Source Test Report for 2022 Compliance Testing Combustion Turbine Generators with Heat Recovery Steam Generators GT12 DTE Electric Company Blue Water Energy Center, Facility ID No B2796 China Township, Michigan

Prepared For:

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Prepared By:

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For Submission To:

Michigan Department of Environment, Great Lakes, and Energy
525 West Allegan Street
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ACCREDITED

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:**	6/10/2022
Name:	John Hamner	**Title:**	Account 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:**	6/10/2022
Name:	Roy Slick	**Title:**	Reporting QC Specialist II

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1.0 Introduction

1.1 Summary of Test Program

Kiewit Power Constructors (Kiewit) contracted Montrose Air Quality Services, LLC (Montrose) to perform a compliance emissions test program on the outlet stacks of a natural gas fired combustion turbine generators (CTG) with a heat recovery steam generator (HRSG) designated as GT12 at the DTE Electric Company (DTE) Blue Water Energy Center (BWEC) facility located in China Township, Michigan.

The tests were conducted to demonstrate compliance with the permit limits listed in the facility's plan approval (Permit No: 19-18).

The specific objectives were to:

- Measure emissions of volatile organic compounds (VOC) at the outlet of GT12
- Measure emissions of Sulfur Dioxide (SO_2) at the outlet of GT12
- Measure emissions of Sulfuric Acid (H_2SO_4) at the outlet of GT12
- Measure emissions of Particulate Matter ($PM_{10/2.5}$) at the outlet of GT12
- 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 Date(s)	Unit ID/ Source Name	Activity/Parameters	Test Methods	No. of Runs	Duration (Minutes)
4/8,4/9 4/10,4/12	GT12 Fired GT12 Unfired	Velocity/Volumetric Flow Rate	EPA 1 & 2	3	180
4/8,4/9 4/10,4/12	GT12 Fired GT12 Unfired	O_2, CO_2	EPA 3A	3	180
4/8,4/9 4/10,4/12	GT12 Fired GT12 Unfired	Moisture	EPA 4	3	180
4/8,4/9 4/10,4/12	GT12 Fired GT12 Unfired	TPM	EPA 5/202	3	180
4/8 4/12	GT12 Fired GT12 Unfired	VOC	EPA 25A/18	3	60
4/8,4/9 4/10,4/12	GT12 Fired GT12 Unfired	H_2SO_4	EPA CTM-013	3	120
4/8 4/12	Fuel Sample	SO_2	ASTM D-5504	1	Fuel Gas Grab Sample
4/8,4/9 4/10,4/12	Fuel Sample	Fuel Factor	EPA Method 19/ASTM D-1945	1	Fuel Gas Grab Sample
4/8,4/9 4/10,4/12	GT12 Fired GT12 Unfired	Post-test meter calibration check	EPA ALT-009	--	--
4/8,4/9 4/10,4/12	GT12 Fired GT12 Unfired	Post-test thermocouple calibration check	EPA ALT-011	--	--

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. Detailed results for individual test runs can be found in Section 4.0. All supporting data can be found in the appendices.

The testing was conducted by the Montrose personnel listed in Table 1-3. The tests were conducted according to the test plan (protocol) dated June 28th, 2021 that was submitted to and approved by the Michigan Department of Environment, Great Lakes, and Energy

Table 1-2
Summary of Average Compliance Results – GT12 FIRED

April 8 and 9, 2022

Parameter/Units	Average Results	Emission Limits
Particulate Matter (PM)		
gr/dscf	0.000781	XX
lb/hr	8.90	16
lb/MMBtu	0.002175	XX
Sulfur Dioxide (SO_2)		
ppmvd	0.027	XX
ppmvd @ 15% O2	0.017	XX
lb/MMBtu	0.000086	0.0012
Sulfuric Acid Mist (H_2SO_4)		
ppmvd	0.0015	XX
lb/hr	0.0303	5.04
lb/MMBtu	0.000008	0.0013
Total Non-Methane/Non-Ethane Hydrocarbons, as Propane (VOC)		
ppmvd	0.00	XX
lb/MMBtu	0.000	0.0026

