Consumers Energy

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Test Report
40 CFR Part 63 Subpart UUUUU
Mercury LEE Demonstration

EUBOILER01 and 02
T.E.S. Filer City Station

T.E.S. Filer City Station
700 Mee Street
Filer City, Michigan 48634
Test Dates: October 22 – November 30, 2015

January, 2015
Work Order No. 4101341

Revision 0

Test Performed by the Consumers Energy Company
Regulatory Compliance Testing Section – Air Emissions Testing Body
Engineering Services Department
Written by D.A. King, Engineering Technical Analyst I

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1.0 INTRODUCTION

Consumers Energy Company (CECo) Regulatory Compliance Testing Section (RCTS) performed the Mercury (Hg) Low Emitting Electric Generating Unit (LEE) demonstration testing per Subpart UUUUU, 40 CFR Part 63 (commonly referred to as the Mercury and Air Toxics Standard [MATS] Rule) at the stack exhausts associated with emissions units EUBOILER01 (Unit 1) and EUBOILER02 (Unit 2) in operation at the Tondu Energy Systems (TES) Filer City Station, located in Filer City, Michigan.

The test was performed to demonstrate qualification as a LEE for Hg. This was the first test performed of the annual testing regimen. The Hg LEE demonstration requires continuous sampling at each unit over a period of 30 boiler operating days. The results of each annual test must either: 1) be less than or equal to 10 percent of the applicable Hg standard listed in Table 2 of the MATS Rule (see Table 1.1 below), equating to 0.12 lb/TBtu for each of Units 1 and 2 or 2) demonstrate that annualized emissions from each unit does not exceed 29 pounds per year (lb/yr) with the emission rate not exceeding the Hg standard listed in Table 2 of the MATS Rule. A test protocol was submitted to the Michigan Department of Environmental Quality (MDEQ) in September, 2015 and subsequently approved by Mr. Jeremy Howe, MDEQ Environmental Quality Analyst, in his letter dated October 2nd, 2015.

Table 1.1
UUUUU, 40 CFR Part 63 (MATS Rule) Emission Limit

EGU Subcategory	Pollutant Being Sampled	Emission Limit
Existing Unit, Coal-fired not low rank virgin coal	Mercury	1.2 lb/TBtu

lb/TBtu: pound per trillion British thermal unit

1.1 Summary of Test Program

The test program was conducted in accordance with applicable MATS Rule requirements and followed the sampling, calibration and quality assurance procedures specified in U.S. EPA CFR Part 60, Appendix A, Reference Methods (RM) 19 and 30B, and approved alternative method ALT-091. Carbon dioxide (CO_2) concentration data was obtained from the facility CEMS over the 30 boiler operating day test period.

1.2 Key Personnel

RCTS representatives Brian Glendening and Gregg Koteskey conducted the testing October 22 through November 30, 2015. Mr. Richard Brown, TES Environmental Health & Safety Coordinator, coordinated the test program with plant personnel. Mr. Jeremy Howe of the MDEQ observed portions of the testing.

Table 1.2
Key Personnel Contact Information

Responsible Party	Address	Contact
Test Facility	TES Filer City Station 700 Mee Street Filer City, Michigan 49634	Mr. Richard Brown 231-723-6573 Environmental Health & Safety richard.brown@cmsenergy.com
Test Representative & Qualified Individuals	Consumers Energy Company RCTS - AETB 17000 Croswell Street West Olive, Michigan 49460	Mr. Brian Glendening Senior Technical Analyst II 616-738-3234 brian.glendening@cmsenergy.com
		Mr. Gregg Koteskey, QI Technical Analyst 616-738-3712 gregg.koteskey@cmsenergy.com
Regulatory Agency Representative	Michigan Department of Environmental Quality 120 W. Chapin Street Cadillac, Michigan 49601	Mr. Jeremy Howe Environmental Quality Analyst 231-876-4416 howej1@michigan.gov

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2.0 SOURCE DESCRIPTION

2.1 Process Description

TES Filer City Station operates a cogeneration power plant with a rated output of 60-megawatts (MW) net and 50,000 pounds of process steam per hour. At full load, each of Units 1 and 2 are capable of producing approximately 320,000 pounds per hour of steam, and this steam is fed to a common steam turbine and electrical generator. The electricity and process steam are sold under contract to public and/or private companies.

