BTEC Inc.

VOC Destruction Efficiency Emissions Test Report

Prepared for:

JVIS Manufacturing LLC

JVIS Manufacturing LLC
1285 North Crystal Avenue
Benton Harbor, Michigan 49022

Project No. 14-4609.00
January 8, 2015

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

EXECUTIVE SUMMARY

BT Environmental Consulting, Inc. (BTEC) was retained by JVIS Manufacturing, LLC (JVIS) to conduct a compliance volatile organic compound (VOC) abatement system destruction efficiency (DE) emissions test program at the JVIS facility in Benton Harbor, Michigan. The emissions test program was conducted on November 13, 2014.

Testing of abatement system consisted of triplicate 60-minute test runs conducted simultaneously at the inlet and outlet of the RTO unit. The emissions test program was required by MDEQ Air Quality Division Permit To Install No. 202-95D. The RTO achieved an average VOC DE of 96.8%.

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1. Introduction

BT Environmental Consulting, Inc. (BTEC) was retained by JVIS Manufacturing, LLC (JVIS) to conduct a compliance volatile organic compound (VOC) abatement system destruction efficiency (DE) emissions test program at the JVIS facility in Benton Harbor, Michigan. The emissions test program was conducted on November 13, 2014. The purpose of this report is to document the results of the test program.

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

1.a Identification, Location, and Dates of Test

Sampling and analysis for the emission test program was conducted on November 13, 2014 at the JVIS facility located in Benton Harbor, Michigan. The test program included evaluation of VOC DE of the RTO.

1.b Purpose of Testing

AQD issued Permit To Install 202-95D to JVIS on May 23, 2014. Permit To Install No. 202-95D requires a minimum RTO VOC destruction efficiency of 95%.

1.c Source Description

The emission unit is a plastic automotive interior parts coating line consisting of six (6) booths utilizing high volume low pressure (HVLP) or comparable applicators and two (2) natural gas fired and two electric ovens. VOC emissions are controlled by a non-fugitive enclosure (NFE) and a regenerative thermal oxidizer (RTO).

The coating line is conveyorized and consists of a wash section, robotic and manual spray application stations, and drying ovens.

1.d Test Program Contacts

The contact for the source and test report is:

Mr. Jason Hoose
Quality Manager
JVIS Manufacturing LLC
1285 North Crystal Avenue
Benton Harbor, Michigan 49022
269-932-4488

Mr. Randal Tysar
Senior Environmental Engineer
BT Environmental Consulting, Inc.
4949 Fernlee Avenue
Royal Oak, Michigan 48073
248-548-8070

Names and affiliations for personnel who were present during the testing program are summarized by Table 1.

Table 1
Test Personnel

Name and Title	Affiliation	Telephone
Mr. Jason Hoose Quality Manager	JVIS Manufacturing LLC 1285 North Crystal Avenue Benton Harbor, Michigan 49022	(269) 932-4488
Mr. Todd Wessel Senior Project Manager	BTEC 4949 Fernlee Royal Oak, MI 48073	(248) 548-8070
Mr. Paul Draper Environmental Technician	BTEC 4949 Fernlee Royal Oak, MI 48073	(248) 548-8070
Mr. Paul Molenda Environmental Technician	BTEC 4949 Fernlee Royal Oak, MI 48073	(248) 548-8070
Mr. David Patterson	MDEQ Air Quality Division	(517) 284-6782
Mr. Dennis Dunlap	MDEQ Air Quality Division	(269) 567-3553

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 recorded during the emissions test program include production rate (parts/hr), coating usage rate (gal/hr), coating identifications and VOC content, and RTO operating temperature. This data is summarized in Appendix E.

2.b Applicable Permit

The applicable permit for this emissions test program is Permit To Install 202-95D.

2.c Results

The RTO achieved an average VOC DE of 96.8%. The overall results of the emission test program are summarized by Table 2. Also, consistent with the requirements of Permit No. 202-95D Special Condition V.3, the emissions test program included the evaluation of natural draft opening air flow directions using smoke tubes. The evaluation was witnessed by the MDEQ personnel listed in Table 1 and was considered acceptable.

3. Source Description

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

3.a Process Description

The emission unit is a plastic automotive interior parts coating line consisting of six (6) booths utilizing high volume low pressure (HVLP) or comparable applicators and two (2) natural gas fired and two electric ovens. VOC emissions are controlled by a non-fugitive enclosure (NFE) and a regenerative thermal oxidizer (RTO).

The coating line is conveyorized and consists of a wash section, robotic and manual spray application stations, and drying ovens.

