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40 CFR Part 75 Flow CEMS Relative Accuracy Test Audit Report

EUBOILER

Grayling Generating Station Limited Partnership
4400 West Four Mile Road
Grayling, Michigan 49738
SRN: N2388
FRS: 110028027917
ORIS: 10822

November 20, 2023

Test Dates: October 16 and 17, 2023

Test Performed by the Consumers Energy Company
Regulatory Compliance Testing Section
Air Emissions Testing Body
Laboratory Services Section
Work Order No. 4103642
Revision No. 0

CERTIFICATION FOR 40 CFR PART 75 TEST REPORT

(To be completed by authorized AETB firm representative and included in source test report)

Facility ID: ORIS: 10822, SRN: N2388 Date(s) Tested October 16 and 17, 2023

Facility Name: Grayling Generating Station Limited Partnership

Facility Address: 4400 West Four Mile Road, Grayling, MI 49738

Equipment Tested: EUBOILER Volumetric Flow CEMS

AETB Firm: CECo/RCTS AETB

Business Address: 135 W. Trail St., Jackson MI 49201

Phone: (616) 738-3234 Email: thomas.schmelter@cmsenergy.com

As the legally authorized representative of the RCTS AETB, I certify that I have reviewed this test report in conjunction with the relevant Quality Manual Appendix D checklist. Having checked each item, I believe the information provided in this test report is true, accurate, and complete.

Signature: _____ Date: 11/20/2023

Name: Thomas R. Schmelter Title: AETB Technical Director

Phone: (616) 738-3234 Email: thomas.schmelter@cmsenergy.com

RELATIVE ACCURACY TEST REPORT CHECKLIST

	Description (Typical location(s) in report) [ASTM D 7036-04 Section Reference]
☒	Title (Title Page) [15.3.1]
☒	AETB name & address (QM App. D pg. D-2) [15.3.2]
☒	Unique identification number on each page and a clear identification of the end of the report (Headers & Footers; "End of Report" page) [15.3.3]
☒	Name and address of the customer (Title Page; QM App. D pg. D-2) [15.3.4]
☒	Date(s) the testing was performed (Title page; Introduction; QM App. D pg. D-2) [15.3.10]
☒	Identification of the units tested (Title page; Introduction) [15.3.9]
☒	Identification of regulatory personnel that observed testing (Introduction; Appendix D1) [Note 13]
☒	Clear identification of the pollutants/parameters tested (Summary & Discussion) [15.3.5]
☒	Identification of the test methods used (Sampling and Analytical Procedures) [15.3.8]
☒	Identification of the sampling location, including diagrams, sketches, or photographs (Figures) [15.3.6]
☒	Detailed process description and process operations for each test run (Source and Monitor Description; Appendix B CEMS data sheets) [15.3.7]
☒	Reference to the test protocol and procedures used by the AETB (Introduction) [15.3.11]
☒	Test results and units of measure (Summary and Discussion) [15.3.12]
☒	Information on specific test conditions, including text description of process operations for each test run and description of any operational issues with the unit or the control device (Discussion of Test Results) [15.3.14]
☒	Discussion of the test results including the uncertainty associated with the test and discussion of possible errors or limiting conditions (Quality Assurance Procedures) [15.3.15]
N/A ☐	Reference Method analyzer calibrations for each RM gas RATA run. (Appendix B) [15.3.16]
☒	Raw plant CEMS data for each RATA run and each CEMS component (i.e. all gas analyzers, flow monitors). (Appendix B) [15.3.17]
N/A ☐	Raw Reference Method DAS data for each RM gas RATA run. (Appendix B) [15.3.17]
☒	CEMS "Operating Load Analysis" report. (Appendix C) [15.3.11]
☒	Meter box post-test calibration results (Appendix C) [15.3.16]
N/A ☐	NO_x converter check results (Appendix C) [15.3.16]
☒	Pitot calibrations and inspections (Appendix C) [15.3.16]
☒	FRRS/manometer/Magnehelic gage calibration results (Appendix C) [15.3.16]
N/A ☐	Reference Method calibration gas certificates of analysis (Appendix C) [15.3.16]
☒	RATA field data sheets verified against spreadsheet data (Field data sheets in project file) [15.3.17]
☒	RCTS AETB Letter of Certification (Appendix D1) [15.3.19]
☒	Completed QM Appendix F – "AETB Field Test Signature Form" (Appendix D1) [3.1.3; 3.1.9; 3.1.14; 8.3; Note 14; 12.2; 12.3; 12.4; 14.1.1]
☒	Deviations from, additions to, or exclusions from the test protocol, test methods, or AETB Quality Manual entered on QM App. F pg. F-2 (Appendix D2) [15.3.13]
☒	Names, titles, and signatures of persons authorizing the test report – "QM App. D pg. D-2" (After Title Page) [15.3.18]
☒	QSTI certificates for Qualified Individuals overseeing/performing the test (Appendix D2)
☒	Table of Contents is correct (Report Body) [Neatness & professionalism]
☒	Report Headers & Footers are correct (Report Body) [Neatness & professionalism]
☒	RM and CEMS run data in correct order (Appendix B) [Neatness & professionalism]

