EXECUTIVE SUMMARY

Chase Young Environmental Testing Inc (CYET) was retained by Brent Run Landfill, Inc (BRL) SRN: N5987 to conduct emission testing at the Source(s) at their facility located at 8335 West Vienna Road in Montrose, Michigan 48457 in Genessee County. The emissions test program was conducted on July 20, 25, and 26, 2023, and was performed in accordance with CYET project number 231656 Emission Test Plan as well as the Michigan Department of Environment, Great Lakes, and Energy (EGLE) Air Quality Division (AQD) acceptance letter.

The test program was conducted to determine compliance with MI-ROP-N5987-2023 issued by the Michigan department of Environment, Great Lakes, and Energy (EGLE). The average combustion temperature of the enclosed flare during testing was 1604°F. The results of the test program are presented in Table 1.

Table 1
Overall Emission Summary
Test Dates: July 20, 25, and 26, 2023

Source	Parameter	Reporting Units	Test Result	Limit
EUENCLOSEDFLARE	NMOC	ppmv, dry as hexane @3% O_2	9.58	20
EUOPENFLARE	Visible Emissions	% opacity	0	0
	Exit Velocity	ft/min	46.1	<60
	Net Heating Value	MJ/m^3	17.55	>7.45

CYET ChaseYoung Environmental Testing

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1. Introduction

Chase Young Environmental Testing Inc (CYET) was retained by Brent Run Landfill, Inc (BRL) SRN: N5987 to conduct emission testing at the sources at their facility located at 8335 West Vienna Road in Montrose, Michigan 48457 in Genessee County. The emissions test program was conducted on July 20, 25, and 26, 2023, and was performed in accordance with CYET project number 231656 Emission Test Plan as well as the Michigan Department of Environment, Great Lakes, and Energy (EGLE) Air Quality Division (AQD) acceptance letter.

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1.a Identification, Location, and Dates of Test

Sampling and analysis for the emission test program was conducted on July 20, 25, and 26, 2023, at the Brent Run Landfill located in Montrose, MI.

1.b Purpose of Testing

AQD issued Renewable Operating Permit No. MI-ROP- N5987-2023 to BRL on January 26, 2023. This permit limits emissions as summarized by Table 1.

1.c Source Description

EUENCLOSEDFLARE is part of the Flexible Groups FGLANDFILL-OOO, FGLANDFILL-AAAA, FGENCLOSEDFLARE-OOO, and FGENCLOSEDFLARE-AAAA.

EUOPENFLARE is part of the Flexible Groups FGLANDFILL-OOO, FGLANDFILL-AAAA, FGOPENFLARE-OOO, and FGOPENFLARE-AAAA. Both units are subject to the emission limits of the MI-ROP-N5987-2023 and 40 CFR Part 62, Subpart OOO, and 40 CFR Part 63, Subpart AAAA requirements.

Method 3A, 4, and 25A sampling on EUENCLOSEDFLARE was conducted through a single port at a single point near the centroid of the stack.

Method 3C sampling on the EUOPENFLARE was conducted at a single point from a horizontal section of duct at ground level.

1.d Test Program Contacts

The contact for the source and test report is:

Mr. Tim Church
General Manager
Brent Run Landfill, Inc.
(810) 444-0811

Names and affiliations for personnel who were present during the testing program are summarized by Table 2.

Table 2
Test Personnel

Name, Title, and Email	Affiliation	Telephone
Ms. Tami Craig Regional Landfill Gas Program Manager tamicraig@gflenv.com	GFL Environmental 8335 Vienna Rd Montrose, Michigan 48457	(770)575-7610
Mr. Khaled Mahmood Client Manager Khaled.Mahmood@tetratech.com	Tetra Tech 39395 W. Twelve Mile Road Suite 103 Farmington Hills, Michigan 48331	(248) 991-9694
Mr. Brandon Chase Senior Environmental Engineer bchase@cyetinc.com	CYET 28744 Groveland Street Madison Heights, MI 48071	(248) 506-0107
Mr. Matthew Young Senior Project Manager myoung@cyetinc.com	CYET 28744 Groveland Street Madison Heights, MI 48071	(586) 744-9133
Ms. Michelle Luplow Environmental Quality Analyst Luplowm1@michigan.gov	Air Quality Division Michigan Dept of Environment, Great Lakes & Energy	(517) 294-9294
Mr. Daniel J Droste Environmental Quality Analyst DrosteD3@michigan.gov	Technical Programs Unit Air Quality Division – Field Operations Michigan Dept of Environment, Great Lakes & Energy	(989) 225-6052

2. Summary of Results

Sections 2.a through 2.d summarize the results of the emissions compliance test program.

2.a Operating Data

Process data monitored during the emissions test program include:

During the test, EUOPENFLARE was operated at maximum routine landfill gas flow. During each test run, the following information was recorded:

- Landfill gas flow to flare in CFM (recorded at least every 15 minutes);
- Flare temperature (recorded at least every 15 minutes); and
- Visible Emission readings according to Method 22 and/or ALT-42.

During the test, EUENCLOSEDFLARE was operated at maximum routine landfill gas flow. During each run, the following information was recorded at least once every 15 minutes:

- Combustion temperature; and
- Landfill gas flow to flare in CFM.

The average combustion temperature was 1604°F, and the average landfill gas flowrate was 920 scfm during testing on the EUENCLOSEDFLARE.

