COMPLIANCE STACK EMISSION TEST REPORT

BASIC OXYGEN FURNACE (EUBOF) AND BASIC OXYGEN FURNACE SHOP OPERATIONS (FGBOFSHOP)

Determination of Filterable Particulate Matter, Particulate Matter less than 10 microns, Particulate Matter less than 2.5 microns, Nitrogen Oxides, Carbon Monoxide, Manganese, Lead, and Mercury Emissions

Utilizing US EPA Methods 1, 2, 3, 3A, 4, 5, 7E, 10, 29, and 202

Test Date(s): August 13-14, 2019
State Registration Number: A8640
Source Location: Dearborn, Michigan
Permit: EGLE Renewable Operating Permit
No. MI-ROP-A8640-2016a

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STAC STACK TESTING ACCREDITATION COUNCIL
A2LA ACCREDITED TO ASTM D7036 ONLY CERT #3925.01

MONTROSE AIR QUALITY SERVICES

TABLE OF CONTENTS

SECTION	PAGE
TEST RESULTS SUMMARY	5
REVIEW AND CERTIFICATION	9
1.0 INTRODUCTION	10
1.1 SUMMARY OF TEST PROGRAM	10
1.2 KEY PERSONNEL	10
2.0 SUMMARY AND DISCUSSION OF TEST RESULTS	12
2.1 OBJECTIVES AND TEST MATRIX	12
2.2 FIELD TEST CHANGES AND PROBLEMS	12
2.3 PRESENTATION OF RESULTS	13
2.3.1 US EPA METHOD 29 SAMPLING	13
2.3.2 US EPA METHOD 5/202 AND CEMS SAMPLING	13
2.4 TEST METHOD DEVIATIONS	14
2.4.1 ESP EXHAUST SAMPLING	14
2.4.2 SEC BAGHOUSE EXHAUST STACK SAMPLING	14
3.0 PLANT AND SAMPLING LOCATION DESCRIPTIONS	19
3.1 PROCESS DESCRIPTION AND OPERATION	19
3.2 CONTROL EQUIPMENT DESCRIPTION	19
3.3 SAMPLING LOCATION	19
3.3.1 ESP EXHAUST SAMPLING LOCATION	19
3.3.2 SEC BAGHOUSE EXHAUST SAMPLING LOCATION	19
3.4 PROCESS SAMPLING LOCATION	20
4.0 SAMPLING AND ANALYTICAL PROCEDURES	24
4.1 TEST METHODS	24
4.1.1 US EPA METHOD 1	24
4.1.2 US EPA METHOD 2	24
4.1.3 US EPA METHOD 3	24
4.1.4 US EPA METHOD 3A	24
4.1.5 US EPA METHOD 4	25
4.1.6 US EPA METHOD 5	25
4.1.7 US EPA METHOD 7E	25
4.1.8 US EPA METHOD 10	25
4.1.9 US EPA METHOD 29	26
4.1.10 US EPA METHOD 202	26
4.2 PROCEDURES FOR OBTAINING PROCESS DATA	26

SECTION **PAGE**

5.0 INTERNAL QA/QC ACTIVITIES 33
5.1 QA AUDITS 33
5.2 QA/QC PROBLEMS 33
5.3 QUALITY STATEMENT 34
APPENDIX CHECKLIST 50
APPENDIX A FACILITY DATA 51
APPENDIX B LABORATORY DATA 76
APPENDIX B.1.1 US EPA METHOD 5 77
APPENDIX B.1.2 US EPA METHOD 29 83
APPENDIX B.1.3 US EPA METHOD 202 105
APPENDIX C FIELD DATA 121
APPENDIX C.1.1 ESP EXHAUST - METHODS 3A, 29 122
APPENDIX C.1.2 ESP EXHAUST - METHOD 3A, 5/202, 7E, 10 142
APPENDIX C.2.1 SEC BAGHOUSE EXHAUST - METHOD 29 177
APPENDIX C.2.1 SEC BAGHOUSE EXHAUST - METHOD 5/202, 7E 198
APPENDIX D CALIBRATIONS AND CERTIFICATIONS 222
APPENDIX D.1 CEMS ANALYZERS 223
APPENDIX D.2 FIELD EQUIPMENT 235
APPENDIX D.3 REFERENCE EQUIPMENT 242
APPENDIX D.4 MONTROSE STAC AND PERSONNEL CERTIFICATES 254
APPENDIX E US EPA METHOD 9 - VISIBLE EMISSIONS DATA 259
APPENDIX E. 1 ESP US EPA METHOD 9 CALCULATIONS 260
APPENDIX E. 2 ESP US EPA METHOD 9 FIELD DATA 263
APPENDIX E. 3 SEC BAGHOUSE US EPA METHOD 9 FIELD DATA 268
APPENDIX E. 4 OBSERVER CERTIFICATION 201
APPENDIX F TEST PLANS AND APPROVALS 282
APPENDIX F.1 ESP TEST PLAN AND APPROVAL 283
APPENDIX F.2 SEC BAGHOUSE TEST PLAN AND APPROVAL 307

LIST OF TABLES

TABLE 2.1.1 and 2.1.2 SAMPLING MATRICES 15
TABLES 2.2 and 2.3 EMISSION RESULTS 17
TABLES 5.1.1 and 5.1.2 SAMPLING TRAIN AUDIT RESULTS 34
TABLE 5.2 DRY GAS METER AUDIT RESULTS 36
TABLE 5.3 US EPA METHOD 3 AUDIT RESULTS 37
TABLES 5.4.1 to 5.6 CEMS ANALYZERS CALIBRATION AND QA 38
TABLES 5.7.1 and 5.7.2 US EPA METHOD 7E NOx CONVERTER CHECK 45

SECTION **PAGE**

TABLE 5.8 US EPA METHOD 205 GAS DILUTION SYSTEM QA 46
TABLE 5.9.1 US EPA METHOD 29 LABORATORY QA 47
TABLE 5.9.2 US EPA METHOD 29 AUDIT RESULTS 48

LIST OF FIGURES

FIGURE 3.1 SAMPLING LOCATION SCHEMATIC 21
FIGURES 3.2 and 3.3 TRAVERSE POINT LOCATION DRAWINGS 22
FIGURES 4.1 to 4.5 SAMPLING TRAIN SCHEMATICS 27

TEST RESULTS SUMMARY-1

Source Name:	**Basic Oxygen Furnace (BOF)**	**BOF Shop Operations**
Source ID :	**EUBOF**	**FGBOFSHOP**
Control Device:	**Electrostatic Precipitator (ESP)**	**Secondary Emissions Capture (SEC) Baghouse**
Sampling Location:	**Exhaust Stack**	**Exhaust Stack**
Sampling Location ID:	**SVBOFESP**	**SVBOFBH**
Test Date:	**8/13/2019**	
Production Rate (ton/hr)*	**379.6**	
Combined Manganese Emissions (lb/hr)	**0.23**	
Combined Permit Limit - Manganese (lb/hr)	*0.10*	
Compliance Permit Requirement Met (YES/NO)	*NO*	
Combined Lead Emissions (lb/hr)	**0.095**	
Combined Permit Limit - Lead (lb/hr)	*0.067*	
Compliance Permit Requirement Met (YES/NO)	*NO*	
Combined Mercury Emissions (lb/hr)†	**<0.0060**	
Combined Permit Limit - Mercury (lb/hr)	*0.0086*	
Compliance Permit Requirement Met (YES/NO)	*YES*	
EGLE Renewable Operating Permit No.	**MI-ROP-A8640-2016a**	

* Production data was supplied by AK Steel Corporation - Dearborn Works personnel.

† The compound was not present in quantities above the Minimum Detection Limit (MDL) in at least one fraction of the analytical method. See Section 2.3 fo details.

TEST RESULTS SUMMARY-2

Source Name:	**BOF Shop Operations**
Source ID :	**FGBOFSHOP**
Control Device:	**Secondary Emissions Capture (SEC) Baghouse**
Sampling Location:	**Exhaust Stack**
Sampling Location ID:	**SVBOFBH**
Test Date:	**8/13/2019**
Production Rate (ton/hr)*	**379.6**
Manganese Emissions (lb/hr)	**0.01**
Permit Limit - Manganese (lb/hr)	*0.07*
Compliance Permit Requirement Met (YES/NO)	*YES*
EGLE Renewable Operating Permit No.	**MI-ROP-A8640-2016a**

* Production data was supplied by AK Steel Corporation - Dearborn Works personnel.

TEST RESULTS SUMMARY-3

Source Name:	**Basic Oxygen Furnace (BOF)**	**BOF Shop Operations**
Source ID :	**EUBOF**	**FGBOFSHOP**
Control Device:	**Electrostatic Precipitator (ESP)**	**Secondary Emissions Capture (SEC) Baghouse**
Sampling Location:	**Exhaust Stack**	**Exhaust Stack**
Sampling Location ID:	**SVBOFESP**	**SVBOFBH**
Test Date:	**8/14/2019**	
Production Rate (ton/hr)*	**307.5**	
Particulate Matter < 10-microns Emissions (lb/hr)†	**39.72**	**<4.73**
Permit Limit - Total PM (lb/hr)	*47.5*	*17.71*
Compliance Permit Requirement Met (YES/NO)	*YES*	*YES*
Particulate Matter < 2.5-microns Emissions (lb/hr)†	**39.72**	**<4.73**
Permit Limit - Total PM (lb/hr)	*46.85*	*17.71*
Compliance Permit Requirement Met (YES/NO)	*YES*	*YES*
Filterable PM Emissions (lb/hr)‡	**36.1**	**<2.95**
Permit Limit - Fitlerable PM (lb/hr)	*62.6*	*15.6*
Compliance Permit Requirement Met (YES/NO)	*YES*	*YES*
Filterable PM Emissions (grains/dscf)‡	**0.0077**	**<0.0007**
Permit Limit - Filterable PM (grains/dscf)	*0.0152*	*0.003*
Compliance Permit Requirement Met (YES/NO)	*YES*	*YES*
EGLE Renewable Operating Permit No.	**MI-ROP-A8640-2016a**	

* Production data was supplied by AK Steel Corporation - Dearborn Works personnel.

† The compound was not present in quantities above the Minimum Detection Limit (MDL) of at least on fraction of the analytical method. See Section 2.3 for details.

‡ The compound was not present in quantities above the Minimum Detection Limit (MDL) of the analytical method. See Section 2.3 for details

TEST RESULTS SUMMARY-4

Source Name:	**Basic Oxygen Furnace (BOF)**	**BOF Shop Operations**
Source ID :	**EUBOF**	**FGBOFSHOP**
Control Device:	**Electrostatic Precipitator (ESP)**	**Secondary Emissions Capture (SEC) Baghouse**
Sampling Location:	**Exhaust Stack**	**Exhaust Stack**
Sampling Location ID:	**SVBOFESP**	**SVBOFBH**
Test Date:	**8/14/2019**	
Production Rate (ton/hr)*	**307.5**	
Nitrogen Oxides (NO_x) as (NO_2) Emissions (lb/hr)†	**24.9**	**1.7**
Permit Limit - NO_x (lb/hr)	*52.9*	*10.2*
Compliance Permit Requirement Met (YES/NO)	*YES*	*YES*
Carbon Monoxide (CO) Emissions (lb/hr)	**1,128**	**N/A**
Permit Limit - CO (lb/hr)	*7,048*	*N/A*
Compliance Permit Requirement Met (YES/NO)	*YES*	*N/A*
Visible Emissions (VE) (% of opacity)‡	**27**	**0**
Permit Limit - VE (% of opacity)	*20%, 6-minute average§*	*20%, 3-minute average*
Compliance Permit Requirement Met (YES/NO)	*YES*	*YES*
EGLE Renewable Operating Permit No.	**MI-ROP-A8640-2016a**	

* Production data was supplied by AK Steel Corporation - Dearborn Works personnel.

† The compound was not present in quantities above the Minimum Detection Limit (MDL) of at least on fraction of the analytical method. See Section 2.3 for details.

‡ Visible emissions data was recorded by Smoke Reader LLC, personnel.

§ Except for one 6-minute average per hour of not more than 27% opacity

REVIEW AND CERTIFICATION

The results of the Compliance Test conducted on August 13-14, 2019 are a product of the application of the United States Environmental Protection Agency (US EPA) Stationary Source Sampling Methods listed in 40 CFR Part 60, and Appendix A, 40 CFR Part 51, Appendix M, that were in effect at the time of this test.

