BTEC Inc.

Machine Scarfing Emissions Test Report

Prepared for:

AK Steel Corporation – Dearborn Works

Dearborn, Michigan

AK Steel Corporation – Dearborn Works
4001 Miller Road
Dearborn, Michigan 48120

Project No. 15-4766.00
December 3, 2015

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

EXECUTIVE SUMMARY

BT Environmental Consulting, Inc. (BTEC) was retained by AK Steel Corporation – Dearborn Works (AK Steel) to evaluate emissions on one source at the AK Steel facility in Dearborn, Michigan. The purpose of the project was to evaluate filterable particulate matter (PM) and condensable particulate matter (CPM) emissions at the Machine Scarfing Baghouse. Particulate matter less than 2.5 microns and particulate matter less than 10 microns were calculated as the sum of the filterable and condensable particulate matter fractions. Triplicate visible emissions (VE) observations were also performed by Smoke Reader, LLC.

Testing of the machine scarfing baghouse exhaust consisted of triplicate 120-minute test runs for PM and CPM, and triplicate 60-minute VE observations. The emissions test program was required by MDEQ Air Quality Division Facility SRN A8640, PTI 20-14. The results of the emission test program are summarized by Table I.

Table I
Machine Scarfing Overall Emission Summary
Test Date: October 27, 2015

Pollutant	Average Emission Rate	Emission Limit
Filterable Particulate Matter (PM)	0.0005 gr/dscf	0.003 gr/dscf
Particulate Matter < 10 microns and Particulate Matter < 2.5 microns (PM+CPM)	0.0009 gr/dscf	0.005 gr/dscf
Particulate Matter < 10 microns and Particulate Matter < 2.5 microns (PM+CPM)	1.00 lbs/hr	4.52 lbs/hr
Opacity (Baghouse Stack)(1)	0% (6-minute average) 0% (1.5-minute average)	5% (6-minute average), 25% (1.5 minute average)

(1) Emission Rate reported as highest 1.5 minute and 6-minute averages observed

1. Introduction

BT Environmental Consulting, Inc. (BTEC) was retained by AK Steel Corporation – Dearborn Works (AK Steel) to evaluate emissions on one source at the AK Steel facility in Dearborn, Michigan. The purpose of the project was to evaluate filterable particulate matter (PM) and condensable particulate matter (CPM) emissions at the Machine Scarfing Baghouse. Particulate matter less than 2.5 microns and particulate matter less than 10 microns were calculated as the sum of the filterable and condensable particulate matter fractions. Triplicate visible emissions (VE) observations were also performed by Smoke Reader LLC. The emissions test program was conducted on October 27, 2015. The purpose of this report is to document the results of the test program.

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

1.a Identification, Location, and Dates of Test

Sampling and analysis for the emission test program was conducted on October 27, 2015 at the AK Steel facility located in Dearborn, Michigan. The test program included evaluation of PM, CPM, and Opacity emissions from the machine scarfing baghouse exhaust.

1.b Purpose of Testing

AQD issued Facility SRN A8640, PTI 20-14 to AK Steel. Permit condition V.1 require testing within 180 days of commencement of trial operation. This permit limits emissions from the machine scarfing baghouse exhaust as summarized by Table 1.

Table 1
Facility SRN A8640, PTI 20-14 Emission Limitations

Pollutant	Emission Limit
Filterable Particulate Matter (PM)	0.003 gr/dscf
Particulate Matter < 10 microns and Particulate Matter < 2.5 microns (PM+CPM)	0.005 gr/dscf
Particulate Matter < 10 microns and Particulate Matter < 2.5 microns (PM+CPM)	4.52 lbs/hr
Opacity (Baghouse Stack)	5% (6-minute average), 25% (1.5 minute average)

