BTEC Inc.

Scalebreaker Baghouse Emissions Test Report

Prepared for:

AK Steel Corporation – Dearborn Works

Dearborn, Michigan

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

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Project No. 049AS-438587.00
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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 conduct an evaluation of particulate matter (PM) and condensable particulate matter (CPM) on the Scalebreaker Baghouse exhaust. This emissions testing program included evaluation of particulate matter less than 10 microns (PM_{10}). While the permit specifies an emission limit of 0.005 gr/dscf for filterable PM_{10}, also condensable particle matter (CPM) from the Scalebreaker Baghouse exhaust was measured to quantify total PM_{10}. Testing took place on July 18, 2018.

Testing of the Scalebreaker Baghouse exhaust consisted of triplicate 60-Minute test runs. The emissions test program was required by MDEQ Air Quality Division Permit to Install (PTI) 120-16. The results of the emission test program are summarized by Table I.

Table I
Overall Emission Summary
Test Date: July 18, 2018

Emission Unit	Pollutant	Permit Limit	Test Result
EUSCALEBREAKER	Particulate Matter less than 10 microns (filterable)	0.005 gr/dscf	0.005 gr/dscf

1. Introduction

BT Environmental Consulting, Inc. (BTEC) was retained by AK Steel Corporation – Dearborn Works (AK Steel) to conduct an evaluation of particulate matter (PM) and condensable particulate matter (CPM) on the Scalebreaker Baghouse exhaust. This emissions testing program included evaluation of particulate matter less than 10 microns (PM_{10}). While the permit specifies an emission limit of 0.005 gr/dscf for filterable PM_{10}, condensable particle matter (CPM) from the Scalebreaker Baghouse exhaust was measured to quantify total PM_{10}. Testing took place on July 18, 2018.

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. All testing was performed in accordance with BTEC test plan 049AS-438587.00.

1.a Identification, Location, and Dates of Test

Sampling and analysis for the emission test program was conducted on July 18, 2018 at the AK Steel facility located in Dearborn, Michigan.

1.b Purpose of Testing

AQD issued PTI 120-16, condition EUSCALEBREAKER V.1 requires testing once per ROP permit term. This test was conducted to satisfy that requirement. The permit limits are summarized by Table 1.

Table 1
Emission Limitations
AK Steel Corporation – Dearborn Works
PTI 120-16 Emission Limitations

Emission Unit	Pollutant	Permit Limit
Scalebreaker	Particulate Matter Less Than 10 Microns (filterable)	0.005 gr/dscf

1.c Source Description

The pickling process uses a mineral acid (hydrochloric acid) to remove metal oxides formed when steel is hot rolled and cooled in the presence of oxygen. These oxides need to be removed to provide a smooth, clean surface for use as hot roll steel and/or to perform subsequent cold forming operations. Prior to entering the continuous pickling line, a series of rollers are used to straighten the coiled steel (straightener) and remove or loosen scale (scale breaker). The scale breaker uses a mechanical process to grind off any unwanted surface material that has built up on the steel coils in the time that has elapsed between

pressing of the coil at the hot strip mill and the time the coils enter the PLTCM process. In addition, a coil welder and an accumulator section allows the steel to be continuously fed into the line. A pulse-jet filter-cartridge baghouse, rated at 35,315 acfm (actual ft^3/minute), is used to capture and control emissions from the scale breaker, coil straightener, and welder at the entry end of the pickling line process. This control device is referred to as the scale breaker baghouse, which is manufactured by Wheelabrator. The scale breaker baghouse is rated for a 99% removal efficiency for filterable particulate.

1.d Test Program Contacts

The contacts for the source and test report are:

Mr. David Pate
Senior Environmental Engineer
AK Steel Dearborn Works
4001 Miller Rd.
Dearborn, Michigan 48120
(313) 323-1261

Mr. Barry Boulianne
Senior Project Manager
BT Environmental Consulting, Inc.
4949 Fernlee Avenue
Royal Oak, Michigan 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. Paul Diven Project Manager	BTEC 4949 Fernlee Royal Oak, MI 48073	(248) 548-8070
Mr. Steven Smith Project Manager	BTEC 4949 Fernlee Royal Oak, MI 48073	(248) 548-8070
Mr. David Trahan Environmental Technician	BTEC 4949 Fernlee Royal Oak, MI 48073	(248) 548-8070
Mr. Mason Sakshaug Environmental Technician	BTEC 4949 Fernlee Royal Oak, MI 48073	(248) 548-8070
Mrs. Regina Hines MDEQ	MDEQ Air Quality Division	(313) 418-0895
Mrs. Katherine Koster MDEQ	MDEQ Air Quality Division	(313) 456-4678

2. Summary of Results

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

2.a Operating Data

Line speed, coil weight, number of coils, tons per hour, and differential pressure across the baghouse were recorded during each run and can be found in Appendix E.

