Source Test Report for 2022 Compliance Emissions Testing

Electric Arc Furnace (EUEAF) and Ladle Metallurgy System (EULMF)

Gerdau Monroe Mill
Monroe, MI

Prepared For:

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For Submission To:

EGLE
525 W. Allegan Street
Lansing, MI 48933

Document Number: MW011AS-015066-RT-968
Test Dates: March 22, 2022 and March 24-25, 2022
Submittal Date: May 18, 2022

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Review and Certification

All work, calculations, and other activities and tasks performed and presented in this document were carried out by me or under my direction and supervision. I hereby certify that, to the best of my knowledge, Montrose operated in conformance with the requirements of the Montrose Quality Management System and ASTM D7036-04 during this test project.

Signature: Jeremiah Hicks **Date:** 05 / 12 / 2022

Name: Jeremiah Hicks **Title:** Client Project Manager

I have reviewed, technically and editorially, details, calculations, results, conclusions, and other appropriate written materials contained herein. I hereby certify that, to the best of my knowledge, the presented material is authentic, accurate, and conforms to the requirements of the Montrose Quality Management System and ASTM D7036-04.

Signature: robert j lisy jr **Date:** 05 / 04 / 2022

Name: Robert J. Lisy, Jr. **Title:** Reporting Hub Manager

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1.0 Introduction

1.1 Summary of Test Program

Gerdau Monroe Mill (State Registration No.: B7061) contracted Montrose Air Quality Services, LLC (Montrose) to perform a compliance emissions test program on the Electric Arc Furnace (EUEAF) and Ladle Metallurgy System (EULMF) at the Gerdau Monroe Mill facility located in Monroe, Michigan. The tests were conducted on March 22, 2022, and March 24-25, 2022, to satisfy the emissions testing requirements pursuant to Michigan Department of Environment, Great Lakes, and Energy (EGLE) Renewable Operation Permit No. MI-ROP-B7061-2016 and PTI No. 75-18.

The specific objectives were to:

- Verify the emissions of nitrogen oxides (NO_x as NO_2), volatile organic compounds (VOC), lead (Pb), and mercury (Hg) from the Baghouse (DVBAGHOUSE-01) Exhaust Stack No. 1 (SVBH-01-STACK1) and Exhaust Stack No. 2 (SVBH-01-STACK2) serving EUEAF
- Verify the emissions of sulfur dioxide (SO_2), nitrogen oxides (NO_x as NO_2), carbon monoxide (CO), volatile organic compounds (VOC), and lead (Pb) from the Baghouse (DVLMFBAGHOUSE) Exhaust Stack (SVBHLMF-STACK) serving EULMF
- Verify the percent opacity of visible emissions (VE) at the Baghouse Exhaust Stack No. 1 and Baghouse Exhaust Stack No. 2 serving EUEAF and the Baghouse Exhaust Stack serving EULMF
- Conduct the test program with a focus on safety

Montrose performed the tests to measure the emission parameters listed in Table 1-1.

Table 1-1
Summary of Test Program

Test Date(s)	Unit ID/ Source Name	Activity/Parameters	Test Methods	No. of Runs	Duration (Minutes)
3/22/2022, 3/24/2022, 3/25/2022	EUEAF	Velocity/Volumetric Flow Rate	EPA 1 & 2	3	240
3/22/2022, 3/24/2022, 3/25/2022	EUEAF	O_2, CO_2	EPA 3A	3	240
3/22/2022, 3/24/2022, 3/25/2022	EUEAF	Moisture	EPA 4	3	240

Table 1-1 continued
Summary of Test Program

Test Date(s)	Unit ID/ Source Name	Activity/Parameters	Test Methods	No. of Runs	Duration (Minutes)
3/22/2022, 3/24/2022, 3/25/2022	EUEAF	NO_x	EPA 7E	3	240
3/24/2022	EUEAF	Opacity	EPA 9	3	60
3/22/2022, 3/24/2022, 3/25/2022	EUEAF	VOC	EPA 25A/18	3	240
3/22/2022, 3/24/2022, 3/25/2022	EUEAF	Pb, Hg	EPA 29	3	240
3/22/2022, 3/24/2022, 3/25/2022	EULMF	Velocity/Volumetric Flow Rate	EPA 1 & 2	3	240
3/22/2022, 3/24/2022, 3/25/2022	EULMF	O_2, CO_2	EPA 3A	3	240
3/22/2022, 3/24/2022, 3/25/2022	EULMF	Moisture	EPA 4	3	240
3/22/2022, 3/24/2022, 3/25/2022	EULMF	SO_2	EPA 6C	3	240
3/22/2022, 3/24/2022, 3/25/2022	EULMF	NO_x	EPA 7E	3	240
3/22/2022	EULMF	Opacity	EPA 9	3	60
3/22/2022, 3/24/2022, 3/25/2022	EULMF	CO	EPA 10	3	240
3/22/2022, 3/24/2022, 3/25/2022	EULMF	VOC	EPA 25A/18	3	240
3/22/2022, 3/24/2022, 3/25/2022	EULMF	Pb	EPA 29	3	240

To simplify this report, a list of Units and Abbreviations is included in Appendix D.1. Throughout this report, chemical nomenclature, acronyms, and reporting units are not defined. Please refer to the list for specific details.

This report presents the test results and supporting data, descriptions of the testing procedures, descriptions of the facility and sampling locations, and a summary of the quality assurance procedures used by Montrose. The average emission test results are summarized and compared to their respective permit limits in Tables 1-2 and 1-3. Detailed results for individual test runs can be found in Section 4.0. All supporting data can be found in the appendices.

The testing was conducted by the Montrose personnel listed in Table 1-4. The tests were conducted according to the test plan (protocol) dated October 13, 2022, that was submitted to EGLE.

Table 1-2
Summary of Average Compliance Results Combined – EUEAF and EULMF

March 22, 2022 and March 24-25, 2022

Parameter/Units	Average Results	Emission Limits*
Nitrogen Oxides (NO_x)		
lb/hr	27.8	26
lb/ton liquid steel	0.2	0.2
Volatile Organic Compounds, as Propane (VOC)		
lb/hr	7.8	16.9
lb/ton liquid steel	0.07	0.13
Lead (Pb)		
lb/hr	0.002	0.09

* Emissions Limits per MI-ROP-B7061-2016.

Table 1-3
Summary of Average Compliance Results – EUEAF

March 22, 2022 and March 24-25, 2022

Parameter/Units	Average Results	Emission Limits*
Nitrogen Oxides (NO_x)		
lb/hr	22.5	35.1
lb/ton liquid steel	0.19	0.27
Volatile Organic Compounds, as Propane (VOC)		
lb/hr	4.7	13
lb/ton liquid steel	0.039	0.1
Mercury (Hg)		
lb/hr	0.0043	0.033
Lead (Pb)		
lb/hr	0.00085	0.10
Visible Emissions (3/24/22)		
Highest 6-Minute Average Opacity, %	0.00	3.0

* Emissions Limits per PTI No. 75-18.

Table 1-4
Summary of Average Compliance Results – EULMF

March 22, 2022 and March 24-25, 2022

Parameter/Units	Average Results	Emission Limits*
Sulfur Dioxide (SO_2)		
lb/hr	32.40	13.05
Nitrogen Oxides (NO_x)		
lb/hr	5.38	10.3
Carbon Monoxide (CO)		
lb/hr	20.65	18.5
Volatile Organic Coumpounds, as Propane (VOC)		
lb/hr	3.08	1.63
Lead (Pb)		
lb/hr	0.0011	0.03
Visible Emissions (3/22/22)		
Highest 6-Minute Average Opacity, %	0.00	6.00

* Emissions Limits per PTI No. 75-18.

