Consumers Energy
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40 CFR 60 & 75 CEMS Relative Accuracy Test Audit Report

EUGT1A, EUGT1B, EUGT2A, and EUGT2B

Consumers Energy Company
Zeeland Generating Station
425 Fairview Road
Zeeland, Michigan 49464
SRN: N6521
ORIS: 55087

July 24, 2024

Test Dates: June 25 – 26, 2024

Test Performed by the Consumers Energy Company
Regulatory Compliance Testing Section
Air Emissions Testing Body
Laboratory Services Section
Work Order No. 41222040

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 55087; SRN N6521 Date(s) Tested: June 25-26, 2024

Facility Name: Zeeland Generating Station

Facility Address: 425 Fairview Road, Zeeland, MI 49464

Equipment Tested: EUGT1A; EUGT1B; EUGT2A; EUGT2B 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, the information provided in this test report is true, accurate, and complete.

Signature: Date: July 24, 2024

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]
■	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]
■	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]
■	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]
■	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 continuous emission monitoring systems (CEMS) quality assurance (QA) audits at the exhausts of simple cycle combustion turbine emission units EUGT1A (Unit 1A) and EUGT1B (Unit 1B), and combined cycle combustion turbines EUGT2A (Unit 2A) and EUGT2B (Unit 2B) operating at the CECo Zeeland Generating Station (ZGS) in Zeeland, Michigan.

The relative accuracy test audits (RATA) were conducted on June 25 and 26, 2024, to satisfy requirements in Michigan Department of Environment, Great Lakes, and Energy (EGLE) Renewable Operating Permit (ROP) No. MI-ROP-N6521-2020a, Appendix 3.1, which incorporates United States Environmental Protection Agency (USEPA) Title 40, Code of Federal Regulations (40 CFR) Part 60, Appendix F, and Part 75, Appendices A and B requirements. The 40 CFR Part 75 required monitoring plan designates EUGT1A as CC1; EUGT1B as CC2; EUGT2A as CC3; and EUGT2B as CC4.

A test protocol describing the sampling, calibration, and QA procedures in USEPA Reference Methods (RM) 3A, 7E, 10, and 19, in conjunction with Performance Specifications (PS) 2, 3, 4, and 4A, and 40 CFR 75, Appendices A and B, was submitted May 24, 2024, to the USEPA Region 5 and EGLE offices. The protocol was subsequently approved in a letter dated June 21, 2024, by EGLE representative Jeremy Howe. Neither USEPA nor EGLE were present during testing.

The CEMS audits were performed by RCTS representatives Thomas Schmelter, David Kawasaki, and Thomas Duchane. J. Homer Manning, Senior Environmental Analyst with ZGS, coordinated the tests with applicable plant personnel and collected CEMS data.

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 David Kawasaki met these requirements and assumed the on-site lead QI role for the duration of the CEMS audits.

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

Table 1-1
Test Program Contact List

Program Role	Contact	Address
EPA Regional Contact	r5ardreporting@epa.gov	USEPA Region 5 77 W. Jackson Blvd. (AR-18J) Chicago, IL 60604
State Regulatory Administrator	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
EGLE AQD Site Inspector	Heidi Hollenbach District Supervisor 616-540-1136 hollenbachh@michigan.gov	EGLE Grand Rapids District Office 350 Ottawa Avenue NW, Unit 10 Grand Rapids, Michigan 49503-2316
Responsible Official	Jason Ricketts Sr. Manager Plant Operations 616-237-4001 jason.ricketts@cmsenergy.com	Consumers Energy Company Zeeland Generating Station 425 N. Fairview Road Zeeland, Michigan 49464
Test Facility	J. Homer Manning III Senior Environmental Analyst 616-237-4004 homer.manningiii@cmsenergy.com	
Corporate Air Quality Contact	Jason Prentice Principal Environmental Engineer 517-788-1467 jason.prentice@cmsenergy.com	Consumers Energy Company Parnall Office (P22-334) 1945 W. Parnall Road Jackson, Michigan 49201
Test Team Representative	Thomas Schmelter, QSTI Prin Laboratory 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 ZGS CEMS relative accuracy (RA) results indicate the CEMS meet the semi-annual RA frequency standards in 40 CFR 75, Appendix A, and the annual reduced RA frequency test incentives in 40 CFR 75, Appendix B, or the quality assurance requirements in 40 CFR Part 60, Appendix F, Procedure 1, as applicable. In addition, the results comply with requirements in EGLE ROP MI-ROP-N6521-2020a. Results are presented in Tables 2-1 through 2-3 and Appendix B of this report. The RA equations and other applicable calculations are presented in Appendix A. Comprehensive test data are presented in Appendix B.

