BTEC Inc.

Line 6 Emissions Test Report

Prepared for:

General Motors

Saginaw, Michigan

GM SMCO
1629 N. Washington St.
Saginaw, Michigan

Project No. 13-4408.00
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BT Environmental Consulting, Inc.
4949 Fernlee Avenue
Royal Oak, Michigan 48071
(248) 548-8070

Executive Summary

BT Environmental Consulting, Inc. (BTEC) was retained by General Motors LLC (GM) to conduct a compliance evaluation of particulate matter (PM), volatile organic compounds (VOC), oxides of nitrogen (NOx), carbon monoxide (CO), hydrogen chloride (HCl), chlorine (Cl_2), and hydrogen fluoride (HF) emission rates from various exhaust stacks associated with the with Mold Line 6 at the GM Saginaw Metal Casting Operations (SMCO) located in Saginaw, Michigan. Sampling was conducted on November 7th-13th 2013.

Testing consisted of triplicate test runs of approximately 60 minutes for each pollutant except for single test runs during furnace fluxing and drossing operations. Sampling was performed utilizing United States Environmental Protection Agency (USEPA) test methods. The results of the emissions test program are highlighted by Table E-I.

Table E-I
Overall Results Summary

Source	Pollutant	Average Test Result	Emission Limit
EU-6ML-DC-67	PM	3.40 lbs/hr	2.1 lbs/hr
		0.017 lb/1000 exhaust gas[4]	0.01 lb/1000 exhaust gas[4]
	VOC[3]	6.3 lbs/hr	10.5 lbs/hr
EU-6CR-DC-69	PM	1.06 lbs/hr	17.8 lbs/hr
		0.006 lb/1000 exhaust gas[4]	0.02 lb/1000 exhaust gas[4]
EU-6ML-EF-03	PM	2.63 lbs/hr	11.3 lbs/hr
		0.014 lb/1000 exhaust gas[4]	0.05 lb/1000 exhaust gas[4]
EU-6ML-EF-04	PM	16.11 lbs/hr	11.3 lbs/hr
		0.077 lb/1000 exhaust gas[4]	0.05 lb/1000 exhaust gas[4]
EU-6CR-ISO-04	VOC[3]	4.9 lbs/hr	125.5 lbs/hr
EU-6ML-GV-02 Furnace (Hold)	PM	0.17 lbs/hr	2.1 lbs/hr
		0.002 lb/1000 exhaust gas[4]	0.02 lb/1000 exhaust gas[4]
	HCL	0.00 lbs/hr[2]	NA
	HF	0.01 lbs/hr	NA
	CL_2	0.00 lbs/hr[2]	NA
	VOC[1,3]	0.15 lbs/hr	0.23 lbs/hr
	NOx	0.5 lbs/hr	4.2 lbs/hr
	CO	0.8 lbs/hr	3.5 lbs/hr
EU-6ML-GV-02 Furnace (Flux) Run 4	PM	6.12 lbs/hr	4.1 lbs/hr
		0.058 lb/1000 exhaust gas[4]	0.04 lb/1000 exhaust gas[4]
	HCL	0.27 lbs/hr	2.2 lbs/hr
	HF	1.54 lbs/hr	1.9 lbs/hr
	CL_2	0.00 lbs/hr[2]	0.5 lbs/hr
	VOC[1,3]	0.27 lbs/hr	0.23 lbs/hr
	NOx	0.6 lbs/hr	4.2 lbs/hr
	CO	0.8 lbs/hr	3.5 lbs/hr
EU-6ML-GV-02 Furnace (Dross) Run 5	PM	2.35 lbs/hr	5.2 lbs/hr
		0.023 lb/1000 exhaust gas[4]	0.05 lb/1000 exhaust gas[4]
	HCL	0.02 lbs/hr	NA
	HF	0.04 lbs/hr	NA
	CL_2	0.00 lbs/hr[2]	NA
	VOC[1,3]	0.32 lbs/hr	0.23 lbs/hr
	NOx	0.5 lbs/hr	4.2 lbs/hr
	CO	0.5 lbs/hr	3.5 lbs/hr

1- Calculated using methane subtraction.
2- Laboratory results are below detection limit.
3- VOC calculated as propane
4- lb/1000 lb of exhaust gas, dry

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1. Introduction

BT Environmental Consulting, Inc. (BTEC) was retained by General Motors LLC (GM) to conduct a compliance evaluation of particulate matter (PM), volatile organic compounds (VOC), oxides of nitrogen (NOx), carbon monoxide (CO), hydrogen chloride (HCl), chlorine (Cl_2), and hydrogen fluoride (HF) emission rates from various exhaust stacks associated with the with Mold Line 6 at the GM Saginaw Metal Casting Operations (SMCO) located in Saginaw, Michigan. Sampling was conducted on November 7th-13th 2013.

The Air Quality Division (AQD) of Michigan's Department of Environmental Quality has published a guidance document entitled "Format for Submittal of Source Emission Test Plans and Reports" (February 2008). 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

The source tested is located at the GM Saginaw Metal Casting Operations located in Saginaw, Michigan. Testing on all sources was conducted November 7th-13th, 2013.

1.b Purpose of Testing

The purpose of the testing is to demonstrate compliance with Michigan Renewable Operating Permit MI-ROP-B1991-2009a.

1.c Source Description

Sources identified under this project specifically include, EU-6MLGV-01 is the aluminum reverberatory furnace #1 (West) and EU-6MLGV-02 is the aluminum reverberatory furnace #2 (East). EU-6MLGV-01 and EU-6MLGV-02 are identical sources. Currently only one furnace operates at a time. EU-6MLGV-02 demonstrates compliance for both EU-6MLGV-01 and EU-6MLGV-02. EU-6MLDC-67 is associated with aluminum degate on Mold Line 6 (Cells #1 - #5, Unit #9 secondary scalping screen located in the basement). EU-6MLEF-03 services #6ML mold conveyor (Basement cooling conveyor, degate cells #1-#3) and #6 Drag flask Pick-off. While EU-6MLEF-04 #6ML exhausts mold conveyor (Basement cooling conveyor, 1st floor conveyor). Sources associated with the core room include EU-6CRDC-69, the cold box machines sand delivery exhaust and EU-6CRISO-04 which covers cold box core making, 1 through 16 cold box machines (4 Osborn 10A-CB, 12 Sutter 1630 CB, Biscuit Core Maker). In addition, EU-SCREF-72 exhausts the core box cleaning tanks, which is currently not operational and therefore was not tested.

1.d Test Program Contact

The contact for information regarding the test program as well as the test report is:

Jennifer Tegen
GECS - Facility Air Compliance & Permit
GM Warren Technical Center
30200 Mound Road - Bldg 1-11,
Warren, MI 48090-9010
Phone: 810-706-1319
jennifer.tegen@gm.com

Renee M Mietz, CHMM
Sr. Environmental Project Engineer
Saginaw Metal Casting Operations
1629 North Washington Avenue
Saginaw, Michigan 48605
Phone: 313-608-1169
renee.mietz@gm.com

1.e Test Personnel

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

Table 2
Test Personnel

Name	Affiliation
Jennifer Tegen	GM-WTC
Renee Mietz	GM-SMCO
Matthew Young	BTEC
Jeff Peitzsch	BTEC
Ken Lievense	BTEC
Randal Tysar	BTEC
Paul Molenda	BTEC
Andrew Lusk	BTEC
Nathan Hude	MDEQ-AQD
Kathy Brewer	MDEQ-AQD

2. Summary of Results

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

2.a Operating Data

Process and control equipment operating data relevant to the emissions test program is provided in Appendix A.

2.b Applicable Permit

The emission units tested for mold line 6 are included in Renewable Operating Permit (ROP) No. MI-ROP-B1991-2009a.

2.c Results

The results of the emissions test program are summarized by Table 1. Detailed results for each source are summarized in tables 4-15.

2.d Emission Regulation Comparison

The Emission regulations are summarized by the following table.

Table 3
MI-ROP-B1991-2009a Emission Limitations

Emission Unit	Pollutant	Permit Limit
EU-6ML-DC-67	PM_{10}	0.01 lb / 1,000 lb of exhaust gas, dry
		2.1 lb / hr
	VOC	10.5 lb / hr
EU-6CR-DC-69	PM_{10}	0.02 lb / 1,000 lb of exhaust gas
		17.8 lb / hr
EU-6CR-ISO-04	VOC	125.5 lb / hr
EU-6ML-GV-02	PM_{10} (holding)	0.02 lb / 1,000 lb of exhaust gas, dry
		2.1 lb / hr
	PM_{10} (charging)	0.02 lb / 1,000 lb of exhaust gas, dry
		2.6 lb / hr
	PM_{10} (fluxing)	0.04 lb / 1,000 lb of exhaust gas, dry
		4.1 lb / hr
	PM_{10} (drossing)	0.05 lb / 1,000 lb of exhaust gas, dry
		5.2 lb / hr
	VOC[1]	0.23 lb / hr
	CO[1]	3.5 lb / hr
	NOx[1]	4.2 lb / hr
	HCl (charging)[2]	2.4 lb / hr
	HCl (fluxing)[2]	2.2 lb / hr
	Cl_2 (charging)[2]	0.6 lb / hr
	Cl_2 (fluxing)[2]	0.5 lb / hr
	HF (fluxing)[3]	1.9 lb / hr
EU-6ML-EF-03	PM_{10}	0.05 lb / 1,000 lb of exhaust gas, dry
		11.3 lb / hr
EU-6ML-EF-04	PM_{10}	0.05 lb / 1,000 lb of exhaust gas, dry
		11.3 lb / hr

1: VOC, CO, and NOx emission limits are the same for all 4 operating conditions.
2: No HCl or Cl_2 emission limits during holding and drossing operating conditions.
3: No HF emission limits during holding, charging, or drossing operating conditions.

3. Source Description

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

3.a Process Description

The Mold Line 6 process generates aluminum engine heads. The mold line activity includes the delivery of molten aluminum, generation of a greensand mold, pouring,

cooling, shakeout, or removal of the casting, and the finishing operations. To generate the casting package, a two part resin is used to coat sand and molded sand grains are packed together into a form (a core) and cured with an amine catalyst, DMIPA. DMIPA is scrubbed out of the air with H_2SO_4. At the same time, sand, clay and water are 'mulled' together (greensand as there are no chemical binders) and then packed into a large base and a cover mold that will form the outside of the casting, it is called a 'greensand' mold. The core is set into the "greensand" molds, the cover, made of greensand, and is placed on top. The cover has a pouring cup, which acts as a funnel for the aluminum. Aluminum is melted to 1370-1450° F and poured into the mold to create the casting. The casting is cooled and the loose sand is shaken from the part. The (heads) parts are then processed through a heat treat oven, quenched with water to set up the microstructure of the key places on the casting and excess sand is cleaned from the ports using a water blast. Then the parts have an initial machining phase prior to inspection and shipping.

3.b Process Flow Diagram

Due to the simplicity of the Mold Line 6 operations, a process flow diagram is not necessary.

3.c Raw and Finished Materials

The raw materials used in the Mold Line 6 processes include molten aluminum, sand, and resin. See section 3.a.

3.d Process Capacity

Mold Line 6 has a current target production rate of 180 molds/hr.

3.e Process Instrumentation

Process instrumentation relevant to the emissions test program includes monitoring the Water flow for the wet and acid scrubbers, pH for the acid scrubber. And temperature natural gas usage, and high and low fire rate for the furnace.

4. Sampling and Analytical Procedures

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

4.a Sampling Train and Field Procedures

Sampling and analytical methodologies for the emissions test program can be separated into six categories as follows:

(1) Measurement of exhaust gas velocity, molecular weight, and moisture content;
(2) Measurement of exhaust gas filterable PM concentration;

(3) Measurement of exhaust gas filterable/condensible PM concentration;
(4) Measurement of exhaust gas HCL, HF, and Cl_2 concentration;
(5) Measurement of exhaust gas VOC concentration; and
(6) Measurement of exhaust gas NOx and CO concentration.

Sampling and analytical methodologies by category are summarized below.

Exhaust Gas Velocity, Molecular Weight, and Moisture Content

Stack gas velocity traverses were conducted in accordance with the procedures outlined in Method 1 and Method 2. S-type pitot tubes with thermocouple assemblies, calibrated in accordance with Method 2, Section 4.1.1, were used to measure exhaust gas velocity pressures (using a manometer) and temperatures during testing. The S-type pitot tube dimensions outlined in Sections 2-6 through 2-8 were within specified limits, therefore, a baseline pitot tube coefficient of 0.84 (dimensionless) was assigned. A diagram of the sample points is provided in Figures 1-6.

Cyclonic flow checks were performed at each sampling location. The existence of cyclonic flow is determined by measuring the flow angle at each sample point. The flow angle is the angle between the direction of flow and the axis of the stack. If the average of the absolute values of the flow angles is greater than 20 degrees, cyclonic flow exists. The null angle was determined to be less than 20 degrees at each sampling point.

The Molecular Weight of the gas stream was evaluated according to procedures outlined in Title 40, Part 60, Appendix A, Method 3A. The O_2/CO_2 content of the gas stream was measured using a Fyrite combustion analyzer.

Exhaust gas was extracted as part of the sampling train. Exhaust gas moisture content was then determined gravimetrically.

