FINAL REPORT

GERDAU MACSTEEL, INC

MONROE, MICHIGAN

MONROE MILL:
STACK TEST REPORT – ELECTRIC ARC FURNACE (EAF) AND LADLE METALLURGY SYSTEM (LMF)

RWDI #2300259

January 27, 2023

SUBMITTED TO

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Executive Table i: Average – ROP Limits for FGMELTSHOP - EAF, LMF, and VTD

Parameter	Concentration	
	Test Average	Permit Limit
PM2.5	5.06 lb/hr	10.9 lb/hr
PM2.5	0.037 lb/ton of liquid steel	0.1 lb/ton of liquid steel
PM10	7.29 lb/hr	10.9 lb/hr
PM (Filterable Only)	0.0014 Grains/dscf	0.0018 Grains/dscf
PM (Filterable Only)	3.24 lb/hr	7.2 lb/hr

Executive Table ii: Average – PTI Limits for – EUEAF - EAF Baghouse

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Executive Table iii: Average – PTI Limits for – FGLMFVTD – LMF Baghouse

Parameter	Concentration	
	Test Average	Permit Limit
PM2.5	2.61 lb/hr	8.95 lb/hr
PM10	4.69 lb/hr	8.95 lb/hr
PM (Filterable Only)	0.0010 Grains/dscf	0.0018 Grains/dscf
PM (Filterable Only)	2.61 lb/hr	3.88 lb/hr

Executive Table iv: Average – ROP Limits for – EUEAF – EAF Baghouse

Parameter	Concentration	
	Test Average	Permit Limit
PM (Filterable Only)	0.0004 Grains/dscf	0.0052 Grains/dscf
Visual Emissions from Baghouse Stack	0% Opacity	3% Opacity
Visual Emissions from Vents and Openings	0% Opacity	0% Opacity
Visible Emissions from EUEAF Shop Building	0% Opacity	6% Opacity

Executive Table v: Average – ROP Limits for – EULMF – LMF Baghouse

Parameter	Concentration	
	Test Average	Permit Limit
Visual Emissions from Baghouse Stack	0% Opacity	5% Opacity

TABLE OF CONTENTS

1 INTRODUCTION

RWDI USA LLC (RWDI) has been retained by Gerdau MacSteel, Inc (Gerdau) to complete the emission sampling program at the Gerdau Monroe Mill located at 3000 East Front Street, Monroe, Michigan. The testing evaluated PM, PM_{10}, $PM_{2.5}$, and Visual Emissions from the Electric Arc Furnace (EAF) and Ladle Metallurgic Furnace (LMF).

1.1 Location and Dates of Testing

The test program was completed at the Gerdau Monroe Mill the week of November 28th, 2022.

1.2 Purpose of Testing

The purpose of this test program was conducted per PTI 75-18 and MI-ROP-B7061-2016.

1.3 Description of Source

Gerdau Monroe Mill is a producer of Special Bar Quality (SBQ) steel. The steel-melting process utilizes Electric Arc Furnace Technology (EAF). The EAF is a refractory-lined cylindrical vessel made of steel plates and having a bowl-shaped hearth and a dome-shaped roof. Water-cooled panels are used for the shell and roof to improve refractory efficiency. Three electrodes, powered by a transformer, are mounted on a superstructure above the furnace and are lowered and raised through ports in the furnace roof. The electrode conveys the energy for melting the scrap steel. Supplemental energy is provided by an oxy-fuel burner and an oxygen/coke lance which swings into the slag door area and operates during the melting/refining process. The furnace is mounted on curved rockers, which allow tilting for slagging and bottom tapping. The EAF melts scrap metal in a batch operation referred to as a heat.

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

2 SUMMARY OF RESULTS

2.1 Operating Data

Gerdau personnel made sure the process was operating correctly and production was at acceptable capacity.

2.2 Applicable Permit Number

MI-ROP-B7061-2016 and PTI 75-18.

3 SOURCE DESCRIPTION

3.1 Description of Process and Emission Control Equipment

Emissions from the processes within the Melt Shop are directed to two baghouses (DVBAGHOUSE-01 and DVLMFBAGHOUSE). DVBAGHOUSE-01 serves EUEAF and also accepts emissions captured by the canopy hood in the Melt Shop. DVBAGHOUSE-01 is a positive pressure baghouse with reverse air cleaning. Three main exhaust fans and one direct evacuation control (DEC) fan. The baghouse is equipped with two exhaust stacks, SVBH-01-STACK1 and SVBH-01-STACK2. CO is combusted in the DEC combustion chamber. Screw conveyors transfer the collected baghouse dust to a pneumatic conveying system which transfers the dust into a silo for storage until removed from the site. The second baghouse (DVLMFBAGHOUSE) serves the LMF and VTD operations in the Melt Shop. DVLMFBAGHOUSE is a positive pressure baghouse with reverse air cleaning and is equipped with a single exhaust stack. Dust collected by DVLMFBAGHOUSE is stored in the baghouse hoppers until it is removed from the site.

Fugitive emissions from within the Melt Shop that reach the roof top monitors are captured and directed to the LMF Baghouse.

3.2 Process Flow Sheet or Diagram (if applicable)

A process flow diagram can be sent upon request.

3.3 Type and Quantity of Raw and Finished Materials

Scrap steel is charged per heat into the EAF. During the heat, additives, alloys, and fluxes are added.

