1.0 INTRODUCTION

1.1 SUMMARY OF TEST PROGRAM

ZFS Ithaca, LLC (ZFS) (State Registration Number: P0788) contracted Montrose Air Quality Services, LLC (Montrose) to perform a compliance emissions test program on the EUSHIPRECEIVE and EUDRYER1 at the ZFS Ithaca, LLC facility located in Ithaca, Michigan. Testing was conducted to demonstrate compliance with Michigan Department of Environment, Great Lakes, and Energy (EGLE) Permit-to-Install (PTI) No. 20-17B.

- Verify the filterable particulate matter (PM) emissions from the EUSHIPRECEIVE Baghouse Exhaust Stack.
- Verify the emissions of total PM, PM under 10-µm (PM_{10}), PM under 2.5-µm ($PM_{2.5}$), NO_x (as NO_2), and CO from the EUDRYER1 Exhaust Stack.
- 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)
6/9/2020	EUSHIPRECEIVE	Velocity/Volumetric Flow Rate	EPA 1 & 2	3	60
6/9/2020	EUSHIPRECEIVE	O_2, CO_2	EPA 3	3	60
6/9/2020	EUSHIPRECEIVE	Moisture	EPA 4	3	60
6/9/2020	EUSHIPRECEIVE	Filterable PM	EPA 5	3	60
6/11/2020	EUDRYER1	Velocity/Volumetric Flow Rate	EPA 1 & 2	3	75
6/11/2020	EUDRYER1	Moisture	EPA 4	3	75
6/11/2020	EUDRYER1	Filterable PM	EPA 5	3	75
6/11/2020	EUDRYER1	Condensable PM	EPA 202	3	75
6/11/2020	EUDRYER1	O_2, CO_2	EPA 3A	3	60
6/11/2020	EUDRYER1	NO_x	EPA 7E	3	60
6/11/2020	EUDRYER1	CO	EPA 10	3	60
6/11/2020	EUDRYER1	Velocity/Volumetric	EPA 1 & 2	3	131-132

		Flow Rate			
6/11/2020	EUDRYER1	Moisture	EPA 4	3	131-132
6/11/2020	EUDRYER1	PM_{10}	EPA 201A	3	131-132
6/11/2020	EUDRYER1	$PM_{2.5}$	EPA 201A	3	131-132
6/11/2020	EUDRYER1	Condensable PM	EPA 202	3	131-132

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 Table 1-2 and 1-3. Detailed results for individual test runs can be found in Section 4.0. All supporting data can be found in the appendices.

The testing was conducted by the Montrose personnel listed in Table 1-4. The tests were conducted according to the test plan (protocol) dated June 3, 2020 that was submitted to EGLE.

TABLE 1-2
SUMMARY OF AVERAGE COMPLIANCE RESULTS -
EUSHIPRECEIVE
JUNE 9, 2020

Parameter/Units	Average Results	Emission Limits
Filterable Particulate Matter (PM)		
gr/dscf	0.0004	0.01
lb/1000lb wet stack gas	0.0008	0.10

TABLE 1-3
SUMMARY OF AVERAGE COMPLIANCE RESULTS -
EUDRYER1
JUNE 11, 2020

Parameter/Units	Average Results (Single Stack)	Average Results† (5 Stacks Combined)	Emission Limits
Particulate Matter (PM)			
lb/1000lb wet stack gas	0.003	-	0.10
PM_{10}			
lb/hr	0.56	2.80	12.5
$PM_{2.5}$			
lb/hr*	<0.47	<2.35	9.38
Nitrogen Oxides (NO_x as NO_2)			
lb/hr	0.41	2.05	6.60
Carbon Monoxide (CO)			
lb/hr	1.17	5.85	5.54

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

† One representative stack for EUDRYING1 was tested. The emission rate results have been multiplied by 5 to represent the total emissions for all five stacks combined.

