EGLE

MICHIGAN DEPARTMENT OF ENVIRONMENT, GREAT LAKES, AND ENERGY
AIR QUALITY DIVISION

RENEWABLE OPERATING PERMIT REPORT CERTIFICATION

Authorized by 1994 P.A. 451, as amended. Failure to provide this information may result in civil and/or criminal penalties.

Reports submitted pursuant to R 336.1213 (Rule 213), subrules (3)(c) and/or (4)(c), of Michigan's Renewable Operating Permit (ROP) program must be certified by a responsible official. Additional information regarding the reports and documentation listed below must be kept on file for at least 5 years, as specified in Rule 213(3)(b)(ii), and be made available to the Department of Environment, Great Lakes, and Energy, Air Quality Division upon request.

Source Name: Riverview Energy Systems, LLC — County: Wayne

Source Address: 20000 Grange Road — City: Riverview

AQD Source ID (SRN): M4469 — ROP No.: MI-ROP-M4469-2015a — ROP Section No.: 1

Please check the appropriate box(es):

☐ **Annual Compliance Certification (Pursuant to Rule 213(4)(c))**

Reporting period (provide inclusive dates): From _____ To _____

☐ 1. During the entire reporting period, this source was in compliance with **ALL** terms and conditions contained in the ROP, each term and condition of which is identified and included by this reference. The method(s) used to determine compliance is/are the method(s) specified in the ROP.

☐ 2. During the entire reporting period this source was in compliance with all terms and conditions contained in the ROP, each term and condition of which is identified and included by this reference, **EXCEPT** for the deviations identified on the enclosed deviation report(s). The method used to determine compliance for each term and condition is the method specified in the ROP, unless otherwise indicated and described on the enclosed deviation report(s).

☐ **Semi-Annual (or More Frequent) Report Certification (Pursuant to Rule 213(3)(c))**

Reporting period (provide inclusive dates): From _____ To _____

☐ 1. During the entire reporting period, **ALL** monitoring and associated recordkeeping requirements in the ROP were met and no deviations from these requirements or any other terms or conditions occurred.

☐ 2. During the entire reporting period, all monitoring and associated recordkeeping requirements in the ROP were met and no deviations from these requirements or any other terms or conditions occurred, **EXCEPT** for the deviations identified on the enclosed deviation report(s).

☒ **Other Report Certification**

Reporting period (provide inclusive dates): From Oct 12, 2022 To Oct 13, 2022

Additional monitoring reports or other applicable documents required by the ROP are attached as described:

Emissions Test Report for NOx, CO, & HCl Turbines 1 & 2 Riverview Energy Systems, LLC

I certify that, based on information and belief formed after reasonable inquiry, the statements and information in this report and the supporting enclosures are true, accurate and complete

Kevin Dobson	Vice President - Biomass	734-358-1408
Name of Responsible Official (print or type)	Title	Phone Number

Kevin Dobson — 11.22.2022

Signature of Responsible Official — Date

* Photocopy this form as needed.

EQP 5736 (Rev 04/30/2019)

EMISSIONS TEST REPORT

for

OXIDES OF NITROGEN (NO_X), CARBON MONOXIDE (CO), & HYDROGEN CHLORIDE (HCL)

EUTURBINE1 & EUTURBINE2

RIVERVIEW ENERGY SYSTEMS, LLC
Riverview, Michigan

October 12-13, 2022

Prepared By:
Environmental Management & Safety
Ecology, Monitoring, and Remediation
DTE Corporate Services, LLC
7940 Livernois H-136
Detroit, MI 48210

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EXECUTIVE SUMMARY

DTE Energy's Environmental Management and Safety (EM&S) Ecology, Monitoring, and Remediation, performed emissions testing at Riverview Energy Systems, LLC, located in Riverview, Michigan. The fieldwork, performed on October 12 & 13, 2022 was conducted to satisfy requirements of the Michigan Renewable Operating Permit No. MI-ROP-M4469-2015a. Emissions tests were performed on Turbines 1 & 2 for oxides of nitrogen (NO_x), carbon monoxide (CO), and Hydrogen Chloride (HCl).

