

**Final Test Report  
for**

**Based on information and belief formed after reasonable inquiry, I certify that the statements and information in this test report are true, accurate, and complete.**

\_\_\_\_\_  
**Permitted Facility Representative / Date**

**Name:** Lowell Miller Stolte  
**Title:** Environmental Director  
**Company:** Flint Hills Resources  
**Sign Date:** 9/14/2011

**I have reviewed all testing details and results in this test report and hereby certify that the test report is authentic and accurate.**

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**Testing Company Representative / Date**

**Name:** James Trowbridge  
**Title:** Project Manager  
**Company:** Pace Analytical Services  
**Sign Date:** 9/14/2011

9/14/2011

**Facility Information:**

Flint Hills Resources Pine Bend Refinery		
12555 Clark Road		
Rosemount, MN	MN	55068

**Contact:** Ms. Kari Lorch

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**Testing Company:**

Pace Analytical		
1700 Elm St. #200		
Minneapolis	MN	55092

**Contact:** Jamie Trowbridge

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**Email:** Jamie.trowbridge@pacelabs.com

**Industry/SCC/NAIS** 324110

**AFS #:**

**FRS #:**

**Air Permit Number:**

**Permitted Source ID/Name:**

MN2B0720

EU228

FCCU

**Permitted Maximum Process Rate:**

**Max. Normal Operation Process Rate:**

**Target Process Test Rate:**

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75000 bbl/day

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**SCC / Description** 30600201

Industrial Processes - Petroleum Industry - Catalytic Cracking Units - Fluid Catalytic Cracking Unit

The following state and federal regulations that apply to the proposed testing:

**Description of the source (including control equipment). Please see the attachments for source or process flow diagram:**

FCCU - with ESP. Combustion controls include selective noncatalytic reduction, Sox reduction additive, CO combustion promotore additive.

**Sampling Location Information:**

Location	Round Duct Diam.	Rect. Duct Length /Width		Equiv. Diam	Distance from upstream dist.	Distance from downstream dist.	Number of Traverse Ports	Min.Travers Points
Stack	115	0	0	0	733	772	4	16

**Test Parameter Information:**

Location	Target Parameter	Test Method	Number of Test Runs	Test Run Duration	Sample Points	Comments
Stack	Formaldehyde	Method 0011	3	64	0	
Stack	Inorganic (Aqueous) Condensable Part.	Method 201A/202	3	251	0	
Stack	Filterable PM10	Method 201A/202	3	251	0	
Stack	Organic Condensable Particulate	Method 201A/202	3	251	0	
Stack	2,3,7,8-TCDD	Method 23	3	160	0	
Stack	1,2,3,7,8-PeCDD	Method 23	3	160	0	

9/14/2011

Stack	1,2,3,4,7,8-HxCDD	Method 23	3	160	0	
Stack	1,2,3,6,7,8-HxCDD	Method 23	3	160	0	
Stack	1,2,3,7,8,9-HxCDD	Method 23	3	160	0	
Stack	1,2,3,4,6,7,8-HpCDD	Method 23	3	160	0	
Stack	OCDD	Method 23	3	160	0	
Stack	2,3,7,8-TCDF	Method 23	3	160	0	
Stack	1,2,3,7,8-PeCDF	Method 23	3	160	0	
Stack	2,3,4,7,8-PeCDF	Method 23	3	160	0	
Stack	1,2,3,4,7,8-HxCDF	Method 23	3	160	0	
Stack	1,2,3,6,7,8-HxCDF	Method 23	3	160	0	
Stack	2,3,4,6,7,8-HxCDF	Method 23	3	160	0	
Stack	1,2,3,7,8,9-HxCDF	Method 23	3	160	0	
Stack	1,2,3,4,6,7,8-HpCDF	Method 23	3	160	0	
Stack	1,2,3,4,7,8,9-HpCDF	Method 23	3	160	0	
Stack	OCDF	Method 23	3	160	0	
Stack	Other TCDD	Method 23	3	160	0	
Stack	Other PeCDD	Method 23	3	160	0	
Stack	Other HxCDD	Method 23	3	160	0	
Stack	Other HpCDD	Method 23	3	160	0	
Stack	Other TCDF	Method 23	3	160	0	
Stack	Other PeCDF	Method 23	3	160	0	
Stack	Other HxCDF	Method 23	3	160	0	
Stack	Other HpCDF	Method 23	3	160	0	
Stack	3,3',4,4'-TCB (PCB77)	Method 23	3	160	0	
Stack	3,4,4',5-TCB (PCB81)	Method 23	3	160	0	
Stack	2,3,3',4,4'-PeCB (PCB105)	Method 23	3	160	0	
Stack	2,3,4,4',5-PeCB (PCB114)	Method 23	3	160	0	
Stack	2,3',4,4',5-PeCB (PCB118)	Method 23	3	160	0	
Stack	2',3,4,4',5-PeCB (PCB123)	Method 23	3	160	0	
Stack	3,3',4,4',5-PeCB (PCB126)	Method 23	3	160	0	
Stack	2,3,3',4,4',5/2,3,3',4,4',5'-HxCB (PCBs156/157)	Method 23	3	160	0	
Stack	2,3',4,4',5,5'-HxCB (PCB167)	Method 23	3	160	0	
Stack	3,3',4,4',5,5'-HxCB (PCB169)	Method 23	3	160	0	
Stack	2,3,3',4,4',5,5'-HpCB (PCB189)	Method 23	3	160	0	
Stack	Total TEQ	Method 23	3	160	0	
Stack	Total organic compounds (TOC) as Propane	Method 25A	3	60	0	DSCFM airflow entered not SCFM due to apparent error in ERT calculation
Stack	Hydrogen Fluoride	Method 26A	3	96	0	
Stack	Chlorine	Method 26A	3	96	0	
Stack	Hydrogen Chloride	Method 26A	3	96	0	
Stack	Nickel	Method 29	3	160	0	
Stack	Filterable Particulate	Method 29	3	160	0	
Stack	Selenium	Method 29	3	160	0	
Stack	Cobalt	Method 29	3	160	0	
Stack	Arsenic	Method 29	3	160	0	
Stack	Beryllium	Method 29	3	160	0	
Stack	Cadmium	Method 29	3	160	0	
Stack	Magnesium	Method 29	3	160	0	
Stack	Lead	Method 29	3	160	0	

