BTEC Inc.

# Thermal Oxidizer VOC Destruction Efficiency Test Summary Report



M4199

*Prepared for:*

**General Motors Company**

Detroit, Michigan

Detroit Hamtramck Assembly Center
2500 East General Motors Boulevard
Detroit, Michigan 48211

Project No. 13-4466.00
January 29, 2014

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

BTEC Inc.

Environmental Consulting

4949 Fernlee
Royal Oak, Michigan 48073
(248) 548-8070
**Fax** (248) 548-8073

## EXECUTIVE SUMMARY

BT Environmental Consulting, Inc. (BTEC) was retained by General Motors Company Detroit Hamtramck Assembly Center (GM) to conduct a Volatile Organic Compound (VOC) Destruction Efficiency (DE) compliance emissions test program on nine Thermal Oxidizers (TO) at the GM facility located at 2500 E. GM Blvd., Detroit, MI 48211.

Three of the nine TOs (MOD 1, MOD 3, and North Prime) were chosen by Michigan Department of Environmental Quality (MDEQ) personnel for triplicate 60-minute test runs to demonstrate compliance for the entire system. In addition a single 60-minute test run was performed at six of the TOs.

Testing was conducted December 10 through 13, 2013. Mr. Tom Maza, of MDEQ was onsite December 10th, to witness a portion of the testing program and Mr. Jeff Korniski of MDEQ was onsite December 11th to witness a portion of the testing program.

The results of the VOC DE test program are summarized by Table I.

**Table I**
**Test Program VOC DE Summary**

| Source | VOC DE |
|---|---|
| Mod 1 TO | 96.9 % |
| Mod 3 TO | 98.5 % |
| North Prime TO | 95.1 % |

Detailed results for each test run can be found in Tables 4-12.

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### APPENDIX

## 1. Introduction

BT Environmental Consulting, Inc. (BTEC) was retained by General Motors Corporation Detroit Hamtramck Assembly Center (GM) to conduct a Volatile Organic Compound (VOC) Destruction Efficiency (DE) compliance emissions test program on nine Thermal Oxidizers (TO) at the GM facility located at 2500 E. GM Blvd., Detroit, MI 48211. The DE test program was conducted on December 10th through the 13th, 2013. The purpose of this report is to document the results of the test program.

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

### 1.a Identification, Location, and Dates of Test

Sampling and analysis for the DE test program was conducted on December 10th through the 13th, 2013 at the GM facility in Detroit, Michigan. The test program included evaluation of VOC DE from nine TO's.

### 1.b Purpose of Testing

AQD issued Permit No. MI-ROP-M4199-2010 to GM on February 17, 2010. Table 1 summarizes the limitations included in this permit.

**Table 1**
**AQD Permit No. MI-ROP-M4199-2010 Emission Limitations**

| Operating Parameter | Limitation |
|---|---|
| Minimum VOC DE | 90 % |

The purpose of the testing was to determine the VOC DE on six units with a single 60-minute test run. The VOC DE, specified in Permit No. MI-ROP-M4199-2010, must not be less than 90% for the topcoat oven incinerators. Three of the nine units were chosen by MDEQ personnel (two topcoat units and one primer surfacer unit) for testing (totaling three 60-minute test runs) to demonstrate compliance for the entire system.

### 1.c Source Description

EUTOPCOATSYSTEM - A topcoat spray booth followed by a curing oven. There is a heated flash-off area located between the basecoat portion of the booth and the clear coat portion of the booth. The waterborne basecoat is applied automatically with air atomized or electrostatic spray guns. The solvent borne clear coat is applied automatically with air atomized or electrostatic spray guns. The topcoat booth is equipped with a downdraft water

wash system to control particulate emissions from paint overspray. VOC emissions from the curing ovens are controlled by a thermal oxidizer.

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

### 1.d Test Program Contact

The contacts for the source and test report is:

Jennifer Tegen
GECS - Facility Air Compliance & Permit
GM Warren Technical Center
30200 Mound Road - Bldg 1-11,
Warren, MI 48090-9010
(810)706-1319

Ms. Jessica Jeffery
Environmental Engineer
General Motors Company
Detroit/Hamtramck Assembly
2500 East General Motors Boulevard
Detroit, MI 48211
(313) 215-8203

Mr. Barry Boulianne
Senior Project Manager
BTEC
4949 Fernlee Ave.
Royal Oak, Michigan 48073
(248) 548-8072

### 1.e Testing Personnel

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

**Table 2**
**Test Personnel**

| Name and Title | Affiliation | Telephone |
|---|---|---|
| Ms. Jennifer Tegen<br>Environmental Engineer | GECS - Facility Air<br>Compliance & Permit | (810) 706-1319 |
| Ms. Jessica Jeffery<br>Environmental Engineer | General Motors Detroit/<br>Hamtramck Assembly Plant | (313) 215-8203 |
| Mr. Matthew Young<br>Project Manager | BTEC<br>4949 Fernlee Ave.<br>Royal Oak, MI 48073 | (586) 744-9133 |
| Mr. Andrew Lusk<br>Environmental Technician | BTEC<br>4949 Fernlee Ave.<br>Royal Oak, MI 48073 | (248) 548-8070 |
| Mr. Tom Maza<br>MDEQ | Air Quality Division<br>Cadillac Place<br>3058 West Grand Blvd.<br>Suite 2-300<br>Detroit, MI 48202 | (313) 456-4709 |
| Mr. Jeff Korniski<br>MDEQ | Air Quality Division<br>Cadillac Place<br>3058 West Grand Blvd.<br>Suite 2-300<br>Detroit, MI 48202 | (313) 456-4681 |

## 2. Summary of Results

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

### 2.a Operating Data

Process data monitored during the emissions test program included vehicle count and TO operating temperature.

