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**COMPLIANCE TEST REPORT**

for

**OXIDES OF NITROGEN (NO<sub>x</sub>) & CARBON MONOXIDE  
EMISSIONS (CO)**

**UNITS 11-1 & 12-1**

**Delray Power Plant (B2798)  
Detroit, Michigan**

**September 25 & October 30, 2014**

Prepared By  
Environmental Management & Resources  
Environmental Field Services Group  
DTE Corporate Services, LLC  
7940 Livernois H-136  
Detroit, MI 48210

**DTE Energy®**





MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY  
AIR QUALITY DIVISION

RENEWABLE OPERATING PERMIT  
REPORT CERTIFICATION

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 DTE Electric Delray Power Plant County Wayne  
Source Address 6603 West Jefferson City Detroit  
AQD Source ID (SRN) B2798 RO Permit No. MI-ROP-B2798-2011 RO Permit Section No. \_\_\_\_\_

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 November 2009 To Present (November 2014)

Additional monitoring reports or other applicable documents required by the RO Permit are attached as described:

Stack Testing for NOx and CO on Combustion Turbine Generator Peaker Units 11-1 and 12-1.

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.

Nader Rajabian  
Name of Responsible Official (print or type)

Plant Manager - Peakers  
Title

313-897-1065  
Phone Number

N. Rajabian  
Signature of Responsible Official

12/4/2014  
Date



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**EXECUTIVE SUMMARY**

DTE Energy's Environmental Management and Resources (EMR) Field Services Group performed emissions testing at the Detroit Edison, Delray Power Plant, located in Detroit, Michigan. The fieldwork, performed on September 25 & October 30, 2014, was conducted to satisfy requirements of Michigan Renewable Operating Permit No. B2798-2011. Emissions tests were performed on two natural gas-fired peaker turbines (CTG's) (11-1 & 12-1) for oxides of nitrogen (NO<sub>x</sub>) and carbon monoxide (CO).

The results of the emissions testing are highlighted below:

**Emissions Testing Summary  
Delray CTG's 11-1 and 12-1  
September 25 & October 30, 2014**

Unit <sup>1</sup>	Parameter <sup>2</sup>	High Load	Mid-High Load	Mid-Low Load	Low Load
11-1 (9/25/14)	NO <sub>x</sub> (ppm @ 15% O <sub>2</sub> )	12.89	13.03	13.14	13.24
	CO (lbs/hr)	28.16	23.67		
12-1 (10/30/14)	NO <sub>x</sub> (ppm @ 15% O <sub>2</sub> )	14.28	14.21	14.33	14.69
	CO (lbs/hr)	25.45	23.79		

- (1) Permit Limits: NO<sub>x</sub> – 15 ppm @ 15% O<sub>2</sub>  
CO – 64 lbs/hr
- (2) Concentrations corrected according to USEPA Method 7E



## **1.0 INTRODUCTION**

DTE Energy's Environmental Management and Resources (EMR) Field Services Group performed emissions testing at the Detroit Edison, Delray Power Plant, located in Detroit, Michigan. The fieldwork, performed on September 25 & October 30, 2014, was conducted to satisfy requirements of Michigan Renewable Operating Permit No. B2798-2011. Emissions tests were performed on two natural gas-fired peaker turbines (CTG's) (11-1 & 12-1) for oxides of nitrogen (NO<sub>x</sub>) and carbon monoxide (CO).

Testing was performed pursuant to Title 40, *Code of Federal Regulations*, Part 60, Appendix A (40 CFR §60 App. A), Methods 3A, 7E, 10, 19 and 20.

The fieldwork was performed in accordance with EPA Reference Methods and EMR's Intent to Test<sup>1</sup>, Test Plan Submittal, which was approved by the Michigan Department of Environmental Quality (MDEQ) on September 5, 2014<sup>2</sup>. The following Detroit Energy EMR personnel participated in the testing program: Mr. Mark Grigereit, Senior Specialist-Environmental, Mr. Thomas Snyder, and Mr. Fred Meinecke, Senior Environmental Technicians. Mr. Grigereit was the project leader. Mr. Rahn Ledesma, with DTE Energy provided process coordination for the testing program. Mr. Mark Dziadosz with the Air Quality Division of the Michigan Department of Environmental Quality (MDEQ) reviewed the Test Plan and observed the testing.