2.b Applicable Permit

AQD issued Permit To Install No. 120-16, Facility SRN A8640 to AK Steel.

2.c Results

See Table 1 in Section 1.b.

3. Source Description

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

3.a Process Description

See section 1.c.

3.b Process Flow Diagram

A process flow diagram is available on request.

3.c Raw and Finished Materials

Steel is processed on a coil-by-coil basis; once a coil enters the process, it continues from the Scale breaker to the pickling section and then to the tandem cold mill. Steel coils range from approximately 15 to 20 tons, depending on specific customer orders. Dust collected from the scale breaking operations is collected in super sacks.

3.d Process Capacity

Because the mill is designed to operate continuously when running, hourly capacity is very dependent upon the characteristics of the product that is going through the line. Steel coils range from approximately 15-20 tons, depending on specific customer orders. Hourly production rates are typically approximately 175-250 tons/hour depending on the product. During this test, production averaged 354 TPH.

3.e Process Instrumentation

The differential pressure across the baghouse is continuously monitored and is recorded once per shift. Routine quarterly maintenance is conducted to determine the operational and physical condition of the baghouse.

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

Measurement of exhaust gas velocity, molecular weight, and moisture content were conducted using the following reference test methods codified at Title 40, Part 60, Appendix A of the Code of Federal Regulations (40 CFR 60, Appendix A):

- Method 1 - *"Location of the Sampling Site and Sampling Points"*
- Method 2 - *"Determination of Stack Gas Velocity and Volumetric Flowrate"*
- Method 3 - *"Determination of Oxygen and Carbon Dioxide Concentrations in Emissions from Stationary Sources"(Fyrite)*
- Method 4 - *"Determination of Moisture Content in Stack Gases"*

Stack gas velocity traverses were conducted in accordance with the procedures outlined in Method 1 and Method 2 (see Figure 1 for a schematic of the sampling location). 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 were within specified limits, therefore, a baseline pitot tube coefficient of 0.84 (dimensionless) was assigned.

A cyclonic flow check was 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 angle is greater than 20 degrees, cyclonic flow exists. The null angle was determined to be less than 20 degrees at each sampling point.

Molecular weight was determined according to USEPA Method 3, "Gas Analysis for the Determination of Dry Molecular Weight." The equipment used for this evaluation consisted of a one-way squeeze bulb with connecting tubing and a set of Fyrite® combustion gas analyzers. Carbon dioxide and oxygen content were analyzed using the Fyrite® procedure.

Exhaust gas moisture content was evaluated using Method 4. Exhaust gas was extracted as part of the PM sampling trains and passed through the impinger configuration (see Figure 2). Exhaust gas moisture content was then determined gravimetrically.

4.b Particulate Matter less than 10 Microns (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"* were used to measure PM concentrations and emission rates (see Figure 2 for a schematic of the sampling train). All collected filterable particulate was assumed to be PM_{10}.

BTEC's Nutech® Model 2010 modular isokinetic stack sampling system consisted of (1) a borosilicate glass nozzle, (2) a glass 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 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 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. The condensable particulate samples were sent by courier to Maxxam's laboratory in Mississauga, Ontario for analysis.

4.c Recovery and Analytical Procedures

Filterable particulate matter samples were processed at BTEC's laboratory in Royal Oak, Michigan. Condensable particulate matter samples were sent to Maxxam's laboratory in Mississauga, Ontario.

4.d Sampling Ports

Diagrams of the stacks showing sampling ports in relation to upstream and downstream disturbances are included as Figure 1.

