AIR EMISSION TEST REPORT
FOR THE
VERIFICATION OF AIR POLLUTANT EMISSIONS
FROM
LANDFILL GAS FIRED ENGINE – GENERATOR SETS

Prepared for:

Adrian Energy Associates, LLC
SRN N2369

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October 16, 2020

IMPACT
COMPLIANCE & TESTING

Report Certification

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Adrian Energy Associates, LLC
Adrian, Michigan

The material and data in this document were prepared under the supervision and direction of the undersigned.

Impact Compliance and Testing, Inc.

Andy Rusnak, QSTI
Technical Manager

Table of Contents

List of Tables

List of Appendices

1.0 Introduction

Adrian Energy Associates, LLC (AEA) operates gas-fired reciprocating internal combustion engine (RICE) and electricity generator sets at the AEA facility in Adrian, Lenawee County, Michigan. The RICE are fueled by landfill gas (LFG) that is recovered from the Adrian Landfill, Inc., which is owned and operated by Republic Services, Inc. The recovered gas is transferred to AEA where it is treated and used as fuel.

The Michigan Department of Environment, Great Lakes and Energy – Air Quality Division (EGLE-AQD) has issued to AEA a Renewable Operating Permit (MI-ROP-N2369-2020) for operation of the renewable electricity generation facility, which consists of:

- Three (3) Caterpillar (CAT®) Model No. 3516LE RICE-generator set identified as emission units EUICENGINE#1-2, EUICENGINE#2-2 and EUICENGINE#3-2 (Flexible Group ID: FGENGINE-2)

- Gas treatment system identified as emission unit EUTREATMENTSYS-2.

Air emission compliance testing was performed pursuant to MI-ROP-N2369-2020. Conditions of MI-ROP-N2369-2020 for FGENGINE-2 state:

1. *The permittee shall verify NOx, CO, and VOC, emission rates from each engine in FGENGINES-2, by testing at owner's expense, in accordance with Department requirements..*

The VOC emission limit for FGENGINE-2 states that the VOC emission limit includes emissions of formaldehyde.

The compliance testing presented in this report was performed by Impact Compliance and Testing, Inc. (ICT), a Michigan-based environmental consulting and testing company. ICT representatives Clay Gaffey and Andrew Rusnak performed the field sampling and measurements September 29 – 30, 2020.

The engine emission performance tests consisted of triplicate, one-hour sampling periods for nitrogen oxides (NOx), carbon monoxide (CO), formaldehyde (CHOH) and volatile organic compounds (VOC, as non-methane hydrocarbons). Exhaust gas velocity, moisture, oxygen (O_2) content, and carbon dioxide (CO_2) content were determined for each test period to calculate pollutant mass emission rates.

The exhaust gas sampling and analysis was performed using procedures specified in the Test Plan dated June 16, 2020 that was reviewed and approved by the EGLE-AQD. Ms. Gina Angellotti and Ms. Diane Kavanaugh Vetort of the EGLE-AQD observed portions of the compliance testing.

Questions regarding this emission test report should be directed to:

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2.0 Summary of Test Results and Operating Conditions

2.1 Purpose and Objective of the Tests

Conditions of MI-ROP-N2369-2020 require AEA to test each engine in FGENGINE-2 for CO, NOx, CHOH and VOC emissions.

2.2 Operating Conditions During the Compliance Tests

The testing was performed while the AEA engine/generator sets were operated at maximum operating conditions (within 10% of rated capacity). The rated capacity for the three CAT® Model G3516 engine generator sets (EUICENGINE#1-2, EUICENGINE#2-2 and EUICENGINE#3-2) is 800 kW electricity output. AEA representatives provided kW output in 15-minute increments for each test period. The EUICENGINE#1-2 generator kW output ranged between 760 and 800 kW, EUICENGINE#2-2 generator kW output ranged between 760 and 800 kW and the EUICENGINE#3-2 generator kW output ranged between 780 and 800 kW for each test period.