Table 1-3
Summary of Average Compliance Results – GT12 UNFIRED

April 10 and 12, 2022

Parameter/Units	Average Results	Emission Limits
Particulate Matter (PM)		
gr/dscf	0.000710	XX
lb/hr	8.13	12.2
lb/MMBtu	0.002146	XX
Sulfur Dioxide (SO_2)		
ppmvd	0.024	XX
ppmvd @ 15% O2	0.017	XX
lb/MMBtu	0.000086	0.0012
Sulfuric Acid Mist (H_2SO_4)		
ppmvd	0.0017	XX
lb/hr	0.0383	5.04
lb/MMBtu	0.000011	0.0013
Total Non-Methane/Non-Ethane Hydrocarbons, as Propane (VOC)		
ppmvd	0.00	XX
lb/MMBtu	0.000	0.0013

1.2 Key Personnel

A list of project participants is included below:

Facility Information

Source Location:	DTE Electric Company Blue Water Energy Center 4400 River Road East China, MI 48054	
Project Contact:	Mr. Jon Campbell	Mr. Mark Grigereit
Role:	Commissioning & Start Up Manager	
Company:	Kiewit	DTE Electric Company
Telephone:	913-522-2634	313-412-0305
Email:	Jonathan.campbell@kiewit.com	mark.grigereit@dteenergy.com

Agency Information

Regulatory Agency:	Michigan Department of Environment, Great Lakes, and Energy
Agency Contact:	Gina Angellotti
Telephone:	313-418-0895
Email:	angellottir1@michigan.gov

Testing Company Information

Testing Firm:	Montrose Air Quality Services, LLC
Contact:	Mr. John Hamner
Title:	Account Manager
Telephone:	630-519-5135
Email:	jhamner@montrose-env.com

Laboratory Information

Laboratory:	Enthalpy Analytical	Montrose Air Quality Services	Texas Oil Tech Laboratories
City, State:	Durham, North Carolina	Elk Grove Village, Illinois	Houston, Texas
Method:	EPA CTM-013	EPA Methods 5/202, 18	ASTM 1945

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
Justin Merryman	Montrose	Project Manager/Qualified Individual (QI)
Sam Grunky	Montrose	Qualified Individual (QI)
Cody Shifflett	Montrose	Qualified Individual (QI)
Jon Campbell	Kiewit Power Constructors	Observer/Client Liaison/Test Coordinator
Mark Grigereit	DTE Electric	Observer
Gina Angellotti	Michigan EGLE	Observer

2.0 Plant and Sampling Location Descriptions

2.1 Process Description, Operation, and Control Equipment

The Blue Water Energy Center consists of two combustion turbines in a combined cycle configuration. A combined cycle electric generating unit consisting of two (2) General Electric ("GE") "H"-class combustion turbines each with maximum fuel type-based heat input of 3,658 million British Thermal Units per hour (MMBtu/hr) (natural gas) coupled with a heat recovery steam generator (HRSG) was constructed. Each HRSG is equipped with a natural gas-fired duct burner rated at 800 MMBTU/hr to provide heat for additional steam production. The HRSG is not capable of operating independently from the CTG on each unit. The CTG/HRSG is equipped with a combined oxidation catalyst for the control of CO and VOCs, and selective catalytic reduction (SCR) with dry low NOx burners for the control of nitrogen oxides. Exhaust emissions from each HRSG will be controlled by oxidation catalyst and selective catalytic reduction (SCR).

2.2 Flue Gas Sampling Location

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

Table 2-1
Sampling Location

Sampling Location	Stack Inside Diameter (in.)	Distance from Nearest Disturbance Downstream EPA "B" (in./dia.)	Distance from Nearest Disturbance Upstream EPA "A" (in./dia.)	Number of Traverse Points
GT12	275.64	552.36/2.0	149.76/0.54	Isokinetic: 24 (6/port) Flow: 24 (6/port) Gaseous: 3

The sample location was verified in the field to conform to EPA Method 1. Acceptable cyclonic flow conditions were confirmed prior to testing using EPA Method 1, Section 11.4. See Appendix A.1 for more information.

