COMPLIANCE TEST REPORT

for

RELATIVE ACCURACY TEST AUDIT (RATA) REPORT

Mercury (Hg) Sorbent Trap Monitoring System (STMS)

UNIT 4 – FGD Stack

Monroe Power Plant
Monroe, Michigan

January 11 & 12, 2023

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EXECUTIVE SUMMARY

DTE Energy's Environmental Management and Safety (EM&S) Ecology, Monitoring, and Remediation Group performed a Relative Accuracy Test Audit (RATA) on the Unit 4 FGD Mercury (Hg) sorbent trap monitoring system (STMS) at the Monroe Power Plant, in Monroe, Michigan. The testing was required by 40 CFR Part 63, Subpart UUUUU. The testing was conducted on January 11 & 12, 2023.

A summary of the emission test results is shown below:

Relative Accuracy Test Audit
Mercury Sorbent Trap Monitoring System
Monroe Power Plant - Unit 4
January 11 & 12, 2023

	STMS (ug/dscm)	30B (ug/dscm)	Mean Difference + /CC/ (ug/dscm)[1]	Relative Accuracy (%)[2]
Unit 4	0.14	0.12	0.03	24.51

Compliance Limits
(1) Mean Difference + CC ≤ 0.5 ug/dscm (R336.2158, Table 111)
(2) RA ≤ 20% (R336.2158, Table 111)

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1.0 INTRODUCTION

DTE Energy's Environmental Management and Safety (EM&S) Ecology, Monitoring, and Remediation Group performed a Relative Accuracy Test Audit (RATA) on the Unit 4 FGD Mercury (Hg) sorbent trap monitoring system (STMS) at the Monroe Power Plant, in Monroe, Michigan. The testing was required by 40 CFR Part 63, Subpart UUUUU. The testing was conducted on January 11 & 12, 2023.

Testing was performed in accordance with specifications of EGLE Rule 336.2158, sub rule 5. 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 were used to collect the samples.

The fieldwork was performed in accordance with R336.2158, EPA Reference Methods and EM&S'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&S personnel participated in the testing program: Mr. Mark Grigereit, Principal Engineer, Mr. Thom Snyder, Senior Environmental Specialist and Mr. Fred Meinecke, Senior Environmental Technician. Cory Yeager, I&C Specialist from Monroe Power Plant assisted with the collection of the sorbent tube samples. Mr. Grigereit was the project Leader. Ms. Elise Ciak, Environmental Engineer at MONPP, provided process coordination for the testing program.

2.0 SOURCE DESCRIPTION

The Monroe Power Plant is a DTE Energy facility located at 3500 E. Front Street in Monroe, Michigan. The plant has four (4) coal-fired electric generating units, referred to as Units 1, 2, 3, and 4. These units were placed in service between 1971 and 1974, and have a total electric generating capacity of 3,135 megawatts (gross). The boiler (Babcock & Wilcox) for each unit is a similar supercritical pressure, pulverized coal-fired cell burner boiler. Boilers 1 through 4 each exhaust into individual stacks.

Units 1 and 4 have General Electric turbine generators, each with a rated capability of 817 gross megawatts (GMW). Units 2 and 3 have Westinghouse turbine generators, each with a rated capability of 823 GMW. The boilers employ the use of continuous soot-blowing.
The boiler exhausts are equipped with Research Cottrell electrostatic precipitators (ESPs) with particulate removal efficiencies of 99.6%. There is a sulfur trioxide flue gas conditioning system

[1] EGLE, Test Plan, Submitted October 18, 2021. (Attached-Appendix A)

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on each unit that is only used on an "as needed basis" to lower the resistivity of the fly ash for better collection by the ESPs. None of the four units are equipped with sulfuric acid mist control equipment.

Each unit has Selective Catalytic Reduction (SCR) systems to control 90% of the NOx emissions prior to their respective ESP's and wet Flue Gas Desulfurization (FGD) Scrubbers to control sulfur dioxide (SO_2), and other acid gases. The exhaust stacks are 580 feet tall with internal diameters of 28 feet. See Figure 1 for a diagram of the sampling locations and stack dimensions.

The coal blend for Unit 4 was 75% low-sulfur western (LSW) / 15% high-sulfur eastern (HSE)/ 10% petcoke. During the RATA Unit 4 was fired with 100% potassium iodide treated coal. Testing was performed while the boiler was operated at normal "as found" conditions.

