Consumers Energy

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40 CFR 63, Subpart UUUUU Mercury MATS LEE Test Report

EUBOILER01 and EUBOILER02

CMS Enterprises
TES Filer City Station
700 Mee Street
Filer City, Michigan 49634
SRN: N1685
FRS: 110056958225
December 7, 2023

Test Dates: October 3 through November 10, 2023

Test Performed by the Consumers Energy Company
Regulatory Compliance Testing Section
Air Emissions Testing Body
Laboratory Services Section
Work Order No. 4103643
Version No. 0

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EXECUTIVE SUMMARY

Consumers Energy Regulatory Compliance Testing Section conducted total vapor phase mercury (Hg) testing at the exhaust of 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 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 and Air Toxics Standard (MATS) regulation.

This test program was conducted to satisfy the annual performance testing requirements in accordance with §63.10005(h) to evaluate whether the EGUs continue to qualify as low emitting EGUs (LEE) for mercury. To qualify for LEE status, annual continuous sampling of each unit must occur over a 30-boiler operating day period, and the average result must either:

1. be 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 the emission rate is 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 subject to the emission limits within Table 2 of the MATS rule, is 1.2 pounds of mercury per trillion British thermal unit (lb/TBtu) or 0.013 pounds of mercury per gigawatt hour (lb/GWh). The plant has elected to comply with the Hg lb/TBtu limit.

The testing was performed in accordance with the test protocol submitted to the Department of Environment, Great Lakes, and Energy on September 1, 2017, and subsequently approved by Jeremy Howe in his letter dated September 29, 2017. A test notification was submitted to EGLE on September 26, 2023 for this annual round of testing.

The results of the testing are:

- Unit 1: 0.63 lb/TBtu and 2.1 lbs/yr mass emissions based upon the average of thirty boiler operating days.
- Unit 2: 0.57 lb/TBtu and 1.9 lbs/yr mass emissions based upon the average of thirty boiler operating days.

The results indicate EUBOILER01 and EUBOILER02 comply with the MATS 1.2 lb/TBtu emission limit and have potential emissions less than 29.0 lb/yr, and therefore meet LEE qualification criteria. Because the sources qualify as LEE for mercury, continuous compliance through mercury continuous emissions monitoring or sorbent trap systems is not required; however, mercury performance testing must be performed annually to evaluate LEE status.

Detailed results are presented in Appendix Tables 1 and 2. Sample calculations, field data sheets, and laboratory data are presented in Appendices A, B, and C. Boiler operating data and supporting documentation are provided in Appendices D and E.

1.0 INTRODUCTION

This report summarizes the results of total vapor phase mercury (Hg) testing conducted 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.

This document was prepared using the Michigan Department of Environment, Great Lakes, and Energy (EGLE) *Format for Submittal of Source Emission Test Plans and Reports* published in November of 2019. Please exercise due care if portions of this report are reproduced, as critical substantiating documentation and/or other information may be omitted or taken out of context.

1.1 IDENTIFICATION, LOCATION, AND DATES OF TESTS

Consumers Energy Regulatory Compliance Testing Section (RCTS) conducted continuous Hg testing at the exhaust stacks of EUBOILER01 and EUBOILER02 operating at the TES Filer City Station in Filer City, Michigan. Testing was conducted from October 3 through November 10, 2023.

A test protocol was submitted to EGLE in September 2017 and subsequently approved by Jeremy Howe in his letter dated September 29, 2017. The approval letter reflects standing blanket approval of subsequent 40 CFR 63, Subpart UUUUU Hg LEE tests conducted at TES Filer City if no modifications from the original protocol are needed. On September 26, 2023, TES Filer City notified EGLE in writing of its intent to begin the Hg testing on October 3, 2023.

1.2 PURPOSE OF TESTING

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 and Air Toxics Standard (MATS) regulation.

This test program was conducted to satisfy the annual performance testing requirements in accordance with §63.10005(h) to evaluate whether the EGUs continue to qualify as low emitting EGUs (LEE) for mercury. To qualify for LEE status, annual continuous sampling of each unit must occur over a 30-boiler operating day period, and the average result must either:

1. be 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 the emission rate is 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
Mercury	1.2 or 0.013	lb/TBtu lb/GWh	Table 2 §1.(c) to Subpart UUUUU of Part 63—Emission Limits for Existing EGU's
lb/TBtu pound of mercury per trillion British thermal unit heat input lb/GWh pound of mercury per gigawatt hour gross output			

1.3 Brief Description of Source

TES Filer City Station is a cogeneration power plant consisting of two predominantly solid fuel fired boilers. EUBOILER01 and EUBOILER02 are spreader stoker boilers that produce steam, which is used to generate electricity and sold to an adjacent property, when needed.

1.4 Contact Information

Table 1-2 presents the names, addresses, and telephone numbers for contacts involved in this test program.

