BTEC Inc.

THROX Exhaust Stack Particulate Matter and Flow RATA Test Report

Prepared for:

Dow Corning Corporation

Dow Corning Corporation
3901 S. Saginaw Rd.
Midland, MI 48640

RECEIVED
JAN 22 2014
AIR QUALITY DIV.

Project No. 13-4462.00
January 8, 2014

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

EXECUTIVE SUMMARY

BT Environmental Consulting, Inc. (BTEC) was retained by Dow Corning Corporation (Dow) to conduct a Relative Accuracy Test Audit (RATA) and an emissions rate compliance test of the THROX unit at the Dow facility in Midland, Michigan. The emissions test program was conducted on November 19-21, 2013.

Testing of Throx exhaust consisted of eleven 21-minute test runs on the flowrate, CO2, and NOx monitors, triplicate 60-minute test runs for PM_{10}, CO, and VOC. Triplicate 60-minute test runs for PM_{10} were also conducted on the Throx inlet. The emissions test program was required by MDEQ Air Quality Division Permit to Install 91-07D. The overall results of the emissions test program are detailed by Table I.

Table I
Overall Emission Summary
Test Date: November 19-21, 2012

Source	Pollutant	Emission Result	Emission Limit
Throx Inlet	PM_{10}	25.96 lb/hr	NA
Throx Exhaust	PM_{10}	1.16 lb/hr	3.5 lb/hr
	CO	0.01 lb/hr	90 ton/yr
	VOC	0.03 lb/hr	6.6 lb/hr
	Flow RATA	6.8%	20%
	CO_2 RATA	7.5%	20%
	NOx RATA	0.5%	20%

BTEC Inc.

TABLE OF CONTENTS

BTEC Inc.

TABLE OF CONTENTS (continued)

SUMMARY TABLES

FIGURES

APPENDIX

1. Introduction

BT Environmental Consulting, Inc. (BTEC) was retained by Dow Corning Corporation (Dow) to conduct a Relative Accuracy Test Audit (RATA) and an emissions rate compliance test of the THROX unit at the Dow facility in Midland, Michigan. The emissions test program was conducted on November 19-21, 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" (February 2008). The following is a summary of the emissions test program and results in the format suggested by the aforementioned document.

1.a Identification, Location, and Dates of Test

Sampling and analysis for the emission test program was conducted on November 19 and 21, 2013 at the Dow Corning facility located in Midland, Michigan. Testing of Throx exhaust consisted of eleven 21-minute test runs on the flowrate, CO2, and NOx monitors, triplicate 60-minute test runs for PM_{10}, CO, and VOC. Triplicate 60-minute test runs for PM_{10} were also conducted on the Throx inlet

1.b Purpose of Testing

The purpose of testing was to quantify PM_{10}, CO, and VOC emissions from the Throx Exhaust, PM_{10} emissions from the Throx Inlet, and perform a RATA on the Throx Exhaust flow, CO_2, and NOx monitors.

1.c Source Description

The emission unit is a thermal oxidizer followed in series by a quench, a caustic scrubber, and two ionizing wet scrubbers.

1.d Test Program Contacts

The contact for the source and test report is:

Mr. Michael Gruber, II
Environmental Manager
Dow Corning Corporation
P.O. Box 995, Mail#065
Midland, Michigan 48686
(989) 496-5539

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. Michael Gruber, II Environmental Manager	Dow Corning Corporation P.O. Box 995, Mail#065 Midland, Michigan 48686	(989) 496-5539
Mr. Barry Boulianne Senior Project Manager	BTEC 4949 Fernlee Avenue Royal Oak, MI 48073	(248) 548-8070
Mr. Brandon Chase Staff Environmental Engineer	BTEC 4949 Fernlee Avenue Royal Oak, MI 48073	(248) 548-8070
Mr. Jeff Peitzsch Staff Environmental Engineer	BTEC 4949 Fernlee Avenue Royal Oak, MI 48073	(248) 548-8070
Mr. Kenny Felder Environmental Technician	BTEC 4949 Fernlee Avenue Royal Oak, MI 48073	(248) 548-8070

2. Summary of Results

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

2.a Operating Data

Process operating data collected during the emissions test program is included in Appendix C.

2.b Applicable Permit

The Dow facility is covered by Permit No. MI-ROP-A4043-2008.

The emissions test program was required by AQD Permit No. 91-07D.

2.c Results

The overall results of the emissions test program are detailed by Table 2. Detailed results for each test run are included in Tables 3-8.

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 thermal oxidizer followed in series by a quench; a caustic scrubber, and two ionizing wet scrubbers.

3.b Process Flow Diagram

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

3.c Raw and Finished Materials

The raw materials include natural gas and process operations exhaust gas.

3.d Process Capacity

The FGTHROX has a 99.9% destruction efficiency for hydrocarbons and is nominally rated for approximately 95 MMBTU/hr heat input.

3.e Process Instrumentation

Process instrumentation is summarized by the operating data provided in Appendix C.

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

Sampling and analysis procedures utilized the following test methods codified at Title 40, Part 60, Appendix A of the Code of Federal Regulations:

- Method 1 - *"Sample and Velocity Traverses for Stationary Sources"*
- Method 2 - *"Determination of Stack Gas Velocity and Volumetric Flowrate"*
- Method 3A - *"Determination of Molecular Weight of Dry Stack Gas"*
- Method 4 - *"Determination of Moisture Content in Stack Gases"*
- Method 5 - *"Determination of Particulate Emissions from Stationary Sources"*
- Method 7E - *"Determination of Nitrogen Oxide Emissions from Stationary Sources"*

- Method 10 - *"Determination of Carbon Monoxide Emissions from Stationary Sources"*

- Method 25A - *"Determination of Total Gaseous Organic Concentration using a Flame Ionization Analyzer""*

- Method 202 - *"Determination of Condensable Particulate Emissions from Stationary Sources""*

Stack gas velocity traverses were conducted in accordance with the procedures outlined in Methods 1 and 2. A cyclonic flow evaluation was conducted at each sampling location. An S-type pitot tube and thermocouple assembly calibrated in accordance with Method 2, Section 4.1.1 was used to measure exhaust gas velocity pressures and temperatures during testing. Because the pitot tube dimensions outlined in Sections 2.6 through 2.8 were within the specified limits, the baseline pitot tube coefficient of 0.84 (dimensionless) was assigned for this testing.

