Tim J. Hall
Environmental Specialist

ConocoPhillips Company
Ferndale Refinery
3901 Unick Road – P.O. Box 8
Ferndale, WA 98248

ConocoPhillips

July 12, 2010
HSE480-001-004, File No. 6.2.3.9.7

Annie Naismith, P.E.
Northwest Clean Air Agency
1600 South Second Street
Mount Vernon, WA 98273-5202

RE: Sulfur Recover Unit #1 Compliance Test Report for NO_x, and CO.

Dear Ms. Naismith,

On May 29, 2010, carbon monoxide and NO_x performance tests were conducted on the SRU #1 incinerator stack. As summarized in the attached test report, all test parameters were in compliance with the applicable standards.

If you have any questions, I can be reached at (360) 384-8424.

Sincerely,

Tim Hall
Environmental Specialist

Encl: Performance Test Summary for Oxides of Nitrogen and Carbon Monoxide

ConocoPhillips Refining Company
Sulfur Recovery Unit

Performance Test for
Oxides of Nitrogen and Carbon Monoxide

Report Number: 10-1891
May 29, 2010

Prepared for:

ConocoPhillips Refining Company
P.O. Box 8
Ferndale, WA 98248

Prepared by:

Emission Technologies, Inc.
15609 D Peterson Road
Burlington, WA 98233

Report Certification

The emission testing for this report was carried out under my direction and supervision. In addition, I have reviewed all analysis and test results, and certify that the test and report meet EPA requirements and that, to the best of my knowledge, this test report is authentic and accurate.

Date: 7-1-10 Signed: ______________________

Sr. Project Manager
Scott Chesnut

I have reviewed all analysis and test results, and certify that, to the best of my knowledge, this test report is authentic and accurate.

Date: 7-1-10 Signed: ______________________

Quality Assurance Supervisor
Wendy Pounds

northwest Clean Air agency
1600 South Second Street
Mount Vernon, WA 98273-5202
ph 360.428.1617
fax 360.428.1620
www.nwcleanair.org

Emission Test Summary :

Please fill out the pertinent information and submit the form with your test plan **and** with the final test report! Submit separate sheets for each emission unit.

Source Name:	ConocoPhillips Refining Company
Test performed by:	Emission Technologies, Inc.
Emission/Process Unit:	Sulfur Recovery Unit
List Operational Parameters recorded during testing (e.g., Btu input, gallons loaded, steam production, % capacity, fuel feed rate, control device parameters, etc.):	Net tons of sulfur production
Regulation requiring test: --------------------- Required frequency of test:	AOP #16 Permit Term 5.5.10 and 5.5.11 -- annual
Proposed Test Date(s): --------------------- Actual Test Date(s)	May 26, 2010 -- May 29, 2010
Test Method(s): --------------------- Modifications (if any):	US EPA Methods – 1-4, 7E and 10 --
Pollutant(s), units: --------------------- Emission or concentration limit:	NO_x: ppmdv @ 7% O_2; lb/hr; ton/yr CO: ppmdv @ 7% O_2; lb/hr; ton/yr -- NO_x: 42.2ppmdv @ 7% O_2; 9.9 ton/yr CO: 57.1ppmdv @ 7% O_2; 8.3 ton/yr
Average Emission/Concentration: (include averaging time, correction if applicable)	NO_x: 28.5 ppmdv @ 7% O_2 3.1 ton/yr CO: 1.2 ppmdv @ 7% O_2 0.08 ton/yr
In Compliance (Y/N)	Y
Comments:	
For Official Use Only:	

INVOLVED PARTIES:

ConocoPhillips Refining Company

Contact:
Tim Hall
P.O. Box 8
Ferndale, WA 98248

Phone:	(360) 384-8424
Fax:	(360) 384-8422
E-mail:	Tim.J.Hall@conocophillips.com

Northwest Clean Air Agency

Contact:
Annie Naismith
1600 S. Second Street
Mount Vernon, WA 98273

Phone:	(360) 428-1617 x 225
Fax:	(360) 428-1620

Emission Technologies, Inc.

Contact:
Robert Rusi
Wendy Pounds
15609-D Peterson Rd.
Burlington, Washington 98233

Phone:	(800) 507-9018
Phone:	(360) 757-1210
Fax:	(360) 757-1118
E-mail:	eti@eti-usepa.com

1 *REPORT TEXT*

2 *SUMMARY*

3 *FIELD DATA - GASES*

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5 *QUALITY ASSURANCE QUALITY CONTROL*

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Report Text

Introduction
Test Overview
Overview of Sampling Methods
Results
Process Overview
Participants

ETI Emission Technologies, Inc.

Introduction

Emission Technologies (ETI) was contracted by ConocoPhillips (CP) to provide emission test services at their refinery in Ferndale, Washington. Their air-operating permit (004-V-W) requires annual performance testing on the Sulfur Recovery Unit (SRU) for carbon monoxide (CO) and oxides of nitrogen (NO_x).

Test Overview:

Gas samples were extracted from a single point in the middle of the stack after an initial three point traverse (16.7, 50.0 and 83.3 percent of the stack diameter) showed that there was less than 5% variation in the stack gas. Calibration drift values for the analyzers used in gas sample analysis did not deviate from calibration gas standards by more than 3% of the span value over the period of each run.

Gas concentration data are reported on a dry basis. Sample gas was conditioned to remove moisture before going to the analyzers. Gas concentrations were measured in ppmdv and corrected to 7% O_2. EPA Methods 1-4 were used to determine stack gas flow rates to be used to calculate pollutant emission rates.

The test was scheduled for May 26, 2010, but equipment problems caused a delay. ETI performed the testing on the SRU on May 29, 2010. EPA Methods 3A, 7E and 10 were used to perform the tests for O_2, NO_x and CO respectively. A description of the test program is listed below in Table 1.0.

Table 1.0

Parameter	Test Method	Sample Runs	Time/Run
Flows & Moisture	EPA Methods 1-4	3 runs	1 hour each run
O_2/CO_2	EPA Method 3A	3 runs	1 hour each run
NO_x	EPA Method 7E	3 runs	1 hour each run
CO	EPA Method 10	3 runs	1 hour each run

Corporate Office: 156094-D Peterson Road, Burlington, WA 98233 Toll Free 1-800-507-9018
Makati City, Philippines • Hagatna, Guam
www.eti-usepa.com

Test Methods

EPA Method 1- Sample and Velocity Traverses

EPA Method 1 was used to aid in the representative measurement of pollutant emissions and/or total volumetric flow rate from a stationary source. A measurement site where the effluent stream was flowing in a known direction was selected. A cross-section of the stack was divided into a number of equal areas. A traverse point was then located within each of these equal areas.

EPA Method 2 – Determination of Stack Gas Velocity and Volumetric Flow Rate

The average gas velocity in a stack was determined from the gas density and from measurement of the average velocity head with a Type S (Stausscheibe or reverse type) pitot tube.

EPA Method 3A –Determination of Oxygen and Carbon Dioxide Emissions (Instrumental)

Sample gases were first extracted from the stack through a heated probe/gas fiber filter assembly. A calibration gas purge valve was fitted ahead of the filter. The sample extraction rate was maintained for the entire test. The sample was transported through a Teflon line to a portable unit containing the analyzers. The analyzers detected the concentration of analyte gas within the sample and an electrical signal was recorded simultaneously on both a strip chart recorder and a digital disk. Pre and post-test calibrations are performed at the beginning and end of each test.

EPA Method 4 - Determination of Moisture Content in Stack Gases

The moisture content of extracted stack gas was determined from the removed stack gas by passing the gas through a series of impingers (back half of an EPA Method 5 sampling train). The moisture content of the stack gas was determined gravimetrically by measuring the weight change of the impingers.

EPA Methods 7E & 10 – Determination of NO_x and CO Emissions (Instrumental)

Sample gases were first extracted from the stack through a heated probe/glass fiber filter assembly. A calibration gas purge valve was fitted ahead of the filter. The sample extraction rate was maintained for the entire test. The sample was transported through a Teflon line to a portable unit containing the analyzers. The analyzers detected the concentration of analyte gases within the sample and an electrical signal was recorded simultaneously on both a strip chart recorder and a digital disk. Pre and post test calibrations were performed at the beginning and end of each test.

Process Overview

Figure 1.0 shows the layout of the CEMS.

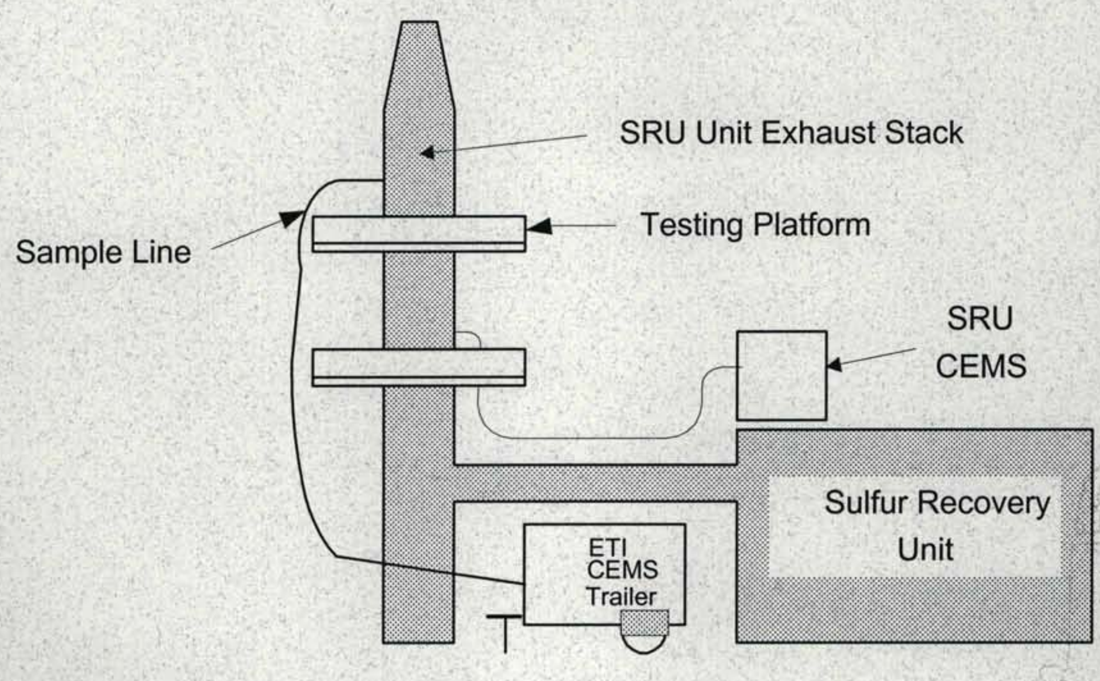


Figure 1.0

Results:

The results of the tests are summarized in Table 2.0 in section 2 of this report. The emission limits for the unit are 42.2 ppm @7% O_2 and 9.9 ton/yr for NO_x; 57.1 ppm @7% O_2 and 8.1 ton/yr for CO. The unit passed these limits.

Participants

The following participants for ETI were involved with the testing program:

- Mr. Scott Chesnut, Project Manager
- Mr. Dave Worgum, Field Technician
- Ms. Wendy Pounds, Quality Assurance Supervisor

Mr. Tim Hall served as Project Manager for ConocoPhillips.

Summary

Table 2.0 Summary Gases

Gas Summaries

Client: Conoco Phillips	**Date:** 05/29/10
City: Ferndale, WA	
Site: SRU	**ETI Job No:** 10-1891

Table 2.0

O_2	Run Number 1	2	3	Average
%	4.01	3.88	4.19	**4.03**

CO_2	Run Number: 1	2	3	Average
%	7.61	7.46	7.37	**7.48**

NO_x	Run Number: 1	2	3	Average
ppmdv	34.4	35.1	34.3	**34.6**
ppmdv @ 7% O_2	28.3	28.7	28.5	**28.5**
lb/hr	0.75	0.71	0.69	**0.72**
ton/yr	3.29	3.09	3.03	**3.14**

CO	Run Number: 1	2	3	Average
ppmdv	2.10	0.54	1.60	**1.41**
ppmdv @ 7% O_2	1.73	0.44	1.33	**1.17**
lb/hr	0.03	0.01	0.02	**0.02**
ton/yr	0.12	0.03	0.09	**0.08**

NO_x: 42.2 ppmdv @ 7% O_2; 9.9 ton/yr

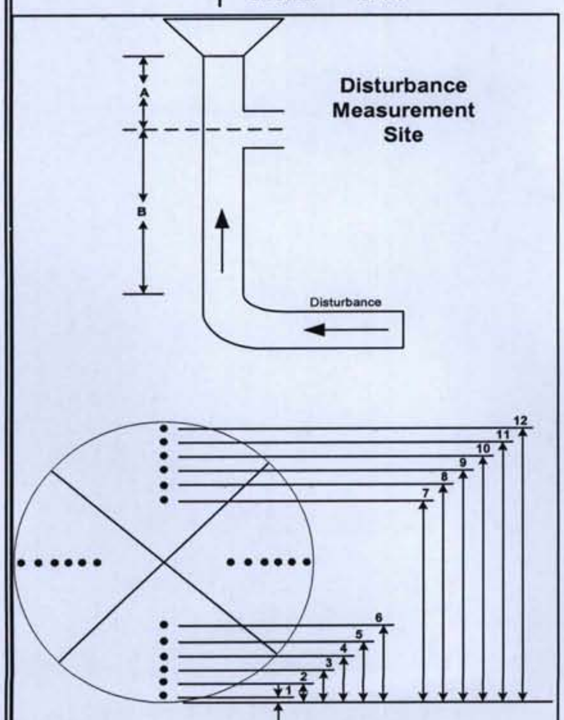
CO: 57.1 ppmdv @ 7% O_2; 8.1 ton/yr

ETI Field Test Data

Client: Conoco Phillips	Date: 05/29/10
City: Ferndale, WA	
Site: SRU	ETI Job No: 10-1891

Table 3.0.0
Sample Site Selection and Location of Traverse Points in Circular Stacks and Determination of Stratification

Traverse Point	% of Diameter Distance	Actual Distance	O_2 or CO_2 Conc. (%)	O_2 or CO_2 Conc. % diff. of mean	SO_2 Conc. ppmdv	SO_2 Conc. % diff. of mean	NO_x Conc. ppmdv	NO_x Conc. % diff. of mean	CO Conc. ppmdv	CO Conc. % diff. of mean
1	16.7	22.2	3.70	0.0%	-	-	34.8	-0.5%	7.5	0.9%
2	50.0	42.5	3.70	0.0%	-	-	35.0	0.1%	7.3	-1.8%
3	83.3	62.8	3.70	0.0%	-	-	35.1	0.4%	7.5	0.9%
4	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-	-	-	-
		Mean:	3.70		-		35.0		7.4	



Stack Diameter (inches): 61
Port Length (inches): 12
# of Traverse Pts. (3,12): 3

3 point sample: ≤10% or ±1 ppm of mean
1 point sample: ≤5% or ±0.5 ppm of mean

Calibration Data

Client:	Conoco Phillips	**ETI:**	Scott Chesnut
Location:	Ferndale, WA		Dave Worgum
Site:	SRU		
Date:	05/29/10	**ETI Job No:**	10-1891

Table 3.0.1

Instrument Information:

