BTEC Inc.

Test Cell Exhaust NOx, O_2, CO, and VOC Emissions Report

Prepared for:

Ford Motor Company

Research Innovation Center
2101 Village Road
Dearborn, Michigan 48124

Project No. 14-4617.00
May 11, 2015

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

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY
AIR QUALITY DIVISION

RENEWABLE OPERATING PERMIT
REPORT CERTIFICATION

Authorized by 1994 P.A. 451, as amended. Failure to provide this information may result in civil and/or criminal penalties.

Reports submitted pursuant to R 336.1213 (Rule 213), subrules (3)(c) and/or (4)(c), of Michigan's Renewable Operating Permit (ROP) program must be certified by a responsible official. Additional information regarding the reports and documentation listed below must be kept on file for at least 5 years, as specified in Rule 213(3)(b)(ii), and be made available to the Department of Environmental Quality, Air Quality Division upon request.

Source Name: Ford Motor Company – Research Innovation Center County: Wayne

Source Address: 2101 Village Road City: Dearborn

AQD Source ID (SRN): B6230 ROP No.: MI-ROP-B6230-2013 ROP Section No.: 2

Please check the appropriate box(es):

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

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

☐ 1. During the entire reporting period, this source was in compliance with ALL terms and conditions contained in the ROP, each term and condition of which is identified and included by this reference. The method(s) used to determine compliance is/are the method(s) specified in the ROP.

☐ 2. During the entire reporting period this source was in compliance with all terms and conditions contained in the ROP, each term and condition of which is identified and included by this reference, EXCEPT for the deviations identified on the enclosed deviation report(s). The method used to determine compliance for each term and condition is the method specified in the ROP, unless otherwise indicated and described on the enclosed deviation report(s).

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

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

☐ 1. During the entire reporting period, ALL monitoring and associated recordkeeping requirements in the ROP were met and no deviations from these requirements or any other terms or conditions occurred.

☐ 2. During the entire reporting period, all monitoring and associated recordkeeping requirements in the ROP were met and no deviations from these requirements or any other terms or conditions occurred, EXCEPT for the deviations identified on the enclosed deviation report(s).

☒ **Other Report Certification**

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

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

Air emissions test report submission for Research Innovation Center (RIC) Dynamometer Laboratory.

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

Nina McIntyre	Manager, Dearborn Dynamometer	313-953-2633
Name of Responsible Official (print or type)	Title	Phone Number

Signature of Responsible Official Date: 6/9/15

* Photocopy this form as needed.

EQP 5736 (Rev 11-04)

EXECUTIVE SUMMARY

BT Environmental Consulting, Inc. (BTEC) was retained by Ford Motor Company (Ford) to conduct a compliance emissions test program on two exhaust sampling locations that handle exhaust from the Ford Research Innovation Center (RIC) in Dearborn, Michigan. This emissions testing program included evaluation of oxides of nitrogen (NOx), Oxygen (O_2), carbon monoxide (CO), and volatile organic compounds (VOC) at both exhaust locations during a single mobilization to the Dearborn RIC facility.

The purpose of this document is to present the test results for this emissions testing program. Sampling and analysis for this emissions test program was conducted on April 7th, 2015.

Testing consisted of triplicate 60-minute test runs with sampling conducted at both sampling locations. The emissions test program was required by Michigan Department of Environmental Quality (MDEQ) Air Quality Division (AQD) Permit No. MI-PTI-B6230-2013. The results of the emission test program are summarized by Tables I and II.

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

Table I
Test Program Results Summary
Test Date: April 7, 2015

South Cells	
Test Parameter	**Outlet Emission Rate**
NOx Emission Rate	1.67 lb/MMBtu
NOx Emission Rate	0.193 lb/gal
CO Emission Rate	2.35 lb/MMBtu
CO Emission Rate	0.274 lb/gal
VOC Emission Rate	0.46 lb/MMBtu
VOC Emission Rate	0.053 lb/gal

North Cells	
Test Parameter	**Outlet Emission Rate**
NOx Emission Rate	0.26 lb/MMBtu
NOx Emission Rate	0.033 lb/gal
CO Emission Rate	0.46 lb/MMBtu
CO Emission Rate	0.060 lb/gal
VOC Emission Rate	0.05 lb/MMBtu
VOC Emission Rate	0.006 lb/gal

Note: VOC emission rate is as propane; minus methane; and corrected per Method 7E

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1. Introduction

BT Environmental Consulting, Inc. (BTEC) was retained by Ford Motor Company (Ford) to conduct a compliance emissions test program on two exhaust sampling locations that handle exhaust from the Ford Research Innovation Center (RIC) in Dearborn, Michigan. This emissions testing program included evaluation of oxides of nitrogen (NOx), Oxygen (O_2), carbon monoxide (CO), and volatile organic compounds (VOC) at both exhaust locations during a single mobilization to the Dearborn RIC facility.

