PERMIT
COMPLIANCE TEST REPORT

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PARTICULATE MATTER (PM) EMISSIONS

UNIT 2

Monroe Power Plant
Monroe, Michigan

October 24, 2013

Prepared By
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EXECUTIVE SUMMARY

DTE Energy's Environmental Management and Resources (EMR) Field Services Group performed quarterly particulate emissions testing on the Unit 2 exhaust stack located at the Monroe Power Plant, in Monroe, Michigan. The testing was required by the Michigan Department of Environmental Quality (MDEQ) Renewable Operating Permit #B2816-2009A to document filterable Particulate Matter (PM) emissions during normal operating conditions. The testing was conducted on October 24, 2013.

A summary of the emission test results are shown below:

Emissions Testing Summary
Unit 2 FGD Stack
Monroe Power Plant
October 24, 2013

Source	Load (GMW)	PM[1] (lb/1000 Lb_{wet} @ 50% EA)
Unit 2	708.6	**0.036**
Permit Limit		***0.12***

(1) = Total Filterable Particulate

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1.0 INTRODUCTION

DTE Energy's Environmental Management and Resources (EMR) Field Services Group performed quarterly particulate emissions testing on the Unit 2 exhaust Stack located at the Monroe Power Plant (MONPP), in Monroe, Michigan. The testing was required by the Michigan Department of Environmental Quality (MDEQ) Renewable Operating Permit #B2816-2009A to document filterable Particulate Matter (PM) emissions from the Stack during normal operating conditions. The testing was conducted on October 24, 2013.

Testing was performed pursuant to Title 40, *Code of Federal Regulations*, Part 60, Appendix A (40 CFR §60 App. A), Methods 1-17.

The fieldwork was performed in accordance with EPA Reference Methods and EMR's Intent to Test[1], which was submitted to Ms. Karen Kajiya-Mills and Mr. Brian Carley with the Michigan Department of Environmental Quality (MDEQ) on September 16, 2013. The following EMR Field Services personnel participated in the testing program: Mr. Mark Grigereit, Senior Specialist, Mr. Thomas Snyder, Senior Environmental Technician, and Mr. Fred Meinecke, Senior Environmental Technician. Mr. Grigereit was the project leader. Ms. Kelly Johnson, Associate Environmental Engineer, with EM&R, 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 and 2 exhaust into a common stack, boiler 3 and 4 exhaust into dedicated separate stacks.

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

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 on each unit that is only used on an "as needed basis" to lower the resistivity of the

[1] MDEQ, Test Plan, Submitted September 18, 2013. (Attached-Appendix A)

fly ash for better collection by the ESPs. None of the four units is equipped with Sulfuric acid mist control equipment.

Units 1, 3, and 4 have Selective Catalytic Reduction (SCR) systems to control 90% of the NO_x emissions prior to their respective ESP's.

Units 3 and 4 have wet Flue Gas Desulfurization (FGD) Scrubbers to control sulfur dioxide (SO_2), and other acid gases.

The typical coal blend for each unit is a 65% low-sulfur western (LSW) / 35% mid-sulfur eastern (MSE). During the emissions testing the coal blend was approximately 65 LSW/35 MSE. Unit 2 was operated at normal, full load conditions (>700 GMW).

The boilers at Monroe Power Plant employ the use of continuous soot-blowing, thus there was not a separate PM test conducted specifically during a soot-blowing period.

The exhaust stack for Units 1 and 2 is 800 feet tall with an internal diameter of 28 feet. The exhaust stacks for Units 3 and 4 are 580 feet tall with an internal diameter of 28 feet. See Figure 1 for a diagram of the Units 2 sampling location and stack dimension.

3.0 SAMPLING AND ANALYTICAL PROCEDURES

DTE Energy obtained emissions measurements in accordance with procedures specified in the USEPA *Standards of Performance for New Stationary Sources*. The sampling and analytical methods used in the testing program are indicated in the table below

Sampling Method	Parameter	Analysis
USEPA Methods 1-2	Exhaust Gas Flow Rates	Field data analysis and reduction
USEPA Method 3A	Oxygen & CO2	Instrumental Analyzer Method
USEPA Method 4	Moisture Content	Field data analysis and reduction
USEPA Method 17	Particulate Matter	Gravimetric Analysis

3.1 STACK GAS VELOCITY AND FLOWRATES (USEPA Methods 1-2)

3.1.1 *Sampling Method*

Stack gas velocity traverses were conducted in accordance with the procedures outlined in USEPA Method 1, "Sample and Velocity Traverses for Stationary Sources," and Method 2, "Determination of Stack Gas Velocity and Volumetric Flowrate." Four (4) sampling ports were utilized on the Unit's exhaust stack, sampling at four (4) points per port for a total of sixteen (16) points. Velocity traverses were conducted simultaneously with the particulate sampling. See Figures 1 & 2 for diagrams of the stack dimensions and traverse/sampling points used.

