



May 13, 2019

Ms. Karen Kajiya-Mills
MICHIGAN DEPARTMENT OF ENVIRONMENT, GREAT LAKES, AND ENERGY
Air Quality Division
Constitution Hall, 2nd Floor South
525 West Allegan Street
Lansing, Michigan 48933

Subject: Compliance Performance Evaluation Test Results of One (1) New Utility Flare (EU5000CFMFLARE) at Advanced Disposal Services Arbor Hills Landfill, Inc. in Northville, Michigan (SRN: N2688, PTI No. 79-17)

Dear Ms. Kajiya-Mills:

Advanced Disposal Services Arbor Hills Landfill, Inc. (Arbor Hills) is pleased to provide you two copies of the compliance performance evaluation test results for the new utility flare (EU5000CFMFLARE) located at Arbor Hills in Northville, Michigan.

The purpose of the test program was to demonstrate that the utility flare meets the performance requirements of 40 Code of Federal Regulations (CFR), §60.18, and is thus in compliance with 40 CFR 60, Subpart WWW, 60.752(b)(2)(iii).

The utility flare was tested on April 2, 2019, at maximum expected operating conditions and in accordance with the test plan dated November 16, 2018. The test results demonstrate that the new utility flare EU5000CFMFLARE meets the performance criteria of §60.18.

Please contact me at (248) 412-0702 if you have any questions or require additional information.

Sincerely,

ADVANCED DISPOSAL SERVICES ARBOR HILLS LANDFILL, INC.

Anthony Testa
Environmental Manager

Attachments – Responsible Official Certification
– Test Report for Utility Flare EU5000CFMFLARE

cc: Ms. Diane Kavanaugh-Vetort, MDEQ – Jackson



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 (RO) Permit 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 described in General Condition No. 22 in the RO Permit and be made available to the Department of Natural Resources and Environment, Air Quality Division upon request.

Source Name Advanced Disposal Services Arbor Hills Landfill, Inc. County Washtenaw

Source Address 10690 West Six Mile Road City Northville

AQD Source ID (SRN) N2688 RO Permit No. PTI 79-17 RO Permit Section No. N/A

Please check the appropriate box(es):

Annual Compliance Certification (General Condition No. 28 and No. 29 of the RO Permit)

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 RO Permit, 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 RO Permit.
- 2. During the entire reporting period this source was in compliance with all terms and conditions contained in the RO Permit, 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 RO Permit, unless otherwise indicated and described on the enclosed deviation report(s).

Semi-Annual (or More Frequent) Report Certification (General Condition No. 23 of the RO Permit)

Reporting period (provide inclusive dates): From _____ To _____

- 1. During the entire reporting period, ALL monitoring and associated recordkeeping requirements in the RO Permit 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 RO Permit 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 04/02/2019 To 04/02/2019

Additional monitoring reports or other applicable documents required by the RO Permit are attached as described:

Utility Flare EUOPENFLARE_TEMP Test Report, Compliance with 40 CFR Part 60, Subpart WWW, and §60.18.

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, and that any observed, documented or known instances of noncompliance have been reported as deviations, including situations where a different or no monitoring method is specified by the RO Permit.

Mark Johnson

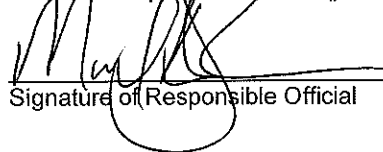
General Manager

(317) 771-3615

Name of Responsible Official (print or type)

Title

Phone Number



5.13.19

Signature of Responsible Official

Date



Compliance Test Report
Utility Flare Performance Test

Advanced Disposal Services
Arbor Hills Landfill
Northville, Michigan

May 13, 2019

Prepared for:
Advanced Disposal Services
Arbor Hills Landfill
10833 West Five Mile Road – Bldg B
Northville, Michigan 48168

Prepared by:
Air Quality Specialist, Inc.
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EXECUTIVE SUMMARY

Advanced Disposal Services (ADS) retained Air Quality Specialist, Inc. (AQSI) to conduct a performance evaluation of the new utility (open) flare (EU5000CFMFLARE) located at Arbor Hills Landfill in Northville, Michigan. The utility flare is an ancillary control device to control landfill gas emissions from Arbor Hills Landfill.