The purpose of this document is to present the test results for this emissions testing program. Sampling and analysis for this emissions test program was conducted on April 7th, 2015.

The Air Quality Division (AQD) of Michigan's Department of Environmental Quality (MDEQ) 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 outlined by the AQD document.

1.a Identification, Location, and Dates of Test

Sampling and analysis for the emissions test program was conducted on April 7th, 2015 at the Ford Research Innovation Center (RIC) in Dearborn, Michigan.

1.b Purpose of Testing

The emissions test program was required by MDEQ AQD Permit No. MI-PTI-B6230-2013

1.c Source Description

Ford's Research Innovation Center is located in Dearborn, Michigan.

1.d Test Program Contacts

Names and affiliations for personnel involved in the emissions test program are summarized by Table 1.

Table 1
Test Personnel

Name and Title	Affiliation	Telephone
Ms. Susan Hicks Senior Environmental Engineer	Ford Motor Company Fairlane Plaza North 290 Town Center Drive, Suite 800 Dearborn, Michigan 48126	(313) 594-3185
Mr. Matt Young Project Manager	BTEC 4949 Fernlee Ave. Royal Oak, MI 48073	(248) 548-8070
Mr. Paul Draper Environmental Technician	BTEC 4949 Fernlee Ave. Royal Oak, MI 48073	(248) 548-8070
Mr. Tom Maza	MDEQ Air Quality Division	(313) 456-4709

2. Summary of Results

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

2.a Operating Data

Process operating, fuel usage and fuel analytical data for this emissions test program is provided in Appendix D. A summary of the room data has been provided. Each room recorded process data during each run, the sheets are available upon request.

2.b Applicable Permit

The applicable permit for this emissions test program is Permit No. MI-PTI-B6230-2013. Permit emission limitations are summarized in Table 2.

Table 2
Permit Emission Limitations

Pollutant	Emission Limitation	Emission Limitation Units
CO	28.62	lbs/mmBTU of heat input
VOC	1.69	lbs/mmBTU of heat input

NOx emissions testing was performed to establish an emission factor to be used for recordkeeping purposes.

2.c Results

The results of the emissions test program are summarized by Table 3 (see Section 5.a).

3. Source Description

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

3.a Process Description

10 Dynamometer Test Cells located in the Research Innovation Center.

3.b Process Flow Diagram

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

3.c Raw and Finished Materials

The test cells use gasoline or diesel fuel.

3.d Process Capacity

The Research Innovation Center has 10 test cells. During each test the status of each cells operating parameters were recorded. A summary is provided in the process data in appendix D.

3.e Process Instrumentation

Operating data recorded during the emissions test program is provided in Appendix D.

4. Sampling and Analytical Procedures

Sections 4.a through 4.d provide a summary of the sampling and analytical procedures used to verify emission rates from the test cells.

4.a Sampling Train and Field Procedures

- Method 1 - "Sample and Velocity Traverses for Stationary Sources"
- Method 2 - "Determination of Stack Gas Velocity and Volumetric Flowrate"
- Method 3 - "Determination of Molecular Weight of Dry Stack Gas"
- Method 4 - "Determination of Moisture Content in Stack Gases"

- Method 7E - "Determination of Nitrogen Oxide Emissions from stationary Sources"
- Method 10 - "Visual Determination Carbon Monoxide Emissions from Stationary Sources"
- Method 19 - "Determination of Sulfur Dioxide Removal Efficiency and Particulate Matter, Sulfur Dioxide and Nitrogen Oxide Emission Rates"
- Method 25A - "Determination of Total Gaseous Concentration Using a Flame Ionization Analyzer" (JUM 109A methane subtraction at the outlet)

Stack gas velocity traverses were conducted in accordance with the procedures outlined in Methods 1 and 2 (see Figures 4 and 5). An S-type pitot tube with a thermocouple assembly, calibrated in accordance with Method 2, Section 4.1.1, was used to measure exhaust gas velocity pressures (using a manometer) and temperatures at each traverse location. The S-type pitot tube dimensions were within specified limits, therefore, a baseline pitot tube coefficient of 0.84 (dimensionless) was assigned.

A cyclonic flow check was 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. Both sampling locations, on each TO, were evaluated for cyclonic flow and deemed acceptable for flowrate measurement.

Exhaust gas molecular weight was determined according to Method 3. The equipment used for the Method 3 evaluation consisted of a one-way squeeze bulb with connecting tubing and a set of Fyrite® combustion gas analyzers. CO_2 and O_2 content was analyzed using the Fyrite® procedure.