9/14/2011

Stack	Chromium	Method 29	3	160	0	
Stack	Antimony	Method 29	3	160	0	

**The following describes any modifications and/or deviations to the applicable test methods. If alternative methods were requested, see the attachments for documentation of request AND approval, including dates.**

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9/14/2011

## Sampling / Stack Data Results Summary

Location Stack - Method 0011

				Average
Run Number	1	2	3	
Test Date	7/26/2011	7/26/2011	7/26/2011	
Run Start Time	12:08:00 PM	1:50:00 PM	3:40:00 PM	
Run Finish Time	1:20:00 PM	3:13:00 PM	4:52:00 PM	
Net Run Time, minutes	64	64	64	
Dry Gas Meter Volume Sampled, dscf	55.821	54.151	54.325	54.766
Moisture Content of Stack Gas, %	12.22	12.14	12.57	12.310
Moisture Saturation at Stack Gas Temperature, %	100.00	100.00	100.00	100.000
Carbon Dioxide, %	13.4	13.5	13.5	13.467
Oxygen, %	4.13	4.5	4.5	4.377
Average Stack Gas Temperature, °F	463.81	465.06	466.13	465.000
Dry Volumetric Flow Rate, dry scfm	177,392.3	172,371.8	172,225.1	173,996.400
Actual Wet Volumetric Flue Gas Flow Rate, acfm	366,439.9	356,226.2	358,087.1	360,251.067
Percent Isokinetic of Sampling Rate, %	98.4	98.3	98.7	98.467
F-Factor, dscfm/MMBtu @ %O2	0	0	0	0.000
Fw	0	0	0	0.000
Fc	0	0	0	0.000

9/14/2011

**Location**    Stack - Method 201A/202

**Average**

Run Number  
Test Date  
Run Start Time  
Run Finish Time  
Net Run Time, minutes  
Dry Gas Meter Volume Sampled, dscf  
Moisture Content of Stack Gas, %  
Moisture Saturation at Stack Gas Temperature, %  
Carbon Dioxide, %  
Oxygen, %  
Average Stack Gas Temperature, °F  
Dry Volumetric Flow Rate, dry scfm  
Actual Wet Volumetric Flue Gas Flow Rate, acfm  
Percent Isokinetic of Sampling Rate, %  
F-Factor, dscfm/MMBtu @ %O<sub>2</sub>  
Fw  
Fc

**Location**    Stack - Method 23

**Average**

Run Number  
Test Date  
Run Start Time  
Run Finish Time  
Net Run Time, minutes  
Dry Gas Meter Volume Sampled, dscf  
Moisture Content of Stack Gas, %  
Moisture Saturation at Stack Gas Temperature, %  
Carbon Dioxide, %  
Oxygen, %  
Average Stack Gas Temperature, °F  
Dry Volumetric Flow Rate, dry scfm  
Actual Wet Volumetric Flue Gas Flow Rate, acfm  
Percent Isokinetic of Sampling Rate, %  
F-Factor, dscfm/MMBtu @ %O<sub>2</sub>  
Fw  
Fc

9/14/2011

**Location**    Stack - Method 25A

**Average**

Run Number  
Test Date  
Run Start Time  
Run Finish Time  
Carbon Dioxide, %  
Oxygen, %  
Dry Volumetric Flow Rate, dry scfm  
F-Factor, dscfm/MMBtu @ %O2  
Moisture, %  
Fuel Type  
Fw  
Fc

**Location**    Stack - Method 26A

**Average**

Run Number  
Test Date  
Run Start Time  
Run Finish Time  
Net Run Time, minutes  
Dry Gas Meter Volume Sampled, dscf  
Moisture Content of Stack Gas, %  
Moisture Saturation at Stack Gas Temperature, %  
Carbon Dioxide, %  
Oxygen, %  
Average Stack Gas Temperature, °F  
Dry Volumetric Flow Rate, dry scfm  
Actual Wet Volumetric Flue Gas Flow Rate, acfm  
Percent Isokinetic of Sampling Rate, %  
F-Factor, dscfm/MMBtu @ %O2  
Fw  
Fc

