Source Test Report for 2024 Compliance Testing
GE Frame 7E Combustion Turbine
(EUCOMBTURB01)
CMS Generation Michigan Power LLC
Kalamazoo River Generating Station
Comstock, MI

Prepared For:

CMS Generation Michigan Power LLC
Kalamazoo River Generating Station
6900 East Michigan Avenue
Comstock, MI 49041

Prepared By:

Montrose Air Quality Services, LLC
4949 Fernlee Ave.
Royal Oak, MI 48073

For Submission To:

Michigan Department of Environment, Great Lakes, and Energy
Technical Programs Unit
525 W. Allegan St.
Lansing, MI 48933

Document Number: MW023AS-045613-RT-2393
Test Date: October 1, 2024
Submittal Date: November 25, 2024

MONTROSE
AIR QUALITY SERVICES

STAC
STACK TESTING ACCREDITATION COUNCIL

ACCREDITED
TO ASTM D7036 ONLY
CERT #3925.01

MONTROSE
AIR QUALITY SERVICES

Review and Certification

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

Signature: John Nestor **Date:** 11 / 25 / 2024

Name: John Nestor, QSTI **Title:** District 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: **Date:** 11 / 18 / 2024

Name: Scott Brown **Title:** Reporting Hub Manager - Midwest

MONTROSE
AIR QUALITY SERVICES

Table of Contents

Section		Page
1.0	Introduction	5
	1.1 Summary of Test Program	5
	1.2 Key Personnel	6
2.0	Plant and Sampling Location Descriptions	8
	2.1 Process Description, Operation, and Control Equipment	8
	2.2 Flue Gas Sampling Location	8
	2.3 Operating Conditions and Process Data	8
3.0	Sampling and Analytical Procedures	10
	3.1 Test Methods	10
	3.1.1 EPA Method 3A	10
	3.1.2 EPA Method 7E	10
	3.1.3 EPA Method 19	11
	3.2 Process Test Methods	12
4.0	Test Discussion and Results	13
	4.1 Field Test Deviations and Exceptions	13
	4.2 Presentation of Results	13
5.0	Internal QA/QC Activities	14
	5.1 QA/QC Audits	14
	5.2 QA/QC Discussion	14
	5.3 Quality Statement	14

List of Appendices

A	Field Data and Calculations	15
	A.1 Sampling Locations	16
	A.2 EUCOMBTURB01 Data Sheets	19
	A.3 Example Calculations	25
B	Facility Process Data	28
C	Quality Assurance/Quality Control	35
	C.1 Units and Abbreviations	36
	C.2 Instrumental Test Method QA/QC Data	45
	C.3 Accreditation Information/Certifications	59

List of Tables

1-1 Summary of Test Program 5
1-2 Summary of Average Compliance Results – EUCOMBTURB01 6
1-3 Test Personnel and Observers 7
2-1 Sampling Location 8
4-1 NO_x Emissions Results - EUCOMBTURB01 12

List of Figures

3-1 US EPA Method 3A and 7E Sampling Train 10

1.0 Introduction

1.1 Summary of Test Program

CMS Generation Michigan Power LLC Kalamazoo River Generating Stations (KRGS) contracted Montrose Air Quality Services, LLC (Montrose) to perform a compliance emissions test program on the GE Frame 7E Combustion Turbine (EUCOMBTURB01) at the facility located in Comstock, Michigan.

The tests were conducted determine compliance with the 40 CFR Part 60 Subpart KKKK requirements listed in permit number MI-ROP-N6731-2021 issued by the Michigan Department of Environment, Great Lakes, and Energy AQD.

The specific objectives were to:

- Measure emissions of NO_x and O_2 at the normal running load on the outlet of the EUCOMBTURB01
- 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)
10/1/2024	EUCOMBTURB01	O_2	EPA 3A	3	21
		NO_x	EPA 7E	3	21

To simplify this report, a list of Units and Abbreviations is included in Appendix C.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. 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 1-3. The tests were conducted according to the test plan (protocol).

