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

Prepared for:

Munson Medical Center
Cogeneration Facility
SRN D5884

ICT Project No.: 2200156
September 1, 2023

IMPACT COMPLIANCE & TESTING

Report Certification

AIR EMISSION TEST REPORT

FOR THE
VERIFICATION OF AIR POLLUTANT EMISSIONS
FROM A
NATURAL GAS FIRED ENGINE – GENERATOR SET

Munson Medical Center
Cogeneration Facility
Traverse City, MI

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

Report Prepared By:
[signature]
Max Fierro Environmental Consultant Impact Compliance & Testing, Inc.

Executive Summary

MUNSON MEDICAL CENTER
COGENERATION FACILITY
NATURAL GAS FUELED IC ENGINE
EMISSION TEST RESULTS

Trane Technologies (Trane) contracted Impact Compliance & Testing, Inc. (ICT) to conduct a performance demonstration for the determination of nitrogen oxides (NOx), carbon monoxide (CO), volatile organic compounds (VOC), and formaldehyde (HCOH) concentrations and emission rates from one (1) Caterpillar (CAT®) Model No. G3520H gas-fired reciprocating internal combustion engine and electricity generator set (RICE genset) identified as EUCHP operated at the Munson Medical Center Cogeneration Facility (Munson) located in Traverse City, Grand Traverse County, Michigan. The RICE is fueled with landfill gas (LFG) that is produced at the Autumn Hills Landfill.

Compliance testing was performed with regards to conditions specified in the Michigan Department of Environment, Great Lakes, and Energy - Air Quality Division (EGLE-AQD) Permit to Install (PTI) No. 43-22 and the federal Standards of Performance for Stationary Spark Ignition Internal Combustion Engines (SI-RICE NSPS; 40 CFR Part 60 Subpart JJJJ). The performance testing was conducted August 9, 2023.

The following table presents the CAT® G3520H emissions results from the performance demonstration.

Emission Unit	NOx g/bhp-hr	NOx lb/hr	CO g/bhp-hr	CO lb/hr	VOC g/bhp-hr	VOC lb/hr	HCOH lb/hr
EUCHP	0.49	3.46	0.0	0.0	0.13	0.91	0.15
Permit Limit	*1.0*	*3.81*	*2.0*	*1.44*	*0.41*	*1.58**	*0.823*

Note*: The VOC limit includes HCOH.

The following table presents the operating data recorded during the performance demonstration.

Emission Unit	Generator Output (kW)	Engine Output (bhp)	Fuel Flow (scfm)	Inlet Air Temp (°F)	Oil Pressure	Engine Speed
EUCHP	2,275	3,174	328	123.7	69.9	1499.5

The data presented above indicates that EUCHP was tested while the unit operated within 10% of maximum capacity and is in compliance with the emission standards specified in the PTI.

TABLE OF CONTENTS

List of Tables

List of Appendices

1.0 Introduction

Munson operates a natural gas-fired RICE genset at the cogeneration facility in Traverse City, Grand Traverse County, Michigan. The EGLE-AQD has issued Munson PTI No. 43-22 for operation of the RICE genset.

Air emission compliance testing was performed pursuant to conditions specified in PTI 43-22 and the SI-RICE NSPS; 40 CFR Part 60 Subpart JJJJ. The compliance emission testing was performed on EUCHP. EUCHP is required to test for NOx, CO, VOC and HCOH within 180 after startup. Emissions testing required by the NSPS Subpart JJJJ must be completed within 180 after startup and every 8,760 hours (or three (3) years). This test event satisfied both the PTI 43-22 testing requirement and the NSPS Subpart JJJJ testing requirement.

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 Blake Beddow, Andy Rusnak and Max Fierro performed the field sampling and measurements August 9, 2023.

The emission performance tests consisted of triplicate, one-hour sampling periods for NOx, CO, VOC and HCOH on EUCHP. 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 Stack Test Protocol dated July 28, 2022, that was reviewed and approved by EGLE-AQD.

Questions regarding this air emission test report should be directed to:

Andy Rusnak, QSTI
Technical Manager
Impact Compliance & Testing, Inc.
4180 Keller Rd., Ste. B
Holt, MI 48842
(517) 481-3283
andy.rusnak@impactcandt.com

Mr. Matthew Bloem
Project Manager
Trane
5005 Corporate Exchange Blvd. SE
Grand Rapids, MI 49512
(616) 971-1400
MBloem@trane.com

2.0 Summary of Test Results and Operating Conditions

2.1 Purpose and Objective of the Tests

Conditions of PTI 43-22 and 40 CFR Part 60, Subpart JJJJ, require Munson to test EUCHP for CO, NOx, VOC, and HCOH emissions.

