NEW SOURCE PERFORMANCE STANDARD AND NESHAP FORMALDEHYDE EMISSIONS TEST REPORT
2022 COMPLIANCE TEST
THE UNIVERSITY OF MICHIGAN
CENTRAL POWER PLANT
COMBINED HEAT AND POWER UNIT (EUCPP-CHPHRSG)
ANN ARBOR, MICHIGAN

Prepared For:

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For Submittal To:

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Test Dates: **August 23, 24, and 25, 2022**
Submittal Date: **October 26, 2022**

STAC STACK TESTING ACCREDITATION COUNCIL

A2LA ACCREDITED TO ASTM D7036 ONLY CERT #3925.01

MONTROSE AIR QUALITY SERVICES

REVIEW AND CERTIFICATION

All work, calculations, and other activities and tasks performed and presented in this document were carried out by me or under my direction and supervision. I hereby certify that, to the best of my knowledge, Montrose operated in conformance with the requirements of the Montrose Quality Management System and ASTM D7036-04 during this test project.

Signature: _____ Date: 10/19/2022

Name: Blake Ericson Title: Business Development Manager

I have reviewed, technically and editorially, details, calculations, results, conclusions, and other appropriate written materials contained herein. I hereby certify that, to the best of my knowledge, the presented material is authentic, accurate, and conforms to the requirements of the Montrose Quality Management System and ASTM D7036-04.

Signature: _____ Date: 10/19/2022

Name: John Nestor Title: District Manager

TABLE OF CONTENTS

LIST OF APPENDICES

LIST OF TABLES

LIST OF FIGURES

1.0 INTRODUCTION

1.1 SUMMARY OF TEST PROGRAM

The University of Michigan (U-M) contracted Montrose Air Quality Services, LLC (Montrose) to perform New Source Performance Standard and NESHAP Formaldehyde emissions testing on the EUCPP-CHPHRSG at the Central Power Plant facility located in Ann Arbor, Michigan. The tests were conducted to meet the requirements of the Michigan Department of Environment, Great Lakes, and Energy (EGLE) Renewable Operating Permit (ROP) No. MI-ROP-M0675-2021a (permit number at time of test); 40 CFR Part 63, Subpart YYYY; and 40 CFR Part 60, Subpart KKKK.

The specific objectives were to:

- Determine the concentrations and emission rates of PM as $PM_{2.5}/PM_{10}$, CO, VOC, and formaldehyde (CH_2O) from EUCPP-CHPHRSG while burning natural gas (NG)
- Determine the concentrations and emission rates of PM as $PM_{2.5}/PM_{10}$, CO, and VOC from EUCPP-CHPHRSG while burning fuel oil (FO)
- Conduct the test program with a focus on safety

Montrose performed the tests to measure the emission parameters listed in Table 1-1.

TABLE 1-1
SUMMARY OF TEST PROGRAM

Test Dates	Unit ID/ Source Name	Activity/ Parameters	Test Methods	No. of Runs	Duration (Minutes)
8/23/22	EUCPP-	Velocity/Volumetric Flow	EPA 1 & 2	3	180
8/25/22	CHPHRSG (NG)	O_2, CO_2	EPA 3A	3	180
		Moisture	EPA 4	3	180
		FPM, CPM, TPM	EPA 5/202	3	180
		CO	EPA 10	3	60
		VOC	EPA 25A/18	3	60
		CH_2O	EPA 320	3	60
8/24/22	EUCPP-	Velocity/Volumetric Flow	EPA 1 & 2	3	180
	CHPHRSG (FO)	O_2, CO_2	EPA 3A	3	180
		Moisture	EPA 4	3	180
		FPM, CPM, TPM	EPA 5/202	3	180
		CO	EPA 10	3	60
		VOC	EPA 25A/18	3	60

To simplify this report, a list of Units and Abbreviations is included in Appendix D.1. Throughout this report, chemical nomenclature, acronyms, and reporting units are not defined. Please refer to the list for specific details.

This report presents the test results and supporting data, descriptions of the testing procedures, descriptions of the facility and sampling locations, and a summary of the quality assurance procedures used by Montrose. The average emission test results are summarized and compared to their respective permit limits in Table 1-2 and Table 1-3. Detailed results for individual test runs can be found in Section 4.0. All supporting data can be found in the appendices.

The tests were conducted according to Test Plan No. MW011AS-018271-PP-553 dated July 19, 2022, and according to the EGLE Approval Letter dated August 11, 2022. At the time of the test, there was a change from the approved test protocol. Details can be found in section 4.1.

TABLE 1-2
SUMMARY OF AVERAGE COMPLIANCE RESULTS -
EUCPP-CHPHRSG (NG)
AUGUST 23 AND 25, 2022

Parameter/Units	Average Results	Emission Limits
Formaldehyde(CH_2O)		
ppbvd	22	--
ppbvd @ 15% O_2	17	91
lb/hr	0.065	--
Carbon Monoxide (CO)		
ppmvd	0.073	--
lb/hr	0.036	19.33
Total Non-Methane/Non-Ethane Hydrocarbons, as Propane (VOC)		
ppmvd	0.000	--
lb/hr	0.000	4.08
Total Particulate Matter (TPM) as PM2.5/PM10		
gr/dscf	0.0005	--
lb/hr	0.441	3.60

TABLE 1-3
SUMMARY OF AVERAGE COMPLIANCE RESULTS -
EUCPP-CHPHRSG (FO)
August 24, 2022

Parameter/Units	Average Results	Emission Limits
Carbon Monoxide (CO)		
ppmvd	0.673	--
lb/hr	0.264	10.10
Total Non-Methane/Non-Ethane Hydrocarbons, as Propane (VOC)		
ppmvd	0.000	--
lb/hr	0.000	5.8
Total Particulate Matter (TPM) as PM2.5/PM10		
gr/dscf	0.0007	--
lb/hr	0.6082	3.50

1.2 KEY PERSONNEL

A list of project participants is included below:

Facility Information

Source Location:	The University of Michigan Central Power Plant 1120 E. Huron Street Ann Arbor, MI 48104
Project Contact:	Brandi Campbell
Role:	Sr. Environmental Specialist
Company:	The University of Michigan
Telephone:	734-647-9017
Email:	campbelb@umich.edu

Agency Information

Regulatory Agency:	EGLE
Agency Contact:	TPU Supervisor
Address:	525 West Allegan Street Lansing, MI 48933-1502

Testing Company Information

Testing Firm:	Montrose Air Quality Services, LLC	
Contact:	Blake Ericson	John Nestor
Title:	Business Development Manager	District Manager
Telephone:	586-242-3599	248-548-8070
Email:	bericson@montrose-env.com	jonestor@montrose-env.com

Laboratory Information

Laboratory:	Enthalpy Analytical, LLC
City, State:	Durham, NC 27713
Methods:	5 and 202

Test personnel and observers are summarized in Table 1-4.

