



Thermal Oxidizer VOC Destruction Efficiency Test Report

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AIR QUALITY DIV.

Prepared for:

General Motors

Detroit Hamtramck Assembly Center

2500 East General Motors Blvd
Detroit, Michigan 48211

Project No. 15-4679.00
June 3, 2015

BT Environmental Consulting, Inc.
4949 Fernlee Avenue
Royal Oak, Michigan 48073
(248) 548-8070



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 Permit (ROP) 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 specified in Rule 213(3)(b)(ii), and be made available to the Department of Environmental Quality, Air Quality Division upon request.

Source Name GM Detroit/Hamtramck Assembly County Wayne
 Source Address 2500 E. GM Blvd. City Detroit
 AQD Source ID (SRN) M4199 ROP No. MI-ROP-M4199-2010 ROP Section No. 1

Please check the appropriate box(es):

Annual Compliance Certification (Pursuant to Rule 213(4)(c))

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 ROP, 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 ROP.

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

Semi-Annual (or More Frequent) Report Certification (Pursuant to Rule 213(3)(c))

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

1. During the entire reporting period, ALL monitoring and associated recordkeeping requirements in the ROP 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 ROP 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 _____ To _____

Additional monitoring reports or other applicable documents required by the ROP are attached as described:
 Test report dated (June 3, 2015) for EUPRIMERSURFACER testing the
 destruction efficiency of thermal oxidizers.

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

<u>Gary L. West</u>	<u>Plant Manager</u>	<u>313-972-6020</u>
Name of Responsible Official (print or type)	Title	Phone Number
		<u>6/10/2015</u>
Signature of Responsible Official		Date



EXECUTIVE SUMMARY

BT Environmental Consulting, Inc. (BTEC) was retained by General Motors, LLC (GM) to evaluate volatile organic compounds (VOC) destruction efficiency (DE) on two TO incinerators at the GM Detroit-Hamtramck Assembly Plant located in Detroit, Michigan. The emissions test program was conducted on April 14-15, 2015.

Testing of the sources consisted of triplicate 60-minute test runs conducted simultaneously at the inlet and outlet of each source. Testing runs were done while production was maximized and the oven was loaded. Sampling was performed utilizing United States Environmental Protection Agency (USEPA) reference test methods. The emissions test program was required by MDEQ Air Quality Division Renewable Operating Permit (ROP) No. MI-ROP-M4199-2010. The results of the emission test program are summarized by Table I.

Table I
EUPRIMERSURFACER Overall Emission Summary
Test Date: April 14-15, 2015

Source	VOC DE (%)*
North Prime Oven Exhaust	99.7
South Prime Oven Exhaust	99.7

*DE based on concentration basis

1. Introduction

BT Environmental Consulting, Inc. (BTEC) was retained by General Motors, LLC (GM) evaluate volatile organic compounds (VOC) destruction efficiency (DE) on two TO incinerators at the GM Detroit-Hamtramck Assembly Plant located in Detroit, Michigan. The emissions test program was conducted on April 14-15, 2015. The purpose of this report is to document the results of the test program.

AQD has published a guidance document entitled "Format for Submittal of Source Emission Test Plans and Reports" (December 2013). The following is a summary of the emissions test program and results in the format suggested by the aforementioned document.

1.a Identification, Location, and Dates of Test

Sampling and analysis for the emission test program was conducted on April 14-15, 2015 at the General Motors Detroit-Hamtramck Assembly Plant located in Detroit, Michigan. The test program included evaluation of volatile organic compounds (VOC) destruction efficiency (DE) on two incinerators.

1.b Purpose of Testing

AQD issued Renewable Operating Permit No. MI-ROP-M4199-2010 to GM. This permit limits emissions from each turbine as summarized by Table 1.

**Table 1
EUPRIMERSURFACER Emission Limitations
General Motors Detroit-Hamtramck Assembly Center**

Facility	Permit No.	DE Limit
Detroit-Hamtramck, MI	MI-ROP-M4199-2010	90%

1.c Source Description

EUPRIMERSURFACER - A guidecoat (primer surfacer) spray booth followed by a curing oven. The solvent borne primer surfacer is applied automatically with air atomized or electrostatic spray guns. The primer booth is equipped with a downdraft water wash system to control particulate emissions from paint overspray. VOC emissions from the curing ovens are controlled by a thermal oxidizer. There is one guidecoat booth and two curing ovens (North and South).



