BTEC Inc.

LMF and EAF Baghouse Emissions Test Report

Prepared for:

Gerdau Special Steel – North America

Monroe, Michigan

Gerdau Special Steel
3000 E. Front Street
Monroe, Michigan

Project No. 16-4925.00
November 23, 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 Gerdau Special Steel North America (GSS) to conduct an evaluation on two sources at the GSS facility in Monroe, Michigan. The emission test program included evaluation of particulate matter (PM 10/2.5), condensable particulate matter (CPM), and volatile organic compounds (VOC) from the Ladle Metallurgic Furnace (LMF) and the Electric Arc Furnace (EAF). The emissions test program was conducted on October 20-21, 2016.

Testing of the LMF and EAF stacks consisted of triplicate 240 minute test runs conducted simultaneously for PM and CPM, and triplicate 60 minute test runs for VOC. The emissions test program was required by MDEQ Air Quality Division Permit to Install (PTI) No. 102-12A. The results of the emission test program are summarized by Table I.

Table I
Overall Emission Summary
Test Date: October 20-21, 2016

Emission Unit	Pollutant	Permit Limit	Test Result
EAF+LMF Baghouse Stacks	$PM_{2.5}$	10.9 lb/hr	3.5 lb/hr
		0.1 lb/ton of liquid steel	0.05 lb/ ton of liquid steel
	PM_{10}	10.9 lb/hr	3.8 lb/hr
	VOC	16.9 lb/hr	1.6 lb/hr
		0.13 lb/ ton of liquid steel	0.02 lb/ ton of liquid steel

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1. Introduction

BT Environmental Consulting, Inc. (BTEC) was retained by Gerdau Special Steel North America (GSS) to conduct an evaluation on two sources at the GSS facility in Monroe, Michigan. The emission test program included evaluation of particulate matter (PM 10/2.5), condensable particulate matter (CPM), and volatile organic compounds (VOC) from the Ladle Metallurgic Furnace (LMF) and the Electric Arc Furnace (EAF). The emissions test program was conducted on October 20-21, 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 20-21, 2016 at the GSS facility located in Monroe, Michigan.

1.b Purpose of Testing

AQD issued Permit To Install No. 102-12a. The permit limits emissions from the sources as summarized by Table 1.

Table 1
Emission Limitations
PTI No. 102-12a Emission Limitations

Test Parameter	Combined FG Melt Shop Limits (EAF,LMF,VTD)
	Limit
PM_{10}	10.9 lb/hr
$PM_{2.5}$	10.9 lb/hr 0.1 lb/ton liquid steel
Volatile Organic Compounds (VOC)	16.9 lb/hr 0.13 lb/ton liquid steel

1.c Source Description

The electric arc furnace (EAF) melts steel scrap in a batch operation. The EAF is a refractory lined cylindrical vessel with a bowl-shaped hearth and dome shaped roof. Electrodes are lowered and raised through the furnace roof for melting the steel scrap.

The LMF is a complete ladle metallurgy system which includes arc reheating, alloy additions, powder injections and stirring.

1.d Test Program Contacts

The contact for the source and test report is:

Mr. Craig Metzger
Environmental Manager
Gerdau Special Steel North America – Monroe Mill
3000 E. Front Street
Monroe, Michigan
(734) 818-7113

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. Jake Zott 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. Mason Sakshaug Environmental Technician	BTEC 4949 Fernlee Royal Oak, MI 48073	(248) 548-8070
Mr. Tom Gasloli MDEQ	MDEQ Air Quality Division	(517) 284-6778

2. Summary of Results

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

2.a Operating Data

EAF Baghouse
Temperature 125-175°F
Moisture Content 1-5%

LMF Baghouse
Temperature 100-125°F
Moisture Content 1-5%

2.b Applicable Permit

AQD Permit To Install No. 102-12a.

2.c Results

See Table 3 in Section 5.a.

3. Source Description

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

3.a Process Description

LMF Baghouse
The LMF is controlled by a baghouse. Emissions from the LMF will be directed to the baghouse (DVLMFBAGHOUSE) via removable covers or decks, which are located over the ladle while the process is operating.

EAF Baghouse
The EAF is evacuated with a positive pressure baghouse (DVBAGHOUSE-01) with reverse air cleaning to control particulate emissions. The evacuation is by means of three main exhaust fans and one direct evacuation control (DEC) fan with a single stack emission point. CO is combusted in a DEC combustion chamber. Dust disposal is accomplished by means of hopper screw conveyors to a pneumatic conveying system, which loads the dust into a storage silo.

3.b Process Flow Diagram

A process flow diagram is available upon request.

3.c Raw and Finished Materials

On average, approximately 134.6 tons of scrap steel is charged per heat into the EAF. During this same time frame an average of 9.9 tons of additives, alloys, and fluxes are added to each heat.

3.d Process Capacity

The rated capacity of the process is 850,000 liquid steel tons per year.

3.e Process Instrumentation

Section 3.d provides summary.

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 Molecular Weight of Dry Stack Gas"(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. 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. Calibrated s-type pitot tubes were used during this test (0.768 and 0.769).

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.