Fuel flowrate (cubic feet per minute) and fuel methane content (%) were also recorded by AEA representatives in 15-minute increments for each test period. The EUICENGINE#1-2 fuel consumption rate ranged between 451 and 546 scfm and the fuel methane content ranged between 47.6 and 52.5%. The EUICENGINE#2-2 fuel consumption rate ranged between 447 and 485 scfm and the fuel methane content ranged between 47.3 and 51.5%. The EUICENGINE#3-2 fuel consumption rate ranged between 490 and 504 scfm and the fuel methane content ranged between 50.8 and 52.7%. The LFG H_2S content, measured using Drager tubes, ranged between 20 ppm – 40 ppm during the test periods.

Appendix 2 provides operating records provided by AEA representatives for the test periods.

Table 2.1 presents a summary of the average engine operating conditions during the test periods.

2.3 Summary of Air Pollutant Sampling Results

The gases exhausted from the sampled LFG fueled RICE (EUICENGINE#1-2, EUICENGINE#2-2 and EUICENGINE#3-2) were sampled for three (3) one-hour test periods during the compliance testing performed September 29 – 30, 2020.

Table 2.2 presents the average measured CO, NO_X, CHOH and VOC emission rates for each engine (average of the three test periods).

Test results for each one hour sampling period and comparison to the permitted emission rates are presented in Section 6.0 of this report.

Table 2.1 Average engine operating conditions during the test periods

Engine Parameter	EUICENGINE#1-2 CAT®3516	EUICENGINE#2-2 CAT®3516	EUICENGINE#3-2 CAT®3516
Generator output (kW)	781	781	787
Engine LFG fuel use (scfm)	506	461	497
LFG methane content (%)	50.4	49.6	52.2
LFG H_2S content (ppm)	40	27	40

Table 2.2 Average measured emission rates for each engine (three-test average)

Emission Unit	CO (lb/hr)	NOx (lb/hr)	CHOH (lb/hr)	NMHC (lb/hr)	Total VOC (lb/hr)
EUICENGINE#1-2	6.22	1.10	0.89	0.49	1.38
EUICENGINE#2-2	6.61	0.68	0.93	0.62	1.54
EUICENGINE#3-2	6.56	1.29	0.83	0.46	1.29
FGENGINE-2	**19.39**	**3.07**	-	-	**4.21**
Permit Limit	***21.25***	***15.38***	-	-	***6.73***

3.0 Source and Sampling Location Description

3.1 General Process Description

AEA is permitted to operate three RICE-generator sets at its facility; three (3) CAT® Model No. G3516 RICE. The units are fired exclusively with LFG that is recovered from the Adrian Landfill solid waste disposal facility and treated prior to use.

3.2 Rated Capacities and Air Emission Controls

The CAT® G3516 engine generator set has a rated design capacity of:

- Engine Power: 1,148 bhp
- Electricity Generation: 800 kW

Each engine is equipped with an air-to-fuel ratio (AFR) controller that blends the appropriate ratio of combustion air and treated LFG fuel.

The RICE are not equipped with add-on emission control devices. The AFR controller maintains efficient fuel combustion, which minimizes air pollutant emissions. Exhaust gas is exhausted directly to atmosphere through a noise muffler and vertical exhaust stack.

3.3 Sampling Locations

The RICE exhaust gas is directed through a muffler and is released to the atmosphere through a dedicated vertical exhaust stack with a vertical release point.

The exhaust stacks for the CAT® Model G3516 RICE are identical. The exhaust stack sampling ports are located after the muffler in the vertical exhaust stack with an inner diameter of 12.0 inches. The stack is equipped with two (2) sample ports, opposed 90°, that provide a sampling location 9.0 inches (0.75 duct diameters) upstream and 27.0 inches (2.25 duct diameters) downstream from any flow disturbance.

