BTEC Inc.

EU-SPMCASTLINE
Emissions Test Report

Prepared for:

General Motors

Saginaw, Michigan

GM SMCO
1629 N. Washington Ave.
Saginaw, Michigan

Project No. 15-4755.00
April 11, 2016

BT Environmental Consulting, Inc.
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Royal Oak, Michigan 48071
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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 LLC Saginaw Metal Casting Operations — County: Saginaw

Source Address: 1629 N. Washington — City: Saginaw

AQD Source ID (SRN): B1991 — ROP No.: B1991-2015a — 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 2-24-2016 To 2-24-2016

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

EU-SPMCASTLINE Emissions Test Report Certification, Project No. 15-4755.00
for SV-Z05-BH-2, dated April 11, 2016, for SPM Castline 2.
Note: EU-SPMCASTLINE is covered under MI-ROP-B1991-2015s, revision date March 22, 2016.
EU-SPMCASTLINE is also under PTI 36-12E, not yet incorporated into the active ROP.

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

John Lancaster	Plant Manager	989-757-1432
Name of Responsible Official (print or type)	Title	Phone Number

Signature of Responsible Official — Date: 4/20/16

* Photocopy this form as needed.

EQP 5736 (Rev 11-04)

BTEC Inc.

Executive Summary

BT Environmental Consulting, Inc. (BTEC) was retained by General Motors, LLC (GM) to conduct emissions testing at the GM SMCO facility in Saginaw, Michigan. The test program consisted of sampling for filterable particulate matter (PM), carbon monoxide (CO), oxides of nitrogen (NOx), and volatile organic compounds (VOC) concentrations and emissions from the SPM Castline 2 which is one of three cast lines covered by Permit to Install No. 36-12E, EU-SPMCASTLINE.

Testing of the sources consisted of triplicate 60-minute test runs for PM conducted simultaneously at the inlet and exhaust of the Castline 2 fabric filter collector, and triplicate approximate 60-minute test runs for NOx, CO, and VOC at the exhaust of the SPM Castline 2 fabric filter collector. Sampling was performed utilizing United States Environmental Protection Agency (USEPA) reference test methods. Testing occurred on February 24th, 2016. The results of the emissions test program are summarized by Table 1. The permit does not contain PM limits at the inlet to the fabric filter collector and does not require inlet testing. GM tested PM at the inlet to evaluate the need for PM emissions control for portions of the SPM Castline processes.

Table 1
Overall Results Summary
Sampling Dates: February 24, 2016

Source	Pollutant	Emission Limitation (lb/hr)	Average Test Result (lb/hr)
SPM Castline 2 Inlet Stack	Particulate Matter (PM)	NA	0.13
SPM Castline 2 Exhaust Stack	Particulate Matter (PM)	7.07	0.06
	NOx	1.9	0.1
	CO	12.47	1.32
	VOC	10.81	1.94

Note: The emission limitations are applicable to SPM Castlines 1, 2, and 3, combined, with a maximum nominal combined production rate of 106 castings per hour.

BTEC Inc.

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BTEC Inc.

1. Introduction

BT Environmental Consulting, Inc. (BTEC) was retained by General Motors, LLC (GM) to conduct emissions testing at the GM SMCO facility in Saginaw, Michigan. The test program consisted of sampling for filterable particulate matter (PM), carbon monoxide (CO), oxides of nitrogen (NOx), and volatile organic compounds (VOC) concentrations and emissions from the fabric filter collector outlet of SPM Castline 2 which is one of three cast lines covered by Permit to Install No. 36-12E, EU-SPMCASTLINE. In addition, SMCO evaluated the PM present in the inlet to the fabric filter collector. The inlet test results may be used to evaluate the need for particulate emissions control for portions of the SPM Castline processes. Inlet testing is not required by the permit.

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" (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

The source tested is located at the GM Saginaw Metal Casting Operations located in Saginaw, Michigan. Testing on the source was conducted February 24th, 2016.

1.b Purpose of Testing

The purpose of the testing is to demonstrate compliance with emission limitations for EU-SPMCASTLINE under Michigan PTI 36-12E.

1.c Source Description

Sources identified under this project specifically include, EU-SPMCASTLINE.

1.d Test Program Contact

The contacts for information regarding the test program as well as the test report are:

Karen Carlson
GECS - Facility Air Compliance & Permit
Lansing Delta Township
8175 Millett Highway
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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
Renee Mietz	GM-SMCO
Ray Ilkka	GM-SMCO
Barry Boulianne	BTEC
Matthew Young	BTEC
Brandon Chase	BTEC
Paul Molenda	BTEC
Mike Nummer	BTEC
Sydney Bruestle	MDEQ
Gina McCann	MDEQ

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 D.

2.b Applicable Permit

The emission units tested for EU-SPMCASTLINE are included in PTI 36-12E.

