# 40 CFR Part 63, Subpart UUUUU
# Mercury CEMS
# Certification Test Report

## Consumers Energy
## J.H. Campbell Generating Complex
## Boiler Unit 3
## SRN B2835

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MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY
AIR QUALITY DIVISION

# RENEWABLE OPERATING PERMIT REPORT CERTIFICATION

*Authorized by 1994 P.A. 451, as amended. Failure to provide this information may result in civil and/or criminal penalties.*

**Reports submitted pursuant to R 336.1213 (Rule 213), subrules (3)(c) and/or (4)(c), of Michigan's Renewable Operating Permit (ROP) program must be certified by a responsible official. Additional information regarding the reports and documentation listed below must be kept on file for at least 5 years, as specified in Rule 213(3)(b)(ii), and be made available to the Department of Environmental Quality, Air Quality Division upon request.**

Source Name: Consumers Energy Company, J.H. Campbell Plant — County: Ottawa

Source Address: 17000 Croswell — City: West Olive

AQD Source ID (SRN): B2835 — ROP No.: MI-ROP-2835-2013a — ROP Section No.: 1

Please check the appropriate box(es):

☐ **Annual Compliance Certification (Pursuant to Rule 213(4)(c))**

Reporting period (provide inclusive dates): From _____ To _____

☐ 1. During the entire reporting period, this source was in compliance with **ALL** terms and conditions contained in the ROP, each term and condition of which is identified and included by this reference. The method(s) used to determine compliance is/are the method(s) specified in the ROP.

☐ 2. During the entire reporting period this source was in compliance with all terms and conditions contained in the ROP, each term and condition of which is identified and included by this reference, **EXCEPT** for the deviations identified on the enclosed deviation report(s). The method used to determine compliance for each term and condition is the method specified in the ROP, unless otherwise indicated and described on the enclosed deviation report(s).

☐ **Semi-Annual (or More Frequent) Report Certification (Pursuant to Rule 213(3)(c))**

Reporting period (provide inclusive dates): From _____ To _____

☐ 1. During the entire reporting period, **ALL** monitoring and associated recordkeeping requirements in the ROP were met and no deviations from these requirements or any other terms or conditions occurred.

☐ 2. During the entire reporting period, all monitoring and associated recordkeeping requirements in the ROP were met and no deviations from these requirements or any other terms or conditions occurred, **EXCEPT** for the deviations identified on the enclosed deviation report(s).

☒ **Other Report Certification**

Reporting period (provide inclusive dates): From 8/09/2016 To present

Additional monitoring reports or other applicable documents required by the ROP are attached as described:

Submittal of Boiler Unit 3 Mercury Continuous Emissions Monitor Certification for the MATS regulation.

I certify that, based on information and belief formed after reasonable inquiry, the statements and information in this report and the supporting enclosures are true, accurate and complete

| Norman J. Kapala | Executive Director of Coal Generation | (616) 738-3200 |
|---|---|---|
| Name of Responsible Official (print or type) | Title | Phone Number |
| Signature of Responsible Official | | 10/07/2016 Date |

* Photocopy this form as needed.

EQP 5736 (Rev 11-04)

# 1 INTRODUCTION

The J.H. Campbell Generating Complex is subject to 40 CFR Part 63, Subpart UUUUU—*National Emission Standards for Hazardous Air Pollutants: Coal- and Oil-Fired Electric Utility Steam Generating Units*. The preceding rule is also known as the Mercury and Air Toxics Standard, or MATS. In order to comply with the mercury monitoring obligations of MATS, Consumers Energy has elected to install a mercury continuous emissions monitoring system (CEMS) on all of the boiler units.

The purpose of this test program is to satisfy the mercury CEMS certification requirements for boiler Unit 3, as specified in Appendix A of 40 CFR Part 63, Subpart UUUUU. Consistent with Section 4.0 of Appendix A, the required certification tests consist of a 7-day calibration error test, linearity check, three-level system integrity check, and relative accuracy test audit (RATA). Each of required certification checks or tests has been conducted on the mercury CEMS; all but the RATA were conducted by Consumers Energy employees with assistance from the mercury CEMS vendor's technical staff. The mercury CEMS RATA was conducted by C.E.M. Solutions, Inc. of Hernando, Florida.

