# Compliance Test Report
# Utility Flare Performance Test

## Oakland Heights Development, Inc.
Auburn Hills, Michigan

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October 29, 2015

*Prepared for:*
**Oakland Heights Development, Inc.**
2350 Brown Road
Auburn Hills, Michigan 48326

*Prepared by:*
**Air Quality Specialist, Inc.**
672 N. Milford Road, Suite 152
Highland, Michigan 48357
248.887.7565

# 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 Environmental Quality, Air Quality Division upon request.**

Source Name: Oakland Heights Development, Inc. County: Oakland

Source Address: 2350 Brown Road City: Auburn Hills

AQD Source ID (SRN): N6008 RO Permit No.: MI-ROP-N6008-2015 & PTI No. 11-15 RO Permit Section No.: 01

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 08/25/2015 To 08/25/2015

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

Utility Flare Performance Test Report

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.

| Ralph Dach | General Manager | 734-348-5151 |
|---|---|---|
| Name of Responsible Official (print or type) | Title | Phone Number |
| Ralph Dach | | 11/2/2015 |
| Signature of Responsible Official | | Date |

## EXECUTIVE SUMMARY

Republic Services, Inc. (Republic) retained Air Quality Specialist, Inc. (AQSI) to conduct a performance evaluation of one new utility (open) flare located at Oakland Heights Development, Inc. in Auburn Hills, Michigan. The utility flare controls landfill gas (LFG) emissions from the municipal solid waste 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 September 28, 2015, and in accordance with the Test Plan, dated August 25, 2015. Mr. Andrew Secord, Mr. Andrew Karg, and Mr. Jeremy Chrobak conducted the tests. Mr. Pete Campbell with Monitoring Control and Compliance Inc. provided on-site coordination of the tests with landfill operations. Ms. Rebecca Loftus with Michigan Department of Environmental Quality (MDEQ) witnessed a portion of the test program. The results of the performance evaluation were:

| Parameter | Applicable Requirement | Average Test Result |
|---|---|---|
| Flare Exhaust Smoke Emissions (Visual Emissions in a 2-hour Period) | <5 minutes over 2 hours [1] | 0 minutes, 38 seconds |
| Flare Inlet Gas Net Heating Value (MJ/scm) | >7.45 [2] | 18.04 |
| Flare Exhaust Gas Exit Velocity (feet per second) | <60 [3] | 33.41 |
| Maximum Permitted Velocity ($V_{max}$, feet per second) | <98.4 [4] | 33.41 |

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

Republic Services, Inc. (Republic) retained Air Quality Specialist, Inc. (AQSI) to conduct a performance evaluation of one new utility (open) flare located at Oakland Heights Development, Inc. in Auburn Hills, Michigan. The utility flare controls landfill gas (LFG) emissions from the municipal solid waste 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 September 28, 2015, and in accordance with the Test Plan, dated August 25, 2015. Mr. Andrew Secord, Mr. Andrew Karg, and Mr. Jeremy Chrobak conducted the tests. Mr. Pete Campbell with Monitoring Control and Compliance Inc. provided on-site coordination of the tests with landfill operations. Ms. Rebecca Loftus with Michigan Department of Environmental Quality (MDEQ) witnessed a portion of 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/Fax** |
|---|---|---|
| Mr. Andrew Secord<br>Environmental Scientist | Air Quality Specialist, Inc.<br>672 N. Milford Road, Suite 152<br>Highland, Michigan 48357 | (248) 887-7565<br>(248) 887-3913 |

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. Robb Moore, P.E.<br>Environmental Manager | Republic Services, Inc.<br>2361 West Grand Blanc Road<br>Grand Blanc, Michigan 48439 | (810) 655-6906 |

## 2.0 SUMMARY OF RESULTS

On September 28, 2015, the utility flare operated at an average inlet volumetric flow rate of approximately 2,800 standard cubic feet per minute (scfm) as measured by USEPA Methods 1 and 2, or 2,364 scfm as averaged from available process flow meter data.

The average test results were:

1) visible emissions: 0 minutes, 38 seconds (accumulated, total),
2) average net heating value of the gas being combusted: 18.04 megajoules per standard cubic meter (MJ/scm), and
3) average exhaust gas exit velocity: 33.41 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 98.4 fps).

The test results demonstrate that the 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

Oakland Heights Development, Inc. is a 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 (~40-45%, typical), with the remainder balance gases nitrogen, oxygen and trace amounts of non-methane organic compounds.

Oakland Heights Development, Inc. 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 third party gas developer. The utility flare is used to control landfill gas emissions in the event the gas developer experiences downtime; the flare is otherwise offline or reduced capacity.

