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Test Report
40 CFR Part 63, Subpart UUUUU
Mercury LEE Demonstration

EUBOILER01 and EUBOILER02

CMS Enterprises
TES Filer City Station
700 Mee Street
Filer City, Michigan 49634
SRN: N1685

Test Dates: October 2 through November 15, 2017

Report Date: December 19, 2017

Test Performed by the Consumers Energy Company
Regulatory Compliance Testing Section – Air Emissions Testing Body
Laboratory Services

Work Order No. 4101583
Version No. 0

EXECUTIVE SUMMARY

Consumers Energy Company (Consumers Energy) Regulatory Compliance Testing Section (RCTS) conducted total vapor phase mercury (Hg) testing at the stack exhausts associated with electric utility steam generating units (EGU) EUBOILER01 (Unit 1) and EUBOILER02 (Unit 2) operating at the Tondu Energy Systems (TES) Filer City Station in Filer City, Michigan. The facility is a cogeneration power plant with a rated output of 60-megawatts (MW) net and 50,000 pounds of process steam per hour subject to 40 Code of Federal Regulations (CFR) 63, Subpart UUUUU – *National Emission Standards for Hazardous Air Pollutants: Coal- and Oil-fired Electric Utility Steam Generating Units*, aka the Mercury Air Toxics (MATS) Rule, regulations.

This test program was conducted in October and November of 2017 to satisfy the annual performance testing requirements in accordance with §63.10005(h) to determine whether the EGU's qualify as Low Emitting Electric Generating (LEE) units for mercury. The Hg LEE evaluation requires annual sampling of each unit over a 30 boiler operating day period and the average results must be either:

1. less than 10 percent of the applicable Hg emissions limit in Table 2 of the MATS rule, or
2. demonstrate the potential Hg mass emissions are less than or equal to 29.0 pounds per year and compliant with the applicable emissions limit in Table 2 of the MATS rule.

The applicable emission limit for EUBOILER01 and EUBOILER02, which are existing EGUs that are coal-fired not low rank virgin coal and subject to the emission limits within Table 2 of the MATS rule, is 1.2 pounds of mercury per trillion British thermal unit (lb Hg/TBtu) or 1.3×10^{-2} pounds of mercury per gigawatt hour (lb/GWh).

The testing was performed in accordance with the test protocol submitted to the Michigan Department of Environmental Quality (MDEQ) on September 1, 2017 and subsequently approved by Mr. Jeremy Howe, MDEQ Environmental Quality Analyst, in his letter dated September 29, 2017. No deviations from the protocol occurred. The results of the testing are presented below:

- Unit 1: 0.00670 lb/TBtu, 0.02254 lb/yr mass emissions based upon the average of thirty boiler operating days.
- Unit 2: 0.02455 lb/TBtu, 0.08257 lb/yr mass emissions based upon the average of thirty boiler operating days.

The results indicate EUBOILER01 and EUBOILER02 comply with the MATS Hg lb/TBtu limit as well as the annual mass emissions limit and meet LEE qualification criteria.

1.0 INTRODUCTION

Consumers Energy Company (Consumers Energy) Regulatory Compliance Testing Section (RCTS) conducted total vapor phase mercury (Hg) testing at the stack exhausts associated with electric utility steam generating units (EGU) EUBOILER01 (Unit 1) and EUBOILER02 (Unit 2) operating at the Tondu Energy Systems (TES) Filer City Station in Filer City, Michigan. The facility is a cogeneration power plant with a rated output of 60-megawatts (MW) net and 50,000 pounds of process steam per hour subject to 40 Code of Federal Regulations (CFR) 63, Subpart UUUUU – *National Emission Standards for Hazardous Air Pollutants: Coal- and Oil-fired Electric Utility Steam Generating Units*, aka the Mercury Air Toxics (MATS) Rule, regulations.

This test program was conducted to satisfy the annual performance testing requirements in accordance with §63.10005(h) to determine whether the EGU's qualify as a Low Emitting Electric Generating (LEE) units for mercury. The Hg LEE evaluation requires annual sampling of each unit over a 30 boiler operating day period and the average results must be either:

1. less than 10 percent of the applicable Hg emissions limit in Table 2 of the MATS rule (see Table 1-1 below), or
2. demonstrate the potential Hg mass emissions are less than or equal to 29.0 pounds per year and compliant with the applicable emissions limit in Table 2 of the MATS rule.

Table 1-1
40 CFR 63, Subpart UUUUU – Table 2 Emission Limit

Parameter	Emission Limit	Units	Applicable Requirement(s)
Mercury	1.2 or 1.3	Lb/TBtu lb/GWh	Table 2(1)(c) to Subpart UUUUU of Part 63—Emission Limits for Existing EGU's

lb/TBtu: pounds of mercury per trillion British thermal unit
lb/GWh: pounds of mercury per gigawatt hour

A revised test protocol was submitted to the Michigan Department of Environmental Quality (MDEQ) on September 1, 2017 and subsequently approved by Mr. Jeremy Howe, MDEQ Environmental Quality Analyst, in his letter dated September 29, 2017. The revised test protocol was requested by the MDEQ, after Consumers Energy Environmental Services department had requested and subsequently received approval from the Environmental Protection Agency (EPA)

Region 5 to perform the 2017 Hg LEE test at Filer City at approximately 270 days separation from the 2016 Hg LEE test, as opposed to the 320 days cited in §63.1006(f)(1)(ii)(B) {*Time Between Performance Tests*}. The request to perform the 2017 test earlier in the year was to mitigate the safety hazards associated with performing the emissions tests upon the stack during the northern Michigan winter months, as well as to reduce the likelihood of invalidated test runs caused by sample equipment freezing as had been experienced in the 2016 TES Filer City Hg LEE demonstration.

The Unit 1 Hg LEE test was conducted from October 2, through November 15, 2017. The Unit 2 Hg LEE test was conducted from October 2, through November 2, 2017.

1.1 CONTACT INFORMATION

Table 1-2 presents the test program organization, major lines of communication, and names and phone numbers of responsible individuals.