Filterable Particulate Matter – Method 17

40 CFR 60, Appendix A, Method 17, *"Determination of Particulate Emissions from Stationary Sources"* was used to measure PM concentrations and calculate PM emission rates (see Figure 8 for a schematic of the sampling train). Triplicate 60-minute test runs were conducted on each source.

BTEC's Nutech® Model 2010 modular isokinetic stack sampling system (USEPA Method 17) consisted of (1) a stainless-steel nozzle, (2) an in stack stainless-steel filter housing with a pre weighed 47-mm diameter filter, (3) a steel probe, (4) a set of four Greenburg-Smith (GS) impingers with the first modified and second standard GS impingers each containing 100 ml of deionized water, and with a third dry modified GS impinger and a fourth modified GS impinger containing approximately 300 g of silica gel desiccant, (5) a length of sample line, and (6) a Nutech® control case equipped with a pump, dry gas meter, and calibrated orifice. A schematic drawing of the Method 17 particulate sample train is provided as Figure 8.

A sampling train leak test was conducted before and after each test run. After completion of the final leak test for each test run, the filter was recovered, and the nozzle and the front half of the filter holder assembly were brushed and triple rinsed with acetone. The acetone rinses were collected in a pre-cleaned sample container.

BTEC labeled each container with the test number, test location, and test date, and marked the level of liquid on the outside of the container. In addition, blank samples of the acetone and filter were collected. BTEC personnel carried all samples to BTEC's laboratory (for filter and acetone gravimetric analysis) in Royal Oak, Michigan.

Condensable Particulate Matter – 5/202 and 201a/202

40 CFR 60, Appendix A, Method 5, *"Determination of Particulate Emissions from Stationary Sources"* and 40 CFR 60, Appendix A, Method 202, *"Dry Impinger Method for Determining Condensable Particulate Emissions from Stationary Sources"* was used to measure PM concentrations and calculate PM emission rates (see Figure 9 for a schematic of the sampling train).

BTEC's Nutech® Model 2010 modular isokinetic stack sampling system consisted of (1) a Steel nozzle, (2) a glass probe, (3) a heated filter holder, (4) a vertical condenser, (5) an empty pot bellied impinger, (6) an empty modified Greenburg-Smith (GS) impinger, (7) unheated filter holder with a teflon filter, (8) a second modified GS impinger with 100 ml of deionized water, and a third modified GS impinger containing approximately 300 g of silica gel desiccant, (9) a length of sample line, and (10) a Nutech® control case equipped with a pump, dry gas meter, and calibrated orifice.

A sampling train leak test was conducted before and after each test run. After completion of the final leak test for each test run, the filter was recovered, and the nozzle and the front half of the filter holder assembly were brushed and triple rinsed with acetone. The acetone rinses were collected in a pre-cleaned sample container. The impinger train was then purged with nitrogen for one hour at a flow rate of 14 liters per minute. The CPM filter was recovered and placed in a petri dish. The back half of the filter housing, the condenser, the pot bellied impinger, the moisture drop out impinger, and the front half of the CPM filter housing and all connecting glassware were triple rinsed with deionized water which was collected in a pre-cleaned sample container. The same glassware was then rinsed with acetone which was collected in a pre-cleaned sample container labeled as the organic fraction. The glassware was then double rinsed with hexane which was added to the same organic fraction sample bottle.

BTEC labeled each container with the test number, test location, and test date, and marked the level of liquid on the outside of the container. In addition, blank samples of the acetone, DI water, hexane, and filter were collected. BTEC personnel carried all samples to BTEC's laboratory (for filter and acetone gravimetric analysis) in Royal Oak, Michigan. Samples were transported to the Maxxam laboratory in Mississauga, Ontario for Method 202 analysis by Maxxam Analytics personnel.

40 CFR 60, Appendix A, Method 201A, *"Determination of PM_{10} and $PM_{2.5}$ Emissions from Stationary Sources (Constant Sampling Rate Procedure)"* and 40 CFR 60, Appendix A, Method 202, *"Dry Impinger Method for Determining Condensable Particulate Emissions from Stationary Sources"* was used to measure PM concentrations and calculate PM emission rates for Run 4 (Flux) on the Furnace (see Figure 13 for a schematic of the sampling train).

BTEC's Nutech® Model 2010 modular isokinetic stack sampling system consisted of (1) a stainless-steel nozzle, (2) a stainless-steel PM_{10} head, (3) an in stack stainless-steel filter housing, (4) a borosilicate glass probe liner, (5) a vertical condenser, (6) an empty pot bellied impinger, (7) an empty modified Greenburg-Smith (GS) impinger, (8) unheated borosilicate filter holder with a teflon filter and Teflon filter support, (9) a second modified GS impinger with 100 ml of deionized water, and a third modified GS impinger containing approximately 300 g of silica gel desiccant, (10) a length of sample line, and (11) a Nutech® control case equipped with a pump, dry gas meter, and calibrated orifice.

A sampling train leak test was conducted before and after each test run. After completion of the final leak test for each test run, the filter was recovered, the nozzle, probe, PM_{10} head, and front half of the filter housing were brushed and triple rinsed with acetone. The acetone rinses were collected in a pre-cleaned sample container. The Method 202 portion of the sampling train was recovered the same as previously described.

Hydrogen Halide and Halogen

40 CFR 60, Appendix A Method 26A, *"Determination of Hydrogen Halide and Halogen Emissions from Stationary Sources (isokinetic method)"* were used to evaluate HCl, HF, and Cl_2 concentrations. The Method 26A sampling train consisted of: (1) a heated borosilicate or quartz probe liner; (2) a heated borosilicate or quartz glass filter holder containing a 90-mm diameter filter with Teflon filter support; (3) a set of two GS impingers each containing 100 ml of 0.1 Normal Sulfuric Acid (0.1 N H_2SO_4), (4) a set of two GS impingers each containing 100 ml of 0.1 Normal Sodium Hydroxide NaOH, (5) modified GS impinger containing a known weight of silica gel desiccant; (7) a length of sample line, and (8) a Nutech control case equipped with a pump, dry gas meter, and calibrated orifice. Figure 12 provides an illustration of the Method 26A sample train.

After completion of the final leak test for each test run, the impinger train was carefully disassembled. The nozzle, probe, and front half of the filter housing were brushed and rinsed with acetone which was discarded. The filter was also discarded. The liquid volume of each impinger was measured gravimetrically and any mass increase was noted on field sheets. The impinger catch solution from the first 2 impingers was then transferred to pre-cleaned sample containers labled as 0.1N H_2SO_4. The impingers were then triple rinsed with deionized water (DI H_2O), and the rinses added to the H_2SO_4 sample containers. The back-half of the filter holder was rinsed and added to the H_2SO_4 sample container. The impinger catch solution from impingers 3 and 4 were then transferred to a pre-cleaned sample container and labled as 0.1N NaOH. Impinger 3 and 4 were then triple rinsed with DI H_2O and the rinse was added to the 0.1N NaOH sample container.

BTEC labeled each container with the test number, test location, and test date, and marked the level of liquid on the outside of the container. In addition, blank samples of the DI water, H_2SO_4, and NaOH were collected. Samples were couriered by Maxxam Analytical's (Maxxam) personnel to Maxxam's laboratory in Mississauga, Ontario for analysis.

Volatile Organic Compounds

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 data acquisition software. BTEC used a VIG Model 20 or a J.U.M 109 Methane/Nonmethane hydrocarbon analyzer to determine the VOC concentration.

The J.U.M. Model 109A utilizes two flame ionization detectors (FID) to determine the average concentration (ppm) for THC (as Hexane) and the average concentration for methane. Upon entry, the gas stream is split by the analyzer. One FID ionizes all of the hydrocarbons in the gas stream sample into carbon, which is then detected as a concentration of total hydrocarbons. 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). The analyzer was calibrated for a range of 0-100 ppm. See figure 11 for a diagram of the sampling train.

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 day of testing.

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.

NOx and Carbon Monoxide

40 CFR 60, Appendix A, Method 7E, *"Determination of Nitrogen Oxides Emissions from Stationary Sources (Instrumental Analyzer Procedure)" and* 40 CFR 60, Appendix A, Method 10, *"Determination of Carbon Monoxide Emissions from Stationary Sources (Instrumental Analyzer Procedure)"* were used to measure NOx and CO concentrations and calculate emission rates (see Figure 10 for a schematic of the sampling train).

The gas stream was drawn through a stainless-steel probe with a heated in-line filter to remove any particulate, a heated Teflon® sample line, through a refrigerated sample conditioner with a peristaltic pump to remove the moisture from the sample before it entered the analyzers. Data was recorded on a PC equipped with Labview® II data acquisition software. Recorded NOx and CO concentrations were averaged and reported for the duration of each test (as drift corrected per Method 7E). The analyzers were calibrated for a range of 0 to 50 ppm for NOx and CO.

In accordance with Method 7E, a 3-point (zero, mid, and high) calibration check was performed on each analyzer. Calibration drift checks were performed at the completion of each run.

4.b Recovery and Analytical Procedures

Descriptions of the recovery procedures are provided in section 4.a for each sampling method.

4.c Sampling Ports

A diagram of the stacks showing sampling ports are included as Figures 1-6.

4.d Traverse Points

A diagram of the stacks showing sampling ports are included as Figures 1-6.

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. Emission limits are summarized by Table 3. Detailed results for the emissions test program are summarized by Tables 4-15.

5.b Discussion of Results

The average results of the particulate matter emissions of EU-6ML-DC-67, EU-6ML-EF-04, and EU-6ML-GV-02 (Flux) are inconclusive. As summarized by the following table, the test results are inconsistent with the previous source evaluation conducted in 2013 under similar production and testing conditions.

EU-6ML-DC-67 (8/6/2013)	PM	0.52 lbs/hr	2.1 lbs/hr
		0.003 lb/1000 exhaust gas[4]	0.01 lb/1000 exhaust gas[4]
EU-6ML-EF-04 (8/7/2013)	PM	4.80 lbs/hr	11.3 lbs/hr
		0.023 lb/1000 exhaust gas[4]	0.05 lb/1000 exhaust gas[4]
EU-6ML-GV-02 Furnace (Flux) (10/4/2013)	PM	3.28 lbs/hr	4.1 lbs/hr
		0.030 lb/1000 exhaust gas[4]	0.04 lb/1000 exhaust gas[4]

In addition, VOC test results for EU-6ML-GV-02 (Flux) and EU-6ML-GV-02 (Dross) were in excess of their corresponding VOC emission limitation of 0.23 pounds per hour. However, the VOC emission limitation of 0.23 pounds per hour from a stack that has an exhaust gas flowrate on the order of 23,000 scfm corresponds to a VOC concentration limitation of less than approximately 1.5 ppmv. Because the majority of total hydrocarbons in the exhaust stream are methane, the accuracy of Method 25A is inadequate to demonstrate compliance with a VOC concentration limitation of 1.5 ppmv. In addition, it is unlikely that any U.S. EPA reference test method would be adequate to measure a VOC concentration at that level.

5.c Sampling Procedure Variations

There were no sampling variations used during the emission compliance test program.

5.d Process or Control Device Upsets

No process or control device upsets occurred during the emissions test program.

5.e Control Device Maintenance

There was no control equipment maintenance performed during the emissions test program.

5.f Audit Sample Analyses

Audit samples were not analyzed as part of this emissions test program.

5.g Calibration Sheets

Calibration documents are provided as Appendix B.

5.h Sample Calculations

Sample calculations are provided as Appendix C.

5.i Field Data Sheets

Field data sheets and CEM data are provided in Appendix D.

5.j Laboratory Data

Laboratory analysis is provided in Appendix E.

