Source Test Report

Consumers Energy Company
Covert Generating Station
26000 77th Street
Covert, Michigan 49043

Sources Tested: EU-Turbine 1 and EU-Turbine 3
Test Dates: July 15 and 16, 2024

Project No. AST-2024-3613

Prepared By
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Regulatory Information

Permit No. Michigan Department of Environment, Great Lakes, and Energy (EGLE) Air Quality Division Renewable Operating Permit MI-ROP-N6767-2020a

Source Information

Source Name	*Source ID*	*Target Parameter*
EU-Turbine 1/ Unit 1	EU-Turbine 1	TPM, H_2SO_4
EU-Turbine 3/ Unit 3	EU-Turbine 3	TPM, H_2SO_4

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Alliance Technical Group, LLC (Alliance) has completed the source testing as described in this report. Results apply only to the source(s) tested and operating condition(s) for the specific test date(s) and time(s) identified within this report. All results are intended to be considered in their entirety, and Alliance is not responsible for use of less than the complete test report without written consent. This report shall not be reproduced in full or in part without written approval from the customer.

To the best of my knowledge and abilities, all information, facts and test data are correct. Data presented in this report has been checked for completeness and is accurate, error-free and legible. Onsite testing was conducted in accordance with approved internal Standard Operating Procedures. Any deviations or problems are detailed in the relevant sections in the test report.

This report is only considered valid once an authorized representative of Alliance has signed in the space provided below; any other version is considered draft. This document was prepared in portable document format (.pdf) and contains pages as identified in the bottom footer of this document.

Chris Wehner – Operations Manager
Alliance Technical Group, LLC

9.12.24
Date

TABLE OF CONTENTS

1.0 Introduction 1-1
1.1 Facility Description 1-1
1.2 Source and Control System Descriptions 1-1
1.3 Project Team 1-2
1.4 Process Operating Data and Parameters 1-2
1.5 Test Protocol and Notification 1-2
1.6 Test Program Notes 1-2
2.0 Summary of Results 2-1
3.0 Testing Methodology 3-1
3.1 U.S. EPA Reference Test Methods 1 and 2 – Sampling/Traverse Points and Volumetric Flow Rate 3-1
3.2 U.S. EPA Reference Test Method 3/3A – Oxygen/Carbon Dioxide 3-1
3.3 U.S. EPA Reference Test Method 4 – Moisture Content 3-1
3.4 U.S. EPA Reference Test Methods 5 and 202 – Total Particulate Matter 3-2
3.5 U.S. EPA Conditional Test Method CTM-013A – Sulfur Acid Mist 3-2
3.6 Quality Assurance/Quality Control – U.S. EPA Reference Test Method 3/3A 3-3

LIST OF TABLES AND FIGURE

Figure 1-1: Source Diagram 1-1
Table 1-1: Project Team 1-2
Table 2-1: Summary of Results – EU-Turbine 1 2-1
Table 2-2: Summary of Results - EU-Turbine 3 2-2
Table 3-1: Source Testing Methodology 3-1

APPENDICES

Appendix A Sample Calculations
Appendix B Field Data
Appendix C Laboratory Data
Appendix D Quality Assurance/Quality Control Data
Appendix E Process Operating/Control System Data
Appendix F Test Protocol and Associated Documentation

Introduction

1.0 Introduction

Alliance Technical Group, LLC (Alliance) was retained by Apex Companies, LLC (Apex), on behalf of Consumers Energy Company (CEC), to conduct compliance testing at the Covert, Michigan facility. The facility operates under Michigan Department of Environment, Great Lakes, and Energy (EGLE) Air Quality Division Renewable Operating Permit (ROP) MI-ROP-N6767-2020a. Testing was conducted to determine the emission rates of total particulate matter (TPM) and sulfuric acid mist (H_2SO_4) from the exhaust stacks of EU-Turbine 1 and EU-Turbine 3. In this report, TPM is equivalent to particulate matter less than 10 and 2.5 microns ($PM_{10/2.5}$).