TABLE 1-4
TEST PERSONNEL AND OBSERVERS

Name	Affiliation	Role/Responsibility
John Hamner	Montrose	Project Manager/Field Team Leader/Qualified Individual (QI)/Trailer operator/Sample recovery/Sample train operator
Thomas Cassin	Montrose	Project Manager/Field Team Leader/Qualified Individual (QI)/Sample train operator
Blake Ericson	Montrose	Chemist/FTIR operator
John Nestor	Montrose	Project Manager/Field Team Leader/Qualified Individual (QI)/Sample train operator
William Lambourn	Montrose	Tech
David Koponen	Montrose	Tech/Sample train operator
Gina Angellotti	EGLE	AQD/Observer
Jacob Cartee	Montrose	Report preparation
Brandi Campbell	U-M	Client Liaison/Test Coordinator

2.0 PLANT AND SAMPLING LOCATION DESCRIPTIONS

2.1 PROCESS DESCRIPTION, OPERATION, AND CONTROL EQUIPMENT

2.1.1 Combined Heat and Power Unit (EUCPP-CHPHRSG)

The combined heat and power unit (CHP) with heat recovery steam generator (HRSG) (EUCPP-CHPHRSG) produces a nominal 15.8 MW of electricity. The primary fuel for the turbine is natural gas, but it is also capable of firing ultra-low sulfur diesel (ULSD) as a back-up fuel. The combustion gas turbine (CTG) is a Solar Titan 130E with a rating of 190.1 MMBtu/hr (HHV) when firing natural gas and 173.4 MMBtu/hr (HHV) when firing ULSD. The HRSG is equipped with a natural gas-fired duct burner rated at 112 MMBtu/hr (HHV) to provide heat for additional steam production. The HRSG is not capable of operating independently from the CTG. The natural gas duct burner is not operated when ULSD is being fired in the turbine. The CTG/HRSG is equipped with dry low NOx combustion technology and selective catalytic reduction (SCR).

2.2 FLUE GAS SAMPLING LOCATIONS

Information regarding the sampling locations is presented in Table 2-1.

TABLE 2-1
SAMPLING LOCATIONS

Sampling Location	Stack Inside Diameter (in.)	Distance from Nearest Disturbance		Number of Traverse Points
		Downstream EPA "B" (in./dia.)	Upstream EPA "A" (in./dia.)	
SV-B0260-02	168.0	>336.0/>2.0	>84.0/>0.5	Isokinetic: 24 (12/port); Gaseous: 12

The sample locations were verified in the field to conform to EPA Method 1. Absence of cyclonic flow conditions was confirmed following EPA Method 1, Section 11.4. See Appendix A.1 for more information.

2.3 OPERATING CONDITIONS AND PROCESS DATA

Emission tests were performed on EUCPP-CHPHRSG during normal maximum operations. The performance test was performed within ±10% of 100% of peak load or at the highest achievable load point, if at least 75 percent of peak load cannot be achieved in practice. Three separate test runs were performed for each performance test. The minimum time per run is 20 minutes. Plant personnel were responsible for establishing the test conditions and collecting all applicable unit-operating data. Data collected includes the following parameters:

- Heat input, MMBtu/hr
- Fuel flow
- Load, MW

3.0 SAMPLING AND ANALYTICAL PROCEDURES

3.1 TEST METHODS

The test methods for this test program were presented previously in Table 1-1. Additional information regarding specific applications or modifications to standard procedures is presented below.

3.1.1 EPA Method 1, Sample and Velocity Traverses for Stationary Sources

EPA Method 1 is used to assure that representative samples or measurements of volumetric flow rate are obtained by dividing the cross-section of the stack or duct into equal areas, and then locating a traverse point within each of the equal areas. Acceptable sample locations must be located at least two stack or duct equivalent diameters downstream from a flow disturbance and one-half equivalent diameter upstream from a flow disturbance.

Pertinent information regarding the performance of the method is presented below:

- Method Options:
  - None
- Method Exceptions:
  - None

The sample port and traverse point locations are detailed in Appendix A.

3.1.2 EPA Method 2, Determination of Gas Velocity and Volumetric Flow Rate (Type S Pitot Tube)

EPA Method 2 is used to measure the gas velocity using an S-type pitot tube connected to a pressure measurement device, and to measure the gas temperature using a calibrated thermocouple connected to a thermocouple indicator. Typically, Type S (Stausscheibe) pitot tubes conforming to the geometric specifications in the test method are used, along with an inclined manometer. The measurements are made at traverse points specified by EPA Method 1. The molecular weight of the gas stream is determined from independent measurements of O_2, CO_2, and moisture. The stack gas volumetric flow rate is calculated using the measured average velocity head, the area of the duct at the measurement plane, the measured average temperature, the measured duct static pressure, the molecular weight of the gas stream, and the measured moisture.

Pertinent information regarding the performance of the method is presented below:

- Method Options:
  - S-type pitot tube coefficient is 0.84
- Method Exceptions:
  - None

The typical sampling system is detailed in Figure 3-2.