9/14/2011

**Location**    Stack - Method 29

**Average**

Run Number

Test Date

Run Start Time

Run Finish Time

Net Run Time, minutes

Dry Gas Meter Volume Sampled, dscf

Moisture Content of Stack Gas, %

Moisture Saturation at Stack Gas Temperature, %

Carbon Dioxide, %

Oxygen, %

Average Stack Gas Temperature, °F

Dry Volumetric Flow Rate, dry scfm

Actual Wet Volumetric Flue Gas Flow Rate, acfm

Percent Isokinetic of Sampling Rate, %

F-Factor, dscfm/MMBtu @ %O<sub>2</sub>

F<sub>w</sub>

F<sub>c</sub>



9/14/2011

## Emissions Summary

**Location:** Stack - Method 0011

**Compound:** Formaldehyde

				<b>Average</b>
RunNumber	1	2	3	
Mass_mg	0.0866	0.0107	0.00664	0.035
Elb/hr	3.64E-02	4.51E-03	2.78E-03	0.015
ug/dscm	5.48E+01	6.98E+00	4.32E+00	22.033

**Location:** Stack - Method 201A/202

**Compound:** Filterable PM10

				<b>Average</b>
RunNumber	1	2	3	
Mass_mg	12.3	10.2	6.4	9.633
Elb/hr	3.35E+00	3.01E+00	1.90E+00	2.753
gr/dscf	2.14E-03	1.93E-03	1.22E-03	0.002

**Compound:** Inorganic (Aqueous) Condensable P

				<b>Average</b>
RunNumber	1	2	3	
Mass_mg	80.1	140	83.3	101.133
Elb/hr	2.18E+01	4.13E+01	2.47E+01	29.267
gr/dscf	1.40E-02	2.65E-02	1.59E-02	0.019

**Compound:** Organic Condensable Particulate

				<b>Average</b>
RunNumber	1	2	3	
Mass_mg	1.1	43.7	1.7	15.500
Elb/hr	2.99E-01	1.29E+01	5.05E-01	4.568
gr/dscf	1.92E-04	8.26E-03	3.25E-04	0.003

**Location:** Stack - Method 23

**Compound:** 1,2,3,4,6,7,8-HpCDD

				<b>Average</b>
RunNumber	1	2	3	
Mass_mg	0.00000001157	0.000000009635	0.00000001352	0.000
Elb/hr	2.50E-09	2.10E-09	2.90E-09	0.000
pg/dscm	3.87E+00	3.24E+00	4.47E+00	3.860

**Compound:** 1,2,3,4,6,7,8-HpCDF

				<b>Average</b>
RunNumber	1	2	3	
Mass_mg	0.00000001122	0.000000008105	0.00000001263	0.000
Elb/hr	2.43E-09	1.76E-09	2.71E-09	0.000
pg/dscm	3.75E+00	2.72E+00	4.18E+00	3.550

**Compound:** 1,2,3,4,7,8,9-HpCDF

				<b>Average</b>
RunNumber	1	2	3	
Mass_mg	0.00000000447	0.00000000405	0.00000000445	0.000
Elb/hr	9.66E-10	8.82E-10	9.54E-10	0.000

9/14/2011

pg/dscm	1.49E+00	1.36E+00	1.47E+00	1.440
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**Compound:** 1,2,3,4,7,8-HxCDD

				Average
RunNumber	1	2	3	
Mass_mg	0.00000000411	0.00000000415	0.000000004	0.000
Elb/hr	8.89E-10	9.03E-10	8.57E-10	0.000
pg/dscm	1.37E+00	1.39E+00	1.32E+00	1.360

**Compound:** 1,2,3,4,7,8-HxCDF

				Average
RunNumber	1	2	3	
Mass_mg	0.00000000348	0.000000002629	0.00000000379	0.000
Elb/hr	7.52E-10	5.72E-10	8.12E-10	0.000
pg/dscm	1.16E+00	8.83E-01	1.25E+00	1.098

**Compound:** 1,2,3,6,7,8-HxCDD

				Average
RunNumber	1	2	3	
Mass_mg	0.00000000406	0.000000004165	0.00000000425	0.000
Elb/hr	8.78E-10	9.07E-10	9.11E-10	0.000
pg/dscm	1.36E+00	1.40E+00	1.41E+00	1.390

**Compound:** 1,2,3,6,7,8-HxCDF

				Average
RunNumber	1	2	3	
Mass_mg	0.00000000316	0.000000002909	0.00000000415	0.000
Elb/hr	6.83E-10	6.33E-10	8.89E-10	0.000
pg/dscm	1.06E+00	9.77E-01	1.37E+00	1.136

**Compound:** 1,2,3,7,8,9-HxCDD

				Average
RunNumber	1	2	3	
Mass_mg	0.00000000429	0.00000000457	0.00000000499	0.000
Elb/hr	9.28E-10	9.95E-10	1.07E-09	0.000
pg/dscm	1.43E+00	1.53E+00	1.65E+00	1.537

**Compound:** 1,2,3,7,8,9-HxCDF

				Average
RunNumber	1	2	3	
Mass_mg	0.00000000302	0.000000002856	0.00000000338	0.000
Elb/hr	6.53E-10	6.22E-10	7.24E-10	0.000
pg/dscm	1.01E+00	9.59E-01	1.12E+00	1.030

**Compound:** 1,2,3,7,8-PeCDD

				Average
RunNumber	1	2	3	
Mass_mg	0.00000000507	0.000000004645	0.00000000504	0.000
Elb/hr	1.10E-09	1.01E-09	1.08E-09	0.000
pg/dscm	1.69E+00	1.56E+00	1.67E+00	1.640

