1.0 Introduction

1.1 Summary of Test Program

Cleveland-Cliffs - Dearborn Works Inc. (State Registration No.: A8640) contracted Montrose Air Quality Services, LLC (Montrose) to perform a compliance test program on the Basic Oxygen Furnace (EUBOF) at the Cleveland-Cliffs Dearborn Works (CCDW) facility located in Dearborn, Michigan. Testing was conducted on July 26-27, 2022, for the purpose of satisfying the emission testing requirements pursuant to Michigan Department of Environment, Great Lakes, and Energy (EGLE) Renewable Operating Permit No. MI-ROP-A8640-2016a and for evaluating compliance with the filterable particulate matter (FPM), particulate matter <10 µm (PM_{10}), particulate matter <2.5 µm ($PM_{2.5}$), lead (Pb), manganese (Mn), and mercury (Hg) emission limits after the completion of phase III of the ESP rebuild project. The compliance test program was conducted with a new ESP casing built during Phase I, the casing replaced in Phase II, the casing replaced in Phase III, and the casing replaced in Phase V. The casing in Phase IV was offline.

The specific objectives were to:

- Verify the emissions of FPM, PM_{10}, and $PM_{2.5}$ from the ESP exhaust stack (SVBOFESP) serving EUBOF and secondary emissions baghouse (SEBH) exhaust stack (SVBOFBH) serving EUFGSHOP
- Verify the emissions of nitrogen oxides (NO_x) as NO_2 from SVBOFESP and SVBOFBH.
- Verify the emissions of carbon monoxide (CO) from SVBOFESP
- Verify the emissions of lead (Pb), manganese (Mn), and mercury (Hg) from the SVBOFESP and SVBOFBH
- Verify the percent opacity of visible emissions (VE) from the SVBOFESP, SVBOFBH, and EUBOF Roof Monitor
- 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)
7/26/2022-7/27/2022	EUBOF ESP	Velocity/Volumetric Flow Rate	EPA 1 & 2	3	90-102.5 and 2 Heats
7/26/2022-7/27/2022	EUBOF ESP	O_2, CO_2	EPA 3A	3	90-102.5 and 2 Heats
7/26/2022-7/27/2022	EUBOF ESP	Moisture	EPA 4	3	90-102.5 and 2 Heats
7/26/2022-7/27/2022	EUBOF ESP	TPM (PM_{10} and $PM_{2.5}$)	EPA 5/202	3	90-102.5 and 2 Heats
7/26/2022-7/27/2022	EUBOF ESP	NO_x	EPA 7E	3	90-102.5 and 2 Heats
7/26/2022-7/27/2022	EUBOF ESP	Opacity	EPA 9	3	60-120 and 1 Heat
7/26/2022-7/27/2022	EUBOF ESP	CO	EPA 10	3	90-102.5 and 2 Heats
7/26/2022-7/27/2022	EUBOF ESP	Pb, Mn, and Hg	EPA 29	3	90-102.5 and 2 Heats
7/26/2022-7/27/2022	FGBOFSHOP SEBH	Velocity/Volumetric Flow Rate	EPA 1 & 2	3	91-105 and 2 Heats
7/26/2022-7/27/2022	FGBOFSHOP SEBH	O_2, CO_2	EPA 3A	3	91-105 and 2 Heats
7/26/2022-7/27/2022	FGBOFSHOP SEBH	Moisture	EPA 4	3	91-105 and 2 Heats
7/26/2022-7/27/2022	FGBOFSHOP SEBH	TPM (PM_{10} and $PM_{2.5}$)	EPA 5/202	3	91-105 and 2 Heats
7/26/2022-7/27/2022	FGBOFSHOP SEBH	NO_x	EPA 7E	3	91-105 and 2 Heats
7/26/2022-7/27/2022	FGBOFSHOP SEBH	Opacity	EPA 9	3	60-71 and 1 Heat
7/26/2022-7/27/2022	FGBOFSHOP SEBH	Pb, Mn, and Hg	EPA 29	3	90-102.5 and 2 Heats
7/26/2022-7/27/2022	EUBOF Roof Monitor	Opacity	EPA 9	N/A	262 minutes and 5 Heats

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 through 1-5. Detailed results for individual test runs can be found in Section 4.0. All supporting data can be found in the appendices.

All Total PM emissions are to be considered as $PM_{2.5}$ and PM_{10} for compliance determination. 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 1-6. The tests were conducted according to the test plan (protocol) dated June 6, 2022 that was submitted to the EGLE.

Table 1-2
Summary of Average Compliance Results – EUBOF ESP

July 26-27, 2022

Parameter/Units	Average Results	Emission Limits
Filterable Particulate Matter (FPM)		
gr/dscf	0.0027	0.0152
lb/hr	10.2	62.6
Total Particulate Matter (TPM)*		
lb/hr	25.35	47.5†, 46.85‡
Nitrogen Oxides (NO_x)		
lb/hr	36.1	52.9
Carbon Monoxide (CO)		
lb/hr	1,268	7,048

* Total PM emissions are to be considered as PM10 and PM2.5 for compliance determination.
† PM_{10} Emission limit
‡ $PM_{2.5}$ Emission limit

Table 1-3
Summary of Average Compliance Results – FGBOFSHOP SEBH

July 26-27, 2022

Parameter/Units	Average Results	Emission Limits
Filterable Particulate Matter (FPM)		
gr/dscf	0.0010	0.003
lb/hr	4.2	15.6
Total Particulate Matter (TPM)*		
lb/hr	11.03	17.71
Nitrogen Oxides (NO_x)		
lb/hr	3.3	10.2
Manganese (Mn)		
lb/hr	0.03	0.07

* Total PM emissions are to be considered as PM10 and PM2.5 for compliance determination.