Table 1-2
Contact Information

Program Role	Contact	Address
EPA Regional Contact	Michael Compher Chief, Air Monitoring and Analysis 312-886-5745 compher.michael@epa.gov	USEPA Region 5 77 W. Jackson Boulevard (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
State Regional Agency Inspector	Caryn Owens Environmental Engineer 231-878-6688 owensc1@michigan.gov	EGLE Cadillac District – Air Quality Division 120 West Chapin Street Cadillac, Michigan 49601
Responsible Official	Todd Guenthardt Senior Plant Manager 231-723-6573 todd.guenthardt@cmsenergy.com	CMS Energy TES Filer City Generating Station 700 Mee Street Filer City, Michigan 49634
Corporate Environmental Coordinator	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 Facility	Austin Swiatlowski 231-690-9418 Sr. Env. and Compliance Coordinator austin.swiatlowski@cmsenergy.com	CMS Energy TES Filer City Generating Station 700 Mee Street Filer City, Michigan 49634
Test Team Representative	Thomas Schmelter, QSTI Sr. Engineering Technical Analyst 616-738-3234 thomas.schmelter@cmsenergy.com	Consumers Energy Company L&D Training Center 17010 Croswell Street West Olive, Michigan 49460

2.0 SUMMARY 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.

As noted in Consumers Energy's Test Notification to EGLE, while there were no modifications of the test methods and procedures employed during the Hg LEE tests relative to the 2017 test protocol, TES Filer City Station noted that the boiler operating conditions would no longer be at 90-110% of rated capacity throughout testing. Starting in May of 2023, the typical operating level for each boiler has been 200-210 klbs/hr steam (or about 20 megawatts), with infrequent short periods of operation at full capacity (311 klbs/hr steam or about 30 megawatts per boiler). Pursuant to discussions with EGLE and US EPA, the MATS Hg LEE testing was conducted at the preceding operating conditions to ensure the testing is representative of site-specific normal operations.

The boilers fired blends of coal, wood, tire-derived fuel (TDF) and/or natural gas during testing. The average steam generation rates during the 30-boiler operating day tests were approximately 210 klbs/hr for Unit 1 and 211 klbs/hr for Unit 2. These steam generation rates are approximately 67.6 and 67.9% of the full load ratings of 311,000 lb/hr for each unit.

Refer to Appendix D for detailed operating data, including CEMS based CO_2 concentrations, fuel blend firing rate and composite fuel factor data, which was recorded in Eastern Standard Time (EST). Note the time convention for the reference method (RM) testing was also in EST.

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 1.2 lb/TBtu limit, as well as the mass-based LEE qualification criteria. Table 2-1 presents a summary of the Hg test results.

Table 2-1
Summary of Test Results

Source	Hg Concentration (µg/scm)	Hg Emission Rate (lb/TBtu)		Emission Rate (lb/yr)	
	Result	Result	LEE Criteria	Result	LEE Criteria
Unit 1†	**0.503**	**0.63**	**0.12**	**2.1**	**29.0**
Unit 2‡	**0.436**	**0.57**	**0.12**	**1.9**	**29.0**

†: Test run 4 void due to sampling during boiler shutdown period; sample was discarded without analysis
‡: Test run 3 void due to sorbent trap section 2 breakthrough exceeding acceptance criteria; results are not included in average

Detailed results are presented in Appendix Tables 1 and 2. A discussion of the results is presented in Section 5.0. Sample calculations, field data sheets and laboratory data sheets are presented in Appendices A, B, and C. Boiler operating data and supporting information are provided in Appendices D and E.

3.0 SOURCE DESCRIPTION

TES Filer City Station is a cogeneration facility consisting of two predominantly solid fuel fired boilers. 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

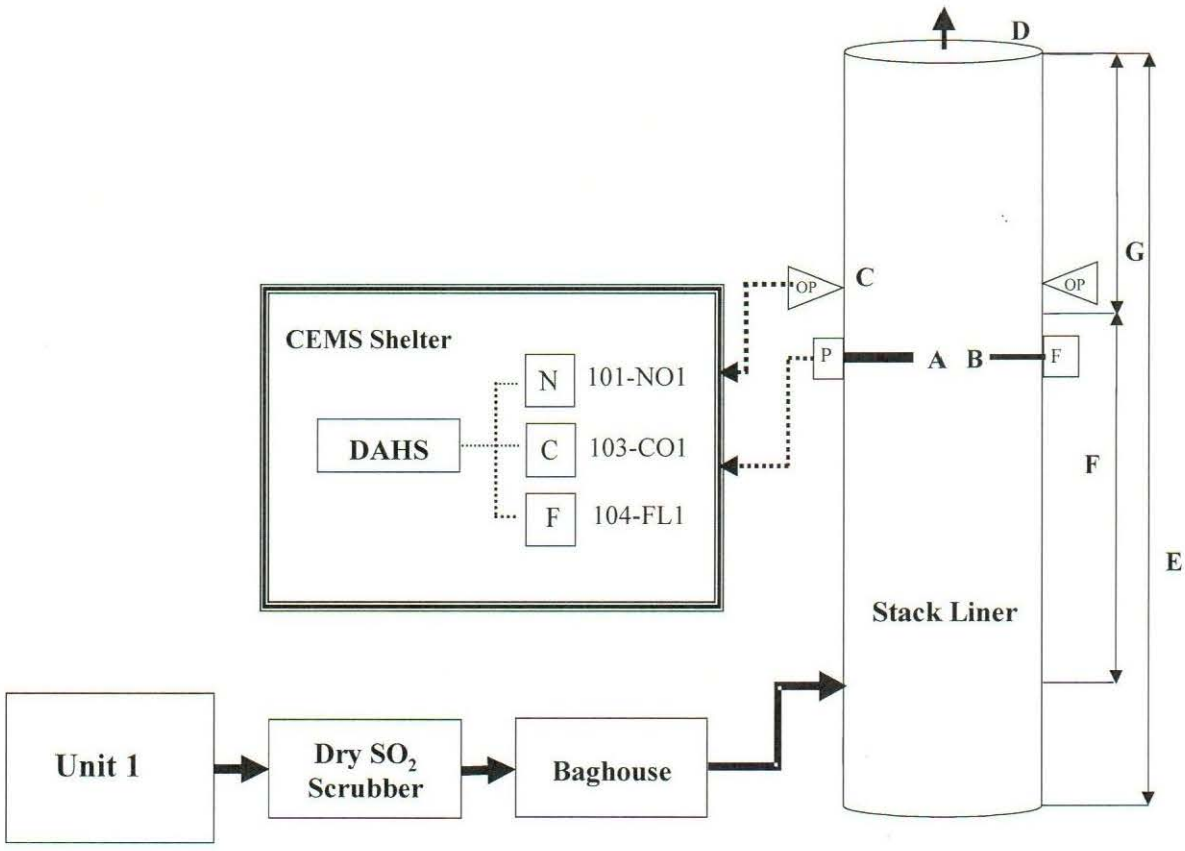
TES Filer City Station operates as a cogeneration electric power plant with a rated output of approximately 60-megawatts net (MW_n) and is also capable of generating 50,000 pounds of process steam per hour. The electricity and process steam are sold under contract to public and/or private companies.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

