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CONTINUOUS EMISSIONS MONITORING SYSTEM RELATIVE ACCURACY DETERMINATION AND EMISSION COMPLIANCE STUDY

Performed At
New Covert Generating Company, LLC
New Covert Generating Plant
EU-TURBINE1
Covert, Michigan

Test Date(s)
September 11, 12 and 13, 2018

Report No.
TRC Environmental Corporation Report 302509A

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1.0 INTRODUCTION

TRC Environmental Corporation (TRC) performed a continuous emissions monitoring system (CEMS) relative accuracy test audit (RATA) and emission compliance test program on September 11, 12 and 13, 2018 on EU-TURBINE1 at the New Covert Generating Plant of New Covert Generating Company, LLC in Covert, Michigan. The tests were authorized by and performed for New Covert Generating Company, LLC.

The results of the test program will be used to determine compliance with Michigan Department of Environmental Quality (MDEQ) Renewable Operating Permit (ROP) No. MI-ROP-N6767-2014c and the source-wide Permit To Install (PTI) permit No. MI-PTI-N6767-2014c. The test program was conducted according to the TRC Test Protocol 302509 Revision 1, dated August 6, 2018.

1.1 Project Contact Information

Participants		
Test Facility	New Covert Generating Company, LLC New Covert Generating Plant 26000 77th Street Covert, Michigan 49043 Permit No. MI-ROP-N6767-2014c State Registration No. (SRN) N6767	Chris A. Head Operations Manager 269-764-3805 (phone) CHead@camstex.com
Air Emissions Testing Body (AETB)	TRC Environmental Corporation 7521 Brush Hill Road Burr Ridge, Illinois 60527	Anthony Sakellariou Senior Project Manager 312-533-2035 asakellariou@trcsolutions.com

The tests were conducted by Chris Miller, Ben Cacao, Bill Harris, Tom Lundin, Kevin Harris, Charlie Kerber, Greg Rock and Anthony Sakellariou of TRC. Documentation of the on-site ASTM D7036-04 Qualified Individual(s) (QI) can be located in the appendix to this report.

Amanda Chapel of the Michigan State Department of Environmental Quality (MDEQ) observed the testing on September 11 and 12, 2018. And Tom Gasloli of the MDEQ observed testing on September 12, 2018.

1.2 Facility and Process Description

The New Covert Generating Plant consists of three (3) natural gas fired Mitsubishi model 501G combustion turbines (EU-TURBINE1, EU-TURBINE2, and EU-TURBINE3) equipped with dry low NOx combustor, HRSG, inlet air evaporative cooling, SCR system for NOx control, and a CO oxidizer. They are also each equipped with a 256 MMBtu/hr heat input capacity, natural gas fired duct burner (EU-DB1, EU-DB2, and EU-DB3) with a dry low NOx burner. These units are permitted as a single combined flexible group identified as FG-TURB/DB1-3 in the ROP.

2.0 SUMMARY OF RESULTS

2.1 CEMS RATA/Bias Test Results

Load	Parameter	Units	Performance Specifications (40CFR75)	CEMS Performance	
			Annual	Relative Accuracy	Bias Adjustment Factor
High Normal	NO_X	lb/MMBtu	RA ≤ ±0.015 lb/MMBtu [1]	0.000 lb/MMBtu	1.054

[1] The performance specification based on the difference between CEMS and RM mean values may be used for NOx when the mean RM value during the RATA is ≤0.200 lb/MMBtu.

Load	Parameter	Units	Performance Specifications (40CFR60)		CEMS Performance
			Specification No.	Acceptance Criteria	Relative Accuracy
> 50%	NO_X	ppmvd @ 15% O_2	2	RA ≤ 20% of the reference method	6.77 %
> 50%	CO	ppmvd	4	RA ≤ 5 ppm of absolute difference plus the confidence coefficient	1.4 ppm
> 50%	O_2	%	3	RA ≤ 1.0% difference	0.26 %

2.2 Compliance Test Results

Parameter	Units*	100% DB ON	100% DB OFF	60% DB OFF	Permitted Emission Limit**
NOx	ppmvd@15% O_2	2.4	---	---	2.5
CO	lb/hr	0.77	---	---	33.7
VOC	lb/hr	4.03	< 0.55	0.77	7.7
	lb/MMBtu	0.0015	< 0.0002	0.0004	---
PM_{10}	lb/hr	10.69	8.38	5.99	33.8
	lb/MMBtu	0.0040	0.0033	0.0032	---
Formaldehyde	lb/MMBtu	< 0.00008	0.00039	0.00036	---
Ammonia	ppmvd@15% O_2	6.6	---	---	10
Sulfur Dioxide (SO_2)	lb/MMBtu***	0.0003	---	---	---

*lb/hr values are for reference only. Compliance with the lb/hr emission limit is determined by calculating 24-hour rolling averages from the test results and measured heat inputs.

**NOx requires measurement of emission in ppmvd corrected to 15% O_2. CO requires measurement of emission in lb/hr. VOC, PM_{10} and Formaldehyde require measurement in lb/hr derived from the emission factor in lb/MMBtu obtained from source test. Ammonia requires measurement in ppmvd corrected to 15% O2.

*** There is no permit limit for SO_2. SO_2 value is derived from the fuel sulfur content analysis (refer to page 29 in the report).

The table below summarizes the test methods used, as well as the number and duration of each at each test location:

Parameter		Load	Method	# of Runs	Duration (min)
RATA	O_2	100% DB ON	USEPA Method 3A	10	21
	NO_X		USEPA Method 7E		
	CO		USEPA Method 10		
Compliance	NO_X	100% DB ON	USEPA Method 7E	3	60
	CO		USEPA Method 10	3	60
	Ammonia		USEPA Method 320	3	60
	VOC	100% DB ON, 100% DB OFF and 60% DB OFF	USEPA Method 25A	3	60
	PM_{10}		USEPA Methods 5 & 202	3	120
	Formaldehyde		USEPA Method 320	3	60

3.0 DISCUSSION OF RESULTS

The complete test results from this program are tabulated in Section 6.0.

