Compliance Test Report
Non-methane Organic Compound Mass Emission Rate

Lyon Development, Inc.
New Hudson, Michigan
SRN: N2803

November 11, 2013

Prepared for:
Republic Services, Inc.
5011 S. Lilley Road
Canton, Michigan 48188

Prepared by:
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EXECUTIVE SUMMARY

Republic Services, Inc. (Republic) retained Air Quality Specialist, Inc. (AQSI) to conduct non-methane organic compound (NMOC) tests at Lyon Development, Inc. in New Hudson, Michigan. A utility flare supplies vacuum and controls landfill gas (LFG) emissions from Lyon Development, Inc. The facility is a closed landfill.

The purpose of the test program is to demonstrate that NMOC produced by the landfill is less than 50 megagrams (Mg) per year, on three successive test dates. A successful demonstration will satisfy one of three criteria that will allow the facility to be relieved of NSPS monitoring and reporting requirements, pursuant to 60.752(b)(2)(v). A test plan for Non-methane Organic Compound Tests at Lyon Development, Inc., New Hudson, Michigan (Test Plan) prepared by AQSI was submitted to the Michigan Department of Environmental Quality, Air Quality Division - Technical Programs Unit on January 11, 2013.

AQSI conducted the fieldwork for this third NMOC test event on October 9, 2013, and in accordance with the submitted Test Plan. Mr. Andrew Secord and Mr. Andrew Karg conducted the tests. Mr. Pete Campbell with Monitoring Control and Compliance Inc. provided on-site coordination of the tests with landfill operations. Michigan Department of Environmental Quality (MDEQ) did not elect to witness the test program. The results of this third NMOC test event were:

Parameter	Applicable Requirement	Average Test Result
NMOC Mass Emission Rate	<50 Mg/yr [1]	13.2 Mg/yr

Mg/yr: megagrams per year

[1] 40 CFR 60.752(b)(2)(v)(C)

1.0 INTRODUCTION

Republic Services, Inc. (Republic) retained Air Quality Specialist, Inc. (AQSI) to conduct non-methane organic compound (NMOC) tests at Lyon Development, Inc. in New Hudson, Michigan. A utility flare supplies vacuum and controls landfill gas (LFG) emissions from Lyon Development, Inc. The facility is a closed landfill.

The purpose of the test program is to demonstrate that NMOC produced by the landfill is less than 50 megagrams (Mg) per year, on three successive test dates. A successful demonstration will satisfy one of three criteria that will allow the facility to be relieved of NSPS monitoring and reporting requirements, pursuant to 60.752(b)(2)(v).

AQSI conducted the test program with methodologies outlined in 40 CFR 60.754(b).

AQSI conducted the fieldwork for this third NMOC test event on October 9, 2013, and in accordance with the Test Plan, dated January 11, 2013. Mr. Andrew Secord and Mr. Andrew Karg conducted the tests. Mr. Pete Campbell with Monitoring Control and Compliance Inc. provided on-site coordination of the tests with landfill operations. Michigan Department of Environmental Quality (MDEQ) did not elect to witness 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 Environmental Scientist	Air Quality Specialist, Inc. 672 N. Milford Road, Suite 152 Highland, Michigan 48357	(248) 887-7565 (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
Ms. Christina Pearse Environmental Manager	Republic Services, Inc. 5011 S. Lilley Road Canton, Michigan 48188	(734) 231-8217

2.0 SUMMARY OF RESULTS

On October 9, 2013, the utility flare operated at an average inlet volumetric flow rate of approximately 1,230 standard cubic feet per minute (scfm) as measured by USEPA Methods 1 and 2, or 979 scfm as averaged from recorded process flow meter data. The average NMOC concentration obtained from the landfill gas header (before flare skid condensate knockout pot and blower) was 1,200 parts per million (ppm) as carbon, or 200 ppm, as hexane.

The average NMOC mass emission rate is calculated as 13.2 megagrams per year (Mg/yr), using the equation in 60.754(b).

The limit is a NMOC mass emission rate of less than 50 Mg/yr per 60.752(b)(2)(v)(C).

The test results demonstrate that the calculated NMOC gas produced by the closed landfill is less than 50 Mg/yr for this third and final test event.

3.0 SOURCE DESCRIPTION

Lyon Development, Inc. is a closed 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.

Lyon 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 the utility flare for landfill gas control.