### 2.b Applicable Permit

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

### 2.c Results

The overall results of the emission test program are summarized by Table 3 (see Section 5.a). Detailed results for each source can be found in tables 4-12.

### 2.d Emission Regulation Comparison

The results summarized by table 3 (section 5.a) shows that the VOC DE for the entire system is well above the minimum requirement of 90%.

## 3. Source Description

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

### 3.a Process Description

EUTOPCOATSYSTEM - A topcoat spray booth followed by a curing oven. There is a heated flash-off area located between the basecoat portion of the booth and the clear coat portion of the booth. The waterborne basecoat is applied automatically with air atomized or electrostatic spray guns. The solvent borne clear coat is applied automatically with air atomized or electrostatic spray guns. The topcoat booth is equipped with a downdraft water wash system to control particulate emissions from paint overspray. VOC emissions from the curing ovens are controlled by a thermal oxidizer.

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

### 3.b Raw and Finished Materials

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

### 3.c Process Capacity

The facility is restricted in the number of finished products produced as being 78.5 fully assembled vehicles per hour and not more than 337,500 assemblies per year.

### 3.d Process Instrumentation

The only process operating parameters relevant to the emissions test program are TO operating temperature, retention time, and vehicle production counts.

## 4. Sampling and Analytical Procedures

Sections 4.a through 4.d provide a summary of the sampling and analytical procedures used to verify VOC DE.

### 4.a Sampling Train and Field Procedures

Volatile Organic compound (VOC) concentrations were measured according to 40 CFR 60, Appendix A, Method 25A. A sample of the gas stream was drawn through a stainless steel probe, 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 VIG Model 20 THC hydrocarbon analyzer and a JUM 109A methane/non methane hydrocarbon analyzer to determine the VOC concentration.

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

The JUM Model 109A analyzer utilizes two flame ionization detectors (FIDs) in order to report the average ppm for total hydrocarbons (THC), as propane, as well as the average ppm 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 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 determined during testing was 2.42 and 2.15.

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

Recovery and analytical procedures were described in Section 4.a.

### 4.c Sampling Ports

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

### 4.d Traverse Points

The stack was not traversed. The sample was drawn through a stainless steel probe at single fixed point.

## 5. Test Results and Discussion

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

### 5.a Results Tabulation

The results of the emissions test program are summarized by Table 3.

**Table 3**
**Test Program VOC DE Summary**

| Source | VOC DE |
|---|---|
| Mod 1 TO | 96.9 % |
| Mod 3 TO | 98.5 % |
| North Prime TO | 95.1 % |

Detailed data for each test run can be found in Tables 4-12.

### 5.b Discussion of Results

The purpose of the testing was to determine the VOC DE on all nine units with a single 60-minute test run. The VOC DE, specified in Permit No. MI-ROP-M4199-2010 must not be less than 90% for the topcoat oven incinerators. Three of the nine TOs were chosen by Michigan Department of Environmental Quality (MDEQ) personnel for three test runs of sixty minutes each. MOD 1, MOD 3, and North Prime TOs were chosen for three 60-minute test runs to demonstrate compliance for the entire system. All TO's sampled in this test program achieved a destruction efficiency of 95.1% or greater, this value is well above the required minimum destruction efficiency listed in the applicable permit.

The results of the DE test program are summarized by Tables 4-12.

### 5.c Sampling Procedure Variations

The TO inlet sampling locations did not meet requirements listed in USEPA Method 1. Preliminary discussion with MDEQ resulted in the approval of a concentration based VOC destruction efficiency program. Per the requirement listed in the MDEQ test plan approval letter dated November 19, 2013 the VOC DE was calculated on a concentration basis (ppm) and the inlet concentration was reduced 5% to compensate for possible dilution in the process.

### 5.d Process or Control Device Upsets

No upset conditions occurred during testing.

### 5.e Control Device Maintenance

No maintenance was performed during the test program.

### 5.f Audit Sample Analyses

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

### 5.g Calibration Sheets

Relevant equipment calibration documents are provided as Appendix B.

### 5.h Sample Calculations

Sample calculations are provided in Appendix D.

### 5.i Field Data Sheets

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

## 5.j Laboratory Data

There are no laboratory results for this test program.