The results of the emissions testing are highlighted below:

Emissions Testing Summary – Turbines 1 & 2
Riverview Energy Systems, LLC
Riverview, MI
October 12 & 13, 2022

	Oxides of Nitrogen (% by volume @ 15% O2)	Carbon Monoxide (lb/hr)	Hydrogen Chloride (lb/hr)
EUTURBINE1	0.0030	3.48	0.12
EUTURBINE2	0.0030	2.84	0.13
Permit Limit	**0.0071**	**15.78**	**2.05***

* HCl permit limit – Turbine 1 and Turbine 2 combined.

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1.0 INTRODUCTION

DTE Energy's Environmental Management and Safety (EM&S) Ecology, Monitoring, and Remediation, performed emissions testing at Riverview Energy Systems, LLC, located in Riverview, Michigan. The fieldwork, performed on October 12 & 13, 2022 was conducted to satisfy requirements of the Michigan Renewable Operating Permit No. MI-ROP-M4469-2015a. Testing was performed pursuant to Title 40, *Code of Federal Regulations*, Part 60, Appendix A (40 CFR §60 App. A), Method 3A and ASTM D6348.

The fieldwork was performed in accordance with EPA Reference Methods, ASTM Methods, and EM&S's Intent to Test[1], which was approved by the Michigan Department of Environmental Quality (EGLE)[2]. The following EM&S personnel participated in the testing program: Mr. Mark Grigereit, Principal Engineer, Mr. Thomas Snyder, Senior Environmental Specialist, and Mr. Fred Meinecke, Environmental Specialist. Mr. Snyder was the project leader.

Mr. Joe Davis, Facility Technician, DTE Biomass Energy, provided on-site operation of the Turbines. Ms. Gina Angellotti and Mr. Jonathan Lamb, EGLE, reviewed the test plan and observed the testing.

2.0 SOURCE DESCRIPTION

The Riverview Energy Systems, LLC power generating facility, located at 20000 Grange Road, Riverview, MI is a power generating facility. The facility consists of two (2) landfill gas-fired Solar T-4701 turbines with associated electrical generators.

The purpose of the source is to utilize land fill gas from the Riverview Energy Systems Landfill to produce energy to be sent to the electrical grid. Each Turbine was tested while operating at greater than 90% of full load conditions.

See Figure 1 for a diagram of the Turbine sampling locations.

3.0 SAMPLING AND ANALYTICAL PROCEDURES

DTE Energy obtained emissions measurements in accordance with procedures specified in the USEPA *Standards of Performance for New Stationary Sources*. The sampling and analytical methods used in the testing program are indicated in the table below.

[1] EGLE, Test Plan, Submitted May 24, 2022. (Attached-Appendix A)
[2] EGLE, Acceptance Letter, September 28, 2022. (Attached-Appendix A)

Sampling Method	Parameter	Analysis
USEPA Method 3A	Oxygen	Instrumental Analyzer Method
USEPA Method 19	Mass Emissions Calculations	Heat Input
ASTM D6348	Methane, Ethane, NO_X, CO, and Moisture	FTIR

3.1 OXYGEN (USEPA METHOD 3A)

3.1.1 Sampling Method

Oxygen (O_2) emissions were evaluated using USEPA Method 3A, "Gas Analysis for Carbon Dioxide, Oxygen, Excess Air, and Dry Molecular Weight (Instrumental Analyzer Method)". The analyzer utilizes paramagnetic sensors. The O_2 sample was drawn from the exhaust of the FTIR instrument.

The EPA Method 3A sampling system (Figure 2) consisted of the following:

(1) Single-point sampling probe
(2) Flexible heated PTFE sampling line
(3) Air Dimensions Heated Head Diaphragm Pump
(4) MKS MultiGas 2030 FTIR spectrometer
(5) Servomex 1400 analyzer
(6) Appropriate calibration gases
(7) Data Acquisition System

3.1.2 Sampling Train Calibration

The O_2 analyzer was calibrated according to procedures outlined in USEPA Methods 3A. Zero, span, and mid-range calibration gases were introduced directly into the instruments to verify linearity. A zero and mid-range gas was then introduced through the entire sampling system to determine sampling system bias for each analyzer at the completion of each test.

3.1.3 Quality Control and Assurance

All sampling and analytical equipment was calibrated according to the guidelines referenced in Method 3A. Calibration gases were EPA Protocol 1 gases and the concentrations were within the acceptable ranges (40-60% mid range and span) specified in Method 7E. Calibration gas certification sheets are located in Appendix C.

