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COMPLIANCE TEST REPORT

for

RELATIVE ACCURACY TEST AUDIT (RATA) REPORT

Mercury (Hg) Sorbent Trap Monitoring System (STMS)

EU-BOILER1-BR (UNIT 1)

Belle River Power Plant
China Township, Michigan

January 24-25, 2024

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EXECUTIVE SUMMARY

DTE Energy's Environmental Management and Safety (EM&S) Ecology, Environment, & Remediation performed a Relative Accuracy Test Audit (RATA) on the EU-BOILER1-BR (Unit 1) mercury (Hg) sorbent trap monitoring system (STMS) at the Belle River Power Plant, in China Township, Michigan. The testing was required by Michigan Renewable Operating Permit ROP-MI-B2796-2015c & 40 CFR Part 63, Subpart UUUUU. The testing was conducted on January 24-25, 2024.

A summary of the emission test results is shown below:

Relative Accuracy Test Audit
Mercury Sorbent Trap Monitoring System
Belle River Power Plant - Unit 1
January 24-25, 2024

	STMS (ug/dscm)	30B (ug/dscm)	Mean Difference + CC (ug/dscm)[1]	Relative Accuracy (%)[1]
January 24-25	0.79	0.80	0.03	3.51

Compliance Limits
(1) ABS Mean Difference +CC ≤ 0.5 if 30B ≤2.5 ug/dscm or RA ≤ 20%

1.0 INTRODUCTION

DTE Energy's Environmental Management and Safety (EM&S) Ecology, Environment, & Remediation performed a Relative Accuracy Test Audit (RATA) on the EU-BOILER1-BR (Unit 1) mercury (Hg) sorbent trap monitoring system (STMS) at the Belle River Power Plant, in China Township, Michigan. The testing was required by Michigan Renewable Operating Permit ROP-MI-B2796-2015c & 40 CFR Part 63, Subpart UUUUU. The testing was conducted on January 24-25, 2024.

Testing was performed in accordance with specifications of Test Methods 30B, Performance Specification PS-12B from, Title 40, *Code of Federal Regulations*, Part 60, Appendix A (40 CFR §60 App. A), and Part 63, Sub-Part UUUUU, Section 4.1.2.2.

The fieldwork was performed in accordance with EPA Reference Methods and EM&R's Intent to Test[1], which was submitted to the Michigan Department of Environment, Great Lakes and Energy – Air Quality Division (EGLE-AQD). The following EM&R personnel participated in the testing program: Mr. Mark Grigereit, Principal Engineer, Mr. Thomas Snyder, Senior Environmental Specialist and Mr. Fred Meinecke, Environmental Specialist. I&C Specialists from Belle River Power Plant assisted with the collection of the sorbent tube samples. Mr. Grigereit was the project leader. Ms. Jamie Stanislawski, Environmental Engineer at BRPP, provided process coordination for the testing program.

2.0 SOURCE DESCRIPTION

The Belle River Power Plant (BRPP) located at 4505 King Road in China Township, Michigan, employs the use of two (2) Babcock and Wilcox coal-fired boilers (Units 1 & 2) each capable of producing 4,550,000 pounds per hour of steam. Each Unit has a Siemens Power Corporation turbine generator with a nominally rated capability of 635 (Unit 1) and 645 (Unit 2) megawatts (MW). Each unit exhausts into dedicated, separate stacks.

See Figure 1 for a diagram of the sampling locations and stack dimensions.

The coal blend for Unit 1 was a 100% low-sulfur western (LSW). Unit 1 injects activated carbon to assist in the collection of Hg. Testing was performed while the boiler was operated at normal high load conditions.

Mercury (Hg) emissions from the Unit 1 Stack are monitored continuously using a sorbent trap monitoring system (STMS). The STMS is a CleanAir MET-80 sorbent trap system with the following serial numbers.

