533.14

SUNCOR ENERGY (U.S.A.) INC.
COMMERCE CITY REFINERY
PLANT 1
COMMERCE CITY, COLORADO

RELATIVE ACCURACY TEST REPORT
PLANT 1 HYDROGEN PLANT FURNACE STACK (H-2101)

TESTING REQUIRED PURSUANT TO CONSTRUCTION PERMIT 04AD0109

Submitted May 9, 2009 to:

Mr. Bryan Clode
Suncor Energy (U.S.A.) Inc.
5801 Brighton Blvd.
Commerce City, CO 80022

Prepared by:

Optimal
AIR TESTING SERVICES, INC

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I certify that I have examined the information submitted in this report and believe the results presented are true, accurate, and complete.

Michael Pierce
Technical Writer

1.0 PROJECT OVERVIEW

Optimal Air Testing Services, Inc. (Optimal) was contracted by Suncor Energy (U.S.A.) Inc. (Suncor) to complete a relative accuracy test audit (RATA) for the Plant 1 Hydrogen Plant steam methane reformer furnace (H-2101) continuous emission monitors at their Commerce City Refinery. The RATA of the oxygen (O_2), and carbon monoxide (CO) Continuous Emissions Monitoring System (CEMS) is a requirement of 40 CFR 60, Appendix B. The RATA of the oxides of nitrogen (NOx) and exhaust gas flow rate CEMS is required by Air Pollution Control Division Construction Permit 04AD0109.

The purpose of this test program was to determine whether analyzers recording concentrations and emissions from H-2101 are operating within the allowable limits listed in Title 40 of EPA's Code of Federal Regulations, Part 60 (40 CFR 60), Appendix B. Relative Accuracy (RA) was calculated by comparing the H-2101 CEMS reported O_2, NOx and CO concentrations, volumetric flow rate and emissions to concentrations, volumetric flow rate, and emissions measured following reference methods.

The test program followed procedures prescribed in Title 40 of the Code of Federal Regulations, Part 51 (40 CFR 51), Method 205, Part 60 (40 CFR 60), Appendix A, Methods 1, 2, 3A, 4, 7E and 10 and Appendix B, Performance Specifications (PS) 2, 3, 4A and 6.

Samples were collected while Suncor operated H-2101 at the normal to maximum capacity levels expected to occur during normal operations. Coordinating the testing was Mr. Bryan Clode for Suncor and Steve Freeman for Optimal. The test program took place on April 29th and 30th, 2009.

Measured parameters and calculated relative accuracy results are summarized in Table 1.

Table 1 – RATA Results

Source **Constituent**	**Sampling Methods**	**Relative Accuracy (%)**	**Relative Accuracy Limit (%)**
H_2 Plant Furnace H-2101 Stack –Plant 1			
Oxygen (%, dry)	EPA 3A	2.51	20
Volumetric Flow Rate (mscfh)	EPA 1, 2, 3A & 4	9.04	20
Nitrogen Oxides (ppmdv)	EPA 7E	3.82	20
Nitrogen Oxides (lb/hr)	EPA 1, 2, 3A, 4 & 7E	2.62	20
Carbon Monoxide (ppmdv @3% O_2)[1]	EPA 3A & 10	0.0744	5
Carbon Monoxide (lb/hr)[2]	EPA 1, 2, 3A, 4 & 10	4,317	10

A complete summary of test results is presented in Appendix A. Included with the Appendix A results are charts visually comparing Suncor's CEMS data to Reference Method results.

[1] Calculated using the previously applicable standard from 40 CFR 63, Subpart DDDDD NESHAP for Industrial, Commercial, and Institutional Boilers and Process Heaters of 400 ppmdv @ 3% O_2.
[2] Refer to page five for explanation.

Company: Suncor
Facility: Plant 1
Source: Hydrogen Plant Furnace
Location: H-2101 Stack

Date: 4/29-30/09
Job No.: 9002I

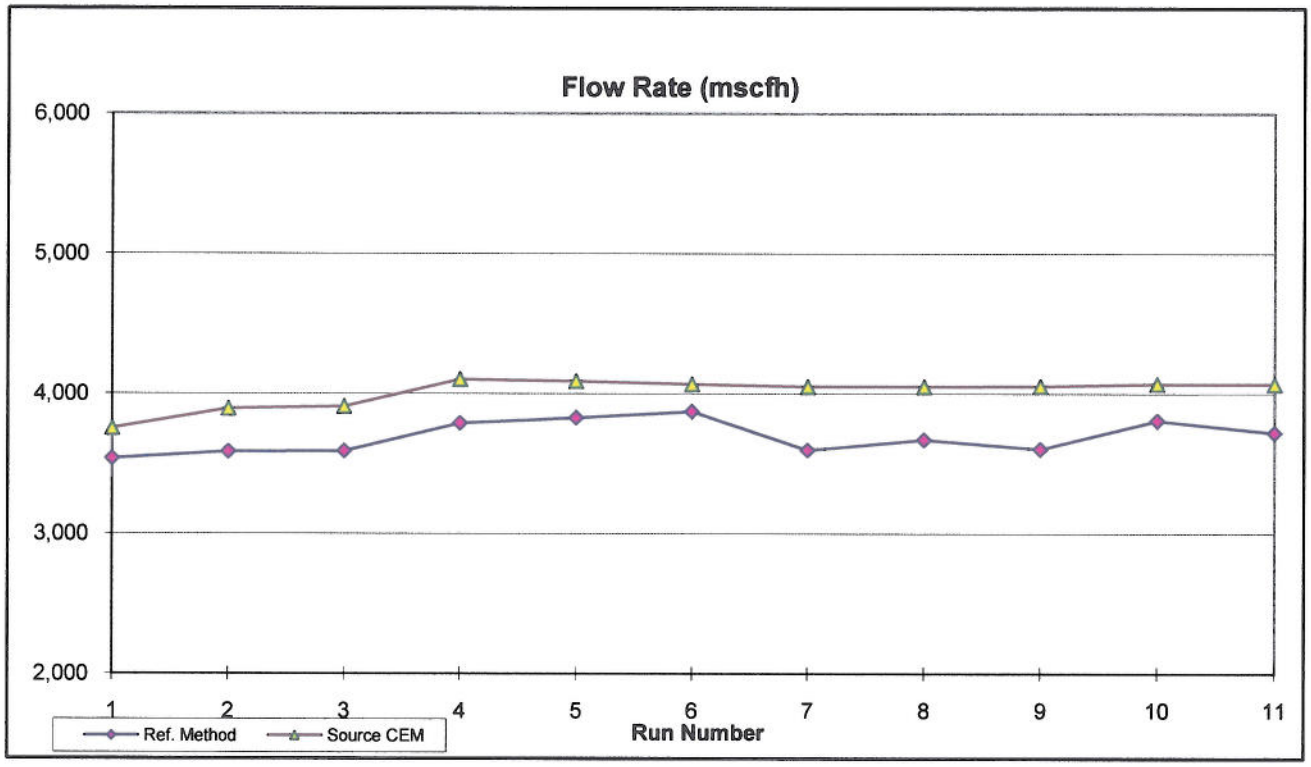
Optimal AIR TESTING SERVICES, INC

Volumetric Flow msfch

Relative Accuracy 9.04
Confidence Coefficient (CC) 46.1
Standard Deviation 59.9

Limit = 20%

Mean of Difference -290
Mean of Reference Method 3,711.00
Mean of Source CEM Values 4,000.53



Run	Flag	Initial Minute	Stop Time	Flowrate (mscfh) Ref. Method	Source CEM	Difference, d_i	Standard Deviation
1	1	15:26	15:46	3,536.18	3,752.13	-216	
2	1	16:00	16:20	3,584.99	3,893.53	-309	65.5
3	1	16:30	16:50	3,589.55	3,908.72	-319	56.8
4	1	8:34	8:54	3,789.34	4,102.81	-313	49.1
5	1	9:04	9:24	3,827.50	4,089.91	-262	44.2
6	1	9:36	9:56	3,872.19	4,068.54	-196	53.3
7	0	10:10	10:30	3,596.86	4,050.75	NA	53.3
8	1	10:40	11:00	3,671.48	4,050.55	-379	63.9
9	0	11:10	11:30	3,604.37	4,054.75	NA	63.9
10	1	11:42	12:02	3,807.30	4,070.56	-263	59.7
11	1	12:13	12:33	3,720.48	4,068.04	-348	59.9

Company: Suncor
Facility: Plant 1
Source: Hydrogen Plant Furnace Date: 4/29-30/09
Location: H-2101 Stack Job No.: 9002I

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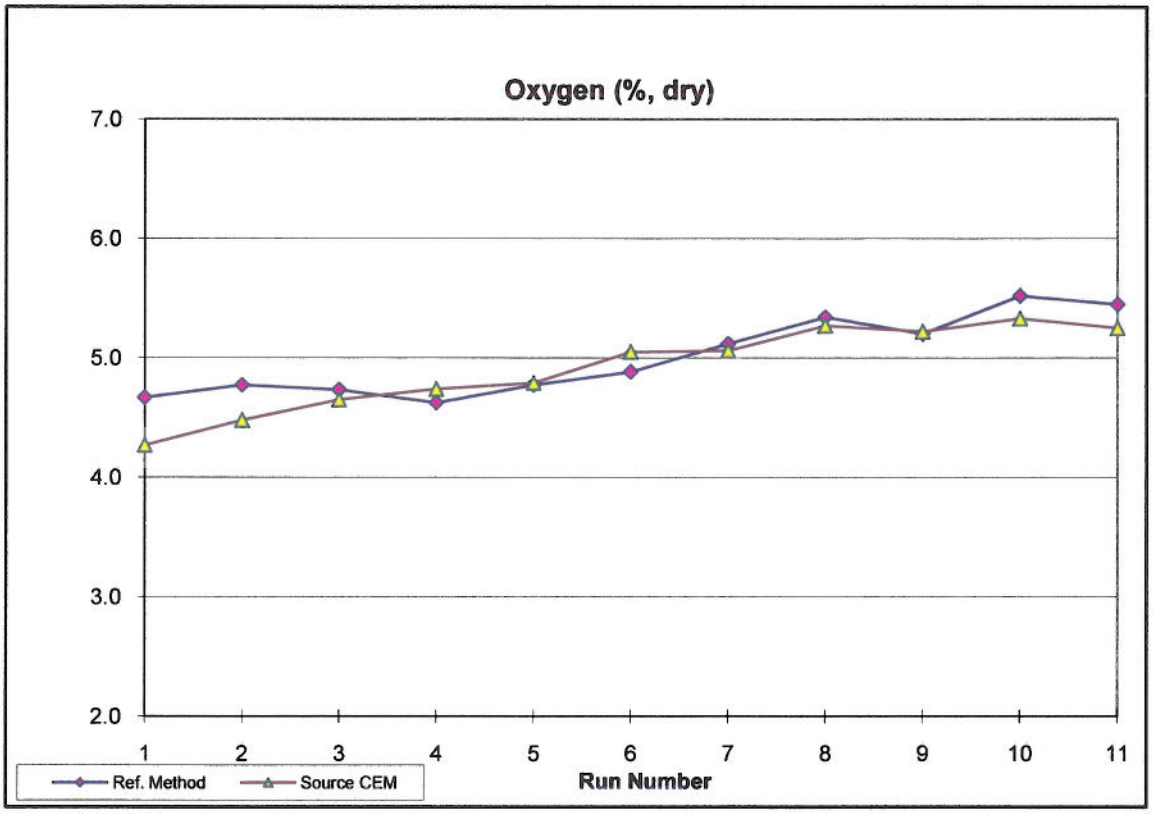
Oxygen %, dry

Relative Accuracy	2.51	*Limit = 20%*	Mean of Difference 0.0318
Confidence Coefficient (CC)	0.0955		Mean of Reference Method 5.07
Standard Deviation	0.124		Mean of Source CEM Values 5.04



Run	Flag	Initial Minute	Stop Time	Oxygen (percent, dry) Ref. Method	Source CEM	Difference, d	Standard Deviation
1	0	15:26	15:46	4.67	4.27	NA	
2	0	16:00	16:20	4.77	4.48	NA	NA
3	1	16:30	16:50	4.73	4.65	0.0837	NA
4	1	8:34	8:54	4.62	4.74	-0.115	0.141
5	1	9:04	9:24	4.77	4.79	-0.0169	0.099
6	1	9:36	9:56	4.88	5.05	-0.166	0.110
7	1	10:10	10:30	5.12	5.06	0.0585	0.108
8	1	10:40	11:00	5.34	5.27	0.0729	0.106
9	1	11:10	11:30	5.20	5.22	-0.0186	0.096
10	1	11:42	12:02	5.52	5.33	0.190	0.115
11	1	12:13	12:33	5.45	5.25	0.198	0.124

Company: Suncor
Facility: Plant 1
Source: Hydrogen Plant Furnace
Location: H-2101 Stack

Date: 4/29-30/09
Job No.: 9002I

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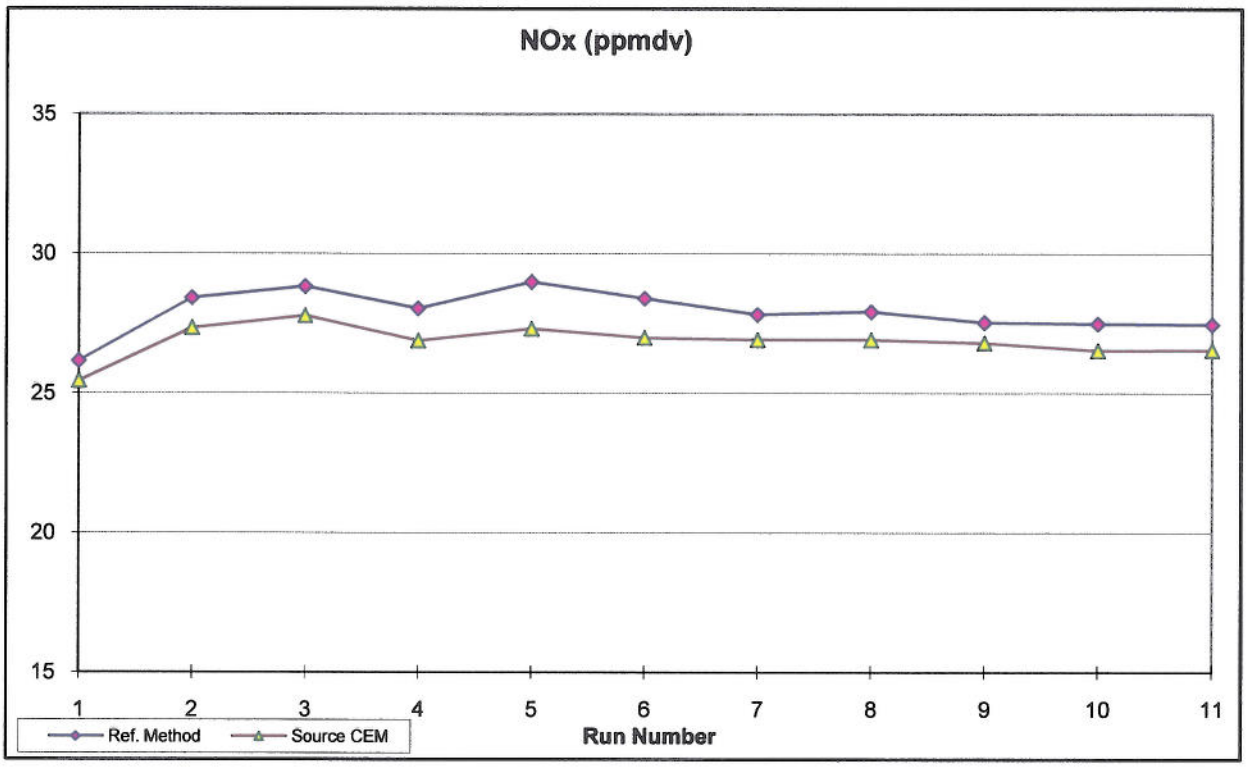
Nitrogen Oxides ppmdv

Relative Accuracy 3.82
Confidence Coefficient (CC) 0.113
Standard Deviation 0.148

Limit = 20%

Mean of Difference 0.946
Mean of Reference Method 27.74
Mean of Source CEM Values 26.80



Run	Flag	Initial Minute	Stop Time	Nitrogen Oxides (ppmdv) Ref. Method	Source CEM	Difference, d_i	Standard Deviation
1	1	15:26	15:46	26.16	25.44	0.717	
2	1	16:00	16:20	28.42	27.34	1.08	0.254
3	1	16:30	16:50	28.82	27.78	1.04	0.199
4	1	8:34	8:54	28.03	26.88	1.15	0.193
5	0	9:04	9:24	28.99	27.31	NA	0.193
6	0	9:36	9:56	28.40	26.99	NA	0.193
7	1	10:10	10:30	27.83	26.92	0.908	0.172
8	1	10:40	11:00	27.93	26.92	1.01	0.154
9	1	11:10	11:30	27.54	26.81	0.733	0.170
10	1	11:42	12:02	27.49	26.53	0.962	0.157
11	1	12:13	12:33	27.46	26.55	0.911	0.148

Company: Suncor
Facility: Plant 1
Source: Hydrogen Plant Furnace
Location: H-2101 Stack

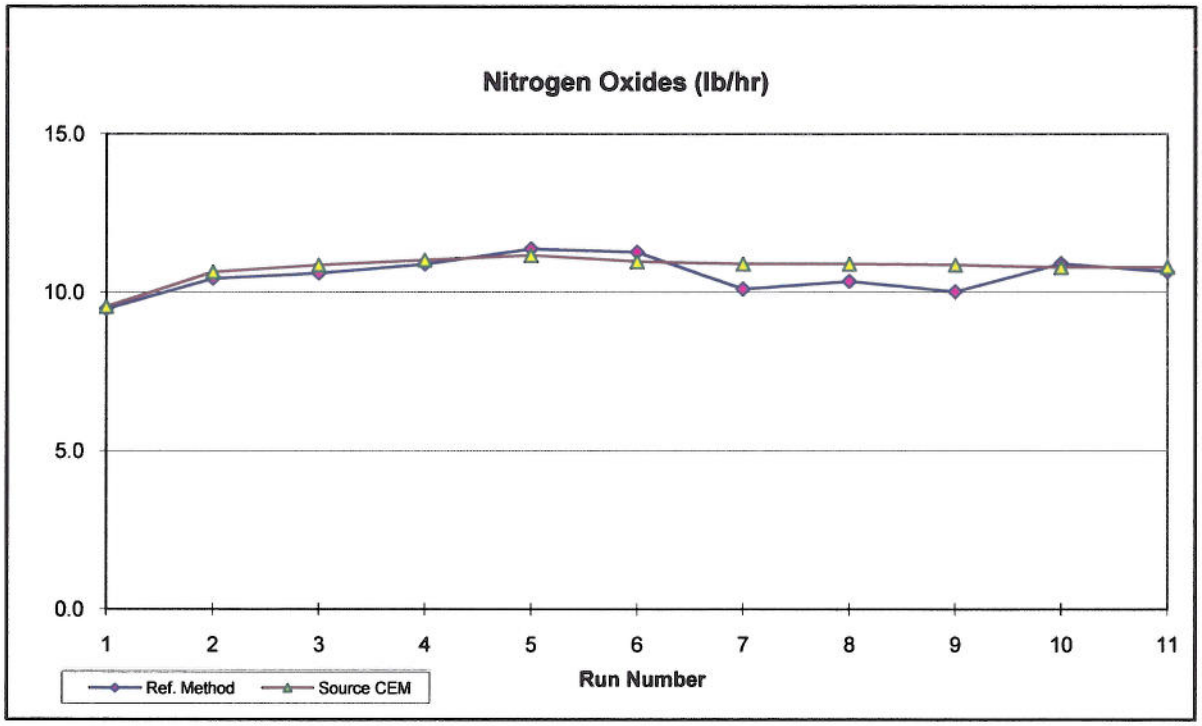
Date: 4/29-30/09
Job No.: 9002I

Optimal AIR TESTING SERVICES, INC

Nitrogen Oxides lb/hr

Relative Accuracy 2.62 *Limit = 20%*
Confidence Coefficient (CC) 0.199
Standard Deviation 0.259

Mean of Difference -0.0800
Mean of Reference Method 10.67
Mean of Source CEM Values 10.75