3.1.3 EPA Methods 3A and 10, Determination of Oxygen, Carbon Dioxide, and Carbon Monoxide Concentrations in Emissions from Stationary Sources (Instrumental Analyzer Procedure)

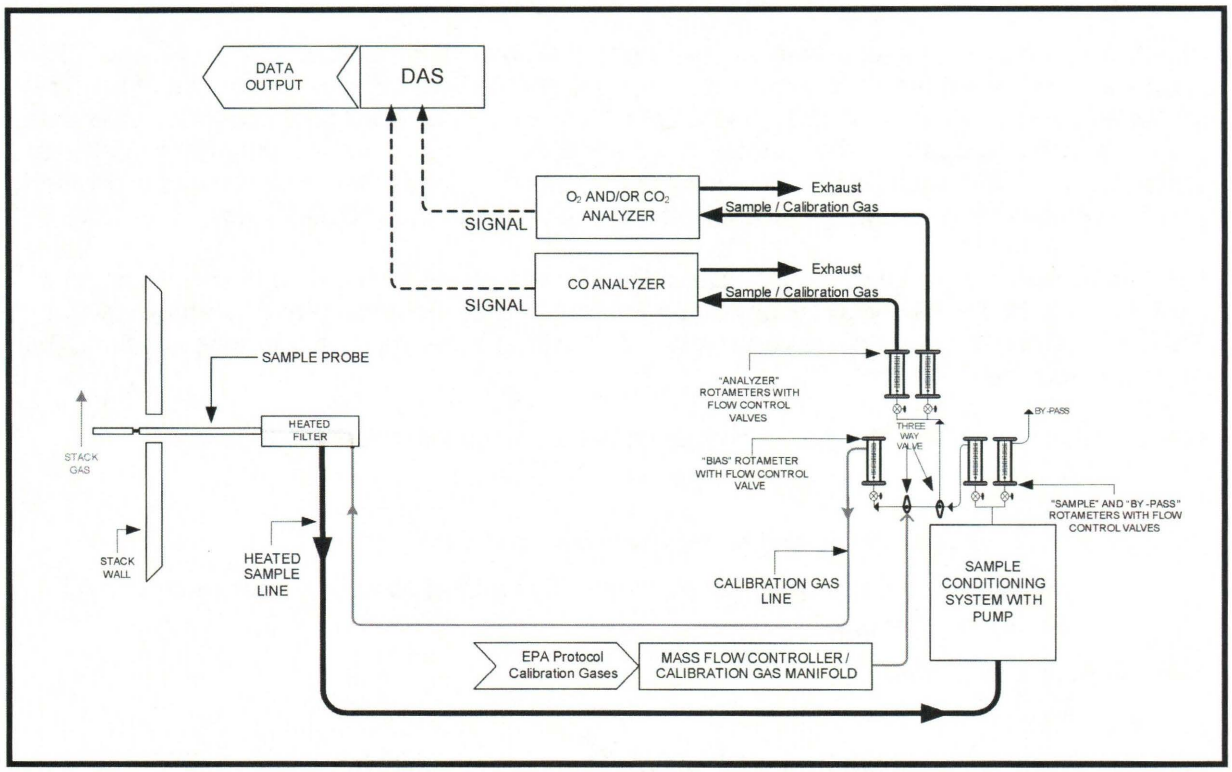
Concentrations of O_2, CO_2, and CO are measured simultaneously using EPA Methods 3A and 10, which are instrumental test methods. Conditioned gas is sent to a series of analyzers to measure the gaseous emission concentrations. The performance requirements of the method must be met to validate the data.

Pertinent information regarding the performance of the method is presented below:

- Method Options:
  - A dry extractive sampling system is used to report emissions on a dry basis
  - A paramagnetic analyzer is used to measure O_2
  - A nondispersive infrared analyzer is used to measure CO_2
  - A gas filter correlation nondispersive infrared analyzer is used to measure CO
- Method Exceptions:
  - None
- Target and/or Minimum Required Sample Duration: 60 minutes
- Target Analytes: O_2, CO_2, and CO

The typical sampling system is detailed in Figure 3-1.

FIGURE 3-1
EPA METHOD 3A AND 10 SAMPLING TRAIN



3.1.4 EPA Method 4, Determination of Moisture Content in Stack Gas

EPA Method 4 is a manual, non-isokinetic method used to measure the moisture content of gas streams. Gas is sampled at a constant sampling rate through a probe and impinger train. Moisture is removed using a series of pre-weighed impingers containing methodology-specific liquids and silica gel immersed in an ice water bath. The impingers are weighed after each run to determine the percent moisture.

Pertinent information regarding the performance of the method is presented below:

- Method Options:
  - Moisture sampling is performed as part of the pollutant sample trains
  - Since it is theoretically impossible for measured moisture to be higher than psychrometric moisture, the psychrometric moisture is also calculated, and the lower moisture value is used in the calculations
- Method Exceptions:
  - None
- Target and/or Minimum Required Sample Duration: 180 minutes

The typical sampling system is detailed in Figure 3-2.

3.1.5 EPA Methods 5 and 202, Determination of Particulate Matter Emissions from Stationary Sources and Dry Impinger Method for Determining Condensable Particulate Emissions from Stationary Sources

EPA Methods 5 and 202 are manual, isokinetic methods used to measure FPM and CPM emissions. FPM is withdrawn isokinetically from the source and collected on a glass fiber filter maintained at a temperature of 120 ± 14 °C (248 ± 25 °F) or such other temperature as specified by an applicable subpart of the standards or approved by the Administrator for a particular application. The FPM mass, which includes any material that condenses at or above the filtration temperature, is determined gravimetrically after the removal of uncombined water.

