1.0 INTRODUCTION

1.1 SUMMARY OF TEST PROGRAM

Tetra Tech, Inc. contracted Montrose Air Quality Services, LLC (Montrose) to perform a compliance test program on the EUINCINERATOR at the City of Warren Waste Water Treatment Plant (WWTP) (SRN ID: B1792) facility located in Warren, Michigan. Testing was performed on June 15, 2021 for the purpose of satisfying the emission testing requirements pursuant to Michigan Department of Environment, Great Lakes, and Energy (EGLE) Renewable Operating Permit No. MI-ROP-B1792-2016, 40 CFR Part 60 Subpart MMMM, and R336.1972.

The specific objectives were to:

- Verify the concentration of nitrogen oxides (NO_x), corrected to 7% O_2, carbon monoxide (CO), corrected to 7% Oxygen (O_2), at the scrubber exhaust stack serving EUINCINERATOR
- 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	Unit ID/ Source Name	Activity/ Parameters	Test Methods	No. of Runs	Duration (Minutes)
6/15/2021	EUINCINERATOR	O_2	EPA 3A	3	81
6/15/2021	EUINCINERATOR	NO_x	EPA 7E	3	81
6/15/2021	EUINCINERATOR	CO	EPA 10	3	81

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 dated April 14, 2021 that was submitted to EGLE.

TABLE 1-2
SUMMARY OF AVERAGE COMPLIANCE RESULTS - EUINCINERATOR
JUNE 15, 2021

Parameter/Units	Average Results	Emission Limits	Percentage of Emission Limit
Nitrogen Oxides (NO_2) ppmvd @ 7% O_2	168	220	76.4%
Carbon Monoxide (CO) ppmvd @ 7% O_2	2966	3800	78.1%

1.2 KEY PERSONNEL

A list of project participants is included below:

Facility Information

Source Location:	City of Warren WWTP 32360 Warkrop Ave. Warren, MI 48093	
Project Contact:	Bryan Clor	Ted Bishop
Role:	Division Head	Sr. Project Manager
Company:	City of Warren WWTP	Tetra Tech. Inc.
Telephone:	586-264-2530 ext. 8103	248-991-9702
Email:	bclor@cityofwarren.org	ted.bishop@tetratech.com

Agency Information

Regulatory Agency:	EGLE
Agency Contact:	Karen Kajiya-Mills
Telephone:	517-256-0880
Email:	kajiya-millsk@michigan.gov

Testing Company Information

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

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

TABLE 1-3
TEST PERSONNEL AND OBSERVERS

Name	Affiliation	Role/Responsibility
Matthew Young	Montrose	District Manager, QI
Jeff Peitzsch	Montrose	Field Technician
Ted Bishop	Tetra Tech, Inc.	Observer/Client Liaison/Test Coordinator
Todd Schaedig	City of Warren WWTP	Facility Environmental Engineer/Test Coordinator

2.0 PLANT AND SAMPLING LOCATION DESCRIPTIONS

2.1 PROCESS DESCRIPTION, OPERATION, AND CONTROL EQUIPMENT

The City of Warren owns and operates a multiple hearth sewage sludge incinerator located at the City Waste Water Treatment Plant in Warren, Michigan. The incinerator combusts natural gas and sewage sludge, a product of secondary and tertiary waste water treatment processes, also known as biosolids. The incinerator exhaust gases are passed through a wet scrubber prior to discharge to atmosphere. The incinerator vents into a VenturiPak™ scrubber system which consists of a quench vessel, a multistage VenturiPak scrubber vessel and a pump skid with associated field instrumentation. The exhaust gases exit the multiple hearth incinerator breech and flow directly into the quencher/scrubber system. The quench vessel cools the exhaust gases and commences the scrubbing process before the gases enter the scrubber vessel. The main components of the VenturiPak scrubber vessel are the impingement tray stage, venturi stage, separator stage, and high efficiency mesh pad mist eliminator stage. The impingement tray stage conditions the gases by lowering the temperature to moisture saturation and condensing volatile compounds. The venturi stage utilizes finely atomized water droplets combined with differential velocity to scrub gas entrained aerosols and fine particulate that penetrate the preceding stages. The separator impingement tray and mesh pad mist eliminator remove any remaining dirty water droplets from the gas stream. The capacity of the VenturiPak Is custom designed to accommodate the incinerator with an inlet flow rate of 59,725 ACFM @ -10" water column (WC) and inlet temperature of 1200°F. The efficiency of the VenturiPak varies depending on the pollutant but generally will remove 99+ %. The system is guaranteed to meet the regulatory limits, which are defined in Table 1-2.