# Tables

**Table 4**
**Mod 1**
**General Motors**
**Hamtramck, MI**
**BTEC Project No. 13-4466.00**
**Sampling Dates: 12/11/13**

| Parameter | Run 1 | Run 2 | Run 3 | Average |
|---|---|---|---|---|
| Test Run Date | 12/11/2013 | 12/11/2013 | 12/11/2013 | |
| Test Run Time | 6:30 | 7:59 | 9:48 | |
| Inlet VOC Concentration (ppmv as propane) | 73.6 | 71.6 | 64.1 | **69.8** |
| Inlet VOC Concentration (ppmv, corrected as per USEPA 7E) | 72.9 | 70.4 | 62.9 | **68.7** |
| **Inlet VOC Concentration (Adjusted -5%)** | **69.3** | **66.9** | **59.8** | **65.3** |
| Outlet VOC Concentration (ppmv as propane) | 2.1 | 1.2 | 2.3 | **1.9** |
| Outlet VOC Concentration (ppmv, corrected as per USEPA 7E) | 2.2 | 1.4 | 2.4 | **2.0** |
| Total Concentration DE (ppmv Corrected as per USEPA 7E) | 96.9% | 98.0% | 96.2% | **97.0%** |
| **Total Concentration DE (ppmv Corrected as per USEPA 7E) (Inlet Adjusted -5%)** | **96.8%** | **97.9%** | **96.0%** | **96.9%** |

| Inlet VOC Correction | | | |
|---|---|---|---|
| **Co** | 1.41 | 2.57 | 2.61 |
| **Cma** | 89.5 | 89.5 | 89.5 |
| **Cm** | 90.05 | 90.37 | 90.15 |

| Outlet VOC Correction | | | |
|---|---|---|---|
| **Co** | -0.11 | -0.24 | -0.15 |
| **Cma** | 9.9 | 9.9 | 9.9 |
| **Cm** | 9.65 | 9.76 | 9.84 |

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, 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

Co= Average of initial and final zero gases
Cma=Actual concentration of the calibration gas
Cm= Average of initial and final calibration gases

**Table 5**
**Mod 2**
**General Motors**
**Hamtramck, MI**
**BTEC Project No. 13-4466.00**
**Sampling Dates: 12/12/13**

| Parameter | Mod 2 |
|---|---|
| Test Run Date | 12/12/2013 |
| Test Run Time | 12:25 |
| Inlet VOC Concentration (ppmv as propane) | 59.6 |
| Inlet VOC Concentration (ppmv, corrected as per USEPA 7E) | 61.0 |
| **Inlet VOC Concentration (Adjusted -5%)** | **58.0** |
| Outlet VOC Concentration (ppmv as propane) | 2.0 |
| Outlet VOC Concentration (ppmv, corrected as per USEPA 7E) | 1.6 |
| Total Concentration DE (ppmv Corrected as per USEPA 7E) | 97.5% |
| **Total Concentration DE (ppmv Corrected as per USEPA 7E) (Inlet Adjusted -5%)** | **97.3%** |

| Inlet VOC Correction | |
|---|---|
| Co | 0.33 |
| Cma | 49.9 |
| Cm | 48.79 |

| Outlet VOC Correction | |
|---|---|
| Co | 0.52 |
| Cma | 9.9 |
| Cm | 10.22 |

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, 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

Co= Average of initial and final zero gases
Cma=Actual concentration of the calibration gas
Cm= Average of initial and final calibration gases

**Table 6**
**Mod 3**
**General Motors**
**Hamtramck, MI**
**BTEC Project No. 13-4466.00**
**Sampling Dates: 12/12/13**

| Parameter | Run 1 | Run 2 | Run 3 | Average |
|---|---|---|---|---|
| Test Run Date | 12/12/2013 | 12/12/2013 | 12/12/2013 | |
| Test Run Time | 6:38 | 8:00 | 11:00 | |
| Inlet VOC Concentration (ppmv as propane) | 48.0 | 64.5 | 66.5 | **59.7** |
| Inlet VOC Concentration (ppmv, corrected as per USEPA 7E) | 48.3 | 65.7 | 68.6 | **60.9** |
| **Inlet VOC Concentration (Adjusted -5%)** | **45.9** | **62.4** | **65.1** | **57.8** |
| Outlet VOC Concentration (ppmv as propane) | 2.1 | 2.7 | 2.8 | **2.5** |
| Outlet Methane Concentration (ppmv as methane) | 4.1 | 3.8 | 4.1 | **4.0** |
| Outlet VOC Concentration (ppmv, corrected as per USEPA 7E) | 2.2 | 2.9 | 3.2 | **2.7** |
| Outlet Methane Concentration (ppmv, corrected as per USEPA 7E) | 4.4 | 4.4 | 4.7 | **4.5** |
| Outlet VOC Concentration (ppmv propane, -Methane) | 0.4 | 1.1 | 1.1 | **0.9** |
| Outlet VOC Concentration (ppmv propane, -Methane, corrected as per USEPA 7E) | 0.4 | 1.1 | 1.2 | **0.9** |
| Total Concentration DE (ppmv Corrected as per USEPA 7E) | 99.3% | 98.3% | 98.2% | **98.6%** |
| **Total Concentration DE (ppmv Corrected as per USEPA 7E) (Inlet Adjusted -5%)** | **99.2%** | **98.2%** | **98.1%** | **98.5%** |

| Inlet VOC Correction | | | |
|---|---|---|---|
| Co | 1.11 | 1.37 | 0.24 |
| Cma | 49.7 | 49.7 | 49.7 |
| Cm | 49.38 | 49.13 | 48.24 |

| Outlet VOC Correction | | | |
|---|---|---|---|
| Co | -0.09 | -0.42 | -0.58 |
| Cma | 9.9 | 9.9 | 9.9 |
| Cm | 9.88 | 10.04 | 9.89 |

| Outlet Methane Correction | | | |
|---|---|---|---|
| Co | -0.33 | -0.78 | -0.73 |
| Cma | 29.9 | 29.9 | 29.9 |
| Cm | 29.86 | 30.17 | 30.10 |

