COMPLIANCE TEST REPORT

for

PARTICULATE MATTER (PM) EMISSIONS

UNITS 1 & 3 – FGD Stack

Monroe Power Plant
Monroe, Michigan

July 29 and August 19, 2014

DTE Energy

Prepared By
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EXECUTIVE SUMMARY

DTE Energy's Environmental Management and Resources (EMR) Field Services Group performed a third quarter 2014 retest for particulate emissions on Units 1 & 3 FGD exhaust stacks located at the Monroe Power Plant, in Monroe, Michigan. The testing is required by the Michigan Department of Environmental Quality (MDEQ) Permit to Install #27-13 to document filterable Particulate Matter (PM) emissions during normal operating conditions on a quarterly basis. The retest for the 3rd quarter of 2014 was conducted on July 29 and August 19, 2014.

A summary of the emission test results are shown below:

Emissions Testing Summary
Units 1 & 3 FGD Stack
Monroe Power Plant
July 29 and August 19, 2014

Source	Load (GMW)	PM(1) (lb/MMBtu)
Unit 1 (7/29/14)	705.1	0.007
Unit 3 (8/19/14)	781.7	0.005
Permit Limit		***0.011***

(1)= Total Filterable Particulate

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1.0 INTRODUCTION

DTE Energy's Environmental Management and Resources (EMR) Field Services Group performed a third quarter 2014 retest for particulate emissions on Units 1 & 3 FGD exhaust stacks located at the Monroe Power Plant (MONPP), in Monroe, Michigan. The testing is required by the Michigan Department of Environmental Quality (MDEQ) Permit to Install #27-13 to document filterable Particulate Matter (PM) emissions from the FGD stacks during normal operating conditions on a quarterly basis. The retest for the 3rd quarter of 2014 was conducted on July 29 and August 19, 2014.

Testing was performed pursuant to Title 40, *Code of Federal Regulations*, Part 60, Appendix A (40 CFR §60 App. A), Methods 1-4, 5 (Unit 1) and 5B (Unit 3).

The fieldwork was performed in accordance with EPA Reference Methods and EMR's Intent to Test[1], which was approved in a letter by Mr. Tom Gasloli from the Michigan Department of Environmental Quality (MDEQ), dated October 14, 2010. The following EMR Field Services personnel participated in the testing program: Mr. Mark Grigereit, Senior Specialist, Mr. Fred Meinecke, Senior Environmental Technician, and Mr Thomas Snyder, Senior Environmental Technician. Mr. Grigereit was the project leader. Ms. Atira Mabin, Environmental Engineer, with EMR, provided process coordination for the testing program. Mr. Nathan Hude, Mark Dziadosz and Mr. Brian Carley with the Air Quality Division of the Michigan Department of Environmental Quality (MDEQ) observed portions of the testing.

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. 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 a current capability of 823 GMW.

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[1] MDEQ, Test Plan, Submitted July 17, 2011. (Attached-Appendix A)
[2] MDEQ, Approval Letter. (Attached-Appendix A)

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

Units 1, 3 and 4 each 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 60%LSW/40%MSE for Unit 1 and Unit 3. Units 1 & 3 were operated at normal, full load conditions (>700 GMW).

The boilers at Monroe Power Plant employ the use of continuous soot-blowing, therefore a separate soot blowing PM test was not necessary.

The exhaust stack for Units 1-4 are each 580 feet tall with an internal diameter of 28 feet. See Figure 1 for a diagram of the sampling locations 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 & CO_2	Instrumental Analyzer Method
USEPA Method 4	Moisture Content	Field data analysis and reduction
USEPA Method 5	Particulate Matter	Gravimetric Analysis
USEPA Method 5B	Particulate Matter (Non-Sulfuric Acid)	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 each unit's exhaust stack, sampling at three (3) points per port for a total of twelve (12) points. Velocity traverses were conducted simultaneously with the particulate sampling. See Figure 2 for a diagram of the traverse/sampling points used.

Cyclonic flow checks were performed on each stack during their initial flow monitor certification RATAs. Testing at the sampling location demonstrated that no cyclonic flow was present at either location. No changes to the stacks have occurred since the cyclonic flow checks were performed. Additionally, verifications of null angle at 0° were observed while performing static pressure checks on each unit.

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 (Figure 3) 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™ connecting 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, prior to sampling, and again at the completion of each test run.