1.2 KEY PERSONNEL

A list of project participants is included below:

Facility Information

Source Location:	ZFS Solutions, LLC ZFS Ithaca, LLC 1266 E Washington Road Ithaca, MI 48847
Project Contact:	Bridgette L. Rillema
Role:	Environmental Manager
Company:	ZFS Solutions, LLC
Telephone:	616-897-1711
Email:	brudgetter@zfs.com

Agency Information

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

Testing Company Information

Testing Firm:	Montrose Air Quality Services, LLC	
Contact:	Matthew Young	Steven Smith
Title:	District Manager	Client Project Manager
Telephone:	248-548-8070	248-548-8070
Email:	myoung@montrose-env.com	ssmith@montrose-env.com

Laboratory Information

Laboratory:	Montrose
City, State:	Royal Oak, MI
Method:	5 and 201A
Laboratory:	Enthalpy Analytical, LLC
City, State:	Durham, NC
Method:	202

Test personnel and observers are summarized in Table 1-4.

TABLE 1-4
TEST PERSONNEL AND OBSERVERS

Name	Affiliation	Role/Responsibility
Matthew Young	Montrose	District Manager, QI
Shane Rabideau	Montrose	Field Technician
Ben Durham	Montrose	Field Technician
David Kopenen	Montrose	Field Technician
Scott Dater	Montrose	Field Technician
Bridgette L. Rillema	ZFS Solutions, LLC	Coordinator/Test Liaison

2.0 PLANT AND SAMPLING LOCATION DESCRIPTIONS

2.1 PROCESS DESCRIPTION, OPERATION, AND CONTROL EQUIPMENT

ZFS Ithaca, LLC is a processing plant for soybeans. This plant utilizes various different processes to transport and treat the soybeans as they arrive. Emissions from the EUSHIPRECEIVE were controlled by a baghouse and emissions from EUDRYER1 were uncontrolled. During testing the EUSHIPRECEIVE and EUDRYER1 were in operation.

2.2 FLUE GAS SAMPLING LOCATION(S)

Information regarding the sampling location(s) is presented in Table 2-1.

TABLE 2-1
SAMPLING LOCATION(S)

Sampling Location	Stack Inside Diameter (in.)	Distance from Nearest Disturbance		Number of Traverse Points
		Downstream EPA "B" (in./dia.)	Upstream EPA "A" (in./dia.)	
EUSHIPRECEIVE Baghouse Exhaust Stack	53.0	1444.0 / 27.2	125.0 / 2.4	Isokinetic: 12 (6/port);
EUDRYER1 Exhaust Stack	32.0 X 66.0 Rectangular	120.0 / 2.8	30.0 / 0.7	Isokinetic (M5/202): 25 (5/port); Isokinetic (M201A/202): 15 (3/port); Gaseous: 3 (single port)

Sample location(s) were verified in the field to conform to EPA Method 1. Acceptable cyclonic flow conditions were confirmed prior to testing using EPA Method 1, Section 11.4. See Appendices A.1 through A.3 for more information.

2.3 OPERATING CONDITIONS AND PROCESS DATA

Emission tests were performed while the source/units and air pollution control devices were operating at the conditions required by the permit. The EUSHIPRECEIVE operated at a process rating of 48,000,000 Bu/yr. The EUDRYER1 operated as close to maximum capacity as possible.

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

- EUSHIPRECEIVE - Soybeans Received, lb
- EUSHIPRECEIVE - Soybeans Received Rate, ton/hr

- EUSHIPRECEIVE - Baghouse Differential Pressure, in-H_2O
- EUDRYING1 - Soybeans Processed, bushels
- EUDRYING1 - Soybeans Processed, ton
- EUDRYING1 - Soybeans Extraction Size, bushels/hr

3.0 SAMPLING AND ANALYTICAL PROCEDURES

3.1 TEST METHODS

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

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

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

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

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

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

3.1.3 EPA Method 3, Gas Analysis for the Determination of Dry Molecular Weight

EPA Method 3 is used to calculate the dry molecular weight of the stack gas using one of three methods. The first choice is to measure the percent O_2 and CO_2 in the gas stream. 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 and percent O_2 using either an Orsat or a Fyrite analyzer.