Run	Flag	Initial Minute	Stop Time	Nitrogen Oxides (lb/hr) Ref. Method	Source CEM	Difference, d_i	Standard Deviation
1	1	15:26	15:46	9.48	9.55	-0.0720	
2	1	16:00	16:20	10.44	10.64	-0.201	
3	1	16:30	16:50	10.60	10.86	-0.258	0.0954
4	1	8:34	8:54	10.89	11.02	-0.127	0.082
5	1	9:04	9:24	11.38	11.17	0.207	0.181
6	1	9:36	9:56	11.28	10.98	0.296	0.226
7	0	10:10	10:30	10.11	10.90	NA	0.226
8	1	10:40	11:00	10.35	10.90	-0.546	0.285
9	0	11:10	11:30	10.02	10.87	NA	0.285
10	1	11:42	12:02	10.92	10.79	0.126	0.276
11	1	12:13	12:33	10.66	10.80	-0.144	0.259

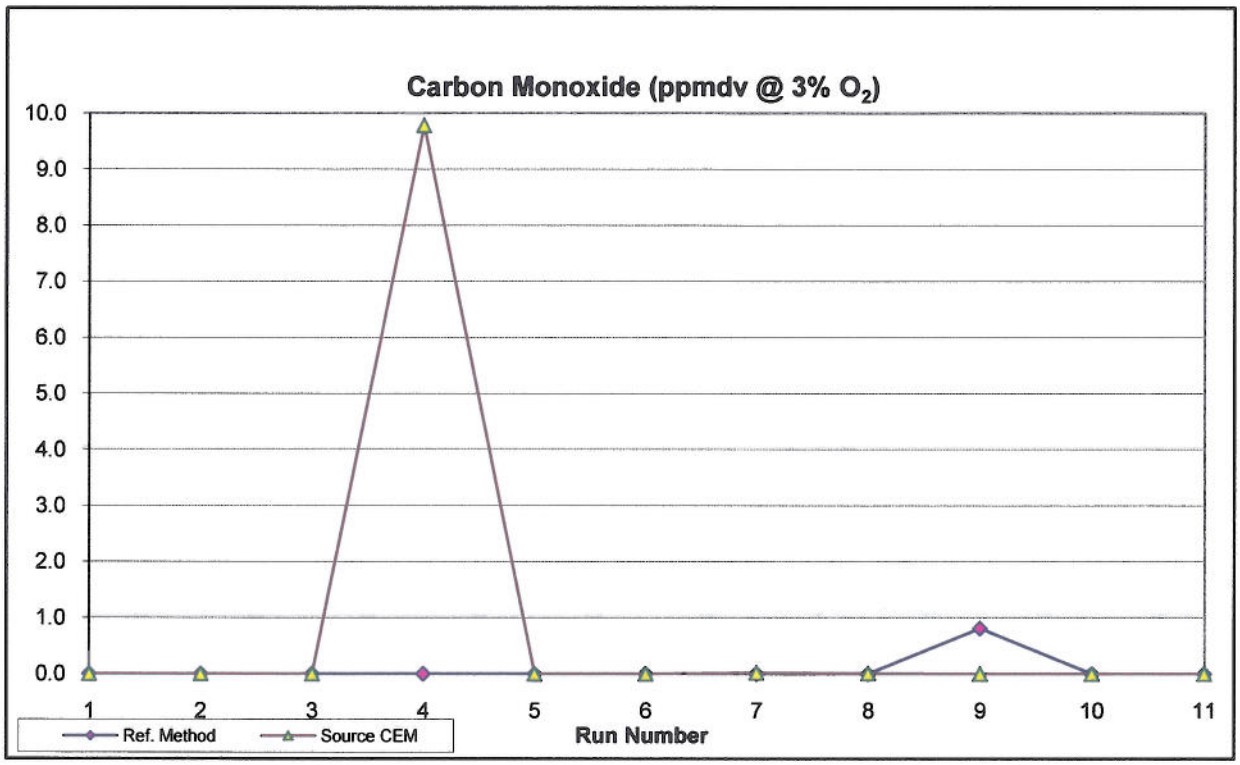
Company: Suncor
Facility: Plant 1
Source: Hydrogen Plant Furnace
Location: H-2101 Stack

Date: 4/29-30/09
Job No.: 9002I

Optimal AIR TESTING SERVICES, INC

Carbon Monoxide ppmdv @ 3% O_2

Relative Accuracy	329.7	*Limit = 10%*	Mean of Difference	0.0891
RA based on Applicable std.	0.0744	*Limit = 5%*	Applicable Standard	400
Confidence Coefficient (CC)	0.208		Mean of Reference Method	0.0902
Standard Deviation	0.271		Mean of Source CEM Values	0.00111



Run	Flag	Initial Minute	Stop Time	Carbon Monoxide (ppmdv @ 3% O_2) Ref. Method	Source CEM	Difference, d_i	Standard Deviation
1	1	15:26	15:46	0.00	0.00	0.000	
2	1	16:00	16:20	0.00	0.00	0.000	0.000
3	1	16:30	16:50	0.00	0.00	0.000	0.000
4	0	8:34	8:54	0.00	9.79	NA	NA
5	1	9:04	9:24	0.00	0.00	0.000	0.00
6	1	9:36	9:56	0.00	0.00	0.000	0.00
7	0	10:10	10:30	0.00	0.02	NA	0.00
8	1	10:40	11:00	0.00	0.01	-0.0100	0.00
9	1	11:10	11:30	0.81	0.00	0.812	0.31
10	1	11:42	12:02	0.00	0.00	0.00	0.29
11	1	12:13	12:33	0.00	0.00	0.00	0.27

Company: Suncor
Facility: Plant 1
Source: Hydrogen Plant Furnace
Location: H-2101 Stack

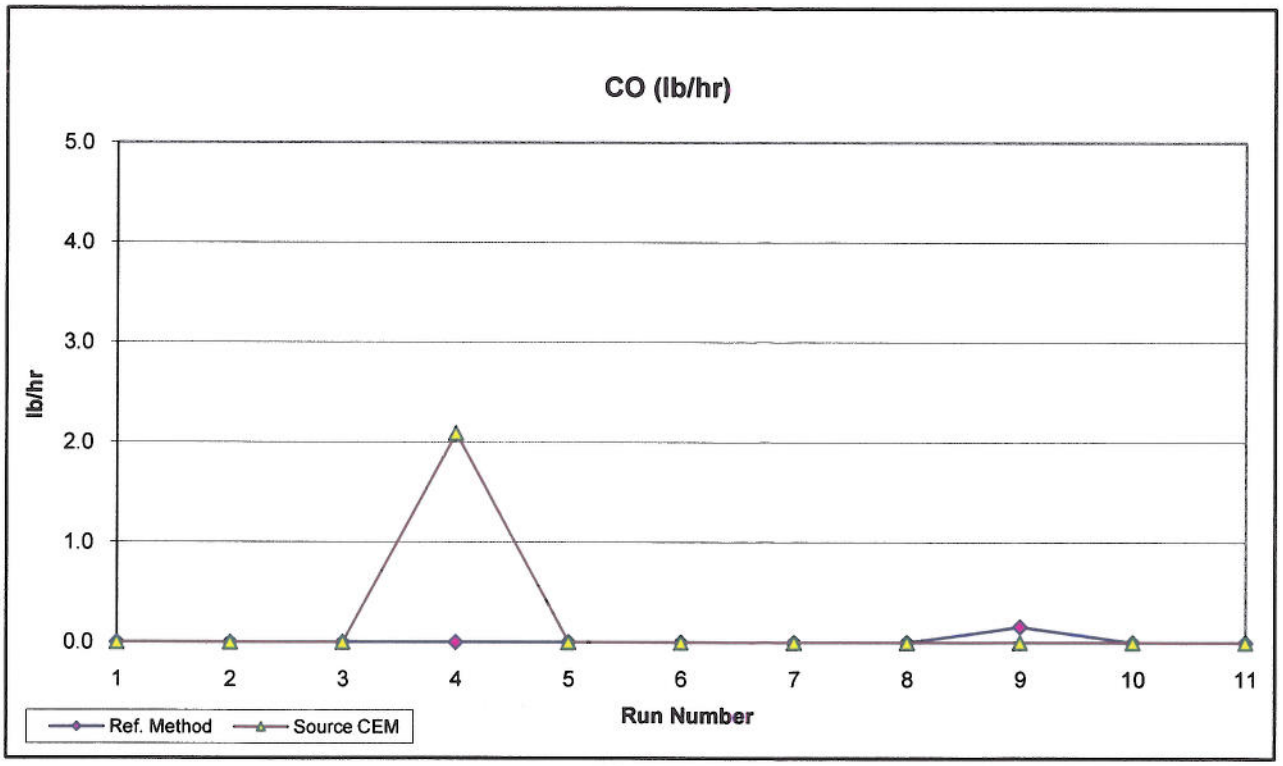
Date: 4/29-30/09
Job No.: 9002I

Optimal AIR TESTING SERVICES, INC

Carbon Monoxide Emissions lb/hr

Relative Accuracy 4,317 *Limit = 10%*
Confidence Coefficient (CC) 0.542
Standard Deviation 0.705

Mean of Difference -0.215
Mean of Reference Method 0.0175
Mean of Source CEM Values 0.232



Run	Flag	Initial Minute	Stop Time	Carbon Monoxide (lb/hr) Ref. Method	Source CEM	Difference, d	Standard Deviation
1	0	15:26	15:46	0.00	0.00	NA	
2	0	16:00	16:20	0.00	0.00	NA	NA
3	1	16:30	16:50	0.00	0.00	0.000	NA
4	1	8:34	8:54	0.00	2.09	-2.09	1.48
5	1	9:04	9:24	0.00	0.00	0.000	1.207
6	1	9:36	9:56	0.00	0.00	0.000	1.045
7	1	10:10	10:30	0.00	0.00	0.000	0.935
8	1	10:40	11:00	0.00	0.00	0.000	0.853
9	1	11:10	11:30	0.16	0.00	0.158	0.802
10	1	11:42	12:02	0.00	0.00	0.000	0.749
11	1	12:13	12:33	0.00	0.00	0.000	0.705

WP H2 Plant . Testing
CEMS Data

Example Formula		PI Tag	21FC416	21AI181	21FI185		21AI182D				21AI180K_1		
PICalcVal(C9,A13,B13,"a		Name	Main Burner BTU Controller	O2 RAW PPM	STACK FLOW	Raw Stack NOx	NOx w/ NO O2	Stack NOx at 3% O2	NOx Emissions	Raw Stack CO	CO PPM w/ 0% O2 1-Hour Average	Stack CO at 3% O2	COx Emissions
		Units	MM BTU/HR	%	MSCFH	PPM	PPM	PPM	(lb/hr)	PPM	PPM	PPM	(lb/hr)
Avg. Period Start	Avg. Period End												
04/29/2009 15:25:00	04/29/2009 15:26:00		177.42	3.82	3618.20	25.15	30.77	26.35	9.10	-0.29	-0.35	-0.33	-0.06
04/29/2009 15:26:00	04/29/2009 15:27:00		176.49	3.96	3603.11	25.83	31.87	27.30	9.30	-0.28	-0.35	-0.33	-0.06
04/29/2009 15:27:00	04/29/2009 15:28:00		177.60	4.04	3628.31	25.78	31.96	27.37	9.35	-0.28	-0.35	-0.33	-0.06
04/29/2009 15:28:00	04/29/2009 15:29:00		178.96	3.79	3642.51	25.33	30.94	26.50	9.22	-0.29	-0.35	-0.33	-0.06
04/29/2009 15:29:00	04/29/2009 15:30:00		180.69	3.41	3634.99	24.76	29.58	25.34	9.00	-0.29	-0.35	-0.34	-0.06
04/29/2009 15:30:00	04/29/2009 15:31:00		181.64	3.42	3646.35	24.82	29.68	25.42	9.05	-0.29	-0.35	-0.34	-0.06
04/29/2009 15:31:00	04/29/2009 15:32:00		181.13	3.45	3671.23	24.91	29.84	25.56	9.14	-0.29	-0.35	-0.34	-0.07
04/29/2009 15:32:00	04/29/2009 15:33:00		180.32	3.54	3656.44	25.16	30.28	25.94	9.20	-0.29	-0.35	-0.34	-0.06
04/29/2009 15:33:00	04/29/2009 15:34:00		179.65	3.60	3648.80	25.28	30.53	26.15	9.22	-0.29	-0.35	-0.34	-0.06
04/29/2009 15:34:00	04/29/2009 15:35:00		180.16	3.40	3656.07	24.84	29.67	25.41	9.08	-0.29	-0.35	-0.34	-0.07
04/29/2009 15:35:00	04/29/2009 15:36:00		179.70	3.53	3677.61	24.70	29.71	25.45	9.08	-0.29	-0.35	-0.34	-0.07
04/29/2009 15:36:00	04/29/2009 15:37:00		177.38	4.25	3724.47	25.56	32.08	27.48	9.52	-0.28	-0.35	-0.33	-0.06
04/29/2009 15:37:00	04/29/2009 15:38:00		175.93	4.82	3793.97	26.67	34.66	29.68	10.12	-0.27	-0.35	-0.31	-0.06
04/29/2009 15:38:00	04/29/2009 15:39:00		177.11	4.95	3859.16	26.56	34.80	29.81	10.25	-0.27	-0.35	-0.31	-0.06
04/29/2009 15:39:00	04/29/2009 15:40:00		179.51	4.85	3858.34	25.93	33.76	28.91	10.00	-0.27	-0.35	-0.31	-0.06
04/29/2009 15:40:00	04/29/2009 15:41:00		180.89	4.84	3883.21	25.58	33.30	28.52	9.93	-0.27	-0.35	-0.31	-0.06
04/29/2009 15:41:00	04/29/2009 15:42:00		181.60	5.02	3902.58	25.45	33.50	28.69	9.93	-0.27	-0.35	-0.31	-0.06
04/29/2009 15:42:00	04/29/2009 15:43:00		181.13	5.21	3910.89	25.23	33.60	28.77	9.86	-0.26	-0.35	-0.31	-0.06
04/29/2009 15:43:00	04/29/2009 15:44:00		180.96	5.30	3919.42	25.64	34.34	29.41	10.05	-0.26	-0.35	-0.31	-0.06
04/29/2009 15:44:00	04/29/2009 15:45:00		181.43	5.21	3928.83	25.53	34.00	29.12	10.03	-0.26	-0.35	-0.31	-0.06
04/29/2009 15:45:00	04/29/2009 15:46:00		181.37	5.22	3930.18	25.57	34.09	29.19	10.04	-0.26	-0.35	-0.31	-0.06
			179.58	4.27	3,752.13	25.44	32.05	27.45	9.55	-0.28	-0.35	-0.33	-0.06

WP H2 Plant RATA Testing
CEMS Data

Example Formula	PI Tag	21FC416	21AI181	21FI185	21AI182D					21AI180K_1		
PICalcVal(C9,A13,B13,"a	Name	Main Burner BTU Controller	O2 RAW PPM	STACK FLOW	Raw Stack NOx	NOx w/ NO O2	Stack NOx at 3% O2	NOx Emissions	Raw Stack CO	CO PPM w/ 0% O2 1-Hour Average	Stack CO at 3% O2	COx Emissions
	Units	MM BTU/HR	%	MSCFH	PPM	PPM	PPM	(lb/hr)	PPM	PPM	PPM	(lb/hr)
Avg. Period Start	Avg. Period End											
04/29/2009 15:59:00	04/29/2009 16:00:00	182.23	4.40	3886.56	27.98	35.44	30.35	10.87	-0.26	-0.32	-0.30	-0.06
04/29/2009 16:00:00	04/29/2009 16:01:00	184.80	4.17	3887.39	28.22	35.25	30.19	10.97	-0.25	-0.32	-0.30	-0.06
04/29/2009 16:01:00	04/29/2009 16:02:00	186.07	3.96	3879.24	27.65	34.10	29.21	10.72	-0.25	-0.31	-0.29	-0.06
04/29/2009 16:02:00	04/29/2009 16:03:00	186.93	4.09	3877.64	27.49	34.19	29.28	10.66	-0.24	-0.30	-0.28	-0.06
04/29/2009 16:03:00	04/29/2009 16:04:00	187.10	4.24	3888.48	27.73	34.78	29.79	10.78	-0.23	-0.29	-0.27	-0.06
04/29/2009 16:04:00	04/29/2009 16:05:00	186.77	4.24	3896.55	27.51	34.51	29.56	10.71	-0.23	-0.29	-0.27	-0.05
04/29/2009 16:05:00	04/29/2009 16:06:00	185.57	4.18	3899.05	27.51	34.38	29.45	10.72	-0.22	-0.28	-0.26	-0.05
04/29/2009 16:06:00	04/29/2009 16:07:00	184.62	4.47	3899.30	27.73	35.27	30.20	10.81	-0.22	-0.28	-0.26	-0.05
04/29/2009 16:07:00	04/29/2009 16:08:00	184.17	4.72	3895.63	27.69	35.76	30.63	10.78	-0.22	-0.28	-0.25	-0.05
04/29/2009 16:08:00	04/29/2009 16:09:00	184.22	4.68	3893.57	27.29	35.16	30.11	10.62	-0.22	-0.28	-0.25	-0.05
04/29/2009 16:09:00	04/29/2009 16:10:00	185.16	4.36	3894.63	27.29	34.48	29.53	10.62	-0.22	-0.28	-0.26	-0.05
04/29/2009 16:10:00	04/29/2009 16:11:00	185.25	4.38	3893.45	27.56	34.87	29.87	10.73	-0.22	-0.28	-0.26	-0.05
04/29/2009 16:11:00	04/29/2009 16:12:00	183.70	4.66	3892.37	27.42	35.28	30.22	10.67	-0.22	-0.28	-0.25	-0.05
04/29/2009 16:12:00	04/29/2009 16:13:00	183.11	4.86	3899.20	27.21	35.46	30.37	10.61	-0.21	-0.28	-0.25	-0.05
04/29/2009 16:13:00	04/29/2009 16:14:00	184.21	4.79	3901.31	26.93	34.93	29.92	10.50	-0.22	-0.28	-0.25	-0.05
04/29/2009 16:14:00	04/29/2009 16:15:00	185.08	4.58	3894.37	26.73	34.23	29.31	10.41	-0.22	-0.28	-0.26	-0.05
04/29/2009 16:15:00	04/29/2009 16:16:00	185.14	4.56	3890.45	26.80	34.28	29.36	10.42	-0.22	-0.28	-0.26	-0.05
04/29/2009 16:16:00	04/29/2009 16:17:00	183.70	4.62	3892.46	26.94	34.58	29.61	10.48	-0.22	-0.28	-0.25	-0.05
04/29/2009 16:17:00	04/29/2009 16:18:00	183.26	4.80	3903.34	26.86	34.87	29.87	10.48	-0.22	-0.28	-0.25	-0.05
04/29/2009 16:18:00	04/29/2009 16:19:00	184.71	4.78	3908.49	26.77	34.72	29.73	10.46	-0.22	-0.28	-0.25	-0.05
04/29/2009 16:19:00	04/29/2009 16:20:00	186.19	4.50	3890.59	26.73	34.06	29.17	10.40	-0.22	-0.28	-0.26	-0.05
		184.86	4.48	3,893.53	27.34	34.79	29.80	10.64	-0.23	-0.29	-0.26	-0.05