Tables

Table 1
Overall Results Summary
Sampling Dates: November 7 through 13, 2013

Source	Pollutant	Average Test Result	Emission Limit
EU-6ML-DC-67	PM	3.40 lbs/hr	2.1 lbs/hr
		0.017 lb/1000 exhaust gas[4]	0.01 lb/1000 exhaust gas[4]
	VOC[3]	6.3 lbs/hr	10.5 lbs/hr
EU-6CR-DC-69	PM	1.06 lbs/hr	17.8 lbs/hr
		0.006 lb/1000 exhaust gas[4]	0.02 lb/1000 exhaust gas[4]
EU-6ML-EF-03	PM	2.63 lbs/hr	11.3 lbs/hr
		0.014 lb/1000 exhaust gas[4]	0.05 lb/1000 exhaust gas[4]
EU-6ML-EF-04	PM	16.11 lbs/hr	11.3 lbs/hr
		0.077 lb/1000 exhaust gas[4]	0.05 lb/1000 exhaust gas[4]
EU-6CR-ISO-04	VOC[3]	4.9 lbs/hr	125.5 lbs/hr
EU-6ML-GV-02 Furnace (Hold)	PM	0.17 lbs/hr	2.1 lbs/hr
		0.002 lb/1000 exhaust gas[4]	0.02 lb/1000 exhaust gas[4]
	HCL	0.00 lbs/hr[2]	NA
	HF	0.01 lbs/hr	NA
	CL_2	0.00 lbs/hr[2]	NA
	VOC[1,3]	0.15 lbs/hr	0.23 lbs/hr
	NOx	0.5 lbs/hr	4.2 lbs/hr
	CO	0.8 lbs/hr	3.5 lbs/hr
EU-6ML-GV-02 Furnace (Flux) Run 4	PM	6.12 lbs/hr	4.1 lbs/hr
		0.058 lb/1000 exhaust gas[4]	0.04 lb/1000 exhaust gas[4]
	HCL	0.27 lbs/hr	2.2 lbs/hr
	HF	1.54 lbs/hr	1.9 lbs/hr
	CL_2	0.00 lbs/hr[2]	0.5 lbs/hr
	VOC[1,3]	0.27 lbs/hr	0.23 lbs/hr
	NOx	0.6 lbs/hr	4.2 lbs/hr
	CO	0.8 lbs/hr	3.5 lbs/hr
EU-6ML-GV-02 Furnace (Dross) Run 5	PM	2.35 lbs/hr	5.2 lbs/hr
		0.023 lb/1000 exhaust gas[4]	0.05 lb/1000 exhaust gas[4]
	HCL	0.02 lbs/hr	NA
	HF	0.04 lbs/hr	NA
	CL_2	0.00 lbs/hr[2]	NA
	VOC[1,3]	0.32 lbs/hr	0.23 lbs/hr
	NOx	0.5 lbs/hr	4.2 lbs/hr
	CO	0.5 lbs/hr	3.5 lbs/hr

1- Calculated using methane subtraction.
2- Laboratory results are below detection limit.
3- VOC calculated as propane
4- lb/1000 lb of exhaust gas, dry

Table 2
Test Personnel

Name	Affiliation
Jennifer Tegen	GM-WTC
Renee Mietz	GM-SMCO
Matthew Young	BTEC
Jeff Peitzsch	BTEC
Ken Lievense	BTEC
Randal Tysar	BTEC
Paul Molenda	BTEC
Andrew Lusk	BTEC
Nathan Hude	MDEQ-AQD
Kathy Brewer	MDEQ-AQD

Table 3
MI-ROP-B1991-2009a Emission Limitations

Emission Unit	Pollutant	Permit Limit
EU-6ML-DC-67	PM_{10}	0.01 lb / 1,000 lb of exhaust gas, dry
		2.1 lb / hr
	VOC	10.5 lb / hr
EU-6CR-DC-69	PM_{10}	0.02 lb / 1,000 lb of exhaust gas
		17.8 lb / hr
EU-6CR-ISO-04	VOC	125.5 lb / hr
EU-6ML-GV-02	PM_{10} (holding)	0.02 lb / 1,000 lb of exhaust gas, dry
		2.1 lb / hr
	PM_{10} (charging)	0.02 lb / 1,000 lb of exhaust gas, dry
		2.6 lb / hr
	PM_{10} (fluxing)	0.04 lb / 1,000 lb of exhaust gas, dry
		4.1 lb / hr
	PM_{10} (drossing)	0.05 lb / 1,000 lb of exhaust gas, dry
		5.2 lb / hr
	VOC[1]	0.23 lb / hr
	CO[1]	3.5 lb / hr
	NOx[1]	4.2 lb / hr
	HCl (charging)[2]	2.4 lb / hr
	HCl (fluxing)[2]	2.2 lb / hr
	Cl_2 (charging)[2]	0.6 lb / hr
	Cl_2 (fluxing)[2]	0.5 lb / hr
	HF (fluxing)[3]	1.9 lb / hr
EU-6ML-EF-03	PM_{10}	0.05 lb / 1,000 lb of exhaust gas, dry
		11.3 lb / hr
EU-6ML-EF-04	PM_{10}	0.05 lb / 1,000 lb of exhaust gas, dry
		11.3 lb / hr

1: VOC, CO, and NOx emission limits are the same for all 4 operating conditions.
2: No HCl or Cl_2 emission limits during holding and drossing operating conditions.
3: No HF emission limits during holding, charging, or drossing operating conditions.

Table 4
EU-6ML-DC-67 Particulate Matter Emission Rates

Company	**GM SMCO**			
Source Designation	**DC-67**			
Test Date	**11/12/2013**	**11/12/2013**	**11/12/2013**	
Meter/Nozzle Information	P-1	P-2	P-3	Average
Meter Temperature Tm (F)	62.9	67.7	67.8	66.1
Meter Pressure - Pm (in. Hg)	30.0	29.9	30.0	30.0
Measured Sample Volume (Vm)	35.1	33.8	38.0	35.6
Sample Volume (Vm-Std ft3)	35.7	34.1	38.3	36.0
Sample Volume (Vm-Std m3)	1.01	0.96	1.08	1.02
Condensate Volume (Vw-std)	0.269	0.222	0.655	0.382
Gas Density (Ps(std) lbs/ft3) (wet)	0.0743	0.0743	0.0741	0.0742
Gas Density (Ps(std) lbs/ft3) (dry)	0.0745	0.0745	0.0745	0.0745
Total weight of sampled gas (m g lbs) (wet)	2.68	2.55	2.89	2.70
Total weight of sampled gas (m g lbs) (dry)	2.66	2.54	2.86	2.69
Nozzle Size - An (sq. ft.)	0.000185	0.000177	0.000185	0.000182
Isokinetic Variation - I	97.0	97.5	99.4	98.0
Stack Data				
Average Stack Temperature - Ts (F)	58.4	58.1	57.3	57.9
Molecular Weight Stack Gas- dry (Md)	28.8	28.8	28.8	28.8
Molecular Weight Stack Gas-wet (Ms)	28.8	28.8	28.7	28.7
Stack Gas Specific Gravity (Gs)	0.993	0.993	0.989	0.992
Percent Moisture (Bws)	0.75	0.65	1.68	1.03
Water Vapor Volume (fraction)	0.0075	0.0065	0.0168	0.0103
Pressure - Ps ("Hg)	28.8	28.8	28.8	28.8
Average Stack Velocity -Vs (ft/sec)	56.9	56.3	60.0	57.8
Area of Stack (ft2)	13.1	13.1	13.1	13.1
Exhaust Gas Flowrate				
Flowrate ft^3(Actual)	44,721	44,219	47,141	45,360
Flowrate ft^3 (Standard Wet)	43,853	43,385	46,330	44,523
Flowrate ft^3 (Standard Dry)	43,525	43,105	45,551	44,060
Flowrate m^3 (standard dry)	1,233	1,221	1,290	1,248
Total Particulate Weights (mg)				
Nozzle/Probe/Filter	21.9	16.8	24.3	21.0
Total Particulate Concentration				
lb/1000 lb (wet)	0.018	0.015	0.019	0.017
lb/1000 lb (dry)	0.018	0.015	0.019	0.017
mg/dscm (dry)	21.6	17.4	22.4	20.5
gr/dscf	0.0095	0.0076	0.0098	0.0090
Total Particulate Emission Rate				
lb/ hr	3.54	2.82	3.84	3.40

Table 5
EU-6ML-DC-67 VOC Emission Rates
General Motors SMCO
Saginaw, Michigan
BTEC Project No. 13-4408
Sampling Dates: November 12, 2013

Parameter	Run 1	Run 2	Run 3	Average
Test Run Date	11/12/2013	11/12/2013	11/12/2013	
Test Run Time	9:15-10:15	11:00-12:00	13:58-14:58	
Outlet Flowrate (scfm)	43,853	43,385	46,330	44,523
Outlet VOC Concentration (ppmv as propane)	21.4	19.0	21.2	20.5
Outlet VOC Concentration (ppmv, corrected as per USEPA 7E)	21.2	19.2	21.6	20.7
VOC Emission Rate as Propane (lb/hr)	6.4	5.6	6.7	6.3
VOC Emission Rate as Propane(lb/hr) (corrected as per USEPA 7E)	6.4	5.7	6.8	6.3

VOC Correction			
Co	0.70	1.45	1.20
Cma	30.6	30.6	30.6
Cm	30.51	29.34	29.63

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 (C_3H_8 = 44.10)
24.14 = molar volume of air at standard conditions (70°F, 29.92" Hg)
35.31 = ft^3 per m^3
453600 = mg per lb

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

Table 6
EU-6CR-DC-69 Particulate Matter Emission Rates

Company	**GM SMCO**					
Source Designation	**DC 69**					
Test Date	**11/12/2013**	**11/12/2013**	**11/12/2013**			
Meter/Nozzle Information	P-1	P-2	*P-3-1*	*P-3-2*	P-3	Average
Meter Temperature Tm (F)	64.4	69.9	*67.4*	*70.5*	69.0	67.8
Meter Pressure - Pm (in. Hg)	30.0	30.0	*30.0*	*30.0*	30.0	30.0
Measured Sample Volume (Vm)	45.0	46.2	*20.6*	*20.9*	41.5	44.3
Sample Volume (Vm-Std ft3)	46.2	46.9	*21.0*	*21.0*	42.0	45.0
Sample Volume (Vm-Std m3)	1.31	1.33	*0.60*	*0.59*	01.2	1.28
Condensate Volume (Vw-std)	0.080	0.363			0.231	0.225
Gas Density (Ps(std) lbs/ft3) (wet)	0.0745	0.0743	*0.0744*	*0.0744*	0.0744	0.0744
Gas Density (Ps(std) lbs/ft3) (dry)	0.0745	0.0745	*0.0745*	*0.0745*	0.0745	0.0745
Total weight of sampled gas (m g lbs) (wet)	3.45	3.52	*1.57*	*1.57*	3.14	3.37
Total weight of sampled gas (m g lbs) (dry)	3.44	3.50	*1.57*	*1.56*	3.13	3.36
Nozzle Size - An (sq. ft.)	0.000254	0.000254	*0.000254*	*0.000254*		0.000254
Isokinetic Variation - I	99.7	101.3	*98.8*	*99.6*	99.2	100.1
Stack Data						
Average Stack Temperature - Ts (F)	48.8	49.2	*50.0*	*50.0*	50.0	49.3
Molecular Weight Stack Gas- dry (Md)	28.8	28.8	*28.8*	*28.8*	28.8	28.8
Molecular Weight Stack Gas-wet (Ms)	28.8	28.8	*28.8*	*28.8*	28.8	28.8
Stack Gas Specific Gravity (Gs)	0.995	0.993	*0.994*	*0.994*	0.994	0.994
Percent Moisture (Bws)	0.17	0.77	*0.55*	*0.55*	0.55	0.50
Water Vapor Volume (fraction)	0.0017	0.0077	*0.0055*	*0.0055*	0.0055	0.0050
Pressure - Ps ("Hg)	29.0	29.0	*29.0*	*29.0*	29.0	29.0
Average Stack Velocity -Vs (ft/sec)	50.3	50.7	*46.7*	*46.3*	46.5	49.2
Area of Stack (ft2)	13.1	13.1	*13.1*	*13.1*	13.1	13.1
Exhaust Gas Flowrate						
Flowrate ft^3(Actual)	39,502	39,795	*36,688*	*36,351*	36,520	38,606
Flowrate ft^3 (Standard Wet)	39,770	40,032	*36,850*	*36,511*	36,680	38,828
Flowrate ft^3 (Standard Dry)	39,701	39,725	*36,648*	*36,311*	36,480	38,635
Flowrate m^3 (standard dry)	1,124	1,125	*1,038*	*1,028*	1,033	1,094
Total Particulate Weights (mg)						
Nozzle/Probe/Filter	5.2	10.4			12.4	9.3
Total Particulate Concentration						
lb/1000 lb (wet)	0.003	0.007			0.009	0.006
lb/1000 lb (dry)	0.003	0.007			0.009	0.006
mg/dscm (dry)	4.0	7.8			10.4	7.4
gr/dscf	0.0017	0.0034			0.0046	0.0032
Total Particulate Emission Rate						
lb/ hr	0.59	1.17			1.43	1.06

Note: Run 3 was paused during the port change and the meter box was changed from MB4 to MB3.

