BTEC Inc.

Boilers 6 & 7 Particulate Matter, Carbon Monoxide, and NOx PEMS RATA Test Report

Prepared for:

Detroit Thermal, LLC

Detroit, Michigan

Detroit Thermal, LLC
541 Madison Ave
Detroit, MI 48226

Project No. 15-4739.00
November 2, 2015

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MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY
AIR QUALITY DIVISION

RENEWABLE OPERATING PERMIT REPORT CERTIFICATION

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

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

Source Name: Detroit Thermal Beacon Heating Plant — County: Wayne

Source Address: 541 Madison Ave — City: Detroit

AQD Source ID (SRN): B2814 — ROP No.: 82814-2014 — ROP Section No.: FG Boiler 6,7

Please check the appropriate box(es):

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

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

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

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

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

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

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

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

☑ **Other Report Certification**

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

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

(R 336.2001, R 336.2003, R 336.2004, R336.1213(3), 40 CFR 60.49b(c)(3))

Boiler 6 & 7 Particulate Matter, Carbon Monoxide and NOx PEMS RATA Testing Report

I certify that, based on information and belief formed after reasonable inquiry, the statements and information in this report and the supporting enclosures are true, accurate and complete

Linwood Bubar	President	313-963-3844
Name of Responsible Official (print or type)	Title	Phone Number
[signature]		11-20-15
Signature of Responsible Official		Date

* Photocopy this form as needed.

EQP 5736 (Rev 11-04)

Executive Summary

BT Environmental Consulting, Inc. (BTEC) was retained by Detroit Thermal L.L.C. (Detroit Thermal) to evaluate oxides of nitrogen (NO_x), carbon monoxide (CO) and PM_{10} particulate on the two boilers No's 6 and 7 (EUBOILER6 & EUBOILER7) at the Detroit Thermal facility located in Detroit, Michigan. Detroit Thermal is required by Michigan Renewable Operating Permit Number: MI-ROP-B2814-2014 to perform annual relative accuracy test audits (RATA's) on the predictive emissions monitoring systems (PEMS) installed on Boilers 6 & 7. In addition, every five years the CO and PM_{10} particulate mass emissions rates shall be determined. The boilers fired natural gas (NG) and are designated as Boiler 6 and Boiler 7. The testing on Boiler 6 and Boiler 7 was conducted on September 12, 2015 and September 26, 2015, respectively.

The testing was performed to demonstrate compliance with Michigan Department of Environmental Quality (MDEQ) Permit to Install No.140-12A and MI-ROP-B2814-2014 and in accordance with Appendix A, 40 CFR, Part 60, subpart Db, U.S. EPA Reference Methods 1-5, 3A, 7E, 10, and 202 found in 40 CFR, Part 60, Appendix A and Performance Specifications (PS) 2, 3 and 16 stipulated in 40 CFR, Part 60, Appendix B. The testing on the boilers consisted of triplicate 120- minute test runs for PM_{10}, triplicate 63-minute runs for NOx and CO, and twelve test runs (minimum sample time of 21-minutes) at a normal load (50%) while combusting pipeline natural gas.

The results of the emissions test program are summarized in the following Executive Summary Tables.

Table E-1a
NOx Lb/MMBtu PEMS RATA Results
Test Dates: September 12 and 26, 2015

Source Name	RM NOx Lb/MMBtu	PEMS NOx Lb/MMBtu	% Relative Accuracy	40 CFR Part 60 % Relative Accuracy Limit
Boiler 6	0.024	0.024	6.1	20
Boiler 7	0.021	0.024	13.7	20

Table E-1b
NOx, CO, and PM_{10} Results
Test Dates: September 12 and 26, 2015

Source Name	Pollutant	Emission Rate	Emission Limit
Boiler 6	NOx	0.0239 lb/MMBtu	0.036 lb/MMBtu
	CO	0.0014 lb/MMBtu	0.073 lb/MMBtu
		0.1 lb/hr	84.6 lb/hr
	PM_{10}	0.0033 lb/MMBtu	0.007 lb/MMBtu
Boiler 7	NOx	0.0213 lb/MMBtu	0.036 lb/MMBtu
	CO	0.0111 lb/MMBtu	0.073 lb/MMBtu
		1.7 lb/hr	84.6 lb/hr
	PM_{10}	0.0020 lb/MMBtu	0.007 lb/MMBtu

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1.0 Introduction

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The testing was conducted on September 12 and 26, 2015. BTEC personnel Todd Wessel, Paul Molenda, Shane Rabideau, and John Mason performed the testing. Marcus Ellis of Detroit Renewable Power and Bryan Bush with CMC Solutions LLC assisted the study by coordinating process test times and gathering PEMS data. Mr. Tom Maza of the Michigan Department of Environmental Quality (MDEQ) witnessed portions of the testing.

2.0 Process Description

The DT facility located in Detroit, Michigan operates two NG fired boilers. Each boiler has the input capacity of 180.2 MMBtu/hr while firing natural gas (NG). The steam from the boilers is dispatched to the Detroit network for electrical generation. Low-NOx combustors minimize the emissions of nitrogen oxides from the boilers.

2.1 Predictive Emissions Monitoring System (PEMS) Description

The SmartCEMS™ -60 Predictive Emission Monitoring System (PEMS) provides continuous data recording and report generation for compliance with 40 CFR Part 60 regulations. The data acquisition system provides a secure and reliable means of collecting and retrieving compliance data. This application has been customized to meet the requirements of gas-fired boiler under 40 CFR Part 60, Subpart Da; and as a predictive emissions monitoring system (PEMS), an alternative to continuous emissions monitoring under 40 CFR Part 60, Draft Performance Specifications for Predicitve

Emissions Monitoring Systems (PEMS) (PS-16) "Example Specifications and Test Procedures for Predicitve Emission Monitoring Systems".