- Unit 1 – Serial No. BRPP1: 1269106

[1] EGLE, Test Plan, Submitted October 31, 2023 (Attached-Appendix A)

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3.0 SAMPLING AND ANALYTICAL PROCEDURES

EM&R obtained emissions measurements in accordance with procedures specified in the USEPA *Standards of Performance for New Stationary Sources* or listed as an approved *"Other Test Method"*. The sampling and analytical methods used in the testing program are indicated in the table below:

Sampling Method	Parameter	Analysis
USEPA Method 30B	Total Vapor Phase Mercury Emission Concentrations	Thermal Desorption/Atomic Absorption
USEPA Performance Specification 12B	Total Vapor Phase Mercury Emission Concentrations	Thermal Desorption/Atomic Absorption

3.1 TOTAL VAPOR PHASE MERCURY EMISSIONS (USEPA Method 30B & PS 12B)

3.1.1 Total Mercury Sampling Methods

USEPA Method 30B, "Determination of Total Vapor Phase Mercury Emissions from Coal-Fired Combustion Sources Using Carbon Sorbent Traps" was the Reference Method (RM) used to measure the mass concentration of total vapor phase Hg in flue gas, including elemental Hg (Hg^0) and oxidized forms of Hg (Hg^{+2}), in micrograms per dry standard cubic meter (ug/dscm) (see Figure 2 for a schematic of the sampling train). A minimum of nine (9), 30-minute test runs were conducted concurrently with the STMS system.

Performance Specification 12B, "Specification and Test Procedures for Monitoring Total Vapor Phase Mercury Emissions from Stationary Sources Using a Sorbent Trap Monitoring System" established the performance benchmarks for evaluating the acceptability of sorbent trap monitoring systems (STMS) used to monitor total vapor phase Hg emissions in stationary flue gas streams.

The Method 30B (RM) modular stack sampling system (Figure 2) consisted of the following:

(1) Ohio Lumex 2-section sorbent tubes containing Iodated Activated Carbon
(2) Heated stainless-steel probe (Containing paired sorbent traps)
(3) Heated PTFE sampling line (maintained at a temperature of 250 $\pm$ 25 °F)
(4) Set of glass impingers submerged in an ice bath for the condensation and collection of moisture

(5) Length of sample line
(6) CleanAir control case equipped with duplicate pumps, dry gas meters, and calibrated orifices.

Sampling was performed at three (3) sampling points, 0.4, 1.2, and 2.0 meters, from the stack wall.

The Sorbent Trap Monitoring System (STMS) consisted of the following:

(1) Ohio Lumex 3-section sorbent tubes containing Iodated Activated Carbon
(2) Heated stainless-steel probe (Containing paired sorbent traps)
(3) Heated PTFE sampling line (maintained at a temperature of 250 ± 25 °F)
(4) CleanAir MET-80 Sorbent Trap Systems

Pre-and post-leak checks were performed on the assembled sampling systems. Post leak checks are mandatory and were performed at a vacuum higher than or equal to the highest vacuum achieved during each respective test run.

Samples were delivered to the DTE ESO DELAB in Detroit for analysis. Sorbent tube analysis was performed on Ohio Lumex Model RA-915+ analyzers utilizing thermal desorption/atomic absorption.

The field data sheets containing the initial and final leak checks, barometric pressures, sample volumes, stack and trap temperatures and dry gas meter readings can be found in Appendix B.

3.1.2 Quality Control and Assurance

EPA Method 30B

Reference Method 30B includes specific analytical QA/QC criteria that must be met to generate valid results. These criteria include spike recovery, sorbent trap breakthrough and paired trap agreement as described below:

- Spike recovery was determined in accordance with RM 30B requirements for the RATA testing. A pre-test spike level of 30 nanograms (ng) was used for the RM traps. A minimum of three (3) acceptable spike recovery sample runs was obtained. The average of the three spike recoveries must be within 85%-115% of the target.

- Sorbent trap breakthrough was determined in accordance with RM 30B requirements for the RATA testing. The Section 2 results are compared to the Section 1 results to determine the amount of breakthrough which must be ≤10% of the Section 1 Hg mass for Hg concentrations > 1 micrograms/dry

standard cubic meter (ug/dscm) or ≤20% of the Section 1 Hg mass for Hg concentrations ≤ 1 ug/dscm.

- The paired trap agreement was determined in accordance with RM 30B requirements for the RATA testing. The two (2) trap concentrations (ug/dscm) are compared for each run and must have a relative deviation (RD) of ≤10% for Hg concentrations > 1 ug/dscm or ≤20% for Hg concentrations ≤ 1 ug/dscm.

