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Consumers Energy

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Hydrogen Chloride Test

EUBOILER1

Consumers Energy Company

J.H. Campbell Plant

17000 Croswell Street

West Olive, Michigan 49460

SRN: B2835

FRS: 110000411108

Test Date: November 9, 2016

January 5, 2017

**Test Performed by the Consumers Energy Company
Regulatory Compliance Testing Section – Air Emissions Testing Body
Laboratory Services Section
Work Order No. 19619987**

Revision 0



MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY
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**RENEWABLE OPERATING PERMIT
REPORT CERTIFICATION**

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Authorized by 1994 P.A. 451, as amended. Failure to provide this information may result in civil and/or criminal penalties.

Reports submitted pursuant to R 336.1213 (Rule 213), subrules (3)(c) and/or (4)(c), of Michigan's Renewable Operating Permit (ROP) program must be certified by a responsible official. Additional information regarding the reports and documentation listed below must be kept on file for at least 5 years, as specified in Rule 213(3)(b)(ii), and be made available to the Department of Environmental Quality, Air Quality Division upon request.

Source Name Consumers Energy Company, J.H. Campbell Plant County Ottawa

Source Address 17000 Croswell City West Olive

AQD Source ID (SRN) B2835 ROP No. MI-ROP-2835-2013a ROP Section No. 1

Please check the appropriate box(es):

Annual Compliance Certification (Pursuant to Rule 213(4)(c))

Reporting period (provide inclusive dates): From _____ To _____

1. During the entire reporting period, this source was in compliance with ALL terms and conditions contained in the ROP, each term and condition of which is identified and included by this reference. The method(s) used to determine compliance is/are the method(s) specified in the ROP.

2. During the entire reporting period this source was in compliance with all terms and conditions contained in the ROP, each term and condition of which is identified and included by this reference, EXCEPT for the deviations identified on the enclosed deviation report(s). The method used to determine compliance for each term and condition is the method specified in the ROP, unless otherwise indicated and described on the enclosed deviation report(s).

Semi-Annual (or More Frequent) Report Certification (Pursuant to Rule 213(3)(c))

Reporting period (provide inclusive dates): From _____ To _____

1. During the entire reporting period, ALL monitoring and associated recordkeeping requirements in the ROP were met and no deviations from these requirements or any other terms or conditions occurred.

2. During the entire reporting period, all monitoring and associated recordkeeping requirements in the ROP were met and no deviations from these requirements or any other terms or conditions occurred, EXCEPT for the deviations identified on the enclosed deviation report(s).

Other Report Certification

Reporting period (provide inclusive dates): From 10/1/2016 To 12/31/2016

Additional monitoring reports or other applicable documents required by the ROP are attached as described:

Submittal of Unit 1 Hydrogen Chloride stack test report for MATS compliance.

I certify that, based on information and belief formed after reasonable inquiry, the statements and information in this report and the supporting enclosures are true, accurate and complete

Norman J. Kapala Executive Director of Coal Generation (616) 738-3200
Name of Responsible Official (print or type) Title Phone Number

1-6-2017
Signature of Responsible Official Date

* Photocopy this form as needed.

EXECUTIVE SUMMARY

Consumers Energy Company (Consumers Energy) Regulatory Compliance Testing Section (RCTS) conducted hydrogen chloride (HCl) testing following requirements in the United States Environmental Protection Agency (U.S. EPA) Title 40, Code of Federal Regulations (CFR) Part 63, Subpart UUUUU – *National Emission Standards for Hazardous Air Pollutants: Coal- and Oil-fired Electric Utility Steam Generating Units*, aka the Mercury Air Toxics Standard (MATS) Rule. HCl testing was performed at the single dedicated exhaust location of coal-fired boiler EUBOILER1 (Unit 1) operating at the J.H. Campbell Generating Station in West Olive, Michigan. The 274 gross megawatt (MW) output electric utility steam generating unit (EGU) creates steam to turn a turbine associated with an electricity producing generator.

This 4th quarter 2016 test was performed to satisfy MATS quarterly HCl test requirements in § 63.10006(d). Testing was used to demonstrate compliance with the 2.0E-03 HCl lb/mmBtu limit in MATS Table 2, § 2b, and to verify Unit 1 HCl emissions were less than 50 percent of the 2.0E-03 lb/mmBtu limit to qualify as a Low Emitting EGU (LEE) as specified in § 63.10005(h)(1)(i). The following summary of 4th quarter 2016 HCl emission rates indicates Unit 1 is in compliance with the MATS HCl lb/mmBtu limit and achieves LEE Status criteria for the 2nd consecutive calendar quarter.

Summary of J.H. Campbell Unit 1 HCl Emission Rates, 4th Quarter 2016

Run	Boiler Operating Load (MW, Gross)	Actual HCl Sample Volume (Liters)	HCl Emission Rate (Lb/mmBtu)	MATS Rule LEE Status HCl Limit (Lb/mmBtu)	MATS Rule Performance Test HCl Limit (Lb/mmBtu)
1 ²	275.0	223.5	1.24E-04	-	-
2 ²	275.6	250.7	1.14E-04	-	-
3	275.6	252.3	1.26E-04	-	-
4 ²	275.8	253.0	1.12E-04	-	-
Averages (Runs 2-4)	275.7	252.0	1.17E-04¹	1.0E-03	2.0E-03

¹ Demonstration of Unit 1 HCl LEE qualification status is based upon Runs 2, 3 and 4 results only, as the actual sample volume collected during Run 1 was potentially less than the minimum volume defined in the MATS Rule § 63.10005(h)(2)(i).

