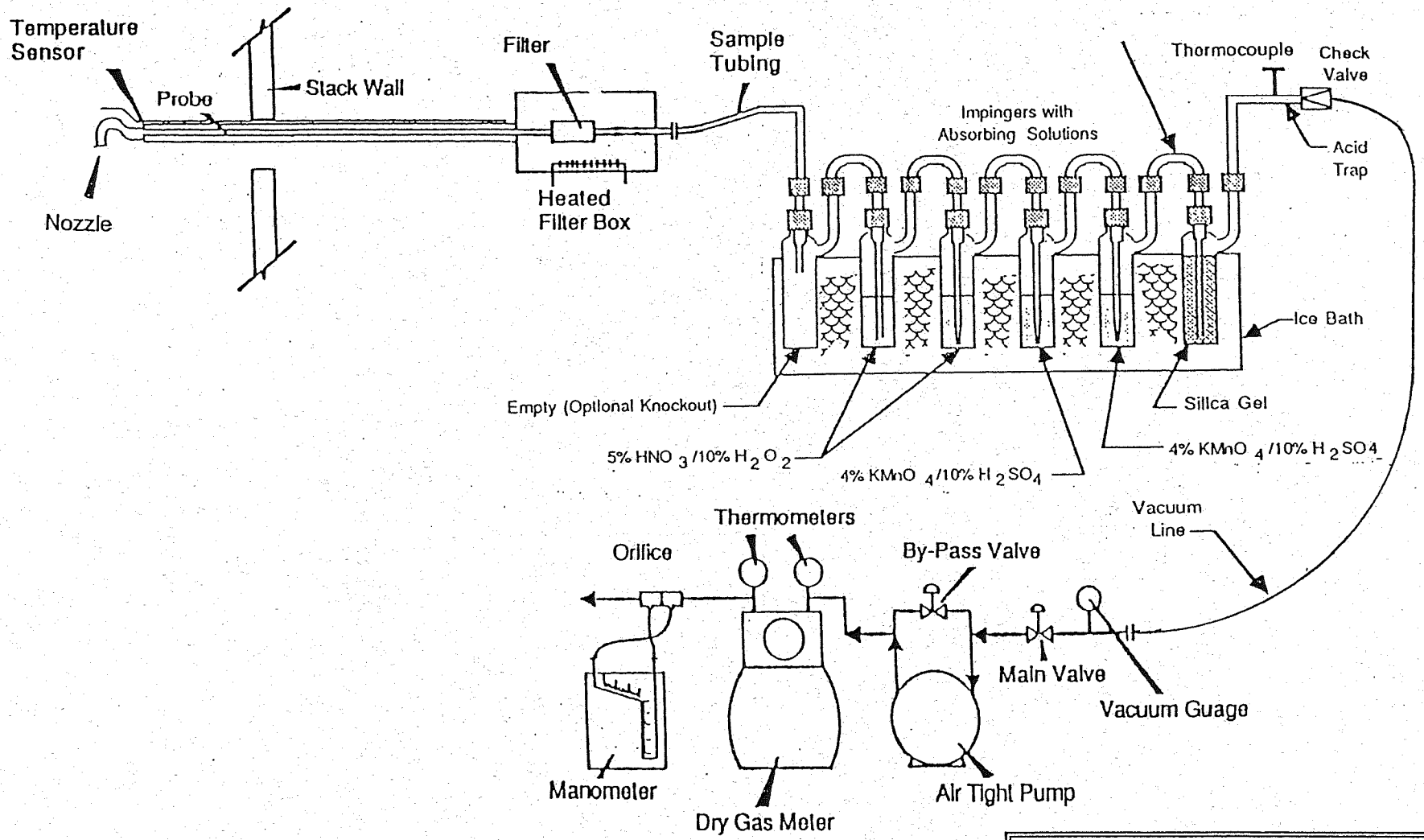

Figure 1

Hg
Sampling Train

