Consumers Energy

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PM and HCl
40 CFR 63, Subpart UUUUU
Test Report

EUBOILER2

Consumers Energy Company
J.H. Campbell Plant
17000 Croswell Street
West Olive, Michigan 49460
SRN: B2835
FRS: 110000411108

July 12, 2022

Test Date: May 16, 2022

Test performed by the Consumers Energy Company
Regulatory Compliance Testing Section
Air Emissions Testing Body
Laboratory Services Department
Work Order No. 39546442
Version No.: 0

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EXECUTIVE SUMMARY

Consumers Energy Regulatory Compliance Testing Section (RCTS) conducted both filterable particulate matter (PM) and hydrogen chloride (HCl) testing at the exhaust of EUBOILER2 (Unit 2). Unit 2 is a coal fired boiler and an electric utility steam generating unit (EGU), which generates steam to turn a turbine and generate electricity at the J.H. Campbell Generating Station in West Olive, Michigan.

The test program was performed on May 16, 2022 to satisfy the Low Emitting Unit (LEE) subsequent (every three year) performance test requirements found in 40 CFR 63, Subpart UUUUU, *National Emission Standards for Hazardous Air Pollutants: Coal- and Oil-Fired Electric Utility Steam Generating Units* (Mercury and Air Toxics Rule (MATS), Section 63.100006(b), and Table 5, as incorporated in the Michigan Department of Environment, Great Lakes, and Energy (EGLE) Renewable Operating Permit (ROP) MI-ROP-B2835-2020b. The PM and HCl results in this report are also used to determine ongoing compliance with the applicable MATS emission limits, MATS LEE thresholds, and the two non-MATS ROP PM emission limits.

Triplicate PM and HCl test runs were conducted following the procedures in United States Environmental Protection Agency (USEPA) Reference Methods (RM) 1, 2, 3A, 4, 5, 19, and 26A in 40 CFR 60, Appendix A. During testing, Unit 2 was operated while firing 100% western coal and within the maximum normal operating load requirement range of 90 and 110 percent of design capacity as specified in 40 CFR §63.10007(2). There were no deviations from the approved stack test protocol or the USEPA Reference Methods therein. The Unit 2 PM and HCl results are summarized in the following table.

Table E-1
Summary of JHC EUBOILER2 Test Results

Parameter	Units	Three Run Result Average	Emission Limit		
			MATS	MATS LEE[1]	Non-MATS ROP[2]
PM	lb/mmBtu	**0.0011**	**0.030**	**0.015**	**0.015**
HCl	lb/mmBtu	**0.00005**	**0.0020**	**0.0010**	
PM	lb/1,000 lb exhaust gas @ 50% EA	**0.0009**			**0.15**

[1] Applicable qualifying PM and HCl emission limits for low emitting EGU (LEE) status
[2] Applicable qualifying Non-MATS ROP PM emission limit

The Unit 2 PM and HCl test results indicate the boiler emissions comply with the applicable MATS regulation limits found in ROP special condition (SC) FGMATS I. 1. and 2., and the MATS low emitting EGU (LEE) thresholds found in ROP SC FGMATS 4. The PM results also demonstrate compliance with the ROP Rule 331 PM emission limit of 0.15 lb/1,000 lb of exhaust gas, corrected to 50% excess air in ROP SC EUBOILER2 I.1. and the ROP PM emission limit of 0.015 lb/mmBtu in ROP SC EUBOILER2 I.5.

Detailed results are presented in Appendix Table 1. Sample calculations, field data sheets, and laboratory data are presented in Appendices A, B, and C. Boiler operating data and supporting documentation are provided in Appendices D and E.

1.0 INTRODUCTION

This report summarizes the results of compliance filterable particulate matter (PM) and hydrogen chloride (HCl) air emissions tests conducted May 16, 2022, on EUBOILER2 operating at the Consumers Energy J.H. Campbell Plant in West Olive, Michigan.

This document follows the EGLE format described in the November 2019, *Format for Submittal of Source Emission Test Plans and Reports*. Please exercise due care when reproducing portions of this report, as critical substantiating documentation and/or other information may be omitted or taken out of context.

1.1 IDENTIFICATION, LOCATION, AND DATES OF TESTS

Consumers Energy Regulatory Compliance Testing Section (RCTS) conducted PM and HCl tests at the dedicated exhaust of coal-fired boiler EUBOILER2 (Unit 2) operating at the J.H. Campbell Generating Station in West Olive, Michigan. A test protocol was submitted to EGLE on April 13, 2022. Ms. Lindsey Wells, EGLE Environmental Quality Analyst approved the protocol in her email dated May 10, 2022, stating that the *Testing will be performed in accordance with the standing approval issued by AQD (Tom Gasloli) on October 18, 2016, which remains valid, as no changes to the test methods and/or boiler operation were proposed. The approved test methods are 1, 2/CTM-041, 3/3A, 4, 5+26A, and 19. Please include copies of the site-specific test method approvals from EPA, referenced in page 17 of the protocol, in the test report package.* Copies of these EPA approvals are found in Appendix E of this report.

Furthermore, Ms. Wells stated that *AQD acknowledges that MI-ROP-B2835-2020b contains a new requirement to identify "targets for key operational parameters associated with air pollution control equipment to be monitored and recorded during testing" [FGMATS_U12 SCV.4], which are detailed on page 12 of the protocol.* Appendix D of this report contains the operating data in question.

1.2 PURPOSE OF TESTING

This test was performed on May 16, 2022, to satisfy the Low Emitting Unit (LEE) subsequent (every three year) performance test requirements described in 40 CFR 63, Subpart UUUUU, *National Emission Standards for Hazardous Air Pollutants: Coal- and Oil-Fired Electric Utility Steam Generating Units* (Mercury and Air Toxics Rule (MATS), Section 63.10006(b), Table 5, as incorporated in the EGLE ROP MI-ROP-B2835-2020b. The PM and HCl results in this report are also used to demonstrate ongoing compliance with the applicable MATS limits, MATS LEE thresholds described in Table 2, and Section 63.10005(h)(1)(i); and non-MATS ROP PM limits. The applicable emission limits are presented in Table 1-1.