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1.0 INTRODUCTION

Consumers Energy Company (CECo) Regulatory Compliance Testing Section (RCTS) conducted a continuous emission monitoring system (CEMS) quality assurance (QA) audit associated with emission unit EUBOILER operating at the Grayling Generating Station located in Grayling, Michigan.

The relative accuracy test audit (RATA) was conducted on October 16 and 17, 2023, to satisfy the periodic QA required in the consent order entered by the Michigan Department of Environment, Great Lakes, and Energy (EGLE), Air Quality Division (AQD) and Grayling Generating Station Limited Partnership on July 28, 2022 (EGLE AQD ACO 2022-14). The CEMS are installed in the EUBOILER exhaust to satisfy U.S. EPA Code of Federal Regulations, Chapter 40, Part 75 (40 CFR Part 75) monitoring requirements, the Cross State Air Pollution Rule (CSAPR), and 40 CFR Part 60, Subpart Db, as specified in State of Michigan Renewable Operating Permit (ROP) MI-ROP-N2388-2014a.

A test protocol describing the sampling, calibration, and QA procedures in USEPA Reference Methods (RM) 1, 2, 2H, 3, and ALT-008 was submitted September 12, 2023, to EGLE offices. The protocol was subsequently approved in a letter dated October 2, 2023, by EGLE representative Daniel Droste.

The CEMS audit was performed by RCTS representatives Thomas Schmelter and David Kawasaki. Kathryn Cunningham, Principal Environmental Engineer with NorthStar Clean Energy, coordinated the tests with applicable plant personnel and provided CEMS data. Daniel Droste and Becky Radulski witnessed portions of the testing.

RCTS operates as a self-accredited Air Emission Testing Body (AETB) as described in the AETB Letter of Certification contained in Appendix D of this report and is accordingly qualified to conduct 40 CFR Part 75 test programs. RCTS' AETB program is developed in accordance with the American Society for Testing and Materials (ASTM) D 7036-04, *Standard Practice for Competence of Air Emissions Testing Bodies*, in which the AETB is required during test projects to provide at least one qualified individual (QI), qualified in the specific methods for that project, to be on-site at all times. RCTS representative Thomas Schmelter met these requirements and assumed the on-site lead QI role for the duration of the flow CEMS audit.

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Table 1-1 presents the test program organization, major lines of communication, and names of responsible individuals.

Table 1-1
Contact Information

Program Role	Contact	Address
EPA Regional Contact	Michael Compher 312-886-5745 compher.michael@epa.gov	USEPA Region 5 77 W. Jackson Blvd. (AR-18J) Chicago, IL 60604
Regulatory Agency Representative	Jeremy Howe Technical Programs Unit Supervisor 231-878-6687 howej1@michigan.gov	EGLE Technical Programs Unit 525 W. Allegan, Constitution Hall, 2nd Floor S Lansing, Michigan 48933-1502
Regulatory Agency Representative	Becky Radulski Environmental Engineer 989-217-0051 radulskir@michigan.gov	EGLE Gaylord District Office 2100 West M-32 Gaylord, Michigan 49735-9282
Regulatory Agency Representative	Mr. Daniel Droste Environmental Quality Analyst 989-225-6052 drosted3@michigan.gov	EGLE Bay City District Office 401 Ketchum Street, Suite B Bay City, Michigan 48708-5430
Primary Designated Representative	Edward Going Senior Manager Plant 989-348-4575 edward.going@cmsenergy.com	NorthStar Clean Energy Grayling Generating Station Limited Partnership 4400 West 4 Mile Road Grayling, Michigan 49738
Alternate Designated Representative	Richard Laur Environmental and Compliance Manager 989-348-4575 x112 richard.laur@cmsenergy.com	NorthStar Clean Energy Grayling Generating Station Limited Partnership 4400 West 4 Mile Road Grayling, Michigan 49738
Field Operations Environmental Compliance	Kathryn Cunningham Principal Environmental Engineer 517-768-3462 kathryn.cunningham@cmsenergy.com	Consumers Energy Company / NorthStar Clean Energy Howell Service Center (HGO-107A-NOA) 1000 Grand Oaks Dr. Howell, Michigan 48843
Test Team Representative	Thomas Schmelter, QSTI Sr. Engineering Technical Analyst 616-738-3234 thomas.schmelter@cmsenergy.com	Consumers Energy Company L&D Training Center 17010 Croswell Street West Olive, Michigan 49460