The purpose of the test program was to demonstrate that the utility flare meets the performance requirements of 40 Code of Federal Regulations (CFR), §60.18, and thus is also in compliance with 40 CFR 60, Subpart WWW, 60.752(b)(2)(iii).

AQSI conducted the fieldwork on April 2, 2019, and in accordance with the Test Plan prepared by AQSI and submitted to the Michigan Department of Environmental Quality (MDEQ), Air Quality Division, Lansing, Michigan, dated November 16, 2018. Mr. Tom Gasloli with MDEQ reviewed and approved the Test Plan. Messrs. Andrew Secord, Alex Schreiber, and Tyler Smith conducted the tests. Mr. Anthony Testa with ADS provided on-site coordination of the tests with landfill and third party operations. Mr. Gasloli and Ms. Dianne Kavanaugh-Vetort with MDEQ witnessed the test program.

The results of the performance evaluations were:

Parameter	Applicable Requirement	Average Test Result
Flare Exhaust Smoke Emissions (Visual Emissions in a 2-hour Period)	<5 minutes over 2 hours ¹	3 minutes, 4 seconds
Flare Inlet Gas Net Heating Value (MJ/scm)	>7.45 ²	11.90
Flare Exhaust Gas Exit Velocity (feet per second)	<60 ³	57.0
Maximum Permitted Velocity (V _{max} , feet per second)	<63.0 ⁴	57.0

MJ: megajoules
scm: standard cubic meter

¹ 40 CFR 60.18(c)(1)

² 40 CFR 60.18(c)(3)(ii)

³ 40 CFR 60.18(c)(4)(i)

⁴ 40 CFR 60.18(c)(4)(iii)

1.0 INTRODUCTION

Advanced Disposal Services (ADS) retained Air Quality Specialist, Inc. (AQSI) to conduct a performance evaluation of the new utility (open) flare (EU5000CFMFLARE) located at Arbor Hills Landfill in Northville, Michigan. The utility flare is an ancillary control device to control landfill gas emissions from Arbor Hills Landfill.

The purpose of the test program was to demonstrate that the utility flare meets the performance requirements of 40 Code of Federal Regulations (CFR), §60.18, and thus is also in compliance with 40 CFR 60, Subpart WWW, 60.752(b)(2)(iii).

AQSI conducted the test program with methodologies outlined in 40 CFR 60.18, except that United States Environmental Protection Agency (USEPA) Method 3C, "Determination of Carbon Dioxide, Methane, Nitrogen, and Oxygen from Stationary Sources," was employed for net heating value determination in lieu of Method 18 and ASTM D1946. Method 3C is the applicable method for utility flares at landfills, in accordance with Subpart WWW, 60.754(e).

AQSI conducted the fieldwork on April 2, 2019, and in accordance with the Test Plan prepared by AQSI and submitted to the Michigan Department of Environmental Quality (MDEQ), Air Quality Division, Lansing, Michigan, dated November 16, 2018. Mr. Tom Gasloli with MDEQ reviewed and approved the Test Plan. Messrs. Andrew Secord, Alex Schreiber, and Tyler Smith conducted the tests. Mr. Anthony Testa with ADS provided on-site coordination of the tests with landfill and third party operations. Mr. Gasloli and Ms. Dianne Kavanaugh-Vetort with MDEQ witnessed the test program.

The name, address, and telephone number of the primary contact for further information about the tests and this test report is:

Name and Title	Company	Telephone
Mr. Andrew Secord Environmental Scientist	Air Quality Specialist, Inc. 672 N. Milford Road, Suite 152 Highland, Michigan 48357	(248) 887-7565

The name, address, and telephone number of the primary contact for further information about the flare and associated operations is:

Name and Title	Company	Telephone
Mr. Anthony Testa Environmental Manager	Advanced Disposal Services Arbor Hills Landfill 10833 West Five Mile Road – Bldg B Northville, Michigan 48168	(248) 412-0702



2.0 SUMMARY OF RESULTS

On April 2, 2019, the new utility flare operated at an average inlet volumetric flow rate of approximately 4,780 standard cubic feet per minute (scfm) as measured and calculated by USEPA Methods 1A and 2C, or 4,300 scfm as averaged from the recorded process flow meter data.

