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Source Test Report for 2022 Compliance Testing
Diesel-fired Emergency Generator
DTE Electric Company
Blue Water Energy Center, Facility ID No B2796
China Township, Michigan

Prepared For:

Kiewit Power Constructors
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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
Lansing, Michigan 48933

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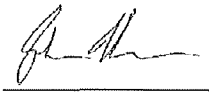
MONTROSE

STAC ACCREDITED

B2796_test_20220414

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 the diesel-fired emergency generator (EDG) 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 GT11
- 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)
4/14/2022	EDG	Velocity/Volumetric Flow Rate	EPA 1 & 2	3	60
4/14/2022	EDG	O_2, CO_2	EPA 3A	3	60
4/14/2022	EDG	Moisture	EPA 4	3	60
4/14/2022	EDG	VOC	EPA 25A/18	3	60
4/14/2022	EDG	Post-test meter calibration check	EPA ALT-009	--	--
4/14/2022	EDG	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 September 7th, 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 – EDG

April 14, 2022

Parameter/Units	Average Results	Emission Limits
Total Non-Methane/Non-Ethane Hydrocarbons, as Propane (VOC)		
ppmvd	4.09	XX
lb/hr	0.24	1.89

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 1-3.

Table 1-3
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 combined cycle gas turbines. 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. The 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. 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 combined cycle electric generating unit will be controlled by oxidation catalyst and selective catalytic reduction (SCR). In support of the gas turbines an emergency use engine generator was constructed.

A nominal 2 MW diesel-fueled emergency engine with a model year of 2011 or later, and a displacement of <10 liters/cylinder. The engine is an EPA Tier 2 certified engine subject to NSPS IIII.).

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		Number of Traverse Points
		Downstream EPA "B" (in./dia.)	Upstream EPA "A" (in./dia.)	
EDG	18	36/2.0	19/1.06	Flow: 16 (8/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 while operating above 90% or above of 2 MW.

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:

- Load, kW

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

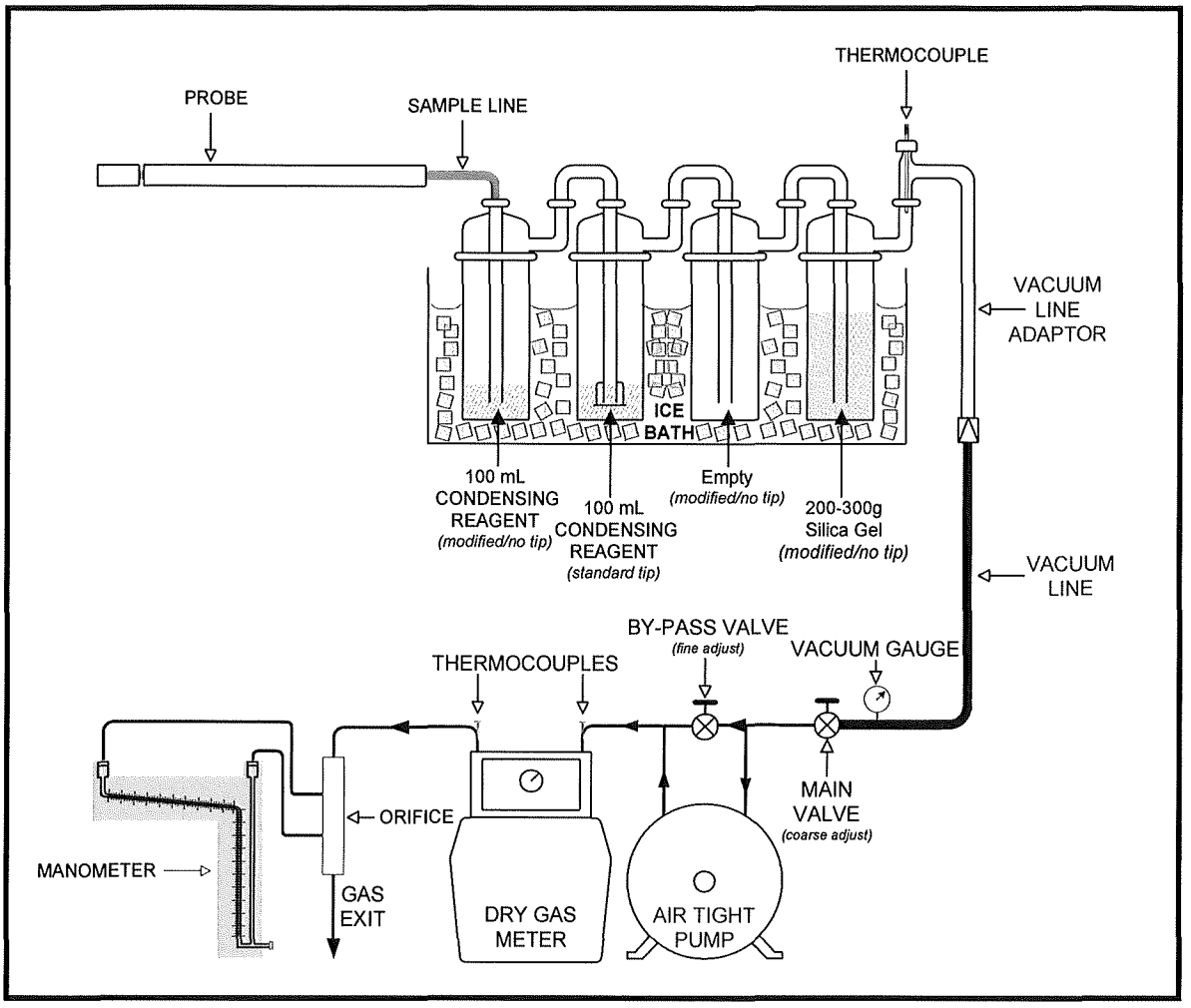
EPA Method 4 is a manual, non-isokinetic method used to measure the moisture content of gas streams. Gas is sampled at a constant sampling rate through a probe and impinger train. Moisture is removed using a series of pre-weighed impingers containing methodology-specific liquids and silica gel immersed 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:
  - 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: 60 minutes
- Target and/or Minimum Required Sample Volume: 21 scf

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

Figure 3-1
US EPA METHOD 4 SAMPLING TRAIN



3.1.4 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.