1.1 Facility Description

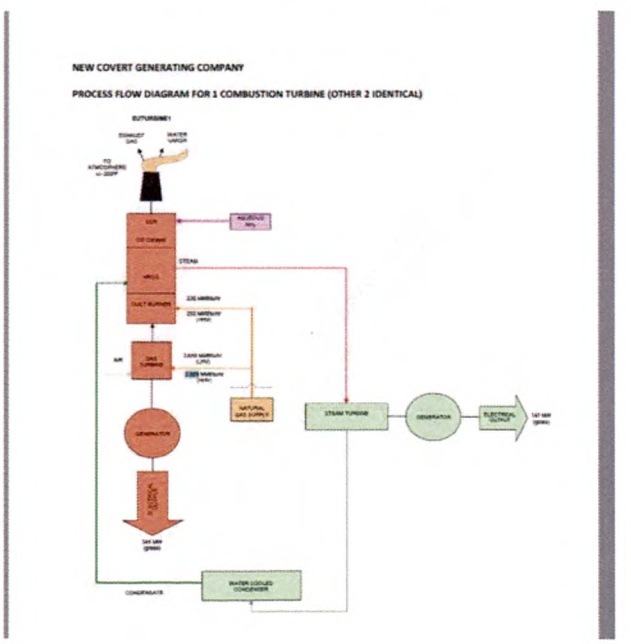
The Covert Generating Station (CGS), operated by CEC, includes three electric generating units (EGUs 1, 2, and 3). Each EGU is a combined cycle unit, comprised of one combustion turbine with duct burners that supplement heat to the heat recovery steam generator (HRSG). These turbine and duct pairs exhaust to common stacks per individual EGU.

1.2 Source and Control System Descriptions

EU-Turbine 1 and EU-Turbine 3 are natural gas-fired Mitsubishi model 501G KIA combustion turbines (CT), installed in 2001. Turbine 1 was updated in 2020 and Turbine-03 in 2019. Both turbines are equipped with a dry low nitrogen oxide (DLN) combustor and utilize inlet air evaporative cooling. Both turbines operate in combined cycles with a HRSG and a steam turbine generator. This CT/HRSG operation is equipped with a selective catalytic reduction (SCR) and an oxidation catalyst system.

Duct Burners 1 and 3 are both natural gas-fired burners, installed in 2001, and operate at a maximum heat input capacity of 256 mmBtu/hr in the HRSG of their respective turbines.

Figure 1-1: Source Diagram



1.3 Project Team

Personnel involved in this project are identified in the following table.

Table 1-1: Project Team

Facility Personnel	Thomas Schmelter - CEC
Apex Personnel	Dr. Derek Wong
Regulatory Personnel	Mariah Scott Trevor Drost
Alliance Personnel	Michael McDaniel Jonathan Boyle Jerrit Hall Jacob Luker

1.4 Process Operating Data and Parameters

The process data of each turbine is monitored and recorded by the facility's responsive data acquisition handling system (DAHS). The following parameters are provided for the duration of each test run and can be found in Appendix E of this report. Per CEC correspondence, plant CEMS data was recorded 1-hour off (Eastern Standard Time) from the test run data (Eastern Daylight Savings Time).

- CTGASFLW = Combustion turbine gas flow in units of hundred standard cubic feet per hour (HSCFH)
- CTHEAT = Combustion turbine heat input in units of millions of Btu per hour (MMBtu/hr)
- CTLOAD = Combustion turbine percent load
- DBGASFLW = Duct burner gas flow in units of HSCFH
- DBHEAT = Duct burner heat input in units of MMBtu/hr
- GASFLOW = Total combustion turbine and duct burner fuel flow in units of HSCFH
- HEATIN = Total combustion turbine and duct burner heat input in units of MMBtu/hr
- LOADMW = Combustion turbine gross load in megawatts (MW)
- TOTLOAD = Total combustion turbine and associated steam turbine gross load in MW

1.5 Test Protocol and Notification

Testing was conducted in accordance with the test protocol submitted to EGLE by CEC and amended via email on July 11, 2024, with regard to the H_2SO_4 test method.