Table 7
EU-6ML-EF-03 Particulate Matter Emission Rates

Company	**SMCO**			
Source Designation	**EF3**			
Test Date	**11/13/2013**	**11/13/2013**	**11/13/2013**	
Meter/Nozzle Information	P-1	P-2	P-3	Average
Meter Temperature Tm (F)	71.0	78.9	81.9	77.2
Meter Pressure - Pm (in. Hg)	30.0	30.0	30.0	30.0
Measured Sample Volume (Vm)	53.4	54.2	50.3	52.7
Sample Volume (Vm-Std ft3)	53.4	53.4	49.2	52.0
Sample Volume (Vm-Std m3)	1.51	1.51	1.39	1.47
Condensate Volume (Vw-std)	0.858	0.500	0.505	0.621
Gas Density (Ps(std) lbs/ft3) (wet)	0.0741	0.0743	0.0742	0.0742
Gas Density (Ps(std) lbs/ft3) (dry)	0.0745	0.0745	0.0745	0.0745
Total weight of sampled gas (m g lbs) (wet)	4.02	4.00	3.69	3.90
Total weight of sampled gas (m g lbs) (dry)	3.98	3.98	3.67	3.88
Nozzle Size - An (sq. ft.)	0.000398	0.000409	0.000398	0.000402
Isokinetic Variation - I	99.2	98.4	99.3	99.0
Stack Data				
Average Stack Temperature - Ts (F)	76.2	78.8	81.6	78.8
Molecular Weight Stack Gas- dry (Md)	28.8	28.8	28.8	28.8
Molecular Weight Stack Gas-wet (Ms)	28.7	28.7	28.7	28.7
Stack Gas Specific Gravity (Gs)	0.990	0.992	0.992	0.991
Percent Moisture (Bws)	1.58	0.93	1.01	1.17
Water Vapor Volume (fraction)	0.0158	0.0093	0.0101	0.0117
Pressure - Ps ("Hg)	29.7	29.7	29.7	29.7
Average Stack Velocity -Vs (ft/sec)	39.1	38.2	36.2	37.9
Area of Stack (ft2)	19.0	19.0	19.0	19.0
Exhaust Gas Flowrate				
Flowrate ft^3(Actual)	44,648	43,604	41,321	43,191
Flowrate ft^3 (Standard Wet)	43,591	42,367	39,939	41,966
Flowrate ft^3 (Standard Dry)	42,901	41,974	39,534	41,470
Flowrate m^3 (standard dry)	1,215	1,189	1,119	1,174
Total Particulate Weights (mg)				
Nozzle/Probe/Filter	26.4	25.5	22.6	24.8
Total Particulate Concentration				
lb/1000 lb (wet)	0.014	0.014	0.013	0.014
lb/1000 lb (dry)	0.015	0.014	0.014	0.014
mg/dscm (dry)	17.5	16.9	16.2	16.8
gr/dscf	0.0076	0.0074	0.0071	0.0074
Total Particulate Emission Rate				
lb/ hr	2.82	2.66	2.41	2.63

Table 8
EU-6ML-EF-04 Particulate Matter Emission Rates

Company	**SMCO**			
Source Designation	**EF-4**			
Test Date	**11/11/2013**	**11/11/2013**	**11/12/2013**	
Meter/Nozzle Information	P-1	P-2	P-3	Average
Meter Temperature Tm (F)	64.5	73.8	67.3	68.5
Meter Pressure - Pm (in. Hg)	29.5	29.5	30.0	29.7
Measured Sample Volume (Vm)	47.9	48.7	47.5	48.0
Sample Volume (Vm-Std ft3)	48.0	47.9	48.0	47.9
Sample Volume (Vm-Std m3)	1.36	1.35	1.36	1.36
Condensate Volume (Vw-std)	0.330	0.391	0.387	0.369
Gas Density (Ps(std) lbs/ft3) (wet)	0.0743	0.0743	0.0743	0.0743
Gas Density (Ps(std) lbs/ft3) (dry)	0.0745	0.0745	0.0745	0.0745
Total weight of sampled gas (m g lbs) (wet)	3.59	3.58	3.60	3.59
Total weight of sampled gas (m g lbs) (dry)	3.57	3.57	3.58	3.57
Nozzle Size - An (sq. ft.)	0.000327	0.000344	0.000327	0.000333
Isokinetic Variation - I	98.9	94.6	99.1	97.5
Stack Data				
Average Stack Temperature - Ts (F)	71.7	71.8	68.0	70.5
Molecular Weight Stack Gas- dry (Md)	28.8	28.8	28.8	28.8
Molecular Weight Stack Gas-wet (Ms)	28.8	28.7	28.7	28.8
Stack Gas Specific Gravity (Gs)	0.993	0.993	0.993	0.993
Percent Moisture (Bws)	0.68	0.81	0.80	0.76
Water Vapor Volume (fraction)	0.0068	0.0081	0.0080	0.0076
Pressure - Ps ("Hg)	29.4	29.4	29.8	29.5
Average Stack Velocity -Vs (ft/sec)	42.5	42.3	41.6	42.1
Area of Stack (ft2)	19.0	19.0	19.0	19.0
Exhaust Gas Flowrate				
Flowrate ft^3(Actual)	48,482	48,290	47,421	48,064
Flowrate ft^3 (Standard Wet)	47,255	47,057	47,240	47,184
Flowrate ft^3 (Standard Dry)	46,932	46,675	46,862	46,823
Flowrate m^3 (standard dry)	1,329	1,322	1,327	1,326
Total Particulate Weights (mg)				
Nozzle/Probe/Filter	140.5	129.4	102.6	124.2
Total Particulate Concentration				
lb/1000 lb (wet)	0.086	0.080	0.063	0.076
lb/1000 lb (dry)	0.087	0.080	0.063	0.077
mg/dscm (dry)	103.5	95.5	75.5	91.5
gr/dscf	0.0452	0.0417	0.0330	0.0400
Total Particulate Emission Rate				
lb/ hr	18.26	16.76	13.30	16.11

Table 9
EU-6CR-ISO-04 VOC Emission Rates
General Motors SMCO
Saginaw, Michigan
BTEC Project No. 13-4408
Sampling Dates: November 13, 2013

Parameter	Run 1	Run 2	Run 3	Average
Test Run Date	11/13/2013	11/13/2013	11/13/2013	
Test Run Time	10:10-11:10	11:20-12:20	12:29-13:29	
Outlet Flowrate (scfm)	7,108	6,460	6,891	6,820
Outlet VOC Concentration (ppmv as propane)	91.2	108.7	124.9	108.2
Outlet VOC Concentration (ppmv, corrected as per USEPA 7E)	89.6	105.5	121.3	105.5
VOC Emission Rate as Propane (lb/hr)	4.4	4.8	5.9	5.0
VOC Emission Rate as Propane(lb/hr) (corrected as per USEPA 7E)	4.4	4.7	5.7	4.9

VOC Correction			
Co	1.35	2.90	3.28
Cma	92.5	92.5	92.5
Cm	94.02	95.62	96.01

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 (C_3H_8 = 44.10)
24.14 = molar volume of air at standard conditions (70°F, 29.92" Hg)
35.31 = ft^3 per m^3
453600 = mg per lb

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

Table 10
EU-6ML-GV-02 (Furnace) Particulate Matter Emission Rates (Hold)

Company	SMCO			
Source Designation	EU-6ML-GV-02 (Furnace) (Hold)			
Test Date	11/7/2013	11/7/2013	11/8/2013	
Meter/Nozzle Information	P-1	P-2	P-3	Average
Meter Temperature Tm (F)	63.3	67.4	63.6	64.8
Meter Pressure - Pm (in. Hg)	29.5	29.5	29.6	29.5
Measured Sample Volume (Vm)	44.9	54.3	52.7	50.6
Sample Volume (Vm-Std ft3)	45.1	54.2	53.2	50.8
Sample Volume (Vm-Std m3)	1.28	1.54	1.51	1.44
Condensate Volume (Vw-std)	0.754	1.381	1.051	1.062
Gas Density (Ps(std) lbs/ft3) (wet)	0.0741	0.0738	0.0740	0.0740
Gas Density (Ps(std) lbs/ft3) (dry)	0.0745	0.0745	0.0745	0.0745
Total weight of sampled gas (m g lbs) (wet)	3.40	4.11	4.01	3.84
Total weight of sampled gas (m g lbs) (dry)	3.36	4.04	3.96	3.79
Nozzle Size - An (sq. ft.)	0.000727	0.000727	0.000727	0.000727
Isokinetic Variation - I	96.9	101.9	98.3	99.0
Stack Data				
Average Stack Temperature - Ts (F)	194.1	268.0	270.4	244.2
Molecular Weight Stack Gas- dry (Md)	28.8	28.8	28.8	28.8
Molecular Weight Stack Gas-wet (Ms)	28.7	28.6	28.6	28.6
Stack Gas Specific Gravity (Gs)	0.990	0.986	0.988	0.988
Percent Moisture (Bws)	1.64	2.48	1.94	2.02
Water Vapor Volume (fraction)	0.0164	0.0248	0.0194	0.0202
Pressure - Ps ("Hg)	29.3	29.3	29.4	29.4
Average Stack Velocity -Vs (ft/sec)	21.5	27.5	27.8	25.6
Area of Stack (ft2)	19.6	19.6	19.6	19.6
Exhaust Gas Flowrate				
Flowrate ft^3(Actual)	25,258	32,392	32,751	30,134
Flowrate ft^3 (Standard Wet)	19,985	23,029	23,287	22,100
Flowrate ft^3 (Standard Dry)	19,656	22,456	22,836	21,650
Flowrate m^3 (standard dry)	557	636	647	613
Total Particulate Weights (mg)				
Total Nozzle/Probe/Filter	0.3	0.1	0.0	0.1
Organic Condensible Particulate	1.0	3.1	1.8	2.0
Inorganic Condensible Particulate	1.8	3.2	2.1	2.4
Condensible Blank Correction	1.4	1.4	1.4	1.4
Total Condensible Particulate	1.4	4.9	2.5	2.9
Total Filterable and Condensible Particulate	1.7	5.0	2.5	3.1
Filterable Particulate Concentration				
lb/1000 lb (wet)	0.000	0.000	0.000	0.000
lb/1000 lb (dry)	0.000	0.000	0.000	0.000
mg/dscm (dry)	0.2	0.1	0.0	0.1
gr/dscf	0.0001	0.0000	0.0000	0.0000
Filterable Particulate Emission Rate				
lb/ hr	0.02	0.01	0.00	0.01
Condensible Particulate Concentration				
lb/1000 lb (wet)	0.001	0.003	0.001	0.002
lb/1000 lb (dry)	0.001	0.003	0.001	0.002
mg/dscm (dry)	1.1	3.2	1.7	2.0
gr/dscf	0.0005	0.0014	0.0007	0.0009
Condensible Particulate Emission Rate				
lb/ hr	0.08	0.27	0.14	0.16
Total Particulate Concentration				
lb/1000 lb (wet)	0.001	0.003	0.001	0.002
lb/1000 lb (dry)	0.001	0.003	0.001	0.002
mg/dscm (dry)	1.3	3.3	1.7	2.1
gr/dscf	0.0006	0.0014	0.0007	0.0009
Total Particulate Emission Rate				
lb/ hr	0.10	0.27	0.14	0.17

Table 11
EU-6ML-GV-02 (Furnace) Particulate Matter Emission Rates (Flux and Dross)

Company	GM SMCO	
Source Designation	EU-6ML-GV-02 (Flux and Dross)	
Test Date	11/8/2013	11/8/2013
Meter/Nozzle Information	P-4	P-5
Meter Temperature Tm (F)	71.1	75.0
Meter Pressure - Pm (in. Hg)	29.5	29.7
Measured Sample Volume (Vm)	26.9	54.9
Sample Volume (Vm-Std ft3)	26.6	54.3
Sample Volume (Vm-Std m3)	0.75	1.54
Condensate Volume (Vw-std)	0.231	0.882
Gas Density (Ps(std) lbs/ft3) (wet)	0.0743	0.0741
Gas Density (Ps(std) lbs/ft3) (dry)	0.0745	0.0745
Total weight of sampled gas (m g lbs) (wet)	2.00	4.09
Total weight of sampled gas (m g lbs) (dry)	1.99	4.05
Nozzle Size - An (sq. ft.)	0.000380	0.000727
Isokinetic Variation - I	80.2	101.7
Stack Data		
Average Stack Temperature - Ts (F)	239.7	240.7
Molecular Weight Stack Gas- dry (Md)	28.8	28.8
Molecular Weight Stack Gas-wet (Ms)	28.7	28.7
Stack Gas Specific Gravity (Gs)	0.993	0.990
Percent Moisture (Bws)	0.86	1.60
Water Vapor Volume (fraction)	0.0086	0.0160
Pressure - Ps ("Hg)	29.4	29.5
Average Stack Velocity -Vs (ft/sec)	27.3	26.2
Area of Stack (ft2)	19.6	19.6
Exhaust Gas Flowrate		
Flowrate ft^3 (Actual)	32,155	30,860
Flowrate ft^3 (Standard Wet)	23,866	22,911
Flowrate ft^3 (Standard Dry)	23,660	22,545
Flowrate m^3 (standard dry)	670	638
Total Particulate Weights (mg)		
Total Nozzle/Probe/Filter	43.7	40.8
Organic Condensible Particulate	2.3	1.8
Inorganic Condensible Particulate	7.3	1.4
Condensible Blank Correction	1.4	1.4
Total Condensible Particulate	8.2	1.8
Total Filterable and Condensible Particulate	51.9	42.6
Filterable Particulate Concentration		
lb/1000 lb (wet)	0.048	0.022
lb/1000 lb (dry)	0.049	0.022
mg/dscm (dry)	57.9	26.5
gr/dscf	0.0253	0.0116
Filterable Particulate Emission Rate		
lb/ hr	5.15	2.25
Condensible Particulate Concentration		
lb/1000 lb (wet)	0.009	0.001
lb/1000 lb (dry)	0.009	0.001
mg/dscm (dry)	10.9	1.2
gr/dscf	0.0047	0.0005
Condensible Particulate Emission Rate		
lb/ hr	0.97	0.10
Total Particulate Concentration		
lb/1000 lb (wet)	0.057	0.023
lb/1000 lb (dry)	0.058	0.023
mg/dscm (dry)	68.8	27.7
gr/dscf	0.0301	0.0121
Total Particulate Emission Rate		
lb/ hr	6.12	2.35

Table 12
EU-6ML-GV-02 (Furnace) HCl, HF, and Cl_2 Emission Rates (Hold)

