AIR EMISSION TEST REPORT
FOR THE
VERIFICATION OF AIR POLLUTANT EMISSIONS FROM ENCLOSED FLARES AND OPEN FLARE DEMONSTRATIONS

Prepared for:

Woodland Meadows RDF – Woodland Meadows Landfill
SRN M4449

Test Date: May 16, 2024 & June 18-20, 2024

ICT Project No.: 2400122

July 01, 2024

IMPACT COMPLIANCE & TESTING

Report Certification

AIR EMISSION TEST REPORT
FOR THE
VERIFICATION OF AIR POLLUTANT EMISSIONS
FROM ENCLOSED FLARES AND
OPEN FLARE DEMONSTRATIONS

Woodland Meadows RDF – Woodland Meadows Landfill
Wayne, MI

Report Certification

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

Impact Compliance & Testing, Inc.

Andrew Eisenberg
Project Manager

Table of Contents

1.0	**INTRODUCTION**	**1**
2.0	**SUMMARY OF TEST RESULTS AND OPERATING CONDITIONS**	**3**
	2.1 Purpose and Objective of the Tests	3
	2.2 Operating Conditions During the Compliance Tests	3
	2.3 Summary of Air Pollutant Sampling Results	3
3.0	**SOURCE AND SAMPLING LOCATION DESCRIPTION**	**6**
	3.1 General Process Description	6
	3.2 Rated Capacities and Air Emission Controls	6
	3.3 Sampling Locations	6
4.0	**SAMPLING AND ANALYTICAL PROCEDURES**	**7**
	4.1 Summary of Sampling Methods	7
	4.2 Exhaust Gas O_2 Determination (USEPA Method 3A)	7
	4.3 Exhaust Gas Moisture Content (USEPA Method 4)	8
	4.4 Measurement of NMOC (USEPA Method 25A / ALT-097)	8
	4.5 Visual Determination of Fugitive Emissions from Material Sources and Smoke Emissions from Flare (USEPA Method 22, Alternative 42)	8
	4.6 Determination of Net Heating Value of the Landfill Gas (USEPA Method 3C, Alternative 42)	9
	4.7 Volumetric Flow Rate (USEPA Method 2D, Alternative 55)	9
5.0	**QA/QC ACTIVITIES**	**10**
	5.1 Gas Divider Certification (USEPA Method 205)	10
	5.2 Instrumental Analyzer Interference Check	10
	5.3 Instrument Calibration and System Bias Checks	10
	5.4 Determination of Exhaust Gas Stratification	11
	5.5 System Response Time	11
	5.6 Methane/NMHC Separation Study	11
	5.7 Meter Box Calibrations	11
	5.8 Open Flare Testing QA/QC Procedures	12
	5.9 Laboratory QA/QC Procedures	12
6.0	**RESULTS**	**13**
	6.1 Test Results and Allowable Limits	13
	6.2 Variations from Normal Sampling Procedures or Operating Conditions	13