SmartCEMS™-60 was designed to operate on a personal computer with a standard interface to the boiler and a relational database such as the one provided with the CMC Solutions supplied data acquisition systems such as Process Analytical Inc. Cirrus™ system installed at DT. The application itself actually consists of two independent databases and three configurable application modules. The first database is secured and contains only data (both raw collected data that is not editable and historical data formatted as specified by the applicable regulations) as well as a compliance message archive with operator comments. The second database contains compliance reporting data including collections statuses, summarized and calculated fields, and formatted electronic data reports (EDR) components.

The first application is the data acquisition module that runs on startup of the system and collects the data continuously providing compliance emissions data for reporting purposes. There are two other independent SmartCEMS™ components that work with the data acquisition service. The second application provides the operator interface for display of real-time data, display and acknowledgement of compliance alarms, and input of operator data including gas sampling results and certification test results. The third application provides the reporting and EDR generation capacities. Both of these applications support the operator and interface with the data and the data acquisition services and can be run from any workstation on the local area network providing information on the compliance status of the units in real-time. The following Serial Numbers apply to the SmartCEMS™-60 Analyzers at DT:

Unit	Model	Serial Number
Boiler 6	SmartCEM-60™ Analyzer	BL6.9999.
Boiler 7	SmartCEM-60™ Analyzer	BL7.10054.

Boiler process data includes steam generation, NG fuel flow. The Boiler process data can be found in Appendix B.

3.0 Sampling and Analytical Methodologies

Sampling and analytical methodologies are summarized in Sections 3.1 through 3.5. A Schematic drawing of BTEC's continuous emissions monitoring system is presented as Figure 2. A Schematic drawing of BTEC's PM_{10} sampling system is presented as Figure 3. Traverse point locations for the Boilers are illustrated in Figure 1.

3.1 Continuous Emissions Monitoring

Measurement of exhaust gas concentrations was conducted utilizing the following reference test methods codified at 40 CFR 60, Appendix A:

- Method 3A- Determinations of Oxygen and Carbon Dioxide Concentrations in Emissions From Stationary Sources;
- Method 7E - Determination of Nitrogen Oxides Emissions From Stationary Sources;
- Method 10 - Determination of Carbon Monoxide Emissions From Stationary Sources;
- Performance Specification 2 – Specifications and Test Procedures for SO_2 and NO_x Continuous Emission Monitoring Systems in Stationary Sources;
- Performance Specification 3 – Specifications and Test Procedures for O_2 and CO_2 Continuous Emission Monitoring Systems in Stationary Sources;
- Performance Specification 16 – For Predictive Emissions Monitoring Systems and Amendments to Testing and Monitoring Provisions;

BTEC's extractive monitors require that the effluent gas sample be conditioned to eliminate any possible interference (i.e., water vapor and/or particulate matter) before being transported and injected into each analyzer. All components of the sampling system that contact the sample were constructed of Type 316 stainless steel, Pyrex glass or Teflon®. The output signal from each monitor was recorded at 10-second intervals on a PC equipped with Labview® II data acquisition software (DAS). The samples were extracted from the stack using a stainless steel probe assembly, heated sample line, stack gas conditioner with a Teflon diaphragm pump and routed through a distribution manifold for delivery to the analyzers. The configuration of the sampling system allowed for the injection of calibration gases directly to the analyzers or through the sampling system. All monitors in use were calibrated with U.S. EPA Protocol No. 1 calibration gases and operated to insure that zero drift, calibration gas drift, and calibration error met the specified method requirements. Copies of the Protocol gas certificates can be found in Appendix B.

The sample gas was extracted at three points through a stainless steel probe positioned at approximately 16.7%, 50% and 83.3% of the sample stream diameter as described by 40 CFR Part 60, Appendix B Performance Specification 2 Section 8.1.3.2 and illustrated in Figure 2. Twelve 21-minute test runs were conducted on each monitor at normal load, with the best nine runs used to calculate the relative accuracy (RA). A diagram of the reference monitoring system is illustrated in Figure 2.

The boiler NO_X concentrations were measured in parts per million (ppm), converted to an emission rate and reported as Lb/MMBtu, using equation 19-1 of U.S. EPA Method 19 of Appendix A, 40 CFR 60. Oxygen concentrations are reported in percent (%).

3.2 Oxygen (USEPA Method 3A)

A M&C PMA 100L non-dispersive infra-red (NDIR) analyzer was used to measure O_2 concentrations following the guidelines of U.S. EPA Method 3A, "Determination of Oxygen and Carbon Dioxide Concentrations in Emissions from a Stationary Source (Instrumental Analyzer Procedure)", in conjunction with Performance Specification No. 2 of Appendix B, 40 CFR 60. The analyzer was set at 25% instrument span and calibrated before the RATA with zero nitrogen and high range USEPA Protocol 1 span gas (80 to 100% of span). Following calibration, a mid range USEPA Protocol 1 gas (40 to 60% of span) was introduced. The response error did not exceed 2% of the instrument span, as required by the method. Calibration error results are presented in Appendix B. Calibration drift checks were performed at the completion of each run.