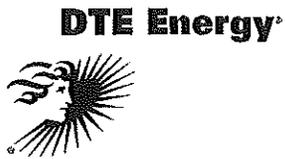
## **2.0 SOURCE DESCRIPTION**

The Detroit Edison, Delray Power Plant (Delray) located at 6603 West Jefferson Road in Detroit, Michigan, employs the use of two General Electric combustion turbines nominally rated at 80 megawatts (MW) (dependent upon ambient conditions). Flue gases from each unit exhaust through a separate rectangular stack (108" x 228") that has an exit height of 56.0 feet above ground level. See Figure 1 for a diagram of the units' sampling locations and stack dimensions.

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<sup>1</sup> MDEQ, Test Plan, Submitted August 11, 2014. (Attached-Appendix A)

<sup>2</sup> MDEQ, Approval Letter, Approved September 5, 2014(Attached-Appendix A)



### 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 Method 3A	Oxygen & CO <sub>2</sub>	Instrumental Analyzer Method
USEPA Method 7E	Oxides of Nitrogen	Chemiluminescent Instrumental Analyzer Method
USEPA Method 10	Carbon Monoxide	NDIR Instrumental Analyzer Method
USEPA Method 19	Exhaust Gas Flow rates	Stoichiometric Calculations
USEPA Method 20	Oxides of Nitrogen	Ref. Method 7E

#### 3.1 OXYGEN, OXIDES OF NITROGEN AND CARBON MONOXIDE (USEPA METHODS 3A, 7E, 10)

##### 3.1.1 Sampling Method

Oxygen (O<sub>2</sub>) emissions were evaluated using USEPA Method 3A, "Gas Analysis for Carbon Dioxide, Oxygen, Excess Air, and Dry Molecular Weight (Instrumental Analyzer Method)". The O<sub>2</sub> analyzer utilizes a paramagnetic sensor. Oxides of nitrogen (NO<sub>x</sub>) emissions were evaluated using USEPA Method 7E, "Determination of Oxides of Nitrogen Emissions from Stationary Sources". The NO<sub>x</sub> analyzer utilizes a Chemiluminescent detector. Carbon monoxide (CO) emissions were evaluated using USEPA Method 10, "Determination of Carbon Monoxide Emissions from Stationary Sources". The CO analyzer utilizes a NDIR detector.

The EPA Methods 3A, 7E, and 10 sampling system (Figure 2) consisted of the following:



- (1) Stainless Steel sampling probe (traversed across 12 points of each stack)
- (2) Heated Teflon™ sampling line
- (3) MAK® gas conditioner with particulate filter
- (4) Flexible unheated Teflon™ sampling line
- (5) Servomex 1400 O<sub>2</sub> gas analyzer, TECO 42i Chemiluminescent NO/NO<sub>x</sub> gas analyzer, and TECO 48i NDIR CO gas analyzer
- (6) Appropriate USEPA Protocol 1 calibration gases
- (7) IOtech® Data Acquisition System.

Oxides of Nitrogen and Carbon Monoxide emissions testing were performed according to Method 20, and Sub-Part GG. Testing at each of four loads (equally spaced between maximum load and minimum load) was performed. Each load was tested in triplicate with a run consisting of sampling for 1-minute plus response time at each of 12 points. Each test was 25 minutes. The probe was moved to each point with sufficient time to allow for sampling system response according to the guidelines of Sub-Part GG. Oxygen concentrations were also measured during the sampling.

### 3.1.2 Quality Control and Assurance

All sampling and analytical equipment were calibrated according to the guidelines referenced in Methods 7E and 10. Calibration gases were EPA Protocol 1 gases and the concentrations were within the acceptable ranges (40-60% mid range and span) specified in Method 7E. Calibration gas certification sheets are located in Appendix C.

Zero, span, and mid-range calibration gases were introduced directly into the analyzer to determine the instruments linearity. A zero and mid range span gas for each pollutant was then introduced through the entire sampling system to determine sampling system bias for each analyzer at the completion of each test.

