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REPORT ON RELATIVE
RESPONSE AUDIT OF FACILITY
PM CEMS

DTE, St. Clair Power Plant
Unit 6 Stack

DTE
One Energy Plaza
Detroit, MI 48226

CleanAir Project No. 13357
STAC Certificate No. 2007.002.0113.1217
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1. PROJECT OVERVIEW

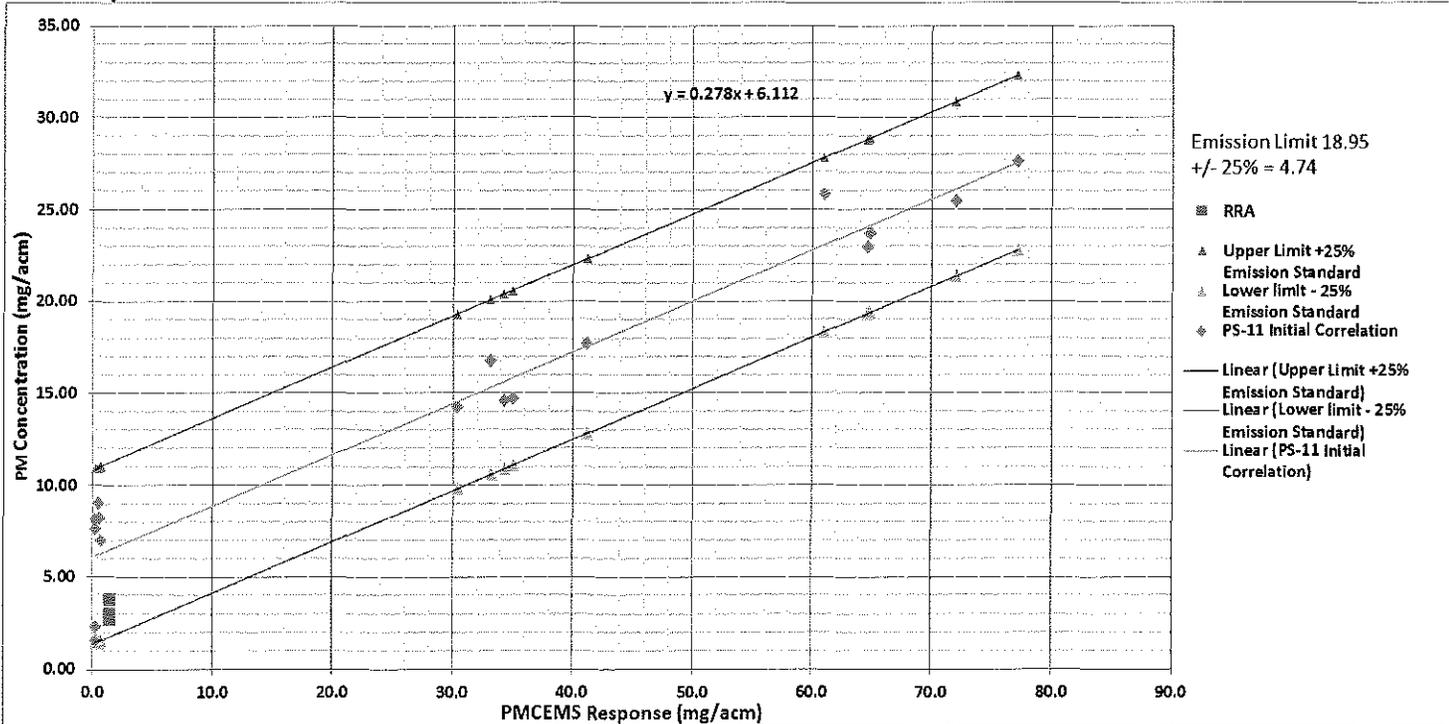
Test Program Summary

DTE contracted CleanAir Engineering (CleanAir) to successfully complete particulate testing on the Unit 6 Stack at the St. Clair Power Plant located in River Rouge, Michigan.