Table 1-1
Applicable Emission Limits

Parameter	Units	Required Emission Limits		
		MATS Emission Limit	MATS LEE Emission Limit[1]	Non-MATS ROP Emission Limit
PM	lb/mmBtu	**0.030**	**0.015**	**0.015**
HCl	lb/mmBtu	**0.0020**	**0.0010**	
PM	lb/1,000 lb exhaust gas @ 50% EA			**0.15**

[1]Applicable qualifying PM and HCl emission limits for low emitting EGU (LEE) status

Qualifying for MATS LEE status requires demonstration of EGU emissions ≤50 percent of the 0.030 lb/mmBtu PM and 0.0020 lb/mmBtu HCl applicable standards in Table 2 of the MATS rule on a quarterly basis over a three-year period. Twelve consecutive quarterly test events demonstrating EUBOILER2 met the PM and HCl MATS LEE requirements were conducted starting in the third quarter of 2016 and ending in the first quarter of 2019.

1.3 Brief Description of Source

EUBOILER2 is a coal-fired EGU that operates as needed to provide electricity to the regional grid and Consumers Energy customers.

1.4 Contact Information

Table 1-2 presents the names, addresses, and telephone numbers of the contacts for information regarding the test and the test report, and names and affiliation of personnel involved in conducting the testing.

Table 1-2
Contact Information

Program Role	Contact	Address
Regulatory Agency Representative	Mr. Jeremy Howe Technical Programs Unit Supervisor 231-878-6687 Howej1@michigan.gov	EGLE Technical Programs Unit Cadillac District Office 120 West Chapin Street Cadillac, MI 49601-2158
Regulatory Agency Inspector	Ms. Kaitlyn DeVries Environmental Quality Analyst 616-558-0552 devriesk1@michigan.gov	EGLE Grand Rapids District Office 350 Ottawa Avenue NW; Unit 10 Grand Rapids, Michigan 49503
Responsible Official	Mr. Nathan J. Hoffman Plant Business Manager 616-738-5436 nathan.hoffman@cmsenergy.com	Consumers Energy Company J.H. Campbell Power Plant 17000 Croswell Street West Olive, Michigan 49460
Corporate Air Quality Contact	Mr. Michael Gruber II Sr. Engineer II 989-493-3363 michael.gruberii@cmsenergy.com	Consumers Energy Company Environmental Services Department 1945 West Parnall Road; P22-232 Jackson, Michigan 49201
Test Facility	Mr. Kevin Starken Sr. Engineer II 616-738-3241 kevin.starken@cmsenergy.com	Consumers Energy Company J.H. Campbell Power Plant 17000 Croswell Street West Olive, Michigan 49460
Test Facility	Mr. Roger Vargo Sr. Technician / Environmental 616-738-3270 roger.vargo@cmsenergy.com	Consumers Energy Company J.H. Campbell Power Plant 17000 Croswell Street West Olive, Michigan 49460
Test Team Representatives	Mr. Joe Mason, QSTI Sr. Engineering Technical Analyst 231-720-4856 Joe.mason@cmsenergy.com Mr. Joe Gallagher General Engineering Technical Analyst 517-788-2076 joseph.gallagher@cmsenergy.com	Consumers Energy Company L&D Training Center 7010 Croswell Street West Olive, Michigan 49460

2.0 SUMMARY OF RESULTS

2.1 OPERATING DATA

The boiler fired 100% western coal during the performance test and operated at a maximum normal load range of 299 gross megawatts (MWg), equating to 99.7% of the 300 MWg rated output. 40 CFR §63.10007(2) describes maximum normal operating load is generally between 90 and 110 percent of design capacity but should be representative of site-specific normal operations during each test run.

Refer to Attachment D for detailed operating data, which was recorded in Eastern Standard Time (EST). Note the time convention for the reference method (RM) testing and dry sorbent injection (DSI) rates were in Eastern Daylight Time (EDT).

2.2 APPLICABLE PERMIT INFORMATION

The J.H. Campbell generating station, State of Michigan Registration Number (SRN) B2835, operates in accordance with ROP MI-ROP-B2835-2020b, which incorporates State and Federal air regulations, including applicable MATS Rule requirements. The permit identifies EUBOILER2 as an emission unit with requirements and includes EUBOILER2 in two flexible groups designated FGBOILER12 and FGMATS_U12 with each flexible group containing additional requirements. The facility is also associated with Federal Registry Service (FRS) Id: 110000411108.

2.3 RESULTS

The Unit 2 PM and HCl test results indicate the boiler emissions comply with the applicable MATS regulation limits found in ROP special condition (SC) FGMATS I. 1. and 2., and the MATS low emitting EGU (LEE) thresholds found in ROP SC FGMATS 4. The PM results also demonstrate compliance with the ROP Rule 331 PM emission limit of 0.15 lb/1,000 lb of exhaust gas, corrected to 50% excess air in ROP SC EUBOILER2 I.1. and the ROP PM emission limit of 0.015 lb/mmBtu in ROP SC EUBOILER2 I.5. Refer to Table 2-1 for a summary of the PM and HCl test results.

Table 2-1
Summary of Test Results

Parameter	Units	Run			Average	Emission Limit		
		1	2	3		MATS	MATS LEE[1]	Non-MATS ROP[2]
PM	lb/mmBtu	0.0009	0.0011	0.0012	**0.0011**	**0.030**	**0.015**	**0.015**
HCl	lb/mmBtu	0.00005	0.00005	<0.00004	**0.00005**	**0.0020**	**0.0010**	
PM	lb/1,000 lb exhaust gas @ 50% EA	0.0008	0.0009	0.0010	**0.0009**			**0.15**

[1] Applicable qualifying PM and HCl emission limits for low emitting EGU (LEE) status
[2] Applicable qualifying Non-MATS ROP PM emission limit

Detailed results are presented in Appendix Table 1. A discussion of the results is presented in Section 5.0. Sample calculations, field data sheets, and laboratory results are presented

in Appendices A, B, and C. Boiler operating data and supporting information are provided in Appendices D and E.