2.c Results

The results of the emissions test program are summarized by Table 1. Detailed results for are summarized in Tables 3-5.

2.d Emission Regulation Comparison

The Emission regulations are summarized by Table 1.

3. Source Description

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

3.a Process Description

Cast Line processes
Cast Lines – Three cast lines with a nominal maximum combined production rate of 106 castings per hour (2,460 castings per day) and a nominal maximum production rate of 53 castings per hour on any single casting line.

The cast lines consist of the following: *Section #1:* (3 modular units) making a final mold; mold filling; initial cooling; extraction; and cut sprue. Making a final mold includes mold and core assembly and mold heating with natural gas-fired 18 MMBtu/hr (total heat input rate) burners/torches. Mold filling is conducted by gravity pour. Initial cooling and solidification of the molten metal occurs inside the mold. Extraction of the casting (including sand cores) from the steel mold is completed by the casting extraction unload robot. Top core and down sprue removal. Additional cooling and complete solidification occur in the casting solidification buffer area. Sprue is collected and transported to the sand separator (EU-SANDSEP). *Section #2:* (3 identical modular units) extended casting cooling in the cooling garage.

3.b Process Flow Diagram

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

3.c Raw and Finished Materials

The raw materials used in the processes include molten aluminum and sand. Natural gas is used in the burners to preheat the molds. See section 3.a.

3.d Process Capacity

Process Production Capacities

Process	Maximum Production Rate	Current Targeted Production Rate	Current Average Production Rate	Average Production Rate Emission Testing
EU-SPMCASTLINE	106 molds/hr, (combined cast lines)	38 molds/hr, (combined cast lines)	22 molds/hr, (combined cast lines)	32 molds/hr on cast line 2

3.e Process Instrumentation

The fabric filter pressure drop (in. H2O), natural gas use, and the production throughput (molds per hour) were recorded during every run of the compliance test. This data is included in Appendix D. During the test, no natural gas usage registered on the meter, therefore, GM is investigating to determine whether the meter may have scaling issues.

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 five categories as follows:

(1) Measurement of exhaust gas velocity, molecular weight, and moisture content;
(2) Measurement of exhaust gas filterable PM concentration using USEPA Method 5
(3) Measurement of exhaust gas NOx concentration using USEPA Method 7E
(4) Measurement of exhaust gas CO concentration using USEPA Method 10
(5) Measurement of exhaust gas VOC concentration using USEPA Method 25A.

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 1-2.

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 PM (USEPA Method 5)

40 CFR 60, Appendix A, Method 5, *"Determination of Particulate Emissions from Stationary"* was used to measure PM concentrations and calculate PM emission rates for EU-PSANDCASTLINE (see Figure 3 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 Teflon connecting line to the impingers, (4) a set of four Greenburg-Smith (GS) impingers with the (i) first two with 100 ml of deionized water, (ii) an empty impinger, (iii) and an impinger filled with approximately 300 grams of silica gel. (5) a length of sample line, and (6) a Nutech® control case equipped with a pump, dry gas meter, and calibrated orifice.

Upon completion of the final leak test for each test run, the filter was recovered, and the nozzle, probe, and the front half of the filter holder assembly were brushed and triple rinsed with acetone which was 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.

NOx (USEPA Method 7E)

The NOx content of the exhaust gas was evaluated according to procedures outlined in 40 CFR 60, Appendix A, Method 7E. The NOx content of the gas stream was measured using a Thermo Model 42i NOx gas analyzer. 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 Teflon® sample conditioner to remove the moisture from the sample before it entered the NOx analyzer. Data was recorded on a PC equipped with data acquisition software. Recorded NOx concentrations were averaged and reported for the

duration of each 60-minute test (as drift corrected per Method 7E). A drawing of the sampling train used for the testing program is presented as Figure 4.

In accordance with Method 7E, a 3-point (zero, mid, and high) bias check and calibration check was performed on the NOx analyzer prior to initiating the test program. Following each test run, a 2-point (zero and high) calibration drift check was performed. The NOx analyzer was operated at the 0-50 ppm range.

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.

CO (USEPA Method 10)

The CO content of the exhaust gas was evaluated according to procedures outlined in 40 CFR 60, Appendix A, Method 10. The CO content of the gas stream was measured using a TECO 48 CO gas analyzer (see Figure 4 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 analyzer. Data was recorded on a PC equipped with Labview® II data acquisition software. Recorded CO concentrations were averaged and reported for the duration of each 60-minute test (as drift corrected per Method 7E). The analyzer was calibrated for a range of 0 to 50 ppm.

In accordance with Method 10, a 3-point (zero, mid, and high) calibration check was performed on the CO analyzer. Calibration drift checks were performed at the completion of each run. Calibration gases were mixed to desired concentrations using an Environics Series 4040 Computerized Gas Dilution System.