Table 1-2
Contact Information

Program Role	Contact	Address
Regulatory Agency Representative	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
Regulatory Agency Inspector	Ms. Caryn Owens Environmental Engineer 231-876-4414 owenscl@michigan.gov	Michigan Department of Environmental Quality Cadillac District 120 W. Chapin Street Cadillac, Michigan 49601
Regulatory Agency Representative	Mr. Jeremy Howe Environmental Quality Analyst 231-876-4416 howejl@michigan.gov	Michigan Department of Environmental Quality Cadillac District 120 W. Chapin Street Cadillac, Michigan 49601
Responsible Official	Mr. Henry Hoffman General Manager 231-723-6573, Ext 102 henry.hoffman@cmsenergy.com	CMS Generation Filer City Operating, LLC Filer City Station 700 Mee Street Filer City, Michigan 49634

Table 1-2
Contact Information

Program Role	Contact	Address
Plant Representative	Mr. Austin S. Swiatlowski Plant Operator 231-723-6573, Ext 108 austin.swiatlowski@cmsenergy.com	CMS Generation Filer City Operating, LLC Filer City Station 700 Mee Street Filer City, Michigan 49634
Test Team Lead	Mr. Gregg A. 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
Test Team Representative	Mr. Thomas R. Schmelter, QSTI 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 OF RESULTS

2.1 OPERATING DATA

In accordance with 40 CFR 63.10007(a)(2) the boilers were operated at maximum normal operating load conditions during the 30 boiler operating day test program; maximum normal operating load condition will generally be between 90 and 110 percent of design capacity but should be representative of site specific normal operations during each test run. The boilers fired blends of coal, tire derived fuel, and/or wood during testing. The average steam generating rates during the valid tests were approximately 299,700 lbs/hr for Unit 1 and 298,300 lbs/hr for Unit 2. These steam generating rates are approximately 93.7 and 93.2% of the full load ratings of 320,000 lbs/hr for each unit. Recorded operating data, including fuel blend firing rate and composite fuel factor data, is included in Appendix C.

2.2 APPLICABLE PERMIT INFORMATION

The TES Filer City Station is currently operating pursuant to the terms and conditions of State of Michigan Registration Number (SRN) N1685 air permit MI-ROP-N1685-2015b. The air permit incorporates state and federal regulations. The USEPA has assigned a Facility Registry Service (FRS) identification number of 110056958225. EUBOILER01 and EUBOILER02 are the emission unit sources listed within the permit and collectively comprise the FGBOILERS flexible group.

Incorporated within the permit are the applicable requirements of 40 CFR 63, Subpart UUUUU – National Emission Standards for Hazardous Air Pollutants: Coal- and Oil-fired Electric Utility Steam Generating Units.

2.3 RESULTS

The results of the testing indicate EUBOILER01 and EUBOILER02 comply with the MATS Hg lb/TBtu limit as well as the annual mass emissions limit and meet LEE qualification criteria.

Refer to Table 2-1 for a summary of the results. Refer to Section 5.0 and the Results Table in the Appendix for additional detail and further discussion of the results.

Table 2-1
Summary of Hg Emission Test Results

Source	Test Run	Hg Concentration (µg/dscm)	Hg Emission Rate (lb/TBtu)		Hg Emission Rate† (lb/yr)	
		Result	Result	LEE Limit	Result	LEE Limit
Unit 1	1	0.00418	0.00366	-	0.01233	-
	2‡	0.00283	0.00251	-	0.00845	-
	3‡	0.00569	0.00515	-	0.01734	-
	4	0.00618	0.00551	-	0.01853	-
	5‡	0.01304	0.01204	-	0.04050	-
	6	0.00889	0.00811	-	0.02729	-
	7	0.01040	0.00952	-	0.03202	-
	Average	**0.00741**	**0.00670**	**0.12**	**0.02254**	**29.0**
Unit 2	1	0.02149	0.01897	-	0.06380	-
	2	0.01933	0.01757	-	0.05909	-
	3‡	0.07254	0.06609	-	0.22230	-
	6	0.03945	0.03488	-	0.11733	-
	7	0.02877	0.02677	-	0.09005	-
	Average	**0.02726**	**0.02455**	**0.12**	**0.08257**	**29.0**

µg/dscm, dry — microgram per dry standard cubic meter
lb/yr — pound per year
lb/TBtu — pound per trillion British thermal unit
† — based on multiplying the average lb/TBtu by 8,760 hours/year X 384 mmBtu/hr X TBtu/10^6 Btu
‡ — Run invalidated; results excluded from the test series averages and emissions calculations

3.0 SOURCE DESCRIPTION

TES Filer City Station is a cogeneration plant consisting of two solid-fuel fired boilers, with coal being the primary fuel. The electricity output is sold pursuant to a long-term power purchase agreement with Consumers Energy Company. Process steam is sold to an adjacent industrial customer.