Company	SMCO			
Source Designation	EU-6ML-GV-02 (Furnace) (Hold)			
Test Date	11/7/2013	11/7/2013	11/8/2013	
Meter/Nozzle Information	P-1	P-2	P-3	Average
Meter Temperature Tm (F)	61.3	67.7	70.2	66.4
Meter Pressure - Pm (in. Hg)	29.4	29.5	29.6	29.5
Measured Sample Volume (Vm)	49.3	56.7	56.2	54.1
Sample Volume (Vm-Std ft3)	48.3	55.1	54.5	52.6
Sample Volume (Vm-Std m3)	1.37	1.56	1.54	1.49
Condensate Volume (Vw-std)	0.773	1.386	1.264	1.141
Gas Density (Ps(std) lbs/ft3) (wet)	0.0741	0.0738	0.0739	0.0739
Gas Density (Ps(std) lbs/ft3) (dry)	0.0745	0.0745	0.0745	0.0745
Total weight of sampled gas (m g lbs) (wet)	3.64	4.17	4.12	3.98
Total weight of sampled gas (m g lbs) (dry)	3.60	4.11	4.06	3.92
Nozzle Size - An (sq. ft.)	0.000715	0.000715	0.000715	0.000715
Isokinetic Variation - I	97.8	99.5	97.7	98.3
Stack Data				
Average Stack Temperature - Ts (F)	187.9	269.1	268.6	241.9
Molecular Weight Stack Gas- dry (Md)	28.8	28.8	28.8	28.8
Molecular Weight Stack Gas-wet (Ms)	28.7	28.6	28.6	28.6
Stack Gas Specific Gravity (Gs)	0.990	0.987	0.987	0.988
Percent Moisture (Bws)	1.57	2.45	2.27	2.10
Water Vapor Volume (fraction)	0.0157	0.0245	0.0227	0.0210
Pressure - Ps ("Hg)	29.3	29.3	29.4	29.4
Average Stack Velocity -Vs (ft/sec)	22.9	29.1	29.2	27.1
Area of Stack (ft2)	19.6	19.6	19.6	19.6
Exhaust Gas Flowrate				
Flowrate ft^3(Actual)	26,980	34,289	34,341	31,870
Flowrate ft^3 (Standard Wet)	21,551	24,341	24,479	23,457
Flowrate ft^3 (Standard Dry)	21,212	23,744	23,924	22,960
Flowrate m^3 (standard dry)	601	672	677	650
Total HCl Weight (ug)				
Sample Catch	0	0	0	0
Blank correction	0	0	0	0
Total	0	0	0	0
Total HCl Concentration				
lb/1000 lb (wet)	0.000	0.000	0.000	0.000
lb/1000 lb (dry)	0.000	0.000	0.000	0.000
mg/dscm (dry)	0.0	0.0	0.0	0.0
Total HCl Emission Rate				
lb/ hr	0.00	0.00	0.00	0.00
Total HF Weight (ug)				
Sample Catch	0	290	250	180
Blank correction	0	0	0	0
Total	0	290	250	180
Total HF Concentration				
lb/1000 lb (wet)	0.000	0.000	0.000	0.000
lb/1000 lb (dry)	0.000	0.000	0.000	0.000
mg/dscm (dry)	0.0	0.2	0.2	0.1
Total HF Emission Rate				
lb/ hr	0.00	0.02	0.01	0.01
Total Cl_2 Weight (ug)				
Sample Catch	0	0	0	0
Blank correction	0	0	0	0
Total	0	0	0	0
Total Cl_2 Concentration				
lb/1000 lb (wet)	0.000	0.000	0.000	0.000
lb/1000 lb (dry)	0.000	0.000	0.000	0.000
mg/dscm (dry)	0.0	0.0	0.0	0.0
Total Cl_2 Emission Rate				
lb/ hr	0.00	0.00	0.00	0.00

Table 13
EU-6ML-GV-02 (Furnace) HCl, HF, and Cl_2 Emission Rates (Flux and Dross)

Company	SMCO	
Source Designation	EU-6ML-GV-02 (Flux and Dross)	
Test Date	11/8/2013	11/8/2013
	Flux	Dross
Meter/Nozzle Information	P-4	P-5
Meter Temperature Tm (F)	76.0	88.1
Meter Pressure - Pm (in. Hg)	29.6	29.7
Measured Sample Volume (Vm)	59.4	60.4
Sample Volume (Vm-Std ft3)	57.0	56.8
Sample Volume (Vm-Std m3)	1.61	1.61
Condensate Volume (Vw-std)	1.122	0.783
Gas Density (Ps(std) lbs/ft3) (wet)	0.0740	0.0741
Gas Density (Ps(std) lbs/ft3) (dry)	0.0745	0.0745
Total weight of sampled gas (m g lbs) (wet)	4.30	4.27
Total weight of sampled gas (m g lbs) (dry)	4.25	4.23
Nozzle Size - An (sq. ft.)	0.000715	0.000715
Isokinetic Variation - I	100.1	99.6
Stack Data		
Average Stack Temperature - Ts (F)	282.6	241.0
Molecular Weight Stack Gas- dry (Md)	28.8	28.8
Molecular Weight Stack Gas-wet (Ms)	28.6	28.7
Stack Gas Specific Gravity (Gs)	0.988	0.991
Percent Moisture (Bws)	1.93	1.36
Water Vapor Volume (fraction)	0.0193	0.0136
Pressure - Ps ("Hg)	29.4	29.5
Average Stack Velocity -Vs (ft/sec)	30.3	28.4
Area of Stack (ft2)	19.6	19.6
Exhaust Gas Flowrate		
Flowrate ft^3(Actual)	35,655	33,412
Flowrate ft^3 (Standard Wet)	24,936	24,795
Flowrate ft^3 (Standard Dry)	24,455	24,457
Flowrate m^3 (standard dry)	692	693
Total HCl Weight (ug)		
Sample Catch	4800	410
Blank correction	0	0
Total	4800	410
Total HCl Concentration		
lb/1000 lb (wet)	0.002	0.000
lb/1000 lb (dry)	0.002	0.000
mg/dscm (dry)	3.0	0.3
Total HCl Emission Rate		
lb/ hr	0.27	0.02
Total HF Weight (ug)		
Sample Catch	27000	690
Blank correction	0	0
Total	27000	690
Total HF Concentration		
lb/1000 lb (wet)	0.014	0.000
lb/1000 lb (dry)	0.014	0.000
mg/dscm (dry)	16.7	0.4
Total HF Emission Rate		
lb/ hr	1.54	0.04
Total Cl_2 Weight (ug)		
Sample Catch	0	0
Blank correction	0	0
Total	0	0
Total Cl_2 Concentration		
lb/1000 lb (wet)	0.000	0.000
lb/1000 lb (dry)	0.000	0.000
mg/dscm (dry)	0.0	0.0
Total Cl_2 Emission Rate		
lb/ hr	0.00	0.00

Table 14
EU-6ML-GV-02 (Furnace) Nox, CO, and VOC Emission Rates (Hold)
GM SMCO
Furnace
BTEC Project No. 13-1408.00
Sampling Dates: 11/7-8/13

Parameter	Run 1	Run 2	Run 3	Average
	Hold	Hold	Hold	
Test Run Date	11/7/2013	11/7/2013	11/8/2013	
Test Run Time	13:36-14:45	15:25-16:37	7:53-9:01	
Outlet Flowrate (dscfm)	19,656	22,456	22,836	21,650
Outlet Flowrate (scfm)	19,985	23,029	23,287	22,100
Oxygen Concentration (%, drift corrected as per USEPA 7E)	20.4	19.6	19.5	19.8
Carbon Dioxide Concentration (%, drift corrected as per USEPA 7E)	0.3	0.8	0.8	0.7
Outlet NOx Concentration (ppmv, corrected as per USEPA 7E)	1.9	4.0	4.2	3.4
NOx Emission Rate (lb/hr) (corrected as per USEPA 7E)	0.3	0.6	0.7	0.5
Outlet CO Concentration (ppmv, corrected as per USEPA 7E)	4.7	9.3	10.2	8.0
CO Emission Rate (lb/hr) (corrected as per USEPA 7E)	0.4	0.9	1.0	0.8
Outlet VOC Concentration (ppmv as propane)	6.5	10.6	12.4	9.8
Outlet Methane Concentration (ppmv as methane)	12.1	21.4	24.6	19.3
Outlet VOC Concentration (ppmv, corrected as per USEPA 7E)	6.4	10.8	12.3	9.8
Outlet Methane Concentration (ppmv, corrected as per USEPA 7E)	12.2	22.1	24.6	19.6
Outlet VOC Concentration (ppmv propane, -Methane)	1.1	1.0	1.3	1.1
Outlet VOC Concentration (ppmv propane, -Methane, corrected as per USEPA 7E)	0.9	0.8	1.2	1.0
VOC Emission Rate as Propane (lb/hr) (-Methane)	0.15	0.15	0.21	0.17
VOC Emission Rate as Propane(lb/hr) (-Methane) (corrected as per USEPA 7E)	0.12	0.13	0.19	0.15

VOC Correction			
Co	0.24	0.24	0.13
Cma	29.9	29.9	29.8
Cm	29.69	28.83	29.92

Methane Correction			
Co	0.24	0.09	0.19
Cma	29.9	29.9	29.9
Cm	29.30	28.82	29.87

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 (CO = 28.01, NOx = 45.01, SO_2 = 64.05, C_3H_8 = 44.10)
24.14 = molar volume of air at standard conditions (70°F, 29.92" Hg)
35.31 = ft^3 per m^3
453600 = mg per lb
Response factor obtained from introducing propane into methane analyzer: 2.22

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

Table 15
EU-6ML-GV-02 (Furnace) Nox, CO, and VOC Emission Rates (Flux and Dross)
GM SMCO
Furnace
BTEC Project No. 13-4408.00
Sampling Dates: 11/7-8/13

Parameter	Run 4	Run 5
	Flux	Dross
Test Run Date	11/8/2013	11/8/2013
Test Run Time	10:13-11:57	13:26-14:34
Outlet Flowrate (dscfm)	23,660	22,545
Outlet Flowrate (scfm)	23,866	22,911
Outlet NOx Concentration (ppmv, corrected as per USEPA 7E)	3.7	3.0
NOx Emission Rate (lb/hr)	0.6	0.5
Outlet CO Concentration (ppmv, corrected as per USEPA 7E)	7.4	4.9
CO Emission Rate (lb/hr)	0.8	0.5
Outlet VOC Concentration (ppmv as propane)	12.9	9.4
Outlet Methane Concentration (ppmv as methane)	24.6	16.1
Outlet VOC Concentration (ppmv, corrected as per USEPA 7E)	12.9	9.6
Outlet Methane Concentration (ppmv, corrected as per USEPA 7E)	24.9	16.7
Outlet VOC Concentration (ppmv propane, -Methane)	1.8	2.2
Outlet VOC Concentration (ppmv propane, -Methane, corrected as per USEPA 7E)	1.7	2.0
VOC Emission Rate as Propane(lb/hr) (-Methane) (corrected as per USEPA 7E)	0.27	0.32

VOC Correction		
Co	0.17	0.18
Cma	29.8	29.8
Cm	29.57	29.09

Co	0.11	-0.09
Cma	29.9	29.9
Cm	29.48	28.88

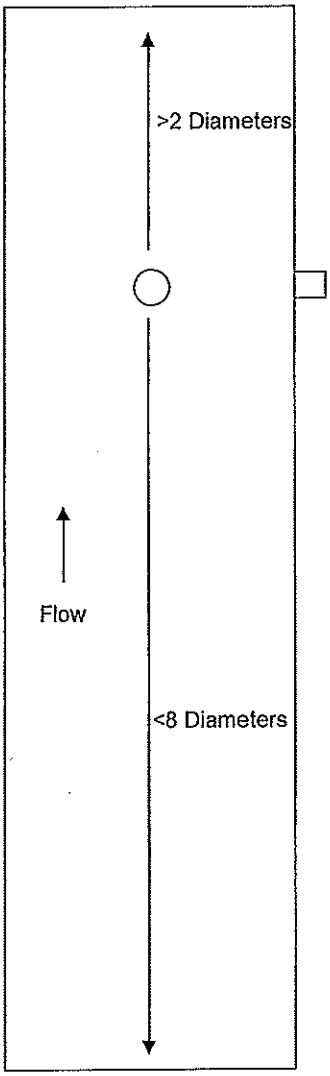
scfm = standard cubic feet per minute
dscfm = dry standard cubic feet per minute
ppmv = parts per million on a volume-to-volume basis
lb/hr = pounds per hour
MW = molecular weight (CO = 28.01, NOx = 46.01, SO_2 = 64.05, C_3H_8 = 44.10)
24.14 = molar volume of air at standard conditions (70°F, 29.92" Hg)
35.31 = ft^3 per m^3
453600 = mg per lb
Response factor obtained from introducing propane into methane analyzer: **2.22**

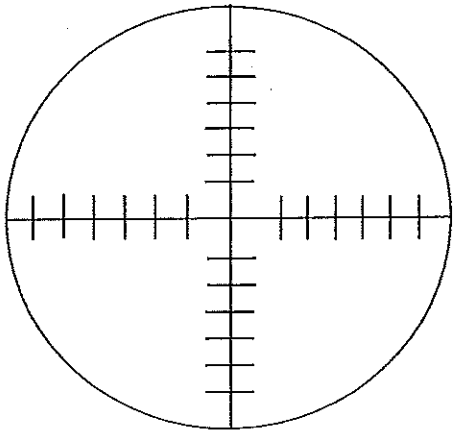
Co= Average of initial and final zero gases
Cma=Actual concentration of the calibration gas
lb/hr = ppmv * MW/24.14 * 1/35.31 * 1/453,600 * *dcfm* * 60
$Conc_{@15\%O2}$ = Conc * (20.9 -15)/(20.9 - $\%O_2$)