Volatile Organic Compounds (USEPA Method 25A)

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 IOtech® data acquisition software. BTEC used a JUM Model 109A Methane/Non-Methane THC hydrocarbon analyzer to determine the VOC concentration.

The JUM Model 109A analyzer utilizes two flame ionization detectors (FIDs) in order to report the average ppmv for total hydrocarbons (THC), as propane, as well as the average ppmv for methane (as methane). Upon entry, the analyzer splits the gas stream. One FID ionizes all of the hydrocarbons in the gas stream sample into carbon, which is then detected as a concentration of total hydrocarbons. Using an analog signal, specifically voltage, the concentration of THC is then sent to the data acquisition system (DAS), where recordings are taken at 4-second intervals to produce an average based on the overall duration of the test. This average is then used to determine the average ppmv for THC reported as the calibration gas, propane, in equivalent units.

The second FID reports methane only. The sample enters a chamber containing a catalyst that destroys all of the hydrocarbons present in the gas stream other than methane. As with the THC sample, the methane gas concentration is sent to the DAS and recorded. The methane concentration, reported as methane, can then be converted to methane, reported as propane, by dividing the measured methane concentration by the analyzer's response factor.

The analyzer's response factor is obtained by introducing a methane calibration gas to the calibrated J.U.M. 109A. The response of the analyzer's THC FID to the methane calibration gas, in ppmv as propane, is divided by the Methane analyzer's response to the methane calibration gas, in ppmv as methane. The response factor determined during testing was 2.38.

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.

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

Diagrams of the stacks showing sampling ports are included as Figures 1 and 2.

4.d Traverse Points

Diagrams of the stacks showing traverse points are included as Figures 1 and 2.

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

5.b Discussion of Results

Table 1
Overall Results Summary
Sampling Dates: February 24, 2016

Source	Pollutant	Emission Limitation (lb/hr)	Average Test Result (lb/hr)
SPM Castline 2 Inlet Stack	Particulate Matter (PM)	NA	0.13
SPM Castline 2 Exhaust Stack	Particulate Matter (PM)	7.07	0.06
	NOx	1.9	0.1
	CO	12.47	1.32
	VOC	10.81	1.94

As noted earlier in the report, PTI 36-12E, does not contain a PM emissions limit on the inlet to the SPM Castline 2 fabric filter collector. GM will be evaluating the inlet PM emissions to determine the PM control strategies for the SPM Castline processes.

The average production rate during the testing was 32 molds per hour on SPM Castline 2. The permit emission limitations for all pollutants are applicable to the emissions from all three SPM Castlines, combined, at a nominal maximum combined production rate of 106 molds per hour. Prorating the Average Test Results by a factor of 106 divided by 32 yields the resulting calculated emission rates shown below. These calculated emission rates demonstrate predicted compliance with the emission limitations for the three SPM Castlines, combined.

PM: 0.20 lb/hr
NOx: 0.33 lb/hr
CO: 4.37 lb/hr
VOC: 6.43 lb/hr

5.c Sampling Procedure Variations

The use of USEPA method 202 was omitted from the test program due to stack temperatures being below 85 degrees. The average temperature for the Inlet stack was 75.3 °F. The average temperature for the outlet was 78.4 °F.

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 are provided in Appendix A.

5.j Laboratory Data

Laboratory analysis is provided in Appendix E.

Table 3
SPM Castline 2 Baghouse Inlet Particulate Matter Emission Rates

Company	**General Motors SMCO**			
Source Designation	**Castline Inlet**			
Test Date	**2/24/2016**	**2/24/2016**	**2/24/2016**	
Meter/Nozzle Information	P-1	P-2	P-3	Average
Meter Temperature Tm (F)	77.2	78.0	79.6	78.2
Meter Pressure - Pm (in. Hg)	29.5	29.5	29.5	29.5
Measured Sample Volume (Vm)	67.9	68.5	70.5	69.0
Sample Volume (Vm-Std ft3)	65.1	65.6	67.4	66.0
Sample Volume (Vm-Std m3)	1.84	1.86	1.91	1.87
Condensate Volume (Vw-std)	0.443	0.566	0.509	0.506
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)	4.87	4.91	5.05	4.94
Total weight of sampled gas (m g lbs) (dry)	4.85	4.89	5.02	4.92
Nozzle Size - An (sq. ft.)	0.000309	0.000309	0.000309	0.000309
Isokinetic Variation - I	99.8	102.0	101.8	101.2
Stack Data				
Average Stack Temperature - Ts (F)	78.4	73.8	73.8	75.3
Molecular Weight Stack Gas- dry (Md)	28.8	28.8	28.8	28.8
Molecular Weight Stack Gas-wet (Ms)	28.8	28.7	28.8	28.8
Stack Gas Specific Gravity (Gs)	0.993	0.993	0.993	0.993
Percent Moisture (Bws)	0.68	0.86	0.75	0.76
Water Vapor Volume (fraction)	0.0068	0.0086	0.0075	0.0076
Pressure - Ps ("Hg)	28.7	28.7	28.7	28.7
Average Stack Velocity -Vs (ft/sec)	62.8	61.4	63.2	62.5
Area of Stack (ft2)	15.9	15.9	15.9	15.9
Exhaust Gas Flowrate				
Flowrate ft^3(Actual)	59,878	58,602	60,325	59,602
Flowrate ft^3 (Standard Wet)	56,295	55,578	57,203	56,359
Flowrate ft^3 (Standard Dry)	55,915	55,102	56,774	55,930
Flowrate m^3 (standard dry)	1,583	1,560	1,608	1,584
Total Particulate Weights (mg)				
Nozzle/Probe/Filter	1.0	1.2	1.3	1.2
Total Particulate Concentration				
lb/1000 lb (wet)	0.000	0.001	0.001	0.001
lb/1000 lb (dry)	0.000	0.001	0.001	0.001
mg/dscm (dry)	0.5	0.6	0.7	0.6
gr/dscf	0.0002	0.0003	0.0003	0.0003
Total Particulate Emission Rate				
lb/ hr	0.11	0.13	0.15	0.13