List of Tables

2.1 Average enclosed flare operating conditions during the test periods 4

2.2 Average open flare operating conditions during the compliance demonstration 4

2.3 Measured air pollutant concentrations for the enclosed flare (three-test average) 4

2.4 Average measured opacity for the open flare 5

6.1 Measured exhaust gas conditions and air pollutant concentrations for the enclosed flare (EUSOUTHENCLOSED1).. 14

6.2 Measured exhaust gas conditions and air pollutant concentrations for the enclosed flare (EUSOUTHENCLOSED3).. 14

6.3 Measured exhaust gas conditions and air pollutant concentrations for the enclosed flare (EUSOUTHENCLOSED4).. 15

6.4 Measured exhaust gas conditions and air pollutant concentrations for the enclosed flare (EUSOUTHENCLOSED2).. 15

6.5 Measured exhaust gas conditions and air pollutant concentrations for the enclosed flare (EUVBENCLOSED1) 16

6.6 Open flare demonstration summary (EUNORTHSTICK).. 16

6.7 Open flare demonstration summary (2000SCFMOPENFLARE)...................................... 17

List of Appendices

APPENDIX 1	ENCLOSED FLARE OPERATING RECORDS
APPENDIX 2	DIAGRAMS OF SAMPLING LOCATIONS
APPENDIX 3	ENCLOSED FLARE O_2 AND NMOC CALCULATIONS
APPENDIX 4	INSTRUMENTAL ANALYZER RAW DATA
APPENDIX 5	ENCLOSED FLARE MOISTURE CALCULATIONS AND DATA SHEETS
APPENDIX 6	OPEN FLARE DEMONSTRATION FIELD DATA SHEETS
APPENDIX 7	OPEN FLARE INLET GAS SAMPLE LABORATORY REPORT
APPENDIX 8	OPEN FLARE NET HEATING VALUE CALCULATIONS
APPENDIX 9	QA/QC RECORDS

1.0 Introduction

Woodland Meadows RDF (WM RDF) operates landfill gas (LFG) enclosed flares identified as emission units EUSOUTHENCLOSED1, EUSOUTHENCLOSED2, EUSOUTHENCLOSED3, EUSOUTHENCLOSED4, and EUVBENCLOSED1 and two (2) LFG open flares identified as emission unit EUNORTHSTICK and 2000SCFMOPENFLARE (the 2000 scfm open flare has not yet been named in the ROP so we will refer to it as 2000SCFMOPENFLARE throughout this report), in Wayne, Wayne County, Michigan. The flares are fueled by LFG that is recovered from the Woodland Meadows Landfill.

The State of Michigan Department of Environment, Great Lakes, and Energy – Air Quality Division (EGLE-AQD) has issued to WM RDF a Renewable Operating Permit (MI-ROP-M4449-2024) for operation of the facility, which consists of:

- Five (5) enclosed flares identified as emission units EUSOUTHENCLOSED1-4 & EUVBENCLOSED1; and
- Two (2) open flares identified as emission unit EUNORTHSTICK and 2000SCFMOPENFLARE.

Air emission compliance testing was performed pursuant to MI-ROP-M4449-2024. Conditions of MI-ROP-M4449-2024 for EUSOUTHENCLOSED1-4, EUVBENCLOSED1, EUNORTHSTICK, and 2000SCFMOPENFLARE state:

1. *Within 180 days of permit issuance, the permittee must verify visible emissions, and exit velocity from EUNORTHSTICK and (2000SCFMOPENFLARE) and at a minimum, every five years from the date of the last test, thereafter…*

2. *Within 180 days of permit issuance, the permittee must verify the NMOC weight-percent efficiency or ppmv by volume outlet concentration level from EUVBENCLOSED1, EUSOUTHENCLOSED1, EUSOUTHENCLOSED2, EUSOUTHENCLOSED2, EUSOUTHENCLOSED3, and EUSOUTHENCLOSED4 and at a minimum, every five years from the date of the last test, thereafter…*

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 Andrew Eisenberg and Blake Beddow performed the field sampling and measurements on June 18-20, 2024, and Blake Beddow and Scott Herron performed the open flare demonstrations on May 16, 2024.

The enclosed flare performance tests consisted of triplicate, one-hour sampling periods for non-methane organic compounds (NMOC, as non-methane hydrocarbons (NMHC)). Exhaust gas moisture and oxygen (O_2) content were determined for each test period to calculate NMOC concentrations, corrected to parts per million by volume, dry basis (ppmvd) as hexane @ 3% O_2, for comparison to the permit limit.

The open flare demonstrations consisted of one (1) 30-minute observation (visible emissions) and sampling period (inlet gas sampling).

The exhaust gas sampling and analysis was performed using procedures specified in the Stack Test Protocols dated April 17,2024, and May 6, 2024, that was reviewed and approved by EGLE-AQD. Mr. Jonathan Lamb of EGLE-AQD observed portions of the compliance testing.