The analytical QA/QC data generated from the RM 30B samples can be found in Appendix C. The RM 30B sampling and analytical equipment was calibrated per the guidelines referenced in EPA Method 30B and PS-12B (see Appendix D for equipment calibration).

STMS (Plant Hg Monitors)

EPA Performance Specification 12B includes operational and analytical QA/QC criteria that must be met for valid long-term sampling data using a sorbent trap monitoring system. The analytical QA/QC criteria are also applicable to RATA testing and include spike recovery, sorbent trap breakthrough and paired trap agreement as described below:

- Spike recovery was determined in accordance with PS-12B requirements. A pre-test spike level of 30 ng was used to spike Section 3 of every STMS trap. The spike recovery of every trap must be measured. The spike recovery of each sample must be within 75%-125% of the target.

- Sorbent trap breakthrough was determined in accordance with Sub-Part UUUUU Section 4.1.2.2.3 and PS-12B requirements. The Section 2 results are compared to the Section 1 results to determine the amount of breakthrough which must be ≤50% of the Section 1 Hg mass when concentrations are ≤0.5 ug/dscm and >0.1 ug/dscm. The Section 2 results are compared to the Section 1 results to determine the amount of breakthrough which must be ≤20% of the Section 1 Hg mass when concentrations are ≤1.0 ug/dscm and >0.5 ug/dscm. The Section 2 results are compared to the Section 1 results to determine the amount of breakthrough which must be ≤10% of the Section 1 Hg mass when concentrations are ≥1.0 ug/dscm.

- The paired trap agreement was determined in accordance with Sub-Part UUUUU Section 4.1.2.2.3 and PS-12B requirements. The two (2) trap concentrations (ug/dscm) are compared for each run and must have a relative deviation (RD) of ≤10% RD for Hg concentrations > 1 ug/dscm or ≤20% RD (or ≤ 0.2 ug/dscm absolute difference) for Hg concentrations ≤ 1 ug/dscm.

The analytical QA/QC data generated from the STMS samples can be found in Appendix C.

3.1.3 Data Reduction

The Relative Accuracy (RA) of each STMS was determined by comparison of a minimum of nine (9) concurrent RM 30B and STMS mercury measurements in units of ug/dscm. A total of 10 Hg RATA runs were completed. Run 1 was not utilized. The RATA acceptance criteria specified in Sub-Part UUUUU Section 4.1.2.2.3 and PS-12B were used to evaluate the STMS. The RATA results are acceptable if the RA, based on the percentage of the average RM 30B concentration, is $\leq$20% or the absolute mean difference between the RM and STMS concentration plus the confidence coefficient (CC) is $\leq$ 0.5 ug/dscm if the RM mean value is $\leq$ 2.5 ug/dscm.

Emissions calculations were based on calculations located in USEPA Methods 30B and PS-12B. Example calculations are presented in Appendix E.

4.0 OPERATING PARAMETERS

The average load in gross mega-watts (GMW) was collected along with the plants STMS data during the test program. This data is presented in Appendix F.

5.0 DISCUSSION OF RESULTS

Table 1 presents the Hg Relative Accuracy Test Audit (RATA) results for the STMS on Unit 1. Mercury (Hg) emissions are reported for each test run in micrograms per dry standard cubic meter (ug/dscm). The table provides results from the Reference Method (30B) and the Sorbent Trap Monitoring Systems (STMS), the absolute difference of the two sampling systems, and the Relative Accuracy (%RA).

The results for Unit 1 show an RA of 3.51% and an absolute difference + CC of 0.03 ug/dscm. The Hg STMS meets the Acceptance Criteria stated in Sub-Part UUUUU Section 4.1.2.2.3 and PS-12B of 20% RA or absolute difference + CC of $\leq$ 0.5 ug/dscm.

Table 2 presents the summary of QA/QC results for the RM 30B samples. The spike recovery, breakthrough and paired trap agreement are presented in percentage. The criteria for each of the QA/QC tests were met.

Table 3 presents the summary of QA/QC results for the STMS samples. The spike recovery, breakthrough and paired trap agreement are presented in percentage. The criteria for each of the QA/QC tests were met for all tests.

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6.0 CERTIFICATION STATEMENT

"I certify that I believe the information provided in this document is true, accurate, and complete. Results of testing are based on the good faith application of sound professional judgment, using techniques, factors, or standards approved by the Local, State, or Federal Governing body, or generally accepted in the trade."