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Table 4
SPM Castline 2 Baghouse Exhaust Particulate Matter Emission Rates

Company	**GM SMCO**			
Source Designation	**Castline 2 Baghouse Exhaust**			
Test Date	**2/24/2016**	**2/24/2016**	**2/24/2016**	
Meter/Nozzle Information	P-1	P-2	P-3	Average
Meter Temperature Tm (F)	44.8	52.1	51.0	49.3
Meter Pressure - Pm (in. Hg)	29.4	29.4	29.4	29.4
Measured Sample Volume (Vm)	64.4	65.0	65.5	65.0
Sample Volume (Vm-Std ft3)	66.6	66.2	66.9	66.6
Sample Volume (Vm-Std m3)	1.89	1.87	1.89	1.88
Condensate Volume (Vw-std)	0.613	0.773	0.509	0.632
Gas Density (Ps(std) lbs/ft3) (wet)	0.0743	0.0742	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)	4.99	4.97	5.01	4.99
Total weight of sampled gas (m g lbs) (dry)	4.96	4.93	4.99	4.96
Nozzle Size - An (sq. ft.)	0.000317	0.000317	0.000317	0.000317
Isokinetic Variation - I	99.2	99.6	99.9	99.6
Stack Data				
Average Stack Temperature - Ts (F)	77.8	78.9	78.6	78.4
Molecular Weight Stack Gas- dry (Md)	28.8	28.8	28.8	28.8
Molecular Weight Stack Gas-wet (Ms)	28.7	28.7	28.8	28.7
Stack Gas Specific Gravity (Gs)	0.992	0.991	0.993	0.992
Percent Moisture (Bws)	0.91	1.15	0.76	0.94
Water Vapor Volume (fraction)	0.0091	0.0115	0.0076	0.0094
Pressure - Ps ("Hg)	29.1	29.1	29.1	29.1
Average Stack Velocity -Vs (ft/sec)	62.2	61.8	62.1	62.0
Area of Stack (ft2)	15.0	15.0	15.0	15.0
Exhaust Gas Flowrate				
Flowrate ft^3(Actual)	56,072	55,754	55,944	55,924
Flowrate ft^3 (Standard Wet)	53,532	53,125	53,330	53,329
Flowrate ft^3 (Standard Dry)	53,043	52,511	52,928	52,827
Flowrate m^3 (standard dry)	1,502	1,487	1,499	1,496
Total Particulate Weights (mg)				
Nozzle/Probe/Filter	0.7	0.8	0.3	0.6
Total 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)	0.4	0.4	0.2	0.3
gr/dscf	0.0002	0.0002	0.0001	0.0001
Total Particulate Emission Rate				
lb/ hr	0.07	0.08	0.03	0.06

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Table 5
SPM Castline 2 Baghouse Exhaust NOx, CO, and VOC Emission Rates
General Motors
Saginaw, Michigan
BTEC Project No. 15-4755.00
Sampling Dates: 2/24/16

