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**AIR QUALITY DIV.**



REPORT ON TOTAL  
PARTICULATE TESTING

EES Coke Battery, LLC  
Pushing Emissions Control System Stack

DTE Energy  
P.O. Box 18309  
River Rouge, Michigan 48218  
Client Reference No. 4701012851

CleanAir Project No. 13094  
STAC Certificate No. 2007.002.0113.1217  
Revision 0, Final Report  
November 17, 2016



**RENEWABLE OPERATING PERMIT  
REPORT CERTIFICATION**

**AIR QUALITY DIV.**

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 (RO) Permit 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 described in General Condition No. 22 in the RO Permit and be made available to the Department of Environmental Quality, Air Quality Division upon request.

Source Name EES Coke Battery LLC County Wayne  
Source Address PO Box 18309, Zug Island City River Rouge  
AQD Source ID (SRN) A7809 RO Permit No. 199600132,51-08C RO Permit Section No. 7

Please check the appropriate box(es):

**Annual Compliance Certification (General Condition No. 28 and No. 29 of the RO Permit)**

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 RO Permit, 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 RO Permit.

2. During the entire reporting period this source was in compliance with all terms and conditions contained in the RO Permit, 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 RO Permit, unless otherwise indicated and described on the enclosed deviation report(s).

**Semi-Annual (or More Frequent) Report Certification (General Condition No. 23 of the RO Permit)**

Reporting period (provide inclusive dates): From \_\_\_\_\_ To \_\_\_\_\_

1. During the entire reporting period, **ALL** monitoring and associated recordkeeping requirements in the RO Permit 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 RO Permit 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 N/A To N/A

Additional monitoring reports or other applicable documents required by the RO Permit are attached as described:  
Test Report at EUCKE-BATTERY PECS Baghouse Stack performed September 20-22, 2016

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

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.

<u>M Krchmar</u>	<u>Plant Manager</u>	<u>313-216-2535</u>
Name of Responsible Official (print or type)	Title	Phone Number
		<u>11/18/16</u>
Signature of Responsible Official		Date

## AIR QUALITY DIV.

## 1. PROJECT OVERVIEW

## Test Program Summary

CleanAir Engineering (CleanAir) was contracted by DTE Energy to successfully complete the following project objectives at the Zug Island EES Coke Battery, LLC facility located in River Rouge, Michigan. The testing was performed at the Pushing Emissions Control System (PECS) Stack on September 20-22, 2016.

- Perform total particulate and CEMS testing in order to demonstrate compliance with Permit to Install 51-08C.
- Conduct all sampling measurements in accordance with the regulations set-forth by the USEPA and the Michigan Department of Environmental Quality (DEQ). The methods used and their respective sources are outlined in Section 4 of the test report.
- Provide DTE Energy with the highest quality engineering services, data and results.

The test program results are summarized below. Section 2 of the test report contains a more detailed presentation of the test conditions and results of analysis. Details regarding the test program, including the test parameters, on-site schedule and a project discussion, begin on page 2.

**Table 1-1:  
Summary of Results**

Source Constituent	Sampling Method	Average Emission	Permit Limit <sup>1</sup>
<i>PECS Stack</i>			
PM (lb/Ton Coke)	EPA M5	0.004	0.02
PM (ton/yr)	EPA M5	1.1	9.7
PM <sub>10</sub> (lb/hr) <sup>2</sup>	EPA M5/202	0.43	0.69
PM <sub>2.5</sub> (lb/hr) <sup>2</sup>	EPA M5/202	0.43	0.69
Oxides of Nitrogen (lb/hr) <sup>2</sup>	EPAM7E	2.26	2.61

<sup>1</sup> Permit limits obtained from Michigan Permit to Install number: MI-PTI-51-08C.

<sup>2</sup> The source does not emit continuously; (lb/hr) values are operating hour of the PECS exhaust fan.

## Test Program Details

### Parameters

The test program included the following emissions measurements:

- filterable particulate matter (FPM)
- condensable particulate matter (CPM)
- nitrogen oxide (NO<sub>x</sub>)
- flue gas composition (e.g., O<sub>2</sub>, CO<sub>2</sub>, H<sub>2</sub>O)
- flue gas temperature
- flue gas flow rate

### Schedule

The on-site schedule followed during the test program is outlined in Table 1-2.