1.c Source Description

After steel slabs are cast at the Continuous Caster or are purchased from outside suppliers, some slabs require further conditioning prior to reheating to meet customer specifications. This conditioning includes the removal of surface defects through scarfing as well as cutting to the desired slab length. Slabs are transferred to the machine scarfing building by a slab carrier where they are stock piled on the ground and logged in the computer system. The slab is picked up by a crane and is placed on a special table where the slab can be oriented to the side that needs to be scarfed. The slab is then placed on the scarfing table which slides into the scarfing enclosure. Once within the scarfing enclosure, a natural gas fired oxy-fuel torch mounted on a robotic arm is used to remove the surface (or skin) of the slab. The torch is controlled by an operator within a booth in the scarfing enclosure. Once the scarfing is complete, the scarfing table exits the enclosure. The crane removes the slab from the scarfing table and places it on the ground. A manual touchup and inspection is performed on the slab. Once completed, the slab is flipped so that the opposite side can be scarfed. After the scarfing is complete, the slab is cut to specifications on a cutting table. Emissions within the scarfing enclosure are routed to a baghouse for particulate removal. Two scarfing tables exist. This allows for one slab to be scarfed while the other slab is either removed from or inserted into the scarfing enclosure. The baghouse consists of four cells. Emissions from cutting and touching up the slabs are exhausted from the building roof monitor. Normal production for the process is 50 to 100 tons per hour.

1.d Test Program Contacts

The contacts for the source and test report are:

Mr. James E. Earl
Environmental Affairs Manager
AK Steel Corporation – Dearborn Works
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Dearborn, Michigan 48120
(313) 845-3217

Mr. David Pate
Environmental Engineer
AK Steel Corporation – Dearborn Works
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Mr. Barry P. Boulianne
Senior Project Manager
BT Environmental Consulting, Inc.
4949 Fernlee Avenue
Royal Oak, MI 48073
313-449-2361

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. David Pate Environmental Engineer	AK Steel Corporation Dearborn Works 4001 Miller Road Dearborn, Michigan 48120	(313) 323-1261
Mr. James E. Earl Environmental Affairs Manager	AK Steel Corporation Dearborn Works 4001 Miller Road Dearborn, Michigan 48120	(313) 845-3217
Mr. Steve Smith Project Manager	BTEC 4949 Fernlee Royal Oak, MI 48073	(248) 548-8070
Mr. Paul Diven Environmental Technician	BTEC 4949 Fernlee Royal Oak, MI 48073	(248) 548-8070
Mr. Paul Molenda Environmental Technician	BTEC 4949 Fernlee Royal Oak, MI 48073	(248) 548-8070
Mr. Robert Bingham Visible Emissions Observer	Smoke Reader, LLC 7608 Tulane St. Taylor, MI 48180	(586) 942-8548
Mr. Jeremy Howe Environmental Quality Analyst	MDEQ Air Quality Division	(231) 876-4416

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:

Slab ID
Start and stop times for each slab scarfed
Slab Weight
Overall and compartment Baghouse DP readings were collected before and after each test run

2.b Applicable Permit

The applicable permit for this emissions test program is Facility SRN A8640, PTI 20-14.

2.c Results

The overall results of the emission test program are summarized by Table 3 (see Section 5.a). Detailed results for each run are summarized by Table 4.

3. Source Description

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

3.a Process Description

The operation consists of two scarfing tables. While one slab is scarfed, another slab can either be removed from the enclosure or placed into the enclosure. At the conclusion of scarfing the slab, the torch is moved to the other table to scarf the other slab. The slab that had been scarfed is removed from the enclosure and a new slab is placed on the table and inserted into the enclosure. The continuous nature of this operation is expected to produce relatively constant emissions.

3.b Process Flow Diagram

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

3.c Raw and Finished Materials

Steel slabs that are cast at the Continuous Caster or are purchased from outside suppliers.

3.d Process Capacity

Normal production for the process is 50 to 100 tons per hour. The process averaged 73 tons per hour during the emission test.

3.e Process Instrumentation

See section 2.a.

