FINAL REPORT

DTE ENERGY

MONROE, MICHIGAN

MONROE POWER PLANT (MPP) UNIT 2: RESPONSE CORRELATION AUDIT (RCA)

RWDI #2305821

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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 a Response Correlation Audit (RCA) on the Particulate Matter Continuous Emission Monitoring System (PM CEMS). The RCA was performed on the Unit 2 exhaust stack. Testing was performed in accordance with the Procedure 2 of 40 CFR Part 60, Appendix F, and was conducted from May 26th-31st, 2023.

Response Correlation Audit – Monroe Power Plant - Unit 2

Test Number	PM CEMS (mg/wac)[2]	PM CEMS (correction)	RM CEMS (mg/acm)[2]	Correction (-25% Emission Limit)	Correction (+25% Emission Limit)
Test 1	7.4	4.1	3.6	2.4	5.8
Test 2	6.9	4.0	2.5	2.3	5.7
Test 3	6.9	4.0	3.2	2.3	5.7
Test 4	7.0	4.0	2.9	2.3	5.7
Test 5	7.2	4.0	3.4	2.3	5.7
Test 6	18.3	5.9	4.2	4.2	7.6
Test 7	16.8	5.7	3.5	4.0	7.4
Test 8	15.7	5.5	4.1	3.8	7.2
Test 9	14.9	5.4	3.0	3.7	7.1
Test 10	14.1	5.3	3.4	3.6	7.0
Test 11	46.0	8.2	8.1	6.5	9.9
Test 12	47.5	8.4	8.3	6.7	10.1
Test 13	45.3	8.2	7.1	6.5	9.9
Test 14	45.1	8.4	7.8	6.7	10.1
Test 15	43.0	8.3	8.8	6.6	10.0

Notes: 1 – DTE CEMS is 1 hour behind test times
2 – milligrams per actual cubic meter at 160°C

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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 a Response Correlation Audit (RCA) on the Particulate Matter Continuous Emission Monitoring System (PM CEMS). The RCA was performed on the Unit 2 exhaust stack. Testing was conducted from May 26th-31st, 2023.

Testing was performed pursuant to Title 40, Code of Federal Regulations, Part 60, Appendix A (40 CFR 60 App. A), Methods 1-5B. Criterion for acceptable RCA results are located in Procedure 2 Sec 10.4(5)(i-ii) or alternatively, Sec 10.4(5)(i-ii).

1.1 Location and Dates of Testing

The test program was completed from May 26th-31st, 2023.

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 8223 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 Figure 1 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.

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 field 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.

3 OPERATING PARAMETERS

The test program included the collection of PM CEMs emission data and load during each PM emission test. CEMS data can be found in **Appendix A**.

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 H**.

4.7 PS-11 Statistical Analysis

PS-11 statistical analysis can be found in **Appendix I**.

TABLES

Table 1
MPP Unit 2 Table of Results

Test Number	Test Date (2023)	Test Time	PM CEMS[1] (mg/wac)[2]	RM PM (mg/acm)[2]	PM CEMS[1] (correction)	Correction (-25% Emission Limit)	Correction (+25% Emission Limit)	PM Load Range	Unit Load[1] (GMW)
Test 1	26-May	7:07-8:21	7.4	3.6	4.1	2.4	5.8	Low	392.3
Test 2	26-May	8:40-9:50	6.9	2.5	4.0	2.3	5.7	Low	392.3
Test 3	26-May	10:11-11:22	6.9	3.2	4.0	2.3	5.7	Low	392.4
Test 4	26-May	11:38-12:48	7.0	2.9	4.0	2.3	5.7	Low	392.5
Test 5	26-May	13:06-14:25	7.2	3.4	4.0	2.3	5.7	Low	392.7
Test 6	30-May	7:23-8:36	18.3	4.2	5.9	4.2	7.6	Mid	749.4
Test 7	30-May	8:52-10:04	16.8	3.5	5.7	4.0	7.4	Mid	749.4
Test 8	30-May	10:23-11:33	15.7	4.1	5.5	3.8	7.2	Mid	748.9
Test 9	30-May	11:49-12:58	14.9	3.0	5.4	3.7	7.1	Mid	749.5
Test 10	30-May	13:11-14:20	14.1	3.4	5.3	3.6	7.0	Mid	749.2
Test 11	31-May	7:58-9:06	46.0	8.1	8.2	6.5	9.9	High	777.0
Test 12	31-May	9:24-10:33	47.5	8.3	8.4	6.7	10.1	High	813.0
Test 13	31-May	10:49-12:05	45.3	7.1	8.2	6.5	9.9	High	740.7
Test 14	31-May	12:20-13:29	45.1	7.8	8.4	6.7	10.1	High	675.7
Test 15	31-May	13:47-14:58	43.0	8.8	8.3	6.6	10.0	High	685.6