The data acquisition and handling system (DAHS) computer printout for the same time periods as the RM testing was used to determine the relative accuracy. The watches of the test crew were synchronized with the CEMS prior to testing.

No problems were encountered with the testing equipment during the course of the test program. Source operation appeared normal during the entire test program. No changes or problems were encountered that required modification of any procedures presented in the test plan. No adverse test or environmental conditions were encountered during the conduct of this test program.

4.0 TEST PROCEDURES

All testing, sampling, analytical, and calibration procedures used for this test program were performed in accordance with the methods presented in the following sections. Where applicable, the Quality Assurance Handbook for Air Pollution Measurement Systems, Volume III, Stationary Source Specific Methods, USEPA 600/R-94/038c, September 1994 was used to supplement procedures.

4.1 Determination of Sample Point Locations by USEPA Method 1

This method is applicable to gas streams flowing in ducts, stacks, and flues and is designed to aid in the representative measurement of pollutant emissions and/or total volumetric flow rates from stationary sources. In order to qualify as an acceptable sample location, it must be located at a position at least two stack or duct equivalent diameters downstream and a half equivalent diameter upstream from any flow disturbance.

The cross-section of the measurement site was divided into a number of equal areas, and the traverse points were then located in the center of these areas. The minimum number of points were determined from either Figure 1-1 (particulate) or Figure 1-2 (non-particulate) of USEPA Method 1.

4.2 Volumetric Flow Rate Determination by USEPA Method 2

This method is applicable for the determination of the average velocity and the volumetric flow rate of a gas stream.

The gas velocity head (ΔP) and temperature were measured at traverse points defined by USEPA Method 1. The velocity head was measured with a Type S (Stausscheibe or reverse type) pitot tube and oil-filled manometer; and the gas temperature was measured with a

Type K thermocouple. The average gas velocity in the flue was calculated based on: the gas density (as determined by USEPA Methods 3 and 4); the flue gas pressure; the average of the square roots of the velocity heads at each traverse point, and the average flue gas temperature.

4.3 Determination of the Concentration of Gaseous Pollutants Using a Multi-Pollutant Sampling System

Concentrations of the pollutants in the following sub-sections were determined using one sampling system. The number of points at which sample was collected was determined in accordance with 40CFR75 Appendix A, Section 6.5.6.

A straight-extractive sampling system was used. A data logger continuously recorded pollutant concentrations and generated one-minute averages of those concentrations. All calibrations and system checks were conducted using USEPA Protocol gases. Three-point linearity checks were performed prior to sampling, and in the event of a failing system bias or drift test (and subsequent corrective action). System bias and drift checks were performed using the low-level gas and either the mid- or high-level gas prior to and following each test run.

The Low Concentration Analyzers (those that routinely operate with a calibration span of less than 20 ppm) used by TRC are ambient-level analyzers. Per Section 3.12 of Method 7E, a Manufacturer's Stability Test is not required for ambient-level analyzers. Analyzer interference tests were conducted in accordance with the regulations in effect at the time that TRC placed an analyzer model in service.

4.3.1 CO_2 Determination by USEPA Method 3A

This method is applicable for the determination of CO_2 concentrations in controlled and uncontrolled emissions from stationary sources only when specified within the regulations. The CO_2 analyzer was equipped with a non-dispersive infrared (IR) detector.

4.3.2 O_2 Determination by USEPA Method 3A

This method is applicable for the determination of O_2 concentrations in controlled and uncontrolled emissions from stationary sources only when specified within the regulations. The O_2 analyzer was equipped with a paramagnetic-based detector.

4.3.3 NO_X Determination by USEPA Method 7E

This method is applicable for the determination of NO_X concentrations in controlled and uncontrolled emissions from stationary sources only when specified within the regulations. The NO_X analyzer used a photomultiplier tube to measure the light emitted from the chemiluminescent decomposition of NO_2.

4.3.4 CO Determination by USEPA Method 10

This method is applicable for the determination of CO concentrations in controlled and uncontrolled emissions from stationary sources only when specified within the regulations. The non-dispersive infrared analyzer (NDIR) CO analyzer is equipped with an internal gas correlation filter wheel, eliminating potential detector interference. Therefore, use of an interference removal trap is not required.

4.4 Filterable PM Determination by USEPA Method 5

This method is applicable for the determination of PM emissions from stationary sources. USEPA Methods 2-4 were performed concurrently with, and as an integral part of, these determinations.

Flue gas was withdrawn isokinetically from the source at traverse points determined per USEPA Method 1, and PM was collected in the nozzle, probe liner, and on a glass fiber filter. The probe liner and filter were 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 PM mass, which included any material that condensed at or above the filtration temperature, was determined gravimetrically after the removal of uncombined water.

4.5 Condensable PM Determination by USEPA Method 202 (As Revised December, 2010)

This method is applicable for the determination of condensable particulate matter (CPM) from stationary sources. CPM is measured in the emissions after removal from the stack and after passing through a filter.