² HCl lb/mmBtu emission rates for Runs 1, 2 and 4 are based upon the laboratory reported quantitation limit (QL), as the HCl concentrations were “not detected” or below the QL for these runs.

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1.0 INTRODUCTION

Consumers Energy Company (Consumers Energy) Regulatory Compliance Testing Section (RCTS) conducted hydrogen chloride (HCl) testing at the single dedicated exhaust location of coal-fired boiler EUBOILER1 (Unit 1), an electric utility steam generating unit (EGU) operating at the J.H. Campbell Generating Station in West Olive, Michigan. The test event followed requirements in the United States Environmental Protection Agency (U.S. EPA) Title 40, Code of Federal Regulations (CFR) Part 63, Subpart UUUUU – National Emission Standards for Hazardous Air Pollutants: Coal- and Oil-fired Electric Utility Steam Generating Units, aka the Mercury Air Toxics Standard (MATS) Rule. Applicable MATS Rule criteria are also incorporated into the Michigan Department of Environmental Quality (MDEQ) facility specific Renewable Operating Permit (ROP) MI-ROP-B2835-2013a.

This 4th quarter 2016 test was performed to satisfy MATS quarterly HCl test requirements in § 63.10006(d) Testing was used to demonstrate compliance with the 2.0E-03 HCl lb/mmBtu limit in MATS Table 2, § 2b, and to verify Unit 1 HCl emissions were less than 50 percent of the 2.0E-03 lb/mmBtu limit, thereby qualifying as a Low Emitting EGU (LEE) as specified in § 63.1005(h)(2)(i) and also as demonstrated during the initial Unit 1 test on July 16, 2016.

Steam created by Unit 1 turns a turbine associated with an electricity producing generator with an output capacity rating of 274 gross megawatt (MWg). During this HCl test event, Unit 1 operated within the maximum normal operating load requirement of *between 90 and 110 percent of design capacity (or other condition if more representative of site specific normal operations)* as described in the MATS Rule, § 63.10007(2).

Four HCl runs were conducted on November 9, 2016 following procedures in U. S. EPA Reference Methods (RM) 3A, 19, and 26 in 40 CFR 60, Appendix A, and the MATS Rule, Table 5—*Performance Testing Requirements*. The fourth HCl run was added because the actual sample volume collected during Run 1 was potentially less than the minimum volume defined in the MATS Rule § 63.1005(h)(2)(i) which states: *When conducting emissions testing to demonstrate LEE status, you must increase the minimum sample volume specified in Table 1 or 2 nominally by a factor of two.* The MATS Rule RM 26 work practice standard in Table 2, *Emission Limits for Existing EGU's* requires a minimum sample volume of 120 liters, based on typical in-stack RM 26 HCl detection limits. As such, increasing the minimum sample volume nominally by a factor of two (240 liters) is theoretically necessary to demonstrate the Unit emission rate is less than 50 percent of the 2.0E-03 lb/mmBtu HCl MATS Rule emission limit in the event that the sample analysis is non-detect. Therefore, Run 1 HCl results are included in

this document for informational purposes only, and demonstration of Unit 1 HCl LEE status is based entirely upon Runs 2, 3 and 4 results.

1.1 CONTACT INFORMATION

Figure 1-1 presents the test program organization, major lines of communication, and names of responsible individuals and Table 2-1 presents contact information for these individuals.