1.6 Test Program Notes

As approved by the EGLE Air Quality Division, US. EPA Method CTM-013 was performed in place of US EPA Method 8 for H2SO4. Upon internal plant review of the test report, in an effort to review the stack diameter measured onsite, plant drawings and a post test physical measurement of the stack diameters resulted in the drawings showing a diameter of 259" and the physical measurement showing 261.5". For the purpose of this test, a diameter of 261.5" was used to determine the velocity flow rate. The sample points selected were based on the Method 1 measurements taken onsite.

Summary of Results

2.0 Summary of Results

Alliance conducted compliance testing at the CEC facility in Covert, Michigan on July 15 and 16, 2024. Testing consisted of determining the emission rates of TPM (which is equivalent to $PM_{10/2.5}$) and H_2SO_4 at the exhausts of EU-Turbine 1 and EU-Turbine 3.

Tables 2-1 and 2-2 provide a summary of the emission testing results with comparisons to the applicable federal rule or EGLE permit limits. Any difference between the summary of results listed in the following tables and the detailed results contained in the appendices is due to rounding for presentation.

Table 2-1: Summary of Results – EU-Turbine 1

Emissions Data				
Run Number	**Run 1**	**Run 2**	**Run 3**	**Average**
Date	7/15/24	7/15/24	7/15/24	--
H_2SO_4 Mist				
Concentration, ppmvd	0.023	0.019	0.0070	0.016
Emission Factor, lb/MMBtu (O_2)	1.4E-04	1.2E-04	4.3E-05	9.9E-05
Emission Rate, lb/hr	0.38	0.34	0.12	0.28
Permit Limit, lb/hr	--	--	--	1.0
Percent of Limit, %	--	--	--	**28**
Filterable Particulate Matter				
Concentration, grain/dscf	4.7E-04	5.7E-04	4.9E-04	5.1E-04
Emission Factor, lb/MMBtu (O_2)	0.0016	0.0020	0.0017	0.0017
Emission Rate, lb/hr	4.5	5.6	4.7	4.9
Condensable Particulate Matter				
Concentration, grain/dscf	0.0012	0.0014	0.0014	0.0014
Emission Factor, lb/MMBtu (O_2)	0.0041	0.0049	0.0049	0.0047
Emission Rate, lb/hr	11.6	14.2	13.7	13.2
Total Particulate Matter				
Concentration, grain/dscf	0.0017	0.0020	0.0019	0.0019
Emission Factor, lb/MMBtu (O_2)	0.0057	0.0069	0.0065	0.0064
Emission Rate, lb/hr	16.1	19.9	18.4	18.1
Permit Limit, lb/hr	--	--	--	10.7
Percent of Limit, %	--	--	--	**169**

Table 2-2: Summary of Results - EU-Turbine 3

Emissions Data				
Run Number	**Run 1**	**Run 2**	**Run 3**	**Average**
Date	7/16/24	7/16/24	7/16/24	--
H_2SO_4 Mist				
Concentration, ppmvd	0.0068	0.010	0.0089	0.0086
Emission Factor, lb/MMBtu (O_2)	4.1E-05	6.1E-05	6.2E-05	5.5E-05
Emission Rate, lb/hr	0.10	0.16	0.14	0.13
Permit Limit, lb/hr	--	--	--	1.0
Percent of Limit, %	--	--	--	**13**
Filterable Particulate Matter				
Concentration, grain/dscf	7.5E-04	4.7E-04	6.2E-04	6.1E-04
Emission Factor, lb/MMBtu (O_2)	0.0026	0.0016	0.0024	0.0022
Emission Rate, lb/hr	6.5	4.1	5.5	5.3
Condensable Particulate Matter				
Concentration, grain/dscf	6.2E-04	8.6E-04	5.7E-04	6.9E-04
Emission Factor, lb/MMBtu (O_2)	0.0021	0.0029	0.0022	0.0024
Emission Rate, lb/hr	5.4	7.5	5.0	5.9
Total Particulate Matter				
Concentration, grain/dscf	0.0014	0.0013	0.0012	0.0013
Emission Factor, lb/MMBtu (O_2)	0.0047	0.0045	0.0047	0.0046
Emission Rate, lb/hr	11.8	11.5	10.5	11.3
Permit Limit, lb/hr	--	--	--	10.7
Percent of Limit, %	--	--	--	**106**

