Figure 2 – EPA Method 5
Belle River Power Plant

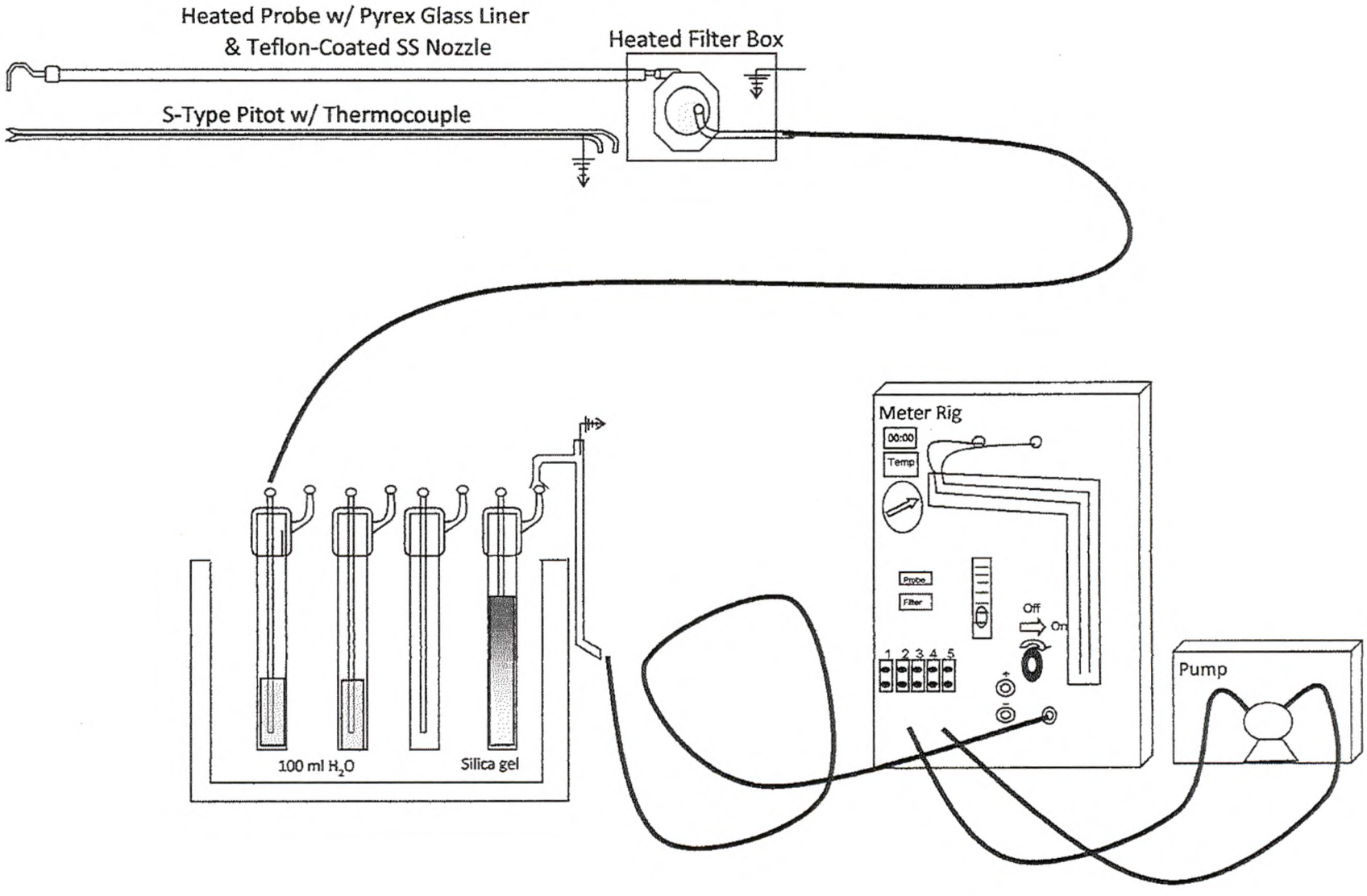
