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Cargill Salt, Inc.
SRN: A6240
St. Clair, Michigan

RATA Emissions Test Report
EUBOILER24

Prepared For:
Cargill Salt, Inc.
916 South Riverside Avenue
St. Clair, Michigan 48079

Prepared By:
Chase Young Environmental Testing Inc
28744 Groveland Street
Madison Heights, MI 48071

CYET Project Number: 241679
Test Date: June 7, 2024

EXECUTIVE SUMMARY

Chase Young Environmental Testing Inc (CYET) was retained by Cargill Salt, Inc. (Cargill) [SRN: A6240] to conduct a single load relative accuracy test audit (RATA) of one continuous emission monitoring system (CEMS) serving EUBOILER24 at the Cargill facility located in Saint Clair, Michigan. The emissions test program was conducted on June 7, 2024 and was performed in accordance with CYET project number 241679 Emission Test Plan as well as the Michigan Department of Environment, Great Lakes, and Energy (EGLE) Air Quality Division (AQD) acceptance letter.

The emissions test program was conducted to determine compliance with Permit To Install (PTI) No. 167-14C issued by the Michigan department of Environment, Great Lakes, and Energy (EGLE). EUBOILER24 is subject to the emission limits of the PTI No. 167-14C and 40 CFR Part 60, Subpart Db. The emission limit for EUBOILER24 is 0.20 lb/MMBtu.

Table 1
EUBOILER24 Overall Emission Summary
Test Date: June 7, 2024

Source Name	RM NO_x lb/MMBTU	CEMS NO_x lb/MMBTU	% Relative Accuracy	40 CFR Part 60 % Relative Accuracy Limit
EUBOILER24	0.028	0.027	6.2	20

Cargill analyzers: CAI NOx analyzer, SN 2403024
Brand-Gaus O_2 analyzer, SN 11878

TABLE OF CONTENTS

1. INTRODUCTION 5
   - 1.A Identification, Location, and Dates of Test 5
   - 1.B Purpose of Testing 5
   - 1.C Source Description 5
   - 1.D Test Program Contacts 6
2. SUMMARY OF RESULTS 7
   - 2.A Operating Data 8
   - 2.B Applicable Permit 8
   - 2.C Results 8
3. SOURCE DESCRIPTION 8
   - 3.A Process Description 8
   - 3.B Process Flow Diagram 8
   - 3.C Raw and Finished Materials 8
   - 3.D Process Capacity 8
   - 3.E Process Instrumentation 9
4. SAMPLING AND ANALYTICAL PROCEDURES 9
   - 4.A Sampling Train and Field Procedures 9
   - 4.B Recovery and Analytical Procedures 10
   - 4.C Sampling Ports 10
   - 4.D Traverse Points 10
5. TEST RESULTS AND DISCUSSION 10
   - 5.A Results Tabulation 11
   - 5.B Discussion of Results 11
   - 5.C Sampling Procedure Variations 11
   - 5.D Process or Control Device Upsets 12
   - 5.E Control Device Maintenance 12
   - 5.F Re-Test 12
   - 5.G Audit Sample Analyses 12
   - 5.H Calibration Sheets 12
   - 5.I Sample Calculations 12
   - 5.J Field Data Sheets 13
   - 5.K Laboratory Data 13

TABLE OF CONTENTS (continued)

APPENDIX A – EMISSION RESULTS TABLES

Table 1 EUBOILER24 Overall Emission Summary
Table 2 Test Personnel
Table 3 EUBOILER24 NOx lb/mmbtu RATA Results
Table 4 EUBOILER 24 Process Data Summary

APPENDIX B - FIGURES

Figure 1 – EUBOILER24 Exhaust Stack Diagram
Figure 2 – USEPA Method 3A/7E Sampling Train Diagram

ADDITIONAL APPENDICES

Appendix C Field and Computer-Generated Raw Data and Field Notes
Appendix D Equipment Calibration and Span Gas Documents
Appendix E Example Calculations
Appendix F Process Data

1. Introduction

Chase Young Environmental Testing Inc (CYET) was retained by Cargill Salt, Inc. (Cargill) [SRN: A6240] to conduct a single load relative accuracy test audit (RATA) of one continuous emission monitoring system (CEMS) serving EUBOILER24 at the Cargill facility located in Saint Clair, Michigan. The emissions test program was conducted on June 7, 2024 and was performed in accordance with CYET project number 241679 Emission Test Plan as well as the Michigan Department of Environment, Great Lakes, and Energy (EGLE) Air Quality Division (AQD) acceptance letter.