Units 1 and 2 are capable of firing mixtures of coal (bituminous and subbituminous), wood and wood waste, construction/demolition (C/D) material, petroleum (pet) coke and tire-derived-fuel (TDF) and are classified as "existing unit, coal-fired not low rank virgin coal" in Item 1 of Table 2 Subpart UUUUU. Starting in 2016, Units 1 and 2 will have the capability to fire natural gas as a clean startup fuel under MATS, as well as at other times for flame stabilization and other purposes. Each unit has a nominal heat input rating of approximately 384 mmBtu.

2.2 Control Device Description

The exhaust gas from each boiler is vented to an individual baghouse for PM control and a spray dryer absorber (SDA) flue gas desulfurization (FGD) system for sulfur dioxide (SO_2) and acid gas control. The abated exhaust is discharged through separate circular stacks which are approximately 250 feet in height.

3.0 SUMMARY OF TEST RESULTS

During the test program, Units 1 and 2 burned a mixture of coal, petroleum coke, tire-derived fuel, and wood. Recorded operating data including CEMS CO_2 measurements, fuel blend firing rate, steam flow data, composite fuel factor, and SO_2 reduction rate (in lieu of scrubber flow rate as requested in the test protocol approval letter) is included in Attachment 4. SO_2 reduction rate was included in lieu of scrubber flow rate as SO_2 reduction rate is logged automatically, while scrubber flow rate is not. Except as noted, testing was conducted continuously over 30 operating days with Units 1 and Unit 2 operating under routine operating conditions.

3.1 Objectives

The objective of this test was to qualify Units 1 and 2 as LEE's for Hg. In order to demonstrate LEE status, the results of annual testing must be less than or equal to 10% of the mercury emission limit of 1.2 lb/TBtu or the potential Units 1 and 2 Hg emissions must not exceed 29 pounds per year (lb/yr) with the emission rate not exceeding the Hg standard listed in Table 2 of the MATS Rule (1.2 lb/TBtu). Table 3.1 presents the specified sampling matrix.

Table 3.1
Test Matrix

Source	Run	Sampling Dates	Sampling Duration	Parameter	Reference Method
Unit 1	1	Oct 22 to Oct 28	5d 16h 57 m	Moisture Content Mercury	ALT-091 30B
	2†	Oct 28 to Nov 5	7d 20h 18m		
	3	Nov 5 to Nov 14	8d 21h 41m		
	4	Nov 14 to Nov 20	6d 1h 37m		
	5	Nov 20 to Nov 30	9d 22h 13m		
Unit 2	1	Oct 22 to Oct 28	5d 17h 17m		
	2	Oct 28 to Nov 5	7d 19h 47m		
	3	Nov 5 to Nov 14	8d 23h 20m		
	4	Nov 14 to Nov 20	5d 22h 59m		

† Did not pass post-test leak check, results excluded from calculations

3.2 Test Results and Discussion

As shown in Table 3.2 below, the results of the 30 operating day tests for each unit were below the 40 CFR Part 63 Subpart UUUUU limits of 1.2 lb/TBtu for Units 1 and 2. Both units demonstrated eligibility for LEE qualification as emission rates were below 0.12 lb/TBtu (i.e., 10% of the Hg limit) as well as emitting less than 29 lb/yr while not exceeding the Hg standard listed in Table 2 of the

MATS Rule (1.2 lb/TBtu). This test program was the first in a series of annual Hg LEE demonstration tests to qualify Units 1 and 2 for LEE status.

Table 3.2
TES Filer City Unit 1 and Unit 2 Hg Emission Test Summary

Source	Test Run	Hg Concentration (ug/dscm, dry)	Hg Emission Rate (lb/TBtu)		Hg Emission Rate (lb/yr)	
		Result	Result	LEE	Result	LEE
UNIT 1	1	0.00296	0.00248	-	0.0085	-
	2†	0.00537	0.00454	-	0.0155	-
	3	0.01996	0.01700	-	0.0582	-
	4	0.00591	0.00493	-	0.0170	-
	5	0.00205	0.00176	-	0.0060	-
	Average	**0.00772**	**0.00654**	**0.12**	**0.0224**	**29.0**
UNIT 2	1	0.00318	0.00272	-	0.0092	-
	2	0.00527	0.00456	-	0.0153	-
	3	0.02781	0.02429	-	0.0810	-
	4	0.01573	0.01366		0.0453	-
	Average	**0.01300**	**0.01131**	**0.12**	**0.0377**	**29.0**

