REPORT

DTE ENERGY

DETROIT, MICHIGAN

MONROE POWER PLANT (MPP): PARTICULATE MATTER TESTING EU-UNIT1, EU-UNIT2 AND EU-UNIT4

RWDI #2205126

August 16, 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 the Particulate Matter testing required for EU-UNIT1, EU-UNIT2 and EU-UNIT4 as per the Renewable Operating Permit (ROP) MI-ROP-B2816-2019. Under Condition V(3) under "EMISSION UNIT CONDITIONS" for EU-UNIT1, EU-UNIT2 and EU-UNIT4, DTE was required to verify the $PM_{2.5}$ emission rates from EU-UNIT1, EU-UNIT2, and EU-UNIT4 once per calendar year for a 10-year period. Testing was completed from June 21st to June 23rd, 2022.

The test plan for the test program was completed on February 4, 2022 and is provided in **Appendix A**. The EGLE approval letter is also provided in **Appendix A**.

EU-UNIT1, EU-UNIT2, and EU-UNIT4 - Average Emission Data - Particulate Testing

Source	Units	Concentration & Emission Rate			
		Test 1	Test 2	Test 3	Average
EU-UNIT1	lb/MMBTU	0.014	0.016	0.016	0.015
	lb/hr	107.2	123.1	122.3	117.5
EU-UNIT2	lb/MMBTU	0.022	0.040	0.040	0.034
	lb/hr	136.7	297.3	299.3	244.4
EU-UNIT4	lb/MMBTU	0.008	0.008	0.008	0.008
	lb/hr	56.9	56.4	61.6	58.3

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1 INTRODUCTION

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 the Particulate Matter testing required for EU-UNIT1, EU-UNIT2 and EU-UNIT4 as per the Renewable Operating Permit (ROP) MI-ROP-B2816-2019. Under Condition V(3) under "EMISSION UNIT CONDITIONS" for EU-UNIT1, EU-UNIT2 and EU-UNIT4, DTE was required to verify the $PM_{2.5}$ emission rates from EU-UNIT1, EU-UNIT2, and EU-UNIT4 once per calendar year for a 10-year period. Testing was completed from June 21st to June 23rd, 2022.

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1.1 Location and Dates of Testing

The test program was completed from June 21st to 23rd, 2022.

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 **Figures 1 and 2** 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

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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.

2.5 USEPA Method 202 - "Dry Impinger Method for Determining Condensable Particulate Emissions from Stationary Sources"

USEPA Method 202 is an isokinetic method used to measure condensable particulate (CPM) emissions from a stationary source. CPM is collected after the filterable particulate matter is removed by the filterable particulate matter filter. The test follows all procedures laid out in USEPA Method 5 or 17. The impingers for the 202 train are as follows:

- After leaving the filter housing of the filterable particulate matter filter, the gas stream enters a vertical condenser to begin cooling the air sample and dropping out CPM;
- The sample is drawn through a large potbelly impinger that collects moisture;
- The sample is then drawn through a modified Greenburg-Smith impinger to drop out any remaining CPM;
- The CPM filter collects any remaining CPM in the air sample. The gas must be kept at a temperature between 65° and 85° Fahrenheit.

After the filter, the gas is then passed through a modified Greenberg-Smith impinger containing water, and an impinger containing silica gel to capture any remaining moisture.

Recovery of the USEPA Method 202 train begins immediately following sampling. Weights on all impingers are taken to determine moisture content. If necessary, a nitrogen purge is performed for one hour in compliance with section 8.5.3 of the test method (if sulfur dioxide is not suspected to be part of the process, then the nitrogen purge may be skipped). Following the nitrogen purge, everything following the filterable particulate filter and up to the CPM filter must be rinsed twice with water, once with acetone, and twice with hexane. Any condensed water in the first two impingers can be poured into the sample jar with the water rinses. The acetone and hexane rinses can be combined into the same jar. The CPM filter is put into either a sample jar on its own, or a petri dish. All samples are carried via courier to Enthalpy in Durham, North Carolina for analysis.

3 OPERATING PARAMETERS

Operating parameter are provided in **Appendix B**.

4 TEST RESULTS AND DISCUSSION

4.1 Discussion of Results

The following table gives a summary of the results. Full details of PM data is provided in **Appendix C**.