2.3 Operating Conditions and Process Data

Emission tests were performed while the source/units and air pollution control devices were operating at the conditions required by the permit. The unit was tested when operating normally. Full load conditions for the units range from 2,437-3,658 mmbtu/hr without duct firing and from 2,798-4,458 mmbtu/hr with duct firing. This range is based on the amount of fuel the unit requires for maximum routine operating load. The amount of fuel necessary for maximum routine operating load varies based on temperature and other factors. Testing occurred as close to maximum routine operating conditions at the time of testing, but not less than 90% of the maximum routine operating condition at that time.

Plant personnel were responsible for establishing the test conditions and collecting all applicable unit-operating data. The process data that was provided is presented in Appendix B. Data collected includes the following parameters:

- Gas Fuel Flow, lb/s

3.0 Sampling and Analytical Procedures

3.1 Test Methods

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

3.1.1 EPA Method 2 – Determination of Stack 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 O2, CO2, 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

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

3.1.2 EPA Method 3A – Determination of Oxygen and Carbon Dioxide Concentrations in Emissions from Stationary Sources (Instrumental Analyzer Procedure)

EPA Method 3A is an instrumental test method used to measure the concentration of O2 and CO2 in stack gas. The effluent gas is continuously or intermittently sampled and conveyed to analyzers that measure the concentration of O2 and CO2. The performance requirements of the method must be met to validate data.

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

- Method Options:
  - Calibration span values are 20.12% O_2 and 19.87% CO_2
- Target and/or Minimum Required Sample Duration: 60 minutes

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

3.1.3 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:
  - The reference method is used to measure moisture
  - 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
- Target and/or Minimum Required Sample Duration: 180 minutes
- Target and/or Minimum Required Sample Volume: 21 scf

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

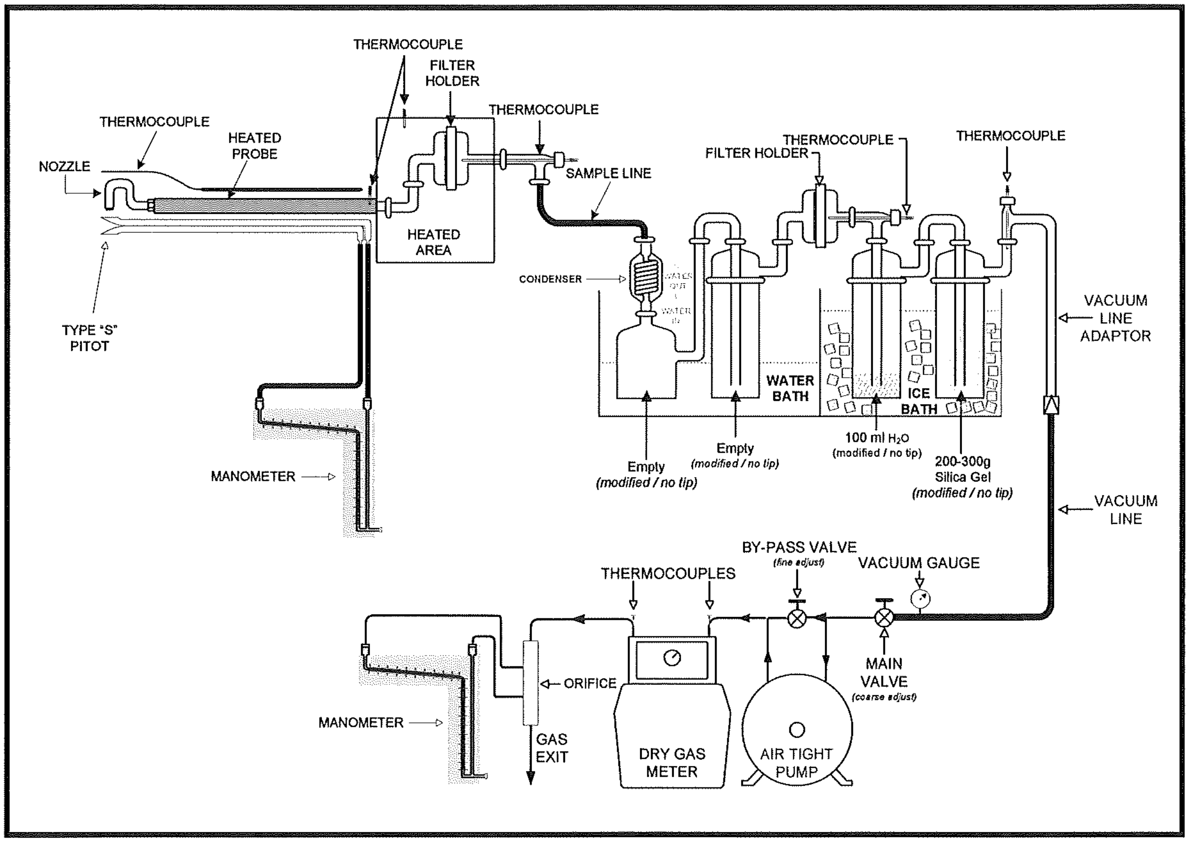
3.1.4 EPA Method 5 and 202 – Determination of Particulate Matter from Stationary Sources and Dry Impinger Method for Determining Condensable Particulate Emissions from Stationary Sources