The average flare temperature was 1263°F, and average landfill gas flowrate was 965 scfm during testing on EUOPENFLARE.

Process operating data is included in Appendix G.

2.b Applicable Permit

The applicable permit for this emissions test program is Renewable Operating Permit (ROP) No. MI-ROP-N5987-2023.

2.c Results

The overall results of the emission test program as well as emission limits are summarized by Table 1 (see Section 5.a, and Appendix A). Detailed emission rates are presented in Tables 3-4 in Appendix A.

3. Source Description

Sections 3.a through 3.e provide a detailed description of the process.

3.a Process Description

The BRL is located in Montrose, Michigan and is a solid waste landfill that began accepting waste in 1993. Approximately 155 acres are permitted for waste disposal with approximately 30 acres having reached final grades. The landfill has an overall design capacity of 33,279 million

cubic yards and is therefore required to collect and control the landfill gas from the facility. The BRL does this via a landfill gas collection and control system (GCCS).

The primary control device at the facility is the LFG treatment system. The LFG treatment system involves: compression through one of two Lamson blowers to at least 8 psig, filtering through a Mueller steam strainer, Jenco scrubber and coalescing filter consisting of a 2-micron filter and dewatering through a series of three knock-out pots and an air cooler. The LFG treatment system discharges the LFG to an energy plant for destruction to produce electricity.

BRL owns and operates an enclosed flare with capacity of 1,389 scfm at 50% methane and an open flare rated at 1,350 scfm at 50% methane. Both flares operate as backup control devices. The enclosed flare at the BRL is a John Zink Enclosed Ground Flare, Model BF-AO8195. It has an exhaust stack height of 40 feet and a diameter of eight (8) feet. The main landfill gas control device is the third-party gas to energy plant.

3.b Process Flow Diagram

A process flow diagram is included as Figure 5 in Appendix B.

3.c Raw and Finished Materials

Both units control landfill gas. The quantity of landfill gas is monitored and recorded a minimum of once every 15 minutes.

3.d Process Capacity

The enclosed flare has an inlet design capacity of 1,389 scfm at 50% methane. The open flare has an inlet design capacity of 1,350 scfm at 50% methane.

3.e Process Instrumentation

Process data monitored during the emissions test program include:

EUENCLOSEDFLARE (recorded at least once every 15 minutes)

- Combustion Temperate
- Landfill gas flow to flare in CFM

EUOPENFLARE (recorded at least once every 15 minutes)

- Presence of a flame.
- Landfill gas flow to flare in CFM

Process operating data is included in Appendix G.

4. Sampling and Analytical Procedures

Sections 4.a through 4.d provide a summary of the sampling and analytical procedures used.

4.a Sampling Train and Field Procedures

Sampling and analysis procedures followed the methods codified at 40 CFR 60, Appendix A and 40 CFR 63, Appendix A:

- Method 3 - *"Gas Analysis for Determination of Dry Molecular Weight" (Fyrite Method)* was used to evaluate the molecular weight of the exhaust gas.
- Method 3A – *"Determination of Oxygen and Carbon Dioxide Concentrations in emissions from stationary sources" (Instrumental Analyzer Procedure)* was used to determine the oxygen of the exhaust gas.
- Method 3C – *"Determination of Carbon Dioxide, Methane, Nitrogen, and Oxygen from stationary sources"* was used to determine the oxygen of the exhaust gas.
- Method 4 - *"Determination of Moisture Content in Stack Gases"* was used to determine the moisture content of the exhaust gas.
- Method 22 - *"Visual Determination of Fugitive Emissions from Material Sources and Smoke Emissions from Flares"* was used to determine visible emissions from the flare
- Method 25A - *"Determination of Total Gaseous Organic concentration using a flame ionization analyzer" (modified for methane subtraction)* was used to determine the NMOC concentration of the exhaust gas.

Molecular weight determinations were evaluated using the Fyrite® procedure. The equipment used for this evaluation consists of a one-way squeeze bulb with connecting tubing and a set of Fyrite® combustion gas analyzers (O_2 and CO_2). A grab sample of the exhaust gas was analyzed for each test run.

The Fyrite analyzers are audited monthly by collecting a known concentration of O_2 and CO_2 (protocol 1 gas cylinder) in a tedlar bag and analyzing using the fyrite. Three consecutive samples are measured and must agree with the protocol 1 gas cylinder values within $\pm$0.5%.

USEPA Method 4 was utilized to measure the moisture content of the gas.

The O_2 content was continuously measured via gas analyzer. The gas stream is drawn through a stainless-steel probe with an in-line filter to remove any particulate, a heated Teflon® sample line (~250°F), and through a refrigerated gas sample conditioner to remove the moisture from the sample before it enters the gas analyzers. Data is recorded on a PC equipped with data acquisition software.

In accordance with Method 7E, an analyzer calibration error test was performed prior to sampling. Zero-, mid- and high-level gases are introduced directly to the analyzer sequentially and recording the analyzer response. For method 3A, the calibration error must be within 0.5% of each calibration gas. An initial system bias check is determined by introducing zero- and mid-gases into the sampling system and recording the analyzer response for each calibration gas. This check is performed after each test run to determine that both the system bias is 0.5%, and that the analyzer drift does not exceed 0.5% during any run.

