REPORT

DTE ENERGY

DETROIT, MICHIGAN

MONROE POWER PLANT (MPP) UNIT 3:
PS-11 CORRELATION STUDY

RWDI #2205126

August 17, 2022

SUBMITTED TO

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EXECUTIVE SUMMARY

RWDI USA LLC (RWDI) has been retained by DTE Energy (DTE) to complete the emission sampling program at the Monroe Power Plant (MPP) located in Monroe, Michigan. RWDI performed a Response Correlation Audit (RCA) on the Particulate Matter Continuous Emission Monitoring System (PM CEMS). The RCA was performed on the Unit 3 exhaust stack. The testing was completed according to 40 CFR Part 63, Subpart UUUUU.

Testing was originally performed in accordance with the Procedure 2 of 40 CFR Part 60, Appendix F, and was conducted from May 5th-6th, 2022. Further testing was completed on July 8th, 2022 which included completing three (3) additional tests at > 820 MW. This information was used to further refine and expend the PS-11 statistical analysis for Unit 3. The May 2022 results were originally presented to EGLE in the June 28, 2022 report.

Testing was performed to establish a new curve which would more accurately demonstrate emissions at the lower PM ranges and high PM ranges. Existing curve crossed the y-axis at 3.9 (lowest reportable pm reading). RWDI also performed three (3) runs during rotor warm-up to determine emissions during that operating condition. This data is not included in the RCA as it is not considered normal operation however a summary is provided in **Appendix B5**. (Note: rotor warm-up data does not exceed 0.011 lb/MMBtu based on 5% CO_2). A new linear equation was introduced into the PM CEMS and backdated to July 8th, 2022. PS-11 statistical analysis is provided in **Appendix I**.

Response Correlation Audit – Monroe Power Plant - Unit 3

Test Number / Date	PM CEMS (mg/wac)²	PM CEMS (correction)	RM CEMS (mg/acm)²	Correction (-25% Emission Limit)¹	Correction (+25% Emission Limit)
Test 1 [2] (May 4)	1.5	2.1	2.3	0.4	3.7
Test 2 [2] (May 4)	2.2	2.3	1.7	0.6	3.9
Test 3 [2] (May 4)	2.4	2.3	2.0	0.7	4.0
Test 4 [1] (May 5)	18.3	6.2	20.8	4.6	7.9
Test 5 (May 5)	17.5	6.0	7.3	4.4	7.7
Test 6 (May 5)	16.5	5.8	5.1	4.1	7.4
Test 7 (May 5)	16.2	5.7	5.5	4.1	7.4
Test 8 (May 5)	16.3	5.7	6.2	4.1	7.4
Test 9 (May 5)	13.3	5.0	6.2	3.4	6.7
Test 10 (May 5)	12.8	4.9	3.7	3.2	6.5
Test 11(May 5)	13.9	5.1	5.6	3.5	6.8
Test 12 (May 5)	13.6	5.1	4.3	3.4	6.7
Test 13 (May 6)	5.3	3.0	2.5	1.4	4.7
Test 14 (May 6)	3.6	2.6	2.8	1.0	4.3
Test 15 (May 6)	3.6	2.6	3.1	1.0	4.3
Test 16 (May 6)	3.6	2.6	2.5	1.0	4.3
Test 17 [1] (May 6)	3.5	2.6	3.2	0.9	4.2
Test 18 (July 8)	24.6	7.8	6.7	6.1	9.4
Test 19 (July 8)	23.4	7.5	6.8	5.8	9.1
Test 20 (July 8)	26.3	8.2	9.5	6.6	9.9

Notes: 1 – negative values replaced with zero
2 – milligrams per actual cubic meter at 160°C
[1] – Not used in correlation
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1 INTRODUCTION

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1.1 Location and Dates of Testing

The test program was completed from May 4th, 5th & 6th, 2022 for Tests 1 to 17 and July 8th, 2022 for Tests 18 to 20.

1.2 Description of Source

The Monroe Power Plant (MPP) is a DTE Facility located at 3500 East Front Street, 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. Units 1-4 exhaust into dedicated, separate stacks.

Units 1 and 4 have General Electric turbine generators, each having a current capability of 817 gross megawatts (GMW). Units 2 and 3 have Westinghouse turbine generators, each having current capability of 823 GMW.

The boiler exhausts are each equipped with Research Cottrell electrostatic precipitators (ESPs), with particulate removal efficiencies of 99.6%. There is a sulfur trioxide flue gas conditioning system 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.