WP H2 Plar A Testing
CEMS Data

Example Formula	PI Tag	21FC416	21AI181	21FI185		21AI182D				21AI180K_1		
PICalcVal(C9,A13,B13,"a	Name	Main Burner BTU Controller	O2 RAW PPM	STACK FLOW	Raw Stack NOx	NOx w/ NO O2	Stack NOx at 3% O2	NOx Emissions	Raw Stack CO	CO PPM w/ 0% O2 1-Hour Average	Stack CO at 3% O2	COx Emissions
	Units	MM BTU/HR	%	MSCFH	PPM	PPM	PPM	(lb/hr)	PPM	PPM	PPM	(lb/hr)
Avg. Period Start	Avg. Period End											
04/29/2009 16:29:00	04/29/2009 16:30:00	188.38	4.33	3910.18	27.82	35.08	30.05	10.87	-0.22	-0.28	-0.26	-0.05
04/29/2009 16:30:00	04/29/2009 16:31:00	189.14	4.44	3886.29	27.92	35.45	30.36	10.85	-0.22	-0.28	-0.26	-0.05
04/29/2009 16:31:00	04/29/2009 16:32:00	188.62	4.47	3877.74	27.91	35.52	30.42	10.82	-0.22	-0.28	-0.26	-0.05
04/29/2009 16:32:00	04/29/2009 16:33:00	188.75	4.46	3898.85	27.85	35.42	30.33	10.85	-0.22	-0.28	-0.26	-0.05
04/29/2009 16:33:00	04/29/2009 16:34:00	188.89	4.58	3915.98	27.97	35.82	30.68	10.95	-0.22	-0.28	-0.26	-0.05
04/29/2009 16:34:00	04/29/2009 16:35:00	189.03	4.54	3924.76	27.97	35.74	30.61	10.97	-0.22	-0.28	-0.26	-0.05
04/29/2009 16:35:00	04/29/2009 16:36:00	188.76	4.57	3923.90	28.02	35.85	30.70	10.99	-0.22	-0.28	-0.26	-0.05
04/29/2009 16:36:00	04/29/2009 16:37:00	187.72	4.70	3912.42	28.16	36.33	31.11	11.01	-0.22	-0.28	-0.25	-0.05
04/29/2009 16:37:00	04/29/2009 16:38:00	187.34	4.83	3913.13	28.08	36.53	31.28	10.98	-0.22	-0.28	-0.25	-0.05
04/29/2009 16:38:00	04/29/2009 16:39:00	188.20	4.81	3914.98	27.87	36.20	31.00	10.91	-0.22	-0.28	-0.25	-0.05
04/29/2009 16:39:00	04/29/2009 16:40:00	189.09	4.60	3918.39	27.97	35.86	30.72	10.96	-0.22	-0.28	-0.25	-0.05
04/29/2009 16:40:00	04/29/2009 16:41:00	189.63	4.59	3915.94	27.81	35.63	30.52	10.89	-0.22	-0.28	-0.26	-0.05
04/29/2009 16:41:00	04/29/2009 16:42:00	189.53	4.58	3906.52	27.80	35.60	30.49	10.86	-0.22	-0.28	-0.26	-0.05
04/29/2009 16:42:00	04/29/2009 16:43:00	189.42	4.64	3904.12	27.67	35.57	30.46	10.80	-0.22	-0.28	-0.25	-0.05
04/29/2009 16:43:00	04/29/2009 16:44:00	189.92	4.73	3906.02	27.50	35.54	30.44	10.74	-0.22	-0.28	-0.25	-0.05
04/29/2009 16:44:00	04/29/2009 16:45:00	190.58	4.64	3914.27	27.48	35.32	30.25	10.75	-0.22	-0.28	-0.25	-0.05
04/29/2009 16:45:00	04/29/2009 16:46:00	189.52	4.68	3920.35	27.47	35.39	30.31	10.77	-0.22	-0.28	-0.25	-0.05
04/29/2009 16:46:00	04/29/2009 16:47:00	188.69	4.96	3912.87	27.80	36.45	31.22	10.87	-0.21	-0.28	-0.25	-0.05
04/29/2009 16:47:00	04/29/2009 16:48:00	188.73	5.06	3894.26	27.70	36.54	31.30	10.78	-0.21	-0.28	-0.25	-0.05
04/29/2009 16:48:00	04/29/2009 16:49:00	189.44	4.79	3900.70	27.42	35.58	30.48	10.69	-0.22	-0.28	-0.25	-0.05
04/29/2009 16:49:00	04/29/2009 16:50:00	190.17	4.69	3911.53	27.25	35.12	30.08	10.65	-0.22	-0.28	-0.25	-0.05
		189.03	4.65	3,908.72	27.78	35.74	30.61	10.86	-0.22	-0.28	-0.25	-0.05

WP H2 Plant RATA Testing
CEMS Data

Example Formula	PI Tag	21FC416	21AI181	21FI185		21AI182D				21AI180K_1		
PICalcVal(C9,A13,B13,"a	Name	Main Burner BTU Controller	O2 RAW PPM	STACK FLOW	Raw Stack NOx	NOx w/ NO O2	Stack NOx at 3% O2	NOx Emissions	Raw Stack CO	CO PPM w/ 0% O2 1-Hour Average	Stack CO at 3% O2	COx Emissions
	Units	MM BTU/HR	%	MSCFH	PPM	PPM	PPM	(lb/hr)	PPM	PPM	PPM	(lb/hr)
Avg. Period Start	Avg. Period End											
04/30/2009 08:30:00	04/30/2009 08:31:00	215.59	4.76	4125.62	26.28	34.02	29.14	10.84	8.38	10.85	9.78	2.10
04/30/2009 08:31:00	04/30/2009 08:32:00	215.70	4.81	4114.47	26.10	33.90	29.03	10.74	8.35	10.85	9.75	2.09
04/30/2009 08:32:00	04/30/2009 08:33:00	215.50	4.81	4101.76	26.18	34.00	29.12	10.73	8.35	10.85	9.75	2.08
04/30/2009 08:33:00	04/30/2009 08:34:00	214.71	4.86	4087.94	26.12	34.04	29.16	10.67	8.32	10.85	9.72	2.07
04/30/2009 08:34:00	04/30/2009 08:35:00	214.28	4.77	4083.65	25.85	33.49	28.68	10.55	8.37	10.85	9.78	2.08
04/30/2009 08:35:00	04/30/2009 08:36:00	214.54	4.80	4100.56	26.07	33.84	28.98	10.68	8.36	10.85	9.76	2.08
04/30/2009 08:36:00	04/30/2009 08:37:00	214.01	5.07	4105.87	26.65	35.19	30.14	10.94	8.22	10.85	9.59	2.05
04/30/2009 08:37:00	04/30/2009 08:38:00	212.78	5.19	4095.90	26.90	35.79	30.65	11.01	8.15	10.85	9.52	2.03
04/30/2009 08:38:00	04/30/2009 08:39:00	212.91	5.02	4098.20	26.72	35.18	30.13	10.95	8.24	10.85	9.62	2.05
04/30/2009 08:39:00	04/30/2009 08:40:00	213.25	4.90	4103.63	26.74	34.93	29.92	10.97	8.31	10.85	9.70	2.07
04/30/2009 08:40:00	04/30/2009 08:41:00	213.91	4.87	4114.29	26.95	35.13	30.09	11.08	8.32	10.85	9.72	2.08
04/30/2009 08:41:00	04/30/2009 08:42:00	213.48	4.83	4128.53	27.36	35.59	30.48	11.29	8.34	10.85	9.74	2.09
04/30/2009 08:42:00	04/30/2009 08:43:00	212.07	4.80	4133.65	27.01	35.06	30.03	11.16	8.36	10.85	9.76	2.10
04/30/2009 08:43:00	04/30/2009 08:44:00	212.57	4.69	4110.24	26.94	34.73	29.74	11.07	8.41	10.85	9.83	2.10
04/30/2009 08:44:00	04/30/2009 08:45:00	213.10	4.52	4098.73	27.26	34.79	29.79	11.17	8.50	10.85	9.93	2.12
04/30/2009 08:45:00	04/30/2009 08:46:00	213.07	4.52	4110.52	27.46	35.04	30.01	11.28	8.50	10.85	9.93	2.13
04/30/2009 08:46:00	04/30/2009 08:47:00	211.98	4.57	4106.65	27.53	35.24	30.18	11.30	8.48	10.85	9.90	2.12
04/30/2009 08:47:00	04/30/2009 08:48:00	212.51	4.57	4079.78	27.14	34.72	29.74	11.07	8.48	10.85	9.90	2.10
04/30/2009 08:48:00	04/30/2009 08:49:00	214.42	4.35	4077.35	27.26	34.43	29.48	11.11	8.59	10.85	10.03	2.13
04/30/2009 08:49:00	04/30/2009 08:50:00	213.35	4.37	4098.17	27.34	34.56	29.60	11.20	8.58	10.85	10.02	2.14
04/30/2009 08:50:00	04/30/2009 08:51:00	212.18	4.55	4117.92	27.27	34.86	29.86	11.23	8.49	10.85	9.91	2.13
		213.40	4.74	4,102.81	26.88	34.77	29.78	11.02	8.39	10.85	9.79	2.09

WP H2 Plan (Testing
CEMS Data

Example Formula		PI Tag	21FC416	21AI181	21FI185		21AI182D				21AI180K_1		
PICalcVal(C9,A13,B13,"a		Name	Main Burner BTU Controller	O2 RAW PPM	STACK FLOW	Raw Stack NOx	NOx w/ NO O2	Stack NOx at 3% O2	NOx Emissions	Raw Stack CO	CO PPM w/ 0% O2 1-Hour Average	Stack CO at 3% O2	COx Emissions
		Units	MM BTU/HR	%	MSCFH	PPM	PPM	PPM	(lb/hr)	PPM	PPM	PPM	(lb/hr)
Avg. Period Start	Avg. Period End												
04/30/2009 09:03:00	04/30/2009 09:04:00		211.49	4.97	4089.36	27.04	35.48	30.38	11.06	-0.05	-0.07	-0.06	-0.01
04/30/2009 09:04:00	04/30/2009 09:05:00		212.17	5.10	4082.13	27.69	36.64	31.38	11.30	-0.17	-0.22	-0.19	-0.04
04/30/2009 09:05:00	04/30/2009 09:06:00		211.48	5.14	4071.22	27.59	36.58	31.33	11.23	-0.17	-0.22	-0.19	-0.04
04/30/2009 09:06:00	04/30/2009 09:07:00		211.18	5.00	4070.52	27.01	35.52	30.42	10.99	-0.17	-0.22	-0.20	-0.04
04/30/2009 09:07:00	04/30/2009 09:08:00		211.67	4.95	4080.56	26.90	35.25	30.19	10.97	-0.17	-0.22	-0.20	-0.04
04/30/2009 09:08:00	04/30/2009 09:09:00		212.48	4.94	4083.34	27.21	35.63	30.52	11.11	-0.17	-0.22	-0.20	-0.04
04/30/2009 09:09:00	04/30/2009 09:10:00		213.15	4.82	4075.60	27.40	35.62	30.50	11.16	-0.17	-0.22	-0.20	-0.04
04/30/2009 09:10:00	04/30/2009 09:11:00		212.49	4.81	4073.60	27.14	35.24	30.18	11.05	-0.17	-0.22	-0.20	-0.04
04/30/2009 09:11:00	04/30/2009 09:12:00		211.99	4.63	4078.42	26.80	34.42	29.48	10.92	-0.17	-0.22	-0.20	-0.04
04/30/2009 09:12:00	04/30/2009 09:13:00		211.84	4.56	4095.52	26.81	34.29	29.36	10.98	-0.17	-0.22	-0.20	-0.04
04/30/2009 09:13:00	04/30/2009 09:14:00		211.78	4.68	4089.67	27.00	34.79	29.79	11.04	-0.17	-0.22	-0.20	-0.04
04/30/2009 09:14:00	04/30/2009 09:15:00		212.17	4.81	4069.15	27.19	35.31	30.24	11.06	-0.17	-0.22	-0.20	-0.04
04/30/2009 09:15:00	04/30/2009 09:16:00		213.20	4.77	4095.59	27.14	35.16	30.12	11.11	-0.17	-0.22	-0.20	-0.04
04/30/2009 09:16:00	04/30/2009 09:17:00		213.28	4.61	4101.38	27.05	34.71	29.73	11.09	-0.17	-0.22	-0.20	-0.04
04/30/2009 09:17:00	04/30/2009 09:18:00		212.01	4.79	4088.63	27.41	35.57	30.46	11.20	-0.17	-0.22	-0.20	-0.04
04/30/2009 09:18:00	04/30/2009 09:19:00		211.52	4.88	4114.23	27.49	35.86	30.71	11.30	-0.17	-0.22	-0.20	-0.04
04/30/2009 09:19:00	04/30/2009 09:20:00		212.20	4.79	4129.89	27.85	36.14	30.95	11.50	-0.17	-0.22	-0.20	-0.04
04/30/2009 09:20:00	04/30/2009 09:21:00		213.68	4.62	4121.76	28.08	36.04	30.87	11.57	-0.17	-0.22	-0.20	-0.04
04/30/2009 09:21:00	04/30/2009 09:22:00		212.74	4.42	4105.53	27.79	35.25	30.19	11.41	-0.17	-0.22	-0.20	-0.04
04/30/2009 09:22:00	04/30/2009 09:23:00		211.36	4.55	4088.93	27.39	35.02	30.00	11.20	-0.17	-0.22	-0.20	-0.04
04/30/2009 09:23:00	04/30/2009 09:24:00		210.56	4.84	4083.14	27.55	35.85	30.70	11.25	-0.17	-0.22	-0.20	-0.04
			212.12	4.79	4,089.91	27.31	35.45	30.36	11.17	-0.16	-0.21	-0.19	-0.04

WP H2 Plant RATA Testing
CEMS Data

Example Formula		PI Tag	21FC416	21AI181	21FI185		21AI182D				21AI180K_1		
PICalcVal(C9,A13,B13,"a		Name	Main Burner BTU Controller	O2 RAW PPM	STACK FLOW	Raw Stack NOx	NOx w/ NO O2	Stack NOx at 3% O2	NOx Emissions	Raw Stack CO	CO PPM w/ 0% O2 1-Hour Average	Stack CO at 3% O2	COx Emissions
		Units	MM BTU/HR	%	MSCFH	PPM	PPM	PPM	(lb/hr)	PPM	PPM	PPM	(lb/hr)
Avg. Period Start	Avg. Period End												
04/30/2009 09:35:00	04/30/2009 09:36:00		208.50	5.43	4064.86	26.67	36.02	30.85	10.84	-0.16	-0.22	-0.19	-0.04
04/30/2009 09:36:00	04/30/2009 09:37:00		207.97	5.33	4057.71	26.49	35.55	30.45	10.75	-0.16	-0.22	-0.19	-0.04
04/30/2009 09:37:00	04/30/2009 09:38:00		207.45	5.24	4061.13	26.46	35.30	30.24	10.74	-0.16	-0.22	-0.19	-0.04
04/30/2009 09:38:00	04/30/2009 09:39:00		207.15	5.32	4070.14	26.45	35.49	30.40	10.76	-0.16	-0.22	-0.19	-0.04
04/30/2009 09:39:00	04/30/2009 09:40:00		207.26	5.27	4088.98	26.44	35.35	30.28	10.81	-0.16	-0.22	-0.19	-0.04
04/30/2009 09:40:00	04/30/2009 09:41:00		206.86	5.07	4096.28	26.56	35.06	30.03	10.88	-0.17	-0.22	-0.19	-0.04
04/30/2009 09:41:00	04/30/2009 09:42:00		205.51	5.13	4082.01	26.86	35.61	30.50	10.96	-0.17	-0.22	-0.19	-0.04
04/30/2009 09:42:00	04/30/2009 09:43:00		205.03	5.26	4078.78	26.80	35.81	30.67	10.93	-0.16	-0.22	-0.19	-0.04
04/30/2009 09:43:00	04/30/2009 09:44:00		206.19	5.12	4091.11	26.69	35.35	30.27	10.92	-0.17	-0.22	-0.19	-0.04
04/30/2009 09:44:00	04/30/2009 09:45:00		207.39	4.88	4093.39	26.88	35.06	30.03	11.00	-0.17	-0.22	-0.20	-0.04
04/30/2009 09:45:00	04/30/2009 09:46:00		207.79	4.83	4084.21	26.76	34.81	29.81	10.92	-0.17	-0.22	-0.20	-0.04
04/30/2009 09:46:00	04/30/2009 09:47:00		206.73	4.80	4054.15	26.50	34.39	29.45	10.74	-0.17	-0.22	-0.20	-0.04
04/30/2009 09:47:00	04/30/2009 09:48:00		206.07	4.88	4042.71	26.78	34.94	29.93	10.82	-0.17	-0.22	-0.20	-0.04
04/30/2009 09:48:00	04/30/2009 09:49:00		206.49	4.99	4049.93	27.01	35.48	30.39	10.93	-0.17	-0.22	-0.20	-0.04
04/30/2009 09:49:00	04/30/2009 09:50:00		207.39	4.82	4046.50	27.11	35.24	30.18	10.97	-0.17	-0.22	-0.20	-0.04
04/30/2009 09:50:00	04/30/2009 09:51:00		207.72	4.86	4062.81	27.27	35.55	30.44	11.08	-0.17	-0.22	-0.20	-0.04
04/30/2009 09:51:00	04/30/2009 09:52:00		207.01	5.08	4051.12	27.94	36.91	31.61	11.31	-0.17	-0.22	-0.19	-0.04
04/30/2009 09:52:00	04/30/2009 09:53:00		206.86	5.15	4049.43	28.08	37.26	31.91	11.37	-0.17	-0.22	-0.19	-0.04
04/30/2009 09:53:00	04/30/2009 09:54:00		207.76	4.93	4067.37	27.62	36.15	30.96	11.23	-0.17	-0.22	-0.20	-0.04
04/30/2009 09:54:00	04/30/2009 09:55:00		208.60	4.83	4075.83	27.76	36.10	30.92	11.31	-0.17	-0.22	-0.20	-0.04
04/30/2009 09:55:00	04/30/2009 09:56:00		209.29	4.89	4070.94	27.65	36.10	30.92	11.25	-0.16	-0.21	-0.19	-0.04
			207.19	5.05	4,068.54	26.99	35.60	30.49	10.98	-0.17	-0.22	-0.19	-0.04

WP H2 Plan ، Testing
CEMS Data

Example Formula		PI Tag	21FC416	21AI181	21FI185		21AI182D				21AI180K_1		
PICalcVal(C9,A13,B13,"a		Name	Main Burner BTU Controller	O2 RAW PPM	STACK FLOW	Raw Stack NOx	NOx w/ NO O2	Stack NOx at 3% O2	NOx Emissions	Raw Stack CO	CO PPM w/ 0% O2 1-Hour Average	Stack CO at 3% O2	COx Emissions
		Units	MM BTU/HR	%	MSCFH	PPM	PPM	PPM	(lb/hr)	PPM	PPM	PPM	(lb/hr)
Avg. Period Start	Avg. Period End												
04/30/2009 10:09:00	04/30/2009 10:10:00		205.73	5.26	4044.74	26.40	35.28	30.22	10.67	0.01	0.02	0.02	0.00
04/30/2009 10:10:00	04/30/2009 10:11:00		205.07	5.43	4045.28	26.78	36.18	30.99	10.83	0.01	0.02	0.02	0.00
04/30/2009 10:11:00	04/30/2009 10:12:00		204.99	5.47	4044.52	27.02	36.59	31.34	10.92	0.01	0.02	0.02	0.00
04/30/2009 10:12:00	04/30/2009 10:13:00		206.45	5.26	4038.86	26.37	35.23	30.18	10.65	0.01	0.02	0.02	0.00
04/30/2009 10:13:00	04/30/2009 10:14:00		207.91	5.04	4032.94	26.55	34.99	29.96	10.70	0.02	0.02	0.02	0.00
04/30/2009 10:14:00	04/30/2009 10:15:00		207.72	4.92	4042.92	26.58	34.77	29.78	10.74	0.02	0.02	0.02	0.00
04/30/2009 10:15:00	04/30/2009 10:16:00		207.49	4.98	4049.55	26.71	35.06	30.02	10.81	0.02	0.02	0.02	0.00
04/30/2009 10:16:00	04/30/2009 10:17:00		207.26	4.93	4049.36	27.31	35.75	30.62	11.05	0.02	0.02	0.02	0.00
04/30/2009 10:17:00	04/30/2009 10:18:00		207.23	4.70	4047.98	27.50	35.47	30.38	11.13	0.02	0.02	0.02	0.00
04/30/2009 10:18:00	04/30/2009 10:19:00		206.88	4.58	4049.04	27.47	35.18	30.13	11.12	0.02	0.02	0.02	0.00
04/30/2009 10:19:00	04/30/2009 10:20:00		205.35	4.74	4058.08	27.14	35.10	30.06	11.01	0.02	0.02	0.02	0.00
04/30/2009 10:20:00	04/30/2009 10:21:00		204.89	4.99	4059.18	26.96	35.42	30.34	10.94	0.02	0.02	0.02	0.00
04/30/2009 10:21:00	04/30/2009 10:22:00		206.00	5.04	4047.71	26.88	35.42	30.33	10.88	0.02	0.02	0.02	0.00
04/30/2009 10:22:00	04/30/2009 10:23:00		206.25	4.88	4040.33	26.86	35.04	30.01	10.85	0.02	0.02	0.02	0.00
04/30/2009 10:23:00	04/30/2009 10:24:00		206.48	5.02	4046.25	27.01	35.55	30.45	10.93	0.02	0.02	0.02	0.00
04/30/2009 10:24:00	04/30/2009 10:25:00		206.58	5.17	4069.42	27.32	36.30	31.09	11.11	0.02	0.02	0.02	0.00
04/30/2009 10:25:00	04/30/2009 10:26:00		206.46	5.28	4080.20	26.99	36.12	30.94	11.01	0.01	0.02	0.02	0.00
04/30/2009 10:26:00	04/30/2009 10:27:00		206.36	5.26	4077.31	27.01	36.09	30.91	11.01	0.01	0.02	0.02	0.00
04/30/2009 10:27:00	04/30/2009 10:28:00		206.28	5.11	4049.64	26.79	35.45	30.36	10.85	0.02	0.02	0.02	0.00
04/30/2009 10:28:00	04/30/2009 10:29:00		205.88	5.06	4036.43	26.72	35.27	30.20	10.78	0.02	0.02	0.02	0.00
04/30/2009 10:29:00	04/30/2009 10:30:00		205.36	5.22	4056.10	26.96	35.93	30.78	10.93	0.02	0.02	0.02	0.00
			206.32	5.06	4,050.75	26.92	35.53	30.43	10.90	0.02	0.02	0.02	0.00