4.e Traverse Points

Diagrams of the stacks indicating traverse point locations and stack dimensions are 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
Overall Emission Summary
Test Date: July 18, 2018

Emission Unit	Pollutant	Permit Limit	Test Result
EUSCALEBREAKER	Particulate Matter less than 10 microns (filterable)	0.005 gr/dscf	0.005 gr/dscf

5.b Discussion of Results

The test results for filterable PM_{10} were in compliance with the permit limit.

5.c Sampling Procedure Variations

After completing the front half sample recovery, some of the loose PM on the filter for Run 1 and Run 2 was dislodged from the filter and adhered to the petri dish due to static electricity. The loose PM was recovered from the petri dishes using deionized water and dried in a beaker following the same procedures as the acetone rinse.

5.d Process or Control Device Upsets

A line stop during run 1 of the 7/18/18 test occurred. Testing was paused when the line stopped and was resumed when the line was restarted and reached a normal operating speed. The downtime was subtracted out of the production calculations.

5.e Control Device Maintenance

Routine quarterly maintenance is conducted to determine the operational and physical condition of the baghouse.

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 analytical results for this test program are presented in Appendix D.

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MEASUREMENT UNCERTAINTY STATEMENT

Both qualitative and quantitative factors contribute to field measurement uncertainty and should be taken into consideration when interpreting the results contained within this report. Whenever possible, Montrose Air Quality Services, LLC, (MAQS) personnel reduce the impact of these uncertainty factors through the use of approved and validated test methods. In addition, MAQS personnel perform routine instrument and equipment calibrations and ensure that the calibration standards, instruments, and equipment used during test events meet, at a minimum, test method specifications as well as the specifications of our Quality Manual and ASTM D 7036-04. The limitations of the various methods, instruments, equipment, and materials utilized during this test have been reasonably considered, but the ultimate impact of the cumulative uncertainty of this project is not fully identified within the results of this report.

Limitations

All testing performed was done in conformance to the ASTM D7036-04 standard. The information and opinions rendered in this report are exclusively for use by AK Steel. BTEC will not distribute or publish this report without AK Steel'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: _____

Paul Diven
Project Manager

This report was reviewed by: _____

Brandon Chase
QA/QC Manager

Table 4
Scalebreaker Particulate Matter Emission Rates

Company	**AK Steel**			
Source Designation	**Scale Breaker**			
Test Date	**7/18/2018**	**7/18/2018**	**7/18/2018**	
Meter/Nozzle Information	Run 1	Run 2	Run 3	Average
Meter Temperature Tm (F)	84.6	93.3	103.8	93.9
Meter Pressure - Pm (in. Hg)	29.6	29.6	29.6	29.6
Measured Sample Volume (Vm)	62.6	63.6	64.4	63.5
Sample Volume (Vm-Std ft3)	61.6	61.5	61.1	61.4
Sample Volume (Vm-Std m3)	1.74	1.74	1.73	1.74
Condensate Volume (Vw-std)	1.047	0.929	0.835	0.937
Gas Density (Ps(std) lbs/ft3) (wet)	0.0741	0.0741	0.0742	0.0741
Gas Density (Ps(std) lbs/ft3) (dry)	0.0745	0.0745	0.0745	0.0745
Total weight of sampled gas (m g lbs) (wet)	4.64	4.62	4.59	4.62
Total weight of sampled gas (m g lbs) (dry)	4.59	4.58	4.56	4.57
Nozzle Size - An (sq. ft.)	0.000425	0.000425	0.000425	0.000425
Isokinetic Variation - I	98.4	98.9	99.0	98.8
Stack Data				
Average Stack Temperature - Ts (F)	102.6	103.5	105.2	103.8
Molecular Weight Stack Gas- dry (Md)	28.8	28.8	28.8	28.8
Molecular Weight Stack Gas-wet (Ms)	28.7	28.7	28.7	28.7
Stack Gas Specific Gravity (Gs)	0.989	0.990	0.991	0.990
Percent Moisture (Bws)	1.67	1.49	1.35	1.50
Water Vapor Volume (fraction)	0.0167	0.0149	0.0135	0.0150
Pressure - Ps ("Hg)	29.3	29.3	29.3	29.3
Average Stack Velocity -Vs (ft/sec)	45.2	45.0	44.7	45.0
Area of Stack (ft2)	12.6	12.6	12.6	12.6
Exhaust Gas Flowrate				
Flowrate ft^3(Actual)	34,083	33,888	33,702	33,891
Flowrate ft^3 (Standard Wet)	31,357	31,126	30,864	31,116
Flowrate ft^3 (Standard Dry)	30,832	30,663	30,448	30,648
Flowrate m^3 (standard dry)	873	868	862	868
Total Particulate Weights (mg)				
Total Nozzle/Probe/Filter	19.0	25.9	13.6	19.5
Organic Condensible Particulate	< 1.0	< 1.0	< 1.0	< 1.0
Inorganic Condensible Particulate	3.0	2.9	3.4	3.1
Condensible Blank Correction	2.0	2.0	2.0	2.0
Total Condensible Particulate	< 2.0	< 1.9	< 2.4	< 2.1
Total Filterable and Condensible Particulate	< 21.0	< 27.8	< 16.0	< 21.6
Filterable Particulate Concentration				
lb/1000 lb (wet)	0.009	0.012	0.007	0.009
lb/1000 lb (dry)	0.009	0.012	0.007	0.009
mg/dscm (dry)	10.9	14.9	7.9	11.2
gr/dscf	0.0048	0.0065	0.0034	0.0049
Filterable Particulate Emission Rate				
lb/ hr	1.26	1.72	0.90	1.29
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)	< 1.1	< 1.1	< 1.4	< 1.2
gr/dscf	< 0.001	< 0.000	< 0.001	< 0.001
Condensible Particulate Emission Rate				
lb/ hr	< 0.13	< 0.13	< 0.16	< 0.14
Total Particulate Concentration				
lb/1000 lb (wet)	< 0.010	< 0.013	< 0.008	< 0.010
lb/1000 lb (dry)	< 0.010	< 0.013	< 0.008	< 0.010
mg/dscm (dry)	< 12.0	< 16.0	< 9.2	< 12.4
gr/dscf	< 0.005	< 0.007	< 0.004	< 0.005
Total Particulate Emission Rate				
lb/ hr	< 1.40	< 1.84	< 1.06	< 1.43