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

Andrew Eisenberg	Mr. James Bobby Reese
Project Manager	District Engineer
Impact Compliance & Testing, Inc.	Woodland Meadows RDF
37660 Hills Tech Drive	5900 Hannan Road
Farmington Hills, MI 48331	Wayne, MI 48184
(734) 357-8046	(734) 292-6927
Andrew.Eisenberg@impactCandT.com	Jreese4@wm.com

2.0 Summary of Test Results and Operating Conditions

2.1 Purpose and Objective of the Tests

Conditions of MI-ROP-M4449-2024, require WM RDF to test the enclosed flares (EUSOUTHENCLOSED1-4 & EUVBENCLOSED1) for NMOC concentration and perform an open flare demonstration for the open flares (EUNORTHSTICK and 2000SCFMOPENFLARE) within 180 days of permit issuance. EUVBENCLOSED1, EUSOUTHENCLOSED1, EUSOUTHENCLOSED2, EUENCLOSED3, EUENCLOSED4, EUNORTHSTICK, and 2000SCFMOPENFLARE were tested during these compliance test events.

2.2 Operating Conditions During the Compliance Tests

The enclosed flare testing was performed while EUVBENCLOSED1 and EUSOUTHENCLOSED1-4 operated at a maximum achievable operating capacity based on the amount of LFG that was available at the time of testing. WM RDF representatives provided fuel use (standard cubic feet per minute, scfm) and enclosed flare combustion zone chamber temperature (°F) were recorded by WM RDF representatives in 15-minute increments for each test period via their Yokogawa data logger.

LFG fuel methane content (%) and heating value (MBtu/hr), were also recorded by WM RDF representatives once per test period.

Appendix 1 provides operating records provided by WM RDF representatives for the enclosed flare test periods.

Average LFG fuel flowrate, LFG fuel methane content, calculated heating value, and combustion zone chamber temperature for the enclosed flare is presented in Table 2.1 and Table 6.1.

The open flare testing was performed while EUNORTHSTICK and 2000SCFMOPENFLARE operated at a maximum achievable operating capacity based on the amount of LFG that was available at the time of testing. ICT representatives recorded fuel use (scfm), combustion temperature (°F), and methane content (%) at the beginning and end of the open flare demonstration.

Average LFG fuel flowrate for the open flare is presented in Table 2.2 and Table 6.2.

2.3 Summary of Air Pollutant Sampling Results

The gas exhausted from the sampled LFG fueled enclosed flares (EUVBENCLOSED1 and EUSOUTHENCLOSED1-4) were sampled for three (3) one-hour test periods during the compliance testing performed June 18-20, 2024, and the open flare demonstration for EUNORTHSTICK and 2000SCFMOPENFLARE consisted of one (1) 30-minute observation (visible emissions) and sampling period (inlet gas sampling), during the compliance testing performed May 16, 2024.

Table 2.3 presents the average measured NMOC concentration for the enclosed flares (average of the three test periods).

Table 2.4 presents the average measured opacity for the open flare.

Test results for each one-hour enclosed flare sampling periods and the open flare demonstrations, and comparison to the permitted limits are presented in Section 6.0 of this report.

Table 2.1 Average enclosed flare operating conditions during the test periods

Enclosed Flare Parameter	EUSOUTH1	EUSOUTH2	EUSOUTH3	EUSOUTH4	EUVB1
LFG fuel use (scfm)	2,277	1,997	2,436	2,383	1,909
LFG fuel methane content (%)	51.5	51.5	51.4	51.6	54.2
Calculated Heating Value (MBtu/hr)	71	62	76	74	63
Combustion zone chamber temperature (°F)	1,650	1,700	1,646	1,650	1,610

Table 2.2 Average open flare operating conditions during the compliance demonstration

Open Flare Parameter	EUNORTHSTICK	2000SCFMOPENFLARE
LFG fuel use (scfm)	233	750
Combustion Temp (°F)	1,222	1,337