Mercury (Hg) emissions from the Unit 4 FGD stack are monitored continuously using sorbent trap monitoring systems (STMS). The STMS is a CleanAir MET-80 sorbent trap system with the following serial numbers.

- Unit 4 – Serial No. M80MF-1105-45-09

3.0 SAMPLING AND ANALYTICAL PROCEDURES

EM&S 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

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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), 60-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 dual probe (Containing paired sorbent traps)
(3) Heated PTFE sampling line (maintained at a temperature of 250 ± 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 MET-80 control case equipped with automated gas sampler (containing two mass flow meters) and a logic control system

Stratification testing is not required in accordance with Reference Method 30A, Section 8.1.3.4. Sampling was performed at three (3) sampling points, 0.4, 1.2, and 2.0 meters, from the stack wall in accordance with Performance Specification 2, 8.1.3.2.

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 analyzed on-site immediately following each test run. Sorbent tube analysis was performed on Ohio Lumex Model RA-915+ analyzers utilizing thermal desorption/atomic absorption.

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The analyzer data sheets containing the initial and final leak checks, barometric pressures, sample volumes, stack and trap temperatures and sample volumes 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 $\leq$10% of the Section 1 Hg mass for Hg concentrations > 1 micrograms/dry standard cubic meter (ug/dscm) or $\leq$20% of the Section 1 Hg mass for Hg concentrations $\leq$ 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 $\leq$10% for Hg concentrations > 1 ug/dscm or $\leq$20% for Hg concentrations $\leq$ 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)

Michigan R336.1258 and 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 QA/QC specifications are also summarized in Table 111 of the Michigan rule. 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:

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- 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. For Unit 4 a total of 9 Hg RATA runs were completed. 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 ≤20% or the absolute mean difference between the RM and STMS concentration plus the confidence coefficient (CC) is ≤ 0.5 ug/dscm if the RM mean value is ≤ 2.5 ug/dscm.

Emissions calculations were based on calculations located in R336.1258 and USEPA Methods 30B and PS-12B. Example calculations are presented in Appendix E.

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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 4. 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 4 show an RA of 24.51% and the absolute mean difference between the RM and STMS concentration plus the confidence coefficient (CC) is $\leq$ 0.5 ug/dscm. The system meets the acceptance criteria stated in R336.1258 Table 111.

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
Monroe Power Plant - Unit 4
January 11 & 12, 2023

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	7:55	8:50	0.11	0.11	0.11	0.13	0.13	0.13	-0.02
2	9:08	10:08	0.11	0.12	0.11	0.15	0.15	0.15	-0.04
3	10:26	11:26	0.11	0.11	0.11	0.13	0.14	0.13	-0.03
4	11:43	12:43	0.11	0.07	0.09	0.13	0.13	0.13	-0.04
5	12:59	13:59	0.12	0.10	0.11	0.13	0.13	0.13	-0.02
6	7:35	8:35	0.16	0.14	0.15	0.17	0.17	0.17	-0.02
7	8:51	9:51	0.14	0.14	0.14	0.15	0.15	0.15	-0.01
8	10:07	11:07	0.15	0.14	0.15	0.16	0.16	0.16	-0.01
9	11:22	12:22	0.15	0.14	0.14	0.15	0.15	0.15	0.00
				Average:	**0.12**			**0.14**	**-0.02**
								Standard Deviation:	**0.01**
								Confidence Coefficient (CC):	**0.01**
								RELATIVE ACCURACY:	24.51
								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
Monroe Power Plant - Unit 4
January 11 & 12, 2023

Test No.	Spike Recovery[1]	Breakthrough[2]		Trap Agreement[3]
	Trap "A"	Trap "A"	Trap "B"	Relative Deviation
1		2.96%	3.54%	0.94%
2		0.78%	5.45%	2.68%
3		2.15%	4.70%	1.88%
4	92.0%	2.89%	0.63%	25.04%
5	96.2%	3.37%	0.41%	9.47%
6	97.5%	1.79%	0.80%	4.54%
7		3.19%	2.40%	0.77%
8		4.26%	2.38%	3.08%
9		5.41%	1.31%	3.40%

(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
Monroe Power Plant - Unit 4
January 11 & 12, 2023