1.d Test Program Contacts

The contact for the source and test report is:

Ms. Jennifer Tegen
Staff Environmental Engineer
General Motors, LLC
GECS Facility Air Compliance & Permit
(810) 706-1319

Ms. Jessica Jeffery
Senior Environmental Engineer
General Motors, LLC
Detroit-Hamtramck Assembly Plant
(313) 215-8203

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

Table 2
Test Personnel

Name and Title	Affiliation	Telephone
Mr. Matthew Young Project Manager	BTEC 4949 Fernlee Royal Oak, MI 48073	(248) 548-8070
Mr. Paul Molenda Environmental Technician	BTEC 4949 Fernlee Royal Oak, MI 48073	(248) 548-8070
Mr. Ken Felder Environmental Technician	BTEC 4949 Fernlee Royal Oak, MI 48073	(248) 548-8070
Mr. Tom Maza	MDEQ Air Quality Division	(313) 456-4709
Mr. U. Sam Amer	MDEQ Air Quality Division	(313) 456-4684

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 included (1) the temperature of the RTO combustion zone at least once every 15 minutes and (2) the number of cars processed in the oven per run.

2.b Applicable Permit

The applicable permit for this emissions test program is Renewable Operating Permit (ROP) No. MI-ROP-M4199-2010.

2.c Results

The overall results of the emission test program are summarized by Table 3 (see Section 5.a). DE emissions from each oven were above the corresponding limit of 90%.

3. Source Description

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

3.a Process Description

The GM facility is an automotive assembly center. The facility utilizes numerous raw materials in the process of automotive assembly, varying from imported parts and products to pre-assembled automotive supplies. The materials utilized that are influential for the proposed emissions test program are paints that are cured in curing ovens. The facility is restricted in the number of finished products produced as being 78.5 fully assembled vehicles per hour and not more than 337,500 assemblies per year.

3.b Process Flow Diagram

Due to the simplicity of the TO, a process flow diagram is not necessary.

3.c Raw and Finished Materials

See section 3.a.

3.d Process Capacity

See section 3.a.

3.e Process Instrumentation

Process data monitored during the emissions test program included (1) the temperature of the TO combustion zone at least once every 15 minutes and (2) the number of cars processed in the oven per run

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

Volatile Organic compound (VOC) concentrations were measured according to 40 CFR 60, Appendix A, Method 25A. A sample of the gas stream was drawn through a stainless steel probe with an in-line glass fiber filter to remove any particulate, and a heated Teflon[®] sample line to prevent the condensation of any moisture from the sample before it enters the analyzer. Data was recorded at 4-second intervals on a PC equipped with Labview[®] II data acquisition software. BTEC used a VIG Model 20 THC hydrocarbon analyzer to determine the VOC concentration.

The VIG THC hydrocarbon analyzer channels a fraction of the gas sample through a capillary tube that directs the sample to the flame ionization detector (FID), where the hydrocarbons present in the sample are ionized into carbon. The carbon concentration is then determined by the detector in parts per million (ppm). This concentration is transmitted to the data acquisition system (DAS) at 4-second intervals in the form of an analog signal, specifically voltage, to produce data that can be averaged over the duration of the testing program. This data is then used to determine the average ppm for total hydrocarbons (THC) using the equivalent units of propane (calibration gas).

In accordance with Method 25A, a 4-point (zero, low, mid, and high) calibration check was performed on the THC analyzer. Calibration drift checks were performed at the completion of each run.

For analyzer calibrations, calibration gases were mixed to desired concentrations using an Environics Series 4040 Computerized Gas Dilution System. The Series 4040 consists of a single chassis with four mass flow controllers. The mass flow controllers are factory-calibrated using a primary flow standard traceable to the United States National Institute of Standards and Technology (NIST). Each flow controller utilizes an 11-point calibration table with linear interpolation, to increase accuracy and reduce flow controller nonlinearity. A field quality assurance check of the system was performed pursuant to Method 205 by setting the diluted concentration to a value identical to a Protocol 1 calibration gas and then verifying that the analyzer response is the same with the diluted gas as with the Protocol 1 gas.

4.b Recovery and Analytical Procedures

This test program did not include laboratory samples, consequently, sample recovery and analysis is not applicable to this test program.

4.c Sampling Ports

Sampling ports are located at the inlet and outlet of each thermal oxidizer (inside the building).