Exhaust gas moisture content was evaluated using Method 4. Exhaust gas was extracted and passed through (i) two impingers, each with 100 ml deionized water, (ii) an empty impinger, and (iii) an impinger filled with silica gel. Exhaust gas moisture content was then determined gravimetrically. A schematic drawing of the Method 4 sampling train is provided as Figure 1.

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. 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 800 ppm for the south stack, and 0 to 100 for the north stack.

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.

The NO_x content of the TO outlet gas was measured using a TECO 42C NO_x gas analyzer. A sample of the gas stream was be drawn through an insulated stainless-steel probe with an in-line glass fiber filter to remove any particulate, a heated Teflon® sample line, and through a Universal Analyzers 3080PV electronic sample conditioner to remove the moisture from the sample before it entered the analyzer. Data was recorded at 4-second intervals on a PC equipped with a data acquisition system.

VOC concentrations were measured at the inlet and outlet of the TO according to USEPA Method 25A, "Determination of Total Gaseous Organic Concentration Using a Flame Ionization Analyzer." The samples were collected through a probe and heated sample line, and into the analyzers, in accordance with Method 25A procedures. BTEC used a J.U.M. Model 109A methane/non-methane hydrocarbon analyzer was used at the exhaust of the dyno cells to determine the methane/non-methane concentrations.

The J.U.M. Model 109A utilizes two FIDs to determine the average ppm for THC (as propane), as well as the average ppm for methane (as 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. Using an analog signal, specifically voltage, the concentration of THC is then sent to the 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 ppm 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 ppm as propane, is divided by the Methane analyzer's response to the methane calibration gas, in ppm as methane. The response factor was determined to be approximately 2.36.

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 State's 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 schematic drawing of the continuous emission system is provided as Figures 2-3.

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4.b Recovery and Analytical Procedures

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

4.c Sampling Ports

A diagram of the stacks showing sampling ports in relation to upstream and downstream disturbances are included as Figures 4-5.

4.d Traverse Points

Each stack was traversed at a total of six points consistent with the requirements of Method 1 and as illustrated by Figures 4-5.

5. Test Results and Discussion

Sections 5.a through 5.k provide a summary of the test results.

5.a Results Tabulation

The overall results of the emissions test program are summarized by Table 3. Detailed results for the emissions test program are summarized by Tables 4-5.

Table 3
Test Program Results Summary
Test Date: April 7, 2015

South Cells	
Test Parameter	**Outlet Emission Rate**
NOx Emission Rate	1.67 lb/mmBtu
NOx Emission Rate	0.193 lb/gal
CO Emission Rate	2.35 lb/mmBtu
CO Emission Rate	0.274 lb/gal
VOC Emission Rate	0.46 lb/mmBtu
VOC Emission Rate	0.053 lb/gal

North Cells	
Test Parameter	**Outlet Emission Rate**
NOx Emission Rate	0.26 lb/mmBtu
NOx Emission Rate	0.033 lb/gal
CO Emission Rate	0.46 lb/mmBtu
CO Emission Rate	0.060 lb/gal
VOC Emission Rate	0.05 lb/mmBtu
VOC Emission Rate	0.006 lb/gal

Note: VOC emission rate is as propane; minus methane; and corrected per Method 7E

5.b Discussion of Results

The overall results of the emissions test program are summarized by Table 3. Detailed results for the emissions test program are summarized by Tables 4-5.

5.c Sampling Procedure Variations

No sampling procedure variations occurred during testing.

5.d Process or Control Device Upsets

No upset conditions occurred during testing.

5.e Control Device Maintenance

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

5.f Re-Test

The emissions test program was not a re-test.

5.g Audit Sample Analyses

No audit samples were collected as part of the test program.

5.h Calibration Sheets

Relevant equipment calibration documents are provided in Appendix B.

5.i Sample Calculations

Sample calculations are provided in Appendix C.

5.j Field Data Sheets

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

5.k Laboratory Data

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

Table 4
South Exhaust Overall Results Summary
Ford
Dearborn
BTEC Project No. 14-4617.00
Sampling Dates: 4/7/15