3.1.4 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 3-2.

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

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

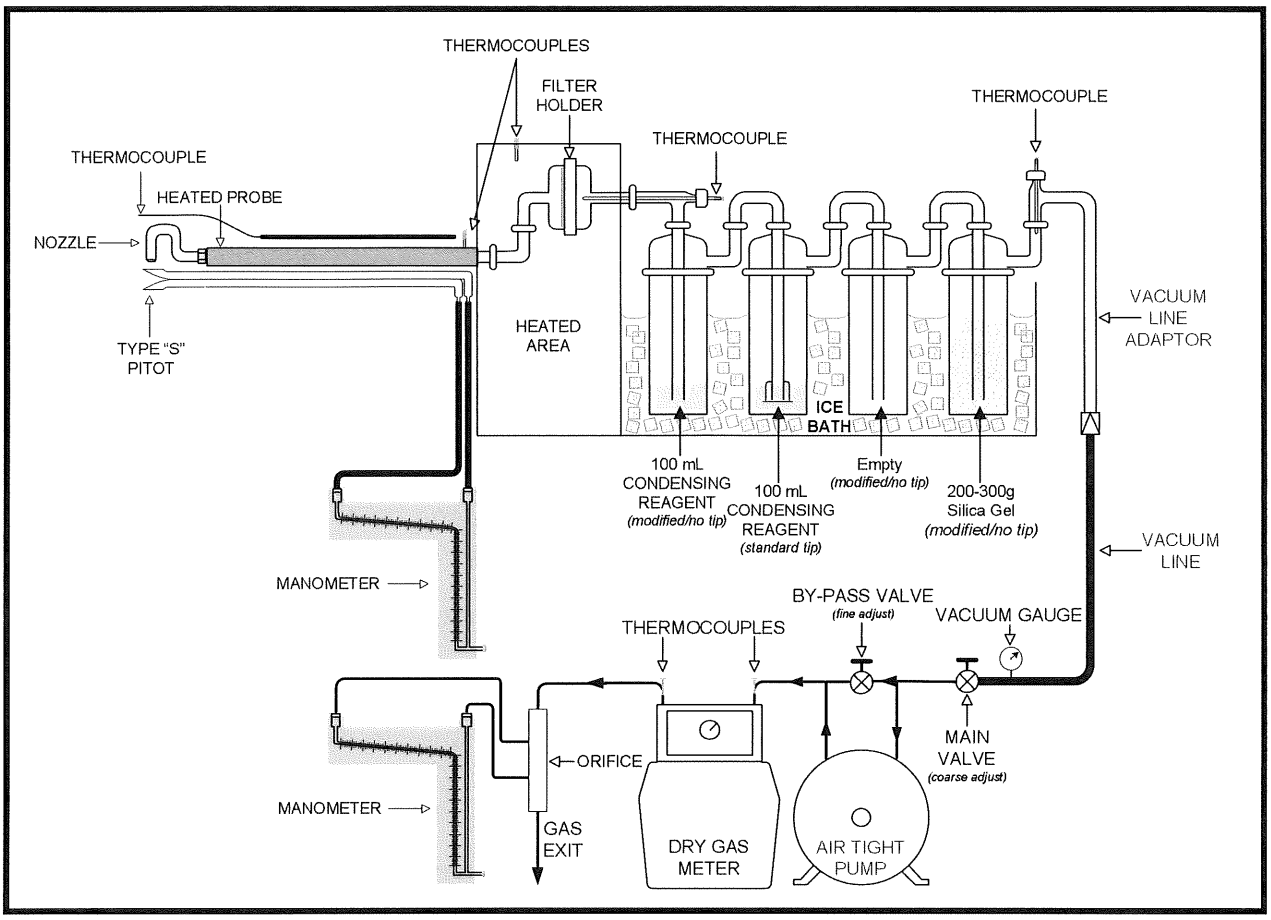
The typical sampling system is detailed in Figures 3-1, 3-3, and 3-4.