Test No.	Spike Recovery[1]		Breakthrough[2]		Trap Agreement[3]
	Trap "A"	Trap "B"	Trap "A"	Trap "B"	Relative Deviation
1	96.9%	97.0%	0.51%	3.74%	0.32%
2	97.0%	96.7%	1.48%	2.41%	0.16%
3	96.2%	96.8%	1.89%	2.46%	1.88%
4	95.4%	96.5%	1.22%	2.57%	0.07%
5	96.8%	99.2%	1.53%	2.26%	1.35%
6	99.8%	98.2%	1.60%	0.92%	0.50%
7	99.2%	99.2%	2.18%	2.58%	0.55%
8	99.0%	100.2%	1.97%	4.35%	0.22%
9	99.5%	96.2%	2.21%	2.22%	0.06%

(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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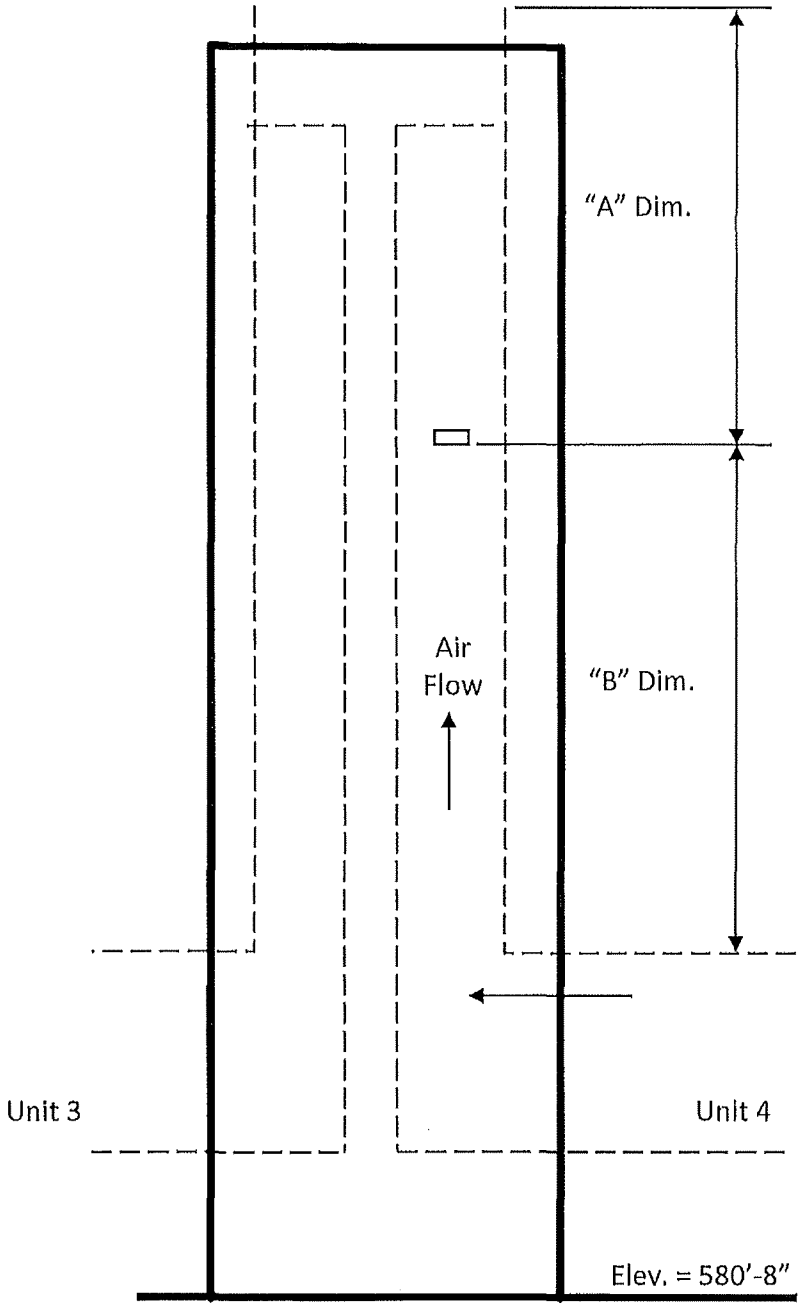
FIGURES

