Consumers Energy

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PM, PM_{10}, VOCs, and HCHO ROP Test Report

EUGT1A

EUGT2A

Consumers Energy Company
Zeeland Generating Station
425 Fairview Road
Zeeland, Michigan 49464
SRN: N6521

August 14, 2023

Test Dates: June 13 through 16, 2023

Test Performed by the Consumers Energy Company
Regulatory Compliance Testing Section
Air Emissions Testing Body
Laboratory Services Section
Work Order No. 41221477
Version No.: 0

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EXECUTIVE SUMMARY

Consumers Energy Regulatory Compliance Testing Section (RCTS) personnel conducted filterable particulate matter (PM), and PM less than 10 microns in diameter (PM10), volatile organic compounds (VOCs), formaldehyde (HCHO) testing at the exhaust of gas turbine EUGT1A and EUGT2A (Units 1A and 2A) in operation at the Zeeland Generating Station in Zeeland, Michigan. The 190-megawatt gross (MW) output Unit 1A and 307 MW output Unit 2A are natural gas fired combustion turbines that generate electricity, with Unit 2A also generating steam to turn a turbine connected to an electricity producing generator. The electricity is routed to the electrical transmission system.

The test program, performed June 13 through 16, 2023, was conducted to satisfy testing requirements in renewable operating permit (ROP) MI-ROP-N6521-2020a. For VOCs, PM10, and formaldehyde, the results of the most recent stack tests shall be used in conjunction with heat input measurements to determine mass emission rates. For each of the pollutants, the higher of the emission factors derived from stack testing at 70% and 100% load shall be used for the calculations unless an alternate approach is approved by the District Supervisor. On June 6, 2012, the EGLE-AQD Grand Rapids District Supervisor approved an alternative PM10 emissions calculation methodology which relies on stack test results and linear interpolation based upon hourly heat input rate to calculate unit specific PM10 emission factors (as lb/MMBTU) in lieu of the preceding default methodology.

Triplicate, 120-minute PM10 test runs and 60-minute VOC and HCHO test runs were conducted following the procedures in USEPA Reference Methods (RM) 1, 2, 3A, 4, 5, 19 and 25A in 40 CFR 60, Appendix A, RM 202 in 40 CFR 51, Appendix M, and RM 320 in 40 CFR 63, Appendix A. One set of test runs was conducted with Units 1A and 2A operating at 100% load, and another set of test runs was conducted at 70% load as required in the facility's air permit. There were no deviations from the approved stack test protocol or the USEPA Reference Methods, except for the blank corrections applied to the RM 202 results.

Despite following EPA Method 202 Best Practices procedures and those incorporated into internal quality systems, the Method 202 blank values indicate contamination, which caused a high bias to the test results. After discussions with Ned Shappley with EPA and Jeremy Howe with EGLE, and to avoid overestimation of the results that could affect ongoing compliance determinations, the field train proof blanks were used in lieu of the field train recovery blanks, up to values as high as 5.1 mg, in the calculation of PM10 as stipulated in EPA's Interim Guidance on the Treatment of Condensable Particulate Matter Test Results. The Units 1A and 2A PM10, VOCs, and HCHO results are summarized in the following table.

Table E-1
Executive Summary of Test Results

Parameter	Units	Average	Emission Limit
Unit 2A - 100% Load			
PM_{10}	lb/hr	12.93	14.7
	ton/yr	56.65	64.4
	lb/mmBtu	0.00595	N/A*
VOCs†	lb/hr	1.87	16.8
	ton/yr	8.20	73.6
	lb/mmBtu	9.2E-04	N/A*
HCHO‡	ton/yr	0.500	2.35‡
	lb/mmBtu	5.6E-05	N/A*

Table E-1
Executive Summary of Test Results

Parameter	Units	Average	Emission Limit
Unit 2A - 70% Load			
PM_{10}	lb/hr	7.10	14.7
	ton/yr	31.08	64.4
	lb/mmBtu	0.00451	N/A*
VOCs†	lb/hr	0.69	16.8
	ton/yr	3.02	73.6
	lb/mmBtu	4.8E-04	N/A*
HCHO‡	ton/yr	0.399	2.35‡
	lb/mmBtu	6.4E-05	N/A*
Unit 1A - 100% Load			
PM_{10}	lb/hr	6.91	10.8
	ton/yr	30.29	47.3
	lb/mmBtu	0.00433	N/A*
VOCs†	lb/hr	0.85	5.8
	ton/yr	3.72	25.4
	lb/mmBtu	4.7E-04	N/A*
HCHO‡	ton/yr	0.506	2.35‡
	lb/mmBtu	6.4E-05	N/A*
Unit 1A - 70% Load			
PM_{10}	lb/hr	3.91	10.8
	ton/yr	17.12	47.3
	lb/mmBtu	0.00308	N/A*
VOCs†	lb/hr	0.62	5.8
	ton/yr	2.71	25.4
	lb/mmBtu	4.4E-04	N/A*
HCHO‡	ton/yr	0.402	2.35‡
	lb/mmBtu	6.5E-05	N/A*

*: lb/mmBtu results are used in mass emission calculations with continuous heat input to evaluate compliance with the mass emission limits. While lb/hr and ton/yr results are presented in this table, these results cannot be directly used to assess compliance with the permit limits.
†: VOCs mass emissions calculated using ppmv as propane
‡: HCHO limit is applicable to all turbine operations, the presented limit is the permit limit divided by four

Although not consistent with the prescribed compliance methodology in the ROP, the Units 1A and 2A PM_{10}, VOC, and HCHO emission results generally indicate compliance with the mass emission limits in the permit. The preceding tons per year values are extrapolated assuming continuous operation at the pounds per hour emission rates observed during the testing. The facility uses lb/mmBtu emission factors in conjunction with continuous heat input determinations to calculate mass emission rates, consistent with Appendix 5 of the ROP.

Detailed test results are presented in Appendix Tables 1 through 8. Sample calculations, field data sheets, and laboratory data are presented in Appendices A, B, and C. Operating data and supporting documentation are provided in Appendices D and E.

1.0 INTRODUCTION

This report summarizes the results of the filterable particulate matter (PM), PM less than 10 microns in diameter (PM10), volatile organic compounds (VOCs), and formaldehyde (HCHO) testing at the exhaust of gas turbine EUGT1A and EUGT2A (Units 1A and 2A) in operation at the Zeeland Generating Station in Zeeland, Michigan.

This document was prepared using the Michigan Department of Environment, Great Lakes, and Energy (EGLE) *Format for Submittal of Source Emission Test Plans and Reports* published in November of 2019. Please exercise due care if portions of this report are reproduced, 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) personnel conducted the PM, PM_{10} (as the sum of filterable and condensable PM), VOCs, and HCHO tests at the dedicated exhausts of natural gas-fired combustion turbines Unit 1A and 2A operating at the Zeeland Generating Station in Zeeland, Michigan on June 13 through 16, 2023.

A test protocol was submitted to the EGLE on May 11, 2023, and subsequently approved by Mr. Jeremy Howe, Air Quality Division Unit Supervisor, in his letter dated June 7, 2023.

1.2 PURPOSE OF TESTING

The purpose of the test was to satisfy testing requirements in renewable operating permit (ROP) MI-ROP-N6521-2020a. For VOCs, PM10, and formaldehyde, the results of the most recent stack tests shall be used in conjunction with heat input measurements to determine mass emission rates. For each of the pollutants, the higher of the emission factors derived from stack testing at 70% and 100% load shall be used for the calculations unless an alternate approach is approved by the District Supervisor. On June 6, 2012, the EGLE-AQD Grand Rapids District Supervisor approved an alternative PM10 emissions calculation methodology which relies on stack test results and linear interpolation based upon hourly heat input rate to calculate unit specific PM10 emission factors (as lb/MMBTU) in lieu of the preceding default methodology. The applicable emission limits are presented in Table 1-1.

Table 1-1
Emission Limits

Parameter	Emission Limit	Units	Applicable Requirement
EUGT1A, EUGT1B			
PM10†	10.8	lb/hr	MI-ROP-N6521-2020a, Section D, FGSIMPLECYCLE Emission Limits
	47.3	ton/yr	
VOC†	5.8	lb/hr	
	25.4	ton/yr	
HCHO‡	9.4	ton/yr	MI-ROP-N6521-2020a, Section D, FGSIMPLECYCLE Emission Limits & FGCOMBINEDCYCLE Emission Limits

Table 1-1
Emission Limits

Parameter	Emission Limit	Units	Applicable Requirement
EUGT2A, EUGT2B			
PM10†	14.7	lb/hr	MI-ROP-N6521-2020a, Section D, FGCOMBINEDCYCLE Emission Limits
	64.4	ton/yr	
VOC†	16.8	lb/hr	
	73.6	ton/yr	
HCHO‡	9.4	ton/yr	MI-ROP-N6521-2020a, Section D, FGSIMPLECYCLE Emission Limits & FGCOMBINEDCYCLE Emission Limits

†: The PM10 and VOC lb/hr limits are based upon the average of all operating hours in a calendar day, while the ton/yr limits are based on 12-month rolling totals.
‡: HCHO limit is applicable to all combustion turbine operations, based on a 12-month rolling total.

