Consumers Energy

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Hg CEMS RATA Test Report

EUBOILER1
EUBOILER2

Consumers Energy Company
J.H. Campbell Plant
17000 Croswell Street
West Olive, Michigan 49460

August 14, 2018

Test Dates: Unit 1 - June 19, 2018
Unit 2 - June 21, 2018

Test performed by the Consumers Energy Company
Regulatory Compliance Testing Section
Air Emissions Testing Body
Laboratory Services Department
Work Order No. 31683039 and 31683120
Initial Revision No.: 1.0

1.0 INTRODUCTION

Consumers Energy Company (Consumers Energy), Regulatory Compliance Testing Section (RCTS) performed relative accuracy test audits (RATAs) on the mercury (Hg) continuous emission monitoring systems (CEMS) installed in the exhaust ducts of emission units EUBOILER1 and EUBOILER2 (Units 1 and 2) operating at the Consumers Energy J.H. Campbell Generating Station located in West Olive, Michigan. The Hg CEMS RATAs were performed on June 19 (Unit 1) and June 21, 2018 (Unit 2) to satisfy United States Environmental Protection Agency (USEPA) requirements in 40 CFR 63, Subpart UUUUU, "National Emission Standards for Hazardous Air Pollutants: Coal and Oil-Fired Electric Utility Steam Generating Units," (aka Mercury and Air Toxics [MATS] Rule) as incorporated in Michigan Department of Environmental Quality (MDEQ) Renewable Operating Permit (ROP) No. MI-ROP-B2835-2013b.

A test notification and/or protocol containing detailed sampling, calibration and quality assurance procedures to be utilized during the test program was submitted to the USEPA and MDEQ on May 16, 2018. MDEQ representative Mr. Jeremy Howe approved the sampling protocol in a letter dated May 25, 2018. This Hg CEMS RATA test program followed the test protocol without deviation and incorporated USEPA test methods ALT-008, 30A, and 30B.

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1.1 CONTACT INFORMATION

RCTS representatives Gregg Koteskey, Dillon King, and Thomas Schmelter conducted the RATAs on June 19 for unit 1 and June 21, for unit 2, 2018; Mr. Koteskey was the RCTS Lead Qualified Individual (QI) for the Hg CEMS RATA. Mr. Joe Firlit, Environmental Lead, and Mr. Roger Vargo, Senior Technician, at the Consumers Energy J.H. Campbell facility coordinated the tests with applicable plant personnel and verified CEMS data.

Table 1-1 presents 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	Compliance Tracker, Air Enforcement and Compliance Assurance Branch	U.S. EPA Region 5 77 W. Jackson Blvd. (AE-18J) Chicago, IL 60604
State Regulatory Administrator	Ms. Karen Kajiya-Mills Technical Programs Unit Manager 517-335-4874 Kajiya-Millsk@michigan.gov	Michigan Department of Environmental Quality Technical Programs Unit 525 W. Allegan, Constitution Hall, 2nd Floor S Lansing, Michigan 48933
State Regulatory Inspector	Mr. Jeremy Howe Environmental Quality Analyst 231-878-6687 Howej1@michigan.gov	Michigan Department of Environmental Quality Cadillac District Office 120 W. Chapin Street Cadillac, Michigan 49601
State Regulatory Inspector	Ms. Kaitlyn DeVries Environmental Quality Analyst 616-558-0552 Devriesk1@michigan.gov	Michigan Department of Environmental Quality Grand Rapids District Office 350 Ottawa Avenue NW; Unit 10 Grand Rapids, Michigan 49503

Table 1-1 Test Program Contact List

Program Role	Contact	Address
Responsible Official	Mr. Norman J. Kapala Executive Director Coal Generation 616-738-3200 Norman.Kapala@cmsenergy.com	Consumers Energy J.H. Campbell Generating Complex 17000 Croswell Street West Olive, Michigan 49460
Test Facility	Mr. Joseph J. Firlit Sr. Engineering Tech Analyst Lead 616-738-3260 Joseph.Firlit@cmsenergy.com	Consumers Energy J.H. Campbell Generating Complex 17000 Croswell Street West Olive, Michigan 49460
	Mr. Roger Vargo Senior Technician 616-738-3270 Roger.Vargo@cmsenergy.com	Consumers Energy J.H. Campbell Generating Complex 17000 Croswell Street West Olive, Michigan 49460
Test Team Representative	Mr. Gregg Koteskey, QSTI Engineering Technical Analyst 616-738-3712 Gregg.Koteskey@cmsenergy.com	Consumers Energy Company L&D Training Center 17010 Croswell Street West Olive, Michigan 49460

2.0 SUMMARY OF RESULTS

The RATA results presented in Appendix B of this report indicate the Units 1 and 2 Hg CEMS installed and operating at the J.H. Campbell Generating Station meet the RATA performance specification standards in the MATS Rule.