Molecular weight determinations were evaluated according to USEPA Method 3, "Gas Analysis for the Determination of Dry Molecular Weight." The equipment used for this evaluation consist 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 train. Exhaust gas moisture content is then determined gravimetrically.

Particulate Matter (USEPA Method 201A/202):

40 CFR 60, Appendix A, Method 201A, *"Determination of PM_{10} and $PM_{2.5}$ 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 concentrations and calculate PM 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, (2a) a stainless-steel PM_{10} head, (2b) a stainless-steel $PM_{2.5}$ head, (3) an in stack stainless-steel filter housing, (4) a borosilicate glass probe liner, (5) a vertical condenser, (6) an empty pot bellied impinger, (7) an empty modified Greenburg-Smith (GS) impinger, (8) unheated borosilicate filter holder with a teflon filter and Teflon filter support, (9) 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, (10) a length of sample line, and (11) 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, the nozzle, probe, PM10 and PM2.5 head, and front half of the filter housing 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 double 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 also collected.

Method 25A (Volatile Organic Compounds):

Triplicate 60-minute test runs were conducted on the LMF and EAF sources. Volatile Organic compound (VOC) concentrations were measured according to 40 CFR 60, Appendix A, Method 25A. A sample of the gas stream was drawn through a stainless steel probe with an in-line glass fiber filter to remove any particulate, and a heated Teflon®

sample line to prevent the condensation of any moisture from the sample before it enters the analyzer. Data was recorded at 4-second intervals on a PC equipped with Labview® II data acquisition software. A JUM THC hydrocarbon analyzer was used to determine the VOC concentration.

The JUM THC hydrocarbon analyzer channels a fraction of the gas sample through a capillary tube that directs the sample to the flame ionization detector (FID), where the hydrocarbons present in the sample are ionized into carbon. The carbon concentration is then determined by the detector in parts per million (ppm). This concentration is transmitted to the data acquisition system (DAS) at 4-second intervals in the form of an analog signal, specifically voltage, to produce data that can be averaged over the duration of the testing program. This data is then used to determine the average ppm for total hydrocarbons (THC) using the equivalent units of propane (calibration gas).

4.b Recovery and Analytical Procedures

The samples were sent to Maxxam Analytical in Ontario, Canada.

4.c Sampling Ports

A diagram of the stack showing sampling ports in relation to upstream and downstream disturbances is included as Figures 3 and 4.

4.d Traverse Points

A diagram of the stack indicating traverse point locations and stack dimensions is 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 20-21, 2016

Emission Unit	Pollutant	Permit Limit	Test Result
EAF+LMF Baghouse Stacks	$PM_{2.5}$	10.9 lb/hr	3.5 lb/hr
		0.1 lb/ton of liquid steel	0.05 lb/ ton of liquid steel
	PM_{10}	10.9 lb/hr	3.8 lb/hr
	VOC	16.9 lb/hr	1.6 lb/hr
		0.13 lb/ ton of liquid steel	0.02 lb/ ton of liquid steel

5.b Discussion of Results

All of the test results for each pollutant were well below the permit limits.

5.c Sampling Procedure Variations

All 3 VOC tests for each source were conducted during one of the 240 minute PM tests. The flowrate was calculated using an average of all three PM runs at each source.

5.d Process or Control Device Upsets

There were no process upsets during this test.

5.e Control Device Maintenance

There has been no maintenance in the last three months.

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.
Raw CEM data is provided electronically in Appendix E.

Tables

Table 4
EAF Particulate Matter ($PM_{2.5}$) Detailed Emission Test Results Summary