3.1.4 Data Reduction

Data collected during the emissions testing was recorded at 10-second intervals and averaged in 1-minute increments. The O_2 emissions were recorded in percent (%) by volume on a dry basis. The 1-minute readings collected during the testing can be found in Appendix B.

3.2 MASS EMISSIONS (USEPA METHOD 19)

3.2.1 Sampling Method

Pollutant mass emissions were calculated using procedures used in USEPA Method 19. Fuel flow (scf/min) was recorded during each test period and reduced to 100 scf/hr. A gas sample of the fuel burned was taken and analyzed by DTE Gas Laboratory Services. GPA 2286 analysis was performed along with heat content (btu/scf), and specific gravity. An F-factor (F_d) was calculated based on the results of the fuel sample analysis. The gas analysis report is in Appendix D. Sample emissions calculations are in Appendix E. Process operational data is located in Appendix F.

3.3 OXIDES of NITROGEN, CARBON MONOXIDE, and HYDROGEN CHLORIDE (ASTM METHOD D6348)

3.3.1 Sampling Method

Oxides of Nitrogen, Carbon Monoxide, and Hydrogen Chloride emissions were evaluated using ASTM Method D6348, "Measurement of Vapor Phase Organic Emissions by Extractive Fourier Transform Infrared (FTIR)". Triplicate 60-minute test runs were performed on each turbine.

The ASTM D6348 sampling system (Figure 2) consisted of the following:

1) Single-point sampling probe (traversed to 3 points across the duct)
2) Flexible heated PTFE sampling line
3) Air Dimensions Heated Head Diaphragm Pump
4) MKS MultiGas 2030 FTIR spectrometer
5) Appropriate calibration gases
6) Data Acquisition System

Testing was conducted at three points across the diameter of the duct during each run. Sampling was performed simultaneously for O_2, NO_x, CO, and HCl.

The FTIR was equipped with a temperature controlled, 5.11 meter multipass gas cell maintained at 191°C. Gas flows and sampling system pressures were monitored using a rotometer and pressure transducer. All data was collected at 0.5 cm^{-1} resolution.

3.3.2 Sampling Train Calibration

The FTIR was calibrated per procedures outlined in ASTM Method D6348. Direct measurements of nitrogen, nitric oxide (NO), carbon monoxide (CO), and hydrogen chloride (HCl) gas standards were made at the test location to confirm concentrations.

A calibration transfer standard (CTS) was analyzed before and after testing at each location. The concentration determined for all CTS runs were within ±5% of the certified value of the standard. Ethylene was passed through the entire system to determine the sampling system response time and to ensure that the entire sampling system was leak-free.

Nitrogen was purged through the sampling system at each test location to confirm the system was free of contaminants.

NO, CO, and HCl gas standards were passed through the sampling system at each test location to determine the response time and confirm recovery.

NO, CO, and HCl spiking was performed to verify the ability of the sampling system to quantitatively deliver a sample containing NO, CO, and HCl from the base of the probe to the FTIR. Analyte spiking assures the ability of the FTIR to quantify NO, CO, and HCl in the presence of effluent gas.

As part of the spiking procedure, samples from each engine were measured to determine NO, CO, and HCl concentrations to be used in the spike recovery calculations. The determined sulfur hexafluoride (SF_6) concentration in the spiked and unspiked samples was used to calculate the dilution factor of the spike and thus used to calculate the concentration of the spiked NO, CO, and HCl. The following equation illustrates the percent recovery calculation.

$$DF = \frac{SF_{6(spike)}}{SF_{6(direct)}}$$

(Sec. 9.2.3 (3) ASTM Method D6348)

$$CS = DF * Spike_{dir} + Unspike\ (1 - DF)$$

(Sec. 9.2.3 (4) ASTM Method D6348)

DF = Dilution factor of the spike gas
SF_6(direct) = SF6 concentration measured directly in undiluted spike gas
SF_6(spike) = Diluted SF_6 concentration measured in a spiked sample

$Spike_{dir}$ = Concentration of the analyte in the spike standard measured by the FTIR directly
CS = Expected concentration of the spiked samples
Unspike = Native concentration of analytes in unspiked samples

All analyte spikes were introduced using an instrument grade stainless steel rotometer. The spike target dilution ratio was 1:10 or less. All NO, CO, and HCl spike recoveries were within the ASTM D6348 allowance of ±30%.

