

Open Flare Performance Test Report

Prepared for:

**Tri-City Recycling and
Disposal Facility (RDF)**



March 27, 2023



Report Certification

Open Flare Performance Test

Tri-City Landfill

426 North Ruth Road, Carsonville, MI 48419

This document has been reviewed by Tri-City Landfill representatives and approved for submittal to the Michigan Department of Environment, Great Lakes and Energy (EGLE) – Air Quality Division as part of this Open Flare Performance Test Report.

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

Impact Compliance & Testing, Inc.



Max Fierro

Environmental Consultant

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Table 1.1 – Contact Information

Phone Number	Company Name	Address
734-937-1397	ICT	4180 N. Lincoln Rd. B Hall, MI
734-937-1398	ICT	1700 Hills Road SW Lansing, MI 48202
616-634-8800	Waste Management	100 W. River Street Grand Haven, MI

The name, address and telephone number of those involved with the open data test are listed in Table 1.1 below.

The test was performed as required by the facility's Title V Permit. The test was performed in accordance with EPA Method 19 and EPA Method 19A. The test was performed by the City of Grand Haven, Michigan, in accordance with the test protocol. The test was performed on March 13, 2023. The test results are provided in Table 5.1. The test was performed in accordance with the test protocol. The test was performed in accordance with the test protocol. The test was performed in accordance with the test protocol.

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1 Introduction

The Tri-City Recycling and Disposal Facility (Tri-City RDF) is owned and operated by Waste Management located in Carsonville, Michigan. Tri-City RDF retained Impact Compliance & Testing (ICT) to conduct an open flare performance test on Tri-City RDF's open flare (EUOPENFLARE). The open flare is utilized as a control system for the landfill gas (LFG) collection system which captures LFG generated within the landfill.

The test was performed as required by the facility's Title V Permit MI-ROP-N6007-2022 in accordance with FGOPENFLARE-000 Condition V and FGOPENFLARE-AAAA Condition V. Tri-City RDF is required to demonstrate compliance with 40 CFR 60.18 and 40 CFR 63.11 by conducting a performance test no later than 180-days (March 13, 2023) after permit re-issuance (September 13, 2022). ICT conducted the field work on March 9, 2023 in accordance with the previously referenced regulations and the test plan submitted to the Michigan Department of Environment, Great Lakes and Energy (EGLE) on February 6, 2023.

The names, addresses and telephone numbers of those involved with the open flare testing are listed in Table 1.1 below:

Table 1.1 – Contact Information

Name and Title	Company/Address	Phone Number
Steve Walters, District Engineer	Waste Management 600 W Silver Bell Rd. Orion, MI	586-634-8085
Tyler Wilson, Sr. Project Manager	ICT 37660 Hills Tech Dr. Farmington Hills, MI	734-357-8046
Max Fierro, Environmental Consultant	ICT 4180 Keller Rd. Ste B Holt, MI	734-357-8397

2 Summary of Results

The Tri-City RDF open flare serves as the control device for the LFG collection system which captures LFG generated within the landfill. The flare is designed to meet the performance requirements of 40 CFR 60.18 at flows up to 1,000 scfm. The flare operated at an average measured inlet volumetric flow rate of approximately 169 scfm during the testing.

The results of the tests were:

- Visible emissions: no accumulated emission time,
- Average net heating value of the gas being combusted: 21.50 mega joules per standard cubic meter (MJ/m³), and
- Average exhaust gas exit velocity: 7.95 feet per second (ft/sec).

The performance criteria are less than 5 minutes visible emissions in a 30-minute period, a net heating value of greater than 7.45 MJ/m³, and a maximum exit velocity less than 60 ft/sec.

The test results demonstrate the Tri-City RDF open flare meets the performance requirements of 40 CFR 60.18, and thus also satisfies the requirements of 63.1959(b)(2)(iii)(B)/62.16714(c)(2) at the test flow rate.

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3 Sampling and Analytical Procedures

ICT conducted the measurements in accordance with USEPA approved alternative methods as explained in the test plan. A copy of the approved test plan is included in Appendix A. The test procedures are as summarized below:

3.1 Visual Determination of Fugitive Emissions from Material Sources and Smoke Emissions from Flares (Method 22, Alternative 42)

ICT conducted a single, 30-minute, non-continuous observation of the flare exhaust for smoke emissions. ICT observed continuously for 15 minutes, then took a break for 5 minutes, and resumed observation for another 15 minutes, to ensure completion of the full 30-minute period of observation time. A copy of Method 22 observation data is presented in Appendix B.