Parameter	Run 1	Run 2	Run 3	Average
Test Run Date	4/7/2015	4/7/2015	4/7/2015	
Test Run Time	8:30-9:31	10:00-11:00	11:30-12:30	
Inlet Flowrate (dscfm)	6,034	5,985	5,990	**6,003**
Inlet Flowrate (scfm)	6,107	6,058	6,075	**6,080**
Heat Input (Btu/hr) - From fuel	1,342,791	1,498,456	1,622,342	**1,487,863**
Fuel Used (gallons)	11.66	12.73	14.02	**12.80**
Oxygen Concentration (%)	20	20	20	**20.1**
Oxygen Concentration (%, drift corrected as per USEPA 7E)	20.1	19.9	20.0	**20.0**
Carbon Dioxide Concentration (%)	0.5	1	1	**0.6**
Carbon Dioxide Concentration (%, drift corrected as per USEPA 7E)	0.5	0.6	0.5	**0.5**
Outlet Oxides of Nitrogen Concentration (ppmv)	69.3	21.9	81.5	**57.5**
Outlet NOx Concentration (ppmv, corrected as per USEPA 7E)	69.4	22.4	81.6	**57.8**
NOx Emission Rate (lb/hr)	**3.0**	**0.9**	**3.5**	**2.5**
NOx Emission Rate (lb/hr) (corrected as per USEPA 7E)	**2.989**	**1.0**	**3.5**	**2.5**
NOx Emission Rate (lb/gal fuel) (corrected as per USEPA 7E)	**0.256**	**0.075**	**0.249**	**0.193**
NOx Emission Rate (lb/MMbtu) (corrected as per USEPA 7E)	**2.23**	**0.64**	**2.15**	**1.67**
Outlet Carbon Monoxide Concentration (ppmv)	73.9	196.3	134.8	**135.0**
Outlet CO Concentration (ppmv, corrected as per USEPA 7E)	73.7	197.8	135.8	**135.8**
CO Emission Rate (lb/hr)	**1.9**	**5.1**	**3.5**	**3.5**
CO Emission Rate (lb/hr) (corrected as per USEPA 7E)	**1.9**	**5.1**	**3.5**	**3.5**
CO Emission Rate (lb/gal fuel) (corrected as per USEPA 7E)	**0.166**	**0.404**	**0.252**	**0.274**
CO Emission Rate (lb/MMbtu) (corrected as per USEPA 7E)	**1.44**	**3.43**	**2.18**	**2.35**
Outlet VOC Concentration (ppmv as propane)	14.2	21.5	17.1	**17.6**
Outlet Methane Concentration (ppmv as methane)	3.8	5.0	4.1	**4.3**
Outlet VOC Concentration (ppmv, corrected as per USEPA 7E)	14.1	21.8	17.3	**17.7**
Outlet Methane Concentration (ppmv, corrected as per USEPA 7E)	2.9	4.0	3.1	**3.3**
Outlet VOC Concentration (ppmv propane, - methane)	12.6	19.4	15.4	**15.8**
Outlet VOC Concentration (ppmv propane, - methane)(corrected as per USEPA 7E)	12.9	20.1	15.9	**16.3**
VOC Emission Rate as Propane(lb/hr)(- Methane)	**0.526**	**0.805**	**0.640**	**0.657**
VOC Emission Rate as Propane(lb/hr)(- Methane)(corrected as per USEPA 7E)	**0.539**	**0.832**	**0.663**	**0.678**
VOC Emission Rate as Propane(lb/gal fuel)(- Methane)(corrected as per USEPA 7E)	**0.046**	**0.065**	**0.047**	**0.053**
VOC Emission Rate as Propane(lb/MMbtu)(- Methane)(corrected as per USEPA 7E)	**0.40**	**0.56**	**0.41**	**0.46**

VOC Correction			
Co	0.26	0.37	0.49
Cma	29.7	29.7	29.7
Cm	29.60	29.20	29.11

Methane Correction			
Co	0.97	0.99	1.01
Cma	29.9	29.9	29.9
Cm	30.71	30.34	30.29

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, NO_X = 46.01, C_3H_8 = 44.10, carbon = 12.01)
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: **2.36**

ppm as propane (-Methane) = ppm propane - (ppm Methane)/Response factor
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 5
South Exhaust Overall Results Summary
Ford
Dearborn
BTEC Project No. 14-4617.00
Sampling Dates: 4/7/15