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

EPA Method 5 is a manual, isokinetic method used to measure Filterable PM 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 impinger train. FPM results are reported in emission concentration and emission rate units.

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

FIGURE 3-1
US EPA METHOD 5 SAMPLING TRAIN



3.1.7 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.

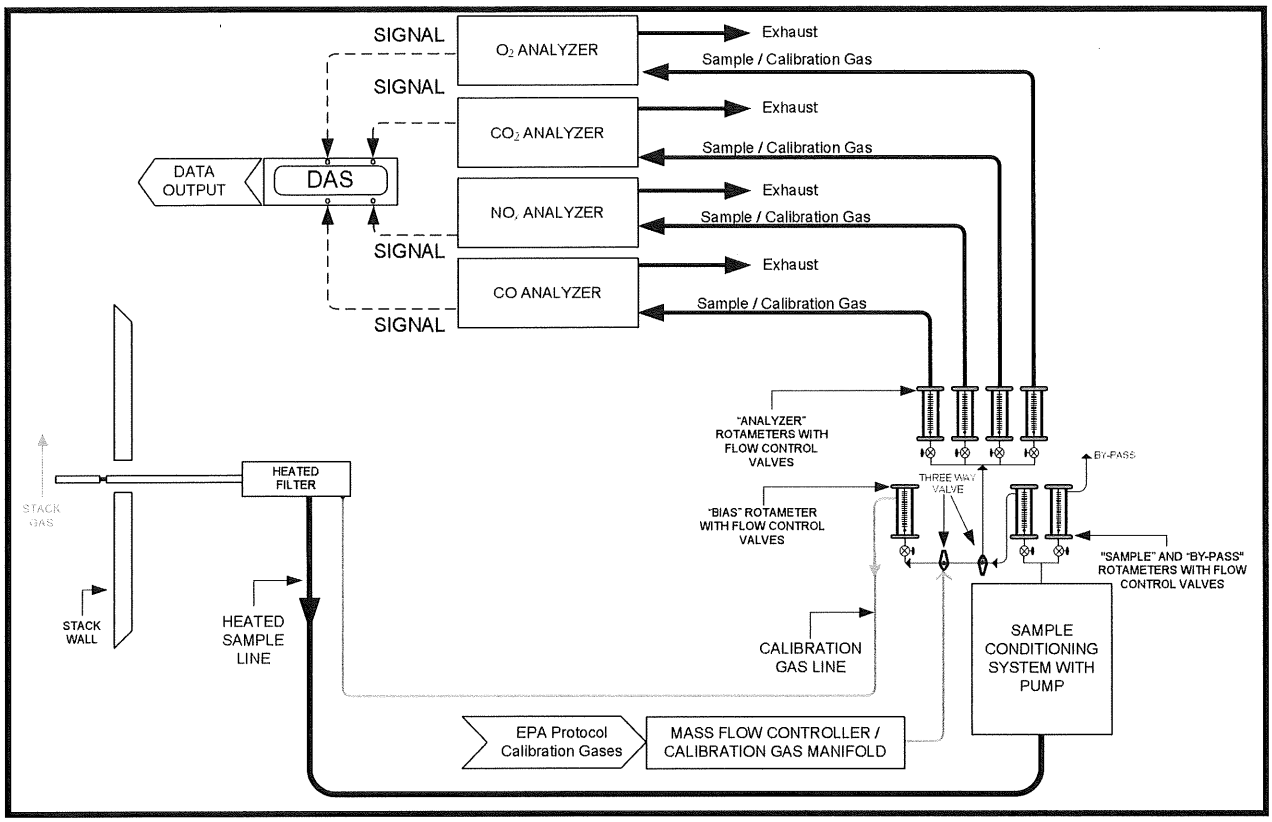
The typical sampling system is detailed in Figure 3-2.