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

ICT used Method 3C to determine the net heating value of the landfill gas. ICT conducted two (2) 30-minute tests, one sample collected for backup, and submitted the samples to ALS Environmental (ALS), Simi Valley, California. ALS analyzed the sample for carbon dioxide (CO₂), methane (CH₄), nitrogen (N₂), and oxygen (O₂). The ALS laboratory analytical report is presented in Appendix C. Net heating values were then calculated in accordance with 40 CFR 63.1959(d)/62.16718(d) for the laboratory analyzed sample. The net heating value calculations have been included in Appendix D.

3.3 Stack Gas Velocity and Volumetric Flow Rate (Method 2C, 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 stipulated the calculation had to be 'recent.' ICT used the flare flow meter to measure the flow rate at the flare. The flare's exhaust velocity calculations have been included in Appendix D.

4 Test Results and Discussion

ICT performed the performance testing in accordance with the test methods as proposed in the open flare test plan. Mr. Max Fierro performed the testing as detailed below. The flare operated as designated with no upset conditions during the test, therefore no re-testing was required. Additionally, during the three months prior to the test there was no significant maintenance activities performed on the non-enclosed flare. Find below a detailed discussion of the test methods utilized and discussion of the results and compliance status of the non-enclosed flares.

4.1 Method 22, Alternative 42

Visible emissions testing by Method 22, Alternative 42 was performed by Mr. Fierro of ICT. Mr. Fierro observed continuously for 15 minutes, took a break for 5 minutes and resumed observation until the full 30-minute period of observation was complete. A copy of Mr. Fierro's observations including weather conditions and wind direction during the test are included with the field forms in Appendix B. No visible emissions were observed during either 15-minute period for the flare and therefore it is compliant with 40 CFR 60.18(f)(1) which requires less than 5 minutes of visible emissions during a 30-minute test period. The field readings are included in the field data provided in Appendix B.

4.2 Method 3C, Alternative 42

The net heating value of the gas being combusted in the flare was performed in accordance with Method 3C, Alternative 42. Mr. Fierro performed the LFG sampling. During the performance test, two (2) gas samples were taken using 6-L Summa canisters and sent to ALS for analysis (one as a back-up). In addition, two (2) methane readings were taken using an Envirovision gas analyzer at the common header prior to the flare. The gas readings were taken prior to and after the collection of the LFG sample.

The results of the gas readings and laboratory analytical results are detailed in Table 5.1 below:

Table 5.1 – LFG & Analytical Results

Date	Time	CH ₄ (%)	CO ₂ (%)	O ₂ (%)	Balance (%)	Heating Value (MJ/m ³)
3/9/2023	13:19	56.0	32.8	0.5	13.6	21.91
3/9/2023 (Laboratory Analysis)	13:21-13:51	53.5	32.8	1.25	12.4	20.93 (calculated)
3/9/2023	14:05	55.4	32.5	0.6	11.5	21.67

Sample calculations of the net heating value in accordance with 40 CFR 60.18(f)(3) can be found in Appendix D. As detailed in the above table and supporting calculations the net heating value for the LFG combusted in the flare is at least 7.45 MJ/m³ and therefore is compliant with 40 CFR 60.18(f)(3).

4.3 Method 2C, Alternative 55

The actual exhaust velocity of the flare was determined by Method 2C, Alternative 55. During the testing period the flow rate to the flare was monitored by a mass flow meter and recorded in 5-minute intervals. The exhaust velocity was then determined by dividing the volumetric flow rate by the unobstructed cross-sectional area of the flare tip. The exhaust velocity at the beginning and end of the testing period are provided in Table 5.2 below:

Table 5.2 – Exhaust Velocity Readings

Date	Time	Flow (scfm)	Exit Velocity (ft/sec)
3/9/2023	13:20	166	7.93
3/9/2023	14:05	167	7.97

Sample calculations of the flare exhaust velocity calculations and recorded flow information are included in Appendix D. As detailed in the above table and supporting calculations, the actual exhaust velocity is less than 60 ft/sec and is therefore in compliance with 40 CFR 60.18(f)(4)(i).

4.4 Conclusions

The test results demonstrate the Tri-City RDF open flare meets the performance requirements of 40 CFR 60.18, and thus also satisfies the requirements of 40 CFR 63.1959(d)/62.16718(d) at the test flow rate.