The landfill gas heating content was determined according to USEPA Method 3C, "Determination of Carbon Dioxide, Methane, Nitrogen, and Oxygen from Stationary Sources." The equipment used for this evaluation consisted of evacuated summa canisters and a flow control unit to deliver samples of the landfill gas to the tanks. Triplicate 30-minute test runs were conducted on EUOPENFLARE. A schematic of the Method 3C sampling train used for the testing program is presented as Figure 2.

The THC ppm was continuously measured via a flame ionization analyzer calibrated with propane. The gas stream is drawn through a stainless-steel probe with an in-line filter to remove any particulate, and a heated Teflon® sample line (~250°F) before it enters the gas analyzer. Data is recorded on a PC equipped with data acquisition software.

The JUM Model 109A analyzer utilizes two flame ionization detectors (FIDs) to report the average ppmv for total hydrocarbons (THC), as propane, as well as the average ppmv for methane (as methane). Upon entry, the analyzer splits the gas stream. One FID ionizes all of the hydrocarbons in the gas stream sample into carbon, which is then detected as a concentration of total hydrocarbons. Using an analog signal, specifically voltage, the concentration of THC is then sent to the data acquisition system (DAS), where recordings are taken at 4-second intervals to produce an average based on the overall duration of the test. This average is then used to determine the average ppmv for THC reported as the calibration gas, propane, in equivalent units.

The second FID reports methane only. The sample enters a chamber containing a catalyst that destroys all of the hydrocarbons present in the gas stream other than methane. As with the THC sample, the methane gas concentration is sent to the DAS and recorded.

An analyzer calibration error test was performed prior to sampling. Zero-, low-, mid- and high-level gases are introduced to the sampling system sequentially, recording the analyzer response. The calibration error must be within 5% of each calibration gas. A drift determination was performed after each test run by introducing the zero and mid-level calibration gases, to determine that the analyzer drift does not exceed 3% of the calibration span during any run.

Recorded THC concentrations are averaged and reported for the duration of each test (as drift corrected per Method 7E). A drawing of the sampling train used for the testing program is presented as Figure 4.

Visual Emissions from the operation of the open flare was evaluated according to USEPA Method 22, "Visual Determination of Fugitive Emissions from Material Sources and Smoke Emissions from Flares". The frequency and length of time that visible emissions were observed was recorded during the course of one 30-minute observation period. Field data relating to this test method are available in Appendix C.

Method 2C, Alternative 55 was used to determine the exit velocity of EUOPENFLARE. Alternative 55 allows the use of a mass flow meter in place of Method 2, 2A, 2C, or 2D to satisfy the requirements of 60.18(f)(4).

4.b Recovery and Analytical Procedures

Recovery and analytical procedures are included in section 4.a.

4.c Sampling Ports

Sampling on both sources was performed at a single point through a single port.

4.d Traverse Points

Sampling on both sources was performed at a single point through a single port.

5. Test Results and Discussion

Sections 5.a through 5.k provide a summary of the test results.

5.a Results Tabulation

The overall results of the emissions test program are summarized by Table 1. Detailed results for the emissions test program are summarized by Tables 3-4 in Appendix A.

Table 1
Overall Emission Summary
Test Dates: July 20, 25, and 26, 2023

Source	Parameter	Reporting Units	Test Result	Limit
EUENCLOSEDFLARE	NMOC	ppmv, dry as hexane @3% O_2	9.58	20
EUOPENFLARE	Visible Emissions	% opacity	0	0
	Exit Velocity	ft/min	46.1	<60
	Net Heating Value	MJ/m^3	17.55	>7.45

5.b Discussion of Results

All test results are in compliance with permit limits.

The initial moisture run on EUENCLOSEDFLARE was aborted because the high heat of the exhaust caused the tubing connected to the probe to melt and disconnect from the probe. The tubing was repaired, impingers re-weighed, and the location of the ice bath was moved to allow the back end of the probe and tubing to be placed into the ice bath. Samling was resumed after these modifications and there were no further issues regarding moisture sampling.

On July 20, 2023 EUOPENFLARE was inadvertently shut down at 13:44, 19 minutes into the third run of the Method 3C sampling. Sampling was immediately paused. The flare had to cool down to 250°F before being restarted. The flare was started at 14:02, and sampling for Run 3 resumed at 14:04. Severe inclement weather began at the end of Run 3 which prevented CYET from performing additional tests. A fourth run was completed the following week on July 26, 2023.

5.c Sampling Procedure Variations

The following method variations were granted for the test program:

Method 22, Alternative 42 was used to determine visible emissions. Alternative 42 allows Method 22 visible emissions to be determined over a 30-minute period instead of a 2-hour period.

Method 2C, Alternative 55 was used to determine the exit velocity of EUOPENFLARE. Alternative 55 allows the use of a mass flow meter in place of Method 2, 2A, 2C, or 2D to satisfy the requirements of 60.18(f)(4).

The aforementioned method deviations were approved for use in the test plan acceptance letter dated June 13, 2023. The approval letter from EGLE is provided in Appendix H.

5.d Process or Control Device Upsets

On July 20,2023 prior to conducting any testing on EUENCLOSEDFLARE, the anticipated instrument span of 10 ppm for both the THC and Methane on the J.U.M were exceeded. The instrument span was raised to the highest available range per the gas cylinders onsite (280 ppm). Initial readings after the recalibration showed both the THC and Methane remained above the instrument span. After the burner tips were inspected, it was determined that they were not performing correctly. Testing was suspended until the burner tips could be maintained. The maintenance was completed on July 24, 2023. The test program was completed on July 25, 2023.