2.1 O_2 GAS RATA

The facility operates oxygen (O_2) dry extractive paramagnetic CEMS at the exhaust stacks of each unit to report continuous emissions. The O_2 CEMS measure diluent concentrations in tandem with pollutant CEMS, where the percent (%) O_2 concentrations are used to calculate diluent-corrected NO_x concentrations in part per million by volume dry (ppmvd) at 15% O_2, and to support pound per million British thermal unit (lb/MMBtu) and mass emissions reporting.

The O_2 RATA results met the ≤10% RA and ±1.0% O_2 mean RM to CEMS difference semi-annual RA frequency standard in 40 CFR Part 75, App A, § 3.3.3 and the reduced RATA test frequency incentive standard in 40 CFR 75, Appendix B §2.3.1.2 (a) and (h) where the RA is ≤7.5% RA or the mean difference does not exceed ±0.7% O_2, respectively. The O_2 CEMS RA results are summarized in Table 2-1.

Table 2-1
Summary of Oxygen RATA Results

CEMS Make and Model	CEMS Location and Serial Number	Required Performance Criteria	Actual RATA Performance
Servomex 1440D	Unit 1A 01440D1V02/5355	≤10% of mean RA or ±1.0% O_2 RM-CEMS difference	0.73% RA 0.100 difference
	Unit 1B 01440D1VO2/5358		0.97% RA 0.089 difference
	Unit 2A 1440D1V02/5359		0.78% RA 0.100 difference
	Unit 2B 01440D1V02/5354		0.78% RA 0.040 difference

2.2 NO_x Gas RATA

The facility operates nitrogen oxides (NO_x) dry-extractive chemiluminescence CEMS used to support 40 CFR Part 75 lb/MMBtu and mass emissions reporting and to evaluate compliance with NO_x emission limits, including ppmv @ 15% O_2 and ton per year (tpy). The 40 CFR Part 75 NO_x RA criteria is on a NO_x-diluent lb/MMBtu basis, while the 40 CFR Part 60 NO_x RA criteria is on a ppmvd basis, corrected to 15% O_2 (ppmvd @15% O_2).

The NO_x ppm CEMS met the PS 2 criteria of ≤20% RA using the average reference method value in the denominator of the RA calculation, as the average emissions during the RATA were >50% of the emission standard (9.0 ppmv @ 15% O_2 for Units 1A and 1B, and 3.5 ppm @ 15% O_2 for Units 2A and 2B based on an average of all operating hours in a calendar day).

The NO_x-diluent CEMS met the ≤10% RA or the ±0.020 lb/MMBtu mean difference criteria where the RM measured NO_x average emission rate is ≤0.200 lb/MMBtu, as specified in 40 CFR Part 75, App A, § 3.3.2. The NO_x-diluent CEMS also met the reduced test frequency incentives of ≤7.5% RA or ±0.015 lb/MMBtu mean difference criteria in 40 CFR Part 75, App. B §2.3.1.2(f). Table 2-2 summarizes the NO_x RATA results.

Table 2-2
Summary of Nitrogen Oxides RATA Results

CEMS Make and Model	CEMS Location & Serial Number	RATA Performance Criteria	Required RATA Performance	Actual RATA Performance
Thermo Model 42iQLS-ABBNN	Unit 1A 12105510965	ppmvd @ 15% O_2	≤20% of mean RM[1]	12.60%
		lb/MMBtu	≤10% of mean RM or ±0.020 lb/MMBtu RM-CEMS difference	12.80%
				0.003 lb/MMBtu
		Bias	|d|≤|CC|=Pass	1.111
	Unit 1B 12105510963	ppmvd @ 15% O_2	≤20% of mean RM[1]	10.26%
		lb/MMBtu	≤10% of mean RM or ±0.020 lb/MMBtu RM-CEMS difference	10.69%
				0.003 lb/MMBtu
		Bias	|d|≤|CC|=Pass	1.099
Thermo Model 42iQLS-ABBNN	Unit 2A 12105610987	ppmvd @ 15% O_2	≤20% of mean RM[1]	15.38%
		lb/MMBtu	≤10% of mean RM or ±0.020 lb/MMBtu RM-CEMS difference	10.00%
				-0.001 lb/MMBtu
		Bias	|d|≤|CC|=Pass	Pass
	Unit 2B 12105610988	ppmvd @ 15% O_2	≤20% of mean RM[1]	7.37%
		lb/MMBtu	≤10% of mean RM or ±0.020 lb/MMBtu RM-CEMS difference	9.63%
				0.001 lb/MMBtu
		Bias	|d|≤|CC|=Pass	1.081