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: _____ Date: 10-7-19

Name: Mason Sakshaug Title: Field 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: _____ pp. Date: 10-7-19

Name: Steven Smith Title: Client Project Manager

1.0 INTRODUCTION

1.1 SUMMARY OF TEST PROGRAM

The AK Steel Corporation - Dearborn Works (State Registration Number: A8640), located in Dearborn, Michigan, contracted Montrose Air Quality Services, LLC (Montrose) of Detroit, Michigan, to conduct compliance stack emission testing for their Basic Oxygen Furnace (EUBOF) and Basic Oxygen Furnace Shop Operations (FGBOFSHOP). Testing was performed to satisfy the emissions testing requirements pursuant to Michigan Department of Environment, Great Lakes, and Energy (EGLE) Renewable Operating Permit MI-ROP-A8640-2016a. The testing was performed on August 13-14, 2019.

Simultaneous sampling was performed at the EUBOF electrostatic precipitator (ESP) Exhaust Stack (SVBOFESP) and FGBOFSHOP secondary emissions capture (SEC) Baghouse Exhaust Stack (SVBOFBH) to determine the combined emissions of manganese (Mn), lead (Pb), and mercury (Hg). Testing was also performed to determine the emissions of filterable particulate matter (PM), filterable PM less than 10-microns (PM_{10}), filterable PM less than 2.5-microns ($PM_{2.5}$), Nitrogen Oxides (NO_x) (as NO_2), carbon monoxide (CO), and visible emissions (VE) at the ESP Exhaust Stack and filterable PM, PM_{10}, $PM_{2.5}$, NO_x (as NO_2), and VE at the SEC Baghouse Exhaust Stack. Sampling was also performed at the ESP Exhaust Stack to determine the emissions of carbon monoxide (CO). PM_{10} and $PM_{2.5}$ emissions were calculated as the sum of the filterable and condensable fractions as measured by US EPA Method 5 and 202. Testing was conducted during normal shop operations. During this test emissions from EUBOF and FGBOFSHOP were controlled by an ESP and a baghouse.

The test methods that were conducted during this test were US EPA Methods 1, 2, 3, 3A, 4, 5, 7E, 10, 29, and 202.

1.2 KEY PERSONNEL

The key personnel who coordinated this test program (and their phone numbers) were:

- David Pate, Senior Environmental Engineer, AK Steel Dearborn Works, 313-323-1261
- Mark Dziadosz, Environmental Quality Analyst (EQA), Michigan Department of Environment, Great Lakes and Energy (EGLE), 586-753-3745
- Jonathan Lamb, EQA, EGLE, 313-456-4685
- Robert Bingham, VE Observer, Smoke Reader LLC, 586-942-8548
- Steven Smith QI, Client Project Manager, Montrose, 734-751-9701
- Mason Sakshaug QI, Field Project Manager, Montrose, 248-548-7980
- Paul Diven QI, Field Project Manager, Montrose, 248-548-7980
- Ben Durham QI, Field Technician, Montrose, 248-548-7980

- David Koponen QI, Field Techician, Montrose, 248-548-7980
- David Trahan QI, Field Technician, Montrose, 248-548-7980
- Jacob Young QI, Field Technician, Montrose, 248-548-7980

2.0 SUMMARY AND DISCUSSION OF TEST RESULTS

2.1 OBJECTIVES AND TEST MATRIX

The purpose of this test was to determine the emissions of filterable PM, PM_{10}, $PM_{2.5}$, NO_x (as NO_2), Mn, Pb, Hg, and VE at the ESP Exhaust Stack and SEC Baghouse Exhaust Stack during normal shop operations. The purpose of this test was also to determine the emissions of CO at the ESP Exhaust Stack during normal shop operations. Testing was performed to satisfy the emissions testing requirements pursuant to EGLE Renewable Operating Permit MI-ROP-A8640-2016a.

The specific test objectives for this test were as follows:

- Simultaneously measure the concentrations of Mn, Pb, and Hg at the ESP Exhaust Stack and SEC Baghouse Exhaust Stack.
- Measure the concentrations of oxygen (O_2) and carbon dioxide (CO_2), NO_x, and CO at the ESP Exhaust Stack.
- Measure the concentrations of O_2, CO_2, and NO_x at the SEC Baghouse Exhaust Stack.
- Measure the VEs at the ESP Exhaust Stack and SEC Baghouse Exhaust Stack.
- Measure the actual and dry standard volumetric flow rate of the stack gas at the ESP Exhaust Stack and SEC Baghouse Exhaust Stack.
- Utilize the above variables to determine the emissions of Mn, Pb, and Hg at the ESP Exhaust Stack and SEC Baghouse Exhaust Stack during normal shop operations.
- Measure the concentrations of filterable PM, condensable PM, and NO_x at the ESP Exhaust Stack and SEC Baghouse Exhaust Stack.
- Utilize the above variables to determine the emissions of filterable PM, PM_{10}, $PM_{2.5}$, and NO_x (as NO_2), at the ESP Exhaust Stack and SEC Baghouse Exhaust Stack, and the emissions of CO at the ESP Exhaust Stack during normal shop operations.

Tables 2.1.1 and 2.1.2 present the sampling matrix log for this test.

2.2 FIELD TEST CHANGES AND PROBLEMS

No field test changes or problems occurred during the performance of this test that would bias the accuracy of the results of this test.

2.3 PRESENTATION OF RESULTS

2.3.1 US EPA Method 29 Sampling

Two sampling trains were utilized during each run at the ESP Exhaust Stack and one sampling train was utilized at the SEC Baghouse Exhaust Stack to determine the emissions of Mn, Pb, and Hg. At the ESP Exhaust Stack, one sampling train measured the stack gas volumetric flow rate, moisture content, and concentrations of Mn, Pb, and Hg while a second sampling train measured the concentrations of O_2 and CO_2. At the SEC Baghouse Exhaust Stack, one sampling train measured the stack gas volumetric flow rate, dry molecular weight, moisture content, and concentrations of Mn, Pb, and Hg.

Table 2.2 displays the emissions of Mn, Pb, and Hg measured at the ESP Exhaust Stack and SEC Exhaust Stack during normal shop operations.

Concentration values in Table 2.2 denoted with a '<' were measured to be below the minimum detection limit (MDL) of at least one fraction of the applicable analytical method. Emissions denoted with a '<' in Table 2.2 were calculated utilizing the applicable MDL concentration value instead of the "as measured" concentration value.

2.3.2 US EPA Method 5/202 and CEMS Sampling

Two sampling trains were utilized during each run at the ESP Exhaust Stack to determine the emissions of filterable PM, PM_{10}, $PM_{2.5}$, NO_x (as NO_2), and CO. One sampling train measured the stack gas volumetric flow rate, moisture content, and concentrations of filterable PM and condensable PM. A second sampling train measured the concentrations of O_2, CO_2, NO_x and CO. Two sampling trains were utilized during each run at the SEC Baghouse Exhaust Stack to determine the emissions of filterable PM, PM_{10}, $PM_{2.5}$, and NO_x (as NO_2). One sampling train measured the stack gas volumetric flow rate, dry molecular weight, moisture content and the concentrations of filterable PM and condensable PM. A second sampling train measured the concentration of NO_x. Note that PM_{10} and $PM_{2.5}$ emissions were calculated as the sum of the filterable PM and condensable PM fractions as measured by US EPA Methods 5 and 202.

Table 2.3 displays the emissions of filterable PM, PM_{10}, $PM_{2.5}$, and NO_x (as NO_2) measured at the ESP Exhaust Stack and SEC Baghouse Exhaust Stack during normal shop operations. Table 2.3 also displays the emissions of CO measured at the ESP Exhaust Stack during normal shop operations.

Concentration values in Table 2.3 denoted with a '<' were measured to be below the minimum detection limit (MDL) of the applicable analytical method or below the MDL of at least one fraction of the applicable analytical method. Emissions denoted with a '<' in Table 2.3 were calculated utilizing the applicable MDL concentration value instead of the "as measured" concentration value.

The graphs that present the raw, uncorrected concentration data measured in the field by the US EPA Method 3A, 7E, and 10 sampling systems at the ESP Exhaust Stack, and US EPA Method 7E at the SEC Baghouse Exhaust Stack are located in the Field Data section of the Appendix.

2.4 TEST METHOD DEVIATIONS

2.4.1 ESP Exhaust Stack Sampling

In order to provide a more representative sample, port changes did not take place during the oxygen blowing portion of the heat.

Testing was performed for an integral number of production cycles. All sample points were sampled while the heat was still in progress. Sampling was repeated for the final test port (and if necessary, moved to the previous test port) until the production cycle was completed.

The BOF facility at Dearborn Works consists of 2 BOF Vessels. The end of a heat on one vessel could overlap with portions of a heat on the other vessel. In this case, testing was concluded 3 minutes after the slag was emptied from the vessel being tested into a slag pot. For production calculations, production from the overlapping heat was pro-rated and included in the production rate calculations.

2.4.2 SEC Baghouse Exhaust Stack Sampling

Testing was performed for an integral number of production cycles. All sample points were sampled while the heat was still in progress. Sampling was repeated for the final test port (and if necessary, moved to the previous test port) until the production cycle was completed.

The BOF facility at Dearborn Works consists of 2 BOF Vessels. The end of a heat on one vessel could overlap with portions of a heat on the other vessel. In this case, testing was concluded 3 minutes after the slag was emptied from the vessel being tested into a slag pot. For production calculations, production from the overlapping heat was pro-rated and included in the production rate calculations.

All method deviations were specified in the test protocols and were approved in the EGLE test plan and approval letters. See Appendix E.

TABLE 2.1.1
SAMPLING MATRIX OF TEST METHODS UTILIZED

Date	Run No.	Sampling Location	US EPA METHODS 1/2 (Flow)	US EPA METHOD 3 (Dry Molecular Wt.)	US EPA METHOD 3A (O_2/CO_2)	US EPA METHOD 4 (%H_2O)	US EPA METHOD 29 (Mn, Pb, Hg)
			Sampling Time / Duration (min)	Sampling Time / Duration (min)	Sampling Time / Duration (min)	Sampling Time / Duration (min)	Sampling Time / Duration (min)
8/13/2019	1	ESP Exhaust Stack	8:07 - 10:02 / 91	N/A	8:07 - 10:02 / 91	8:07 - 10:02 / 91	8:07 - 10:02 / 91
8/13/2019	2	ESP Exhaust Stack	10:39 - 12:53 / 96	N/A	10:39 - 12:53 / 96	10:39 - 12:53 / 96	10:39 - 12:53 / 96
8/13/2019	3	ESP Exhaust Stack	13:56 - 15:51 / 101	N/A	13:56 - 15:51 / 101	13:56 - 15:51 / 101	13:56 - 15:51 / 101
8/13/2019	1	SEC Baghouse Exhaust Stack	8:07 - 10:00 / 90	8:56 - 8:59 / 3	N/A	8:07 - 10:00 / 90	8:07 - 10:00 / 90
8/13/2019	2	SEC Baghouse Exhaust Stack	10:39 - 12:53 / 96	11:49 - 11:52 / 3	N/A	10:39 - 12:53 / 96	10:39 - 12:53 / 96
8/13/2019	3	SEC Baghouse Exhaust Stack	13:56 - 15:51 / 98	14:22 - 14:25 / 3	N/A	13:56 - 15:51 / 98	13:56 - 15:51 / 98

All times are Eastern Daylight Time.