Table 4.1.1: EU-UNIT1, EU-UNIT2, and EU-UNIT4 - Average Emission Data - Particulate Testing

Source	Units	Concentration & Emission Rate			
		Test 1	Test 2	Test 3	Average
EU-UNIT1	lb/MMBTU	0.014	0.016	0.016	0.015
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EU-UNIT2	lb/MMBTU	0.022	0.040	0.040	0.034
	lb/hr	136.7	297.3	299.3	244.4
EU-UNIT4	lb/MMBTU	0.008	0.008	0.008	0.008
	lb/hr	56.9	56.4	61.6	58.3

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

4.2 Calibration Sheets

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

4.3 Sample Calculations

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

4.4 Field Data Sheets

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

4.5 Laboratory Data

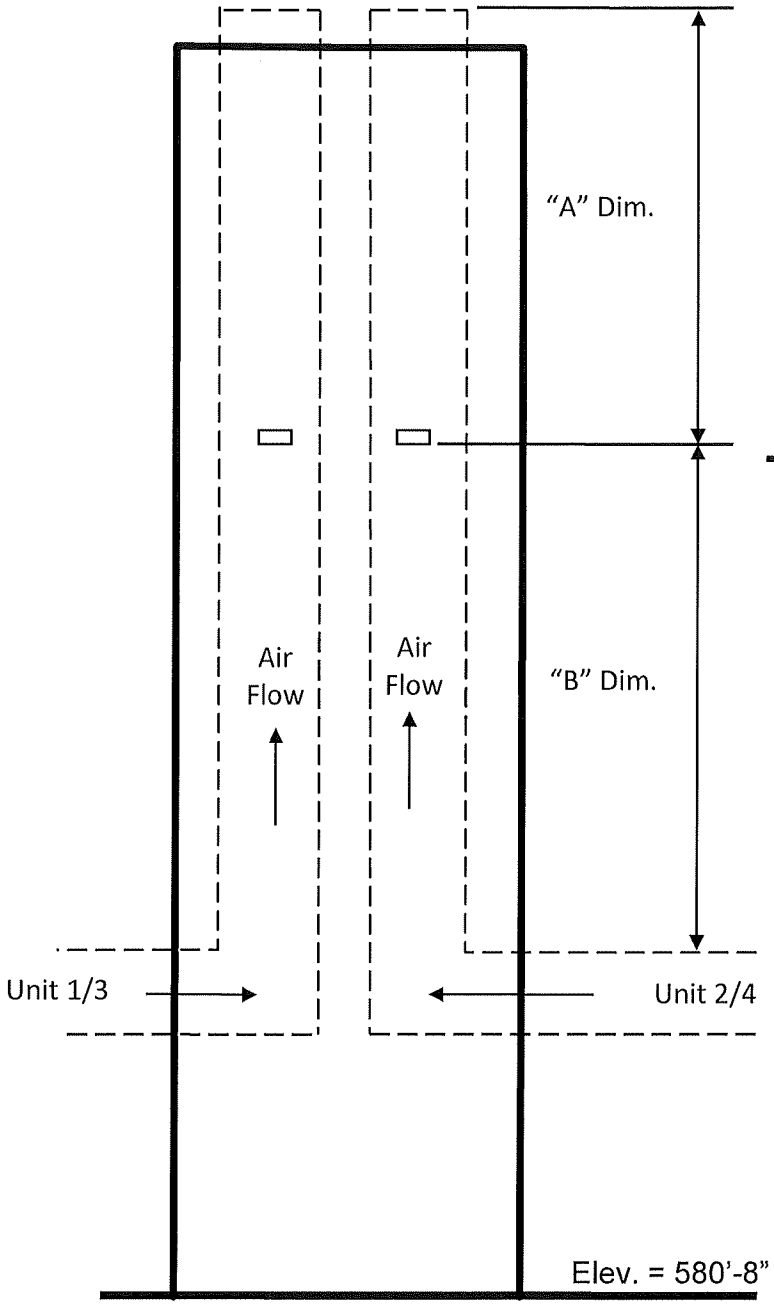
Laboratory analytical results can be found in **Appendix G**.