Units 1-4 each have Selective Catalytic Reduction (SCR) systems to control 90% of the NOx emissions prior to their respective ESPs. Each unit has wet Flue Gas Desulfurization (FGD) Scrubbers to control sulfur dioxide (SO_2), and other acid gases. The boilers at MPP employ the use of continuous soot-blowing, therefore a separate soot blowing PM test was not necessary. The exhaust stacks for units 1-4 are each 580 feet tall with an internal diameter of 28 feet. See **Figure 1** for a diagram of the unit's sampling locations and stack dimensions.

MPP utilizes Sick AG model FW200 dust measuring systems. The analyzers utilize a measuring technique based off scattered light principal. The FWE200 model is specific for low to medium dust collections after a wet scrubber.

1.3 Personnel Involved in Testing

Mason Sakshaug Senior Scientist – Team Lead	**RWDI USA LLC** 2239 Star Court Rochester Hills, MI 48309	Mason.Sakshaug@rwdi.com
Brad Bergeron Senior Project Manager		Brad.Bergeron@rwdi.com
Juan Vargas Environmental Scientist		Juan.Vargas@rwdi.com

2 SAMPLING AND ANALYTICAL PROCEDURES

2.1 Stack Velocity, Temperature, and Volumetric Flow Rate Determination (USEPA Method 1 and 2)

The exhaust velocities and flow rates were determined following the US EPA Method 2, "Determination of Stack Gas Velocity and Flow Rate (Type S Pitot Tube)". Velocity measurements were taken with a pre-calibrated S-Type pitot tube and digital manometer. Volumetric flow rates were determined following the equal area method as outlined in US EPA Method 1. Temperature measurements were made simultaneously with the velocity measurements and were conducted using a chromel-alumel type "k" thermocouple in conjunction with a digital temperature indicator.

A cyclonic flow check was performed on the stack during the initial flow monitor certification. There was no cyclonic flow present during testing.

2.2 Oxygen and Carbon Dioxide (USEPA Method 3A)

Oxygen (O_2) and carbon dioxide (CO_2) emissions were evaluated using USEPA Method 3A, "Gas Analysis for Carbon Dioxide, Excess Air, and Dry Molecular Weight (Instrumental Analyzer Method)". The analyzers utilize paramagnetic sensors.

The O_2 and CO_2 analyzers were calibrated per procedures outlined in USEPA Method 3A. Zero, span, and mid-range calibration gases were introduced directly into the analyzer to verify the instruments linearity prior to sampling. Zero and mid gases were introduced after each test period to determine instrument drift.

2.3 Moisture Determination (USEPA Method 4)

Determination of the moisture content of the exhaust gas was performed using USEPA Method 4, "Determination of Moisture Content in Stack Gases". The moisture was collected in the USEPA Method 5 glass impingers and the percentage of water was then derived from the calculations outlined in USEPA Method 4.

2.4 Particulate Matter (USEPA Method 5B)

Filterable Particulate Matter testing was performed using USEPA Method 5B "Determination of Non-Sulfuric Particulate Emissions from Stationary Sources" to measure the filterable (front half) particulate emissions.

The quartz filters used in the sampling were initially baked for 3 hours at 320°F, desiccated for 24 hours and weighed to a constant weight as described in Method 5B to obtain the initial tare weight.

After completion of the final leak test for each test, the filter was recovered and the probe, nozzle, and the front half of the filter holder assembly were brushed and rinsed with acetone. The acetone rinses were collected in a pre-cleaned sample container. The container was labeled with the test number, location, test date, and level of liquid was marked. Immediately after recovery, the samples were placed in a storage container for safe handling.

At the laboratory, the acetone rinses were transferred to clean pre-weighed beakers and evaporated to dryness. The beakers and filters were baked for 6 hours at 320°F, desiccated for 24 hours and weighed to a constant weight (within 0.5 mg).

Collection of filed blanks consist of a blank filter and acetone solution blank. The acetone blank was collected from the rinse bottle used during sample recovery. The blank filter and acetone were collected and analyzed following the sample procedures used to recover the filed samples.

3 OPERATING PARAMETERS

The test program included the collection of PM CEMs emission data and load during each PM emission test. CEMS data can be found in **Appendix A**.

4 TEST RESULTS AND DISCUSSION

4.1 Discussion of Results

Table 1 presents the reference method particulate emission testing results (RM PM), raw particulate matter continuous emissions monitoring system (PM CEMS) results, unit load, and PM range designation for each test. Particulate emissions are presented in milligram per actual cubic meter corrected to 160°C (mg/acm).

Procedure 2 10.4(5)(i-ii) outlines the following criteria:.

1 – For all 12 data points, the PM CEMS Correlation value can be no greater than the greatest PM CEMS Correlation value used to develop your correlation curve.

