



Marathon Petroleum Company LP
Illinois Refining Division
400 South Marathon Avenue
Robinson, IL 62454

REPORT ON PETROLEUM REFINERY ICR TESTING

Performed for:
MARATHON PETROLEUM COMPANY LP
FCCU SCRUBBER STACK
ILLINOIS REFINING DIVISION
ROBINSON REFINERY

Client Reference No: CN00072225
CleanAir Project No: 11265-3
Revision 1: October 5, 2011

To the best of our knowledge, the data presented in this report are accurate, complete, error free, legible and representative of the actual emissions during the test program. Clean Air Engineering operates in conformance with the requirements of ASTM D7036-04 Standard Practice for Competence of Air Emission Testing Bodies.

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REVISION HISTORY

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REPORT ON PETROLEUM REFINERY ICR TESTING***DRAFT REPORT REVISION HISTORY***

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PROJECT OVERVIEW

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INTRODUCTION

Marathon Petroleum Company LP (MPC) contracted Clean Air Engineering (CleanAir) to perform emission measurements at the Robinson Refinery (Facility ID IL2A0420), located in Robinson, Illinois, to provide data for the Refinery Information Collection Request (ICR) conducted by the Environmental Protection Agency (EPA) Office of Air and Radiation (OAR).

This report describes the sampling, analytical, quality assurance (QA) and quality control (QC) procedures that CleanAir followed during test program. The test program was designed to collect the highest quality data in the safest, most efficient manner possible, for the constituents specified in the ICR.

Key Project Participants

Individuals responsible for coordinating and conducting the test program are listed in Table 1-1 on the following page.

PROJECT OVERVIEW**1-2****Table 1-1:
Project Contact Information**

Client Contact	CleanAir Contact
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PROJECT OVERVIEW

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INTRODUCTION (CONTINUED)

Background

On February 2, 2011, the United States Environmental Protection Agency (EPA), under authority of Section 114 of the Clean Air Act (CAA), issued an Information Collection Request (ICR) for petroleum refinery process units in support of its efforts to develop National Emission Standards for Hazardous Air Pollutants (NESHAP). Included in the ICR were requirements for sampling and analysis of stack gases, scrubber water, fuel gas systems, cooling water and wastewater treatment from a variety of emission sources at a large number of petroleum refineries throughout the United States.

This information will be used by EPA to:

- assess whether additional control strategies are necessary for these sources, and if so, evaluate which are the most effective,
- evaluate compliance options during start-up and shutdown periods,
- consolidate monitoring, reporting and recordkeeping requirements, and
- review other rules specific to petroleum refineries (such as the Benzene NESHAPs in Subparts BB and FF).

MPC received a Section 114 letter on March 31, 2011, detailing the required testing at the Robinson Refinery. The FCCU Scrubber Stack was selected to provide a complete set of gaseous emissions data and scrubber water data for the hazardous air pollutants (HAPs) and criteria pollutants specified in the ICR.

PROJECT OVERVIEW**1-4****INTRODUCTION (CONTINUED)****Test Program Parameters**

Testing for the gaseous parameters was performed at the FCCU Scrubber Stack and included the emissions parameters listed in Table 1-2, organized by the HAPs categories defined in the ICR.

**Table 1-2:
ICR Test Parameters – FCCU Scrubber Stack**

Parameter ¹	Abbr.	Sampling Method (EPA)	Analytical Method (EPA)	Analytical Laboratory	ICR Group	Notes
Speciated volatile organic HAP – all but methanol ¹	VOC	Mod. M-18	M-18	ALS	A1	1
Methanol	CH ₃ OH	M-18	M-18	ALS	A1	
Aldehydes		SW-846 M-0011	SW-846 M-8315A	ALS	A1	2
Speciated semi-volatile organic HAP	SVOC	SW-846 M-0010	SW-846 M-8270C	ALS	A2	3
Polyaromatic hydrocarbons	PAH	SW-846 M-0010	SW-846 M-8270C	ALS	A2	3
Total hydrocarbons	THC	M-25A	M-25A	N/A	A3	
Methane	CH ₄	M-18	M-18	CleanAir	A3	
Ethane	C ₂ H ₆	M-18	M-18	CleanAir	A3	
Carbon monoxide	CO	Facility CEMs		N/A	A3	
Polychlorinated dibenzo-p-dioxins	PCDD	M-23	SW-846 M-8290	ALS	B	
Polychlorinated dibenzofurans	PCDF	M-23	SW-846 M-8290	ALS	B	
Polychlorinated biphenyls	PCB	M-23	SW-846 M-1668B	ALS	B	4

Notes

1. Target volatile analytes are listed in Table 1-3 on page 1-6.
2. Target aldehyde analytes are listed in Table 1-4 on page 1-7.
3. Target semi-volatile and polyaromatic hydrocarbon analytes are listed in Table 1-5 on page 1-7.
4. Only the 12 “dioxin-like” PCB congeners (IUPAC Numbers PCB-77, PCB-81, PCB-105, PCB-114, PCB-118, PCB-123, PCB-126, PCB-156, PCB-157, PCB-167, PCB-169 and PCB-189).

PROJECT OVERVIEW

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**Table 1-2, Continued:
ICR Test Parameters – FCCU Scrubber Stack**

Parameter ¹	Abbr.	Sampling Method (EPA)	Analytical Method (EPA)	Analytical Laboratory	ICR Group	Notes
Filterable particulate matter	FPM	M-5	M-5	CleanAir	D1	
Condensable particulate matter	CPM	M-202	M-202	CleanAir	D1	
Total dissolved solids, total suspended solids from wet scrubber recirculation liquid	TDS, TSS	Grab	ASTM D5907	CleanAir	D1	
Ammonia	NH ₃	Mod. CTM-027	CTM-027	CleanAir	D1	
Other metals		M-29	M-29	ALS	D1	1
Particle-bound mercury	Hg _p	ASTM D6784	ASTM D6784	ALS	D2	
Oxidized mercury	Hg _o	ASTM D6784	ASTM D6784	ALS	D2	
Elemental mercury	Hg _E	ASTM D6784	ASTM D6784	ALS	D2	
Hexavalent chromium	Cr ⁶⁺	SW-846 M-0061	SW-846 M-0061	ALS	D3	
Nitrogen oxides	NO _x	Facility CEMs		N/A	D4	
Sulfur dioxide	SO ₂	Facility CEMs		N/A	D4	
Hydrogen chloride	HCl	M-26A	M-26	CleanAir	E	
Chlorine	Cl ₂	M-26A	M-26	CleanAir	E	
Hydrogen fluoride	HF	M-26A	M-26	CleanAir	E	
Hydrogen cyanide	HCN	OTM-29	OTM-29	Enthalpy	E	
Flow rate	Flow	M-2	M-2	N/A	All	2
Oxygen	O ₂	M-3A / Mod. M-3A	M-3A / Mod. M-3A	N/A	All	2
Carbon dioxide	CO ₂	M-3A / Mod. M-3A	M-3A / Mod. M-3A	N/A	All	2
Moisture	H ₂ O	M-4	M-4	N/A	All	2

Notes

1. Metals include antimony (Sb), arsenic (As), beryllium (Be), cadmium (Cd), chromium (Cr), cobalt (Co), lead (Pb), manganese (Mn), nickel (Ni) and selenium (Se).
2. Flow, O₂, CO₂ and H₂O measurements were performed nearly concurrent with each pollutant measurement.

PROJECT OVERVIEW**1-6****Table 1-3:
Target Volatile Analytes**

Compound	CAS Number	Compound	CAS Number
Acetone	67-64-1	Methyl isobutyl ketone	108-10-1
Acetonitrile	75-05-8	Methyl t-butyl ether	1634-04-4
Acrolein	107-05-8	Methylene chloride	75-09-2
Acrylonitrile	107-13-1	Nitrobenzene	98-95-3
Benzene	71-43-2	2-Nitropropane	79-46-9
1,3-Butadiene	106-99-0	Pentane	109-66-0
Carbon disulfide	75-15-0	Styrene	100-42-5
Chlorobenzene	108-90-7	Tetrachloroethene	127-18-4
Cumene (isopropylbenzene)	98-82-8	Toluene	108-88-3
1,2-Dibromoethane	106-93-4	Trichloroethene	79-01-6
Ethylbenzene	100-41-4	2,2,4 Trimethylpentane	540-84-1
Hexane	110-54-3	Xylenes (mixed isomers)	1330-20-7
Methanol	67-56-1		

PROJECT OVERVIEW

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**Table 1-4:
Target Aldehyde Analytes**

Compound	CAS Number
Formaldehyde	50-00-0
Acetaldehyde	75-07-0
Propanal (Propionaldehyde)	123-38-6

**Table 1-5:
Target Semi-Volatile / PAH Analytes**

Compound	CAS Number	Compound	CAS Number
Acenaphthene	83-32-9	Dimethylaminobenzene	60-11-7
Acenaphthylene	208-96-8	7,12-Dimethylbenz(a)anthracene	57-97-6
Aniline	62-53-3	3,3'-Dimethylbenzidine	119-93-7
Anthracene	120-12-7	α,α -Dimethylphenethylamine	122-09-8
Benazidine	92-87-5	2,4-Dimethylphenol	105-67-9
Benzo[a]anthracene	56-55-3	Fluoranthene	206-44-0
Benzo[b]fluoranthene	205-99-2	Fluorene	86-73-7
Benzo[k]fluoranthene	207-08-9	Indeno[1,2,3-cd]pyrene	193-39-5
Benzo[g,h,i]perylene	191-24-2	Isophorone	78-59-1
Benzo[a]pyrene	50-32-8	3-Methylcholanthrene	56-49-5
Benzo[e]pyrene	192-97-2	2-Methylnaphthalene	91-57-6
Biphenyl	92-52-4	Naphthalene	91-20-3
Cresol (mixed isomers)	1319-77-3	Perylene	198-55-0
Chrysene	218-01-9	Phenanthrene	85-01-8
Dibenz[a,h]anthracene	53-70-3	Phenol	108-95-2
Dibenzofuran	132-64-9	1,4-Phenylenediamine	106-50-3
Dibenzo(a,e)pyrene	192-65-4	Pyrene	129-00-0
3,3'-Dimethoxybenzidine	119-90-4	o-Toluidine	95-53-4

PROJECT OVERVIEW**1-8****TEST PROGRAM SYNOPSIS****Test Schedule**

The on-site schedule followed during the test program is outlined in Table 1-6 (organized chronologically) and Table 1-7 (grouped by ICR HAPs category) on pages 1-8 through 1-10.

**Table 1-6:
Schedule of Activities - Chronological**

Date (2011)	Start Time	End Time	Run No.	Constituent	Test Method (USEPA)	ICR Group
7/12 (Tue)	13:40	14:00	Preliminary	Cyclonic Flow	M-1	N/A
7/13 (Wed)	09:36	10:56	1	VOC (all but CH ₃ OH)	Mod. M-18	A1
	09:50	12:05	Preliminary	O ₂ / CO ₂	M-3A	N/A
	09:55	12:02	1	Aldehydes	M-0011	A1
	11:53	13:13	1	CH ₃ OH	M-18	A1
	13:16	15:36	2	Aldehydes	M-0011	A1
	14:40	16:00	2	CH ₃ OH	M-18	A1
	16:15	17:35	2	VOC (all but CH ₃ OH)	Mod. M-18	A1
7/14 (Thu)	08:55	10:15	3	VOC (all but CH ₃ OH)	Mod. M-18	A1
	08:56	11:09	3	Aldehydes	M-0011	A1
	10:55	12:15	3	CH ₃ OH	M-18	A1
	11:51	14:10	Matrix Spike	Aldehydes	M-0011	A1
	13:22	14:23	1	O ₂ / CO ₂ / THC	M-3A / 25A	A3
	13:20	14:20	1	CH ₄ / C ₂ H ₆	M-18	A3
	15:04	16:04	2	O ₂ / CO ₂ / THC	M-3A / 25A	A3
	15:05	16:05	2	CH ₄ / C ₂ H ₆	M-18	A3
	16:18	17:18	3	O ₂ / CO ₂ / THC	M-3A / 25A	A3
	16:20	17:20	3	CH ₄ / C ₂ H ₆	M-18	A3
7/15 (Fri)	08:57	14:49	1	SVOC / PAH	M-0010	A2
	08:58	13:06	1	Cr ⁶⁺	M-0061	D3
	09:00	13:14	1	Hg _p / Hg _O / Hg _E	ASTM D6784	D2
	13:27	16:04	2	Hg _p / Hg _O / Hg _E	ASTM D6784	D2
	14:06	17:42	2	Cr ⁶⁺	M-0061	D3
	15:55	20:55	2	SVOC / PAH	M-0010	A2
7/16 (Sat)	08:36	12:59	3	SVOC / PAH	M-0010	A2
	08:36	12:21	3	Cr ⁶⁺	M-0061	D3
	08:40	11:07	3	Hg _p / Hg _O / Hg _E	ASTM D6784	D2

PROJECT OVERVIEW**1-9****Table 1-6, Continued:
Schedule of Activities - Chronological**

Date (2011)	Start Time	End Time	Run No.	Constituent	Test Method (USEPA)	ICR Group
7/19 (Tue)	07:42	10:52	1	Other Metals	M-29	D1
	07:56	09:38	1	NH ₃	Mod CTM-027	D1
	08:09	10:14	1	FPM / CPM	M-5/202	D1
	11:23	14:37	2	Other Metals	M-29	D1
	11:51	14:19	2	FPM / CPM	M-5/202	D1
	12:00	13:19	2	NH ₃	Mod CTM-027	D1
	15:17	18:30	3	Other Metals	M-29	D1
	15:22	17:36	3	FPM / CPM	M-5/202	D1
	15:38	17:15	3	NH ₃	Mod CTM-027	D1
7/20 (Wed)	07:59	11:12	1	PCDD / PCDF / PCB	M-23	B
	09:36	10:57	1	HCN	OTM-29	E
	09:49	12:18	1	HCl / Cl ₂ / HF	M-26A	E
	11:50	15:22	2	PCDD / PCDF / PCB	M-23	B
	12:50	15:10	2	HCl / Cl ₂ / HF	M-26A	E
	12:29	14:01	2	HCN	OTM-29	E
7/21 (Thu)	07:53	11:09	3	PCDD / PCDF / PCB	M-23	B
	07:54	10:07	3	HCl / Cl ₂ / HF	M-26A	E
	07:56	09:15	3	HCN	OTM-29	E

**Table 1-7:
Schedule of Activities – HAPs Category**

ICR Group	Constituent	Test Method (USEPA)	Run No.	Date (2011)	Start Time	End Time
N/A	Cyclonic Flow	M-1	Preliminary	7/12	13:40	14:00
N/A	O ₂ / CO ₂	M-3A	Preliminary	7/13	09:50	12:05
A1	VOC (all but CH ₃ OH)	Mod. M-18	1	7/13	09:36	10:56
A1	VOC (all but CH ₃ OH)	Mod. M-18	2	7/13	16:15	17:35
A1	VOC (all but CH ₃ OH)	Mod. M-18	3	7/14	08:55	10:15
A1	CH ₃ OH	M-18	1	7/13	11:53	13:13
A1	CH ₃ OH	M-18	2	7/13	14:40	16:00
A1	CH ₃ OH	M-18	3	7/14	10:55	12:15
A1	Aldehydes	M-0011	1	7/13	09:55	12:02
A1	Aldehydes	M-0011	2	7/13	13:16	15:36
A1	Aldehydes	M-0011	3	7/14	08:56	11:09
A1	Aldehydes	M-0011	Matrix Spike	7/14	11:51	14:10

PROJECT OVERVIEW**1-10****Table 1-7, Continued:
Schedule of Activities – HAPs Category**

ICR Group	Constituent	Test Method (USEPA)	Run No.	Date (2011)	Start Time	End Time
A2	SVOC / PAH	M-0010	1	7/15	08:57	14:49
A2	SVOC / PAH	M-0010	2	7/15	15:55	20:55
A2	SVOC / PAH	M-0010	3	7/16	08:36	12:59
A3	O ₂ / CO ₂ / THC	M-3A / 25A	1	7/14	13:22	14:23
A3	O ₂ / CO ₂ / THC	M-3A / 25A	2	7/14	15:04	16:04
A3	O ₂ / CO ₂ / THC	M-3A / 25A	3	7/14	16:18	17:18
A3	CH ₄ / C ₂ H ₆	M-18	1	7/14	13:20	14:20
A3	CH ₄ / C ₂ H ₆	M-18	2	7/14	15:05	16:05
A3	CH ₄ / C ₂ H ₆	M-18	3	7/14	16:20	17:20
B	PCDD / PCDF / PCB	M-23	1	7/20	07:59	11:12
B	PCDD / PCDF / PCB	M-23	2	7/20	11:50	15:22
B	PCDD / PCDF / PCB	M-23	3	7/21	07:53	11:09
D1	FPM / CPM	M-5/202	1	7/19	08:09	10:14
D1	FPM / CPM	M-5/202	2	7/19	11:51	14:19
D1	FPM / CPM	M-5/202	3	7/19	15:22	17:36
D1	NH ₃	Mod CTM-027	1	7/19	07:56	09:38
D1	NH ₃	Mod CTM-027	2	7/19	12:00	13:19
D1	NH ₃	Mod CTM-027	3	7/19	15:38	17:15
D1	Other Metals	M-29	1	7/19	07:42	10:52
D1	Other Metals	M-29	2	7/19	11:23	14:37
D1	Other Metals	M-29	3	7/19	15:17	18:30
D2	Hg _p / Hg _O / Hg _E	ASTM D6784	1	7/15	09:00	13:14
D2	Hg _p / Hg _O / Hg _E	ASTM D6784	2	7/15	13:27	16:04
D2	Hg _p / Hg _O / Hg _E	ASTM D6784	3	7/16	08:40	11:07
D3	Cr ⁶⁺	M-0061	1	7/15	08:58	13:06
D3	Cr ⁶⁺	M-0061	2	7/15	14:06	17:42
D3	Cr ⁶⁺	M-0061	3	7/16	08:36	12:21
E	HCl / Cl ₂ / HF	M-26A	1	7/20	09:49	12:18
E	HCl / Cl ₂ / HF	M-26A	2	7/20	12:50	15:10
E	HCl / Cl ₂ / HF	M-26A	3	7/21	07:54	10:07
E	HCN	OTM-29	1	7/20	09:36	10:57
E	HCN	OTM-29	2	7/20	12:29	14:01
E	HCN	OTM-29	3	7/21	07:56	09:15

PROJECT OVERVIEW**1-11****TEST PROGRAM SYNOPSIS (CONTINUED)****Results Summary**

Table 1-8 summarizes the results of the test program. A more detailed presentation of the test conditions and results of analysis are shown in Tables 2-1 through 2-22 on pages 2-1 through 2-34.

**Table 1-8:
Summary of Test Results**

<u>Source</u>						
Constituent	Average Result	Units	Method (USEPA)	ICR Group	Sample Time (min)	Sample Volume ¹
<u>FCCU Scrubber Stack</u>						
VOC		* lb/hr	Mod. M-18	A1	80	20 L
(all but CH ₃ OH)		* µg/dscm				
CH ₃ OH	7.67	lb/hr	M-18	A1	80	20 L
	15,137	µg/dscm				
Formaldehyde	2.05E-03	lb/hr	SW-846	A1	120	1.3 dscm
	4.10	µg/dscm	M-0011			(45.9 dscf)
Acetaldehyde	3.62E-03	lb/hr	SW-846	A1	120	1.3 dscm
	7.21	µg/dscm	M-0011			(45.9 dscf)
Propanal	2.83E-03	lb/hr	SW-846	A1	120	1.3 dscm
	5.60	µg/dscm	M-0011			(45.9 dscf)
SVOC		* lb/hr	SW-846	A2	240	4 dscm
		* µg/dscm	M-0010			(141 dscf)
PAH		* lb/hr	SW-846	A2	240	4 dscm
		* µg/dscm	M-0010			(141 dscf)
THC	1.30	lb/hr	M-25A	A3	60	N/A
	1.41	ppmdv as C ₃ H ₈				
CH ₄	0.80	lb/hr	M-18	A3	60	N/A
	2.4	ppmdv				
C ₂ H ₆	<0.10	lb/hr	M-18	A3	60	N/A
	<0.16	ppmdv				
PCDD		* lb/hr	M-23	B	180	3 dscm
		* pg/dscm				(106 dscf)
PCDF		* lb/hr	M-23	B	180	3 dscm
		* pg/dscm				(106 dscf)
PCB		* lb/hr	M-23	B	180	3 dscm
		* pg/dscm				(106 dscf)

PROJECT OVERVIEW**1-12****Table 1-8, Continued:
Summary of Test Results**

<u>Source</u>						
Constituent	Average Result	Units	Method (USEPA)	ICR Group	Sample Time (min)	Sample Volume ¹
<u>FCCU Scrubber Stack</u>						
FPM	22.7 0.0203	lb/hr gr/dscf	M-5	D1	120	2 dscm 70.6 dscf
CPM	8.53 7.64E-03	lb/hr gr/dscf	M-202	D1	120	2 dscm 70.6 dscf
TSS	1,890	mg/L	ASTM D5907	D1	N/A	N/A
TDS	78,923	mg/L				
NH ₃	0.723 2.10	lb/hr ppmdv	Mod. CTM-027	D1	60	N/A
Other Metals	* *	lb/hr mg/dscm	M-29	D1	180	3 dscm (106 dscf)
Hg _p	<1.43E-05 <2.80E-02	lb/hr µg/dscm	ASTM D6784	D2	120	< 2.5 dscm (< 88.3 dscf)
Hg _O	<7.24E-05 <1.40E-01	lb/hr µg/dscm	ASTM D6784	D2	120	< 2.5 dscm (< 88.3 dscf)
Hg _E	1.04E-04 2.01E-01	lb/hr µg/dscm	ASTM D6784	D2	120	< 2.5 dscm (< 88.3 dscf)
Cr ⁶⁺	<8.14E-05 <0.164	lb/hr µg/dscm	SW-846 M-0061	D3	180	3 dscm (106 dscf)
HCl	0.0312 0.0640	lb/hr mg/dscm	M-26A	E	120	2 dscm 70.6 dscf
Cl ₂	<0.0017 <0.0036	lb/hr mg/dscm	M-26A	E	120	2 dscm 70.6 dscf
HF	<0.0020 <0.0042	lb/hr mg/dscm	M-26A	E	120	2 dscm 70.6 dscf
HCN	2.07 4,440	lb/hr µg/dscm	OTM-29	E	60	< 0.9 dscm (< 31.8 dscf)

PROJECT OVERVIEW**1-13****TEST PROGRAM SYNOPSIS (CONTINUED)*****Discussion of Test Program***General Considerations

Per EPA Method 1 requirements, a verification of the absence of cyclonic flow was performed at the FCCU Scrubber Stack prior to sampling. Documentation is included in Appendix E.

Test runs for constituents in the same Group as defined in Table 1.1 of the EPA's "Instructions for Component 4 Emissions Source Testing" were performed at concurrent or overlapping times.

All gaseous emissions tests were comprised of three (3) test runs and fulfilled the specified sampling times and volumes in Table 1.2 of the EPA's "Instructions for Component 4 Emissions Source Testing."

O₂ and CO₂ data (units of dry volume percent, %_{dv}) used in molecular weight calculations were obtained in the following manner during the test program:

- For M-25A and M-18 (integrated bag sampling – direct pump sampling procedure), O₂ and CO₂ data was obtained from a continuous paramagnetic / non-dispersive infrared (NDIR) analyzer operated concurrently and in parallel with the FIA analyzer.
- For non-instrumental (wet) sampling methods other than M-18 (integrated bag sampling – direct pump sampling procedure), a hybrid version of EPA M-3A and M-3B was utilized.
 - Multi-point, integrated gas samples (IGS) were continuously collected at a constant rate from a slipstream of the exhaust of the sample trains into a flexible vinyl bag (IGS bag) per M-3B specifications.
 - A calibrated paramagnetic/IR analyzer was used in place of a traditional Orsat analyzer to measure O₂ and CO₂ concentrations of the IGS bags per M-3A specifications.
 - Documentation of preliminary instrument calibrations and post-analysis calibration checks are included in Appendix E.

H₂O data (units of volume percent, %_v) used for moisture correction of concentration data were obtained in the following manner during the test program:

- For non-instrumental (wet) sampling methods, EPA M-4 measurements were incorporated into the sampling and recovery procedures.
- For M-18 and Modified M-18 runs, H₂O data was obtained from an overlapping SW-846 0010 or SW-846 0011 test run.
- For instrumental (continuous) sampling methods using CEM analyzers, H₂O data was obtained from another overlapping test run with an incorporated moisture measurement.

PROJECT OVERVIEW**1-14****TEST PROGRAM SYNOPSIS (CONTINUED)**VOC Results (Mod. M-18, Midget Impinger Method)

Flow, moisture, and O₂ data associated with each Mod. M-18 test run were obtained from a nearly-concurrent SW-846 0011 run.

Samples were refrigerated after collection and shipped on ice packs. Despite the best efforts to keep the samples cold during transit, some samples were received at 18°C by the laboratory due to a shipping delay attributed to the carrier.

Xylene (mixed isomers – CAS No. 1330-20-7) was reported by the laboratory as two (2) separate constituents: "m,p-Xylene" and "o-Xylene". For each constituent, results were below detection levels for all fractions.

For all runs and all constituents, the majority of the results were below detection levels in all of the sample fractions. The total analytical result for each run is equivalent to the sum of the result for each sample fraction, using the full value of the analytical detection limit in instances of non-detectable results. The data was not blank corrected.

Only acetone and methylene chloride were observed at above detection levels in all of the sample fractions for all runs. Similar levels were observed in all of the field blank fractions. It is likely that these results are due to background contamination as these compounds are ubiquitous in sampling and laboratory environments. Acetone and methylene chloride reagents were present on-site during the test program, but not opened until the conclusion of VOC testing. To the maximum extent possible, these samples were kept segregated from other field samples recovered with acetone and methylene chloride.

Nitrobenzene quantification suffered from instrument related run-to-run carry-over. Reporting limits for nitrobenzene were raised by the laboratory to account for the uncertainty associated with the run-to-run carry-over.

Recovery was demonstrated for the constituents specified by EPA using isotopically-labeled spikes whenever available. For the constituents not available in stable isotopically-labeled spikes, paired trains (designated as the A-Side and B-Side) were operated for each run and the B-side sample train was pre-spiked with native recovery surrogates. The B-Side results were only used to demonstrate recovery of the natively-spiked constituents; average VOC results represent the average of the A-Side results.

Table 1-9 on the following page summarizes the recovery study results.

PROJECT OVERVIEW**Table 1-9:
Summary of Mod. M-18 Spike Recovery**

Run No.	1A Recovery (%)	2A Recovery (%)	3A Recovery (%)	Average Recovery (%)	Field Blank A Recovery (%)
Labelled Analyte Recoveries					
1,3-Butadiene-d6	18	3	0	7	0
Benzene-d6	83	87	87	86	97
Acrylonitrile-d3	115	76	98	96	102
Nitrobenzene-d5	31	16	16	21	23
2,2,4-Trimethylpentane-d18	73	58	66	66	61
Ethylbenzene-d10	87	97	96	93	116
Pentane-d12	24	4	0	9	3
Methyl t-butyl ether-d12	88	74	81	81	83
n-Hexane-d14	57	23	26	35	23
2-Nitropropane-d6	100	60	82	81	82
1,2-Dibromoethane-d4	90	77	85	84	96
Styrene-d8	83	88	86	85	105
Run No.	1B Recovery (%)	1B Recovery (%)	1B Recovery (%)	Average Recovery (%)	Field Blank B Recovery (%)
Native Analyte Recoveries					
Acrolein	46	33	81	53	37
Acetonitrile	73	100	87	86	87
Trichloroethene	92	74	100	89	114
Methyl iso-Butyl Ketone	65	105	83	84	80
Toluene	95	84	102	94	115

Bold, italicized numbers indicate data outside of M-18 recovery criteria (70-130%)

The M-18 recovery criteria were not met for 1-3-butadiene, nitrobenzene, 2-2-4-trimethylpentane, pentane, n-hexane, or acrolein. Similar recoveries were observed in the paired field blank train which was subjected to all of the same setup, recovery, and analysis procedures as the run samples.

Recovery losses may be partially attributed to:

- Elevated sample temperatures prior to analysis as a result of the shipping delay
- The presence of headspace in the sample containers (zero-headspace conditions were specified as not required in the referenced test method).

The laboratory's reporting limit was defined by the level equivalent to the low instrument calibration point and sensitivity standard.

PROJECT OVERVIEW**1-16****TEST PROGRAM SYNOPSIS (CONTINUED)**CH₃OH Results (M-18, Adsorption Tube Procedure)

Flow, moisture, and O₂ data associated with each M-18 test run were obtained from a nearly-concurrent SW-846 0011 run.

Samples were refrigerated after collection and shipped on ice packs. Despite the best efforts to keep the samples cold during transit, samples were received at 18°C by the laboratory due to a shipping delay attributed to the carrier.

The CH₃OH results were below detection levels in of the condensate sample fractions and above detection levels in the adsorbent tube fractions for all of the runs. The total analytical result for each run is equivalent to the sum of the results of all sample fractions, using the entire value of the detection limit for the condensate fraction. CH₃OH was not detected in the trip blanks or unspiked field blank trains.

Recovery was demonstrated for the constituents specified by EPA using paired trains (designated as the A-Side and B-Side) for each run. The B-side sample train was pre-spiked with a known quantity of CH₃OH. The B-Side results were only used to demonstrate recovery; average CH₃OH results represent the average of the A-Side results. All QA/QC criteria were met.

The analytical detection limit for the condensate fractions reported by the laboratory is forty times greater than reported for the adsorbent tube sections. While the ICR instructions dictate that non-detects are to be treated as its full values, it should be noted that the CH₃OH emission results are somewhat skewed as a result. The total summed result for each run includes a single non-detectable fraction that is significantly higher than the two (2) detectable fractions. Table 1-10 on the following page summarizes the laboratory results and the calculated emissions results.

PROJECT OVERVIEW

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**Table 1-10:
Summary of M-18 CH₃OH Results**

Run No.	1A	2A	3A	Average
Date (2011)	Jul 13	Jul 13	Jul 14	
Start Time (approx.)	11:53	14:40	10:55	
Stop Time (approx.)	13:13	16:00	12:15	
Laboratory Results				
m _c Matter detected in condensate (MDL = 200 µg)	< 200.0000	< 200.0000	< 200.0000	
m ₁ Matter detected in trap section 1 (MDL = 5 µg)	10.8000	30.5000	122.0000	
m ₂ Matter detected in trap section 2 (MDL = 5 µg)	14.0000	24.9000	63.3000	
m Total matter collected - excluding condensate (µg)	24.8000	55.4000	185.3000	
m Total matter collected - all fractions (µg)	224.8000	255.4000	385.3000	
Methanol Results - Excluding Condensate				
m Matter collected (µg)				
n _{RL} Number of fractions below reporting limit	0 out of 2	0 out of 2	0 out of 2	
DLC Detection limit classification	ADL	ADL	ADL	
C _{sd} Concentration (µg/dscm)	1.29E+03	2.93E+03	9.70E+03	4.64E+03
C _{sd} Concentration (lb/dscf)	8.07E-08	1.83E-07	6.05E-07	2.90E-07
E _{lb/hr} Emission rate (lb/hr)	6.39E-01	1.46E+00	5.04E+00	2.38E+00
Methanol Results - All Fractions				
n _{RL} Number of fractions below reporting limit	1 out of 3	1 out of 3	1 out of 3	
DLC Detection limit classification	DLL	DLL	DLL	
C _{sd} Concentration (µg/dscm)	1.17E+04	1.35E+04	2.02E+04	1.51E+04
C _{sd} Concentration (lb/dscf)	7.32E-07	8.44E-07	1.26E-06	9.45E-07
E _{lb/hr} Emission rate (lb/hr)	5.79E+00	6.73E+00	1.05E+01	7.67E+00

The laboratory's reporting limit was defined by the level equivalent to the low instrument calibration point and sensitivity standard.

Aldehyde Results (SW-846 M-0011)

Samples were refrigerated after collection and shipped on ice packs. Despite the best efforts to keep the samples cold during transit, some samples were received at 16°C by the laboratory.

The impinger absorbing solution for this method (acidified dinitrophenylhydrazine, or DNPH) was prepared ahead of the test program by the laboratory and shipped to the site. Upon receipt of the DNPH reagent in the field, the following were noted:

- Nearly all of the reagent bottles slightly leaked in transit around their caps. The effect on data quality appears to be minimal as the DNPH reagent blank contained non-detectable results for formaldehyde and propanal, with only trace amounts of acetaldehyde (just above the detection limit).
- The method states to prepare the reagent within five (5) days of proposed use. The laboratory had been informed of the anticipated M-0011 test dates well in advance of the test program, yet the reagent was received with labels stating that it was prepared on July 6, 2011.

PROJECT OVERVIEW**1-18****TEST PROGRAM SYNOPSIS (CONTINUED)**

Formaldehyde, acetaldehyde and propanal were above detection levels for all runs. However, the accuracy of the results may be called into question due to several QA/QC issues, summarized below:

- The “sample blank” contained a detectable amount of formaldehyde (2.36 µg). The sample blank consisted of a combined DNPH and methylene chloride reagent blank, of an equivalent volume as the run sample fractions, collected in the field. Formaldehyde was not measured in detectable amounts in either the stand-alone DNPH or methylene chloride reagent blanks, which were also collected in the field. The sample blank contained greater volumes of both chemicals (400 ml DNHP and about 500 ml methylene chloride) than the stand-alone reagent blanks (200 ml each), which may have contributed to the detectable result.
- The “method blank” contained detectable amounts of formaldehyde (5.56 µg), acetaldehyde (4.18 µg) and propanal (2.14 µg). The method blank consisted of an aliquot of the DNPH taken by the laboratory during reagent preparation (prior to testing) and held until sample analysis. The laboratory report attributes the results to an extended holding time prior to analysis (greater than five days) and collection of additional analyte from the environment. M-0011 does not contain any requirements or guidance regarding the time interval between sample collection and analysis.
- According to the laboratory report, the results have been “corrected for method blank as appropriate”. M-0011 does contain any provisions for blank correction of the data. No documentation on the net amount of correction (or the method in which the correction was calculated) was included with the laboratory report. Results in this report are based on the numbers in the laboratory report; no further blank correction was made by CleanAir.
- The “field spike” formaldehyde recovery was 87.4%; this is slightly outside of the limit of 90-110% specified by M-0011. The potential effect on data quality is a low bias for formaldehyde. The field spike consisted of a known amount of a formaldehyde standard introduced into an impinger containing 200 ml DNPH reagent. The impinger is recovered and analyzed per standard procedures. A field spike was not performed for acetaldehyde or propanal.
- The “matrix spike” formaldehyde recovery was 61.9%; no limit for matrix spike recovery is specified by M-0011. The potential effect on data quality is a low bias for formaldehyde. The matrix spike consisted of a complete sample run that sampled flue gas for the same duration as the other runs, pre-spiked with a known amount of formaldehyde in the impinger train. The entire sample train was recovered and analyzed per standard procedures. A matrix spike was not performed for acetaldehyde or propanal.

The laboratory’s detection limit was determined following Procedure 1 in SW846 M-8315A.

PROJECT OVERVIEW**1-19****TEST PROGRAM SYNOPSIS (CONTINUED)**SVOC / PAH Results (SW-846 M-0010)

The Run 1 sample train developed a slight leak about 100 minutes into the test run. Elevated O₂ in the dry gas meter exhaust (continuously monitored during testing) was immediately noted and the test was paused. A loose screw cap was identified and tightened, a successful leak check was performed, and the sample train was restarted.

An unextracted quartz fiber filter was used in the Run 3 sample train due to an unanticipated media shortage. The effect on data quality is negligible as the Run 3 data does not appear to be significantly different than the other runs.

Samples were refrigerated after collection and shipped on ice packs. Despite the best efforts to keep the samples cold during transit, some samples were received at 14 to 20°C by the laboratory due to a shipping delay attributed to the carrier.

The Container 4 sample fraction (Impinger 1 Catch and Rinse) from Run 3 was accidentally placed in an excessively-cold spot in the refrigerator during sample storage, causing the sample to freeze and crack the sample jar. Approximately 95% of the sample was recovered, thawed under refrigeration and transferred to a new sample jar.

Cresol (mixed isomers – CAS No. 1319-77-3) was reported by the laboratory as two (2) separate constituents: "2-Methylphenol" and "4-Methylphenol & 3-Methylphenol". For each constituent, results were below detection levels.

Chrysene (CAS No. 218-01-9) was reported by the laboratory as "Chrysene / Triphenylene".

For all runs and all constituents, the majority of the results were non-detectable. These results are equivalent to the analytical detection limit. The data was not blank corrected.

The following constituents were above detection levels in the single sample fraction for all runs at levels greater than five (5) times the amount detected in the field blank (if detected in the field blank):

- Naphthalene
- 2-Methylnaphthalene
- Acenaphthylene
- Phenanthrene
- Anthracene
- Fluoranthene
- Chrysene
- Biphenyl

PROJECT OVERVIEW**1-20****TEST PROGRAM SYNOPSIS (CONTINUED)**

The following constituents were detected above detection levels in the single sample fraction for all runs, but at levels less than five (5) times the amount detected in the field blank:

- Dibenzofuran
- Benzo[k]fluoranthene

Phenol quantification suffered from a laboratory ratio failure on the confirming ion due to interference. Reporting limits for phenol were raised by the laboratory to account for the uncertainty associated with the interference.

The results for naphthalene were reported from the analysis of a diluted sample extract for selected samples due to high levels.

The recovery of acenaphthylene exceeded method control limits for the laboratory control sample. The low calibration standard contained high levels of acenaphthene from the 8270 spiking solution that likely contained trace levels of acenaphthylene. No negative impact to data quality is expected by the laboratory.

For SVOC via SW-846 M-0010/3542/8270D, the laboratory reported to a minimum detection limit (MDL) determined via 40 CFR Part 136 Appendix B and using a formula derived a function of the standard deviation obtained from a minimum of eight (8) replicate low level spiked blank samples.

For SIM PAHs (LRMS option), the laboratory reported to a quantitation limit defined by the concentration or amount equivalent to the low calibration standard.

O₂, CO₂ and THC Results (M-3A / 25A)

Flow and moisture data associated with each M-25A test run were obtained from the SW-846 0011 Matrix Spike run, which overlapped M-25A, Run 1. O₂ and CO₂ data were obtained from concurrent M-3A test runs performed at a single point. A stratification check for O₂ and CO₂ was performed on July 13, 2011, in order to confirm the acceptability of single-point sampling. Results are summarized in Appendix D, and the raw data is included in Appendix I.

The results of the post-Run 1 bias check (probe tip calibration) indicated that the system bias as a percent (%) of the calibration span value was -3.8% for the mid-level gas. This meets the specifications for system bias ($\pm 5\%$), but not for system drift ($\pm 3\%$), which technically invalidates Run 1.

PROJECT OVERVIEW**1-21****TEST PROGRAM SYNOPSIS (CONTINUED)**

The results of the post-Run 1 bias check compelled the analyst to perform a recalibration of the instrument prior to starting Run 2, and all subsequent bias and drift assessments were within specifications. However, the analyst was unaware of the system drift criterion and mistakenly reported that Run 1 was a valid run, and a fourth run was not performed.

The effect on overall data quality is quite small given the low THC results obtained for all three (3) runs:

- Run 1: THC (as C_3H_8) = 1.34 ppm_{dv} / 1.23 lb/hr
- Run 2: THC (as C_3H_8) = 1.45 ppm_{dv} / 1.33 lb/hr
- Run 3: THC (as C_3H_8) = 1.44 ppm_{dv} / 1.32 lb/hr

The drift-corrected result from Run 1 is only slightly lower than the results for Run 2 and Run 3, which are quite consistent. The CH_4 results (obtained concurrently with the THC results) were consistent for all three (3) runs, which supports the notion that the Run 1 THC result is likely biased slightly low.

The results for each run were well above 1% of the operating range of the analyzer (15 ppm).

 CH_4 and C_2H_6 Results (M-18, Integrated Bag Sampling Method)

Flow and moisture data associated with each M-18 test run were obtained from the SW-846 0011 Matrix Spike run, which overlapped M-18 Run 1. O_2 and CO_2 data were obtained from concurrent M-3A test runs.

Sampling and analysis were performed with no significant deviations from test methodology. CH_4 results were above detection levels; C_2H_6 results were below detection levels.

Detection limits were determined in accordance with procedures in 40 CFR 136, Appendix B, and in accordance with procedures outlined in CleanAir SOP EPA5-11. The laboratory defines their reporting limit as the detection limit multiplied by a factor of five (5); per EPA request, this is disregarded and the detection limit is instead used in calculations.

PCDD / PCDF / PCB Results (M-23)

Due to a shipping error by the carrier, the XAD traps prepared for this project were diverted prior to receipt and were not kept cold for the entire period prior to their use. From past experience, the laboratory did not anticipate any significant impact to the overall data quality as a result. During analysis of the samples, the laboratory did not meet the method control limit for the ion abundance ratio of the labeled extraction standard $^{13}C_{12}$ -1,2,3,4,6,7,8-HpCDF. All other method control limits were met.

PROJECT OVERVIEW**1-22****TEST PROGRAM SYNOPSIS (CONTINUED)**

The Run 2 sample train developed a slight leak about 102 minutes into the test run. Elevated O₂ in the dry gas meter exhaust (continuously monitored during testing) was immediately noted and the test was paused. A loose screw cap was identified and tightened, a successful leak check was performed and the sample train was restarted.

Due to an error in the field laboratory, unextracted quartz filters were mistakenly used for all of the test runs. There was no apparent effect on overall data quality as analysis of the field blank (prepared with the same type of filter) yielded non-detectable results.

For PCDDs and PCDFs, the results for all constituents were below detection levels for Run 1, Run 2 and the field blank. Run 3 had a detectable result for the following constituents:

- 1,2,3,4,6,7,8-HpCDD
- 1,2,3,6,7,8-HxCDF
- Total (Other) HpCDD
- Total (Other) HxCDF
- Total (Other) HpCDF

For PCBs, the majority of the results for the individual constituents were below detection levels. The following is an accounting of the PCB constituents that were present in detectable amounts.

For Tetrachlorobiphenyl (77):

- Run 1, Run 2 and Run 3 results were above detection levels.
- A detectable amount was present in the field blank.
- The amount detected in each run sample was less than five (5) times the amount detected in the field blank.

For Pentachlorobiphenyl (105):

- Run 3 results were above detection levels.
- Pentachlorobiphenyl (105) was not detected in the field blank.

For Pentachlorobiphenyl (118):

- Run 1, Run 2 and Run 3 results were above detection levels.
- A detectable amount was present in the field blank.
- The amount detected in each run sample was less than five (5) times the amount detected in the field blank.

For Hexachlorobiphenyl (156):

- Run 1 and Run 2 results were above detection levels.
- Hexachlorobiphenyl (156) was not detected in the field blank.

PROJECT OVERVIEW**1-23****TEST PROGRAM SYNOPSIS (CONTINUED)**

For Hexachlorobiphenyl (157):

- Run 2 results were above detection levels.
- A detectable amount was present in the field blank.
- The amount detected in the run sample was less than five (5) times the amount detected in the field blank.

For Hexachlorobiphenyl (167):

- Hexachlorobiphenyl (167) was detected in the field blank, but not in any of the run samples.

For Hexachlorobiphenyl (169) and Heptachlorobiphenyl (189):

- Run 2 results were above detection levels.
- Hexachlorobiphenyl (169) and Heptachlorobiphenyl (189) were not detected in the field blank.

For all HRMS analyses (including PCDD/F and PCB), the laboratory reports to an EDL or “Estimated Detection Limit”. This approach is defined in SW-846 method 8290A (the most recent version of 8290A defines this as an EQL or “Estimated Quantitation Limit”; due to its long established history, EDL is the more commonly recognized term).

For an EDL, the detection limit is determined on a per analyte per injection basis and is defined as the concentration or amount equivalent to 2.5:1 signal to noise on the quantitation ions. Since an EDL is based upon the individual injection and upon the quality of the extract, the values are based upon real per analyte instrument responses. Therefore, this approach provides the most accurate and comprehensive measurement of a detection limit for an individual sample extract.

FPM / CPM Results (M-5/202)

The Run 2 sample train developed a slight leak about 14.5 minutes into the test run. Elevated O₂ in the dry gas meter exhaust (continuously monitored during testing) was immediately noted and the test was paused. A loose screw cap was identified and tightened, a successful leak check was performed and the sample train was restarted.

The M-202 field blank result had a mass of 3.18 mg (1.90 mg in the inorganic fraction; 1.28 mg in the organic fraction). The maximum M-202-permitted blank correction of 2 mg was applied to the run results as a ratio of the amounts detected in the run fractions.

FPM, inorganic CPM and organic CPM results were above detection levels for all runs. The organic CPM results for all of the runs were less than five (5) times the amount detected in the corresponding sample fraction of the field blank.

PROJECT OVERVIEW**1-24****TEST PROGRAM SYNOPSIS (CONTINUED)**

Detection limits were determined for each fraction in accordance with 40 CFR 136, Appendix B from a series of laboratory blanks and laboratory spikes. The laboratory defines their reporting limit as 0.5 mg based on language in M-5; per EPA request, this is disregarded and the detection limit is instead used in calculations.

TDS / TSS Results (ASTM D6784)

Due to an oversight, scrubber water samples were not collected concurrently with M-5/202 testing. Samples were instead collected on August 15, 2011. In addition to the required 30 days of daily average process data, daily average process data up to and including the date of scrubber water sample collection is included in Appendix H.

NH₃ Results (Mod. CTM-027)

Due to saturated flue gas conditions, the in-stack filter was replaced with an external filter heated to 248±25°F. Aside from this, sampling and analysis were performed with no major deviations from test methodology.

NH₃ results were above detection levels in both the Impinger #1 and Impinger #2 fractions for all runs. Impinger #3 fractions were not analyzed as analysis of the Impinger #1 and Impinger #2 fractions for all runs indicated NH₃ breakthrough levels less than 10%.

Detection limits were determined in accordance with procedures in 40 CFR 136, Appendix B. The laboratory defines their reporting limit as the detection limit multiplied by a factor of five (5); per EPA request, this is disregarded and the detection limit is instead used in calculations.

Other Metals Results (M-29)

For informational purposes, separate front-half and back-half analyses of the sample train were performed. Results from each fraction of the sample train were combined into a total metals result.

Table 1-11 on the following page summarizes the analytical results of the M-29 run samples in relation to the front-half and back-half reagent blanks collected in the field and used for blank correction.

PROJECT OVERVIEW**1-25****Table 1-11:
Summary of M-29 Analytical Results**

	Detection Limit		Reagent Blank		Run 1		Run 2		Run 3	
	Front Half	Back Half	Front Half	Back Half	Front Half	Back Half	Front Half	Back Half	Front Half	Back Half
Sb	0.200	0.100	0.226	<0.100	16.700	<0.100	14.200	<0.100	14.100	<0.100
As	1.000	0.200	<1.000	<0.200	1.190	<0.200	<1.000	<0.200	1.130	<0.200
Be	0.200	0.100	<0.200	<0.100	<0.200	<0.100	<0.200	<0.100	<0.200	<0.100
Cd	0.100	0.050	<0.100	<0.050	0.180	<0.050	<0.100	<0.050	<0.100	0.062
Cr	1.000	0.150	1.380	0.276	11.000	0.352	9.360	0.997	8.790	0.385
Co	0.200	0.100	<0.200	<0.100	1.400	<0.100	1.220	<0.100	1.250	<0.100
Pb	0.500	0.050	0.578	0.090	11.100	0.423	7.440	0.515	5.620	0.246
Mn	0.500	0.150	0.964	<0.150	2.590	0.273	2.280	44.100	2.120	0.303
Ni	0.200	0.100	0.695	<0.100	33.200	0.416	31.500	0.730	29.100	0.348
Se	2.000	1.000	<2.000	<1.000	4.110	<1.000	3.660	<1.000	3.950	<1.000

Notes:

Sample run results are prior to blank correction. For values in bold italics:

1. A detectable amount of the compound was measured in the reagent blank.
2. For samples, the amount measured is less than 5 x the amount measured in the reagent blank.

For Sb:

- Front-half results for all run samples were above detection levels; back-half results for all run samples were below detection levels.
- A detectable amount was present in the front-half reagent blank.
- The amount detected in each front-half run sample was at least five (5) times higher than the amount detected in the front-half reagent blank.

For As:

- The Run 1 and Run 3 front-half results were above detection levels; the Run 2 front-half result was below the detection level. Back-half results for all run samples were below detection levels.
- As was not detected in the front-half or back-half reagent blank.

For Be:

- Front-half and back-half results for all run samples were below detection levels.
- Be was not detected in the front-half or back-half reagent blank.

For Cd:

- The Run 1 front-half result and the Run 3 back-half result were above detection levels; results for all other run samples were below detection levels.
- Cd was not detected in the front-half or back-half reagent blank.

PROJECT OVERVIEW**1-26****TEST PROGRAM SYNOPSIS (CONTINUED)**

For Cr:

- Front-half and back-half results for all run samples were above detection levels.
- A detectable amount was present in the front-half and back-half reagent blanks.
- The amount detected in each front-half run sample was at least five (5) times higher than the amount detected in the front-half reagent blank.
- The amount detected in each back-half run sample was less than (5) times the amount detected in the back-half reagent blank. After blank correction, this value was less than the detection limit.

For Co:

- Front-half results for all run samples were above detection levels; back-half results for all run samples were below detection levels.
- Co was not detected in the front-half or back-half reagent blank.

For Pb:

- Front-half and back-half results for all run samples were above detection levels.
- A detectable amount was present in the front-half and back-half reagent blanks.
- The amount detected in each front-half run sample was at least five (5) times higher than the amount detected in the front-half reagent blank.
- The amounts detected in the Run 1 and Run 3 back-half samples were less than (5) times the amount detected in the back-half reagent blank; the amount detected in the Run 2 back-half sample was greater than (5) times the amount detected in the back-half reagent blank.

For Mn:

- Front-half and back-half results for all run samples were above detection levels.
- A detectable amount was present in the front-half reagent blank.
- The amount detected in all of the front-half run samples was less than (5) times higher than the amount detected in the front-half reagent blank.
- The front-half results for all run samples were nearly equivalent (about two (2) times the detection limit). However, the Run 2 back-half fraction had an elevated Mn result that is inconsistent with the results from Run 1 and Run 3, which each contained similar Mn levels in the front-half but only trace levels in the back-half (about two (2) times the detection limit).

For Ni:

- Front-half and back-half results for all run samples were above detection levels.
- A detectable amount was present in the front-half reagent blank.
- The amounts detected in each front-half sample was at least five (5) times higher than the amount detected in the front-half reagent blank.

PROJECT OVERVIEW**1-27****TEST PROGRAM SYNOPSIS (CONTINUED)**

For Se:

- Front-half results for all run samples were above detection levels; back-half results for all run samples were below detection levels.
- Se was not detected in the front-half or back-half reagent blank.

The anomalous Mn result in the Run 2 back-half sample fraction was confirmed on re-analysis of the sample digestate. There were no Mn concentrations of this level used in any of the laboratory QC, and the concentration does not match the laboratory's sample spiking level.

It is possible that KMnO_4 reagent used in the ASTM D6784 sample train may have been somehow introduced into the sample (through accidental glassware cross-contamination or incidental exposure). An effort was made in the field laboratory to segregate the M-29 and ASTM D6784 glassware and reagents. Potassium permanganate is used by the analytical laboratory, but it is handled in a physically separate area.

For the front-half laboratory control blank, Sb, Cr, Mn, and Ni levels were above detection limits. Sb, Cr and Ni levels in the samples were all at least five (5) times higher and no significant bias is expected for these elements as a result. Sample levels of Mn are three (3) times higher than the laboratory blank. Reported data may be biased somewhat high as a result.

For the back-half laboratory control blank sample and duplicate, recovery of Se exceeded method control limits. However, this element was not detected in the associated samples.

For Metals via ICPMS (Method 29/6020) and for VOC via 0031/5041/8260B, the laboratory's reporting limit is a quantitation limit based upon a factor of 2 to 3 above the determined minimum detection limit (MDL) as determined via 40 CFR Part 136 Appendix B. The actual detection limits are unknown.

Speciated Hg Results (ASTM D6784)

Due to a shortage of glass sample jars, select Container 1 (Sample Filter) and Container 2 (All Rinses in Front of the Sample Filter) sample fractions were instead recovered and stored in Nalgene sample jars. Aside from this, sampling and analysis were performed with no significant deviations from test methodology.

Particulate-bound Hg results were below detection levels in all individual sample fractions for all runs.

PROJECT OVERVIEW**1-28****TEST PROGRAM SYNOPSIS (CONTINUED)**

Oxidized Hg results were above detection levels in the single sample fraction for Run 1 and below detection levels in the single sample fraction for Runs 2 and 3. The Run 1 result was less than five (5) times the amount detected in the corresponding sample fraction of the field blank (the field blank Hg result was actually higher than the Run 1 result).

Elemental Hg results were below detection levels in the Container 4 sample fraction (Impinger 4, HNO₃-H₂O₂ Impinger Contents and Rinses) and above detection levels in the Container 5 sample fraction (Impingers 5 through 7, H₂SO₄-KMnO₄ Impinger Contents and Rinses). For Runs 2 and 3, the Container 5 results were less than five (5) times the amount detected in the corresponding sample fraction of the field blank. The H₂SO₄-KMnO₄ reagent blank also contained trace amounts of Hg.

The elevated Hg results in Run 1 and the field blank could have possibly been due to trace amounts of mercury contamination present in the unused glassware. Both the field blank and the Run 1 sample trains happened to have been built using clean (unused) glassware in this test program. Prior to testing, two (2) sample trains were assembled using clean (unused) glassware; the field blank was originally set up to be the Run 1 sample train, but instead used as a field blank due to a test program delay. Trace contamination present in the unused glassware would have been removed following the first field recovery and not present for subsequent runs.

For Hg analysis via CVAA (Method 29/7470A), for SIM PAHs (LRMS option), the laboratory reported to a quantitation limit defined by the concentration or amount equivalent to the low calibration standard.

Cr⁶⁺ Results (SW-846 M-0061)

The Run 1 silica gel impinger exhaust stem broke about 50 minutes into the test run. Elevated O₂ in the dry gas meter exhaust (continuously monitored during testing) was immediately noted and the test was paused. The silica gel impinger was replaced, a successful leak check was performed and the sample train was restarted.

Recovery of the Run 1 sample train revealed that the second silica gel impinger condensed over 100 ml of H₂O despite the fact that monitored impinger outlet temperatures were under the limit during the test run. The calculated moisture number for Run 1 was reasonable, and a check of the meter calibration per ALT-009 did not indicate any excessive moisture breakthrough into the dry gas meter. Further efforts were made to keep the sample train adequately cooled for Runs 2 and 3.

PROJECT OVERVIEW**1-29****TEST PROGRAM SYNOPSIS (CONTINUED)**

Cr⁶⁺ results were below detection levels in the single sample fraction for all runs. Puzzlingly, Cr⁶⁺ results were below detection levels in the DI H₂O reagent blank, but well above the detection level in the 0.5 M KOH reagent blank. All run samples were recovered, purged, filtered and stored per method specifications. All run samples were received by the laboratory at a strongly basic pH and analyzed within the timeframe specified in the method.

For Cr⁶⁺ analysis via IC (Method 7199), the laboratory reported to a quantitation limit defined by the concentration or amount equivalent to the low calibration standard.

HCl / Cl₂ / HF Results (M-26A)

The Run 1 filter became plugged after 45 minutes of sampling. The cause was suspected to be the TFE mat filter (The use of TFE mat filters is prescribed by the method). Due to high moisture conditions at the sampling location, the further use of TFE mat filters was judged to be impractical. A successful leak check was performed, the TFE mat filter was replaced with a quartz fiber filter, a second successful leak check was performed and the sample train was restarted. Quartz fiber filters were used for all subsequent runs and no more plugging issues were noted.

The Run 3 sample train developed a slight leak about 92 minutes into the test run. Elevated O₂ in the dry gas meter exhaust (continuously monitored during testing) was immediately noted and the test was paused. A loose screw cap was identified and tightened, a successful leak check was performed and the sample train was restarted.

HCl results were above detection levels in the single sample fraction for all runs. Cl₂ and HF results were below detection levels in the single sample fraction for all runs.

Detection limits were determined in accordance with procedures in 40 CFR 136, Appendix B. The laboratory defines their reporting limit as the detection limit multiplied by a factor of five (5); per EPA request, this is disregarded and the detection limit is instead used in calculations.

HCN Results (OTM-29)

Per OTM-29, CO₂ concentration in the stack and at the outlet of the dry gas meter must be measured continuously throughout the test runs. Continuous CO₂ measurements were obtained in a simplified manner by collecting two (2) integrated gas samples continuously throughout each run. One (1) sample was collected from the meter exhaust of the OTM-29 sample train (which is known to scrub CO₂); the other sample was collected from the meter exhaust of a nearly-concurrent M-26A sample train (which does not scrub CO₂). This data was used to correct the meter volumes when calculating the final results.

PROJECT OVERVIEW**1-30****TEST PROGRAM SYNOPSIS (CONTINUED)**

HCN results were above detection levels in all individual sample fractions for all runs. Trace amounts of HCN was detected in the 6N sodium hydroxide (NaOH) reagent blank; this was corrected out of the final results. All sampling and laboratory QA acceptance criteria specified in OTM-29 were met (sample pH, reagent blank and laboratory method blank levels, field spike recoveries, etc...).

The laboratory initially reported that the amount detected the Impinger 1-3 fraction of the field blank was the same magnitude as the run samples. Upon reanalysis by the laboratory, this result was discovered to be erroneous. A revised report was issued by the laboratory indicating that only trace amounts of HCN were detected in the field blank.

Detection limits were determined in accordance with procedures in 40 CFR 136, Appendix B.

Plant Data

The following data is included in Appendix H:

- Hourly average scrubber CEMs data for NO_x, O₂, and CO from July 1 to July 31, 2011, along with a copy of the most recent CEMS accuracy certification

The following data is considered confidential business information (CBI) and has been reserved from this report:

- Daily average process data for all relevant parameters from July 1 to August 17, 2011
- Hourly average process data for coke burn rate and feed rate over the intervals of each test run

This data has been submitted separately to EPA.

The alternate method, described in “Alternate Method for FCCU Coke Burn-Off Rate Determination”, was used in determining coke burn rates. This means of determining the coke burn rate was approved by the EPA in correspondence with MPC, dated December 17, 2003. The method and approval letter are presented in Appendix H.

End of Section 1 – Project Overview

RESULTS**2-1****Table 2-1:
VOC Results – Mod. M-18 (Midget Impinger Method)**

Run No.	1A	2A	3A	Average
Date (2007)	Jul 13	Jul 13	Jul 14	
Start Time (approx.)	09:36	16:15	08:55	
Stop Time (approx.)	10:56	17:35	10:15	
Sampling Conditions				
O ₂ Oxygen (dry volume %) ¹	3.9	3.9	4.6	4.1
T _s Sample temperature (°F) ¹	147	147	147	147
B _w Actual water vapor in gas (% by volume) ¹	23.6	23.9	23.7	23.7
Q _{std} Volumetric flow rate, dry standard (dscfm) ¹	131,944	132,914	138,738	134,532
¹ Data obtained from concurrent SW-846 0011 run.				
Sampling Results				
V _{metd-m} Volume metered, standard (dsl)	18.9512	18.9704	19.3793	19.1003
V _{metd-m} Volume metered, standard (dscm)	0.0190	0.0190	0.0194	0.0191
V _{metd-E} Volume metered, standard (dscf)	0.6693	0.6699	0.6844	0.6745
1,3-Butadiene Results				
m Matter collected (µg)	<11.1000	<10.0000	<11.3000	
n _{RL} Number of fractions below reporting limit	3 out of 3	3 out of 3	3 out of 3	
DLC Detection limit classification	BDL	BDL	BDL	
C _{sd} Concentration (µg/dscm)	<5.86E+02	<5.27E+02	<5.83E+02	<5.65E+02
C _{sd} Concentration (lb/dscf)	<3.66E-08	<3.29E-08	<3.64E-08	<3.53E-08
E _{lb/hr} Emission rate (lb/hr)	<2.89E-01	<2.62E-01	<3.03E-01	<2.85E-01
Pentane Results				
m Matter collected (µg)	<11.1000	<10.0000	<11.3000	
n _{RL} Number of fractions below reporting limit	3 out of 3	3 out of 3	3 out of 3	
DLC Detection limit classification	BDL	BDL	BDL	
C _{sd} Concentration (µg/dscm)	<5.86E+02	<5.27E+02	<5.83E+02	<5.65E+02
C _{sd} Concentration (lb/dscf)	<3.66E-08	<3.29E-08	<3.64E-08	<3.53E-08
E _{lb/hr} Emission rate (lb/hr)	<2.89E-01	<2.62E-01	<3.03E-01	<2.85E-01
Acrolein Results				
m Matter collected (µg)	<11.1000	<10.0000	<11.3000	
n _{RL} Number of fractions below reporting limit	3 out of 3	3 out of 3	3 out of 3	
DLC Detection limit classification	BDL	BDL	BDL	
C _{sd} Concentration (µg/dscm)	<5.86E+02	<5.27E+02	<5.83E+02	<5.65E+02
C _{sd} Concentration (lb/dscf)	<3.66E-08	<3.29E-08	<3.64E-08	<3.53E-08
E _{lb/hr} Emission rate (lb/hr)	<2.89E-01	<2.62E-01	<3.03E-01	<2.85E-01
Acetone Results				
m Matter collected (µg)	147.3920	62.0840	115.5630	
n _{RL} Number of fractions below reporting limit	0 out of 3	0 out of 3	0 out of 3	
DLC Detection limit classification	ADL	ADL	ADL	
C _{sd} Concentration (µg/dscm)	7.78E+03	3.27E+03	5.96E+03	5.67E+03
C _{sd} Concentration (lb/dscf)	4.86E-07	2.04E-07	3.72E-07	3.54E-07
E _{lb/hr} Emission rate (lb/hr)	3.84E+00	1.63E+00	3.10E+00	2.86E+00

RESULTS**2-2****Table 2-1, Continued:
VOC Results – Mod. M-18 (Midget Impinger Method)**

Run No.	1A	2A	3A	Average
Date (2007)	Jul 13	Jul 13	Jul 14	
Start Time (approx.)	09:36	16:15	08:55	
Stop Time (approx.)	10:56	17:35	10:15	
Sampling Conditions				
O ₂ Oxygen (dry volume %) ¹	3.9	3.9	4.6	4.1
T _s Sample temperature (°F) ¹	147	147	147	147
B _w Actual water vapor in gas (% by volume) ¹	23.6	23.9	23.7	23.7
Q _{std} Volumetric flow rate, dry standard (dscfm) ¹	131,944	132,914	138,738	134,532
¹ Data obtained from concurrent SW-846 0011 run.				
Sampling Results				
V _{metd-m} Volume metered, standard (dsl)	18.9512	18.9704	19.3793	19.1003
V _{metd-m} Volume metered, standard (dscm)	0.0190	0.0190	0.0194	0.0191
V _{metd-E} Volume metered, standard (dscf)	0.6693	0.6699	0.6844	0.6745
Acetonitrile Results				
m Matter collected (µg)	<11.1000	<10.0000	<11.3000	
n _{RL} Number of fractions below reporting limit	3 out of 3	3 out of 3	3 out of 3	
DLC Detection limit classification	BDL	BDL	BDL	
C _{sd} Concentration (µg/dscm)	<5.86E+02	<5.27E+02	<5.83E+02	<5.65E+02
C _{sd} Concentration (lb/dscf)	<3.66E-08	<3.29E-08	<3.64E-08	<3.53E-08
E _{lb/hr} Emission rate (lb/hr)	<2.89E-01	<2.62E-01	<3.03E-01	<2.85E-01
Carbon disulfide Results				
m Matter collected (µg)	<11.1000	<10.0000	<11.3000	
n _{RL} Number of fractions below reporting limit	3 out of 3	3 out of 3	3 out of 3	
DLC Detection limit classification	BDL	BDL	BDL	
C _{sd} Concentration (µg/dscm)	<5.86E+02	<5.27E+02	<5.83E+02	<5.65E+02
C _{sd} Concentration (lb/dscf)	<3.66E-08	<3.29E-08	<3.64E-08	<3.53E-08
E _{lb/hr} Emission rate (lb/hr)	<2.89E-01	<2.62E-01	<3.03E-01	<2.85E-01
Methylene chloride Results				
m Matter collected (µg)	15.2250	11.8140	14.4030	
n _{RL} Number of fractions below reporting limit	0 out of 3	0 out of 3	0 out of 3	
DLC Detection limit classification	ADL	ADL	ADL	
C _{sd} Concentration (µg/dscm)	8.03E+02	6.23E+02	7.43E+02	7.23E+02
C _{sd} Concentration (lb/dscf)	5.02E-08	3.89E-08	4.64E-08	4.51E-08
E _{lb/hr} Emission rate (lb/hr)	3.97E-01	3.10E-01	3.86E-01	3.64E-01
Acrylonitrile Results				
m Matter collected (µg)	<11.1000	<10.0000	<11.3000	
n _{RL} Number of fractions below reporting limit	3 out of 3	3 out of 3	3 out of 3	
DLC Detection limit classification	BDL	BDL	BDL	
C _{sd} Concentration (µg/dscm)	<5.86E+02	<5.27E+02	<5.83E+02	<5.65E+02
C _{sd} Concentration (lb/dscf)	<3.66E-08	<3.29E-08	<3.64E-08	<3.53E-08
E _{lb/hr} Emission rate (lb/hr)	<2.89E-01	<2.62E-01	<3.03E-01	<2.85E-01

RESULTS**2-3****Table 2-1, Continued:
VOC Results – Mod. M-18 (Midget Impinger Method)**

Run No.	1A	2A	3A	Average
Date (2007)	Jul 13	Jul 13	Jul 14	
Start Time (approx.)	09:36	16:15	08:55	
Stop Time (approx.)	10:56	17:35	10:15	
Sampling Conditions				
O ₂ Oxygen (dry volume %) ¹	3.9	3.9	4.6	4.1
T _s Sample temperature (°F) ¹	147	147	147	147
B _w Actual water vapor in gas (% by volume) ¹	23.6	23.9	23.7	23.7
Q _{std} Volumetric flow rate, dry standard (dscfm) ¹	131,944	132,914	138,738	134,532
¹ Data obtained from concurrent SW-846 0011 run.				
Sampling Results				
V _{metd-m} Volume metered, standard (dsl)	18.9512	18.9704	19.3793	19.1003
V _{metd-m} Volume metered, standard (dscm)	0.0190	0.0190	0.0194	0.0191
V _{metd-E} Volume metered, standard (dscf)	0.6693	0.6699	0.6844	0.6745
Methyl t-butyl ether Results				
m Matter collected (µg)	<11.1000	<10.0000	<11.3000	
n _{RL} Number of fractions below reporting limit	3 out of 3	3 out of 3	3 out of 3	
DLC Detection limit classification	BDL	BDL	BDL	
C _{sd} Concentration (µg/dscm)	<5.86E+02	<5.27E+02	<5.83E+02	<5.65E+02
C _{sd} Concentration (lb/dscf)	<3.66E-08	<3.29E-08	<3.64E-08	<3.53E-08
E _{lb/hr} Emission rate (lb/hr)	<2.89E-01	<2.62E-01	<3.03E-01	<2.85E-01
Hexane Results				
m Matter collected (µg)	<11.1000	<10.0000	<11.3000	
n _{RL} Number of fractions below reporting limit	3 out of 3	3 out of 3	3 out of 3	
DLC Detection limit classification	BDL	BDL	BDL	
C _{sd} Concentration (µg/dscm)	<5.86E+02	<5.27E+02	<5.83E+02	<5.65E+02
C _{sd} Concentration (lb/dscf)	<3.66E-08	<3.29E-08	<3.64E-08	<3.53E-08
E _{lb/hr} Emission rate (lb/hr)	<2.89E-01	<2.62E-01	<3.03E-01	<2.85E-01
2,2,4 Trimethylpentane Results				
m Matter collected (µg)	<11.1000	<10.0000	<11.3000	
n _{RL} Number of fractions below reporting limit	3 out of 3	3 out of 3	3 out of 3	
DLC Detection limit classification	BDL	BDL	BDL	
C _{sd} Concentration (µg/dscm)	<5.86E+02	<5.27E+02	<5.83E+02	<5.65E+02
C _{sd} Concentration (lb/dscf)	<3.66E-08	<3.29E-08	<3.64E-08	<3.53E-08
E _{lb/hr} Emission rate (lb/hr)	<2.89E-01	<2.62E-01	<3.03E-01	<2.85E-01
Benzene Results				
m Matter collected (µg)	<11.1000	<10.0000	<11.3000	
n _{RL} Number of fractions below reporting limit	3 out of 3	3 out of 3	3 out of 3	
DLC Detection limit classification	BDL	BDL	BDL	
C _{sd} Concentration (µg/dscm)	<5.86E+02	<5.27E+02	<5.83E+02	<5.65E+02
C _{sd} Concentration (lb/dscf)	<3.66E-08	<3.29E-08	<3.64E-08	<3.53E-08
E _{lb/hr} Emission rate (lb/hr)	<2.89E-01	<2.62E-01	<3.03E-01	<2.85E-01

RESULTS**Table 2-1, Continued:
VOC Results – Mod. M-18 (Midget Impinger Method)**

Run No.	1A	2A	3A	Average
Date (2007)	Jul 13	Jul 13	Jul 14	
Start Time (approx.)	09:36	16:15	08:55	
Stop Time (approx.)	10:56	17:35	10:15	
Sampling Conditions				
O ₂ Oxygen (dry volume %) ¹	3.9	3.9	4.6	4.1
T _s Sample temperature (°F) ¹	147	147	147	147
B _w Actual water vapor in gas (% by volume) ¹	23.6	23.9	23.7	23.7
Q _{std} Volumetric flow rate, dry standard (dscfm) ¹	131,944	132,914	138,738	134,532
¹ Data obtained from concurrent SW-846 0011 run.				
Sampling Results				
V _{metd-m} Volume metered, standard (dsl)	18.9512	18.9704	19.3793	19.1003
V _{metd-m} Volume metered, standard (dscm)	0.0190	0.0190	0.0194	0.0191
V _{metd-E} Volume metered, standard (dscf)	0.6693	0.6699	0.6844	0.6745
Trichloroethene Results				
m Matter collected (µg)	<11.1000	<10.0000	<11.3000	
n _{RL} Number of fractions below reporting limit	3 out of 3	3 out of 3	3 out of 3	
DLC Detection limit classification	BDL	BDL	BDL	
C _{sd} Concentration (µg/dscm)	<5.86E+02	<5.27E+02	<5.83E+02	<5.65E+02
C _{sd} Concentration (lb/dscf)	<3.66E-08	<3.29E-08	<3.64E-08	<3.53E-08
E _{lb/hr} Emission rate (lb/hr)	<2.89E-01	<2.62E-01	<3.03E-01	<2.85E-01
2-Nitropropane Results				
m Matter collected (µg)	<11.1000	<10.0000	<11.3000	
n _{RL} Number of fractions below reporting limit	3 out of 3	3 out of 3	3 out of 3	
DLC Detection limit classification	BDL	BDL	BDL	
C _{sd} Concentration (µg/dscm)	<5.86E+02	<5.27E+02	<5.83E+02	<5.65E+02
C _{sd} Concentration (lb/dscf)	<3.66E-08	<3.29E-08	<3.64E-08	<3.53E-08
E _{lb/hr} Emission rate (lb/hr)	<2.89E-01	<2.62E-01	<3.03E-01	<2.85E-01
Methyl isobutyl ketone Results				
m Matter collected (µg)	<11.1000	<10.0000	<11.3000	
n _{RL} Number of fractions below reporting limit	3 out of 3	3 out of 3	3 out of 3	
DLC Detection limit classification	BDL	BDL	BDL	
C _{sd} Concentration (µg/dscm)	<5.86E+02	<5.27E+02	<5.83E+02	<5.65E+02
C _{sd} Concentration (lb/dscf)	<3.66E-08	<3.29E-08	<3.64E-08	<3.53E-08
E _{lb/hr} Emission rate (lb/hr)	<2.89E-01	<2.62E-01	<3.03E-01	<2.85E-01
Toluene Results				
m Matter collected (µg)	<11.1000	<10.0000	<11.3000	
n _{RL} Number of fractions below reporting limit	3 out of 3	3 out of 3	3 out of 3	
DLC Detection limit classification	BDL	BDL	BDL	
C _{sd} Concentration (µg/dscm)	<5.86E+02	<5.27E+02	<5.83E+02	<5.65E+02
C _{sd} Concentration (lb/dscf)	<3.66E-08	<3.29E-08	<3.64E-08	<3.53E-08
E _{lb/hr} Emission rate (lb/hr)	<2.89E-01	<2.62E-01	<3.03E-01	<2.85E-01

RESULTS**2-5****Table 2-1, Continued:
VOC Results – Mod. M-18 (Midget Impinger Method)**

Run No.	1A	2A	3A	Average
Date (2007)	Jul 13	Jul 13	Jul 14	
Start Time (approx.)	09:36	16:15	08:55	
Stop Time (approx.)	10:56	17:35	10:15	
Sampling Conditions				
O ₂ Oxygen (dry volume %) ¹	3.9	3.9	4.6	4.1
T _s Sample temperature (°F) ¹	147	147	147	147
B _w Actual water vapor in gas (% by volume) ¹	23.6	23.9	23.7	23.7
Q _{std} Volumetric flow rate, dry standard (dscfm) ¹	131,944	132,914	138,738	134,532
¹ Data obtained from concurrent SW-846 0011 run.				
Sampling Results				
V _{metd-m} Volume metered, standard (dsl)	18.9512	18.9704	19.3793	19.1003
V _{metd-m} Volume metered, standard (dscm)	0.0190	0.0190	0.0194	0.0191
V _{metd-E} Volume metered, standard (dscf)	0.6693	0.6699	0.6844	0.6745
Tetrachloroethene Results				
m Matter collected (µg)	<11.1000	<10.0000	<11.3000	
n _{RL} Number of fractions below reporting limit	3 out of 3	3 out of 3	3 out of 3	
DLC Detection limit classification	BDL	BDL	BDL	
C _{sd} Concentration (µg/dscm)	<5.86E+02	<5.27E+02	<5.83E+02	<5.65E+02
C _{sd} Concentration (lb/dscf)	<3.66E-08	<3.29E-08	<3.64E-08	<3.53E-08
E _{lb/hr} Emission rate (lb/hr)	<2.89E-01	<2.62E-01	<3.03E-01	<2.85E-01
1,2-Dibromoethane Results				
m Matter collected (µg)	<11.1000	<10.0000	<11.3000	
n _{RL} Number of fractions below reporting limit	3 out of 3	3 out of 3	3 out of 3	
DLC Detection limit classification	BDL	BDL	BDL	
C _{sd} Concentration (µg/dscm)	<5.86E+02	<5.27E+02	<5.83E+02	<5.65E+02
C _{sd} Concentration (lb/dscf)	<3.66E-08	<3.29E-08	<3.64E-08	<3.53E-08
E _{lb/hr} Emission rate (lb/hr)	<2.89E-01	<2.62E-01	<3.03E-01	<2.85E-01
Chlorobenzene Results				
m Matter collected (µg)	<11.1000	<10.0000	<11.3000	
n _{RL} Number of fractions below reporting limit	3 out of 3	3 out of 3	3 out of 3	
DLC Detection limit classification	BDL	BDL	BDL	
C _{sd} Concentration (µg/dscm)	<5.86E+02	<5.27E+02	<5.83E+02	<5.65E+02
C _{sd} Concentration (lb/dscf)	<3.66E-08	<3.29E-08	<3.64E-08	<3.53E-08
E _{lb/hr} Emission rate (lb/hr)	<2.89E-01	<2.62E-01	<3.03E-01	<2.85E-01
Ethylbenzene Results				
m Matter collected (µg)	<11.1000	<10.0000	<11.3000	
n _{RL} Number of fractions below reporting limit	3 out of 3	3 out of 3	3 out of 3	
DLC Detection limit classification	BDL	BDL	BDL	
C _{sd} Concentration (µg/dscm)	<5.86E+02	<5.27E+02	<5.83E+02	<5.65E+02
C _{sd} Concentration (lb/dscf)	<3.66E-08	<3.29E-08	<3.64E-08	<3.53E-08
E _{lb/hr} Emission rate (lb/hr)	<2.89E-01	<2.62E-01	<3.03E-01	<2.85E-01

RESULTS**2-6****Table 2-1, Continued:
VOC Results – Mod. M-18 (Midget Impinger Method)**

Run No.	1A	2A	3A	Average
Date (2007)	Jul 13	Jul 13	Jul 14	
Start Time (approx.)	09:36	16:15	08:55	
Stop Time (approx.)	10:56	17:35	10:15	
Sampling Conditions				
O ₂ Oxygen (dry volume %) ¹	3.9	3.9	4.6	4.1
T _s Sample temperature (°F) ¹	147	147	147	147
B _w Actual water vapor in gas (% by volume) ¹	23.6	23.9	23.7	23.7
Q _{std} Volumetric flow rate, dry standard (dscfm) ¹	131,944	132,914	138,738	134,532
¹ Data obtained from concurrent SW-846 0011 run.				
Sampling Results				
V _{metd-m} Volume metered, standard (dsl)	18.9512	18.9704	19.3793	19.1003
V _{metd-m} Volume metered, standard (dscm)	0.0190	0.0190	0.0194	0.0191
V _{metd-E} Volume metered, standard (dscf)	0.6693	0.6699	0.6844	0.6745
m,p-Xylenes Results				
m Matter collected (µg)	<11.1000	<10.0000	<11.3000	
n _{RL} Number of fractions below reporting limit	3 out of 3	3 out of 3	3 out of 3	
DLC Detection limit classification	BDL	BDL	BDL	
C _{sd} Concentration (µg/dscm)	<5.86E+02	<5.27E+02	<5.83E+02	<5.65E+02
C _{sd} Concentration (lb/dscf)	<3.66E-08	<3.29E-08	<3.64E-08	<3.53E-08
E _{lb/hr} Emission rate (lb/hr)	<2.89E-01	<2.62E-01	<3.03E-01	<2.85E-01
o-Xylene Results				
m Matter collected (µg)	<11.1000	<10.0000	<11.3000	
n _{RL} Number of fractions below reporting limit	3 out of 3	3 out of 3	3 out of 3	
DLC Detection limit classification	BDL	BDL	BDL	
C _{sd} Concentration (µg/dscm)	<5.86E+02	<5.27E+02	<5.83E+02	<5.65E+02
C _{sd} Concentration (lb/dscf)	<3.66E-08	<3.29E-08	<3.64E-08	<3.53E-08
E _{lb/hr} Emission rate (lb/hr)	<2.89E-01	<2.62E-01	<3.03E-01	<2.85E-01
Styrene Results				
m Matter collected (µg)	<11.1000	<10.0000	<11.3000	
n _{RL} Number of fractions below reporting limit	3 out of 3	3 out of 3	3 out of 3	
DLC Detection limit classification	BDL	BDL	BDL	
C _{sd} Concentration (µg/dscm)	<5.86E+02	<5.27E+02	<5.83E+02	<5.65E+02
C _{sd} Concentration (lb/dscf)	<3.66E-08	<3.29E-08	<3.64E-08	<3.53E-08
E _{lb/hr} Emission rate (lb/hr)	<2.89E-01	<2.62E-01	<3.03E-01	<2.85E-01
Cumene Results				
m Matter collected (µg)	<11.1000	<10.0000	<11.3000	
n _{RL} Number of fractions below reporting limit	3 out of 3	3 out of 3	3 out of 3	
DLC Detection limit classification	BDL	BDL	BDL	
C _{sd} Concentration (µg/dscm)	<5.86E+02	<5.27E+02	<5.83E+02	<5.65E+02
C _{sd} Concentration (lb/dscf)	<3.66E-08	<3.29E-08	<3.64E-08	<3.53E-08
E _{lb/hr} Emission rate (lb/hr)	<2.89E-01	<2.62E-01	<3.03E-01	<2.85E-01

RESULTS**2-7****Table 2-1, Continued:
VOC Results – Mod. M-18 (Midget Impinger Method)**

Run No.		1A	2A	3A	Average
Date (2007)		Jul 13	Jul 13	Jul 14	
Start Time (approx.)		09:36	16:15	08:55	
Stop Time (approx.)		10:56	17:35	10:15	
Sampling Conditions					
O ₂	Oxygen (dry volume %) ¹	3.9	3.9	4.6	4.1
T _s	Sample temperature (°F) ¹	147	147	147	147
B _w	Actual water vapor in gas (% by volume) ¹	23.6	23.9	23.7	23.7
Q _{std}	Volumetric flow rate, dry standard (dscfm) ¹	131,944	132,914	138,738	134,532
¹ Data obtained from concurrent SW-846 0011 run.					
Sampling Results					
V _{mstd-m}	Volume metered, standard (dsl)	18.9512	18.9704	19.3793	19.1003
V _{mstd-m}	Volume metered, standard (dscm)	0.0190	0.0190	0.0194	0.0191
V _{mstd-E}	Volume metered, standard (dscf)	0.6693	0.6699	0.6844	0.6745
Nitrobenzene Results					
m	Matter collected (µg)	<55.5000	<50.0000	<56.5000	
n _{RL}	Number of fractions below reporting limit	3 out of 3	3 out of 3	3 out of 3	
DLC	Detection limit classification	BDL	BDL	BDL	
C _{sd}	Concentration (µg/dscm)	<2.93E+03	<2.64E+03	<2.92E+03	<2.83E+03
C _{sd}	Concentration (lb/dscf)	<1.83E-07	<1.65E-07	<1.82E-07	<1.76E-07
E _{lb/hr}	Emission rate (lb/hr)	<1.45E+00	<1.31E+00	<1.52E+00	<1.42E+00

RESULTS**2-8****Table 2-2:
CH₃OH Results – M-18 (Adsorption Tube Procedure)**

Run No.		1A	2A	3A	Average
Date (2007)		Jul 13	Jul 13	Jul 14	
Start Time (approx.)		11:53	14:40	10:55	
Stop Time (approx.)		13:13	16:00	12:15	
Sampling Conditions					
O ₂	Oxygen (dry volume %) ¹	3.9	3.9	4.6	4.1
T _s	Sample temperature (°F) ¹	147	147	147	147
B _w	Actual water vapor in gas (% by volume) ¹	23.6	23.9	23.7	23.7
Q _{std}	Volumetric flow rate, dry standard (dscfm) ¹	131,944	132,914	138,738	134,532
¹ Data obtained from concurrent SW-846 0011 run.					
Sampling Results					
V _{mstd-m}	Volume metered, standard (dsl)	19.1810	18.8829	19.1060	19.0566
V _{mstd-m}	Volume metered, standard (dscm)	0.0192	0.0189	0.0191	0.0191
V _{mstd-E}	Volume metered, standard (dscf)	0.6774	0.6668	0.6747	0.6730
Methanol Results					
m	Matter collected (µg)	224.8000	255.4000	385.3000	
n _{RL}	Number of fractions below reporting limit	1 out of 3	1 out of 3	1 out of 3	
DLC	Detection limit classification	DLL	DLL	DLL	
C _{sd}	Concentration (µg/dscm)	1.17E+04	1.35E+04	2.02E+04	1.51E+04
C _{sd}	Concentration (lb/dscf)	7.32E-07	8.44E-07	1.26E-06	9.45E-07
E _{lb/hr}	Emission rate (lb/hr)	5.79E+00	6.73E+00	1.05E+01	7.67E+00

RESULTS

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**Table 2-3:
Aldehyde Results – SW-846 M-0011**

Run No.	1	2	3	Average
Date (2011)	Jul 13	Jul 13	Jul 14	
Start Time (approx.)	09:55	13:16	08:56	
Stop Time (approx.)	12:02	15:36	11:09	
Gas Conditions				
O ₂ Oxygen (dry volume %)	3.9	3.9	4.6	4.1
CO ₂ Carbon dioxide (dry volume %)	13.1	13.2	12.5	12.9
T _s Sample temperature (°F)	147	147	147	147
B _w Actual water vapor in gas (% by volume)	23.6	23.9	23.7	23.7
Gas Flow Rate				
Q _a Volumetric flow rate, actual (acfm)	202,165	204,537	212,728	206,477
Q _s Volumetric flow rate, standard (scfm)	172,767	174,662	181,736	176,388
Q _{std} Volumetric flow rate, dry standard (dscfm)	131,944	132,914	138,738	134,532
Sampling Data				
V _{mstd} Volume metered, standard (dscf)	74.95	72.83	67.21	71.66
%I Isokinetic sampling (%)	98.5	95.0	96.7	96.7
Laboratory Data				
m _n Total CH ₂ O collected (mg)	0.00913	0.01180	0.00432	
m _n Total CH ₃ CHO collected (mg)	0.01420	0.01910	0.01080	
m _n Total CH ₃ CH ₂ CHO collected (mg)	0.00832	0.01510	0.01060	
Formaldehyde (CH₂O) Results				
C _{sd} CH ₂ O Concentration (lb/dscf)	2.69E-10	3.57E-10	1.42E-10	2.56E-10
C _{sd} CH ₂ O Concentration (ppmdv)	3.45E-03	4.59E-03	1.82E-03	3.28E-03
C _{sd} CH ₂ O Concentration (µg/dscm)	4.30	5.72	2.27	4.10
E _{lb/hr} CH ₂ O Rate (lb/hr)	2.13E-03	2.85E-03	1.18E-03	2.05E-03
Acetaldehyde (CH₃CHO) Results				
C _{sd} CH ₃ CHO Concentration (lb/dscf)	4.18E-10	5.78E-10	3.54E-10	4.50E-10
C _{sd} CH ₃ CHO Concentration (ppmdv)	3.66E-03	5.06E-03	3.10E-03	3.94E-03
C _{sd} CH ₃ CHO Concentration (µg/dscm)	6.69	9.26	5.67	7.21
E _{lb/hr} CH ₃ CHO Rate (lb/hr)	3.31E-03	4.61E-03	2.95E-03	3.62E-03
Propanal (CH₃CH₂CHO) Results				
C _{sd} CH ₃ CH ₂ CHO Concentration (lb/dscf)	2.45E-10	4.57E-10	3.48E-10	3.50E-10
C _{sd} CH ₃ CH ₂ CHO Concentration (ppmdv)	1.62E-03	3.03E-03	2.31E-03	2.32E-03
C _{sd} CH ₃ CH ₂ CHO Concentration (µg/dscm)	3.92	7.32	5.6	5.60
E _{lb/hr} CH ₃ CH ₂ CHO Rate (lb/hr)	1.94E-03	3.65E-03	2.89E-03	2.83E-03

RESULTS**2-10****Table 2-4:
SVOC Results – SW-846 M-0010**

Run No.		1	2	3	Average
Date (2011)		Jul 15	Jul 15	Jul 16	
Start Time (approx.)		08:57	15:55	08:36	
Stop Time (approx.)		14:49	20:55	12:59	
Gas Conditions					
O ₂	Oxygen (dry volume %)	4.1	3.8	3.4	3.8
CO ₂	Carbon dioxide (dry volume %)	13.0	13.4	13.9	13.4
T _s	Sample temperature (°F)	147	147	147	147
B _w	Actual water vapor in gas (% by volume)	23.9	23.9	23.9	23.9
Gas Flow Rate					
Q _a	Volumetric flow rate, actual (acfm)	205,434	204,717	205,097	205,083
Q _s	Volumetric flow rate, standard (scfm)	175,472	174,835	175,420	175,242
Q _{std}	Volumetric flow rate, dry standard (dscfm)	133,541	132,969	133,497	133,336
Sampling Data					
V _{mstd}	Volume metered, standard (dscf)	149.91	147.73	149.77	149.14
%I	Isokinetic sampling (%)	97.3	96.3	97.3	97.0
Aniline Results					
m _n	Net Weight (ng)	<1.80E+03	<1.80E+03	<1.80E+03	
C _{sd}	Concentration (ug/dscm)	<4.24E-01	<4.30E-01	<4.24E-01	<4.26E-01
E _{lb/hr}	Emissions Rate (lb/hr)	<2.12E-04	<2.14E-04	<2.12E-04	<2.13E-04
Phenol Results					
m _n	Net Weight (ng)	<2.30E+04	<2.00E+04	<8.80E+03	
C _{sd}	Concentration (ug/dscm)	<5.42E+00	<4.78E+00	<2.07E+00	<4.09E+00
E _{lb/hr}	Emissions Rate (lb/hr)	<2.71E-03	<2.38E-03	<1.04E-03	<2.04E-03
2-Methylphenol Results					
m _n	Net Weight (ng)	<2.10E+03	<2.10E+03	<2.10E+03	
C _{sd}	Concentration (ug/dscm)	<4.95E-01	<5.02E-01	<4.95E-01	<4.97E-01
E _{lb/hr}	Emissions Rate (lb/hr)	<2.47E-04	<2.50E-04	<2.48E-04	<2.48E-04
4-Methylphenol & 3-Methylphenol Results					
m _n	Net Weight (ng)	<5.60E+03	<5.60E+03	<5.60E+03	
C _{sd}	Concentration (ug/dscm)	<1.32E+00	<1.34E+00	<1.32E+00	<1.33E+00
E _{lb/hr}	Emissions Rate (lb/hr)	<6.60E-04	<6.67E-04	<6.60E-04	<6.62E-04
o-Toluidine Results					
m _n	Net Weight (ng)	<5.00E+03	<5.00E+03	<5.00E+03	
C _{sd}	Concentration (ug/dscm)	<1.18E+00	<1.20E+00	<1.18E+00	<1.18E+00
E _{lb/hr}	Emissions Rate (lb/hr)	<5.89E-04	<5.95E-04	<5.90E-04	<5.91E-04

RESULTS**2-11****Table 2-4, Continued:
SVOC Results – SW-846 M-0010**

Run No.		1	2	3	Average
Date (2011)		Jul 15	Jul 15	Jul 16	
Start Time (approx.)		08:57	15:55	08:36	
Stop Time (approx.)		14:49	20:55	12:59	
Gas Conditions					
O ₂	Oxygen (dry volume %)	4.1	3.8	3.4	3.8
CO ₂	Carbon dioxide (dry volume %)	13.0	13.4	13.9	13.4
T _s	Sample temperature (°F)	147	147	147	147
B _w	Actual water vapor in gas (% by volume)	23.9	23.9	23.9	23.9
Gas Flow Rate					
Q _a	Volumetric flow rate, actual (acfm)	205,434	204,717	205,097	205,083
Q _s	Volumetric flow rate, standard (scfm)	175,472	174,835	175,420	175,242
Q _{std}	Volumetric flow rate, dry standard (dscfm)	133,541	132,969	133,497	133,336
Sampling Data					
V _{mstd}	Volume metered, standard (dscf)	149.91	147.73	149.77	149.14
%I	Isokinetic sampling (%)	97.3	96.3	97.3	97.0
Isophorone Results					
m _n	Net Weight (ng)	<2.20E+03	<2.20E+03	<2.20E+03	
C _{sd}	Concentration (ug/dscm)	<5.18E-01	<5.26E-01	<5.19E-01	<5.21E-01
E _{lb/hr}	Emissions Rate (lb/hr)	<2.59E-04	<2.62E-04	<2.59E-04	<2.60E-04
2,4-Dimethylphenol Results					
m _n	Net Weight (ng)	<2.60E+03	<2.60E+03	<2.60E+03	
C _{sd}	Concentration (ug/dscm)	<6.12E-01	<6.21E-01	<6.13E-01	<6.16E-01
E _{lb/hr}	Emissions Rate (lb/hr)	<3.06E-04	<3.10E-04	<3.07E-04	<3.08E-04
Dibenzofuran Results					
m _n	Net Weight (ng)	2.85E+03	3.20E+03	3.30E+03	
C _{sd}	Concentration (ug/dscm)	6.71E-01	7.65E-01	7.78E-01	7.38E-01
E _{lb/hr}	Emissions Rate (lb/hr)	3.36E-04	3.81E-04	3.89E-04	3.69E-04
α,α-Dimethylphenethylamine Results					
m _n	Net Weight (ng)	<1.20E+04	<1.20E+04	<1.20E+04	
C _{sd}	Concentration (ug/dscm)	<2.83E+00	<2.87E+00	<2.83E+00	<2.84E+00
E _{lb/hr}	Emissions Rate (lb/hr)	<1.41E-03	<1.43E-03	<1.42E-03	<1.42E-03
1,4-Phenylenediamine Results					
m _n	Net Weight (ng)	<1.80E+04	<1.80E+04	<1.80E+04	
C _{sd}	Concentration (ug/dscm)	<4.24E+00	<4.30E+00	<4.24E+00	<4.26E+00
E _{lb/hr}	Emissions Rate (lb/hr)	<2.12E-03	<2.14E-03	<2.12E-03	<2.13E-03

RESULTS**2-12****Table 2-4, Continued:
SVOC Results – SW-846 M-0010**

Run No.		1	2	3	Average
Date (2011)		Jul 15	Jul 15	Jul 16	
Start Time (approx.)		08:57	15:55	08:36	
Stop Time (approx.)		14:49	20:55	12:59	
Gas Conditions					
O ₂	Oxygen (dry volume %)	4.1	3.8	3.4	3.8
CO ₂	Carbon dioxide (dry volume %)	13.0	13.4	13.9	13.4
T _s	Sample temperature (°F)	147	147	147	147
B _w	Actual water vapor in gas (% by volume)	23.9	23.9	23.9	23.9
Gas Flow Rate					
Q _a	Volumetric flow rate, actual (acfm)	205,434	204,717	205,097	205,083
Q _s	Volumetric flow rate, standard (scfm)	175,472	174,835	175,420	175,242
Q _{std}	Volumetric flow rate, dry standard (dscfm)	133,541	132,969	133,497	133,336
Sampling Data					
V _{mstd}	Volume metered, standard (dscf)	149.91	147.73	149.77	149.14
%I	Isokinetic sampling (%)	97.3	96.3	97.3	97.0
Benzidine Results					
m _n	Net Weight (ng)	<3.80E+04	<3.80E+04	<3.80E+04	
C _{sd}	Concentration (ug/dscm)	<8.95E+00	<9.08E+00	<8.96E+00	<9.00E+00
E _{lb/hr}	Emissions Rate (lb/hr)	<4.48E-03	<4.52E-03	<4.48E-03	<4.49E-03
Dimethylaminobenzene Results					
m _n	Net Weight (ng)	<2.00E+03	<2.00E+03	<2.00E+03	
C _{sd}	Concentration (ug/dscm)	<4.71E-01	<4.78E-01	<4.72E-01	<4.74E-01
E _{lb/hr}	Emissions Rate (lb/hr)	<2.36E-04	<2.38E-04	<2.36E-04	<2.37E-04
3,3'-Dimethylbenzidine Results					
m _n	Net Weight (ng)	<2.90E+04	<2.90E+04	<2.90E+04	
C _{sd}	Concentration (ug/dscm)	<6.83E+00	<6.93E+00	<6.84E+00	<6.87E+00
E _{lb/hr}	Emissions Rate (lb/hr)	<3.42E-03	<3.45E-03	<3.42E-03	<3.43E-03
3,3'-Dimethoxybenzidine Results					
m _n	Net Weight (ng)	<2.90E+04	<2.90E+04	<2.90E+04	
C _{sd}	Concentration (ug/dscm)	<6.83E+00	<6.93E+00	<6.84E+00	<6.87E+00
E _{lb/hr}	Emissions Rate (lb/hr)	<3.42E-03	<3.45E-03	<3.42E-03	<3.43E-03
Total SVOCs* Results					
m _n	Net Weight (ng)	<1.73E+05	<1.71E+05	<1.59E+05	
C _{sd}	Concentration (ug/dscm)	<4.08E+01	<4.08E+01	<3.76E+01	<3.97E+01
E _{lb/hr}	Emissions Rate (lb/hr)	<2.04E-02	<2.03E-02	<1.88E-02	<1.98E-02

* Total SVOCs are calculated using the full detection limit for results below the detection limit.