2.0 SUMMARY AND DISCUSSION

The Grayling Generating Station volumetric airflow CEMS relative accuracy (RA) results indicate the CEMS meet the annual RA frequency standards in 40 CFR 75, Appendix A.

Results are presented in Table 2-1 and Appendix B of this report. Applicable sample calculations are presented in Appendix A.

2.1 WALL ADJUSTMENT FACTOR

For both the high-load and low-load testing at EUBOILER, the applicable default wall adjustment factor (WAF) of 0.9950 (dimensionless) was used to adjust the flue gas velocity and calculate volumetric flow rate. Accordingly, when reviewing the volumetric flow RATA

results, note the volumetric flowrate corrected for WAF is used in relative accuracy calculations.

2.2 VOLUMETRIC FLOWRATE

The flow monitoring system consists of a Sick Model FLSE100-PR ultrasonic air flow probe installed in the EUBOILER exhaust stack. Two high frequency ultrasonic sender/receiver transducer units are installed opposite one another on a probe situated at a 45° angle within the exhaust stack. Pulses of sound are emitted between the sender/receiver units and the transit time is used to calculate the gas flow rate. The signal transducer produces an electronic signal to the control unit and output is captured in a VIM Technologies CEMLink6 data acquisition system. The flow monitor is used in conjunction with diluent measurements to calculate heat input rate, as well as to calculate pollutant mass emission rates.

As part of the RATA test program, trial flow RATA runs were performed on October 16 and 17, 2023, at high and low operating loads, respectively, for the purpose of evaluating and optimizing the flow CEMS if necessary, as allowed in 40 CFR 75, Appendix B §2.3.2(b)(2). The trial flow data was included in the 12-run flow RATA results at both loads, as the individual trial run results from the EUBOILER flow monitor were within the ±10% difference specification in 40 CFR 75, § 75.20(b)(3)(vii)(E).

The flow RATA results for the CEMS system met the annual reduced test frequency incentive standard of ≤7.5% in 40 CFR 75, Appendix B §2.3.1.2(c). Table 2-1 summarizes the volumetric airflow RATA results.

Table 2-1
Summary of Volumetric Airflow RATA Results

CEMS Make/ Model	CEMS Duct Location & Serial Number	RATA Criteria	Required RATA Performance	Actual RATA Performance
Sick Model FLOWSIC 100 V1.8	EUBOILER SN: 22248469	Low (normal) Load	≤10% of mean RM	1.38%
		High (normal) Load	≤10% of mean RM	2.66%
		Bias†	|d| ≤ |CC| = Pass	1.019

|d| average absolute difference between the RM and CEMS
|CC| confidence coefficient
† highest bias measured at normal or second load level is presented

When two operating loads have been designated as normal and a 2-load or 3-load RATA is performed, the bias test is conducted at both normal operating loads. If the bias test is failed at only one normal operating load, a BAF is calculated for this load level and applied to all subsequent flow CEMS data. If the bias test is failed at both normal operating loads, the higher of the two resulting BAFs is applied to all subsequent flow CEMS data. [40 CFR 75, Appendix A, Section 7.6.5(d)]

3.0 SOURCE AND MONITOR DESCRIPTION

The Grayling Generation Station Limited Partnership is an electric utility facility located southeast of Grayling, Michigan. The facility commenced operation on May 9, 1992, and includes one 635 MMBtu/hr wood and tire-derived fuel (TDF) fired boiler equipped with natural gas auxiliary burners. The boiler is of a spreader-stoker design with a source classification code (SCC) of 10100911. The facility receives both chipped wood and TDF by

truck and uses these fuels in the boiler to produce steam. The steam is used to turn a turbine and generator to produce approximately 38 MW of electricity at full capacity. The electricity is sold to Consumers Energy (the utility subsidiary of CMS Energy) and routed through transmission and distribution systems to consumers. Emissions from the boiler are controlled by multiple air pollution control systems and monitored by the CEMS systems.