Appendix A

Open Flare Performance Test Plan



MICHIGAN DEPARTMENT OF ENVIRONMENT, GREAT LAKES, AND ENERGY
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 Environment, Great Lakes, and Energy, Air Quality Division upon request.

Source Name Tri-City Landfill County Sanilac
Source Address 426 North Ruth Road City Carsonville
AQD Source ID (SRN) N6007 ROP No. MI-ROP-N6007-2022 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:
Open Flare Performance Test Plan

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

John G... SE DISTRICT MANAGER 810-343-9231
Name of Responsible Official (print or type) Title Phone Number
[Signature] 2-6-2023
Signature of Responsible Official Date

* Photocopy this form as needed.



February 6, 2023

EGLE – Technical Programs Unit
Constitution Hall, 2nd Floor South
525 W. Allegan Street
Lansing, MI 48909-1502

Subject: Non-Enclosed Flare Performance Test
Tri-City Landfill
MI-ROP-N6007-2022

On behalf of our client, Tri-City Landfill, Impact Compliance & Testing, Inc. (ICT) is submitting this test plan for the compliance performance demonstration test for one (1) non-enclosed flare/open flare (Emission Unit ID: EUOPENFLARE). The purpose of this document is to notify the State of Michigan Department of Environment, Great Lakes, and Energy – Air Quality Division (EGLE-AQD) of the proposed sampling date and provide the required source and sampling program information.

The demonstration/sample collection is tentatively scheduled for March 9, 2023, pending EGLE-AQD approval of this test plan. Please provide confirmation if the March 9, 2023 test date is approved.

Under 40 CFR 62.16714(c)/63.1959(b), Tri-City Landfill is required to demonstrate compliance with 40 CFR 60.18(f) by conducting a performance test no later than 180-days of permit re-issuance and at a minimum, every 5-years from the date of the last test, thereafter. Tri-City Landfill is also required to evaluate visible emissions from EUOPENFLARE within 180-days of permit re-issuance and at a minimum, every 5-years from the date of the last test, thereafter, in accordance with 40 CFR 60.18(f)(1) and 40 CFR 62.16714(c)(1)/63.1959(b)(2)(iii)(A).

This test plan has been formatted in accordance with the EGLE-AQD "Format for Submittal of Source Emission Test Plans and Reports (November 2019) as follows:

1. Identification and brief description of the source to be tested:
 - a. Names, address and telephone numbers of the facility and consultant/personnel who will perform the test:

Name and Title	Company/Address	Phone Number
Steve Walters District Engineer	WM 600 West Silver Bell Road Orion, MI	(586) 634-8085
Tyler J. Wilson Sr. Project Manager	ICT 37660 Hills Tech Dr. Farmington Hills, MI	(734) 357-8046

- b. Expected test date: March 9, 2023
 - c. Type of Facility: Municipal Solid Waste (MSW) Landfill with active gas collection and control system (GCCS).
 - d. Type and quantity of raw and finished materials used in process, description of any cyclical or batch operations, which would tend to produce variable emissions with time: The raw material involved is landfill gas (LFG) produced due to decomposition of waste material. There is no finished product, as this is not a production operation. There are no cyclical or batch operations.
 - e. Basic operating parameters used to regulate process: The GCCS is operated in general conformance with the parameters as listed in 40 CFR 62.16716/63.1958.
 - f. Rated capacity of the process: Not Applicable
2. A brief description of any air pollution control equipment associated with the process:
- a. Type of control device: Not Applicable
 - b. Operating parameters: Not Applicable
 - c. Rated capacity and efficiency: Not Applicable
 - d. Any maintenance activity on the air pollution control equipment within the last three months: Not Applicable
3. Applicable facility SRN, permit number and emission limits for the process to be tested: Tri-City Landfill operates under the State of Michigan Renewable Operating Permit No. MI-ROP-N6007-2022. This test is being conducted for performance demonstration purposes; therefore, emission limit discussion is not applicable.

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4. Identify all pollutants to be measured: Carbon dioxide, methane, nitrogen, and oxygen will be collected using Method 3C Alternative 42.
5. Describe in detail the sampling and analysis procedures: The sample collection and analysis methods will include the following:

The purpose of this test plan is to demonstrate the non-enclosed flares at Tri-City Landfill meets the performance requirements of 40 CFR 60.18 and thus follows 40 CFR 62.16714(c)(1)/63.1959(b)(2)(iii)(A), as noted in the table below.