3.0 SOURCE DESCRIPTION

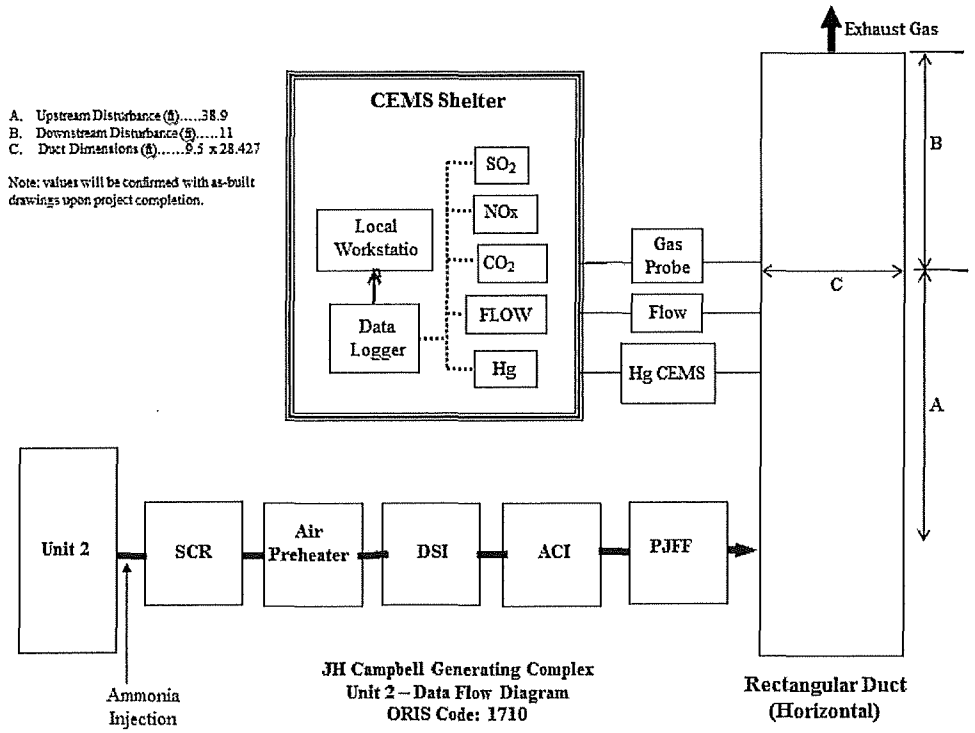
3.1 PROCESS

Unit 2 is a wall-fired boiler, classified as an existing unit under MATS, which combusts pulverized subbituminous coal as the primary fuel and oil as an ignition/flame stabilization fuel. The unit is also permitted to burn eastern coal blends. The source classification code (SCC) is 10100222. Coal is fired in the furnace where the combustion heats water within boiler tubes producing steam. The steam turns a turbine that is connected to an electricity producing generator. The electricity is routed through the transmission and distribution system to consumers.

3.2 PROCESS FLOW

The flue gas generated through coal combustion is controlled by multiple pollution control devices. The unit is currently equipped with low nitrogen oxides (NO_x) burners (LNB) and over fire air (OFA), a selective catalytic reduction (SCR) system for NO_x control, a dry sorbent (lime) injection (DSI) system for control of sulfur dioxides (SO_2) and other acid gasses, an activated carbon injection (ACI) system for mercury (Hg) reduction, and a pulse jet fabric filter (PJFF) baghouse to control PM emissions. Post control flue gas exhausts to atmosphere through an approximately 400-feet high stack shared with EUBOILER1. Refer to Figure 3-1 for the Unit 2 Data Flow Diagram.

Figure 3-1. Unit 2 Data Flow Diagram



3.3 Materials Processed

Unit 2 is classified as a coal-fired unit not firing low rank virgin coal as described in Table 2 to Subpart UUUUU. The unit fired 100% western coal for this compliance test, however the unit is also capable of firing blends of eastern and low-sulfur western coal.

3.4 Rated Capacity

Unit 2 has a nominal heat input capacity of 3,560 mmBtu/hr and a gross electrical output of approximately 378 MWg while firing a blend of eastern and western coal. Unit 2 is capable of firing 100% bituminous (eastern) coal, 100% subbituminous (western) coal, and various mixtures of the two coal types, however when firing only western coal, the unit is limited to approximately 300 MWg, and the nominal heat input rating is achievable only when firing at least 40% eastern coal with all coal mills operating. The boiler operates in a continuous manner to meet the electrical demands of Midcontinent Independent System Operator, Inc. (MISO) and Consumers Energy customers. EUBOILER2 is considered a baseload unit as it is designed to operate 24 hours a day, 365 days a year.

3.5 Process Instrumentation

The process was continuously monitored by boiler operators, environmental technicians, and data acquisition systems during testing. As shown in Appendix D, data for the following parameters were collected during each PM and HCl test run:

- CO_2 (Vol-%)
- Load (MWg)
- Opacity (%)
- Dry sorbent injection auger rate (%)

4.0 SAMPLING AND ANALYTICAL PROCEDURES

Tests for PM and HCl used the USEPA test methods presented in Table 4-1. The sampling and analytical procedures associated with each parameter are described further below.

Table 4-1
Test Methods

Parameter	Method	USEPA Title
Sample/Traverse Point Locations	1	Sample and Velocity Traverses for Stationary Sources
Flow Rate	2	Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S Pitot Tube)
Molecular Weight (O_2 and CO_2)	3A	Determination of Oxygen and Carbon Dioxide Concentrations in Emissions from Stationary Sources (Instrumental Analyzer Procedure)
Moisture Content	4	Determination of Moisture Content in Stack Gases
Filterable Particulate Matter	5	Determination of Particulate Matter Emissions from Stationary Sources
Emission Rates	19	Sulfur Dioxide Removal and Particulate, Sulfur Dioxide and Nitrogen Oxides from Electric Utility Steam Generators

Hydrogen Chloride	26A	Determination of Hydrogen Halide and Halogen Emissions from Stationary Sources Isokinetic Method

4.1 Description of Sampling Train 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

Date (2019)	Run	Sample Type	Start Time (EST)	Stop Time (EST)	Test Duration (min)	EPA Test Method	Comment
May 16	1	O_2/CO_2 Moisture PM HCl	8:55	11:18	125	1 3A 4 5 19 26A	Isokinetic sampling from 25 traverse points collected 3.335 dscm of sample volume to meet LEE minimums of 2 dscm (PM) and 1.5 dscm (HCl)
	2		11:49	14:11	125		Isokinetic sampling from 25 traverse points collected 3.680 dscm of sample volume to meet LEE minimums of 2 dscm (PM) and 1.5 dscm (HCl).
	3		14:34	16:54	125		Isokinetic sampling from 25 traverse points collected 3.566 dscm of sample volume to meet LEE minimums of 2 dscm (PM) and 1.5 dscm (HCl)

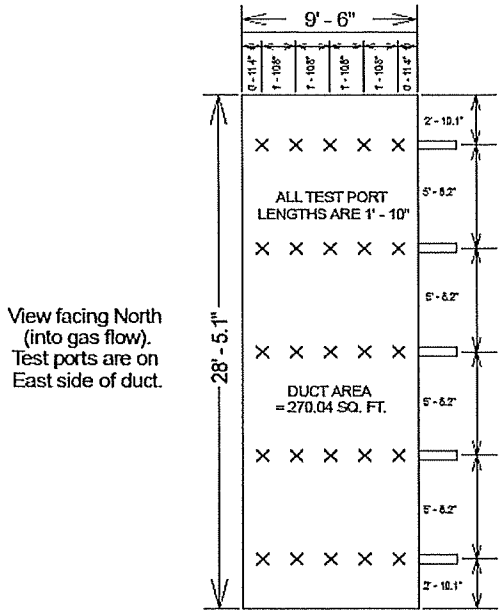
4.1.1 Location and Traverse Points (USEPA Method 1)

The number and location of traverse points for determining exhaust gas velocity and volumetric airflow was determined in accordance with USEPA Method 1, *Sample and Velocity Traverses for Stationary Sources*. Five test ports are located in the horizontal plane on east side of the 9.5 feet by 28 feet 5.1-inch rectangular duct. The duct has an equivalent duct diameter of 14 feet 2.4 inches. The ports are situated:

- Approximately 38.9 feet or 2.7 duct diameters downstream of a duct diameter change flow disturbance, and
- Approximately 11 feet or 0.8 duct diameters upstream of flow disturbance caused by a change in duct diameter as it enters the exhaust stack.

