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

Prepared for:

North American Natural Resources
Venice Park Renewable Energy Facility
SRN N5910

ICT Project No.: 2400084
June 27, 2024

IMPACT
COMPLIANCE & TESTING

Report Certification

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FROM
LANDFILL GAS FIRED ENGINE – GENERATOR SETS

North American Natural Resources
Venice Park Renewable Energy Facility
Lennon, Michigan

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

Impact Compliance and Testing, Inc.

Max Fierro
Project Manager

Table of Contents

List of Tables

List of Appendices

1.0 Introduction

North American Natural Resources (NANR) operates landfill gas (LFG) fueled reciprocating internal combustion engine and electricity generator sets (RICE gensets) at the Venice Park Renewable Energy Facility (Venice Park) in Lennon, Shiawassee County, Michigan. The RICE gensets are fueled by LFG that is recovered from the Venice Park Recycling & Disposal facility (RDF) and treated prior to use. The State of Michigan Department of Environment, Great Lakes, and Energy – Air Quality Division (EGLE-AQD) has issued to NANR a Renewable Operating Permit (MI-ROP-N5910-2022) for operation of the renewable electricity generation facility, which consists of:

- Four (4) Caterpillar (CAT®) Model No. G3520C RICE gensets identified as emission units EUNANRENGINE7R, EUNANRENGINE8R, EUNANRENGINE9, and EUNANRENGINE10 (Flexible Group ID: FGENGINES7R-10)

Unit EUNANRENGINE7R was tested as part of this compliance event. Air emission compliance testing was performed pursuant to MI-ROP-N5910-2022. Conditions of MI-ROP-N5910-2022 for FGENGINES7R-10 state:

1. *…the permittee shall conduct an initial performance test for each engine in FGENGINES7R-10 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)…*

2. *Within 180 days after commencement of initial startup, the permittee shall verify NOx, CO, VOC, PM10 and PM2.5 emission rates from EUNANRENGINE7R and EUNANRENGINE8R at maximum routine operating conditions, by testing at owner's expense, in accordance with Department requirements. The permittee must complete the testing once every five years, thereafter for FGENGINES7R-10.*

The compliance testing presented in this report was performed by Impact Compliance & Testing, Inc. (ICT), a Michigan-based environmental consulting and testing company. ICT representatives Max Fierro, Blake Beddow, and Scott Herron performed the field sampling and measurements May 30, 2024.

Engine emission performance tests for EUNANRENGINE7R consisted of triplicate one-hour sampling periods for NOx, CO, VOC, as NMHC or NMOC, and particulate matter (PM2.5/PM10). Exhaust gas velocity, moisture, oxygen (O_2) content, and carbon dioxide (CO_2) content were determined for each test period to calculate volumetric exhaust gas flowrate and pollutant mass emission rates.The exhaust gas sampling and analysis was performed using procedures specified in the Stack Test Protocol dated January 18, 2024, that was reviewed and approved by EGLE-AQD. Questions regarding this air emission test report should be directed to:

Max Fierro
Project Manager
Impact Compliance & Testing, Inc.
4180 Keller Rd. STE B
Holt, MI 48842
(734) 357-8397
Max.Fierro@ImpactCandT.com

Mr. Mike Williams
Specialist-Engineer/Tech Sr II
Kinder Morgan
1001 Louisiana St.
Houston, TX 77002
(713) 420-4571
Michael_J_Williams@kindermorgan.com

2.0 Summary of Test Results and Operating Conditions

2.1 Purpose and Objective of the Tests

Conditions of MI-ROP-N5910-2022 require NANR to test each engine in FGENGINES7R-10 for CO, NOx, and VOC emissions (NSPS JJJJ) and EUNANRENGINE7R & EUNANRENGINE8R for PM 10 and PM2.5 emissions. EUNANRENGINE7R was tested during this compliance test event. EUNANRENGINE8R, EUNANRENGINE9, and EUNANRENGINE10 were previously tested on March 5-6, 2024.

2.2 Operating Conditions During the Compliance Tests

The testing was performed while the NANR engine/generator set was operated at maximum operating conditions (within 10% of 1,600-kilowatt (kW) electricity output). NANR representatives monitored and recorded generated power output (kW), fuel use (pounds per hour, lb/hr), and fuel methane content (%) at 15-minute increments for each test period.

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

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

Average kW output, fuel consumption, and fuel methane content for the RICE are presented in Table 2.1 and Table 6.1.