**Compound:** 1,2,3,7,8-PeCDF

				Average
RunNumber	1	2	3	

9/14/2011

Mass_mg	0.00000000347	0.000000003365	0.00000000391	0.000
Elb/hr	7.50E-10	7.32E-10	8.38E-10	0.000
pg/dscm	1.16E+00	1.13E+00	1.29E+00	1.193

**Compound:** 2,3,3',4,4',5,5'-HpCB (PCB189)

				<b>Average</b>
RunNumber	1	2	3	
Mass_mg	0.000000029	0.0000000331	0.0000000414	0.000
Elb/hr	6.27E-09	7.20E-09	8.87E-09	0.000
pg/dscm	9.69E+00	1.11E+01	1.37E+01	11.497

**Compound:** 2,3,3',4,4',5/2,3,3',4,4',5'-HxCB (PC

				<b>Average</b>
RunNumber	1	2	3	
Mass_mg	0.00000009058	0.000000070195	0.00000012443	0.000
Elb/hr	1.96E-08	1.53E-08	2.67E-08	0.000
pg/dscm	3.03E+01	2.36E+01	4.12E+01	31.700

**Compound:** 2,3,3',4,4'-PeCB (PCB105)

				<b>Average</b>
RunNumber	1	2	3	
Mass_mg	0.000000059	0.00000003935	0.0000000872	0.000
Elb/hr	1.28E-07	8.57E-08	1.87E-07	0.000
pg/dscm	1.97E+02	1.32E+02	2.89E+02	206.000

**Compound:** 2,3',4,4',5,5'-HxCB (PCB167)

				<b>Average</b>
RunNumber	1	2	3	
Mass_mg	0.00000003585	0.000000024425	0.0000000532	0.000
Elb/hr	7.75E-09	5.32E-09	1.14E-08	0.000
pg/dscm	1.20E+01	8.20E+00	1.76E+01	12.600

**Compound:** 2,3,4,4',5-PeCB (PCB114)

				<b>Average</b>
RunNumber	1	2	3	
Mass_mg	0.0000000821	0.00000005615	0.0000001122	0.000
Elb/hr	1.78E-08	1.22E-08	2.40E-08	0.000
pg/dscm	2.74E+01	1.89E+01	3.71E+01	27.800

**Compound:** 2,3',4,4',5-PeCB (PCB118)

				<b>Average</b>
RunNumber	1	2	3	
Mass_mg	0.000001275	0.000000807	0.000001961	0.000
Elb/hr	2.76E-07	1.76E-07	4.20E-07	0.000
pg/dscm	4.26E+02	2.71E+02	6.49E+02	448.667

**Compound:** 2',3,4,4',5-PeCB (PCB123)

				<b>Average</b>
RunNumber	1	2	3	
Mass_mg	0.0000000254	0.0000000274	0.0000000337	0.000
Elb/hr	5.49E-09	5.96E-09	7.22E-09	0.000
pg/dscm	8.49E+00	9.20E+00	1.12E+01	9.630

9/14/2011

**Compound: 2,3,4,6,7,8-HxCDF**

				<b>Average</b>
RunNumber	1	2	3	
Mass_mg	0.00000000358	0.000000003048	0.00000000426	0.000
Elb/hr	7.74E-10	6.63E-10	9.13E-10	0.000
pg/dscm	1.20E+00	1.02E+00	1.41E+00	1.210

**Compound: 2,3,4,7,8-PeCDF**

				<b>Average</b>
RunNumber	1	2	3	
Mass_mg	0.00000000373	0.00000000316	0.00000000311	0.000
Elb/hr	8.06E-10	6.88E-10	6.66E-10	0.000
pg/dscm	1.25E+00	1.06E+00	1.03E+00	1.113

**Compound: 2,3,7,8-TCDD**

				<b>Average</b>
RunNumber	1	2	3	
Mass_mg	0.00000000446	0.00000000404	0.0000000039	0.000
Elb/hr	9.64E-10	8.79E-10	8.36E-10	0.000
pg/dscm	1.49E+00	1.36E+00	1.29E+00	1.380

**Compound: 2,3,7,8-TCDF**

				<b>Average</b>
RunNumber	1	2	3	
Mass_mg	0.00000000516	0.00000000436	0.00000000584	0.000
Elb/hr	1.12E-09	9.49E-10	1.25E-09	0.000
pg/dscm	1.72E+00	1.46E+00	1.93E+00	1.703

**Compound: 3,3',4,4',5,5'-HxCB (PCB169)**

				<b>Average</b>
RunNumber	1	2	3	
Mass_mg	0.00000002112	0.00000002156	0.0000000248	0.000
Elb/hr	4.57E-09	4.69E-09	5.31E-09	0.000
pg/dscm	7.06E+00	7.24E+00	8.21E+00	7.503

**Compound: 3,3',4,4',5-PeCB (PCB126)**

				<b>Average</b>
RunNumber	1	2	3	
Mass_mg	0.0000000355	0.00000003655	0.0000000393	0.000
Elb/hr	7.68E-09	7.96E-09	8.42E-09	0.000
pg/dscm	1.19E+01	1.23E+01	1.30E+01	12.400

**Compound: 3,3',4,4'-TCB (PCB77)**

				<b>Average</b>
RunNumber	1	2	3	
Mass_mg	0.0000002675	0.0000002074	0.0000003843	0.000
Elb/hr	5.78E-08	4.51E-08	8.23E-08	0.000
pg/dscm	8.94E+01	6.96E+01	1.27E+02	95.333