† Did not pass post-test leak check, results excluded from calculations
ug/dscm: microgram per dry square cubic meter
lb/yr: pound per year
lb/TBtu: pound per trillion British thermal unit

4.0 SAMPLING AND ANALYTICAL PROCEDURES

The Hg test runs were performed on Unit 1 October 22 through November 30, 2015. Test runs were performed on the Unit 2 stack October 22 through November 20, 2015. The test runs collected data over a period of at least 30 boiler operating days. During the testing, each boiler was operating under routine operating conditions. Operating data collected at 1-hour intervals during the test period included CEMS CO_2 measurements, fuel blend firing rate, steam flow data, fuel blend fuel factor, and SO_2 reduction rate.

4.1 Moisture

The exhaust gas moisture content was determined using U.S. EPA Alternative Approved Method ALT-091, in conjunction with the 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 g before and after each test run to determine the amount of water vapor collected and calculate stack gas percent moisture using the applicable calculations in Section 12 of U.S. EPA RM 4. U.S. EPA Alternative Approved Method ALT-091 requires the moisture content to also be determined using the average stack gas temperature in conjunction with saturation vapor tables, with the lower of the two values considered the moisture content for the LEE demonstration. The stack gas temperature run averages ranged from 173.9 degrees Fahrenheit (°F) to 179.5 °F during the test period. The water vapor content at these temperatures equate to 37.2% to 41.8% moisture by volume at saturation, much higher than the average measured using the mass of water collected in RM 30B sample apparatus (Unit 1 averaged 13.8% moisture, Unit 2 averaged 13.9%). Therefore, for each run, the RM 30B moisture content was used in emissions calculations.

4.2 Mercury

Mercury was collected utilizing 40 CFR Part 60, U.S. EPA Reference Method 30B, *Determination of Total Vapor Phase Mercury Emissions from Coal-Fired Combustion Sources Using Carbon Sorbent Traps* with extended sample times. Each test run consisted of paired sorbent traps and ranged from 6 to 10 boiler operating days in duration. Hg emissions data was collected continuously over the entire test period except when changing sorbent traps or performing required Method 30B QA procedures. The Hg sorbent trap system probe tip was positioned within the 10 percent centroidal 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 Ohio Lumex Laboratory in Twinsburg, Ohio and analyzed in accordance with Section 11.0 of RM 30B.

5.0 QUALITY ASSURANCE PROCEDURES

Each U.S. EPA 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. Extreme 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 was documented for each run.

All manual test equipment was calibrated before the test program in accordance with appropriate U.S. EPA procedures. Dry gas meter and thermocouple calibrations are included in Attachment 5. Annual and benchtop mercury analyzer calibration data and certificates of analysis for mercury standards are included in Attachment 3. The QA/QC requirements associated with the performance of RM 30B are summarized in Table 5.1below.

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 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 don 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.

Table 5.1
Summary of RM 30B Sampling QA/QC Requirements

QA/QC test or specification	Acceptance criteria	Frequency	Consequences if not met
Test run total sample volume	Within ± 20% of the total volume sampled during the field recovery test.	Each individual sample	Sample invalidated.
Sorbent trap section 2 breakthrough	≤ 10% of section 1 Hg mass for Hg concentrations > 1 µg/dscm; ≤ 20% of section 1 Hg mass for Hg concentrations ≤ 1 µg/dscm	Every sample	Sample invalidated.
Paired sorbent trap agreement	≤ 10% Relative Deviation mass for Hg concentrations > 1 µg/dscm; ≤ 20% or ≤ 0.2 µg/dscm absolute difference for Hg concentrations ≤ 1 µg/dscm.	Every run	Run invalidated.
Field recovery	Average recovery between 85% and 115% for Hg^0.	Average from a minimum three spiked sorbent traps.	Field sample runs not validated without successful field recovery test.

5.1 Field Test Issues

The second test run on Unit 1, conducted from October 28 to November 5, 2015, did not pass the post-test leak check and thus, the samples were invalidated. An additional test run was conducted on Unit 1 from November 20 to 30, 2015 to ensure emissions data was collected over 30 boiler operating days. Results from the invalidated test run were excluded from the 30 boiler operating day emissions calculations; however data from the run is included in Attachments 2 and 3. It should be noted that the Method 30B DAHS printout for Unit 1 Run 2 (Attachment 3), shows the post-test leak check as passing. This result reflects the leak rate after troubleshooting, which was conducted to correct the issue causing the leak. All other test run DAHS printouts represent the as-found condition of the sample apparatus.