For Method 4, BTEC's Nutech® Model 2010 modular isokinetic stack sampling system consisted of (1) a stainless-steel probe with glass liner, (2) a set of four Greenburg-Smith (GS) impingers with the first and third modified and the second a standard GS impinger, the first two containing 100 ml of deionized water, the third empty, and a fourth modified GS impinger containing approximately 300 g of silica gel desiccant, (3) a length of sample line, and (4) a Nutech® control case equipped with a pump, dry gas meter, and calibrated orifice.

40 CFR 60, Appendix A, Method 5, *"Determination of Particulate Emissions from Stationary Sources"* and 40 CFR 60, Appendix A, Method 202, *"Dry Impinger Method for Determining Condensable Particulate Emissions from Stationary Sources"* was used to measure PM concentrations and calculate PM emission rates (see Figure 4 for a schematic of the sampling train). Triplicate 60-minute test runs were conducted for each source.

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

A sampling train leak test was conducted before and after each test run. After completion of the final leak test for each test run, the filter was recovered, and the nozzle and the front half of the filter holder assembly were brushed and triple rinsed with acetone. The acetone rinses were collected in a pre-cleaned sample container. The impinger train was then purged with nitrogen for one hour at a flow rate of 18 liters per minute. The CPM filter was recovered and placed in a petri dish. The back half of the filter housing, the condenser, the pot bellied impinger, the moisture drop out impinger, and the front half of the CPM filter housing and all connecting glassware were triple rinsed with deionized water which was collected in a pre-cleaned sample container. The same glassware was then rinsed with acetone which was collected in a pre-cleaned sample container labeled as the organic fraction. The glassware was then double rinsed with hexane which was added to the same organic fraction sample bottle.

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

Exhaust NOx content was measured using a Teledyne Model T-200H NOx gas analyzer, and the CO and CO_2 content were measured using a Teledyne Model 300EM CO/CO_2 gas analyzer. A sample of the gas stream was 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 an electronic sample conditioner to remove the moisture from the sample before it enters the analyzer. Data was recorded at 4-second intervals on a PC equipped with data acquisition software.

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 Labview® II data acquisition software. BTEC used a VIG Model 20 THC 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 analyzer was calibrated for a range of 0 to 100 ppm.

In accordance with Method 25A, a 3-point (zero, 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

A diagram of the stack indicating traverse point locations and stack dimensions is included as Figures 1-2.

4.d Traverse Points

A diagram of the stack indicating traverse point locations and stack dimensions is included as Figures 1-2.

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 detailed by Table 2.

Table 2
Overall Emission Summary
Test Date: November 19-21, 2012

Source	Pollutant	Emission Result	Emission Limit
Throx Inlet	PM_{10}	25.96 lb/hr	NA
Throx Exhaust	PM_{10}	1.16 lb/hr	3.5 lb/hr
	CO	0.01 lb/hr	90 ton/yr
	VOC	0.03 lb/hr	6.6 lb/hr
	Flow RATA	6.8%	20%
	CO_2 RATA	7.5%	20%
	NOx RATA	0.5%	20%

5.b Discussion of Results

All emission results are below the emission limits.

5.c Sampling Procedure Variations

There were no variations in the sampling procedures from that specified by the emissions test plan.

5.d Process or Control Device Upsets

Dow process monitor recording went off-line during Run 3 of the RATA. Run 3 has been discarded.

5.e Control Device Maintenance

There was no non-routine control equipment maintenance performed immediately 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 C.

5.i Sample Calculations

Sample calculations are provided in Appendix D.

5.j Field Data Sheets

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

5.k Laboratory Data

Laboratory analytical results are available in Appendix F.

Table 4
Throx Exhaust Particulate Matter Emission Rates

Company	**Dow**			
Source Designation	**Throx**			
Test Date	**11/21/2013**	**11/21/2013**	**11/21/2013**	
Meter/Nozzle Information	P-1	P-2	P-3	Average
Meter Temperature Tm (F)	57.7	65.0	67.3	63.3
Meter Pressure - Pm (in. Hg)	29.7	29.6	29.6	29.6
Measured Sample Volume (Vm)	53.7	37.2	36.9	42.6
Sample Volume (Vm-Std ft3)	54.4	37.1	36.6	42.7
Sample Volume (Vm-Std m3)	1.54	1.05	1.04	1.21
Condensate Volume (Vw-std)	11.189	7.497	7.502	8.729
Gas Density (Ps(std) lbs/ft3) (wet)	0.0697	0.0698	0.0698	0.0698
Gas Density (Ps(std) lbs/ft3) (dry)	0.0745	0.0745	0.0745	0.0745
Total weight of sampled gas (m g lbs) (wet)	4.58	3.11	3.08	3.59
Total weight of sampled gas (m g lbs) (dry)	4.06	2.76	2.73	3.18
Nozzle Size - An (sq. ft.)	0.001294	0.000860	0.000860	0.001004
Isokinetic Variation - I	95.3	95.9	95.8	95.7
Stack Data				
Average Stack Temperature - Ts (F)	135.9	135.2	135.3	135.4
Molecular Weight Stack Gas- dry (Md)	28.8	28.8	28.8	28.8
Molecular Weight Stack Gas-wet (Ms)	27.0	27.0	27.0	27.0
Stack Gas Specific Gravity (Gs)	0.932	0.933	0.932	0.932
Percent Moisture (Bws)	17.05	16.82	17.01	16.96
Water Vapor Volume (fraction)	0.1705	0.1682	0.1701	0.1696
Pressure - Ps ("Hg)	29.5	29.5	29.5	29.5
Average Stack Velocity -Vs (ft/sec)	16.9	17.2	17.0	17.0
Area of Stack (ft2)	15.9	15.9	15.9	15.9
Exhaust Gas Flowrate				
Flowrate ft^3(Actual)	16,124	16,371	16,204	16,233
Flowrate ft^3 (Standard Wet)	14,096	14,330	14,182	14,202
Flowrate ft^3 (Standard Dry)	11,692	11,920	11,769	11,794
Flowrate m^3 (standard dry)	331	338	333	334
Total Particulate Weights (mg)				
Total Nozzle/Probe/Filter	34.5	23.7	26.6	28.3
Organic Condensible Particulate	1.3	1.1	0.0	0.8
Inorganic Condensible Particulate	3.0	5.3	3.9	4.1
Condensible Blank Correction	2.0	2.0	2.0	2.0
Total Condensible Particulate	2.3	4.4	1.9	2.9
Total Filterable and Condensible Particulate	36.8	28.1	28.5	31.1
Filterable Particulate Concentration				
lb/1000 lb (wet)	0.017	0.017	0.019	0.017
lb/1000 lb (dry)	0.019	0.019	0.022	0.020
mg/dscm (dry)	22.4	22.6	25.7	23.5
gr/dscf	0.010	0.010	0.011	0.010
Filterable Particulate Emission Rate				
lb/ hr	0.98	1.01	1.14	1.04
Condensible Particulate Concentration				
lb/1000 lb (wet)	0.001	0.003	0.001	0.002
lb/1000 lb (dry)	0.001	0.004	0.002	0.002
mg/dscm (dry)	1.5	4.2	1.8	2.5
gr/dscf	0.001	0.002	0.001	0.001
Condensible Particulate Emission Rate				
lb/ hr	0.07	0.19	0.08	0.11
Total Particulate Concentration				
lb/1000 lb (wet)	0.018	0.020	0.020	0.019
lb/1000 lb (dry)	0.020	0.022	0.023	0.022
mg/dscm (dry)	23.9	26.8	27.5	26.0
gr/dscf	0.010	0.012	0.012	0.011
Total Particulate Emission Rate				
lb/ hr	1.05	1.20	1.22	1.16