Testing Methodology

3.0 Testing Methodology

The emission testing program was conducted in accordance with the test methods listed in Table 3-1. Method descriptions are provided below while quality assurance/quality control data is provided in Appendix D.

Table 3-1: Source Testing Methodology

Parameter	U.S. EPA Reference Test Methods	Notes/Remarks
Volumetric Flow Rate	1 and 2	Full Velocity Traverses
Oxygen/Carbon Dioxide	3/3A	Integrated Bag / Instrumental Analysis
Moisture Content	4	Gravimetric Analysis
Filterable and Condensable Particulate Matter	5/202	Isokinetic Sampling
Sulfuric Acid Mist	CTM-013A	Constant Rate Sampling

3.1 U.S. EPA Reference Test Methods 1 and 2 – Sampling/Traverse Points and Volumetric Flow Rate

The sampling location and number of traverse (sampling) points were selected in accordance with U.S. EPA Reference Test Method 1. To determine the minimum number of traverse points, the upstream and downstream distances were equated into equivalent diameters and compared to Figure 1-1 in U.S. EPA Reference Test Method 1. Please refer to Appendix B Method 1 data for a summary of the number and location of traverse points used for the TPM and H_2SO_4 sampling.

Full velocity traverses were conducted in accordance with U.S. EPA Reference Test Method 2 to determine the average stack gas velocity pressure, static pressure and temperature. The velocity and static pressure measurement system consisted of a Pitot tube and inclined manometer. The stack gas temperature was measured with a K-type thermocouple and pyrometer.

Stack gas velocity pressure and temperature readings were recorded during each test run. The data collected was utilized to calculate the volumetric flow rate in accordance with U.S. EPA Reference Test Method 2.

3.2 U.S. EPA Reference Test Method 3/3A – Oxygen/Carbon Dioxide

The oxygen (O_2) and carbon dioxide (CO_2) testing was conducted in accordance with U.S. EPA Reference Test Method 3/3A. One (1) integrated Tedlar bag sample was collected during each test run. The bag samples were analyzed on site with a gas analyzer. The remaining stack gas constituent was assumed to be nitrogen for the stack gas molecular weight determination. The samples were collected for the same duration as the particulate test (2-hours). The quality control measures are described in Section 3.6.

3.3 U.S. EPA Reference Test Method 4 – Moisture Content

The stack gas moisture content (BWS) was determined in accordance with U.S. EPA Reference Test Method 4. The gas conditioning train consisted of a series of chilled impingers. Prior to testing, each impinger was filled with a known quantity of water or silica gel. Each impinger was analyzed gravimetrically before and after each test run on the same balance to determine the amount of moisture condensed.

3.4 U.S. EPA Reference Test Methods 5 and 202 – Total Particulate Matter

The total particulate matter (filterable and condensable PM) testing was conducted in accordance with U.S. EPA Reference Test Methods 5 and 202. The complete sampling system consisted of a stainless-steel nozzle, glass-lined probe, pre-weighed quartz filter, coil condenser, un-weighed Teflon filter, gas conditioning train, pump and calibrated dry gas meter. The gas conditioning train consisted of a coiled condenser and four (4) chilled impingers. The first, and second impingers were initially empty, the third contained 100 mL of de-ionized water and the last impinger contained 200-300 grams of silica gel. The un-weighed 90 mm Teflon filter was placed between the second and third impingers. The probe liner heating system was maintained at a temperature of 248 ±25°F, and the impinger temperature was maintained at 68°F or less throughout testing. The temperature of the Teflon filter was maintained greater than 65°F but less than or equal to 85°F.