Instrument	Channel	Color	Make	Model	Serial No.
O_2	1	Purple	Servomex	1440	01420C/985
CO_2	2	Red	Servomex	1440	01420C/986
SO_2	-	-	-	-	-
NO_x	4	Green	Teco	42C	73780
CO	5	Brown	Horiba	510	10018
HCs	-	-	-	-	-
Recorders	-	-	ETI	104	249

Calibration Information:

Instrument	Units	Zero	Span	Range	Gas Cyl. No.	Gas Flow (L/min)
O_2	%	N_2	12.52	20.9	CC165569	0.5
O_2	%	N_2	20.9	20.9	CC126939	0.5
CO_2	%	N_2	12.5	20.9	CC165569	0.5
CO_2	%	N_2	20.9	20.9	CC126939	0.5
SO_2	ppmdv	-	-	-	-	-
SO_2	ppmdv	-	-	-	-	-
NO_x	ppmdv	N_2	45.3	95.7	CC125550	0.5
NO_x	ppmdv	N_2	95.7	95.7	CC233222	0.5
CO	ppmdv	N_2	44.3	97.4	CC125550	0.5
CO	ppmdv	N_2	97.4	97.4	CC233222	0.5
HCs	ppmv	-	-	-	-	-
HCs	ppmv	-	-	-	-	-
HCs	ppmv	-	-	-	-	-

Client: Conoco Phillips	**Date:** 05/29/10
City: Ferndale, WA	
Site: SRU	**ETI Job No:** 10-1891

Table 3.0.2
O_2 Analyzer Calibration Data

3-Point Linearity Check (Internal Cal)	Direct Calibration Mode: Cylinder Value (ppmdv)	Calibration Response (ppmdv)	Difference from Cylinder Value	Difference (% of Calibration Span)
Zero Gas	0.00	0.00	0.00	0.00%
Mid-Range Gas	12.52	12.50	0.02	0.10%
High-Range Gas	20.90	21.10	0.20	0.96%

40 CFR 60 Method 3A-13.0
Analyzer calibration error ≤2.0% of calibration span or 0.5% absolute difference
System Bias must be ≤5.0% of calibration span or 0.5% absolute difference
Calibration Drift must be ≤3.0% of calibration span or 0.5% absolute difference
Calibration Span = High-Range Gas Cylinder Value
Upscale Gas = Mid 12.52

System Bias and Calibration Drift Assessments	Run	Analyzer Calibration Response (ppmdv) Direct	System	Direct - System Difference	Pre - Post System Response	System Bias	Calibration Drift
Zero Gas	**Pre**	0.00	0.00	0.00		0.00%	
Upscale Gas		12.50	12.50	0.00		0.00%	
Zero Gas	**1**	0.00	0.00	0.00	0.00	0.00%	0.00%
Upscale Gas		12.50	12.40	0.10	0.10	0.48%	0.48%
Zero Gas	**2**	0.00	0.00	0.00	0.00	0.00%	0.00%
Upscale Gas		12.50	12.40	0.10	0.00	0.48%	0.00%
Zero Gas	**3**	0.00	0.00	0.00	0.00	0.00%	0.00%
Upscale Gas		12.50	12.40	0.10	0.00	0.48%	0.00%

Client: Conoco Phillips **City:** Ferndale, WA **Site:** SRU	**Date:** 05/29/10 **ETI Job No:** 10-1891

Table 3.0.3
CO_2 Analyzer Calibration Data

3-Point Linearity Check (Internal Cal)	Direct Calibration Mode: Cylinder Value (ppmdv)	Calibration Response (ppmdv)	Difference from Cylinder Value	Difference (% of Calibration Span)
Zero Gas	0.00	0.00	0.00	0.00%
Mid-Range Gas	12.50	12.50	0.00	0.00%
High-Range Gas	20.90	21.00	0.10	0.48%

40 CFR 60 Method 3A-13.0
Analyzer calibration error ≤2.0% of calibration span or 0.5% absolute difference
System Bias must be ≤5.0% of calibration span or 0.5% absolute difference
Calibration Drift must be ≤3.0% of calibration span or 0.5% absolute difference
Calibration Span = High-Range Gas Cylinder Value
Upscale Gas = Mid 12.5

System Bias and Calibration Drift Assessments	Run	Analyzer Calibration Response (ppmdv) Direct	System	Direct - System Difference	Pre - Post System Response	System Bias	Calibration Drift
Zero Gas	**Pre**	0.00	0.00	0.00		0.00%	
Upscale Gas		12.50	12.50	0.00		0.00%	
Zero Gas	**1**	0.00	0.03	0.03	0.03	0.14%	0.14%
Upscale Gas		12.50	12.50	0.00	0.00	0.00%	0.00%
Zero Gas	**2**	0.00	0.01	0.01	0.02	0.05%	0.10%
Upscale Gas		12.50	12.50	0.00	0.00	0.00%	0.00%
Zero Gas	**3**	0.00	0.03	0.03	0.02	0.14%	0.10%
Upscale Gas		12.50	12.50	0.00	0.00	0.00%	0.00%

Client: Conoco Phillips	**Date:** 05/29/10
City: Ferndale, WA	
Site: SRU	**ETI Job No:** 10-1891

Table 3.0.4
NO_x Analyzer Calibration Data

3-Point Linearity Check (Internal Cal)	Direct Calibration Mode: Cylinder Value (ppmdv)	Calibration Response (ppmdv)	Difference from Cylinder Value	Difference (% of Calibration Span)
Zero Gas	0.0	0.0	0.0	0.00%
Mid-Range Gas	45.3	46.6	1.3	1.36%
High-Range Gas	95.7	94.3	1.4	1.46%

40 CFR 60 Method 7E-13.0
Analyzer calibration error ≤2.0% of calibration span or 0.5 ppmv absolute difference
System Bias must be ≤5.0% of calibration span or 0.5 ppmv absolute difference
Calibration Drift must be ≤3.0% of calibration span or 0.5 ppmv absolute difference
Calibration Span = High-Range Gas Cylinder Value
Upscale Gas = High 95.7

System Bias and Calibration Drift Assessments	Run	Analyzer Calibration Response (ppmdv) Direct	System	Direct - System Difference	Pre - Post System Response	System Bias	Calibration Drift
Zero Gas	**Pre**	0.0	0.1	0.1		0.10%	
Upscale Gas		94.3	93.1	1.2		1.25%	
Zero Gas	**1**	0.0	0.2	0.2	0.1	0.21%	0.10%
Upscale Gas		94.3	93.0	1.3	0.1	1.36%	0.10%
Zero Gas	**2**	0.0	0.1	0.1	0.1	0.10%	0.10%
Upscale Gas		94.3	93.0	1.3	0.0	1.36%	0.00%
Zero Gas	**3**	0.0	0.2	0.2	0.1	0.21%	0.10%
Upscale Gas		94.3	92.9	1.4	0.1	1.46%	0.10%

Client: Conoco Phillips
City: Ferndale, WA
Site: SRU

Date: 05/29/10

ETI Job No: 10-1891

Table 3.0.5
CO Analyzer Calibration Data

3-Point Linearity Check (Internal Cal)	Direct Calibration Mode			
	Cylinder Value (ppmdv)	Calibration Response (ppmdv)	Difference from Cylinder Value	Difference (% of Calibration Span)
Zero Gas	0.0	0.0	0.00	0.00%
Mid-Range Gas	44.3	45.6	1.30	1.33%
High-Range Gas	97.4	97.3	0.10	0.10%

40 CFR 60 Method 10-13.0
Analyzer calibration error ≤2.0% of calibration span or 0.5 ppmv absolute difference
System Bias must be ≤5.0% of calibration span or 0.5 ppmv absolute difference
Calibration Drift must be ≤3.0% of calibration span or 0.5 ppmv absolute difference
Calibration Span = High-Range Gas Cylinder Value
Upscale Gas = High 97.4

System Bias and Calibration Drift Assessments	Run	Analyzer Calibration Response (ppmdv) Direct	Analyzer Calibration Response (ppmdv) System	Direct - System Difference	Pre - Post System Response	System Bias	Calibration Drift
Zero Gas	Pre	0.0	1.3	1.3		1.33%	
Upscale Gas		97.3	96.6	0.7		0.72%	
Zero Gas	1	0.0	3.9	3.9	2.6	4.00%	2.67%
Upscale Gas		97.3	98.3	1.0	1.7	1.03%	1.75%
Zero Gas	2	0.0	4.8	4.8	0.9	4.93%	0.92%
Upscale Gas		97.3	99.0	1.7	0.7	1.75%	0.72%
Zero Gas	3	0.0	3.0	3.0	1.8	3.08%	1.85%
Upscale Gas		97.3	96.3	1.0	2.7	1.03%	2.77%

Field Data

Client: Conoco Phillips	**Run:** 1
Site: SRU	**Start Time:** 9:53
Date: 05/29/10	**End Time:** 10:52

Table 3.1.1

Raw Emission Data: Measurement Time	O_2 %	CO_2 %	SO_2 ppmdv	NO_x ppmdv	CO ppmdv	HCs ppmv
9:53	4.3	7.2	-	32.7	2.8	-
9:54	4.2	7.3	-	32.7	2.8	-
9:55	4.3	7.3	-	32.8	2.7	-
9:56	4.2	7.3	-	32.9	2.7	-
9:57	4.1	7.4	-	33.5	2.7	-
9:58	4.0	7.4	-	33.4	2.8	-
9:59	4.0	7.4	-	33.3	2.9	-
10:00	4.0	7.3	-	33.3	2.8	-
10:01	4.0	7.4	-	33.3	2.9	-
10:02	3.9	7.4	-	33.9	2.9	-
10:03	4.0	7.4	-	33.9	3.0	-
10:04	3.9	7.5	-	34.0	3.0	-
10:05	3.8	7.5	-	34.2	3.0	-
10:06	3.8	7.5	-	34.5	3.1	-
10:07	3.8	7.5	-	34.4	3.1	-
10:08	3.9	7.4	-	34.5	3.1	-
10:09	3.8	7.5	-	34.7	3.1	-
10:10	3.8	7.5	-	34.9	3.1	-
10:11	3.8	7.5	-	34.9	6.9	-
10:12	3.7	7.5	-	34.6	36.5	-
10:13	3.5	7.6	-	34.8	27.1	-
10:14	3.5	7.6	-	35.2	7.6	-
10:15	3.5	7.6	-	35.1	5.8	-
10:16	3.5	7.6	-	35.1	6.2	-
10:17	3.6	7.6	-	35.4	4.1	-
10:18	3.7	7.6	-	35.5	3.3	-
10:19	3.6	7.6	-	35.5	3.4	-
10:20	3.6	7.6	-	35.5	3.4	-
10:21	3.6	7.6	-	35.2	3.4	-
10:22	3.7	7.5	-	34.6	3.4	-
10:23	3.7	7.5	-	34.4	3.4	-
10:24	3.8	7.5	-	33.9	3.4	-
10:25	3.8	7.5	-	34.0	3.5	-
10:26	4.0	7.4	-	33.8	3.5	-
10:27	9.2	10.3	-	19.3	3.2	-
10:28	10.4	11.5	-	4.5	3.2	-
10:29	4.2	7.9	-	31.0	3.5	-
10:30	3.7	7.6	-	34.5	3.6	-
10:31	3.6	7.6	-	34.6	3.6	-
10:32	3.6	7.6	-	34.5	3.7	-
10:33	3.7	7.5	-	34.4	3.7	-
10:34	3.8	7.6	-	34.6	3.7	-
10:35	3.8	7.5	-	34.7	3.7	-
10:36	3.9	7.5	-	34.7	3.7	-
10:37	3.9	7.5	-	34.7	3.8	-
10:38	3.7	7.6	-	34.5	3.8	-
10:39	3.6	7.6	-	34.5	3.9	-
10:40	3.7	7.6	-	34.4	4.0	-
10:41	3.7	7.6	-	34.5	4.0	-
10:42	3.7	7.5	-	34.3	4.0	-
10:43	3.7	7.5	-	34.5	4.1	-
10:44	3.8	7.5	-	34.4	4.1	-
10:45	3.8	7.5	-	34.2	4.1	-
10:46	3.9	7.5	-	34.3	4.1	-
10:47	3.9	7.5	-	34.1	4.2	-
10:48	3.8	7.5	-	34.3	4.2	-
10:49	3.7	7.6	-	34.3	4.3	-
10:50	3.5	7.6	-	34.5	4.3	-
10:51	3.5	7.6	-	34.5	4.3	-
10:52	3.7	7.5	-	34.5	4.4	-
Raw Avg:	**3.99**	**7.61**	**-**	**33.53**	**4.64**	**-**
Bias Corrected Emissions:						
Average:	**4.01**	**7.61**	**-**	**34.38**	**2.10**	**-**

Field Data

Client: Conoco Phillips
Site: SRU
Date: 05/29/10

Run: 2
Start Time: 11:07
End Time: 12:06

Table 3.1.2

Raw Emission Data: Measurement Time	O_2 %	CO_2 %	SO_2 ppmdv	NO_x ppmdv	CO ppmdv	HCs ppmv
11:07	3.7	7.4	-	36.6	5.4	-
11:08	3.7	7.5	-	34.7	4.8	-
11:09	3.6	7.5	-	35.0	4.7	-
11:10	3.6	7.5	-	35.2	4.7	-
11:11	3.6	7.6	-	35.6	4.6	-
11:12	3.7	7.6	-	35.4	4.6	-
11:13	3.7	7.6	-	35.4	4.6	-
11:14	3.6	7.6	-	35.3	4.6	-
11:15	3.6	7.6	-	35.2	4.6	-
11:16	3.7	7.6	-	35.0	4.7	-
11:17	3.7	7.6	-	35.0	4.6	-
11:18	3.8	7.5	-	35.2	4.7	-
11:19	3.7	7.6	-	35.6	4.7	-
11:20	3.8	7.5	-	35.3	4.7	-
11:21	3.7	7.5	-	34.8	4.7	-
11:22	3.8	7.5	-	34.2	4.7	-
11:23	3.8	7.5	-	33.8	4.7	-
11:24	3.9	7.4	-	33.5	4.7	-
11:25	4.0	7.4	-	33.4	4.7	-
11:26	4.0	7.4	-	33.4	4.7	-
11:27	4.0	7.4	-	33.5	4.7	-
11:28	4.1	7.4	-	33.5	4.7	-
11:29	4.0	7.4	-	33.6	4.8	-
11:30	3.9	7.5	-	33.8	4.7	-
11:31	3.8	7.5	-	33.8	4.8	-
11:32	3.8	7.5	-	33.7	4.7	-
11:33	3.8	7.5	-	33.7	4.8	-
11:34	3.8	7.5	-	33.8	4.8	-
11:35	3.9	7.5	-	33.8	4.8	-
11:36	4.0	7.4	-	33.6	4.8	-
11:37	4.0	7.4	-	33.7	4.8	-
11:38	3.9	7.5	-	33.7	4.9	-
11:39	4.0	7.4	-	33.6	4.9	-
11:40	3.9	7.4	-	33.4	4.8	-
11:41	3.9	7.4	-	33.4	4.8	-
11:42	3.9	7.4	-	33.7	4.9	-
11:43	4.0	7.4	-	33.7	4.9	-
11:44	4.0	7.4	-	33.7	4.9	-
11:45	4.0	7.4	-	34.0	5.0	-
11:46	3.9	7.5	-	34.2	5.0	-
11:47	3.8	7.5	-	34.2	5.0	-
11:48	3.7	7.6	-	34.3	5.0	-
11:49	3.7	7.6	-	34.2	5.0	-
11:50	4.0	7.4	-	33.5	5.0	-
11:51	4.0	7.4	-	33.5	5.0	-
11:52	4.0	7.4	-	33.8	5.0	-
11:53	4.0	7.4	-	34.0	5.0	-
11:54	4.0	7.4	-	34.0	5.0	-
11:55	3.9	7.4	-	33.9	5.1	-
11:56	3.9	7.4	-	33.8	5.1	-
11:57	4.0	7.4	-	33.7	5.1	-
11:58	4.0	7.4	-	33.5	5.1	-
11:59	4.0	7.4	-	33.5	5.1	-
12:00	3.9	7.5	-	34.1	5.1	-
12:01	3.9	7.5	-	34.3	5.1	-
12:02	3.9	7.5	-	34.2	5.1	-
12:03	3.9	7.5	-	34.4	5.1	-
12:04	3.7	7.5	-	34.3	5.2	-
12:05	3.6	7.6	-	34.8	5.2	-
12:06	3.8	7.5	-	34.6	5.2	-
Raw Avg:	**3.84**	**7.47**	**-**	**34.20**	**4.87**	**-**
Bias Corrected Emissions:						
Average:	**3.88**	**7.46**	**-**	**35.10**	**0.54**	**-**