TABLE 5

Throx Exhaust Flow RATA Results Summary

Dow Corning Corp.

Midland, Michigan

THROX

FLOW Relative Accuracy

	Relative Accuracy:		6.8		
Run #	**Time***	**RM KSCFM**	**CEM KSCFM**	**Diff**	**%Diff**
1	7:32-7:53	17.1	18.9	-1.7932	-0.10
2	**8:06-8:27**	**18.8**	**21.1**	**-2.2991**	**-0.12**
4	11:20-11:41	19.5	21.1	-1.5778	-0.08
5	11:56-12:17	20.0	20.8	-0.8358	-0.04
6	12:30-12:51	20.5	21.7	-1.2487	-0.06
7	13:01-13:22	21.2	21.7	-0.5380	-0.03
8	13:34-13:55	19.2	20.1	-0.8999	-0.05
9	14:06-14:27	18.4	19.0	-0.6313	-0.03
10	14:40-15:01	20.1	20.0	0.0524	0.00
11	15:12-15:33	19.8	19.8	-0.0446	0.00
12				**#VALUE!**	**#VALUE!**
13				**#VALUE!**	**#VALUE!**
		19.5	20.3	-0.835	-0.044
		Sdev	0.6312		
		CC	0.4852		
	RA (based on Ref. Meth.)		**6.8%**		

*: Time stamp is according to Dow's clock. BTEC time is 10 minutes behind Dow.
i.e., 7:42 BTEC time = 7:32 Dow time
Note: Run 3 is omitted because Dow process monitoring recording went offline.

Confidence Coefficient =
n=9
t = 2.306

$$CC = t_{0.975} \frac{S_d}{\sqrt{n}}$$

P.S. 2 Equation 2-5

Standard Deviation =

$$S_d = \left[\frac{\sum_{i=1}^{n} d_i^2 - \frac{\left(\sum_{i=1}^{n} d_i\right)^2}{n}}{n-1} \right]^{1/2}$$

P.S. 2 Equation 2-4

Relative Accuracy =
RM=Reference Monitor

$$RA = \frac{|\bar{d}| + |cc|}{\overline{RM}} x100$$

P.S. 2 Equation 2-6

RA calculated as specified in Performance Specification 2, Appendix B, 40 CFR 60 - Equation 2-4

As specified in P.S. 2, subsection 8.4.4, three sets of test runs may be rejected, these rejected test runs are high-lighted in the table

TABLE 6

Throx Exhaust CO_2 % RATA Results Summary

Dow Corning Corp.

Midland, Michigan

THROX

CO2 % Relative Accuracy

	Relative Accuracy:		7.5		
Run #	Time*	RM %	CEM %	Diff	%Diff
1	**7:32-7:53**	**1.89**	**1.7**	**0.1900**	**0.10**
2	8:06-8:27	1.94	1.8	0.1400	0.07
4	11:20-11:41	2.69	2.5	0.1900	0.07
5	11:56-12:17	2.37	2.2	0.1700	0.07
6	12:30-12:51	2.39	2.2	0.1900	0.08
7	13:01-13:22	2.38	2.2	0.1800	0.08
8	13:34-13:55	2.46	2.3	0.1600	0.07
9	14:06-14:27	2.49	2.4	0.0900	0.04
10	14:40-15:01	2.37	2.3	0.0700	0.03
11	15:12-15:33	2.41	2.3	0.1100	0.05
12				**#VALUE!**	**#VALUE!**
13				**#VALUE!**	**#VALUE!**
		2.389	2.24	0.144	0.061
		Sdev	0.0448		
		CC	0.0344		
	RA (based on Ref. Meth.)		**7.5%**		

*: Time stamp is according to Dow's clock. BTEC time is 10 minutes behind Dow.
i.e., 7:42 BTEC time = 7:32 Dow time
Note: Run 3 is omitted because Dow process monitoring recording went offline.