Figure 1-1. Test Program Organization

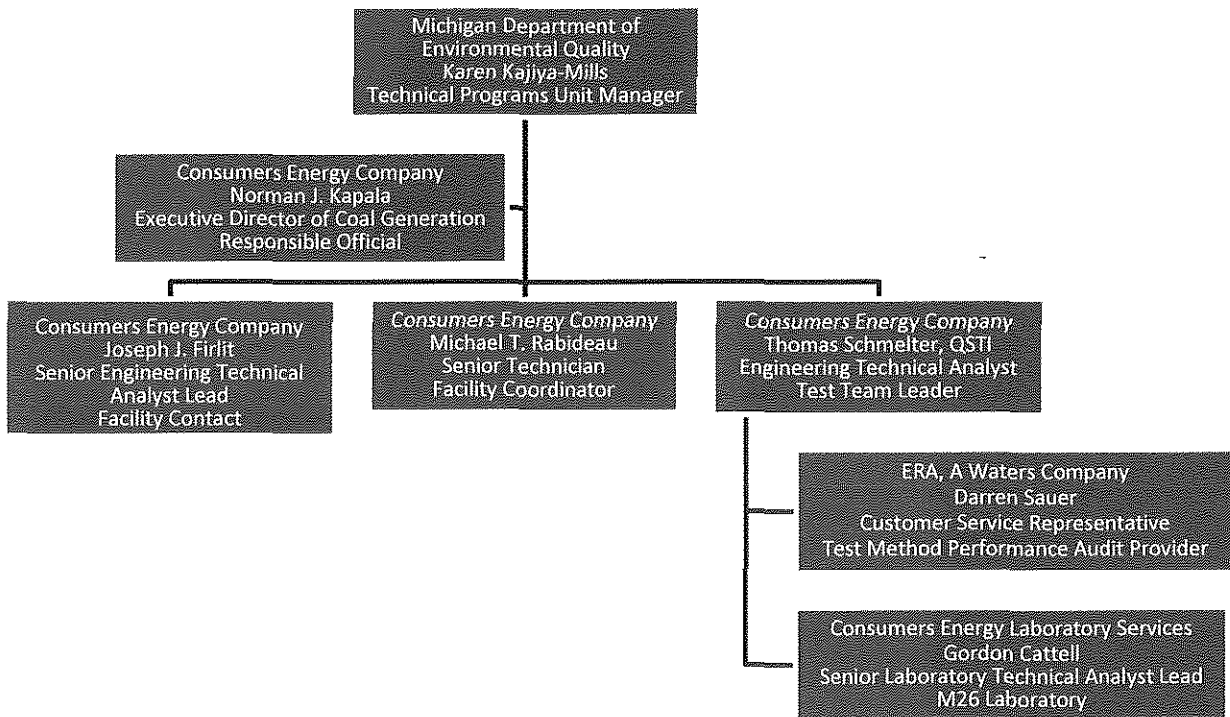


Table 1-1
Contact Information

Program Role	Contact	Address
Regulatory Agency Representative	Ms. Karen Kajiya-Mills Technical Programs Unit Manager 517-335-4874 kajiya-millsk@michigan.gov	Michigan Department of Environmental Quality Technical Programs Unit 525 W. Allegan, Constitution Hall, 2 nd Floor S Lansing, Michigan 48933
Responsible Official	Mr. Norman J. Kapala 616-738-3200 Executive Director of Coal Generation Norman.Kapala@cmsenergy.com	Consumers Energy Company J. H. Campbell Power Plant 17000 Croswell Street West Olive, Michigan 49460
Test Facility	Mr. Joseph J. Firlit 616-738-3260 Sr. Engineering Tech Analyst Lead Joseph.Firlit@cmsenergy.com	Consumers Energy Company J. H. Campbell Power Plant 17000 Croswell Street West Olive, Michigan 49460
Test Facility	Mr. Michael T. Rabideau 616-738-3273 Senior Technician Michael.Rabideau@cmsenergy.com	Consumers Energy Company J. H. Campbell Power Plant 17000 Croswell Street West Olive, Michigan 49460
Test Team Representative	Mr. Thomas Schmelter, QSTI 616-738-3334 Engineering Technical Analyst Thomas.Schmelter@cmsenergy.com	Consumers Energy Company L&D Training Center 17010 Croswell Street West Olive, Michigan 49460
Laboratory	Mr. Gordon Cattell 517-788-2334 Senior Laboratory Technical Analyst Lead Gordon.Cattell@cmsenergy.com	Consumers Energy Company Laboratory Services 135 W Trail Street Jackson, MI 49201
Test Method Performance Audit Provider	Mr. Darren Sauer 303-463-3515 Customer Service Representative dsauer@eraqc.com	ERA, A Waters Company 16341 Table Mountain Parkway Golden CO 80403

2.0 SUMMARY OF RESULTS

2.1 OPERATING DATA

Unit 1 is a dry bottom, tangential-fired boiler with a nominal heat input capacity rating of 2,490 mmBtu/hr, generating approximately 274 MWg electricity output. The average gross load across Runs 2 – 4 was approximately 276 MWg (100.7% of design capacity). Thus, unit operation during the HCl testing was at maximum representative normal operating load conditions of between 90 and 110 percent of design capacity. Refer to Appendix D for detailed operating data.

2.2 APPLICABLE PERMIT INFORMATION

The J.H. Campbell Generating Station, State of Michigan Registration Number (SRN) B2835, operates in accordance with Renewable Operating Permit (ROP) Number MI-ROP-B2835-2013a, in which EUBOILER1 is identified as an emission unit. The applicable Unit 1 MATS Rule requirements are described in the ROP under *EUBOILER1 Emission Unit Conditions, § IX, Other Requirement(s)*. The J.H. Campbell facility is also associated with the comprehensive EPA Facility Registry Service (FRS) database, FRS number 110000411108.

2.3 RESULTS

The Unit 1 individual and 3-run average HCl results shown in Table 2-1 are below the MATS limit of 2.0E-03 lb/mmBtu and also qualify for LEE Status for the 2nd consecutive calendar quarter. Please note that lb/mmBtu emission rates for Runs 1, 2 and 4 are based upon the laboratory reported quantitation limit (QL), as the reported HCl concentrations were “not detected” or below the QL and thus actual HCl concentrations were less. The HCl Results Summary table at the end of this report and the Laboratory data in Appendix B contain additional comprehensive details. Example calculations and calculation data sheets are presented in Appendices A and B.

Table 2-1
Summary of Unit 1 Hydrogen Chloride Emission Rates

Run	HCl Emission Rate (Lb/mmBtu)	MATS Rule LEE Status HCl Limit (Lb/mmBtu)	MATS Rule Performance Test HCl Limit (Lb/mmBtu)
1 ²	1.24E-04	-	-
2 ²	1.14E-04	-	-
3	1.26E-04	-	-
4 ²	1.12E-04	-	-
Averages (Runs 2-4)	1.17E-04¹	1.0E-03	2.0E-03

¹ Demonstration of Unit 1 LEE qualification status is based upon Runs 2, 3 and 4 results only, as the actual sample volume collected during Run 1 was potentially less than the minimum volume defined in the MATS Rule § 63.10005(h)(2)(i).

² HCl concentrations from Runs 1, 2 and 4 were reported as “not detected” or below the quantitation limit (QL) by the laboratory. The QL was therefore used to calculate Lb/mmBtu emission rates for the applicable runs.

3.0 SOURCE DESCRIPTION

The approximate 274 megawatt (MW) gross output Unit 1 EGU is a coal-fired boiler that generates steam to turn a turbine connected to an electricity producing generator.