Table 1-4
Summary of Average Compliance Results – EUBOF ESP and FGBOFSHOP SEBH
July 26-27, 2022

Parameter/Units	Average Combined Results	Emission Limits
Lead (Pb)		
lb/hr	0.020	0.067
Manganese (Mn)		
lb/hr	0.077	0.10
Mercury (Hg)		
lb/hr	<0.0045	0.0086

Table 1-5
Summary of VE Results – EUBOF ESP, Roof Monitor, and FGBOFSHOP SEBH
July 26-27, 2022

Parameter/Units	Emissions Results	Emission Limit
EUBOF ESP Visible Emissions (VE)		
%, 6-minute average	1.5	20
FGBOFSHOP SEBH VE		
%, 3-minute average	0.0	20
EUBOF Roof Monitor VE		
% (EUBOF), 3-minute average	5.0	15
% (FGSHOP), 3-minute average	5.0	20

1.2 Key Personnel

A list of project participants is included below:

Facility Information

Source Location:	Cleveland-Cliffs Dearborn Works 4001 Miller Road Dearborn, MI 48120
Project Contact:	David Pate
Role:	Senior Environmental Engineer
Company:	Cleveland-Cliffs Dearborn Works
Telephone:	313-323-1261
Email:	david.pate@clevelandcliffs.com

Agency Information

Regulatory Agency:	EGLE-AQD
Agency Contact:	Regina Angellotti
Address:	Constitution Hall 2nd Floor South 525 West Allegan Street Lansing, MI 48933-1502

Testing Company Information

Testing Firm:	Montrose Air Quality Services, LLC	
Contact:	John Nestor	Robert J. Lisy, Jr.
Title:	District Manager	Reporting Hub Manager
Telephone:	248-548-8070	440-262-3760
Email:	jonestor@montrose-env.com	rlisy@montrose-env.com

Laboratory Information

Laboratory:	Montrose Brecksville Lab
City, State:	Brecksville, OH
Method:	EPA Methods 5 and 202
Laboratory:	Enthalpy Analytical, LLC
City, State:	Durham, NC
Method:	EPA Methods 29

Test personnel and observers are summarized in Table 1-6.

Table 1-6
Test Personnel and Observers

Name	Affiliation	Role/Responsibility
John Nestor	Montrose	District Manager
James Christ	Montrose	Client Project Manager, QI
Jeremiah Hicks	Montrose	Client Project Manager, QI
Shawn Jaworski	Montrose	Field Technician, QI
Jeffrey Peitzsch	Montrose	Shop Coordinator
David Koponen	Montrose	Field Technician
Urbano Leos	Montrose	Field Technician
Lucas Rosetti	Montrose	Field Technician
David Pate	Cleveland-Cliffs - Dearborn Works	Test Coordinator
Regina Angellotti	EGLE	Observer
Katie Koster	EGLE	Observer

2.0 Plant and Sampling Location Descriptions

2.1 Process Description, Operation, and Control Equipment

Cleveland-Cliffs Dearborn Works owns and operates an electrostatic precipitator (ESP) located in Dearborn, Michigan. Scrap steel is charged into the basic oxygen furnace (BOF) vessel and then molten iron is charged into the vessel on top of the scrap. Fluxing agents are also added during the steelmaking process. Oxygen is blown into the molten iron/scrap mixture causing the scrap to melt and refining the iron into steel by reducing the carbon content. The heat for the steelmaking process comes from the reaction of oxygen with the dissolved carbon in the molten iron.

Particulate emissions consisting of iron oxides and various other metal oxides are also produced. In order to remove the large amounts of particulate, flue gas is controlled by an ESP. The ESP is considered to be the "Primary" control device in the steel making process at CCDW's BOF shop. The dust-laden gases enter the ESP where the dust particulates are electrically charged. The charged particles then migrate over to the positively charged collector plates, where the particulate matter is collected. Rappers are used to impart a vibration to both the discharge electrodes and the collection plates to dislodge the accumulated dust. The clean gases pass through the ID fans and are discharged out the stack. A continuous opacity monitor (COMS) measures opacity of the clean gas on the stack.

In addition to the ESP, a Secondary Emission Control Baghouse (SEBH) is in operation at the facility, which collects and controls particulate emissions during the hot metal charging and tapping operations that occur at the BOF vessels during the steel making process. Additionally, the BOF Secondary Baghouse controls emissions generated by the iron reladling operation.

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.)	Upstream EPA "A" (in./dia.)	Number of Traverse Points
EUBOF ESP SVBOFESP	204.0	1,200.0 / 5.9	600.0 / 2.9	Isokinetic: 24 (6/port); Concentration: 3
FGSHOP SEBH SVBOFBH	222.0	>444.0 / >2.0	>111.0 / >0.5	Isokinetic: 24 (6/port); Concentration: 3

The sample location utilizes historical stack dimensions. Stack schematics and process flow diagrams are included in Appendix A.

2.3 Operating Conditions and Process Data

Emission tests will be performed while the EUBOF and air pollution control devices are operating at the conditions specified in the test plan. The EUBOF will be tested when operating normally for a minimum of two process heats and 60 minutes for each sampling run.

Plant personnel are responsible for establishing the test conditions and collecting all applicable unit-operating data. Process data to be collected includes the following parameters:

- Production rate, TPH
- Steel production cycle and oxygen blow periods, start/stop times
- Average Oxygen blow rate per heat
- Start/Stop times of charging, tapping, reladling per run
- Number and identification of ESP casings compartments and fields in operation
- Average ESP inlet draft during oxygen blowing measured per heat
- Average primary louver position of the blowing vessel per heat
- ESP COMS data, 6-minute and 1-hour block average data
- Baghouse pressure drop and bag leak detector readings per run
- Number of baghouse fans in operation, damper positions, and fan speeds per run
- Identification of baghouse compartments in operation per heat
- Mn and Pb concentration in the hot metal per heat
- Collection and analysis of dust sample for Pb and Mn from the ESP hopper per test run

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)

