NESHAP/Federal Plan Initial Performance Test Report: Utility (Open) Flare

Smiths Creek Landfill
Smiths Creek, Michigan

Prepared for:

Smiths Creek Landfill
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Prepared by:

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September 20, 2024

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1.0 INTRODUCTION

Environmental Information Logistics, LLC (EIL) was retained by the Smiths Creek Landfill (Smiths Creek) to conduct Initial Performance Testing of one new utility (open) flare at the site pursuant to the requirements of the National Emissions Standards for Hazardous Air Pollutants (NESHAP): Municipal Solid Waste Landfills. The facility and new flare are located in Smiths Creek, Michigan. The testing was conducted by EIL on August 21, 2024. The testing was performed to demonstrate conformance of the open flare with the general requirements of 40 CFR 63.11 and 40 CFR 60.18. The requirements of §60.18 and §63.11 include the following:

- The determination of visible emissions at the flare using United States Environmental Protection Agency (USEPA) Method 22, as per 40 CFR 60.18(f)(1) and 40 CFR 63.11(b)(4);
- The determination of net heating value of the landfill gas that is combusted in the flare per 40 CFR 60.18(c)(3)(ii) and CFR 63.11(b)(6)(ii) except as provided in 40 CFR 62.16718(d) and 40 CFR 63.1959(e); and
- The determination of exit velocity, per 40 CFR 60.18(f)(4) and 40 CFR 63.11(b)(6)(i)(B).

EIL submitted a Test Protocol with the date and time of the test to EGLE on July 18, 2024. No comments on the protocol were received from EGLE and no personnel from EGLE were present at the site during the testing.

The active Smiths Creek Landfill is subject to the Landfill NESHAP – 40 CFR 63, Subpart AAAA and the Federal Plan – 40 CFR 62 Subpart OOO. The site recently installed a utility flare in order to supplement gas collection and control odors. The NESHAP and the Federal Plan require that the site conduct an Initial Performance Test on the new flare within 180 days of startup.

Names, addresses and telephone numbers of the persons and companies involved in the testing are as follows:

Facility Contacts:	Matt Williams 6779 Smiths Creek Rd Smiths Creek, MI 48074 (810) 989-6979
Test Personnel:	Laura Niemann (Contact) – (616) 891-2592 Andrew Medaugh (Testing Personnel) – (586) 804-8714 EIL, LLC 130 E. Main Street Caledonia, MI 49316

2.0 SUMMARY OF RESULTS

Operating data for the open flare is provided in the field data and calculated data sheets in Appendix B. The flare combusts landfill gas produced by the decomposing municipal solid waste landfill disposed of within the Smiths Creek Landfill. The open flare location is provided on Figure 1.

The facility's SRN number is N6207. The Smiths Creek Landfill, located at 6779 Smiths Creek Rd, Smiths Creek, MI 48074, was issued a Renewable Operating Permit (No. MI-ROP-N6207-2018) on June 7, 2018. The Emissions Unit ID for the source being tested is EUOPENFLARE2024 pursuant to a draft air construction permit to install (PTI) currently being developed by EGLE AQD.

The following table summarizes the results of the performance testing at the open flare:

Device Name	Results of VE Testing (minutes: seconds of accumulated total visible emissions)	Net Heating Value (BTU/SCF – HHV Basis)	Actual Exit Velocity (feet/second)
Flare 3	0 min: 0 sec	521.9	40.2

The open flare met the performance requirements of 40 CFR 60.18 and 40 CFR 63.11 as discussed later in this test report.

3.0 SOURCE DESCRIPTION

The Smiths Creek Landfill is an active municipal solid waste (MSW) landfill. Municipal, commercial, industrial, construction and demolition debris are all permitted for disposal at the facility. Complex microbial and biochemical reactions occur within the landfill's interior after the waste has been deposited for a period of time. Initial decomposition of the waste is rapid and continues until the entrained oxygen within the refuse is depleted.