Confidence Coefficient =
n=9
t = 2.306

$$CC = t_{0.975} \frac{S_d}{\sqrt{n}}$$

P.S. 2 Equation 2-5

Standard Deviation =

$$S_d = \left[\frac{\sum_{i=1}^{n} d_i^2 - \frac{\left(\sum_{i=1}^{n} d_i\right)^2}{n}}{n-1}\right]^{1/2}$$

P.S. 2 Equation 2-4

Relative Accuracy =
RM=Reference Monitor

$$RA = \frac{|\bar{d}| + |cc|}{RM} x100$$

P.S. 2 Equation 2-6

RA calculated as specified in Performance Specification 2, Appendix B, 40 CFR 60 - Equation 2-4

As specified in P.S. 2, subsection 8.4.4, three sets of test runs may be rejected, these rejected test runs are high-lighted in the table

TABLE 7

Throx Exhaust NOx ppm RATA Results Summary

Dow Corning Corp.

Midland, Michigan

THROX

NO_X PPM Relative Accuracy

	Relative Accuracy:		0.5		
Run #	**Time***	**RM PPMVD**	**CEM PPMVD**	**Diff**	**%Diff**
1	**7:32-7:53**	**64.14**	**63.0**	**1.1400**	**0.02**
2	8:06-8:27	58.43	58.5	-0.0700	0.00
4	11:20-11:41	47.79	48.1	-0.3100	-0.01
5	11:56-12:17	57.84	57.8	0.0400	0.00
6	12:30-12:51	51.38	51.1	0.2800	0.01
7	13:01-13:22	49.55	49.1	0.4500	0.01
8	13:34-13:55	50.53	50.6	-0.0700	0.00
9	14:06-14:27	52.56	52.1	0.4600	0.01
10	14:40-15:01	53.52	53.5	0.0200	0.00
11	15:12-15:33	56.11	56.3	-0.1900	0.00
12				**#VALUE!**	**#VALUE!**
13				**#VALUE!**	**#VALUE!**
		53.079	53.01	0.068	0.001
		Sdev	0.2728		
		CC	0.2097		
	RA (based on Ref. Meth.)		**0.5%**		

*: Time stamp is according to Dow's clock. BTEC time is 10 minutes behind Dow.
i.e., 7:42 BTEC time = 7:32 Dow time
Note: Run 3 is omitted because Dow process monitoring recording went offline.

Confidence Coefficient =
n=9
t=2.306

$$CC = t_{0.975}\frac{S_d}{\sqrt{n}}$$

P.S. 2 Equation 2-5

Standard Deviation =

$$S_d = \left[\frac{\sum_{i=1}^{n} d_i^2 - \frac{\left(\sum_{i=1}^{n} d_i\right)^2}{n}}{n-1}\right]^{1/2}$$

P.S. 2 Equation 2-4

Relative Accuracy =
RM=Reference Monitor

$$RA = \frac{|\bar{d}| + |cc|}{RM} x100$$

P.S. 2 Equation 2-6

RA calculated as specified in Performance Specification 2, Appendix B, 40 CFR 60 - Equation 2-4

As specified in P.S. 2, subsection 8.4.4, three sets of test runs may be rejected, these rejected test runs are high-lighted in the table

Table 8
Throx Exhaust CO and VOC Emission Rates
Dow Corning
Midland, Michigan
BTEC Project No. 13-4462
Sampling Dates: November 21, 2013

Parameter	Run 1	Run 2	Run 3	Average
Test Run Date	11/21/2013	11/21/2013	11/21/2013	
Test Run Time	11:06-12:06	12:35-13:35	14:14-15:14	
Outlet Flowrate (dscfm)	11,692	11,920	11,769	**11,794**
Outlet Flowrate (scfm)	14,096	14,330	14,182	**14,202**
Outlet Carbon Monoxide Concentration (ppmv)	0.57	0.66	0.99	**0.74**
Outlet CO Concentration (ppmv, corrected as per USEPA 7E)	0.10	0.35	0.39	**0.28**
CO Emission Rate (lb/hr)	**0.03**	**0.03**	**0.05**	**0.04**
CO Emission Rate (lb/hr) (corrected as per USEPA 7E)	**0.01**	**0.02**	**0.02**	**0.01**
Outlet VOC Concentration (ppmv as propane)	1.20	0.21	0.24	**0.55**
Outlet VOC Concentration (ppmv, corrected as per USEPA 7E)	0.81	*0.00*	0.14	**0.32**
VOC Emission Rate as Propane (lb/hr)	**0.12**	**0.02**	**0.02**	**0.05**
VOC Emission Rate as Propane(lb/hr) (corrected as per USEPA 7E)	**0.08**	***0.00***	**0.01**	**0.03**

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

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

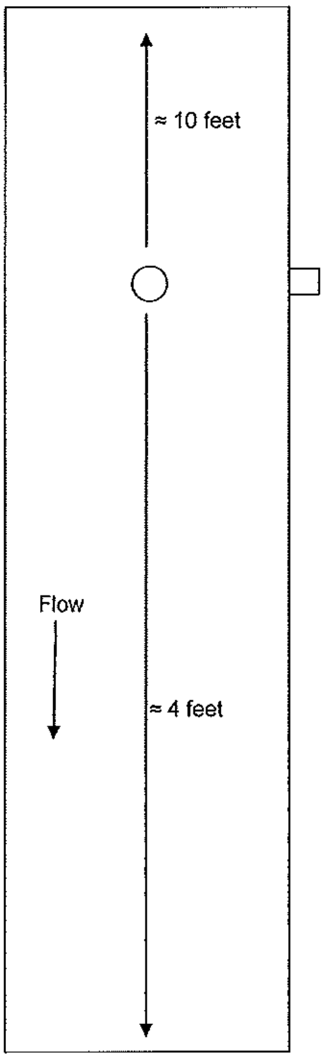
Table 3
Throx Inlet Particulate Matter Emission Rates