3.3 Nitrogen Oxides (USEPA Method 7E)

A Thermo Environmental Model 42i-HL Chemiluminescence analyzer was used to measure parts per million of nitrogen oxides in the dry sample gas following the guidelines of U.S. EPA Method 7E, "Determination of Nitrogen Oxides from Stationary Sources (Instrumental Analyzer Procedure)", in conjunction with Performance Specification No. 2 of Appendix B, 40 CFR 60. The analyzer measures the concentration of NO_x by converting NO_x to NO and then measuring the light emitted by the reaction of NO with ozone. The NO_x analyzer was set at 0-100 ppm instrument span during the RATAs. The NO_X sampling system was calibrated at three points: zero, mid range (40-60% of span), and high range (80-100% of span) with USEPA Protocol 1 calibration gases. BTEC conducted a NO_2 to NO conversion efficiency tests, as specified in U.S. EPA Method 7E. The results of the NO_2 to NO conversion efficiency test can be found on the enclosed compact disk.

3.4 Carbon Monoxide (USEPA Method 10)

The CO content of the exhaust gas was evaluated according to procedures outlined in 40 CFR 60, Appendix A, Method 10. The CO content of the gas stream was measured using a TECO 48 CO gas analyzer. The gas stream was drawn through a stainless-steel probe with a heated in-line filter to remove any particulate, a heated Teflon® sample line, through a refrigerated sample conditioner with a peristaltic pump to remove the moisture from the sample before it entered the analyzer. Data was recorded on a PC equipped with Labview® II data acquisition software. Recorded CO concentrations were averaged and reported for the duration of each 63-minute test (as drift corrected per Method 7E). The analyzer was calibrated for a range of 0 to 100.

3.5 Particulate Matter (USEPA Method 5/202)

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 3 for a schematic of the sampling train). Triplicate 120-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 to Maxxam Analytical for analysis.

Emission results in lb/MMBtu were calculated using USEPA Method 19.

4.0 Test Results

All PEMS associated with the sources tested at Detroit Thermal passed the Relative Accuracy Test Audit. The best runs were used to calculate the relative accuracy. The RATA testing on the boilers was performed at a normal load (50%). Note: The tester may choose to perform more than nine sets of RM tests. If this option is chosen the tester may, at his discretion, reject a maximum of three sets of the test results so long as the total number of test results used to determine the RA is greater than or equal to nine, but all data including the rejected data must be reported".

The Boiler PEMS results are expressed in Lb/MMBtu on a dry basis. The 40 CFR Part 60, requires that relative accuracy for the NO_x system be less than or equal to 20% when expressed as a percentage of the average reference method result in Lb/MMBtu. The percent relative accuracy for Boiler 6 PEMS NOx Lb/MMBtu was 6.1 and the percent relative accuracy for Boiler 7 PEMS NOx Lb/MMBtu was 13.7.

The results of all testing is presented in Tables 1-6.

5.0 Special Situations and Test Procedure Variations

Boiler 7 was originally scheduled to be tested on Sunday September 13, 2015. Due to a malfunction of the PEMS unit testing for Boiler 7 was postponed until September 26, 2015. Field sheets from the voided run are included in Appendix A. Raw CEM data from the voided run is included in Appendix D.

Some RATA test runs (Boiler 6 Runs 1 and 5, and Boiler 7 Run 1) were extended beyond 21 minutes with the intention of using the data for the NOx and CO lb/hr and lb/MMBtu emission rates in Tables 5 and 6. These extended length RATA runs were not used to calculate the emission rates in Tables 5 and 6, but are still included as RATA test runs. Three 21-minute RATA test runs were combined into a single 63-minute test run for each test run listed on Table 5 and Table 6. CO testing was performed simultaneously with NOx testing.

Boiler 6 and Boiler 7 exhaust through a common exhaust stack. Due to the physical structure of the exhaust duct and it's connection to Boiler 6 and Boiler 7 some of the sampling ports demonstrate a lower flower than other sampling points depending on which boiler is being tested. For each boiler the two sampling ports with the lowest flow were not sampled from. See Figure 1 for a diagram showing which sample ports were tested and which were omitted from testing.

BTEC Inc.

Limitations

The information and opinions rendered in this report are exclusively for use by Detroit Thermal LLC. BTEC will not distribute or publish this report without Detroit Thermal's consent except as required by law or court order. BTEC accepts responsibility for the competent performance of its duties in executing the assignment and preparing reports in accordance with the normal standards of the profession, but disclaims any responsibility for consequential damages.

This report was prepared by: _____
Todd Wessel
Senior Project Manager

This report was reviewed by: _____
Brandon Chase
Staff Environmental Engineer

TABLE 2

SUMMARY OF NO_X Lb/MMBTU RATA RESULTS (O_2)

September 26, 2015

DETROIT THERMAL

BOILER No. 7

NO_X Lb/MMBtu Relative Accuracy

Relative Accuracy: **13.7**

Run #	Time	RM Lb/MMBtu	PEM Lb/MMBtu	Diff	%Diff
1	8:28-9:03	0.0214	0.0243	-0.0029	-0.13
2	**9:18-9:38**	**0.0211**	**0.0245**	**-0.0034**	**-0.16**
3	**9:48-10:08**	**0.0211**	**0.0244**	**-0.0033**	**-0.16**
4	**10:17-10:37**	**0.0210**	**0.0241**	**-0.0031**	**-0.15**
5	10:50-11:10	0.0210	0.0240	-0.0030	-0.14
6	11:18-11:38	0.0210	0.0241	-0.0031	-0.15
7	11:47-12:07	0.0213	0.0241	-0.0028	-0.13
8	12:15-12:35	0.0214	0.0240	-0.0026	-0.12
9	12:45-13:05	0.0214	0.0241	-0.0027	-0.13
10	13:13-13:33	0.0216	0.0237	-0.0021	-0.10
11	13:44-14:04	0.0216	0.0241	-0.0025	-0.11
12	14:42-15:02	0.0223	0.0242	-0.0019	-0.09
		0.021	0.024	-0.003	-0.123