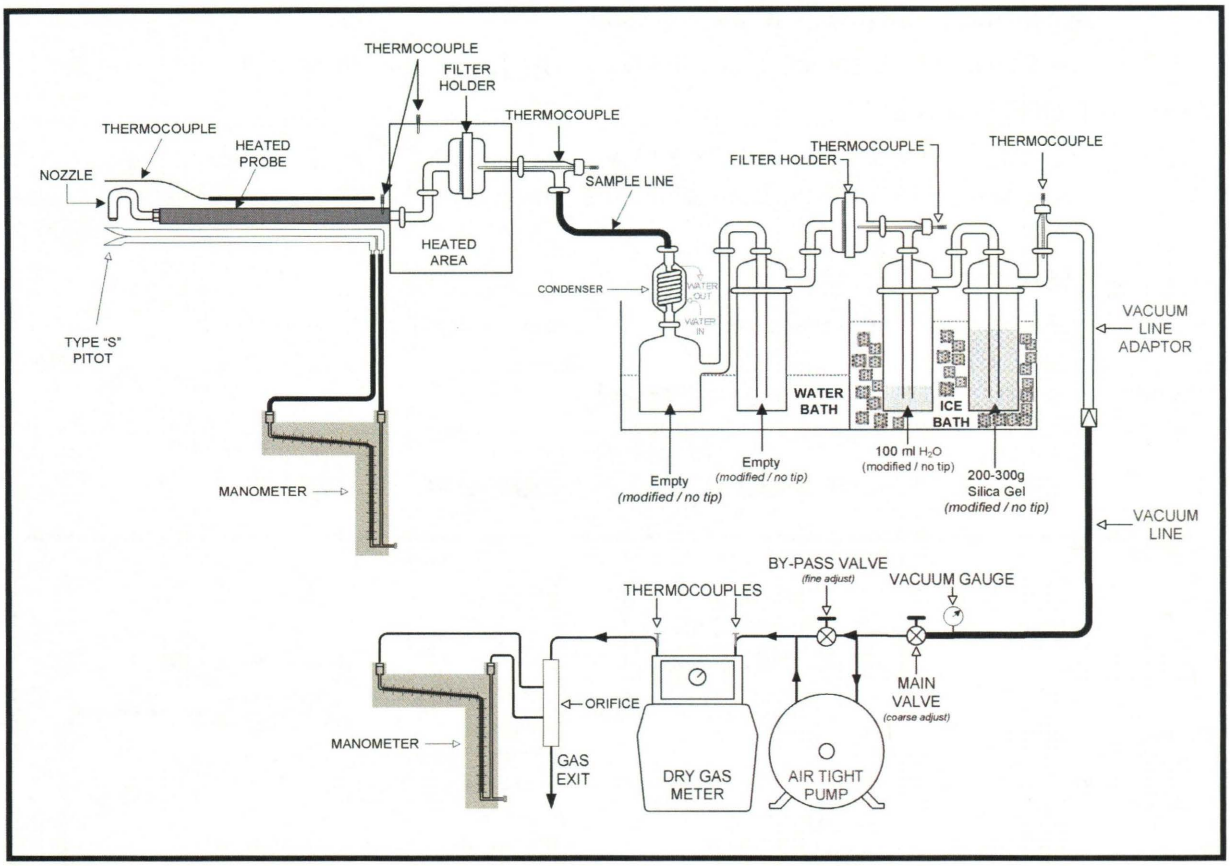
CPM is collected in dry impingers after filterable PM has been collected on a filter maintained as specified in Method 5. The organic and aqueous fractions of the impingers and an out-of-stack CPM filter are then taken to dryness and weighed. The total of the impinger fractions and the CPM filter represents the CPM.

Pertinent information regarding the performance of the method is presented below:

- Method Options:
  - Glass sample nozzles and probe liners are used
  - The post-test nitrogen purge is performed by passing nitrogen through the train under pressure
- Method Exceptions:
  - None
- Target and/or Minimum Required Sample Duration: 180 minutes
- Analytical Laboratory: Enthalpy Analytical LLC, Durham, North Carolina

The typical sampling system is detailed in Figure 3-2.

FIGURE 3-2
EPA METHOD 2, 4, 5/202 (DETACHED) SAMPLING TRAIN



3.1.6 EPA Methods 25A and 18, Determination of Total Gaseous Organic Concentration Using a Flame Ionization Analyzer and Measurement of Gaseous Organic Compound Emissions by Gas Chromatography

EPA Method 25A is an instrumental test method used to measure the concentration of THC in stack gas. A gas sample is extracted from the source through a heated sample line and glass fiber filter to an FIA. Results are reported as volume concentration equivalents of the calibration gas or as carbon equivalents.

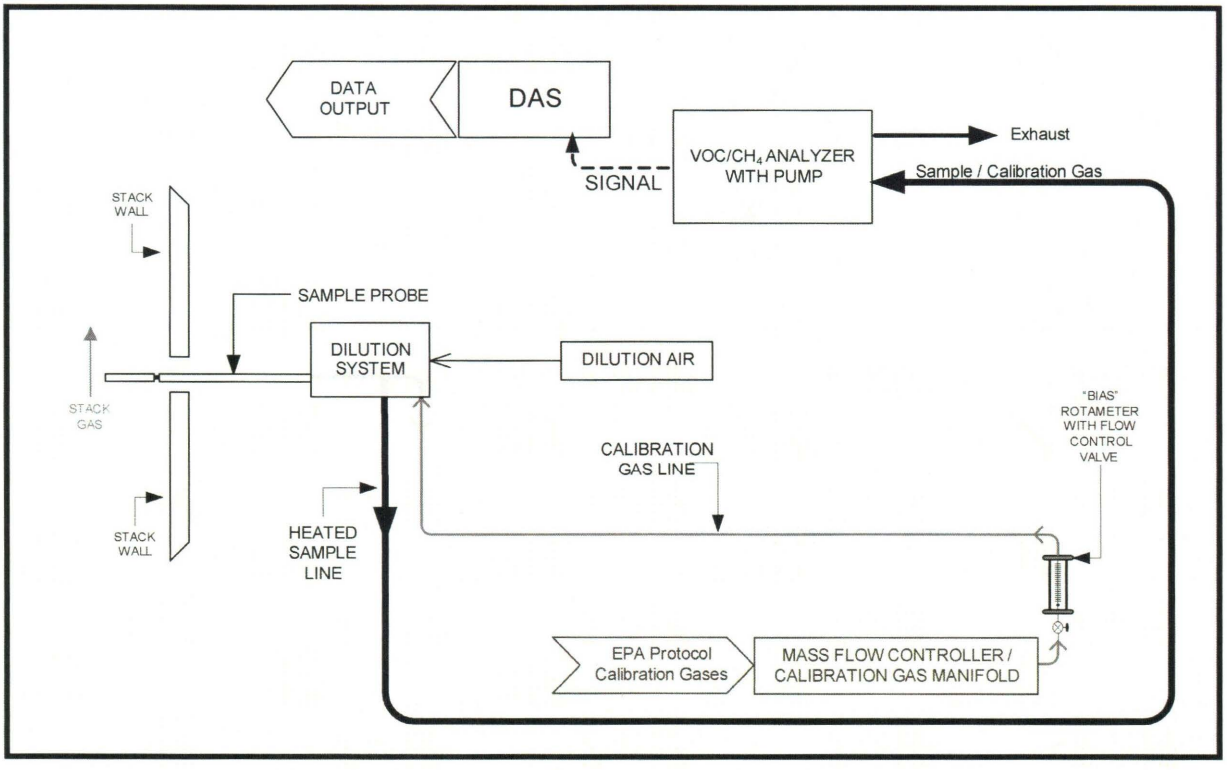
EPA Method 18 is used to measure gaseous organic compounds from stationary sources. The major organic components of a gas mixture are separated by GC and are individually quantified using a FID, PID, ECD, or other appropriate detection principles. The retention times of each separated component are compared with those of known compounds under identical conditions. The GC analyst confirms the identity and approximate concentrations of the organic emission components beforehand. With this information, the analyst then prepares or purchases commercially available standard mixtures to calibrate the GC under conditions identical to those of the samples. The analyst also determines the need for sample dilution to avoid detector saturation, gas stream filtration to eliminate particulate matter, and prevention of moisture condensation.