Field Data

Client: Conoco Phillips
Site: SRU
Date: 05/29/10

Run: 3
Start Time: 12:31
End Time: 13:30

Table 3.1.3

Raw Emission Data: Measurement Time	O_2 %	CO_2 %	SO_2 ppmdv	NO_x ppmdv	CO ppmdv	HCs ppmv
12:31	4.2	7.4	-	33.1	5.2	-
12:32	4.2	7.4	-	33.4	5.3	-
12:33	4.1	7.4	-	33.7	5.3	-
12:34	4.2	7.4	-	33.7	5.3	-
12:35	4.2	7.4	-	33.6	5.3	-
12:36	4.2	7.4	-	33.6	5.3	-
12:37	4.0	7.5	-	34.1	5.3	-
12:38	4.1	7.4	-	33.7	5.3	-
12:39	3.9	7.5	-	33.9	5.3	-
12:40	4.0	7.5	-	33.8	5.4	-
12:41	3.9	7.4	-	33.7	5.4	-
12:42	4.0	7.4	-	33.8	5.3	-
12:43	4.1	7.4	-	33.8	5.4	-
12:44	4.1	7.4	-	33.6	5.4	-
12:45	4.2	7.4	-	33.3	5.4	-
12:46	4.1	7.4	-	33.3	5.3	-
12:47	4.2	7.4	-	33.3	5.4	-
12:48	4.3	7.4	-	33.0	5.4	-
12:49	4.3	7.3	-	33.1	5.4	-
12:50	4.4	7.3	-	33.4	5.4	-
12:51	4.4	7.3	-	33.4	5.4	-
12:52	4.1	7.4	-	33.8	5.4	-
12:53	4.2	7.3	-	33.9	5.4	-
12:54	4.0	7.4	-	33.6	5.4	-
12:55	4.1	7.4	-	33.6	5.4	-
12:56	4.1	7.4	-	33.0	5.5	-
12:57	4.0	7.4	-	33.3	5.4	-
12:58	4.1	7.4	-	33.4	5.4	-
12:59	4.1	7.4	-	33.4	5.4	-
13:00	4.1	7.4	-	33.5	5.4	-
13:01	4.4	7.3	-	33.2	5.5	-
13:02	4.3	7.3	-	33.1	5.5	-
13:03	4.5	7.3	-	32.9	5.5	-
13:04	4.2	7.4	-	33.0	5.5	-
13:05	4.0	7.5	-	33.6	5.5	-
13:06	3.9	7.5	-	33.9	5.5	-
13:07	4.1	7.4	-	33.4	5.5	-
13:08	4.0	7.4	-	33.9	5.5	-
13:09	4.1	7.4	-	33.4	5.5	-
13:10	4.0	7.4	-	33.7	5.5	-
13:11	4.0	7.4	-	33.6	5.5	-
13:12	4.0	7.4	-	33.5	5.5	-
13:13	4.2	7.4	-	33.2	5.5	-
13:14	4.1	7.4	-	33.5	5.5	-
13:15	4.1	7.4	-	33.9	5.5	-
13:16	4.2	7.4	-	33.7	5.5	-
13:17	4.2	7.4	-	33.6	5.5	-
13:18	4.2	7.4	-	33.6	5.5	-
13:19	4.1	7.4	-	33.2	5.5	-
13:20	3.9	7.5	-	33.8	5.5	-
13:21	4.2	7.4	-	33.4	5.6	-
13:22	4.1	7.4	-	33.0	5.6	-
13:23	4.1	7.4	-	33.2	5.5	-
13:24	4.2	7.3	-	32.9	5.6	-
13:25	4.1	7.4	-	33.4	5.6	-
13:26	4.4	7.2	-	33.0	5.6	-
13:27	4.4	7.3	-	33.0	5.6	-
13:28	4.7	7.2	-	32.1	5.6	-
13:29	4.4	7.3	-	32.8	5.6	-
13:30	4.3	7.3	-	32.6	5.6	-
Raw Avg:	**4.15**	**7.38**	**-**	**33.42**	**5.44**	**-**
Bias Corrected Emissions:						
Average:	**4.19**	**7.37**	**-**	**34.30**	**1.60**	**-**

Date	Time	ETI O2 Minute Averag	ETI CO2 Minute Averag	ETI SO2 Minute Averag	ETI NOx Minute Averag	ETI CO Minute Averag
--------	------	------	------	------	------	------
5/29/2010	8:00	OFF	OFF	OFF	OFF	OFF
5/29/2010	8:01	OFF	OFF	OFF	OFF	OFF
5/29/2010	8:02	OFF	OFF	OFF	OFF	OFF
5/29/2010	8:03	OFF	OFF	OFF	OFF	OFF
5/29/2010	8:04	OFF	OFF	OFF	OFF	OFF
5/29/2010	8:05	OFF	OFF	OFF	OFF	OFF
5/29/2010	8:06	OFF	OFF	OFF	OFF	OFF
5/29/2010	8:07	OFF	OFF	OFF	OFF	OFF
5/29/2010	8:08	OFF	OFF	OFF	OFF	OFF
5/29/2010	8:09	OFF	OFF	OFF	OFF	OFF
5/29/2010	8:10	OFF	OFF	OFF	OFF	OFF
5/29/2010	8:11	OFF	OFF	OFF	OFF	OFF
5/29/2010	8:12	OFF	OFF	OFF	OFF	OFF
5/29/2010	8:13	OFF	OFF	OFF	OFF	OFF
5/29/2010	8:14	OFF	OFF	OFF	OFF	OFF
5/29/2010	8:15	OFF	OFF	OFF	OFF	OFF
5/29/2010	8:16	OFF	OFF	OFF	OFF	OFF
5/29/2010	8:17	OFF	OFF	OFF	OFF	OFF
5/29/2010	8:18	21.3	101	0.056	50	74.2
5/29/2010	8:19	21.3	101	0.127	50	74.2
5/29/2010	8:20	21.3	101	0.242	50	74.4
5/29/2010	8:21	21.3	101	0.251	50	74.4
5/29/2010	8:22	21.3	101	0.303	50	74.4
5/29/2010	8:23	21.3	101	0.363	50	74.5
5/29/2010	8:24	21.3	101	0.372	50	74.5
5/29/2010	8:25	21.3	101	0.318	50	74.6
5/29/2010	8:26	21.3	101	0.461	50	74.6
5/29/2010	8:27	21.3	101	0.456	50	74.6
5/29/2010	8:28	21.3	101	0.583	50	74.6
5/29/2010	8:29	21.2	101	0.519	50	74.6
5/29/2010	8:30	21.2	101	0.652	50	74.7
5/29/2010	8:31	21.2	101	0.689	50	74.7
5/29/2010	8:32	21.2	101	0.766	50	74.7
5/29/2010	8:33	21.2	101	0.84	50	74.7
5/29/2010	8:34	21.2	101	0.896	50	74.8
5/29/2010	8:35	21.2	101	1	50	74.8
5/29/2010	8:36	21.2	101	1.02	50	74.8
5/29/2010	8:37	21.2	101	1.19	50	74.8
5/29/2010	8:38	21.2	101	1.25	50	74.8
5/29/2010	8:39	21.2	101	1.37	50	74.8

Date	Time	ETI O2 Minute Averag	ETI CO2 Minute Averag	ETI SO2 Minute Averag	ETI NOx Minute Averag	ETI CO Minute Averag
5/29/2010	8:40	19.4	101	4.36	50	92.6
5/29/2010	8:41	0.45	100	76.2	50	169
5/29/2010	8:42	0	1.35	94	62.1	169
5/29/2010	8:43	0	0	95.6	126	136
5/29/2010	8:44	0	0	92.6	127	97.4
5/29/2010	8:45	0	0	92	126	97.5
5/29/2010	8:46	0.004	0	89.7	62.5	97.5
5/29/2010	8:47	0.008	0	88.5	5.28	97.5
5/29/2010	8:48	0.012	0	88.4	4.99	97.5
5/29/2010	8:49	0.936	0	83.6	7.79	82.5
5/29/2010	8:50	12.4	2.9	5.45	7.31	0.002
5/29/2010	8:51	12.6	12.6	0.406	0.117	0.006
5/29/2010	8:52	12.5	12.5	0.363	0.092	0.015
5/29/2010	8:53	12.5	12.5	0.435	0.083	0.042
5/29/2010	8:54	12.7	12.5	-0.1	0.643	0
5/29/2010	8:55	20.6	20.1	-0.1	1.44	-0.3
5/29/2010	8:56	7.41	7.92	53	41.7	81.6
5/29/2010	8:57	0.014	0.044	89.5	97.9	97.7
5/29/2010	8:58	0.003	0.018	90.3	97.4	97.7
5/29/2010	8:59	0	0.013	91.7	95.8	97.5
5/29/2010	9:00	0.02	0.011	91.1	95.8	95.1
5/29/2010	9:01	0.055	0.007	50.2	53.6	45.7
5/29/2010	9:02	0	0.006	44.6	47.6	45.5
5/29/2010	9:03	0	0.004	44.7	47.5	45.5
5/29/2010	9:04	0	0.005	44.8	47.5	45.5
5/29/2010	9:05	0	0.004	44.7	47.5	45.5
5/29/2010	9:06	0	0.003	44.8	47.5	45.6
5/29/2010	9:07	0	0.003	44.8	46.7	45.7
5/29/2010	9:08	0	0.003	69.8	54.6	80.2
5/29/2010	9:09	0	0.004	94.1	94.1	97.7
5/29/2010	9:10	5.36	0.446	58.8	52	50.2
5/29/2010	9:11	7.5	5.2	9.12	23.6	17.4
5/29/2010	9:12	0.707	0.95	46.5	75.1	91.3
5/29/2010	9:13	0.018	0.036	76	92.6	96.5
5/29/2010	9:14	0	0.008	86	92.9	96.5
5/29/2010	9:15	0	0.007	90.1	93.1	96.6
5/29/2010	9:16	0	0.005	92.2	93	96.6
5/29/2010	9:17	0	0.001	93.5	93.1	96.6
5/29/2010	9:18	0	0.001	94.2	92.9	96.6
5/29/2010	9:19	5.48	5.3	71.7	66.2	35.8
5/29/2010	9:20	12.2	12.3	24.1	4.05	1.84

Date	Time	ETI O2 Minute Averag	ETI CO2 Minute Averag	ETI SO2 Minute Averag	ETI NOx Minute Averag	ETI CO Minute Averag
5/29/2010	9:21	12.5	12.5	10.9	0.18	1.27
5/29/2010	9:22	12.5	12.5	6.39	0.093	1.26
5/29/2010	9:23	12.5	12.5	4.63	0.082	1.28
5/29/2010	9:24	12.5	12.5	3.82	0	1.35
5/29/2010	9:25	12.2	11.6	4.33	1.32	1.66
5/29/2010	9:26	8.09	6.51	31.5	21.8	3.41
5/29/2010	9:27	8.6	5.51	46.1	26.1	4.35
5/29/2010	9:28	6.13	6.49	60.2	29.1	3.22
5/29/2010	9:29	3.89	7.47	83.6	35.3	2.9
5/29/2010	9:30	3.9	7.44	87.2	34.1	3.95
5/29/2010	9:31	4.01	7.39	86.2	33.5	4.55
5/29/2010	9:32	4.15	7.32	81.7	32.8	4.78
5/29/2010	9:33	5.32	6.84	75.1	31.4	4.92
5/29/2010	9:34	7.38	5.95	58.8	26	3.49
5/29/2010	9:35	5.42	6.83	67.2	30.5	2.6
5/29/2010	9:36	9.44	5.27	60.7	28.1	2.6
5/29/2010	9:37	20.2	0.412	16.6	2.97	1.87
5/29/2010	9:38	20.8	0.108	8.16	0.185	1.75
5/29/2010	9:39	20.9	0.07	6.07	0.015	1.72
5/29/2010	9:40	20.9	0.063	5.57	0	1.7
5/29/2010	9:41	20.9	0.057	5.34	0	1.73
5/29/2010	9:42	20.7	0.103	5.42	0	1.88
5/29/2010	9:43	8.08	5.48	51.3	20.6	2.39
5/29/2010	9:44	3.8	7.49	79.6	34.7	2.48
5/29/2010	9:45	3.83	7.47	80	35.2	2.47
5/29/2010	9:46	3.71	7.53	81.3	35.4	2.53
5/29/2010	9:47	3.8	7.49	80.7	34.8	2.58
5/29/2010	9:48	3.89	7.42	80	34.1	2.62
5/29/2010	9:49	3.9	7.41	80.4	33.6	2.66
5/29/2010	9:50	3.96	7.37	77	33.2	2.66
5/29/2010	9:51	3.98	7.35	75.1	33.1	2.65
5/29/2010	9:52	4.1	7.3	72.9	33.1	2.67
5/29/2010	9:53	4.33	7.23	69.3	32.7	2.81
5/29/2010	9:54	4.2	7.3	66.6	32.7	2.75
5/29/2010	9:55	4.31	7.28	65	32.8	2.72
5/29/2010	9:56	4.23	7.3	65.9	32.9	2.74
5/29/2010	9:57	4.08	7.35	63.7	33.5	2.74
5/29/2010	9:58	3.96	7.38	65.6	33.4	2.8
5/29/2010	9:59	4.02	7.36	66.9	33.3	2.85
5/29/2010	10:00	4.04	7.33	65.4	33.3	2.83
5/29/2010	10:01	3.97	7.36	65.8	33.3	2.88

