BTEC Inc.

LRF 1 and LRF 2 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. 16-4888.00
December 14, 2016

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), particulate matter less than 10 microns (PM_{10}), particulate matter less than 2.5 microns ($PM_{2.5}$), lead (Pb), and Visual Emissions (VE) from the LRF 1 and LRF 2 baghouses. Particulate matter less than 10 and 2.5 microns (PM_{10} and $PM_{2.5}$) were determined as the sum of the filterable and condensable PM fractions. The emissions test program was conducted on October 31-November 4, 2016.

Testing of the LRF 1 and LRF 2 baghouses consisted of triplicate test runs for each pollutant. The emissions test program was required by MDEQ Air Quality Division PTI 182-05C, Facility SRN A8640. The results of the emission test program are summarized by Table I.

Table I
Overall Emission Summary
Test Date: October 31-Novmber 4, 2016

Emission Unit	Pollutant	Permit Limit	Test Result
LRF 1	PM	0.005 gr/dscf	0.0003 gr/dscf
		6.33 lb/hr	0.20 lb/hr
	$PM_{2.5}$, PM_{10}	6.65 lb/hr	0.82 lb/hr
	Lead	0.022 lb/hr	0.004 lb/hr
	VE	5%-6 Minute Average	0%(1)

Emission Unit	Pollutant	Permit Limit	Test Result
LRF 2	PM	0.005 gr/dscf	0.0005 gr/dscf
		3.72 lb/hr	0.25 lb/hr
	$PM_{2.5}$, PM_{10}	3.91 lb/hr	0.47 lb/hr
	Lead	0.013 lb/hr	0.002 lb/hr
	VE	5%-6 Minute Average	0%(1)

(1) Calculated as highest 6-minute average observed

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), particulate matter less than 10 microns (PM_{10}), particulate matter less than 2.5 microns ($PM_{2.5}$), lead (Pb), and Visual Emissions (VE) from the LRF 1 and LRF 2 baghouses. Particulate matter less than 10 and 2.5 microns (PM_{10} and $PM_{2.5}$) were determined as the sum of the filterable and condensable PM fractions. The emissions test program was conducted on October 31-November 4, 2016.

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 31-November 4, 2016 at the AK Steel facility located in Dearborn, Michigan.

1.b Purpose of Testing

AQD issued Permit To Install No. 182-05C, Facility SRN A8640 to AK Steel. The permit limits are summarized by Table 1.

Table 1
Emission Limitations
AK Steel Corporation – Dearborn Works
PTI 182-05C Emission Limitations

Emission Unit	Pollutant	Permit Limit
LRF 1	PM	0.005 gr/dscf
		6.33 lb/hr
	$PM_{2.5}$, PM_{10}	6.65 lb/hr
	Lead	0.022 lb/hr
	VE	5% - 6 Minute Average

Emission Unit	Pollutant	Permit Limit
LRF 2	PM	0.005 gr/dscf
		3.72 lb/hr
	$PM_{2.5}$, PM_{10}	3.91 lb/hr
	Lead	0.013 lb/hr
	VE	5% - 6 Minute Average

1.c Source Description

LRF No. 1 Baghouse
The No. 1 LRF dust collector is a continuous automatic, suction type, pulse-jet baghouse. The baghouse consists of five (5) chambers in parallel and is manufactured by Flakt. One (1) main induced draft (ID) fan provides the suction for moving the fume and dust laden gases through the fume control system. The fan is of the radial tip design and designed to handle 175,000 actual cubic feet per minute (acfm).

LRF No.2 Baghouse
The No. 2 LRF dust collector is a continuous automatic, suction type, pulse-jet baghouse. The baghouse consists of six (6) chambers in parallel and is manufactured by Wheelabrator. One (1) main ID fan provides the suction for moving the fume and dust laden gases through the fume control system. The fan is of the radial tip design and designed to handle 100,000 acfm.

1.d Test Program Contacts

The contacts for the source and test report are:

Mr. David Pate
Environmental Engineer
AK Steel Corporation – Dearborn Works
4001 Miller Rd.
Dearborn, Michigan
(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. Steve Smith Project Manager	BTEC 4949 Fernlee Royal Oak, MI 48073	(248) 548-8070
Mr. Dave Trahan 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. Mark Dziadosz MDEQ	MDEQ Air Quality Division	(586) 753-3745
Ms. Katherine Koster MDEQ	MDEQ Detroit District Office	(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

LRF 1 Baghouse

Temperature 100-150°F
Moisture Content 1-2%

LRF2 Baghouse

Temperature 100-200°F
Moisture Content 1-2%

2.b Applicable Permit

AQD issued Permit To Install No. 182-05C, 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

The purpose of the LRF is to prepare the molten steel for casting through final temperature and chemistry adjustments. The LRF receives molten steel from the basic oxygen furnace (BOF). The steel is reheated by electricity and, if necessary, alloys are added to achieve the required alloy composition. Emissions from LRFs are controlled by their own individual pulse-jet baghouses equipped with a bag leak detection system that continuously monitors the particulate matter loading in the exhaust to ensure proper operation.