1.2 Key Personnel

A list of project participants is included below:

Facility Information

Source Location: Gerdau Monroe Mill
3000 East Front Street
Monroe, MI 48161
Project Contact: Christopher Hessler
Role: Regional Environmental Manager
Company: Gerdau Monroe Mill
Telephone: 734-384-6544
Email: Christopher.hessler@gerdau.com

Agency Information

Regulatory Agency:	EGLE
Agency Contact:	Karen Kajiya-Mills
Telephone:	517-335-3122
Email:	Kajiya-millsk@michigan.gov

Testing Company Information

Testing Firm:	Montrose Air Quality Services, LLC	
Contact:	Robert J. Lisy, Jr.	Robert H. Sava, Jr.
Title:	Reporting Hub Manager	Client Project Manager
Telephone:	440-262-3760	440-262-3760
Email:	rlisy@montrose-env.com	rsava@montrose-env.com

Laboratory Information

Laboratory:	Enthalpy Analytical, LLC
City, State:	Durham, NC
Method:	EPA 18 and 29

Test personnel and observers are summarized in Table 1-5.

Table 1-5
Test Personnel and Observers

Name	Affiliation	Role/Responsibility
Robert H. Sava, Jr.	Montrose	Client Project Manager, QI
Jeremiah Hicks	Montrose	Client Project Manager, QI
Dalton Macalla	Montrose	Field Project Manager, QI
Jonathan Grech	Montrose	Senior Field Technician, QI
Shawn Jaworski	Montrose	Senior Field Technician, QI
Colin Rodkey	Montrose	Field Technician
Shane Downey	Montrose	Field Technician
Hayden Carl	Montrose	Field Technician
John Ziber	Montrose	Field Technician
Scott Dater	Montrose	Field Technician
Conner Mahoney	Montrose	Field Technician
Mo Elzaibak	Montrose	Field Technician
Robert Kolar	Montrose	Field Technician
Christopher Hessler	Gerdau Monroe Mill	Observer/Client Liaison/Test Coordinator

2.0 Plant and Sampling Location Descriptions

2.1 Process Description, Operation, and Control Equipment

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 reduce refractory costs. 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 electrodes convey the energy for melting the steel scrap. Supplemental energy is provided by an oxy-fuel burner and an oxygen/coke lance which swing into the slag door area and operate during the melting/refining process. The furnace is mounted on curved rockers, which allow tiling for slagging and bottom tapping.

The EAF melts scrap metal in a batch operation referred to as a heat (each heat is considered a batch operation). The EAF operators primarily follow Standard Operating Procedures (SOPs) to make individual heats. The operators use customized touch screen software to assist them with individual tasks. Also, there is an arc regulation system, which assists the operators in the steel-making process, minimizing energy consumption.

An EAF melting cycle, or heat, consists of three phases: scrap preparation and charging, scrap meltdown, and molten steel tapping. On average, approximately 130 tons of liquid steel is produced per heat. Emissions from heat to heat should not vary significantly, except SO_2 emission during production of high-sulfur steel grades. The rated capacity of each process is 900,000 liquid steel tons per year.

Emissions from 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. Evacuation is by means of 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.

2.2 Flue Gas Sampling Locations

Information regarding the sampling locations is presented in Table 2-1.

Table 2-1
Sampling Locations

Sampling Location	Stack Inside Diameter (in.)	Distance from Nearest Disturbance Downstream EPA "B" (in./dia.)	Distance from Nearest Disturbance Upstream EPA "A" (in./dia.)	Number of Traverse Points
EUEAF Baghouse Exhaust Stack No. 1	134.8 X 135.1 Elliptical	350.0 / 2.6	370.0 / 2.7	Isokinetic: 24 (6/port) Gaseous: 12 (3/port)
EUEAF Baghouse Exhaust Stack No. 2	135.5	350.0 / 2.6	370.0 / 2.7	Isokinetic: 24 (6/port) Gaseous: 12 (3/port)
EULMF Baghouse Exhaust Stack	109.5	948.0 / 8.7	510.0 / 4.7	Isokinetic: 12 (3/port) Gaseous: 12 (3/port)

Sample locations were verified in the field to conform to EPA Method 1. Acceptable cyclonic flow conditions were confirmed prior to testing using EPA Method 1, Section 11.4. See Appendix A.1 for more information.

2.3 Operating Conditions and Process Data

Emission tests were performed while EUEAF, EULMF, and the air pollution control devices were operating at the conditions required by the permit. EUEAF and EULMF were tested when operating normally.

Plant personnel were responsible for establishing the test conditions and collecting all applicable unit-operating data. The process data that was provided is presented in Appendix B. Data collected includes the following parameters:

- Cast rate, tons/hr
- Tap amount, tons

3.0 Sampling and Analytical Procedures

3.1 Test Methods

The test methods for this test program have been presented in Table 1-1. Additional information regarding specific applications or modifications to standard procedures is presented below.

3.1.1 EPA Method 1, Sample and Velocity Traverses for Stationary Sources

EPA Method 1 is used to assure that representative measurements of volumetric flow rate are obtained by dividing the cross-section of the stack or duct into equal areas, and then locating a traverse point within each of the equal areas. Acceptable sample locations must be located at least two stack or duct equivalent diameters downstream from a flow disturbance and one-half equivalent diameter upstream from a flow disturbance.

The sample port and traverse point locations are detailed in Appendix A.

3.1.2 EPA Method 2, Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S Pitot Tube)

EPA Method 2 is used to measure the gas velocity using an S-type pitot tube connected to a pressure measurement device, and to measure the gas temperature using a calibrated thermocouple connected to a thermocouple indicator. Typically, Type S (Stausscheibe) pitot tubes conforming to the geometric specifications in the test method are used, along with an inclined manometer. The measurements are made at traverse points specified by EPA Method 1.

3.1.3 EPA Method 3A, Determination of Oxygen and Carbon Dioxide Concentrations in Emissions from Stationary Sources (Instrumental Analyzer Procedure)

EPA Method 3A is an instrumental test method used to measure the concentration of O_2 and CO_2 in stack gas. The effluent gas is continuously or intermittently sampled and conveyed to analyzers that measure the concentration of O_2 and CO_2. The performance requirements of the method must be met to validate data.

The sampling train at the EUEAF locations were paired with EPA Methods 7E, 18, and 25A whereas the sampling train at the EULMF location was paired with EPA Methods 6C, 7E, 10, 18, and 25A.

The typical sampling system is detailed in Figure 3-1.

3.1.4 EPA Method 4, Determination of Moisture Content in Stack Gas

EPA Method 4 is a manual, non-isokinetic method used to measure the moisture content of gas streams. Gas is sampled at a constant sampling rate through a probe and impinger train. Moisture is removed using a series of pre-weighed impingers containing methodology-specific liquids and silica gel immersed in an ice water bath. The impingers are weighed after each run to determine the percent moisture.

The typical sampling system is detailed in Figures 3-2 and 3-3.