[1] 40 CFR Part 60, Appendix B, PS 2 §13.2, ≤20% RA criteria is applied when the average RM value measured is ≥50% of the applicable emission standard, which is 9.0 ppmv at 15% O_2 for Units 1A and 1B and 3.5 ppmv at 15% O_2 for Units 2A and 2B.

|d| average absolute difference between the RM and CEMS

|CC| confidence coefficient

2.3 CO Gas RATA

The facility operates carbon monoxide (CO) dry-extractive infrared gas filter correlation CEMS at the exhaust stacks of each unit to report continuous emissions. The CO lb/MMBtu emission rates are used to evaluate compliance with emission limits within the ROP. The

ROP CO emission limits for EUGT1A, EUGT1B, EUGT2A, and EUGT2B are expressed in tons per year (tpy) on a 12-month rolling time period and lb/MMBtu basis (0.021 lb/MMBtu/unit for Units 1A/1B and 0.042 lb/MMBtu/unit for Units 2A/2B, based on all operating hours in a calendar day). The applicable lb/MMBtu emission limit was used as the denominator in the RA calculation because the average RM emissions during the RATA were <50% of the emission standard pursuant to PS 4/4A.

The CO CEMS RA met one or more of the quality assurance criteria of PS 4A: 1) ≤5% RA criterion when the applicable lb/MMBtu emission standard was used to calculate RA, or 2) a difference of ≤5 ppmv calculated as the absolute difference between the RM and CEMS measurements, plus the 2.5 percent confidence coefficient. Table 2-3 summarizes the CO RATA results.

The CO RATA results met the 40 CFR Part 40, Appendix B, PS 4, §13.2, ≤5.0% lb/MMBtu RA criteria using the applicable emission standard for each unit. The CO CEMS also met the 40 CFR Part 40, Appendix B, PS 4A, §13.2, ≤5 ppmvd calculated as the absolute average difference between the RM and CEMS plus the 2.5% CC criteria.

Table 2-3
Summary of Carbon Monoxide RATA Results

CEMS Make and Model	CEMS Location & Serial Number	RATA Performance Criteria	Required RATA Performance	Actual RATA Performance
CO Thermo Model 48iQ-ABN	Unit 1A 12105510966	ppmv[1]	≤5 ppmvd difference	0.496 ppmvd
		lb/MMBtu[2]	≤5% of emission limit	4.76%
	Unit 1B 12105510967	ppmv[1]	≤5 ppmvd difference	0.368 ppmvd
		lb/MMBtu[2]	≤5% of emission limit	1.75%
	Unit 2A 12105510968	ppmv[1]	≤5 ppmvd difference	0.737 ppmvd
		lb/MMBtu[2]	≤5% of emission limit	3.72%
	Unit 2B 12105510969	ppmv[1]	≤5 ppmvd difference	1.173 ppmvd
		lb/MMBtu[2]	≤5% of emission limit	4.76%

[1] 40 CFR Part 60, Appendix B, PS 4A §13.2, when $|d|+2.5\% |CC| \leq 5$ ppmv
[2] The 5% RA limit is applied when the average measured RM value is ≤50% of the applicable emission standard, which for Units 1A and 1B is 0.021 lb/MMBtu and 0.042 lb/MMBtu for Units 2A and 2B.
|d| average absolute difference between the RM and CEMS
|CC| confidence coefficient

3.0 SOURCE AND MONITOR DESCRIPTION

ZGS operates four General Electric model 7FA natural gas fired combustion turbines that produce high-pressure exhaust gas which turn electricity-producing generators. Units 1A and 1B are rated at 2,205 MMBtu/hr heat input, with an Upper Bound Range of Operation

(UBRO) of 190 megawatts (MW) and a Lower Bound Range of Operation (LBRO) of 17 MW. Units 2A and 2B are rated at 2,323 MMBtu/hr and 2,345 MMBtu/hr heat input, respectively, with an UBRO of 309 and 308 MW, respectively, and an LBRO of 17 MW. The combined cycle units are equipped with natural gas-fired duct burners to augment steam production and selective catalytic reduction (SCR) systems for controlling NO_x.