Figures

BTEC Inc.

diameter = 49 inches





Not to Scale

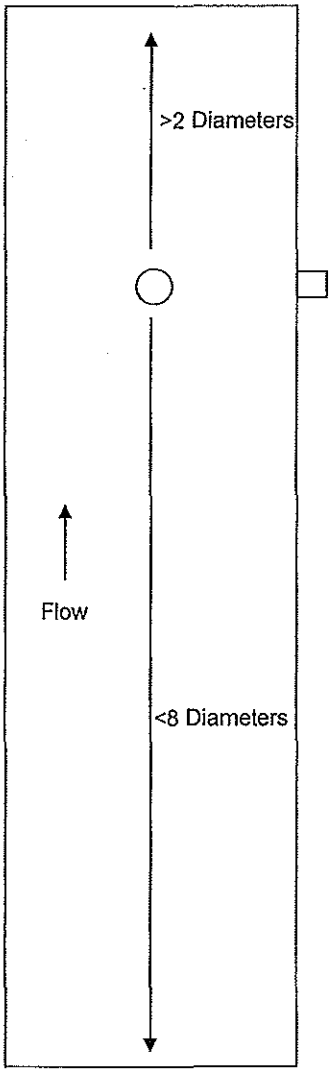
Points	Distance "
1	1.0
2	3.3
3	5.8
4	8.7
5	12.3
6	17.4
7	31.6
8	36.8
9	40.3
10	43.2
11	45.7
12	48.0

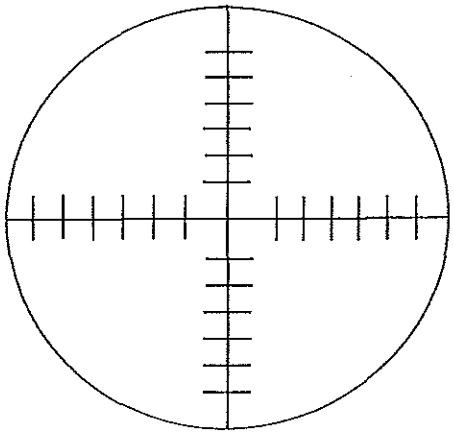
Figure No. 1

Site: **EU-6ML-DC-67** **GM SMCO** **Saginaw, MI**	**Sampling Date:** **November 12, 2013**	**BT Environmental Consulting, Inc.** **4949 Fernlee Avenue** **Royal Oak, Michigan 48073**

BTEC Inc.

diameter = 49 inches





Not to Scale

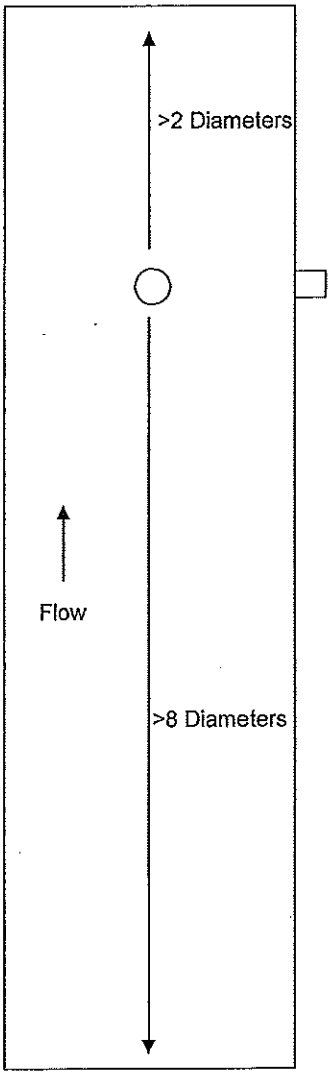
Points	Distance "
1	1.0
2	3.3
3	5.8
4	8.7
5	12.3
6	17.4
7	31.6
8	36.8
9	40.3
10	43.2
11	45.7
12	48.0

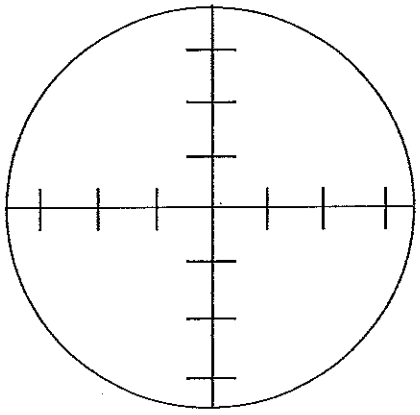
Figure No. 2

Site:	Sampling Date:	
EU-6CR-DC-69 GM SMCO Saginaw, MI	November 12, 2013	BT Environmental Consulting, Inc. 4949 Fernlee Avenue Royal Oak, Michigan 48073

BTEC Inc.

diameter = 30 inches





Not to Scale

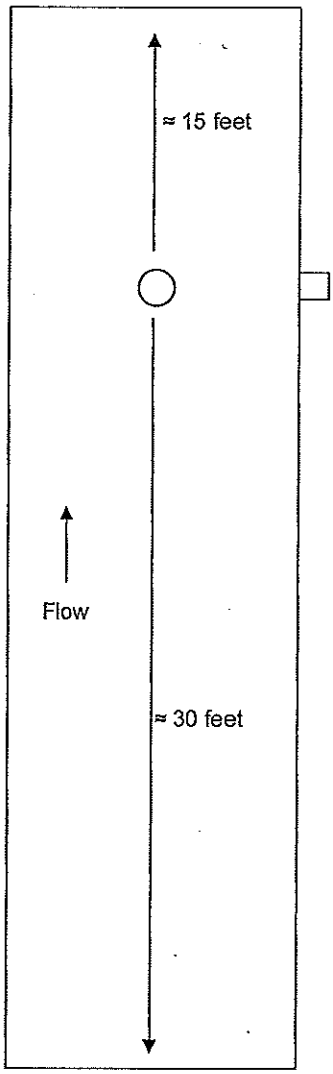
Points	Distance "
1	1.3
2	4.4
3	8.9
4	21.1
5	25.6
6	28.7

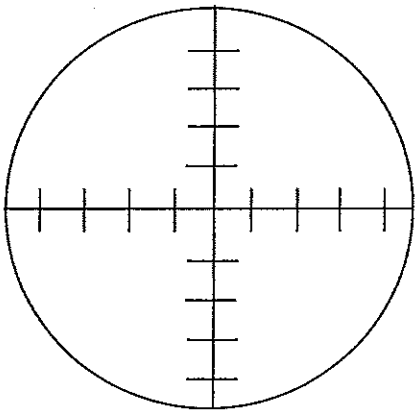
Figure No. 3

Site:	Sampling Date:	
EU-6CR-ISO-04 GM SMCO Saginaw, MI	November 13, 2013	BT Environmental Consulting, Inc. 4949 Fernlee Avenue Royal Oak, Michigan 48073

BTEC Inc.

diameter = 60 inches





Not to Scale

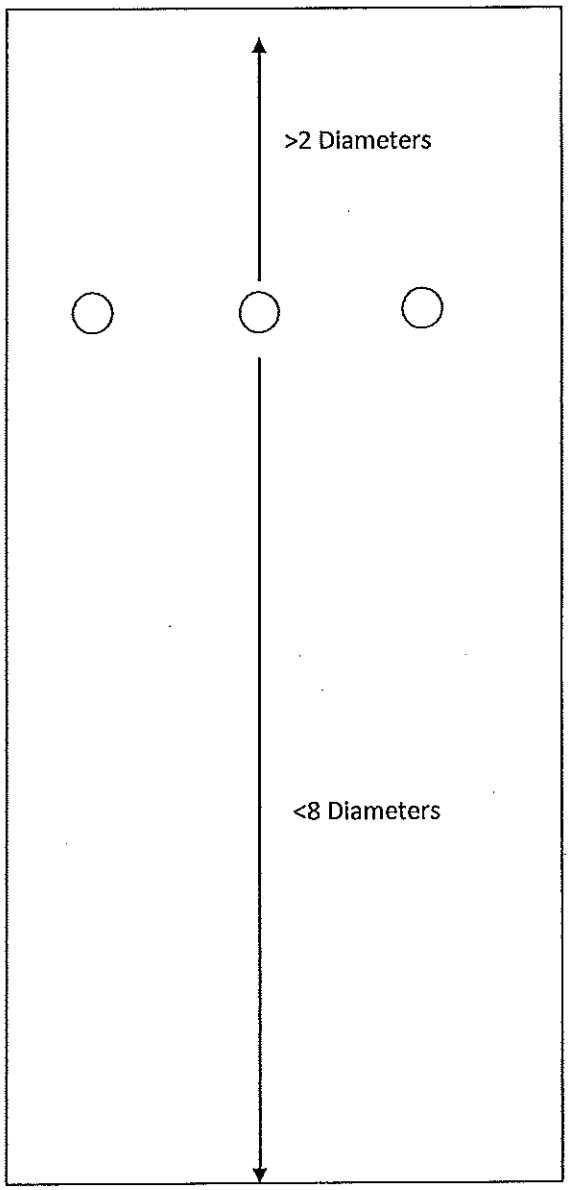
Points	Distance "
1	1.9
2	6.3
3	11.6
4	19.4
5	40.6
6	48.4
7	53.7
8	58.1

Figure No. 4

Site:	Sampling Date:	
EU-6ML-GV-02 (Furnace)	November 7-8, 2013	BT Environmental Consulting, Inc.
GM SMCO		4949 Fernlee Avenue
Saginaw, MI		Royal Oak, Michigan 48073

BTEC Inc.

Stack Dimensions:
Depth: 74 inches
Width: 37 inches



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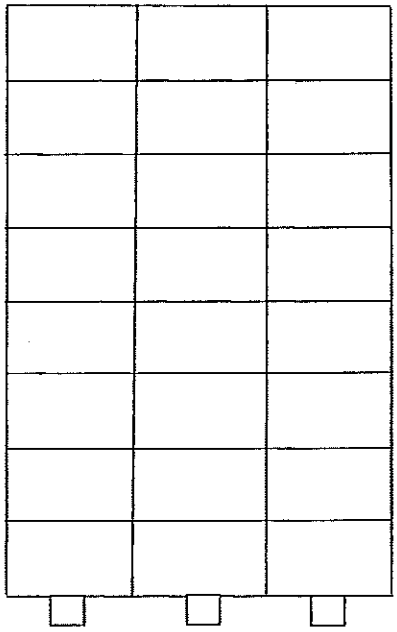


Points	Distance "
1	4.6
2	13.9
3	23.1
4	32.4
5	41.6
6	50.9
7	60.1
8	69.4

Figure No. 5

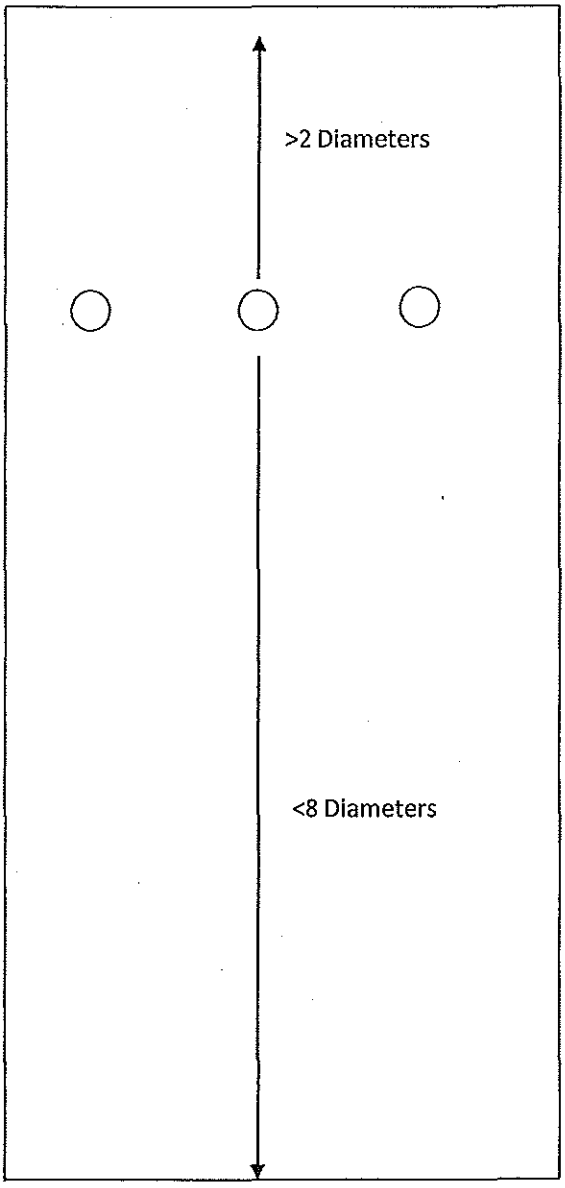
Site: **EU-6ML-EF-03** **GM SMCO** **Saginaw, MI**	**Sampling Date:** **November 13, 2013**	**BT Environmental Consulting, Inc.** **4949 Fernlee Avenue** **Royal Oak, Michigan 48073**

BTEC Inc.

