BTEC Inc.

Dearborn Industrial Generation
Emissions Test Report
PM_{10}, VOC, and CH_2O

Prepared for:

Dearborn Industrial Generation

Dearborn, MI

Dearborn Industrial Generation
2400 Miller Road
Dearborn, MI 48121

Project No. 17-5053.00
September 20, 2017

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EXECUTIVE SUMMARY

BT Environmental Consulting, Inc. (BTEC) was retained by Dearborn Industrial Generation LLC (DIG) to evaluate particulate matter with an aerodynamic diameter less than or equal to 10 microns (PM_{10}), volatile organic compounds (VOC), and formaldehyde (CH_2O) emission rates from 6 sources at the DIG facility located in Dearborn, Michigan. The sources tested included three boilers, two combined cycle turbines, and one simple cycle turbine. The boilers fired a mixture of blast furnace gas (BFG) and natural gas (NG) and are designated as EU-BOILER1 (Boiler 1100), EU-BOILER2 (Boiler 2100), and EU-BOILER3 (Boiler 3100). The two combined cycle turbines designated as EUCTG2 (Turbine 2100) and EUCTG3 (Turbine 3100) and simple cycle turbine EUCTG1 (Turbine 1100) fire NG only. The emissions testing was conducted on July 18th through July 27th, 2017.

The testing was performed to demonstrate compliance with Michigan Department of Environmental Quality (MDEQ) Permit No. MI-ROP-N6631-2012a and develop emission factors for ongoing source-wide calculation requirements.

The results of the emissions test program are summarized in Executive Summary Table E-1.

Table E-1
Overall Emission Rates Summary

Source	PM_{10} (lb/hr)	VOC (lb/hr)	CH_2O (lb/hr)
Boiler 1100	8.9	0.0	0.54
Boiler 2100	9.0	0.0	0.16
Boiler 3100	8.0	0.0	0.28
Turbine 1100	2.8	0.4	1.16
Turbine 2100	3.7	0.0	1.31
Turbine 3100	4.2	0.0	2.02

1. Introduction

BT Environmental Consulting, Inc. (BTEC) was retained by Dearborn Industrial Generation LLC (DIG) to evaluate particulate matter with an aerodynamic diameter less than or equal to 10 microns (PM_{10}), volatile organic compounds (VOC), and formaldehyde (CH2O) emission rates from 6 sources at the DIG facility located in Dearborn, Michigan. The sources tested included three boilers, two combined cycle turbines, and one simple cycle turbine. The boilers fired a mixture of blast furnace gas (BFG) and natural gas (NG) and are designated as EU-BOILER1 (Boiler 1100), EU-BOILER2 (Boiler 2100), and EU-BOILER3 (Boiler 3100). The two combined cycle turbines designated as EUCTG2 (Turbine 2100) and EUCTG3 (Turbine 3100) and simple cycle turbine EUCTG1 (Turbine 1100) fire NG only.

The testing was conducted on July 18th Through July 27th, 2017. BTEC personnel Todd Wessel, Paul Diven, Paul Molenda, Jake Zott, Mike Nummer and Josh Boulianne performed the testing. Mr. Paul Snoes of DIG provided onsite coordination for the test program. Mr. Dave Patterson with the MDEQ was onsite to witness a portion of the testing.

The testing was performed to demonstrate compliance with Michigan Department of Environmental Quality (MDEQ) Permit No. MI-ROP-N6631-2012a and develop emission factors for ongoing source-wide calculation requirements. The purpose of this report is to document the results of the emissions compliance test program.

The Air Quality Division (AQD) of Michigan's Department of Environmental Quality has published a guidance document entitled "Format for Submittal of Source Emission Test Plans and Reports" (December 2013). The following is a summary of the emissions test program and results in the format outlined by the AQD document.

1.a Identification, Location, and Dates of Test

Field sampling for the emissions compliance test program was conducted on July 18th through the 27th, 2017 at the DIG facility at 2400 Miller Road in Dearborn, Michigan. The emission test program included the evaluation of PM_{10}, VOC, and formaldehyde emissions from three boilers and three turbines.

1.b Purpose of Testing

AQD issued Permit No. MI-ROP-N6631-2012 to DIG on March 28, 2012 and issued revised version MI-ROP-N6631-2012a on June 28, 2016. This permit specifies the following limits:

Table 1
Emission Limits Summary

Source	Pollutant	Emission Limit
EUCTG1	VOC	2.8 lb/hr
	PM_{10}	9 lb/hr
EUCTG2; EUCTG3 (limits apply per unit)	VOC	2.8 lb/hr
	PM_{10}	9 lb/hr
EUBOILER1; EUBOILER2; EUBOILER3 (limits apply per unit)	VOC	7.5 lb/hr
	PM_{10}	22.3 lb/hr
FGPLANT	CH_2O	9.9 ton/yr (calculated on a 12-month rolling basis)

1.c Source Description

The DIG facility located in Dearborn, Michigan operates two combined-cycle turbines and one simple-cycle Turbine that fire natural gas (NG) and three boilers that are capable of firing a mixture of NG and blast furnace gas (BFG), or NG only.

1.d Test Program Contact

The contact for the source and test plan is:

Facility Contact:
Mr. Paul Snoes
Dearborn Industrial Generation, LLC
2400 Miller Rd.
Dearborn, MI 48120
(313) 336-7189

Testing Team Contact:
Mr. Barry Boulianne
Source Testing Manager
BT Environmental Consulting, Inc.
4949 Fernlee Avenue
Royal Oak, Michigan 48073
Phone (313) 449-2361

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
Mr. Paul Snoes Health & Safety Coordinator	Dearborn Industrial Generation LLC 2400 Miller Rd. Dearborn, MI 48120	(313) 336-7189
Mr. Todd Wessel Senior Client Project Manager	BTEC 4949 Fernlee Avenue Royal Oak, MI 48073	(616) 885-4013
Mr. Paul Diven Field Project Manager	BTEC 4949 Fernlee Avenue Royal Oak, MI 48073	(248) 548-8070
Mr. Paul Molenda Senior Field Technician	BTEC 4949 Fernlee Avenue Royal Oak, MI 48073	(248) 548-8070
Mr. Mike Nummer Field Technician	BTEC 4949 Fernlee Avenue Royal Oak, MI 48073	(248) 548-8070
Mr. Jake Zott Field Technician	BTEC 4949 Fernlee Avenue Royal Oak, MI 48073	(248) 548-8070
Mr. Josh Boulianne Field Technician	BTEC 4949 Fernlee Avenue Royal Oak, MI 48073	(248) 548-8070
Mr. David Patterson Air Quality Division, MDEQ	525 West Allegan (Constitution Hall, 1st Floor, South), P.O. Box 30242, Lansing, MI 48909-7742	(517) 284-6782

2. Summary of Results

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

2.a Operating Data

The following information was collected during the performance test and can be found in Appendix E.

1. Date, time, steam flow, MW
2. Natural gas flow (Turbines and Boilers)
3. Calculated F-Factors (Boilers)
4. Blast Furnace gas flow (Boilers)

2.b Applicable Permit

The applicable permit for this emissions test program is Permit No. MI-ROP-N6631-2012a

2.c Results

The overall results of the emissions compliance test program are summarized by Table 3 (see Section 5.a). Detailed results for each source are included as Tables 4-15.

2.d Emission Regulation Comparison

Emission limitations for DIG are summarized by Table 1.

3. Source Description

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

3.a Process Description

The DIG facility located in Dearborn, Michigan operates two combined-cycle turbines and one simple-cycle Turbine that fire natural gas (NG) and three boilers that are capable of firing a mixture of NG and blast furnace gas (BFG), or NG only.

The simple cycle turbine is nominally rated at an output capacity of approximately 170 Megawatts (MW) and 1,586 million British thermal unit per hour (MMBTU/hr) heat input, and the combined-cycle turbines are each nominally rated at an output capacity of approximately 179 MW and 1,626 MMBTU/hr heat input. The turbines use natural gas as a primary fuel. The turbine generator consists of a compressor, combustion turbine, and generator. Energy is generated at the combustion turbine by drawing in ambient air by means of burning fuel and expanding the hot combustion gases in a three-stage turbine. The hot exhaust gases from the combined-cycle combustion turbines are directed to a multi-pressure heat recovery steam generator (HRSG) to produce steam. Low-NO_x combustors minimize the emissions of nitrogen oxides from the turbines, while the emissions of CO and SO_2 are minimized by the efficient combustion of low sulfur bearing clean-burning fuels.