2.2 Operating Conditions During the Compliance Tests

The testing was performed while the Munson engine/generator set was operated at maximum operating conditions. Munson representatives provided kW output in 15-minute increments for each test period.

Natural Gas (NG) fuel flowrate (standard cubic feet per minute, scfm), inlet air temperature (°F), oil pressure, and engine speed were also recorded by Munson representatives in 15-minute increments for each test period.

Engine output (bhp) cannot be measured directly and was calculated based on the recorded electricity output, the calculated CAT® Model G3520H generator efficiency (91.8%), and the unit conversion factor for kW to horsepower (0.7457 kW/hp).

Engine output (bhp) = Electricity output (kW) / (0.918) / (0.7457 kW/hp)

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

Average output, fuel consumption and fuel methane content are presented in Table 2.1.

2.3 Summary of Air Pollutant Sampling Results

The gases exhausted from EUCHP were sampled for three (3) one-hour test periods during the compliance testing performed August 9, 2023.

Table 2.2 presents the average measured CO, NO_X, VOC, and HCOH 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	EUCHP
Generator output (kW)	2,275
Engine output (bhp)	3,174
Engine LFG fuel use (scfm)	328
Inlet air temperature (°F)	123.7
Oil pressure	69.9
Engine speed	1499.5

Table 2.2 Measured CAT® G3520H air pollutant emission rates (three-test average)

	NOx		CO		VOC		HCOH
Emission Unit	g/bhp-hr	lb/hr	g/bhp-hr	lb/hr	g/bhp-hr	lb/hr	lb/hr
EUCHP	0.49	3.46	0.0	0.0	0.13	0.91	0.15
Permit Limit	*1.0*	*3.81*	*2.0*	*1.44*	*0.41*	*1.58**	*0.823*

Note*: The VOC limit includes HCOH.

3.0 Source and Sampling Location Description

3.1 General Process Description

Munson purchases NG to use as fuel in its cogeneration facility located in Traverse City, MI. The gas is collected and directed to the facility through a pipeline where it is used as fuel for the RICE gensets that produce electricity.

The cogeneration facility primarily consists of one (1) CAT® Model No. G3520H RICE, that is connected to an electricity generator.

3.2 Rated Capacities and Air Emission Controls

The CAT® G3520H engine generator set has a rated design capacity of 2500 kW.

The RICE is equipped with an add-on oxidation catalyst for the reduction of air pollutant emissions. The oxidation catalyst primarily reduces carbon monoxide (CO) and volatile organic compounds (VOC as non-methane hydrocarbon (NMHC or NMOC)) emissions from the engine.

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 stack sampling ports for EUCHP is located in an individual exhaust duct (horizontal section of the stack before the noise muffler) with an inner diameter of 23.25 inches. The duct is equipped with two (2) sample ports, opposed 90°, that provide a sampling location 102 inches (4.3 duct diameters) upstream and greater than 168 inches (>7.2 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 1 provides diagrams 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 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 D6348	Exhaust gas HCOH and moisture content were measured using a Fourier transform infrared spectroscopy (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 once during 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 for each 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 were measured continuously throughout each test period in accordance with USEPA Method 3A. The CO_2 content of the exhaust was monitored using a M&C GenTwo infrared gas analyzer. The O_2 content of the exhaust was monitored using a M&C GenTwo 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 each RICE exhaust gas stream were determined using a Thermo Environmental Instruments, Inc. (TEI) Model 42i High Level chemiluminescence NO_X analyzer and a M&C GenTwo 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 VOC (USEPA Method 25A/ALT-096)

The VOC emission rate was determined by measuring the nonmethane hydrocarbon (NMHC or NMOC) concentration in each RICE 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 HCOH and Moisture Content via FTIR (ASTM D6348)

HCOH concentrations, and moisture content in the RICE exhaust gas stream were 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 the engine, with acetaldehyde and sulfur hexafluoride 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 HCOH calculation sheets. Moisture content data is provided in the flowrate calculations presented in Appendix 3. 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 (or onsite prior to beginning compliance testing), 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.

5.2 NO_x Converter Efficiency Test

The NO_2 – NO conversion efficiency of the TEI 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 instrumental analyzer will be deemed acceptable if the measured NOx concentration is at least 90% of the expected value (within 10%).

The NO_2 – NO conversion efficiency test satisfied the USEPA Method 7E criteria (measured NOx concentration was 93.9% 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 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 the 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 stack indicated that the measured CO, NOx, 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 the 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 FTIR QA/QC Activities

At the beginning of each day a calibration transfer standard (CTS, ethylene gas), analyte of interest (acetaldehyde and sulfur hexafluoride) 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 passed through the sampling system to ensure the system was free of contaminants.