3.2 PROCESS FLOW

EUBOILER01 and EUBOILER02 are spreader stoker grate boilers used to generate steam. Each unit has a nominal heat input rating of approximately 384 MMBtu/hour and is currently allowed to combust 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 to produce steam. At full load, each unit can produce approximately 311,000 pounds of steam per hour. 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 individual lime slurry dry scrubber systems 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 both units.

Figure 3-1. Unit 1 Data Flow Diagram



3.3 MATERIALS PROCESSED

Units 1 and 2 are 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, wood, TDF, and natural gas 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. Since mid-2018, natural gas has been a consistent part of the fuel mixture for each boiler.

TES executed an Administrative Consent Order with the United States Environmental Protection Agency (USEPA) which resulted in petroleum coke removal by March 31, 2016. Following issuance of Permit to Install No. 110-14B, TESFC does not anticipate firing petroleum coke in the future.

3.4 RATED CAPACITY

EUBOILER01 and EUBOILER02 each have a nominal rated heat input capacity of 384 MMBtu/hr and a steam generation capacity of 311,000 lb/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 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 CO_2/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)
- SO_2 reduction (%)
- 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 personnel 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	Method	USEPA Title
Sample/traverse point locations	1	Sample and Velocity Traverses for Stationary Sources
Moisture	ALT-091	Alternative Procedures for Determination of Moisture Content of Flue Gas Emissions during Low Emitting EGU (LEE) Testing for Mercury
Emission rates	19	Determination of Sulfur Dioxide Removal Efficiency and Particulate Matter, Sulfur Dioxide, and Nitrogen Oxides Emission Rates
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	Run	Sample Type	Start Date/ Time (EST)	Stop Date/ Time (EST)	Test Duration (hours)	EPA Test Method	Comment
Unit 1	1	Hg, moisture	10/3/2023 10:17	10/11/2023 7:24	189.1	30B Alt-091	Valid run
	2	Hg, moisture	10/11/2023 8:26	10/18/23 7:14	166.8	30B Alt-091	Valid run
	3	Hg, moisture	10/18/2023 7:43	10/26/2023 7:08	191.4	30B Alt-091	Valid run
	4	Hg, moisture	10/26/2023 7:42	10/30/2023 14:43	103.0	30B Alt-091	Void run
	5	Hg, moisture	10/30/2023 15:18	11/7/2023 10:33	187.3	30B Alt-091	Valid run
Unit 2	1	Hg, moisture	10/3/2023 11:00	10/11/2023 8:29	189.5	30B Alt-091	Valid run
	2	Hg, moisture	10/11/2023 9:24	10/18/2023 7:46	166.4	30B Alt-091	Valid run
	3	Hg, moisture	10/18/2023 8:25	10/26/2023 7:44	191.3	30B Alt-091	Void run
	4	Hg, moisture	10/26/2023 8:18	11/2/2023 12:32	172.3	30B Alt-091	Valid run
	5	Hg, moisture	11/2/2023 12:58	11/10/2023 13:09	192.2	30B Alt-091	Valid run

4.2 SAMPLE LOCATION AND TRAVERSE POINTS (USEPA METHOD 1)

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

- Approximately 90 feet or 14 duct diameters downstream of a duct bend disturbance where the combustion gases exit the ID fan outlet ducts and enter the vertical stack, and

- Approximately 150 feet or 24 duct diameters upstream of the exhaust to atmosphere

The sampling locations are at least eight duct diameters downstream and two diameters upstream from any flow disturbance such as a bend, expansion, or contraction in the stack, and meet the requirements of USEPA Method 1. As allowed in MATS Table 5, §4.a. for mercury LEE testing, the sample probe tips for a dual sample train probe, with a single opening for each train was located at a point within the 10 percent centroidal area of the duct.

