1.0 Introduction

Environmental Partners, Inc. performed a series of tests on September 22, 2020 at the Delta Solid Waste Management Authority (DSWMA) Delta County North Landfill located at 5701 19th Avenue North, Escanaba, Michigan. Testing was performed in accordance with the test plan dated June 19, 2020. The purpose of the test was to verify the performance criteria of the non-assisted flare used to control the organic compounds associated with the landfill gas generated from the cells of the municipal solid waste (MSW) north landfill at the Escanaba facility. Testing was performed under representative meteorological and source operating conditions.

The facility is regulated by the New Source Performance Standard (NSPS) for MSW landfills (40 CFR Part 60 subpart WWW). NSPS General Provision §60.18(c) outlines the requirements of a non-assisted flare control device. General Provision §60.8 requires a performance test be completed to demonstrate compliance with the performance requirements listed under §60.18(c).

The test program was coordinated by Don Pyle, Facility Manager of the Delta County Landfill. The test program was conducted by Bruce Connell, of Environmental Partners, Inc.

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2.0 Testing Methodologies and Results

All testing was performed in accordance with the Test Plan dated June 19, 2020, using the test methodologies as detailed in the *Code of Federal Regulations, Title 40 Part 60 Appendix A* as follows:

Test Methods

USEPA Method	Description
2A	Direct Measurement of Gas Volume Through Pipes and Small Ducts
3C	Determination of Carbon Dioxide, Methane, Nitrogen, and Oxygen from Stationary Sources
22	Visual Determination of Fugitive Emissions from Material Sources and Smoke Emissions From Flares

Testing was performed to:

1. Determine the cumulative time of visible emissions observed during the prescribed 2 hour observation period.
2. Determine the exit velocity of the landfill gas at the flare tip.
3. Determine the heat content of the collected landfill gas.

2.1 Visible Emissions Test

Verification of visible emissions was conducted utilizing USEPA Method 22 as described in the *Code of Federal Regulations, Title 40, Part 60, Appendix A*. In accordance with NSPS General Provision §60.18(f)(1), the observation period was two hours. No visible emissions were observed. The Field Data Sheet for the Visible Emission Test is included in Appendix A. A diagram showing the relative positions of the flare and the Method 22 observer is included as Figure 1.

2.2 Flare Exit Velocity Test

The exit velocity of the landfill gases at the flare tip was determined by obtaining more than 3 hours of cumulative volumetric measurements in accordance with US EPA Method 2A, determining the average flow rate, and dividing the standard volumetric flow rate (in units of standard temperature and pressure) by the unobstructed cross sectional discharge area of the flare tip. The diameter of the discharge point of the flare tip is 8 inches. The volumetric flow rate was determined in accordance with US EPA Method 2A using a Fluid Components International (FCI) Model ST51-4G11CA001 in-situ thermal dispersion air flow meter, having an accuracy of ±0.5% of full scale. The exit velocity was determined to be 5.70 feet per second. The flare exit velocity calculations are included in Table 1. The Field Data Sheets for the test are included in Appendix A.

2.3 Net Heating Value Test

In accordance with §60.754(e), three duplicate 30 minute integrated landfill gas samples were taken in sealed Tedlar bags, and one of each duplicate pair was analyzed for methane content per US EPA Method 3C. The net heating value of the collected landfill gas was determined using the average of the methane concentration in the three gas samples, and applying the higher heating value of methane (1014 BTU/ft^3) as described in the reference manual "Combustion – Fossil Power Systems" by Combustion Engineering, 1981. The net heating value of the collected landfill gas was determined to be 382.3 BTU/ft^3. The landfill gas net heating value calculations are shown in Table 1. The Field Data Sheets for the test are included in Appendix A.

3.0 Operating Conditions and Process Data Monitoring

Open Flare Operation

Testing was conducted while the non-assisted flare was operating under representative conditions, in accordance with the test methods and procedures set forth in Michigan Air Pollution Control Rules R336.2003.

Process Monitoring

The following process and control device parameters were monitored and recorded during testing:

1. Control Panel display provided information on the following elements, which were recorded periodically throughout the testing.
   a. Flare Temperature
   b. Inlet Gas Temperature
   c. Blower Amp Draw
   d. Blower Vacuum (in. w.c.)
   e. Gas Flow Valve Position

   During the test the gas flow valve position always read "Open" and the blower amp draw was a constant 4.4 amps.

2. The installed Fluid Components International (FCI) Model ST51-4G11CA001 in-situ thermal dispersion air flow meter was used to measure the flow of landfill gas to the flare throughout the test. This meter is factory calibrated with the most recent calibration was performed on June 10, 2019. The Calibration Certificate is included with the Field Data Sheets in Appendix A.

Table 1

Delta Solid Waste Management Authority
Delta County Landfill

North Landfill Gas (LFG) Test Calculations

Flare Exit Velocity Test

	Time	Meter Volume (std ft^3)
Ending	10:46	11,080,354
Starting	07:34	11,057,414
Difference	03:12	22,940 std ft^3

Flare Exit Tip Diameter = 8 inches Area = $\frac{\pi D^2}{4} = \frac{\pi (8/12)^2}{4} = 0.349$ ft^2

Flare Exit Velocity = $\frac{22{,}940 \text{ std } ft^3}{192 \text{ min}} \times \frac{\text{min}}{60 \text{ sec}} \times \frac{1}{0.349 \text{ } ft^2} =$ 5.70 ft/sec

LFG Net Heating Value Test

Gas Sample ID	%Methane
1A	37.2
2A	37.9
3A	37.9
Average =	37.7%

Higher Heating Value of Methane = 1014 BTU/ std ft^3
(Source: Combustion Engineering – Fossil Power Systems, 1981)

LFG Net Heating Value = 1014 BTU/ std ft^3 x 0.377 = 382.3 BTU/ std ft^3

FIGURE 1
NORTH LANDFILL FLARE LOCATION
Delta Solid Waste Management Assoc.

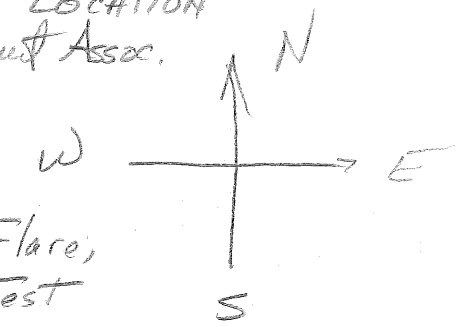
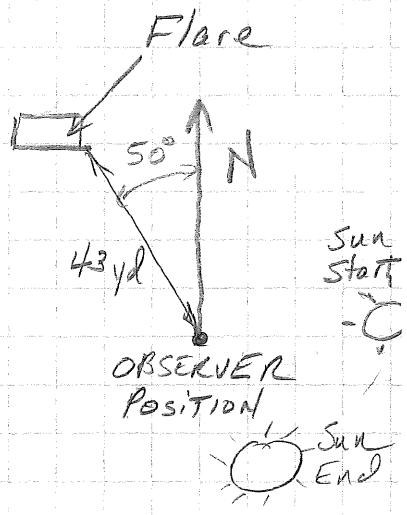


Diagram Depicting the Relative Position of the Flare, Observer, and the Sun During the Method 22 Test

North Landfill



Location
45° 46' 1" N
87° 7' 52" W

← 19TH AVENUE N →

Observation Period — Method 22
07:34 EDST – 10:46 EDST
September 22, 2020
Bruce H. Connell – observer
The location of the sun began to the east of the observer and ended to the southeast, always behind the Observer

FLARE VIEW

From Position of the Observer