The CPM was collected in dry impingers after filterable particulate material had been collected on filters maintained above 30°C (85°F) using Method 5 or 17 (Appendix A, 40CFR60) or 201A (Appendix M, 40CFR51) type sampling train. The sample train included a Method 23 type condenser capable of cooling the stack gas to less than 85°F, followed by a water dropout impinger. One modified Greenburg Smith impinger and a CPM filter followed the water dropout impinger. The impinger contents were immediately purged after the run with nitrogen (N2) to remove dissolved sulfur dioxide. The impinger solution was then extracted with hexane, and the CPM filter was extracted with water and hexane. The organic and aqueous fractions were then taken to dryness and the residues weighed. A correction, if necessary, was made for any ammonia present due to laboratory analysis procedures. The total of all fractions represented the CPM.

4.6 Total Organic Concentration Determination by USEPA Method 25A

This method is applicable for the determination of total gaseous organic concentration of vapors consisting primarily of alkanes, alkenes, and/or arenes (aromatic hydrocarbons). The concentration is expressed in terms of propane (or other appropriate organic calibration gas) or in terms of carbon.

A gas sample was extracted from the source through a heated sample line and glass fiber filter to a flame ionization analyzer (FIA). If necessary, a source-specific response factor was developed for the FIA.

4.7 Ammonia and Formaldehyde Determination by Extractive FTIR

The Method 320, 40CFR63, sampling and measurement system meets the requirements for stack sampling of gaseous organic and inorganic compounds set forth by the United States Environmental Protection Agency (USEPA). In particular, it meets the requirements of USEPA Reference Method 320, "Measurement Of Vapor Phase Organic And Inorganic Emissions By Extractive Fourier Transform Infrared (FTIR) Spectroscopy," 40CFR63. This method applies to the analysis of a range of volatile organic compounds (VOCs) and volatile inorganic compounds emitted from an industrial source.

The source emissions were transported to the FTIR analyzer via a heated, extractive sampling system. The various components of the matrix were identified and quantified by absorbance of infrared radiation. Data measurements and analytical results were stored on a computer. The data were copied to a flash drive and a second hard drive before departing the test site.

The FTIR spectrometer used was an MKS 2030 Analyzer outfitted with a liquid nitrogen cooled MCT (mercury cadmium telluride) detector and a heated 5.11 meter pathlength gas cell. The spectral resolution was 0.5 cm^{-1} (wavenumbers). The FTIR instrument was calibrated using a spectral library of reference spectra stored on computer. Calibration was verified on site through direct and system calibration measurements using gas standards. These gases include the method-required CTS (calibration transfer standard, nominally 10 ppm Ethylene) and nitrogen zero gas. Direct and dynamic matrix spiking calibrations were conducted using an ammonia (NH_3) / sulfur hexafluoride (SF_6) and acetaldehyde / SF_6 gas standards. A formaldehyde gas standard was not available for this test program, therefore acetaldehyde was used as a surrogate since they have similar chemical and physical properties.

Method 320 Testing Details:

- The total sampling system flow rate was 12 liters/minute with 5 lpm directed to the FTIR analyzer.
- The sampling system included a heated probe maintained at 365 °F that utilized a heated ceramic filter at the probe exit to remove particulate.
- Calibration and spiking gases were injected into the probe upstream of the heated filter.
- The heated sampling umbilical was 165 feet in length and was maintained at 365 °F.
- The heated head pump, manifold, and FTIR gas cell were maintained at 365 °F.
- In order to calculate the formaldehyde emission rate in ton/year, the flow measurements from the Method 5 train were used. And in order to calculate the ammonia emission rate in ppmvd corrected to 15% oxygen, O_2 concentrations from the calibrated Method 3A O_2 analyzer and moisture from the FTIR system were used.

The sampling system was checked for leaks after assembling the sampling equipment on-site and allowing all heated equipment to stabilize. The leak-check was performed by capping the end of the sample probe and verifying the absence of sampling system flow as measured by an inline rotameter.

The CTS gas (nominally 10.0 ppm Ethylene (C_2H_4) in nitrogen cylinder) was flowed directly to the FTIR (direct calibration) and through the sampling system (system calibration) prior to and upon completion of testing. The repeatability (%RPD) is also reported as a calculation comparing two successive CTS measurements. Repeatability of <2% indicates the measurement had stabilized. The % Difference calculation compares measurements at the start and end of the test day; the method requirement of <5% difference was achieved in all measurements. The sampling system response time was determined at the test location using the System CTS calibration. The CTS was measured in a system calibration immediately after a system zero calibration. A response time was measured at the location based on measuring 95% of the calibration cylinder concentration.

Direct and system zero measurements were conducted at the start and end of each test day. An acceptable zero calibration is generally defined by detection of analytes (except H_2O and CO_2) below 1 ppm. Acceptable zero calibration values were obtained for all measured compounds.

The FTIR Classical Least Squares (CLS) analysis determines the concentration, in parts per million wet basis (ppmvw), for each analyzed compound as well as the residual, which is the error associated with each measured concentration. When the residual error exceeds the measured concentration, the compound is considered a non-detect, and the residual is reported as the detection limit. Therefore if the measured concentration is 0.05 ppmvw and the residual error is 0.10 ppmvw, the concentration is reported as "<0.10".

Calibration and detailed test data can be found in the report appendix. The report appendix includes summaries of QA data collected during the test program. QA procedures included system leak checks, direct and system calibration and zero measurements, detector linearity checks, and verification of analysis accuracy by manual subtraction. The analysis was confirmed by manual subtraction of the measured compounds from a representative spectrum. This confirmation served to validate the computerized FTIR analysis.

4.8 Determination of F-Factors by 40CFR75 Appendix F

This method is applicable for the determination of the pollutant emission rate using oxygen (O_2) or carbon dioxide (CO_2) concentrations and the appropriate F factor (the ratio of combustion gas volumes to heat inputs) and the pollutant concentration. The appropriate F-Factor was selected from Table 19-2 of Method 19 for the RATA and. calculated from fuel analyses using the equations in Section 3.3.6 of 40CFR75 Appendix F for compliance tests.