Lyon Development, Inc. installed the new utility flare in March of 2011. The flare is designed to meet the requirements of 60.752(b)(2)(iii)(A) at a flow rate up to 1,350 scfm. AQSI tested the flare on June 16, 2011, and the test results demonstrated that the flare met the requirements of 60.752(b)(2)(iii)(A) at the tested landfill gas flow rate (1,240 scfm). The landfill gas flow rate to the flare for this NMOC test event was expected to be approximately 1,200 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 October 9, 2013, may be considered 'typical:' methane, 43.3%; carbon dioxide, 33.2%; oxygen, 2.1%; and nitrogen, 24%.

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 25C	Non-methane Organic Compound concentration	Gas Chromatography / Flame Ionization Detector (GC/FID)

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 an inclined manometer with increments of 0.01 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 (USEPA Method 3C) and Determination of Non-methane Organic Compounds in Landfill Gases (USEPA Method 25C)

AQSI used Methods 3C and 25C to determine landfill gas composition and NMOC concentration. AQSI collected three, 30-minute (minimum), integrated tank samples of landfill gas from the inlet to the utility flare (upstream of the condensate knockout pot and blower). Figure 3 depicts the Method 3C/25C sample location.

AQSI submitted the samples to Triangle Environmental Services, Inc. (TES), Durham, North Carolina for analysis. TES analyzed each tank for carbon dioxide, methane, nitrogen, oxygen, and NMOC concentration, and moisture fraction. Figure 4 depicts the Method 3C/25C 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) to measure carbon dioxide, methane, nitrogen, and oxygen concentrations. TES used a GC equipped with a flame ionization detector (FID) for NMOC analysis. The TES laboratory analytical report is presented in Appendix B.

AQSI used the Method 3C analytical results to calculate stack gas molecular weight (for use in stack gas velocity and volumetric flow rate calculations). TES used the Method 3C analytical results to oxygen-correct the raw NMOC concentration data.

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.

TES reported the NMOC concentration as carbon. AQSI converted the laboratory results to "as hexane" [$NMOC_{(hexane)}$] by dividing the raw NMOC concentration by six, pursuant to 60.754(b)(2). The individual $NMOC_{(hexane)}$ data from the three test runs was used in the equation from 60.754(b) to calculate NMOC mass emission rate from the landfill.

5.0 RESULTS AND DISCUSSION

The calculated NMOC mass emission rate from Lyon Development, Inc. for the October 9, 2013 test event was 13.2 Mg/yr.

The results demonstrate that the calculated NMOC gas produced by the landfill is less than 50 Mg/yr for this third and final test event.

AQSI noted one variation and/or anomaly in the normal sample collection procedures. NMOC Test No. 2 was to be collected in tank N32, but upon conduct of initial leak check, AQSI noted that there was no vacuum in the tank. AQSI used tank N171 for NMOC Test No. 2.

AQSI did not note any control equipment upset conditions over the test period. However, AQSI notes that the process flow meter data recorded from the flare control panel screen is approximately 20 percent lower than the flow rate obtained by USEPA Methods 1 and 2 measurement and calculation. AQSI used the measured and calculated flow rate data in equation 60.754(b) to calculate NMOC mass emission rate. The use of the calculated flow rate data does not benefit Lyon Development, Inc.; use of the recorded process flow meter data in equation 60.754(b) would yield an approximately 20% lower NMOC emission rate.

MDEQ did not elect to witness the test program. 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/25C train prior to each sample collection

Raw field and computer-calculated data used in the determination of the utility flare velocity and volumetric flow rate, and recorded process flow meter data, are presented in Appendix A. The Method 3C/25C laboratory analytical results and chain-of-custody forms are presented in Appendix B. Sample calculations, including the determination of NMOC mass emission rate, are presented in Appendix C.

This report prepared by:

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This report reviewed by:

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November 11, 2013

TABLE

Table 1

Non-methane Organic Compound Emission Rate Test Results
Lyon Development, Inc.
Landfill Gas Header
New Hudson, Michigan
October 9, 2013

Test No.	Molecular Weight	Concentration (ppmv)	Flow Rate (scfm)	Flow Rate (m^3/min)	Emission Rate (Mg/yr)
1	86.18	201	1,214.9	34.41	13.1
2	86.18	179	1,243.4	35.21	11.9
3	86.18	221	1,237.1	35.04	14.6
Averages:		**200**	**1,231.8**	**34.88**	**13.2**

ppmv: parts per million (volume), as hexane

scfm: standard cubic feet per minute

m^3/min: cubic meters per minute

Mg/yr: megagrams per year

Equations

m^3/min: scfm / (35.31 ft^3 / m^3)

Constant: 1.89×10^{-3} from 40 CFR 60, §60.754(b).