Company	Gerdau Steel			
Source Designation	EAF			
Test Date	10/20/2016	10/20/2016	10/21/2016	
Meter/Nozzle Information	Run 1	Run 2	Run 3	Average
Meter Temperature Tm (F)	69.2	67.7	68.5	68.5
Meter Pressure - Pm (in. Hg)	29.3	29.3	29.3	29.3
Measured Sample Volume (Vm)	92.9	94.5	94.3	93.9
Sample Volume (Vm-Std ft3)	90.3	92.2	91.8	91.4
Sample Volume (Vm-Std m3)	2.56	2.61	2.60	2.59
Condensate Volume (Vw-std)	2.273	2.683	1.985	2.313
Gas Density (Ps(std) lbs/ft3) (wet)	0.0738	0.0737	0.0739	0.0738
Gas Density (Ps(std) lbs/ft3) (dry)	0.0745	0.0745	0.0745	0.0745
Total weight of sampled gas (m g lbs) (wet)	6.84	6.99	6.93	6.92
Total weight of sampled gas (m g lbs) (dry)	6.73	6.87	6.84	6.81
Nozzle Size - An (sq. ft.)	0.000101	0.000101	0.000101	0.000101
Isokinetic Variation - I	125.2	115.8	118.1	119.7
Stack Data				
Average Stack Temperature - Ts (F)	147.1	160.1	150.2	152.4
Molecular Weight Stack Gas- dry (Md)	28.8	28.8	28.8	28.8
Molecular Weight Stack Gas-wet (Ms)	28.6	28.5	28.6	28.6
Stack Gas Specific Gravity (Gs)	0.987	0.985	0.988	0.986
Percent Moisture (Bws)	2.45	2.83	2.12	2.47
Water Vapor Volume (fraction)	0.0245	0.0283	0.0212	0.0247
Pressure - Ps ("Hg)	29.2	29.2	29.2	29.2
Average Stack Velocity -Vs (ft/sec)	61.9	66.3	64.6	64.3
Area of Stack (ft2)	100.8	100.8	100.8	100.8
Production Data				
Ton of steel per hour	86.19	82.47	64.86	77.84
Exhaust Gas Flowrate				
Flowrate ft^3(Actual)	374,775	401,269	390,544	388,863
Flowrate ft^3 (Standard Wet)	318,061	333,405	329,429	326,965
Flowrate ft^3 (Standard Dry)	310,255	323,974	322,455	318,895
Flowrate m^3 (standard dry)	8,785	9,174	9,131	9,030
Total Particulate Weights (mg)				
Total Nozzle/Probe/Filter	0.0	0.0	0.0	0.0
Organic Condensible Particulate	1.2	1.0	0.7	1.0
Inorganic Condensible Particulate	6.7	4.4	3.8	5.0
Condensible Blank Correction	2.0	2.0	2.0	2.0
Total Condensible Particulate	5.9	3.4	2.5	3.9
Total Filterable and Condensible Particulate	5.9	3.4	2.5	3.9
Filterable Particulate Concentration				
lb/1000 lb (wet)	0.000	0.000	0.000	0.000
lb/1000 lb (dry)	0.000	0.000	0.000	0.000
mg/dscm (dry)	0.0	0.0	0.0	0.0
gr/dscf	0.0000	0.0000	0.0000	0.0000
Filterable Particulate Emission Rate				
lb/ hr	0.00	0.00	0.00	0.00
Condensible Particulate Concentration				
lb/1000 lb (wet)	0.002	0.001	0.001	0.001
lb/1000 lb (dry)	0.002	0.001	0.001	0.001
mg/dscm (dry)	2.3	1.3	1.0	1.5
gr/dscf	0.0010	0.0006	0.0004	0.0007
Condensible Particulate Emission Rate				
lb/ hr	2.69	1.59	1.17	1.81
Total Particulate Concentration				
lb/1000 lb (wet)	0.002	0.001	0.001	0.001
lb/1000 lb (dry)	0.002	0.001	0.001	0.001
mg/dscm (dry)	2.3	1.3	1.0	1.5
gr/dscf	0.0010	0.0006	0.0004	0.0007
Total Particulate Emission Rate				
lb/ hr	2.7	1.6	1.2	1.8
lb/ Ton of steel	0.03	0.02	0.02	0.02
Total LMF Particulate Emission Rate				
lb/ hr	1.2	2.0	1.9	1.7
lb/ Ton of steel	0.01	0.02	0.03	0.02
Total EAF + LMF Combined Particulate Emission Rate				
lb/ hr	3.9	3.6	3.0	3.5
lb/ Ton of steel	0.05	0.04	0.05	0.05

Table 6
LMF Particulate Matter ($PM_{2.5}$) Detailed Emission Test Results Summary

Company	Gerdau Steel			
Source Designation	LMF			
Test Date	10/20/2016	10/20/2016	10/21/2016	
Meter/Nozzle Information	Run 1	Run 2	Run 3	Average
Meter Temperature Tm (F)	67.5	68.5	68.3	68.1
Meter Pressure - Pm (in. Hg)	29.3	29.3	29.3	29.3
Measured Sample Volume (Vm)	101.9	98.3	103.8	101.3
Sample Volume (Vm-Std ft3)	99.5	95.7	101.1	98.8
Sample Volume (Vm-Std m3)	2.82	2.71	2.86	2.80
Condensate Volume (Vw-std)	1.641	1.735	1.306	1.561
Gas Density (Ps(std) lbs/ft3) (wet)	0.0741	0.0740	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)	7.49	7.22	7.59	7.43
Total weight of sampled gas (m g lbs) (dry)	7.42	7.13	7.53	7.36
Nozzle Size - An (sq. ft.)	0.000101	0.000101	0.000101	0.000101
Isokinetic Variation - I	93.4	90.6	91.0	91.7
Stack Data				
Average Stack Temperature - Ts (F)	108.5	109.6	109.6	109.2
Molecular Weight Stack Gas- dry (Md)	28.8	28.8	28.8	28.8
Molecular Weight Stack Gas-wet (Ms)	28.7	28.6	28.7	28.7
Stack Gas Specific Gravity (Gs)	0.990	0.989	0.991	0.990
Percent Moisture (Bws)	1.62	1.78	1.28	1.56
Water Vapor Volume (fraction)	0.0162	0.0178	0.0128	0.0156
Pressure - Ps ("Hg)	29.2	29.2	29.1	29.1
Average Stack Velocity -Vs (ft/sec)	77.1	78.8	78.8	78.2
Area of Stack (ft2)	66.0	66.0	66.0	66.0
Production Data				
Ton of steel per hour	86.28	86.74	58.71	77.24
Exhaust Gas Flowrate				
Flowrate ft^3(Actual)	305,096	311,899	311,762	309,586
Flowrate ft^3 (Standard Wet)	276,088	281,708	281,294	279,697
Flowrate ft^3 (Standard Dry)	271,609	276,692	277,706	275,336
Flowrate m^3 (standard dry)	7,691	7,835	7,864	7,797
Total Particulate Weights (mg)				
Total Nozzle/Probe/Filter	0.2	1.2	0.0	0.5
Organic Condensible Particulate	1.0	1.4	1.5	1.3
Inorganic Condensible Particulate	4.2	4.6	5.6	4.8
Condensible Blank Correction	2.0	2.0	2.0	2.0
Total Condensible Particulate	3.2	4.0	5.1	4.1
Total Filterable and Condensible Particulate	3.4	5.2	5.1	4.6
Filterable Particulate Concentration				
lb/1000 lb (wet)	0.000	0.000	0.000	0.000
lb/1000 lb (dry)	0.000	0.000	0.000	0.000
mg/dscm (dry)	0.1	0.4	0.0	0.2
gr/dscf	0.0000	0.0002	0.0000	0.0001
Filterable Particulate Emission Rate				
lb/ hr	0.1	0.5	0.0	0.2
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	1.5	1.8	1.5
gr/dscf	0.0005	0.0006	0.0008	0.0006
Condensible Particulate Emission Rate				
lb/ hr	1.2	1.5	1.9	1.5
Total Particulate Concentration				
lb/1000 lb (wet)	0.001	0.002	0.001	0.001
lb/1000 lb (dry)	0.001	0.002	0.001	0.001
mg/dscm (dry)	1.2	1.9	1.8	1.6
gr/dscf	0.0005	0.0008	0.0008	0.0007
Total Particulate Emission Rate				
lb/ hr	1.2	2.0	1.9	1.7
lb/ Ton of steel	0.01	0.02	0.03	0.02
Total EAF Particulate Emission Rate				
lb/ hr	2.7	1.6	1.2	1.8
lb/ Ton of steel	0.03	0.02	0.02	0.02
Total EAF + LMF Combined Particulate Emission Rate				
lb/ hr	3.9	3.6	3.0	3.5
lb/ Ton of steel	0.05	0.04	0.05	0.05