Sdev	0.0004
CC	0.0003
RA (based on Ref. Meth.)	**13.7%**
Bias Adjustment Factor	**1.000**

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

Used Method 19 Eq. 19-1

Part 75 Requires +/- 0.015 lb/MMBtu

Table 3
Summary of Particulate Matter Emission Rates Boiler 6

Company	**Detroit Thermal**			
Source Designation	**Boiler 6**			
Test Date	**9/12/2015**	**9/12/2015**	**9/12/2015**	
Meter/Nozzle Information	P-1	P-2	P-3	Average
Meter Temperature Tm (F)	88.7	93.3	95.1	92.3
Meter Pressure - Pm (in. Hg)	29.5	29.6	29.5	29.5
Measured Sample Volume (Vm)	92.8	100.9	95.7	96.5
Sample Volume (Vm-Std ft3)	87.1	94.1	88.9	90.1
Sample Volume (Vm-Std m3)	2.47	2.67	2.52	2.55
Condensate Volume (Vw-std)	15.819	16.861	16.078	16.253
Gas Density (Ps(std) lbs/ft3) (wet)	0.0719	0.0720	0.0720	0.0719
Gas Density (Ps(std) lbs/ft3) (dry)	0.0765	0.0765	0.0766	0.0765
Total weight of sampled gas (m g lbs) (wet)	7.40	7.99	7.56	7.65
Total weight of sampled gas (m g lbs) (dry)	6.66	7.20	6.81	6.89
Nozzle Size - An (sq. ft.)	0.001004	0.001004	0.001004	0.001004
Isokinetic Variation - I	99.7	96.5	95.3	97.1
Stack Data				
Average Stack Temperature - Ts (F)	308.2	320.8	315.9	315.0
Molecular Weight Stack Gas- dry (Md)	29.6	29.6	29.6	29.6
Molecular Weight Stack Gas-wet (Ms)	27.8	27.8	27.9	27.8
Stack Gas Specific Gravity (Gs)	0.960	0.961	0.962	0.961
Percent Moisture (Bws)	15.36	15.19	15.31	15.29
Water Vapor Volume (fraction)	0.1536	0.1519	0.1531	0.1529
Pressure - Ps ("Hg)	29.3	29.3	29.3	29.3
Average Stack Velocity -Vs (ft/sec)	21.2	24.0	22.9	22.7
Area of Stack (ft2)	39.2	39.2	39.2	39.2
Oxygen Concentration, dry (%)	5.25	5.61	5.49	5.45
Exhaust Gas Flowrate				
Flowrate ft^3(Actual)	49,918	56,484	53,769	53,390
Flowrate ft^3 (Standard Wet)	33,594	37,401	35,828	35,608
Flowrate ft^3 (Standard Dry)	28,433	31,718	30,341	30,164
Flowrate m^3 (standard dry)	805	898	859	854
Total Particulate Weights (mg)				
Total Nozzle/Probe/Filter	7.6	5.6	6.1	6.4
Organic Condensible Particulate	2.9	3.0	5.1	3.7
Inorganic Condensible Particulate	2.6	2.5	2.9	2.7
Condensible Blank Correction	1.5	1.5	1.5	1.5
Total Condensible Particulate	4.0	4.0	6.5	4.8
Total Filterable and Condensible Particulate	11.6	9.6	12.6	11.3
Filterable Particulate Concentration				
lb/1000 lb (wet)	0.002	0.002	0.002	0.002
lb/1000 lb (dry)	0.003	0.002	0.002	0.002
mg/dscm (dry)	3.1	2.1	2.4	2.5
gr/dscf	0.0013	0.0009	0.0011	0.0011
Filterable Particulate Emission Rate				
lb/ hr	0.33	0.25	0.28	0.29
Condensible Particulate Concentration				
lb/1000 lb (wet)	0.001	0.001	0.002	0.001
lb/1000 lb (dry)	0.001	0.001	0.002	0.002
mg/dscm (dry)	1.6	1.5	2.6	1.9
gr/dscf	0.0007	0.0007	0.0011	0.0008
Condensible Particulate Emission Rate				
lb/ hr	0.17	0.18	0.29	0.22
Total Particulate Concentration				
lb/1000 lb (wet)	0.003	0.003	0.004	0.003
lb/1000 lb (dry)	0.004	0.003	0.004	0.004
mg/dscm (dry)	4.7	3.6	5.0	4.4
gr/dscf	0.0021	0.0016	0.0022	0.0019
Total Particulate Emission Rate				
lb/ MMBtu	0.0034	0.0027	0.0037	0.0033
lb/ hr	0.50	0.43	0.57	0.50