2.3 Summary of Air Pollutant Sampling Results

The gases exhausted from the sampled LFG fueled RICE (EUNANRENGINE7R) were sampled for three (3) one-hour test periods during the compliance testing performed May 30, 2024.

Table 2.2 presents the average measured CO, NO_X, VOC, and PM2.5/10 emission rates for the 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	EUNANRENGINE7R CAT® G3520C
Generator output (kW)	1,601
Engine output (bhp)	2,244
Engine LFG fuel use (lb/hr)	2,635
Engine LFG fuel use (scfm)[1]	564
LFG methane content (%)	50.0

1. Engine fuel use data is recorded in the engine management system as lb/hr. This value was converted to scfm using a fuel molecular weight (MW) of 30.
Flow (scfm) = (Flow, lb/hr) x (385 scf/lb-mol) / (MW) / (60 min/hr)

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

Emission Unit	CO		NOx		VOC	PM2.5/ PM10
	(lb/hr)	(g/bhp-hr)	(lb/hr)	(g/bhp-hr)	(g/bhp-hr)	(lb/hr)
EUNANRENGINE7R	15.22	3.08	1.54	0.31	0.17	0.50
Permit Limit	***16.30***	***3.30***	***2.97***	***2.0***	***0.63***	***0.74***

3.0 Source and Sampling Location Description

3.1 General Process Description

NANR is permitted to operate four (4) RICE-generator sets (CAT® Model No. G3520C) at its facility. The units are fired exclusively with LFG that is recovered from the Venice Park RDF facility and treated prior to use.

3.2 Rated Capacities and Air Emission Controls

The CAT® G3520C engine generator sets each have a rated design capacity of:

- Engine Power: 2,242 brake horsepower (bhp)
- Electricity Generation: 1,600 kW

Each engine is equipped with an electronic 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 noise mufflers and vertical exhaust stacks.

3.3 Sampling Locations

Each 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 stack for EUNANRENGINE7R is located after the muffler in the vertical exhaust stack, with an interior diameter of 14 inches. Each stack is equipped with two (2) sample ports, opposed 90°, that provide a sampling location at least 0.5 duct diameters upstream and at least 2.0 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 a diagram of the emission test sampling locations with actual stack dimension measurements.

4.0 Sampling and Analytical Procedures

A Stack 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 4	Exhaust gas moisture was determined based on the water weight gain in chilled impingers (as part of the particulate sampling train).
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.
USEPA Method 5	Exhaust gas filterable particulate matter concentration using isokinetic sampling.
USEPA Method 202	Exhaust gas condensable particulate matter concentration using isokinetic sampling.

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 throughout each test period as part of the isokinetic sampling procedures.. 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 isokinetic 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 were measured continuously throughout each test period in accordance with USEPA Method 3A. The CO_2 content of the exhaust was monitored using a Servomex infrared gas analyzer. The O_2 content of the exhaust was monitored using a Servomex 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 8864 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 Exhaust Moisture Determination via Isokinetic Sampling (USEPA Method 4)

Moisture content was measured concurrently with the particulate matter sampling trains and determined in accordance with USEPA Method 4. Moisture from the gas sample was removed by the chilled impingers of the isokinetic sampling train. The net moisture gain from the gas sample was determined by either volumetric or gravimetric analytical techniques in the field. Percent moisture was calculated based on the measured net gain from the impingers and the metered gas sample volume of dry air.

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 42i 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 8864 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.

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

The VOC emission rate was determined by measuring the nonmethane hydrocarbon (NMHC or NMOC) 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.

4.7 Measurement of Particulate Matter Emissions (USEPA Method 5/202)

The conditions of MI-ROP-N5910-2022 specify PM2.5/PM10 emission limits for the RICE generators sets. The testing was performed using a combined filterable and condensable particulate matter (PM) sampling train. The filterable and condensable fractions were added to calculate total PM2.5/PM10 emissions (i.e., all filterable and condensable PM emissions were assumed to be in the PM2.5/PM10 size range).

4.7.1 Filterable Particulate Matter Sample Train (USEPA Method 5)

Filterable PM was determined using USEPA Method 5. RICE exhaust gas was withdrawn from the exhaust stack at an isokinetic sampling rate using an appropriately-sized stainless steel sample nozzle and heated probe with stainless steel liner. The collected exhaust gas was passed through a pre-tared glass fiber filter that was housed in an independent heated filter box. The back half of the filter housing was connected directly to the condensable PM impinger train.