3.1 PROCESS

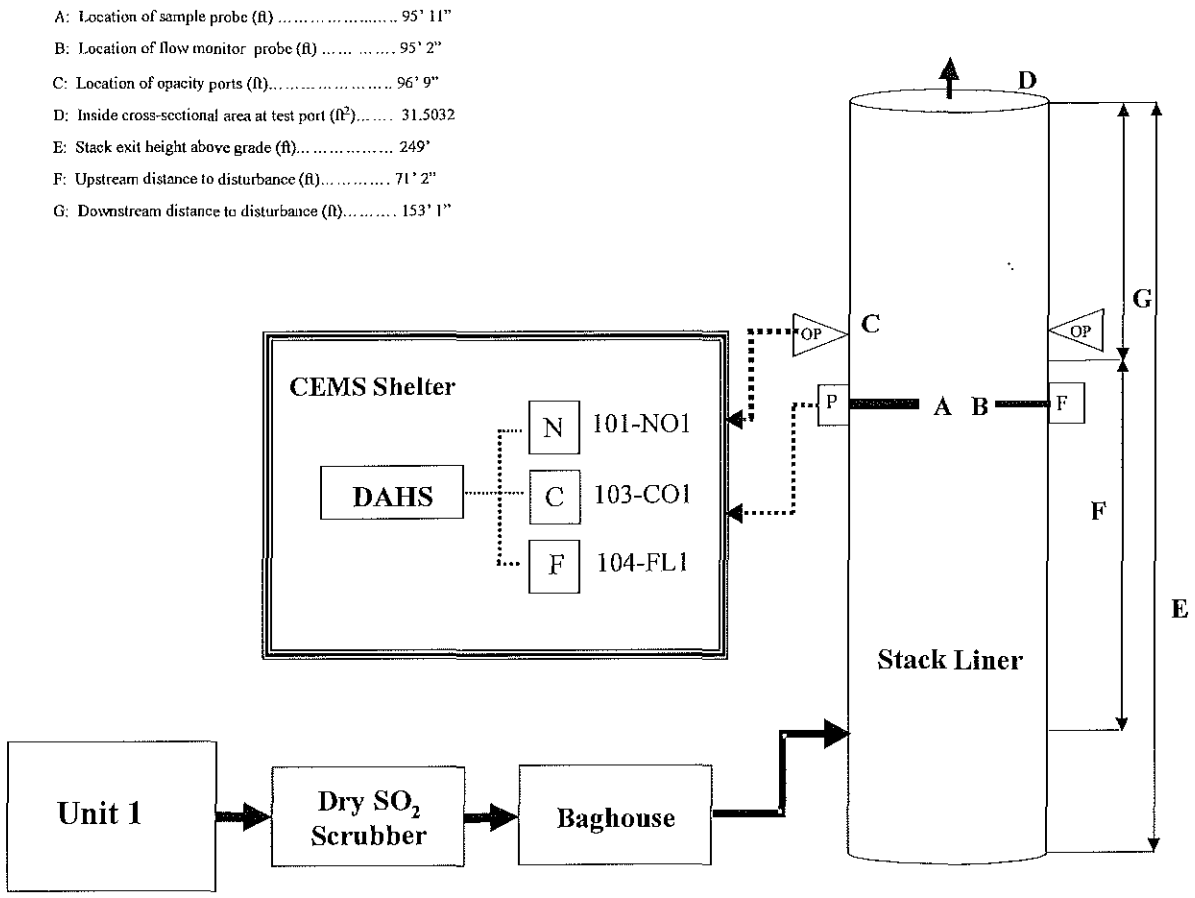
TES Filer City Station operates as a cogeneration electric power plant with a rated output of approximately 60-megawatts net (MW_n) and is also capable of generating 50,000 pounds of process steam per hour. The electricity and process steam are sold under contract to public and/or private companies. The facility commenced commercial operations beginning in 1990.

3.2 PROCESS FLOW

EUBOILER01 and EUBOILER02 are spreader stoker boilers used to generate steam. Each unit has a nominal heat input rating of approximately 384 mmBtu/hour and is currently allowed to combust bituminous coal, wood and wood waste, industrial construction/demolition wood waste, tire derived fuel and natural gas. The fuel is fired in the furnace where the combustion heats water within boiler tubes producing steam. At full load, each unit is capable of producing approximately 320,000 pounds per hour of steam. This steam is used to turn a common steam turbine that is connected to an electricity producing generator. The electricity is routed through the transmission and distribution system to customers.

The exhaust gas from each boiler is vented to a spray dryer absorber (SDA) flue gas desulfurization (FGD) system for sulfur dioxide (SO_2) and acid gas (i.e., HCl) control and a baghouse to control particulate matter. The abated exhaust gases are discharged through separate circular flues housed within a single exhaust stack. The separate flues discharge approximately 250 feet above grade. Refer to Figure 3-1 for a Process Flow Diagram of Unit 1 which is representative of Unit 2.

Figure 3-1. Process Flow Diagram



3.3 Raw and Finished Materials Processed

At the time of testing, Units 1 and 2 were capable of firing mixtures of coal (bituminous and subbituminous), wood and wood waste, construction/demolition (C/D) material, tire-derived-fuel (TDF) and natural gas. During the tests, coal, TDF and wood were fired. Refer to Appendix D for facility operating data recorded during the test program.

In March of 2016, two low NO_x natural gas-fired burners were installed in each boiler. Natural gas is utilized as a clean startup fuel, as well as at other times for flame stabilization and other purposes.

TES executed an Administrative Consent Order with the EPA which resulted in all petroleum coke having been removed from the site by March 31, 2016, and TES does not anticipate firing petroleum coke in the near future.

3.4 Rated Capacity

EUBOILER01 and EUBOILER02 each have a nominally rated heat input capacity of 384 mmBtu/hr and a steam generation capacity of 320,000 lbs/hr; they can generate a combined net electrical output of approximately 60 MW_n and 50,000 pounds of process steam per hour. The boilers normally operate in a continuous manner near their rated capacity in order to meet the contractual electrical and steam requirements of TES Filer City Station customers.

3.5 Process Instrumentation

The process was continuously monitored by boiler operators, environmental technicians, and data acquisition systems during testing. The following operating parameters were recorded during the test program and are included in Appendix D:

- Carbon dioxide concentration (CO_2, %)
- Fuel blend (coal, natural gas, TDF, and wood) firing rates (lb/hr) (scfh for natural gas)
- Exhaust volumetric flowrate (standard cubic foot per hour [scfh])
- Mixed fuel factor, Fc (scf/mmBtu)
- Total heat input (mmBtu/hr)
- Steam load flow (1,000s lb/hr) [In lieu of electrical load, which is only determined on a combined basis.]
- Steam pressure (psia)
- Opacity (%)

Due to the various instrumentation monitoring systems, the reference method test times were correlated to facility instrumentation time stamps. The reference method data acquisition system clock was adjusted to match the facility time stamp which uses Eastern Standard Time.

4.0 SAMPLING AND ANALYTICAL PROCEDURES

RCTS tested for total vapor phase mercury using the USEPA test methods presented in Table 4-1. Descriptions of the sampling and analytical procedures are presented in the following sections.

Table 4-1
Test Methods

Parameter	USEPA	
	Method	Title
Sampling location	1	Sample and Velocity Traverses for Stationary Sources
Moisture	ALT-091	Alternative Procedures for Determination of Moisture Content
Total vapor phase mercury	30B	Determination of Total Vapor Phase Mercury Emissions from Coal-Fired Combustion Sources Using Carbon Sorbent Traps

4.1 DESCRIPTION OF SAMPLING TRAIN AND FIELD PROCEDURES

The test matrix presented in Table 4-2 summarizes the sampling and analytical methods performed for the specified parameters during this test program.