6.0 CERTIFICATION

I hereby certify that the statements and information in this test report and supporting enclosures are true, accurate, and complete, and that the test program was performed in accordance with test methods specified in this report.

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FIGURES

FIGURE 1

TES FILER CITY UNIT 1 & 2 TEST PORT ELEVATION

IN-STACK TEST PORT LOCATION
(elevation looking east)

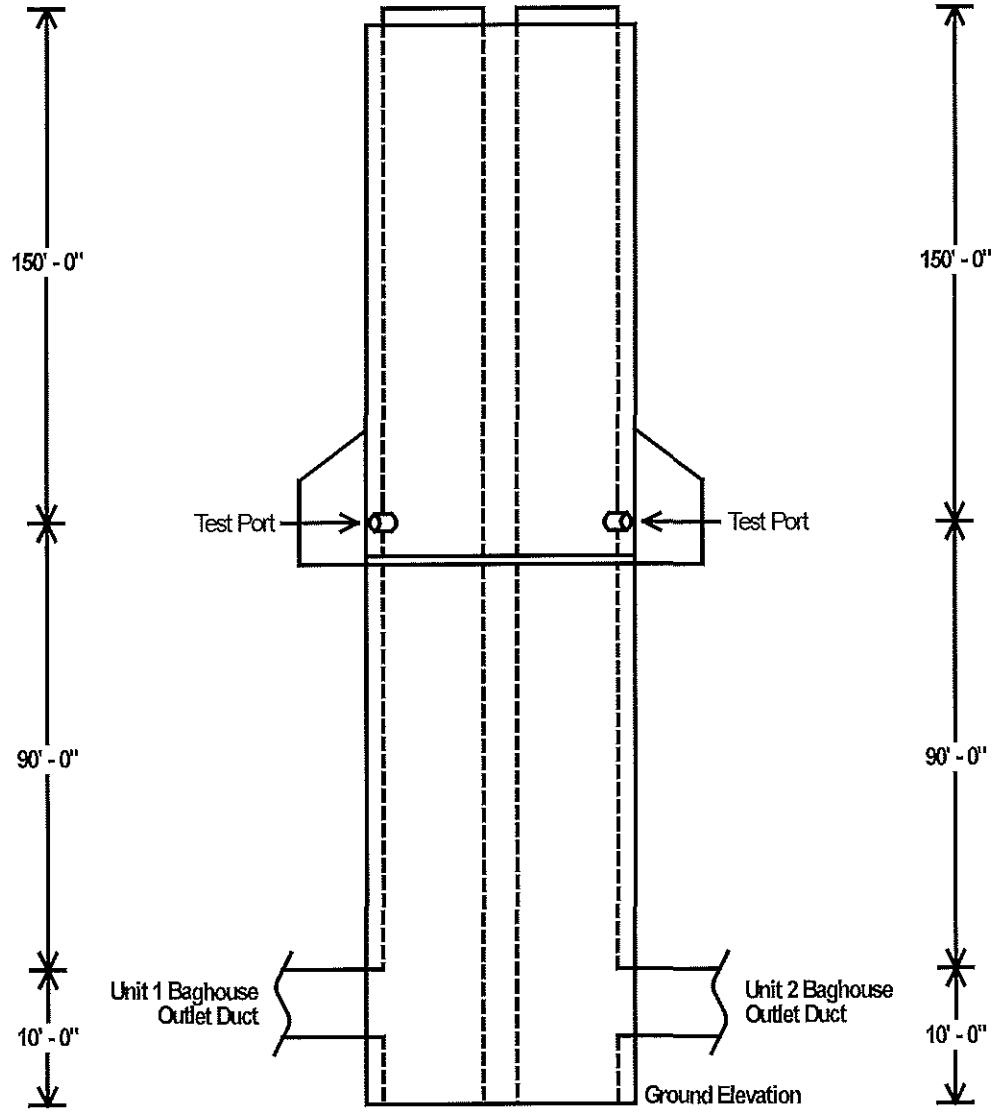

FIGURE 2

Method 30B Mercury Sample Apparatus