RESULTS**2-13****Table 2-5:
PAH Results – SW-846 M-0010**

Run No.		1	2	3	Average
Date (2011)		Jul 15	Jul 15	Jul 16	
Start Time (approx.)		08:57	15:55	08:36	
Stop Time (approx.)		14:49	20:55	12:59	
Gas Conditions					
O ₂	Oxygen (dry volume %)	4.1	3.8	3.4	3.8
CO ₂	Carbon dioxide (dry volume %)	13.0	13.4	13.9	13.4
T _s	Sample temperature (°F)	147	147	147	147
B _w	Actual water vapor in gas (% by volume)	23.9	23.9	23.9	23.9
Gas Flow Rate					
Q _a	Volumetric flow rate, actual (acfm)	205,434	204,717	205,097	205,083
Q _s	Volumetric flow rate, standard (scfm)	175,472	174,835	175,420	175,242
Q _{std}	Volumetric flow rate, dry standard (dscfm)	133,541	132,969	133,497	133,336
Sampling Data					
V _{mstd}	Volume metered, standard (dscf)	149.91	147.73	149.77	149.14
%I	Isokinetic sampling (%)	97.3	96.3	97.3	97.0
Naphthalene Results					
m _n	Net Weight (ng)	3.61E+04	8.46E+04	8.03E+04	
C _{sd}	Concentration (ug/dscm)	8.50E+00	2.02E+01	1.89E+01	1.59E+01
E _{lb/hr}	Emissions Rate (lb/hr)	4.25E-03	1.01E-02	9.47E-03	7.93E-03
2-Methylnaphthalene Results					
m _n	Net Weight (ng)	2.76E+02	1.63E+02	1.80E+02	
C _{sd}	Concentration (ug/dscm)	6.50E-02	3.90E-02	4.24E-02	4.88E-02
E _{lb/hr}	Emissions Rate (lb/hr)	3.25E-05	1.94E-05	2.12E-05	2.44E-05
Acenaphthylene Results					
m _n	Net Weight (ng)	7.00E+01	7.76E+01	8.84E+01	
C _{sd}	Concentration (ug/dscm)	1.65E-02	1.85E-02	2.08E-02	1.86E-02
E _{lb/hr}	Emissions Rate (lb/hr)	8.25E-06	9.24E-06	1.04E-05	9.31E-06
Acenaphthene Results					
m _n	Net Weight (ng)	<1.20E+02	<3.10E+01	<3.90E+01	
C _{sd}	Concentration (ug/dscm)	<2.83E-02	<7.41E-03	<9.19E-03	<1.50E-02
E _{lb/hr}	Emissions Rate (lb/hr)	<1.41E-05	<3.69E-06	<4.60E-06	<7.48E-06
Fluorene Results					
m _n	Net Weight (ng)	<3.00E+02	<2.80E+02	<3.10E+02	
C _{sd}	Concentration (ug/dscm)	<7.07E-02	<6.69E-02	<7.31E-02	<7.02E-02
E _{lb/hr}	Emissions Rate (lb/hr)	<3.54E-05	<3.33E-05	<3.66E-05	<3.51E-05

RESULTS**2-14****Table 2-5, Continued:
PAH Results – SW-846 M-0010**

Run No.		1	2	3	Average
Date (2011)		Jul 15	Jul 15	Jul 16	
Start Time (approx.)		08:57	15:55	08:36	
Stop Time (approx.)		14:49	20:55	12:59	
Gas Conditions					
O ₂	Oxygen (dry volume %)	4.1	3.8	3.4	3.8
CO ₂	Carbon dioxide (dry volume %)	13.0	13.4	13.9	13.4
T _s	Sample temperature (°F)	147	147	147	147
B _w	Actual water vapor in gas (% by volume)	23.9	23.9	23.9	23.9
Gas Flow Rate					
Q _a	Volumetric flow rate, actual (acfm)	205,434	204,717	205,097	205,083
Q _s	Volumetric flow rate, standard (scfm)	175,472	174,835	175,420	175,242
Q _{std}	Volumetric flow rate, dry standard (dscfm)	133,541	132,969	133,497	133,336
Sampling Data					
V _{mstd}	Volume metered, standard (dscf)	149.91	147.73	149.77	149.14
%I	Isokinetic sampling (%)	97.3	96.3	97.3	97.0
Phenanthrene Results					
m _n	Net Weight (ng)	2.36E+03	2.78E+03	2.60E+03	
C _{sd}	Concentration (ug/dscm)	5.56E-01	6.64E-01	6.13E-01	6.11E-01
E _{lb/hr}	Emissions Rate (lb/hr)	2.78E-04	3.31E-04	3.07E-04	3.05E-04
Anthracene Results					
m _n	Net Weight (ng)	2.54E+01	2.98E+01	3.93E+01	
C _{sd}	Concentration (ug/dscm)	5.98E-03	7.12E-03	9.27E-03	7.46E-03
E _{lb/hr}	Emissions Rate (lb/hr)	2.99E-06	3.55E-06	4.63E-06	3.73E-06
Fluoranthene Results					
m _n	Net Weight (ng)	3.67E+02	4.44E+02	4.30E+02	
C _{sd}	Concentration (ug/dscm)	8.64E-02	1.06E-01	1.01E-01	9.80E-02
E _{lb/hr}	Emissions Rate (lb/hr)	4.33E-05	5.29E-05	5.07E-05	4.89E-05
Pyrene Results					
m _n	Net Weight (ng)	<1.80E+02	<2.40E+02	<2.10E+02	
C _{sd}	Concentration (ug/dscm)	<4.24E-02	<5.74E-02	<4.95E-02	<4.98E-02
E _{lb/hr}	Emissions Rate (lb/hr)	<2.12E-05	<2.86E-05	<2.48E-05	<2.49E-05
Benz[a]anthracene Results					
m _n	Net Weight (ng)	<4.60E+00	<5.70E+00	<7.00E+00	
C _{sd}	Concentration (ug/dscm)	<1.08E-03	<1.36E-03	<1.65E-03	<1.37E-03
E _{lb/hr}	Emissions Rate (lb/hr)	<5.42E-07	<6.79E-07	<8.25E-07	<6.82E-07

RESULTS**2-15****Table 2-5, Continued:
PAH Results – SW-846 M-0010**

Run No.		1	2	3	Average
Date (2011)		Jul 15	Jul 15	Jul 16	
Start Time (approx.)		08:57	15:55	08:36	
Stop Time (approx.)		14:49	20:55	12:59	
Gas Conditions					
O ₂	Oxygen (dry volume %)	4.1	3.8	3.4	3.8
CO ₂	Carbon dioxide (dry volume %)	13.0	13.4	13.9	13.4
T _s	Sample temperature (°F)	147	147	147	147
B _w	Actual water vapor in gas (% by volume)	23.9	23.9	23.9	23.9
Gas Flow Rate					
Q _a	Volumetric flow rate, actual (acfm)	205,434	204,717	205,097	205,083
Q _s	Volumetric flow rate, standard (scfm)	175,472	174,835	175,420	175,242
Q _{std}	Volumetric flow rate, dry standard (dscfm)	133,541	132,969	133,497	133,336
Sampling Data					
V _{mstd}	Volume metered, standard (dscf)	149.91	147.73	149.77	149.14
%I	Isokinetic sampling (%)	97.3	96.3	97.3	97.0
Chrysene/Triphenylene Results					
m _n	Net Weight (ng)	8.78E+01	1.10E+02	1.09E+02	
C _{sd}	Concentration (ug/dscm)	2.07E-02	2.63E-02	2.57E-02	2.42E-02
E _{lb/hr}	Emissions Rate (lb/hr)	1.03E-05	1.31E-05	1.29E-05	1.21E-05
Benzo[b]fluoranthene Results					
m _n	Net Weight (ng)	<2.70E+01	<4.00E+01	<4.10E+01	
C _{sd}	Concentration (ug/dscm)	<6.36E-03	<9.56E-03	<9.67E-03	<8.53E-03
E _{lb/hr}	Emissions Rate (lb/hr)	<3.18E-06	<4.76E-06	<4.83E-06	<4.26E-06
Benzo[k]fluoranthene Results					
m _n	Net Weight (ng)	7.86E+00	5.06E+00	<4.80E+00	
C _{sd}	Concentration (ug/dscm)	1.85E-03	1.21E-03	<1.13E-03	<1.40E-03
E _{lb/hr}	Emissions Rate (lb/hr)	9.26E-07	6.03E-07	<5.66E-07	<6.98E-07
Benzo[e]pyrene Results					
m _n	Net Weight (ng)	<1.60E+01	<1.20E+01	<1.30E+01	
C _{sd}	Concentration (ug/dscm)	<3.77E-03	<2.87E-03	<3.06E-03	<3.23E-03
E _{lb/hr}	Emissions Rate (lb/hr)	<1.89E-06	<1.43E-06	<1.53E-06	<1.62E-06
Benzo[a]pyrene Results					
m _n	Net Weight (ng)	<4.00E+00	<4.00E+00	<4.00E+00	
C _{sd}	Concentration (ug/dscm)	<9.42E-04	<9.56E-04	<9.43E-04	<9.47E-04
E _{lb/hr}	Emissions Rate (lb/hr)	<4.71E-07	<4.76E-07	<4.72E-07	<4.73E-07

RESULTS**2-16****Table 2-5, Continued:
PAH Results – SW-846 M-0010**

Run No.		1	2	3	Average
Date (2011)		Jul 15	Jul 15	Jul 16	
Start Time (approx.)		08:57	15:55	08:36	
Stop Time (approx.)		14:49	20:55	12:59	
Gas Conditions					
O ₂	Oxygen (dry volume %)	4.1	3.8	3.4	3.8
CO ₂	Carbon dioxide (dry volume %)	13.0	13.4	13.9	13.4
T _s	Sample temperature (°F)	147	147	147	147
B _w	Actual water vapor in gas (% by volume)	23.9	23.9	23.9	23.9
Gas Flow Rate					
Q _a	Volumetric flow rate, actual (acfm)	205,434	204,717	205,097	205,083
Q _s	Volumetric flow rate, standard (scfm)	175,472	174,835	175,420	175,242
Q _{std}	Volumetric flow rate, dry standard (dscfm)	133,541	132,969	133,497	133,336
Sampling Data					
V _{mstd}	Volume metered, standard (dscf)	149.91	147.73	149.77	149.14
%I	Isokinetic sampling (%)	97.3	96.3	97.3	97.0
Perylene Results					
m _n	Net Weight (ng)	<4.00E+00	<4.00E+00	<4.00E+00	
C _{sd}	Concentration (ug/dscm)	<9.42E-04	<9.56E-04	<9.43E-04	<9.47E-04
E _{lb/hr}	Emissions Rate (lb/hr)	<4.71E-07	<4.76E-07	<4.72E-07	<4.73E-07
Indeno[1,2,3-cd]pyrene Results					
m _n	Net Weight (ng)	<4.00E+00	<4.00E+00	<4.00E+00	
C _{sd}	Concentration (ug/dscm)	<9.42E-04	<9.56E-04	<9.43E-04	<9.47E-04
E _{lb/hr}	Emissions Rate (lb/hr)	<4.71E-07	<4.76E-07	<4.72E-07	<4.73E-07
Dibenzo[a,h]anthracene Results					
m _n	Net Weight (ng)	<4.00E+00	<4.00E+00	<4.00E+00	
C _{sd}	Concentration (ug/dscm)	<9.42E-04	<9.56E-04	<9.43E-04	<9.47E-04
E _{lb/hr}	Emissions Rate (lb/hr)	<4.71E-07	<4.76E-07	<4.72E-07	<4.73E-07
Benzo[g,h,i]perylene Results					
m _n	Net Weight (ng)	<4.00E+00	<4.00E+00	<4.00E+00	
C _{sd}	Concentration (ug/dscm)	<9.42E-04	<9.56E-04	<9.43E-04	<9.47E-04
E _{lb/hr}	Emissions Rate (lb/hr)	<4.71E-07	<4.76E-07	<4.72E-07	<4.73E-07
Biphenyl Results					
m _n	Net Weight (ng)	2.42E+03	2.59E+03	2.60E+03	
C _{sd}	Concentration (ug/dscm)	5.70E-01	6.19E-01	6.13E-01	6.01E-01
E _{lb/hr}	Emissions Rate (lb/hr)	2.85E-04	3.08E-04	3.07E-04	3.00E-04

RESULTS**2-17****Table 2-5, Continued:
PAH Results – SW-846 M-0010**

Run No.		1	2	3	Average
Date (2011)		Jul 15	Jul 15	Jul 16	
Start Time (approx.)		08:57	15:55	08:36	
Stop Time (approx.)		14:49	20:55	12:59	
Gas Conditions					
O ₂	Oxygen (dry volume %)	4.1	3.8	3.4	3.8
CO ₂	Carbon dioxide (dry volume %)	13.0	13.4	13.9	13.4
T _s	Sample temperature (°F)	147	147	147	147
B _w	Actual water vapor in gas (% by volume)	23.9	23.9	23.9	23.9
Gas Flow Rate					
Q _a	Volumetric flow rate, actual (acfm)	205,434	204,717	205,097	205,083
Q _s	Volumetric flow rate, standard (scfm)	175,472	174,835	175,420	175,242
Q _{std}	Volumetric flow rate, dry standard (dscfm)	133,541	132,969	133,497	133,336
Sampling Data					
V _{mstd}	Volume metered, standard (dscf)	149.91	147.73	149.77	149.14
%I	Isokinetic sampling (%)	97.3	96.3	97.3	97.0
7,12-Dimethylbenzo[a]anthracene Results					
m _n	Net Weight (ng)	<4.00E+00	<4.00E+00	<4.00E+00	
C _{sd}	Concentration (ug/dscm)	<9.42E-04	<9.56E-04	<9.43E-04	<9.47E-04
E _{lb/hr}	Emissions Rate (lb/hr)	<4.71E-07	<4.76E-07	<4.72E-07	<4.73E-07
3-Methylcholanthrene Results					
m _n	Net Weight (ng)	<4.00E+00	<4.00E+00	<4.00E+00	
C _{sd}	Concentration (ug/dscm)	<9.42E-04	<9.56E-04	<9.43E-04	<9.47E-04
E _{lb/hr}	Emissions Rate (lb/hr)	<4.71E-07	<4.76E-07	<4.72E-07	<4.73E-07
Dibenzo[a,e]pyrene Results					
m _n	Net Weight (ng)	<4.00E+00	<4.00E+00	<4.00E+00	
C _{sd}	Concentration (ug/dscm)	<9.42E-04	<9.56E-04	<9.43E-04	<9.47E-04
E _{lb/hr}	Emissions Rate (lb/hr)	<4.71E-07	<4.76E-07	<4.72E-07	<4.73E-07
Total PAHs* Results					
m _n	Net Weight (ng)	<4.24E+04	<9.14E+04	<8.70E+04	
C _{sd}	Concentration (ug/dscm)	<9.99E+00	<2.19E+01	<2.05E+01	<1.75E+01
E _{lb/hr}	Emissions Rate (lb/hr)	<5.00E-03	<1.09E-02	<1.03E-02	<8.72E-03

* Total PAHs are calculated using the full detection limit for results below the detection limit.

RESULTS**2-18****Table 2-6:
THC Results – M-25A**

Run No.	1	2	3	Average
Date (2011)	Jul 14	Jul 14	Jul 14	
Start Time (approx.)	13:22	15:04	16:18	
Stop Time (approx.)	14:23	16:04	17:18	
Gas Conditions				
O ₂ Oxygen (dry volume %)	3.3	3.3	3.3	3.3
CO ₂ Carbon dioxide (dry volume %)	14.2	14.2	14.2	14.2
B _w Actual water vapor in gas (% by volume) ¹	23.6	23.6	23.6	23.6
Gas Flow Rate¹				
Q _a Volumetric flow rate, actual (acfm)	205,000	205,000	205,000	205,000
Q _s Volumetric flow rate, standard (scfm)	175,000	175,000	175,000	175,000
Q _{std} Volumetric flow rate, dry standard (dscfm)	134,000	134,000	134,000	134,000
THC Results				
C _{sd} Concentration (ppmdv as C ₃ H ₈)	1.34	1.45	1.44	1.41
C _{sd} Concentration (lb/dscf)	1.53E-07	1.65E-07	1.65E-07	1.61E-07
E _{lb/hr} Emission Rate (lb/hr)	1.23	1.33	1.32	1.30

¹ Flow and moisture data used in lb/hr calculations obtained from nearly-concurrent SW-846 M-0011, Matrix Spike Run (11:51 to 14:10).

RESULTS**2-19****Table 2-7:
CH₄ and C₂H₆ Results – M-18 (Integrated Bag Sampling Procedure)**

Run No.	1	2	3	Average
Date (2011)	Jul 14	Jul 14	Jul 14	
Start Time (approx.)	13:20	15:05	16:20	
Stop Time (approx.)	14:20	16:05	17:20	
Gas Conditions				
O ₂ Oxygen (dry volume %) ¹	3.3	3.3	3.3	3.3
CO ₂ Carbon dioxide (dry volume %) ¹	14.2	14.2	14.2	14.2
T _s Sample temperature (°F) ²	146	146	146	146
B _w Actual water vapor in gas (% by volume) ²	23.6	23.6	23.6	23.6
Gas Flow Rate²				
Q _a Volumetric flow rate, actual (acfm)	205,000	205,000	205,000	205,000
Q _s Volumetric flow rate, standard (scfm)	175,000	175,000	175,000	175,000
Q _{std} Volumetric flow rate, dry standard (dscfm)	134,000	134,000	134,000	134,000
Methane Results				
C _{sd} Concentration (ppmdv)	2.6	2.5	2.1	2.4
C _{sd} Concentration (lb/dscf)	1.1E-07	1.0E-07	8.7E-08	1.0E-07
E _{lb/hr} Emission Rate (lb/hr)	0.87	0.84	0.70	0.80
Ethane Results				
C _{sd} Concentration (ppmdv)	< 0.16	< 0.16	< 0.16	< 0.16
C _{sd} Concentration (lb/dscf)	<1.2E-08	<1.2E-08	<1.2E-08	<1.2E-08
E _{lb/hr} Emission Rate (lb/hr)	< 0.10	< 0.10	< 0.10	< 0.10

¹ O₂ and CO₂ data obtained from nearly-concurrent M-3A runs.² Moisture, temperature, and flow data used in lb/hr calculations obtained from nearly-concurrent SW-846 M-0011, Matrix Spike Run (11:51 to 14:10).

RESULTS**2-20****Table 2-8:
PCDD / PCDF Results (NDs and EMPCs Included) – M-23**

Run No.		1	2	3	Average
Date (2011)		Jul 20	Jul 20	Jul 21	
Start Time (approx.)		07:59	11:50	07:53	
Stop Time (approx.)		11:12	15:22	11:09	
Gas Conditions					
O ₂	Oxygen (dry volume %)	3.5	3.7	3.5	3.6
CO ₂	Carbon dioxide (dry volume %)	14.0	13.5	13.8	13.8
T _s	Sample temperature (°F)	151	150	151	151
B _w	Actual water vapor in gas (% by volume)	24.2	24.3	24.5	24.3
Gas Flow Rate					
Q _a	Volumetric flow rate, actual (acfm)	205,721	205,654	209,398	206,924
Q _s	Volumetric flow rate, standard (scfm)	173,960	174,070	177,348	175,126
Q _{std}	Volumetric flow rate, dry standard (dscfm)	131,819	131,791	133,872	132,494
Sampling Data					
V _{mstd}	Volume metered, standard (dscf)	114.52	111.27	115.75	113.85
%I	Isokinetic sampling (%)	100.4	97.6	99.9	99.3
Laboratory Data from USEPA Method 23, including NDs and EMPCs					
	Total PCDDs (ng)	0.0633	0.0789	0.0734	
	Total PCDFs (ng)	0.0581	0.0702	0.0797	
m _n	Total PCDDs & PCDFs (ng)	0.1214	0.1491	0.1531	
	Total TEQ PCDDs (ng)	0.0151	0.0199	0.0199	
	Total TEQ PCDFs (ng)	0.0043	0.0056	0.0071	
m _{n,TEQ}	Total TEQ PCDDs & PCDFs (ng)	0.0194	0.0255	0.0270	
Total PCDD/F Results (TEF=1)					
C _{sd}	PCDD/F Concentration (ng/dscm)	3.74E-02	4.73E-02	4.67E-02	4.38E-02
E _{lb/hr}	PCDD/F Rate (lb/hr)	1.85E-08	2.34E-08	2.34E-08	2.18E-08
Total PCDD/F TEQ Results (using USEPA/INTL 2005 TEFs)					
C _{sdTEQ}	TEQ Concentration (ng/dscm)	5.98E-03	8.09E-03	8.24E-03	7.43E-03
E _{lb/hrTEQ}	TEQ Rate (lb/hr)	2.95E-09	3.99E-09	4.13E-09	3.69E-09

TEQ based on USEPA/INTL 2005 TEFs.

RESULTS**2-21****Table 2-9:
PCB Results – M-23**

Run No.		1	2	3	Average
Date (2011)		Jul 20	Jul 20	Jul 21	
Start Time (approx.)		07:59	11:50	07:53	
Stop Time (approx.)		11:12	15:22	11:09	
Gas Conditions					
O ₂	Oxygen (dry volume %)	3.5	3.7	3.5	3.6
CO ₂	Carbon dioxide (dry volume %)	14.0	13.5	13.8	13.8
T _s	Sample temperature (°F)	151	150	151	151
B _w	Actual water vapor in gas (% by volume)	24.2	24.3	24.5	24.3
Gas Flow Rate					
Q _a	Volumetric flow rate, actual (acfm)	205,723	205,656	209,400	206,926
Q _s	Volumetric flow rate, standard (scfm)	173,962	174,071	177,349	175,127
Q _{std}	Volumetric flow rate, dry standard (dscfm)	131,813	131,786	133,867	132,489
Sampling Data					
V _{mstd}	Volume metered, standard (dscf)	114.52	111.27	115.75	113.85
%I	Isokinetic sampling (%)	100.4	97.6	99.9	99.3
Total PCBs					
m _n	Net Weight (ng)	<8.77E-02	<1.65E-01	<1.70E-01	
C _{sd}	Concentration (ng/dscm)	<2.70E-02	<5.22E-02	<5.19E-02	<4.37E-02
E _{lb/hr}	Emissions Rate (lb/hr)	<1.33E-08	<2.58E-08	<2.61E-08	<2.17E-08
PCB TEQs using WHO 2005 TEF Values (Note 1)					
m _n	TEQ Weight (ng)	1.16E-03	1.18E-03	8.74E-04	
C _{sd}	TEQ Concentration (ng/dscm)	3.58E-04	3.76E-04	2.67E-04	3.33E-04
E _{lb/hr}	TEQ Emissions Rate (lb/hr)	1.77E-10	1.86E-10	1.34E-10	1.65E-10

* Total PCBs are calculated using the full detection limit for results below the detection limit.

¹ Toxic Equivalency Factor relative to 2378-TCDD

RESULTS**2-22****Table 2-10:
FPM / CPM Results – M-5/202**

Run No.		1	2	3	Average
Date (2011)		Jul 19	Jul 19	Jul 19	
Start Time (approx.)		08:09	11:51	15:22	
Stop Time (approx.)		10:14	14:19	17:36	
Gas Conditions					
O ₂	Oxygen (dry volume %)	3.7	3.4	3.5	3.5
CO ₂	Carbon dioxide (dry volume %)	13.4	13.7	13.7	13.6
T _s	Sample temperature (°F)	148	148	148	148
B _w	Actual water vapor in gas (% by volume)	24.5	24.5	24.5	24.5
Gas Flow Rate					
Q _a	Volumetric flow rate, actual (acfm)	204,000	202,000	202,000	203,000
Q _s	Volumetric flow rate, standard (scfm)	174,000	172,000	172,000	173,000
Q _{std}	Volumetric flow rate, dry standard (dscfm)	131,000	130,000	130,000	130,000
Sampling Data					
V _{mstd}	Volume metered, standard (dscf)	75.05	73.55	73.41	74.00
%I	Isokinetic sampling (%)	99.4	98.1	98.0	98.5
Laboratory Data					
m _n	Total FPM (g)	0.10398	0.09680	0.09171	
m _{CPM}	Total CPM (g)	0.03460	0.03595	0.03927	
m _{Part}	Total particulate matter (g)	0.13858	0.13275	0.13098	
n _{MDL}	Number of non-detectable fractions	N/A	N/A	N/A	
DLC	Detection level classification	ADL	ADL	ADL	
FPM Results					
C _{sd}	Particulate Concentration (lb/dscf)	3.06E-06	2.90E-06	2.75E-06	2.90E-06
C _{sd}	Particulate Concentration (gr/dscf)	0.0214	0.0203	0.0193	0.0203
E _{lb/hr}	Particulate Rate (lb/hr)	24.0	22.6	21.5	22.7
CPM Results					
C _{sd}	Particulate Concentration (lb/dscf)	1.02E-06	1.08E-06	1.18E-06	1.09E-06
C _{sd}	Particulate Concentration (gr/dscf)	7.11E-03	7.54E-03	8.25E-03	7.64E-03
E _{lb/hr}	Particulate Rate (lb/hr)	7.99	8.41	9.19	8.53
Total Particulate Matter Results					
C _{sd}	Particulate Concentration (lb/dscf)	4.07E-06	3.98E-06	3.93E-06	4.00E-06
C _{sd}	Particulate Concentration (gr/dscf)	0.0285	0.0279	0.0275	0.0280
E _{lb/hr}	Particulate Rate (lb/hr)	32.0	31.0	30.7	31.2

Detection level classifications are defined as follows:

ADL = Above Detection Level - all fractions are above detection limit

MARATHON PETROLEUM COMPANY LP
ILLINOIS REFINING DIVISION

Client Reference No: CN00072225
CleanAir Project No: 11265-3

RESULTS

2-23

**Table 2-11:
TSS/TDS Results – ASTM D5907**

Sample No.	1	2	3	Average
Date (2011)	Aug 15	Aug 15	Aug 15	
Sampling Data				
V_{mstd} Volume metered, standard (dscf)				
Laboratory Data				
V_l Sample volume (mL)	100.23	101.41	104.09	
m_{TSS} Total TSS sample weight (mg)	193.80	187.18	196.82	
m_{TDS} Total TDS sample weight (mg)	7,901.37	7,993.16	8,235.21	
TSS / TDS Results				
TSS Total suspended solids (mg/L)	1,934	1,846	1,891	1,890
TDS Total dissolved solids (mg/L)	78,832	78,820	79,116	78,923

RESULTS**2-24****Table 2-12:
NH₃ – Mod. CTM-027**

Run No.	1	2	3	Average
Date (2011)	Jul 19	Jul 19	Jul 19	
Start Time (approx.)	07:56	12:00	15:38	
Stop Time (approx.)	09:38	13:19	17:15	
Gas Conditions				
O ₂ Oxygen (dry volume %)	3.3	3.4	3.5	3.4
CO ₂ Carbon dioxide (dry volume %)	13.8	13.6	13.7	13.7
T _s Sample temperature (°F)	151	152	152	152
B _w Actual water vapor in gas (% by volume)	25.2	25.7	25.4	25.4
Gas Flow Rate				
Q _a Volumetric flow rate, actual (acfm)	208,502	205,010	205,100	206,204
Q _s Volumetric flow rate, standard (scfm)	176,898	173,580	173,656	174,712
Q _{std} Volumetric flow rate, dry standard (dscfm)	132,267	128,958	129,609	130,278
Sampling Data				
V _{mstd} Volume metered, standard (dscf)	37.70	37.22	36.75	37.22
%I Isokinetic sampling (%)	99.6	100.9	99.1	99.9
Laboratory Data				
m _n Total NH ₃ collected (mg)	1.25439	1.31065	2.11494	
Ammonia (NH₃) Results				
C _{sd} Ammonia Concentration (lb/dscf)	7.34E-08	7.76E-08	1.27E-07	9.26E-08
C _{sd} Ammonia Concentration (ppmdv)	1.66	1.76	2.87	2.10
C _{sd} Ammonia Concentration (mg/dscm)	1.17	1.24	2.03	1.48
E _{lb/hr} Ammonia Rate (lb/hr)	0.582	0.601	0.987	0.723

RESULTS**2-25****Table 2-13:
Sb and As Results – M-29**

Run No.	1	2	3	Average
Date (2011)	Jul 19	Jul 19	Jul 19	
Start Time (approx.)	07:42	11:23	15:17	
Stop Time (approx.)	10:52	14:37	18:30	
Gas Conditions				
O ₂ Oxygen (dry volume %)	3.6	3.3	3.4	3.4
CO ₂ Carbon dioxide (dry volume %)	13.6	13.5	13.7	13.6
T _s Sample temperature (°F)	152	151	151	152
B _w Actual water vapor in gas (% by volume)	25.0	24.9	24.8	24.9
Gas Flow Rate				
Q _a Volumetric flow rate, actual (acfm)	212,000	212,000	206,000	210,000
Q _s Volumetric flow rate, standard (scfm)	179,000	179,000	175,000	178,000
Q _{std} Volumetric flow rate, dry standard (dscfm)	135,000	135,000	131,000	134,000
Sampling Data				
V _{mstd} Volume metered, standard (dscf)	121.32	120.82	114.89	119.01
%I Isokinetic sampling (%)	104.2	103.7	101.1	103.0
Antimony Laboratory Data				
m _F Front half corrected for allowable blank (µg)	16.4740	13.9740	13.8740	
m _B Back half corrected for allowable blank (µg)	<0.1000	<0.1000	<0.1000	
m _n Total matter corrected for allowable blanks (µg)	<16.5740	<14.0740	<13.9740	
Antimony Results - Total				
C _{sd} Concentration (lb/dscf)	<3.01E-10	<2.57E-10	<2.68E-10	<2.75E-10
C _{sd} Concentration (mg/dscm)	<4.82E-03	<4.11E-03	<4.29E-03	<4.41E-03
E _{lb/hr} Rate (lb/hr)	<2.43E-03	<2.08E-03	<2.11E-03	<2.21E-03
Arsenic Laboratory Data				
m _F Front half corrected for allowable blank (µg)	1.1900	<1.0000	1.1300	
m _B Back half corrected for allowable blank (µg)	<0.2000	<0.2000	<0.2000	
m _n Total matter corrected for allowable blanks (µg)	<1.3900	<1.2000	<1.3300	
Arsenic Results - Total				
C _{sd} Concentration (lb/dscf)	<2.53E-11	<2.19E-11	<2.55E-11	<2.42E-11
C _{sd} Concentration (mg/dscm)	<4.05E-04	<3.51E-04	<4.09E-04	<3.88E-04
E _{lb/hr} Rate (lb/hr)	<2.04E-04	<1.77E-04	<2.01E-04	<1.94E-04

RESULTS**2-26****Table 2-14:
Be and Cd Results – M-29**

Run No.	1	2	3	Average
Date (2011)	Jul 19	Jul 19	Jul 19	
Start Time (approx.)	07:42	11:23	15:17	
Stop Time (approx.)	10:52	14:37	18:30	
Gas Conditions				
O ₂ Oxygen (dry volume %)	3.6	3.3	3.4	3.4
CO ₂ Carbon dioxide (dry volume %)	13.6	13.5	13.7	13.6
T _s Sample temperature (°F)	152	151	151	152
B _w Actual water vapor in gas (% by volume)	25.0	24.9	24.8	24.9
Gas Flow Rate				
Q _a Volumetric flow rate, actual (acfm)	212,000	212,000	206,000	210,000
Q _s Volumetric flow rate, standard (scfm)	179,000	179,000	175,000	178,000
Q _{std} Volumetric flow rate, dry standard (dscfm)	135,000	135,000	131,000	134,000
Sampling Data				
V _{mstd} Volume metered, standard (dscf)	121.32	120.82	114.89	119.01
%I Isokinetic sampling (%)	104.2	103.7	101.1	103.0
Beryllium Laboratory Data				
m _F Front half corrected for allowable blank (µg)	<0.2000	<0.2000	<0.2000	
m _B Back half corrected for allowable blank (µg)	<0.1000	<0.1000	<0.1000	
m _n Total matter corrected for allowable blanks (µg)	<0.3000	<0.3000	<0.3000	
Beryllium Results - Total				
C _{sd} Concentration (lb/dscf)	<5.45E-12	<5.48E-12	<5.76E-12	<5.56E-12
C _{sd} Concentration (mg/dscm)	<8.73E-05	<8.77E-05	<9.22E-05	<8.91E-05
E _{lb/hr} Rate (lb/hr)	<4.40E-05	<4.42E-05	<4.54E-05	<4.46E-05
Cadmium Laboratory Data				
m _F Front half corrected for allowable blank (µg)	0.1800	<0.1000	<0.1000	
m _B Back half corrected for allowable blank (µg)	<0.0500	<0.0500	0.0616	
m _n Total matter corrected for allowable blanks (µg)	<0.2300	<0.1500	<0.1616	
Cadmium Results - Total				
C _{sd} Concentration (lb/dscf)	<4.18E-12	<2.74E-12	<3.10E-12	<3.34E-12
C _{sd} Concentration (mg/dscm)	<6.69E-05	<4.38E-05	<4.97E-05	<5.35E-05
E _{lb/hr} Rate (lb/hr)	<3.38E-05	<2.21E-05	<2.44E-05	<2.68E-05

RESULTS**2-27****Table 2-15:
Cr and Co Results – M-29**

Run No.	1	2	3	Average
Date (2011)	Jul 19	Jul 19	Jul 19	
Start Time (approx.)	07:42	11:23	15:17	
Stop Time (approx.)	10:52	14:37	18:30	
Gas Conditions				
O ₂ Oxygen (dry volume %)	3.6	3.3	3.4	3.4
CO ₂ Carbon dioxide (dry volume %)	13.6	13.5	13.7	13.6
T _s Sample temperature (°F)	152	151	151	152
B _w Actual water vapor in gas (% by volume)	25.0	24.9	24.8	24.9
Gas Flow Rate				
Q _a Volumetric flow rate, actual (acfm)	212,000	212,000	206,000	210,000
Q _s Volumetric flow rate, standard (scfm)	179,000	179,000	175,000	178,000
Q _{std} Volumetric flow rate, dry standard (dscfm)	135,000	135,000	131,000	134,000
Sampling Data				
V _{mstd} Volume metered, standard (dscf)	121.32	120.82	114.89	119.01
%I Isokinetic sampling (%)	104.2	103.7	101.1	103.0
Chromium Laboratory Data				
m _F Front half corrected for allowable blank (µg)	9.6200	7.9800	7.4100	
m _B Back half corrected for allowable blank (µg)	<0.1500	0.7210	<0.1500	
m _n Total matter corrected for allowable blanks (µg)	<9.7700	8.7010	<7.5600	
Chromium Results - Total				
C _{sd} Concentration (lb/dscf)	<1.78E-10	1.59E-10	<1.45E-10	<1.60E-10
C _{sd} Concentration (mg/dscm)	<2.84E-03	2.54E-03	<2.32E-03	<2.57E-03
E _{lb/hr} Rate (lb/hr)	<1.43E-03	1.28E-03	<1.14E-03	<1.29E-03
Cobalt Laboratory Data				
m _F Front half corrected for allowable blank (µg)	1.4000	1.2200	1.2500	
m _B Back half corrected for allowable blank (µg)	<0.1000	<0.1000	<0.1000	
m _n Total matter corrected for allowable blanks (µg)	<1.5000	<1.3200	<1.3500	
Cobalt Results - Total				
C _{sd} Concentration (lb/dscf)	<2.73E-11	<2.41E-11	<2.59E-11	<2.58E-11
C _{sd} Concentration (mg/dscm)	<4.37E-04	<3.86E-04	<4.15E-04	<4.12E-04
E _{lb/hr} Rate (lb/hr)	<2.20E-04	<1.95E-04	<2.04E-04	<2.06E-04

RESULTS**2-28****Table 2-16:
Pb and Mn Results – M-29**

Run No.	1	2	3	Average
Date (2011)	Jul 19	Jul 19	Jul 19	
Start Time (approx.)	07:42	11:23	15:17	
Stop Time (approx.)	10:52	14:37	18:30	
Gas Conditions				
O ₂ Oxygen (dry volume %)	3.6	3.3	3.4	3.4
CO ₂ Carbon dioxide (dry volume %)	13.6	13.5	13.7	13.6
T _s Sample temperature (°F)	152	151	151	152
B _w Actual water vapor in gas (% by volume)	25.0	24.9	24.8	24.9
Gas Flow Rate				
Q _a Volumetric flow rate, actual (acfm)	212,000	212,000	206,000	210,000
Q _s Volumetric flow rate, standard (scfm)	179,000	179,000	175,000	178,000
Q _{std} Volumetric flow rate, dry standard (dscfm)	135,000	135,000	131,000	134,000
Sampling Data				
V _{mstd} Volume metered, standard (dscf)	121.32	120.82	114.89	119.01
%I Isokinetic sampling (%)	104.2	103.7	101.1	103.0
Lead Laboratory Data				
m _F Front half corrected for allowable blank (µg)	10.5220	6.8620	5.0420	
m _B Back half corrected for allowable blank (µg)	0.3331	0.4251	0.1561	
m _n Total matter corrected for allowable blanks (µg)	10.8551	7.2871	5.1981	
Lead Results - Total				
C _{sd} Concentration (lb/dscf)	1.97E-10	1.33E-10	9.98E-11	1.43E-10
C _{sd} Concentration (mg/dscm)	3.16E-03	2.13E-03	1.60E-03	2.30E-03
E _{lb/hr} Rate (lb/hr)	1.59E-03	1.07E-03	7.86E-04	1.15E-03
Manganese Laboratory Data				
m _F Front half corrected for allowable blank (µg)	1.6260	1.3160	1.1560	
m _B Back half corrected for allowable blank (µg)	0.2730	44.1000	0.3030	
m _n Total matter corrected for allowable blanks (µg)	1.8990	45.4160	1.4590	
Manganese Results - Total				
C _{sd} Concentration (lb/dscf)	3.45E-11	8.29E-10	2.80E-11	2.97E-10
C _{sd} Concentration (mg/dscm)	5.53E-04	1.33E-02	4.48E-04	4.76E-03
E _{lb/hr} Rate (lb/hr)	2.79E-04	6.70E-03	2.21E-04	2.40E-03

RESULTS**2-29****Table 2-17:
Ni and Se Results – M-29**

Run No.	1	2	3	Average
Date (2011)	Jul 19	Jul 19	Jul 19	
Start Time (approx.)	07:42	11:23	15:17	
Stop Time (approx.)	10:52	14:37	18:30	
Gas Conditions				
O ₂ Oxygen (dry volume %)	3.6	3.3	3.4	3.4
CO ₂ Carbon dioxide (dry volume %)	13.6	13.5	13.7	13.6
T _s Sample temperature (°F)	152	151	151	152
B _w Actual water vapor in gas (% by volume)	25.0	24.9	24.8	24.9
Gas Flow Rate				
Q _a Volumetric flow rate, actual (acfm)	212,000	212,000	206,000	210,000
Q _s Volumetric flow rate, standard (scfm)	179,000	179,000	175,000	178,000
Q _{std} Volumetric flow rate, dry standard (dscfm)	135,000	135,000	131,000	134,000
Sampling Data				
V _{mstd} Volume metered, standard (dscf)	121.32	120.82	114.89	119.01
%I Isokinetic sampling (%)	104.2	103.7	101.1	103.0
Nickel Laboratory Data				
m _F Front half corrected for allowable blank (µg)	32.5050	30.8050	28.4050	
m _B Back half corrected for allowable blank (µg)	0.4160	0.7300	0.3480	
m _n Total matter corrected for allowable blanks (µg)	32.9210	31.5350	28.7530	
Nickel Results - Total				
C _{sd} Concentration (lb/dscf)	5.98E-10	5.76E-10	5.52E-10	5.75E-10
C _{sd} Concentration (mg/dscm)	9.58E-03	9.22E-03	8.84E-03	9.21E-03
E _{lb/hr} Rate (lb/hr)	4.83E-03	4.65E-03	4.35E-03	4.61E-03
Selenium Laboratory Data				
m _F Front half corrected for allowable blank (µg)	4.1100	3.6600	3.9500	
m _B Back half corrected for allowable blank (µg)	<1.0000	<1.0000	<1.0000	
m _n Total matter corrected for allowable blanks (µg)	<5.1100	<4.6600	<4.9500	
Selenium Results - Total				
C _{sd} Concentration (lb/dscf)	<9.29E-11	<8.50E-11	<9.50E-11	<9.10E-11
C _{sd} Concentration (mg/dscm)	<1.49E-03	<1.36E-03	<1.52E-03	<1.46E-03
E _{lb/hr} Rate (lb/hr)	<7.50E-04	<6.87E-04	<7.49E-04	<7.29E-04

RESULTS**2-30****Table 2-18:
Particulate Bound, Oxidized and Elemental Hg Results – ASTM D6784**

Run No.		1	2	3	Average
Date (2011)		Jul 15	Jul 15	Jul 16	
Start Time (approx.)		09:00	13:27	08:40	
Stop Time (approx.)		13:14	16:04	11:07	
Gas Conditions					
O ₂	Oxygen (dry volume %)	3.6	4.0	3.5	3.7
CO ₂	Carbon dioxide (dry volume %)	13.4	13.0	13.7	13.4
T _s	Sample temperature (°F)	150	150	150	150
B _w	Actual water vapor in gas (% by volume)	24.4	24.4	24.4	24.4
Gas Flow Rate					
Q _a	Volumetric flow rate, actual (acfm)	215,956	212,442	209,383	212,594
Q _s	Volumetric flow rate, standard (scfm)	183,652	180,615	178,247	180,838
Q _{std}	Volumetric flow rate, dry standard (dscfm)	138,794	136,493	134,693	136,660
Sampling Data					
V _{mstd}	Volume metered, standard (dscf)	84.06	81.37	80.45	81.96
%I	Isokinetic sampling (%)	105.0	103.4	103.6	104.0
Laboratory Data					
Hg _{particle}	Total Particulate Bound Mercury (µg)	<0.0650	<0.0650	<0.0650	
n _{MDL}	Number of non-detectable fractions	2 out of 2	2 out of 2	2 out of 2	
DLC	Detection level classification	BDL	BDL	BDL	
Hg _O	Total Oxidized Mercury (µg)	0.8930	<0.0500	<0.0500	
n _{MDL}	Number of non-detectable fractions	N/A	1 out of 1	1 out of 1	
DLC	Detection level classification	ADL	BDL	BDL	
Hg _E	Total Elemental Mercury (µg)	1.2505	0.0655	0.1150	
n _{MDL}	Number of non-detectable fractions	1 out of 2	1 out of 2	1 out of 2	
DLC	Detection level classification	DLL	DLL	DLL	
Particulate Bound Mercury Results					
C _{sd}	Concentration (lb/dscf)	<1.71E-12	<1.76E-12	<1.78E-12	<1.75E-12
C _{sd}	Concentration (µg/dscm)	<2.73E-02	<2.82E-02	<2.85E-02	<2.80E-02
E _{lb/hr}	Rate (lb/hr)	<1.42E-05	<1.44E-05	<1.44E-05	<1.43E-05
Oxidized Mercury Results					
C _{sd}	Concentration (lb/dscf)	2.34E-11	<1.36E-12	<1.37E-12	<8.72E-12
C _{sd}	Concentration (µg/dscm)	3.75E-01	<2.17E-02	<2.19E-02	<1.40E-01
E _{lb/hr}	Rate (lb/hr)	1.95E-04	<1.11E-05	<1.11E-05	<7.24E-05
Elemental Mercury Results					
C _{sd}	Concentration (lb/dscf)	3.28E-11	1.77E-12	3.15E-12	1.26E-11
C _{sd}	Concentration (µg/dscm)	5.25E-01	2.84E-02	5.05E-02	2.01E-01
E _{lb/hr}	Rate (lb/hr)	2.73E-04	1.45E-05	2.55E-05	1.04E-04

Detection level classifications are defined as follows:

ADL = Above Detection Level - all fractions are above detection limit

DLL = Detection Level Limited - some fractions are below detection limit

BDL = Below Detection Limit - all fractions are below detection limit

RESULTS**2-31****Table 2-19:
Total Hg Results – ASTM D6784**

Run No.		1	2	3	Average
Date (2011)		Jul 15	Jul 15	Jul 16	
Start Time (approx.)		09:00	13:27	08:40	
Stop Time (approx.)		13:14	16:04	11:07	
Gas Conditions					
O ₂	Oxygen (dry volume %)	3.6	4.0	3.5	3.7
CO ₂	Carbon dioxide (dry volume %)	13.4	13.0	13.7	13.4
T _s	Sample temperature (°F)	150	150	150	150
B _w	Actual water vapor in gas (% by volume)	24.4	24.4	24.4	24.4
Gas Flow Rate					
Q _a	Volumetric flow rate, actual (acfm)	215,956	212,442	209,383	212,594
Q _s	Volumetric flow rate, standard (scfm)	183,652	180,615	178,247	180,838
Q _{std}	Volumetric flow rate, dry standard (dscfm)	138,794	136,493	134,693	136,660
Sampling Data					
V _{mstd}	Volume metered, standard (dscf)	84.06	81.37	80.45	81.96
%I	Isokinetic sampling (%)	105.0	103.4	103.6	104.0
Laboratory Data					
m _n	Total Mercury (µg)	<2.2085	<0.1805	<0.2300	
n _{MDL}	Number of non-detectable fractions	3 out of 5	4 out of 5	4 out of 5	
DLC	Detection level classification	DLL	DLL	DLL	
Total Mercury Results					
C _{sd}	Concentration (lb/dscf)	<5.79E-11	<4.89E-12	<6.30E-12	<2.30E-11
C _{sd}	Concentration (µg/dscm)	<9.28E-01	<7.83E-02	<1.01E-01	<3.69E-01
E _{lb/hr}	Rate (lb/hr)	<4.82E-04	<4.01E-05	<5.09E-05	<1.91E-04

Detection level classifications are defined as follows:

DLL = Detection Level Limited - some fractions are below detection limit

RESULTS**2-32****Table 2-20:
Cr⁶⁺ Results – SW-846 M-0061**

Run No.	1	2	3	Average
Date (2011)	Jul 15	Jul 15	Jul 16	
Start Time (approx.)	08:58	14:06	08:36	
Stop Time (approx.)	13:06	17:42	12:21	
Gas Conditions				
O ₂ Oxygen (dry volume %)	4.2	3.6	3.6	3.8
CO ₂ Carbon dioxide (dry volume %)	12.9	13.3	13.5	13.2
T _s Sample temperature (°F)	150	150	150	150
B _w Actual water vapor in gas (% by volume)	24.1	23.8	24.7	24.2
Gas Flow Rate				
Q _a Volumetric flow rate, actual (acfm)	210,452	202,943	205,305	206,233
Q _s Volumetric flow rate, standard (scfm)	178,845	172,409	174,724	175,326
Q _{std} Volumetric flow rate, dry standard (dscfm)	135,720	131,455	131,618	132,931
Sampling Data				
V _{mstd} Volume metered, standard (dscf)	116.43	108.23	112.62	112.43
%I Isokinetic sampling (%)	99.2	95.2	98.9	97.7
Laboratory Data				
m _n Total Cr ⁶⁺ collected (μg)	<0.48600	<0.53400	<0.54000	
Hexavalent Chromium (Cr⁶⁺) Results				
C _{sd} Cr ⁶⁺ Concentration (lb/dscf)	<9.20E-12	<1.09E-11	<1.06E-11	<1.02E-11
C _{sd} Cr ⁶⁺ Concentration (μg/dscm)	<1.47E-01	<1.74E-01	<1.69E-01	<1.64E-01
E _{lb/hr} Cr ⁶⁺ Rate (lb/hr)	<7.50E-05	<8.58E-05	<8.35E-05	<8.14E-05

RESULTS**2-33****Table 2-21:
HCl, Cl₂ and HF Results – M-26A**

Run No.	1	2	3	Average
Date (2011)	Jul 20	Jul 20	Jul 21	
Start Time (approx.)	09:49	12:50	07:54	
Stop Time (approx.)	12:18	15:10	10:07	
Gas Conditions				
O ₂ Oxygen (dry volume %)	3.7	3.7	3.7	3.7
CO ₂ Carbon dioxide (dry volume %)	13.9	13.7	13.7	13.8
T _s Sample temperature (°F)	147	147	147	147
B _w Actual water vapor in gas (% by volume)	24.0	24.0	24.2	24.1
Gas Flow Rate				
Q _a Volumetric flow rate, actual (acfm)	199,990	198,702	204,364	201,019
Q _s Volumetric flow rate, standard (scfm)	170,228	169,133	174,066	171,142
Q _{std} Volumetric flow rate, dry standard (dscfm)	129,369	128,536	131,986	129,964
Sampling Data				
V _{mstd} Volume metered, standard (dscf)	71.18	71.47	73.57	72.07
%I Isokinetic sampling (%)	95.4	96.4	96.6	96.1
Laboratory Data				
m _n Total HCl collected (mg)	0.14248	0.09437	0.15574	
m _n Total Cl ₂ collected (mg)	<0.00792	<0.00720	<0.00666	
m _n Total HF collected (mg)	<0.00834	<0.00859	<0.00851	
Hydrogen Chloride (HCl) Results				
C _{sd} HCl Concentration (lb/dscf)	4.41E-09	2.91E-09	4.67E-09	4.00E-09
C _{sd} HCl Concentration (ppmdv)	0.0467	0.0308	0.0494	0.0423
C _{sd} HCl Concentration (mg/dscm)	0.0707	0.0466	0.0747	0.0640
E _{lb/hr} HCl Rate (lb/hr)	0.0343	0.0225	0.0370	0.0312
Chlorine (Cl₂) Results				
C _{sd} Chlorine Concentration (lb/dscf)	<2.45E-10	<2.22E-10	<2.00E-10	<2.22E-10
C _{sd} Chlorine Concentration (ppmdv)	<1.33E-03	<1.21E-03	<1.09E-03	<1.21E-03
C _{sd} Chlorine Concentration (mg/dscm)	<3.93E-03	<3.56E-03	<3.20E-03	<3.56E-03
E _{lb/hr} Chlorine Rate (lb/hr)	<1.90E-03	<1.71E-03	<1.58E-03	<1.73E-03
Hydrogen Fluoride (HF) Results				
C _{sd} HF Concentration (lb/dscf)	<2.58E-10	<2.65E-10	<2.55E-10	<2.59E-10
C _{sd} HF Concentration (ppmdv)	<4.98E-03	<5.11E-03	<4.91E-03	<5.00E-03
C _{sd} HF Concentration (mg/dscm)	<4.14E-03	<4.25E-03	<4.08E-03	<4.16E-03
E _{lb/hr} HF Rate (lb/hr)	<2.01E-03	<2.04E-03	<2.02E-03	<2.02E-03

RESULTS**2-34****Table 2-22:
HCN Results – OTM-29**

Run No.	1	2	3	Average
Date (2011)	Jul 20	Jul 20	Jul 21	
Start Time (approx.)	09:36	12:29	07:56	
Stop Time (approx.)	10:57	14:01	09:15	
Gas Conditions				
O ₂ Oxygen (dry volume %)	3.8	3.8	3.8	3.8
CO ₂ Carbon dioxide, flue gas (dry volume %) ¹	13.9	13.7	13.7	13.8
T _s Sample temperature (°F)	150	151	151	151
B _w Actual water vapor in gas (% by volume)	26.1	26.6	26.5	26.4
Gas Flow Rate				
Q _a Volumetric flow rate, actual (acfm)	197,012	193,501	207,016	199,176
Q _s Volumetric flow rate, standard (scfm)	166,755	163,583	175,266	168,535
Q _{std} Volumetric flow rate, dry standard (dscfm)	123,177	120,034	128,855	124,022
Sampling Data				
V _{mstd} Volume metered, standard (dscf)	33.39	31.22	34.30	32.97
%I Isokinetic sampling (%)	108.2	103.8	106.3	106.1
Laboratory Data				
m _n Total HCN collected (µg)	2,115.6384	4,473.1555	5,850.3097	
Hydrogen Cyanide (HCN) Results				
C _{sd} HCN Concentration (lb/dscf)	1.40E-07	3.16E-07	3.76E-07	2.77E-07
C _{sd} HCN Concentration (ppmdv)	1.99	4.51	5.36	3.95
C _{sd} HCN Concentration (µg/dscm)	2,237	5,059	6,022	4,440
E _{lb/hr} HCN Rate (lb/hr)	1.03	2.28	2.91	2.07

¹ Actual flue gas CO₂ obtained from concurrent M-26A run.*End of Section 2 – Results*

DESCRIPTION OF INSTALLATION**3-1****PROCESS DESCRIPTION**

The fluidized catalytic cracking unit (FCCU) at the Robinson Refinery uses hydrotreated gas oil as its primary raw material and produces fuel gas, mixed C3/C4 hydrocarbons, gasoline, light and heavy cycle oil, slurry and coke as its products.

The FCCU charges a combined stream of light and heavy vacuum and atmospheric gas oil from the Crude Unit and tank farm. Fluid catalytic cracking is a low pressure, high temperature method of cracking a wide variety of gas oils by using a powdered catalyst which boosts the cracking reaction in the direction of higher octane gasoline and more aromatic products. Carbon deposits on the catalyst are burned off to regenerate the catalyst in the unit's regenerator vessel.

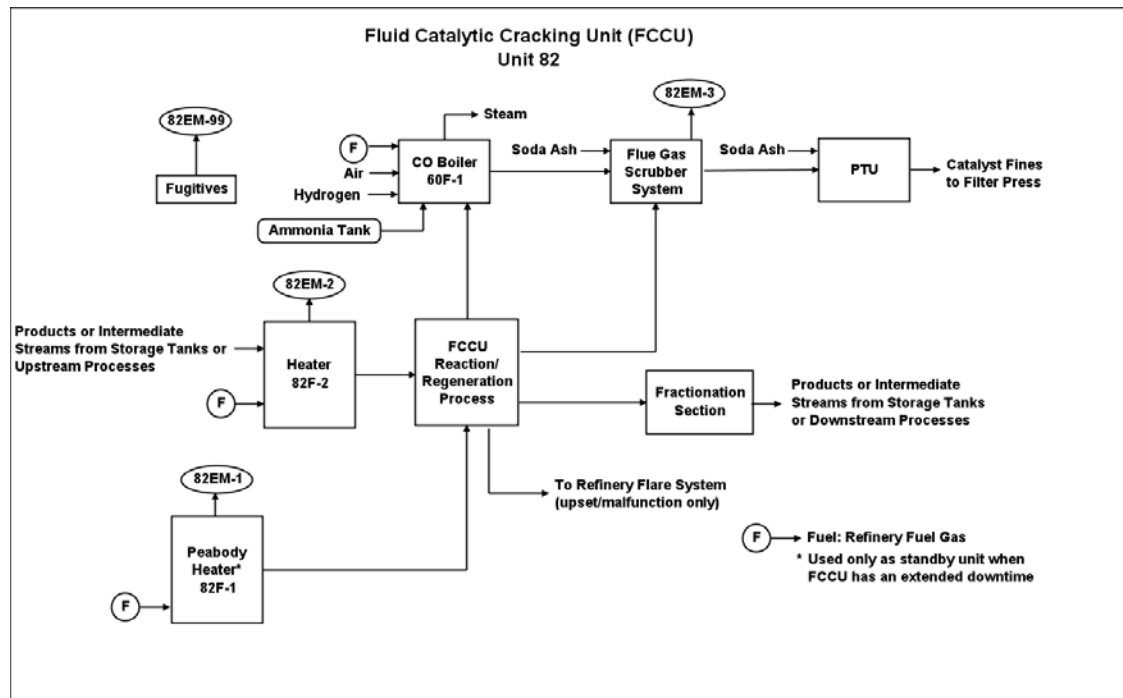
The partially-combusted flue gas from the regenerator has a high content of carbon monoxide (CO), and this additional fuel value is recovered in a CO boiler, which also fires refinery fuel gas. The CO boiler produces 600# steam and superheats 150# steam. Flue gases leaving the CO boiler enter the Flue Gas Scrubber. The hot flue gas contains sulfur gases and catalyst fines and is cooled to its saturation temperature in the Flue Gas Scrubber. Sulfur gases and catalyst fines are removed.

A small amount of soda ash solution is added to control pH. A purge stream from the Flue Gas Scrubber is sent to the Purge Treatment Unit (PTU). At the PTU, solids contained in the purge stream settle out and are run through a filter press. Liquid remaining after the solids are removed is aerated to oxidize sodium salts present and then disposed off-site. Soda ash solution is injected into the PTU to control pH.

Finished products (gas and gasoline) from the main fractionator leaving the unit are sent to the light ends plant. Additional products leaving the process include slurry oil and light/heavy cycle oil. The unit employs one (1) gas/oil-fired feed preheater (82F-2) and a waste heat CO boiler (60F-1), various chemical and fuel/oil storage tanks and a unit sump system.

The Peabody Heater (82F-1) remains idle for the most part. This heater is used only as a standby unit. When the FCCU has an extended downtime, this heater is used to bring the unit back on-line.

The testing reported in this document was performed at the FCCU Scrubber Stack. An outline of the FCCU process is shown in Figure 3-1 on the following page.

DESCRIPTION OF INSTALLATION**3-2****Figure 3-1: Process Schematic**

DESCRIPTION OF INSTALLATION**DESCRIPTION OF SAMPLING LOCATION**

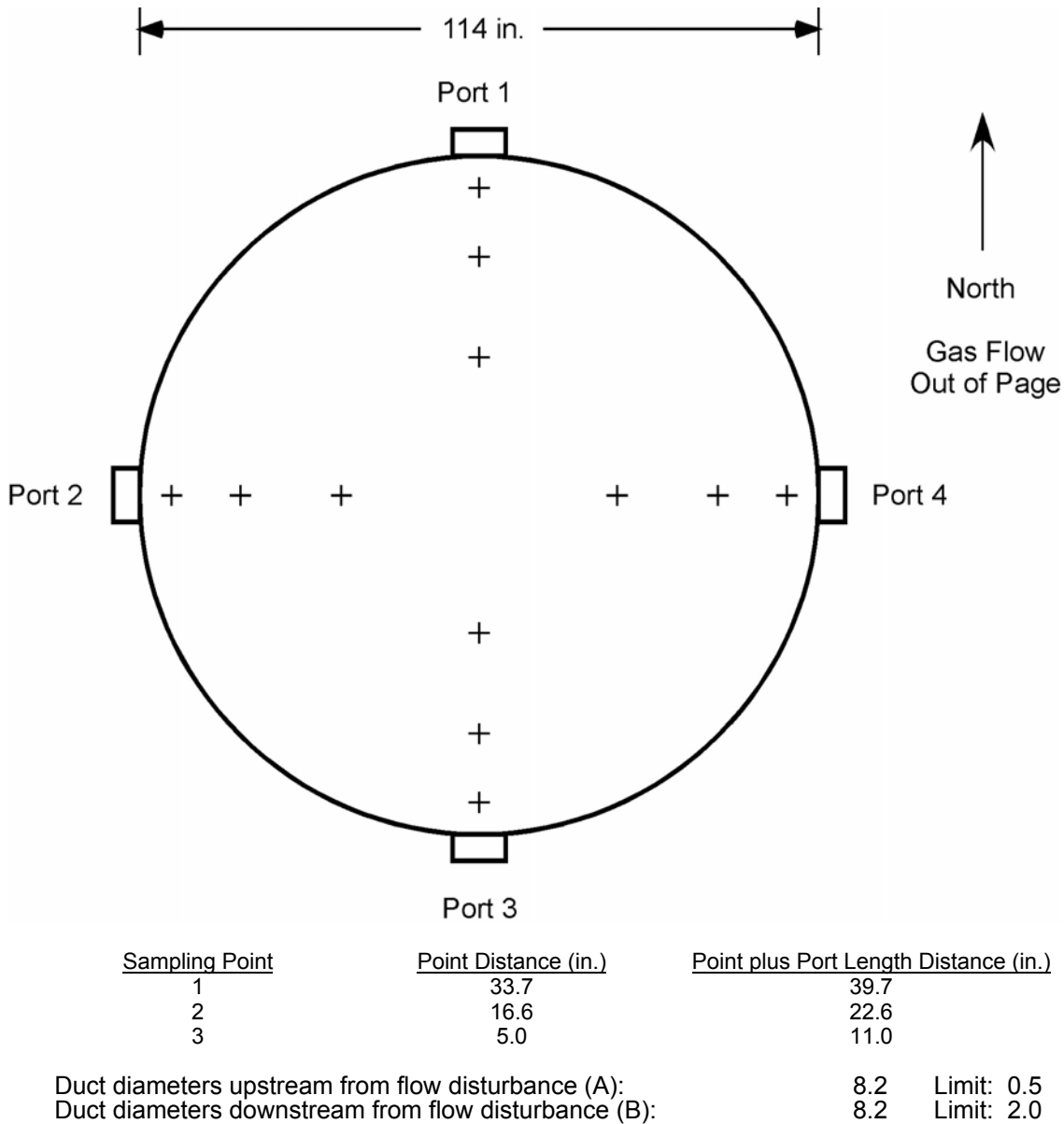
Sampling point locations were determined according to EPA Method 1.

Table 3-1 outlines the sampling point configurations. Figure 3-2 on the following page illustrates the sampling points and orientation of sampling ports for the source tested in the program.

**Table 3-1:
Sampling Points**

<u>Source</u>							
Constituent	Method	Run No.	Ports	Points per Port	Minutes per Point	Total Minutes	Figure
<u>FCCU Scrubber Stack</u>							
VOC (all but CH ₃ OH)	Mod. M-18	1-3	1	1	80	80	NA ¹
CH ₃ OH	M-18	1-3	1	1	80	80	NA ¹
Aldehydes	SW-846 M-0011	1-3	4	3	10	120	3-2
SVOC / PAH	SW-846 M-0010	1-3	4	3	20	240	3-2
O ₂ / CO ₂ / THC	M-3A / 25A	1-3	1	1	60	60	NA ¹
CH ₄ / C ₂ H ₆	M-18	1-3	1	1	60	60	NA ¹
PCDD / PCDF / PCB	M-23	1-3	4	3	15	180	3-2
FPM / CPM	M-5 / 202	1-3	4	3	10	120	3-2
NH ₃	Mod. CTM-027	1-3	4	3	5	60	3-2
Other Metals	M-29	1-3	4	3	15	180	3-2
Hg _p / Hg _o / Hg _E	ASTM D6784	1-3	4	3	10	120	3-2
Cr ⁶⁺	SW-846 M-0061	1-3	4	3	15	180	3-2
HCl / Cl ₂ / HF	M-26A	1-3	4	3	10	120	3-2
HCN	OTM-29	1-3	4	3	5	60	3-2
Flow	M-2	1-3	4	3	Various	Various	3-2
O ₂	Mod. M-3A	1-3	4	3	Various	Various	3-2
CO ₂	Mod. M-3A	1-3	4	3	Various	Various	3-2
H ₂ O	M-4	1-3	4	3	Various	Various	3-2

¹ Sampling performed at a single point no closer than 1 meter to the stack wall.

DESCRIPTION OF INSTALLATION**3-4****DESCRIPTION OF SAMPLING LOCATION (CONTINUED)****Figure 3-2: FCCU Scrubber Stack Sampling Point Determination (EPA Method 1)***End of Section 3 – Description of Installation*

METHODOLOGY**4-1**

Clean Air Engineering followed procedures as detailed in Methods 1, 2, 3, 3A, 4, 5, 18, 23, 25A, 29, 202, SW-846 0010, SW-846 0011, SW-846 0061, CTM-027, and OTM-29, as well as ASTM-D6784 and the modified version of M-18 posted on the Petroleum ICR website. The following table summarizes the methods and their respective sources.

**Table 4-1:
Summary of Sampling Procedures**

Title 40 CFR Part 60 Appendix A

Method 1	"Sample and Velocity Traverses for Stationary Sources"
Method 2	"Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S Pitot Tube)"
Method 3	"Gas Analysis for the Determination of Dry Molecular Weight"
Method 3A	"Determination of Oxygen and Carbon Dioxide Concentrations in Emissions from Stationary Sources (Instrumental Analyzer Procedure)"
Method 4	"Determination of Moisture Content in Stack Gases"
Method 5	"Determination of Particulate Matter Emissions from Stationary Sources"
Method 18	"Measurement of Gaseous Organic Compound Emissions by Gas Chromatography"
Method 23	"Determination of Polychlorinated Dibenzo-p-Dioxins and Polychlorinated Dibenzofurans from Municipal Waste Conductors"
Method 25A	"Determination of Total Gaseous Organic Concentration Using a Flame Ionization Analyzer"
Method 29	"Determination of Metals Emissions from Stationary Sources"

Title 40 CFR Part 51 Appendix M

Method 202	"Dry Impinger Method for Determining Condensable Particulate Emissions from Stationary Sources"
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SW-846 Methods

Method 0010	"Modified Method 5 Sampling Train"
Method 0011	"Sampling for Selected Aldehyde and Ketone Emissions from Stationary Sources"
Method 0061	"Determination of Hexavalent Chromium Emissions from Stationary Sources"

Conditional Test Methods (CTM)

CTM-027	"Procedure for Collection and Analysis of Ammonia in Stationary Sources"
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American Society for Testing and Materials (ASTM) Methods

ASTM D6784-02	"Standard Test Method for Elemental, Oxidized, Particle-Bound and Total Mercury in Flue Gas Generated from Coal-Fired Stationary Sources (Ontario HYDRO Method)"
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Other Test Methods

OTM-29	"Sampling and Analysis for Hydrogen Cyanide Emissions from Stationary Sources"
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Petroleum ICR Test Methods

Mod. Method 18	"Midget Impinger Method for Determining Volatile Organic Emissions in Elevated Concentrations of Stack Gas"
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These methods appear in detail in Title 40 of the Code of Federal Regulations (CFR) and on the World Wide Web at <http://ecfr.gpoaccess.gov>, <http://www.astm.org> and <https://refineryicr.rti.org/>.

METHODOLOGY**4-2**

Diagrams of the sampling apparatus and major specifications of the sampling, recovery and analytical procedures are summarized for each method in Appendix A.

CleanAir followed specific quality assurance and quality control (QA/QC) procedures as outlined in the individual methods and as prescribed in CleanAir's internal Quality Manual.

Gaseous Emissions Testing – ICR Group A1VOC – all but CH₃OH

Emissions of all VOCs except CH₃OH were determined using a modified version of M-18 posted on the Refinery ICR website and two (2) co-located, constant-rate (non-isokinetic), single-point sample trains. Each sampling train consisted of a heated probe, TFE jumper, water-jacketed condenser and a midjet impinger train in a dry ice/methanol bath. The VOC-collecting midjet impingers were charged with purge grade methanol.

In order to more easily facilitate co-located sampling trains and to minimize the chance of breakage in the field, the glass probe liner specified in the method was replaced with a dual-chambered TFE probe liner. The effect on data quality is negligible.

The modified method specifies a final midjet impinger containing silica gel in an ice water bath. For this test program, it was assumed that the majority of the moisture in the sample gas was removed by the water-jacketed condenser and the impinger train in the dry ice/methanol bath. The silica gel impinger was therefore replaced by a Drierite tube at ambient temperatures. Rather than attempting to quantify the condensed moisture in each midjet impinger train, moisture data required for molecular weight calculations was instead obtained from a concurrent isokinetic SW-846 M-0011 sample train.

Each paired sampling train was pre-spiked with the following isotopically-labeled recovery surrogates:

- 1,3-Butadiene-d6
- Benzene-d6
- Acrylonitrile-d3
- Nitrobenzene-d5
- 2,2,4-Trimethylpentane-d18
- Ethylbenzene-d10
- Pentane-d12
- Methyl t-butyl ether-d12
- n-Hexane-d14
- 2-Nitropropane-d6
- 1,2-Dibromoethane-d4
- Styrene-d8

METHODOLOGY**4-3**

Since not all of the required recovery surrogates required by the EPA were available as stable isotopically-labeled spikes, one (1) of the paired sampling trains was pre-spiked with the following native recovery surrogates:

- Acrolein
- Acetonitrile
- Trichloroethene
- Toluene
- Methyl isobutyl ketone

During sampling, approximately 20 L of sample gas was drawn through each sample train at rate of 0.25 liter per minute (lpm) for a total of 80 minutes per run. Sampling occurred from a single point in an unoccupied port located on a different plane than the ports used for isokinetic testing. The sample point was located approximately four (4) feet from the stack wall.

Each sample train was recovered separately in the following manner:

- The probe rinse, jumper rinse, condenser rinse and Impingers #1 and #2 were recovered in a combined fraction.
- Impinger #3 and Impinger #4 were each recovered in a separate fraction.

A paired field train blank was assembled, transported to the location, heated, leak-checked, left to sit for an equivalent amount of time (or greater) as the test runs and recovered as if it were an actual test sample. Reagent blanks (identified in this particular method as a “trip blank”) were collected to quantify background contamination. All samples were stored under refrigeration or on cold packs prior to analysis.

Sample rinses and blanks were shipped to ALS Laboratory Group in Burlington, Ontario, who performed the analysis using gas chromatography/mass spectroscopy (GC/MS). The laboratory followed all specifications in SW-846 8260 when conducting the requisite surrogate spiking, sample and blank analyses and reporting results.

CH₃OH

CH₃OH emissions were determined using M-18 (adsorbent tube procedure) and two (2) co-located, constant rate (non-isokinetic), single-point sample trains. Each sampling train consisted of a heated probe, TFE jumper, a single midjet impinger in an ice bath (for moisture removal), an adsorbent tube and a dry gas meter. The midjet impinger was charged with distilled organic-free water (Type II); the adsorbent tubes were charged with silica.

In order to more easily facilitate co-located sampling trains and to minimize the chance of breakage in the field, the glass probe liner specified in the method was replaced with a dual-chambered TFE probe liner. The effect on data quality is negligible.

METHODOLOGY**4-4**

For each run, one (1) of the paired sampling trains was pre-spiked with methanol in both the midjet impinger and adsorbent tube in order to demonstrate recovery.

During sampling, approximately 20 L of sample gas was drawn through each sample train at rate of 0.25 liter per minute (lpm) for a total of 80 minutes per run. Sampling occurred from a single point in an unoccupied port located on a different plane than the ports used for isokinetic testing. The sample point was located approximately four (4) feet from the stack wall.

A field train blank was assembled, transported to the location, heated, leak-checked, left to sit for an equivalent amount of time (or greater) as the test runs and recovered as if it were an actual test sample. Reagent blanks (identified in this particular method as a “trip blank”) were collected to quantify background contamination. All samples were stored under refrigeration or on cold packs prior to analysis.

Sample rinses and blanks were shipped to ALS Laboratory Group in Burlington, Ontario, who performed the analysis using gas chromatography/mass spectroscopy (GC/MS). The laboratory followed all specifications in SW-846 8260 when conducting the requisite surrogate spiking, sample, and blank analyses and reporting results.

Aldehydes

Aldehyde emissions were determined using SW-846 M-0011 and an isokinetic, multi-point sample train. The sampling system consisted of a nozzle, heated glass-lined probe, impinger train (for aldehyde collection and H₂O removal/measurement) and a dry gas meter. The aldehyde-collecting impingers were charged with 2,4-dinitrophenylhydrazine (DNPH) solution.

The sampling system traversed all of the M-1 points during each run. A minimum volume of 1.3 dry standard cubic meters (dscm), or 45.9 dry standard cubic feet (dscf), was sampled during each 2-hour run. The probe rinse and impinger train catch and rinse were recovered as one (1) sample fraction.

A “matrix spike” (for formaldehyde only, per SW-846 0011) was performed by operating a sample train pre-spiked with formaldehyde for the same duration as the actual runs and recovering the sample. A field spike sample (for formaldehyde only, per SW-846 0011) was performed by introducing a spike standard into a single impinger containing absorbing reagent and recovering the impinger following standard procedures. Reagent blanks were collected to quantify background contamination. All samples were stored under refrigeration or on cold packs prior to analysis.

Sample rinses and blanks were shipped to ALS Laboratory Group in Burlington, Ontario, who performed the required high performance liquid chromatography (HPLC) analysis. The laboratory followed all specifications in SW846 M-8315A when conducting the requisite sample and blank analyses and reporting results.

METHODOLOGY**4-5****Gaseous Emissions Testing – ICR Group A2****SVOC**

SVOC emissions were determined using SW-846 M-0010 and an isokinetic, multi-point sample train. The sampling system consisted of a nozzle, heated glass-lined probe, heated pre-cleaned filter, water-jacketed condenser and XAD trap (packed with an SVOC-adsorbing resin), impinger train (for additional SVOC collection and H₂O removal/measurement) and a dry gas meter. The SVOC-collecting impingers were charged with distilled organic-free water (Type II).

The sampling system traversed all of the M-1 points during each run. A minimum volume of four (4) dry standard cubic meters (dscm), or 141 dry standard cubic feet (dscf), was sampled during each 4-hour run. The probe rinse, filter, XAD trap and impinger train catch and rinse were recovered.

A field train blank was assembled, transported to the location, heated, leak-checked and recovered as if it were an actual test sample. Reagent blanks were collected to quantify background contamination. All samples were stored under refrigeration or cold packs prior to analysis.

Sample traps, rinses and blanks were shipped to ALS Laboratory Group in Burlington, Ontario, who performed the analysis. The laboratory followed all specifications in SW-846 M-8270D when conducting the requisite surrogate spiking, sample and blank analyses and reporting results.

Gaseous Emissions Testing – ICR Group A3**THC**

THC emissions were determined using a flame ionization analyzer (FIA) per M-25A specifications. Sample gas was extracted at a constant rate and delivered at 250°F to a FIA which measured concentration expressed in terms of propane (C₃H₈) on an actual (wet) basis.

Analyzer calibration was performed by introducing zero air, high, mid- and low-range C₃H₈ calibration gases to the inlet of the sampling system's heated filter. Bias and drift checks were performed before and after each sampling run in a similar manner.

During each run, minute-average data points for THC concentration (as propane, wet basis) were collected over a period of one (1) hour. Sampling occurred from a single point in an unoccupied port located on a different plane than the ports used for isokinetic testing. The sample point was located approximately four (4) feet from the stack wall.

METHODOLOGY**4-6**CH₄ and C₂H₆

CH₄ and C₂H₆ emissions were determined using M-18 (integrated bag sampling – direct pump sampling procedure) and a gas chromatograph (GC). Sample gas was extracted and delivered through an unheated probe, TFE line, gas conditioner (for moisture removal), TFE-coated diaphragm pump and mass flow meter into a Kynar bag. The condensate was not collected for analysis as CH₄ and C₂H₆ are insoluble in water.

Each bag was filled at a constant rate over a period of one (1) hour for each test run. Sampling occurred from a single point in an unoccupied port located on a different plane than the ports used for isokinetic testing. The sample point was located approximately four (4) feet from the stack wall.

Analysis for CH₄ and C₂H₆ was performed off-site by CleanAir Analytical Services using GC. Since moisture was removed from the sample prior to collection, the GC analyzer measured concentration on a dry basis. At least three (3) chromatograms were analyzed for each bag.

Analyzer calibration was performed by generating a calibration curve from triplicate injections of three (3) distinct CH₄ and C₂H₆ concentrations introduced directly into the GC. Upon completion of calibration, a recovery study was performed by spiking one (1) of the bag samples with a known concentration of CH₄ and C₂H₆, storing the bags for the same period of time prior to analysis as the field samples and analyzing the bags to determine percent (%) recovery.

METHODOLOGY**4-7****Gaseous Emissions Testing – ICR Group B**PCDD, PCDF and PCB

PCDD, PCDF and PCB emissions were determined using M-23 and an isokinetic, multi-point sample train. The sampling system consisted of a nozzle, heated glass-lined probe, heated pre-cleaned filter, water-jacketed condenser and XAD trap (packed with a PCDD/PCDF/PCB-adsorbing resin), impinger train (for additional PCB collection and H₂O removal/measurement) and a dry gas meter. The PCB-collecting impingers were charged with distilled organic-free water (Type II).

The sampling system traversed all of the M-1 points during each run. A minimum volume of three (3) dry standard cubic meters (dscm), or 106 dry standard cubic feet (dscf), was sampled during each 3-hour run. The probe rinse, filter, XAD trap and impinger train catch and rinse were recovered.

A field train blank was assembled, transported to the location, leak-checked and recovered as if it were an actual test sample. Reagent blanks were collected to quantify background contamination. All samples were stored under refrigeration or cold packs prior to analysis.

Sample traps, rinses and blanks were shipped to ALS Laboratory Group in Burlington, Ontario, who performed the analysis. The laboratory followed all specifications in SW-846 M-8290 and 1668B when conducting the requisite surrogate spiking, sample and blank analyses and reporting results.

Gaseous Emissions Testing – ICR Group D1FPM and CPM

FPM and CPM emissions were determined using a combined M-5/202 isokinetic, multi-point sample train. The sampling system consisted of a nozzle, heated glass-lined probe, tared heated quartz filter, water-jacketed condenser, impinger train (for CPM and moisture collection), a TFE membrane filter (for additional CPM collection) and dry gas meter. The CPM-collecting impingers were kept empty prior to testing.

The probe and heated filter was heated to 320±25°F (rather than 248±25°F) during sampling (to facilitate both a FPM result for the ICR and a non-sulfuric acid FPM analytical result for annual compliance testing).

The sampling system traversed all of the M-1 points during each run. A minimum volume of two (2) dry standard cubic meters (dscm), or 70.6 dry standard cubic feet (dscf), was sampled during each 2-hour run.

METHODOLOGY**4-8**

The front-half portion of the sample train (nozzle, probe and heated filter) was recovered per M-5 requirements; the back-half of the sample train (heated filter outlet, condenser, dry impingers and TFE membrane filter) was recovered per M-202 requirements. The impinger train was purged with nitrogen at a rate of 14 liters per minute (lpm) for one (1) hour following each test run and prior to recovery.

A field train blank was assembled, purged and recovered as if it were an actual test sample. Reagent blanks were collected to quantify background contamination. Samples and blanks were returned to CleanAir Analytical Services for gravimetric analysis. Samples were maintained at a temperature <85°F during transport to the laboratory.

NH₃

NH₃ emissions were determined using a modified version of CTM-027 and an isokinetic, multi-point sample train. The sampling system consisted of a nozzle, heated probe, high-efficiency heated quartz filter, impinger train (for NH₃ collection and H₂O removal/measurement) and a dry gas meter. The NH₃-collecting impingers were charged with 0.1 N sulfuric acid (H₂SO₄) solution.

Due to saturated flue gas conditions, the in-stack filter specified by the method was replaced with an external filter heated to 248±25°F.

The sampling system traversed all of the M-1 points during each run. No sample time or volume requirement was specified in the ICR. Based on past data, at least one (1) dry standard cubic meters (dscm), or 35.3 dry standard cubic feet (dscf), was sampled during each 1-hour run and was sufficient to obtain a detectable result.

The front-half portion of the sample train (nozzle, probe and heated filter) was not recovered or analyzed. The three (3) NH₃-collecting impingers were recovered separately per CTM-027 requirements. The back-half of the sample train prior to Impinger #1 (heated filter outlet and connecting glassware) was recovered into Impinger #1.

A field blank was collected by charging an impinger with reagent for one (1) hour and recovering it as if it were an actual test sample. Reagent blanks were collected to quantify background contamination. Samples and blanks were returned to CleanAir Analytical Services for ion chromatography (IC) analysis.

METHODOLOGY**4-9**Other Metals

Metals emissions (excluding mercury) were determined using M-29 and an isokinetic, multi-point sample train. The sampling system consisted of a nozzle, heated probe, heated quartz filter, impinger train (for metals collection and H₂O removal/measurement) and a dry gas meter. The metals-collecting impingers were charged with 0.1 N nitric acid (HNO₃) solution.

The sampling system traversed all of the M-1 points during each run. A minimum volume of three (3) dry standard cubic meters (dscm), or 106 dry standard cubic feet (dscf), was sampled during each 3-hour run.

The front-half (nozzle, probe, and filter) and back-half (impingers) of the sample train were recovered separately per M-29 requirements.

Reagent blanks were collected to quantify background contamination.

Samples and blanks were shipped to ALS Laboratory Group in Burlington, Ontario, who performed the analysis. Separate front-half and back-half analyses were performed in order to quantify particulate-bound and gaseous metals emissions. The sample fractions were combined into front- and back-half fractions, separately reduced to near dryness, digested and analyzed for metals using inductively-coupled plasma emission spectroscopy (ICPMS).

Hg_p, Hg²⁺ and Hg⁰

Hg_p, Hg²⁺ and Hg⁰ emissions were determined using ASTM D6784 and an isokinetic, multi-point sample train. The sampling system consisted of a nozzle, heated probe, heated quartz filter, impinger train (for mercury collection and H₂O removal/measurement) and a dry gas meter. The Hg²⁺-collecting impingers were charged with either 1 M potassium chloride (KCl) or 5% nitric acid (HNO₃) / 10% hydrogen peroxide (H₂O₂) solution; the Hg⁰-collecting impingers were charged with 4% potassium permanganate (KMnO₄) / 10% sulfuric acid (H₂SO₄) solution.

The sampling system traversed all of the M-1 points during each run. Close to the maximum volume of 2.5 dry standard cubic meters (dscm), or 88.3 dry standard cubic feet (dscf), was sampled during each 2-hour run (without exceeding the maximum volume).

METHODOLOGY**4-10**

The front-half (nozzle, probe and filter) and back-half (impingers) of the sample train were recovered per ASTM D6784 requirements.

A field train blank was assembled, transported to the location, leak-checked and recovered as if it were an actual test sample. Reagent blanks were collected to quantify background contamination.

Samples and blanks were shipped to ALS Laboratory Group in Burlington, Ontario, who performed the analysis. Separate analyses of the front-half (Hg_p), Hg^{2+} impingers and Hg^0 impingers were performed in order to quantify Hg_p , Hg^{2+} and Hg^0 emissions. The sample fractions were separately reduced to near dryness, digested and analyzed for Hg using inductively-coupled plasma emission spectroscopy (ICPMS).

Cr^{6+}
 Cr^{6+} emissions were determined using SW-846 M-0061 and an isokinetic, multi-point sample train. The sampling system consisted of a TFE nozzle, TFE sample line, TFE impinger train (for Cr^{6+} collection and H_2O removal/measurement), TFE pump/sprayer assembly with a TFE recirculation line (to continuously recirculate the impinger absorbing reagent to the probe tip) and a dry gas meter. The Cr^{6+} -collecting impingers were charged with 0.5 N potassium hydroxide (KOH) solution.

The sampling system traversed all of the M-1 points during each run. A minimum volume of three (3) dry standard cubic meters (dscm), or 106 dry standard cubic feet (dscf), was sampled during each 3-hour run.

At the end of each test run and prior to recovery, the pH of the reagent in Impinger #1 was verified to be > 8.5 , and the impinger train was purged with nitrogen at a rate of 10 liters per minute (lpm) for one (1) hour. The entire sample train (nozzle, sample line and impinger train) was then rinsed, filtered and recovered into a combined fraction per SW-846 0061 requirements.

Reagent blanks were collected to quantify background contamination.

Samples and blanks were shipped to ALS Laboratory Group in Burlington, Ontario, who performed the analysis. The sample fractions were filtered, pre-concentrated and analyzed for Cr^{6+} using ion chromatography (IC) coupled with a post column reactor (ICPCR).

METHODOLOGY**4-11**HCl, Cl₂ and HF

HCl, Cl₂ and HF emissions were determined using M-26A and an isokinetic, multi-point sample train. The sampling system consisted of a nozzle, heated probe, heated TFE mat filter, impinger train (for HCl, Cl₂, and HF collection and H₂O removal/measurement) and a dry gas meter. The HCl/HF-collecting impingers were charged with 0.1 N sulfuric acid (H₂SO₄) solution; the Cl₂-collecting impingers were charged with 0.1 N sodium hydroxide (NaOH) solution.

The sampling system traversed all of the M-1 points during each run. A minimum volume of two (2) dry standard cubic meters (dscm), or 70.6 dry standard cubic feet (dscf), was sampled during each 2-hour run.

Immediately after each run was completed, the filter was visually inspected and no condensed moisture was visible on the filter. The front-half portion of the sample train (nozzle, probe and heated filter) was not recovered or analyzed. The back-half of the sample train (heated filter outlet and HCl/HF impinger fraction, Cl₂ impinger fraction) was recovered separately per M-26A requirements. The Cl₂ fraction was preserved with sodium thiosulfate as part of the recovery process.

Reagent blanks were collected to quantify background contamination.

Samples and blanks were returned to CleanAir Analytical Services for ion chromatography (IC) analysis. Separate analyses of the halide and halogen-collecting fractions were performed in order to quantify HCl, Cl₂ and HF emissions.

HCN

HCN emissions were determined using OTM-29 and an isokinetic, multi-point sample train. The sampling system consisted of a nozzle, heated probe, heated quartz filter, impinger train (for HCN collection and H₂O removal/measurement) and a dry gas meter. The HCN-collecting impingers were charged with 6.0 N sodium hydroxide (NaOH) solution.

OTM-29 calls for the use of multiple Greenburg-Smith impingers with the standard (restricted) stems. In practice, the 6.0 N NaOH absorbing solution in the impingers forms a slurry (and occasionally solidifies) as it absorbs carbon dioxide (CO₂) from the flue gas. This can cause complete plugging of the impinger train and severely delay testing. In order to reduce the chance of plugging, all impinger stems were of the modified Greenburg-Smith (unrestricted stem) design.

METHODOLOGY**4-12**

The sampling system traversed all of the M-1 points during each run. A maximum volume of 0.9 dry standard cubic meters (dscm), or 31.8 dry standard cubic feet (dscf), was sampled during each 1-hour run. CO₂ concentrations in both the flue gas and sample train exhaust were measured throughout the test. The pH in the final impinger containing absorbing solution was shown to be maintained >12.0 throughout the test using alizarin yellow indicator solution.

The front-half portion of the sample train (nozzle, probe and heated filter) was not recovered or analyzed. The back-half of the heated filter outlet was also not recovered or analyzed per the method. Prior to recovery, the pH of each impinger preceding the final impinger was measured and adjusted to > 12.0 if necessary. The impinger fractions were then combined or recovered separately per OTM-29 requirements (Impingers #1 and #2 recovered together, Impinger #3 recovered separately).

A field train blank was assembled, transported to the location, heated, leak-checked and recovered as if it were an actual test sample. A field spike sample was performed by introducing a spike standard into a single impinger containing absorbing reagent and recovering the impinger following standard procedures. Reagent blanks were collected to quantify background contamination. All samples were stored under refrigeration or cold packs prior to analysis.

Samples and blanks were shipped to Enthalpy Analytical in Durham, North Carolina, who performed the analysis. The sample fractions were filtered, pre-concentrated and analyzed for CN⁻ using ion chromatography (IC).

End of Section 4 – Methodology

APPENDIX

5-1

TEST METHOD SPECIFICATIONS	A
SAMPLE CALCULATIONS	B
PARAMETERS	C
QA/QC DATA	D
FIELD DATA	E
FIELD DATA PRINTOUTS	F
LABORATORY DATA	G
PLANT DATA	H
MONITOR DATA	I
PROTOCOL	J

TEST METHOD SPECIFICATIONS

A

I hereby certify that all pages contained within this Appendix have been reviewed and, to the best of my ability, verified accurate.

