TEST REPORT
3Q 2018 MERCURY AIR TOXICS
WE ENERGIES
PRESQUE ISLE POWER PLANT FACILITY ID 1769
BOILER 7
MARQUETTE, MICHIGAN

Prepared For:

We Energies
2701 Lakeshore Boulevard
Marquette, Michigan

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SEP 26 2018
AIR QUALITY DIVISION

Prepared By:

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Document Number:	023AS-365577-RT-175
Test Date:	July 26, 2018
Document Date:	September 12, 2018

REPORT CERTIFICATION

STATEMENT OF CONFORMANCE AND TEST REPORT CERTIFICATION

I certify, to the best of my knowledge, that this test program was conducted in a manner conforming to the criteria set forth in ASTM D7036-04: Standard Practice for Competence of Air Emission Testing Bodies, and that project management and supervision of all project related activities were performed by qualified individuals as defined by this practice.

I further certify that this test report and all attachments were prepared under my direction or supervision in accordance with the Montrose Air Quality Services, LLC quality management system designed to ensure that qualified personnel gathered and evaluated the test information submitted. Based on my inquiry of the person or persons who performed the sampling and analysis relating to this performance test, the information submitted in this test report is, to the best of my knowledge and belief, true, accurate and complete.

Performance data is available upon request.

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1.0 PROJECT OVERVIEW

1.1 GENERAL

Montrose Air Quality Services, LLC (Montrose) formerly known as Airtech Environmental Services Inc. (Airtech) located at 1371 Brummel Avenue, Elk Grove Village, Illinois was contracted by We Energies to perform an air emissions test program at the Presque Isle Power Plant (PIPP) located in Marquette, Michigan. The objective of the test program was to perform testing for filterable particulate matter (PM) and hydrogen chloride (HCl) from the exhaust of Unit 7. Testing was conducted to meet the requirements of We Energies, the Michigan Department of Quality (MDEQ) and the United States Environmental Protection Agency (U.S. EPA); and 40 CFR Part 60 and 63, Subpart UUUUU, as applicable.

Testing was performed on July 26, 2018. Coordinating the field aspects of the test program were:

Cynthia Brandt – We Energies - (920) 433-1830
Rob Bregger – We Energies - (414) 221-4772
Blu Kaput – Montrose Air Quality Services, LLC – (630) 860-4740

1.2 EXECUTIVE SUMMARY

The results of the Method 5 PM and Method 26A HCl testing are summarized in the table below. Testing was performed according to Test Plan No. 042AS-339307-PP-1. The procedures outlined in that document were followed except where noted.

TABLE 1 – 1 EXECUTIVE SUMMARY

Unit	Constituent	Run 1	Run 2	Run 3	Average	MATS Limit
7	Filterable PM (lb/mmBtu)	0.000602	0.000666	0.000680	**0.000649**	0.03
7	Filterable PM (lb/hr)	0.531	0.593	0.596	**0.573**	
7	HCl (lb/mmBtu)	0.000550	0.000778	0.000715	**0.000681**	0.002
7	HCl (lb/hr)	0.485	0.693	0.627	**0.602**	

1.3 ASTM D7036-04(2011)

All applicable Montrose field personnel used on-site for this test program were compliant with ASTM D7036-04(2011) "Standard Practice for Competence of Air Emissions Testing Bodies" for all tests performed. This includes having the appropriate QSTI directly supervise the testing.

The following table summarizes the key personnel that were involved with this project:

TABLE 1 – 2
PROJECT PERSONNEL

Personnel	Position on Project	Date of QSTI Exam
Brandon Check, Q.S.T.I.	Project Manager	3/31/2016
Blu Kaput, Q.S.T.I.	Overall Test Leader	05/05/2017

1.4 METHODOLOGY

1.4.1 Particulate Matter and Hydrogen Chloride Testing Methodology

EPA Methods 5 and 26A were used to determine the PM and HCl concentrations at the test location in a combined sample train. In Method 5, a sample of the gas stream was withdrawn isokinetically from the stack. The PM in the sample gas stream was collected in a glass lined sample probe and on a glass fiber filter. The weight of PM collected with the sample train combined with the volume of dry gas withdrawn from the stack was used to calculate the particulate concentration.

EPA Method 26A was used to determine the HCl concentration at the test location. In Method 26A, a sample of the gas stream was withdrawn isokinetically from the stack. The HCl in the sample gas stream passed through a probe and filter assembly and collected in an impinger condenser system. The impingers contained a solution of dilute sulfuric acid to collect the HCl. After each test run, the impinger contents were recovered and subsequently analyzed at the Montrose laboratory located in Elk Grove Village, Illinois using ion chromatography (IC).