The emissions test program was conducted to determine compliance with Permit To Install (PTI) No. 167-14C issued by the Michigan department of Environment, Great Lakes, and Energy (EGLE). EUBOILER24 is subject to the emission limits of the PTI No. 167-14C and 40 CFR Part 60, Subpart Db. The emission limit for EUBOILER24 is 0.20 lb/MMBtu.

1.a Identification, Location, and Dates of Test

Sampling and analysis for the emission test program was conducted on June 7, 2024 at the Cargill facility in Saint Clair, Michigan.

Testing on the EUBOILER24 consisted of twelve 21-minute test runs. A stratification test was performed on June 5, 2024.

1.b Purpose of Testing

The emissions test program was conducted to determine compliance with Permit To Install (PTI) No. 167-14C issued by the Michigan department of Environment, Great Lakes, and Energy (EGLE). EUBOILER24 is subject to the emission limits of the PTI No. 167-14C and 40 CFR Part 60, Subpart Db. The emission limit for EUBOILER24 is 0.20 lb/MMBtu. Performance Specification 2 specifies the RA must be $\leq$ 20%.

1.c Source Description

A natural gas-fired boiler, identified as EUBOILER24 in Permit to Install No. 167-14C, with a maximum rated heat input of 250 million British thermal units per hour(MMBtu/hour) and equipped with low NOx burners.

Figure1 presents the test ports and traverse/sampling point locations used.

1.d Test Program Contacts

The contacts for the source and test report are:

Cargill Salt, Inc.

Neil Byers, MS, CSP
EHS Supervisor II
Cargill Salt, Inc.
810-989-7590
Neil_Byers@cargill.com

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CYET

Matthew Young, QSTI
Senior Project Manager
586-744-9133
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Brandon Chase, QSTI
Senior Environmental Engineer
248-506-0107
bchase@cyetinc.com

Names and affiliations for personnel who were present during the testing program are summarized by Table 2.

Table 2
Test Personnel

Name, Title, and Email	Affiliation	Telephone
Neil Byers, MS, CSP EHS Supervisor II Neil_Byers@cargill.com	Cargill Salt, Inc. 916 South Riverside Avenue St. Clair, Michigan 48079	(810) 989-7590
Mr. Donovan Hughes EHS Specialist II Donovan_Hughes@cargill.com	Cargill Salt, Inc. 916 South Riverside Avenue St. Clair, Michigan 48079	(810) 989-7015
Mr. Chris Occhipinti Project Manager cocchipinti@nthconsultants.com	NTH Consultants 3300 Eagle Run Dr. NE, Suite 202 Grand Rapids, MI 49525	(616) 951-4774
Mr. Dave Muz Field Service Technician	ESC Spectrum	(989) 670-2246
Mr. Brandon Chase Senior Environmental Engineer bchase@cyetinc.com	CYET 28744 Groveland Street Madison Heights, MI 48071	(248) 506-0107
Mr. Matthew Young Senior Project Manager myoung@cyetinc.com	CYET 28744 Groveland Street Madison Heights, MI 48071	(586) 744-9133
Ms. Noshin Khan Environmental Engineer khanN5@michigan.gov	Air Quality Division – Warren District Office 27700 Donald Ct, Warren, MI 48092 Michigan Department of Environment, Great Lakes, and Energy	(586) 536-1197
Mr. Andrew Riley Environmental Quality Analyst Rileya8@michigan.gov	Air Quality Division Michigan Dept of Environment, Great Lakes & Energy	(586) 565-7379
Ms. Amanda Battershell Environmental Quality Analyst BattershellA1@michigan.gov	Air Quality Division Michigan Dept of Environment, Great Lakes & Energy	(517) 388-4706

2. Summary of Results

Sections 2.a through 2.d summarize the results of the emissions compliance test program.