Date	Time	ETI O2 Minute Averag	ETI CO2 Minute Averag	ETI SO2 Minute Averag	ETI NOx Minute Averag	ETI CO Minute Averag
5/29/2010	10:02	3.87	7.42	64.4	33.9	2.92
5/29/2010	10:03	3.99	7.4	64.3	33.9	2.95
5/29/2010	10:04	3.91	7.46	63.8	34	2.99
5/29/2010	10:05	3.76	7.53	64.8	34.2	3
5/29/2010	10:06	3.76	7.52	65.3	34.5	3.08
5/29/2010	10:07	3.84	7.48	64.2	34.4	3.14
5/29/2010	10:08	3.9	7.44	62.9	34.5	3.11
5/29/2010	10:09	3.84	7.46	62.3	34.7	3.12
5/29/2010	10:10	3.75	7.49	62	34.9	3.14
5/29/2010	10:11	3.75	7.5	61.8	34.9	6.92
5/29/2010	10:12	3.7	7.52	67.3	34.6	36.5
5/29/2010	10:13	3.53	7.59	73	34.8	27.1
5/29/2010	10:14	3.51	7.6	74.2	35.2	7.58
5/29/2010	10:15	3.5	7.6	71.1	35.1	5.8
5/29/2010	10:16	3.51	7.61	69.1	35.1	6.15
5/29/2010	10:17	3.62	7.6	69.8	35.4	4.12
5/29/2010	10:18	3.66	7.58	68.8	35.5	3.32
5/29/2010	10:19	3.59	7.59	69.2	35.5	3.37
5/29/2010	10:20	3.61	7.58	67.4	35.5	3.36
5/29/2010	10:21	3.63	7.55	68.6	35.2	3.4
5/29/2010	10:22	3.66	7.53	69.6	34.6	3.41
5/29/2010	10:23	3.67	7.53	69.2	34.4	3.4
5/29/2010	10:24	3.75	7.49	70	33.9	3.42
5/29/2010	10:25	3.8	7.49	68.8	34	3.45
5/29/2010	10:26	3.95	7.43	60.6	33.8	3.47
5/29/2010	10:27	9.21	10.3	34.7	19.3	3.23
5/29/2010	10:28	10.4	11.5	14.8	4.47	3.22
5/29/2010	10:29	4.18	7.85	63	31	3.51
5/29/2010	10:30	3.67	7.56	72.1	34.5	3.56
5/29/2010	10:31	3.62	7.55	73.3	34.6	3.61
5/29/2010	10:32	3.6	7.55	72.3	34.5	3.66
5/29/2010	10:33	3.72	7.53	69.4	34.4	3.66
5/29/2010	10:34	3.75	7.55	69.4	34.6	3.69
5/29/2010	10:35	3.84	7.51	70	34.7	3.73
5/29/2010	10:36	3.87	7.47	67.5	34.7	3.73
5/29/2010	10:37	3.85	7.48	66.4	34.7	3.75
5/29/2010	10:38	3.67	7.56	67.6	34.5	3.82
5/29/2010	10:39	3.61	7.6	65.2	34.5	3.9
5/29/2010	10:40	3.66	7.56	62.3	34.4	3.96
5/29/2010	10:41	3.67	7.55	63.6	34.5	4.01
5/29/2010	10:42	3.71	7.51	62.8	34.3	4.03

Date	Time	ETI O2 Minute Averag	ETI CO2 Minute Averag	ETI SO2 Minute Averag	ETI NOx Minute Averag	ETI CO Minute Averag
5/29/2010	10:43	3.68	7.53	65.1	34.5	4.08
5/29/2010	10:44	3.77	7.5	63.5	34.4	4.11
5/29/2010	10:45	3.76	7.5	62.5	34.2	4.13
5/29/2010	10:46	3.88	7.48	63.1	34.3	4.14
5/29/2010	10:47	3.88	7.49	61.9	34.1	4.18
5/29/2010	10:48	3.8	7.53	61.4	34.3	4.23
5/29/2010	10:49	3.72	7.55	63	34.3	4.25
5/29/2010	10:50	3.52	7.58	62.9	34.5	4.28
5/29/2010	10:51	3.5	7.58	62.3	34.5	4.33
5/29/2010	10:52	3.66	7.52	61.5	34.5	4.35
5/29/2010	10:53	3.81	7.49	59.5	34.2	4.36
5/29/2010	10:54	9.6	10.7	27.7	18.3	4.08
5/29/2010	10:55	12.3	12.5	3.63	0.593	3.98
5/29/2010	10:56	12.4	12.6	1.91	0.091	4.12
5/29/2010	10:57	7.39	9.39	27.7	16.1	10.7
5/29/2010	10:58	1.78	3.67	69.5	56.3	74.4
5/29/2010	10:59	0.033	0.176	88	91.1	100
5/29/2010	11:00	0	0.045	90	93	100
5/29/2010	11:01	0	0.035	90.5	93.1	100
5/29/2010	11:02	0	0.031	90.8	93.1	100
5/29/2010	11:03	0	0.029	90.9	93.1	100
5/29/2010	11:04	0	0.025	91	93.2	100
5/29/2010	11:05	0	0.018	91.1	93.2	98.3
5/29/2010	11:06	1.81	3.48	81.1	73.7	37
5/29/2010	11:07	3.65	7.39	67.9	36.6	5.42
5/29/2010	11:08	3.66	7.54	65.9	34.7	4.79
5/29/2010	11:09	3.63	7.54	31.6	35	4.68
5/29/2010	11:10	3.6	7.53	65.2	35.2	4.69
5/29/2010	11:11	3.56	7.57	67.8	35.6	4.64
5/29/2010	11:12	3.66	7.56	67.3	35.4	4.64
5/29/2010	11:13	3.65	7.59	67.4	35.4	4.62
5/29/2010	11:14	3.62	7.6	67.9	35.3	4.61
5/29/2010	11:15	3.63	7.6	67.3	35.2	4.64
5/29/2010	11:16	3.65	7.59	66.2	35	4.65
5/29/2010	11:17	3.71	7.57	64.8	35	4.64
5/29/2010	11:18	3.76	7.54	63.9	35.2	4.65
5/29/2010	11:19	3.67	7.55	64.7	35.6	4.67
5/29/2010	11:20	3.78	7.52	64.8	35.3	4.72
5/29/2010	11:21	3.72	7.54	64.2	34.8	4.67
5/29/2010	11:22	3.77	7.5	64.6	34.2	4.69
5/29/2010	11:23	3.78	7.48	63.5	33.8	4.73

		ETI O2 Minute Averag	ETI CO2 Minute Averag	ETI SO2 Minute Averag	ETI NOx Minute Averag	ETI CO Minute Averag
Date	Time					
5/29/2010	11:24	3.91	7.42	62.8	33.5	4.72
5/29/2010	11:25	4	7.41	60.4	33.4	4.69
5/29/2010	11:26	4.04	7.38	57	33.4	4.72
5/29/2010	11:27	4.01	7.39	56.2	33.5	4.73
5/29/2010	11:28	4.08	7.36	55.9	33.5	4.74
5/29/2010	11:29	4.01	7.4	54.8	33.6	4.75
5/29/2010	11:30	3.92	7.45	55.4	33.8	4.74
5/29/2010	11:31	3.8	7.48	56	33.8	4.75
5/29/2010	11:32	3.79	7.46	57	33.7	4.74
5/29/2010	11:33	3.81	7.45	58.6	33.7	4.77
5/29/2010	11:34	3.78	7.5	57.1	33.8	4.8
5/29/2010	11:35	3.92	7.46	55.5	33.8	4.84
5/29/2010	11:36	3.96	7.43	54	33.6	4.81
5/29/2010	11:37	3.96	7.43	54.2	33.7	4.84
5/29/2010	11:38	3.91	7.45	53.4	33.7	4.86
5/29/2010	11:39	3.97	7.43	53.5	33.6	4.85
5/29/2010	11:40	3.92	7.43	54.7	33.4	4.83
5/29/2010	11:41	3.92	7.41	54.7	33.4	4.83
5/29/2010	11:42	3.85	7.43	55.4	33.7	4.92
5/29/2010	11:43	3.98	7.39	54.7	33.7	4.91
5/29/2010	11:44	4.01	7.4	56.5	33.7	4.93
5/29/2010	11:45	3.95	7.44	58.3	34	4.95
5/29/2010	11:46	3.93	7.46	58.8	34.2	4.95
5/29/2010	11:47	3.81	7.51	59.3	34.2	4.98
5/29/2010	11:48	3.7	7.55	62.1	34.3	5
5/29/2010	11:49	3.69	7.55	62.1	34.2	5
5/29/2010	11:50	3.95	7.43	60.2	33.5	5.01
5/29/2010	11:51	4.02	7.39	59	33.5	5.01
5/29/2010	11:52	3.97	7.41	60.4	33.8	5.01
5/29/2010	11:53	3.99	7.42	60.6	34	5.02
5/29/2010	11:54	3.98	7.43	60.9	34	5.04
5/29/2010	11:55	3.92	7.43	61.1	33.9	5.09
5/29/2010	11:56	3.93	7.42	61.9	33.8	5.08
5/29/2010	11:57	3.98	7.4	61.2	33.7	5.08
5/29/2010	11:58	3.99	7.4	60.3	33.5	5.11
5/29/2010	11:59	3.98	7.41	57	33.5	5.13
5/29/2010	12:00	3.94	7.45	61.3	34.1	5.1
5/29/2010	12:01	3.86	7.49	63	34.3	5.1
5/29/2010	12:02	3.87	7.49	63.6	34.2	5.13
5/29/2010	12:03	3.85	7.51	63.1	34.4	5.13
5/29/2010	12:04	3.72	7.54	63.2	34.3	5.16

		ETI O2 Minute	ETI CO2 Minute	ETI SO2 Minute	ETI NOx Minute	ETI CO Minute
Date	Time	Averag	Averag	Averag	Averag	Averag
5/29/2010	12:05	3.64	7.57	63.6	34.8	5.16
5/29/2010	12:06	3.8	7.51	62.6	34.6	5.18
5/29/2010	12:07	3.72	7.52	61.2	34.8	5.17
5/29/2010	12:08	2.97	5.89	64.8	42.1	42.5
5/29/2010	12:09	0.197	0.463	84.2	86.2	97.4
5/29/2010	12:10	0	0.05	88.4	92.6	99
5/29/2010	12:11	0	0.032	89	92.8	99
5/29/2010	12:12	0	0.028	89.5	92.7	99
5/29/2010	12:13	0	0.024	89.6	92.7	99
5/29/2010	12:14	0	0.022	89.7	92.8	99
5/29/2010	12:15	0	0.02	89.9	92.8	99
5/29/2010	12:16	0	0.017	90.1	92.9	99
5/29/2010	12:17	0	0.017	90	92.8	99
5/29/2010	12:18	0	0.015	90.2	92.9	99
5/29/2010	12:19	0	0.016	90.2	92.9	99
5/29/2010	12:20	0	0.02	90.2	92.8	97.4
5/29/2010	12:21	3.18	5.17	75.4	62.4	20.4
5/29/2010	12:22	3.92	7.37	71.5	34.9	5.45
5/29/2010	12:23	3.9	7.44	71.8	33.9	5.24
5/29/2010	12:24	4.05	7.38	69.9	33.7	5.28
5/29/2010	12:25	4.96	7.78	65.3	33.1	5.22
5/29/2010	12:26	11.6	11.9	18.6	7.42	4.92
5/29/2010	12:27	12.4	12.5	3.39	0.252	4.91
5/29/2010	12:28	12.4	12.6	1.7	0.091	4.86
5/29/2010	12:29	9.75	11	12.7	6.01	5.03
5/29/2010	12:30	4.49	7.52	55.8	30.5	5.2
5/29/2010	12:31	4.15	7.37	64.4	33.1	5.22
5/29/2010	12:32	4.15	7.38	66.2	33.4	5.27
5/29/2010	12:33	4.13	7.41	66.6	33.7	5.27
5/29/2010	12:34	4.18	7.38	66.4	33.7	5.29
5/29/2010	12:35	4.21	7.36	65.9	33.6	5.3
5/29/2010	12:36	4.19	7.37	65.3	33.6	5.28
5/29/2010	12:37	3.98	7.46	66.3	34.1	5.3
5/29/2010	12:38	4.07	7.44	66.9	33.7	5.31
5/29/2010	12:39	3.87	7.52	68.8	33.9	5.31
5/29/2010	12:40	3.95	7.46	68.3	33.8	5.35
5/29/2010	12:41	3.93	7.44	64.9	33.7	5.37
5/29/2010	12:42	4.03	7.41	63.6	33.8	5.34
5/29/2010	12:43	4.08	7.37	64.8	33.8	5.36
5/29/2010	12:44	4.13	7.35	64.4	33.6	5.36
5/29/2010	12:45	4.2	7.35	64.3	33.3	5.35

Date	Time	ETI O2 Minute Averag	ETI CO2 Minute Averag	ETI SO2 Minute Averag	ETI NOx Minute Averag	ETI CO Minute Averag
5/29/2010	12:46	4.09	7.4	65.2	33.3	5.32
5/29/2010	12:47	4.19	7.38	65.3	33.3	5.38
5/29/2010	12:48	4.31	7.35	65	33	5.43
5/29/2010	12:49	4.3	7.34	64.8	33.1	5.42
5/29/2010	12:50	4.37	7.3	64.9	33.4	5.44
5/29/2010	12:51	4.41	7.27	64.9	33.4	5.4
5/29/2010	12:52	4.14	7.37	65.7	33.8	5.37
5/29/2010	12:53	4.21	7.34	65.4	33.9	5.41
5/29/2010	12:54	4.03	7.42	66.1	33.6	5.39
5/29/2010	12:55	4.06	7.43	67	33.6	5.37
5/29/2010	12:56	4.09	7.39	66.8	33	5.46
5/29/2010	12:57	4.02	7.4	67.3	33.3	5.42
5/29/2010	12:58	4.08	7.38	66.3	33.4	5.42
5/29/2010	12:59	4.11	7.37	66	33.4	5.41
5/29/2010	13:00	4.11	7.36	64.6	33.5	5.43
5/29/2010	13:01	4.39	7.26	63.2	33.2	5.48
5/29/2010	13:02	4.3	7.33	60.8	33.1	5.48
5/29/2010	13:03	4.47	7.3	59.2	32.9	5.51
5/29/2010	13:04	4.23	7.37	62.8	33	5.54
5/29/2010	13:05	3.99	7.45	65.3	33.6	5.53
5/29/2010	13:06	3.93	7.47	63.5	33.9	5.48
5/29/2010	13:07	4.1	7.41	61.6	33.4	5.5
5/29/2010	13:08	4.03	7.44	64.8	33.9	5.49
5/29/2010	13:09	4.13	7.38	65	33.4	5.52
5/29/2010	13:10	4.04	7.41	65.6	33.7	5.49
5/29/2010	13:11	3.99	7.43	65.4	33.6	5.5
5/29/2010	13:12	4.02	7.42	65.9	33.5	5.48
5/29/2010	13:13	4.21	7.36	65.8	33.2	5.47
5/29/2010	13:14	4.07	7.42	67.1	33.5	5.47
5/29/2010	13:15	4.07	7.42	66.9	33.9	5.52
5/29/2010	13:16	4.18	7.39	66	33.7	5.48
5/29/2010	13:17	4.16	7.38	65.8	33.6	5.49
5/29/2010	13:18	4.23	7.36	65.5	33.6	5.51
5/29/2010	13:19	4.12	7.4	65.4	33.2	5.51
5/29/2010	13:20	3.92	7.46	67.4	33.8	5.51
5/29/2010	13:21	4.16	7.36	66.8	33.4	5.55
5/29/2010	13:22	4.1	7.38	66.3	33	5.58
5/29/2010	13:23	4.09	7.39	66.9	33.2	5.52
5/29/2010	13:24	4.23	7.33	67	32.9	5.62
5/29/2010	13:25	4.06	7.37	67.2	33.4	5.57
5/29/2010	13:26	4.36	7.24	65.3	33	5.61