WP H2 Plant RATA Testing
CEMS Data

Example Formula		PI Tag	21FC416	21AI181	21FI185		21AI182D				21AI180K_1		
PICalcVal(C9,A13,B13,"a		Name	Main Burner BTU Controller	O2 RAW PPM	STACK FLOW	Raw Stack NOx	NOx w/ NO O2	Stack NOx at 3% O2	NOx Emissions	Raw Stack CO	CO PPM w/ 0% O2 1-Hour Average	Stack CO at 3% O2	COx Emissions
		Units	MM BTU/HR	%	MSCFH	PPM	PPM	PPM	(lb/hr)	PPM	PPM	PPM	(lb/hr)
Avg. Period Start	Avg. Period End												
04/30/2009 10:39:00	04/30/2009 10:40:00		202.06	5.76	4054.42	26.77	36.95	31.65	10.85	0.01	0.02	0.02	0.00
04/30/2009 10:40:00	04/30/2009 10:41:00		203.54	5.55	4032.76	26.50	36.07	30.90	10.68	0.01	0.02	0.02	0.00
04/30/2009 10:41:00	04/30/2009 10:42:00		204.07	5.29	4044.70	26.42	35.38	30.30	10.68	0.01	0.02	0.02	0.00
04/30/2009 10:42:00	04/30/2009 10:43:00		202.77	5.30	4044.97	26.61	35.64	30.52	10.76	0.01	0.02	0.02	0.00
04/30/2009 10:43:00	04/30/2009 10:44:00		201.75	5.45	4034.96	26.98	36.50	31.26	10.88	0.01	0.02	0.02	0.00
04/30/2009 10:44:00	04/30/2009 10:45:00		201.30	5.46	4047.68	27.00	36.56	31.31	10.93	0.01	0.02	0.02	0.00
04/30/2009 10:45:00	04/30/2009 10:46:00		201.35	5.21	4043.70	27.13	36.14	30.95	10.97	0.02	0.02	0.02	0.00
04/30/2009 10:46:00	04/30/2009 10:47:00		201.58	5.09	4038.01	26.92	35.58	30.47	10.87	0.02	0.02	0.02	0.00
04/30/2009 10:47:00	04/30/2009 10:48:00		200.52	5.19	4066.88	27.06	36.01	30.84	11.00	0.02	0.02	0.02	0.00
04/30/2009 10:48:00	04/30/2009 10:49:00		200.47	5.30	4061.52	26.97	36.13	30.94	10.95	0.01	0.02	0.02	0.00
04/30/2009 10:49:00	04/30/2009 10:50:00		202.35	5.28	4057.81	26.92	36.03	30.86	10.92	0.01	0.02	0.02	0.00
04/30/2009 10:50:00	04/30/2009 10:51:00		204.35	5.03	4048.53	26.63	35.07	30.04	10.78	0.02	0.02	0.02	0.00
04/30/2009 10:51:00	04/30/2009 10:52:00		205.43	4.85	4043.20	26.71	34.78	29.78	10.80	0.02	0.02	0.02	0.00
04/30/2009 10:52:00	04/30/2009 10:53:00		204.61	4.90	4064.04	26.82	35.02	29.99	10.89	0.02	0.02	0.02	0.00
04/30/2009 10:53:00	04/30/2009 10:54:00		204.31	5.12	4063.17	26.84	35.56	30.46	10.90	0.02	0.02	0.02	0.00
04/30/2009 10:54:00	04/30/2009 10:55:00		205.06	5.21	4038.25	27.25	36.30	31.09	11.00	0.02	0.02	0.02	0.00
04/30/2009 10:55:00	04/30/2009 10:56:00		205.02	5.11	4041.51	27.52	36.42	31.19	11.12	0.01	0.01	0.01	0.00
04/30/2009 10:56:00	04/30/2009 10:57:00		203.47	5.21	4042.71	27.42	36.52	31.28	11.08	-0.01	-0.01	-0.01	0.00
04/30/2009 10:57:00	04/30/2009 10:58:00		202.76	5.46	4046.68	27.24	36.87	31.58	11.02	-0.03	-0.04	-0.03	-0.01
04/30/2009 10:58:00	04/30/2009 10:59:00		203.64	5.52	4064.13	27.05	36.76	31.49	10.99	-0.05	-0.06	-0.05	-0.01
04/30/2009 10:59:00	04/30/2009 11:00:00		204.16	5.30	4081.97	26.67	35.73	30.60	10.88	-0.07	-0.09	-0.08	-0.02
			203.08	5.27	4,050.55	26.92	36.00	30.83	10.90	0.00	0.01	0.01	0.00

WP H2 Plant . Testing
CEMS Data

Example Formula	PI Tag	21FC416	21AI181	21FI185	21AI182D					21AI180K_1		
PICalcVal(C9,A13,B13,"a	Name	Main Burner BTU Controller	O2 RAW PPM	STACK FLOW	Raw Stack NOx	NOx w/ NO O2	Stack NOx at 3% O2	NOx Emissions	Raw Stack CO	CO PPM w/ 0% O2 1-Hour Average	Stack CO at 3% O2	COx Emissions
	Units	MM BTU/HR	%	MSCFH	PPM	PPM	PPM	(lb/hr)	PPM	PPM	PPM	(lb/hr)
Avg. Period Start	Avg. Period End											
04/30/2009 11:09:00	04/30/2009 11:10:00	202.12	5.27	4052.15	26.40	35.31	30.24	10.69	-0.13	-0.18	-0.16	-0.03
04/30/2009 11:10:00	04/30/2009 11:11:00	202.89	5.22	4055.96	26.61	35.47	30.38	10.79	-0.14	-0.18	-0.16	-0.03
04/30/2009 11:11:00	04/30/2009 11:12:00	203.22	5.31	4059.27	27.18	36.45	31.22	11.03	-0.13	-0.18	-0.16	-0.03
04/30/2009 11:12:00	04/30/2009 11:13:00	202.73	5.41	4061.72	26.87	36.25	31.05	10.91	-0.13	-0.18	-0.16	-0.03
04/30/2009 11:13:00	04/30/2009 11:14:00	202.58	5.43	4052.11	26.91	36.36	31.14	10.90	-0.13	-0.18	-0.16	-0.03
04/30/2009 11:14:00	04/30/2009 11:15:00	203.11	5.32	4020.07	26.93	36.14	30.95	10.82	-0.13	-0.18	-0.16	-0.03
04/30/2009 11:15:00	04/30/2009 11:16:00	203.06	5.31	4002.71	26.76	35.88	30.73	10.71	-0.13	-0.18	-0.16	-0.03
04/30/2009 11:16:00	04/30/2009 11:17:00	201.94	5.47	4013.69	27.05	36.64	31.38	10.85	-0.13	-0.18	-0.16	-0.03
04/30/2009 11:17:00	04/30/2009 11:18:00	201.70	5.46	4029.02	27.05	36.62	31.36	10.89	-0.13	-0.18	-0.16	-0.03
04/30/2009 11:18:00	04/30/2009 11:19:00	203.11	5.22	4051.17	26.57	35.42	30.34	10.76	-0.14	-0.18	-0.16	-0.03
04/30/2009 11:19:00	04/30/2009 11:20:00	203.88	5.15	4056.20	26.43	35.08	30.04	10.72	-0.14	-0.18	-0.16	-0.03
04/30/2009 11:20:00	04/30/2009 11:21:00	203.38	5.09	4042.26	26.67	35.27	30.20	10.78	-0.14	-0.18	-0.16	-0.03
04/30/2009 11:21:00	04/30/2009 11:22:00	202.86	5.13	4051.12	26.86	35.61	30.50	10.88	-0.14	-0.18	-0.16	-0.03
04/30/2009 11:22:00	04/30/2009 11:23:00	203.04	5.19	4058.31	26.92	35.82	30.68	10.92	-0.14	-0.18	-0.16	-0.03
04/30/2009 11:23:00	04/30/2009 11:24:00	204.54	4.96	4070.65	26.93	35.30	30.24	10.96	-0.14	-0.18	-0.16	-0.03
04/30/2009 11:24:00	04/30/2009 11:25:00	205.17	4.85	4099.65	26.97	35.11	30.07	11.05	-0.14	-0.18	-0.16	-0.03
04/30/2009 11:25:00	04/30/2009 11:26:00	204.29	4.99	4107.44	27.05	35.54	30.44	11.11	-0.14	-0.18	-0.16	-0.03
04/30/2009 11:26:00	04/30/2009 11:27:00	203.62	5.17	4075.58	26.98	35.83	30.69	10.99	-0.14	-0.18	-0.16	-0.03
04/30/2009 11:27:00	04/30/2009 11:28:00	203.41	5.24	4057.51	26.63	35.53	30.43	10.80	-0.13	-0.18	-0.16	-0.03
04/30/2009 11:28:00	04/30/2009 11:29:00	204.05	5.17	4066.84	26.48	35.19	30.14	10.76	-0.14	-0.18	-0.16	-0.03
04/30/2009 11:29:00	04/30/2009 11:30:00	204.09	5.33	4066.37	26.70	35.84	30.70	10.85	-0.13	-0.18	-0.16	-0.03
		203.27	5.22	4,054.75	26.81	35.74	30.61	10.87	-0.14	-0.18	-0.16	-0.03

WP H2 Plant RATA Testing
CEMS Data

Example Formula		PI Tag	21FC416	21AI181	21FI185		21AI182D				21AI180K_1		
PICalcVal(C9,A13,B13,"a		Name	Main Burner BTU Controller	O2 RAW PPM	STACK FLOW	Raw Stack NOx	NOx w/ NO O2	Stack NOx at 3% O2	NOx Emissions	Raw Stack CO	CO PPM w/ 0% O2 1-Hour Average	Stack CO at 3% O2	COx Emissions
		Units	MM BTU/HR	%	MSCFH	PPM	PPM	PPM	(lb/hr)	PPM	PPM	PPM	(lb/hr)
Avg. Period Start	Avg. Period End												
04/30/2009 11:41:00	04/30/2009 11:42:00		199.30	5.48	4087.24	25.58	34.66	29.68	10.45	-0.13	-0.18	-0.16	-0.03
04/30/2009 11:42:00	04/30/2009 11:43:00		200.55	5.24	4087.05	25.76	34.39	29.46	10.53	-0.13	-0.18	-0.16	-0.03
04/30/2009 11:43:00	04/30/2009 11:44:00		200.73	5.15	4085.13	26.06	34.58	29.61	10.64	-0.14	-0.18	-0.16	-0.03
04/30/2009 11:44:00	04/30/2009 11:45:00		198.89	5.31	4081.68	26.56	35.61	30.50	10.84	-0.13	-0.18	-0.16	-0.03
04/30/2009 11:45:00	04/30/2009 11:46:00		198.16	5.48	4081.30	26.60	36.05	30.87	10.85	-0.13	-0.18	-0.16	-0.03
04/30/2009 11:46:00	04/30/2009 11:47:00		199.30	5.51	4076.46	26.22	35.59	30.48	10.68	-0.13	-0.18	-0.15	-0.03
04/30/2009 11:47:00	04/30/2009 11:48:00		200.06	5.37	4052.89	26.40	35.53	30.43	10.69	-0.13	-0.18	-0.16	-0.03
04/30/2009 11:48:00	04/30/2009 11:49:00		200.66	5.44	4045.83	26.46	35.77	30.64	10.70	-0.13	-0.18	-0.16	-0.03
04/30/2009 11:49:00	04/30/2009 11:50:00		200.52	5.49	4058.37	26.70	36.22	31.02	10.83	-0.13	-0.18	-0.15	-0.03
04/30/2009 11:50:00	04/30/2009 11:51:00		199.56	5.49	4049.95	26.76	36.31	31.10	10.84	-0.13	-0.18	-0.15	-0.03
04/30/2009 11:51:00	04/30/2009 11:52:00		199.21	5.44	4045.56	26.95	36.44	31.21	10.90	-0.13	-0.18	-0.16	-0.03
04/30/2009 11:52:00	04/30/2009 11:53:00		199.99	5.29	4049.50	26.76	35.83	30.69	10.83	-0.13	-0.18	-0.16	-0.03
04/30/2009 11:53:00	04/30/2009 11:54:00		200.00	5.26	4044.90	26.71	35.69	30.57	10.80	-0.13	-0.18	-0.16	-0.03
04/30/2009 11:54:00	04/30/2009 11:55:00		198.52	5.44	4045.64	26.95	36.42	31.19	10.90	-0.13	-0.18	-0.16	-0.03
04/30/2009 11:55:00	04/30/2009 11:56:00		197.86	5.45	4070.40	26.87	36.35	31.13	10.93	-0.13	-0.18	-0.16	-0.03
04/30/2009 11:56:00	04/30/2009 11:57:00		198.77	5.25	4068.26	26.44	35.30	30.23	10.75	-0.13	-0.18	-0.15	-0.03
04/30/2009 11:57:00	04/30/2009 11:58:00		199.71	5.18	4085.64	26.47	35.19	30.14	10.81	-0.13	-0.17	-0.15	-0.03
04/30/2009 11:58:00	04/30/2009 11:59:00		200.16	5.11	4114.40	26.52	35.10	30.06	10.91	-0.12	-0.16	-0.14	-0.03
04/30/2009 11:59:00	04/30/2009 12:00:00		199.71	5.15	4097.22	26.56	35.25	30.19	10.88	-0.11	-0.15	-0.13	-0.03
04/30/2009 12:00:00	04/30/2009 12:01:00		199.55	5.26	4081.98	26.82	35.83	30.69	10.94	-0.10	-0.14	-0.12	-0.03
04/30/2009 12:01:00	04/30/2009 12:02:00		199.98	5.12	4072.35	26.96	35.72	30.59	10.98	-0.10	-0.13	-0.11	-0.02
			199.58	5.33	4,070.56	26.53	35.61	30.50	10.79	-0.13	-0.17	-0.15	-0.03

WP H2 Plant Testing
CEMS Data

Example Formula		PI Tag	21FC416	21AI181	21FI185		21AI182D				21AI180K_1		
PICalcVal(C9,A13,B13,"a		Name	Main Burner BTU Controller	O2 RAW PPM	STACK FLOW	Raw Stack NOx	NOx w/ NO O2	Stack NOx at 3% O2	NOx Emissions	Raw Stack CO	CO PPM w/ 0% O2 1-Hour Average	Stack CO at 3% O2	COx Emissions
		Units	MM BTU/HR	%	MSCFH	PPM	PPM	PPM	(lb/hr)	PPM	PPM	PPM	(lb/hr)
Avg. Period Start	Avg. Period End												
04/30/2009 12:12:00	04/30/2009 12:13:00		200.68	5.15	4063.38	25.91	34.39	29.45	10.52	-0.06	-0.08	-0.07	-0.01
04/30/2009 12:13:00	04/30/2009 12:14:00		200.46	5.23	4074.00	26.36	35.15	30.10	10.74	-0.06	-0.08	-0.07	-0.01
04/30/2009 12:14:00	04/30/2009 12:15:00		200.63	5.15	4083.62	26.85	35.61	30.50	10.96	-0.06	-0.08	-0.07	-0.01
04/30/2009 12:15:00	04/30/2009 12:16:00		200.81	4.93	4084.82	26.59	34.81	29.81	10.86	-0.06	-0.08	-0.07	-0.02
04/30/2009 12:16:00	04/30/2009 12:17:00		200.99	4.99	4070.82	26.20	34.42	29.48	10.66	-0.06	-0.08	-0.07	-0.02
04/30/2009 12:17:00	04/30/2009 12:18:00		201.17	5.06	4056.89	26.43	34.86	29.85	10.72	-0.06	-0.08	-0.07	-0.01
04/30/2009 12:18:00	04/30/2009 12:19:00		201.35	5.12	4056.99	26.66	35.32	30.25	10.81	-0.06	-0.08	-0.07	-0.01
04/30/2009 12:19:00	04/30/2009 12:20:00		201.53	5.18	4074.46	26.66	35.45	30.36	10.86	-0.06	-0.08	-0.07	-0.01
04/30/2009 12:20:00	04/30/2009 12:21:00		200.96	5.25	4076.88	26.43	35.29	30.23	10.77	-0.06	-0.08	-0.07	-0.01
04/30/2009 12:21:00	04/30/2009 12:22:00		199.00	5.41	4078.50	26.64	35.94	30.78	10.86	-0.06	-0.08	-0.07	-0.01
04/30/2009 12:22:00	04/30/2009 12:23:00		197.43	5.76	4079.29	26.84	37.05	31.73	10.94	-0.06	-0.08	-0.07	-0.01
04/30/2009 12:23:00	04/30/2009 12:24:00		197.69	5.86	4069.57	26.71	37.12	31.79	10.87	-0.06	-0.08	-0.07	-0.01
04/30/2009 12:24:00	04/30/2009 12:25:00		199.18	5.50	4055.57	26.36	35.78	30.64	10.68	-0.06	-0.08	-0.07	-0.01
04/30/2009 12:25:00	04/30/2009 12:26:00		199.31	5.25	4069.09	26.54	35.45	30.36	10.79	-0.06	-0.08	-0.07	-0.01
04/30/2009 12:26:00	04/30/2009 12:27:00		199.07	5.22	4072.95	26.57	35.41	30.33	10.82	-0.06	-0.08	-0.07	-0.01
04/30/2009 12:27:00	04/30/2009 12:28:00		198.18	5.28	4057.92	26.45	35.38	30.30	10.73	-0.06	-0.08	-0.07	-0.01
04/30/2009 12:28:00	04/30/2009 12:29:00		198.19	5.40	4052.75	26.32	35.50	30.41	10.66	-0.06	-0.08	-0.07	-0.01
04/30/2009 12:29:00	04/30/2009 12:30:00		199.88	5.24	4066.59	26.51	35.39	30.31	10.78	-0.06	-0.08	-0.07	-0.01
04/30/2009 12:30:00	04/30/2009 12:31:00		200.28	4.98	4064.64	26.51	34.79	29.80	10.77	-0.06	-0.08	-0.07	-0.02
04/30/2009 12:31:00	04/30/2009 12:32:00		198.21	5.03	4050.73	26.92	35.45	30.36	10.90	-0.06	-0.08	-0.07	-0.01
04/30/2009 12:32:00	04/30/2009 12:33:00		197.37	5.31	4069.34	27.13	36.37	31.15	11.04	-0.06	-0.08	-0.07	-0.01
			199.64	5.25	4,068.04	26.55	35.47	30.38	10.80	-0.06	-0.08	-0.07	-0.01

Optimal Air Testing Services, Inc.
SOURCE TESTING MOISTURE (Method 4) DATA SHEET

Client: Suncor	Date: 4/27/20	OATS Project No.: 9002
Plant: WSI	Meter ID: 3	Ambient Temp. °F: 70°
Test Location: Stack	Meter ΔH@: 1.975	Bar. Pressure in. Hg: 25.11
Unit: H2	Meter Y_d: 0.980	
Technician: CH / ZP		

Run (s) 1-3

Orifice Setting (ΔH): 2.0

System Leak Checks

Initial .004 CFM @ 15 in. Hg

Post-Test .004 CFM @ 15 in. Hg

Impinger	Initial	Final	Condensate
Fraction / Contents	Wt. (g)	Wt. (g)	Wt. (g)
1 / ~100 ml H2O	746.1	785.1	39.0
2 / ~100 ml H2O	720.6	749.4	28.8
3 / Empty	631.5	636.5	5.0
4 / Silica Gel	913.1	1287.7	374.6
	134/.3	Total	449.4

Clock Time	Dry Gas Meter (ft^3)	Gas Meter Temp. (F) Inlet	Gas Meter Temp. (F) Outlet
1540 0	639.023		
5	643.40	82	80
10	647.78	82	80
15	652.06	82	80
20	656.44	82	80
25	660.72	82	80
30	665.10	81	80
35	669.48	81	80
40	673.86	81	80
45	678.24	81	80
50	682.62	81	80
55	687.13	81	80
1640 60	691.64	81	80