The sample ports are 6-inches in diameter and extend 22 inches beyond the stack wall. The area of the exhaust duct was calculated, and the cross-sectional area divided into a number of equal rectangular areas based on distances to air flow disturbances. Flue gas was sampled for five minutes at each of the five traverse points from the five sample ports for a total of 25 sample points and 125 minutes. A drawing of the Unit 2 exhaust test port and traverse point locations is presented as Figure 4-1.

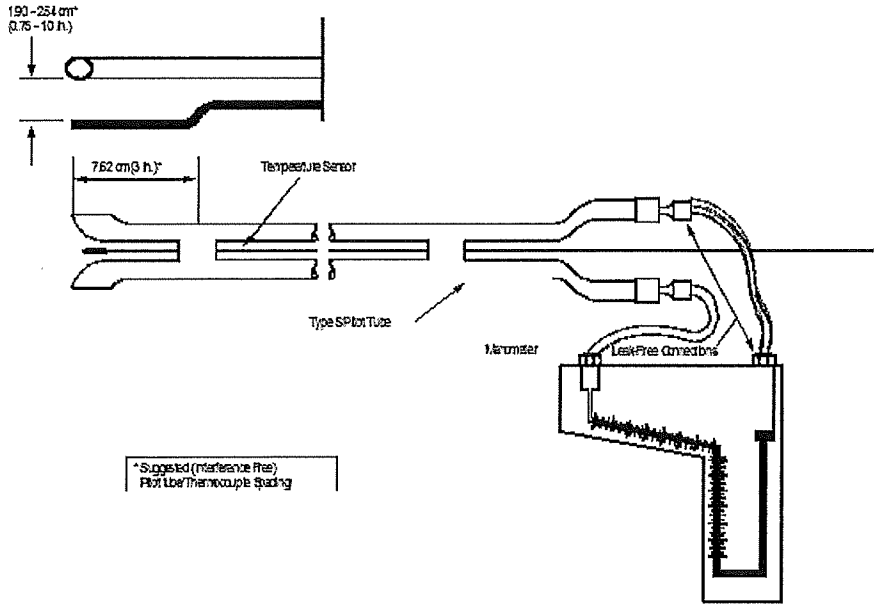
Figure 4-1. Unit 2 Duct Cross Section and Test Port/Traverse Point Detail



4.1.2 Velocity and Temperature (USEPA Method 2)

The exhaust gas velocity and temperature were measured using USEPA Method 2, *Determination of Stack Gas Temperature and Velocity (Type S Pitot Tube)*. Refer to Figure 4-2 for an example of the apparatus. The pressure differential (ΔP) across the positive impact and negative static openings of the Pitot tube were measured using an "S Type" (Stauscheibe or reverse type) Pitot tube connected to an appropriately sized oil filled inclined manometer. Exhaust gas temperatures were measured using a nickel-chromium/nickel-alumel "Type K" thermocouple and a temperature indicator.

Figure 4-2. Method 2 Sample Apparatus



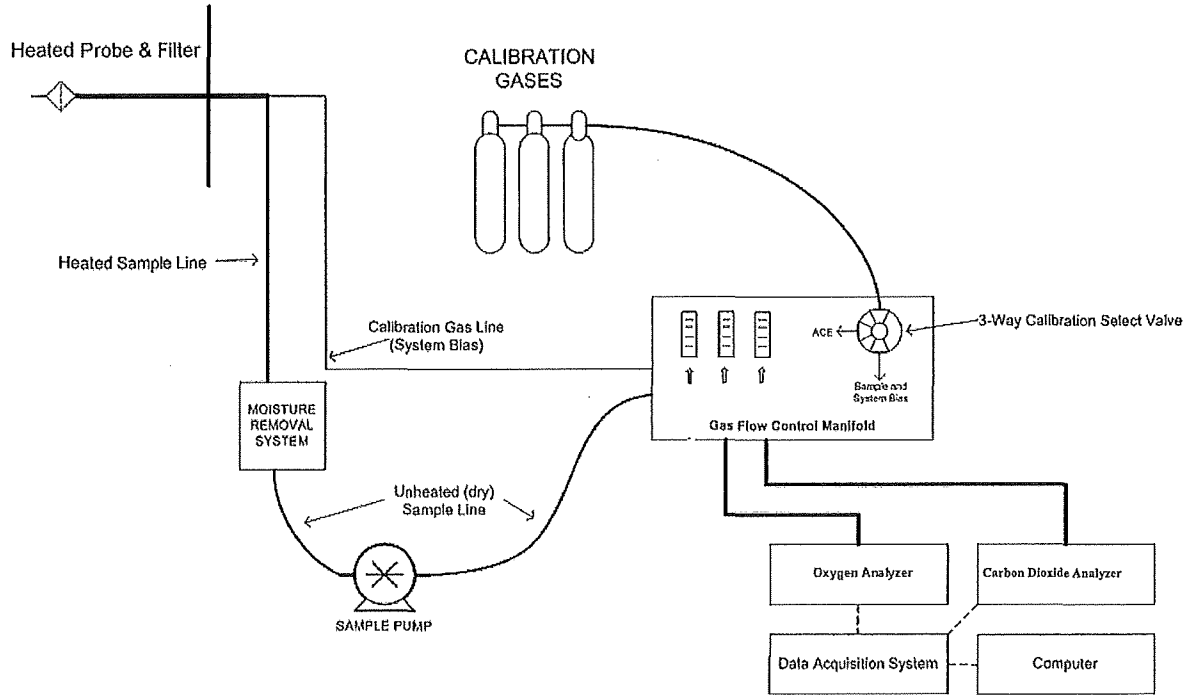
Appendix B of this report includes cyclonic flow test data as verification of the absence of cyclonic flow at the sample location. Method 1, § 11.4.2 states "if the average (null angle) is greater than 20°, the overall flow condition in the stack is unacceptable, and alternative methodology...must be used." The average null yaw angle measured at the Unit 2 exhaust on August 23, 2016, was measured to be 3.4°, thus meeting the less than 20° requirement and in the absence of ductwork and/or stack configuration changes, this null angle information is considered to be valid and additional cyclonic flow verification was not performed.