1 DTE CEMS data is 1 hour behind test times
2 milligrams per actual cubic meter at 160°C

Table 2

Company	DTE Monroe					
Source	Boiler Unit 2 - Low					
Date	26-May-23	26-May-23	26-May-23	26-May-23	26-May-23	
Test Number	Test 1	Test 2	Test 3	Test 4	Test 5	Average
Test Times	7:07-8:21	8:40-9:50	10:11-11:22	11:38-12:48	13:06-14:25	
Stack Information						
Flow ft3 (Actual)	1,418,295	1,447,035	1,403,675	1,410,460	1,399,930	1,415,879
Flow ft3 (Standard Wet)	1,270,951	1,296,556	1,257,705	1,263,785	1,254,349	1,268,669
Flow ft3 (Standard Dry)	1,105,421	1,125,747	1,104,941	1,098,863	1,102,407	1,107,476
Flow m3 (Standard Dry)	31,302	31,878	31,289	31,117	31,217	31,360
Percent Moisture	13.0	13.2	12.1	13.0	12.1	12.7
Pressure Ps ("Hg)	29.45	29.45	29.45	29.45	29.45	29.45
Average Stack Temperature Ts (F)	119.9	120.0	120.0	120.0	120.0	120.0
Molecular Weight of Stack Gas dry (Md)	30.08	30.06	30.09	30.09	30.10	30.08
Molecular Weight of Stack Gas wet (Ms)	28.51	28.47	28.62	28.62	28.63	28.57
Stack Gas Specific Gravity (Gs)	1.0	1.0	1.0	1.0	1.0	1.0
Water Vapor Volume Fraction	0.1	0.1	0.1	0.1	0.1	0.1
Average Stack Velocity Vs (ft/sec)	38.4	39.2	38.0	38.2	37.9	38.3
Area of Stack (ft2)	615.8	615.8	615.8	615.8	615.8	615.8
Percent Carbon Dioxide	10.8	10.7	10.9	10.9	10.9	10.8
Percent Oxygen	8.8	8.8	8.7	8.7	8.8	8.8
Percent Carbon Monoxide	0.0	0.0	0.0	0.0	0.0	0.0
Percent Excess Air at Test Location	70.8	70.7	69.5	69.5	71.0	70.3
Meter Info						
Isokinetic Variation I	105.4	98.9	104.8	102.5	102.5	102.8
Meter Pressure Pm ("Hg)	29.7	29.7	29.7	29.7	29.7	29.7
Meter Temperature Tm (F)	73.3	74.1	74.3	76.3	77.5	75.1
Measured Sample Volume Vm	51.98	49.78	51.77	50.53	50.84	50.98
Sample Volume (Vm St ft3)	52.08	49.78	51.77	50.33	50.53	50.90
Sample Volume (Vm St m3)	1.47	1.41	1.47	1.43	1.43	1.44
Total Weight of Sampled Gas (m g lbs) wet	4.41	4.22	4.36	4.27	4.25	4.30
Total Weight of Sampled Gas (m g lbs) dry	4.05	3.87	4.03	3.91	3.93	3.96
Gas Density Ps wet	0.07	0.07	0.07	0.07	0.07	0.07
Gas Density Ps dry	0.08	0.08	0.08	0.08	0.08	0.08
Condensate Volume	7.80	7.55	7.16	7.55	6.96	7.41
Nozzle Size	0.00046	0.00046	0.00046	0.00046	0.00046	0.00
Impinger Gain	151.6	149.7	140.1	150.8	139.0	146.2
Silica Gel Gain	13.8	10.5	11.7	9.4	8.7	10.8
Total Gas Sampled (vm st ft3 + condensate volume)	59.88	57.34	58.93	57.88	57.49	58.30
Particulate Results						
Nozzle/Probe/Filter Weight (mg)	9.0	6.1	8.0	7.0	8.3	7.7
lb/hr	25.4	18.3	22.7	20.3	24.0	22.1
mg/dscm (dry)	6.103	4.327	5.457	4.912	5.801	5.320
gr/dscf	0.003	0.002	0.002	0.002	0.003	0.002
lb/MMBtu @ 10033 lb/BTU	0.007	0.005	0.006	0.005	0.006	0.006
mg/acm @ 160 C	3.565	2.522	3.219	2.867	3.423	3.119
lbs/1,000 lbs Gas @ 50% EA (wet)	0.005	0.004	0.005	0.004	0.005	0.004