QA/QC Initials: SB

Date: 9/14



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Specification Sheet for

EPA Method 18 (Midget Impinger Train)

Source Location Name(s) FCCU Scrubber Stack
 Pollutant(s) to be Determined All VOCs but Methanol (CH₃OH)
 Other Parameters to be Determined from Train None

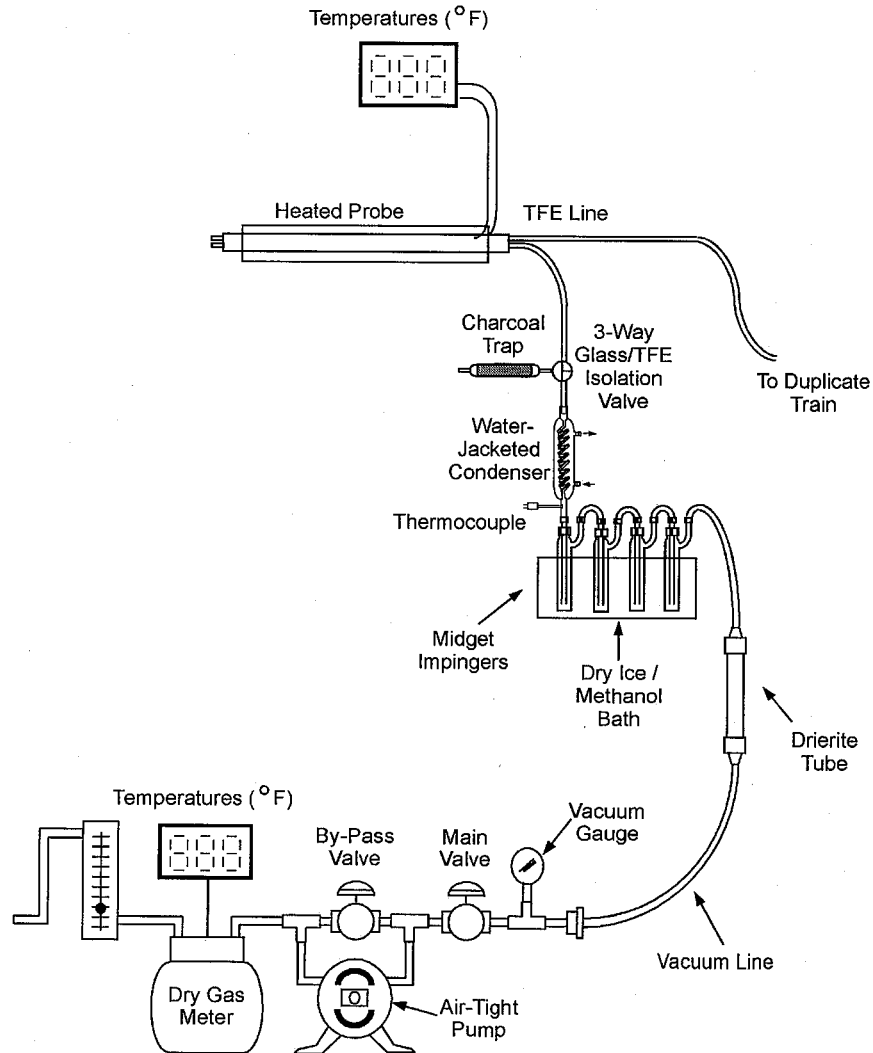
	Standard Method Specification	Actual Specification Used
Pollutant Sampling Information		
Duration of Run	N/A	80 minutes
No. of Sample Traverse Points	N/A	1
Sample Time per Point	N/A	80 minutes
Sampling Rate	Constant Rate (2 lpm±10%)	Constant Rate (0.25 lpm±10%)
Sampling Probe		
Nozzle Material	N/A	None
Nozzle Design	N/A	N/A
Probe Liner Material	Borosilicate Glass or Stainless Steel	Teflon
Effective Probe Length	N/A	4 feet
Probe Temperature Set-Point	Prevent condensation	291°F±11°F
Velocity Measuring Equipment		
Pitot Tube Design	None	None
Pitot Tube Coefficient	N/A	N/A
Pitot Tube Calibration by	N/A	N/A
Pitot Tube Attachment	N/A	N/A
Metering System Console		
Meter Type	Bubble Meter, Critical Orifice or equivalent	Dry Gas Meter
Meter Accuracy	±1%	±1%
Meter Resolution	N/A	0.01 liters
Meter Size	N/A	0.1 liter/revolution
Meter Calibrated Against	Bubble Meter	Bubble Meter
Pump Type	Diaphragm or equivalent	Diaphragm
Temperature Measurements	Dial Thermometer or equivalent	Type K Thermocouple/Pyrometer
Temperature Resolution	N/A	1.0°F
ΔP Differential Pressure Gauge	N/A	N/A
ΔH Differential Pressure Gauge	N/A	Magnehelic
Barometer	Mercury, aneroid or other.	Digital Barometer calibrated w/Mercury Aneroid
Filter Description		
Filter Location	N/A	None
Filter Holder Material	N/A	N/A
Filter Support Material	N/A	N/A
Cyclone Material	N/A	None
Filter Heater Set-Point	N/A	N/A
Filter Material	N/A	N/A
Other Components		
Description	Water-Jacketed Condenser	Water-Jacketed Condenser
Location	N/A	After probe
Operating Temperature	N/A	<50°F

Specification Sheet for

EPA Method 18 (Midget Impinger Train)

	Standard Method Specification	Actual Specification Used
Impinger Train Description		
Type of Glassware Connections	N/A	Screw Joint with Teflon Gasket
Connection to Probe or Filter by	Inert flexible tubing	Flexible Teflon Line
Number of Impingers	N/A	4
Impinger Stem Types		
Impinger 1	Midget Bubbler	Midget Bubbler
Impinger 2	Midget Bubbler	Midget Bubbler
Impinger 3	Midget Bubbler	Midget Bubbler
Impinger 4	Midget Bubbler	Midget Bubbler
Impinger 5		
Impinger 6		
Impinger 7		
Impinger 8		
Gas Density Determination		
Sample Collection	N/A	N/A
Sample Collection Medium	N/A	N/A
Sample Analysis	N/A	N/A
Sample Recovery Information		
Probe Brush Material	N/A	N/A
Probe Rinse Reagent	N/A	Methanol
Probe Rinse Wash Bottle Material	N/A	Glass
Probe Rinse Storage Container	N/A	Glass
Filter Recovered?	No	No
Filter Storage Container	N/A	N/A
Impinger Contents Recovered?	Yes	Yes
Impinger Rinse Reagent	N/A	Methanol
Impinger Wash Bottle	N/A	Teflon
Impinger Storage Container	N/A	Glass
Analytical Information		
Method 4 H ₂ O Determination by	N/A	N/A
Filter Preparation Conditions	N/A	N/A
Aqueous Fraction Analysis	N/A	Gas chromatography
Sorbent Tube Analysis	N/A	Gas chromatography
Additional Analysis	N/A	N/A

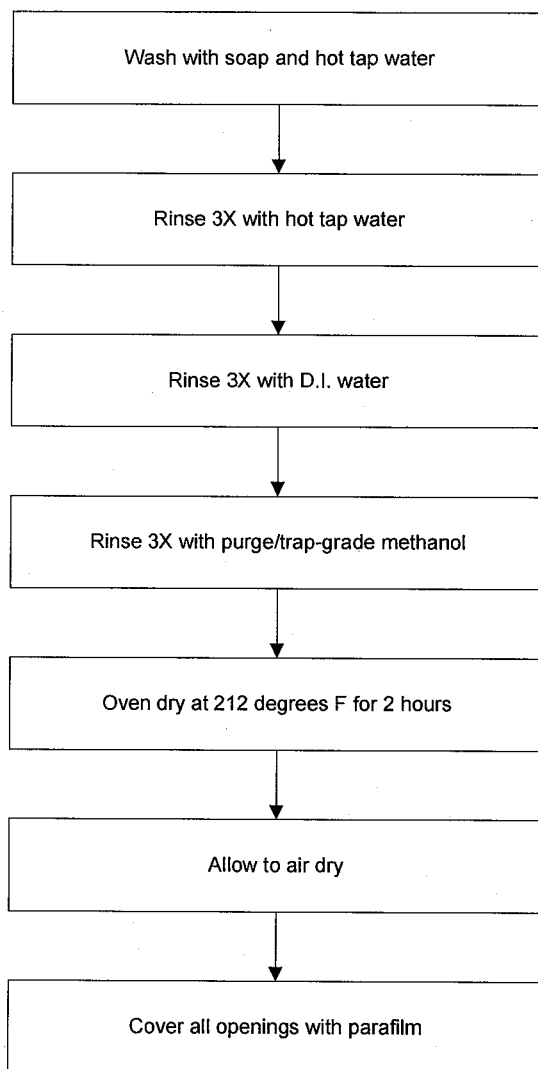
EPA Modified Method 18 Sampling Train Configuration (Midget Impinger Train)



Impinger Contents

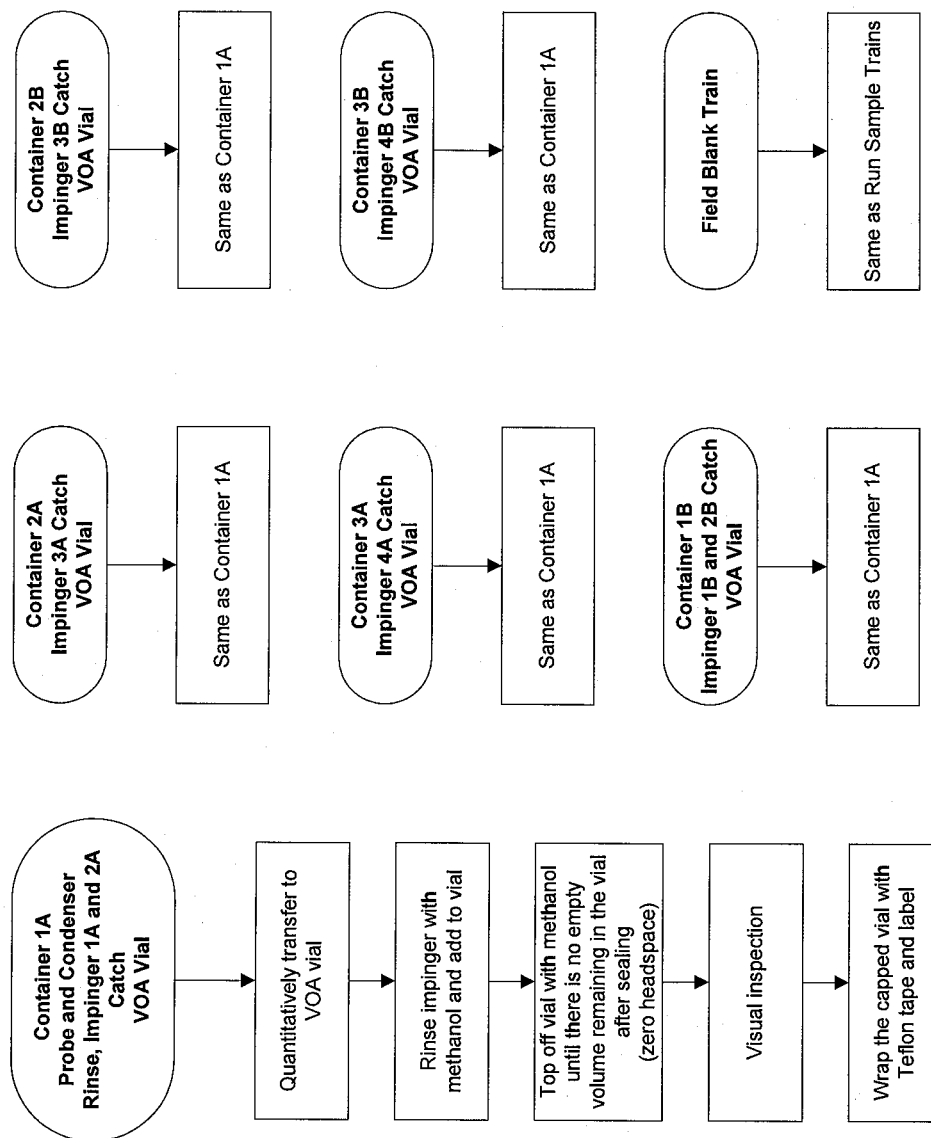
Impinger 1	Empty
Impinger 2	10 mL CH ₃ OH + Spike A or 5 mL CH ₃ OH + Spike A + Spike B
Impinger 3	15 mL CH ₃ OH
Impinger 4	15 mL CH ₃ OH

Modified EPA Method 18 Sample Train Preparation Procedures



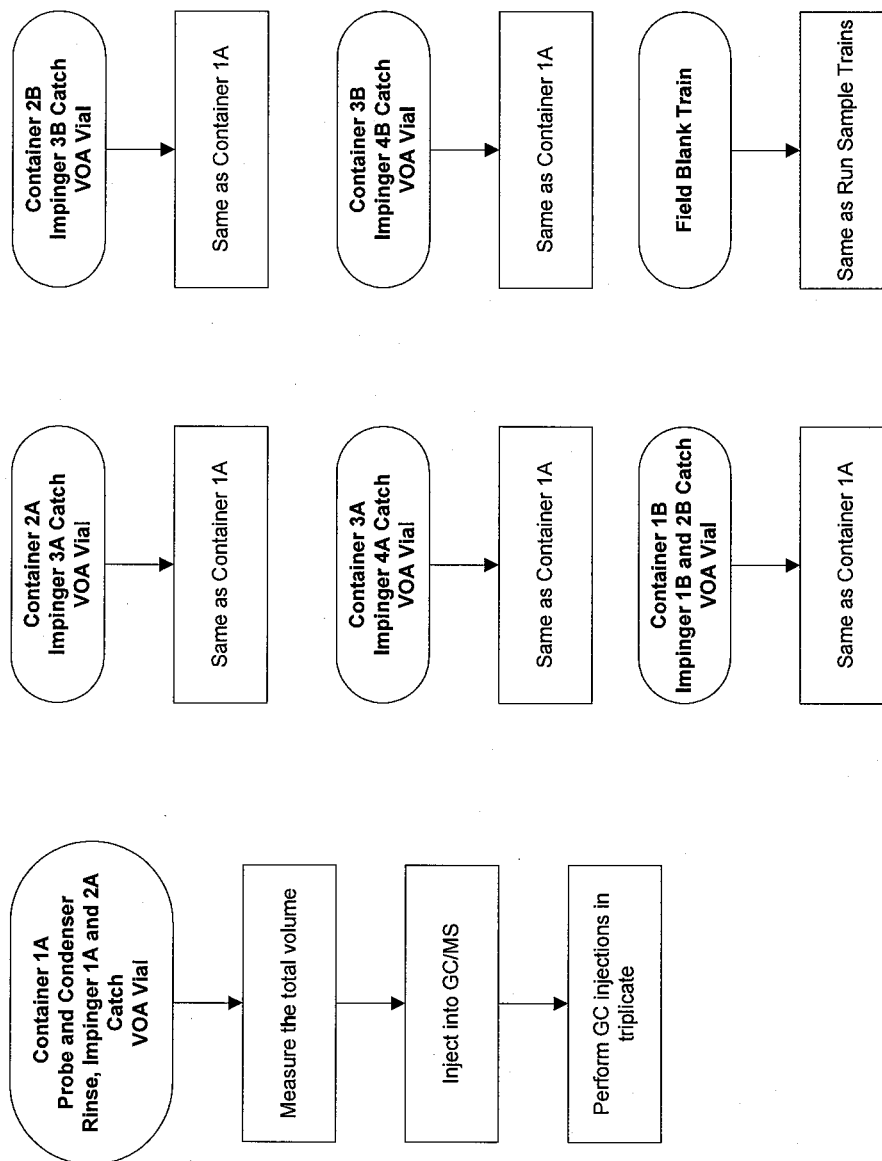
Modified EPA Method 18 **Sample Recovery Flowchart**

- Tare all sample containers before sample collection
- Mark all liquid levels and final weights on the outside of each sample container
- Seal all sample containers with Teflon tape
- Store and ship all samples at ice temperature



Modified EPA Method 18 Analytical Flowchart

- Log each sample in shipment and verify against chain-of-custody sheet
- Note liquid levels in the sample containers and confirm on the chain-of-custody sheet condition
- Recovery study using spiked components must yield an R such that 0.70 less than or equal to R less than or equal to 1.30
- Audit sample analysis should agree with audit value within 10%



Specification Sheet for

EPA Method 18 (Adsorbent Tube)

Source Location Name(s) FCCU Scrubber Stack
 Pollutant(s) to be Determined Methanol (CH₃OH)
 Other Parameters to be Determined from Train None

	Standard Method Specification	Actual Specification Used
Pollutant Sampling Information		
Duration of Run	N/A	80 minutes
No. of Sample Traverse Points	N/A	1
Sample Time per Point	N/A	80 minutes
Sampling Rate	Constant Rate (2 lpm±10%)	Constant Rate (0.25 lpm±10%)
Sampling Probe		
Nozzle Material	N/A	None
Nozzle Design	N/A	N/A
Probe Liner Material	Borosilicate Glass or Stainless Steel	Teflon
Effective Probe Length	N/A	4 feet
Probe Temperature Set-Point	Prevent condensation	291°F±11°F
Velocity Measuring Equipment		
Pitot Tube Design	None	None
Pitot Tube Coefficient	N/A	N/A
Pitot Tube Calibration by	N/A	N/A
Pitot Tube Attachment	N/A	N/A
Metering System Console		
Meter Type	Bubble Meter, Critical Orifice or equivalent	Dry Gas Meter
Meter Accuracy	±1%	±1%
Meter Resolution	N/A	0.01 liters
Meter Size	N/A	0.1 liter/revolution
Meter Calibrated Against	Bubble Meter	Bubble Meter
Pump Type	Diaphragm or equivalent	Diaphragm
Temperature Measurements	Dial Thermometer or equivalent	Type K Thermocouple/Pyrometer
Temperature Resolution	N/A	1.0°F
ΔP Differential Pressure Gauge	N/A	N/A
ΔH Differential Pressure Gauge	N/A	Magnehelic
Barometer	Mercury, aneroid or other.	Digital Barometer calibrated w/Mercury Aneroid
Filter Description		
Filter Location	N/A	None
Filter Holder Material	N/A	N/A
Filter Support Material	N/A	N/A
Cyclone Material	N/A	None
Filter Heater Set-Point	N/A	N/A
Filter Material	N/A	N/A
Other Components		
Description	Sorbent tubes suitable for analytes and application	Silica Tube
Location	N/A	After 1st Impinger
Operating Temperature	N/A	Ambient

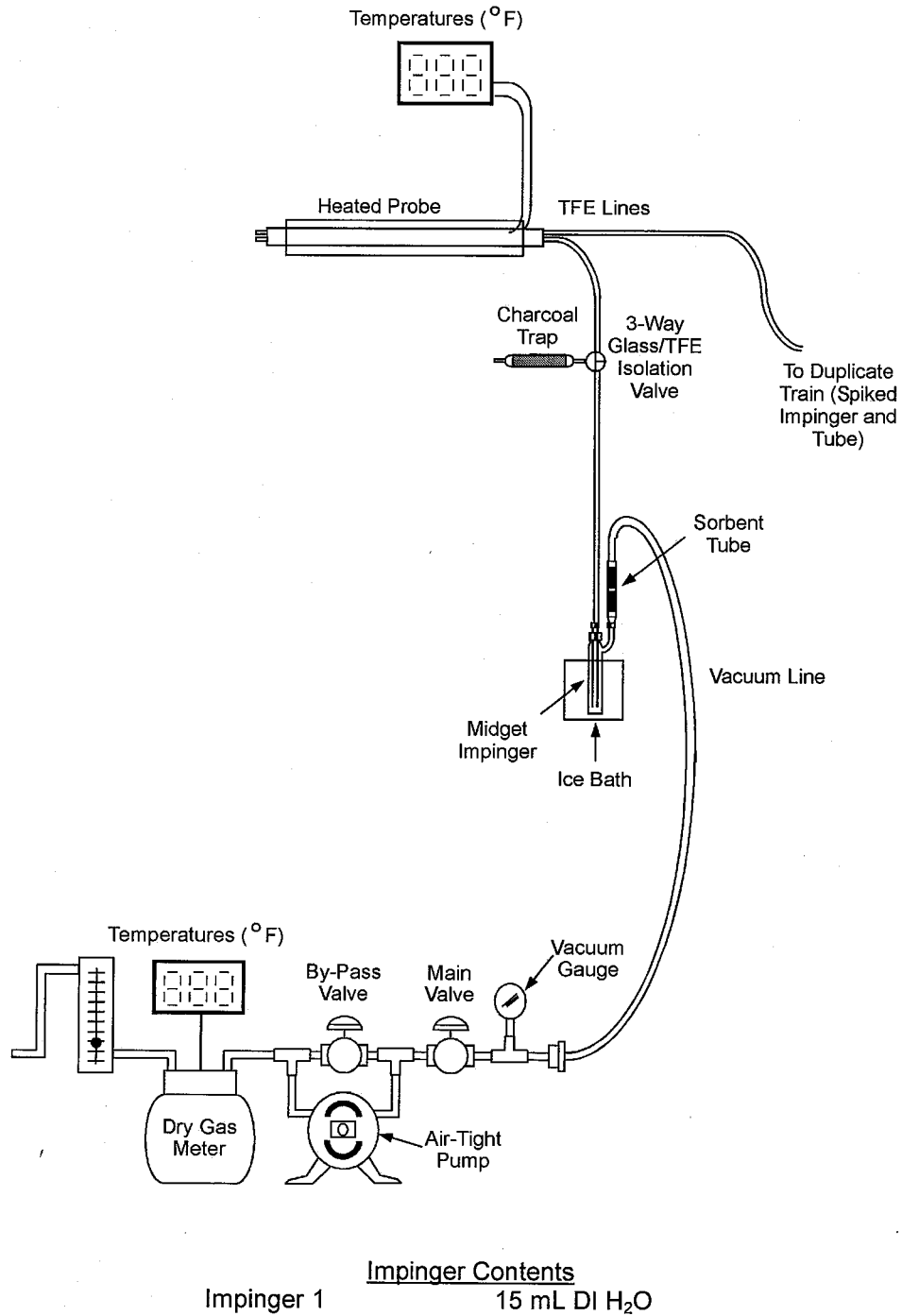
Specification Sheet for

EPA Method 18 (Adsorbent Tube)

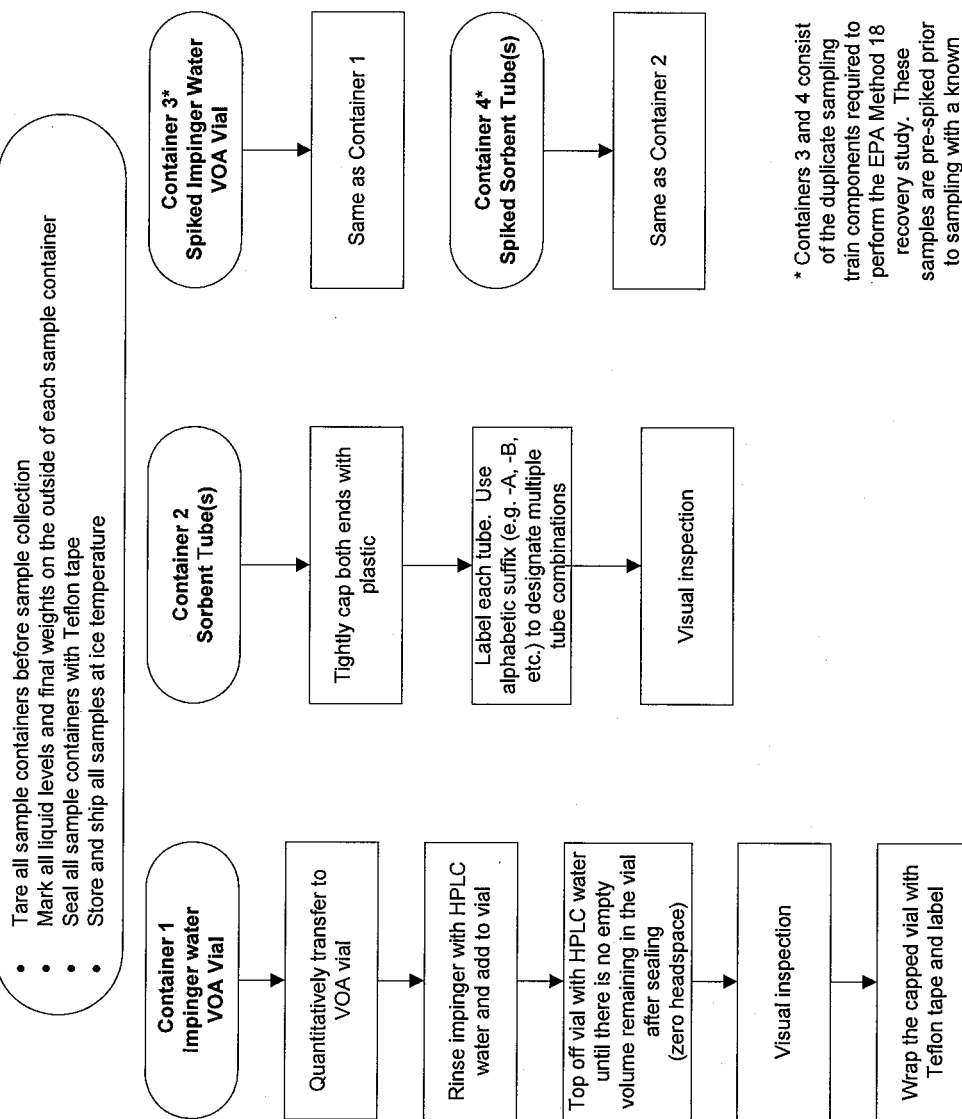
	Standard Method Specification	Actual Specification Used
Impinger Train Description		
Type of Glassware Connections	N/A	Screw Joint with Teflon Gasket
Connection to Probe or Filter by	Inert flexible tubing	Flexible Teflon Line
Number of Impingers	N/A	1
Impinger Stem Types		
Impinger 1	Midget Bubbler (optional)	Midget Bubbler
Impinger 2		
Impinger 3		
Impinger 4		
Impinger 5		
Impinger 6		
Impinger 7		
Impinger 8		
Gas Density Determination		
Sample Collection	N/A	N/A
Sample Collection Medium	N/A	N/A
Sample Analysis	N/A	N/A
Sample Recovery Information		
Probe Brush Material	N/A	N/A
Probe Rinse Reagent	N/A	HPLC Water
Probe Rinse Wash Bottle Material	N/A	Glass
Probe Rinse Storage Container	N/A	Glass
Filter Recovered?	No	No
Filter Storage Container	N/A	N/A
Impinger Contents Recovered?	Yes	Yes
Impinger Rinse Reagent	N/A	HPLC Water
Impinger Wash Bottle	N/A	Teflon
Impinger Storage Container	N/A	Glass
Analytical Information		
Method 4 H ₂ O Determination by	N/A	N/A
Filter Preparation Conditions	N/A	N/A
Aqueous Fraction Analysis	N/A	Gas chromatography
Sorbent Tube Analysis	N/A	Gas chromatography
Additional Analysis	N/A	N/A

EPA Method 18

Sampling Train Configuration (Adsorbent Tubes)



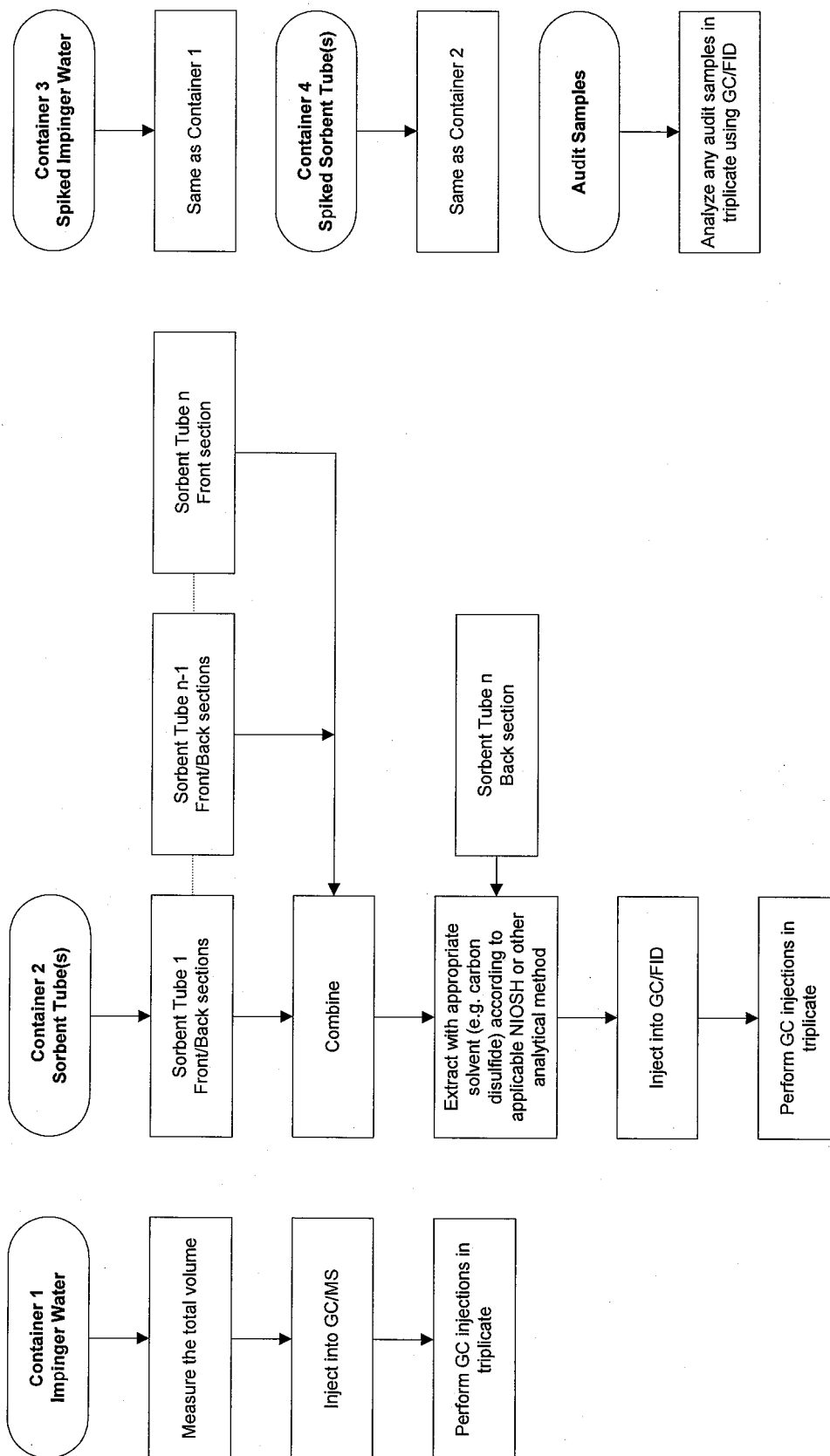
EPA Method 18 – Adsorbent Tubes Sample Recovery Flowchart



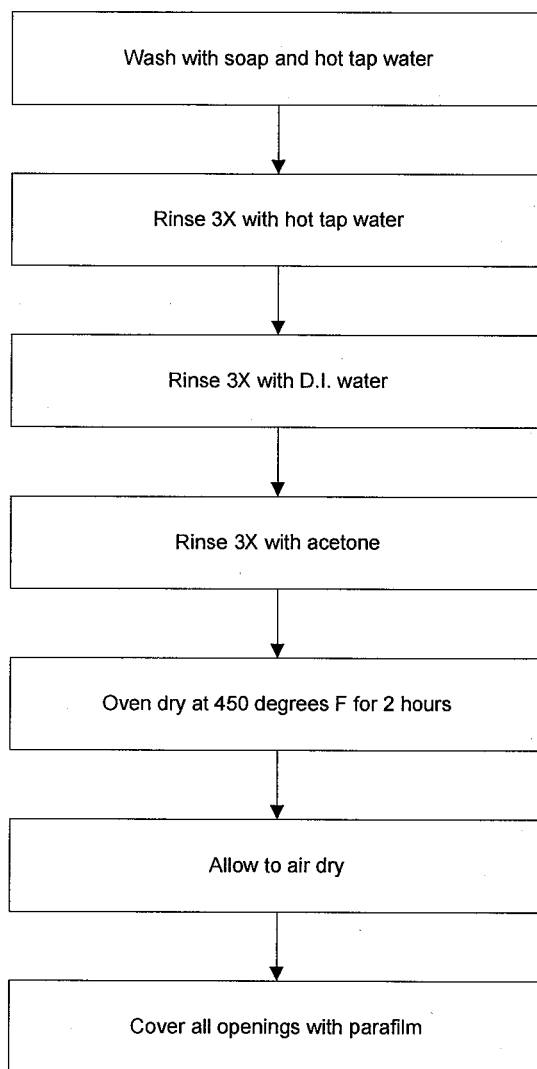
* Containers 3 and 4 consist of the duplicate sampling train components required to perform the EPA Method 18 recovery study. These samples are pre-spiked prior to sampling with a known quantity of target analyte.

EPA Method 18 – Adsorbent Tubes Analytical Flowchart

- Log each sample in shipment and verify against chain-of-custody sheet
- Note liquid levels in the sample containers and confirm on the chain-of-custody sheet condition
- Recovery study using spiked components must yield an R such that 0.70 less than or equal to R less than or equal to 1.30
- Audit sample analysis should agree with audit value within 10%



EPA Method 18 – Adsorbent Tubes Sample Train Preparation Procedures



Specification Sheet for

SW846 Method 0011

Source Location Name(s) FCCU Scrubber Stack
Pollutant(s) to be Determined Aldehyde and Ketone Emissions
Other Parameters to be Determined from Train Gas Density, Moisture, Flow Rate

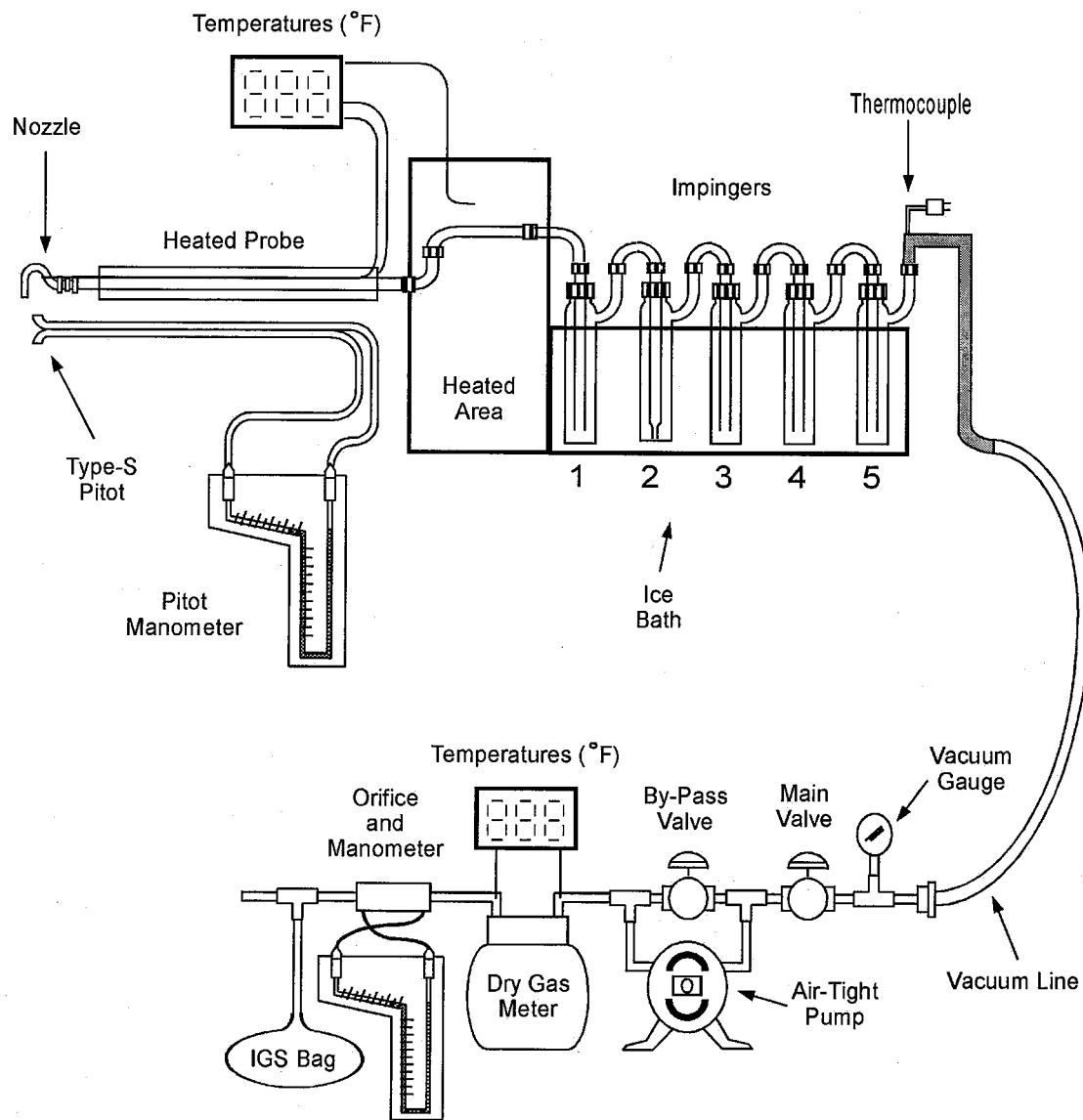
	Standard Method Specification	Actual Specification Used
Pollutant Sampling Information		
Duration of Run	N/A	120 minutes
No. of Sample Traverse Points	N/A	12
Sample Time per Point	N/A	10 minutes
Sampling Rate	Isokinetic (90-110%) - 1 cfm maximum	Isokinetic (90-110%) - 1 cfm maximum
Sampling Probe		
Nozzle Material	Quartz or Glass	Borosilicate Glass
Nozzle Design	Button-Hook or Elbow	Button-Hook
Probe Liner Material	Borosilicate Glass or Quartz	Borosilicate Glass
Effective Probe Length	N/A	4 feet
Probe Temperature Set-Point	248°F±25°F	248°F±25°F
Velocity Measuring Equipment		
Pitot Tube Design	Type S	Type S
Pitot Tube Coefficient	N/A	0.827
Pitot Tube Calibration by	Geometric or Wind Tunnel	Wind-Tunnel
Pitot Tube Attachment	Attach to Probe	Attached to Probe
Metering System Console		
Meter Type	Dry Gas Meter	Dry Gas Meter
Meter Accuracy	±2%	±1%
Meter Resolution	0.01 cubic feet	0.01 cubic feet
Meter Size	N/A	0.1 dcf/revolution
Meter Calibrated Against	Wet Test Meter or Standard DGM	Wet Test Meter
Pump Type	N/A	Rotary Vane
Temperature Measurements	N/A	Type K Thermocouple/Pyrometer
Temperature Resolution	5.4°F	1.0°F
ΔP Differential Pressure Gauge	Inclined Manometer or Equivalent	Inclined Manometer
ΔH Differential Pressure Gauge	Inclined Manometer or Equivalent	Inclined Manometer
Barometer	Mercury or Aneroid	Digital Barometer calibrated w/Mercury Aneroid
Filter Description		
Filter Location	None	None
Filter Holder Material	N/A	N/A
Filter Support Material	N/A	N/A
Cyclone Material	N/A	None
Filter Heater Set-Point	N/A	N/A
Filter Material	N/A	N/A
Other Components		
Description	N/A	N/A
Location	N/A	N/A
Operating Temperature	N/A	N/A

Specification Sheet for

SW846 Method 0011

	Standard Method Specification	Actual Specification Used
Impinger Train Description		
Type of Glassware Connections	Ground Glass or Equivalent	Screw Joint with Silicone Gasket
Connection to Probe or Filter by	Direct Glass Connection	Direct Glass Connection
Number of Impingers	5	5
Impinger Stem Types		
Impinger 1	Modified Greenburg-Smith	Modified Greenburg-Smith
Impinger 2	Greenburg-Smith	Greenburg-Smith
Impinger 3	Modified Greenburg-Smith	Modified Greenburg-Smith
Impinger 4	Modified Greenburg-Smith	Modified Greenburg-Smith
Impinger 5	Modified Greenburg-Smith	Modified Greenburg-Smith
Impinger 6		
Impinger 7		
Impinger 8		
Gas Density Determination		
Sample Collection	Multi-Point Integrated	Multi-Point Integrated
Sample Collection Medium	Flexible Gas Bag	Vinyl Bag
Sample Analysis	Orsat or Fyrite Analyzer	CEM
Sample Recovery Information		
Probe Brush Material	Teflon Bristle	Teflon Mat
Probe Rinse Reagent	Methylene Chloride	Methylene Chloride
Probe Rinse Wash Bottle Material	Glass or Teflon	Teflon
Probe Rinse Storage Container	Amber Glass	Amber Glass
Filter Recovered?	N/A	N/A
Filter Storage Container	N/A	N/A
Impinger Contents Recovered?	Yes	Yes
Impinger Rinse Reagent	Methylene Chloride/Water	Methylene Chloride/Water
Impinger Wash Bottle	Glass or Teflon	Teflon
Impinger Storage Container	Amber Glass	Amber Glass
Analytical Information		
Method 4 H ₂ O Determination by	Volumetric or Gravimetric	Gravimetric and Volumetric
Filter Preparation Conditions	N/A	N/A
Front-Half Rinse Preparation	N/A	N/A
Back-Half Analysis	High Performance Liquid Chromatography	HPLC
Additional Analysis	N/A	None

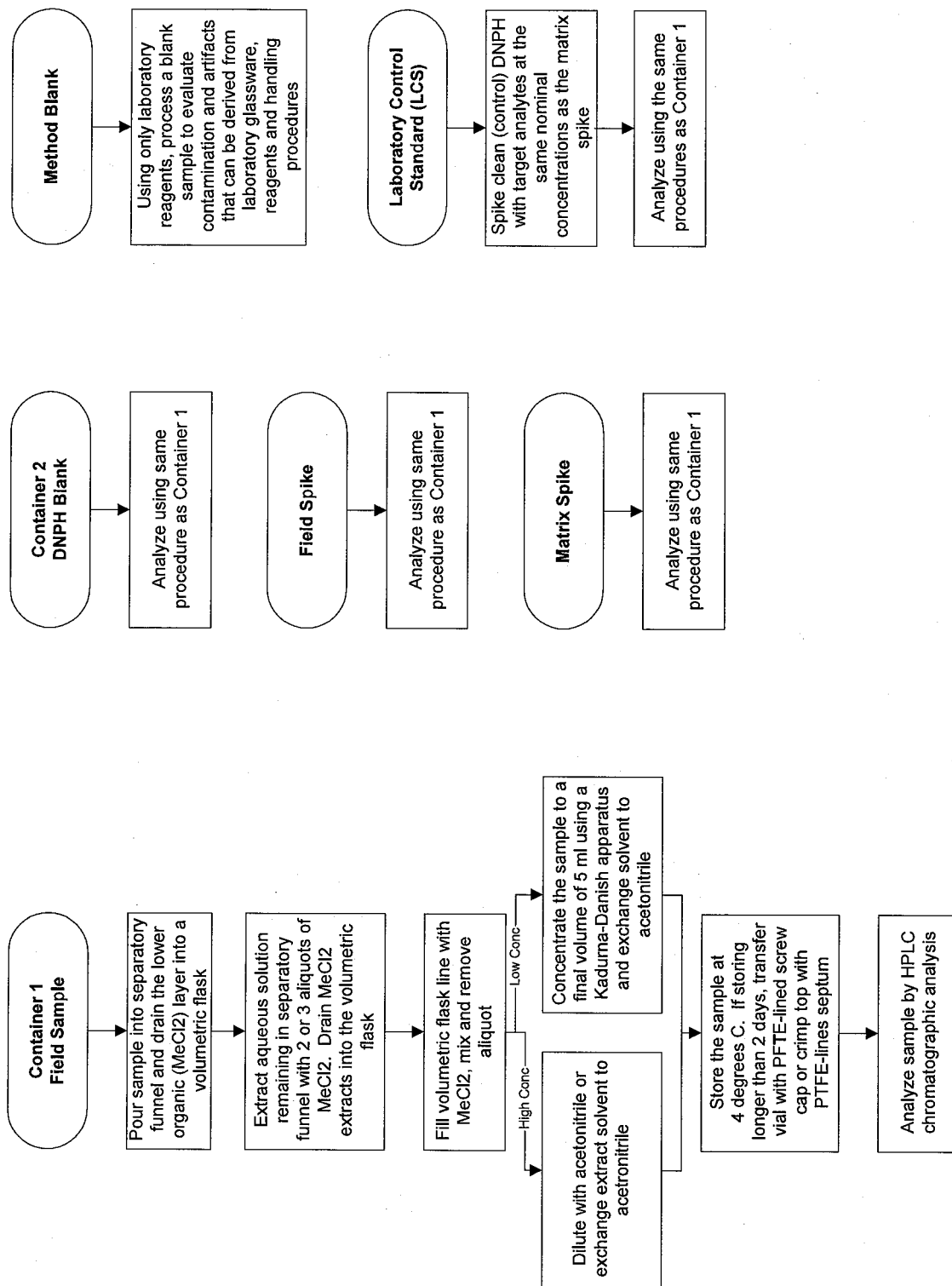
SW846 Method 0011 Sampling Train Configuration



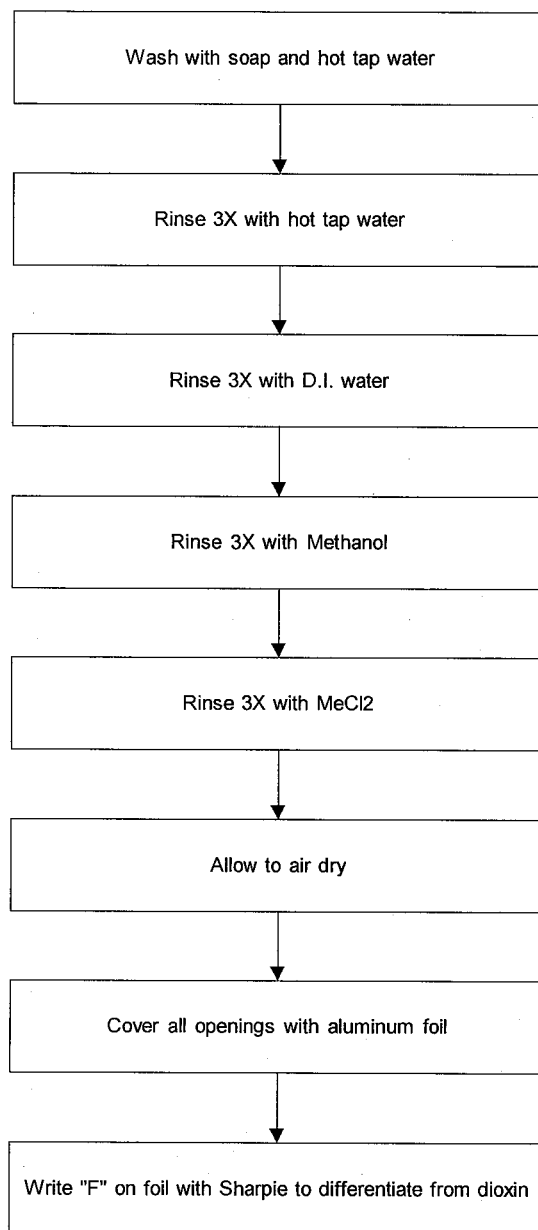
Impinger Contents

Impinger 1	200 mL DNPH
Impinger 2	100 mL DNPH
Impinger 3	100 mL DNPH
Impinger 4	Empty
Impinger 5	Silica Gel

SW846 Method 0011 Analytical Flowchart

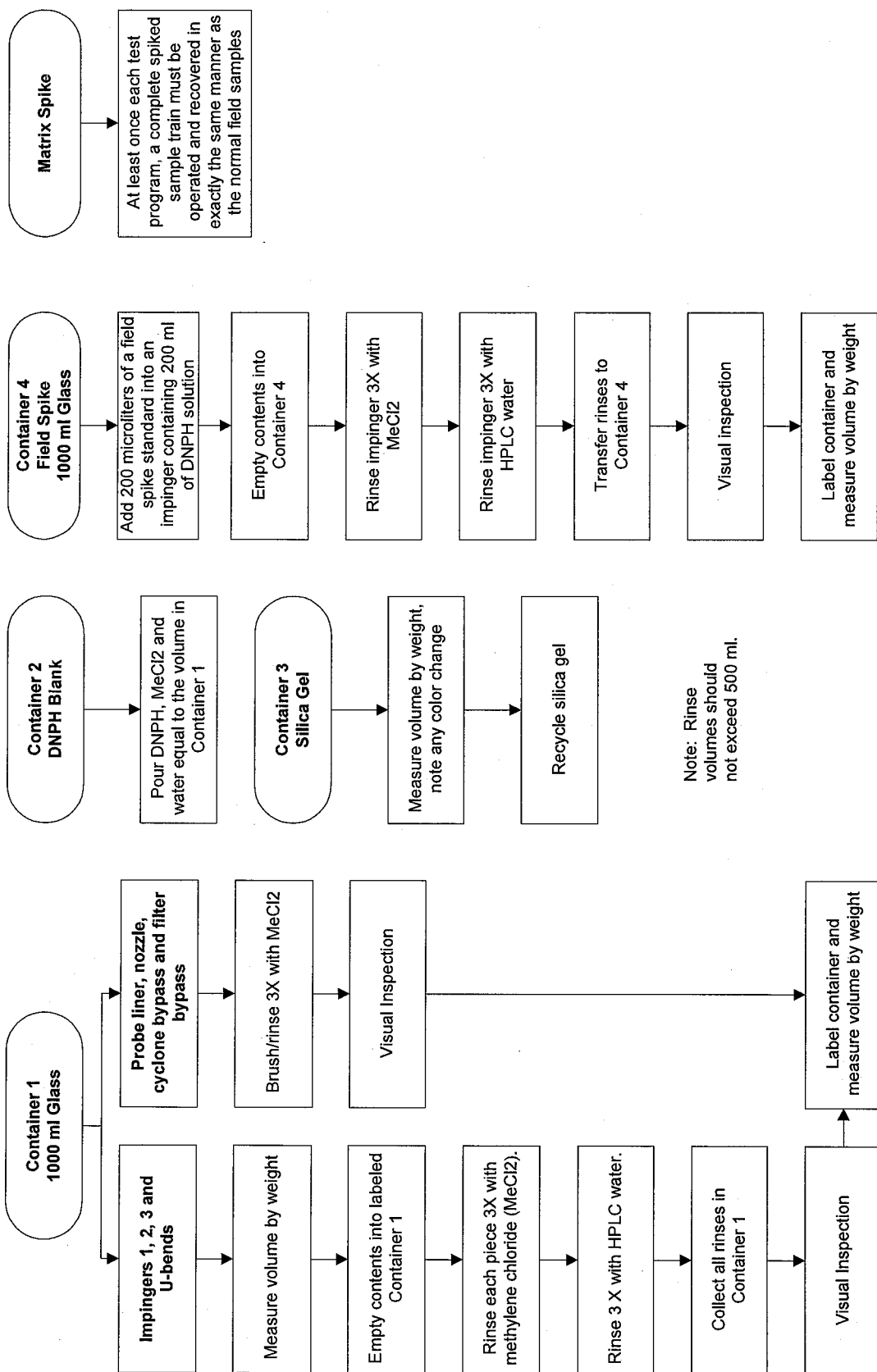


SW846 Method 0011 Glassware Preparation Procedures



SW846 Method 0011 Sample Recovery Flowchart

- Tare all sample containers before sample collection
- Mark all liquid levels and final weights on the outside of each sample container
- Seal all sample containers with Teflon tape
- If recycling, bake silica gel for two hours at 350 degrees F (175 degrees C)
- Containers must be amber glass with Teflon lids
- Store and ship samples at ice temperature



Specification Sheet for**SW-846 Method 0010**

Source Location Name(s) FCCU Scrubber Stack
Pollutant(s) to be Determined SVOC
Other Parameters to be Determined from Train Gas Density, Moisture, Flow Rate

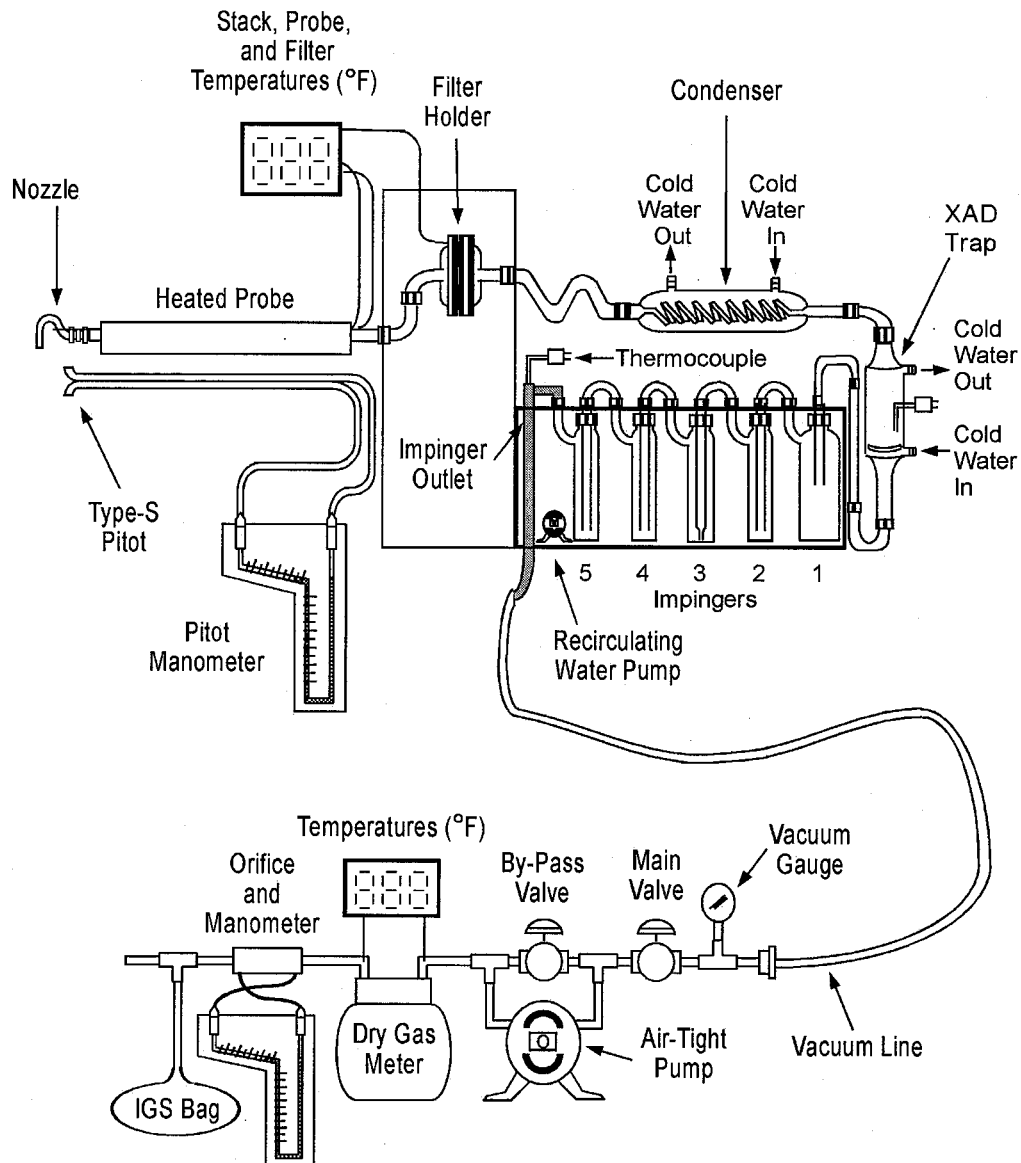
	Standard Method Specification	Actual Specification Used
Pollutant Sampling Information		
Duration of Run	N/A	240 minutes
No. of Sample Traverse Points	N/A	12
Sample Time per Point	N/A	20 minutes
Sampling Rate	Isokinetic (90-110%)	Isokinetic (90-110%)
Sampling Probe		
Nozzle Material	Nickel, Quartz, Stainless Steel or Glass	Borosilicate Glass
Nozzle Design	Button-Hook or Elbow	Button-Hook
Probe Liner Material	Borosilicate or Quartz Glass	Borosilicate Glass
Effective Probe Length	N/A	4 feet
Probe Temperature Set-Point	248°F±25°F	248°F±25°F
Velocity Measuring Equipment		
Pitot Tube Design	Type S	Type S
Pitot Tube Coefficient	N/A	0.827
Pitot Tube Calibration by	Geometric or Wind Tunnel	Wind-Tunnel
Pitot Tube Attachment	Attached to Probe	Attached to Probe
Metering System Console		
Meter Type	Dry Gas Meter	Dry Gas Meter
Meter Accuracy	±2%	±1%
Meter Resolution	N/A	0.01 cubic feet
Meter Size	N/A	0.1 dcf/revolution
Meter Calibrated Against	Wet Test Meter or Standard DGM	Wet Test Meter
Pump Type	N/A	Rotary Vane
Temperature Measurements	N/A	Type K Thermocouple/Pyrometer
Temperature Resolution	5.4°F	1.0°F
ΔP Differential Pressure Gauge	Inclined Manometer or Equivalent	Inclined Manometer
ΔH Differential Pressure Gauge	Inclined Manometer or Equivalent	Inclined Manometer
Barometer	Mercury or Aneroid	Digital Barometer calibrated w/Mercury Aneroid
Filter Description		
Filter Location	After Probe	Exit of Probe
Filter Holder Material	Borosilicate Glass	Borosilicate Glass
Filter Support Material	Glass Frit	Teflon
Cyclone Material	N/A	None
Filter Heater Set-Point	248°F±25°F	248°F±25°F
Filter Material	Glass Fiber - Toluene Extracted	Quartz Fiber - Methylene Chloride Extracted
Other Components		
Adsorbent Module	XAD-2 Trap	XAD-II Adsorbent Trap
Location	After filter and condenser	After filter and condenser
Operating Temperature	< 68°F	< 68°F

Specification Sheet for

SW-846 Method 0010

	Standard Method Specification	Actual Specification Used
Impinger Train Description		
Type of Glassware Connections	Ground Glass or Equivalent	Screw Joint with Silicone Gasket
Connection to Probe or Filter by	Direct Glass Connection	Direct Glass Connection
Number of Impingers	5	5
Impinger Stem Types		
Impinger 1	Modified Greenburg-Smith	Shortened Stem (open tip)
Impinger 2	Modified Greenburg-Smith	Modified Greenburg-Smith
Impinger 3	Greenburg-Smith	Greenburg-Smith
Impinger 4	Modified Greenburg-Smith	Modified Greenburg-Smith
Impinger 5	Modified Greenburg-Smith	Modified Greenburg-Smith
Impinger 6		
Impinger 7		
Impinger 8		
Gas Density Determination		
Sample Collection	Multi-point integrated	Multi-Point Integrated
Sample Collection Medium	Flexible Gas Bag	Vinyl Bag
Sample Analysis	Orsat or Fyrite Analyzer	CEM
Sample Recovery Information		
Probe Brush Material	Inert Bristle	Teflon Mat
Probe Rinse Reagent	Acetone/Methylene Chloride	Acetone/Methylene Chloride
Probe Rinse Wash Bottle Material	Glass or Teflon	Teflon
Probe Rinse Storage Container	Glass	Glass
Filter Recovered?	Yes	Yes
Filter Storage Container	Petri Dish - Glass or Polystyrene	Glass
Impinger Contents Recovered?	No	Yes
Impinger Rinse Reagent	N/A	HPLC Water
Impinger Wash Bottle	N/A	Teflon
Impinger Storage Container	N/A	Amber Glass
Analytical Information		
Method 4 H ₂ O Determination by	Volumetric or Gravimetric	Gravimetric and Volumetric
Filter Preparation Conditions	See Method 0010 Analytical Flow Chart	For Organic Analysis
Front-Half Rinse Preparation	See Method 0010 Analytical Flow Chart	Organic Analysis
Back-Half Analysis	N/A	See Analytical Flow Chart
Additional Analysis	None	None

SW-846 Method 0010 Sampling Train Configuration

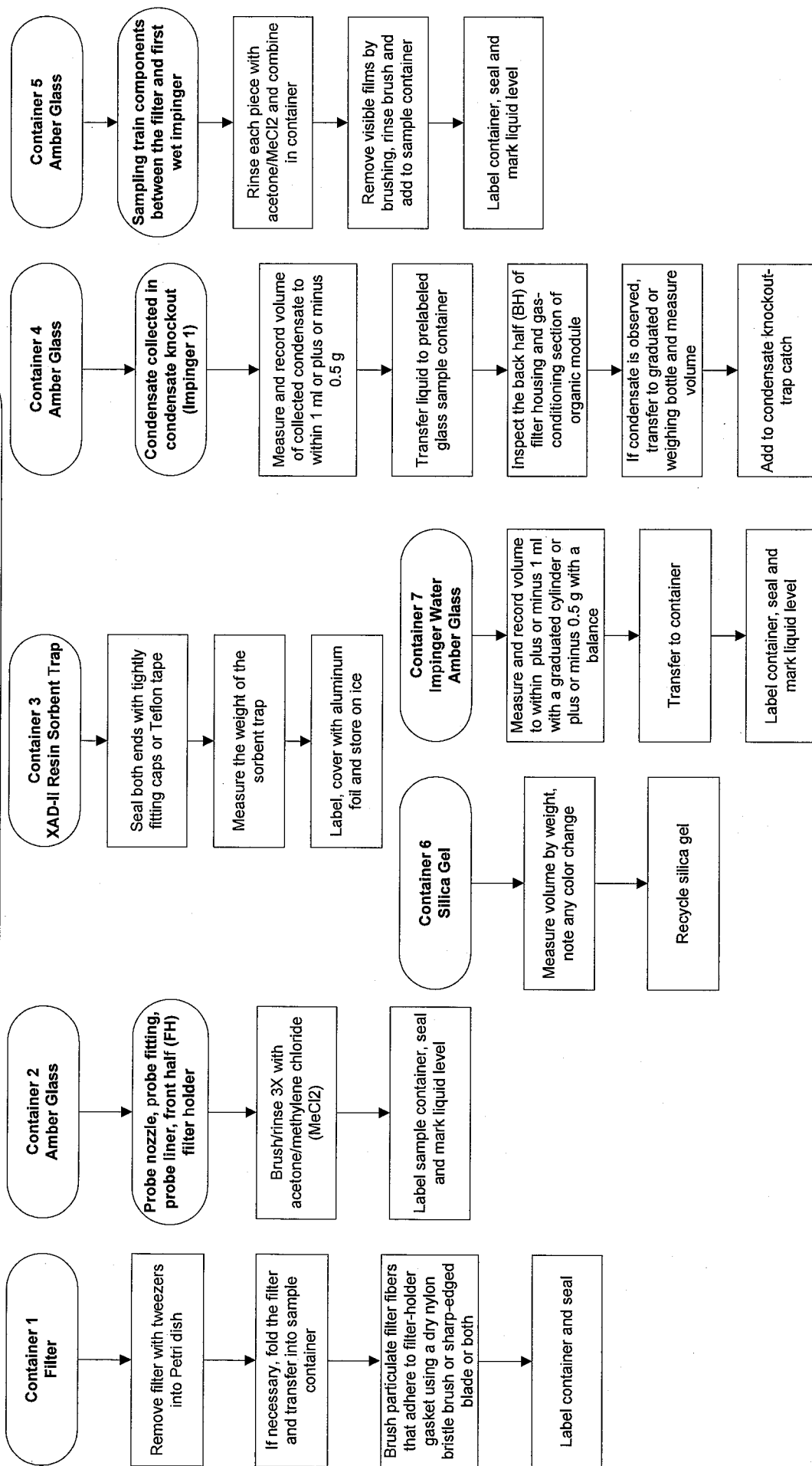


Impinger Contents

Impinger 1	Empty
Impinger 2	100 mL DI H ₂ O
Impinger 3	100 mL DI H ₂ O
Impinger 4	Empty
Impinger 5	Silica Gel

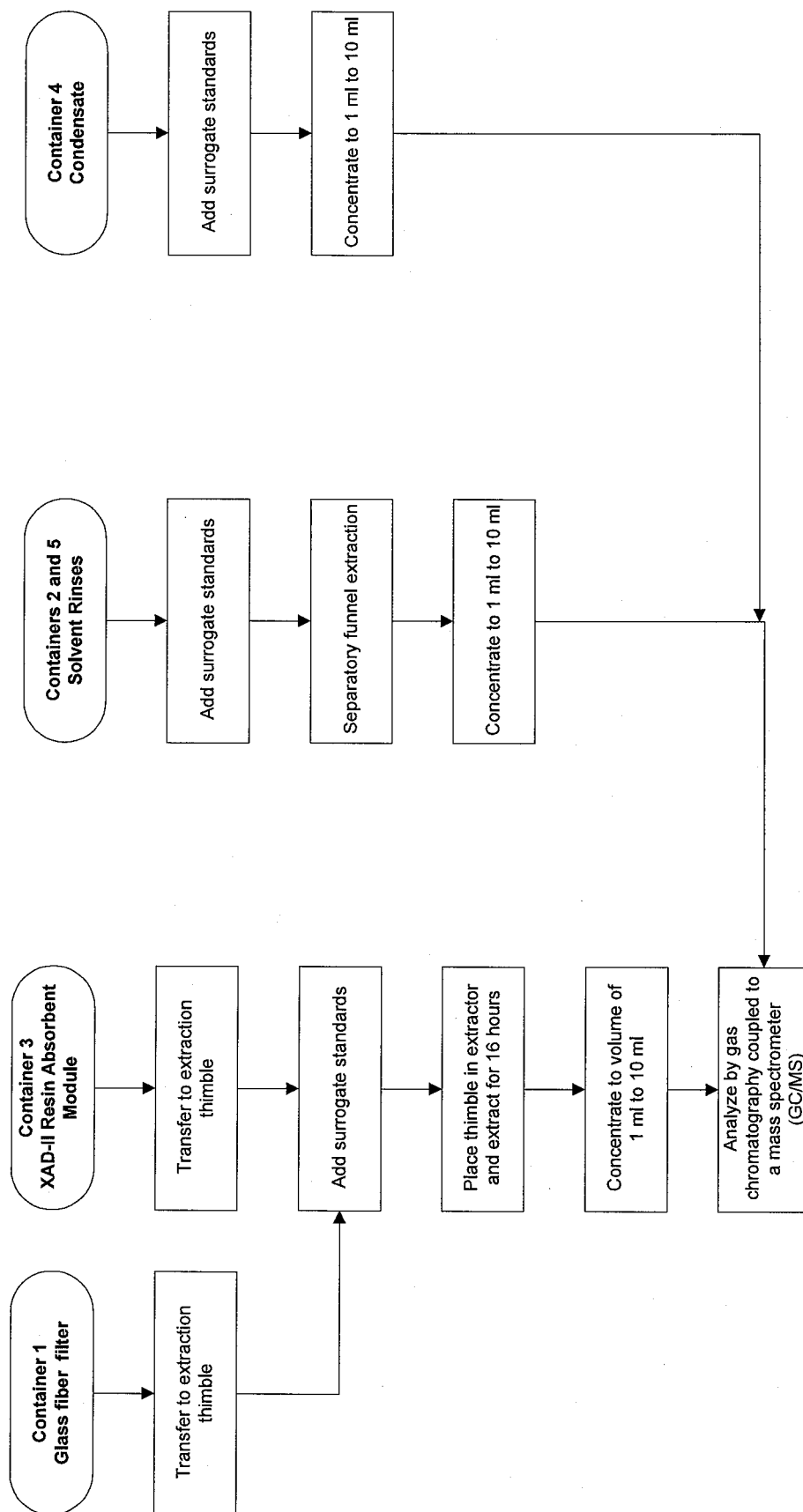
SW846 Method 0010 Sample Recovery Flowchart

- Tare all sample containers before sample collection
- Mark all liquid levels and final weights on the outside of each sample container
- Seal all sample containers with Teflon tape
- If recycling, bake silica gel for two hours at 350 degrees F (175 degrees C)
- Containers must be amber glass with Teflon lids



SW846 Method 0010 Analytical Flowchart

- Log each sample in shipment and verify against chain-of-custody sheet
- Note liquid levels in the sample containers and confirm on the chain-of-custody sheet condition
- All samples must be extracted within 30 days of collection
- All samples must be analyzed within 45 days of extraction
- All laboratory glassware must be cleaned as described in Section 3A of the "Manual of Analytical Methods for the Analysis of Pesticides"



Specification Sheet for

EPA Method 25A

Source Location Name(s) FCCU Scrubber Stack
 Pollutant(s) to be Determined Total Hydrocarbon (THC)
 Other Parameters to be Determined from Train O2 and CO2 (EPA Method 3A)

	Standard Method Specification	Actual Specification Used
Pollutant Sampling Information		
Duration of Run	N/A	60 minutes
No. of Sample Traverse Points	N/A	1
Sample Time per Point	N/A	60 minutes
Sampling Rate	Constant Rate	Constant Rate
Sampling Probe		
Nozzle Material	N/A	None
Nozzle Design	N/A	N/A
Probe Liner Material	Stainless Steel or Pyrex Glass	Stainless Steel
Effective Probe Length	Sufficient to Traverse Points	4 feet
Probe Temperature Set-Point	Prevent Condensation	248°F±25°F
Particulate Filter		
In-Stack Filter	Yes	Yes
In-Stack Filter Material	Non-reactive to gas	Fritted Stainless Steel
External Filter	Yes	Yes
External Filter Material	Borosilicate, Quartz Glass Wool or Fiber Mat	Borosilicate Glass Fiber Mat
External Filter Set-Point	Prevent Condensation	248°F±25°F
Sample Delivery System		
Heated Sample Line Material	Stainless Steel or Teflon	Teflon
Heated Sample Line Set-Point	Prevent Condensation	248°F±25°F
Heated Sample Line Connections	Probe Exit to Moisture Removal System	Probe to Moisture Removal System
Moisture Removal System	Refrigerator-type condenser or similar	Refrigerator-type condenser
Sample Pump Type	Leak-Free, minimal response time	Diaphragm
Sample Pump Material	Non-reactive to sample gases	Teflon
Sample Flow Control	Constant Rate	Constant Rate (±10%)
Non-Heated Sample Line Material	Stainless Steel or Teflon	Teflon
Non-Heated Sample Line Connections	Moisture Removal to Sample Gas Manifold	Moisture Removal to Sample Gas Manifold
Additional Filters	Optional	Yes
Additional Filter Type	N/A	Particulate Removal
Additional Filter Location	Optional	Entrance to Sample Manifold
Filter Material	Non-reactive to sample gases	Glass Fiber
Analyzer Description		
Oxygen (O ₂)	EPA Method 3A (Paramagnetic)	EPA Method 3A (Paramagnetic)
Carbon Dioxide (CO ₂)	EPA Method 3A (NDIR)	EPA Method 3A (NDIR)
Sulfur Dioxide (SO ₂)	EPA Method 6C (UV, NDIR or Fluorescence)	N/A
Nitrogen Oxides (NO _x)	EPA Method 7E (Chemiluminescent)	N/A
Carbon Monoxide (CO)	EPA Method 10 (Gas Filter Correlation IR)	N/A
Total Hydrocarbon (THC)	EPA Method 25A (Flame Ionization)	EPA Method 25A (Flame Ionization Detection)

Specification Sheet for

EPA Method 25A

Standard Method Specification

Actual Specification Used

Instrument Span Range

Oxygen (O ₂)	≤ 1.33 x Expected Maximum	0-25%
Carbon Dioxide (CO ₂)	≤ 1.33 x Expected Maximum	0-25%
Sulfur Dioxide (SO ₂)	≤ 1.33 x Expected Maximum	N/A
Nitrogen Oxides (NO _x)	≤ 1.33 x Expected Maximum	N/A
Carbon Monoxide (CO)	1000 ppm maximum	N/A
Total Hydrocarbon (THC)	1.5 to 2.5 x Expected Maximum	0-15 ppm
		N/A
		N/A

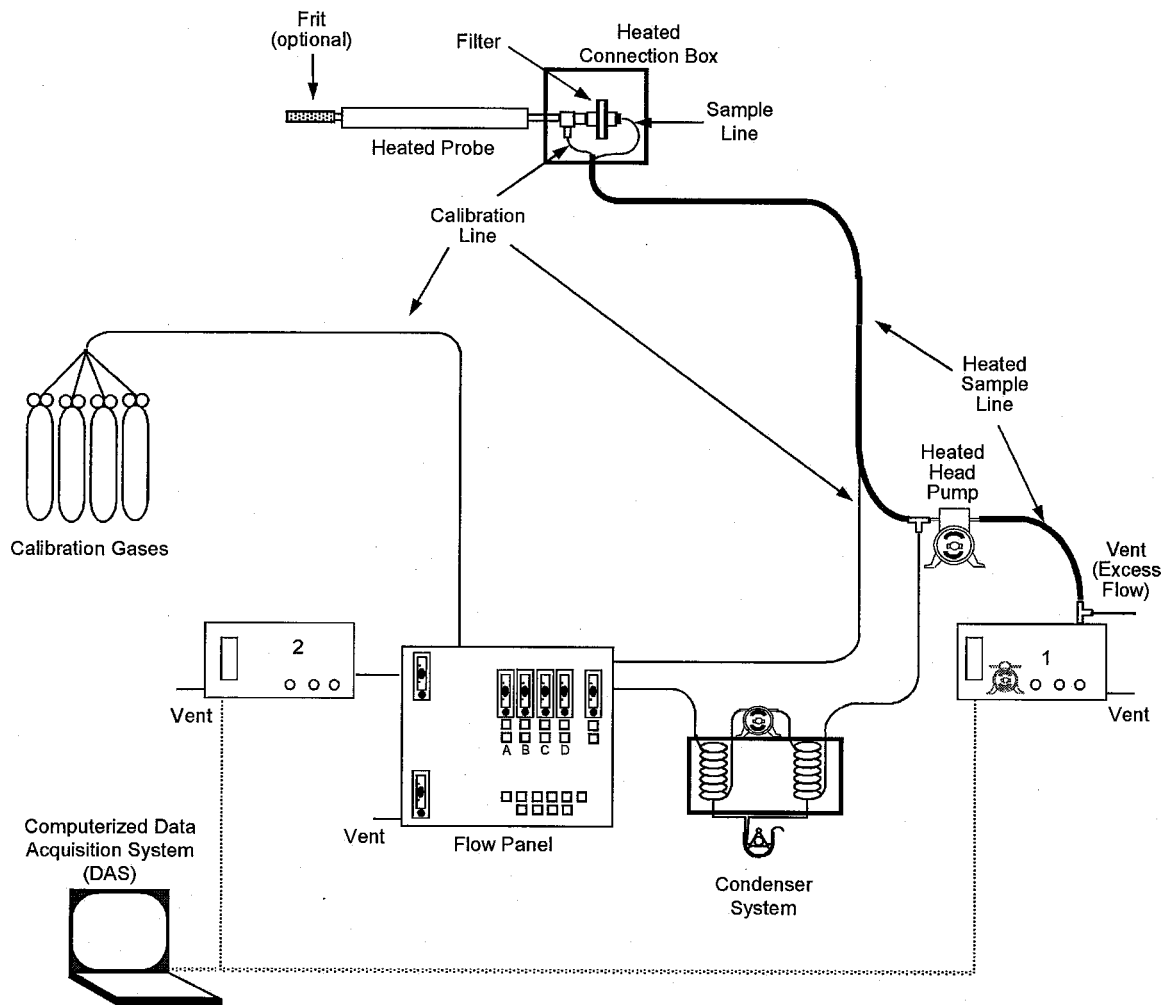
Data Acquisition

Data Recorder	Strip chart, Analog Computer or Digital Recorder	Digital Recorder
Recorder Resolution	0.5 Percent of Span	0.1 Percent of Span
Data Storage	Manually or Automatic	Automatic
Measurement Freq. (M-3A, M-10, and M-25A)	1-min. intervals	One reading per second
Recording Freq. (M-3A, M-10, and M-25A)	1-min. intervals or 30 measurements (less restrictive)	One Minute Average (60, 1 second readings)

Calibration Gas Specifications

Oxygen (O ₂)	EPA Protocol 1	EPA Protocol 1
Carbon Dioxide (CO ₂)	EPA Protocol 1	EPA Protocol 1
Sulfur Dioxide (SO ₂)	EPA Protocol 1	
Nitrogen Oxides (NO _x)	EPA Protocol 1	
Carbon Monoxide (CO)	EPA Protocol 1	
Total Hydrocarbon (THC)	EPA Protocol 1	EPA Protocol 1

EPA Methods 3A / 25A Sampling Train Configuration (CEMs)



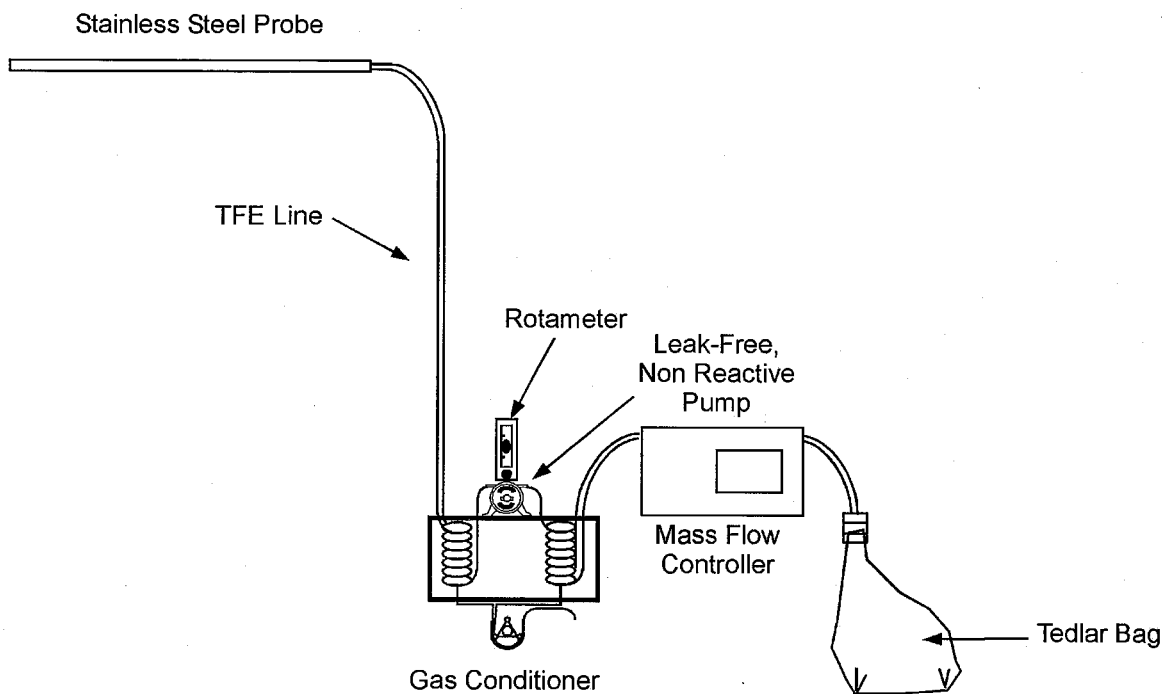
Number	Gas	Monitor	Range Used	Calibration Gas Concentrations
1	THC	Thermo 51i	0-15 ppm	5.13, 7.95, 15.0 ppm
2	O ₂ CO ₂	Servomex 1415 / Servomex 1420	0-25% 0-25%	0, 10.2, 21.1% 0, 9.93, 20.8%

Specification Sheet for EPA Method 18

Source Location Name(s) FCCU Scrubber Stack
 Pollutant(s) to be Determined Methane (CH₄) and Ethane (C₂H₆)
 Other Parameters to be Determined from Train None

	Standard Method Specification	Actual Specification Used
Pollutant Sampling Information		
Duration of Run	N/A	60 minutes
No. of Sample Traverse Points	N/A	1
Sample Time per Point	N/A	60 minutes
Sampling Rate	Constant Rate (±10%)	Constant Rate (0.5 lpm±10%)
Sampling Probe		
Nozzle Material	N/A	None
Nozzle Design	N/A	N/A
Probe Liner Material	Teflon or Stainless Steel	Stainless Steel
Effective Probe Length	N/A	4 feet
Probe Temperature Set-Point	Prevent condensation	None
Velocity Measuring Equipment		
Pitot Tube Design	None	None
Pitot Tube Coefficient	N/A	N/A
Pitot Tube Calibration by	N/A	N/A
Pitot Tube Attachment	N/A	N/A
Metering System Console		
Meter Type	Flow Meter, Critical Orifice or equivalent	Mass flow controller
Meter Accuracy	±1%	±5%
Meter Resolution	N/A	0.01 liters
Meter Size	N/A	N/A
Meter Calibrated Against	Bubble Meter	N/A
Pump Type	Diaphragm or equivalent	Diaphragm
Temperature Measurements	Dial Thermometer or equivalent	N/A
Temperature Resolution	N/A	N/A
ΔP Differential Pressure Gauge	N/A	N/A
ΔH Differential Pressure Gauge	N/A	N/A
Barometer	Mercury, aneroid or other.	Digital Barometer calibrated w/Mercury Aneroid
Filter Description		
Filter Location	N/A	None
Filter Holder Material	N/A	N/A
Filter Support Material	N/A	N/A
Cyclone Material	N/A	None
Filter Heater Set-Point	N/A	N/A
Filter Material	N/A	N/A
Sample Storage Components		
Description	Tedlar Bag or Stainless Steel Canister	Tedlar Bag
Location	After Pump and Flow Meter	After Pump and Flowmeter
Operating Temperature	N/A	Ambient

EPA Method 18 Sampling Train Configuration (Direct Pump Sampling)



Specification Sheet for

EPA Method 23

Source Location Name(s) FCCU Scrubber Stack
Pollutant(s) to be Determined PCDD/PCDF/PCB/PAH
Other Parameters to be Determined from Train Gas Density, Moisture, Flow Rate

	Standard Method Specification	Actual Specification Used
Pollutant Sampling Information		
Duration of Run	N/A	180 minutes
No. of Sample Traverse Points	N/A	12
Sample Time per Point	N/A	15 minutes
Sampling Rate	Isokinetic (90-110%)	Isokinetic (90-110%)
Sampling Probe		
Nozzle Material	Nickel, Quartz, Stainless Steel or Glass	Borosilicate Glass
Nozzle Design	Button-Hook or Elbow	Button-Hook
Probe Liner Material	Borosilicate or Quartz Glass	Borosilicate Glass
Effective Probe Length	N/A	4 feet
Probe Temperature Set-Point	248°F±25°F	248°F±25°F
Velocity Measuring Equipment		
Pitot Tube Design	Type S	Type S
Pitot Tube Coefficient	N/A	0.82
Pitot Tube Calibration by	Geometric or Wind Tunnel	Wind-Tunnel
Pitot Tube Attachment	Attached to Probe	Attached to Probe
Metering System Console		
Meter Type	Dry Gas Meter	Dry Gas Meter
Meter Accuracy	±2%	±1%
Meter Resolution	N/A	0.01 cubic feet
Meter Size	N/A	0.1 dcf/revolution
Meter Calibrated Against	Wet Test Meter or Standard DGM	Wet Test Meter
Pump Type	N/A	Rotary Vane
Temperature Measurements	N/A	Type K Thermocouple/Pyrometer
Temperature Resolution	5.4°F	1.0°F
ΔP Differential Pressure Gauge	Inclined Manometer or Equivalent	Inclined Manometer
ΔH Differential Pressure Gauge	Inclined Manometer or Equivalent	Inclined Manometer
Barometer	Mercury or Aneroid	Digital Barometer calibrated w/Mercury Aneroid
Filter Description		
Filter Location	After Probe	Exit of Probe
Filter Holder Material	Borosilicate Glass	Borosilicate Glass
Filter Support Material	Glass Frit	Teflon
Cyclone Material	N/A	None
Filter Heater Set-Point	248°F±25°F	248°F±25°F
Filter Material	Glass Fiber - Toluene Extracted	Quartz Fiber - Methylene Chloride Extracted
Other Components		
Adsorbent Module	XAD-2 Trap	XAD-II Adsorbent Trap
Location	After filter and condenser	After filter and condenser
Operating Temperature	< 68°F	<68°F

Specification Sheet for

EPA Method 23

Impinger Train Description

Type of Glassware Connections

Connection to Probe or Filter by

Number of Impingers

Impinger Stem Types

Impinger 1

Impinger 2

Impinger 3

Impinger 4

Impinger 5

Impinger 6

Impinger 7

Impinger 8

Gas Density Determination

Sample Collection

Sample Collection Medium

Sample Analysis

Sample Recovery Information

Probe Brush Material

Probe Rinse Reagent

Probe Rinse Wash Bottle Material

Probe Rinse Storage Container

Filter Recovered?

Filter Storage Container

Impinger Contents Recovered?

Impinger Rinse Reagent

Impinger Wash Bottle

Impinger Storage Container

Analytical Information

Method 4 H₂O Determination by

Filter Preparation Conditions

Front-Half Rinse Preparation

Back-Half Analysis

Additional Analysis

Standard Method Specification

Ground Glass or Equivalent

Direct Glass Connection

5

Modified Greenburg-Smith

Modified Greenburg-Smith

Greenburg-Smith

Modified Greenburg-Smith

Modified Greenburg-Smith

Multi-point integrated

Flexible Gas Bag

Orsat or Fyrite Analyzer

Inert Bristle

Acetone/Toluene

Glass or Teflon

Glass

Yes

Petri Dish - Glass or Polystyrene

No

N/A

N/A

N/A

Volumetric or Gravimetric

See Method 23 Analytical Flow Chart

See Method 23 Analytical Flow Chart

N/A

None

Actual Specification Used

Screw Joint with Silicone Gasket

Direct Glass Connection

5

Shortened Stem (open tip)

Modified Greenburg-Smith

Greenburg-Smith

Modified Greenburg-Smith

Modified Greenburg-Smith

Multi-Point Integrated

Vinyl Bag

CEM

Nylon Bristle

Acetone/Toluene

Teflon

Glass

Yes

Glass

Yes

HPLC Water

Teflon

Amber Glass

Gravimetric and Volumetric

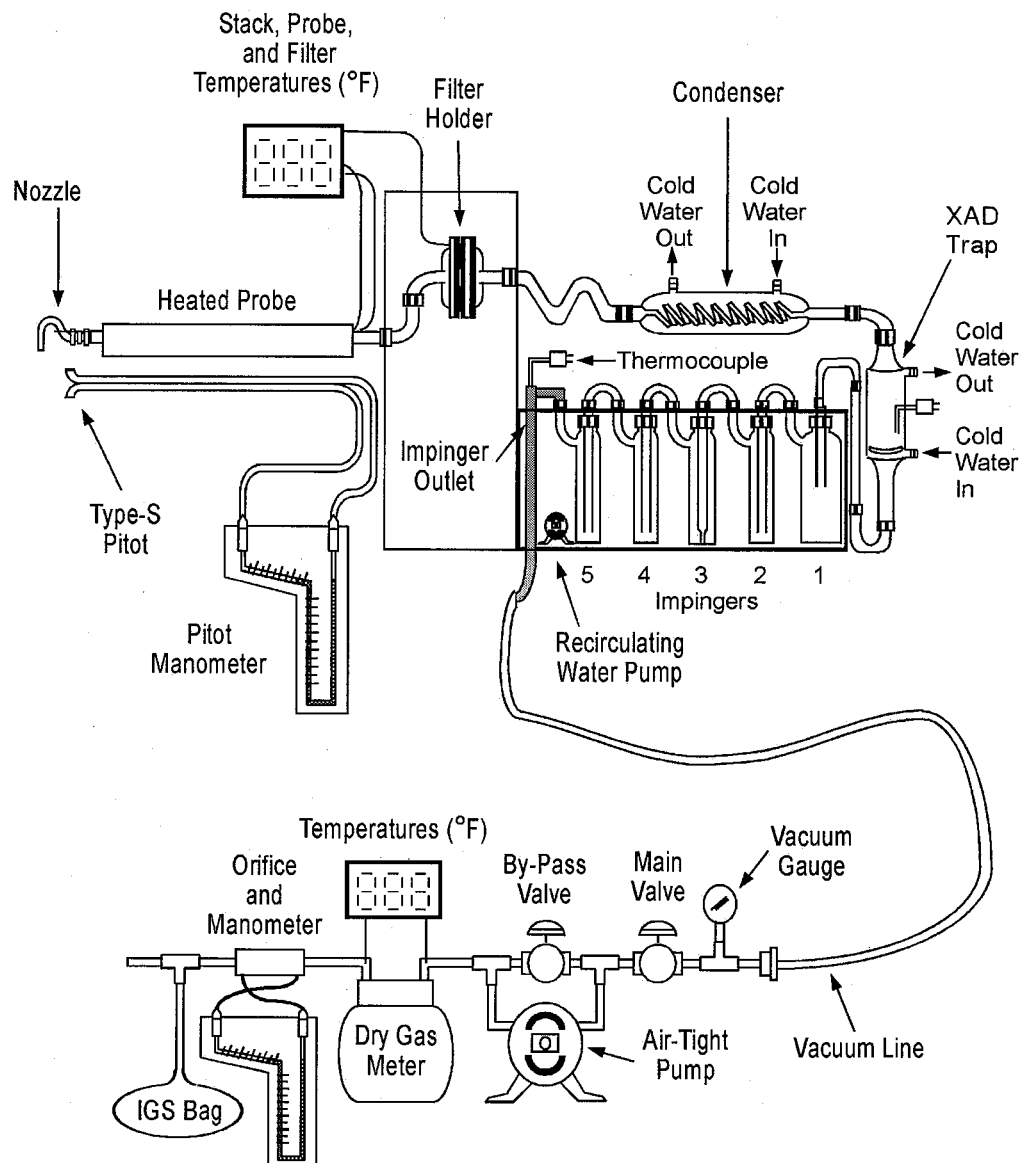
For Organic Analysis

Organic Analysis

See Analytical Flow Chart

None

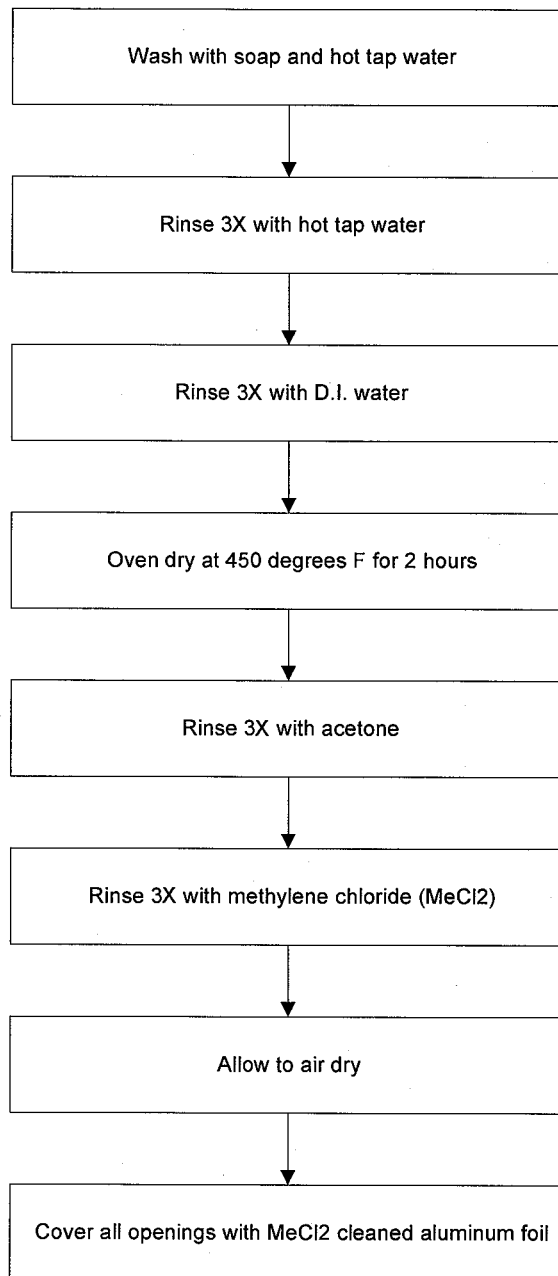
EPA Method 23 Sampling Train Configuration



Impinger Contents

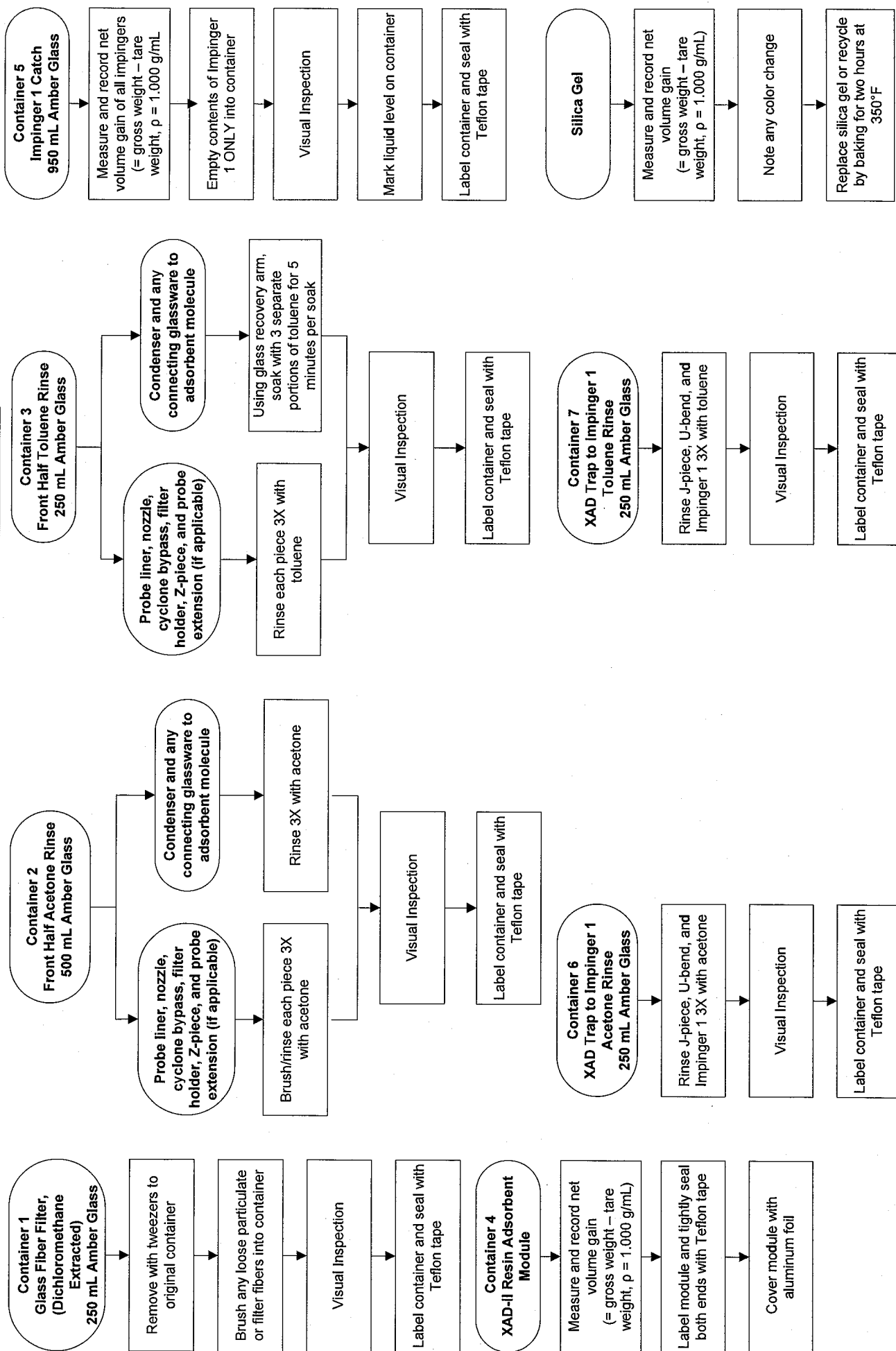
Impinger 1	Empty
Impinger 2	100 mL DI H ₂ O
Impinger 3	100 mL DI H ₂ O
Impinger 4	Empty
Impinger 5	Silica Gel

EPA Method 23 Glassware Preparation Procedures



EPA Method 23 Sample Recovery Flowchart – Test Runs

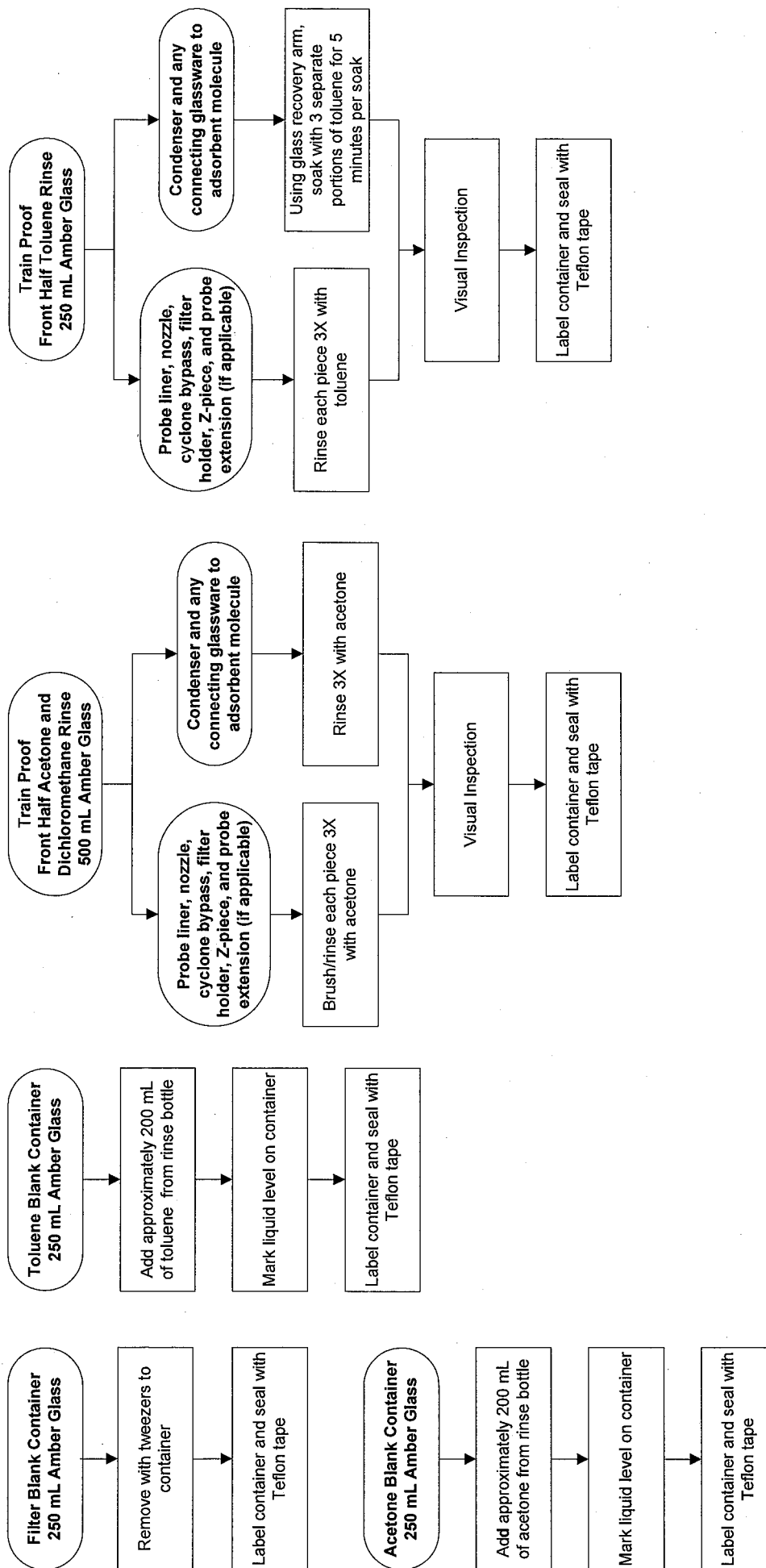
NOTE: Store all samples at ice temperature; transport to laboratory with ice packs



EPA Method 23

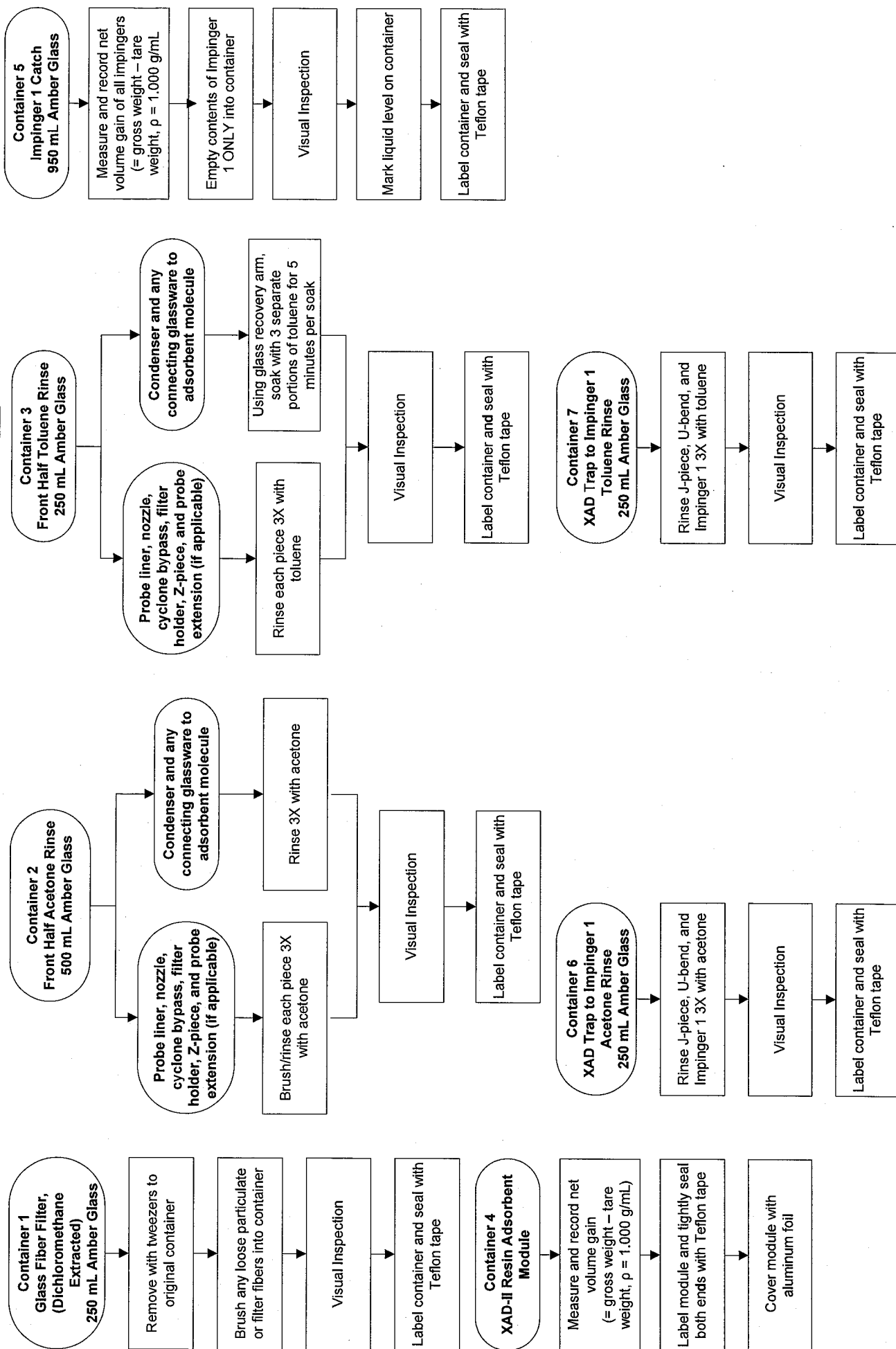
Sample Recovery Flowchart – Blanks and Proofs

NOTE: Store all samples at ice temperature; transport to laboratory with ice packs



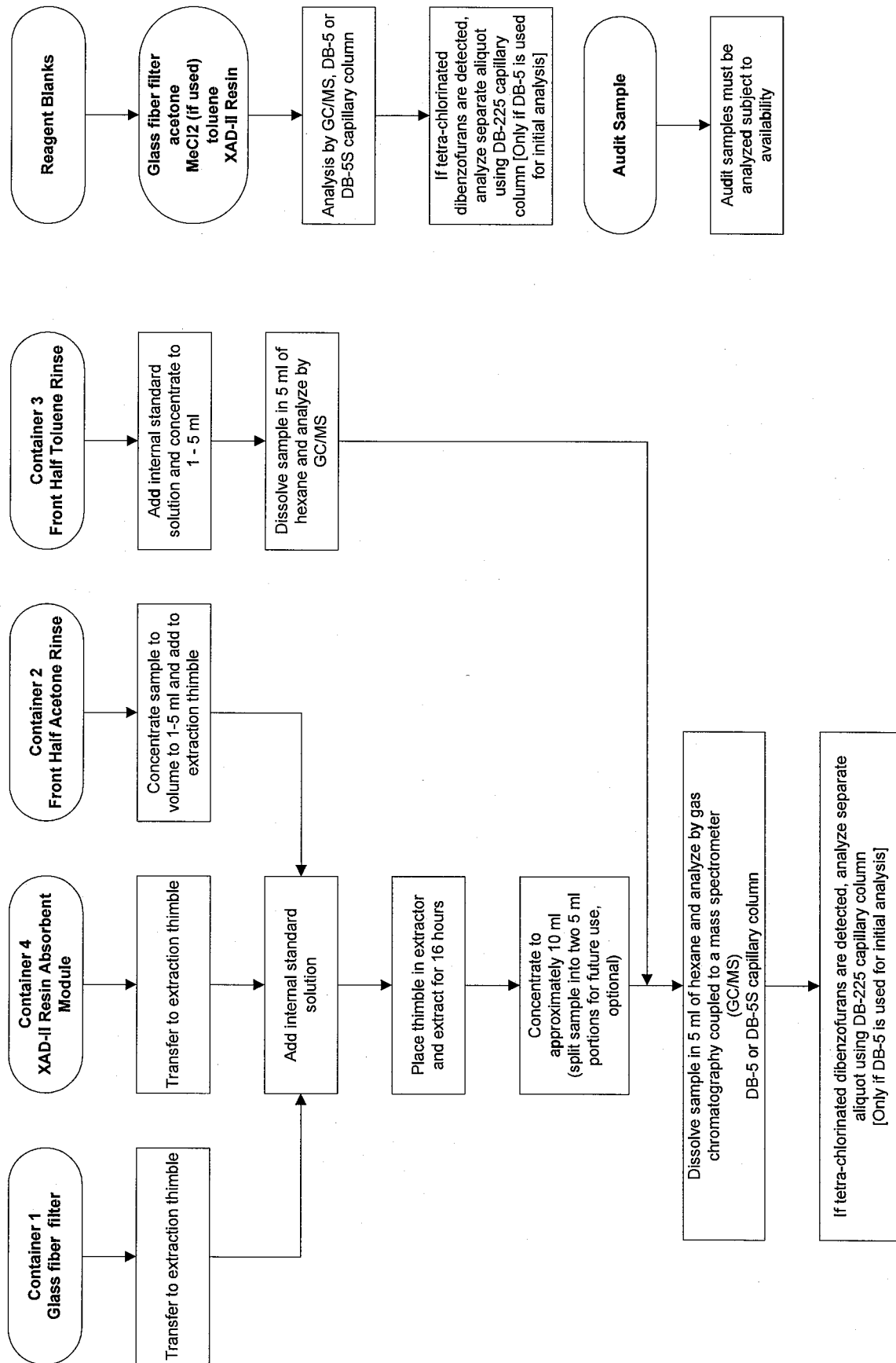
EPA Method 23 Sample Recovery Flowchart – Field Train Blank