TABLE 2.1.2
SAMPLING MATRIX OF TEST METHODS UTILIZED

Date	Run No.	Sampling Location	US EPA METHODS 1/2 (Flow)	US EPA METHOD 3 (Dry Molecular Wt.)	US EPA METHOD 3A (O_2/CO_2)	US EPA METHOD 4 ($\%H_2O$)
			Sampling Time / Duration (min)	Sampling Time / Duration (min)	Sampling Time / Duration (min)	Sampling Time / Duration (min)
8/14/2019	1	ESP Exhaust Stack	8:59 - 10:50 / 90	N/A	8:59 - 10:50 / 90	8:59 - 10:50 / 90
8/14/2019	2	ESP Exhaust Stack	11:41 - 13:31 / 96	N/A	11:41 - 13:31 / 96	11:41 - 13:31 / 96
8/14/2019	3	ESP Exhaust Stack	14:09 - 16:06 / 96	N/A	14:09 - 16:06 / 96	14:09 - 16:06 / 96
8/14/2019	1	SEC Baghouse Exhaust Stack	8:59 - 10:50 / 87	9:33 - 9:35 / 2	N/A	8:59 - 10:50 / 87
8/14/2019	2	SEC Baghouse Exhaust Stack	11:41 - 13:31 / 88	12:35 - 12:37 / 2	N/A	11:41 - 13:31 / 88
8/14/2019	3	SEC Baghouse Exhaust Stack	14:09 - 16:06 / 90	14:33 - 14:36 / 3	N/A	14:09 - 16:06 / 90

Date	Run No.	Sampling Location	US EPA METHOD 5 (Filterable PM)	US EPA METHOD 7E (NO_x)	US EPA METHOD 10 (CO)	US EPA METHOD 202 (Condensable PM)
			Sampling Time / Duration (min)	Sampling Time / Duration (min)	Sampling Time / Duration (min)	Sampling Time / Duration (min)
8/14/2019	1	ESP Exhaust Stack	8:59 - 10:50 / 90	8:59 - 10:50 / 90	8:59 - 10:50 / 90	8:59 - 10:50 / 90
8/14/2019	2	ESP Exhaust Stack	11:41 - 13:31 / 96	11:41 - 13:31 / 96	11:41 - 13:31 / 96	11:41 - 13:31 / 96
8/14/2019	3	ESP Exhaust Stack	14:09 - 16:06 / 96	14:09 - 16:06 / 96	14:09 - 16:06 / 96	14:09 - 16:06 / 96
8/14/2019	1	SEC Baghouse Exhaust Stack	8:59 - 10:50 / 87	8:59 - 10:50 / 87	N/A	8:59 - 10:50 / 87
8/14/2019	2	SEC Baghouse Exhaust Stack	11:41 - 13:31 / 88	11:41 - 13:31 / 88	N/A	11:41 - 13:31 / 88
8/14/2019	3	SEC Baghouse Exhaust Stack	14:09 - 16:06 / 90	14:09 - 16:06 / 90	N/A	14:09 - 16:06 / 90

All times are Eastern Daylight Time.

TABLE 2.2
EMISSION RESULTS

Parameter	ESP Exhaust Stack				SEC Baghouse Exhaust Stack			
	Run 1	Run 2	Run 3	Average	Run 1	Run 2	Run 3	Average
Lead Emissions (lb/hr)	0.0647	0.0824	0.1294	0.0921	0.0036	0.0020	0.0018	0.0025
Lead Concentration (mg/dscm)	0.031	0.042	0.062	0.045	0.0018	0.0011	0.00090	0.0013
Manganese Emissions (lb/hr)	0.194	0.244	0.222	0.220	0.023	0.005	0.015	0.014
Manganese Concentration (mg/dscm)	0.093	0.12	0.11	0.11	0.012	0.0030	0.0071	0.0073
Mercury Emissions (lb/hr)†	<0.00409	<0.00266	<0.00260	<0.00312	<0.00395	<0.00145	<0.00314	<0.00285
Mercury Concentration (mg/dscm)†	<0.0019	<0.0013	<0.0013	<0.0015	<0.0020	<0.0008	<0.0015	<0.0014
Stack Gas Average Flow Rate (acfm)	873,378	833,184	852,672	853,078	602,042	542,464	633,327	592,611
Stack Gas Average Flow Rate (scfm)	649,936	622,811	625,091	632,613	542,794	483,531	559,015	528,447
Stack Gas Average Flow Rate (dscfm)	560,372	526,693	555,257	547,440	530,231	473,650	548,112	517,331
Stack Gas Average Velocity (fpm)	3,848	3,671	3,757	3,758	2,240	2,018	2,356	2,205
Stack Gas Average Static Pressure (in-H_2O)	-0.59	-0.59	-0.59	-0.59	-0.31	-0.31	-0.31	-0.31
Stack Gas Average Temperature (°F)	227	224	238	230	108	114	120	114
Stack Gas Percent by Volume Moisture (%H_2O)	13.8	15.4	11.2	13.5	2.31	2.04	1.95	2.10
Measured Stack Inner Diameter (in)			204				222	
Percent by Volume Carbon Dioxide in Stack Gas (%-dry)	3.00	3.05	2.52	2.85	0.00	0.00	0.00	0.00
Percent by Volume Oxygen in Stack Gas (%-dry)	19.22	19.10	19.57	19.29	20.90	20.90	20.90	20.90
Percent by Volume Nitrogen in Stack Gas (%-dry)	77.78	77.86	77.91	77.85	79.10	79.10	79.10	79.10

* Production Data provided by AK Steel - Dearborn Works personnel.
† The "<" symbol indicates that compound was below the Minimum Detection Limit (MDL) in at least one fraction of the analytical method. See Section 2.3 for details.

TABLE 2.3
EMISSION RESULTS

Parameter	ESP Exhaust Stack				SEC Baghouse Exhaust Stack			
	Run 1	Run 2	Run 3	Average	Run 1	Run 2	Run 3	Average
Max. 6-Minute Average of Visible Emissions (% opacity)†	4.4	13.8	26.7	N/A	N/A	N/A	N/A	N/A
Max. 3-Minute Average of Visible Emissions (% opacity)†	N/A	N/A	N/A	N/A	0.0	0.0	0.0	N/A
Total Particulate Matter Emissions (lb/hr)‡	39.60	38.32	41.25	39.72	9.57	<2.17	<2.45	<4.73
Filterable Particulate Matter Emissions (lb/hr)§	36.95	34.71	36.73	36.13	7.16	<0.85	<0.83	<2.95
Filterable Particulate Matter Concentration (grains/dscf)§	0.0079	0.0074	0.0077	0.0077	0.0017	<0.00026	<0.00024	<0.00074
Condensable Particulate Matter Emissions (lb/hr)	2.65	3.61	4.52	3.59	2.41	1.33	1.62	1.79
Condensable Particulate Matter Concentration (grains/dscf)	0.00057	0.00077	0.0010	0.00076	0.00058	0.00041	0.00047	0.00048
Nitrogen Oxides Emissions (as NO_2) (lb/hr)	26.1	20.4	28.1	24.9	1.68	2.21	1.34	1.74
Nitrogen Oxides Concentration (ppmvd)	6.71	5.20	7.08	6.33	0.48	0.82	0.46	0.59
Carbon Monoxide Emissions (lb/hr)	965	1,561	859	1,128	N/A	N/A	N/A	N/A
Carbon Monoxide Concentration (ppmvd)	408	652	356	472	N/A	N/A	N/A	N/A
Stack Gas Average Flow Rate (acfm)	813,560	809,673	827,077	816,770	555,606	430,506	461,279	482,464
Stack Gas Average Flow Rate (scfm)	618,899	619,273	627,479	621,883	498,809	382,622	411,346	430,926
Stack Gas Average Flow Rate (dscfm)	542,394	549,112	553,341	548,282	489,419	376,731	406,051	424,067
Stack Gas Average Velocity (fpm)	3,584	3,567	3,644	3,598	2,067	1,602	1,716	1,795
Stack Gas Average Static Pressure (in-H_2O)	-0.59	-0.59	-0.59	-0.59	-0.31	-0.31	-0.31	-0.31
Stack Gas Average Temperature (°F)	216	212	218	215	113	119	117	116
Stack Gas Percent by Volume Moisture (%H_2O)	12.4	11.3	11.8	11.8	1.88	1.54	1.29	1.57
Measured Stack Inner Diameter (in)	204				222			
Percent by Volume Carbon Dioxide in Stack Gas (%-dry)	2.44	2.38	2.43	2.42	0.00	0.00	0.00	0.00
Percent by Volume Oxygen in Stack Gas (%-dry)	19.29	19.32	19.29	19.30	20.90	20.90	20.90	20.90
Percent by Volume Nitrogen in Stack Gas (%-dry)	78.27	78.30	78.28	78.28	79.10	79.10	79.10	79.10

* Production data provided by AK Steel - Dearborn Works personnel.
† Visible emissions data was provided by Smoke Reader, LLC personnel.
‡ The "<" symbol indicates that compound was below the Minimum Detection Limit (MDL) in at least on fraction of the analytical method. See Section 2.3 for details.

3.0 PLANT AND SAMPLING LOCATION DESCRIPTIONS

3.1 PROCESS DESCRIPTION AND OPERATION

AK Steel Corporation - Dearborn Works is a steel-producing facility. The facility operates a Basic Oxygen Furnace (BOF) (EUBOF) which was in operation during this test event. The process and its operations are described in detail in Sections 1.b - 1.f of Test Plans M049AS-555875-PP-7 and M049AS-555875-PP-16 in Section F of the Appendix.

Figure 3.1 schematically depicts the sampling location.

3.2 CONTROL EQUIPMENT DESCRIPTION

During this test, emissions from BOF and FGBOFSHOP were controlled by an ESP and a baghouse.

3.3 SAMPLING LOCATION(S)

3.3.1 ESP Exhaust Stack

The ESP Exhaust Stack had an inner diameter of 204-inches, was oriented in the vertical plane, and was accessed from a permanent platform. Four sampling ports were located 90° apart from one another at a location that met US EPA Method 1, Section 11.1.1 criteria. Prior to emissions sampling, the stack was traversed to verify the absence of cyclonic flow. An average yaw angle of 0.21° was measured. Therefore, the sampling location also met US EPA Method 1, Section 11.4.2 criteria. During emissions sampling, the stack was traversed for stack gas volumetric flow rate, moisture content, filterable PM, condensable PM, O_2, CO_2, NO_x, CO, Pb, Mn, and Hg concentration determinations.

3.3.2 SEC Baghouse Exhaust Stack

The SEC Baghouse Exhaust Stack had an inner diameter of 222-inches, was oriented in the vertical plane, and was accessed from a permanent platform. Four sampling ports were located 90° apart from one another at a location that met US EPA Method 1, Section 11.1.1 criteria. Prior to emissions sampling, the stack was traversed to verify the absence of cyclonic flow. An average yaw angle of 0.21° was measured. Therefore, the sampling location also met US EPA Method 1, Section 11.4.2 criteria. During emissions sampling, the stack was traversed for stack gas volumetric flow rate, moisture content, filterable PM, condensable PM, NO_x, Pb, Mn, and Hg concentration determinations. Grab samples were taken for stack gas dry molecular weight determination.

Figures 3.2 and 3.3 schematically illustrate the traverse point and sample port locations utilized.

3.4 PROCESS SAMPLING LOCATION(S)

The US EPA Reference Test Methods performed did not specifically require that process samples were to be taken during the performance of this testing event. It is in the best knowledge of Montrose that no process samples were obtained and therefore no process sampling location was identified in this report.