4. Sampling and Analytical Procedures

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

4.a Sampling Train and Field Procedures

The emissions test program utilized the following test methods codified at Title 40, Part 60, Appendix A (40 CFR 60, Appendix A) and Title 40, Part 51, Appendix M (40 CFR 51, Appendix M) 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 3 - *"Determination of Molecular Weight of Dry Stack Gas"(Fyrite)*
- Method 4 - *"Determination of Moisture Content in Stack Gases"*
- Method 5 - *"Determination of Particulate Emissions from Stationary Sources"*
- Method 202 - *"Dry Impinger Method for Determining Condensable Particulate Emissions from Stationary Sources"*
- Method 9 - *"Visible Determination of the Opacity of Emissions from Stationary Sources"*

USEPA Method 1-4

Stack gas velocity traverses were conducted in accordance with the procedures outlined in Method 1 and Method 2. S-type pitot tubes with thermocouple assemblies, calibrated in accordance with Method 2, Section 4.1.1, were used to measure exhaust gas velocity pressures (using a manometer) and temperatures during testing. The S-type pitot tube dimensions outlined in Sections 2-6 through 2-8 are within specified limits, therefore, a baseline pitot tube coefficient of 0.84 (dimensionless) is assigned. A diagram of the sample points is provided in Figure 1.

Cyclonic flow checks were performed at the sampling location. The existence of cyclonic flow is determined by measuring the flow angle at each sample point. The flow angle is the angle between the direction of flow and the axis of the stack. If the average of the absolute values of the flow angles is greater than 20 degrees, cyclonic flow exists. Cyclonic flow was confirmed to not exist at the machine scarfing baghouse sampling location.

The Molecular Weight of the gas stream was evaluated according to procedures outlined in Title 40, Part 60, Appendix A, Method 3. The O_2 /CO_2 content of the gas stream was measured using a Fyrite combustion analyzer.

Exhaust gas was extracted as part of the Method 5/202 sampling train. Exhaust gas moisture content was then determined gravimetrically.

Particulate Matter (PM) and Condensable Particulate Matter (CPM) (USEPA Method 5/202)

40 CFR 60, Appendix A, Method 5, *"Determination of Particulate Emissions from Stationary Sources"* and 40 CFR 51, Appendix M, Method 202, *"Dry Impinger Method for Determining Condensable Particulate Emissions from Stationary Sources"* was used to measure PM, $PM_{2.5}$, and PM_{10} concentrations and to calculate emission rates (see Figure 2 for a schematic of the sampling train).

BTEC's Nutech® Model 2010 modular isokinetic stack sampling system consists of (1) a Stainless Steel nozzle, (2) a glass probe, (3) a heated filter holder, (4) a vertical condenser, (5) an empty potbellied 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 14 liters per minute. The CPM filter was recovered and placed in a petri dish. The back half of the filter housing, the condenser, the potbellied 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 and 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 hand delivered to Maxxam Analytical for analysis.

Visible Emissions (USEPA Method 9)

40 CFR 60, Appendix A, Method 9, *"Determination of the Visible Emissions of Opacity from Stationary Sources"* will be used to determine visible emissions from the baghouse stack. A certified reader from Smoke Reader LLC conducted a 60-minute visible emissions observation during each test 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 showing sampling ports in relation to upstream and downstream disturbances is included as Figure 1.

4.d Traverse Points

A diagram of the stack indicating traverse point locations and stack dimensions is included as Figure 1

5. Test Results and Discussion

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

5.a Results Tabulation

The overall results of the emissions test program are summarized by Table 3. Detailed results for the emissions test program are summarized by Table 4.

Table 3
Machine Scarfing Overall Emission Summary
Test Date: October 27, 2015

Pollutant	Average Emission Rate	Emission Limit
Filterable Particulate Matter (PM)	0.0005 gr/dscf	0.003 gr/dscf
Particulate Matter < 10 microns and Particulate Matter < 2.5 microns (PM+CPM)	0.0009 gr/dscf	0.005 gr/dscf
Particulate Matter < 10 microns and Particulate Matter < 2.5 microns (PM+CPM)	1.00 lbs/hr	4.52 lbs/hr
Opacity (Baghouse Stack)(1)	0% (6-minute average) 0% (1.5-minute average)	5% (6-minute average), 25% (1.5 minute average)

(1) Emission Rate reported as highest 1.5 minute and 6-minute averages observed

5.b Discussion of Results

Emissions from the machine scarfing baghouse exhaust are below the corresponding emission limits as displayed in Table 3.