2 – At least 75 percent of minimum number of 12 sets of PM CEMS and reference method measurements must fall within a specified area on a graph of the correlation regression line. The specified area on the graph of the correlation regression line is defined by two lines parallel to the correlation regression line, offset at a distance of +/- 25 percent of the numerical emission limit value from the correlation regression line. If any of the PM CEMS response values resulting from your RCA are lower than the lowest PM CEMS response value of your existing correlation curve, you may extend your correlation regression line to the point corresponding to the lowest PM CEMS response value obtained during the RCA. This extended correlation regression line must be used to determine if the RCA data meets this criterion.

Testing was performed to establish a new curve which would more accurately demonstrate emissions at the lower PM ranges. Existing curve crossed the y-axis at 3.9 (lowest reportable pm reading). RWDI also performed three (3) runs during rotor warm-up to determine emissions during that operating condition. This data is not included in the RCA as it is not considered normal operation however a summary is provided in **Appendix B5**. (Note: rotor warm-up data does not exceed 0.011 lb/MMBtu based on 5% CO_2). A new linear equation was introduced into the PMCEMS and backdated to May 5th, 2022. PS-11 statistical analysis is provided in **Appendix I**.

Particulate Matter results are provided in **Appendix B**. CEMS data for oxygen and carbon dioxide for each PM run is provided in **Appendix C**.

4.2 Calibration Sheets

Calibration sheets can be found in **Appendix D**.

4.3 Sample Calculations

Sample calculations can be found in **Appendix E**.

4.4 Field Data Sheets

Field data sheets can be found in **Appendix F**.

4.5 Laboratory Data

Laboratory analytical results can be found in **Appendix G**.

4.6 Coal Analysis

Analytical results from the coal samples can be found in **Appendix H**.

4.7 PS-11 Statistical Analysis

PS-11 statistical analysis can be found in **Appendix I**.

TABLES

Table 1
MPP Unit 3 Table of Results

Test Number	Test Date (2022)	Test Time	PM CEMS (mg/wac)[2]	RM PM (mg/acm)[2]	PM CEMS (correction)	Correction (-25% Emission Limit)[1]	Correction (+25% Emission Limit)	PM Load Range	Unit Load (GMW)
Test 1 [2]	4-May	7:26 to 8:35	1.5	2.3	2.1	0.4	3.7	Rotor Start-Up	0
Test 2 [2]	4-May	8:49 to 9:57	2.2	1.7	2.3	0.6	3.9	Rotor Start-Up	0
Test 3 [2]	4-May	10:10 to 11:17	2.4	2.0	2.3	0.7	4.0	Rotor Start-Up	0
Test 4 [1]	5-May	6:55-8:06	18.3	20.8	6.2	4.6	7.9	High	761.0
Test 5	5-May	8:18-9:29	17.5	7.3	6.0	4.4	7.7	High	752.9
Test 6	5-May	9:43-10:50	16.5	5.1	5.8	4.1	7.4	High	754.5
Test 7	5-May	11:04-12:09	16.2	5.5	5.7	4.1	7.4	High	753.9
Test 8	5-May	12:21-13:27	16.3	6.2	5.7	4.1	7.4	High	753.2
Test 9	5-May	14:19-15:27	13.3	6.2	5.0	3.4	6.7	Mid	651.8
Test 10	5-May	15:40-16:47	12.8	3.7	4.9	3.2	6.5	Mid	640.5
Test 11	5-May	16:58-18:05	13.9	5.6	5.1	3.5	6.8	Mid	640.3
Test 12	5-May	18:19-19:24	13.6	4.3	5.1	3.4	6.7	Mid	631.9
Test 13	6-May	7:40-8:47	5.3	2.5	3.0	1.4	4.7	Low	446.8
Test 14	6-May	8:59-10:05	3.6	2.8	2.6	1.0	4.3	Low	434.2
Test 15	6-May	10:19-11:27	3.6	3.1	2.6	1.0	4.3	Low	434.4
Test 16	6-May	11:39-12:44	3.6	2.5	2.6	1.0	4.3	Low	434.5
Test 17 [1]	6-May	12:57-14:02	3.5	3.2	2.6	0.9	4.2	Low	434.4
Test 18	8-July	9:07 to 10:14	24.6	6.7	7.8	6.1	9.4	>820 MW	824.2