NOTE: Store all samples at ice temperature; transport to laboratory with ice packs

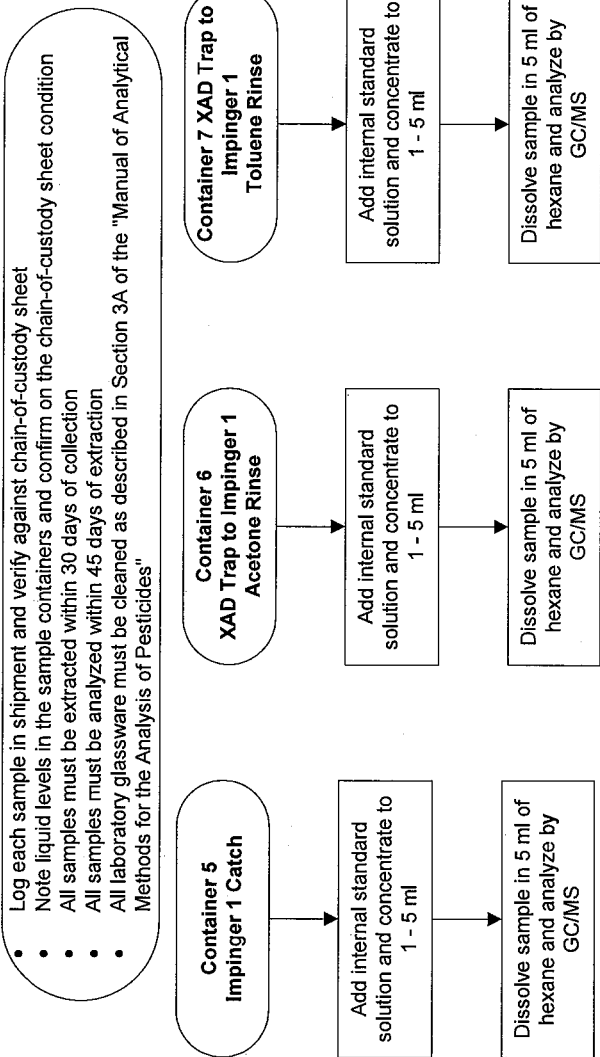


EPA Method 23 Analytical Flowchart (PCDD/PCDF/PCB)

- Log each sample in shipment and verify against chain-of-custody sheet
- Note liquid levels in the sample containers and confirm on the chain-of-custody sheet condition
- All samples must be extracted within 30 days of collection
- All samples must be analyzed within 45 days of extraction
- All laboratory glassware must be cleaned as described in Section 3A of the "Manual of Analytical Methods for the Analysis of Pesticides"



EPA Method 23 Analytical Flowchart (PCB Only)



Specification Sheet for

EPA Method 5/202

Source Location Name(s) FCCU Scrubber Stack
Pollutant(s) to be Determined Filterable Particulate Matter (FPM) and Condensable Particulate Matter (CPM)
Other Parameters to be Determined from Train Gas Density, Moisture, Flow Rate, Non-Sulfuric Acid Filterable Particulate Matter (NSFPM)

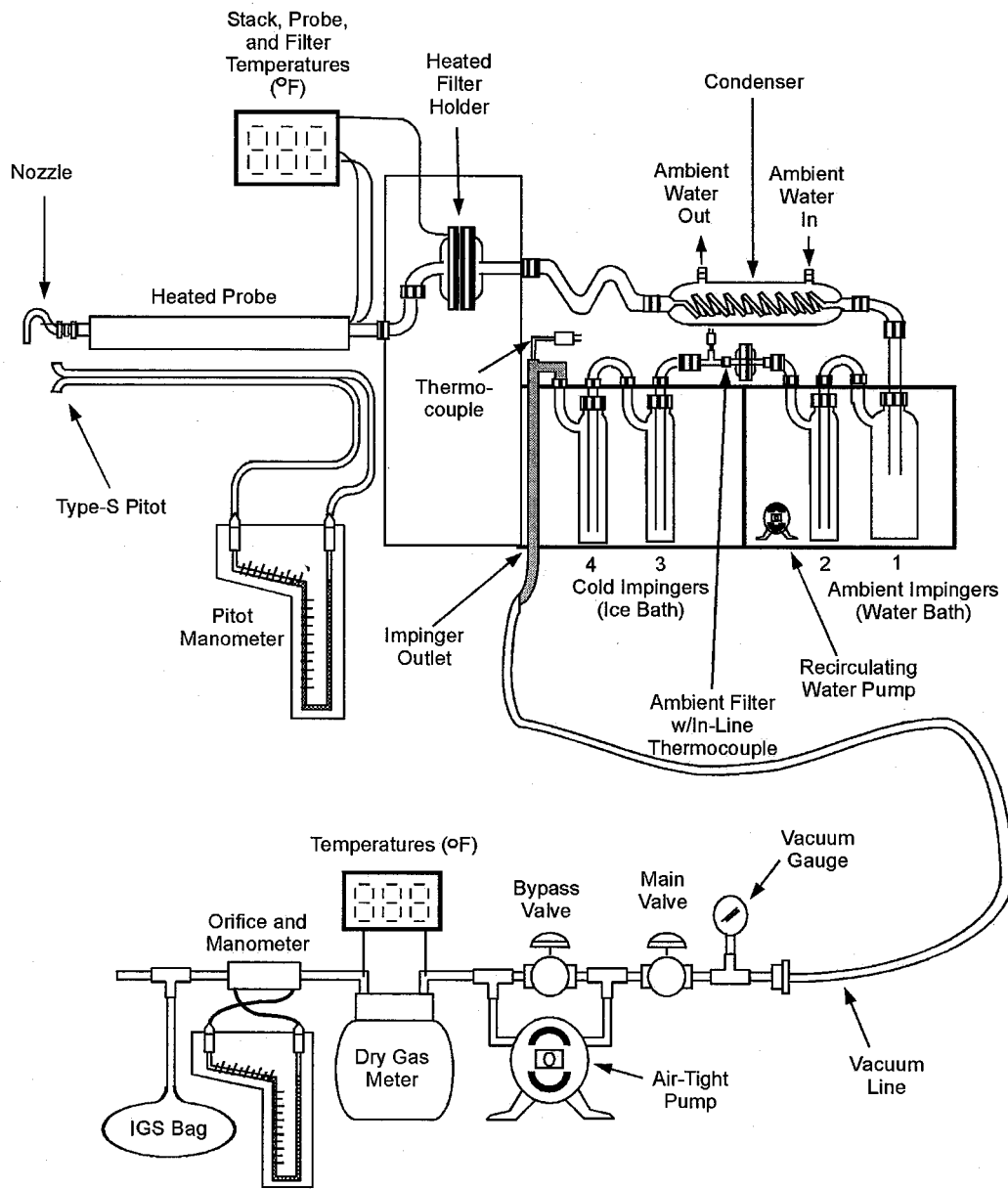
	Standard Method Specification	Actual Specification Used
Pollutant Sampling Information		
Duration of Run	N/A	120 minutes
No. of Sample Traverse Points	N/A	12
Sample Time per Point	N/A	10 minutes
Sampling Rate	Isokinetic (90-110%)	Isokinetic (90-110%)
Sampling Probe		
Nozzle Material	Stainless Steel or Glass	Borosilicate Glass
Nozzle Design	Button-Hook or Elbow	Button-Hook
Probe Liner Material	Glass or Teflon	Borosilicate Glass
Effective Probe Length	N/A	4 feet
Probe Temperature Set-Point	248°F±25°F	320°F±25°F
Velocity Measuring Equipment		
Pitot Tube Design	Type S	Type S
Pitot Tube Coefficient	N/A	0.827
Pitot Tube Calibration by	Geometric or Wind Tunnel	Wind-Tunnel
Pitot Tube Attachment	Attached to Probe	Attached to Probe
Metering System Console		
Meter Type	Dry Gas Meter	Dry Gas Meter
Meter Accuracy	±2%	±1%
Meter Resolution	N/A	0.01 cubic feet
Meter Size	N/A	0.1 dcf/revolution
Meter Calibrated Against	Wet Test Meter or Standard DGM	Wet Test Meter
Pump Type	N/A	Rotary Vane
Temperature Measurements	N/A	Type K Thermocouple/Pyrometer
Temperature Resolution	5.4°F	1.0°F
ΔP Differential Pressure Gauge	Inclined Manometer or Equivalent	Inclined Manometer
ΔH Differential Pressure Gauge	Inclined Manometer or Equivalent	Inclined Manometer
Barometer	Mercury or Aneroid	Digital Barometer calibrated w/Mercury Aneroid
FPM Filter Description		
Filter Location	After Probe	Exit of Probe
Filter Holder Material	Quartz	Borosilicate Glass
Filter Support Material	Glass Frit	Teflon
Cyclone Material	N/A	None
Filter Heater Set-Point	248°F±25°F	320°F±25°F
Filter Material	Glass Fiber	Quartz Fiber
Other Components		
Description	Condenser	Condenser
Location	Before Impinger 1	Before 1st Impinger
Operating Temperature	≤85°F	≤85°F

Specification Sheet for

EPA Method 5/202

	Standard Method Specification	Actual Specification Used
Impinger Train Description		
Type of Glassware Connections	Leak-Free Glass Connectors	Screw Joint with Silicone Gasket
Connection to Probe or Filter by	Direct or Flexible Connection	Direct Glass Connection
Number of Impingers	4	4
Impinger Stem Types		
Impinger 1	Shortened Stem (open tip)	Shortened Stem (open tip)
Impinger 2	Modified Greenburg-Smith	Modified Greenburg-Smith
Impinger 3	Modified Greenburg-Smith	Modified Greenburg-Smith
Impinger 4	Modified Greenburg-Smith	Modified Greenburg-Smith
Impinger 5		
Impinger 6		
Impinger 7		
Impinger 8		
CPM Filter Description		
Filter Location	Between 2nd and 3rd Impingers	Between 2nd and 3rd Impingers
Filter Holder Material	Glass, Stainless Steel or Teflon	Borosilicate Glass
Filter Support Material	Teflon	Teflon
Cyclone Material	None	None
Filter Heater Set-Point	>65°F but ≤85°F	>65°F but ≤85°F
Filter Material	Teflon Membrane	Teflon Membrane
Gas Density Determination		
Sample Collection	Multi-point integrated	Multi-Point Integrated
Sample Collection Medium	Flexible Gas Bag	Vinyl Bag
Sample Analysis	Orsat or CEM Analyzer	CEM
Sample Recovery Information		
Nozzle Brush Material	Nylon Bristle or Teflon	Nylon Bristle
Nozzle Rinse Reagent	Acetone	Acetone
Nozzle Rinse Wash Bottle Material	Glass or Polyethylene	Inorganic in polyethylene, organic in Teflon
Nozzle Rinse Storage Container	Glass or Polyethylene	Glass
Filter Recovered?	Yes	Yes
Filter Storage Container	FH filter in petri dish, CPM filter in petri dish	FH filter in petri dish, CPM filter in petri dish
Impinger Contents Recovered?	Yes	Yes
Impinger Rinse Reagent	DI Water/Acetone/Hexane	DI Water/Acetone/Hexane
Impinger Wash Bottle	Inorganic in polyethylene, organic in Teflon	Inorganic in polyethylene, organic in Teflon
Impinger Storage Container	Inorganic in polyethylene, organic in glass	Inorganic in amber glass, organic in amber glass
Analytical Information		
Method 4 H ₂ O Determination by	Volumetric or Gravimetric	Gravimetric and Volumetric
Filter Preparation Conditions	Dessiccate 24 Hours or Filter Extraction	See Analytical Flow Chart
Front-Half Rinse Preparation	Evaporate at ambient temperature and pressure	Evaporate at ambient temperature and pressure
Back-Half Analysis	Sonication and Extraction	See Analytical Flow Chart
Additional Analysis	N/A	NSFPM per USEPA M-5B analytical

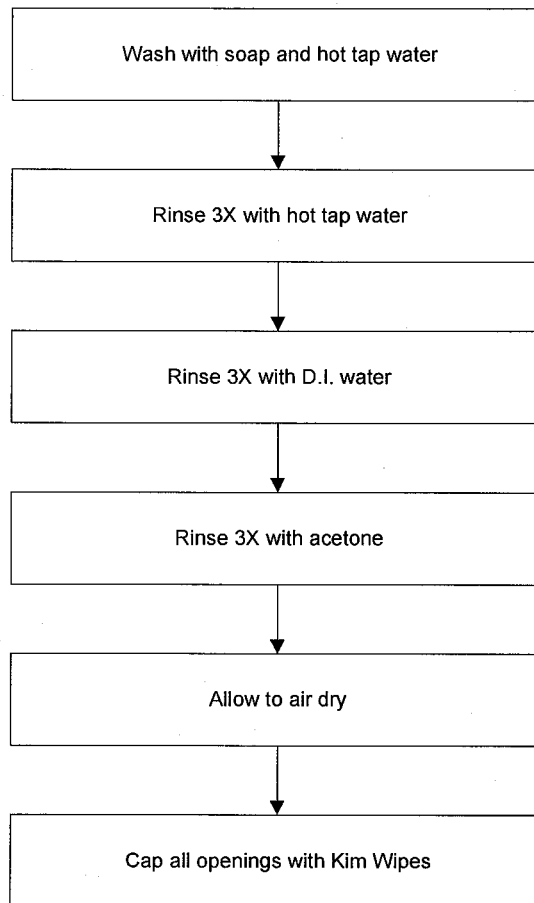
EPA Method 5/202 Sampling Train Configuration



Impinger Contents

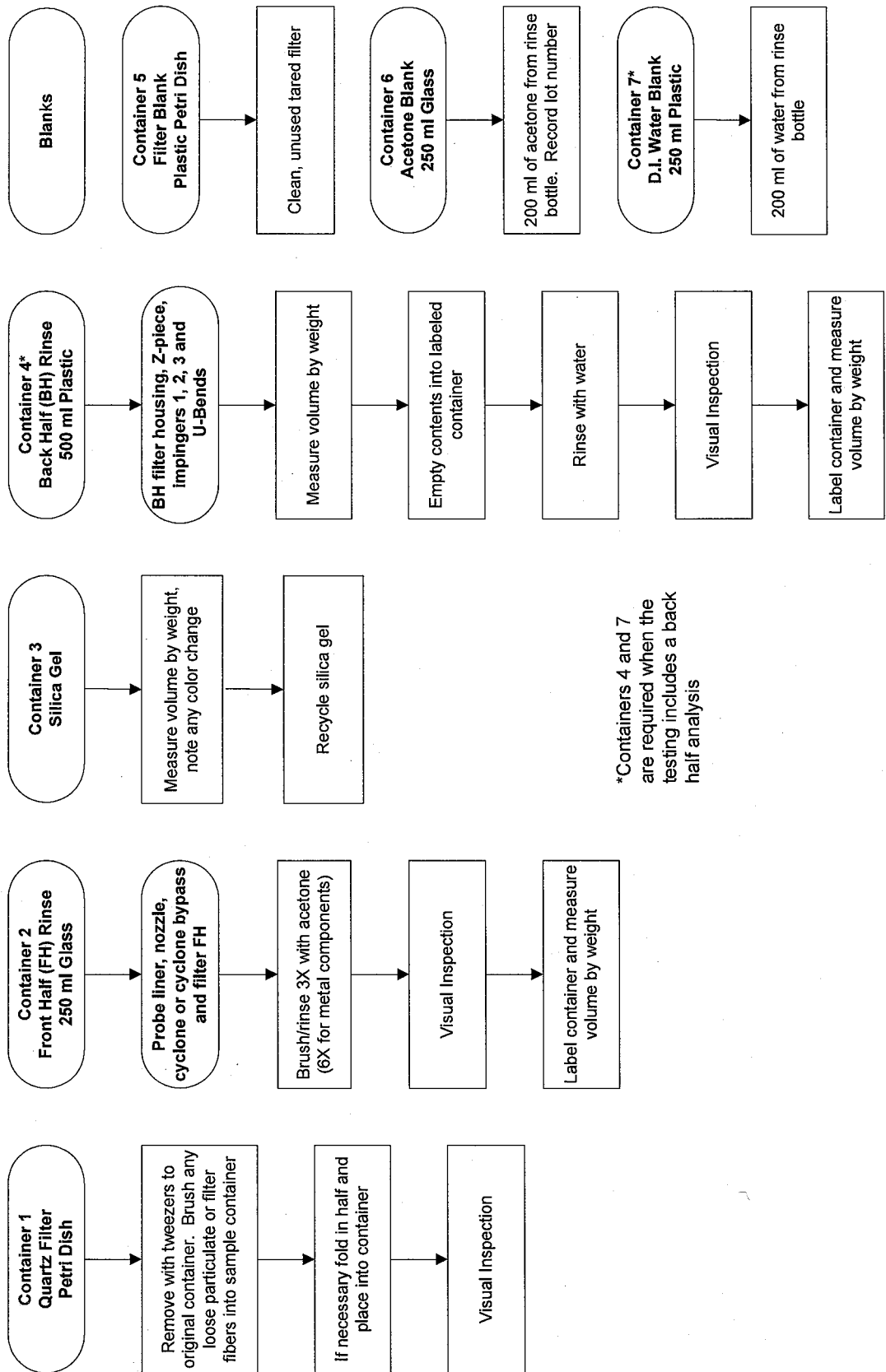
Impinger 1	Empty
Impinger 2	Empty
Impinger 3	DI H ₂ O
Impinger 4	Silica Gel

EPA Method 5 Glassware Preparation Procedures



EPA Method 5 Sample Recovery Flowchart

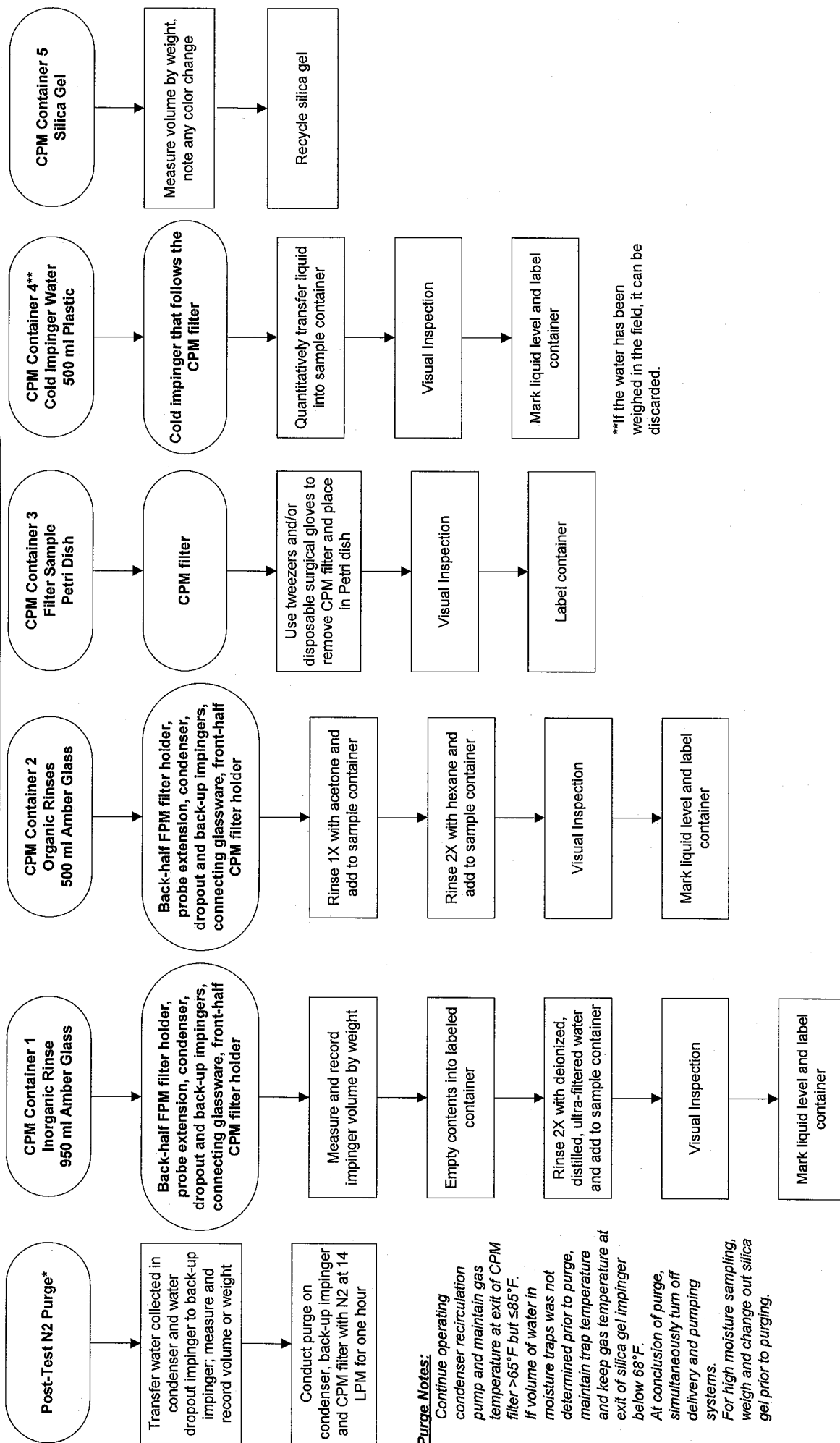
- Tare all sample containers before sample collection
- Mark all liquid levels and final weights on the outside of each sample container
- Seal all sample containers with Teflon tape
- If recycling, bake silica gel for two hours at 350 degrees F (175 degrees C)



*Containers 4 and 7
are required when the
testing includes a back
half analysis

EPA Method 202 Sample Recovery Flowchart (1 of 2)

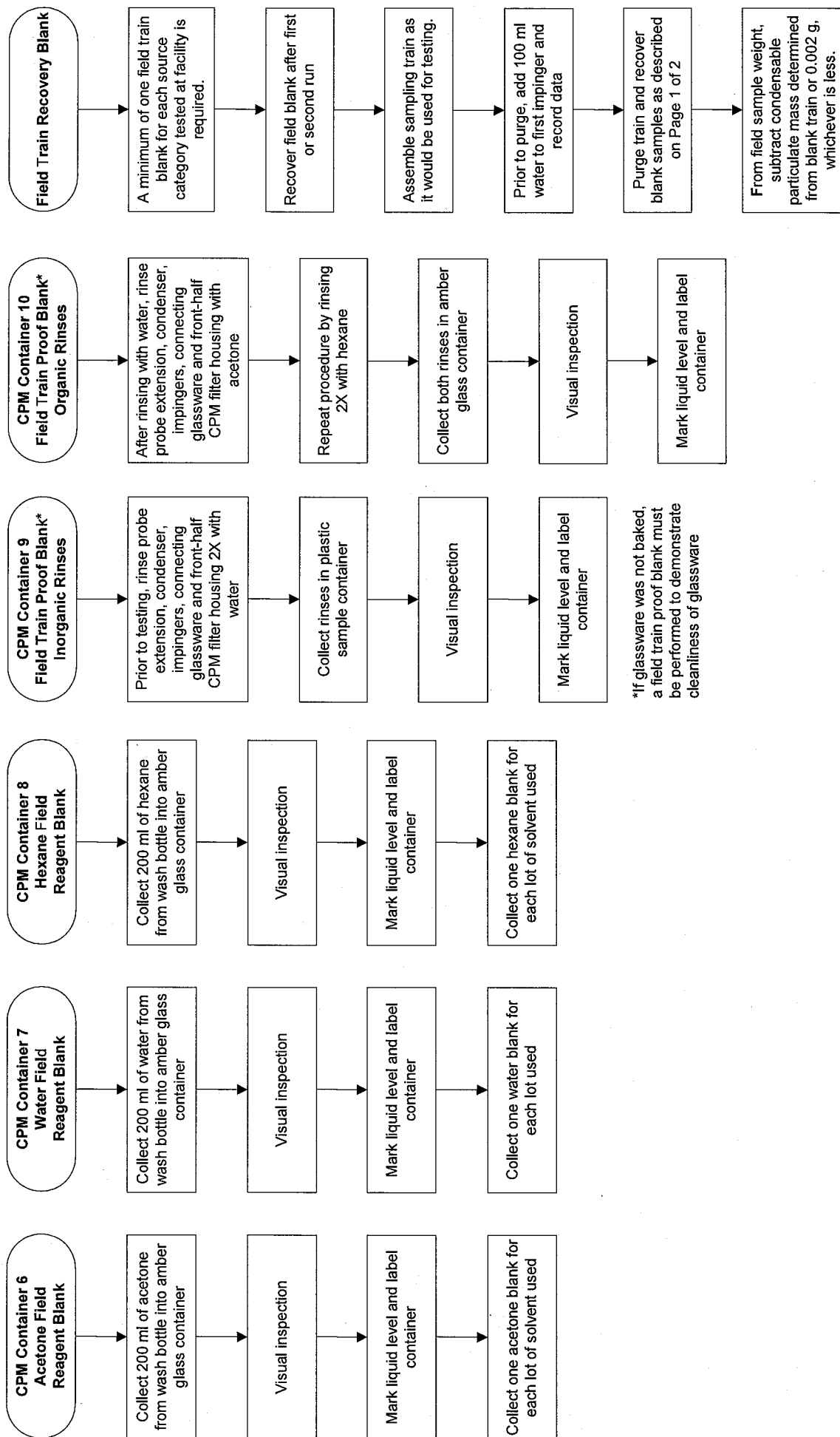
- Tare all sample containers before sample collection
- Mark all liquid levels and final weights on the outside of each sample container
- Seal all sample containers with Teflon tape
- If recycling, bake silica gel for two hours at 350 degrees F (175 degrees C)
- Samples must be maintained at or below 85 degrees F (30 degrees C) during shipping.



EPA Method 202

Sample Recovery Flowchart (2 of 2)

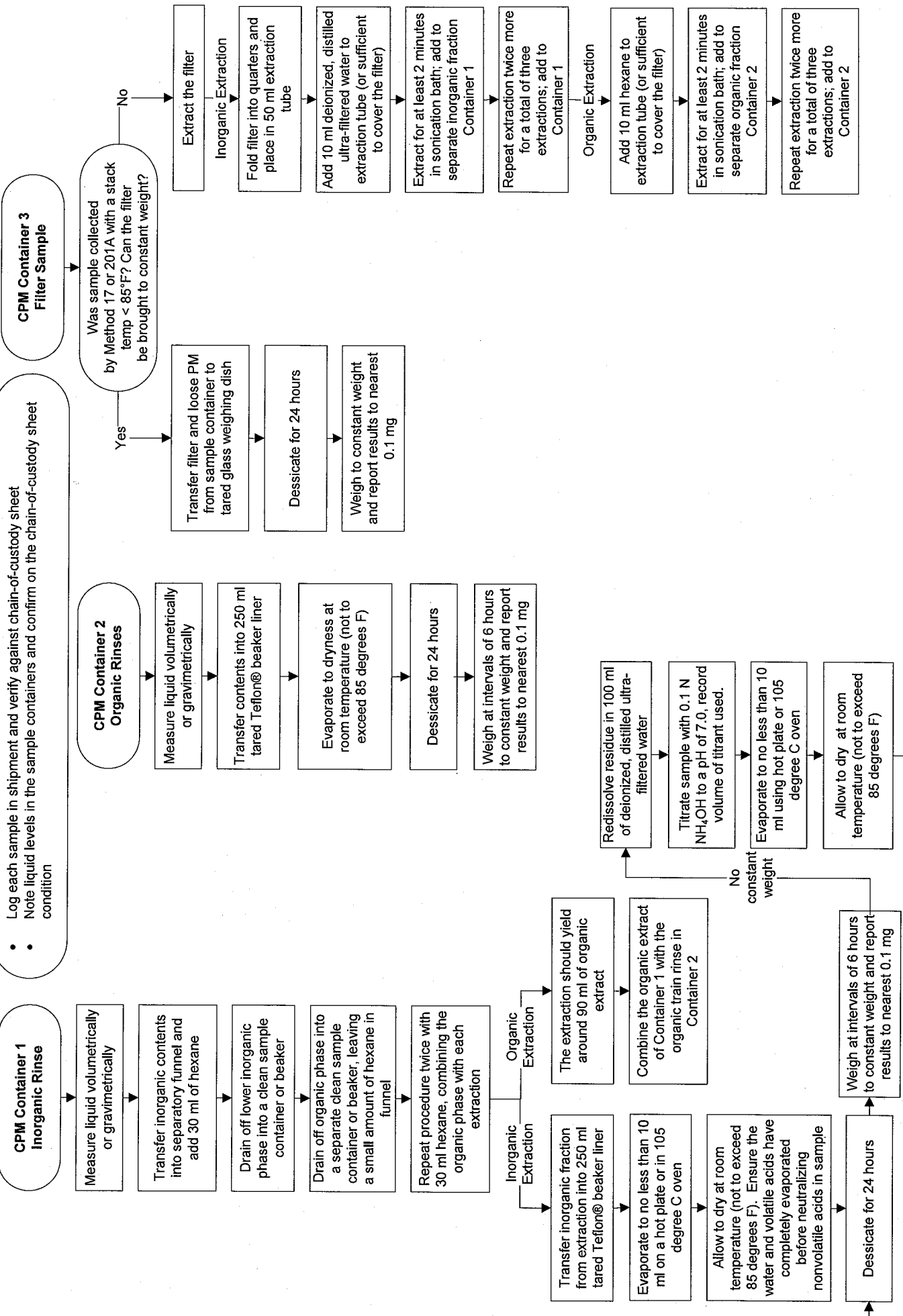
- Tare all sample containers before sample collection
- Mark all liquid levels and final weights on the outside of each sample container
- Seal all sample containers with Teflon tape
- If recycling, bake silica gel for two hours at 350 degrees F (175 degrees C)
- Samples must be maintained at or below 85 degrees F (30 degrees C) during shipping.



*If glassware was not baked, a field train proof blank must be performed to demonstrate cleanliness of glassware

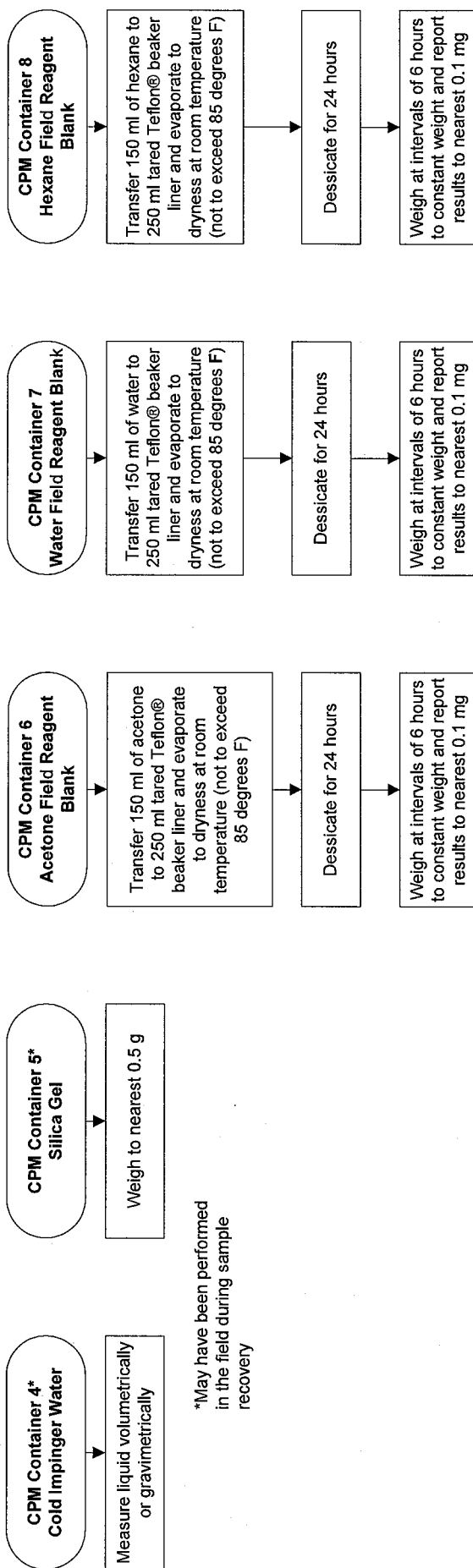
EPA Method 202 Analytical Flowchart (1 of 2)

- Log each sample in shipment and verify against chain-of-custody sheet
- Note liquid levels in the sample containers and confirm on the chain-of-custody sheet condition



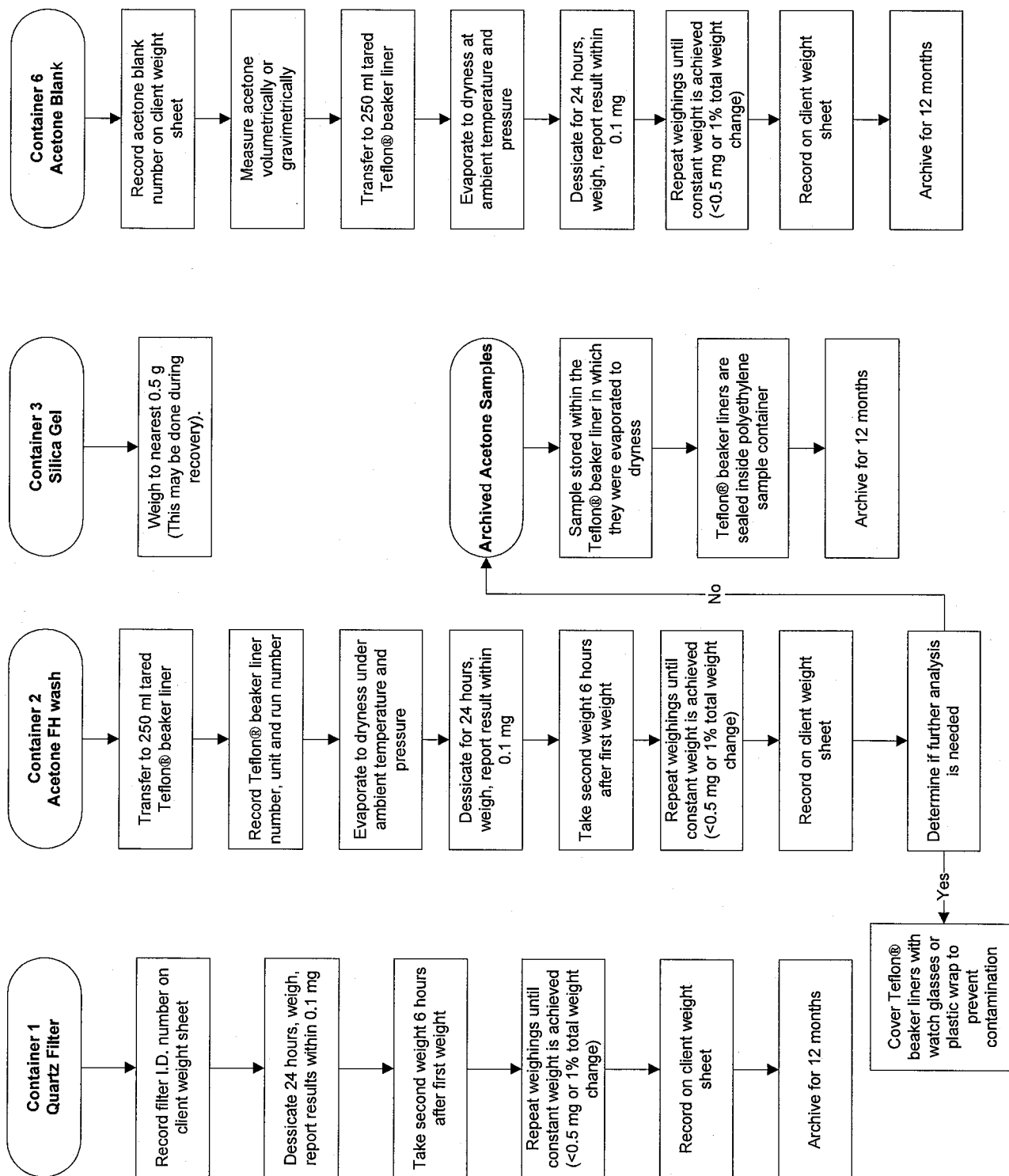
EPA Method 202 Analytical Flowchart (2 of 2)

- Log each sample in shipment and verify against chain-of-custody sheet
- Note liquid levels in the sample containers and confirm on the chain-of-custody sheet condition

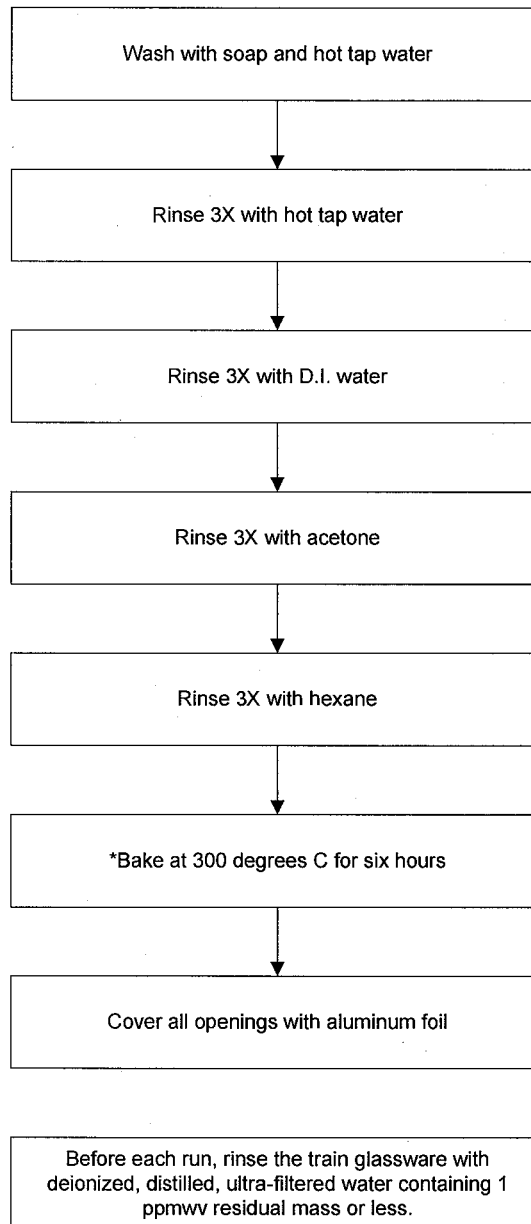


*May have been performed
in the field during sample
recovery

EPA Method 5 Analytical Flowchart



EPA Method 202 Glassware Preparation Procedures



*As an alternative to baking glassware, a field train proof blank can be performed on the sampling train glassware.

Specification Sheet for

Modified Conditional Test Method (CTM) 027

Source Location Name(s) FCCU Scrubber Stack
 Pollutant(s) to be Determined Ammonia
 Other Parameters to be Determined from Train Gas Density, Moisture, Flow Rate

	Standard Method Specification	Actual Specification Used
Pollutant Sampling Information		
Duration of Run	N/A	60 minutes
No. of Sample Traverse Points	N/A	12
Sample Time per Point	N/A	5 minutes
Sampling Rate	Isokinetic (90-110%)	Isokinetic (90-110%)
Sampling Probe		
Nozzle Material	Borosilicate or Quartz Glass	Borosilicate Glass
Nozzle Design	Button-Hook or Elbow	Button-Hook
Probe Liner Material	Borosilicate or Quartz Glass	Borosilicate Glass
Effective Probe Length	N/A	4 feet
Probe Temperature Set-Point	Stack Temperature	248°F±25°F
Velocity Measuring Equipment		
Pitot Tube Design	Type S	Type S
Pitot Tube Coefficient	N/A	0.819
Pitot Tube Calibration by	Geometric or Wind Tunnel	Wind-Tunnel
Pitot Tube Attachment	Attached to Probe	Attached to Probe
Metering System Console		
Meter Type	Dry Gas Meter	Dry Gas Meter
Meter Accuracy	±2%	±1%
Meter Resolution	N/A	0.01 cubic feet
Meter Size	N/A	0.1 dcf/revolution
Meter Calibrated Against	Wet Test Meter or Standard DGM	Wet Test Meter
Pump Type	N/A	Rotary Vane
Temperature Measurements	N/A	Type K Thermocouple/Pyrometer
Temperature Resolution	5.4°F	1.0°F
ΔP Differential Pressure Gauge	Inclined Manometer or Equivalent	Inclined Manometer
ΔH Differential Pressure Gauge	Inclined Manometer or Equivalent	Inclined Manometer
Barometer	Mercury or Aneroid	Digital Barometer calibrated w/Mercury Aneroid
Filter Description		
Filter Location	In Stack	Exit of Probe
Filter Holder Material	Borosilicate Glass or Teflon	Borosilicate Glass
Filter Support Material	Borosilicate Glass or Teflon	Teflon
Thimble Material	N/A	None
Filter Heater Set-Point	N/A	248°F±25°F
Filter Material	Glass Fiber	Quartz Fiber
Other Components		
Description	N/A	N/A
Location	N/A	N/A
Operating Temperature	N/A	N/A

Specification Sheet for

Modified Conditional Test Method (CTM) 027

Impinger Train Description

Type of Glassware Connections

Connection to Probe or Filter by

Number of Impingers

Impinger Stem Types

Impinger 1

Impinger 2

Impinger 3

Impinger 4

Impinger 5

Impinger 6

Impinger 7

Impinger 8

Gas Density Determination

Sample Collection

Sample Collection Medium

Sample Analysis

Sample Recovery Information

Probe Brush Material

Probe Rinse Reagent

Probe Rinse Wash Bottle Material

Probe Rinse Storage Container

Filter Recovered?

Filter Storage Container

Impinger Contents Recovered?

Impinger Rinse Reagent

Impinger Wash Bottle

Impinger Storage Container

Analytical Information

Method 4 H₂O Determination by

Filter Preparation Conditions

Front-Half Rinse Preparation

Back-Half Analysis

Additional Analysis

Standard Method Specification

Leak-Free Glass Connectors

Direct or Flexible Tubing

4

Greenburg-Smith

Greenburg-Smith

Modified Greenburg-Smith

Modified Greenburg-Smith

Multi-point integrated

Flexible Gas Bag

Orsat or Fyrite Analyzer

None

Deionized Water

Polyethylene

Polyethylene

No

N/A

Yes

Deionized Water

Polyethylene

Polyethylene

Volumetric or Gravimetric

N/A

Combined with back-half

Ion Chromatography Analysis

N/A

Actual Specification Used

Screw Joint with Silicone Gasket

Direct Glass Connection

4

Greenburg-Smith

Greenburg-Smith

Modified Greenburg-Smith

Modified Greenburg-Smith

Multi-Point Integrated

Vinyl Bag

CEM

None

Deionized Water

Polyethylene

Polyethylene

Archived

Polystyrene

Yes

Deionized Water

Polyethylene

Polyethylene

Gravimetric and Volumetric

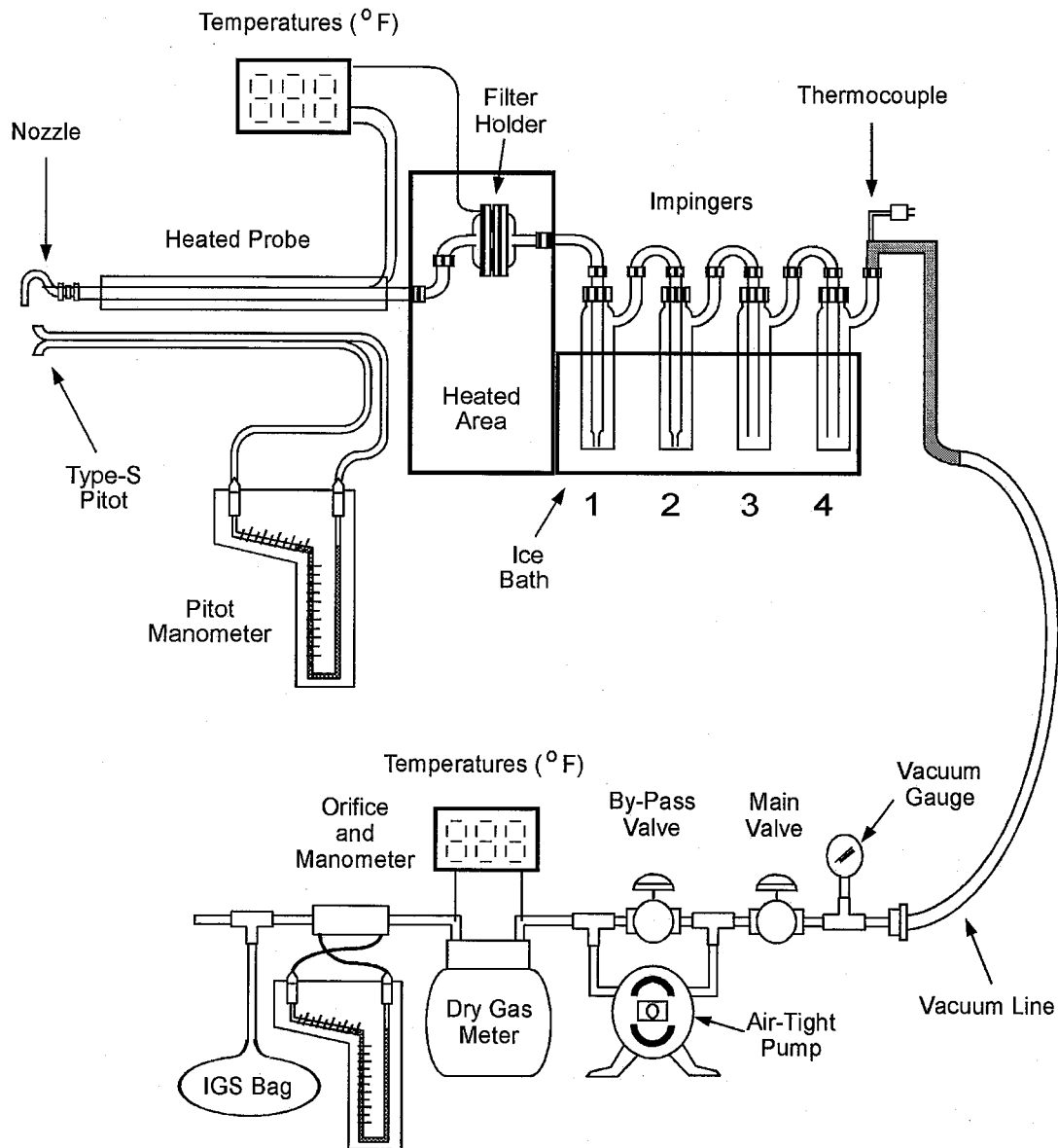
N/A

See Analytical Flow Chart

Ion Chromatography

None

Modified CTM-027 Sampling Train Configuration

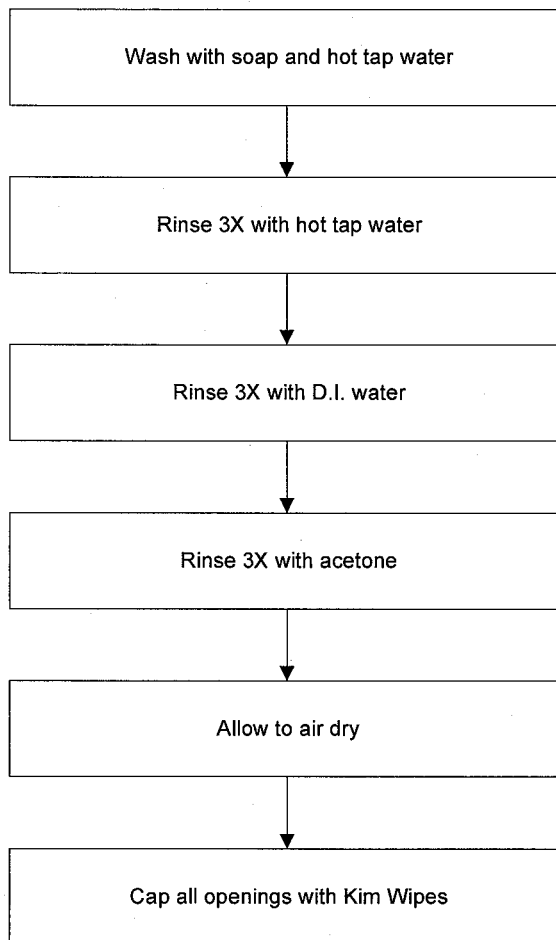


Impinger Contents

Impinger 1	0.1 N H ₂ SO ₄
Impinger 2	0.1 N H ₂ SO ₄
Impinger 3	0.1 N H ₂ SO ₄
Impinger 4	Silica Gel

CTM-027

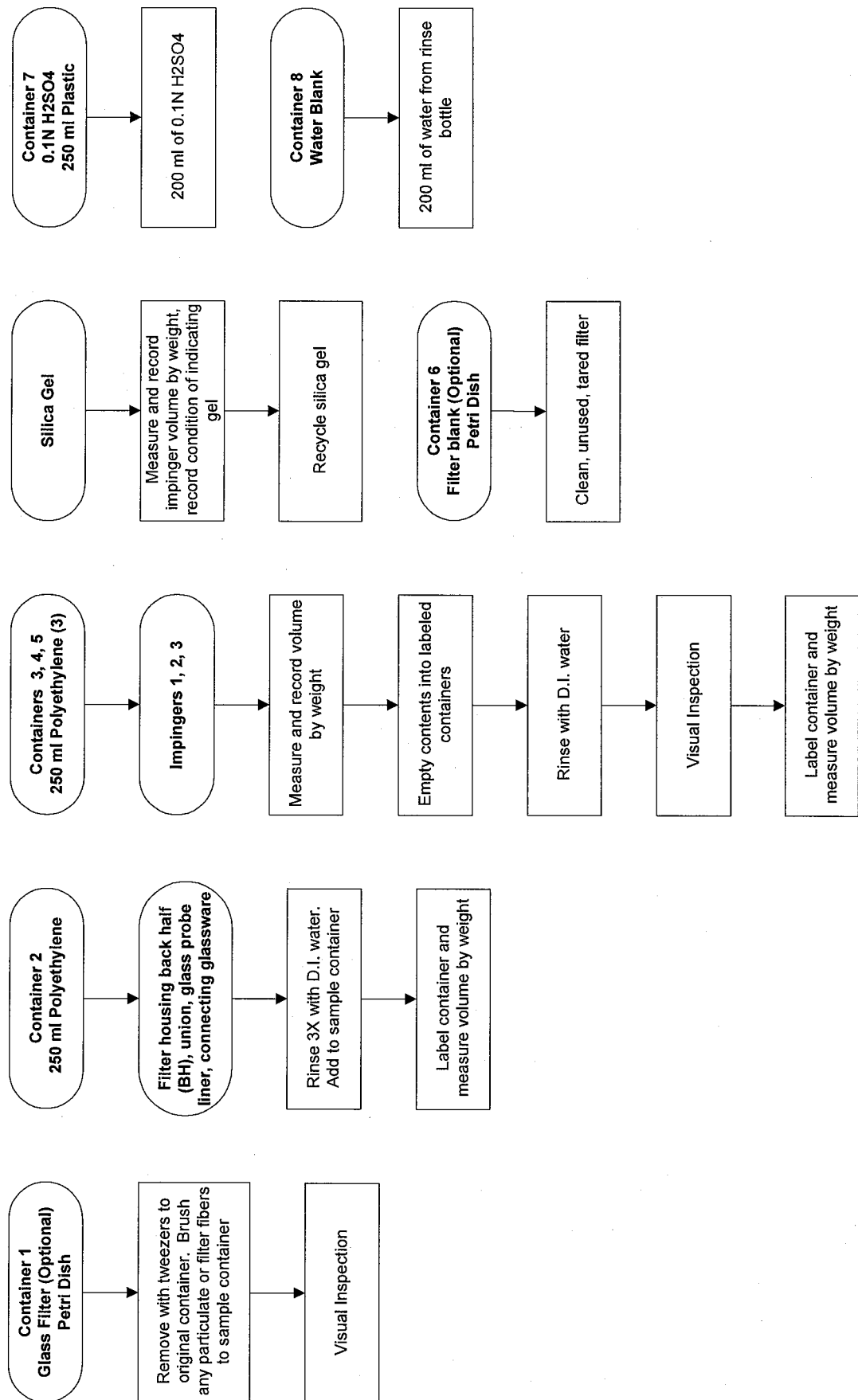
Glassware Preparation Procedures



CTM-027

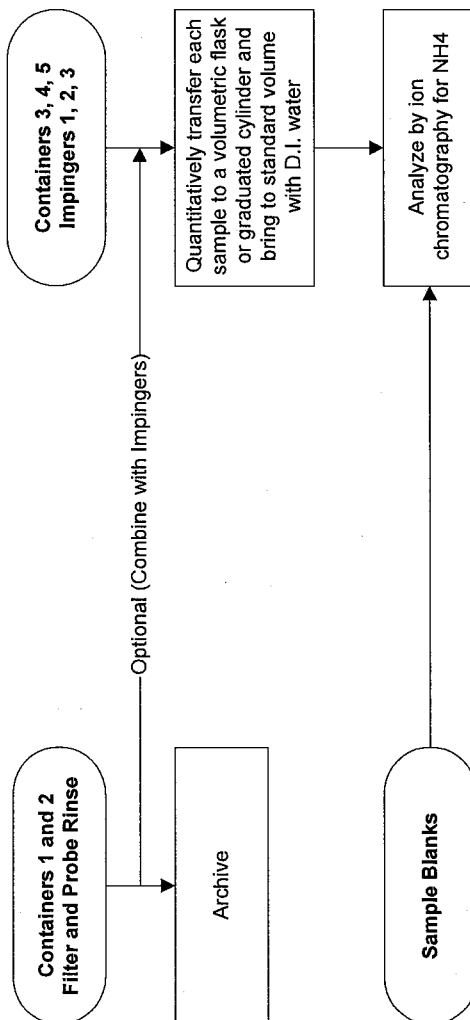
Sample Recovery Flowchart

- Tare all sample containers before sample collection
- Mark all liquid levels and final weights on the outside of each sample container
- Seal all sample containers with Teflon tape
- If recycling, bake silica gel for two hours at 350 degrees F (175 degrees C)
- Store and ship all samples at ice temperature.



CTM-027 Analytical Flowchart

- Log each sample in shipment and verify against chain-of-custody sheet
- Note liquid levels in the sample containers and confirm on the chain-of-custody sheet condition



Specification Sheet for

EPA Method 29

Source Location Name(s) FCCU Scrubber Stack
 Pollutant(s) to be Determined Trace Metals (excluding mercury)
 Other Parameters to be Determined from Train Gas Density, Moisture, Flow Rate

	Standard Method Specification	Actual Specification Used
Pollutant Sampling Information		
Duration of Run	N/A	180 minutes
No. of Sample Traverse Points	N/A	12
Sample Time per Point	N/A	15 minutes
Sampling Rate	Isokinetic (90-110%)	Isokinetic (90-110%)
Sampling Probe		
Nozzle Material	Borosilicate or Quartz Glass	Borosilicate Glass
Nozzle Design	Button-Hook or Elbow	Button-Hook
Probe Liner Material	Borosilicate or Quartz Glass	Borosilicate Glass
Effective Probe Length	N/A	4 feet
Probe Temperature Set-Point	248°F±25°F	248°F±25°F
Velocity Measuring Equipment		
Pitot Tube Design	Type S	Type S
Pitot Tube Coefficient	N/A	0.82
Pitot Tube Calibration by	Geometric or Wind Tunnel	Wind-Tunnel
Pitot Tube Attachment	Attached to Probe	Attached to Probe
Metering System Console		
Meter Type	Dry Gas Meter	Dry Gas Meter
Meter Accuracy	±2%	±1%
Meter Resolution	N/A	0.01 cubic feet
Meter Size	N/A	0.1 dcf/revolution
Meter Calibrated Against	Wet Test Meter or Standard DGM	Wet Test Meter
Pump Type	N/A	Rotary Vane
Temperature Measurements	N/A	Type K Thermocouple/Pyrometer
Temperature Resolution	5.4°F	1.0°F
ΔP Differential Pressure Gauge	Inclined Manometer or Equivalent	Inclined Manometer
ΔH Differential Pressure Gauge	Inclined Manometer or Equivalent	Inclined Manometer
Barometer	Mercury or Aneroid	Digital Barometer calibrated w/Mercury Aneroid
Filter Description		
Filter Location	After Probe	Exit of Probe
Filter Holder Material	Borosilicate Glass	Borosilicate Glass
Filter Support Material	Teflon (or other non-metallic material)	Teflon
Cyclone Material	N/A	None
Filter Heater Set-Point	248°F±25°F	248°F±25°F
Filter Material	Quartz or Glass Fiber	Quartz Fiber
Other Components		
Description	N/A	N/A
Location	N/A	N/A
Operating Temperature	N/A	N/A

Specification Sheet for

EPA Method 29

Impinger Train Description

Type of Glassware Connections

Connection to Probe or Filter by

Number of Impingers

Impinger Stem Types

Impinger 1

Impinger 2

Impinger 3

Impinger 4

Impinger 5

Impinger 6

Impinger 7

Impinger 8

Gas Density Determination

Sample Collection

Sample Collection Medium

Sample Analysis

Sample Recovery Information

Probe Brush Material

Probe Rinse Reagent

Probe Rinse Wash Bottle Material

Probe Rinse Storage Container

Filter Recovered?

Filter Storage Container

Impinger Contents Recovered?

Impinger Rinse Reagent

Impinger Wash Bottle

Impinger Storage Container

Analytical Information

Method 4 H₂O Determination by

Filter Preparation Conditions

Front-Half Rinse Preparation

Back-Half Analysis

Additional Analysis

Standard Method Specification

Ground Glass or Equivalent

Direct Glass Connection

4

Modified Greenburg-Smith

Modified Greenburg-Smith

Greenburg-Smith

Modified Greenburg-Smith

Multi-point integrated

Flexible Gas Bag

Orsat or Fyrite Analyzer

Non-metallic swab or bristle

0.1N Nitric Acid

Glass or Teflon

Polyethylene or glass

Yes

Petri Dish - Glass or Polystyrene

Yes

See Method 29 Recovery Flow Chart

Glass or Teflon

See Recovery Flow Chart

Volumetric or Gravimetric

See Method 29 Analytical Flow Chart

See Method 29 Analytical Flow Chart

See Method 29 Analytical Flow Chart

None

Actual Specification Used

Screw Joint with Silicone Gasket

Direct Glass Connection

4

Modified Greenburg-Smith

Modified Greenburg-Smith

Greenburg-Smith

Modified Greenburg-Smith

Single Point Integrated

Vinyl Bag

CEM

Teflon Mat

0.1 N Nitric Acid

Teflon

Polyethylene

Yes

Glass

Yes

See Recovery Flow Chart

Teflon

See Recovery Flow Chart

Gravimetric and Volumetric

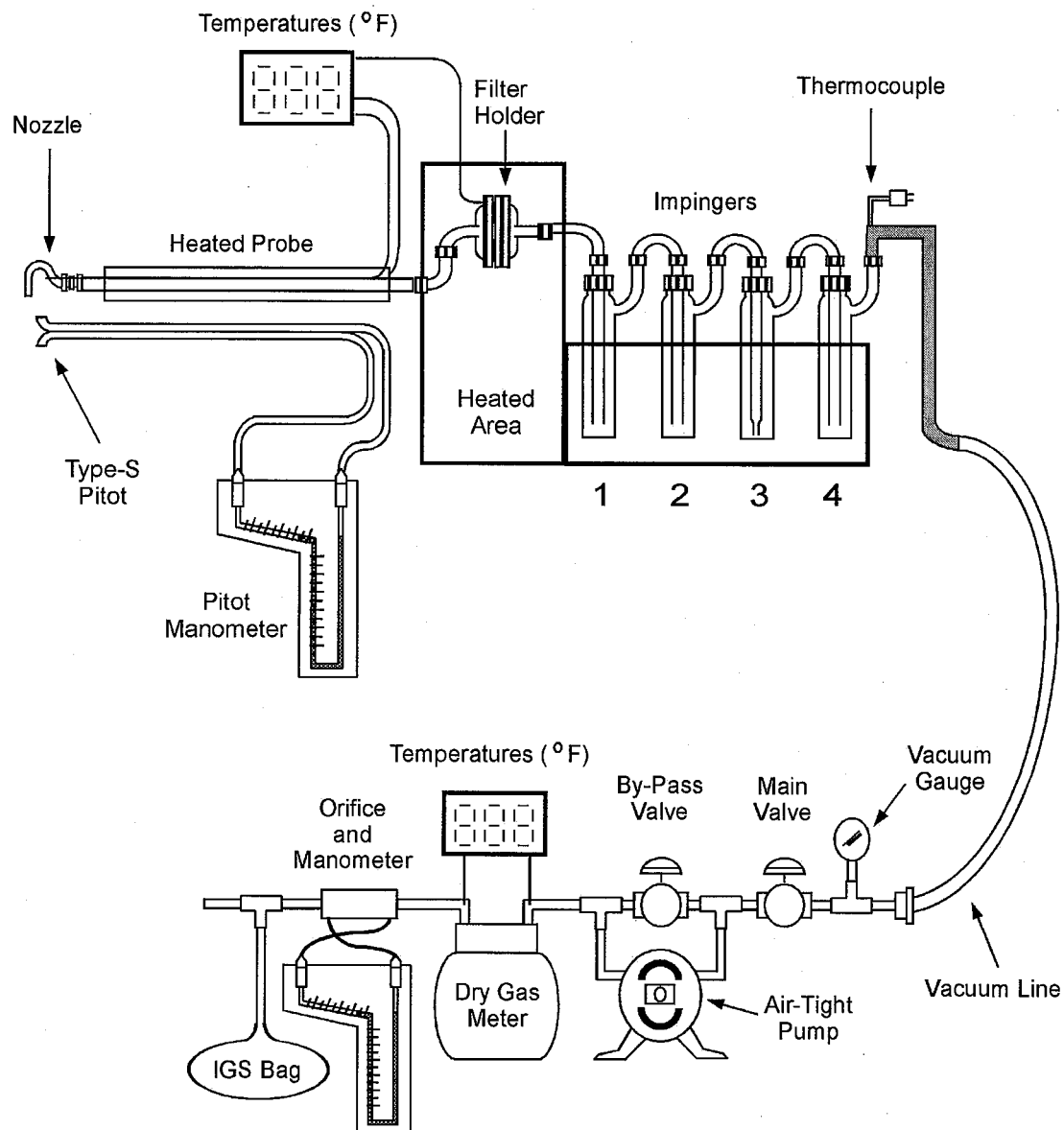
For Metals Analysis

See Analytical Flow Chart

See Analytical Flow Chart

None

EPA Method 29 Sampling Train Configuration

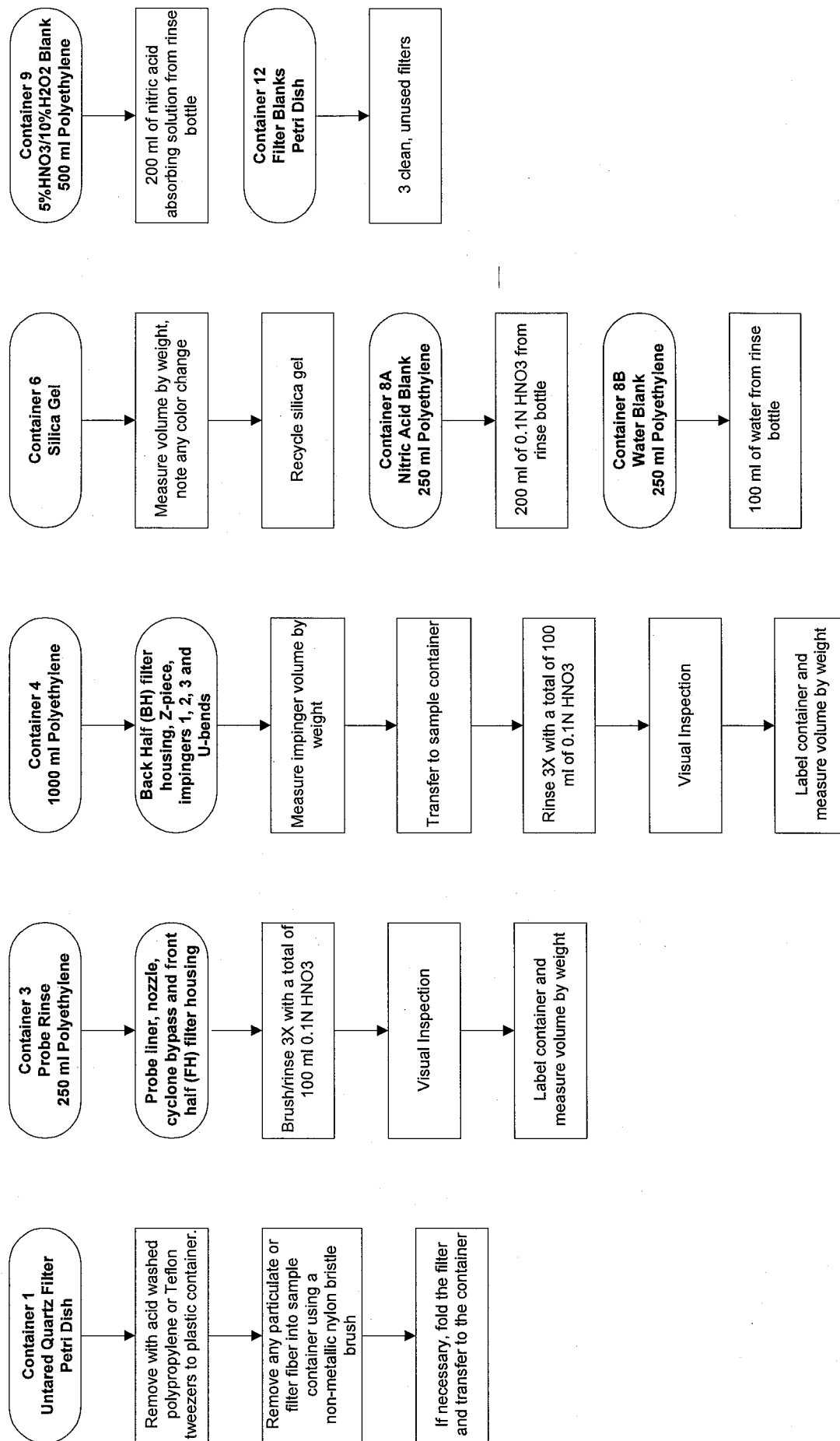


Impinger Contents

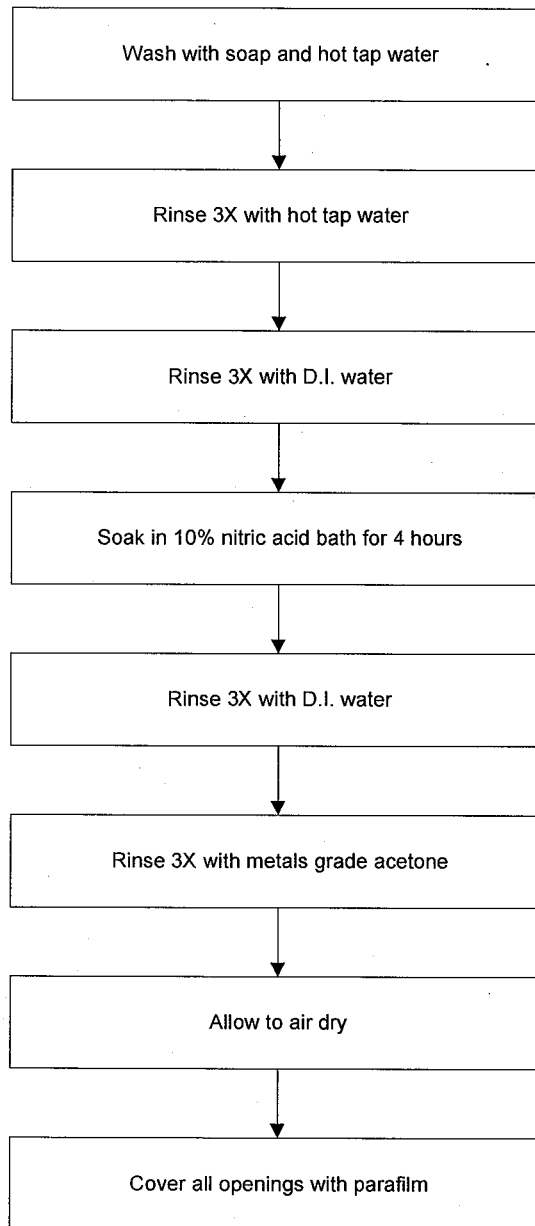
Impinger 1	Empty
Impinger 2	100 mL 0.1N HNO_3
Impinger 3	100 mL 0.1N HNO_3
Impinger 4	Silica Gel

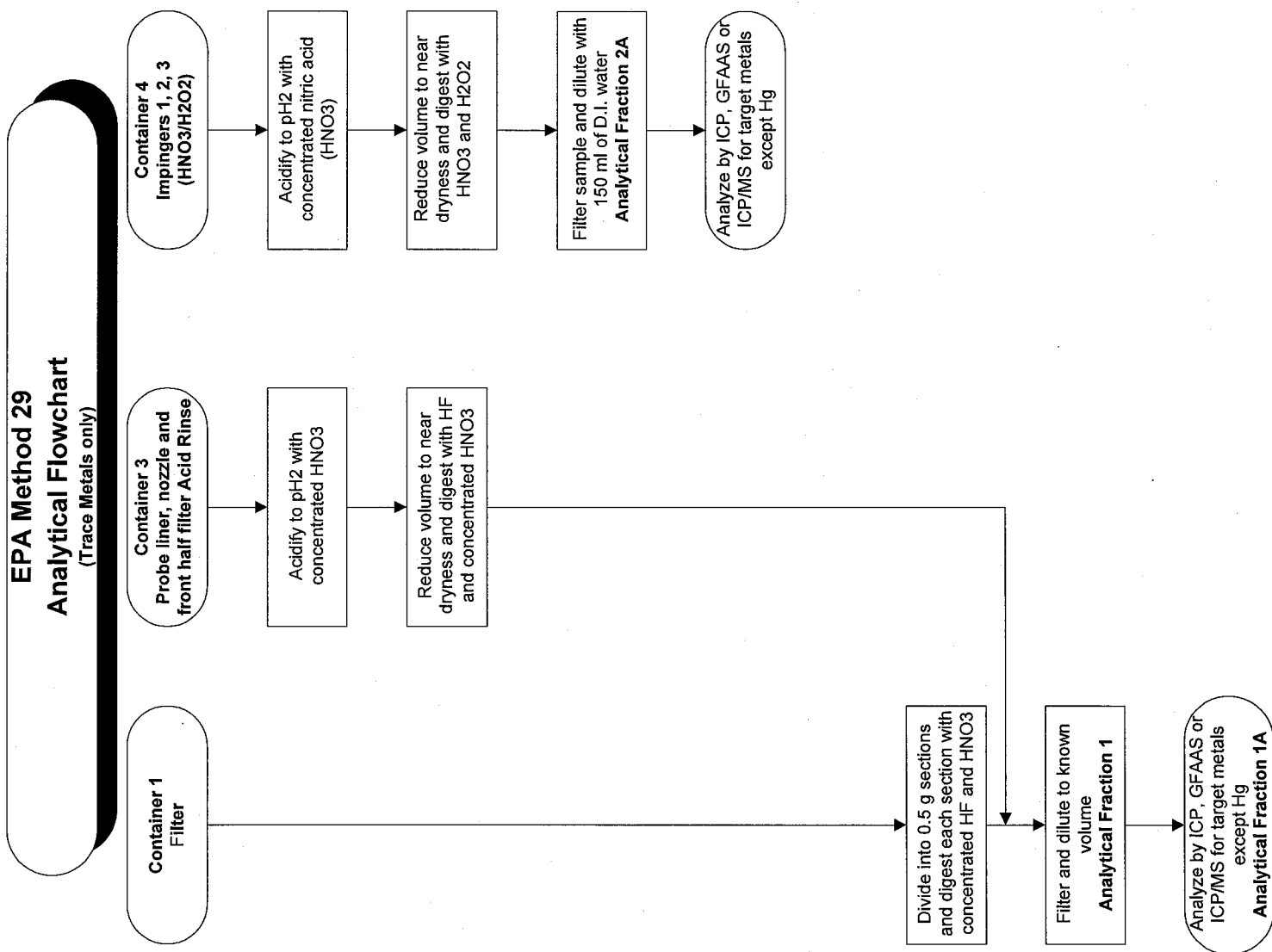
EPA Method 29 Sample Recovery Flowchart (Trace Metals only)

- Tare all sample containers before sample collection
- Mark all liquid levels and final weights on the outside of each sample container
- Seal all sample containers with Teflon tape
- If recycling, bake silica gel for two hours at 350 degrees F (175 degrees C)
- Collect one complete blank set per field test.



EPA Method 29 Glassware Preparation Procedures





Specification Sheet for

ASTM D6784 (Ontario Hydro Method)

Source Location Name(s) FCCU Scrubber Stack
 Pollutant(s) to be Determined Particulate-Bound, Oxidized and Elemental Mercury (Hg)
 Other Parameters to be Determined from Train Particulate, Gas Density, Moisture, Flow Rate

	Standard Method Specification	Actual Specification Used
Pollutant Sampling Information		
Sampling System Configuration	EPA Method 5 or 17	EPA Method 5
Duration of Run	At least 120 minutes and < 180 minutes	120 minutes
No. of Sample Traverse Points	EPA Method 1 requirements or ASTM Test Method 3154	12
Sample Time per Point	5 minutes minimum	10 minutes
Sampling Rate	Isokinetic (90-110%)	Isokinetic (90-110%)
Minimum Sampling Volume	Between 1.0 dscm and 2.5 dscm	~2.5 dscm
Sampling Probe		
Nozzle Material	Borosilicate or Quartz Glass	Borosilicate Glass
Nozzle Design	Button-Hook or Elbow	Button-Hook
Probe Liner Material	(Borosilicate or Quartz Glass (Method 5) or (PTFE (Method 17))	Borosilicate Glass
Effective Probe Length	N/A	4 feet
Probe Temperature Set-Point	Flue Gas Temperature $\pm 27^{\circ}\text{F}$ or $> 248^{\circ}\text{F}$	$> 248^{\circ}\text{F}$
Velocity Measuring Equipment		
Pitot Tube Design	Type S	Type S
Pitot Tube Coefficient	N/A	0.82
Pitot Tube Calibration by	Geometric or Wind Tunnel	Wind-Tunnel
Pitot Tube Attachment	Attached to Probe	Attached to Probe
Metering System Console		
Meter Type	Dry Gas Meter	Dry Gas Meter
Meter Accuracy	$\pm 2\%$	$\pm 1\%$
Meter Resolution	N/A	0.01 cubic feet
Meter Size	N/A	0.1 dcf/revolution
Meter Calibrated Against	Wet Test Meter or Standard DGM	Wet Test Meter
Pump Type	N/A	Rotary Vane
Temperature Measurements	N/A	Type K Thermocouple/Pyrometer
Temperature Resolution	5.4°F	1.0°F
ΔP Differential Pressure Gauge	Inclined Manometer or Equivalent	Inclined Manometer
ΔH Differential Pressure Gauge	Inclined Manometer or Equivalent	Inclined Manometer
Barometer	Mercury or Aneroid	Digital Barometer calibrated w/Mercury Aneroid
Filter Description		
Filter Location	After Probe	Exit of Probe
Filter Holder Material	Borosilicate Glass or PTFE coated stainless steel	Borosilicate Glass
Filter Support Material	Teflon (or other non-metallic)	Teflon
Cyclone Material	N/A	None
Filter Heater Set-Point	Flue Gas Temperature $\pm 27^{\circ}\text{F}$ or $> 248^{\circ}\text{F}$	$> 248^{\circ}\text{F}$
Filter Material	Quartz or Glass Fiber	Quartz Fiber
Other Components		
Description	Heated PTFE Tubing $> 0.5\text{ m}$	N/A
Location	Between filter holder and impinger train	N/A
Operating Temperature	$> 248^{\circ}\text{F}$	N/A

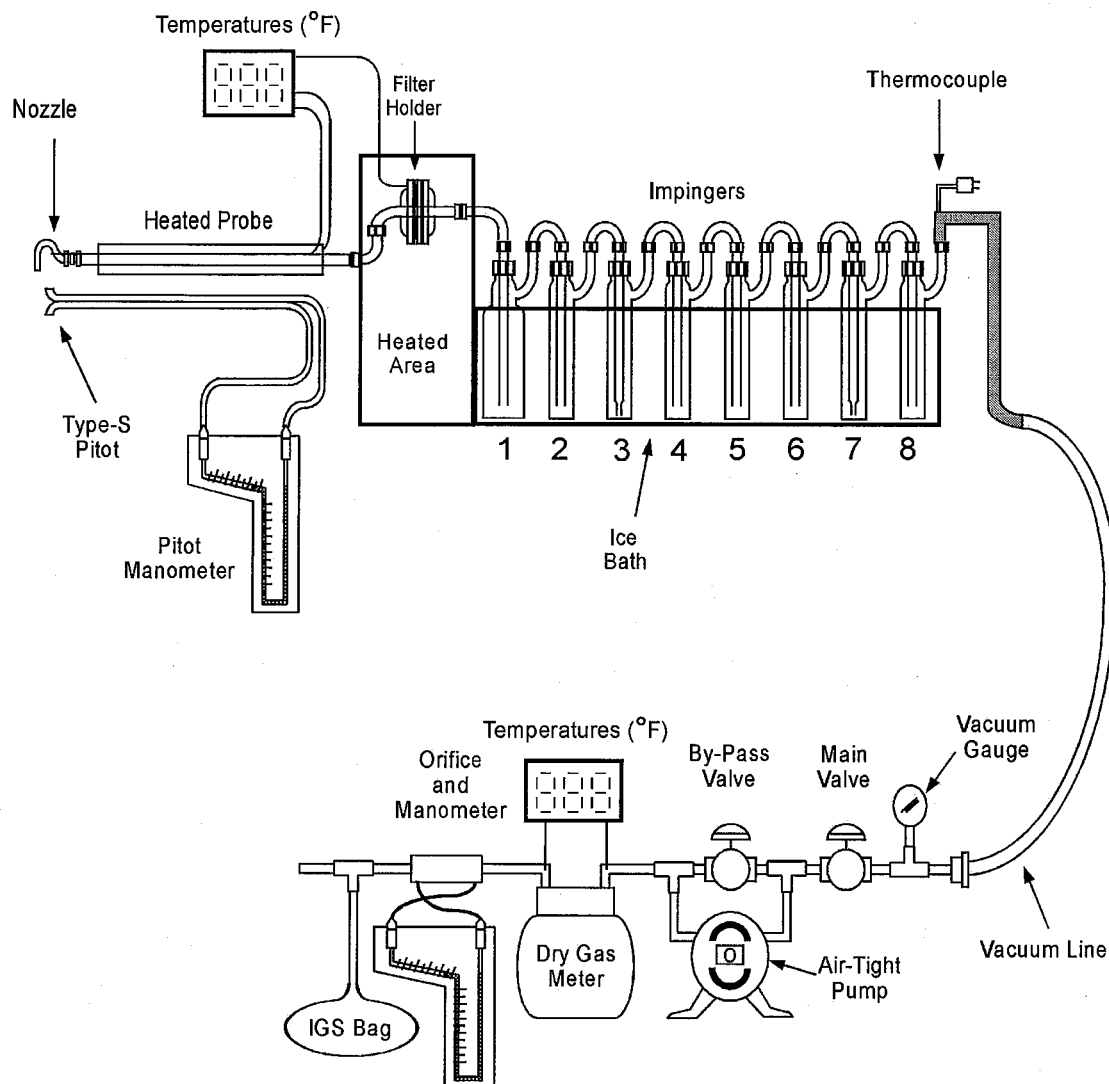
Specification Sheet for

ASTM D6784 (Ontario Hydro Method)

	Standard Method Specification	Actual Specification Used
Impinger Train Description		
Type of Glassware Connections	Ground Glass or Equivalent	Screw Joint with Silicone Gasket
Connection to Probe or Filter by	Direct Glass Connection or heated PTFE tubing	Direct Glass Connection
Number of Impingers	8	8
Impinger Stem Types		
Impinger 1	Modified Greenburg-Smith	Modified Greenburg-Smith
Impinger 2	Modified Greenburg-Smith	Modified Greenburg-Smith
Impinger 3	Greenburg-Smith	Greenburg-Smith
Impinger 4	Modified Greenburg-Smith	Modified Greenburg-Smith
Impinger 5	Modified Greenburg-Smith	Modified Greenburg-Smith
Impinger 6	Modified Greenburg-Smith	Modified Greenburg-Smith
Impinger 7	Greenburg-Smith	Greenburg-Smith
Impinger 8	Modified Greenburg-Smith	Modified Greenburg-Smith
Gas Density Determination		
Sample Collection	Multi-point integrated	Multi-Point Integrated
Sample Collection Medium	Flexible Gas Bag	Vinyl Bag
Sample Analysis	Orsat or Fyrite Analyzer	CEM
Sample Recovery Information		
Probe Brush Material	Non-metallic swab or bristle	Teflon Mat
Probe Rinse Reagent	0.1N Nitric Acid	0.1 N Nitric Acid
Probe Rinse Wash Bottle Material	Glass or Teflon	Teflon
Probe Rinse Storage Container	Polyethylene or glass	Polyethylene
Filter Recovered?	Yes	Yes
Filter Storage Container	Petri Dish - Glass or Polystyrene	Glass
Impinger Contents Recovered?	Yes	Yes
Impinger Rinse Reagent	See Ontario Hydro Recovery Flow Chart	See Recovery Flow Chart
Impinger Wash Bottle	Glass or Teflon	Teflon
Impinger Storage Container	See Ontario Hydro Recovery Flow Chart	See Recovery Flow Chart
Analytical Information		
Method 4 H ₂ O Determination by	Volumetric or Gravimetric	Gravimetric and Volumetric
Filter Preparation Conditions	See Ontario Hydro Analytical Flow Chart	Dessicate 24 hours minimum at 58-78F
Front-Half Rinse Preparation	See Ontario Hydro Analytical Flow Chart	See Analytical Flow Chart
Back-Half Analysis	See Ontario Hydro Analytical Flow Chart	See Analytical Flow Chart
Additional Analysis	Particulate Analysis (Method 5)	None

ASTM D6784

Sampling Train Configuration

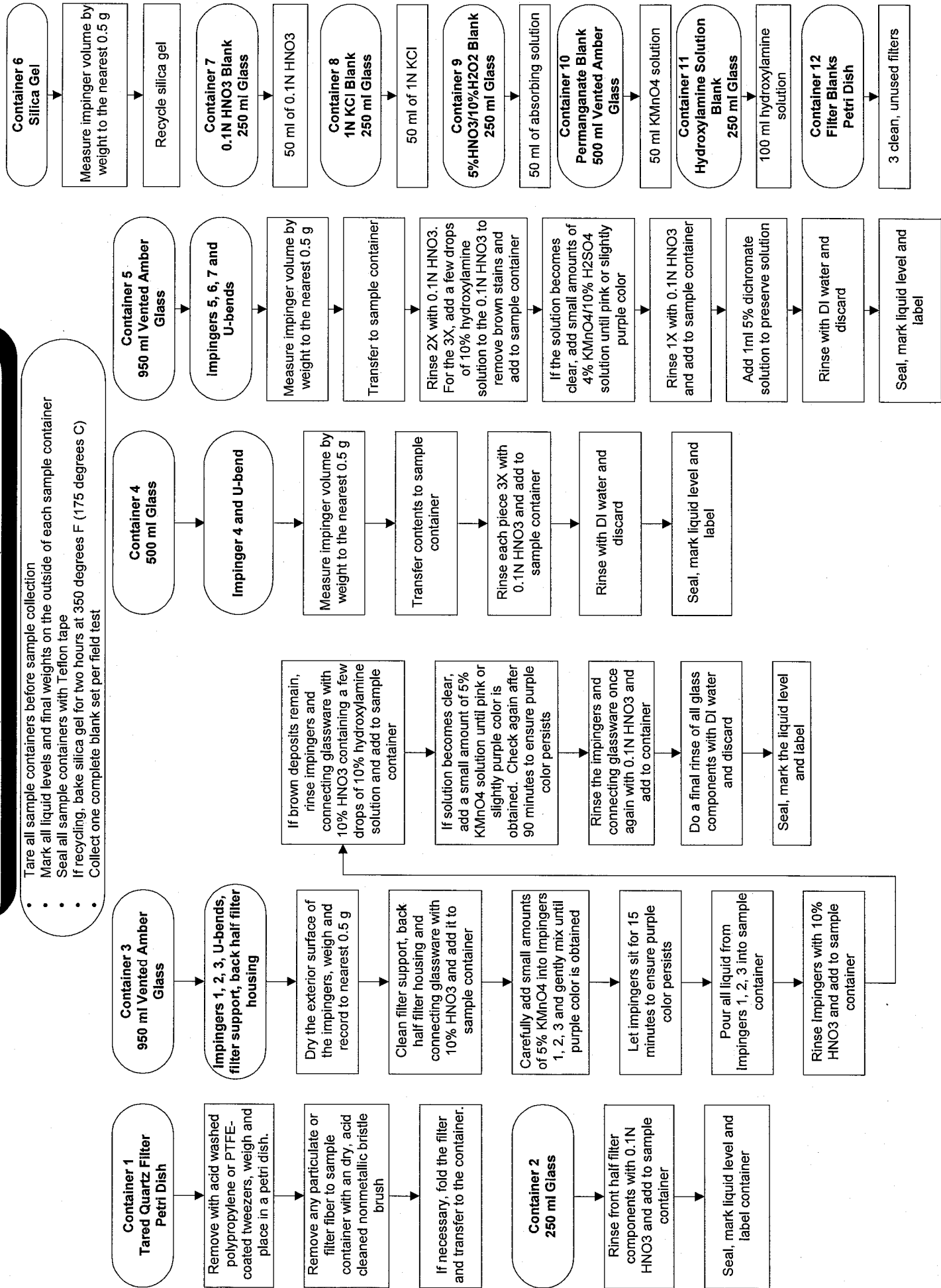


Impinger Contents

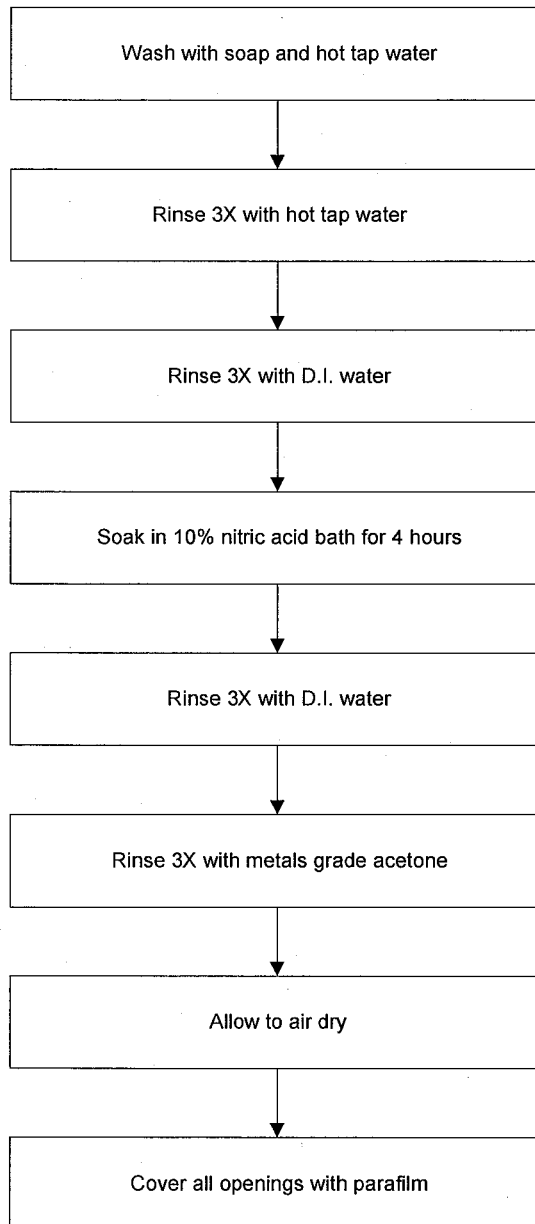
Impinger 1	1 M KCl
Impinger 2	1 M KCl
Impinger 3	1 M KCl
Impinger 4	5% HNO_3 / 10% H_2O_2
Impinger 5	4% KMnO_4 / 10% H_2SO_4
Impinger 6	4% KMnO_4 / 10% H_2SO_4
Impinger 7	4% KMnO_4 / 10% H_2SO_4
Impinger 8	Silica Gel

Ontario Hydro Method Sample Recovery Flowchart (without Particulate Matter)

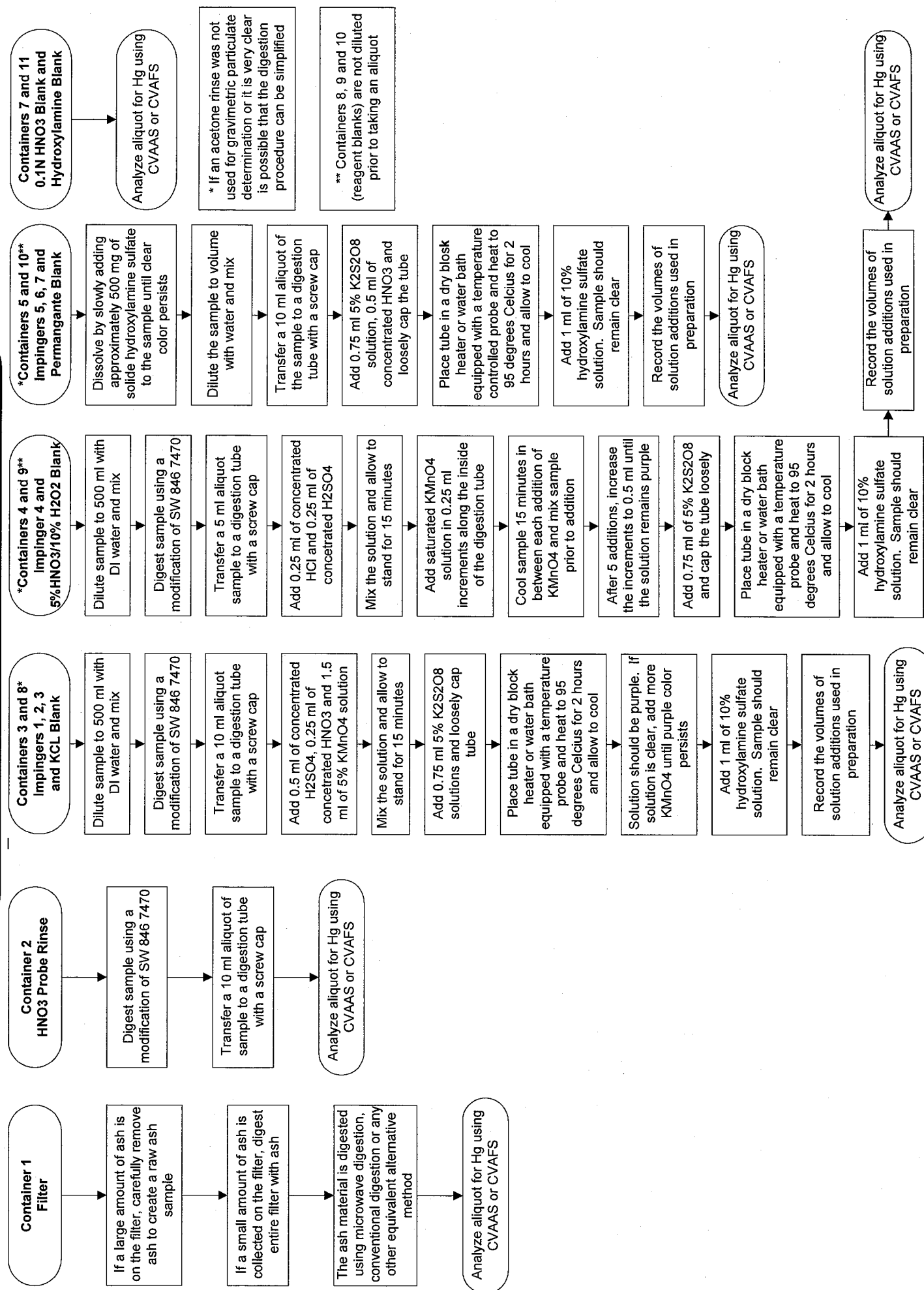
- Tare all sample containers before sample collection
- Mark all liquid levels and final weights on the outside of each sample container
- Seal all sample containers with Teflon tape
- If recycling, bake silica gel for two hours at 350 degrees F (175 degrees C)
- Collect one complete blank set per field test



Ontario Hydro Method Glassware Preparation Procedures



Ontario Hydro Method Analytical Flowchart (without Particulate Matter)



Specification Sheet for

SW-846 Method 0061

Source Location Name(s) FCCU Scrubber Stack
Pollutant(s) to be Determined Hexavalent Chromium
Other Parameters to be Determined from Train Gas Density, Moisture, Flow Rate

	Standard Method Specification	Actual Specification Used
Pollutant Sampling Information		
Duration of Run	N/A	180 minutes
No. of Sample Traverse Points	N/A	12
Sample Time per Point	N/A	15 minutes
Sampling Rate	Isokinetic (90-110%)	Isokinetic (90-110%)
Sampling Probe		
Nozzle Material	Glass or Teflon	Borosilicate Glass
Nozzle Design	Button-Hook or Elbow	Button-Hook
Probe Liner Material	Teflon	Teflon
Effective Probe Length	N/A	4 feet
Probe Temperature Set-Point	N/A	None
Velocity Measuring Equipment		
Pitot Tube Design	Type S	Type S
Pitot Tube Coefficient	N/A	0.819
Pitot Tube Calibration by	Geometric or Wind Tunnel	Wind-Tunnel
Pitot Tube Attachment	Attached to Probe	Attached to Probe
Metering System Console		
Meter Type	Dry Gas Meter	Dry Gas Meter
Meter Accuracy	±2%	±1%
Meter Resolution	0.01 cubic feet	0.01 cubic feet
Meter Size	N/A	0.1 dcf/revolution
Meter Calibrated Against	Wet Test Meter or Standard DGM	Wet Test Meter
Pump Type	N/A	Rotary Vane
Temperature Measurements	N/A	Type K Thermocouple/Pyrometer
Temperature Resolution	5.4°F	1.0°F
ΔP Differential Pressure Gauge	Inclined Manometer or Equivalent	Inclined Manometer
ΔH Differential Pressure Gauge	Inclined Manometer or Equivalent	Inclined Manometer
Barometer	Mercury or Aneroid	Digital Barometer calibrated w/Mercury Aneroid
Filter Description		
Filter Location	None	None
Filter Holder Material	N/A	N/A
Filter Support Material	N/A	N/A
Cyclone Material	N/A	None
Filter Heater Set-Point	N/A	Ambient
Filter Material	N/A	N/A
Other Components		
Description	Teflon recirculation line	Teflon recirculation line
Location	From first impinger to front of probe	In-stack (before probe)
Operating Temperature	N/A	N/A

Specification Sheet for

SW-846 Method 0061

Impinger Train Description

Type of Glassware Connections

Connection to Probe or Filter by

Number of Impingers

Impinger Stem Types

Impinger 1

Impinger 2

Impinger 3

Impinger 4

Impinger 5

Impinger 6

Impinger 7

Impinger 8

Gas Density Determination

Sample Collection

Sample Collection Medium

Sample Analysis

Sample Recovery Information

Probe Brush Material

Probe Rinse Reagent

Probe Rinse Wash Bottle Material

Probe Rinse Storage Container

Filter Recovered?