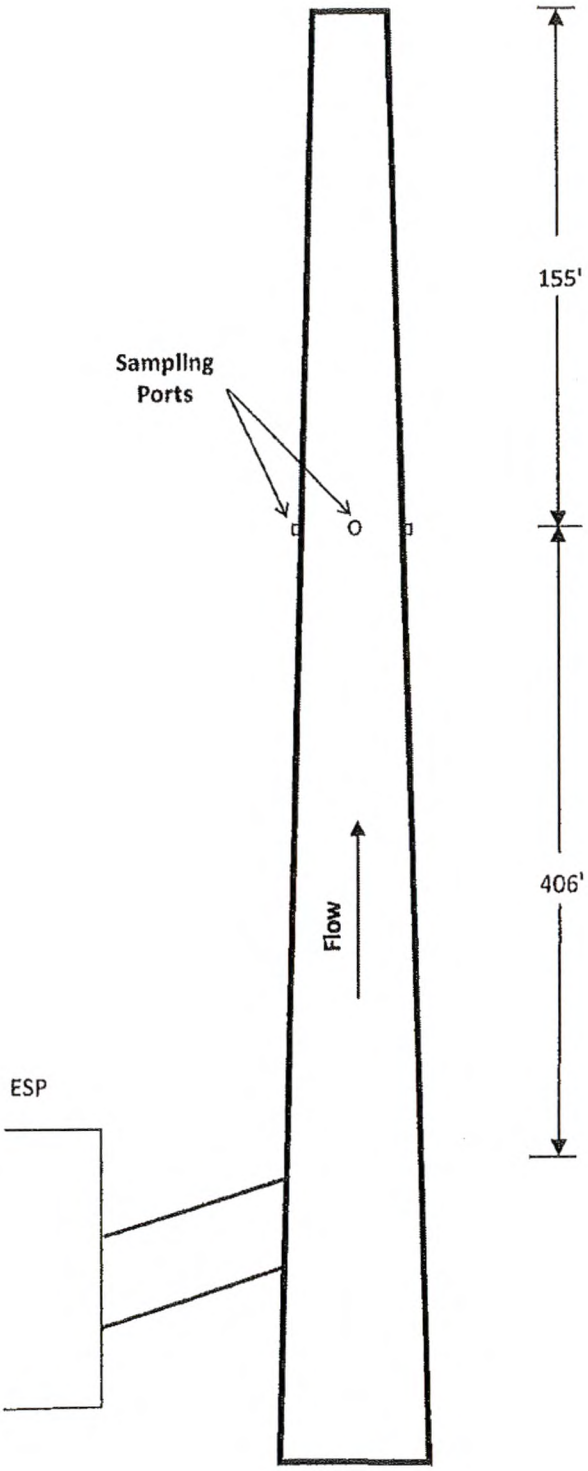
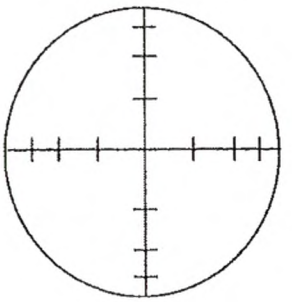