Table 3

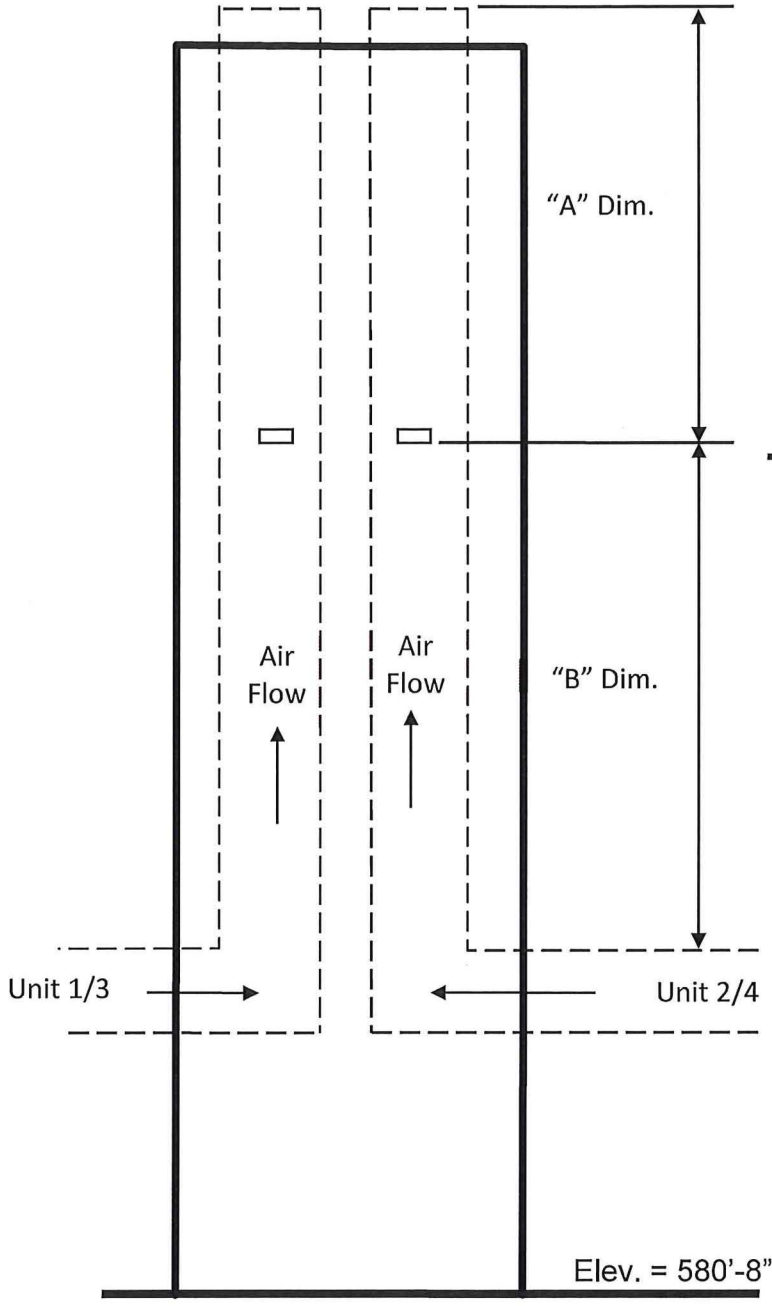
Company	DTE Monroe					
Source	Boiler Unit 2 - Mid					
Date	30-May-23	30-May-23	30-May-23	30-May-23	30-May-23	
Test Number	Test 1	Test 2	Test 3	Test 4	Test 5	Average
Test Times	7:23 to 8:36	8:52 to 10:04	10:23 to 11:33	11:49 to 12:58	13:11 to 14:20	
Stack Information						
Flow ft3 (Actual)	2,207,385	2,207,428	2,227,310	2,167,431	2,214,942	2,204,899
Flow ft3 (Standard Wet)	1,934,415	1,933,629	1,950,628	1,900,010	1,941,866	1,932,109
Flow ft3 (Standard Dry)	1,635,223	1,635,794	1,652,586	1,613,560	1,640,671	1,635,567
Flow m3 (Standard Dry)	46,305	46,321	46,796	45,691	46,459	46,314
Percent Moisture	15.5	15.4	15.3	15.1	15.5	15.3
Pressure Ps ("Hg)	29.11	29.11	29.11	29.11	29.11	29.11
Average Stack Temperature Ts (F)	126.1	126.4	126.5	125.9	125.9	126.2
Molecular Weight of Stack Gas dry (Md)	30.38	30.38	30.34	30.38	30.38	30.37
Molecular Weight of Stack Gas wet (Ms)	28.46	28.47	28.45	28.49	28.49	28.47
Stack Gas Specific Gravity (Gs)	1.0	1.0	1.0	1.0	1.0	1.0
Water Vapor Volume Fraction	0.2	0.2	0.2	0.2	0.2	0.2
Average Stack Velocity Vs (ft/sec)	59.7	59.7	60.3	58.7	60.0	59.7
Area of Stack (ft2)	615.8	615.8	615.8	615.8	615.8	615.8
Percent Carbon Dioxide	13.4	13.4	13.0	13.4	13.4	13.3
Percent Oxygen	5.8	5.9	6.4	6.0	6.0	6.0
Percent Carbon Monoxide	0.0	0.0	0.0	0.0	0.0	0.0