DTE performed NO<sub>x</sub> converter efficiency testing by directly challenging the NO<sub>x</sub> analyzer with a nitrogen dioxide (NO<sub>2</sub>) calibration gas of 25.49 ppm. Results from the converter efficiency test demonstrated that the analyzer met the requirements of Method 7E (Eq-1).

$$\text{Eq. 1} \quad \text{Eff}_{NO_2} = \frac{C_{Dir}}{C_v} = \frac{23.6}{25.49} = 92.6\%$$



### 3.1.3 Data Reduction

Data was recorded at 10-second intervals and averaged in 1-minute increments. The NO<sub>x</sub> and CO emissions were reported in parts per million corrected to 15% oxygen (ppm @ 15% O<sub>2</sub>). The 1-minute readings collected can be found in Appendix B.

## 4.0 OPERATING PARAMETERS

The test program included the collection of turbine operating data during each test run. Parameters recorded included fuel flowrate (pounds per second), power generation (MW), inlet guide vane angle (%), compressor discharge temperature (°F), compressor discharge pressure (psi), and exhaust temperature (°F).

Natural gas samples were collected once during the testing of each unit and analyzed for heat content and percent sulfur.

Operational data is located in Appendix F and results of the fuel analysis are located in Appendix D.

## 5.0 DISCUSSION OF RESULTS

### Unit 11-1:

Table No. 1 presents the NO<sub>x</sub> and CO emissions testing results and operational data for CTG 11-1 at 4 loads (72.7MW, 68.5MW, 65MW, and 62MW). NO<sub>x</sub> emissions are presented as ppm (parts per million) at 15% Oxygen. Carbon Monoxide emissions are presented as pounds per hour (lbs/hr). CTG 11-1 has a permit limit for NO<sub>x</sub> of 15 ppm, and a Permit Limit for CO of 64 lbs/hr. The average NO<sub>x</sub> emissions were 12.89 ppm (72.7MW), 13.03 ppm (68.5MW), 13.14 ppm (65MW), and 13.24 ppm (62MW). These values were all below the permit limit of 15 ppm. The average CO emissions were 28.16 lbs/hr (72.7MW), and 23.67 lbs/hr (68.5MW). These values were below the permit limit of 64 lbs/hr.

### Unit 12-1:

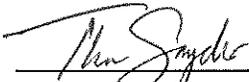
Table No. 2 presents the NO<sub>x</sub> and CO emissions testing results and operational data for CTG 12-1 at 4 loads (66.6MW, 64MW, 62MW, and 60MW). NO<sub>x</sub> emissions are presented as ppm (parts per million) at 15% Oxygen. Carbon Monoxide emissions are presented as pounds per hour (lbs/hr). CTG 12-1 has a permit limit for NO<sub>x</sub> of 15 ppm, and a Permit Limit for CO of 64 lbs/hr. The average NO<sub>x</sub> emissions were 14.28 ppm (66.6MW), 14.21 ppm (64MW), 14.33 ppm (62MW), and 14.69 ppm (60MW). These values were all below the permit limit of 15 ppm. The average CO emissions were 25.45 lbs/hr (66.6MW), and 23.79 lbs/hr (64MW). These values were below the permit limit of 64 lbs/hr.

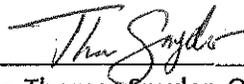


The Results of the testing indicate that Units 11-1 & 12-1 are in compliance with Michigan ROP #B2798-2011 for NO<sub>x</sub> and CO across all operating ranges tested.