On July 20, 2023 EUOPENFLARE was inadvertently shut down at 13:44, 19 minutes into the third run of the Method 3C sampling. Sampling was immediately paused. The flare had to cool down to 250°F before being restarted. The flare was started at 14:02, and sampling for Run 3

resumed at 14:04. Severe inclement weather began at the end of Run 3 which prevented CYET from performing additional tests. A fourth run was completed the following week on July 26, 2023.

5.e Control Device Maintenance

The burner tips for EUENCLOSEDFLARE were cleaned on July 24, 2023.

5.f Re-Test

The emissions test program was not a re-test.

5.g Audit Sample Analyses

No audit samples were collected as part of the test program.

5.h Calibration Sheets

Relevant equipment calibration documents are provided in Appendix D.

5.i Sample Calculations

Sample calculations are provided in Appendix E.

5.j Field Data Sheets

Field documents and raw CEM data relevant to the emissions test program are presented in Appendix C.

5.k Laboratory Data

Laboratory analytical data is provided electronically in Appendix F.

MEASUREMENT UNCERTAINTY STATEMENT

Both qualitative and quantitative factors contribute to field measurement uncertainty and should be taken into consideration when interpreting the results contained within this report. Whenever possible, CYET personnel reduce the impact of these uncertainty factors through the use of approved and validated test methods. In addition, CYET personnel perform routine instrument and equipment calibrations and ensure that the calibration standards, instruments, and equipment used during test events meet, at a minimum, test method specifications as well as the specifications of our Quality Manual and ASTM D 7036-04. The limitations of the various methods, instruments, equipment, and materials utilized during this test have been reasonably considered, but the ultimate impact of the cumulative uncertainty of this project is not fully identified within the results of this report.

REPORT SIGNATURES

CYET operated in conformance with the requirements of ASTM D7036-04 during this emissions test project and this emissions test report:

This report was prepared by: _____

Brandon Chase
Senior Environmental Engineer

This report was reviewed by: _____

Matthew Young
Senior Project Manager

Appendix A – Emission Results Tables

Table 1
Overall Emission Summary
Test Dates: July 20, 25, and 26, 2023

Source	Parameter	Reporting Units	Test Result	Limit
EUENCLOSEDFLARE	NMOC	ppmv, dry as hexane @3% O_2	9.58	20
EUOPENFLARE	Visible Emissions	% opacity	0	0
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Table 2
Test Personnel

Name, Title, and Email	Affiliation	Telephone
Ms. Tami Craig Regional Landfill Gas Program Manager tamicraig@gflenv.com	GFL Environmental 8335 Vienna Rd Montrose, Michigan 48457	(770)575-7610
Mr. Khaled Mahmood Client Manager Khaled.Mahmood@tetratech.com	Tetra Tech 39395 W. Twelve Mile Road Suite 103 Farmington Hills, Michigan 48331	(248) 991-9694
Mr. Brandon Chase Senior Environmental Engineer bchase@cyetinc.com	CYET 28744 Groveland Street Madison Heights, MI 48071	(248) 506-0107
Mr. Matthew Young Senior Project Manager myoung@cyetinc.com	CYET 28744 Groveland Street Madison Heights, MI 48071	(586) 744-9133
Ms. Michelle Luplow Environmental Quality Analyst Luplowm1@michigan.gov	Air Quality Division Michigan Dept of Environment, Great Lakes & Energy	(517) 294-9294
Mr. Daniel J Droste Environmental Quality Analyst DrosteD3@michigan.gov	Technical Programs Unit Air Quality Division – Field Operations Michigan Dept of Environment, Great Lakes & Energy	(989) 225-6052

Table 3
EUENCLOSEDFLARE NMOC Emission Rates
Brent Run Landfill
Montrose, MI
CYET Project No. 231656
Sampling Dates: July 25, 2023

Parameter	Run 1	Run 2	Run 3	Average
Test Run Date	7/25/2023	7/25/2023	7/25/2023	
Test Run Time	15:00-16:00	16:26-17:26	17:40-18:40	
Oxygen Concentration (%)	12.81	13.06	13.46	**13.11**
Oxygen Concentration (%, drift corrected as per USEPA 7E)	12.77	13.11	13.47	**13.12**
Moisture Content (%)	11.2	12.5	9.9	**11.20**
Outlet VOC Concentration (ppmv as propane, corrected as per USEPA 7E)	21.07	29.49	35.24	**28.60**
Outlet Methane Concentration (ppmv as methane, corrected as per USEPA 7E)	49.80	61.98	79.69	**63.82**
Outlet VOC Concentration (ppmv as carbon, corrected as per USEPA 7E)	63.21	88.47	105.72	**85.80**
Outlet Methane Concentration (ppmv as carbon, corrected as per USEPA 7E)	49.80	61.98	79.69	**63.82**
Outlet VOC Concentration (-Methane) (ppmv as carbon, corrected as per USEPA 7E)	13.41	26.49	26.03	**21.98**
Outlet VOC Concentration (-Methane) (ppmv as hexane, corrected as per USEPA 7E)	2.24	4.42	4.34	**3.66**
Outlet VOC Concentration (-Methane) (ppmv hexane dry, corrected as per USEPA 7E)	2.52	5.05	4.82	**4.13**
Outlet NMOC Concentration (-Methane) (ppmv hexane dry, corrected as per USEPA 7E, corrected to 3%O_2)	5.54	11.59	11.60	**9.58**