Oakland Heights Development, Inc. installed the new utility flare in July 2015. The flare is designed to meet the requirements of 60.753(b)(2)(iii) at a flow rate up to 4,500 scfm. The landfill gas flow rate to the flare was expected to be approximately 2,200 scfm. The landfill gas flow 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 September 28, 2015, may be considered 'typical:' methane, 54.2%; carbon dioxide, 42.1%; oxygen, 0.3%; and nitrogen, 2.0%. The landfill gas temperature at the flare inlet averaged 155 °F.

The utility flare is equipped with a thermocouple to monitor for the presence of a flame. The utility flare is equipped with an automatic shutdown 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.

| **Sample Method** | **Parameter** | **Analysis** |
|---|---|---|
| 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 the 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 a digital 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 gas 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, integrated tank samples of landfill gas from the inlet to the utility flare (downstream of the blower).

AQSI submitted the samples to Triangle Environmental Services, Inc. (TES), Durham, North Carolina for analysis. TES analyzed each tank for carbon dioxide ($CO_2$), methane ($CH_4$), nitrogen ($N_2$), and oxygen ($O_2$) 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). Attachment B presents the TES laboratory analytical report.

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 September 28, 2015, AQSI observed an accumulated total of 0 minutes, 38 seconds of visible emissions from the utility flare exhasut. The limit for visible emissions is less than 5 minutes per 2-hour time period [60.18(c)(1)].

On September 28, 2015, the average net heating value of the gas being combusted was 18.04 MJ/scm. The requirement for net heating value is >7.45 MJ/scm [60.18(c)(3)(ii)].

On September 28, 2015, the average stack gas exit velocity, calculated from field data, was 33.4 fps. The limit is <60 fps [60.18(c)(4)(i)], or less than the Maximum Permitted Velocity, $V_{max}$, calculated to be 98.4 fps [60.18(c)(4)(iii)].

The September 28, 2015 results demonstrate that the utility flare meets the performance requirements of §60.18, and thus satisfies 40 CFR 60.752(b)(2)(iii).

AQSI notes variations and/or anomalies in normal sample collection procedures. AQSI intended to use an inclined water column manometer for velocity pressure measurements, however, due to the extreme static pressure, a digital manometer was used. The high static pressure would have blown the water out of the manometer. In addition, due to the difficulty of measuring the velocity pressures under such conditions, AQSI conducted a velocity measurement before and after the Method 3C sample collections.

AQSI noted two (2) control equipment upset conditions over the test period. The flare shutdown and re-started automatically due to loss of flame signal. MDEQ witnessed a portion of the test program and had no objection to the use of the digital manometer for the measurement of velocity pressure. MDEQ did not provide any audit samples for analysis. AQSI quality assurance (QA) procedures included:

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

Raw field and computer-calculated data used in the determination of the utility flare average exit velocity and net heating value, visible emissions observation data, and available 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, including the determination of $V_{max}$, are presented in Appendix C.

This report prepared by: _____
Jeremy M. Chrobak
Environmental Technician

This report reviewed by: _____
Dana A. Oleniacz
President

October 29, 2015

AQS Inc.

# TABLES

**Table 1**

**Utility Flare Inlet Volumetric Flow Rate and Flare Exit Velocity**
**Oakland Heights Development, Inc.**
**Auburn Hills, Michigan**
**AQSI Project No. 15F1005**
**September 28, 2015**

| Parameter | Test 1 | Test 2 | Test 3 | Average |
|---|---|---|---|---|
| Inlet Volumetric Flow Rate (scfm) – Measured Field Data | 2,883 | (2,799) | 2,715 | 2,799 |
| Exit Tip Diameter (inches) | 16 | 16 | 16 | |
| Exit Tip Cross-Sectional Area ($ft^2$) | 1.396 | 1.396 | 1.396 | |
| Allowable Exit Velocity (fps)[1] | **60** | **60** | **60** | **60** |
| Maximum Permitted Velocity, $V_{max}$ (fps) [2] | **101.7** | **(97.0)** | **96.7** | **98.4** |
| Exit Velocity (fps) | **34.4** | **(33.4)** | **32.4** | **33.4** |

[1] 40 CFR 60.18(c)(4)(i)
[2] 40 CFR 60.18(c)(4)(iii)
scfm: standard cubic feet per minute
$ft^2$: square feet
fps: feet per second

AQS Inc.