Table 2.3 Measured air pollutant concentrations for the enclosed flare (three-test average)

Emission Unit	NMOC
	(ppmvd as hexane @ 3% O_2)
EUSOUTHENCLOSED1	0.51
EUSOUTHENCLOSED2	0.07
EUCOUTHENCLOSED3	0.29
EUSOUTHENCLOSED4	0.07
EUVBENCLOSED1	6.87
Permit Limit	*20*

Table 2.4 Average measured opacity for the open flare

Emission Unit	Opacity
EUNORTHSTICK	0%
2000SCFMOPENFLARE	0%
Permit Limit	*0%**

Note: There must be no visible emissions except for periods not to exceed a total of 5 minutes during any 2 consecutive hours.

3.0 Source and Sampling Location Description

3.1 General Process Description

WM RDF is permitted to operate five (5) enclosed flares (EUVBENCLOSED1 and EUSOUTHENCLOSED1-4) and two (2) open flares (EUNORTHSTICK and 2000SCFMOPENFLARE) at its facility. The units are fueled with LFG and have a natural gas pilot.

3.2 Rated Capacities and Air Emission Controls

EUVBENCLOSED1 has a rated design capacity of 2,400 scfm.

EUSOUTHENCLOSED1-4 have a rated design capacity of 2,500 scfm.

EUNORTHSTICK has a rated design capacity of 680 scfm.

2000SCFMOPENFLARE has a rated design capacity of 2,000 scfm.

The enclosed flares and open flares serve as control devices for LFG at the WM RDF facility. The flares themselves are not equipped with add-on emission control equipment.

3.3 Sampling Locations

The exhaust gas for the enclosed flares is released to the atmosphere through dedicated vertical exhaust stacks with a vertical release point.

The five (5) enclosed flares exhaust stack sampling ports are located in the vertical exhaust stacks, with an inner diameter of 120 inches. The stacks are 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 and satisfies the USEPA Method 1 criteria for a representative sample location.

The five (5) enclosed flares sample port locations were determined in accordance with USEPA Method 1.

Appendix 2 provides a diagram of the enclosed flares emission test sampling locations with actual stack dimension measurements.

The two (2) open flares exhaust gas is released to the atmosphere through dedicated vertical exhaust stacks with a vertical release point.

EUNORTHSTICK has a tip diameter of 6.0 inches and 2000SCFMOPENFLARE has a tip diameter of 8.0 inches.

Appendix 2 provides a diagram of the open flare demonstration sampling location.

4.0 Sampling and Analytical Procedures

The Stack Test Protocols for the air emission testing were 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

EUVBENCLOSED1 & EUSOUTHENCLOSED1-4

USEPA Method 4	Exhaust gas moisture was determined based on the water weight gain in chilled impingers.
USEPA Method 3A	Exhaust gas O_2 content was determined using a paramagnetic instrumental analyzer.
USEPA Method 25A / ALT-097	Exhaust gas NMOC (as NMHC) concentration was determined using a flame ionization analyzer equipped with methane separation column.

EUNORTHSTICK & 2000SCFMOPENFLARE

USEPA Method 22, Alternative 42	Exhaust visible emissions were determined by observation of opacity.
USEPA Method 3C, Alternative 42	Inlet gas carbon dioxide (CO_2), methane (CH_4), nitrogen (N_2), and O_2 were measured by evacuated canister to determine net heating value of the inlet gas.
USEPA Method 2D, Alternative 55	Exhaust gas exit velocity was calculated by flowrate measurements of the inlet gas stream, using a recently calibrated gas meter.

4.2 Exhaust Gas O_2 Determination (USEPA Method 3A)

O_2 content in the five (5) enclosed flares exhaust gas streams was measured continuously throughout each test period in accordance with USEPA Method 3A. 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 enclosed flare 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 analyzer; therefore, measurement of O_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 analyzer continuously and logged data as one-minute averages.