3.b Process Flow Diagram

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

3.c Raw and Finished Materials

During the emissions test program, the conveyor was operate at its normal speed. For the purpose of maximum VOC emission rate during the test program, large surface area parts were coated using solvent-based coatings.

3.d Process Capacity

VOC/acetone emissions from the RTO are limited to not more than 68.5 tons per year.

3.e Process Instrumentation

Process data recorded during the emissions test program include production rate (parts/hr), coating usage rate (gal/hr), coating identifications and VOC content, and RTO operating temperature.

4. Sampling and Analytical Procedures

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

4.a Sampling Train and Field Procedures

The emissions test program utilized the following test methods codified at Title 40, Part 60, Appendix A of the Code of Federal Regulations (40 CFR 60, Appendix A):

- 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"(Fyrite)
- Method 4 - "Determination of Moisture Content in Stack Gases"
- Method 25A - "Determination of Total Gaseous Organic Concentration Using A Flame Ionization Analyzer"

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.

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.

Molecular weight determinations were evaluated according to USEPA Method 3, "Gas Analysis for the Determination of Dry Molecular Weight." The equipment used for this evaluation

consists of a one-way squeeze bulb with connecting tubing and a set of Fyrite® combustion gas analyzers. Carbon dioxide and oxygen content were analyzed using the Fyrite® procedure.

Exhaust gas moisture content was evaluated using Method 4. Exhaust gas was extracted as part of the moisture sampling 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 single Method 4 test run was conducted at the RTO inlet and RTO outlet.

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 JUM 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. Initial methane readings indicated the amount of methane in the exhaust stream was negligible, therefore methane measurement and subtraction was not performed.

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.

Consistent with the requirements of Permit No. 202-95D Special Condition V.3, the emissions test program also included the evaluation of natural draft opening air flow directions using smoke tubes.

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

4.b Recovery and Analytical Procedures

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

4.c Sampling Ports

A diagram of the stacks showing sampling ports in relation to upstream and downstream disturbances is included as Figures 1 and 2.

4.d Traverse Points

A diagram of the stacks indicating traverse point locations and stack dimensions is 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 2.

5.b Discussion of Results

The RTO achieved an average VOC DE of 96.8% which is greater than the 95% required by Permit To Install 202-95D.

5.c Sampling Procedure Variations

There were no sampling variations used during the emission compliance test program. However, the sampling date recorded on some field sheets was November 14, 2014 instead of November 13, 2014. All testing was conducted on November 13, 2014.

5.d Process or Control Device Upsets

No upset conditions occurred during testing.

5.e Control Device Maintenance

The RTO system is new and no control equipment maintenance performed prior to 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.

Tables

Table 2
RTO VOC Destruction Efficiency Summary
JVIS Manufacturing, LLC
Benton Harbor, Michigan

Parameter	Run 1	Run 2	Run 3	Average
Sampling Date	11/14/2014	11/14/2014	11/14/2014	
Sampling Time	9:40-10:39	11:04-12:03	12:20-13:19	
Inlet Flowrate (scfm)	56,928	57,024	55,347	56,433
Outlet Flowrate (scfm)	61,781	61,083	59,632	60,832
Inlet VOC Concentration (ppmv propane)	308.09	240.57	321.18	289.95
Inlet VOC Concentration (ppmv propane, corrected as per USEPA 7E)	304.02	234.10	312.91	283.68
Inlet VOC Mass Flowrate (lb/hr)	120.0	93.9	121.7	111.85
Inlet VOC Mass Flowrate (lb/hr, corrected as per USEPA 7E)	118.4	91.4	118.5	109.44
Inlet VOC Concentration (ppmv propane)	9.56	7.92	10.34	9.27
Inlet VOC Concentration (ppmv propane, corrected as per USEPA 7E)	8.9	6.9	9.2	8.33
Inlet VOC Mass Flowrate (lb/hr)	4.0	3.3	4.2	3.86
Inlet VOC Mass Flowrate (lb/hr, corrected as per USEPA 7E)	3.8	2.9	3.7	3.47
VOC Destruction Efficiency (%)	**96.8**	**96.8**	**96.8**	**96.8**

Inlet VOC Correction			
Co	2.32	3.49	3.14
Cma	250	250	250
Cm	253.76	256.67	257.24

Outlet VOC Correction			
Co	0.96	1.43	1.56
Cma	50	50	50
Cm	49.10	48.48	49.50

Note: Flow 1 was voided. Flows 2, 3, and 4 have been used to calculated emission rates

scfm: standard cubic feet per minute
ppmv: parts per million on a volume to volume basis
lb/hr: pounds per hour
VOC: volatile organic compound
MW = molecular weight (C_3H_8 = 44.10)
24.14: molar volume of air at standard conditions (70°F, 29.92" Hg)
35.31: ft^3 per m^3
453,600: mg per lb