Each combustion turbine is equipped with dedicated dry extractive NO_x, O_2, and CO CEMS to continuously monitor exhaust gas concentrations in accordance with 40 CFR Parts 60 and/or 75, as dictated by the specific pollutant or unit of measure. Specifically, the NO_x and O_2 CEMS operate in tandem as NO_x – diluent CEMS to monitor NO_x pound per British thermal unit (lb/MMBtu) emission rates in accordance with 40 CFR Part 75, and the NO_x ppmvd at 15% O_2 relative accuracy follow criteria contained in 40 CFR Part 60. The CO and O_2 CEMS used to monitor CO lb/MMBtu emission rates are also regulated by 40 CFR Part 60 CEMS RA criteria. Each CEMS is connected to an ESC Spectrum (ESC) StackVision© data acquisition and handling system (DAHS).

In preparation for the audits, an Operating Load Analysis (OLA) was obtained for each unit encompassing the April 1, 2023 – March 31, 2024. Based on these four quarters of representative historical operating data, the first (i.e., normal) and second most frequently (i.e., additional normal load) used load levels were determined to ensure appropriate load level selection during the RATA. The OLA indicated High Load Level was most frequently used for Units 1A, 1B, 2A, and 2B, with Mid Load the second most frequently used load level, which is identical to the load usage levels identified in the ZGS 40 CFR Part 75 Monitoring Plans. Therefore, each unit operated at its respective normal High load during this test event, which was approximately 160 MWg for Unit 1A, 160 MWg for Unit 1B, 263 MWg for Unit 2A, and 261 MWg for Unit 2B.

4.0 SAMPLING AND ANALYTICAL PROCEDURES

Specific test procedures detailed in 40 CFR Part 60, Appendix A, Reference Methods 3A, 7E, 10, and 19 were followed in conjunction with Part 75 Appendices A and B to conduct 10 runs at Units 1A and 1B, and 11 runs at Units 2A and 2B, and to calculate CEMS RA. The O_2, NO_x, and CO concentrations were measured for 21-minutes during each gas RATA run. The following sections provide the sampling and analytical procedures employed.

4.1 Sample Location and Traverse Points (USEPA Method 1)

The number and location of traverse points for measuring gas concentrations were determined in accordance with 40 CFR 75, Appendix A, Section 6.5.6. Since the stack diameters are greater than 7.8 feet and stratification was not expected, flue gas concentrations were measured at three traverse points located on a line 15.7 (0.4 m), 47.2 (1.2 m) and 78.7 (2.0 m) inches from the duct wall parallel to the sample port at 7-minute intervals throughout each test run.

The test ports at Units 1A and 1B (Figure 1) are located approximately 36 feet (2.2 duct diameters) downstream of a flow disturbance (duct confluence and bend) and 29 feet (1.8 duct diameters) upstream of a flow disturbance (baffles). The test ports at Units 2A and 2B (Figure 2) are located approximately 67 feet (4 duct diameters) downstream of a flow disturbance (duct confluence and bend) and 20 feet (1.2 duct diameters) upstream of a flow disturbance (exhaust to atmosphere).

4.2 O_2, NO_x, AND CO CONCENTRATION (USEPA METHODS 3A, 7E, AND 10)

Oxygen, nitrogen oxides, and carbon monoxide concentrations were measured using the following sampling and analytical procedures:

- USEPA Method 3A, *Determination of Oxygen and Carbon Dioxide Concentrations in Emissions from Stationary Sources (Instrumental Analyzer Procedure),*
- USEPA Method 7E*, Determination of Nitrogen Oxides Emissions from Stationary Sources (Instrumental Analyzer Procedure)*, and
- USEPA Method 10, *Determination of Carbon Monoxide Emissions from Stationary Sources (Instrumental Analyzer Procedure).*

The sampling procedures of the methods are similar apart from the analyzers and analytical technique used to quantify the parameters of interest. Components of the extractive gaseous RM system in contact with flue gas are constructed of Type 316 stainless steel and Teflon. Exhaust gas was extracted from the stacks through a heated steel tube probe, heated Teflon® tubing, and a gas conditioning system to remove water and dry the sample before entering a sample pump, gas flow control manifold, and the gas analyzers. The output signal from each analyzer was connected to a computerized data acquisition system (DAS).