Table 4-2
Test Matrix

Source	Sample Type	Run	Start (local time)	Stop (local time)	Test Duration (hours)	EPA Test Method	Comment
Unit 1	Moisture content and mercury	1	10/2/17 11:35	10/9/17 12:05	168.5	ALT-091 30B	Valid run
		2	10/9/17 13:20	10/16/17 10:40	165.4		Run invalidated; results excluded from emissions calculations
		3	10/16/17 11:14	10/18/17 11:14	48.0		Run invalidated; results excluded from emissions calculations
		4	10/18/17 12:47	10/26/17 9:47	189.0		Valid run

Table 4-2
Test Matrix

Source	Sample Type	Run	Start (local time)	Stop (local time)	Test Duration (hours)	EPA Test Method	Comment
		5	10/26/17 10:45	11/2/17 11:21	168.6		Run invalidated; results excluded from emissions calculations
		6	11/2/17 12:01	11/9/17 12:19	168.3		Valid run
		7	11/9/17 12:11	11/15/17 10:42	142.5		Valid run
Unit 2	Moisture content and mercury	1	10/2/17 11:00	10/9/17 11:00	168.0	ALT-091 30B	Valid run
		2	10/9/17 11:50	10/16/17 9:54	166.1		Valid run
		3	10/16/17 10:36	10/18/17 13:38	51.1		Run invalidated; results excluded from emissions calculations
		4	10/19/17 13:00	10/26/17 11:06	166.1		Valid run
		5	10/26/17 12:00	11/2/17 10:22	166.4		Valid run

4.1.1 Sample Location (USEPA Method 1 and MATS Table 5)

The selection of the measurement site was evaluated using the procedure in USEPA Method 1, *Sample and Velocity Traverses for Stationary Sources* and MATS Table 5. Each exhaust gas flue is 76 inches in diameter with two 6-inch internal diameter sample ports that extend 20 inches from the flue interior wall. The sample ports are situated:

- Approximately 90 feet or 14 duct diameters downstream of a duct bend disturbance where the combustion gases exit the baghouse, and
- Approximately 150 feet or 24 duct diameters upstream of the exhaust to atmosphere.

The sampling locations are at least eight stack or duct diameters downstream and two diameters upstream from any flow disturbance such as a bend, expansion, or contraction in the stack, or from a visible flame and meet the requirements of USEPA Method 1. As allowed in MATS Table 5, Item 4.a for mercury LEE testing, a dual sample train probe, with a single opening for

each train, was positioned to collect exhaust gas samples from the centrally located 10 percent area of the stack cross-section.

A dimensioned sketch of the sample location showing the sampling ports in relation to breeching and to upstream and downstream disturbances or obstructions in gas flow is presented as Figure 4-1. The Unit 1 duct cross section and sampling point detail is presented as Figure 4-2; Unit 2 is identical to Unit 1 with the exception the two test ports are located at the northeast and northwest compass positions.