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, 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: **2.42**

Co= Average of initial and final zero gases
Cma=Actual concentration of the calibration gas
Cm= Average of initial and final calibration gases

**Table 7**
**Mod 4**
**General Motors**
**Hamtramck, MI**
**BTEC Project No. 13-4466.00**
**Sampling Dates: 12/11/13**

| Parameter | Mod 4 |
|---|---|
| Test Run Date | 12/11/2013 |
| Test Run Time | 12:20 |
| Inlet VOC Concentration (ppmv as propane) | 56.9 |
| Inlet VOC Concentration (ppmv, corrected as per USEPA 7E) | 57.9 |
| **Inlet VOC Concentration (Adjusted -5%)** | **55.0** |
| Outlet VOC Concentration (ppmv as propane) | 1.6 |
| Outlet VOC Concentration (ppmv, corrected as per USEPA 7E) | 1.4 |
| Total Concentration DE (ppmv Corrected as per USEPA 7E) | 97.6% |
| **Total Concentration DE (ppmv Corrected as per USEPA 7E) (Inlet Adjusted -5%)** | **97.5%** |

| Inlet VOC Correction | |
|---|---|
| Co | 0.84 |
| Cma | 49.9 |
| Cm | 49.08 |

| Outlet VOC Correction | |
|---|---|
| Co | 0.29 |
| Cma | 9.9 |
| Cm | 9.96 |

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, $C_3H_x$ = 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

Co= Average of initial and final zero gases
Cma=Actual concentration of the calibration gas
Cm= Average of initial and final calibration gases

**Table 8**
**Mod 5**
**General Motors**
**Hamtramck, MI**
**BTEC Project No. 13-4466.00**
**Sampling Dates: 12/13/13**

| Parameter | Mod 5 |
|---|---|
| Test Run Date | 12/13/2013 |
| Test Run Time | 9:39 |
| Inlet VOC Concentration (ppmv as propane) | 50.7 |
| Inlet VOC Concentration (ppmv, corrected as per USEPA 7E) | 52.0 |
| **Inlet VOC Concentration (Adjusted -5%)** | **49.4** |
| Outlet VOC Concentration (ppmv as propane) | 0.9 |
| Outlet VOC Concentration (ppmv, corrected as per USEPA 7E) | 0.4 |
| Total Concentration DE (ppmv Corrected as per USEPA 7E) | 99.2% |
| **Total Concentration DE (ppmv Corrected as per USEPA 7E) (Inlet Adjusted -5%)** | **99.1%** |

| Inlet VOC Correction | |
|---|---|
| **Co** | 0.28 |
| **Cma** | 49.7 |
| **Cm** | 48.48 |

| Outlet VOC Correction | |
|---|---|
| **Co** | 0.50 |
| **Cma** | 9.9 |
| **Cm** | 10.02 |

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, 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

Co= Average of initial and final zero gases
Cma=Actual concentration of the calibration gas
Cm= Average of initial and final calibration gases

**Table 9**
**Mod 6**
**General Motors**
**Hamtramck, MI**
**BTEC Project No. 13-4466.00**
**Sampling Dates: 12/13/13**

| Parameter | Mod 6 |
|---|---|
| Test Run Date | 12/13/2013 |
| Test Run Time | 13:35 |
| Inlet VOC Concentration (ppmv as propane) | 44.4 |
| Inlet VOC Concentration (ppmv, corrected as per USEPA 7E) | 45.0 |
| **Inlet VOC Concentration (Adjusted -5%)** | **42.7** |
| Outlet VOC Concentration (ppmv as propane) | 1.0 |
| Outlet VOC Concentration (ppmv, corrected as per USEPA 7E) | 1.0 |
| Total Concentration DE (ppmv Corrected as per USEPA 7E) | 97.7% |
| **Total Concentration DE (ppmv Corrected as per USEPA 7E) (Inlet Adjusted -5%)** | **97.6%** |

| Inlet VOC Correction | |
|---|---|
| Co | 0.07 |
| Cma | 49.7 |
| Cm | 49.08 |

| Outlet VOC Correction | |
|---|---|
| Co | -0.08 |
| Cma | 9.9 |
| Cm | 9.81 |

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, 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

Co= Average of initial and final zero gases
Cma=Actual concentration of the calibration gas
Cm= Average of initial and final calibration gases