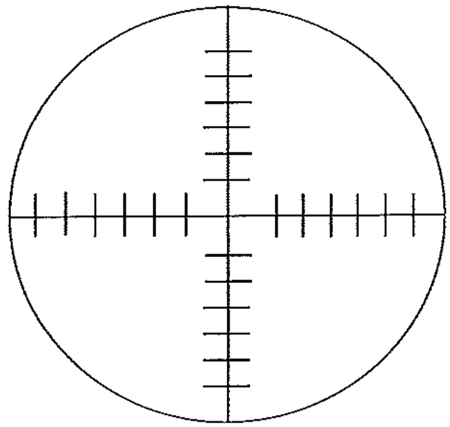
Company	**Dow**			
Source Designation	**Throx Inlet**			
Test Date	**11/21/2013**	**11/21/2013**	**11/21/2013**	
Meter/Nozzle Information	P-1	P-2	P-3	Average
Meter Temperature Tm (F)	56.6	62.0	63.3	60.6
Meter Pressure - Pm (in. Hg)	29.7	29.6	29.6	29.6
Measured Sample Volume (Vm)	32.8	18.3	17.3	22.8
Sample Volume (Vm-Std ft3)	33.6	18.5	17.4	23.2
Sample Volume (Vm-Std m3)	0.95	0.52	0.49	0.66
Condensate Volume (Vw-std)	8.624	4.889	4.291	5.935
Gas Density (Ps(std) lbs/ft3) (wet)	0.0688	0.0687	0.0690	0.0689
Gas Density (Ps(std) lbs/ft3) (dry)	0.0746	0.0746	0.0746	0.0746
Total weight of sampled gas (m g lbs) (wet)	2.91	1.61	1.50	2.00
Total weight of sampled gas (m g lbs) (dry)	2.51	1.38	1.30	1.73
Nozzle Size - An (sq. ft.)	0.000759	0.000346	0.000346	0.000484
Isokinetic Variation - I	94.6	101.7	101.8	99.4
Stack Data				
Average Stack Temperature - Ts (F)	146.8	145.3	145.3	145.8
Molecular Weight Stack Gas- dry (Md)	28.8	28.8	28.8	28.8
Molecular Weight Stack Gas-wet (Ms)	26.6	26.6	26.7	26.6
Stack Gas Specific Gravity (Gs)	0.920	0.918	0.922	0.920
Percent Moisture (Bws)	20.42	20.92	19.76	20.36
Water Vapor Volume (fraction)	0.2042	0.2092	0.1976	0.2036
Pressure - Ps ("Hg)	29.2	29.2	29.2	29.2
Average Stack Velocity -Vs (ft/sec)	19.3	21.7	20.1	20.3
Area of Stack (ft2)	12.6	12.6	12.6	12.6
Exhaust Gas Flowrate				
Flowrate ft^3(Actual)	14,515	16,325	15,158	15,333
Flowrate ft^3 (Standard Wet)	12,318	13,887	12,894	13,033
Flowrate ft^3 (Standard Dry)	9,803	10,982	10,346	10,377
Flowrate m^3 (standard dry)	278	311	293	294
Total Particulate Weights (mg)				
Total Nozzle/Probe/Filter	605.6	319.6	357.4	427.5
Organic Condensible Particulate	2.7	1.4	2.2	2.1
Inorganic Condensible Particulate	6.0	5.7	4.5	5.4
Condensible Blank Correction	2.0	2.0	2.0	2.0
Total Condensible Particulate	6.7	5.1	4.7	5.5
Total Filterable and Condensible Particulate	612.3	324.7	362.1	433.0
Filterable Particulate Concentration				
lb/1000 lb (wet)	0.459	0.439	0.526	0.475
lb/1000 lb (dry)	0.533	0.511	0.606	0.550
mg/dscm (dry)	636.2	610.6	724.4	657.0
gr/dscf	0.278	0.267	0.317	0.287
Filterable Particulate Emission Rate				
lb/ hr	23.45	25.21	28.18	25.61
Condensible Particulate Concentration				
lb/1000 lb (wet)	0.005	0.007	0.007	0.006
lb/1000 lb (dry)	0.006	0.008	0.008	0.007
mg/dscm (dry)	7.0	9.7	9.5	8.8
gr/dscf	0.003	0.004	0.004	0.004
Condensible Particulate Emission Rate				
lb/ hr	0.26	0.40	0.37	0.34
Total Particulate Concentration				
lb/1000 lb (wet)	0.464	0.446	0.533	0.481
lb/1000 lb (dry)	0.539	0.519	0.614	0.557
mg/dscm (dry)	643.2	620.3	733.9	665.8
gr/dscf	0.281	0.271	0.321	0.291
Total Particulate Emission Rate				
lb/ hr	23.71	25.61	28.55	25.96

Figures

BTEC Inc.

diameter = 48 inches





Not to Scale

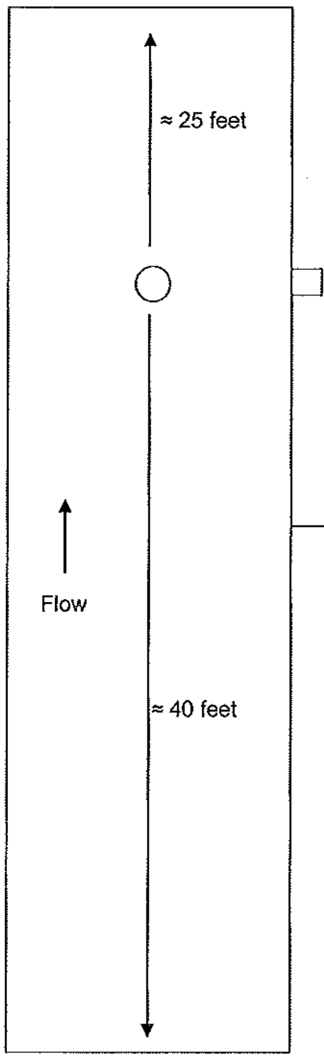
Points	Distance "
1	1.0
2	3.2
3	5.7
4	8.5
5	12.0
6	17.1
7	30.9
8	36.0
9	39.5
10	42.3
11	44.8
12	47.0