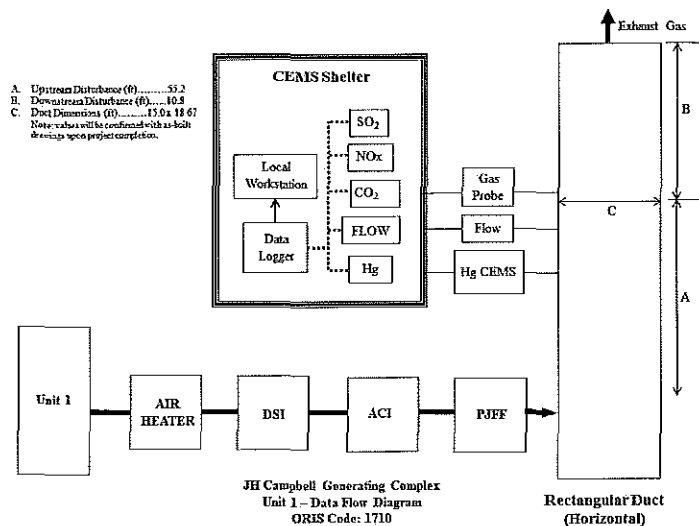
3.1 PROCESS

Unit 1 is a dry bottom tangentially-fired boiler constructed in 1958 which first began providing electricity in 1962. Its source classification code (SCC) is 10100226. Pulverized sub-bituminous coal is the primary fuel and oil is an ignition/flame stabilization fuel. Coal is fired in the furnace where combustion heats boiler tubes containing water, thus producing steam used to turn a steam turbine connected to an electricity producing generator. The electricity is routed through the transmission and distribution system to consumers.

3.2 PROCESS FLOW

Flue gas generated from coal combustion is controlled by multiple pollution control devices, including low nitrogen oxides (NO_x) burners and over fire air (OFA) for NO_x control, an activated carbon injection (ACI) system for mercury (Hg) reduction, a dry sorbent (lime) injection (DSI) system for control of sulfur dioxides (SO₂) and other acid gasses, and a pulse jet fabric filter (PJFF) baghouse to control particulate matter emissions. Clean flue gas is eventually exhausted to atmosphere through an approximately 400-foot high stack, which is shared with EUBOILER2. During the initial performance test, the hydrated lime sorbent was injected prior to the air heater. During this test event, the lance location was moved to the air heater outlet, as shown in Figure 3.1.

Figure 3-1. Unit 1 Process Flow Diagram



Note that all pollution control devices were operating during the HCl test event; however delays during a DSI Silo change-over caused the injection rate to stop from 13:23 to 13:40 and from 15:01 to 15:35; and contributed to reduced injection levels from 13:40 to 14:48.

3.3 PROCESS INSTRUMENTATION

The process was continuously monitored by boiler operators and environmental technicians. Due to the various instrumentation systems, the sampling times were correlated to instrumentation times. The control equipment process instrumentation is recorded on Eastern Daylight Time (EDT), whereas the continuous emissions monitoring systems records data on Eastern Standard Time (EST). As Daylight Savings Time ended on November 6, 2016, there was no time offset between the CEMS time and RM/process data times. Refer to Appendix D for detailed operating data.

4.0 SAMPLING AND ANALYTICAL PROCEDURES

Consumers Energy tested for HCl using the U.S. EPA Reference Methods in Table 4-1. The sampling and analytical procedures associated with each are described in the following sections.

**Table 4-1
 Test Methods**

Parameter	U.S. EPA	
	Method	Title
Molecular Weight	3A	<i>Determination of Oxygen and Carbon Dioxide Concentrations in Emissions from Stationary Sources (Instrumental Analyzer Procedure)</i>
Pollutant Emission Rate	19	<i>Determination of Sulfur Dioxide Removal Efficiency and Particulate Matter, Sulfur Dioxide, and Nitrogen Oxide Emission Rates</i>
Hydrogen Chloride	26	<i>Determination of Hydrogen Chloride Emissions from Stationary Sources</i>

In addition, the MATS Rule requires test method performance audit (PA) samples (if available) for each test method employed for regulatory compliance purposes as described in 40 CFR Part 63.7(c)(2)(iii). The PA samples consist of blind audit samples, as supplied by an accredited audit sample provider (AASP), which are analyzed during the performance test in order to provide a measure of test data bias. After determining the approximate HCl concentration needed using The NELAC Institute (TNI) Stationary Source Audit Sample (SSAS) Program audit sample calculation tool, the HCl PA was requested from Environmental Resource Associates (ERA) and obtained prior to the test event.

4.1 DESCRIPTION OF SAMPLE APPARATUS AND FIELD PROCEDURES

The test matrix presented in Table 4-2 summarizes the sampling and analytical methods performed for the specified parameters during this test program.

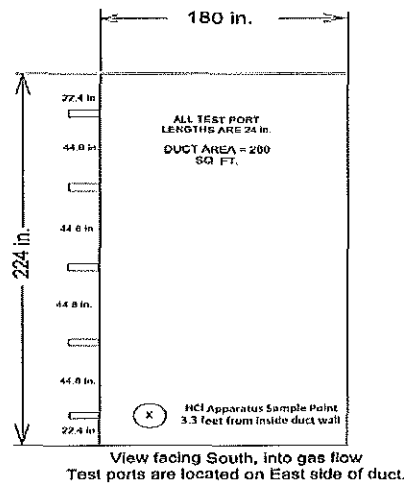
**Table 4-2
 Test Matrix**

No. of Runs	Sample/Type Pollutant	Test Method	Test Organization	Run Time (minutes)	Analytical Method	Analytical Laboratory
4	O ₂ and CO ₂	M3A	CE	120 (Run 1) & 135	Instrumental	NA
4	Pollutant Emission Rate	M19	CE	-	Stoichiometric	NA
4	Hydrogen Chloride	M26	CE	120 (Run 1) & 135	Ion Chromatography	CE; Laboratory Services

4.1.1 Sample Location and Traverse Points

Method 26 is a non-isokinetic integrated method drawing gas from a single (vs. multiple) sample point within the duct or stack. MATS HCl lb/mmBtu emission rates are calculated using stoichiometric Method 19. Therefore, exhaust gas velocity and temperature data are not required, and moisture content data are not required when the pollutant and diluent concentrations are measured on a consistent moisture basis. The sample apparatus was positioned at the fifth of five eastern-facing, vertically oriented sample ports. During each HCl run, the sample was drawn from a single point located *no closer to the walls than 1.0 m (3.3 ft)*, within the Unit 1 common exhaust duct as described in 40 CFR 60, Method 3, Section 8.1.1. A drawing of the Unit 1 exhaust duct and existing test port locations is shown in Figure 4-1.