4.7.2 Condensable Particulate Matter Sample Train (USEPA Method 202)

Condensable PM (CPM) concentrations were measured in accordance with USEPA Method 202. Following the Method 5 filter assembly, the sample gas travelled through the heated filter box to the impinger train which consisted of a condenser, a knock-out impinger, a standard Greenberg-Smith (G-S) impinger (dry), a Teflon-coated CPM filter (with exhaust thermocouple), a modified G-S impinger containing 100 milliliters of deionized water, and a modified G-S impinger containing a known amount of indicating silica gel.

The CPM components of the Method 202 sampling train (dry knockout impinger and dry GS impinger) were placed in a tempered water bath and a pump was used to circulate water through the condenser. Crushed ice was used to maintain the temperature of the bath such that the CPM filter outlet temperature remained between 65 and 85°F. Crushed ice was placed around the last two impingers to chill the gas to below 68°F.

4.7.3 Sample Recovery and Analysis (USEPA Method 5/202)

At the conclusion of each one-hour test period, the sample train was leak-checked and disassembled. The sample nozzle, stainless steel probe liner, and filter holder were brushed and rinsed with acetone. The recovered particulate filter and acetone rinses were stored in sealed containers and picked up by Enthalpy Analytical, Inc. (Durham, North Carolina) for gravimetric measurements.

The impingers were transported to the recovery area where they were weighed. The exhaust gas contained significant amounts of moisture. Therefore, prior to recovery, the CPM portion of the sample train underwent the nitrogen purge step of Method 202. The glassware (between the particulate filter and CPM filter) was rinsed with DI water, acetone, and hexane in accordance with the Method 202 sample recovery procedures. The CPM filter and recovered rinses were clearly and uniquely labeled and transferred to Enthalpy Analytical, Inc. for analysis.

Diluent gas content (Method 3A O_2 and CO_2) measurements were performed with each of the PM2.5/PM10 isokinetic sampling periods.

Appendix 4 provides PM2.5/PM10 calculation sheets. The PM2.5/PM10 laboratory report is provided in Appendix 7.

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 (Pitot tube and scale) were calibrated to specifications in the sampling methods.

5.2 NO_x Converter Efficiency Test

The NO_2 – NO conversion efficiency of the Model 42i 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 10% of the expected value.

The NO_2 – NO conversion efficiency test satisfied the USEPA Method 7E criteria (measured NO_x concentration was 92.98 % 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 the 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 O_2, CO_2, CO, and NOx 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 System Response Time

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.

Sampling periods did not commence until the sampling probe had been in place for at least twice the greatest system response time.

5.8 Meter Box Calibrations

The dry gas meter sampling console used for moisture testing 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 metering console was calibrated using a NIST traceable Omega® Model CL 23A temperature calibrator.

5.9 Cyclonic Flow Check

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 multiple 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).

Appendix 6 presents test equipment quality assurance data (NO_2 – NO conversion efficiency test data, instrument calibration and system bias check records, calibration gas certifications, interference test results, meter box calibration records, and field equipment calibration records).

5.10 Particulate Matter Recovery and Analysis

All recovered particulate matter samples were stored and picked up in pre-rinsed glass sample bottles with Teflon® lined caps. The liquid level on each bottle was marked with a permanent marker prior to pick-up and the caps were secured closed with tape. Samples of the reagents used in the test event (200 milliliters each of deionized high-purity water, acetone and hexane) were picked up by a laboratory representative for analysis to verify that the reagents used to recover the samples have low particulate matter residues.

The glassware used in the condensable PM impinger trains was washed and rinsed prior to use in accordance with the procedures of USEPA Method 202. The glassware was not baked prior to use; therefore, ICT used the field train proof blank option provided in USEPA Method 202. Analysis of the collected field train proof blank rinses (sample train rinse performed prior to use) indicated a total of 1.96 milligrams (mg) of recovered PM from the sample train. In addition, a field train recovery proof blank was performed following the second sampling period. Analysis of the field train recovery proof blank resulted in 3.03 mg of recovered PM from the sample train. The reported condensable PM test results were blank-corrected according to the method (USEPA Method 202 allows a blank correction of up to 2 mg).

5.11 Laboratory QA/QC Procedures

The particulate matter analyses were conducted by a qualified third-party laboratory according to the appropriate QA/QC procedures specified in the USEPA Methods 5 and 202 and are included in the final report provided by Enthalpy Analytical.

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 Table 6.1.