4.d Traverse Points

The VOC sampling probe was inserted into the centroidal area of both the Inlet and Outlet exhaust stacks.

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 3. Detailed results for the emissions test program are summarized by Tables 4 and 5.

Table 3
EUPRIMERSURFACER Overall Emission Summary
Test Date: April 14-15, 2015

Source	VOC DE (%)*
North Prime Oven Exhaust	99.7
South Prime Oven Exhaust	99.7

*DE based on concentration basis

5.b Discussion of Results

VOC DE from the prime ovens were higher than the corresponding emission limit of 90%.

5.c Sampling Procedure Variations

Although flow rate and moisture measurements were performed, it was requested by Tom Maza (MDEQ-AQD) on April 15, 2015, that DE calculations be performed on a concentration basis.

5.d Process or Control Device Upsets

On April 14, 2015, during Run 2 on the south primer oven a fan belt broke and shut down the oven incinerator process. The conveyor interlocked were in place and no new vehicles entered the oven during this time. The fan belt was repaired immediately and the testing was able to resume after the oven incinerator was at proper operating temperature.

5.e Control Device Maintenance

Routine repair and replacement activities associated with the North and South Primer Surfacer ovens and thermal oxidizers were completed on November 7, 2014. These activities included refurbishment of the entrance and exit end air seals of the ovens, refurbishment of the existing filter boxes, indirect heating realignment within the equalization zone, replacement of some of the oven exterior ductwork, gas trains, wiring and controls, and the recuperative thermal oxidizers were replaced with equivalent or more efficient thermal oxidizers. On December 26, 2014 – January 4, 2015 the following repairs were made to the north and south primer thermal oxidizers, additional structural stiffeners were welded to the external wall, insulation and cladding was replaced, heavy walled drive tube was installed and two universal joints were installed on each drive shaft.

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 B.

5.i Sample Calculations

Sample calculations are provided in Appendix C.

5.j Field Data Sheets

Field documents relevant to the emissions test program are presented in Appendix A.

5.k Laboratory Data

There are no laboratory results for this test program. Raw CEM data is provided electronically in Appendix D.

Tables

Table 4
South Prime Oven VOC Destruction Efficiency
General Motors
Hamtramck, MI
BTEC Project No. 15-4679.00
Sampling Dates: April 14, 2015

Parameter	Run 1	Run 2	Run 3	Average
Test Run Date	4/14/2015	4/14/2015	4/14/2015	
Test Run Time	7:12-8:12	13:14-14:14	14:14-15:14	
Inlet VOC Concentration (ppmv as propane)	85.7	64.9	58.9	69.8
Inlet VOC Concentration (ppmv, corrected as per USEPA 7E)	84.0	61.5	55.8	67.1
Outlet VOC Concentration (ppmv as propane)	0.3	0.1	0.0	0.1
Outlet Methane Concentration (ppmv as methane)	0.2	0.4	0.6	0.4
Outlet VOC Concentration (ppmv, corrected as per USEPA 7E)	0.4	0.1	0.1	0.2
Outlet Methane Concentration (ppmv, corrected as per USEPA 7E)	-0.1	-0.1	0.2	0.0
Outlet VOC Concentration (ppmv propane, -Methane)	0.1	-0.1	-0.2	-0.1
Outlet VOC Concentration (ppmv propane, -Methane, corrected as per USEPA 7E)	0.4	0.2	0.0	0.2
VOC Destruction Efficiency (Concentration Basis)(Did not use Methane subtraction)	99.6%	99.8%	99.8%	99.7%

scfm = standard cubic feet per minute

dscfm = dry standard cubic feet per minute

ppmv = parts per million on a volume-to-volume basis

lb/hr = pounds per hour

MW = molecular weight (C₃H₈ = 44.10)

24.14 = molar volume of air at standard conditions (70°F, 29.92" Hg)

35.31 = ft³ per m³

453600 = mg per lb

Response factor obtained from introducing propane into methane analyzer: 2.3

Equations

ppmv propane, -methane = ppmv propane - ppmv methane / RF

lb/hr = ppmv * MW/24.14 * 1/35.31 * 1/453,600 * scfm * 60 for VOC

VOC Correction			
Co	1.12	1.22	1.22
Cma	99.1	99.1	99.1
Cm	100.90	103.73	103.73

VOC Correction			
Co	-0.13	-0.07	-0.07
Cma	9.8	9.8	9.8
Cm	10.01	10.15	10.15

Methane Correction			
Co	0.35	0.47	0.47
Cma	9.9	9.9	9.9
Cm	10.04	9.99	9.99

Table 5
North Prime Oven VOC Destruction Efficiency
General Motors
Hamtramck, MI
BTEC Project No. 15-4679.00
Sampling Dates: April 15, 2015