Parameter	Run 1	Run 2	Run 3	Average
Test Run Date	4/7/2015	4/7/2015	4/7/2015	
Test Run Time	13:00-14:00	15:00-16:00	16:15-17:15	
Inlet Flowrate (dscfm)	6,351	6,481	6,460	**6,431**
Inlet Flowrate (scfm)	6,415	6,560	6,538	**6,504**
Heat Input (Btu/hr) - From fuel	417,227	491,216	486,948	**465,130**
Fuel Used (gallons)	3.26	3.80	3.76	**3.61**
Oxygen Concentration (%)	21	20	20	**20.5**
Oxygen Concentration (%, drift corrected as per USEPA 7E)	20.5	20.5	20.5	**20.5**
Carbon Dioxide Concentration (%)	0.3	0	0	**0.3**
Carbon Dioxide Concentration (%, drift corrected as per USEPA 7E)	0.2	0.2	0.2	**0.2**
Outlet Oxides of Nitrogen Concentration (ppmv)	0.6	0.1	5.0	**1.9**
Outlet NOx Concentration (ppmv, corrected as per USEPA 7E)	1.4	0.8	5.8	**2.6**
NOx Emission Rate (lb/hr)	**0.0**	**0.0**	**0.2**	**0.1**
NOx Emission Rate (lb/hr) (corrected as per USEPA 7E)	**0.062**	**0.0**	**0.3**	**0.1**
NOx Emission Rate (lb/gal fuel) (corrected as per USEPA 7E)	**0.019**	**0.009**	**0.071**	**0.033**
NOx Emission Rate (lb/MMbtu) (corrected as per USEPA 7E)	**0.15**	**0.07**	**0.55**	**0.26**
Outlet Carbon Monoxide Concentration (ppmv)	9.3	7.2	6.8	**7.7**
Outlet CO Concentration (ppmv, corrected as per USEPA 7E)	9.1	7.0	6.8	**7.6**
CO Emission Rate (lb/hr)	**0.3**	**0.2**	**0.2**	**0.2**
CO Emission Rate (lb/hr) (corrected as per USEPA 7E)	**0.3**	**0.2**	**0.2**	**0.2**
CO Emission Rate (lb/gal fuel) (corrected as per USEPA 7E)	**0.077**	**0.052**	**0.051**	**0.060**
CO Emission Rate (lb/MMbtu) (corrected as per USEPA 7E)	**0.60**	**0.40**	**0.39**	**0.46**
Outlet VOC Concentration (ppmv as propane)	1.6	1.4	1.6	**1.6**
Outlet Methane Concentration (ppmv as methane)	2.8	2.8	2.8	**2.8**
Outlet VOC Concentration (ppmv, corrected as per USEPA 7E)	1.2	1.2	1.4	**1.3**
Outlet Methane Concentration (ppmv, corrected as per USEPA 7E)	1.8	1.9	1.7	**1.8**
Outlet VOC Concentration (ppmv propane, - methane)	0.4	0.2	0.4	**0.4**
Outlet VOC Concentration (ppmv propane, - methane)(corrected as per USEPA 7E)	0.5	0.4	0.6	**0.5**
VOC Emission Rate as Propane(lb/hr)(- Methane)	**0.019**	**0.011**	**0.018**	**0.016**
VOC Emission Rate as Propane(lb/hr)(- Methane)(corrected as per USEPA 7E)	**0.020**	**0.019**	**0.028**	**0.022**
VOC Emission Rate as Propane(lb/gal fuel)(- Methane)(corrected as per USEPA 7E)	**0.006**	**0.005**	**0.008**	**0.006**
VOC Emission Rate as Propane(lb/MMbtu)(- Methane)(corrected as per USEPA 7E)	**0.05**	**0.04**	**0.06**	**0.05**

VOC Correction			
Co	0.44	0.25	0.29
Cma	29.7	29.7	29.7
Cm	28.99	28.60	28.70

Methane Correction			
Co	1.01	0.87	1.16
Cma	29.9	29.9	29.9
Cm	30.81	30.51	30.05

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, carbon = 12.01)
24.14 = molar volume of air at standard conditions (70F, 29.92" Hg)
35.31 = ft^3 per m^3
453600 = mg per lb
Response factor obtained from introducing propane into methane analyzer: **2.36**

ppm as propane (-Methane) = ppm propane - (ppm Methane)/Response factor
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.