The permit requires the permittee to verify VOC, PM10, and HCHO emission rates from one of the turbines associated with FGSIMPLECYLE and FGCOMBINEDCYCLE by testing at owner's expense, in accordance with the Department requirements. Testing must be completed at 70% and 100% of base load for one of the simple and combined cycle turbines that were not tested during the previous test. Units 1B and 2B were tested in 2018; therefore, Units 1A and 2A were tested during this test program.

1.3 Brief Description of Source

The 190-megawatt gross (MW) output Unit 1A and 307 MW output Unit 2A are natural gas fired combustion turbines that generate electricity, with Unit 2A also generating steam to turn a turbine connected to an electricity producing generator. The electricity is routed to the electrical transmission system.

1.4 Contact Information

Table 1-2 presents names, addresses, and telephone numbers for contacts involved in this test program.

Table 1-2
Test Program Contact List

Program Role	Contact	Address
State Regulatory Administrator	Jeremy Howe Technical Programs Unit Supervisor Environmental Manager 231-878-6687 howej1@michigan.gov	EGLE Technical Programs Unit (TPU) Constitution Hall, 2nd Floor S 525 W. Allegan Lansing, Michigan 48933
State Regional Agency Inspector	Mike Cox Air Quality Manager Grand Rapids District 616-240-3607 CoxM9@michigan.gov	EGLE Grand Rapids District Office 350 Ottawa Avenue NW, Unit 10 Grand Rapids, Michigan 49503-2316
Responsible Official	Jason Ricketts Sr. Manager Plant Operations 616-237-4001 jason.ricketts@cmsenergy.com	Consumers Energy Company Zeeland Generating Station 425 N. Fairview Road Zeeland, Michigan 49464
Test Facility	J. Homer Manning Sr. Environmental Analyst 616-237-4004 homer.manningiii@cmsenergy.com	
Corporate Environmental Coordinator	Jason Prentice Principal Environmental Engineer 517-788-1467 jason.prentice@cmsenergy.com	Consumers Energy Company Parnall Office (P22-334) 1945 W. Parnall Road Jackson, Michigan 49201

Table 1-2
Test Program Contact List

Program Role	Contact	Address
Test Team Representative	Thomas Schmelter, QSTI Engineering Technical Analyst 616-738-3234 thomas.schmelter@cmsenergy.com	Consumers Energy Company L&D Training Center 17010 Croswell Street West Olive, Michigan 49460

2.0 SUMMARY OF RESULTS

2.1 OPERATING DATA

The simple (1A) and combined cycle (2A) combustion turbines fired natural gas during the test event. The achievable load for a combustion turbine varies with ambient conditions. Based upon weather conditions at the time of testing, the 100% load condition was run at the maximum achievable load condition and corresponded to approximately 165 gross megawatts (MW) at Unit 1A and 278 MW at Unit 2A. The reduced load testing was run at approximately 118 MW, or 72% of the load achieved at the 100% load condition for Unit 1A and approximately 195 MW, or 70% of the load achieved at the 100% load condition for Unit 2A. Note that the preceding loads for Unit 2A reflect electrical production for the combustion turbine and the share of electrical production from the common steam turbine and electrical generator. Refer to Attachment D for detailed operating data, which was recorded in Eastern Standard Time (EST).

2.2 APPLICABLE PERMIT INFORMATION

The Zeeland generating station operates under State of Michigan Registration Number (SRN) N6521 and in accordance with air permit MI-ROP-N6521-2020a. The air permit incorporates state and federal requirements and reporting under comprehensive EPA Federal Registry Service (FRS) database, FRS number 110012534551. EUGT1A, EUGT1B, EUGT2A and EUGT2B are the emission units affected by this test program.

EUGT1A and EUGT1B are included in the flexible group FGSIMPLECYCLE. EUGT2A and EUGT2B are included in the FGCOMBINEDCYCLE flexible group. The permit requires testing to be completed at 70% and 100% of base load for one simple cycle and one combined cycle turbine that was not tested during the previous test. Because Units 1B and 2B were tested in 2018, Units 1A and 2A were tested during this test program.

2.3 RESULTS

The Units 1A and 2A PM10, VOCs, and HCHO results are summarized in Table 2-1.

Table 2-1
Summary of Test Results

Parameter	Units	Average	Emission Limit
Unit 2A - 100% Load			
PM_{10}	lb/hr	12.93	14.7
	ton/yr	56.65	64.4
	lb/mmBtu	0.00595	N/A*
VOCs†	lb/hr	1.87	16.8
	ton/yr	8.20	73.6
	lb/mmBtu	9.2E-04	N/A*
HCHO‡	ton/yr	0.500	2.35‡
	lb/mmBtu	5.6E-05	N/A*

Table 2-1
Summary of Test Results

Parameter	Units	Average	Emission Limit
Unit 2A - 70% Load			
PM_{10}	lb/hr	7.10	14.7
	ton/yr	31.08	64.4
	lb/mmBtu	0.00451	N/A*
VOCs†	lb/hr	0.69	16.8
	ton/yr	3.02	73.6
	lb/mmBtu	4.8E-04	N/A*
HCHO‡	ton/yr	0.399	2.35‡
	lb/mmBtu	6.4E-05	N/A*
Unit 1A - 100% Load			
PM_{10}	lb/hr	6.91	10.8
	ton/yr	30.29	47.3
	lb/mmBtu	0.00433	N/A*
VOCs†	lb/hr	0.85	5.8
	ton/yr	3.72	25.4
	lb/mmBtu	4.7E-04	N/A*
HCHO‡	ton/yr	0.506	2.35‡
	lb/mmBtu	6.4E-05	N/A*
Unit 1A - 70% Load			
PM_{10}	lb/hr	3.91	10.8
	ton/yr	17.12	47.3
	lb/mmBtu	0.00308	N/A*
VOCs†	lb/hr	0.62	5.8
	ton/yr	2.71	25.4
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HCHO‡	ton/yr	0.402	2.35‡
	lb/mmBtu	6.5E-05	N/A*

*: lb/mmBtu results are used in mass emission calculations with continuous heat input to evaluate compliance with the mass emission limits. While lb/hr and ton/yr results are presented in this table, these results cannot be directly used to assess compliance with the permit limits.
†: VOCs mass emissions calculated using ppmv as propane
‡: HCHO limit is applicable to all turbine operations, the presented limit is the permit limit divided by four

The preceding tons per year values are extrapolated assuming continuous operation at the pounds per hour emission rates observed during the testing. The facility uses lb/mmBtu emission factors in conjunction with continuous heat input determinations to calculate mass emission rates, consistent with Appendix 5 of the ROP.

Detailed test results are presented in Appendix Tables 1 through 8. Sample calculations, field data sheets, and laboratory data are presented in Appendices A, B, and C. Operating data and supporting documentation are provided in Appendices D and E.

3.0 SOURCE DESCRIPTION

The Zeeland Generating Station operates two natural gas-fired simple cycle turbines identified as EUGT1A (Unit 1A) and EUGT1B (Unit 1B) and two combined cycle turbines with natural gas fired duct burners and heat recovery steam generators (HRSGs), identified as EUGT2A / EUDUCTBURNER2A (Unit 2A) and EUGT2B / EUDUCTBURNER2B (Unit 2B). The turbines are referenced in the facility's 40 CFR Part 75 CEMS Monitoring Plan as Units CC1, CC2, CC3, and CC4. The source classification code (SCC) is 20100201.

3.1 PROCESS

The Zeeland Generating Station has a capacity to produce approximately 860 gross megawatts of electricity. Natural gas is combusted in the GE Model 7FA turbines to produce high-pressure exhaust gas, which turn electricity-producing generators. The combined cycle units are equipped with natural gas-fired duct burners to augment steam production. Steam generated in the associated HRSGs is then fed to a common steam extraction turbine and electrical generator shared by EUGT2A and EUGT2B.

Typically, the simple cycle turbines are operated in a batch manner and the combined cycle turbines are operated in a continuous (i.e., baseload) manner to meet the electrical demands of the Midcontinent Independent System Operator, Inc. (MISO) and Consumers Energy customers.

3.2 PROCESS FLOW

Air pollution control is achieved on all four combustion turbines using Dry Low NO_x Burners. The combined cycle units are also equipped with selective catalytic reduction (SCR) systems for controlling NO_x.

3.3 MATERIALS PROCESSED

The turbines fire pipeline quality natural gas defined within the ROP as 0.0006 lb/mmBtu sulfur content, which is equivalent to 0.2 grains total sulfur per 100 standard cubic feet (scf), 6.8 ppm by weight total sulfur or 3.4 ppm by volume total sulfur.

3.4 RATED CAPACITY

Units 1A and 1B are rated at 2,205 mmBtu/hr heat input, with an Upper Bound Range of Operation (UBRO) of 190 megawatts (MW) and a Lower Bound Range of Operation (LBRO) of 17 MW. Units 2A and 2B are rated at 2,323 mmBtu/hr and 2,345 mmBtu/hr heat input, respectively, with an UBRO of 307 and 308 MW, respectively, and an LBRO of 17 MW. Testing was performed on one simple cycle unit, Unit 1A, and one combined-cycle unit, Unit 2A at 100% and 70% load as required in MI-ROP-N6521-2020a.

