AIR EMISSION TEST REPORT

Title	AIR EMISSION TEST REPORT FOR THE LANDFILL GAS FUELED INTERNAL COMBUSTION ENGINES OPERATED AT PINE TREE ACRES LANDFILL
Report Date	January 14, 2015
Test Date(s)	December 3, 2014

Facility Information	
Name	Sumpter Energy Associates
Street Address	Pine Tree Acres Landfill 36450 29-Mile Rd.
City, County	Lenox Township, Macomb
SRN	N8004

Facility Permit Information	
Renewable Operating Permit No.	MI-ROP-N8004-2013
Emission Unit ID:	EUICENGINE8 through EUICENGINE9

Testing Contractor	
Company	Derenzo and Associates, Inc.
Mailing Address	39395 Schoolcraft Road Livonia, MI 48150
Phone	(734) 464-3880
Project No.	1401021

DEQ

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY
AIR QUALITY DIVISION

RENEWABLE OPERATING PERMIT REPORT CERTIFICATION

Authorized by 1994 P.A. 451, as amended. Failure to provide this information may result in civil and/or criminal penalties.

Reports submitted pursuant to R 336.1213 (Rule 213), subrules (3)(c) and/or (4)(c), of Michigan's Renewable Operating Permit (ROP) program must be certified by a responsible official. Additional information regarding the reports and documentation listed below must be kept on file for at least 5 years, as specified in Rule 213(3)(b)(ii), and be made available to the Department of Environmental Quality, Air Quality Division upon request.

Source Name Sumpter Energy Associates-Pine Tree Acres Landfill County Macomb

Source Address 36600 29 Mile Road City Lenox

AQD Source ID (SRN) N8004 ROP No. MI-ROP-N8004-2013 ROP Section No. ______

Please check the appropriate box(es):

☐ **Annual Compliance Certification (Pursuant to Rule 213(4)(c))**

Reporting period (provide inclusive dates): From ______ To ______

☐ 1. During the entire reporting period, this source was in compliance with **ALL** terms and conditions contained in the ROP, each term and condition of which is identified and included by this reference. The method(s) used to determine compliance is/are the method(s) specified in the ROP.

☐ 2. During the entire reporting period this source was in compliance with all terms and conditions contained in the ROP, each term and condition of which is identified and included by this reference, **EXCEPT** for the deviations identified on the enclosed deviation report(s). The method used to determine compliance for each term and condition is the method specified in the ROP, unless otherwise indicated and described on the enclosed deviation report(s).

☐ **Semi-Annual (or More Frequent) Report Certification (Pursuant to Rule 213(3)(c))**

Reporting period (provide inclusive dates): From ______ To ______

☐ 1. During the entire reporting period, **ALL** monitoring and associated recordkeeping requirements in the ROP were met and no deviations from these requirements or any other terms or conditions occurred.

☐ 2. During the entire reporting period, all monitoring and associated recordkeeping requirements in the ROP were met and no deviations from these requirements or any other terms or conditions occurred, **EXCEPT** for the deviations identified on the enclosed deviation report(s).

☒ **Other Report Certification**

Reporting period (provide inclusive dates): From ______ To ______

Additional monitoring reports or other applicable documents required by the ROP are attached as described:

Emission verification Test Report for LFG-fired IC engines (EUICENGINE8-9) in MI-ROP-N8004-2013. The testing was conducted in accordance with the Test Plan dated Oct 1, 2014 and the facility was operated in compliance with the permit conditions or at the maximum routine operating conditions for the facility.

I certify that, based on information and belief formed after reasonable inquiry, the statements and information in this report and the supporting enclosures are true, accurate and complete

Dennis Plaster — Name of Responsible Official (print or type)

Vice President of Operations — Title

585-948-8580 — Phone Number

[signature] — Signature of Responsible Official

2/25/15 — Date

* Photocopy this form as needed.