**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."

  
\_\_\_\_\_  
Thomas Snyder, QSTI

This report prepared by:   
\_\_\_\_\_  
Mr. Thomas Snyder, QSTI  
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Field Services Group  
Environmental Management and Resources  
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This report reviewed by:   
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**TABLE NO. 1**  
**NOx & CO EMISSIONS TESTING RESULTS**  
 Delray Power Plant - CTG 11-1  
 October 30, 2014

High Load Test #	Test Date	Test Time	Unit Load (GMW)	Stack Temperature (°F)	Fuel Flow (lb/sec)	Inlet Guide Vane Angle	Compressor Discharge Temperature	Compressor Discharge Pressure	Heat Input (MMBtu/hr)	NOx Emissions (ppm@15%O <sub>2</sub> ) <sup>(1)</sup>	CO Emissions (lbs/hr) <sup>(2)</sup>
Run 1	30-Oct-14	8:46-9:11	72.8	999.5	10.3	66.4	607.3	144.5	887.0	12.7	27.8
Run 2		9:19-9:44	73.0	999.2	10.3	66.9	609.5	145.0	895.0	13.0	30.1
Run 3		9:52-10:17	72.2	1002.0	10.2	66.2	609.3	143.5	878.0	13.0	26.6
<i>Average:</i>			<i>72.7</i>	<i>1000.2</i>	<i>10.3</i>	<i>66.5</i>	<i>608.7</i>	<i>144.3</i>	<i>886.7</i>	<i>12.9</i>	<i>28.2</i>

Mid-High Load Test #	Test Date	Test Time	Unit Load (GMW)	Stack Temperature (°F)	Fuel Flow (lb/sec)	Inlet Guide Vane Angle	Compressor Discharge Temperature	Compressor Discharge Pressure	Heat Input (MMBtu/hr)	NOx Emissions (ppm@15%O <sub>2</sub> ) <sup>(1)</sup>	CO Emissions (lbs/hr) <sup>(2)</sup>
Run 1	30-Oct-14	10:26-10:51	68.5	1012.6	9.8	62.5	600.0	136.6	844.0	13.1	25.2
Run 2		11:00-11:24	68.5	1013.1	9.8	62.6	601.5	136.6	844.0	13.0	23.4
Run 3		11:33-11:58	68.4	1013.4	9.8	62.8	602.7	136.8	844.0	13.0	22.4
<i>Average:</i>			<i>68.5</i>	<i>1013.0</i>	<i>9.8</i>	<i>62.6</i>	<i>601.4</i>	<i>136.7</i>	<i>844.0</i>	<i>13.0</i>	<i>23.7</i>

Mid-Low Load Test #	Test Date	Test Time	Unit Load (GMW)	Stack Temperature (°F)	Fuel Flow (lb/sec)	Inlet Guide Vane Angle	Compressor Discharge Temperature	Compressor Discharge Pressure	NOx Emissions (ppm@15%O <sub>2</sub> ) <sup>(1)</sup>
Run 1	30-Oct-14	12:07-12:32	65.0	1022.4	9.4	59.8	593.1	130.7	13.3
Run 2		12:38-13:03	65.0	1022.3	9.5	59.8	593.0	130.6	13.1
Run 3		13:10-13:35	65.0	1022.6	9.5	59.8	593.3	130.5	13.0
<i>Average:</i>			<i>65.0</i>	<i>1022.4</i>	<i>9.5</i>	<i>59.8</i>	<i>593.1</i>	<i>130.6</i>	<i>13.1</i>

Low Load Test #	Test Date	Test Time	Unit Load (GMW)	Stack Temperature (°F)	Fuel Flow (lb/sec)	Inlet Guide Vane Angle	Compressor Discharge Temperature	Compressor Discharge Pressure	NOx Emissions (ppm@15%O <sub>2</sub> ) <sup>(1)</sup>
Run 1	30-Oct-14	13:41-14:07	62.1	1031.5	9.2	57.6	587.1	125.6	13.3
Run 2		14:14-14:39	61.9	1031.7	9.2	57.5	586.4	125.4	13.3
Run 3		14:49-15:14	62.0	1032.1	9.2	57.6	587.7	125.5	13.1
<i>Average:</i>			<i>62.0</i>	<i>1031.8</i>	<i>9.2</i>	<i>57.6</i>	<i>587.1</i>	<i>125.5</i>	<i>13.2</i>