Stack Dimensions:

Depth: 74 inches

Width: 37 inches



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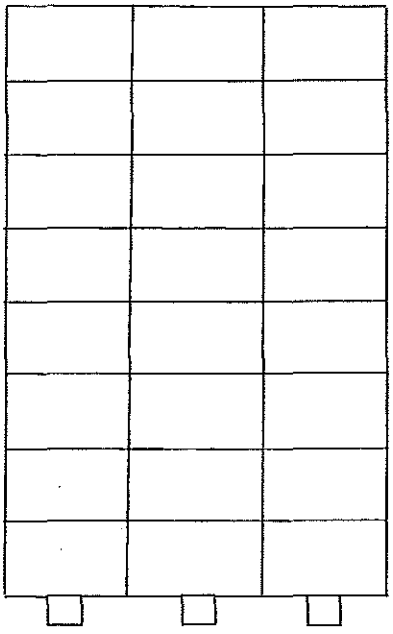

Points	Distance "
1	4.6
2	13.9
3	23.1
4	32.4
5	41.6
6	50.9
7	60.1
8	69.4

Figure No. 6

Site: EU-6ML-EF-04 GM SMCO Saginaw, MI	Sampling Date: November 11, 2013	BT Environmental Consulting, Inc. 4949 Fernlee Avenue Royal Oak, Michigan 48073

BTEC Inc.

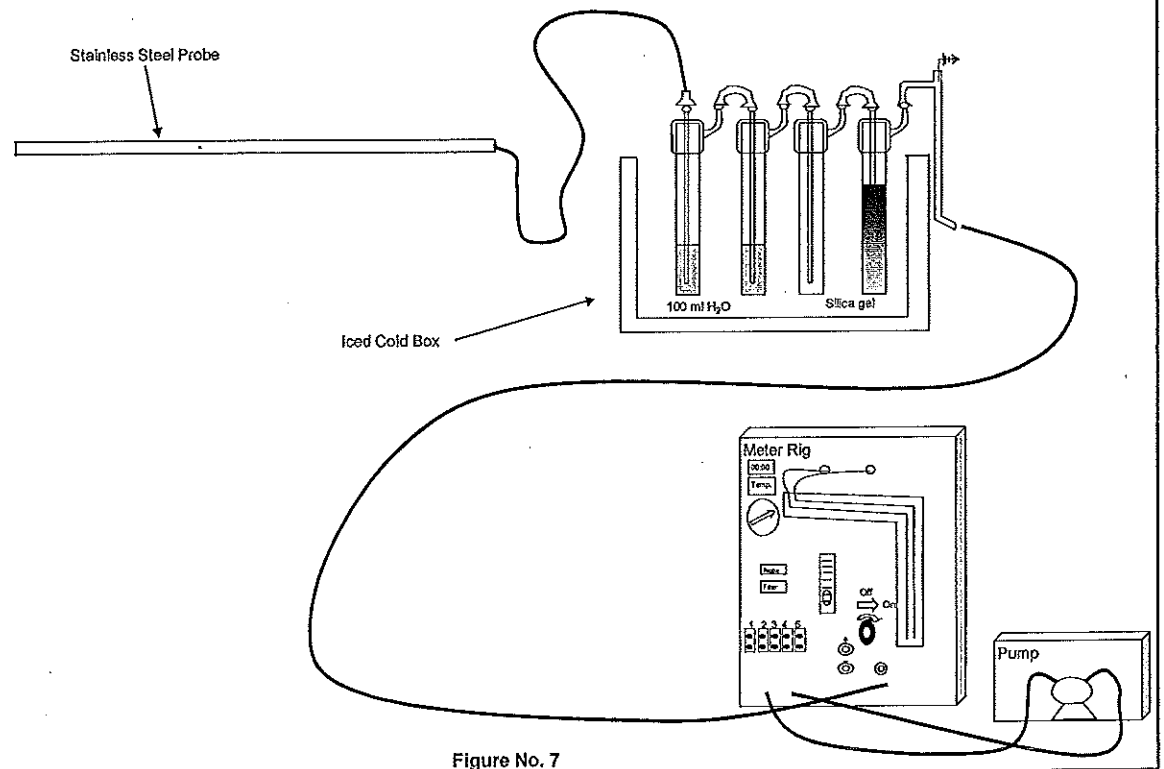

Figure No. 7

Site:	Sampling Date:	
USEPA Method 4 GM SMCO Saginaw, MI	November 13, 2013	BT Environmental Consulting, Inc. 4949 Fernlee Avenue Royal Oak, Michigan 48073

BTEC Inc.

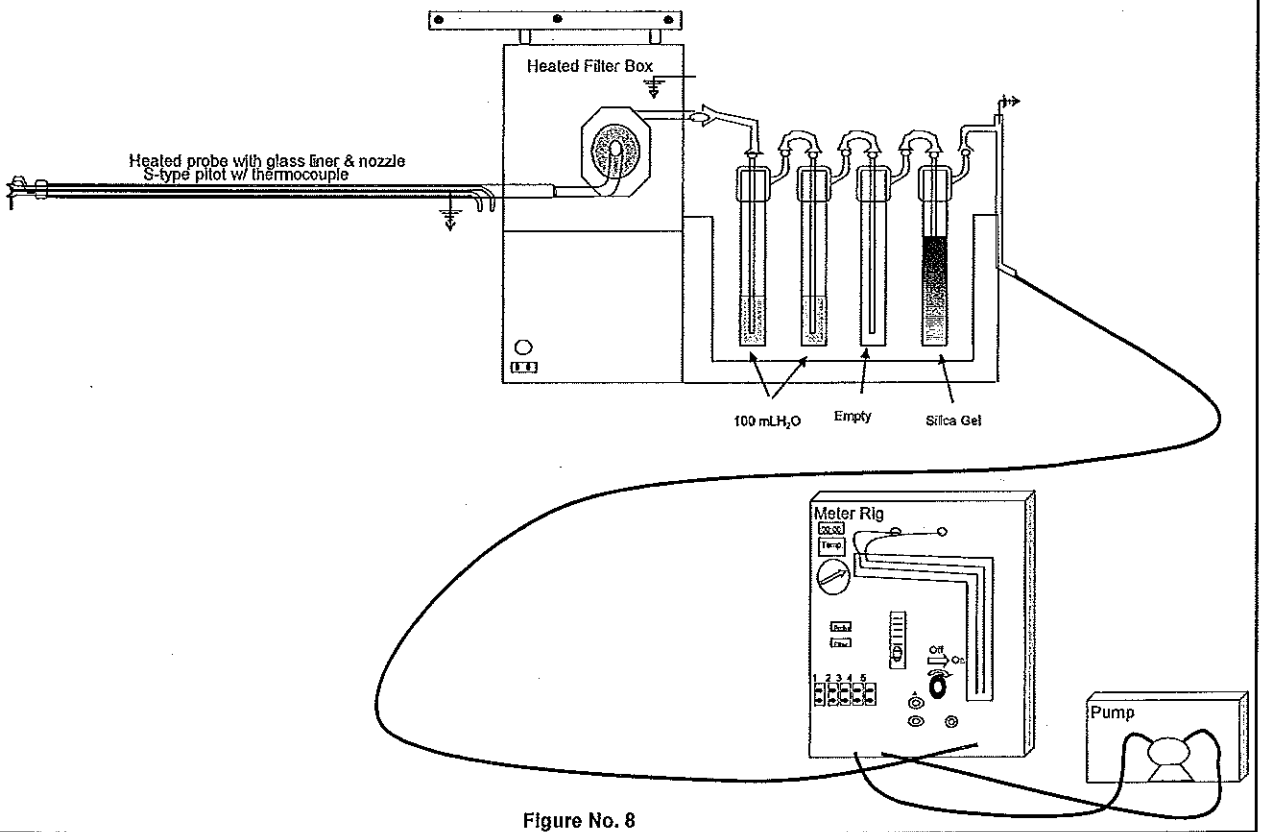

Figure No. 8

Site:	Sampling Date:	
USEPA Method 5 GM SMCO Saginaw, MI	November 11-13, 2013	BT Environmental Consulting, Inc. 4949 Fernlee Avenue Royal Oak, Michigan 48073

BTEC Inc.

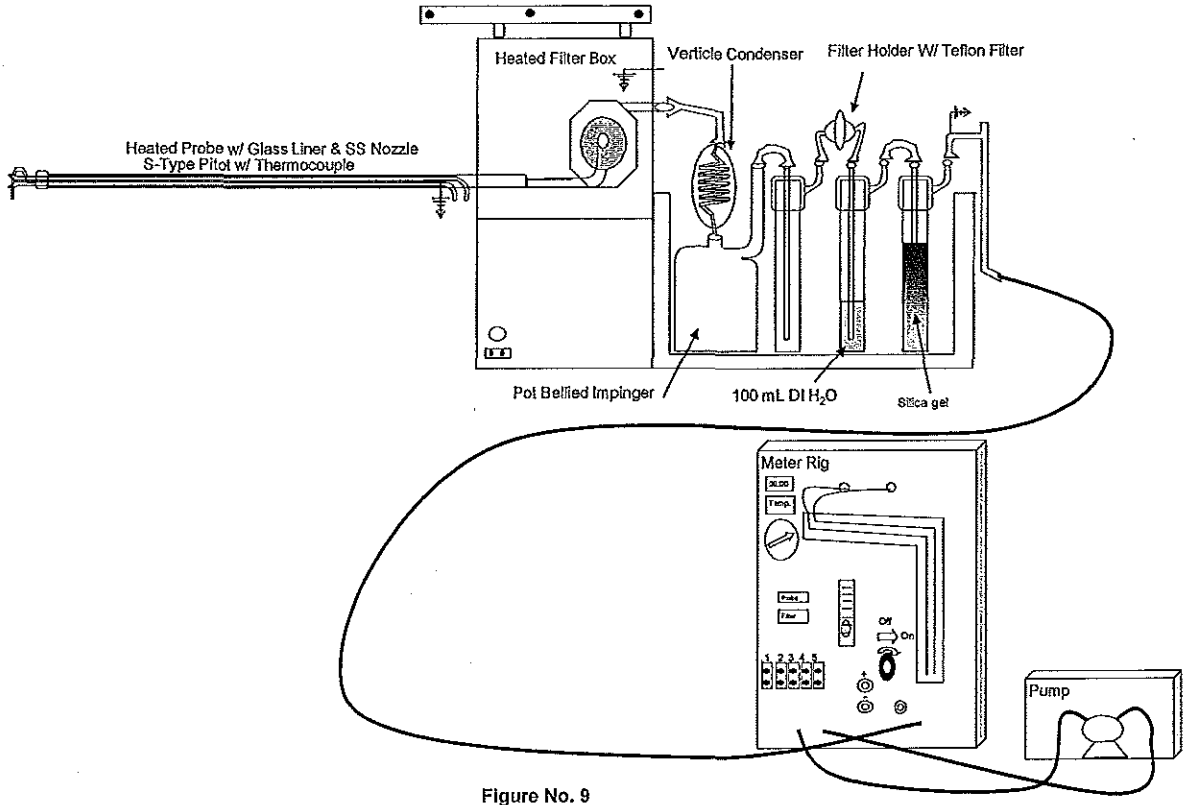

Figure No. 9

Site: USEPA Method 5/202 GM SMCO Saginaw, MI	Sampling Date: November 7-8, 2013	BT Environmental Consulting, Inc. 4949 Fernlee Avenue Royal Oak, Michigan 48073

BTEC Inc.

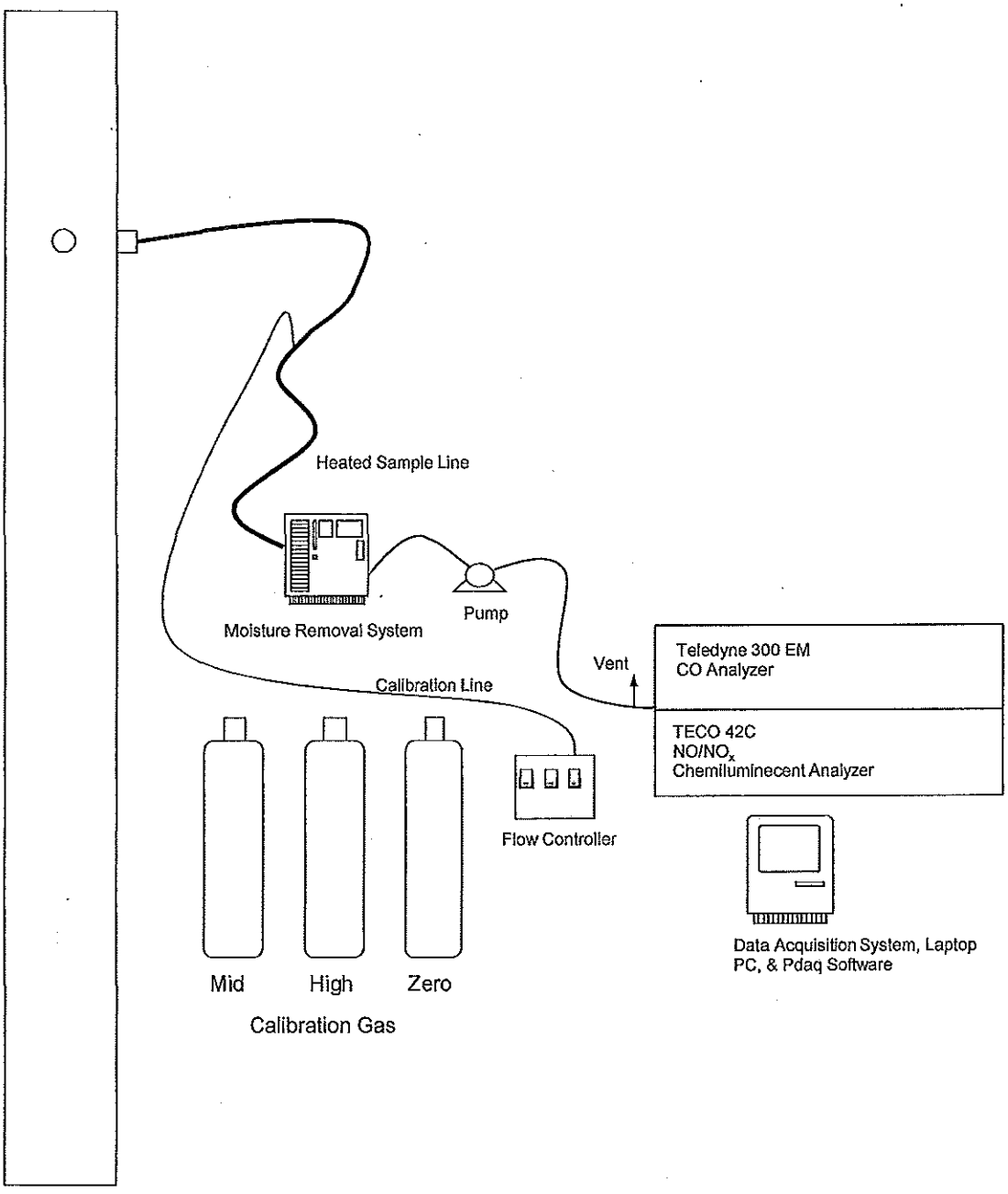

Figure No. 10

Site:	Sampling Date:	
USEPA Method 7E and 10 GM SMCO Saginaw, MI	November 7-8, 2013	BT Environmental Consulting Inc. 4949 Fernlee Avenue Royal Oak, MI 48073

BTEC Inc.