Parameter	Run 1	Run 2	Run 3	Average
Test Run Date	2/24/2016	2/24/2016	2/24/2016	
Test Run Time	7:48-8:48	10:03-11:03	12:25-13:25	
Outlet Flowrate (dscfm)	53,043	52,511	52,928	**52,827**
Outlet Flowrate (scfm)	53,532	53,125	53,330	**53,329**
Outlet Oxides of Nitrogen Concentration (ppmv)	0.39	0.37	0.33	**0.36**
Outlet NOx Concentration (ppmv, corrected as per USEPA 7E)	0.36	0.33	0.29	**0.33**
NOx Emission Rate (lb/hr)	**0.1**	**0.1**	**0.1**	**0.1**
NOx Emission Rate (lb/hr) (corrected as per USEPA 7E)	**0.1**	**0.1**	**0.1**	**0.1**
Outlet Carbon Monoxide Concentration (ppmv)	6.01	5.52	6.17	**5.90**
Outlet CO Concentration (ppmv, corrected as per USEPA 7E)	5.76	5.39	6.07	**5.74**
CO Emission Rate (lb/hr)	**1.39**	**1.26**	**1.42**	**1.36**
CO Emission Rate (lb/hr) (corrected as per USEPA 7E)	**1.33**	**1.23**	**1.40**	**1.32**
Outlet VOC Concentration (ppmv as propane)	9.82	8.66	8.09	**8.86**
Outlet Methane Concentration (ppmv as methane)	11.17	7.05	5.87	**8.03**
Outlet VOC Concentration (ppmv, corrected as per USEPA 7E)	9.66	8.46	7.68	**8.60**
Outlet Methane Concentration (ppmv, corrected as per USEPA 7E)	10.94	6.84	5.71	**7.83**
Outlet VOC Concentration (ppmv propane, -Methane)	5.13	5.70	5.62	**5.48**
Outlet VOC Concentration (ppmv propane, -Methane, corrected as per USEPA 7E)	5.07	5.58	5.28	**5.31**
VOC Emission Rate as Propane (lb/hr) (-Methane)	**1.88**	**2.07**	**2.05**	**2.00**
VOC Emission Rate as Propane(lb/hr) (-Methane) (corrected as per USEPA 7E)	**1.86**	**2.03**	**1.93**	**1.94**

NOx Correction			
Co	0.05	0.05	0.05
Cma	24.95	24.95	24.95
Cm	23.95	24.64	24.91

CO Correction			
Co	0.28	0.16	0.09
Cma	24.1	24.1	24.1
Cm	24.28	24.14	24.21

VOC Correction			
Co	0.21	0.28	0.52
Cma	14.95	14.95	14.95
Cm	15.08	15.10	15.26

Methane Correction			
Co	0.32	0.35	0.31
Cma	14.95	14.95	14.95
Cm	15.15	15.00	14.86

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, 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: **2.38**

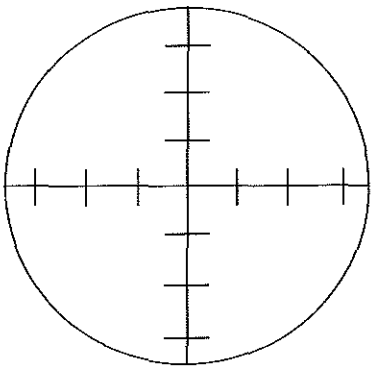
Equations
lb/hr = ppmv * MW/24.14 * 1/35.31 * 1/453,600 * ***scfm*** * 60 *for* VOC
lb/hr = ppmv * MW/24.14 * 1/35.31 * 1/453,600 * ***dcfm*** * 60

Figures

BTEC Inc.

diameter = 54 inches

Points	Distance "
1	2.4
2	7.9
3	16.0
4	38.0
5	46.1
6	51.6



Not to Scale

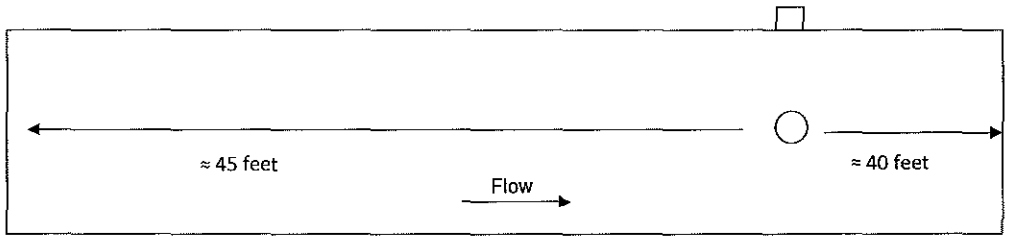
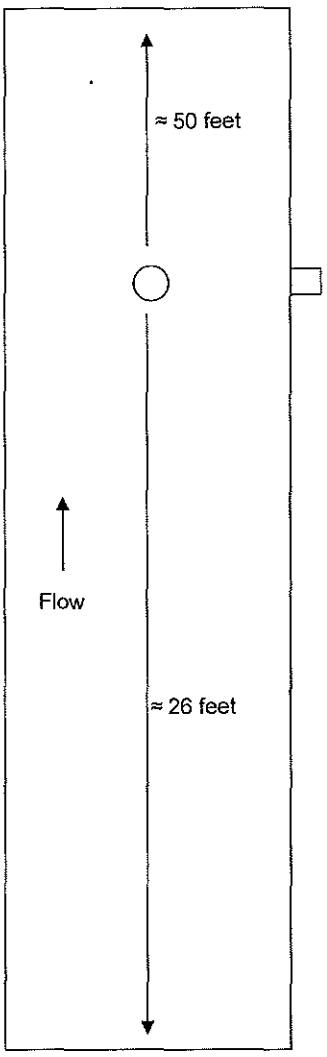