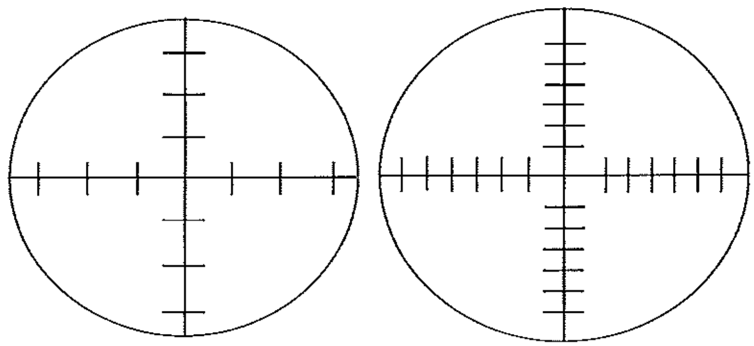
Figure No. 1

Site: THROX Inlet, Dow Corning, Midland, Michigan	**Sampling Date:** November 19-21, 2013	**BT Environmental Consulting, Inc.** 4949 Fernlee Avenue, Royal Oak, Michigan 48073

BTEC Inc.

diameter = 54 inches





Traverse points used for flow measurements

Traverse points used for PM measurements

Not to Scale

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

Points	Distance "
1	1.1
2	3.6
3	6.4
4	9.6
5	13.5
6	19.2
7	34.8
8	40.5
9	44.4
10	47.6
11	50.4
12	52.9

Figure No. 2

Site: THROX Exhaust, Dow Corning, Midland, Michigan	Sampling Date: November 19-21, 2013	BT Environmental Consulting, Inc., 4949 Fernlee Avenue, Royal Oak, Michigan 48073

Site:
THROX Exhaust
Dow Corning
Midland, Michigan

Sampling Date:
November 19-21, 2013

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

BTEC Inc.

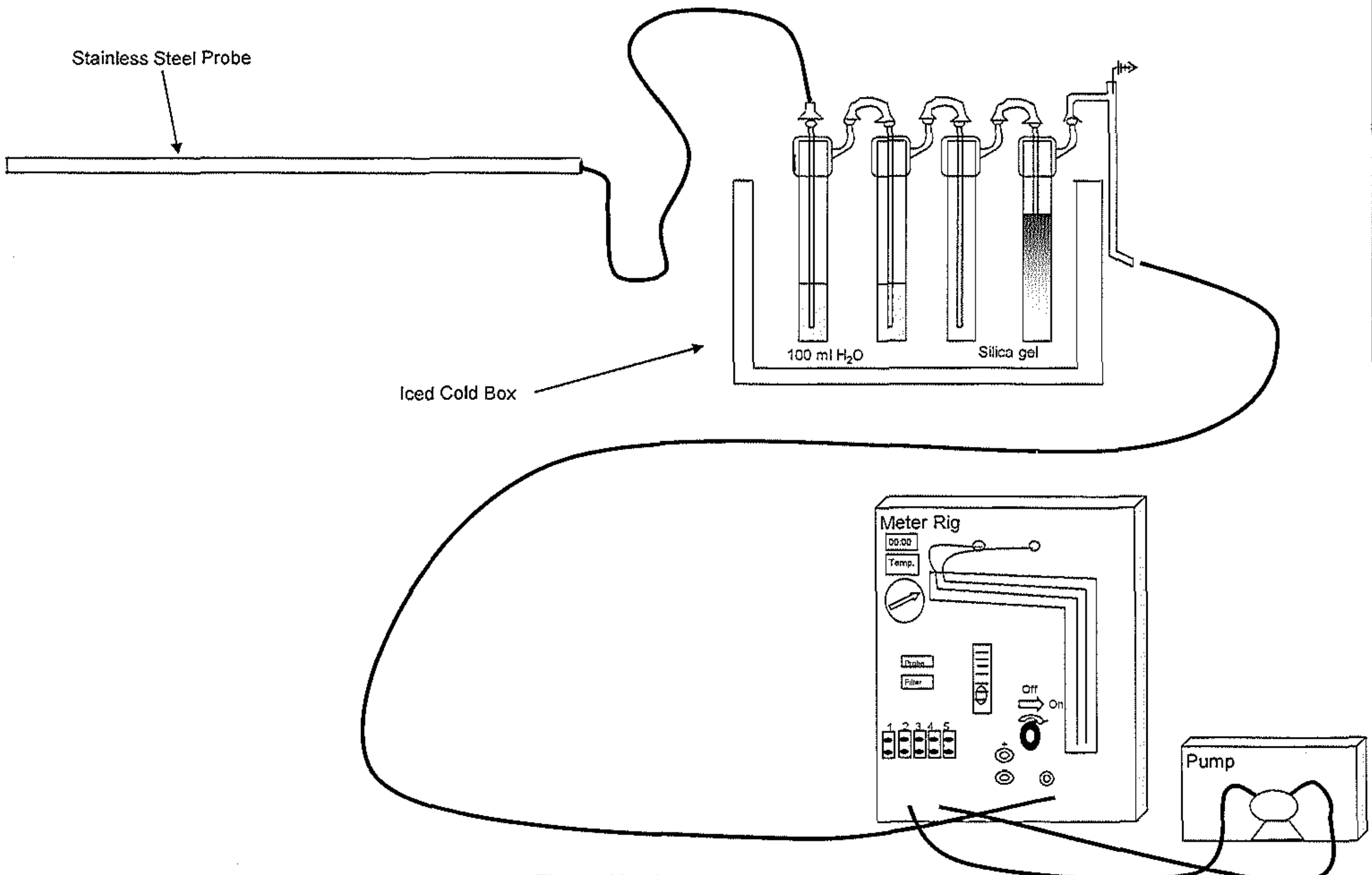


Figure No. 3

Site: **USEPA Method 4** **Dow Corning** **Midland, Michigan**	**Sampling Date:** **November 19, 2013**	**BT Environmental Consulting, Inc.** **4949 Fernlee Avenue** **Royal Oak, Michigan 48073**