Cyclonic flow checks were performed on the Unit 2 Stack during the initial flow monitor certification RATAs. Testing at the sampling location demonstrated that no cyclonic flow was present. No changes to the stack have occurred since the cyclonic flow check was performed.

3.1.2 *Method 2 Sampling Equipment*

The EPA Method 2 sampling equipment consisted of a 0-10" incline manometer, S-type Pitot tube (C_p = 0.84) and a Type-K calibrated thermocouple.

3.2 OXYGEN & CARBON DIOXIDE (USEPA Method 3A)

3.2.1 *Sampling Method*

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

3.2.2 *O_2/CO_2 Sampling Train*

The EPA Method 3A sampling system consisted of the following:

(1) Teflon™ sampling line (collecting gas sample from the meter rig exhaust)
(2) Universal® gas conditioner with particulate filter
(3) Teflon™ sampling line
(4) Servomax 1400 O_2/CO_2 gas analyzer
(5) Appropriate USEPA Protocol 1 calibration gases
(6) Data Acquisition System

3.2.3 *Sampling Train Calibration*

The O_2 and CO_2 analyzers were calibrated according to procedures outlined in USEPA Methods 3A. Zero, span, and mid range calibration gases were introduced directly into the analyzer to verify the instruments linearity.

3.3 MOISTURE DETERMINATION (USEPA Method 4)

3.3.1 *Sampling Method*

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 Method 17 glass impingers, and the percentage of water was then derived from calculations outlined in USEPA Method 4.

3.4 PARTICULATE MATTER (USEPA Method 17)

3.4.1 *Filterable Particulate Sampling Method*

USEPA Method 17, "Determination of Particulate Emissions from Stationary Sources, Insitu-Filtration" was used to measure the filterable (front-half) particulate emissions (see Figure 3 for a schematic of the sampling train). Triplicate, 64-minute test runs were conducted.

The Method 17 modular isokinetic stack sampling system consisted of the following:

(1) Stainless-steel button-hook nozzle
(2) 47mm SS filter holder with a glass fiber filter
(3) Stainless-steel lined probe
(4) Set of impingers for the collection of condensate for moisture determination
(5) Length of sample line
(6) Environmental Supply® control case equipped with a pump, dry gas meter, and calibrated orifice.

The filters used in the sampling were initially desiccated for 24 hours and weighed to a constant weight, as described in Method 5, to obtain the initial tare weight.

After completion of the final leak test for each test run, 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, test location and test date. The level of liquid was marked on the outside of the container. Immediately after recovery, the sample containers were placed in a cooler for storage.

At the laboratory the acetone rinses were transferred to clean pre-weighed beakers, and evaporated to dryness at ambient temperature and pressure. The beakers were desiccated for 24 hours and weighed to a constant weight (within 0.1 mg). The data

sheets containing the initial and final weights on the filters and beakers can be found in Appendix C.

Collected field blanks consisted of a blank filter and acetone solution blank. The acetone blank was collected from the rinse bottle used in sample recovery. The blank filter and acetone were collected and analyzed following the same procedures used to recover and analyze the field samples. Field data sheets for the Method 17 sampling are found in Appendix B.

3.4.2 *Quality Control and Assurance*

All sampling and analytical equipment was calibrated according to the guidelines referenced in EPA Method 17. All Method 1-4, and 17 calibration data can be found in Appendix D.

3.4.3 *Data Reduction*

The Filterable PM emissions data collected during the testing was calculated and reported as pounds of particulate per 1,000 pounds (wet) of stack exhaust gas corrected to 50% excess air (lbs/1000 lbs_{wet} @ 50% EA).

4.0 OPERATING PARAMETERS

The test program included the collection of boiler operating data, CEMs emission data, and precipitator operating data during each PM emissions test.

During each day of emissions sampling, a representative coal sample was collected from the unit and analyzed for ultimate and proximate analysis, including % Sulfur, % Ash, and heat content. The results of the coal analysis was used to calculate an Fd value for each day of testing. (Appendix C)

CEMs data and control equipment operational data collected during the testing are presented in Appendix E.

5.0 DISCUSSION OF RESULTS

Table 1 presents the Filterable Particulate emission testing results. Filterable Particulate emissions are presented in pounds of particulate per 1,000 pounds (wet) of stack exhaust gas corrected to 50% excess air (lbs/1000 lbs_{wet} @ 50% EA).