Run (s)

Orifice Setting (ΔH):

System Leak Checks

Initial _____ CFM @ _____ in. Hg

Post-Test _____ CFM @ _____ in. Hg

Impinger	Initial	Final	Condensate
Fraction / Contents	Wt. (g)	Wt. (g)	Wt. (g)
1 / ~100 ml H2O			
2 / ~100 ml H2O			
3 / Empty			
4 / Silica Gel			
		Total	

Clock Time	Dry Gas Meter (ft^3)	Gas Meter Temp. (F) Inlet	Gas Meter Temp. (F) Outlet
0			
5			
10			
15			
20			
25			
30			
35			
40			
45			
50			
55			
60			

Optimal Air Testing
SOURCE TESTING TRAVERSE DATA SHEET

Client: Sunoco	Date: 4/29/09	OATS Project No.: 9002
Plant: WOST	Pitot ID V-8-1	Ambient Temp. °F: 70°
Test Location: Stack	Pitot Cp 0.84	Bar. Pressure in. Hg: 25.19
Unit: HT2	% CO_2 15.8	Assumed % Moist 15%
Technicians: CH / ZD	% O_2 4.6	Static Press. in. H_2O + − .20

Run, Time	1 1550			1			2 1600			2		
Pitot Check	Pretest Pass ☑ Posttest Pass ☑			Pretest Pass ☑ Posttest Pass ☑			Pretest Pass ☑ Posttest Pass ☑			Pretest Pass ☑ Posttest Pass ☑		
Traverse Point	Port Δp	Ts	∝	Port Δp	Ts	∝	Port Δp	Ts	∝	Port Δp	Ts	∝
1	.31	335		.30	334		.32	331		.30	331	
2	.31	333		.31	333		.33	330		.31	330	
3	.29	335		.30	334		.34	331		.31	332	
4	.29	334		.28	334		.32	328		.30	331	
5	.37	334		.29	335		.29	330		.35	330	
6	.36	335		.34	336		.35	330		.35	330	
7	.35	334		.31	334		.36	331		.34	331	
8	.34	333		.36	333		.36	332		.34	332	
9												
10												
11												
12												

Run, Time	3 1625			3								
Pitot Check	Pretest Pass ☑ Posttest Pass ☑			Pretest Pass ☑ Posttest Pass ☑			Pretest Pass ☐ Posttest Pass ☐			Pretest Pass ☐ Posttest Pass ☐		
Traverse Point	Port Δp	Ts	∝	Port Δp	Ts	∝	Port Δp	Ts	∝	Port Δp	Ts	∝
1	[illegible]	[illegible]		[illegible]	[illegible]							
2	[illegible]	[illegible]		[illegible]	[illegible]							
3	[illegible]	[illegible]		[illegible]	[illegible]							
4	[illegible]	[illegible]		[illegible]	[illegible]							
5	[illegible]	[illegible]		[illegible]	[illegible]							
6	[illegible]	[illegible]		[illegible]	[illegible]							
7	[illegible]	[illegible]		[illegible]	[illegible]							
8	[illegible]	[illegible]		[illegible]	[illegible]							
9												
10												
11												
12												

Optimal Air Testing Services, Inc.
SOURCE TESTING MOISTURE (Method 4) DATA SHEET

Client:	Sunoco	Date:	7-30-07	OATS Project No.:	9002
Plant:	West	Meter ID:	V-8-1	Ambient Temp. °F:	80
Test Location:	stack	Meter ΔH@:	1.975	Bar. Pressure in. Hg:	29.15
Unit:	H2	Meter Y_d:	.980	Stack DIA	82 ft
Technician:	CH ZP			~~Stack~~ Test Length	18 28

Run (s): 4-6

Orifice Setting (ΔH): 2.0

System Leak Checks

Initial .004 CFM @ 15 in. Hg

Post-Test .004 CFM @ 15 in. Hg

Impinger	Initial	Final	Condensate
Fraction / Contents	Wt. (g)	Wt. (g)	Wt. (g)
1 / ~100 ml H2O	758.3	871.0	112.7
2 / ~100 ml H2O	749.4	761.0	11.6
3 / Empty	696.0	699.6	3.6
4 / Silica Gel	951	985	air — 10.5
	127.9	Total	138.4

Clock Time	Dry Gas Meter (ft^3)	Gas Meter Temp. (F) Inlet	Gas Meter Temp. (F) Outlet
8:45 (0)	691.88		
5	695.63	63	64
10	699.43	64	62
15	703.38	64	61
20	707.32	64	62
25	711.36	65	64
30	715.35	64	65
35	719.47	68	65
40	723.35	68	64
45	727.32	71	65
50	731.41	70	66
55	735.65	69	65
60	739.38	68	64

Run (s): 7-9

Orifice Setting (ΔH):

System Leak Checks

Initial .004 CFM @ 15 in. Hg

Post-Test .004 CFM @ 15 in. Hg

Impinger	Initial	Final	Condensate
Fraction / Contents	Wt. (g)	Wt. (g)	Wt. (g)
1 / ~100 ml H2O	[illegible]	[illegible]	[illegible]
2 / ~100 ml H2O	[illegible]	[illegible]	[illegible]
3 / Empty	[illegible]	[illegible]	[illegible]
4 / Silica Gel	[illegible]	[illegible]	[illegible]
	143.2	Total	[illegible]

Clock Time	Dry Gas Meter (ft^3)	Gas Meter Temp. (F) Inlet	Gas Meter Temp. (F) Outlet
[illegible] (0)	[illegible]		
5	[illegible]	[illegible]	[illegible]
10	[illegible]	[illegible]	[illegible]
15	[illegible]	[illegible]	[illegible]
20	556.[illegible]	[illegible]	[illegible]
25	[illegible]	[illegible]	[illegible]
30	[illegible]	[illegible]	[illegible]
35	[illegible]	[illegible]	[illegible]
40	[illegible]	[illegible]	[illegible]
45	[illegible]	[illegible]	[illegible]
50	[illegible]	[illegible]	[illegible]
55	[illegible]	[illegible]	[illegible]
60	[illegible]	[illegible]	[illegible]

Optimal Air Testing
SOURCE TESTING TRAVERSE DATA SHEET

Client:	[illegible]	Date:	4-30-07	OATS Project No.:	9002
Plant:	[illegible]	Pitot ID	V-8-1	Ambient Temp. °F:	50
Test Location:	stack	Pitot Cp	.84	Bar. Pressure in. Hg:	25.15
Unit:	#2	% CO_2	15.8	Assumed % Moist	15%
Technicians:	CH JP	% O_2	4.6	Static Press. in. H_2O + −	.20

Run, Time	8:40 Run 4			Run 4			Run 5 9:05			Run 5		
Pitot Check	Pretest Pass ☑ Posttest Pass ☑			Pretest Pass ☑ Posttest Pass ☑			Pretest Pass ☑ Posttest Pass ☑			Pretest Pass ☑ Posttest Pass ☑		
Traverse Point	Port Δp	Ts	∝	Port Δp	Ts	∝	Port Δp	Ts	∝	Port Δp	Ts	∝
1	.36	336		.35	335		.34	335		.34	336	
2	.35	331		.34	334		.35	336		.39	336	
3	.34	333		.33	334		.35	336		.39	335	
4	.36	334		.35	335		.36	335		.36	335	
5	.41	334		.34	335		.43	334		.41	336	
6	.39	335		.41	332		.42	332		.39	332	
7	.41	336		.35	335		.46	335		.41	337	
8	.42	335		.42	335		.42	335		.42	331	
9												
10												
11												
12												

Run, Time	Run 6 9:35			Run 6								
Pitot Check	Pretest Pass ☑ Posttest Pass ☑			Pretest Pass ☑ Posttest Pass ☑			Pretest Pass ☐ Posttest Pass ☐			Pretest Pass ☐ Posttest Pass ☐		
Traverse Point	Port Δp	Ts	∝	Port Δp	Ts	∝	Port Δp	Ts	∝	Port Δp	Ts	∝
1	[illegible]	[illegible]		[illegible]	[illegible]							
2	[illegible]	[illegible]		[illegible]	[illegible]							
3	[illegible]	[illegible]		[illegible]	[illegible]							
4	[illegible]	[illegible]		[illegible]	[illegible]							
5	[illegible]	[illegible]		[illegible]	[illegible]							
6	[illegible]	[illegible]		[illegible]	[illegible]							
7	[illegible]	[illegible]		[illegible]	[illegible]							
8	[illegible]	[illegible]		.42	[illegible]							
9												
10												
11												
12												

Optimal Air Testing
SOURCE TESTING TRAVERSE DATA SHEET

Client:	Sunoco	Date:	4-30-09	OATS Project No.:	9602
Plant:	West	Pitot ID	W-8-1	Ambient Temp. °F:	60
Test Location:	stack	Pitot Cp	.84	Bar. Pressure in. Hg:	25.15
Unit:	H2	% CO_2	16.4	Assumed % Moist	15%
Technicians:	CH JD	% O_2	5.2	Static Press. in. H_2O + −	.20

Run, Time	Run 7 10:10			Run 7			10:35 Run 8			Run 8		
Pitot Check	Pretest Pass ☑ Posttest Pass ☑			Pretest Pass ☑ Posttest Pass ☑			Pretest Pass ☑ Posttest Pass ☑			Pretest Pass ☑ Posttest Pass ☑		
Traverse Point	Port Δp	Ts	∝	Port Δp	Ts	∝	Port Δp	Ts	∝	Port Δp	Ts	∝
1	.34	334		.33	334		.34	334		.35	334	
2	.33	332		.35	335		.35	335		.35	334	
3	.37	332		.33	336		.35	333		.31	335	
4	.36	332		.35	336		.34	334		.38	335	
5	.41	334		.35	336		.34	335		.35	337	
6	.30	336		.34	337		.36	337		.36	335	
7	.34	340		.32	336		.31	334		.39	334	
8	.27	339		.33	335		.32	336		.28	334	
9												
10												
11												
12												

Run, Time	Run 9 11:50			Run 9								
Pitot Check	Pretest Pass ☑ Posttest Pass ☑			Pretest Pass ☑ Posttest Pass ☑			Pretest Pass ☐ Posttest Pass ☐			Pretest Pass ☐ Posttest Pass ☐		
Traverse Point	Port Δp	Ts	∝	Port Δp	Ts	∝	Port Δp	Ts	∝	Port Δp	Ts	∝
1	.34	334		.35	332							
2	.35	337		.34	333							
3	.31	336		.32	333							
4	.31	332		.32	332							
5	.33	334		.31	335							
6	.31	337		.33	333							
7	.29	337		.31	334							
8	.32	334		.31	332							
9												
10												
11												
12												

Optimal Air Testing Services, Inc.
SOURCE TESTING MOISTURE (Method 4) DATA SHEET

Client: Sussex	Date: 4-30-01	OATS Project No.: 9642
Plant: West	Meter ID: V8-1	Ambient Temp. °F: 67
Test Location: Stack	Meter ΔH@: 1.975	Bar. Pressure in. Hg: 29.15
Unit: #2	Meter Y_d: 0.980	
Technician: EH TP		

Run (s) 10, 11
Orifice Setting (ΔH): 2

System Leak Checks
Initial .004 CFM @ 15 in. Hg
Post-Test .004 CFM @ 15 in. Hg

Impinger	Initial	Final	Condensate
Fraction / Contents	Wt. (g)	Wt. (g)	Wt. (g)
1 / ~100 ml H2O	775.4	775.5	0.1
2 / ~100 ml H2O	782.3	786.6	4
3 / Empty	632.2	636.6	4
4 / Silica Gel	958.4	963.1	4.7
54.5		Total	16.2

Clock Time	Dry Gas Meter (ft^3)	Gas Meter Temp. (F) Inlet	Gas Meter Temp. (F) Outlet
0 (11:50)	776.24		
5	794.23	72	71
10	798.61	72	70
15	802.33	71	69
20	806.72	68	68
25	810.45	65	67
30 (12:20)	814.75	63	70
35			
40			
45			
50			
55			
60			

Run (s)
Orifice Setting (ΔH):

System Leak Checks
Initial _____ CFM @ _____ in. Hg
Post-Test _____ CFM @ _____ in. Hg

Impinger	Initial	Final	Condensate
Fraction / Contents	Wt. (g)	Wt. (g)	Wt. (g)
1 / ~100 ml H2O			
2 / ~100 ml H2O			
3 / Empty			
4 / Silica Gel			
		Total	

Clock Time	Dry Gas Meter (ft^3)	Gas Meter Temp. (F) Inlet	Gas Meter Temp. (F) Outlet
0			
5			
10			
15			
20			
25			
30			
35			
40			
45			
50			
55			
60			

Optimal Air Testing
SOURCE TESTING TRAVERSE DATA SHEET

Client:	Sunoco	Date:	4-30-09	OATS Project No.:	9402
Plant:	Ver	Pitot ID	V-8-1	Ambient Temp. °F:	67
Test Location:	stack	Pitot Cp	.84	Bar. Pressure in. Hg:	28.15
Unit:	HS	% CO_2	16.4	Assumed % Moist	16%
Technicians:	CH JP	% O_2	5.2	Static Press. in. H_2O +	-0.20

Run, Time	Run 10 11:45			Run 10			12:20 Run 11			Run 11		
Pitot Check	Pretest Pass ☒ Posttest Pass ☒			Pretest Pass ☒ Posttest Pass ☒			Pretest Pass ☒ Posttest Pass ☒			Pretest Pass ☒ Posttest Pass ☒		
Traverse Point	Port Δp	Port Ts	∝	Port Δp	Port Ts	∝	Port Δp	Port Ts	∝	Port Δp	Port Ts	∝
1	.35	335		.34	334		.34	331		.34	331	
2	.34	334		.33	334		.35	332		.37	334	
3	.33	333		.36	341		.34	332		.36	331	
4	.33	334		.39	346		.35	332		.37	331	
5	.42	336		.42	340		.40	332		.40	331	
6	.40	337		.41	339		.41	332		.35	333	
7	.38	337		.38	337		.35	331		.36	334	
8	.37	334		.41	338		.34	332		.31	335	
9												
10												
11												
12												

Run, Time												
Pitot Check	Pretest Pass ☐ Posttest Pass ☐			Pretest Pass ☐ Posttest Pass ☐			Pretest Pass ☐ Posttest Pass ☐			Pretest Pass ☐ Posttest Pass ☐		
Traverse Point	Port Δp	Port Ts	∝	Port Δp	Port Ts	∝	Port Δp	Port Ts	∝	Port Δp	Port Ts	∝
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												

Suncor-Plant 1
H-2101 Stack

RATA Parameters

Optimal Project: 9002I

Run No.	**1**	**2**	**3**
Date (2009)	4/29	4/29	4/29
Start Time (CEM)	15:26	16:00	16:30
Stop Time (CEM)	15:46	16:20	16:50
Sampling Parameters			
Y_d, Dry Gas Meter Correction Factor	0.9798	0.9798	0.9798
A_s, Area of Sample Location (ft^2)	41.38	41.38	41.38
P_b, Barometric Pressure (in. Hg)	25.19	25.19	25.19
C_p, Pitot Coefficient	0.84	0.84	0.84
P_s, Static Pressure (in. H_2O)	-0.20	-0.20	-0.20
$\Delta P^{1/2}$, Velocity Pressure (in. H_2O)	0.5646	0.5746	0.5769
T_s, Gas Temperature (^oF)	334.0	330.3	332.6
T_m, Meter Temperature (^oF)	80.7	80.7	80.7
V_m, Volume Metered (ft^3)	52.62	52.62	52.62
ΔH, Meter Orifice Pressure Drop (in. H_2O)	2.00	2.00	2.00
CO_2, Carbon Dioxide (% dry)	14.87	17.49	17.98
O_2, Oxygen (%dry)	4.67	4.77	4.73
W_{wc}, Weight of Water Collected (g)	134.3	134.3	134.3
W_{sg}, Silica Gel Net Weight (g)	15.6	15.6	15.6
θ, Sampling Time (min)	21	21	21
Volumetric Flow Results			
P_a, Absolute Stack Pressure (in.Hg)	25.18	25.18	25.18
V_{wstd}, Volume of Water Vapor (ft^3)	7.07	7.07	7.07
V_{mstd}, Volume Metered Standard (ft^3)	42.62	42.62	42.62
B_{wo}, Percent Moisture (%)	14.2	14.2	14.2
M_d, MW of Sample Gas, dry (lb/lb-mole)	30.57	30.99	31.07
M_s, MW of Sample Gas, wet (lb/lb-mole)	28.78	29.14	29.21
V_s, Gas Velocity (ft/sec)	42.4	42.8	43.0
Q_a, Actual Flowrate (acfm)	105,373	106,323	106,779
Q_{std}, Standard Flowrate (scfm)	58,936	59,750	59,826
Q_{dstd}, Dry Standard Flowrate (dscfm)	50,573	51,271	51,336
Q_{dstd}, Standard Flowrate (mscfh)	3,536.18	3,584.99	3,589.55
CEM Results			
C, NOx (ppmdv)	26.16	28.42	28.82
E, NOx (lb/hr)	9.48	10.44	10.60
C, CO (ppmdv)	0.00	0.00	0.00
C, CO (ppmdv @ 3% O_2)	0.00	0.00	0.00

Suncor-Plant 1
H-2101 Stack

RATA Parameters

Optimal Project: 9002I

Run No.	**4**	**5**	**6**
Date (2009)	4/30	4/30	4/30
Start Time (CEM)	8:34	9:04	9:36
Stop Time (CEM)	8:54	9:24	9:56
Sampling Parameters			
Y_d, Dry Gas Meter Correction Factor	0.9798	0.9798	0.9798
A_s, Area of Sample Location (ft^2)	41.38	41.38	41.38
P_b, Barometric Pressure (in. Hg)	25.15	25.15	25.15
C_p, Pitot Coefficient	0.84	0.84	0.84
P_s, Static Pressure (in. H_2O)	-0.20	-0.20	-0.20
$\Delta P^{1/2}$, Velocity Pressure (in. H_2O)	0.6087	0.6158	0.6196
T_s, Gas Temperature (^oF)	335.4	335.3	327.8
T_m, Meter Temperature (^oF)	64.9	64.9	64.9
V_m, Volume Metered (ft^3)	47.47	47.47	47.47
ΔH, Meter Orifice Pressure Drop (in. H_2O)	2.00	2.00	2.00
CO_2, Carbon Dioxide (% dry)	16.67	17.36	17.03
O_2, Oxygen (%dry)	4.62	4.77	4.88
W_{wc}, Weight of Water Collected (g)	127.9	127.9	127.9
W_{sg}, Silica Gel Net Weight (g)	10.5	10.5	10.5
θ, Sampling Time (min)	21	21	21
Volumetric Flow Results			
P_a, Absolute Stack Pressure (in.Hg)	25.14	25.14	25.14
V_{wstd}, Volume of Water Vapor (ft^3)	6.53	6.53	6.53
V_{mstd}, Volume Metered Standard (ft^3)	39.54	39.54	39.54
B_{wo}, Percent Moisture (%)	14.2	14.2	14.2
M_d, MW of Sample Gas, dry (lb/lb-mole)	30.85	30.97	30.92
M_s, MW of Sample Gas, wet (lb/lb-mole)	29.03	29.13	29.09
V_s, Gas Velocity (ft/sec)	45.6	46.1	46.2
Q_a, Actual Flowrate (acfm)	113,301	114,416	114,669
Q_{std}, Standard Flowrate (scfm)	63,156	63,792	64,537
Q_{dstd}, Dry Standard Flowrate (dscfm)	54,230	54,776	55,416
Q_{dstd}, Standard Flowrate (mscfh)	3,789.34	3,827.50	3,872.19
CEM Results			
C, NOx (ppmdv)	28.03	28.99	28.40
E, NOx (lb/hr)	10.89	11.38	11.28
C, CO (ppmdv)	0.00	0.00	0.00
C, CO (ppmdv @ 3% O_2)	0.00	0.00	0.00