Note: The RDL was used the calculations for organic consensibles. Actual results are less than the reported results.

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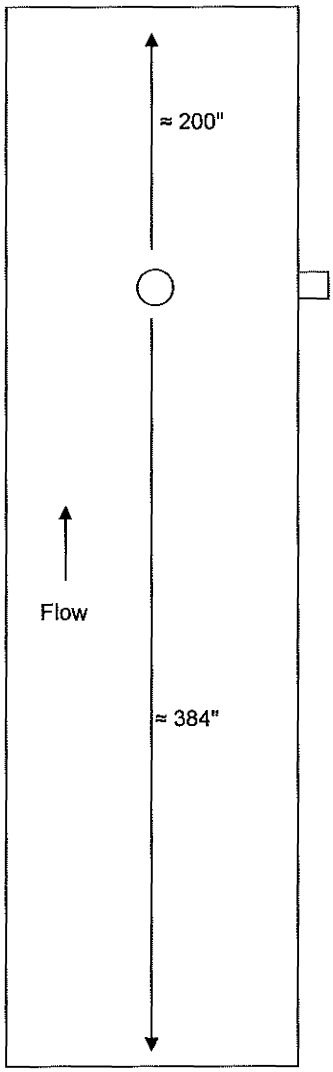
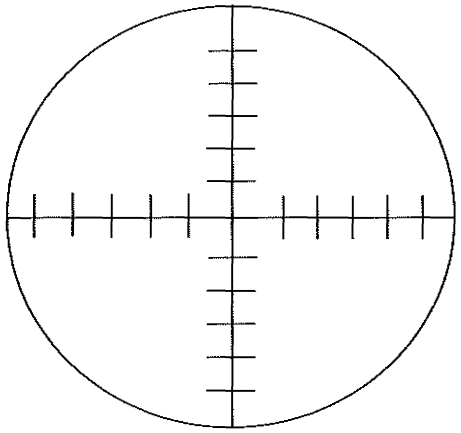
diameter = 48 inches





Not to Scale

Points	Distance "
1	2.1
2	7.0
3	14.2
4	33.8
5	41.0
6	45.9

Figure No. 1

Site: **Scalebreaker** **AK Steel** **Dearborn, MI**	**Sampling Date:** **July 18, 2018**	**BT Environmental Consulting, Inc.** **4949 Fernlee Avenue** **Royal Oak, Michigan 48073**