The organic condensable fraction of Run 2 and Run 3 was less than the reportable detection limit (RDL) of 1.0 mg. The minimum detection limit (MDL) of 0.2 mg was used for calculations.

5.c Sampling Procedure Variations

There were no sampling variations used during the emission compliance test program.

5.d Process or Control Device Upsets

No upset conditions occurred during testing.

5.e Control Device Maintenance

There was no control equipment maintenance performed during the emissions test program.

5.f Re-Test

The emissions test program was not a re-test.

5.g Audit Sample Analyses

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

5.h Calibration Sheets

Relevant equipment calibration documents are provided in Appendix B.

5.i Sample Calculations

Sample calculations are provided in Appendix C.

5.j Field Data Sheets

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

5.k Laboratory Data

Laboratory Data is provided in Appendix D.

Tables

Table 4
Machine Scarfing Exhaust Particulate Matter Emission Rates

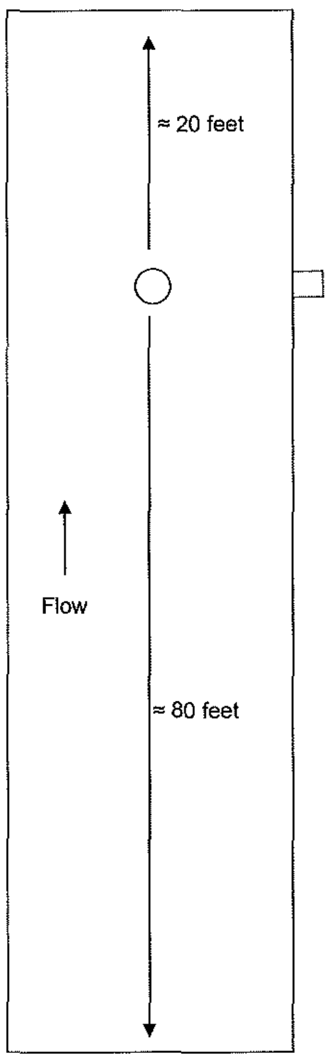
Company	**AK Steel**			
Source Designation	**Machine Scarfing**			
Test Date	**10/27/2015**	**10/27/2015**	**10/27/2015**	
Meter/Nozzle Information	Run 1	Run 2	Run 3	Average
Meter Temperature Tm (F)	64.2	71.6	71.1	69.0
Meter Pressure - Pm (in. Hg)	29.8	29.8	29.8	29.8
Measured Sample Volume (Vm)	80.2	79.8	81.3	80.4
Sample Volume (Vm-Std ft3)	79.6	78.1	79.7	79.1
Sample Volume (Vm-Std m3)	2.25	2.21	2.26	2.24
Condensate Volume (Vw-std)	1.396	1.471	1.410	1.426
Gas Density (Ps(std) lbs/ft3) (wet)	0.0740	0.0740	0.0740	0.0740
Gas Density (Ps(std) lbs/ft3) (dry)	0.0745	0.0745	0.0745	0.0745
Total weight of sampled gas (m g lbs) (wet)	6.00	5.89	6.01	5.96
Total weight of sampled gas (m g lbs) (dry)	5.93	5.82	5.94	5.90
Nozzle Size - An (sq. ft.)	0.000401	0.000401	0.000401	0.000401