3.b Process Flow Diagram

A process flow diagram is available on request.

3.c Raw and Finished Materials

The LRFs receive molten steel from the BOF. The steel is reheated by electric power and, when necessary, alloys are added to achieve the required steel chemistry specification. Approximately 250 tons of molten steel are processed at the LRFs during each heat.

3.d Process Capacity

Note that the LRF production rates are highly dependent upon proper functioning of downstream equipment, customer demand, and the final desired chemistry of the steel. Below are approximate hourly maximum production rates.

LRF No. 1 Process/Baghouse: Approximately 300-400 tons per hour
LRF No. 2 Process/Baghouse: Approximately 150-275 tons per hour

During the testing, the following average production rates were achieved:

LRF1 PM, PM_{10}, $PM_{2.5}$ Testing – 343 tons per hour
LRF1 Lead Testing – 222 tons per hour
LRF2 PM, PM_{10}, $PM_{2.5}$ Testing – 285 tons per hour
LRF2 Lead Testing – 205 tons per hour

3.e Process Instrumentation

To ensure the baghouses are operating correctly, a bag leak detection system has been installed on each LRF stack. The bag leak detection system monitors the particulate matter loading in the exhaust on a continuous basis. The baghouses are typically operated at an

overall differential pressure of 2-9" W.C. for each baghouse. Typical differential pressure for each individual compartment for each baghouse ranges from 1-8" W.C.

4. Sampling and Analytical Procedures

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

4.a Sampling Train and Field Procedures

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 3 and 4 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 and lead sampling trains and passed through the impinger configuration (see Figures 1-2). Exhaust gas moisture content was then determined gravimetrically.

4.b *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"* were used to measure PM, $PM_{2.5}$, and PM_{10} concentrations and emission rates (see Figure 1 for a schematic of the sampling train). $PM_{2.5}$, and PM_{10} were calculated as the sum of the filterable and condensable fractions.

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 Analytical's laboratory in Ontario, Canada for analysis.

4.c *Lead (USEPA Method 12)*

40 CFR 60, Appendix A, Method 12, *"Determination of Lead Emissions From Stationary Sources"* was used to measure lead concentrations and to calculate appropriate emission rates (see Figure 2 for a schematic of the sampling train).

BTEC's Nutech® Model 2010 modular isokinetic stack sampling system consisted of (1) a borosilicate glass nozzle, (2) a borosilicate glass probe, (3) a heated borosilicate or quartz glass filter holder containing a pre-weighed 90-mm diameter glass fiber filter with

Teflon filter support; (4) a set of four Greenburg-Smith (GS) impingers with the first two with 100 ml of a 0.1N HNO_3 solution (ii) an empty impinger, (iii) and an impinger filled with approximately 300 grams of silica gel. (5) a length of sample line, and (6) a Nutech® control case equipped with a pump, dry gas meter, and calibrated orifice.

Upon 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 100 ml of 0.1N HNO_3. The rinses were collected in a pre-cleaned sample container and prepared for transport.

The back half of the filter housing and first three impingers were triple rinsed with 300 ml of 0.1N HNO_3.

BTEC labeled each container with the test number, test location, and test date, then marked the level of liquid on the outside of the container. In addition, blank samples of the filter, and 0.1N HNO_3 solutions, were collected. The samples were sent by courier to Maxxam Analytical's laboratory in Ontario, Canada for analysis.

4.d Recovery and Analytical Procedures

Filterable particulate matter samples were processed at BTEC's laboratory in Royal Oak, Michigan. Lead and condensable particulate matter samples were sent to Maxxam Laboratories in Ontario, Canada.

4.e Sampling Ports

Diagrams of the stacks showing sampling ports in relation to upstream and downstream disturbances are included as Figures 3 and 4.

4.f Traverse Points

Diagrams of the stacks indicating traverse point locations and stack dimensions are included as Figures 3 and 4.

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 Tables 4-7.