Pertinent information regarding the performance of the method is presented below:

- Method Options:
  - Results are reported in terms of propane
  - Dilution interface sampling and analysis is performed for Method 18
- Method Exceptions:
  - For gaseous emissions sampling, MDL are calculated for each analyzer. The ISDL is equal to the sensitivity of the instrumentation, which is 2% of the span value.
- Target Analytes: Total VOC
- Target and/or Minimum Required Sample Duration: 60 minutes

The typical sampling system is detailed in Figure 3-3.

FIGURE 3-3
EPA METHOD 18 AND 25A SAMPLING TRAIN



3.1.7 EPA Method 320, Measurement of Vapor Phase Organic and Inorganic Emissions by Extractive FTIR Spectroscopy

EPA Method 320 is an instrumental test method used to measure specific analyte concentrations for which EPA reference spectra have been developed or prepared. Extractive emission measurements are performed using FTIR spectroscopy. The FTIR analyzer is composed of a

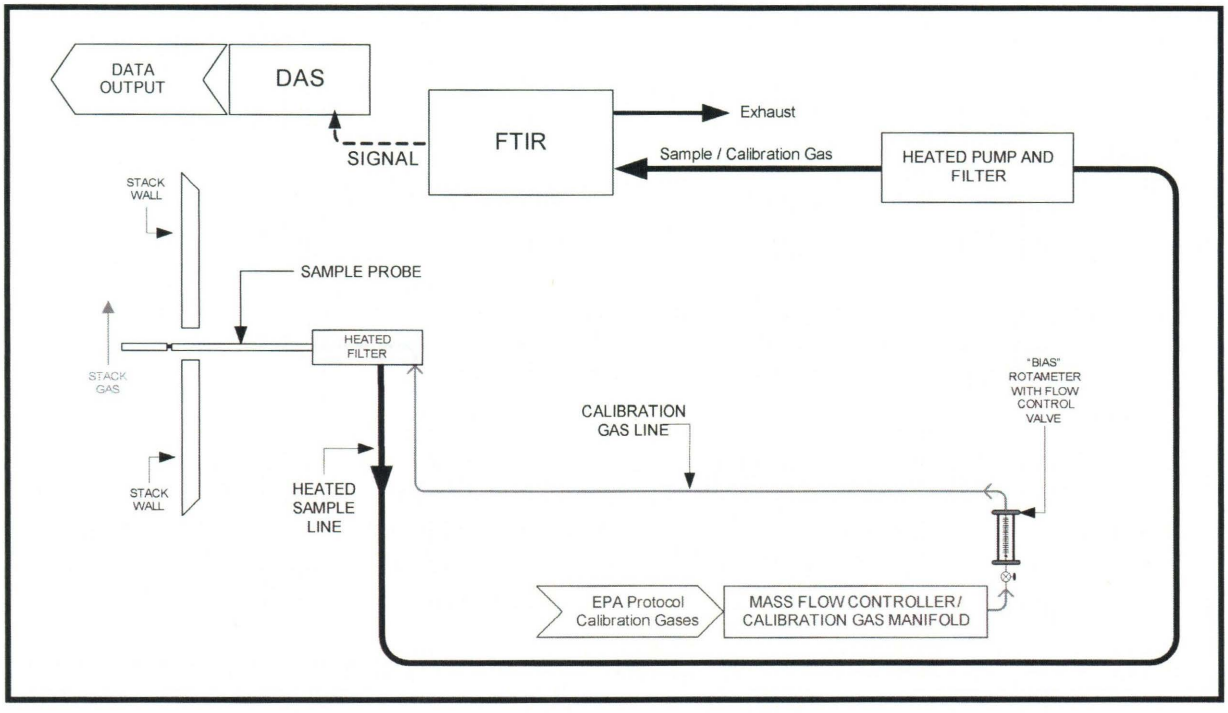
spectrometer and detector, a high optical throughput sampling cell, analysis software, and a quantitative spectral library. The analyzer collects high resolution spectra in the mid infrared spectral region (400 to 4,000 cm-1), which are analyzed using the quantitative spectral library. This provides an accurate, highly sensitive measurement of gases and vapors.

Pertinent information regarding the performance of the method is presented below:

- Method Options:
  - The specific analyte concentrations include H_2O and formaldehyde.
  - Continuous static sampling is performed at a flow rate of approximately 6 liters per minute
  - Previous spiking studies validate the use of FTIR spectroscopy to accurately measure the concentrations of the specific analytes from similar sources
  - A dynamic matrix spike is performed using formaldehyde and SF_6 as a tracer gas
- Method Exceptions:
  - To calculate the MDL for the target analytes, the guidelines in Appendix B of 40 CFR 136 are followed using the Student t-test to calculate the MDL for each analyte at a 99% confidence level. This follows EPA guidelines for reporting of zeroes or non-detects and also meets the NELAC requirements for determination of MDL values.
  - The minimum detectable concentration values are determined using the MDC2 calculation specified in ASTM Method D6348-12
  - Independent calculations of optical path length are not performed because the instrument has a fixed path of 5.11 meters
- Target and/or Minimum Required Sample Duration: 60-240 minutes

The typical sampling system is detailed in Figure 3-4.