5.0 QUALITY ASSURANCE PROCEDURES

TRC integrates our Quality Management System (QMS) into every aspect of our testing service. We follow the procedures specified in current published versions of the test Method(s) referenced in this report. Any modifications or deviations are specifically identified in the body of the report. We routinely participate in independent, third party audits of our activities, and maintain:

- Accreditation from the Louisiana Environmental Laboratory Accreditation Program (LELAP);
- Accreditation from the Stack Testing Accreditation Council (STAC) and the American Association for Laboratory Accreditation (A2LA) that our operations conform with the requirements of ASTM D 7036 as an Air Emission Testing Body (AETB).

These accreditations demonstrate that our systems for training, equipment maintenance and calibration, document control and project management will fully ensure that project objectives are achieved in a timely and efficient manner with a strict commitment to quality.

All calibrations are performed in accordance with the test Method(s) identified in this report. If a Method allows for more than one calibration approach, or if approved alternatives are available, the calibration documentation in the appendices specifies which approach was used. All measurement devices are calibrated or verified at set intervals against standards traceable to the National Institute of Standards and Technology (NIST). NIST traceability information is available upon request.

ASTM D7036-04 specifies that: *"AETBs shall have and shall apply procedures for estimating the uncertainty of measurement. Conformance with this section may be demonstrated by the use of approved test protocols for all tests. When such protocols are used, reference shall be made to published literature, when available, where estimates of uncertainty for test methods may be found."* TRC conforms with this section by using approved test protocols for all tests.

RATA Type: **Nitrogen Oxides (NO_X), lb/MMBtu**
Regulation: **40CFR75**
RM Used: **3A, 7E**

Customer:	New Covert Generating Company	Project #:	302509
Unit ID:	EU-TURBINE1	CEM Model:	Teledyne T200M
Sample Loc:	Stack	CEM Serial #:	781

Use? 1 = Y 0 = N	Test Run	Date	Start Time	End Time	RM NO_X lb/MMBtu	CEM NO_X lb/MMBtu	(RM-CEM) Difference (di)
1	1	9/11/18	8:59	9:19	0.008	0.008	0.000
1	2	9/11/18	10:48	11:08	0.008	0.008	0.000
1	3	9/11/18	11:37	11:57	0.009	0.008	0.001
1	4	9/11/18	12:21	12:41	0.008	0.008	0.000
1	5	9/11/18	13:19	13:39	0.009	0.008	0.001
1	6	9/11/18	14:01	14:21	0.009	0.009	0.000
1	7	9/11/18	14:46	15:06	0.009	0.009	0.000
1	8	9/11/18	15:39	15:59	0.009	0.008	0.001
0	9	9/11/18	16:40	17:00	0.009	0.008	0.001
1	10	9/11/18	17:29	17:49	0.009	0.008	0.001

n	9	
t(0.025)	2.306	
Mean RM Value	0.009	RM avg
Mean CEM Value	0.008	CEM avg
Mean Difference	0.0004	d avg
Standard Deviation	0.001	sd
Confidence Coefficient	0.000	CC
RA based on RM	9.80	%
Alternative for Low Emitters	0.000	lb/MMBtu
Bias Adjustment Factor	1.054	BAF

RATA Type: **Nitrogen Oxides (NO_X), ppmvd at 15% Oxygen**
Regulation: **40CFR60**
RM Used: **7E**

Customer:	New Covert Generating Company	Project #:	302509
Unit ID:	EU-TURBINE1	CEM Model:	Teledyne T200M
Sample Loc:	Stack	CEM Serial #:	781

Use? 1 = Y 0 = N	Test Run	Date	Start Time	End Time	RM NO_X ppmvd at 15% Oxygen	CEM NO_X ppmvd at 15% Oxygen	(RM-CEM) Difference (di)
1	1	9/11/18	8:59	9:19	2.1	2.1	0.000
1	2	9/11/18	10:48	11:08	2.3	2.2	0.100
1	3	9/11/18	11:37	11:57	2.3	2.1	0.200
1	4	9/11/18	12:21	12:41	2.3	2.1	0.200
1	5	9/11/18	13:19	13:39	2.3	2.2	0.100
1	6	9/11/18	14:01	14:21	2.4	2.3	0.100
1	7	9/11/18	14:46	15:06	2.4	2.3	0.100
1	8	9/11/18	15:39	15:59	2.4	2.3	0.100
0	9	9/11/18	16:40	17:00	2.5	2.3	0.200
1	10	9/11/18	17:29	17:49	2.4	2.3	0.100

n	9	
t(0.975)	2.306	
Mean RM Value	2.322	RM avg
Mean CEM Value	2.211	CEM avg
Mean Difference	0.111	d avg
Sum of Differences^2	0.140	di^2
Standard Deviation	0.060	sd
Confidence Coefficient	0.046	CC
RA based on RM	6.77	%

RATA Type: **Carbon Monoxide (CO), ppm**
Regulation: **40CFR60**
RM Used: **10**

Customer:	New Covert Generating Company	Project #:	302509
Unit ID:	EU-TURBINE1	CEM Model:	Teledyne T300M
Sample Loc:	Stack	CEM Serial #:	413