EPA Methods 5 and 202 are manual, isokinetic methods used to measure FPM and CPM emissions. The methods are performed in conjunction with EPA Methods 1 through 4. The stack gas is sampled through a nozzle, probe, heated filter, unheated CPM filter, condenser, and impinger train. FPM is collected from the probe and heater filter. CPM is collected from the unheated CPM filter and the impinger train. The samples are analyzed gravimetrically. The sum of FPM and CPM represents TPM. The FPM, CPM, and TPM results are reported in emission concentration and emission rate units. Pertinent information regarding the performance of the method is presented below:

- Method Options:
  - Glass sample nozzles and probe liners are used
  - Condensed water is measured gravimetrically
- Target and/or Minimum Required Sample Duration: 180 minutes
- Target and/or Minimum Required Sample Volume: 120 dscf
- Analytical Laboratory: Montrose, Elk Grove Village, IL

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

Figure 3-1
US EPA METHOD 5/202 SAMPLING TRAIN



3.1.5 EPA Method 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.

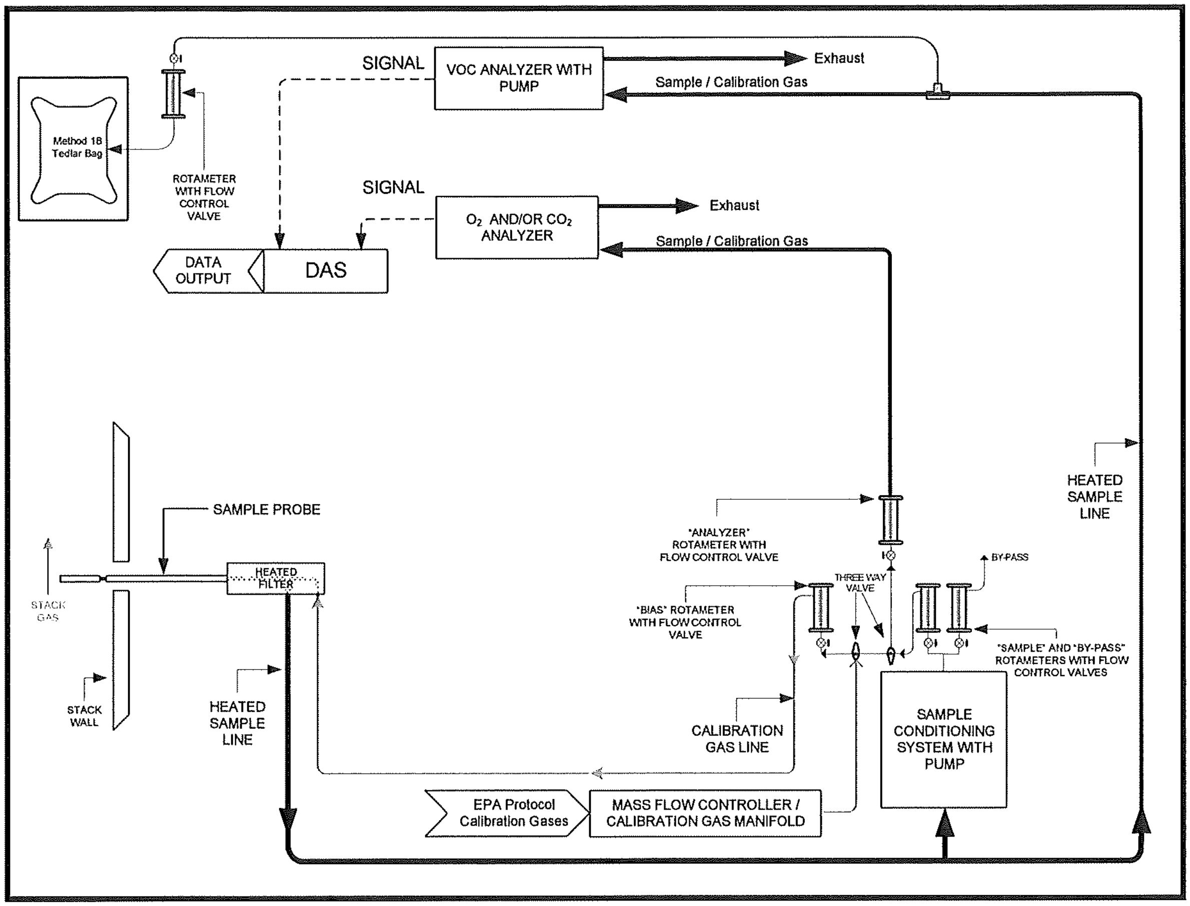
Total non-methane/non-ethane hydrocarbons concentrations are determined by subtracting methane and ethane from THC.

