AIR EMISSION TEST REPORT

Title: TEST REPORT FOR THE VERIFICATION OF ENCLOSED LANDFILL GAS FLARE NMHC REDUCTION EFFICIENCY

Report Date: June 1, 2016

Test Date: April 5-6, 2016

Facility Information	
Name:	Waste Management of Michigan, Inc. Eagle Valley Recycle and Disposal Facility
Street Address:	600 West Silver Bell Rd.
City, County:	Orion, Oakland
SRN:	N3845

Permit / Emission Unit Information	
Operating Permit No.:	MI-ROP-N3845-2015
Emission Units:	Flare #3 and Flare #4

Testing Contractor	
Company:	Derenzo Environmental Services
Mailing Address:	39395 Schoolcraft Rd. Livonia, MI 48150
Phone:	(734) 464-3880
Project No.	1602020

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AIR QUALITY DIV.

DEQ

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY
AIR QUALITY DIVISION

RENEWABLE OPERATING PERMIT REPORT CERTIFICATION

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

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

Source Name: Waste Management of Michigan, Inc. (Eagle Valley) County: Oakland

Source Address: 600 West Silver Bell Rd. City: Orion

AQD Source ID (SRN): N3845 ROP No.: MI-ROP-N3845-2015 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:

Test report for the verification of NMOC exhaust gas concentration from two (2) landfill gas fueled enclosed flares. Initial testing required per 40 CFR Part 60, Subpart WWW. The flares were operated in compliance with the permit conditions or at the maximum achievable firing rate during testing.

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

Charles H. Cassie	Senior District Manager	(248) 391-0990
Name of Responsible Official (print or type)	Title	Phone Number
Signature of Responsible Official		6/2/16 Date

* Photocopy this form as needed.

EQP 5736 (Rev 11-04)

TEST REPORT
FOR THE
VERIFICATION OF ENCLOSED LANDFILL GAS FLARE
NMHC REDUCTION EFFICIENCY

WASTE MANAGEMENT OF MICHIGAN, INC.
EAGLE VALLEY RECYCLE AND DISPOSAL FACILITY

Test Dates: April 5 – 6, 2016

1.0 INTRODUCTION

Waste Management of Michigan, Inc. (WM) operates the Eagle Valley Recycle and Disposal Facility (Eagle Valley RDF) in Orion, Oakland County, Michigan (Facility State Registration No., SRN N3845). Landfill gas (LFG) recovered from the landfill is either treated and used as fuel in reciprocating internal combustion engine (RICE) generator sets, treated and sent to the GM Orion Assembly plant, or combusted in on-site flaring systems.

The facility has been issued Renewable Operating (RO) Permit No. MI-ROP-N3845-2015 for the operation of the landfill, LFG collection and treatment systems, LFG flares, and renewable energy facility. The RO Permit includes two enclosed flares identified as emission units EUENCLOSEDFLARE1 AND EUENCLOSEDFLARE2 (emission group FGENCLOSEDFLARES). These units were located within the footprint of a landfill expansion project that occurred in 2015. Therefore, the existing units were replaced with two enclosed flares that are identified as Flare #3 and Flare #4.

The landfill and associated enclosed flare control devices are subject to the air emission standards specified in 40 CFR §60.752 (the Municipal Solid Waste Landfill New Source Performance Standards, Subpart WWW). Conditions of RO Permit MI-ROP-N3845-2015 specify that: *The permittee shall route all collected non treated gas to the enclosed flare or another control system designed and operated to reduce NMHC by 98 weight-percent or reduce the outlet NMHC concentration to less than 20 ppm by volume, dry basis as hexane at 3 percent oxygen. The enclosed flare shall be operated within the parameter ranges established during the most recent performance test in compliance with §60.754(d).*

The two enclosed flares were tested on April 5-6, 2016 to verify the NMHC reduction efficiency as required in 40 CFR §60.754(d). The testing was performed by Derenzo Environmental Services (DES) personnel Daniel Wilson and Tyler Wilson. The Michigan Department of Environmental Quality (MDEQ) was notified of the test dates but did not have an on-site observer present during the compliance testing. The project was coordinated by Mr. Rich Paajanen, Engineering Manager for the Eagle Valley RDF. The sampling and analysis was performed using procedures specified in the Test Plan that was reviewed and approved by the MDEQ in the March 22, 2016 test plan approval letter.