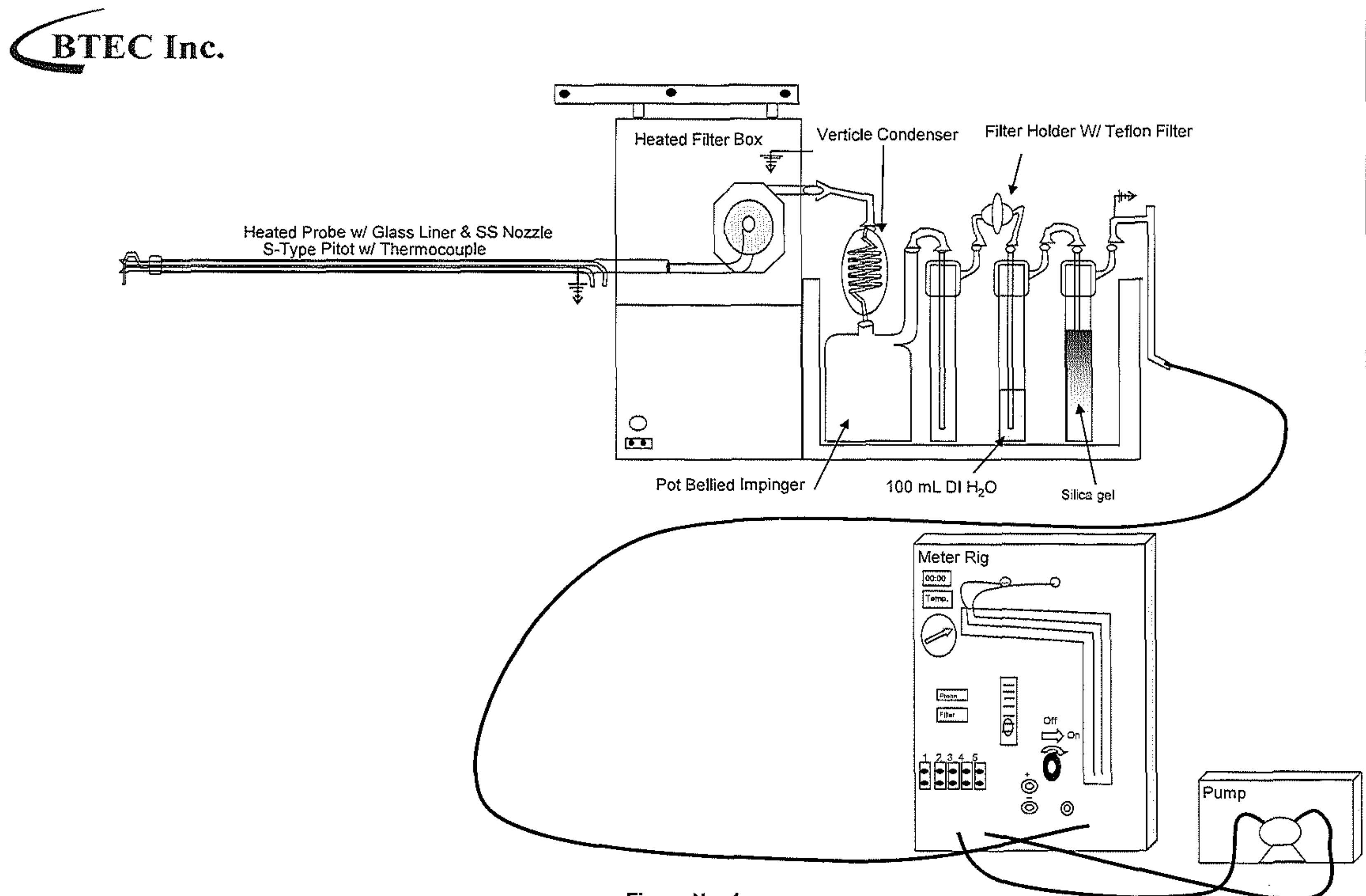


Figure No. 4

Site: **USEPA Method 5/202** **Dow Corning** **Midland, Michigan**	**Sampling Date:** **November 21, 2013**	**BT Environmental Consulting, Inc.** **4949 Fernlee Avenue** **Royal Oak, Michigan 48073**

BTEC Inc.