4.1.3 Molecular Weight (USEPA Method 3A)

Oxygen and carbon dioxide concentrations were measured using the sampling and analytical procedures of USEPA Method 3A, *Determination of Oxygen and Carbon Dioxide Concentrations in Emissions from Stationary Sources (Instrumental Analyzer Procedure).* The measured concentrations were used to calculate emissions rates using USEPA Method 19 (refer to Section 4.1.8). The method 3A sample probe was attached to the method 5 sample probe to collect O_2 and CO_2 concentrations at each of the 25 traverse points simultaneously with FPM and HCl measurements.

Flue gas was sampled from the stack through a stainless steel probe, heated Teflon® sample line, and through a gas conditioning system to remove water and dry the sample before entering a sample pump, gas flow control manifold, and paramagnetic, and infrared gas filter correlation gas analyzers. Figure 4-3 depicts the Method 3A sampling system.

Figure 4-3. USEPA Method 3A Sampling System



Prior to sampling boiler exhaust gas, the analyzers were calibrated by performing a calibration error test where zero-, mid-, and high-level calibration gases were introduced directly to the back of the analyzers. The calibration error check was performed to evaluate if the analyzers response was within ±2.0% of the calibration gas span or high calibration gas concentration. An initial system-bias test was performed where the zero- and mid- or high- calibration gases were introduced at the sample probe to measure the ability of the system to respond accurately to within ±5.0% of span.

Upon successful completion of the calibration error and initial system bias tests, sample flow rates and component temperatures were verified and the probe was inserted into the duct at the appropriate traverse point. After confirming the boiler was operating at established conditions, the test run was initiated. Oxygen and carbon dioxide concentrations were recorded at 1-minute intervals throughout the test run. Oxygen and carbon dioxide concentration data collected during port changes were excluded from the test run average.

At the conclusion of the test run, a post-test system bias check was performed to evaluate analyzer bias and drift from the pre- and post-test system bias checks. The system-bias checks evaluate if the analyzers bias was within ±5.0% of span and drift was within ±3.0%. The analyzers responses were used to correct the measured oxygen and carbon dioxide concentrations for analyzer drift. The corrected concentrations were used to calculate molecular weight and emission rates. Refer to Appendix E for analyzer calibration supporting documentation.

4.1.4 Moisture Content (USEPA Method 4)

The exhaust gas moisture content was measured using USEPA Method 4, *Determination of Moisture in Stack Gases* in conjunction with the Method 5 and 26A sample apparatus. Sampled gas was drawn through a series of impingers immersed in an ice bath to condense and remove water from the flue gas. The amount of water condensed and collected in the impingers was measured gravimetrically and used to calculate the exhaust gas moisture content.

4.1.5 Particulate Matter and Hydrogen Chloride (USEPA Methods 5 and 26A)

Filterable particulate matter and hydrogen chloride samples were collected isokinetically following the procedures of USEPA Method 5 (RM5), *Determination of Particulate Matter Emissions from Stationary Sources,* and USEPA Method 26A (RM26A), *Determination of Hydrogen Halide and Halogen Emissions from Stationary Sources Isokinetic Method.* RM 5 measures filterable particulate matter (aka PM, FPM) collected on a filter heated to 248±25°F, while RM26A measures hydrogen halides collected in acidic absorbing solutions. These reference methods were combined into a single sample apparatus to collect PM and HCl samples simultaneously.

In a letter to the USEPA dated February 10, 2016, Consumers Energy requested and received approval for the use of RM5, rather than MATS5 when conducting quarterly PM testing to demonstrate compliance with MATS PM limits. Consumers Energy also requested and received approval to combine RM5 and RM26A in one apparatus when determining quarterly PM and HCl MATS compliance. As part of this approval, the USEPA included additional test specifications; the first of which required comparative RM5 and MATS5 testing consisting of triplicate RM5 test runs immediately followed by triplicate MATS5 test runs at the same boiler operating condition. This comparative approach would help determine if the RM5 front half filter temperature criterion of 248±25°F would bias PM loading, relative to the 320±25°F front half filter criterion in MATS5. The comparative RM5/MATS5 test program requested by USEPA was conducted at the source on August 23-24, 2016. The subsequent RM5/MATS5 results indicated there was no appreciable PM emission rate differences between the methodologies used, thus for all subsequent quarterly Unit 2 PM events, including this test event, RM5 methodology was employed.

The second approval stipulation for a combined RM5 and RM26A sampling apparatus required substituting the RM5 specific glass fiber filter without organic binders with a 99.95 percent efficient on 0.3 dioctyl phthalate (DOP) smoke particles, Teflon and borosilicate glass fiber PM filter. Furthermore, a filter temperature maintained between 248°F and

273°F was required during sampling as specified in RM26A. Therefore, a combined RM5 and RM26A sample apparatus was used for each test run during this event that met the prescribed USEPA stated filter and sampling temperature stipulations.

The RM5 and 26A sampling apparatus was setup and operated in accordance with method requirements. The flue gas was passed through a Teflon lined nozzle, heated probe, heated borosilicate glass microfiber reinforced with woven glass cloth and bonded with polytetrafluoroethylene (PTFE) filter, and into a series of impingers with the configuration presented in Table 4-3. The filter collected filterable particulate matter and halide salts while the impingers collected water vapor, hydrogen halides, and halogens. Figure 4-4 depicts the USEPA Method 5/26A sampling apparatus.