Figure 1 – Sampling Location
Hg RATA - MONPP Unit 3/4
January 11 & 12, 2023



Details

"A" Dim = Upstream Distance
"A" Dim = 201.6'
"B" Dim = Downstream Distance
"B" Dim = 233.8'

Dia. @ Sample Location = 28'-0"

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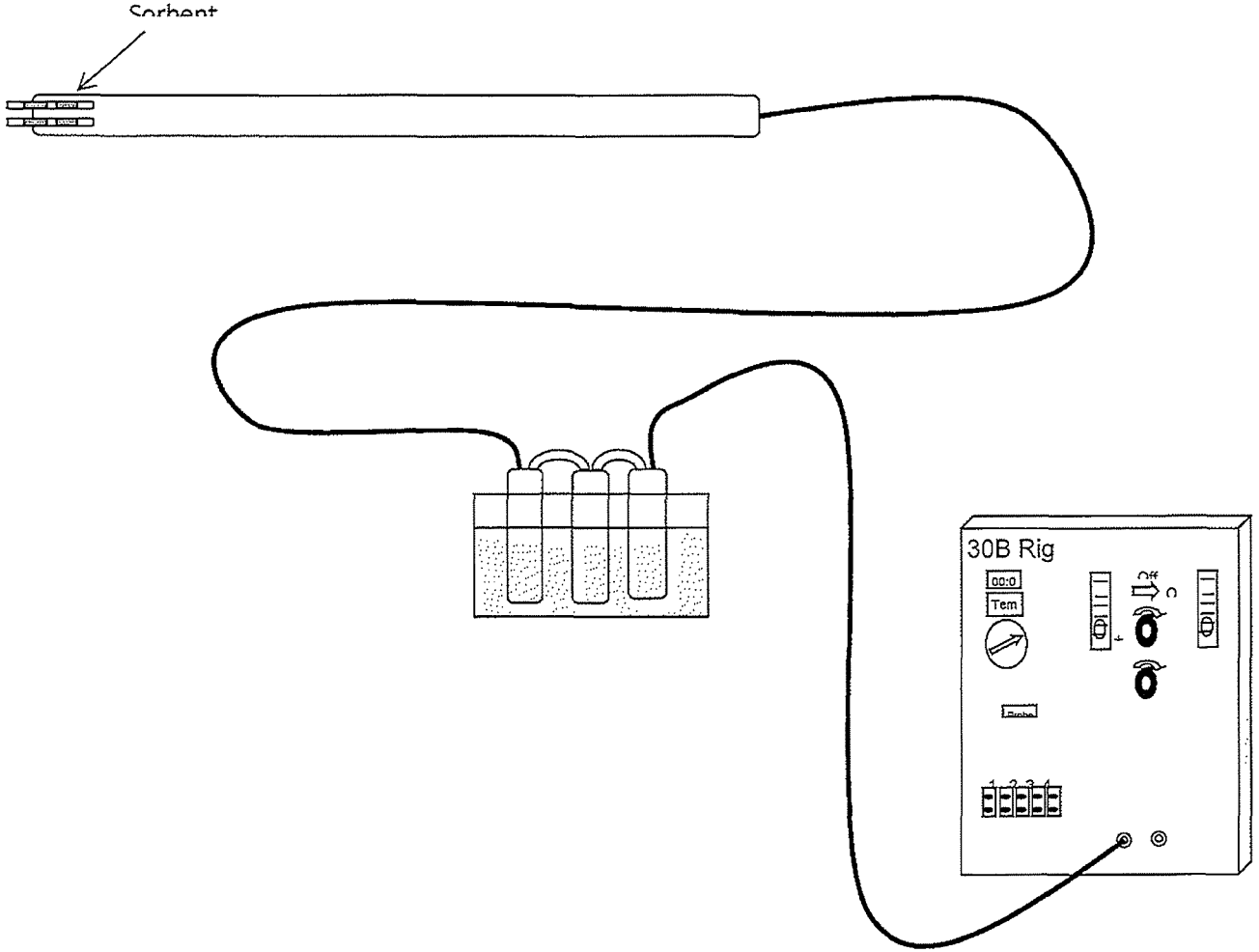
Figure 2 – USEPA Method 30B
Hg RATA - MONPP Unit 4
January 11 & 12, 2023



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APPENDIX A

EGLE TEST PLAN