Table 3
Overall Emission Summary
Test Date: October 31-Novmber 4, 2016

Emission Unit	Pollutant	Permit Limit	Test Result
LRF 1	PM	0.005 gr/dscf	0.0003 gr/dscf
		6.33 lb/hr	0.20 lb/hr
	$PM_{2.5}$, PM_{10}	6.65 lb/hr	0.82 lb/hr
	Lead	0.022 lb/hr	0.004 lb/hr
	VE	5% - 6 Minute Average	0%(1)

Emission Unit	Pollutant	Permit Limit	Test Result
LRF 2	PM	0.005 gr/dscf	0.0005 gr/dscf
		3.72 lb/hr	0.25 lb/hr
	$PM_{2.5}$, PM_{10}	3.91 lb/hr	0.47 lb/hr
	Lead	0.013 lb/hr	0.002 lb/hr
	VE	5% - 6 Minute Average	0%(1)

(1) Calculated as highest 6-minute average observed

5.b Discussion of Results

The test results for PM, $PM_{2.5}$, PM_{10}, lead, and VE were below the permit limits for LRF1 and LRF2.

5.c Sampling Procedure Variations

During Run 1 of the LRF2 PM test, the addition of alloys was performed while the testing was paused. After consultation with the MDEQ, it was agreed that the test run should be voided. Compliance was determined as the average of the results for runs 2, 3, and 4. The field data sheet for Run 1 and the analysis results for the filterable PM are included in this report.

The test protocol and the MDEQ acceptance letter stated that each run would be a minimum of 3 heats in duration. Onsite conversations between AK Steel and MDEQ determined that as long as the production rate was acceptable and enough sample volume was collected, the run could be ended without testing for 3 heats. All runs consisted of an integral number of heats and ranged from 1-3 heats in duration.

5.d Process or Control Device Upsets

There were no process upsets during this test.

5.e Control Device Maintenance

Routine monthly and quarterly MACT inspections were performed in the 3 months prior to the test. The Quarterly Tubesheet check for LRF1 during the third quarter of 2016 revealed

a broken bag in compartment 3. The bag was removed and a cap was placed over the tubesheet hole. No other major abnormalities were observed during the inspections for LRF1 and LRF2.

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.

Table 4
LRF 1 Particulate Matter Emission Rates

Company	**AK Steel**			
Source Designation	**LRF 1**			
Test Date	**11/3/2016**	**11/3/2016**	**11/3/2016**	
Meter/Nozzle Information	Run 1	Run 2	Run 3	Average
Meter Temperature Tm (F)	61.4	67.0	66.2	64.9
Meter Pressure - Pm (in. Hg)	29.5	29.5	29.6	29.5
Measured Sample Volume (Vm)	92.4	61.8	78.5	77.6
Sample Volume (Vm-Std ft3)	92.5	61.4	78.1	77.3
Sample Volume (Vm-Std m3)	2.62	1.74	2.21	2.19
Condensate Volume (Vw-std)	1.443	0.971	1.075	1.163
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)	6.96	4.62	5.87	5.82
Total weight of sampled gas (m g lbs) (dry)	6.89	4.57	5.82	5.76
Nozzle Size - An (sq. ft.)	0.000576	0.000576	0.000576	0.000576
Isokinetic Variation - I	101.0	100.6	100.4	100.7
Stack Data				
Average Stack Temperature - Ts (F)	102.3	110.6	105.7	106.2
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)	0.990	0.990	0.991	0.990
Percent Moisture (Bws)	1.54	1.56	1.36	1.48
Water Vapor Volume (fraction)	0.0154	0.0156	0.0136	0.0148
Pressure - Ps ("Hg)	29.3	29.4	29.4	29.4
Average Stack Velocity -Vs (ft/sec)	24.4	24.6	24.9	24.6
Area of Stack (ft2)	63.6	63.6	63.6	63.6
Exhaust Gas Flowrate				
Flowrate ft^3(Actual)	92,973	94,016	94,817	93,936
Flowrate ft^3 (Standard Wet)	85,585	85,543	87,031	86,053
Flowrate ft^3 (Standard Dry)	84,271	84,211	85,849	84,777
Flowrate m^3 (standard dry)	2,386	2,385	2,431	2,401
Total Particulate Weights (mg)				
Total Nozzle/Probe/Filter	2.2	0.6	1.6	1.5
Organic Condensible Particulate	2.1	1.2	0.5	1.3
Inorganic Condensible Particulate	4.6	6.0	3.7	4.8
Condensible Blank Correction	2.0	2.0	2.0	2.0
Total Condensible Particulate	4.7	5.2	2.2	4.0
Total Filterable and Condensible Particulate	6.9	5.8	3.8	5.5
Filterable Particulate Concentration				
lb/1000 lb (wet)	0.001	0.000	0.001	0.001
lb/1000 lb (dry)	0.001	0.000	0.001	0.001
mg/dscm (dry)	0.8	0.3	0.7	0.6
gr/dscf	0.0004	0.0002	0.0003	0.0003
Filterable Particulate Emission Rate				
lb/ hr	0.27	0.11	0.23	0.20
Condensible Particulate Concentration				
lb/1000 lb (wet)	0.001	0.002	0.001	0.002
lb/1000 lb (dry)	0.002	0.003	0.001	0.002
mg/dscm (dry)	1.8	3.0	1.0	1.9
gr/dscf	0.0008	0.0013	0.0004	0.0008
Condensible Particulate Emission Rate				
lb/ hr	0.57	0.95	0.32	0.61
Total Particulate Concentration				
lb/1000 lb (wet)	0.002	0.003	0.001	0.002
lb/1000 lb (dry)	0.002	0.003	0.001	0.002
mg/dscm (dry)	2.6	3.3	1.7	2.6
gr/dscf	0.0012	0.0015	0.0008	0.0011
Total Particulate Emission Rate				
lb/ hr	0.83	1.06	0.55	0.82