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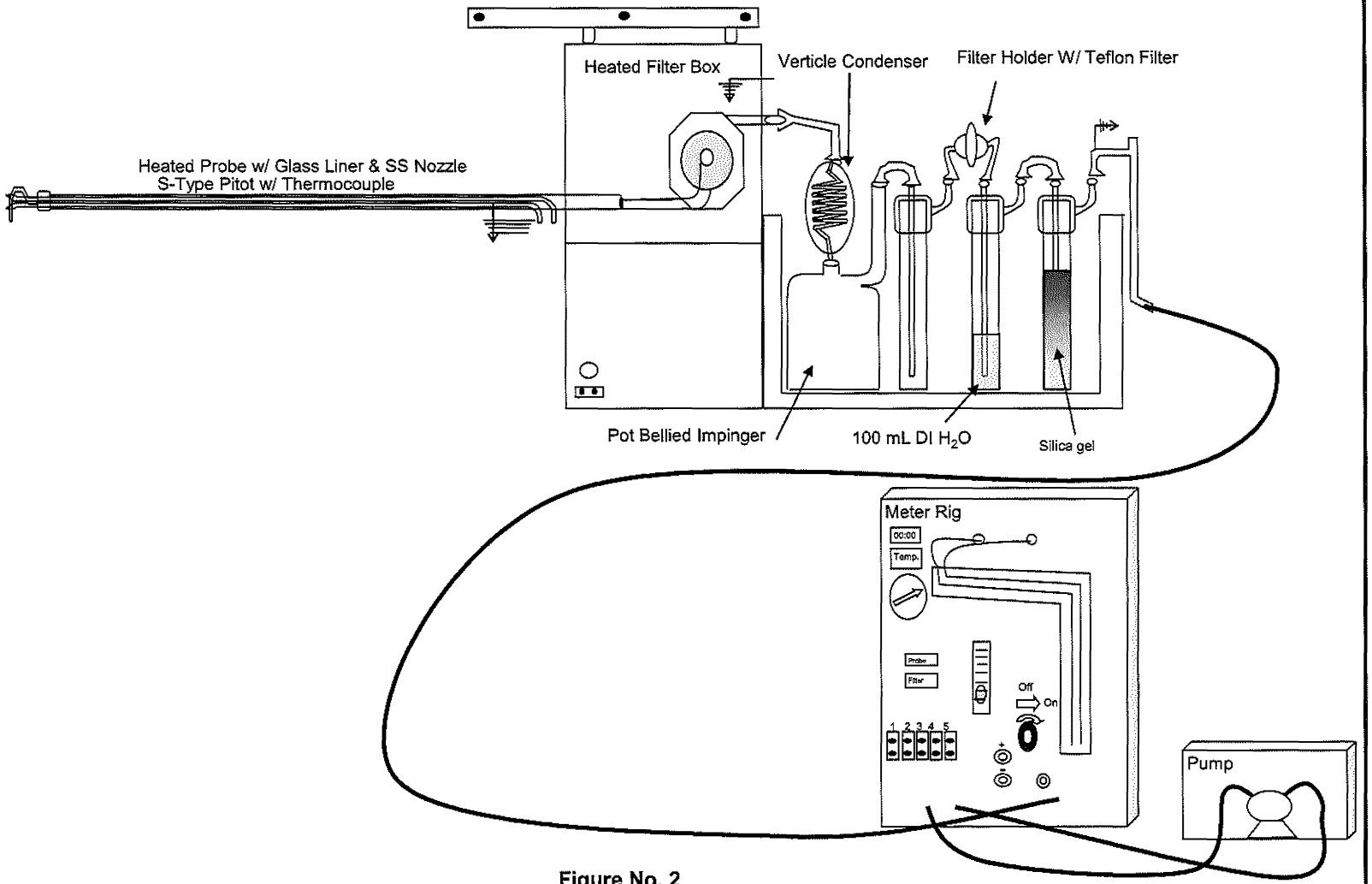

Figure No. 2

Site: **USEPA Method 5/202** **AK Steel** **Dearborn, MI**	**Sampling Date:** **July 18, 2018**	**BT Environmental Consulting, Inc.** **4949 Fernlee Avenue** **Royal Oak, Michigan 48073**