The RATA results are summarized in Table 2-1. RA equations and other applicable sample calculations are presented in Appendix A. Comprehensive test results are presented in Appendix B.

2.1 Operating Data

During the relative accuracy tests the boilers were operated at the normal operating level(s) as defined in the site specific monitoring plan and determined following the provisions in 40 CFR 75, Appendix A, §6.5.2.1. Add-on controls were operated in a manner that allowed Hg concentrations to be measured by the reference method and CEMS systems. Due to variation in boiler operating conditions and residence of activated carbon within the control devices and exhaust duct system, mercury concentrations may not be detected by the CEMS system during normal operation. Boiler operating data recorded during the testing are provided in Appendix D.

2.2 Applicable Permit Information

The J.H. Campbell Generating Station operates under State of Michigan Registration Number (SRN) B2835 and in accordance with air permit MI-ROP-B2835-2013b. The air permit incorporates federal regulations and reporting requirements, and the facility has been assigned a Federal Registry Service (FRS) identification number 110000411108. EUBOILER1 and EUBOILER2 are the emission unit source identifications in the permit and included in the FGBOILER12 flexible group. Incorporated within the permit are the applicable requirements of the MATS Rule.

2.3 RESULTS

The Hg CEMS installed and operated at J.H. Campbell Generating Complex Units 1 and 2 meet 40 CFR, Part 63, Subpart UUUUU, Appendix A, Section 4.1.1.5 relative accuracy (RA) requirements as summarized in Table 2-1. The results of the Hg CEMS RATAs indicate that both Units 1 and 2 either meet the performance specification RA criterion of ≤20% and/or the alternative performance specification criterion where the absolute difference of the RM and CEMS Hg concentrations plus the confidence coefficient must be ≤0.5 µg/scm when the average RM Hg concentration is <2.5 µg/scm under the MATS Rule.

Table 2-1 Summary of Hg CEMS RATA Results

Source	RATA Acceptance Criteria Options	RM_{avg} (µg/scm)	C_{avg} (µg/scm)	CC	RATA RA Result (%)	Alternative RATA Result (µg/scm)
EUBOILER1	≤20.0% RA or $\lvert RM_{avg} - C_{avg} \rvert + \lvert CC \rvert \leq 0.5$ µg/scm when $RM_{avg} < 2.5$ µg/scm	0.578	0.544	0.0384	12.42	0.072
EUBOILER2		0.811	0.578	0.0544	35.47	0.288

RA relative accuracy
C_{avg} mean CEMS value
RM_{avg} mean reference method value
CC confidence coefficient from Equation 2-5 of Performance Specification 2 in Appendix B of 40 CFR Part 60

The preceding Hg concentration RA results for Unit 1 meet the standard 20% RA criteria, while the results for both units meet the alternative RA requirements of less than or equal to 0.5 µg/scm difference between the mean RM and CEMs measurements, plus the confidence coefficient. To be consistent with the USEPA's Emission Collection Monitoring Plan System (ECMPS) reporting instructions[1], the above Hg CEMS values, as well as the RM values have been rounded to the nearest 0.1 µg/scm before evaluating the RA. Unrounded Hg CEMS and RM values are also presented in Appendices B1 and B2.

Sample calculations are presented in Appendix A. Detailed results are presented in Appendices B1 for Unit 1 and B2 for Unit 2. Laboratory data is presented in Appendices C1 and C2. Boiler operating data and supporting information are provided in Appendices D1 and D2. Quality assurance data is presented in Appendix E.

3.0 SOURCE AND MONITOR DESCRIPTION

EUBOILER1 and EUBOILER2 are coal-fired EGUs that turn turbines connected to electricity producing generators.

3.1 PROCESS

Unit 1 is a dry bottom tangentially-fired boiler which combusts pulverized sub-bituminous coal as the primary fuel and oil as an ignition/flame stabilization fuel. Unit 2 is a wall-fired

[1] Refer to Page 65 of the ECMPS Reporting Instructions for Quality Assurance and Certification (March 7, 2018).

boiler which combusts pulverized sub-bituminous coal as the primary fuel and oil as an ignition/flame stabilization fuel. Unit 2 is also permitted to burn eastern coal blends.

Coal is fired in the furnace where the combustion heats boiler tubes containing water producing steam. The steam is used to turn a turbine that is connected to an electricity producing generator. The electricity is routed through the transmission and distribution system to consumers.