The average test results for the utility flare were:

- 1) visible emissions: 3 minutes, 4 seconds (accumulated, total),
- 2) average net heating value of the gas being combusted: 11.90 megajoules per standard cubic meter (MJ/scm), and,
- 3) average exhaust gas exit velocity: 57.0 feet per second (fps).

The performance criteria are less than 5 minutes visible emissions in a 2-hour period, a net heating value of greater than 7.45 MJ/scm, and an exit velocity less than 60 fps (or less than the maximum permitted velocity (V_{max}), calculated to be 63.0 fps).

The test results demonstrate that that utility flare meets the performance requirements of §60.18, and thus also satisfies the requirements of 60.752(b)(2)(iii)(B), at the test flow rate.

3.0 SOURCE DESCRIPTION

Arbor Hills Landfill is an active municipal solid waste (MSW) landfill. Anaerobic bacteria decompose the emplaced waste. The primary by-products of decomposition are methane (~45-55%, typical) and carbon dioxide (~35-45%, typical), with the remainder balance gases nitrogen, oxygen and trace amounts of non-methane organic compounds.

Arbor Hills Landfill employs a gas collection and control system to meet the requirements of Subpart WWW. Gas collection wells are installed in a grid pattern about the landfill. The wells are connected to a common header system. A blower produces a vacuum on the well field. Collected gas is routed to a treatment system for subsequent use by a third party landfill gas-to-energy (LFGTE) plant. ADS employs two (2) enclosed flares, and the utility flare, as backup / ancillary control devices in the event the LFGTE experiences downtime. The LFGTE plant was 'de-rated' to allow the utility flare to operate for this testing.

Advanced Disposal Services installed the new utility flare at Arbor Hills Landfill in September 2018, with formal start-up on November 16, 2018. The utility flare is designed to meet the requirements of 60.753(b)(2)(iii) at a flow rate of up to 5,000 scfm. The utility flare was tested at a flow meter flow rate of approximately 4,300 scfm, or 4,800 scfm as measured and calculated by USEPA Methods 1A and 2C.



The landfill gas flow rate is variable, and depends on gas production in the landfill. The composition of the landfill gas varies, but the average Method 3C values obtained on April 2, 2019, may be considered 'typical:' methane, 35.8%; carbon dioxide, 27.3%; oxygen, 5.6%; and nitrogen, 29.9%. The landfill gas temperature at the utility flare inlet averaged 121 °F.

The utility flare is equipped with a thermocouple to monitor for the presence of a flame, and an automatic shutdown software routine that activates if the presence of flame cannot be verified by the sensor.

4.0 SAMPLE AND ANALYTICAL PROCEDURES

AQSI conducted measurements in accordance with USEPA Reference Test Methods, as presented in 40 CFR 60, Appendix A. The sample collection and analytical methods used in the test program are listed in the table below. Figure 1 depicts the sample site.

<u>Sample Method</u>	<u>Parameter</u>	<u>Analysis</u>
USEPA Methods 1A & 2C	Stack Gas Velocity and Volumetric Flow Rate	Field Data
USEPA Method 3C	Carbon Dioxide, Methane, Nitrogen, Oxygen, and moisture fraction	Gas Chromatography / Thermal Conductivity Detector (GC/TCD)
USEPA Method 22	Visible Emissions	Field Observation

4.1 Stack Gas Velocity and Volumetric Flow Rate (USEPA Methods 1A and 2C)

AQSI used Method 1A to determine the appropriate number and location of traverse points on the utility flare inlet duct. AQSI selected traverse points based on division of the stack cross-section into equal areas, and the number of upstream and downstream stack diameters from the sample ports to the nearest flow disturbance. Figure 2 depicts a representative flare inlet cross-section and traverse point locations.

AQSI used Method 2C to measure stack gas velocity pressure and temperature at each traverse point. AQSI positioned a standard pitot tube, with a baseline coefficient of 0.99, at each traverse point. The velocity pressure and temperature were measured and recorded. Velocity pressure measurements were read from an inclined water-column manometer with increments of 0.1 inches of water column.

The raw field data, and computer-generated velocity and volumetric flow rate spreadsheets are presented in Appendix A.



The average stack gas velocity is a function of the average velocity pressure, absolute stack gas pressure, average stack gas temperature, stack gas wet molecular weight, and pitot tube coefficient. AQSI derived the average stack gas velocity from equations presented in Method 2.