Figure 1 – Sampling Location & Traverse Points
Belle River Power Plant – Units 1 & 2



Stack Diameter 25'-6"



Sample Points

Points	Distance From Inner Wall
1	13.6
2	44.7
3	90.6

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FIGURES

PARTICULATE EMISSION TEST RESULTS (Method 5)
Belle River Power Plant
EU-BOILER2
July 31, 2024

Project Information			
Start Time:	6:21	7:47	9:10
End Time:	7:26	8:57	10:16

Particulate Sampling Train Data			
Test No:	1	2	3
Pitot Cal. Factor	0.84	0.84	0.84
Meter Calibration Factor:	1.012	1.012	1.012
Stack Diameter, inches:	306	306	306
Nozzle Diameter, inches:	0.179	0.179	0.179
Barometric Pressure, inches Hg:	29.87	29.87	29.87
Static Pressure in Stack, inches H2O:	-1.80	-1.80	-1.80
Duration of Sample, minutes	60	60	60
Meter Leak Rate:	0	0	0
Meter Start Volume:	900.66	940.66	980.59
Meter Final Volume:	940.57	980.48	1021.25
Average Meter Pressure, inches H2O:	1.37	1.39	1.41
Average Meter Temperature, degrees F:	90.9	92.3	94.4
Average Sqrt. Velocity Pressure:	1.456	1.472	1.486
Stack Gas Temperature, degrees F:	305.6	313.6	317.5
% Carbon Dioxide:	10.9	11.0	10.9
% Oxygen:	8.7	8.6	8.7
% Carbon Monoxide:	0.0	0.0	0.0
Liquid Volume Collected, milliliters:	98.4	108.2	110.0
Total Weight of Particulate-M5, mg:	**8.4**	**8.5**	**7.4**

Sampling Train Results			
Meter Volume, Actual:	39.91	39.81	40.66
Meter Volume, STP:	38.78	38.58	39.26
Volume of Water Vapor Condensed:	4.66	5.13	5.21
Total Gas Sampled:	43.44	43.71	44.47
% Moisture:	10.74	11.73	11.72
Area of Stack, Square Feet:	510.71	510.71	510.71
% Excess Air at Test Location:	69.2	67.8	68.9
Density Dry at STP:	0.0778	0.0778	0.0778
Density Wet at STP:	0.0744	0.0741	0.0741
Density Wet at Stack Cond:	0.0510	0.0503	0.0500
Molecular Weight, lb/lb-Mole	30.10	30.11	30.10
Isokinetic, %	101.8	101.7	102.8

Velocity and Flow Results			
Average Stack Gas Velocity FPM:	5,935	6,041	6,115
Stack Gas Flow Rate, ACFM:	3,030,938	3,085,391	3,123,187
Stack Gas Flow Rate, SCFM:	2,077,807	2,093,263	2,108,231
Stack Gas Flow Rate, DSCFM:	1,854,710	1,847,654	1,861,061
Pounds of Gas Sampled, Dry	3.017	3.002	3.054
Pounds of Gas Sampled, Wet	3.233	3.241	3.297

Particulate Results - Filterable			
Grains per DSCF:	0.003	0.003	0.003
Lbs/1000 Lbs Gas, Actual:	0.006	0.006	0.005
Lbs/1000 Lbs Gas, Dry:	0.006	0.006	0.005
Lbs/1000 Lbs Gas, Actual @ 50% EA:	0.006	0.006	0.006
Lbs/Hr:	53.10	53.80	46.36
Lbs/MMBtu:	**0.008**	**0.008**	**0.007**
		Average	**0.008**

Std Conditions (68°F, 29.92" Hg)

PARTICULATE EMISSION TEST RESULTS (Method 5)

Belle River Power Plant

EU-BOILER1

August 1, 2024

Project Information

Start Time:	7:31	9:00	10:52
End Time:	8:37	10:05	11:58

Particulate Sampling Train Data

Test No:	1	2	3
Pitot Cal. Factor	0.84	0.84	0.84
Meter Calibration Factor:	1.012	1.012	1.012
Stack Diameter, Inches:	306	306	306
Nozzle Diameter, Inches:	0.179	0.179	0.179
Barometric Pressure, Inches Hg:	29.95	29.95	29.95
Static Pressure in Stack, Inches H2O:	-1.80	-1.80	-1.80
Duration of Sample, minutes	60	60	60
Meter Leak Rate:	0	0	0
Meter Start Volume:	21.30	61.59	102.77
Meter Final Volume:	61.51	101.44	142.59
Average Meter Pressure, Inches H2O:	1.43	12.69	1.39
Average Meter Temperature, degrees F:	93.3	96.0	97.7
Average Sqrt. Velocity Pressure:	1.480	1.460	1.460
Stack Gas Temperature, degrees F:	300.5	304.5	309.7
% Carbon Dioxide:	10.9	10.9	11.2
% Oxygen:	8.6	8.6	8.5
% Carbon Monoxide:	0.0	0.0	0.0
Liquid Volume Collected, milliliters:	110.4	113.2	116.1
Total Weight of Particulate-M5, mg:	**3.9**	**4.1**	**4.2**