Equations

Eq. 25A-1, $C_c = KC_{meas}$

where Cc = Concentration as Carbon (ppmv), K= Carbon equivalent correction factor (3 for Propane, 6 for Hexane)
and C_{meas} = concentration as measured (as propane)

$Conc_{@3\%O2} = Conc * (20.9 - 3)/(20.9 - \%O_2)$

Table 4
EUOPENFLARE Exit Velocity and Net Heating Value
Brent Run Landfill
Montrose, MI
CYET Project No. 231656
Sampling Dates: July 20 and 26, 2023

Parameter	Test 1	Test 2	Test 3	Test 4	Average
Sample Date:	7/20/2023	7/20/2023	7/20/2023	7/26/2023	
Sample Time Start	12:23	12:55	13:25	11:33	
Pause			13:44		
Resume			14:04		
Sample Time End	12:51	13:24	14:14	12:03	
Total Sample Time (min)	28	29	29	30	
Flare Inlet Gas Volumetric Flowrate (scfm)	986	1,023	944	909	966
Flare Tip Diameter (in.)	8.0	8.0	8.0	8.0	
Flare Tip Cross-Sectional Area (ft^2)	0.35	0.35	0.35	0.35	
Allowable V_{max} (fps)[1]	**60**	**60**	**60**	**60**	**60**
Flare Gas Exit Velocity (fps)	**47.1**	**48.8**	**45.1**	**43.4**	**46.1**
Flare Inlet Gas Methane Content (%)	53.0	52.9	53.6	51.5	52.8
Flare Inlet Gas Methane Content (ppm)	530,000	529,000	536,000	515,000	527,500
Methane Molecular Weight (lb/lb mol)	16	16	16	16	
Methane Heating Value (kcal/g)[2]	11.9533	11.9533	11.9533	11.9533	
Methane Heating Value (kcal/g mol)	191.3	191.3	191.3	191.3	
Flare Inlet Gas Minimum Net Heating Value Requirment (MJ/scm)[3]	**7.45**	**7.45**	**7.45**	**7.45**	**7.45**
Flare Inlet Gas Net Heating Value (MJ/scm)	**17.64**	**17.60**	**17.84**	**17.14**	**17.55**

[1] from 40 CFR 60.18(c)(4)(i)
[2] USEPA Office of Air Quality Planning and Standards' Control Cost Manual
[3] from 40 CFR 60.18(c)(3)(ii)
scfm standard cubic feet per minute
in. : inchs
fps : feet per second
ppm : parts per million volume
kcal/g : kilocalories per gram
kcal/g mol : kilocalories per gram mole
MJ/scm : megajoules per standard cubic meter