2.a Operating Data

Process data monitored during the emissions test program include:

- NOx emission rate (lb/MMBtu),
- O2 content of exhaust gas,
- natural gas usage, (kscf/hr)

Process operating data is included in Appendix F.

2.b Applicable Permit

The applicable permit for this emissions test program is PTI No. 167-14C.

2.c Results

The overall results of the emission test program are summarized by Table 1 (see Section 5.a, and Appendix A). Emission limits are presented in section 1.b. Detailed emission results are presented in Table 3 in Appendix A.

3. Source Description

Sections 3.a through 3.e provide a detailed description of the process.

3.a Process Description

A natural gas-fired boiler, identified as EUBOILER24 in Permit to Install No. 167-14C, with a maximum rated heat input of 250 million British thermal units per hour(MMBtu/hour) and equipped with low NOx burners.

3.b Process Flow Diagram

Due to the simplicity of the process, a process flow diagram is not necessary.

3.c Raw and Finished Materials

Raw material used is natural gas. The finished product is electricity.

3.d Process Capacity

EUBOILER24 has a maximum rated heat input of 250 million British thermal units per hour (MMBtu/hour). The boiler was operated at greater than 50% of normal load during the rata testing, as per the load requirements of 40 CFR, Part 60.

3.e Process Instrumentation

Process data monitored during the emissions test program include:

- NOx emission rate (lb/MMBtu),
- O2 content of exhaust gas,
- natural gas usage, (kscf/hr)

Process operating data is included in Appendix F.

4. Sampling and Analytical Procedures

Sections 4.a through 4.d provide a summary of the sampling and analytical procedures used.

4.a Sampling Train and Field Procedures

Sampling and analysis procedures followed the methods codified at 40 CFR 60, Appendix A:

- Method 1 - *"Sample and Velocity Traverses for Stationary Sources"* was used to determine the sampling locations and the stack traverse points.
- Method 3A – *"Determination of Oxygen and Carbon Dioxide Concentrations in emissions from stationary sources" (Instrumental Analyzer Procedure)* was used to determine the oxygen concentration of the exhaust gas.
- Method 7E – *"Determination of Nitrogen Oxides Emissions from Stationary Sources"(Instrumental Analyzer Procedure)* was used to determine the nitrogen oxide concentration of the exhaust gas.

USEPA Method 1 was utilized to determine the necessary sampling points in which to collect the air pollutants. Twelve sampling points were used for the stratification test which was performed on June 5, 2024.

The NOx and O_2 content of the gas stream was measured using a Teledyne API 200EH NOx and O_2 gas analyzer. The gas stream was drawn through a stainless-steel probe with a heated in-line filter to remove any particulate, a heated Teflon® sample line, through a refrigerated Teflon® sample conditioner to remove the moisture from the sample before it entered the analyzer. Data was recorded on a PC equipped with data acquisition software. Recorded NOx and O_2 concentrations were averaged and reported for the duration of each test (as drift corrected per Method 7E). A drawing of the sampling train used for the testing program is presented as Figure 2.

In accordance with Method 7E, a 3-point (zero, mid, and high) bias check and calibration check was performed on the analyzer prior to initiating the test program. Following each test run, a 2-point (zero and high) calibration drift check was performed. The analyzer was operated at the 0-25% range for O_2 and 0-100 ppm range for NOx.

Prior to the field test, a NO_2 to NO conversion efficiency test was performed.

A stratification test was performed on June 5, 2024, as specified in Method 7E. The probe was marked for 12 sampling points using Method 1. Each point was sampled for 4 minutes (more than twice the sample response time of 100 seconds), for a total of 48 minutes. The NOx concentrations were averaged for each sample point. NOx concentrations for each sampling point were then compared with the overall average NOx concentration. None of the sampling points differed by greater than 10% from the overall average, therefore three sampling points on a line passing through the centroidal area was used for each RATA run.