The second stage of refuse decomposition is anaerobic, and can be divided into two separate and independent processes: non-methanogenic and methanogenic. Carbon dioxide (CO_2) is a byproduct of the non-methanogenic process and methane (CH_4) is a byproduct of the methanogenic process. These two compounds are the primary constituents of landfill gas; CO_2 content can range from 30% to 50% and CH_4 ranges from approximately 50% to 60%. The production of landfill gas is a continuous process. It begins a few months after initial waste placement and continues until the microbial reactions are limited by substrate or moisture availability.

Multiple control devices installed at this facility have undergone previous performance testing. The new open flare was installed to supplement the control of landfill gas emissions in a discrete area of the landfill (Cell 8).

The open flare is designed to meet the requirements of 40 CFR 60.18 and 40 CFR 63.11 at a flow rate of up to 1,300 standard cubic feet per minute (scfm); however, the facility adheres to a 1,000 scfm restriction on flare operation. Flares designed and operated in accordance with 40 CFR 60.18 and 40 CFR 63.11 are assumed to have a destruction efficiency for NMOC of 98%.

The measured landfill gas flow at the open flare was approximately 840 scfm at the time of the testing. The average gas quality measured in the field was 51.3% methane, 38.0% CO_2, 1.3% oxygen (O_2), and 9.5% balance gas. This is considered typical for landfill gas.

The open flare is equipped with a thermocouple to monitor for the presence of a flame as required by 40 CFR 60.18(f)(2) and 40 CFR 63.11(b)(5).

4.0 SAMPLING AND ANALYTICAL PROCEDURES

EIL conducted testing in accordance with USEPA Reference Test Methods in 40 CFR 60 and 40 CFR 63. Sample collection and analysis methods included:

PARAMETER	TEST METHOD	ANALYTICAL METHOD
Landfill Gas Velocity/Flow Rate; Flare Exit Velocity	Maximum Permitted Exit Velocity equations (40 CFR 60.18(f)(5) and 40 CFR 63.11(b)(7))	Calibrated Flow Meter Data as allowed by USEPA (see July 18, 2024 test protocol)
Gas Composition and Moisture Content; Net Heating Value	USEPA Method 3C (As allowed by 40 CFR 62.16718(d) and 40 CFR 63.1959(e))	Gas Chromatography / Thermal Conductivity (GC/TCD)
Visible Emissions	USEPA Method 22	Visual Observation – two hours

4.1 Landfill Gas Exit Velocity from the Flare Stack

The exit velocity from the flare's stack was determined based on landfill gas flow rates measured by the calibrated (Appendix A) mass flow meter. This alternative method of determining the flow described in 40 CFR 60.18(f)(4) received a blanket approval from the US EPA Office of Air Quality Planning and Standards in a letter to SCS Engineers in 2009. A copy of the determination letter was provided with the Test Protocol submitted on July 18, 2024.

Flow rate data were recorded by the flare's digital data logger and downloaded for the evaluation. The flare operational data is included in Appendix B.

The flow rate to the flare was also manually recorded before and after each Method 3C gas sample run. Those measurements are shown in field data logs included in Appendix B. However, these values were not used in the subsequent calculations because the flow meter data from the data logger were deemed valid.

The average flow rates measured during each sample run by the calibrated flow meter, in standard units of temperature and pressure (see Appendix B), were converted to cubic feet per second, and then divided by the unobstructed cross-sectional area of the flare tip (0.3 ft^2) to determine the exit velocity. The flare tip diameter is 8 inches.

4.2 Determination of CO_2, CH_4, N_2 and O_2 (Field Instrument & USEPA Method 3C)

The determination of fixed gases for calculation of net heating value was conducted using USEPA Method 3C. The technician utilized a calibrated rental Landtec GEM5000 meter to collect and analyze field gas quality from the flare's sample port to provide later verification of laboratory data. Data collected at the flare was recorded on data sheets included in Appendix B.