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

3.4 PARTICULATE MATTER (USEPA Method 5)

3.4.1 *Filterable Particulate Sampling Method*

USEPA Method 5, "Determination of Particulate Emissions from Stationary Sources" was used to measure the filterable (front-half) particulate emissions from Unit 1 (see Figure 4 for a schematic of the sampling train). The first two test runs were performed for 60 minutes. The third test run was performed for 180 minutes. The third test run was performed for 180 minutes in order to collect a sufficient amount of particulate for DTE Energy to perform future analytical analysis of the particulate matter for DTE's internal engineering purposes.

The Method 5 modular isokinetic stack sampling system consisted of the following:

(1) Teflon coated stainless-steel button-hook nozzle
(2) Heated glass-lined probe
(3) Heated 3" glass filter holder with a Quartz filter (maintained at a temperature of 248 $\pm$ 25 °F)
(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 stored for transport.

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 desiccated for 24 hours and weighed to a constant weight (within 0.5 mg). The data sheets containing the initial and final weights on the filters and beakers are located 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 5 sampling are located 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 5. All Method 1-4, and 5 calibration data is located in Appendix D.

3.4.3 *Data Reduction*

The Unit 1 filterable PM emissions data collected during the testing was calculated and reported as lb/MMBtu.

3.5 PARTICULATE MATTER (USEPA Method 5B)

3.5.1 *Filterable Particulate Sampling Method*

USEPA Method 5B, "Determination of Non-Sulfuric Acid Particulate Emissions from Stationary Sources" was used to measure the filterable (front-half) particulate emissions from Unit 3 (see Figure 4 for a schematic of the sampling train). Triplicate, 120-minute test runs were conducted.

The Method 5B modular isokinetic stack sampling system (Figure 5) consisted of the following:

(1) Teflon coated stainless-steel button-hook nozzle
(2) Heated glass-lined probe
(3) Heated 3" glass filter holder with a Quartz filter (maintained at a temperature of 320 ± 25 °F)
(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 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 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 baked for 6 hours at 320 °F, desiccated for 24 hours and weighed to a constant weight (within 0.5 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 5B sampling can be found in Appendix B.

3.5.2 *Quality Control and Assurance*

All sampling and analytical equipment was calibrated according to the guidelines referenced in EPA Method 5B. All Method 1-4, and 5B calibration data is located in Appendix D.

3.5.3 *Data Reduction*

The Unit 3 Filterable PM emissions data collected during the testing was calculated and reported as lbs/hr and lb/MMBtu.

4.0 OPERATING PARAMETERS

The test program included the collection of CEMs emission data, electrostatic precipitator data, flue gas desulfurization system data, selective catalytic reduction system data, and sulfur trioxide conditioning system data during each PM emissions test. CEMs data collected during the testing is located in Appendix E.

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 and used in the lb/MMBtu calculations (Appendix C).

5.0 DISCUSSION OF RESULTS

Table 1 presents the Unit 1 filterable particulate emission testing results. Filterable particulate emissions are presented in pounds per million British thermal units (lbs/MMBtu). The Unit 1 filterable PM emissions during the testing averaged 0.007 lbs/MMBtu. The average filterable PM emissions are less than the permit limit of 0.011 lbs/MMBtu.

Table 2 presents the Unit 3 filterable particulate emission testing results. Filterable particulate emissions are presented in pounds per million British thermal units (lbs/MMBtu). The Unit 3 filterable PM emissions during the testing averaged 0.005 lbs/MMBtu. The average filterable PM emissions are less than the permit limit of 0.011 lbs/MMBtu.

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 (^{o}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).

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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."

Thom Snyder for :
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TABLE NO. 1
FILTERABLE PARTICULATE EMISSION TESTING RESULTS
Monroe Power Plant - Unit 1
July 29, 2014

Test	Test Date	Test Time	Unit Load (GMW)	Stack Temperature (°F)	Stack Moisture (%)	Stack Velocity (ft/min)	Exhaust Gas Flowrates (ACFM)	(SCFM)	(DSCFM)	Filterable PM Emissions (lbs/MMBtu)[1]
PM-1	**29-Jul-14**	7:15-8:23	705.4	127.9	16.2	3,305	2,035,043	1,760,078	1,474,383	0.008
PM-2		8:51-10:04	704.6	126.9	15.2	3,212	1,977,755	1,714,040	1,454,349	0.007
PM-3		10:30-13:41	705.2	127.7	15.7	3,217	1,980,730	1,714,427	1,445,683	0.006
	Average:		***705.1***	***127.5***	***15.7***	***3,245***	***1,997,843***	***1,729,515***	***1,458,138***	***0.007***