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

- Method Options:
  - Results are reported in terms of propane
  - Span value for THC is 17.13 ppmvw
  - VOC emissions on a C_3H_8 basis will be calculated by dividing the concentrations as CH_4 by a factor of 3 and concentrations as C_2H_6 by a factor of 2/3
  - Integrated bag sampling and analysis is performed for Method 18
- Method Exceptions:
  - If the gas bags are not analyzed within 48 hours of sampling time, one sample is spiked for the recovery study after analysis. The spiked bag is stored for the same period of time as the samples before analysis.
- Target Analytes: Total non-methane, non-ethane hydrocarbons excluding exempt compounds as defined by EGLE
- Target and/or Minimum Required Sample Duration: 60 minutes
- Analytical Laboratory: Montrose, Elk Grove Village, IL

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

Figure 3-2
US EPA METHOD 3A, 18 (BAG), AND 25A SAMPLING TRAIN



3.1.6 EPA Method CTM-013 – Determination of Sulfuric Acid Vapor or Mist and Sulfur Dioxide Emissions from Kraft Recovery Furnaces

EPA Method CTM-013 is a manual method used to measure SO_X emissions including sulfuric acid mist and SO_2. A gas sample is extracted from the sampling point in the recovery furnace stack. The sulfuric acid vapor or mist (including SO_3) and the SO_2 are separated, and both fractions are measured separately by the barium-thorin titration method.

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

- Target and/or Minimum Required Sample Duration: 120 minutes
- Target and/or Minimum Required Sample Volume: 35 dscf
- Analytical Laboratory: Enthalpy Analytic, Durham, North Carolina

3.1.7 EPA Method 19 – Determination of Sulfur Dioxide Removal Efficiency and Particulate Matter, Sulfur Dioxide, and Nitrogen Oxide Emission Rates

EPA Method 19 is a manual method used to determine (a) PM, SO_2, and NO_X emission rates; (b) sulfur removal efficiencies of fuel pretreatment and SO_2 control devices; and (c) overall reduction of potential SO_2 emissions. This method provides data reduction procedures, but does not include any sample collection or analysis procedures.

EPA Method 19 is used to calculate the stack gas volumetric flow rate from the measurement of the heat input rate, stack concentration of O_2 or CO_2, and an F factor determined from fuel analysis. Volumetric flow rates are used to calculate mass emission rates in units of lb/hr. The metered fuel flow rate is recorded during each test period. A fuel sample is collected and analyzed for higher heating value (HHV) and composition (C,H,O,N,S) to calculate the F factor. F factors are determined daily, if not more frequently, from each unique fuel supply.