3.1.5 EPA Method 6C, Determination of Sulfur Dioxide Emissions from Stationary Sources (Instrumental Analyzer Procedure)

EPA Method 6C is an instrumental test method used to continuously measure emissions of SO_2. Conditioned gas is sent to an analyzer to measure the concentration of SO_2. The performance requirements of the method must be met to validate the data.

The sampling train at the EULMF location was paired with EPA Methods 3A, 7E, 10, 18, and 25A. The typical sampling system is detailed in Figure 3-1.

3.1.6 EPA Method 7E, Determination of Nitrogen Oxides Emissions from Stationary Source (Instrumental Analyzer Procedure)

EPA Method 7E is an instrumental test method used to continuously measure emissions of NO_x as NO_2. Conditioned gas is sent to an analyzer to measure the concentration of NO_x. NO and NO_2 can be measured separately or simultaneously together but, for the purposes of this method, NO_x is the sum of NO and NO_2. The performance requirements of the method must be met to validate the data.

The sampling train at the EUEAF locations were paired with EPA Methods 3A, 18, and 25A, whereas the sampling train at the EULMF location was paired with EPA Methods 3A, 6C, 10, 18, and 25A. The typical sampling system is detailed in Figure 3-1.

3.1.7 EPA Method 9, Visual Determination of the Opacity of Emissions

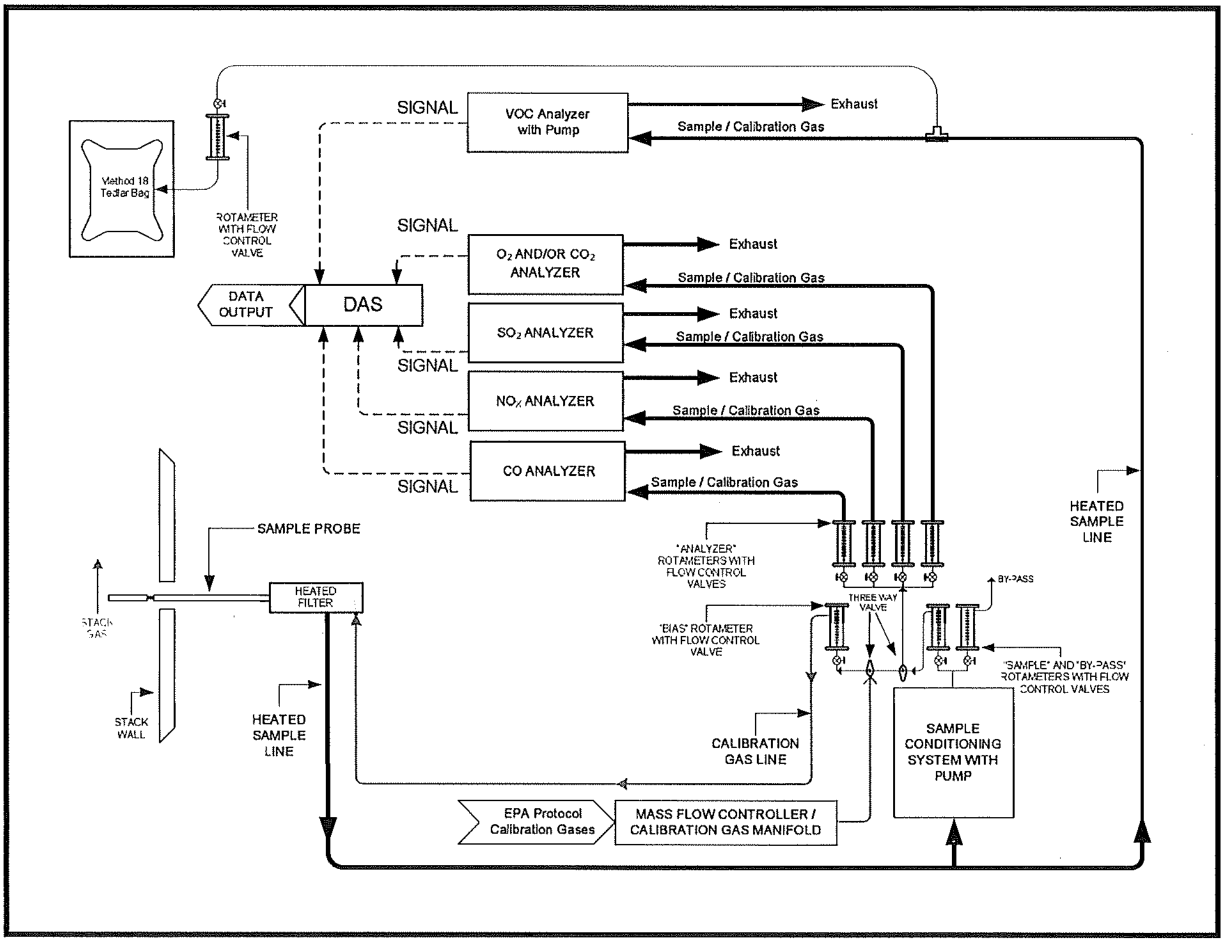
EPA Method 9 is used to observe the visual opacity of emissions (opacity). The observer stands at a distance sufficient to provide a clear view of the emissions with the sun oriented in the 140° sector to their back. The line of vision is perpendicular to the plume direction and does not include more than one plume diameter. Observations are recorded at 15-second intervals and are made to the nearest 5% opacity. The qualified observer is certified according to the requirements of EPA Method 9, section 3.1.

3.1.8 EPA Method 10, Determination of Carbon Monoxide Emissions from Stationary Sources (Instrumental Analyzer Procedure)

EPA Method 10 is an instrumental test method used to continuously measure emissions of CO. Conditioned gas is sent to an analyzer to measure the concentration of CO. The performance requirements of the method must be met to validate the data.

The sampling train at the EULMF location was paired with EPA Methods 3A, 6C, 7E, 18, and 25A. The typical sampling system is detailed in Figure 3-1.

Figure 3-1
EPA METHOD 3A, 6C, 7E, 10, 18 (BAG), AND 25A SAMPLING TRAIN



3.1.9 EPA Method 18, Measurement of Gaseous Organic Compound Emissions by Gas Chromatography

EPA Method 18 is used to measure gaseous organic compounds from stationary sources. The major organic components of a gas mixture are separated by gas chromatography (GC) and are individually quantified using a flame ionization detector (FID), photoionization detector (PID), electron capture detector (ECD), or other appropriate detection principles. The retention times of each separated component are compared with those of known compounds under identical conditions.

The sampling train at the EUEAF locations were paired with EPA Methods 3A, 7E, and 25A, whereas the sampling train at the EULMF location was paired with EPA Methods 3A, 6C, 7E, 10, and 25A. The typical sampling system is detailed in Figure 3-1.

3.1.10 EPA Method 25A, Determination of Total Gaseous Organic Concentration Using a Flame Ionization Analyzer

EPA Method 25A is an instrumental test method used to measure the concentration of THC in stack gas. A gas sample is extracted from the source through a heated sample line and glass fiber filter to a flame ionization analyzer (FIA). Results are reported as volume concentration equivalents of the calibration gas or as carbon equivalents.

The sampling train at the EUEAF locations were paired with EPA Methods 3A, 7E, and 18, whereas the sampling train at the EULMF location was paired with EPA Methods 3A, 6C, 7E, 10, and 18. The typical sampling system is detailed in Figure 3-1.