A dimensioned sketch of the sample location showing the sampling ports in relation to upstream and downstream disturbances 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 Unit 2 Sample Location

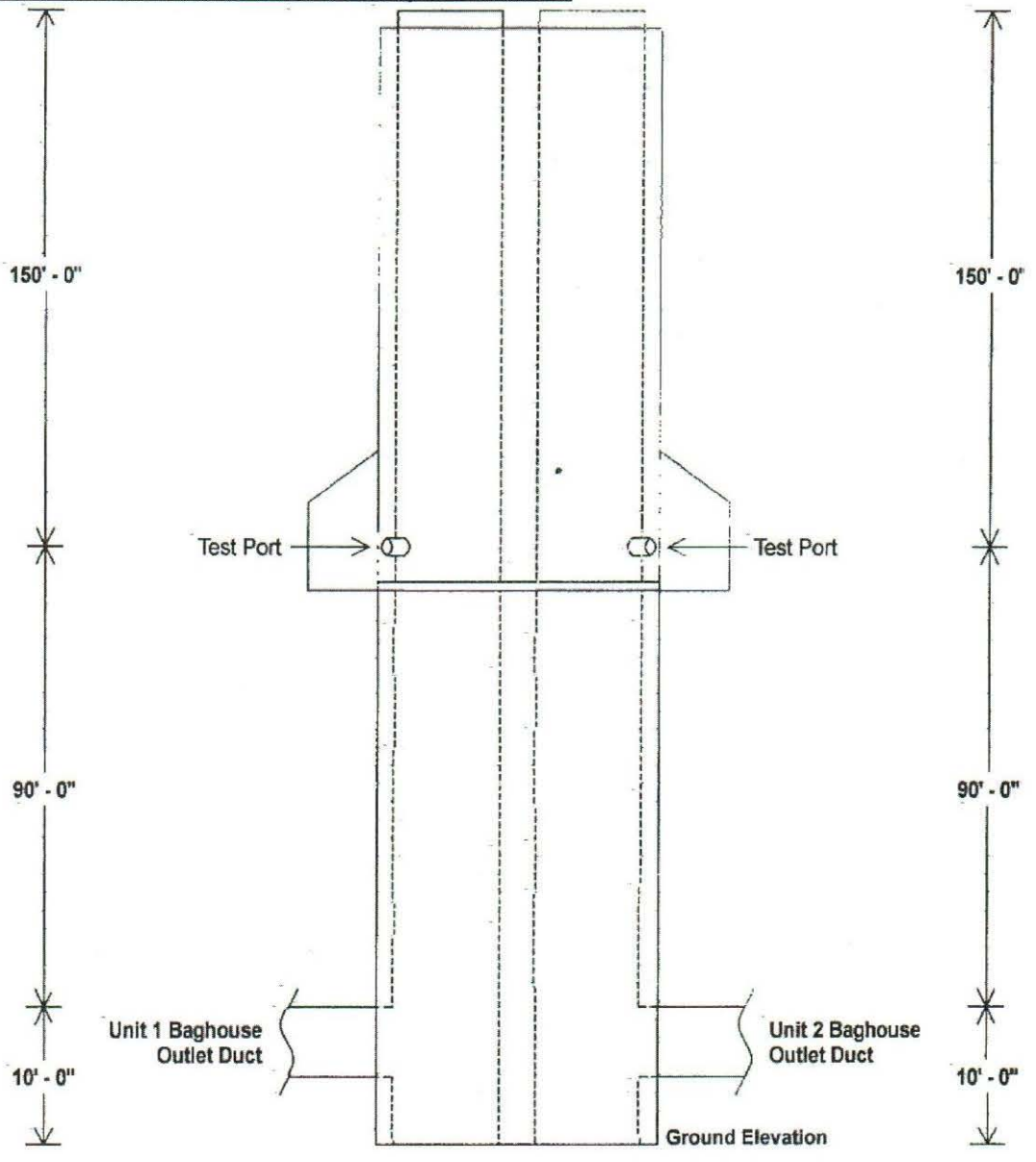
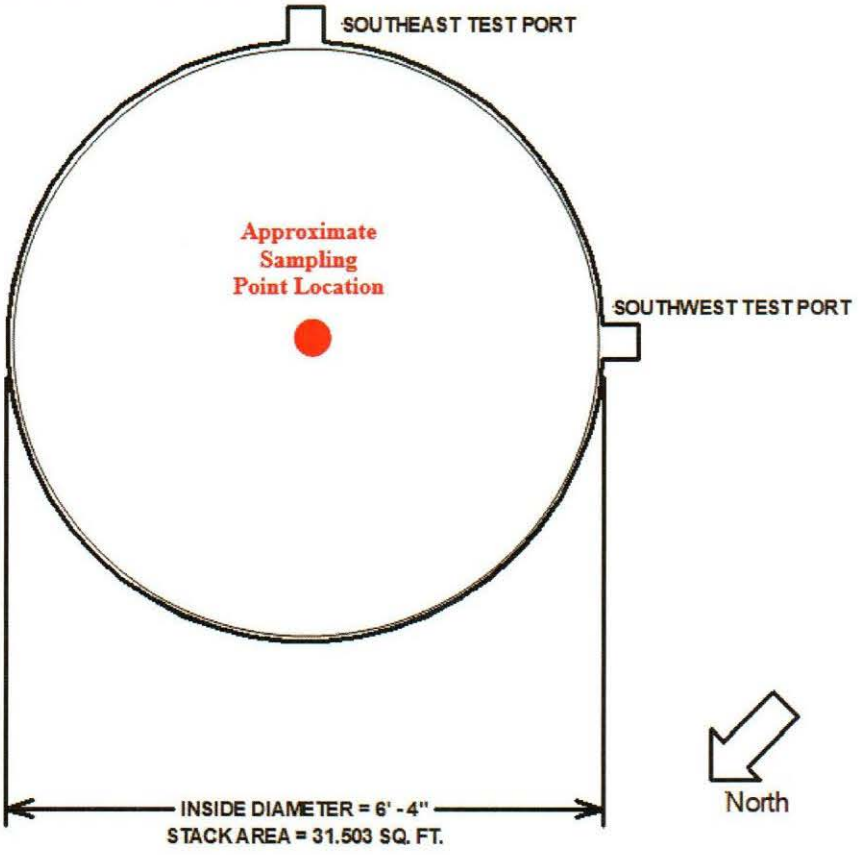