In order to convert the concentration of each constituent to a mass emissions rate, the volumetric gas flow rate through the test location was determined concurrently with each test run, using EPA Methods 1, 2, 3A and 4.

Results for PM and HCl are expressed in units of pounds per million British thermal units (lb/mmBtu). Three (3) test runs were conducted for PM and HCl at the test location. Testing was conducted as close to maximum load as possible.

The PM test was conducted using a probe temperature of 248°F (+/- 25°F) as allowed by the EPA in letters dated May 11, 2016 and March 8, 2017 and the MDEQ dated May 5, 2017. The volume collected was increased nominally by a factor of two as required for conducting emissions testing to demonstrate LEE status.

1.5 SPECIAL CONSIDERATIONS

Per the requirements of 40 CFR Part 63, Subpart UUUUU, the following strategies were utilized:

- Under §63.10005(h)(2)(i), the minimum sample volume specified in Table 2 was increased nominally by a factor of two (i.e. 2x1.00 dscm; 2x0.75)

- Under §63.10007(A) (2), the unit was operated at maximum normal operating load conditions during each periodic (e.g., quarterly) performance test. Maximum normal operating load was generally between 90 and 110 percent of design capacity but was representative of site specific normal operations during each test run.
- Under Table 5 (1) (f) and 5 (3) (f), emissions concentrations for PM and HCl were converted to lb/MMBtu or lb/MWh emissions rates, using the calculations found in EPA Method 19. The F-factor was 9,820 for subbituminous coal.
- Per the Stationary Source Audit Program (SSAP) for testing requirements under 40 CFR parts 51, 60, 61 and 63 the owner or operator of a stationary source is required to use an audit sample during a compliance test which applies to all test methods for which a commercially available audit exists (i.e. Method 26A)

1.6 PARAMETERS

The following parameters were determined at the Unit 7 test location during each test run:

- gas velocity
- gas temperature
- oxygen concentration
- carbon dioxide concentration
- moisture content
- filterable particulate matter concentration
- hydrogen chloride concentration

1.7 RESULTS

A complete summary of test results may be found in Table 2-1[1].

An HCl audit sample was submitted for analysis. The results of the audit sample may be found in the Laboratory section of the Appendix.

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[1] MEASUREMENT UNCERTAINTY STATEMENT
Both qualitative and quantitative factors contribute to field measurement uncertainty and should be taken into consideration when interpreting the results contained within this report. Whenever possible, Montrose personnel reduce the impact of these uncertainty factors through the use of approved and validated test methods. In addition, Montrose personnel perform routine instrument and equipment calibrations and ensure that the calibration standards, instruments, and equipment used during test events meet, at a minimum, test method specifications as well as the specifications of the Montrose Quality Manual and ASTM D7036-04. The limitations of the various methods, instruments, equipment, and materials utilized during this test have been reasonably considered, but the ultimate impact of the cumulative uncertainty of this project is not fully identified within the results of this report.

2.0 SUMMARY OF RESULTS

TABLE 2 – 1
SUMMARY OF UNIT 7 PM & HCL RESULTS

Test Parameters	Run 1	Run 2	Run 3	Average
Date	7/26/18	7/26/18	7/26/18	
Start Time	5:52	8:10	10:25	
Stop Time	8:00	10:18	12:33	
Fd Factor	9,820	9,820	9,820	
Gas Conditions				
Temperature (°F)	325	329	339	**331**
Volume Metered Standard, $V_{m(std)}$ (ft^3)	73.07	72.55	73.49	**73.04**
Volumetric Flow Rate (acfm)	347,300	348,300	350,600	**348,800**
Volumetric Flow Rate (scfm)	224,400	224,000	222,700	**223,700**
Volumetric Flow Rate (dscfm)	197,200	197,800	193,400	**196,100**
Carbon Dioxide (% dry)	13.8	13.8	13.9	**13.8**
Oxygen (% dry)	5.6	5.5	5.4	**5.5**
Moisture (%)	12.2	11.7	13.2	**12.4**
Particulate Results				
Concentration (grains/dscf)	0.000314	0.000350	0.000359	**0.000341**
Emission Rate (lb/MMBtu, F_d)	0.000602	0.000666	0.000680	**0.000649**
Emission Rate (lb/hr)	0.531	0.593	0.596	**0.573**
Hydrogen Chloride Results				
Concentration (lb/dscf)	4.10E-08	5.83E-08	5.40E-08	**5.11E-08**
Concentration (ppmdv)	0.434	0.617	0.571	**0.540**
Emission Rate (lb/MMBtu, Fd)	0.000550	0.000778	0.000715	**0.000681**
Emission Rate (lb/hr)	0.485	0.693	0.627	**0.602**

3.0 TEST PROCEDURES

3.1 METHOD LISTING

The following EPA test methods were referenced for the test program. These methods can be found in 40 CFR Part 60 Appendix A.