All sample port locations satisfy the USEPA Method 1 criteria for a representative sample location. Individual traverse points were determined in accordance with USEPA Method 1.

Appendix 1 provides diagrams of the emission test sampling locations.

4.0 Sampling and Analytical Procedures

A test protocol for the air emission testing was reviewed and approved by the EGLE-AQD. This section provides a summary of the sampling and analytical procedures that were used during the testing periods.

4.1 Summary of Sampling Methods

USEPA Method 1	Exhaust gas velocity measurement locations were determined based on the physical stack arrangement and requirements in USEPA Method 1
USEPA Method 2	Exhaust gas velocity pressure was determined using a Type-S Pitot tube connected to a red oil incline manometer; temperature was measured using a K-type thermocouple connected to the Pitot tube.
USEPA Method 3A	Exhaust gas O_2 and CO_2 content was determined using paramagnetic and infrared instrumental analyzers, respectively.
USEPA Method 7E	Exhaust gas NOx concentration was determined using chemiluminescence instrumental analyzers.
USEPA Method 10	Exhaust gas CO concentration was measured using an infrared instrumental analyzer
USEPA Method 25A / ALT-096	Exhaust gas VOC (as NMHC) concentration was determined using a flame ionization analyzer equipped with methane separation column
ASTM Method D6348	Exhaust gas CHOH and moisture content was determined using a FTIR instrumental analyzer

4.2 Exhaust Gas Velocity Determination (USEPA Method 2)

The RICE exhaust stack gas velocities and volumetric flow rates were determined using USEPA Method 2 prior to and after each test period. An S-type Pitot tube connected to a red-oil manometer was used to determine velocity pressure at each traverse point across the stack cross section. Gas temperature was measured using a K-type thermocouple mounted to the Pitot tube. The Pitot tube and connective tubing were leak-checked periodically throughout the test periods to verify the integrity of the measurement system.

The absence of significant cyclonic flow at the sampling location was verified using an S-type Pitot tube and oil manometer. The Pitot tube was positioned at each velocity traverse point with the planes of the face openings of the Pitot tube perpendicular to the stack cross-sectional plane. The Pitot tube was then rotated to determine the null angle (rotational angle as measured from the perpendicular, or reference, position at which the differential pressure is equal to zero).

Appendix 3 provides exhaust gas flowrate calculations and field data sheets.

4.3 Exhaust Gas Molecular Weight Determination (USEPA Method 3A)

CO_2 and O_2 content in the RICE exhaust gas stream was measured continuously throughout each test period in accordance with USEPA Method 3A. The CO_2 content of the exhaust was monitored using a Servomex 1440D infrared gas analyzer. The O_2 content of the exhaust was monitored using a Servomex 1440D gas analyzer that uses a paramagnetic sensor.

During each sampling period, a continuous sample of the RICE exhaust gas stream was extracted from the stack using a stainless steel probe connected to a Teflon® heated sample line. The sampled gas was conditioned by removing moisture prior to being introduced to the analyzers; therefore, measurement of O_2 and CO_2 concentrations correspond to standard dry gas conditions. Instrument response data were recorded using an ESC Model 8816 data acquisition system that monitored the analog output of the instrumental analyzers continuously and logged data as one-minute averages.

Prior to, and at the conclusion of each test, the instruments were calibrated using upscale calibration and zero gas to determine analyzer calibration error and system bias (described in Section 5.0 of this document). Sampling times were recorded on field data sheets.

Appendix 4 provides O_2 and CO_2 calculation sheets. Raw instrument response data are provided in Appendix 5.

4.4 NO_x and CO Concentration Measurements (USEPA Methods 7E and 10)

NO_X and CO pollutant concentrations in the RICE exhaust gas streams were determined using a Thermo Environmental Instruments, Inc. (TEI) Model 42c High Level chemiluminescence NO_X analyzer and a TEI Model 48i infrared CO analyzer.