The Unit 2 Filterable PM emissions during the testing ranged from 0.034 – 0.038 lbs/1000 lbs_{wet} @ 50% EA and averaged 0.036 lbs/1000 lbs_{wet} @ 50% EA. The average Filterable PM emissions were less than the permit limit of 0.12 lbs/1000 lbs_{wet} @ 50% EA.

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The Auxiliary test data presented in the results table for each test includes the Unit Load in gross megawatts (GMW), stack temperature in degrees Fahrenheit (°F), stack gas moisture in percent (%), stack gas velocity in feet per minute (ft/min), and stack gas flow rate in actual cubic feet per minute (ACFM), standard cubic feet per minute (SCFM) and dry standard cubic feet per minute (DSCFM).

The results of the emissions testing indicate that Unit 2 is in compliance with Michigan Department of Environmental Quality Renewable Operating Permit #B2816-2009A.

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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TABLE NO. 1
FILTERABLE PARTICULATE EMISSION TESTING RESULTS
Monroe Power Plant - Unit 2
October 24, 2013

Test	Test Date	Test Time	Unit Load (GMW)	Unit Opacity (%)	Stack Temperature (°F)	Stack Moisture (%)	Stack Velocity (ft/min)	Exhaust Gas Flowrates (ACFM)	(SCFM)	(DSCFM)	Filterable PM Emissions (lbs/1000 $lbs_{(wet)}$ @ 50% EA)[1]
PM-1	**24-Oct-13**	8:08-9:24	708.5	10.7	259.2	8.8	3,776	2,325,332	1,668,539	1,522,457	0.038
PM-2		9:39-10:55	708.7	13.2	261.2	9.0	3,846	2,368,277	1,694,642	1,541,948	0.034
PM-3		11:06-12:21	708.6	12.7	261.6	8.9	3,810	2,345,869	1,677,735	1,528,872	0.034
	Average:		***708.6***	***12.2***	***260.7***	***8.9***	***3,811***	***2,346,493***	***1,680,305***	***1,531,092***	***0.036***

(1) Permit Limit = 0.12 lb/1000 $lb_{(wet)}$ @ 50% EA

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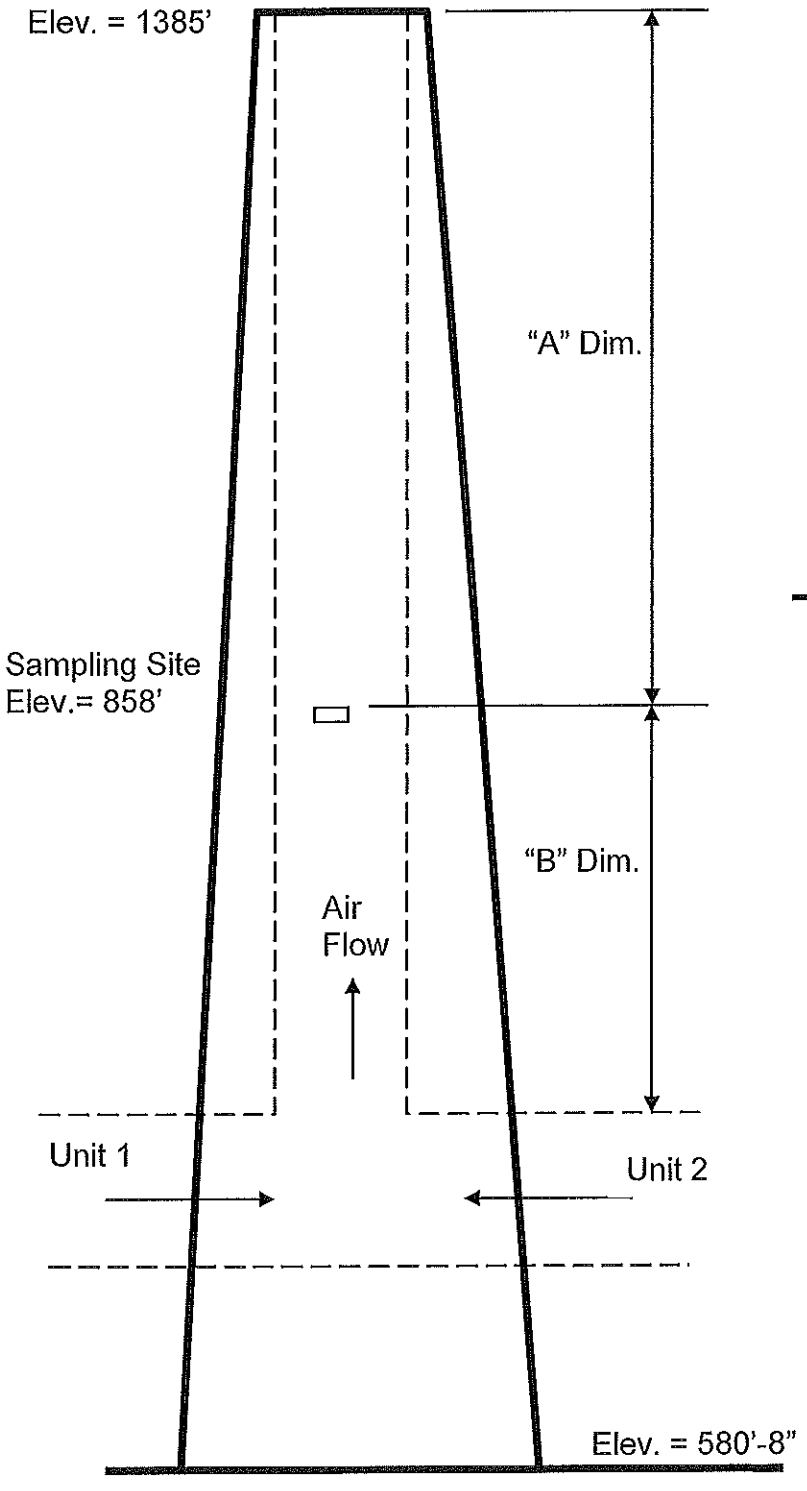
Figure 1 – Sampling Location
Monroe Power Plant - Stack 1 (Units 1/2)
October 24, 2013