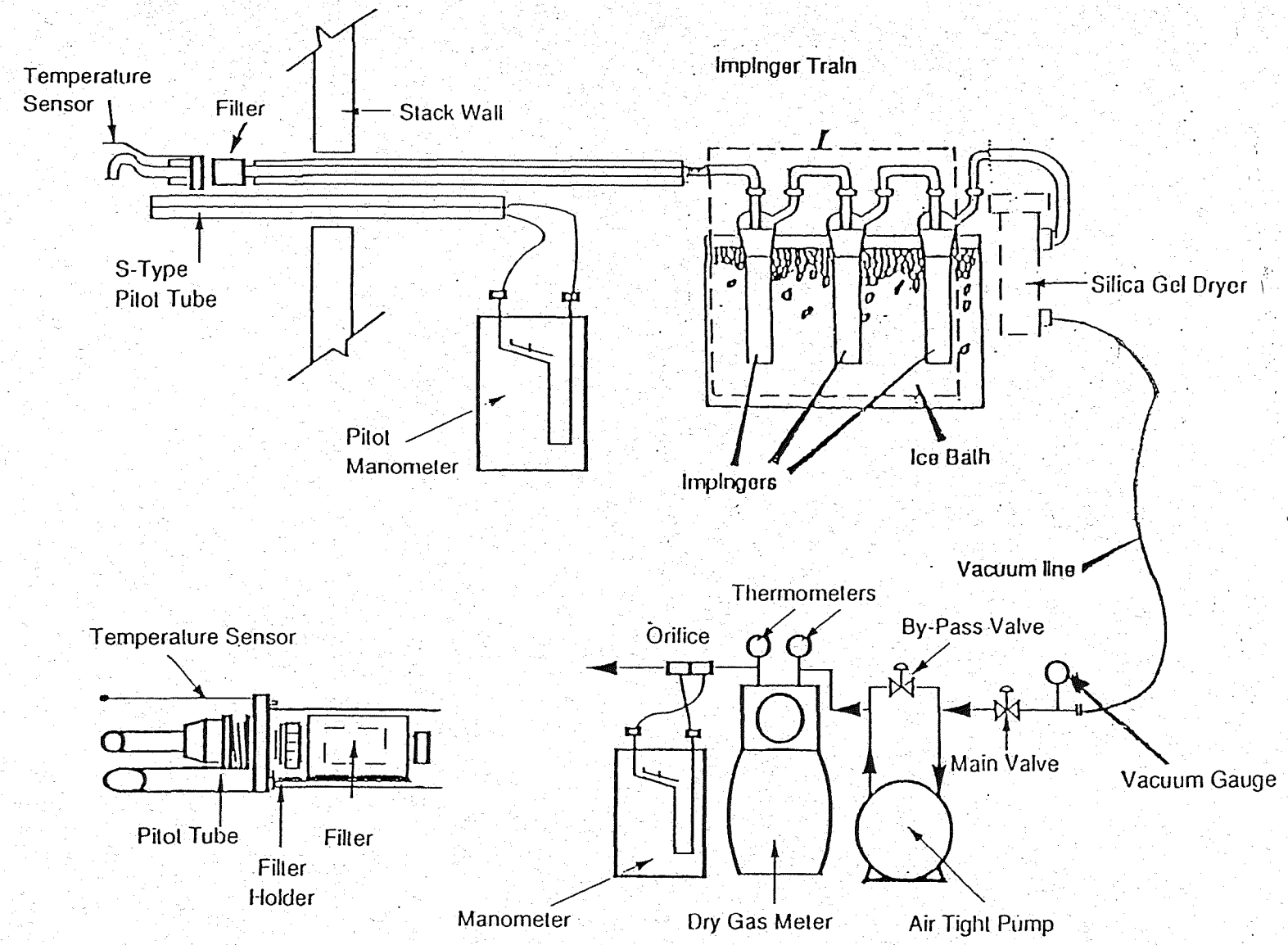

Figure 2

HCl
Sampling Train