(1) Permit Limit = 0.011 lb/MMBtu

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TABLE NO. 2
FILTERABLE PARTICULATE EMISSION TESTING RESULTS
Monroe Power Plant - Unit 3
August 19, 2014

Test	Test Date	Test Time	Unit Load (GMW)	Stack Temperature (°F)	Stack Moisture (%)	Stack Velocity (ft/min)	Exhaust Gas Flowrates (ACFM)	(SCFM)	(DSCFM)	Filterable PM Emissions (lbs/MMBtu)[1]
PM-1	**19-Aug-14**	6:55-9:32	779.7	127.3	15.5	3,742	2,304,098	1,999,495	1,690,015	0.005
PM-2		9:54-12:01	782.7	128.5	15.8	3,762	2,316,632	2,006,103	1,689,609	0.004
PM-3		12:25-14:31	782.6	128.9	15.8	3,780	2,327,433	2,014,030	1,696,425	0.004
	Average:		*781.7*	*128.2*	*15.7*	*3,761*	*2,316,054*	*2,006,543*	*1,692,016*	*0.004*

(1) Permit Limit = 0.011 lb/MMBtu

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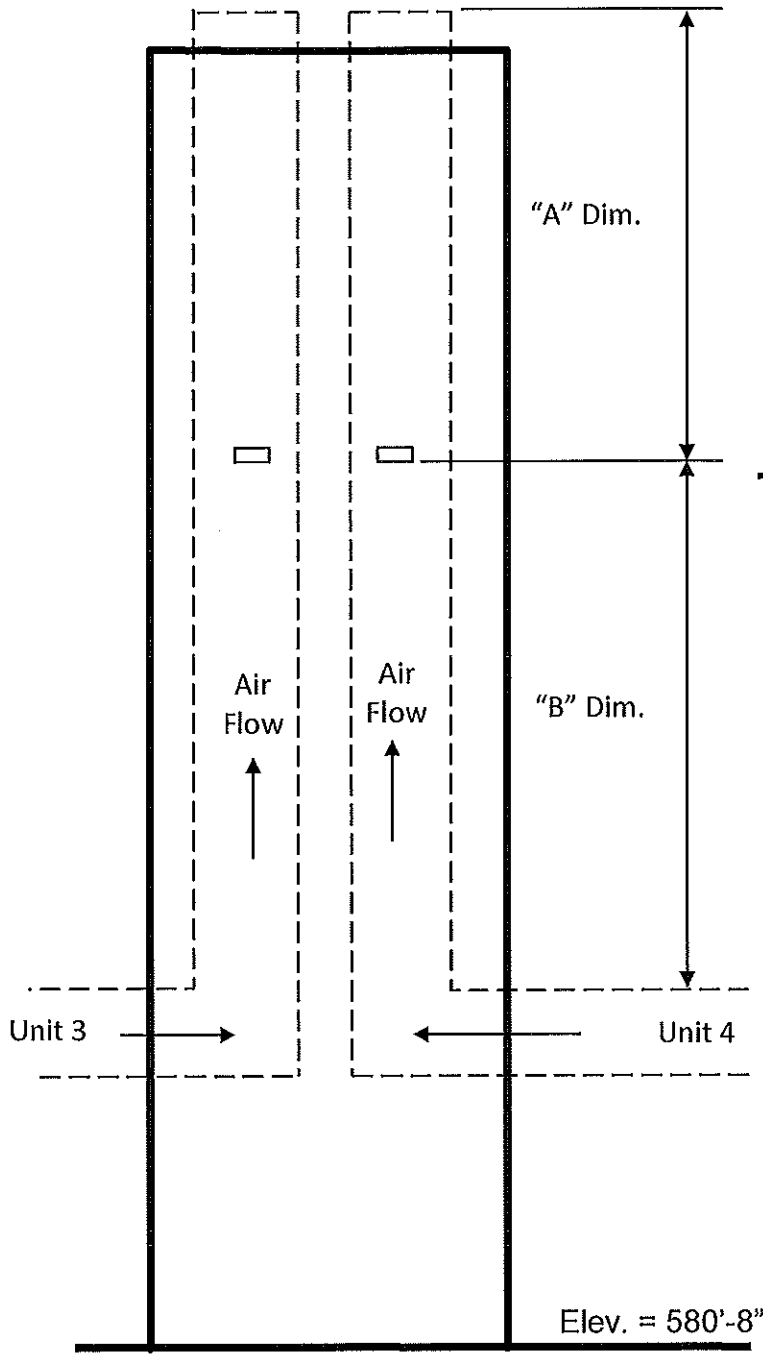
Figure 1 – Sampling Location
Monroe Power Plant – Units 1 & 3
July 29 and August 19, 2014