The RM analyzers were calibrated with USEPA Protocol calibration gases and operated to ensure that zero drift, calibration gas drift, bias and calibration error met the specified method requirements. Refer to Appendix Figure 3 for a drawing of the reference method gaseous RATA sample apparatus.

Data collected from the RM analyzers were averaged for each run with CO and NO_x concentrations measured in ppmvd, with NO_x additionally corrected to 15 percent O_2 using Equation 2-2 from 40 CFR Part 60, Appendix B, PS 2. Equation 19-1 from 40 CFR Part 60, Appendix A, Method 19 was used to calculate NO_x and CO lb/MMBtu emission rates.

4.3 EMISSION RATES (USEPA METHOD 19)

USEPA Method 19, *Determination of Sulfur Dioxide Removal Efficiency and Particulate Matter, Sulfur Dioxide, and Nitrogen Oxide Emission Rates*, was used to calculate lb/MMBtu emission rates. Measured O_2 and pollutant concentrations and F factors (ratios of combustion gas volume to heat input) were used to calculate emission rates using equation 19-1 from the method.

USEPA Method 19, Equation 19-1:

$$E = C_d F_d \frac{20.9}{(20.9 - \%O_{2d})}$$

Where:

E	=	Pollutant emission rate (lb/MMBtu)
C_d	=	Pollutant concentration, dry basis (lb/dscf)
F_d	=	Volumes of combustion components per unit of heat content
$\%O_{2d}$	=	Concentration of oxygen on a dry basis (%, dry)

An F_d factor of 8,710 dscf O_2/MMBtu for natural gas was used to calculate RM lb/MMBtu emissions and calculate CEMS relative accuracy. Refer to Appendix A for a RATA calculation summary presenting the calculations used in this report.

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, QSTI Certificates and signature forms are contained in Appendix D.

5.1 USEPA Protocol Gas Standards

USEPA Protocol gas standards used by RCTS were purchased from an outside vendor participating in the USEPA Protocol Gas Verification Program (PGVP) calibration gas audit program described 40 CFR Part 75 § 75.21(g) following RCTS AETB Standard Operating Procedure 2-10. The standards are certified to have a total relative uncertainty of no greater than ±2.0 percent according to the *USEPA Traceability Protocol for Assay & Certification of Gaseous Calibration Standards; EPA – 600/R-97/121; September 1997* or the current version of the traceability protocol (*EPA – 600/R-12/531; May 2012*). Appendix C contains a summary of the PGVP calibration gas standards used during this test program and the certificates of analysis.

5.2 Analyzer Calibrations

The RM instruments measuring gaseous concentrations were calibrated on-site and operated following manufacturer's specifications and the applicable RM based in part on the quality assurance and quality control requirements contained in USEPA Methods 3A, 7E, and 10.

Before beginning the gas RATA, a three-point analyzer calibration error (ACE) check was conducted on each analyzer by injecting zero-, mid-, and high-level calibration gases directly into the instruments and measuring the responses. The instrument response must be within ±2.0% of the respective analyzer span or within ±0.5 ppmv or ±0.5% for O_2 absolute difference to be acceptable.

A NO_x analyzer nitrogen dioxide (NO_2) to nitric oxide (NO) conversion efficiency (CE) test was conducted to verify the analyzer's ability to convert NO_2 to NO and accurately measure NO_x by chemiluminescence.

An initial system bias check was then performed by measuring instrument responses to zero- and mid- or high-level (upscale) calibration gases introduced at the probe, upstream of all sample conditioning components, drawing it through the various sample components in the same manner as flue gas. System response times were documented during the initial system bias tests. The initial system bias check is acceptable if the instrument response at the zero and upscale calibration is within ±5.0% of the calibration span or ±0.5 ppmv or ±0.5% for O_2 absolute difference.

After each gas RATA run, post-test zero and upscale system bias checks were performed to quantify and compensate for RM analyzer drift and bias. The RM system bias is acceptable if those values remain within ±5.0% of the calibration span or ±0.5 ppmv or ±0.5% for O_2 absolute difference. The RM drift is acceptable if the zero and upscale values are within ±3.0% of the calibration span.

Calibration gas flow rates were maintained at the target sample rate, with each subsequent run started after twice the system response time elapsed. Analyzer bias and drift data is presented in Appendix B, while calibration data is in Appendix C.