FIGURE 3-4
EPA METHOD 320 SAMPLING TRAIN



3.2 PROCESS TEST METHODS

The test plan did not require that process samples be collected during this test program; therefore, no process sample data are presented in this test report.

4.0 TEST DISCUSSION AND RESULTS

4.1 FIELD TEST DEVIATIONS AND EXCEPTIONS

It was agreed upon by EGLE that 180-minute runs were approved and the 240-minute runs were not performed as it was stated in the approval letter. Besides the method exceptions listed in Sections 3.1.6 and 3.1.7, no other field deviations or exceptions from the test plan or test methods occurred during this test program.

4.2 PRESENTATION OF RESULTS

The average results are compared to the permit limits in Tables 1-2 and 1-3. The results of individual compliance test runs performed are presented in Tables 4-1 through 4-3. Emissions are reported in units consistent with those in the applicable regulations or requirements. Additional information is included in the appendices as presented in the Table of Contents.

TABLE 4-1
CH_2O EMISSIONS RESULTS -
EUCPP-CHPHRSG (NG)

	EUCPP-CHPHRSG	EUCPP-CHPHRSG	EUCPP-CHPHRSG	
	8/23/2022	8/23/2022	8/23/2022	
	Base Load	Base Load	Base Load	
	9:15-10:15	10:40-11:40	12:05-13:05	
	T1	T2	T3	
Formaldehyde (ppm)	0.022	0.022	0.023	
MW Formaldehyde	30.031	30.031	30.031	
O2 (%)	13.4	13.43	13.47	
Fd	8710	8710	8710	
Formaldehyde (lb/MMBtu)	4.1619E-05	4.17866E-05	4.39212E-05	
Fuel Heat Input (MMBTU/hr)	1525.8	1524.6	1523.8	**Average**
Formaldehyde (lb/hr)	**0.064**	**0.064**	**0.067**	**0.065**
Formaldehyde (lb/MMBtu)	ppm x fd x MW x 20.9/((385300000 x (20.9 - O2%))			
Formaldehyde (lb/hr)	lb/MMBtu x MMBTU/hr			

TABLE 4-2
TPM as $PM_{2.5}/PM_{10}$ EMISSIONS RESULTS - EUCPP-CHPHRSG (NG)

Test Parameters	Run 1	Run 2	Run 3	Average
Date	8/25/2022	8/25/2022	8/25/2022	
Start Time	7:40	11:25	15:11	
Stop Time	10:54	14:45	18:29	
Gas Conditions				
Temperature (°F)	273	273	273	**273**
Volumetric Flow Rate (acfm)	155,000	168,900	166,700	**163,500**
Volumetric Flow Rate (scfm)	112,300	122,480	120,800	**118,540**
Volumetric Flow Rate (dscfm)	102,400	111,300	110,300	**108,000**
Carbon Dioxide (% dry)	4.6	4.5	4.5	**4.6**
Oxygen (% dry)	13.40	13.43	13.47	**13.43**
Moisture (%)	8.87	9.18	8.74	**8.93**
Filterable PM Results				
Concentration (grains/dscf)	0.000	0.000	0.000	**0.00007**
Concentration (mg/dscm)	0.135	0.214	0.109	**0.15268**
Emission Rate, Fd (lb/MMBtu)	0.000	0.000	0.000	**0.00026**
Emission Rate, Fc (lb/MMBtu)	0.000	0.001	0.000	**0.00038**
Emission Rate (lb/hr)	0.052	0.089	0.045	**0.06200**
Emission Rate (ton/yr)	0.226	0.391	0.197	**0.27157**
Condensable PM Results				
Concentration (grains/dscf)	0.000	0.000	0.000	**0.0004**
Concentration (mg/dscm)	0.884	1.018	0.902	**0.9350**
Emission Rate, Fd (lb/MMBtu)	0.002	0.002	0.002	**0.0016**
Emission Rate, Fc (lb/MMBtu)	0.002	0.003	0.002	**0.0023**
Emission Rate (lb/hr)	0.339	0.424	0.373	**0.3788**
Emission Rate (ton/yr)	1.485	1.859	1.633	**1.6591**
Total PM Results				
Concentration (grains/dscf)	0.0004	0.0005	0.0004	**0.0005**
Concentration (mg/dscm)	1.019	1.233	1.012	**1.0877**
Emission Rate, Fd (lb/MMBtu)	0.002	0.002	0.002	**0.0019**
Emission Rate, Fc (lb/MMBtu)	0.002	0.003	0.003	**0.0027**
Emission Rate (lb/hr)	0.391	0.514	0.418	**0.4408**

TABLE 4-3
CO EMISSIONS RESULTS -
EUCPP-CHPHRSG (NG)

Uncorrected Reference Method Analyzer Results

Run Number	Test Date	Start Minute	End Minute	CO (ppmvd)	NO_x (ppmvd)	SO_2 (ppmvd)	O_2 (% v/v Dry)	CO_2 (% v/v Dry)
1 - NG COMP	08/23/22	10:10	11:10	-0.11	-	-	13.35	4.60
2 - NG COMP	08/23/22	11:35	12:35	-0.19	-	-	13.33	4.58
3 - NG COMP	08/23/22	13:20	14:20	-0.27	-	-	13.37	4.51

Calibration Corrected Reference Method Analyzer Results
Moisture Basis As Measured

Run Number	Test Date	Start Minute	End Minute	CO (ppmvd)	NO_x (ppmvd)	SO_2 (ppmvd)	O_2 (% v/v Dry)	CO_2 (% v/v Dry)
1 - NG COMP	08/23/22	10:10	11:10	0.11	-	-	13.40	4.62
2 - NG COMP	08/23/22	11:35	12:35	0.07	-	-	13.43	4.54
3 - NG COMP	08/23/22	13:20	14:20	0.04	-	-	13.47	4.49