Throughout each test period, a continuous sample of the engine exhaust gas was extracted from the stack using the Teflon® heated sample line and gas conditioning system and delivered to the instrumental analyzers. Instrument response for each analyzer was recorded on an ESC Model 8816 data acquisition system that logged data as one-minute averages. Prior to, and at the conclusion of each test, the instruments were calibrated using upscale calibration and zero gas to determine analyzer calibration error and system bias.

Appendix 4 provides CO and NO_X calculation sheets. Raw instrument response data are provided in Appendix 5.

4.5 Measurement of Volatile Organic Compounds (USEPA Method 25A/ALT-096)

The VOC emission rate was determined by measuring the nonmethane hydrocarbon (NMHC) concentration in the engine exhaust gas. NMHC pollutant concentration was determined using a TEI Model 55i Methane / Nonmethane hydrocarbon analyzer. The TEI 55i analyzer contains an internal gas chromatograph column that separates methane from non-methane components. The concentration of NMHC in the sampled gas stream, after separation from methane, is determined relative to a propane standard using a flame ionization detector in accordance with USEPA Method 25A.

The USEPA Office of Air Quality Planning and Standards (OAQPS) has issued an alternate test method approving the use of the TEI 55i-series analyzer as an effective instrument for measuring NMOC from gas-fueled RICE (ALT-096).

Samples of the exhaust gas were delivered directly to the instrumental analyzer using the Teflon® heated sample line to prevent condensation. The sample to the NHMC analyzer was not conditioned to remove moisture. Therefore, VOC measurements correspond to standard conditions with no moisture correction (wet basis).

Prior to, and at the conclusion of each test, the instrument was calibrated using mid-range calibration (propane) and zero gas to determine analyzer calibration error and system bias (described in Section 5.0 of this document).

Appendix 4 provides VOC calculation sheets. Raw instrument response data for the NMHC analyzer is provided in Appendix 5.

4.6 Measurement of Formaldehyde and Moisture via FTIR (ASTM D6348)

Formaldehyde and moisture concentration in the exhaust gas streams was determined using an MKS Multi-Gas 2030 Fourier transform infrared (FTIR) spectrometer in accordance with test method ASTM D6348.

The USEPA New Source Performance Standard (NSPS) for landfill gas fired engines (Subpart JJJJ) specifies ASTM D6348 as an acceptable test method for moisture concentration determinations. Additionally, the USEPA National Emissions Standard for Hazardous Air Pollutants (NESHAP) for landfill gas fired engines (Subpart ZZZZ) specifies ASTM D6348 as an acceptable test method for moisture and formaldehyde concentration determinations.

Samples of the exhaust gas were delivered directly to the instrumental analyzer using a Teflon® heated sample line to prevent condensation. The sample to the FTIR analyzer was not conditioned to remove moisture. Therefore, measurements correspond to standard conditions with no moisture correction (wet basis).

A calibration transfer standard (CTS), ethylene standard, and nitrogen zero gas were analyzed before and after each test run. Analyte spiking, of each engine, with acetaldehyde was performed to verify the ability of the sampling system to quantitatively deliver a sample containing the compound of interest from the base of the probe to the FTIR. Data was collected at 0.5 cm-1 resolution. Instrument response was recorded using MG2000 data acquisition software.

Appendix 4 provides CHOH calculation sheets. Raw instrument response data for the FTIR analyzer is provided in Appendix 6.

5.0 QA/QC Activities

5.1 Flow Measurement Equipment

Prior to arriving onsite, the instruments used during the source test to measure exhaust gas properties and velocity (barometer and Pitot tube) were calibrated to specifications in the sampling methods.

The absence of cyclonic flow for each sampling location was verified using an S-type Pitot tube and oil manometer. The Pitot tube was positioned at each of the velocity traverse points with the planes of the face openings of the Pitot tube perpendicular to the stack cross-sectional plane. The Pitot tube was then rotated to determine the null angle (rotational angle as measured from the perpendicular, or reference, position at which the differential pressure is equal to zero).