3.1.11 EPA Method 29, Determination of Metals Emissions from Stationary Sources

EPA Method 29 is a manual, isokinetic test method to measure a variety of metals using inductively coupled argon plasma emission spectroscopy (ICAP) and cold vapor atomic absorption (CVAA) spectroscopy. This method is performed in conjunction with EPA Methods 1-4. A stack sample is withdrawn isokinetically from the source, filterable emissions are collected in the probe and on a heated filter, and condensable emissions are collected in an aqueous acidic solution of hydrogen peroxide (analyzed for all target analytes) and an optional aqueous acidic solution of potassium permanganate (required only when Hg is a target analyte). The recovered samples are digested, and appropriate fractions are analyzed for the target analytes which may include Hg by CVAAS and for Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Mn, Ni, P, Se, Ag, Tl, and Zn by ICAP or atomic absorption spectroscopy (AAS). Graphite furnace atomic absorption spectroscopy (GFAAS) is used for analysis of Sb, As, Cd, Co, Pb, Se, and Tl if these elements require greater analytical sensitivity than can be obtained using ICAP. AAS may be used for analysis of all target analytes if the resulting in-stack method detection limits meet the goal of the testing program. Similarly, inductively coupled plasma-mass spectroscopy (ICP-MS) may be used for analysis of Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Mn, Ni, Ag, Tl and Zn.

The results from analysis of individual fractions of the sample train are summed to obtain the total concentration of each metal per sample train.

The sampling train used at the EUEAF locations are displayed in Figure 3-2 whereas the sampling train used at the EULMF location is displayed in Figure 3-3.

Figure 3-2
EPA METHOD 5/29 (Hg) SAMPLING TRAIN

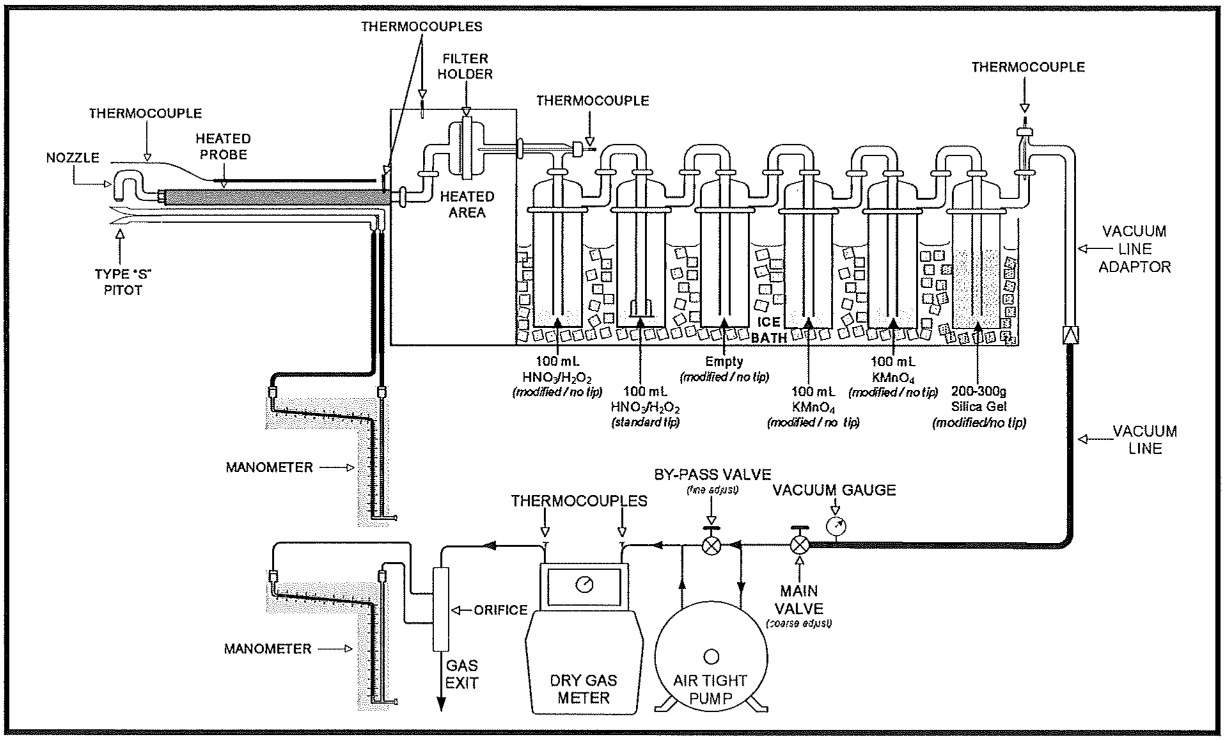
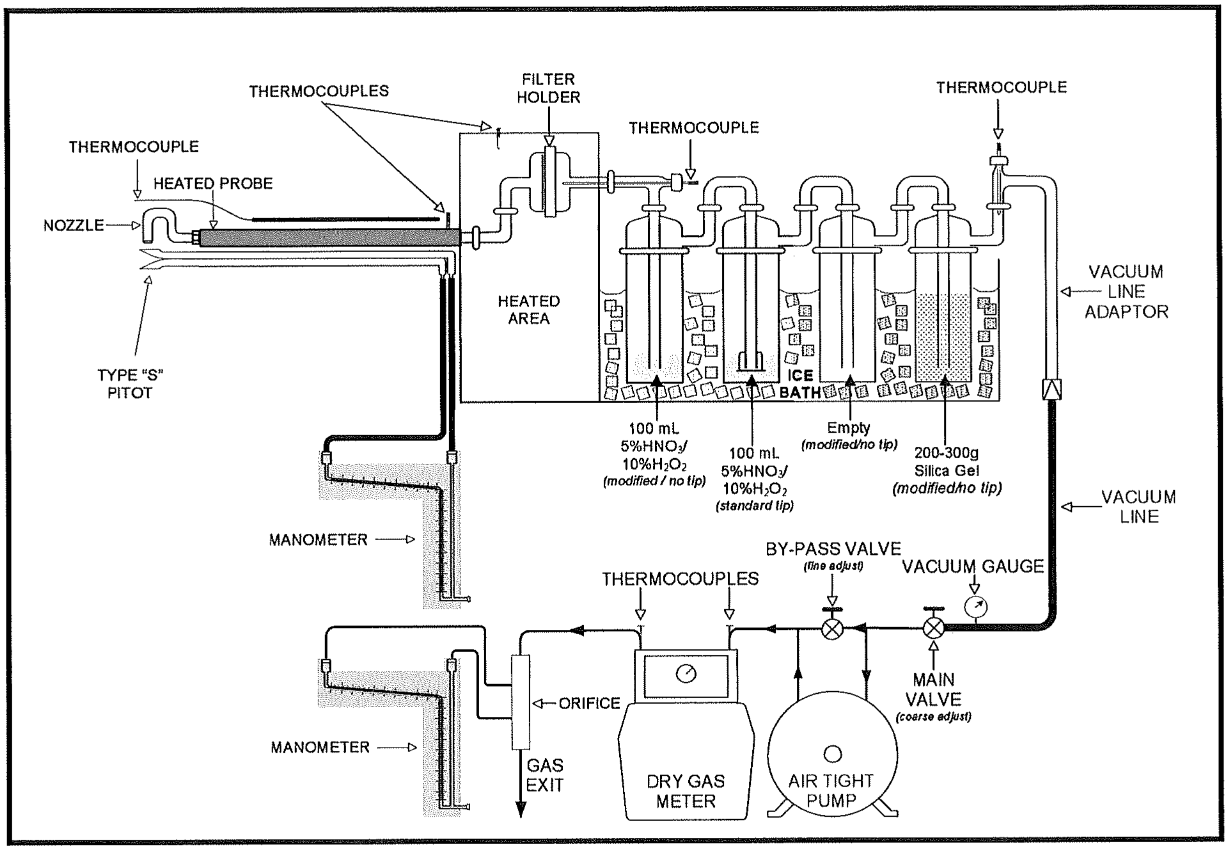


Figure 3-3
EPA METHOD 5/29 (No Hg) SAMPLING TRAIN



3.2 Process Test Methods

The test plan did not require that process samples be collected during this test program; therefore, no process sample data are presented in this test report.