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 3-2.

FIGURE 3-2
EPA METHODS 3A (O_2/CO_2), 7E, AND 10 SAMPLING TRAIN

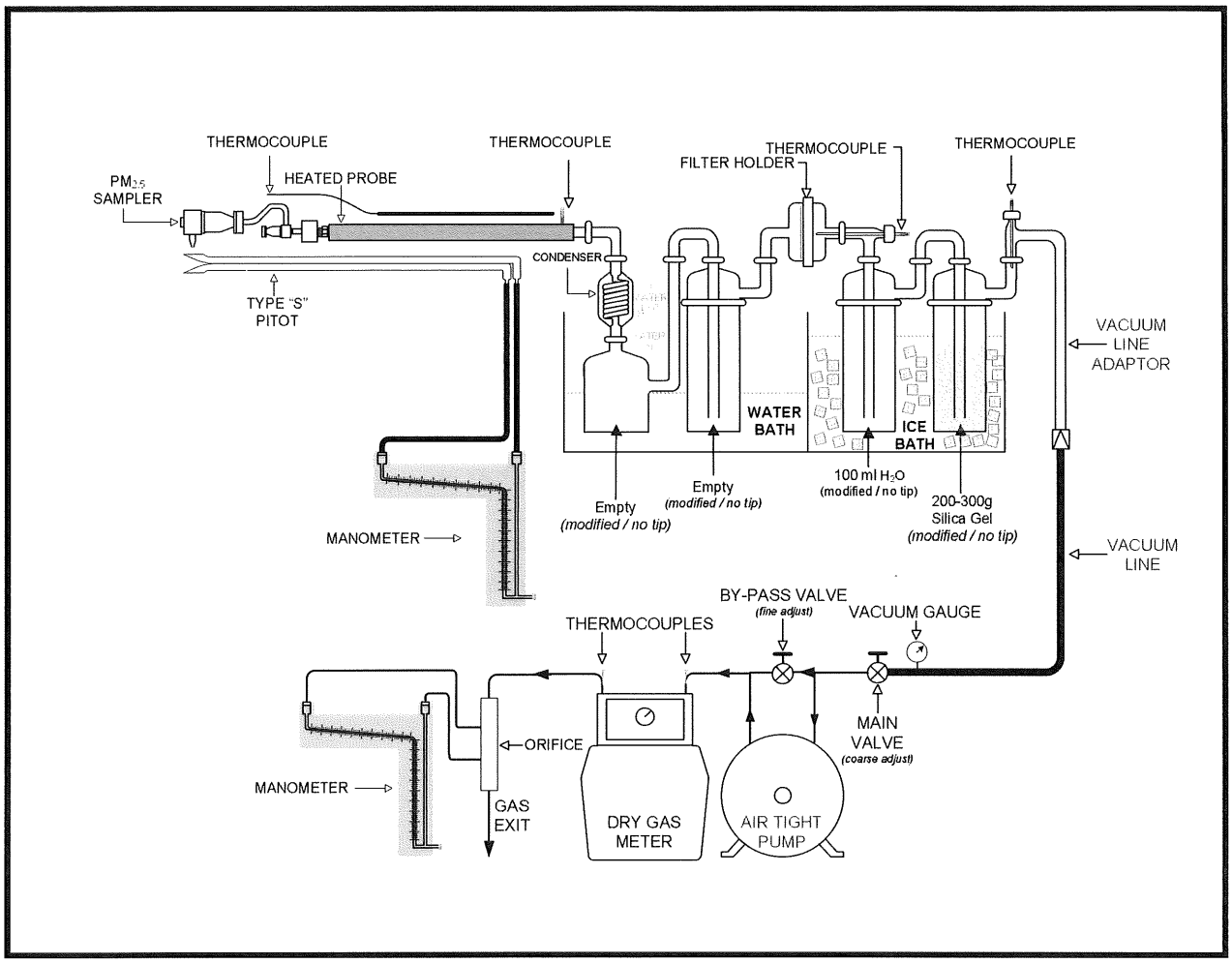


3.1.9 EPA Method 201A, Determination of PM10 and PM2.5 Emissions from Stationary Sources (Constant Sampling Rate Procedure)

A sample of gas is extracted at a predetermined constant flow rate through an in-stack sizing device. The particle-sizing device separates particles with nominal aerodynamic diameters of 10 micrometers and 2.5 micrometers. To minimize variations in the isokinetic sampling conditions, you must establish well-defined limits. After a sample is obtained, remove uncombined water from the particulate, then use gravimetric analysis to determine the particulate mass for each size fraction. The original method, as promulgated in 1990, has been changed by adding a $PM_{2.5}$ cyclone downstream of the PM_{10} cyclone. Both