AQSI calculated the stack gas flow rate by multiplication of the stack gas velocity and the cross-sectional area of the stack.

AQSI used the measured inlet flow rate from each individual test to calculate the corresponding exhaust exit velocity for that test.

4.2 Determination of Carbon Dioxide, Methane, Nitrogen, and Oxygen from Stationary Sources (Method 3C)

AQSI used Method 3C to determine the net heating value of the landfill gas. AQSI collected three, 30-minute (minimum), integrated tank samples of landfill gas from the utility flare inlet (downstream of the blower).

AQSI submitted the samples to Triangle Environmental Services, Inc. (TES), Hillsborough, North Carolina for analysis. TES analyzed each tank for carbon dioxide (CO₂), methane (CH₄), nitrogen (N₂), and oxygen (O₂) concentration and moisture fraction. Figure 3 depicts the Method 3C sample train.

TES followed the analytical procedures of Method 3C by using a gas chromatograph (GC), with appropriate separation column for the expected parameters, equipped with a thermal conductivity detector (TCD). The TES laboratory analytical report, and the letter of approval from USEPA for use of Method 3C, is presented in Appendix B.

AQSI used the Method 3C analytical results to calculate stack gas molecular weight (for use in stack gas velocity calculation), and to calculate the net heating value of the gas being combusted per §60.18(f)(3). The reported net heating value is the arithmetic average of three valid test runs.

AQSI calculated the dry molecular weight of the stack gas based on the assumption that the primary constituents were methane, carbon dioxide, nitrogen, and oxygen (other compounds present have a negligible relative concentration). The stack gas dry molecular weight is equal to the sum of stack gas constituent concentrations (%) multiplied by the corresponding molecular weight of that constituent. TES calculated stack gas moisture content by Equation 3C-1 of Method 3C.



4.3 Visual Determination of Fugitive Emissions from Material Sources and Smoke Emissions from Flares (Method 22)

AQSI conducted a single, 120-minute, non-continuous observation of the utility flare exhaust for smoke emissions. AQSI observed continuously for 15 to 20 minutes, then took a break for at least 5 – but no more than 10 minutes, and then resumed observation in this pattern until a full 120-minute period of observation time had accrued. A copy of the Method 22 observation data is presented in Appendix A.

5.0 RESULTS AND DISCUSSION

On April 2, 2019, AQSI observed an accumulated total of 3 minutes, 4 seconds of visible emissions from the utility flare exhaust. The limit for visible emissions is less than 5 minutes per 2-hour time period [60.18(c)(1)].

On April 2, 2019, the average net heating value of the gas being combusted in the utility flare was 11.90 MJ/scm. The requirement for net heating value is >7.45 MJ/scm [60.18(c)(3)(ii)].

On April 2, 2019, the average stack gas exit velocity from the utility flare, calculated from field data, was 57.0 fps. The limit is <60 fps [60.18(c)(4)(i)], or less than the Maximum Permitted Velocity, V_{max} , calculated to be 63.0 fps [60.18(c)(4)(iii)].

The results demonstrate that the utility flare meets the performance requirements of §60.18, and thus satisfies 40 CFR 60.752(b)(2)(iii). All test results are consistent and repeatable.

AQSI did not note any variations and/or anomalies in normal sample collection procedures, nor any control equipment upset conditions over the test period.

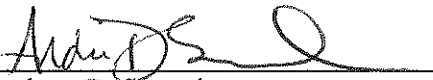
Mr. Tom Gasloli with MDEQ reviewed the Test Plan, and had no objections. Mr. Gasloli and Ms. Dianne Kavanaugh-Vetort with MDEQ witnessed the test program

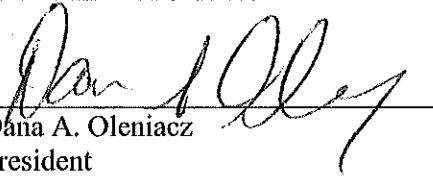
AQSI quality assurance (QA) procedures included:

- 1) leak-check of the velocity measurement system (pitot tube through manometer), prior to each test,
- 2) leak-check of the Method 3C train, prior to each test, and,
- 3) verification of sufficient evacuation of each Method 3C canister prior to initiation of each sample collection.