Use? 1 = Y 0 = N	Test Run	Date	Start Time	End Time	RM CO ppmvd	CEM CO ppmvd	(RM-CEM) Difference (di)
1	1	9/11/18	8:59	9:19	0.3	1.6	-1.30
1	2	9/11/18	10:48	11:08	0.1	1.5	-1.40
1	3	9/11/18	11:37	11:57	0.2	1.6	-1.40
1	4	9/11/18	12:21	12:41	0.2	1.6	-1.40
1	5	9/11/18	13:19	13:39	0.2	1.6	-1.40
1	6	9/11/18	14:01	14:21	0.2	1.5	-1.30
1	7	9/11/18	14:46	15:06	0.2	1.6	-1.40
1	8	9/11/18	15:39	15:59	0.2	1.6	-1.40
1	9	9/11/18	16:40	17:00	0.2	1.6	-1.40
0	10	9/11/18	17:29	17:49	0.2	1.6	-1.40

n	9	
t(0.975)	2.306	
Mean RM Value	0.200	RM avg
Mean CEM Value	1.578	CEM avg
Mean Difference	-1.378	d avg
Standard Deviation	0.044	sd
Confidence Coefficient	0.034	CC
Alternative for Low Emitters (PS 4A)	1.4	ppm

RATA Type: **Oxygen (O_2), % by volume**
Regulation: **40CFR60**
RM Used: **3A**

Customer:	New Covert Generating Company			Project #:	302509	
Unit ID:	EU-TURBINE1			CEM Model:	Teledyne T300M	
Sample Loc:	Stack			CEM Serial #:	413	
Use? 1 = Y 0 = N	Test Run	Date	Start Time	End Time	RM O_2 % v/v dry	CEM O_2 % v/v dry	(RM-CEM) Difference (di)
1	1	9/11/18	8:59	9:19	12.9	12.7	0.200
1	2	9/11/18	10:48	11:08	13.1	12.8	0.300
1	3	9/11/18	11:37	11:57	13.1	12.8	0.300
1	4	9/11/18	12:21	12:41	13.1	12.8	0.300
1	5	9/11/18	13:19	13:39	13.1	12.8	0.300
1	6	9/11/18	14:01	14:21	13.0	12.8	0.200
1	7	9/11/18	14:46	15:06	13.0	12.8	0.200
1	8	9/11/18	15:39	15:59	13.0	12.8	0.200
0	9	9/11/18	16:40	17:00	13.1	12.8	0.300
1	10	9/11/18	17:29	17:49	13.1	12.8	0.300

n	9	
t(0.975)	2.306	
Mean RM Value	13.044	RM avg
Mean CEM Value	12.789	CEM avg
Mean Difference	0.256	d avg
Standard Deviation	0.053	sd
Confidence Coefficient	0.041	CC
RA based on RM	2.27	%
RA (Absolute Mean Difference)	0.26	% vol diff.

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Compliance Gaseous Test Results Summary

Project Number:	302509	Start Date:	9/11/18
Customer:	New Covert Generating Company	End Date:	9/11/18
Unit Identification:	EU-TURBINE1	Facility:	Covert, MI
Sample Location:	Stack	Recorded by:	C. Miller
RM Probe Type:	Extractive (Dry)	Fc Factor:	-
Load Level/Condition:	100% Duct Burners On	Fd Factor:	8710

Reference Method Results, As Measured Moisture Basis

Run #	Date	Start Time	End Time	NOx ppmvd	CO ppmvd	CO2 % v/v dry	O2 % v/v dry
2	9/11/18	10:48	11:08	3.1	0.1	4.3	13.1
3	9/11/18	11:37	11:57	3.1	0.2	4.3	13.1
4	9/11/18	12:21	12:41	3.0	0.2	4.3	13.1
Compliance Run 1 Average				3.0	0.2	4.3	13.1
5	9/11/18	13:19	13:39	3.1	0.2	4.3	13.1
6	9/11/18	14:01	14:21	3.2	0.2	4.3	13.0
7	9/11/18	14:46	15:06	3.2	0.2	4.3	13.0
Compliance Run 2 Average				3.2	0.2	4.3	13.1
8	9/11/18	15:39	15:59	3.2	0.2	4.3	13.0
9	9/11/18	16:40	17:00	3.3	0.2	4.2	13.1
10	9/11/18	17:29	17:49	3.2	0.2	4.2	13.1
Compliance Run 3 Average				3.2	0.2	4.3	13.1
Total Average				**3.1**	**0.2**	**4.3**	**13.1**

Emission Rate Calculation Summary

Run #	NOx lb/MMBtu	CO lb/MMBtu	NOx lb/hr	CO lb/hr	Flow DSCFM	NO_X ppmvd corrected to 15% O2
2	0.008	0.000	22.11	0.58	1,011,640	2.3
3	0.009	0.000	22.23	0.76	1,011,640	2.3
4	0.008	0.000	22.13	0.81	1,034,789	2.3
Compliance Run 1 Average	0.008	0.000	22.16	0.72	1,019,356	2.3
5	0.009	0.000	23.03	0.74	1,034,789	2.3
6	0.009	0.000	23.93	0.81	1,034,789	2.4
7	0.009	0.000	24.13	0.86	1,042,725	2.4
Compliance Run 2 Average	0.009	0.000	23.70	0.80	1,037,434	2.4
8	0.009	0.000	23.79	0.90	1,042,725	2.4
9	0.009	0.000	24.35	0.79	1,042,725	2.5
10	0.009	0.000	23.84	0.72	1,042,725	2.4
Compliance Run 3 Average	0.009	0.000	23.99	0.80	1,042,725	2.4
Total Average	**0.009**	**0.000**	**23.28**	**0.77**	**1,033,172**	**2.4**

TRC
Results you can rely on

METHOD 25A TEST RESULTS SUMMARY

Project Number:	302509	Test Date(s):	09/11/18
Customer:	New Covert Generating Company	Facility:	Covert, MI
Unit Identification:	EU-TURBINE1	Recorded by:	C. Miller
Load Level/Condition:	100% Duct Burner On		