Table 7
LMF Particulate Matter (PM_{10}) Detailed Emission Test Results Summary

Company	Gerdau Steel			
Source Designation	LMF			
Test Date	10/20/2016	10/20/2016	10/21/2016	
Meter/Nozzle Information	Run 1	Run 2	Run 3	Average
Meter Temperature Tm (F)	67.5	68.5	68.3	68.1
Meter Pressure - Pm (in. Hg)	29.3	29.3	29.3	29.3
Measured Sample Volume (Vm)	101.9	98.3	103.8	101.3
Sample Volume (Vm-Std ft3)	99.5	95.7	101.1	98.8
Sample Volume (Vm-Std m3)	2.82	2.71	2.86	2.80
Condensate Volume (Vw-std)	1.641	1.735	1.306	1.561
Gas Density (Ps(std) lbs/ft3) (wet)	0.0741	0.0740	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)	7.49	7.22	7.59	7.43
Total weight of sampled gas (m g lbs) (dry)	7.42	7.13	7.53	7.36
Nozzle Size - An (sq. ft.)	0.000101	0.000101	0.000101	0.000101
Isokinetic Variation - I	93.4	90.6	91.0	91.7
Stack Data				
Average Stack Temperature - Ts (F)	108.5	109.6	109.6	109.2
Molecular Weight Stack Gas- dry (Md)	28.8	28.8	28.8	28.8
Molecular Weight Stack Gas-wet (Ms)	28.7	28.6	28.7	28.7
Stack Gas Specific Gravity (Gs)	0.990	0.989	0.991	0.990
Percent Moisture (Bws)	1.62	1.78	1.28	1.56
Water Vapor Volume (fraction)	0.0162	0.0178	0.0128	0.0156
Pressure - Ps ("Hg)	29.2	29.2	29.1	29.1
Average Stack Velocity -Vs (ft/sec)	77.1	78.8	78.8	78.2
Area of Stack (ft2)	66.0	66.0	66.0	66.0
Exhaust Gas Flowrate				
Flowrate ft^3(Actual)	305,096	311,899	311,762	309,586
Flowrate ft^3 (Standard Wet)	276,088	281,708	281,294	279,697
Flowrate ft^3 (Standard Dry)	271,609	276,692	277,706	275,336
Flowrate m^3 (standard dry)	7,691	7,835	7,864	7,797
Total Particulate Weights (mg)				
Total Nozzle/Probe/Filter	1.0	1.5	0.0	0.8
Organic Condensible Particulate	1.0	1.4	1.5	1.3
Inorganic Condensible Particulate	4.2	4.6	5.6	4.8
Condensible Blank Correction	2.0	2.0	2.0	2.0
Total Condensible Particulate	3.2	4.0	5.1	4.1
Total Filterable and Condensible Particulate	4.2	5.5	5.1	4.9
Filterable Particulate Concentration				
lb/1000 lb (wet)	0.000	0.000	0.000	0.000
lb/1000 lb (dry)	0.000	0.000	0.000	0.000
mg/dscm (dry)	0.4	0.6	0.0	0.3
gr/dscf	0.0002	0.0002	0.0000	0.0001
Filterable Particulate Emission Rate				
lb/ hr	0.36	0.58	0.00	0.31
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	1.5	1.8	1.5
gr/dscf	0.0005	0.0006	0.0008	0.0006
Condensible Particulate Emission Rate				
lb/ hr	1.16	1.54	1.86	1.52
Total Particulate Concentration				
lb/1000 lb (wet)	0.001	0.002	0.001	0.001
lb/1000 lb (dry)	0.001	0.002	0.001	0.001
mg/dscm (dry)	1.5	2.0	1.8	1.8
gr/dscf	0.0007	0.0009	0.0008	0.0008
Total Particulate Emission Rate				
lb/ hr	1.52	2.11	1.86	1.83