The objective of the test program was to perform particulate measurements that would be used to audit the facility's PM CEMS according to Procedure 2, "Quality Assurance Requirements for Particulate Matter Continuous Emission Monitoring Systems at Stationary Sources (40 CFR 60, Appendix F). The PM CEMS audit is referred to as the Relative Response Audit (RRA).

A summary of the test program results is presented below, indicating that the results of three particulate test runs fell within the applicable tolerance range of the PM CEMS correlation requirements. Section 2 Results provides a more detailed account of the test conditions and data analysis. Test program information, including the test parameters, on-site schedule and a project discussion, begin on page 2.

**Figure 1-1:
 Summary of RRA Results**



**Table 1-1:
 RRA Test Data Comparison**

Run	PM CEMS Response (mg/acm)	PM Concentration (mg/acm)	Within $\pm 25\%$ of Emission Limit Value from Correlation Regression Line (Yes or No)
4	1.5	3.0	Yes
5	1.5	2.7	Yes
6	1.5	3.8	Yes

Test Program Details

Parameters

The test program included the following emissions measurements:

- nonsulfuric acid filterable particulate matter (NSFPM)
- flue gas composition (e.g., O₂, CO₂, H₂O)
- flue gas temperature
- flue gas flow rate

Schedule

The RRA was performed on July 19, 2017. The on-site schedule followed for the RRA is outlined in Table 1-2.

**Table 1-2:
 Test Schedule**

Run Number	Location	Method	Analyte	Date	Start Time	End Time
4	U6 Stack	USEPA Method 5B	NSFPM	07/19/17	13:29	14:23
5	U6 Stack	USEPA Method 5B	NSFPM	07/19/17	14:49	15:46
6	U6 Stack	USEPA Method 5B	NSFPM	07/19/17	16:11	17:06

Note: NSFPM test run times are in Eastern Time, whereas the facility PM CEMS data is in Central Time (-1 hour).

Discussion

CleanAir conducted a test program to measure nonsulfuric acid filterable particulate matter (NSFPM) at the St. Clair Unit 6 exhaust stack. The gravimetric results of three tests were compared to the facility's PM CEMS during the same sample time frame and the Relative Response Audit (RRA) was passed according to the audit requirement criteria mentioned in Procedure 2.

Relative Response Audit (RRA)

CleanAir compared three reference method (RM) particulate measurements and recorded the simultaneous PM CEMS responses to each. The PM CEMS response for all three data points was less than the highest PM CEMS response used to develop the initial correlation curve. All three responses during the RRA were within the PM CEMS response used to develop the correlation curve, and all three of the responses were within the area defined by parallel lines ± 25 percent of the emission limit above and below the correlation line.

The three RM particulate test runs were plotted within the ± 25 percent limitations, as shown in Figure 1-1.

The facility PM CEMS Data acquisition system is in Central Time, so the corresponding RM PM test runs are in local Eastern Time (+1 hour).

The Unit 6 load was at approximately 185 Megawatts (low load) during the RRA test program.

End of Section

2. RESULTS

This section summarizes the test program results. Additional results are available in the report appendices, specifically Appendix C Parameters.