**Table 10**
**Mod 7**
**General Motors**
**Hamtramck, MI**
**BTEC Project No. 13-4466.00**
**Sampling Dates: 12/13/13**

| Parameter | Mod 7 |
|---|---|
| Test Run Date | 12/13/2013 |
| Test Run Time | 7:21 |
| Inlet VOC Concentration (ppmv as propane) | 89.0 |
| Inlet VOC Concentration (ppmv, corrected as per USEPA 7E) | 89.2 |
| **Inlet VOC Concentration (Adjusted -5%)** | **84.7** |
| Outlet VOC Concentration (ppmv as propane) | 1.0 |
| Outlet VOC Concentration (ppmv, corrected as per USEPA 7E) | 1.0 |
| Total Concentration DE (ppmv Corrected as per USEPA 7E) | 98.9% |
| **Total Concentration DE (ppmv Corrected as per USEPA 7E) (Inlet Adjusted -5%)** | **98.8%** |

| Inlet VOC Correction | |
|---|---|
| Co | 0.89 |
| Cma | 89.5 |
| Cm | 89.36 |

| Outlet VOC Correction | |
|---|---|
| Co | 0.03 |
| Cma | 9.9 |
| Cm | 9.85 |

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, 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

Co= Average of initial and final zero gases

Cma=Actual concentration of the calibration gas

Cm= Average of initial and final calibration gases

**Table 11**
**North Prime VOC DE**
**General Motors**
**Hamtramck, MI**
**BTEC Project No. 13-4466.00**
**Sampling Dates: 12/10/13**

| Parameter | Run 1 | Run 2 | Run 3 | Average |
|---|---|---|---|---|
| Test Run Date | 12/10/2013 | 12/10/2013 | 12/10/2013 | |
| Test Run Time | 6:56 | 8:15 | 10:19 | |
| Inlet VOC Concentration (ppmv as propane) | 41.2 | 37.1 | 32.3 | **36.8** |
| Inlet VOC Concentration (ppmv, corrected as per USEPA 7E) | 41.2 | 37.7 | 33.3 | **37.4** |
| **Inlet VOC Concentration (Adjusted -5%)** | **39.2** | **35.8** | **31.6** | **35.5** |
| Outlet VOC Concentration (ppmv as propane) | 2.0 | 1.2 | 1.0 | **1.4** |
| Outlet VOC Concentration (ppmv, corrected as per USEPA 7E) | 1.9 | 1.4 | 1.9 | **1.7** |
| Total Concentration DE (ppmv Corrected as per USEPA 7E) | 95.3% | 96.2% | 94.4% | **95.3%** |
| **Total Concentration DE (ppmv Corrected as per USEPA 7E) (Inlet Adjusted -5%)** | **95.1%** | **96.0%** | **94.1%** | **95.1%** |

| Inlet VOC Correction | | | |
|---|---|---|---|
| **Co** | -0.04 | -0.13 | -0.13 |
| **Cma** | 49.5 | 49.5 | 49.5 |
| **Cm** | 49.41 | 48.75 | 48.10 |

| Outlet VOC Correction | | | |
|---|---|---|---|
| **Co** | 0.05 | -0.24 | -0.79 |
| **Cma** | 29.9 | 29.9 | 29.9 |
| **Cm** | 29.70 | 28.90 | 28.05 |

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, 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

Co= Average of initial and final zero gases
Cma=Actual concentration of the calibration gas
Cm= Average of initial and final calibration gases

**Table 12**
**South Prime**
**General Motors**
**Hamtramck, MI**
**BTEC Project No. 13-4466.00**
**Sampling Dates: 12/10/13**

| Parameter | South Prime |
|---|---|
| Test Run Date | 12/10/2013 |
| Test Run Time | 13:25 |
| Inlet VOC Concentration (ppmv as propane) | 83.3 |
| Inlet VOC Concentration (ppmv, corrected as per USEPA 7E) | 82.5 |
| **Inlet VOC Concentration (Adjusted -5%)** | **78.3** |
| Outlet VOC Concentration (ppmv as propane) | 1.4 |
| Outlet Methane Concentration (ppmv as methane) | 1.1 |
| Outlet VOC Concentration (ppmv, corrected as per USEPA 7E) | 1.6 |
| Outlet Methane Concentration (ppmv, corrected as per USEPA 7E) | 1.7 |
| Outlet VOC Concentration (ppmv propane, -Methane) | 0.9 |
| Outlet VOC Concentration (ppmv propane, -Methane, corrected as per USEPA 7E) | 0.9 |
| Total Concentration DE (ppmv Corrected as per USEPA 7E) | 98.9% |
| **Total Concentration DE (ppmv Corrected as per USEPA 7E) (Inlet Adjusted -5%)** | **98.9%** |

| Inlet VOC Correction | |
|---|---|
| Co | -0.26 |
| Cma | 89 |
| Cm | 89.96 |

| Outlet VOC Correction | |
|---|---|
| Co | -0.23 |
| Cma | 29.9 |
| Cm | 29.32 |

| Outlet Methane Correction | |
|---|---|
| Co | -0.58 |
| Cma | 29.9 |
| Cm | 29.35 |

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, 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: **2.15**

Co= Average of initial and final zero gases
Cma=Actual concentration of the calibration gas
Cm= Average of initial and final calibration gases