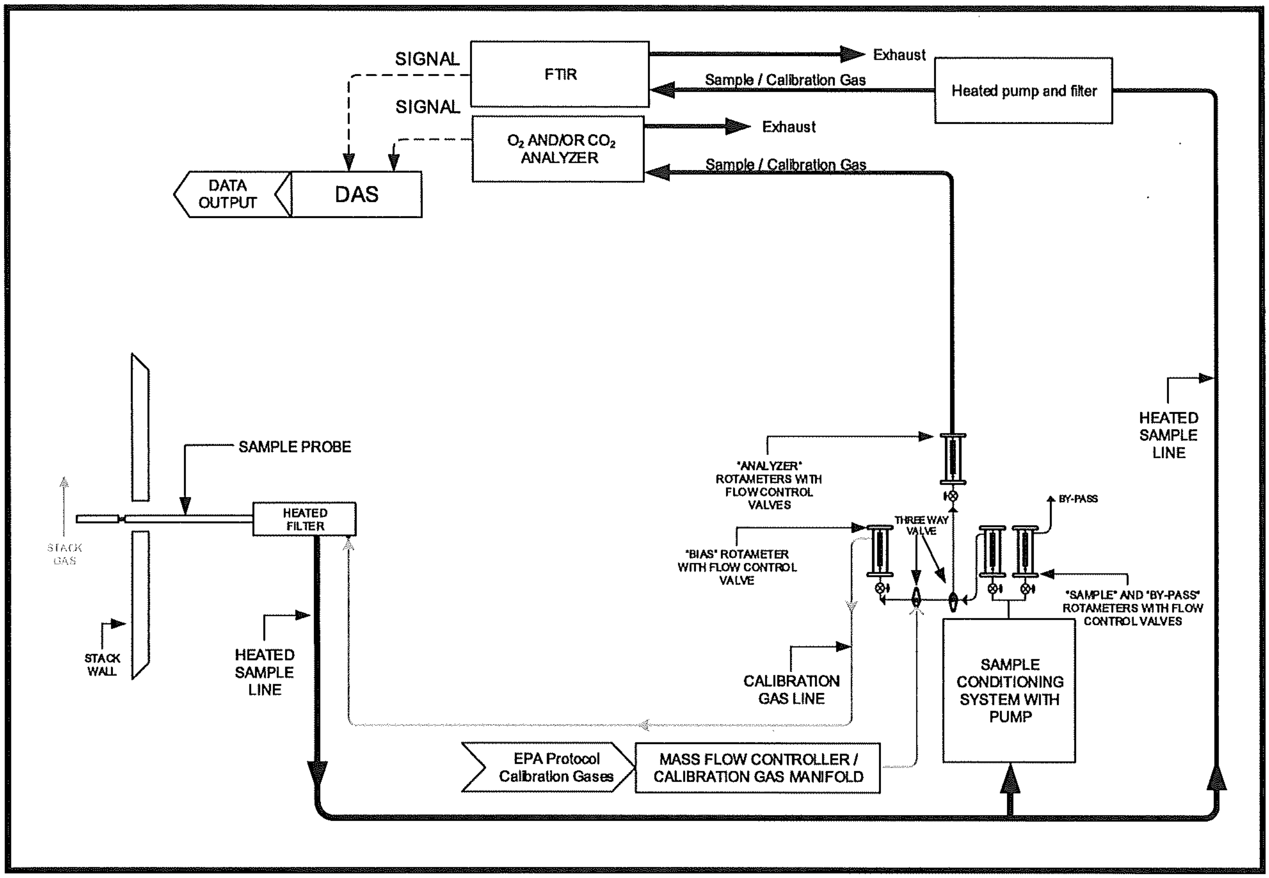
EPA Method 2 is used to measure the gas velocity using an S-type pitot tube connected to a pressure measurement device, and to measure the gas temperature using a calibrated thermocouple connected to a thermocouple indicator. Typically, Type S (Stauβcheibe) pitot tubes conforming to the geometric specifications in the test method are used, along with an inclined manometer. The measurements are made at traverse points specified by EPA Method 1.3

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 typical sampling system is detailed in Figure 3-1 (EPA Methods 3A, 7E, and 10 Sampling Train).

Figure 3-1
EPA Method 3A, 7E, and/or 10 Sampling Train



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

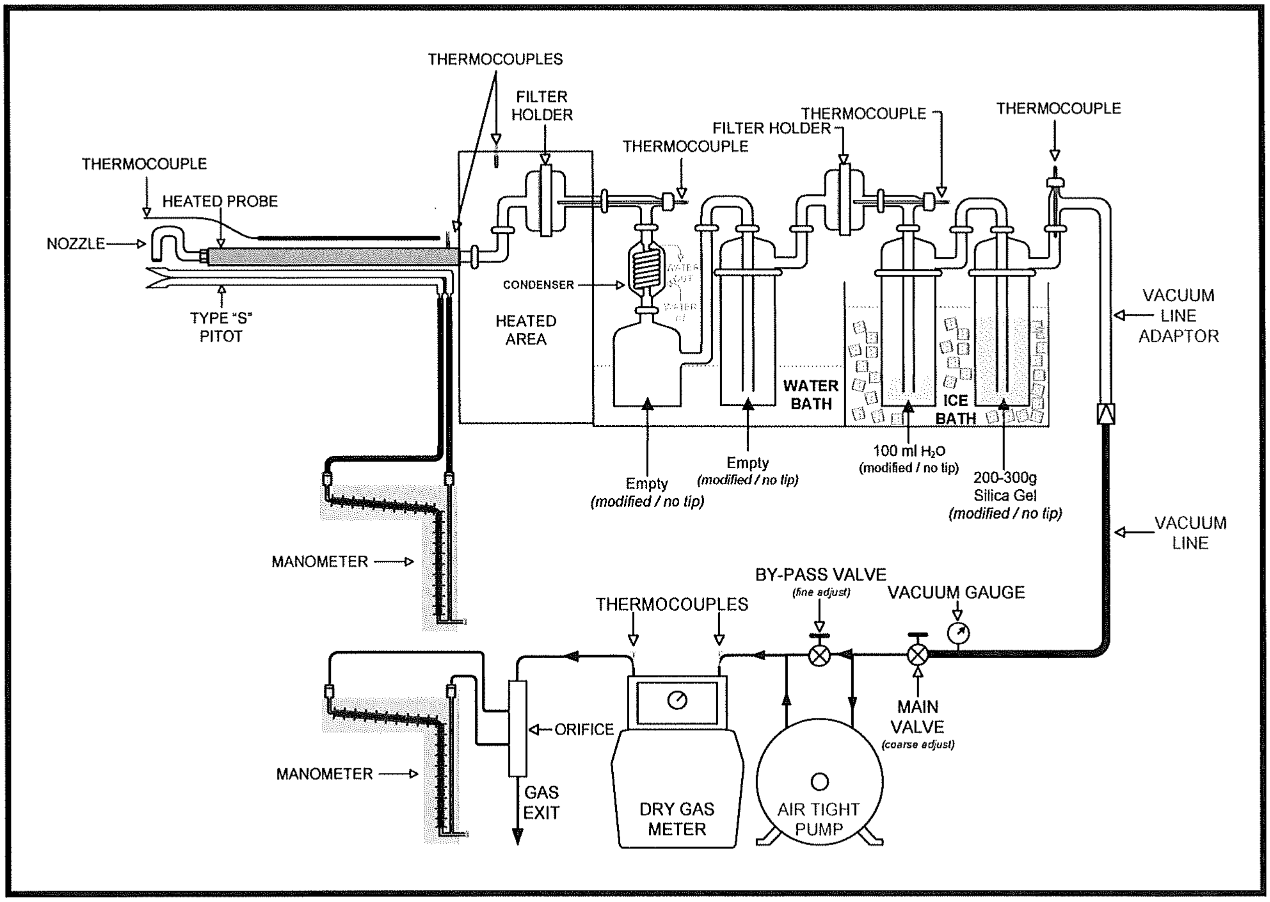
EPA Method 4 is a manual, non-isokinetic method used to measure the moisture content of gas streams. Gas is sampled at a constant sampling rate through a probe and 16mpinge train. Moisture is removed using a series of pre-weighed impingers containing methodology-specific liquids and silica gel immersed in an ice water bath. The impingers are weighed after each run to determine the percent moisture.