Filter Storage Container

Impinger Contents Recovered?

Impinger Rinse Reagent

Impinger Wash Bottle

Impinger Storage Container

Analytical Information

Method 4 H₂O Determination by

Filter Preparation Conditions

Front-Half Rinse Preparation

Back-Half Analysis

Additional Analysis

Standard Method Specification

Teflon or Teflon Lined Glass

Teflon or Teflon Lined Glass

5

Teflon - Short Stem

Teflon - Restricted Tip

Teflon - Restricted Tip

Teflon - Open Tip

Glass - Modified Greenburg-Smith

Glass - Modified Greenburg-Smith

Multi-point integrated

Flexible Gas Bag

Orsat or Fyrite Analyzer

N/A

Reagent Water

Polyethylene

Polyethylene

N/A

N/A

Yes

Reagent Water

Polyethylene

Polyethylene

Volumetric or Gravimetric

N/A

Filtration, combined with back-half

Filtration, Ion Chromatography w/Post Column Rx

N/A

Actual Specification Used

Screw Joint with Silicone Gasket

Direct Teflon Connection

6

Teflon - Shortened Stem (open tip)

Teflon - Restricted Tip

Teflon - Restricted Tip

Teflon - Open Tip

Glass - Modified Greenburg-Smith

Glass - Modified Greenburg-Smith

Multi-Point Integrated

Vinyl Bag

CEM

N/A

Deionized Distilled Water

Teflon

Polyethylene

N/A

N/A

Yes

Deionized Distilled Water

Teflon

Polyethylene

Gravimetric and Volumetric

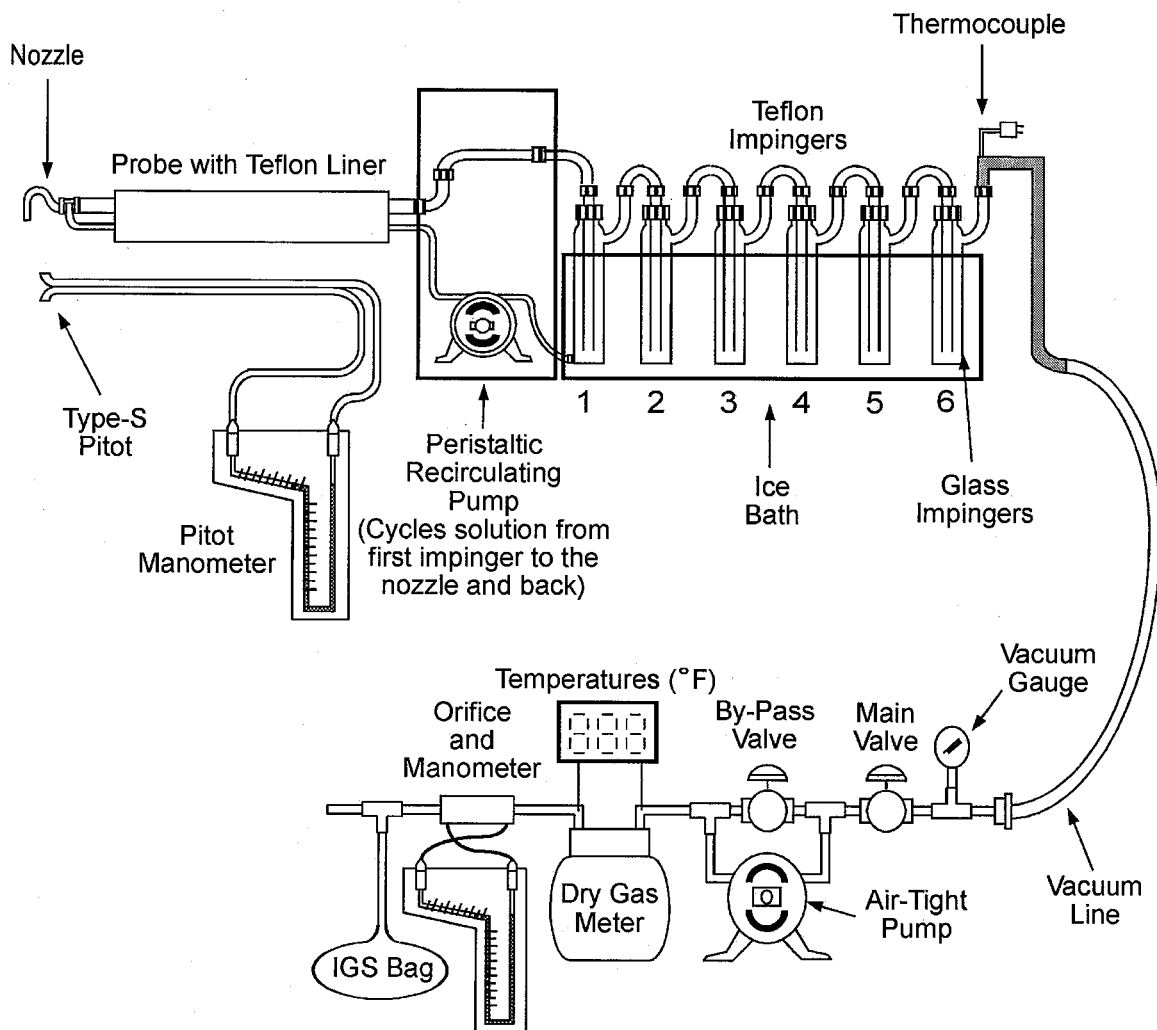
N/A

Filtration, combined with back-half

Filtration, Ion Chromatography w/Post Column Rx

None

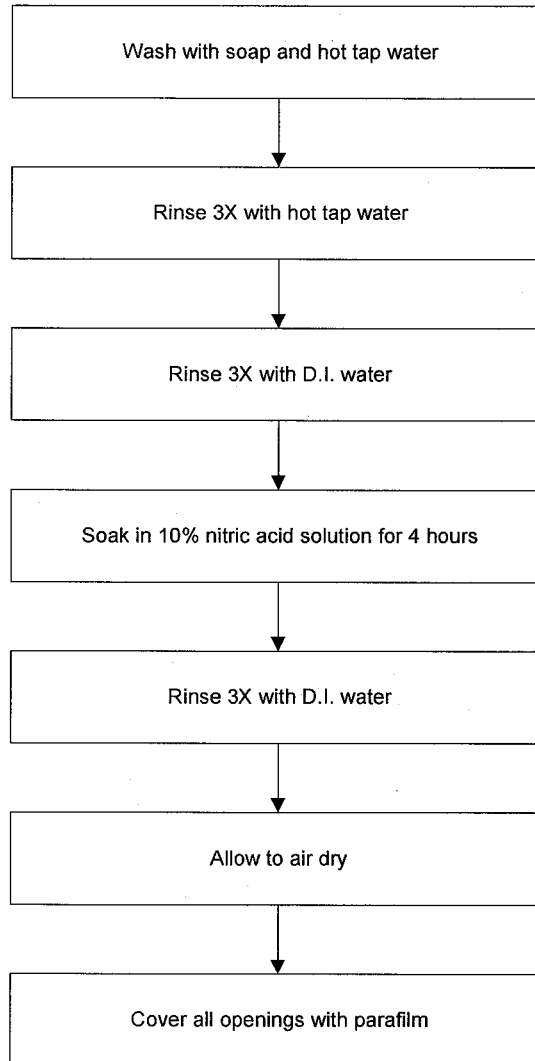
SW-846 Method 0061 Sampling Train Configuration



Impinger Contents

Impinger 1	140 mL 0.5 M KOH
Impinger 2	80 mL 0.5 M KOH
Impinger 3	80 mL 0.5 M KOH
Impinger 4	Empty
Impinger 5	Empty
Impinger 6	Silica Gel

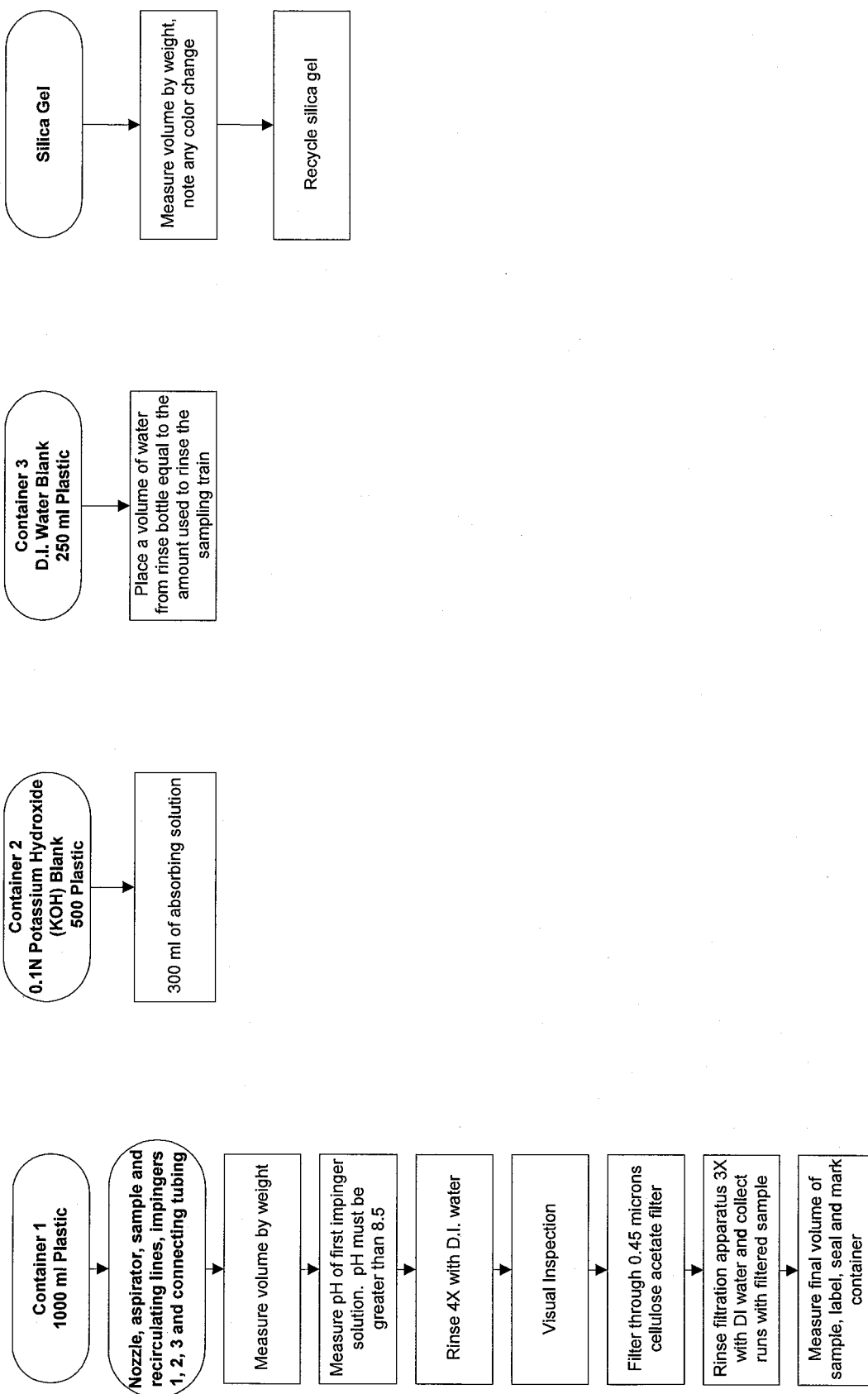
SW846 Method 0061 Glassware Preparation Procedures



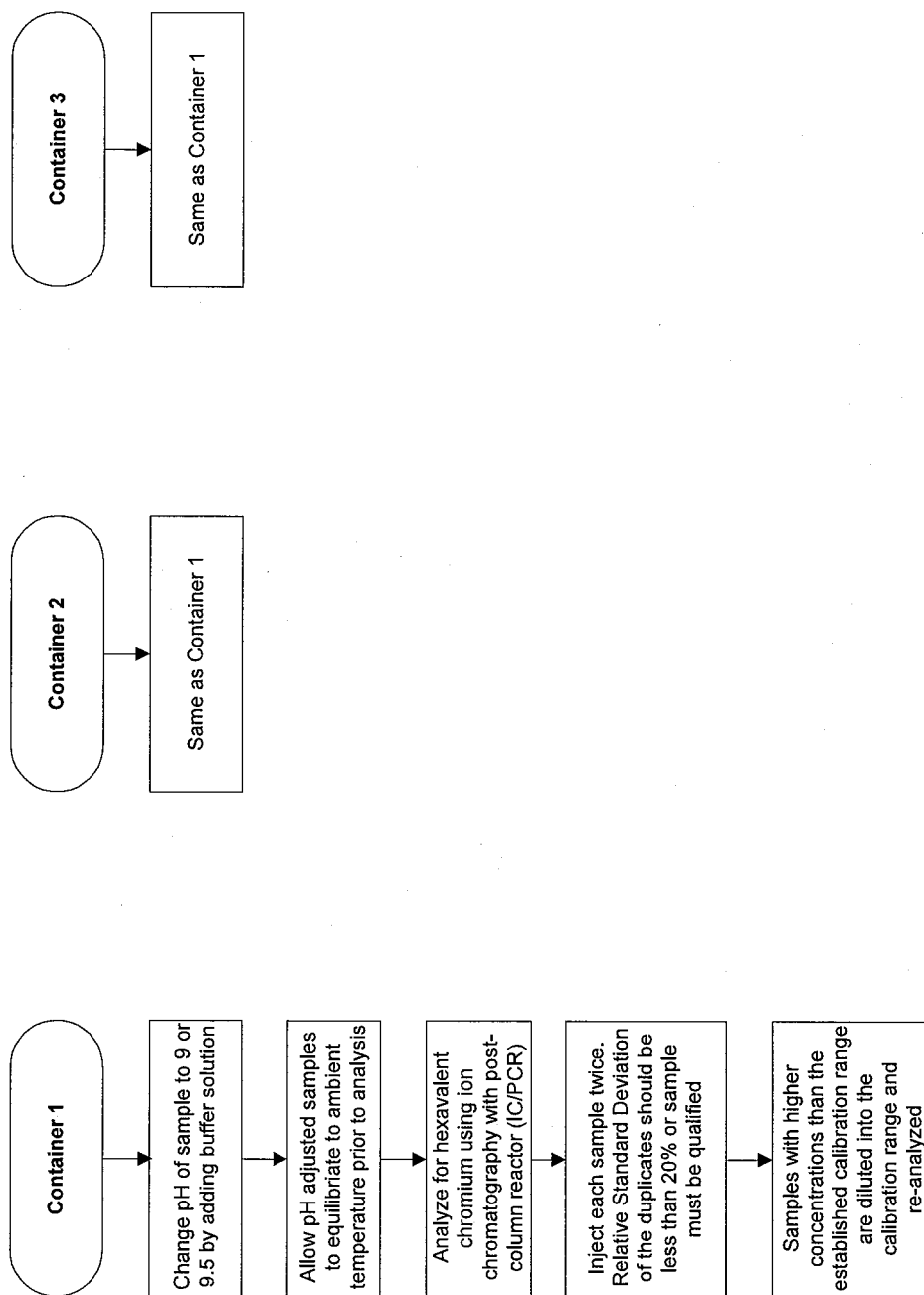
SW846 Method 0061

Sample Recovery Flowchart

- Tare all sample containers before sample collection
- Sample train should be purged with N2 at 10 LPM for 30 minutes prior to sample recovery
- Mark all liquid levels and final weights on the outside of each sample container
- Seal all sample containers with Teflon tape
- If recycling, bake silica gel for two hours at 350 degrees F (175 degrees C)



EPA Method 0061 Analytical Flowchart



Specification Sheet for

EPA Method 26A

Source Location Name(s) FCCU Scrubber Stack
 Pollutant(s) to be Determined Hydrogen Halides and Halogens
 Other Parameters to be Determined from Train Gas Density, Moisture, Flow Rate

	Standard Method Specification	Actual Specification Used
Pollutant Sampling Information		
Duration of Run	N/A	120 minutes
No. of Sample Traverse Points	N/A	12
Sample Time per Point	N/A	10 minutes
Sampling Rate	Isokinetic (90-110%)	Isokinetic (90-110%)
Sampling Probe		
Nozzle Material	Borosilicate or Quartz Glass	Borosilicate Glass
Nozzle Design	Button-Hook or Elbow	Button-Hook
Probe Liner Material	Borosilicate or Quartz Glass or Teflon	Borosilicate Glass
Effective Probe Length	N/A	4 feet
Probe Temperature Set-Point	> 248°F	> 248°F
Velocity Measuring Equipment		
Pitot Tube Design	Type S	None
Pitot Tube Coefficient	N/A	0.827
Pitot Tube Calibration by	Geometric or Wind Tunnel	Wind-Tunnel
Pitot Tube Attachment	Attached to Probe	Attached to Probe
Metering System Console		
Meter Type	Dry Gas Meter	Dry Gas Meter
Meter Accuracy	±2%	±1%
Meter Resolution	N/A	0.01 cubic feet
Meter Size	N/A	0.1 dcf/revolution
Meter Calibrated Against	Wet Test Meter or Standard DGM	Wet Test Meter
Pump Type	N/A	Rotary Vane
Temperature Measurements	N/A	Type K Thermocouple/Pyrometer
Temperature Resolution	5.4°F	1.0°F
ΔP Differential Pressure Gauge	Inclined Manometer or Equivalent	Inclined Manometer
ΔH Differential Pressure Gauge	Inclined Manometer or Equivalent	Inclined Manometer
Barometer	Mercury or Aneroid	Digital Barometer calibrated w/Mercury Aneroid
Filter Description		
Filter Location	After Probe	Exit of Probe
Filter Holder Material	Borosilicate, Quartz Glass or Teflon	Borosilicate Glass
Filter Support Material	Teflon Frit	Teflon
Cyclone Material	Glass or Teflon	None
Filter Heater Set-Point	> 248°F	> 248°F
Filter Material	Teflon Mat (Quartz, Optional High Temp>410°F)	Teflon Mat
Other Components		
Description	N/A	N/A
Location	N/A	N/A
Operating Temperature	N/A	N/A

Specification Sheet for

EPA Method 26A

Impinger Train Description

Type of Glassware Connections

Connection to Probe or Filter by

Number of Impingers

Impinger Stem Types

Impinger 1

Impinger 2

Impinger 3

Impinger 4

Impinger 5

Impinger 6

Impinger 7

Impinger 8

Gas Density Determination

Sample Collection

Sample Collection Medium

Sample Analysis

Sample Recovery Information

Probe Brush Material

Probe Rinse Reagent

Probe Rinse Wash Bottle Material

Probe Rinse Storage Container

Filter Recovered?

Filter Storage Container

Impinger Contents Recovered?

Impinger Rinse Reagent

Impinger Wash Bottle

Impinger Storage Container

Analytical Information

Method 4 H₂O Determination by

Filter Preparation Conditions

Front-Half Rinse Preparation

Back-Half Analysis

Additional Analysis

Standard Method Specification

Ground Glass or Equivalent

Direct Glass Connection

5 or 6

Short-Stem Greenburg-Smith (Optional)

Greenburg-Smith

Greenburg-Smith

Modified Greenburg-Smith

Modified Greenburg-Smith

Modified Greenburg-Smith

Multi-point integrated

Flexible Gas Bag

Orsat or Fyrite Analyzer

Nylon Bristle

None

N/A

N/A

No

N/A

Yes

Deionized Distilled Water

Glass or Polyethylene

Polyethylene

Volumetric or Gravimetric

N/A

N/A

Ion Chromatography

None

Actual Specification Used

Screw Joint with Silicone Gasket

Direct Glass Connection

6

Shortened Stem (open tip)

Greenburg-Smith

Greenburg-Smith

Modified Greenburg-Smith

Modified Greenburg-Smith

Modified Greenburg-Smith

Multi-Point Integrated

Vinyl Bag

CEM

N/A

N/A

N/A

N/A

Archived

Polystyrene

Yes

Deionized Distilled Water

Teflon

Polyethylene

Gravimetric and Volumetric

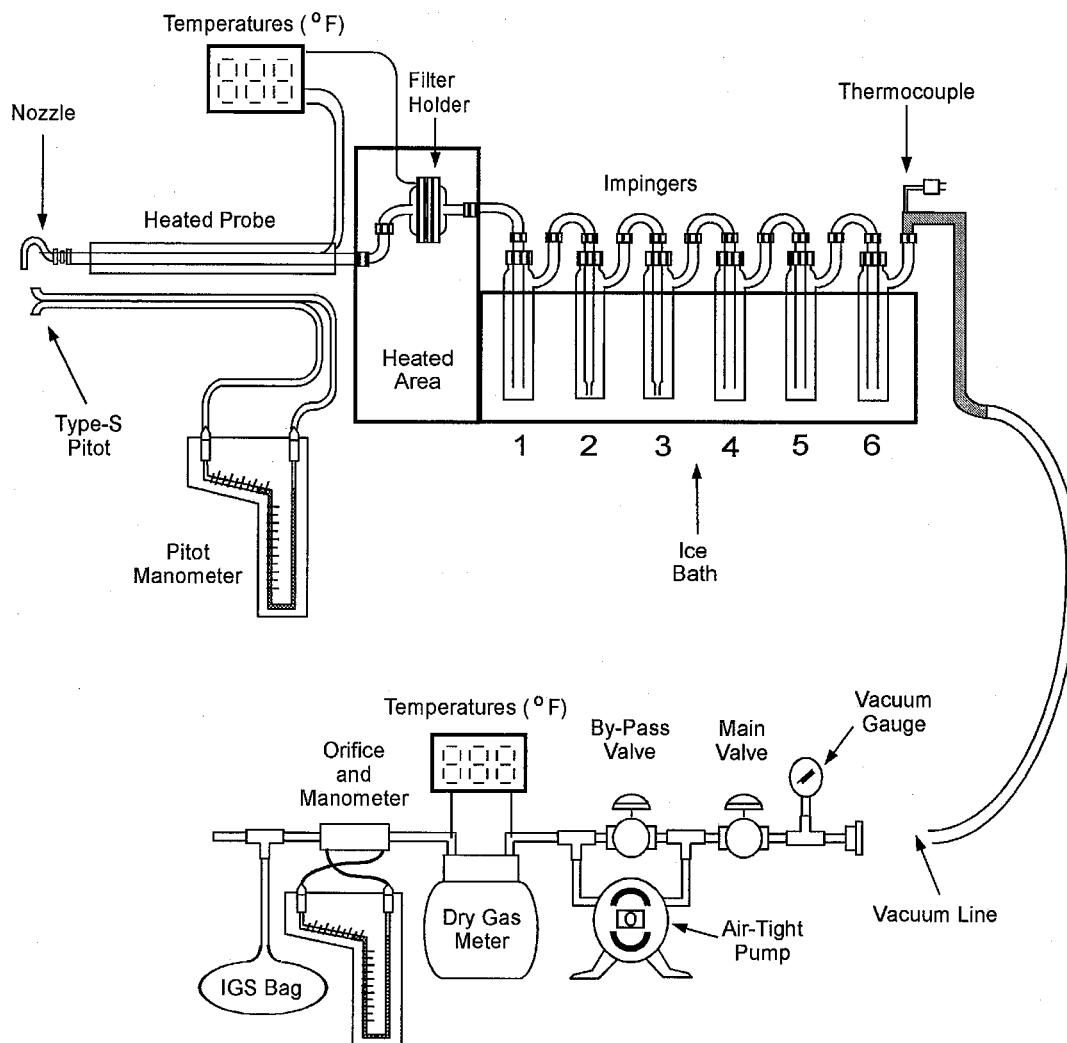
N/A

N/A

Ion Chromatography

None

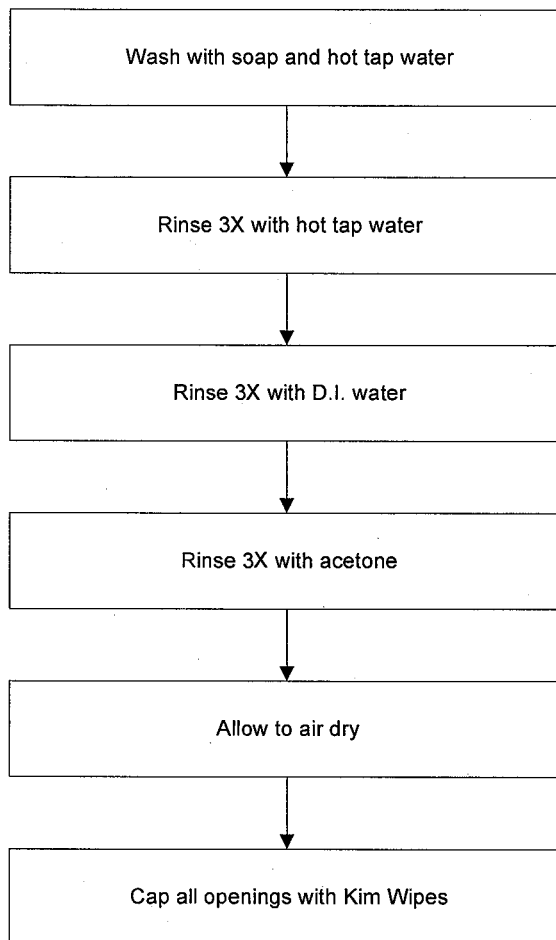
EPA Method 26A Sampling Train Configuration



Impinger Contents

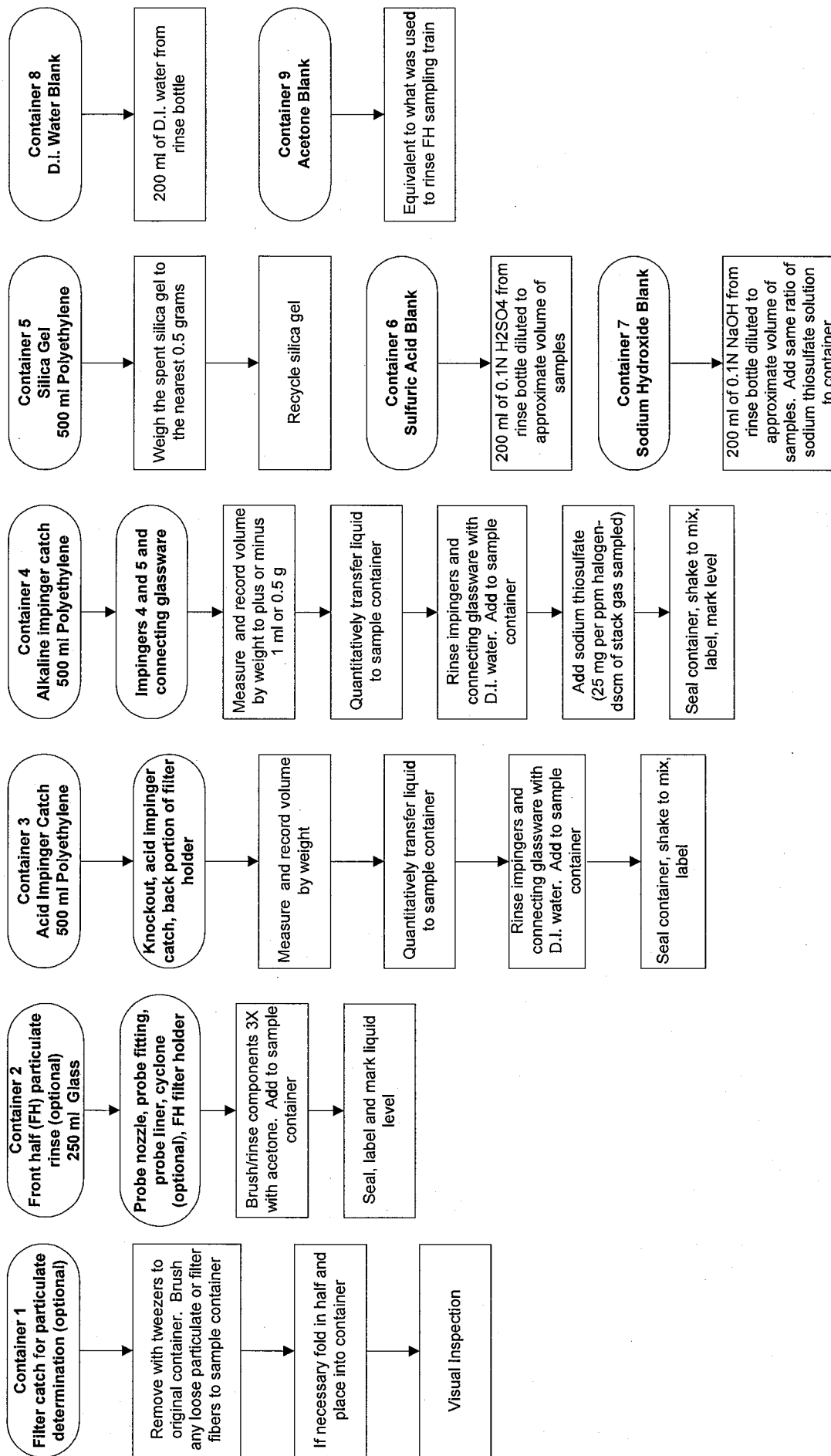
Impinger 1	50 mL 0.1 N H_2SO_4
Impinger 2	100 mL 0.1 N H_2SO_4
Impinger 3	100 mL 0.1 N H_2SO_4
Impinger 4	100 mL 0.1 N NaOH
Impinger 5	100 mL 0.1 N NaOH
Impinger 6	Silica Gel

EPA Method 26A Glassware Preparation Procedures



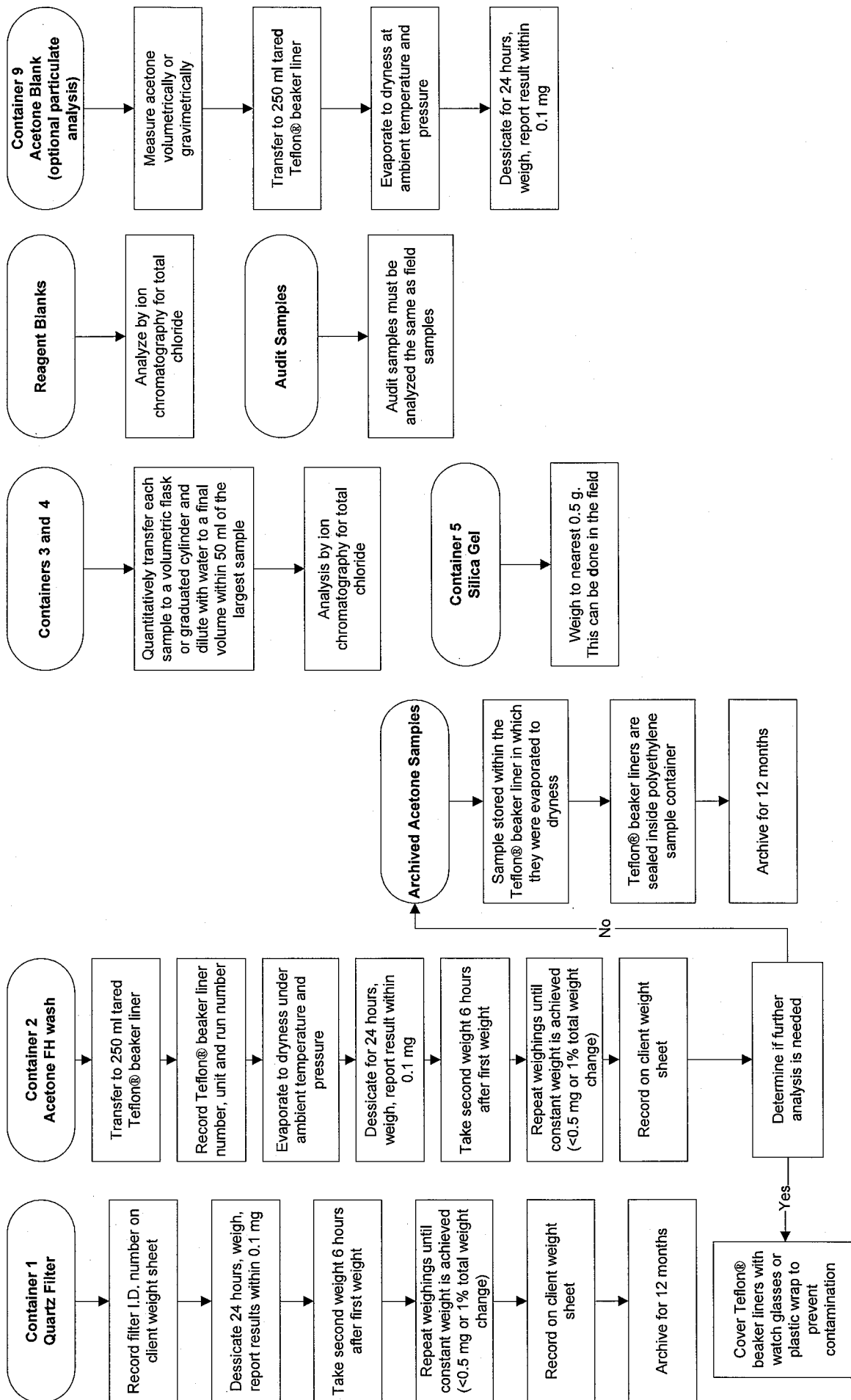
EPA Method 26A Sample Recovery Flowchart

- Tare all sample containers before sample collection
- Mark all liquid levels and final weights on the outside of each sample container
- Seal all sample containers with Teflon tape



EPA Method 26A Analytical Flowchart

- Log each sample in shipment and verify against chain-of-custody sheet
- Note liquid levels in the sample containers and confirm on the chain-of-custody sheet condition



Specification Sheet for

Other Test Method 29

Source Location Name(s) FCCU Scrubber Stack
Pollutant(s) to be Determined Hydrogen Cyanide
Other Parameters to be Determined from Train Gas Density, Flow Rate

Pollutant Sampling Information

	Standard Method Specification	Actual Specification Used
Duration of Run	N/A	60 minutes
No. of Sample Traverse Points	N/A	12
Sample Time per Point	N/A	5 minutes
Sampling Rate	Isokinetic (90-110%)	Isokinetic (90-110%)

Sampling Probe

Nozzle Material	Borosilicate or Quartz Glass	Borosilicate Glass
Nozzle Design	Button-Hook or Elbow	Button-Hook
Probe Liner Material	Borosilicate or Quartz Glass	Borosilicate Glass
Effective Probe Length	N/A	4 feet
Probe Temperature Set-Point	248°F ± 25°F	248°F ± 25°F

Velocity Measuring Equipment

Pitot Tube Design	Type S	Type S
Pitot Tube Coefficient	Known coefficient	0.819
Pitot Tube Calibration by	Geometric or Wind Tunnel	Wind-Tunnel
Pitot Tube Attachment	Attached to Probe	Attached to Probe

Metering System Console

Meter Type	Dry Gas Meter	Dry Gas Meter
Meter Accuracy	±2%	±2%
Meter Resolution	N/A	0.01 cubic feet
Meter Size	N/A	0.1 dcf/revolution
Meter Calibrated Against	Wet Test Meter or Standard DGM	Wet Test Meter
Pump Type	N/A	Rotary Vane
Temperature Measurements	N/A	Type K Thermocouple/Pyrometer
Temperature Resolution	5.4°F	5.4°F
ΔP Differential Pressure Gauge	Inclined Manometer or Equivalent	Inclined Manometer
ΔH Differential Pressure Gauge	Inclined Manometer or Equivalent	Inclined Manometer
Barometer	Mercury or Aneroid	Digital Barometer calibrated w/Mercury Aneroid

Filter Description

Filter Location	After Probe	Exit of Probe
Filter Holder Material	Borosilicate, Quartz Glass	Borosilicate Glass
Filter Support Material	Teflon	Teflon
Cyclone Material	NA	None
Filter Heater Set-Point	248°F ± 25°F	248°F ± 25°F
Filter Material	Quartz or Fluoropolymer Coated Fiber Filter	Quartz Fiber

Other Components

Description	N/A	N/A
Location	N/A	N/A
Operating Temperature	N/A	N/A

Specification Sheet for

Other Test Method 29

Impinger Train Description

Type of Glassware Connections

Connection to Probe or Filter by

Number of Impingers

Impinger Stem Types

Impinger 1

Impinger 2

Impinger 3

Impinger 4

Impinger 5

Impinger 6

Impinger 7

Impinger 8

Gas Density Determination

Sample Collection

Sample Collection Medium

Sample Analysis

Sample Recovery Information

Probe Brush Material

Probe Rinse Reagent

Probe Rinse Wash Bottle Material

Probe Rinse Storage Container

Filter Recovered?

Filter Storage Container

Impinger Contents Recovered?

Impinger Rinse Reagent

Impinger Wash Bottle

Impinger Storage Container

Analytical Information

Method 4 H₂O Determination by

Filter Preparation Conditions

Front-Half Rinse Preparation

Back-Half Analysis

Additional Analysis

Standard Method Specification

Ground Glass or Equivalent

Direct Glass Connection

4 or 5

Greenburg-Smith

Greenburg-Smith

Greenburg-Smith

Greenburg-Smith

Modified Greenburg-Smith

Multi-point integrated

Flexible Gas Bag

Orsat or Fyrite Analyzer

Teflon Bristle

Acetone

Teflon or glass

N/A

Yes (for PM analysis only)

N/A

Yes

0.1N NaOH

Glass or Polyethylene

Alkali resistant polyethylene or glass

Separate EPA Method 4 Sampling Train

See Analytical Flowchart

See Analytical Flowchart

Ion Chromatography

None

Actual Specification Used

Ground Glass with Silicone O-Ring

Direct Glass Connection

5

Modified Greenburg-Smith

Modified Greenburg-Smith

Modified Greenburg-Smith

Modified Greenburg-Smith

Modified Greenburg-Smith

Multi-Point Integrated

Direct Interface

CEM

Teflon Bristle

Acetone

Teflon

Glass

No

Polyethylene

Yes

0.1 N Sodium Hydroxide

Polyethylene

Polyethylene

Gravimetric

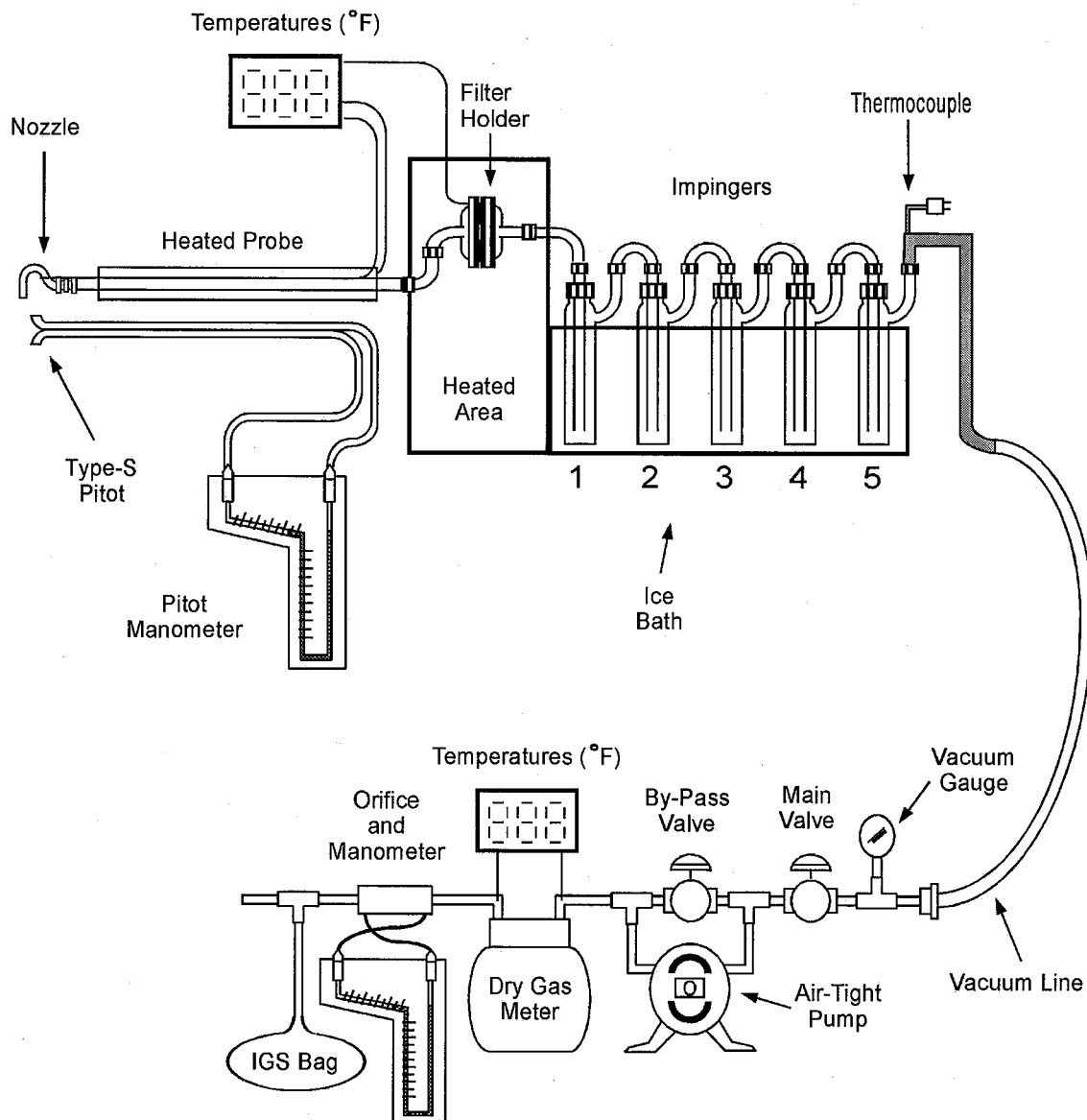
See Analytical Flow Chart

See Analytical Flow Chart

Ion Chromatography

None

Other Test Method 29 Sampling Train Configuration

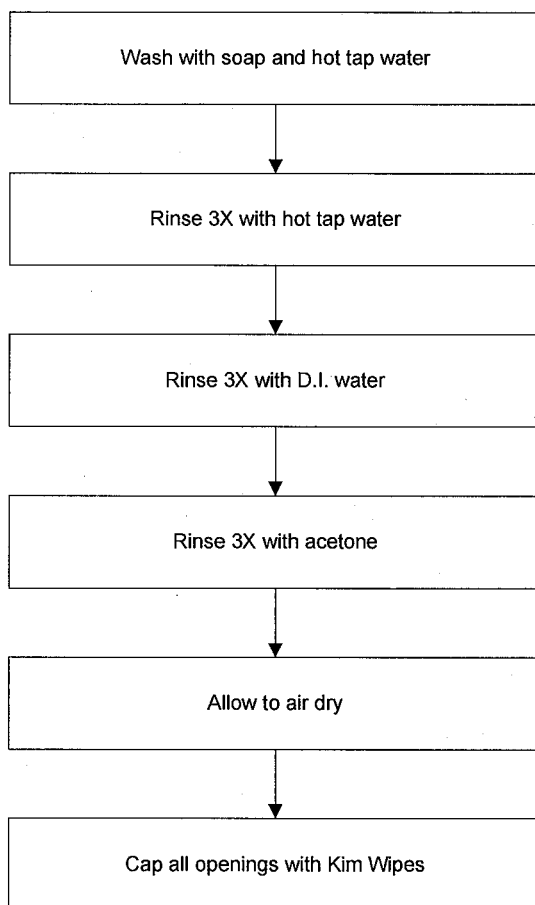


Impinger Contents

Impinger 1	200 mL 6N NaOH
Impinger 2	200 mL 6N NaOH
Impinger 3	200 mL 6N NaOH
Impinger 4	100 mL 6N NaOH
Impinger 5	Silica Gel

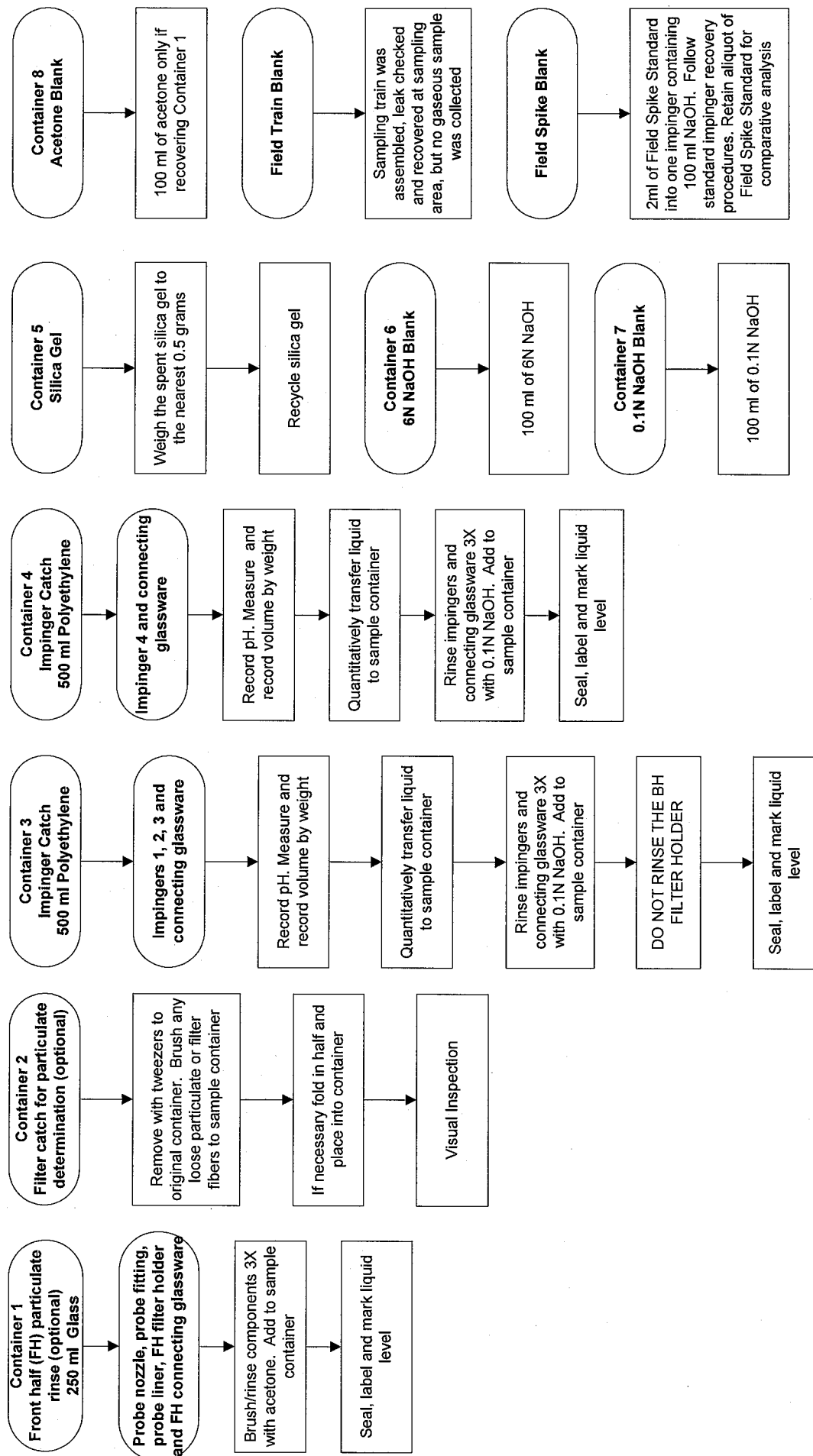
Other Test Method 29

Glassware Preparation Procedures



Other Test Method 29 Sample Recovery Flowchart

- Tare all sample containers before sample collection
- Mark all liquid levels and final weights on the outside of each sample container
- Seal all sample containers with Teflon tape



Other Test Method 29 Analytical Flowchart

- Log each sample in shipment and verify against chain-of-custody sheet
- Note liquid levels in the sample containers and confirm on the chain-of-custody sheet condition

Containers 1 and 2
(Optional particulate
analysis)

Follow analytical procedures
outlined in EPA Method 5

Containers 3 and 4

Measure the sample volume.
Sample dilution with 0.1N or
0.6N NaOH is
recommended. The pH
should not drop below 12 as
a result of dilution

Analysis by ion
chromatography for HCN

Each sample injected for
analysis must have duplicate
injection.

Perform a matrix spike at
least once per set of sample
or once per 10 samples
analyzed. The amount of
HCN recovered must be
20% of spiked value

If the response from cyanide
in any sample is greater than
the highest calibration
standard, dilute with 0.1N or
0.6N NaOH and repeat
analysis until response falls
within calibration curve

Container 5
Silica Gel

Weigh to nearest 0.5 g.
This can be done in the field

Reagent Blanks

Analyze by ion
chromatography for HCN

SAMPLE CALCULATIONS

B

I hereby certify that all pages contained within this Appendix have been reviewed and, to the best of my ability, verified accurate.

QA/QC Initials: SB

Date: 9/14



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USEPA Mod. Method 18 (VOCs) Sampling Calculations

Note: The tables presenting the results are generated electronically from raw data. It may not be possible to exactly duplicate these results using a method data, results, and all calculations are carried to sixteen decimal places throughout. The final table is formatted to an appropriate number of significant

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1. Volume of gas metered, standard conditions (dsl)

$$V_{mstd} = \frac{(17.64)(V_m)(Y_d)(P_{bar})}{(T_m + 460)}$$

Where:			Run 1A	Run 2A	Run 3A	
17.64	= standard temperature to pressure ratio (°R/in. Hg)	=	17.64	17.64	17.64	°R/in. Hg
V _m	= volume of gas sample through the dry gas meter at meter conditions (liters)	=	20.01	20.01	20.06	liters
Y _d	= gas meter correction factor (dimensionless)	=	0.9967	1.0061	1.0061	
P _{bar}	= barometric pressure (in. Hg)	=	29.40	29.40	29.40	in. Hg
T _m	= average dry gas meter temperature (°F)	=	85.81	90.38	80.00	°F
460	= °F to °R conversion constant	=	460	460	460	
V _{mstd}	= volume of gas sampled through the dry gas meter at standard conditions (dsl)	=	18.951	18.970	19.379	dsl

2. Volume of gas metered, standard conditions (dscm)

$$V_{mstd-m} = \frac{(17.64)(V_m)(Y_d)(P_{bar})}{(T_m + 460)(1000)}$$

Where:			Run 1A	Run 2A	Run 3A	
17.64	= standard temperature to pressure ratio (°R/in. Hg)	=	17.64	17.64	17.64	°R/in. Hg
V _m	= volume of gas sample through the dry gas meter at meter conditions (liters)	=	20.01	20.01	20.06	liters
Y _d	= gas meter correction factor (dimensionless)	=	0.9967	1.0061	1.0061	
P _{bar}	= barometric pressure (in. Hg)	=	29.40	29.40	29.40	in. Hg
T _m	= average dry gas meter temperature (°F)	=	85.81	90.38	80.00	°F
460	= °F to °R conversion constant	=	460	460	460	
1000	= conversion factor (liter/cubic meter)	=	1000	1000	1000	liter/m ³
V _{mstd-m}	= volume of gas sampled through the dry gas meter at standard conditions (dscm)	=	0.019	0.019	0.019	dscm

3. Volume of gas metered, standard conditions (dscf)

$$V_{mstd-E} = \frac{(17.64)(V_m)(Y_d)(P_{bar})(35.315)}{(460 + T_m)(1000)}$$

Where:			Run 1A	Run 2A	Run 3A	
17.64	= standard temperature to pressure ratio (°R/in. Hg)	=	17.64	17.64	17.64	°R/in. Hg
V _m	= volume of gas sample through the dry gas meter at meter conditions (liters)	=	20.01	20.01	20.06	liters
Y _d	= gas meter correction factor (dimensionless)	=	0.9967	1.0061	1.0061	
P _{bar}	= barometric pressure (in. Hg)	=	29.40	29.40	29.40	in. Hg
T _m	= average dry gas meter temperature (°F)	=	85.81	90.38	80.00	°F
460	= °F to °R conversion constant	=	460	460	460	
1000	= conversion factor (liter/cubic meter)	=	1000	1000	1000	liter/m ³
35.315	= conversion factor (cubic feet/cubic meter)	=	35.315	35.315	35.315	ft ³ /m ³
V _{mstd-E}	= volume of gas sampled through the dry gas meter at standard conditions (dscf)	=	0.669	0.670	0.684	dscf

USEPA Mod. Method 18 (VOCs) Laboratory Calculations

Sample data taken from
acrolein analysis

Note: The tables presenting the results are generated electronically from raw data. It may not be possible to exactly duplicate these results using The reference method data, results, and all calculations are carried to sixteen decimal places throughout. The final table is formatted to an of significant figures.

1. Total acrolein in sample fraction set (µg)

CASE 1	All sample fraction results are \geq RL	$m_{S-Total} = \Sigma (S_D)$
CASE 2	Some sample fraction results are $<$ RL; $\Sigma (S_{ND}) < 10\% \times \Sigma (S_D)$	$m_{S-Total} = \Sigma (S_D) + \Sigma (S_{ND} \cdot BF_2)$
CASE 3	Some sample fraction results are $<$ RL; $\Sigma (S_{ND}) \geq 10\% \times \Sigma (S_D)$	$m_{S-Total} = \Sigma (S_D) + \Sigma (S_{ND} \cdot BF_3)$
CASE 4	All trap fraction results are $<$ RL.	$m_{S-Total} = \Sigma (S_{ND} \cdot BF_4)$

Where:

RL	= reporting limit (µg)	=	*	µg
BF ₂	= blank factor for Case 2 (dimensionless)	=	1.00	
BF ₃	= blank factor for Case 3 (dimensionless)	=	1.00	
BF ₄	= blank factor for Case 4 (dimensionless)	=	1.00	
$\Sigma (S_D)$	= sum of detectable sample fraction results (\geq RL)			
$\Sigma (S_{ND})$	= sum of non-detectable sample fraction results ($<$ RL), assuming $S_{ND-i} = RL$			
* Detection limits calculated on a per-run, per-fraction basis.				

		<u>Run 1A</u>	<u>Run 2A</u>	<u>Run 3A</u>	
total acrolein detected in Condensate + Impinger 1&2 (µg)	=	<6.700	<6.100	<6.600	µg
total acrolein detected in Impinger 3 (µg)	=	<2.600	<2.100	<2.500	µg
total acrolein detected in Impinger 4 (µg)	=	<1.800	<1.800	<2.200	µg
 $m_{S-Total}$	 = total acrolein in sample fraction set (µg)	 =	 <11.100	 <10.000	 <11.300 µg

USEPA Mod. Method 18 (VOCs) Emissions Calculations

Sample data taken from
acrolein analysis

Note: The tables presenting the results are generated electronically from raw data. It may not be possible to exactly duplicate these results using a calculator. The method data, results, and all calculations are carried to sixteen decimal places throughout. The final table is formatted to an appropriate number of significant

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1. Acrolein concentration (µg/dscm)

$$C_{sd} = \frac{(m_{S-Total})}{(V_{mstd-m})}$$

Where:

$m_{S-Total}$	= total acrolein in sample fraction set (µg)	=	Run 1A <11.100	Run 2A <10.000	Run 3A <11.300	µg
V_{mstd-m}	= volume of gas sampled through the dry gas meter at standard conditions (dscm)	=	0.019	0.019	0.019	dscm
C_{sd}	= acrolein concentration (µg/dscm)	=	<5.86E+02	<5.27E+02	<5.83E+02	µg/dscm

2. Acrolein concentration corrected to x% O₂ (µg/dscm @ x% O₂)

$$C_{sdx} = C_{sd} \left(\frac{20.9 - x}{20.9 - O_2} \right)$$

Where:

C_{sd}	= acrolein concentration (µg/dscm)	=	Run 1A <5.86E+02	Run 2A <5.27E+02	Run 3A <5.83E+02	µg/dscm
20.9	= oxygen content of ambient air (%)	=	20.9	20.9	20.9	%
x	= oxygen content of corrected gas (%)	=	7.0	7.0	7.0	%
O ₂	= proportion of oxygen in the gas stream by volume (%)	=	3.9	3.9	4.6	%
C_{sdx}	= acrolein concentration (µg/dscm @ x% O ₂)	=	<4.79E+02	<4.31E+02	<4.97E+02	µg/dscm @ x% O ₂

3. Acrolein concentration (lb/dscf)

$$C_{sd} = \frac{(m_{S-Total})}{(4.536 \times 10^8)(V_{mstd-E})}$$

Where:

$m_{S-Total}$	= total acrolein in sample fraction set (µg)	=	Run 1A <11.100	Run 2A <10.000	Run 3A <11.300	µg
4.536E+08	= conversion factor (µg/lb)	=	4.536E+08	4.536E+08	4.536E+08	µg/lb
V_{mstd-E}	= volume of gas sampled through the dry gas meter at standard conditions (dscf)	=	0.669	0.670	0.684	dscf
C_{sd}	= acrolein concentration (lb/dscf)	=	<3.66E-08	<3.29E-08	<3.64E-08	lb/dscf

4. Acrolein emission rate (lb/hr)

$$E_{lb/hr} = \frac{(m_{S-Total})(Q_{std})(60)}{(4.536 \times 10^8)(V_{mstd-E})}$$

Where:

$m_{S-Total}$	= total acrolein in sample fraction set (µg)	=	Run 1A <11.100	Run 2A <10.000	Run 3A <11.300	µg
Q_{std}	= volumetric flow rate, dry standard (dscfm)	=	131,944	132,914	138,738	dscfm
60	= conversion factor (min/hr)	=	60	60	60	min/hr
4.536E+08	= conversion factor (µg/lb)	=	4.536E+08	4.536E+08	4.536E+08	µg/lb
V_{mstd-E}	= volume of gas sampled through the dry gas meter at standard conditions (dscf)	=	0.669	0.670	0.684	dscf
$E_{lb/hr}$	= acrolein emission rate (lb/hr)	=	<2.89E-01	<2.62E-01	<3.03E-01	lb/hr

USEPA Method 18 (Methanol) Sampling Calculations

Note: The tables presenting the results are generated electronically from raw data. It may not be possible to exactly duplicate these results using a method data, results, and all calculations are carried to sixteen decimal places throughout. The final table is formatted to an appropriate number of

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1. Volume of gas metered, standard conditions (dsl)

$$V_{mstd} = \frac{(17.64)(V_m)(Y_d)(P_{bar})}{(T_m + 460)}$$

Where:			Run 1A	Run 2A	Run 3A	
17.64	= standard temperature to pressure ratio (°R/in. Hg)	=	17.64	17.64	17.64	°R/in. Hg
V _m	= volume of gas sample through the dry gas meter at meter conditions (liters)	=	20.09	20.02	20.06	liters
Y _d	= gas meter correction factor (dimensionless)	=	1.0061	1.0061	1.0061	
P _{bar}	= barometric pressure (in. Hg)	=	29.40	29.40	29.40	in. Hg
T _m	= average dry gas meter temperature (°F)	=	86.56	93.06	87.75	°F
460	= °F to °R conversion constant	=	460	460	460	
V _{mstd}	= volume of gas sampled through the dry gas meter at standard conditions (dsl)	=	19.181	18.883	19.106	dsl

2. Volume of gas metered, standard conditions (dscm)

$$V_{mstd-m} = \frac{(17.64)(V_m)(Y_d)(P_{bar})}{(T_m + 460)(1000)}$$

Where:			Run 1A	Run 2A	Run 3A	
17.64	= standard temperature to pressure ratio (°R/in. Hg)	=	17.64	17.64	17.64	°R/in. Hg
V _m	= volume of gas sample through the dry gas meter at meter conditions (liters)	=	20.09	20.02	20.06	liters
Y _d	= gas meter correction factor (dimensionless)	=	1.0061	1.0061	1.0061	
P _{bar}	= barometric pressure (in. Hg)	=	29.40	29.40	29.40	in. Hg
T _m	= average dry gas meter temperature (°F)	=	86.56	93.06	87.75	°F
460	= °F to °R conversion constant	=	460	460	460	
1000	= conversion factor (liter/cubic meter)	=	1000	1000	1000	liter/m ³
V _{mstd-m}	= volume of gas sampled through the dry gas meter at standard conditions (dscm)	=	0.019	0.019	0.019	dscm

3. Volume of gas metered, standard conditions (dscf)

$$V_{mstd-E} = \frac{(17.64)(V_m)(Y_d)(P_{bar})(35.315)}{(460 + T_m)(1000)}$$

Where:			Run 1A	Run 2A	Run 3A	
17.64	= standard temperature to pressure ratio (°R/in. Hg)	=	17.64	17.64	17.64	°R/in. Hg
V _m	= volume of gas sample through the dry gas meter at meter conditions (liters)	=	20.09	20.02	20.06	liters
Y _d	= gas meter correction factor (dimensionless)	=	1.0061	1.0061	1.0061	
P _{bar}	= barometric pressure (in. Hg)	=	29.40	29.40	29.40	in. Hg
T _m	= average dry gas meter temperature (°F)	=	86.56	93.06	87.75	°F
460	= °F to °R conversion constant	=	460	460	460	
1000	= conversion factor (liter/cubic meter)	=	1000	1000	1000	liter/m ³
35.315	= conversion factor (cubic feet/cubic meter)	=	35.315	35.315	35.315	ft ³ /m ³
V _{mstd-E}	= volume of gas sampled through the dry gas meter at standard conditions (dscf)	=	0.677	0.667	0.675	dscf

USEPA Method 18 (Methanol) Laboratory Calculations

Sample data taken from
methanol analysis

Note: The tables presenting the results are generated electronically from raw data. It may not be possible to exactly duplicate these results using The reference method data, results, and all calculations are carried to sixteen decimal places throughout. The final table is formatted to an of significant figures.

1. Total methanol in sample fraction set (µg)

CASE 1	All sample fraction results are \geq RL	$m_{S-Total} = \Sigma (S_D)$
CASE 2	Some sample fraction results are $<$ RL; $\Sigma (S_{ND}) < 10\% \times \Sigma (S_D)$	$m_{S-Total} = \Sigma (S_D) + \Sigma (S_{ND} * BF_2)$
CASE 3	Some sample fraction results are $<$ RL; $\Sigma (S_{ND}) \geq 10\% \times \Sigma (S_D)$	$m_{S-Total} = \Sigma (S_D) + \Sigma (S_{ND} * BF_3)$
CASE 4	All trap fraction results are $<$ RL.	$m_{S-Total} = \Sigma (S_{ND} * BF_4)$

Where:

RL	= reporting limit (µg)	=	5.00	µg	(tube)
			200.00	µg	(condensate)
BF ₂	= blank factor for Case 2 (dimensionless)	=	1.00		
BF ₃	= blank factor for Case 3 (dimensionless)	=	1.00		
BF ₄	= blank factor for Case 4 (dimensionless)	=	1.00		
$\Sigma (S_D)$	= sum of detectable sample fraction results (\geq RL)				
$\Sigma (S_{ND})$	= sum of non-detectable sample fraction results ($<$ RL), assuming $S_{ND-i} = RL$				

		<u>Run 1A</u>	<u>Run 2A</u>	<u>Run 3A</u>	
total methanol detected in Condensate (µg)	=	< 200.0000	< 200.0000	< 200.0000	µg
total methanol detected in Adsorbent Tube Section 1 (µg)	=	10.800	30.5000	122.000	µg
total methanol detected in Adsorbent Tube Section 2 (µg)	=	14.000	24.900	63.300	µg
 m _{S-Total}	= total methanol in sample fraction set (µg)	=	224.800	255.400	385.300 µg

USEPA Method 18 (Methanol) Emissions Calculations

Sample data taken from
methanol analysis

Note: The tables presenting the results are generated electronically from raw data. It may not be possible to exactly duplicate these results using a calculator. Method data, results, and all calculations are carried to sixteen decimal places throughout. The final table is formatted to an appropriate number of significant

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1. Methanol concentration (µg/dscm)

$$C_{sd} = \frac{(m_{S-Total})}{(V_{mstd-m})}$$

Where:

$m_{S-Total}$	= total methanol in sample fraction set (µg)	=	Run 1A 224.8000	Run 2A 255.4000	Run 3A 385.3000	µg
V_{mstd-m}	= volume of gas sampled through the dry gas meter at standard conditions (dscm)	=	0.019	0.019	0.019	dscm

C_{sd}	= methanol concentration (µg/dscm)	=	1.172E+04	1.353E+04	2.017E+04	µg/dscm
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2. Methanol concentration corrected to x% O₂ (µg/dscm @ x% O₂)

$$C_{sdx} = C_{sd} \left(\frac{20.9 - x}{20.9 - O_2} \right)$$

Where:

C_{sd}	= methanol concentration (µg/dscm)	=	Run 1A 1.172E+04	Run 2A 1.353E+04	Run 3A 2.017E+04	µg/dscm
20.9	= oxygen content of ambient air (%)	=	20.9	20.9	20.9	%
x	= oxygen content of corrected gas (%)	=	7.0	7.0	7.0	%
O ₂	= proportion of oxygen in the gas stream by volume (%)	=	3.9	3.9	4.6	%
C_{sdx}	= methanol concentration (µg/dscm @ x% O ₂)	=	9.583E+03	1.106E+04	1.720E+04	µg/dscm @ x% O ₂

3. Methanol concentration (lb/dscf)

$$C_{sd} = \frac{(m_{S-Total})}{(4.536 \times 10^8)(V_{mstd-E})}$$

Where:

$m_{S-Total}$	= total methanol in sample fraction set (µg)	=	Run 1A 224.8000	Run 2A 255.4000	Run 3A 385.3000	µg
4.536E+08	= conversion factor (µg/lb)	=	4.536E+08	4.536E+08	4.536E+08	µg/lb
V_{mstd-E}	= volume of gas sampled through the dry gas meter at standard conditions (dscf)	=	0.677	0.667	0.675	dscf

C_{sd}	= methanol concentration (lb/dscf)	=	7.316E-07	8.444E-07	1.259E-06	lb/dscf
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4. Methanol emission rate (lb/hr)

$$E_{lb/hr} = \frac{(m_{S-Total})(Q_{std})(60)}{(4.536 \times 10^8)(V_{mstd-E})}$$

Where:

$m_{S-Total}$	= total methanol in sample fraction set (µg)	=	Run 1A 224.8000	Run 2A 255.4000	Run 3A 385.3000	µg
Q_{std}	= volumetric flow rate, dry standard (dscfm)	=	131,944	132,914	138,738	dscfm
60	= conversion factor (min/hr)	=	60	60	60	min/hr
4.536E+08	= conversion factor (µg/lb)	=	4.536E+08	4.536E+08	4.536E+08	µg/lb
V_{mstd-E}	= volume of gas sampled through the dry gas meter at standard	=	0.677	0.667	0.675	dscf

$E_{lb/hr}$	= methanol emission rate (lb/hr)	=	5.792E+00	6.734E+00	1.048E+01	lb/hr
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USEPA SW-846 Method 0011 (Aldehydes) Sampling, Velocity and Moisture Sample Calculations

Sample data taken from Run 1

Note: The tables presenting the results are generated electronically from raw data. It may not be possible to exactly duplicate these results using a calculator. The reference method data, results, and all calculations are carried to sixteen decimal places throughout. The final table is formatted to an appropriate number of significant figures.

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1. Volume of water collected (wscf)

$$V_{wstd} = (0.04706)(V_{lc})$$

Where:

V_{lc}	= total volume of liquid collected in impingers and silica gel (ml)	=	527.6	ml
0.04706	= ideal gas conversion factor (ft ³ water vapor/ml or gm)	=	0.04706	ft ³ /ml
V_{wstd}	= volume of water vapor collected at standard conditions (ft ³)	=	24.83	ft ³

2. Volume of gas metered, standard conditions (dscf)

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

Where:

P_{bar}	= barometric pressure (in. Hg)	=	29.40	in. Hg
T_m	= average dry gas meter temperature (°F)	=	96.71	°F
V_m	= volume of gas sample through the dry gas meter at meter conditions (dcf)	=	81.12	dcf
Y_d	= gas meter correction factor (dimensionless)	=	0.9882	
ΔH	= average pressure drop across meter box orifice (in. H ₂ O)	=	1.43	in. H ₂ O
17.64	= standard temperature to pressure ratio (°R/in. Hg)	=	17.64	°R/in. Hg
13.6	= conversion factor (in. H ₂ O/in. Hg)	=	13.6	in. H ₂ O/in. Hg
460	= °F to °R conversion constant	=	460	
V_{mstd}	= volume of gas sampled through the dry gas meter at standard conditions (dscf)	=	74.946	dscf

3. Sample gas pressure (in. Hg)

$$P_s = P_{bar} + \left(\frac{P_g}{13.6} \right)$$

Where:

P_{bar}	= barometric pressure (in. Hg)	=	29.40	in. Hg
P_g	= sample gas static pressure (in. H ₂ O)	=	-0.40	in. H ₂ O
13.6	= conversion factor (in. H ₂ O/in. Hg)	=	13.6	in. H ₂ O/in. Hg
P_s	= absolute sample gas pressure (in. Hg)	=	29.37	in. Hg

4. Actual water vapor pressure at sample gas temperature less than 212°F (in. Hg)

$$P_v = \frac{e^{\left(\frac{18.3036 - \frac{3816.44}{\frac{5}{9}(T_s - 32) + 273.15 - 46.13}}{25.4} \right)}}{25.4}$$

Where:

T_s	= average sample gas temperature (°F)	=	146.50	°F
18.3036	= Antoine coefficient	=	18.3036	°K
3816.44	= Antoine coefficient	=	3816.44	°K
273.15	= temperature conversion factor	=	273.15	°K
46.13	= Antoine coefficient	=	46.13	°K
25.4	= conversion factor	=	25.4	mm Hg/in. Hg
5/9	= Fahrenheit to Celsius conversion factor	=	5/9	°C/°F
32	= temperature conversion (°F)	=	32	°F
P_v	= vapor pressure, actual (in. Hg)	=	6.94	in. Hg

5. Water vapor pressure at gas temperature greater than 212°F (in. Hg)

$$P_v = P_s$$

Where:

P_s	= absolute sample gas pressure (in. Hg)	=	29.37	in. Hg
P_v	= water vapor pressure, actual (in. Hg)	=	Previously Defined	in. Hg

6. Moisture measured in sample (% by volume)

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

Where:

V_{mstd}	= volume of gas sampled through the dry gas meter at standard conditions (dscf)	=	74.946	dscf
V_{wstd}	= volume of water collected at standard conditions (scf)	=	24.83	scf
B_{wo}	= proportion of water measured in the gas stream by volume	=	0.2488	%
		=	24.88	%

7. Saturated moisture content (% by volume)

$$B_{ws} = \frac{P_v}{P_s}$$

Where:

P_s	= absolute sample gas pressure (in. Hg)	=	29.37	in. Hg
P_v	= water vapor pressure, actual (in. Hg)	=	6.94	in. Hg
B_{ws}	= proportion of water vapor in the gas stream by volume at saturated conditions	=	0.2363	%
		=	23.63	%

8. Actual water vapor in gas (% by volume)

$$B_w = \text{MINIMUM} [B_{wo}, B_{ws}]$$

Where:

B_{ws}	= proportion of water vapor in the gas stream by volume at saturated conditions	=	0.2363	
B_{wo}	= proportion of water measured in the gas stream by volume	=	0.2488	
B_w	= actual water vapor in gas	=	0.2363	
		=	23.63	%

9. Nitrogen (plus carbon monoxide) in gas stream (% by volume, dry)

$$N_2 + CO = 100 - CO_2 - O_2$$

Where:

CO_2	= proportion of carbon dioxide in the gas stream by volume (%)	=	13.1	%
O_2	= proportion of oxygen in the gas stream by volume (%)	=	3.9	%
100	= conversion factor (%)	=	100	%
N_2+CO	= proportion of nitrogen and CO in the gas stream by volume (%)	=	83.00	%

10. Molecular weight of dry gas stream (lb/lb-mole)

$$M_d = (M_{CO_2}) \left(\frac{CO_2}{100} \right) + (M_{O_2}) \left(\frac{O_2}{100} \right) + (M_{N_2+CO}) \left(\frac{N_2 + CO}{100} \right)$$

Where:

M_{CO_2}	= molecular weight of carbon dioxide (lb/lb-mole)	=	44.00	lb/lb-mole
M_{O_2}	= molecular weight of oxygen (lb/lb-mole)	=	32.00	lb/lb-mole
M_{N_2+CO}	= molecular weight of nitrogen and carbon monoxide (lb/lb-mole)	=	28.00	lb/lb-mole
CO_2	= proportion of carbon dioxide in the gas stream by volume (%)	=	13.1	%
O_2	= proportion of oxygen in the gas stream by volume (%)	=	3.9	%
N_2+CO	= proportion of nitrogen and CO in the gas stream by volume (%)	=	83.0	%
100	= conversion factor (%)	=	100	%
M_d	= dry molecular weight of sample gas (lb/lb-mole)	=	30.25	lb/lb-mole

11. Molecular weight of sample gas (lb/lb-mole)

$$M_s = (M_d)(1 - B_w) + (M_{H_2O})(B_w)$$

Where:

B_w	= proportion of water vapor in the gas stream by volume	=	0.2363	
M_d	= dry molecular weight of sample gas (lb/lb-mole)	=	30.25	lb/lb-mole
M_{H_2O}	= molecular weight of water (lb/lb-mole)	=	18.00	lb/lb-mole
M_s	= molecular weight of sample gas, wet basis (lb/lb-mole)	=	27.36	lb/lb-mole

12. Velocity of sample gas (ft/sec)

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

Where:

K_p	= velocity pressure constant	=	85.49	
C_p	= pitot tube coefficient	=	0.83	
M_s	= wet molecular weight of sample gas, wet basis (lb/lb-mole)	=	27.36	lb/lb-mole
P_s	= absolute sample gas pressure (in. Hg)	=	29.37	in. Hg
T_s	= average sample gas temperature (°F)	=	146.50	°F
$\sqrt{\Delta P}$	= average square roots of velocity heads of sample gas (in. H ₂ O)	=	0.774	√in. H ₂ O
460	= °F to °R conversion constant	=	460	
V_s	= sample gas velocity (ft/sec)	=	47.54	ft/sec

13. Volumetric flow rate of sample gas at actual gas conditions (acfm)

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

Where:

A_s	= cross sectional area of sampling location (ft ²)	=	70.88	ft ²
V_s	= sample gas velocity (ft/sec)	=	47.54	ft/sec
60	conversion factor (sec/min)	=	60	sec/min
Q_a	= volumetric flow rate at actual conditions (acfm)	=	202,165	acfm

14. Total flow of sample gas (scfm)

$$Q_s = (Q_a) \left(\frac{P_s}{29.92} \right) \left(\frac{68 + 460}{T_s + 460} \right)$$

Where:

Q_a	= volumetric flow rate at actual conditions (acfm)	=	202,165	acfm
P_s	= absolute sample gas pressure (in. Hg)	=	29.37	in. Hg
29.92	= standard pressure (in. Hg)	=	29.92	in. Hg
T_s	= average sample gas temperature (°F)	=	146.5	°F
68	= standard temperature (°F)	=	68	°F
460	= °F to °R conversion constant	=	460	
Q_s	= volumetric flow rate at standard conditions, wet basis (scfm)	=	172,767	scfm

15. Dry flow of sample gas (dscfm)

$$Q_{std} = (Q_s)(1 - B_w)$$

Where:

B_w	= proportion of water vapor in the gas stream by volume	=	0.2363	
Q_s	= volumetric flow rate at standard conditions, wet basis (scfm)	=	172,767	scfm
Q_{std}	= volumetric flow rate at standard conditions, dry basis (dscfm)	=	131,944	dscfm

16. Hourly time basis conversion of volumetric flow rate (Q_{std} example)

$$Q_{std-hr} = (Q_{std-min})(60)$$

Where

$Q_{std-min}$	= volumetric flow rate, english units (ft ³ /min)	=	131,944	dscfm
60	= conversion factor (min/hr)	=	60	min/hr

Q_{std-hr}	= volumetric flow rate, hourly basis (dscf/hr)	=	7,916,650	dscf/hr
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17. Metric Conversion of Gas Volumes (Q_{std} example)

$$Q_{std-metric} = (Q_{std-english}) \left(\frac{60}{35.31} \right)$$

Where:

$Q_{std-english}$	= volumetric flow rate, english units (ft ³ /min)	=	131,944	dscfm
35.31	= conversion factor (ft ³ /m ³)	=	35.31	ft ³ /m ³
60	= conversion factor (min/hr)	=	60	min/hr

$Q_{std-metric}$	= volumetric flow rate, metric units (m ³ /hr)	=	224,204	dry std m ³ /hr
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18. Standard to Normal Conversion of Gas Volumes (Q_{std} example)

$$Q_{Normal} = (Q_{std-metric}) \left(\frac{32 + 460}{68 + 460} \right)$$

Where:

$Q_{std-metric}$	= volumetric flow rate, metric units (dry std m ³ /hr)	=	224,204	dry std m ³ /hr
32	= normal temperature (°F)	=	32	°F
68	= standard temperature (°F)	=	68	°F
460	= standard temperature in Rankine (68°F)	=	460	

Q_{Normal}	= volumetric flow rate, metric units (dry Nm ³ /hr)	=	208,918	dry Nm ³ /hr
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19. Percent isokinetic (%)

$$I = \frac{(0.09450)(T_s + 460)(V_{mstd})}{(P_s)(V_s)\left(\frac{(D_n)^2(\pi)}{(144)(4)}\right)(\Theta)(1 - B_w)}$$

Where:

D_n	= diameter of nozzle (in)	=	0.250	in.
B_w	= proportion of water vapor in the gas stream by volume	=	0.2363	
P_s	= absolute sample gas pressure (in. Hg)	=	29.37	in. Hg
T_s	= average sample gas temperature (°F)	=	146.5	°F
V_{mstd}	= volume of gas sample through the dry gas meter at standard conditions (dscf)	=	74.946	dscf
V_s	= sample gas velocity (ft/sec)	=	47.54	ft/sec
Θ	= total sampling time (min)	=	120	min
0.0945	= conversion constant	=	0.0945	
460	= °F to °R conversion constant	=	460	
I	= percent of isokinetic sampling (%)	=	98.48	%

20. Alternative Method 5 Post-Test Meter Calibration Factor

$$Y_{qa} = \frac{\Theta}{V_m} \sqrt{\frac{(0.0319)(T_m + 460)(28.96)}{(\Delta H_{@})(P_{bar} + \frac{\Delta H}{13.6})(M_d)}} (\sqrt{\Delta H})_{avg}$$

Where:

Θ	= total sampling time (min)	=	120	min
V_m	= volume of gas sample through the dry gas meter at meter conditions (dcf)	=	81.12	dcf
T_m	= average dry gas meter temperature (°F)	=	96.71	°F
$\Delta H_{@}$	= dry gas meter orifice coefficient	=	1.7571	
P_{bar}	= barometric pressure (in. Hg)	=	29.40	in. Hg
ΔH	= average pressure drop across meter box orifice (in. H ₂ O)	=	1.428	in. H ₂ O
M_d	= dry molecular weight of sample gas (lb/lb-mole)	=	30.25	lb/lb-mole
$\sqrt{\Delta H}_{avg}$	= average of square root of pressure drop across meter orifice	=	1.191	$\sqrt{\text{in. H}_2\text{O}}$
0.0319	= conversion constant	=	0.0319	
28.96	= molecular weight of ambient air (lb/lb-mole)	=	28.96	lb/lb-mole
13.6	= conversion factor (in. H ₂ O/in. Hg)	=	13.6	in. H ₂ O/in. Hg
460	= °F to °R conversion constant	=	460	
Y_{qa}	= alternative Method 5 post-test meter calibration factor	=	1.0086	

USEPA SW-846 Method 0011 Formaldehyde Analyte Calculations

Sample data taken from Run 1

Note: The tables presenting the results are generated electronically from raw data. It may not be possible to exactly duplicate these results using a calculator. The reference method data, results, and all calculations are carried to sixteen decimal places throughout. The final table is formatted to an appropriate number of significant figures.

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1. Allowable blank subtraction (µg)

$$m_b = B_i \text{ if } B_i > MDL \text{ and } m_i > MDL$$

$$= 0 \text{ if } B_i < MDL \text{ or } m_i < MDL$$

Where:

B_i	= amount of Formaldehyde collected in blank (µg)	=	2.36000	µg
m_i	= amount of Formaldehyde collected in sample (µg)	=	9.13000	µg
m_b	= allowable blank subtraction (µg)	=	0.00000	µg

2. Formaldehyde in sample corrected for blank (µg)

$$m_{nb} = m_i - m_b$$

Where:

m_i	= amount of Formaldehyde collected in sample (µg)	=	9.13000	µg
m_b	= allowable blank subtraction (µg)	=	0.00000	µg
m_{nb}	= Formaldehyde in sample corrected for blank (µg)	=	9.13000	µg

3. Formaldehyde used in emissions calculations (mg)

$$m_n = \text{MAXIMUM} [m_{nb}, m_{MDL}] \times cf$$

Where:

m_{nb}	= Formaldehyde in sample corrected for blank (µg)	=	9.13000	µg
m_{MDL}	= analytical detection limit (µg)	=	0.50000	µg
cf	= conversion factor	=	0.001	mg/µg
m_n	= Formaldehyde used in emissions calculations (mg)	=	0.00913	mg

USEPA SW-846 Method 0011 Formaldehyde Sample Calculations

Sample data taken from Run 1

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1. Formaldehyde concentration (lb/dscf)

$$C_{sd} = \left(\frac{m_n}{V_{mstd}} \right) \left(\frac{2.205 \times 10^{-3}}{1000} \right)$$

Where:

m_n	= total Formaldehyde collected, minus applicable blank (mg)	=	0.0091	mg
V_{mstd}	= volume metered, standard (dscf)	=	74.9463	dscf
2.205×10^{-3}	= conversion factor (lb/g)	=	2.205E-03	lb/g
1000	= conversion factor (mg/g)	=	1,000	mg/g
C_{sd}	= Formaldehyde concentration (lb/dscf)	=	2.6861E-10	lb/dscf

2. Formaldehyde concentration (ppmdv)

$$C_{sd} = \left(\frac{m_n}{V_{mstd}} \right) \left(\frac{0.850}{1000} \right) \left(\frac{10^6}{MW} \right)$$

Where:

m_n	= total Formaldehyde collected, minus applicable blank (mg)	=	0.0091	mg
V_{mstd}	= volume metered, standard (dscf)	=	74.9463	dscf
MW	= molecular weight of Formaldehyde (g/g-mole)	=	30.030	g/g-mole
0.850	= conversion factor (dscf/g-mole)	=	0.850	dscf/g-mole
1000	= conversion factor (mg/g)	=	1,000	mg/g
10^6	= conversion factor (ppm)	=	10^6	ppm
C_{sd}	= Formaldehyde concentration (ppmdv)	=	0.0034	ppmdv

3. Formaldehyde concentration (ppmwv)

$$C_w = C_{sd} \left(1 - \frac{B_w}{100} \right)$$

Where:

C_{sd}	= Formaldehyde concentration (ppmdv)	=	0.0034	ppmdv
B_w	= actual water vapor in gas (% v/v)	=	23.6288	% v/v
100	= conversion factor (%)	=	100	%
C_w	= Formaldehyde concentration (ppmwv)	=	0.0026	ppmwv

4. Formaldehyde concentration (mg/dscm)

$$C_{sd} = \left(\frac{m_n}{V_{mstd}} \right) (35.31)$$

Where:

m_n	= total Formaldehyde collected, minus applicable blank (mg)	=	0.0091	mg
V_{mstd}	= volume metered, standard (dscf)	=	74.9463	dscf
35.31	= conversion factor (dscf/dscm)	=	35.31	dscf/dscm
C_{sd}	= Formaldehyde concentration (mg/dscm)	=	0.0043	mg/dscm

5. Formaldehyde concentration (µg/dscm)

$$C_{sd} = \left(\frac{m_n}{V_{mstd}} \right) (35.31)(1000)$$

Where:

m_n	= total Formaldehyde collected, minus applicable blank (mg)	=	0.0091	mg
V_{mstd}	= volume metered, standard (dscf)	=	74.9463	dscf
35.31	= conversion factor (dscf/dscm)	=	35.31	dscf/dscm
1000	= conversion factor (µg/mg)	=	1000	µg/mg
C_{sd}	= Formaldehyde concentration (µg/dscm)	=	4.3015	µg/dscm

6. Formaldehyde concentration (mg/Nm³ dry)

$$C_{sd} = \left(\frac{m_n}{V_{mstd}} \right) (35.31) \left(\frac{68 + 460}{32 + 460} \right)$$

Where:

m_n	= total Formaldehyde collected, minus applicable blank (mg)	=	0.0091	mg
V_{mstd}	= volume metered, standard (dscf)	=	74.9463	dscf
35.31	= conversion factor (dscf/dscm)	=	35.31	dscf/dscm
68	= standard temperature (°F)	=	68	°F
32	= normal temperature (°F)	=	32	°F
460	= °F to °R conversion constant	=	460	
C_{sd}	= Formaldehyde concentration (mg/Nm ³ dry)	=	0.0046	mg/Nm ³ dry

7. Formaldehyde concentration (µg/Nm³ dry)

$$C_{sd} = \left(\frac{m_n}{V_{mstd}} \right) (35.31) \left(\frac{68 + 460}{32 + 460} \right) (1000)$$

Where:

m_n	= total Formaldehyde collected, minus applicable blank (mg)	=	0.0091	mg
V_{mstd}	= volume metered, standard (dscf)	=	74.9463	dscf
35.31	= conversion factor (dscf/dscm)	=	35.31	dscf/dscm
68	= standard temperature (°F)	=	68	°F
32	= normal temperature (°F)	=	32	°F
460	= °F to °R conversion constant	=	460	
1000	= conversion factor (µg/mg)	=	1000	µg/mg

C_{sd}	= Formaldehyde concentration (µg/Nm ³ dry)	=	4.6162	µg/Nm ³ dry
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8. Formaldehyde concentration at actual gas conditions (lb/acf example)

$$C_a = C_{sd} \left(\frac{Q_{std}}{Q_a} \right)$$

Where:

C_{sd}	= Formaldehyde concentration (lb/dscf)	= 2.6861E-10	lb/dscf
Q_{std}	= volumetric flow rate at standard conditions, dry basis (dscfm)	= 131,944	dscfm
Q_a	= volumetric flow rate at actual conditions (acfm)	= 202,165	acfm
C_a	= Formaldehyde concentration at actual gas conditions (lb/acf)	= 1.7531E-10	lb/acf

9. Formaldehyde rate (lb/hr)

$$E_{lb/hr} = \left(\frac{m_n}{V_{mstd}} \right) \left(\frac{2.205 \times 10^{-3}}{1000} \right) (Q_{std}) (60)$$

Where:

m_n	= total Formaldehyde collected, minus applicable blank (mg)	= 0.0091	mg
V_{mstd}	= volume metered, standard (dscf)	= 74.9463	dscf
2.205×10^{-3}	= conversion factor (lb/g)	= 2.205E-03	lb/g
1000	= conversion factor (mg/g)	= 1,000	mg/g
Q_{std}	= volumetric flow rate at standard conditions, dry basis (dscfm)	= 131,944	dscfm
60	= conversion factor (min/hr)	= 60	min/hr
$E_{lb/hr}$	= Formaldehyde rate (lb/hr)	= 0.0021	lb/hr

USEPA SW-846 Method 0011 Formaldehyde QA/QC Calculations

Note: The tables presenting the results are generated electronically from raw data. It may not be possible to exactly duplicate these results using a calculator. The reference method data, results, and all calculations are carried to sixteen decimal places throughout. The final table is formatted to an appropriate number of significant figures.

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1. Field Spike Recovery

$$R_{FS} = \frac{m_{ns-fieldspike}}{m_{s-fieldspike}}$$

Where:

$m_{ns-fieldspike}$	= amount of Formaldehyde found in field spike (µg)	= 701.00000	µg
$m_{s-fieldspike}$	= amount of Formaldehyde added to field spike (µg)	= 802.00000	µg
R_{FS}	= field spike recovery (%)	= 87.41	%

2. Matrix Spike Recovery

$$R_{FS} = \frac{m_{ns-matrixspike} - m_{n-avg} \left(\frac{V_{mstd-QC}}{V_{mstd-avg}} \right)}{m_{s-matrixspike}}$$

Where:

$m_{ns-matrixspike}$	= amount of Formaldehyde found in matrix spike (µg)	= 504.00000	µg
m_{n-avg}	= average amount of Formaldehyde found in run samples (µg)	= 8.41667	µg
$m_{s-matrixspike}$	= amount of Formaldehyde added to matrix spike (µg)	= 802.00000	µg
$V_{mstd-QC}$	= volume metered for matrix spike sample, standard (dscf)	= 64.893	dscf
$V_{mstd-avg}$	= average volume metered for run samples, standard (dscf)	= 71.664	dscf
m_{nb}	= Formaldehyde in sample corrected for blank (µg)	= 61.89	%

USEPA SW-846 Method 0010 (SVOC / PAH) Sampling, Velocity and Moisture Sample Calculations

Sample data taken from Run 1

Note: The tables presenting the results are generated electronically from raw data. It may not be possible to exactly duplicate these results using a calculator. The reference method data, results, and all calculations are carried to sixteen decimal places throughout. The final table is formatted to an appropriate number of significant figures.

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1. Volume of water collected (wscf)

$$V_{wstd} = (0.04706)(V_{lc})$$

Where:

V_{lc}	= total volume of liquid collected in impingers and silica gel (ml)	=	1042.4	ml
0.04706	= ideal gas conversion factor (ft ³ water vapor/ml or gm)	=	0.04706	ft ³ /ml
V_{wstd}	= volume of water vapor collected at standard conditions (ft ³)	=	49.06	ft ³

2. Volume of gas metered, standard conditions (dscf)

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

Where:

P_{bar}	= barometric pressure (in. Hg)	=	29.40	in. Hg
T_m	= average dry gas meter temperature (°F)	=	101.45	°F
V_m	= volume of gas sample through the dry gas meter at meter conditions (dcf)	=	163.63	dcf
Y_d	= gas meter correction factor (dimensionless)	=	0.9882	
ΔH	= average pressure drop across meter box orifice (in. H ₂ O)	=	1.47	in. H ₂ O
17.64	= standard temperature to pressure ratio (°R/in. Hg)	=	17.64	°R/in. Hg
13.6	= conversion factor (in. H ₂ O/in. Hg)	=	13.6	in. H ₂ O/in. Hg
460	= °F to °R conversion constant	=	460	
V_{mstd}	= volume of gas sampled through the dry gas meter at standard conditions (dscf)	=	149.909	dscf

3. Sample gas pressure (in. Hg)

$$P_s = P_{bar} + \left(\frac{P_g}{13.6} \right)$$

Where:

P_{bar}	= barometric pressure (in. Hg)	=	29.40	in. Hg
P_g	= sample gas static pressure (in. H ₂ O)	=	-0.30	in. H ₂ O
13.6	= conversion factor (in. H ₂ O/in. Hg)	=	13.6	in. H ₂ O/in. Hg
P_s	= absolute sample gas pressure (in. Hg)	=	29.38	in. Hg

4. Actual water vapor pressure at sample gas temperature less than 212°F (in. Hg)

$$P_v = \frac{e^{\left(\frac{18.3036 - \frac{3816.44}{\frac{5}{9}(T_s - 32) + 273.15 - 46.13}}{25.4} \right)}}{25.4}$$

Where:

T_s	= average sample gas temperature (°F)	=	146.96	°F
18.3036	= Antoine coefficient	=	18.3036	°K
3816.44	= Antoine coefficient	=	3816.44	°K
273.15	= temperature conversion factor	=	273.15	°K
46.13	= Antoine coefficient	=	46.13	°K
25.4	= conversion factor	=	25.4	mm Hg/in. Hg
5/9	= Fahrenheit to Celsius conversion factor	=	5/9	°C/°F
32	= temperature conversion (°F)	=	32	°F
P_v	= vapor pressure, actual (in. Hg)	=	7.02	in. Hg

5. Water vapor pressure at gas temperature greater than 212°F (in. Hg)

$$P_v = P_s$$

Where:

P_s	= absolute sample gas pressure (in. Hg)	=	29.38	in. Hg
P_v	= water vapor pressure, actual (in. Hg)	=	Previously Defined	in. Hg

6. Moisture measured in sample (% by volume)

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

Where:

V_{mstd}	= volume of gas sampled through the dry gas meter at standard conditions (dscf)	=	149.909	dscf
V_{wstd}	= volume of water collected at standard conditions (scf)	=	49.06	scf
B_{wo}	= proportion of water measured in the gas stream by volume	=	0.2466	%

7. Saturated moisture content (% by volume)

$$B_{ws} = \frac{P_v}{P_s}$$

Where:

P_s	= absolute sample gas pressure (in. Hg)	=	29.38	in. Hg
P_v	= water vapor pressure, actual (in. Hg)	=	7.02	in. Hg
B_{ws}	= proportion of water vapor in the gas stream by volume at saturated conditions	=	0.2390	%

8. Actual water vapor in gas (% by volume)

$$B_w = \text{MINIMUM} [B_{wo}, B_{ws}]$$

Where:

B_{ws}	= proportion of water vapor in the gas stream by volume at saturated conditions	=	0.2390	
B_{wo}	= proportion of water measured in the gas stream by volume	=	0.2466	
B_w	= actual water vapor in gas	=	0.2390	
		=	23.90	%

9. Nitrogen (plus carbon monoxide) in gas stream (% by volume, dry)

$$N_2 + CO = 100 - CO_2 - O_2$$

Where:

CO_2	= proportion of carbon dioxide in the gas stream by volume (%)	=	13.0	%
O_2	= proportion of oxygen in the gas stream by volume (%)	=	4.1	%
100	= conversion factor (%)	=	100	%
N_2+CO	= proportion of nitrogen and CO in the gas stream by volume (%)	=	82.90	%

10. Molecular weight of dry gas stream (lb/lb-mole)

$$M_d = (M_{CO_2}) \left(\frac{CO_2}{100} \right) + (M_{O_2}) \left(\frac{O_2}{100} \right) + (M_{N_2+CO}) \left(\frac{N_2 + CO}{100} \right)$$

Where:

M_{CO_2}	= molecular weight of carbon dioxide (lb/lb-mole)	=	44.00	lb/lb-mole
M_{O_2}	= molecular weight of oxygen (lb/lb-mole)	=	32.00	lb/lb-mole
M_{N_2+CO}	= molecular weight of nitrogen and carbon monoxide (lb/lb-mole)	=	28.00	lb/lb-mole
CO_2	= proportion of carbon dioxide in the gas stream by volume (%)	=	13.0	%
O_2	= proportion of oxygen in the gas stream by volume (%)	=	4.1	%
N_2+CO	= proportion of nitrogen and CO in the gas stream by volume (%)	=	82.9	%
100	= conversion factor (%)	=	100	%
M_d	= dry molecular weight of sample gas (lb/lb-mole)	=	30.24	lb/lb-mole

11. Molecular weight of sample gas (lb/lb-mole)

$$M_s = (M_d)(1 - B_w) + (M_{H_2O})(B_w)$$

Where:

B_w	= proportion of water vapor in the gas stream by volume	=	0.2390	
M_d	= dry molecular weight of sample gas (lb/lb-mole)	=	30.24	lb/lb-mole
M_{H_2O}	= molecular weight of water (lb/lb-mole)	=	18.00	lb/lb-mole
M_s	= molecular weight of sample gas, wet basis (lb/lb-mole)	=	27.32	lb/lb-mole

12. Velocity of sample gas (ft/sec)

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

Where:

K_p	= velocity pressure constant	=	85.49	
C_p	= pitot tube coefficient	=	0.83	
M_s	= wet molecular weight of sample gas, wet basis (lb/lb-mole)	=	27.32	lb/lb-mole
P_s	= absolute sample gas pressure (in. Hg)	=	29.38	in. Hg
T_s	= average sample gas temperature (°F)	=	146.96	°F
$\sqrt{\Delta P}$	= average square roots of velocity heads of sample gas (in. H ₂ O)	=	0.786	in. H ₂ O
460	= °F to °R conversion constant	=	460	
V_s	= sample gas velocity (ft/sec)	=	48.30	ft/sec

13. Volumetric flow rate of sample gas at actual gas conditions (acfm)

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

Where:

A_s	= cross sectional area of sampling location (ft ²)	=	70.88	ft ²
V_s	= sample gas velocity (ft/sec)	=	48.30	ft/sec
60	conversion factor (sec/min)	=	60	sec/min
Q_a	= volumetric flow rate at actual conditions (acfm)	=	205,434	acfm

14. Total flow of sample gas (scfm)

$$Q_s = (Q_a) \left(\frac{P_s}{29.92} \right) \left(\frac{68 + 460}{T_s + 460} \right)$$

Where:

Q_a	= volumetric flow rate at actual conditions (acfm)	=	205,434	acfm
P_s	= absolute sample gas pressure (in. Hg)	=	29.38	in. Hg
29.92	= standard pressure (in. Hg)	=	29.92	in. Hg
T_s	= average sample gas temperature (°F)	=	147.0	°F
68	= standard temperature (°F)	=	68	°F
460	= °F to °R conversion constant	=	460	
Q_s	= volumetric flow rate at standard conditions, wet basis (scfm)	=	175,472	scfm

15. Dry flow of sample gas (dscfm)

$$Q_{std} = (Q_s)(1 - B_w)$$

Where:

B_w	= proportion of water vapor in the gas stream by volume	=	0.2390	
Q_s	= volumetric flow rate at standard conditions, wet basis (scfm)	=	175,472	scfm
Q_{std}	= volumetric flow rate at standard conditions, dry basis (dscfm)	=	133,541	dscfm

16. Hourly time basis conversion of volumetric flow rate (Q_{std} example)

$$Q_{std-hr} = (Q_{std-min})(60)$$

Where

$Q_{std-min}$	= volumetric flow rate, english units (ft ³ /min)	=	133,541	dscfm
60	= conversion factor (min/hr)	=	60	min/hr

Q_{std-hr}	= volumetric flow rate, hourly basis (dscf/hr)	=	8,012,470	dscf/hr
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17. Metric Conversion of Gas Volumes (Q_{std} example)

$$Q_{std-metric} = (Q_{std-english}) \left(\frac{60}{35.31} \right)$$

Where:

$Q_{std-english}$	= volumetric flow rate, english units (ft ³ /min)	=	133,541	dscfm
35.31	= conversion factor (ft ³ /m ³)	=	35.31	ft ³ /m ³
60	= conversion factor (min/hr)	=	60	min/hr

$Q_{std-metric}$	= volumetric flow rate, metric units (m ³ /hr)	=	226,918	dry std m ³ /hr
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18. Standard to Normal Conversion of Gas Volumes (Q_{std} example)

$$Q_{Normal} = (Q_{std-metric}) \left(\frac{32 + 460}{68 + 460} \right)$$

Where:

$Q_{std-metric}$	= volumetric flow rate, metric units (dry std m ³ /hr)	=	226,918	dry std m ³ /hr
32	= normal temperature (°F)	=	32	°F
68	= standard temperature (°F)	=	68	°F
460	= standard temperature in Rankine (68°F)	=	460	

Q_{Normal}	= volumetric flow rate, metric units (dry Nm ³ /hr)	=	211,446	dry Nm ³ /hr
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19. Percent isokinetic (%)

$$I = \frac{(0.09450)(T_s + 460)(V_{mstd})}{(P_s)(V_s)\left(\frac{(D_n)^2(\pi)}{(144)(4)}\right)(\Theta)(1 - B_w)}$$

Where:

D_n	= diameter of nozzle (in)	=	0.250	in.
B_w	= proportion of water vapor in the gas stream by volume	=	0.2390	
P_s	= absolute sample gas pressure (in. Hg)	=	29.38	in. Hg
T_s	= average sample gas temperature (°F)	=	147.0	°F
V_{mstd}	= volume of gas sample through the dry gas meter at standard conditions (dscf)	=	149.909	dscf
V_s	= sample gas velocity (ft/sec)	=	48.30	ft/sec
Θ	= total sampling time (min)	=	240	min
0.0945	= conversion constant	=	0.0945	
460	= °F to °R conversion constant	=	460	
I	= percent of isokinetic sampling (%)	=	97.32	%

20. Alternative Method 5 Post-Test Meter Calibration Factor

$$Y_{qa} = \frac{\Theta}{V_m} \sqrt{\frac{(0.0319)(T_m + 460)(28.96)}{(\Delta H_{@})(P_{bar} + \frac{\Delta H}{13.6})(M_d)}} (\sqrt{\Delta H})_{avg}$$

Where:

Θ	= total sampling time (min)	=	240	min
V_m	= volume of gas sample through the dry gas meter at meter conditions (dcf)	=	163.63	dcf
T_m	= average dry gas meter temperature (°F)	=	101.45	°F
$\Delta H_{@}$	= dry gas meter orifice coefficient	=	1.7571	
P_{bar}	= barometric pressure (in. Hg)	=	29.40	in. Hg
ΔH	= average pressure drop across meter box orifice (in. H ₂ O)	=	1.466	in. H ₂ O
M_d	= dry molecular weight of sample gas (lb/lb-mole)	=	30.24	lb/lb-mole
$\sqrt{\Delta H}_{avg}$	= average of square root of pressure drop across meter orifice	=	1.209	$\sqrt{\text{in. H}_2\text{O}}$
0.0319	= conversion constant	=	0.0319	
28.96	= molecular weight of ambient air (lb/lb-mole)	=	28.96	lb/lb-mole
13.6	= conversion factor (in. H ₂ O/in. Hg)	=	13.6	in. H ₂ O/in. Hg
460	= °F to °R conversion constant	=	460	
Y_{qa}	= alternative Method 5 post-test meter calibration factor	=	1.0202	

USEPA SW-846 Method 0010 Sample Calculations - SVOC Lab Results

Sample data taken from Run 1

The tables presenting the results are generated electronically from raw data. It may not be possible to exactly duplicate these results using a calculator. The reference method data, results and all calculations are carried to sixteen decimal places throughout. The final table is formatted to an appropriate number of significant figures.