Appendix B – Figures

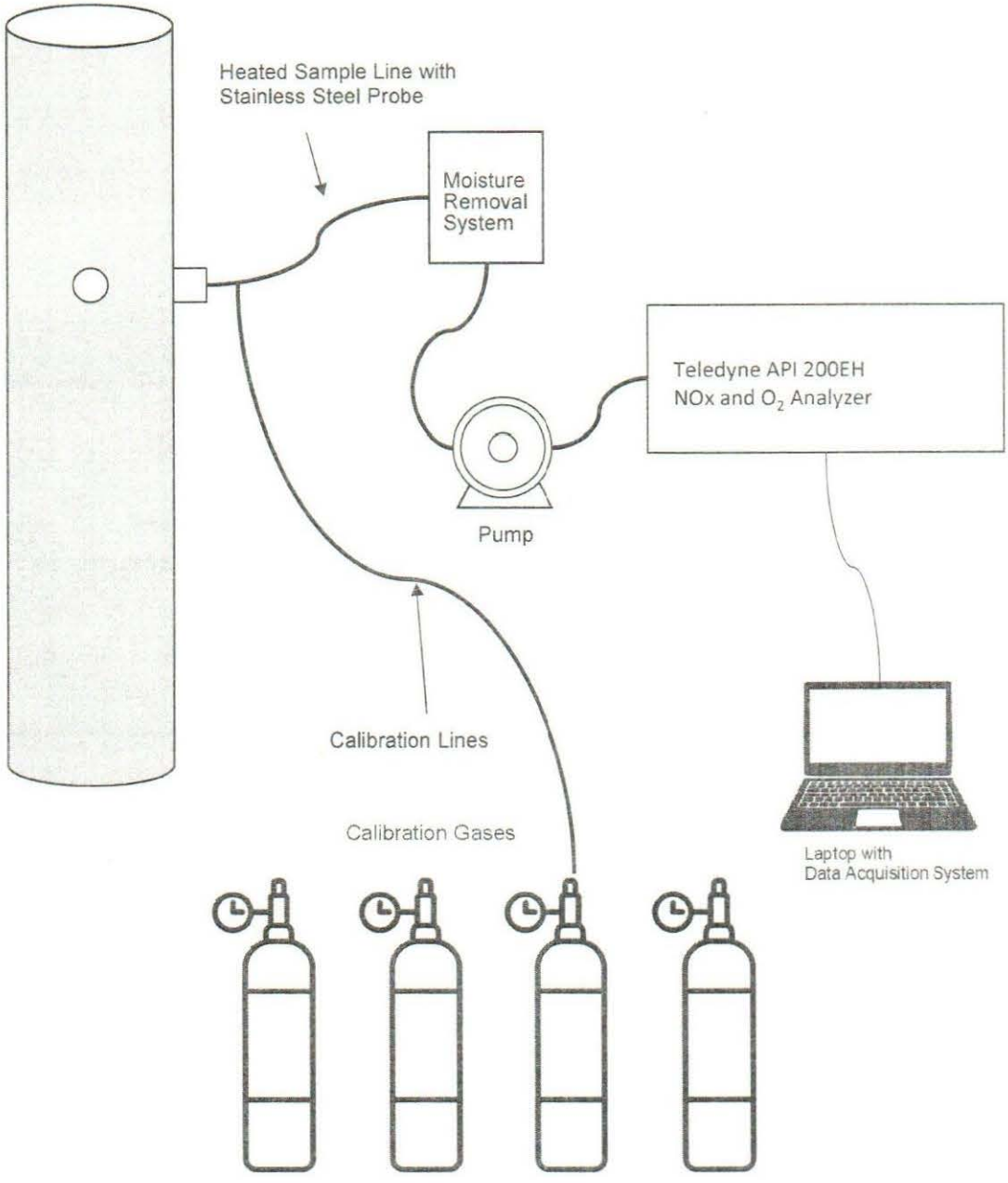

Figure 1

USEPA Method 3A Sampling Train

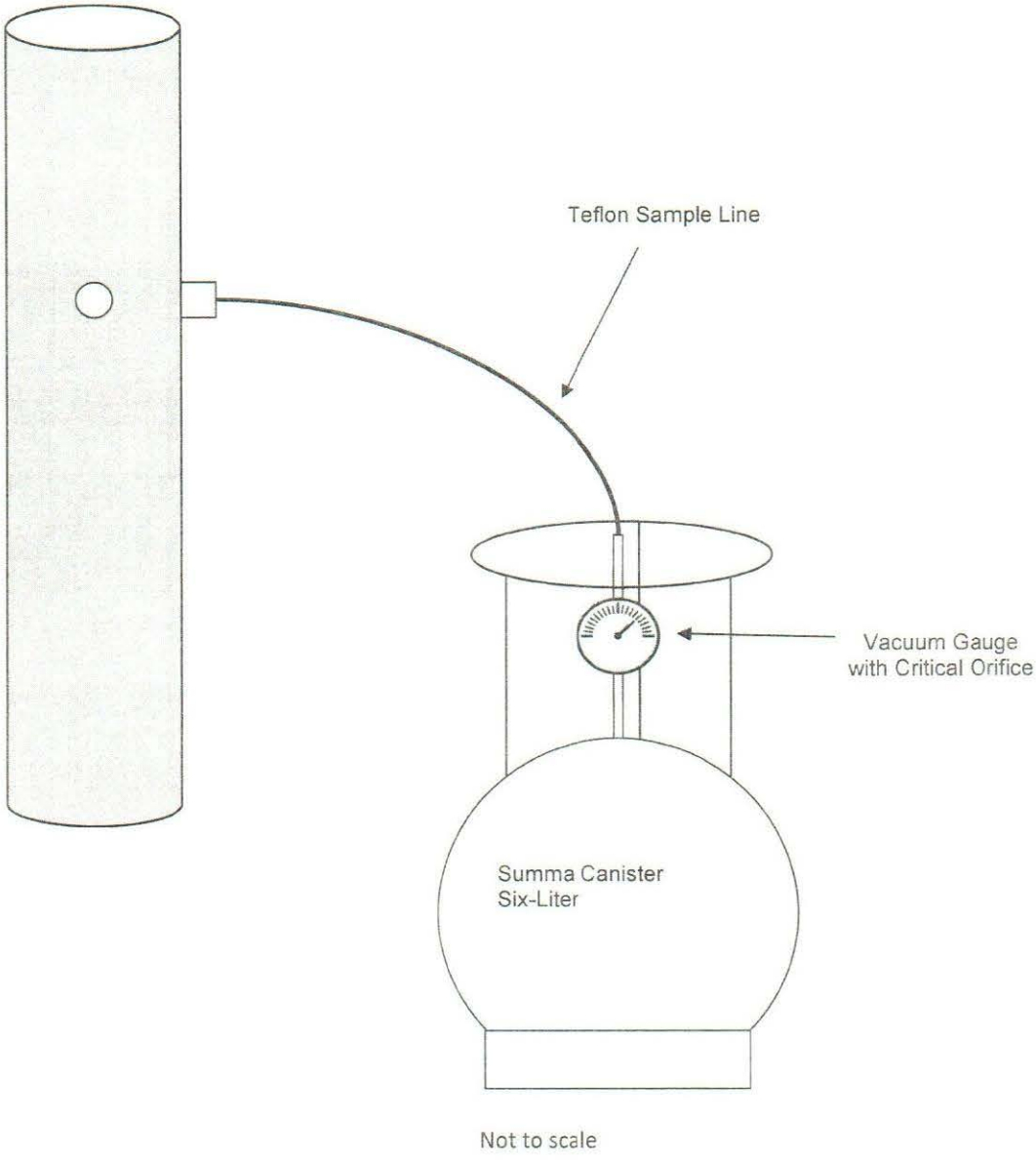