Raw field and computer-calculated data used in the determination of the utility flare average exit velocities and net heating values, visible emissions observation data, and recorded process flow meter data, are presented in Appendix A. The Method 3C laboratory analytical results and chain-of-custody forms are presented in Appendix B. Sample calculations are presented in Appendix C.

This report prepared by: 
Andrew D. Secord
Environmental Scientist

This report reviewed by: 
Dana A. Oleniacz
President

May 13, 2019



TABLES

Table 1

**Utility Flare Inlet Volumetric Flow Rate and Flare Exit Velocity
Advanced Disposal Services
Arbor Hills Landfill
Northville, Michigan
AQSI Project No. 19F1003
April 2, 2019**

Parameter	Test 1	Test 2	Test 3	Average
Inlet Volumetric Flow Rate (scfm) – Measured Field Data	4,805	4,723	4,808	4,778
Exit Tip Diameter (inches)	16	16	16	
Exit Tip Cross-Sectional Area (ft ²)	1.3963	1.3963	1.3963	
Allowable Exit Velocity (fps) ¹	60	60	60	60
Maximum Permitted Velocity, V _{max} (fps) ²	62.2	63.6	63.3	63.0
Exit Velocity (fps)	57.4	56.4	57.4	57.0

¹ 40 CFR 60.18(c)(4)(i)

² 40 CFR 60.18(c)(4)(iii)

scfm: standard cubic feet per minute

ft²: square feet

fps: feet per second



Table 2

**Utility Flare Inlet Gas Net Heating Value
Advanced Disposal Services
Arbor Hills Landfill
Northville, Michigan
AQSI Project No. 19F1003
April 2, 2019**

Parameter	Test 1	Test 2	Test 3	Average
Flare Inlet Gas Methane Content (ppm)	352,315	360,946	359,246	357,502
Flare Inlet Gas Methane Content (%)	35.23	36.09	35.92	35.75
Methane, Molecular Weight (lb/lb mole)	16	16	16	
Methane, Heating Value (kcal/g) ¹	11.9533	11.9533	11.9533	
Methane, Heating Value (kcal/g mole)	191.25	191.25	191.25	
Minimum Net Heating Value (MJ/scm) ²	7.45	7.45	7.45	7.45
Flare Inlet Gas Net Heating Value (MJ/scm)	11.72	12.01	11.95	11.90

¹ USEPA Office of Air Quality Planning And Standards' Control Cost Manual

² 40 CFR 60.18(c)(3)(ii)