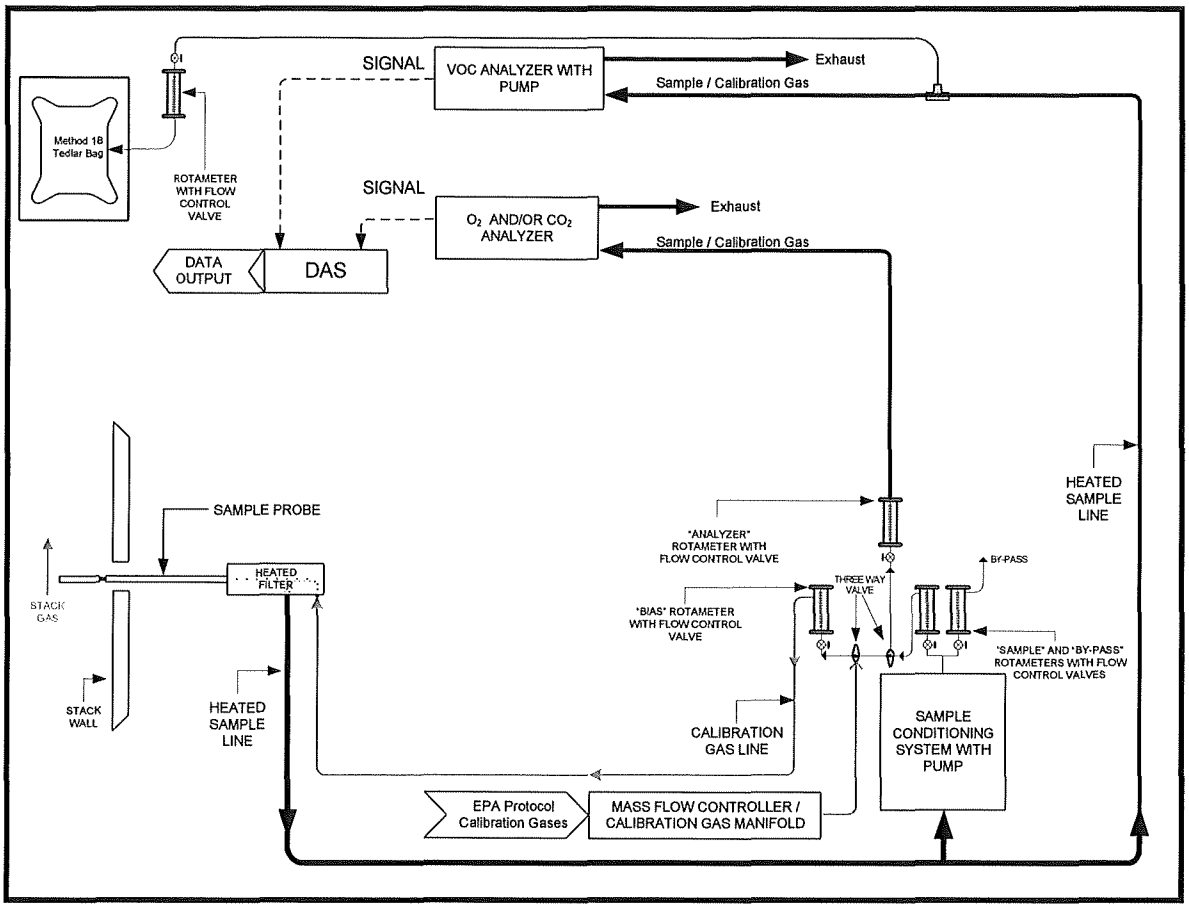
Total non-methane/non-ethane hydrocarbons concentrations are determined by subtracting methane and ethane from THC.

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



3.2 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

No 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 Table 1-2. The results of individual compliance test runs performed are presented in Table 4-1. 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 -
EDG

Parameter/Units	Run 1	Run 2	Run 3	Average
Date	4/14/2022	4/14/2022	4/14/2022	
Time	10:10-11:09	11:26-12:25	12:40-13:39	
Process Data				
Load, kW	1911.814	1906.731	1909.348	
Sampling & Flue Gas Parameters				
sample duration, minutes	60	60	60	
O_2, % volume dry	11.61	11.50	11.46	11.52
CO_2, % volume dry	6.93	7.02	7.01	6.99
flue gas temperature, °F	1321.00	1324.56	1327.56	1324.38
moisture content, % volume	5.69	5.27	5.36	5.44
volumetric flow rate, dscfm	8547	8612	8730	8630
Total Non-Methane/Non-Ethane Hydrocarbons, as Propane (VOC)				
ppmvd	4.26	3.80	4.20	4.09
lb/hr	0.25	0.22	0.25	0.24

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 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).

Appendix A
Field Data and Calculations