3.2 Process Flow

The flue gas generated through coal combustion is controlled by multiple pollution control devices. Units 1 and 2 are equipped with low nitrogen oxides (NO_x) burners, over fire air (OFA), activated carbon injection (ACI) systems for mercury (Hg) reduction, dry sorbent (lime) injection (DSI) systems for control of sulfur dioxides (SO_2) and other acid gasses, and pulse jet fabric filter (PJFF) baghouses to control particulate matter emissions. In addition, Unit 2 has a selective catalytic reduction (SCR) system for NO_x control. After passing through the control device systems, flue gas is exhausted to atmosphere through an approximate 400-feet high stack, shared by both EUBOILER2 and EUBOIELR2. Refer to Figures 2-1 and 2-2 for the Unit 1 and Unit 2 Data Flow Diagram.

Figure 2-1. Unit 1 Data Flow Diagram

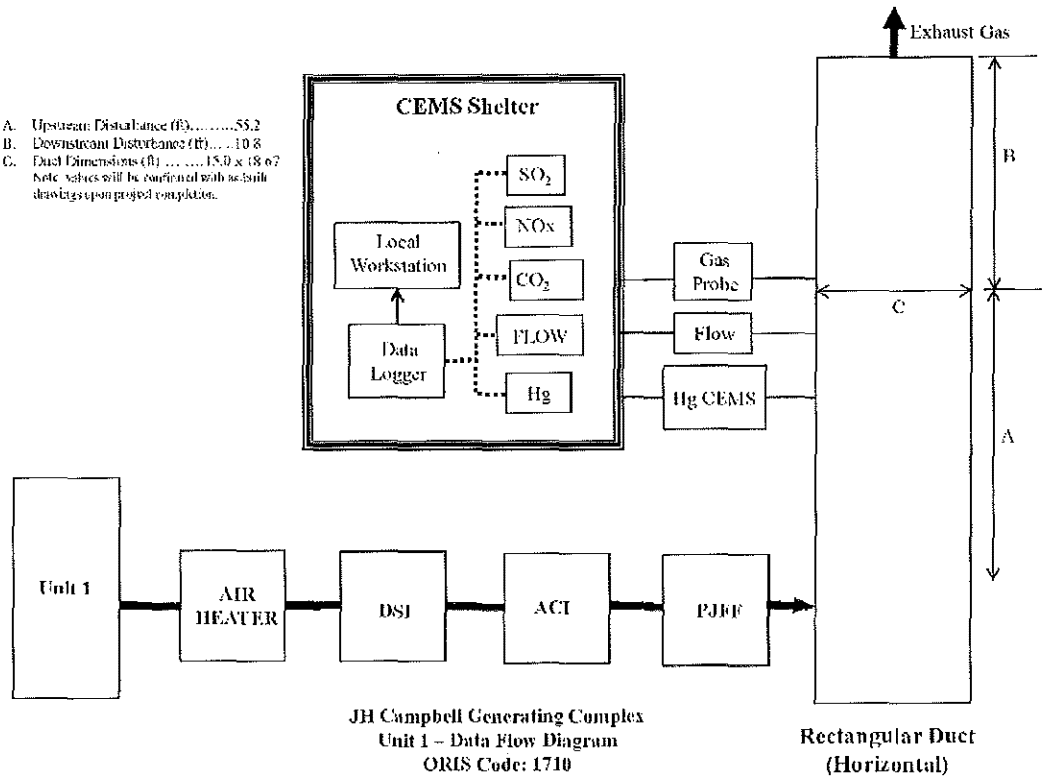
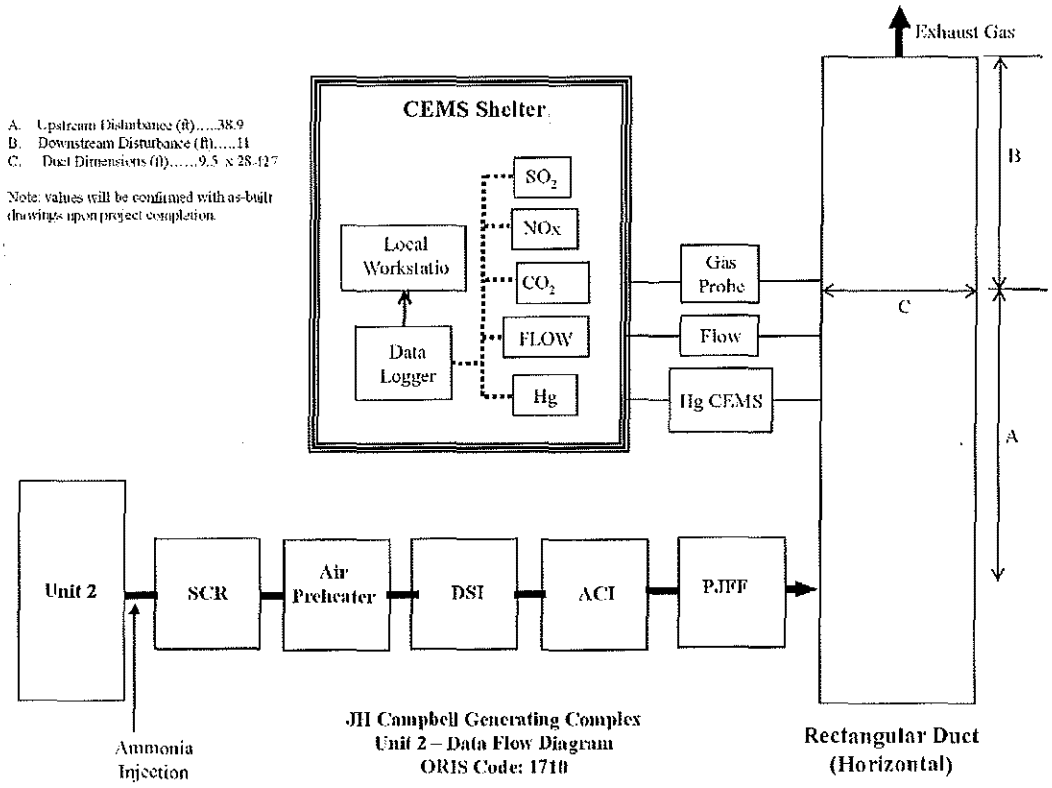