3.1.5 EPA Method 5, Determination of Particulate Matter from Stationary Sources

EPA Method 5 is a manual, isokinetic method used to measure FPM emissions. The samples are analyzed gravimetrically. This method is performed in conjunction with EPA Methods 1 through 4. The stack gas is sampled through a nozzle, probe, filter, and 16mpinge train. FPM results are reported in emission concentration and emission rate units.

The typical sampling system is detailed in Figure 3-2 (EPA Methods 5 and 202 Sampling Train).

Figure 3-2
EPA Methods 5 and 202 Sampling Train



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 typical sampling system is detailed in Figure 3-1 (EPA Methods 3A, 7E, and 10 Sampling Train).

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 typical sampling system is detailed in Figure 3-1 (EPA Methods 3A, 7E, and 10 Sampling Train).

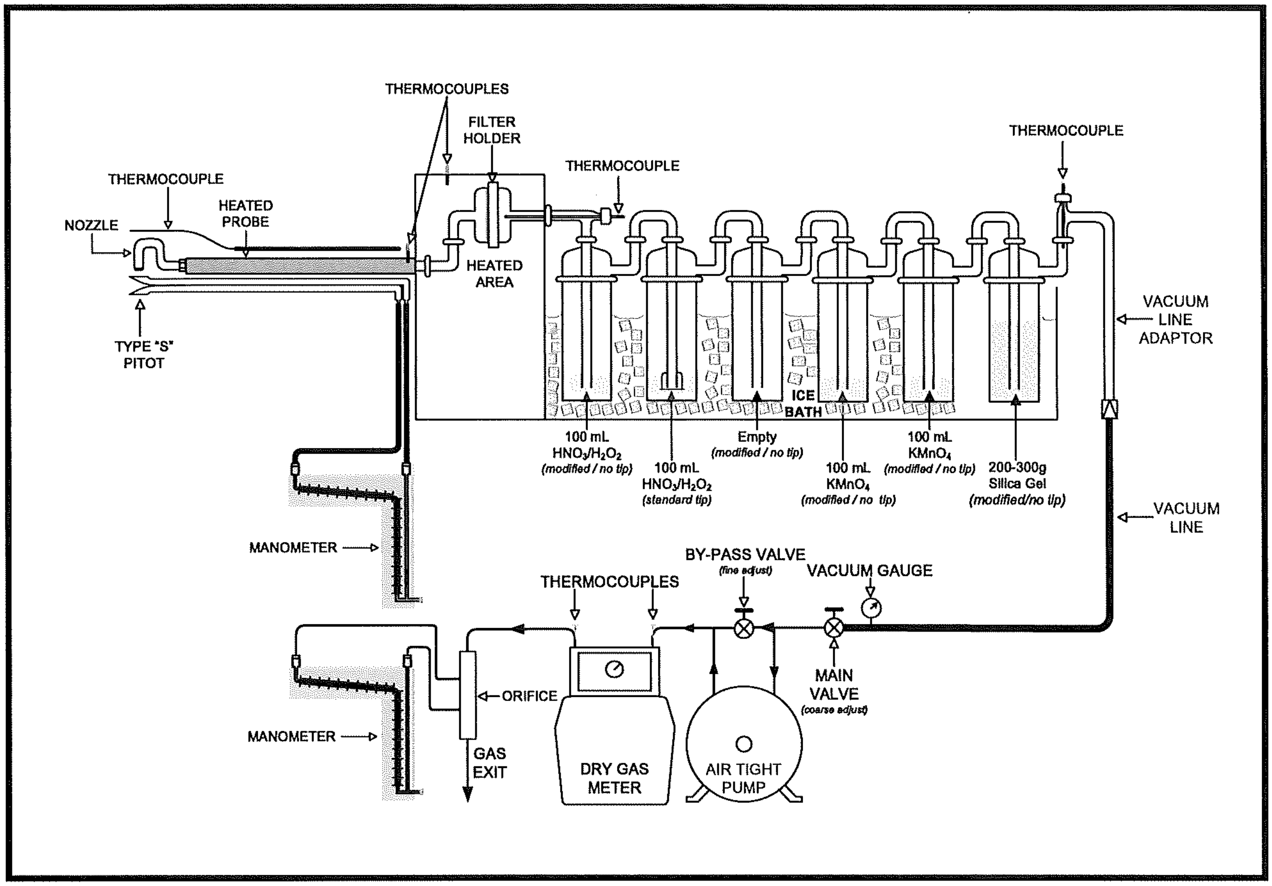
3.1.9 EPA Method 29, Determination of Metals Emissions from Stationary Sources

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 target metals for this compliance emissions testing program are Pb, Mn, and Hg.

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

Figure 3-3
EPA Method 29 Sampling Train



3.1.10 EPA Method 202, Dry Impinger Method for Determining Condensable Particulate Emissions from Stationary Sources

The CPM is collected in dry impingers after filterable PM has been collected on a filter maintained as specified in either Method 5 of Appendix A-3 to 40 CFR 60, Method 17 of Appendix A-6 to 40 CFR 60, or Method 201A of Appendix M to 40 CFR 51. The organic and aqueous fractions of the impingers and an out-of-stack CPM filter are then taken to dryness and weighed. The total of the 19mpinge fractions and the CPM filter represents the CPM. Compared to the version of Method 202 that was promulgated on December 17, 1991, this method eliminates the use of water as the collection media in impingers and includes the addition of a condenser followed by a water dropout 19mpinge immediately after the final in-stack or heated filter. This method also includes the addition of one modified Greenburg Smith 19mpinge (backup 19mpinge) and a CPM filter following the water dropout 19mpinge.

CPM is collected in the water dropout 19mpinge, the modified Greenburg Smith 19mpinge, and the CPM filter of the sampling train as described in this method. The 19mpinge contents are purged with nitrogen immediately after sample collection to remove dissolved SO_2 gases from the 20mpinge. The CPM filter is extracted with water and hexane. The 20mpinge solution is then extracted with hexane. The organic and aqueous fractions are dried and the residues are weighed. The total of the aqueous and organic fractions represents the CPM.

The potential artifacts from SO_2 are reduced using a condenser and water dropout 20mpinge to separate CPM from reactive gases. No water is added to the impingers prior to the start of sampling. To improve the collection efficiency of CPM, an additional filter (the "CPM filter") is placed between the second and third impingers

The typical sampling system is detailed in Figure 3-2 (EPA Methods 5 and 202 Sampling Train).