Table 4
Summary of Particulate Matter Emission Rates Boiler 7

Company	Detroit Thermal			
Source Designation	Boiler 7			
Test Date	9/26/2015	9/26/2015	9/26/2015	
Meter/Nozzle Information	P-1	P-2	P-3	Average
Meter Temperature Tm (F)	81.3	77.3	77.9	78.8
Meter Pressure - Pm (in. Hg)	29.7	29.8	29.8	29.8
Measured Sample Volume (Vm)	79.0	81.1	82.1	80.7
Sample Volume (Vm-Std ft3)	76.9	79.5	80.4	78.9
Sample Volume (Vm-Std m3)	2.18	2.25	2.28	2.23
Condensate Volume (Vw-std)	14.522	14.796	14.447	14.588
Gas Density (Ps(std) lbs/ft3) (wet)	0.0717	0.0718	0.0720	0.0719
Gas Density (Ps(std) lbs/ft3) (dry)	0.0765	0.0765	0.0766	0.0765
Total weight of sampled gas (m g lbs) (wet)	6.55	6.77	6.83	6.72
Total weight of sampled gas (m g lbs) (dry)	5.88	6.09	6.16	6.04
Nozzle Size - An (sq. ft.)	0.000524	0.000524	0.000524	0.000524
Isokinetic Variation - I	100.2	100.2	99.6	100.0
Stack Data				
Average Stack Temperature - Ts (F)	325.5	325.7	318.5	323.3
Molecular Weight Stack Gas- dry (Md)	29.6	29.6	29.6	29.6
Molecular Weight Stack Gas-wet (Ms)	27.8	27.8	27.9	27.8
Stack Gas Specific Gravity (Gs)	0.958	0.960	0.962	0.960
Percent Moisture (Bws)	15.89	15.69	15.24	15.61
Water Vapor Volume (fraction)	0.1589	0.1569	0.1524	0.1561
Pressure - Ps ("Hg)	29.6	29.6	29.6	29.6
Average Stack Velocity -Vs (ft/sec)	36.3	37.6	37.6	37.2
Area of Stack (ft2)	39.2	39.2	39.2	39.2
Oxygen Concentration, dry (%)	5.30	5.43	5.54	5.42
Exhaust Gas Flowrate				
Flowrate ft^3(Actual)	85,422	88,246	88,466	87,378
Flowrate ft^3 (Standard Wet)	56,761	58,622	59,309	58,231
Flowrate ft^3 (Standard Dry)	47,740	49,425	50,273	49,146
Flowrate m^3 (standard dry)	1,352	1,400	1,424	1,392
Total Particulate Weights (mg)				
Total Nozzle/Probe/Filter	3.4	2.8	3.8	3.3
Organic Condensible Particulate	0.0	1.3	0.0	0.4
Inorganic Condensible Particulate	2.1	2.6	8.7	4.5
Condensible Blank Correction	2.0	2.0	2.0	2.0
Total Condensible Particulate	0.1	1.9	6.7	2.9
Total Filterable and Condensible Particulate	3.5	4.7	10.5	6.2
Filterable 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)	1.6	1.2	1.7	1.5
gr/dscf	0.0007	0.0005	0.0007	0.0007
Filterable Particulate Emission Rate				
lb/ hr	0.28	0.23	0.32	0.28
Condensible Particulate Concentration				
lb/1000 lb (wet)	0.000	0.001	0.002	0.001
lb/1000 lb (dry)	0.000	0.001	0.002	0.001
mg/dscm (dry)	0.0	0.8	2.9	1.3
gr/dscf	0.0000	0.0004	0.0013	0.0006
Condensible Particulate Emission Rate				
lb/ hr	0.01	0.16	0.56	0.24
Total Particulate Concentration				
lb/1000 lb (wet)	0.001	0.002	0.003	0.002
lb/1000 lb (dry)	0.001	0.002	0.004	0.002
mg/dscm (dry)	1.6	2.1	4.6	2.8
gr/dscf	0.0007	0.0009	0.0020	0.0012
Total Particulate Emission Rate				
lb/ MMBtu	0.0012	0.0015	0.0034	0.0020
lb/ hr	0.29	0.39	0.87	0.52

Table 5
Boiler 6 NOx and CO Emission Rates
Detroit Thermal
Detroit Michigan
BTEC Project No. 15-4739.00
Sampling Dates: September 12, 2015

Parameter	Run 1	Run 2	Run 3	Average
Test Run Date	9/12/2015	9/12/2015	9/12/2015	
Test Run Times	10:58-11:18	14:17-14:37	16:34-16:54	
	11:35-11:55	14:51-15:11	17:13-17:33	
	12:06-12:26	15:25-15:45	17:51-18:11	
Total Test Time (minutes)	63	63	63	
Outlet Flowrate (dscfm)	28,433	31,718	30,341	**30,164**
Outlet Flowrate (scfm)	33,594	37,401	35,828	**35,608**
Oxygen Concentration (%)	5.14	5.60	5.27	**5.34**
Oxygen Concentration (%, drift corrected as per USEPA 7E)	5.25	5.61	5.49	**5.45**
Carbon Dioxide Concentration (%)	8.41	8.42	8.66	**8.50**
Carbon Dioxide Concentration (%, drift corrected as per USEPA 7E)	8.57	8.63	8.83	**8.68**
Outlet Oxides of Nitrogen Concentration (ppmv)	18.08	17.14	16.89	**17.37**
Outlet NOx Concentration (ppmv, corrected as per USEPA 7E)	17.76	16.82	16.54	**17.04**
NOx Emission Rate (lb/hr)	**3.7**	**3.9**	**3.7**	**3.7**
NOx Emission Rate (lb/hr) (corrected as per USEPA 7E)	**3.6**	**3.8**	**3.6**	**3.7**
NOx Emission Rate (lb/mmbtu) (corrected as per USEPA 7E)	**0.0246**	**0.0238**	**0.0233**	**0.0239**
Outlet Carbon Monoxide Concentration (ppmv)	2.36	1.65	0.70	**1.57**
Outlet CO Concentration (ppmv, corrected as per USEPA 7E)	1.68	1.14	0.09	**0.97**
CO Emission Rate (lb/hr)	**0.3**	**0.2**	**0.1**	**0.2**
CO Emission Rate (lb/hr) (corrected as per USEPA 7E)	**0.2**	**0.2**	**0.0**	**0.1**
CO Emission Rate (lb/mmbtu) (corrected as per USEPA 7E)	**0.0023**	**0.0016**	**0.0001**	**0.0014**