Parameter	Run 1	Run 2	Run 3	Average
Test Run Date	4/15/2015	4/15/2015	4/15/2015	
Test Run Time	7:15-8:15	9:15-11:08	12:00-13:00	
Inlet VOC Concentration (ppmv as propane)	62.5	65.3	99.5	75.8
Inlet VOC Concentration (ppmv, corrected as per USEPA 7E)	61.5	63.0	97.0	73.8
Outlet VOC Concentration (ppmv as propane)	0.4	0.1	0.4	0.3
Outlet Methane Concentration (ppmv as methane)	0.3	0.3	0.5	0.4
Outlet VOC Concentration (ppmv, corrected as per USEPA 7E)	0.41	0.1	0.1	0.2
Outlet Methane Concentration (ppmv, corrected as per USEPA 7E)	0.1	-0.1	-0.2	-0.1
Outlet VOC Concentration (ppmv propane, -Methane)	0.3	0.0	0.1	0.1
Outlet VOC Concentration (ppmv propane, -Methane, corrected as per USEPA 7E)	0.4	0.2	0.2	0.2
VOC Destruction Efficiency (Concentration Basis)(Did not use Methane subtraction)	99.3%	99.8%	99.9%	99.7%

scfm = standard cubic feet per minute

dscfm = dry standard cubic feet per minute

ppmv = parts per million on a volume-to-volume basis

lb/hr = pounds per hour

MW = molecular weight (C₃H₈ = 44.10)

24.14 = molar volume of air at standard conditions (70°F, 29.92" Hg)

35.31 = ft³ per m³

453600 = mg per lb

Response factor obtained from introducing propane into methane analyzer:

2.3

Equations

ppmv propane, -methane = ppmv propane - ppmv methane / RF

lb/hr = ppmv * MW/24.14 * 1/35.31 * 1/453,600 * scfm * 60 for VOC

VOC Correction			
Co	1.15	1.75	1.61
Cma	99.4	99.4	99.4
Cm	100.26	102.12	101.95

VOC Correction			
Co	0.02	0.03	0.24
Cma	9.8	9.8	9.8
Cm	9.96	9.81	9.91

Methane Correction			
Co	0.20	0.44	0.72
Cma	9.9	9.9	9.9
Cm	9.89	10.09	10.15

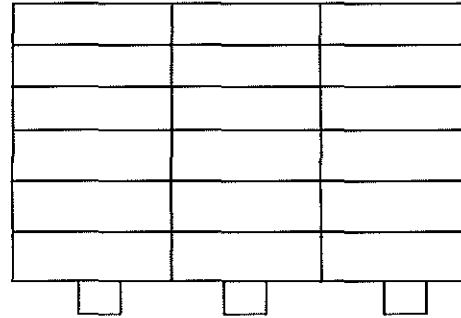
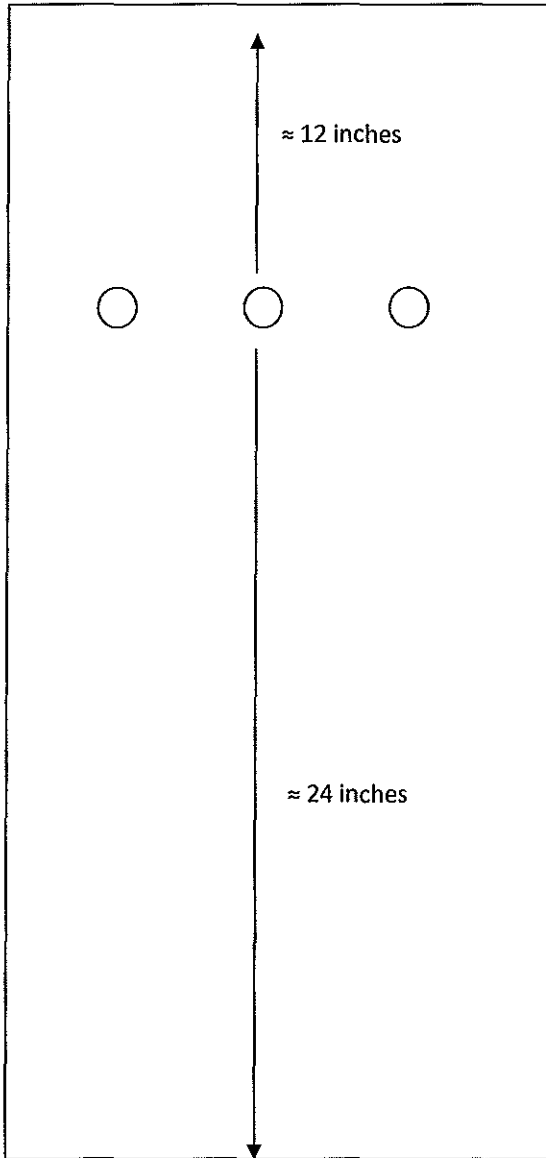
Figures