FIGURE 3.1
BOF/FGBOFSHOP SAMPLING LOCATION SCHEMATIC

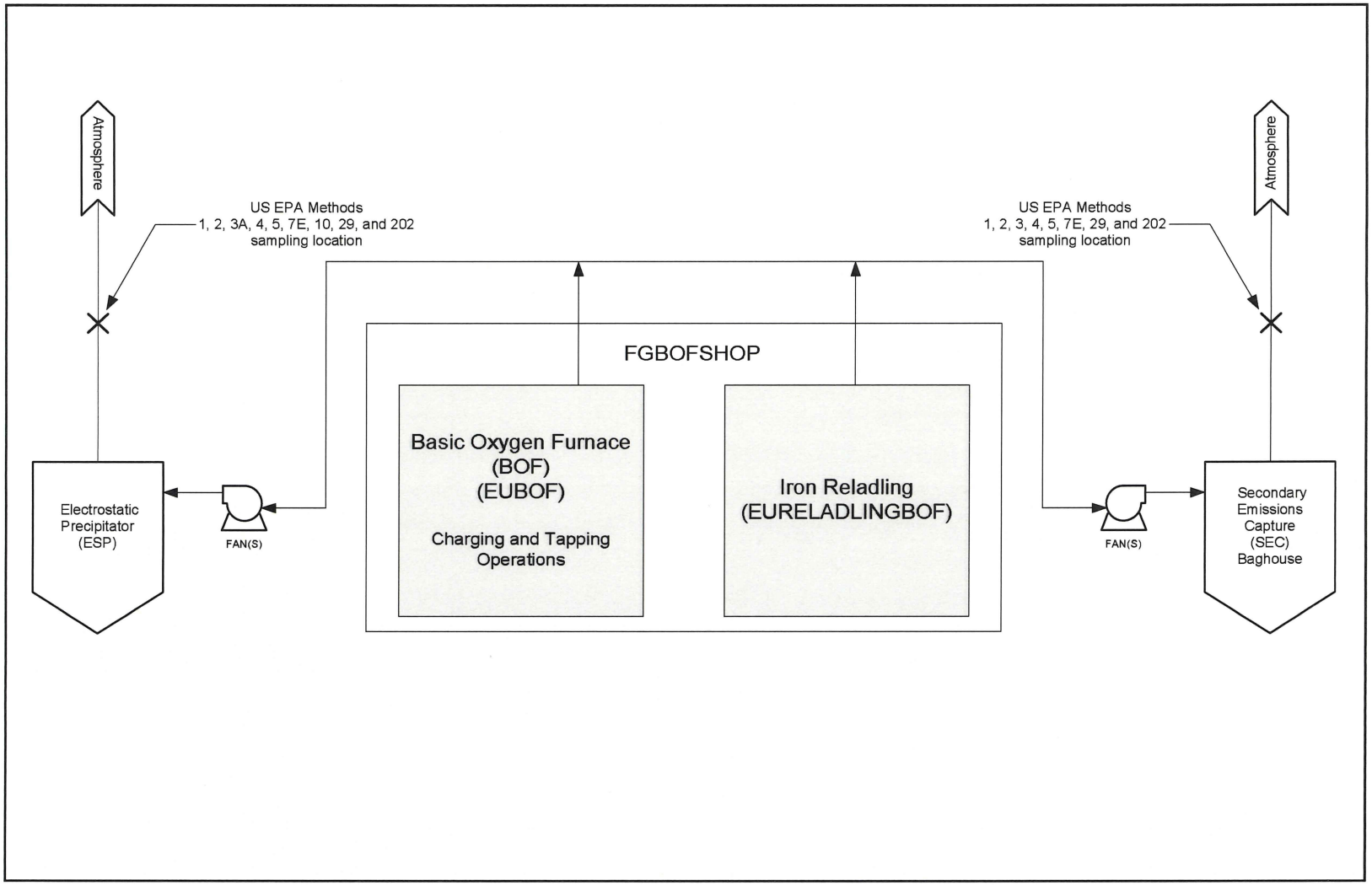
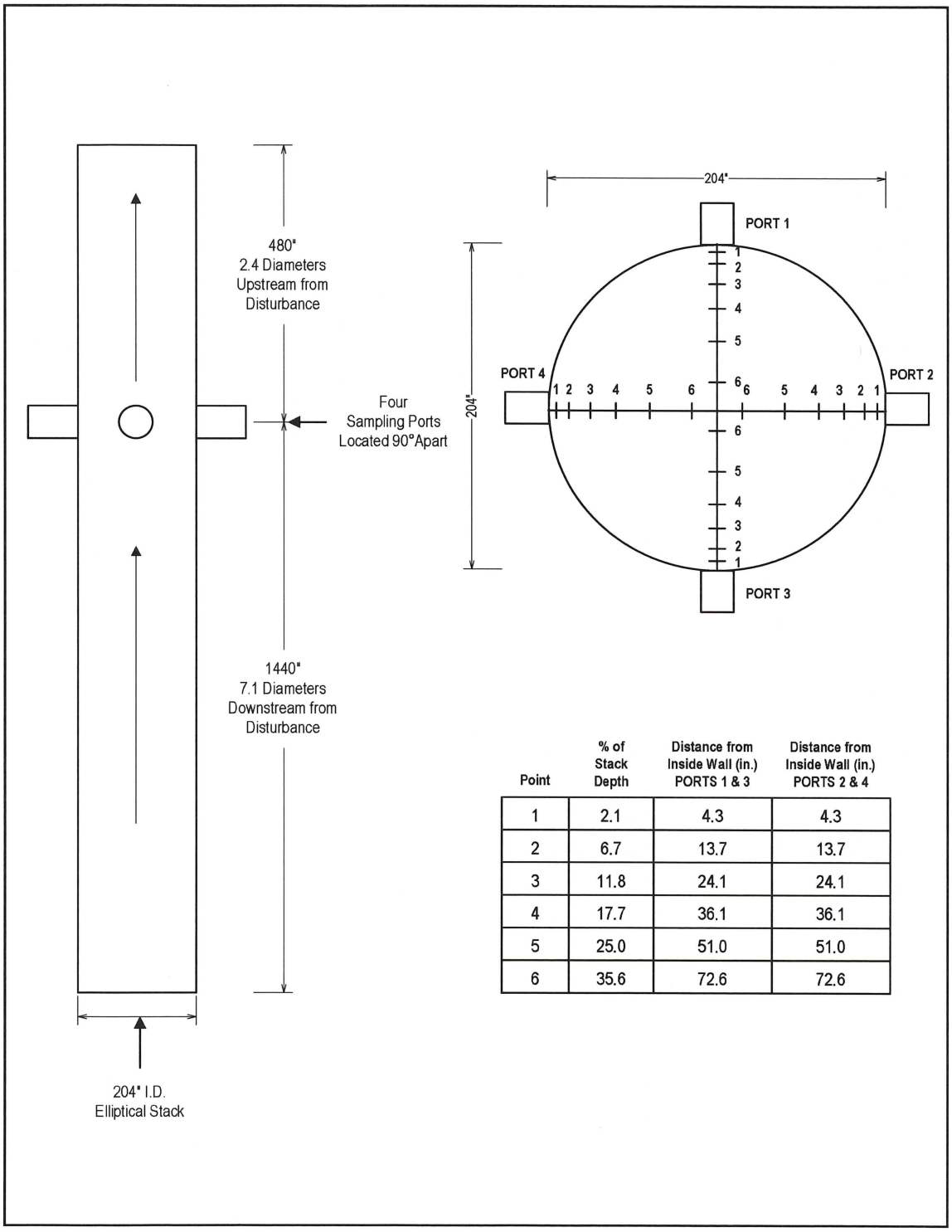
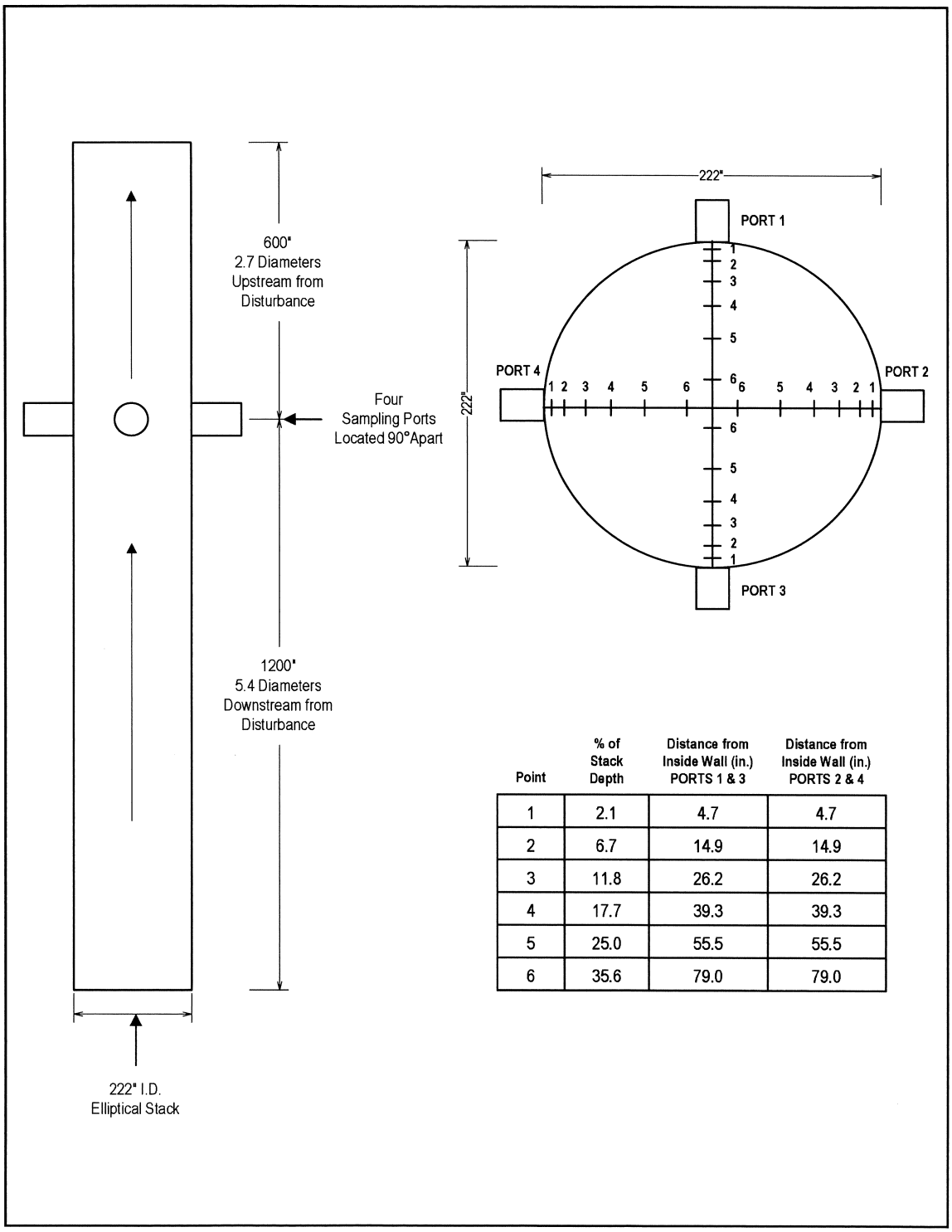


FIGURE 3.2
ESP EXHAUST TRAVERSE POINT LOCATION DRAWING



Point	% of Stack Depth	Distance from Inside Wall (in.) PORTS 1 & 3	Distance from Inside Wall (in.) PORTS 2 & 4
1	2.1	4.3	4.3
2	6.7	13.7	13.7
3	11.8	24.1	24.1
4	17.7	36.1	36.1
5	25.0	51.0	51.0
6	35.6	72.6	72.6

FIGURE 3.3
SEC 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	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

4.0 SAMPLING AND ANALYTICAL PROCEDURES

4.1 TEST METHODS

4.1.1 US EPA Method 1: "Sample and Velocity Traverses for Stationary Sources"

Principle: To aid in the representative measurement of pollutant emissions and/or total volumetric flow rate from a stationary source, a measurement site where the effluent stream is flowing in a known direction is selected, and the cross-section of the stack is divided into a number of equal areas. A traverse point is then located within each of these equal areas. This method was utilized in its entirety as per the procedures outlined in 40 CFR Part 60, Appendix A.

4.1.2 US EPA Method 2: "Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S Pitot Tube)"

Principle: The average gas velocity in a stack is determined from the gas density and from measurement of the average velocity head with a Type S (Stausscheibe or reverse type) pitot tube. This method was utilized in its entirety as per the procedures outlined in 40 CFR Part 60, Appendix A.

4.1.3 US EPA Method 3: "Gas Analysis for the Determination of Dry Molecular Weight"

Principle: A gas sample is extracted from a stack by one of the following methods: (1) single-point, grab sampling; (2) single-point, integrated sampling; or (3) multi-point, integrated sampling. The gas sample is analyzed for percent CO_2, percent O_2, and if necessary, for percent CO. For dry molecular weight determination, either an Orsat or a Fyrite analyzer may be used for the analysis. This method was utilized in its entirety as per the procedures outlined in 40 CFR Part 60, Appendix A.

4.1.4 US EPA Method 3A: "Determination of Oxygen and Carbon Dioxide Concentrations in Emissions from Stationary Sources (Instrumental Analyzer Procedure)"

Principle: A gas sample is continuously extracted from the effluent stream. A portion of the sample stream is conveyed to an instrumental analyzer(s) for determination of O_2 and CO_2 concentration(s). Performance specifications and test procedures are provided to ensure reliable data. This method was utilized in its entirety as per the procedures outlined in 40 CFR Part 60, Appendix A.