Three main and one spare 30-minute integrated samples of landfill gas from the sample port were collected by EIL for laboratory analyses using Method 3C. EIL contracted with Enthalpy Analytical to analyze the main samples for CO_2, CH_4, nitrogen (N_2), and O_2 concentrations and moisture fraction using Method 3C. Figure 3 details the Method 3C sample train. Since the three main samples were valid, the fourth sample was not analyzed.

Enthalpy Analytical followed the analytical procedures of Method 3C using a gas chromatograph (GC), with appropriate separation column for the expected parameters, equipped with a thermal conductivity detector (TCD). The Enthalpy laboratory analytical report is provided in Appendix C.

EIL used the averaged Method 3C analytical results to calculate stack gas molecular weight (for use in the allowable stack gas exit velocity calculation), and to calculate the net heating value of the gas being combusted per §63.11(b)(6).

4.3 Visual Determination of Smoke Emissions from Flares (USEPA Method 22)

EIL used Method 22, *"Visual Determination of Fugitive Emissions from Material Sources and Smoke Emissions from Flares,"* to determine the presence and duration of visible emissions.

EIL observed the open flare continuously for 20 minutes, took a break of 5 minutes, and repeated this process until 2 hours of observation time had been accrued. Data for the observation was recorded on the Method 22 data sheets provided in Appendix B.

5.0 RESULTS

EIL did not observe any visible emissions from the flare during the 2 hour observation.

The average net heating value of the gas being combusted at the open flare was 521.9 BTU/SCF (HHV basis), or 19.44 MJ/scm. The requirement for net heating value is that the landfill gas quality for a non-assisted flare be greater than 200 BTU/SCF, which equates to 7.45 MJ/scm 40 CFR [63.11(b)(6)(ii)]. The average net heating values in BTU/scm and MJ/scm are provided in Table 1. Table 3 provides a summary of the major constituents of the landfill gas quality at each flare (CH_4, CO_2, O_2 and N_2) measured in the field using a calibrated rental Landtec GEM 5000 meter, and via laboratory analyses using Method 3C.

Additionally, open flares are required by 40 CFR 60.18 and 40 CFR 63.11 to determine an exit velocity and demonstrate that it is less than Vmax (per 40 CFR 60.18(f)(5)) and 40 CFR 63.11(b)(7)).

$Log_{10}(V_{max})=(H_T+28.8)/31.7$

V_{max}=Maximum permitted velocity, M/sec

28.8=Constant

31.7=Constant

H_T=The net heating value as determined in paragraph (b)(6).

The average exit velocity calculations are provided in Table 2. A calculation page to determine the allowable flare exit velocity is provided in Appendix D. The permitted stack gas exit velocity was 77.6 feet/second. The actual exit velocity of 40.2 feet/second is less than the maximum allowable flare exit velocity. Therefore, the Smiths Creek utility flare meets the requirement of exit velocity.

The results demonstrate that the utility flare tested meet the performance requirements of §60.18 and §63.11, and thus satisfy 40 CFR 62.16714(c)(1) and 40 CFR 63.1959(b)(iii)(A).

EIL did not note any variations and/or anomalies in normal sample collection procedures.

EIL quality assurance (QA) procedures included verification of sufficient evacuation of each Method 3C canister prior to initiation of each sample collection.

Appendix A includes equipment calibration sheets. Lab data used in the determination of the utility flare allowable exit velocity and net heating value and visible emissions observation data are presented in Appendix B. The Method 3C laboratory analytical results and chain-of-custody forms are provided in

Appendix C. Sample calculations are contained in Appendix D. The Responsible Official Certification for the test report is included in Appendix E.