3.5 PROCESS INSTRUMENTATION

Operators, environmental technicians, and/or data acquisition systems continuously monitored the process during testing. Due to the various instrumentation systems, the sampling times were correlated to instrumentation times. One-minute data for the following parameters were collected during the PM, CPM, VOCs, and HCHO test runs:

- total heat input (mmBtu/hr)
- gross electricity output (MW)
- turbine and duct burner gas flow (hundred scfh)
- ammonia injection rate (lb/hr)
- oxygen (%)
- nitrogen oxides (ppmv at 15% O_2, lb/mmBtu)
- carbon monoxide (ppmv, lb/mmBtu)

Refer to Appendix D for operating data.

4.0 SAMPLING AND ANALYTICAL PROCEDURES

RCTS personnel tested for PM, CPM, VOCs and HCHO using the USEPA test methods presented in Table 4-1. The sampling and analytical procedures associated with each parameter are described in the following sections.

Table 4-1
Test Methods

Parameter	Method	USEPA Title
Sampling location	1	Sample and Velocity Traverses for Stationary Sources
Traverse points	2	Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S Pitot Tube)
Oxygen	3A	Determination of Oxygen and Carbon Dioxide Concentrations in Emissions from Stationary Sources (Instrumental Analyzer Procedure)
Moisture	4	Determination of Moisture Content in Stack Gases
Filterable Particulate Matter*	5	Determination of Particulate Matter Emissions from Stationary Sources
Emission Rates	19	Determination of Sulfur Dioxide Removal Efficiency and Particulate Matter, Sulfur Dioxide, and Nitrogen Oxide Emission Rates
Volatile Organic Compounds	25A	Determination of Total Gaseous Phase Organic Concentration Using a Flame Ionization Analyzer
Condensable Particulate Matter*	202	Dry Impinger Method for Determining Condensable Particulate Emissions From Stationary Sources
Formaldehyde and Moisture	320	Vapor Phase Organic and Inorganic Emissions by Extractive FTIR

*: Methods 5 and 202 were conducted in conjunction to measure PM_{10}

4.1 Description of Sampling Train and Field Procedures

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

Table 4-2
Test Matrix

Source / Date (2023)	Run	Sample Type	Start Time (EST)	Stop Time (EST)	Test Duration (min)	Comment
Unit 2A 100% Load June 13	1	PM_{10}	7:55	10:18	120	Isokinetic sampling from 24 points collected 2.845 dscm sample volume; suspected leak in method 3A sample train; inaccurate oxygen and carbon dioxide data omitted from run average.
	1	VOCs HCHO	7:55	8:54	60	Single point sample; suspected leak in method 3A sample train; inaccurate oxygen and carbon dioxide data omitted from run average; oxygen and carbon dioxide data from PM10 Run 1 used in lb/mmBtu calculations.
	2	PM_{10}	10:33	13:37	120	Isokinetic sampling from 24 traverse points collected 2.960 dscm sample volume
	2	VOCs HCHO	10:37	11:36	60	Single point sample. Oxygen and carbon dioxide data from PM10 Run 2 used in lb/mmBtu calculations
	3	PM_{10}	14:00	16:25	120	Isokinetic sampling from 24 traverse points collected 3.028 dscm sample volume
	3	VOCs HCHO	14:00	14:59	60	Single point sample

Table 4-2
Test Matrix

Source / Date (2023)	Run	Sample Type	Start Time (EST)	Stop Time (EST)	Test Duration (min)	Comment
Unit 2A 70% Load June 14	1	PM_{10}	7:46	10:05	120	Isokinetic sampling from 24 traverse points collected 2.498 dscm sample volume
	1	VOCs HCHO	7:46	8:45	60	Single point sample
	2	PM_{10}	10:22	12:40	120	Isokinetic sampling from 24 traverse points collected 2.491 dscm sample volume
	2	VOCs HCHO	10:22	11:21	60	Single point sample
	3	PM_{10}	13:17	15:37	120	Isokinetic sampling from 24 traverse points collected 2.418 dscm sample volume
	3	VOCs HCHO	13:17	14:16	60	Single point sample
Unit 1A 100% Load June 15	1	PM_{10}	08:26	10:55	120	Isokinetic sampling from 24 traverse points collected 2.752 dscm sample volume
	1	VOCs HCHO	08:26	09:25	60	Single point sample
	2	PM_{10}	11:18	13:38	120	Isokinetic sampling from 24 traverse points collected 2.785 dscm sample volume
	2	VOCs HCHO	11:18	12:17	60	Single point sample
	3	PM_{10}	13:55	16:07	120	Isokinetic sampling from 24 traverse points collected 2.780 dscm sample volume
	3	VOCs HCHO	13:55	14:54	60	Single point sample
Unit 1A 70% Load June 16	1	PM_{10}	7:30	9:44	120	Isokinetic sampling from 24 traverse points collected 2.269 dscm sample volume
	1	VOCs HCHO	7:30	8:29	60	Single point sample
	2	PM_{10}	10:02	12:18	120	Isokinetic sampling from 24 traverse points collected 2.181 dscm sample volume
	2	VOCs HCHO	10:02	11:01	60	Single point sample
	3	PM_{10}	12:51	15:07	120	Isokinetic sampling from 24 traverse points collected 2.236 dscm sample volume
	3	VOCs HCHO	12:51	13:50	60	Single point sample

4.2 Sample Location and Traverse Points (USEPA Method 1)

The number and location of traverse points for determining exhaust gas velocity and volumetric airflow were determined in accordance with USEPA Method 1, Sample and Velocity Traverses for Stationary Sources. Four test ports are in the horizontal plane of each stack. The ports for the combined cycle units (2A and 2B) are situated:

- Approximately 67 feet or 4 duct diameters downstream of a flow disturbance, and
- Approximately 20 feet or 1.2 duct diameters upstream of the stack exit.

The ports for the simple cycle units (1A and 1B) are situated:

- Approximately 35 feet or 2.1 duct diameters downstream of a flow disturbance, and

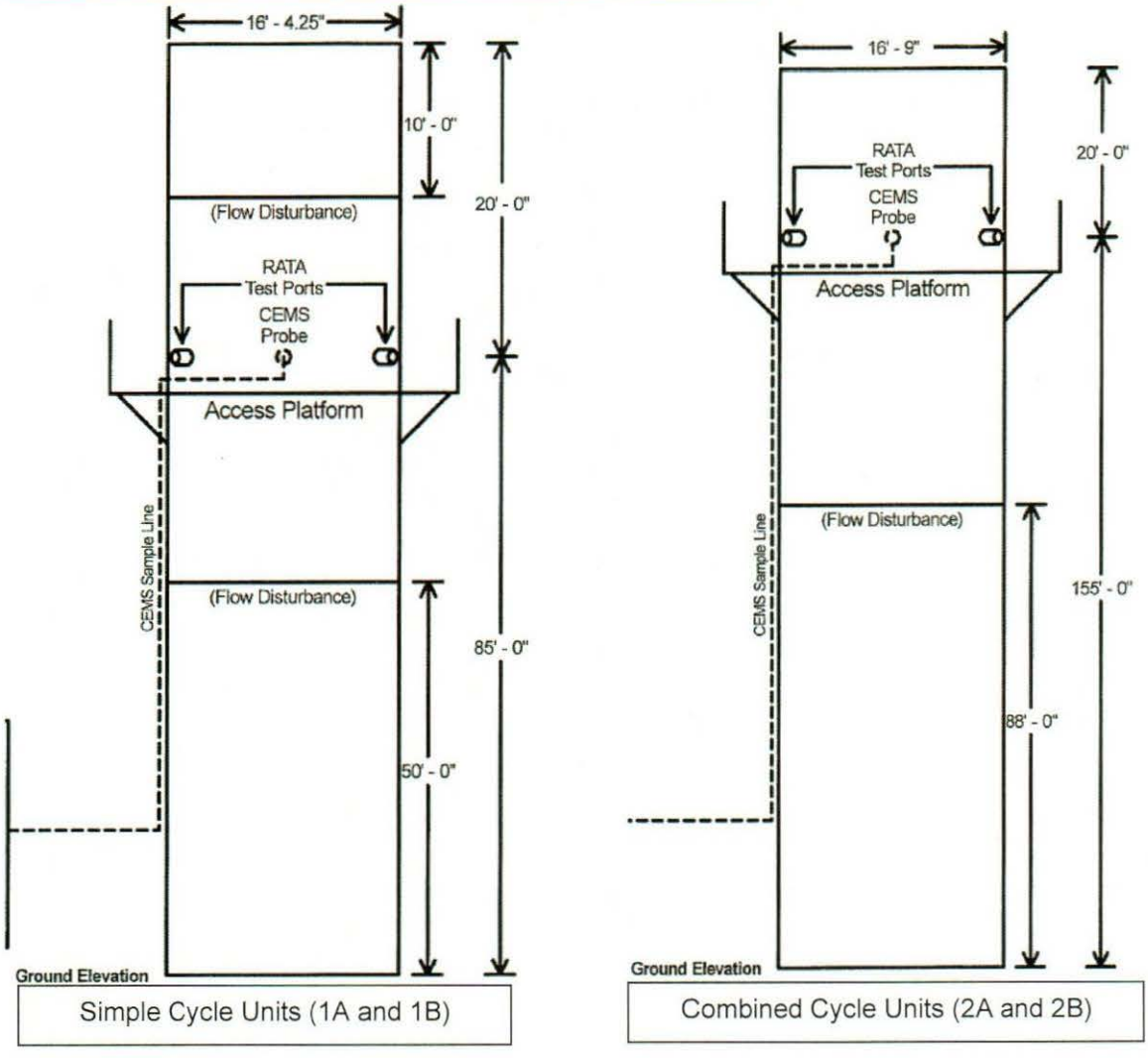
- Approximately 20 feet or 1.2 duct diameters upstream of the stack exit.