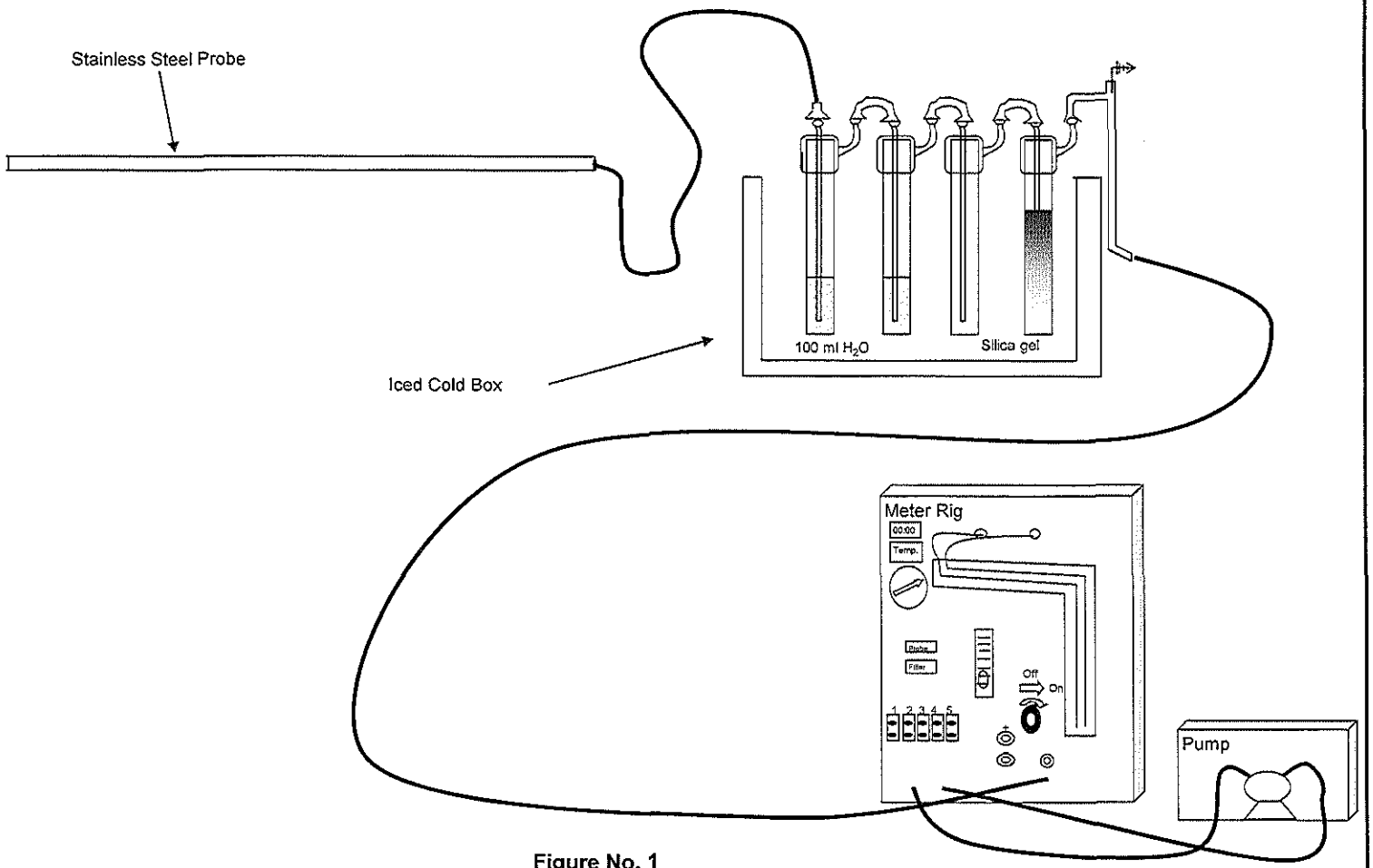


Figure No. 1

Site: **USEPA Method 4** **Ford Motor Company** **Dearborn, Michigan**	**Sampling Date:** **April 7, 2015**	**BT Environmental Consulting, Inc.** **4949 Fernlee Avenue** **Royal Oak, Michigan 48073**

BTEC Inc.