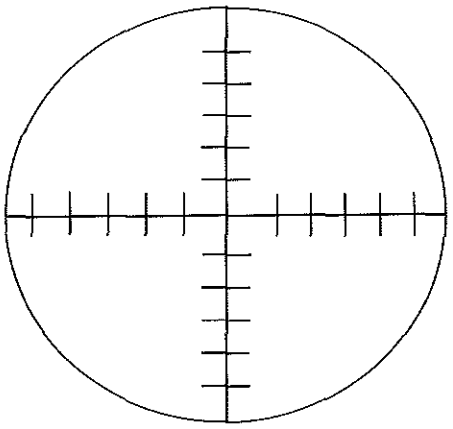
Figure No. 1

Site: **SPMCASTLINE Inlet** **General Motors, LLC** **Saginaw, Michigan**	**Sampling Date:** **February 24, 2016**	**BT Environmental Consulting, Inc.** **4949 Fernlee Avenue** **Royal Oak, Michigan 48073**

BTEC Inc.

diameter = 52.5 inches





Not to Scale

Points	Distance "
1	1.4
2	4.3
3	7.7
4	11.9
5	18.0
6	34.5
7	40.6
8	44.8
9	48.2
10	51.1

Figure No. 2

Site: **SPM Castline Outlet** **General Motors, LLC** **Saginaw, Michigan**	**Sampling Date:** **February 24, 2016**	**BT Environmental Consulting, Inc.** **4949 Fernlee Avenue** **Royal Oak, Michigan 48073**