Date	Time	ETI O2 Minute Averag	ETI CO2 Minute Averag	ETI SO2 Minute Averag	ETI NOx Minute Averag	ETI CO Minute Averag
5/29/2010	13:27	4.37	7.28	63.5	33	5.59
5/29/2010	13:28	4.69	7.17	59.7	32.1	5.62
5/29/2010	13:29	4.37	7.32	62	32.8	5.61
5/29/2010	13:30	4.31	7.33	63.6	32.6	5.62
5/29/2010	13:31	4.22	7.36	64	33	5.58
5/29/2010	13:32	6.07	7.92	56.1	30.5	5.51
5/29/2010	13:33	12	12.1	13.4	4.82	5.18
5/29/2010	13:34	12.4	12.5	2.45	0.158	2.84
5/29/2010	13:35	5.15	5.66	35.6	38	70.8
5/29/2010	13:36	0.127	0.247	80.9	89.7	94
5/29/2010	13:37	0	0.052	87.1	92	96.3
5/29/2010	13:38	0	0.035	88.3	92.2	96.3
5/29/2010	13:39	0	0.028	88.9	92.3	96.3
5/29/2010	13:40	0.114	0.196	88.6	91.7	85.5
5/29/2010	13:41	3.56	5.87	74.4	49.2	-13
5/29/2010	13:42	4.06	7.34	69.2	0.592	-25
5/29/2010	13:43	4.19	7.37	67.6	-8.8	-25
5/29/2010	13:44	4.19	7.38	65.9	-25	-25
5/29/2010	13:45	4.07	7.42	65.2	-25	-25
5/29/2010	13:46	4.05	7.4	64.8	-25	-25
5/29/2010	13:47	4.22	7.32	61.3	-25	-25
5/29/2010	13:48	4.33	7.29	62.7	-25	-25
5/29/2010	13:49	4.31	7.3	64	-25	-25
5/29/2010	13:50	4.36	7.29	63.8	-25	-25
5/29/2010	13:51	4.15	7.39	65.3	-25	-25
5/29/2010	13:52	4.29	7.33	65.1	-25	-25
5/29/2010	13:53	4.24	7.35	64.6	-25	-25
5/29/2010	13:54	4.18	7.37	65.3	-25	-25
5/29/2010	13:55	4.16	7.34	65.1	-25	-25
5/29/2010	13:56	4.08	7.36	66.1	-25	-25
5/29/2010	13:57	4.29	7.29	65.7	-25	-25
5/29/2010	13:58	4.19	7.34	66.1	-25	-25
5/29/2010	13:59	4.19	7.37	66.9	-25	-25
5/29/2010	14:00	4.26	7.36	66.3	-25	-25
5/29/2010	14:01	4.2	7.37	64.7	-25	-25
5/29/2010	14:02	4.29	7.33	62.3	-25	-25
5/29/2010	14:03	2.09	3.46	70.5	-25	-25
5/29/2010	14:04	0.036	0.151	85.9	-25	-25
5/29/2010	14:05	0	0.031	88	-25	-25
5/29/2010	14:06	0	0.021	88.6	-25	-25
5/29/2010	14:07	1.43	1.25	83.3	-25	-25

Date	Time	ETI O2 Minute Averag	ETI CO2 Minute Averag	ETI SO2 Minute Averag	ETI NOx Minute Averag	ETI CO Minute Averag
5/29/2010	14:08	11.3	11.3	23.5	-25	-25
5/29/2010	14:09	12.4	12.5	4.44	-25	-25
5/29/2010	14:10	10.8	11.3	7.32	-25	-25
5/29/2010	14:11	5.35	7.16	49.2	-25	-25
5/29/2010	14:12	4.92	7.07	62.4	-25	-25
5/29/2010	14:13	4.78	7.12	64.9	-25	-25
5/29/2010	14:14	4.83	7.11	64.4	-25	-25
5/29/2010	14:15	4.28	7.37	66.3	-25	-25
5/29/2010	14:16	4.41	7.31	66.9	-25	-25
5/29/2010	14:17	4.27	7.36	68.6	-25	-25
5/29/2010	14:18	4.14	7.42	70.7	-25	-25
5/29/2010	14:19	4.1	7.41	71.9	-25	-25
5/29/2010	14:20	4.34	7.33	70.5	-25	-25
5/29/2010	14:21	4.73	7.17	67	-25	-25
5/29/2010	14:22	4.43	7.29	67.2	-25	-25
5/29/2010	14:23	4.48	7.26	66.8	-25	-25
5/29/2010	14:24	4.51	7.25	66.6	-25	-25
5/29/2010	14:25	4.37	7.31	67.2	-25	-25
5/29/2010	14:26	4.47	7.27	67.1	-25	-25
5/29/2010	14:27	4.32	7.31	67.1	-25	-25
5/29/2010	14:28	4.24	7.36	66.3	-25	-25
5/29/2010	14:29	4.8	7.16	64.1	-25	-25
5/29/2010	14:30	4.82	7.14	63.5	-25	-25
5/29/2010	14:31	4.42	7.32	64.1	-25	-25
5/29/2010	14:32	4.43	7.31	63.7	-25	-25
5/29/2010	14:33	3.95	7.28	66.8	-25	-25
5/29/2010	14:34	0.731	1.54	80.6	-25	-25
5/29/2010	14:35	0	0.071	87	-25	-25
5/29/2010	14:36	0	0.027	88.1	-25	-25
5/29/2010	14:37	2.73	2.5	76.8	-25	-25
5/29/2010	14:38	11.8	11.8	17.2	-25	-25
5/29/2010	14:39	12.4	12.5	3.63	-25	-25
5/29/2010	14:40	9.91	10.4	11	-25	-25
5/29/2010	14:41	4.44	7.08	53.8	-25	-25
5/29/2010	14:42	4.52	7.27	61.7	-25	-25
5/29/2010	14:43	4.28	7.33	63.5	-25	-25
5/29/2010	14:44	4.04	7.42	66.7	-25	-25
5/29/2010	14:45	4.24	7.36	65.2	-25	-25
5/29/2010	14:46	4.35	7.33	66.4	-25	-25
5/29/2010	14:47	4.43	7.3	65.3	-25	-25
5/29/2010	14:48	4.31	7.35	65.8	-25	-25

Date	Time	ETI O2 Minute Averag	ETI CO2 Minute Averag	ETI SO2 Minute Averag	ETI NOx Minute Averag	ETI CO Minute Averag
5/29/2010	14:49	4.32	7.34	64.3	-25	-25
5/29/2010	14:50	4.39	7.31	64.2	-25	-25
5/29/2010	14:51	4.37	7.31	64.1	-25	-25
5/29/2010	14:52	4.3	7.3	62.8	-25	-25
5/29/2010	14:53	4.42	7.26	62.2	-25	-25
5/29/2010	14:54	4.22	7.36	65.1	-25	-25
5/29/2010	14:55	4.33	7.34	65.9	-25	-25
5/29/2010	14:56	4.54	7.27	64.1	-25	-25
5/29/2010	14:57	4.27	7.39	65.7	-25	-25
5/29/2010	14:58	4.2	7.39	65.6	-25	-25
5/29/2010	14:59	4.15	7.4	66	-25	-25
5/29/2010	15:00	4.26	7.35	61.6	-25	-25
5/29/2010	15:01	4.45	7.27	60.6	-25	-25
5/29/2010	15:02	4.6	7.2	63.2	-25	-25
5/29/2010	15:03	4.63	7.18	63.4	-25	-25
5/29/2010	15:04	1.25	2.16	76.8	-25	-25
5/29/2010	15:05	0.004	0.088	86.8	-25	-25
5/29/2010	15:06	0	0.027	88.1	-25	-25
5/29/2010	15:07	1.33	1.15	83.1	-25	-25
5/29/2010	15:08	11.3	11.2	23	-25	-25
5/29/2010	15:09	12.4	12.5	4.06	-25	-25
5/29/2010	15:10	12.4	12.5	1.4	-25	-25
5/29/2010	15:11	8.24	9.79	21.9	-25	-25
5/29/2010	15:12	5.03	7.17	55.4	-25	-25
5/29/2010	15:13	4.7	7.2	61	-25	-25
5/29/2010	15:14	4.66	7.22	61.1	-25	-25
5/29/2010	15:15	4.67	7.22	61.4	-25	-25
5/29/2010	15:16	4.44	7.28	64.1	-25	-25
5/29/2010	15:17	4.57	7.23	62.6	-25	-25
5/29/2010	15:18	4.66	7.19	58.6	-25	-25
5/29/2010	15:19	4.54	7.23	60.8	-25	-25
5/29/2010	15:20	4.68	7.2	62.7	-25	-25
5/29/2010	15:21	4.69	7.21	62.5	-25	-25
5/29/2010	15:22	4.8	7.19	62.4	-25	-25
5/29/2010	15:23	4.5	7.31	63.3	-25	-25
5/29/2010	15:24	4.65	7.24	63	-25	-25
5/29/2010	15:25	4.82	7.15	61.8	-25	-25
5/29/2010	15:26	4.91	7.09	60.1	-25	-25
5/29/2010	15:27	4.8	7.15	59.7	-25	-25
5/29/2010	15:28	4.83	7.16	60	-25	-25
5/29/2010	15:29	4.51	7.28	62.3	-25	-25

Date	Time	ETI O2 Minute Averag	ETI CO2 Minute Averag	ETI SO2 Minute Averag	ETI NOx Minute Averag	ETI CO Minute Averag
5/29/2010	15:30	4.62	7.25	62.1	-25	-25
5/29/2010	15:31	4.77	7.19	61.1	-25	-25
5/29/2010	15:32	4.72	7.23	61.4	-25	-25
5/29/2010	15:33	3.66	5.95	64.8	-25	-25
5/29/2010	15:34	0.249	0.522	83	-25	-25
5/29/2010	15:35	0	0.045	87.4	-25	-25
5/29/2010	15:36	1.54	1.37	82	-25	-25
5/29/2010	15:37	11.4	11.4	21.9	-25	-25
5/29/2010	15:38	12.4	12.5	3.92	-25	-25
5/29/2010	15:39	11.8	12.1	3.1	-25	-25
5/29/2010	15:40	5.27	7.71	38.2	-25	-25
5/29/2010	15:41	4.57	7.27	52.1	-25	-25
5/29/2010	15:42	4.64	7.21	55.7	-25	-25
5/29/2010	15:43	4.72	7.18	58.6	-25	-25
5/29/2010	15:44	4.68	7.21	60	-25	-25
5/29/2010	15:45	4.69	7.21	59.6	-25	-25
5/29/2010	15:46	4.62	7.23	60.1	-25	-25
5/29/2010	15:47	5.17	6.98	58.1	-25	-25
5/29/2010	15:48	4.76	7.17	60.3	-25	-25
5/29/2010	15:49	4.59	7.26	62	-25	-25
5/29/2010	15:50	4.88	7.16	61.1	-25	-25
5/29/2010	15:51	5.02	7.07	59.8	-25	-25
5/29/2010	15:52	4.86	7.13	60.3	-25	-25
5/29/2010	15:53	5.04	7.04	59.3	-25	-25
5/29/2010	15:54	4.48	7.29	62.4	-25	-25
5/29/2010	15:55	4.43	7.3	62.1	-25	-25
5/29/2010	15:56	4.6	7.23	61.5	-25	-25
5/29/2010	15:57	4.79	7.14	58.9	-25	-25
5/29/2010	15:58	4.68	7.18	56.7	-25	-25
5/29/2010	15:59	5.21	6.96	55.6	-25	-25
5/29/2010	16:00	4.7	7.18	60.2	-25	-25
5/29/2010	16:01	4.6	7.24	61.3	-25	-25
5/29/2010	16:02	3.96	6.26	62.8	-25	-25
5/29/2010	16:03	0.336	0.656	82.3	-25	-25
5/29/2010	16:04	0	0.047	87.5	-25	-25
5/29/2010	16:05	2.68	2.45	76.6	-25	-25
5/29/2010	16:06	11.8	11.8	16.5	-25	-25
5/29/2010	16:07	12.4	12.5	2.98	-25	-25
5/29/2010	16:08	10	10.8	10.9	-25	-25
5/29/2010	16:09	4.78	7.37	50.7	-25	-25
5/29/2010	16:10	4.52	7.28	58.8	-25	-25

Date	Time	ETI O2 Minute Averag	ETI CO2 Minute Averag	ETI SO2 Minute Averag	ETI NOx Minute Averag	ETI CO Minute Averag
5/29/2010	16:11	4.43	7.3	59.1	-25	-25
5/29/2010	16:12	4.52	7.26	59.3	-25	-25
5/29/2010	16:13	4.35	7.34	60.3	-25	-25
5/29/2010	16:14	4.43	7.32	59.2	-25	-25
5/29/2010	16:15	4.29	7.39	57.1	-25	-25
5/29/2010	16:16	4.56	7.28	54.3	-25	-25
5/29/2010	16:17	4.51	7.27	55.5	-25	-25
5/29/2010	16:18	4.43	7.29	59.1	-25	-25
5/29/2010	16:19	4.47	7.28	61.8	-25	-25
5/29/2010	16:20	4.46	7.29	61.4	-25	-25
5/29/2010	16:21	4.48	7.29	61.5	-25	-25
5/29/2010	16:22	4.41	7.32	62.1	-25	-25
5/29/2010	16:23	4.6	7.24	62.1	-25	-25
5/29/2010	16:24	4.52	7.28	63	-25	-25
5/29/2010	16:25	4.77	7.16	62.4	-25	-25
5/29/2010	16:26	4.51	7.23	62.7	-25	-25
5/29/2010	16:27	4.43	7.28	63.1	-25	-25
5/29/2010	16:28	4.32	7.33	62.5	-25	-25
5/29/2010	16:29	4.45	7.27	62	-25	-25
5/29/2010	16:30	4.56	7.21	62	-25	-25
5/29/2010	16:31	2.6	4.22	69.5	-25	-25
5/29/2010	16:32	0.069	0.21	85.6	-25	-25
5/29/2010	16:33	0	0.034	87.9	-25	-25
5/29/2010	16:34	5.56	5.28	61.6	-25	-25
5/29/2010	16:35	12.2	12.3	9.49	-25	-25
5/29/2010	16:36	12.2	12.4	2.82	-25	-25
5/29/2010	16:37	14.1	5	11.4	-25	-25
5/29/2010	16:38	OFF	OFF	OFF	OFF	OFF
5/29/2010	16:39	OFF	OFF	OFF	OFF	OFF
5/29/2010	16:40	OFF	OFF	OFF	OFF	OFF
5/29/2010	16:41	OFF	OFF	OFF	OFF	OFF
5/29/2010	16:42	OFF	OFF	OFF	OFF	OFF
5/29/2010	16:43	OFF	OFF	OFF	OFF	OFF
5/29/2010	16:44	OFF	OFF	OFF	OFF	OFF
5/29/2010	16:45	OFF	OFF	OFF	OFF	OFF
5/29/2010	16:46	OFF	OFF	OFF	OFF	OFF
5/29/2010	16:47	OFF	OFF	OFF	OFF	OFF
5/29/2010	16:48	OFF	OFF	OFF	OFF	OFF
5/29/2010	16:49	OFF	OFF	OFF	OFF	OFF
5/29/2010	16:50	OFF	OFF	OFF	OFF	OFF
5/29/2010	16:51	OFF	OFF	OFF	OFF	OFF