Stack Dimensions:

Depth: 44.5 inches

Width: 31 inches



Not to Scale

Points	Distance "
1	3.7
2	11.1
3	18.5
4	26.0
5	33.4
6	40.80

Figure No. 1

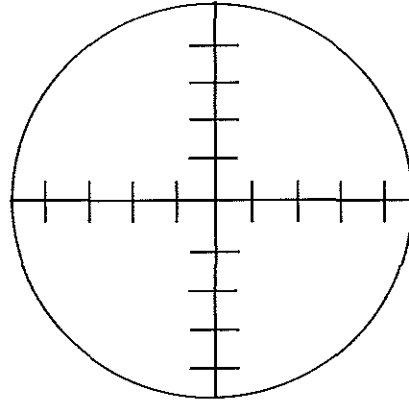
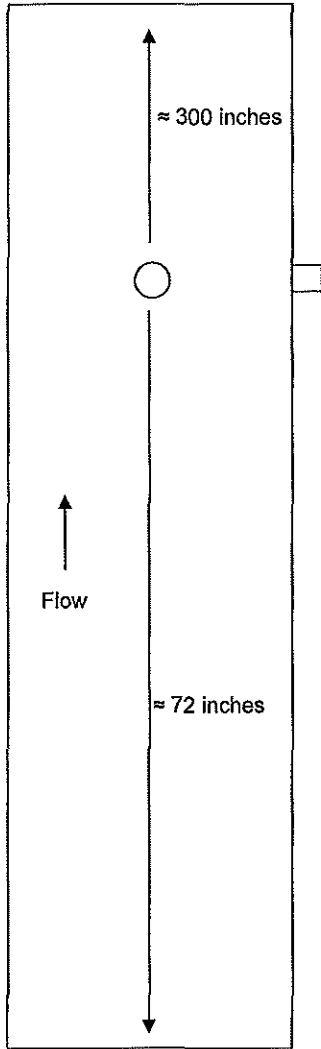
Site:
South Prime Oven Inlet
General Motors
Hamtramck, MI