Table 5
LRF 1 Lead Emission Rates

Company	**AK Steel**			
Source Designation	**LRF 1**			
Test Date	**11/4/2016**	**11/4/2016**	**11/4/2016**	
Meter/Nozzle Information	Run 1	Run 2	Run 3	Average
Meter Temperature Tm (F)	63.8	68.0	65.3	65.7
Meter Pressure - Pm (in. Hg)	29.7	29.8	29.6	29.7
Measured Sample Volume (Vm)	82.3	107.7	67.9	86.0
Sample Volume (Vm-Std ft3)	82.8	107.7	67.9	86.1
Sample Volume (Vm-Std m3)	2.35	3.05	1.92	2.44
Condensate Volume (Vw-std)	1.099	1.117	0.698	0.971
Gas Density (Ps(std) lbs/ft3) (wet)	0.0742	0.0742	0.0742	0.0742
Gas Density (Ps(std) lbs/ft3) (dry)	0.0745	0.0745	0.0745	0.0745
Total weight of sampled gas (m g lbs) (wet)	6.22	8.08	5.09	6.47
Total weight of sampled gas (m g lbs) (dry)	6.17	8.03	5.06	6.42
Nozzle Size - An (sq. ft.)	0.000576	0.000576	0.000576	0.000576
Isokinetic Variation - I	99.4	99.4	99.2	99.3
Stack Data				
Average Stack Temperature - Ts (F)	126.6	121.6	125.2	124.5
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)	0.991	0.992	0.992	0.992
Percent Moisture (Bws)	1.31	1.03	1.02	1.12
Water Vapor Volume (fraction)	0.0131	0.0103	0.0102	0.0112
Pressure - Ps ("Hg)	29.6	29.7	29.5	29.6
Average Stack Velocity -Vs (ft/sec)	24.9	25.1	25.0	25.0
Area of Stack (ft2)	63.6	63.6	63.6	63.6
Exhaust Gas Flowrate				
Flowrate ft^3(Actual)	95,103	95,931	95,259	95,431
Flowrate ft^3 (Standard Wet)	84,749	86,335	84,807	85,297
Flowrate ft^3 (Standard Dry)	83,639	85,449	83,944	84,344
Flowrate m^3 (standard dry)	2,368	2,420	2,377	2,388
Total Lead Weights (ug)				
Lead	18.5	36.3	41.8	32.2
Lead Concentrations				
lb/1000 lb (wet)	0.000007	0.000010	0.000018	0.000012
lb/1000 lb (dry)	0.000007	0.000010	0.000018	0.000012
mg/dscm (dry)	0.008	0.012	0.022	0.014
gr/dscf	0.00000	0.00001	0.00001	0.00001
Lead Emission Rate				
lb/ hr	0.002	0.004	0.007	0.004