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Report Reviewed by: Laura J. Niemann

Laura Niemann, P.E.
Senior Project Engineer
EIL, LLC

Septebmer 20, 2024

TABLES

Table 1: BTU Determination from Laboratory Testing
Smiths Creek Landfill

Device	Sample Date	Run #2 CH_4 (%)	Run #3 CH_4 (%)	Run #4 CH_4 (%)	Average CH_4 (%)	BTU/SCF (LHV)[1]	BTU/SCF (HHV)[2]	MJ/scm (HHV)
Open Flare	8/21/2024	52.50%	49.90%	52.30%	51.57%	468.7	521.9	19.44

[1]BTU Constant (LHV) = 909 BTU/scf. Landfill Gas BTU/ SCF (LHV) = % CH_4 x 909 BTU/SCF

[2]BTU Constant (HHV) = 1012 BTU/scf. Landfill Gas BTU/ SCF (HHV) = % CH4 x 1012 BTU/SCF

Table 2

Average Exit Velocity Calculation
Smiths Creek Landfill

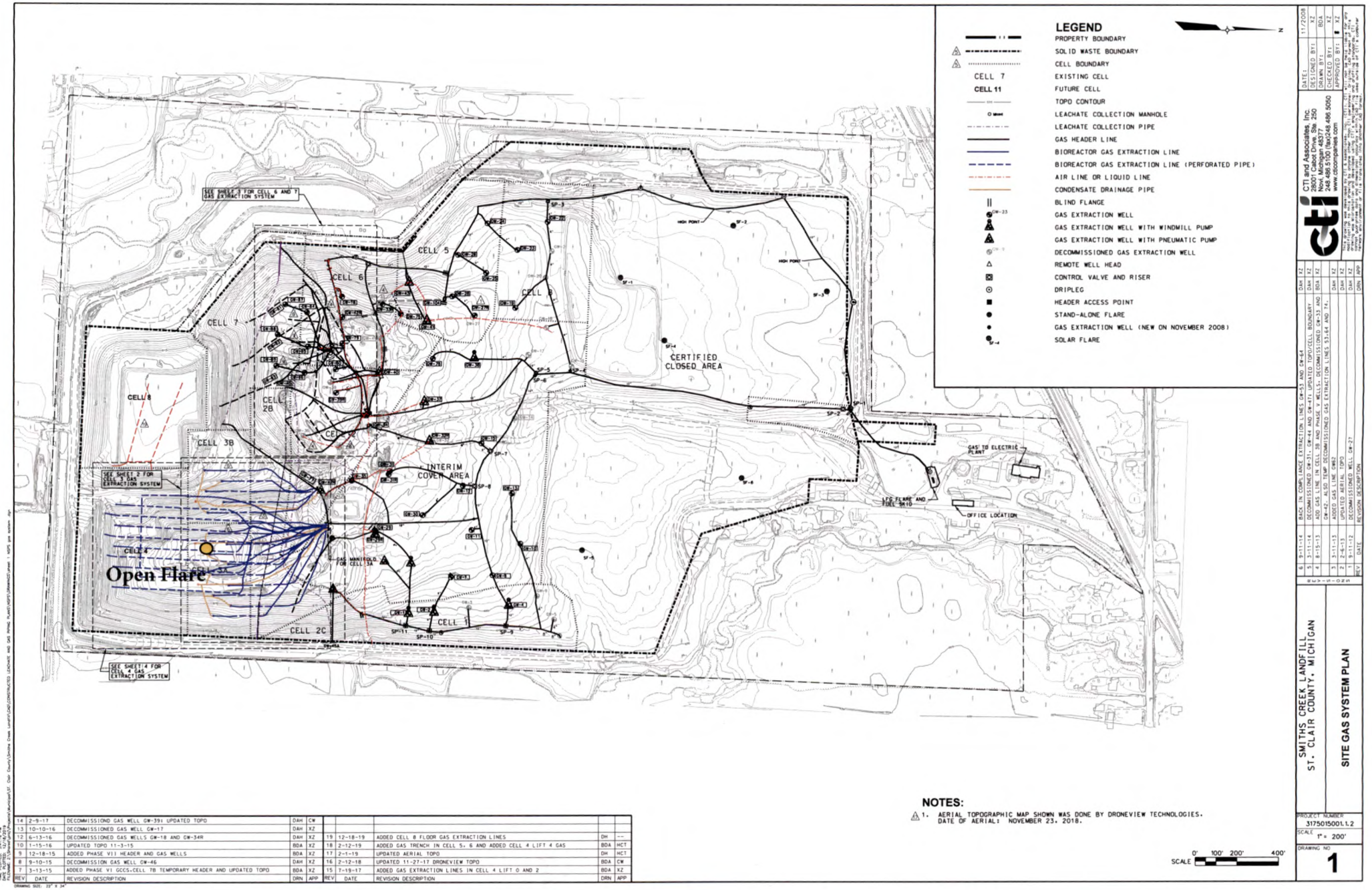
Flare 3	Run 1	Run 2	Run 3	Run 4	Average
Flow Rate (ft^3/min)	849	842	840	836	842
Flow Rate (ft^3/sec)	14.2	14.0	14.0	13.9	14.0
Exit Tip Diameter (in)	8.0	8.0	8.0	8.0	8.0
Exit Tip Cross-Sectional Area (ft^2)	0.3	0.3	0.3	0.3	0.3
Calculated Exit Velocity (ft/sec)	40.5	40.2	40.1	39.9	40.2
Maximum Allowable Exit Velocity (ft/sec)	77.6	77.6	77.6	77.6	77.6