**Compound: 3,4,4',5-TCB (PCB81)**

				<b>Average</b>
RunNumber	1	2	3	
Mass_mg	0.0000000291	0.00000002525	0.000000034	0.000

9/14/2011

Elb/hr	6.29E-09	5.50E-09	7.29E-09	0.000
pg/dscm	9.73E+00	8.48E+00	1.13E+01	9.837

**Compound: OCDD**

				<b>Average</b>
RunNumber	1	2	3	
Mass_mg	0.0000000392	0.0000000369	0.0000000519	0.000
Elb/hr	8.48E-09	8.03E-09	1.11E-08	0.000
pg/dscm	1.31E+01	1.24E+01	1.72E+01	14.233

**Compound: OCDF**

				<b>Average</b>
RunNumber	1	2	3	
Mass_mg	0.00000001319	0.00000000981	0.00000001306	0.000
Elb/hr	2.85E-09	2.14E-09	2.80E-09	0.000
pg/dscm	4.41E+00	3.29E+00	4.32E+00	4.007

**Compound: Other HpCDD**

				<b>Average</b>
RunNumber	1	2	3	
Mass_mg	0.00000001341	0.000000010495	0.00000001488	0.000
Elb/hr	2.90E-09	2.28E-09	3.19E-09	0.000
pg/dscm	4.48E+00	3.52E+00	4.92E+00	4.307

**Compound: Other HpCDF**

				<b>Average</b>
RunNumber	1	2	3	
Mass_mg	0	0	0.00000000155	0.000
Elb/hr	0.00E+00	0.00E+00	3.32E-10	0.000
pg/dscm	0.00E+00	0.00E+00	5.13E-01	0.171

**Compound: Other HxCDD**

				<b>Average</b>
RunNumber	1	2	3	
Mass_mg	0.00000001395	0.000000007425	0.00000002037	0.000
Elb/hr	3.02E-09	1.62E-09	4.36E-09	0.000
pg/dscm	4.66E+00	2.49E+00	6.74E+00	4.630

**Compound: Other HxCDF**

				<b>Average</b>
RunNumber	1	2	3	
Mass_mg	0.00000001054	0.000000009035	0.00000001519	0.000
Elb/hr	2.28E-09	1.97E-09	3.25E-09	0.000
pg/dscm	3.52E+00	3.03E+00	5.03E+00	3.860

**Compound: Other PeCDD**

				<b>Average</b>
RunNumber	1	2	3	
Mass_mg	0.0000000157	0.00000001243	0.0000000199	0.000
Elb/hr	3.39E-09	2.71E-09	4.26E-09	0.000
pg/dscm	5.25E+00	4.17E+00	6.59E+00	5.337

**Compound: Other PeCDF**

				<b>Average</b>
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9/14/2011

RunNumber	1	2	3	
Mass_mg	0.0000000123	0	0.0000000172	0.000
Elb/hr	2.66E-09	0.00E+00	3.69E-09	0.000
pg/dscm	4.11E+00	0.00E+00	5.69E+00	3.267

**Compound:** Other TCDD

				<b>Average</b>
RunNumber	1	2	3	
Mass_mg	0.00000001726	0.00000001318	0.0000000288	0.000
Elb/hr	3.73E-09	2.87E-09	6.17E-09	0.000
pg/dscm	5.77E+00	4.43E+00	9.53E+00	6.577

**Compound:** Other TCDF

				<b>Average</b>
RunNumber	1	2	3	
Mass_mg	0.00000004291	0.00000003565	0.00000006729	0.000
Elb/hr	9.28E-09	7.76E-09	1.44E-08	0.000
pg/dscm	1.43E+01	1.20E+01	2.23E+01	16.200

**Compound:** Total TEQ

				<b>Average</b>
RunNumber	1	2	3	
Mass_mg	0.00000001243	0.000000011225	0.000000012	0.000
Elb/hr	2.69E-09	2.44E-09	2.57E-09	0.000
pg/dscm	4.15E+00	3.77E+00	3.97E+00	3.963

**Location:** Stack - Method 25A

**Compound:** Total organic compounds (TOC) as

				<b>Average</b>
Run	1	2	3	
Elb/hr	3.32E+00	2.46E+00	2.40E+00	2.727
ppm	2.79E+00	2.07E+00	2.02E+00	2.293

**Location:** Stack - Method 26A

**Compound:** Chlorine

				<b>Average</b>
RunNumber	1	2	3	
Mass_mg	0.06	0.058	0.06	0.059
Elb/hr	1.73E-02	1.65E-02	1.73E-02	0.017
mg/dscm	2.61E-02	2.53E-02	2.63E-02	0.026

**Compound:** Hydrogen Chloride

				<b>Average</b>
RunNumber	1	2	3	
Mass_mg	7.021	6.722	6.884	6.876
Elb/hr	2.03E+00	1.92E+00	1.99E+00	1.980
mg/dscm	3.05E+00	2.94E+00	3.02E+00	3.003

**Compound:** Hydrogen Fluoride

				<b>Average</b>
RunNumber	1	2	3	
Mass_mg	0.15	0.151	0.152	0.151
Elb/hr	4.33E-02	4.30E-02	4.39E-02	0.043