For the analyzer calibrations, calibration gases were mixed to desired concentrations using an Environics Series 4040 Computerized Gas Dilution System. The Series 4040 consists of a single chassis with four mass flow controllers. The mass flow controllers are factory-calibrated using a primary flow standard traceable to the United States National Institute of Standards and Technology (NIST). Each flow controller utilizes an 11-point calibration table with linear interpolation, to increase accuracy and reduce flow controller nonlinearity. A field quality assurance check of the system was performed pursuant to Method 205 by setting the diluted concentration to a value identical to a Protocol 1 calibration gas and then verifying that the analyzer response is the same with the diluted gas as with the Protocol 1 gas.

4.b Recovery and Analytical Procedures

This test program did not include laboratory samples, consequently, sample recovery and analysis are not applicable to this test program.

4.c Sampling Ports

A diagram of the stack indicating traverse point and sampling locations and stack dimensions is included as Figure 1.

4.d Traverse Points

A diagram of the stack indicating traverse point and sampling locations and stack dimensions is included as Figure 1.

5. Test Results and Discussion

Sections 5.a through 5.k provide a summary of the test results.

5.a Results Tabulation

The overall results of the emissions test program are summarized by Table 1. Detailed results for the emissions test program are summarized by Table 2 in Appendix A.

Table 1
EUBOILER24 Overall Emission Summary
Test Date: June 7, 2024

Source Name	RM NO_x lb/MMBTU	CEMS NO_x lb/MMBTU	% Relative Accuracy	40 CFR Part 60 % Relative Accuracy Limit
EUBOILER24	0.028	0.027	6.2	20

Cargill analyzers: CAI NOx analyzer, SN 2403024
Brand-Gaus O_2 analyzer, SN 11878

5.b Discussion of Results

All test results are in compliance with permit limits.

5.c Sampling Procedure Variations

During the stratification test, the second port sampled was obstructed by a wall. CYET elected to complete the 12-Point traverse by using two 3/8" probes connected together via swagelock fittings in order to collect data at each sampling point (both probes connected for points 4-6, and a single smaller probe for points 1-3). After successful completion of the stratification test, this combined probe was used for the RATA testing. During Run 3 CYET personnel noticed the RM oxygen concentration was fluctuating and was greater than the concentration measured by Cargill's CEM. CYET suspects that there was an intermittent leak in the probe that was pulling in ambient air at the swagelock connection when out of the stack. After discussing the issue with onsite EGLE representatives, CYET decommissioned the faulty CEM probe and replaced it with a new single piece of 3/8" stainless steel tubing. A calibration was performed after replacing the probe, and the RATA was resumed at Run 4. Runs 1-3 have been flagged and discarded from the RATA calculations.

After replacing the CEM probe CYET received permission from the EGLE on site representative, Andrew Riley, to perform three RATA runs consecutively without stopping to perform calibrations, i.e. a single 63-minute test run was split up into three 21-minute RATA runs. Runs 4-6, runs 7-9, and runs 10-12 were all conducted this way.

Cargill's CEM timestamp is offset 1 hour and 6 minutes earlier than CYET's timestamp (which is synchronized to UTC). See below for CYET timestamps for the start of each run, and the corresponding Cargill timestamp.

	CYET time	Cargill time
Run 1	7:58	6:52
Run 2	8:28	7:22
Run 3	9:00	7:54
Run 4	9:46	8:40
Run 5	10:07	9:01
Run 6	10:28	9:22
Run 7	10:57	9:51
Run 8	11:18	10:12
Run 9	11:39	10:33
Run 10	12:10	11:04
Run 11	12:31	11:25
Run 12	12:52	11:46

5.d Process or Control Device Upsets

No upset conditions occurred during testing.

5.e Control Device Maintenance

There was no control equipment maintenance performed during the emissions test program.

5.f Re-Test

The emissions test program was not a re-test.

5.g Audit Sample Analyses

No audit samples were collected as part of the test program.

5.h Calibration Sheets

Relevant equipment calibration documents are provided in Appendix D.

5.i Sample Calculations

Sample calculations are provided in Appendix E.

5.j Field Data Sheets

Field documents relevant to the emissions test program, including one-minute averages, are presented in Appendix C.