6.0 DISCUSSION OF TEST RESULTS

The RATA results indicate the simple and combined cycle combustion turbine CEMS operating at ZGS meet the semi-annual RATA test frequency standards in 40 CFR 75, Appendix A, and the annual reduced RATA test frequency incentive standards in 40 CFR 75, Appendix B, or the annual QA criteria in 40 CFR Part 60, Appendix F, Procedure 1, as applicable. These data indicate compliance with the CEMS monitoring and recordkeeping requirements of the facility's air permit ROP MI-ROP-N6521-2020a.

Please note that the RM NO_x analyzer span values at Units 2A and 2B, as represented by the High-Level calibration gas value of 11.91 ppm, meet the Low-Concentration Analyzer definition found in USEPA Method 7E, Section 3.12, which states a *Low-Concentration Analyzer means any analyzer that operates with a calibration span of 20 ppm NO_X or lower.* The definition goes on to say that *Each analyzer model used routinely to measure low NO_X concentrations must pass a manufacturer's stability test (MST)...*which *subjects the analyzer to a range of line voltages and temperatures that reflect potential field conditions to demonstrate its stability following procedures similar to those provided in 40 CFR 53.23.*

With that said, while the RM NO_x analyzer spans used at Units 2A and 2B were less than 20 ppm, the same analyzers are not *routinely* used to measure low NO_x concentrations, as further defined by Method 7E. Therefore, RCTS has not provided any MST documentation in this report.

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, including protocol gas certificates of analysis, analyzer calibration error and system response time, NO_2 to NO CE checks and instrument interference information are presented in Appendix C. Gas RATA instrument system bias/drift data are presented in Appendix B. AETB certifications and signature forms are provided in Appendices D1 and D2.

6.1 Clock Time Synchronization

The electronic timestamps recorded for RM gas RATA runs are on military time basis and synchronized to the CEMS DAHS, which is in Eastern Standard Time (EST).