4.0 Test Discussion and Results

4.1 Field Test Deviations and Exceptions

4.1.1 CEMS Analyzer Malfunction

During the first half of Run 2 at the EUEAF Baghouse Exhaust Stack No. 1, it was determined that the Method 3A O_2 analyzer was malfunctioning. A grab bag sample of stack gas was then obtained. The O_2 analyzer was replaced, calibrated, and the grab sample was analyzed and Run 2 was resumed. The concentration of O_2 for Run 2 is the average of the grab sample and O_2 measured during the second half of Run 2.

4.1.2 Failed Drift Check

Following Run 1, the zero gas system drift check performed for the EPA Method 3A analyzer at EUEAF Baghouse Exhaust Stack No. 2 failed the drift check requirement. As per EPA Method 3A Section 8.5, a 3-point analyzer calibration error test and a system bias check was performed, and testing was resumed.

4.2 Presentation of Results

The average results are compared to the permit limits in Tables 1-2 and 1-3. The results of individual compliance test runs performed are presented in Tables 4-1 through 4-6. Emissions are reported in units consistent with those in the applicable regulations or requirements. Additional information is included in the appendices as presented in the Table of Contents.

Table 4-1
NO_x, VOC, and Pb Combined Emissions Results - EUEAF and EULMF

Run Number	1	2	3	Average
Date	3/22/2022	3/24/2022	3/25/2022	--
Nitrogen Oxides (NO_x as NO_2)				
lb/hr	26.0	31.0	26.5	27.8
lb/ton liquid steel	0.21	0.29	0.22	0.24
Volatile Organic Compounds (VOC), as propane				
lb/hr	10.6	5.1	7.6	7.8
lb/ton liquid steel	0.084	0.048	0.063	0.065
Lead(Pb)				
lb/hr	0.0025	0.0019	0.0015	0.0020

Table 4-2
NO_x, VOC, Hg, and Pb Combined Emissions Results - EUEAF

Run Number	1	2	3	Average
Date	3/22/2022	3/24/2022	3/25/2022	--
Time	12:06-17:31	13:13-18:23	10:49-15:58	--
Nitrogen Oxides (NO_x as NO_2)				
lb/hr	19.1	26.7	21.6	22.5
lb/ton liquid steel	0.15	0.25	0.18	0.19
Volatile Organic Compounds (VOC), as propane				
lb/hr	7.6	2.7	3.7	4.7
lb/ton liquid steel	0.060	0.026	0.031	0.039
Mercury (Hg)				
lb/hr	0.0056	0.0056	0.0018	0.0043
Lead(Pb)				
lb/hr	0.00100	0.00091	0.00063	0.00085

Table 4-3
NO_x, VOC, Hg, and Pb Emissions Results - EUEAF Baghouse Exhaust Stack No. 1

Run Number	1	2	3	Average
Date	3/22/2022	3/24/2022	3/25/2022	--
Time	12:06-17:31	13:13-18:23	10:49-15:58	--
Process Data *				
Liquid Steel Produced, ton/hr	126.20	105.68	120.03	117.30
Sampling & Flue Gas Parameters				
sample duration, minutes	240	240	240	240
O_2, % volume dry	20.15	19.32	19.60	19.69
CO_2, % volume dry	1.00	1.17	1.16	1.11
flue gas temperature, °F	184.5	166.4	162.8	171.2
moisture content, % volume	2.85	3.45	2.93	3.08
volumetric flow rate, dscfm	155,280	172,063	149,910	159,084
Nitrogen Oxides (NO_x as NO_2)				
ppmvd	8.69	11.08	9.56	9.78
lb/hr	9.67	13.66	10.26	11.20
lb/ton liquid steel	0.077	0.129	0.086	0.097
Methane (CH_4), as propane				
ppmvd, as propane †	4.49	2.25	3.60	3.45
Total Gaseous Organics (TGO), as propane				
ppmvd	8.34	3.43	5.63	5.80
Volatile Organic Compounds (VOC), as propane				
ppmvd	3.85	1.18	2.03	2.35
lb/hr	4.10	1.40	2.09	2.53
lb/ton liquid steel	0.032	0.013	0.017	0.021
Mercury (Hg)				
mg/dscm	0.0048	0.0045	0.0014	0.0036
lb/hr	0.0028	0.0029	0.0008	0.0022
Lead(Pb)				
mg/dscm	0.0014	0.0012	0.0009	0.0012
lb/hr	0.00079	0.00076	0.00052	0.00069

* Process Data was provided by Gerdau Monroe Mill personnel.
† CH_4 ppmvd, as propane (concentrations are based on bag sample moisture content of 2%).

Table 4-4
NO_x, VOC, Hg, and Pb Emissions Results - EUEAF Baghouse Exhaust Stack No. 2

Run Number	1	2	3	Average
Date	3/22/2022	3/24/2022	3/25/2022	--
Time	12:06-17:31	13:13-18:23	10:49-15:58	--
Process Data *				
Liquid Steel Produced, ton/hr	126.20	105.68	120.03	117.30
Sampling & Flue Gas Parameters				
sample duration, minutes	240	240	240	240
O_2, % volume dry	20.41	20.42	20.44	20.43
CO_2, % volume dry	0.89	1.05	1.06	1.00
flue gas temperature, °F	173.5	164.9	163.2	167.2
moisture content, % volume	2.69	3.24	2.81	2.91
volumetric flow rate, dscfm	162,523	164,091	169,164	165,259
Nitrogen Oxides (NO_x as NO_2)				
ppmvd	8.12	11.06	9.38	9.52
lb/hr	9.45	13.00	11.37	11.27
lb/ton liquid steel	0.075	0.123	0.095	0.098
Methane (CH_4), as propane				
ppmvd, as propane †	5.38	2.47	3.93	3.93
Total Gaseous Organics (TGO), as propane				
ppmvd	8.51	3.65	5.30	5.82
Volatile Organic Compounds (VOC), as propane				
ppmvd	3.13	1.18	1.36	1.89
lb/hr	3.49	1.33	1.58	2.14
lb/ton liquid steel	0.028	0.013	0.013	0.018
Mercury (Hg)				
mg/dscm	0.0046	0.0044	0.0017	0.0035
lb/hr	0.0028	0.0027	0.0011	0.0022
Lead(Pb)				
mg/dscm	0.00035	0.00024	0.00018	0.00025
lb/hr	0.00021	0.00015	0.00011	0.00016

* Process data was provided by Gerdau Monroe Mill personnel.

† CH_4 ppmvd, as propane (concentrations are based on bag sample moisture content of 2%).