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J

1. Net Weight determination (µg) [Aniline example]

$$m_{net} = m_{gross} \quad \text{if} \quad m_{gross} \text{ or } m_{fieldblank} < DL$$

$$m_{net} = m_{gross} - m_{fieldblank} \quad \text{if} \quad m_{gross} - m_{fieldblank} \geq DL$$

$$m_{net} < DL \quad \text{if} \quad m_{gross} - m_{fieldblank} < DL$$

Where:

m_{gross}	= gross weight of Aniline (µg)	= <1.8000E+00 µg
$m_{field\ blank}$	= field blank weight of Aniline (µg)	= <1.8000E+00 µg
DL	= detection limit of Aniline (µg)	= 1.8000E+00 µg
m_{net}	= net weight of Aniline (µg)	= <1.8000E+00 µg

2. Net Weight for Summing (µg) [Aniline example]

$$m_{Snet} = m_{net} \quad \text{if} \quad m_{net} \geq DL$$

$$m_{Snet} = m_{net} \times DL_{modifier} \quad \text{if} \quad m_{net} < DL$$

Where:

m_{net}	= net weight of Aniline	= <1.8000E+00 µg
$DL_{modifier}$	= fraction of detection limit to include for non-detects	= 1.0
m_{Snet}	= net weight of Aniline for summing (µg)	= <1.8000E+00 µg

3. Total SVOC mass (µg)

$$m_{total} = \sum_{PAHs} m_{Snet}$$

Where:

		mnet		m _{Snet}
m _{net}	= net weight of Aniline (µg)	= <1.8000E+00	µg	<1.8000E+00
m _{net}	= net weight of Phenol (µg)	= <2.3000E+01	µg	<2.3000E+01
m _{net}	= net weight of 2-Methylphenol (µg)	= <2.1000E+00	µg	<2.1000E+00
m _{net}	= net weight of 4-Methylphenol&3-Methylphenol (µg)	= <5.6000E+00	µg	<5.6000E+00
m _{net}	= net weight of o-Toluidine (µg)	= <5.0000E+00	µg	<5.0000E+00
m _{net}	= net weight of Isophorone (µg)	= <2.2000E+00	µg	<2.2000E+00
m _{net}	= net weight of 2,4-Dimethylphenol (µg)	= <2.6000E+00	µg	<2.6000E+00
m _{net}	= net weight of Dibenzofuran (µg)	= 2.8500E+00	µg	2.8500E+00
m _{net}	= net weight of α,α-Dimethylphenethylamine (µg)	= <1.2000E+01	µg	<1.2000E+01
m _{net}	= net weight of 1,4-Phenylenediamine (µg)	= <1.8000E+01	µg	<1.8000E+01
m _{net}	= net weight of Benzidine (µg)	= <3.8000E+01	µg	<3.8000E+01
m _{net}	= net weight of Dimethylaminobenzene (µg)	= <2.0000E+00	µg	<2.0000E+00
m _{net}	= net weight of 3,3'-Dimethylbenzidine (µg)	= <2.9000E+01	µg	<2.9000E+01
m _{net}	= net weight of 3,3'-Dimethoxybenzidine (µg)	= <2.9000E+01	µg	<2.9000E+01
m _{total}	= net weight of Total SVOCs* (µg)	=	µg	<1.7315E+02

USEPA SW-846 Method 0010 Sample Calculations - SVOC Emissions

Sample data taken from Run 1

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1. Total SVOC concentration (ng/dscm)

$$C_{sd} = \left(\frac{m_{total}}{V_{mstd}} \right) \times k \times (35.31)$$

Where:

m_{total}	= Total weight of PAHs (µg)	= <1.7315E+02	µg
V_{mstd}	= volume metered, standard (dscf)	= 149.9093	dscf
k	= conversion factor to convert laboratory data to nanograms	= 1E+03	ng/µg
35.31	= conversion factor (dscf/dscm)	= 35.31	dscf/dscm
C_{sd}	= Total SVOC concentration (ng/dscm)	= <4.0784E+04	ng/dscm

2. Total SVOC concentration (µg/dscm)

$$C_{sd} = \left(\frac{m_{total}}{V_{mstd}} \right) \times k_{rev} \times (35.31)$$

Where:

m_{total}	= Total weight of PAHs (µg)	= <1.7315E+02	µg
V_{mstd}	= volume metered, standard (dscf)	= 149.9093	dscf
k_{rev}	= conversion factor to convert laboratory data to micrograms	= 1E+00	ug/µg
35.31	= conversion factor (dscf/dscm)	= 35.31	dscf/dscm
C_{sd}	= Total SVOC concentration (µg/dscm)	= <4.0784E+01	µg/dscm

3. Total SVOC concentration at normal conditions (µg/Nm3 example)

$$C_{sd} = \left(\frac{m_{total}}{V_{mstd}} \right) \times k_{rev} \times (35.31) \times \left(\frac{68 + 460}{32 + 460} \right)$$

Where:

m_{total}	= Total weight of PAHs (µg)	= <1.7315E+02	µg
V_{mstd}	= volume metered, standard (dscf)	= 149.9093	dscf
k_{rev}	= conversion factor to convert laboratory data to micrograms	= 1E+00	ug/µg
35.31	= conversion factor (dscf/dscm)	= 35.31	dscf/dscm
68	= standard temperature (°F)	= 68	°F
32	= normal temperature (°F)	= 32	°F
460	= °F to °R conversion constant	= 460	
C_{sd}	= Total SVOC concentration (µg/Nm3 dry)	= <4.3768E+01	µg/Nm³ dry

4. Total SVOC emission rate (lb/hr)

$$E_{lb/hr} = \left(\frac{m_{total}}{V_{mstd}} \right) \times k \times \left(\frac{2.205 \times 10^{-3}}{10^9} \right) \times (Q_{std} \times 60)$$

Where:

m_{total}	= Total weight of PAHs (μg)	= <1.7315E+02	μg
V_{mstd}	= volume metered, standard (dscf)	= 149.9093	dscf
2.205×10^{-3}	= conversion factor (lb/g)	= 2.205E-03	lb/g
10^9	= conversion factor (ng/g)	= 1E+09	ng/g
k	= conversion factor to convert laboratory data to nanograms	= 1E+03	ng/μg
Q_{std}	= volumetric flow rate at standard conditions, dry basis (dscfm)	= 133,541	dscfm
60	= conversion factor (min/hr)	= 60	min/hr
$E_{lb/hr}$	= Total SVOC emission rate (lb/hr)	= <2.0407E-02	lb/hr

USEPA SW-846 Method 0010 Sample Calculations - PAH Lab Results

Sample data taken from Run 1

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N

1. Net Weight determination (ng) [Naphthalene example]

$$m_{net} = m_{gross} \quad \text{if} \quad m_{gross} \text{ or } m_{fieldblank} < DL$$

$$m_{net} = m_{gross} - m_{fieldblank} \quad \text{if} \quad m_{gross} - m_{fieldblank} \geq DL$$

$$m_{net} < DL \quad \text{if} \quad m_{gross} - m_{fieldblank} < DL$$

Where:

m_{gross}	= gross weight of Naphthalene (ng)	=	3.6100E+04	ng
$m_{field\ blank}$	= field blank weight of Naphthalene (ng)	=	3.6500E+02	ng
DL	= detection limit of Naphthalene (ng)	=	2.2700E+02	ng
m_{net}	= net weight of Naphthalene (ng)	=	3.6100E+04	ng

2. Net Weight for Summing (ng) [Naphthalene example]

$$m_{Snet} = m_{net} \quad \text{if} \quad m_{net} \geq DL$$

$$m_{Snet} = m_{net} \times DL_{modifier} \quad \text{if} \quad m_{net} < DL$$

Where:

m_{net}	= net weight of Naphthalene	=	3.6100E+04	ng
$DL_{modifier}$	= fraction of detection limit to include for non-detects	=	1.0	
m_{Snet}	= net weight of Naphthalene for summing (ng)	=	3.6100E+04	ng

3. Total PAH mass (ng)

$$m_{total} = \sum_{PAHs} m_{Snet}$$

Where:

		m_{net}		m_{Snet}
m_{net}	= net weight of Naphthalene (ng)	= 3.6100E+04	ng	3.6100E+04
m_{net}	= net weight of 2-Methylnaphthalene (ng)	= 2.7600E+02	ng	2.7600E+02
m_{net}	= net weight of Acenaphthylene (ng)	= 7.0000E+01	ng	7.0000E+01
m_{net}	= net weight of Acenaphthene (ng)	= <1.2000E+02	ng	<1.2000E+02
m_{net}	= net weight of Fluorene (ng)	= <3.0000E+02	ng	<3.0000E+02
m_{net}	= net weight of Phenanthrene (ng)	= 2.3600E+03	ng	2.3600E+03
m_{net}	= net weight of Anthracene (ng)	= 2.5400E+01	ng	2.5400E+01
m_{net}	= net weight of Fluoranthene (ng)	= 3.6700E+02	ng	3.6700E+02
m_{net}	= net weight of Pyrene (ng)	= <1.8000E+02	ng	<1.8000E+02
m_{net}	= net weight of Benz[a]anthracene (ng)	= <4.6000E+00	ng	<4.6000E+00
m_{net}	= net weight of Chrysene/Triphenylene (ng)	= 8.7800E+01	ng	8.7800E+01
m_{net}	= net weight of Benzo[b]fluoranthene (ng)	= <2.7000E+01	ng	<2.7000E+01
m_{net}	= net weight of Benzo[k]fluoranthene (ng)	= 7.8600E+00	ng	7.8600E+00
m_{net}	= net weight of Benzo[e]pyrene (ng)	= <1.6000E+01	ng	<1.6000E+01
m_{net}	= net weight of Benzo[a]pyrene (ng)	= <4.0000E+00	ng	<4.0000E+00
m_{net}	= net weight of Perylene (ng)	= <4.0000E+00	ng	<4.0000E+00
m_{net}	= net weight of Indeno[1,2,3-cd]pyrene (ng)	= <4.0000E+00	ng	<4.0000E+00
m_{net}	= net weight of Dibenzo[a,h]anthracene (ng)	= <4.0000E+00	ng	<4.0000E+00
m_{net}	= net weight of Benzo[g,h,i]perylene (ng)	= <4.0000E+00	ng	<4.0000E+00
m_{net}	= net weight of 2-Chloronaphthalene (ng)	= <4.0000E+00	ng	<4.0000E+00
m_{net}	= net weight of Biphenyl (ng)	= 2.4200E+03	ng	2.4200E+03
m_{net}	= net weight of 7,12-Dimethylbenzo[a]anthracene (ng)	= <4.0000E+00	ng	<4.0000E+00
m_{net}	= net weight of 3-Methylcholanthrene (ng)	= <4.0000E+00	ng	<4.0000E+00
m_{net}	= net weight of Dibenzo[a,e]pyrene (ng)	= <4.0000E+00	ng	<4.0000E+00
m_{net}	= net weight of (ng)	=	ng	
m_{total}	= net weight of Total PAHs* (ng)	=	ng	<4.2398E+04

USEPA SW-846 Method 0010 Sample Calculations - PAH Emissions

Sample data taken from Run 1

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1. Total PAH concentration (ng/dscm)

LN

$$C_{sd} = \left(\frac{m_{total}}{V_{mstd}} \right) \times k \times (35.31)$$

Where:

m_{total}	= Total weight of PAHs (ng)	= <4.2398E+04	ng
V_{mstd}	= volume metered, standard (dscf)	= 149.9093	dscf
k	= conversion factor to convert laboratory data to nanograms	= 1E+00	ng/ng
35.31	= conversion factor (dscf/dscm)	= 35.31	dscf/dscm
C_{sd}	= Total PAH concentration (ng/dscm)	= <9.9864E+03	ng/dscm

2. Total PAH concentration (µg/dscm)

$$C_{sd} = \left(\frac{m_{total}}{V_{mstd}} \right) \times k_{rev} \times (35.31)$$

Where:

m_{total}	= Total weight of PAHs (ng)	= <4.2398E+04	ng
V_{mstd}	= volume metered, standard (dscf)	= 149.9093	dscf
k_{rev}	= conversion factor to convert laboratory data to micrograms	= 1E-03	ug/ng
35.31	= conversion factor (dscf/dscm)	= 35.31	dscf/dscm
C_{sd}	= Total PAH concentration (µg/dscm)	= <9.9864E+00	µg/dscm

3. Total PAH concentration at normal conditions (µg/Nm3 example)

$$C_{sd} = \left(\frac{m_{total}}{V_{mstd}} \right) \times k_{rev} \times (35.31) \times \left(\frac{68 + 460}{32 + 460} \right)$$

Where:

m_{total}	= Total weight of PAHs (ng)	= <4.2398E+04	ng
V_{mstd}	= volume metered, standard (dscf)	= 149.9093	dscf
k_{rev}	= conversion factor to convert laboratory data to micrograms	= 1E-03	ug/ng
35.31	= conversion factor (dscf/dscm)	= 35.31	dscf/dscm
68	= standard temperature (°F)	= 68	°F
32	= normal temperature (°F)	= 32	°F
460	= °F to °R conversion constant	= 460	
C_{sd}	= Total PAH concentration (µg/Nm3 dry)	= <1.0717E+01	µg/Nm³ dry

4. Total PAH emission rate (lb/hr)

$$E_{lb/hr} = \left(\frac{m_{total}}{V_{mstd}} \right) \times k \times \left(\frac{2.205 \times 10^{-3}}{10^9} \right) \times (Q_{std} \times 60)$$

Where:

m_{total}	= Total weight of PAHs (ng)	= <4.2398E+04	ng
V_{mstd}	= volume metered, standard (dscf)	= 149.9093	dscf
2.205×10^{-3}	= conversion factor (lb/g)	= 2.205E-03	lb/g
10^9	= conversion factor (ng/g)	= 1E+09	ng/g
k	= conversion factor to convert laboratory data to nanograms	= 1E+00	ng/ng
Q_{std}	= volumetric flow rate at standard conditions, dry basis (dscfm)	= 133,541	dscfm
60	= conversion factor (min/hr)	= 60	min/hr
$E_{lb/hr}$	= Total PAH emission rate (lb/hr)	= <4.9968E-03	lb/hr

CEM Field Sample Calculations for THC FCCU Scrubber Stack

Sample data taken from Run 1
and Channel 2

Note: The tables presenting the results are generated electronically from raw data. It may not be possible to exactly duplicate these results using a calculator. The reference method data, results and all calculations are carried to sixteen decimal places throughout. The final table is formatted to an appropriate number of significant figures.

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1. Average of a calibration series

$$C_{mce} = \frac{(C_1 + C_2 + C_3)}{3}$$

Where:

C_1, C_2, C_3 = concentrations of 3 consecutive gas samples that are representative of the calibration gas

C_{mce} = average concentration of a calibration series = 5.041 ppmwv
In this case the low cal series for channel 2

2a. Calibration Error Check for Hydrocarbons (5% of actual calibration gas value error allowed by Method 25A)

$$E_{HC} = abs \left| \frac{C_{mce} - C_{ma}}{C_{ma}} \right| \leq l_{cal}$$

Where:

C_{mce} = average concentration of a calibration series = 5.041 ppmwv
In this case the low cal series for channel 2

C_{ma} = concentration of actual calibration gas value = 5.130 ppmwv

l_{cal} = limit for calibration error for hydrocarbons = 5.0%

E_{HC} = calibration error check value = 1.73% Pass

2b. Calibration Error Check for non-Hydrocarbons (2% of Instrument Span)

$$E = abs \left| \frac{C_{mce} - C_{ma}}{Span} \right| \leq l_{cal}$$

Where:

C_{mce} = average concentration of a calibration series = 5.041 ppmwv
In this case the low cal series for channel 2

C_{ma} = concentration of actual calibration gas value = 5.130 ppmwv

Span = instrument span value = 15.000

l_{cal} = limit for calibration error for non-hydrocarbons = 2.0%

E = calibration error check value = NA

3. System Bias as Percent of Span Value (5% is allowed)

$$E_{Bias} = abs \left| \frac{C_{mf} - C_{mce}}{Span} \right| \leq l_{bias}$$

Where:

C_{mce} = average concentration of a calibration series = 7.989 ppmwv
in this case the Mid cal series for channel 2

C_{mf} = calibration error response concentration for Cal01 = 7.426 ppmwv

Span = instrument span value = 15.000 ppmwv

l_{bias} = limit for system bias error = 5.0%

E_{bias} = calibration bias error check value = 3.75% Pass

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Robinson Refinery

FCCU Scrubber Stack

4. System Drift as Percent of Span Value (3%)

$$E_{Drift} = abs \left| \frac{C_{mf} - C_{mi}}{Span} \right| \leq l_{drift}$$

Where:

C_{mf}	= calibration error response concentration for Cal01 (final)	=	7.426	ppmwv
C_{mi}	= calibration error response concentration for Cal00 (initial)	=	7.989	ppmwv
Span	= instrument span value	=	15.000	ppmwv
l_{drift}	= limit for system drift error	=	3.0%	
E_{drift}	= calibration drift error check value	=	3.75%	Fail

5. Average Concentration for an entire Run

$$C = \frac{\sum_{i=1}^N C_i}{N}$$

Where:

C_i	= All concentration readings for the entirety of Run 1 for the monitor looking for THC on channel 2	=	1.100	ppmwv
N	= total number of readings in Run 1	=	61	
C	= average THC concentration for Run 1	=	0.831	ppmwv

6. Drift-Corrected Average Concentration for an entire Run

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

C_{ma}	= concentration of actual calibration gas value	=	7.950	ppmwv
C	= average THC concentration for Run 1	=	0.831	ppmwv
C_{mf}	= calibration error response concentration for Cal01 (final)	=	7.426	ppmwv
C_{mi}	= calibration error response concentration for Cal00 (initial)	=	7.989	ppmwv
C_{of}	= calibration error response concentration for Cal01 (final) for zero gas	=	-0.369	ppmwv
C_{oi}	= calibration error response concentration for Cal00 (initial) for zero gas	=	-0.003	ppmwv
C_{DC}	= drift corrected average concentration for Run 1	=	1.024	ppmwv

CEM Emissions Sample Calculations for THC FCCU Scrubber Stack

Sample data taken from Run 1
and Channel 2

Note: The tables presenting the results are generated electronically from raw data. It may not be possible to exactly duplicate these results using a calculator. The reference method data, results and all calculations are carried to sixteen decimal places throughout. The final table is formatted to an appropriate number of significant figures.

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1. THC concentration (ppmdv)

$$C(ppmdv) = k_1 \times C_{DC} \quad \text{if dry gas}$$

$$C(ppmdv) = \frac{k_1 \times C_{DC}}{\left(1 - \frac{B_w}{100}\right)} \quad \text{if wet gas}$$

Where:

C_{DC}	= drift corrected average concentration	=	1.024	ppmwv
B_w	= actual water vapor in gas (% v/v)	=	23.579	% v/v
100	= conversion factor to change percentage to decimal	=	100	
k_1	= ppm/% to ppm conversion factor for diluent gases	=	1	

$C(ppmdv)$	= THC concentration (ppmdv)	=	1.341	ppmdv
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2. THC concentration (lb/dscf)

$$C(lb/dscf) = \frac{C(ppmdv) \times MW(gas)}{10^6 ppm \times 385.3}$$

Where:

$C(ppmdv)$	= THC concentration (ppmdv)	=	1.341	ppmdv
MW	= Molecular Weight of THC gas	=	44.0972	lb/lb-mole
10^6	= conversion factor from decimal to ppm	=	1.00E+06	
385.3	= molar volume	=	385.3	dscf/lb-mole

$C(lb/dscf)$	= THC concentration (lb/dscf)	=	1.534E-07	lb/dscf
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3. THC emission rate (lb/hr)

$$E_{lb/hr} = C(lb/dscf) \times Q_{std} \times 60$$

Where:

$C(lb/dscf)$	= THC concentration (lb/dscf)	=	1.534E-07	lb/dscf
Q_{std}	= volumetric flow rate at standard conditions, dry basis (dscfm)	=	134094.604	dscfm
60	= conversion factor (min/hr)	=	60	min/hr
$E_{lb/hr}$	= THC emission rate (lb/hr)	=	1.234	lb/hr

USEPA Method 23 (PCDD/PCDF/PCB) Sampling, Velocity and Moisture Sample Calculations

Sample data taken from Run 1

Note: The tables presenting the results are generated electronically from raw data. It may not be possible to exactly duplicate these results using a calculator. The reference method data, results, and all calculations are carried to sixteen decimal places throughout. The final table is formatted to an appropriate number of significant figures.

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1. Volume of water collected (wscf)

$$V_{wstd} = (0.04706)(V_{lc})$$

Where:

V_{lc}	= total volume of liquid collected in impingers and silica gel (ml)	=	778.0	ml
0.04706	= ideal gas conversion factor (ft ³ water vapor/ml or gm)	=	0.04706	ft ³ /ml
V_{wstd}	= volume of water vapor collected at standard conditions (ft ³)	=	36.61	ft ³

2. Volume of gas metered, standard conditions (dscf)

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

Where:

P_{bar}	= barometric pressure (in. Hg)	=	29.30	in. Hg
T_m	= average dry gas meter temperature (°F)	=	106.26	°F
V_m	= volume of gas sample through the dry gas meter at meter conditions (dcf)	=	125.15	dcf
Y_d	= gas meter correction factor (dimensionless)	=	0.9992	
ΔH	= average pressure drop across meter box orifice (in. H ₂ O)	=	1.35	in. H ₂ O
17.64	= standard temperature to pressure ratio (°R/in. Hg)	=	17.64	°R/in. Hg
13.6	= conversion factor (in. H ₂ O/in. Hg)	=	13.6	in. H ₂ O/in. Hg
460	= °F to °R conversion constant	=	460	
V_{mstd}	= volume of gas sampled through the dry gas meter at standard conditions (dscf)	=	114.525	dscf

3. Sample gas pressure (in. Hg)

$$P_s = P_{bar} + \left(\frac{P_g}{13.6} \right)$$

Where:

P_{bar}	= barometric pressure (in. Hg)	=	29.30	in. Hg
P_g	= sample gas static pressure (in. H ₂ O)	=	-0.30	in. H ₂ O
13.6	= conversion factor (in. H ₂ O/in. Hg)	=	13.6	in. H ₂ O/in. Hg
P_s	= absolute sample gas pressure (in. Hg)	=	29.28	in. Hg

4. Actual water vapor pressure at sample gas temperature less than 212°F (in. Hg)

$$P_v = \frac{e^{\left(\frac{18.3036 - \frac{3816.44}{\frac{5}{9}(T_s - 32) + 273.15 - 46.13}}{25.4} \right)}}{25.4}$$

Where:

T_s	= average sample gas temperature (°F)	=	151.00	°F
18.3036	= Antoine coefficient	=	18.3036	°K
3816.44	= Antoine coefficient	=	3816.44	°K
273.15	= temperature conversion factor	=	273.15	°K
46.13	= Antoine coefficient	=	46.13	°K
25.4	= conversion factor	=	25.4	mm Hg/in. Hg
5/9	= Fahrenheit to Celsius conversion factor	=	5/9	°C/°F
32	= temperature conversion (°F)	=	32	°F
P_v	= vapor pressure, actual (in. Hg)	=	7.76	in. Hg

5. Water vapor pressure at gas temperature greater than 212°F (in. Hg)

$$P_v = P_s$$

Where:

P_s	= absolute sample gas pressure (in. Hg)	=	29.28	in. Hg
P_v	= water vapor pressure, actual (in. Hg)	=	Previously Defined	in. Hg

6. Moisture measured in sample (% by volume)

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

Where:

V_{mstd}	= volume of gas sampled through the dry gas meter at standard conditions (dscf)	=	114.525	dscf
V_{wstd}	= volume of water collected at standard conditions (scf)	=	36.61	scf
B_{wo}	= proportion of water measured in the gas stream by volume	=	0.2422	%

7. Saturated moisture content (% by volume)

$$B_{ws} = \frac{P_v}{P_s}$$

Where:

P_s	= absolute sample gas pressure (in. Hg)	=	29.28	in. Hg
P_v	= water vapor pressure, actual (in. Hg)	=	7.76	in. Hg
B_{ws}	= proportion of water vapor in the gas stream by volume at saturated conditions	=	0.2651	%

8. Actual water vapor in gas (% by volume)

$$B_w = \text{MINIMUM} [B_{wo}, B_{ws}]$$

Where:

B_{ws}	= proportion of water vapor in the gas stream by volume at saturated conditions	=	0.2651	
B_{wo}	= proportion of water measured in the gas stream by volume	=	0.2422	
B_w	= actual water vapor in gas	=	0.2422	
		=	24.22	%

9. Nitrogen (plus carbon monoxide) in gas stream (% by volume, dry)

$$N_2 + CO = 100 - CO_2 - O_2$$

Where:

CO_2	= proportion of carbon dioxide in the gas stream by volume (%)	=	14.0	%
O_2	= proportion of oxygen in the gas stream by volume (%)	=	3.5	%
100	= conversion factor (%)	=	100	%
N_2+CO	= proportion of nitrogen and CO in the gas stream by volume (%)	=	82.50	%

10. Molecular weight of dry gas stream (lb/lb-mole)

$$M_d = (M_{CO_2}) \left(\frac{CO_2}{100} \right) + (M_{O_2}) \left(\frac{O_2}{100} \right) + (M_{N_2+CO}) \left(\frac{N_2 + CO}{100} \right)$$

Where:

M_{CO_2}	= molecular weight of carbon dioxide (lb/lb-mole)	=	44.00	lb/lb-mole
M_{O_2}	= molecular weight of oxygen (lb/lb-mole)	=	32.00	lb/lb-mole
M_{N_2+CO}	= molecular weight of nitrogen and carbon monoxide (lb/lb-mole)	=	28.00	lb/lb-mole
CO_2	= proportion of carbon dioxide in the gas stream by volume (%)	=	14.0	%
O_2	= proportion of oxygen in the gas stream by volume (%)	=	3.5	%
N_2+CO	= proportion of nitrogen and CO in the gas stream by volume (%)	=	82.5	%
100	= conversion factor (%)	=	100	%
M_d	= dry molecular weight of sample gas (lb/lb-mole)	=	30.38	lb/lb-mole

11. Molecular weight of sample gas (lb/lb-mole)

$$M_s = (M_d)(1 - B_w) + (M_{H_2O})(B_w)$$

Where:

B_w	= proportion of water vapor in the gas stream by volume	=	0.2422	
M_d	= dry molecular weight of sample gas (lb/lb-mole)	=	30.38	lb/lb-mole
M_{H_2O}	= molecular weight of water (lb/lb-mole)	=	18.00	lb/lb-mole
M_s	= molecular weight of sample gas, wet basis (lb/lb-mole)	=	27.38	lb/lb-mole

12. Velocity of sample gas (ft/sec)

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

Where:

K_p	= velocity pressure constant	=	85.49	
C_p	= pitot tube coefficient	=	0.82	
M_s	= wet molecular weight of sample gas, wet basis (lb/lb-mole)	=	27.38	lb/lb-mole
P_s	= absolute sample gas pressure (in. Hg)	=	29.28	in. Hg
T_s	= average sample gas temperature (°F)	=	151.00	°F
$\sqrt{\Delta P}$	= average square roots of velocity heads of sample gas (in. H ₂ O)	=	0.790	√in. H ₂ O
460	= °F to °R conversion constant	=	460	
V_s	= sample gas velocity (ft/sec)	=	48.37	ft/sec

13. Volumetric flow rate of sample gas at actual gas conditions (acfm)

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

Where:

A_s	= cross sectional area of sampling location (ft ²)	=	70.88	ft ²
V_s	= sample gas velocity (ft/sec)	=	48.37	ft/sec
60	conversion factor (sec/min)	=	60	sec/min
Q_a	= volumetric flow rate at actual conditions (acfm)	=	205,721	acfm

14. Total flow of sample gas (scfm)

$$Q_s = (Q_a)\left(\frac{P_s}{29.92}\right)\left(\frac{68 + 460}{T_s + 460}\right)$$

Where:

Q_a	= volumetric flow rate at actual conditions (acfm)	=	205,721	acfm
P_s	= absolute sample gas pressure (in. Hg)	=	29.28	in. Hg
29.92	= standard pressure (in. Hg)	=	29.92	in. Hg
T_s	= average sample gas temperature (°F)	=	151.0	°F
68	= standard temperature (°F)	=	68	°F
460	= °F to °R conversion constant	=	460	
Q_s	= volumetric flow rate at standard conditions, wet basis (scfm)	=	173,960	scfm

15. Dry flow of sample gas (dscfm)

$$Q_{std} = (Q_s)(1 - B_w)$$

Where:

B_w	= proportion of water vapor in the gas stream by volume	=	0.2422	
Q_s	= volumetric flow rate at standard conditions, wet basis (scfm)	=	173,960	scfm
Q_{std}	= volumetric flow rate at standard conditions, dry basis (dscfm)	=	131,819	dscfm

16. Hourly time basis conversion of volumetric flow rate (Q_{std} example)

$$Q_{std-hr} = (Q_{std-min})(60)$$

Where

$Q_{std-min}$	= volumetric flow rate, english units (ft ³ /min)	=	131,819	dscfm
60	= conversion factor (min/hr)	=	60	min/hr

Q_{std-hr}	= volumetric flow rate, hourly basis (dscf/hr)	=	7,909,129	dscf/hr
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17. Metric Conversion of Gas Volumes (Q_{std} example)

$$Q_{std-metric} = (Q_{std-english}) \left(\frac{60}{35.31} \right)$$

Where:

$Q_{std-english}$	= volumetric flow rate, english units (ft ³ /min)	=	131,819	dscfm
35.31	= conversion factor (ft ³ /m ³)	=	35.31	ft ³ /m ³
60	= conversion factor (min/hr)	=	60	min/hr

$Q_{std-metric}$	= volumetric flow rate, metric units (m ³ /hr)	=	223,991	dry std m ³ /hr
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18. Standard to Normal Conversion of Gas Volumes (Q_{std} example)

$$Q_{Normal} = (Q_{std-metric}) \left(\frac{32 + 460}{68 + 460} \right)$$

Where:

$Q_{std-metric}$	= volumetric flow rate, metric units (dry std m ³ /hr)	=	223,991	dry std m ³ /hr
32	= normal temperature (°F)	=	32	°F
68	= standard temperature (°F)	=	68	°F
460	= standard temperature in Rankine (68°F)	=	460	

Q_{Normal}	= volumetric flow rate, metric units (dry Nm ³ /hr)	=	208,719	dry Nm ³ /hr
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19. Percent isokinetic (%)

$$I = \frac{(0.09450)(T_s + 460)(V_{mstd})}{(P_s)(V_s)\left(\frac{(D_n)^2(\pi)}{(144)(4)}\right)(\Theta)(1 - B_w)}$$

Where:

D_n	= diameter of nozzle (in)	=	0.250	in.
B_w	= proportion of water vapor in the gas stream by volume	=	0.2422	
P_s	= absolute sample gas pressure (in. Hg)	=	29.28	in. Hg
T_s	= average sample gas temperature (°F)	=	151.0	°F
V_{mstd}	= volume of gas sample through the dry gas meter at standard conditions (dscf)	=	114.525	dscf
V_s	= sample gas velocity (ft/sec)	=	48.37	ft/sec
θ	= total sampling time (min)	=	180	min
0.0945	= conversion constant	=	0.0945	
460	= °F to °R conversion constant	=	460	
I	= percent of isokinetic sampling (%)	=	100.42	%

20. Alternative Method 5 Post-Test Meter Calibration Factor

$$Y_{qa} = \frac{\Theta}{V_m} \sqrt{\frac{(0.0319)(T_m + 460)(28.96)}{(\Delta H_{@})(P_{bar} + \frac{\Delta H}{13.6})(M_d)}} (\sqrt{\Delta H})_{avg}$$

Where:

θ	= total sampling time (min)	=	180	min
V_m	= volume of gas sample through the dry gas meter at meter conditions (dcf)	=	125.15	dcf
T_m	= average dry gas meter temperature (°F)	=	106.26	°F
$\Delta H_{@}$	= dry gas meter orifice coefficient	=	1.7185	
P_{bar}	= barometric pressure (in. Hg)	=	29.30	in. Hg
ΔH	= average pressure drop across meter box orifice (in. H ₂ O)	=	1.350	in. H ₂ O
M_d	= dry molecular weight of sample gas (lb/lb-mole)	=	30.38	lb/lb-mole
$\sqrt{\Delta H}_{avg}$	= average of square root of pressure drop across meter orifice	=	1.159	$\sqrt{\text{in. H}_2\text{O}}$
0.0319	= conversion constant	=	0.0319	
28.96	= molecular weight of ambient air (lb/lb-mole)	=	28.96	lb/lb-mole
13.6	= conversion factor (in. H ₂ O/in. Hg)	=	13.6	in. H ₂ O/in. Hg
460	= °F to °R conversion constant	=	460	
Y_{qa}	= alternative Method 5 post-test meter calibration factor	=	0.9730	

USEPA Method 23 PCDD/PCDF Analyte Calculations

Sample data taken from Run 1

Note: The tables presenting the results are generated electronically from raw data. It may not be possible to exactly duplicate these results using a calculator. The reference method data, results and all calculations are carried to sixteen decimal places throughout. The final table is formatted to an appropriate number of significant figures.

Note: PCDD/F results may be presented in two formats - normally expected levels and the maximum possible levels. In the normal case, data classified as ND (non-detect) or EMPC (estimated maximum possible concentration) are not counted. In the maximum possible emissions case, NDs and EMPCs are fully counted.

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			Normal Case (ND & EMPC = 0)		Maximum Case (ND & EMPC fully counted)	
1. Mass of 'Other', non-2,3,7,8 isomers (example using HxCDD) (pg)						
	$m_{\text{other}} = m_T - \sum_i^{\text{\# isomers}} m_i$					
Where						
m_1	= mass of 1,2,3,4,7,8-HxCDD (pg)	=	nd	pg	5.1000E+00	pg
m_2	= mass of 1,2,3,6,7,8-HxCDD (pg)	=	nd	pg	5.0000E+00	pg
m_3	= mass of 1,2,3,7,8,9-HxCDD (pg)	=	nd	pg	5.2000E+00	pg
m_T	= total mass of hexa isomers (HxCDDs) (pg)	=	nd	pg	5.2000E+00	pg
m_{other}	= mass of 'Other', non-2,3,7,8 HxCDD isomers (pg)	=	0.0000E+00	pg	N/A	pg

2. Toxic Equivalent Dibenzo-Dioxin or DibenzoFuran mass (1,2,3,4,7,8 HxCDD example) (ng)

	$m_{i_TEQ} = m_i \times TEF_i$					
Where:						
m_i	= mass of Analyte 'i' (1,2,3,4,7,8-HxCDD) (ng)	=	nd	ng	5.1000E-03	ng
TEF_i	= toxic equivalency factor for Analyte 'i' (1,2,3,4,7,8-HxCDD) from the USEPA/INTL 2005	=	0.1000		0.1000	
m_{i_TEQ}	= TEQ mass of 1,2,3,4,7,8-HxCDD (ng)	=	NA	ng	5.1000E-04	ng

3. Total mass of compound series (PCDD example) (ng)

	$m_{PCDD} = \sum_i^{\text{\# Dioxin isomers}} m_i$					
Where:						
$m_{2,3,7,8\text{-TCDD}}$	= mass of 2,3,7,8-TCDD	=	0.0000E+00	ng	5.9000E-03	ng
$m_{\text{other-TCDD}}$	= mass of other-TCDD	=	0.0000E+00	ng	0.0000E+00	ng
$m_{1,2,3,7,8\text{-PeCDD}}$	= mass of 1,2,3,7,8-PeCDD	=	0.0000E+00	ng	7.6000E-03	ng
$m_{\text{other-PeCDD}}$	= mass of other-PeCDD	=	0.0000E+00	ng	0.0000E+00	ng
$m_{1,2,3,4,7,8\text{-HxCDD}}$	= mass of 1,2,3,4,7,8-HxCDD	=	0.0000E+00	ng	5.1000E-03	ng
$m_{1,2,3,6,7,8\text{-HxCDD}}$	= mass of 1,2,3,6,7,8-HxCDD	=	0.0000E+00	ng	5.0000E-03	ng
$m_{1,2,3,7,8,9\text{-HxCDD}}$	= mass of 1,2,3,7,8,9-HxCDD	=	0.0000E+00	ng	5.2000E-03	ng
$m_{\text{other-HxCDD}}$	= mass of other-HxCDD	=	0.0000E+00	ng	N/A	ng
$m_{1,2,3,4,6,7,8\text{-HpCDD}}$	= mass of 1,2,3,4,6,7,8-HpCDD	=	0.0000E+00	ng	6.5000E-03	ng
$m_{\text{other-HpCDD}}$	= mass of other-HpCDD	=	0.0000E+00	ng	0.0000E+00	ng
$m_{1,2,3,4,6,7,8,9\text{-OCDD}}$	= mass of 1,2,3,4,6,7,8,9-OCDD	=	0.0000E+00	ng	2.8000E-02	ng
$m_{\text{Total MCDD}}$	= mass of total Mono-CDD	=		ng		ng
$m_{\text{Total DCDD}}$	= mass of total Di-CDD	=		ng		ng
$m_{\text{Total TRICDD}}$	= mass of total Tri-CDD	=		ng		ng
m_{PCDD}	= Total mass of PCDD's compound series	=	0.0000E+00	ng	6.3300E-02	ng

4. Total TEQ mass of compound series (PCDD example) (ng)

$$m_{PCDD_TEQ} = \sum_i^{\#Dioxin\ isomers} m_{i_TEQ}$$

Where:

$m_{2,3,7,8\text{-TCDD_TEQ}}$	= TEQ mass of 2,3,7,8-TCDD	=	0.0000E+00	ng	5.9000E-03	ng
$m_{\text{other-TCDD_TEQ}}$	= TEQ mass of other-TCDD	=	0.0000E+00	ng	0.0000E+00	ng
$m_{1,2,3,7,8\text{-PeCDD_TEQ}}$	= TEQ mass of 1,2,3,7,8-PeCDD	=	0.0000E+00	ng	7.6000E-03	ng
$m_{\text{other-PeCDD_TEQ}}$	= TEQ mass of other-PeCDD	=	0.0000E+00	ng	0.0000E+00	ng
$m_{1,2,3,4,7,8\text{-HxCDD_TEQ}}$	= TEQ mass of 1,2,3,4,7,8-HxCDD	=	0.0000E+00	ng	5.1000E-04	ng
$m_{1,2,3,6,7,8\text{-HxCDD_TEQ}}$	= TEQ mass of 1,2,3,6,7,8-HxCDD	=	0.0000E+00	ng	5.0000E-04	ng
$m_{1,2,3,7,8,9\text{-HxCDD_TEQ}}$	= TEQ mass of 1,2,3,7,8,9-HxCDD	=	0.0000E+00	ng	5.2000E-04	ng
$m_{\text{other-HxCDD_TEQ}}$	= TEQ mass of other-HxCDD	=	0.0000E+00	ng	N/A	ng
$m_{1,2,3,4,6,7,8\text{-HpCDD_TEQ}}$	= TEQ mass of 1,2,3,4,6,7,8-HpCDD	=	0.0000E+00	ng	6.5000E-05	ng
$m_{\text{other-HpCDD_TEQ}}$	= TEQ mass of other-HpCDD	=	0.0000E+00	ng	0.0000E+00	ng
$m_{1,2,3,4,6,7,8,9\text{-OCDD_TEQ}}$	= TEQ mass of 1,2,3,4,6,7,8,9-OCDD	=	0.0000E+00	ng	8.4000E-06	ng
$m_{\text{Total MCDD_TEQ}}$	= TEQ mass of total Mono-CDD	=		ng		ng
$m_{\text{Total DCDD_TEQ}}$	= TEQ mass of total Di-CDD	=		ng		ng
$m_{\text{Total TRICDD_TEQ}}$	= TEQ mass of total Tri-CDD	=		ng		ng
m_{PCDD_TEQ}	= Total TEQ mass of PCDD's compound series	=	0.0000E+00	ng	1.5103E-02	ng

5. Total PCDD & PCDF Mass (ng)

$$m_{PCDD\ IF} = m_{PCDD} + m_{PCDF}$$

Where

m_{PCDD}	= Total mass of PCDD's compound series	=	0.0000E+00	ng	6.3300E-02	ng
m_{PCDF}	= Total mass of PCDF's compound series	=	0.0000E+00	ng	5.8100E-02	ng
$m_{PCDD\ IF}$	= Total mass of PCDDs and PCDFs	=	0.0000E+00	ng	1.2140E-01	ng

6. Total TEQ Mass for PCDDs & PCDFs (ng)

$$m_{PCDD\ IF_TEQ} = m_{PCDD_TEQ} + m_{PCDF_TEQ}$$

Where

m_{PCDD_TEQ}	= Total TEQ mass of PCDD's compound series	=	0.0000E+00	ng	1.5103E-02	ng
m_{PCDF_TEQ}	= Total TEQ mass of PCDF's compound series	=	0.0000E+00	ng	4.2874E-03	ng
$m_{PCDD\ IF_TEQ}$	= Total TEQ mass for PCDDs and PCDFs	=	0.0000E+00	ng	1.9391E-02	ng

USEPA Method 23 PCDD/PCDF Emissions Calculations

Sample data taken from Run 1

Note: The tables presenting the results are generated electronically from raw data. It may not be possible to exactly duplicate these results using a calculator. The reference method data, results and all calculations are carried to sixteen decimal places throughout. The final table is formatted to an appropriate number of significant figures.

Note: PCDD/F results may be presented in two formats - normally expected levels and the maximum possible levels. In the normal case, data classified as ND (non-detect) or EMPC (estimated maximum possible concentration) are not counted. In the maximum possible emissions case, NDs and EMPCs are fully counted.

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N_O

		Normal Case (ND & EMPC = 0)		Maximum Case (ND & EMPC fully counted)	
1. TEQ concentration (ng/dscm)					
C_{sd}	$= \left(\frac{m_{n_TEQ}}{V_{mstd}} \right) \times 35.31$				
Where:					
m_{n_TEQ}	= total TEQ mass for PCDDs and PCDFs (ng)	= 0.0000E+00	ng	1.9391E-02	ng
V_{mstd}	= volume metered, standard (dscf)	= 114.5248	dscf	114.5248	dscf
35.31	= conversion factor (dscf/dscm)	= 35.31	dscf/dscm	35.31	dscf/dscm
C_{sd}	= PCDD/F TEQ concentration (ng/dscm)	= 0.0000E+00	ng/dscm	5.9785E-03	ng/dscm
2. TEQ concentration (ng/Nm3 dry)					
C_{sd}	$= \left(\frac{m_{n_TEQ}}{V_{mstd}} \right) (35.31) \left(\frac{68 + 460}{32 + 460} \right)$				
Where:					
m_{n_TEQ}	= total TEQ mass for PCDDs and PCDFs (ng)	= 0.0000E+00	ng	1.9391E-02	ng
V_{mstd}	= volume metered, standard (dscf)	= 114.5248	dscf	114.5248	dscf
35.31	= conversion factor (dscf/dscm)	= 35.31	dscf/dscm	35.31	dscf/dscm
68	= standard temperature (°F)	= 68	°F	68	°F
32	= normal temperature (°F)	= 32	°F	32	°F
460	= °F to °R conversion constant	= 460		460	
C_{sd}	= PCDD/F TEQ concentration (ng/Nm3 dry)	= 0.0000E+00	ng/Nm ³ dry	6.4160E-03	ng/Nm ³ dry
3. TEQ concentration at actual gas conditions (ng/acm example)					
C_a	$= C_{sd} \left(\frac{Q_{std}}{Q_a} \right)$				
Where:					
C_{sd}	= PCDD/F TEQ concentration (ng/dscm)	= 0.0000E+00	ng/dscm	5.9785E-03	ng/dscm
Q_{std}	= volumetric flow rate at standard conditions, dry basis (dscm/h)	= 223,991	dry std m ³ /hr	223,991	dry std m ³ /hr
Q_a	= volumetric flow rate at actual conditions (acm/h)	= 349,568	actual m ³ /hr	349,568	actual m ³ /hr
C_a	= PCDD/F TEQ concentration at actual gas conditions (ng/acm)	= 0.0000E+00	ng/acm	3.8308E-03	ng/acm

4. TEQ Emission rate (lb/hr)

$$E_{lb/hr} = \left(\frac{m_{n_TEQ}}{V_{mstd}} \right) (2.205 \times 10^{-3}) (Q_{std}) \frac{(60)}{(10^9)}$$

Where:

m_{n_TEQ}	= total TEQ mass for PCDDs and PCDFs (ng)	=	0.0000E+00	ng	1.9391E-02	ng
V_{mstd}	= volume metered, standard (dscf)	=	114.5248	dscf	114.5248	dscf
2.205×10^{-3}	= conversion factor (lb/g)	=	2.205E-03	lb/g	2.205E-03	lb/g
Q_{std}	= volumetric flow rate at standard conditions, dry basis (dscfm)	=	131,819	dscfm	131,819	dscfm
60	= conversion factor (min/hr)	=	60	min/hr	60	min/hr
10^9	= conversion factor to convert from ng to grams	=	1.0E+09	ng/g	1.0E+09	ng/g
$E_{lb/hr}$	= PCDDF TEQ Emission rate (lb/hr)	=	0.0000E+00	lb/hr	2.9528E-09	lb/hr

USEPA Method 23 Sample Calculations - PCB Lab Results

Sample data taken from Run 1

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N

1. Net Weight determination (pg) [Tetrachlorobiphenyl (77) example]

$$m_{net} = m_{gross} \quad \text{if} \quad m_{gross} \text{ or } m_{fieldblank} < DL$$

$$m_{net} = m_{gross} - m_{fieldblank} \quad \text{if} \quad m_{gross} - m_{fieldblank} \geq DL$$

$$m_{net} < DL \quad \text{if} \quad m_{gross} - m_{fieldblank} < DL$$

Where:

m_{gross}	= gross weight of Tetrachlorobiphenyl (77) (pg)	=	6.6600E+00	pg
$m_{field\ blank}$	= field blank weight of Tetrachlorobiphenyl (77) (pg)	=	9.8100E+00	pg
DL	= detection limit of Tetrachlorobiphenyl (77) (pg)	=	0.0000E+00	pg
m_{net}	= net weight of Tetrachlorobiphenyl (77) (pg)	=	6.6600E+00	pg

2. Net Weight for Summing (pg) [Tetrachlorobiphenyl (77) example]

$$m_{Snet} = m_{net} \quad \text{if} \quad m_{net} \geq DL$$

$$m_{Snet} = m_{net} \times DL_{modifier} \quad \text{if} \quad m_{net} < DL$$

Where:

m_{net}	= net weight of Tetrachlorobiphenyl (77)	=	6.6600E+00	pg
$DL_{modifier}$	= fraction of detection limit to include for non-detects	=	1.0	
m_{Snet}	= net weight of Tetrachlorobiphenyl (77) for summing (pg)	=	6.6600E+00	pg

3. Total PCB mass (pg)

$$m_{total} = \sum_{PAHs} m_{Snet}$$

Where:

PAHs		m_{net}	m_{Snet}
Where:			
m_{net}	= net weight of Tetrachlorobiphenyl (77) (pg)	= 6.6600E+00	pg 6.6600E+00
m_{net}	= net weight of Tetrachlorobiphenyl (81) (pg)	= <2.7000E+00	pg <2.7000E+00
m_{net}	= net weight of Pentachlorobiphenyl (105) (pg)	= <1.2000E+01	pg <1.2000E+01
m_{net}	= net weight of Pentachlorobiphenyl (114) (pg)	= <1.1000E+01	pg <1.1000E+01
m_{net}	= net weight of Pentachlorobiphenyl (118) (pg)	= 2.0700E+01	pg 2.0700E+01
m_{net}	= net weight of Pentachlorobiphenyl (123) (pg)	= <1.1000E+01	pg <1.1000E+01
m_{net}	= net weight of Pentachlorobiphenyl (126) (pg)	= <1.1000E+01	pg <1.1000E+01
m_{net}	= net weight of Hexachlorobiphenyl (156) (pg)	= <3.0000E+00	pg <3.0000E+00
m_{net}	= net weight of Hexachlorobiphenyl (157) (pg)	= <2.7000E+00	pg <2.7000E+00
m_{net}	= net weight of Hexachlorobiphenyl (167) (pg)	= <3.1000E+00	pg <3.1000E+00
m_{net}	= net weight of Hexachlorobiphenyl (169) (pg)	= <1.9000E+00	pg <1.9000E+00
m_{net}	= net weight of Heptachlorobiphenyl (189) (pg)	= <1.9000E+00	pg <1.9000E+00
m_{total}	= net weight of Total PCB's* (pg)	=	pg <8.7660E+01

USEPA Method 23 Sample Calculations - PCB TEQ Lab Results

Sample data taken from Run 1

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4. Toxic Equivalency calculation (pg) [Tetrachlorobiphenyl (77) example]

$$m_{TEQ} = m_{net} \times TEF$$

Where:

m_{net}	= net weight of Tetrachlorobiphenyl (77) (pg)	=	6.6600E+00	pg
TEF	= toxic equivalency factor for Tetrachlorobiphenyl (77)	=	1.0000E-04	
m_{TEQ}	= toxic equivalent mass of Tetrachlorobiphenyl (77) (pg)	=	6.6600E-04	pg

5. Net Weight for Summing TEQs (pg) [Tetrachlorobiphenyl (77) example]

$$m_{Snet-TEQ} = m_{TEQ} \quad \text{if} \quad m_{TEQ} \geq DL$$

$$m_{Snet-TEQ} = m_{TEQ} \times DL_{modifier} \quad \text{if} \quad m_{TEQ} < DL$$

Where:

m_{TEQ}	= toxic equivalent mass of Tetrachlorobiphenyl (77) (pg)	=	6.6600E-04	pg
$DL_{modifier}$	= fraction of detection limit to include for non-detects	=	1.0	
$m_{Snet-TEQ}$	= toxic equivalent mass of Tetrachlorobiphenyl (77) for summing	=	6.6600E-04	pg

6. Total Toxic Equivalency mass of PCBs (pg)

$$m_{tot-TEQ} = \sum_{PAHs} m_{Snet-TEQ}$$

Where:

$m_{tot-TEQ}$	$\sum_{PAHs} m_{Snet-TEQ}$	m_{TEQ}	$m_{Snet-TEQ}$
Where:			
m_{TEQ}	= toxic equivalent mass of Tetrachlorobiphenyl (77) (pg)	= 6.6600E-04	pg 6.6600E-04
m_{TEQ}	= toxic equivalent mass of Tetrachlorobiphenyl (81) (pg)	= <8.1000E-04	pg 8.1000E-04
m_{TEQ}	= toxic equivalent mass of Pentachlorobiphenyl (105) (pg)	= <3.6000E-04	pg 3.6000E-04
m_{TEQ}	= toxic equivalent mass of Pentachlorobiphenyl (114) (pg)	= <3.3000E-04	pg 3.3000E-04
m_{TEQ}	= toxic equivalent mass of Pentachlorobiphenyl (118) (pg)	= 6.2100E-04	pg 6.2100E-04
m_{TEQ}	= toxic equivalent mass of Pentachlorobiphenyl (123) (pg)	= <3.4100E-04	pg 3.4100E-04
m_{TEQ}	= toxic equivalent mass of Pentachlorobiphenyl (126) (pg)	= <1.1000E+00	pg 1.1000E+00
m_{TEQ}	= toxic equivalent mass of Hexachlorobiphenyl (156) (pg)	= <9.0000E-05	pg 9.0000E-05
m_{TEQ}	= toxic equivalent mass of Hexachlorobiphenyl (157) (pg)	= <8.1000E-05	pg 8.1000E-05
m_{TEQ}	= toxic equivalent mass of Hexachlorobiphenyl (167) (pg)	= <9.3000E-05	pg 9.3000E-05
m_{TEQ}	= toxic equivalent mass of Hexachlorobiphenyl (169) (pg)	= <5.7000E-02	pg 5.7000E-02
m_{TEQ}	= toxic equivalent mass of Heptachlorobiphenyl (189) (pg)	= <5.7000E-05	pg 5.7000E-05
$m_{tot-TEQ}$	= toxic equivalent mass of Total PCB's* (pg)	=	pg 1.1604E+00

USEPA Method 23 Sample Calculations - PCB Emissions

Sample data taken from Run 1

The tables presenting the results are generated electronically from raw data. It may not be possible to exactly duplicate these results using a calculator. The reference method data, results and all calculations are carried to sixteen decimal places throughout. The final table is formatted to an appropriate number of significant figures.

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N_N

1. Total PCB concentration (ng/dscm)

$$C_{sd} = \left(\frac{m_{total}}{V_{mstd}} \right) \times k \times (35.31)$$

Where:

m_{total}	= Total weight of PCBs (pg)	= <8.7660E+01	pg
V_{mstd}	= volume metered, standard (dscf)	= 114.5248	dscf
k	= conversion factor to convert laboratory data to nanograms	= 1E-03	ng/pg
35.31	= conversion factor (dscf/dscm)	= 35.31	dscf/dscm
C_{sd}	= Total PCB concentration (ng/dscm)	= <2.7027E-02	ng/dscm

2. Total PCB concentration (µg/dscm)

$$C_{sd} = \left(\frac{m_{total}}{V_{mstd}} \right) \times k_{rev} \times (35.31)$$

Where:

m_{total}	= Total weight of PCBs (pg)	= <8.7660E+01	pg
V_{mstd}	= volume metered, standard (dscf)	= 114.5248	dscf
k_{rev}	= conversion factor to convert laboratory data to micrograms	= 1E-06	ug/pg
35.31	= conversion factor (dscf/dscm)	= 35.31	dscf/dscm
C_{sd}	= Total PCB concentration (µg/dscm)	= <2.7027E-05	µg/dscm

3. Total PCB concentration at normal conditions (µg/Nm³ example)

$$C_{sd} = \left(\frac{m_{total}}{V_{mstd}} \right) \times k_{rev} \times (35.31) \times \left(\frac{68 + 460}{32 + 460} \right)$$

Where:

m_{total}	= Total weight of PCBs (pg)	= <8.7660E+01	pg
V_{mstd}	= volume metered, standard (dscf)	= 114.5248	dscf
k_{rev}	= conversion factor to convert laboratory data to micrograms	= 1E-06	ug/pg
35.31	= conversion factor (dscf/dscm)	= 35.31	dscf/dscm
68	= standard temperature (°F)	= 68	°F
32	= normal temperature (°F)	= 32	°F
460	= °F to °R conversion constant	= 460	
C_{sd}	= Total PCB concentration (µg/Nm ³ dry)	= <2.9005E-05	µg/Nm ³ dry

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FCCU Scrubber Stack

4. Total PCB emission rate (lb/hr)

$$E_{lb/hr} = \left(\frac{m_{total}}{V_{mstd}} \right) \times k \times \left(\frac{2.205 \times 10^{-3}}{10^9} \right) \times (Q_{std} \times 60)$$

Where:

m_{total}	= Total weight of PCBs (pg)	= <8.7660E+01	pg
V_{mstd}	= volume metered, standard (dscf)	= 114.5248	dscf
2.205×10^{-3}	= conversion factor (lb/g)	= 2.205E-03	lb/g
10^9	= conversion factor (ng/g)	= 1E+09	ng/g
k	= conversion factor to convert laboratory data to nanograms	= 1E-03	ng/pg
Q_{std}	= volumetric flow rate at standard conditions, dry basis (dscfm)	= 131,813	dscfm
60	= conversion factor (min/hr)	= 60	min/hr
$E_{lb/hr}$	= Total PCB emission rate (lb/hr)	= <1.3348E-08	lb/hr

USEPA Method 5/202 (FPM / CPM) Sampling, Velocity and Moisture Sample Calculations

Sample data taken from Run 1

Note: The tables presenting the results are generated electronically from raw data. It may not be possible to exactly duplicate these results using a calculator. The reference method data, results, and all calculations are carried to sixteen decimal places throughout. The final table is formatted to an appropriate number of significant figures.

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N

1. Volume of water collected (wscf)

$$V_{wstd} = (0.04706)(V_{lc})$$

Where:

V_{lc}	= total volume of liquid collected in impingers and silica gel (ml)	=	537.3	ml
0.04706	= ideal gas conversion factor (ft ³ water vapor/ml or gm)	=	0.04706	ft ³ /ml
V_{wstd}	= volume of water vapor collected at standard conditions (ft ³)	=	25.29	ft ³

2. Volume of gas metered, standard conditions (dscf)

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

Where:

P_{bar}	= barometric pressure (in. Hg)	=	29.40	in. Hg
T_m	= average dry gas meter temperature (°F)	=	103.25	°F
V_m	= volume of gas sample through the dry gas meter at meter conditions (dcf)	=	81.83	dcf
Y_d	= gas meter correction factor (dimensionless)	=	0.9925	
ΔH	= average pressure drop across meter box orifice (in. H ₂ O)	=	1.43	in. H ₂ O
17.64	= standard temperature to pressure ratio (°R/in. Hg)	=	17.64	°R/in. Hg
13.6	= conversion factor (in. H ₂ O/in. Hg)	=	13.6	in. H ₂ O/in. Hg
460	= °F to °R conversion constant	=	460	
V_{mstd}	= volume of gas sampled through the dry gas meter at standard conditions (dscf)	=	75.046	dscf

3. Sample gas pressure (in. Hg)

$$P_s = P_{bar} + \left(\frac{P_g}{13.6} \right)$$

Where:

P_{bar}	= barometric pressure (in. Hg)	=	29.40	in. Hg
P_g	= sample gas static pressure (in. H ₂ O)	=	-0.50	in. H ₂ O
13.6	= conversion factor (in. H ₂ O/in. Hg)	=	13.6	in. H ₂ O/in. Hg
P_s	= absolute sample gas pressure (in. Hg)	=	29.36	in. Hg

4. Actual water vapor pressure at sample gas temperature less than 212°F (in. Hg)

$$P_v = \frac{e^{\left(\frac{18.3036 - \frac{3816.44}{\frac{5}{9}(T_s - 32) + 273.15 - 46.13}}{25.4} \right)}}{25.4}$$

Where:

T_s	= average sample gas temperature (°F)	=	148.00	°F
18.3036	= Antoine coefficient	=	18.3036	°K
3816.44	= Antoine coefficient	=	3816.44	°K
273.15	= temperature conversion factor	=	273.15	°K
46.13	= Antoine coefficient	=	46.13	°K
25.4	= conversion factor	=	25.4	mm Hg/in. Hg
5/9	= Fahrenheit to Celsius conversion factor	=	5/9	°C/°F
32	= temperature conversion (°F)	=	32	°F
P_v	= vapor pressure, actual (in. Hg)	=	7.21	in. Hg

5. Water vapor pressure at gas temperature greater than 212°F (in. Hg)

$$P_v = P_s$$

Where:

P_s	= absolute sample gas pressure (in. Hg)	=	29.36	in. Hg
P_v	= water vapor pressure, actual (in. Hg)	=	Previously Defined	in. Hg

6. Moisture measured in sample (% by volume)

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

Where:

V_{mstd}	= volume of gas sampled through the dry gas meter at standard conditions (dscf)	=	75.046	dscf
V_{wstd}	= volume of water collected at standard conditions (scf)	=	25.29	scf
B_{wo}	= proportion of water measured in the gas stream by volume	=	0.2520	%

7. Saturated moisture content (% by volume)

$$B_{ws} = \frac{P_v}{P_s}$$

Where:

P_s	= absolute sample gas pressure (in. Hg)	=	29.36	in. Hg
P_v	= water vapor pressure, actual (in. Hg)	=	7.21	in. Hg
B_{ws}	= proportion of water vapor in the gas stream by volume at saturated conditions	=	0.2454	%

8. Actual water vapor in gas (% by volume)

$$B_w = \text{MINIMUM} [B_{wo}, B_{ws}]$$

Where:

B_{ws}	= proportion of water vapor in the gas stream by volume at saturated conditions	=	0.2454	
B_{wo}	= proportion of water measured in the gas stream by volume	=	0.2520	
B_w	= actual water vapor in gas	=	0.2454	
		=	24.54	%

9. Nitrogen (plus carbon monoxide) in gas stream (% by volume, dry)

$$N_2 + CO = 100 - CO_2 - O_2$$

Where:

CO_2	= proportion of carbon dioxide in the gas stream by volume (%)	=	13.4	%
O_2	= proportion of oxygen in the gas stream by volume (%)	=	3.7	%
100	= conversion factor (%)	=	100	%
N_2+CO	= proportion of nitrogen and CO in the gas stream by volume (%)	=	82.90	%

10. Molecular weight of dry gas stream (lb/lb-mole)

$$M_d = (M_{CO_2}) \left(\frac{CO_2}{100} \right) + (M_{O_2}) \left(\frac{O_2}{100} \right) + (M_{N_2+CO}) \left(\frac{N_2 + CO}{100} \right)$$

Where:

M_{CO_2}	= molecular weight of carbon dioxide (lb/lb-mole)	=	44.00	lb/lb-mole
M_{O_2}	= molecular weight of oxygen (lb/lb-mole)	=	32.00	lb/lb-mole
M_{N_2+CO}	= molecular weight of nitrogen and carbon monoxide (lb/lb-mole)	=	28.00	lb/lb-mole
CO_2	= proportion of carbon dioxide in the gas stream by volume (%)	=	13.4	%
O_2	= proportion of oxygen in the gas stream by volume (%)	=	3.7	%
N_2+CO	= proportion of nitrogen and CO in the gas stream by volume (%)	=	82.9	%
100	= conversion factor (%)	=	100	%
M_d	= dry molecular weight of sample gas (lb/lb-mole)	=	30.29	lb/lb-mole

11. Molecular weight of sample gas (lb/lb-mole)

$$M_s = (M_d)(1 - B_w) + (M_{H_2O})(B_w)$$

Where:

B_w	= proportion of water vapor in the gas stream by volume	=	0.2454	
M_d	= dry molecular weight of sample gas (lb/lb-mole)	=	30.29	lb/lb-mole
M_{H_2O}	= molecular weight of water (lb/lb-mole)	=	18.00	lb/lb-mole
M_s	= molecular weight of sample gas, wet basis (lb/lb-mole)	=	27.28	lb/lb-mole

12. Velocity of sample gas (ft/sec)

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

Where:

K_p	= velocity pressure constant	=	85.49	
C_p	= pitot tube coefficient	=	0.83	
M_s	= wet molecular weight of sample gas, wet basis (lb/lb-mole)	=	27.28	lb/lb-mole
P_s	= absolute sample gas pressure (in. Hg)	=	29.36	in. Hg
T_s	= average sample gas temperature (°F)	=	148.00	°F
$\sqrt{\Delta P}$	= average square roots of velocity heads of sample gas (in. H ₂ O)	=	0.777	√in. H ₂ O
460	= °F to °R conversion constant	=	460	
V_s	= sample gas velocity (ft/sec)	=	47.88	ft/sec

13. Volumetric flow rate of sample gas at actual gas conditions (acfm)

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

Where:

A_s	= cross sectional area of sampling location (ft ²)	=	70.88	ft ²
V_s	= sample gas velocity (ft/sec)	=	47.88	ft/sec
60	conversion factor (sec/min)	=	60	sec/min
Q_a	= volumetric flow rate at actual conditions (acfm)	=	203,609	acfm

14. Total flow of sample gas (scfm)

$$Q_s = (Q_a) \left(\frac{P_s}{29.92} \right) \left(\frac{68 + 460}{T_s + 460} \right)$$

Where:

Q_a	= volumetric flow rate at actual conditions (acfm)	=	203,609	acfm
P_s	= absolute sample gas pressure (in. Hg)	=	29.36	in. Hg
29.92	= standard pressure (in. Hg)	=	29.92	in. Hg
T_s	= average sample gas temperature (°F)	=	148.0	°F
68	= standard temperature (°F)	=	68	°F
460	= °F to °R conversion constant	=	460	
Q_s	= volumetric flow rate at standard conditions, wet basis (scfm)	=	173,528	scfm

15. Dry flow of sample gas (dscfm)

$$Q_{std} = (Q_s)(1 - B_w)$$

Where:

B_w	= proportion of water vapor in the gas stream by volume	=	0.2454	
Q_s	= volumetric flow rate at standard conditions, wet basis (scfm)	=	173,528	scfm
Q_{std}	= volumetric flow rate at standard conditions, dry basis (dscfm)	=	130,946	dscfm

16. Hourly time basis conversion of volumetric flow rate (Q_{std} example)

$$Q_{std-hr} = (Q_{std-min})(60)$$

Where

$Q_{std-min}$	= volumetric flow rate, english units (ft ³ /min)	=	130,946	dscfm
60	= conversion factor (min/hr)	=	60	min/hr

Q_{std-hr}	= volumetric flow rate, hourly basis (dscf/hr)	=	7,856,778	dscf/hr
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17. Metric Conversion of Gas Volumes (Q_{std} example)

$$Q_{std-metric} = (Q_{std-english}) \left(\frac{60}{35.31} \right)$$

Where:

$Q_{std-english}$	= volumetric flow rate, english units (ft ³ /min)	=	130,946	dscfm
35.31	= conversion factor (ft ³ /m ³)	=	35.31	ft ³ /m ³
60	= conversion factor (min/hr)	=	60	min/hr

$Q_{std-metric}$	= volumetric flow rate, metric units (m ³ /hr)	=	222,509	dry std m ³ /hr
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18. Standard to Normal Conversion of Gas Volumes (Q_{std} example)

$$Q_{Normal} = (Q_{std-metric}) \left(\frac{32 + 460}{68 + 460} \right)$$

Where:

$Q_{std-metric}$	= volumetric flow rate, metric units (dry std m ³ /hr)	=	222,509	dry std m ³ /hr
32	= normal temperature (°F)	=	32	°F
68	= standard temperature (°F)	=	68	°F
460	= standard temperature in Rankine (68°F)	=	460	

Q_{Normal}	= volumetric flow rate, metric units (dry Nm ³ /hr)	=	207,338	dry Nm ³ /hr
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19. Percent isokinetic (%)

$$I = \frac{(0.09450)(\overline{T_s} + 460)(V_{mstd})}{(P_s)(V_s)\left(\frac{(D_n)^2(\pi)}{(144)(4)}\right)(\Theta)(1 - B_w)}$$

Where:

D_n	= diameter of nozzle (in)	=	0.250	in.
B_w	= proportion of water vapor in the gas stream by volume	=	0.2454	
P_s	= absolute sample gas pressure (in. Hg)	=	29.36	in. Hg
T_s	= average sample gas temperature (°F)	=	148.0	°F
V_{mstd}	= volume of gas sample through the dry gas meter at standard conditions (dscf)	=	75.046	dscf
V_s	= sample gas velocity (ft/sec)	=	47.88	ft/sec
θ	= total sampling time (min)	=	120	min
0.0945	= conversion constant	=	0.0945	
460	= °F to °R conversion constant	=	460	
I	= percent of isokinetic sampling (%)	=	99.37	%

20. Alternative Method 5 Post-Test Meter Calibration Factor

$$Y_{qa} = \frac{\Theta}{V_m} \sqrt{\frac{(0.0319)(T_m + 460)(28.96)}{(\Delta H_{@})(P_{bar} + \frac{\Delta H}{13.6})(M_d)}} (\sqrt{\Delta H})_{avg}$$

Where:

θ	= total sampling time (min)	=	120	min
V_m	= volume of gas sample through the dry gas meter at meter conditions (dcf)	=	81.83	dcf
T_m	= average dry gas meter temperature (°F)	=	103.25	°F
$\Delta H_{@}$	= dry gas meter orifice coefficient	=	1.7792	
P_{bar}	= barometric pressure (in. Hg)	=	29.40	in. Hg
ΔH	= average pressure drop across meter box orifice (in. H ₂ O)	=	1.433	in. H ₂ O
M_d	= dry molecular weight of sample gas (lb/lb-mole)	=	30.29	lb/lb-mole
$\sqrt{\Delta H}_{avg}$	= average of square root of pressure drop across meter orifice	=	1.195	$\sqrt{\text{in. H}_2\text{O}}$
0.0319	= conversion constant	=	0.0319	
28.96	= molecular weight of ambient air (lb/lb-mole)	=	28.96	lb/lb-mole
13.6	= conversion factor (in. H ₂ O/in. Hg)	=	13.6	in. H ₂ O/in. Hg
460	= °F to °R conversion constant	=	460	
Y_{qa}	= alternative Method 5 post-test meter calibration factor	=	1.0021	

**USEPA Method 5/202 (FPM/CPM)
Sample Laboratory Analysis Calculations for FPM**

Sample data taken from Run 1

Note: The tables presenting the results are generated electronically from raw data. It may not be possible to exactly duplicate these results using a calculator. The reference method data, results, and all calculations are carried to sixteen decimal places throughout. The final table is formatted to an appropriate number of significant figures.

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1. Residue mass of filter used in calculation

$$m_{fi-calc} = m_{fi} \quad \text{if } m_{fi} \geq MDL_f$$

$$m_{fi-calc} = (MDL_f)(F_r) \quad \text{if } m_{fi} < MDL_f$$

Where:

m_{f1}	= reported mass of filter "1" from gravimetric analysis (g)	= 0.08529 g
m_{f2}	= reported mass of filter "2" from gravimetric analysis (g)	= g
m_{f3}	= reported mass of filter "3" from gravimetric analysis (g)	= g
m_{f4}	= reported mass of filter "4" from gravimetric analysis (g)	= g
MDL_f	= reported minimum gravimetric detection limit for filter fraction (g)	= 0.00016 g
F_r	= fraction of MDL applied to non-detectable run sample (g)	= 0.00
$m_{f1-calc}$	= residue mass of filter "1" used in calculation (g)	= 0.08529 g
$m_{f2-calc}$	= residue mass of filter "2" used in calculation (g)	= g
$m_{f3-calc}$	= residue mass of filter "3" used in calculation (g)	= g
$m_{f4-calc}$	= residue mass of filter "4" used in calculation (g)	= g

2. Total filter residue (g)

$$m_{filter} = \sum_{i=1}^n m_{fi-calc}$$

Where:

$m_{f1-calc}$	= residue mass of filter "1" used in calculation (g)	= 0.08529 g
$m_{f2-calc}$	= residue mass of filter "2" used in calculation (g)	= g
$m_{f3-calc}$	= residue mass of filter "3" used in calculation (g)	= g
$m_{f4-calc}$	= residue mass of filter "4" used in calculation (g)	= g
m_{filter}	= total particulate collected on filters (g)	= 0.08529 g

3. Aliquot residue mass of blank sample used in calculation (g)

$$r_{ai-blank-calc} = r_{ai-blank} \quad \text{if } r_{ai-blank} \geq MDL_s$$

$$r_{ai-blank-calc} = (MDL_s)(F_b) \quad \text{if } r_{ai-blank} < MDL_s$$

Where:

$r_{ai-blank}$	= aliquot residue mass of blank sample for solvent "i" (g)	= Acetone < 0.00027 g
MDL_s	= reported minimum gravimetric detection limit for solvent rinse (g)	= 0.00027 g
F_b	= fraction of MDL applied to non-detectable blank sample (g)	= 0.00
$r_{ai-blank-calc}$	= aliquot residue mass of blank sample for solvent "i" used in calculation (g)	= 0.00000 g

4. Aliquot residue mass of run sample used in calculation (g)

$$r_{ai-calc} = r_{ai} \quad \text{if } r_{ai} \geq MDL_s$$

$$r_{ai-calc} = (MDL_s)(F_r) \quad \text{if } r_{ai} < MDL_s$$

Where:

r_{ai}	= aliquot residue mass of run sample for solvent "i" (g)	= Acetone 0.01869 g
MDL_s	= reported minimum gravimetric detection limit for solvent rinse (g)	= 0.00027 g
F_r	= fraction of MDL applied to non-detectable run sample (g)	= 1.00
$r_{ai-calc}$	= aliquot residue mass of run sample for solvent "i" used in calculation (g)	= 0.01869 g

5. Residue mass of run sample (g)

$$r_{si} = \left(r_{ai-calc} \right) \left(\frac{v_{si}}{v_{ai}} \right)$$

Where:

$r_{ai-calc}$	= aliquot residue mass of run sample for solvent "i" used in calculation (g)	Acetone	= 0.01869 g
v_{si}	= liquid volume of run sample for solvent rinse "i" (mL)	=	152 mL
v_{ai}	= aliquot volume use for solvent rinse "i" (mL) used in gravimetric analysis (mL)	=	152 mL
r_{si}	= residue mass of run sample for solvent rinse "i" (g)	=	0.01869 g

6. Maximum allowable blank correction for solvent rinse (g)

$$m_{bi} = \text{MINIMUM} \left[\left(\frac{(r_{ai-blank-calc})(v_{si})}{v_{ai-blank}} \right) \text{ or } (0.00001)(\rho_i)(v_{si}) \text{ or } (r_{si}) \right]$$

Where:

$r_{ai-blank-calc}$	= blank aliquot residue mass for solvent "i" used in calculation (g)	Acetone	= 0.00000 g
v_{si}	= liquid volume of run sample for solvent rinse "i" (mL)	=	152.0 mL
$v_{ai-blank}$	= liquid volume of blank sample for solvent rinse "i" (mL)	=	158.0 mL
0.00001	= EPA M-5 fraction of total rinse that can be subtracted (g)	=	0.00001
ρ_i	= density of solvent rinse "i" (g/mL)	=	0.7845 g/ml
r_{si}	= residue mass of run sample for solvent rinse "i" (g)	=	0.01869 g
m_{bi}	= maximum allowable blank correction for solvent rinse "i" (g)	=	0.00000 g

The first part of the expression is used for solvent rinse 1; the blank is the concentration of the blank, times the size of the sample

7. Net residue mass of run sample (g)

$$m_i = (r_{si} - m_{bi})$$

Where:

r_{si}	= residue mass of run sample for solvent rinse "i" (g)	Acetone	= 0.01869 g
m_{bi}	= maximum allowable blank correction for solvent rinse "i" (g)	=	0.00000 g
m_i	= net residue mass of run sample for solvent rinse "i" (g)	=	0.01869 g

8. Total solvent residue - (g)

$$m_s = \sum_{i=1}^n m_i$$

Where:

m_1	= net residue mass of solvent rinse "1" (g)	=	0.01869 g
m_2	= net residue mass of solvent rinse "2" (g)	=	N/A g
m_3	= net residue mass of solvent rinse "3" (g)	=	N/A g
m_s	= total solvent residue (g)	=	0.01869 g

9. Total gravimetric result (g)

$$m_T = m_{filter} + m_s$$

Where:

m_{filter}	= total particulate collected on filters (g)	=	0.08529 g
m_s	= total solvent residue (g)	=	0.01869 g
m_T	= total gravimetric result (g)	=	0.10398 g

10. Total gravimetric detection limit (g)

$$m_D = (MDL_f)(n_f) + (MDL_s)(n_s)$$

Where:

MDL _f	= reported minimum gravimetric detection limit for filter fraction (g)	= 0.00016 g
n _f	= number of filters in analysis	= 1
MDL _s	= reported minimum gravimetric detection limit for solvent rinse (g)	= 0.00027 g
n _s	= number of solvent rinses in analysis	= 1
m _D	= total gravimetric detection limit (g)	= 0.00043 g

11. Total filterable particulate matter (g)

$$m_n = \text{MAXIMUM}[m_T \text{ or } m_D]$$

Where:

m _T	= total gravimetric result (g)	= 0.10398 g
m _D	= total gravimetric detection limit (g)	= 0.00043 g
m _n	= total filterable particulate matter (g)	= 0.10398 g

**USEPA Method 5/202 (FPM/CPM)
Sample Laboratory Analysis Calculations for CPM**

Sample data taken from Run 1

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1. Aliquot residue mass of inorganic blank sample used in calculation (g)

$$\begin{aligned} r_{ai-blank-calc} &= r_{ai-blank} && \text{if } r_{ai-blank} \geq MDL_i \\ r_{ai-blank-calc} &= (MDL_i)(F_b) && \text{if } r_{ai-blank} < MDL_i \end{aligned}$$

Where:

$r_{ai-blank}$	= aliquot residue mass of inorganic blank sample (g)	=	0.00190	g
MDL_i	= reported minimum gravimetric detection limit for inorganic fraction (g)	=	0.00034	g
F_b	= fraction of MDL applied to non-detectable blank samples (g)	=	0.00	
$r_{ai-blank-calc}$	= aliquot residue mass of inorganic blank sample used in calculation (g)	=	0.00190	g

2. Aliquot residue mass of inorganic run sample used in calculation (g)

$$\begin{aligned} r_{ai-calc} &= r_{ai} && \text{if } r_{ai} \geq MDL_i \\ r_{ai-calc} &= (MDL_i)(F_r) && \text{if } r_{ai} < MDL_i \end{aligned}$$

Where:

r_{ai}	= aliquot residue mass of inorganic run sample (g)	=	0.03899	g
MDL_i	= reported minimum gravimetric detection limit for inorganic fraction (g)	=	0.00034	g
F_r	= fraction of MDL applied to non-detectable run samples (g)	=	1.00	
$r_{ai-calc}$	= aliquot residue mass of inorganic run sample used in calculation (g)	=	0.03899	g

3. Residue mass of inorganic run sample (g)

$$r_i = (r_{ai-calc}) \left(\frac{v_{sl}}{v_{ai}} \right)$$

Where:

$r_{ai-calc}$	= aliquot residue mass of inorganic run sample used in calculation (g)	=	0.03899	g
v_{sl}	= liquid volume of inorganic run sample (mL)	=	771	mL
v_{ai}	= aliquot volume of inorganic run sample used in gravimetric analysis (mL)	=	771	mL
r_i	= residue mass of inorganic run sample (g)	=	0.03899	g

4. Mass of NH_3 added to form ammonium sulfate during titration of inorganic fraction (g)

$$\begin{aligned} m_c &= (17.03)(N)(v_t)(0.001) && \text{if } pH < 7.00 \\ m_c &= 0 && \text{if } pH \geq 7.00 \end{aligned}$$

Where:

17.03	= conversion constant for NH_3 (equation 12.2.1 of EPA M-202)	=	17.03	
N	= normality of titrant (meq/mL)	=	0.054422	mg/L
v_t	= volume of titrant added (mL)	=	3.95	mL
0.001	= conversion factor, (g/mg)	=	0.001	g/mg
pH	= pH of the inorganic fraction	=	2.58	
m_c	= mass of NH_3 added to form ammonium sulfate during titration of inorganic fraction (g)	=	0.00366	g

For Run 1, this correction was made due to a sample pH less than 7.0 and the addition of NH_4OH to the sample.

5. Aliquot residue mass of organic blank sample used in calculation (g)

$$r_{ao-blank-calc} = r_{ao-blank} \quad \text{if } r_{ao-blank} \geq MDL_o$$

$$r_{ao-blank-calc} = (MDL_o)(F_b) \quad \text{if } r_{ao-blank} < MDL_o$$

Where:

$r_{ao-blank}$	= aliquot residue mass of organic blank sample (g)	= 0.00126 g
MDL_o	= reported minimum gravimetric detection limit for organic fraction (g)	= 0.00028 g
F_b	= fraction of MDL applied to non-detectable blank samples (g)	= 0.00
$r_{ao-blank-calc}$	= aliquot residue mass of organic blank sample used in calculation (g)	= 0.00126 g

6. Aliquot residue mass of organic run sample used in calculation (g)

$$r_{ao-calc} = r_{ao} \quad \text{if } r_{ao} \geq MDL_o$$

$$r_{ao-calc} = (MDL_o)(F_r) \quad \text{if } r_{ao} < MDL_o$$

Where:

r_{ao}	= aliquot residue mass of organic run sample (g)	= 0.00127 g
MDL_o	= reported minimum gravimetric detection limit for organic fraction (g)	= 0.00028 g
F_r	= fraction of MDL applied to non-detectable run samples (g)	= 1.00
$r_{ao-calc}$	= organic sample aliquot residue mass used in calculation (g)	= 0.00127 g

7. Residue mass of organic sample (g)

$$r_o = (r_{ao-calc}) \left(\frac{v_{so}}{v_{ao}} \right)$$

Where:

$r_{ao-calc}$	= aliquot residue mass of organic run sample used in calculation (g)	= 0.00127 g
v_{so}	= liquid volume of organic run sample (mL)	= 458 mL
v_{ao}	= aliquot volume of organic run sample used in gravimetric analysis (mL)	= 458 mL
r_o	= residue mass of organic sample (g)	= 0.00127 g

8. Maximum allowable inorganic blank correction (g)

$$m_{bi} = \text{MINIMUM} \left[\left(\frac{(r_{ai-blank-calc} - m_{c-blank})(v_{si})}{v_{ai-blank}} \right) \text{ or } (0.002) \left(\frac{(r_{ai-blank-calc} - m_{c-blank})}{(r_{ai-blank-calc} - m_{c-blank}) + r_{ao-blank-calc}} \right) \text{ or } (r_i - m_c) \right]$$

if $(r_{ai-blank-calc} - m_{c-blank}) + r_{ao-blank-calc} > 0$

if $(r_{ai-blank-calc} - m_{c-blank}) + r_{ao-blank-calc} \leq 0$

$$m_{bi} = 0$$

Where:

$r_{ai-blank-calc}$	= aliquot residue mass of inorganic blank sample used in calculation (g)	= 0.00190 g
$m_{c-blank}$	= mass of NH ₃ added to form ammonium sulfate during titration of inorganic blank (g)	= 0.00000 g
v_{si}	= liquid volume of inorganic run sample (mL)	= 771 mL
$v_{ai-blank}$	= aliquot volume of inorganic blank sample used in gravimetric analysis (mL)	= 438 mL
0.002	= maximum total blank correction (equation 12.2.2 of EPA M-202) (g)	= 0.002 g
$r_{ao-blank-calc}$	= aliquot residue mass of organic blank sample used in calculation (g)	= 0.00126 g
r_i	= residue mass of inorganic run sample (g)	= 0.03899 g
m_c	= mass of NH ₃ added to form ammonium sulfate during titration of inorganic fraction (g)	= 0.00366 g
m_{bi}	= maximum allowable inorganic blank correction (g)	= 0.00120 g

The second part of the first expression is used; the blank exceeds the maximum inorganic blank correction

9. Net residue mass of inorganic run sample after NH₃ and blank correction (g)

$$m_{ri} = r_i - m_c - m_{bi}$$

Where:

r_i	= residue mass of inorganic run sample (g)	= 0.03899 g
m_c	= mass of NH ₃ added to form ammonium sulfate during titration of inorganic fraction (g)	= 0.00366 g
m_{bi}	= maximum allowable inorganic blank correction (g)	= 0.00120 g
m_{ri}	= net residue mass of inorganic run sample after NH ₃ and blank correction (g)	= 0.03413 g

10. Total inorganic condensable particulate matter (g)

$$m_{CPMi} = \text{MAXIMUM}[m_{ri} \text{ or } MDL_i]$$

Where:

m_{ri}	= net inorganic residue mass of sample after NH ₃ and blank correction (g)	= 0.03413 g
MDL_i	= reported minimum gravimetric detection limit for inorganic fraction (g)	= 0.00034 g
m_{CPMi}	= total inorganic condensable particulate matter (g)	= 0.03413 g

11. Maximum allowable organic blank correction (g)

$$m_{bo} = \text{MINIMUM} \left[\left(\frac{(r_{ao-blank-calc})(v_{so})}{v_{ao-blank}} \right) \text{ or } (0.002) \left(\frac{r_{ao-blank-calc}}{(r_{ai-blank-calc} - m_{c-blank}) + r_{ao-blank-calc}} \right) \text{ or } (r_o) \right]$$

if $(r_{ai-blank-calc} - m_{c-blank}) + r_{ao-blank-calc} > 0$

$$m_{bo} = 0 \quad \text{if } (r_{ai-blank-calc} - m_{c-blank}) + r_{ao-blank-calc} \leq 0$$

Where:

$r_{ao-blank-calc}$	= aliquot residue mass of organic blank sample used in calculation (g)	= 0.00126 g
v_{so}	= liquid volume of organic run sample (mL)	= 458 mL
$v_{ao-blank}$	= aliquot volume of organic blank sample used in gravimetric analysis (mL)	= 454 mL
0.002	= maximum total blank correction (equation 12.2.2 of EPA M-202) (g)	= 0.002 g
$r_{ai-blank-calc}$	= aliquot residue mass of inorganic blank sample used in calculation (g)	= 0.00190 g
$m_{c-blank}$	= mass of NH ₃ added to form ammonium sulfate during titration of inorganic blank (g)	= 0.00000 g
r_o	= residue mass of organic run sample (g)	= 0.00127 g
m_{bo}	= maximum allowable organic blank correction (g)	= 0.00080 g

The second part of the expression is used; the blank exceeds the maximum organic blank correction

12. Net organic residue mass of sample after blank correction (g)

$$m_{ro} = r_o - m_{bo}$$

Where:

r_o	= residue mass of organic run sample (g)	= 0.00127 g
m_{bo}	= maximum allowable organic blank correction (g)	= 0.00080 g
m_{ro}	= net organic residue mass of sample after blank correction (g)	= 0.00047 g

13. Total organic condensable particulate matter (g)

$$m_{CPMo} = \text{MAXIMUM}[m_{ro} \text{ or } MDL_o]$$

Where:

m_{ro} = net organic residue mass of sample after blank correction (g) = 0.00047 g

MDL_o = reported minimum gravimetric detection limit for organic fraction (g) = 0.00028 g

m_{CPMo} = total organic condensable particulate matter (g) = 0.00047 g

14. Total gravimetric result (g)

$$m_T = m_{CPMi} + m_{CPMo}$$

Where:

m_{CPMi} = total inorganic condensable particulate matter (g) = 0.03413 g

m_{CPMo} = total organic condensable particulate matter (g) = 0.00047 g

m_T = total gravimetric result (g) = 0.03460 g

15. Minimum detection limit for combined fractions (g)

$$MDL_c = MDL_i + MDL_o$$

Where:

MDL_i = reported minimum gravimetric detection limit for inorganic fraction (g) = 0.00034 g

MDL_o = reported minimum gravimetric detection limit for organic fraction (g) = 0.00028 g

MDL_c = minimum detection limit for combined fractions (g) = 0.00062 g

16. Total condensable particulate matter (g)

$$m_{CPM} = \text{MAXIMUM}[m_T \text{ or } MDL_c]$$

Where:

m_T = total gravimetric result (g) = 0.03460 g

MDL_c = minimum detection limit for combined fractions (g) = 0.00062 g

m_{CPM} = total condensable particulate matter (g) = 0.03460 g

USEPA Method 5/202 (FPM/CPM) Sample Emission Calculations for FPM

Sample data taken from Run 1

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1. Filterable particulate matter concentration (lb/dscf)

$$C_{sd} = \left(\frac{m_n}{V_{mstd}} \right) (2.205 \times 10^{-3})$$

Where:

m_n	= total filterable particulate matter (g)	= 0.10398	g
V_{mstd}	= volume metered, standard (dscf)	= 75.0457	dscf
2.205×10^{-3}	= conversion factor (lb/g)	= 2.205E-03	lb/g
C_{sd}	= filterable particulate matter concentration (lb/dscf)	= 3.055E-06	lb/dscf

2. Filterable particulate matter concentration (gr/dscf)

$$C_{sd} = \left(\frac{m_n}{V_{mstd}} \right) (15.43)$$

Where:

m_n	= total filterable particulate matter (g)	= 0.10398	g
V_{mstd}	= volume metered, standard (dscf)	= 75.0457	dscf
15.43	= conversion factor (gr/g)	= 15.43	gr/g
C_{sd}	= filterable particulate matter concentration (gr/dscf)	= 0.02138	gr/dscf

3. Filterable particulate matter concentration (mg/dscm)

$$C_{sd} = \left(\frac{m_n}{V_{mstd}} \right) (1000)(35.31)$$

Where:

m_n	= total filterable particulate matter (g)	= 0.10398	g
V_{mstd}	= volume metered, standard (dscf)	= 75.0457	dscf
1000	= conversion factor (mg/g)	= 1000	mg/g
35.31	= conversion factor (dscf/dscm)	= 35.31	dscf/dscm
C_{sd}	= filterable particulate matter concentration (mg/dscm)	= 48.92396	mg/dscm

4. Filterable particulate matter concentration (mg/Nm³ dry)

$$C_{sd} = \left(\frac{m_n}{V_{mstd}} \right) (1000)(35.31) \left(\frac{68+460}{32+460} \right)$$

Where:

m_n	= total filterable particulate matter (g)	= 0.10398	g
V_{mstd}	= volume metered, standard (dscf)	= 75.0457	dscf
1000	= conversion factor (mg/g)	= 1000	mg/g
35.31	= conversion factor (dscf/dscm)	= 35.31	dscf/dscm
68	= standard temperature (°F)	= 68	°F
32	= normal temperature (°F)	= 32	°F
460	= °F to °R conversion constant	= 460	
C_{sd}	= filterable particulate matter concentration (mg/Nm ³ dry)	= 52.50376	mg/Nm ³ dry

5. Filterable particulate matter concentration at actual gas conditions (gr/acf example)

$$C_a = C_{sd} \left(\frac{Q_{std}}{Q_a} \right)$$

Where:

C_{sd}	= filterable particulate matter concentration (gr/dscf)	=	0.02138	gr/dscf
Q_{std}	= volumetric flow rate at standard conditions, dry basis (dscfm)	=	130,946	dscfm
Q_a	= volumetric flow rate at actual conditions (acfm)	=	203,609	acfm
C_a	= filterable particulate matter concentration at actual gas conditions (gr/acf)	=	0.01375	gr/acf

6. Filterable particulate matter rate (lb/hr)

$$E_{lb/hr} = \left(\frac{m_n}{V_{mstd}} \right) (2.205 \times 10^{-3}) (Q_{std}) (60)$$

Where:

m_n	= total filterable particulate matter (g)	=	0.10398	g
V_{mstd}	= volume metered, standard (dscf)	=	75.0457	dscf
2.205×10^{-3}	= conversion factor (lb/g)	=	2.205E-03	lb/g
Q_{std}	= volumetric flow rate at standard conditions, dry basis (dscfm)	=	130,946	dscfm
60	= conversion factor (min/hr)	=	60	min/hr
$E_{lb/hr}$	= filterable particulate matter rate (lb/hr)	=	24.0036	lb/hr

**USEPA Method 5/202 (FPM/CPM)
Sample Emission Calculations for CPM**

Sample data taken from Run 1

Note: The tables presenting the results are generated electronically from raw data. It may not be possible to exactly duplicate these results using a calculator. The reference method data, results, and all calculations are carried to sixteen decimal places throughout. The final table is formatted to an appropriate number of significant figures.