Suncor-Plant 1
H-2101 Stack

RATA Parameters

Optimal Project: 9002I

Run No.	**7**	**8**	**9**
Date (2009)	4/30	4/30	4/30
Start Time (CEM)	10:10	10:40	11:10
Stop Time (CEM)	10:30	11:00	11:30
Sampling Parameters			
Y_d, Dry Gas Meter Correction Factor	0.9798	0.9798	0.9798
A_s, Area of Sample Location (ft^2)	41.38	41.38	41.38
P_b, Barometric Pressure (in. Hg)	25.15	25.15	25.15
C_p, Pitot Coefficient	0.84	0.84	0.84
P_s, Static Pressure (in. H_2O)	-0.20	-0.20	-0.20
$\Delta P^{1/2}$, Velocity Pressure (in. H_2O)	0.5768	0.5876	0.5762
T_s, Gas Temperature (^oF)	335.6	334.4	333.8
T_m, Meter Temperature (^oF)	75.2	75.2	75.2
V_m, Volume Metered (ft^3)	49.70	49.70	49.70
ΔH, Meter Orifice Pressure Drop (in. H_2O)	2.00	2.00	2.00
CO_2, Carbon Dioxide (% dry)	16.99	16.44	16.18
O_2, Oxygen (%dry)	5.12	5.34	5.20
W_{wc}, Weight of Water Collected (g)	143.2	143.2	143.2
W_{sg}, Silica Gel Net Weight (g)	14.4	14.4	14.4
θ, Sampling Time (min)	21	21	21
Volumetric Flow Results			
P_a, Absolute Stack Pressure (in.Hg)	25.14	25.14	25.14
V_{wstd}, Volume of Water Vapor (ft^3)	7.43	7.43	7.43
V_{mstd}, Volume Metered Standard (ft^3)	40.60	40.60	40.60
B_{wo}, Percent Moisture (%)	15.5	15.5	15.5
M_d, MW of Sample Gas, dry (lb/lb-mole)	30.92	30.84	30.80
M_s, MW of Sample Gas, wet (lb/lb-mole)	28.92	28.86	28.82
V_s, Gas Velocity (ft/sec)	43.3	44.2	43.3
Q_a, Actual Flowrate (acfm)	107,572	109,631	107,551
Q_{std}, Standard Flowrate (scfm)	59,948	61,191	60,073
Q_{dstd}, Dry Standard Flowrate (dscfm)	50,694	51,746	50,800
Q_{dstd}, Standard Flowrate (mscfh)	3,596.86	3,671.48	3,604.37
CEM Results			
C, NOx (ppmdv)	27.83	27.93	27.54
E, NOx (lb/hr)	10.11	10.35	10.02
C, CO (ppmdv)	0.00	0.00	0.71
C, CO (ppmdv @ 3% O_2)	0.00	0.00	0.81

Suncor-Plant 1
H-2101 Stack

RATA Parameters

Optimal Project: 9002I

Run No.	**10**	**11**
Date (2009)	4/30	4/30
Start Time (CEM)	11:42	12:13
Stop Time (CEM)	12:02	12:33
Sampling Parameters		
Y_d, Dry Gas Meter Correction Factor	0.9798	0.9798
A_s, Area of Sample Location (ft^2)	41.38	41.38
P_b, Barometric Pressure (in. Hg)	25.15	25.15
C_p, Pitot Coefficient	0.84	0.84
P_s, Static Pressure (in. H_2O)	-0.20	-0.20
$\Delta P^{1/2}$, Velocity Pressure (in. H_2O)	0.6140	0.5986
T_s, Gas Temperature (°F)	336.4	332.1
T_m, Meter Temperature (°F)	69.4	69.4
V_m, Volume Metered (ft^3)	24.03	24.03
ΔH, Meter Orifice Pressure Drop (in. H_2O)	2.00	2.00
CO_2, Carbon Dioxide (% dry)	16.46	16.66
O_2, Oxygen (%dry)	5.52	5.45
W_{wc}, Weight of Water Collected (g)	56.5	56.5
W_{sg}, Silica Gel Net Weight (g)	4.7	4.7
θ, Sampling Time (min)	21	21
Volumetric Flow Results		
P_a, Absolute Stack Pressure (in.Hg)	25.14	25.14
V_{wstd}, Volume of Water Vapor (ft^3)	2.89	2.89
V_{mstd}, Volume Metered Standard (ft^3)	19.84	19.84
B_{wo}, Percent Moisture (%)	12.7	12.7
M_d, MW of Sample Gas, dry (lb/lb-mole)	30.85	30.88
M_s, MW of Sample Gas, wet (lb/lb-mole)	29.22	29.25
V_s, Gas Velocity (ft/sec)	45.9	44.6
Q_a, Actual Flowrate (acfm)	113,982	110,771
Q_{std}, Standard Flowrate (scfm)	63,455	62,008
Q_{dstd}, Dry Standard Flowrate (dscfm)	55,422	54,158
Q_{dstd}, Standard Flowrate (mscfh)	3,807.30	3,720.48
CEM Results		
C, NOx (ppmdv)	27.49	27.46
E, NOx (lb/hr)	10.92	10.66
C, CO (ppmdv)	0.00	0.00
C, CO (ppmdv @ 3% O_2)	0.00	0.00

CARBON DIOXIDE

Analyzer Values	Actual	Initial	Bias	Run 1	Run 2	Run 3
Date		4/29/09	4/29/09	4/29/09	4/29/09	4/29/09
Start Time		9:12	15:15	15:26	16:00	16:30
Stop Time		9:32	15:21	15:46	16:20	16:50
Concentration, C (%)				14.85	17.21	17.27
Zero Cal Gas, C_0 (%)	0.00	0.06	0.05	0.02	0.08	0.18
Low Cal Gas (%)	5.79	5.74				
High Cal Gas (%)	11.58	11.52				
Span Value (%)	12.00					
Bias/Drift Check Gas, C_s (%)	5.79		5.80	5.81	5.65	5.65
RESULTS						
Zero Error (%)	2 % of Span	0.5				
Low Error (%)		-0.4				
High Error (%)		-0.5				
Zero Bias (%)	5 % of Span		-0.1	-0.3	0.2	1.0
Upscale Bias (%)			0.5	0.6	-0.7	-0.7
Zero Drift (%)	3 % of Span			-0.3	0.5	0.8
Upscale Drift (%)				0.1	-1.3	0.0
Concentration Corrected for Drift, C_d (%)				**14.87**	**17.49**	**17.98**

OXYGEN

Analyzer Values	Actual	Initial	Bias	Run 1	Run 2	Run 3
Date		4/29/09	4/29/09	4/29/09	4/29/09	4/29/09
Start Time		9:12	15:15	15:26	16:00	16:30
Stop Time		9:32	15:21	15:46	16:20	16:50
Concentration, C (%)				4.68	4.82	4.78
Zero Cal Gas, C_0 (%)	0.00	0.15	0.08	0.12	0.18	0.15
Low Cal Gas (%)	6.00	6.03				
High Cal Gas (%)	12.00	12.12				
Span Value (%)	12.00					
Bias/Drift Check Gas, C_s (%)	6.00		5.95	6.01	6.04	6.00
RESULTS						
Zero Error (%)	2 % of Span	1.3				
Low Error (%)		0.3				
High Error (%)		1.0				
Zero Bias (%)	5 % of Span		-0.6	-0.3	0.3	0.0
Upscale Bias (%)			-0.7	-0.2	0.1	-0.3
Zero Drift (%)	3 % of Span			0.3	0.5	-0.3
Upscale Drift (%)				0.5	0.3	-0.3
Concentration Corrected for Drift, C_d (%)				**4.67**	**4.77**	**4.73**

NITROGEN OXIDES

Analyzer Values	Actual	Initial	Bias	Run 1	Run 2	Run 3
Date		4/29/09	4/29/09	4/29/09	4/29/09	4/29/09
Start Time		9:12	15:15	15:26	16:00	16:30
Stop Time		9:32	15:21	15:46	16:20	16:50
Concentration, C (ppm)				26.30	28.49	28.68
Zero Cal Gas, C_0 (ppm)	0.00	0.36	0.27	0.33	0.27	0.30
Low Cal Gas (ppm)	25.00	24.78				
High Cal Gas (ppm)	50.00	49.36				
Span Value (ppm)	50.00					
Bias/Drift Check Gas, C_s (ppm)	25.00		25.24	25.05	25.15	24.67
RESULTS						
Zero Error (%)	2 % of Span	0.7				
Low Error (%)		-0.4				
High Error (%)		-1.3				
Zero Bias (%)	5 % of Span		-0.2	-0.1	-0.2	-0.1
Upscale Bias (%)			0.9	0.5	0.7	-0.2
Zero Drift (%)	3 % of Span			0.1	-0.1	0.1
Upscale Drift (%)				-0.4	0.2	-1.0
Concentration Corrected for Drift, C_d (ppm)				**26.16**	**28.42**	**28.82**

CARBON MONOXIDE

Analyzer Values	**Actual**	**Initial**	**Bias**	**Run 1**	**Run 2**	**Run 3**
Date		4/29/09	4/29/09	4/29/09	4/29/09	4/29/09
Start Time		9:12	15:15	15:26	16:00	16:30
Stop Time		9:32	15:21	15:46	16:20	16:50
Concentration, C (ppm)				0.11	0.12	0.13
Zero Cal Gas, C_0 (ppm)	0.00	0.08	0.66	0.65	0.60	0.64
Low Cal Gas (ppm)	25.20	24.86				
High Cal Gas (ppm)	50.40	49.94				
Span Value (ppm)	51.00					
Bias/Drift Check Gas, C_s (ppm)	25.20		25.34	25.57	25.27	25.27
RESULTS						
Zero Error (%)	2 % of Span	0.2				
Low Error (%)		-0.7				
High Error (%)		-0.9				
Zero Bias (%)	5 % of Span		1.1	1.1	1.0	1.1
Upscale Bias (%)			0.9	1.4	0.8	0.8
Zero Drift (%)	3 % of Span			0.0	-0.1	0.1
Upscale Drift (%)				0.5	-0.6	0.0
Concentration Corrected for Drift, C_d (ppm)				**-0.56**	**-0.51**	**-0.51**

Suncor-Plant 1
Hydrogen Plant Furnace (H-2101)

Reference Method CEM Data
Calibration Error

Optimal Project: 9002I

Date
4/29/2009

Time	CO_2 (%, dry)	O_2 (%, dry)	NO_X (ppmdv)	CO (ppmdv)
Zero	0.06	0.15	0.36	0.08
High	11.52	12.12	49.36	49.94
Low	5.74	6.03	24.78	24.86
9:12:04	0.06	0.15	0.58	13.05
9:13:04	0.06	0.15	0.36	0.08
9:14:04	0.06	0.15	4.32	0.11
9:15:04	0.06	0.14	50.61	33.14
9:16:04	0.08	0.14	49.20	49.99
9:17:04	0.09	0.14	49.36	49.94
9:18:04	0.09	0.14	49.04	49.89
9:19:04	0.08	0.15	31.23	42.10
9:20:04	0.08	0.15	24.54	24.06
9:21:04	0.09	0.25	24.78	24.86
9:22:04	0.09	0.26	18.21	24.80
9:23:04	12.25	12.08	9.72	15.17
9:24:04	21.17	21.50	0.68	3.17
9:25:04	20.33	21.14	0.47	-0.81
9:26:04	17.69	18.51	0.34	-0.93
9:27:04	11.52	12.12	0.25	-0.67
9:28:04	8.66	9.21	5.73	2.49
9:29:04	5.41	5.83	0.23	3.15
9:30:04	5.42	5.95	0.20	0.06
9:31:04	5.74	6.03	0.18	0.02
9:32:04	5.73	6.03	0.18	-0.01

Suncor-Plant 1
Hydrogen Plant Furnace (H-2101)

Reference Method CEM Data
Bias

Optimal Project: 9002I

Date
4/29/2009

Time	CO_2 (%, dry)	O_2 (%, dry)	NO_X (ppmdv)	CO (ppmdv)
Zero	0.05	0.08	0.27	0.66
Upscale	5.80	5.95	25.24	25.34
15:15:04	2.24	2.77	0.37	2.05
15:16:04	5.79	5.90	0.27	0.66
15:17:04	5.80	5.95	0.24	0.64
15:18:04	1.95	2.38	2.50	2.72
15:19:04	0.05	0.08	10.02	22.74
15:20:04	0.03	0.08	25.24	25.34
15:21:04	9.79	2.88	26.05	19.08

Suncor-Plant 1
Hydrogen Plant Furnace (H-2101)

Reference Method CEM Data
Run 1

Optimal Project: 9002I

Date
4/29/2009

Time	CO_2 (%, dry)	O_2 (%, dry)	NO_X (ppmdv)	CO (ppmdv)
Average	14.85	4.68	26.30	0.11
15:26:04	15.24	4.13	26.10	-0.03
15:27:04	16.01	3.58	25.43	-0.04
15:28:04	16.17	3.42	25.38	0.08
15:29:04	15.97	3.58	25.59	0.11
15:30:04	16.05	3.49	25.65	0.11
15:31:04	15.71	3.77	25.95	0.12
15:32:04	15.80	3.68	25.83	0.12
15:33:04	16.06	3.46	25.82	0.10
15:34:04	15.56	3.92	25.50	0.10
15:35:04	14.42	4.84	26.63	0.14
15:36:04	14.12	5.25	28.20	0.14
15:37:04	14.29	5.26	27.20	0.13
15:38:04	14.51	5.07	27.04	0.12
15:39:04	14.45	5.22	26.48	0.11
15:40:04	14.34	5.30	26.40	0.13
15:41:04	14.04	5.63	26.17	0.15
15:42:04	13.95	5.65	26.32	0.12
15:43:04	14.14	5.50	26.35	0.13
15:44:04	14.01	5.62	26.26	0.15
15:45:04	13.59	5.87	26.83	0.14
15:46:04	13.41	5.94	27.07	0.14

Suncor-Plant 1
Hydrogen Plant Furnace (H-2101)

Reference Method CEM Data
Cal 1

Optimal Project: 9002I

Date
4/29/2009

Time	CO_2 (%, dry)	O_2 (%, dry)	NO_x (ppmdv)	CO (ppmdv)
Zero	0.02	0.12	0.33	0.65
Upscale	5.81	6.01	25.05	25.57

15:49:04	2.78	3.51	0.77	0.25
15:50:04	5.80	5.98	0.33	0.65
15:51:04	5.81	6.01	0.26	0.79
15:52:04	1.47	1.63	10.61	4.85
15:53:04	0.02	0.12	23.19	24.50
15:54:04	1.96	0.78	25.05	25.57
15:55:04	3.15	5.75	3.21	10.99

Suncor-Plant 1
Hydrogen Plant Furnace (H-2101)

Reference Method CEM Data
Run 2

Optimal Project: 9002I

Date
4/29/2009

Time	CO_2 (%, dry)	O_2 (%, dry)	NO_X (ppmdv)	CO (ppmdv)
Average	17.21	4.82	28.49	0.12
16:00:04	17.75	4.21	28.95	0.12
16:01:04	17.62	4.34	29.33	0.13
16:02:04	17.34	4.58	29.00	0.13
16:03:04	17.55	4.46	28.98	0.11
16:04:04	17.34	4.67	28.69	0.11
16:05:04	16.79	4.95	29.28	0.11
16:06:04	16.56	5.15	29.13	0.12
16:07:04	17.15	4.86	28.41	0.13
16:08:04	17.62	4.52	28.53	0.11
16:09:04	17.23	4.84	28.49	0.12
16:10:04	16.64	5.25	28.56	0.14
16:11:04	16.88	5.13	28.29	0.12
16:12:04	17.10	4.99	28.03	0.12
16:13:04	17.28	4.88	27.99	0.12
16:14:04	17.25	4.97	27.96	0.12
16:15:04	16.95	5.14	28.07	0.12
16:16:04	16.64	5.30	28.31	0.14
16:17:04	17.16	4.98	27.88	0.12
16:18:04	17.52	4.73	27.97	0.13
16:19:04	17.43	4.70	28.22	0.11
16:20:04	17.53	4.66	28.20	0.12

Suncor-Plant 1
Hydrogen Plant Furnace (H-2101)

Reference Method CEM Data
Cal 2

Optimal Project: 9002I

Date
4/29/2009

Time	CO_2 (%, dry)	O_2 (%, dry)	NO_X (ppmdv)	CO (ppmdv)
Zero	0.08	0.18	0.27	0.60
Upscale	5.65	6.04	25.15	25.27

16:22:04	10.20	3.94	14.84	0.72
16:23:04	5.56	6.02	0.27	0.60
16:24:04	5.65	6.04	0.21	0.66
16:25:04	3.95	4.16	1.20	0.81
16:26:04	0.08	0.18	21.39	17.38
16:27:04	0.02	0.14	25.15	25.27
16:28:04	6.00	1.77	25.78	25.00

Suncor-Plant 1
Hydrogen Plant Furnace (H-2101)

Reference Method CEM Data
Run 3

Optimal Project: 9002I

Date
4/29/2009

Time	CO_2 (%, dry)	O_2 (%, dry)	NO_X (ppmdv)	CO (ppmdv)
Average	17.27	4.78	28.68	0.13
16:30:04	17.14	4.74	28.93	0.14
16:31:04	17.04	4.85	28.92	0.15
16:32:04	17.16	4.75	29.12	0.12
16:33:04	17.41	4.65	28.92	0.13
16:34:04	17.29	4.76	28.86	0.12
16:35:04	16.94	4.98	28.97	0.15
16:36:04	16.80	5.09	28.87	0.14
16:37:04	17.35	4.75	28.80	0.12
16:38:04	17.45	4.71	28.83	0.13
16:39:04	17.45	4.67	28.71	0.12
16:40:04	17.56	4.62	28.76	0.11
16:41:04	17.29	4.84	28.48	0.14
16:42:04	17.46	4.69	28.45	0.11
16:43:04	17.62	4.61	28.39	0.12
16:44:04	17.29	4.82	28.55	0.11
16:45:04	16.95	4.98	28.71	0.13
16:46:04	16.97	5.00	28.48	0.13
16:47:04	17.56	4.64	28.25	0.11
16:48:04	17.34	4.78	28.45	0.13
16:49:04	17.37	4.73	28.48	0.12
16:50:04	17.32	4.81	28.28	0.11

Suncor-Plant 1
Hydrogen Plant Furnace (H-2101)

Reference Method CEM Data
Cal 3

Optimal Project: 9002I

Date
4/29/2009

Time	CO_2 (%, dry)	O_2 (%, dry)	NO_x (ppmdv)	CO (ppmdv)
Zero	0.18	0.15	0.30	0.64
Upscale	5.65	6.00	24.67	25.27
17:02:04	0.23	0.32	0.32	0.88
17:03:04	5.56	6.04	0.30	0.64
17:04:04	5.65	6.00	0.16	0.81
17:05:04	4.44	4.78	1.30	0.73
17:06:04	0.18	0.15	17.86	15.08
17:07:04	0.08	0.13	24.67	25.27
17:08:04	0.08	5.67	24.30	25.05

Suncor-Plant 1
Hydrogen Plant Furnace (H-2101

CEM Parameters

Optimal Project: 9002I

CARBON DIOXIDE

Analyzer Values	Actual	Initial	Bias	Run 4	Run 5	Run 6	Run 7	Run 8
Date		4/30/09	4/30/09	4/30/09	4/30/09	4/30/09	4/30/09	4/30/09
Start Time		7:35	8:04	8:34	9:04	9:36	10:10	10:40
Stop Time		7:56	8:30	8:54	9:24	9:56	10:30	11:00
Concentration, C (%)				16.28	16.92	16.74	16.92	16.40
Zero Cal Gas, C_0 (%)	0.00	0.19	0.03	0.07	0.07	0.14	0.13	0.13
Low Cal Gas (%)	5.79	5.76						
High Cal Gas (%)	11.58	11.56						
Span Value (%)	12.00							
Bias/Drift Check Gas, C_s (%)	5.79		5.69	5.68	5.70	5.82	5.89	5.83
RESULTS								
Zero Error (%)	2 % of Span	1.6						
Low Error (%)		-0.3						
High Error (%)		-0.2						
Zero Bias (%)	5 % of Span		-1.3	-1.0	-1.0	-0.4	-0.5	-0.5
Upscale Bias (%)			-0.6	-0.7	-0.5	0.5	1.1	0.6
Zero Drift (%)	3 % of Span			0.3	0.0	0.6	-0.1	0.0
Upscale Drift (%)				-0.1	0.2	1.0	0.6	-0.5
Concentration Corrected for Drift, C_d (%)				**16.67**	**17.36**	**17.03**	**16.99**	**16.44**