Percent Excess Air at Test Location	37.3	38.3	43.0	39.3	39.3	39.4
Meter Info						
Isokinetic Variation I	106.1	101.1	103.8	101.0	99.8	102.3
Meter Pressure Pm ("Hg)	29.4	29.4	29.4	29.4	29.4	29.4
Meter Temperature Tm (F)	84.0	85.6	85.3	88.1	87.8	86.1
Measured Sample Volume Vm	57.82	55.26	57.28	54.73	54.95	56.01
Sample Volume (Vm St ft3)	56.26	53.61	55.61	52.83	53.09	54.28
Sample Volume (Vm St m3)	1.59	1.52	1.57	1.50	1.50	1.54
Total Weight of Sampled Gas (m g lbs) wet	4.90	4.66	4.83	4.58	4.62	4.72
Total Weight of Sampled Gas (m g lbs) dry	4.42	4.21	4.36	4.15	4.17	4.26
Gas Density Ps wet	0.07	0.07	0.07	0.07	0.07	0.07
Gas Density Ps dry	0.08	0.08	0.08	0.08	0.08	0.08
Condensate Volume	10.29	9.76	10.03	9.38	9.75	9.84
Nozzle Size	0.00033	0.00033	0.00033	0.00033	0.00033	0.00
Impinger Gain	199.5	193.5	192.8	186.4	179.9	190.4
Silica Gel Gain	18.8	13.5	19.9	12.5	26.8	18.3
Total Gas Sampled (vm st ft3 + condensate volume)	66.55	63.37	65.64	62.20	62.83	64.12
Particulate Results						
Nozzle/Probe/Filter Weight (mg)	11.9	9.4	11.4	7.9	9.0	9.9
lb/hr	45.9	38.1	45.0	32.0	36.9	39.6
mg/dscm (dry)	7.470	6.193	7.240	5.281	5.987	6.434
gr/dscf	0.003	0.003	0.003	0.002	0.003	0.003
lb/MMBtu @ 10033 lb/BTU	0.007	0.005	0.007	0.005	0.005	0.006
mg/acm @ 160 C	4.201	3.485	4.081	2.982	3.365	3.623
lbs/1,000 lbs Gas @ 50% EA (wet)	0.005	0.004	0.005	0.004	0.004	0.004