Each boiler is nominally rated at an output capacity of 500,000 pounds per hour of superheated steam at a minimum pressure of 1,350 psig and temperature of 960°F. The input capacity of the boilers while firing NG and BFG is 746 MMBTU/hr and 763 MMBTU/hr while burning natural gas only. The steam from the boilers is dispatched to a steam turbine for electrical generation and or utilized as process steam.

The boilers at DIG are designed to burn a mixture of BFG and NG or natural gas only. The BFG to NG ratio is approximately 95% BFG to 5% NG, based upon the heat inputs of the fuels.

3.b Raw and Finished Materials

The raw material supplied includes BFG and NG.

3.c Process Capacity

The simple cycle turbine is nominally rated at an output capacity of approximately 170 Megawatts (MW) and 1,586 million British thermal unit per hour (MMBTU/hr) heat input. The combined-cycle turbines are each nominally rated at an output capacity of approximately 179 MW and 1,626 MMBTU/hr heat input

Each boiler is nominally rated at an output capacity of 500,000 pounds per hour of superheated steam at a minimum pressure of 1,350 psig and temperature of 960°F. The input capacity of the boilers while firing NG and BFG is 746 MMBTU/hr and 763 MMBTU/hr while burning natural gas only.

3.d Process Instrumentation

The following information was collected during the performance test and can be found in Appendix E.

1. Date, time, steam flow, MW
2. Natural gas flow (Turbines and Boilers)
3. Calculated F-Factors (Boilers)
4. Blast Furnace gas flow (Boilers)

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.

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 (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 5 - "Determination of Particulate Matter Emissions from Stationary Sources"

- Method 25A - "Determination of total gaseous organic concentration using a flame ionization analyzer"
- Method 202 - "Dry Impinger Method for Determining Condensable Particulate Emissions from Stationary Sources"
- Method 320 - "Measurement of Vapor Phase Organic and Inorganic Emissions by Extractive Fourier Transform Infrared (FTIR) Spectroscopy"

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 total PM concentrations and calculate total PM emission rates (see Figure 1 for a schematic of the sampling train) for comparison to PM_{10} emission limits. Triplicate 240-minute test runs were conducted for each source (Boiler 1100, Boiler 2100, Boiler 3100, Turbine 1100, Turbine 2100 and Turbine 3100).

BTEC's Nutech® Model 2010 modular isokinetic stack sampling system consisted of (1) a stainless-steel nozzle, (2) a glass-lined 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 Ferndale, Michigan. DI water and organic samples were hand delivered to Bureau Veritas for analysis.

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 (see Figure 2 for a schematic of the sampling train). Triplicate 60-minute test runs were conducted on each source (Boiler 1100, Boiler 2100, Boiler 3100, Turbine 1100, Turbine 2100 and Turbine 3100).

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.

Formaldehyde concentrations were measured according to 40 CFR 63, Appendix A, Method 320. FTIR data was collected using a MKS MultiGas 2030 FTIR spectrometer, serial number 016252291. The sampling system consisted of: a 4 ft., 3/8 inch diameter, stainless steel probe; 2 - 100 ft., 3/8 inch diameter, Teflon heated transfer lines, maintained at 191°C; and a 0.01µ glass filter for particulate matter removal. The FTIR was equipped with a temperature-controlled, 5.11 meter multipass gas cell maintained at 191°C. Gas flows and sampling system pressures were monitored using a rotometer and pressure transducer. All data were collected at 0.5 cm-1 resolution. Each spectrum was derived from the coaddition of 64 scans, with a new data point generated approximately every one minute. Triplicate 60-minute test runs were performed on each source.

Direct FTIR measurements of N_2, acetaldehyde, SF_6, and ethylene gas standards were made at each test location to confirm concentrations

A calibration transfer standard (CTS), 100.0 ppm ethylene standard (Airgas Cylinder # CC124827) was analyzed before and after testing at each test location. The concentration determined for all CTS runs were within ± 5% of the certified value of the standard. The ethylene was passed through the entire system (system purge) to determine the sampling system response time and to ensure that the sampling system was leak-free at the stack location.

See the FTIR Report by Prism included in Appendix G for a more detailed explanation of the FTIR sampling train. See Figure 4 for a schematic of the sampling train

4.b Recovery and Analytical Procedures

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

4.c Sampling Ports

Sampling port and traverse point locations for the exhaust stacks are illustrated by Figures 5-7.

4.d Traverse Points

Sampling port and traverse point locations for the exhaust stacks are illustrated by Figures 5-7.

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
Overall Emission Rates Summary

Source	PM_{10} (lb/hr)	VOC (lb/hr)	CH_2O (lb/hr)
Boiler 1100	8.9	0.0	0.54
Boiler 2100	9.0	0.0	0.16
Boiler 3100	8.0	0.0	0.28
Turbine 1100	2.8	0.4	1.16
Turbine 2100	3.7	0.0	1.31
Turbine 3100	4.2	0.0	2.02

Detailed data for each test run can be found in Tables 4-15.

5.b Discussion of Results

Emission rates for PM_{10} and VOC were within the emission limits for the six (6) units. Results from CH_2O tests will be applied to emission calculations starting in August 2017, to demonstrate compliance with the FGPLANT 9.9 ton per year (tpy) CH_2O rolling 12-month emission limit. Measured concentrations of CH_2O, measured in parts per million (ppm), remain relatively low (0.18 ppm to 0.64 ppm) compared to the Minimum Detectable Concentrations (MDC) (0.07 ppm to 0.33 ppm). We are in the process of evaluating and quantifying actual CH_2O emissions for comparison to the FGPLANT CH_2O annual limit

5.c Sampling Procedure Variations

Turbine 1100 stack is equipped with silencing baffles at the sample location. After deducting the area of the baffles the actual stack area is 247.75 ft^2. This stack area was used in all flow rate calculations. Furthermore the PM_{10} testing was modified due to the extreme heat (1,143 °F) of the exhaust gas and the accessibility of the testing ports. The terrane around the source is not level which causes the manlift to error. This in turn disables the lift and its features. BTEC had to rearrange the lift for access to each of the sampling ports. Given the testing duration and the time it takes to access the testing ports a modification was requested to test one side of the turbine for each test run. For test Runs 1 and 3 the sampling was conducted on using the ports on the south side of the stack, and for test Run 2 the sampling was conducted using the ports on the north side of the stack. This variation was discussed and approved on site by Mr. David Patterson of the MDEQ.

5.d Process or Control Device Upsets

No upset conditions occurred during testing.

5.e Control Device Maintenance

No control device maintenance was performed during the testing.

5.f Audit Sample Analyses

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

5.g Calibration Sheets

All relevant equipment calibration documents are provided as Appendix B.

5.h Sample Calculations

Sample calculations are provided in Appendix C.

5.i Field Data Sheets

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

5.j Laboratory Data

Analytical results documents relevant to the emissions test program are provided in Appendix D.