Figure 4-1. Unit 1 and 2 Sample Location

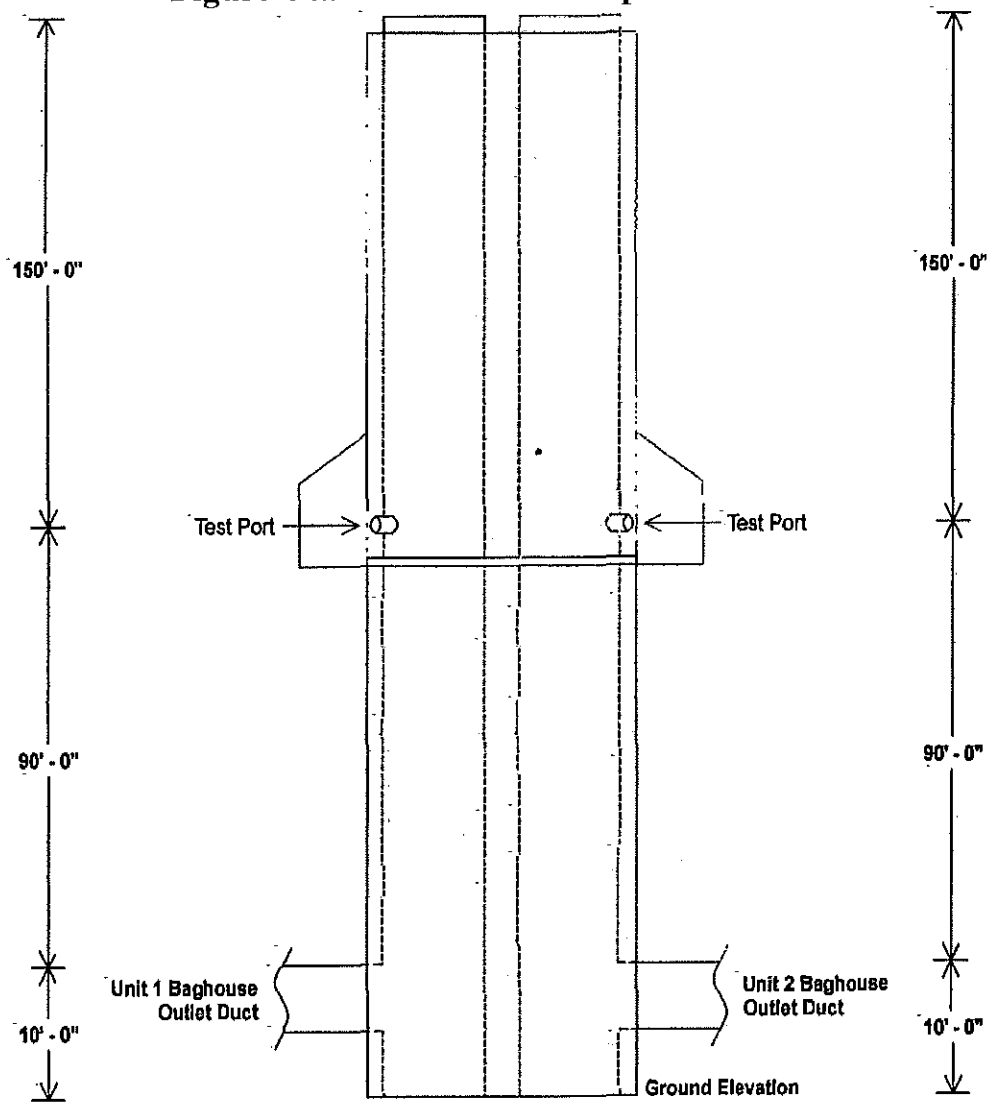
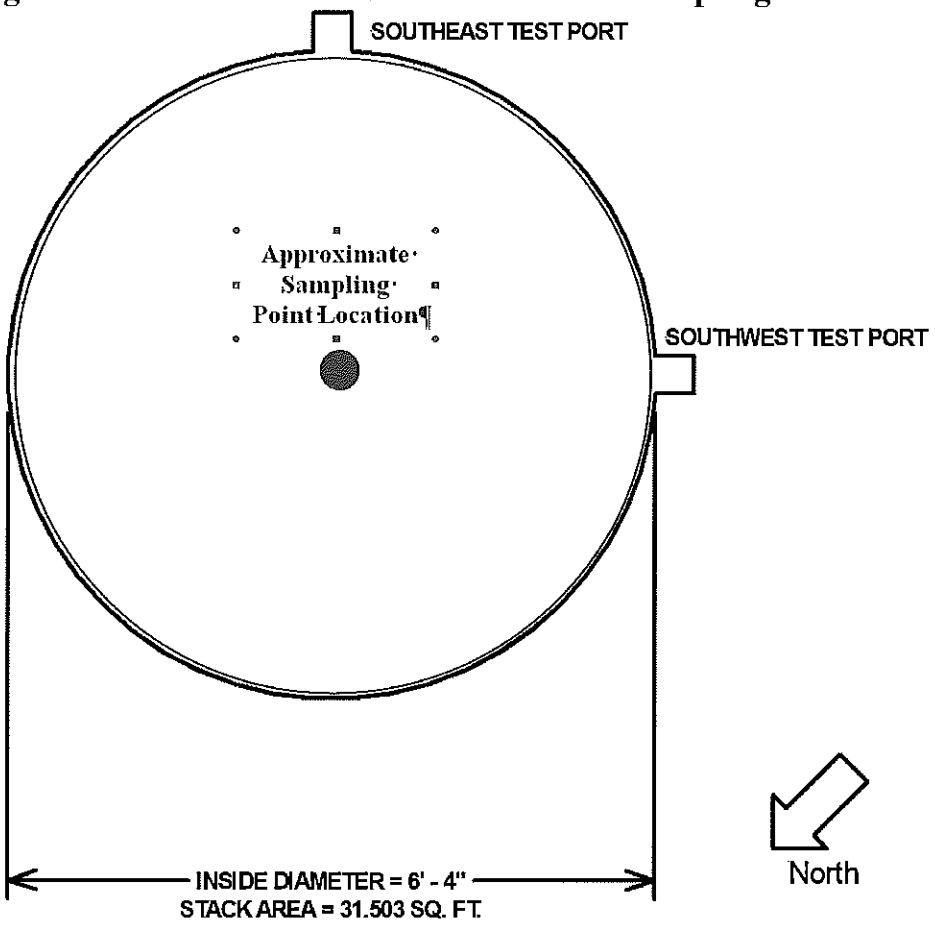


Figure 4-2. Unit 1 Duct Cross Section and Sampling Point Detail



4.1.2 Moisture (USEPA Method ALT-091)

The exhaust gas moisture content was determined using USEPA Approved Alternative Method ALT-091, in conjunction with the reference method (RM) 30B sample apparatus. Exhaust gas was drawn through the RM 30B sample apparatus, which includes water knockout and desiccant vessels to remove stack gas moisture. The water knockout and desiccant vessels were weighed within 0.5 grams before and after each test run to measure the mass of water vapor collected and calculate stack gas percent moisture using the applicable calculations in Section 12 of USEPA RM 4.

USEPA Approved Alternative Method ALT-091 requires the moisture content to also be determined using the average stack gas temperature in conjunction with saturation vapor tables, specifying the lower of the two values shall be considered the moisture content for the LEE

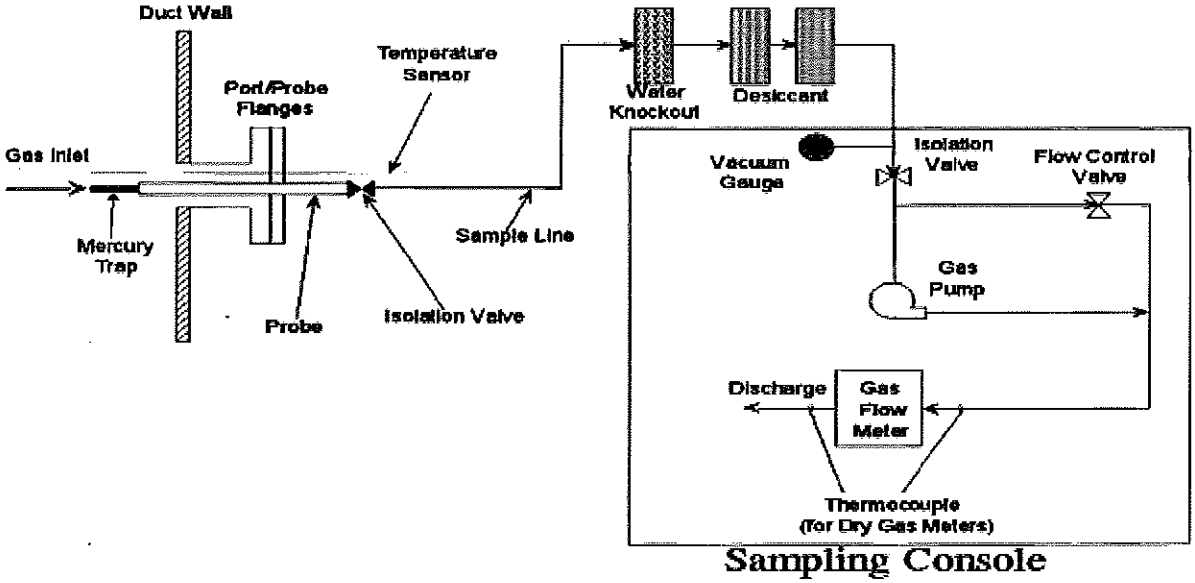
demonstration. The stack gas temperature run averages ranged from 174.9 degrees Fahrenheit (°F) to 178.8 °F during the test period. The water vapor content at these temperatures equate to approximately 45% moisture by volume at saturation, much higher than the average measured using the mass of water collected in the RM 30B sample apparatus (Unit 1 averaged 13.7% moisture, Unit 2 averaged 14.8%). Therefore, the moisture content measured using the applicable calculations in Section 12 of RM 4 and the mass of water collected in the RM 30B sample apparatus were used in emissions calculations.