Figure 2-2. Unit 2 Data Flow Diagram



3.3 Rated Capacity

Unit 1 has a nominally rated heat input capacity of 2,490 mmBtu/hr and can generate a gross electrical output of approximately 274 megawatts (MWg). Unit 2 has a nominally rated heat input capacity of 3,560 mmBtu/hr and can generate a gross electrical output of approximately 378 megawatts (MWg), while firing a blend of eastern and western coal. Unit 2 is capable of firing 100% bituminous (eastern) coal, 100% subbituminous (western) coal, and various mixtures of the two coal types. When all coal mills are available, the preceding nominal rating can only be achieved when firing at least 40% eastern coal. Unit 2 is limited to approximately 300 MWg gross when firing only western subbituminous coal.

The boilers operate in a continuous manner in order to meet the electrical demands of Midcontinent Independent System Operator, Inc. (MISO) and Consumers Energy customers. EUBOILER1 and EUBOILER2 are considered baseload units because they are designed to operate 24 hours a day, 365 days a year.

Relative accuracy testing was performed independently on each unit, with each unit operating at its current normal operating level(s), as defined in 40 CFR 75, Appendix A, §6.5.2.1. The range of operation for Units 1 and 2 are as follows: Unit 1 = 110 to 300 MWg; Unit 2 = 110 to 400 MWg. The low operating level is the first 30% of the range of operation, mid is between 30% and 60% of the range of operation, and high is greater than 60% of the range of operation. During the test, Unit 1 average load was approximately 254 MWg, and Unit 2 average load was approximately 300 MWg.

3.4 Process Instrumentation

The process was continuously monitored by boiler operators, environmental technicians, and data acquisition systems during testing. One-minute data for the following parameters were collected during each Hg RATA test run: Load (MWg), total vapor phase Hg (µg/scm), heat input (MBtu/hr), and percent Carbon Dioxide (CO_2). The sampling console clock times were synchronized with the Unit CEMS data logger times.

The facility measured Hg concentrations using a Tekran Instruments Corporation Series 3300 Mercury CEMS dilution-based system with data recorded by an Environmental Systems Corporation (ESC) data acquisition and handling system (DAHS). Table 3-1 provides a summary of the mercury CEMS analyzers used to evaluate compliance with 40 CFR 63, Subpart UUUUU and audited during this test program.

Table 3-1 Mercury Analyzer Specification Summary

Unit	Manufacturer and Model Number	Serial Number	Span Value (µg/scm)
EUBOILER1	Tekran Model 2537 S	3080	10.0
EUBOILER2	Tekran Model 2537 S	3075	10.0

4.0 SAMPLING AND ANALYTICAL PROCEDURES

Consumers Energy performed the Hg CEMS RATAs using the USEPA reference methods listed in 40 CFR 63, Subpart UUUUU, Appendix A §4.1.1.5. The applicable reference methods utilized during this test program are presented in Table 4-1. Ten 30-minute runs were conducted on Units 1 and 2 to calculate the mercury CEMS RA. Descriptions of the sampling and analytical procedures are presented in the following sections.