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RESULTS TABLES

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Table 1
Hg Sorbent Trap Monitoring System (STMS) RATA Results
Belle RiverPower Plant - Unit 1
January 24-25, 2024

Test No.	Start Time	End Time	Mercury Concentration (ug/dscm)						Difference
			Reference Method 30B			Plant Hg System (STMS)			
			Trap "A"	Trap "B"	Average 30B	Trap "A"	Trap "B"	Average STMS	
1	7:31	8:01	0.75	0.75	0.75	0.73	0.73	0.73	0.02
2	8:14	8:44	0.81	0.79	0.80	0.76	0.75	0.76	0.04
3	8:56	9:26	0.92	0.75	0.84	0.74	0.74	0.74	0.10
4	9:38	10:08	0.79	0.74	0.76	0.76	0.77	0.76	0.00
5	10:20	10:50	0.75	0.72	0.73	0.74	0.74	0.74	0.00
6	11:02	11:32	0.69	0.68	0.69	0.68	0.68	0.68	0.01
7	11:45	12:15	1.13	1.11	1.12	1.13	1.14	1.13	-0.01
8	7:02	7:32	0.82	0.80	0.81	0.78	0.79	0.78	0.03
9	7:43	8:13	0.76	0.76	0.76	0.74	0.74	0.74	0.02
10	8:26	8:56	0.79	0.79	0.79	0.76	0.76	0.76	0.03
				Average:	**0.80**			**0.79**	**0.01**
								Standard Deviation:	**0.02**
								Confidence Coefficient (CC):	**0.01**
								RELATIVE ACCURACY:	3.51
								MEAN DIFFERENCE + CC (<0.5 ug/dscm):	0.03

= Test not used in Calculation

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Table 2
Summary of QA/QC Results - RM 30B
Belle River Power Plant - Unit 1
January 24-25, 2024

Test No.	Spike Recovery[1]	Breakthrough[2]		Trap Agreement[3]
	Trap "A"	Trap "A"	Trap "B"	Relative Deviation
1		0.82%	2.07%	0.03%
2		1.37%	1.20%	1.41%
3	94.9%	1.08%	1.18%	10.07%
4	96.1%	1.19%	1.72%	3.04%
5	98.5%	0.82%	0.92%	2.41%
6		1.18%	1.13%	1.03%
7		1.09%	0.68%	0.92%
8		1.61%	1.04%	1.34%
9		1.66%	1.05%	0.33%
10		1.33%	1.60%	0.39%

(1) Criteria: 85%-115%. Average of three (3) runs meeting specification are required.

(2) Criteria: ≤ 10% of section 1 Hg mass for Hg concentrations > 1 ug/dscm
≤ 20% of section 1 Hg mass for Hg concentrations ≤ 1 ug/dscm
≤ 50% of section 1 Hg mass for Hg concentrations ≤0.5 ug/dscm
No breakthrough requirements for Hg concentrations ≤0.1 ug/dscm

(3) Criteria: ≤ 10% RD for Hg concentrations > 1 ug/dscm
≤ 20% RD or ≤ 0.2 ug/dscm absolute difference for Hg concentrations ≤ 1 ug/dscm

RED indicates value outside the criteria

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Table 3
Summary of QA/QC Results - STMS
Belle River Power Plant - Unit 1
January 24-25, 2024

Test No.	Spike Recovery[1]		Breakthrough[2]		Trap Agreement[3]
	Trap "A"	Trap "B"	Trap "A"	Trap "B"	Relative Deviation
1	98.0%	99.7%	0.81%	0.73%	0.29%
2	99.8%	99.7%	0.90%	0.29%	0.68%
3	99.6%	97.8%	0.09%	0.63%	0.11%
4	97.0%	96.2%	0.13%	0.71%	0.71%
5	96.9%	97.3%	0.85%	0.35%	0.34%
6	97.9%	96.1%	0.61%	0.52%	0.49%
7	97.5%	98.5%	0.01%	0.21%	0.55%
8	97.9%	98.0%	0.80%	0.44%	0.73%
9	98.0%	97.5%	0.48%	0.43%	0.15%
10	97.8%	97.4%	0.62%	0.27%	0.42%