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

- Method Options:
  - F factor is the oxygen-based F factor, dry basis (F_d)
  - F factor is calculated from analysis of fuel samples collected on the test day
  - Heat input data is calculated based on the fuel flow rate and higher heating value
  - Higher Heating Value data is obtained from analysis of fuel samples

3.2 Process Test Methods

One sample from each turbine's natural gas supply pipeline was collected into a sample container during testing of that unit. Each container was submitted to Texas Oil Tech for analysis of samples. The analysis provided results of trace fuel sulfur content by ASTM Method D-5504.

4.0 Test Discussion and Results

4.1 Field Test Deviations and Exceptions

The second particulate run during the fired condition is excluded from the results because load and duct firing were lost for approximately 2.5 hours. CTM 013 Test 3 was aborted because of an issue with the probe. A replacement test was performed.

4.2 Presentation of Results

The average results are compared to the permit limits in Table 1-2 and 1-3. The results of individual compliance test runs performed are presented in Tables 4-1 through 4-8. 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
VOC Emissions Results -
GT12 Fired

Parameter/Units	Run 1	Run 2	Run 3	Average
Date	4/9/2022	4/9/2022	4/9/2022	
Time	11:55-12:54	13:25-14:24	15:01-16:00	
Process Data				
Fuel Factor, F_d	8603.767	8603.767	8603.767	
Sampling & Flue Gas Parameters				
sample duration, minutes	60	60	60	60
O_2, % volume dry	11.56	11.49	11.46	11.50
CO_2, % volume dry	5.48	5.48	5.52	5.49
Total Non-Methane/Non-Ethane Hydrocarbons, as Propane (VOC)				
ppmvw	0.00	0.00	0.00	0.00
Lb/MMBtu	0.000	0.000	0.000	0.000

Table 4-2
SO_2 Emissions Results -
GT12 Fired

Parameter/Units	Run 1	Run 2	Run 3	Average
Date	4/9/2022	4/9/2022	4/9/2022	
Test Number	Grab 1	Grab 1	Grab 1	
Process Data				
Fuel Factor, F_d	8613	8613	8613	
Fuel density, lb/scf	0.0456	0.0456	0.0456	
Fuel flow, lb/sec	45.26	45.27	45.27	
Fuel Flow, scfh	3,572,842	3,574,105	3,574,105	
Fuel Sulfur, ppm weight	1.0	1.0	1.0	
Fuel Sulfur, gr/100 scf	0.0319	0.0319	0.0319	
Sampling & Flue Gas Parameters				
O_2, % volume dry	11.56	11.49	11.46	11.50
Sulfur Dioxide (SO_2)				
ppmvd	0.027	0.027	0.027	0.027
ppmvd @ 15% O_2	0.017	0.017	0.017	0.017
lb/hr	0.325	0.326	0.326	0.326
lb/MMBtu	0.000086	0.000086	0.000086	0.000086

Table 4-3
PM Emissions Results -
GT12 Fired

Parameter/Units	Run 1	Run 3	Run 4	Average
Date	4/8/2022	4/9/2022	4/9/2022	
Time	9:49-13:00	7:50-11:47	12:12-15:42	
Process Data				
Fuel Factor F_d, dscf/MMBtu	8608.80	8613.00	8613.00	
Fuel Density, lb/scf	0.0451	0.0456	0.0456	
HHV, Btu/scf	1057.00	1065.27	1065.27	
Fuel Flow Rate, lb/sec	44.82	45.14	45.26	
Fuel Heat Input, MMBtu/hr	3781.4	3796.5	3806.2	
Sampling & Flue Gas Parameters				
sample duration, minutes	180.00	180.00	180.00	180.00
sample volume, dscf	140.787	153.129	150.381	148.099
isokinetic rate, %	95.87	98.87	94.26	96.33
O_2, % volume dry	11.57	11.84	11.50	11.64
CO_2, % volume dry	5.31	5.34	5.53	5.39
flue gas temperature, °F	168.9	168.0	167.3	168.1
moisture content, % volume	8.79	8.80	9.23	8.94
volumetric flow rate, dscfm	1,269,411	1,338,814	1,379,149	1,329,124
Filterable Particulate Matter (PM)				
mg	1.2	1.4	0.8	1.2
gr/dscf	0.000132	0.000141	0.000082	0.000118
lb/hr	1.43	1.62	0.97	1.35
lb/MMBtu	0.000362	0.000400	0.000224	0.000329
Condensable PM				
mg	7.1	6.9	5.1	6.4
gr/dscf	0.000778	0.000695	0.000523	0.000663
lb/hr	8.47	7.98	6.19	7.56
lb/MMBtu	0.002141	0.001970	0.001429	0.001846
Total PM				
mg	8.3	8.3	5.9	7.5
gr/dscf	0.000910	0.000836	0.000605	0.000781
lb/hr	9.90	9.60	7.16	8.90
lb/MMBtu	0.00250	0.002369	0.001653	0.002175