4.1.5 US EPA Method 4: "Determination of Moisture Content in Stack Gases"

Principle: A gas sample is extracted at a constant rate from the source; moisture is removed from the sample stream and determined either volumetrically or gravimetrically. This method was utilized in its entirety as per the procedures outlined in 40 CFR Part 60, Appendix A.

4.1.6 US EPA Method 5: "Determination of Particulate Emissions from Stationary Sources (Filterable PM Only)"

Principle: Particulate matter is withdrawn isokinetically from the source and collected on a glass fiber filter maintained at a temperature of 120 ± 14°C (248 ± 25°F) or such other temperature as specified by an applicable subpart of the standards or approved by the Administrator for a particular application. The PM mass, which includes any material that condenses at or above the filtration temperature, is determined gravimetrically after the removal of uncombined water. This method was utilized in its entirety as per the procedures outlined in 40 CFR Part 60, Appendix A.

4.1.7 US EPA Method 7E: "Determination of Nitrogen Oxides Emissions from Stationary Sources (Instrumental Analyzer Procedure)"

Principle: A gas sample is continuously extracted from the effluent stream. A portion of the sample stream is conveyed to an instrumental analyzer for the determination of NO_x concentration. NO and NO_2 may be measured separately or simultaneously. For the purposes of this method, NO_x is the sum of NO and NO_2. Performance specifications and test procedures are provided to ensure reliable data. This method was utilized in its entirety as per the procedures outlined in 40 CFR Part 60, Appendix A.

4.1.8 US EPA Method 10: "Determination of Carbon Monoxide Emissions from Stationary Sources (Instrumental Analyzer Procedure)"

Principle: A gas sample is continuously extracted from the effluent stream. A portion of the sample stream is conveyed to an instrumental analyzer for determination of CO concentration. Performance specifications and test procedures are provided to ensure reliable data. This method was utilized in its entirety as per the procedures outlined in 40 CFR Part 60, Appendix A.

4.1.9 US EPA Method 29: "Determination of Metals Emissions from Stationary Sources"

Principle: A stack sample is withdrawn isokinetically from the source, particulate emissions are collected in the probe and on a heated filter, and gaseous emissions are then collected in an aqueous acidic solution of hydrogen peroxide (analyzed for all metals including Hg) and an aqueous acidic solution of potassium permanganate (analyzed only for Hg). The recovered samples are digested, and appropriate fractions are analyzed for Hg by cold vapor atomic absorption spectroscopy (CVAAS) and for Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Mn, Ni, P, Se, Ag, Tl, and Zn by inductively coupled argon plasma emission 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 by ICAP. Additionally, if desired, the tester may use AAS for analysis of all listed metals if the resulting in-stack method detection limits meet the goal of the testing program. Only Mn, Pb, and Hg were sampled during this test event. This method was utilized in its entirety as per the procedures outlined in 40 CFR Part 60, Appendix A.

4.1.10 US EPA Method 202: "Determination of Condensable Particulate Emissions from Stationary Sources"

Principle: Condensable Particulate Matter (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 part 60, US EPA Method 17 of appendix A-6 to part 60, or US EPA Method 201A of appendix M to this part. 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 impinger fractions and the CPM filter represents the CPM. Compared to the version of US EPA 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 impinger immediately after the final in-stack or heated filter. This method also includes the addition of one modified Greenburg Smith impinger (backup impinger) and a CPM filter following the water dropout impinger. This method was utilized in its entirety as per the procedures outlined in 40 CFR Part 51, Appendix M.

The sampling trains utilized during this testing project are depicted in Figures 4.1 to 4.4.

4.2 PROCEDURES FOR OBTAINING PROCESS DATA

Process data was recorded by AK Steel Corporation - Dearborn Works personnel utilizing their typical record keeping procedures. Recorded process data was provided to Montrose personnel at the conclusion of this test event. The process data is located in the Appendix