4.6 Coal Analysis

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

FIGURES

Figure 1 – Sampling Location
Monroe Power Plant – Units 1-4



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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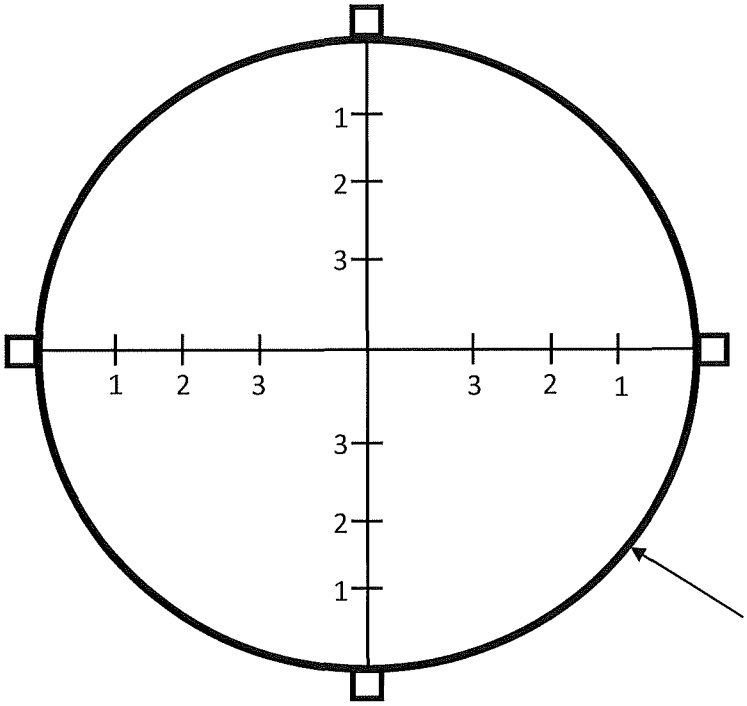
Figure 2 – Sampling Points
Monroe Power Plant – Units 1-4



VELOCITY / MEASUREMENT POINTS

Point	Distance from Inside Wall
1	14.78”
2	49.06”
3	99.46”

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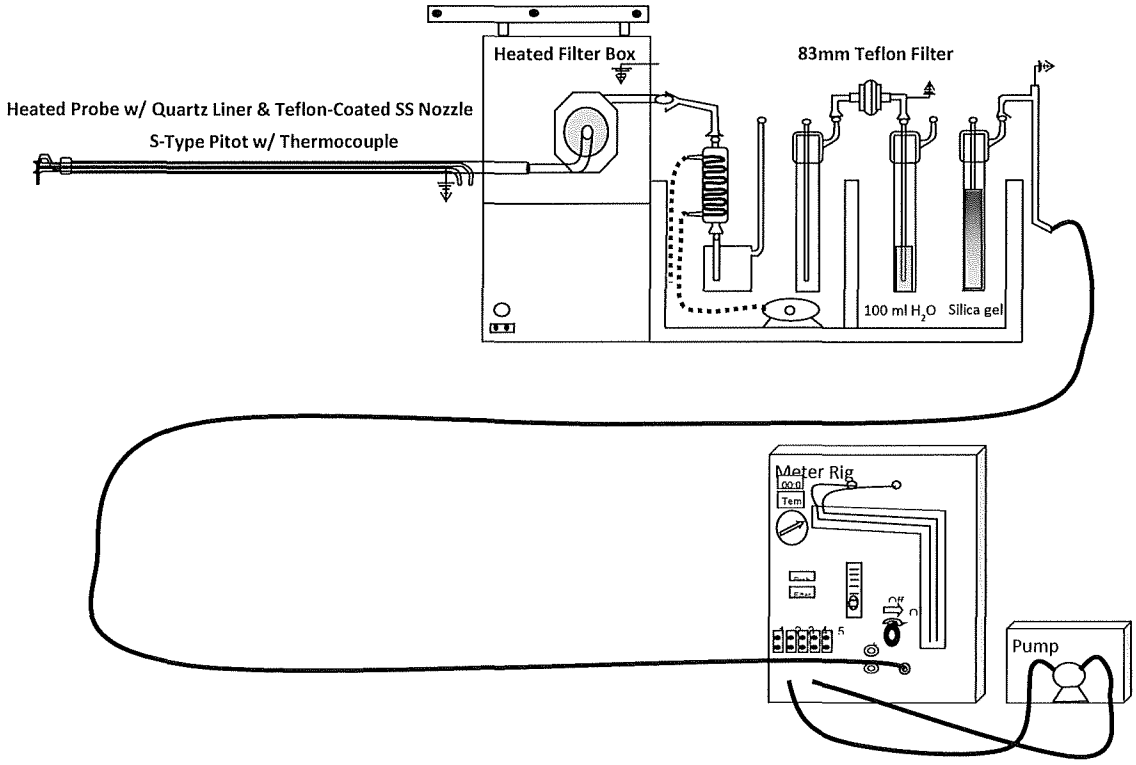
Figure 3 – EPA Method 5B / 202
Monroe Power Plant – Units 1-4



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