Sampling Train Results

Meter Volume, Actual:	40.21	39.85	39.82
Meter Volume, STP:	39.01	39.53	38.32
Volume of Water Vapor Condensed:	5.23	5.37	5.50
Total Gas Sampled:	44.24	44.90	43.82
% Moisture:	11.83	11.95	12.56
Area of Stack, Square Feet:	510.71	510.71	510.71
% Excess Air at Test Location:	68.3	67.4	66.4
Density Dry at STP:	0.0778	0.0778	0.0779
Density Wet at STP:	0.0741	0.0741	0.0739
Density Wet at Stack Cond:	0.0513	0.0510	0.0505
Molecular Weight, lb/lb-Mole	30.10	30.10	30.13
Isokinetic, %	101.3	104.5	102.2

Velocity and Flow Results

Average Stack Gas Velocity FPM:	6,019	5,955	5,980
Stack Gas Flow Rate, ACFM:	3,074,060	3,041,306	3,054,147
Stack Gas Flow Rate, SCFM:	2,127,161	2,093,485	2,088,212
Stack Gas Flow Rate, DSCFM:	1,875,574	1,843,296	1,825,980
Pounds of Gas Sampled, Dry	3.035	3.076	2.984
Pounds of Gas Sampled, Wet	3.278	3.325	3.240

Particulate Results - Filterable

Grains per DSCF:	0.002	0.002	0.002
Lbs/1000 Lbs Gas, Actual:	0.003	0.003	0.003
Lbs/1000 Lbs Gas, Dry:	0.003	0.003	0.003
Lbs/1000 Lbs Gas, Actual @ 50% EA:	0.003	0.003	0.003
Lbs/Hr:	24.78	25.27	26.45
Lbs/MMBtu:	**0.004**	**0.004**	**0.004**
		Average	0.004

Std Conditions (68°F, 29.92" Hg)

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RESULTS TABLES

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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."

Mark Grigereit, QSTI

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4.0 OPERATING PARAMETERS

The test program included the collection of PM CEMs emission data and Load during each PM emissions test. The test program included the collection of boiler load and stack CEMs monitoring during each test run. Parameters recorded included gross Megawatts (MW), CO_2, and CEMs PM.

Coal samples were collected during sampling and subject to proximate and ultimate analysis. Data collected during testing is presented in Appendix E.

5.0 DISCUSSION OF RESULTS

Tables 1 and 2 present the Particulate Emission testing results from Unit 1 and Unit 2. Particulate (Total Filterable) emissions are presented in grain per dry standard cubic foot (gr/DSCF), pounds per hour (lbs/hr) and pounds per million British thermal unit (lbs/MMBtu).

Additional test data presented for each test includes the Unit load in gross megawatts (GMW), stack temperature in degrees Fahrenheit (°F), 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 average filterable PM emissions from Unit 1 was 0.004 lbs/MMBtu and Unit 2 was 0.008 lbs/MMBtu which are both less than the permit limit of 0.10 lbs/MMBtu.

(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 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, 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 PTFE beaker liners and evaporated to dryness at ambient temperature and pressure. The beaker liners 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 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 5 sampling can be found in Appendix B.

3.4.2 *Quality Control and Assurance*

All sampling and analytical equipment were calibrated per the guidelines referenced in EPA Method 5. All Method 1-4, and 5 calibration data is in Appendix D.

3.4.3 *Data Reduction*

The filterable PM emissions data collected during the testing were calculated and reported as lb/MMBTU.

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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) PTFE sampling line (collecting gas sample from the meter rig exhaust)
(2) Servomex 1400 O_2/CO_2 gas analyzer
(3) Appropriate USEPA Protocol 1 calibration gases
(4) Data acquisition system

3.2.3 *Sampling Train Calibration*

The O_2 and CO_2 analyzers were calibrated per 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. Upscale and downscale gases were introduced after each test period to determine instrument drift.