Sick ultrasonic air flow CEMS, and Thermo Scientific dilution-extractive SO_2, NO_x CO_2, and CO CEMS are installed in the EUBOILER exhaust stack. The CEMS interface with a data acquisition and handling system (DAHS) manufactured by VIM Technologies, responsible for recording data that includes exhaust gas flow rate, pollutant and diluent concentrations, emission rates, and operating parameters. Figure 1 illustrates the EUBOILER Data Flow Diagram and Sampling Location.

The CEMS system quality assured during this test program is summarized in Table 3-1.

Table 3-1
CEMS Information

Make and Model	System ID	Component ID	Span	Serial Number
Flow Sick Model FLOWSIC 100 V1.8	FL1	106	200,000 SCFM	22248469

In preparation for the testing, an Operating Load Analysis was obtained for EUBOILER encompassing a period of September 1, 2022, through September 5, 2023. Based on these four or more quarters of representative historical operating data, the first (i.e., normal) and second most frequently used load levels were determined to ensure the appropriate load levels were selected during the RATAs. According to the Part 75 Monitoring Plan and the Operating Load Analysis reviewed, Low and High are the most frequently used load levels, with Low designated as the normal operating level and High as the second most frequently used (and designated 2nd normal load indicator) operating level. Therefore, the flow RATAs were performed at low and high loads.

4.0 SAMPLING AND ANALYTICAL PROCEDURES

Specific test procedures detailed in 40 CFR Part 60, Appendix A, Reference Methods 1, 2, 2H, 3, and ALT-008, were followed in conjunction with Part 75 Appendices A and B to conduct 12 runs and to calculate CEMS RA. Flue gas velocity and temperature were measured for a minimum of 5-minutes during each flow RATA test run. The following sections provide the sampling and analytical procedures employed.

4.1 Traverse Points (USEPA Method 1)

The number and location of traverse points used for determining exhaust gas velocity and flow RA was determined in accordance with USEPA Method 1, *Sample and Velocity Traverses for Stationary Sources*. The exhaust stack area was calculated, and the cross-section divided into traverse points of equal area based on the location of existing airflow disturbances. Sixteen traverse points, 8 traverse points in each of 2 test ports, were used to measure flue gas volumetric flowrate. Refer to Figure 2 for the EUBOILER flow traverse points dimensions and detail.

4.2 Velocity and Volumetric Flow (USEPA Methods 2 and 2H)

The exhaust gas velocity and temperature measurements were conducted in accordance with USEPA Method 2, *Determination of Stack Gas Velocity and Volumetric Flow Rate*. The

pressure differential across the positive and negative openings of an S-type Pitot tube connected to a pressure transducer were used to calculate exhaust gas velocity and volumetric flowrate. Refer to Figure 3 for an illustration of the volumetric flow RM apparatus.

As described in Section 2.1, the RM flow data incorporates the applicable default WAF of 0.9950 for EUBOILER as referenced in USEPA Method 2H, *Determination of Stack Gas Velocity Taking into Account Velocity Decay near the Stack Wall.*

It should be noted that the most recent calibration for the pitot employed during sampling (2331) showed an A-side C_p of 0.820 and a B side C_p of 0.826. Rather than use the average of the A and B-side C_p values, the A-side C_p of 0.820 was used in accordance with Section 10.1.5.1.1 of Method 2, as the A-side of the pitot consistently faced the flow direction throughout testing.

4.3 Diluent/Molecular Weight (USEPA Method 3 and 3A)

During the flow RATA, oxygen (O_2) and carbon dioxide (CO_2) concentrations were measured using Fyrite gas analyzers to calculate flue gas composition, following USEPA Method 3, *Gas Analysis for the Determination of Dry Molecular Weight.* Triplicate grab samples were captured in absorbing fluid, resulting in a proportional fluid rise to the gas concentration absorbed. Each sample concentration was read on the instrument scale, and the calculated dry molecular weight verified to not differ from the triplicate sample mean by more than 0.3 g/g-mole (0.3 lb/lb-mole), with the average result reported to the nearest 0.1 g/g-mole (0.1 lb/lb-mole).