Figure 4-1. Unit 1 Outlet Duct Test Port Detail



4.1.2 Velocity and Temperature

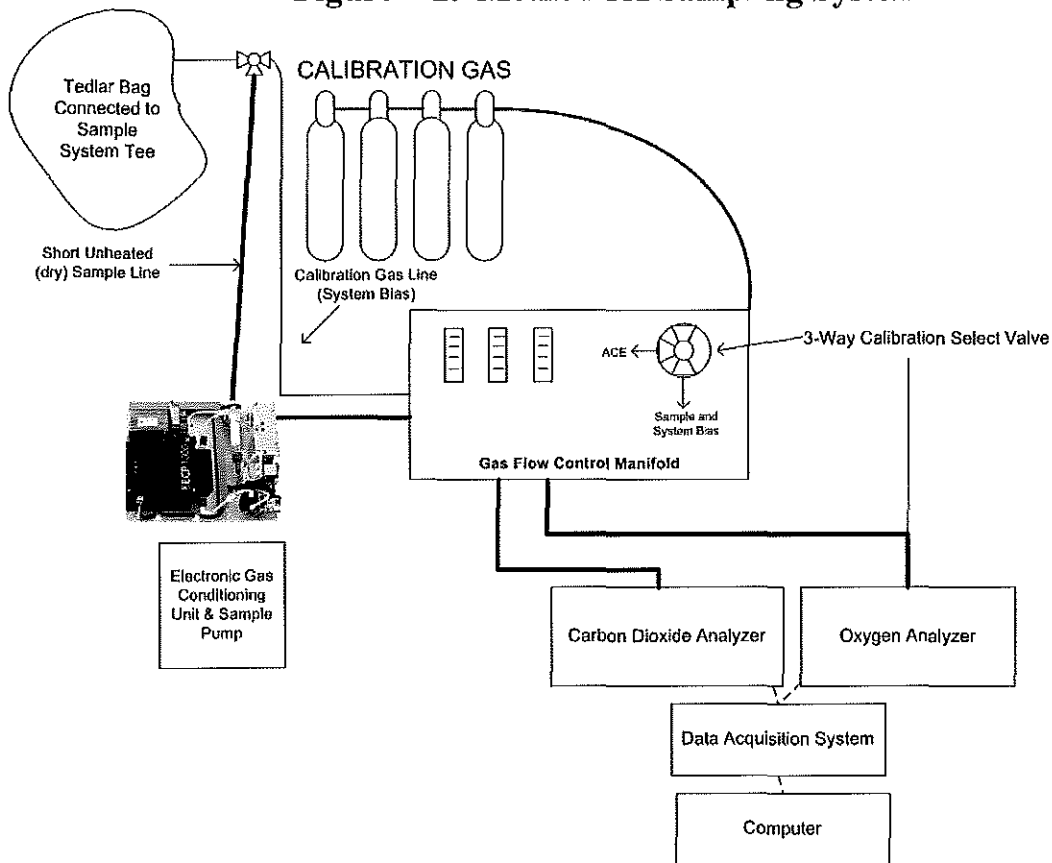
MATS HCl lb/mmBtu emission rates are calculated using stoichiometric Method 19 and does not require exhaust gas velocity and temperature measurements; therefore, a velocity and temperature profile measurement was not performed.

4.1.3 Molecular Weight

The exhaust gas composition and molecular weight was measured using the sampling and analytical procedures of EPA Method 3A, *Determination of Oxygen and Carbon Dioxide Concentrations in Emissions from Stationary Sources (Instrumental Analyzer Procedure)*.

Flue gas was extracted from the stack through a stainless steel lined probe and Teflon® sample line into a flexible Tedlar sample bag. The gas sample was then drawn from the flexible bag into a gas conditioning system to remove water vapor and particulate and conveyed into paramagnetic and infrared gas analyzers that measured the oxygen and carbon dioxide concentrations. Figure 4-2 depicts the Method 3A sampling system.

Figure 4-2. Method 3A Sampling System



Prior to sampling flue gas, the analyzers were calibrated by performing a calibration error test where zero-, mid-, and high-level calibration gases are introduced to the back of the analyzers. The calibration error check was performed to evaluate if the analyzers response was within $\pm 2.0\%$ of the calibration gas span. A system-bias and drift test was performed where the zero- and mid- or high- calibration gases are introduced at the inlet to the gas conditioner/sample delivery system to measure the ability of the system to respond to within ± 5.0 percent of span.

At the conclusion of each test run, an additional system bias check was performed to evaluate the drift from the pre- and post-test system bias checks. The system-bias checks evaluated if the analyzers drift was within the allowable criterion of $\pm 3.0\%$ of span from pre- to post-test system bias checks. The measured O₂ and CO₂ concentrations were corrected for analyzer drift. Refer to Appendix E for analyzer calibration supporting documentation.