Table 4
Boiler 1100 Particulate Matter Emission Rates

Company	**DIG**			
Source Designation	**Boiler 1**			
Test Date	**7/20/2017**	**7/20/2017**	**7/21/2017**	
Test Time	800-1258	1403-1823	803-1233	
Meter/Nozzle Information	Run 1	Run 2	Run 3	Average
Meter Temperature Tm (F)	86.1	89.8	86.7	87.5
Meter Pressure - Pm (in. Hg)	29.3	29.3	29.3	29.3
Measured Sample Volume (Vm)	175.5	182.0	171.2	176.2
Sample Volume (Vm-Std ft3)	166.1	171.1	161.8	166.4
Sample Volume (Vm-Std m3)	4.70	4.85	4.58	4.71
Condensate Volume (Vw-std)	19.077	19.553	20.421	19.684
Gas Density (Ps(std) lbs/ft3) (wet)	0.0785	0.0785	0.0781	0.0784
Gas Density (Ps(std) lbs/ft3) (dry)	0.0821	0.0821	0.0821	0.0821
Total weight of sampled gas (m g lbs) (wet)	14.53	14.96	14.24	14.58
Total weight of sampled gas (m g lbs) (dry)	13.64	14.05	13.29	13.66
Nozzle Size - An (sq. ft.)	0.000357	0.000357	0.000357	0.000357
Isokinetic Variation - I	99.2	99.7	100.4	99.7
Stack Data				
Average Stack Temperature - Ts (F)	263.5	265.3	265.7	264.8
Molecular Weight Stack Gas- dry (Md)	31.8	31.8	31.8	31.8
Molecular Weight Stack Gas-wet (Ms)	30.4	30.4	30.2	30.3
Stack Gas Specific Gravity (Gs)	1.048	1.048	1.044	1.047
Percent Moisture (Bws)	10.30	10.25	11.21	10.59
Water Vapor Volume (fraction)	0.1030	0.1025	0.1121	0.1059
Pressure - Ps ("Hg)	29.2	29.2	29.2	29.2
Average Stack Velocity -Vs (ft/sec)	51.0	52.4	49.7	51.1
Area of Stack (ft2)	86.5	86.5	86.5	86.5
Exhaust Gas Flowrate				
Flowrate ft^3/min (Actual)	264,906	272,061	258,336	265,101
Flowrate ft^3/min (Standard Wet)	188,395	193,006	183,169	188,190
Flowrate ft^3/min (Standard Dry)	168,990	173,215	162,643	168,282
Flowrate m^3/min (standard dry)	4,785	4,905	4,606	4,765
Total Particulate Weights (mg)				
Total Nozzle/Probe/Filter	53.2	43.1	27.7	41.3
Organic Condensible Particulate	6.1	2.3	< 1.0	3.1
Inorganic Condensible Particulate	21.0	29.0	18.0	22.7
Condensible Blank Correction	1.2	1.2	1.2	1.2
Total Condensible Particulate	25.9	30.1	17.8	24.6
Total Filterable and Condensible Particulate	79.1	73.2	45.5	65.9
Filterable Particulate Concentration				
lb/1000 lb (wet)	0.008	0.006	0.004	0.006
lb/1000 lb (dry)	0.009	0.007	0.005	0.007
mg/dscm (dry)	11.3	8.9	6.0	8.7
gr/dscf	0.0049	0.0039	0.0026	0.0038
Filterable Particulate Emission Rate				
lb/ hr	7.19	5.79	3.70	5.56
Condensible Particulate Concentration				
lb/1000 lb (wet)	0.004	0.004	0.003	0.004
lb/1000 lb (dry)	0.004	0.005	0.003	0.004
mg/dscm (dry)	5.5	6.2	3.9	5.2
gr/dscf	0.0024	0.0027	0.0017	0.0023
Condensible Particulate Emission Rate				
lb/ hr	3.50	4.05	2.38	3.31
Total Particulate Concentration				
lb/1000 lb (wet)	0.012	0.011	0.007	0.010
lb/1000 lb (dry)	0.013	0.011	0.008	0.011
mg/dscm (dry)	16.8	15.1	9.9	14.0
gr/dscf	0.0073	0.0066	0.0043	0.0061
Total Particulate Emission Rate				
lb/ hr	10.7	9.8	6.1	8.9

Table 5
Boiler 2100 Particulate Matter Emission Rates

Company	**DIG**			
Source Designation	**Boiler 2**			
Test Date	**7/24/2017**	**7/25/2017**	**7/25/2017**	
Test Time	1027-1448	718-1143	1210-1640	
Meter/Nozzle Information	Run 1	Run 2	Run 3	Average
Meter Temperature Tm (F)	81.6	83.8	85.6	83.7
Meter Pressure - Pm (in. Hg)	29.2	29.5	29.5	29.4
Measured Sample Volume (Vm)	180.4	179.1	151.3	170.2
Sample Volume (Vm-Std ft3)	171.3	171.4	144.2	162.3
Sample Volume (Vm-Std m3)	4.85	4.85	4.08	4.60
Condensate Volume (Vw-std)	18.719	17.776	12.273	16.256
Gas Density (Ps(std) lbs/ft3) (wet)	0.0784	0.0786	0.0791	0.0787
Gas Density (Ps(std) lbs/ft3) (dry)	0.0819	0.0819	0.0819	0.0819
Total weight of sampled gas (m g lbs) (wet)	14.90	14.86	12.38	14.05
Total weight of sampled gas (m g lbs) (dry)	14.03	14.04	11.81	13.29
Nozzle Size - An (sq. ft.)	0.000357	0.000357	0.000314	0.000343
Isokinetic Variation - I	99.4	98.5	97.8	98.6
Stack Data				
Average Stack Temperature - Ts (F)	250.3	251.2	253.3	251.6
Molecular Weight Stack Gas- dry (Md)	31.7	31.7	31.7	31.7
Molecular Weight Stack Gas-wet (Ms)	30.3	30.4	30.6	30.4
Stack Gas Specific Gravity (Gs)	1.047	1.050	1.057	1.051
Percent Moisture (Bws)	9.85	9.40	7.84	9.03
Water Vapor Volume (fraction)	0.0985	0.0940	0.0784	0.0903
Pressure - Ps ("Hg)	29.0	29.4	29.4	29.3
Average Stack Velocity -Vs (ft/sec)	51.5	51.2	48.7	50.5
Area of Stack (ft2)	86.5	86.5	86.5	86.5
Exhaust Gas Flowrate				
Flowrate ft^3/min (Actual)	267,530	265,771	252,714	262,005
Flowrate ft^3/min (Standard Wet)	192,976	193,702	183,637	190,105
Flowrate ft^3/min (Standard Dry)	173,970	175,504	169,233	172,902
Flowrate m^3/min (standard dry)	4,926	4,970	4,792	4,896
Total Particulate Weights (mg)				
Total Nozzle/Probe/Filter	47.5	25.2	29.3	34.0
Organic Condensible Particulate	1.2	1.3	1.4	1.3
Inorganic Condensible Particulate	29.0	41.0	19.0	29.7
Condensible Blank Correction	1.2	1.2	1.2	1.2
Total Condensible Particulate	29.0	41.1	19.2	29.8
Total Filterable and Condensible Particulate	76.5	66.3	48.5	63.8
Filterable Particulate Concentration				
lb/1000 lb (wet)	0.007	0.004	0.005	0.005
lb/1000 lb (dry)	0.007	0.004	0.005	0.006
mg/dscm (dry)	9.8	5.2	7.2	7.4
gr/dscf	0.0043	0.0023	0.0031	0.0032
Filterable Particulate Emission Rate				
lb/ hr	6.40	3.43	4.57	4.80
Condensible Particulate Concentration				
lb/1000 lb (wet)	0.004	0.006	0.003	0.005
lb/1000 lb (dry)	0.005	0.006	0.004	0.005
mg/dscm (dry)	6.0	8.5	4.7	6.4
gr/dscf	0.0026	0.0037	0.0021	0.0028
Condensible Particulate Emission Rate				
lb/ hr	3.91	5.59	2.99	4.16
Total Particulate Concentration				
lb/1000 lb (wet)	0.011	0.010	0.009	0.010
lb/1000 lb (dry)	0.012	0.010	0.009	0.010
mg/dscm (dry)	15.8	13.7	11.9	13.8
gr/dscf	0.0069	0.0060	0.0052	0.0060
Total Particulate Emission Rate				
lb/ hr	10.3	9.0	7.6	9.0