Table 4-3
USEPA Methods 5 and 26A Impinger Configuration

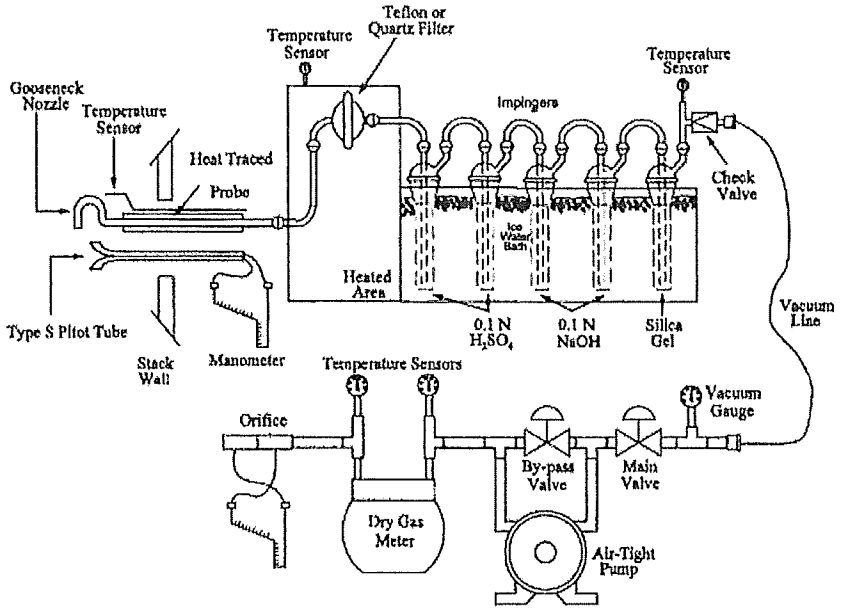
Impinger Order (Upstream to Downstream	Impinger Type	Impinger Contents	Amount (gram)
1	Greenburg-Smith	0.1 N H_2SO_4	~100
2	Greenburg-Smith	0.1 N H_2SO_4	~100
3	Modified	0.1 N NaOH	~100
4	Modified	0.1 N NaOH	~100
5	Modified	Silica Gel Desiccant	~200-300

Prior to testing, representative velocity head and temperature data were reviewed to calculate an ideal nozzle diameter that would allow isokinetic sampling to be performed. The diameter of the selected nozzle was measured with calipers across three cross-sectional chords and used to calculate its cross-sectional area. Prior to testing the nozzle was rinsed and brushed with deionized water and acetone and connected to the sample probe.

The impact and static pressure openings of the Pitot tube were leak-checked at or above a velocity head of 3.0 inches of water for a minimum of 15 seconds. The sampling train was leak-checked by capping the nozzle and applying a vacuum of approximately 15 inches of mercury. The dry-gas meter was monitored for approximately 1 minute to verify the sample train leak rate was less than 0.02 cubic foot per minute (cfm). The sample probe was then inserted into the sampling port to begin sampling.

Ice and water were placed around the impingers, and the probe and filter temperature were allowed to stabilize to between 248°F and 273°F. After the desired operating conditions were coordinated with the facility, testing was initiated. Stack and sampling apparatus parameters (e.g., flue gas velocity head, filter temperature) were monitored to calculate and sample at the isokinetic rate within 100±10% for the duration of the test. Refer to Appendix B for field data sheets.

Figure 4-4. USEPA Methods 5 and 26A Sampling Apparatus

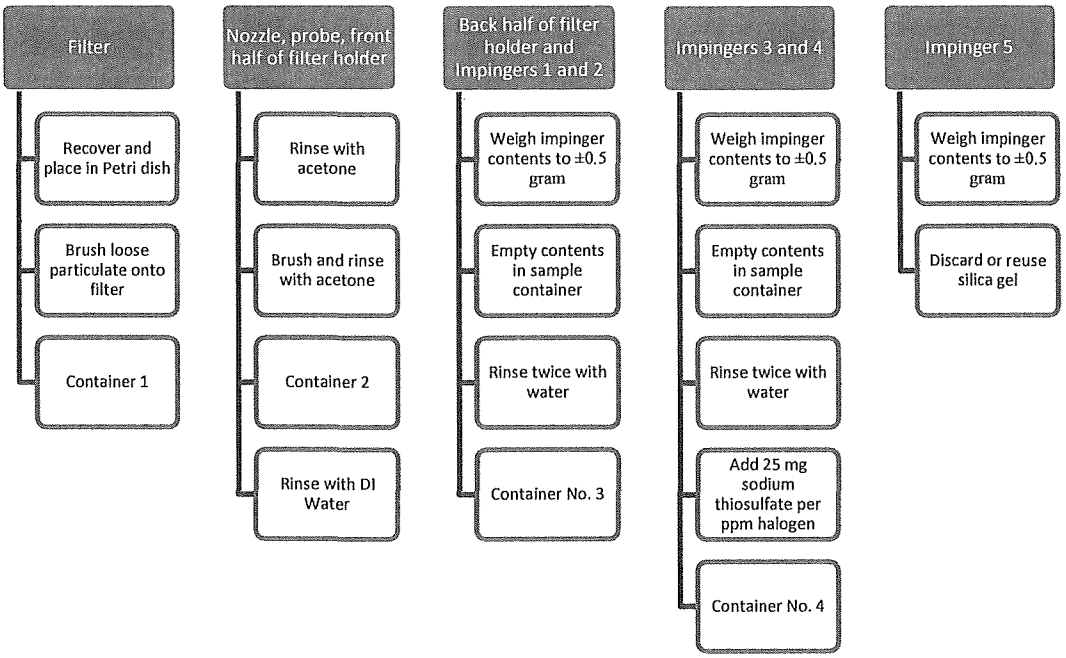


At the conclusion of a test run and post-test leak check, the sampling apparatus was disassembled and the impingers and filter housing were transported to the recovery area.

The filter was recovered from the filter housing and placed in a Petri dish, sealed with Teflon tape, and labeled as "FPM Container 1." The nozzle, probe liner, and the front half of the filter housing were triple rinsed with acetone to collect particulate matter. The rinsate was collected in pre-cleaned sample containers, sealed with Teflon tape, and labeled as "FPM Container 2." Prior to the start of subsequent runs, deionized, distilled water was used to final rinse the probe liner and nozzle; this rinse was discarded.