Details

"A" Dim = Upstream Distance
"A" Dim = 527'
"B" Dim = Downstream Distance
"B" Dim = 188'

Dia. @ Sample Location = 28'-0"

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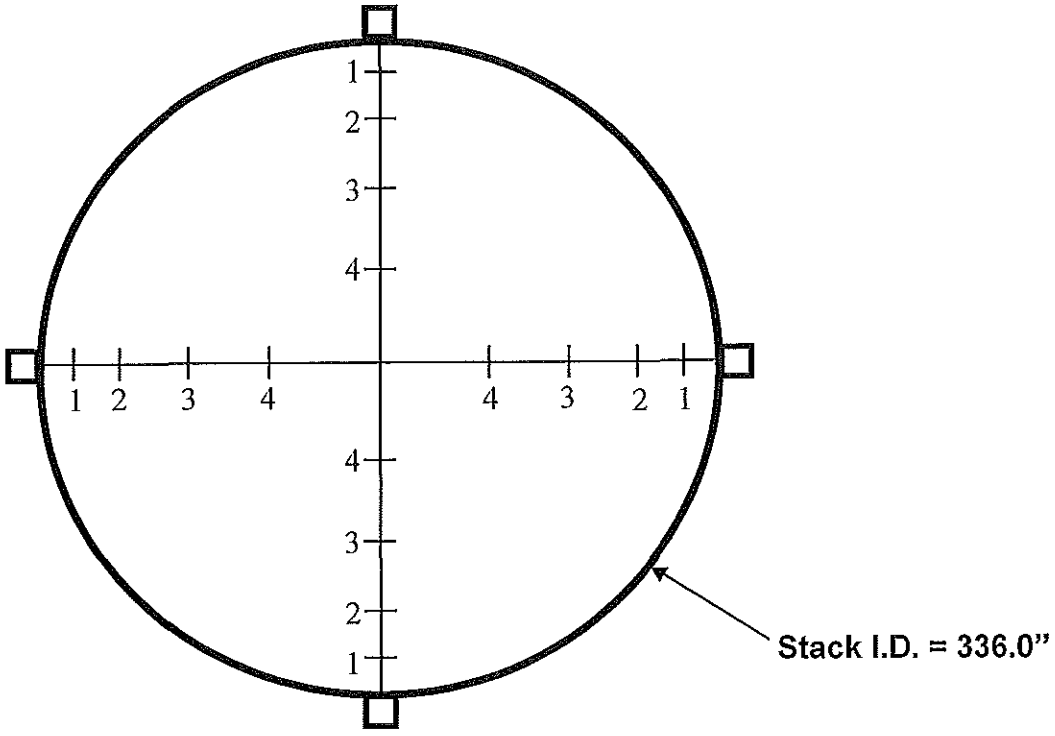
Figure 2 – Sampling Points
Monroe Power Plant - Stack (Typ)
October 24, 2013



VELOCITY / PM MEASUREMENT POINTS

Point	Distance from Inside Wall
1	10.75"
2	35.28"
3	65.18"
4	108.53"

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Figure 3 – EPA Method 17
Monroe Power Plant
October 24, 2013