Table 4-1 Test Methods

Parameter	USEPA Method	USEPA Title
Moisture	ALT-008	Alternative Moisture Measurement Method - Midget Impingers
Mercury (sampling location)	30A	Determination of Total Vapor Phase Mercury Emissions from Stationary Sources (Instrumental Analyzer Procedure)
Mercury (sampling and analysis)	30B	Determination of Total Vapor Phase Mercury Emissions from Coal-Fired Combustion Sources using Carbon Traps

4.1 Sample Location and Traverse Points (USEPA Method 30A)

The location and number of traverse points used to measure mercury concentrations were determined in accordance with USEPA Method 30A, *Determination of Total Vapor Phase Mercury Emissions from Stationary Sources (Instrumental Analyzer Procedure*). Prior to testing, a minimum of one hour of representative Hg emissions data was collected by the CEMS. This data indicated the expected Hg concentration at the time of the Hg monitoring system RATA to be ≤3 µg/m^3, which met the stratification testing exemption provisions of Section 8.1.3.4 of Method 30A. Quality assured data from the certified Units 1 and 2 mercury CEMS used to document Hg concentrations prior to the RATAs and the associated sixty-minute stratification exemption reports for Units 1 and 2 are presented in Appendices D1 and D2, respectively. In accordance with Section 8.1.2 of Method 30A, samples were collected at three traverse points located at 0.4, 1.2, and 2.0 meters from the stack wall.

For the Unit 1 sampling location, five test ports are located in the horizontal plane on one side of the 15 feet by 18 feet 8-inch rectangular duct. The duct has an equivalent duct diameter of 16 feet 7.6 inches. The ports are situated:

- Approximately 55.2 feet or 3.3 duct diameters downstream of a sound deadening silencer flow disturbance, and

- Approximately 10.8 feet or 0.6 duct diameters upstream of flow disturbance caused by a curve in the duct as it enters the exhaust stack.

The sample ports are 6-inches in diameter and extend 2 feet beyond the duct wall. For the purposes of the Unit 1 Hg RATA testing, the flue gas samples were collected from the second test port from the bottom of the duct, at three traverse points.

For the Unit 2 sampling location, five test ports are located in the horizontal plane on one side of the 9.5 feet by 28 feet 5.1-inch rectangular duct. The duct has an equivalent duct diameter of 14.2 feet. The ports are situated:

- Approximately 38.9 feet or 2.7 duct diameters downstream of a duct diameter change flow disturbance, and

- Approximately 11 feet or 0.8 duct diameters upstream of flow disturbance caused by a change in duct diameter as it enters the exhaust stack.

The sample ports are 6-inches in diameter and extend 22 inches beyond the duct wall. For the purposes of the Unit 2 Hg RATA testing, the flue gas samples were collected from the third test port, at three traverse points. Figures of the Unit 1 and Unit 2 duct cross section are presented in Figures 4-1 and 4-2.

Figure 4-1. Unit 1 Duct Cross Section and Test Port/Traverse Point Detail

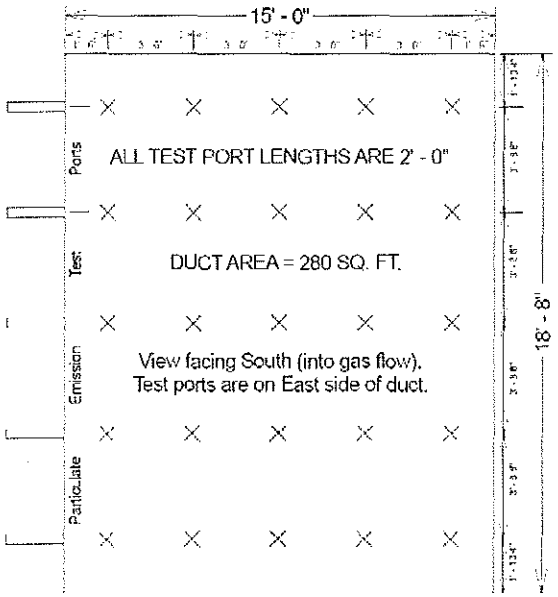
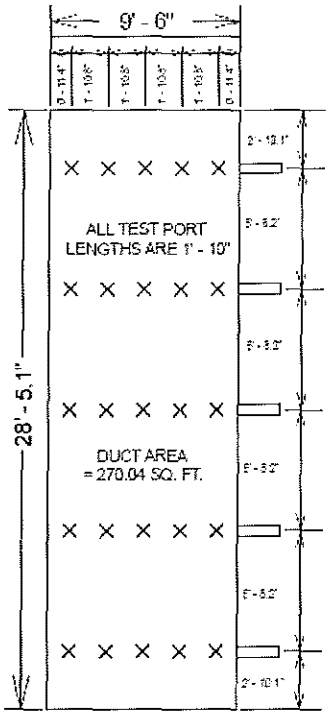


Figure 4-2. Unit 2 Duct Cross Section and Test Port/Traverse Point Detail

View facing North (into gas flow). Test ports are on East side of duct.