Reference Method Emission Rate Summary - lb/MMBtu

Run Number	Test Date	CO lb/MMBtu	NO_x lb/MMBtu	SO_2 lb/MMBtu	F_c Factor	F_d Factor
1 - NG COMP	08/23/22	0.000	-	-	-	8710
2 - NG COMP	08/23/22	0.000	-	-	-	8710
3 - NG COMP	08/23/22	0.000	-	-	-	8710

Reference Method Emission Rate Summary - lb/hr Using Measured Flow

Run Number	Test Date	CO lb/hr	NO_x lb/hr	SO_2 lb/hr	Volumetric Flow Rate DSCFM
1 - NG COMP	08/23/22	0.05	-	-	102396
2 - NG COMP	08/23/22	0.04	-	-	111286
3 - NG COMP	08/23/22	0.02	-	-	110327

Test Run Data Corrected to Reference O_2

		Corrected Data			Data Used for Correction			
Run Number	Test Date	CO ppmvd Corrected to 15% Oxygen	NO_x ppmvd Corrected to 15% Oxygen	SO_2 ppmvd Corrected to NA	CO ppmvd	NO_x ppmvd	SO_2 ppmvd	O_2 (% v/v Dry)
1 - NG COMP	08/23/22	0.08	-	-	0.11	-	-	13.40
2 - NG COMP	08/23/22	0.06	-	-	0.07	-	-	13.43
3 - NG COMP	08/23/22	0.03	-	-	0.04	-	-	13.47

TABLE 4-4
VOC EMISSIONS RESULTS -
EUCPP-CHPHRSG (NG)

Location	Source 1			
Test Run Number	1	2	3	Average
Condition	Base (NG)	Base (NG)	Base (NG)	
Test Date	8/23/2022	8/23/2022	8/23/2022	
Test Start	10:10	11:35	13:20	
Test End	11:10	12:35	14:20	
Test Duration (Minutes)	1:00	1:00	1:00	1:00:00
THC (ppmvw as Propane)	-0.15	-0.13	-0.09	-0.12
THC Corrected for Drift	-0.175	-0.155	-0.115	-0.148
THC (ppmvd as Propane)	-0.19	-0.17	-0.13	-0.16
Methane/Ethane (ppmvd as Propane)	1.04	0.82	0.85	0.90
NMHC (ppmvd as Propane)	-1.2329	0.0000	-0.9739	-0.7356
Moisture Content (%)	9.86	9.84	9.52	9.74
Oxygen (% Dry)	13.4	13.43	13.47	13.43
F_d	8710	8710	8710	8710

TABLE 4-5
TPM as $PM_{2.5}/PM_{10}$ EMISSIONS RESULTS - EUCPP-CHPHRSG (FO)

Test Parameters	**Run 1**	**Run 2**	**Run 3**	**Average**
Date	9/24/2022	9/24/2022	9/24/2022	
Start Time	8:02	11:53	15:45	
Stop Time	11:11	15:10	19:00	
Gas Conditions				
Temperature (°F)	296	296	295	**295**
Volumetric Flow Rate (acfm)	160,700	155,200	149,400	**155,100**
Volumetric Flow Rate (scfm)	109,300	105,600	101,700	**105,550**
Volumetric Flow Rate (dscfm)	104,500	99,900	96,700	**100,400**
Carbon Dioxide (% dry)	4.1	4.0	4.0	**4.1**
Oxygen (% dry)	16.14	16.19	16.18	**16.17**
Moisture (%)	4.44	5.45	4.98	**4.96**
Filterable PM Results				
Concentration (grains/dscf)	0.000062	0.00010	0.00005	**0.00007**
Concentration (mg/dscm)	0.141586	0.21908	0.11451	**0.15839**
Emission Rate, Fd (lb/MMBtu)	0.000379	0.00059	0.00031	**0.00043**
Emission Rate, Fc (lb/MMBtu)	0.000384	0.00061	0.00032	**0.00044**
Emission Rate (lb/hr)	0.055405	0.08195	0.04147	**0.05961**
Emission Rate (ton/yr)	0.242673	0.35894	0.18163	**0.26108**
Condensable PM Results				
Concentration (grains/dscf)	0.001	0.001	0.001	**0.0006**
Concentration (mg/dscm)	1.263	1.659	1.466	**1.4627**
Emission Rate, Fd (lb/MMBtu)	0.003	0.004	0.004	**0.0039**
Emission Rate, Fc (lb/MMBtu)	0.003	0.005	0.004	**0.0040**
Emission Rate (lb/hr)	0.494	0.620	0.531	**0.5486**
Emission Rate (ton/yr)	2.165	2.717	2.326	**2.4028**
Total PM Results				
Concentration (grains/dscf)	0.001	0.001	0.001	**0.0007**
Concentration (mg/dscm)	1.405	1.878	1.581	**1.6211**
Emission Rate, Fd (lb/MMBtu)	0.004	0.005	0.004	**0.0044**
Emission Rate, Fc (lb/MMBtu)	0.004	0.005	0.004	**0.0045**
Emission Rate (lb/hr)	0.550	0.702	0.572	**0.6082**

TABLE 4-6
CO EMISSIONS RESULTS -
EUCPP-CHPHRSG (FO)

Uncorrected Reference Method Analyzer Results

Run Number	Test Date	Start Minute	End Minute	CO (ppmvd)	NO_x (ppmvd)	SO_2 (ppmvd)	O_2 (% v/v Dry)	CO_2 (% v/v Dry)
1 - LF COMP	08/24/22	8:05	9:05	0.58	-	-	15.98	4.15
2 - LF COMP	08/24/22	9:25	10:25	0.52	-	-	15.99	4.13
3 - LF COMP	08/24/22	11:52	12:52	0.37	-	-	16.02	4.05
1 - LF PM	08/24/22	8:02	11:11	-	-	-	15.99	4.13
2 - LF PM	08/24/22	11:53	15:10	-	-	-	16.03	4.03
3 - LF PM	08/24/22	15:45	19:00	-	-	-	16.04	4.01