4.1.3 Mercury (USEPA Method 30B)

Mercury was measured utilizing USEPA Reference Method 30B, *Determination of Total Vapor Phase Mercury Emissions from Coal-Fired Combustion Sources Using Carbon Sorbent Traps.* Each valid test run consisted of paired sorbent traps and ranged from 5.9 to 7.9 boiler operating days in duration. Hg emissions data was collected continuously over the entire test period except when changing sorbent traps, performing required Method 30B QA procedures, or as indicated otherwise in Section 5.0. Refer to Figure 4-3 for a drawing of the USEPA Method 30B Hg Sample Apparatus.

The Hg sorbent trap system probe tip was positioned within 10 percent centroid area of each stack in accordance with sampling point specifications in Table 5 of 40 CFR Part 63 Subpart UUUUU. Following sampling, the sorbent traps were transported to Consumers Energy Laboratory and analyzed in accordance with Section 11.0 of RM 30B

Figure 4-3. USEPA Method 30B Hg Sample Apparatus



5.0 TEST RESULTS AND DISCUSSION

The test program results indicate EUBOILER01 and EUBOILER02 are in compliance with MATS Rule LEE Hg emission limits (lb/TBtu) as well as the annual potential Hg emissions (lb/yr). The results are presented in the table which follows this report body and precedes the appendices.

5.1 VARIATIONS AND UPSET CONDITIONS

Two boiler operating condition variations occurred during this test program which could have affected the results of this test program. The test runs affected by these upsets were invalidated and not used in the Hg emissions calculations to demonstrate LEE status, and are explained further in sections 5.1.1 and 5.1.2.

5.1.1 Unit 1 Discussion

Sorbent trap analysis of Unit 1 Run 2 (October 9-16) resulted in Hg breakthrough into Section 2 of the B Train sorbent tube exceeding the limits (i.e., ≤ 50% of the section 1 mass) established in RM 30B Table 9-1, Quality Assurance/Quality Control Criteria for Method 30B. The results of this run were invalidated and not used in the Hg LEE demonstration calculations due to the failed breakthrough specification. It was noted by RCTS during the analysis of the individual carbon sections of Run 2 that the carbon was exhibiting signs of high moisture, which indicated that the sorbent trap heater located in the sampling probe may not have been heating the traps adequately to prevent condensation.

RCTS returned to the source on October 18 to end Run 3 (October 16-18) early in order to investigate the status of the sorbent trap heater located in the sample probe tip. Post-run leak check procedures were performed and the sorbent traps and moistures were recovered for this run, however Run 3 was invalidated due to the limited sample volume collected. After removing the sorbent traps, a secondary thermocouple was inserted into the sorbent trap wells to verify the temperature of the trap heater. It was confirmed that the heater was operating below the temperature set point. RCTS took corrective actions and confirmed the proper operation of the sorbent trap heater before initiating Run 4.

During Run 5 (October 26 – November 2), shutdown procedures were initiated on Unit 1 on October 28, at approximately 12:48 but were subsequently aborted before the unit was offline. Fuel feed rates

were increased at 13:30 and the unit was returned to full load shortly afterwards at approximately 13:54. Hg sampling had continued throughout the period of time in which the Unit 1 load was being lowered and then ramped back up to full load, which invalidated the results of Run 5.

Due to the issues cited above, three additional runs were performed on Unit 1 for a total of seven runs, in order to obtain 30 valid boiler operating days of data for the Hg LEE demonstration. Runs 2, 3, and 5 were not included in the Unit 1 Hg LEE calculations; however the results of these runs were included in this report to demonstrate the continuous sampling throughout the test.

At the completion of the Hg LEE sampling procedures, RCTS performed a post-test "Console Audit" on the sampling equipment used on Units 1 and 2 for the duration of the tests. The console audit performs quality verification of the console barometric pressure sensor, vacuum sensors, thermocouples, and dry gas meter (DGM) Y values. During the console audit of the Unit 1 sampling equipment, the A sample train DGM, serial number 20151053, post-test Y value failed to meet the ±5% tolerance of the initial Y_i value (1.007). Per Table 9-1 of RM 30B, the dry gas meter was recalibrated at three separate flow rates to determine a new Y value (1.120). The new Y value was then applied to the gas volume measurements made by the A train DGM during the field test for both the Hg concentration calculations, as well as the ALT-091 moisture analysis calculations. The uncorrected Hg emissions results, uncorrected moisture analysis results, and the DGM recalibration sheet are included in Appendix E.

Runs 1, 4, 6 and 7 were used for calculating emissions of Unit 1 with Runs 4, 6 and 7 comprising the successful Field Recovery Test at 95.5% average recovery.

Several analyses of Section 2 of the sorbent traps during this test program resulted in negative Hg mass values ranging from -0.21 ng to -3.18 ng. A value of zero (0.00) was used in emissions calculations when this occurred.

5.1.2 Unit 2 Discussion

During Run 3 (October 16-18), Unit 2 was brought offline on October 18, at approximately 12:30 due to a ruptured economizer tube. The Hg sampling had continued during the time the Unit was offline, invalidating the test run. RCTS ended the sample run, performed post-test leak checks, and recovered the sorbent traps and moistures for analysis. RCTS returned to the source following the completion of boiler repairs, and initiated Run 4 on October 19.