Figures

Figure 1 – Zeeland Generating Station Units 1A & 1B Stack and CEMS Schematic

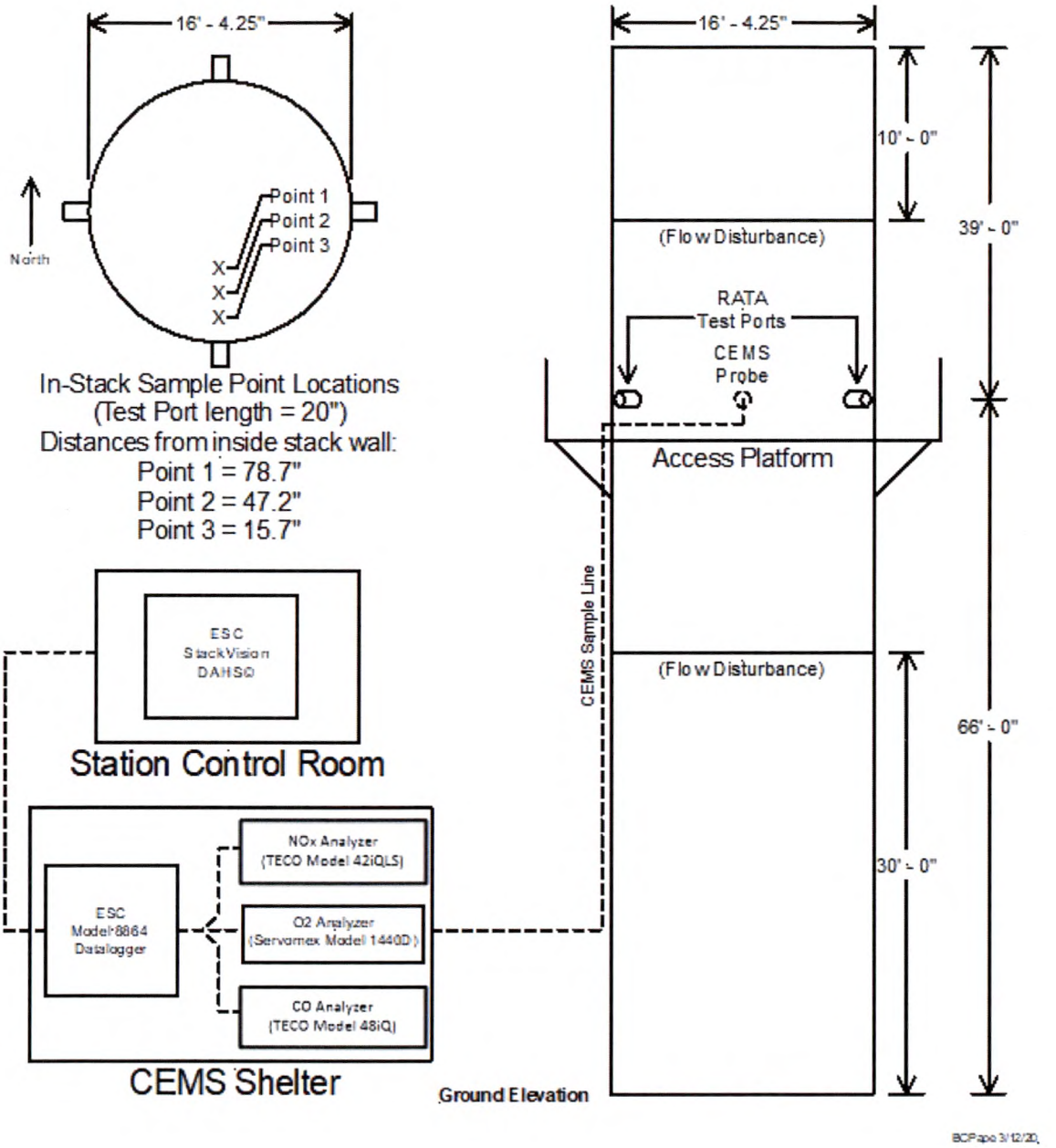

Figure 2 – Zeeland Generating Station Units 