Figure 4-2. Unit 1 Stack Cross-Section and Sampling Point Detail



4.3 Moisture Content (USEPA Approved Alternative ALT-091)

The exhaust gas moisture content was measured using USEPA Approved Alternative Method ALT-091, in conjunction with the Method 30B sample apparatus. Exhaust gas was drawn through the Method 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. Using the mass of water collected and the volume of gas sampled, the stack gas moisture content was calculated using the applicable calculations in Section 12 of Method 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 for both boilers ranged from 183.6 degrees Fahrenheit (°F) to 184.9 °F during the test period. The water vapor content at these temperatures equate to approximately 50% moisture by volume at saturation, greater than the average measured using the mass of water collected in the Method 30B sample apparatus (Units 1 and 2 averaged 13.5% and 13.4% moisture by volume, respectively, across the valid test runs). Therefore, the moisture content measured using the applicable calculations in Section 12 of Method 4 and the mass of water collected in the Method 30B sample apparatus was used in emissions calculations.

4.4 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 Hg emission rates in units of lb/MMBtu. Carbon dioxide concentrations obtained from the facility's 40 CFR 75 certified diluent gas monitoring system and site-specific pro-rated F-factor (ratios of combustion gas volumes to heat inputs) were used to calculate emission rates using equation 19-7 from the method. Figure 4-3 presents the equation used to calculate lb/MMBtu emission rate:

Figure 4-3. USEPA Method 19 Equation 19-7

$$E = C_w F_c \frac{100}{\%CO_{2w}}$$

where:

E	=	Pollutant emission rate (lb/MMBtu)
C_w	=	Pollutant concentration, wet basis (lb/dscf)
F_c	=	Volumes of combustion components per unit of heat content (scf CO_2/MMBtu)
$\%CO_{2w}$	=	Concentration of carbon dioxide on a wet basis (%, dry)

Consistent with §63.10007(e)(2)(v), the Hg concentrations as µg/scm were first multiplied by 6.24×10^{-11} to convert the concentrations into the required lb/scf units. The Hg emission rates in units of lb/TBtu were then determined by multiplying the lb/MMBtu emission rates by 10^6.

4.5 MERCURY (USEPA METHOD 30B)

Mercury was measured using USEPA Method 30B, *Determination of Total Vapor Phase Mercury Emissions from Coal-Fired Combustion Sources Using Carbon Sorbent Traps.* Volumes of flue gas were continuously extracted from the stack through paired, in-stack, sorbent media traps 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. One of the traps contained sorbent media pre-spiked with mercury, which was used to evaluate sample quality assurance. A heated sample line connected to the end of the heated probe transferred the sample gas through a chilled moisture removal system, consisting of a water knockout impinger and silica gel desiccant, before entering a dry gas sampling console where sample volume and other parameters were recorded. The sorbent traps in the sampling system were periodically exchanged with new ones over the 30-boiler operating day test period, with a total of 4 valid runs of nominally equal length. Refer to Figure 4-4 for a drawing of the USEPA Method 30B mercury sample apparatus.

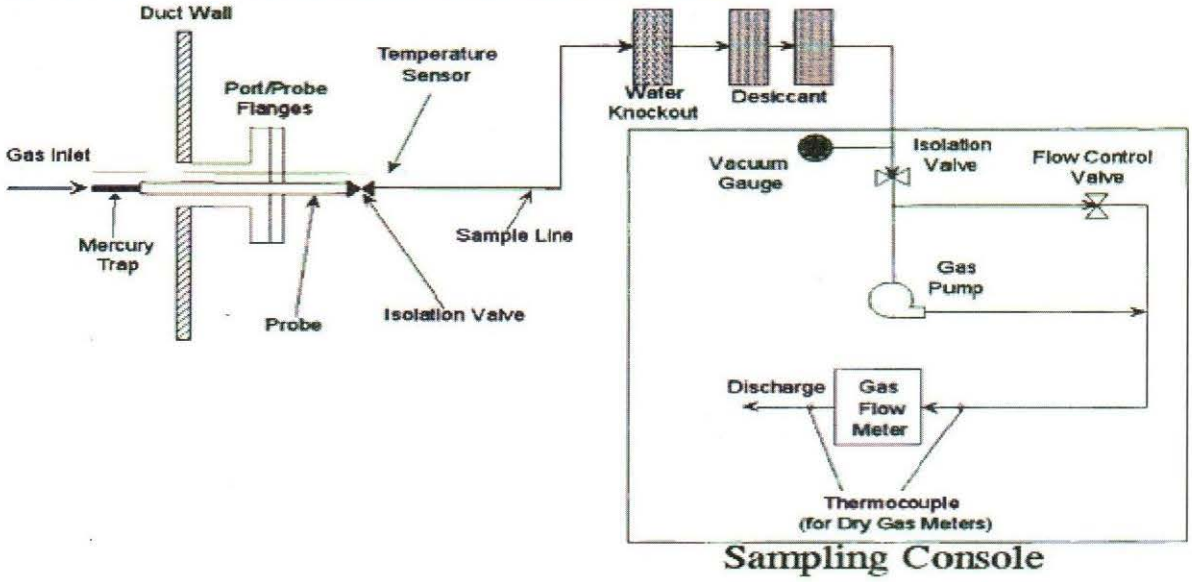
Each Hg sampling train was leak-checked before and after each test. Care was exercised to minimize effects of stray or ambient Hg at the sampling site, such as ensuring the sample ports are cleaned thoroughly and maintaining sufficient distance from duct walls and/or other sources of Hg so that bias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

At the conclusion of the test run and after the post-test leak check, the sorbent traps were recovered from the sampling system and transported to the RCTS field office in West Olive, Michigan for analysis. 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 approximately 680 degrees Celsius.