The applicable MATS mercury emission rate limit for existing non-low rank coal-fired generating units is 1.2 pounds per trillion British Thermal Units (lb/TBtu), or 0.013 pounds per gigawatt-hour (lb/GWh). At this time, Consumers Energy has decided to demonstrate compliance with the 1.2 lb/TBtu limit. The mercury CEMS records mercury concentrations in the exhaust gas in micrograms per standard cubic meter (µg/scm). Auxiliary CEMS measurements such as the diluent concentration of the exhaust gas needed to calculate the lb/TBtu emission rate are obtained from $CO_2$ and/or flow CEMS which were previously certified pursuant to 40 CFR Part 75. The $CO_2$ and flow CEMS continue to follow the quality assurance and quality control procedures found within 40 CFR Part 75, Appendices A and B. Therefore, certification of auxiliary CEMS is not required for purposes of conducting mercury monitoring pursuant to 40 CFR Part 63, Subpart UUUUU.

The mercury CEMS RATA on Unit 3 was conducted on August 8-9, 2016. Consumers Energy conducted the other certification tests prior to the mercury CEMS RATA. The detailed RATA test report from vendor C.E.M. Solutions which reports that the CEMS meets the RATA certification criteria, is contained in Attachment 5 and will not be further discussed in the body of this report. The non-RATA certification test results are provided in Attachments 1 through 3 describing the outcome of the 7-day calibration error test, linearity test check, and 3-level system integrity check respectively. Consumers Energy asserted in the protocol that the mercury CEMS is exempted from the cycle time test requirement, without exception from MDEQ (please refer to Section 3.4).

# 2 SOURCE DESCRIPTION

The J.H. Campbell Generating Facility is operated to comply with the requirements described in Renewable Operating Permit (ROP) MI-ROP-B2835-2013a.

EUBOILER3 is a pulverized coal-fired 8,240 mmBtu per hour dry bottom, wall-fired boiler with fuel oil startup capability. Sampling ports are installed in a single duct located upstream of the associated exhaust stack. The unit is fueled with low sulfur (100% Power River Basin, or PRB, subbituminous) pulverized coal and uses a Pulse Jet Fabric Filter or PJFF (i.e. Baghouse) for particulate control. A Selective Catalytic Reduction (SCR) system is used to control the $NO_x$ emissions, and a Spray Dryer Absorber, or SDA (i.e. dry scrubber) has been installed and will be in continuous service by the end of

2016 in order to control $SO_2$ and acid gases. Activated Carbon Injection or ACI is used to control mercury emissions from Unit 3.

Thermo Scientific (Thermo) dilution-extractive $CO_2$, $SO_2$ and $NO_X$ CEMS, a dilution-extractive Tekran Model 3300 mercury CEMS, and Teledyne ultrasonic air flow CEMS are installed at the exhaust duct of the unit prior to the exhaust streams discharging through the main common stack. The air flow CEMS incorporate dual ultrasonic flow monitors (A and B) configured in an X-pattern in the Unit's duct. In this configuration the individual monitors act in tandem as components of the primary flow system or as redundant backup flow systems, if necessary. A Tekran Model 2537S Mercury Vapor Analyzer is used for monitoring mercury (Hg) emissions.