**Table 1-2:  
 Test Schedule**

Run Number	Location	Method	Analyte	Date	Start Time	End Time
1	PECS Stack	USEPA Method 5/202	FPM/CPM	09/20/16	08:59	16:19
2	PECS Stack	USEPA Method 5/202	FPM/CPM	09/21/16	08:01	16:37
3	PECS Stack	USEPA Method 5/202	FPM/CPM	09/22/16	07:42	15:02
1	PECS Stack	USEPA Method 7E	NO <sub>x</sub>	09/20/16	08:46	16:33
2	PECS Stack	USEPA Method 7E	NO <sub>x</sub>	09/21/16	08:14	16:45
3	PECS Stack	USEPA Method 7E	NO <sub>x</sub>	09/22/16	08:14	14:47

10 18 16 09 16 07

## Discussion

### *Project Synopsis*

#### *Method 5/202*

Due to the intermittent nature of the process, it took approximately 7.5-8.5 hours to complete one test run. A push would occur approximately every 15-20 minutes and during each push, roughly three minutes of sample was collected during fan operation. Twelve total points were sampled isokinetically. Each point was sampled for six minutes. The test program was completed over the span of three test days with each day completing one test run.

#### *CEMS – Methods 3A & 7E*

CEMS measurements for O<sub>2</sub>, CO<sub>2</sub> and NO<sub>x</sub> were measured continuously and 15 second averages were recorded throughout each test. Data was parsed to remove ambient readings from the average concentrations similar to previous projects.

### *Emission Calculation Explanation*

The approach to the emission calculations was adjusted due to the intermittent nature of the facility process operation. Each test run consisted of 72 minutes of sampling time. However, it required between 440-516 minutes to obtain each sample since sampling could only occur while the PECS exhaust fan was operating. A ratio of the metered sample time to elapsed test time was applied to the emission rate values to ensure representative results based on the process operations.

### *Modifications to Test Methodology*

Due to the extended nature of the test runs, CleanAir proposed performing a mid-test bias calibration of the CEMS system. This was attempted to occur only during non-push periods and all attempts were made to avoid missing peaks during each push.

Prior to the project, Josh Childers (CleanAir) and Thomas Maza (MDEQ) exchanged emails regarding the bias/drift check procedures. In an e-mail dated Friday, September 9, 2016, Thomas Maza provided the following in regards to the proposed procedures:

*"The proposal to check the calibration of the analyzers mid run, during non-push periods is appropriate. To simplify calculations, the data may be corrected using the initial and final drift/bias checks, provided that all intermediate checks are within the acceptable range. (i.e. if the run is 6 hours long and drift bias checks were done every hour and all are acceptable you may use the 1<sup>st</sup> and last calibration checks to correct all pushing data.)"*

CleanAir followed Thomas Maza's instruction and used only the initial and final drift/bias results to correct each test run. Intermediate checks are included in Appendix G.

### *Analysis of CEMS Data*

CEMS data was parsed to remove all ambient readings from the test run average. All raw data can be found in Appendix G of this test report. The oxygen and carbon dioxide measurements were analyzed together in regards to parsing while NO<sub>x</sub> was treated separately due to the longer resonance time of NO<sub>x</sub> concentrations. Measurable NO<sub>x</sub> concentrations were recorded approximately five times longer than O<sub>2</sub>/CO<sub>2</sub> values. The specific sample time for NO<sub>x</sub> was reviewed for each test when determining run time versus clock time.

### *NO<sub>x</sub> Calibration Gas Certification*

The mid-level NO<sub>x</sub> calibration gas (cylinder ID CC406433, 25.51 ppm concentration) used for the CEMS testing has an expired certificate of analysis (September 2015). The manufacturer label on the tank was incorrectly labeled as having an expiration date of September 2020. Table 2-3 in the "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards" lists nitric oxide gases with a concentration range of 0.5-50 ppm as having a certification period of three years. The label found on the tank mistakenly certifies the gas for eight years. The calibration gas certificates, including the certificate for the expired gas, are located in Appendix D.

The expired NO<sub>x</sub> gas was used during all system calibration checks (mid level gas for the calibration error, system bias and drift). All the system calibration checks performed in the field were within the applicable span value limits; 2% limit for analyzer calibration error, 5% limit for system bias and 3% limit for drift assessment. The calibration error checks performed at the beginning of each test day are located in Appendix D. System bias and drift checks are provided in Appendix G. In addition, the NO<sub>2</sub>-NO conversion efficiency check passed (96.6%). Those results are available in Appendix D.