5.2 NO_x Converter Efficiency Test

The NO_2 – NO conversion efficiency of the Model 42c analyzer was verified prior to the testing program. A USEPA Protocol 1 certified concentration of NO_2 was injected directly into the analyzer, following the initial three-point calibration, to verify the analyzer's conversion efficiency. The analyzer's NO_2 – NO converter uses a catalyst at high temperatures to convert the NO_2 to NO for measurement. The conversion efficiency of the analyzer is deemed acceptable if the measured NO_x concentration is within 90% of the expected value.

The NO_2 – NO conversion efficiency test satisfied the USEPA Method 7E criteria (measured NO_x concentration was 95.8% of the expected value).

5.3 Gas Divider Certification (USEPA Method 205)

A STEC Model SGD-710C 10-step gas divider was used to obtain appropriate calibration span gases. The ten-step STEC gas divider was NIST certified (within the last 12 months) with a primary flow standard in accordance with Method 205. When cut with an appropriate zero gas, the ten-step STEC gas divider delivered calibration gas values ranging from 0% to 100% (in 10% step increments) of the USEPA Protocol 1 calibration gas that was introduced into the system. The field evaluation procedures presented in Section 3.2 of Method 205 were followed prior to use of gas divider. The field evaluation yielded no errors greater than 2% of the triplicate measured average and no errors greater than 2% from the expected values.

5.4 Instrumental Analyzer Interference Check

The instrumental analyzers used to measure NO_X, CO, O_2 and CO_2 have had an interference response test preformed prior to their use in the field, pursuant to the interference response test procedures specified in USEPA Method 7E. The appropriate interference test gases (i.e., gases that would be encountered in the exhaust gas stream) were introduced into each analyzer, separately and as a mixture with the analyte that each analyzer is designed to measure. All of analyzers exhibited a composite deviation of less than 2.5% of the span for all measured interferent gases. No major analytical components of the analyzers have been replaced since performing the original interference tests.

5.5 Instrument Calibration and System Bias Checks

At the beginning of each day of the testing program, initial three-point instrument calibrations were performed for the NO_x, CO, CO_2 and O_2 analyzers by injecting calibration gas directly into the inlet sample port for each instrument. System bias checks were performed prior to and at the conclusion of each sampling period by introducing the upscale calibration gas and zero gas into the sampling system (at the base of the stainless steel sampling probe prior to the particulate filter and Teflon® heated sample line) and determining the instrument response against the initial instrument calibration readings.

At the beginning of each test day, appropriate high-range, mid-range, and low-range span gases followed by a zero gas were introduced to the NMHC analyzer, in series at a tee connection, which is installed between the sample probe and the particulate filter, through a poppet check valve. After each one hour test period, mid-range and zero gases were re-introduced in series at the tee connection in the sampling system to check against the method's performance specifications for calibration drift and zero drift error.

The instruments were calibrated with USEPA Protocol 1 certified concentrations of CO_2, O_2, NO_x, and CO in nitrogen and zeroed using hydrocarbon free nitrogen. The NMHC (VOC) instrument was calibrated with USEPA Protocol 1 certified concentrations of propane in air and zeroed using hydrocarbon-free air. A STEC Model SGD-710C ten-step gas divider was used to obtain intermediate calibration gas concentrations as needed.

5.6 Determination of Exhaust Gas Stratification

A stratification test was performed for each RICE exhaust stack. The stainless steel sample probe was positioned at sample points correlating to 16.7, 50.0 (centroid) and 83.3% of the stack diameter. Pollutant concentration data were recorded at each sample point for a minimum of twice the maximum system response time.

The recorded concentration data for the RICE exhaust stacks indicated that the measured CO, O_2 and CO_2 concentrations did not vary by more than 5% of the mean across the stack diameter. Therefore, the RICE exhaust gas was considered to be unstratified and the compliance test sampling was performed at a single sampling location within each RICE exhaust stack.