Table 4-4
H_2SO_4 Mist Emissions Results -
GT12 Fired

Parameter/Units	Run 1	Run 2	Run 3	Average
Date	4/8/2022	4/8/2022	4/9/2022	
Time	9:46-11:46	12:42-14:42	12:51-14:51	
Process Data				
Fuel Heat Input, MMBtu/hr	3781	3763	3806	3784
Sampling & Flue Gas Parameters				
sample duration, minutes	120.00	120.00	120.00	120.00
sample volume, dscf	43.419	43.489	44.809	43.906
O_2, % volume dry	11.57	11.46	11.50	11.51
CO_2, % volume dry	5.31	5.36	5.53	5.40
moisture content, % volume	9.39	9.27	8.95	9.20
volumetric flow rate, dscfh	76,164,660	75,898,920	82,730,100	78,264,560
Sulfuric Acid Mist (H_2SO_4)				
mg	0.0028	0.0189	0.0019	0.0078
ppmvd	0.0005	0.0035	0.0003	0.0015
lb/hr	0.0106	0.0727	0.0077	0.0303
lb/MMBtu	0.000003	0.000019	0.000002	0.000008

Table 4-5
VOC Emissions Results -
GT12 Unfired

Parameter/Units	Run 1	Run 2	Run 3	Average
Date	4/10/2022	4/10/2022	4/10/2022	
Time	9:05-10:04	10:30-11:29	12:00-12:59	
Process Data				
Fuel Factor, F_d	8603.767	8603.767	8603.767	
Sampling & Flue Gas Parameters				
sample duration, minutes	60	60	60	60
O_2, % volume dry	12.40	12.41	12.40	12.40
CO_2, % volume dry	5.03	5.04	5.04	5.04
Total Non-Methane/Non-Ethane Hydrocarbons, as Propane (VOC)				
ppmvw	0.00	0.00	0.00	0.00
lb/MMBtu	0.000	0.000	0.000	0.000

Table 4-6
SO_2 Emissions Results -
GT12 Unfired

Parameter/Units	Run 1	Run 2	Run 3	Average
Date	4/10/2022	4/10/2022	4/10/2022	
Test Number	Grab 1	Grab 1	Grab 1	
Process Data				
Fuel Factor, F_d	8,613	8,613	8,613	
Fuel density, lb/scf	0.0456	0.0456	0.0456	
Fuel flow, lb/sec	41.41	41.29	41.14	
Fuel Flow, scfh	3,269,526	3,259,579	3,247,500	
Fuel Sulfur, ppm weight	1.0	1.0	1.0	
Fuel Sulfur, gr/100 scf	0.0319	0.0319	0.0319	
Sampling & Flue Gas Parameters				
O_2, % volume dry	12.40	12.41	12.40	12.40
Sulfur Dioxide (SO_2)				
ppmvd	0.024	0.024	0.024	0.024
ppmvd @ 15% O_2	0.017	0.017	0.017	0.017
lb/hr	0.298	0.297	0.296	0.297
lb/MMBtu	0.000086	0.000086	0.000086	0.000086