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 4 – EPA Method 5
Monroe Power Plant – Units 1 & 3
July 29 and August 19, 2014

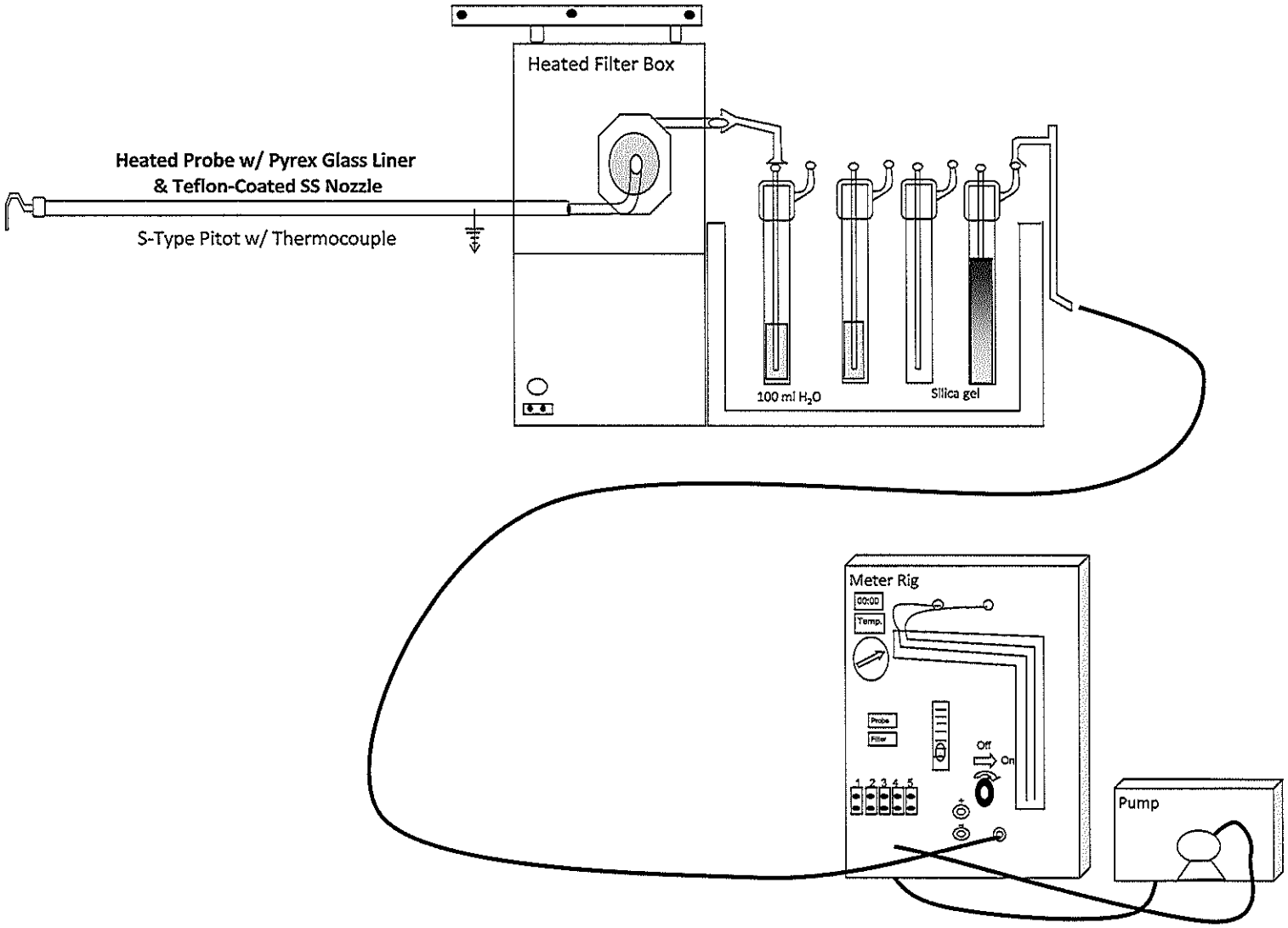

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Figure 5 – EPA Method 5B
Monroe Power Plant – Units 1 & 3
July 29 and August 19, 2014