Table 4

Company	DTE Monroe					
Source	Boiler Unit 2 - High					
Date	31-May-23	31-May-23	31-May-23	31-May-23	31-May-23	
Test Number	Test 11	Test 12	Test 13	Test 14	Test 15	Average
Test Times	7:58-9:06	9:24-10:33	10:49-12:05	12:20-13:29	13:47-14:58	
Stack Information						
Flow ft3 (Actual)	2,249,054	2,293,202	2,261,954	2,249,907	2,088,891	2,228,602
Flow ft3 (Standard Wet)	1,976,636	2,011,142	1,982,471	1,975,277	1,836,265	1,956,358
Flow ft3 (Standard Dry)	1,664,919	1,698,659	1,675,864	1,665,795	1,557,024	1,652,452
Flow m3 (Standard Dry)	47,146	48,101	47,455	47,170	44,090	46,792
Percent Moisture	15.8	15.5	15.5	15.7	15.2	15.5
Pressure Ps ("Hg)	29.16	29.16	29.16	29.16	29.16	29.16
Average Stack Temperature Ts (F)	125.4	126.7	127.1	126.1	125.3	126.1
Molecular Weight of Stack Gas dry (Md)	30.37	30.38	30.36	30.35	30.36	30.36
Molecular Weight of Stack Gas wet (Ms)	28.42	28.46	28.45	28.44	28.45	28.44
Stack Gas Specific Gravity (Gs)	1.0	1.0	1.0	1.0	1.0	1.0
Water Vapor Volume Fraction	0.2	0.2	0.2	0.2	0.2	0.2
Average Stack Velocity Vs (ft/sec)	60.9	62.1	61.2	60.9	56.5	60.3
Area of Stack (ft2)	615.8	615.8	615.8	615.8	615.8	615.8
Percent Carbon Dioxide	13.3	13.4	13.2	13.1	13.2	13.2
Percent Oxygen	6.0	5.9	6.1	6.3	6.2	6.1
Percent Carbon Monoxide	0.0	0.0	0.0	0.0	0.0	0.0
Percent Excess Air at Test Location	39.2	38.3	40.1	42.1	41.1	40.2
Meter Info						
Isokinetic Variation I	102.1	100.3	99.5	100.2	98.7	100.2
Meter Pressure Pm ("Hg)	29.5	29.5	29.5	29.5	29.4	29.5
Meter Temperature Tm (F)	89.3	90.6	88.3	88.8	88.7	89.2
Measured Sample Volume Vm	57.09	57.37	55.89	56.01	51.64	55.60
Sample Volume (Vm St ft3)	55.10	55.26	54.04	54.11	49.85	53.67
Sample Volume (Vm St m3)	1.56	1.56	1.53	1.53	1.41	1.52
Total Weight of Sampled Gas (m g lbs) wet	4.80	4.81	4.70	4.71	4.33	4.67
Total Weight of Sampled Gas (m g lbs) dry	4.32	4.34	4.24	4.24	3.91	4.21
Gas Density Ps wet	0.07	0.07	0.07	0.07	0.07	0.07
Gas Density Ps dry	0.08	0.08	0.08	0.08	0.08	0.08
Condensate Volume	10.32	10.17	9.89	10.05	8.94	9.87
Nozzle Size	0.00033	0.00033	0.00033	0.00033	0.00033	0.00
Impinger Gain	200.2	203.7	196.6	195.0	175.6	194.2
Silica Gel Gain	18.6	11.9	13.1	18.2	14.0	15.2
Total Gas Sampled (vm st ft3 + condensate volume)	65.42	65.43	63.93	64.16	58.79	63.54
Particulate Results						
Nozzle/Probe/Filter Weight (mg)	22.5	23.1	19.3	21.3	22.0	21.6
lb/hr	90.3	94.3	79.5	87.1	91.2	88.5
mg/dscm (dry)	14.420	14.762	12.612	13.902	15.586	14.256
gr/dscf	0.006	0.006	0.006	0.006	0.007	0.006
lb/MMBtu @ 10033 lb/BTU	0.013	0.013	0.011	0.013	0.014	0.013
mg/acm @ 160 C	8.094	8.311	7.105	7.813	8.798	8.024
lbs/1,000 lbs Gas @ 50% EA (wet)	0.010	0.010	0.008	0.009	0.011	0.010