5.k Laboratory Data

There are no laboratory results for this test program.

MEASUREMENT UNCERTAINTY STATEMENT

Both qualitative and quantitative factors contribute to field measurement uncertainty and should be taken into consideration when interpreting the results contained within this report. Whenever possible, CYET personnel reduce the impact of these uncertainty factors through the use of approved and validated test methods. In addition, CYET personnel perform routine instrument and equipment calibrations and ensure that the calibration standards, instruments, and equipment used during test events meet, at a minimum, test method specifications as well as the specifications of our Quality Manual and ASTM D 7036-04. The limitations of the various methods, instruments, equipment, and materials utilized during this test have been reasonably considered, but the ultimate impact of the cumulative uncertainty of this project is not fully identified within the results of this report.

REPORT SIGNATURES

CYET operated in conformance with the requirements of ASTM D7036-04 during this emissions test project and this emissions test report:

This report was prepared by: _____
Brandon Chase
Senior Environmental Engineer

This report was reviewed by: _____
Matthew Young
Senior Project Manager

Appendix A – Emission Results Tables

Table 1
EUBOILER24 Overall Emission Summary
Test Date: June 7, 2024

Source Name	RM NO_x lb/MMBTU	CEMS NO_x lb/MMBTU	% Relative Accuracy	40 CFR Part 60 % Relative Accuracy Limit
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Mr. Chris Occhipinti Project Manager cocchipinti@nthconsultants.com	NTH Consultants 3300 Eagle Run Dr. NE, Suite 202 Grand Rapids, MI 49525	(616) 951-4774
Mr. Dave Muz Field Service Technician	ESC Spectrum	(989) 670-2246
Mr. Brandon Chase Senior Environmental Engineer bchase@cyetinc.com	CYET 28744 Groveland Street Madison Heights, MI 48071	(248) 506-0107
Mr. Matthew Young Senior Project Manager myoung@cyetinc.com	CYET 28744 Groveland Street Madison Heights, MI 48071	(586) 744-9133
Ms. Noshin Khan Environmental Engineer khanN5@michigan.gov	Air Quality Division – Warren District Office 27700 Donald Ct, Warren, MI 48092 Michigan Department of Environment, Great Lakes, and Energy	(586) 536-1197
Mr. Andrew Riley Environmental Quality Analyst Rileya8@michigan.gov	Air Quality Division Michigan Dept of Environment, Great Lakes & Energy	(586) 565-7379
Ms. Amanda Battershell Environmental Quality Analyst BattershellA1@michigan.gov	Air Quality Division Michigan Dept of Environment, Great Lakes & Energy	(517) 388-4706

Table 3
Summary of NOx lb/mmbtu RATA Results
Cargill Salt, Inc
June 7, 2024

EUBOILER24

NO_X Lb/MMBtu Relative Accuracy

Relative Accuracy: **6.2**

Run #	Time	RM Lb/MMBtu	CEM Lb/MMBtu	Diff	%Diff
1	**758-819**	**0.027**	**0.027**	**0.0003**	**0.01**
2	**828-849**	**0.027**	**0.027**	**0.0004**	**0.01**
3	**900-921**	**0.028**	**0.027**	**0.0006**	**0.02**
4	946-1007	0.028	0.027	0.0006	0.02
5	1007-1028	0.028	0.027	0.0013	0.05
6	1028-1049	0.028	0.027	0.0014	0.05
7	1057-1118	0.029	0.027	0.0018	0.06
8	1118-1139	0.029	0.027	0.0019	0.07
9	1139-1200	0.029	0.027	0.0020	0.07
10	1210-1231	0.028	0.027	0.0010	0.04
11	1231-1252	0.028	0.027	0.0013	0.04
12	1252-1313	0.028	0.027	0.0014	0.05
		0.0284	0.0270	0.0014	0.0490