090911 115313

1. Condensable particulate matter concentration (lb/dscf)

$$C_{sd} = \left(\frac{m_{CPM}}{V_{mstd}} \right) (2.205 \times 10^{-3})$$

Where:

m_{CPM}	= total condensable particulate matter (g)	= 0.03460	g
V_{mstd}	= volume metered, standard (dscf)	= 75.0457	dscf
2.205×10^{-3}	= conversion factor (lb/g)	= 2.205E-03	lb/g
C_{sd}	= condensable particulate matter concentration (lb/dscf)	= 1.0166E-06	lb/dscf

2. Condensable particulate matter matter concentration (gr/dscf)

$$C_{sd} = \left(\frac{m_{CPM}}{V_{mstd}} \right) (15.43)$$

Where:

m_{CPM}	= total condensable particulate matter (g)	= 0.03460	g
V_{mstd}	= volume metered, standard (dscf)	= 75.0457	dscf
15.43	= conversion factor (gr/g)	= 15.43	gr/g
C_{sd}	= condensable particulate matter concentration (gr/dscf)	= 0.00711	gr/dscf

3. Condensable particulate matter concentration (mg/dscm)

$$C_{sd} = \left(\frac{m_{CPM}}{V_{mstd}} \right) (1000)(35.31)$$

Where:

m_{CPM}	= total condensable particulate matter (g)	= 0.03460	g
V_{mstd}	= volume metered, standard (dscf)	= 75.0457	dscf
1000	= conversion factor (mg/g)	= 1,000	mg/g
35.31	= conversion factor (dscf/dscm)	= 35.31	dscf/dscm
C_{sd}	= condensable particulate matter concentration (mg/dscm)	= 16.27934	mg/dscm

4. Condensable particulate matter concentration (mg/Nm³ dry)

$$C_{sd} = \left(\frac{m_{CPM}}{V_{mstd}} \right) (1000)(35.31) \left(\frac{68 + 460}{32 + 460} \right)$$

Where:

m_{CPM}	= total condensable particulate matter (g)	= 0.03460	g
V_{mstd}	= volume metered, standard (dscf)	= 75.0457	dscf
1000	= conversion factor (mg/g)	= 1,000	mg/g
35.31	= conversion factor (dscf/dscm)	= 35.31	dscf/dscm
68	= standard temperature (°F)	= 68	°F
32	= normal temperature (°F)	= 32	°F
460	= °F to °R conversion constant	= 460	
C_{sd}	= condensable particulate matter concentration (mg/Nm ³ dry)	= 17.47051	mg/Nm ³ dry

5. Condensable particulate matter concentration at actual gas conditions (gr/acf example)

$$C_a = C_{sd} \left(\frac{Q_{std}}{Q_a} \right)$$

Where:

C_{sd}	= condensable particulate matter concentration (gr/dscf)	=	0.00711	gr/dscf
Q_{std}	= volumetric flow rate at standard conditions, dry basis (dscfm)	=	130,946	dscfm
Q_a	= volumetric flow rate at actual conditions (acfm)	=	203,609	acfm
C_a	= condensable particulate matter concentration at actual gas conditions (gr/acf)	=	0.00458	gr/acf

6. Condensable particulate matter rate (lb/hr)

$$E_{lb/hr} = \left(\frac{m_{CPM}}{V_{mstd}} \right) (2.205 \times 10^{-3}) (Q_{std}) (60)$$

Where:

m_{CPM}	= total condensable particulate matter (g)	=	0.03460	g
V_{mstd}	= volume metered, standard (dscf)	=	75.0457	dscf
2.205×10^{-3}	= conversion factor (lb/g)	=	2.205E-03	lb/g
Q_{std}	= volumetric flow rate at standard conditions, dry basis (dscfm)	=	130,946	dscfm
60	= conversion factor (min/hr)	=	60	min/hr
$E_{lb/hr}$	= condensable particulate matter rate (lb/hr)	=	7.98716	lb/hr

USEPA Method 5/202 (FPM/CPM) Sample Emission Calculations for Total Particulate Matter

Sample data taken from Run 1

Note: The tables presenting the results are generated electronically from raw data. It may not be possible to exactly duplicate these results using a calculator. The reference method data, results, and all calculations are carried to sixteen decimal places throughout. The final table is formatted to an appropriate number of significant figures.

090911 115313

1. Total particulate matter

$$m_{Part} = m_n + m_{CPM}$$

Where:

m_n	= total filterable particulate matter from 5 (g)	= 0.10398
m_{CPM}	= total condensable particulate matter from 202 (g)	= 0.03460
m_{Part}	= total particulate matter (g)	= 0.13858

2. Total particulate matter concentration (lb/dscf)

$$C_{sd} = \left(\frac{m_{Part}}{V_{mstd}} \right) (2.205 \times 10^{-3})$$

Where:

m_{Part}	= total particulate matter (g)	= 0.13858	g
V_{mstd}	= volume metered, standard (dscf)	= 75.0457	dscf
2.205×10^{-3}	= conversion factor (lb/g)	= 2.205E-03	lb/g
C_{sd}	= total particulate matter concentration (lb/dscf)	= 4.0717E-06	lb/dscf

3. Total particulate matter concentration (gr/dscf)

$$C_{sd} = \left(\frac{m_{Part}}{V_{mstd}} \right) (15.43)$$

Where:

m_{Part}	= total particulate matter (g)	= 0.13858	g
V_{mstd}	= volume metered, standard (dscf)	= 75.0457	dscf
15.43	= conversion factor (gr/g)	= 15.43	gr/g
C_{sd}	= total particulate matter concentration (gr/dscf)	= 0.02849	gr/dscf

4. Total particulate matter concentration (mg/dscm)

$$C_{sd} = \left(\frac{m_{Part}}{V_{mstd}} \right) (1000)(35.31)$$

Where:

m_{Part}	= total particulate matter (g)	= 0.13858	g
V_{mstd}	= volume metered, standard (dscf)	= 75.0457	dscf
1000	= conversion factor (mg/g)	= 1000	mg/g
35.31	= conversion factor (dscf/dscm)	= 35.31	dscf/dscm
C_{sd}	= total particulate matter concentration (mg/dscm)	= 65.20330	mg/dscm

5. Total particulate matter concentration (mg/Nm³ dry)

$$C_{sd} = \left(\frac{m_{Part}}{V_{mstd}} \right) (1000) (35.31) \left(\frac{68 + 460}{32 + 460} \right)$$

Where:

m_{Part}	= total particulate matter (g)	= 0.13858	g
V_{mstd}	= volume metered, standard (dscf)	= 75.0457	dscf
1000	= conversion factor (mg/g)	= 1000	mg/g
35.31	= conversion factor (dscf/dscm)	= 35.31	dscf/dscm
68	= standard temperature (°F)	= 68	°F
32	= normal temperature (°F)	= 32	°F
460	= °F to °R conversion constant	= 460	

C_{sd}	= total particulate matter concentration (mg/Nm ³ dry)	= 69.97427	mg/Nm ³ dry
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6. Total particulate matter concentration at actual gas conditions (gr/acf example)

$$C_a = C_{sd} \left(\frac{Q_{std}}{Q_a} \right)$$

Where:

C_{sd}	= particulate concentration (gr/dscf)	= 0.02849	gr/dscf
Q_{std}	= volumetric flow rate at standard conditions, dry basis (dscfm)	= 130,946	dscfm
Q_a	= volumetric flow rate at actual conditions (acfm)	= 203,609	acfm

C_a	= total particulate matter concentration at actual gas conditions (gr/acf)	= 0.01832	gr/acf
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7. Total particulate matter rate (lb/hr)

$$E_{lb/hr} = \left(\frac{m_{Part}}{V_{mstd}} \right) (2.205 \times 10^{-3}) (Q_{std}) (60)$$

Where:

m_{Part}	= total particulate matter (g)	= 0.13858	g
V_{mstd}	= volume metered, standard (dscf)	= 75.0457	dscf
2.205×10^{-3}	= conversion factor (lb/g)	= 2.205E-03	lb/g
Q_{std}	= volumetric flow rate at standard conditions, dry basis (dscfm)	= 130,946	dscfm
60	= conversion factor (min/hr)	= 60	min/hr

$E_{lb/hr}$	= total particulate matter rate (lb/hr)	= 31.99079	lb/hr
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USEPA Mod. CTM-027 NH₃ Analyte Calculations

Sample data taken from Run 1

Note: The tables presenting the results are generated electronically from raw data. It may not be possible to exactly duplicate these results using a calculator. The reference method data, results, and all calculations are carried to sixteen decimal places throughout. The final table is formatted to an appropriate number of significant figures.

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H

1. Ammonium to NH₃ conversion factor

$$K_{NH_3} = \frac{MW_{NH_3}}{n \times MW_{NH_4^+}}$$

Where:

MW _{NH3}	= molecular weight of NH ₃ (mg/mg-mole)	=	17.030	mg/mg-mole
MW _{NH4+}	= molecular weight of ammonium ion (mg/mg-mole)	=	18.040	mg/mg-mole
n	= molar ratio of ammonium to NH ₃	=	1.0	mole NH ₄ /mole NH ₃
K _{NH3}	= conversion factor to convert mass NH ₄ ⁺ to mass NH ₃	=	0.944	

2. Total NH₃ collected (mg)

$$m_{NH_3} = K_{NH_3} \times \frac{(S_{NH_4} v_1 + S_{NH_4} v_2)}{1000}$$

Where:

K _{NH3}	= conversion factor to convert mass NH ₄ ⁺ to mass NH ₃	=	0.944	
S _{NH4-1}	= ammonium concentration of sample fraction 1 (mg/liter)	=	3.1400	mg/liter
v ₁	= liquid volume of sample fraction 1 (ml)	=	410.0	ml
S _{NH4-2}	= ammonium concentration of sample fraction 2 (mg/liter)	=	0.1800	mg/liter
v ₂	= liquid volume of sample fraction 2 (ml)	=	230.0	ml
1000	= conversion factor (ml/liter)	=	1000	ml/liter
m _{NH3}	= total NH ₃ collected in sample (mg)	=	1.2544	mg

DEFINITION

Fraction 1 = entire sample except last impinger containing applicable absorbing reagent.
Fraction 2 = last impinger containing applicable absorbing reagent, analyzed separately to evaluate collection efficiency.
If entire sample is analyzed as a single fraction, then data is included as Fraction 1 (Fraction 2 = 0).

3. Allowable blank subtraction (mg)

$$m_b = K_{NH_3} \times B_{NH_4} \times \frac{(v_1 + v_2)}{1000}$$

$$m_b = 0 \text{ if } B_{NH_4} < MDL$$

Where:

K _{NH3}	= conversion factor to convert mass NH ₄ ⁺ to mass NH ₃	=	0.944	
B _{NH4}	= ammonium concentration of blank (mg/liter)	=	<0.0110	mg/liter
v ₁	= liquid volume of sample fraction 1 (ml)	=	410.0	ml
v ₂	= liquid volume of sample fraction 2 (ml)	=	230.0	ml
1000	= conversion factor (ml/liter)	=	1000	ml/liter
m _b	= allowable blank subtraction (mg)	=	0.0000	mg

4. Total NH₃ collected, corrected for blank (mg)

$$m_{nb} = m_{NH_3} - m_b$$

Where:

m_{NH_3}	= total NH ₃ collected in sample (mg)	=	1.2544	mg
m_b	= allowable blank subtraction (mg)	=	0.0000	mg
m_{nb}	= total NH ₃ collected, corrected for blank (mg)	=	1.2544	mg

5. Minimum detectable NH₃ (mg)

$$m_{MDL} = K_{NH_3} \times MDL \times \frac{(v_1 + v_2)}{1000}$$

Where:

K_{NH_3}	= conversion factor to convert mass NH ₄ ⁺ to mass NH ₃	=	0.944	
MDL	= minimum detectable ammonium concentration	=	0.011	mg/liter
v_1	= liquid volume of sample fraction 1 (ml)	=	410.0	ml
v_2	= liquid volume of sample fraction 2 (ml)	=	230.0	ml
1000	= conversion factor (ml/liter)	=	1000	ml/liter
m_{MDL}	= minimum detectable NH ₃ (mg)	=	0.0066	mg

6. Total NH₃ value used in emission calculations (mg)

$$m_n = \text{MAXIMUM} [m_{nb} \text{ or } < m_{MDL}]$$

Where:

m_{nb}	= total NH ₃ collected, corrected for blank (mg)	=	1.2544	mg
m_{MDL}	= minimum detectable NH ₃ (mg)	=	0.0066	mg
m_n	= total NH ₃ value used in emission calculations (mg)	=	1.2544	mg

7. Collection QC check (% mass collected in second fraction)

$$EFF = 100 \times \frac{K_{NH_3} \times S_{NH_4-2} \times \frac{v_2}{1000}}{m_{NH_3}}$$

Where:

K_{NH_3}	= conversion factor to convert mass NH ₄ ⁺ to mass NH ₃	=	0.944	
S_{NH_4-2}	= ammonium concentration of sample fraction 2 (mg/liter)	=	0.1800	mg/liter
v_2	= liquid volume of sample fraction 2 (ml)	=	230.0	ml
m_{NH_3}	= total NH ₃ collected in sample (mg)	=	1.2544	mg
1000	= conversion factor (ml/liter)	=	1000	ml/liter
100	= conversion factor	=	100	%
EFF	= Collection QC check (% mass collected in second fraction)	=	3.12	%

USEPA Mod. CTM-027 NH₃ Sample Calculations

Sample data taken from Run 1

Note: The tables presenting the results are generated electronically from raw data. It may not be possible to exactly duplicate these results using a calculator. The reference method data, results, and all calculations are carried to sixteen decimal places throughout. The final table is formatted to an appropriate number of significant figures.

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N_H

1. NH₃ concentration (lb/dscf)

$$C_{sd} = \left(\frac{m_n}{V_{mstd}} \right) \left(\frac{2.205 \times 10^{-3}}{1000} \right)$$

Where:

m_n	= total NH ₃ collected, corrected for applicable blank (mg)	= 1.2544	mg
V_{mstd}	= volume metered, standard (dscf)	= 37.6969	dscf
2.205×10^{-3}	= conversion factor (lb/g)	= 2.205E-03	lb/g
1000	= conversion factor (mg/g)	= 1,000	mg/g
C_{sd}	= NH ₃ concentration (lb/dscf)	= 7.3373E-08	lb/dscf

2. NH₃ concentration (ppmdv)

$$C_{sd} = \left(\frac{m_n}{V_{mstd}} \right) \left(\frac{0.850}{1000} \right) \left(\frac{10^6}{MW} \right)$$

Where:

m_n	= total NH ₃ collected, corrected for applicable blank (mg)	= 1.2544	mg
V_{mstd}	= volume metered, standard (dscf)	= 37.6969	dscf
MW	= molecular weight of NH ₃ (g/g-mole)	= 17.030	g/g-mole
0.850	= conversion factor (dscf/g-mole)	= 0.850	dscf/g-mole
1000	= conversion factor (mg/g)	= 1,000	mg/g
10^6	= conversion factor (ppm)	= 10^6	ppm
C_{sd}	= NH ₃ concentration (ppmdv)	= 1.6609	ppmdv

3. NH₃ concentration (ppmwv)

$$C_w = C_{sd} \left(1 - \frac{B_w}{100} \right)$$

Where:

C_{sd}	= NH ₃ concentration (ppmdv)	= 1.6609	ppmdv
B_w	= actual water vapor in gas (% v/v)	= 25.2301	% v/v
100	= conversion factor (%)	= 100	%
C_w	= NH ₃ concentration (ppmwv)	= 1.2418	ppmwv

4. NH₃ concentration (mg/dscm)

$$C_{sd} = \left(\frac{m_n}{V_{mstd}} \right) (35.31)$$

Where:

m_n	= total NH ₃ collected, corrected for applicable blank (mg)	=	1.2544	mg
V_{mstd}	= volume metered, standard (dscf)	=	37.6969	dscf
35.31	= conversion factor (dscf/dscm)	=	35.31	dscf/dscm
C_{sd}	= NH ₃ concentration (mg/dscm)	=	1.1750	mg/dscm

5. NH₃ concentration (mg/Nm³ dry)

$$C_{sd} = \left(\frac{m_n}{V_{mstd}} \right) (35.31) \left(\frac{68 + 460}{32 + 460} \right)$$

Where:

m_n	= total NH ₃ collected, corrected for applicable blank (mg)	=	1.2544	mg
V_{mstd}	= volume metered, standard (dscf)	=	37.6969	dscf
35.31	= conversion factor (dscf/dscm)	=	35.31	dscf/dscm
68	= standard temperature (°F)	=	68	°F
32	= normal temperature (°F)	=	32	°F
460	= °F to °R conversion constant	=	460	
C_{sd}	= NH ₃ concentration (mg/Nm ³ dry)	=	1.2609	mg/Nm ³ dry

6. NH₃ concentration at actual gas conditions (lb/acf example)

$$C_a = C_{sd} \left(\frac{Q_{std}}{Q_a} \right)$$

Where:

C_{sd}	= NH ₃ concentration (lb/dscf)	=	7.3373E-08	lb/dscf
Q_{std}	= volumetric flow rate at standard conditions, dry basis (dscfm)	=	132,267	dscfm
Q_a	= volumetric flow rate at actual conditions (acfm)	=	208,502	acfm
C_a	= NH ₃ concentration at actual gas conditions (lb/acf)	=	4.6545E-08	lb/acf

7. NH₃ rate (lb/hr)

$$E_{lb/hr} = \left(\frac{m_n}{V_{mstd}} \right) \left(\frac{2.205 \times 10^{-3}}{1000} \right) (Q_{std}) (60)$$

Where:

m_n	= total NH ₃ collected, corrected for applicable blank (mg)	=	1.2544	mg
V_{mstd}	= volume metered, standard (dscf)	=	37.6969	dscf
2.205×10^{-3}	= conversion factor (lb/g)	=	2.205E-03	lb/g
1000	= conversion factor (mg/g)	=	1,000	mg/g
Q_{std}	= volumetric flow rate at standard conditions, dry basis (dscfm)	=	132,267	dscfm
60	= conversion factor (min/hr)	=	60	min/hr
$E_{lb/hr}$	= NH ₃ rate (lb/hr)	=	0.5823	lb/hr

USEPA Method 29 (Non-Mercury Metals) Sampling, Velocity and Moisture Sample Calculations

Sample data taken from Run 1

Note: The tables presenting the results are generated electronically from raw data. It may not be possible to exactly duplicate these results using a calculator. The reference method data, results, and all calculations are carried to sixteen decimal places throughout. The final table is formatted to an appropriate number of significant figures.

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M

1. Volume of water collected (wscf)

$$V_{wstd} = (0.04706)(V_{lc})$$

Where:

V_{lc}	= total volume of liquid collected in impingers and silica gel (ml)	=	858.0	ml
0.04706	= ideal gas conversion factor (ft ³ water vapor/ml or gm)	=	0.04706	ft ³ /ml
V_{wstd}	= volume of water vapor collected at standard conditions (ft ³)	=	40.38	ft ³

2. Volume of gas metered, standard conditions (dscf)

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

Where:

P_{bar}	= barometric pressure (in. Hg)	=	29.40	in. Hg
T_m	= average dry gas meter temperature (°F)	=	102.15	°F
V_m	= volume of gas sample through the dry gas meter at meter conditions (dcf)	=	131.11	dcf
Y_d	= gas meter correction factor (dimensionless)	=	0.9992	
ΔH	= average pressure drop across meter box orifice (in. H ₂ O)	=	1.52	in. H ₂ O
17.64	= standard temperature to pressure ratio (°R/in. Hg)	=	17.64	°R/in. Hg
13.6	= conversion factor (in. H ₂ O/in. Hg)	=	13.6	in. H ₂ O/in. Hg
460	= °F to °R conversion constant	=	460	
V_{mstd}	= volume of gas sampled through the dry gas meter at standard conditions (dscf)	=	121.318	dscf

3. Sample gas pressure (in. Hg)

$$P_s = P_{bar} + \left(\frac{P_g}{13.6} \right)$$

Where:

P_{bar}	= barometric pressure (in. Hg)	=	29.40	in. Hg
P_g	= sample gas static pressure (in. H ₂ O)	=	-0.50	in. H ₂ O
13.6	= conversion factor (in. H ₂ O/in. Hg)	=	13.6	in. H ₂ O/in. Hg
P_s	= absolute sample gas pressure (in. Hg)	=	29.36	in. Hg

4. Actual water vapor pressure at sample gas temperature less than 212°F (in. Hg)

$$P_v = \frac{e^{\left(\frac{18.3036 - \frac{3816.44}{\frac{5}{9}(T_s - 32) + 273.15 - 46.13}}{25.4} \right)}}{25.4}$$

Where:

T_s	= average sample gas temperature (°F)	=	151.72	°F
18.3036	= Antoine coefficient	=	18.3036	°K
3816.44	= Antoine coefficient	=	3816.44	°K
273.15	= temperature conversion factor	=	273.15	°K
46.13	= Antoine coefficient	=	46.13	°K
25.4	= conversion factor	=	25.4	mm Hg/in. Hg
5/9	= Fahrenheit to Celsius conversion factor	=	5/9	°C/°F
32	= temperature conversion (°F)	=	32	°F
P_v	= vapor pressure, actual (in. Hg)	=	7.90	in. Hg

5. Water vapor pressure at gas temperature greater than 212°F (in. Hg)

$$P_v = P_s$$

Where:

P_s	= absolute sample gas pressure (in. Hg)	=	29.36	in. Hg
P_v	= water vapor pressure, actual (in. Hg)	=	Previously Defined	in. Hg

6. Moisture measured in sample (% by volume)

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

Where:

V_{mstd}	= volume of gas sampled through the dry gas meter at standard conditions (dscf)	=	121.318	dscf
V_{wstd}	= volume of water collected at standard conditions (scf)	=	40.38	scf
B_{wo}	= proportion of water measured in the gas stream by volume	=	0.2497	%

7. Saturated moisture content (% by volume)

$$B_{ws} = \frac{P_v}{P_s}$$

Where:

P_s	= absolute sample gas pressure (in. Hg)	=	29.36	in. Hg
P_v	= water vapor pressure, actual (in. Hg)	=	7.90	in. Hg
B_{ws}	= proportion of water vapor in the gas stream by volume at saturated conditions	=	0.2691	%

8. Actual water vapor in gas (% by volume)

$$B_w = \text{MINIMUM} [B_{wO}, B_{wS}]$$

Where:

B_{wS}	= proportion of water vapor in the gas stream by volume at saturated conditions	=	0.2691	
B_{wO}	= proportion of water measured in the gas stream by volume	=	0.2497	
B_w	= actual water vapor in gas	=	0.2497	
		=	24.97	%

9. Nitrogen (plus carbon monoxide) in gas stream (% by volume, dry)

$$N_2 + CO = 100 - CO_2 - O_2$$

Where:

CO_2	= proportion of carbon dioxide in the gas stream by volume (%)	=	13.6	%
O_2	= proportion of oxygen in the gas stream by volume (%)	=	3.6	%
100	= conversion factor (%)	=	100	%
N_2+CO	= proportion of nitrogen and CO in the gas stream by volume (%)	=	82.80	%

10. Molecular weight of dry gas stream (lb/lb-mole)

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

Where:

M_{CO_2}	= molecular weight of carbon dioxide (lb/lb-mole)	=	44.00	lb/lb-mole
M_{O_2}	= molecular weight of oxygen (lb/lb-mole)	=	32.00	lb/lb-mole
M_{N_2+CO}	= molecular weight of nitrogen and carbon monoxide (lb/lb-mole)	=	28.00	lb/lb-mole
CO_2	= proportion of carbon dioxide in the gas stream by volume (%)	=	13.6	%
O_2	= proportion of oxygen in the gas stream by volume (%)	=	3.6	%
N_2+CO	= proportion of nitrogen and CO in the gas stream by volume (%)	=	82.8	%
100	= conversion factor (%)	=	100	%
M_d	= dry molecular weight of sample gas (lb/lb-mole)	=	30.32	lb/lb-mole

11. Molecular weight of sample gas (lb/lb-mole)

$$M_s = (M_d)(1 - B_w) + (M_{H_2O})(B_w)$$

Where:

B_w	= proportion of water vapor in the gas stream by volume	=	0.2497	
M_d	= dry molecular weight of sample gas (lb/lb-mole)	=	30.32	lb/lb-mole
M_{H_2O}	= molecular weight of water (lb/lb-mole)	=	18.00	lb/lb-mole
M_s	= molecular weight of sample gas, wet basis (lb/lb-mole)	=	27.24	lb/lb-mole

12. Velocity of sample gas (ft/sec)

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

Where:

K_p	= velocity pressure constant	=	85.49	
C_p	= pitot tube coefficient	=	0.82	
M_s	= wet molecular weight of sample gas, wet basis (lb/lb-mole)	=	27.24	lb/lb-mole
P_s	= absolute sample gas pressure (in. Hg)	=	29.36	in. Hg
T_s	= average sample gas temperature (°F)	=	151.72	°F
$\sqrt{\Delta P}$	= average square roots of velocity heads of sample gas (in. H ₂ O)	=	0.812	√in. H ₂ O
460	= °F to °R conversion constant	=	460	
V_s	= sample gas velocity (ft/sec)	=	49.80	ft/sec

13. Volumetric flow rate of sample gas at actual gas conditions (acfm)

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

Where:

A_s	= cross sectional area of sampling location (ft ²)	=	70.88	ft ²
V_s	= sample gas velocity (ft/sec)	=	49.80	ft/sec
60	conversion factor (sec/min)	=	60	sec/min
Q_a	= volumetric flow rate at actual conditions (acfm)	=	211,786	acfm

14. Total flow of sample gas (scfm)

$$Q_s = (Q_a) \left(\frac{P_s}{29.92} \right) \left(\frac{68 + 460}{T_s + 460} \right)$$

Where:

Q_a	= volumetric flow rate at actual conditions (acfm)	=	211,786	acfm
P_s	= absolute sample gas pressure (in. Hg)	=	29.36	in. Hg
29.92	= standard pressure (in. Hg)	=	29.92	in. Hg
T_s	= average sample gas temperature (°F)	=	151.7	°F
68	= standard temperature (°F)	=	68	°F
460	= °F to °R conversion constant	=	460	
Q_s	= volumetric flow rate at standard conditions, wet basis (scfm)	=	179,399	scfm

15. Dry flow of sample gas (dscfm)

$$Q_{std} = (Q_s)(1 - B_w)$$

Where:

B_w	= proportion of water vapor in the gas stream by volume	=	0.2497	
Q_s	= volumetric flow rate at standard conditions, wet basis (scfm)	=	179,399	scfm
Q_{std}	= volumetric flow rate at standard conditions, dry basis (dscfm)	=	134,601	dscfm

16. Hourly time basis conversion of volumetric flow rate (Q_{std} example)

$$Q_{std-hr} = (Q_{std-min})(60)$$

Where

$Q_{std-min}$	= volumetric flow rate, english units (ft ³ /min)	=	134,601	dscfm
60	= conversion factor (min/hr)	=	60	min/hr

Q_{std-hr}	= volumetric flow rate, hourly basis (dscf/hr)	=	8,076,037	dscf/hr
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17. Metric Conversion of Gas Volumes (Q_{std} example)

$$Q_{std-metric} = (Q_{std-english}) \left(\frac{60}{35.31} \right)$$

Where:

$Q_{std-english}$	= volumetric flow rate, english units (ft ³ /min)	=	134,601	dscfm
35.31	= conversion factor (ft ³ /m ³)	=	35.31	ft ³ /m ³
60	= conversion factor (min/hr)	=	60	min/hr

$Q_{std-metric}$	= volumetric flow rate, metric units (m ³ /hr)	=	228,718	dry std m ³ /hr
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18. Standard to Normal Conversion of Gas Volumes (Q_{std} example)

$$Q_{Normal} = (Q_{std-metric}) \left(\frac{32 + 460}{68 + 460} \right)$$

Where:

$Q_{std-metric}$	= volumetric flow rate, metric units (dry std m ³ /hr)	=	228,718	dry std m ³ /hr
32	= normal temperature (°F)	=	32	°F
68	= standard temperature (°F)	=	68	°F
460	= standard temperature in Rankine (68°F)	=	460	

Q_{Normal}	= volumetric flow rate, metric units (dry Nm ³ /hr)	=	213,124	dry Nm ³ /hr
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19. Percent isokinetic (%)

$$I = \frac{(0.09450)(\overline{T_s} + 460)(V_{mstd})}{(P_s)(V_s)\left(\frac{(D_n)^2(\pi)}{(144)(4)}\right)(\Theta)(1 - B_w)}$$

Where:

D_n	= diameter of nozzle (in)	=	0.250	in.
B_w	= proportion of water vapor in the gas stream by volume	=	0.2497	
P_s	= absolute sample gas pressure (in. Hg)	=	29.36	in. Hg
T_s	= average sample gas temperature (°F)	=	151.7	°F
V_{mstd}	= volume of gas sample through the dry gas meter at standard conditions (dscf)	=	121.318	dscf
V_s	= sample gas velocity (ft/sec)	=	49.80	ft/sec
Θ	= total sampling time (min)	=	180	min
0.0945	= conversion constant	=	0.0945	
460	= °F to °R conversion constant	=	460	
I	= percent of isokinetic sampling (%)	=	104.18	%

20. Alternative Method 5 Post-Test Meter Calibration Factor

$$Y_{qa} = \frac{\Theta}{V_m} \sqrt{\frac{(0.0319)(T_m + 460)(28.96)}{(\Delta H_{@})(P_{bar} + \frac{\Delta H}{13.6})(M_d)}} (\sqrt{\Delta H})_{avg}$$

Where:

Θ	= total sampling time (min)	=	180	min
V_m	= volume of gas sample through the dry gas meter at meter conditions (dcf)	=	131.11	dcf
T_m	= average dry gas meter temperature (°F)	=	102.15	°F
$\Delta H_{@}$	= dry gas meter orifice coefficient	=	1.7185	
P_{bar}	= barometric pressure (in. Hg)	=	29.40	in. Hg
ΔH	= average pressure drop across meter box orifice (in. H ₂ O)	=	1.517	in. H ₂ O
M_d	= dry molecular weight of sample gas (lb/lb-mole)	=	30.32	lb/lb-mole
$\sqrt{\Delta H}_{avg}$	= average of square root of pressure drop across meter orifice	=	1.229	$\sqrt{\text{in. H}_2\text{O}}$
0.0319	= conversion constant	=	0.0319	
28.96	= molecular weight of ambient air (lb/lb-mole)	=	28.96	lb/lb-mole
13.6	= conversion factor (in. H ₂ O/in. Hg)	=	13.6	in. H ₂ O/in. Hg
460	= °F to °R conversion constant	=	460	
Y_{qa}	= alternative Method 5 post-test meter calibration factor	=	0.9803	

LOGIC FOR TREATING DETECTION LIMITS

(all metals except mercury)

1. Logic for Determining Maximum Allowable Front-Half Blank Correction ($m_{FB-allow}$)

	CASE 1 $m_{FB} = D$	CASE 2 $m_{FB} = ND$
Rule		
$ND = 0$	$m_{FB-allow} = M29 \text{ Rule}$	$m_{FB-allow} = 0$
$ND = 1x$	$m_{FB-allow} = M29 \text{ Rule}$	$m_{FB-allow} = 0$
$ND = 0.5x$	$m_{FB-allow} = M29 \text{ Rule}$	$m_{FB-allow} = 0$

2. Logic for Determining Blank-Corrected Front-Half Sample Amount (m_F)

	CASE 1 $m_{FS} - m_{FB-allow} \geq MDL$	CASE 2 $m_{FS} - m_{FB-allow} < MDL$
Rule		
$ND = 0$	$m_F = m_{FS} - m_{FB-allow}$	$m_F = < MDL$
$ND = 1x$	$m_F = m_{FS} - m_{FB-allow}$	$m_F = < MDL$
$ND = 0.5x$	$m_F = m_{FS} - m_{FB-allow}$	$m_F = < MDL$

3. Logic for Determining Maximum Allowable Back-Half Blank Correction ($m_{BB-allow}$)

	CASE 1 $m_{BB} = D$	CASE 2 $m_{BB} = ND$
Rule		
$ND = 0$	$m_{BB-allow} = M29 \text{ Rule}$	$m_{BB-allow} = 0$
$ND = 1x$	$m_{BB-allow} = M29 \text{ Rule}$	$m_{BB-allow} = 0$
$ND = 0.5x$	$m_{BB-allow} = M29 \text{ Rule}$	$m_{BB-allow} = 0$

4. Logic for Determining Blank-Corrected Back-Half Sample Amount (m_B)

	CASE 1 $m_{BS} - m_{BB-allow} \geq MDL$	CASE 2 $m_{BS} - m_{BB-allow} < MDL$
Rule		
$ND = 0$	$m_B = m_{BS} - m_{BB-allow}$	$m_B = < MDL$
$ND = 1x$	$m_B = m_{BS} - m_{BB-allow}$	$m_B = < MDL$
$ND = 0.5x$	$m_B = m_{BS} - m_{BB-allow}$	$m_B = < MDL$

5. Logic for Adding Front and Back-Half Corrected Samples (m_n)

	CASE 1 Both are D	CASE 2 One is D, other is ND	CASE 3 Both are ND
Rule			
$ND = 0$	$m_n = m_F + m_B$	$m_n = D$	$m_n = < \text{Sum ND}$
$ND = 1x$	$m_n = m_F + m_B$	$m_n = < [D + ND]$	$m_n = < \text{Sum ND}$
$ND = 0.5x$	$m_n = m_F + m_B$	$m_n = < [D + 0.5ND]$	$m_n = < 0.5 \text{ Sum ND}$

Definitions and Notes

The term "Rule" refers to the rule being implemented for handling non-detectable quantities in summations
MDL = minimum detection limit.

D = Detectable quantity reported as D.

ND = Non-Detectable quantity reported at a value of ND.

If Front and Back-Half fractions are combined, then only Items 1 and 2 are used.

USEPA Method 29 Antimony Analyte Calculations

Sample data taken from Run 1

Note: The tables presenting the results are generated electronically from raw data. It may not be possible to exactly duplicate these results using a calculator. The reference method data, results, and all calculations are carried to sixteen decimal places throughout. The final table is formatted to an appropriate number of significant figures.

Note: Please see the preceding page concerning treatment of minimum detection limits and mathematical operations on values that are below minimum detection limits.

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K

1. Maximum front-half blank correction criteria (µg)

$$A = (1.4) \left(\frac{3.141593}{4} \right) \left(\frac{D}{2.54} \right)^2$$

Where:

D	= diameter of filter used in sample apparatus	=	8.2	cm
1.4	= allowable blank per square inch of filter area	=	1.4	µg/in ²
2.54	= conversion constant	=	2.54	cm/in
4	= conversion constant	=	4	
3.141593	= conversion constant (pi)	=	3.141593	
A	= maximum front-half blank correction criteria	=	11.46	µg

2. Allowable blank correction - front-half sample fraction (µg)

$$m_{FB-allow} = m_{FB} \text{ if } m_{FB} \leq A$$

$$m_{FB-allow} = MAX [A, MIN (m_{FB}, 0.05 \times m_{FS})] \text{ if } m_{FB} > A$$

Where:

m _{FB}	= antimony amount in front-half blank	=	0.2260	µg
m _{FS}	= antimony amount in front-half sample	=	16.7000	µg
A	= maximum front-half blank correction criteria	=	11.46	µg
0.05 x m _{FS}	= 5% of front-half sample amount	=	0.8350	µg
MAX	= arithmetic operator that returns the maximum of two values			
MIN	= arithmetic operator that returns the minimum of two values			

m _{FB-allow}	= allowable front-half Antimony blank correction	=	0.2260	µg
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NOTE: In this case, the first criteria applies.

3. Front-half sample corrected for allowable blank (µg)

$$m_F = m_{FS} - m_{FB-allow}$$

Where:

m _{FS}	= antimony amount in front-half sample	=	16.7000	µg
m _{FB-allow}	= allowable front-half antimony blank correction	=	0.2260	µg
m _F	= blank-corrected antimony in front-half sample	=	16.4740	µg

4. Allowable blank correction - back-half sample fraction (μg)

$$m_{BB-\text{allow}} = m_{BB} \text{ if } m_{BB} \leq 1.0$$

$$m_{BB-\text{allow}} = \text{MAX} [1.0, \text{MIN} (m_{BB}, 0.05 \times m_{BS})] \text{ if } m_{BB} > 1.0$$

Where:

m_{BB}	= antimony amount in back-half blank	=	<0.1000	μg
m_{BS}	= antimony amount in back-half sample	=	<0.1000	μg
1.0	= maximum back-half blank correction criteria	=	1.0	μg
$0.05 \times m_{BS}$	= 5% of back-half sample amount	=	<0.0050	μg

$m_{BB-\text{allow}}$	= allowable back-half antimony blank correction	=	0.0000	μg
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NOTE: In this case, the first criteria applies.

5. Back-half sample corrected for allowable blank (μg)

$$m_B = m_{BS} - m_{BB-\text{allow}}$$

Where:

m_{BS}	=	#NAME?	=	<0.1000	μg
$m_{BB-\text{allow}}$	= allowable back-half antimony blank correction	=	0.0000	μg	
m_B	= blank-corrected antimony in back-half sample	=	<0.1000	μg	(Detection Limit Used)

6. Total front and back-half sample amounts corrected for blanks

$$m_n = m_F + m_B$$

Where:

m_F	= blank-corrected antimony in front-half sample	=	16.4740	μg
m_B	= blank-corrected antimony in back-half sample	=	<0.1000	μg
m_n	= blank-corrected antimony in total sample	=	<16.5740	μg

USEPA Method 29 Antimony Sample Calculations

Sample data taken from Run 1

Note: The tables presenting the results are generated electronically from raw data. It may not be possible to exactly duplicate these results using a calculator. The reference method data, results, and all calculations are carried to sixteen decimal places throughout. The final table is formatted to an appropriate number of significant figures.

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M_K

1. Antimony concentration (lb/dscf)

$$C_{sd} = \left(\frac{m_n}{V_{mstd}} \right) \left(\frac{2.205 \times 10^{-3}}{10^6} \right)$$

Where:

m_n	= antimony collected in sample (total µg)	= <16.5740	µg
V_{mstd}	= volume metered, standard (dscf)	= 121.3177	dscf
2.205×10^{-3}	= conversion factor (lb/g)	= 2.205E-03	lb/g
10^6	= conversion factor (µg/g)	= 1.0E+06	µg/g
C_{sd}	= antimony concentration (lb/dscf)	= <3.0124E-10	lb/dscf

2. Antimony concentration (µg/dscm)

$$C_{sd} = \left(\frac{m_n}{V_{mstd}} \right) (35.31)$$

Where:

m_n	= antimony collected in sample (total µg)	= <16.5740	µg
V_{mstd}	= volume metered, standard (dscf)	= 121.3177	dscf
35.31	= conversion factor (dscf/dscm)	= 35.31	dscf/dscm
C_{sd}	= antimony concentration (µg/dscm)	= <4.8239E+00	µg/dscm

3. Antimony concentration (mg/dscm)

$$C_{sd} = \left(\frac{m_n}{V_{mstd}} \right) \left(\frac{35.31}{1000} \right)$$

Where:

m_n	= antimony collected in sample (total µg)	= <16.5740	µg
V_{mstd}	= volume metered, standard (dscf)	= 121.3177	dscf
35.31	= conversion factor (dscf/dscm)	= 35.31	dscf/dscm
1000	= conversion factor (µg/mg)	= 1000	µg/mg
C_{sd}	= antimony concentration (mg/dscm)	= <4.8239E-03	mg/dscm

4. Antimony concentration ($\mu\text{g}/\text{Nm}^3$ dry)

$$C_{sd} = \left(\frac{m_n}{V_{mstd}} \right) (35.31) \left(\frac{68 + 460}{32 + 460} \right)$$

Where:

m_n	= antimony collected in sample (total μg)	=	<16.5740	μg
V_{mstd}	= volume metered, standard (dscf)	=	121.3177	dscf
35.31	= conversion factor (dscf/dscm)	=	35.31	dscf/dscm
68	= standard temperature ($^{\circ}\text{F}$)	=	68	$^{\circ}\text{F}$
32	= normal temperature ($^{\circ}\text{F}$)	=	32	$^{\circ}\text{F}$
460	= $^{\circ}\text{F}$ to $^{\circ}\text{R}$ conversion constant	=	460	
C_{sd}	= antimony concentration ($\mu\text{g}/\text{Nm}^3$ dry)	=	<5.1769E+00	$\mu\text{g}/\text{Nm}^3$ dry

5. Antimony concentration at actual gas conditions (lb/acf example)

$$C_a = C_{sd} \left(\frac{Q_{std}}{Q_a} \right)$$

Where:

C_{sd}	= antimony concentration (lb/dscf)	=	<3.0124E-10	lb/dscf
Q_{std}	= volumetric flow rate at standard conditions, dry basis (dscfm)	=	134,601	dscfm
Q_a	= volumetric flow rate at actual conditions (acfm)	=	211,786	acfm
C_a	= antimony concentration at actual gas conditions (lb/acf)	=	<1.9145E-10	lb/acf

6. Antimony emission rate (lb/hr)

$$E_{lb/hr} = \left(\frac{m_n}{V_{mstd}} \right) \left(\frac{2.205 \times 10^{-3}}{10^6} \right) (Q_{std}) (60)$$

Where:

m_n	= antimony collected in sample (total μg)	=	<16.5740	μg
V_{mstd}	= volume metered, standard (dscf)	=	121.3177	dscf
2.205×10^{-3}	= conversion factor (lb/g)	=	2.205E-03	lb/g
10^6	= conversion factor ($\mu\text{g}/\text{g}$)	=	1.0E+06	$\mu\text{g}/\text{g}$
Q_{std}	= volumetric flow rate at standard conditions, dry basis (dscfm)	=	134,601	dscfm
60	= conversion factor (min/hr)	=	60	min/hr
$E_{lb/hr}$	= antimony emission rate (lb/hr)	=	<2.4328E-03	lb/hr

ASTM D6784-02 (Mercury)
Sampling, Velocity and Moisture Sample Calculations

Sample data taken from Run 1

Note: The tables presenting the results are generated electronically from raw data. It may not be possible to exactly duplicate these results using a calculator. The reference method data, results, and all calculations are carried to sixteen decimal places throughout. The final table is formatted to an appropriate number of significant figures.

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L

1. Volume of water collected (wscf)

$$V_{wstd} = (0.04706)(V_{lc})$$

Where:

V_{lc}	= total volume of liquid collected in impingers and silica gel (ml)	=	577.3	ml
0.04706	= ideal gas conversion factor (ft ³ water vapor/ml or gm)	=	0.04706	ft ³ /ml

V_{wstd}	= volume of water vapor collected at standard conditions (ft ³)	=	27.17	ft ³
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2. Volume of gas metered, standard conditions (dscf)

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

Where:

P_{bar}	= barometric pressure (in. Hg)	=	29.40	in. Hg
T_m	= average dry gas meter temperature (°F)	=	103.10	°F
V_m	= volume of gas sample through the dry gas meter at meter conditions (dcf)	=	90.97	dcf
Y_d	= gas meter correction factor (dimensionless)	=	0.9992	
ΔH	= average pressure drop across meter box orifice (in. H ₂ O)	=	1.63	in. H ₂ O
17.64	= standard temperature to pressure ratio (°R/in. Hg)	=	17.64	°R/in. Hg
13.6	= conversion factor (in. H ₂ O/in. Hg)	=	13.6	in. H ₂ O/in. Hg
460	= °F to °R conversion constant	=	460	

V_{mstd}	= volume of gas sampled through the dry gas meter at standard conditions (dscf)	=	84.058	dscf
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3. Sample gas pressure (in. Hg)

$$P_s = P_{bar} + \left(\frac{P_g}{13.6} \right)$$

Where:

P_{bar}	= barometric pressure (in. Hg)	=	29.40	in. Hg
P_g	= sample gas static pressure (in. H ₂ O)	=	-0.30	in. H ₂ O
13.6	= conversion factor (in. H ₂ O/in. Hg)	=	13.6	in. H ₂ O/in. Hg
P_s	= absolute sample gas pressure (in. Hg)	=	29.38	in. Hg

4. Actual water vapor pressure at sample gas temperature less than 212°F (in. Hg)

$$P_v = \frac{e^{\left(\frac{18.3036 - \frac{3816.44}{\frac{5}{9}(T_s - 32) + 273.15 - 46.13}}{25.4} \right)}}{25.4}$$

Where:

T_s	= average sample gas temperature (°F)	=	149.63	°F
18.3036	= Antoine coefficient	=	18.3036	°K
3816.44	= Antoine coefficient	=	3816.44	°K
273.15	= temperature conversion factor	=	273.15	°K
46.13	= Antoine coefficient	=	46.13	°K
25.4	= conversion factor	=	25.4	mm Hg/in. Hg
5/9	= Fahrenheit to Celsius conversion factor	=	5/9	°C/°F
32	= temperature conversion (°F)	=	32	°F
P_v	= vapor pressure, actual (in. Hg)	=	7.50	in. Hg

5. Water vapor pressure at gas temperature greater than 212°F (in. Hg)

$$P_v = P_s$$

Where:

P_s	= absolute sample gas pressure (in. Hg)	=	29.38	in. Hg
P_v	= water vapor pressure, actual (in. Hg)	=	Previously Defined	in. Hg

6. Moisture measured in sample (% by volume)

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

Where:

V_{mstd}	= volume of gas sampled through the dry gas meter at standard conditions (dscf)	=	84.058	dscf
V_{wstd}	= volume of water collected at standard conditions (scf)	=	27.17	scf
B_{wo}	= proportion of water measured in the gas stream by volume	=	0.2443	
		=	24.43	%

7. Saturated moisture content (% by volume)

$$B_{ws} = \frac{P_v}{P_s}$$

Where:

P_s	= absolute sample gas pressure (in. Hg)	=	29.38	in. Hg
P_v	= water vapor pressure, actual (in. Hg)	=	7.50	in. Hg
B_{ws}	= proportion of water vapor in the gas stream by volume at saturated conditions	=	0.2554	
		=	25.54	%

8. Actual water vapor in gas (% by volume)

$$B_w = \text{MINIMUM} [B_{wo}, B_{ws}]$$

Where:

B_{ws}	= proportion of water vapor in the gas stream by volume at saturated conditions	=	0.2554	
B_{wo}	= proportion of water measured in the gas stream by volume	=	0.2443	
B_w	= actual water vapor in gas	=	0.2443	
		=	24.43	%

9. Nitrogen (plus carbon monoxide) in gas stream (% by volume, dry)

$$N_2 + CO = 100 - CO_2 - O_2$$

Where:

CO_2	= proportion of carbon dioxide in the gas stream by volume (%)	=	13.4	%
O_2	= proportion of oxygen in the gas stream by volume (%)	=	3.6	%
100	= conversion factor (%)	=	100	%
N_2+CO	= proportion of nitrogen and CO in the gas stream by volume (%)	=	83.00	%

10. Molecular weight of dry gas stream (lb/lb-mole)

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

Where:

M_{CO_2}	= molecular weight of carbon dioxide (lb/lb-mole)	=	44.00	lb/lb-mole
M_{O_2}	= molecular weight of oxygen (lb/lb-mole)	=	32.00	lb/lb-mole
M_{N_2+CO}	= molecular weight of nitrogen and carbon monoxide (lb/lb-mole)	=	28.00	lb/lb-mole
CO_2	= proportion of carbon dioxide in the gas stream by volume (%)	=	13.4	%
O_2	= proportion of oxygen in the gas stream by volume (%)	=	3.6	%
N_2+CO	= proportion of nitrogen and CO in the gas stream by volume (%)	=	83.0	%
100	= conversion factor (%)	=	100	%
M_d	= dry molecular weight of sample gas (lb/lb-mole)	=	30.29	lb/lb-mole

11. Molecular weight of sample gas (lb/lb-mole)

$$M_s = (M_d)(1 - B_w) + (M_{H_2O})(B_w)$$

Where:

B_w	= proportion of water vapor in the gas stream by volume	=	0.2443	
M_d	= dry molecular weight of sample gas (lb/lb-mole)	=	30.29	lb/lb-mole
M_{H_2O}	= molecular weight of water (lb/lb-mole)	=	18.00	lb/lb-mole
M_s	= molecular weight of sample gas, wet basis (lb/lb-mole)	=	27.29	lb/lb-mole

12. Velocity of sample gas (ft/sec)

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

Where:

K_p	= velocity pressure constant	=	85.49	
C_p	= pitot tube coefficient	=	0.82	
M_s	= wet molecular weight of sample gas, wet basis (lb/lb-mole)	=	27.29	lb/lb-mole
P_s	= absolute sample gas pressure (in. Hg)	=	29.38	in. Hg
T_s	= average sample gas temperature (°F)	=	149.63	°F
$\sqrt{\Delta P}$	= average square roots of velocity heads of sample gas (in. H ₂ O)	=	0.831	√in. H ₂ O
460	= °F to °R conversion constant	=	460	
V_s	= sample gas velocity (ft/sec)	=	50.78	ft/sec

13. Volumetric flow rate of sample gas at actual gas conditions (acfm)

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

Where:

A_s	= cross sectional area of sampling location (ft ²)	=	70.88	ft ²
V_s	= sample gas velocity (ft/sec)	=	50.78	ft/sec
60	conversion factor (sec/min)	=	60	sec/min
Q_a	= volumetric flow rate at actual conditions (acfm)	=	215,956	acfm

14. Total flow of sample gas (scfm)

$$Q_s = (Q_a)\left(\frac{P_s}{29.92}\right)\left(\frac{68 + 460}{T_s + 460}\right)$$

Where:

Q_a	= volumetric flow rate at actual conditions (acfm)	=	215,956	acfm
P_s	= absolute sample gas pressure (in. Hg)	=	29.38	in. Hg
29.92	= standard pressure (in. Hg)	=	29.92	in. Hg
T_s	= average sample gas temperature (°F)	=	149.6	°F
68	= standard temperature (°F)	=	68	°F
460	= °F to °R conversion constant	=	460	
Q_s	= volumetric flow rate at standard conditions, wet basis (scfm)	=	183,652	scfm

15. Dry flow of sample gas (dscfm)

$$Q_{std} = (Q_s)(1 - B_w)$$

Where:

B_w	= proportion of water vapor in the gas stream by volume	=	0.2443	
Q_s	= volumetric flow rate at standard conditions, wet basis (scfm)	=	183,652	scfm
Q_{std}	= volumetric flow rate at standard conditions, dry basis (dscfm)	=	138,794	dscfm

16. Hourly time basis conversion of volumetric flow rate (Q_{std} example)

$$Q_{std-hr} = (Q_{std-min})(60)$$

Where

$Q_{std-min}$	= volumetric flow rate, english units (ft ³ /min)	=	138,794	dscfm
60	= conversion factor (min/hr)	=	60	min/hr

Q_{std-hr}	= volumetric flow rate, hourly basis (dscf/hr)	=	8,327,613	dscf/hr
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17. Metric Conversion of Gas Volumes (Q_{std} example)

$$Q_{std-metric} = (Q_{std-english}) \left(\frac{60}{35.31} \right)$$

Where:

$Q_{std-english}$	= volumetric flow rate, english units (ft ³ /min)	=	138,794	dscfm
35.31	= conversion factor (ft ³ /m ³)	=	35.31	ft ³ /m ³
60	= conversion factor (min/hr)	=	60	min/hr

$Q_{std-metric}$	= volumetric flow rate, metric units (m ³ /hr)	=	235,843	dry std m ³ /hr
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18. Standard to Normal Conversion of Gas Volumes (Q_{std} example)

$$Q_{Normal} = (Q_{std-metric}) \left(\frac{32 + 460}{68 + 460} \right)$$

Where:

$Q_{std-metric}$	= volumetric flow rate, metric units (dry std m ³ /hr)	=	235,843	dry std m ³ /hr
32	= normal temperature (°F)	=	32	°F
68	= standard temperature (°F)	=	68	°F
460	= standard temperature in Rankine (68°F)	=	460	

Q_{Normal}	= volumetric flow rate, metric units (dry Nm ³ /hr)	=	219,763	dry Nm ³ /hr
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19. Percent isokinetic (%)

$$I = \frac{(0.09450)(T_s + 460)(V_{mstd})}{(P_s)(V_s)\left(\frac{(D_n)^2(\pi)}{(144)(4)}\right)(\Theta)(1 - B_w)}$$

Where:

D_n	= diameter of nozzle (in)	=	0.250	in.
B_w	= proportion of water vapor in the gas stream by volume	=	0.2443	
P_s	= absolute sample gas pressure (in. Hg)	=	29.38	in. Hg
T_s	= average sample gas temperature (°F)	=	149.6	°F
V_{mstd}	= volume of gas sample through the dry gas meter at standard conditions (dscf)	=	84.058	dscf
V_s	= sample gas velocity (ft/sec)	=	50.78	ft/sec
Θ	= total sampling time (min)	=	120	min
0.0945	= conversion constant	=	0.0945	
460	= °F to °R conversion constant	=	460	
I	= percent of isokinetic sampling (%)	=	105.01	%

20. Alternative Method 5 Post-Test Meter Calibration Factor

$$Y_{ga} = \frac{\Theta}{V_m} \sqrt{\frac{(0.0319)(T_m + 460)(28.96)}{(\Delta H_{@})(P_{bar} + \frac{\Delta H}{13.6})(M_d)}} (\sqrt{\Delta H})_{avg}$$

Where:

Θ	= total sampling time (min)	=	120	min
V_m	= volume of gas sample through the dry gas meter at meter conditions (dcf)	=	90.97	dcf
T_m	= average dry gas meter temperature (°F)	=	103.10	°F
$\Delta H_{@}$	= dry gas meter orifice coefficient	=	1.7185	
P_{bar}	= barometric pressure (in. Hg)	=	29.40	in. Hg
ΔH	= average pressure drop across meter box orifice (in. H ₂ O)	=	1.633	in. H ₂ O
M_d	= dry molecular weight of sample gas (lb/lb-mole)	=	30.29	lb/lb-mole
$\sqrt{\Delta H}_{avg}$	= average of square root of pressure drop across meter orifice	=	1.276	$\sqrt{\text{in. H}_2\text{O}}$
0.0319	= conversion constant	=	0.0319	
28.96	= molecular weight of ambient air (lb/lb-mole)	=	28.96	lb/lb-mole
13.6	= conversion factor (in. H ₂ O/in. Hg)	=	13.6	in. H ₂ O/in. Hg
460	= °F to °R conversion constant	=	460	
Y_{ga}	= alternative Method 5 post-test meter calibration factor	=	0.9796	

ASTM D6784-02 Mercury Analyte Calculations

Sample data taken from Run 1

Note: The tables presenting the results are generated electronically from raw data. It may not be possible to exactly duplicate these results using a calculator. The reference method data, results, and all calculations are carried to sixteen decimal places throughout. The final table is formatted to an appropriate number of significant figures.

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1. Allowable Blank Subtraction for Filter Sample (µg)

$$Hg_{fb-allow} = \begin{cases} Hg_{fb} & \text{if } Hg_{ash} \geq Hg_{fb} \\ Hg_{ash} & \text{if } Hg_{ash} < Hg_{fb} \\ 0 & \text{if } Hg_{ash} < DL_{ash} \text{ or } Hg_{fb} < DL_{ash} \end{cases}$$

Where:

Hg_{fb}	= mercury amount in blank filter	=	<0.0150	µg
Hg_{ash}	= mercury amount in filter	=	<0.0150	µg
DL_{ash}	= analytical detection limit for filter analysis	=	0.0150	µg
$Hg_{fb-allow}$	= allowable blank subtraction for filter sample	=	0.0000	µg

2. Particulate-bound Mercury Fraction Corrected for Blank (µg)

$$Hg_{particle} = \begin{cases} Hg_{ash} + Hg_{pr} - Hg_{fb-allow} & \text{if } Hg_{ash} + Hg_{pr} - Hg_{fb-allow} \geq (DL_{ash} + DL_{pr}) \\ "<" (DL_{ash} + DL_{pr}) & \text{if } Hg_{ash} + Hg_{pr} - Hg_{fb-allow} < (DL_{ash} + DL_{pr}) \end{cases}$$

Where:

Hg_{ash}	= mercury amount in filter	=	<0.0150	µg
Hg_{pr}	= mercury amount in probe rinse(s)	=	<0.0500	µg
$Hg_{fb-allow}$	= allowable blank subtraction for filter sample	=	0.0000	µg
DL_{ash}	= analytical detection limit for filter analysis	=	0.0150	µg
DL_{pr}	= analytical detection limit for probe wash analysis	=	0.0500	µg
$Hg_{particle}$	= total amount of particulate-bound mercury	=	<0.0650	µg

3. Allowable Blank Subtraction for KCl Sample (µg)

$$Hg_{Ob-allow} = \begin{cases} Hg_{Ob} & \text{if } Hg_{KCl} \geq Hg_{Ob} \\ Hg_{KCl} & \text{if } Hg_{KCl} < Hg_{Ob} \\ 0 & \text{if } Hg_{KCl} < DL_{KCl} \text{ or } Hg_{Ob} < DL_{KCl} \end{cases}$$

Where:

Hg_{Ob}	= mercury amount in KCl blank	=	<0.0050	µg
Hg_{KCl}	= mercury amount in KCl sample	=	0.8930	µg
$Hg_{Ob-allow}$	= allowable blank subtraction for KCl sample	=	0.0000	µg

4. Oxidized Mercury Fraction Corrected for Blank (µg)

$$Hg_o = \begin{cases} Hg_{KCl} - Hg_{Ob-allow} & \text{if } Hg_{KCl} - Hg_{Ob-allow} \geq DL_{KCl} \\ "<" DL_{KCl} & \text{if } Hg_{KCl} - Hg_{Ob-allow} < DL_{KCl} \end{cases}$$

Where:

Hg_{KCl}	= mercury amount in KCl sample	=	0.8930	µg
$Hg_{Ob-allow}$	= allowable blank subtraction for KCl sample	=	0.0000	µg
DL_{KCl}	= analytical detection limit for KCl analysis	=	0.0050	µg
Hg_o	= amount of oxidized mercury	=	0.8930	µg

5. Allowable Blank Subtraction for HNO3-H2O2 Sample (µg)

$$Hg_{Eb1-allow} = \begin{cases} Hg_{Eb1} & \text{if } Hg_{H2O2} \geq Hg_{Eb1} \\ Hg_{H2O2} & \text{if } Hg_{H2O2} < Hg_{Eb1} \\ 0 & \text{if } Hg_{H2O2} < DL_{H2O2} \text{ or } Hg_{Eb1} < DL_{H2O2} \end{cases}$$

Where:

Hg _{Eb1}	= mercury amount in HNO3-H2O2 blank	=	<0.0250	µg
Hg _{H2O2}	= mercury amount in HNO3-H2O2 sample	=	<0.0250	µg
Hg _{Eb1-allow}	= allowable blank subtraction for HNO3-H2O2 sample	=	0.0000	µg

6. Allowable Blank Subtraction for KMnO4 Sample (µg)

$$Hg_{Eb2-allow} = \begin{cases} Hg_{Eb2} & \text{if } Hg_{KMnO4} \geq Hg_{Eb2} \\ Hg_{H2O2} & \text{if } Hg_{KMnO4} < Hg_{Eb2} \\ 0 & \text{if } Hg_{KMnO4} < DL_{KMnO4} \text{ or } Hg_{Eb2} < DL_{KMnO4} \end{cases}$$

Where:

Hg _{Eb2}	= mercury amount in KMnO4 blank	=	0.0045	µg
Hg _{KMnO4}	= mercury amount in KMnO4 sample	=	1.2300	µg
Hg _{Eb2-allow}	= allowable blank subtraction for KMnO4 sample	=	0.0045	µg

7. Elemental Mercury Fraction Corrected for Blank (µg)

$$Hg_E = \begin{cases} Hg_{H2O2} + Hg_{KMnO4} - Hg_{Eb1-allow} - Hg_{Eb2-allow} & \text{if } Hg_{H2O2} + Hg_{KMnO4} - Hg_{Eb1-allow} - Hg_{Eb2-allow} \geq (DL_{H2O2} + DL_{KMnO4}) \\ "<"(DL_{H2O2} + DL_{KMnO4}) & \text{if } Hg_{H2O2} + Hg_{KMnO4} - Hg_{Eb1-allow} - Hg_{Eb2-allow} < (DL_{H2O2} + DL_{KMnO4}) \end{cases}$$

Where:

Hg _{H2O2}	= mercury amount in HNO3-H2O2 sample	=	<0.0250	µg	Treated as full value
Hg _{KMnO4}	= mercury amount in KMnO4 sample	=	1.2300	µg	
Hg _{Eb1-allow}	= allowable blank subtraction for HNO3-H2O2 sample	=	0.0000	µg	
Hg _{Eb2-allow}	= allowable blank subtraction for KMnO4 sample	=	0.0045	µg	
DL _{H2O2}	= analytical detection limit for HNO3-H2O2 analysis	=	0.0250	µg	
DL _{KMnO4}	= analytical detection limit for KMnO4 analysis	=	0.0250	µg	
Hg _E	= total amount of elemental mercury	=	1.2505	µg	

8. Total Mercury in Sample (µg)

$$m_n = Hg_{particle} + Hg_O + Hg_E$$

Where:

Hg _{particle}	= total amount of particulate-bound mercury	=	<0.0650	µg
Hg _O	= amount of oxidized mercury	=	0.8930	µg
Hg _E	= total amount of elemental mercury	=	1.2505	µg
m _n	= total mercury in sample	=	<2.2085	µg
ND counted at 100% value in sum.				

ASTM D6784-02 Total Mercury Sample Calculations

Sample data taken from Run 1

Note: The tables presenting the results are generated electronically from raw data. It may not be possible to exactly duplicate these results using a calculator. The reference method data, results, and all calculations are carried to sixteen decimal places throughout. The final table is formatted to an appropriate number of significant figures.

Calculations are for Total Mercury only. Particulate-bound, oxidized and elemental mercury results are calculated similarly.

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1. Mercury concentration (lb/dscf)

$$C_{sd} = \left(\frac{m_n}{V_{mstd}} \right) \left(\frac{2.205 \times 10^{-3}}{10^6} \right)$$

Where:

m_n	= mercury collected in sample (total μg)	=	<2.2085	μg
V_{mstd}	= volume metered, standard (dscf)	=	84.0578	dscf
2.205×10^{-3}	= conversion factor (lb/g)	=	2.2050E-03	lb/g
10^6	= conversion factor ($\mu\text{g/g}$)	=	1.00E+06	$\mu\text{g/g}$
C_{sd}	= mercury concentration (lb/dscf)	=	<5.7933E-11	lb/dscf

2. Mercury concentration ($\mu\text{g/dscm}$)

$$C_{sd} = \left(\frac{m_n}{V_{mstd}} \right) (35.31)$$

Where:

m_n	= mercury collected in sample (total μg)	=	<2.2085	μg
V_{mstd}	= volume metered, standard (dscf)	=	84.0578	dscf
35.31	= conversion factor (dscf/dscm)	=	35.31	dscf/dscm
C_{sd}	= mercury concentration ($\mu\text{g/dscm}$)	=	<9.2772E-01	$\mu\text{g/dscm}$

3. Mercury concentration ($\mu\text{g/scm}$)

$$C_{sd} = \left(\frac{m_n}{V_{mstd}} \right) (35.31)(1 - B_w)$$

Where:

m_n	= mercury collected in sample (total μg)	=	<2.2085	μg
V_{mstd}	= volume metered, standard (dscf)	=	84.0578	dscf
B_w	= proportion of water vapor in gas stream, by volume	=	0.2443	
35.31	= conversion factor (dscf/dscm)	=	35.31	dscf/dscm
C_{sw}	= mercury concentration ($\mu\text{g/scm}$)	=	<7.0111E-01	$\mu\text{g/scm}$

4. Mercury concentration (mg/dscm)

$$C_{sd} = \left(\frac{m_n}{V_{mstd}} \right) \left(\frac{35.31}{1000} \right)$$

Where:

m_n	= mercury collected in sample (total µg)	=	<2.2085	µg
V_{mstd}	= volume metered, standard (dscf)	=	84.0578	dscf
35.31	= conversion factor (dscf/dscm)	=	35.31	dscf/dscm
1000	= conversion factor (µg/mg)	=	1000	µg/mg
C_{sd}	= mercury concentration (mg/dscm)	=	<9.2772E-04	mg/dscm

5. Mercury concentration (µg/Nm³ dry)

$$C_{sd} = \left(\frac{m_n}{V_{mstd}} \right) (35.31) \left(\frac{68 + 460}{32 + 460} \right)$$

Where:

m_n	= mercury collected in sample (total µg)	=	<2.2085	µg
V_{mstd}	= volume metered, standard (dscf)	=	84.0578	dscf
35.31	= conversion factor (dscf/dscm)	=	35.31	dscf/dscm
68	= standard temperature (°F)	=	68	°F
32	= normal temperature (°F)	=	32	°F
460	= °F to °R conversion constant	=	460	
C_{sd}	= mercury concentration (µg/Nm ³ dry)	=	<9.9560E-01	µg/Nm ³ dry

6. Mercury concentration at actual gas conditions (lb/acf example)

$$C_a = C_{sd} \left(\frac{Q_{std}}{Q_a} \right)$$

Where:

C_{sd}	= mercury concentration (lb/dscf)	=	<5.7933E-11	lb/dscf
Q_{std}	= volumetric flow rate at standard conditions, dry basis (dscfm)	=	138,794	dscfm
Q_a	= volumetric flow rate at actual conditions (acfm)	=	215,956	acfm
C_a	= mercury concentration at actual gas conditions (lb/acf)	=	<3.7233E-11	lb/acf

7. Mercury emission rate (lb/hr)

$$E_{lb/hr} = \left(\frac{m_n}{V_{mstd}} \right) \left(\frac{2.205 \times 10^{-3}}{10^6} \right) (Q_{std}) (60)$$

Where:

m_n	= mercury collected in sample (total µg)	=	<2.2085	µg
V_{mstd}	= volume metered, standard (dscf)	=	84.0578	dscf
2.205×10^{-3}	= conversion factor (lb/g)	=	2.2050E-03	lb/g
10^6	= conversion factor (µg/g)	=	1.00E+06	µg/g
Q_{std}	= volumetric flow rate at standard conditions, dry basis (dscfm)	=	138,794	dscfm
60	= conversion factor (min/hr)	=	60	min/hr
$E_{lb/hr}$	= mercury emission rate (lb/hr)	=	<4.8244E-04	lb/hr

USEPA SW-846 Method 0061 (Hexavalent Chromium) Sampling, Velocity and Moisture Sample Calculations

Sample data taken from Run 1

Note: The tables presenting the results are generated electronically from raw data. It may not be possible to exactly duplicate these results using a calculator. The reference method data, results, and all calculations are carried to sixteen decimal places throughout. The final table is formatted to an appropriate number of significant figures.

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1. Volume of water collected (wscf)

$$V_{wstd} = (0.04706)(V_k)$$

Where:

V_{lc}	= total volume of liquid collected in impingers and silica gel (ml)	=	786.1	ml
0.04706	= ideal gas conversion factor (ft ³ water vapor/ml or gm)	=	0.04706	ft ³ /ml
V_{wstd}	= volume of water vapor collected at standard conditions (ft ³)	=	36.99	ft ³

2. Volume of gas metered, standard conditions (dscf)

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

Where:

P_{bar}	= barometric pressure (in. Hg)	=	29.40	in. Hg
T_m	= average dry gas meter temperature (°F)	=	103.58	°F
V_m	= volume of gas sample through the dry gas meter at meter conditions (dcf)	=	128.23	dcf
Y_d	= gas meter correction factor (dimensionless)	=	0.9827	
ΔH	= average pressure drop across meter box orifice (in. H ₂ O)	=	1.61	in. H ₂ O
17.64	= standard temperature to pressure ratio (°R/in. Hg)	=	17.64	°R/in. Hg
13.6	= conversion factor (in. H ₂ O/in. Hg)	=	13.6	in. H ₂ O/in. Hg
460	= °F to °R conversion constant	=	460	
V_{mstd}	= volume of gas sampled through the dry gas meter at standard conditions (dscf)	=	116.425	dscf

3. Sample gas pressure (in. Hg)

$$P_s = P_{bar} + \left(\frac{P_g}{13.6} \right)$$

Where:

P_{bar}	= barometric pressure (in. Hg)	=	29.40	in. Hg
P_g	= sample gas static pressure (in. H ₂ O)	=	-0.30	in. H ₂ O
13.6	= conversion factor (in. H ₂ O/in. Hg)	=	13.6	in. H ₂ O/in. Hg
P_s	= absolute sample gas pressure (in. Hg)	=	29.38	in. Hg

4. Actual water vapor pressure at sample gas temperature less than 212°F (in. Hg)

$$P_v = \frac{e^{\left(\frac{18.3036 - \frac{3816.44}{\frac{5}{9}(T_s - 32) + 273.15 - 46.13}}{25.4} \right)}}{25.4}$$

Where:

T_s	= average sample gas temperature (°F)	=	150.06	°F
18.3036	= Antoine coefficient	=	18.3036	°K
3816.44	= Antoine coefficient	=	3816.44	°K
273.15	= temperature conversion factor	=	273.15	°K
46.13	= Antoine coefficient	=	46.13	°K
25.4	= conversion factor	=	25.4	mm Hg/in. Hg
5/9	= Fahrenheit to Celsius conversion factor	=	5/9	°C/°F
32	= temperature conversion (°F)	=	32	°F
P_v	= vapor pressure, actual (in. Hg)	=	7.58	in. Hg

5. Water vapor pressure at gas temperature greater than 212°F (in. Hg)

$$P_v = P_s$$

Where:

P_s	= absolute sample gas pressure (in. Hg)	=	29.38	in. Hg
P_v	= water vapor pressure, actual (in. Hg)	=	Previously Defined	in. Hg

6. Moisture measured in sample (% by volume)

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

Where:

V_{mstd}	= volume of gas sampled through the dry gas meter at standard conditions (dscf)	=	116.425	dscf
V_{wstd}	= volume of water collected at standard conditions (scf)	=	36.99	scf
B_{wo}	= proportion of water measured in the gas stream by volume	=	0.2411	%
		=	24.11	%

7. Saturated moisture content (% by volume)

$$B_{ws} = \frac{P_v}{P_s}$$

Where:

P_s	= absolute sample gas pressure (in. Hg)	=	29.38	in. Hg
P_v	= water vapor pressure, actual (in. Hg)	=	7.58	in. Hg
B_{ws}	= proportion of water vapor in the gas stream by volume at saturated conditions	=	0.2581	%
		=	25.81	%

8. Actual water vapor in gas (% by volume)

$$B_w = \text{MINIMUM} [B_{wo}, B_{ws}]$$

Where:

B_{ws}	= proportion of water vapor in the gas stream by volume at saturated conditions	=	0.2581	
B_{wo}	= proportion of water measured in the gas stream by volume	=	0.2411	
B_w	= actual water vapor in gas	=	0.2411	
		=	24.11	%

9. Nitrogen (plus carbon monoxide) in gas stream (% by volume, dry)

$$N_2 + CO = 100 - CO_2 - O_2$$

Where:

CO_2	= proportion of carbon dioxide in the gas stream by volume (%)	=	12.9	%
O_2	= proportion of oxygen in the gas stream by volume (%)	=	4.2	%
100	= conversion factor (%)	=	100	%
N_2+CO	= proportion of nitrogen and CO in the gas stream by volume (%)	=	82.90	%

10. Molecular weight of dry gas stream (lb/lb-mole)

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

Where:

M_{CO_2}	= molecular weight of carbon dioxide (lb/lb-mole)	=	44.00	lb/lb-mole
M_{O_2}	= molecular weight of oxygen (lb/lb-mole)	=	32.00	lb/lb-mole
M_{N_2+CO}	= molecular weight of nitrogen and carbon monoxide (lb/lb-mole)	=	28.00	lb/lb-mole
CO_2	= proportion of carbon dioxide in the gas stream by volume (%)	=	12.9	%
O_2	= proportion of oxygen in the gas stream by volume (%)	=	4.2	%
N_2+CO	= proportion of nitrogen and CO in the gas stream by volume (%)	=	82.9	%
100	= conversion factor (%)	=	100	%
M_d	= dry molecular weight of sample gas (lb/lb-mole)	=	30.23	lb/lb-mole

11. Molecular weight of sample gas (lb/lb-mole)

$$M_s = (M_d)(1 - B_w) + (M_{H_2O})(B_w)$$

Where:

B_w	= proportion of water vapor in the gas stream by volume	=	0.2411	
M_d	= dry molecular weight of sample gas (lb/lb-mole)	=	30.23	lb/lb-mole
M_{H_2O}	= molecular weight of water (lb/lb-mole)	=	18.00	lb/lb-mole
M_s	= molecular weight of sample gas, wet basis (lb/lb-mole)	=	27.28	lb/lb-mole

12. Velocity of sample gas (ft/sec)

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

Where:

K_p	= velocity pressure constant	=	85.49	
C_p	= pitot tube coefficient	=	0.82	
M_s	= wet molecular weight of sample gas, wet basis (lb/lb-mole)	=	27.28	lb/lb-mole
P_s	= absolute sample gas pressure (in. Hg)	=	29.38	in. Hg
T_s	= average sample gas temperature (°F)	=	150.06	°F
$\sqrt{\Delta P}$	= average square roots of velocity heads of sample gas (in. H ₂ O)	=	0.810	√in. H ₂ O
460	= °F to °R conversion constant	=	460	
V_s	= sample gas velocity (ft/sec)	=	49.48	ft/sec

13. Volumetric flow rate of sample gas at actual gas conditions (acfm)

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

Where:

A_s	= cross sectional area of sampling location (ft ²)	=	70.88	ft ²
V_s	= sample gas velocity (ft/sec)	=	49.48	ft/sec
60	conversion factor (sec/min)	=	60	sec/min
Q_a	= volumetric flow rate at actual conditions (acfm)	=	210,452	acfm

14. Total flow of sample gas (scfm)

$$Q_s = (Q_a) \left(\frac{P_s}{29.92} \right) \left(\frac{68 + 460}{T_s + 460} \right)$$

Where:

Q_a	= volumetric flow rate at actual conditions (acfm)	=	210,452	acfm
P_s	= absolute sample gas pressure (in. Hg)	=	29.38	in. Hg
29.92	= standard pressure (in. Hg)	=	29.92	in. Hg
T_s	= average sample gas temperature (°F)	=	150.1	°F
68	= standard temperature (°F)	=	68	°F
460	= °F to °R conversion constant	=	460	
Q_s	= volumetric flow rate at standard conditions, wet basis (scfm)	=	178,845	scfm

15. Dry flow of sample gas (dscfm)

$$Q_{std} = (Q_s)(1 - B_w)$$

Where:

B_w	= proportion of water vapor in the gas stream by volume	=	0.2411	
Q_s	= volumetric flow rate at standard conditions, wet basis (scfm)	=	178,845	scfm
Q_{std}	= volumetric flow rate at standard conditions, dry basis (dscfm)	=	135,720	dscfm

16. Hourly time basis conversion of volumetric flow rate (Q_{std} example)

$$Q_{std-hr} = (Q_{std-min})(60)$$

Where

$Q_{std-min}$	= volumetric flow rate, english units (ft ³ /min)	=	135,720	dscfm
60	= conversion factor (min/hr)	=	60	min/hr

Q_{std-hr}	= volumetric flow rate, hourly basis (dscf/hr)	=	8,143,218	dscf/hr
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17. Metric Conversion of Gas Volumes (Q_{std} example)

$$Q_{std-metric} = (Q_{std-english}) \left(\frac{60}{35.31} \right)$$

Where:

$Q_{std-english}$	= volumetric flow rate, english units (ft ³ /min)	=	135,720	dscfm
35.31	= conversion factor (ft ³ /m ³)	=	35.31	ft ³ /m ³
60	= conversion factor (min/hr)	=	60	min/hr

$Q_{std-metric}$	= volumetric flow rate, metric units (m ³ /hr)	=	230,621	dry std m ³ /hr
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18. Standard to Normal Conversion of Gas Volumes (Q_{std} example)

$$Q_{Normal} = (Q_{std-metric}) \left(\frac{32 + 460}{68 + 460} \right)$$

Where:

$Q_{std-metric}$	= volumetric flow rate, metric units (dry std m ³ /hr)	=	230,621	dry std m ³ /hr
32	= normal temperature (°F)	=	32	°F
68	= standard temperature (°F)	=	68	°F
460	= standard temperature in Rankine (68°F)	=	460	

Q_{Normal}	= volumetric flow rate, metric units (dry Nm ³ /hr)	=	214,897	dry Nm ³ /hr
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19. Percent isokinetic (%)

$$I = \frac{(0.09450)(T_s + 460)(V_{mstd})}{(P_s)(V_s)\left(\frac{(D_n)^2(\pi)}{(144)(4)}\right)(\Theta)(1 - B_w)}$$

Where:

D_n	= diameter of nozzle (in)	=	0.250	in.
B_w	= proportion of water vapor in the gas stream by volume	=	0.2411	
P_s	= absolute sample gas pressure (in. Hg)	=	29.38	in. Hg
T_s	= average sample gas temperature (°F)	=	150.1	°F
V_{mstd}	= volume of gas sample through the dry gas meter at standard conditions (dscf)	=	116.425	dscf
V_s	= sample gas velocity (ft/sec)	=	49.48	ft/sec
θ	= total sampling time (min)	=	180	min
0.0945	= conversion constant	=	0.0945	
460	= °F to °R conversion constant	=	460	
I	= percent of isokinetic sampling (%)	=	99.16	%

20. Alternative Method 5 Post-Test Meter Calibration Factor

$$Y_{qa} = \frac{\Theta}{V_m} \sqrt{\frac{(0.0319)(T_m + 460)(28.96)}{(\Delta H_{@})(P_{bar} + \frac{\Delta H}{13.6})(M_d)}} (\sqrt{\Delta H})_{avg}$$

Where:

θ	= total sampling time (min)	=	180	min
V_m	= volume of gas sample through the dry gas meter at meter conditions (dcf)	=	128.23	dcf
T_m	= average dry gas meter temperature (°F)	=	103.58	°F
$\Delta H_{@}$	= dry gas meter orifice coefficient	=	1.8294	
P_{bar}	= barometric pressure (in. Hg)	=	29.40	in. Hg
ΔH	= average pressure drop across meter box orifice (in. H ₂ O)	=	1.614	in. H ₂ O
M_d	= dry molecular weight of sample gas (lb/lb-mole)	=	30.23	lb/lb-mole
$\sqrt{\Delta H}_{avg}$	= average of square root of pressure drop across meter orifice	=	1.262	$\sqrt{\text{in. H}_2\text{O}}$
0.0319	= conversion constant	=	0.0319	
28.96	= molecular weight of ambient air (lb/lb-mole)	=	28.96	lb/lb-mole
13.6	= conversion factor (in. H ₂ O/in. Hg)	=	13.6	in. H ₂ O/in. Hg
460	= °F to °R conversion constant	=	460	
Y_{qa}	= alternative Method 5 post-test meter calibration factor	=	1.0004	

USEPA SW-846 Method 0061 (Hexavalent Chromium) Cr⁺⁶ Analyte Calculations

Sample data taken from Run 1

Note: The tables presenting the results are generated electronically from raw data. It may not be possible to exactly duplicate these results using a calculator. The reference method data, results, and all calculations are carried to sixteen decimal places throughout. The final table is formatted to an appropriate number of significant figures.

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M

1. Total Cr⁺⁶ collected (µg)

$$m_{Cr^{+6}} = (S)(v_{fs})(d)$$

Where:

S	= Cr ⁺⁶ concentration of sample (µg/ml)	=	<0.0006	µg/ml
v _{fs}	= liquid volume of filtered sample (ml)	=	810.0	ml
d	= dilution factor	=	1.0	
m _{Cr⁺⁶}	= total Cr ⁺⁶ collected (µg)	=	<0.4860	µg

2. Allowable blank subtraction (µg)

$$m_b = (B)(v_{fs})(d)$$

$$m_b = 0 \text{ if } B < MDL$$

Where:

B	= Cr ⁺⁶ concentration of blank (µg/ml)	=	0.0013	µg/ml
v _{fs}	= liquid volume of filtered sample (ml)	=	810.0	ml
d	= dilution factor	=	1.0	
m _b	= allowable blank subtraction (µg)	=	0.0000	µg

Note: No blank correction is made since total Cr+6 collected is < MDL.

3. Total Cr⁺⁶ collected, corrected for blank (µg)

$$m_{nb} = m_{Cr^{+6}} - m_b$$

Where:

m _{Cr⁺⁶}	= total Cr ⁺⁶ collected (µg)	=	<0.4860	µg
m _b	= allowable blank subtraction (µg)	=	0.0000	µg
m _{nb}	= total Cr ⁺⁶ collected, corrected for blank (µg)	=	<0.4860	µg

4. Minimum detectable Cr⁺⁶ (µg)

$$m_{MDL} = (MDL)(v_{fs})(d)$$

Where:

MDL	= minimum detectable Cr ⁺⁶ concentration (µg/ml)	=	0.001	µg/ml
v _{fs}	= liquid volume of filtered sample (ml)	=	810.0	ml
d	= dilution factor	=	1.0	
m _{MDL}	= minimum detectable Cr ⁺⁶ (µg)	=	0.4860	µg

5. Total Cr⁺⁶ value used in emission calculations (µg)

$$m_n = \text{MAXIMUM} [m_{nb} \text{ or } < m_{MDL}]$$

Where:

m _{nb}	= total Cr ⁺⁶ collected, corrected for blank (µg)	=	<0.4860	µg
m _{MDL}	= minimum detectable Cr ⁺⁶ (µg)	=	0.4860	µg
m _n	= total Cr ⁺⁶ value used in emission calculations (µg)	=	<0.4860	µg

USEPA SW-846 Method 0061 (Hexavalent Chromium) Cr⁺⁶ Sample Calculations

Sample data taken from Run 1

Note: The tables presenting the results are generated electronically from raw data. It may not be possible to exactly duplicate these results using a calculator. The reference method data, results, and all calculations are carried to sixteen decimal places throughout. The final table is formatted to an appropriate number of significant figures.

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P_M

1. Cr⁺⁶ concentration (lb/dscf)

$$C_{sd} = \left(\frac{m_n}{V_{mstd}} \right) \left(\frac{2.205 \times 10^{-3}}{10^6} \right)$$

Where:

m_n	= total Cr ⁺⁶ collected, corrected for applicable blank (µg)	=	<0.4860	µg
V_{mstd}	= volume metered, standard (dscf)	=	116.4254	dscf
2.205×10^{-3}	= conversion factor (lb/g)	=	2.205E-03	lb/g
10^6	= conversion factor (µg/g)	=	1.00E+06	µg/g
C_{sd}	= Cr ⁺⁶ concentration (lb/dscf)	=	<9.2044E-12	lb/dscf

2. Cr⁺⁶ concentration (gr/dscf)

$$C_{sd} = \left(\frac{m_n}{V_{mstd}} \right) \left(\frac{15.43}{10^6} \right)$$

Where:

m_n	= total Cr ⁺⁶ collected, corrected for applicable blank (µg)	=	<0.4860	µg
V_{mstd}	= volume metered, standard (dscf)	=	116.4254	dscf
15.43	= conversion factor (grains/g)	=	15.43	grains/g
10^6	= conversion factor (µg/g)	=	1.00E+06	µg/g
C_{sd}	= Cr ⁺⁶ concentration (gr/dscf)	=	<6.4410E-08	gr/dscf

3. Cr⁺⁶ concentration (µg/dscm)

$$C_{sd} = \left(\frac{m_n}{V_{mstd}} \right) (35.31)$$

Where:

m_n	= total Cr ⁺⁶ collected, corrected for applicable blank (µg)	=	<0.4860	µg
V_{mstd}	= volume metered, standard (dscf)	=	116.4254	dscf
35.31	= conversion factor (dscf/dscm)	=	35.31	dscf/dscm
C_{sd}	= Cr ⁺⁶ concentration (µg/dscm)	=	<1.4740E-01	µg/dscm

4. Cr⁺⁶ concentration (µg/Nm³ dry)

$$C_{sd} = \left(\frac{m_n}{V_{mstd}} \right) (35.31) \left(\frac{68 + 460}{32 + 460} \right)$$

Where:

m_n	= total Cr ⁺⁶ collected, corrected for applicable blank (µg)	=	<0.4860	µg
V_{mstd}	= volume metered, standard (dscf)	=	116.4254	dscf
35.31	= conversion factor (dscf/dscm)	=	35.31	dscf/dscm
68	= standard temperature (°F)	=	68	°F
32	= normal temperature (°F)	=	32	°F
460	= °F to °R conversion constant	=	460	

$$C_{sd} = \text{Cr}^{+6} \text{ concentration (µg/Nm}^3 \text{ dry)} = <1.5818\text{E-01 } \mu\text{g/Nm}^3 \text{ dry}$$

5. Cr⁺⁶ concentration at actual gas conditions (lb/acf example)

$$C_a = C_{sd} \left(\frac{Q_{std}}{Q_a} \right)$$

Where:

C_{sd}	= Cr ⁺⁶ concentration (lb/dscf)	=	<9.2044E-12	lb/dscf
Q_{std}	= volumetric flow rate at standard conditions, dry basis (dscfm)	=	135,720	dscfm
Q_a	= volumetric flow rate at actual conditions (acfm)	=	210,452	acfm

$$C_a = \text{Cr}^{+6} \text{ concentration at actual gas conditions (lb/acf)} = <5.9359\text{E-12 } \text{lb/acf}$$

6. Cr⁺⁶ rate (lb/hr)

$$E_{lb/hr} = \left(\frac{m_n}{V_{mstd}} \right) \left(\frac{2.205 \times 10^{-3}}{10^6} \right) (Q_{std}) (60)$$

Where:

m_n	= total Cr ⁺⁶ collected, corrected for applicable blank (µg)	=	<0.4860	µg
V_{mstd}	= volume metered, standard (dscf)	=	116.4254	dscf
2.205×10^{-3}	= conversion factor (lb/g)	=	2.205E-03	lb/g
10^6	= conversion factor (µg/g)	=	1.00E+06	µg/g
Q_{std}	= volumetric flow rate at standard conditions, dry basis (dscfm)	=	135,720	dscfm
60	= conversion factor (min/hr)	=	60	min/hr

$$E_{lb/hr} = \text{Cr}^{+6} \text{ rate (lb/hr)} = <7.4954\text{E-05 } \text{lb/hr}$$

USEPA Method 26A (Halides / Halogens) Sampling, Velocity and Moisture Sample Calculations

Sample data taken from Run 1

Note: The tables presenting the results are generated electronically from raw data. It may not be possible to exactly duplicate these results using a calculator. The reference method data, results, and all calculations are carried to sixteen decimal places throughout. The final table is formatted to an appropriate number of significant figures.

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N

1. Volume of water collected (wscf)

$$V_{wstd} = (0.04706)(V_{lc})$$

Where:

V_{lc}	= total volume of liquid collected in impingers and silica gel (ml)	=	500.5	ml
0.04706	= ideal gas conversion factor (ft ³ water vapor/ml or gm)	=	0.04706	ft ³ /ml
V_{wstd}	= volume of water vapor collected at standard conditions (ft ³)	=	23.55	ft ³

2. Volume of gas metered, standard conditions (dscf)

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

Where:

P_{bar}	= barometric pressure (in. Hg)	=	29.30	in. Hg
T_m	= average dry gas meter temperature (°F)	=	110.04	°F
V_m	= volume of gas sample through the dry gas meter at meter conditions (dcf)	=	78.83	dcf
Y_d	= gas meter correction factor (dimensionless)	=	0.9925	
ΔH	= average pressure drop across meter box orifice (in. H ₂ O)	=	1.35	in. H ₂ O
17.64	= standard temperature to pressure ratio (°R/in. Hg)	=	17.64	°R/in. Hg
13.6	= conversion factor (in. H ₂ O/in. Hg)	=	13.6	in. H ₂ O/in. Hg
460	= °F to °R conversion constant	=	460	
V_{mstd}	= volume of gas sampled through the dry gas meter at standard conditions (dscf)	=	71.179	dscf

3. Sample gas pressure (in. Hg)

$$P_s = P_{bar} + \left(\frac{P_g}{13.6} \right)$$

Where:

P_{bar}	= barometric pressure (in. Hg)	=	29.30	in. Hg
P_g	= sample gas static pressure (in. H ₂ O)	=	-0.30	in. H ₂ O
13.6	= conversion factor (in. H ₂ O/in. Hg)	=	13.6	in. H ₂ O/in. Hg
P_s	= absolute sample gas pressure (in. Hg)	=	29.28	in. Hg

4. Actual water vapor pressure at sample gas temperature less than 212°F (in. Hg)

$$P_v = \frac{e^{\left(\frac{18.3036 - \frac{3816.44}{\frac{5}{9}(T_s - 32) + 273.15 - 46.13}}{25.4} \right)}}{25.4}$$

Where:

T_s	= average sample gas temperature (°F)	=	147.00	°F
18.3036	= Antoine coefficient	=	18.3036	°K
3816.44	= Antoine coefficient	=	3816.44	°K
273.15	= temperature conversion factor	=	273.15	°K
46.13	= Antoine coefficient	=	46.13	°K
25.4	= conversion factor	=	25.4	mm Hg/in. Hg
5/9	= Fahrenheit to Celsius conversion factor	=	5/9	°C/°F
32	= temperature conversion (°F)	=	32	°F
P_v	= vapor pressure, actual (in. Hg)	=	7.03	in. Hg

5. Water vapor pressure at gas temperature greater than 212°F (in. Hg)

$$P_v = P_s$$

Where:

P_s	= absolute sample gas pressure (in. Hg)	=	29.28	in. Hg
P_v	= water vapor pressure, actual (in. Hg)	=	Previously Defined	in. Hg

6. Moisture measured in sample (% by volume)

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

Where:

V_{mstd}	= volume of gas sampled through the dry gas meter at standard conditions (dscf)	=	71.179	dscf
V_{wstd}	= volume of water collected at standard conditions (scf)	=	23.55	scf
B_{wo}	= proportion of water measured in the gas stream by volume	=	0.2486	%

7. Saturated moisture content (% by volume)

$$B_{ws} = \frac{P_v}{P_s}$$

Where:

P_s	= absolute sample gas pressure (in. Hg)	=	29.28	in. Hg
P_v	= water vapor pressure, actual (in. Hg)	=	7.03	in. Hg
B_{ws}	= proportion of water vapor in the gas stream by volume at saturated conditions	=	0.2400	%

8. Actual water vapor in gas (% by volume)

$$B_w = \text{MINIMUM} [B_{wo}, B_{ws}]$$

Where:

B_{ws}	= proportion of water vapor in the gas stream by volume at saturated conditions	=	0.2400	
B_{wo}	= proportion of water measured in the gas stream by volume	=	0.2486	
B_w	= actual water vapor in gas	=	0.2400	
		=	24.00	%

9. Nitrogen (plus carbon monoxide) in gas stream (% by volume, dry)

$$N_2 + CO = 100 - CO_2 - O_2$$

Where:

CO_2	= proportion of carbon dioxide in the gas stream by volume (%)	=	13.9	%
O_2	= proportion of oxygen in the gas stream by volume (%)	=	3.7	%
100	= conversion factor (%)	=	100	%
N_2+CO	= proportion of nitrogen and CO in the gas stream by volume (%)	=	82.45	%

10. Molecular weight of dry gas stream (lb/lb-mole)

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

Where:

M_{CO_2}	= molecular weight of carbon dioxide (lb/lb-mole)	=	44.00	lb/lb-mole
M_{O_2}	= molecular weight of oxygen (lb/lb-mole)	=	32.00	lb/lb-mole
M_{N_2+CO}	= molecular weight of nitrogen and carbon monoxide (lb/lb-mole)	=	28.00	lb/lb-mole
CO_2	= proportion of carbon dioxide in the gas stream by volume (%)	=	13.9	%
O_2	= proportion of oxygen in the gas stream by volume (%)	=	3.7	%
N_2+CO	= proportion of nitrogen and CO in the gas stream by volume (%)	=	82.5	%
100	= conversion factor (%)	=	100	%
M_d	= dry molecular weight of sample gas (lb/lb-mole)	=	30.37	lb/lb-mole

11. Molecular weight of sample gas (lb/lb-mole)

$$M_s = (M_d)(1 - B_w) + (M_{H_2O})(B_w)$$

Where:

B_w	= proportion of water vapor in the gas stream by volume	=	0.2400	
M_d	= dry molecular weight of sample gas (lb/lb-mole)	=	30.37	lb/lb-mole
M_{H_2O}	= molecular weight of water (lb/lb-mole)	=	18.00	lb/lb-mole
M_s	= molecular weight of sample gas, wet basis (lb/lb-mole)	=	27.40	lb/lb-mole

12. Velocity of sample gas (ft/sec)

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

Where:

K_p	= velocity pressure constant	=	85.49	
C_p	= pitot tube coefficient	=	0.83	
M_s	= wet molecular weight of sample gas, wet basis (lb/lb-mole)	=	27.40	lb/lb-mole
P_s	= absolute sample gas pressure (in. Hg)	=	29.28	in. Hg
T_s	= average sample gas temperature (°F)	=	147.00	°F
$\sqrt{\Delta P}$	= average square roots of velocity heads of sample gas (in. H ₂ O)	=	0.765	√in. H ₂ O
460	= °F to °R conversion constant	=	460	
V_s	= sample gas velocity (ft/sec)	=	47.02	ft/sec

13. Volumetric flow rate of sample gas at actual gas conditions (acfm)

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

Where:

A_s	= cross sectional area of sampling location (ft ²)	=	70.88	ft ²
V_s	= sample gas velocity (ft/sec)	=	47.02	ft/sec
60	conversion factor (sec/min)	=	60	sec/min
Q_a	= volumetric flow rate at actual conditions (acfm)	=	199,990	acfm

14. Total flow of sample gas (scfm)

$$Q_s = (Q_a) \left(\frac{P_s}{29.92} \right) \left(\frac{68 + 460}{T_s + 460} \right)$$

Where:

Q_a	= volumetric flow rate at actual conditions (acfm)	=	199,990	acfm
P_s	= absolute sample gas pressure (in. Hg)	=	29.28	in. Hg
29.92	= standard pressure (in. Hg)	=	29.92	in. Hg
T_s	= average sample gas temperature (°F)	=	147.0	°F
68	= standard temperature (°F)	=	68	°F
460	= °F to °R conversion constant	=	460	
Q_s	= volumetric flow rate at standard conditions, wet basis (scfm)	=	170,228	scfm

15. Dry flow of sample gas (dscfm)

$$Q_{std} = (Q_s)(1 - B_w)$$

Where:

B_w	= proportion of water vapor in the gas stream by volume	=	0.2400	
Q_s	= volumetric flow rate at standard conditions, wet basis (scfm)	=	170,228	scfm
Q_{std}	= volumetric flow rate at standard conditions, dry basis (dscfm)	=	129,369	dscfm

16. Hourly time basis conversion of volumetric flow rate (Q_{std} example)

$$Q_{std-hr} = (Q_{std-min})(60)$$

Where

$Q_{std-min}$	= volumetric flow rate, english units (ft ³ /min)	=	129,369	dscfm
60	= conversion factor (min/hr)	=	60	min/hr

Q_{std-hr}	= volumetric flow rate, hourly basis (dscf/hr)	=	7,762,144	dscf/hr
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17. Metric Conversion of Gas Volumes (Q_{std} example)

$$Q_{std-metric} = (Q_{std-english}) \left(\frac{60}{35.31} \right)$$

Where:

$Q_{std-english}$	= volumetric flow rate, english units (ft ³ /min)	=	129,369	dscfm
35.31	= conversion factor (ft ³ /m ³)	=	35.31	ft ³ /m ³
60	= conversion factor (min/hr)	=	60	min/hr

$Q_{std-metric}$	= volumetric flow rate, metric units (m ³ /hr)	=	219,828	dry std m ³ /hr
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18. Standard to Normal Conversion of Gas Volumes (Q_{std} example)

$$Q_{Normal} = (Q_{std-metric}) \left(\frac{32 + 460}{68 + 460} \right)$$

Where:

$Q_{std-metric}$	= volumetric flow rate, metric units (dry std m ³ /hr)	=	219,828	dry std m ³ /hr
32	= normal temperature (°F)	=	32	°F
68	= standard temperature (°F)	=	68	°F
460	= standard temperature in Rankine (68°F)	=	460	

Q_{Normal}	= volumetric flow rate, metric units (dry Nm ³ /hr)	=	204,840	dry Nm ³ /hr
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19. Percent isokinetic (%)

$$I = \frac{(0.09450)(T_s + 460)(V_{mstd})}{(P_s)(V_s)\left(\frac{(D_n)^2(\pi)}{(144)(4)}\right)(\Theta)(1 - B_w)}$$

Where:

D_n	= diameter of nozzle (in)	=	0.250	in.
B_w	= proportion of water vapor in the gas stream by volume	=	0.2400	
P_s	= absolute sample gas pressure (in. Hg)	=	29.28	in. Hg
T_s	= average sample gas temperature (°F)	=	147.0	°F
V_{mstd}	= volume of gas sample through the dry gas meter at standard conditions (dscf)	=	71.179	dscf
V_s	= sample gas velocity (ft/sec)	=	47.02	ft/sec
θ	= total sampling time (min)	=	120	min
0.0945	= conversion constant	=	0.0945	
460	= °F to °R conversion constant	=	460	
I	= percent of isokinetic sampling (%)	=	95.39	%

20. Alternative Method 5 Post-Test Meter Calibration Factor

$$Y_{qa} = \frac{\Theta}{V_m} \sqrt{\frac{(0.0319)(T_m + 460)(28.96)}{(\Delta H_{@})(P_{bar} + \frac{\Delta H}{13.6})(M_d)}} (\sqrt{\Delta H})_{avg}$$

Where:

θ	= total sampling time (min)	=	120	min
V_m	= volume of gas sample through the dry gas meter at meter conditions (dcf)	=	78.83	dcf
T_m	= average dry gas meter temperature (°F)	=	110.04	°F
$\Delta H_{@}$	= dry gas meter orifice coefficient	=	1.7792	
P_{bar}	= barometric pressure (in. Hg)	=	29.30	in. Hg
ΔH	= average pressure drop across meter box orifice (in. H ₂ O)	=	1.350	in. H ₂ O
M_d	= dry molecular weight of sample gas (lb/lb-mole)	=	30.37	lb/lb-mole
$\sqrt{\Delta H}_{avg}$	= average of square root of pressure drop across meter orifice	=	1.159	$\sqrt{\text{in. H}_2\text{O}}$
0.0319	= conversion constant	=	0.0319	
28.96	= molecular weight of ambient air (lb/lb-mole)	=	28.96	lb/lb-mole
13.6	= conversion factor (in. H ₂ O/in. Hg)	=	13.6	in. H ₂ O/in. Hg
460	= °F to °R conversion constant	=	460	
Y_{qa}	= alternative Method 5 post-test meter calibration factor	=	1.0156	

USEPA Method 26A HCl Analyte Calculations

Sample data taken from Run 1

Note: The tables presenting the results are generated electronically from raw data. It may not be possible to exactly duplicate these results using a calculator. The reference method data, results, and all calculations are carried to sixteen decimal places throughout. The final table is formatted to an appropriate number of significant figures.