9/14/2011

mg/dscm	6.53E-02	6.59E-02	6.67E-02	0.066
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**Location: Stack - Method 29**

**Compound: Antimony**

				<b>Average</b>
RunNumber	1	2	3	
Mass_mg	0.000529	0.000491	0.000348	0.000
Elb/hr	8.68E-05	8.07E-05	5.74E-05	0.000
mg/dscm	1.32E-04	1.22E-04	8.79E-05	0.000

**Compound: Arsenic**

				<b>Average</b>
RunNumber	1	2	3	
Mass_mg	0.0002	0.0002	0.0002	0.000
Elb/hr	3.28E-05	3.29E-05	3.30E-05	0.000
mg/dscm	4.99E-05	4.96E-05	5.05E-05	0.000

**Compound: Beryllium**

				<b>Average</b>
RunNumber	1	2	3	
Mass_mg	0.0002	0.0002	0.0002	0.000
Elb/hr	3.28E-05	3.29E-05	3.30E-05	0.000
mg/dscm	4.99E-05	4.96E-05	5.05E-05	0.000

**Compound: Cadmium**

				<b>Average</b>
RunNumber	1	2	3	
Mass_mg	0.003828	0.005051	0.000252	0.003
Elb/hr	6.28E-04	8.30E-04	4.16E-05	0.000
mg/dscm	9.55E-04	1.25E-03	6.37E-05	0.001

**Compound: Chromium**

				<b>Average</b>
RunNumber	1	2	3	
Mass_mg	0.011095	0.00495	0.005711	0.007
Elb/hr	1.82E-03	8.13E-04	9.42E-04	0.001
mg/dscm	2.77E-03	1.23E-03	1.44E-03	0.002

**Compound: Cobalt**

				<b>Average</b>
RunNumber	1	2	3	
Mass_mg	0.000341	0.000338	0.00029	0.000
Elb/hr	5.60E-05	5.55E-05	4.78E-05	0.000
mg/dscm	8.51E-05	8.38E-05	7.33E-05	0.000

**Compound: Filterable Particulate**

				<b>Average</b>
RunNumber	1	2	3	
Mass_mg	19.9	24.2	20.3	21.467
Elb/hr	3.27E+00	3.98E+00	3.35E+00	3.533
mg/dscm	4.96E+00	6.00E+00	5.13E+00	5.363

9/14/2011

**Compound:** Lead

				<b>Average</b>
RunNumber	1	2	3	
Mass_mg	0.003077	0.001559	0.00204	0.002
Elb/hr	5.05E-04	2.56E-04	3.37E-04	0.000
mg/dscm	7.68E-04	3.87E-04	5.15E-04	0.001

**Compound:** Magnesium

				<b>Average</b>
RunNumber	1	2	3	
Mass_mg	0.01223	0.001559	0.01077	0.008
Elb/hr	2.01E-03	2.56E-04	1.78E-03	0.001
mg/dscm	3.05E-03	3.87E-04	2.72E-03	0.002

**Compound:** Nickel

				<b>Average</b>
RunNumber	1	2	3	
Mass_mg	0.006031	0.00311	0.004954	0.005
Elb/hr	9.90E-04	5.11E-04	8.17E-04	0.001
mg/dscm	1.50E-03	7.71E-04	1.25E-03	0.001

**Compound:** Selenium

				<b>Average</b>
RunNumber	1	2	3	
Mass_mg	0.0002	0.000243	0.0002	0.000
Elb/hr	3.28E-05	3.99E-05	3.30E-05	0.000
mg/dscm	4.99E-05	6.03E-05	5.05E-05	0.000



9/14/2011

**Process Run Data**

<b>Run</b>	<b>Name</b>	<b>Value</b>	<b>UOM</b>	<b>Target Value</b>	<b>Comments</b>
1	Fresh Feed Processed	0	1000 Barrels/h	3.125	

**APCD Run Data**

<b>Run</b>	<b>Name</b>	<b>Value</b>	<b>UOM</b>	<b>Target Value</b>	<b>Comments</b>
1	ELECTROSTATIC PRECIPITATOR	0		0	