CleanAir does not believe that the mislabeled expiration date of the gas cylinder adversely impacts the results of the CEMS testing. Plans to have the calibration gas re-certified are underway. No significant impact to the results is expected. A revision to the test report will be issued once the re-certification is complete.

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*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:  
 PECS Stack – FPM/CPM**

Run No.		1	2	3	Average
Date (2016)		Sep 20	Sep 21	Sep 22	
Start Time (approx.)		08:59	08:01	07:42	
Stop Time (approx.)		16:19	16:37	15:02	
<b>Process Conditions</b>					
R <sub>P</sub>	Production rate (ton/hr)	69	68	69	69
P <sub>1</sub>	Oven number	60	40	20	
P <sub>2</sub>	Elapsed push time (minutes)	440	516	440	465
P <sub>3</sub>	Amount of coke pushed (tons)	505	587	505	532
Cap	Capacity factor (hours/year)	8,760	8,760	8,760	8,760
<b>Gas Conditions</b>					
O <sub>2</sub>	Oxygen (dry volume %)	20.4	20.2	20.4	20.3
CO <sub>2</sub>	Carbon dioxide (dry volume %)	0.7	0.7	0.7	0.7
T <sub>s</sub>	Sample temperature (°F)	135	135	139	136
B <sub>w</sub>	Actual water vapor in gas (% by volume)	2.7	2.8	2.8	2.7
<b>Gas Flow Rate</b>					
Q <sub>a</sub>	Volumetric flow rate, actual (acfm)	190,000	188,000	185,000	187,000
Q <sub>s</sub>	Volumetric flow rate, standard (scfm)	166,000	164,000	160,000	163,000
Q <sub>std</sub>	Volumetric flow rate, dry standard (dscfm)	161,000	159,000	155,000	159,000
<b>FPM Results (Method 5) = PM</b>					
C <sub>std</sub>	Particulate Concentration (lb/dscf)	1.78E-07	1.53E-07	1.61E-07	1.64E-07
C <sub>std</sub>	Particulate Concentration (gr/dscf)	1.25E-03	1.07E-03	1.12E-03	1.15E-03
E <sub>lb/hr</sub>	Particulate Rate (lb/hr)*	0.283	0.204	0.245	0.244
E <sub>T/yr</sub>	Particulate Rate (Ton/yr)	1.24	0.895	1.07	1.07
E <sub>Rp</sub>	Particulate Rate - Production-based (lb/ton)	4.11E-03	2.99E-03	3.56E-03	3.55E-03
<b>CPM Results (Method 202)</b>					
C <sub>std</sub>	Particulate Concentration (lb/dscf)	1.22E-07	1.38E-07	1.10E-07	1.23E-07
C <sub>std</sub>	Particulate Concentration (gr/dscf)	8.53E-04	9.62E-04	7.73E-04	8.63E-04
E <sub>lb/hr</sub>	Particulate Rate (lb/hr)*	0.193	0.183	0.168	0.182
E <sub>T/yr</sub>	Particulate Rate (Ton/yr)	0.846	0.803	0.738	0.796
E <sub>Rp</sub>	Particulate Rate - Production-based (lb/ton)	2.81E-03	2.69E-03	2.45E-03	2.65E-03
<b>Total Particulate Matter Results (Method 5/202) = PM<sub>10</sub> = PM<sub>2.5</sub></b>					
C <sub>std</sub>	Particulate Concentration (lb/dscf)	3.00E-07	2.91E-07	2.71E-07	2.87E-07
C <sub>std</sub>	Particulate Concentration (gr/dscf)	2.10E-03	2.03E-03	1.90E-03	2.01E-03
E <sub>lb/hr</sub>	Particulate Rate (lb/hr)*	0.476	0.388	0.413	0.426
E <sub>T/yr</sub>	Particulate Rate (Ton/yr)	2.08	1.70	1.81	1.86
E <sub>Rp</sub>	Particulate Rate - Production-based (lb/ton)	6.91E-03	5.68E-03	6.01E-03	6.20E-03

Average includes 3 runs.

\* O<sub>2</sub>/CO<sub>2</sub> values obtained from CEMS data.