Isokinetic Variation - I	99.3	99.8	98.3	99.1
Stack Data				
Average Stack Temperature - Ts (F)	103.9	106.0	104.2	104.7
Molecular Weight Stack Gas- dry (Md)	28.8	28.8	28.8	28.8
Molecular Weight Stack Gas-wet (Ms)	28.6	28.6	28.6	28.6
Stack Gas Specific Gravity (Gs)	0.989	0.989	0.989	0.989
Percent Moisture (Bws)	1.72	1.85	1.74	1.77
Water Vapor Volume (fraction)	0.0172	0.0185	0.0174	0.0177
Pressure - Ps ("Hg)	29.7	29.7	29.7	29.7
Average Stack Velocity -Vs (ft/sec)	30.4	29.8	30.7	30.3
Area of Stack (ft2)	78.5	78.5	78.5	78.5
Exhaust Gas Flowrate				
Flowrate ft^3(Actual)	143,131	140,479	144,831	142,813
Flowrate ft^3 (Standard Wet)	133,208	130,258	134,710	132,725
Flowrate ft^3 (Standard Dry)	130,912	127,850	132,369	130,377
Flowrate m^3 (standard dry)	3,707	3,620	3,748	3,692
Total Particulate Weights (mg)				
Total Nozzle/Probe/Filter	2.8	3.6	1.7	2.7
Organic Condensible Particulate*	1.3	**0.2**	**0.2**	0.6
Inorganic Condensible Particulate	3.3	3.3	3.3	3.3
Condensible Blank Correction	2.0	2.0	2.0	2.0
Total Condensible Particulate	2.6	1.5	1.5	1.9
Total Filterable and Condensible Particulate	5.4	5.1	3.2	4.6
Filterable Particulate Concentration				
lb/1000 lb (wet)	0.0010	0.0013	0.0006	0.0010
lb/1000 lb (dry)	0.0010	0.0014	0.0006	0.0010
mg/dscm (dry)	1.2	1.6	0.8	1.2
gr/dscf	0.0005	0.0007	0.0003	0.0005
Filterable Particulate Emission Rate				
lb/ hr	0.61	0.78	0.37	0.59
Condensible Particulate Concentration				
lb/1000 lb (wet)	0.0010	0.0006	0.0006	0.0007
lb/1000 lb (dry)	0.0010	0.0006	0.0006	0.0007
mg/dscm (dry)	1.2	0.7	0.7	0.8
gr/dscf	0.0005	0.0003	0.0003	0.0004
Condensible Particulate Emission Rate				
lb/ hr	0.57	0.33	0.33	0.41
Total Particulate Concentration				
lb/1000 lb (wet)	0.0020	0.0019	0.0012	0.0017
lb/1000 lb (dry)	0.0020	0.0019	0.0012	0.0017
mg/dscm (dry)	2.4	2.3	1.4	2.0
gr/dscf	0.0010	0.0010	0.0006	0.0009
Total Particulate Emission Rate				
lb/ hr	1.18	1.11	0.71	1.00