ppm: parts per million

%: percent

lb/lb mole: pounds per pound-mole

kcal/g: kilocalories per gram

kcal/g mole: kilocalories per gram-mole

MJ/scm: megajoules per standard cubic meter



FIGURES

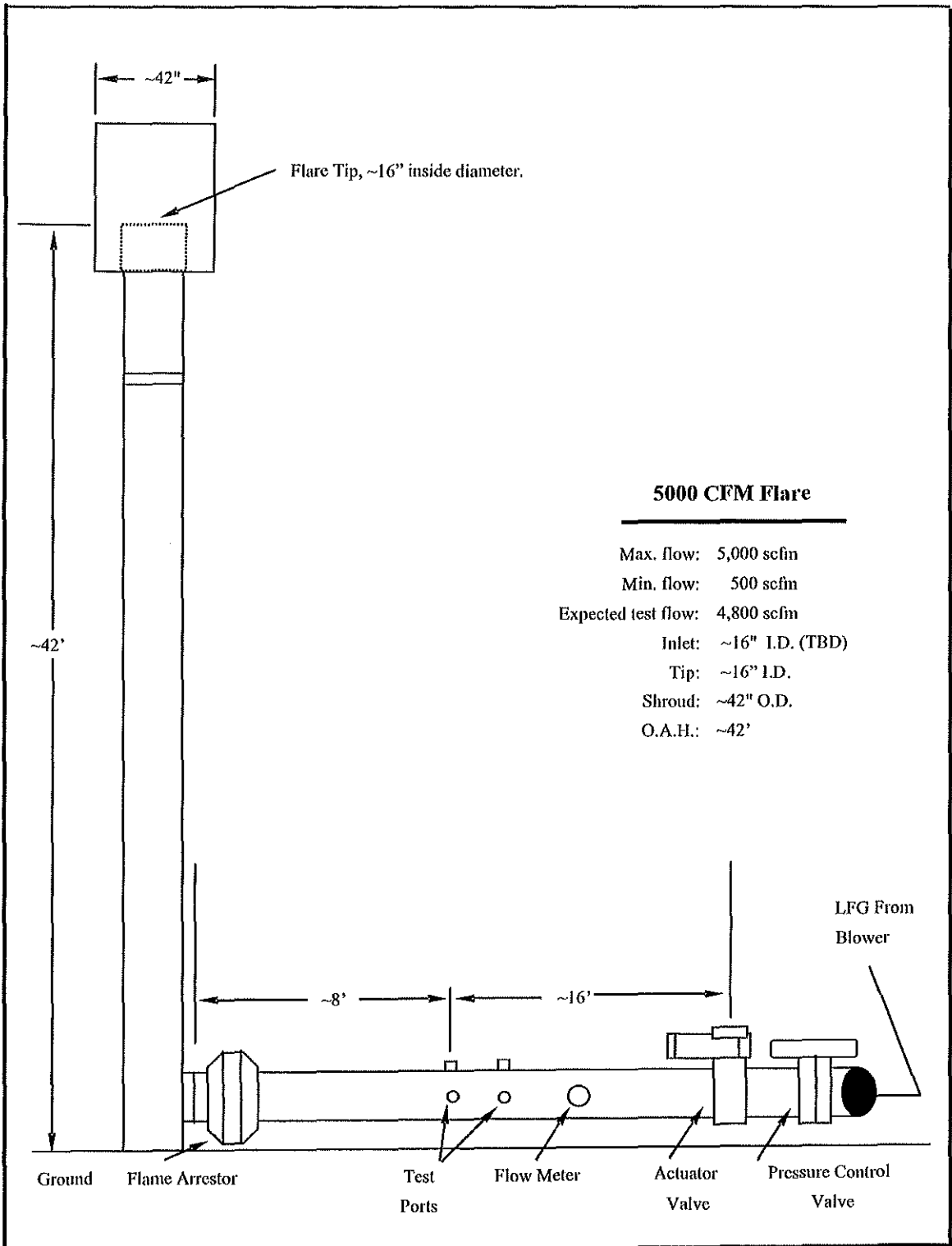
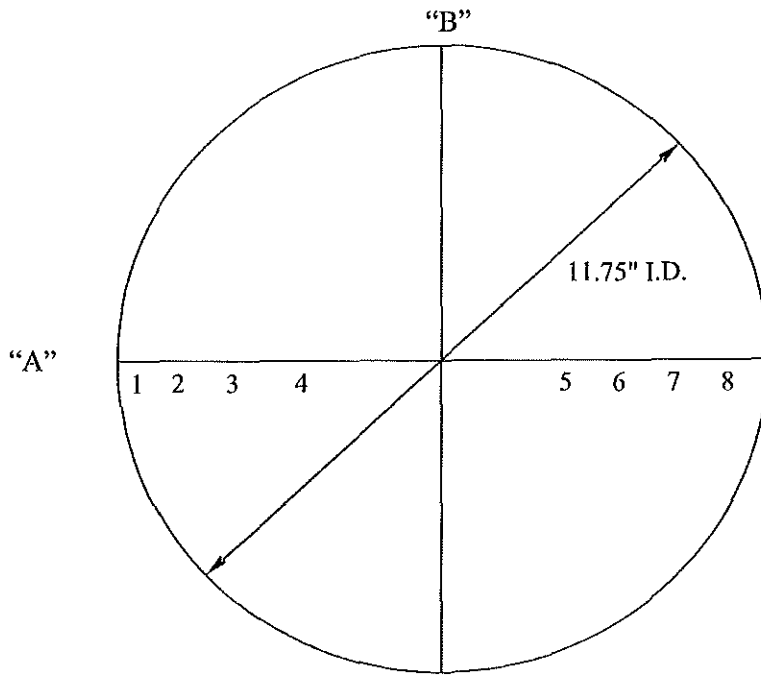


Figure 1
 Representative utility flare duct and stack arrangement, approximate test port locations, Arbor Hills Landfill, in Northville, Michigan.

Air Quality Specialist, Inc.
 April 2, 2019



Traverse Point Number	Distance From Wall (inches)
1	0.50
2	1.23
3	2.28
4	3.80
5	7.95
6	9.47
7	10.52
8	11.25

Figure 2
 Traverse point numbers and locations, enclosed flare inlet
 Arbor Hills Landfill, Inc. in Northville, Michigan.