Sdev	0.0005
CC	0.0004
RA (based on Ref. Meth.)	**6.2%**

Confidence Coefficient =
n=9
t = 2.306

$$cc = t_{0.975} \frac{S_d}{\sqrt{n}}$$

P.S. 2 Equation 2-5

Standard Deviation =

$$S_d = \left[\frac{\sum_{i=1}^{n} d_i^2 - \frac{\left(\sum_{i=1}^{n} d_i\right)^2}{n}}{n-1}\right]^{1/2}$$

P.S. 2 Equation 2-4

Relative Accuracy =
RM=Reference Monitor

$$RA = \frac{|\bar{d}| + |cc|}{\overline{RM}} x100$$

P.S. 2 Equation 2-6

RA calculated as specified in Performance Specification 2, Appendix B, 40 CFR 60 - Equation 2-4

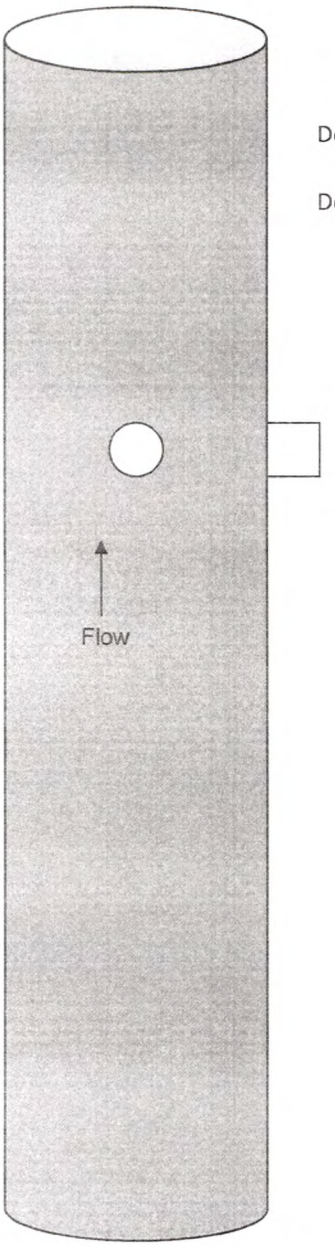
As specified in P.S. 2, subsection 8.4.4, three sets of test runs may be rejected, these rejected test runs are high-lighted in the table

Used Method 19 Eq. 19-1

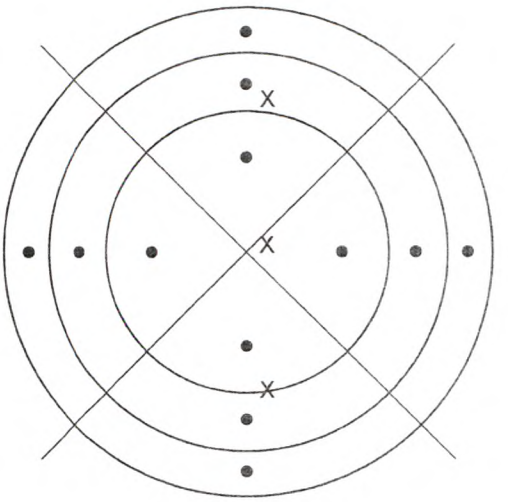
Table 4
EUBOILER24 Process Data Summary
Test Date: June 7, 2024

Test Number	Fuel Usage (KSCFH)	Heat Input (MMBtu/hr)	Boiler Load (%)
1	164.3	168.57	67.4%
2	164.8	169.08	67.6%
3	166.0	170.32	68.1%
4	165.8	170.11	68.0%
5	166.0	170.32	68.1%
6	165.5	169.80	67.9%
7	164.7	168.98	67.6%
8	165.4	169.70	67.9%
9	166.5	170.83	68.3%
10	164.3	168.57	67.4%
11	163.4	167.65	67.1%
12	165.1	169.39	67.8%
Average	165.2	169.44	67.8%

Appendix B – Figures



Diameter	63	inches
Upstream >	180	inches
Downstream >	180	inches
Upstream >	2.9	diameters
Downstream >	2.9	diameters