Mg/yr = 1.89×10^{-3} * m^3/min * ppm

FIGURES

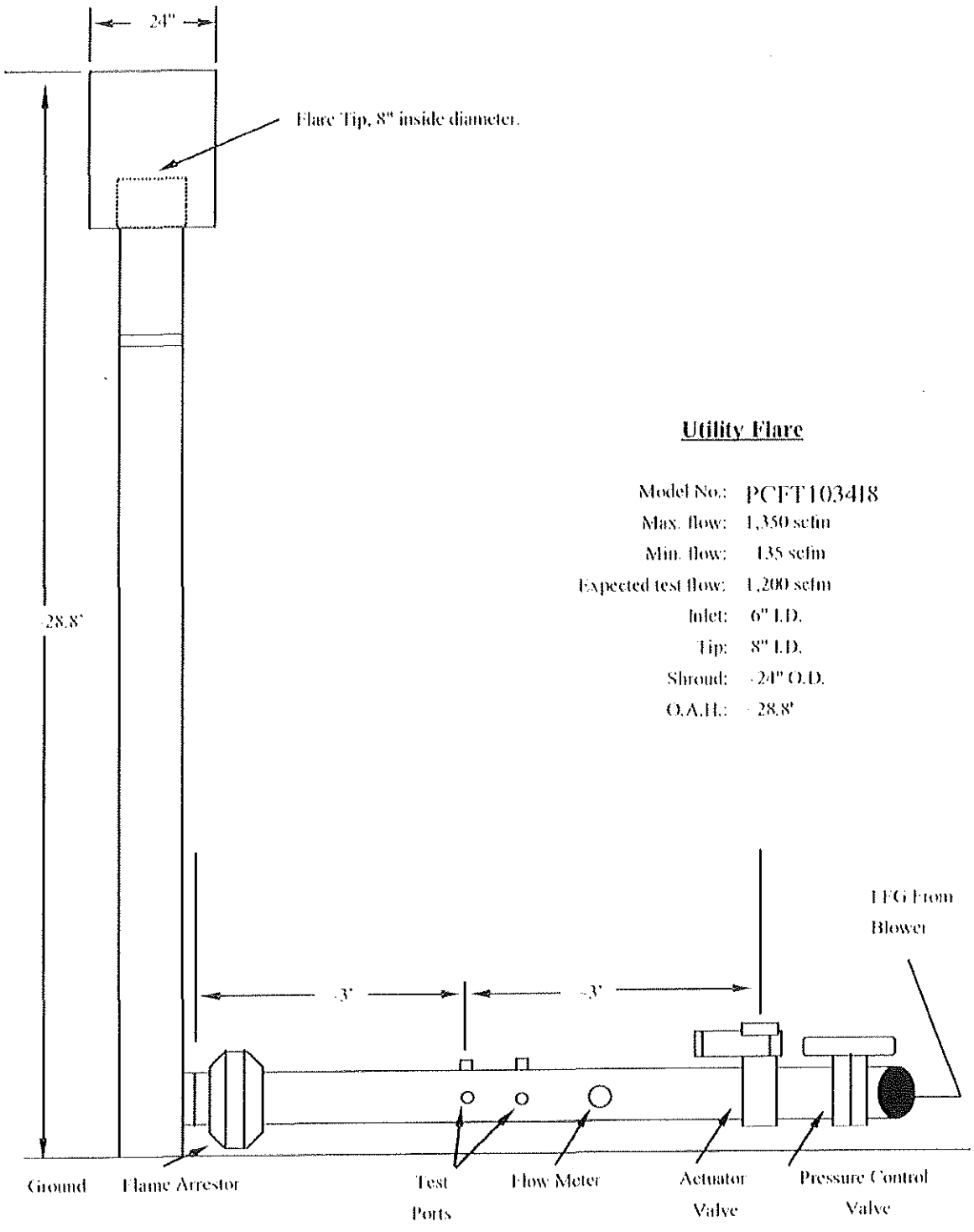

Figure 1
Utility flare duct and stack arrangement, approximate dimensions, and test locations, Lyon Development, Inc. in New Hudson, Michigan.