Location	Stack			
Test Run No.	1	2	3	Average
Test Date	9/11/2018	9/11/2018	9/11/2018	
Test Time - Start	10:48	13:19	15:39	
Test Time - End	12:41	15:06	17:49	
THC (ppmvw as Propane)	0.46	0.51	0.58	0.52
Volumetric Flow Rate (scfm)	1,120,140	1,143,345	1,145,029	1,136,171
THC (lb/hr as Propane)	3.54	4.00	4.56	4.03
Fractional Gas Moisture Content (B_{ws})	0.097	0.095	0.090	0.094
THC (ppmvd as Propane)	0.509	0.56	0.64	0.57
O_2 (% dry)	13.10	13.10	13.10	13.10
F_d	8658	8658	8658	8658
THC - F_d Basis (lb/MMBTU)	0.0014	0.0015	0.0017	0.0015

TRC
Results you can rely on

PARTICULATE TEST RESULTS SUMMARY

Company:	New Covert Generating Company
Plant:	New Covert Generating Plant
Unit:	EU-TURBINE1
Location:	Stack

Test Run Number:	1	2	3	Average
Source Condition:	100% DB ON	100% DB ON	100% DB ON	
Date:	9/11/2018	9/11/2018	9/11/2018	
Start Time:	8:52	12:06	15:00	
End Time:	11:23	14:20	17:14	
Sample Duration (min):	120.0	120.0	120.0	120.0
Average Gas Temp, T_s, (^oF):	186.4	185.3	185.3	185.7
Fractional Gas Moisture Content, B_{ws}:	0.097	0.095	0.090	0.094
Gas CO_2 Content (%vol):	4.3	4.3	4.3	4.3
Gas O_2 Content (%vol):	13.1	13.1	13.1	13.1
Gas Wet MW, M_s, (lb/lbmole-mole):	28.13	28.15	28.20	28.16
Average Gas Velocty, V_s, (ft/sec):	61.57	62.73	62.88	62.39
Measured Volumetric Flow Rate:				
Q (actual ft^3/min):	1,404,232	1,430,828	1,434,186	1,423,082
Q_{std} (std ft^3/min):	1,120,140	1,143,345	1,146,029	1,136,505
$Q_{std(dry)}$ (dry std ft^3/min):	1,011,640	1,034,789	1,042,725	1,029,718
F_d (dscf/MMBtu):	8,658	8,658	8,658	8,658
Sample Volume, $V_{m(std)}$, (dry std ft^3):	67.789	68.361	68.866	68.339
PM Collected, (mg):				
Filterable, m_n:	3.37	4.21	3.41	3.66
Condensable, m_{cpm}:	2.10	1.40	1.60	1.70
Total, m_{total}:	5.47	5.61	5.01	5.36
PM Concentration, (gr/dscf):				
Filterable, C_s:	0.0008	0.0009	0.0008	0.0008
Condensable, C_{cpm}:	0.0005	0.0003	0.0004	0.0004
Total, C:	0.0012	0.0013	0.0011	0.0012
PM Emission Rate, ER_{M2}, (lb/hr based on measured volumetric flow rate):				
Filterable:	6.66	8.42	6.83	7.30
Condensable:	4.14	2.80	3.20	3.38
Total:	10.80	11.23	10.04	10.69
PM Emission Rate, ER_{Fd}, (lb/MMBtu using F_d):				
Filterable	0.0025	0.0031	0.0025	0.0027
Condensable:	0.0016	0.0010	0.0012	0.0013
Total:	0.0041	0.0042	0.0037	0.0040
Isokinetic Variance, I:	100.3	98.9	98.9	99.4

TRC
Results you can rely on

EMISSIONS TEST RESULTS SUMMARY - EPA METHOD 320						
Company:	New Covert		Date:	9/11/2018		
Plant:	EU-TURBINE1		TRC Project	302509		
Unit:	Stack		Load:	100% DB ON		
	Date		09/11/18	09/11/18	09/11/18	
	Start Time		12:10	13:30	15:10	
	End Time		13:10	14:30	16:10	
	Test Run		1	2	3	**Average**
Flow	Stack Flow Method 5	dscfm	1,034,789	1,034,789	1,042,725	**1,037,434**
Moisture	Moisture Method 320	Fraction	0.093	0.093	0.092	**0.093**
F Factor	Fc	scf/MMBtu	1029	1029	1029	**1029**
	CO_2 Method 3A	%, Dry	4.3	4.3	4.3	**4.3**
	O_2 Method 3A	%, Dry	13.1	13.1	13.1	**13.1**
	O_2 Basis for Correction	15				
	Ammonia NH3	ppmvw	7.9	7.7	8.1	**7.9**
MW=	17.0306	ppmvd	8.7	8.5	9.0	**8.7**
		ppmvd at 15% O2	6.6	6.4	6.8	**6.6**
	Formaldehyde CH2O	ppmvw	0.04	<0.04	<0.04	**<0.04**
MW=	30.026	ppmvd	0.04	<0.04	<0.04	**<0.04**
		lb/hr	0.21	<0.19	<0.19	**<0.21**
		lb/MMBtu	0.00008	<0.00007	<0.00007	**<0.00008**

TRC
Results you can rely on

METHOD 25A TEST RESULTS SUMMARY

Project Number:	302509	Test Date(s):	09/12/18
Customer:	New Covert Generating Company	Facility:	Covert, MI
Unit Identification:	EU-TURBINE1	Recorded by:	C. Miller
Load Level/Condition:	100% Duct Burner Off		