Table 3: Open Flare Landfill Gas Quality Data
Smiths Creek Landfill
Smiths Creek, MI

Sample ID	Sample Date	Sample Time Start	Sample Time End	Ambient Temp (°F)	Initial Tank Pressure ("W.C.)	FinalTank Pressure ("W.C.)	Field Data (%)				Lab Data (ppm)			
							CH_4	CO_2	O_2	Balance Gas	CH_4	CO_2	O_2	N_2
SCL-1	8/21/2024	10:15	10:45	63	-17.5	-4.00	50.7%	38.0%	1.3%	10.0%	Spare Cannister Not Analyzed			
SCL-2	8/21/2024	10:57	11:27	66	-19.0	-4.00	51.6%	38.2%	1.4%	8.9%	525000	370000	17100	101000
SCL-3	8/21/2024	11:38	12:08	67	-19.5	-4.50	51.8%	38.1%	1.3%	8.8%	499000	353000	20400	110000
SCL-4	8/21/2024	12:20	12:50	68	-20.0	-5.00	51.0%	37.6%	1.2%	10.3%	523000	370000	16200	98300
						Averages:	**51.3%**	**38.0%**	**1.3%**	**9.5%**				

FIGURES

Figure 1
Open Flare Location



REV	DATE	REVISION DESCRIPTION	DRN	APP
14	2-9-17	DECOMMISSIOND GAS WELL GW-39I UPDATED TOPO	DAH	CW
13	10-10-16	DECOMMISSIONED GAS WELL GW-17	DAH	XZ
12	6-13-16	DECOMMISSIONED GAS WELLS GW-18 AND GW-34R	DAH	XZ
10	1-15-16	UPDATED TOPO 11-3-15	BDA	XZ
9	12-18-15	ADDED PHASE VII HEADER AND GAS WELLS	BDA	XZ
8	9-10-15	DECOMMISSION GAS WELL GW-46	DAH	XZ
7	3-13-15	ADDED PHASE VI GCCS-CELL 7B TEMPORARY HEADER AND UPDATED TOPO	BDA	XZ
19	12-18-19	ADDED CELL 8 FLOOR GAS EXTRACTION LINES	DH	--
18	2-12-19	ADDED GAS TRENCH IN CELL 5, 6 AND ADDED CELL 4 LIFT 4 GAS	BDA	HCT
17	2-1-19	UPDATED AERIAL TOPO	DH	HCT
16	2-12-18	UPDATED 11-27-17 DRONEVIEW TOPO	BDA	CW
15	7-19-17	ADDED GAS EXTRACTION LINES IN CELL 4 LIFT 0 AND 2	BDA	XZ