Prior to, and at the conclusion of each test, the instrument was 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 3 provides O_2 calculation sheets. Raw instrument response data are provided in Appendix 4.

4.3 Exhaust Gas Moisture Content (USEPA Method 4)

The moisture content of the five (5) enclosed flares exhaust gas was determined in accordance with USEPA Method 4 using a chilled impinger sampling train. Exhaust gas moisture content measurements were performed concurrently with the instrumental analyzer sampling periods. 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.

Appendix 5 provides moisture content calculations and field data sheets.

4.4 Measurement of NMOC (USEPA Method 25A / ALT-097)

The NMOC concentration in the five (5) enclosed flares exhaust gas streams was measured continuously throughout each test period in accordance with USEPA Method 25A / ALT-097. NMOC pollutant concentration was determined using a Thermo Environmental Instruments, Inc. (TEI) Model 55i Methane / non-methane hydrocarbon (non-methane organic compound) analyzer. The TEI 55i analyzer contains an internal gas chromatograph column that separates methane from non-methane components. The concentration of NMOC 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 alternative test method approving the use of the TEI 55i-series analyzer as an effective instrument for measuring NMOC from LFG fueled sources (ALT-097).

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 NMHC analyzer was not conditioned to remove moisture. Therefore, NMOC 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 3 provides NMOC calculation sheets. Raw instrument response data for the NMHC analyzer is provided in Appendix 4.

4.5 Visual Determination of Fugitive Emissions from Material Sources and Smoke Emissions from Flare (USEPA Method 22, Alternative 42)

ICT conducted a single, 30-minute observation of each open flares exhaust for smoke emissions. ICT observed continuously for 20 minutes, then took a break for six (6) minutes, and resumed observation for another 10 minutes, to ensure completion of the full 30-minute observation period.

Field data sheets for the open flare demonstration are provided in Appendix 6.

4.6 Determination the Net Heating Value of the Landfill Gas (USEPA Method 3C, Alternative 42)

ICT used Method 3C to determine the net heating value and major gases of the LFG used as fuel for the open flares. ICT obtained four (4) 30-minute integrated gas samples (two as duplicates in case of sample dilution) and submitted to AirTECHNOLOGY Laboratories, Inc. (AirTECH) in City of Industry, California. AirTECH analyzed the compliance samples for CO_2, CH_4, N_2, and O_2 per USEPA Method 3C. Net heating values were then calculated based on the gas CH_4 content in accordance with 40 CFR 60.754(e) for the laboratory analyzed samples.

The AirTECH analytical report is presented in Appendix 7. Net heating value calculations for the open flare inlet gas are presented in Appendix 8.

The flare inlet gas (LFG) CH_4 content was also verified on-site using a calibrated Envision 200B series prior to, and after, the laboratory samples were obtained.

4.7 Volumetric Flow Rate (USEPA Method 2D, Alternative 55)

On May 20, 2009, USEPA approved the use of a mass flow meter in place of Method 2C to measure the flow rate to a utility flare. This alternative requires a "recent" calibration for the open flare flow meter. ICT used the open flare flow meter to measure the gas flowrate directed to the open flare. The measured flowrate was then divided by the open flare unobstructed cross-sectional areas to calculate flare tip exit velocity.

5.0 QA/QC Activities

5.1 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.

5.2 Instrumental Analyzer Interference Check

The instrumental analyzer used to measure O_2 has had an interference response test preformed prior to its 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 the analyzer, separately and as a mixture with the analyte that the analyzer is designed to measure. The analyzer exhibited a composite deviation of less than 2.5% of the span for all measured interferent gases. No major analytical components of the analyzer have been replaced since performing the original interference test.

5.3 Instrument Calibration and System Bias Checks

At the beginning of the day of the testing program, an initial three-point instrument calibration was performed for the O_2 analyzer by injecting calibration gas directly into the inlet sample port for the 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 the 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 O_2 instrument was calibrated with USEPA Protocol 1 certified concentrations of O_2 in nitrogen and zeroed using hydrocarbon free nitrogen. The NMHC (NMOC) 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.