FIGURE 4.1
US EPA METHOD 5/202 SAMPLING TRAIN SCHEMATIC

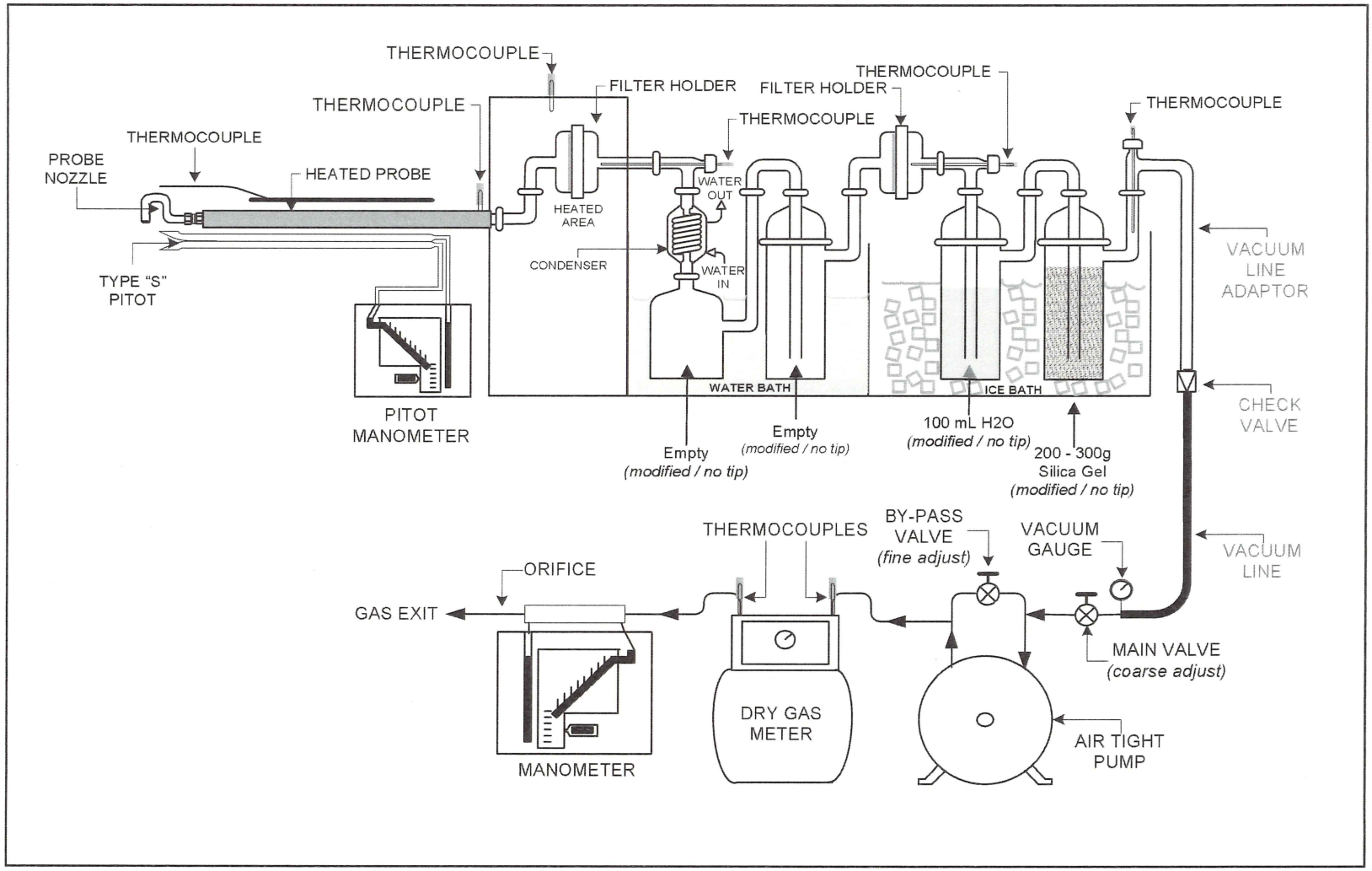


FIGURE 4.2
US EPA METHOD 29 SAMPLING TRAIN SCHEMATIC

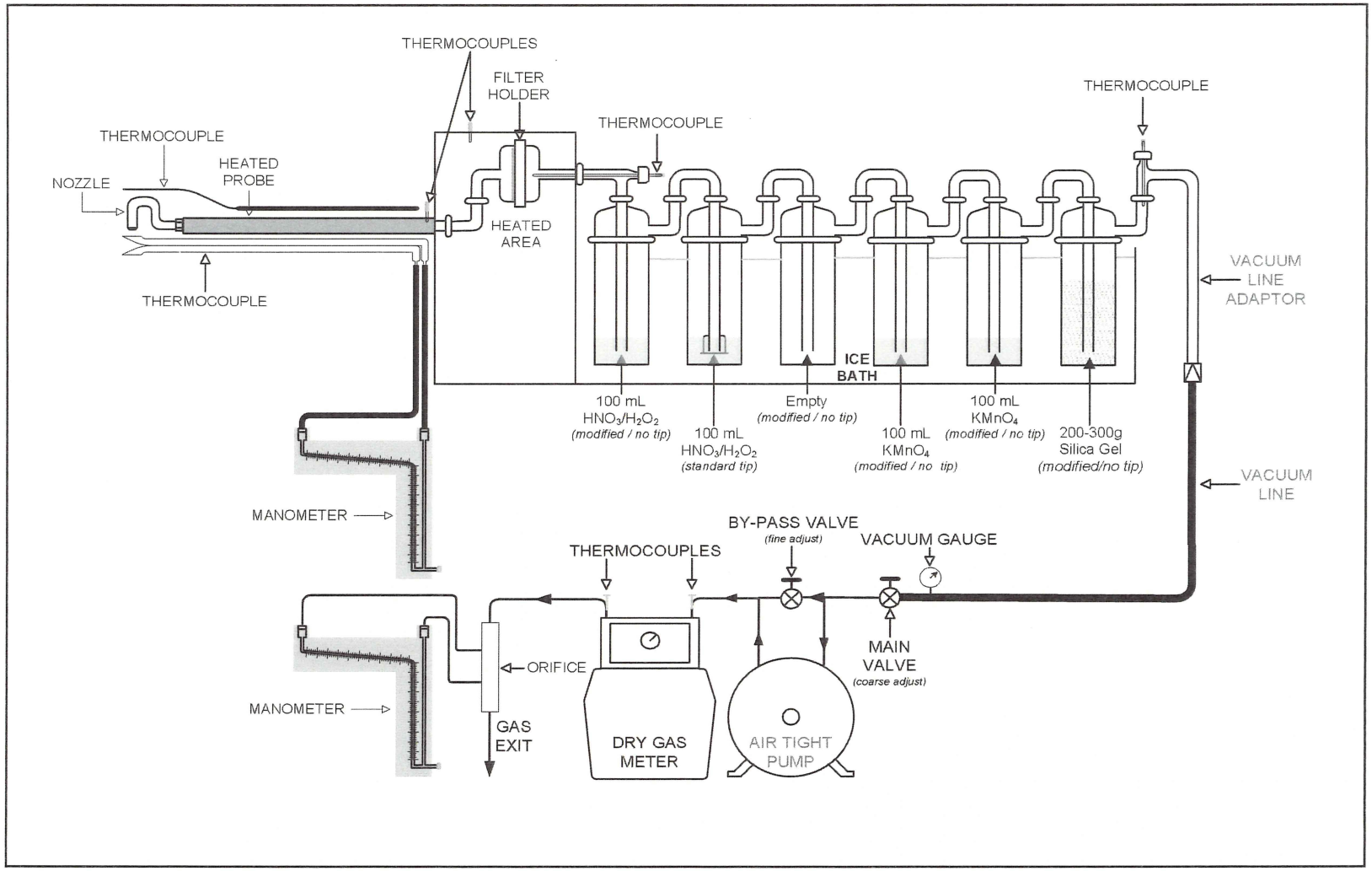


FIGURE 4.3
US EPA METHOD 3A SAMPLING TRAIN SCHEMATIC

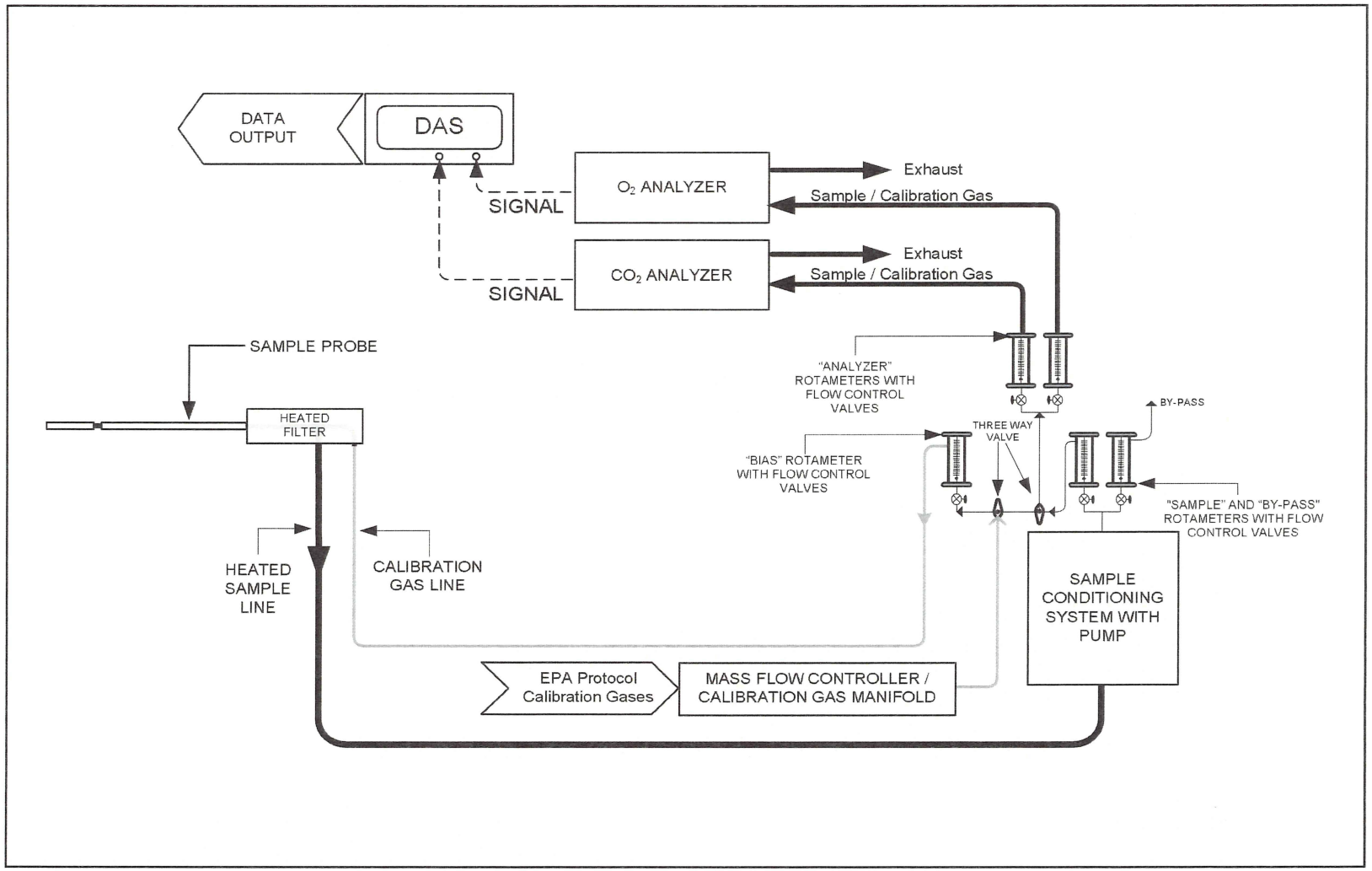


FIGURE 4.4
US EPA METHOD 7E SAMPLING TRAIN SCHEMATIC

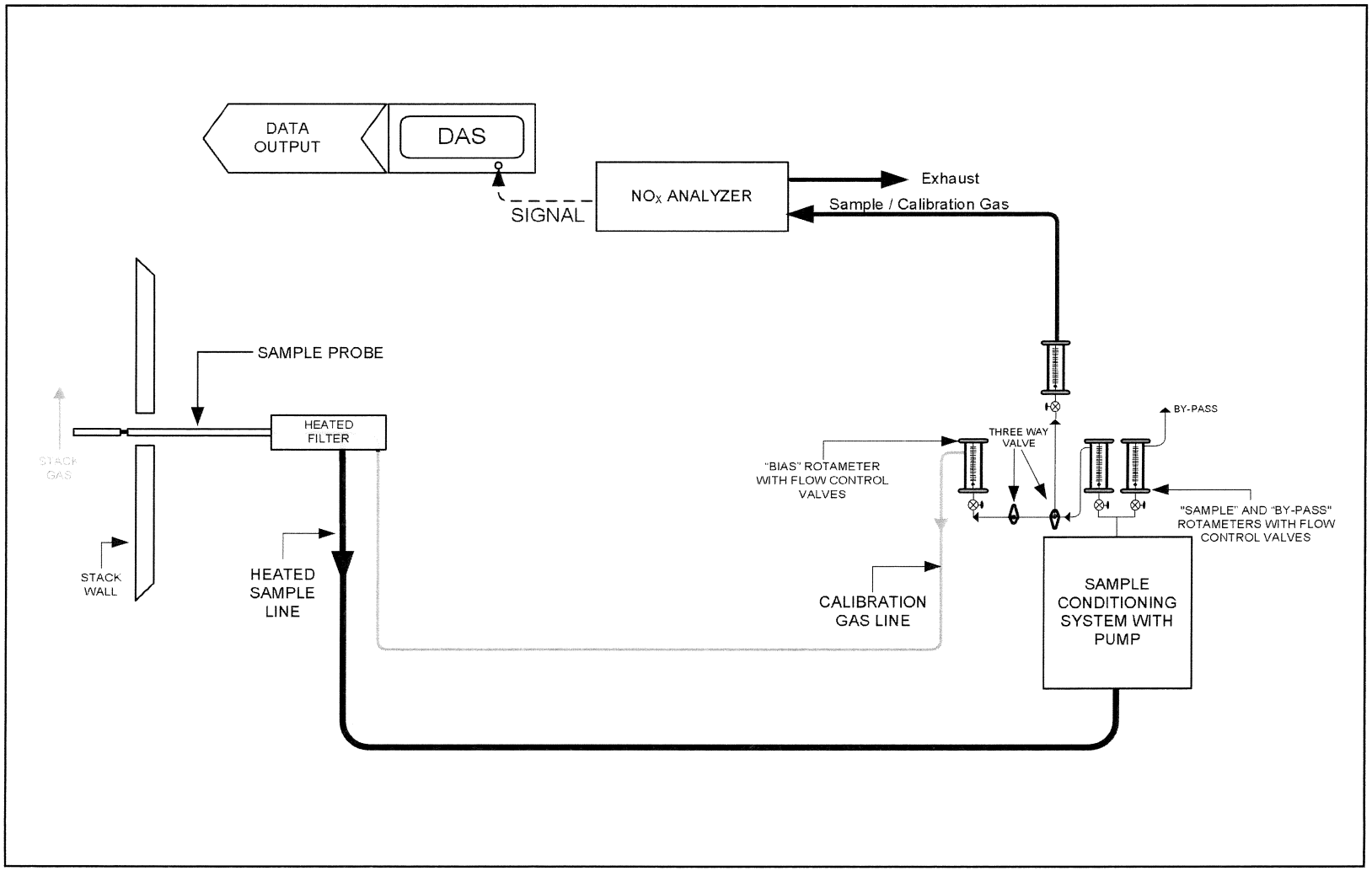
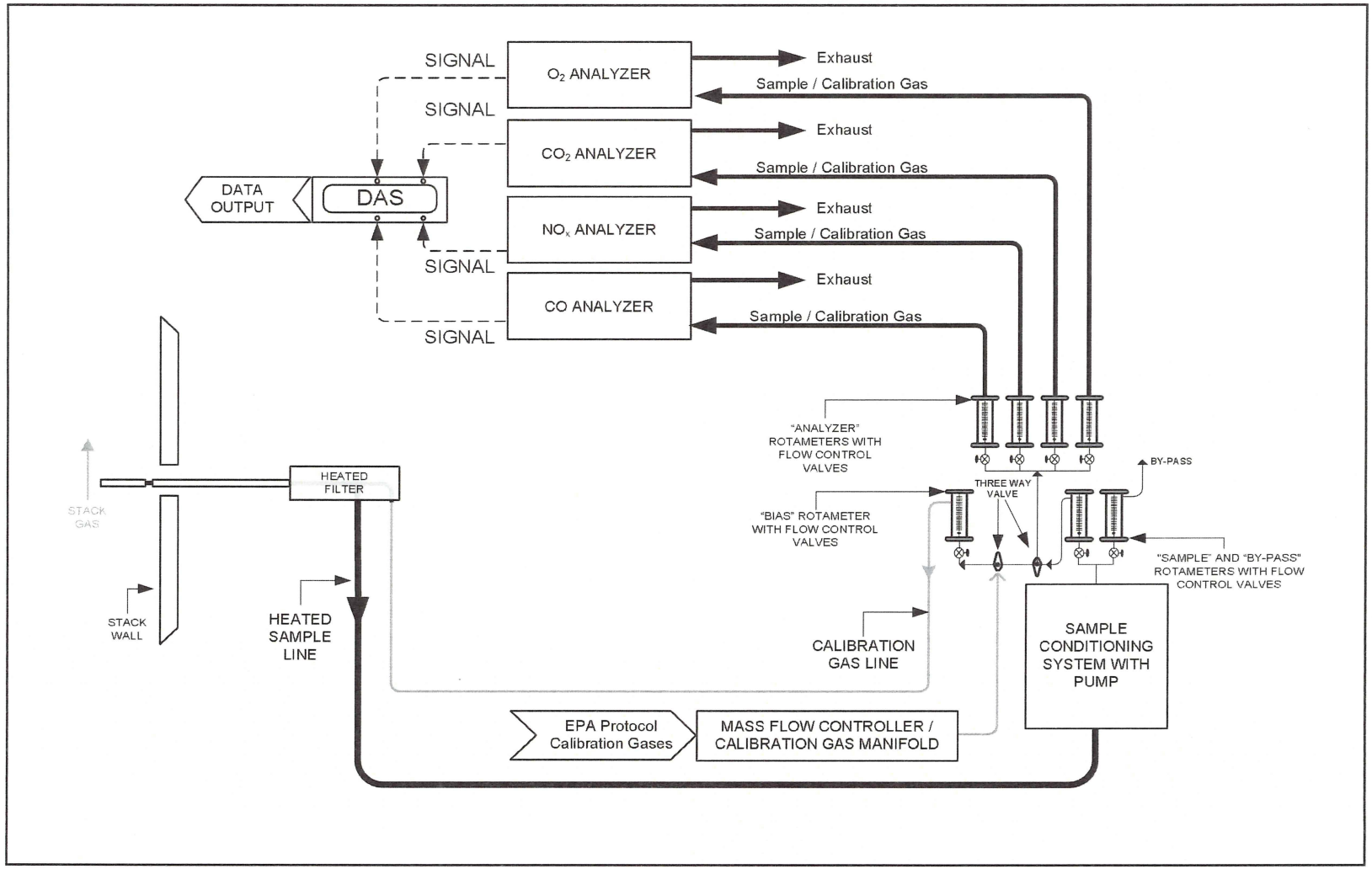


FIGURE 4.5
US EPA METHOD 3A, 7E, 10 SAMPLING TRAIN SCHEMATIC



5.0 INTERNAL QA/QC ACTIVITIES

5.1 QA AUDITS

Tables 5.1 to 5.9.2 illustrate the QA audits that were performed during this test.

All meter boxes and sampling trains used during sampling performed within the requirements of their respective methods as is shown in Tables 5.1 and 5.2. All post-test leak checks were well below the applicable limit. Minimum metered volumes and percent isokinetics were also met where applicable.

Table 5.3 displays the US EPA Method 3 Fyrite Audits which were performed during this test in accordance with US EPA Method 3, Section 10.1 requirements. As shown, all Fyrite analyzer results were within ±0.5% of the respective Audit Gas concentrations.