Figure 2

USEPA Method 3C Sampling Train

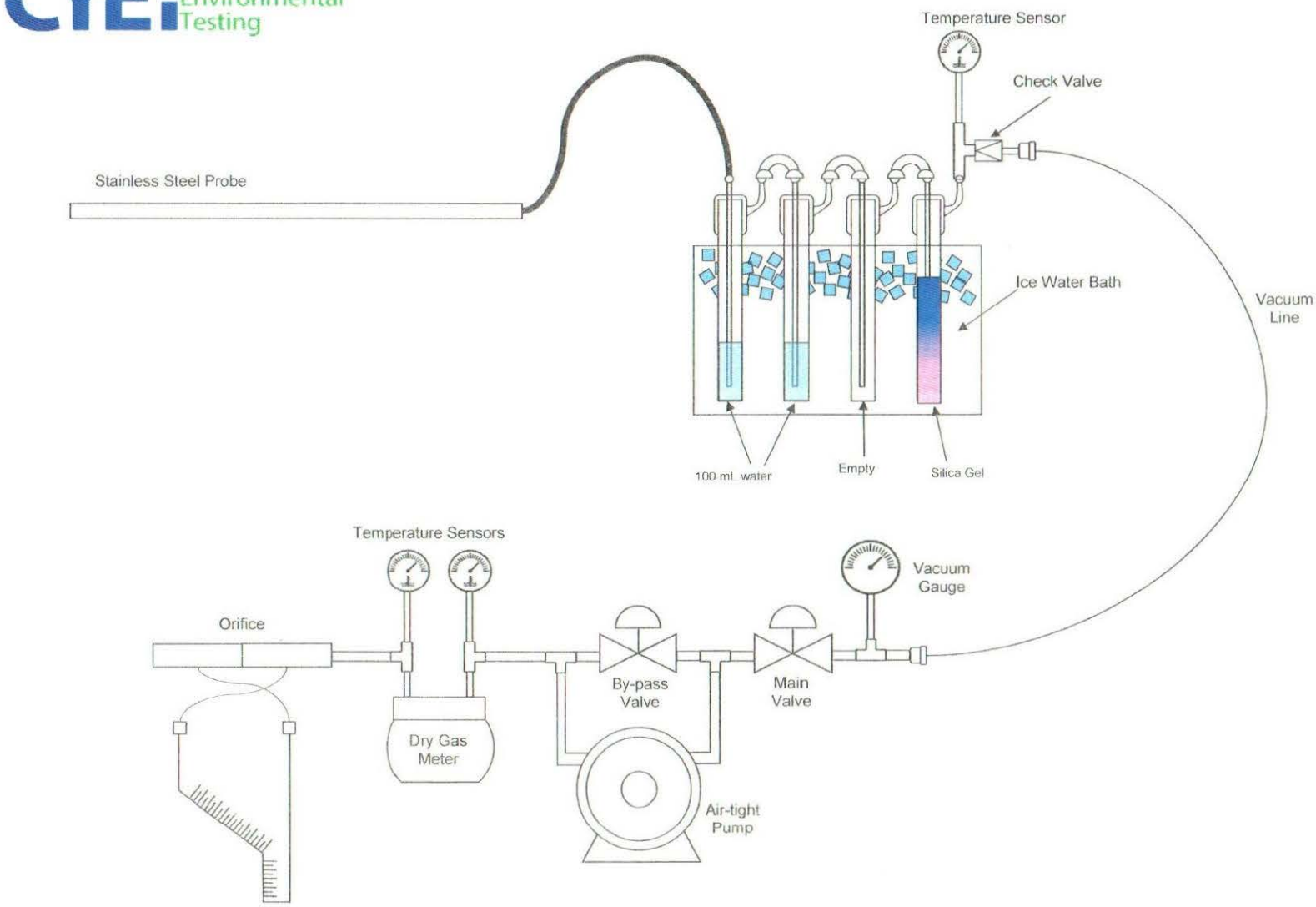

Figure 3

USEPA Method 4 Sampling Train

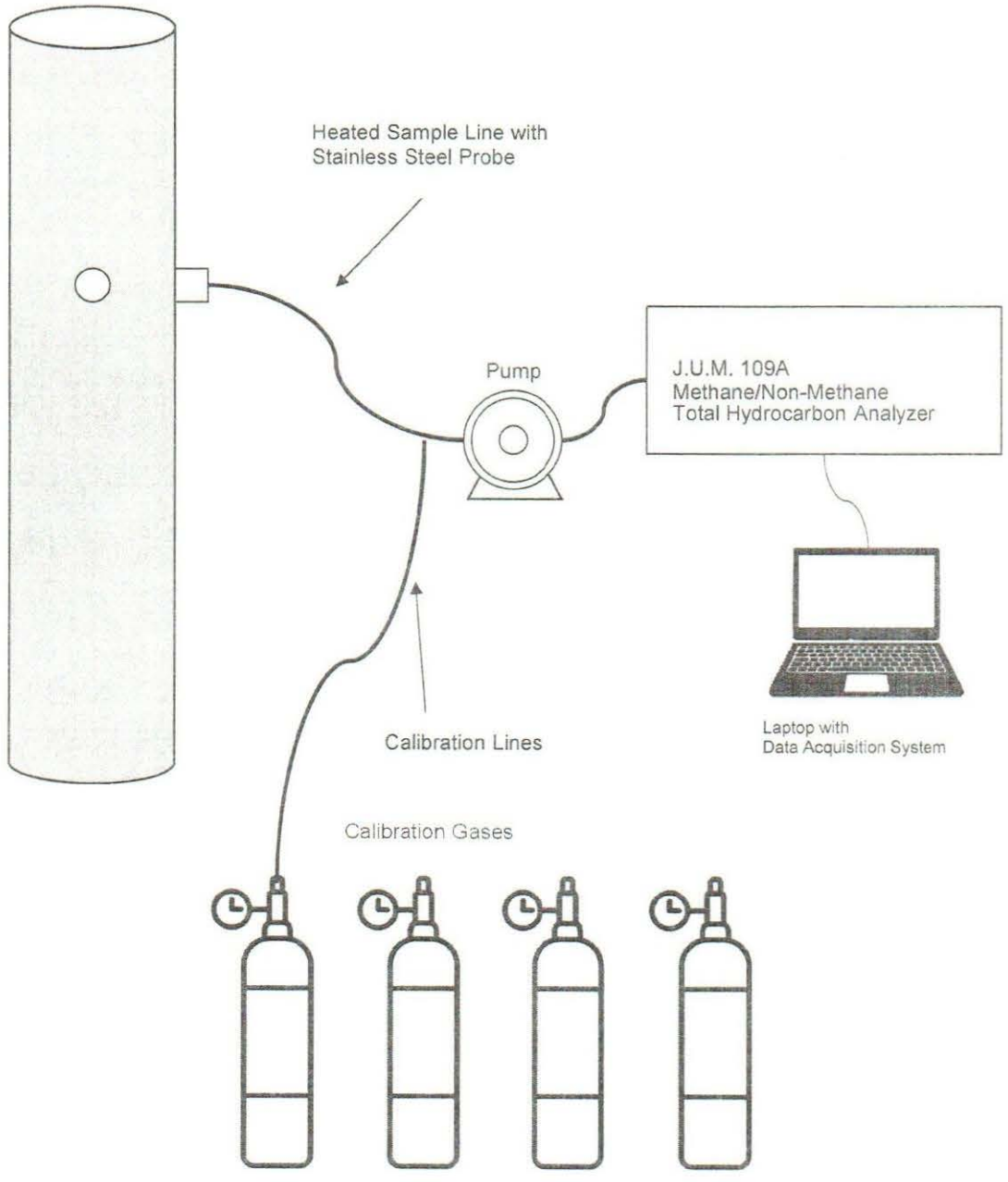