REV	DATE	REVISION DESCRIPTION	DRN	APP
6	9-11-14	BACK IN COMPLIANCE EXTRACTION LINES GW-53 AND GW-64	DAH	XZ
5	3-11-14	DECOMMISSIONED GW-31, GW-44 AND GW-47I UPDATED TOPO/CELL BOUNDARY	DAH	XZ
4	8-15-13	ADD GAS LINE IN CELL 3B AND PHASE V WELLS, DECOMMISSIONED GW-33 AND GW-42. ALSO TEMP DECOMMISSIONED GAS EXTRACTION LINES 53,64 AND 74.	BDA	XZ
3	3-11-13	ADDED GAS LINE CW52	DAH	XZ
2	2-6-13	UPDATED AERIAL TOPO	DAH	XZ
1	9-11-12	DECOMMISSIONED WELL GW-27	DAH	XZ

NOTES:

1. AERIAL TOPOGRAPHIC MAP SHOWN WAS DONE BY DRONEVIEW TECHNOLOGIES. DATE OF AERIAL: NOVEMBER 23, 2018.

SCALE 0' 100' 200' 400'

CTI and Associates, Inc.
28001 Cabot Drive, Ste. 250
Novi, MI 48377
248.486.5100 (fax)248.486.5050
www.ctiompanies.com