Total EAF Particulate Emission Rate				
lb/ hr	2.87	1.59	1.45	1.97

Total EAF + LMF Combined Particulate Emission Rate				
lb/ hr	4.40	3.70	3.31	3.80

Table 8
EAF VOC Detailed Emission Test Results
Gerdau Steel
Monroe, Michigan
BTEC Project No. 16-4925.00
Sampling Dates: 10/20/2016

Parameter	Run 1	Run 2	Run 3	Average
Test Run Date	10/20/2016	10/20/2016	10/20/2016	
Test Run Time	19:41-20:41	20:55-21:55	22:27-23:27	
Outlet Flowrate (scfm)*	326,965	326,965	326,965	**326,965**
Production (Ton of steel/hour)	82.47	82.47	82.47	**82.47**
Outlet VOC Concentration (ppmv as propane)	2.0	2.4	2.6	**2.4**
Outlet Methane Concentration (ppmv as methane)	6.6	6.3	6.0	**6.3**
Outlet VOC Concentration (ppmv, corrected as per USEPA 7E)	2.6	3.2	3.5	**3.1**
Outlet Methane Concentration (ppmv, corrected as per USEPA 7E)	6.5	6.3	6.1	**6.3**
Outlet VOC Concentration (ppmv propane, -Methane)	0.0	0.0	0.0	**0.0**
Outlet VOC Concentration (ppmv propane, -Methane, corrected as per USEPA 7E)	0.0	0.5	0.9	**0.5**
VOC Emission Rate as Propane (lb/hr) (-Methane)	**0.0**	**0.0**	**0.0**	**0.0**
VOC Emission Rate as Propane(lb/hr) (-Methane) (corrected as per USEPA 7E)	**0.0**	**1.2**	**2.0**	**1.1**
VOC Emission Rate as Propane(lb/ton of steel) (-Methane) (corrected as per USEPA 7E)	**0.00**	**0.01**	**0.02**	**0.01**
LMF VOC Emission Rate as Propane(lb/hr)	**0.3**	**0.7**	**0.7**	**0.6**
LMF VOC Emission Rate as Propane(lb/ton of steel)	**0.00**	**0.01**	**0.01**	**0.01**
EAF + LMF Combined VOC Emission Rate as Propane(lb/hr)	**0.3**	**1.8**	**2.8**	**1.6**
EAF + LMF Combined VOC Emission Rate as Propane(lb/ton of steel)	**0.00**	**0.02**	**0.03**	**0.02**

VOC Correction			
Co	-0.56	-0.86	-0.90
Cma	29.9	29.9	29.9
Cm	29.57	29.16	28.85

Methane Correction			
Co	0.14	0.10	0.04
Cma	29.9	29.9	29.9
Cm	29.59	29.27	29.24

*=Used the average from all 3 runs for M201A/202 to calculate the scfm

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 (C_3H_8 = 44.10)
24.14 = molar volume of air at standard conditions (70°F, 29.92" Hg)
35.31 = ft^3 per m^3
453600 = mg per lb
Response factor obtained from introducing propane into methane analyzer: **2.33**

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

Table 9
LMF VOC Emission Rates
Gerdau Steel
Monroe, Michigan
BTEC Project No. 16-4925.00
Sampling Dates: 10/20/2016

Parameter	Run 1	Run 2	Run 3	Average
Test Run Date	10/20/2016	10/20/2016	10/20/2016	
Test Run Time	10:27-11:27	12:02-13:02	13:39-14:39	
Outlet Flowrate (scfm)*	278,236	278,236	278,236	**278,236**
Production (Ton of steel/hour)	86.28	86.28	86.28	**86.28**
Outlet VOC Concentration (ppmv as propane)	2.5	3.8	4.5	**3.6**
Outlet Methane Concentration (ppmv as methane)	5.2	7.8	9.4	**7.5**
Outlet VOC Concentration (ppmv, corrected as per USEPA 7E)	2.5	3.9	4.7	**3.7**
Outlet Methane Concentration (ppmv, corrected as per USEPA 7E)	5.2	7.9	9.6	**7.6**
Outlet VOC Concentration (ppmv propane, -Methane)	0.2	0.3	0.3	**0.3**
Outlet VOC Concentration (ppmv propane, -Methane, corrected as per USEPA 7E)	0.2	0.4	0.4	**0.3**
VOC Emission Rate as Propane (lb/hr) (-Methane)	**0.3**	**0.6**	**0.6**	**0.5**
VOC Emission Rate as Propane(lb/hr) (-Methane) (corrected as per USEPA 7E)	**0.3**	**0.7**	**0.7**	**0.6**
VOC Emission Rate as Propane(lb/ton of steel) (-Methane) (corrected as per USEPA 7E)	**0.00**	**0.01**	**0.01**	**0.01**
EAF VOC Emission Rate as Propane(lb/hr)	**0.0**	**1.2**	**2.0**	**1.1**
EAF VOC Emission Rate as Propane(lb/ton of steel)	**0.00**	**0.01**	**0.02**	**0.01**
EAF + LMF Combined VOC Emission Rate as Propane(lb/hr)	**0.3**	**1.8**	**2.8**	**1.6**
EAF + LMF Combined VOC Emission Rate as Propane(lb/ton of steel)	**0.00**	**0.02**	**0.03**	**0.02**