3.4 Rated Capacity of Process

Maximum rated capacity is 130 tons of liquid steel produced per heat.

3.5 Process Instrumentation Monitored During the Test

Operators regulate the process and control production rates.

- Cast Rate (tons/hr)
- Tap Amounts (tons)

4 SAMPLING AND ANALYTICAL PROCEDURES

4.1 Description of Sampling Train and Field Procedures

The emission test program will utilize the following test methods codified at Title 40, Part 60, Appendix A of the Code of Federal Regulations (40 CFR 60, Appendix A):

- 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 Gases (by Fyrite)
- Method 4 – Determination of Moisture Content in Stack Gases
- Method 201A – Determination of PM/PM2.5/PM10 from Stationary Sources
- Method 202 – Determination of Condensable Particulate Matter from Stationary Sources
- Method 9 – Visual Emissions from Stationary Sources

4.1.1 Stack Velocity, Temperature, and Volumetric Flow Rate Determination (USEPA Method 1-4)

Traverse points and determination of upstream and downstream distances from flow disturbance were determined using U.S. EPA Method 1.

The exhaust velocities and flow rates were determined following U.S. EPA Method 2, "Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S Pitot Tube)". Velocity measurements were taken with a pre-calibrated S-Type pitot tube and incline manometer or digital manometer. Volumetric flow rates were determined following the equal area method as outlined in U.S. EPA Method 2. Temperature measurements were made simultaneously with the velocity measurements and were conducted using a chromel-alumel type "k" thermocouple in conjunction with a calibrated digital temperature indicator.

The dry molecular weight of the stack gas was determined following calculations outlined in U.S. EPA Method 3, using a fyrite.

Stack moisture content was determined through direct condensation and according to U.S. EPA Method 4, "Determination of Moisture Content of Stack Gases". Method 4 was conducted through the 201A/202 train.

4.1.2 Sampling for PM/PM_{10}/$PM_{2.5}$/CPM (USEPA Method 201A/202)

Three (3) 240-minute tests were performed on SVBH-01-Stack-01 (EAF West (Red)), SVBH-01-Stack-02 (EAF East (White)) and SVBHLMF-Stack (LMF). All tests were completed simultaneously. RWDI's USEPA Method 201A/202 sampling train consists of (1) a stainless steel nozzle, (2) a stainless steel PM_{10} cyclone head, (3) a stainless steel $PM_{2.5}$ cyclone head, (4) an in stack filter housing, (5) a borosilicate glass probe or liner, (6) a vertical condenser, (7) an empty pot-bellied impinger, (8) an empty modified Greenburg-Smith (GS) impinger, (9) Teflon filter, (10) a second modified GS impinger with 100 ml of water and a third impinger containing silica gel, (11) a sample line and meter box. USEPA Method 201A collects the filterable fractions of PM/PM_{10}/$PM_{2.5}$ and USEPA Method 202 collects the condensable fraction of PM_{10} and $PM_{2.5}$.

A sampling train leak check was conducted before and after each test. After completion of each test, the filter was recovered, the nozzle, PM_{10}, and $PM_{2.5}$ head were recovered into clean sample jars following USEPA Method 201A. The impinger train was purged with nitrogen for one hour at a flowrate of 14 liters per minute. After the purge, all the glassware was recovered per USEPA Method 202.

4.2 Description of Recovery and Analytical Procedures

The samples were all recovered following USEPA Method 201A and 202.

4.3 Sampling Port Description

The sampling locations are all outside.

Table 4.3: Summary of Exhaust Parameters

Source	Diameter (in.)	Approximate Duct Diameters from Flow Disturbance	Number of Ports	Points per Traverse	Total Points per Test
SVBH-01-Stack-01 EUEAF Baghouse Stack 1 (EAF West (Red))	135	~2.6 downstream and 2.7 upstream	4	12	24
SVBH-01-Stack-02 EUEAF Baghouse Stack 2 (EAF East (White))	135.5	~2.6 downstream and ~2.7 upstream	4	12	24
SVBHLMF-Stack LMF Baghouse (LMF)	110	>8 downstream and >2 upstream	4	6	12

5 TEST RESULTS AND DISCUSSION

5.1 Detailed Results

Table 5.1: Average – ROP Limits for FGMELTSHOP - EAF, LMF, and VTD

Parameter	Concentration	
	Test Average	Permit Limit
PM2.5	5.06 lb/hr	10.9 lb/hr
PM2.5	0.037 lb/ton of liquid steel	0.1 lb/ton of liquid steel
PM10	7.29 lb/hr	10.9 lb/hr
PM (Filterable Only)	0.0014 Grains/dscf	0.0018 Grains/dscf
PM (Filterable Only)	3.24 lb/hr	7.2 lb/hr

Table 5.2: Average – PTI Limits for – EUEAF - EAF Baghouse

Parameter	Concentration	
	Test Average	Permit Limit
PM2.5	2.45 lb/hr	12.91 lb/hr
PM10	2.60 lb/hr	12.91 lb/hr
PM (Filterable Only)	0.0004 Grains/dscf	0.0018 Grains/dscf
PM (Filterable Only)	0.63 lb/hr	7.84 lb/hr
Visual Emissions from Baghouse Stack	0% Opacity	3% Opacity
Visual Emissions from vents/openings	0% Opacity	6% Opacity