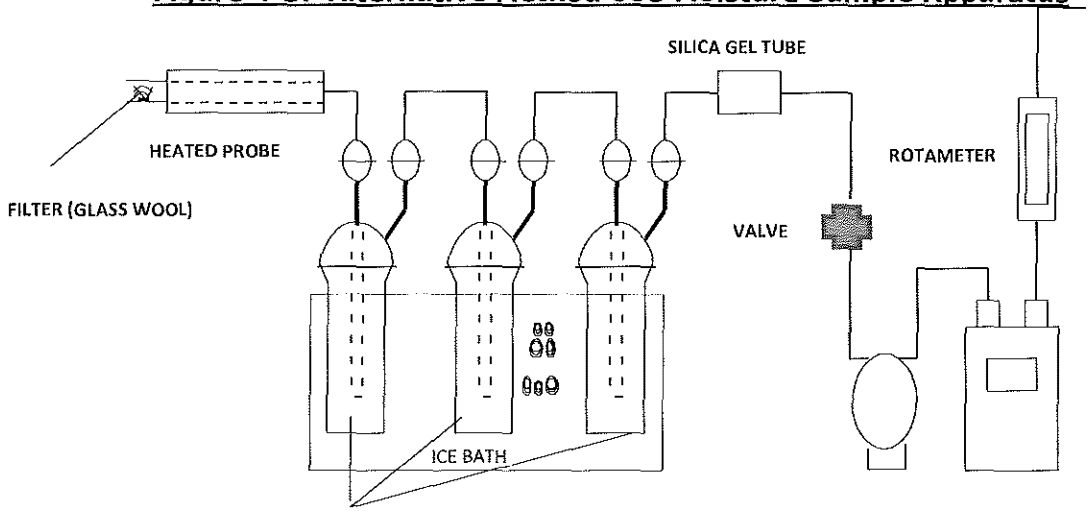


4.2 Moisture Content (USEPA ALT-008)

Exhaust gas moisture content was measured in accordance with USEPA ALT-008, *Alternative Moisture Measurement Method Midget Impingers*, an alternative method for correcting pollutant concentration data to appropriate moisture conditions (e.g. pollutant and/or air flow data on a dry or wet basis) validated May 19, 1993 by the U.S. EPA Emission Measurement Branch. The procedure is incorporated into Method 6A of 40 CFR Part 60 and is based on field validation tests described in *An Alternative Method for Stack Gas Moisture Determination* (Jon Stanley, Peter Westlin, 1978, U.S. EPA Emissions Measurement Branch). The sample apparatus configuration follows the general guidelines contained in Figure 4-2 and § 8.2 of U.S. EPA Method 4, *Determination of Moisture Content in Stack Gases,* and ALT-008 Figure 1 or 2.

The exhaust gas was drawn through a series of midget impingers immersed in an ice bath to condense water in the flue gas. The amount of water collected was measured gravimetrically and used to calculate the exhaust gas moisture content. In accordance with Method 30B, Section 8.3.3.7, one moisture sample was collected for each pollutant sample run performed in order to correct the measured Hg concentrations from a dry basis to a wet basis (consistent with the Hg CEMS measurement). Refer to Figure 4-3 for a figure of the Alternative Method 008 Moisture Sample Apparatus.

Figure 4-3. Alternative Method 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.

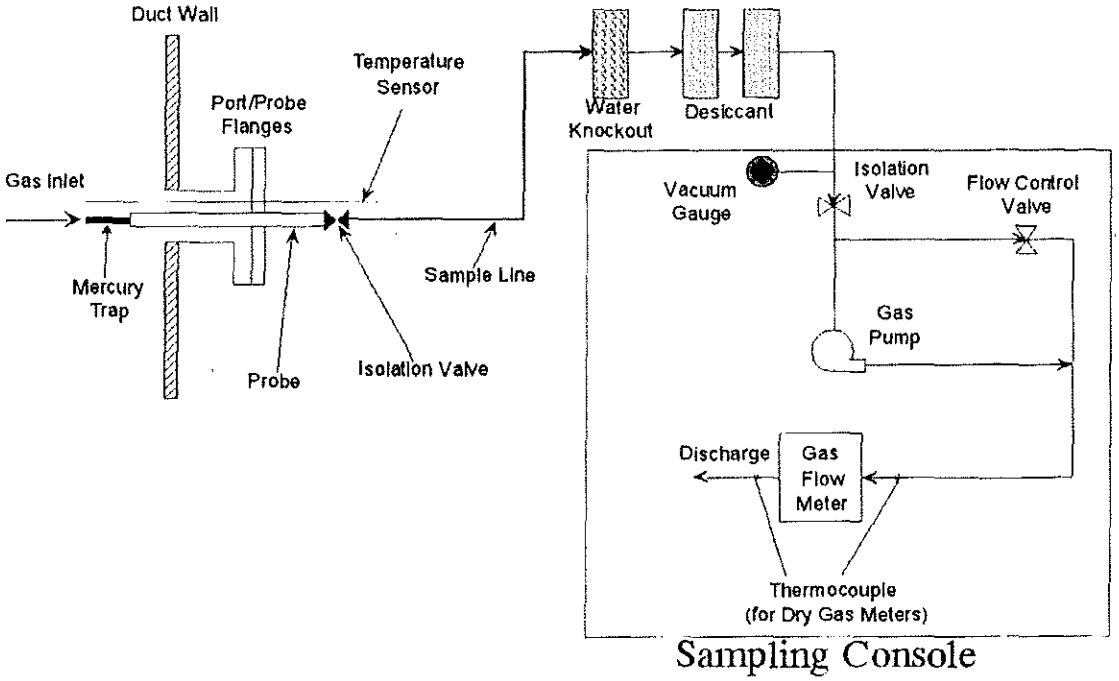
4.3 Mercury (USEPA Method 30B)