Derenzo and Associates, Inc.
Environmental Consultants

AIR EMISSION TEST REPORT FOR THE LANDFILL GAS FUELED INTERNAL COMBUSTION ENGINES OPERATED AT PINE TREE ACRES LANDFILL

1.0 INTRODUCTION

Sumpter Energy Associates (SEA) operates two landfill gas (LFG) to energy facilities at the Pine Tree Acres (PTA) Landfill in Lenox Township, Macomb County, Michigan. The two Sumpter Energy facilities, referred to as SEA Phase I and SEA Phase II, have been issued Renewable Operating Permit (ROP) No. MI-ROP-N8004-2013 by the Michigan Department of Environmental Quality (MDEQ).

The SEA Phase II facility consists of (2) Caterpillar (CAT®) Model G3520C LFG-fueled reciprocating internal combustion engines (RICE) and electricity generator sets that are identified in ROP No. MI-ROP-N8004-2013 as Emission Unit ID: EUICENGINE8 and EUICENGINE9 (Flexible Group ID: FGICENGINE2).

Air emission compliance testing was performed pursuant to Special Condition No. V.1. of ROP No. MI-ROP-N8004-3013, which states:

> *Except as provided in 40 CFR 60.4243(b), the permittee shall conduct an initial performance test for each engine in FGICENGINE2 within one year after startup of the engine and every 8760 hours of operation (as determined through the use of a non-resettable hour meter) or three years, whichever occurs first, to demonstrate compliance with the emission limits in 40 CFR 60.4233(e)...*

The compliance testing was performed by Derenzo and Associates, Inc. (Derenzo and Associates), a Michigan-based environmental consulting and testing company. Derenzo and Associates representatives Tyler Wilson, Robert Harvey, and Jeffrey Schlaf performed the field sampling and measurements December 3, 2014.

The exhaust gas sampling and analysis was performed using procedures specified in the Test Plan that was reviewed and approved by the MDEQ in the November 13, 2014 test plan approval letter. MDEQ representatives Mr. Iranna Konanahalli and Mr. Samuel Liveson observed portions of the testing project.

2.0 SOURCE AND SAMPLING LOCATION DESCRIPTION

2.1 General Process Description

LFG containing methane is generated in the Pine Tree Acres Landfill from the anaerobic decomposition of disposed waste materials. The LFG is collected from both active and capped landfill cells using a system of wells (gas collection system). The collected LFG is transferred to the SEA Pine Tree LFGTE facility where it is treated and used as fuel for the two (2) RICE. Each RICE is connected to an electricity generator that produces electricity that is transferred to the local utility.

2.2 Rated Capacities and Air Emission Controls

The CAT® Model No. 3520C RICE generator set has a rated output of 2,242 brake-horsepower (bhp) and the connected generator has a rated electricity output of 1,600 kilowatts (kW). The engine is designed to fire low-pressure, lean fuel mixtures (e.g., LFG) and employs lean-burn technology for efficient fuel combustion and to minimize emissions. The air-to-fuel ratio is set based on the gas quality (methane or heat content) of the treated fuel for the most efficient combustion. Exhaust gas is released directly to atmosphere through a noise muffler and vertical exhaust stack.

The engine/generator sets are not equipped with add-on emission control devices. Air pollutant emissions are minimized through the proper operation of the gas treatment system and efficient fuel combustion in the engines.

2.3 Sampling Locations

The RICE exhaust gas is directed through mufflers and is released to the atmosphere through dedicated vertical exhaust stacks with vertical release points. The two (2) CAT® Model 3520C RICE exhaust stacks are identical.

The exhaust stack sampling ports for the CAT® Model 3520C engines (EUICENGINE8 through 9) are located in individual exhaust stacks with an inner diameter of 15.0 inches. Each stack is equipped with two (2) sample ports, opposed 90°, that provide a sampling location 66.0 inches (4.4 duct diameters) upstream and 144.0 inches (9.6 duct diameters) downstream from any flow disturbance and satisfies the USEPA Method 1 criteria for a representative sample location.

Individual traverse points were determined in accordance with USEPA Method 1.

Appendix A provides diagrams of the emission test sampling locations.

3.0 SUMMARY OF TEST RESULTS AND OPERATING CONDITIONS

3.1 Purpose and Objective of the Tests

The conditions of ROP No. MI-ROP-N8004-2013 require Sumpter Energy to test each RICE (EUICENGINE8 through 9) for carbon monoxide (CO), nitrogen oxides (NOx) and volatile organic compounds (VOC) emissions within 180 days after issuance of the ROP (the permit was issued December 9, 2013) and every 8,760 hours of operation. Measurements were performed for each RICE exhaust to determine CO, NO_X and VOC (as non-methane hydrocarbons (NMHC)) concentrations, diluent gas content (oxygen and carbon dioxide) and volumetric flowrate.