VOC Correction			
Co	-0.03	-0.06	-0.12
Cma	29.9	29.9	29.9
Cm	29.98	29.70	29.57

Methane Correction			
Co	-0.05	-0.07	-0.15
Cma	29.9	29.9	29.9
Cm	29.89	29.62	29.71

*=Used the average from all 3 runs for M201A/202 to calculate the scfm

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, SO_2 = 64.05, C_3H_8 = 44.10, carbon = 12.01)
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
Response factor obtained from introducing propane into methane analyzer: 2.23

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

Figures

BTEC Inc.

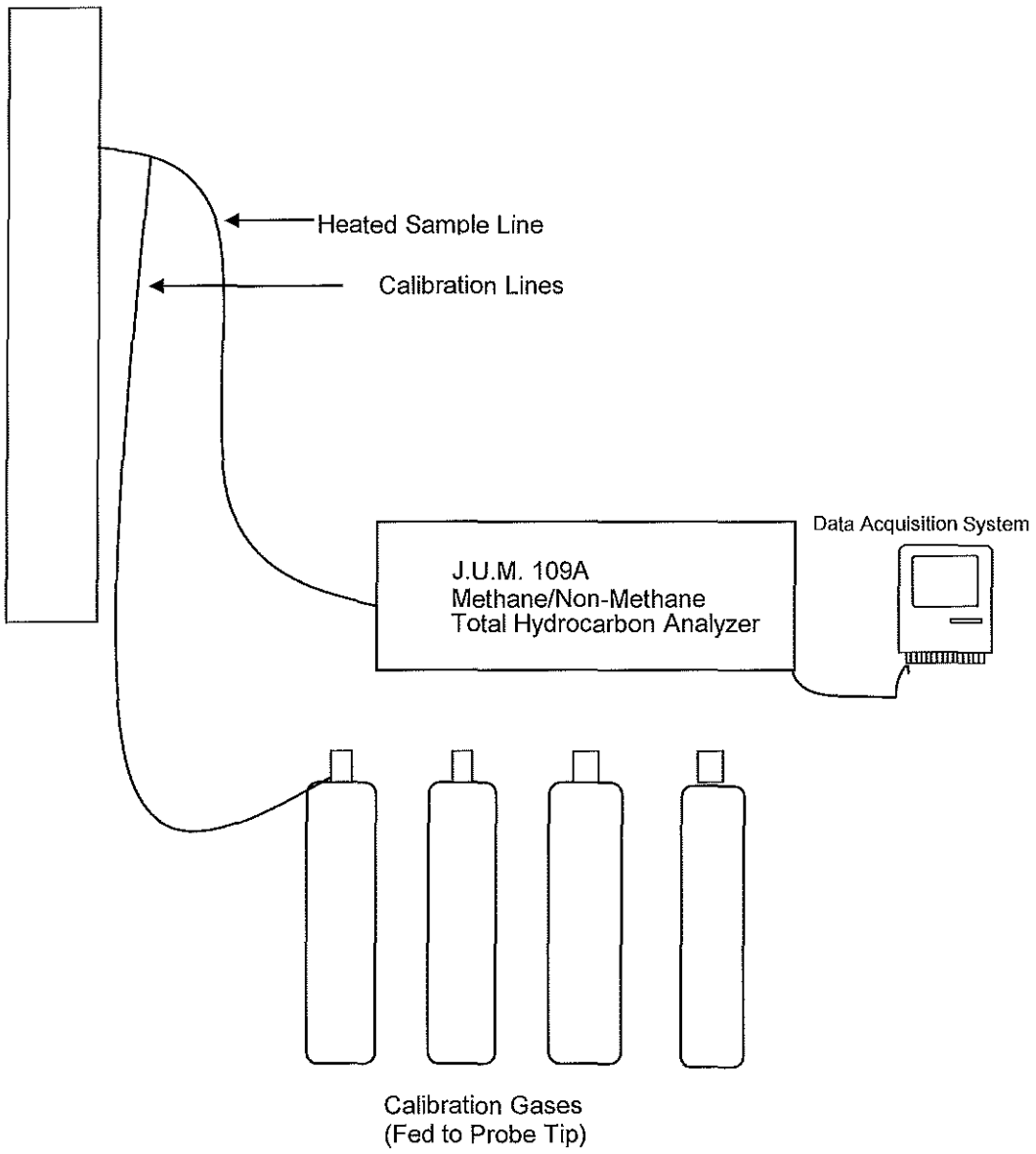


Figure No. 1

Site: **USEPA Method 25A** **Gerdau Steel** **Monroe, Michigan**	**Sampling Date:** **October 20-21, 2016**	**BT Environmental Consulting, Inc.** **4949 Fernlee Avenue** **Royal Oak, Michigan 48073**

BTEC Inc.