		ETI O2 Minute Averag	ETI CO2 Minute Averag	ETI SO2 Minute Averag	ETI NOx Minute Averag	ETI CO Minute Averag
Date	Time					
5/29/2010	16:52	OFF	OFF	OFF	OFF	OFF
5/29/2010	16:53	OFF	OFF	OFF	OFF	OFF
5/29/2010	16:54	OFF	OFF	OFF	OFF	OFF
5/29/2010	16:55	OFF	OFF	OFF	OFF	OFF
5/29/2010	16:56	OFF	OFF	OFF	OFF	OFF
5/29/2010	16:57	OFF	OFF	OFF	OFF	OFF
5/29/2010	16:58	OFF	OFF	OFF	OFF	OFF
5/29/2010	16:59	OFF	OFF	OFF	OFF	OFF

Flows and Moisture Field Data

Table 4.0 Field Data; Flows and Moisture Determinations

Raw Data Sheets

Process Flow Data

Flows and Moisture
Field Data

Client: Conoco Phillips
City: Ferndale, WA
Site: SRU

Date: 05/29/10
ETI Job No: 10-1891

Table 4.0

FIELD DATA:		Run Number 1	2	3
	START TIME:...	9:54	11:03	12:08
	END TIME..	10:54	12:03	13:08
θ	Sample Time, minutes	60	60	60
	Stack Shape (Circle or Rectangle):	Circle		
V_m	Volume of dry gas sampled, cf	35.091	43.872	44.530
Y	Meter box calibration factor	0.993	0.993	0.993
P_{bar}	Barometric pressure, inches Hg	30.21	30.21	30.21
P_{static}	Stack static pressure, inches H_2O	0.00	0.00	0.00
ΔH	Differential meter press, inches H_2O	1.50	1.50	1.50
T_m	Meter temperature, degrees F	60.8	66.4	68.0
V_{lc}	Volume of H_2O collected, ml	71.8	64.0	65.1
$\%O_2$	Percent of oxygen in stack gas	4.01	3.88	4.19
$\%CO_2$	Percent carbon dioxide in stack gas	7.61	7.46	7.37
C_p	Type-S pitot tube coefficient	0.84	0.84	0.84
$\sqrt{\Delta P}_{avg}$	Ave. square root of pitot readings, (inches $H_2O)^{1/2}$	0.0875	0.0805	0.0805
T_s	Stack temperature, degrees F	1283.8	1349.0	1346.4
D_s	Stack diameter, feet - CIRCLE	5.08	5.08	5.08
L_s, W_s	Stack dimensions, feet - RECTANGLE	NA	NA	NA
D_n	Nozzle diameter, inches	NA	NA	NA
A_n	Nozzle area, ft^2	NA	NA	NA
Calculated Values:				
$V_{m(std)}$	Meter corrected volume,dscf	35.800	44.282	44.810
$V_{w(std)}$	Volume of water vapor,dscf	3.385	3.018	3.069
B_{ws}	Fraction of H_2O vapor	0.0864	0.0638	0.0641
$\%N_2$	Percent nitrogen in stack gas	88.38	88.66	88.44
M_d	Dry molecular weight of stack gas, lb/lb-mole	29.38	29.35	29.35
M_w	Wet molecular weight of stack gas, lb/lb-mole	28.40	28.62	28.62
A_d	Cross sectional area of stack, ft^2	20.29	20.29	20.29
P_s	Absolute stack gas pressure, inches Hg	30.21	30.21	30.21
V_s	Average stack gas velocity, ft/sec	8.96	8.36	8.36
Q_{std}	Average stack volumetric flowrate, dscfm	3,047	2,809	2,810
I	Percent isokinetic sampling	NA	NA	NA

FIELD DATA

Project # 10-1891 | Page 1 of 1

Test Date 5/29/10	Run # 1	Probe Length 7'	Filter #
Client	Test Box # HF-C	Pitot Tube Cp 0.84	P Bar 30.21
Plant	Stack Diameter 61	Delta H @ 1.63	Est.% H_2O
Site	Avg. Nozzle	Y Factor 0.993	Static Pres. 0
Operator SO	Diameter "	Pitot #	% O_2
EPA Method 1-4	1. 2. 3.	Thermocouple #	% CO_2

System Leak Check

	Vacuum in. HG	DGM cfm
Post	5"	0

Pitot Leak Check

	Pos. +	Neg. -
Post	3.5 ✓	7.0 ✓

#	Contents	Final Grams	Initial Grams	Net Wt. Grams
1		867.0	806.1	60.9
2		648.8	644.5	4.3
3		626.8	625.5	1.3
4		893.5	888.2	5.3
5				
6				

Total Back Half Volume W/Rinse ______ Total Grams 71.8 ✓

Pt.	Time Min.	Clock Time	Stack °F	Meter Temp. In °F	Meter Temp. Out °F	Pitot Delta P " H_2O	Dry Gas Meter Cu. Ft.	Orifice Delta H " H_2O	Vac "Hg	Filter Temp.	Impin. Exit Temp
	9:54	0	1335	55	55	0.005	1.919	1.5	0	–	42
		5	1337	57	56	0.005	4.12	1.5	0	–	42
		10	1345	59	58	0.010	6.71	1.5	0	–	42
		15	1356	60	56	0.010	9.28	1.5	0	–	42
		20	1358	61	57	0.010	11.69	1.5	0	–	42
		25	1351	63	58	0.010	14.16	1.5	0	–	42
		30	1335	64	58	0.005	16.75	1.5	0	–	42
		35	1323	66	59	0.010	19.13	1.5	0	–	43
		40	1270	67	59	0.010	22.35	1.5	0	–	43
		45	1198	68	60	0.010	026.750	1.5	0		43
		50	1195	70	60	0.005	029.090	1.5	0		43
		55	1185	71	61	0.005	033.420	1.5			
		60	1328			0.005	037.010				
			1352			0.005					
			1180			0.010					
			1231			0.010					
			1259			0.015					
			1291			0.010					
			1315			0.005					
			1329			0.010					
			1334			0.010					
			1333			0.005					
			1335			0.005					
			1337			0.005					
							35.091				

TS °F			ΔP	DGM	ΔH
1283.8 ✓	Avg.	60.8 ✓	0	~~7.925~~	1.5

$\sqrt{\Delta P} =$ 0.0875 ✓

Project # 10-1891

FIELD DATA

Test Date 5/29/10	Run # 2	Probe Length 7'	Filter # —
Client ConocoPhillips	Test Box # HF-C	Pitot Tube Cp 0.84	P Bar 30.21
Plant Ferndale, WA	Stack Diameter 61	Delta H @ 1.63	Est.% H_2O
Site SRU #1	Avg. Nozzle	Y Factor 0.993	Static Pres. Ø
Operator [illegible]	Diameter "	Pitot #	% O_2
EPA Method 1-4	1. 2. 3.	Thermocouple #	% CO_2

System Leak Check

	Vacuum in. HG	DGM cfm
Post	5	Ø

Pitot Leak Check

	Pos. +	Neg. -
Post	3" ✓	7" ✓

#	Contents	Final Grams	Initial Grams	Net Wt. Grams
1		670.4	620.7	49.7
2		794.6	789.8	4.8
3		645.9	644.4	1.5
4		901.0	893.0	8.0
5				
6				
	Total Back Half Volume W/Rinse		Total Grams	64.0 ✓

Pt.	Time Min.	Clock Time	Stack °F	Meter Temp. In °F	Meter Temp. Out °F	Pitot Delta P " H_2O	Dry Gas Meter Cu. Ft.	Orifice Delta H " H_2O	Vac "Hg	Filter Temp.	Impin. Exit Temp
1	11:03	11:03	1347	65	61	0.005	037.239	1.5	Ø	—	42
2	5	5	1355	68	61	0.005	40.85	1.5	Ø	—	42
3	10		1352	70	63	0.005	44.11	1.5	Ø	—	42
4	15		1353	71	63	0.005	48.20	1.5	Ø	—	42
5	20		1355	70	62	0.010	51.980	1.5	Ø		42
6	25		1358	71	62	0.005	55.601	1.5	Ø		42
7	30		1359	72	63	0.005	59.190	1.5	Ø		42
8	35		1358	72	63	0.005	62.580	1.5	Ø		42
9	40		1358	71	63	0.010	66.150	1.5	Ø		42
10	45		1358	71	63	0.010	70.260	1.5	Ø		42
11	50		1354	71	63	0.010	73.825	1.5	Ø		43
12	55		1343	72	63	0.005	77.420	1.5			
1	60		1315			0.005	81.111				
2			1322			0.005					
3			1334			0.010					
4			1347			0.010					
5			1350			0.010					
6			1358			0.010					
7			1358			0.005					
8			1359			0.005					
9			1358			0.005					
10			1356			0.005					
11			1348			0.005					
12			1321			0.005					
		Avg.	1349.0 ✓	66.4 ✓		~~0.05~~	43.872 ✓	1.5			
			TS °F			ΔP	DGM	ΔH			

FIELD DATA

Project # ____ Page ____ of ____

Test Date 5/29/10	Run # 3	Probe Length 7'	Filter # —
Client Conoco Phillips	Test Box # HF-C	Pitot Tube Cp 0.84	P Bar 30.21
Plant Ferndale, WA	Stack Diameter 61"	Delta H @ 1.63	Est.% H_2O
Site SRU #1	Avg. Nozzle	Y Factor 0.993	Static Pres. 0
Operator	Diameter ____ "	Pitot #	% O_2
EPA Method 1-4	1. ____ 2. ____ 3. ____	Thermocouple #	% CO_2

System Leak Check

	Vacuum in. HG	DGM cfm
Post	5	0

Pitot Leak Check

	Pos. +	Neg. -
Post	3" ✓	7" ✓

#	Contents	Final Grams	Initial Grams	Net Wt. Grams
1		919.0	867.0	52.0
2		654.3	648.8	5.5
3		628.1	626.8	1.3
4		899.8	893.5	6.3
5				
6				

Total Back Half Volume W/Rinse ____ Total Grams 65.1 ✓

Pt.	Time Min.	Clock Time	Stack °F	Meter Temp. In °F	Meter Temp. Out °F	Pitot Delta P " H_2O	Dry Gas Meter Cu. Ft.	Orifice Delta H " H_2O	Vac "Hg	Filter Temp.	Impin. Exit Temp
1	0	12:08	1352	67	63	0.005	81.296	1.5	0	—	42
2	5		1352	69	63	0.005	84.88	1.5	0	—	42
3	10		1353	71	64	0.010	88.60	1.5	0	—	42
4	15		1352	71	64	0.005	92.150	1.5	0		42
5	20		1354	72	64	0.005	96.050	1.5	0		42
6	25		1355	73	64	0.005	100.150	1.5	0		43
7	30		1356	73	64	0.010	103.580	1.5	0		43
8	35		1356	73	65	0.005	110.96	1.5	0		43
9	40		1356	73	65	0.010	113.100	1.5	0		43
10	45		1354	73	65	0.005	114.71	1.5	0		43
11	50		1351	73	65	0.010	117.19	1.5	0		43
12	55		1327	73	65	0.005	121.86	1.5	0		43
1	60		1289			0.005	125.826				
2			1305			0.010					
3			1320			0.005					
4			1338			0.005					
5			1346			0.005					
6			1350			0.010					
7			1359			0.005					
8			1360			0.005					
9			1360			0.005					
10			1361			0.010					
11			1356			0.010					
12			1351			0.005					
Avg.			1346.4 ✓	66.0 ✓			44.530 ✓	1.5			
			TS °F			ΔP	DGM	ΔH			

Quality Assurance and Quality Control

Emission Technologies, Inc. QA/QC Statement
Example Calculations
Calibration Gas Certificates
Meter Calibration
NO_x Converter Check

QUALITY ASSURANCE/QUALITY CONTROL

Emission Technologies, Inc. continued success is an example of their pride taken in quality testing.

Analytical procedures and environmental measurement data are structured with a quality assurance program which equals or exceeds the minimum QA/QC requirements set forth by the U.S. Environmental Protection Agency (EPA) for each applicable method.

ETI executes the following topics through every test project to ensure valid measurement data:

* Preventable Maintenance
* Pre-test and Post-test Calibration
* Blanks and Spiked Samples
* Field System Checks
* QA/QC Matrix Tables
* Employment of QA/QC Officer

The following table is an activity matrix for Method 8 from the EPA Quality Assurance Handbook for Air Pollution Measurement Systems. By diligently following such activity matrix tables, Emission Technologies, Inc. reports justifiable, valid measurement data.

TABLE 1.1 ACTIVITY MATRIX FOR PROCUREMENT OF APPARATUS & SUPPLIES

APPARATUS	ACCEPTANCE LIMITS	FREQUENCY AND METHOD OF MEASUREMENT	ACTION IF REQUIREMENTS ARE NOT MET
Sampling			
Sampling probe with heating system	Capable of 100° C (212° F) exit air at flow rate of 20 L/min	Visually check; run heating system checkout	Repair, return to supplier, or reject
Probe nozzle	Stainless steel (316); sharp, tapered, leading edge (angle ≤30°); difference between measured ID's ≤0.1 mm (0.004 in.); no nicks, dents, or corrosion; uniquely identified (Meth. 5, Sec. 3.4.2)	Visually check before each test; use a micrometer to measure ID before field use after each repair	Reshape and sharpen, return to the supplier, or reject
Pitot tube	Type-S (Meth. 2, Sec. 3.1.2); attached to probe with impact (high pressure) opening plane even with or above nozzle entry plane	Calibrate according to Meth. 2, Sec. 3.1.2	Repair or return to supplier

TABLE 1.1 (CONTINUED)

APPARATUS	ACCEPTANCE LIMITS	FREQUENCY AND METHOD OF MEASUREMENT	ACTION IF REQUIREMENTS ARE NOT MET
Differential pressure gauge (manometer)	Criteria in Meth. 2, Sec. 3.1.2; agree within 5% of gauge-oil manometer used to calibrate	Check against gauge-oil manometer at a minimum of three points: [0.64(0.025), 12.7(0.5), 25.4(1.0)] mm (in.) H_20	As above
Vacuum gauge	0-760 mm Hg range; $\underline{+}$25 mm (1 in.) Hg accuracy at 380 mm (15 in.) Hg	Check against a mercury U-tube manometer upon receipt	Adjust or return to supplier
Vacuum pump	Capable of maintaining a flow rate of 0.03-0.05 m^3/ min (1-1.7 ft^3/ min) for pump inlet vacuum of 380 mm (15 in.) Hg with pump outlet at 760 mm (29.92 in.) Hg; leak free at 380 mm (15 in.) Hg	Check upon receipt for leaks and capacity	Repair or return to supplier
Orifice meter	ΔH @ of 46.74 $\underline{+}$6.35 mm (1.84 $\underline{+}$0.25 in.) (recommended)	Visually check upon receipt for damage; calibrate against wet test meter	Repair, if possible; otherwise, return to supplier
Impingers	Standard stock glass; pressure drop across impingers not excessive	Visually check upon receipt; check pressure drop (Method 8, Sec. 3.7.1)	Return to supplier
Filter holder	Leak free (Method 8, Sec. 3.7.1)	Visually check before use	As above
Filters	Glass fiber without organic binder designed to remove 99.95% (≤0.05% penetration) of 0.3-µm dioctyl phthalate smoke particles	Manufacture's guarantee that filters meet ASTM standard method D2986-71; observe under light for defects	Return to supplier and replace