Air Quality Specialist, Inc.
 April 2, 2019

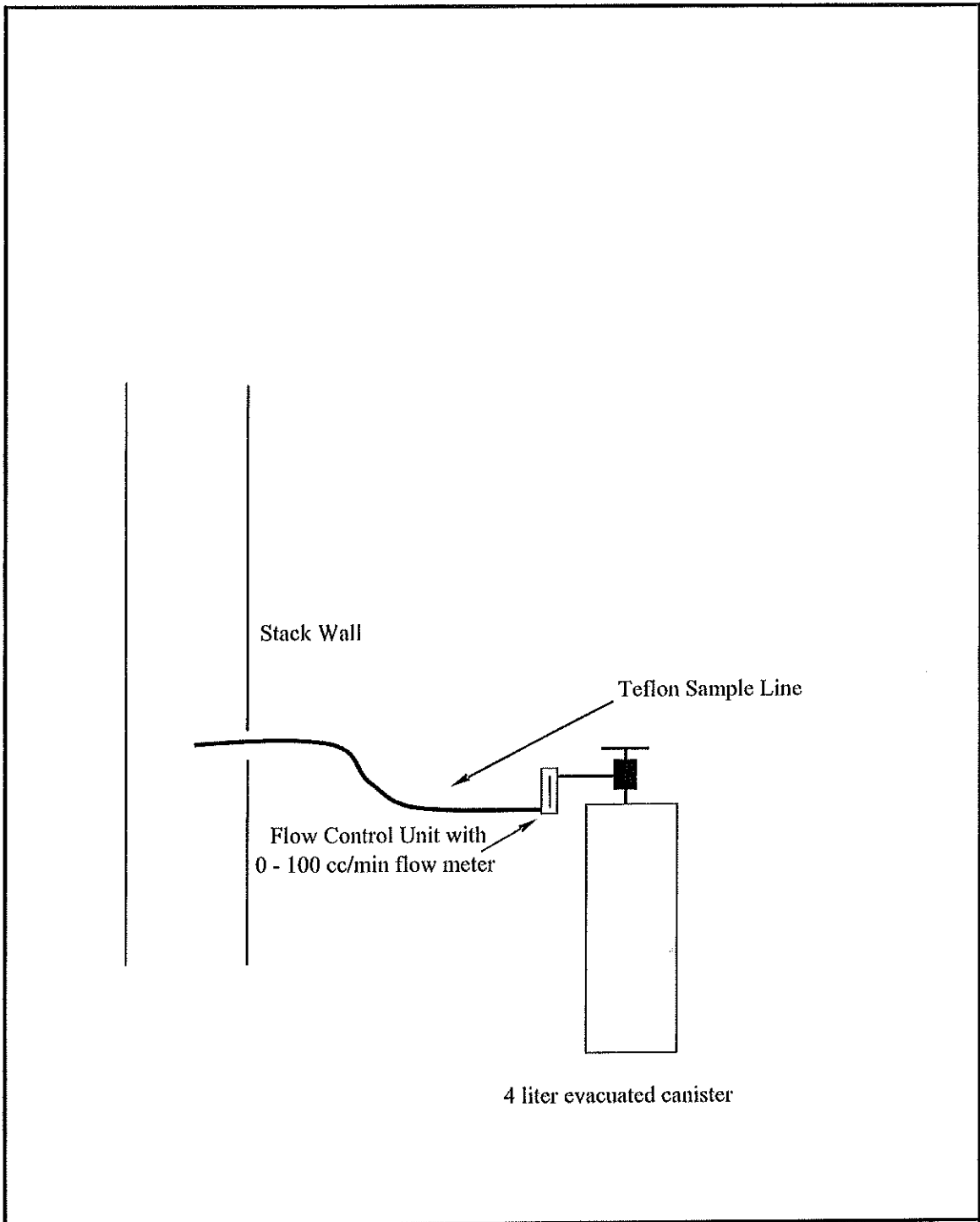


Figure 3
USEPA Method 3C sample train used at the utility flare inlet duct
at Arbor Hills Landfill in Northville, Michigan.

Air Quality Specialist, Inc.
April 2, 2019