Table 4-5
Visible Emissions Results -
EUEAF

Run Number	1	2	3	Average
Date	3/24/2022	3/24/2022	3/24/2022	--
Time	11:57-12:57	12:57-14:18	14:18-15:18	--
Visible Emissions (VE) - EUEAF Baghouse Exhaust Stack No. 1				
observation duration, minutes	60	60	60	60
Highest 6-Minute Average Opacity, %	0.00	0.00	0.00	0.00
Visible Emissions (VE) - EUEAF Baghouse Exhaust Stack No. 2				
observation duration, minutes	60	60	60	60
Highest 6-Minute Average Opacity, %	0.00	0.00	0.00	0.00

Table 4-6
SO_2, NO_x, CO, VOC, and Pb Emissions Results -
EULMF

Run Number	1	2	3	Average
Date	3/22/2022	3/24/2022	3/25/2022	--
Time	11:28-16:38	13:11-18:02	10:50-15:36	--
Process Data *				
Liquid Steel Produced, ton/hr	126.20	105.68	120.03	117.30
Sampling & Flue Gas Parameters				
sample duration, minutes	240	240	240	240
O_2, % volume dry	20.43	20.62	20.90	20.65
CO_2, % volume dry	0.10	0.10	0.12	0.10
flue gas temperature, °F	110.2	104.8	118.8	111.2
moisture content, % volume	0.93	0.97	1.01	0.97
volumetric flow rate, dscfm	273,875	283,357	266,237	274,490
Sulfur Dioxide (SO_2)				
ppmvd	12.24	7.77	15.73	11.92
lb/hr	33.45	21.96	41.79	32.40
lb/ton liquid steel	0.265	0.208	0.348	0.274
Nitrogen Oxides (NO_x as NO_2)				
ppmvd	3.49	2.17	2.57	2.74
lb/hr	6.84	4.40	4.90	5.38
lb/ton liquid steel	0.054	0.042	0.041	0.046

Table 4-6 continued
SO_2, NO_x, CO, VOC, and Pb Emissions Results - EULMF

Run Number	1	2	3	Average
Carbon Monoxide (CO)				
ppmvd	17.60	17.12	17.03	17.25
lb/hr	21.02	21.15	19.77	20.65
lb/ton liquid steel	0.167	0.200	0.165	0.177
Methane (CH_4), as propane				
ppmvd, as propane †	2.12	2.22	2.86	2.40
Total Gaseous Organics (TGO), as propane				
ppmvd	3.71	3.43	4.99	4.04
Volatile Organic Compounds (VOC), as propane				
ppmvd	1.59	1.21	2.13	1.65
lb/hr	3.00	2.36	3.90	3.08
lb/ton liquid steel	0.024	0.022	0.033	0.026
Lead(Pb)				
mg/dscm	0.0015	0.0009	0.0009	0.0011
lb/hr	0.0015	0.0009	0.0009	0.0011

* Process data was provided by Gerdau Monroe Mill personnel.

† CH_4 ppmvd, as propane (concentrations are based on bag sample moisture content of 2%).

Table 4-7
Visible Emissions Results - EULMF

Run Number	1	2	3
Date	3/24/2022	3/24/2022	3/24/2022
Time	11:32-12:32	12:33-13:33	13:33-14:33
Visible Emissions (VE)			
observation duration, minutes	60	60	60
Highest 6-Minute Average Opacity, %	0.00	0.00	0.00

5.0 Internal QA/QC Activities

5.1 QA/QC Audits

The meter boxes and sampling trains used during sampling performed within the requirements of their respective methods. All post-test leak checks, minimum metered volumes, minimum sample durations, and percent isokinetics met the applicable QA/QC criteria.

EPA Method 3A, 6C, 7E, and 10 calibration audits were all within the measurement system performance specifications for the calibration drift checks, system calibration bias checks, and calibration error checks.

EPA Method 25A FIA calibration audits were within the measurement system performance specifications for the calibration drift checks and calibration error checks.

The NO_2 to NO converter efficiency checks of each analyzer were conducted per the procedures in EPA Method 7E, Section 8.2.4. The conversion efficiencies met the criteria.

An EPA Method 205 field evaluation of the calibration gas dilution system was conducted. The dilution accuracy and precision QA specifications were met.

EPA Method 9 was performed by a certified Visible Emissions Evaluator. For quality assurance, the observer obtained a view of the emissions with the best available contrasting background and with the sun oriented in the 140° sector to their back. Readings were taken every 15 seconds and made to the nearest 5% opacity.

EPA Method 18 analytical QA/QC results are included in the laboratory report. The method QA/QC criteria were met.

5.2 QA/QC Discussion

All QA/QC criteria were met during this test program.