cyclones were developed and evaluated as part of a conventional five-stage cascade cyclone train. The addition of a $PM_{2.5}$ cyclone between the PM_{10} cyclone and the stack temperature filter in the sampling train supplements the measurement of PM_{10} with the measurement of $PM_{2.5}$.

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

FIGURE 3-3
US EPA METHOD 201A ($PM_{10}/PM_{2.5}$)/202 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 impinger 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 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.

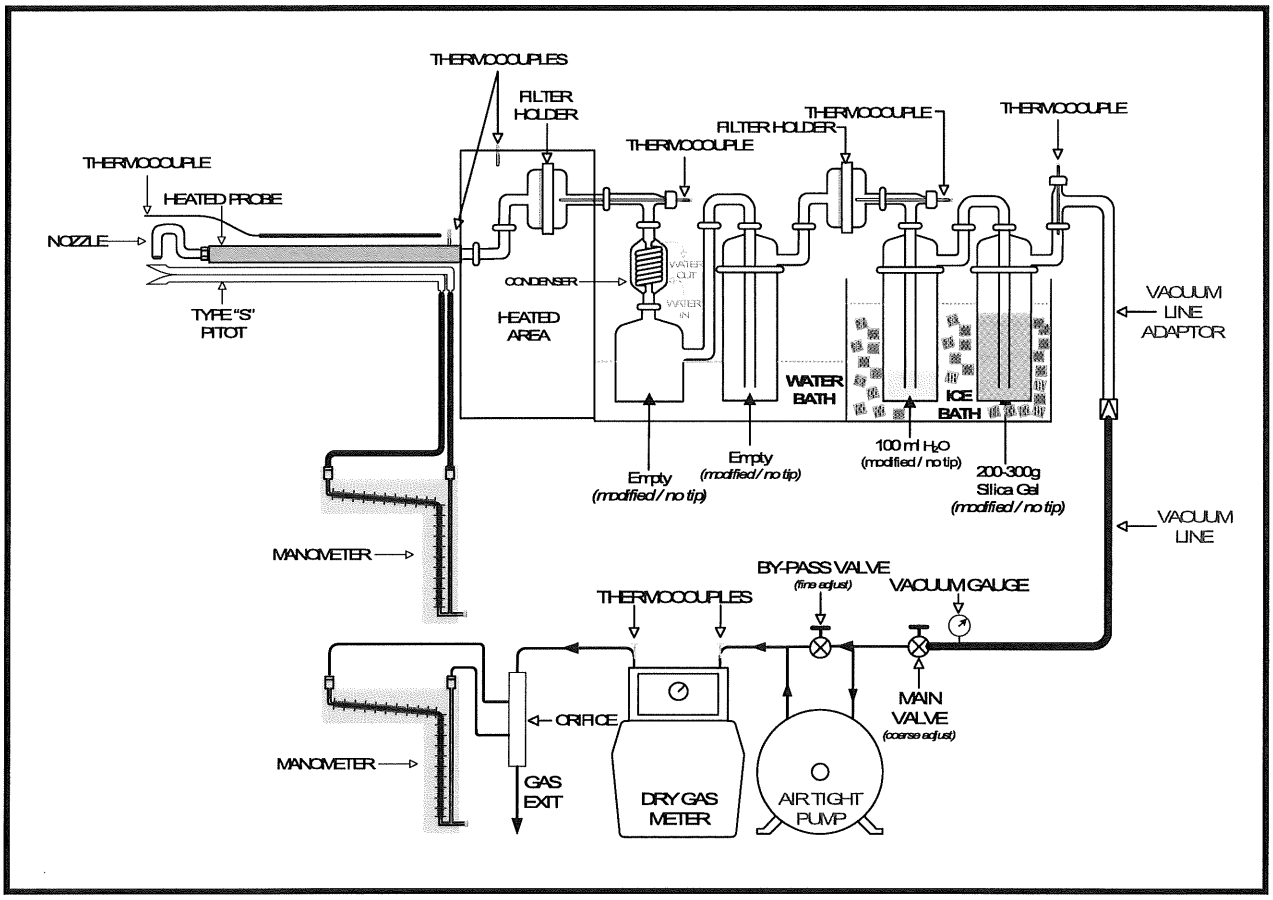
CPM is collected in the water dropout impinger, the modified Greenburg Smith impinger, and the CPM filter of the sampling train as described in this method. The impinger contents are purged with nitrogen immediately after sample collection to remove dissolved SO_2 gases from