3.2 Operating Conditions During the Compliance Tests

The testing was performed while the engine/generator sets were operated within at least 10% of maximum rated capacity of 1,600 kW electricity output. Sumpter Energy representatives provided kW output data at 15-minute intervals for each test period. The RICE generator kW output ranged between 1,520 and 1,551 kW during the test periods (95% of maximum capacity or greater).

Fuel flowrate (cubic feet per minute) and fuel methane content (%) were also recorded by Sumpter Energy representatives in 15-minute increments for each test period. The RICE fuel consumption rate ranged between 538 and 562 scfm and fuel methane content ranged between 51.1 and 52.0% during the test periods. A lower heating value of 910 Btu/scf was used to calculate the LFG heating value (Btu/scf LHV) based on the methane content.

Appendix B provides operating records provided by Sumpter Energy representatives for the test periods.

Engine output (bhp) cannot be measured directly and was calculated based on the recorded electricity output, the calculated CAT® Model 3520C generator efficiency (95.7%), and the unit conversion factor for kW to horsepower (0.7457 kW/hp).

$$\text{Engine output (bhp)} = \text{Electricity output (kW)} / (0.957) / (0.7457 \text{ kW/hp})$$

Table 3.1 presents a summary of the average engine operating conditions during the test periods.

3.3 Summary of Air Pollutant Sampling Results

The gases exhausted from the two (2) LFG fueled RICE generator sets were each sampled for three (3) one-hour test periods during the compliance testing performed December 3, 2014.

Table 3.2 presents the average measured CO, NO_X and VOC emission rates for the engines (average of the three test periods for each engine) and applicable emission limits.

Results of the engine performance tests demonstrate compliance with emission limits specified in ROP No. MI-ROP-N8004-2013. Test results for each one hour sampling period are presented in Section 6.0 of this report.

Table 3.1 Average engine operating conditions during the test periods

Emission Unit	Gen. Output (kW)	Engine Output (bHp)	Fuel Use (scfm)	LFG CH_4 Content (%)	LFG Btu Content (Btu/scf)	Exhaust Temp. (°F)	Inlet Press. (psi)
EUICENGINE8	1,535	2,151	556	51.5	468	915	17.2
EUICENGINE9	1,532	2,147	545	51.7	470	922	17.3

Table 3.2 Average measured emission rates for each LFG-fueled RICE generator set (three-test average)

	CO Emission Rates		NOx Emission Rates		VOC Emission Rates	
Emission Unit	(lb/hr)	(g/bhp-hr)	(lb/hr)	(g/bhp-hr)	(lb/hr)	(g/bhp-hr)
EUICENGINE8	13.0	2.7	1.7	0.4	0.8	0.2
EUICENGINE9	13.0	2.8	1.8	0.4	0.8	0.2
Emission Limit	16.3	3.3	3.0	0.6	-	1.0

4.0 SAMPLING AND ANALYTICAL PROCEDURES

A protocol for the air emission testing was reviewed and approved by the MDEQ-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 4	Exhaust gas moisture was determined based on the water weight gain in chilled impingers.
USEPA Method 7E	Exhaust gas NOx concentration was determined using a chemiluminescence instrumental analyzer.
USEPA Method 10	Exhaust gas CO concentration was measured using an NDIR instrumental analyzer.
USEPA Method 25A /ALT-096	Exhaust gas VOC (as NMHC) concentration was determined using a flame ionization analyzer equipped with an internal methane separation GC column.

4.2 Exhaust Gas Velocity Determination (USEPA Methods 1 and 2)

The RICE exhaust stack gas velocity and volumetric flow rate was determined using USEPA Method 2 prior to and after each test. 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 periodically leak-checked to verify the integrity of the measurement system.

The absence of significant cyclonic flow for the exhaust configuration 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 C 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 exhaust gas CO_2 content was monitored using a Servomex 1440D single beam single wavelength (SBSW) infrared gas analyzer. The exhaust gas O_2 content was monitored using a paramagnetic sensor within the Servomex 1440D gas analyzer.