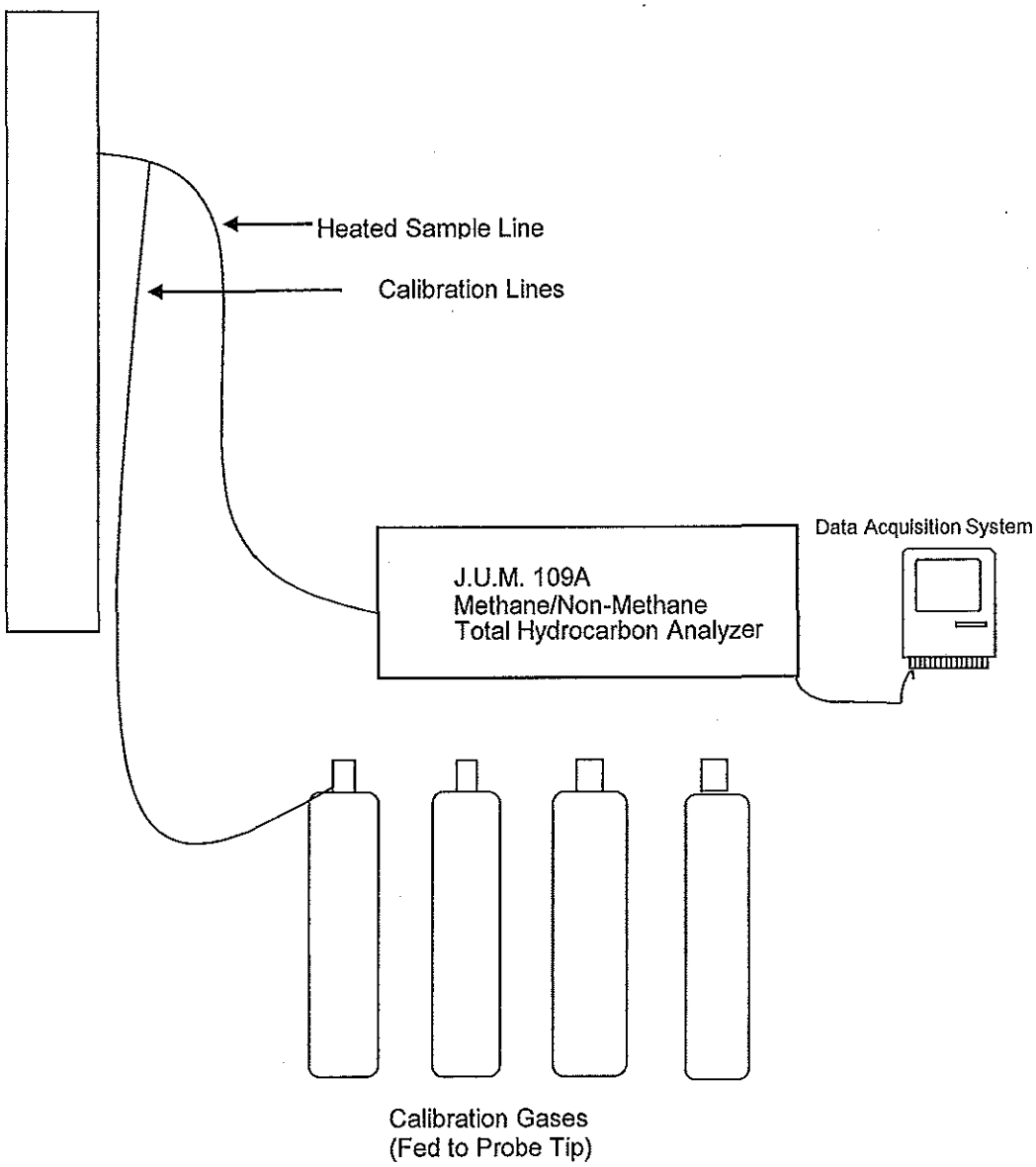

Figure No. 11

Site:	Sampling Date:	
USEPA Method 25A GM SMCO Saginaw, MI	November 7-13, 2013	BT Environmental Consulting, Inc. 4949 Fernlee Avenue Royal Oak, Michigan 48073

BTEC Inc.

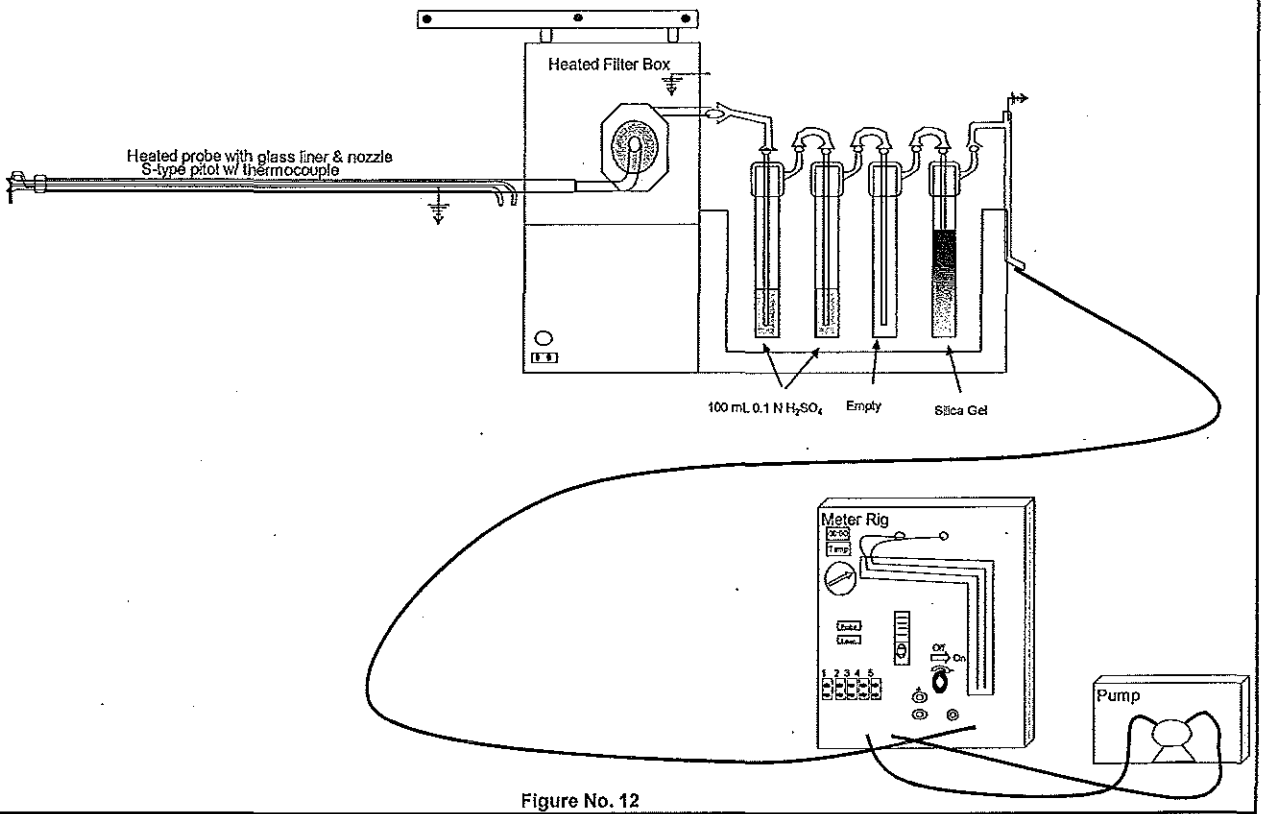

Figure No. 12

Site:	Sampling Date:	
USEPA Method 26A GM SMCO Saginaw, MI	November 7-8, 2013	BT Environmental Consulting, Inc. 4949 Fernlee Avenue Royal Oak, Michigan 48073

BTEC Inc.

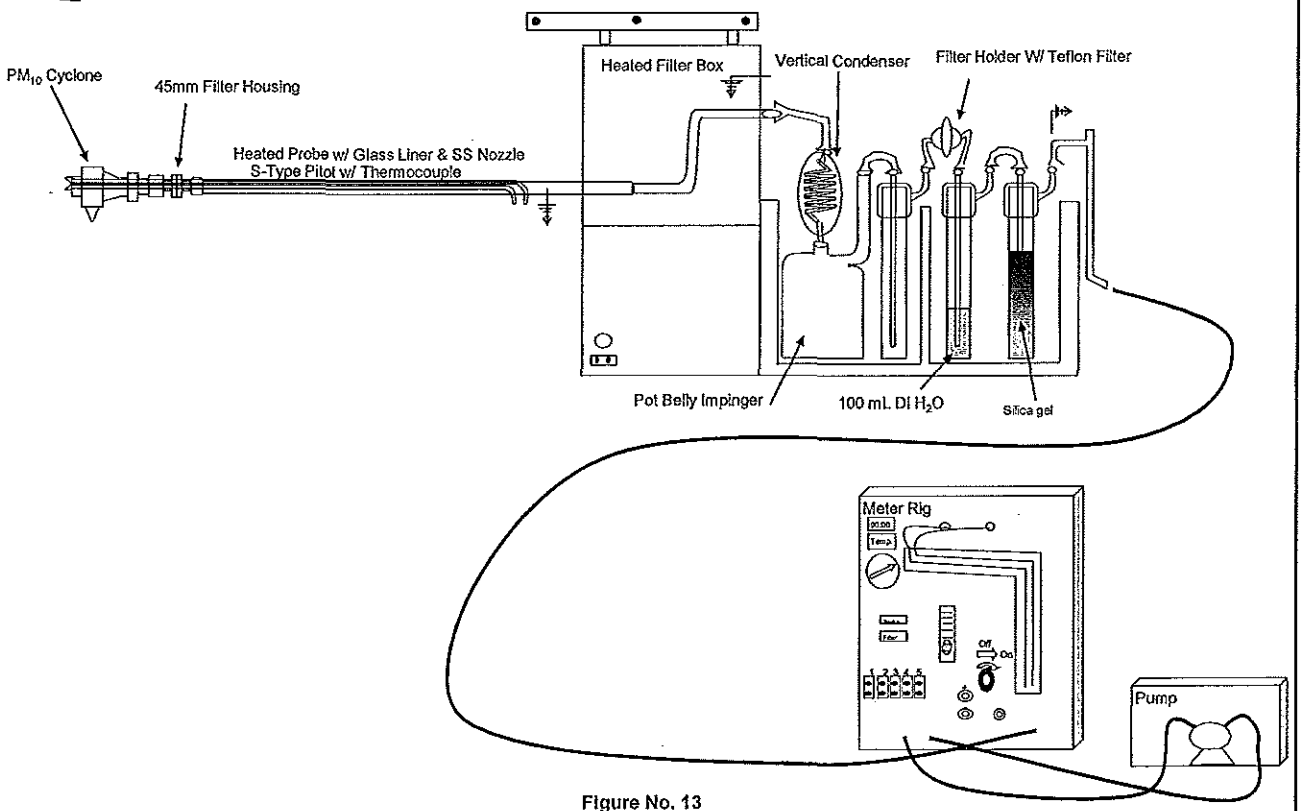

Figure No. 13

Site: USEPA Method 201A/202 GM SMCO Saginaw, MI	Sampling Date: November 8, 2013	BT Environmental Consulting, Inc. 4949 Fernlee Avenue Royal Oak, Michigan 48073

Appendix A
Process Operating Data