Table 4-7
PM Emissions Results -
GT12 Unfired

Parameter/Units	Run 1	Run 2	Run 3	Run 4	Average
Date	4/10/2022	4/10/2022	4/12/2022	4-12-22	
Time	8:04-11:16	11:43-14:56	9:00-12:08	12:25-15:38	
Process Data					
Fuel Factor F_d, dscf/MMBtu	8613.10	8613.10	8613.00	8613.00	
Fuel Density, lb/scf	0.0456	0.0456	0.0456	0.0456	
HHV, Btu/scf	1065.16	1065.16	1064.90	1064.90	
Fuel Flow Rate, lb/sec	41.35	41.00	40.60	40.08	
Fuel Heat Input, MMBtu/hr	3476.8	3448.1	3413.2	3369.9	
Sampling & Flue Gas Parameters					
sample duration, minutes	180.00	180.00	180.00	180.00	180.00
sample volume, dscf	154.562	147.855	143.814	151.080	149.328
isokinetic rate, %	95.88	94.43	95.51	101.27	96.77
O_2, % volume dry	12.40	12.40	12.39	12.46	12.41
CO_2, % volume dry	4.99	5.03	4.91	4.91	4.96
flue gas temperature, °F	183.4	182.8	184.7	184.5	183.8
moisture content, % volume	7.43	7.87	8.26	7.84	7.85
volumetric flow rate, dscfm	1,393,530	1,353,514	1,301,587	1,289,616	1,334,562
Filterable Particulate Matter (PM)					
mg	1.1	0.8	0.7	1.0	0.9
gr/dscf	0.000110	0.000083	0.000075	0.000102	0.000093
lb/hr	1.31	0.97	0.84	1.13	1.06
lb/MMBtu	0.000332	0.000252	0.000227	0.000311	0.000280
Condensable PM					
mg	5.7	5.9	5.0	7.3	6.0
gr/dscf	0.000569	0.000616	0.000536	0.000746	0.000617
lb/hr	6.80	7.14	5.98	8.24	7.06
lb/MMBtu	0.001718	0.001859	0.001618	0.002267	0.001866
Total PM					
mg	6.8	6.7	5.7	8.3	6.9
gr/dscf	0.000679	0.000699	0.000612	0.000848	0.000710
lb/hr	8.11	8.11	6.82	9.37	8.13
lb/MMBtu	0.00205	0.00211	0.001845	0.002578	0.002146

Table 4-8
H_2SO_4 Mist Emissions Results -
GT12 Unfired

Parameter/Units	Run 1	Run 2	Run 3	Average
Date	4/10/2022	4/10/2022	4/10/2022	
Time	9:04-11:13	11:22-13:22	13:28-15:28	
Process Data				
Fuel Heat Input, MMBtu/hr	3477	3448	3448	3458
Sampling & Flue Gas Parameters				
sample duration, minutes	120.00	120.00	120.00	120.00
sample volume, dscf	43.754	44.295	44.242	44.097
O_2, % volume dry	12.40	12.40	12.40	12.40
CO_2, % volume dry	4.90	5.03	5.03	4.99
moisture content, % volume	8.39	8.52	8.93	8.61
volumetric flow rate, dscfh	83,611,800	81,210,840	81,210,840	82,011,160
Sulfuric Acid Mist (H_2SO_4)				
mg	0.0144	0.0063	0.0071	0.0093
ppmvd	0.0027	0.0011	0.0013	0.0017
lb/hr	0.0607	0.0255	0.0288	0.0383
lb/MMBtu	0.000017	0.000007	0.000008	0.000011

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, except where noted in Section 5.2.

EPA Method 3A calibration audits were all within the measurement system performance specifications for the calibration drift checks, system calibration bias checks, and calibration error checks, except where noted in Section 5.2.

EPA Method 25A FIA calibration audits were within the measurement system performance specifications for the calibration drift checks and calibration error checks, except if noted in Section 5.2.

EPA Method 5 analytical QA/QC results are included in the laboratory report. The method QA/QC criteria were met, except if noted in Section 5.2. 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 used. The blank did not exceed the maximum residue allowed.

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). For this project, the FTRB had a mass of 1.1 mg, and 1.1 mg was subtracted.

EPA Method 18 analytical QA/QC results are included in the laboratory report. The method QA/QC criteria were met, except where noted in Section 5.2.

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 Qualified Individual (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).