Rev. 14.0
3-20-15 BC

Table 6
LRF 2 Particulate Matter Emission Rates

Company	**AK Steel**			
Source Designation	**LRF 2**			
Test Date	**10/31/2016**	**10/31/2016**	**11/1/2016**	
Meter/Nozzle Information	Run 2	Run 3	Run 4	Average
Meter Temperature Tm (F)	82.0	84.8	80.6	82.5
Meter Pressure - Pm (in. Hg)	29.7	29.6	29.4	29.6
Measured Sample Volume (Vm)	96.1	96.5	68.2	86.9
Sample Volume (Vm-Std ft3)	93.4	93.0	65.8	84.1
Sample Volume (Vm-Std m3)	2.64	2.63	1.86	2.38
Condensate Volume (Vw-std)	0.726	0.721	1.061	0.836
Gas Density (Ps(std) lbs/ft3) (wet)	0.0743	0.0743	0.0741	0.0742
Gas Density (Ps(std) lbs/ft3) (dry)	0.0745	0.0745	0.0745	0.0745
Total weight of sampled gas (m g lbs) (wet)	6.99	6.97	4.95	6.30
Total weight of sampled gas (m g lbs) (dry)	6.96	6.93	4.91	6.27
Nozzle Size - An (sq. ft.)	0.000425	0.000425	0.000425	0.000425
Isokinetic Variation - I	99.7	98.6	100.7	99.7
Stack Data				
Average Stack Temperature - Ts (F)	113.9	131.5	156.9	134.1
Molecular Weight Stack Gas- dry (Md)	28.8	28.8	28.8	28.8
Molecular Weight Stack Gas-wet (Ms)	28.8	28.7	28.7	28.7
Stack Gas Specific Gravity (Gs)	0.993	0.990	0.990	0.991
Percent Moisture (Bws)	0.77	0.77	1.59	1.04
Water Vapor Volume (fraction)	0.0077	0.0077	0.0159	0.0104
Pressure - Ps ("Hg)	29.5	29.5	29.3	29.4
Average Stack Velocity -Vs (ft/sec)	38.1	38.6	38.9	38.6
Area of Stack (ft2)	28.3	28.3	28.3	28.3
Exhaust Gas Flowrate				
Flowrate ft^3(Actual)	64,657	65,428	66,028	65,371
Flowrate ft^3 (Standard Wet)	58,728	57,500	55,257	57,162
Flowrate ft^3 (Standard Dry)	58,275	57,058	54,380	56,571
Flowrate m^3 (standard dry)	1,650	1,616	1,540	1,602
Total Particulate Weights (mg)				
Total Nozzle/Probe/Filter	1.2	3.0	3.6	2.6
Organic Condensible Particulate	1.1	0.9	0.9	1.0
Inorganic Condensible Particulate	3.3	2.3	4.5	3.4
Condensible Blank Correction	2.0	2.0	2.0	2.0
Total Condensible Particulate	2.4	1.2	3.4	2.3
Total Filterable and Condensible Particulate	3.6	4.2	7.0	4.9
Filterable 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)	0.5	1.1	1.9	1.2
gr/dscf	0.0002	0.0005	0.0008	0.0005
Filterable Particulate Emission Rate				
lb/ hr	0.10	0.24	0.39	0.25
Condensible Particulate Concentration				
lb/1000 lb (wet)	0.001	0.000	0.002	0.001
lb/1000 lb (dry)	0.001	0.000	0.002	0.001
mg/dscm (dry)	0.9	0.5	1.8	1.1
gr/dscf	0.0004	0.0002	0.0008	0.0005
Condensible Particulate Emission Rate				
lb/ hr	0.20	0.10	0.37	0.22
Total Particulate Concentration				
lb/1000 lb (wet)	0.001	0.001	0.003	0.002
lb/1000 lb (dry)	0.001	0.001	0.003	0.002
mg/dscm (dry)	1.4	1.6	3.8	2.2
gr/dscf	0.0006	0.0007	0.0016	0.0010
Total Particulate Emission Rate				
lb/ hr	0.30	0.34	0.77	0.47

Table 7
LRF 2 Lead Emission Rates

Company	**AK Steel**			
Source Designation	**LRF 2**			
Test Date	**11/1/2016**	**11/2/2016**	**11/2/2016**	
Meter/Nozzle Information	Run 1	Run 2	Run 3	Average
Meter Temperature Tm (F)	73.9	77.4	78.5	76.6
Meter Pressure - Pm (in. Hg)	29.4	29.6	29.6	29.5
Measured Sample Volume (Vm)	80.2	87.0	71.2	79.5
Sample Volume (Vm-Std ft3)	78.4	84.8	69.3	77.5
Sample Volume (Vm-Std m3)	2.22	2.40	1.96	2.19
Condensate Volume (Vw-std)	1.400	1.481	1.226	1.369
Gas Density (Ps(std) lbs/ft3) (wet)	0.0740	0.0741	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)	5.91	6.39	5.22	5.84
Total weight of sampled gas (m g lbs) (dry)	5.84	6.32	5.17	5.77
Nozzle Size - An (sq. ft.)	0.000425	0.000425	0.000425	0.000425
Isokinetic Variation - I	100.2	100.4	101.2	100.6
Stack Data				
Average Stack Temperature - Ts (F)	170.6	143.8	176.5	163.7
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)	1.76	1.72	1.74	1.74
Water Vapor Volume (fraction)	0.0176	0.0172	0.0174	0.0174
Pressure - Ps ("Hg)	29.3	29.4	29.4	29.4
Average Stack Velocity -Vs (ft/sec)	40.2	39.3	39.5	39.6
Area of Stack (ft2)	28.3	28.3	28.3	28.3
Exhaust Gas Flowrate				
Flowrate ft^3(Actual)	68,109	66,623	66,936	67,222
Flowrate ft^3 (Standard Wet)	55,761	57,182	54,608	55,850
Flowrate ft^3 (Standard Dry)	54,782	56,200	53,659	54,880
Flowrate m^3 (standard dry)	1,551	1,591	1,519	1,554
Total Lead Weights (ug)				
Lead	25.7	39.0	15.7	26.8
Lead Concentrations				
lb/1000 lb (wet)	0.000010	0.000013	0.000007	0.000010
lb/1000 lb (dry)	0.000010	0.000014	0.000007	0.000010
mg/dscm (dry)	0.012	0.016	0.008	0.012
gr/dscf	0.00001	0.00001	0.00000	0.00001
Lead Emission Rate				
lb/ hr	0.002	0.003	0.002	0.002