Tables 5.4.1 to 5.6 illustrate the O_2, CO_2, NO_x, and CO calibration audits which were performed during this test (and integral to performing US EPA Method 3A, 7E, and 10 correctly) were all within the Measurement System Performance Specifications of ±3% of span for the Zero and Calibration Drift Checks, ±5% of span for the System Calibration Bias Checks, and ±2% of span for the Calibration Error Checks.

Tables 5.7.1 and 5.7.2 display the NO_2 to NO converter efficiency check. The converter efficiency check was conducted as per the procedures contained in US EPA Method 7E, Section 8.2.4.1 which require a conversion of at least 90%. As shown in Table 5.7.1, an average converter efficiency of 91.02% was achieved for the NO_x analyzer utilized at the ESP Exhaust Stack. As shown in Table 5.7.2, an average converter efficiency of 106.8% was achieved for the NO_x analyzer utilized at the SEC Baghouse Exhaust Stack.

Table 5.8 displays the US EPA Method 205 field evaluation of the calibration gas dilution system utilized during this test event. As shown, the average concentration output at each dilution level was within ±2% of the predicted value. The average concentration output of the direct inject gas was also within ±2% of the certified concentration.

Table 5.9.1 displays the laboratory QA results for US EPA Method 29, and Table 5.9.2 displays the results of the US EPA Method 29 Audit Sample analysis. All the spike recoveries were within the US EPA Method 29 limits. The US EPA Method 29 audit samples were within the acceptable ranges established for the ERA Stationary Source Audit Sample (SSAS) Program. The ERA SSAS report can be found in Appendix B.2.

5.2 QA/QC PROBLEMS

Montrose did not have a Qualified Individual (QI) for US EPA Method 29 onsite during the test event. However, Jacob Young did complete the QA exam for US EPA Method 29 (Group 4) and received his QI certification on September 2, 2019.

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 presented in the report appendices.

TABLE 5.1.1
US EPA METHOD 29 SAMPLING TRAIN AUDIT RESULTS

Parameter	Run 1	Run 2	Run 3
Sampling Location		**ESP Exhaust Stack**	
Post-Test Leak Rate Observed (cfm)	0.000	0.000	0.000
Applicable Method Allowable Leak Rate (cfm)	0.020	0.020	0.020
Acceptable	Yes	Yes	Yes
Volume of Dry Gas Collected (dscf)	67.585	68.544	72.804
Recommended Volume of Dry Gas Collected (dscf)	44.143	44.143	44.143
Acceptable	Yes	Yes	Yes
Percent of Isokinetic Sampling Rate (%)	98.2	100.4	96.2
Applicable Method Allowable Isokinetic Sampling Rate (%)	100 ± 10	100 ± 10	100 ± 10
Acceptable	Yes	Yes	Yes
Sampling Location		**SEC Baghouse Exhaust Stack**	
Post-Test Leak Rate Observed (cfm)	0.001	0.003	0.003
Applicable Method Allowable Leak Rate (cfm)	0.020	0.020	0.020
Acceptable	Yes	Yes	Yes
Volume of Dry Gas Collected (dscf)	82.784	79.108	93.387
Recommended Volume of Dry Gas Collected (dscf)	44.143	44.143	44.143
Acceptable	Yes	Yes	Yes
Percent of Isokinetic Sampling Rate (%)	98.2	98.5	98.5
Applicable Method Allowable Isokinetic Sampling Rate (%)	100 ± 10	100 ± 10	100 ± 10
Acceptable	Yes	Yes	Yes

TABLE 5.1.2
US EPA METHOD 5/202 SAMPLING TRAIN AUDIT RESULTS

Parameter	Run 1	Run 2	Run 3
Sampling Location		**ESP Exhaust Stack**	
Post-Test Leak Rate Observed (cfm)	0.000	0.000	0.000
Applicable Method Allowable Leak Rate (cfm)	0.020	0.020	0.020
Acceptable	Yes	Yes	Yes
Volume of Dry Gas Collected (dscf)	64.081	68.637	69.749
Recommended Volume of Dry Gas Collected (dscf)	21.000	21.000	21.000
Acceptable	Yes	Yes	Yes
Percent of Isokinetic Sampling Rate (%)	97.3	96.5	97.3
Applicable Method Allowable Isokinetic Sampling Rate (%)	100 ± 10	100 ± 10	100 ± 10
Acceptable	Yes	Yes	Yes
Sampling Location		**SEC Baghouse Exhaust Stack**	
Post-Test Leak Rate Observed (cfm)	0.003	0.001	0.001
Applicable Method Allowable Leak Rate (cfm)	0.020	0.020	0.020
Acceptable	Yes	Yes	Yes
Volume of Dry Gas Collected (dscf)	73.24	58.79	64.36
Recommended Volume of Dry Gas Collected (dscf)	21.000	21.000	21.000
Acceptable	Yes	Yes	Yes
Percent of Isokinetic Sampling Rate (%)	97.4	100.4	99.7
Applicable Method Allowable Isokinetic Sampling Rate (%)	100 ± 10	100 ± 10	100 ± 10
Acceptable	Yes	Yes	Yes

TABLE 5.2
DRY GAS METER AUDIT RESULTS

Sampling Location / Sampling Train	Pre-Test Dry Gas Meter Calibration Factor (Y)	Average Post-Test Dry Gas Meter Calibration Check Value (Yqa)	Post Test Dry Gas Meter Calibration Check Value Difference From Pre-Test Calibration Factor (%)	Applicable Method Allowable Difference (%)	Acceptable
ESP Exhaust Stack (US EPA Method 29)	1.015	1.023	-0.80%	5.00%	Yes
ESP Exhaust Stack (US EPA Method 5/202)	1.015	1.022	-0.70%	5.00%	Yes

Sampling Location	Pre-Test Dry Gas Meter Calibration Factor (Y)	Average Post-Test Dry Gas Meter Calibration Factor (Y)	Post Test Dry Gas Meter Calibration Factor Difference From Pre-Test Calibration Factor (%)	Applicable Method Allowable Difference (%)	Acceptable
SEC Baghouse Exhaust Stack (US EPA Methods 5/202 and 29)	1.024	1.036	-1.17%	5.00%	Yes

TABLE 5.3
US EPA METHOD 3 FYRITE AUDIT

Audit Date	**July 9, 2019**	
Audit Gas	**%CO_2**	**%O_2**
Audit Gas Concentration (%)	**10.0**	**10.1**
Fyrite Response 1 (%)	10.0	10.0
Fyrite Response 2 (%)	10.0	10.0
Fyrite Response 3 (%)	10.0	10.0
Average (%)	10.0	10.0
Average Within ±0.5%	Yes	Yes

Audit Gas Cylinder Number: EB0024944

TABLE 5.4.1
US EPA METHOD 3A (O_2) ANALYZER CALIBRATION AND QA

	ESP Exhaust Stack - August 13, 2019					
OXYGEN ANALYZER	**RUN 1**	**Acceptable**	**RUN 2**	**Acceptable**	**RUN 3**	**Acceptable**
Analyzer Span During Test Run (%)	20.1	YES	20.1	YES	20.1	YES
Initial System Calibration Response for Zero Gas (%)	0.07	N/A	0.23	N/A	0.09	N/A
Final System Calibration Response for Zero Gas (%)	0.23	N/A	0.09	N/A	0.00	N/A
Actual Concentration of the Upscale Calibration Gas (%)	10.07	N/A	10.07	N/A	10.07	N/A
Initial System Calibration Response for Upscale Gas (%)	10.03	N/A	10.33	N/A	10.26	N/A
Final System Calibration Response for Upscale Gas (%)	10.33	N/A	10.26	N/A	9.94	N/A
Initial System Calibration Bias for Zero Gas (% of Span)	0.15	YES	0.95	YES	0.25	YES
Final System Calibration Bias for Zero Gas (% of Span)	0.95	YES	0.25	YES	-0.20	YES
Initial System Calibration Bias for Upscale Gas (% of Span)	-0.15	YES	1.35	YES	1.00	YES
Final System Calibration Bias for Upscale Gas (% of Span)	1.35	YES	1.00	YES	-0.60	YES
System Drift for Zero Gas (% of Span)	0.80	YES	-0.70	YES	-0.45	YES
System Drift for Upscale Gas (% of Span)	1.50	YES	-0.35	YES	-1.60	YES
Analyzer Calibration Error for Zero Gas (% of Span)	0.20	YES	0.20	YES	0.20	YES
Analyzer Calibration Error for Mid-Level Gas (% of Span)	-0.05	YES	-0.05	YES	-0.05	YES
Analyzer Calibration Error for High-Level Gas (% of Span)	-0.45	YES	-0.45	YES	-0.45	YES

TABLE 5.4.2
US EPA METHOD 3A (CO_2) ANALYZER CALIBRATION AND QA

	SEC Baghouse Exhaust Stack - August 13, 2019					
CARBON DIOXIDE ANALYZER	**RUN 1**	**Acceptable**	**RUN 2**	**Acceptable**	**RUN 3**	**Acceptable**
Analyzer Span During Test Run (%)	20.2	YES	20.2	YES	20.2	YES
Initial System Calibration Response for Zero Gas (%)	0.10	N/A	0.00	N/A	0.00	N/A
Final System Calibration Response for Zero Gas (%)	0.00	N/A	0.00	N/A	0.00	N/A
Actual Concentration of the Upscale Calibration Gas (%)	10.09	N/A	10.09	N/A	10.09	N/A
Initial System Calibration Response for Upscale Gas (%)	10.00	N/A	9.97	N/A	9.85	N/A
Final System Calibration Response for Upscale Gas (%)	9.97	N/A	9.85	N/A	9.85	N/A
Initial System Calibration Bias for Zero Gas (% of Span)	0.25	YES	-0.45	YES	-0.45	YES
Final System Calibration Bias for Zero Gas (% of Span)	-0.25	YES	-0.45	YES	-0.45	YES
Initial System Calibration Bias for Upscale Gas (% of Span)	-0.74	YES	-0.89	YES	-1.49	YES
Final System Calibration Bias for Upscale Gas (% of Span)	-0.89	YES	-1.49	YES	-1.49	YES
System Drift for Zero Gas (% of Span)	-0.50	YES	0.00	YES	0.00	YES
System Drift for Upscale Gas (% of Span)	-0.15	YES	-0.59	YES	0.00	YES
Analyzer Calibration Error for Zero Gas (% of Span)	0.25	YES	0.45	YES	0.45	YES
Analyzer Calibration Error for Mid-Level Gas (% of Span)	0.30	YES	0.30	YES	0.30	YES
Analyzer Calibration Error for High-Level Gas (% of Span)	0.30	YES	0.30	YES	0.30	YES

TABLE 5.5.1
US EPA METHOD 3A (O_2) ANALYZER CALIBRATION AND QA

	ESP Exhaust Stack - August 14, 2019					
OXYGEN ANALYZER	**RUN 1**	**Acceptable**	**RUN 2**	**Acceptable**	**RUN 3**	**Acceptable**
Analyzer Span During Test Run (%)	20.1	YES	20.1	YES	20.1	YES
Initial System Calibration Response for Zero Gas (%)	0.07	N/A	0.07	N/A	0.15	N/A
Final System Calibration Response for Zero Gas (%)	0.07	N/A	0.15	N/A	0.14	N/A
Actual Concentration of the Upscale Calibration Gas (%)	10.07	N/A	10.07	N/A	10.07	N/A
Initial System Calibration Response for Upscale Gas (%)	10.02	N/A	9.91	N/A	9.87	N/A
Final System Calibration Response for Upscale Gas (%)	9.91	N/A	9.87	N/A	9.76	N/A
Initial System Calibration Bias for Zero Gas (% of Span)	0.35	YES	0.15	YES	0.55	YES
Final System Calibration Bias for Zero Gas (% of Span)	0.35	YES	0.55	YES	0.50	YES
Initial System Calibration Bias for Upscale Gas (% of Span)	0.05	YES	-0.75	YES	-0.95	YES
Final System Calibration Bias for Upscale Gas (% of Span)	-0.50	YES	-0.95	YES	-1.50	YES
System Drift for Zero Gas (% of Span)	0.00	YES	0.40	YES	-0.05	YES
System Drift for Upscale Gas (% of Span)	-0.55	YES	-0.20	YES	-0.55	YES
Analyzer Calibration Error for Zero Gas (% of Span)	0.00	YES	0.20	YES	0.20	YES
Analyzer Calibration Error for Mid-Level Gas (% of Span)	-0.30	YES	-0.05	YES	-0.05	YES
Analyzer Calibration Error for High-Level Gas (% of Span)	-0.05	YES	-0.45	YES	-0.45	YES