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 D provides O_2 and CO_2 calculation sheets. Raw instrument response data are provided in Appendix E.

4.4 Exhaust Gas Moisture Content (USEPA Method 4)

Moisture content of the RICE exhaust gas was determined in accordance with USEPA Method 4 using a chilled impinger sampling train. The moisture sampling was performed concurrently with the instrumental analyzer sampling. During each sampling period a gas sample was extracted at a constant rate from the source where moisture was removed from the sampled gas stream using impingers that were submersed in an ice bath. At the conclusion of each sampling period, the moisture gain in the impingers was determined gravimetrically by weighing each impinger to determine net weight gain.

4.5 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 48c infrared CO analyzer.

Throughout each test period, a continuous sample of the engine exhaust gas was extracted from the stack using the heated sample line and gas conditioning system described previously in this section. 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 D provides CO and NO_X calculation sheets. Raw instrument response data are provided in Appendix E.

4.6 Measurement of VOCs (USEPA Method ALT-096)

VOC emission rate was determined by measuring the nonmethane hydrocarbon (NMHC) concentration in the exhaust gas for each RICE. NMHC pollutant concentration was determined using TEI Model 55i Methane / Nonmethane hydrocarbon analyzer.

Throughout each one-hour test period, a continuous sample of the IC engine exhaust gas was extracted from the stack using the Teflon® heated sample line described in Section 4.3 of this document, and delivered to the instrumental analyzer. The sampled gas was not conditioned prior to being introduced to the analyzer; therefore, the measurement of NMHC concentration corresponds to standard wet gas conditions. Instrument NMHC (VOC) response for the analyzer was recorded on an ESC Model 8816 data logging 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 instrument was calibrated using mid-range calibration and zero gas to determine analyzer calibration error and system bias (described in Section 5.0 of this document).

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

5.0 <u>QA/QC ACTIVITIES</u>

5.1 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_2 concentration is within 90% of the expected value.

The NO_2 – NO conversion efficiency test satisfied the USEPA Method 7E criteria (measured NO_2 concentration was -4.74% of the expected value, i.e., within 10% of the expected value as required by Method 7E).

5.2 Sampling System Response Time Determination

The response time of the sampling system was determined prior to the compliance test program by introducing upscale gas and zero gas, in series, into the sampling system using a tee connection at the base of the sample probe. The elapsed time for the analyzer to display a reading of 95% of the expected concentration was determined using a stopwatch.

The TEI Model 42c analyzer exhibited the longest system response time at 73 seconds. Results of the response time determinations were recorded on field data sheets. For each test period, test data were collected once the sample probe was in position for at least twice the maximum system response time.

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 (on December 20, 2013) 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 (July 26, 2006, June 21, 2011 and June 12, 2014), 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 3.0% 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 of the two (2) identical RICE exhaust stacks. 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 both RICE exhaust stacks indicate 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 Meter Box Calibrations

The Nutech Model 2010 sampling console, which was used for exhaust gas moisture content sampling, was calibrated prior to and after the testing program. This calibration uses the critical orifice calibration technique presented in USEPA Method 5. The metering console calibration exhibited no data outside the acceptable ranges presented in USEPA Method 5.

The digital pyrometer in the Nutech metering consoles were calibrated using a NIST traceable Omega® Model CL 23A temperature calibrator.

Appendix F 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, meter box calibration records, stratification checks, cyclonic flow determinations sheets, Pitot tube and probe assembly calibration records).

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 6.2. The serial number (SN) for each RICE is presented at the top of each table.

The measured average air pollutant concentrations and emission rates for Engine Nos. 8 through 9 (EUICENGINE8 through 9) are less than the allowable limits specified in ROP No. MI-ROP-N8004-2013 for the engines:

- 3.3 grams per brake-horsepower hour (g/bhp-hr) CO;
- 16.3 pounds per hour (lbs/hr) CO;
- 0.6 g/bhp-hr NO_x;
- 3.0 lb/hr NO_x; and
- 1.0 g/bhp-hr VOC.