Table 5.3: Average – PTI Limits for – FGLMFVTD – LMF Baghouse

Parameter	Concentration	
	Test Average	Permit Limit
PM2.5	2.61 lb/hr	8.95 lb/hr
PM10	4.69 lb/hr	8.95 lb/hr
PM (Filterable Only)	0.0010 Grains/dscf	0.0018 Grains/dscf
PM (Filterable Only)	2.61 lb/hr	3.88 lb/hr

Table 5.4: Average – ROP Limits for – EUEAF – EAF Baghouse

Parameter	Concentration	
	Test Average	Permit Limit
PM (Filterable Only)	0.0004 Grains/dscf	0.0052 Grains/dscf
Visual Emissions from Baghouse Stack	0% Opacity	3% Opacity
Visual Emissions from Vents and Openings	0% Opacity	0% Opacity
Visible Emissions from EUEAF Shop Building	0% Opacity	6% Opacity

Table 5.5: Average – ROP Limits for – EULMF – LMF Baghouse

Parameter	Concentration	
	Test Average	Permit Limit
Visual Emissions from Baghouse Stack	0% Opacity	5% Opacity

5.2 Discussion of Results

The detailed results can be found in **Appendices B, C, D,** and **E**. Note, the laboratory detected visible solid residue in LMF T1 <10 to >2.5 fraction of the acetone rinse from USEPA Method 201A. The data was used as is for the report. We believe this was an unrelated to the process emissions.

5.3 Variations in Testing Procedures

There were not testing variations.

5.4 Process Upset Conditions During Testing

There were no process upsets.

5.5 Maintenance Performed in Last Three Months

There has been no significant maintenance on the EAF or LMF in the last three months. Normal routine maintenance is completed as scheduled.

5.6 Re-Test

This was not a retest.

5.7 Audit Samples

This test did not require any audit samples.

5.8 Field Data Sheets

Field data sheets can be found in **Appendices B, C, D,** and **E**.

5.9 Calibration Sheets

Calibration sheets can be found in **Appendix F**.

5.10 Sample Calculations

Sample calculations can be found in **Appendix G**.

5.11 Laboratory Data

Laboratory data can be found in **Appendix H**.

TABLES

Table 1: Summary of Sampling Parameters and Methodology

Source Location	No. of Tests per Stack	Sampling Parameter	Sampling Method
SVBH-01-Stack 2 EAF - East (White)	3	Velocity, Temperature and Flow Rate	U.S. EPA [1] Methods 1-4
	3	Total Particulate Matter	U.S. EPA [1] Method 201A (Filterable Only)
	3	PM_{10} / $PM_{2.5}$	U.S. EPA [1] Method 201A/202
	3	Oxygen, Carbon Dioxide	U.S. EPA [1] Method 3
	3	Visible Emissions	U.S. EPA [1] Method 9
SVBH-01-Stack 1 EAF - West (Red)	3	Velocity, Temperature and Flow Rate	U.S. EPA [1] Methods 1-4
	3	Total Particulate Matter	U.S. EPA [1] Method 201A (Filterable Only)
	3	PM_{10} / $PM_{2.5}$	U.S. EPA [1] Method 201A/202
	3	Oxygen, Carbon Dioxide	U.S. EPA [1] Method 3
	3	Visible Emissions	U.S. EPA [1] Method 9
SVBHLMF-Stack LMF	3	Velocity, Temperature and Flow Rate	U.S. EPA [1] Methods 1-4
	3	Total Particulate Matter	U.S. EPA [1] Method 201A (Filterable Only)
	3	PM_{10} / $PM_{2.5}$	U.S. EPA [1] Method 201A/202
	3	Oxygen, Carbon Dioxide	U.S. EPA [1] Method 3
	3	Visible Emissions	U.S. EPA [1] Method 9

Notes:

[1] U.S. EPA - United States Environmental Protection Agency

Table 2A: Sampling Summary and Sample Log (PM/PM10/PM2.5)

Source and Test #	Sampling Date	Start Time	End Time	Filter ID / Trap ID
SVBH-01-Stack 2 (EAF - East (White)) - Velocity / Total Particulate / PM10 / PM2.5				
Blank	2-Dec-22	-	-	QZ 47-35
Test #1	29-Nov-22	9:15 AM	1:25 PM	QZ 47-18
Test #2	1-Dec-22	8:21 AM	12:41 PM	QZ 47-36
Test #3	2-Dec-22	9:15 AM	2:12 PM	QZ 47-33
SVBH-01-Stack 1 (EAF - West (Red)) - Velocity / Total Particulate / PM10 / PM2.5				
Blank	2-Dec-22	-	-	QZ 47-35
Test #1	29-Nov-22	9:15 AM	1:31 PM	QZ 47-40
Test #2	1-Dec-22	8:21 AM	12:42 PM	QZ 47-39
Test #3	2-Dec-22	9:15 AM	2:05 PM	QZ 47-34
SVBHLMF-Stack (LMF) - Velocity / Total Particulate / PM10 / PM2.5				
Blank	2-Dec-22	-	-	QZ 47-35
Test #1	29-Nov-22	9:15 AM	1:47 PM	QZ 47-9
Test #2	1-Dec-22	8:21 AM	1:12 PM	QZ 47-38
Test #3	2-Dec-22	9:15 AM	2:42 PM	QZ 47-32

Table 2B: Sampling Summary and Sample Log (Visible Emissions)