Table 1-2
Summary of Average Compliance Results – EUCOMBTURB01

October 1, 2024

Parameter/Units	Average Results	Emission Limits
Nitrogen Oxides (NO_x)		
ppmvd @ 15% O_2	8.53	15
lb/hr, as NO_2	27.9	72.9

1.2 Key Personnel

A list of project participants is included below:

Facility Information

Source Location: CMS Generation Michigan Power LLC
Kalamazoo River Generating Station
6900 East Michigan ave.
Comstock, MI 49093
Project Contact: Timothy Morrison
Role: Plant Manager
Company: KRGS
Telephone: 269-385-8950
Email: Timothy.morrison@CMS.com

Agency Information

Regulatory Agency: EGLE
Agency Contact: Jeremy Howe

Testing Company Information

Testing Firm:	Montrose Air Quality Services, LLC	
Contact:	John Nestor	Matt Libman
Title:	District Manager	Vice President - Midwest
Telephone:	248-765-5032	630-625-2114
Email:	jonestor@montrose-env.com	mlibman@montrose-env.com

Test personnel and observers are summarized in Table 1-3.

Table 1-3
Test Personnel and Observers

Name	Affiliation	Role/Responsibility
John Nestor	Montrose	Project Manager/Field Team Leader/Qualified Individual (QI)/Trailer operator
Matthew D'Anna	Montrose	Sample train operator
Olivia Rosario	Montrose	Report preparation
Timothy Morrison	KRGS	Observer/Client Liaison/Test Coordinator

2.0 Plant and Sampling Location Descriptions

2.1 Process Description, Operation, and Control Equipment

The KRGS facility located in Comstock, Michigan operates one simple-cycle combustion turbine that fires natural gas (NG).

The turbine has a nominal output capacity of approximately 86 Megawatts (MW). The turbine exclusively uses natural gas as the fuel. The turbine generator consists of a compressor, combustion turbine, and generator. Energy is generated at the combustion turbine by drawing in ambient air by means of burning fuel and expanding the hot combustion gases in a three-stage turbine.

2.2 Flue Gas Sampling Location

Information regarding the sampling location presented in Table 2-1.

Table 2-1
Sampling Location

Sampling Location	Stack Inside Diameter (in.)	Distance from Nearest Disturbance		Number of Traverse Points
		Downstream EPA "B" (in./dia.)	Upstream EPA "A" (in./dia.)	
EUCOMBTURB01	138.0 x 174.0	600.0/3.9	300.0/1.9	Stratification Check: 16 Gaseous: 3

The sample location was verified in the field to conform to EPA Method 1. See Appendix A.1 for more information.

2.3 Operating Conditions and Process Data

In accordance with 40 CFR Part 60, Subpart KKKK. The process data is provided in Appendix B. This data is not required as Part of 60, Subpart KKKK but was provided in accordance with the test protocol approval letter from EGLE. the emission tests were performed while the turbine was at a single load point within plus or minus 25 percent of peak load, depending upon actual ambient conditions.

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:

- Heat Input Rate, MMBtu/hr
- Gas Fuel Flow, scf/hr
- Turbine Load, MW

- Compressor Pressure Ratio
- Compressor Discharge Temperature, (°F)
- Exhaust Temperature, (°F)

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 3A - Determination of Oxygen and Carbon Dioxide 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 concentrations of O_2 and CO_2. The performance requirements of the method must be met to validate data.

Pertinent information regarding the performance of the method is presented below:

- Method Options:
  - A paramagnetic analyzer is used to measure O_2
  - Calibration span values are 20.15% O_2
- Method Exceptions:
  - For gaseous emissions sampling, MDL are calculated for each analyzer. The ISDL is equal to the sensitivity of the instrumentation, which is 2% of the span value.
- Target and/or Minimum Required Sample Duration: 21 minutes
- Target Analytes: O_2

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

3.1.2 EPA Method 7E - Determination of Nitrogen Oxides Emissions from Stationary Sources (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 a chemiluminescent 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.