Figure 4

USEPA Method 25A Sampling Train

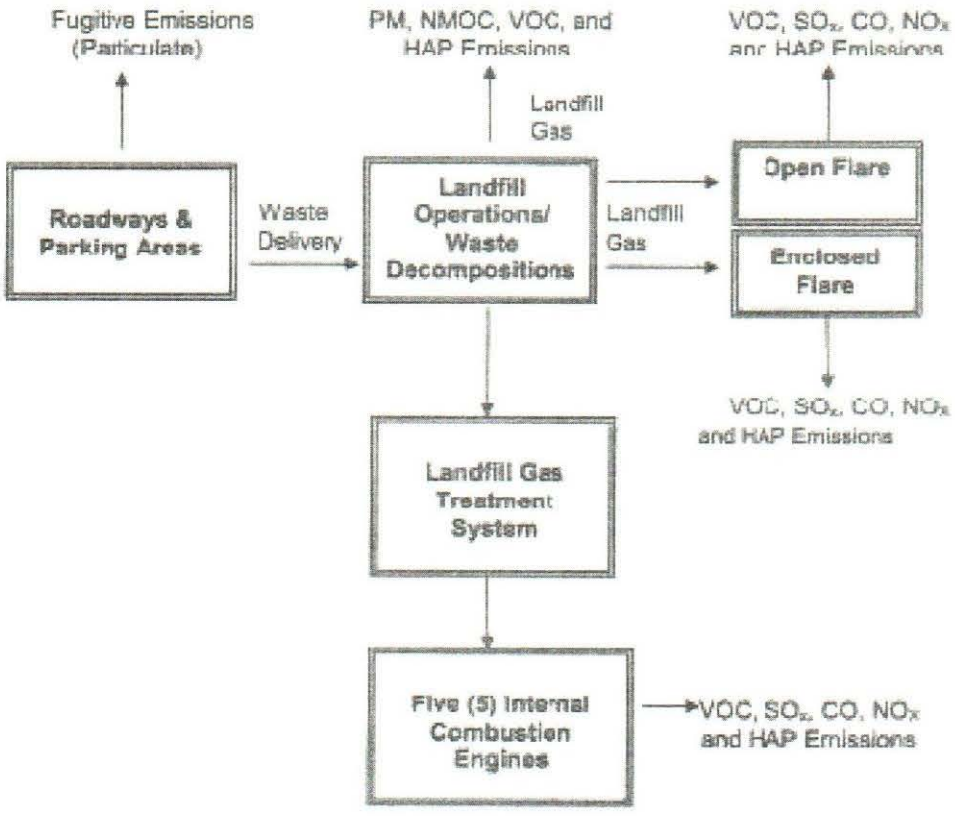

Figure 5

Brent Run Landfill Process Flow Diagram