**Table 2-1:
 Unit 6 Stack - NSFPM**

Run No.		4	5	6	Average
Date (2017)		Jul 19	Jul 19	Jul 19	
Start Time (approx.)		13:29	14:49	16:11	
Stop Time (approx.)		14:23	15:46	17:06	
Process Conditions					
P ₁	Unit Load (MW)	186	185	185	185
F _c	Carbon dioxide-based F-factor (dscf/MMBtu)	1,840	1,840	1,840	1,840
Cap	Capacity factor (hours/year)	8,760	8,760	8,760	8,760
Gas Conditions					
O ₂	Oxygen (dry volume %)	10.7	10.8	10.7	10.7
CO ₂	Carbon dioxide (dry volume %)	8.8	8.8	8.8	8.8
T _s	Sample temperature (°F)	276	277	277	277
B _w	Actual water vapor in gas (% by volume)	6.4	7.0	5.5	6.3
Gas Flow Rate					
Q _a	Volumetric flow rate, actual (acfm)	1,040,000	1,050,000	1,030,000	1,040,000
Q _s	Volumetric flow rate, standard (scfm)	748,000	751,000	740,000	746,333
Q _{std}	Volumetric flow rate, dry standard (dscfm)	700,000	699,000	699,000	699,333
Sampling Data					
V _{mstd}	Volume metered, standard (dscf)	33.48	33.94	33.67	33.70
%I	Isokinetic sampling (%)	93.0	94.5	93.7	93.8
Laboratory Data					
m _{filter}	Matter collected on filter(s) (g)	0.00160	0.00204	0.00255	
m _s	Matter collected in solvent rinse(s) (g)	0.00262	0.00189	0.00276	
m _n	Total NSFPM (g)	0.00422	0.00393	0.00531	
NSFPM Results					
C _a	Particulate Concentration (mg/m ³ (actual,wet))	2.99	2.73	3.78	3.17
E _{lb/hr}	Particulate Rate (lb/hr)	11.7	10.7	14.6	12.3
E _{T/yr}	Particulate Rate (Ton/yr)	51.1	46.9	63.9	54.0
E _{Fc}	Particulate Rate - F _c -based (lb/MMBtu)	0.0058	0.0053	0.0073	0.0061

Average includes 3 runs.

3. DESCRIPTION OF INSTALLATION

Process Description

The DTE Electric Company (DTE) operates the St. Clair Power Plant located in East China Township, Michigan. The station consists of a total of six coal-fired units identified as Unit 1, 2, 3, 4, 6 and 7. The RRA testing outlined in this report was performed on the Unit 6 stack.

Unit 6 is a tangentially-fired Combustion Engineering dual-furnace boiler that burns Western sub-bituminous coal. The unit has a nominal rating of 321 Megawatts and is equipped with low NOx burners, over fire air (OFA), and an electrostatic precipitator for particulate removal.

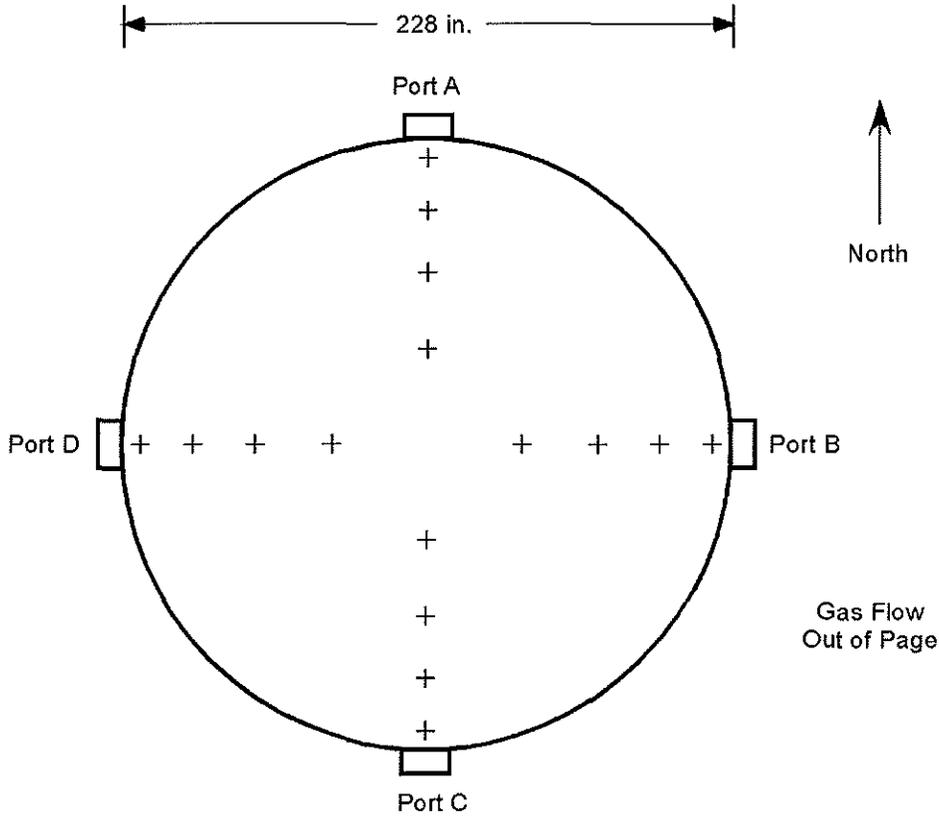
Test Location

EPA Method 1 specifications determined the sample point locations. Table 3-1 presents the sampling information for the test location. The figure shown on page 6 represents the layout of the test location.