EUNANRENGINE7R has the following allowable emission limits specified in MI-ROP-N5910-2022:

- 16.30 pounds per hour (lb/hr) and 3.30 grams per brake horsepower hour (g/bhp-hr) for CO;
- 2.97 lb/hr and 2.0 g/bhp-hr for NOx; and
- 0.63 g/bhp-hr for VOC.
- 0.74 lb/hr for PM2.5/PM10

The measured air pollutant concentrations and emission rates for EUNANRENGINE7R are less than the allowable limits specified in MI-ROP-N5910-2022.

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 Stack Test Protocol. The RICE gensets were operated within 10% of maximum output (1,600 kW generator output for CAT® G3520C RICE) and no variations from normal operating conditions occurred during the engine test periods.

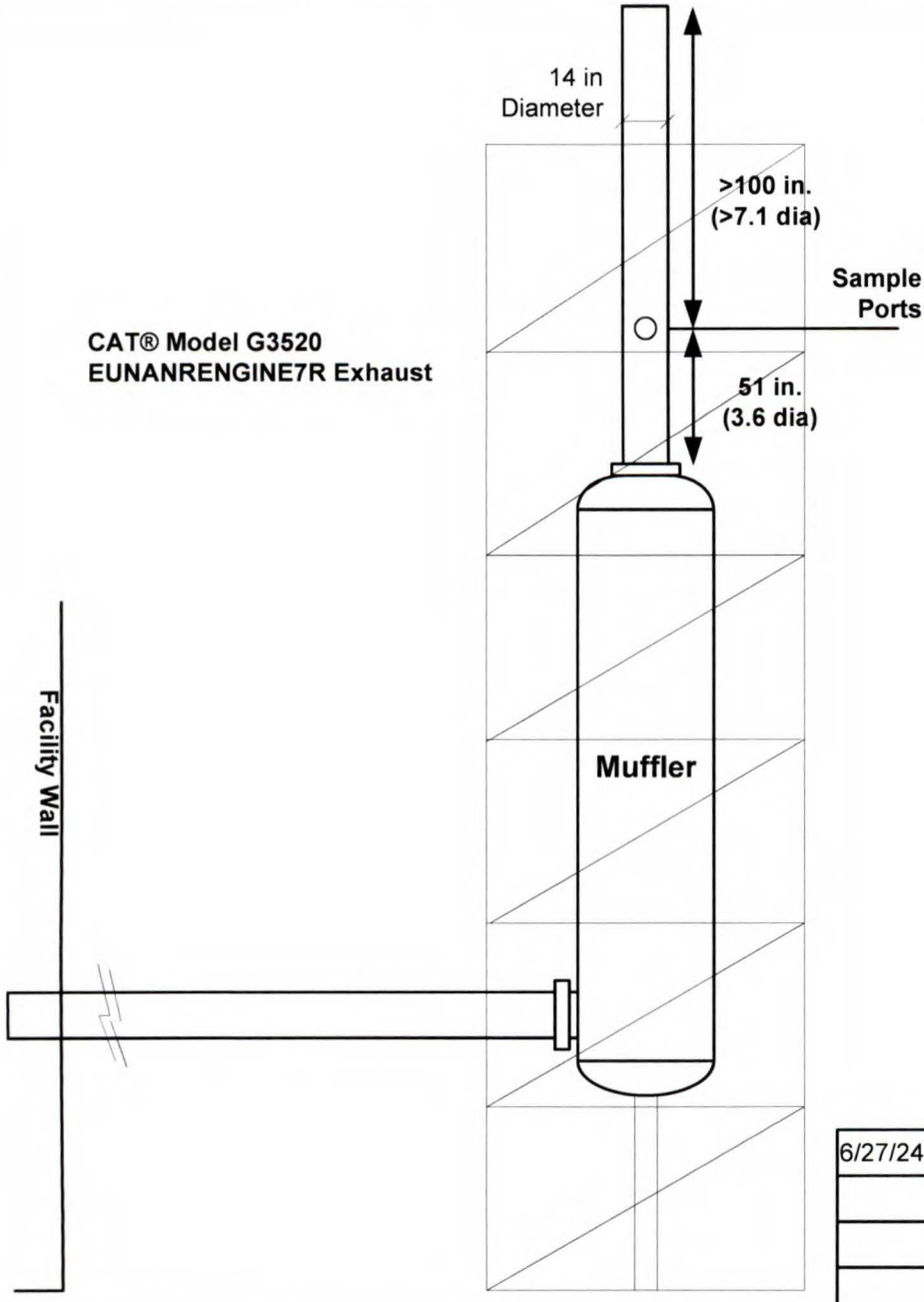
During run number two testing was paused two separate times. The first pause event was due to CPM filter and last impinger temperatures exceeding the allowable ranges by the method. Testing was immediately paused, and ice was added to the caddy to lower the temperatures back into the allowable range. The second pause event was due to the sample probe coming out of the stack. Testing was immediately paused, and the probe was placed in the appropriate position to resume testing.