Sampling Date:
April 14, 2015

BT Environmental Consulting,
Inc.
4949 Fernlee Avenue
Royal Oak, Michigan 48073



diameter = 36 inches



Not to Scale

Points	Distance "
1	1.2
2	3.8
3	7.0
4	11.6
5	24.4
6	29.0
7	32.2
8	34.8

Figure No. 2

Site:
South Prime Oven Exhaust
General Motors
Hamtramck, Michigan

Sampling Date:
April 14, 2015

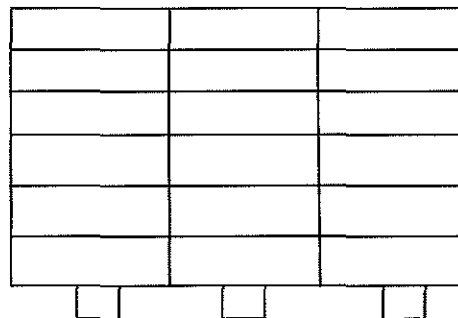
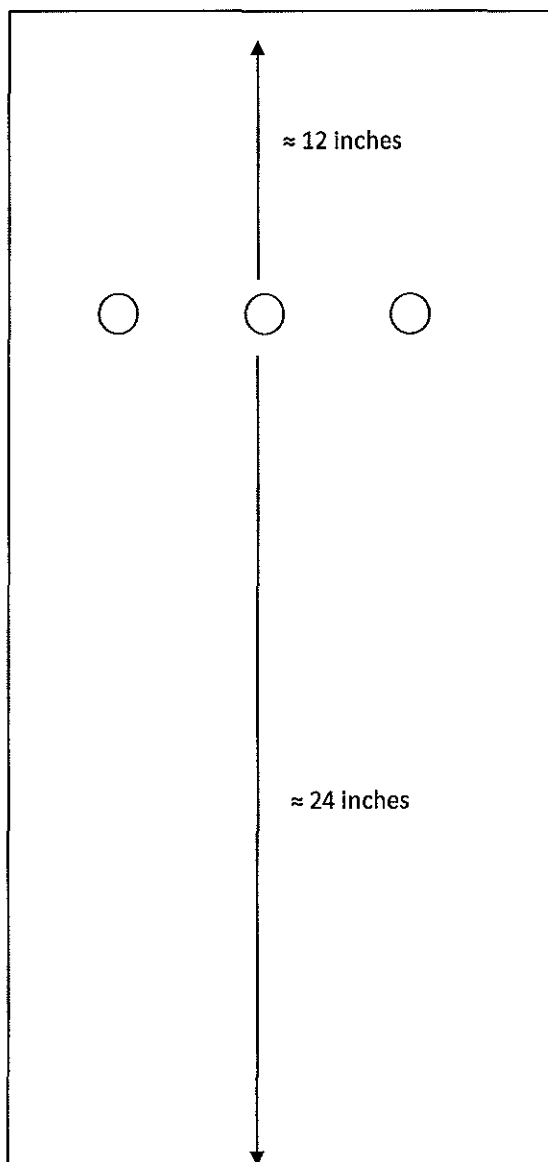
BT Environmental Consulting, Inc.
4949 Fernlee Avenue
Royal Oak, Michigan 48073



Stack Dimensions:

Depth: 44.5 inches

Width: 31 inches



Not to Scale

Points	Distance "
1	3.7
2	11.0
3	18.3
4	25.7
5	33.0
6	40.30

Figure No. 3

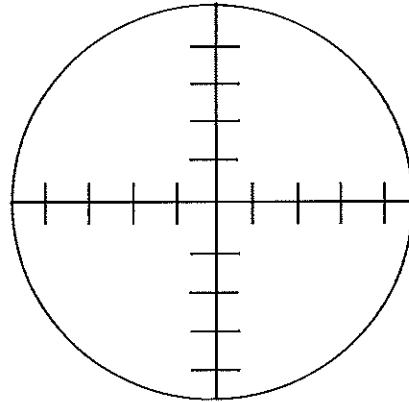
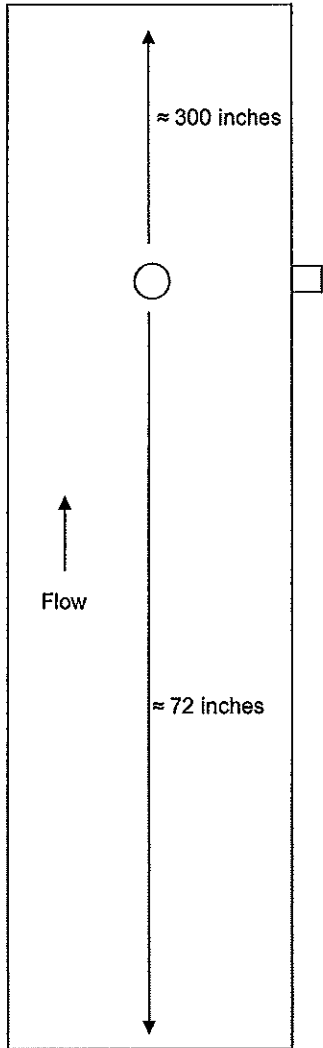
Site:
North Prime Oven Inlet
General Motors
Hamtramck, MI