Following the completion of each test run, the sampling train was leak checked at a vacuum pressure greater than or equal to the highest vacuum pressure observed during the run. The nitrogen purge was conducted on-site during testing. After the leak check the impinger contents were measured for moisture gain.

The pre-weighed quartz filter was carefully removed and placed in container 1. The probe, nozzle and front half of the filter holder were rinsed six (6) times with acetone to remove any adhering particulate matter and these rinses were recovered in container 2. All containers were sealed, labeled and liquid levels marked for transport to the identified laboratory for filterable particulate matter analysis.

The contents of impingers 1 and 2 were recovered in container CPM Cont. #1. The back half of the filterable PM filter holder, the coil condenser, impingers 1 and 2 and all connecting glassware were rinsed with DIUF water and then rinsed with acetone, followed by hexane. The water rinses were added to container CPM Cont. #1 while the solvent rinses were recovered in container CPM Cont. #2. The Teflon filter was removed from the filter holder and placed in container CPM Cont. #3. The front half of the condensable PM filter holder was rinsed with DIUF water and then with acetone, followed by hexane. The water rinse was added to container CPM Cont. #1 while the solvent rinses were added to container CPM Cont. #2. All containers were sealed, labeled and liquid levels marked for transport to the identified laboratory for condensable particulate matter analysis.

3.5 U.S. EPA Conditional Test Method CTM-013A – Sulfur Acid Mist

The sulfuric acid mist (H_2SO_4) testing was conducted in accordance with U.S. EPA Conditional Test Method 013A. The sampling train consisted of a heated glass-lined probe, heated glass filter holder and filter, Teflon jumper, gas conditioning system, pump and calibrated dry gas meter. The gas conditioning system consisted of four (4) chilled impingers. The first impinger contained 100 mL of 80 % isopropyl alcohol (IPA), the second and third impingers were empty and the fourth contained 200 to 300 grams of silica gel. An unheated glass fiber filter was used between the outlet of the first impinger and the inlet of the second impinger. The probe was maintained at $\geq$ 400 °F, and the heated filter was maintained $\geq$ 500 °F.

Following the completion of each test run, the sampling train was leak checked at a vacuum pressure greater than or equal to the highest vacuum pressure observed during the run. The heated filter was placed in Container 1. The probe and front half of the heated filter holder were rinsed with IPA, and the rinses were added to Container 1. After measuring the contents of Impinger 1, the contents were placed in Container 2. The back half of heated filter holder, Teflon jumper and Impinger 1 were rinsed with IPA, and the rinses were added to Container 2. The unheated filter was placed in Container 3. The front half of the unheated filter holder was rinsed with IPA, and the rinses were added to Container 3. The contents of Impingers 2-4 were only measured for moisture gain.

All containers were sealed, labeled, and liquid levels marked for transport to the identified laboratory for analysis. The sulfuric acid mass was determined from Containers 1, 2 and 3.

3.6 Quality Assurance/Quality Control – U.S. EPA Reference Test Method 3/3A

Cylinder calibration gases used met EPA Protocol 1 (+/- 2%) standards. Copies of all calibration gas certificates can be found in the Quality Assurance/Quality Control Appendix.

Low-Level gas was introduced directly to the analyzer. After adjusting the analyzer to the Low-Level gas concentration and once the analyzer reading was stable, the analyzer value was recorded. This process was repeated for the High-Level gas. For the Calibration Error Test, Low, Mid, and High-Level calibration gases were sequentially introduced directly to the analyzer before and after each run. All values were within 2.0 percent of the Calibration Span or 0.5% absolute difference. The measured results were recorded as raw values and no bias correction was applied.

At the completion of testing, the data was also saved to the Alliance server. All data was reviewed by the Field Team Leader before leaving the facility. Once arriving at Alliance's office, all written and electronic data was relinquished to the report coordinator and then a final review was performed by the Project Manager.