Source and Test #	Sampling Date	Start Time	End Time
SVBH-01-Stack 2 (EAF - East (White)) - Visible Emissions			
Test #1	1-Dec-22	8:57 AM	9:56 AM
Test #2	1-Dec-22	9:59 AM	10:59 AM
Test #3	2-Dec-22	9:20 AM	10:20 AM
SVBH-01-Stack 1 (EAF - West (Red)) - Visible Emissions			
Test #1	1-Dec-22	8:58 AM	9:57 AM
Test #2	1-Dec-22	10:00 AM	11:00 AM
Test #3	2-Dec-22	9:20 AM	10:20 AM
SVBHLMF-Stack (LMF) - Visible Emissions			
Test #1	1-Dec-22	8:57 AM	9:56 AM
Test #2	1-Dec-22	9:59 AM	10:59 AM
Test #3	2-Dec-22	9:20 AM	10:20 AM

Table 3A: Sampling Summary - Flow Characteristics
SVBH-01-Stack 2 (EAF - EAST (White))

Stack Gas Parameter		Test No. 1 PM/PM10/PM2.5	Test No. 2 PM/PM10/PM2.5	Test No. 3 PM/PM10/PM2.5	TOTAL AVERAGE
Testing Date		29-Nov-22	1-Dec-22	2-Dec-22	-
Stack Temperature	°F	185	172	176	178
Moisture	%	2.3%	1.5%	1.4%	1.7%
Velocity	ft/s	41.47	40.80	42.87	41.71
Referenced Flow Rate[3]	CFM	195,425	205,455	208,171	203,017
Sampling Isokinetic Rate	%	103	103	99	102

Notes:

[1] Referenced flow rate expressed as dry at 101.3 kPa, 68 °F, and Actual Oxygen

Table 3B: Sampling Summary - Flow Characteristics

SVBH-01-Stack 1 (EAF - West (Red))

Stack Gas Parameter		Test No. 1	Test No. 2	Test No. 3	TOTAL
		PM/PM10/PM2.5	PM/PM10/PM2.5	PM/PM10/PM2.5	AVERAGE
Testing Date		29-Nov-22	1-Dec-22	2-Dec-22	-
Stack Temperature	°F	189	174	180	181
Moisture	%	2.6%	1.3%	1.9%	1.9%
Velocity	ft/s	37.76	36.43	37.14	37.11
Referenced Flow Rate[3]	CFM	175,372	178,302	177,236	176,970
Sampling Isokinetic Rate	%	99	98	97	98

Notes:

[3] Referenced flow rate expressed as dry at 101.3 kPa, 68 °F, and Actual Oxygen

Table 3C: Sampling Summary - Flow Characteristics

SVBHLMF-Stack (LMF)

Stack Gas Parameter		Test No. 1	Test No. 2	Test No. 3	TOTAL
		PM/PM10/PM2.5	PM/PM10/PM2.5	PM/PM10/PM2.5	AVERAGE
Testing Date		29-Nov-22	1-Dec-22	2-Dec-22	-
Stack Temperature	°F	115	104	121	113
Moisture	%	1.2%	0.7%	0.9%	0.9%
Velocity	ft/s	84.83	83.56	86.53	84.97
Referenced Flow Rate[1]	CFM	304,684	312,731	310,005	309,140
Sampling Isokinetic Rate	%	96	93	94	94

Notes:

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	Test Average	Permit Limit
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PM10	4.69 lb/hr	8.95 lb/hr
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PM (Filterable Only)	2.61 lb/hr	3.88 lb/hr

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Executive Table v: Average – ROP Limits for – EULMF – LMF Baghouse

Parameter	Concentration	
	Test Average	Permit Limit
Visual Emissions from Baghouse Stack	0% Opacity	5% Opacity

FINAL REPORT

GERDAU MACSTEEL, INC

MONROE, MICHIGAN

MONROE MILL:
STACK TEST REPORT – ELECTRIC ARC FURNACE (EAF) AND LADLE METALLURGY SYSTEM (LMF)

RWDI #2300259

January 27, 2023

SUBMITTED TO

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EXECUTIVE SUMMARY

RWDI USA LLC (RWDI) has been retained by Gerdau MacSteel, Inc (Gerdau) to complete the emission sampling program at the Gerdau Monroe Mill located at 3000 East Front Street, Monroe, Michigan. The testing evaluated PM, PM2.5, PM10, and Visual Emissions from the EAF and LMF. The test program was completed the week of November 28th, 2022.

Executive Table i: Average – ROP Limits for FGMELTSHOP - EAF, LMF, and VTD

Parameter	Concentration	
	Test Average	Permit Limit
PM2.5	5.06 lb/hr	10.9 lb/hr
PM2.5	0.037 lb/ton of liquid steel	0.1 lb/ton of liquid steel
PM10	7.29 lb/hr	10.9 lb/hr
PM (Filterable Only)	0.0014 Grains/dscf	0.0018 Grains/dscf
PM (Filterable Only)	3.24 lb/hr	7.2 lb/hr

Executive Table ii: Average – PTI Limits for – EUEAF - EAF Baghouse

Parameter	Concentration	
	Test Average	Permit Limit
PM2.5	2.45 lb/hr	12.91 lb/hr
PM10	2.60 lb/hr	12.91 lb/hr
PM (Filterable Only)	0.0004 Grains/dscf	0.0018 Grains/dscf
PM (Filterable Only)	0.63 lb/hr	7.84 lb/hr
Visual Emissions from Baghouse Stack	0% Opacity	3% Opacity
Visual Emissions from vents/openings	0% Opacity	6% Opacity