4.4 Moisture Content (USEPA Method ALT-008)

Flow RATA moisture content was determined using USEPA ALT-008, *Alternative Moisture Measurement Method Midget Impingers*. The sample apparatus followed the general guidelines contained in USEPA Method ALT-008 *Alternative Moisture Measurement Method Midget Impingers* Figure 1 or 2. Exhaust gas was drawn at a constant rate through a series of midget impingers immersed in an ice bath to remove moisture, which was subsequently measured gravimetrically to calculate moisture content. The ALT-008 Moisture Sample Apparatus is shown in Figure 4.

5.0 QUALITY ASSURANCE PROCEDURES

The objective of a Quality Assurance (QA) program is to produce data that are complete, representative, and of known precision and accuracy. Within the RATA test program, completeness can be defined as the percentage of the required field measurements and associated documentation achieved. Representativeness, defined as the "when," "how," and "how many" measurements taken, is typically specified within the regulations governing the source to be tested as well as the Test Protocol submitted to the regulatory agency prior to the test event. Precision and accuracy are measures of data quality and exist by design within each of the USEPA reference test methods and procedures incorporated during the RATA.

RCTS addresses these QA goals by operating within a Quality System in compliance with ASTM D 7036-04, Standard Practice for Competence of Air Emissions Testing Bodies; a practice specifying the general competence requirements applicable to all AETB staff engaged in air emission testing at stationary sources, regardless of testing scope. By employing these requirements in conjunction with the precision and accuracy standards in each reference method, RCTS is better able to ensure consistently accurate data quality from an individual and AETB perspective. RCTS' AETB Letter of Accreditation and individual QSTI Certificates are contained in Appendix D.

5.1 Pitot Tube, Thermocouple, and Pressure Equipment

The Pitot tube-thermocouple assembly for measuring exhaust gas volumetric flow was inspected and/or calibrated according to procedures in RCTS' AETB Standard Operating Procedure 3-5 and Appendix O, USEPA RM 2, and Approved Alternative Method (ALT-011).

A Pitot tube inspection occurred before the field test to confirm there is no gross damage or excess misalignment of the Pitot openings. A post-test Pitot tube inspection and certification was performed to evaluate if the Pitot face openings were still aligned within acceptable tolerances.

ALT-011 describes the inherent accuracy and precision of a thermocouple within ±1.3°F in the range of -32°F and 2,500°F and states that a system performing accurately at one temperature is expected to behave similarly at other temperatures. Therefore, a single point thermocouple calibration procedure to verify accuracy within ±1.0 percent of absolute temperature, considering the presence of disconnected wire junctions or a potential miscalibrated temperature display, was performed. After the test event, the accuracy of the thermocouple system was checked at ambient temperature, or other temperature, within the range specified by the manufacturer, using a reference thermometer. The temperatures of the thermocouple and reference thermometer(s) shall agree within ±2°F.

The differential pressure transmitters used with Method 2 were calibrated in accordance with §6.2.1 of the method and RCTS AETB Standard Operating Procedure Appendix J-4. Refer to Appendix C for Pitot tube, thermocouple, differential pressure and barometer calibration or inspection records.

5.2 Dry Gas Metering Console

The ALT-008 dry gas metering (DGM) console and pump for measuring exhaust gas moisture content was calibrated against a DGM calibration standard as described in Method 5, §16.1, using the procedures in Method 5, §10.3.2 and RCTS AETB Standard Operating Procedure 3-4. Refer to Appendix C for DGM console calibration data.

6.0 DISCUSSION OF TEST RESULTS

The CEMS RATA results presented in Table 2-1 and Appendix B indicate the flow CEMS operating at Grayling Station EUBOILER exhaust met the performance specifications in 40 CFR 75, Appendix A, and the annual reduced RATA test frequency incentive standards in 40 CFR 75, Appendix B. These data indicate compliance with the CEMS monitoring and recordkeeping requirements of the facility's air permit MI-ROP-N2388-2014a and periodic QA required in the consent order entered by the EGLE AQD and Grayling Generating Station Limited Partnership on July 28, 2022 (EGLE AQD ACO 2022-14).

During the test event, no deviations were observed by the QI in attendance. The criteria specified in the applicable Reference Methods and the agency-approved Test Protocol were followed. Hard copy and/or electronic field data were completed in the field and upon return to the home office, verified for data precision and accuracy, further ensuring the appropriate AETB and Reference Method quality measures were met.

Quality Assurance data are presented in Appendix C. AETB certifications and signature forms are provided in Appendices D1 and D2.

6.1 Clock Time Synchronization

The electronic timestamps recorded for RM RATA runs are on military time basis and synchronized to the CEMS DAHS.