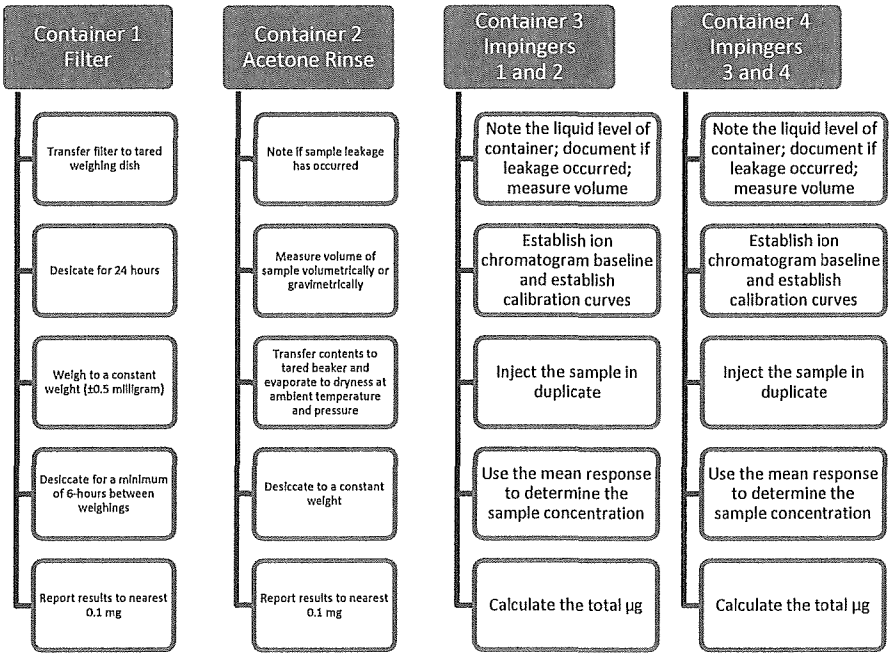
The weight of water vapor liquid collected in each impinger, including the silica gel impinger, was measured using an electronic scale. The volume of gas sampled and the difference between the pre-test and post-test impinger weights was used to calculate the moisture content of the sampled flue gas. The acidic and alkaline impinger contents were transferred to separate, labeled polyethylene sample containers. Each impinger was rinsed with deionized, distilled water and the rinsate was collected in the appropriate sample container. Approximately 20 milligrams of sodium thiosulfate was added to the sample storage bottle containing the 0.1 N NaOH impinger catch to assure a complete reaction with the hypohalous acid to form a second chlorine ion. The alkaline and acidic impinger contents were submitted to the laboratory. Since halogens are not part of this test program, the sample chain of custody directed the lab to not analyze the 0.1N NaOH samples unless notified. Refer to Figure 4-5 for the Method 26A sample recovery scheme.

Figure 4-5. USEPA Methods 5 and 26A Sample Recovery Scheme



The sample containers, including filters, reagents, and water blanks, were transported to the laboratory for analysis. The chain of custody was prepared in accordance with ASTM D4840-99(2010) procedures and included the sample date, collection time, identification, and requested analysis. The sample analysis followed USEPA Method 5 and 26A procedures as summarized in the analytical scheme presented in Figure 4-6. Refer to Appendix C for laboratory data sheets. Included with the samples was an HCl performance audit sample and associated documentation. Refer to Section 5.7.1 for further discussion of the audit sample results.

Figure 4-6. USEPA Methods 5 and 26A Analytical Scheme



4.1.6 Emission Rates (USEPA Method 19)

USEPA Method 19, *Determination of Sulfur Dioxide Removal Efficiency and Particulate Matter, Sulfur Dioxide, and Nitrogen Oxide Emission Rates*, was used to calculate PM and HCl emission rates in units of lb/mmBtu. Measured carbon dioxide concentrations and F factors (ratios of combustion gas volumes to heat inputs) were used to calculate emission rates using equation 19-6 from the method. Figure 4-7 presents the equation used to calculate lb/mmBtu emission rate:

Figure 4-7. USEPA 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 1,840 scf CO_2/mmBtu for subbituminous coal from 40 CFR 75, Appendix F, Table 1
$\%CO_{2d}$	=	Concentration of carbon dioxide on a dry basis (%, dry)

5.0 TEST RESULTS AND DISCUSSION

The test program was performed on May 16, 2022, to satisfy the MATS Low Emitting Unit (LEE) triennial PM and HCl performance test requirements and evaluate compliance with MATS as incorporated in MI-ROP-B2835-2020b. As noted earlier in this report, the Unit 2 PM and HCl results from this test demonstrate ongoing MATS, MATS LEE and ROP limit compliance.

Prior to this test program, twelve consecutive quarters of MATS LEE evaluation tests were performed, which demonstrated EUBOILER2 emissions were ≤50 percent of the 0.030 lb/mmBtu PM and 0.0020 lb/mmBtu HCl applicable standards shown in Table 2 of the MATS rule. The 12 consecutive quarterly test events began in the third quarter of 2016 and ended in the first quarter of 2019.

5.1 Tabulation of Results

Table 2-1 in Section 2 of this report summarizes the results and Appendix Table 1 contains detailed tabulation of results, process operating conditions, and exhaust gas conditions.

5.2 Significance of Results

The EUBOILER2 PM and HCl test results indicate the Unit demonstrates ongoing MATS, MATS LEE, and ROP limit compliance.

5.3 Variations from Sampling or Operating Conditions

No sampling or operating condition variations were encountered during the test program. As noted in page 12 of the test protocol and referenced in the EGLE approval letter, an ROP requirement [FGMATS_U12 SCV.4] identifying key air pollution control equipment operational parameter targets to be monitored and recorded.

Therefore, during the Unit 2 triennial MATS PM test, the outlet opacity of the pulse jet fabric filters (PJFFs) was monitored and recorded, with a target opacity of two (2) or more consecutive 1-hour block average opacity values less than or equal 15% opacity. This 15% opacity target aligns with the current Unit 1 and Unit 2 compliance assurance monitoring (CAM) requirement, which defines an excursion as "any two (2) or more consecutive 1-hour block average opacity values greater than 15%."

Furthermore, the dry sorbent injection (DSI) auger speeds controlling lime sorbent injection rates into the flue gas streams prior to the PJFFs was monitored and recorded. The DSI auger speed target rates were 5% of the maximum auger speed, which represents the DSI system physical minimum design auger speed. The electrical motors driving the DSI augers operate at 60Hz when set at 100% speed, and at 3Hz with the augers at 5% of maximum speed. This 5% minimum auger speed injection rate was selected because there is data suggesting this was a rate adequate for achieving the MATS HCl allowed emission limit of 0.002 lb/MMBTU and the MATS HCl LEE emission rate of 0.001 lb/MMBTU, or 50% of the MATS allowed HCl emission limit when combusting 100% Western Subbituminous Coal. Historical engineering tests and mass balance data also indicated the MATS HCl emission limit of 0.002 lb/MMBTU and the MATS HCl LEE emission rate of 0.001 lb/MMBTU could be achieved without lime injection when combusting 100% Western Subbituminous Coal.

Therefore, as shown in Appendix D, the average DSI auger speed during Unit 2 MATS testing was 7.9% of the maximum auger speed. Even though the target minimum DSI auger speed of 5% of maximum was not achieved during any of the three test runs, it is clear from the HCl test results that a DSI auger speed of 4-5% of maximum would be adequate to keep HCl emissions below the MATS LEE threshold, since a three-run average DSI auger speed of 7.9% was shown to keep HCl emissions below the LEE limit by an order of magnitude, as documented in Table E-1 of this report. Thus, an auger speed of 4-5% of maximum would be more than adequate to keep HCl emissions below the LEE threshold. Also, the opacity data collected during the three test runs demonstrates that an opacity of less than 15% is adequate for demonstrating that Unit 2 meets the MATS PM emission limit and the MATS LEE PM threshold as demonstrated Table E-1.

