DTE Energy

COMPLIANCE TEST REPORT

for

PARTICULATE MATTER (PM) PARTICULATE EMISSIONS

UNIT 7

St. Clair Power Plant
East China, Michigan

July 1-2, 2014

Prepared By
Environmental Management & Resources
Environmental Field Services Group
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DEQ

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY
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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: St. Clair Power Plant — County: St. Clair

Source Address: 4901 Pointe Drive — City: East China Township

AQD Source ID (SRN): B2796 — ROP No.: MI-ROP-B2796-2009 — 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 1-1-2011 To 12-31-2013

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

- St. Clair Unit 7 Particulate Emission Test Report (EU-BOILER7-SC,V.1)

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

Leann S. Warner	Plant Manager	(810)-326-6201
Name of Responsible Official (print or type)	Title	Phone Number

Leann S Warner — 8-12-14

Signature of Responsible Official — Date

* Photocopy this form as needed.

EQP 5736 (Rev 11-04)

EXECUTIVE SUMMARY

DTE Energy's Environmental Management and Resources (EMR) Field Services Group performed emissions testing on the exhaust of Unit 7 at the St. Clair Power Plant, located in St. Clair, Michigan. The testing was required by the Michigan Department of Environmental Quality (MDEQ) Renewable Operating Permit (ROP) B2796-2009a to document total filterable particulate matter (PM) stack emissions from Unit 7 while firing coal during normal boiler operating conditions. The testing was conducted on July 1-2, 2014.

A summary of the emission test results are shown below:

Emissions Testing Summary
St. Clair Unit 7
July 1-2, 2014

Source	PM ($lb/1000lb_{(wet)}$@50%EA)
Unit 7	0.04

Permit Limit: 0.13 $lb/1000lb_{(wet)}$@50%EA

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1.0 INTRODUCTION

DTE Energy's Environmental Management and Resources (EMR) Field Services Group performed emissions testing on the exhaust of Unit 7 at the St. Clair Power Plant, located in St. Clair, Michigan. The testing was required by the Michigan Department of Environmental Quality (MDEQ) Renewable Operating Permit (ROP) B2796-2009a to document total filterable particulate matter (PM) stack emissions from Unit 7 while firing coal during normal boiler operating conditions. The testing was conducted on July 1-2, 2014.

Testing was performed pursuant to Title 40, *Code of Federal Regulations*, Part 60, Appendix A (40 CFR §60 App. A), Methods 1-4, 17, and 202.

The fieldwork was performed in accordance with EPA Reference Methods and EMR Intent to Test[1], which was approved in a letter by Mr. Mark Dziadosz from the Michigan Department of Environmental Quality (MDEQ), dated May 28, 2013[2]. The following EMR personnel participated in the testing program: Mr. Thomas Snyder, Senior Environmental Technician, Mr. Ken St.Amant, Senior Environmental Technician, and Mr. Fred Meinecke, Senior Environmental Technician. Mr. Snyder was the project leader. Mr. Joe Neruda, Environmental Specialist at the plant provided process coordination for the testing program.

2.0 SOURCE DESCRIPTION

The St Clair Power Plant (SCPP) located at 4901 Pointe Drive in East China Township, Michigan, employs the use of six (6) coal-fired boilers (Units 1-4, 6, and 7). Units 1-4 each have Babcock and Wilcox boilers capable of producing 1,070,000 pounds per hour of steam. Units 1 and 4 are equipped with General Electric turbine generators each with a nominally rated capability of 167 megawatts (MW). Units 2 and 3 have Allis Chalmers turbine generators each with a nominally rated capability of 170 MW. Full load capability for Units 1-4, while firing coal only, is 135 MW, and 150 MW while over-firing with oil.

Units 6 and 7 have Combustion Engineering boilers capable of producing 2,100,000 and 3,580,000 pounds of steam per hour respectively. The turbine generators on each unit were manufactured by Westinghouse and have a nominally rated capability of 325 and 500 megawatts respectively. Full load capability for Units 6 and 7 while firing coal only is approximately 315 MW and 470 MW respectively.