Method 1	Sample and velocity traverse for stationary sources
Method 2	Determination of stack gas velocity and volumetric flow rate (type S pitot tube)
Method 3A	Determination of oxygen and carbon dioxide concentrations in emissions from stationary sources (Instrumental analyzer procedure)
Method 4	Determination of moisture content in stack gases
Method 5	Determination of particulate emissions from stationary sources
Method 19	Determination of sulfur dioxide removal efficiency and particulate matter, sulfur dioxide, and nitrogen oxides emission rates
Method 26A	Determination of hydrogen halide and halogen emissions from stationary sources - isokinetic method

3.2 METHOD DESCRIPTIONS

3.2.1 Method 1

Method 1 was used to determine the suitability of each test location and to determine the sample points used for the gas velocity and particulate concentration determinations. Each test location conformed to the minimum requirements of being located at least 2.0 diameters downstream and at least 0.5 diameters upstream from the nearest flow disturbance.

The Unit 7 test location is a round, vertical duct with a diameter of 114 inches. Three points in each of the four test ports were traversed for each volumetric flow test run. The test location was located approximately 15.8 diameters downstream and approximately 10.5 diameters upstream from the nearest flow disturbance. A cross-section of the test location, indicating the traverse points is shown in Figure 1 of the Appendix.

3.2.2 Method 2

Method 2 was used to determine the gas velocity through the test location using a Type-S pitot tube and an incline plane oil manometer. The values measured in Method 2, along with the measurements made in Methods 3A and 4, were used to calculate the volumetric flow rate through the test locations. A diagram of the Method 2 apparatus is shown as part of the Method 5/26A sampling train in Figure 2 of the Appendix.

The manometer was leveled and “zeroed” prior to each test run. The sample train was leak checked before and after each run by pressurizing the positive side, or “high” side, of the pitot tube, creating a deflection on the manometer of at least three inches H_2O. The leak check was considered valid if the manometer remained stable for 15 seconds. This procedure was repeated on the negative side by generating a vacuum of at least three inches H_2O. The velocity head pressure and gas temperature were then determined at each point specified in Method 1. The static pressure of the stack was measured using a water filled U-tube manometer. In addition, the barometric pressure was measured and recorded.

3.2.3 Method 3A

The carbon dioxide and oxygen contents were determined at the test location using EPA Method 3A. A gas sample was collected into a Tedlar bag from the back of each sample train for the duration of each test run. Analysis was performed using a Teledyne infrared carbon dioxide analyzer/paramagnetic oxygen analyzer. The analyzers were calibrated immediately prior to analysis of the bag samples using the procedures outlined in Method 3A using EPA Protocol calibration gases.

The carbon dioxide content and oxygen content were used to calculate the dry molecular weight of the gas stream. The molecular weight was then used, along with the moisture content determined by EPA Method 4, for the calculation of the volumetric flow rate. For these calculations, the balance of the gas stream was assumed to be nitrogen since the other gas stream components are insignificant for the purposes of calculating molecular weight.

3.2.4 Method 4

The moisture content at the test location was determined using Method 4. A known volume of sample gas was withdrawn from the source and the moisture was condensed and measured. The dry standard volume of the sample gas was then compared to the volume of moisture collected to determine the moisture content of the sample gas. A diagram of the Method 4 apparatus is shown as part of the Method 5/26A train in Figure 2 of the Appendix.

To condense the water vapor the gas sample passed through a series of impingers. The impingers were charged as outlined in each individual method. The sample train was leak checked prior to the test run by capping the probe tip and pulling a vacuum greater than the highest vacuum expected during the test run. A leak check was considered valid if the leak rate was below 0.02 cubic feet per minute.

The volume of dry gas exiting the gas condenser system was measured with a dry gas meter. After leaving the dry gas meter, the sample stream passed through an orifice used to meter the flow rate through the sample train. The pressure drop across the orifice was measured with an incline plane, oil manometer. The gas meter reading, gas meter inlet and outlet temperatures, gas meter static pressure and pump vacuum were recorded for each sample point.

After the test run, the sample train was leak checked at the highest vacuum encountered during the test run. The tests were considered valid since the leak rate was less than 0.02 cfm. The amount of water collected in the condenser system was measured gravimetrically. The net weight gain of water was converted to a volume of wet gas and then compared to the amount of dry gas sampled to determine the moisture content.