**Process Lab Run Data**

<b>Run</b>	<b>Name</b>	<b>Value</b>	<b>UOM</b>	<b>Comments</b>
1	NA	0	NA	

9/14/2011

Sampling / Stack Data Results Detail

Location	Stack - Method 0011			Average
Run Number	1	2	3	
Test Date	7/26/2011	7/26/2011	7/26/2011	
Run Start Time	12:08:00 PM	1:50:00 PM	3:40:00 PM	
Run Finish Time	1:20:00 PM	3:13:00 PM	4:52:00 PM	
Net Traversing Points	16	16	16	
Net Run Time, minutes	64	64	64	
Nozzle Diameter, inches	0.257	0.257	0.257	0.257
Pitot Tube Coefficient	0.84	0.84	0.84	0.840
Dry Gas Meter Calibration Factor	1.0053	1.0053	1.0053	1.005
Barometric Pressure, inches of Mercury	28.94	28.94	28.94	28.940
Average Orifice Meter Differential, inches H2O	2.31	2.17	2.18	2.220
Dry Gas Meter Volume Sampled, cubic feet	59.690	57.800	57.850	58.447
Average Dry Gas Meter Temperature, °F	92.22	91.03	89.75	91.000
Dry Gas Meter Volume Sampled, dscf	55.821	54.151	54.325	54.766
Total Moisture Liquid collected, g	165	159	166	163.333
Volume of Water Vapor, standard cubic feet	7.77	7.48	7.81	7.687
Moisture Content of Stack Gas, %	12.22	12.14	12.57	12.310
Moisture Saturation at Stack Gas Temperature, %	100.00	100.00	100.00	100.000
Dry Mole Fraction	0.8778	0.8786	0.8743	0.877
Carbon Dioxide, %	13.4	13.5	13.5	13.467
Oxygen, %	4.13	4.5	4.5	4.377
Carbon Monoxide & Nitrogen, %	82.47	82	82	82.157
Fuel Factor	1.25	1.21	1.21	
Dry Molecular Weight, lb/lb-Mole	30.31	30.34	30.34	30.330
Wet Molecular weight, lb/lb-Mole	28.81	28.84	28.79	28.813
Flue Gas Static Pressure, inches of H2O	-0.95	-0.95	-0.95	-0.950
Absolute Flue Gas Pressure, inches of Mercury	28.87	28.87	28.87	28.870
Average Stack Gas Temperature, °F	463.81	465.06	466.13	465.000
Average Velocity Head, inches of H2O	1.2515686859	1.182323637	1.1913974693	1.208
	9092	70864	6906	
Average Stack Gas Velocity, feet/second	84.67	82.31	82.74	83.240
Stack Cross-Sectional Area, square feet	72.131	72.131	72.131	72.131
Dry Volumetric Flow Rate, dry scfm	177,392.3	172,371.8	172,225.1	173,996.400
Actual Wet Volumetric Flue Gas Flow Rate, acfm	366,439.9	356,226.2	358,087.1	360,251.067
Percent Isokinetic of Sampling Rate, %	98.4	98.3	98.7	98.467
Percent Excess Air, %	23.4	26.2	26.2	25.267
F-Factor, dscfm/MMBtu @ %O2	0	0	0	0.000
Round Duct Diameter, inches	115	115	115	
Rectangular Duct Width, inches	0	0	0	
Rectangular Duct Length, inches	0	0	0	
Fw	0	0	0	0.000
Fc	0	0	0	0.000

9/14/2011

Location Stack - Method 201A/202

**Average**

Run Number  
Test Date  
Run Start Time  
Run Finish Time  
Net Traversing Points  
Net Run Time, minutes  
Nozzle Diameter, inches  
Pitot Tube Coefficient  
Dry Gas Meter Calibration Factor  
Barometric Pressure, inches of Mercury  
Average Orifice Meter Differential, inches H<sub>2</sub>O  
Dry Gas Meter Volume Sampled, cubic feet  
Average Dry Gas Meter Temperature, °F  
Dry Gas Meter Volume Sampled, dscf  
Total Moisture Liquid collected, g  
Volume of Water Vapor, standard cubic feet  
Moisture Content of Stack Gas, %  
Moisture Saturation at Stack Gas Temperature, %  
Dry Mole Fraction  
Carbon Dioxide, %  
Oxygen, %  
Carbon Monoxide & Nitrogen, %  
Fuel Factor  
Dry Molecular Weight, lb/lb-Mole  
Wet Molecular weight, lb/lb-Mole  
Flue Gas Static Pressure, inches of H<sub>2</sub>O  
Absolute Flue Gas Pressure, inches of Mercury  
Average Stack Gas Temperature, °F  
Average Velocity Head, inches of H<sub>2</sub>O  
Average Stack Gas Velocity, feet/second  
Stack Cross-Sectional Area, square feet  
Dry Volumetric Flow Rate, dry scfm  
Actual Wet Volumetric Flue Gas Flow Rate, acfm  
Percent Isokinetic of Sampling Rate, %  
Percent Excess Air, %  
F-Factor, dscfm/MMBtu @ %O<sub>2</sub>  
Round Duct Diameter, inches  
Rectangular Duct Width, inches  
Rectangular Duct Length, inches  
Fw  
Fc

9/14/2011

Location Stack - Method 23

**Average**

Run Number  
Test Date  
Run Start Time  
Run Finish Time  
Net Traversing Points  
Net Run Time, minutes  
Nozzle Diameter, inches  
Pitot Tube Coefficient  
Dry Gas Meter Calibration Factor  
Barometric Pressure, inches of Mercury  
Average Orifice Meter Differential, inches H<sub>2</sub>O  
Dry Gas Meter Volume Sampled, cubic feet  
Average Dry Gas Meter Temperature, °F  
Dry Gas Meter Volume Sampled, dscf  
Total Moisture Liquid collected, g  
Volume of Water Vapor, standard cubic feet  
Moisture Content of Stack Gas, %  
Moisture Saturation at Stack Gas Temperature, %  
Dry Mole Fraction  
Carbon Dioxide, %  
Oxygen, %  
Carbon Monoxide & Nitrogen, %  
Fuel Factor  
Dry Molecular Weight, lb/lb-Mole  
Wet Molecular weight, lb/lb-Mole  
Flue Gas Static Pressure, inches of H<sub>2</sub>O  
Absolute Flue Gas Pressure, inches of Mercury  
Average Stack Gas Temperature, °F  
Average Velocity Head, inches of H<sub>2</sub>O  
Average Stack Gas Velocity, feet/second  
Stack Cross-Sectional Area, square feet  
Dry Volumetric Flow Rate, dry scfm  
Actual Wet Volumetric Flue Gas Flow Rate, acfm  
Percent Isokinetic of Sampling Rate, %  
Percent Excess Air, %  
F-Factor, dscfm/MMBtu @ %O<sub>2</sub>  
Round Duct Diameter, inches  
Rectangular Duct Width, inches  
Rectangular Duct Length, inches  
F<sub>w</sub>  
F<sub>c</sub>