5.7 FTIR QA/QC Activities

At the beginning of each day a calibration transfer standard (CTS, ethylene gas), analyte of interest (acetaldehyde) and nitrogen calibration gas was directly injected into the FTIR to evaluate the unit response.

Prior to and after each test run the CTS was analyzed. The ethylene was passed through the entire system (system purge) to verify the sampling system response and to ensure that the sampling system remained leak-free at the stack location. Nitrogen was also be passed through the sampling system to ensure the system is free of contaminants.

Analyte spiking, of the emission unit, with acetaldehyde was performed to verify the ability of the sampling system to quantitatively deliver a sample containing the compound of interest from the base of the probe to the FTIR and assure the ability of the FTIR to quantify that compound in the presence of effluent gas.

As part of the data validation procedure, reference spectra were manually fit to that of the sample spectra (two spectra from each test period) and a concentration was determined. Concentration data was manually validated using the MKS MG2000 method analyzer software. The software used multi-point calibration curves to quantify each spectrum. The software-calculated results were compared with the measured concentrations to ensure the quality of the data.

Appendix 7 presents test equipment quality assurance data (NO_2 – NO conversion efficiency test data, instrument calibration and system bias check records, calibration gas and gas divider certifications, interference test results, FTIR QA/QC data, Pitot tube calibration records, and stratification checks).

6.0 Results

6.1 Test Results and Allowable Emission Limits

Engine operating data and air pollutant emission measurement results for each one hour test period are presented in Tables 6.1 through 6.3.

FGENGINE-2 has the following allowable emission limits specified in MI-ROP-N2369-2020:

- 21.25 lb/hr for CO;
- 15.38 lb/hr for NOx; and
- 6.73 lb/hr for VOC (includes emissions of formaldehyde).

The measured air pollutant concentrations and emission rates for FGENGINE-2 are less than the allowable limits specified in MI-ROP-N2369-2020.

FGENGINE-2 Test Results

- 19.39 lb/hr for CO;
- 3.07 lb/hr for NOx; and
- 4.21 lb/hr for VOC (includes emissions of formaldehyde).

6.2 Variations from Normal Sampling Procedures or Operating Conditions

The testing for all pollutants was performed in accordance with USEPA methods and the approved test protocol. The engine-generator sets were operated within 10% of maximum output (800 kW generator output for CAT® G3516 RICE) and no variations from normal operating conditions occurred during the engine test periods.

Table 6.1 Measured exhaust gas conditions and air pollutant emission rates for Engine No. 1 (EUICENGINE#1-2)

Test No. Test date Test period (24-hr clock)	1 9/29/20 1345-1445	2 9/29/20 1500-1600	3 9/29/20 1615-1715	Three Test Average
Fuel flowrate (scfm)	535	521	463	506
Generator output (kW)	788	790	766	781
LFG methane content (%)	50.8	50.3	50.0	50.4
LFG H_2S content (ppm)	40	40	40	40
Exhaust Gas Composition				
CO_2 content (% vol)	12.1	12.1	11.9	12.0
O_2 content (% vol)	7.65	7.62	7.86	7.71
Moisture (% vol)	12.7	12.7	12.5	12.6
Exhaust gas flowrate (dscfm)	2,466	2,449	2,462	2,459
Exhaust gas flowrate (scfm)	2,823	2,805	2,813	2,814
Nitrogen Oxides				
NO_X conc. (ppmvd)	60.6	74.0	52.1	62.2
NO_X emissions (lb/hr)	1.07	1.30	0.92	1.10
Carbon Monoxide				
CO conc. (ppmvd)	589	596	554	579
CO emissions (lb/hr)	6.33	6.37	5.95	6.22
Volatile Organic Compounds				
NMHC conc. (ppmv)	25.1	24.3	26.3	25.3
NMHC emissions (lb/hr)	0.49	0.47	0.51	0.49
CHOH conc. (ppmv)	68.4	68.0	67.4	68.0
CHOH emissions (lb/hr)	0.90	0.89	0.89	0.89
Total VOC emissions (lb/hr)	1.39	1.36	1.40	1.38