Table 6
Boiler 3100 Particulate Matter Emission Rates

Company	**DIG**			
Source Designation	**Boiler 3**			
Test Date	**7/26/2017**	**7/26/2017**	**7/27/2017**	
Test Time	738-1207	1241-1702	717-1138	
Meter/Nozzle Information	Run 1	Run 2	Run 3	Average
Meter Temperature Tm (F)	81.5	81.2	75.4	79.4
Meter Pressure - Pm (in. Hg)	29.5	29.5	29.5	29.5
Measured Sample Volume (Vm)	176.8	149.0	169.5	165.1
Sample Volume (Vm-Std ft3)	169.8	143.0	164.4	159.0
Sample Volume (Vm-Std m3)	4.81	4.05	4.65	4.50
Condensate Volume (Vw-std)	19.534	16.295	19.558	18.462
Gas Density (Ps(std) lbs/ft3) (wet)	0.0783	0.0783	0.0782	0.0783
Gas Density (Ps(std) lbs/ft3) (dry)	0.0819	0.0819	0.0819	0.0819
Total weight of sampled gas (m g lbs) (wet)	14.82	12.48	14.38	13.89
Total weight of sampled gas (m g lbs) (dry)	13.91	11.72	13.47	13.03
Nozzle Size - An (sq. ft.)	0.000357	0.000314	0.000357	0.000343
Isokinetic Variation - I	101.0	101.1	100.6	100.9
Stack Data				
Average Stack Temperature - Ts (F)	265.0	264.9	266.1	265.3
Molecular Weight Stack Gas- dry (Md)	31.7	31.7	31.7	31.7
Molecular Weight Stack Gas-wet (Ms)	30.3	30.3	30.2	30.3
Stack Gas Specific Gravity (Gs)	1.046	1.046	1.044	1.045
Percent Moisture (Bws)	10.32	10.23	10.63	10.39
Water Vapor Volume (fraction)	0.1032	0.1023	0.1063	0.1039
Pressure - Ps ("Hg)	29.3	29.3	29.3	29.3
Average Stack Velocity -Vs (ft/sec)	51.0	48.8	49.8	49.9
Area of Stack (ft2)	86.5	86.5	86.5	86.5
Exhaust Gas Flowrate				
Flowrate ft^3/min (Actual)	264,831	253,155	258,789	258,925
Flowrate ft^3/min (Standard Wet)	189,176	180,862	184,401	184,813
Flowrate ft^3/min (Standard Dry)	169,654	162,362	164,791	165,602
Flowrate m^3/min (standard dry)	4,804	4,598	4,666	4,689
Total Particulate Weights (mg)				
Total Nozzle/Probe/Filter	35.7	35.5	18.9	30.0
Organic Condensible Particulate	1.1	< 1.0	2.2	1.4
Inorganic Condensible Particulate	29.0	26.0	27.0	27.3
Condensible Blank Correction	1.2	1.2	1.2	1.2
Total Condensible Particulate	28.9	25.8	28.0	27.6
Total Filterable and Condensible Particulate	64.6	61.3	46.9	57.6
Filterable Particulate Concentration				
lb/1000 lb (wet)	0.005	0.006	0.003	0.005
lb/1000 lb (dry)	0.006	0.007	0.003	0.005
mg/dscm (dry)	7.4	8.8	4.1	6.8
gr/dscf	0.0032	0.0038	0.0018	0.0030
Filterable Particulate Emission Rate				
lb/ hr	4.74	5.35	2.52	4.20
Condensible Particulate Concentration				
lb/1000 lb (wet)	0.004	0.005	0.004	0.004
lb/1000 lb (dry)	0.005	0.005	0.005	0.005
mg/dscm (dry)	6.0	6.4	6.0	6.1
gr/dscf	0.0026	0.0028	0.0026	0.0027
Condensible Particulate Emission Rate				
lb/ hr	3.83	3.89	3.73	3.82
Total Particulate Concentration				
lb/1000 lb (wet)	0.010	0.011	0.007	0.009
lb/1000 lb (dry)	0.010	0.012	0.008	0.010
mg/dscm (dry)	13.4	15.1	10.1	12.9
gr/dscf	0.0059	0.0066	0.0044	0.0056
Total Particulate Emission Rate				
lb/ hr	8.6	9.2	6.2	8.0

Table 7
Turbine 1100 Particulate Matter Emission Rates

Company	**DIG/CMS**			
Source Designation	**T-1100**			
Test Date	**7/18/2017**	**7/18/2017**	**7/19/2017**	
Test Time	830-1319	1533-2022	745-1210	
Meter/Nozzle Information	Run 1	Run 2	Run 3	Average
Meter Temperature Tm (F)	86.1	94.5	85.0	88.5
Meter Pressure - Pm (in. Hg)	29.6	29.5	29.5	29.5
Measured Sample Volume (Vm)	178.8	142.3	191.0	170.7
Sample Volume (Vm-Std ft3)	173.3	135.7	185.4	164.8
Sample Volume (Vm-Std m3)	4.91	3.84	5.25	4.67
Condensate Volume (Vw-std)	16.767	13.796	18.271	16.278
Gas Density (Ps(std) lbs/ft3) (wet)	0.0730	0.0729	0.0730	0.0730
Gas Density (Ps(std) lbs/ft3) (dry)	0.0756	0.0756	0.0756	0.0756
Total weight of sampled gas (m g lbs) (wet)	13.88	10.89	14.86	13.21
Total weight of sampled gas (m g lbs) (dry)	13.10	10.25	14.01	12.45
Nozzle Size - An (sq. ft.)	0.000241	0.000241	0.000241	0.000241
Isokinetic Variation - I	99.3	99.8	99.1	99.4
Stack Data				
Average Stack Temperature - Ts (F)	1142.0	1144.3	1142.4	1142.9
Molecular Weight Stack Gas- dry (Md)	29.2	29.2	29.2	29.2
Molecular Weight Stack Gas-wet (Ms)	28.2	28.2	28.2	28.2
Stack Gas Specific Gravity (Gs)	0.975	0.974	0.975	0.975
Percent Moisture (Bws)	8.82	9.23	8.97	9.01
Water Vapor Volume (fraction)	0.0882	0.0923	0.0897	0.0901
Pressure - Ps ("Hg)	29.5	29.5	29.5	29.5
Average Stack Velocity -Vs (ft/sec)	170.1	133.3	182.9	162.1
Area of Stack (ft2)	247.75	247.75	247.75	247.8
Exhaust Gas Flowrate				
Flowrate ft^3/min (Actual)	2,529,198	1,981,433	2,718,143	2,409,592
Flowrate ft^3/min (Standard Wet)	821,863	642,921	881,799	782,194
Flowrate ft^3/min (Standard Dry)	749,366	583,574	802,690	711,877
Flowrate m^3/min (standard dry)	21,220	16,525	22,730	20,158
Total Particulate Weights (mg)				
Total Nozzle/Probe/Filter	1.5	< 0.5	< 0.5	0.8
Organic Condensible Particulate	< 1.0	< 1.0	1.4	1.1
Inorganic Condensible Particulate	2.9	6.2	3.3	4.1
Condensible Blank Correction	1.2	1.2	1.2	1.2
Total Condensible Particulate	2.7	6.0	3.5	4.1
Total Filterable and Condensible Particulate	4.2	6.5	4.0	4.9
Filterable Particulate Concentration				
lb/1000 lb (wet)	0.000	0.000	0.000	0.000
lb/1000 lb (dry)	0.000	0.000	0.000	0.000
mg/dscm (dry)	0.3	0.1	0.1	0.2
gr/dscf	0.0001	0.0001	0.0000	0.0001
Filterable Particulate Emission Rate				
lb/ hr	0.86	0.29	0.29	0.48
Condensible Particulate Concentration				
lb/1000 lb (wet)	0.000	0.001	0.001	0.001
lb/1000 lb (dry)	0.000	0.001	0.001	0.001
mg/dscm (dry)	0.6	1.6	0.7	0.9
gr/dscf	0.0002	0.0007	0.0003	0.0004
Condensible Particulate Emission Rate				
lb/ hr	1.55	3.43	2.01	2.33
Total Particulate Concentration				
lb/1000 lb (wet)	0.001	0.001	0.001	0.001
lb/1000 lb (dry)	0.001	0.001	0.001	0.001
mg/dscm (dry)	0.9	1.7	0.8	1.1
gr/dscf	0.0004	0.0007	0.0003	0.0005
Total Particulate Emission Rate				
lb/ hr	2.4	3.7	2.3	2.8