Table 6.3 Measured exhaust gas conditions and air pollutant emission rates for Engine No. 7R (EUNANRENGINE7R)

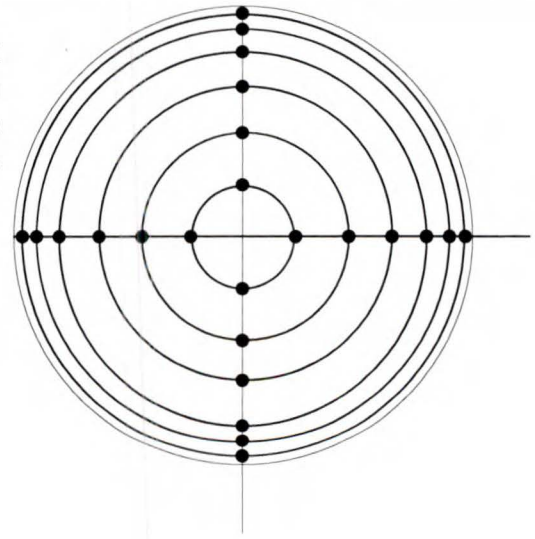
Test No. Test date Test period (24-hr clock)	1 5/30/2024 0823-0853 0901-0931	2 5/30/2024 1017-1047 1058-1110 1127-1137 1142-1149	3 5/30/2024 1241-1311 1323-1353	Three Test Average
Fuel flowrate (lbs/hr)	2,682	2,620	2,604	2,635
Generator output (kW)	1,600	1,615	1,589	1,601
Engine output (bhp)	2,242	2,263	2,227	2,244
LFG methane content (%)	49.8	50.0	50.1	50.0
Exhaust Gas Composition				
CO_2 content (% vol)	11.5	11.4	11.3	11.4
O_2 content (% vol)	8.65	8.72	8.80	8.73
Moisture (% vol)	12.3	12.2	11.8	12.1
Exhaust gas temperature (°F)	882	874	870	875
Exhaust gas flowrate (dscfm)	4,948	4,965	5,030	4,981
Exhaust gas flowrate (scfm)	5,639	5,657	5,705	5,667
Nitrogen Oxides				
NO_X conc. (ppmvd)	41.8	43.4	44.4	43.2
NO_X emissions (lb/hr)	1.48	1.54	1.60	1.54
Permitted emissions (lb/hr)	-	-	-	*2.97*
NO_X emissions (g/bhp*hr)	0.30	0.31	0.33	0.31
*Permitted emissions (g/bhp*hr)*	-	-	-	*2.0*
Carbon Monoxide				
CO conc. (ppmvd)	706	700	693	700
CO emissions (lb/hr)	15.26	15.18	15.21	15.22
Permitted emissions (lb/hr)	-	-	-	*16.3*
CO emissions (g/bhp*hr)	3.1	3.0	3.1	3.08
*Permitted emissions (g/bhp*hr)*	-	-	-	*3.30*
Volatile Organic Compounds				
VOC conc. (ppmv)	22.1	22.0	21.8	21.9
VOC emissions (g/bhp*hr)	0.17	0.17	0.17	0.17
*Permitted emissions (g/bhp*hr)*	-	-	-	*0.63*
Particulate Matter				
Sampled volume (ft^3)	51.93	50.10	49.40	50.48
Filterable catch (mg)	4.51	6.05	7.24	5.93
Condensable catch (mg)	31.6	37.8	27.1	32.2
Total PM2.5/PM10 catch (mg)	36.09	43.89	34.33	38.10
PM2.5/PM10 emissions (lb/hr)	0.45	0.58	0.46	0.50
Permitted emissions (lb/hr)	-	-	-	*0.74*

APPENDIX 1

- RICE Engine Sample Port Diagram



Exhaust Stack Cross-Section with Traverse Points



Velocity and sample locations as measured from stack wall

Pt	inch
1	0.50
2	0.94
3	1.65
4	2.48
5	3.50
6	4.98
7	9.02
8	10.50
9	11.52
10	12.35
11	13.06
12	13.50

6/27/24 MSF	**NANR Venice Park Facility** **Exhaust Sample Location, CAT® G3520 ICE**		
	Scale None	Sheet 1 of 1	Impact Comp. & Testing, Inc. Dwg. No. NANR-VP-7R