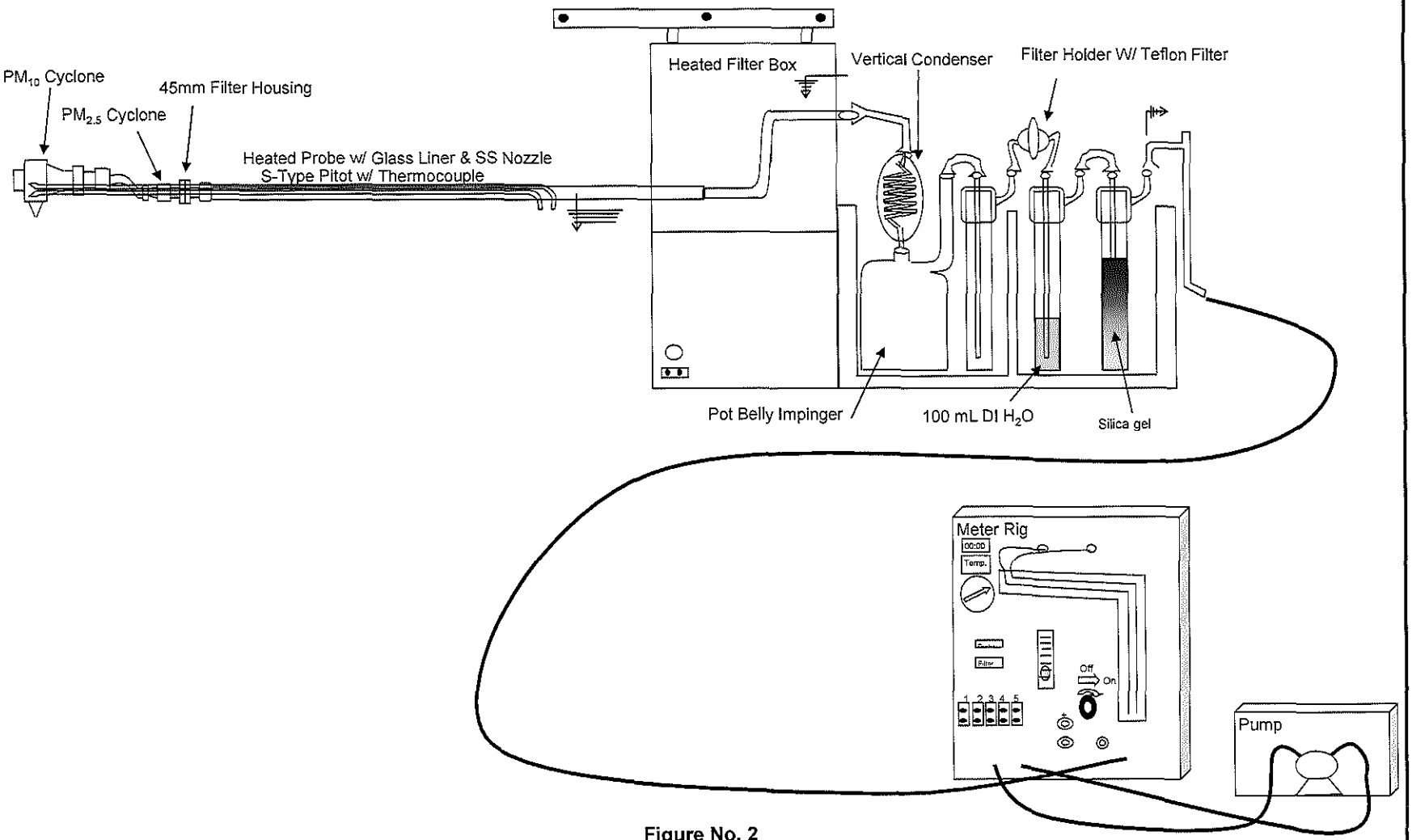
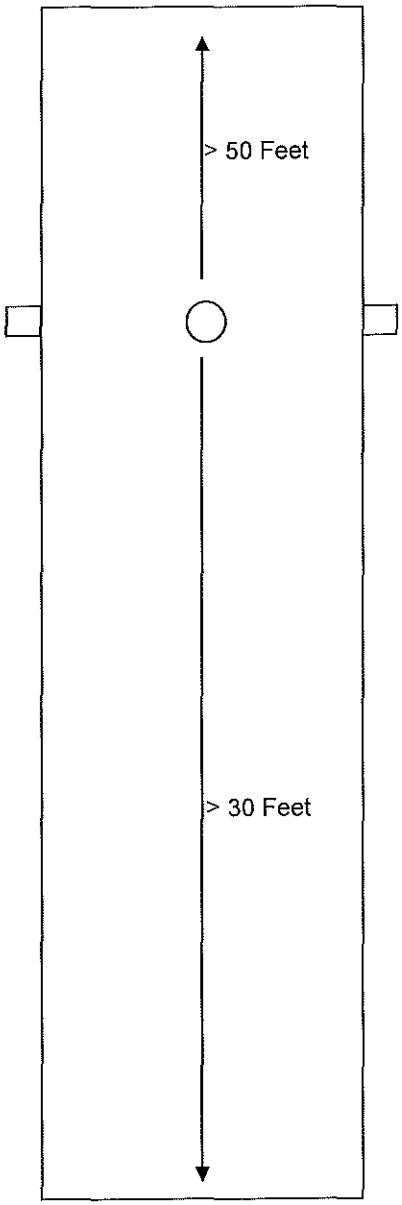