Table 8
Turbine 2100 Particulate Matter Emission Rates

Company	**DIG**			
Source Designation	**Turbine 2100**			
Test Date	**7/18/2017**	**7/18/2017**	**7/19/2017**	
Test Time	745-1210	1249-1712	741-1200	
Meter/Nozzle Information	Run 1	Run 2	Run 3	Average
Meter Temperature Tm (F)	81.6	90.7	81.3	84.5
Meter Pressure - Pm (in. Hg)	29.5	29.5	29.5	29.5
Measured Sample Volume (Vm)	187.0	193.5	191.8	190.8
Sample Volume (Vm-Std ft3)	179.6	182.9	184.2	182.3
Sample Volume (Vm-Std m3)	5.09	5.18	5.22	5.16
Condensate Volume (Vw-std)	17.926	17.573	18.205	17.901
Gas Density (Ps(std) lbs/ft3) (wet)	0.0728	0.0729	0.0729	0.0729
Gas Density (Ps(std) lbs/ft3) (dry)	0.0755	0.0755	0.0755	0.0755
Total weight of sampled gas (m g lbs) (wet)	14.39	14.62	14.75	14.59
Total weight of sampled gas (m g lbs) (dry)	13.56	13.80	13.91	13.76
Nozzle Size - An (sq. ft.)	0.000252	0.000252	0.000252	0.000252
Isokinetic Variation - I	101.1	99.8	100.1	100.3
Stack Data				
Average Stack Temperature - Ts (F)	210.6	210.2	210.3	210.3
Molecular Weight Stack Gas- dry (Md)	29.2	29.2	29.2	29.2
Molecular Weight Stack Gas-wet (Ms)	28.2	28.2	28.2	28.2
Stack Gas Specific Gravity (Gs)	0.973	0.974	0.974	0.974
Percent Moisture (Bws)	9.07	8.77	8.99	8.94
Water Vapor Volume (fraction)	0.0907	0.0877	0.0899	0.0894
Pressure - Ps ("Hg)	29.3	29.3	29.3	29.3
Average Stack Velocity -Vs (ft/sec)	69.7	71.6	72.2	71.2
Area of Stack (ft2)	240.4	240.4	240.4	240.4
Exhaust Gas Flowrate				
Flowrate ft^3/min (Actual)	1,006,083	1,032,872	1,041,034	1,026,663
Flowrate ft^3/min (Standard Wet)	776,754	797,907	803,241	792,634
Flowrate ft^3/min (Standard Dry)	706,274	727,965	731,011	721,750
Flowrate m^3/min (standard dry)	20,000	20,614	20,700	20,438
Total Particulate Weights (mg)				
Total Nozzle/Probe/Filter	2.1	3.0	2.5	2.5
Organic Condensible Particulate	1.6	1.3	1.5	1.5
Inorganic Condensible Particulate	4.4	4.6	3.7	4.2
Condensible Blank Correction	1.2	1.2	1.2	1.2
Total Condensible Particulate	4.8	4.7	4.0	4.5
Total Filterable and Condensible Particulate	6.9	7.7	6.5	7.0
Filterable Particulate Concentration				
lb/1000 lb (wet)	0.000	0.000	0.000	0.000
lb/1000 lb (dry)	0.000	0.000	0.000	0.000
mg/dscm (dry)	0.4	0.6	0.5	0.5
gr/dscf	0.0002	0.0003	0.0002	0.0002
Filterable Particulate Emission Rate				
lb/ hr	1.10	1.59	1.32	1.33
Condensible Particulate Concentration				
lb/1000 lb (wet)	0.001	0.001	0.001	0.001
lb/1000 lb (dry)	0.001	0.001	0.001	0.001
mg/dscm (dry)	0.9	0.9	0.8	0.9
gr/dscf	0.0004	0.0004	0.0003	0.0004
Condensible Particulate Emission Rate				
lb/ hr	2.51	2.48	2.11	2.37
Total Particulate Concentration				
lb/1000 lb (wet)	0.001	0.001	0.001	0.001
lb/1000 lb (dry)	0.001	0.001	0.001	0.001
mg/dscm (dry)	1.4	1.5	1.2	1.4
gr/dscf	0.0006	0.0006	0.0005	0.0006
Total Particulate Emission Rate				
lb/ hr	3.6	4.1	3.4	3.7

Table 9
Turbine 3100 Particulate Matter Emission Rates

Company	**DIG**			
Source Designation	**Turbine 3100**			
Test Date	**7/20/2017**	**7/20/2017**	**7/21/2017**	
Test Time	757-1218	1245-1701	753-1211	
Meter/Nozzle Information	Run 1	Run 2	Run 3	Average
Meter Temperature Tm (F)	87.5	90.5	84.7	87.6
Meter Pressure - Pm (in. Hg)	29.4	29.4	29.4	29.4
Measured Sample Volume (Vm)	204.5	194.8	192.0	197.1
Sample Volume (Vm-Std ft3)	193.8	183.2	182.7	186.6
Sample Volume (Vm-Std m3)	5.49	5.19	5.17	5.28
Condensate Volume (Vw-std)	19.775	18.389	22.382	20.182
Gas Density (Ps(std) lbs/ft3) (wet)	0.0728	0.0728	0.0723	0.0726
Gas Density (Ps(std) lbs/ft3) (dry)	0.0755	0.0755	0.0755	0.0755
Total weight of sampled gas (m g lbs) (wet)	15.55	14.68	14.83	15.02
Total weight of sampled gas (m g lbs) (dry)	14.63	13.83	13.79	14.08
Nozzle Size - An (sq. ft.)	0.000252	0.000252	0.000252	0.000252
Isokinetic Variation - I	101.0	101.1	102.0	101.4
Stack Data				
Average Stack Temperature - Ts (F)	321.8	321.8	321.9	321.8
Molecular Weight Stack Gas- dry (Md)	29.2	29.2	29.2	29.2
Molecular Weight Stack Gas-wet (Ms)	28.2	28.2	28.0	28.1
Stack Gas Specific Gravity (Gs)	0.972	0.973	0.966	0.971
Percent Moisture (Bws)	9.26	9.12	10.91	9.76
Water Vapor Volume (fraction)	0.0926	0.0912	0.1091	0.0976
Pressure - Ps ("Hg)	29.2	29.2	29.2	29.2
Average Stack Velocity -Vs (ft/sec)	88.4	83.4	84.0	85.2
Area of Stack (ft2)	240.4	240.4	240.4	240.4
Exhaust Gas Flowrate				
Flowrate ft^3/min (Actual)	1,274,398	1,203,032	1,211,546	1,229,659
Flowrate ft^3/min (Standard Wet)	840,605	792,361	798,746	810,571
Flowrate ft^3/min (Standard Dry)	762,784	720,094	711,569	731,483
Flowrate m^3/min (standard dry)	21,600	20,391	20,150	20,713
Total Particulate Weights (mg)				
Total Nozzle/Probe/Filter	7.3	4.0	2.5	4.6
Organic Condensible Particulate	1.4	< 1.0	1.1	1.2
Inorganic Condensible Particulate	3.2	3.5	3.7	3.5
Condensible Blank Correction	1.2	1.2	1.2	1.2
Total Condensible Particulate	3.4	3.3	3.6	3.4
Total Filterable and Condensible Particulate	10.7	7.3	6.1	8.0
Filterable Particulate Concentration				
lb/1000 lb (wet)	0.001	0.001	0.000	0.001
lb/1000 lb (dry)	0.001	0.001	0.000	0.001
mg/dscm (dry)	1.3	0.8	0.5	0.9
gr/dscf	0.0006	0.0003	0.0002	0.0004
Filterable Particulate Emission Rate				
lb/ hr	3.81	2.09	1.29	2.40
Condensible Particulate Concentration				
lb/1000 lb (wet)	0.000	0.000	0.001	0.001
lb/1000 lb (dry)	0.001	0.001	0.001	0.001
mg/dscm (dry)	0.6	0.6	0.7	0.7
gr/dscf	0.0003	0.0003	0.0003	0.0003
Condensible Particulate Emission Rate				
lb/ hr	1.78	1.72	1.86	1.79
Total Particulate Concentration				
lb/1000 lb (wet)	0.002	0.001	0.001	0.001
lb/1000 lb (dry)	0.002	0.001	0.001	0.001
mg/dscm (dry)	1.9	1.4	1.2	1.5
gr/dscf	0.0009	0.0006	0.0005	0.0007
Total Particulate Emission Rate				
lb/ hr	5.6	3.8	3.2	4.2

Table 10
Boiler 1100 VOC and Formaldehyde Emission Rates
Dearborn Industrial Generation
Dearborn, Michigan
BTEC Project No. 17-5053.00
Sampling Dates: July 21, 2017

Parameter	Run 1	Run 2	Run 3	Average
Test Run Date	7/21/2017	7/21/2017	7/21/2017	
Test Run Time	9:17-10:17	10:34-11:34	11:54-12:54	
Outlet Flowrate (scfm)	183,163	178,389	180,099	**180,550**
Formaldehyde Concentration (ppmv)	*0.56*	*0.65*	*0.72*	**0.64**
Formaldehyde Emission Rate (lb/hr)	**0.48**	**0.54**	**0.60**	**0.54**
Outlet VOC Concentration (ppmv as propane)	0.24	0.33	1.00	**0.52**
Outlet VOC Concentration (ppmv, corrected as per USEPA 7E)*	0.00	0.00	0.00	**0.00**
VOC Emission Rate as Propane(lb/hr) (corrected as per USEPA 7E)	**0.00**	**0.00**	**0.00**	**0.00**

VOC Correction			
Co	0.54	1.21	1.57
Cma	29.99	29.99	29.99
Cm	30.64	31.10	31.81

*:Drift correction resulted in negative VOC values for some runs. All negative results are displayed as zero.

scfm = standard cubic feet per minute
ppmv = parts per million on a volume-to-volume basis, wet
lb/hr = pounds per hour
MW = molecular weight (CH_2O = 30.03, 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

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

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

Table 11
Boiler 2100 VOC and Formaldehyde Emission Rates
Dearborn Industrial Generation
Dearborn, Michigan
BTEC Project No. 17-5053.00
Sampling Dates: July 24, 2017

Parameter	Run 1	Run 2	Run 3	Average
Test Run Date	7/24/2017	7/24/2017	7/24/2017	
Test Run Time	10:30-11:30	11:47-12:47	13:04-14:04	
Outlet Flowrate (scfm)	192,976	187,146	186,747	**188,956**
Formaldehyde Concentration (ppmv)	*0.20*	*0.17*	*0.16*	**0.18**
Formaldehyde Emission Rate (lb/hr)	**0.18**	**0.15**	**0.14**	**0.16**
Outlet VOC Concentration (ppmv as propane)	-0.10	0.10	-0.11	**-0.04**
Outlet VOC Concentration (ppmv, corrected as per USEPA 7E)*	0.00	0.00	0.00	**0.00**
VOC Emission Rate as Propane(lb/hr) (corrected as per USEPA 7E)	**0.00**	**0.00**	**0.00**	**0.00**