5.4 Process or Control Equipment Upset Conditions

The boiler and associated control equipment were operating under routine conditions and no upsets were encountered during testing.

5.5 Air Pollution Control Device Maintenance

No significant pollution control device maintenance occurred during the three months prior to the test. Optimization of the air pollution control equipment is a continuous process to ensure compliance with regulatory emission limits.

5.6 Re-Test Discussion

Based on the results of this test program, a re-test is not required. The next MATS test event at JHC Unit 2 will be required in the second quarter of 2025. The next test to demonstrate compliance with the ROP limit of 0.15 pound per 1,000 pounds exhaust gas,

corrected to 50% excess air, will also occur in second quarter of 2025. The next test to demonstrate compliance with the ROP PM limit of 0.015 lb/mmBtu that originated in the consent decree will be required in 2024 since the PM emission results in Table E-1 demonstrate that the PM emissions are equal to or less than 0.010 lb/MMBTU threshold, which is the JHC ROP Appendix 5 threshold that allows for biennial testing.

5.7 Results of Audit Samples

5.7.1 Performance Audit Sample

Performance audit (PA) samples for each test method were not available because one of the two stationary source audit program audit sample providers ceased manufacturing them. The general provisions to 40 CFR Parts 60 and 63 (see §60.8(g)(1) and §63.7(c)(2)(iii)(A)) require that the owner or operator obtain audit samples if the audit samples are "commercially available"; which is defined as two or more independent accredited audit sample providers (AASP) having blind audit samples available for purchase. Since there are no longer two providers, the requirement to obtain these audit samples is no longer in effect until such time as another independent AASP has audit samples available for purchase.

5.7.2 Reference Method Audits

The USEPA reference methods performed state reliable results are obtained by persons equipped with a thorough knowledge of the techniques associated with each method. Factors with the potential to cause measurement errors are minimized by implementing quality control (QC) and quality assurance (QA) programs into the applicable components of field testing. QA/QC components were included in this test program. Table 5-1 summarizes the primary field quality assurance and quality control activities that were performed. Refer to Appendix E for supporting documentation.

Table 5-1
QA/QC Procedures

QA/QC Activity	Purpose	Procedure	Frequency	Acceptance Criteria
M1: Sampling Location	Evaluates if the sampling location is suitable for sampling	Measure distance from ports to downstream and upstream flow disturbances	Pre-test	≥2 diameters downstream; ≥0.5 diameter upstream.
M1: Duct diameter/ dimensions	Verifies area of stack is accurately measured	Review as-built drawings and field measurement	Pre-test	Field measurement agreement with as-built drawings
M2: Pitot tube calibration and standardization	Verifies construction and alignment of Pitot tube	Inspect Pitot tube, assign coefficient value	Pre-test and after each field use	Method 2 alignment and dimension requirements
M3A: Calibration gas standards	Ensures accurate calibration standards	Traceability protocol of calibration gases	Pre-test	Calibration gas uncertainty ≤2.0%
M3A/ALT-123: Calibration Error	Evaluates operation of analyzers	Introduce calibration gas directly into analyzers	Pre-test	±2.0% of the calibration span
M3A/ALT-123: System Bias and Analyzer Drift	Evaluates analyzer and sample system integrity and accuracy	Inert calibration gas bag introduced at back of analyzers	Pre-test and Post-test	Bias: ±5.0% of calibration span Drift: ±3.0% of calibration span

Table 5-1
QA/QC Procedures

QA/QC Activity	Purpose	Procedure	Frequency	Acceptance Criteria
M3A: Multi-point integrated sample	Ensure representative sample collection	Insert probe into stack and purge sample system	Pre-test	Collect sample no closer to the stack wall than 1.0 meter; collect samples at traverse points
M4: Field balance calibration	Verify moisture measurement accuracy	Use Class 6 weight to check balance accuracy	Daily before use	The field balance must measure the weight within ±0.5 gram of the certified mass
M5/26A: nozzle diameter measurements	Verify nozzle diameter used to calculate sample rate	Measure inner diameter across three cross-sectional chords	Pre-test	3 measurements agree within ±0.004 inch
M5/26A: sample rate	Ensure representative sample collection	Calculate isokinetic sample rate	During and post-test	100±10% isokinetic rate
M26A: Apparatus Temperature	Ensures purge of acid gases in probe and on filter	Set probe & filter heat controllers to ≥248°F	Verify prior to and during each run	Apparatus temperature must be ≥248°F and ≤ 273°F
M5/26A: Sample volume	Ensure minimum required sample volumes collected	Record pre- and post-test dry gas meter volume reading	Post test	PM: ≥1 dscm LEE PM: ≥2 dscm HCl: ≥0.75 dscm LEE HCl: ≥1.5 dscm
M5/26A: Post-test leak check	Evaluate if system leaks biased the sample	Cap sample train; monitor DGM	Post-test	≤0.020 cfm
M5/26A: post-test meter audit	Evaluates sample volume accuracy	DGM pre- and post-test; compare calibration factors (Y and Yqa)	Pre-test Post-test	±5%

5.8 Calibration Sheets

Calibration sheets, including dry gas meter, gas protocol sheets, and analyzer quality control and assurance checks are presented in Appendix E.

5.9 Sample Calculations

Sample calculations and formulas used to compute emissions data are presented in Appendix A.

5.10 Field Data Sheets

Field data sheets are presented in Appendix B.

5.11 Laboratory Quality Assurance / Quality Control Procedures

The method specific quality assurance and quality control procedures in each method employed during this test program were followed, without deviation. Refer to Appendix C for the laboratory data sheets.

5.11.1 QA/QC BLANKS

Reagent and media blanks were analyzed for the parameters of interest. The results of the blanks analysis are presented in the Table 5-2 Laboratory QA/QC and blank results data are contained in Appendix C.

Table 5-2
QA/QC Blanks

Sample Identification	Result	Comment
Method 5 Acetone Blank	0.4 mg	Sample volume was 200 milliliters Acetone blank corrections were applied
Method 5 Filter Blank	0.0 mg	Reporting limit is 0.1 milligrams
Method 26A 0.1 N H2SO4 Reagent Blank	<116 µg	Blank corrections were not applied
Method 26A Water Blank	<77 µg	Blank corrections were not applied