DATE: 11/2008
DESIGNED BY: XZ
DRAWN BY: BDA
CHECKED BY: XZ
APPROVED BY: XZ

SMITHS CREEK LANDFILL
ST. CLAIR COUNTY, MICHIGAN

SITE GAS SYSTEM PLAN

PROJECT NUMBER
31750150011.2
SCALE
1" = 200'
DRAWING NO
1

Utility Flare Diagram

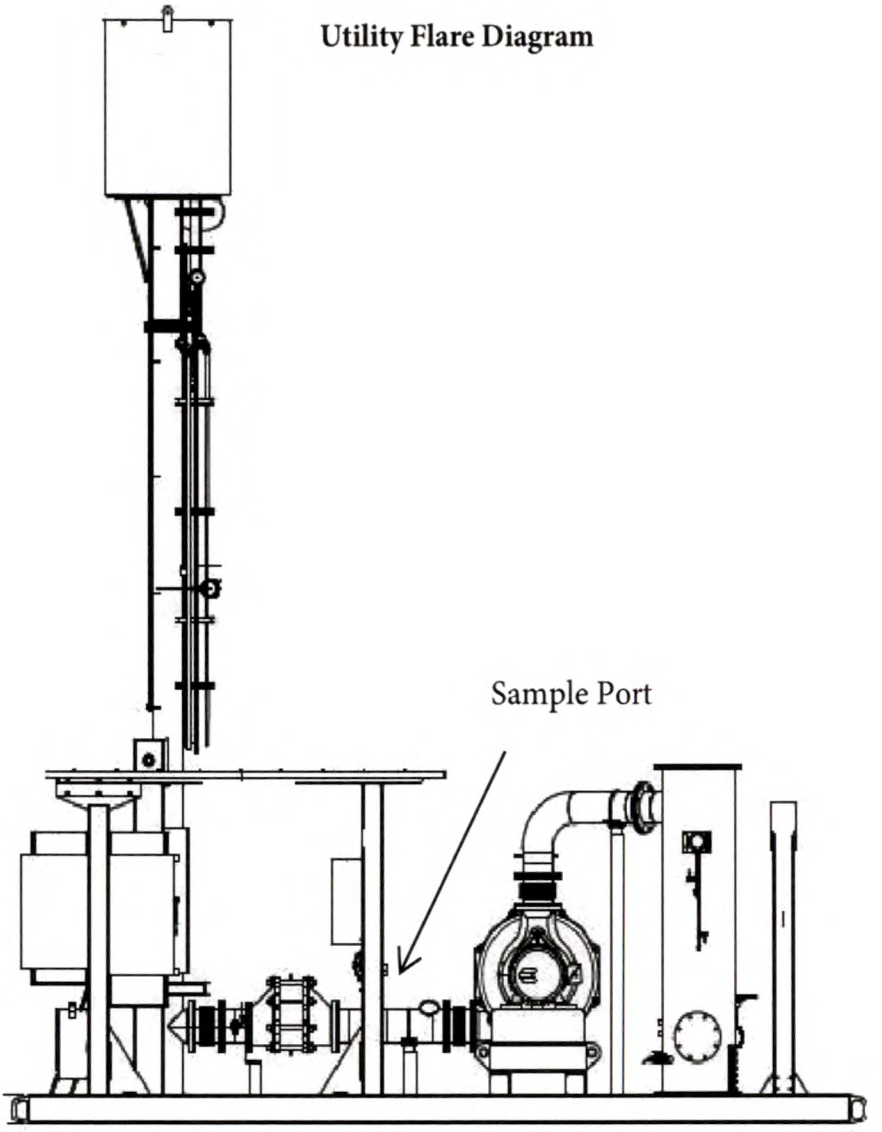


Figure 2

Utility flare diagram and sample port location.

EIL LLC
July 10, 2024

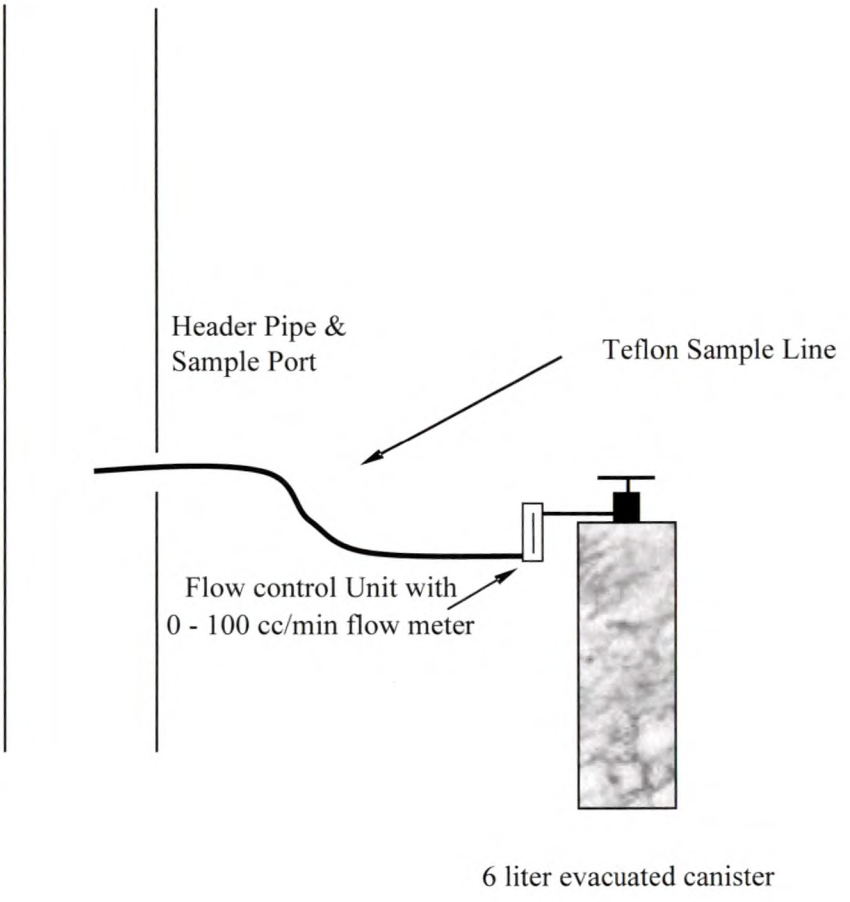


Figure 3
USEPA Method 3C sample train

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July 10, 2024