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

[2] MDEQ, Approval Letter, dated May 28, 2013. (Attached-Appendix A)

The air pollution control equipment on Units 1-4 consists of Wheelebrator Frye electrostatic precipitators on each unit that have design collection efficiencies of 99.6%. Each exhaust stack is 599 feet tall with an internal diameter of 13.3 feet. The air pollution control equipment on Unit 6 consists of Research Corporation electrostatic precipitators that have design collection efficiencies of 99.6%. The exhaust stack is 425 feet tall with an internal diameter of 19.0 feet. The air pollution control equipment on Unit 7 consists of an American Standard electrostatic precipitator that has design collection efficiency of 99.6%. The exhaust stack is 600 feet tall with an internal diameter of 16.0 feet

The air pollution control equipment on Unit 2 consists of Wheelebrator Frye electrostatic precipitators on each unit that have design collection efficiencies of 99.6%. Each exhaust stack is 599 feet tall with an internal diameter of 13.3 feet. The air pollution control equipment on Unit 6 consists of Research Corporation electrostatic precipitators that have design collection efficiencies of 99.6%. The exhaust stack is 425 feet tall with an internal diameter of 19.0 feet. The air pollution control equipment on Unit 7 consists of an American Standard electrostatic precipitator that has design collection efficiency of 99.6%. The exhaust stack is 600 feet tall with an internal diameter of 16.0 feet

Testing occurred on Unit 7 at greater than 80% of normal full load capability while burning coal.

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* or listed as an approved *"Other Test Method"*. 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	Filterable Particulate Matter (In-Stack Filtration)	Gravimetric Analysis
USEPA Method 202	Condensable Particulate Matter (dry impinge method)	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." On Unit 7, four (4) sampling ports were utilized, sampling at three (3) points per port for a total of twelve (12) sampling points. See Figure 1 for a diagram of the traverse/sampling points used.

Cyclonic flow checks were performed on the stack during the first particulate sampling run. Testing at the sampling location demonstrated that no cyclonic flow was present. No changes to the Stack have occurred since the cyclonic flow checks were performed. Additionally, static pressure checks performed confirmed that the null angle was at 0°.

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 AND CARBON DIOXIDE (USEPA Method 3A)

3.2.1 Sampling Method

Stack gas 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 O_2 / CO_2 analyzers utilize paramagnetic sensors.

3.2.2 O_2 / CO_2 Sampling Train

The Unit 7 Method 3A sampling system consisted of collecting an integrated dry gas sample in a Tedlar bag during each test. The Tedlar bag was then analyzed using a Servomex 1400 O_2/CO_2 gas analyzer. The Tedlar bag samples for Runs 2 and 3 were determined not to be accurate based on previous testing and based on the certified CEMS CO_2 readings. Run 1's Tedlar bag results were used for Runs 2 and 3.

3.2.3 Sampling Train Calibration

The O_2 / CO_2 analyzer was calibrated according to procedures outlined in USEPA Method 7E. Zero, span, and mid range calibration gases were introduced directly into the analyzer to verify the instruments linearity. The O_2/CO_2 concentrations were recorded on the field data sheets.

3.3 MOISTURE DETERMINATION (USEPA Method 4)

3.3.1 Sampling Method

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

3.4 PARTICULATE MATTER INCLUDING CONDENSABLES (USEPA Method 17/202)

3.4.1 Filterable Particulate Sampling

USEPA Method 17, "Determination of Particulate Emissions from Stationary Sources – In-situ Filtration" was used to measure the filterable (front-half) particulate emissions (see Figure 2 for a schematic of the sampling train). Triplicate, 120-minute test runs were conducted.