VOC Correction			
Co	0.32	0.61	0.64
Cma	29.99	29.99	29.99
Cm	30.69	30.60	30.40

*:Drift correction resulted in negative VOC values for some runs. All negative results are displayed as zero.

scfm = standard cubic feet per minute
ppmv = parts per million on a volume-to-volume basis, wet
lb/hr = pounds per hour
MW = molecular weight (CH_2O = 30.03, 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

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

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

Table 12
Boiler 3100 VOC and Formaldehyde Emission Rates
Dearborn Industrial Generation
Dearborn, Michigan
BTEC Project No. 17-5053.00
Sampling Dates: July 27, 2017

Parameter	Run 1	Run 2	Run 3	Average
Test Run Date	7/27/2017	7/27/2017	7/27/2017	
Test Run Time	8:49-9:49	10:06-11:06	11:20-12:20	
Outlet Flowrate (scfm)	184,401	186,406	190,118	**186,975**
Formaldehyde Concentration (ppmv)	*0.32*	*0.31*	*0.33*	**0.32**
Formaldehyde Emission Rate (lb/hr)	**0.27**	**0.27**	**0.29**	**0.28**
Outlet VOC Concentration (ppmv as propane)	-0.11	-0.28	-0.22	**-0.20**
Outlet VOC Concentration (ppmv, corrected as per USEPA 7E)*	0.00	0.00	0.00	**0.00**
VOC Emission Rate as Propane(lb/hr) (corrected as per USEPA 7E)	**0.00**	**0.00**	**0.00**	**0.00**

VOC Correction			
Co	-0.02	0.07	0.10
Cma	29.99	29.99	29.99
Cm	29.81	29.67	29.74

*:Drift correction resulted in negative VOC values for some runs. All negative results are displayed as zero.

scfm = standard cubic feet per minute
ppmv = parts per million on a volume-to-volume basis, wet
lb/hr = pounds per hour
MW = molecular weight (CH_2O = 30.03, 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

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

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

Table 13
Turbine 1100 VOC and Formaldehyde Emission Rates
Dearborn Industrial Generation
Dearborn, Michigan
BTEC Project No. 17-5053.00
Sampling Dates: July 18, 2017

Parameter	Run 1	Run 2	Run 3	Average
	Avg of PM R1 and R2	**Avg of PM R1 and R2**	**Flow 1**	
Test Run Date	7/18/2017	7/18/2017	7/18/2017	
Test Run Time	9:30-10:30	11:05-12:05	12:30-13:30	
Outlet Flowrate (scfm)	732,392	732,392	740,956	**735,247**
Formaldehyde Concentration (ppmv)	*0.35*	*0.34*	*0.33*	**0.34**
Formaldehyde Emission Rate (lb/hr)	**1.19**	**1.16**	**1.14**	**1.16**
Outlet VOC Concentration (ppmv as propane)	0.89	0.25	0.16	**0.43**
Outlet VOC Concentration (ppmv, corrected as per USEPA 7E)*	0.24	0.00	0.00	**0.08**
VOC Emission Rate as Propane(lb/hr) (corrected as per USEPA 7E)	**1.18**	**0.00**	**0.00**	**0.39**

VOC Correction			
Co	0.66	1.03	0.72
Cma	29.99	29.99	29.99
Cm	30.62	31.46	30.79

*:Drift correction resulted in negative VOC values for some runs. All negative results are displayed as zero.

scfm = standard cubic feet per minute
ppmv = parts per million on a volume-to-volume basis, wet
lb/hr = pounds per hour
MW = molecular weight (CH_2O = 30.03, 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

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

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

Table 14
Turbine 2100 VOC and Formaldehyde Emission Rates
Dearborn Industrial Generation
Dearborn, Michigan
BTEC Project No. 17-5053.00
Sampling Dates: July 19, 2017

Parameter	Run 1	Run 2	Run 3	Average
	Flow 1	Flow from PM R3	Flow 3	
Test Run Date	7/19/2017	7/19/2017	7/19/2017	
Test Run Time	9:12-10:12	10:33-11:33	11:52-12:52	
Outlet Flowrate (scfm)	800,484	803,241	778,600	**794,108**
Formaldehyde Concentration (ppmv)	*0.31*	*0.37*	*0.38*	**0.35**
Formaldehyde Emission Rate (lb/hr)	**1.16**	**1.38**	**1.38**	**1.31**
Outlet VOC Concentration (ppmv as propane)	0.20	-0.08	-0.23	**-0.04**
Outlet VOC Concentration (ppmv, corrected as per USEPA 7E)*	0.00	0.00	0.00	**0.00**
VOC Emission Rate as Propane(lb/hr) (corrected as per USEPA 7E)	**0.00**	**0.00**	**0.00**	**0.00**

VOC Correction			
Co	0.33	0.73	0.58
Cma	29.99	29.99	29.99
Cm	30.45	30.87	31.17

*:Drift correction resulted in negative VOC values for some runs. All negative results are displayed as zero.

scfm = standard cubic feet per minute
ppmv = parts per million on a volume-to-volume basis, wet
lb/hr = pounds per hour
MW = molecular weight (CH_2O = 30.03, 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

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

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

Table 15
Turbine 3100 VOC and Formaldehyde Emission Rates
Dearborn Industrial Generation
Dearborn, Michigan
BTEC Project No. 17-5053.00
Sampling Dates: July 20, 2017

Parameter	Run 1	Run 2	Run 3	Average
	Flow from PM R1	Flow from PM R2		
Test Run Date	7/20/2017	7/20/2017	7/20/2017	
Test Run Time	9:05-10:05	10:25-11:25	11:43-12:43	
Outlet Flowrate (scfm)	840,605	792,361	730,873	**787,946**
Formaldehyde Concentration (ppmv)	*0.56*	*0.58*	*0.51*	**0.55**
Formaldehyde Emission Rate (lb/hr)	**2.19**	**2.14**	**1.74**	**2.02**
Outlet VOC Concentration (ppmv as propane)	-0.10	-0.26	-0.53	**-0.30**
Outlet VOC Concentration (ppmv, corrected as per USEPA 7E)*	0.00	0.00	0.00	**0.00**
VOC Emission Rate as Propane(lb/hr) (corrected as per USEPA 7E)	**0.00**	**0.00**	**0.00**	**0.00**

VOC Correction			
Co	0.49	0.65	0.10
Cma	29.99	29.99	29.99
Cm	29.97	29.60	29.38

*:Drift correction resulted in negative VOC values for some runs. All negative results are displayed as zero.

scfm = standard cubic feet per minute
ppmv = parts per million on a volume-to-volume basis, wet
lb/hr = pounds per hour
MW = molecular weight (CH_2O = 30.03, 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

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

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

BTEC Inc.