CARBON DIOXIDE

Analyzer Values	Actual	Initial	Run 9	Run 10	Run 11
Date		4/30/09	4/30/09	4/30/09	4/30/09
Start Time		7:35	11:10	11:42	12:13
Stop Time		7:56	11:30	12:02	12:33
Concentration, C (%)			15.99	16.02	16.04
Zero Cal Gas, C_0 (%)	0.00	0.19	0.17	0.18	0.16
Low Cal Gas (%)	5.79	5.76			
High Cal Gas (%)	11.58	11.56			
Span Value (%)	12.00				
Bias/Drift Check Gas, C_s (%)	5.79		5.81	5.69	5.68
RESULTS					
Zero Error (%)	2 % of Span	1.6			
Low Error (%)		-0.3			
High Error (%)		-0.2			
Zero Bias (%)	5 % of Span		-0.2	-0.1	-0.3
Upscale Bias (%)			0.4	-0.6	-0.7
Zero Drift (%)	3 % of Span		0.3	0.1	-0.2
Upscale Drift (%)			-0.2	-1.0	-0.1
Concentration Corrected for Drift, C_d (%)			**16.18**	**16.46**	**16.66**

Suncor-Plant 1
Hydrogen Plant Furnace (H-2101

CEM Parameters

Optimal Project: 9002I

OXYGEN

Analyzer Values	Actual	Initial	Bias	Run 4	Run 5	Run 6	Run 7	Run 8
Date		4/30/09	4/30/09	4/30/09	4/30/09	4/30/09	4/30/09	4/30/09
Start Time		7:35	8:04	8:34	9:04	9:36	10:10	10:40
Stop Time		7:56	8:30	8:54	9:24	9:56	10:30	11:00
Concentration, C (%)				4.64	4.77	4.89	5.13	5.29
Zero Cal Gas, C_0 (%)	0.00	0.03	0.00	0.07	0.13	0.03	0.01	0.06
Low Cal Gas (%)	6.00	6.03						
High Cal Gas (%)	12.00	12.17						
Span Value (%)	12.00							
Bias/Drift Check Gas, C_s (%)	6.00		6.02	5.99	5.94	6.03	5.98	5.90
RESULTS								
Zero Error (%)	2 % of Span	0.3						
Low Error (%)		0.3						
High Error (%)		1.4						
Zero Bias (%)	5 % of Span		-0.3	0.3	0.8	0.0	-0.2	0.3
Upscale Bias (%)			-0.1	-0.3	-0.7	0.0	-0.4	-1.1
Zero Drift (%)	3 % of Span			0.6	0.5	-0.8	-0.2	0.4
Upscale Drift (%)				-0.2	-0.4	0.7	-0.4	-0.7
Concentration Corrected for Drift, C_d (%)				**4.62**	**4.77**	**4.88**	**5.12**	**5.34**

OXYGEN

Analyzer Values	Actual	Initial	Run 9	Run 10	Run 11
Date		4/30/09	4/30/09	4/30/09	4/30/09
Start Time		7:35	11:10	11:42	12:13
Stop Time		7:56	11:30	12:02	12:33
Concentration, C (%)			5.15	5.47	5.37
Zero Cal Gas, C_0 (%)	0.00	0.03	0.03	0.01	0.03
Low Cal Gas (%)	6.00	6.03			
High Cal Gas (%)	12.00	12.17			
Span Value (%)	12.00				
Bias/Drift Check Gas, C_s (%)	6.00		5.96	5.92	5.90
RESULTS					
Zero Error (%)	2 % of Span	0.3			
Low Error (%)		0.3			
High Error (%)		1.4			
Zero Bias (%)	5 % of Span		0.0	-0.2	0.0
Upscale Bias (%)			-0.6	-0.9	-1.1
Zero Drift (%)	3 % of Span		-0.3	-0.2	0.2
Upscale Drift (%)			0.5	-0.3	-0.2
Concentration Corrected for Drift, C_d (%)			**5.20**	**5.52**	**5.45**

NITROGEN OXIDES

Analyzer Values	Actual	Initial	Bias	Run 4	Run 5	Run 6	Run 7	Run 8
Date		4/30/09	4/30/09	4/30/09	4/30/09	4/30/09	4/30/09	4/30/09
Start Time		7:35	8:04	8:34	9:04	9:36	10:10	10:40
Stop Time		7:56	8:30	8:54	9:24	9:56	10:30	11:00
Concentration, C (ppm)				27.71	28.59	28.20	27.80	27.78
Zero Cal Gas, C_0 (ppm)	0.00	0.07	0.05	0.35	0.42	0.47	0.49	0.55
Low Cal Gas (ppm)	25.00	25.46						
High Cal Gas (ppm)	50.00	49.52						
Span Value (ppm)	50.00							
Bias/Drift Check Gas, C_s (ppm)	25.00		24.63	24.83	24.59	25.16	24.89	24.95
RESULTS								
Zero Error (%)	2 % of Span	0.1						
Low Error (%)		0.9						
High Error (%)		-1.0						
Zero Bias (%)	5 % of Span		0.0	0.6	0.7	0.8	0.8	1.0
Upscale Bias (%)			-1.7	-1.3	-1.7	-0.6	-1.1	-1.0
Zero Drift (%)	3 % of Span			0.6	0.1	0.1	0.0	0.1
Upscale Drift (%)				0.4	-0.5	1.1	-0.5	0.1
Concentration Corrected for Drift, C_d (ppm)				**28.03**	**28.99**	**28.40**	**27.83**	**27.93**

NITROGEN OXIDES

Analyzer Values	**Actual**	**Initial**	**Run 9**	**Run 10**	**Run 11**
Date		4/30/09	4/30/09	4/30/09	4/30/09
Start Time		7:35	11:10	11:42	12:13
Stop Time		7:56	11:30	12:02	12:33
Concentration, C (ppm)			27.55	27.49	27.28
Zero Cal Gas, C_0 (ppm)	0.00	0.07	0.45	0.54	0.33
Low Cal Gas (ppm)	25.00	25.46			
High Cal Gas (ppm)	50.00	49.52			
Span Value (ppm)	50.00				
Bias/Drift Check Gas, C_s (ppm)	25.00		25.16	24.92	24.82
RESULTS					
Zero Error (%)	2 % of Span	0.1			
Low Error (%)		0.9			
High Error (%)		-1.0			
Zero Bias (%)	5 % of Span		0.8	0.9	0.5
Upscale Bias (%)			-0.6	-1.1	-1.3
Zero Drift (%)	3 % of Span		-0.2	0.2	-0.4
Upscale Drift (%)			0.4	-0.5	-0.2
Concentration Corrected for Drift, C_d (ppm)			**27.54**	**27.49**	**27.46**

Suncor-Plant 1
Hydrogen Plant Furnace (H-2101

CEM Parameters

Optimal Project: 9002I

CARBON MONOXIDE

Analyzer Values	Actual	Initial	Bias	Run 4	Run 5	Run 6	Run 7	Run 8
Date		4/30/09	4/30/09	4/30/09	4/30/09	4/30/09	4/30/09	4/30/09
Start Time		7:35	8:04	8:34	9:04	9:36	10:10	10:40
Stop Time		7:56	8:30	8:54	9:24	9:56	10:30	11:00
Concentration, C (ppm)				0.04	0.02	-0.05	0.06	0.10
Zero Cal Gas, C_0 (ppm)	0.00	0.09	0.98	0.88	0.95	0.96	0.51	0.72
Low Cal Gas (ppm)	25.20	25.03						
High Cal Gas (ppm)	50.40	49.99						
Span Value (ppm)	51.00							
Bias/Drift Check Gas, C_s (ppm)	25.20		25.00	25.44	24.74	24.39	24.63	24.57
RESULTS								
Zero Error (%)	2 % of Span	0.2						
Low Error (%)		-0.3						
High Error (%)		-0.8						
Zero Bias (%)	5 % of Span		1.7	1.5	1.7	1.7	0.8	1.2
Upscale Bias (%)			-0.1	0.8	-0.6	-1.3	-0.8	-0.9
Zero Drift (%)	3 % of Span			-0.2	0.1	0.0	-0.9	0.4
Upscale Drift (%)				0.9	-1.4	-0.7	0.5	-0.1
Concentration Corrected for Drift, C_d (ppm)				**-0.92**	**-0.93**	**-1.08**	**-0.71**	**-0.54**

CARBON MONOXIDE

Analyzer Values	Actual	Initial	Run 9	Run 10	Run 11
Date		4/30/09	4/30/09	4/30/09	4/30/09
Start Time		7:35	11:10	11:42	12:13
Stop Time		7:56	11:30	12:02	12:33
Concentration, C (ppm)			1.14	0.08	0.08
Zero Cal Gas, C_0 (ppm)	0.00	0.09	0.19	0.45	0.32
Low Cal Gas (ppm)	25.20	25.03			
High Cal Gas (ppm)	50.40	49.99			
Span Value (ppm)	51.00				
Bias/Drift Check Gas, C_s (ppm)	25.20		24.66	24.57	24.51
RESULTS					
Zero Error (%)	2 % of Span	0.2			
Low Error (%)		-0.3			
High Error (%)		-0.8			
Zero Bias (%)	5 % of Span		0.2	0.7	0.5
Upscale Bias (%)			-0.7	-0.9	-1.0
Zero Drift (%)	3 % of Span		-1.0	0.5	-0.3
Upscale Drift (%)			0.2	-0.2	-0.1
Concentration Corrected for Drift, C_d (ppm)			**0.71**	**-0.24**	**-0.32**

Suncor-Plant 1
Hydrogen Plant Furnace (H-2101)

Reference Method CEM Data
Calibration Error

Optimal Project: 9002I

Date
4/30/2009

Time	CO_2 (%, dry)	O_2 (%, dry)	NO_X (ppmdv)	CO (ppmdv)
Zero	0.19	0.03	0.07	0.09
High	11.56	12.17	49.52	49.99
Low	5.76	6.03	25.46	25.03
7:35:19	0.19	0.03	0.05	0.19
7:36:19	0.19	0.03	0.07	0.09
7:37:19	0.16	0.03	0.05	-0.05
7:41:19	11.60	12.15	0.21	-0.11
7:42:19	11.56	12.17	0.23	-0.18
7:43:19	11.31	11.94	0.32	0.06
7:44:19	5.37	5.80	0.44	0.56
7:45:19	5.76	6.03	0.39	0.20
7:46:19	5.73	6.03	0.37	0.16
7:49:19	0.10	0.05	55.69	49.99
7:50:19	0.08	0.04	49.52	49.99
7:51:19	0.08	0.04	48.38	49.99
7:54:19	0.03	0.04	24.46	24.54
7:55:19	0.02	0.03	25.46	25.03
7:56:19	0.02	0.03	25.33	24.98

Suncor-Plant 1
Hydrogen Plant Furnace (H-2101)

Reference Method CEM Data
Bias

Optimal Project: 9002I

Date
4/30/2009

Time	CO_2 (%, dry)	O_2 (%, dry)	NO_X (ppmdv)	CO (ppmdv)
Zero	0.03	0.00	0.05	0.98
Upscale	5.69	6.02	24.63	25.00

8:04:19	0.05	10.54	1.03	1.81
8:05:19	0.03	0.00	0.05	0.98
8:06:19	0.03	-0.03	0.03	0.37
8:20:19	0.07	-0.08	24.72	25.00
8:21:19	0.06	-0.09	24.63	25.00
8:22:19	0.07	-0.09	24.60	24.95
8:28:19	5.57	6.07	0.56	0.18
8:29:19	5.69	6.02	0.45	0.20
8:30:19	5.60	6.01	0.37	0.07

Suncor-Plant 1
Hydrogen Plant Furnace (H-2101)

Reference Method CEM Data
Run 4

Optimal Project: 9002I

Date
4/30/2009

Time	CO_2 (%, dry)	O_2 (%, dry)	NO_X (ppmdv)	CO (ppmdv)
Average	16.28	4.64	27.71	0.04
8:34:19	16.29	4.98	26.97	-0.38
8:35:19	15.95	5.16	27.33	-0.37
8:36:19	16.10	5.07	26.82	-0.08
8:37:19	16.49	4.75	27.17	0.13
8:38:19	16.42	4.71	27.42	0.12
8:39:19	16.37	4.69	27.54	0.11
8:40:19	16.16	4.82	27.37	0.11
8:41:19	16.26	4.69	27.71	0.08
8:42:19	16.51	4.44	28.02	0.09
8:43:19	16.40	4.51	28.03	0.09
8:44:19	16.02	4.75	28.28	0.10
8:45:19	15.95	4.74	28.40	0.10
8:46:19	16.43	4.39	27.87	0.08
8:47:19	16.48	4.37	27.96	0.09
8:48:19	16.30	4.47	27.86	0.09
8:49:19	16.23	4.50	27.86	0.09
8:50:19	16.10	4.59	27.94	0.09
8:51:19	16.37	4.37	27.94	0.08
8:52:19	16.39	4.42	27.68	0.06
8:53:19	16.20	4.53	27.93	0.09
8:54:19	16.36	4.42	27.75	0.09

Suncor-Plant 1
Hydrogen Plant Furnace (H-2101)

Reference Method CEM Data
Cal 4

Optimal Project: 9002I

Date
4/30/2009

Time	CO_2 (%, dry)	O_2 (%, dry)	NO_x (ppmdv)	CO (ppmdv)
Zero	0.07	0.07	0.35	0.88
Upscale	5.68	5.99	24.83	25.44
8:55:19	5.38	2.17	7.02	0.87
8:56:19	5.52	5.94	0.35	0.88
8:57:19	5.68	5.99	0.32	0.62
8:58:19	0.76	0.60	12.82	7.72
8:59:19	0.07	0.07	21.76	25.44
9:00:19	0.04	0.06	24.83	25.44
9:01:19	15.24	4.57	28.50	12.70

Suncor-Plant 1
Hydrogen Plant Furnace (H-2101)

Reference Method CEM Data
Run 5

Optimal Project: 9002I

Date
4/30/2009

Time	CO_2 (%, dry)	O_2 (%, dry)	NO_X (ppmdv)	CO (ppmdv)
Average	16.92	4.77	28.59	0.02
9:04:19	16.77	5.00	28.35	0.06
9:05:19	17.00	4.84	28.46	0.03
9:06:19	16.86	4.92	28.57	0.05
9:07:19	16.91	4.87	28.36	0.06
9:08:19	16.77	5.00	28.40	0.05
9:09:19	16.80	4.94	28.42	0.02
9:10:19	17.12	4.68	28.53	0.04
9:11:19	17.04	4.71	28.67	0.03
9:12:19	16.63	4.97	28.95	0.00
9:13:19	16.47	5.10	28.86	0.04
9:14:19	17.02	4.72	28.43	0.02
9:15:19	17.06	4.63	28.69	0.00
9:16:19	16.94	4.67	28.81	0.01
9:17:19	16.99	4.63	28.90	0.01
9:18:19	17.04	4.57	28.70	0.01
9:19:19	17.33	4.38	28.72	-0.01
9:20:19	17.21	4.50	28.58	0.00
9:21:19	16.79	4.76	28.61	0.00
9:22:19	16.51	4.94	28.87	0.01
9:23:19	16.96	4.70	28.19	0.00
9:24:19	17.17	4.55	28.33	-0.01

Suncor-Plant 1
Hydrogen Plant Furnace (H-2101)

Reference Method CEM Data
Cal 5

Optimal Project: 9002I

Date
4/30/2009

Time	CO_2 (%, dry)	O_2 (%, dry)	NO_X (ppmdv)	CO (ppmdv)
Zero	0.07	0.13	0.42	0.95
Upscale	5.70	5.94	24.59	24.74

9:27:19	4.43	4.52	1.66	5.22
9:28:19	5.66	5.89	0.42	0.95
9:29:19	5.70	5.94	0.32	0.60
9:30:19	0.49	0.27	14.93	8.57
9:31:19	0.07	0.13	22.23	24.16
9:32:19	0.05	0.13	24.59	24.74
9:33:19	15.65	5.11	27.17	11.53

Suncor-Plant 1
Hydrogen Plant Furnace (H-2101)

Reference Method CEM Data
Run 6

Optimal Project: 9002I

Date
4/30/2009

Time	CO_2 (%, dry)	O_2 (%, dry)	NO_X (ppmdv)	CO (ppmdv)
Average	16.74	4.89	28.20	-0.05
9:36:19	16.46	5.32	27.42	-0.03
9:37:19	16.29	5.33	27.66	-0.03
9:38:19	16.52	5.15	27.65	-0.03
9:39:19	16.46	5.18	27.63	-0.03
9:40:19	16.08	5.40	28.09	-0.04
9:41:19	16.06	5.37	28.17	-0.03
9:42:19	16.51	5.07	27.94	-0.05
9:43:19	16.66	4.96	28.09	-0.05
9:44:19	16.75	4.87	27.94	-0.05
9:45:19	16.79	4.80	28.11	-0.04
9:46:19	16.57	4.94	28.46	-0.05
9:47:19	16.86	4.66	28.64	-0.04
9:48:19	17.15	4.50	28.29	-0.06
9:49:19	16.98	4.61	28.45	-0.06
9:50:19	16.77	4.76	28.79	-0.07
9:51:19	17.07	4.60	28.47	-0.08
9:52:19	17.43	4.40	28.41	-0.08
9:53:19	17.23	4.53	28.56	-0.08
9:54:19	17.16	4.57	28.46	-0.08
9:55:19	16.85	4.83	28.52	-0.08
9:56:19	16.93	4.77	28.38	-0.07

Suncor-Plant 1
Hydrogen Plant Furnace (H-2101)

Reference Method CEM Data
Cal 6

Optimal Project: 9002I

Date
4/30/2009

Time	CO_2 (%, dry)	O_2 (%, dry)	NO_x (ppmdv)	CO (ppmdv)
Zero	0.14	0.03	0.47	0.96
Upscale	5.82	6.03	25.16	24.39
10:02:19	1.38	1.35	0.57	0.99
10:03:19	5.79	5.99	0.47	0.96
10:04:19	5.82	6.03	0.34	0.56
10:05:19	3.83	3.68	3.71	0.95
10:06:19	0.14	0.03	19.95	17.99
10:07:19	0.18	0.00	25.16	24.39
10:08:19	7.01	2.24	25.36	22.40

Suncor-Plant 1
Hydrogen Plant Furnace (H-2101)

Reference Method CEM Data
Run 7

Optimal Project: 9002I

Date
4/30/2009

Time	CO_2 (%, dry)	O_2 (%, dry)	NO_X (ppmdv)	CO (ppmdv)
Average	16.92	5.13	27.80	0.06
10:10:19	16.70	5.31	27.36	-0.06
10:11:19	17.01	5.10	27.55	-0.10
10:12:19	16.95	5.10	27.50	-0.11
10:13:19	16.84	5.14	27.72	0.05
10:14:19	16.61	5.29	27.96	0.10
10:15:19	16.73	5.16	28.08	0.10
10:16:19	17.11	4.87	28.42	0.11
10:17:19	16.99	4.97	28.23	0.11
10:18:19	16.53	5.31	28.37	0.10
10:19:19	16.60	5.31	28.15	0.10
10:20:19	17.11	4.97	28.06	0.08
10:21:19	17.15	4.95	28.04	0.09
10:22:19	17.00	5.06	27.98	0.08
10:23:19	16.92	5.16	27.69	0.10
10:24:19	16.95	5.15	27.63	0.10
10:25:19	17.27	4.89	27.86	0.08
10:26:19	17.20	4.96	27.68	0.06
10:27:19	16.91	5.14	27.77	0.09
10:28:19	16.65	5.33	27.88	0.10
10:29:19	17.08	5.17	26.95	0.09
10:30:19	16.93	5.30	26.95	0.07

Suncor-Plant 1
Hydrogen Plant Furnace (H-2101)

Reference Method CEM Data
Cal 7

Optimal Project: 9002I

Date
4/30/2009

Time	CO_2 (%, dry)	O_2 (%, dry)	NO_X (ppmdv)	CO (ppmdv)
Zero	0.13	0.01	0.49	0.51
Upscale	5.89	5.98	24.89	24.63
10:33:19	3.57	3.53	0.91	2.95
10:34:19	5.87	5.96	0.49	0.51
10:35:19	5.89	5.98	0.38	0.73
10:36:19	1.79	1.45	11.23	5.05
10:37:19	0.13	0.01	23.41	23.16
10:38:19	0.19	0.00	24.89	24.63
10:39:19	12.99	4.23	26.56	15.55

Suncor-Plant 1
Hydrogen Plant Furnace (H-2101)