Flowrates are from the PM sampling train.
CEM values are from combining 3 21-minute RATA test runs. Run 1 = RATA runs 2,3,4 - Run 2 = RATA runs 6,7,8 - Run 3 = RATA runs 10,11,12

scfm = standard cubic feet per minute
dscfm = dry standard cubic feet per minute
ppmv = parts per million on a volume-to-volume basis
lb/hr = pounds per hour
MW = molecular weight (CO = 28.01, NOx = 46.01)
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 * ***dcfm*** * 60
Cd (lb/scf) = ppm * (MW/24.14) * (1/35.31) * (1/453,600)
Eq 19-1, E=Cd*Fd*20.9/(20.9-O2%)

Table 6
Boiler 7 NOx and CO Emission Rates
Detroit Thermal
Detroit Michigan
BTEC Project No. 15-4739.00
Sampling Dates: September 26, 2015

Parameter	Run 1	Run 2	Run 3	Average
Test Run Date	9/26/2015	9/26/2015	9/26/2015	
Test Run Times	9:18-9:38	11:18-11:38	13:13-13:33	
	9:48-10:08	11:47-12:07	13:44-14:04	
	10:17-10:37	12:15-12:35	14:42-15:02	
Total Test Time (minutes)	63	63	63	
Outlet Flowrate (dscfm)	47,740	49,425	50,273	**49,146**
Outlet Flowrate (scfm)	56,761	58,622	59,309	**58,231**
Oxygen Concentration (%)	5.53	5.36	5.55	**5.48**
Oxygen Concentration (%, drift corrected as per USEPA 7E)	5.16	5.32	5.55	**5.34**
Carbon Dioxide Concentration (%)	8.99	8.90	8.78	**8.89**
Carbon Dioxide Concentration (%, drift corrected as per USEPA 7E)	9.01	8.92	8.85	**8.93**
Outlet Oxides of Nitrogen Concentration (ppmv)	15.47	15.38	15.53	**15.46**
Outlet NOx Concentration (ppmv, corrected as per USEPA 7E)	15.25	15.21	15.41	**15.29**
NOx Emission Rate (lb/hr)	**5.3**	**5.4**	**5.6**	**5.4**
NOx Emission Rate (lb/hr) (corrected as per USEPA 7E)	**5.2**	**5.4**	**5.5**	**5.4**
NOx Emission Rate (lb/mmbtu) (corrected as per USEPA 7E)	**0.0210**	**0.0211**	**0.0217**	**0.0213**
Outlet Carbon Monoxide Concentration (ppmv)	8.32	7.74	7.79	**7.95**
Outlet CO Concentration (ppmv, corrected as per USEPA 7E)	8.38	7.77	7.71	**7.95**
CO Emission Rate (lb/hr)	**1.7**	**1.7**	**1.7**	**1.7**
CO Emission Rate (lb/hr) (corrected as per USEPA 7E)	**1.7**	**1.7**	**1.7**	**1.7**
CO Emission Rate (lb/mmbtu) (corrected as per USEPA 7E)	**0.0115**	**0.0108**	**0.0109**	**0.0111**

Flowrates are from the PM sampling train.
CEM values are from combining 3 21-minute RATA test runs. Run 1 = RATA runs 2,3,4 - Run 2 = RATA runs 6,7,8 - Run 3 = RATA runs 10,11,12

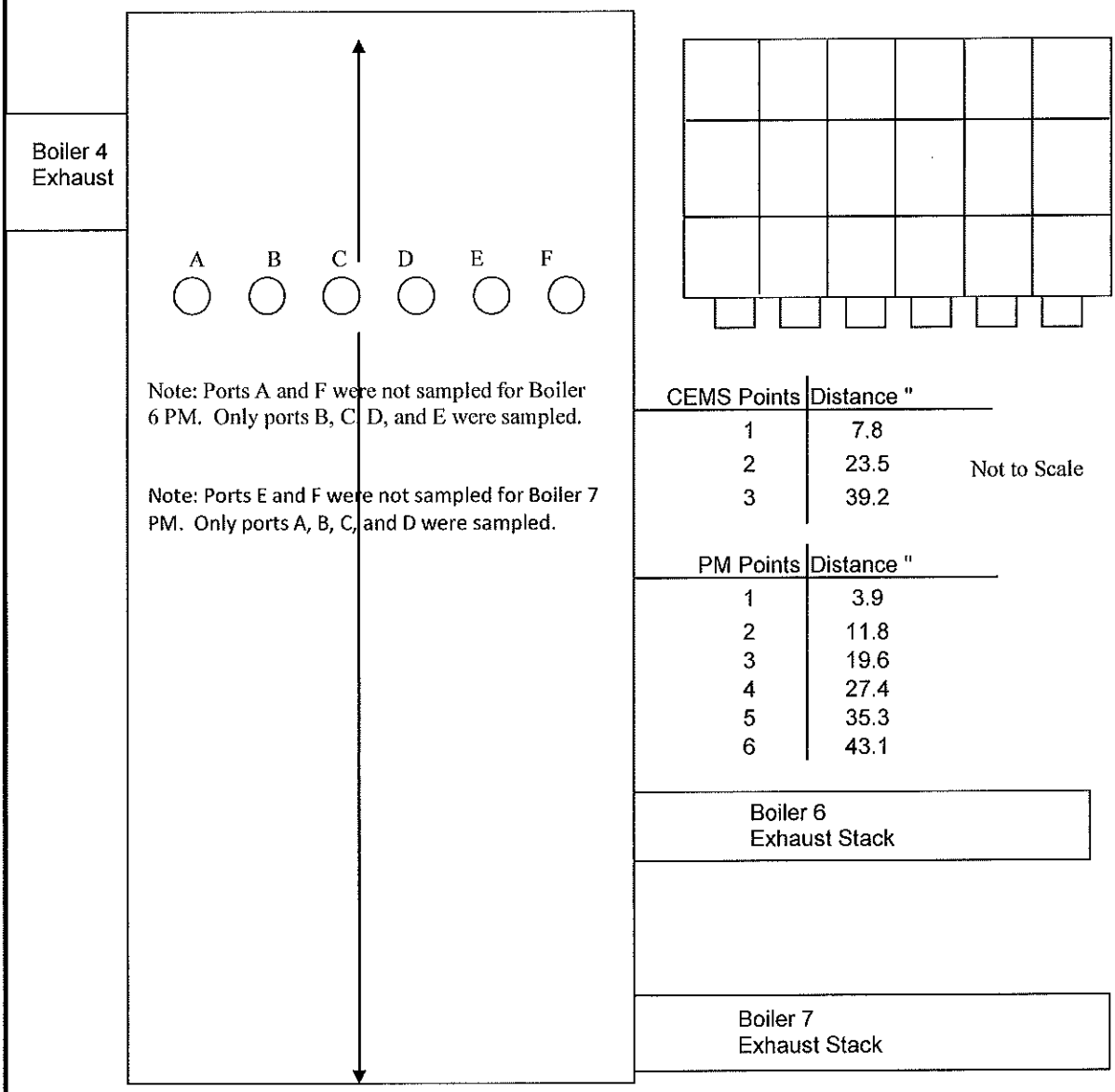
scfm = standard cubic feet per minute
dscfm = dry standard cubic feet per minute
ppmv = parts per million on a volume-to-volume basis
lb/hr = pounds per hour
MW = molecular weight (CO = 28.01, NOx = 46.01)
24.14 = molar volume of air at standard conditions (70 °F, 29.92" Hg)
35.31 = ft^3 per m^3
453600 = mg per lb