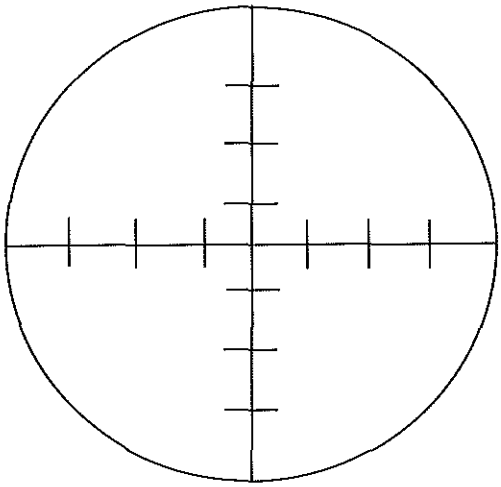
Figure No. 2

Site: **USEPA Method 201A/202** **Gerdau Steel** **Monroe, Michigan**	**Sampling Date:** **October 20-21, 2016**	**BT Environmental Consulting, Inc.** **4949 Fernlee Avenue** **Royal Oak, Michigan 48073**

BTEC Inc.

diameter = 136





Not to Scale

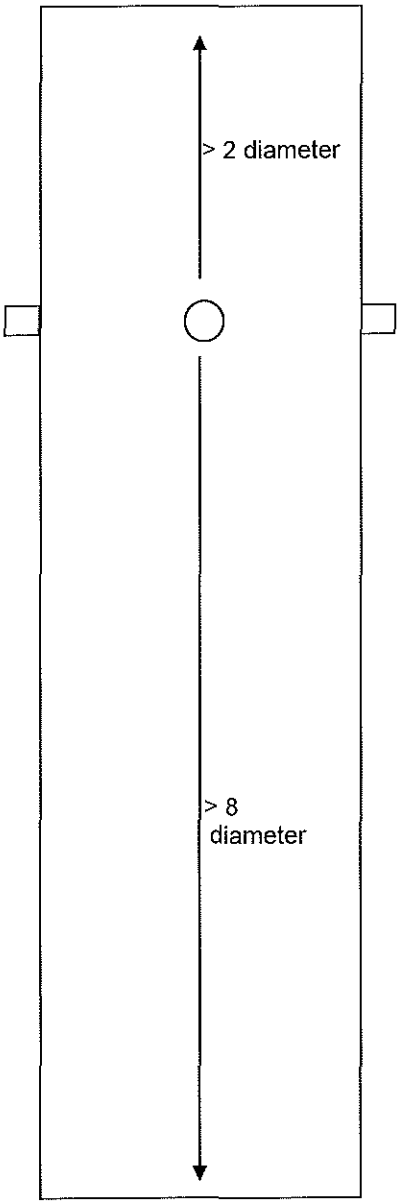
Points	Distance "
1	4.8
2	16.1
3	32.6
4	77.4
5	93.9
6	105.2

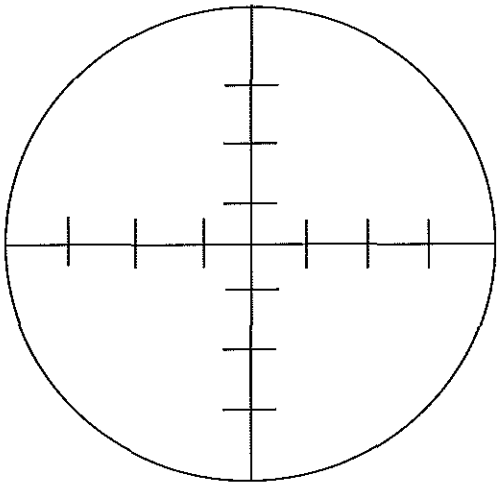
Figure 3

Site: **Gerdau Special Steel** **Monroe, Michigan** **EAF Stack**	**Sampling Dates:** **October 20-21, 2016**	**BT Environmental Consulting, Inc.** **4949 Fernlee** **Royal Oak, Michigan**

BTEC Inc.

diameter = 110





Not to Scale

Points	Distance "
1	4.8
2	16.1
3	32.6
4	77.4
5	93.9
6	105.2

Figure 4

Site: **Gerdau Special Steel** **Monroe, Michigan** **LMF Stack**	**Sampling Dates:** **October 20-21, 2016**	**BT Environmental Consulting, Inc.** **4949 Fernlee** **Royal Oak, Michigan**