TABLE 1.1 (CONTINUED)

APPARATUS	ACCEPTANCE LIMITS	FREQUENCY AND METHOD OF MEASUREMENT	ACTION IF REQUIREMENTS ARE NOT MET
Hydrogen peroxide	30% H_2O_2 reagent grade or certified ACS	Upon receipt, check label for grade or certification	Replace or return to supplier
Potassium iodide	KI reagent grade or certified ACS	As above	As above
Thorin indicator	1-(o-arsonophenylazo)-2-naphthol-3,6 disulfonic acid disodium salt, reagent grade or certified ACS	Upon receipt, check label for grade or certification	As above
Barium perchlorate trihydrate solution	$Ba(ClO_4)_2$ -3H_20, - reagent grade or certified ACS	As above	As above
Sulfuric acid solution	H_2SO_4, 0.0100N $\pm$ 0.0002N	Certified by manufacturer, or standardize against 0.0100N NaOH previously standardized against potassium acid phthalate (primary standard grade)	As above
NO_x Chemiluminescence Analyzer	NO_x to NO conversion efficiency $\geq 90\%$	Before each field test; Introduce a concentration of 40-60 ppm NO_2 to the analyzer in direct cal mode; Calculate converter efficiency: $\mathrm{Eff}_{NO_2} = \frac{C_{Dir}}{C_V} \times 100$	Repair

Conversion From ppm to lb/hr and tons/yr

CLIENT: ConocoPhillips **SITE LOCATION:** SRU

PROJECT #: 10-1891 **Run #** 1 **Date of Test** 5/29/10

Example Flow Rate Calculations
Nomenclature:

A_d = cross-sectional area of stack, ft^2

A_n = cross-sectional area of nozzle, ft^2

B_{ws} = water vapor in the gas stream, proportion by volume

C_p = pitot tube coefficient, dimensionless

D_s = diameter of stack, ft^2

K_p = pitot tube constant = 85.49 ft/sec $\sqrt{\dfrac{(\text{lb/lb} - \text{mole})(\text{inches Hg})}{(^{o}\text{R})(\text{inches H}_2\text{O})}}$

M_d = molecular weight of stack gas, dry basis, lb./lb.-mole

M_w = molecular weight of stack gas, wet basis, lb./lb.-mole
= $M_d(1 - B_{ws}) + 18(B_{ws})$

ΔH = differential meter pressure, inches H_2O

$\sqrt{\Delta P}_{avg}$ = average velocity head of stack gas, $\sqrt{\text{inches H}_2\text{O}}$

$\%CO_2$ = percent by volume of carbon dioxide in stack gas

$\%N_2$ = percent by volume of nitrogen in stack gas

$\%O_2$ = percent by volume of oxygen in stack gas

P_{bar} = barometric pressure, inches Hg

P_s = absolute stack gas pressure, inches Hg

P_{static} = static pressure of the stack, inches H_2O

P_{std} = standard absolute pressure, 29.92 inches Hg

Q_{std} = stack flow rate, dscfm or dscfh

T_m = meter temperature, ^oF

T_{std} = standard absolute temperature, 528^oR

$T_{s(avg)}$ = Absolute stack temperature, $^oR = 460 + T_s$

V_m = meter volume, ft^3

V_{mstd} = corrected meter volume, dscf

V_s = average stack gas velocity, ft/sec

V_{lc} = volume of water gain in the impingers, ml or grams

Y = dry gas meter calibration factor

Volume of metered sample gas at standard conditions:

$$P_{meter} = P_{bar} + \frac{\Delta H}{13.6} = 30.21 + \frac{1.5}{13.6} = 30.320294 \text{ inches Hg}$$

$$V_{m(std)} = \frac{(V_m) \times (T_{std}) \times (P_{meter}) \times (Y)}{(T_m + 460) \times (P_{std})}$$

$$V_{m(std)} = \frac{(35.091) \times (528) \times (30.320294) \times (0.993)}{(60.8 + 460) \times (29.92)} = 35.79973078 \text{ dscf}$$

Moisture Content:

$$V_{w(std)} = \left(0.04715\ ft^3/\text{gram water}\right) \times \left(V_{lc}\right) \qquad 1\ \text{gram water} \equiv 1\ \text{ml water}$$

$$V_{w(std)} = (0.04715) \times (\underline{71.8}) = \underline{3.38537}\ \text{scf}$$

$$B_{ws} = \frac{V_{w(std)}}{\left(V_{w(std)} + V_{m(std)}\right)}$$

$$B_{ws} = \frac{3.38537}{(\underline{3.38537} + \underline{35.79973078})} = \underline{0.08639432}\ \text{water vapor fraction}$$

Molecular Weight:

Percent Nitrogen in Stack Gas

$$\%N_2 = 100\% - \%O_2 - \%CO_2$$

$$\%N_2 = 100 - (\underline{4.01}) - (\underline{7.61}) = \underline{88.38}\ \text{percent } N_2$$

Dry:

$$M_d = (0.44 \times \%CO_2) + (0.32 \times \%O_2) + (0.28 \times \%N_2)$$

$$M_d = (0.44 \times \underline{7.61}) + (0.32 \times \underline{4.01}) + (0.28 \times \underline{88.38}) = \underline{29.378}\ \text{lb/lb-mole}$$

Wet:

$$M_w = M_d \times (1 - B_{ws}) + (18 \times B_{ws})$$

$$M_w = (\underline{29.378}) \times (1 - \underline{0.08639432}) + (18 \times \underline{0.08639432}) = \underline{28.395005}\ \text{lb/lb-mole}$$

Average Velocity of Stack Gas:

$$V_s = K_p \times C_p \times \sqrt{\Delta P_{avg}} \times \sqrt{\frac{T_{s(avg)}}{M_w \times P_s}} \qquad P_s = P_{bar} + \frac{P_{static}}{13.6}$$

$$P_s = (\underline{30.21}) + \frac{(\underline{0})}{13.6} = \underline{30.21}$$

$$V_s = 85.49 \times \underline{0.84} \times \underline{0.0875} \times \sqrt{\frac{(\underline{1283.8} + 460)}{\underline{28.3950055} \times \underline{30.21}}} = \underline{8.95889923}\ \text{ft/sec}$$

Volume Flow Rate:

$$A_d = \pi \times \frac{(D_s)^2}{4}$$

$$A_d = 3.14159 \times \frac{(\ 61/12\ )^2}{4} = 20.294889566\ \text{ft}^2$$

$$Q_{std} = 60 \times (1 - B_{ws}) \times V_s \times A_d \times \frac{T_{std} \times P_s}{T_{s\,(avg)} \times P_{std}}$$

$$Q_{std} = 60 \times (1 - 0.08639432) \times 8.95889923 \times 20.294889566 \times \frac{528 \times (\ 30.21\ )}{(\ 460 + 1283.8\ ) \times 29.92} = 3047.037\ \text{dscfm}$$

System Bias Calibrations

$$C_{gas} = \frac{(C - C_0)}{(C_m - C_0)} \times C_{ma}$$

where: C_{gas} = gas concentration, dry basis ppm
C = average gas concentration indicated by the analyzer
C_o = average of initial and final system bias responses for the zero gas
C_m = average of initial and final system bias responses for the upscale gas
C_{ma} = actual concentration of the upscale calibration gas, ppm

Gas: O_2

$$C_0 = \frac{(C_{pre-zero} + C_{post-zero})}{2} = \frac{(\ 0 + 0\ )}{2} = 0$$

$$C_m = \frac{(C_{pre-span} + C_{post-span})}{2} = \frac{(\ 12.5 + 12.4\ )}{2} = 12.45$$

$$C_{gas} = \frac{(\ 3.99 - 0\ )}{(\ 12.45 - 0\ )} \times 12.52 = 4.012433735$$

Gas: CO_2

$$C_0 = \frac{(\ 0 + 0.03\ )}{2} = 0.015 \quad C_m = = \frac{(\ 12.5 + 12.5\ )}{2} = 12.5$$

$$C_{gas} = \frac{(7.61283333 - 0.015\ )}{(\ 12.5 - 0.015\ )} \times 12.5 = 7.6069617$$

Gas: NOx

$$C_0 = \frac{(0.1 + 0.2)}{2} = 0.15 \qquad C_m = \frac{(93.1 + 93.0)}{2} = 93.05$$

$$C_{gas} = \frac{(33.52783333 - 0.15)}{(93.05 - 0.15)} \times 95.7 = 34.38383907$$

Gas: CO

$$C_0 = \frac{(1.3 + 3.9)}{2} = 2.6 \qquad C_m = \frac{(96.6 + 98.3)}{2} = 97.45$$

$$C_{gas} = \frac{(4.6415 - 2.6)}{(97.45 - 2.6)} \times 97.4 = 2.09638482$$

NO_x:

Parts per million corrected to 7% O_2

$$C_{ppm} = C_{ppm} \times \frac{(20.9 - 7)}{(20.9\% - O_2\%)}$$

$$C_{ppm} = (34.38383907) \times \frac{13.9}{(20.9\% - 4.012433735)} = 28.30102 \text{ ppm}$$

Conversion from ppm to lbs/dscf

$C_d = C_{ppm} \times C_F$ (example for CO: 7.25×10^{-8}, see below)

$$C_d = (34.38383907) \times (1.194 \times 10^{-7}) = 4.1054 \times 10^{-6}$$

Conversion from lbs/dscf to lbs/hour

$$E_1 = C_d \times Q_{std} \times 60$$

$$E_1 = (4.1054 \times 10^{-6}) \times (3{,}047.0373) \times 60 = 0.75056397 \text{ lb/hr}$$

Where: Qstd = flow rate in standard dry cubic ft per hr
60 is to convert minutes to hours

Conversion from lbs/hour to tons/year

$$E_{tpy} = E \times \frac{8760 \text{hrs/yr}}{2000 \text{lbs/ton}}$$

$$E_{tpy} = 0.75056397 \times \frac{8760 \text{hrs/yr}}{2000 \text{lbs/ton}} = 3.2875 \text{ tpy}$$

CO:

Parts per million corrected to 7% O_2

$$C_{ppm} = C_{ppm} \times \frac{(20.9-7)}{(20.9\% - O_2\%)}$$

$$C_{ppm} = (2.09638482) \times \frac{13.9}{(20.9\% - 4.012433735)} = \underline{1.7255} \text{ ppm}$$

Conversion from ppm to lbs/dscf

$C_d = C_{ppm} \times C_F$ (example for CO: 7.25×10^{-8}, see below)

$$C_d = (2.09638482) \times (0.725 \times 10^{-7}) = \underline{1.52 \times 10^{-7}}$$

Conversion from lbs/dscf to lbs/hour

$$E_1 = C_d \times Q_{std} \times 60$$

$$E_1 = (1.52 \times 10^{-7}) \times (3{,}047.0373) \times 60 = \underline{0.0277786768} \text{ lb/hr}$$

Where: Qstd = flow rate in standard dry cubic ft per hr
60 is to convert minutes to hours

Conversion from lbs/hour to tons/year

$$E_{tpy} = E \times \frac{8760 \text{hrs/yr}}{2000 \text{lbs/ton}}$$

$$E_{tpy} = \underline{0.0277786768} \times \frac{8760 \text{hrs/yr}}{2000 \text{lbs/ton}} = \underline{0.1217} \text{ tpy}$$

C_F is calculated as follows:

Air Molecular Weight = 28.95 lb/lb-mole
Air Density = 0.075 lb/ft^3 (at 68°F)
MW = pollutant molecular weight, lb/lb-mole
10^{-6} to convert density to lb/ft^3/ppm

$$density = \frac{MW \times 0.075}{28.95} \times 10^{-6}$$

Parameter	C_F
CO	0.725×10^{-7}
NO_x	1.194×10^{-7}
SO_2	1.660×10^{-7}
VOC @ Methane	0.416×10^{-7}
THC @ Propane	1.142×10^{-7}

Technician Signature Wendy Pardh

Liquid Technology Corporation

Industry Leader in Specialty Gases, Equipment and Service

Certificate of Analysis

- EPA PROTOCOL GAS -

Customer	Emission Technologies, Inc (Burlington, WA)
Date	June 26, 2009
Delivery Receipt	DR-25117
Gas Standard	12.0-13.0% CO2, 12.0-13.0% Oxygen/Nitrogen-EPA PROTOCOL
Final Analysis Date	June 08, 2009
Expiration Date	June 08, 2012

DO NOT USE BELOW 150 psig

Cylinder Data			
Cylinder Serial Number:	CC-165569	Cylinder Outlet:	CGA 590
Cylinder Volume:	140 Cubic Feet	Cylinder Pressure:	2000 psig, 70°F
Expiration Date:	June 08, 2012		

Analytical Data

EPA Protocol, Section No. 2.2, Procedure G-1

Replicate Concentrations

Carbon Dioxide: 12.5% +/- 0.12%

Oxygen: 12.52% +/- 0.12%

Nitrogen: Balance

Reference Standard(s):		
GMIS/SRM:	GMIS/GMIS	GMIS/GMIS
Cylinder Number:	CC-165377/CC-125534	CC-166423/CC-85458
Concentration:	10.05% CO2/13.32% CO2	10.10% Oxygen/20.97% O2/Nitrogen
Expiration Date:	04/06/11 - 01/28/11	03/04/11 - 04/15/11

Certification Instrumentation		
Component:	Carbon Dioxide	Oxygen
Make/Model:	Hewlett Packard 5890 II	Servomex 244a
Serial Number:	3336A59393	1847
Principal of Measurement:	TCD	Paramagnetic
Last Calibration:	June 04, 2009	May 07, 2009

Analytical uncertainty and NIST Traceability are in compliance with EPA-600/R-97/121.

Certified by: Mike Duncan

Mike Duncan

Unmatched Excellence

2564 Pemberton Drive ~ Apopka, Florida 32703 ~ Phone (407)-292-2990 ~ Fax (407)-292-3313 ~ www.liquidtechcorp.com ~

Spectra
Spectra Gases, Inc.

3434 Route 22 West, Branchburg, New Jersey 08876 USA

ISO 9001:2000

Shipped from: 80 Industrial Drive, Alpha, NJ 08865

CERTIFICATE OF ANALYSIS

EPA PROTOCOL MIXTURE

PROCEDURE # : G1

CUSTOMER: Tesoro Hawaii Corporation
SGI ORDER # : 135243
ITEM# : 2
P.O.# : 08-1639

CYLINDER # : CC-126939
CYLINDER PRES: 1900 PSIG
CGA OUTLET: 590

CERTIFICATION DATE: 9/5/2008
EXPIRATION DATE: 9/5/2011

CERTIFICATION HISTORY

COMPONENT	DATE OF ASSAY	MEAN CONCENTRATION	CERTIFIED CONCENTRATION	ANALYTICAL ACCURACY
Carbon Dioxide	9/5/2008	20.9 %	20.9 %	+/- 1%
Oxygen	9/5/2008	20.9 %	20.9 %	+/- 1%

BALANCE Nitrogen

PREVIOUS CERTIFICATION DATES: None

REFERENCE STANDARDS

COMPONENT	SRM/NTRM#	CYLINDER#	CONCENTRATION
Carbon Dioxide	GMIS-1	CC-80872	24.9 %
Oxygen	NTRM-82659x	CC-237212	24.52 %

INSTRUMENTATION

COMPONENT	MAKE/MODEL	SERIAL #	DETECTOR	CALIBRATION DATE(S)
Carbon Dioxide	CAI-300	S03001	NDIR	9/5/2008
Oxygen	CAI-300	S03001	PM	8/29/2008

THIS STANDARD IS NIST TRACEABLE. IT WAS CERTIFIED ACCORDING TO THE EPA PROTOCOL PROCEDURES. DO NOT USE THIS STANDARD IF THE CYLINDER PRESSURE IS LESS THAN 150 PSIG.