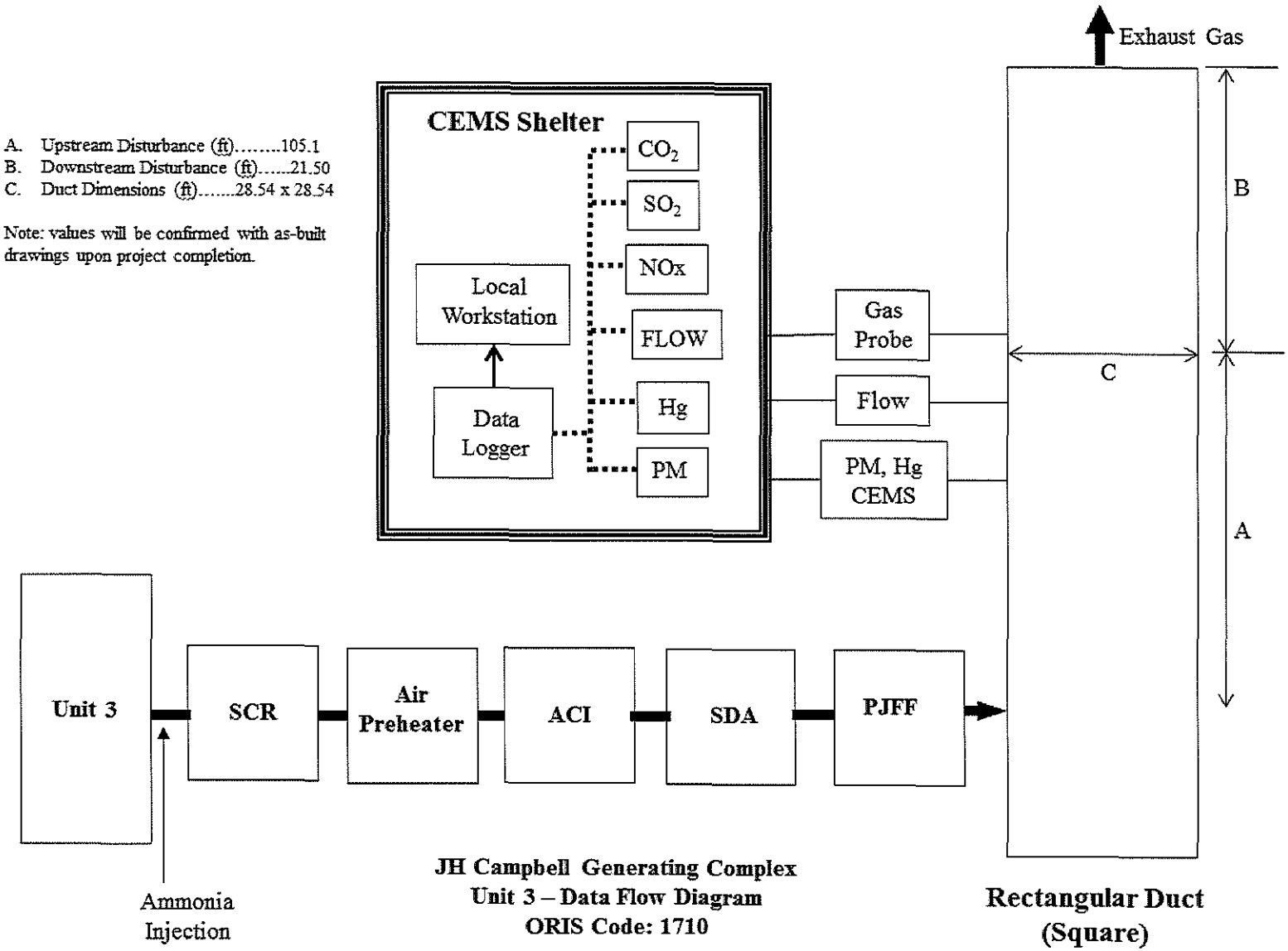
The preceding CEMS interface with a data acquisition handling system (DAHS) manufactured by Environmental Systems Corporation (ESC), with the associated software referred to as StackVision™. The DAHS records various data including exhaust gas flow rates, concentrations and emissions, as well as operating unit parameters such as unit load. The DAHS is used to generate certification test reports for the 7-day calibration error test, linearity check, and three-level system integrity check, as well as per run printouts containing 1-minute and average data for the mercury CEMS RATA.

Figure 1 provides a general schematic of the monitoring equipment, boiler control equipment and testing location relative to upstream and downstream disturbances for the boiler. The mercury CEMS is located with other CEMS equipment.

## Figure 1: JHC Unit 3 CEMS Configuration

A. Upstream Disturbance (ft).....105.1
B. Downstream Disturbance (ft).....21.50
C. Duct Dimensions (ft).....28.54 x 28.54

Note: values will be confirmed with as-built drawings upon project completion.



# 3 CERTIFICATION TEST REPORT

All certification testing for the mercury CEMS was performed in accordance with the requirements in Appendix A of 40 CFR Part 63, Subpart UUUUU, as well as the applicable EPA Reference Methods in Appendix A of 40 CFR Part 60. A description of the certification test procedures is presented in the subsections below.

The RATAs were performed by C.E.M. Solutions, Inc., with support provided by the CEMS vendor and J.H. Campbell Plant personnel. The testing contractor followed all procedures and policies specified in their Quality Manual and Standard Operating Procedures, both of which were developed in accordance with ASTM D-7036-04, *Standard Practice for Competence of Air Emission Testing Bodies*. Please note that the ASTM D-7036-04 requirements do not directly apply to the mercury CEMS RATA, but such principles were applied to the RATA test as a matter of quality assurance.