5.4 Determination of Exhaust Gas Stratification

A stratification test was performed for each of the enclosed flares exhaust stack. The stainless-steel sample probe was positioned at three (3) sample points across 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 enclosed flare exhaust stack indicated that the measured O_2 concentrations did not vary by more than 5% of the mean across the stack diameter. Therefore, the enclosed flare exhaust gas was considered to be unstratified and the compliance test sampling was performed at a single sampling location within the enclosed flare exhaust stack.

5.5 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.

5.6 Methane/NMHC Separation Study

A demonstration of the TEI Model 55i methane / non-methane hydrocarbon (non-methane organic compound) separation efficiency was performed onsite. The analyzer was challenged with a Certified Standard Spec blend gas containing 995.1 ppmv methane and 11.03 ppmv non-methane compounds (specifically propane) for the demonstration. The TEI Model 55i instrumental analyzer was calibrated using certified cylinders of 2,516 ppmv methane and 83.46 ppmv propane. The blend gas was then injected into the analyzer and the measured methane and non-methane concentrations were recorded using a data logger. The measured methane concentration stabilized at 987.40 ppmv and the measured NMHC/NMOC concentration stabilized at 10.90 ppmv. The demonstrations indicate that the non-methane components (propane) did not elute with the methane (i.e., the internal column is highly efficient in separating methane and non-methane compounds).

5.7 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 940A temperature calibrator.

Appendix 9 presents test equipment quality assurance data (instrument calibration and system bias check records, calibration gas certifications, interference test results, meter box calibration records, and field equipment calibration records).

5.8 Open Flare Testing QA/QC Procedures

Prior to performing the sampling, the CH_4 content of the collected LFG was verified with a hand-held direct read-out instrument to verify the CH_4 concentration was greater than 40%. ICT prepared the appropriate Chain-of-Custody (COC) forms, as supplied by selected laboratory, prior to shipment of the sample SUMMA® canisters. Information on the COC included facility name, test and canister number, canister initial and final vacuum, ambient temperature and barometric pressure, and requested analytical parameters. The COC form was signed and dated by the person who conducted the sampling.

5.9 Laboratory QA/QC Procedures

ICT submitted the sample for analysis of fixed gases as outlined in USEPA Method 3C to the contract laboratory and directed the contract laboratory to follow the QA/QC procedures as described in 40 CFR 60, Appendix A, USEPA Method 3C.

The vacuum was verified by laboratory personnel upon receipt to confirm sample container integrity.

6.0 Results

6.1 Test Results and Allowable Limits

Enclosed flare operating data and air pollutant concentration measurement results for each one-hour test period are presented in Table 6.1, 6.2, 6.3, 6.4, and 6.5.

Open flare operating data and compliance demonstration results are presented in Table 6.6 and 6.7.

The five (5) enclosed flares have the following allowable limit specified in MI-ROP-M4449-2024:

- 20 ppmvd as hexane @ 3% O_2 for NMOC.

The measured NMOC concentration for the five (5) enclosed flares was less than the allowable limit specified in MI-ROP-M4449-2024.

The two (2) open flares have the following allowable limit specified in MI-ROP-M4449-2024:

- 0% for opacity.

The measured opacity for the open flares was less than the allowable limit specified in MI-ROP-M4449-2024.

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 Protocols.

The testing was performed while the flares operated at a maximum achievable operating capacity based on the amount of LFG that was available at the time of testing. No variations from normal operating conditions occurred during the test periods.