TABLE 5.5.2
US EPA METHOD 3A (CO_2) ANALYZER CALIBRATION AND QA

	ESP Exhaust Stack - August 14, 2019					
CARBON DIOXIDE ANALYZER	**RUN 1**	**Acceptable**	**RUN 2**	**Acceptable**	**RUN 3**	**Acceptable**
Analyzer Span During Test Run (%)	20	YES	20	YES	20	YES
Initial System Calibration Response for Zero Gas (%)	0.00	N/A	0.00	N/A	0.00	N/A
Final System Calibration Response for Zero Gas (%)	0.00	N/A	0.00	N/A	0.00	N/A
Actual Concentration of the Upscale Calibration Gas (%)	10.09	N/A	10.09	N/A	10.09	N/A
Initial System Calibration Response for Upscale Gas (%)	9.88	N/A	10.00	N/A	10.10	N/A
Final System Calibration Response for Upscale Gas (%)	10.00	N/A	10.10	N/A	10.14	N/A
Initial System Calibration Bias for Zero Gas (% of Span)	0.00	YES	0.00	YES	0.00	YES
Final System Calibration Bias for Zero Gas (% of Span)	0.00	YES	0.00	YES	0.00	YES
Initial System Calibration Bias for Upscale Gas (% of Span)	-0.99	YES	-0.40	YES	0.10	YES
Final System Calibration Bias for Upscale Gas (% of Span)	-0.40	YES	0.10	YES	0.30	YES
System Drift for Zero Gas (% of Span)	0.00	YES	0.00	YES	0.00	YES
System Drift for Upscale Gas (% of Span)	0.59	YES	0.50	YES	0.20	YES
Analyzer Calibration Error for Zero Gas (% of Span)	0.00	YES	0.00	YES	0.00	YES
Analyzer Calibration Error for Mid-Level Gas (% of Span)	-0.05	YES	-0.05	YES	-0.05	YES
Analyzer Calibration Error for High-Level Gas (% of Span)	0.35	YES	0.35	YES	0.35	YES

TABLE 5.5.3
US EPA METHOD 7E ANALYZER CALIBRATION AND QA

	ESP Exhaust Stack - August 14, 2019					
NITROGEN OXIDES ANALYZER	**RUN 1**	**Acceptable**	**RUN 2**	**Acceptable**	**RUN 3**	**Acceptable**
Analyzer Span During Test Run (ppm)	90	YES	90	YES	90	YES
Initial System Calibration Response for Zero Gas (ppm)	0.1	N/A	0.2	N/A	0.3	N/A
Final System Calibration Response for Zero Gas (ppm)	0.2	N/A	0.3	N/A	0.2	N/A
Actual Concentration of the Upscale Calibration Gas (ppm)	49.9	N/A	49.9	N/A	49.9	N/A
Initial System Calibration Response for Upscale Gas (ppm)	49.0	N/A	49.4	N/A	48.2	N/A
Final System Calibration Response for Upscale Gas (ppm)	49.4	N/A	48.2	N/A	48.1	N/A
Initial System Calibration Bias for Zero Gas (% of Span)	0.08	YES	0.23	YES	0.38	YES
Final System Calibration Bias for Zero Gas (% of Span)	0.23	YES	0.38	YES	0.18	YES
Initial System Calibration Bias for Upscale Gas (% of Span)	0.22	YES	0.66	YES	-0.66	YES
Final System Calibration Bias for Upscale Gas (% of Span)	0.66	YES	-0.66	YES	-0.73	YES
System Drift for Zero Gas (% of Span)	0.16	YES	0.14	YES	-0.20	YES
System Drift for Upscale Gas (% of Span)	0.43	YES	-1.31	YES	-0.08	YES
Analyzer Calibration Error for Zero Gas (% of Span)	-0.01	YES	-0.01	YES	-0.01	YES
Analyzer Calibration Error for Mid-Level Gas (% of Span)	-1.27	YES	-1.27	YES	-1.27	YES
Analyzer Calibration Error for High-Level Gas (% of Span)	-0.38	YES	-0.38	YES	-0.38	YES

TABLE 5.5.4
US EPA METHOD 10 ANALYZER CALIBRATION AND QA

	ESP Exhaust Stack - August 14, 2019					
CARBON MONOXIDE ANALYZER	**RUN 1**	**Acceptable**	**RUN 2**	**Acceptable**	**RUN 3**	**Acceptable**
Analyzer Span During Test Run (ppm)	18930	YES	18930	YES	18930	YES
Initial System Calibration Response for Zero Gas (ppm)	-11.97	N/A	-11.87	N/A	-16.74	N/A
Final System Calibration Response for Zero Gas (ppm)	-11.87	N/A	-16.74	N/A	-16.55	N/A
Actual Concentration of the Upscale Calibration Gas (ppm)	9980	N/A	9980	N/A	9980	N/A
Initial System Calibration Response for Upscale Gas (ppm)	10172	N/A	10083	N/A	9832	N/A
Final System Calibration Response for Upscale Gas (ppm)	10083	N/A	9832	N/A	9696	N/A
Initial System Calibration Bias for Zero Gas (% of Span)	-0.06	YES	-0.06	YES	-0.09	YES
Final System Calibration Bias for Zero Gas (% of Span)	-0.06	YES	-0.09	YES	-0.09	YES
Initial System Calibration Bias for Upscale Gas (% of Span)	0.19	YES	-0.28	YES	-1.61	YES
Final System Calibration Bias for Upscale Gas (% of Span)	-0.28	YES	-1.61	YES	-2.33	YES
System Drift for Zero Gas (% of Span)	0.00	YES	-0.03	YES	0.00	YES
System Drift for Upscale Gas (% of Span)	-0.47	YES	-1.33	YES	-0.72	YES
Analyzer Calibration Error for Zero Gas (% of Span)	0.00	YES	0.00	YES	0.00	YES
Analyzer Calibration Error for Mid-Level Gas (% of Span)	0.83	YES	0.83	YES	0.83	YES
Analyzer Calibration Error for High-Level Gas (% of Span)	0.34	YES	0.34	YES	0.34	YES

TABLE 5.6
US EPA METHOD 7E ANALYZER CALIBRATION AND QA

	SEC Baghouse Exhaust Stack - August 14, 2019					
NITROGEN OXIDES ANALYZER	**RUN 1**	**Acceptable**	**RUN 2**	**Acceptable**	**RUN 3**	**Acceptable**
Analyzer Span During Test Run (ppm)	94	YES	94	YES	94	YES
Initial System Calibration Response for Zero Gas (ppm)	0.5	N/A	0.4	N/A	0.4	N/A
Final System Calibration Response for Zero Gas (ppm)	0.4	N/A	0.4	N/A	0.5	N/A
Actual Concentration of the Upscale Calibration Gas (ppm)	50.3	N/A	50.3	N/A	50.3	N/A
Initial System Calibration Response for Upscale Gas (ppm)	50.8	N/A	49.6	N/A	49.2	N/A
Final System Calibration Response for Upscale Gas (ppm)	49.6	N/A	49.2	N/A	49.6	N/A
Initial System Calibration Bias for Zero Gas (% of Span)	0.13	YES	0.03	YES	0.10	YES
Final System Calibration Bias for Zero Gas (% of Span)	0.03	YES	0.10	YES	0.16	YES
Initial System Calibration Bias for Upscale Gas (% of Span)	0.17	YES	-1.09	YES	-1.54	YES
Final System Calibration Bias for Upscale Gas (% of Span)	-1.09	YES	-1.54	YES	-1.13	YES
System Drift for Zero Gas (% of Span)	-0.10	YES	0.06	YES	0.06	YES
System Drift for Upscale Gas (% of Span)	-1.26	YES	-0.46	YES	0.42	YES
Analyzer Calibration Error for Zero Gas (% of Span)	0.37	YES	0.37	YES	0.37	YES
Analyzer Calibration Error for Mid-Level Gas (% of Span)	0.39	YES	0.39	YES	0.39	YES
Analyzer Calibration Error for High-Level Gas (% of Span)	-0.05	YES	-0.05	YES	-0.05	YES

TABLE 5.7.1
US EPA METHOD 7E NOx CONVERTER CHECK - ESP Exhaust Stack

Date / Time	Certified Cylinder Concentration (ppm NO_2)	Analyzer Concentration (ppm NO_x)	Conversion Efficiency (%)	Required Conversion Efficiency (%)	Acceptable
8/14/2019 17:52	50.78	46.22	91.02	90.00	Yes

Analyzer ID: 19
Cylinder Number: CC507531

TABLE 5.7.2
US EPA METHOD 7E NOx CONVERTER CHECK - SEC Baghouse Exhaust Stack

Date / Time	Certified Cylinder Concentration (ppm NO_2)	Analyzer Concentration (ppm NO_x)	Conversion Efficiency (%)	Required Conversion Efficiency (%)	Acceptable
8/14/2019 16:21	50.78	54.25	106.8	90.00	Yes

Analyzer ID: 21
Cylinder Number: CC507531

TABLE 5.8
US EPA METHOD 205 GAS DILUTION SYSTEM QA

Analyzer ID/Serial ID Number: NOx 28
Dilution System ID/Serial Number: 8240
CGD Mass Flow Controllers Used: 1 and 2

	Dilution Level 1	Dilution Level 2	Direct Inject Gas
Calibration Tag Value (ppm):	946.6	946.6	50.26
Dilution Ratio:	10.52	18.93	-
Predicted Diluted Value (ppm):	90	50	-
Injection 1 Response (ppm):	90.26	49.57	50.93
Injection 2 Response (ppm):	90.66	50.00	50.34
Injection 3 Response (ppm):	90.98	50.00	50.28
Average Response (ppm):	90.63	49.86	50.52
Difference From Predicted (%):	-0.70	0.29	-0.51
Acceptable (Yes/No):	Yes	Yes	Yes

TABLE 5.9.1
US EPA METHOD 29 LABORATORY QA

	Pb	Mn
Front-Half Spike Recovery (%)	100	98
Acceptable per US EPA Method 29 (Expected Range 70%-130%)	YES	YES
Back-Half Spike Recovery (%)	105	99
Acceptable per US EPA Method 29 (Expected Range 70%-130%)	YES	YES
Front-Half Duplicate , %RPD	N/A	N/A
Acceptable per US EPA Method 29 (Expected Difference Within 20%)	N/A	N/A
Back-Half Duplicate, %RPD	1.2	1.8
Acceptable per US EPA Method 29 (Expected Difference Within 20%)	YES	YES

	1B Hg	3A Hg
Spike Recovery (%)	109.6	110.6
Acceptable per US EPA Method 29 (Expected Range 85%-125%)	YES	YES
Duplicate, %RPD	N/A	N/A
Acceptable per US EPA Method 29 (Expected Difference Within 20%)	N/A	N/A

TABLE 5.9.2
US EPA METHOD 29 AUDIT RESULTS

Audit Sample I.D.	**1426-081319I**
Reported Mass as Mn (µg)	2.82
Acceptable per ERA SSAS Program *(Expected Range 1.94 µg-3.24 µg)*	Yes
Reported Mass as Pb (µg)	2.31
Acceptable per ERA SSAS Program *(Expected Range 1.70 µg-2.82 µg)*	Yes
Audit Sample I.D.	**1425-081319I**
Reported Mass as Mn (µg)	40.8
Acceptable per ERA SSAS Program *(Expected Range 30.5 µg-45.7 µg)*	Yes
Reported Mass as Pb (µg)	64.2
Acceptable per ERA SSAS Program *(Expected Range 51.3 µg-76.9 µg)*	Yes
Audit Sample I.D.	**1427-081319I**
Reported Mass as Hg (µg)	25.2
Acceptable per ERA SSAS Program *(Expected Range 18.2 µg-30.4 µg)*	Yes
Audit Sample I.D.	**1428-081319I**
Reported Mass as Hg (µg)	13.7
Acceptable per ERA SSAS Program *(Expected Range 11.3 µg-18.9 µg)*	Yes