**Table 2**

**Utility Flare Inlet Gas Net Heating Value**
**Oakland Heights Development, Inc.**
**Auburn Hills, Michigan**
**AQSI Project No. 15F1005**
**September 28, 2015**

| Parameter | Test 1 | Test 2 | Test 3 | Average |
|---|---|---|---|---|
| Flare Inlet Gas Methane Content (ppm) | 555,534 | 535,867 | 534,670 | 542,023 |
| Flare Inlet Gas Methane Content (%) | 55.55 | 53.59 | 53.47 | 54.20 |
| 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) | **18.49** | **17.83** | **17.79** | **18.04** |

[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

AQS Inc.

# FIGURES

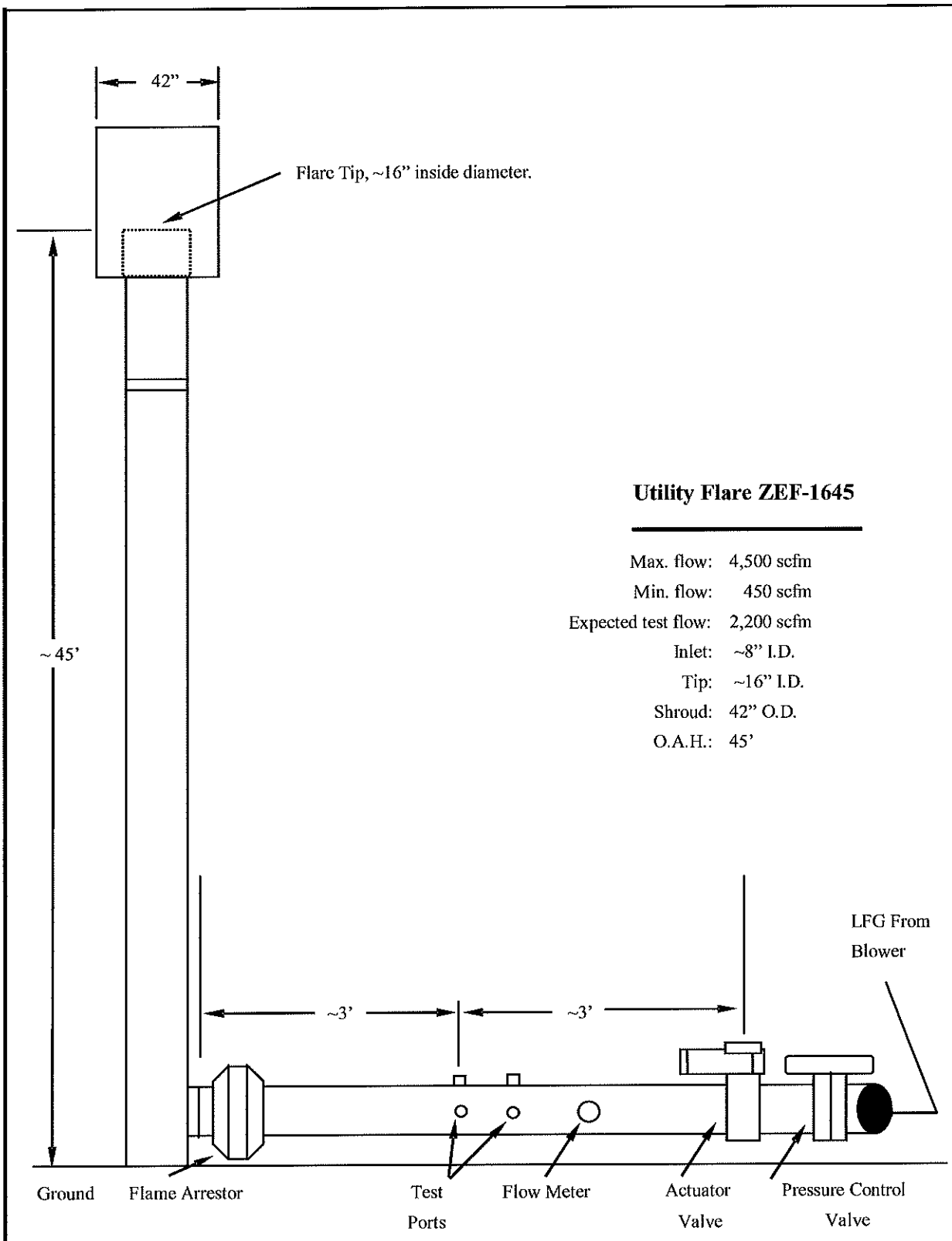
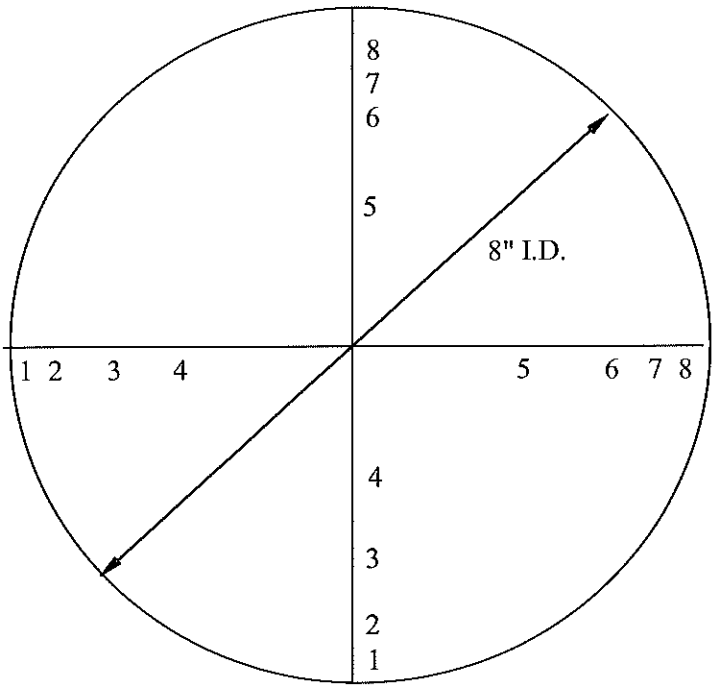