Due to the issue cited above, one additional run was performed on Unit 2 for a total of five runs in order to obtain 30 boiler operating days of valid sample data. Run 3 was invalidated and therefore not included in the emissions calculations for Unit 2 Hg LEE status. The data and results of this run were included in this report to demonstrate the continuous sampling throughout this test. Runs 1, 2, 4, and 5 were used for calculating emissions of Unit 2 with Runs 1, 2 and 5 comprising the successful Field Recovery Test at 99.9% average recovery.

5.2 Air Pollution Control Device Maintenance

No significant air pollution control device maintenance has occurred during the three months prior to the testing.

5.3 Field Quality Assurance / Quality Control Procedures

Each USEPA reference method performed contains specific language stating reliable results are obtained by persons equipped with a thorough knowledge of the techniques associated with each method. To that end, factors which could potentially cause sampling errors were minimized by implementing quality assurance (QA) programs into every applicable component of field testing possible. The following QA components were included in this test program.

Each Hg sampling train was leak-checked before each test run as well as immediately after. Care was exercised to minimize effects of stray or ambient Hg at the sampling site, such as ensuring the sample ports are cleaned thoroughly, maintaining enough distance from duct walls and/or other sources of Hg so that bias was not introduced artificially. Time, dry gas meter temperature, sample rate, barometric pressure, source temperature and total sample volume were documented for each run.

Manual test equipment was calibrated before the test program in accordance with appropriate USEPA procedures. Dry gas meter and thermocouple calibrations are included in Appendix E. Annual and benchtop mercury analyzer calibration data and certificates of analysis for mercury standards are included in Appendix C. The QA/QC requirements associated with the performance of RM 30B are summarized in Table 5.1 below. The valid test runs used to calculate Hg emissions for demonstration of Hg LEE compliance met the following QA/QC criteria.

Table 5-1
Summary of RM 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 tbe 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 calibration	Absolute temperature measures by the sensor within ± 1.5% of the reference sensor.	Prior to initial use and before each test thereafter.	Recalibrate: sensor 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	≤ 4% of average sampling rate	After sampling	Sample invalidated.
Multipoint analyzer calibration	Each analyzer reading within ±10% of true value and r2≥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; ≤ 50% of section 1 Hg mass if the stack Hg concentration ≤ 30% of the Hg concentrations that is equivalent to the applicable emissions limit	Every sample	Sample invalidated.
Paired sorbent trap agreement	≤ 10% Relative Deviation mass for Hg concentrations > 1 µg/dscm;	Every run	Run invalidated.

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

QA/QC test or specification	Aeeeptance criteria	Frequency	Consequences if not met
	≤ 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.

TES Filer City Unit 1 & Unit 2 Mercury Emission Results - 2017 Hg LEE Demonstration