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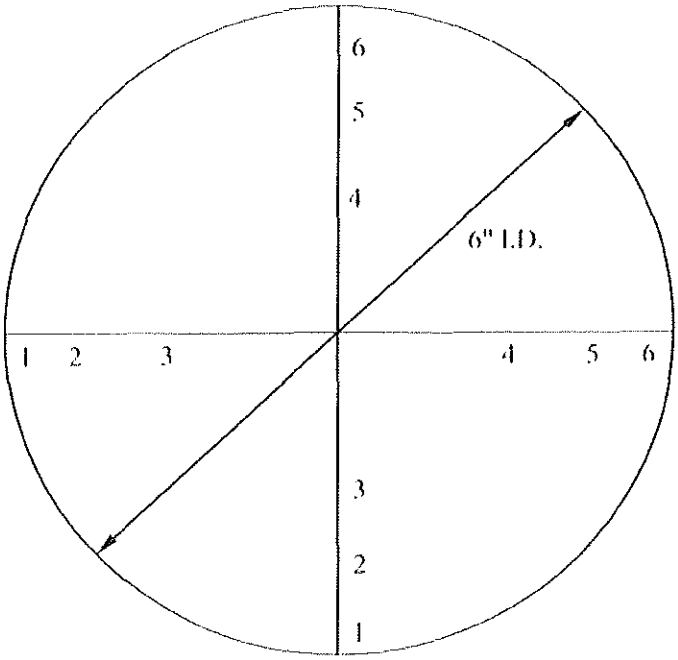

Traverse Point Number	Distance From Wall (inches)
1	0.50
2	0.88
3	1.78
4	4.22
5	5.12
6	5.50

Figure 2
Traverse point numbers and locations on the utility flare inlet at Lyon Development, Inc. in New Hudson, Michigan.

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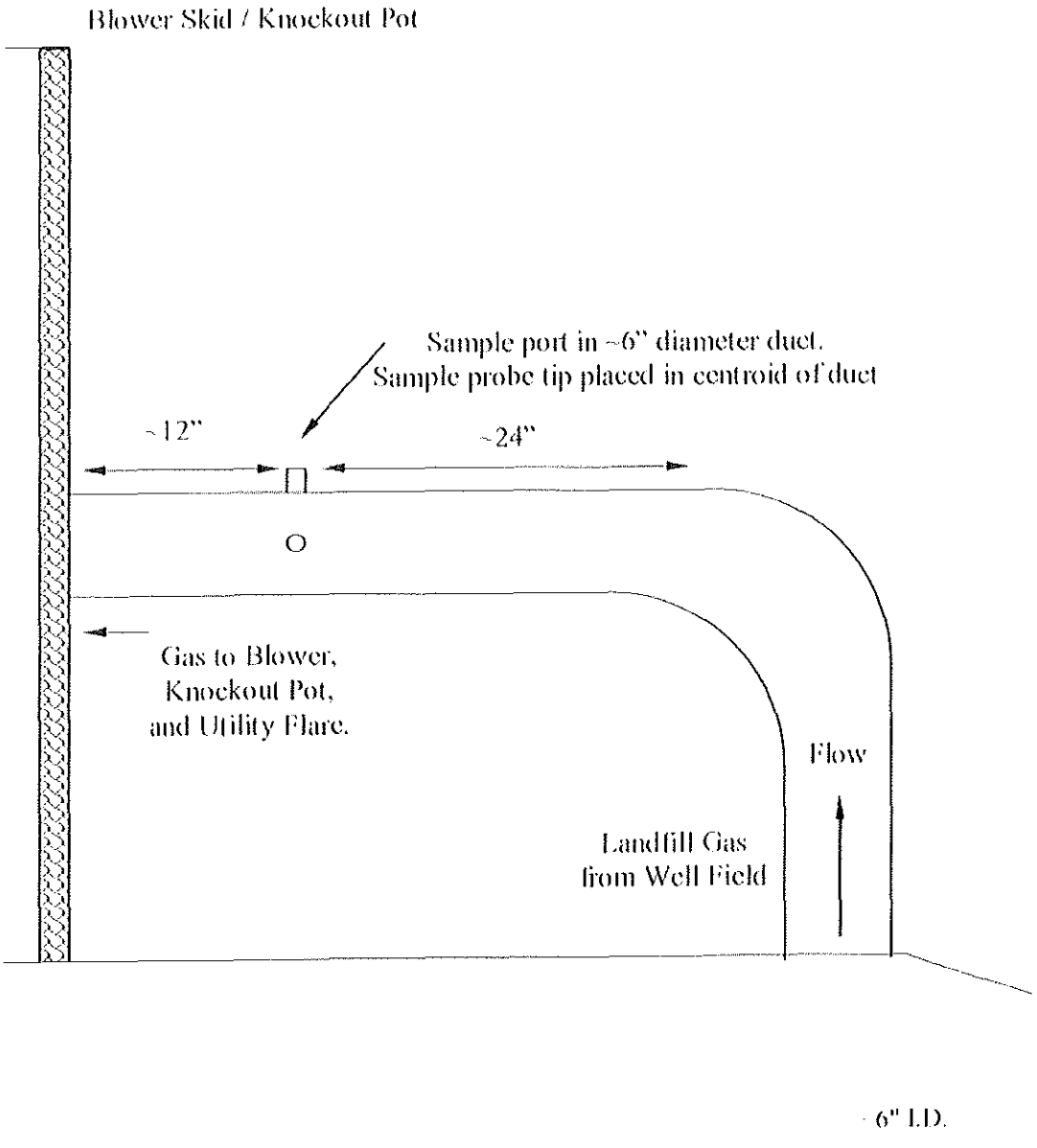