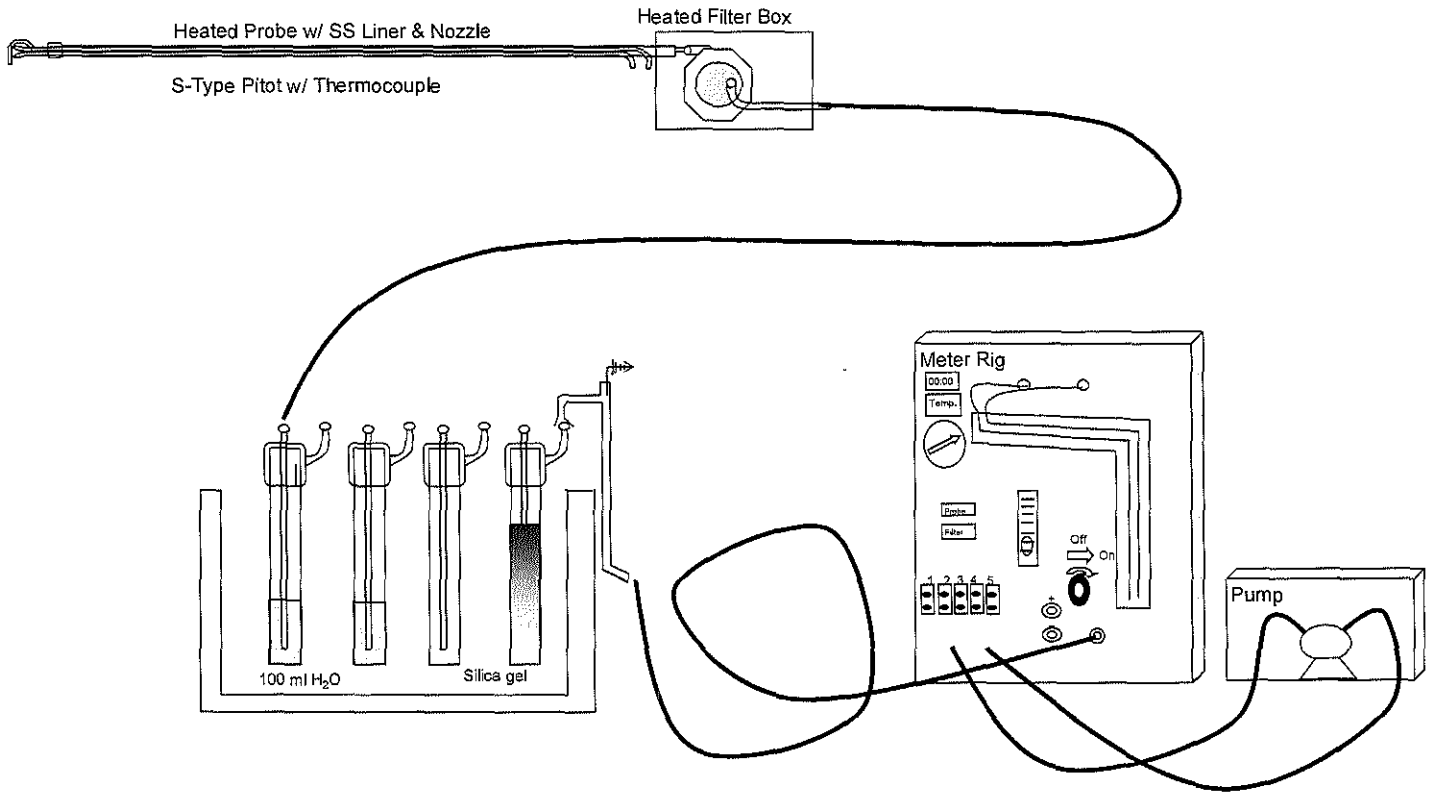


Figure No. 3

Site: **USEPA Method 5 Independent** **General Motors, LLC** **Saginaw, Michigan**	**Sampling Date:** **February 24, 2016**	**BT Environmental Consulting, Inc.** **4949 Fernlee Avenue** **Royal Oak, Michigan 48073**

BTEC Inc.

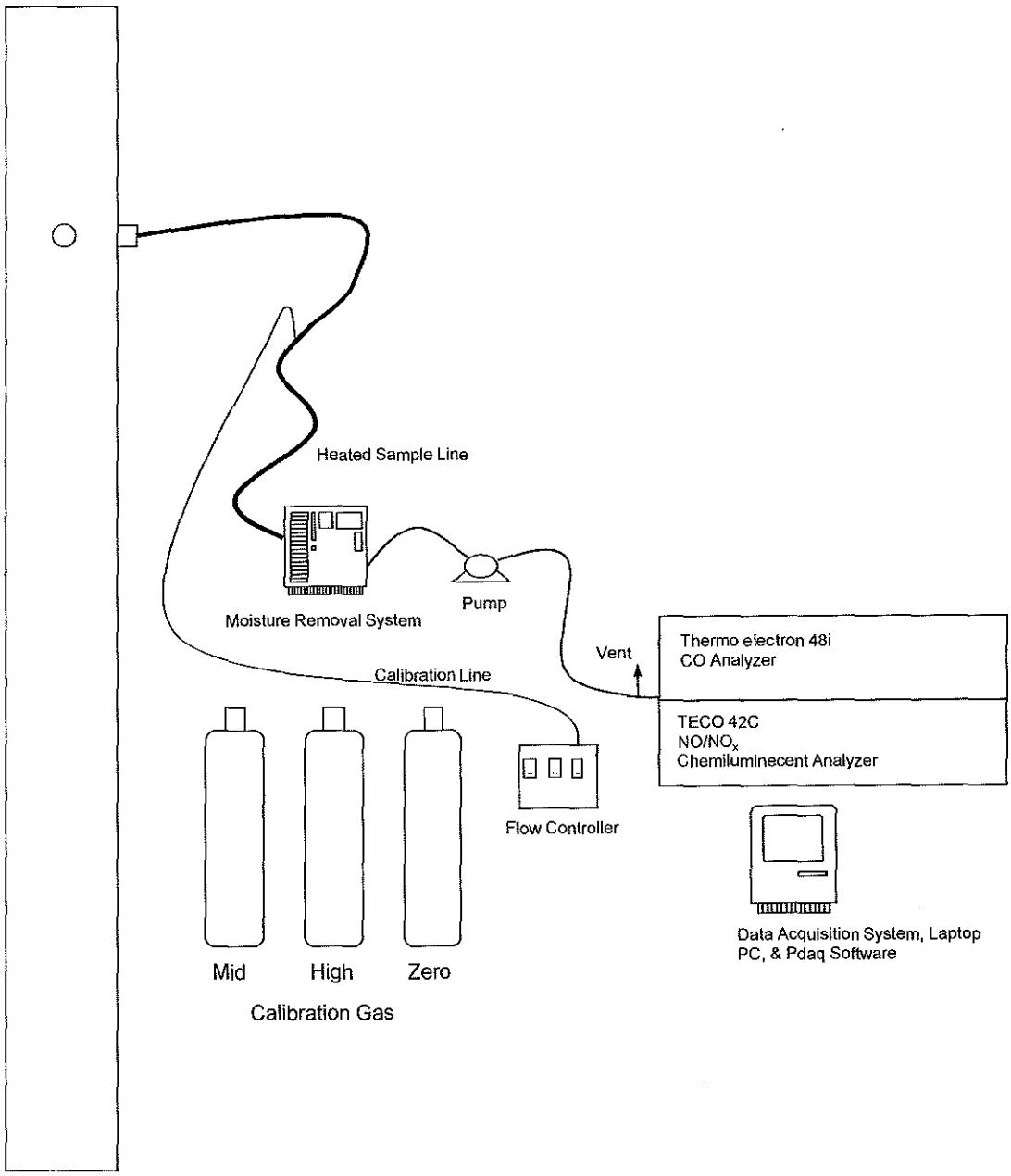


Figure No. 4

Site: **USEPA Method 7E and 10** **General Motors, LLC** **Saginaw, Michigan**	**Sampling Date:** **February 24, 2016**	**BT Environmental Consulting Inc.** **4949 Fernlee Avenue** **Royal Oak, MI 48073**

BTEC Inc.