3.3.3 Quality Control and Assurance

As part of the data validation procedure, reference spectra are manually fit to that of the sample spectra and a concentration is determined. The reference spectra are scaled to match the peak amplitude of the sample, thus providing a scale factor. The scale factor multiplied by the reference spectra concentration is used to determine the concentration value for the sample spectra. Sample pressure and temperature corrections are then applied to compute the final sample concentration. The manually calculated results are then compared with the software-generated results. The data is then validated if the two concentrations are within ± 5% agreement. If there is a difference greater than ± 5%, the spectra are reviewed for possible spectral interferences or any other possible causes that might lead to inaccurately quantified data. PRISM Analytical Technologies, Inc. validated the FTIR data.

Data validation reports are in Appendix D.

3.3.4 Data Reduction

Each spectrum was derived from the coaddition of 64 scans, with a new data point generated approximately every one minute. The NO_x, CO, and HCl emissions were recorded in parts per million (ppm) dry volume basis. The moisture content was recorded in percent (%).

Emissions calculations are based on calculations located in USEPA Methods 7E, 10, and 19 and can be found in Appendix E. The NO_X emissions data was calculated as part per million at 15% oxygen (ppm @ 15% O_2), and % by volume at 15% oxygen (% by vol. @ 15% O_2) on a dry basis. CO and HCl emissions data collected during the testing was calculated as lbs/hr on a dry basis.

4.0 OPERATING PARAMETERS

The test program included the collection of generator load (kW), inlet air temperature (F), exhaust temperature (F), and fuel flow (scfm).

Operational data is located in Appendix F.

5.0 DISCUSSION OF RESULTS

Table Nos. 1 and 2 present the emissions testing results from Turbines 1 & 2 while operating at greater than 90% of full load conditions. The NO_x emissions are presented as ppm @ 15% O_2, and % by volume @ 15% O_2. CO and HCl emissions are presented in pounds per hour (lb/hr).

The Turbine 1 NOx emissions averaged 29.5 ppmv @ 15% O_2, and 0.0030 % by volume @ 15% O_2. The average NOx emissions are less than the permit limit of 0.0071% by volume @ 15% O_2. The Turbine 1 CO emissions averaged 3.48 lb/hr. The average CO emissions are less than the permit limit of 15.78 lb/hr.

The Turbine 2 NOx emissions averaged 24.0 ppmv @ 15% O_2, and 0.0030 % by volume @ 15% O_2. The average NOx emissions are less than the permit limit of 0.0071% by volume @ 15% O_2. The Turbine 2 CO emissions averaged 2.84 lb/hr. The average CO emissions are less than the permit limit of 15.78 lb/hr.

The Turbine 1 HCl emissions averaged 0.12 lb/hr. The Turbine 2 HCl emissions averaged 0.13 lb/hr. The Turbine 1 and Turbine 2 combined HCl emissions averaged 0.25 lb/hr which is less than the permit limit of 2.05 lb/hr.

Additional test data presented in the results tables for each test includes the kilowatts generated (kW), and the fuel flow (scfm).

Turbines 1 & 2 are in compliance with NO_x, CO, and HCl emissions limits stated in Michigan Renewable Operating Permit No. MI-ROP-M4469-2015a.

6.0 CERTIFICATION STATEMENT

"I certify that I believe the information provided in this document is true, accurate, and complete. Results of testing are based on the good faith application of sound professional judgment, using techniques, factors, or standards approved by the Local, State, or Federal Governing body, or generally accepted in the trade."

Thomas Snyder, QSTI

This report prepared by: _____

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Sr. Environmental Specialist
Ecology, Monitoring, and Remediation Group
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This report reviewed by: _____

Mr. Mark R. Grigereit, QSTI
Principal Engineer
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RESULTS TABLES

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TABLE NO. 1
NOx, CO, & HCl EMISSIONS TESTING RESULTS - EUTURBINE1 (Turbine 1)
Riverview Energy Systems, LLC
Riverview, Michigan
October 13, 2022

Test	Test Time	Engine Load (Kw)	Fuel Flow (scf/min)	Heat Input Rate (MMBtu/Hr)	Oxygen[1] $(\%)_{dry}$	NO_x Emissions[1] (ppmv @ 15 % $O_2)_{dry}$	NO_x Emissions[1] (% by volume @ 15 % $O_2)_{dry}$	CO Emissions[1] $(lb/hr)_{dry}$	HCl Emissions[1] $(lb/hr)_{dry}$
Test 1	9:11-10:11	3,347	1,780	52.1	16.1	29.6	0.0030	3.55	0.12
Test 2	10:31-11:31	3,342	1,783	52.2	16.1	29.1	0.0029	3.67	0.12
Test 3	11:54-12:54	3,332	1,775	52.0	16.0	29.9	0.0030	3.23	0.12
	Average:	*3,340*	*1,779*	*52.1*	*16.1*	*29.5*	*0.0030*	*3.48*	*0.12*
	Permit Limit:						***0.0071***	***15.78***	***2.05 ****