The Method 17 modular isokinetic stack sampling system (Figure 2) consisted of the following:

(1) Stainless-steel button-hook nozzle
(2) Stainless Steel Filter Holder with 47 mm glass fiber filter
(3) Un-heated glass-lined probe and Teflon sample line
(4) Set of glass impingers (Method 202) for the collection of condensable particulates and 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 glass fiber filters used in the sampling were initially weighed to a constant weight as described in Method 17 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, test date, and the level of liquid 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 and filters were then placed in a desiccator for 24 hours and weighed to a constant weight (within 0.5 mg). The data sheets containing the initial and final weights of 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 17/202 sampling are located in Appendix B.

3.4.2 Condensable Particulate Sampling Method (Method 202)

USEPA Method 202, "Dry Impinger method for Determining Condensable Particulate Emissions from Stationary Sources" was used to measure the condensable particulate matter (CPM) (see Figure 2 for a schematic of the sampling train). This method includes procedures for measuring both organic and inorganic CPM. The Method 202 samples were collected in conjunction with the Method 17 samples as part of the sampling train. Triplicate, 120-minute test runs were conducted.

The Method 202 impinger configuration (Figure 2) consisted of the following:

(1) Method 23 type condenser (capable of cooling the stack gas to less than 85 °F
(2) Condensate dropout pot belly impinger (dry)
(3) Modified Greenburg-Smith impinger (dry) with no taper as a backup impinger

(4) 82.5mm glass filter holder with a Teflon filter (maintained at a temperature $\leq$ 85 °F)
(5) Modified Greenburg-Smith impinger containing 100 millimeters (ml) of distilled de-ionized (DDI) water
(6) Modified Greenburg-Smith impinger containing approximately 300 grams of silica gel desiccant.

The condensate dropout impinger and backup impinger were placed in an insulated box with water at $\leq$ 85 °F. The water and silica gel impingers were placed in an ice water bath to maintain the exit gas temperature from the silica gel impinger below 68 °F.

All Method 202 glassware was pre-cleaned prior to testing with soap and water, and rinsed using tap water, distilled de-ionized water, and acetone. After cleaning, the glassware was baked at 300 °C for 3 hours. Prior to each sampling run, the train glassware was rinsed thoroughly with distilled de-ionized ultra-filtered water.

As soon as possible after the post-test leak check was completed, the Method 17 filter and probe were detached from the Method 202 condenser and impinger train. Moisture from the condensate dropout impinger was added to the second impinger. The Method 202 impinger train was purged with ultra-high purity compressed nitrogen at 14 liters per minute for one hour. During the purge the condenser recirculation pump was operated and the first two impingers were heated/cooled to maintain the gas temperature exiting the CPM filter below 85 °F. If insufficient water was collected in the dry impinger to allow the modified insert tip to extend below the water level, 50-100 ml of de-gassed, DDI water was added to the impinger and noted on the sampling data sheet.

The Method 202 impinger train was then carefully disassembled. The liquid volume of each impinger was measured (by weight) and recorded on the field data sheet. The silica gel was re-weighed, and any increase was recorded on the field data sheets.

Contents from the dropout impinger and the impinger prior to the CPM filter were collected into a pre-cleaned sample container. The condenser, impingers and front-half of the CPM filter holder were rinsed with DDI water and the rinses added to the sample container. The condenser, impingers and front-half of the CPM filter holder were then rinsed with acetone followed by two rinses with Hexane. The acetone and hexane rinses were collected into a pre-cleaned sample container. The CPM filter was recovered and placed into a labeled container. All containers were labeled with the test number, test location, test date, and the level of liquid marked on the

outside of the container. Immediately after recovery, the sample containers were placed in a cooler for storage.

Collected blanks consisted of an acetone rinse blank, a DDI water rinse blank and a hexane rinse blank taken directly from the bottles used during recovery of the samples. Additionally, a field train blank was assembled and recovered following the same procedures used to prepare and recover the test samples. Prior to the purge, 100 ml of distilled de-ionized (DDI) water was added to the first impinger.