3.2 Test Method Comments and Deviations

1. CCDW operates 2 BOF Vessels that exhaust to a common ESP. While oxygen blowing can only take place on one vessel at a time, oxygen blowing could be occurring on a vessel while performing charging, tapping, and deslagging on the other vessel. Consequently, it is likely that there will be some overlap into a heat on the other vessel when the end of a production cycle is reached on a vessel. In this case, as specified in the test plan, all runs were ended at the end of the production cycle regardless of what was taking place on the other vessel. Production is pro-rated to account for occurrences where there is overlap.

2. No port changes took place while oxygen was blowing on the ESP. When it was time for a port change, the probe was left at the same point until the completion of the oxygen blow. Once the oxygen blow was completed, the probe was moved to the next port and sampling was resumed at the first point.

3. In cases where the end of the sampling run did not correspond with the end of the heat, points were traversed in reverse order until the heat was completed. This is necessary to sample for integral heats.

3.3 Process Test Methods

The following process samples were collected and analyzed for this testing:

- Mn and Pb concentration in Heat; Mn was measured in the hot metal as part of analysis required for CCDW's quality specifications. The steel samples were retained and analyzed onsite at a later date for lead
- ESP hopper dust samples were collected every run and analyzed for Pb and Mn by ALS Environmental utilizing test method SW6010D
- Results of the process data analysis is presented in Appendix B

4.0 Test Discussion and Results

4.1 Field Test Deviations and Exceptions

Information regarding field test deviations and exceptions and QA/QC exceptions are is presented below.

4.1.1 Field Sampling

During Run 2 at the EUBOF ESP Exhaust Stack sampling was paused during the heat. Since sampling was to occur during the entire heat, the pause in sampling invalidated the run. Run 2 was voided and an additional run, Run 4, was performed.

4.1.2 Leak Check

For Run 2 at the FGBOFSHOP SEBH Exhaust Stack, the post-test leak check failed for the EPA Method 5/202 sampling. Run 2 was voided and an additional run, Run 4, was performed.

Samples from voided Run 2 were not recovered for analysis. Since Run 2 samples were not recovered, results of Run 2 are not available to be included in the report.

4.1.3 Sample Train Operating Temperatures

At the EUBOF ESP Exhaust Stack, for both of the EPA Method 5/202 and 29 sampling trains, there were multiple probe and filter exit temperature readings outside of the required 248±25°F range as required by Method 5 Section 8.5. Additionally, for the EPA Method 5/202 sampling train, there was one condensable PM filter exit temperature reading that was outside of the 65-85°F range as required by Method 202 Section 8.5.1.3. See Appendix Section A.2 for further details.

4.2 Presentation of Results

The average results are compared to the permit limits in Table 1-2 through 1-5. The results of individual compliance test runs performed are presented in Tables 4-1 through 4-10. 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.

Concentration values in Tables 4-1, 4-4, and 4-7 denoted with a '<' were measured to be below the minimum detection limit (MDL) of the applicable analytical method. Mass emission rates denoted with a '<' in Tables 4-1, 4-4, and 4-7 were calculated utilizing the applicable MDL concentration value instead of the "as measured" concentration value.

Table 4-1
Combined Metals Emissions Results -
EUBOF ESP and FGSHOP SEBH

Run Number	1	3	4	Average
Date	7/26/2022	7/27/2022	7/27/2022	--
Process Data*				
Heats	2	2	2	2
Production rate, TPH	252.1	321.6	246.5	273.4
Sampling & Flue Gas Parameters				
volumetric flow rate, dscfm	953,848	871,965	950,759	925,524
Lead (Pb)				
mg/dscm	0.0091	0.0050	0.0034	0.0058
lb/hr	0.033	0.016	0.012	0.020
Manganese (Mn)				
mg/dscm	0.017	0.014	0.034	0.022
lb/hr	0.062	0.047	0.120	0.077
Mercury (Hg)				
mg/dscm	<0.0009	<0.0007	<0.0022	<0.0013
lb/hr	<0.0031	<0.0024	<0.0079	<0.0045

* Process data was provided by CCDW personnel.

† The "<" symbol indicates that compound was below the Minimum Detection Limit (MDL) of the analytical method. See Section 4.2 for details.

Table 4-2
TPM Emissions Results -
EUBOF ESP

Run Number	1	3	4	Average
Date	7/26/2022	7/27/2022	7/27/2022	--
Time	14:18-16:16	14:06-16:22	17:58-20:02	--
Sampling & Flue Gas Parameters				
sample duration, minutes	102.5	102.5	90.0	98.3
O_2, % volume dry	19.3	18.9	19.1	19.1
CO_2, % volume dry	2.6	3.0	2.9	2.8
flue gas temperature, °F	256.0	258.9	244.9	253.3
moisture content, % volume	9.30	13.75	11.37	9.48
volumetric flow rate, dscfm	438,629	443,117	443,628	441,791
Filterable Particulate Matter (FPM)				
gr/dscf	0.0024	0.0014	0.0043	0.0027
lb/hr	9.1	5.3	16.3	10.2
Condensable Particulate Matter (CPM)				
grains/dscf	0.0031	0.0037	0.0052	0.0040
lb/hr	11.7	13.9	19.7	15.1
Total Particulate Matter (TPM)*				
lb/hr	20.9	19.2	36.0	25.4

* Total PM emissions are to be considered as PM_{10} and $PM_{2.5}$ for compliance determination.

Table 4-3
NO_x and CO Emissions Results -
EUBOF ESP

Run Number	1	3	4	Average
Date	7/26/2022	7/27/2022	7/27/2022	--
Time	14:18-16:16	14:06-16:17	17:58-20:01	--
Sampling & Flue Gas Parameters				
volumetric flow rate, dscfm	438,629	443,117	443,628	441,791
Nitrogen Oxides (NO_x)				
ppmvd	8.41	15.20	10.57	11.39
lb/hr, as NO_2	26.4	48.3	33.6	36.1
Carbon Monoxide (CO)				
ppmvd	575	798	600	658
lb/hr	1,100	1,543	1,160	1,268

Table 4-4
Metals Emissions Results -
EUBOF ESP

Run Number	1	3	4	Average
Date	7/26/2022	7/27/2022	7/27/2022	--
Time	14:18-16:16	14:06-16:22	17:58-20:02	--
Sampling & Flue Gas Parameters				
sample duration, minutes	102.5	102.5	90.0	98.3
O_2, % volume dry	19.3	18.9	19.1	19.1
CO_2, % volume dry	2.6	3.0	2.9	2.8
flue gas temperature, °F	265.4	246.4	242.1	251.3
moisture content, % volume	9.91	18.37	16.90	15.06
volumetric flow rate, dscfm	441,812	428,647	414,178	428,212
Lead (Pb)				
mg/dscm	0.0072	0.0061	0.0065	0.0066
lb/hr	0.0119	0.0098	0.0101	0.0106
Manganese (Mn)				
mg/dscm	0.033	0.023	0.034	0.030
lb/hr	0.055	0.037	0.053	0.048
Mercury (Hg)*				
mg/dscm	<0.00100	<0.00081	<0.00319	<0.00167
lb/hr	<0.0017	<0.0013	<0.0050	<0.0026

* The "<" symbol indicates that compound was below the Minimum Detection Limit (MDL) of the analytical method. See Section 4.2 for details.