During testing the emission unit EUINCINERATOR was in operation.

2.2 FLUE GAS SAMPLING LOCATION

Information regarding the sampling location is 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.)	
EUINCINERATOR Scrubber Exhaust Stack	47.5	~144.0 / 3.0	~360.0 / 7.6	Gaseous: 3

The sampling 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

Emission tests were performed while the EUINCINERATOR and air pollution control devices were operating at the conditions required by the permit. The EUINCINERATOR was tested when operating under normal daily operating 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:

- Sludge feed rate, ton/hr
- Sludge Feed Moisture content, % Solids and % Moisture
- Operating temperature of hearths, °F
- Shaft speed of incinerator, RPM
- Pressure drop of scrubber, inch WC
- Scrubber Flow Rate, gal/min
- Scrubber pH

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 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 sent to analyzers that measure the concentration of O_2 and CO_2. The performance requirements of the method must be met to validate data.

The typical sampling system is detailed in Figure 3-1

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

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

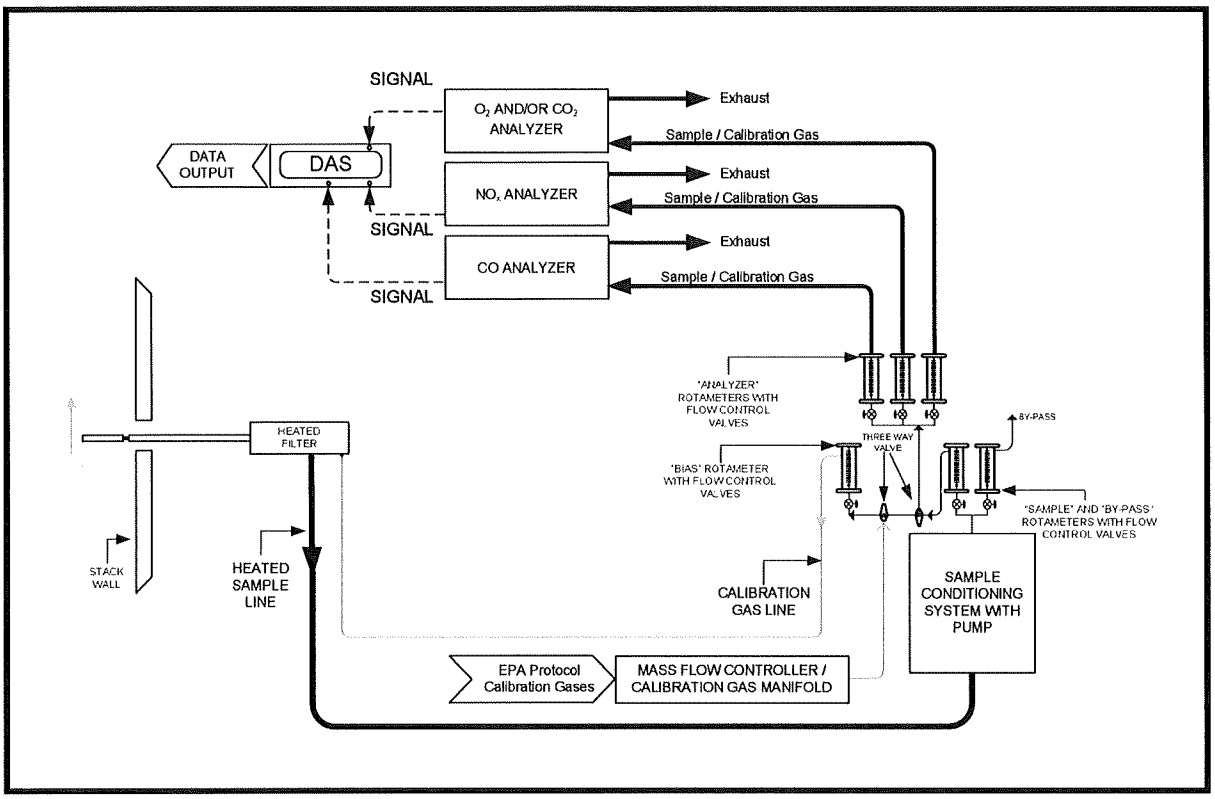
The typical sampling system is detailed in Figure 3-1