* HCl permit limit - Turbine 1 and Turbine 2 combined

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TABLE NO. 2
NOx, CO, & HCl EMISSIONS TESTING RESULTS - EUTURBINE2 (Turbine 2)
Riverview Energy Systems, LLC
Riverview, Michigan
October 12, 2022

Test	Test Time	Engine Load (Kw)	Fuel Flow (scf/min)	Heat Input Rate (MMBtu/Hr)	Oxygen[1] $(\%)_{dry}$	NO_x Emissions[1] $(ppmv\ @\ 15\ \%\ O_2)_{dry}$	NO_x Emissions[1] $(\%\ by\ volume\ @\ 15\ \%\ O_2)_{dry}$	CO Emissions[1] $(lb/hr)_{dry}$	HCl Emissions[1] $(lb/hr)_{dry}$
Test 1	8:45-9:45	3,055	1,737	50.8	16.3	24.7	0.0031	3.05	0.15
Test 2	10:01-11:01	3,052	1,732	50.7	16.3	23.6	0.0030	2.72	0.11
Test 3	11:18-12:18	3,028	1,707	50.0	16.3	23.7	0.0030	2.75	0.11
	Average:	*3,045*	*1,725*	*50.5*	*16.3*	*24.0*	*0.0030*	*2.84*	*0.13*
	Permit Limit:						***0.0071***	***15.78***	***2.05 ****

* HCl permit limit - Turbine 1 and Turbine 2 combined

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FIGURES

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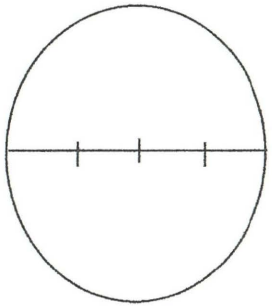
Figure 1 – Stack Drawing and Exhaust Sampling Point Location
Riverview Energy Systems – EUTURBINE1 & EUTURBINE2
October 12-13, 2022

Stack Diameter 30"