the impinger. The CPM filter is extracted with water and hexane. The impinger 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 impinger 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 3-4.

FIGURE 3-4
US EPA METHOD 5/202 SAMPLING TRAIN



3.2 PROCESS TEST METHODS

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

4.0 TEST DISCUSSION AND RESULTS

4.1 FIELD TEST DEVIATIONS AND EXCEPTIONS

No field deviations or exceptions from the test plan or test methods occurred during this test program.

4.2 PRESENTATION OF RESULTS

The average results are compared to the permit limits in Tables 1-2 and 1-3. The results of individual compliance test runs performed are presented in Tables 4-1 through 4-4. 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 1-3 and 4-3 denoted with a '<' were measured to be below the minimum detection limit (MDL) of the applicable analytical method. Emissions denoted with a '<' in Tables 1-3 and 4-3 were calculated utilizing the applicable MDL concentration value instead of the "as measured" concentration value.

TABLE 4-1
PM EMISSIONS RESULTS -
EUSHIPRECEIVE

Run Number	1	2	3	Average
Date	6/9/2020	6/9/2020	6/9/2020	--
Time	9:41-10:45	11:30-12:32	12:50-13:53	--
Flue Gas Parameters				
O_2, % volume dry	21.0	21.0	21.0	21.0
CO_2, % volume dry	0.0	0.0	0.0	0.0
flue gas temperature, °F	77.0	81.8	85.8	81.5
moisture content, % volume	1.14	1.48	1.39	1.34
volumetric flow rate, dscfm	51,266	48,638	49,501	49,802
Filterable PM				
gr/dscf	0.00066	0.00025	0.00031	0.00041
lb/hr	0.29	0.10	0.13	0.18
lb/1000lb wet stack gas	0.0013	0.00046	0.00060	0.00077