The remaining certification tests were conducted by J.H. Campbell Plant personnel with support from Tekran, the mercury CEMS vendor.

## 3.1 7-Day Calibration Error Test

A 7-day calibration error test for the mercury CEMS was performed in accordance with the certification procedures specified in Section 4.1.1.1 of Appendix A, 40 CFR Part 63, Subpart UUUUU. This test measures the stability of the instrument by recording the results of the analyzer's daily calibration error check during seven consecutive unit operating days (versus calendar days).

The test commenced on July 26 through August 1, 2016. A normal calibration error check was conducted approximately 24-hours apart while the unit was operating. The mercury CEMS was challenged at each of two calibration levels while the monitor was operating in its normal sampling mode: (1) zero-level, below the level detectable by the mercury CEMS; and (2) mid-level, at 50.0 – 60.0% of the instrument span. The mid-level calibration gas is generated by a NIST-Traceable Elemental Hg Standard generator (the NIST traceability certification of the Hg Standard generator is provided in Attachment 4). The calibration gas passed through all filters, sample conditioners and other monitor components used to collect the exhaust gas samples, including as much of the sampling probe as is practical. No manual adjustments were made to the instrument during the calibration.

The 7-day calibration error test results are acceptable for the mercury CEMS if none of the test results differ from the reference value of the calibration gas by more than 5.0% of span or an absolute difference of no more than 1.0 µg/scm, whichever is least restrictive. The equation used to determine the calibration error results is:

$$CE = \frac{|R-A|}{S} \times 100 \qquad \textbf{Equation 1}$$

Where:

CE = Percentage calibration error based upon span of the instrument.

R = Reference value of zero- or upscale calibration gas introduced into the monitoring system.

A = Actual monitoring system response to the calibration gas.

S = Span of the instrument.

The mercury CEMS passed the 7-day calibration error test, with results summarized below in Table 1. The results of the 7-day calibration error test, along with calibration error check details from each of the seven days of the test, are provided in Attachment 1.

**Table 1. Summary of Hg CEMS 7-Day Calibration Error Test Results**

| Parameter | Calibration Error (Maximum) | Required Performance | Pass/Fail |
|---|---|---|---|
| Zero-Level | 0.0% | ≤ 5.0% | Pass |
| Span-Level | 0.1% | ≤ 5.0% | Pass |

## 3.2 Linearity Check

A 3-point linearity check was performed for the mercury CEMS in accordance with the requirements specified in Section 4.1.1.2 of Appendix A, 40 CFR Part 63, Subpart UUUUU on July 28, 2016. This check measures the ability of the instrument to accurately measure the elemental mercury content of the exhaust gas across a range of reference values reflective of the measurement span of the instrument. For the linearity check, NIST traceable elemental mercury standards were introduced in the same manner as the daily span calibration gases, consistent with the requirements in Section 3.2.1.1.3.6 of Appendix A. The mercury CEMS was challenged three times at each of three calibration levels; low, mid, and high. The three calibration gas levels are defined in Sections 3.1.9, 3.1.10 and 3.1.11 as follows: (1) a low-level concentration between 20.0 to 30.0% of span, (2) a mid-level concentration between 50.0 to 60.0% of span, and (3) a high-level concentration between 80.0 to 100.0% of span.

Results of the linearity checks are acceptable if the mercury CEMS reading differs from the audit gas concentration by no more than 10.0% of the audit gas concentration or if the absolute value of the average difference between the monitor response and the audit gas concentration does not exceed 0.8 µg/scm, whichever is less restrictive. An analyzer is considered out of control from the time that an unacceptable linearity check is completed until the time that an acceptable linearity check is completed, following corrective maintenance.

The equation used to determine the results of the linearity check is as follows:

$$LE = \frac{|R-A|}{R} \times 100 \qquad \textbf{Equation 2}$$

Where:

LE = Percentage linearity error, based upon the reference value

R = Reference value of calibration gas introduced into the monitoring system

A = Average of the monitoring system responses

The mercury CEMS passed the linearity check with results summarized below in Table 2. The detailed results of the linearity test are provided in Attachment 2.