**Table 13**
**Thermal Oxidizer Operating Temperatures**
**General Motors - Hamtramck Facility**
**Detroit, MI**

| MOD 1 THERMAL OXIDIZER TEMPERATURE °F RUN 1 | | |
|---|---|---|
| Date | Time | Temp. |
| 12/11/2013 | 6:30 | 1309 |
| 12/11/2013 | 6:40 | 1311 |
| 12/11/2013 | 6:50 | 1311 |
| 12/11/2013 | 7:00 | 1311 |
| 12/11/2013 | 7:10 | 1310 |
| 12/11/2013 | 7:20 | 1309 |
| 12/11/2013 | 7:30 | 1310 |

| MOD 1 THERMAL OXIDIZER TEMPERATURE °F RUN 2 | | |
|---|---|---|
| Date | Time | Temp. |
| 12/11/2013 | 8:00 | 1311 |
| 12/11/2013 | 8:10 | 1310 |
| 12/11/2013 | 8:20 | 1315 |
| 12/11/2013 | 8:30 | 1308 |
| 12/11/2013 | 8:40 | 1309 |
| 12/11/2013 | 9:30 | 1314 |
| 12/11/2013 | 9:40 | 1310 |

| MOD 1 THERMAL OXIDIZER TEMPERATURE °F RUN 3 | | |
|---|---|---|
| Date | Time | Temp. |
| 12/11/2013 | 9:50 | 1310 |
| 12/11/2013 | 10:00 | 1309 |
| 12/11/2013 | 10:10 | 1311 |
| 12/11/2013 | 10:20 | 1309 |
| 12/11/2013 | 10:30 | 1311 |
| 12/11/2013 | 10:40 | 1310 |
| 12/11/2013 | 10:50 | 1308 |

| MOD 3 THERMAL OXIDIZER TEMPERATURE °F RUN 1 | | |
|---|---|---|
| Date | Time | Temp. |
| 12/12/2013 | 6:40 | 1309 |
| 12/12/2013 | 6:50 | 1304 |
| 12/12/2013 | 7:00 | 1312 |
| 12/12/2013 | 7:10 | 1310 |
| 12/12/2013 | 7:20 | 1309 |
| 12/12/2013 | 7:30 | 1310 |
| 12/12/2013 | 7:40 | 1308 |

| MOD 3 THERMAL OXIDIZER TEMPERATURE °F RUN 2 | | |
|---|---|---|
| Date | Time | Temp. |
| 12/12/2013 | 8:10 | 1310 |
| 12/12/2013 | 8:20 | 1307 |
| 12/12/2013 | 8:30 | 1313 |
| 12/12/2013 | 8:40 | 1309 |
| 12/12/2013 | 8:50 | 1311 |
| 12/12/2013 | 9:00 | 1314 |
| 12/12/2013 | 9:10 | 1311 |

| MOD 3 THERMAL OXIDIZER TEMPERATURE °F RUN 3 | | |
|---|---|---|
| Date | Time | Temp. |
| 12/12/2013 | 10:20 | 1308 |
| 12/12/2013 | 10:30 | 1313 |
| 12/12/2013 | 10:40 | 1311 |
| 12/12/2013 | 10:50 | 1307 |
| 12/12/2013 | 11:00 | 1308 |
| 12/12/2013 | 11:10 | 1310 |
| 12/12/2013 | 11:20 | 1311 |

| NORTH PRIME THERMAL OXIDIZER TEMPERATURE °F RUN 1 | | |
|---|---|---|
| Date | Time | Temp. |
| 12/10/2013 | 6:58 | 1311 |
| 12/10/2013 | 7:08 | 1313 |
| 12/10/2013 | 7:18 | 1312 |
| 12/10/2013 | 7:28 | 1309 |
| 12/10/2013 | 7:38 | 1309 |
| 12/10/2013 | 7:48 | 1310 |
| 12/10/2013 | 7:58 | 1310 |

| NORTH PRIME THERMAL OXIDIZER TEMPERATURE °F RUN 2 | | |
|---|---|---|
| Date | Time | Temp. |
| 12/10/2013 | 8:08 | 1310 |
| 12/10/2013 | 8:18 | 1310 |
| 12/10/2013 | 8:28 | 1312 |
| 12/10/2013 | 9:28 | 1307 |
| 12/10/2013 | 9:38 | 1310 |
| 12/10/2013 | 9:48 | 1307 |
| 12/10/2013 | 9:58 | 1313 |

| NORTH PRIME THERMAL OXIDIZER TEMPERATURE °F RUN 3 | | |
|---|---|---|
| Date | Time | Temp. |
| 12/10/2013 | 10:18 | 1308 |
| 12/10/2013 | 10:28 | 1309 |
| 12/10/2013 | 10:38 | 1309 |
| 12/10/2013 | 10:48 | 1310 |
| 12/10/2013 | 10:58 | 1310 |
| 12/10/2013 | 11:08 | 1309 |
| 12/10/2013 | 11:18 | 1309 |

| MOD 2 THERMAL OXIDIZER TEMPERATURE °F RUN 1 | | |
|---|---|---|
| Date | Time | Temp. |
| 12/12/2013 | 12:20 | 1311 |
| 12/12/2013 | 12:30 | 1309 |
| 12/12/2013 | 12:40 | 1310 |
| 12/12/2013 | 12:50 | 1310 |
| 12/12/2013 | 13:00 | 1311 |
| 12/12/2013 | 13:10 | 1309 |
| 12/12/2013 | 13:20 | 1310 |

| MOD 4 THERMAL OXIDIZER TEMPERATURE °F RUN 1 | | |
|---|---|---|
| Date | Time | Temp. |
| 12/11/2013 | 12:20 | 1325 |
| 12/11/2013 | 12:30 | 1325 |
| 12/11/2013 | 12:40 | 1321 |
| 12/11/2013 | 12:50 | 1324 |
| 12/11/2013 | 13:00 | 1330 |
| 12/11/2013 | 13:10 | 1326 |
| 12/11/2013 | 13:20 | 1325 |