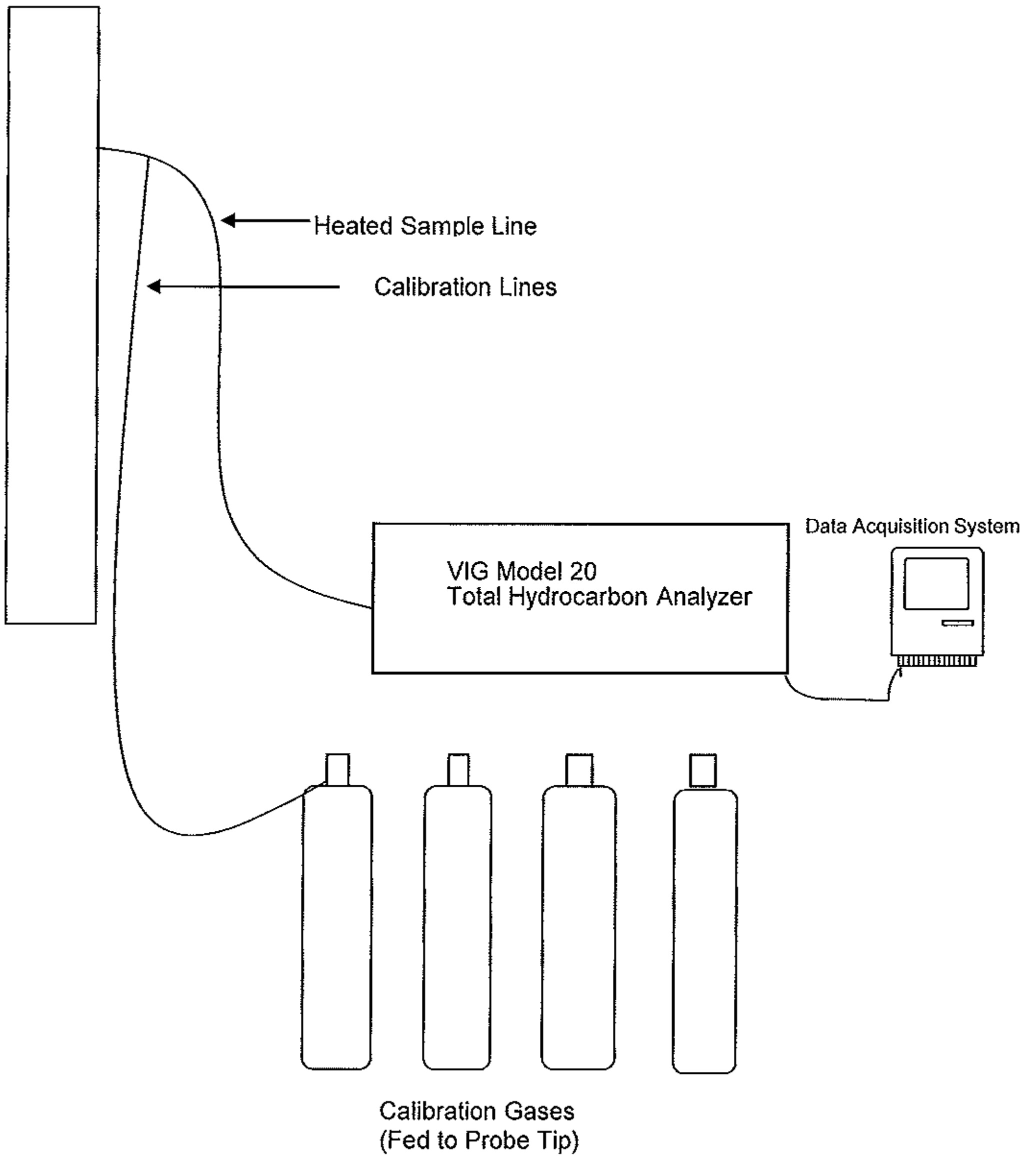


Figure No. 5

Site: **USEPA Method 25A** **Dow Corning** **Midland, Michigan**	**Sampling Date:** **November 21, 2013**	**BT Environmental Consulting, Inc.** **4949 Fernlee Avenue** **Royal Oak, Michigan 48073**

BTEC Inc.

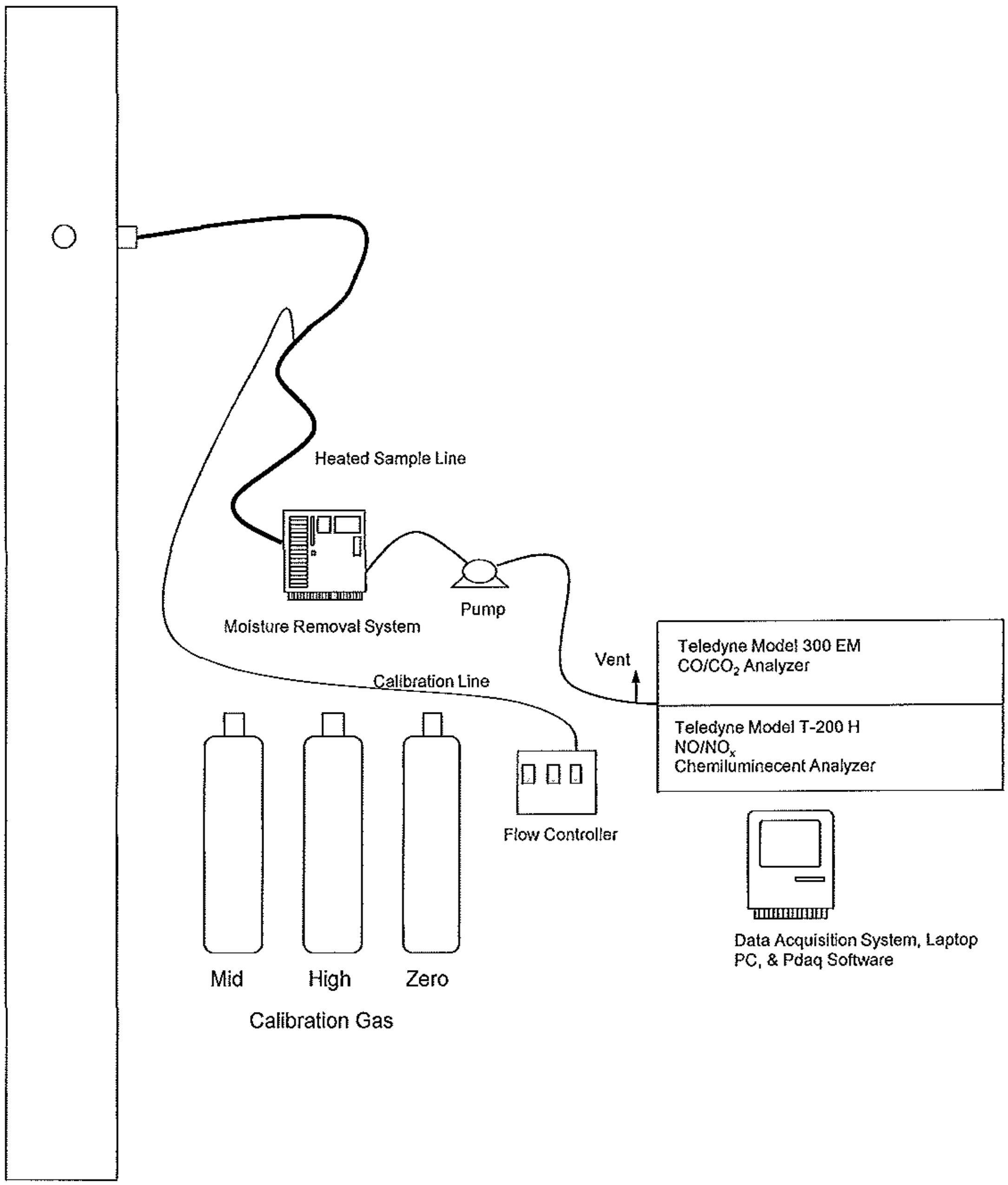


Figure No. 6

Site: **USEPA Method 3A,7E, and 10** **Dow Corning** **Midland, Michigan**	**Sampling Date:** **November 19-21, 2013**	**BT Environmental Consulting Inc.** **4949 Fernlee Avenue** **Royal Oak, MI 48073**