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**Table 2-2:  
 PECS Stack – NOx**

Run No.	1	2	3	Average
Date (2016)	Sep 20	Sep 21	Sep 22	
Start Time	8:46	8:14	8:14	
End Time	16:33	16:45	14:47	
<b>Process Conditions<sup>1</sup></b>				
Oxygen (O <sub>2</sub> ) - PECS Stack (%dv)	20.4	20.2	20.4	<b>20.3</b>
Carbon Dioxide (CO <sub>2</sub> ) - PECS Stack (%dv)	0.69	0.72	0.67	<b>0.69</b>
H <sub>2</sub> O - PECS Stack (%)	2.66	2.77	2.77	<b>2.73</b>
Actual Gas Flow Rate - PECS Stack (acfm)	190,000	188,000	185,000	<b>187,000</b>
Standard Gas Flow Rate - PECS Stack (scfm)	166,000	164,000	160,000	<b>163,000</b>
Dry Standard Gas Flow Rate - PECS Stack (dscfm)	161,000	159,000	155,000	<b>159,000</b>
<b>Nitrogen Oxides (NOx) - PECS Stack</b>				
Concentration (ppmdv)	2.74	3.02	3.02	<b>2.93</b>
Mass Rate (lb/hr)	2.19	2.32	2.27	<b>2.26</b>

Note: Average includes 3 runs.

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<sup>1</sup> Flow and moisture data obtained from USEPA Method 5/202 testing.

*End of Section*



### 3. *DESCRIPTION OF INSTALLATION*

#### Process Description

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EES Coke Battery, LLC is a DTE Energy Service facility located on Zug Island in River Rouge, Michigan. The testing described in this document was performed at the pushing emissions control system (PECS) stack location. The process includes the PECS baghouse, Pushing Stack (PECS Stack) and a Combustion Stack.

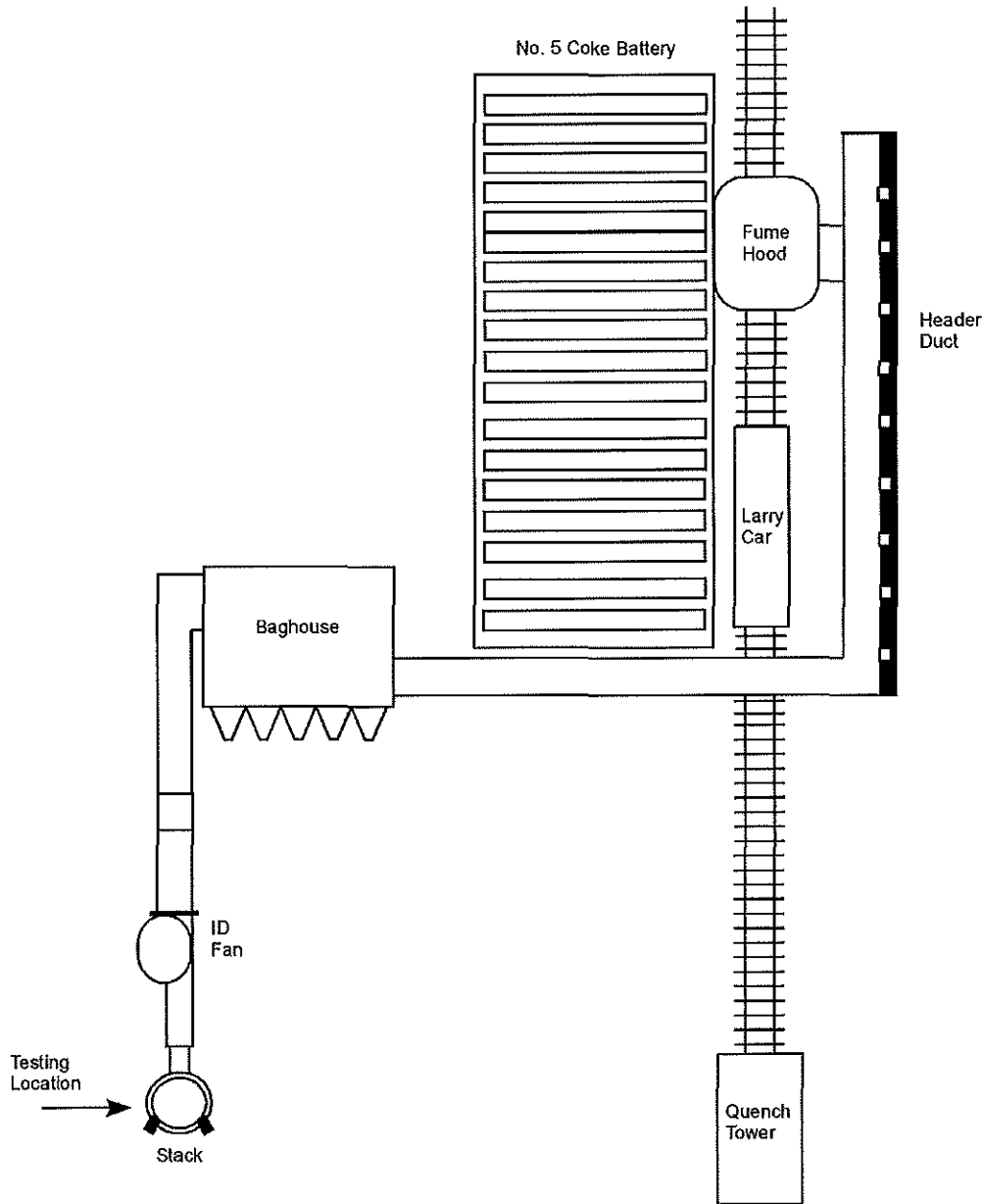
The No. 5 Coke Battery consists of 85 six-meter high ovens producing furnace coke. A coal blend is used to charge each oven on timed intervals depending on the current production of the battery. Coking of the coal occurs in an oxygen free environment typically for 17 to 30 hours and the gases produced are collected, cleaned, and used to under fire the battery, supply fuel for other site sources, and sold to permitted off-site utilities.