Table 4-5
TPM Emissions Results -
FGBOFSHOP SEBH

Run Number	1	3	4	Average
Date	7/26/2022	7/27/2022	7/27/2022	--
Time	14:18-16:16	14:06-16:17	17:58-20:01	--
Sampling & Flue Gas Parameters				
sample duration, minutes	91.0	105.0	91.0	95.7
O_2, % volume dry	20.9	20.8	20.6	20.7
CO_2, % volume dry	0.3	0.0	0.0	0.1
flue gas temperature, °F	126.3	121.1	122.6	123.3
moisture content, % volume	1.74	2.20	2.05	1.99
volumetric flow rate, dscfm	522,805	441,331	517,090	493,742
Filterable Particulate Matter (FPM)				
grains/dscf	0.00158	0.00077	0.00059	0.00098
lb/hr	7.09	2.90	2.60	4.20
Condensable Particulate Matter (CPM)				
grains/dscf	0.00088	0.00246	0.00164	0.00166
lb/hr	3.92	9.30	7.26	6.83
Total Particulate Matter (TPM)*				
lb/hr	11.02	12.19	9.87	11.03

* Total PM emissions are to be considered as PM10 and PM2.5 for compliance determination.

Table 4-6
NO_x Emissions Results -
FGBOFSHOP SEBH

Run Number	1	3	4	Average
Date	7/26/2022	7/27/2022	7/27/2022	--
Time	14:18-16:16	14:06-16:17	17:58-20:01	--
Sampling & Flue Gas Parameters				
volumetric flow rate, dscfm	522,805	441,331	517,090	493,742
Nitrogen Oxides (NO_x)				
ppmvd	0.60	1.43	0.86	0.96
lb/hr, as NO_2	2.23	4.51	3.20	3.32

Table 4-7
Metals Emissions Results -
FGBOFSHOP SEBH

Run Number	1	3	4	Average
Date	7/26/2022	7/27/2022	7/27/2022	--
Time	14:18-16:16	14:06-16:17	17:58-20:01	--
Sampling & Flue Gas Parameters				
sample duration, minutes	91.0	105.0	91.0	95.7
O_2, % volume dry	20.9	20.8	20.6	20.7
CO_2, % volume dry	0.3	0.0	0.0	0.1
flue gas temperature, °F	132.2	126.2	126.9	128.5
moisture content, % volume	1.60	2.55	2.30	2.15
volumetric flow rate, dscfm	512,036	443,318	536,582	497,312
Lead (Pb)				
mg/dscm	0.0107	0.0038	0.0010	0.0052
lb/hr	0.0206	0.0064	0.0020	0.0097
Manganese (Mn)				
mg/dscm	0.004	0.006	0.034	0.015
lb/hr	0.008	0.010	0.068	0.029
Mercury (Hg)*				
mg/dscm	<0.00074	<0.00064	<0.00148	<0.00095
lb/hr	<0.0014	<0.0011	<0.0030	<0.0018

* The "<" symbol indicates that compound was below the Minimum Detection Limit (MDL) of the analytical method. See Section 4.2 for details.

Table 4-8
Visible Emissions Results -
EUBOF ESP

Run Number	1	2	3	Maximum
Date	7/26/2022	7/27/2022	7/27/2022	--
Time	13:30-15:30	14:40-16:40	17:58-20:02	--
Process Data				
Heat No.	16211	55616	55617	--
EUBOF ESP Visible Emissions (VE)				
observation duration, minutes	150	120	60	--
Minimum Opacity Reading				
opacity, %	0.00	0.00	0.00	--
Maximum Opacity Reading				
opacity, %	10.00	5.00	5.00	--
Highest Six-Minute Average Opacity				
opacity, %	0.42	1.04	1.46	1.46

Table 4-9
Visible Emissions Results -
FGBOFSHOP SEBH

Run Number	1	2	3	Maximum
Date	7/26/2022	7/27/2022	7/27/2022	--
Time	14:18-15:18	14:06-15:28	17:58-18:58	--
Process Data				
Heat No.	16211	55615	55617	--
FGSHOP SEBH Visible Emissions (VE)				
observation duration, minutes	60	82	60	--
Minimum Opacity Reading				
opacity, %	0	0	0	--
Maximum Opacity Reading				
opacity, %	0	0	0	--
Highest Three Minute Average Opacity				
opacity, %	0	0	0	--

Table 4-10
Visible Emissions Results -
EUBOF Roof Monitor

Observation Period	1	2	3	Maximum
Date	9/26/2022	9/27/2022	9/27/2022	--
Time	14:18-16:15	9:29-11:28	11:29-12:32	--
Process Data				
Heat No.	16211 16212	16222 55613	55613 55614	--
FGSHOP SEBH Visible Emissions (VE)				
observation duration, minutes	120	120	63	--
Minimum Opacity Reading				
opacity, %	0	0	0	--
Maximum Opacity Reading				
opacity, %	10	10	0	--
Highest Three Minute Average Opacity				
opacity, %	4.2	5.0	0	5.0

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, 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.

The NO_2 to NO converter efficiency check of the analyzer was conducted per the procedures in EPA Method 7E, Section 16.2.2. The conversion efficiency met the criteria.

EPA Method 5 analytical QA/QC results are included in the laboratory report. The method QA/QC criteria were met, except if noted in Section 5.2. An EPA Method 5 reagent blank was analyzed. The maximum allowable amount that can be subtracted is 0.001% of the weight of the acetone used. The blank did not exceed the maximum residue allowed.

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 29 analytical QA/QC results are included in the laboratory report. The method QA/QC criteria were met. Samples 2 and 3 in the lab report are associated with Runs 3 and 4 during the compliance test.