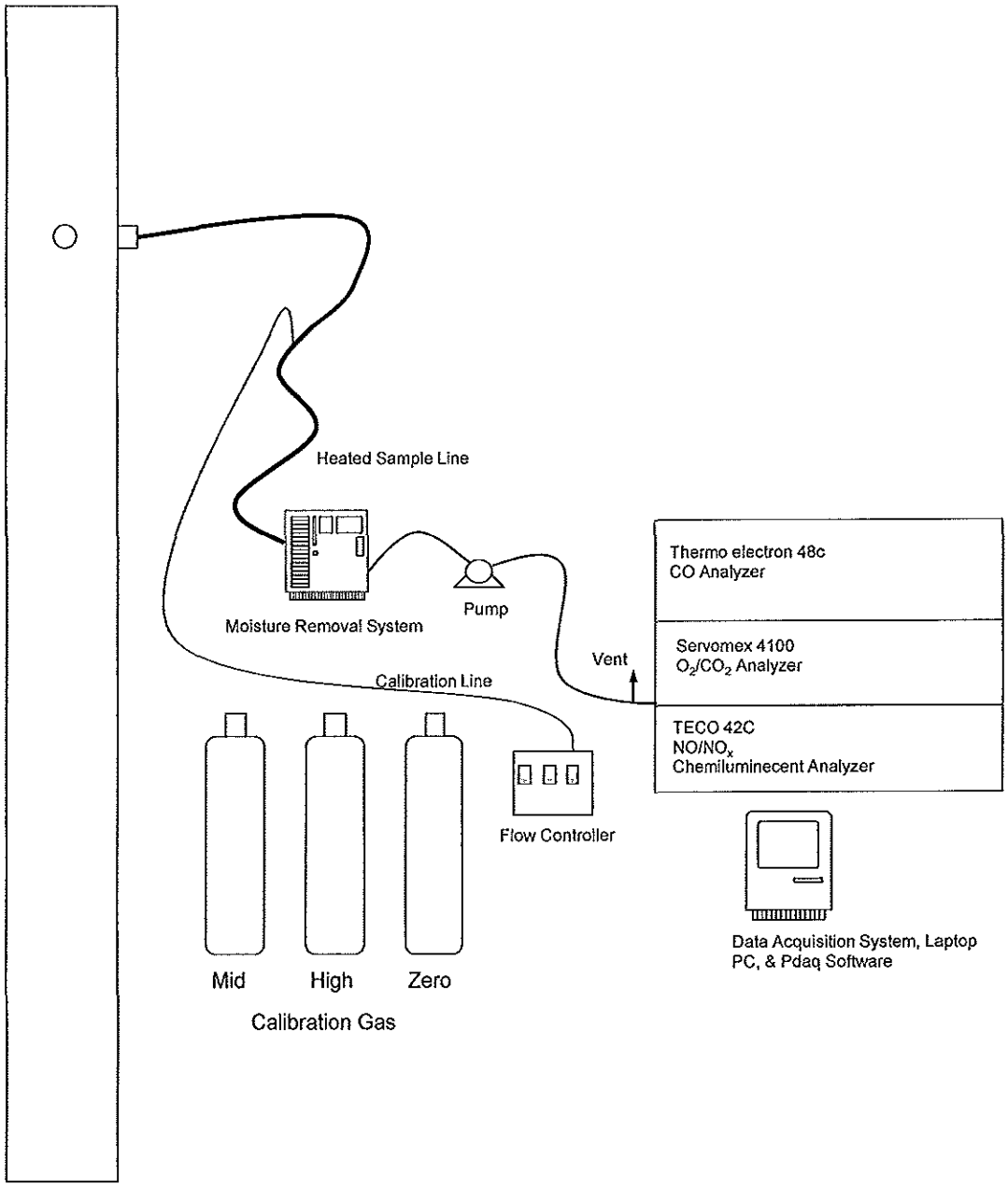


Figure No. 2

Site:	Sampling Date:	
USEPA Method 3A, 7E, and 10 Ford Motor Company Dearborn, Michigan	April 7, 2015	BT Environmental Consulting Inc. 4949 Fernlee Avenue Royal Oak, MI 48073

BTEC Inc.