Figure 3
NMOC sample port and probe tip location, utility flare blower inlet at Lyon Development, Inc. in New Hudson, Michigan.

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October 9, 2013

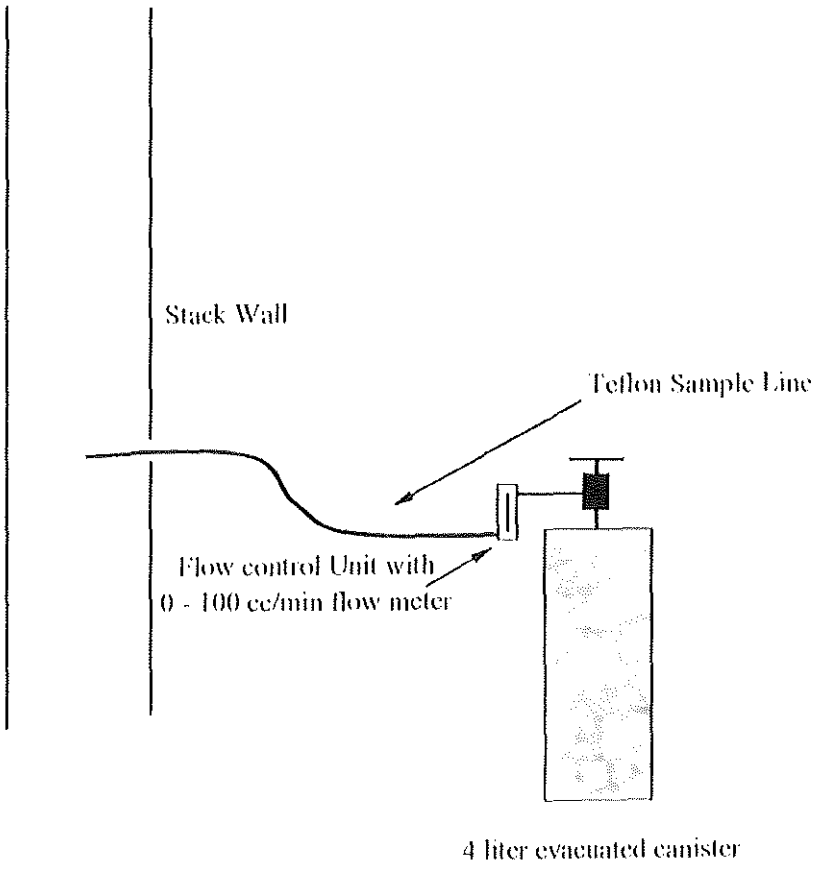

Figure 4
USEPA Method 3C/25C sample train for the utility flare inlet duct at Lyon Development, Inc. in New Hudson, Michigan.

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