Figures

Figure 1 – EUBOILER Data Flow Diagram and Sampling Location

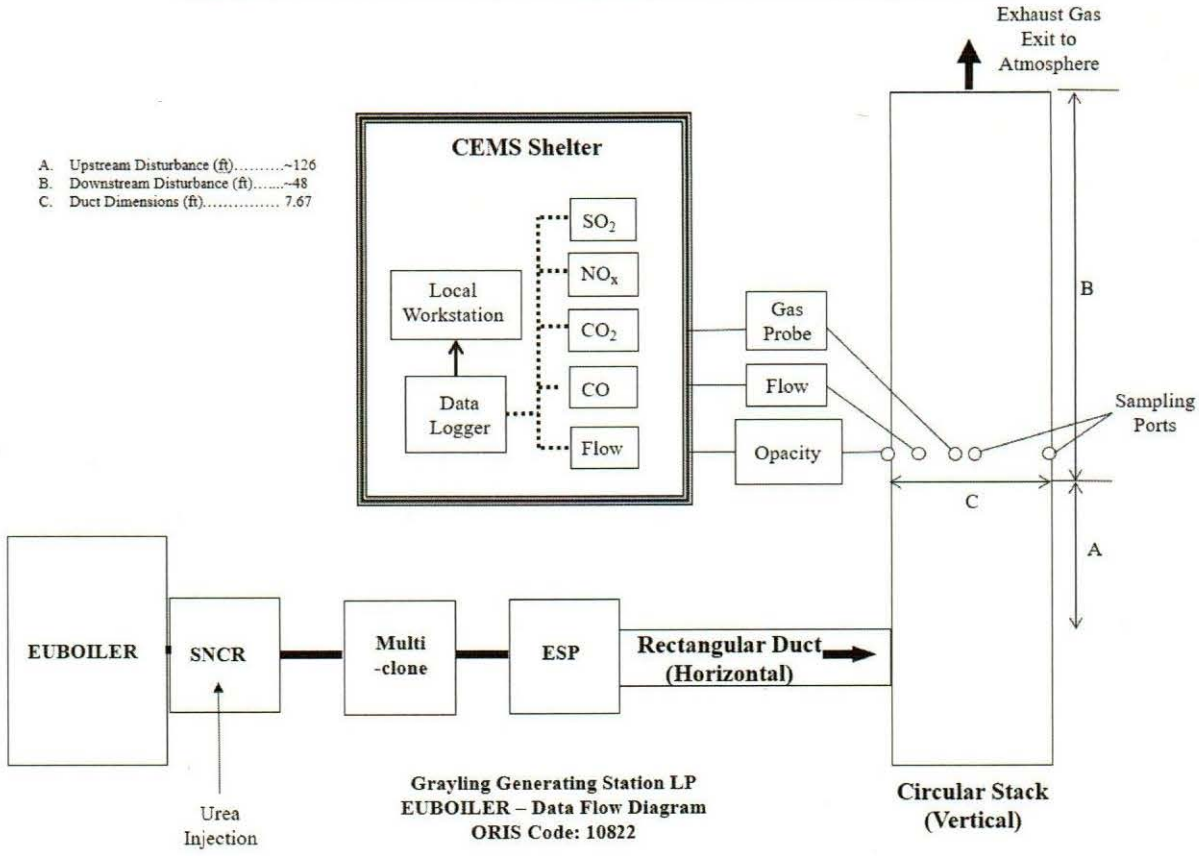


Figure 2 – EUBOILER Flow Traverse Points Dimensions and Detail