The sample ports are 6-inches in diameter and extend 20 inches beyond the stack wall for the simple cycle units and 6.25 inches beyond the stack wall on the combined units. The area of the exhaust duct was calculated, and the cross-section divided into several equal areas based on distances to air flow disturbances. Flue gas was sampled at six traverse points from four sample ports for a total of 24 sample points. A stack schematic of the sample port locations is presented in Figure 4-1 with traverse points listed in Table 4-3.

Table 4-3
Traverse Points

Traverse Point / port	Inches from stack wall (including 6.25" or 20" port length)	
	Unit 1A	Unit 2A
1	24.1	10.5
2	33.1	19.7
3	43.2	30.0
4	54.7	41.8
5	69.1	56.5
6	89.9	77.8

Figure 4-1. Simple and Combined Cycle Sampling Locations



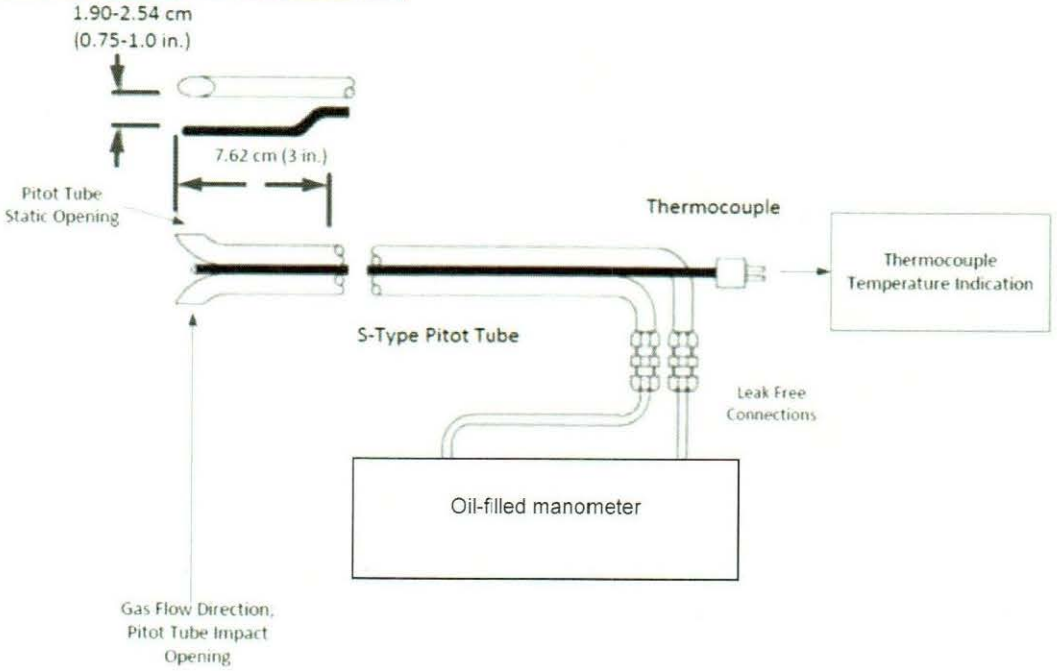
4.3 Velocity and Temperature (USEPA Method 2)

The exhaust gas velocity and temperature were measured using USEPA Method 2, *Determination of Stack Gas Temperature and Velocity (Type S Pitot Tube)*. The pressure differential (Δ P) across the positive and negative openings of the Pitot tube at each traverse point were measured using an "S Type" (Stauscheibe or reverse type) Pitot tube connected to an appropriately sized oil filled manometer. Exhaust gas temperatures were measured using a chromel/alumel "Type K" thermocouple and a temperature indicator. Refer to Figure 4-2 for the Method 2 Pitot tube and thermocouple configuration.

Flue gas velocity and velocity vector measurements (cyclonic flow evaluation) have previously been measured following the procedures in USEPA Method 2 at the sampling locations. Cyclonic flow is defined as a flow condition with an average null angle greater than 20 degrees. The direction of flow can be determined by aligning the Pitot tube to obtain zero (null) velocity head reading—the direction would be parallel to the Pitot tube face openings or perpendicular to the null position. By measuring the angle of the Pitot tube face openings in relation to the stack walls when a null angle is obtained, the direction of flow is measured. 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 1A and 2A exhausts in October 2013 were 5.4° and 3.2° respectively, thus meeting the less than 20° requirement. Since no significant ductwork and/or stack configuration changes have occurred, the null angle information is considered reliable and additional cyclonic flow verification was not performed.

Figure 4-2. Method 2 Sample Apparatus

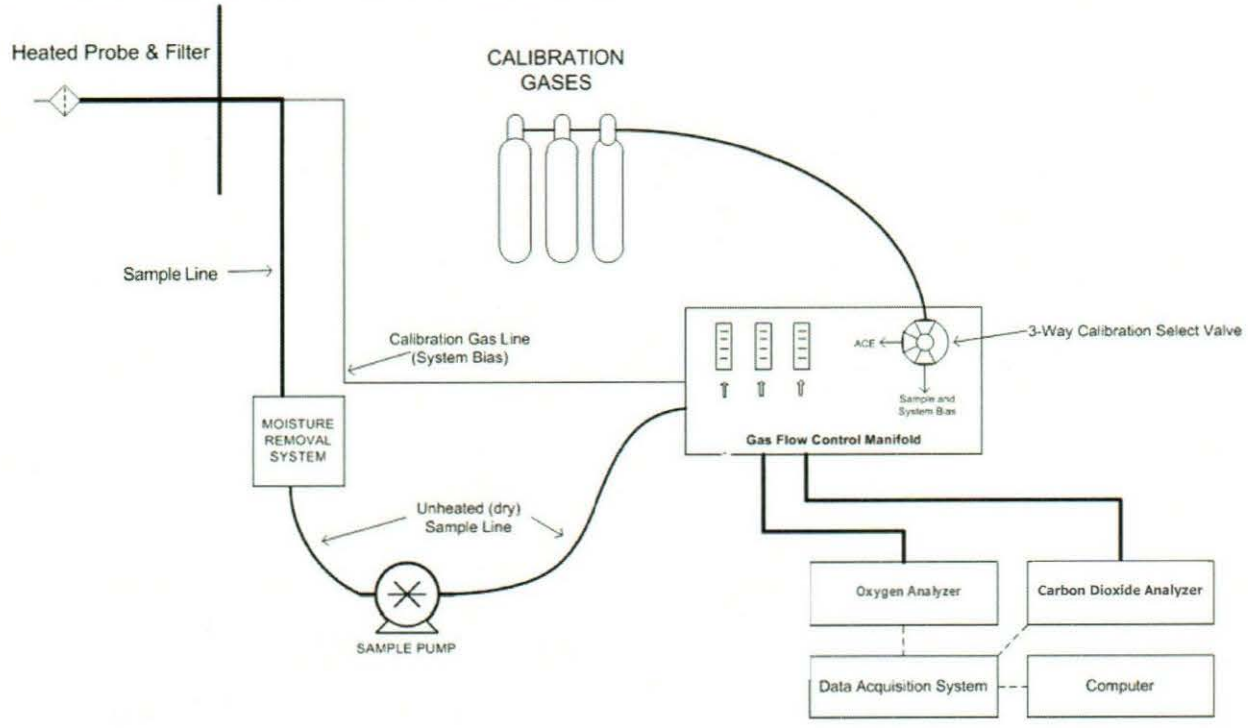


4.4 Molecular Weight (USEPA Method 3A)

Oxygen (O_2) and carbon dioxide (CO_2) 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 Method 3A sample line was attached to the Method 5 sample probe to collect O_2 and CO_2 concentrations at each of the traverse points simultaneously with PM measurements.

Flue gas was sampled from the stack through a stainless-steel probe, 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 turbine 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 or ±0.5% absolute difference to be acceptable.