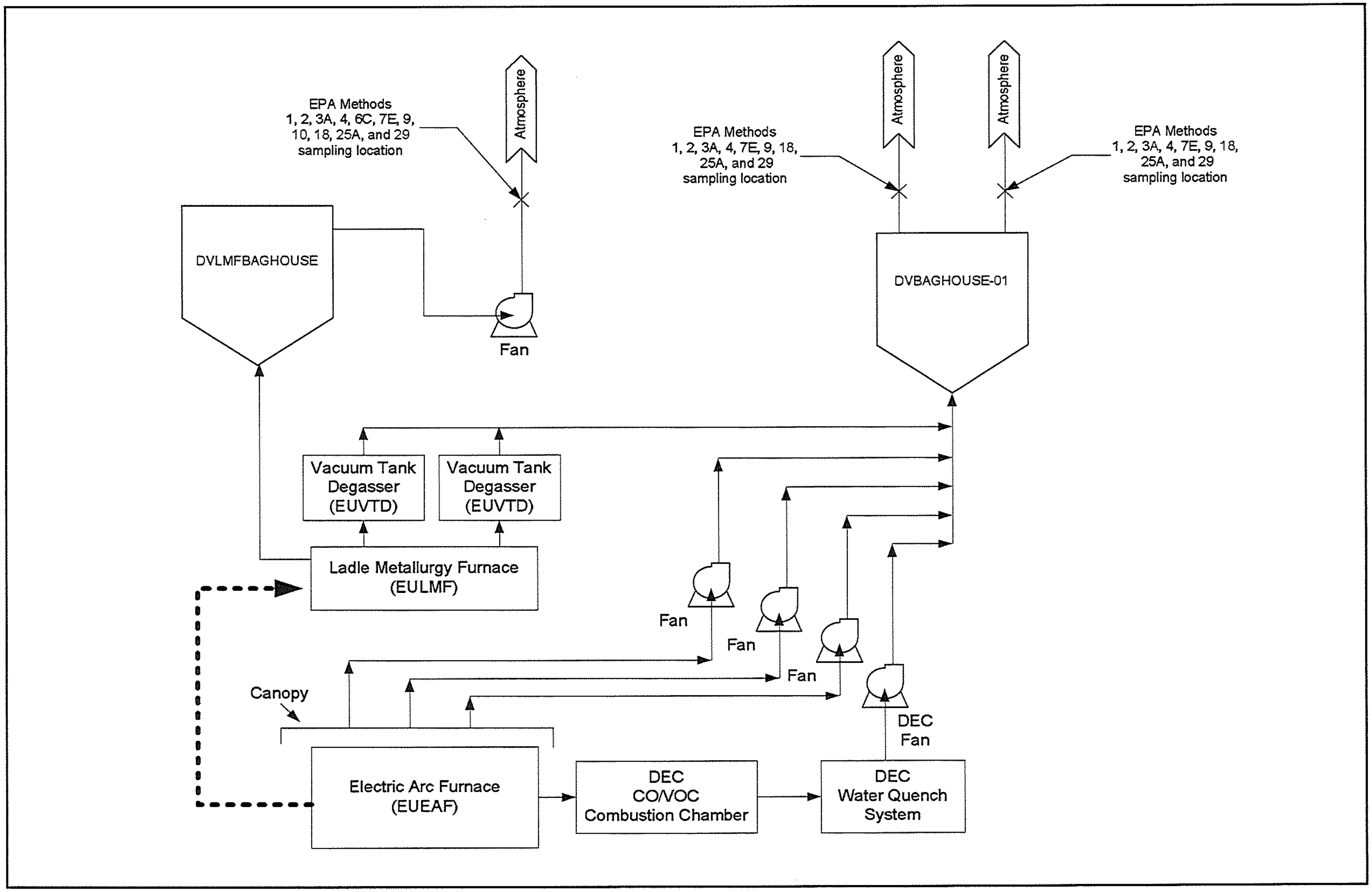
5.3 Quality Statement

Montrose is qualified to conduct this test program and has established a quality management system that led to accreditation with ASTM Standard D7036-04 (Standard Practice for Competence of Air Emission Testing Bodies). Montrose participates in annual functional assessments for conformance with D7036-04 which are conducted by the American Association for Laboratory Accreditation (A2LA). All testing performed by Montrose is supervised on site by at least one Qualified Individual (QI) as defined in D7036-04 Section 8.3.2. Data quality objectives for estimating measurement uncertainty within the documented limits in the test methods are met by using approved test protocols for each project as defined in D7036-04 Sections 7.2.1 and 12.10. Additional quality assurance information is included in the report appendices. The content of this report is modeled after the EPA Emission Measurement Center Guideline Document (GD-043).

Appendix A
Field Data and Calculations

Appendix A.1
Sampling Locations

EUEAF AND EULMF PROCESS AND SAMPLING LOCATION SCHEMATIC



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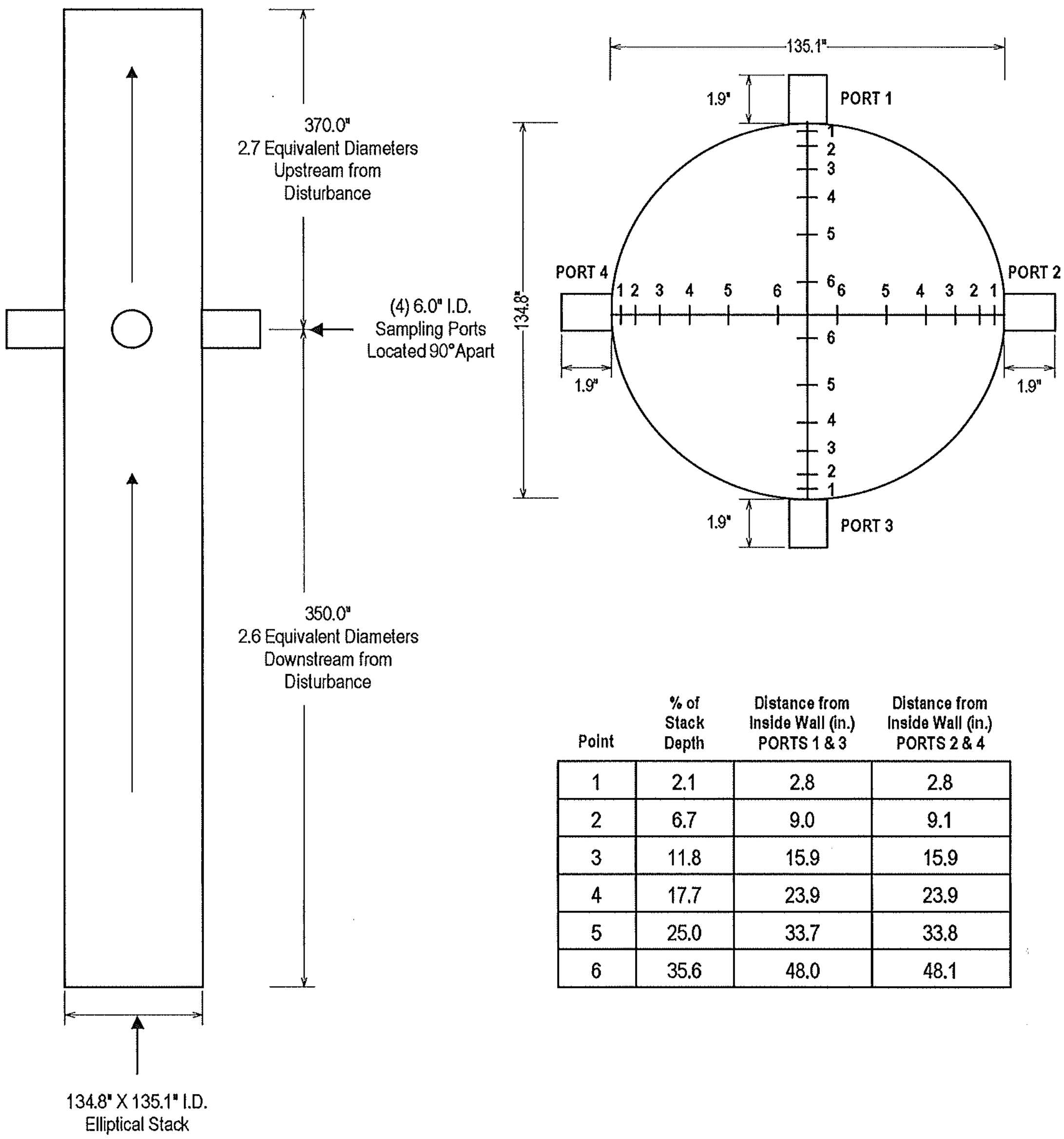
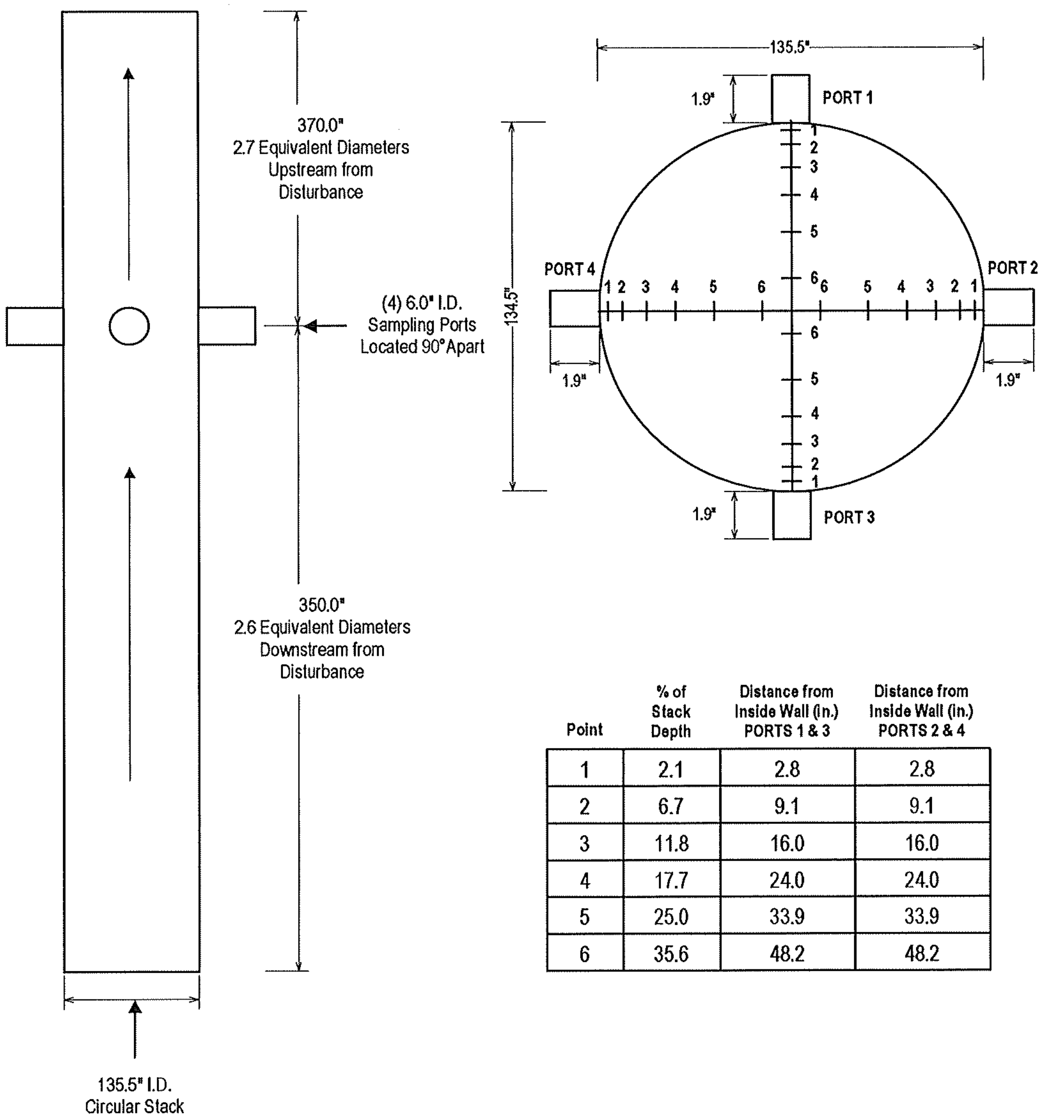
EUEAF BAGHOUSE EXHAUST 1 (M5/29 SAMPLING TRAIN) TRAVERSE POINT LOCATION DRAWING