Questions concerning the source and test report should be addressed to:

Tyler J. Wilson
Livonia Office Supervisor
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39395 Schoolcraft Road
Livonia, MI 48150
Ph: (734) 464-3880

Mr. Rich Paajanen, P.E.
Engineering Manager
Waste Management of Michigan, Inc.
rpaajanen@wm.com
Ph: (248) 640-8292

Report Certification

This test report was prepared by Derenzo Environmental Services based on field sampling data collected by Derenzo Environmental Services personnel. Facility process data were collected and provided by Waste Management Eagle Valley RDF employees or representatives. This test report has been reviewed by Waste Management Eagle Valley RDF representatives and approved for submittal to the MDEQ.

I certify that the testing was conducted in accordance with the specified test methods and submitted test plan unless otherwise specified in this report. I believe the information provided in this report and its attachments are true, accurate, and complete.

Report Prepared By:

Jeff Schlaf

Jeff Schlaf
Environmental Consultant
Derenzo Environmental Services

Reviewed By:

Robert L. Harvey, P.E.
General Manager
Derenzo Environmental Services

A Renewable Operating Permit Report Certification form signed by the source responsible official accompanies this report.

2.0 SUMMARY OF TEST RESULTS AND OPERATING CONDITIONS

2.1 Results and Applicable Emission Standard

Exhaust gas for each enclosed flare was sampled for three (3) one-hour test periods to determine the nonmethane hydrocarbon (NMHC or NMOC) concentration. Exhaust gas oxygen content and moisture were determined for each test period to correct the measured NMHC concentration to dry basis, as-hexane, at 3% oxygen (ppmvd C_6 @3% O_2) for comparison to the NMOC emission reduction standard specified in the MSW Landfill NSPS, 40 CFR §60.754(d).

The measured exhaust gas NMHC concentrations for each enclosed flare satisfied the NMHC emission reduction standard specified in the MSW Landfill NSPS; 20 ppmvd C_6 @ 3% O_2.

Table 2.1 presents the average measured NMHC exhaust concentrations and operating parameters for the two enclosed flares. Measured values for each one-hour test period are presented in Section 6.0.

2.2 Minimum Enclosed Flare Combustion Temperature

Pursuant to the Landfill NSPS (40 CFR §60.758), an enclosed combustor must be operated such that the three-hour average combustion temperature is no more than 28°C (50°F) below the average combustion temperature that was measured during the most recent performance test at which compliance with the NMHC emission standards was determined. The average measured combustion chamber temperature measured during the three (3) one-hour test periods for Flare #3 was 1,596 °F. Therefore, the required minimum three-hour average combustion chamber temperature, based on the results of the April 2016 test event is 1,546 °F.

The average measured combustion chamber testing during the three (3) one-hour test periods for Flare #4 was 1,600 °F. Therefore, the required minimum three-hour average combustion chamber temperature, based on the results of the April 2016 test event is 1,550 °F.

Table 2.1 Summary of enclosed flare test results and operating parameters

Testing Parameter[1]	Flare #3	Flare #4
NMHC conc. (ppmvd C_6 @ 3%O_2)	0.27	0.41
NSPS Standard (ppmvd C_6 @ 3%O_2)	*20*	*20*
Waste gas flowrate (scfm)	885	820
Combustion chamber temp. (°F)	1,596	1,600
Min. combust. chamber temp.[2] (°F)	*1,546*	*1,550*

1. Average for three (3) one-hour test periods, unless noted.
2. Required minimum three-hour average operating temperature based on this test event.