Equations

lb/hr = ppmv * MW/24.14 * 1/35.31 * 1/453,600 * scfm* 60
DE = (VOC_{in} - VOC_{out}) / VOC_{in} *100

Figures

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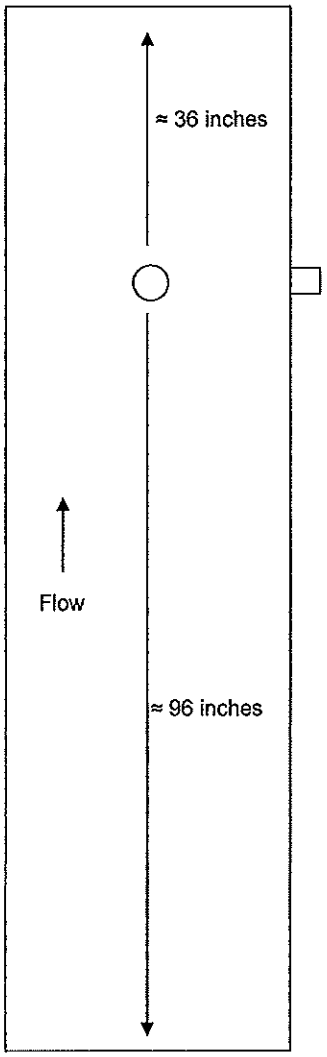
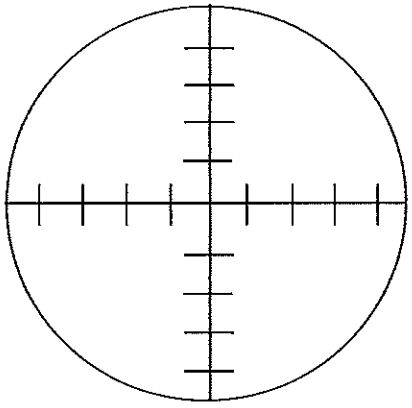
diameter = 60 inches





Not to Scale

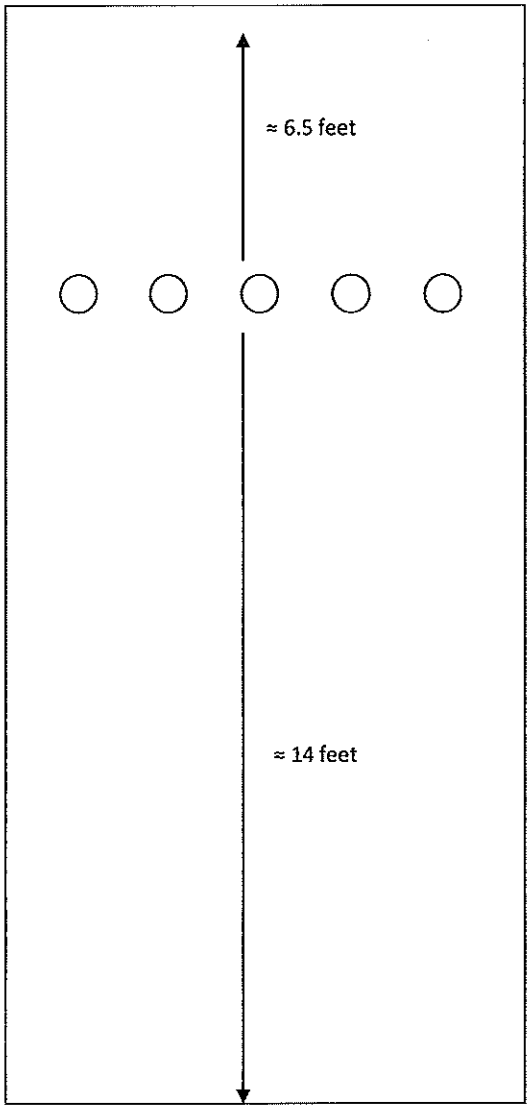
Points	Distance "
1	1.9
2	6.3
3	11.6
4	19.4
5	40.6
6	48.4
7	53.7
8	58.1

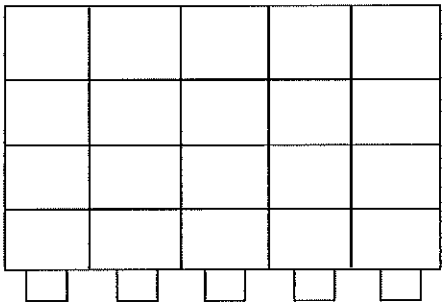
Figure No. 1

Site: **RTO Inlet** **JVIS Manufacturing, LLC** **Benton Harbor, Michigan**	**Sampling Date:** **November 14, 2014**	**BT Environmental Consulting, Inc.** **4949 Fernlee Avenue** **Royal Oak, Michigan 48073**

BTEC Inc.