Mercury concentrations were measured following the procedures of USEPA Method 30B, *Determination of Total Vapor Phase Mercury Emissions from Coal-Fired Combustion Sources Using Carbon Traps*. Flue gas was extracted from the duct through paired, in-stack sorbent media traps situated in a heated probe at a constant flow rate. Each sorbent trap contained two sections, the first section quantitatively captured Hg and the second section was used to evaluate vapor phase Hg breakthrough. A heated sample line connected to the end of the probe transferred the sampled gas through a moisture removal system and into a dry gas metering console where sample volume and other parameters were recorded. Refer to Figure 4-4 for a depiction of the Method 30B sample train.

At the conclusion of the test run and after the post-test leak check, the sorbent traps were recovered from the sampling system and analyzed on-site using an Ohio Lumex RA-915+ analyzer. The contents of each section of the traps were carefully extracted onto a quartz glass ladle and placed into an oven where the captured mercury was thermally desorbed from the sample matrix (i.e., charcoal) at 680° Celsius. Vapor phase mercury was then measured using a calibrated atomic absorption spectrometry analyzer.

A minimum of three field recovery tests were performed where one of the paired sorbent tubes was spiked with a known mass of mercury and used to sample flue gas during the test run. The field recovery tests assessed the recovery of the elemental mercury spike to determine measurement bias and verify data acceptability. The results of the field recovery tests met the acceptable performance criteria for each unit and are presented in Appendices B1 and B2 for Units 1 and 2, respectively.

Figure 4-4. Method 30B Sorbent Trap Sampling Train



5.0 TEST RESULTS AND DISCUSSION

The Hg CEMS RATAs were performed to satisfy USEPA requirements in 40 CFR 63, Subpart UUUUU. The test results indicate that both of the Units 1 and 2 Hg CEMS meet the acceptance criteria listed in Table A-2 of Appendix A of the MATS Rule.

The sampling console clock time was synchronized with the Hg CEMS DAHS clock prior to beginning each RATA (i.e., Eastern Standard Time, or EST). Test runs were 30 minutes in duration and RM field data run times were reported consistent with the Hg CEMS format (where the start minute and end minute are inclusive), however the field datasheets generated by the sampling console included in Appendices B1 and B2 will show what could be perceived as an additional minute at the end of each run, in comparison to the Hg CEMS reports. This additional minute is the time when sampling was completed (i.e., the last reading was taken) and does not represent an average minute data value.

5.1 Variations and Upset Conditions

During Run 1 of the Unit 1 Hg CEMS RATA, the automated sampling console was manually paused by the RCTS operator momentarily to verify boiler operating conditions. Sampling resumed after the operating conditions were verified within 60 seconds of the time the console had been paused. Because the Hg concentration measured by the CEMS was 0.5 µg/scm prior to and after the 1-minute test pause interval, 31 minutes of CEMS data were used in the Run 1 RA calculations as compared to only 30 minutes for the test run. The additional minute of data did not have a significant effect on the Run 1 results.

Several analyses of the Section 2 carbon beds of the sorbent traps during both the Units 1 and 2 RATA tests resulted in slightly negative Hg mass values. These negative values are

presented in the Hg analysis results data tables in Appendices C1 and C2, however in these instances, a mass of zero (0.00) nanograms Hg was used for calculating Hg concentrations.

The process and control equipment were operating in a manner to allow Hg concentrations to be measured by the reference method and CEMS systems and no upsets were encountered.

5.2 Field Quality Assurance / Quality Control Procedures

The USEPA reference methods performed state reliable results are obtained by persons equipped with a thorough knowledge of the techniques associated with each method. Factors with the potential to cause measurement errors are minimized by implementing quality control (QC) and assurance (QA) programs into the applicable components of field testing. QA/QC components were included in this test program. Table 5-1 summarizes the primary field quality assurance and quality control activities that were performed. Refer to Appendices B, C and E for supporting documentation.