| MOD 5 THERMAL OXIDIZER TEMPERATURE °F RUN 1 | | |
|---|---|---|
| Date | Time | Temp. |
| 12/13/2013 | 9:40 | 1311 |
| 12/13/2013 | 9:50 | 1307 |
| 12/13/2013 | 10:00 | 1310 |
| 12/13/2013 | 10:10 | 1310 |
| 12/13/2013 | 10:20 | 1308 |
| 12/13/2013 | 10:30 | 1308 |
| 12/13/2013 | 10:40 | 1309 |

| MOD 6 THERMAL OXIDIZER TEMPERATURE °F RUN 1 | | |
|---|---|---|
| Date | Time | Temp. |
| 12/13/2013 | 13:30 | 1310 |
| 12/13/2013 | 13:40 | 1309 |
| 12/13/2013 | 13:50 | 1310 |
| 12/13/2013 | 14:00 | 1310 |
| 12/13/2013 | 14:10 | 1308 |
| 12/13/2013 | 14:20 | 1311 |
| 12/13/2013 | 14:30 | 1313 |

| MOD 7 THERMAL OXIDIZER TEMPERATURE °F RUN 1 | | |
|---|---|---|
| Date | Time | Temp. |
| 12/13/2013 | 7:20 | 1305 |
| 12/13/2013 | 7:30 | 1306 |
| 12/13/2013 | 7:40 | 1305 |
| 12/13/2013 | 7:50 | 1306 |
| 12/13/2013 | 8:00 | 1304 |
| 12/13/2013 | 8:10 | 1304 |
| 12/13/2013 | 8:20 | 1305 |

| SOUTH PRIME THERMAL OXIDIZER TEMPERATURE °F RUN 1 | | |
|---|---|---|
| Date | Time | Temp. |
| 12/10/2013 | 13:28 | 1330 |
| 12/10/2013 | 13:38 | 1331 |
| 12/10/2013 | 13:48 | 1330 |
| 12/10/2013 | 13:58 | 1331 |
| 12/10/2013 | 14:08 | 1330 |
| 12/10/2013 | 14:18 | 1328 |
| 12/10/2013 | 14:28 | 1328 |

# Figures

BTEC Inc.