Stack Dimensions:
Depth: 35.75 inches
Width: 77.75 inches





Not to Scale

Points	Distance "
1	4.5
2	13.4
3	22.3
4	31.3

Figure No. 2

Site: **RTO Outlet** **JVIS Manufacturing, LLC** **Benton Harbor, Michigan**	**Sampling Date:** **November 14, 2014**

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

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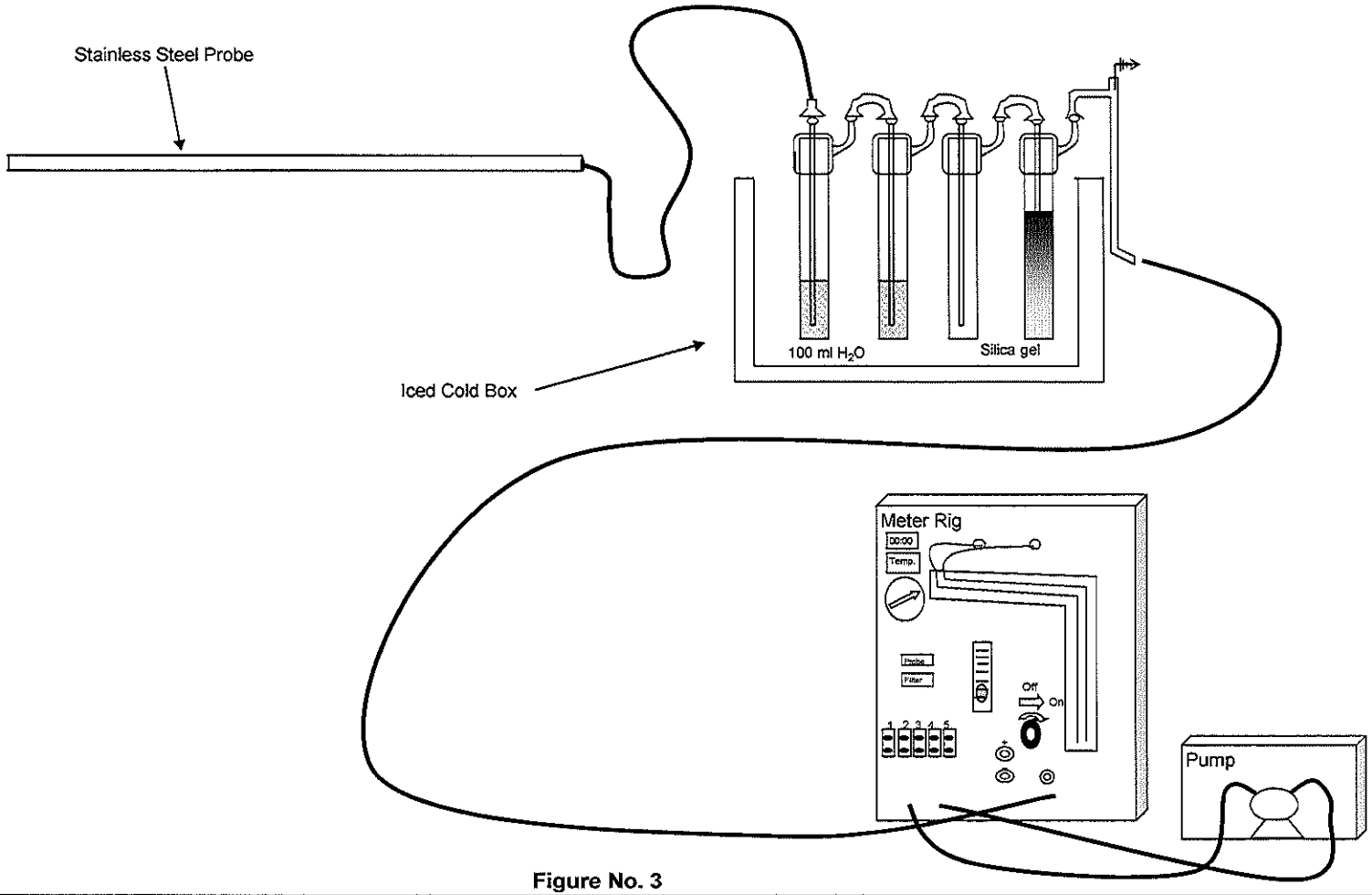

Figure No. 3

Site:	Sampling Date:	
USEPA Method 4 JVIS Manufacturing, LLC Benton Harbor, Michigan	November 14, 2014	BT Environmental Consulting, Inc. 4949 Fernlee Avenue Royal Oak, Michigan 48073

BTEC Inc.