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

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

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

FIGURE 3-1
EPA METHOD 3A, 7E, AND 10 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 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 AND CO EMISSIONS RESULTS -
EUINCINERATOR

Run Number	1	2	3	Average
Date	6/15/2021	6/15/2021	6/15/2021	--
Time	8:36-9:57	10:14-11:35	11:56-13:17	--
Process Data				
Sludge Feed Rate, ton/hr	5.26	5.38	5.83	5.49
Flue Gas Parameters				
O_2, % volume dry	11.70	11.15	11.11	11.32
Nitrogen Oxides (NO_x)				
ppmvd	109.3	118.0	120.4	115.9
ppmvd @ 7% O_2	165.2	168.2	170.9	168.1
			Limit	**220**
			% of Limit	76.4
Carbon Monoxide (CO)				
ppmvd	2145.3	1982.2	1993.3	2040.3
ppmvd @ 7% O_2	3242.8	2825.8	2830.0	2966.2
			Limit	**3800**
			% of Limit	78.1

5.0 INTERNAL QA/QC ACTIVITIES

5.1 QA/QC AUDITS

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.

5.2 QA/QC DISCUSSION

All QA/QC criteria were met during this test program and QA/QC information is provided in Appendix C.

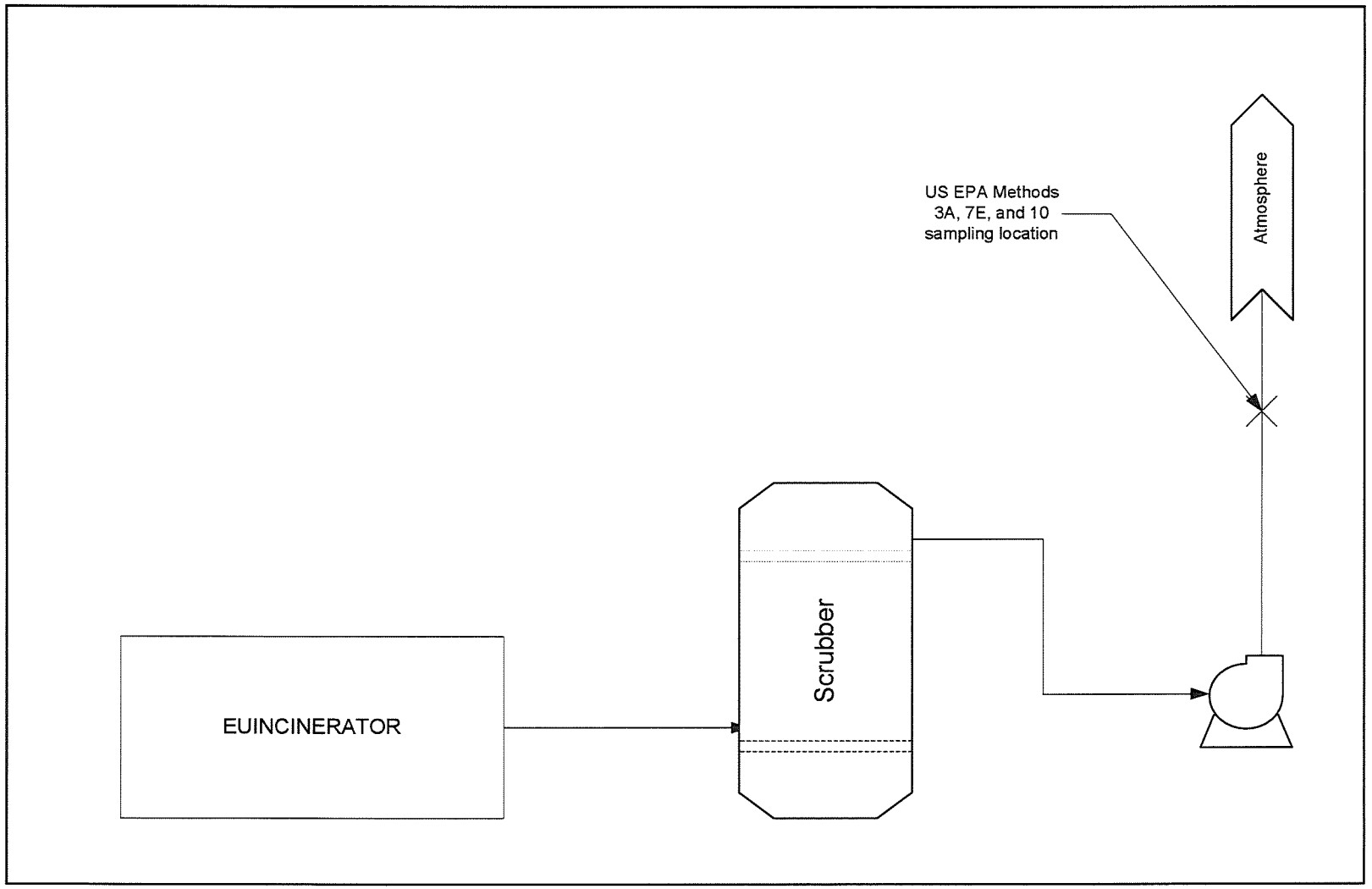
5.3 QUALITY STATEMENT

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).

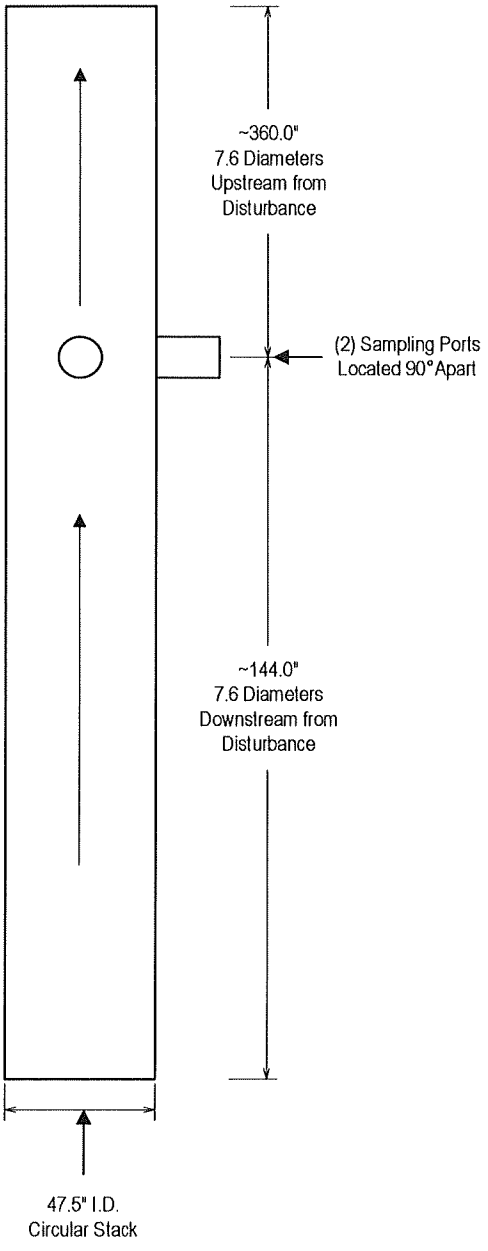
APPENDIX A
FIELD DATA AND CALCULATIONS

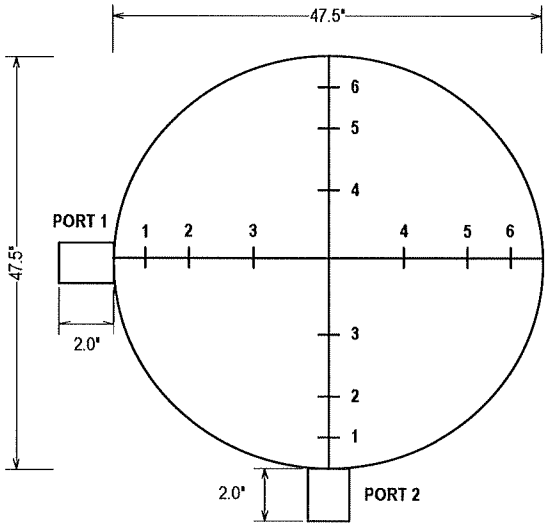
Appendix A.1
Sampling Locations

EUINCINERATOR PROCESS AND SAMPLING LOCATION SCHEMATIC



EUINCINERATOR SCRUBBER EXHAUST TRAVERSE POINT LOCATION DRAWING





Point	% of Stack Depth	Distance from Inside Wall (in.) PORT 1	Distance from Inside Wall (in.) PORT 2
1	4.4	2.1	2.1
2	14.6	6.9	6.9
3	29.6	14.1	14.1
4	70.4	33.4	33.4
5	85.4	40.6	40.6
6	95.6	45.4	45.4