Analysis of the Method 202 samples and blanks were conducted by Maxxam Analytics of Mississauga, Ontario. All analysis followed the procedures listed in Method 202. A complete laboratory report is located in Appendix C.

Field data sheets for the Method 17/202 sampling can be found in Appendix B.

3.4.3 Quality Control and Assurance

All sampling and analytical equipment was calibrated according to the guidelines referenced in EPA Method 17 (see Appendix E for equipment calibration). Maxxam Analytics followed all the appropriate Method 202 analytical QA/QC (see Appendix C).

3.4.4 Data Reduction

Particulate data collected during the emissions testing was calculated and reported as grains per dry standard cubic foot (grains/dscf), pounds per 1000 pounds, (wet), at 50% excess air (lbs/1000 $lb_{(w)}$ @ 50% EA) and pounds per hour (lbs/hr).

The PM emission calculations are based on calculations located in USEPA Method 5. Example calculations are presented in Appendix E.

4.0 OPERATING PARAMETERS

The test program included the collection of boiler load and stack emissions CEMs data during each test run. Parameters recorded included gross Megawatts (MW) and CEMs data (SO_2, NO_x, CO_2, and Opacity).

Process data collected from the Unit's digital control system included load in gross megawatts (MW), main steam flow in thousand pounds per hour (Klbs/hr), total fuel flow in million Btu per hour (MBtu/hr), and coal flow in tons per hour (Tons/hr). CEMs data and process operational data can be found in Appendix F.

Coal samples were collected during particulate sampling and subject to proximate and ultimate analysis. Results of the fuel analysis can be referred to in Appendix C.

5.0 DISCUSSION OF RESULTS

Table 1 presents the Particulate Emission testing results from Unit 7. Particulate (Total Filterable) emissions are presented in grain per dry standard cubic foot (gr/DSCF), pounds per hour (lbs/hr) and pounds per 1000 pounds, (wet), @ 50% excess air ($lb/1000lb_{(w)}$ @ 50% EA). Additional test data presented for each test includes the Unit load in gross megawatts (GMW), stack temperature in degrees Fahrenheit (^{o}F), opacity 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).

Testing demonstrated filterable particulate emissions significantly below the permit limit. Unit 7 had average filterable particulate emissions of 0.04 $lb/1000\ lbs_{(wet)}$ @ 50% ea. The respective Permit Limit for Unit 7 is 0.13 $lb/1000\ lbs_{(wet)}$ @ 50% ea.

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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."

Mr. Thomas J. Snyder, QSTI

This report prepared by:

Mr. Thomas J. Snyder, QSTI
Senior Environmental Technician, Field Services
Environmental Management and Resources
DTE Energy Corporate Services, LLC

This report reviewed by:

Mr. Thomas Durham
Manager, Field Services
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Table No. 1
PARTICULATE EMISSION TESTING SUMMARY
St. Clair Power Plant - Unit 7
July 1-2, 2014

Unit 7 - Total Filterable PM

Test	Test Date	Test Time	Unit Load (GMW)	Stack Temperature (°F)	Opacity (%)	Stack Velocity (ft/min)	Exhaust Gas Flowrates (ACFM)	Exhaust Gas Flowrates (SCFM)	Exhaust Gas Flowrates (DSCFM)	PM Emissions (grains/dscf)	PM Emissions (lbs/hr)	PM Emissions (lbs/1000lb$_{(w)}$ @ 50% EA)[1]
PM-1	1-Jul-14	11:00-13:10	439.6	263	5.5	7,775	1,563,199	1,105,793	996,874	0.012	101.9	0.020
PM-2	2-Jul-14	7:02-9:27	439	268	7.7	7,729	1,554,070	1,095,688	991,892	0.025	213.3	0.042
PM-3	2-Jul-14	10:02-12:28	429.7	267	9.3	7,546	1,517,132	1,070,382	969,779	0.036	295.8	0.059
	Average:		*436.1*	*266*	*7.5*	*7,683*	*1,544,800*	*1,090,621*	*986,182*	*0.024*	*203.7*	*0.040*