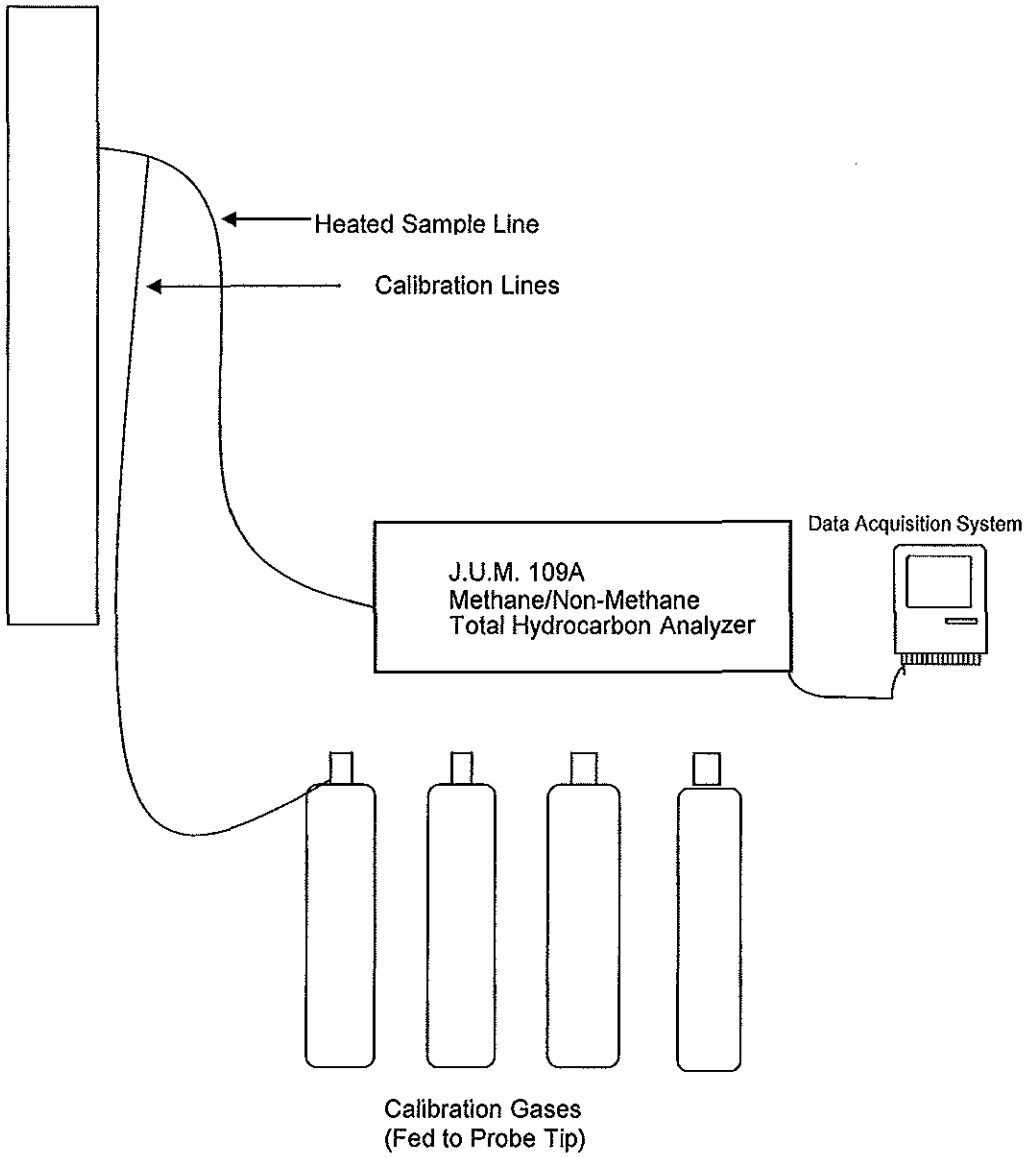

Figure No. 4

Site: **Sampling Date:** **USEPA Method 25A** **November 14, 2014** **JVIS Manufacturing, LLC** **Benton Harbor, Michigan**	**BT Environmental Consulting, Inc.** **4949 Fernlee Avenue** **Royal Oak, Michigan 48073**