An initial system bias check was then performed by measuring the instrument response while introducing zero- and mid- or high-level (upscale) calibration gases at the probe, upstream of all sample conditioning components, and drawing it through the various sample components in the same manner as flue gas. The initial system bias check is acceptable if the instrument response at the zero and upscale calibration is within ±5.0% of the calibration span or ±0.5% absolute difference.

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 turbine was operating at established conditions, the test run was initiated. O_2 and CO_2 concentrations were recorded at 1-minute intervals throughout the test run, however 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 or ±0.5% absolute difference and that 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.

4.5 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 202 sample apparatus. Flue gas was drawn through a series of impingers immersed in an ice bath to condense and remove water from the sample. The amount of water condensed and collected in the impingers was measured gravimetrically and used to calculate the exhaust gas moisture content.

4.6 Filterable Particulate Matter (USEPA Method 5)

Filterable particulate matter samples were collected isokinetically in conjunction with RM 202 following USEPA Method 5, *Determination of Particulate Matter Emissions from Stationary Sources* procedures.

The flue gas was collected using a specifically sized nozzle, probe, quartz-fiber filter, and a series of impingers configured as shown in Table 4-4. The FPM was collected on the filter and water vapor and/or CPM was collected in the impingers. Figure 4-4 depicts the USEPA Method 5 sample apparatus.

Before testing, representative flow data from previous measurements was reviewed to calculate an ideal nozzle size that allowed isokinetic sampling to be performed. A pre-cleaned nozzle that had an inner diameter approximating the calculated value was measured with calipers across three cross-sectional chords, rinsed and brushed with acetone and connected to the sample probe.

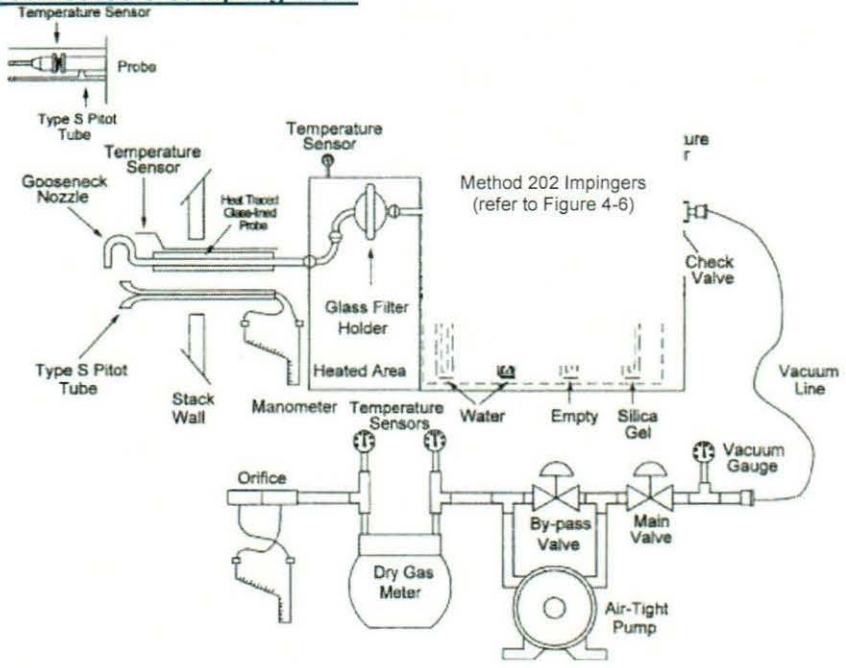
The impact and static pressure openings of the Pitot tube were leak-checked at or above a velocity head of 3.0 inches of water for a minimum of 15 seconds. The PM sample train was leak-checked by capping the nozzle opening and applying a vacuum of approximately 15 inches of mercury. The dry-gas meter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

Ice was placed around the impingers and the probe, and filter temperatures were allowed to stabilize to a temperature of 248±25°F before sampling. After the desired operating conditions were coordinated with the facility, testing was initiated. Stack and sample apparatus parameters (e.g., flue velocity, temperature) were monitored to ensure isokinetic sample rates were within 100±10% for the duration of the test.

Table 4-4
Methods 5/202 Impinger Configuration

Impinger Order (Upstream to Downstream)	Impinger Type	Impinger Contents	Amount (gram)
1	Dropout	Empty	0
2	Modified	Empty	0
CPM Filter			
3	Modified	Water	100
4	Modified	Silica gel desiccant	~200-300

Figure 4-4. USEPA Method 5 Sampling Train



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

The filter was recovered from the filter housing, 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 was triple rinsed with acetone and collected in pre-cleaned sample containers, sealed with Teflon tape, and labeled as "FPM Container 2." The flue gas moisture condensed in the impingers was weighed on an electronic scale to determine flue gas moisture content, after which the impingers were recovered following Method 202 CPM requirements (see Section 4.1.6). Refer to Figure 4-5 for the USEPA Method 5 sample recovery scheme.

The sample containers, including blanks, were transported to the RCTS laboratory for analysis. The sample analysis followed USEPA Method 5 procedures as summarized in the sample recovery scheme presented in Figure 4-6.

Figure 4-5. USEPA Method 5 Sample Recovery Scheme

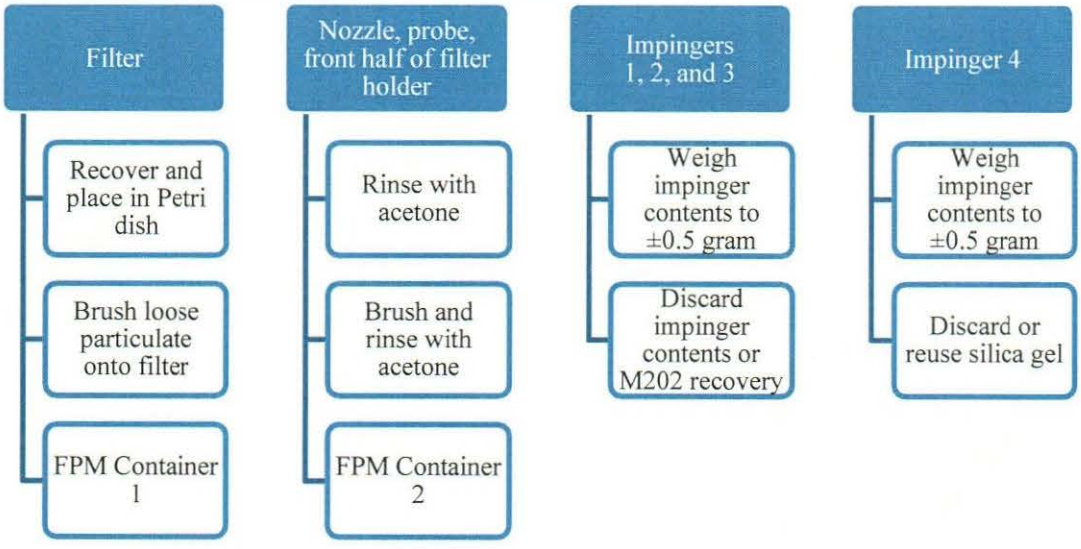
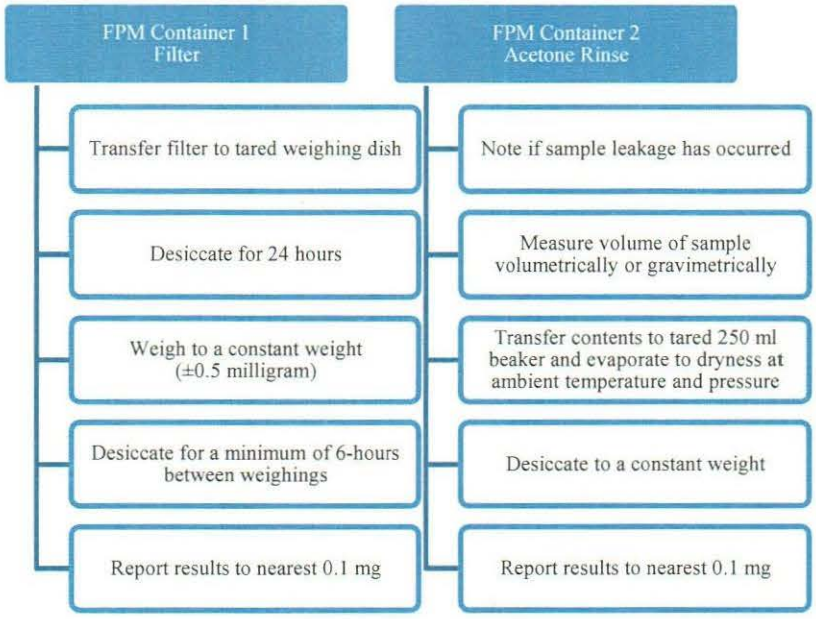