Table 6.1 Measured exhaust gas conditions and air pollutant concentrations for the enclosed flare (EUSOUTHENCLOSED1)

Test No. Test Date Test Period (24-hr clock)	1 6/18/2024 0845-0945	2 6/18/2024 1030-1130	3 6/18/2024 1156-1256	Three Test Average
LFG fuel flowrate (scfm)	2,253	2,283	2,294	2,277
Combustion temperature (°F)	1,648	1,647	1,653	1,650
LFG methane content (%)	52.4	50.9	51.2	51.5
Calculated Net Heating Value (MMBtu/hr)	72	70	71	71
<u>Exhaust Gas Composition</u>				
O_2 content (% vol)	11.9	12.5	12.5	12.3
Moisture (% vol)	12.4	10.8	11.1	11.4
<u>Non-Methane Organic Compounds</u>				
NMOC conc. (ppmv)[1]	0.68	0.36	0.27	0.44
NMOC emissions (ppmvd as C_6)[2]	0.78	0.43	0.32	0.51
NMOC permit limit (ppmvd as C_6)[2]	-	-	-	*20*

1. Measured as non-methane hydrocarbons, as propane.
2. Parts per million by volume, dry basis (ppmvd) as hexane (C_6) @ 3% oxygen.

Table 6.2 Measured exhaust gas conditions and air pollutant concentrations for the enclosed flare (EUSOUTHENCLOSED3)

Test No. Test Date Test Period (24-hr clock)	1 6/18/2024 1415-1515	2 6/18/2024 1549-1608 & 1630-1711	3 6/18/2024 1726-1745 & 1807-1826	Three Test Average
LFG fuel flowrate (scfm)	2,492	2,455	2,361	2,436
Combustion temperature (°F)	1,646	1,646	1,645	1,646
LFG methane content (%)	50.7	51.5	52.1	51.4
Calculated Net Heating Value (MMBtu/hr)	77	77	75	76
<u>Exhaust Gas Composition</u>				
O_2 content (% vol)	11.3	12.4	12.7	12.1
Moisture (% vol)	11.1	10.3	10.1	10.5
<u>Non-Methane Organic Compounds</u>				
NMOC conc. (ppmv)[1]	0.24	0.26	0.26	0.26
NMOC emissions (ppmvd as C_6)[2]	0.26	0.31	0.32	0.29
NMOC permit limit (ppmvd as C_6)[2]	-	-	-	*20*

1. Measured as non-methane hydrocarbons, as propane.
2. Parts per million by volume, dry basis (ppmvd) as hexane (C_6) @ 3% oxygen.

Table 6.3 Measured exhaust gas conditions and air pollutant concentrations for the enclosed flare (EUSOUTHENCLOSED4)

Test No. Test Date Test Period (24-hr clock)	1 6/19/2024 0827-0927	2 6/19/2024 0939-1039	3 6/19/2024 1054-1154	Three Test Average
LFG fuel flowrate (scfm)	2,366	2,386	2,396	2,383
Combustion temperature (°F)	1,648	1,651	1,650	1,650
LFG methane content (%)	50.9	52.1	51.7	51.6
Calculated Net Heating Value (MMBtu/hr)	73	75	75	74
Exhaust Gas Composition				
O_2 content (% vol)	12.3	12.2	12.3	12.3
Moisture (% vol)	11.1	10.6	11.0	10.9
Non-Methane Organic Compounds				
NMOC conc. (ppmv)[1]	0.12	0.04	0.02	0.06
NMOC emissions (ppmvd as C_6)[2]	0.14	0.05	0.03	0.07
NMOC permit limit (ppmvd as C_6)[2]	-	-	-	*20*

1. Measured as non-methane hydrocarbons, as propane.
2. Parts per million by volume, dry basis (ppmvd) as hexane (C_6) @ 3% oxygen.