(1) Permit Limit = 15 ppm@15%O<sub>2</sub>

(2) Permit Limit = 64 lbs/hr



**TABLE NO. 2**  
**NOx & CO EMISSIONS TESTING RESULTS**  
 Delray Power Plant - CTG 12-1  
 September 25, 2014

High Load Test #	Test Date	Test Time	Unit Load (GMW)	Stack Temperature (°F)	Fuel Flow (lb/sec)	Inlet Guide Vane Angle	Compressor Discharge Temperature	Compressor Discharge Pressure	Heat Input (MMBtu/hr)	NOx Emissions (ppm@15%O <sub>2</sub> ) <sup>(1)</sup>	CO Emissions (lbs/hr) <sup>(2)</sup>
Run 1	25-Sep-14	8:27-8:52	67.2	1033.3	9.9	63.9	610.1	134.6	846.0	14.3	25.1
Run 2		9:00-9:25	66.5	1035.3	9.8	63.5	610.7	133.5	838.0	14.2	25.7
Run 3		9:34-9:59	66.0	1037.1	9.8	63.3	612.1	132.7	838.0	14.4	25.6
<i>Average:</i>			<i>66.6</i>	<i>1035.2</i>	<i>9.8</i>	<i>63.6</i>	<i>611.0</i>	<i>133.6</i>	<i>840.7</i>	<i>14.3</i>	<i>25.5</i>

Mid-High Load Test #	Test Date	Test Time	Unit Load (GMW)	Stack Temperature (°F)	Fuel Flow (lb/sec)	Inlet Guide Vane Angle	Compressor Discharge Temperature	Compressor Discharge Pressure	Heat Input (MMBtu/hr)	NOx Emissions (ppm@15%O <sub>2</sub> ) <sup>(1)</sup>	CO Emissions (lbs/hr) <sup>(2)</sup>
Run 1	25-Sep-14	10:08-10:33	64.0	1041.9	9.6	61.2	609.3	129.2	821.0	14.3	24.2
Run 2		10:42-11:07	64.0	1042.6	9.5	61.6	611.4	129.3	812.0	14.2	23.5
Run 3		11:18-11:43	64.0	1043.3	9.5	61.9	614.0	129.5	812.0	14.2	23.6
<i>Average:</i>			<i>64.0</i>	<i>1042.6</i>	<i>9.5</i>	<i>61.6</i>	<i>611.6</i>	<i>129.3</i>	<i>815.0</i>	<i>14.2</i>	<i>23.8</i>

Mid-Low Load Test #	Test Date	Test Time	Unit Load (GMW)	Stack Temperature (°F)	Fuel Flow (lb/sec)	Inlet Guide Vane Angle	Compressor Discharge Temperature	Compressor Discharge Pressure	NOx Emissions (ppm@15%O <sub>2</sub> ) <sup>(1)</sup>
Run 1	25-Sep-14	11:54-12:19	62.0	1050.5	9.3	59.9	611.8	125.8	14.4
Run 2		12:25-12:50	62.0	1051.3	9.3	60.3	615.3	126.0	14.4
Run 3		12:57-13:22	62.0	1051.5	9.3	60.3	616.1	126.0	14.3
<i>Average:</i>			<i>62.0</i>	<i>1051.1</i>	<i>9.3</i>	<i>60.2</i>	<i>614.4</i>	<i>125.9</i>	<i>14.3</i>

Low Load Test #	Test Date	Test Time	Unit Load (GMW)	Stack Temperature (°F)	Fuel Flow (lb/sec)	Inlet Guide Vane Angle	Compressor Discharge Temperature	Compressor Discharge Pressure	NOx Emissions (ppm@15%O <sub>2</sub> ) <sup>(1)</sup>
Run 1	25-Sep-14	13:29-13:54	60.0	1060.1	9.1	57.9	612.1	122.1	14.4
Run 2		14:01-14:26	60.0	1060.3	9.1	57.9	612.8	122.1	14.7
Run 3		14:33-14:58	60.0	1060.5	9.1	58.0	613.8	122.1	15.0
<i>Average:</i>			<i>60.0</i>	<i>1060.3</i>	<i>9.1</i>	<i>57.9</i>	<i>612.9</i>	<i>122.1</i>	<i>14.7</i>