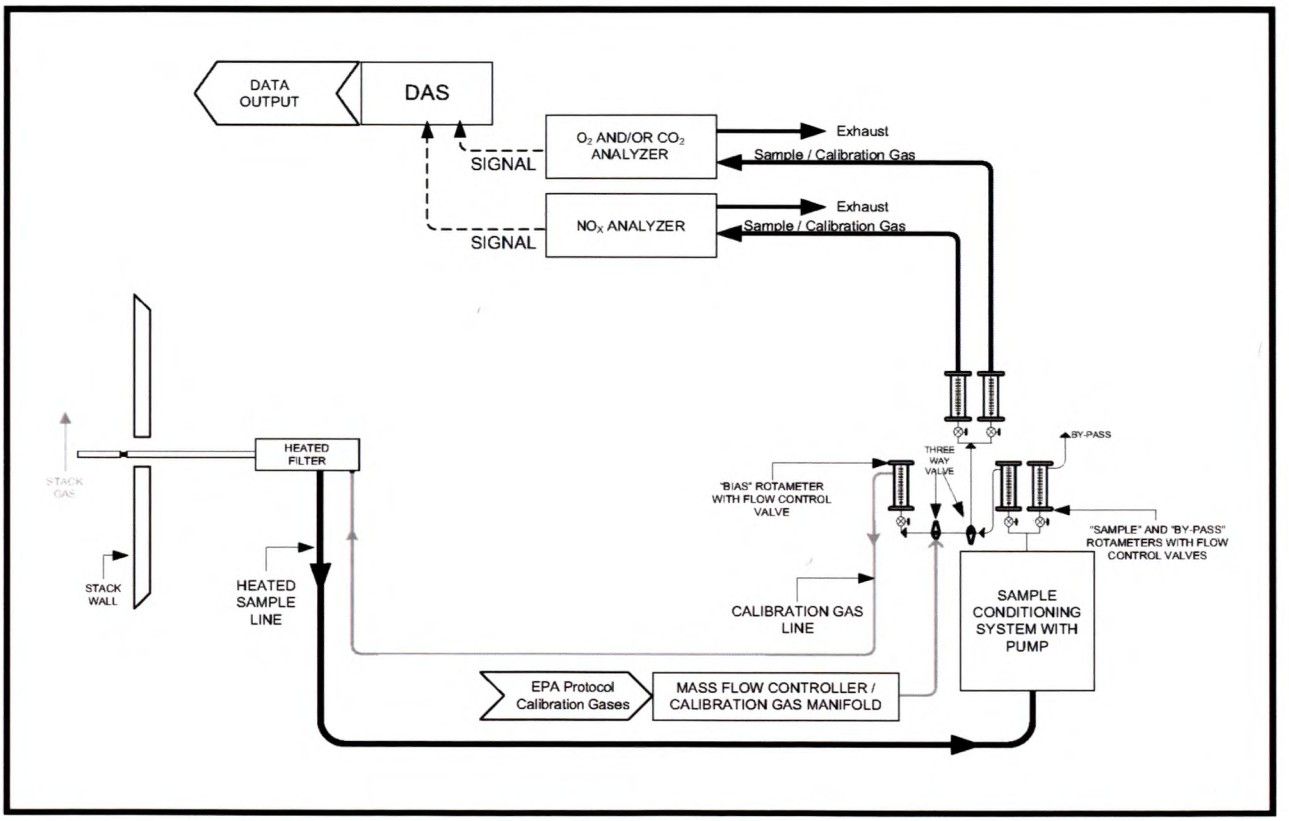
Pertinent information regarding the performance of the method is presented below:

- Method Options:
  - No filter is used since low PM is expected
  - A dry extractive sampling system is used to report emissions on a dry basis

- Calibration span value is 91.32 ppmvd NO_x
- Method Exceptions:
  - For gaseous emissions sampling, MDL are calculated for each analyzer. The ISDL is equal to the sensitivity of the instrumentation, which is 2% of the span value.
- Target and/or Minimum Required Sample Duration: 21 minutes

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

Figure 3-1
US EPA Method 3A and 7E Sampling Train



3.1.3 EPA Method 19, Measurement of Sulfur Dioxide Removal Efficiency and Particulate Matter, Sulfur Dioxide, and Nitrogen Oxide Emission Rates

EPA Method 19 is a manual method used to determine (a) PM, SO_2, and NO_x emission rates; (b) sulfur removal efficiencies of fuel pretreatment and SO_2 control devices; and (c) overall reduction of potential SO_2 emissions. This method provides data reduction procedures but does not include any sample collection or analysis procedures.

EPA Method 19 is used to calculate mass emission rates in units of lb/MMBtu. EPA Method 19, Table 19-2 contains a list of assigned fuel factors for different types of fuels, which can be used for these calculations.

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 Table 1-2. The results of individual compliance test runs performed are presented in Table 4-1. Emissions are reported in units consistent with those in the applicable regulations or requirements. Additional information is included in the appendices as presented in the Table of Contents.