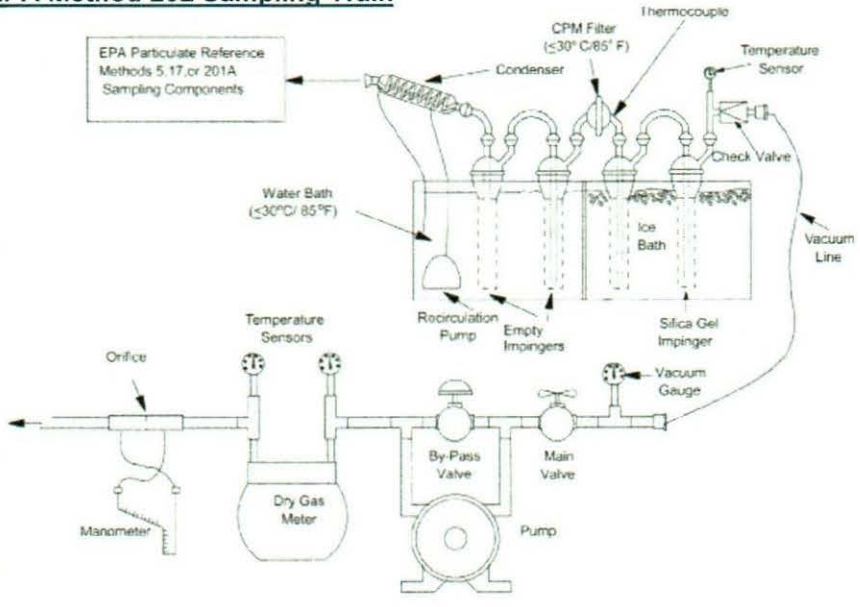
Figure 4-6. USEPA Method 5 Analytical Scheme



4.7 CONDENSABLE PARTICULATE MATTER (USEPA METHOD 202)

Condensable particulate matter was collected isokinetically in conjunction with USEPA Method 5 using 40 CFR Part 51, EPA Method 202, *Dry Impinger Method for Determining Condensable Particulate Emissions from Stationary Sources*. The Method 202 sample apparatus uses clean, oven-baked glassware comprised of a glass coil type condenser, a dropout impinger, a modified Greenburg-Smith (GS) impinger with an open tube tip, a CPM filter holder containing a Teflon filter, one impinger containing approximately 100 milliliters of water and one impinger containing silica gel. During each CPM run, temperature-controlled water recirculated in the coil condenser jacket maintained the CPM filter temperature below 85°F. Refer to Figure 4-7 for a drawing of the Method 202 sample apparatus and prior Table 4-4 which presents the Method 5/202 impinger configuration.

Figure 4-7. USEPA Method 202 Sampling Train



Upon test completion, each impinger was weighed to determine flue gas moisture content. The condenser, dropout, and back-up impingers, and the CPM filter housing were then re-assembled and

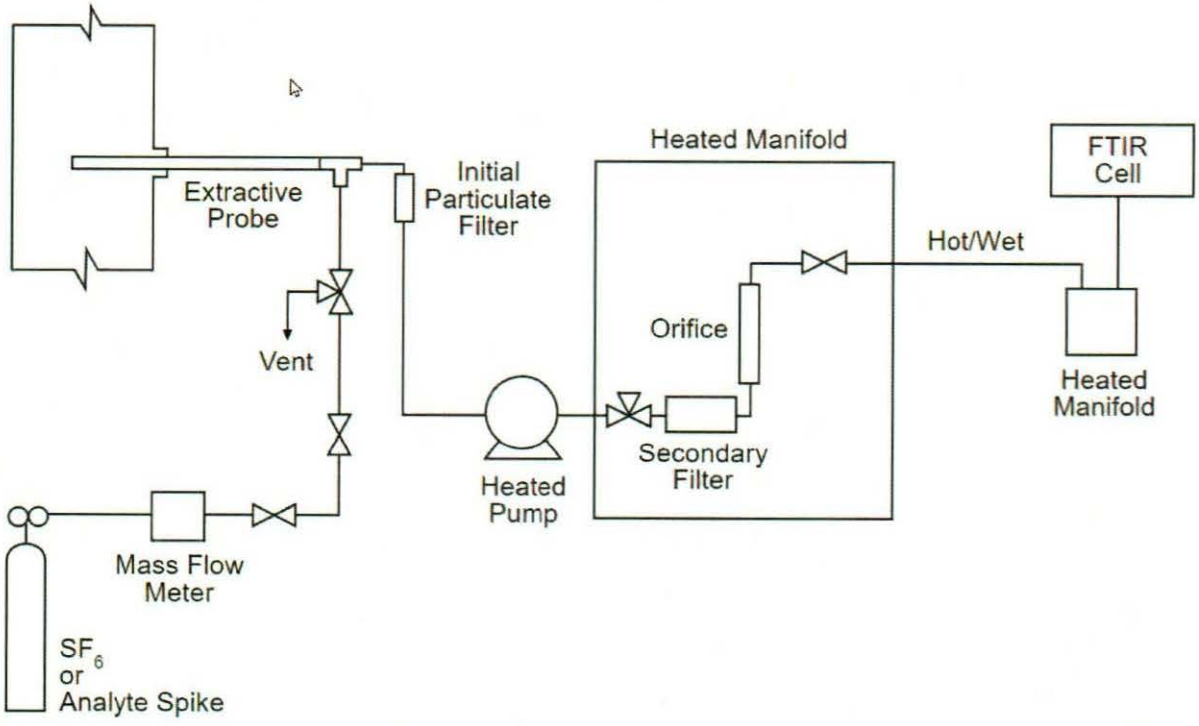
purged with Ultra-high purity nitrogen at a rate of approximately 14 liters per minute for a minimum of one hour to remove dissolved sulfur dioxide (SO_2) gases from the impinger water. During the purge, water continued to recirculate in the condenser jacket to maintain the CPM filter exit temperature and the impingers were observed to ensure the contents did not evaporate.

After the nitrogen purge, the condensate collected in the dropout and back-up impingers were transferred to a clean sample bottle labeled as CPM Container #1, Aqueous Liquid Impinger. The back half of the Method 5 filter bell, condenser, impingers and connecting glassware were then rinsed twice with deionized, ultra-filtered water into the same container. The water rinses were followed by an acetone rinse and duplicate hexane rinses into a separate sample bottle identified as CPM Container #2 (organic rinses). The CPM filter was removed prior to the water and organic rinses and placed in a clean Petri dish identified as CPM Container #3. Liquid levels on the sample bottles were marked and the samples were sealed and transported to Bureau Veritas laboratory in Mississauga, Ontario for analysis.

4.8 Moisture and Formaldehyde (USEPA Method 320)

Formaldehyde and moisture concentrations were measured following the sampling and analytical procedures of USEPA Method 320, *Vapor Phase Organic and Inorganic Emissions by Extractive FTIR.* Exhaust gas was extracted through a heated stainless-steel probe and heated Teflon® sample line prior to being introduced to a heated-head sampling pump and the FTIR. The stainless-steel probe and Teflon® sample line was maintained at approximately 300°F. Refer to Figure 4-8 for a drawing of the USEPA Method 320 Sampling/Spiking System.

Figure 4-8. USEPA Method 320 Sampling/Spiking System



FTIR data was collected using an MKS MultiGas 2030 FTIR spectrometer configured with a StarBoost system. The StarBoost technology consists of a 5-micron infrared detector, optical filtration, and signal amplification. It is designed to optimize signal response and limit instrument noise for low detection limit applications. The FTIR is equipped with a temperature-controlled, 5.11-meter multipass gas cell maintained at 191°C. Data were collected in differential mode with 2 cm-1 resolution sample data and 8 cm-1 resolution background. Each FTIR spectrum was derived from the coaddition of 200 scans with a

new data point generated approximately every 60 seconds. A minimum of 60 minutes of reference spectra data were collected for each run.

Prior to testing, a nitrogen (zero) calibration gas was introduced directly to the FTIR to verify it was free of contaminants. A methane calibration transfer standard (CTS) was introduced used to ensure suitable agreement between the sample and reference spectra. Following the CTS, a calibration gas containing 0.465543-ppmv formaldehyde (spike gas) and 252.8 ppmv N_2O (tracer gas) was introduced to the FTIR to verify calibration. The zero and CTS checks were performed through the sampling system and an analyte spike was performed by introducing the formaldehyde and N_2O calibration gas at an approximate 1:10 ratio with the sampled flue gas. The system passed the applicable QA/QC procedures.

An on-site analyte detection limit analysis was performed. The detection limit is calculated as three times the standard deviation of the concentrations from ten representative background spectra taken during the analysis. The detection limit for this test project was 30 ppbv formaldehyde and 0.1% for water.

Following each run, another CTS and zero check were recorded and compared to the pre-test CTS. The pre-test and post-test CTS are required to be within ±5% of the mean value for the run to be valid. Refer to Appendix C for the formaldehyde testing data.

4.9 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_{10}, VOC and formaldehyde emission rates in units of lb/mmBtu. Measured oxygen concentrations and F factors (ratios of combustion gas volumes to heat inputs) were used to calculate emission rates using equation 19-1 from the method.