Table 6.4 Measured exhaust gas conditions and air pollutant concentrations for the enclosed flare (EUSOUTHENCLOSED2)

Test No. Test Date Test Period (24-hr clock)	1 6/19/2024 1310-1410	2 6/19/2024 1432-1532	3 6/19/2024 1546-1646	Three Test Average
LFG fuel flowrate (scfm)	2,067	1,973	1,952	1,997
Combustion temperature (°F)	1,696	1,701	1,703	1,700
LFG methane content (%)	51.6	50.9	52.1	51.5
Calculated Net Heating Value (MMBtu/hr)	65	61	62	62
Exhaust Gas Composition				
O_2 content (% vol)	13.8	13.8	13.9	13.9
Moisture (% vol)	8.7	9.0	8.3	8.7
Non-Methane Organic Compounds				
NMOC conc. (ppmv)[1]	0.08	0.08	0.00	0.05
NMOC emissions (ppmvd as C_6)[2]	0.11	0.10	0.00	0.07
NMOC permit limit (ppmvd as C_6)[2]	-	-	-	*20*

1. Measured as non-methane hydrocarbons, as propane.
2. Parts per million by volume, dry basis (ppmvd) as hexane (C_6) @ 3% oxygen.

Table 6.5 Measured exhaust gas conditions and air pollutant concentrations for the enclosed flare (EUVBENCLOSED1)

Test No. Test Date Test Period (24-hr clock)	1 6/20/2024 1111-1211	2 6/20/2024 1235-1335	3 6/20/2024 1353-1453	Three Test Average
LFG fuel flowrate (scfm)	1,997	1,874	1,856	1,909
Combustion temperature (°F)	1,613	1,603	1,613	1,610
LFG methane content (%)	54.3	54.3	54.0	54.2
Calculated Net Heating Value (MMBtu/hr)	66	62	61	63
<u>Exhaust Gas Composition</u>				
O_2 content (% vol)	14.6	14.5	14.5	14.6
Moisture (% vol)	9.1	9.2	9.1	9.1
<u>Non-Methane Organic Compounds</u>				
NMOC conc. (ppmv)[1]	3.55	5.33	4.40	4.42
NMOC emissions (ppmvd as C_6)[2]	5.59	8.24	6.77	6.87
NMOC permit limit (ppmvd as C_6)[2]	-	-	-	*20*

1. Measured as non-methane hydrocarbons, as propane.
2. Parts per million by volume, dry basis (ppmvd) as hexane (C_6) @ 3% oxygen.

Table 6.2 Open flare demonstration summary (EUNORTHSTICK)

LFG Sampling Sampling Time (24-hr clock)	Test Date: 5/16/2024 On-site 1043-1113	On-site 1122-1152	Laboratory 1122-1152
CH_4 (%)	58.5	58.6	62.0
CO_2 (%)	37.0	37.0	41.0
O_2 (%)	0.7	0.7	ND
N_2 (%)	N/A	N/A	6.5
Balance (%)	3.7	4.4	N/A
Criteria	**Result**	***Limit***	
Visible Emissions	0 minutes	*<5 minutes during observation*	
Net Heating Value	23.38 MJ/m³	*≥7.45 MJ/m³*	
Exit Velocity	19.57 ft/s	*<60 ft/s*	
Operating Conditions	**Start**	**Start**	**Average**
LFG Fuel Use (scfm)	245	216	233
Combustion Temp (°F)	1,224	1,252	1,222

Table 6.2 Open flare demonstration summary (2000SCFMOPENFLARE)

LFG Sampling Sampling Time (24-hr clock)	Test Date: 5/16/2024 On-site 1230-1300	On-site 1309-1339	Laboratory 1230-1300
CH_4 (%)	55.0	55.15	55.0
CO_2 (%)	37.0	36.95	37.0
O_2 (%)	0.40	0.35	2.20
N_2 (%)	N/A	N/A	15.0
Balance (%)	7.60	7.55	N/A
Criteria	**Result**	***Limit***	
Visible Emissions	0 minutes	*<5 minutes during observation*	
Net Heating Value	20.74 MJ/m^3	*≥7.45 MJ/m^3*	
Exit Velocity	36.05 ft/s	*<60 ft/s*	
Operating Conditions	**Start**	**End**	**Average**
LFG Fuel Use (scfm)	759	751	750
Combustion Temp (°F)	1,405	1,234	1,337