Table 2. Summary of Hg CEMS Linearity Check Results

| Parameter, Linearity Error | Audit Result (%) | Required Performance | Pass/Fail |
|---|---|---|---|
| Zero-Level | 2.5 | ≤ 10.0% | Pass |
| Mid-Level | 3.2 | ≤ 10.0% | Pass |
| High-Level | 4.9 | ≤ 10.0% | Pass |

## 3.3 3-Level System Integrity Check

A 3-level system integrity check was performed for the mercury CEMS in accordance with the requirements specified in Section 4.1.1.3 of Appendix A, 40 CFR Part 63, Subpart on August 2, 2016. Similar to the linearity check, this check measures the ability of the instrument to accurately measure the oxidized mercury content of the exhaust gas across a range of reference values reflective of the measurement span of the instrument. For the 3-level system integrity check, gases from a NIST traceable source of oxidized Hg were introduced in the same manner as the daily span calibration gases, consistent with the requirements in Section 3.2.1.1.3.6 of Appendix A. The calibration gas levels were consistent with those described for the linearity check.

Results of the system integrity checks are acceptable if the mercury CEMS reading differs from the audit gas concentration by no more than 10.0% of the audit gas concentration or if the absolute value of the average difference between the monitor response and the audit gas concentration does not exceed 0.8 µg/scm, whichever is less restrictive. An analyzer is considered out of control from the time that an unacceptable system integrity check is completed until the time that an acceptable system integrity check is completed, following corrective maintenance. The equation used to determine the results of the system integrity check is the same as that for the linearity test.

The mercury CEMS passed the 3-level system integrity check with results summarized in Table 3. The results of the 3-level system integrity check are provided in Attachment 3. The title of the test report is shown as "Linearity Test" rather than "3-Level System Integrity Test". Contained in the summary of the test at the top of the report is a line that reads, "Hg Integrity Check?". It should be noted that this option is selected indicating that this is, in fact, a 3-level system integrity check report despite the title printed (a software default that cannot be edited).

Table 3. Summary of Hg CEMS Three-Level System Integrity Check Results

| Parameter | Audit Result (%) | Required Performance | Pass/Fail |
|---|---|---|---|
| Zero-Level | 1.2 | ≤ 10.0% | Pass |
| Mid-Level | 1.8 | ≤ 10.0% | Pass |
| High-Level | 1.9 | ≤ 10.0% | Pass |

## 3.4 Cycle Time Test

A cycle time test is required to certify mercury CEMS according to Section 4.1.1 and 4.1.1.4 of Appendix A, 40 CFR Part 63, Subpart UUUUU. However, Section 4.1.1.4 states,

*...Integrated batch sampling type Hg CEMS are exempted from this test; however, these must be capable of delivering a measured Hg concentration reading at least once every 15 minutes.*

The Tekran Model 2537S Mercury Vapor Analyzer User Manual (as indicated in the protocol) describes the sampling methodology of the mercury CEMS and verifies that the installed CEMS collect batch samples at a user selected interval with a recommended range of 150 seconds (2.5 minutes) to 900 seconds (15 minutes). Therefore, the mercury CEMS qualifies for the cycle time test exemption and no cycle time test has been conducted on it.

## 3.5 Relative Accuracy Test Audit

A RATA was completed on the mercury CEMS in accordance with the requirements specified in Section 4.1.1.5 of Appendix A, 40 CFR Part 63, Subpart UUUUU on August 8-9, 2016. A complete report of that RATA including the passing test results and the testing contractor's methods and quality assurance tests are included in Attachment 5. Table 4 presents a summary of the RATA results.

**Table 4. Summary of Hg CEMS RATA Results**

| Parameter | Difference (CEMs vs. RM) | Performance Criteria | Pass/Fail |
|---|---|---|---|
| Unit 3 Relative Accuracy | 0.282 ug/m$^3$ | RA ≤ 20.0% or ± 0.5 ug/m$^3$ | Pass |

# 4 CERTIFICATION APPLICATION

As required in Section 7.2.4 of Appendix A, 40 CFR Part 63, Subpart UUUUU, the results of all certification tests will be submitted electronically using the EPA's ECMPS Client Tool concurrent with the quarterly report for the 3rd quarter of 2016.

# 5 MERCURY CEMS CERTIFICATION TEST CONTACT

**J.H. Campbell Generating Complex**

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Office: (616) 738-3260
joseph.firlit@cmsenergy.com

## 6 SUMMARY OF ANALYZER SERIAL NUMBER AND SPAN VALUE

| Unit | Parameter | Analyzer Manufacturer & Model Number | Analyzer Serial Number | Span Value |
|---|---|---|---|---|
| 3 | Hg | Tekran Model 2537 S | 3092 | 10.0 $\mu g/m^3$ |