(1) Permit Limit = 0.13 lbs/1000lbs$_{(w)}$ @ 50% EA

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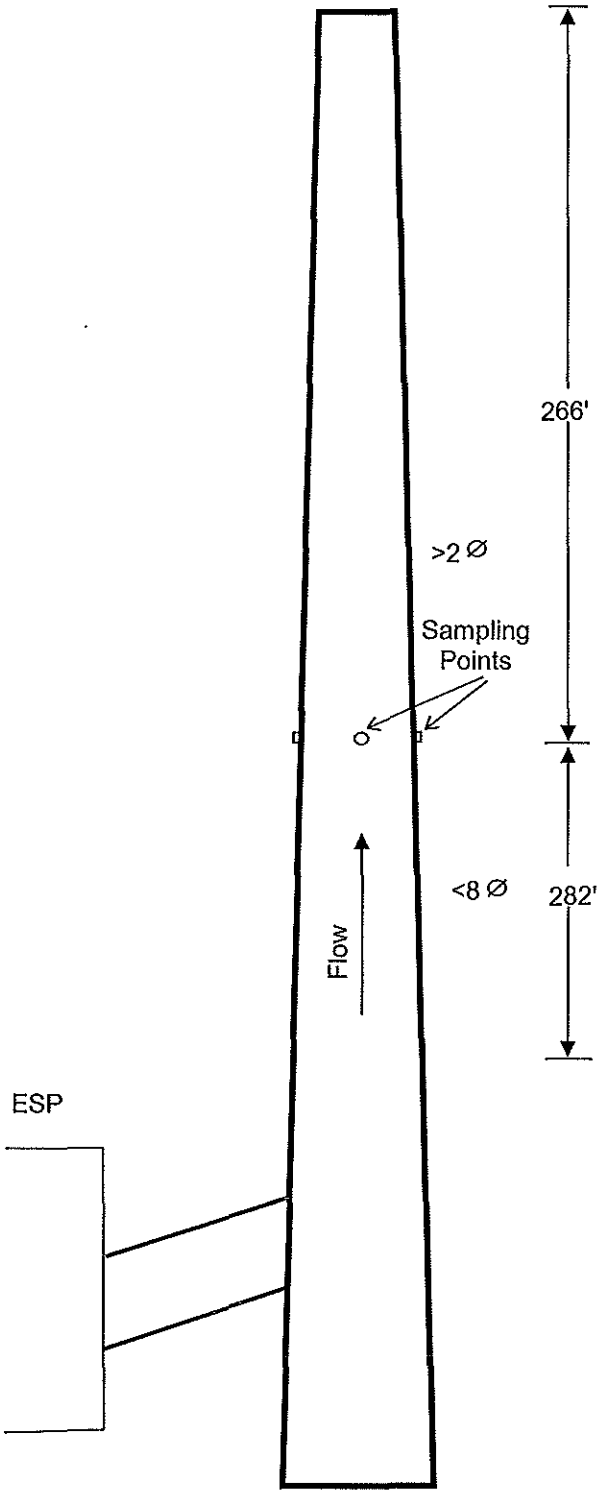
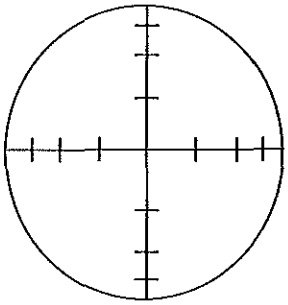
Figure 1 – Sampling Location & Traverse Points
St Clair Power Plant – Unit 7
July 1-2, 2014



Stack Diameter 192"



Velocity Measurement Points

Points	Distance From Inner Wall
1	8.4
2	28.0
3	56.8

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Figure 2 – USEPA Method 17 & 202
St Clair Power Plant – Unit 7
July 1-2, 2014