TABLE 4-2
PM EMISSIONS RESULTS -
EUDRYER1

Run Number	1	2	3	Average
Date	6/11/2020	6/11/2020	6/11/2020	--
Time	9:30-10:52	12:32-13:54	15:41-17:05	--
Flue Gas Parameters				
O_2, % volume dry	20.37	20.40	20.38	20.38
CO_2, % volume dry	0.12	0.09	0.11	0.11
flue gas temperature, °F	93.8	94.1	92.8	93.6
moisture content, % volume	3.78	3.32	3.13	3.41
volumetric flow rate, dscfm	44,275	44,436	44,560	44,424
Filterable PM				
gr/dscf	0.0021	0.0008	0.0004	0.0011
lb/hr	0.80	0.31	0.16	0.42
lb/1000lb wet stack gas	0.0039	0.0015	0.00078	0.0021
Condensable PM				
gr/dscf	0.00059	0.00038	0.00040	0.00045
lb/hr	0.23	0.14	0.15	0.17
lb/1000lb wet stack gas	0.0011	0.00070	0.00074	0.00085
Particulate Emissions				
lb/hr	1.02	0.45	0.31	0.59
lb/1000lb wet stack gas	0.0050	0.0022	0.0015	0.0029

TABLE 4-3
PM_{10} AND $PM_{2.5}$ EMISSIONS RESULTS - EUDRYER1

Run Number	1	2	3	Average
Date	6/11/2020	6/11/2020	6/11/2020	--
Time	9:30-11:54	12:32-14:51	15:41-18:00	--
Flue Gas Parameters				
O_2, % volume dry	20.4	20.4	20.4	20.4
CO_2, % volume dry	0.12	0.094	0.11	0.11
flue gas temperature, °F	89.1	88.1	87.7	88.3
moisture content, % volume	3.62	4.27	3.36	3.75
volumetric flow rate, dscfm	42,347	41,719	42,452	42,173
Filterable PM_{10}				
gr/dscf	0.00088	0.00091	0.00053	0.00077
lb/hr	0.32	0.33	0.19	0.28
Filterable $PM_{2.5}$				
gr/dscf*	0.0006	0.0005	<0.00042	<0.00051
lb/hr*	0.22	0.18	<0.15	<0.18
Condensable PM				
gr/dscf	0.0010	0.00092	0.00042	0.00079
lb/hr	0.38	0.33	0.15	0.29
PM_{10}				
lb/hr	0.70	0.65	0.34	0.56
$PM_{2.5}$				
lb/hr*	0.60	0.51	<0.30	<0.47

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

TABLE 4-4
NO_X AND CO EMISSIONS RESULTS -
EUDRYER1

Run Number	1	2	3	Average
Date	6/11/2020	6/11/2020	6/11/2020	--
Time	9:42-10:59	12:32-14:02	15:41-17:07	--
Flue Gas Parameters				
O_2, % volume dry	20.37	20.40	20.38	20.38
CO_2, % volume dry	0.12	0.094	0.11	0.11
flue gas temperature, °F	93.8	94.1	92.8	93.6
moisture content, % volume	3.78	3.32	3.13	3.41
volumetric flow rate, dscfm	44,275	44,436	44,560	44,424
Nitrogen Oxides (NO_x as NO_2)				
ppmvd	1.27	1.22	1.35	1.28
lb/hr	0.40	0.39	0.43	0.41
Carbon Monoxide (CO)				
ppmvd	5.89	6.00	6.22	6.04
lb/hr	1.14	1.16	1.21	1.17

5.0 INTERNAL QA/QC ACTIVITIES

5.1 QA/QC AUDITS

The meter box(es) and sampling train(s) 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.

Fyrite analyzer audits were performed during this test in accordance with EPA Method 3, Section 10.1 requirements. The results were within ± 0.5% of the respective audit gas concentrations.

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 8.2.4. The conversion efficiency met the criteria.

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

EPA Method 201A QA/QC for $\triangle$Ps and aerodynamic cut sizes (D_{50}) met the criteria specified in Section 8.5 of the method.

EPA Method 5 analytical QA/QC results are included in the laboratory report. The method QA/QC criteria were met. 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 blank. The blank did not exceed the maximum residue allowed.

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 2.0 mg.

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).