Table 4-1
NO_x Emissions Results -
EUCOMBTURB01

Parameter/Units	Run 1	Run 2	Run 3	Average
Date	10/1/2024	10/1/2024	10/1/2024	--
Time	7:30-7:50	8:10-8:30	8:40-9:00	--
Process Data				
heat input, MMBtu/hr	883.8	878.6	877.6	880
load, MW	75.2	74.6	74.5	74.8
% of peak load, %	73.7	73.2	73.1	73.3
Sampling & Flue Gas Parameters				
O_2, % volume dry	14.85	14.85	14.88	14.86
Nitrogen Oxides				
ppmvd	8.80	8.60	8.80	8.73
ppmvd @ 15% O_2	8.60	8.40	8.60	8.53
lb/hr	28.3	27.2	28.1	27.9
lb/MMBtu	0.032	0.031	0.032	0.032

5.0 Internal QA/QC Activities

5.1 QA/QC Audits

EPA Method 3A and 7E 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.

5.2 QA/QC Discussion

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

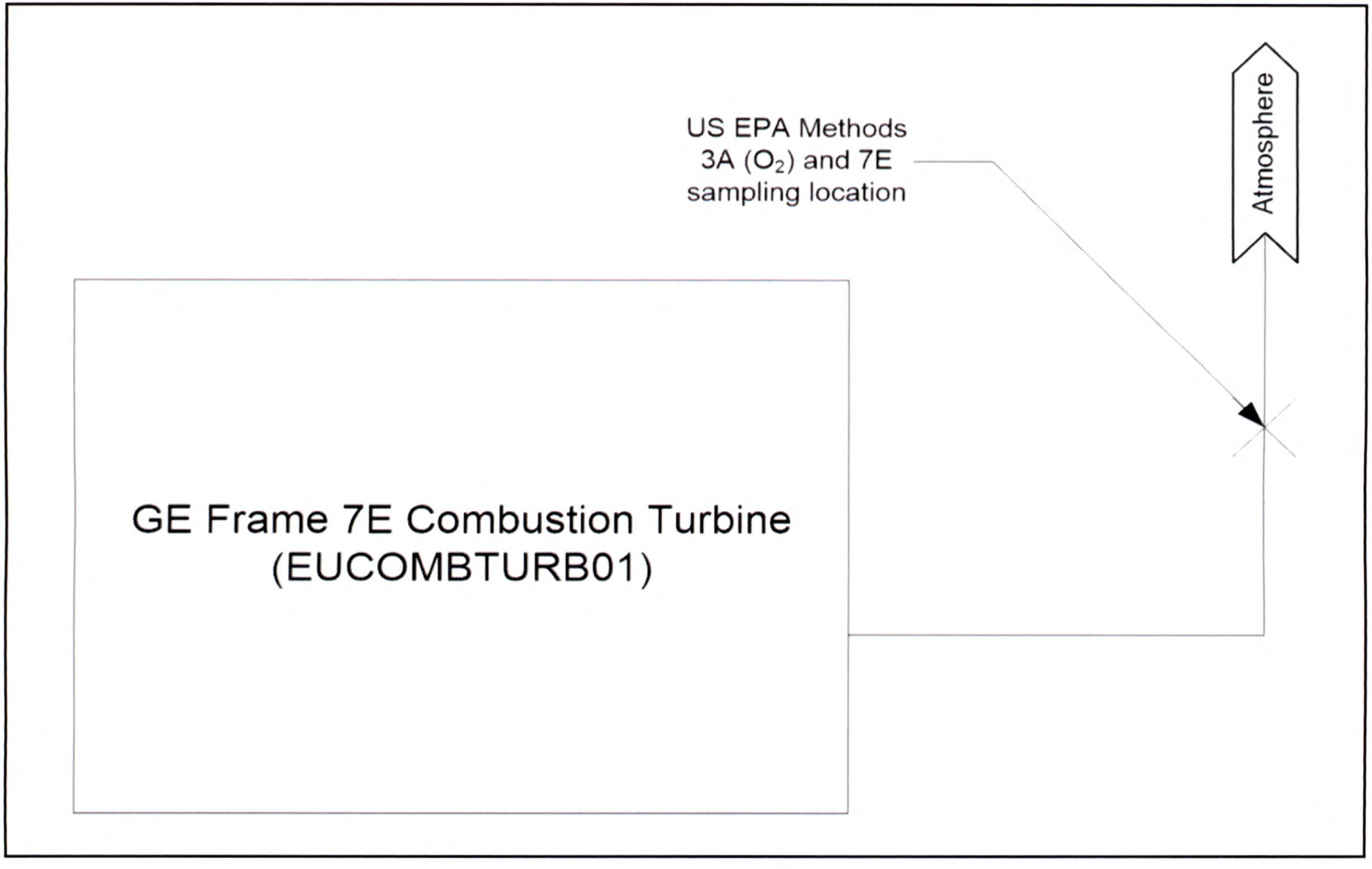