FIGURES

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



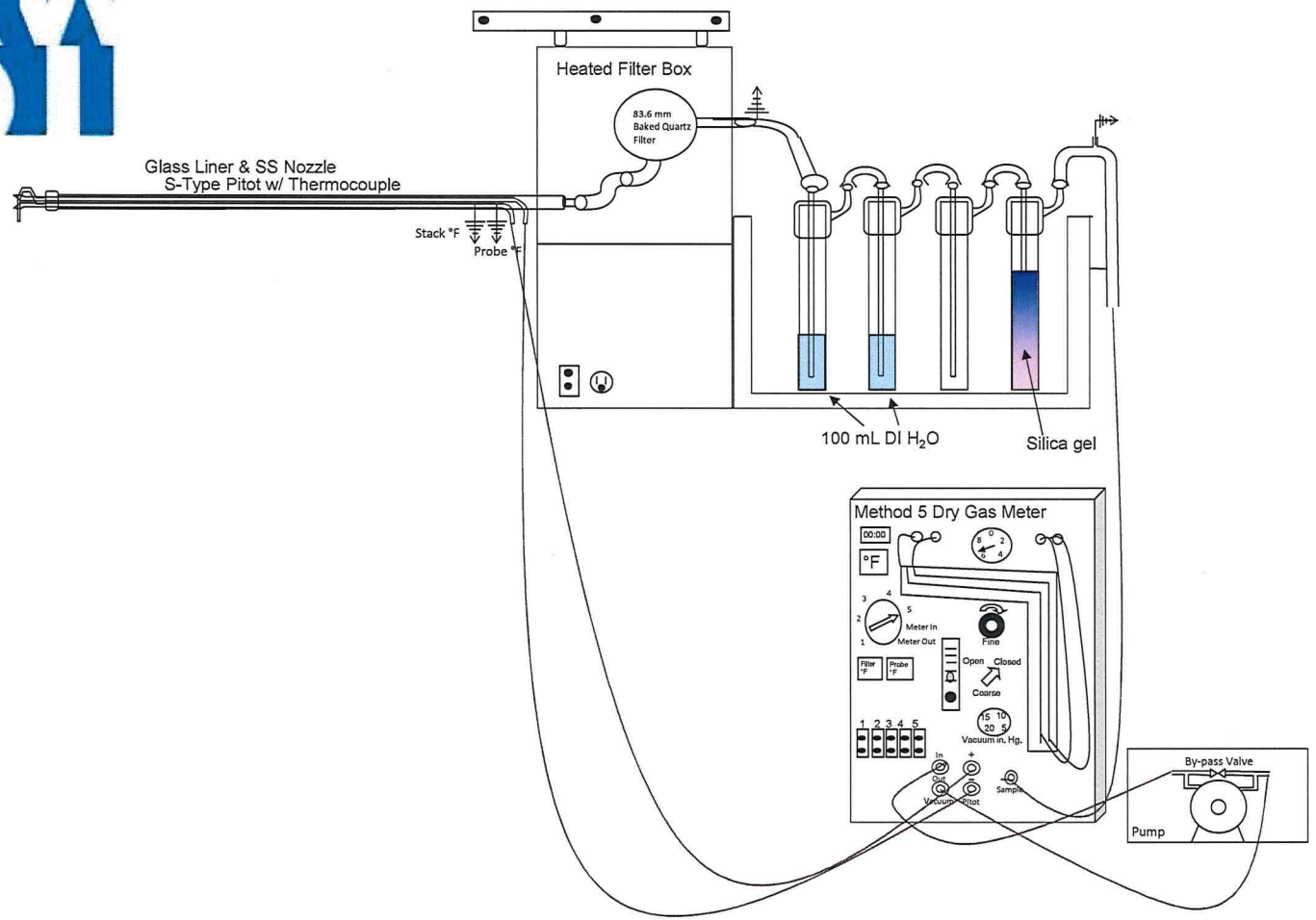
Details

"A" Dim = Upstream Distance
"A" Dim = 201.6'
"B" Dim = Downstream Distance
"B" Dim = 233.8'

Dia. @ Sample Location = 28'-0"

DTE

Figure No. 2: USEPA Method 5B Schematic



USEPA Method 5B **DTE Energy** Monroe Power Plant Monroe, Michigan	**Job Number: 2305821**	