3.0 PROCESS AND CONTROL EQUIPMENT INFORMATION

3.1 General Process Description

The Eagle Valley RDF accepts and landfills municipal solid waste. The anaerobic decomposition of disposed putrescible wastes generates LFG, which is collected using an active gas collection system. The collected LFG is sent to a treatment system prior to end use at the on-site LFG-to-energy facility or sold to the GM Orion Assembly Plant. Excess gas is directed to two enclosed flares, identified as emission units Flare #3 and Flare #4.

3.2 Permit and Applicable Requirements

The facility has been issued RO Permit No. MI-ROP-N3845-2015 for the operation of the landfill, LFG collection and treatment systems, LFG flares, and LFG-fueled engine-generator sets. The RO Permit states that the enclosed flares are subject to the emission reduction standards specified in the MSW Landfill NSPS. An initial performance test is required to demonstrate control device NMHC reduction efficiency for compliance with the MSW Landfill NSPS emission standards (§60.752), which specifies that:

(b)(2) ... the owner or operator shall: (iii) route all of the collected gas to a control system that complies with ...

> *(B) A control system designed and operated to reduce NMOC by 98 weight-percent, or, when an enclosed combustion device is used for control, to either reduce NMOC by 98 weight percent or reduce the outlet NMOC concentration to less than 20 parts per million by volume, dry basis as hexane at 3 percent oxygen. The reduction efficiency or parts per million by volume shall be established by an initial performance test to be completed no later than 180 days after the initial startup of the approved control system using the test methods specified in §60.754(d).*

(2) The control device shall be operated within the parameter ranges established during the initial or most recent performance test. The operating parameters to be monitored are specified in §60.756;

The compliance testing was performed to demonstrate compliance with the enclosed combustor outlet NMOC concentration limit (20 ppmvd C_6 @ 3% O_2).

3.3 Emission Control System Description

The amount of gas required to be controlled in the enclosed flares is dependent on the amount used by the on-site LFG-to-energy facility or sold to the GM Orion Assembly Plant. Gas flow to the flares is controlled by a blower and metering station.

Flare #3 has rated gas throughput of 4,000 scfm and a maximum heat input capacity of 109 million British thermal units per hour (MMBtu/hr).

Flare #4 has rated gas throughput of 1,000 scfm and a maximum heat input capacity of 27 MMBtu/hr.

3.4 Process Operating Conditions During the Compliance Testing

The average waste gas flowrate during the three (3) one-hour test periods for Flare #3 was 885 scfm. The three-hour average combustion chamber temperature was 1,596°F.

The average waste gas flowrate during the three (3) one-hour test periods for Flare #4 was 820 scfm. The three-hour average combustion chamber temperature was 1,600°F.

The flares were operated during the compliance test periods at rates that are representative of typical conditions when landfill gas is being utilized by both the Waste Management Renewable Energy Facility and the GM Orion Assembly plant.

Appendix 1 provides process and control device operating data for the test periods.

4.0 SAMPLING AND ANALYTICAL PROCEDURES

A test protocol was prepared by DES and submitted to the MDEQ prior to performing the compliance test. This section provides a summary of the sampling and analytical procedures that were used during the tests and presented in the test protocol.

Each enclosed flare is a vertical, insulated enclosed combustor that is equipped with sampling ports approximately 72 inches from the exit of the unit.

Appendix 2 provides a general drawing indicating the placement of the sampling ports.

4.1 Enclosed Flare Diluent Gas Content (USEPA Method 3A)

Diluent gas (O_2) content in the enclosed flare exhaust gas stream was measured continuously throughout each test period in accordance with USEPA Method 3A using a Servomex 1440D gas analyzer containing a paramagnetic sensor for O_2.

During each sampling period, a continuous sample of the enclosed flare exhaust gas stream was extracted from the stack using an inconel alloy steel probe connected to a Teflon® heated sample line. The sampled gas was conditioned by removing moisture prior to being introduced to the oxygen analyzer; the measured O_2 content corresponds 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 analyzer continuously and logged data as one-minute averages.