Executive Table iii: Average – PTI Limits for – FGLMFVTD – LMF Baghouse

Parameter	Concentration	
	Test Average	Permit Limit
PM2.5	2.61 lb/hr	8.95 lb/hr
PM10	4.69 lb/hr	8.95 lb/hr
PM (Filterable Only)	0.0010 Grains/dscf	0.0018 Grains/dscf
PM (Filterable Only)	2.61 lb/hr	3.88 lb/hr

Executive Table iv: Average – ROP Limits for – EUEAF – EAF Baghouse

Parameter	Concentration	
	Test Average	Permit Limit
PM (Filterable Only)	0.0004 Grains/dscf	0.0052 Grains/dscf
Visual Emissions from Baghouse Stack	0% Opacity	3% Opacity
Visual Emissions from Vents and Openings	0% Opacity	0% Opacity
Visible Emissions from EUEAF Shop Building	0% Opacity	6% Opacity

Executive Table v: Average – ROP Limits for – EULMF – LMF Baghouse

Parameter	Concentration	
	Test Average	Permit Limit
Visual Emissions from Baghouse Stack	0% Opacity	5% Opacity

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1 INTRODUCTION

RWDI USA LLC (RWDI) has been retained by Gerdau MacSteel, Inc (Gerdau) to complete the emission sampling program at the Gerdau Monroe Mill located at 3000 East Front Street, Monroe, Michigan. The testing evaluated PM, PM_{10}, $PM_{2.5}$, and Visual Emissions from the Electric Arc Furnace (EAF) and Ladle Metallurgic Furnace (LMF).

1.1 Location and Dates of Testing

The test program was completed at the Gerdau Monroe Mill the week of November 28th, 2022.

1.2 Purpose of Testing

The purpose of this test program was conducted per PTI 75-18 and MI-ROP-B7061-2016.

1.3 Description of Source

Gerdau Monroe Mill is a producer of Special Bar Quality (SBQ) steel. The steel-melting process utilizes Electric Arc Furnace Technology (EAF). The EAF is a refractory-lined cylindrical vessel made of steel plates and having a bowl-shaped hearth and a dome-shaped roof. Water-cooled panels are used for the shell and roof to improve refractory efficiency. Three electrodes, powered by a transformer, are mounted on a superstructure above the furnace and are lowered and raised through ports in the furnace roof. The electrode conveys the energy for melting the scrap steel. Supplemental energy is provided by an oxy-fuel burner and an oxygen/coke lance which swings into the slag door area and operates during the melting/refining process. The furnace is mounted on curved rockers, which allow tilting for slagging and bottom tapping. The EAF melts scrap metal in a batch operation referred to as a heat.

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

1.4 Personnel Involved in Testing

Table 1.4: Testing Personnel

Christopher Hessler Regional Environmental Manager Christopher.Hessler@gerdau.com	**Gerdau MacSteel, Inc**	(734) 384-6544
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2 SUMMARY OF RESULTS

2.1 Operating Data

Gerdau personnel made sure the process was operating correctly and production was at acceptable capacity.

2.2 Applicable Permit Number

MI-ROP-B7061-2016 and PTI 75-18.

3 SOURCE DESCRIPTION

3.1 Description of Process and Emission Control Equipment

Emissions from the processes within the Melt Shop are directed to two baghouses (DVBAGHOUSE-01 and DVLMFBAGHOUSE). DVBAGHOUSE-01 serves EUEAF and also accepts emissions captured by the canopy hood in the Melt Shop. DVBAGHOUSE-01 is a positive pressure baghouse with reverse air cleaning. Three main exhaust fans and one direct evacuation control (DEC) fan. The baghouse is equipped with two exhaust stacks, SVBH-01-STACK1 and SVBH-01-STACK2. CO is combusted in the DEC combustion chamber. Screw conveyors transfer the collected baghouse dust to a pneumatic conveying system which transfers the dust into a silo for storage until removed from the site. The second baghouse (DVLMFBAGHOUSE) serves the LMF and VTD operations in the Melt Shop. DVLMFBAGHOUSE is a positive pressure baghouse with reverse air cleaning and is equipped with a single exhaust stack. Dust collected by DVLMFBAGHOUSE is stored in the baghouse hoppers until it is removed from the site.

Fugitive emissions from within the Melt Shop that reach the roof top monitors are captured and directed to the LMF Baghouse.

3.2 Process Flow Sheet or Diagram (if applicable)

A process flow diagram can be sent upon request.

3.3 Type and Quantity of Raw and Finished Materials

Scrap steel is charged per heat into the EAF. During the heat, additives, alloys, and fluxes are added.

3.4 Rated Capacity of Process

Maximum rated capacity is 130 tons of liquid steel produced per heat.

3.5 Process Instrumentation Monitored During the Test

Operators regulate the process and control production rates.

- Cast Rate (tons/hr)
- Tap Amounts (tons)

4 SAMPLING AND ANALYTICAL PROCEDURES

4.1 Description of Sampling Train and Field Procedures

The emission test program will utilize the following test methods codified at Title 40, Part 60, Appendix A of the Code of Federal Regulations (40 CFR 60, Appendix A):

- 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 Gases (by Fyrite)
- Method 4 – Determination of Moisture Content in Stack Gases
- Method 201A – Determination of PM/PM2.5/PM10 from Stationary Sources
- Method 202 – Determination of Condensable Particulate Matter from Stationary Sources
- Method 9 – Visual Emissions from Stationary Sources

4.1.1 Stack Velocity, Temperature, and Volumetric Flow Rate Determination (USEPA Method 1-4)

Traverse points and determination of upstream and downstream distances from flow disturbance were determined using U.S. EPA Method 1.