Measurement Points

Points	Distance From Inner Wall (in.)
1	5.01
2	15
3	24.99

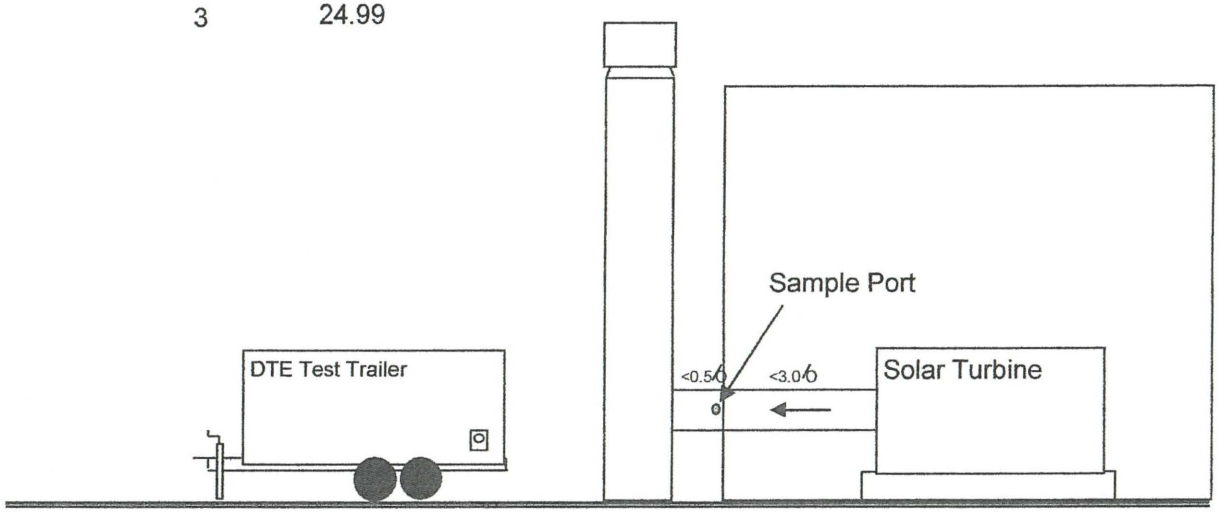


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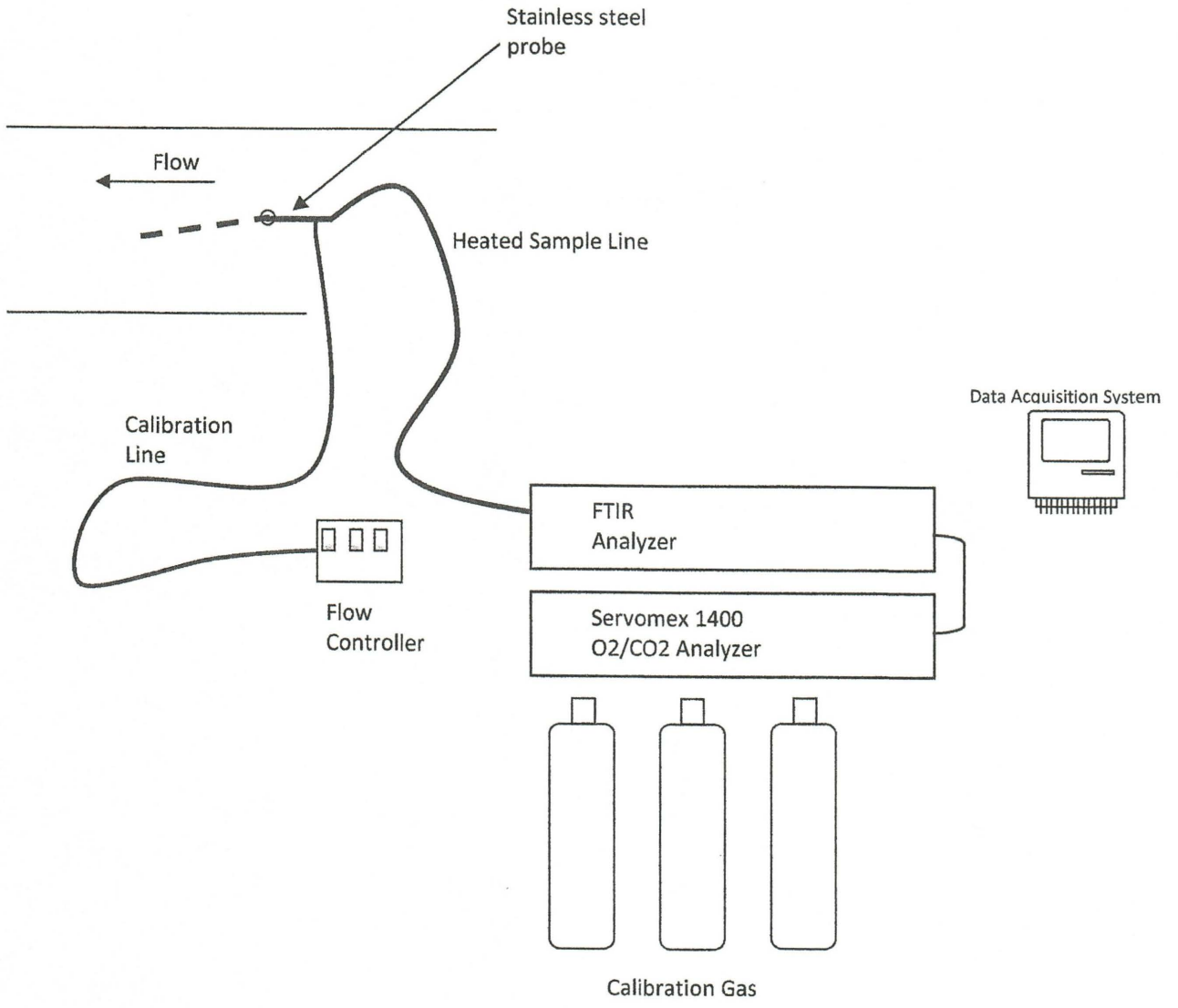
Figure 2 – ASTM D6348/3A
EUTURBINE1 & EUTURBINE2
Willow Compressor Station
October 12&13, 2022



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APPENDIX A

EGLE TEST PLAN