EPA Method 202 analytical QA/QC results are included in the laboratory report. The method QA/QC criteria were met. An EPA Method 202 Field Train Recovery Blank (FTRB) was performed for each source category. The maximum allowable amount that can be subtracted is 0.002 g (2.0 mg). For this project, the FTRB had a mass of 2.8 mg, and 2.0 mg was subtracted at the EUBOF ESP Exhaust Stack and 1.7 mg, and 1.7 mg was subtracted at the FGBOFSHOP Baghouse Exhaust Stack.

5.2 QA/QC Discussion

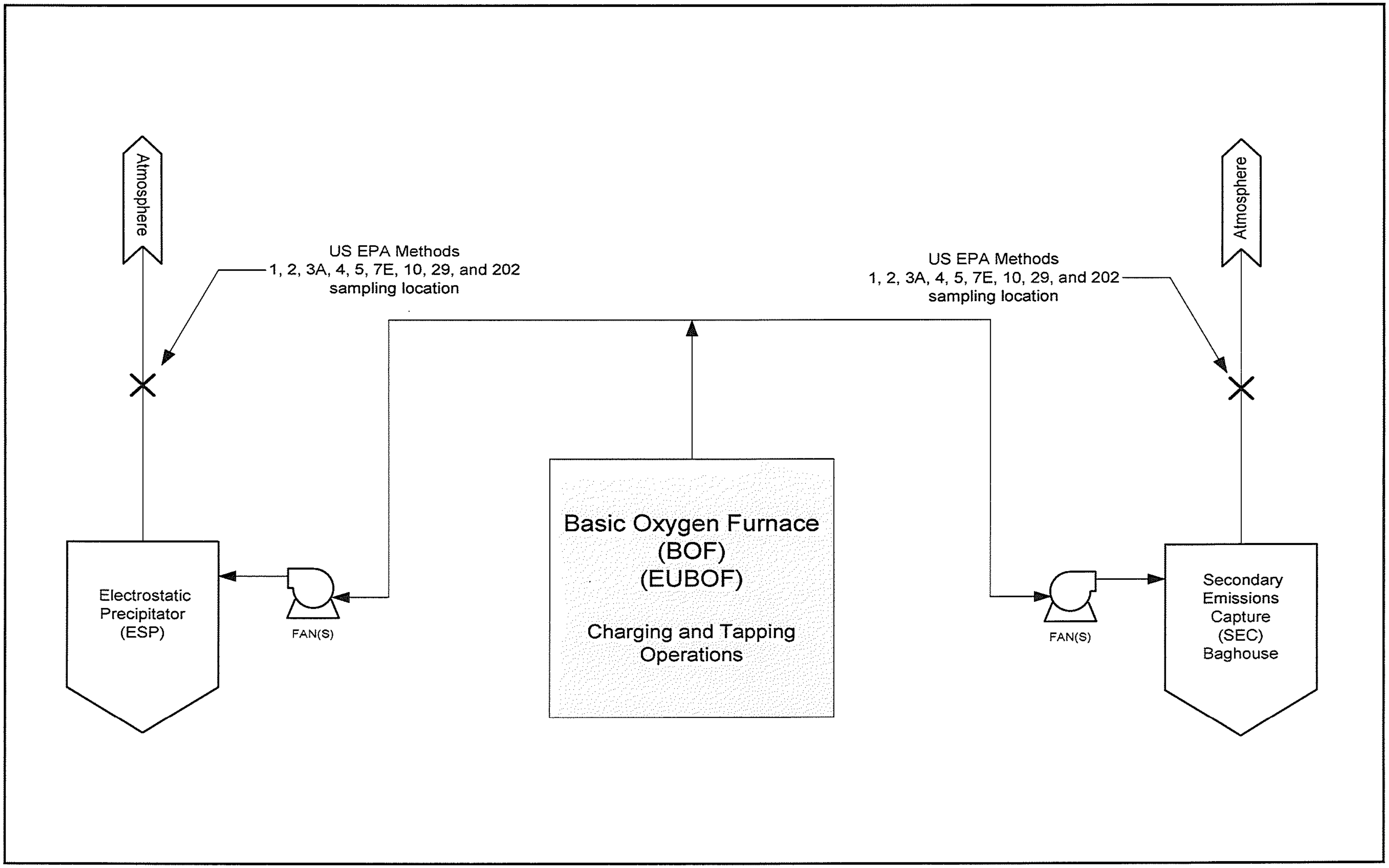
All QA/QC criteria were met during this test program.

5.3 Quality Statement

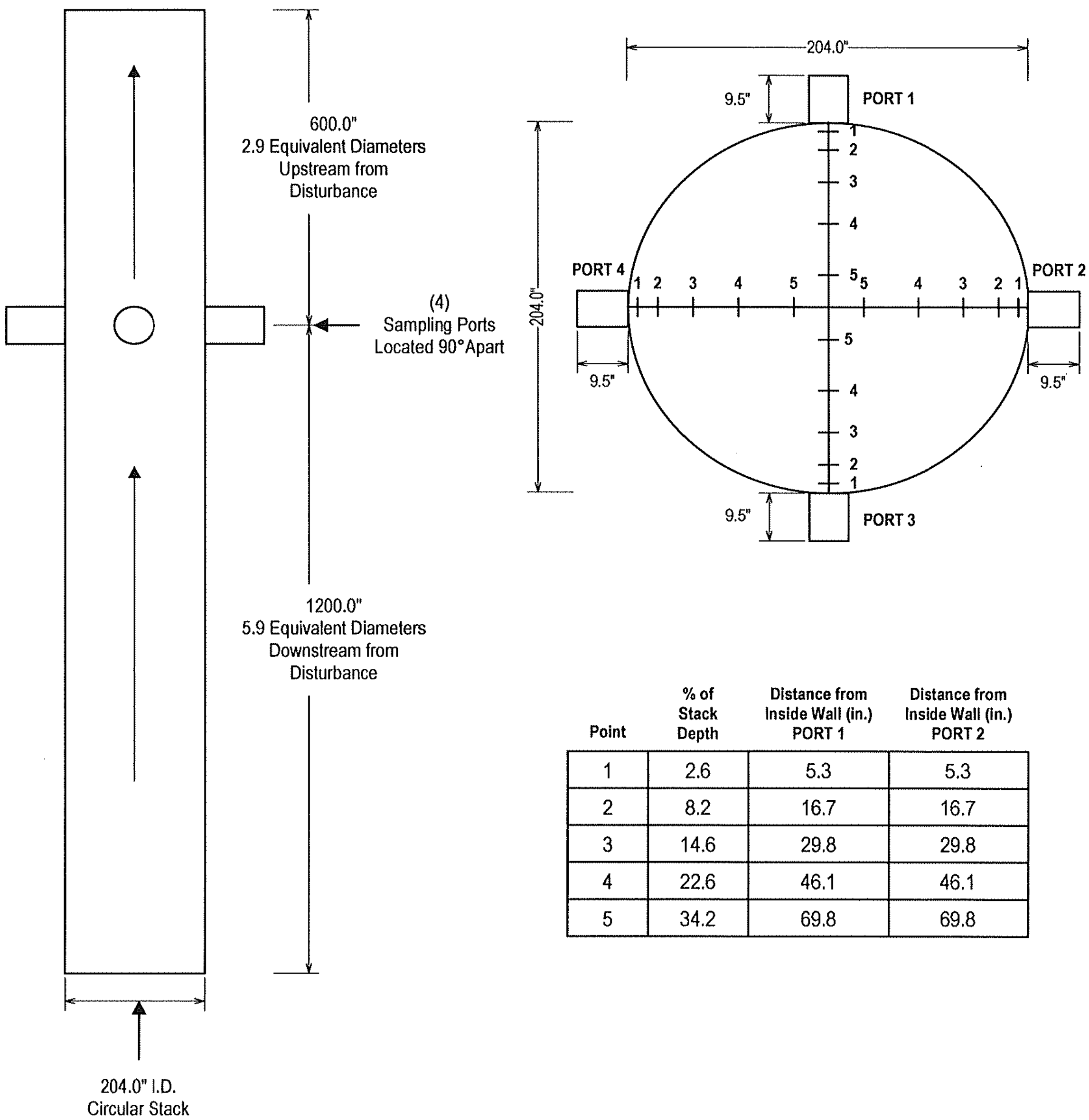
Montrose is qualified to conduct this test program and has established a quality management system that led to accreditation with ASTM Standard D7036-04 (Standard Practice for Competence of Air Emission Testing Bodies). Montrose participates in annual functional assessments for conformance with D7036-04 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).