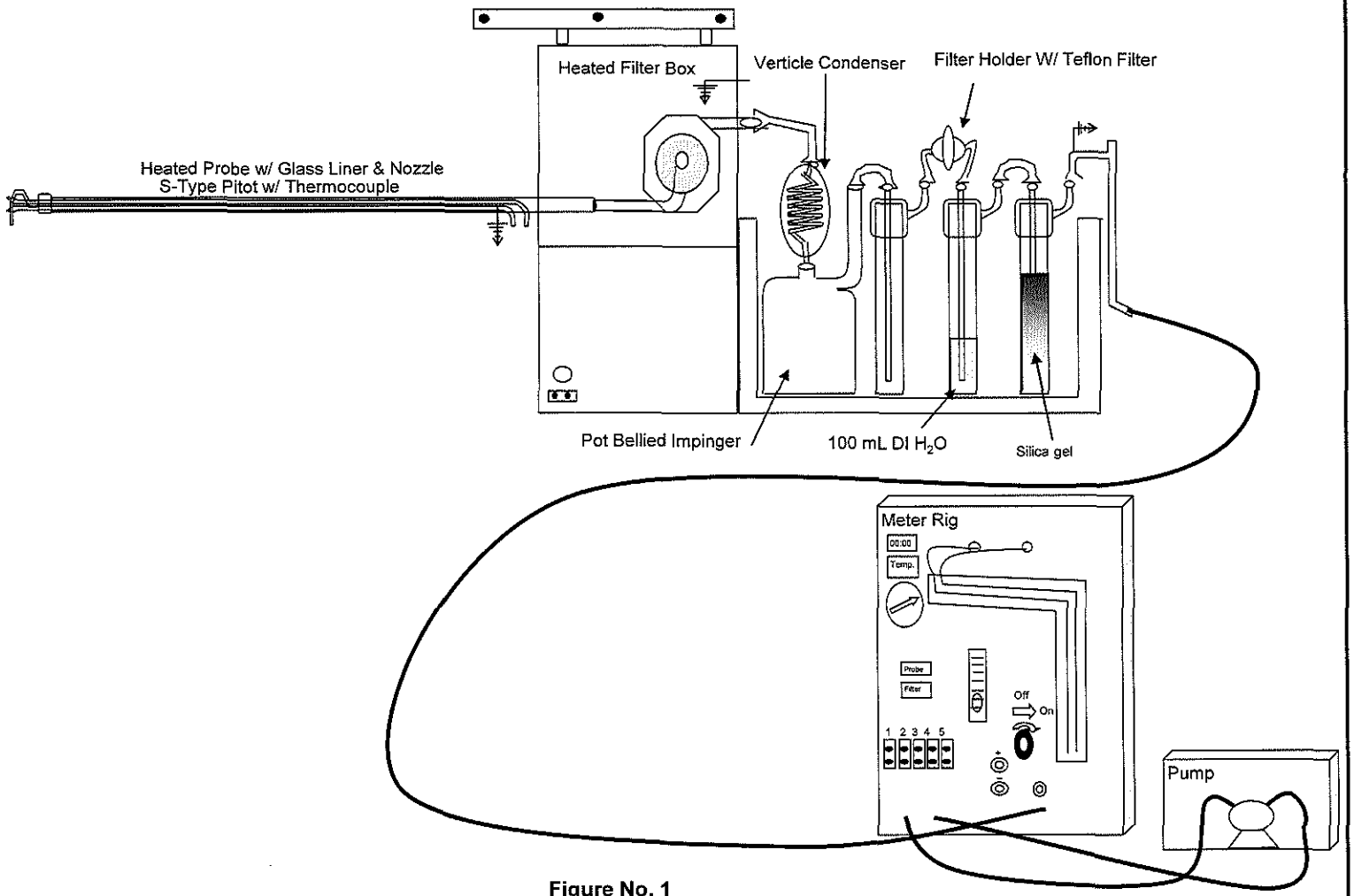


Figure No. 1

Site: **USEPA Method 5/202** **Dearborn Industrial Generation** **Dearborn, Michigan**	**Sampling Date:** **July 18-27, 2017**	**BT Environmental Consulting, Inc.** **4949 Fernlee Avenue** **Royal Oak, Michigan 48073**

BTEC Inc.

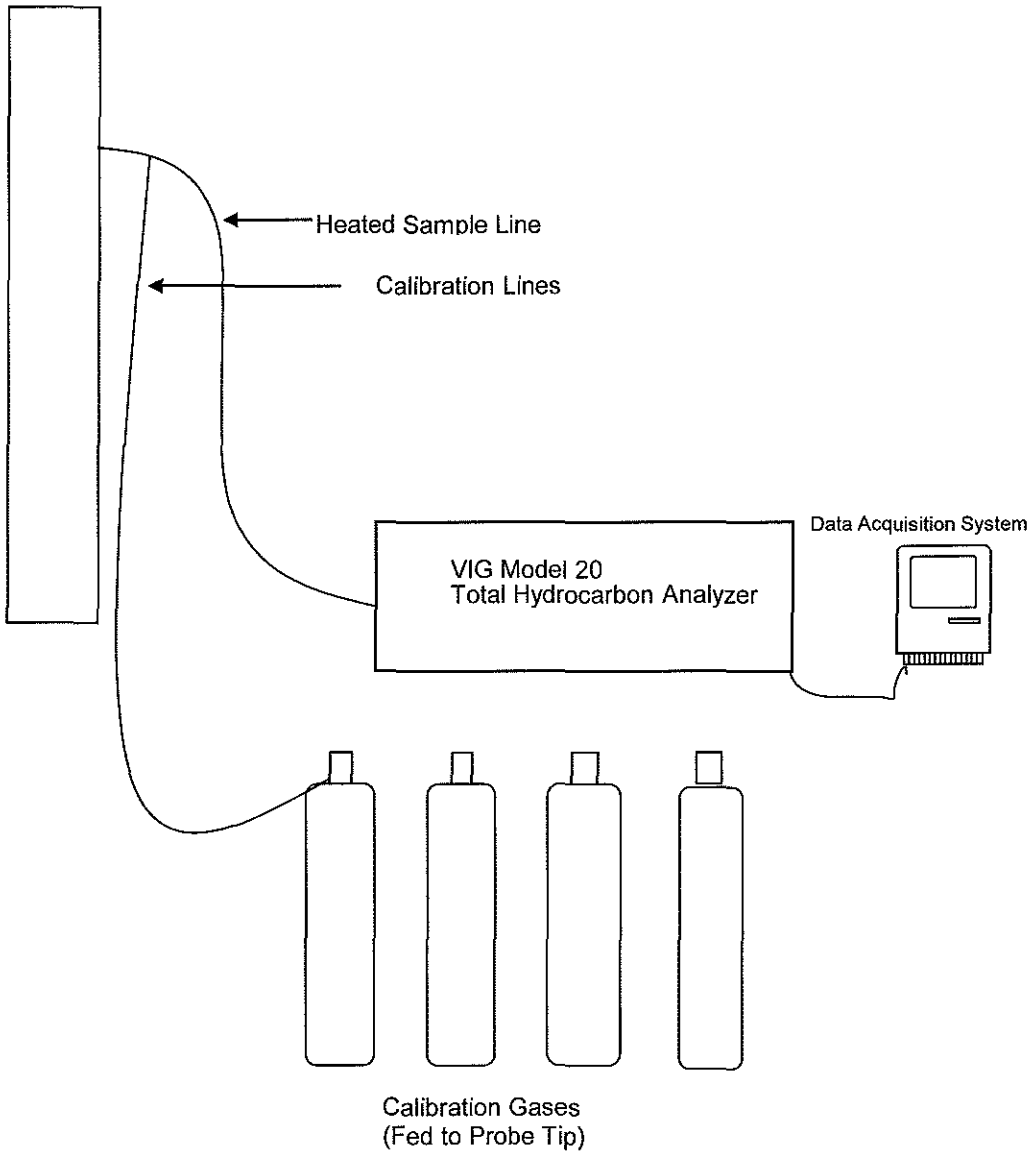


Figure No. 2

Site: **Sampling Date:** **USEPA Method 25A** **July 18-27, 2017** **Dearborn Industrial Generation** **Dearborn, Michigan**	**BT Environmental Consulting, Inc.** **4949 Fernlee Avenue** **Royal Oak, Michigan 48073**

BTEC Inc.