6.2 Variations from Normal Sampling Procedures or Operating Conditions

The testing for all pollutants was performed in accordance with the approved test protocols. The engine-generator sets were operated within 10% of maximum output and no variations from the normal operating conditions of the RICE occurred during the engine test periods.

Table 6.1 Measured exhaust gas conditions and NO_x, CO and VOC air pollutant emission rates PTA Landfill Engine No. 8 (EUICENGINE8), SN: GZJ00422

Test No. Test date Test period (24-hr clock)	1 12/3/14 1315 - 1415	2 12/3/14 1445 - 1545	3 12/3/14 1615 – 1715	Three Test Average
Fuel flowrate (scfm)	553	553	558	556
Generator output (kW)	1,534	1,535	1,536	1,535
Engine output (bhp)	2,150	2,151	2,153	2,151
LFG methane content (%)	51.7	51.5	51.2	51.5
LFG LHV heat content (Btu/scf)	470	469	466	468
Inlet Pressure (psi)	17.2	17.1	17.2	17.2
<u>Exhaust Gas Composition</u>				
CO_2 content (% vol)	11.4	11.3	11.4	11.4
O_2 content (% vol)	7.80	8.85	8.35	8.34
Moisture (% vol)	11.4	11.1	11.2	11.2
Exhaust gas temperature (°F)	913	914	916	915
Exhaust gas flowrate (dscfm)	4,291	4,279	4,242	4,267
Exhaust gas flowrate (scfm)	4,833	4,789	4,726	4,780
<u>Nitrogen Oxides</u>				
NO_X conc. (ppmvd)	55.0	53.5	55.5	54.6
NO_X emissions (g/bhp*hr)	0.36	0.35	0.36	0.35
NO_X emissions (lb/hr)	1.69	1.64	1.69	1.67
<u>Carbon Monoxide</u>				
CO conc. (ppmvd)	699	691	696	695
CO emissions (g/bhp*hr)	2.76	2.72	2.71	2.73
CO emissions (lb/hr)	13.1	12.9	12.9	13.0
<u>Volatile Organic Compounds</u>				
VOC conc. (ppmv)	24.0	23.2	22.8	23.3
VOC emissions (g/bhp*hr)	0.17	0.16	0.16	0.16
VOC emissions (lb/hr)	0.80	0.76	0.74	0.77

Table 6.2 Measured exhaust gas conditions and NO_x, CO and VOC air pollutant emission rates PTA Landfill Engine No. 9 (EUICENGINE9), SN: GZJ00199

Test No. Test date Test period (24-hr clock)	1 12/3/14 820 - 920	2 12/3/14 1000 - 1100	3 12/3/14 1130 - 1230	Three Test Average
Fuel flowrate (scfm)	545	547	543	545
Generator output (kW)	1,529	1,532	1,536	760
Engine output (bhp)	2,143	2,147	2,152	2,147
LFG methane content (%)	51.9	51.6	51.6	51.7
LFG LHV heat content (Btu/scf)	472	470	470	470
Inlet Pressure (psi)	17.1	17.3	17.4	17.3
Exhaust Gas Composition				
CO_2 content (% vol)	11.5	11.4	11.5	11.5
O_2 content (% vol)	8.18	8.29	8.26	8.24
Moisture (% vol)	8.9	10.2	11.5	10.2
Exhaust gas temperature (°F)	925	921	919	922
Exhaust gas flowrate (dscfm)	4,220	4,274	4,313	4,267
Exhaust gas flowrate (scfm)	4,667	4,796	4,875	4,771
Nitrogen Oxides				
NO_X conc. (ppmvd)	62.4	58.1	59.6	60.1
NO_X emissions (g/bhp*hr)	0.40	0.38	0.39	0.39
NO_X emissions (lb/hr)	1.89	1.78	1.84	1.84
Carbon Monoxide				
CO conc. (ppmvd)	706	695	699	700
CO emissions (g/bhp*hr)	2.75	2.74	2.77	2.75
CO emissions (lb/hr)	13.0	13.0	13.1	13.0
Volatile Organic Compounds				
VOC conc. (ppmv)	23.4	24.0	23.5	23.7
VOC emissions (g/bhp*hr)	0.16	0.17	0.17	0.16
VOC emissions (lb/hr)	0.75	0.79	0.79	0.78