Vapor phase mercury was then measured using a calibrated atomic absorption spectrometer.

A minimum of three field recovery test runs 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 test assesses the recovery of the elemental mercury spike to determine measurement bias and verify data acceptability. The results of the field recovery test met the acceptable performance criteria (85%-115%) using all valid runs and are presented in the Appendix Tables. For Unit 1, an average field recovery of 99.8% was calculated based on Runs 1, 2, 3, and 5, whereas an average recovery of 101.7% was calculated for Unit 2 based on Runs 1, 2, 4, and 5.

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



5.0 TEST RESULTS AND DISCUSSION

This test program was conducted in October and November 2023 to satisfy the annual performance testing requirements in accordance with §63.10005(h) and §63.10006(f)(ii)(B) to evaluate if the EGUs qualify as LEE for mercury.

5.1 TABULATION OF RESULTS

Table 2-1 in Section 2 of this report summarizes the results and Appendix Tables 1 and 2 contain detailed tabulation of results, process operating conditions, and exhaust gas conditions.

5.2 SIGNIFICANCE OF RESULTS

The results indicate EUBOILER01 and EUBOILER02 comply with the MATS Hg 1.2 lb/TBtu emission limit and meet LEE qualification criteria. Because the sources qualify as LEE for mercury, continuous compliance through mercury continuous emissions monitoring or sorbent trap systems is not required; however, mercury performance testing must be performed annually to evaluate continued LEE status.

5.3 VARIATIONS FROM SAMPLING OR OPERATING CONDITIONS

Analyses of several sorbent trap section 2 carbon beds during this test program resulted in Hg masses that were greater than the analyzer's minimum detection limit (MDL) of 1.57 ng but were less than the lowest point of the daily calibration curve of 30 ng. In these instances, an additional low-level Hg standard was analyzed to determine a response factor in accordance with USEPA Method 30B Section 11.3. The resulting area counts were divided by the Hg mass of the standard to determine the counts per nanogram response factor; refer to Table 5-1 for specific response factors.

Table 5-1
Response Factors (MDL < Hg Catch < Lowest Point on the Calibration Curve)

Trap Analysis Date	Response Factor (area counts/ng)	Basis for the Response Factor
10/11/2023	46.3	Average of 10/26, 10/30, and 11/10 Response Factors
10/18/2023	46.3	Average of 10/26, 10/30, and 11/10 Response Factors
10/26/2023	45.2	5 ng sample resulting in 226 area counts
10/30/2023	28.6	5 ng sample resulting in 143 area counts
11/10/2023	65.2	5 ng sample resulting in 326 area counts

Response factor samples were not analyzed during the October 11 and 18, 2023 analyses. As response factors were not evaluated during these analyses, the average results of the response factors from the remaining analytical dates were used for response factor determination. These response factors were then applied to the measured area counts of the affected section 2 carbon beds to estimate Hg mass and fully validate the emissions data. Note that the Appendix tables reflect the adjusted section 2 masses, as applicable, while the section 2 sorbent trap analysis results in Appendix C do not reflect these adjustments.

In cases where the Hg masses were less than zero, a value of zero was used in calculations. In cases where the Hg masses were less than the MDL but greater than zero, no adjustments were made. This approach is consistent with past guidance from EPA's Emissions Measurement Center (EMC), confirming that the MDL should not be used in lieu of the measured mass in cases where the measured section 2 mass is below the MDL.

Following the completion of the 30-day sampling period, the sampling consoles were challenged with a post-test console audit to verify the barometric pressure sensors, thermocouples, and dry gas meters met the method quality assurance requirements. All components of the sample console serial number 3311 (used for sampling Unit 1 Runs 1 through 5) and sample console serial number 3310 (used for sampling Unit 2 Runs 1 through 5) met the acceptable QA/QC tolerances.

The results of the post-test console audits are presented in Appendix E.

5.4 SORBENT TUBE SAMPLE BREAKTHROUGH & PAIRED TRAP RD

The analysis of the Unit 2, Test Run 3 A-side sorbent trap resulted in significant breakthrough of mercury. Analysis resulted in a breakthrough of 27.41%, greater than the ≤20% breakthrough requirement in Table 9-1 of USEPA RM 30B. Furthermore, the observed paired trap relative deviation (RD) was 24.0%, above the allowed 20%. Unit 2 Test Run 3 was voided, and the results are not included in the test average calculation.

5.5 Process or Control Equipment Upset Conditions

Unit 1 experienced an upset condition from a boiler tube leak and subsequent downtime from Friday, October 27, 2023, through Monday, October 30, 2023, during Test Run 4. Test Run 4 was voided and discarded as sampling occurring during this unplanned shutdown period.

The boilers and associated control equipment were otherwise operating under routine conditions and no other upsets were encountered during testing.

5.6 Air Pollution Control Device Maintenance

No significant pollution control device maintenance occurred during the three months prior to the test. Optimization of the air pollution control equipment is a continuous process to ensure compliance with regulatory emission limits.