Rev. 14.0
3-20-15 BC

BTEC Inc.

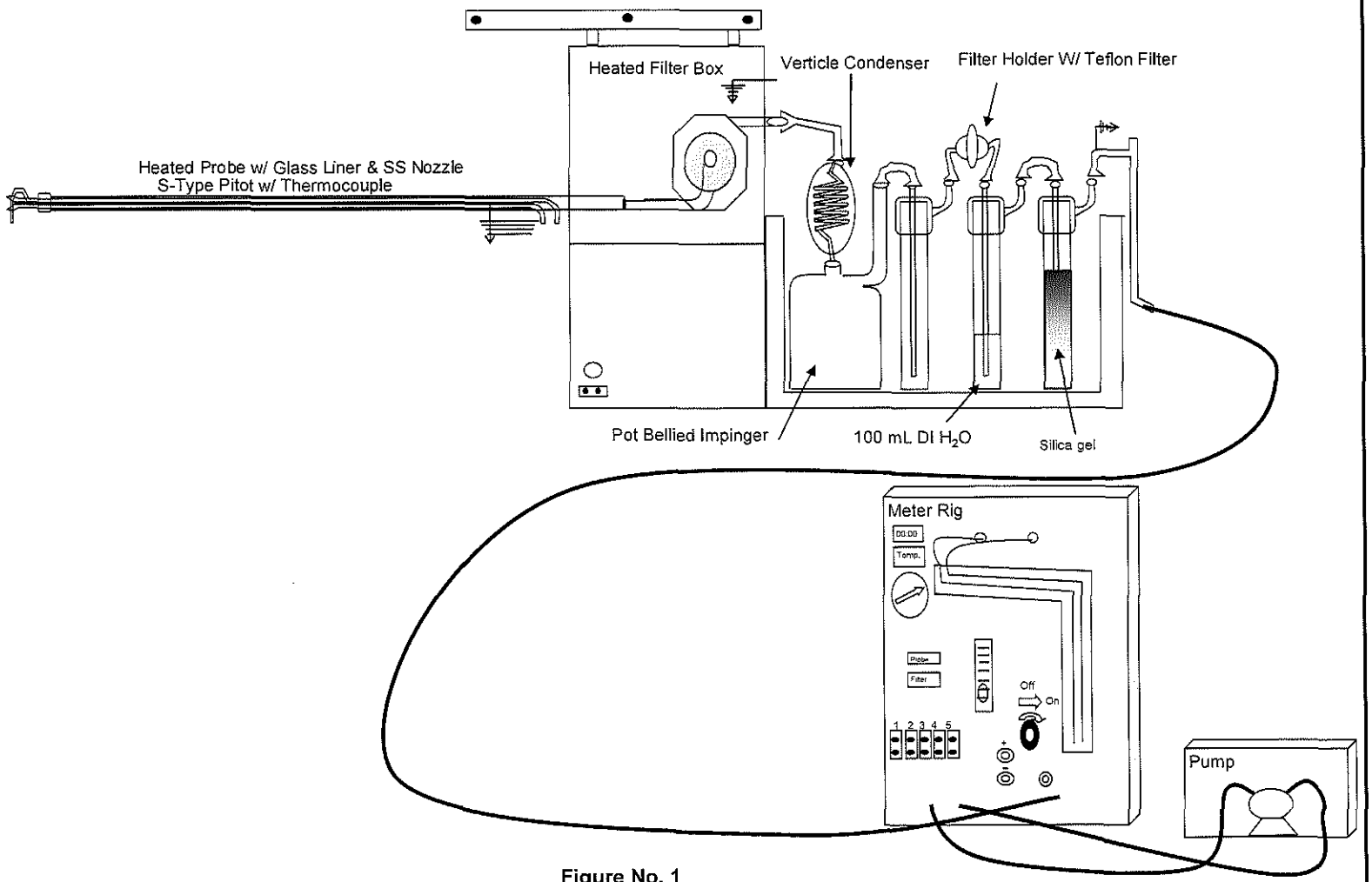


Figure No. 1

Site: **USEPA Method 5/202** **AK Steel** **Dearborn, Michigan**	**Sampling Date:** **October 31-November 4, 2016**	**BT Environmental Consulting, Inc.** **4949 Fernlee Avenue** **Royal Oak, Michigan 48073**

BTEC Inc.