4.1.4 Moisture Content

MATS HCl lb/mmBtu emission rates calculated using stoichiometric Method 19 do not require exhaust gas moisture content measurements; therefore this measurement was not performed.

4.1.5 Emission Rates (U.S. EPA Method 19)

EPA Method 19, *Determination of Sulfur Dioxide Removal Efficiency and Particulate Matter, Sulfur Dioxide, and Nitrogen Oxide Emission Rates* was used to calculate HCl lb/mmBtu emission rates using carbon dioxide concentrations and F factors (ratios of combustion gas volumes to heat inputs) to calculate emission rates using equation 19-6 from Method 19:

Figure 4-3. U.S. EPA Method 19, Equation 19-6

$$E = C_d F_c \frac{100}{(\%CO_{2d})}$$

Where:

- E = Pollutant emission rate (lb/mmBtu)
- C_d = Pollutant concentration, dry basis (lb/dscf)
- F_c = Volumes of combustion components per unit of heat content (scf/mmBtu)
1,840 scf/mmBtu for subbituminous coal
- %CO_{2d} = Concentration of carbon dioxide on a dry basis (% , dry)

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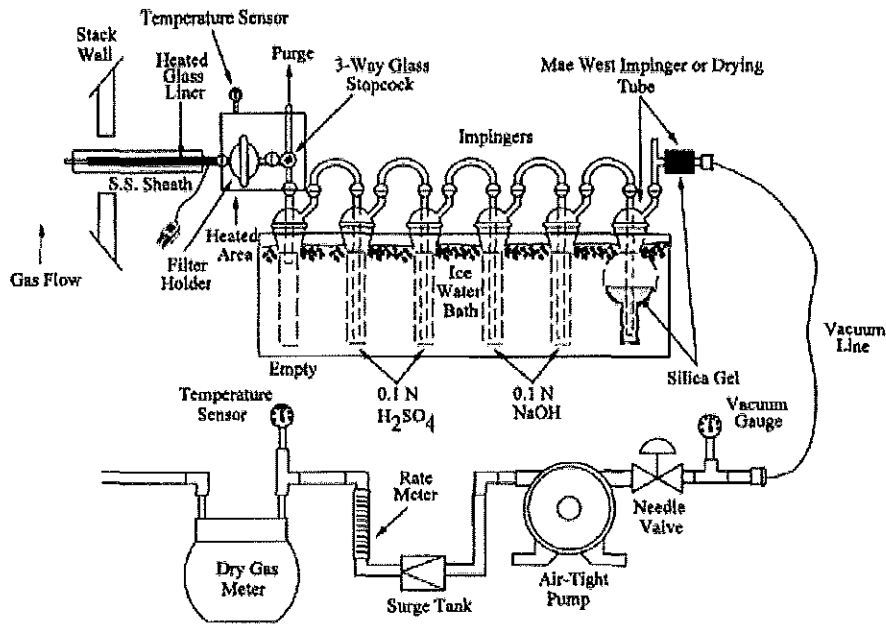
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Refer to Appendix A for example calculations.

4.1.6 Hydrogen Chloride

HCl was measured by collecting an integrated sample of the flue gas following the procedures of U.S. EPA Method 26, *Determination of Hydrogen Halide and Halogen Emissions from Stationary Sources*. Triplicate 120 to 135-minute test runs were performed at the EUBOILER1 sampling location by passing flue gas through a heated glass-lined probe, Teflon filter, and into a series of absorbing solutions. The filter collects particulate matter and halide salts, and the acidic and alkaline absorbing solutions collect the gaseous hydrogen halides (HCl) and halogens, respectively. Figure 4-4 depicts the EPA Method 26 sample apparatus.

Figure 4-4. U.S. EPA Method 26 Sample Apparatus



After charging the impingers, assembling the apparatus, and completing a leak check, the sample probe is inserted into the sampling port and ice is placed around the impingers. After the probe and filter achieve temperatures between 248°F and 273°F, the 3-way stopcock is rotated to purge position and the probe and filter are purged with exhaust gas at a rate of 2 liters per minute for 5 minutes. The 3-way stopcock is then rotated to sample position and sampling starts. During each run, probe and filter temperatures are maintained and dry gas meter (DGM) volume, impinger outlet temperature and sample apparatus vacuum are documented. After the minimum 240 liter MATS LEE sample volume requirement is met, the sample apparatus is withdrawn from the sample port and leak checked.

The sample probe, filter and impinger apparatus are then disassociated and transported to the recovery area where the filter is removed from the filter housing and discarded. The probe liner and front half of the filter housing are rinsed with deionized water to remove particulate matter and the rinsate is discarded. The acidic and alkaline impinger contents are transferred to separate, labeled, amber glass sample containers and the impingers are triple rinsed with DI water with the rinsate captured in the appropriate sample container.

The sample, reagent and DI water blank collection time, date and analysis parameters required were noted on a laboratory chain of custody throughout the test event, as were the PA sample and paper work provided by the AASP. Upon completion of the test event, the PA was packaged and shipped with the collected sample fractions via courier to the Consumers Energy Laboratory Services facility in Jackson Michigan, along with instructions that only the 0.1N H₂SO₄ related samples were to be analyzed for HCl; the 0.1N NaOH related samples were to be held pending further instruction. As only HCl was of interest for this test program, the alkaline samples were not analyzed. At the laboratory, the same analyst conducting the HCl sample analysis performed the PA sample analysis, using the same analytical reagents and analytical system, at the same time as the compliance samples.

Following QA verification, the laboratory submitted PA value successfully met the ± 10% fixed acceptance limit criteria for the specific HCl audit concentration requested for the Unit 1 test event. The reported and assigned HCl value is presented in the following table, along with the allowable acceptance limits.