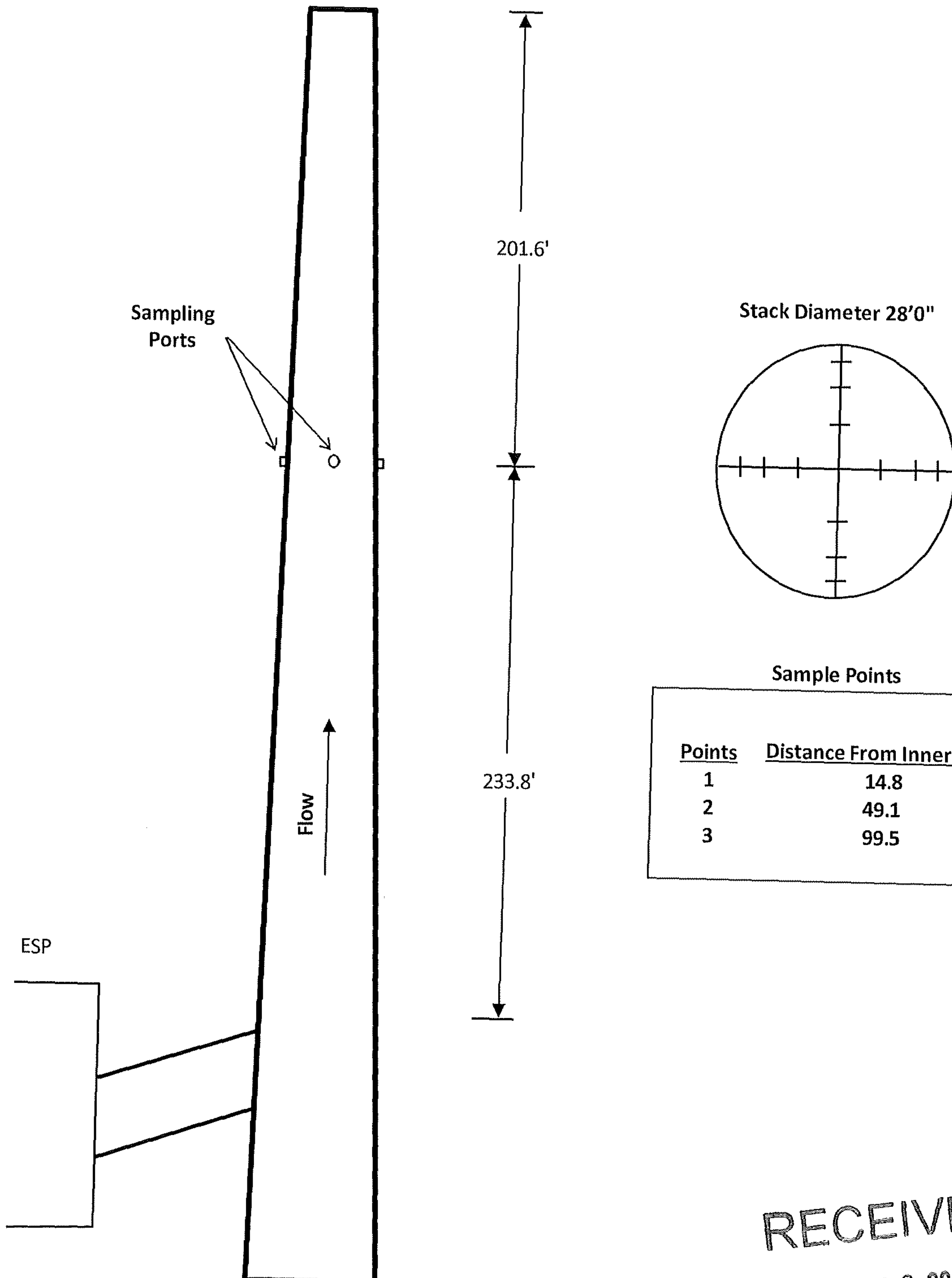
Table 1
MPP Unit 3 Table of Results

Test Number	Test Date (2022)	Test Time	PM CEMS (mg/wac)[2]	RM PM (mg/acm)[2]	PM CEMS (correction)	Correction (-25% Emission Limit)[1]	Correction (+25% Emission Limit)	PM Load Range	Unit Load (GMW)
Test 19	8-July	10:40 to 11:46	23.4	6.8	7.5	5.8	9.1	>820 MW	824.2
Test 20	8-July	12:09 to 13:16	26.3	9.5	8.2	6.6	9.9	>820 MW	824.0

1 negative numbers were replaced with zero
2 milligrams per actual cubic meter at 160°C
[1] Removed due to poor correlation
[2] – Rotor warm up, not used in correlation

FIGURES

Figure 1 – Sampling Location
MPP Unit 3



Sample Points

Points	Distance From Inner Wall
1	14.8
2	49.1
3	99.5

Figure 2 –Method 5B