Table 6.2 Measured exhaust gas conditions and air pollutant emission rates for Engine No. 2 (EUICENGINE#2-2)

Test No. Test date Test period (24-hr clock)	1 9/29/20 915-1015	2 9/29/20 1045-1145	3 9/29/20 1200-1300	Three Test Average
Fuel flowrate (scfm)	474	460	449	461
Generator output (kW)	776	780	788	781
LFG methane content (%)	48.6	49.3	50.8	49.6
LFG H_2S content (ppm)	20	20	40	27
Exhaust Gas Composition				
CO_2 content (% vol)	11.8	11.8	11.9	11.8
O_2 content (% vol)	8.05	7.92	7.91	7.96
Moisture (% vol)	12.4	12.6	12.1	12.4
Exhaust gas flowrate (dscfm)	2,573	2,515	2,482	2,523
Exhaust gas flowrate (scfm)	2,938	2,876	2,825	2,880
Nitrogen Oxides				
NO_X conc. (ppmvd)	34.0	34.0	45.3	37.8
NO_X emissions (lb/hr)	0.63	0.61	0.81	0.68
Carbon Monoxide				
CO conc. (ppmvd)	592	594	614	600
CO emissions (lb/hr)	6.65	6.52	6.65	6.61
Volatile Organic Compounds				
NMHC conc. (ppmv)	31.8	31.4	30.3	31.2
NMHC emissions (lb/hr)	0.64	0.62	0.59	0.62
CHOH conc. (ppmv)	69.4	69.1	67.7	68.7
CHOH emissions (lb/hr)	0.95	0.93	0.89	0.93
Total VOC emissions (lb/hr)	1.60	1.55	1.48	1.54

Table 6.3 Measured exhaust gas conditions and air pollutant emission rates for Engine No. 3 (EUICENGINE#3-2)

Test No. Test date Test period (24-hr clock)	1 9/30/20 845-945	2 9/30/20 1015-1115	3 9/30/20 1145-1245	Three Test Average
Fuel flowrate (scfm)	501	495	494	497
Generator output (kW)	788	784	788	787
LFG methane content (%)	52.3	52.3	52.0	52.2
LFG H_2S content (ppm)	40	40	40	40
Exhaust Gas Composition				
CO_2 content (% vol)	12.5	12.4	12.5	12.5
O_2 content (% vol)	7.23	7.26	7.19	7.23
Moisture (% vol)	11.3	11.0	11.3	11.2
Exhaust gas flowrate (dscfm)	2,475	2,522	2,534	2,510
Exhaust gas flowrate (scfm)	2,791	2,835	2,855	2,827
Nitrogen Oxides				
NO_X conc. (ppmvd)	75.5	66.5	73.4	71.8
NO_X emissions (lb/hr)	1.34	1.20	1.33	1.29
Carbon Monoxide				
CO conc. (ppmvd)	603	592	601	599
CO emissions (lb/hr)	6.51	6.52	6.65	6.56
Volatile Organic Compounds				
NMHC conc. (ppmv)	23.7	24.1	23.2	23.6
NMHC emissions (lb/hr)	0.45	0.47	0.45	0.46
CHOH conc. (ppmv)	65.5	61.5	61.1	62.7
CHOH emissions (lb/hr)	0.86	0.82	0.82	0.83
Total VOC emissions (lb/hr)	1.31	1.29	1.27	1.29

Table 6.4 Measured emission rates for FGFACILITY-2 compared to permitted limits

Emission Unit	CO Emissions (lb/hr)	NOx Emissions (lb/hr)	VOC Emissions (lb/hr)
FGFACILITY-2	19.39	3.07	4.21
Permit Limit	*21.25*	*15.38*	*6.73*