ANALYST: Matt Booth
MATTHEW BOOTH

DATE: 9/5/2008

Liquid Technology Corporation
Industry Leader in Specialty Gases, Equipment and Service

Certificate of Analysis

- EPA PROTOCOL GAS -

Customer	Emission Technologies, Inc (Burlington, WA)
Date	June 26, 2009
Delivery Receipt	DR-25117
Gas Standard	40-50 ppm NO, 40-50 ppm SO2, 40-50 ppm CO/N2-EPA PROTOCOL
Final Analysis Date	June 19, 2009
Expiration Date	June 19, 2011

DO NOT USE BELOW 150 psig

Analytical Data:
EPA Protocol, Section No. 2.2, Procedure G-1.

Reported Concentrations:
Nitric Oxide: 45.3 ppm +/- 0.45 ppm
Sulfur Dioxide: 45.1 ppm +/- 0.45 ppm
Carbon Monoxide: 44.3 ppm +/- 0.44 ppm
Nitrogen: Balance
Total NOx: 45.3 ppm
**** NOx for Reference Use Only ****

Reference Standards

SRM/GMIS:	GMIS/GMIS	GMIS/GMIS	GMIS/GMIS
Cylinder Number:	CC-159073/CC-159052	CC-231264/CC-118009	CC-158976/CC-184191
Concentration:	24.44 ppm/50.6 ppm NO	25.8/50.8 ppm SO2/N2	25.1/50.9 ppm CO/N2
Expiration Date:	09/01/10 - 09/18/10	07/29/10 - 08/14/10	08/04/10 - 06/15/10

Certification Instrumentation

Component:	Nitric Oxide	Sulfur Dioxide	Carbon Monoxide
Make/Model:	NEXUS-470	NEXUS-470	NEXUS-470
Serial Number:	AEP99000154	AEP99000154	AEP99000154
Principal of Measurement:	FTIR	FTIR	FTIR
Last Calibration:	June 03, 2009	June 02, 2009	June 04, 2009

Cylinder Data

Cylinder Number:	CC-125550	Cylinder Volume:	140 Cubic Feet
Cylinder Outlet:	CGA 660	Cylinder Pressure:	2000 psig, 70°F
Expiration Date:	June 19, 2011		

Analytical Uncertainty and NIST Traceability are in compliance with EPA-600/R-97/121.

Certified by: Mike Duncan

Mike Duncan

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Certificate of Analysis

- EPA PROTOCOL GAS -

Customer	Emission Technologies, Inc (Burlington, WA)
Date	May 22, 2009
Delivery Receipt	DR-24782
Gas Standard	85-100 ppm NO, 85-100 ppm SO2, 85-100 ppm CO/N2-EPA PROTOCOL
Final Analysis Date	May 13, 2009
Expiration Date	May 13, 2011

DO NOT USE BELOW 150 psig

Analytical Data:

EPA Protocol, Section No. 2.2, Procedure G-1.

Reported Concentrations:

Nitric Oxide: 95.7 ppm +/- 0.95 ppm

Sulfur Dioxide: 92.0 ppm +/- 0.92 ppm

Carbon Monoxide: 97.4 ppm +/- 0.97 ppm

Nitrogen: Balance

Total NOx: 95.8 ppm

**** NOx for Reference Use Only ****

Reference Standards

SRM/GMIS:	GMIS/GMIS	GMIS/GMIS	GMIS/GMIS
Cylinder Number:	CC-159052/CC-184193	CC-125636/CC-158968	CC-166617/CC-233156
Concentration:	50.6 ppm/100.87 ppm NO	55.22/99.4 ppm SO2/N2	51.0/104.91 ppm CO/N2
Expiration Date:	09/18/10 - 04/17/11	05/04/11 - 10/29/10	09/18/10 - 04/06/11

Certification Instrumentation

Component:	Nitric Oxide	Sulfur Dioxide	Carbon Monoxide
Make/Model:	NEXUS-470	NEXUS-470	NEXUS-470
Serial Number:	AEP99000154	AEP99000154	AEP99000154
Principal of Measurement:	FTIR	FTIR	FTIR
Last Calibration:	May 07, 2009	May 06, 2009	May 06, 2009

Cylinder Data

Cylinder Number:	CC-233222	Cylinder Volume:	140 Cubic Feet
Cylinder Outlet:	CGA 660	Cylinder Pressure:	2000 psig, 70°F
Expiration Date:	May 13, 2011		

Analytical Uncertainty and NIST Traceability are in compliance with EPA-600/R-97/121.

Certified by: Mike Duncan

Mike Duncan

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SCOTT-MARRIN, INC.
6531 Box Springs Blvd • Riverside, CA 92507-0725
Phone: +1(951)653-6780 • Fax: +1(951)653-2430 • www.scottmarrin.com

Report Of Analysis
NIST-Traceable Gas Mixtures

REPORT NO: 57339-01
REPORT DATE: April 1, 2010
CUSTOMER PO NO: 950-21

EMIS01
TO: Emission Technologies Inc
Attn: Mike Hart
15609-D Peterson Rd
Burlington, WA 98233
(360) 757-1210

CYLINDER NUMBER: CC116763

COMPONENT	CONCENTRATION (v/v)	NIST TRACEABLE REFERENCE STANDARD
Nitrogen dioxide	44.1 ± 0.9 ppmv	SRM 1683b
Nitrogen	Balance	

Cylinder Size: 150A (141 std cu ft)
Cylinder Pressure: 2000 psig
Shelf Life: 6 months

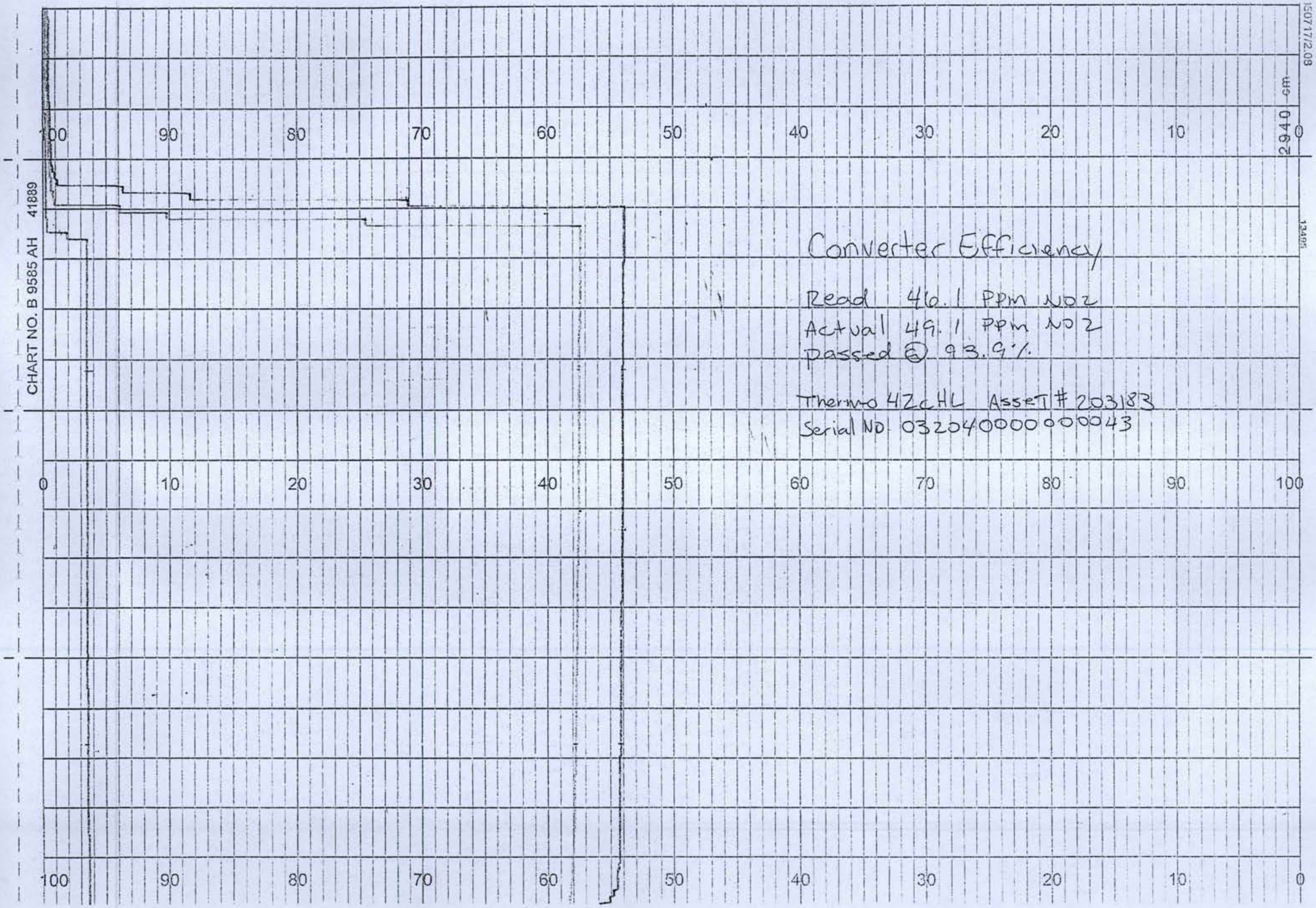
ppm = umole/mole % = mole-%

The above analyses are traceable to the National Institute of Standards and Technology by intercomparison with the reference standard listed herein. Where indicated, volumetric and gravimetric reference standards are traceable thru use of our analytical balance. NIST Certificate Numbers 822/272801-6 and 822/274081-06.

ANALYST: D.C. M [signature] APPROVED: [signature]

D.C.Marrin J. T. Marrin

The ... liability of this company for gas which fails to comply with this analysis shall be replacement or reanalysis thereof by the company without extra cost.



Converter Efficiency

Read 46.1 PPm NO2
Actual 49.1 PPm NO2
passed @ 93.9%

Thermo 42cHL AsseT # 203183
Serial No. 03204000000043

AIR LIQUIDE Air Liquide America Specialty Gases LLC Scott™

CERTIFIED MASTER CLASS

Single-Certified Calibration Standard

1290 COMBERMERE STREET, TROY, MI 48083 Phone: 248-589-2950 Fax: 248-589-2134

CERTIFICATE OF ACCURACY: Certified Master Class Calibration Standard

Product Information
Project No.: 05-76093-001
Item No.: 05020002680PAL
P.O. No.: 57397-71-65000

Cylinder Number: ALM042448
Cylinder Size: AL
Certification Date: 19May2009
Expiration Date: 19May2011

Customer

CLEAN AIR ENGINEERING
DON ALLEN
500 W. WOOD STREET
PALATINE, IL 60067

CERTIFIED CONCENTRATION

Component Name	Concentration (Moles)		Accuracy (+/-%)
NITROGEN DIOXIDE	49.1	PPM	2
NITROGEN		BALANCE	

TRACEABILITY

Traceable To

Scott Reference Standard

APPROVED BY: Hilary Thatcher HILARY THATCHER DATE: 5/27/09

6-22-10

METHOD 5 DRY GAS METER CALIBRATION USING CRITICAL ORIFICES

1) Select three critical orifices to calibrate the dry gas meter which bracket the expected operating range.
2) Record barometric pressure before and after calibration procedure.
3) Run at tested vacuum (from Orifice Calibration Report), for a period of time necessary to achieve a minimum total volume of 5 cubic feet.
4) Record readings in outlined boxes below, other columns are automatically calculated.

DATE: 6/22/2010
METER PART #:

METER SERIAL #: HF-C
CRITICAL ORIFICE SET SERIAL #: 1407S

BAROMETRIC PRESSURE (in Hg): INITIAL 30.13 | FINAL 30.13 | AVG (P_{bar}) 30.13

IF Y VARIATION EXCEEDS 2.00%, ORIFICE SHOULD BE RECALIBRATED

ORIFICE #	RUN #	K' FACTOR (AVG)	TESTED VACUUM (in Hg)	DGM READINGS (FT^3) INITIAL	FINAL	NET (V_m)	TEMPERATURES °F AMBIENT	DGM INLET INITIAL	DGM INLET FINAL	DGM OUTLET INITIAL	DGM OUTLET FINAL	DGM AVG	ELAPSED TIME (MIN) θ	DGM ΔH (in H_2O)	(1) V_m (STD)	(2) V_{cr} (STD)	(3) Y	Y VARIATION (%	$\Delta H_@$
30	1	0.821	17	567.952	574.390	6.438	72	66	70	66	66	67	6.00	3.6	6.5538	6.4367	0.982		1.79
	2	0.821	11	574.390	580.705	6.315	73	71	75	67	67	70	6.00	3.5	6.3906	6.4307	1.006		1.73
	3	0.821	11	580.705	587.035	6.330	73	76	80	68	69	73.25	6.00	3.5	6.3667	6.4307	1.010		1.72
																AVG =	0.999	0.8517	
19	1	0.5129	16	587.362	592.828	5.466	72	80	80	69	70	74.75	8.00	1.3	5.4531	5.3616	0.983		1.62
	2	0.5129	16	592.828	598.307	5.479	72	80	81	70	72	75.75	8.00	1.3	5.4559	5.3616	0.983		1.62
	3	0.5129	16	598.307	603.789	5.482	72	81	83	72	73	77.25	8.00	1.3	5.4436	5.3616	0.985		1.62
																AVG =	0.984	-0.75	
16	1	0.431	12	604.175	609.940	5.765	72	82	84	73	75	78.5	10.00	0.93	5.7062	5.6318	0.987		1.63
	2	0.431	12	609.940	615.710	5.770	72	84	86	75	77	80.5	10.00	0.93	5.690	5.6318	0.990		1.63
	3	0.431	12	615.710	621.478	5.768	72	86	87	77	79	82.25	10.00	0.93	5.6697	5.6318	0.993		1.62
																AVG =	0.990	-0.10	

AVERAGE DRY GAS METER CALIBRATION FACTOR, Y = $\boxed{0.991}$

AVERAGE $\Delta H_@$ = $\boxed{1.67}$

(1) = Net volume of gas sample passed through DGM, corrected to standard conditions
K_1 = 17.64 °R/in. Hg (English), 0.3858 °K/mm Hg (Metric)
T_m = Absolute DGM avg. temperature (°R - English, °K - Metric)

$$\Delta H_@ = \frac{0.75\,\theta}{V_{cr}(std)}\ \Delta H\ \frac{V_m(std)}{V_m}$$

(2) = Volume of gas sample passed through the critical orifice, corrected to standard conditions
T_{amb} = Absolute ambient temperature (°R - English, °K - Metric)
K' = Average K' factor from Critical Orifice Calibration

(3) = DGM calibration factor