5.7 Re-Test Discussion

Based on the results of this test program, a re-test is not required. The next required test will be a Hg LEE 30-boiler operating day test scheduled for the fourth quarter of 2024.

5.8 Performance Audit Sample

A performance audit (PA) sample (if available) for each test method employed is required, unless waived by the administrator for regulatory compliance purposes as described in 40 CFR 63.7(c)(2)(iii). A PA sample consists of blind audit sample(s), as supplied by an accredited audit sample provider (AASP), which are analyzed with the performance test samples to provide a measure of test data bias. Currently a PA sample is not available for mercury measured by USEPA Method 30B.

5.9 Reference Method Audits

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 5-2 summarizes the primary USEPA Method 30B quality assurance and quality control activities completed. Laboratory mercury analyzer calibration data and information on the associated mercury standards are included in Appendices C and E. Refer to Appendix E for additional supporting documentation.

Table 5-2
Summary of USEPA Method 30B QA/QC Procedures

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 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	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.

Table 5-2
Summary of USEPA Method 30B QA/QC Procedures

QA/QC Test or Specification	Acceptance Criteria	Frequency	Consequences if not met
Paired sorbent trap agreement	≤10% Relative Deviation mass for Hg concentrations >1 µg/dscm; ≤20% or ≤0.2 µg/dscm absolute difference for Hg concentrations ≤1 µg/dscm.	Every run	Run invalidated.
Sample analysis	Within the bounds of Hg^0 and $HgCl_2$ Analytical Bias Test.	All section 1 samples where Hg conc. is ≥ 0.5 µg/dscm.	Expand bounds of analytical bias tests; invalidated if not successful.
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.

5.10 CALIBRATION SHEETS

Calibration sheets and equipment quality control and assurance data are presented in Appendix E.

5.11 SAMPLE CALCULATIONS

Sample calculations and formulas used to compute emissions data are presented in Appendix A.

5.12 FIELD DATA SHEETS

Field data sheets are presented in Appendix B.

5.13 LABORATORY QUALITY ASSURANCE / QUALITY CONTROL PROCEDURES

The specific quality assurance and quality control procedures in each method employed during this test program were followed without deviation. Refer to Appendix C for the laboratory data sheets.

5.14 QA/QC BLANKS

The analysis of QA/QC blanks is not required for USEPA Method 30B. The analysis of blanks may be useful to verify the absence of, or an acceptable level of, Hg contamination in the sorbent media. Elevated blank levels can be concerning when quantifying low Hg levels and their potential contribution to meeting the sorbent trap section 2 breakthrough requirements; however, correcting sorbent trap results for blank levels is prohibited.

Appendix Tables

Table 1 - TES Filer City Unit 1 Mercury Emission Results - 2023 MATS Hg LEE Demonstration

Test ID	Run Start	Run End	Sample Duration	Analysis Date	Trap ID	Train	Sorbent Trap Results: Section 1 (ng)	Section 2 (ng)	Total Mass (1+2) (ng)	Break-through (%)	Spike Added (ng)	Spike Recovery (%)	Volume Sampled (L)	Volume RD (%)	Hg Conc. (µg/m³, dry)	Paired Trap RD (%)	Moisture (%)	Hg Conc. (µg/m³, wet)	CO_2 Conc. (%, wet)	Fuel Factor	Hg Emission Rate (lb/Tbtu)	Hg Emission Rate (lb/yr)	FRT % Calculation Include
Run 1	10/03/2023 10:17	10/11/2023 7:24	7d 21h 7m	10/11/2023	OL676257	A	2303	5.5	**2308**	**0.24**	1000	**104.1**	3350.296	**0.5**	0.391	**1.6**	14.5	0.334	8.3	1647.8	0.41	1.4	X
					OL650285	B	1205	*0.9*	**1206**	**0.07**			3187.956		0.378		14.0	0.325			0.40	1.4	
					Run 1 Average										**0.384**		**14.2**	**0.330**			**0.41**	**1.4**	
Run 2	10/11/2023 8:26	10/18/2023 7:14	6d 22h 48m	10/18/2023	OL676256	A	2591	2.1	**2593**	**0.08**	1000	**102.2**	2925.187	**7.8**	0.545	**0.7**	13.1	0.473	8.0	1647.5	0.61	2.1	X
					OLC185357	B	1479	*0.6*	**1480**	**0.04**			2754.753		0.537		12.9	0.468			0.60	2.0	
					Run 2 Average										**0.541**		**13.0**	**0.471**			**0.61**	**2.0**	
Run 3	10/18/2023 7:43	10/26/2023 7:08	7d 23h 25m	10/26/2023	OL676342	A	3588	*0.0*	**3588**	**0.00**	1000	**100.8**	3348.335	**1.3**	0.773	**0.2**	12.8	0.674	8.1	1655.3	0.86	2.9	X
					OLC185681	B	2413	3.9	**2417**	**0.16**			3137.066		0.770		13.2	0.669			0.86	2.9	
					Run 3 Average										**0.772**		**13.0**	**0.672**			**0.86**	**2.9**	
Run 4 VOID	10/26/2023 7:42	10/30/2023 14:43	4d 7h 1m	RUN VOID DUE TO UNIT SHUT DOWN																			
Run 5	10/30/2023 15:18	11/07/2023 10:33	7d 19h 15m	11/10/2023	OLC187195	A	3000	*0.5*	**3001**	**0.02**	1000	**92.3**	3248.792	**3.1**	0.616	**1.9**	13.3	0.534	8.6	1661.2	0.64	2.2	X
					OLC185331	B	1933	*0.0*	**1933**	**0.00**			3022.100		0.640		14.2	0.549			0.66	2.2	
					Run 5 Average										**0.628**		**13.7**	**0.541**			**0.65**	**2.2**	
			30d 14h 35m		**Average**					**Field Recovery Test Results (%):**		**99.8**			**0.581**		**13.5**	**0.503**	**8.2**	**1652.9**	**0.63**	**2.1**	

FRT Average Sample Volume (L): 3218.153

NOTES:

1) Run times listed are synchronized to CEMS time.
2) 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.
3) Field Recovery Test Criteria: Average recovery based upon three runs between 85% and 115%.
4) Paired 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.