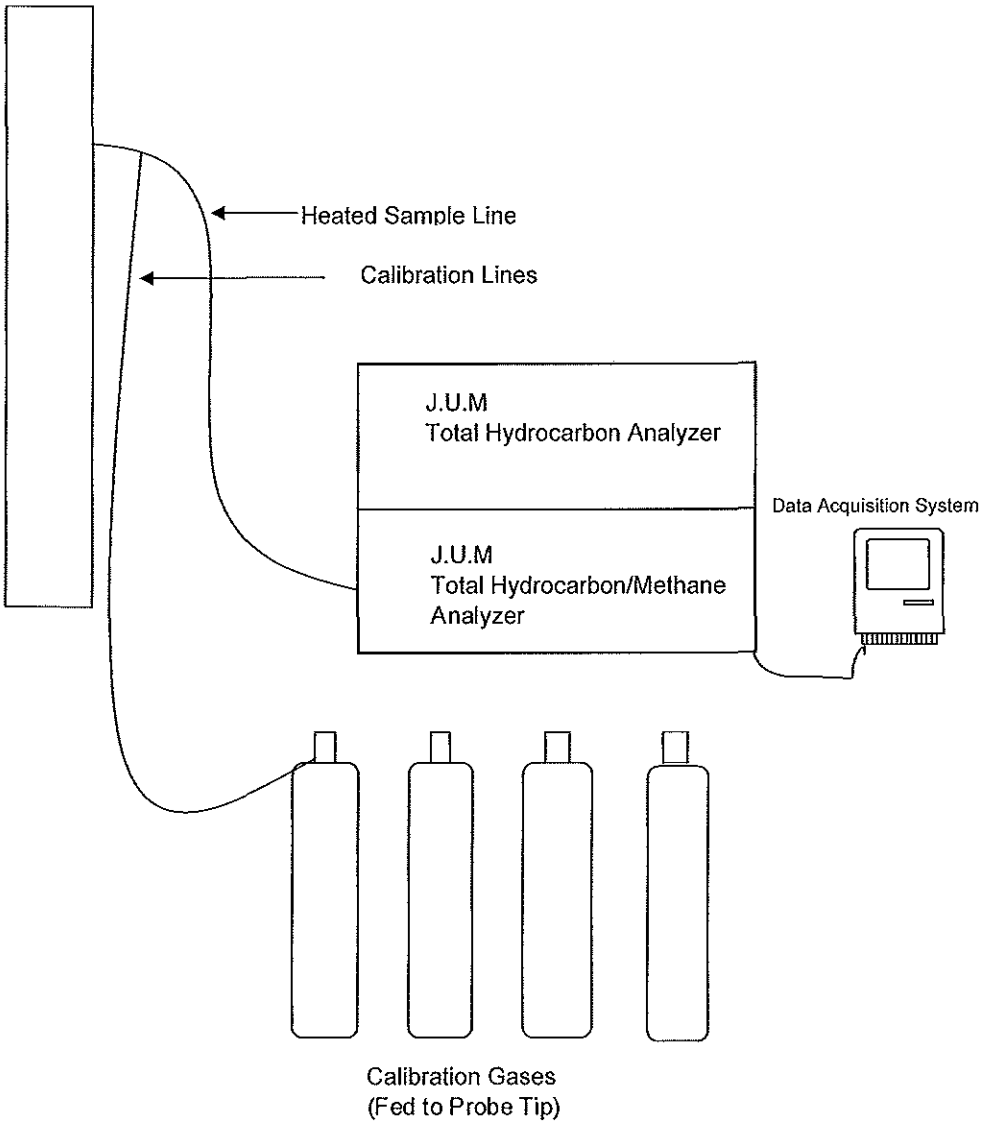


**Figure No. 1**

| | |
|---|---|
| Site:<br>USEPA Method 25A<br>GM Detroit Hamtramck Assembly<br>Detroit, Michigan | Sampling Date:<br>December 10-13, 2013 |
| | BT Environmental Consulting, Inc.<br>4949 Fernlee Avenue<br>Royal Oak, Michigan |

BTEC Inc.

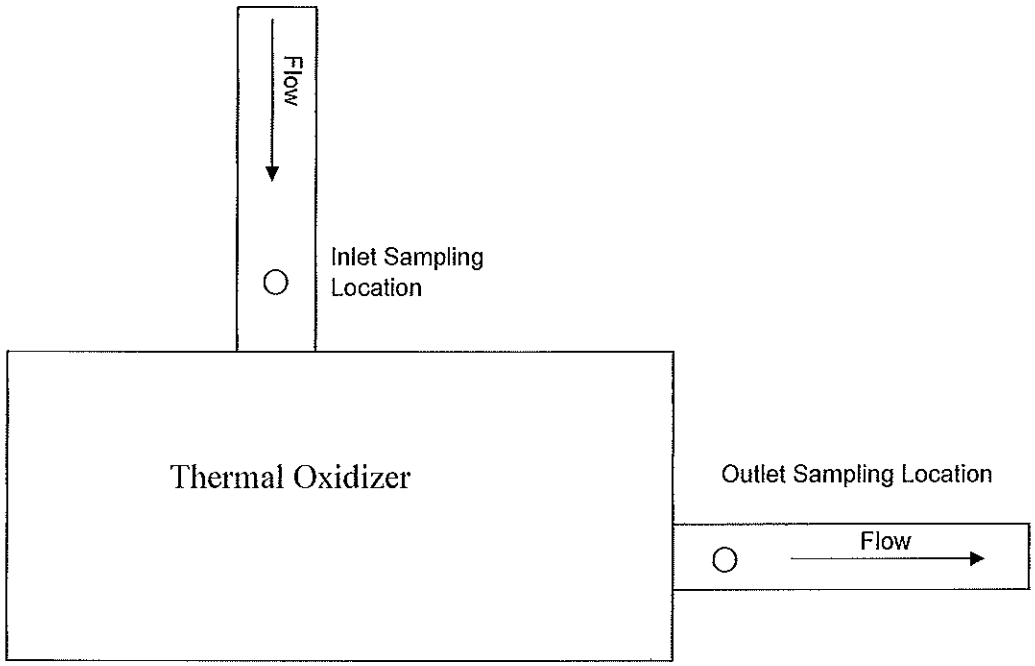


**Figure No. 2**

| | |
|---|---|
| **Site:**<br>**Mod Thermal Oxidizers**<br>**GM Detroit Hamtramck Assembly**<br>**Detroit, Michigan** | **Sampling Date:**<br>**December 10-13, 2013** |
| | **BT Environmental Consulting, Inc.**<br>**4949 Fernlee Avenue**<br>**Royal Oak, Michigan** |

BTEC Inc.

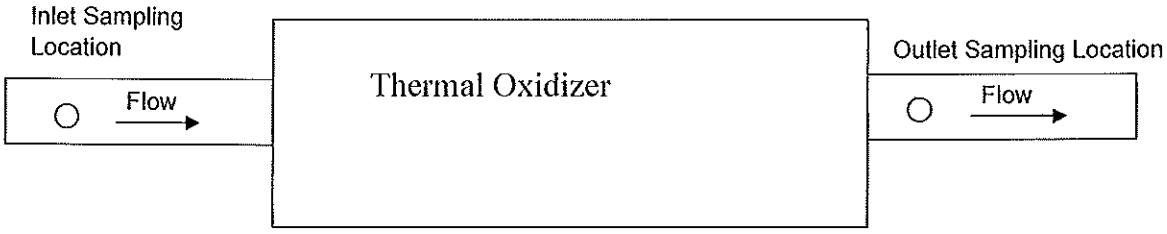


**Figure No. 3**

| | |
|---|---|
| **Site:**<br>**North/South Primer TO**<br>**GM Detroit Hamtramck Assembly**<br>**Detroit, Michigan** | **Sampling Date:**<br>**December 10-13, 2013** |
| | **BT Environmental Consulting, Inc.**<br>**4949 Fernlee Avenue**<br>**Royal Oak, Michigan** |