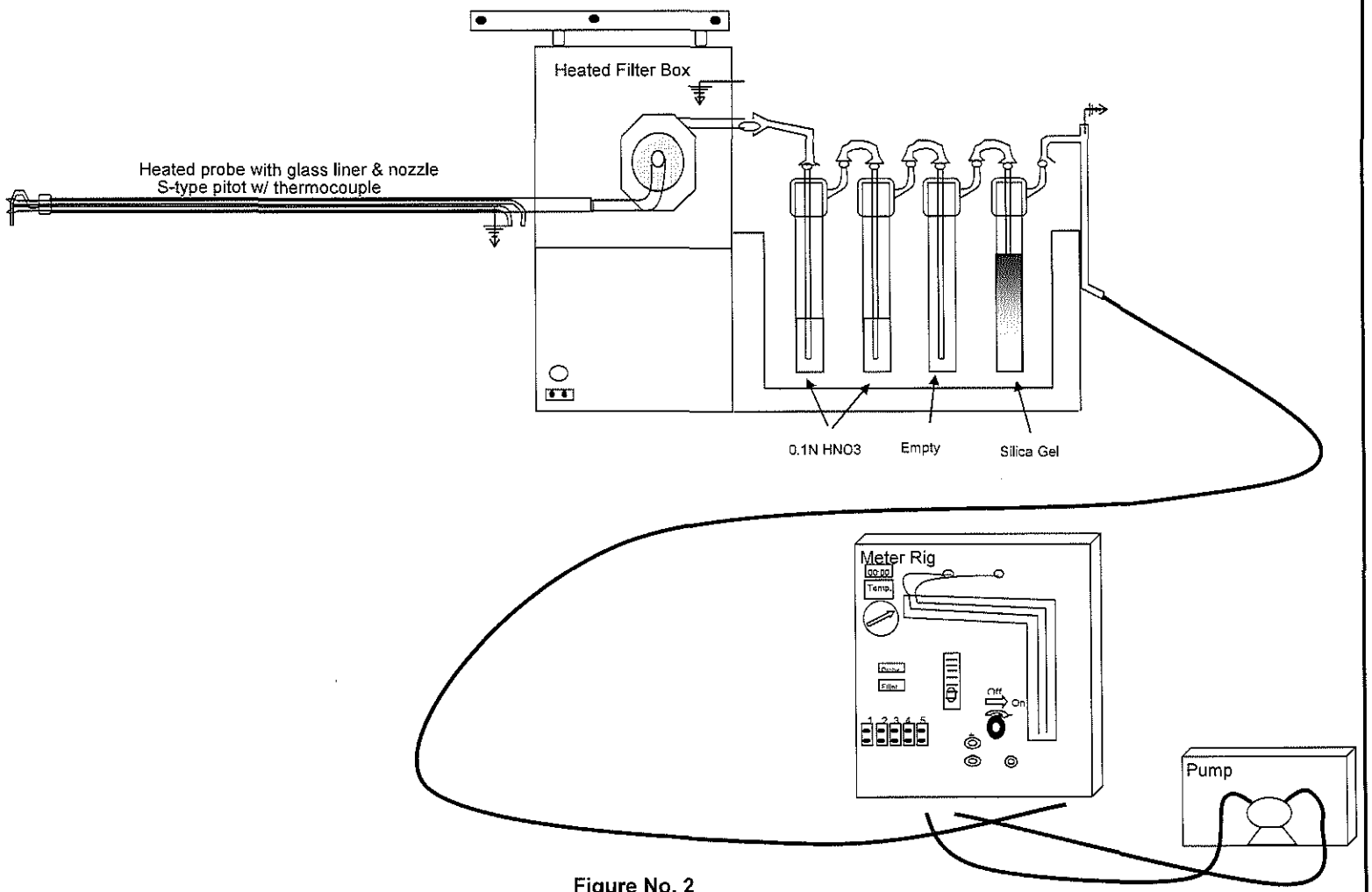
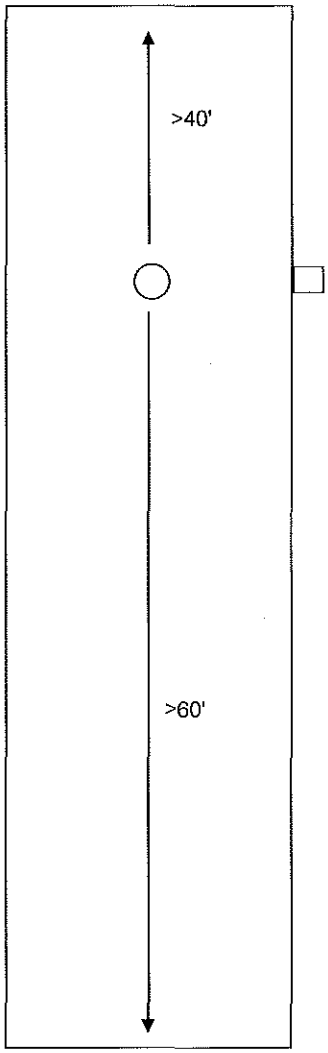