EUBOF PROCESS AND SAMPLING LOCATION SCHEMATIC

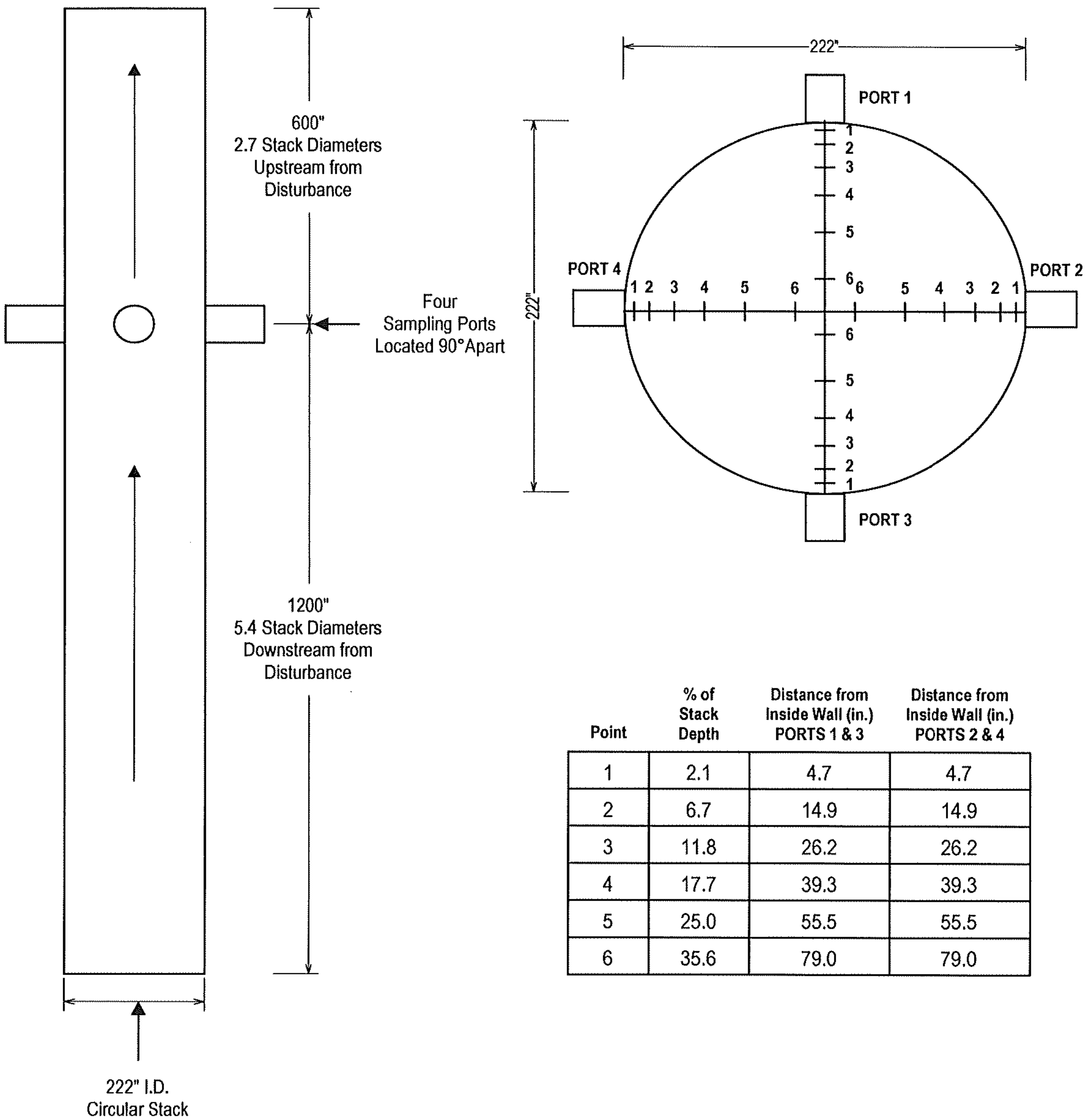


EUBOF ESP EXHAUST TRAVERSE POINT LOCATION DRAWING



Point	% of Stack Depth	Distance from Inside Wall (in.) PORT 1	Distance from Inside Wall (in.) PORT 2
1	2.6	5.3	5.3
2	8.2	16.7	16.7
3	14.6	29.8	29.8
4	22.6	46.1	46.1
5	34.2	69.8	69.8

FGSHOP SEBH 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	2.1	4.7	4.7
2	6.7	14.9	14.9
3	11.8	26.2	26.2
4	17.7	39.3	39.3
5	25.0	55.5	55.5
6	35.6	79.0	79.0