Analyte spiking, of each 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, stratification checks, and field equipment 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.

EUCHP has the following allowable emission limits specified in PTI 43-22. The limits specified in the PTI are equal to or more stringent than the limits specified in the SI-RICE NSPS; 40 CFR Part 60 Subpart JJJJ:

Emission Unit ID	CO Limits	NOx Limits	VOC Limits	HCOH Limits
EUCHP	2.0 g/bhp-hr & 1.44 lb/hr	1.0 g/bhp-hr & 3.81 lb/hr	0.70 g/bhp-hr & 1.58 lb/hr*	0.823 lb/hr

Note*: This VOC limit includes HCOH.

The results of the EUCHP performance testing demonstrate compliance with the emission limits specified in PTI 43-22 and the SI-RICE NSPS; 40 CFR Part 60 Subpart JJJJ.

6.2 Variations from Normal Sampling Procedures or Operating Conditions

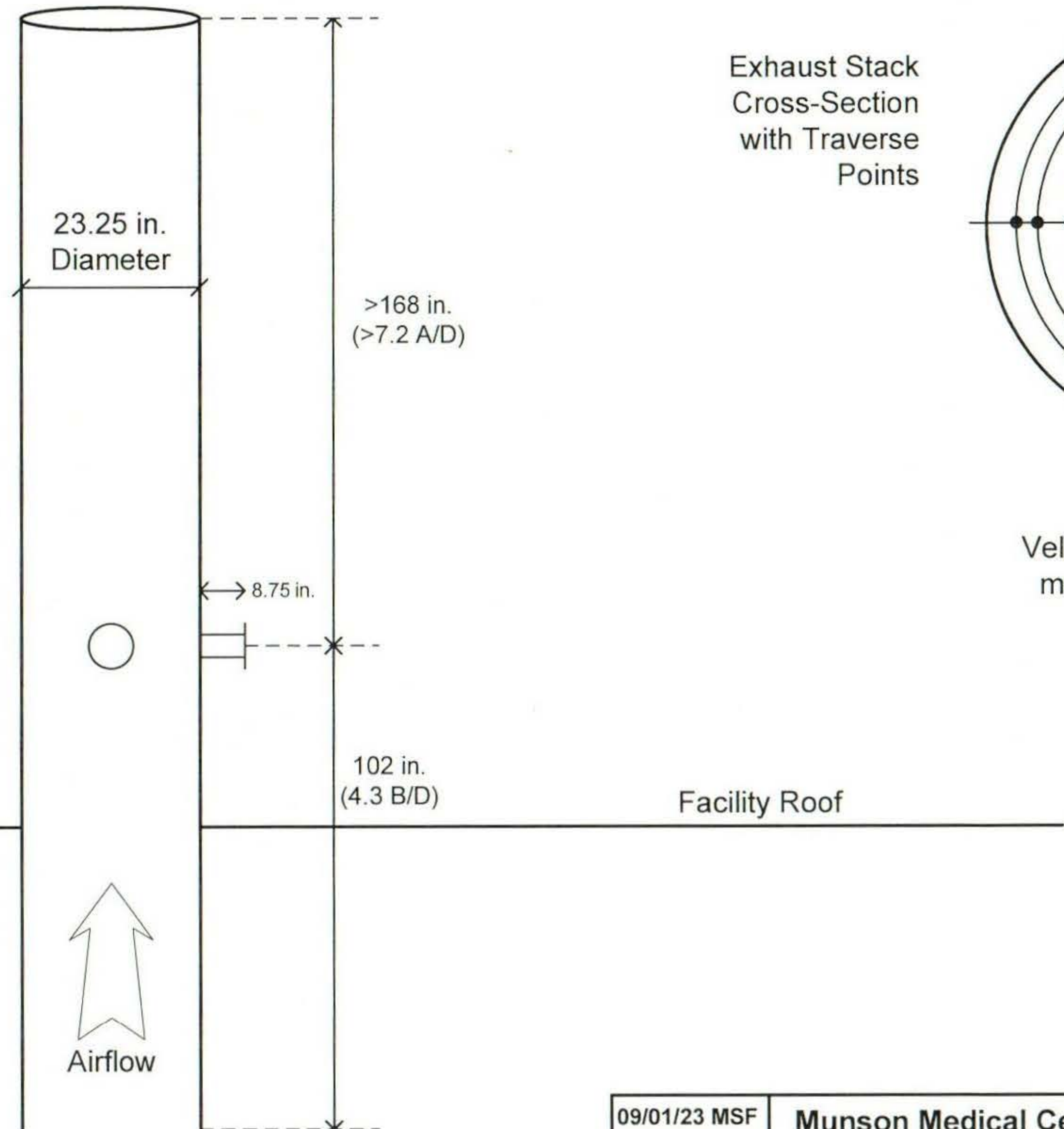
The testing for all pollutants was performed in accordance with USEPA methods and the approved Stack Test Protocol. The RICE-generator set was operated within 10% of maximum output and no variations from normal operating conditions occurred during the engine test periods.