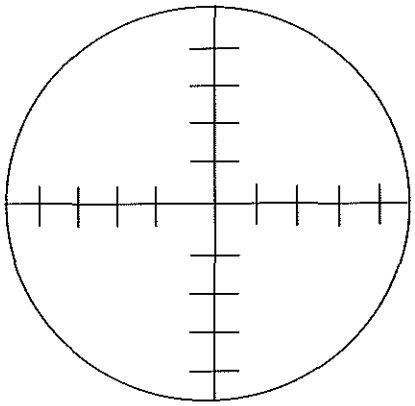
Figure No. 2

Site:	Sampling Date:	
USEPA Method 12 Sampling Train AK Steel Dearborn, MI	October 31-November 4, 2016	BT Environmental Consulting, Inc. 4949 Fernlee Avenue Royal Oak, Michigan 48073

BTEC Inc.

diameter = 108"





Not to Scale

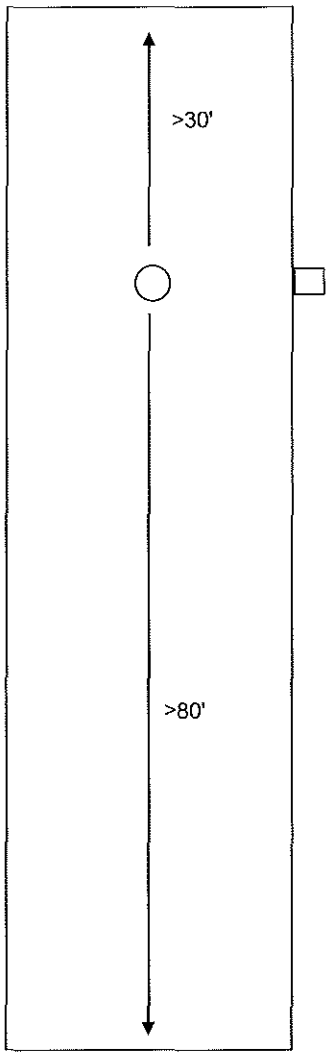
Points	Distance "
1	3.5
2	11.3
3	21.0
4	34.9
5	73.1
6	87.0
7	96.7
8	104.5

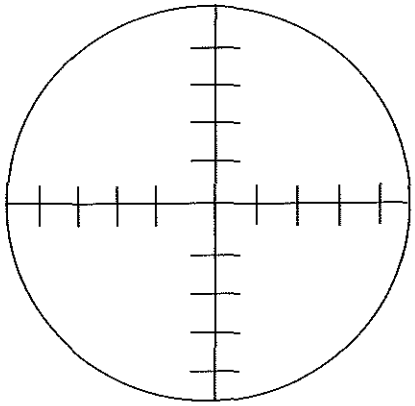
Figure No. 3

Site: **LRF 1** **AK Steel-Dearborn Works** **Dearborn, Michigan**	**Sampling Date:** **November 3-4, 2016**	**BT Environmental Consulting, Inc.** **4949 Fernlee** **Royal Oak, Michigan**

BTEC Inc.

diameter = 72"





Not to Scale

Points	Distance "
1	2.3
2	7.6
3	14.0
4	23.3
5	48.7
6	58.0
7	64.4
8	69.7

Figure No. 4

Site: **LRF 2** **AK Steel-Dearborn Works** **Dearborn, Michigan**	**Sampling Date:** **October 31-November 2, 2016**	**BT Environmental Consulting, Inc.** **4949 Fernlee** **Royal Oak, Michigan**