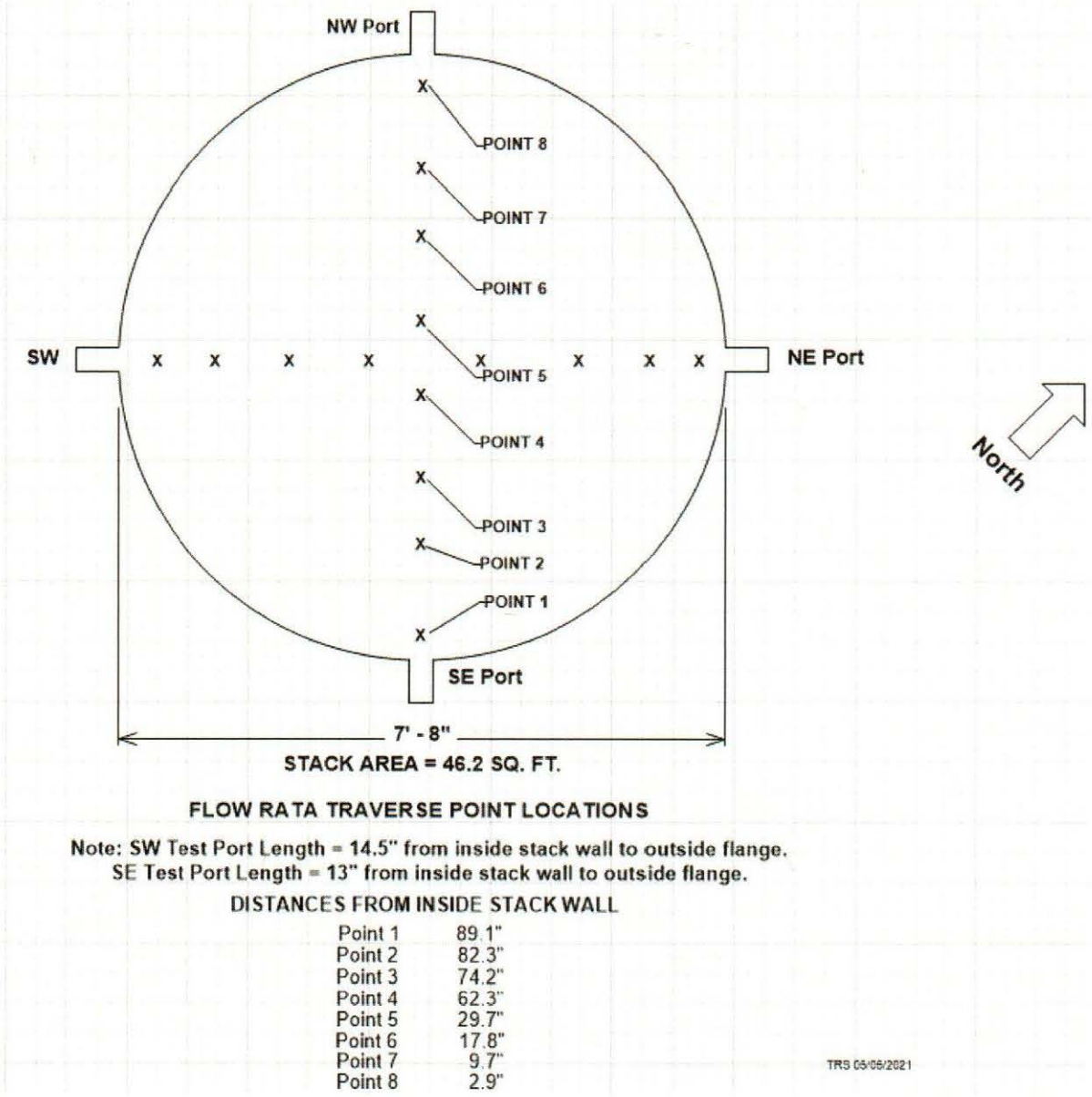


Figure 3 – Volumetric Airflow RATA Sample Apparatus

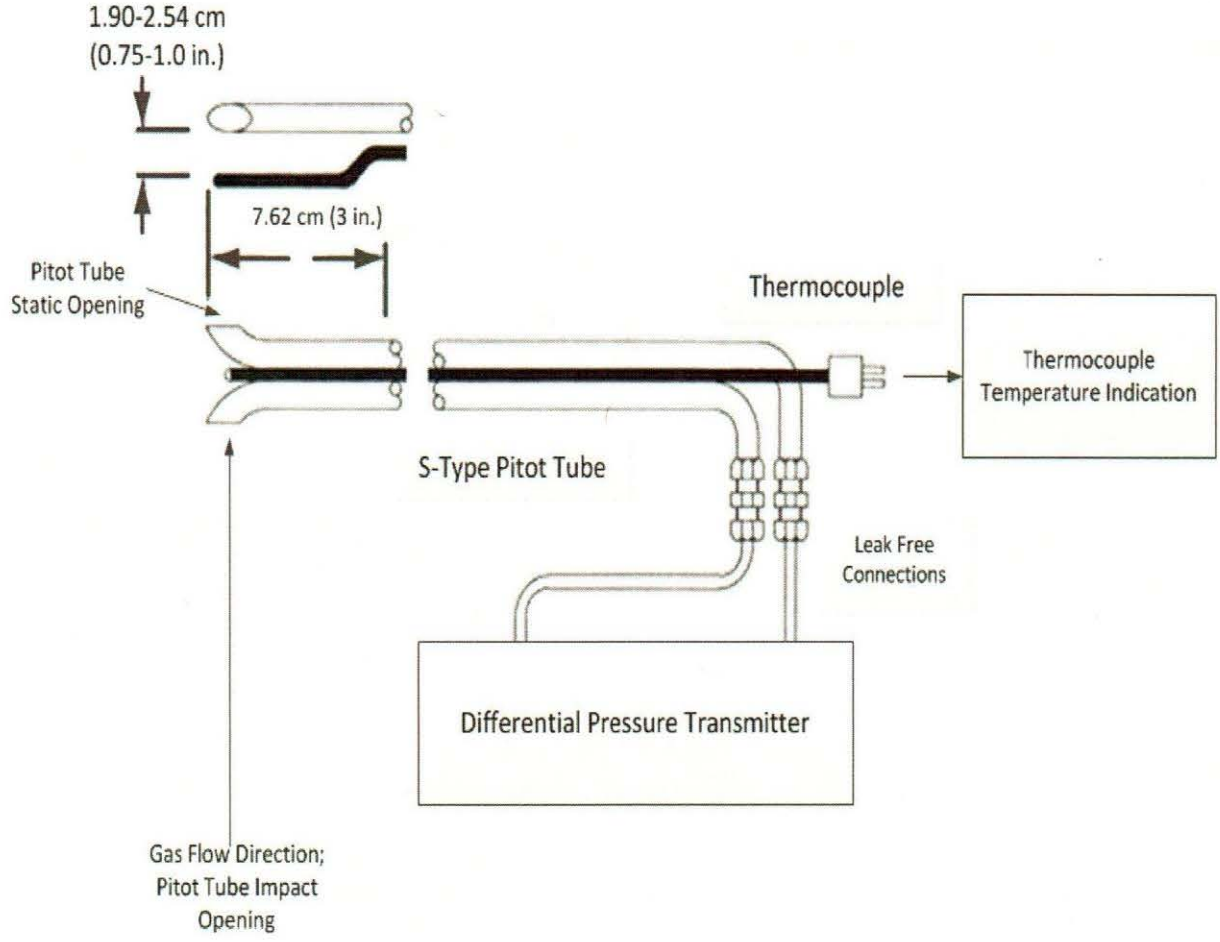
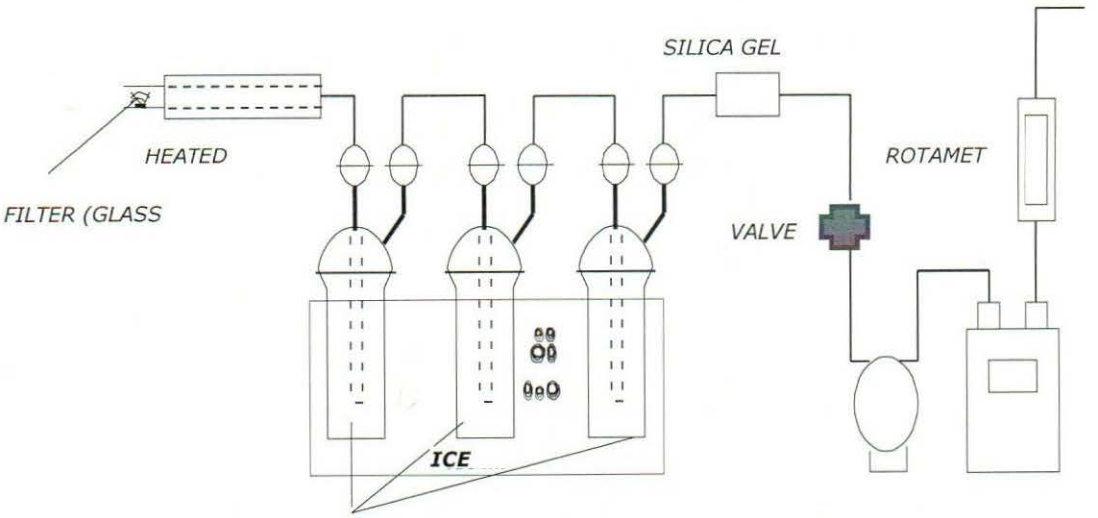


Figure 4 – ALT-008 Moisture Sample Apparatus



The silica gel tube depicted in this figure was replaced with a midget impinger (bubbler) with a straight tube insert, as allowed in ALT-008, §1.

Appendix A
RATA Calculation Summary