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 (see Figure 2 for a schematic of the sampling train). Triplicate, 60-minute test runs were conducted.

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

(1) stainless-steel button-hook nozzle
(2) Heated quartz-lined probe
(3) Heated 3" glass filter holder with a quartz filter
(Maintained at a temperature of 250 $\pm$ 25 °F)

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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	O_2 & CO_2	Instrumental Analyzer Method
USEPA Method 4	Moisture Content	Field data analysis and reduction
USEPA Method 5	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 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 1 for a diagram of the traverse/sampling points used.

Cyclonic flow checks were performed on each location prior to beginning the emissions testing. Testing at the sampling location demonstrated that no cyclonic flow was present at either location. Verifications of null angle at 0° were observed while performing static pressure checks.

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.

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1.0 INTRODUCTION

DTE Energy's Environmental Management and Safety (EMS) Field Services Group performed particulate emissions testing on the exhausts of Units 1 & 2 at the Belle River Power Plant, located in China Township, Michigan. The testing was required by the Michigan Department of Environment, Great Lakes, and Energy (EGLE) Michigan Renewable Operating Permit MI-ROP-B2796-2024 to document total filterable particulate matter (PM) stack emissions. The testing was conducted during the period of July 31-August 1, 2024.

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

The fieldwork was performed in accordance with EPA Reference Methods and EMS's Intent to Test.[1] The following EMS personnel participated in the testing program: Mr. Mark Westerberg, Sr. Environmental Specialist, Mr. Mark Grigereit, Principal Engineer and Mr. Fred Meinecke, Environmental Specialist. Mr. Westerberg was the project leader. Coordination with the facility was performed by Ms. Jamie Stanislawski, Environmental Engineer. Mr. Andrew Riley, The Air Quality Division of the Michigan Department of Environment, Great Lakes, & Energy (EGLE) reviewed the test plan and was notified of the emissions testing.

2.0 SOURCE DESCRIPTION

The Belle River Power Plant (BRPP) located at 4505 King Road in China Township, Michigan, employs the use of two (2) Babcock and Wilcox coal-fired boilers (Units 1 & 2) each capable of producing 4,550,000 pounds per hour of steam. Each Unit has a Siemens Power Corporation turbine generator with a nominally rated capability of 635 (Units 1 & 2) and 645 (Unit 2) megawatts (MW).

[1] EGLE, Test Plan, Submitted March 15, 2024. (Attached-Appendix A)

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EXECUTIVE SUMMARY

DTE Energy's Environmental Management and Safety (EMS) Field Services Group performed particulate emissions testing on the exhausts of Units 1 & 2 at the Belle River Power Plant, located in China Township, Michigan. The testing was required by the Michigan Department of Environment, Great Lakes, and Energy (EGLE) Michigan Renewable Operating Permit MI-ROP-B2796-2024 to document total filterable particulate matter (PM) stack emissions. The testing was conducted during the period of July 31-August 1, 2024.

A summary of the emission test results are shown below:

Emissions Testing Summary
Belle River Units 1 & 2

Source	Filterable PM (lbs/MMBtu)[1]
Unit 1	0.004
Unit 2	0.008

(1) Units 1 & 2 Permit Limit 0.10 lbs/MMBtu

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RESULTS TABLE

Table No. 1: ..... Unit 1 PM Emissions Results
Table No. 2: ..... Unit 2 PM Emissions Results

FIGURES

1 Sampling Location
2 USEPA Method 5
3 USEPA Method 3A

APPENDICES

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B Field Data
C Analytical Data
D Equipment and Analyzer Calibration Data
E Operational Data
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COMPLIANCE TEST REPORT

for

PARTICULATE MATTER EMISSIONS TESTING

EU-BOILER1-BR & EU-BOILER2-BR

Belle River Power Plant
China Twp., Michigan

July 31-August 1, 2024

Prepared By
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