The current permit limits allow for the charging of up to 1.420 million dry tons of coal. The design capacity heating requirement of the battery is approximately 375 MMBtu per hour. Also, the heating requirements of the battery at the current production rate are approximately 325 MMBtu per hour.

Process source description information above was taken directly from written information provided by DTE Energy.

The testing reported in this document was performed at the Combustion Stack. A schematic of the process, indicating sampling locations, is shown in Figure 3-1.

**Figure 3-1:  
Process Schematic**



## Test Location

Sample point locations were determined according to EPA Method 1. Test location sampling information is presented in Table 3-1. The test location layout is represented by the figures shown on pages 10 and 11.

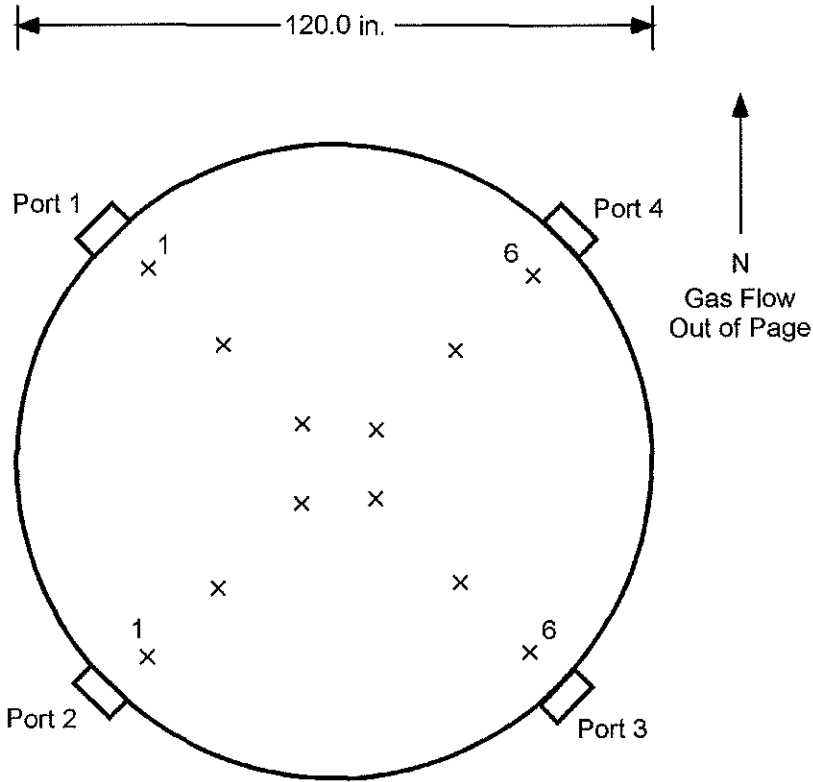
**Table 3-1:  
 Sampling Information**

Source	Constituent	Method	Run No.	Ports	Points per Port <sup>1</sup>	Minutes per Point	Total Minutes <sup>2</sup>	Figure
<i>PECS Stack</i>								
	FPM/CPM	EPA M5/202	1-3	2	6	6	72	3-2
	NO <sub>x</sub>	EPA 7E	1-3	1	1	ALL	Varied	3-2

<sup>1</sup>NO<sub>x</sub> measurements performed at a single point after a stratification check, per Thomas Maza. 102416 140603

<sup>2</sup>CEMS test runs contained no less than 60 minutes of data.