The exhaust velocities and flow rates were determined following U.S. EPA Method 2, "Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S Pitot Tube)". Velocity measurements were taken with a pre-calibrated S-Type pitot tube and incline manometer or digital manometer. Volumetric flow rates were determined following the equal area method as outlined in U.S. EPA Method 2. Temperature measurements were made simultaneously with the velocity measurements and were conducted using a chromel-alumel type "k" thermocouple in conjunction with a calibrated digital temperature indicator.

The dry molecular weight of the stack gas was determined following calculations outlined in U.S. EPA Method 3, using a fyrite.

Stack moisture content was determined through direct condensation and according to U.S. EPA Method 4, "Determination of Moisture Content of Stack Gases". Method 4 was conducted through the 201A/202 train.

4.1.2 Sampling for PM/PM_{10}/$PM_{2.5}$/CPM (USEPA Method 201A/202)

Three (3) 240-minute tests were performed on SVBH-01-Stack-01 (EAF West (Red)), SVBH-01-Stack-02 (EAF East (White)) and SVBHLMF-Stack (LMF). All tests were completed simultaneously. RWDI's USEPA Method 201A/202 sampling train consists of (1) a stainless steel nozzle, (2) a stainless steel PM_{10} cyclone head, (3) a stainless steel $PM_{2.5}$ cyclone head, (4) an in stack filter housing, (5) a borosilicate glass probe or liner, (6) a vertical condenser, (7) an empty pot-bellied impinger, (8) an empty modified Greenburg-Smith (GS) impinger, (9) Teflon filter, (10) a second modified GS impinger with 100 ml of water and a third impinger containing silica gel, (11) a sample line and meter box. USEPA Method 201A collects the filterable fractions of PM/PM_{10}/$PM_{2.5}$ and USEPA Method 202 collects the condensable fraction of PM_{10} and $PM_{2.5}$.

A sampling train leak check was conducted before and after each test. After completion of each test, the filter was recovered, the nozzle, PM_{10}, and $PM_{2.5}$ head were recovered into clean sample jars following USEPA Method 201A. The impinger train was purged with nitrogen for one hour at a flowrate of 14 liters per minute. After the purge, all the glassware was recovered per USEPA Method 202.

4.2 Description of Recovery and Analytical Procedures

The samples were all recovered following USEPA Method 201A and 202.

4.3 Sampling Port Description

The sampling locations are all outside.

Table 4.3: Summary of Exhaust Parameters

Source	Diameter (in.)	Approximate Duct Diameters from Flow Disturbance	Number of Ports	Points per Traverse	Total Points per Test
SVBH-01-Stack-01 EUEAF Baghouse Stack 1 (EAF West (Red))	135	~2.6 downstream and 2.7 upstream	4	12	24
SVBH-01-Stack-02 EUEAF Baghouse Stack 2 (EAF East (White))	135.5	~2.6 downstream and ~2.7 upstream	4	12	24
SVBHLMF-Stack LMF Baghouse (LMF)	110	>8 downstream and >2 upstream	4	6	12

5 TEST RESULTS AND DISCUSSION

5.1 Detailed Results

Table 5.1: Average – ROP Limits for FGMELTSHOP - EAF, LMF, and VTD

Parameter	Concentration	
	Test Average	Permit Limit
PM2.5	5.06 lb/hr	10.9 lb/hr
PM2.5	0.037 lb/ton of liquid steel	0.1 lb/ton of liquid steel
PM10	7.29 lb/hr	10.9 lb/hr
PM (Filterable Only)	0.0014 Grains/dscf	0.0018 Grains/dscf
PM (Filterable Only)	3.24 lb/hr	7.2 lb/hr

Table 5.2: Average – PTI Limits for – EUEAF - EAF Baghouse

Parameter	Concentration	
	Test Average	Permit Limit
PM2.5	2.45 lb/hr	12.91 lb/hr
PM10	2.60 lb/hr	12.91 lb/hr
PM (Filterable Only)	0.0004 Grains/dscf	0.0018 Grains/dscf
PM (Filterable Only)	0.63 lb/hr	7.84 lb/hr
Visual Emissions from Baghouse Stack	0% Opacity	3% Opacity
Visual Emissions from vents/openings	0% Opacity	6% Opacity

Table 5.3: Average – PTI Limits for – FGLMFVTD – LMF Baghouse

Parameter	Concentration	
	Test Average	Permit Limit
PM2.5	2.61 lb/hr	8.95 lb/hr
PM10	4.69 lb/hr	8.95 lb/hr
PM (Filterable Only)	0.0010 Grains/dscf	0.0018 Grains/dscf
PM (Filterable Only)	2.61 lb/hr	3.88 lb/hr

Table 5.4: Average – ROP Limits for – EUEAF – EAF Baghouse

Parameter	Concentration	
	Test Average	Permit Limit
PM (Filterable Only)	0.0004 Grains/dscf	0.0052 Grains/dscf
Visual Emissions from Baghouse Stack	0% Opacity	3% Opacity
Visual Emissions from Vents and Openings	0% Opacity	0% Opacity
Visible Emissions from EUEAF Shop Building	0% Opacity	6% Opacity

Table 5.5: Average – ROP Limits for – EULMF – LMF Baghouse

Parameter	Concentration	
	Test Average	Permit Limit
Visual Emissions from Baghouse Stack	0% Opacity	5% Opacity

5.2 Discussion of Results

The detailed results can be found in **Appendices B, C, D,** and **E**. Note, the laboratory detected visible solid residue in LMF T1 <10 to >2.5 fraction of the acetone rinse from USEPA Method 201A. The data was used as is for the report. We believe this was an unrelated to the process emissions.