Stratification Test

Traverse Point #	Distance (inches)
1	2.77
2	9.20
3	18.65
4	44.35
5	53.80
6	60.23

CEM RATA

Traverse Point #	Distance (inches)
1	10.5
2	31.5
3	52.5

Figure 1

EUBOILER24 Exhaust Stack Traverse Point Diagram

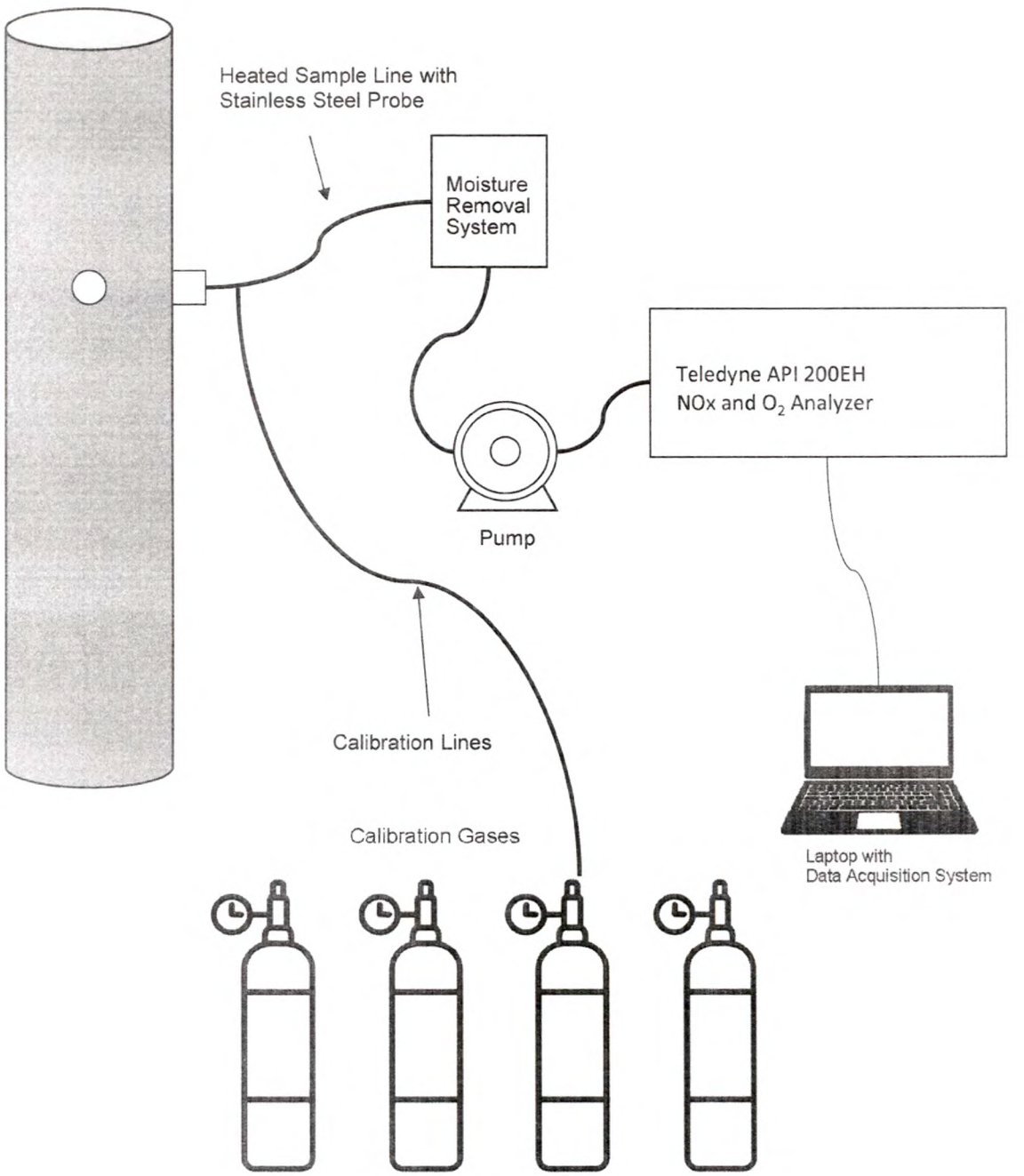


Figure 2

USEPA Method 3A/7E Sampling Train