Table 6.1 Measured exhaust gas conditions and NOx, CO, VOC and HCOH air pollutant emission rates for EUCHP

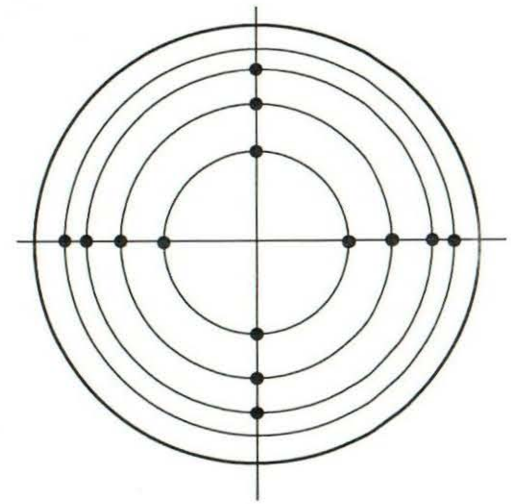
Test No. Test date Test period (24-hr clock)	1 08/09/2023 1508-1608	2 08/09/2023 1626-1726	3 08/09/2023 1743-1843	Three Test Average
Generator output (kW)	2,279	2,274	2,272	2,275
Engine output (bhp)	3,180	3,173	3,171	3,174
LFG flowrate (scfm)	329	328	328	328
Inlet air temp. (°F)	124.2	123.8	123.1	123.7
Oil pressure	69.6	69.8	69.5	69.9
Exhaust Gas Composition				
CO_2 content (% vol)	6.8	6.8	6.8	6.8
O_2 content (% vol)	9.86	9.88	9.80	9.85
Moisture (% vol)	12.2	12.2	12.5	12.3
Exhaust gas temperature (°F)	735	747	749	743
Exhaust gas flowrate (dscfm)	5,700	5,193	5,308	5,401
Exhaust gas flowrate (scfm)	6,492	5,915	6,067	6,158
Nitrogen Oxides				
NO_X conc. (ppmvd)	89.7	89.1	89.3	89.4
NO_X emissions (g/bhp-hr)	0.52	0.47	0.49	0.49
Permit limit (g/bhp-hr)	-	-	-	*1.0*
NO_X emissions (lb/hr)	3.67	3.32	3.40	3.46
Permit limit (lb/hr)	-	-	-	*3.81*
Carbon Monoxide				
CO conc. (ppmvd)	-0.2	0.0	0.0	-0.06
CO emissions (g/bhp-hr)	0.0	0.0	0.0	0.0
Permit limit (g/bhp-hr)	-	-	-	*2.0*
CO emissions (lb/hr)	0.0	0.0	0.0	0.0
Permit limit (lb/hr)	-	-	-	*1.44*
Volatile Organic Compounds				
VOC conc. (ppmv C_3)	21.4	21.8	21.5	21.6
VOC emissions (g/bhp-hr)	0.14	0.13	0.13	0.13
Permit limit (g/bhp-hr)	-	-	-	*0.70*
VOC emissions (lb/hr)	0.95	0.88	0.90	0.91
Permit limit (lb/hr)	-	-	-	*1.58*
Formaldehyde				
HCOH conc. (ppmv)	5.25	5.26	5.33	5.28
HCOH emissions (lb/hr)	0.16	0.15	0.15	0.15
Permit limit (lb/hr)	-	-	-	*0.823*

APPENDIX 1

- RICE Engine Sample Port Diagram



Exhaust Stack Cross-Section with Traverse Points



Velocity sample locations as measured from stack wall

Pt. #	in.
1	.75
2	2.44
3	4.51
4	7.51
5	15.74
6	18.74
7	20.81
8	22.51

09/01/23 MSF	**Munson Medical Center, EUCHP** **Exhaust Sample Location, CAT® G3520H ICE**		
	Scale None	Sheet 1 of 1	Impact Comp. & Testing, Inc. Dwg. No. Mun-1