Location	Stack			
Test Run No.	1	2	3	Average
Test Date	9/12/2018	9/12/2018	9/12/2018	
Test Time - Start	7:31	9:49	12:47	
Test Time - End	9:00	12:03	15:02	
THC (ppmvw as Propane)*	< 0.07	< 0.07	< 0.07	< 0.07
Volumetric Flow Rate (scfm)	1,145,581	1,158,900	1,151,646	1,152,042
THC (lb/hr as Propane)	< 0.55	< 0.56	< 0.55	< 0.55
Fractional Gas Moisture Content (B_{ws})	0.085	0.090	0.052	0.076
THC (ppmvd as Propane)	< 0.08	< 0.08	< 0.07	< 0.08
O_2 (% dry)	13.70	13.70	13.70	13.70
F_d	8658	8658	8658	8658
THC - F_d Basis (lb/MMBTU)	< 0.0002	< 0.0002	< 0.0002	< 0.0002

* THC test results were negative, therefore a method detection limit (MDL) was established below using the analyzer system response to zero calibration gas

	Zero Calibration
Pre 1	-0.04
Post 1 / Pre 2	-0.06
Post 2 / Pre 3	-0.04
Post 3	-0.02
StdDev	0.0163
T.99, N-1= 3	4.541
MDL =	**0.07**

TRC
Results you can rely on

PARTICULATE TEST RESULTS SUMMARY

Company:	New Covert Generating Company
Plant:	New Covert Generating Plant
Unit:	EU-TURBINE1
Location:	Stack

Test Run Number:	1	2	3	Average
Source Condition:	100% DB OFF	100% DB OFF	100% DB OFF	
Date:	9/12/2018	9/12/2018	9/12/2018	
Start Time:	6:46	9:49	12:47	
End Time:	9:00	12:03	15:02	
Sample Duration (min):	120.0	120.0	120.0	120.0
Average Gas Temp, T_s, (^oF):	191.0	192.3	192.0	191.8
Fractional Gas Moisture Content, B_{ws}:	0.085	0.090	0.052	0.076
Gas CO_2 Content (%vol):	4.0	3.9	3.9	3.9
Gas O_2 Content (%vol):	13.7	13.7	13.7	13.7
Gas Wet MW, M_s, (lb/lbmole-mole):	28.23	28.16	28.59	28.33
Average Gas Velocty, V_s, (ft/sec):	63.30	64.17	63.74	63.74
Measured Volumetric Flow Rate:				
Q (actual ft^3/min):	1,443,837	1,463,522	1,453,804	1,453,721
Q_{std} (std ft^3/min):	1,145,581	1,158,900	1,151,646	1,152,042
$Q_{std(dry)}$ (dry std ft^3/min):	1,047,887	1,054,034	1,092,028	1,064,650
F_d (dscf/MMBtu):	8,658	8,658	8,658	8,658
Sample Volume, $V_{m(std)}$, (dry std ft^3):	68.680	69.571	71.079	69.777
PM Collected, (mg):				
Filterable, m_n:	3.35	2.36	4.05	3.25
Condensable, m_{cpm}:	1.10	0.90	0.70	0.90
Total, m_{total}:	4.45	3.26	4.75	4.15
PM Concentration, (gr/dscf):				
Filterable, C_s:	0.0008	0.0005	0.0009	0.0007
Condensable, C_{cpm}:	0.0002	0.0002	0.0002	0.0002
Total, C:	0.0010	0.0007	0.0010	0.0009
PM Emission Rate, ER_{M2}, (lb/hr based on measured volumetric flow rate):				
Filterable:	6.76	4.73	8.22	6.57
Condensable:	2.22	1.80	1.42	1.82
Total:	8.98	6.53	9.64	8.38
PM Emission Rate, ER_{Fd}, (lb/MMBtu using F_d):				
Filterable	0.0027	0.0019	0.0032	0.0026
Condensable:	0.0009	0.0007	0.0005	0.0007
Total:	0.0036	0.0026	0.0037	0.0033
Isokinetic Variance, I:	98.1	98.8	97.5	98.2

TRC
Results you can rely on

EMISSIONS TEST RESULTS SUMMARY - EPA METHOD 320						
Company:	**New Covert**		**Date:**	**9/12/2018**		
Plant:	**EU-TURBINE1**		**TRC Project**	**302509**		
Unit:	**Stack**		**Load:**	**100% DB OFF**		
	Date		09/12/18	09/12/18	09/12/18	
	Start Time		8:00	9:50	11:00	
	End Time		9:00	10:50	12:00	
	Test Run		1	2	3	Average
Flow	Stack Flow Method 5	dscfm	1,047,887	1,054,034	1,054,034	**1,051,985**
Moisture	Moisture Method 320	Fraction	0.087	0.089	0.090	**0.089**
F Factor	Fc	scf/MMBtu	1029	1029	1029	**1029**
	CO_2 Method 3A	%, Dry	4.0	3.9	3.9	**3.9**
	Formaldehyde CH2O	ppmvw	0.31	0.12	0.09	**0.17**
MW=	30.026	ppmvd	0.34	0.13	0.10	**0.19**
		lb/hr	1.67	0.65	0.50	**0.94**
		lb/MMBtu	0.00068	0.00027	0.00021	**0.00039**

TRC
Results you can rely on

METHOD 25A TEST RESULTS SUMMARY

Project Number:	302509	Test Date(s):	9/12-13/2018
Customer:	New Covert Generating Company	Facility:	Covert, MI
Unit Identification:	EU-TURBINE1	Recorded by:	G. Rock
Load Level/Condition:	60% Duct Burner Off		

Location	Stack			
Test Run No.	1	2	3	Average
Test Date	9/12-13/2018	9/12-13/2018	9/12-13/2018	
Test Time - Start	16:45	18:05	19:54	
Test Time - End	17:44	19:04	20:53	
THC (ppmvw as Propane)	0.23	0.13	0.01	0.12
Volumetric Flow Rate (scfm)	896,131	920,808	952,587	923,175
THC (lb/hr as Propane)	1.42	0.82	0.07	0.77
Fractional Gas Moisture Content (B_{ws})	0.089	0.088	0.084	0.087
THC (ppmvd as Propane)	0.25	0.14	0.01	0.14
O_2 (% dry)	14.30	14.20	14.30	14.27
F_d	8658	8658	8658	8658
THC - F_d Basis (lb/MMBTU)	0.0008	0.0004	0.00003	0.0004