Prior to, and at the conclusion of each test period, the instrument was calibrated using upscale calibration and zero gas to determine analyzer calibration error and system bias (described in Section 5.2 of this report).

Appendix 3 provides test data and field data sheets. A print-out of the recorded instrument response data is provided in Appendix 4.

4.2 Enclosed Flare Exhaust Gas Moisture Content (USEPA Method 4)

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

Moisture train sampling data and calculations are provided in Appendix 3.

4.3 Enclosed Flare Outlet NMHC Concentration (USEPA Method 25A/ALT-097)

NMHC reduction efficiency was determined by measuring the nonmethane hydrocarbon (NMHC) concentration in the enclosed flare exhaust gas. NMHC concentration was measured 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.

Samples of the exhaust gas were delivered directly to the instrumental analyzer using the inconel alloy steel probe, Teflon® heated sample line and a heated-head sample pump. The sample to the NMHC analyzer was not conditioned to remove moisture; NMHC concentrations are measured on a wet gas basis.

The instrumental analyzer was calibrated as described in Method 25A and Sections 5.2 and 5.3 of this report using certified propane concentrations in hydrocarbon-free air to demonstrate detector linearity and calibration drift. Hydrocarbon free air was used as the zero gas.

A print-out of the recorded instrument response data is provided in Appendix 4.

4.4 NMHC Correction Calculations

The measured exhaust gas oxygen and moisture content data were used to correct the average measured NMHC concentration (ppmv propane, C_3) for each one-hour test period to hexane (ppmv C_6) on a dry gas basis at 3% oxygen for comparison to the outlet NMHC emission limit (20 ppmv as hexane, dry basis, corrected to 3% O_2) specified in 40 CFR §60.754(d).

$$C_6 \text{ ppmvd @ 3\% } O_2 = \frac{C_{NMHC}}{R_c} \times \frac{1}{(1\text{-Bws})} \times \frac{(20.9 - 3\%)}{(20.9 - \%O_{2\ dry})}$$

Where: C_{NMHC} = Measured NMHC concentration, as propane, wet basis (ppmv)
R_c = Hexane to propane carbon ratio; 6:3 (R_c=2)
Bws = Volume fraction of water in enclosed flare exhaust gas
$\%O_{2\ dry}$ = Measured O_2 content enclosed flare exhaust gas (% volume, dry basis)

A set of example calculations for Test Period No. 2 on Flare #3 is provided in Appendix 5.

5.0 QA / QC ACTIVITIES

5.1 Sampling System Response Time Determination

The response time of the sampling system was determined 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. For each test period, test data were collected once the sample probe was in position for at least twice the maximum system response time. The TEI Model 55i instrument had a system response time of 30 seconds.

5.2 Instrument Calibration and System Bias Checks

At the beginning of the test day, initial three-point instrument calibrations were performed for the O_2 analyzer by injecting calibration gas directly into the instrument inlet sample port. System bias checks, as described in Methods 7E and 3A, 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 sampling probe prior to the particulate filter and Teflon® heated sample line) and determining the instrument response against the initial instrument calibration readings.

The methane/NMHC instrumental analyzer was calibrated using certified concentrations of propane in hydrocarbon-free air and methane in hydrocarbon free air, and zeroed using hydrocarbon-free air. Analyzer linearity was verified at the beginning of the test day. Appropriate high-range, mid-range, and low-range span gases for propane and methane were introduced to the sampling system through the tee connection installed between the sample probe and the particulate filter.

Analyzer calibration error and drift were determined prior to and following each test period as described in USEPA Method 25A. 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.

5.3 Methane / Non-Methane Separation Efficiency

Alternate test method ALT-097 requires a demonstration of methane to non-methane organic compound separation when using an analyzer equipped with an internal gas chromatograph (GC). Each day onsite, after independently calibrating the TEI 55i analyzer using a certified methane calibration gas and a certified non-methane hydrocarbon calibration gas (propane), the analyzer was

challenged with a certified blend gas containing 10.9 ppmv propane and 1004 ppmv methane. The analyzer response for both methane and propane was within 5% of the expected values (the performance criteria of USEPA Method 25A). These data are provided on the calibration sheets in Appendix 6.