**Figure 3-2:  
 PECS Stack – Sample Point Layout (EPA Method 1)**

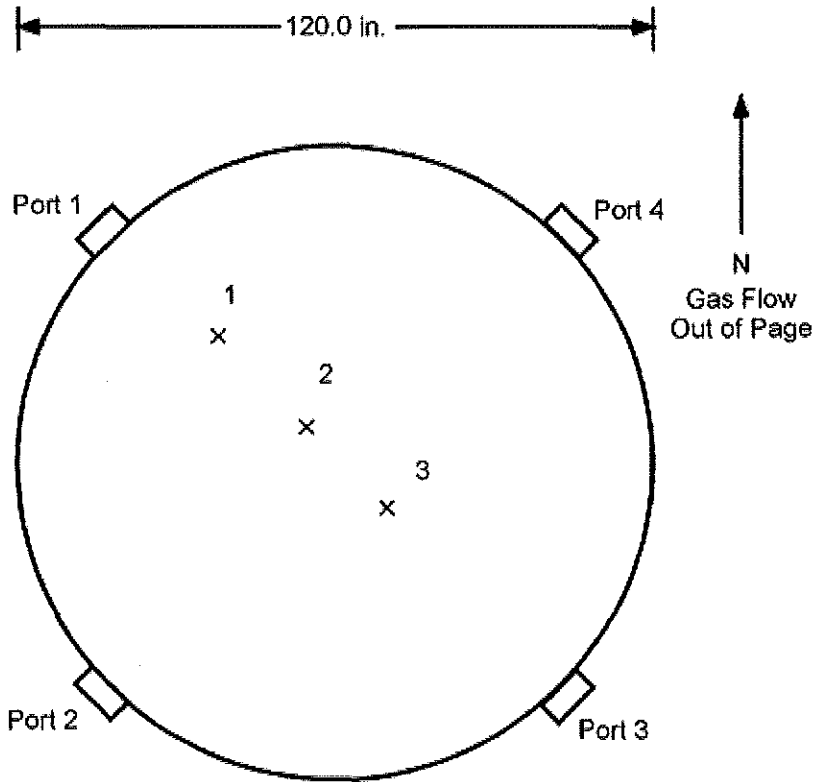


Sampling Point	% of Stack Diameter	Port to Point Distance (inches)
1	95.6	114.7
2	85.4	102.5
3	70.4	84.5
4	29.6	35.5
5	14.6	17.5
6	4.4	5.3

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

Limit: 0.5  
 Limit: 2.0

**Figure 3-3:  
 PECS Stack – Sample Point Layout (EPA Method 7E)**



Sampling Point	Method 7E Long Line Distance (m)	Port to Point Distance (inches)
1	0.4	15.7
2	1.0	39.4
3	2.0	78.7

Duct diameters upstream from flow disturbance (A): 2.0

Limit: 0.5

Duct diameters downstream from flow disturbance (B): 8.0

Limit: 2.0

\*Note: After review of stratification check data, Thomas Maza (MDEQ) approved single-point testing. Testing was performed at Point 2.

*End of Section*

## 4. METHODOLOGY

The test program followed procedures referenced in the methodology listed below. These methods appear in detail in Title 40 of the CFR and on the internet at <https://www.epa.gov/emc>. Diagrams of the sampling apparatus and specifications for sampling, recovery and analytical procedures are summarized in Appendix A.

CleanAir also followed 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. Additional QA/QC measures found in CleanAir's internal Quality Manual were also followed and are summarized in Appendix D.

### Title 40 CFR Part 60, Appendix A

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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 5	"Determination of Particulate Matter Emissions from Stationary Sources"
Method 7E	"Determination of Nitrogen Oxide Emissions from Stationary Sources (Instrumental Analyzer Procedure)"

### Title 40 CFR Part 51, Appendix M

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Method 202	"Dry Impinger Method for Determining Condensable Particulate Emissions from Stationary Sources"
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*End of Section*