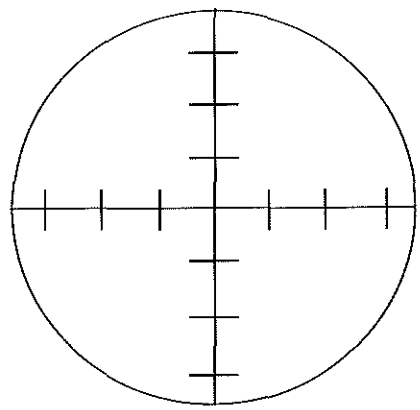
*Note: Organic condensable results for Run 2 and Run 3 were below the reportable detection limit (RDL) of 1.0 mg,
The minimum detection limit (MDL) of 0.2 mg was used for calculations

Figures

BTEC Inc.

diameter = 120 inches at test port location





Not to Scale

Points	Distance "
1	5.3
2	17.5
3	35.5
4	84.5
5	102.5
6	114.7

Figure No. 1

Site:	Sampling Date:	
Machine Scarfing Exhaust	**October 27, 2015**	**BT Environmental Consulting, Inc.**
AK Steel (Dearborn Works)		**4949 Fernlee Avenue**
Dearborn, Michigan		**Royal Oak, Michigan 48073**

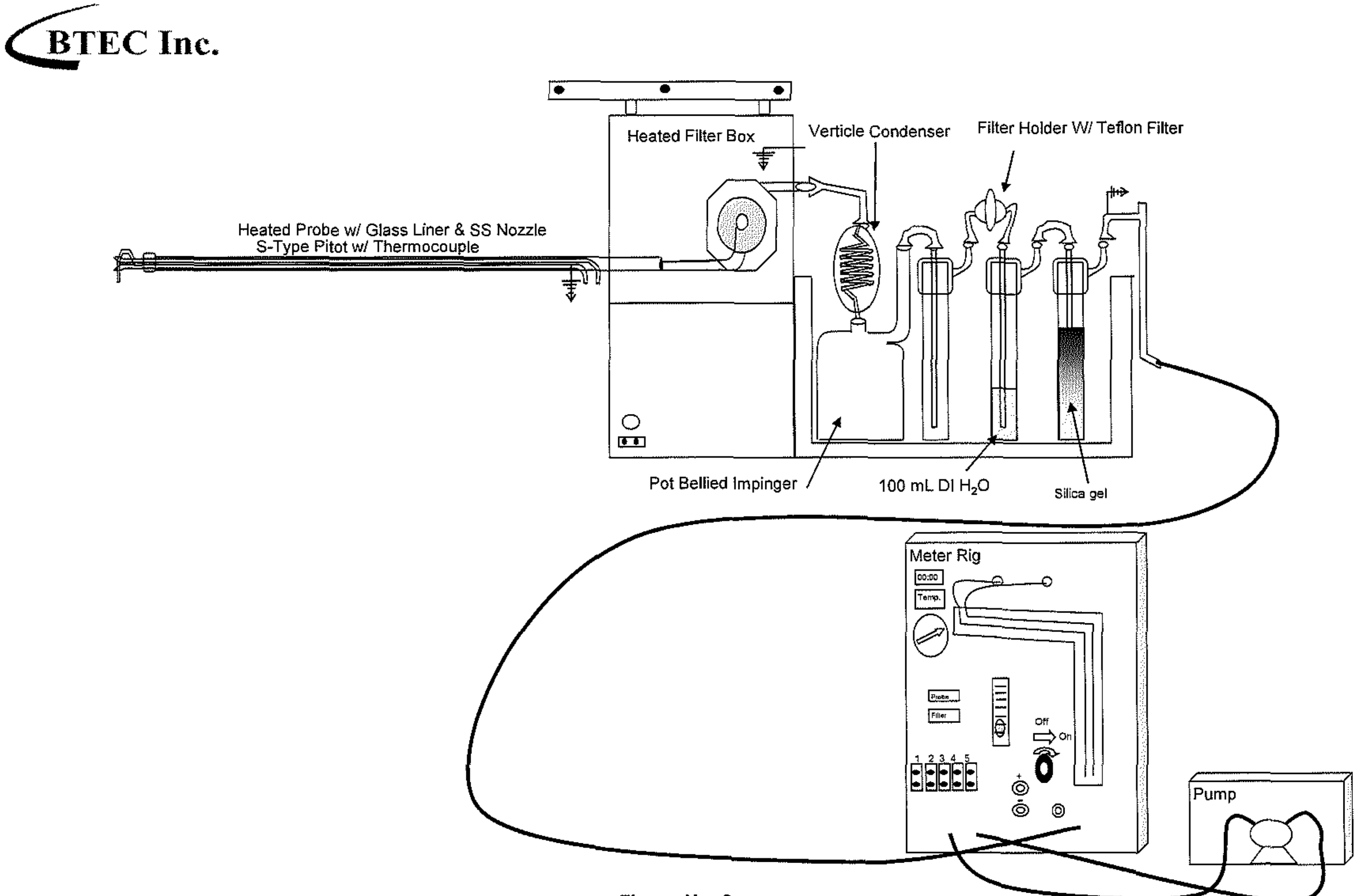


Figure No. 2

Site:	Sampling Date:	BT Environmental Consulting, Inc.
USEPA Method 5/202	October 27, 2015	4949 Fernlee Avenue
AK Steel (Dearborn Works)		Royal Oak, Michigan 48073
Dearborn, Michigan		