(1) Permit Limit = 15 ppm@15%O<sub>2</sub>

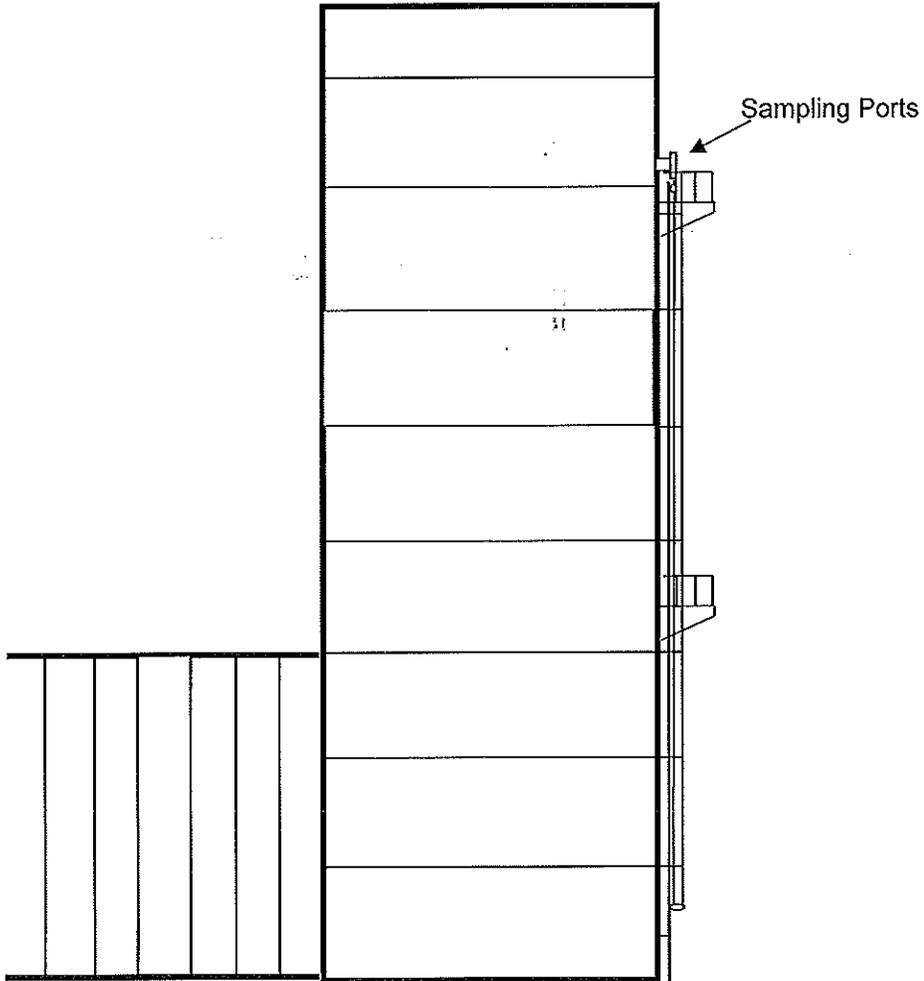
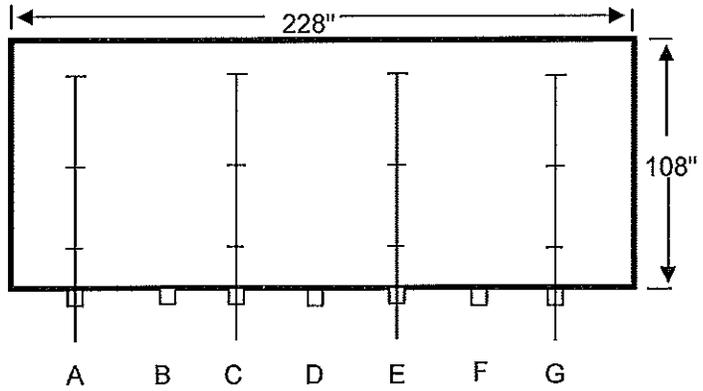
(2) Permit Limit = 64 lbs/hr



**Figure 1 – Sampling Location**  
**DTE – GWEC CTGs**  
**October 24 & 25, 2012**

NOx & CO sampling points

Point	Distance (in.)
3	18
2	54
1	90





# Figure 2 – Method 3A/7E/10 Sample Train Drawing

DTE – GWEC CTGs

October 24 & 25, 2012