2A & 2B Stack and CEMS Schematic

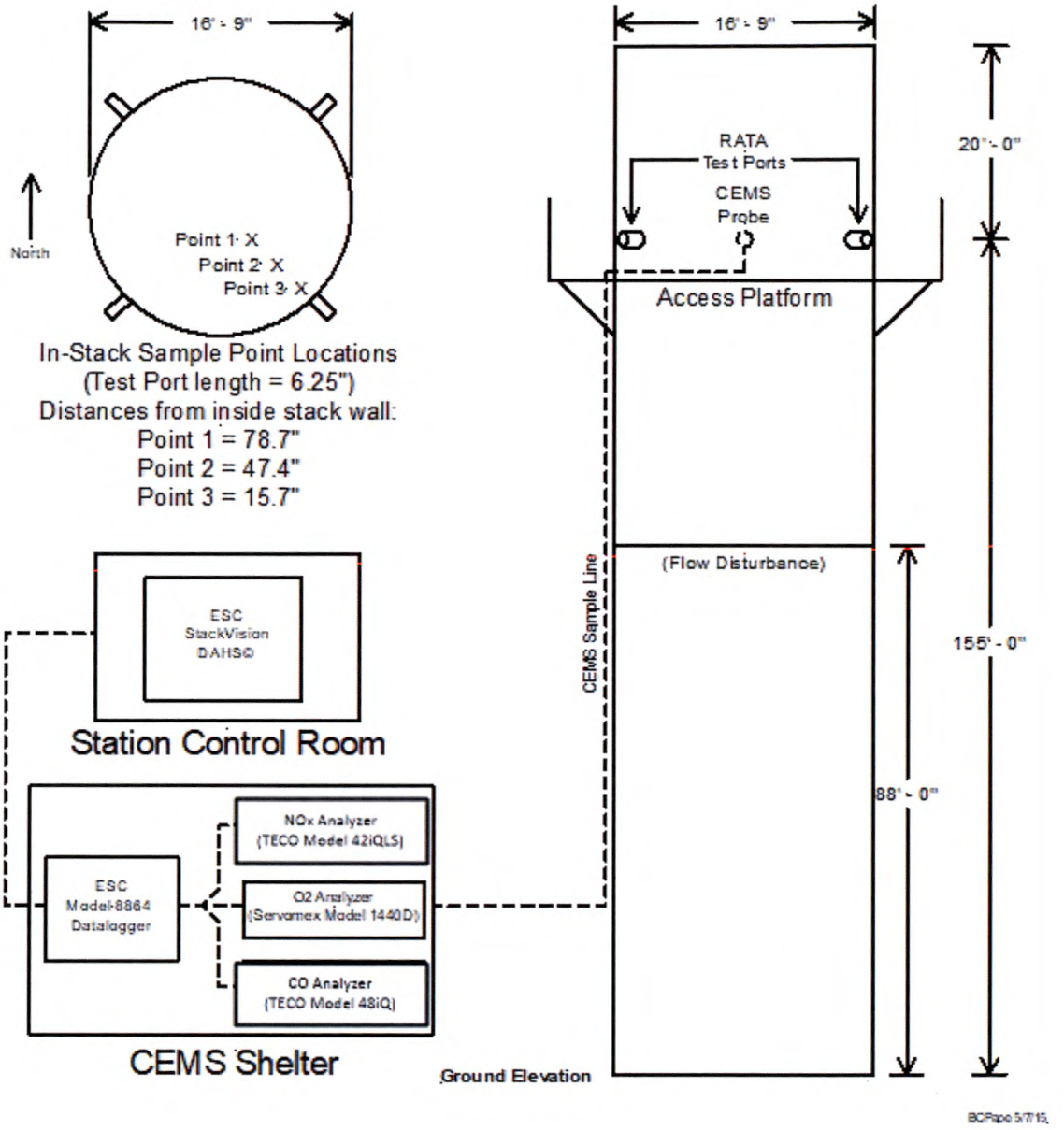
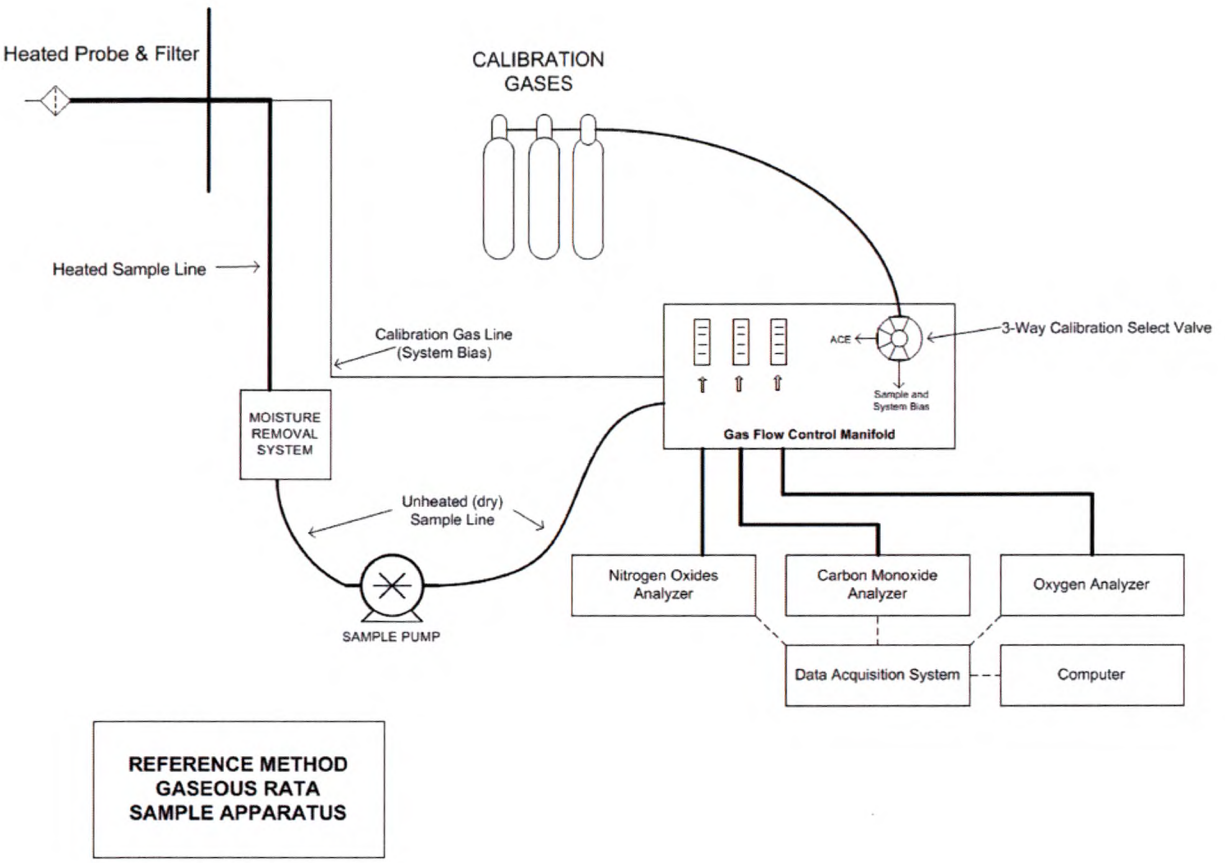
Figure 3 – Reference Method Gaseous RATA Sample Apparatus