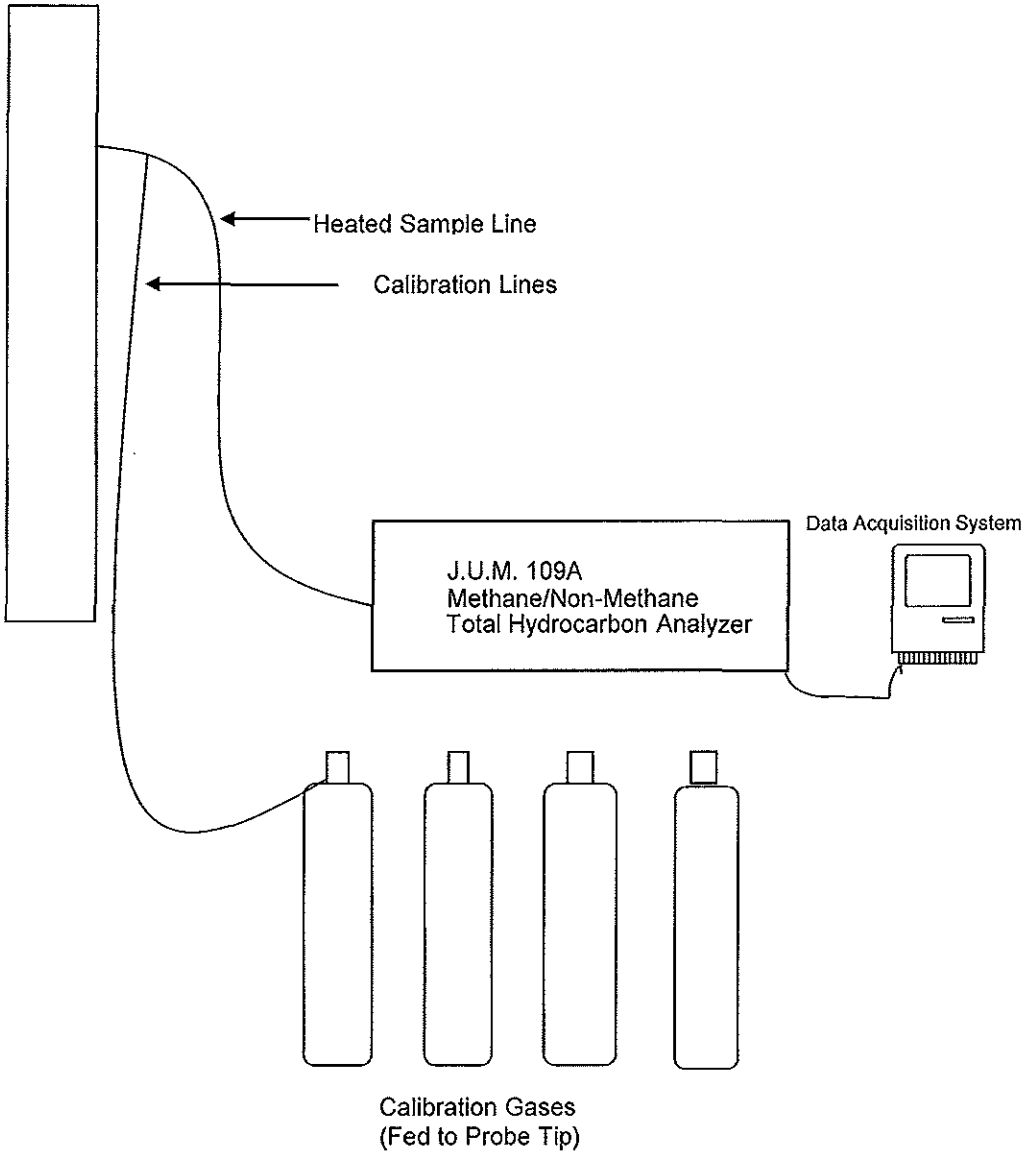


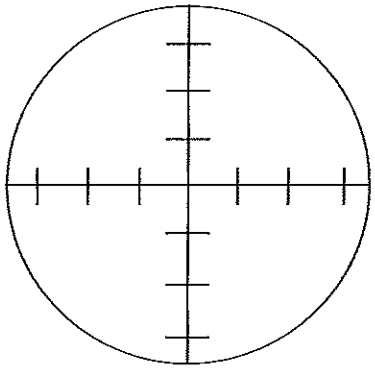
Figure No. 3

Site: **USEPA Method 25A** **Ford Motor Company** **Dearborn, Michigan**	**Sampling Date:** **April 7, 2015**	**BT Environmental Consulting, Inc.** **4949 Fernlee Avenue** **Royal Oak, Michigan 48073**

BTEC Inc.

diameter = 17.5 inches

Points	Distance "
1	0.8
2	2.6
3	5.2
4	12.3
5	14.9
6	16.7



Not to Scale

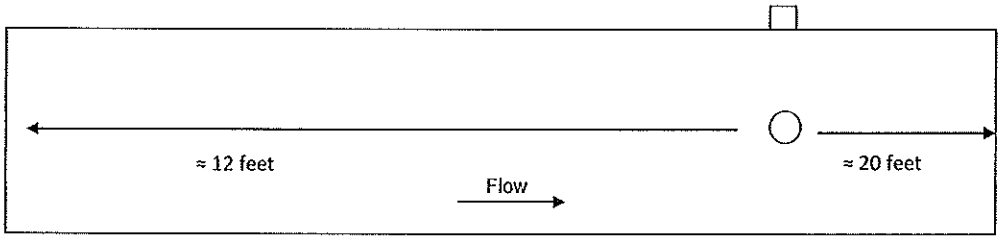


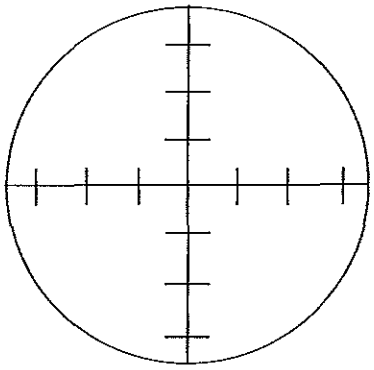
Figure No. 4

Site:	Sampling Date:	
South Exhaust Ford Motor Company Dearborn, Michigan	April 7, 2015	BT Environmental Consulting, Inc. 4949 Fernlee Avenue Royal Oak, Michigan 48073

BTEC Inc.

diameter = 17.5 inches

Points	Distance "
1	0.8
2	2.6
3	5.2
4	12.3
5	14.9
6	16.7



Not to Scale

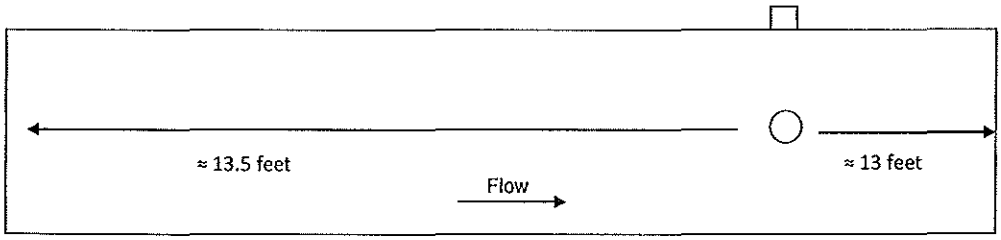


Figure No. 5

Site:	Sampling Date:	
North Exhaust Ford Motor Company Dearborn, Michigan	April 7, 2015	BT Environmental Consulting, Inc. 4949 Fernlee Avenue Royal Oak, Michigan 48073