Method 30B requires that a field recovery test, which evaluates the performance of the combined sampling and analytical practices, must be successfully passed with a three-run average elemental Hg spike recovery of 85 to 115%, once per field test. The Method also allows for these field recovery test runs to be used as test runs when conducting an Hg CEMs RATA under 40 CFR 63, Subpart UUUUU, providing the relative deviation of the calculated Hg concentrations of the paired sorbent traps for each field recovery test run meet the QA criteria specified in Table 9-1 of Method 30B. Sorbent traps spiked with 50 nanograms of elemental Hg were utilized in Runs 1 through 4 for the Unit 1 RATA, with Runs 1, 2 and 4 ultimately used to calculate a field recovery result of 108.4%. Similar spiked sorbent traps were utilized in Runs 1 through 3 for Unit 2, with a calculated field recovery result of 101.2%. Field recovery test results are presented in the Sorbent Trap Results Tables in Appendix B1 and B2 for Units 1 and 2, respectively.

Following the completion of the Units 1 and 2 Hg CEMS RATAs, RCTS performed a single post-test "console audit" on the Hg sampling equipment used during the tests. The console audit is a series of quality verification procedures which confirm that the sampling console barometric pressure sensor, vacuum sensors, thermocouples, and dry gas meter (DGM) correction values meet the QA requirements of Method 30B. The results of the console audit are presented in Appendix E.

Table 5-1 Summary of USEPA Method 30B Sampling QA/QC Requirements

QA/QC Test or Specification	Acceptance Criteria	Frequency	Consequences if not met
Gas flow meter calibration (At 3 settings or points)	Calibration factor (Yi) at each flow rate must be within ± 2% of the avg. value (y).	Prior to initial use and when post-test check is not within ± 5% of Y.	Recalibrate at 3 points until acceptance criteria are met.
Gas flow meter post-test calibration check	Calibration factor (Yi) at each flow rate must be within ± 5% of the Y value form most recent 3-pt. calibration.	After each field test. For mass flow meters must be done onsite, using stack gas.	Recalibrate gas flow meter at 3 pts. To determine a new value for Y. For mass flow meters, must be done onsite. Apply the new Y value to the field test data.
Temperature sensor	Absolute	Prior to initial use	Recalibrate: sensor

Table 5-1 Summary of USEPA Method 30B Sampling QA/QC Requirements

QA/QC Test or Specification	Acceptance Criteria	Frequency	Consequences if not met
calibration	temperature measures by the sensor within ± 1.5% of the reference sensor.	and before each test thereafter.	may not be used until specification is met.
Barometer calibration	Absolute pressure measured by the instrument within ± 10 mmHg of reading with a mercury barometer.	Prior to initial use and before each test thereafter.	Recalibrate: instrument may not be used until specification is met.
Pre-test leak check	≤ 4% of target sampling rate	Prior to sampling	Sampling shall not commence until the leak check is passed.
Post-test leak check	Following daily calibration, 4% of average sampling rate	After sampling	Sample invalidated.
Multipoint analyzer calibration	Each analyzer reading within ±10% of true value and $r^2 \geq 0.99$	On the day of analysis, before analyzing any samples	Recalibrate until successful.
Analysis of independent calibration standard	Within ±10% of true value	Following daily calibration, prior to analyzing field samples	Recalibrate and repeat independent standard analysis until successful.
Analysis of continuing calibration verification standard (CCVS)	Within ±10% of true value	Following daily calibration, after analyzing ≤10 field samples, and at end of each set of analyses	Recalibrate and repeat independent standard analysis, reanalyze samples until successful, if possible; for destructive techniques, samples invalidated
Test run total sample volume	Within ± 20% of the total volume sampled during the field recovery test.	Each individual sample	Sample invalidated.
Sorbent trap section 2 breakthrough	≤ 10% of section 1 Hg mass for Hg concentrations > 1 µg/dscm; ≤ 20% of section 1 Hg mass for Hg concentrations ≤ 1 µg/dscm	Every sample	Sample invalidated.
Paired sorbent trap agreement	≤ 10% Relative Deviation mass for	Every run	Run invalidated.

Table 5-1 Summary of USEPA Method 30B Sampling QA/QC Requirements

QA/QC Test or Specification	Acceptance Criteria	Frequency	Consequences if not met
	Hg concentrations > 1 µg/dscm; ≤ 20% or ≤ 0.2 µg/dscm absolute difference for Hg concentrations ≤ 1 µg/dscm.		
Field recovery	Average recovery between 85% and 115% for Hg.	Average from a minimum three spiked sorbent traps.	Field sample runs not validated without successful field recovery test.