**Table 3-1:
 Sampling Information**

<u>Source</u> Constituent	Method	Run No.	Ports	Points per Port	Minutes per Point	Total Minutes	Figure
Unit 6 Stack NSFPM	EPA M5B	All	4	4	3	48	3-2

**Figure 3-1:
 Unit 6 Stack Sample Point Layout (EPA Method 1)**



Sampling Point	% of Stack Diameter	Port to Point Distance (inches)
1	32.3	73.6
2	19.4	44.2
3	10.5	23.9
4	3.2	7.3

Duct diameters upstream from flow disturbance (A): > 2.0 Limit: 0.5
 Duct diameters downstream from flow disturbance (B): > 8.0 Limit: 2.0

End of Section

4. METHODOLOGY

Procedures and Regulations

The test program sampling measurements followed procedures and regulations outlined by the USEPA and State Agency Name. These methods appear in detail in Title 40 of the CFR and at <https://www.epa.gov/emc>. Appendix A includes diagrams of the sampling apparatus, as well as specifications for sampling, recovery and analytical procedures.

CleanAir follows specific QA/QC procedures outlined in the individual methods and in USEPA "Quality Assurance Handbook for Air Pollution Measurement Systems: Volume III Stationary Source-Specific Methods," EPA/600/R-94/038C. Appendix D contains additional QA/QC measures, as outlined in CleanAir's internal Quality Manual.

Title 40 CFR Part 60, Appendix A

- Method 1 "Sample and Velocity Traverses for Stationary Sources"
- Method 2 "Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S Pitot Tube)"
- Method 3A "Determination of Oxygen and Carbon Dioxide Concentrations in Emissions from Stationary Sources (Instrumental Analyzer Procedure)"
- Method 4 "Determination of Moisture Content in Stack Gases"
- Method 5B "Determination of Nonsulfuric Acid Particulate Matter Emissions from Stationary Sources"

Title 40 CFR Part 60, Appendix B Performance Specifications

- PS11 "Specifications and Test Procedures for Particulate Matter Continuous Emission Monitoring Systems at Stationary Sources"

Title 40 CFR Part 60, Appendix F Procedure 2

- Procedure 2 "Quality Assurance Requirements for Particulate Matter Continuous Emission Monitoring Systems at Stationary Sources"

Methodology Discussion

Average Gas Molecular Weight, Moisture and Flow Rate – USEPA Methods 1-4
EPA Methods 1, 2, 3 and 4 of 40 CFR 60, Appendix A, were used to measure the average flue gas composition and volumetric flow rate. These methods determine several characteristics of the flue gas stream: velocity, moisture, flow rate, and the concentrations of oxygen (O₂) and carbon dioxide (CO₂).

Nonsulfuric Acid Filterable Particulate Matter – USEPA Method 5B

EPA Method 5B, "Determination of Nonsulfuric Acid Particulate Matter Emissions from Stationary Sources", was utilized for the nonsulfuric filterable particulate matter (NSFPM) measurements. This method is contained in Appendix A of 40 CFR 60.

Particulate matter was withdrawn isokinetically from the source and collected on a quartz fiber filter maintained at a temperature of 160°C ± 14°C (320°F ± 25°F). The collected sample was then heated in an oven at 160°C

(320°F) for six hours to volatilize any condensed sulfuric acid that may have been collected, and the non-sulfuric acid particulate mass was determined gravimetrically.

A minimum of 30 dry standard cubic feet of sample gas was collected over a 48-minute test period for each run. Flue gas volumetric flow rate, moisture concentration and flue gas molecular weight are incorporated in this sample method.

End of Section