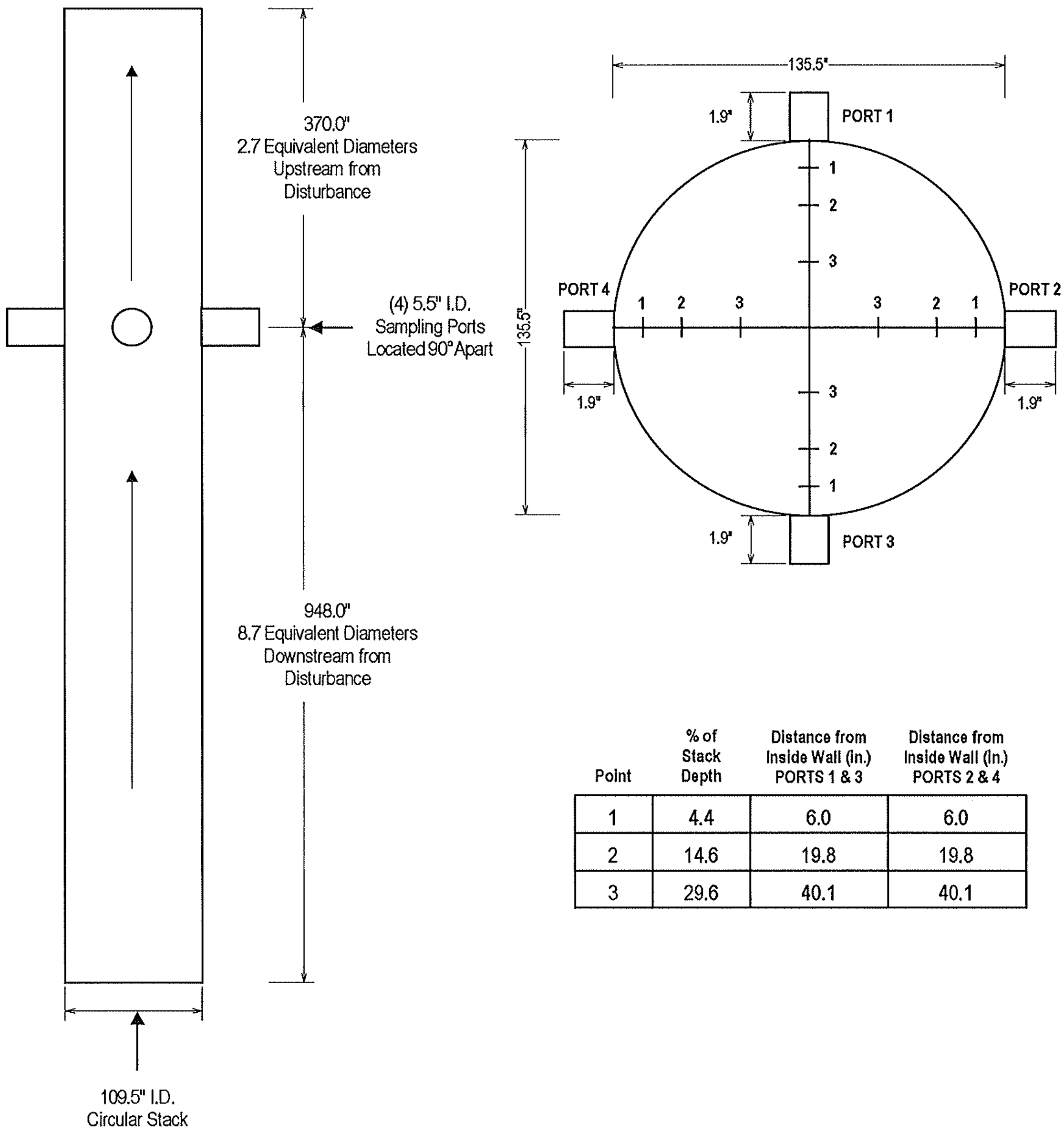
Point	% of Stack Depth	Distance from Inside Wall (in.) PORTS 1 & 3	Distance from Inside Wall (in.) PORTS 2 & 4
1	2.1	2.8	2.8
2	6.7	9.0	9.1
3	11.8	15.9	15.9
4	17.7	23.9	23.9
5	25.0	33.7	33.8
6	35.6	48.0	48.1

EUEAF BAGHOUSE EXHAUST 2 (M5/29 SAMPLING TRAIN) TRAVERSE POINT LOCATION DRAWING



Point	% of Stack Depth	Distance from Inside Wall (in.) PORTS 1 & 3	Distance from Inside Wall (in.) PORTS 2 & 4
1	2.1	2.8	2.8
2	6.7	9.1	9.1
3	11.8	16.0	16.0
4	17.7	24.0	24.0
5	25.0	33.9	33.9
6	35.6	48.2	48.2

EULMF BAGHOUSE EXHAUST TRAVERSE POINT LOCATION DRAWING



Point	% of Stack Depth	Distance from Inside Wall (in.) PORTS 1 & 3	Distance from Inside Wall (in.) PORTS 2 & 4
1	4.4	6.0	6.0
2	14.6	19.8	19.8
3	29.6	40.1	40.1