TRC
Results you can rely on

PARTICULATE TEST RESULTS SUMMARY

Company:	New Covert Generating Company
Plant:	New Covert Generating Plant
Unit:	EU-TURBINE1
Location:	Stack

Test Run Number:	1	2	3	Average
Source Condition:	60% DB Off	60% DB Off	60% DB Off	
Date:	9/12/2018	9/12/2018	9/12-9/13/18	
Start Time:	16:45	19:54	23:19	
End Time:	19:05	22:22	1:35	
Sample Duration (min):	120.0	120.0	120.0	120.0
Average Gas Temp, T_s, (^oF):	179.8	179.0	179.3	179.4
Fractional Gas Moisture Content, B_{ws}:	0.089	0.088	0.084	0.087
Gas CO_2 Content (%vol):	3.6	3.6	3.6	3.6
Gas O_2 Content (%vol):	14.3	14.2	14.3	14.3
Gas Wet MW, M_s, (lb/lbmole-mole):	28.15	28.16	28.21	28.17
Average Gas Velocty, V_s, (ft/sec):	48.74	50.02	51.77	50.18
Measured Volumetric Flow Rate:				
Q (actual ft^3/min):	1,111,761	1,140,962	1,180,724	1,144,482
Q_{std} (std ft^3/min):	896,131	920,808	952,587	923,175
$Q_{std(dry)}$ (dry std ft^3/min):	816,274	839,357	872,128	842,586
F_d (dscf/MMBtu):	8,658	8,658	8,658	8,658
Sample Volume, $V_{m(std)}$, (dry std ft^3):	73.161	74.681	77.224	75.022
PM Collected, (mg):				
Filterable, m_n:	4.32	4.11	3.07	3.83
Condensable, m_{cpm}:	0.00	0.30	0.30	0.20
Total, m_{total}:	4.32	4.41	3.37	4.03
PM Concentration, (gr/dscf):				
Filterable, C_s:	0.0009	0.0008	0.0006	0.0008
Condensable, C_{cpm}:	0.0000	0.0001	0.0001	0.0000
Total, C:	0.0009	0.0009	0.0007	0.0008
PM Emission Rate, ER_{M2}, (lb/hr based on measured volumetric flow rate):				
Filterable:	6.38	6.11	4.58	5.69
Condensable:	0.00	0.45	0.45	0.30
Total:	6.38	6.55	5.03	5.99
PM Emission Rate, ER_{Fd}, (lb/MMBtu using F_d):				
Filterable	0.0036	0.0033	0.0024	0.0031
Condensable:	0.0000	0.0002	0.0002	0.0002
Total:	0.0036	0.0035	0.0026	0.0032
Isokinetic Variance, I:	97.6	96.9	96.4	97.0

TRC
Results you can rely on

EMISSIONS TEST RESULTS SUMMARY - EPA METHOD 320						
Company:	New Covert		Date:	9/12/2018		
Plant:	EU-TURBINE1		TRC Project	302509		
Unit:	Stack		Load:	60% DB OFF		
	Date		09/12/18	09/12/18	09/12/18	
	Start Time		19:54	21:17	23:19	
	End Time		20:54	22:17	0:19	
	Test Run		1	2	3	Average
Flow	Stack Flow Method 5	dscfm	839,357	839,357	872,128	**850,281**
Moisture	Moisture Method 320	Fraction	0.085	0.083	0.081	**0.083**
F Factor	Fc	scf/MMBtu	1029	1029	1029	**1029**
	CO_2 Method 3A	%, Dry	3.6	3.6	3.6	**3.6**
MW= 30.026	Formaldehyde CH2O	ppmvw	0.11	0.17	0.17	**0.15**
		ppmvd	0.12	0.19	0.18	**0.16**
		lb/hr	0.47	0.73	0.75	**0.65**
		lb/MMBtu	0.00027	0.00041	0.00041	**0.00036**

FUEL ANALYSIS SUMMARY		
Project Name	**New Covert Generating Compamy**	
Unit Identification	**EU-TURBINE1**	
Fuel Type	**Natural Gas**	
Turbine Model	**Mitsubishi 501G**	
Test Run Number		1
Date	mm/dd/yy	09/15/18
Fuel Analysis		
Fuel Heating Value	btu/lb	23065
Fd factor	dscf/MMBtu	8658
Relative Density	lb-mole gas/lb-mole air	0.6004
Specific Density	lb/ft3	0.04584
Gross HV (Dry)	Btu/ft3	1057.9
Emission Data		
SO_2 (by fuel analysis)	Molar ppm (fuel gas)	2.20
	grains/100 SCF @STP (fuel gas)	0.10
	lb/MMBtu	0.0003

Example Calculation for SO2 Emissions

$$ER = \left[\frac{2.0}{7000}\right] \times \left[10^6\right] \times \left[\frac{S_{vtal}}{GCV}\right] \qquad (Eq.\ \text{D-1h})$$

Where:
ER = Default SO_2 emission rate for natural gas combustion, lb/mmBtu.
Stotal= Total sulfur content of the natural gas, gr/100scf.
GCV = Gross calorific value of the natural gas, Btu/100scf.
7000 = Conversion of grains/100scf to lb/100scf.
2.0 = Ratio of lb SO_2/lb S.
10^6 = Conversion factor (Btu/mmBtu).