5.3 Variations in Testing Procedures

There were not testing variations.

5.4 Process Upset Conditions During Testing

There were no process upsets.

5.5 Maintenance Performed in Last Three Months

There has been no significant maintenance on the EAF or LMF in the last three months. Normal routine maintenance is completed as scheduled.

5.6 Re-Test

This was not a retest.

5.7 Audit Samples

This test did not require any audit samples.

5.8 Field Data Sheets

Field data sheets can be found in **Appendices B, C, D,** and **E**.

5.9 Calibration Sheets

Calibration sheets can be found in **Appendix F**.

5.10 Sample Calculations

Sample calculations can be found in **Appendix G**.

5.11 Laboratory Data

Laboratory data can be found in **Appendix H**.

TABLES

Table 1: Summary of Sampling Parameters and Methodology

Source Location	No. of Tests per Stack	Sampling Parameter	Sampling Method
SVBH-01-Stack 2 EAF - East (White)	3	Velocity, Temperature and Flow Rate	U.S. EPA [1] Methods 1-4
	3	Total Particulate Matter	U.S. EPA [1] Method 201A (Filterable Only)
	3	PM_{10} / $PM_{2.5}$	U.S. EPA [1] Method 201A/202
	3	Oxygen, Carbon Dioxide	U.S. EPA [1] Method 3
	3	Visible Emissions	U.S. EPA [1] Method 9
SVBH-01-Stack 1 EAF - West (Red)	3	Velocity, Temperature and Flow Rate	U.S. EPA [1] Methods 1-4
	3	Total Particulate Matter	U.S. EPA [1] Method 201A (Filterable Only)
	3	PM_{10} / $PM_{2.5}$	U.S. EPA [1] Method 201A/202
	3	Oxygen, Carbon Dioxide	U.S. EPA [1] Method 3
	3	Visible Emissions	U.S. EPA [1] Method 9
SVBHLMF-Stack LMF	3	Velocity, Temperature and Flow Rate	U.S. EPA [1] Methods 1-4
	3	Total Particulate Matter	U.S. EPA [1] Method 201A (Filterable Only)
	3	PM_{10} / $PM_{2.5}$	U.S. EPA [1] Method 201A/202
	3	Oxygen, Carbon Dioxide	U.S. EPA [1] Method 3
	3	Visible Emissions	U.S. EPA [1] Method 9

Notes:

[1] U.S. EPA - United States Environmental Protection Agency

Table 2A: Sampling Summary and Sample Log (PM/PM10/PM2.5)

Source and Test #	Sampling Date	Start Time	End Time	Filter ID / Trap ID
SVBH-01-Stack 2 (EAF - East (White)) - Velocity / Total Particulate / PM10 / PM2.5				
Blank	2-Dec-22	-	-	QZ 47-35
Test #1	29-Nov-22	9:15 AM	1:25 PM	QZ 47-18
Test #2	1-Dec-22	8:21 AM	12:41 PM	QZ 47-36
Test #3	2-Dec-22	9:15 AM	2:12 PM	QZ 47-33
SVBH-01-Stack 1 (EAF - West (Red)) - Velocity / Total Particulate / PM10 / PM2.5				
Blank	2-Dec-22	-	-	QZ 47-35
Test #1	29-Nov-22	9:15 AM	1:31 PM	QZ 47-40
Test #2	1-Dec-22	8:21 AM	12:42 PM	QZ 47-39
Test #3	2-Dec-22	9:15 AM	2:05 PM	QZ 47-34
SVBHLMF-Stack (LMF) - Velocity / Total Particulate / PM10 / PM2.5				
Blank	2-Dec-22	-	-	QZ 47-35
Test #1	29-Nov-22	9:15 AM	1:47 PM	QZ 47-9
Test #2	1-Dec-22	8:21 AM	1:12 PM	QZ 47-38
Test #3	2-Dec-22	9:15 AM	2:42 PM	QZ 47-32

Table 2B: Sampling Summary and Sample Log (Visible Emissions)

Source and Test #	Sampling Date	Start Time	End Time
SVBH-01-Stack 2 (EAF - East (White)) - Visible Emissions			
Test #1	1-Dec-22	8:57 AM	9:56 AM
Test #2	1-Dec-22	9:59 AM	10:59 AM
Test #3	2-Dec-22	9:20 AM	10:20 AM
SVBH-01-Stack 1 (EAF - West (Red)) - Visible Emissions			
Test #1	1-Dec-22	8:58 AM	9:57 AM
Test #2	1-Dec-22	10:00 AM	11:00 AM
Test #3	2-Dec-22	9:20 AM	10:20 AM
SVBHLMF-Stack (LMF) - Visible Emissions			
Test #1	1-Dec-22	8:57 AM	9:56 AM
Test #2	1-Dec-22	9:59 AM	10:59 AM
Test #3	2-Dec-22	9:20 AM	10:20 AM