Emission Unit	Test Parameter	Applicable Limitation
EUOPENFLARE	Visible Emissions in a two-hour period	<5 minutes over 2-hours ¹
	Flare inlet gas net heating value (MJ/scm)	>7.45 ²
	Flare exhaust gas velocity (ft/sec)	<18.3 m/sec (60 ft/sec) ³

MJ: mega joules

scm: standard cubic meters

¹ 40 CFR 60.18(c)(1)

² 40 CFR 60.18(c)(3)(ii)

³ 40 CFR 60.18(c)(4)(iii)

The standard test method(s) which are used to demonstrate compliance with the above requirements for the non-enclosed flares are noted in the table below.

Test Parameter	USEPA Method	Analysis Description	Number of Sampling Runs
40 CFR 60.18 Appendix A, Method 22 shall be used to determine the compliance of flares with the visible emission provisions of this subpart.	USEPA Method 22	Visible emissions	1 (2-hours)
40 CFR 60.18(f)(3) – The net heating value of the gas being combusted in a flare shall be calculated using the following equation:	USEPA Method 3C	Carbon dioxide, methane, nitrogen, oxygen and moisture fraction with GC/TCD	3 (30 mins each)

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Test Parameter	USEPA Method	Analysis Description	Number of Sampling Runs
$H_T = K \sum_{ni=1} C_i H_i$ <p>However, in accordance with 40 CFR 60.754(e), the heating value is calculated from the concentration of methane in the landfill gas as measured by Method 3C.</p>			
<p>40 CFR 60.18(f)(4) – the actual exit velocity of the flare shall be determined by dividing the volumetric flowrate (in units of standard temperature and pressure), as determined by Reference Methods 2, 2A, 2C or 2D, as appropriate by the unobstructed cross-sectional area of the flare tip.</p>	USEPA Method 1A & 2C	Stack gas velocity and volumetric flow rate	3

Within the past few years, several alternatives to the testing methods and or procedures for non-enclosed flares have been approved by USEPA. Tri-City Landfill proposed to use the following alternatives in place of those listed above. These alternatives have been approved by the USEPA. Copies of the USEPA approval letters are included with this notification.

Test Parameter	USEPA Method	USEPA Approved Alternative
<p>40 CFR 60.18 Appendix A, Method 22 shall be used to determine the compliance of flares with the visible emission provisions of this subpart.</p>	USEPA Method 22	<p>On March 13, 2009, USEPA approved a reduction to the required 2-hour visible emissions test using Method 22 to 30 minutes. Alternative 42 states since the alternative method is applicable to other similar facilities in this source category, the approval letter was posted to the USEPA website for use by other interested parties.</p>
<p>40 CFR 60.18(f)(3) – The net heating value of the gas being combusted in a flare shall be</p>	USEPA Method 3C	<p>On March 13, 2008, USEPA approved a reduction to the required three 30-minute Method 3C samples to a single 30-minute test supplemented by 2 methane readings from a Landtec GEM 2000 or similar</p>

Test Parameter	USEPA Method	USEPA Approved Alternative
<p>calculated using the following equation:</p> $H_T = K \sum_{ni=1} C_i H_i$ <p>However, in accordance with 40 CFR 60.754(e), the heating value is calculated from the concentration of methane in the landfill gas as measured by Method 3C.</p>		<p>instrument. Alternative 42 states that since the alternative method is applicable to other similar facilities in this source category, the approval letter would be posted to the USEPA website for use by other interested parties.</p>
<p>40 CFR 60.18(f)(4) – the actual exit velocity of the flare shall be determined by dividing the volumetric flowrate (in units of standard temperature and pressure), as determined by Reference Methods 2, 2A, 2C or 2D, as appropriate by the unobstructed cross-sectional area of the flare tip.</p>	<p>USEPA Method 1A & 2C</p>	<p>On May 20, 2009, USEPA approved the use of a mass flow meter in place of Method 2C to measure the flow rate to the non-enclosed flare. This alternative stipulated the calibration had to be “recent.” Alternative 55 stated that since the alternate method is applicable to other similar facilities in this source category, the approval letter would be posted to the USEPA website for use by other interested parties.</p>

Sampling and Analysis Procedures

ICT personnel will obtain one (1) sample from the sample location with a minimum of 4-liters collected at the header pipe near the inlet of the blower to the flare, prior to the condensate knockout tank and gas blower system. The sample will be representative of the gas stream collected across the entire LFG collection system. The provision for allowing this sampling protocol (from the LFG header pipe) was addressed in the USEPA’s “Municipal Solid Waste Landfill New Source Performance Standard Emission Guidelines – Question and Answers.”