Equations
lb/hr = ppmv * MW/24.14 * 1/35.31 * 1/453,600 * *dcfm* * 60
Cd (lb/scf) = ppm * (MW/24.14) * (1/35.31) * (1/453,600)
Eq 19-1, E=Cd*Fd*20.9/(20.9-O2%)

Figures

BTEC Inc.

Stack Dimensions: 47" Deep X 120" Wide



CEMS Points	Distance "
1	7.8
2	23.5
3	39.2

PM Points	Distance "
1	3.9
2	11.8
3	19.6
4	27.4
5	35.3
6	43.1

Figure No. 1

Site: **Boilers 6 & 7 Exhaust** **Detroit Thermal LLC** **Detroit, Michigan**	**Sampling Date:** **September 12 and 26, 2015**	**BT Environmental Consulting, Inc.** **4949 Fernlee Avenue** **Royal Oak, Michigan**

BTEC Inc.

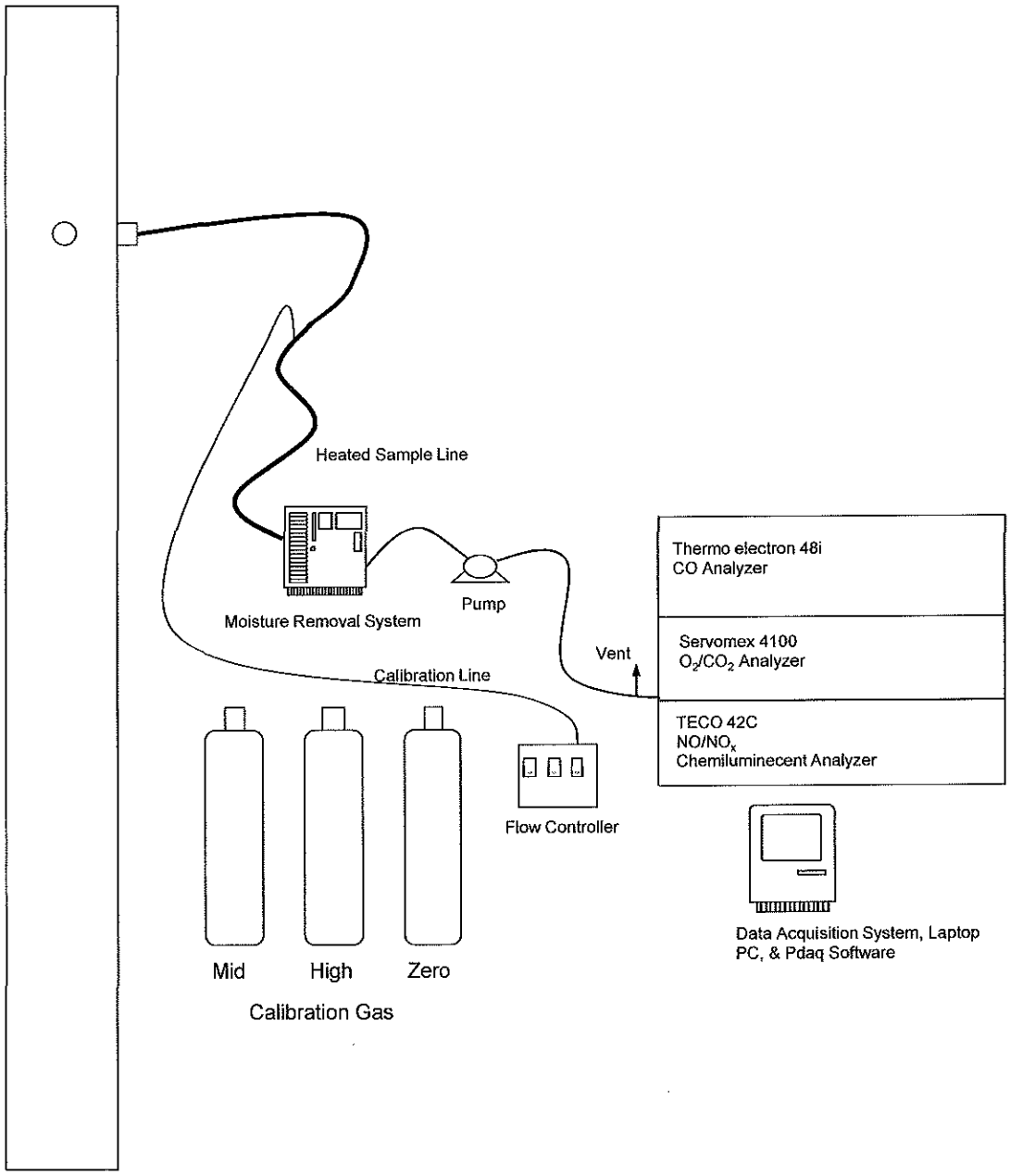


Figure No. 2

Site: **USEPA Method 3A, 7E, and 10** **Detroit Thermal LLC** **Detroit, Michigan**	**Sampling Date:** **September 12 and 26, 2015**	**BT Environmental Consulting Inc.** **4949 Fernlee Avenue** **Royal Oak, MI 48073**

BTEC Inc.

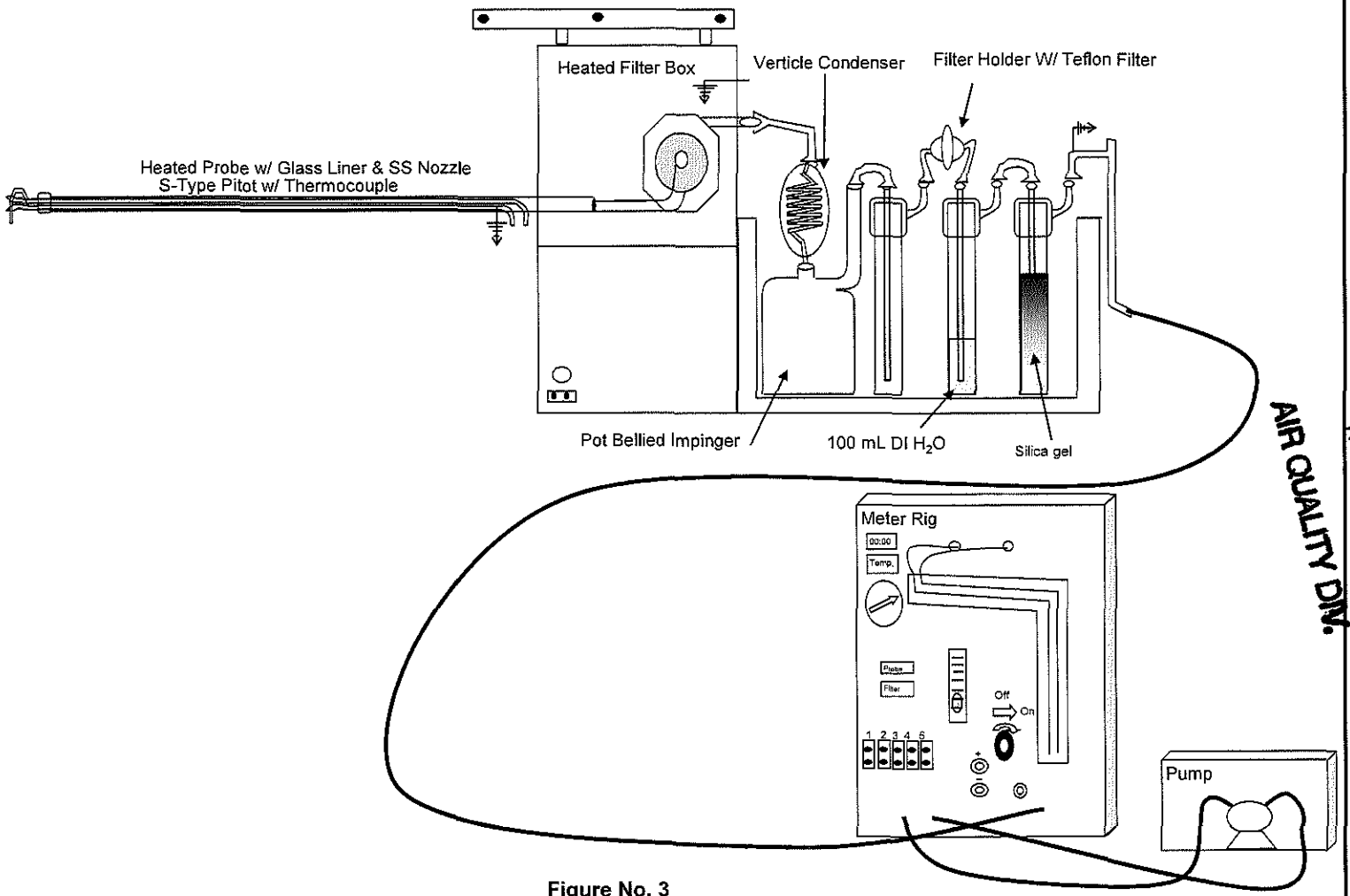


Figure No. 3

Site: **USEPA Method 5/202** **Detroit Thermal LLC** **Detroit, Michigan**	**Sampling Date:** **September 12 and 26, 2015**	**BT Environmental Consulting, Inc.** **4949 Fernlee Avenue** **Royal Oak, Michigan 48073**