Run Start Date	Test ID	Date Analyzed	Trap ID	Side	Trap Analysis Results: Section A (ng)	Section B (ng)	Total Mass (A+B) (ng)	Breakthrough (%)	Spike Added (ng)	Spike Recovery (%)	Actual Time Sampled	Volume Sampled (dscm)	Hg Concentration (ug/dscm)	Side A and B, RPD (%)	Moisture by volume (%)	Hg Concentration (ug/scm, wet)	CO_2 Concentration (%, wet)	Fuel Factor (Fc)	Hg Emission Rate (lb/Tbtu)	Hg Emission Rate (lb/yr)
10/2/2017	Unit 1_Run 1	10/10/2017	OLC054318	A	116.20	0.00	116.20	0.00	100	89.7	7d 0h 30m	5.11077	0.00317		13.5	0.00274			0.00280	0.00942
10/2/2017	Unit 1_Run 1	10/10/2017	OLC052745	B	24.73	0.00	24.73	0.00			7d 0h 30m	4.76434	0.00519	24.2	14.6	0.00443			0.00453	0.01523
			Run 1 Average										**0.00418**		**14.1**	**0.00359**	**11.0**	**1800.7**	**0.00366**	**0.01233**
10/9/2017	Unit 1_Run 2	10/17/2017	OLC054450	A	97.39	1.29	98.68	1.32	100	69.7	6d 21h 20m	4.89193	-0.00027		13.3	-0.00023			-0.00024	-0.00082
10/9/2017	Unit 1_Run 2	10/17/2017	OL432561	B	16.11	11.03	27.14	68.47			6d 21h 20m	4.57888	0.00593	109.5	14.4	0.00507			0.00527	0.01772
	Run 2 Average (omitted from results calculations)												**0.00283**		**13.9**	**0.00242**	**10.8**	**1800.6**	**0.00251**	**0.00845**
10/16/2017	Unit 1_Run 3	10/27/2017	OLC054397	A	106.10	1.50	107.60	1.41	100	99.3	2d 0h 0m	1.39756	0.00544		13.9	0.00468			0.00496	0.01667
10/16/2017	Unit 1_Run 3	10/27/2017	OL432669	B	7.15	0.67	7.81	9.33			2d 0h 0m	1.31369	0.00595	4.5	15.0	0.00506			0.00535	0.01800
	Run 3 Average (omitted from results calcuations)												**0.00569**		**14.5**	**0.00487**	**10.6**	**1800.6**	**0.00515**	**0.01734**
10/18/2017	Unit 1_Run 4	10/27/2017	OLC054410	A	127.80	0.03	127.83	0.02	100	99.8	7d 21h 0m	4.51931	0.00616		13.3	0.00534			0.00552	0.01855
10/18/2017	Unit 1_Run 4	10/27/2017	OLC052738	B	26.59	0.00	26.59	0.00			7d 21h 0m	4.28438	0.00621	0.4	14.2	0.00532			0.00550	0.01850
			Run 4 Average										**0.00618**		**13.8**	**0.00533**	**10.9**	**1800.5**	**0.00551**	**0.01853**
10/26/2017	Unit 1_Run 5	11/3/2017	OLC54391	A	162.80	0.09	162.89	0.05	100	99.3	7d 0h 36m	4.84918	0.01297		13.0	0.01128			0.01199	0.04032
10/26/2017	Unit 1_Run 5	11/3/2017	OLC052797	B	61.64	0.00	61.64	0.00			7d 0h 36m	4.69946	0.01312	0.6	13.2	0.01139			0.01209	0.04068
	Run 5 Average (omitted from results calculations)												**0.01304**		**13.1**	**0.01133**	**10.6**	**1800.7**	**0.01204**	**0.04050**
11/2/2017	Unit 1_Run 6	11/13/2107	OLC054295	A	140.80	0.51	141.31	0.36	100	98.0	7d 0h 18m	4.75735	0.00868		13.1	0.00755			0.00795	0.02673
11/2/2017	Unit 1_Run 6	11/13/2107	OL395341	B	42.02	0.27	42.29	0.64			7d 0h 18m	4.64380	0.00911	2.4	13.7	0.00786			0.00828	0.02784
													0.00889		**13.4**	**0.00770**	**10.7**	**1800.8**	**0.00811**	**0.02729**
11/9/2017	Unit 1_Run 7	11/20/2107	OLC054417	A	133.40	0.00	133.40	0.00	100	88.6	5d 22h 30m	3.76049	0.00888		13.6	0.00767			0.00814	0.02740
11/9/2017	Unit 1_Run 7	11/20/2107	OLC307182	B	39.32	5.81	45.13	14.78			5d 22h 30m	3.78934	0.01191	14.6	13.8	0.01027			0.01090	0.03665
													0.01040		**13.7**	**0.00897**	**10.6**	**1800.8**	**0.00952**	**0.03202**
	Unit 1 LEE Demonstration Average							**Field Recovery Test %**		**95.5**			**0.00741**		**13.7**	**0.00640**	**10.8**	**1800.7**	**0.00670**	**0.02254**
10/2/2017	Unit 2_Run 1	10/10/2017	OLC054455	A	196.70	0.85	197.55	0.43	100	98.9	7d 0h 0m	4.56598	0.02136		15.1	0.01814			0.01887	0.06347
10/2/2017	Unit 2_Run 1	10/10/2017	OL432534	B	96.46	0.00	96.46	0.00			7d 0h 0m	4.46317	0.02161	0.6	15.2	0.01833			0.01906	0.06413
			Run 1 Average										**0.02149**		**15.2**	**0.01823**	**10.8**	**1800.7**	**0.01897**	**0.06380**
10/9/2017	Unit 2_Run 2	10/17/2017	OLC054358	A	182.30	1.24	183.54	0.68	100	95.7	6d 22h 4m	4.43434	0.01884		14.7	0.01607			0.01712	0.05759
10/9/2017	Unit 2_Run 2	10/17/2017	OLC052706	B	84.49	1.50	85.99	1.78			6d 22h 4m	4.33926	0.01982	2.5	14.7	0.01690			0.01801	0.06059
			Run 2 Average										**0.01933**		**14.7**	**0.01649**	**10.5**	**1800.6**	**0.01757**	**0.05909**
10/16/2017	Unit 2_Run 3	10/27/2017	OLC054448	A	195.20	2.32	197.52	1.19	100	99.1	2d 3h 1m	1.35021	0.07222		14.9	0.06146			0.06576	0.22120
10/16/2017	Unit 2_Run 3	10/27/2017	OLC052703	B	96.32	0.20	96.52	0.20			2d 3h 1m	1.32476	0.07286	0.4	14.8	0.06207			0.06641	0.22340
	Run 3 Average (omitted from results calculations)												**0.07254**		**14.9**	**0.06177**	**10.1**	**1731.4**	**0.06609**	**0.22230**
10/19/2017	Unit 2_Run 4	10/27/2017	OLC054330	A	251.40	0.38	251.78	0.15	100	94.5	6d 22h 6m	3.91689	0.03875		14.7	0.03305			0.03438	0.11567
10/19/2017	Unit 2_Run 4	10/27/2017	OL432619	B	153.70	0.00	153.70	0.00			6d 22h 6m	3.82859	0.04015	1.8	15.3	0.03400			0.03537	0.11899
			Run 4 Average										**0.03945**		**15.0**	**0.03353**	**10.8**	**1800.5**	**0.03488**	**0.11733**
10/26/2017	Unit 2_Run 5	11/3/2017	OLC054429	A	227.30	0.00	227.30	0.00	100	105.1	6d 22h 22m	4.33559	0.02936		14.5	0.02510			0.02730	0.09184
10/26/2017	Unit 2_Run 5	11/3/2017	OLC052762	B	120.40	0.00	120.40	0.00			6d 22h 22m	4.27223	0.02818	2.1	14.4	0.02412			0.02624	0.08826
			Run 5 Average										**0.02877**		**14.5**	**0.02461**	**10.3**	**1800.7**	**0.02677**	**0.09005**
	Unit 2 LEE Demonstration Average							**Field Recovery Test %**		**99.9**			**0.02726**		**14.8**	**0.02322**	**10.6**	**1800.6**	**0.02455**	**0.08257**

NOTES:

1) STD Volume Sampled for Unit 1 A train (all runs) has been adjusted to the new dry gas meter Y value of 1.120 after post-test calibration check indicated the DGM A exceeded the ±5% tolerance from initial Y of 1.007
2) Unit 1 Runs 2, 3, and 5 were invalidated and therefore not included in the Hg LEE compliance demonstration emission calculations.
3) Unit 2 Run 3 was invalidated and therefore not included in the Hg LEE compliance demonstration emission calculations.
4) Run times listed are synchronized to CEMS time.
5) Break Through Criteria for Compliance Testing: ≤ 10% of Section 1 for Hg concentrations > 1.0 µg/dscm; ≤ 20% of Section 1 for Hg concentrations ≤ 1.0 µg/dscm; ≤ 50% of Section 1 Hg mass if concentration is ≤ 30% of the Hg equivalent to the applicable emission standard.
6) Field Recovery Test Criteria: Average recovery based upon three runs between 85% and 115%.
7) Paired Sorbent Trap Agreement Criteria: ≤ 10% Relative Deviation (RD) mass for Hg conc. > 1.0 µg/dscm; ≤ 20% RD or ≤ 0.2 µg/dscm absolute difference for Hg conc. ≤ 1.0 µg/dscm.