Sampling Date:
April 15, 2015

BT Environmental Consulting,
Inc.
4949 Fernlee Avenue
Royal Oak, Michigan 48073



diameter = 36 inches



Not to Scale

Points	Distance "
1	1.2
2	3.8
3	7.0
4	11.6
5	24.4
6	29.0
7	32.2
8	34.8

Figure No. 4

Site:
North Prime Oven Exhaust
General Motors
Hamtramck, Michigan

Sampling Date:
April 15, 2015

BT Environmental Consulting, Inc.
4949 Fernlee Avenue
Royal Oak, Michigan 48073

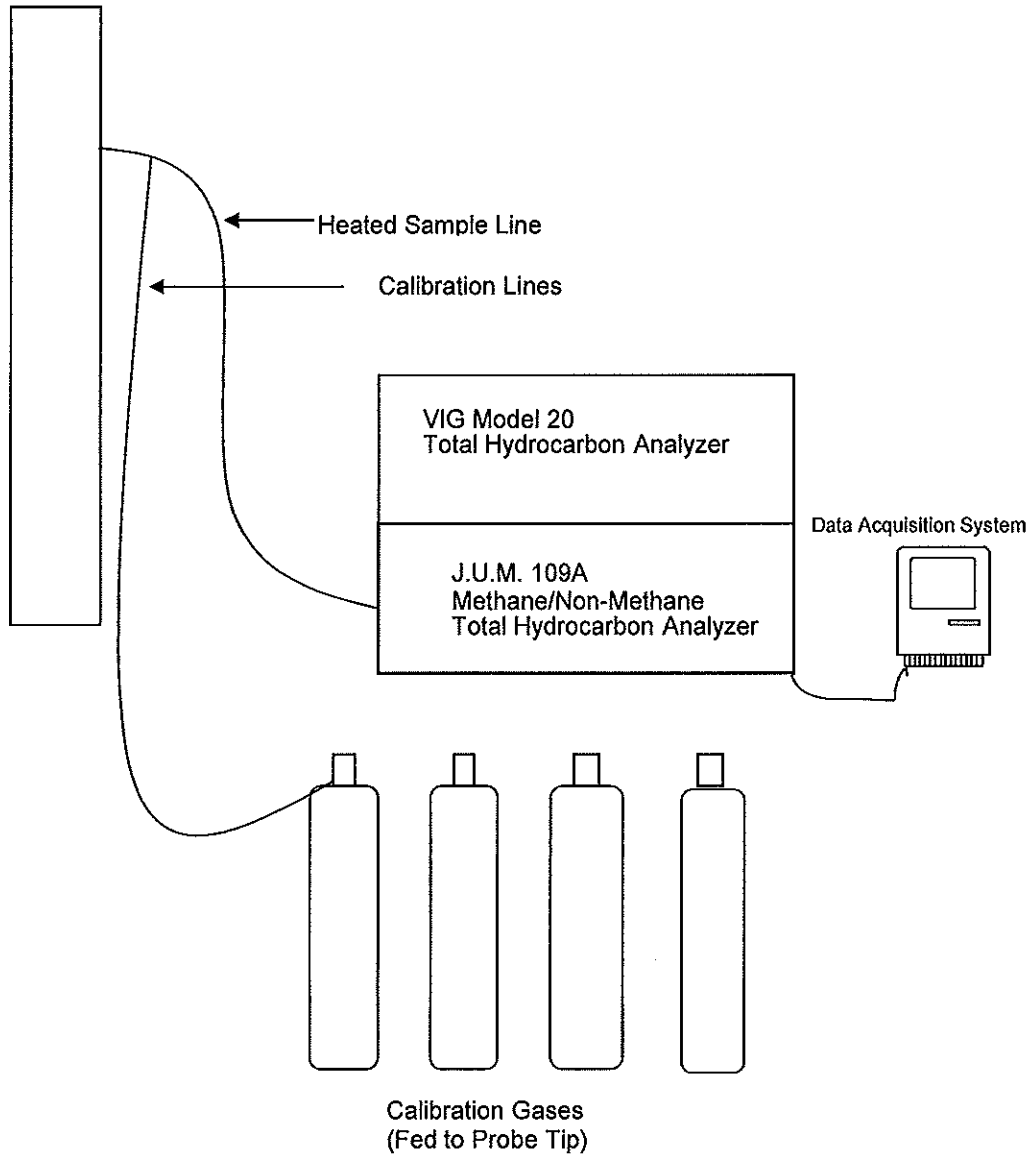


Figure No. 5

Site:
USEPA Method 25A
General Motors
Hamtramck, Michigan

Sampling Date:
April 14-15, 2015

BT Environmental Consulting, Inc.
4949 Fernlee Avenue
Royal Oak, Michigan 48073