Reference Method CEM Data
Run 8

Optimal Project: 9002I

Date
4/30/2009

Time	CO_2 (%, dry)	O_2 (%, dry)	NO_X (ppmdv)	CO (ppmdv)
Average	16.40	5.29	27.78	0.10
10:40:19	16.54	5.31	27.27	0.31
10:41:19	16.04	5.62	27.68	0.11
10:42:19	16.04	5.63	27.65	0.11
10:43:19	16.21	5.47	27.82	0.10
10:44:19	16.52	5.24	27.91	0.08
10:45:19	16.44	5.31	27.92	0.08
10:46:19	16.10	5.53	28.00	0.10
10:47:19	15.93	5.64	27.91	0.09
10:48:19	16.41	5.30	27.63	0.09
10:49:19	16.68	5.08	27.40	0.09
10:50:19	16.78	5.00	27.57	0.07
10:51:19	16.67	5.09	27.67	0.08
10:52:19	16.40	5.26	27.73	0.08
10:53:19	16.66	5.00	28.33	0.10
10:54:19	16.72	5.01	27.90	0.06
10:55:19	16.41	5.22	28.01	0.07
10:56:19	16.11	5.43	27.99	0.09
10:57:19	16.45	5.23	27.69	0.09
10:58:19	16.54	5.19	27.87	0.07
10:59:19	16.49	5.21	27.47	0.08
11:00:19	16.19	5.39	27.89	0.09

Suncor-Plant 1
Hydrogen Plant Furnace (H-2101)

Reference Method CEM Data
Cal 8

Optimal Project: 9002I

Date
4/30/2009

Time	CO_2 (%, dry)	O_2 (%, dry)	NO_X (ppmdv)	CO (ppmdv)
Zero	0.13	0.06	0.55	0.72
Upscale	5.83	5.90	24.95	24.57

11:04:19	2.02	1.90	0.79	1.63
11:05:19	5.79	5.87	0.55	0.72
11:06:19	5.83	5.90	0.37	0.73
11:07:19	3.30	3.00	5.58	1.67
11:08:19	0.13	0.06	20.82	19.63
11:09:19	0.08	0.04	24.95	24.57
11:10:19	8.40	2.86	25.78	21.10

Suncor-Plant 1
Hydrogen Plant Furnace (H-2101)

Reference Method CEM Data
Run 9

Optimal Project: 9002I

Date
4/30/2009

Time	CO_2 (%, dry)	O_2 (%, dry)	NO_X (ppmdv)	CO (ppmdv)
Average	15.99	5.15	27.55	1.14
11:10:19	8.40	2.86	25.78	21.10
11:11:19	16.24	5.34	27.59	1.43
11:12:19	16.53	5.12	27.84	0.07
11:13:19	16.55	5.15	27.61	0.08
11:14:19	16.30	5.30	27.77	0.08
11:15:19	16.00	5.50	28.07	0.08
11:16:19	16.47	5.24	27.29	0.07
11:17:19	16.61	5.13	27.40	0.05
11:18:19	16.52	5.16	27.67	0.06
11:19:19	16.45	5.18	27.69	0.06
11:20:19	16.30	5.35	27.76	0.08
11:21:19	16.39	5.25	27.76	0.07
11:22:19	16.63	5.08	27.72	0.05
11:23:19	16.57	5.13	27.69	0.06
11:24:19	16.29	5.29	27.88	0.09
11:25:19	16.17	5.40	27.59	0.09
11:26:19	16.58	5.13	27.27	0.08
11:27:19	16.45	5.21	27.47	0.07
11:28:19	16.32	5.29	27.57	0.08
11:29:19	16.06	5.46	27.56	0.07
11:30:19	16.00	5.51	27.62	0.07

Suncor-Plant 1
Hydrogen Plant Furnace (H-2101)

Reference Method CEM Data
Cal 9

Optimal Project: 9002I

Date
4/30/2009

Time	CO_2 (%, dry)	O_2 (%, dry)	NO_X (ppmdv)	CO (ppmdv)
Zero	0.17	0.03	0.45	0.19
Upscale	5.81	5.96	25.16	24.66

11:34:19	4.10	4.21	0.96	0.12
11:35:19	5.78	5.94	0.45	0.19
11:36:19	5.81	5.96	0.34	0.70
11:37:19	1.05	0.65	13.97	7.40
11:38:19	0.17	0.03	21.96	23.79
11:39:19	0.15	0.02	25.16	24.66
11:40:19	14.79	5.23	26.68	12.10

Suncor-Plant 1
Hydrogen Plant Furnace (H-2101)

Reference Method CEM Data
Run 10

Optimal Project: 9002I

Date
4/30/2009

Time	CO_2 (%, dry)	O_2 (%, dry)	NO_X (ppmdv)	CO (ppmdv)
Average	16.02	5.47	27.49	0.08
11:42:19	15.99	5.58	27.21	0.10
11:43:19	15.67	5.76	27.72	0.08
11:44:19	15.79	5.69	27.45	0.11
11:45:19	16.16	5.43	27.35	0.08
11:46:19	16.13	5.42	27.39	0.09
11:47:19	16.13	5.40	27.38	0.07
11:48:19	16.14	5.38	27.34	0.08
11:49:19	16.06	5.42	27.52	0.10
11:50:19	16.31	5.21	27.56	0.08
11:51:19	16.40	5.19	27.50	0.08
11:52:19	16.16	5.34	27.68	0.08
11:53:19	15.74	5.61	27.70	0.08
11:54:19	16.15	5.37	27.16	0.09
11:55:19	16.16	5.33	27.51	0.09
11:56:19	16.23	5.27	27.63	0.08
11:57:19	16.11	5.36	27.70	0.07
11:58:19	15.80	5.62	27.53	0.08
11:59:19	15.85	5.58	27.51	0.08
12:00:19	16.16	5.38	27.51	0.08
12:01:19	15.86	5.61	27.47	0.08
12:02:19	15.49	5.85	27.39	0.09

Suncor-Plant 1
Hydrogen Plant Furnace (H-2101)

Reference Method CEM Data
Cal 10

Optimal Project: 9002I

Date
4/30/2009

Time	CO_2 (%, dry)	O_2 (%, dry)	NO_X (ppmdv)	CO (ppmdv)
Zero	0.18	0.01	0.54	0.45
Upscale	5.69	5.92	24.92	24.57

12:05:19	0.58	0.34	0.54	0.95
12:06:19	5.72	5.95	0.54	0.45
12:07:19	5.69	5.92	0.37	0.78
12:08:19	0.77	0.54	13.76	7.46
12:09:19	0.18	0.01	21.46	23.71
12:10:19	0.21	0.03	24.92	24.57
12:11:19	15.48	5.30	27.20	11.07

Suncor-Plant 1
Hydrogen Plant Furnace (H-2101)

Reference Method CEM Data
Run 11

Optimal Project: 9002I

Date
4/30/2009

Time	CO_2 (%, dry)	O_2 (%, dry)	NO_X (ppmdv)	CO (ppmdv)
Average	16.04	5.37	27.28	0.08
12:13:19	16.18	5.27	27.48	0.09
12:14:19	16.25	5.23	27.50	0.08
12:15:19	16.11	5.29	27.54	0.07
12:16:19	16.08	5.30	27.45	0.07
12:17:19	15.97	5.38	27.65	0.08
12:18:19	16.16	5.26	27.31	0.07
12:19:19	16.35	5.16	27.04	0.07
12:20:19	15.92	5.47	27.13	0.08
12:21:19	15.39	5.83	27.17	0.09
12:22:19	15.74	5.62	26.86	0.09
12:23:19	16.16	5.31	26.79	0.08
12:24:19	16.20	5.26	27.20	0.06
12:25:19	16.06	5.37	26.96	0.08
12:26:19	15.82	5.57	27.08	0.07
12:27:19	15.83	5.54	27.35	0.07
12:28:19	16.20	5.27	27.30	0.08
12:29:19	16.21	5.24	27.45	0.06
12:30:19	15.75	5.54	27.66	0.07
12:31:19	15.91	5.43	27.61	0.08
12:32:19	16.31	5.17	27.08	0.08
12:33:19	16.23	5.22	27.18	0.07

Suncor-Plant 1
Hydrogen Plant Furnace (H-2101)

Reference Method CEM Data
Cal 11

Optimal Project: 9002I

Date
4/30/2009

Time	CO_2 (%, dry)	O_2 (%, dry)	NO_X (ppmdv)	CO (ppmdv)
Zero	0.16	0.03	0.33	0.32
Upscale	5.68	5.90	24.82	24.51
12:37:19	1.02	0.92	0.55	1.03
12:38:19	5.64	5.86	0.46	0.36
12:39:19	5.68	5.90	0.33	0.32
12:40:19	4.06	4.11	2.40	0.74
12:41:19	0.16	0.03	19.61	15.71
12:42:19	0.17	0.04	24.82	24.51
12:43:19	5.32	1.77	24.98	23.60

Sample Calculations – Run 1

Volume of Water Vapor Collected (wscf)

$$V_{wstd} = 0.04715\,x\,W_{wc} + 0.04715\,x\,W_{sg}$$

$$V_{wstd} = 0.04715\,x134.3 + 0.04715\,x15.6$$

$$V_{wstd} = 7.07\,wscf$$

Where:

V_{wstd}	volume of water vapor collected at standard conditions (scf)
W_{wc}	weight of liquid collected in the impingers (g)
W_{sg}	weight of liquid collected in silica gel (g)
0.04715	conversion factor (ft^3/g)

Volume of Gas Sample, Corrected to Standard Conditions (dscf)

$$V_{mstd} = \frac{(17.64)(V_m)\left(P_b + \frac{\Delta H}{13.6}\right)(Y_d)}{(460 + T_m)}$$

$$V_{mstd} = \frac{(17.64)(52.62)\left(25.19 + \frac{2.00}{13.6}\right)(0.9798)}{(460 + 80.7)}$$

$$V_{mstd} = 42.62\,dscf$$

Where:

V_{mstd}	volume of gas sample, corrected to standard conditions (scf)
V_m	volume of gas sample at meter conditions (ft^3)
P_b	barometric pressure (in. Hg)
ΔH	average pressure drop across meter orifice (in. H_2O)
Y_d	gas meter correction factor (dimensionless)
T_m	average dry gas meter temperature (^oF)
13.6	conversion factor (in. H_2O/in. Hg)
17.64	ratio of standard temperature over standard pressure (^oR/in. Hg)
460	conversion factor (^oF to ^oR)

Stack Gas Pressure (in. Hg)

$$P_a = P_b + \left(\frac{P_s}{13.6}\right)$$

$$P_a = 25.19 + \left(\frac{-0.20}{13.6}\right)$$

$$P_a = 25.18\ in.Hg$$

Where:

P_a	absolute sample gas pressure (in. Hg)
P_b	barometric pressure (in. Hg)
P_s	static pressure (in. H_2O)
13.6	conversion factor (in. H_2O/in. Hg)

Moisture Content (%)

$$B_{wo} = \frac{V_{wstd}}{V_{mstd} + V_{wstd}}$$

$$B_{wo} = \frac{7.07}{42.62 + 7.07}$$

$$B_{wo} = 0.142$$

$$B_{wo} = x100 = 14.2\ \%$$

Where:

B_{wo}	water vapor of the gas stream (%)
V_{mstd}	volume of gas sample, corrected to standard conditions (scf)
V_{wstd}	volume of water vapor collected at standard conditions (scf)
100	conversion factor

Molecular Weight of Dry Gas Stream (lb/lb-mole)

$$M_d = MW_{CO_2}\frac{(\%CO_2)}{(100)} + MW_{O_2}\frac{(\%O_2)}{(100)} + MW_{CO+N_2}\frac{(\%CO + \%N_2)}{(100)}$$

$$M_d = 44.0\frac{(14.87)}{(100)} + 32.0\frac{(4.67)}{(100)} + 28.0\frac{(80.46)}{(100)}$$

$$M_d = 30.57\, lb/lb-mole$$

Where:

M_d	molecular weight of the dry gas stream (lb/lb-mole)
MW_{CO2}	molecular weight of carbon dioxide (lb/lb-mole)
MW_{O2}	molecular weight of oxygen (lb/lb-mole)
MW_{CO+N2}	molecular weight of carbon monoxide and nitrogen (lb/lb-mole)
$\%CO_2$	carbon dioxide concentration in the dry gas stream (%)
$\%O_2$	oxygen concentration in the dry gas stream (%)
$\%CO + \%N_2$	carbon monoxide and nitrogen in the dry gas stream (%)
100	conversion factor

Molecular Weight of Wet Gas Stream (lb/lb-mole)

$$M_s = (M_d)(1 - B_{wo}) + (MW\ H_2O)(B_{wo})$$

$$M_s = (30.57)(1 - 0.142) + (18.0)(0.142)$$

$$M_s = 28.78\, lb/lb-mole$$

Where:

M_s	molecular weight of the wet gas stream (lb/lb-mole)
M_d	molecular weight of the dry gas stream (lb/lb-mole)
MW_{H2O}	molecular weight of water (lb/lb-mole)
B_{wo}	water vapor of the gas stream (%)

Velocity of Gas Stream (ft/sec)

$$V_s = (85.49)(C_p)\left(\sqrt{\Delta P}\right)\left(\sqrt{\frac{(T_s + 460)}{(M_s)(P_a)}}\right)$$

$$V_s = (85.49)(0.84)(0.5646)\left(\sqrt{\frac{(334.0 + 460)}{(28.78)(25.18)}}\right)$$

$$V_s = 42.4\ ft/\sec$$

Where:

V_s	gas stream velocity (ft/sec)
85.49	pitot tube constant (ft/sec)([lb/lb-mole)(in. Hg)]/[(^oR)(in. H_2O)])$^{1/2}$
C_p	pitot tube coefficient (dimensionless)
$\sqrt{\Delta P}$	average square roots of velocity pressures (in. H_2O)$^{1/2}$
T_s	average gas stream temperature (^oF)
M_s	molecular weight of the wet gas stream (lb/lb-mole)
P_a	absolute sample gas pressure (in. Hg)
460	conversion (^oF to ^oR)

Volumetric Flow Rate of Gas Stream (acfm)

$$Q_a = (60)(A_s)(V_s)$$

$$Q_a = (60)(41.38)(42.4)$$

$$Q_a = 105{,}373\ acfm$$

Where:

Q_a	volumetric flow rate of gas stream at actual conditions (acfm)
V_s	gas stream velocity (ft/sec)
A_s	cross sectional area of sample location (ft^2)
60	conversion factor (sec/min)

Volumetric Flow Rate of Gas Stream (scfm)

$$Q_{std} = \frac{17.64(Q_a)(P_a)}{(T_s + 460)}$$

$$Q_{std} = \frac{17.64(105{,}373)(25.18)}{(334.0 + 460)}$$

$$Q_{std} = 58{,}936\ scfm$$

Where:

Q_{std}	volumetric flow rate of gas stream at standard conditions (scfm)
Q_a	volumetric flow rate of gas stream at actual conditions (acfm)
P_a	absolute sample gas pressure (in. Hg)
T_s	average gas stream temperature (^oF)
460	conversion (^oF to ^oR)
17.64	ratio of standard temperature over standard pressure (^oR/in. Hg)

Volumetric Flow Rate of Gas Stream (dscfm)

$$Q_{dstd} = (Q_{std})(1 - B_{wo})$$

$$Q_{dstd} = (58{,}936)(1 - 0.142)$$

$$Q_{dstd} = 50{,}573\, dscfm$$

Where:

Q_{dstd}	volumetric flow rate of gas stream at standard conditions, dry basis (dscfm)
Q_{std}	volumetric flow rate of gas stream at standard conditions (scfm)
B_{wo}	water vapor of the gas stream (%)

Volumetric Flow Rate of Gas Stream (mscfh)

$$Q_{dstd} = \frac{(Q_{std}x60)}{1{,}000}$$

$$Q_{dstd} = \frac{(58{,}936x60)}{1{,}000}$$

$$Q_{dstd} = 3{,}536.18\, mscfh$$

Where:

Q_{dstd}	volumetric flow rate of gas stream at standard conditions, dry basis (mscfh)
Q_{std}	volumetric flow rate of gas stream at standard conditions (scfm)
60	conversion (min/hr)
1,000	conversion factor

Nitrogen Oxides Concentration (drift corrected, ppmdv)[1]

$$C_d = \left(C - \left(\frac{C_{oi} + C_{of}}{2}\right)\right)\left(\frac{C_{ma}}{\left(\frac{C_{mi} + C_{mf}}{2}\right) - \left(\frac{C_{oi} + C_{of}}{2}\right)}\right)$$

$$C_d = \left(26.30 - \left(\frac{0.27 + 0.33}{2}\right)\right)\left(\frac{25.00}{\left(\frac{25.24 + 25.05}{2}\right) - \left(\frac{0.27 + 0.33}{2}\right)}\right)$$

$$C_d = 26.16\ ppmdv$$

Where:

C_d	nitrogen oxides concentration, corrected for analyzer drift (ppmdv)
C	nitrogen oxides concentration (ppmdv)
C_{oi}	initial system calibration bias check response for the zero gas (ppm)
C_{of}	final system calibration bias check response for the zero gas (ppm)
C_{mi}	initial system calibration bias check response for the upscale gas (ppm)
C_{mf}	final system calibration bias check response for the upscale gas (ppm)
C_{ma}	actual concentration of the upscale calibration gas (ppm)

Nitrogen Oxides Emission Rate (lb/hr)

$$E_{lb/hr} = \frac{(C_d)(MW_{NOx})(Q_{dstd})(60)}{(385.3)(10^6)}$$

$$E_{lb/hr} = \frac{(26.16)(46.01)(50{,}573)(60)}{(385.3)(10^6)}$$

$$E_{lb/hr} = 9.48\ lb/hr$$

Where:

$E_{lb/hr}$	nitrogen oxides emission rate (lb/hr)
C_d	nitrogen oxides concentration, corrected for analyzer drift (ppmdv)
MW_{NOx}	molecular weight of nitrogen oxides (lb/lb-mole)
Q_{dstd}	volumetric flow rate of gas stream at standard conditions, dry basis (dscfm)
60	conversion factor (min/hr)
385.3	volume occupied by one pound of gas at standard conditions (dscf/lb-mole)
10^6	conversion factor (fraction to ppm)

[1] Calculations for oxygen, carbon dioxide and carbon monoxide are performed in the same manner.

Carbon Monoxide Concentration, Corrected to Three Percent Oxygen (ppmdv @ 3% O_2)

$$ppmdv_{@3\%O2} = (C_d)\left(\frac{20.9 - \%O_{2\ to\,correct\,to}}{20.9 - C_{O2\ measured}}\right)$$

$$ppmdv_{@3\%O2} = (0.00)\left(\frac{20.9 - 3.0}{20.9 - 4.67}\right)$$

$$ppmdv_{@3\%O2} = 0.00\ ppmdv@3\%O_2$$

Where:

$ppmdv_{@3\%O2}$	carbon monoxide concentration corrected to three percent oxygen (ppmdv @ 3% O_2)
C_d	carbon monoxide concentration, corrected for analyzer drift (ppmdv)
20.9	concentration of oxygen in at ambient conditions (% O_2)
$\%\ O_{2\ to\ correct\ to}$	percent oxygen to correct to (% O_2)
C_{O2}	average concentration of oxygen for the test run (% O_2)

RATA Calculations – NOx, lb/hr, Runs 1 through 6, 8, 10 and 11

Standard Deviation

$$S_{dev} = \sqrt{\frac{\sum_{i=1}^{n} d_i^2 - \frac{\left(\sum_{i=1}^{n} d_i\right)^2}{n}}{(n-1)}}$$

$$S_{dev} = \sqrt{\frac{0.594 - \frac{0.519}{9}}{(9-1)}}$$

$$S_{dev} = 0.259$$

Where:

S_{dev}	standard deviation
Σ	summation
n	number of data sets used for calculations
d_i	difference between the reference method result and the CEM value for a given run (lb/hr)
i	run number

Confidence Coefficient

$$CC = (t_{0.975})\frac{(S_{dev})}{(\sqrt{n})}$$

$$CC = (2.306)\frac{(0.259)}{(3)}$$

$$CC = 0.199$$

Where:

CC	confidence coefficient
S_{dev}	standard deviation
n	number of data sets used for calculations
$t_{0.975}$	the inverse of the Student's t-distribution for the specified degrees of freedom

Relative Accuracy

$$RA = \left(\frac{\left|\overline{d}_{avg}\right| + |CC|}{RM_{avg}\ or\ E_{s\tan dard}}\right)x100$$

$$RA = \left(\frac{|-0.0800| + |0.199|}{10.67}\right)x100$$

$$RA = 2.62\%$$

Where:

RA	relative accuracy
CC	confidence coefficient
d_{avg}	mean of the differences
RM_{avg}	reference method average
$E_{standard}$	applicable emission standard
100	conversion factor (%)