SUMMA® canisters, preconditioned by the contract laboratory with an inert gas (helium) will be used to collect the samples. Teflon® tubing will be connected to a hose barb or other fitting installed on the header pipe and a particulate filter and rotometer will be installed in the sample line between the sample fitting and the canister. The vacuum within the canister, as indicated by an analog vacuum gauge, will be recorded throughout the sampling event. An integrated sample of the LFG will be obtained over a 30-minute period. The sampling will be terminated once the canister is mostly full, with only a slight vacuum remaining (usually around 3-inches of mercury).

At the conclusion of the sampling event, the canister vacuum will be recorded and shipped to the laboratory for analysis. The canister vacuum will be verified by the laboratory to check for leakage during transport.

ICT will direct the contracted laboratory to use Method 3C of 40 CFR 60 Appendix A, "Determination of Carbon Dioxide, Methane, Nitrogen and Oxygen from Stationary Sources" to determine carbon dioxide, methane, nitrogen and oxygen content.

Alternatives to Maximum Rated Capacity

The permitted capacity of the flare is based upon the maximum design capacity. Since the non-enclosed flare performance test is required to demonstrate the flare meets the design criteria for exit velocity and the landfill gas is of specific quality and not for compliance with a mass emission limitation, testing at the maximum available flow rate will be performed, and will not affect the test outcome. Therefore, Tri-City Landfill proposes to perform the flare performance test at a flow rate similar to the current, typical landfill gas flow rate.

6. The number and length of sampling runs, which will constitute a complete test: One (1) 30-minute sample obtained from one (1) location with a minimum of 4-liters.
7. Dimensioned sketch showing all sampling ports in relation to breaching and upstream and downstream disturbances or obstructions of gas flow: Not Applicable.
8. Estimated flue gas conditions such as temperature, moisture and velocity: The LFG is primarily composed of 50% methane and 35% carbon dioxide. Nitrogen and oxygen are present at smaller quantities, approximately 18% and 2%, respectively.
9. Projected process operating conditions during the tests will be run: Sampling will be performed during normal operations of the active gas collection system. The LFG flow data will be provided in the test report to verify the proper operation of the collection system.
10. Description of any process or control equipment data to be collected during the test period: Continuous flow data will be collected for the sampling period from an electronic data system following the sampling event.
11. Description of any monitoring data to be collected during the test period and subsequently reported: ICT will monitor the LFG at the sampling point to ensure the sample collected contains less than 20% nitrogen or 5% oxygen. The laboratory will conduct a Method 3C analysis on the samples to verify the carbon dioxide, methane, nitrogen, and oxygen concentrations.

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12. Field quality assurance/quality control (QA/QC) procedures and chain of custody procedures: Prior to performing the sampling, the methane content of the collected LFG will be verified with a hand-held direct read-out instrument to verify the methane concentration is greater than 40%. ICT will prepare the appropriate Chain-of-Custody (COC) forms, as supplied by selected laboratory, prior to shipment of the sample SUMMA® canisters. Information on the COC will include facility name, test and canister number, canister initial and final vacuum, ambient temperature and barometric pressure and requested analytical parameters. The COC form will be signed and dated by the ICT sampler.
13. Laboratory QA/QC procedures utilized as part of the testing: ICT will sample and analyze audit gas cylinders for fixed gases as outline in Method 3C and direct the contract laboratory to follow the QA/QC procedures as described in 40 CFR 60, Appendix A, Methods 3C. ICT will not assume any role or responsibility of transport of audit gas cylinder to or from the site or with laboratory QA/QC procedures.

Prior to shipment, each canister is leak checked at the laboratory by evacuating the tank with 10-millimeters of mercury (mm Hg) absolute pressure and filled with helium to an absolute pressure of approximately 345 mm Hg and allowed to sit for at least 60-minutes. If no change to the vacuum is observed each tank is considered to have an acceptable pre-test leak check. The vacuum will be verified by laboratory personnel upon receipt to confirm sample container integrity.

If there are any questions regarding this submittal, please contact Tyler Wilson at Tyler.Wilson@ImpactCandT.com or (734) 357-8046.

Sincerely,

Impact Compliance and Testing, Inc.



Tyler J. Wilson
Sr. Project Manager

Enclosure: USEPA Approved Alternate Test Methods

cc: Steve Walters – WM (Electronically)
USEPA Region 5 (Electronically)
EGLE-AQD (via online submittal procedure)



Last Updated: 2/6/23