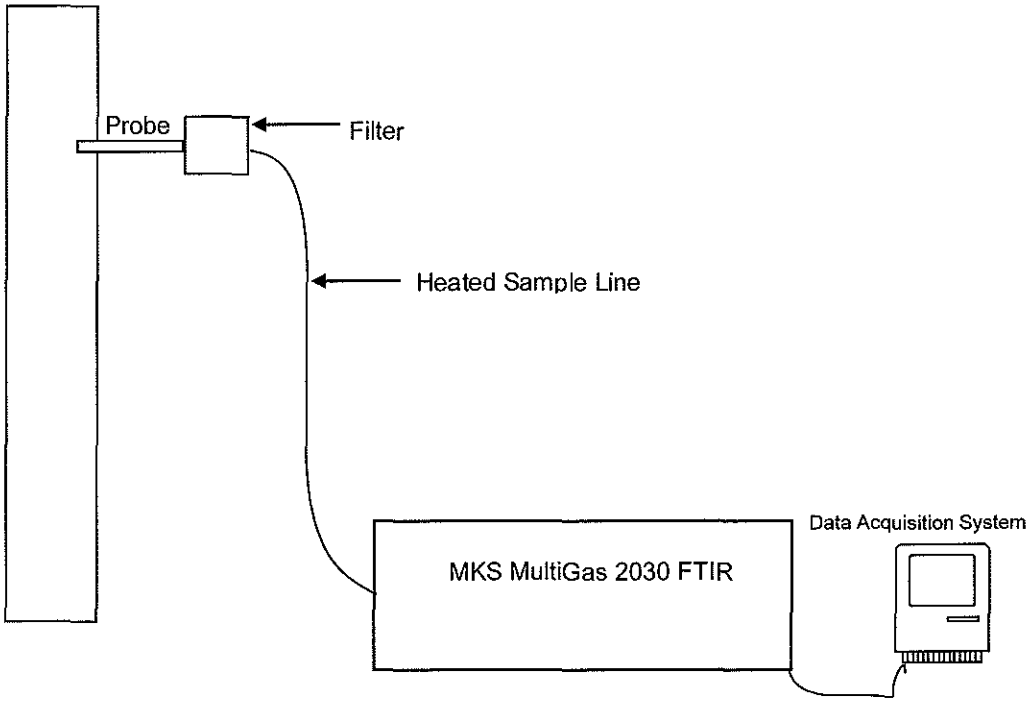
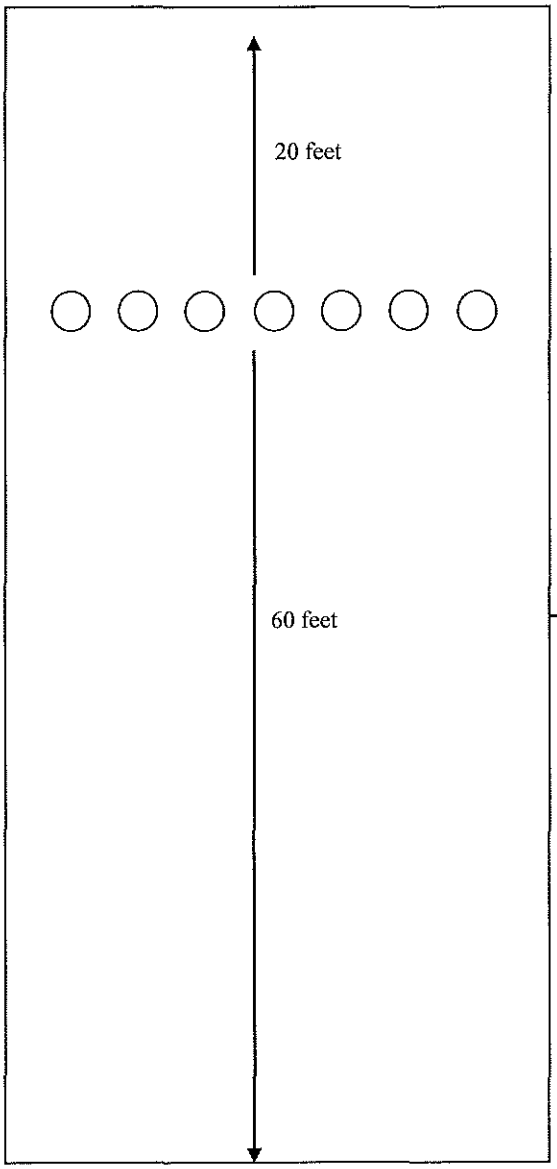


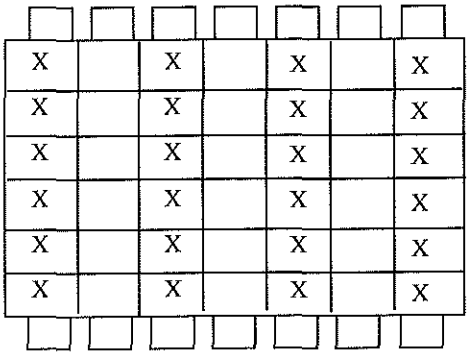
Figure No. 3

Site: **Sampling Date:** **USEPA Method 320** **August 18-27, 2017** **Dearborn Industrial Generation** **Dearborn, Michigan**	**BT Environmental Consulting, Inc.** **4949 Fernlee Avenue** **Royal Oak, Michigan 48073**

BTEC Inc.

Stack Dimensions: 19' Deep X 22' Wide





X = sample point

Not to Scale

Points	Distance "
1	19.0
2	57.0
3	95.0

Note: The stack is equipped with silencing baffles at the sample location. After deducting the area of the baffles the actual stack area is 247.75 ft^2
This stack area was used in all flow rate calculations.

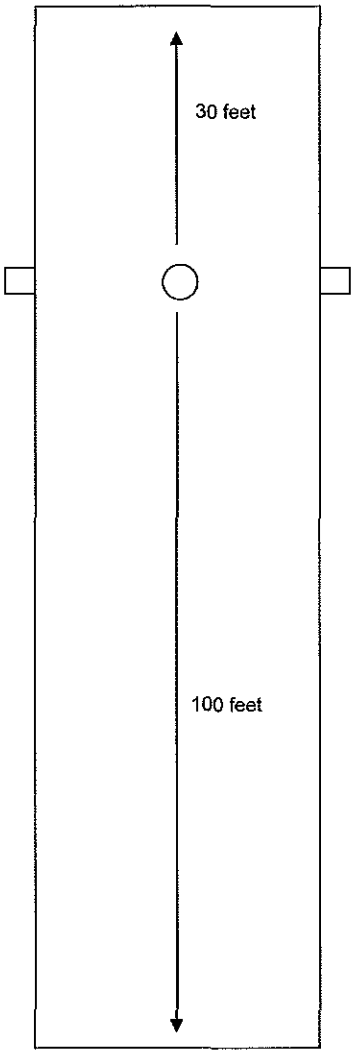
Figure No. 4

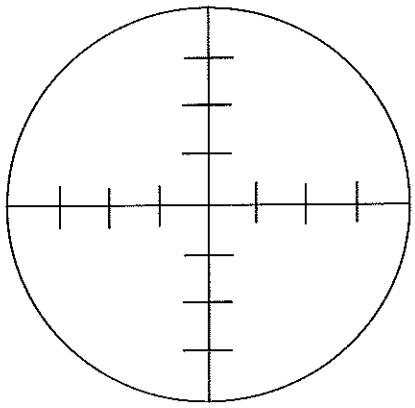
Site: **Turbine 1100 (EUCTG1)** **Dearborn Industrial Generation** **Dearborn, Michigan**	**Sampling Date:** **July 18-27, 2017**

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

BTEC Inc.

diameter = 210 inches





Not to Scale

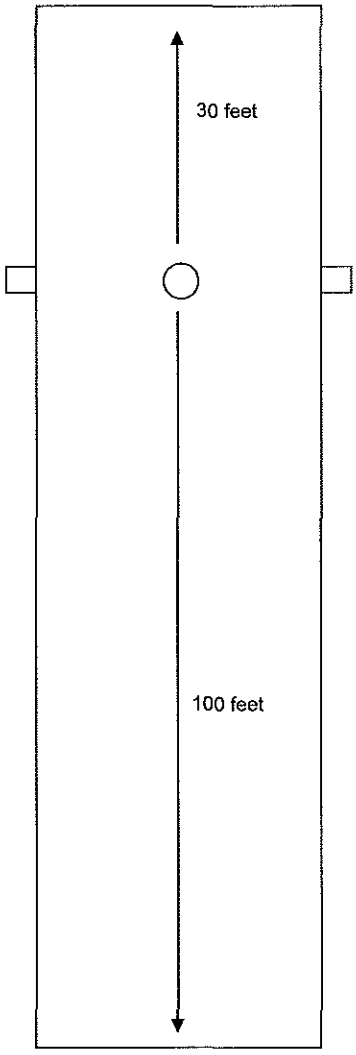
Points	Distance "
1	9.2
2	30.1
3	62.2

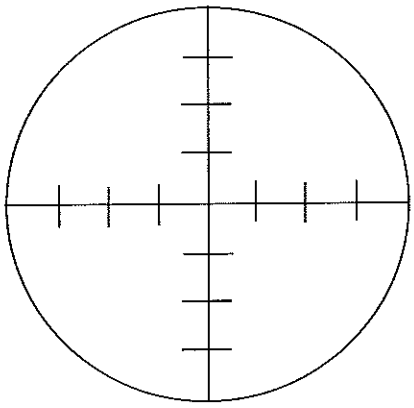
Figure No. 5

Site: **Turbine 2100 and 3100** **Dearborn Industrial Generation** **Dearborn, Michigan**	**Sampling Date:** **August 28-30, 2012**	**BT Environmental Consulting, Inc.** **4949 Fernlee Avenue** **Royal Oak, Michigan 48073**

BTEC Inc.

diameter = 126 inches





Not to Scale

Points	Distance "
1	5.5
2	18.4
3	37.3

Figure No. 6

Site: **Boilers 1100, 2100, and 3100** **Dearborn Industrial Generation** **Dearborn, Michigan**	**Sampling Date:** **August 27-30, 2012**	**BT Environmental Consulting, Inc.** **4949 Fernlee Avenue** **Royal Oak, Michigan 48073**