(1) Criteria: 75%-125%

(2) Criteria: ≤ 10% of section 1 Hg mass for Hg concentrations > 1 ug/dscm
≤ 20% of section 1 Hg mass for Hg concentrations > 0.5 and ≤ 1 ug/dscm
≤ 50% of section 1 Hg mass for Hg concentrations > 0.1 and ≤ 0.5 ug/dscm
No Breakthrough for Hg concentrations < 0.1 ug/dscm

(3) Criteria: ≤ 10% RD for Hg concentrations > 1 ug/dscm
≤ 20% RD or ≤ 0.03 ug/dscm absolute difference for Hg concentrations ≤ 1 ug/dscm

RED indicates value outside the criteria

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FIGURES

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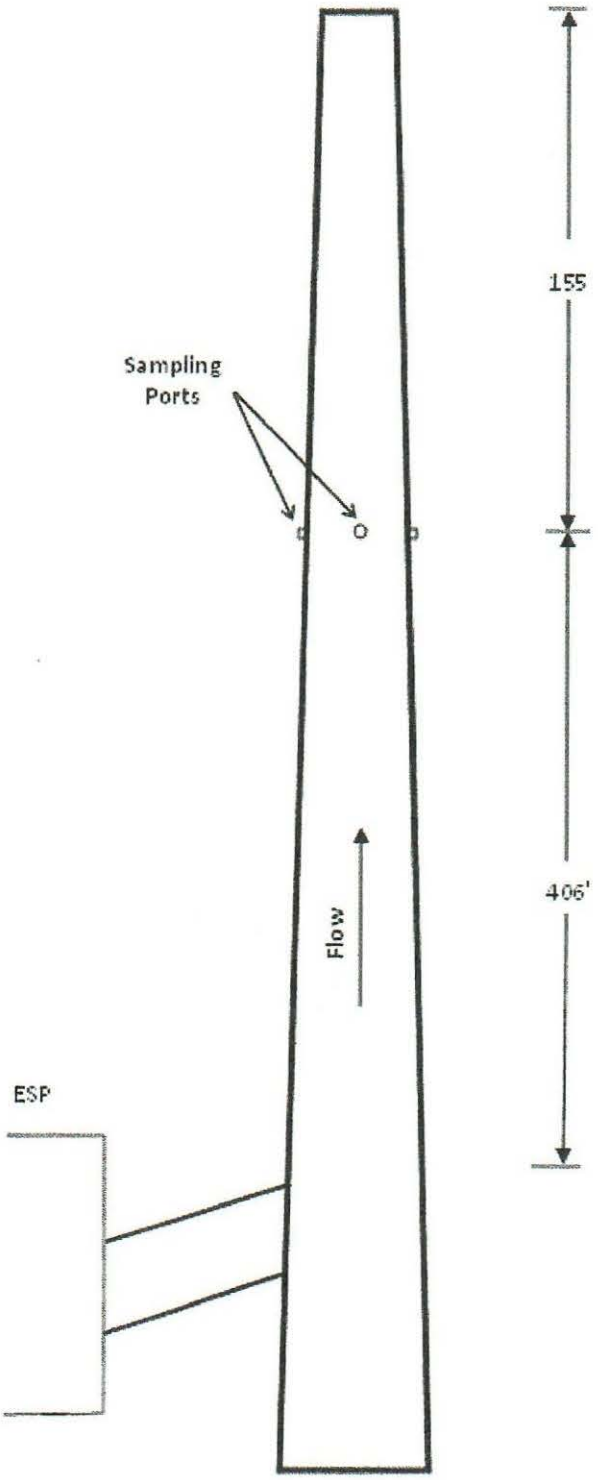
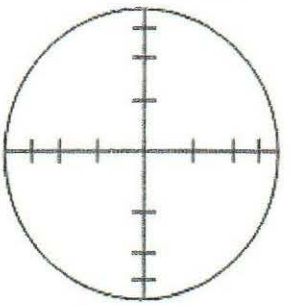
Figure 1 – Sampling Location
Hg RATA - BRPP Units 1 & 2



Stack Diameter 25'-6"



Sample Points

Points	Distance From Inner Wall
1	0.4 meters
2	1.2 meters
3	2.0 meters

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Figure 2 – USEPA Method 30B
Hg RATA - BRPP Units 1 & 2