9/14/2011

Location Stack - Method 25A

**Average**

Run Number  
Test Date  
Run Start Time  
Run Finish Time  
Carbon Dioxide, %  
Oxygen, %  
Fuel Factor  
Dry Volumetric Flow Rate, dry scfm  
F-Factor, dscfm/MMBtu @ %O2  
Moisture, %  
Analyzer Make  
Analyzer Model  
Analyzer Serial Number  
Operating Range  
Operating Units  
No. Readings/Avg.  
Calibration Set  
Calibration Pre Zero Cylinder ID  
Calibration Pre Zero Cylinder Instrument Response  
Calibration Pre Zero Cylinder Bias  
Calibration Pre Zero Cylinder Drift  
Calibration Pre High Cylinder ID  
Calibration Pre High Cylinder Instrument Response  
Calibration Pre High Cylinder Bias  
Calibration Pre High Cylinder Drift  
Calibration Post Zero Cylinder ID  
Calibration Post Zero Cylinder Instrument Response  
Calibration Post Zero Cylinder Bias  
Calibration Post Zero Cylinder Drift  
Calibration Post High Cylinder ID  
Calibration Post High Cylinder Instrument Response  
Calibration Post High Cylinder Bias  
Calibration Post High Cylinder Drift  
Cavg  
Cavg Units  
Cgas  
Cgas Units  
Fuel Type  
Fw  
Fc  
Cgasw  
Cgasw Units

9/14/2011

Location Stack - Method 26A

**Average**

Run Number  
Test Date  
Run Start Time  
Run Finish Time  
Net Traversing Points  
Net Run Time, minutes  
Nozzle Diameter, inches  
Pitot Tube Coefficient  
Dry Gas Meter Calibration Factor  
Barometric Pressure, inches of Mercury  
Average Orifice Meter Differential, inches H<sub>2</sub>O  
Dry Gas Meter Volume Sampled, cubic feet  
Average Dry Gas Meter Temperature, °F  
Dry Gas Meter Volume Sampled, dscf  
Total Moisture Liquid collected, g  
Volume of Water Vapor, standard cubic feet  
Moisture Content of Stack Gas, %  
Moisture Saturation at Stack Gas Temperature, %  
Dry Mole Fraction  
Carbon Dioxide, %  
Oxygen, %  
Carbon Monoxide & Nitrogen, %  
Fuel Factor  
Dry Molecular Weight, lb/lb-Mole  
Wet Molecular weight, lb/lb-Mole  
Flue Gas Static Pressure, inches of H<sub>2</sub>O  
Absolute Flue Gas Pressure, inches of Mercury  
Average Stack Gas Temperature, °F  
Average Velocity Head, inches of H<sub>2</sub>O  
Average Stack Gas Velocity, feet/second  
Stack Cross-Sectional Area, square feet  
Dry Volumetric Flow Rate, dry scfm  
Actual Wet Volumetric Flue Gas Flow Rate, acfm  
Percent Isokinetic of Sampling Rate, %  
Percent Excess Air, %  
F-Factor, dscfm/MMBtu @ %O<sub>2</sub>  
Round Duct Diameter, inches  
Rectangular Duct Width, inches  
Rectangular Duct Length, inches  
Fw  
Fc

9/14/2011

Location Stack - Method 29

**Average**

Run Number  
Test Date  
Run Start Time  
Run Finish Time  
Net Traversing Points  
Net Run Time, minutes  
Nozzle Diameter, inches  
Pitot Tube Coefficient  
Dry Gas Meter Calibration Factor  
Barometric Pressure, inches of Mercury  
Average Orifice Meter Differential, inches H<sub>2</sub>O  
Dry Gas Meter Volume Sampled, cubic feet  
Average Dry Gas Meter Temperature, °F  
Dry Gas Meter Volume Sampled, dscf  
Total Moisture Liquid collected, g  
Volume of Water Vapor, standard cubic feet  
Moisture Content of Stack Gas, %  
Moisture Saturation at Stack Gas Temperature, %  
Dry Mole Fraction  
Carbon Dioxide, %  
Oxygen, %  
Carbon Monoxide & Nitrogen, %  
Fuel Factor  
Dry Molecular Weight, lb/lb-Mole  
Wet Molecular weight, lb/lb-Mole  
Flue Gas Static Pressure, inches of H<sub>2</sub>O  
Absolute Flue Gas Pressure, inches of Mercury  
Average Stack Gas Temperature, °F  
Average Velocity Head, inches of H<sub>2</sub>O  
Average Stack Gas Velocity, feet/second  
Stack Cross-Sectional Area, square feet  
Dry Volumetric Flow Rate, dry scfm  
Actual Wet Volumetric Flue Gas Flow Rate, acfm  
Percent Isokinetic of Sampling Rate, %  
Percent Excess Air, %  
F-Factor, dscfm/MMBtu @ %O<sub>2</sub>  
Round Duct Diameter, inches  
Rectangular Duct Width, inches  
Rectangular Duct Length, inches  
Fw  
Fc