**Figure 2**
Utility flare duct and stack arrangement, approximate dimensions, and test locations, Oakland Heights Development, Inc. in Auburn Hills, Michigan.

Air Quality Specialist, Inc.
September 28, 2015




| Traverse Point Number | Distance From Wall (percent of diameter) |
|---|---|
| 1 | 0.50 |
| 2 | 0.84 |
| 3 | 1.55 |
| 4 | 2.58 |
| 5 | 5.42 |
| 6 | 6.45 |
| 7 | 7.16 |
| 8 | 7.50 |

**Figure 3**
Traverse point numbers and locations on the utility flare inlets at Oakland Heights Development, Inc. in Auburn Hills, Michigan.

Air Quality Specialist, Inc.
September 28, 2015

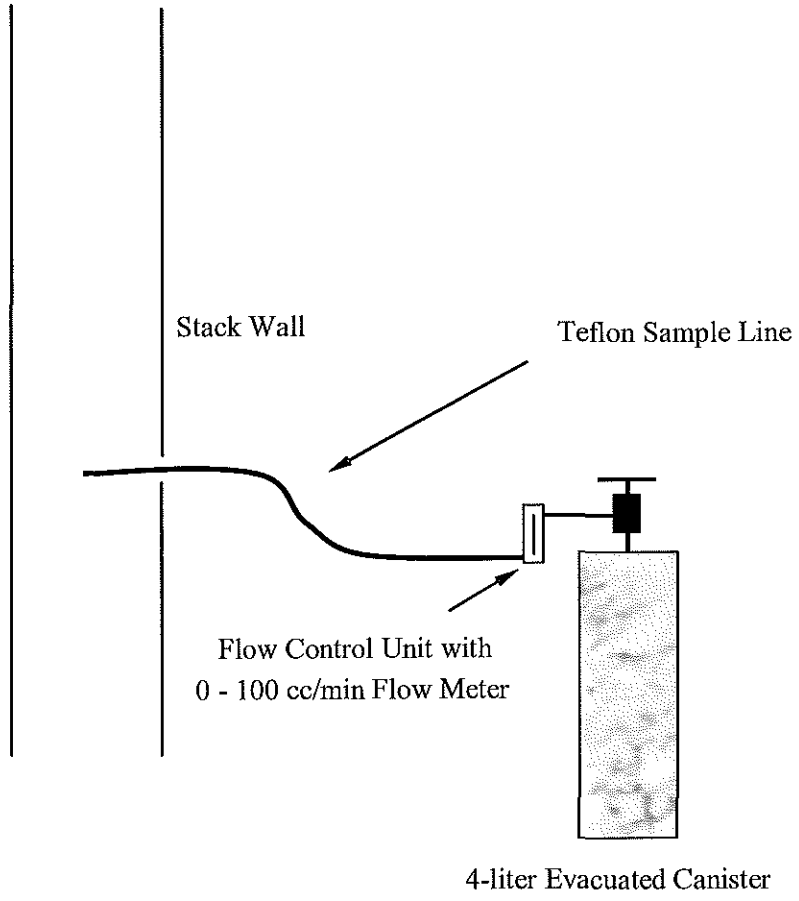



**Figure 1**
USEPA Method 3C sample train for the utility flare inlet duct at Oakland Heights Development, Inc. in Auburn Hills, Michigan.

Air Quality Specialist, Inc.
September 28, 2015