Table 3A: Sampling Summary - Flow Characteristics

SVBH-01-Stack 2 (EAF - EAST (White))

Stack Gas Parameter		Test No. 1	Test No. 2	Test No. 3	TOTAL
		PM/PM10/PM2.5	PM/PM10/PM2.5	PM/PM10/PM2.5	AVERAGE
Testing Date		29-Nov-22	1-Dec-22	2-Dec-22	-
Stack Temperature	°F	185	172	176	178
Moisture	%	2.3%	1.5%	1.4%	1.7%
Velocity	ft/s	41.47	40.80	42.87	41.71
Referenced Flow Rate[3]	CFM	195,425	205,455	208,171	203,017
Sampling Isokinetic Rate	%	103	103	99	102

Notes:

[1] Referenced flow rate expressed as dry at 101.3 kPa, 68 °F, and Actual Oxygen

Table 3B: Sampling Summary - Flow Characteristics

SVBH-01-Stack 1 (EAF - West (Red))

Stack Gas Parameter		Test No. 1 PM/PM10/PM2.5	Test No. 2 PM/PM10/PM2.5	Test No. 3 PM/PM10/PM2.5	TOTAL AVERAGE
Testing Date		29-Nov-22	1-Dec-22	2-Dec-22	-
Stack Temperature	°F	189	174	180	181
Moisture	%	2.6%	1.3%	1.9%	1.9%
Velocity	ft/s	37.76	36.43	37.14	37.11
Referenced Flow Rate[3]	CFM	175,372	178,302	177,236	176,970
Sampling Isokinetic Rate	%	99	98	97	98

Notes:

[3] Referenced flow rate expressed as dry at 101.3 kPa, 68 °F, and Actual Oxygen

Table 3C: Sampling Summary - Flow Characteristics

SVBHLMF-Stack (LMF)

Stack Gas Parameter		Test No. 1 PM/PM10/PM2.5	Test No. 2 PM/PM10/PM2.5	Test No. 3 PM/PM10/PM2.5	TOTAL AVERAGE
Testing Date		29-Nov-22	1-Dec-22	2-Dec-22	-
Stack Temperature	°F	115	104	121	113
Moisture	%	1.2%	0.7%	0.9%	0.9%
Velocity	ft/s	84.83	83.56	86.53	84.97
Referenced Flow Rate[1]	CFM	304,684	312,731	310,005	309,140
Sampling Isokinetic Rate	%	96	93	94	94

Notes:

[1] Referenced flow rate expressed as dry at 101.3 kPa, 68 °F, and Actual Oxygen

Table 4A: Average – ROP Limits for FGMELTSHOP - EAF, LMF, and VTD

Parameter	Concentration	
	Test Average	Permit Limit
$PM_{2.5}$	5.06 lb/hr	10.9 lb/hr
$PM_{2.5}$	0.037 lb/ton of liquid steel	0.1 lb/ton of liquid steel
PM_{10}	7.29 lb/hr	10.9 lb/hr
PM (Filterable Only)	0.0014 Grains/dscf	0.0018 Grains/dscf
PM (Filterable Only)	3.24 lb/hr	7.2 lb/hr

Table 4B: Average – PTI Limits for – EUEAF - EAF Baghouse

Parameter	Concentration	
	Test Average	Permit Limit
$PM_{2.5}$	2.45 lb/hr	12.91 lb/hr
PM_{10}	2.60 lb/hr	12.91 lb/hr
PM (Filterable Only)	0.0004 Grains/dscf	0.0018 Grains/dscf
PM (Filterable Only)	0.63 lb/hr	7.84 lb/hr
Visual Emissions from Baghouse Stack	0% Opacity	3% Opacity
Visual Emissions from vents/openings	0% Opacity	6% Opacity

Table 4C: Average – PTI Limits for – FGLMFVTD – LMF Baghouse

Parameter	Concentration	
	Test Average	Permit Limit
$PM_{2.5}$	2.61 lb/hr	8.95 lb/hr
PM_{10}	4.69 lb/hr	8.95 lb/hr
PM (Filterable Only)	0.0010 Grains/dscf	0.0018 Grains/dscf
PM (Filterable Only)	2.61 lb/hr	3.88 lb/hr

Table 4D: Average – ROP Limits for – EUEAF – EAF Baghouse

Parameter	Concentration	
	Test Average	Permit Limit
PM (Filterable Only)	0.0004 Grains/dscf	0.0052 Grains/dscf
Visual Emissions from Baghouse Stack	0% Opacity	3% Opacity
Visual Emissions from Vents and Openings	0% Opacity	0% Opacity
Visible Emissions from EUEAF Shop Building	0% Opacity	6% Opacity

Table 4E: Average – ROP Limits for – EULMF – LMF Baghouse

Parameter	Concentration	
	Test Average	Permit Limit
Visual Emissions from Baghouse Stack	0% Opacity	5% Opacity

Table 5: Opacity- Averaged Results

	Opacity			Average Opacity
	1-Dec-22	1-Dec-22	1-Dec-22	
Parameter	**(%)**	**(%)**	**(%)**	**(%)**
SVBH-01-Stack-02 (EAF East (White))				
Opacity	0	0	0	0
SVBH-01-Stack-01 (EAF West (Red))				
Opacity	0	0	0	0
SVBHLMF-Stack (LMF)				
Opacity	0	0	0	0

FIGURES