5.3 Quality Statement

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

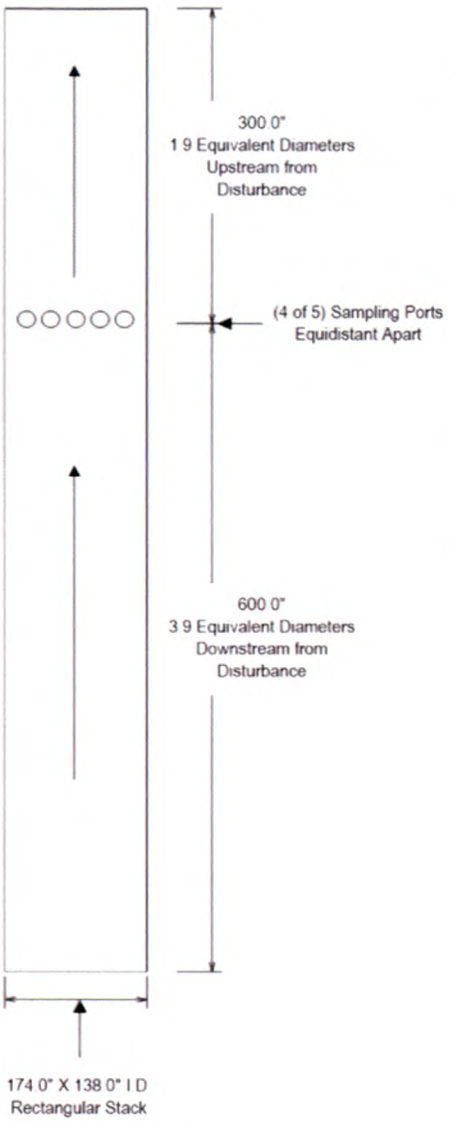
Appendix A
Field Data and Calculations

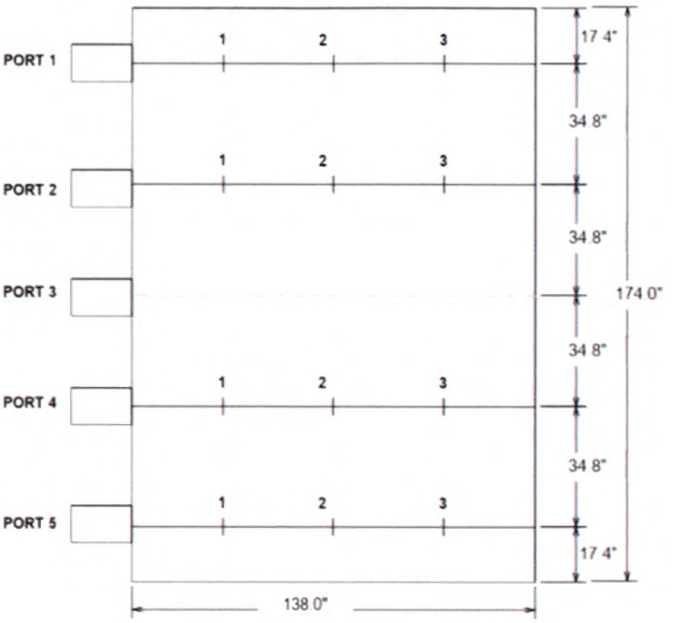
Appendix A.1
Sampling Locations

EUCOMBTURB01 SAMPLING LOCATION SCHEMATIC



EUCOMBTURB01 EXHAUST STACK TRAVERSE POINT LOCATION DRAWING





Point	% of Stack Depth	Distance from Inside Wall (in.) PORT 1	Distance from Inside Wall (in.) PORT 2	Distance from Inside Wall (in.) PORT 3
1	16.7	23.0	23.0	--
2	50.0	69.0	69.0	--
3	83.3	115.0	115.0	--

Point	% of Stack Depth	Distance from Inside Wall (in.) PORT 4	Distance from Inside Wall (in.) PORT 5
1	16.7	23.0	23.0
2	50.0	69.0	69.0
3	83.3	115.0	115.0

* Port 3 was not accessible during this test event