USEPA Method 19 Equation 19-1:

Where:

E	=	Pollutant emission rate (lb/mmBtu)
C_d	=	Pollutant concentration, dry basis (lb/dscf)
F_d	=	Volumes of combustion components per unit of heat content, (dscf O_2/mmBtu)
$\%O_{2d}$	=	Concentration of oxygen on a dry basis (%, dry)

RCTS worked with the natural gas supplier (SEMCO Energy) to obtain representative natural gas analyses, and this information was then used to calculate site specific F_d factors for each day of testing in accordance with Equation 19-13 in 40 CFR Part 60, Appendix A, Reference Method 19. The resultant F_d factors of 8,503.4 – 8,508.4 dscf /mmBtu for natural gas were used to calculate RM lb/mmBtu emission rates. Refer to Appendix A for a calculation summary presenting the calculations used in this report.

4.10 Volatile Organic Compounds (USEPA Method 25A)

VOC concentrations were measured using a Thermo Model 55i Direct Methane and Non-methane analyzer following the guidelines of USEPA Method 25A, *Determination of Total Gaseous Organic Concentration Using a Flame Ionization Analyzer (FIA)*. The instrument uses a flame ionization detector (FID) to measure the exhaust gas total hydrocarbon concentration in conjunction with a gas chromatography column that separates methane from other organic compounds.

The components of the extractive sample interface apparatus are constructed of stainless steel and Teflon. Flue gas was collected from the stack via a sample probe and heated sample line and into the analyzer, which communicates with the data acquisition handling system (DAHS) via output signal cables. The analyzer uses a rotary valve and gas chromatograph column to separate methane from hydrocarbons in the sample and quantifies these components using a flame ionization detector.

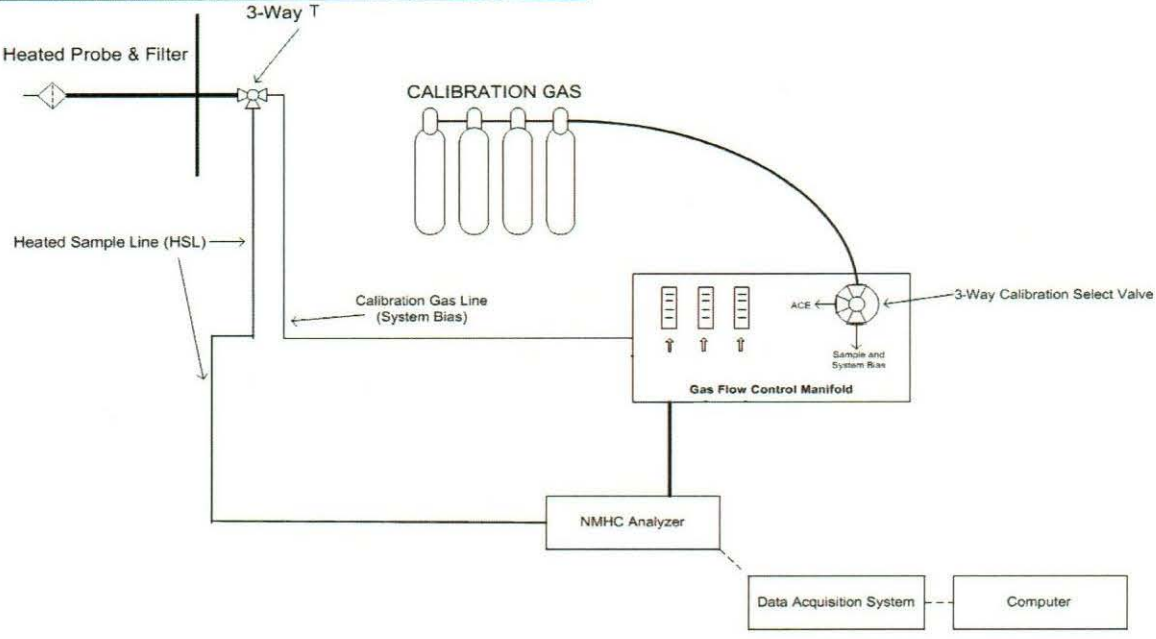
Sample gas is injected into the column and due to methane's low molecular weight and high volatility moves through the column more quickly than other organic compounds that may be present and

quantified by the FID. The column is then flushed with inert carrier gas and the remaining non-methane organic compounds are analyzed in the FID. This analytical technique allows separate measurements for methane and non-methane organic compounds via the use of a single FID. Refer to Figure 4-9 for a drawing of the USEPA Method 25A sampling apparatus.

The field VOC instrument was calibrated with a zero air and three propane in air calibration gases following USEPA Method 25A procedures at the zero level, low (25 to 35 percent of calibration span), mid (45 to 55 percent of calibration span) and high (equivalent to 80 to 90 percent of instrument span) levels. Please note that since the field VOC instrument measures on a wet basis, exhaust gas moisture content was determined during each test run to convert wet VOC concentrations to dry basis for calculating VOC mass emission rates.

The Thermo 55i analyzer used measures exhaust gas ethane as part of the NMOC measurement. Therefore, the NMOC concentrations measured may reflect a positive NMOC bias.

Figure 4-9. USEPA Method 25A Sample Apparatus



5.0 TEST RESULTS AND DISCUSSION

Although not consistent with the prescribed compliance methodology in the ROP, the Units 1A and 2A PM_{10}, VOC, and HCHO emission results generally indicate compliance with the mass emission limits in the permit. The presented tons per year values are extrapolated assuming continuous operation at the pounds per hour emission rates observed during the testing. The facility uses lb/mmBtu emission factors in conjunction with continuous heat input determinations to calculate mass emission rates, consistent with Appendix 5 of the ROP. Refer to Section 2.3 for a summary of the test results.

5.1 TABULATION OF RESULTS

Table 2-1 in Section 2 of this report summarizes the results and Appendix Tables 1 through 8 contain detailed tabulation of results, process operating conditions, and exhaust gas conditions.

Appendix D contains the CEMS related information that was collected. Tables with 1-minute averages for the preceding parameters are presented for each test run, along with the test run averages. When arriving at the test run averages, 1-minute data associated with port changes have been excluded.

When comparing the start and stop times between the RM test runs and the CEMS data, note that the last minute of the CEMS run average data is one minute ahead of the RM run end time for the PM10 testing. This is due to a difference in reporting convention, where the end minute recorded for each PM10 RM run

reflects when the last reading was taken, but not the last minute during which sampling occurred. For example, the times for Unit 2A 100% Load RM Run 1 are listed as 7:55-10:18. While the last RM Run 1 value was recorded at 10:18, the last full minute of sampling was 10:17.

5.2 Significance of Results

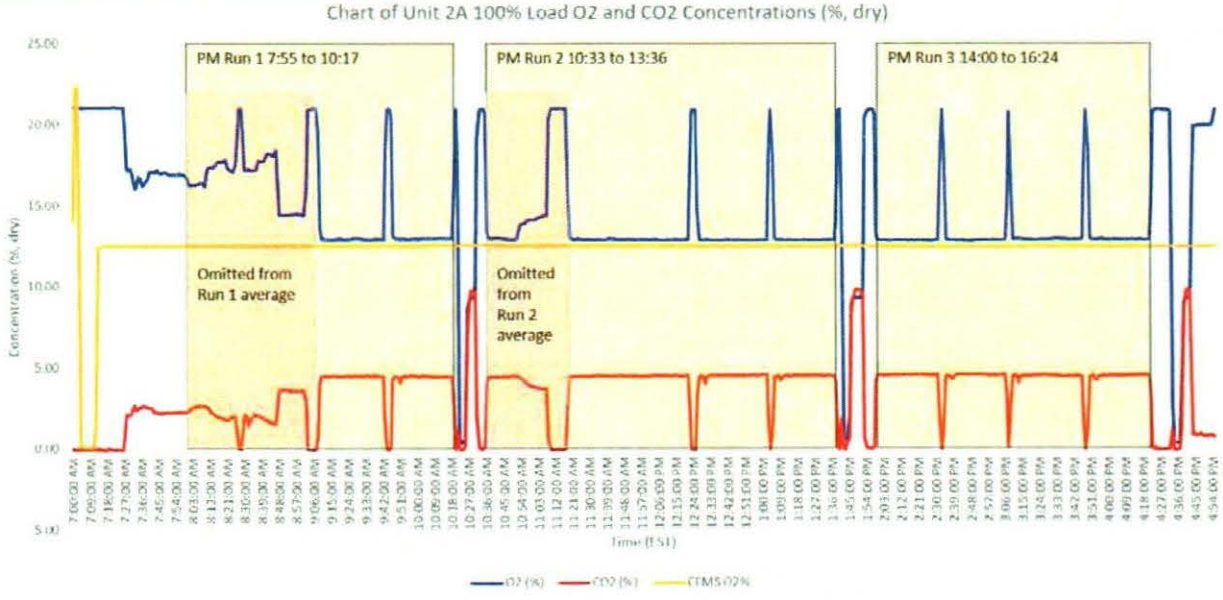
The Units 1A and 2A PM_{10}, VOCs and HCHO results (lb/mmBtu) will be used to demonstrate ongoing compliance with the mass emission limits present in MDEQ ROP MI-ROP-N6521-2020a. The lb/mmBtu emission factors will be used in conjunction with heat input determinations to calculate mass emissions based upon the proper averaging periods.