TABLE 4-3
Stationary Source Audit Program Test Method Performance Audit Results

TNI Analyte Code	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation
1770	Hydrogen Chloride	mg/L	8.69	8.44	7.60 – 9.28	Acceptable

5.0 TEST RESULTS AND DISCUSSION

This 4th quarter 2016 test event satisfies the MATS quarterly test requirement in § 63.10006(1). Testing was used to demonstrate compliance with the 2.0E-03 HCl lb/mmBtu limit in MATS Table 2, § 2b, and to verify Unit 1 HCl emissions were less than 50 percent of the 2.0E-03 lb/mmBtu limit, thereby qualifying the unit as a Low Emitting EGU (LEE) as specified in § 63.10005(h)(1)(i). As the initial Unit 1 HCl test in the 3rd quarter of 2016 on July 16, 2016 also

achieved LEE criteria, this 4th quarter event represents the second consecutive quarterly MATS test demonstrating LEE eligibility.

As previously discussed, a fourth HCl run was conducted because the actual sample volume collected during Run 1 was potentially less than the minimum volume defined in the MATS Rule § 63.10005(h)(2)(i) which states: *When conducting emissions testing to demonstrate LEE status, you must increase the minimum sample volume specified in Table 1 or 2 nominally by a factor of two.* The MATS Rule RM 26 work practice standard in Table 2, *Emission Limits for Existing EGU's* requires a minimum sample volume of 120 liters, based on typical in-stack RM 26 HCl detection limits. As such, increasing the minimum sample volume nominally by a factor of two (240 liters) is theoretically necessary to demonstrate the Unit emission rate is less than 50 percent of the 2.0E-03 lb/mmBtu HCl MATS Rule emission limit in the event that the sample analysis is non-detect. Therefore, Run 1 HCl results have been included in this document for informational purposes only, and demonstration of Unit 1 HCl LEE status has been shown using Runs 2, 3 and 4 results only.

5.1 VARIATIONS AND UPSET CONDITIONS

One item of note specific to sampling procedure variation was an elevated Method 26 probe temperature. The average probe temperature across the four runs was between 280 and 309°F, which is higher than the desired $\geq 248^\circ\text{F}$ and $\leq 273^\circ\text{F}$. Attempts to remedy the elevated temperature were unsuccessful and RCTS believes exhaust gas temperature and exhaust duct static pressure were primary influencing factors as the probe temperature was always within the required temperature window until the probe was inserted into the duct prior to the start of each run, after which the increase was observed.

Despite the elevated probe temperatures, the average filter temperatures during each run remained within the desired $\geq 248^\circ\text{F}$ and $\leq 273^\circ\text{F}$ range (average filter temperatures were approximately 265°F).

To help assess the potential effect of the elevated probe temperatures upon the test results, RCTS reviewed the EPA's Emissions Measurement Center Guideline Document 34 (GD-34), the background paper for Methods 26 and 26A. On Page 2 of 3 under the heading *Discussion of Implementation Problems or Issues – HCl*, the EPA emphasizes that it is critical to maintain the probe/filter temperature above 250°F in order to ensure proper transmission of HCl through the sampling train in the presence of moisture (to prevent a low bias in the measurement).

GD-34 further discusses the concept that volatile halide salts such as NH_4Cl could also introduce some level of bias, as the compound disassociates into NH_3 and HCl at higher temperatures, and could also pass through the filter in a gaseous state and then be captured in the 0.1 N H_2SO_4 impinger solution. Either of the preceding phenomena would tend to result in a positive bias in the reported HCl concentration.

Thus, based upon a review of GD-34, RCTS believes that the elevated probe temperature observed during the HCl testing did not result in a negative bias in the test results. To the extent that NH_4Cl was present in the flue gases, the elevated probe temperature could have resulted in a slight positive bias in the HCl result. However, the substantial compliance margin with the MATS HCl emission limit of $2.0\text{E-}03$ lb/mmBtu makes any slight positive biases irrelevant in regards to the overall compliance determination.

No other results affecting boiler operating condition variations were encountered during the test program. The process and control equipment operated under routine conditions and no upsets were encountered.

5.2 AIR POLLUTION CONTROL DEVICE MAINTENANCE

Optimization of the air pollution control devices is a continuous process to ensure compliance with regulatory emission limits. Note that during the initial performance test, the hydrated lime sorbent was injected prior to the air heater, however during this test event the lance location was moved to the air heater outlet, as shown previously in Figure 3.1. Other than normal control device optimization and operating requirements, no significant pollution control device maintenance occurred during the three months prior to the test.

5.3 QUALITY CONTROL PROCEDURES

The EPA reference methods performed state reliable results are obtained by persons equipped with a thorough knowledge of the techniques associated with each method. To that end, factors with the potential to cause measurement errors are minimized by implementing quality control (QC) and assurance (QA) programs into the applicable components of field testing. QA/QC components are included in this test program.

5.3.1 QC Checklists and Control Limits

A summary of primary QC checks and control limits are provided in Table 5-1.