Italicized sorbent trap results indicate mass measured less than the method detection limit of 1.57 ng Hg. Negative results have been replaced with zero.
Underlined sorbent trap results indicate mass measured greater than the method detection limit, lower than lowest point in calibration curve, and response factor applied.
Results with masses greater than the MDL and lower than the lowest point in the calibration curve have been corrected with the average response factor obtained during the analysis of Sample Runs 3 through 5.

Table 2 - TES Filer City Unit 2 Mercury Emission Results - 2023 MATS Hg LEE Demonstration

Test ID	Run Start	Run End	Sample Duration	Analysis Date	Trap ID	Train	Sorbent Trap Results: Section 1 (ng)	Section 2 (ng)	Total Mass (1+2) (ng)	Break-through (%)	Spike Added (ng)	Spike Recovery (%)	Volume Sampled (L)	Volume RD (%)	Hg Conc. ($\mu g/m^3$, dry)	Paired Trap RD (%)	Moisture (%)	Hg Conc. ($\mu g/m^3$, wet)	CO_2 Conc. (%, wet)	Fuel Factor	Hg Emission Rate (lb/Tbtu)	Hg Emission Rate (lb/yr)	FRT % Calculation Include
Run 1	10/03/2023 11:00	10/11/2023 8:29	7d 21h 29m	10/11/2023	OL676261	A	2549	*0.0*	**2549**	**0.00**	1000	**96.5**	3266.954	**2.5**	0.474	**1.1**	14.7	0.405	8.0	1656.5	0.52	1.8	X
					OLC185615	B	1569	*0.0*	**1569**	**0.00**			3236.087		0.485		14.6	0.414			0.53	1.8	
					Run 1 Average										**0.479**		**14.7**	**0.409**			**0.53**	**1.8**	
Run 2	10/11/2023 9:24	10/18/2023 7:46	6d 22h 22m	10/18/2023	OLC187150	A	2718	*0.0*	**2718**	**0.00**	1000	**118.5**	2851.034	**4.3**	0.603	**5.7**	12.8	0.525	7.6	1651.8	0.71	2.4	X
					OLC185926	B	1519	*0.0*	**1519**	**0.00**			2824.656		0.538		12.8	0.469			0.63	2.1	
					Run 2 Average										**0.570**		**12.8**	**0.497**			**0.67**	**2.3**	
Run 3 VOID	10/18/2023 8:25	10/26/2023 7:44	7d 23h 19m	10/26/2023	OLC187291	A	2429	665.7	**3095**	**27.41**	1000	**181.1**	3288.982	**2.9**	0.637	**24.0**	13.0	0.554	7.7	1635.9	0.73	2.5	
					OLC185279	B	1275	*0.0*	**1275**	**0.00**			3267.326		0.390		13.0	0.339			0.45	1.5	
					Run 3 Average										**0.514**		**13.0**	**0.447**			**0.59**	**2.0**	
Run 4	10/26/2023 8:18	11/02/2023 12:32	7d 4h 14m	11/2/2023	OL676266	A	2069	*0.7*	**2070**	**0.03**	1000	**100.5**	2926.295	**3.0**	0.366	**0.2**	13.4	0.316	8.5	1636.4	0.38	1.3	X
					OLC185667	B	1056	*0.6*	**1057**	**0.06**			2904.072		0.364		13.4	0.315			0.38	1.3	
					Run 4 Average										**0.365**		**13.4**	**0.316**			**0.38**	**1.3**	
Run 5	11/02/2023 12:58	11/10/2023 13:09	8d 0h 11m	11/10/2023	OLC187138	A	2927	*0.0*	**2927**	**0.00**	1000	**91.3**	3280.777	**2.7**	0.587	**2.2**	12.9	0.512	7.9	1657.3	0.67	2.2	X
					OL650282	B	1997	*0.0*	**1997**	**0.00**			3253.743		0.614		12.9	0.535			0.70	2.4	
					Run 5 Average										**0.601**		**12.9**	**0.523**			**0.68**	**2.3**	
			30d 00h 16m		**Average**					**Field Recovery Test Results (%):**		**101.7**			**0.504**		**13.4**	**0.436**	**8.0**	**1650.5**	**0.57**	**1.9**	

FRT Average Sample Volume (L): **3081.265**

NOTES:

1) Run times listed are synchronized to CEMS time.
2) 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.
3) Field Recovery Test Criteria: Average recovery based upon three runs between 85% and 115%.
4) Paired 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.

Italicized sorbent trap results indicate mass measured less than the method detection limit of 1.57 ng Hg. Negative results have been replaced with zero.

Underlined sorbent trap results indicate mass measured greater than the method detection limit, lower than lowest point in calibration curve, and response factor applied.