5.3 Variations from Sampling or Operating Conditions

To present test data on a consistent basis, O_2 and CO_2 (diluent) concentrations, turbine operating parameters, and CEMS concentrations were averaged according to PM sampling start and stop times, omitting sample port changes. No variations from sampling or operating conditions were encountered; however, the diluent RM concentrations measured appear to differ in comparison to the facility O_2 CEMS during the Unit 2A 100% load sampling.

Review of diluent concentration data suggests ambient air was pulled into the sample path during RM Runs 1 and 2 of the Unit 2A 100% load sampling. The cause of in leakage is unknown; however, it is suspected that an intermittent leak within the M3A sampling system, which was connected to the M5/202 sampling apparatus, was the contributing factor. Refer to the chart of Unit 2A 100% load RM O_2, RM CO_2, and CEMS O_2 concentrations.

Figure 5-1. Chart of Unit 2A 100% Load Diluent Concentrations



Because the diluent concentrations are used to calculate emission rates, the inaccurate O_2 and CO_2 concentration data were omitted from the Run 1 and 2 averages. The average O_2 diluent concentrations from Runs 1 and 2 of the PM sampling were used for the Run 1 (7:55-8:54) and Run 2 (10:37-11:36) VOC and formaldehyde emissions calculations.

5.4 Process or Control Equipment Upset Conditions

The turbines 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. However, Consumers Energy is still assessing the newly established emission factors and may choose to retest one or more pollutants in order to establish potentially lower emission factors.

5.7 Results of Audit Samples

Audit samples are not required for the reference methods utilized during this test program and are not available from USEPA Stationary Source Audit Sample Program providers. A list of QA/QC Procedures is listed below in Table 5-1.

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 up- and downstream distance from ports to 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
M1: Cyclonic flow evaluation	Evaluate the sampling location for cyclonic flow	Measure null angles	Pre-test	≤20°
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
M2: Pitot tube leak check	Verify leak free sampling systems	Apply minimum pressure of 3.0 inches of H_2O to Pitot tube	Pre-test and Post-test	±0.01 in H_2O for 15 seconds at minimum 3.0 in H_2O velocity head
M3A: Calibration gas standards	Ensure accurate calibration standards	Traceability protocol of calibration gases	Pre-test	Calibration gas uncertainty ≤2.0%
M3A: Calibration Error	Evaluates operation of analyzers	Calibration gases introduces directly into analyzer	Pre-test	±2.0% of the calibration span
M3A: System bias and analyzer drift	Evaluates sample system stack gas delivery to analyzers	Calibration gases introduced through sample system	Pre- and Post-test	Bias: ±5.0% of analyzer span Drift: ±3.0% of analyzer span
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
M4: Impinger temperature	Ensures collection of condensed water	Maintain last impinger temperature ≤68°F	Throughout test	Last impinger temperature must be ≤68°F
M5: 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: Apparatus Temperature	Prevents condensation within sample apparatus	Set probe & filter heat controllers to 248±25°F	Verify prior to and during each run	Apparatus temperature must be 248±25°F
M5: sample rate	Ensure representative sample collection	Calculate isokinetic sample rate	During and post-test	100±10% isokinetic rate

Table 5-1
QA/QC Procedures

QA/QC Activity	Purpose	Procedure	Frequency	Acceptance Criteria
M5/202: Post-test leak check	Evaluate if system leaks biased the sample	Cap sample train; monitor DGM	Post-test	≤0.020 cfm
M5/202: post-test meter audit	Evaluates sample volume accuracy	DGM pre- and post-test; compare calibration factors (Y and Yqa)	Pre-test Post-test	±5%
M202: impinger temperature	Ensure collection of condensates	Maintain CPM filter temperature below 85°F	Throughout test	CPM filter temperature must be ≥65°F and ≤85°F
M320: Zero	Verify contaminant free system and detection limit	Calibration gas introduced directly into analyzer	Pre- and Post-test	<detection limit
M320: CTS Direct	Verify analytical stability	Calibration gas directly into analyzer	Pre-test	±5% of calibration value
M320: Analyte Direct	Verify FTIR calibration	Calibration gas directly into analyzer	Pre-test	Verify calibration value
M320: CTS Response	Verify sample recovery	Calibration gas through sample system	Pre- and Post-test	±5% of direct measurement
M320: Zero Response Spike	Verify leak free analytical system	Calibration gas through sample system	Pre- and Post-test	Bias correct data
M320: Analyte Spike	Evaluates operation of analyzer	Calibration gas into sampling system at ≤10.0% of sampling rate	Pre-test Post-test	average spiked concentration 0.7 to 1.3 times the expected concentration

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.

5.12 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	-0.6 mg	Sample volume was 200 milliliters Acetone blank corrections were not applied
Method 5 Filter Blank	0.0 mg	Reporting limit is 0.1 milligrams

Table 5-2
QA/QC Blanks

Sample Identification	Result	Comment
Method 202 DI H_2O Blank	0.6 mg	Sample weight was 290 grams Result is for inorganic condensable
Method 202 Acetone Blank	<1.0 mg	Sample weight was 240 grams Result is for organic condensable
Method 202 Hexane Blank	<1.0 mg	Sample weight was 170 grams Result is for organic condensable
Method 202 Field Train Proof Blank (6/12/2023)	2.9 mg inorganic 1.0 mg organic	Total CPM of 3.9 mg. Evaluates M202 glassware after cleaning and oven-baking, prior to sampling. Per discussions with EPA and EGLE, a blank correction of 3.9 mg was applied.
Method 202 Field Train Proof Blank (6/15/2023)	4.2 mg inorganic 6.8 mg organic	Total CPM of 11.0 mg. Evaluates M202 glassware after cleaning but no oven-baking prior to sampling Unit 1A. Per discussions with EPA and EGLE, a blank correction of 5.1 mg was applied.
Method 202 Field Train Recovery Blank (1A)	3.1 mg inorganic 5.6 mg organic	Total CPM of 8.7 mg. Blank correction alternatively based on Field Train Proof Blank.
Method 202 Field Train Recovery Blank (2A)	4.4 mg inorganic 5.3 mg organic	Total CPM of 9.7 mg. Blank correction alternatively based on Field Train Proof Blank.

High Method 202 field train proof and recovery blank results were measured. The origin of the high blank values is unknown and likely bias the CPM and total PM10 results high for the testing performed.

Despite following EPA Method 202 Best Practices procedures and those incorporated into internal quality systems, the Method 202 blank values indicate contamination, which caused a high bias to the test results. After discussions with Ned Shappley with EPA and Jeremy Howe with EGLE, and to avoid overestimation of the results that could affect ongoing compliance determinations, the field train proof blanks were used in lieu of the field train recovery blanks, up to values as high as 5.1 mg, in the calculation of PM10 as stipulated in EPA's Interim Guidance on the Treatment of Condensable Particulate Matter Test Results.

Before the field trains were deployed in the field, they were thoroughly cleaned, and the glassware was baked as described in Section 8.4 of Method 202. Although not required after baking the glassware, a Field Train Proof (FTP) blank was performed on 06/12/2023 before the start of field testing. An additional FTP blank was performed on 06/15/2023 after the completion of the Unit 2A testing and before commencing the Unit 1A testing. The glassware was not baked between the Units 2A and 1A testing.

On the Emissions Measurement Center (EMC) website dedicated to Method 202 (https://www.epa.gov/emc/method-202-condensable-particulate-matter [epa.gov]), EMC links to an EPA memorandum titled "Interim Guidance on Treatment of Condensable Particulate Matter Test Results in the Prevention of Significant Deterioration and Nonattainment New Source Review Permitting Programs". Within that memorandum, EPA discusses the concept that it may be appropriate to use a blank correction of up to 5.1 mg when using a Field Train Proof Blank in lieu of a Field Train Recovery (FTR) blank.

It is appropriate to apply the initial FTP blank value of 3.9 mg to the Unit 2A Method 202 testing, as the initial FTP blank indicates contamination existed before any sampling had commenced, more than the 2.0 mg correction normally allowed by Method 202. Further, a blank correction of 5.1 mg is appropriate for the Unit 1A testing, as the FTP blank for Unit 1A resulted in a total condensable PM catch of 11.0 mg. Without adjustment of the typical 2.0 mg blank correction factor, the bias suggested by the FTP blanks is quite high relative to the total condensable PM catch for each test series.

Table 5-3 below presents a summary of the PM10 lb/mmBtu emission factors based on the standard 2.0 mg blank correction and the alternate blank corrections based upon the FTP blank results.

Table 5-3
Impact of Alternate Method 202 Blank Corrections

Unit	% Load Condition	Normal Maximum M 202 Blank Correction (mg)	Average PM10 Emission Rate Based on Normal Maximum Blank Correction (lb/mmBtu)	Proposed M 202 Blank Correction Based on Field Train Proof (mg)	Average PM10 Emission Rate Based on Proposed Blank Correction (lb/mmBtu)
1A	100	2.0	0.00609	5.1	0.00433
1A	70	2.0	0.00529	5.1	0.00308
2A	100	2.0	0.00683	3.9	0.00595
2A	70	2.0	0.00572	3.9	0.00451