Calibration Corrected Reference Method Analyzer Results

Moisture Basis As Measured

Run Number	Test Date	Start Minute	End Minute	CO (ppmvd)	NO_x (ppmvd)	SO_2 (ppmvd)	O_2 (% v/v Dry)	CO_2 (% v/v Dry)
1 - LF COMP	08/24/22	8:05	9:05	0.63	-	-	16.12	4.15
2 - LF COMP	08/24/22	9:25	10:25	0.58	-	-	16.13	4.13
3 - LF COMP	08/24/22	11:52	12:52	0.47	-	-	16.17	4.05
1 - LF PM	08/24/22	8:02	11:11	-	-	-	16.14	4.14
2 - LF PM	08/24/22	11:53	15:10	-	-	-	16.19	4.04
3 - LF PM	08/24/22	15:45	19:00	-	-	-	16.18	4.04

Reference Method Emission Rate Summary - lb/MMBtu

Run Number	Test Date	CO lb/MMBtu	NO_x lb/MMBtu	SO_2 lb/MMBtu	F_c Factor	F_d Factor
1 - LF COMP	08/24/22	0.002	-	-	-	8710
2 - LF COMP	08/24/22	0.002	-	-	-	8710
3 - LF COMP	08/24/22	0.001	-	-	-	8710

Reference Method Emission Rate Summary - lb/hr Using Measured Flow

Run Number	Test Date	CO lb/hr	NO_x lb/hr	SO_2 lb/hr	Volumetric Flow Rate DSCFM
1 - LF COMP	08/24/22	0.29	-	-	104496
2 - LF COMP	08/24/22	0.25	-	-	99888
3 - LF COMP	08/24/22	0.20	-	-	96708

Test Run Data Corrected to Reference O_2

		Corrected Data			Data Used for Correction			
Run Number	Test Date	CO ppmvd Corrected to 15% Oxygen	NO_x ppmvd Corrected to 15% Oxygen	SO_2 ppmvd Corrected to NA	CO ppmvd	NO_x ppmvd	SO_2 ppmvd	O_2 (% v/v Dry)
1 - LF COMP	08/24/22	0.77	-	-	0.63	-	-	16.12
2 - LF COMP	08/24/22	0.72	-	-	0.58	-	-	16.13
3 - LF COMP	08/24/22	0.58	-	-	0.47	-	-	16.17

TABLE 4-7
VOC EMISSIONS RESULTS -
EUCPP-CHPHRSG (FO)

Location	Source 1			
Test Run Number	1	2	3	Average
Condition	Base (LF)	Base (LF)	Base (LF)	
Test Date	8/24/2022	8/24/2022	8/24/2022	
Test Start	8:05	9:25	11:52	
Test End	9:05	10:25	12:52	
Test Duration (Minutes)	1:00	1:00	1:00	1:00:00
THC (ppmvw as Propane)	-0.11	-0.09	-0.06	-0.09
THC Corrected for Drift	-0.079	-0.060	-0.030	-0.056
THC (ppmvd as Propane)	-0.08	-0.06	-0.03	-0.06
Methane/Ethane (ppmvd as Propane)	0.74	0.73	1.84	1.10
NMHC (ppmvd as Propane)	-0.8191	0.0000	-1.8684	-0.8958
Moisture Content (%)	4.4	5.4	5	4.93
Oxygen (% Dry)	16.12	16.13	16.17	16.14
F_d	8710	8710	8710	8710

5.0 INTERNAL QA/QC ACTIVITIES

5.1 QA/QC AUDITS

The meter boxes and sampling trains used during sampling performed within the requirements of their respective methods. All post-test leak checks, minimum metered volumes, minimum sample durations, and percent isokinetics met the applicable QA/QC criteria.

EPA Methods 3A and 10 calibration audits were all within the measurement system performance specifications for the calibration drift checks, system calibration bias checks, and calibration error checks.

EPA Method 5 analytical QA/QC results are included in the laboratory report. The method QA/QC criteria were met. An EPA Method 5 reagent blank was analyzed. The maximum allowable amount that can be subtracted is 0.001% of the weight of the acetone blank. The blank did not exceed the maximum residue allowed.

EPA Method 18 analytical QA/QC results are included in the laboratory report. The method QA/QC criteria were met.

EPA Method 25A FIA calibration audits were within the measurement system performance specifications for the calibration drift checks and calibration error checks.

EPA Method 202 analytical QA/QC results are included in the laboratory report. The method QA/QC criteria were met. An EPA Method 202 Field Train Recovery Blank (FTRB) was performed for each source category. The maximum allowable amount that can be subtracted is 0.002 g (2.0 mg).

The EPA Method 320 performance parameters measured included signal to noise tests, noise equivalent absorbance (NEA), detector linearity, background spectra, potential interferents, and cell and system leakage. Quality assurance procedures included baseline measurement with ultra-high purity nitrogen, measurement of a calibration transfer standard (~100 ppm ethylene), direct analyte calibration measurements, and measurements to determine baseline shift. SF_6 was also used as a tracer gas in the calibration gases to evaluate dilution ratios and verify the sample delivery system integrity. A dynamic matrix spike was performed using SF_6 as a tracer gas. The method QA/QC criteria were met.

5.2 QA/QC DISCUSSION

All QA/QC criteria were met during this test program.

5.3 QUALITY STATEMENT

Montrose is qualified to conduct this test program and has established a quality management system that led to accreditation with ASTM Standard D7036-04 (Standard Practice for Competence of Air Emission Testing Bodies). Montrose participates in annual functional assessments for conformance with D7036-04 which are conducted by the American Association for Laboratory Accreditation (A2LA). All testing performed by Montrose is supervised on site by at least one QI as defined in D7036-04 Section 8.3.2. Data quality objectives for estimating measurement uncertainty within the documented limits in the test methods are met by using approved test protocols for each project as defined in D7036-04 Sections 7.2.1 and 12.10. Additional quality assurance information is included in the report appendices. The content of this report is modeled after the EPA Emission Measurement Center Guideline Document (GD-043).