5.4 Gas Divider Certification (USEPA Method 205)

A STEC Model SGD-710C ten-step gas divider was used to obtain intermediate calibration gas concentrations as needed. The ten-step STEC gas divider was NIST certified within the previous 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 delivers 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.

5.5 Meter Box Calibrations

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

The digital pyrometer in the metering console was calibrated using a NIST-traceable Omega® Model CL 23A temperature calibrator.

Appendix 6 presents test equipment quality assurance data (instrument calibration and system bias check records, calibration gas and gas divider certificates, meter box calibration records).

6.0 RESULTS

6.1 Test Results and Operating Temperatures

Tables 6.1 and 6.2 present the measured exhaust gas conditions and NMHC concentrations for each one-hour test period for Flare #3 and Flare #4, respectively.

The average measured exhaust gas NMHC concentrations for each flare satisfied the NMHC emission reduction standard, 20 ppmvd C_6 @ 3% O_2 specified in the MSW Landfill NSPS, 40 CFR §60.754(d).

Pursuant to the Landfill NSPS (40 CFR §60.758), an enclosed combustor must be operated such that the three-hour average combustion temperature is no more than 28°C (50°F) below the average combustion temperature that was measured during the most recent performance test at which compliance with the NMHC emission standards was determined. The average measured combustion chamber testing during the three (3) one-hour test periods for Flare #3 was 1,596 °F. Therefore, the required minimum three-hour average combustion chamber temperature, based on the results of the April 2016 test event is 1,546 °F.

The average measured combustion chamber testing during the three (3) one-hour test periods for Flare #4 was 1,600 °F. Therefore, the required minimum three-hour average combustion chamber temperature, based on the results of the April 2016 test event is 1,550 °F.

6.2 Test Method Deviations

The testing was performed as presented in the March 1, 2016 test protocol in accordance with the procedures specified in USEPA Test Methods 3A, 4, 25A and ALT-097.

Table 6.1 Measured exhaust gas conditions and NMOC concentrations for Flare #3

Date	4/5/2016	4/5/16	4/5/16	3-hr
Test Times (EST)	8:25-9:25	9:50-10:50	11:15-12:15	Avg.
Operating / Test Parameter	Test 1	Test 2	Test 3	Average
Enclosed Flare operating temp. (°F)	1,588	1,600	1,600	1,596
Waste gas flowrate to flare (scfm)	866	905	885	885
Exhaust gas composition				
O_2 content (% vol)	14.6	14.0	14.7	14.4
Moisture (% vol)	5.83	6.51	5.75	6.03
NMOC conc. (ppmv as C_3 H_8)	0.09	0.15	0.32	0.19
NMOC conc. (ppmvd as C_6 @3% O_2)	0.13	0.21	0.49	0.27
NMOC limit (ppmvd as C_6 @3% O_2)	--	--	--	20

Table 6.2 Measured exhaust gas conditions and NMOC concentrations for Flare #4

Date	4/6/2016	4/6/16	4/6/16	3-hr
Test Times (EST)	8:41-9:41	10:05-11:05	11:25-12:25	Avg.
Operating / Test Parameter	Test 1	Test 2	Test 3	Average
Enclosed Flare operating temp. (°F)	1,599	1,600	1,602	1,600
Waste gas flowrate to flare (scfm)	804	829	811	820
Exhaust gas composition				
O_2 content (% vol)	11.6	11.7	11.7	11.7
Moisture (% vol)	8.41	8.16	8.35	8.31
NMOC conc. (ppmv as C_3 H_8)	0.35	0.24	0.22	0.27
NMOC conc. (ppmvd as C_6 @3% O_2)	0.55	0.34	0.35	0.41
NMOC limit (ppmvd as C_6 @3% O_2)	--	--	--	20