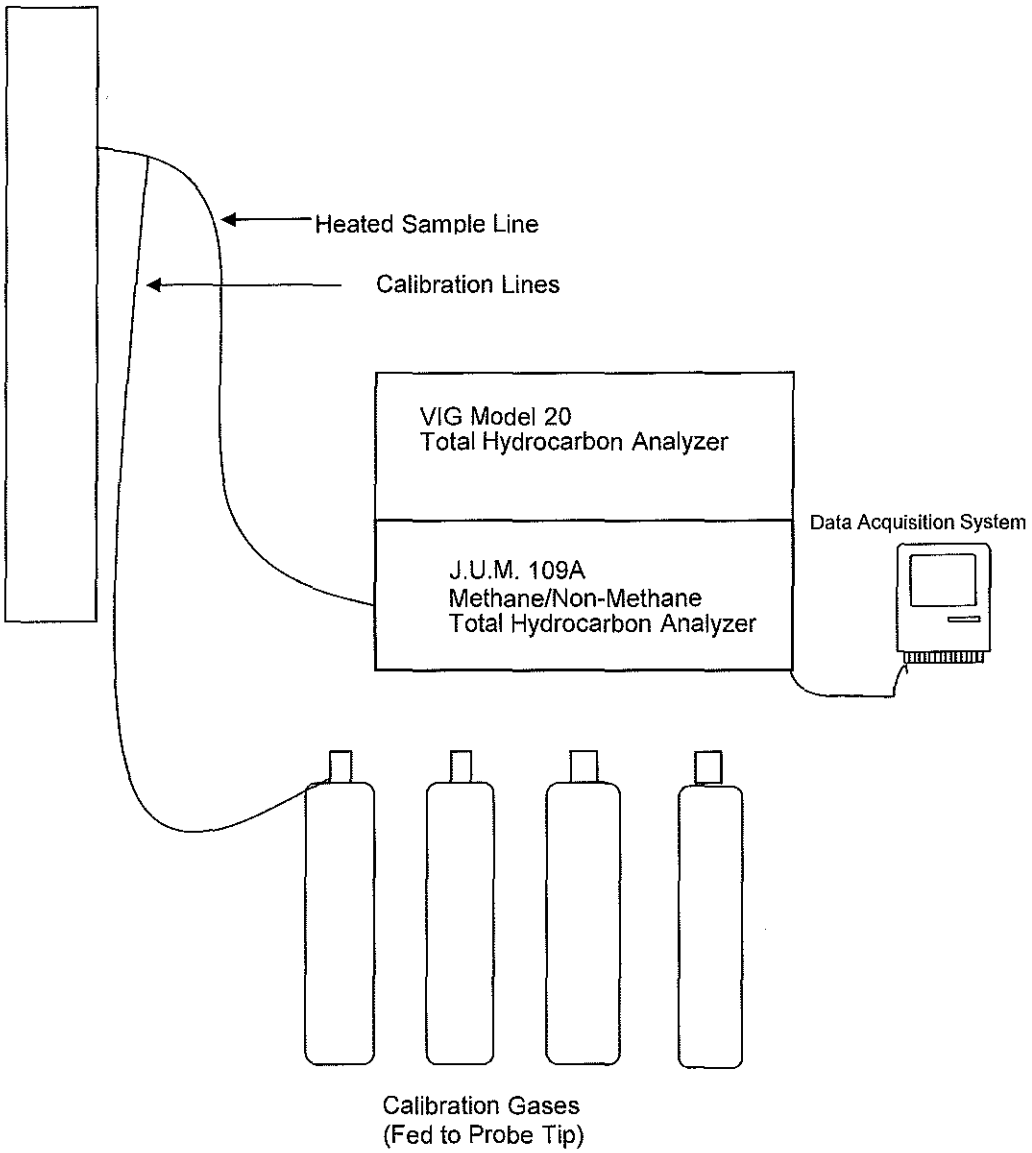


Figure No. 5

Site: **USEPA Method 25A** **General Motors, LLC** **Saginaw, Michigan**	**Sampling Date:** **February 24, 2016**	**BT Environmental Consulting, Inc.** **4949 Fernlee Avenue** **Royal Oak, Michigan 48073**