Table 5-1
QC Procedures

QC Specification	Purpose	Procedure	Frequency	Acceptance Criteria
M1: Sampling Location	Evaluate if sampling location is suitable for sampling	Measure distance from ports to downstream and upstream disturbance	Pre-test	≤ 2 diameters downstream; ≤ 0.5 diameter upstream.
M1: Duct diameter	Verify area of stack is accurately measured	Review as-built drawings and field measurement	Pre-test	Field measurement agreement with as-built drawings
M3A: Calibration gas standards	Ensure accurate calibration standards	Calibration gas traceability protocol	Pre-test	Calibration gas uncertainty $\leq 2.0\%$
M3A: Calibration Error	Evaluates operation of analyzers	Calibration gases introduced directly	Pre-test	$\pm 2\%$ of the calibration span
M3A: System Bias and Analyzer Drift	Evaluates sample system stack gas delivery integrity	Cal gas introduced into sample system	Pre-test and Post-test	$\pm 5\%$ of span for bias and $\pm 3\%$ of span for drift
M3: Single point grab sample	Ensure representative sample collection	Insert probe into stack and purge sample system	Pre-test	Collect sample no closer to stack walls than 1.0 meter
M26: Apparatus Temperature within $\geq 248^\circ\text{F}$ and $\leq 273^\circ\text{F}$	Ensures purge of acid gases in glass probe liner and Teflon filter	Set probe & filter controller to $\geq 248^\circ\text{F}$	Verify prior to and during each run	Apparatus temperature must be $\geq 248^\circ\text{F}$ and $\leq 273^\circ\text{F}$
M26: sample rate	Ensure representative sample collection	Calculate rate based on volume collected	During and post-test	Target sample rate is ~ 2 liters/minute
M26: sample volume	Ensure sufficient sample volume is collected	Record pre- and post-test DGM volume reading	Post test	120 liters minimum requirement (~ 240 liters for purposes of LEE eligibility)
M26: post-test leak check	Evaluate if the collected sample was affected by leak	Cap sample train; monitor DGM	Pre-test optional, post-test mandatory	Leak rate $\leq 2\%$ of the average sample rate
M26: post-test meter audit	Evaluates DGM volume accuracy	Compare DGM pre- and post-test Y_d	Post-test	$\pm 5\%$

5.3.2 Dry Gas Meter QA/QC Checks

The average post-test calibration factor differed from the initial calibration factor by less than 5%, so another initial calibration of the dry gas meter was not conducted and the initial calibration factor was utilized. Refer to Appendix E for complete DGM calibrations.

5.3.3 Thermocouple QA/QC Checks


Thermocouple temperature calibrations were conducted following *Alternative Method 2 Thermocouple Calibration Procedure ALT-011*. ALT-011 describes the inherent accuracy and precision of the thermocouple within $\pm 1.3^{\circ}\text{F}$ in the range of -32°F and 2500°F and states that a system that performs accurately at one temperature is expected to behave similarly at other temperatures. Therefore, the two-point calibration described in Method 2 may be replaced with a single point calibration procedure that verifies the thermocouple and reference thermometers shall agree to within $\pm 2.0^{\circ}\text{F}$, while taking into account the presence of disconnected wire junctions, other loose connections or a potential miscalibrated temperature display. Thermocouple calibration data is presented with the Dry Gas Meter Calibration Data in Appendix E of this report.

5.3.4 Oxygen and Carbon Dioxide Analyzer Calibration Gases

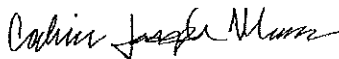
The Method 3A sampling apparatus described in Section 4.1.3 was audited for measurement accuracy and data reliability using NIST traceable calibration gas cylinders containing the species of interest at appropriate concentrations. To the extent practical, the high level calibration gas (and resulting calibration span) was selected such that the majority of the readings fell within 20% to 80% of the calibration span. The low-level and mid-level calibration gases were selected such that the certified gas concentrations were within 0-20% and 40-60% of the calibration span, respectively. The required analyzer QA tests including the analyzer calibration error, bias and drift checks were conducted and passed and the run average concentrations were drift corrected. The instrument QA/QC calibration error, drift and system bias information is contained in Appendix E.

CERTIFICATION

I hereby certify the statements and information in this test report and supporting enclosures are true, accurate, and complete, and the test program was performed in accordance with test methods specified in this report.

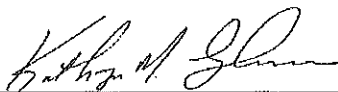


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Table

JH Campbell Generation Station
SUMMARY OF EUBOILERI HCl RESULTS
November 9, 2016

RUN No.	Test Location	O ₂ , Percent, Dry	CO ₂ , Percent, Dry	Hydrogen Chloride Concentration, (mg ²)	Hydrogen Chloride Concentration, (ppm)	Hydrogen Chloride Emission Rate, (lb/mmBtu)	MATS Rule HCl Limit, (lb/mmBtu)	Unit Operating Load (MW)	Unit Fuel Factor (Btu/scfh)
1 ¹	Unit 1 Exhaust Duct	7.14	12.66	0.0312	0.09	1.24E-04	2.00E-03	276.0	1,840
2	Unit 1 Exhaust Duct	7.33	12.43	0.0312	0.08	1.14E-04	2.00E-03	276.0	1,840
3	Unit 1 Exhaust Duct	6.99	12.66	0.0355	0.09	1.26E-04	2.00E-03	276.0	1,840
4	Unit 1 Exhaust Duct	7.17	12.51	0.0312	0.08	1.12E-04	2.00E-03	276.0	1,840
	Averages (Runs 2-4)	7.16	12.53	0.0326	0.08	1.17E-04		276.0	1,840

¹ The Run 1 sample volume may not have achieved the minimum sample volume nominal factor of 2 increase, as described in the MATS Rule, Table 2, Footnote 1; therefore, the HCl lb/mmBtu emission rate is based upon Runs 2 - 4.

² The milligram HCl concentrations for runs 1, 2 and 4 were not detected at the laboratory quantitation limit. Therefore, HCl emission rates are calculated based upon either the laboratory reported quantitation limit or, in the case of Run 3, the actual concentration.