3.2.5 Methods 5/26A

EPA Methods 5 and 26A in a combined sample train were used to determine the PM and HCl concentrations at the test location. A sample of the gas stream was withdrawn isokinetically from the stack and the PM in the sample gas stream was collected in a glass probe and on a glass fiber filter. The HCl was collected in impingers containing a dilute sulfuric acid solution. A diagram of the Method 5/26A sample train is shown in Figure 2 in the Appendix.

To prevent contamination, all components of the sample train were constructed of glass with no metal connections. Prior to testing the components were washed using detergent and then rinsed with tap water, deionized water and lastly with acetone. After drying, all components were sealed with parafilm or Teflon tape.

The sample probe that was used consisted of a glass liner and glass nozzle. Sample gas passed through the nozzle and probe assembly and then through a glass fiber filter heated to 248°F (+/- 25°F). After exiting the filter, the sample gas was passed through a series of four glass impingers. The first and second impingers each contained 100 ml of 0.1 N H_2SO_4. The third impinger was initially empty. The fourth contained a known weight of silica gel to absorb any remaining water vapor. The dry gas exiting the moisture condenser system then passed through a sample pump and a dry gas meter to measure the gas volume. After leaving the dry gas meter, the sample stream passed through an orifice, which was used to meter the flow rate through the sample train. The pressure drop across the orifice was measured with an incline plane oil manometer.

85mm Whatman quartz filters were used as the substrate for the particulate sampling. The filter was loaded into a glass filter holder with a Teflon support screen that was prepared in the same manner as the other components of the sample train. Prior to the test run, the filter was desiccated for at least 24 hours and then weighed to the nearest 0.0001g until a constant weight was achieved. The weight of the filter was considered constant only when two consecutive weights taken at least six hours apart are within 0.0005g of each other.

The probe was thoroughly pre-cleaned with acetone and the probe wash saved prior to each test run as a quality assurance check. The impingers were pre cleaned with distilled water and loaded with the appropriate impinger contents. The sample train was leak checked prior to the test run by capping the probe tip and pulling a vacuum of at least 15 in.Hg. A leak check was considered valid if the leak rate was below 0.02 cfm. When not in operation inside the stack, the nozzle was sealed with Teflon tape.

The probe tip was placed at each of the sample points determined in Method 1. The velocity at the sample point was determined using Method 2 by reading the velocity pressure from the manometer. Sample was withdrawn from the source at a rate such that the velocity at the opening of the nozzle matched the velocity of the stack gas at the sample point (isokinetically). During the test run the train was moved to each of the Method 1 sample points. The sample time at each point was calculated based on the number of sample points and the maximum allowable run time. The gas velocity pressure (ΔP), gas meter reading, gas meter inlet and outlet temperatures, gas meter orifice pressure (ΔH) and pump vacuum was recorded for each sample point.

After the test run the train was leak checked at the highest vacuum encountered during the test run. The probe liner and nozzle were washed with acetone and the rinse saved. The filter was removed from the filter holder, transferred to a container and sealed. The H_2SO_4 impinger contents were recovered separately and stored in HDPE sample jars.

Analysis of the samples for particulate matter was performed at the Montrose laboratory located in Elk Grove Village, Illinois. The probe rinses were transferred to a tared beaker, evaporated to dryness under ambient temperature and pressure conditions, desiccated for 24 hours and weighed to a constant weight. The filters were desiccated for 24 hours and weighed to a constant weight. The weight gain of the probe rinse and filters yield the total weight of particulate collected. To eliminate interference in establishing a constant weight, both the analytical balance and the desiccators were equipped with an ion generating polonium strip designed to eliminate static electricity that may collect on the samples.

Analysis of the samples for HCl was performed at the Montrose laboratory located in Elk Grove Village, Illinois.

3.2.6 Method 19

The equations in EPA Method 19 were used to calculate the emission rates of various pollutants from the test location in units of pounds per million British thermal units (lb/mmBtu). The calculations were based on the O2 concentration of the sample gas and an appropriate F factor, which is the ratio of combustion gas volumes to heat inputs. In order to calculate the pounds per million Btu (lb/mmBtu) emission rate, an Fd factor of 9,820 dscf/mmBtu was used as per 40CFR Part 75 for sub-bituminous coal.

4.0 DESCRIPTION OF INSTALLATION

Boilers #7-9 are Riley pulverized coal wall fired dry bottom utility boilers which use distillate oil start-up guns. Each boiler's nameplate steam capacity rating is 615,000 lb/hr with a heat input capacity of approximately 1010 MMBTU/hr. Each boiler serves a GE steam turbine/generator set rated at 78,982 KW. Mercury emissions from Boilers #7, #8, and #9 are controlled with a TOXECON TM mercury control demonstration system installed in 2005. Each boiler is equipped with an electrostatic precipitator and the TOXECON TM fabric filter baghouse common to Boilers #7 through #9.