090911 111429

T

1. Chloride to HCl conversion factor

$$K_{HCl} = \frac{MW_{HCl}}{n \times MW_{Cl^-}}$$

Where:

MW_{HCl}	= molecular weight of HCl (mg/mg-mole)	=	36.461	mg/mg-mole
MW_{Cl^-}	= molecular weight of chloride ion (mg/mg-mole)	=	35.453	mg/mg-mole
n	= molar ratio of chloride to HCl	=	1.0	mole Cl/mole HCl
K_{HCl}	= conversion factor to convert mass Cl ⁻ to mass HCl	=	1.028	

2. Total HCl collected (mg)

$$m_{HCl} = K_{HCl} \times \frac{(S_{Cl-1}v_1 + S_{Cl-2}v_2)}{1000}$$

Where:

K_{HCl}	= conversion factor to convert mass Cl ⁻ to mass HCl	=	1.028	
S_{Cl-1}	= chloride concentration of sample fraction 1 (mg/liter)	=	0.1400	mg/liter
v_1	= liquid volume of sample fraction 1 (ml)	=	990.0	ml
S_{Cl-2}	= chloride concentration of sample fraction 2 (mg/liter)	=	0.0000	mg/liter
v_2	= liquid volume of sample fraction 2 (ml)	=	0.0	ml
1000	= conversion factor (ml/liter)	=	1000	ml/liter
m_{HCl}	= total HCl collected in sample (mg)	=	0.1425	mg

Note: Non-detects are treated as zero in summations.

DEFINITION

Fraction 1 = entire sample except last impinger containing applicable absorbing reagent.
Fraction 2 = last impinger containing applicable absorbing reagent, analyzed separately to evaluate collection efficiency.
If entire sample is analyzed as a single fraction, then data is included as Fraction 1 (Fraction 2 = 0).

3. Allowable blank subtraction (mg)

$$m_b = K_{HCl} \times B_{Cl} \times \frac{(v_1 + v_2)}{1000}$$

$$m_b = 0 \text{ if } B_{Cl} < MDL$$

Where:

K_{HCl}	= conversion factor to convert mass Cl ⁻ to mass HCl	=	1.0280	
B_{Cl}	= chloride concentration of blank (mg/liter)	=	<0.0	mg/liter
v_1	= liquid volume of sample fraction 1 (ml)	=	990.0	ml
v_2	= liquid volume of sample fraction 2 (ml)	=	0	ml
1000	= conversion factor (ml/liter)	=	1000.0000	ml/liter
m_b	= allowable blank subtraction (mg)	=	0.0000	mg

4. Total HCl collected, corrected for blank (mg)

$$m_{nb} = m_{HCl} - m_b$$

Where:

m_{HCl}	= total HCl collected in sample (mg)	=	0.1425	mg
m_b	= allowable blank subtraction (mg)	=	0.0000	mg
m_{nb}	= total HCl collected, corrected for blank (mg)	=	0.1425	mg

5. Minimum detectable HCl (mg)

$$m_{MDL} = K_{HCl} \times MDL \times \frac{(v_1 + v_2)}{1000}$$

Where:

K_{HCl}	= conversion factor to convert mass Cl ⁻ to mass HCl	=	1.028	
MDL	= minimum detectable chloride concentration	=	0.0	mg/liter
v_1	= liquid volume of sample fraction 1 (ml)	=	990.0	ml
v_2	= liquid volume of sample fraction 2 (ml)	=	0	ml
1000	= conversion factor (ml/liter)	=	1000	ml/liter
m_{MDL}	= minimum detectable HCl (mg)	=	0.0183	mg

6. Total HCl value used in emission calculations (mg)

$$m_n = \text{MAXIMUM} [m_{nb} \text{ or } < m_{MDL}]$$

Where:

m_{nb}	= total HCl collected, corrected for blank (mg)	=	0.1425	mg
m_{MDL}	= minimum detectable HCl (mg)	=	0.0183	mg
m_n	= total HCl value used in emission calculations (mg)	=	0.1425	mg

USEPA Method 26A HCl Sample Calculations

Sample data taken from Run 1

Note: The tables presenting the results are generated electronically from raw data. It may not be possible to exactly duplicate these results using a calculator. The reference method data, results, and all calculations are carried to sixteen decimal places throughout. The final table is formatted to an appropriate number of significant figures.

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N_T

1. HCl concentration (lb/dscf)

$$C_{sd} = \left(\frac{m_n}{V_{mstd}} \right) \left(\frac{2.205 \times 10^{-3}}{1000} \right)$$

Where:

m_n	= total HCl collected, corrected for applicable blank (mg)	=	0.1425	mg
V_{mstd}	= volume metered, standard (dscf)	=	71.1788	dscf
2.205×10^{-3}	= conversion factor (lb/g)	=	2.205E-03	lb/g
1000	= conversion factor (mg/g)	=	1,000	mg/g
C_{sd}	= HCl concentration (lb/dscf)	=	4.4138E-09	lb/dscf

2. HCl concentration (ppmdv)

$$C_{sd} = \left(\frac{m_n}{V_{mstd}} \right) \left(\frac{0.850}{1000} \right) \left(\frac{10^6}{MW} \right)$$

Where:

m_n	= total HCl collected, corrected for applicable blank (mg)	=	0.1425	mg
V_{mstd}	= volume metered, standard (dscf)	=	71.1788	dscf
MW	= molecular weight of HCl (g/g-mole)	=	36.461	g/g-mole
0.850	= conversion factor (dscf/g-mole)	=	0.850	dscf/g-mole
1000	= conversion factor (mg/g)	=	1,000	mg/g
10^6	= conversion factor (ppm)	=	10^6	ppm
C_{sd}	= HCl concentration (ppmdv)	=	0.0467	ppmdv

3. HCl concentration (ppmwv)

$$C_w = C_{sd} \left(1 - \frac{B_w}{100} \right)$$

Where:

C_{sd}	= HCl concentration (ppmdv)	=	0.0467	ppmdv
B_w	= actual water vapor in gas (% v/v)	=	24.0027	% v/v
100	= conversion factor (%)	=	100	%
C_w	= HCl concentration (ppmwv)	=	0.0355	ppmwv

4. HCl concentration (mg/dscm)

$$C_{sd} = \left(\frac{m_n}{V_{mstd}} \right) (35.31)$$

Where:

m_n	= total HCl collected, corrected for applicable blank (mg)	=	0.1425	mg
V_{mstd}	= volume metered, standard (dscf)	=	71.1788	dscf
35.31	= conversion factor (dscf/dscm)	=	35.31	dscf/dscm
C_{sd}	= HCl concentration (mg/dscm)	=	0.0707	mg/dscm

5. HCl concentration (mg/Nm³ dry)

$$C_{sd} = \left(\frac{m_n}{V_{mstd}} \right) (35.31) \left(\frac{68 + 460}{32 + 460} \right)$$

Where:

m_n	= total HCl collected, corrected for applicable blank (mg)	=	0.1425	mg
V_{mstd}	= volume metered, standard (dscf)	=	71.1788	dscf
35.31	= conversion factor (dscf/dscm)	=	35.31	dscf/dscm
68	= standard temperature (°F)	=	68	°F
32	= normal temperature (°F)	=	32	°F
460	= °F to °R conversion constant	=	460	
C_{sd}	= HCl concentration (mg/Nm ³ dry)	=	0.0759	mg/Nm ³ dry

6. HCl concentration at actual gas conditions (lb/acf example)

$$C_a = C_{sd} \left(\frac{Q_{std}}{Q_a} \right)$$

Where:

C_{sd}	= HCl concentration (lb/dscf)	=	4.4138E-09	lb/dscf
Q_{std}	= volumetric flow rate at standard conditions, dry basis (dscfm)	=	129,369	dscfm
Q_a	= volumetric flow rate at actual conditions (acfm)	=	199,990	acfm
C_a	= HCl concentration at actual gas conditions (lb/acf)	=	2.8552E-09	lb/acf

7. HCl rate (lb/hr)

$$E_{lb/hr} = \left(\frac{m_n}{V_{mstd}} \right) \left(\frac{2.205 \times 10^{-3}}{1000} \right) (Q_{std}) (60)$$

Where:

m_n	= total HCl collected, corrected for applicable blank (mg)	=	0.1425	mg
V_{mstd}	= volume metered, standard (dscf)	=	71.1788	dscf
2.205×10^{-3}	= conversion factor (lb/g)	=	2.205E-03	lb/g
1000	= conversion factor (mg/g)	=	1,000	mg/g
Q_{std}	= volumetric flow rate at standard conditions, dry basis (dscfm)	=	129,369	dscfm
60	= conversion factor (min/hr)	=	60	min/hr
$E_{lb/hr}$	= HCl rate (lb/hr)	=	0.0343	lb/hr

USEPA Method 26A Cl₂ Analyte Calculations

Sample data taken from Run 1

Note: The tables presenting the results are generated electronically from raw data. It may not be possible to exactly duplicate these results using a calculator. The reference method data, results, and all calculations are carried to sixteen decimal places throughout. The final table is formatted to an appropriate number of significant figures.

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T

1. Chloride to Cl₂ conversion factor

$$K_{Cl_2} = \frac{MW_{Cl_2}}{n \times MW_{Cl^-}}$$

Where:

MW _{Cl₂}	= molecular weight of Cl ₂ (mg/mg-mole)	=	70.906	mg/mg-mole
MW _{Cl⁻}	= molecular weight of chloride ion (mg/mg-mole)	=	35.453	mg/mg-mole
n	= molar ratio of chloride to Cl ₂	=	2.0	mole Cl/mole Cl ₂
K _{Cl₂}	= conversion factor to convert mass Cl ⁻ to mass Cl ₂	=	1.000	

2. Total Cl₂ collected (mg)

$$m_{Cl_2} = K_{Cl_2} \times \frac{(S_{Cl-1}v_1 + S_{Cl-2}v_2)}{1000}$$

Where:

K _{Cl₂}	= conversion factor to convert mass Cl ⁻ to mass Cl ₂	=	1.000	
S _{Cl-1}	= chloride concentration of sample fraction 1 (mg/liter)	=	<0.0180	mg/liter
v ₁	= liquid volume of sample fraction 1 (ml)	=	440.0	ml
S _{Cl-2}	= chloride concentration of sample fraction 2 (mg/liter)	=	0.0000	mg/liter
v ₂	= liquid volume of sample fraction 2 (ml)	=	0.0	ml
1000	= conversion factor (ml/liter)	=	1000	ml/liter
m _{Cl₂}	= total Cl ₂ collected in sample (mg)	=	<0.0079	mg

Note: Non-detects are treated as zero in summations.

DEFINITION

Fraction 1 = entire sample except last impinger containing applicable absorbing reagent.
Fraction 2 = last impinger containing applicable absorbing reagent, analyzed separately to evaluate collection efficiency.
If entire sample is analyzed as a single fraction, then data is included as Fraction 1 (Fraction 2 = 0).

3. Allowable blank subtraction (mg)

$$m_b = K_{Cl_2} \times B_{Cl} \times \frac{(v_1 + v_2)}{1000}$$

$$m_b = 0 \text{ if } B_{Cl} < MDL$$

Where:

K _{Cl₂}	= conversion factor to convert mass Cl ⁻ to mass Cl ₂	=	1.0000	
B _{Cl}	= chloride concentration of blank (mg/liter)	=	<0.0	mg/liter
v ₁	= liquid volume of sample fraction 1 (ml)	=	440.0	ml
v ₂	= liquid volume of sample fraction 2 (ml)	=	0	ml
1000	= conversion factor (ml/liter)	=	1000.0000	ml/liter
m _b	= allowable blank subtraction (mg)	=	0.0000	mg

4. Total Cl₂ collected, corrected for blank (mg)

$$m_{nb} = m_{Cl_2} - m_b$$

Where:

m_{Cl_2}	= total Cl ₂ collected in sample (mg)	=	<0.0079	mg
m_b	= allowable blank subtraction (mg)	=	0.0000	mg
m_{nb}	= total Cl ₂ collected, corrected for blank (mg)	=	<0.0079	mg

5. Minimum detectable Cl₂ (mg)

$$m_{MDL} = K_{Cl_2} \times MDL \times \frac{(v_1 + v_2)}{1000}$$

Where:

K_{Cl_2}	= conversion factor to convert mass Cl ⁻ to mass Cl ₂	=	1.000	
MDL	= minimum detectable chloride concentration	=	0.0	mg/liter
v_1	= liquid volume of sample fraction 1 (ml)	=	440.0	ml
v_2	= liquid volume of sample fraction 2 (ml)	=	0	ml
1000	= conversion factor (ml/liter)	=	1000	ml/liter
m_{MDL}	= minimum detectable Cl ₂ (mg)	=	0.0079	mg

6. Total Cl₂ value used in emission calculations (mg)

$$m_n = \text{MAXIMUM} [m_{nb} \text{ or } < m_{MDL}]$$

Where:

m_{nb}	= total Cl ₂ collected, corrected for blank (mg)	=	<0.0079	mg
m_{MDL}	= minimum detectable Cl ₂ (mg)	=	0.0079	mg
m_n	= total Cl ₂ value used in emission calculations (mg)	=	<0.0079	mg

USEPA Method 26A HF Analyte Calculations

Sample data taken from Run 1

Note: The tables presenting the results are generated electronically from raw data. It may not be possible to exactly duplicate these results using a calculator. The reference method data, results, and all calculations are carried to sixteen decimal places throughout. The final table is formatted to an appropriate number of significant figures.

090911 111429
H

1. Fluoride to HF conversion factor

$$K_{HF} = \frac{MW_{HF}}{n \times MW_{F^-}}$$

Where:

MW_{HF}	= molecular weight of HF (mg/mg-mole)	=	20.006	mg/mg-mole
MW_{F^-}	= molecular weight of fluoride ion (mg/mg-mole)	=	18.998	mg/mg-mole
n	= molar ratio of fluoride to HF	=	1.0	mole F/mole HF
K_{HF}	= conversion factor to convert mass F to mass HF	=	1.053	

2. Total HF collected (mg)

$$m_{HF} = K_{HF} \times \frac{(S_{F-1}v_1 + S_{F-2}v_2)}{1000}$$

Where:

K_{HF}	= conversion factor to convert mass F to mass HF	=	1.053	
S_{F-1}	= fluoride concentration of sample fraction 1 (mg/liter)	=	<0.0080	mg/liter
v_1	= liquid volume of sample fraction 1 (ml)	=	990.0	ml
S_{F-2}	= fluoride concentration of sample fraction 2 (mg/liter)	=	0.0000	mg/liter
v_2	= liquid volume of sample fraction 2 (ml)	=	0.0	ml
1000	= conversion factor (ml/liter)	=	1000	ml/liter
m_{HF}	= total HF collected in sample (mg)	=	<0.0083	mg

Note: Non-detects are treated as zero in summations.

DEFINITION

Fraction 1 = entire sample except last impinger containing applicable absorbing reagent.
Fraction 2 = last impinger containing applicable absorbing reagent, analyzed separately to evaluate collection efficiency.
If entire sample is analyzed as a single fraction, then data is included as Fraction 1 (Fraction 2 = 0).

3. Allowable blank subtraction (mg)

$$m_b = K_{HF} \times B_F \times \frac{(v_1 + v_2)}{1000}$$

$$m_b = 0 \text{ if } B_F < MDL$$

Where:

K_{HF}	= conversion factor to convert mass F to mass HF	=	1.053	
B_F	= fluoride concentration of blank (mg/liter)	=	<0.0080	mg/liter
v_1	= liquid volume of sample fraction 1 (ml)	=	990.0	ml
v_2	= liquid volume of sample fraction 2 (ml)	=	0.0	ml
1000	= conversion factor (ml/liter)	=	1000	ml/liter
m_b	= allowable blank subtraction (mg)	=	0.0000	mg

4. Total HF collected, corrected for blank (mg)

$$m_{nb} = m_{HF} - m_b$$

Where:

m_{HF}	= total HF collected in sample (mg)	=	<0.0083	mg
m_b	= allowable blank subtraction (mg)	=	0.0000	mg
m_{nb}	= total HF collected, corrected for blank (mg)	=	<0.0083	mg

5. Minimum detectable HF (mg)

$$m_{MDL} = K_{HF} \times MDL \times \frac{(v_1 + v_2)}{1000}$$

Where:

K_{HF}	= conversion factor to convert mass F ⁻ to mass HF	=	1.053	
MDL	= minimum detectable fluoride concentration	=	0.008	mg/liter
v_1	= liquid volume of sample fraction 1 (ml)	=	990.0	ml
v_2	= liquid volume of sample fraction 2 (ml)	=	0.0	ml
1000	= conversion factor (ml/liter)	=	1000	ml/liter
m_{MDL}	= minimum detectable HF (mg)	=	0.0083	mg

6. Total HF value used in emission calculations (mg)

$$m_n = \text{MAXIMUM} [m_{nb} \text{ or } < m_{MDL}]$$

Where:

m_{nb}	= total HF collected, corrected for blank (mg)	=	<0.0083	mg
m_{MDL}	= minimum detectable HF (mg)	=	0.0083	mg
m_n	= total HF value used in emission calculations (mg)	=	<0.0083	mg

USEPA Method 26A HF Sample Calculations

Sample data taken from Run 1

Note: The tables presenting the results are generated electronically from raw data. It may not be possible to exactly duplicate these results using a calculator. The reference method data, results, and all calculations are carried to sixteen decimal places throughout. The final table is formatted to an appropriate number of significant figures.

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N_H

1. HF concentration (lb/dscf)

$$C_{sd} = \left(\frac{m_n}{V_{mstd}} \right) \left(\frac{2.205 \times 10^{-3}}{1000} \right)$$

Where:

m_n	= total HF collected, corrected for applicable blank (mg)	=	<0.0083	mg
V_{mstd}	= volume metered, standard (dscf)	=	71.1788	dscf
2.205×10^{-3}	= conversion factor (lb/g)	=	2.205E-03	lb/g
1000	= conversion factor (mg/g)	=	1,000	mg/g
C_{sd}	= HF concentration (lb/dscf)	=	<2.5835E-10	lb/dscf

2. HF concentration (ppmdv)

$$C_{sd} = \left(\frac{m_n}{V_{mstd}} \right) \left(\frac{0.850}{1000} \right) \left(\frac{10^6}{MW} \right)$$

Where:

m_n	= total HF collected, corrected for applicable blank (mg)	=	<0.0083	mg
V_{mstd}	= volume metered, standard (dscf)	=	71.1788	dscf
MW	= molecular weight of HF (g/g-mole)	=	20.006	g/g-mole
0.850	= conversion factor (dscf/g-mole)	=	0.850	dscf/g-mole
1000	= conversion factor (mg/g)	=	1,000	mg/g
10^6	= conversion factor (ppm)	=	10^6	ppm
C_{sd}	= HF concentration (ppmdv)	=	<0.0050	ppmdv

3. HF concentration (ppmwv)

$$C_w = C_{sd} \left(1 - \frac{B_w}{100} \right)$$

Where:

C_{sd}	= HF concentration (ppmdv)	=	<0.0050	ppmdv
B_w	= actual water vapor in gas (% v/v)	=	24.0027	% v/v
100	= conversion factor (%)	=	100	%
C_w	= HF concentration (ppmwv)	=	<0.0038	ppmwv

4. HF concentration (mg/dscm)

$$C_{sd} = \left(\frac{m_n}{V_{mstd}} \right) (35.31)$$

Where:

m_n	= total HF collected, corrected for applicable blank (mg)	=	<0.0083	mg
V_{mstd}	= volume metered, standard (dscf)	=	71.1788	dscf
35.31	= conversion factor (dscf/dscm)	=	35.31	dscf/dscm
C_{sd}	= HF concentration (mg/dscm)	=	<0.0041	mg/dscm

5. HF concentration (mg/Nm³ dry)

$$C_{sd} = \left(\frac{m_n}{V_{mstd}} \right) (35.31) \left(\frac{68 + 460}{32 + 460} \right)$$

Where:

m_n	= total HF collected, corrected for applicable blank (mg)	=	<0.0083	mg
V_{mstd}	= volume metered, standard (dscf)	=	71.1788	dscf
35.31	= conversion factor (dscf/dscm)	=	35.31	dscf/dscm
68	= standard temperature (°F)	=	68	°F
32	= normal temperature (°F)	=	32	°F
460	= °F to °R conversion constant	=	460	
C_{sd}	= HF concentration (mg/Nm ³ dry)	=	<0.0044	mg/Nm ³ dry

6. HF concentration at actual gas conditions (lb/acf example)

$$C_a = C_{sd} \left(\frac{Q_{std}}{Q_a} \right)$$

Where:

C_{sd}	= HF concentration (lb/dscf)	=	<2.5835E-10	lb/dscf
Q_{std}	= volumetric flow rate at standard conditions, dry basis (dscfm)	=	129,369	dscfm
Q_a	= volumetric flow rate at actual conditions (acfm)	=	199,990	acfm
C_a	= HF concentration at actual gas conditions (lb/acf)	=	<1.6712E-10	lb/acf

7. HF rate (lb/hr)

$$E_{lb/hr} = \left(\frac{m_n}{V_{mstd}} \right) \left(\frac{2.205 \times 10^{-3}}{1000} \right) (Q_{std}) (60)$$

Where:

m_n	= total HF collected, corrected for applicable blank (mg)	=	<0.0083	mg
V_{mstd}	= volume metered, standard (dscf)	=	71.1788	dscf
2.205×10^{-3}	= conversion factor (lb/g)	=	2.205E-03	lb/g
1000	= conversion factor (mg/g)	=	1,000	mg/g
Q_{std}	= volumetric flow rate at standard conditions, dry basis (dscfm)	=	129,369	dscfm
60	= conversion factor (min/hr)	=	60	min/hr
$E_{lb/hr}$	= HF rate (lb/hr)	=	<0.0020	lb/hr

USEPA OTM-29 (Cyanide) Sampling, Velocity and Moisture Sample Calculations

Sample data taken from Run 1

Note: The tables presenting the results are generated electronically from raw data. It may not be possible to exactly duplicate these results using a calculator. The reference method data, results, and all calculations are carried to sixteen decimal places throughout. The final table is formatted to an appropriate number of significant figures.

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N

1. Volume of water collected (wscf)

$$V_{wstd} = (0.04706)(V_{lc})$$

Where:

V_{lc}	= total volume of liquid collected in impingers and silica gel (ml)	=	308.2	ml
0.04706	= ideal gas conversion factor (ft ³ water vapor/ml or gm)	=	0.04706	ft ³ /ml
V_{wstd}	= volume of water vapor collected at standard conditions (ft ³)	=	14.50	ft ³

2. Volume of gas metered, standard conditions (dscf)

$$V_{mstd} = \frac{(17.64)(V_m) \left(P_{bar} + \frac{\Delta H}{13.6} \right) (Y_d) \left(1 - \frac{CO_{2,out}}{100} \right)}{(460 + T_m) \left(1 - \frac{CO_{2,in}}{100} \right)}$$

Where:

P_{bar}	= barometric pressure (in. Hg)	=	29.30	in. Hg
T_m	= average dry gas meter temperature (°F)	=	106.46	°F
V_m	= volume of gas sample through the dry gas meter at meter conditions (dcf)	=	35.46	dcf
Y_d	= gas meter correction factor (dimensionless)	=	0.9827	
ΔH	= average pressure drop across meter box orifice (in. H ₂ O)	=	1.00	in. H ₂ O
17.64	= standard temperature to pressure ratio (°R/in. Hg)	=	17.64	°R/in. Hg
13.6	= conversion factor (in. H ₂ O/in. Hg)	=	13.6	in. H ₂ O/in. Hg
460	= °F to °R conversion constant	=	460	
$CO_{2,out}$	= proportion of carbon dioxide in the sample train outlet (%)	=	9.8	%
$CO_{2,in}$	= proportion of carbon dioxide in the flue gas stream (%)	=	13.9	%
100	= conversion factor (%)	=	100	%
V_{mstd}	= volume of gas sampled through the dry gas meter at standard conditions (dscf)	=	33.388	dscf

3. Sample gas pressure (in. Hg)

$$P_s = P_{bar} + \left(\frac{P_g}{13.6} \right)$$

Where:

P_{bar}	= barometric pressure (in. Hg)	=	29.30	in. Hg
P_g	= sample gas static pressure (in. H ₂ O)	=	-0.30	in. H ₂ O
13.6	= conversion factor (in. H ₂ O/in. Hg)	=	13.6	in. H ₂ O/in. Hg
P_s	= absolute sample gas pressure (in. Hg)	=	29.28	in. Hg

4. Actual water vapor pressure at sample gas temperature less than 212°F (in. Hg)

$$P_v = \frac{e^{\left(\frac{18.3036 - \frac{3816.44}{\frac{5}{9}(T_s - 32) + 273.15 - 46.13}}{25.4} \right)}}{25.4}$$

Where:

T_s	= average sample gas temperature (°F)	=	150.42	°F
18.3036	= Antoine coefficient	=	18.3036	°K
3816.44	= Antoine coefficient	=	3816.44	°K
273.15	= temperature conversion factor	=	273.15	°K
46.13	= Antoine coefficient	=	46.13	°K
25.4	= conversion factor	=	25.4	mm Hg/in. Hg
5/9	= Fahrenheit to Celsius conversion factor	=	5/9	°C/°F
32	= temperature conversion (°F)	=	32	°F
P_v	= vapor pressure, actual (in. Hg)	=	7.65	in. Hg

5. Water vapor pressure at gas temperature greater than 212°F (in. Hg)

$$P_v = P_s$$

Where:

P_s	= absolute sample gas pressure (in. Hg)	=	29.28	in. Hg
P_v	= water vapor pressure, actual (in. Hg)	=	Previously Defined	in. Hg

6. Moisture measured in sample (% by volume)

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

Where:

V_{mstd}	= volume of gas sampled through the dry gas meter at standard conditions (dscf)	=	33.388	dscf
V_{wstd}	= volume of water collected at standard conditions (scf)	=	14.50	scf
B_{wo}	= proportion of water measured in the gas stream by volume	=	0.3028	
		=	30.28	%

Sample train B_{wo} levels biased high due to CO₂ absorbtion. Actual flue gas B_{wo} obtained from saturation assumption.

7. Saturated moisture content (% by volume)

$$B_{ws} = \frac{P_v}{P_s}$$

Where:

P_s	= absolute sample gas pressure (in. Hg)	=	29.28	in. Hg
P_v	= water vapor pressure, actual (in. Hg)	=	7.65	in. Hg
B_{ws}	= proportion of water vapor in the gas stream by volume at saturated conditions	=	0.2613	
		=	26.13	%

8. Actual water vapor in gas (% by volume)

$$B_w = \text{MINIMUM} [B_{wo}, B_{ws}]$$

Where:

B_{ws}	= proportion of water vapor in the gas stream by volume at saturated conditions	=	0.2613	
B_{wo}	= proportion of water measured in the gas stream by volume	=	0.3028	
B_w	= actual water vapor in gas	=	0.2613	
		=	26.13	%

9. Nitrogen (plus carbon monoxide) in gas stream (% by volume, dry)

$$N_2 + CO = 100 - CO_2 - O_2$$

Where:

CO_2	= proportion of carbon dioxide in the gas stream by volume (%)	=	9.8	%
O_2	= proportion of oxygen in the gas stream by volume (%)	=	3.8	%
100	= conversion factor (%)	=	100	%
N_2+CO	= proportion of nitrogen and CO in the gas stream by volume (%)	=	86.40	%

10. Molecular weight of dry gas stream (lb/lb-mole)

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

Where:

M_{CO_2}	= molecular weight of carbon dioxide (lb/lb-mole)	=	44.00	lb/lb-mole
M_{O_2}	= molecular weight of oxygen (lb/lb-mole)	=	32.00	lb/lb-mole
M_{N_2+CO}	= molecular weight of nitrogen and carbon monoxide (lb/lb-mole)	=	28.00	lb/lb-mole
$CO_{2,in}$	= proportion of carbon dioxide in the flue gas stream (%)	=	13.9	%
O_2	= proportion of oxygen in the gas stream by volume (%)	=	3.8	%
N_2+CO	= proportion of nitrogen and CO in the gas stream by volume (%)	=	86.4	%
100	= conversion factor (%)	=	100	%
M_d	= dry molecular weight of sample gas (lb/lb-mole)	=	31.52	lb/lb-mole

11. Molecular weight of sample gas (lb/lb-mole)

$$M_s = (M_d)(1 - B_w) + (M_{H_2O})(B_w)$$

Where:

B_w	= proportion of water vapor in the gas stream by volume	=	0.2613	
M_d	= dry molecular weight of sample gas (lb/lb-mole)	=	31.52	lb/lb-mole
M_{H_2O}	= molecular weight of water (lb/lb-mole)	=	18.00	lb/lb-mole
M_s	= molecular weight of sample gas, wet basis (lb/lb-mole)	=	27.99	lb/lb-mole

12. Velocity of sample gas (ft/sec)

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

Where:

K_p	= velocity pressure constant	=	85.49	
C_p	= pitot tube coefficient	=	0.82	
M_s	= wet molecular weight of sample gas, wet basis (lb/lb-mole)	=	27.99	lb/lb-mole
P_s	= absolute sample gas pressure (in. Hg)	=	29.28	in. Hg
T_s	= average sample gas temperature (°F)	=	150.42	°F
$\sqrt{\Delta P}$	= average square roots of velocity heads of sample gas (in. H ₂ O)	=	0.767	√in. H ₂ O
460	= °F to °R conversion constant	=	460	
V_s	= sample gas velocity (ft/sec)	=	46.32	ft/sec

13. Volumetric flow rate of sample gas at actual gas conditions (acfm)

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

Where:

A_s	= cross sectional area of sampling location (ft ²)	=	70.88	ft ²
V_s	= sample gas velocity (ft/sec)	=	46.32	ft/sec
60	conversion factor (sec/min)	=	60	sec/min
Q_a	= volumetric flow rate at actual conditions (acfm)	=	197,012	acfm

14. Total flow of sample gas (scfm)

$$Q_s = (Q_a) \left(\frac{P_s}{29.92} \right) \left(\frac{68 + 460}{T_s + 460} \right)$$

Where:

Q_a	= volumetric flow rate at actual conditions (acfm)	=	197,012	acfm
P_s	= absolute sample gas pressure (in. Hg)	=	29.28	in. Hg
29.92	= standard pressure (in. Hg)	=	29.92	in. Hg
T_s	= average sample gas temperature (°F)	=	150.4	°F
68	= standard temperature (°F)	=	68	°F
460	= °F to °R conversion constant	=	460	
Q_s	= volumetric flow rate at standard conditions, wet basis (scfm)	=	166,755	scfm

15. Dry flow of sample gas (dscfm)

$$Q_{std} = (Q_s)(1 - B_w)$$

Where:

B_w	= proportion of water vapor in the gas stream by volume	=	0.2613	
Q_s	= volumetric flow rate at standard conditions, wet basis (scfm)	=	166,755	scfm
Q_{std}	= volumetric flow rate at standard conditions, dry basis (dscfm)	=	123,177	dscfm

16. Hourly time basis conversion of volumetric flow rate (Q_{std} example)

$$Q_{std-hr} = (Q_{std-min})(60)$$

Where

$Q_{std-min}$	= volumetric flow rate, english units (ft ³ /min)	= 123,177	dscfm
60	= conversion factor (min/hr)	= 60	min/hr
Q_{std-hr}	= volumetric flow rate, hourly basis (dscf/hr)	= 7,390,594	dscf/hr

17. Metric Conversion of Gas Volumes (Q_{std} example)

$$Q_{std-metric} = (Q_{std-english}) \left(\frac{60}{35.31} \right)$$

Where:

$Q_{std-english}$	= volumetric flow rate, english units (ft ³ /min)	= 123,177	dscfm
35.31	= conversion factor (ft ³ /m ³)	= 35.31	ft ³ /m ³
60	= conversion factor (min/hr)	= 60	min/hr
$Q_{std-metric}$	= volumetric flow rate, metric units (m ³ /hr)	= 209,306	dry std m ³ /hr

18. Standard to Normal Conversion of Gas Volumes (Q_{std} example)

$$Q_{Normal} = (Q_{std-metric}) \left(\frac{32 + 460}{68 + 460} \right)$$

Where:

$Q_{std-metric}$	= volumetric flow rate, metric units (dry std m ³ /hr)	= 209,306	dry std m ³ /hr
32	= normal temperature (°F)	= 32	°F
68	= standard temperature (°F)	= 68	°F
460	= standard temperature in Rankine (68°F)	= 460	
Q_{Normal}	= volumetric flow rate, metric units (dry Nm ³ /hr)	= 195,035	dry Nm ³ /hr

19. Percent isokinetic (%)

$$I = \frac{(0.09450)(T_s + 460)(V_{mstd})}{(P_s)(V_s)\left(\frac{(D_n)^2(\pi)}{(144)(4)}\right)(\Theta)(1 - B_w)}$$

Where:

D_n	= diameter of nozzle (in)	=	0.233	in.
B_w	= proportion of water vapor in the gas stream by volume	=	0.2613	
P_s	= absolute sample gas pressure (in. Hg)	=	29.28	in. Hg
T_s	= average sample gas temperature (°F)	=	150.4	°F
V_{mstd}	= volume of gas sample through the dry gas meter at standard conditions (dscf)	=	33.388	dscf
V_s	= sample gas velocity (ft/sec)	=	46.32	ft/sec
Θ	= total sampling time (min)	=	60	min
0.0945	= conversion constant	=	0.0945	
460	= °F to °R conversion constant	=	460	
I	= percent of isokinetic sampling (%)	=	108.21	%

20. Alternative Method 5 Post-Test Meter Calibration Factor

$$Y_{qa} = \frac{\Theta}{V_m} \sqrt{\frac{(0.0319)(T_m + 460)(28.96)}{(\Delta H_{@})(P_{bar} + \frac{\Delta H}{13.6})(M_d)}} (\sqrt{\Delta H})_{avg}$$

Where:

Θ	= total sampling time (min)	=	60	min
V_m	= volume of gas sample through the dry gas meter at meter conditions (dcf)	=	35.46	dcf
T_m	= average dry gas meter temperature (°F)	=	106.46	°F
$\Delta H_{@}$	= dry gas meter orifice coefficient	=	1.8294	
P_{bar}	= barometric pressure (in. Hg)	=	29.30	in. Hg
ΔH	= average pressure drop across meter box orifice (in. H ₂ O)	=	1.003	in. H ₂ O
M_d	= dry molecular weight of sample gas (lb/lb-mole)	=	31.52	lb/lb-mole
$\sqrt{\Delta H}_{avg}$	= average of square root of pressure drop across meter orifice	=	0.999	$\sqrt{\text{in. H}_2\text{O}}$
0.0319	= conversion constant	=	0.0319	
28.96	= molecular weight of ambient air (lb/lb-mole)	=	28.96	lb/lb-mole
13.6	= conversion factor (in. H ₂ O/in. Hg)	=	13.6	in. H ₂ O/in. Hg
460	= °F to °R conversion constant	=	460	
Y_{qa}	= alternative Method 5 post-test meter calibration factor	=	0.9398	

USEPA OTM-29 HCN Analyte Calculations

Sample data taken from Run 1

Note: The tables presenting the results are generated electronically from raw data. It may not be possible to exactly duplicate these results using a calculator. The reference method data, results, and all calculations are carried to sixteen decimal places throughout. The final table is formatted to an appropriate number of significant figures.

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1. Cyanide to HCN conversion factor

$$K_a = \frac{MW_a}{n \times MW_{ion}}$$

Where:

MW_a	= molecular weight of HCN (mg/mg-mole)	=	27.026	mg/mg-mole
MW_{ion}	= molecular weight of Cyanide ion (mg/mg-mole)	=	27.026	mg/mg-mole
n	= molar ratio of Cyanide to HCN	=	1.0	mole HCN/mole HCN
K_a	= conversion factor to convert mass HCN to mass HCN	=	1.000	

2. Total HCN collected (µg)

$$m_a = K_a \times (S_{i-1} DF_1 v_1 + S_{i-2} DF_2 v_2)$$

Where:

K_a	= conversion factor to convert mass HCN to mass HCN	=	1.000	
S_{i-1}	= Cyanide concentration of sample fraction 1 (µg/mL)	=	0.4286	µg/mL
DF_1	= dilution factor for sample fraction 1 (dimensionless)	=	5.0	
v_1	= liquid volume of sample fraction 1 (mL)	=	1010.0	mL
S_{i-2}	= Cyanide concentration of sample fraction 2 (µg/mL)	=	<0.0227	µg/mL
DF_2	= dilution factor for sample fraction 2 (dimensionless)	=	5.0	
v_2	= liquid volume of sample fraction 2 (mL)	=	210.0	mL
m_a	= total HCN collected in sample (µg)	=	2164.3164	µg

Note: CN- to HCN conversion was made by analytical laboratory when reporting results.

Note: Non-detects are treated as zero in summations.

DEFINITION

Fraction 1 = entire sample except last impinger containing applicable absorbing reagent.
Fraction 2 = last impinger containing applicable absorbing reagent, analyzed separately to evaluate collection efficiency.
If entire sample is analyzed as a single fraction, then data is included as Fraction 1 (Fraction 2 = 0).

3. Allowable blank subtraction (µg)

$$m_b = K_a \times B_i \times (v_1 + v_2)$$

$$m_b = 0 \text{ if } B_i < MDL$$

Where:

K_a	= conversion factor to convert mass HCN to mass HCN	=	1.000	
B_F	= Cyanide concentration of blank (µg/mL)	=	0.0399	µg/mL
v_1	= liquid volume of sample fraction 1 (mL)	=	1010.0	mL
v_2	= liquid volume of sample fraction 2 (mL)	=	210.0	mL
m_b	= allowable blank subtraction (µg)	=	48.6780	µg

Note: CN- to HCN conversion was made by analytical laboratory when reporting results.

4. Total HCN collected, corrected for blank (µg)

$$m_{nb} = m_a - m_b$$

Where:

m_a	= total HCN collected in sample (µg)	= 2164.3164 µg
m_b	= allowable blank subtraction (µg)	= 48.6780 µg
m_{nb}	= total HCN collected, corrected for blank (µg)	= 2115.6384 µg

5. Minimum detectable HCN (µg)

$$m_{MDL} = K_a \times MDL \times (v_1 + v_2)$$

Where:

K_a	= conversion factor to convert mass HCN to mass HCN	= 1.000
MDL	= minimum detectable Cyanide concentration (µg/mL)	= 0.023 µg/mL
v_1	= liquid volume of sample fraction 1 (mL)	= 1010.0 mL
v_2	= liquid volume of sample fraction 2 (mL)	= 210.0 mL
m_{MDL}	= minimum detectable HCN (µg)	= 27.6940 µg

Note: CN- to HCN conversion was made by analytical laboratory when reporting results.

6. Total HCN value used in emission calculations (µg)

$$m_n = \text{MAXIMUM} [m_{nb} \text{ or } < m_{MDL}]$$

Where:

m_{nb}	= total HCN collected, corrected for blank (µg)	= 2115.6384 µg
m_{MDL}	= minimum detectable HCN (µg)	= 27.6940 µg
m_n	= total HCN value used in emission calculations (µg)	= 2115.6384 µg

7. Collection QC check (% mass collected in second fraction)

$$EFF = 100 \times \frac{K_a \times S_{i-2} \times v_2}{m_a}$$

Where:

K_a	= conversion factor to convert mass HCN to mass HCN	= 1.000
S_{i-2}	= Cyanide concentration of sample fraction 2 (µg/mL)	= <0.0227 µg/mL
v_2	= liquid volume of sample fraction 2 (mL)	= 210.0 mL
m_a	= total HCN collected in sample (µg)	= 2164.3164 µg
100	= conversion factor	= 100 %
EFF	= Collection QC check (% mass collected in second fraction)	= <0.22 %

Note: CN- to HCN conversion was made by analytical laboratory when reporting results.

USEPA OTM-29 HCN Sample Calculations

Sample data taken from Run 1

Note: The tables presenting the results are generated electronically from raw data. It may not be possible to exactly duplicate these results using a calculator. The reference method data, results, and all calculations are carried to sixteen decimal places throughout. The final table is formatted to an appropriate number of significant figures.

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N_L

1. HCN concentration (lb/dscf)

$$C_{sd} = \left(\frac{m_n}{V_{mstd}} \right) \left(\frac{2.205 \times 10^{-3}}{10^6} \right)$$

Where:

m_n	= total HCN collected, corrected for applicable blank (µg)	= 2115.6384	µg
V_{mstd}	= volume metered, standard (dscf)	= 33.3881	dscf
2.205×10^{-3}	= conversion factor (lb/g)	= 2.205E-03	lb/g
10^6	= conversion factor (µg/g)	= 10^6	µg/g
C_{sd}	= HCN concentration (lb/dscf)	= 1.3972E-07	lb/dscf

2. HCN concentration (ppmdv)

$$C_{sd} = \left(\frac{m_n}{V_{mstd}} \right) \left(\frac{0.850}{10^6} \right) \left(\frac{10^6}{MW} \right)$$

Where:

m_n	= total HCN collected, corrected for applicable blank (µg)	= 2115.6384	µg
V_{mstd}	= volume metered, standard (dscf)	= 33.3881	dscf
MW	= molecular weight of HCN (g/g-mole)	= 27.026	g/g-mole
0.850	= conversion factor (dscf/g-mole)	= 0.850	dscf/g-mole
10^6	= conversion factor (µg/g)	= 10^6	µg/g
10^6	= conversion factor (ppm)	= 10^6	ppm
C_{sd}	= HCN concentration (ppmdv)	= 1.9929	ppmdv

3. HCN concentration (ppmwv)

$$C_w = C_{sd} \left(1 - \frac{B_w}{100} \right)$$

Where:

C_{sd}	= HCN concentration (ppmdv)	= 1.9929	ppmdv
B_w	= actual water vapor in gas (% v/v)	= 26.1333	% v/v
100	= conversion factor (%)	= 100	%
C_w	= HCN concentration (ppmwv)	= 1.4721	ppmwv

4. HCN concentration (mg/dscm)

$$C_{sd} = \left(\frac{m_n}{V_{mstd}} \right) \left(\frac{35.31}{1000} \right)$$

Where:

m_n	= total HCN collected, corrected for applicable blank (µg)	=	2115.6384	µg
V_{mstd}	= volume metered, standard (dscf)	=	33.3881	dscf
35.31	= conversion factor (dscf/dscm)	=	35.31	dscf/dscm
1000	= conversion factor (µg/mg)	=	1,000	µg/mg
C_{sd}	= HCN concentration (mg/dscm)	=	2.2374	mg/dscm

5. HCN concentration (mg/Nm³ dry)

$$C_{sd} = \left(\frac{m_n}{V_{mstd}} \right) \left(\frac{35.31}{1000} \right) \left(\frac{68 + 460}{32 + 460} \right)$$

Where:

m_n	= total HCN collected, corrected for applicable blank (µg)	=	2115.6384	µg
V_{mstd}	= volume metered, standard (dscf)	=	33.3881	dscf
35.31	= conversion factor (dscf/dscm)	=	35.31	dscf/dscm
1000	= conversion factor (µg/mg)	=	1,000	µg/mg
68	= standard temperature (°F)	=	68	°F
32	= normal temperature (°F)	=	32	°F
460	= °F to °R conversion constant	=	460	
C_{sd}	= HCN concentration (mg/Nm ³ dry)	=	2.4011	mg/Nm ³ dry

6. HCN concentration (µg/dscm)

$$C_{sd} = \left(\frac{m_n}{V_{mstd}} \right) (35.31)$$

Where:

m_n	= total HCN collected, corrected for applicable blank (µg)	=	2115.6384	µg
V_{mstd}	= volume metered, standard (dscf)	=	33.3881	dscf
35.31	= conversion factor (dscf/dscm)	=	35.31	dscf/dscm
C_{sd}	= HCN concentration (µg/dscm)	=	2237.4218	µg/dscm

µ

7. HCN concentration ($\mu\text{g}/\text{Nm}^3$ dry)

$$C_{sd} = \left(\frac{m_n}{V_{mstd}} \right) (35.31) \left(\frac{68 + 460}{32 + 460} \right)$$

Where:

m_n	= total HCN collected, corrected for applicable blank (μg)	= 2115.6384	μg
V_{mstd}	= volume metered, standard (dscf)	= 33.3881	dscf
35.31	= conversion factor (dscf/dscm)	= 35.31	dscf/dscm
68	= standard temperature ($^{\circ}\text{F}$)	= 68	$^{\circ}\text{F}$
32	= normal temperature ($^{\circ}\text{F}$)	= 32	$^{\circ}\text{F}$
460	= $^{\circ}\text{F}$ to $^{\circ}\text{R}$ conversion constant	= 460	
C_{sd}	= HCN concentration ($\mu\text{g}/\text{Nm}^3$ dry)	= 2401.1356	$\mu\text{g}/\text{Nm}^3$ dry

8. HCN concentration at actual gas conditions (lb/acf example)

$$C_a = C_{sd} \left(\frac{Q_{std}}{Q_a} \right)$$

Where:

C_{sd}	= HCN concentration (lb/dscf)	= 1.3972E-07	lb/dscf
Q_{std}	= volumetric flow rate at standard conditions, dry basis (dscfm)	= 123,177	dscfm
Q_a	= volumetric flow rate at actual conditions (acfm)	= 197,012	acfm
C_a	= HCN concentration at actual gas conditions (lb/acf)	= 8.7356E-08	lb/acf

9. HCN rate (lb/hr)

$$E_{lb/hr} = \left(\frac{m_n}{V_{mstd}} \right) \left(\frac{2.205 \times 10^{-3}}{10^6} \right) (Q_{std}) (60)$$

Where:

m_n	= total HCN collected, corrected for applicable blank (μg)	= 2115.6384	μg
V_{mstd}	= volume metered, standard (dscf)	= 33.3881	dscf
2.205×10^{-3}	= conversion factor (lb/g)	= 2.205E-03	lb/g
10^6	= conversion factor ($\mu\text{g}/\text{g}$)	= 10^6	$\mu\text{g}/\text{g}$
Q_{std}	= volumetric flow rate at standard conditions, dry basis (dscfm)	= 123,177	dscfm
60	= conversion factor (min/hr)	= 60	min/hr
$E_{lb/hr}$	= HCN rate (lb/hr)	= 1.0326	lb/hr

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PARAMETERS

C

I hereby certify that all pages contained within this Appendix have been reviewed and, to the best of my ability, verified accurate.

QA/QC Initials: JB

Date: 9/14



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USEPA Mod. Method 18 Volatile Organic Compounds Parameters

Run No.	1A	2A	3A	Average
Date (2007)	Jul 13	Jul 13	Jul 14	
Start Time (approx.)	09:36	16:15	08:55	
Stop Time (approx.)	10:56	17:35	10:15	
Sampling Conditions				
Y _d Dry gas meter correction factor	0.9967	1.0061	1.0061	
P _{bar} Barometric pressure (in. Hg)	29.40	29.40	29.40	29.40
O ₂ Oxygen (dry volume %)¹	3.9000	3.9000	4.6000	4.1333
V _m Volume metered, meter conditions (liters)	20.0110	20.0100	20.0560	
T _m Dry gas meter temperature (°F)	85.8125	90.3750	80.0000	
T _s Sample temperature (°F)¹	146.5000	146.9583	146.5417	146.6667
B _w Actual water vapor in gas (% by volume)¹	23.6288	23.9020	23.6595	23.7301
Q _{std} Volumetric flow rate, dry standard (dscfm)¹	131,944	132,914	138,738	134,532

¹ Data obtained from concurrent SW-846 0011 run.

Sampling Results				
V _{mstd} Volume metered, standard (dsl)	18.9512	18.9704	19.3793	19.1003
V _{mstd-m} Volume metered, standard (dscm)	0.0190	0.0190	0.0194	0.0191
V _{mstd-E} Volume metered, standard (dscf)	0.6693	0.6699	0.6844	0.6745

1,3-Butadiene Results

m	Matter collected (µg)	<11.1000	<10.0000	<11.3000	
n _{RL}	Number of fractions below reporting limit	3 out of 3	3 out of 3	3 out of 3	
DLC	Detection limit classification	BDL	BDL	BDL	
C _{sd}	Concentration (µg/dscm)	<5.8572E+02	<5.2714E+02	<5.8310E+02	<5.6532E+02
C _{sd}	Concentration (lb/dscf)	<3.6565E-08	<3.2908E-08	<3.6401E-08	<3.5291E-08
E _{lb/hr}	Emission rate (lb/hr)	<0.2895	<0.2624	<0.3030	<0.2850

Pentane Results

m	Matter collected (µg)	<11.1000	<10.0000	<11.3000	
n _{RL}	Number of fractions below reporting limit	3 out of 3	3 out of 3	3 out of 3	
DLC	Detection limit classification	BDL	BDL	BDL	
C _{sd}	Concentration (µg/dscm)	<5.8572E+02	<5.2714E+02	<5.8310E+02	<5.6532E+02
C _{sd}	Concentration (lb/dscf)	<3.6565E-08	<3.2908E-08	<3.6401E-08	<3.5291E-08
E _{lb/hr}	Emission rate (lb/hr)	<0.2895	<0.2624	<0.3030	<0.2850

Marathon Petroleum Company
CleanAir Project No: 11265
FCCU Scrubber Stack

USEPA Mod. Method 18 Volatile Organic Compounds Parameters

Run No.		1A	2A	3A	Average
Date (2007)		Jul 13	Jul 13	Jul 14	
Start Time (approx.)		09:36	16:15	08:55	
Acrolein Results					
m	Matter collected (µg)	<11.1000	<10.0000	<11.3000	
n _{RL}	Number of fractions below reporting limit	3 out of 3	3 out of 3	3 out of 3	
DLC	Detection limit classification	BDL	BDL	BDL	
C _{sd}	Concentration (µg/dscm)	<5.8572E+02	<5.2714E+02	<5.8310E+02	<5.6532E+02
C _{sd}	Concentration (lb/dscf)	<3.6565E-08	<3.2908E-08	<3.6401E-08	<3.5291E-08
E _{lb/hr}	Emission rate (lb/hr)	<0.2895	<0.2624	<0.3030	<0.2850
Acetone Results					
m	Matter collected (µg)	147.3920	62.0840	115.5630	
n _{RL}	Number of fractions below reporting limit	0 out of 3	0 out of 3	0 out of 3	
DLC	Detection limit classification	ADL	ADL	ADL	
C _{sd}	Concentration (µg/dscm)	7.7775E+03	3.2727E+03	5.9632E+03	5.6711E+03
C _{sd}	Concentration (lb/dscf)	4.8553E-07	2.0431E-07	3.7227E-07	3.5404E-07
E _{lb/hr}	Emission rate (lb/hr)	3.8438	1.6293	3.0989	2.8573
Acetonitrile Results					
m	Matter collected (µg)	<11.1000	<10.0000	<11.3000	
n _{RL}	Number of fractions below reporting limit	3 out of 3	3 out of 3	3 out of 3	
DLC	Detection limit classification	BDL	BDL	BDL	
C _{sd}	Concentration (µg/dscm)	<5.8572E+02	<5.2714E+02	<5.8310E+02	<5.6532E+02
C _{sd}	Concentration (lb/dscf)	<3.6565E-08	<3.2908E-08	<3.6401E-08	<3.5291E-08
E _{lb/hr}	Emission rate (lb/hr)	<0.2895	<0.2624	<0.3030	<0.2850
Carbon disulfide Results					
m	Matter collected (µg)	<11.1000	<10.0000	<11.3000	
n _{RL}	Number of fractions below reporting limit	3 out of 3	3 out of 3	3 out of 3	
DLC	Detection limit classification	BDL	BDL	BDL	
C _{sd}	Concentration (µg/dscm)	<5.8572E+02	<5.2714E+02	<5.8310E+02	<5.6532E+02
C _{sd}	Concentration (lb/dscf)	<3.6565E-08	<3.2908E-08	<3.6401E-08	<3.5291E-08
E _{lb/hr}	Emission rate (lb/hr)	<0.2895	<0.2624	<0.3030	<0.2850
Methylene chloride Results					
m	Matter collected (µg)	15.2250	11.8140	14.4030	
n _{RL}	Number of fractions below reporting limit	0 out of 3	0 out of 3	0 out of 3	
DLC	Detection limit classification	ADL	ADL	ADL	
C _{sd}	Concentration (µg/dscm)	8.0338E+02	6.2276E+02	7.4322E+02	7.2312E+02
C _{sd}	Concentration (lb/dscf)	5.0153E-08	3.8878E-08	4.6397E-08	4.5143E-08
E _{lb/hr}	Emission rate (lb/hr)	0.3970	0.3100	0.3862	0.3644

USEPA Mod. Method 18 Volatile Organic Compounds Parameters

Run No.	1A	2A	3A	Average
Date (2007)	Jul 13	Jul 13	Jul 14	
Start Time (approx.)	09:36	16:15	08:55	

Acrylonitrile Results

m	Matter collected (µg)	<11.1000	<10.0000	<11.3000	
n _{RL}	Number of fractions below reporting limit	3 out of 3	3 out of 3	3 out of 3	
DLC	Detection limit classification	BDL	BDL	BDL	
C _{sd}	Concentration (µg/dscm)	<5.8572E+02	<5.2714E+02	<5.8310E+02	<5.6532E+02
C _{sd}	Concentration (lb/dscf)	<3.6565E-08	<3.2908E-08	<3.6401E-08	<3.5291E-08
E _{lb/hr}	Emission rate (lb/hr)	<0.2895	<0.2624	<0.3030	<0.2850

Methyl t-butyl ether Results

m	Matter collected (µg)	<11.1000	<10.0000	<11.3000	
n _{RL}	Number of fractions below reporting limit	3 out of 3	3 out of 3	3 out of 3	
DLC	Detection limit classification	BDL	BDL	BDL	
C _{sd}	Concentration (µg/dscm)	<5.8572E+02	<5.2714E+02	<5.8310E+02	<5.6532E+02
C _{sd}	Concentration (lb/dscf)	<3.6565E-08	<3.2908E-08	<3.6401E-08	<3.5291E-08
E _{lb/hr}	Emission rate (lb/hr)	<0.2895	<0.2624	<0.3030	<0.2850

Hexane Results

m	Matter collected (µg)	<11.1000	<10.0000	<11.3000	
n _{RL}	Number of fractions below reporting limit	3 out of 3	3 out of 3	3 out of 3	
DLC	Detection limit classification	BDL	BDL	BDL	
C _{sd}	Concentration (µg/dscm)	<5.8572E+02	<5.2714E+02	<5.8310E+02	<5.6532E+02
C _{sd}	Concentration (lb/dscf)	<3.6565E-08	<3.2908E-08	<3.6401E-08	<3.5291E-08
E _{lb/hr}	Emission rate (lb/hr)	<0.2895	<0.2624	<0.3030	<0.2850

2,2,4 Trimethylpentane Results

m	Matter collected (µg)	<11.1000	<10.0000	<11.3000	
n _{RL}	Number of fractions below reporting limit	3 out of 3	3 out of 3	3 out of 3	
DLC	Detection limit classification	BDL	BDL	BDL	
C _{sd}	Concentration (µg/dscm)	<5.8572E+02	<5.2714E+02	<5.8310E+02	<5.6532E+02
C _{sd}	Concentration (lb/dscf)	<3.6565E-08	<3.2908E-08	<3.6401E-08	<3.5291E-08
E _{lb/hr}	Emission rate (lb/hr)	<0.2895	<0.2624	<0.3030	<0.2850

Benzene Results

m	Matter collected (µg)	<11.1000	<10.0000	<11.3000	
n _{RL}	Number of fractions below reporting limit	3 out of 3	3 out of 3	3 out of 3	
DLC	Detection limit classification	BDL	BDL	BDL	
C _{sd}	Concentration (µg/dscm)	<5.8572E+02	<5.2714E+02	<5.8310E+02	<5.6532E+02
C _{sd}	Concentration (lb/dscf)	<3.6565E-08	<3.2908E-08	<3.6401E-08	<3.5291E-08
E _{lb/hr}	Emission rate (lb/hr)	<0.2895	<0.2624	<0.3030	<0.2850

Marathon Petroleum Company
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FCCU Scrubber Stack

USEPA Mod. Method 18 Volatile Organic Compounds Parameters

Run No.		1A	2A	3A	Average
Date (2007)		Jul 13	Jul 13	Jul 14	
Start Time (approx.)		09:36	16:15	08:55	
Trichloroethene Results					
m	Matter collected (µg)	<11.1000	<10.0000	<11.3000	
n _{RL}	Number of fractions below reporting limit	3 out of 3	3 out of 3	3 out of 3	
DLC	Detection limit classification	BDL	BDL	BDL	
C _{sd}	Concentration (µg/dscm)	<5.8572E+02	<5.2714E+02	<5.8310E+02	<5.6532E+02
C _{sd}	Concentration (lb/dscf)	<3.6565E-08	<3.2908E-08	<3.6401E-08	<3.5291E-08
E _{lb/hr}	Emission rate (lb/hr)	<0.2895	<0.2624	<0.3030	<0.2850
2-Nitropropane Results					
m	Matter collected (µg)	<11.1000	<10.0000	<11.3000	
n _{RL}	Number of fractions below reporting limit	3 out of 3	3 out of 3	3 out of 3	
DLC	Detection limit classification	BDL	BDL	BDL	
C _{sd}	Concentration (µg/dscm)	<5.8572E+02	<5.2714E+02	<5.8310E+02	<5.6532E+02
C _{sd}	Concentration (lb/dscf)	<3.6565E-08	<3.2908E-08	<3.6401E-08	<3.5291E-08
E _{lb/hr}	Emission rate (lb/hr)	<0.2895	<0.2624	<0.3030	<0.2850
Methyl isobutyl ketone Results					
m	Matter collected (µg)	<11.1000	<10.0000	<11.3000	
n _{RL}	Number of fractions below reporting limit	3 out of 3	3 out of 3	3 out of 3	
DLC	Detection limit classification	BDL	BDL	BDL	
C _{sd}	Concentration (µg/dscm)	<5.8572E+02	<5.2714E+02	<5.8310E+02	<5.6532E+02
C _{sd}	Concentration (lb/dscf)	<3.6565E-08	<3.2908E-08	<3.6401E-08	<3.5291E-08
E _{lb/hr}	Emission rate (lb/hr)	<0.2895	<0.2624	<0.3030	<0.2850
Toluene Results					
m	Matter collected (µg)	<11.1000	<10.0000	<11.3000	
n _{RL}	Number of fractions below reporting limit	3 out of 3	3 out of 3	3 out of 3	
DLC	Detection limit classification	BDL	BDL	BDL	
C _{sd}	Concentration (µg/dscm)	<5.8572E+02	<5.2714E+02	<5.8310E+02	<5.6532E+02
C _{sd}	Concentration (lb/dscf)	<3.6565E-08	<3.2908E-08	<3.6401E-08	<3.5291E-08
E _{lb/hr}	Emission rate (lb/hr)	<0.2895	<0.2624	<0.3030	<0.2850
Tetrachloroethene Results					
m	Matter collected (µg)	<11.1000	<10.0000	<11.3000	
n _{RL}	Number of fractions below reporting limit	3 out of 3	3 out of 3	3 out of 3	
DLC	Detection limit classification	BDL	BDL	BDL	
C _{sd}	Concentration (µg/dscm)	<5.8572E+02	<5.2714E+02	<5.8310E+02	<5.6532E+02
C _{sd}	Concentration (lb/dscf)	<3.6565E-08	<3.2908E-08	<3.6401E-08	<3.5291E-08
E _{lb/hr}	Emission rate (lb/hr)	<0.2895	<0.2624	<0.3030	<0.2850

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USEPA Mod. Method 18 Volatile Organic Compounds Parameters

Run No.	1A	2A	3A	Average
Date (2007)	Jul 13	Jul 13	Jul 14	
Start Time (approx.)	09:36	16:15	08:55	

1,2-Dibromoethane Results

m	Matter collected (µg)	<11.1000	<10.0000	<11.3000	
n _{RL}	Number of fractions below reporting limit	3 out of 3	3 out of 3	3 out of 3	
DLC	Detection limit classification	BDL	BDL	BDL	
C _{sd}	Concentration (µg/dscm)	<5.8572E+02	<5.2714E+02	<5.8310E+02	<5.6532E+02
C _{sd}	Concentration (lb/dscf)	<3.6565E-08	<3.2908E-08	<3.6401E-08	<3.5291E-08
E _{lb/hr}	Emission rate (lb/hr)	<0.2895	<0.2624	<0.3030	<0.2850

Chlorobenzene Results

m	Matter collected (µg)	<11.1000	<10.0000	<11.3000	
n _{RL}	Number of fractions below reporting limit	3 out of 3	3 out of 3	3 out of 3	
DLC	Detection limit classification	BDL	BDL	BDL	
C _{sd}	Concentration (µg/dscm)	<5.8572E+02	<5.2714E+02	<5.8310E+02	<5.6532E+02
C _{sd}	Concentration (lb/dscf)	<3.6565E-08	<3.2908E-08	<3.6401E-08	<3.5291E-08
E _{lb/hr}	Emission rate (lb/hr)	<0.2895	<0.2624	<0.3030	<0.2850

Ethylbenzene Results

m	Matter collected (µg)	<11.1000	<10.0000	<11.3000	
n _{RL}	Number of fractions below reporting limit	3 out of 3	3 out of 3	3 out of 3	
DLC	Detection limit classification	BDL	BDL	BDL	
C _{sd}	Concentration (µg/dscm)	<5.8572E+02	<5.2714E+02	<5.8310E+02	<5.6532E+02
C _{sd}	Concentration (lb/dscf)	<3.6565E-08	<3.2908E-08	<3.6401E-08	<3.5291E-08
E _{lb/hr}	Emission rate (lb/hr)	<0.2895	<0.2624	<0.3030	<0.2850

m,p-Xylenes Results

m	Matter collected (µg)	<11.1000	<10.0000	<11.3000	
n _{RL}	Number of fractions below reporting limit	3 out of 3	3 out of 3	3 out of 3	
DLC	Detection limit classification	BDL	BDL	BDL	
C _{sd}	Concentration (µg/dscm)	<5.8572E+02	<5.2714E+02	<5.8310E+02	<5.6532E+02
C _{sd}	Concentration (lb/dscf)	<3.6565E-08	<3.2908E-08	<3.6401E-08	<3.5291E-08
E _{lb/hr}	Emission rate (lb/hr)	<0.2895	<0.2624	<0.3030	<0.2850

o-Xylene Results

m	Matter collected (µg)	<11.1000	<10.0000	<11.3000	
n _{RL}	Number of fractions below reporting limit	3 out of 3	3 out of 3	3 out of 3	
DLC	Detection limit classification	BDL	BDL	BDL	
C _{sd}	Concentration (µg/dscm)	<5.8572E+02	<5.2714E+02	<5.8310E+02	<5.6532E+02
C _{sd}	Concentration (lb/dscf)	<3.6565E-08	<3.2908E-08	<3.6401E-08	<3.5291E-08
E _{lb/hr}	Emission rate (lb/hr)	<0.2895	<0.2624	<0.3030	<0.2850

Marathon Petroleum Company
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USEPA Mod. Method 18 Volatile Organic Compounds Parameters

Run No.		1A	2A	3A	Average
Date (2007)		Jul 13	Jul 13	Jul 14	
Start Time (approx.)		09:36	16:15	08:55	
Styrene Results					
m	Matter collected (µg)	<11.1000	<10.0000	<11.3000	
n _{RL}	Number of fractions below reporting limit	3 out of 3	3 out of 3	3 out of 3	
DLC	Detection limit classification	BDL	BDL	BDL	
C _{sd}	Concentration (µg/dscm)	<5.8572E+02	<5.2714E+02	<5.8310E+02	<5.6532E+02
C _{sd}	Concentration (lb/dscf)	<3.6565E-08	<3.2908E-08	<3.6401E-08	<3.5291E-08
E _{lb/hr}	Emission rate (lb/hr)	<0.2895	<0.2624	<0.3030	<0.2850
Cumene Results					
m	Matter collected (µg)	<11.1000	<10.0000	<11.3000	
n _{RL}	Number of fractions below reporting limit	3 out of 3	3 out of 3	3 out of 3	
DLC	Detection limit classification	BDL	BDL	BDL	
C _{sd}	Concentration (µg/dscm)	<5.8572E+02	<5.2714E+02	<5.8310E+02	<5.6532E+02
C _{sd}	Concentration (lb/dscf)	<3.6565E-08	<3.2908E-08	<3.6401E-08	<3.5291E-08
E _{lb/hr}	Emission rate (lb/hr)	<0.2895	<0.2624	<0.3030	<0.2850
Nitrobenzene Results					
m	Matter collected (µg)	<55.5000	<50.0000	<56.5000	
n _{RL}	Number of fractions below reporting limit	3 out of 3	3 out of 3	3 out of 3	
DLC	Detection limit classification	BDL	BDL	BDL	
C _{sd}	Concentration (µg/dscm)	<2.9286E+03	<2.6357E+03	<2.9155E+03	<2.8266E+03
C _{sd}	Concentration (lb/dscf)	<1.8282E-07	<1.6454E-07	<1.8201E-07	<1.7646E-07
E _{lb/hr}	Emission rate (lb/hr)	<1.4474	<1.3122	<1.5151	<1.4249

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USEPA Method 18 Volatile Organic Compounds Parameters

Run No.		1A	2A	3A	Average
Date (2007)		Jul 13	Jul 13	Jul 14	
Start Time (approx.)		11:53	14:40	10:55	
Stop Time (approx.)		13:13	16:00	12:15	
Sampling Conditions					
Y _d	Dry gas meter correction factor	1.0061	1.0061	1.0061	
P _{bar}	Barometric pressure (in. Hg)	29.40	29.40	29.40	29.40
O ₂ ¹	Oxygen (dry volume %)	3.9000	3.9000	4.6000	4.1333
V _m	Volume metered, meter conditions (liters)	20.0920	20.0150	20.0570	
T _m	Dry gas meter temperature (°F)	86.5625	93.0625	87.7500	
T _s	Sample temperature (°F) ¹	146.5000	146.9583	146.5417	146.6667
B _w	Actual water vapor in gas (% by volume) ¹	23.6288	23.9020	23.6595	23.7301
Q _{std} ¹	Volumetric flow rate, dry standard (dscfm)	131,944	132,914	138,738	134,532
¹ Data obtained from concurrent SW-846 0011 run.					
Sampling Results					
V _{mstd}	Volume metered, standard (dsl)	19.1810	18.8829	19.1060	19.0566
V _{mstd-m}	Volume metered, standard (dscm)	0.0192	0.0189	0.0191	0.0191
V _{mstd-E}	Volume metered, standard (dscf)	0.6774	0.6668	0.6747	0.6730
Methanol Results					
m	Matter collected (µg)	224.8000	255.4000	385.3000	
n _{RL}	Number of fractions below reporting limit	1 out of 3	1 out of 3	1 out of 3	
DLC	Detection limit classification	DLL	DLL	DLL	
C _{sd}	Concentration (µg/dscm)	1.1720E+04	1.3525E+04	2.0166E+04	1.5137E+04
C _{sd}	Concentration (lb/dscf)	7.3165E-07	8.4436E-07	1.2589E-06	9.4499E-07
E _{lb/hr}	Emission rate (lb/hr)	5.7922E+00	6.7337E+00	1.0480E+01	7.6686E+00

Marathon Petroleum Company
Clean Air Project No: 11265
FCCU Scrubber Stack

USEPA SW-846 Method 0011 (Aldehydes) Sampling, Velocity and Moisture Parameters

Run No.	1	2	3	Matrix Spike*	Average
Date (2011)	Jul 13	Jul 13	Jul 14	Jul 14	
Start Time (approx.)	09:55	13:16	08:56	11:51	
Stop Time (approx.)	12:02	15:36	11:09	14:10	
Sampling Conditions					
Y _d Dry gas meter correction factor	0.9882	0.9882	0.9882	0.9882	
C _p Pitot tube coefficient	0.8270	0.8270	0.8270	0.8270	
P _g Static pressure (in. H ₂ O)	-0.4000	-0.4000	-0.5000	-0.4000	
A _s Sample location area (ft ²)	70.8822	70.8822	70.8822	70.8822	
P _{bar} Barometric pressure (in. Hg)	29.40	29.40	29.40	29.40	29.4000
D _n Nozzle diameter (in.)	0.2500	0.2500	0.2330	0.2330	
O ₂ Oxygen (dry volume %)	3.9000	3.9000	4.6000	4.7000	4.1333
CO ₂ Carbon dioxide (dry volume %)	13.1000	13.2000	12.5000	12.5000	12.9333
N ₂ +CO Nitrogen plus carbon monoxide (dry volume %)	83.0000	82.9000	82.9000	82.8000	82.9333
V _{lc} Total Liquid collected (ml)	527.60	517.40	461.80	447.60	
V _m Volume metered, meter conditions (ft ³)	81.1220	80.1360	72.5970	70.9540	
T _m Dry gas meter temperature (°F)	96.7083	105.8958	95.1250	101.8750	
T _s Sample temperature (°F)	146.5000	146.9583	146.5417	146.4167	146.6667
ΔH Meter box orifice pressure drop (in. H ₂ O)	1.4281	1.4125	1.1483	1.0813	
θ Total sampling time (min)	120.0	120.0	120.0	120.0	
Flow Results					
V _{wstd} Volume of water collected (ft ³)	24.8289	24.3488	21.7323	21.0641	23.6367
V _{mstd} Volume metered, standard (dscf)	74.9463	72.8305	67.2147	64.8934	71.6638
P _s Sample gas pressure, absolute (in. Hg)	29.3706	29.3706	29.3632	29.3706	29.3681
P _v Vapor pressure, actual (in. Hg)	6.9399	7.0202	6.9472	6.9254	6.9691
B _{wo} Moisture measured in sample (% by volume)	24.8848	25.0556	24.4329	24.5052	24.7911
B _{ws} Saturated moisture content (% by volume)	23.6288	23.9020	23.6595	23.5794	23.7301
B _w Actual water vapor in gas (% by volume)	23.6288	23.9020	23.6595	23.5794	23.7301
√ΔP Velocity head (√in. H ₂ O)	0.7739	0.7824	0.8134	0.7853	0.7899
M _d MW of sample gas, dry (lb/lb-mole)	30.2520	30.2680	30.1840	30.1880	30.2347
M _s MW of sample gas, wet (lb/lb-mole)	27.3570	27.3357	27.3013	27.3141	27.3313
V _s Velocity of sample (ft/sec)	47.5355	48.0933	50.0192	48.2724	48.5493
%I Isokinetic sampling (%)	98.4836	95.0047	96.7030	96.5965	96.7304
Q _a Volumetric flow rate, actual (acfm)	202,165	204,537	212,728	205,299	206,477
Q _s Volumetric flow rate, standard (scfm)	172,767	174,662	181,736	175,469	176,388
Q _{std} Volumetric flow rate, dry standard (dscfm)	131,944	132,914	138,738	134,095	134,532
Q _a Volumetric flow rate, actual (acf/hr)	12,129,915	12,272,241	12,763,699	12,317,950	12,388,618
Q _s Volumetric flow rate, standard (scf/hr)	10,366,017	10,479,727	10,904,159	10,528,155	10,583,301
Q _{std} Volumetric flow rate, dry standard (dscf/hr)	7,916,650	7,974,864	8,324,294	8,045,676	8,071,936

Comments:

Average includes 3 runs. * indicates that the run is not included in the average.

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USEPA SW-846 Method 0011 Formaldehyde Parameters

Run No.	1	2	3	Average
Date (2011)	Jul 13	Jul 13	Jul 14	
Start Time (approx.)	09:55	13:16	08:56	
Stop Time (approx.)	12:02	15:36	11:09	
Gas Conditions				
O ₂ Oxygen (dry volume %)	3.9000	3.9000	4.6000	4.1333
CO ₂ Carbon dioxide (dry volume %)	13.1000	13.2000	12.5000	12.9333
T _s Sample temperature (°F)	146.5000	146.9583	146.5417	146.6667
B _w Actual water vapor in gas (% by volume)	23.6288	23.9020	23.6595	23.7301
Gas Flow Rate				
Q _a Volumetric flow rate, actual (acfm)	202,165	204,537	212,728	206,477
Q _s Volumetric flow rate, standard (scfm)	172,767	174,662	181,736	176,388
Q _{std} Volumetric flow rate, dry standard (dscfm)	131,944	132,914	138,738	134,532
Q _a Volumetric flow rate, actual (acf/hr)	12,129,915	12,272,241	12,763,699	12,388,618
Q _s Volumetric flow rate, standard (scf/hr)	10,366,017	10,479,727	10,904,159	10,583,301
Q _{std} Volumetric flow rate, dry standard (dscf/hr)	7,916,650	7,974,864	8,324,294	8,071,936
Sampling Data				
V _{mstd} Volume metered, standard (dscf)	74.9463	72.8305	67.2147	71.6638
%I Isokinetic sampling (%)	98.4836	95.0047	96.7030	96.7304
Laboratory Data				
m _n Total CH ₂ O collected (mg)	0.00913	0.01180	0.00432	
Formaldehyde (CH₂O) Results				
C _{sd} CH ₂ O Concentration (lb/dscf)	2.6861E-10	3.5725E-10	1.4172E-10	2.5586E-10
C _a CH ₂ O Concentration (lb/acf)	1.7531E-10	2.3215E-10	9.2427E-11	1.6663E-10
C _{sd} CH ₂ O Concentration (ppmdv)	0.0034	0.0046	0.0018	0.0033
C _w CH ₂ O Concentration (ppmwv)	0.0026	0.0035	0.0014	0.0025
C _{sd} CH ₂ O Concentration (mg/dscm)	0.0043	0.0057	0.0023	0.0041
C _a CH ₂ O Concentration (mg/m3 (actual,wet))	0.0028	0.0037	0.0015	0.0027
C _{sd} CH ₂ O Concentration (mg/Nm3 dry)	0.0046	0.0061	0.0024	0.0044
C _{sd} CH ₂ O Concentration (µg/dscm)	4.3015	5.7209	2.2694	4.0973
C _a CH ₂ O Concentration (µg/m3 (actual,wet))	2.8074	3.7176	1.4801	2.6684
C _{sd} CH ₂ O Concentration (µg/Nm3 dry)	4.6162	6.1395	2.4355	4.3971
E _{lb/hr} CH ₂ O Rate (lb/hr)	0.0021	0.0028	0.0012	0.0021

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USEPA SW-846 Method 0011 Acetaldehyde Parameters

Run No.		1	2	3	Average
Date (2011)		Jul 13	Jul 13	Jul 14	
Start Time (approx.)		09:55	13:16	08:56	
Stop Time (approx.)		12:02	15:36	11:09	
Gas Conditions					
O ₂	Oxygen (dry volume %)	3.9000	3.9000	4.6000	4.1333
CO ₂	Carbon dioxide (dry volume %)	13.1000	13.2000	12.5000	12.9333
T _s	Sample temperature (°F)	146.5000	146.9583	146.5417	146.6667
B _w	Actual water vapor in gas (% by volume)	23.6288	23.9020	23.6595	23.7301
Gas Flow Rate					
Q _a	Volumetric flow rate, actual (acfm)	202,165	204,537	212,728	206,477
Q _s	Volumetric flow rate, standard (scfm)	172,767	174,662	181,736	176,388
Q _{std}	Volumetric flow rate, dry standard (dscfm)	131,944	132,914	138,738	134,532
Q _a	Volumetric flow rate, actual (acf/hr)	12,129,915	12,272,241	12,763,699	12,388,618
Q _s	Volumetric flow rate, standard (scf/hr)	10,366,017	10,479,727	10,904,159	10,583,301
Q _{std}	Volumetric flow rate, dry standard (dscf/hr)	7,916,650	7,974,864	8,324,294	8,071,936
Sampling Data					
V _{mstd}	Volume metered, standard (dscf)	74.9463	72.8305	67.2147	71.6638
%I	Isokinetic sampling (%)	98.4836	95.0047	96.7030	96.7304
Laboratory Data					
m _n	Total CH ₃ CHO collected (mg)	0.01420	0.01910	0.01080	
Acetaldehyde (CH₃CHO) Results					
C _{sd}	CH ₃ CHO Concentration (lb/dscf)	4.1778E-10	5.7827E-10	3.5430E-10	4.5011E-10
C _a	CH ₃ CHO Concentration (lb/acf)	2.7267E-10	3.7578E-10	2.3107E-10	2.9317E-10
C _{sd}	CH ₃ CHO Concentration (ppmdv)	0.0037	0.0051	0.0031	0.0039
C _w	CH ₃ CHO Concentration (ppmwv)	0.0028	0.0039	0.0024	0.0030
C _{sd}	CH ₃ CHO Concentration (mg/dscm)	0.0067	0.0093	0.0057	0.0072
C _a	CH ₃ CHO Concentration (mg/m ³ (actual,wet))	0.0044	0.0060	0.0037	0.0047
C _{sd}	CH ₃ CHO Concentration (mg/Nm ³ dry)	0.0072	0.0099	0.0061	0.0077
C _{sd}	CH ₃ CHO Concentration (µg/dscm)	6.6902	9.2601	5.6736	7.2080
C _a	CH ₃ CHO Concentration (µg/m ³ (actual,wet))	4.3664	6.0175	3.7002	4.6947
C _{sd}	CH ₃ CHO Concentration (µg/Nm ³ dry)	7.1797	9.9377	6.0887	7.7354
E _{lb/hr}	CH ₃ CHO Rate (lb/hr)	0.0033	0.0046	0.0029	0.0036

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Marathon Petroleum Company
Clean Air Project No: 11265
FCCU Scrubber Stack

USEPA SW-846 Method 0011 Propanal Parameters

Run No.	1	2	3	Average
Date (2011)	Jul 13	Jul 13	Jul 14	
Start Time (approx.)	09:55	13:16	08:56	
Stop Time (approx.)	12:02	15:36	11:09	
Gas Conditions				
O ₂ Oxygen (dry volume %)	3.9000	3.9000	4.6000	4.1333
CO ₂ Carbon dioxide (dry volume %)	13.1000	13.2000	12.5000	12.9333
T _s Sample temperature (°F)	146.5000	146.9583	146.5417	146.6667
B _w Actual water vapor in gas (% by volume)	23.6288	23.9020	23.6595	23.7301
Gas Flow Rate				
Q _a Volumetric flow rate, actual (acfm)	202,165	204,537	212,728	206,477
Q _s Volumetric flow rate, standard (scfm)	172,767	174,662	181,736	176,388
Q _{std} Volumetric flow rate, dry standard (dscfm)	131,944	132,914	138,738	134,532
Q _a Volumetric flow rate, actual (acf/hr)	12,129,915	12,272,241	12,763,699	12,388,618
Q _s Volumetric flow rate, standard (scf/hr)	10,366,017	10,479,727	10,904,159	10,583,301
Q _{std} Volumetric flow rate, dry standard (dscf/hr)	7,916,650	7,974,864	8,324,294	8,071,936
Sampling Data				
V _{mstd} Volume metered, standard (dscf)	74.9463	72.8305	67.2147	71.6638
%I Isokinetic sampling (%)	98.4836	95.0047	96.7030	96.7304
Laboratory Data				
m _n Total CH ₃ CH ₂ CHO collected (mg)	0.00832	0.01510	0.01060	
Propanal (CH₃CH₂CHO) Results				
C _{sd} CH ₃ CH ₂ CHO Concentration (lb/dscf)	2.4478E-10	4.5716E-10	3.4774E-10	3.4989E-10
C _a CH ₃ CH ₂ CHO Concentration (lb/acf)	1.5976E-10	2.9708E-10	2.2679E-10	2.2788E-10
C _{sd} CH ₃ CH ₂ CHO Concentration (ppmdv)	0.0016	0.0030	0.0023	0.0023
C _w CH ₃ CH ₂ CHO Concentration (ppmwv)	0.0012	0.0023	0.0018	0.0018
C _{sd} CH ₃ CH ₂ CHO Concentration (mg/dscm)	0.0039	0.0073	0.0056	0.0056
C _a CH ₃ CH ₂ CHO Concentration (mg/m ³ (actual,wet))	0.0026	0.0048	0.0036	0.0036
C _{sd} CH ₃ CH ₂ CHO Concentration (mg/Nm ³ dry)	0.0042	0.0079	0.0060	0.0060
C _{sd} CH ₃ CH ₂ CHO Concentration (µg/dscm)	3.9199	7.3208	5.5685	5.6031
C _a CH ₃ CH ₂ CHO Concentration (µg/m ³ (actual,wet))	2.5583	4.7573	3.6317	3.6491
C _{sd} CH ₃ CH ₂ CHO Concentration (µg/Nm ³ dry)	4.2067	7.8565	5.9760	6.0131
E _{lb/hr} CH ₃ CH ₂ CHO Rate (lb/hr)	0.0019	0.0036	0.0029	0.0028

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Clean Air Project No: 11265
FCCU Scrubber Stack

USEPA SW-846 Method 0011
Formaldehyde Matrix Spike Sampling Parameters

Run No.	Matrix Spike
Date (2011)	Jul 14
Start Time (approx.)	11:51
Stop Time (approx.)	14:10

Sampling Conditions

Y_d	Dry gas meter correction factor	0.9882
P_{bar}	Barometric pressure (in. Hg)	29.40
V_m	Volume metered, meter conditions (ft ³)	70.9540
T_m	Dry gas meter temperature (°F)	101.8750
ΔH	Meter box orifice pressure drop (in. H ₂ O)	1.0813
θ	Total sampling time (min)	120.0

Flow Results

V_{mstd}	Volume metered, standard (dscf)	64.8934
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Comments:

None

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Marathon Petroleum Company
Clean Air Project No: 11265
FCCU Scrubber Stack

**USEPA SW-846 Method 0010 (SVOC / PAH)
Sampling, Velocity and Moisture Parameters**

Run No.	1	2	3	Average
Date (2011)	Jul 15	Jul 15	Jul 16	
Start Time (approx.)	08:57	15:55	08:36	
Stop Time (approx.)	14:49	20:55	12:59	
Sampling Conditions				
Y _d Dry gas meter correction factor	0.9882	0.9882	0.9925	
C _p Pitot tube coefficient	0.8270	0.8270	0.8270	
P _g Static pressure (in. H ₂ O)	-0.3000	-0.3000	-0.4000	
A _s Sample location area (ft ²)	70.8822	70.8822	70.8822	
P _{bar} Barometric pressure (in. Hg)	29.40	29.40	29.45	29.4167
D _n Nozzle diameter (in.)	0.2500	0.2500	0.2500	
O ₂ Oxygen (dry volume %)	4.1000	3.8000	3.4000	3.7667
CO ₂ Carbon dioxide (dry volume %)	13.0000	13.4000	13.9000	13.4333
N ₂ +CO Nitrogen plus carbon monoxide (dry volume %)	82.9000	82.8000	82.7000	82.8000
V _{lc} Total Liquid collected (ml)	1042.40	992.60	1035.40	
V _m Volume metered, meter conditions (ft ³)	163.6280	163.4190	164.8740	
T _m Dry gas meter temperature (°F)	101.4479	108.9271	109.6563	
T _s Sample temperature (°F)	146.9583	147.0417	147.0208	147.0069
ΔH Meter box orifice pressure drop (in. H ₂ O)	1.4663	1.4208	1.4458	
θ Total sampling time (min)	240.0	240.0	240.0	
Flow Results				
V _{wstd} Volume of water collected (ft ³)	49.0553	46.7118	48.7259	48.1643
V _{mstd} Volume metered, standard (dscf)	149.9093	147.7329	149.7679	149.1367
P _s Sample gas pressure, absolute (in. Hg)	29.3779	29.3779	29.4206	29.3922
P _v Vapor pressure, actual (in. Hg)	7.0202	7.0348	7.0312	7.0287
B _{wo} Moisture measured in sample (% by volume)	24.6553	24.0232	24.5478	24.4088
B _{ws} Saturated moisture content (% by volume)	23.8960	23.9459	23.8988	23.9136
B _w Actual water vapor in gas (% by volume)	23.8960	23.9459	23.8988	23.9136
√ΔP Velocity head (√in. H ₂ O)	0.7856	0.7833	0.7861	0.7850
M _d MW of sample gas, dry (lb/lb-mole)	30.2440	30.2960	30.3600	30.3000
M _s MW of sample gas, wet (lb/lb-mole)	27.3182	27.3516	27.4061	27.3586
V _s Velocity of sample (ft/sec)	48.3042	48.1355	48.2248	48.2215
%I Isokinetic sampling (%)	97.3167	96.3163	97.2571	96.9634
Q _a Volumetric flow rate, actual (acfm)	205,434	204,717	205,097	205,083
Q _s Volumetric flow rate, standard (scfm)	175,472	174,835	175,420	175,242
Q _{std} Volumetric flow rate, dry standard (dscfm)	133,541	132,969	133,497	133,336
Q _a Volumetric flow rate, actual (acf/hr)	12,326,057	12,283,019	12,305,816	12,304,964
Q _s Volumetric flow rate, standard (scf/hr)	10,528,318	10,490,117	10,525,204	10,514,546
Q _{std} Volumetric flow rate, dry standard (dscf/hr)	8,012,470	7,978,159	8,009,811	8,000,147

Comments:

Average includes 3 runs.

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Marathon Petroleum Company
Clean Air Project No: 11265
FCCU Scrubber Stack

USEPA SW-846 Method 0010 SVOC Parameters

Run No.		1	2	3	Average
Date (2011)		Jul 15	Jul 15	Jul 16	
Start Time (approx.)		08:57	15:55	08:36	
Stop Time (approx.)		14:49	20:55	12:59	
Process Conditions					
R _p	Production rate (bbl/hr)	2,172	2,170	2,153	2,165
P ₁	Coke burn rate (1000 lb/hr)	34.399	34.558	34.425	34.461
Gas Conditions					
O ₂	Oxygen (dry volume %)	4.1000	3.8000	3.4000	3.7667
CO ₂	Carbon dioxide (dry volume %)	13.0000	13.4000	13.9000	13.4333
T _s	Sample temperature (°F)	147.0	147.0	147.0	147.0
B _w	Actual water vapor in gas (% by volume)	23.8960	23.9459	23.8988	23.9136
Gas Flow Rate					
Q _a	Volumetric flow rate, actual (acfm)	205,434	204,717	205,097	205,083
Q _s	Volumetric flow rate, standard (scfm)	175,472	174,835	175,420	175,242
Q _{std}	Volumetric flow rate, dry standard (dscfm)	133,541	132,969	133,497	133,336
Sampling Data					
V _{mstd}	Volume metered, standard (dscf)	149.9093	147.7329	149.7679	149.1367
%I	Isokinetic sampling (%)	97.32	96.32	97.26	96.96
Total SVOCs*					
m _n	Net Weight (ng)	<1.7315E+05	<1.7050E+05	<1.5940E+05	
C _{sd}	Concentration (ng/dscm)	<4.0784E+04	<4.0752E+04	<3.7581E+04	<3.9706E+04
C _{sd}	Concentration (ng/Nm ³ dry)	<4.3768E+04	<4.3733E+04	<4.0331E+04	<4.2611E+04
C _{sd}	Concentration (ug/dscm)	<4.0784E+01	<4.0752E+01	<3.7581E+01	<3.9706E+01
C _{sd}	Concentration (ug/Nm ³ dry)	<4.3768E+01	<4.3733E+01	<4.0331E+01	<4.2611E+01
E _{lb/hr}	Emissions Rate (lb/hr)	<2.0407E-02	<2.0303E-02	<1.8798E-02	<1.9836E-02

* Total SVOCs are calculated using the full detection limit for results below the detection limit.

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USEPA SW-846 Method 0010 SVOC Parameters

Run No.		1	2	3	Average
Date (2011)		Jul 15	Jul 15	Jul 16	
Start Time (approx.)		08:57	15:55	08:36	
Stop Time (approx.)		14:49	20:55	12:59	
Process Conditions					
P ₁	Production rate (bbl/hr)	2,172	2,170	2,153	2,165
P ₂	Coke burn rate (1000 lb/hr)	34.399	34.558	34.425	34.461
Gas Conditions					
O ₂	Oxygen (dry volume %)	4.1000	3.8000	3.4000	3.7667
CO ₂	Carbon dioxide (dry volume %)	13.0000	13.4000	13.9000	13.4333
T _s	Sample temperature (°F)	146.9583	147.0417	147.0208	147.0069
B _w	Actual water vapor in gas (% by volume)	23.8960	23.9459	23.8988	23.9136
Gas Flow Rate					
Q _a	Volumetric flow rate, actual (acfm)	205,434	204,717	205,097	205,083
Q _s	Volumetric flow rate, standard (scfm)	175,472	174,835	175,420	175,242
Q _{std}	Volumetric flow rate, dry standard (dscfm)	133,541	132,969	133,497	133,336
Sampling Data					
V _{mstd}	Volume metered, standard (dscf)	149.9093	147.7329	149.7679	149.1367
%I	Isokinetic sampling (%)	97.3167	96.3163	97.2571	96.9634
Aniline					
m _n	Net Weight (ng)	<1.8000E+03	<1.8000E+03	<1.8000E+03	
C _{sd}	Concentration (ng/dscm)	<4.2398E+02	<4.3022E+02	<4.2438E+02	<4.2619E+02
C _{sd}	Concentration (ng/Nm ³ dry)	<4.5500E+02	<4.6170E+02	<4.5543E+02	<4.5738E+02
C _{sd}	Concentration (ug/dscm)	<4.2398E-01	<4.3022E-01	<4.2438E-01	<4.2619E-01
C _{sd}	Concentration (ug/Nm ³ dry)	<4.5500E-01	<4.6170E-01	<4.5543E-01	<4.5738E-01
E _{lb/hr}	Emissions Rate (lb/hr)	<2.1214E-04	<2.1434E-04	<2.1227E-04	<2.1292E-04
Phenol					
m _n	Net Weight (ng)	<2.3000E+04	<2.0000E+04	<8.8000E+03	
C _{sd}	Concentration (ng/dscm)	<5.4175E+03	<4.7802E+03	<2.0747E+03	<4.0908E+03
C _{sd}	Concentration (ng/Nm ³ dry)	<5.8139E+03	<5.1300E+03	<2.2265E+03	<4.3901E+03
C _{sd}	Concentration (ug/dscm)	<5.4175E+00	<4.7802E+00	<2.0747E+00	<4.0908E+00
C _{sd}	Concentration (ug/Nm ³ dry)	<5.8139E+00	<5.1300E+00	<2.2265E+00	<4.3901E+00
E _{lb/hr}	Emissions Rate (lb/hr)	<2.7107E-03	<2.3816E-03	<1.0378E-03	<2.0433E-03
2-Methylphenol					
m _n	Net Weight (ng)	<2.1000E+03	<2.1000E+03	<2.1000E+03	
C _{sd}	Concentration (ng/dscm)	<4.9464E+02	<5.0193E+02	<4.9511E+02	<4.9722E+02
C _{sd}	Concentration (ng/Nm ³ dry)	<5.3083E+02	<5.3865E+02	<5.3133E+02	<5.3361E+02
C _{sd}	Concentration (ug/dscm)	<4.9464E-01	<5.0193E-01	<4.9511E-01	<4.9722E-01
C _{sd}	Concentration (ug/Nm ³ dry)	<5.3083E-01	<5.3865E-01	<5.3133E-01	<5.3361E-01
E _{lb/hr}	Emissions Rate (lb/hr)	<2.4749E-04	<2.5007E-04	<2.4765E-04	<2.4840E-04
4-Methylphenol & 3-Methylphenol					
m _n	Net Weight (ng)	<5.6000E+03	<5.6000E+03	<5.6000E+03	
C _{sd}	Concentration (ng/dscm)	<1.3190E+03	<1.3385E+03	<1.3203E+03	<1.3259E+03
C _{sd}	Concentration (ng/Nm ³ dry)	<1.4156E+03	<1.4364E+03	<1.4169E+03	<1.4229E+03
C _{sd}	Concentration (ug/dscm)	<1.3190E+00	<1.3385E+00	<1.3203E+00	<1.3259E+00
C _{sd}	Concentration (ug/Nm ³ dry)	<1.4156E+00	<1.4364E+00	<1.4169E+00	<1.4229E+00
E _{lb/hr}	Emissions Rate (lb/hr)	<6.5999E-04	<6.6684E-04	<6.6039E-04	<6.6241E-04

USEPA SW-846 Method 0010 SVOC Parameters

Run No.		1	2	3	Average
Date (2011)		Jul 15	Jul 15	Jul 16	
Start Time (approx.)		08:57	15:55	08:36	
Stop Time (approx.)		14:49	20:55	12:59	
o-Toluidine					
m _n	Net Weight (ng)	<5.0000E+03	<5.0000E+03	<5.0000E+03	
C _{sd}	Concentration (ng/dscm)	<1.1777E+03	<1.1951E+03	<1.1788E+03	<1.1839E+03
C _{sd}	Concentration (ng/Nm ³ dry)	<1.2639E+03	<1.2825E+03	<1.2651E+03	<1.2705E+03
C _{sd}	Concentration (ug/dscm)	<1.1777E+00	<1.1951E+00	<1.1788E+00	<1.1839E+00
C _{sd}	Concentration (ug/Nm ³ dry)	<1.2639E+00	<1.2825E+00	<1.2651E+00	<1.2705E+00
E _{lb/hr}	Emissions Rate (lb/hr)	<5.8927E-04	<5.9539E-04	<5.8963E-04	<5.9143E-04
Isophorone					
m _n	Net Weight (ng)	<2.2000E+03	<2.2000E+03	<2.2000E+03	
C _{sd}	Concentration (ng/dscm)	<5.1819E+02	<5.2583E+02	<5.1868E+02	<5.2090E+02
C _{sd}	Concentration (ng/Nm ³ dry)	<5.5611E+02	<5.6430E+02	<5.5664E+02	<5.5902E+02
C _{sd}	Concentration (ug/dscm)	<5.1819E-01	<5.2583E-01	<5.1868E-01	<5.2090E-01
C _{sd}	Concentration (ug/Nm ³ dry)	<5.5611E-01	<5.6430E-01	<5.5664E-01	<5.5902E-01
E _{lb/hr}	Emissions Rate (lb/hr)	<2.5928E-04	<2.6197E-04	<2.5944E-04	<2.6023E-04
2,4-Dimethylphenol					
m _n	Net Weight (ng)	<2.6000E+03	<2.6000E+03	<2.6000E+03	
C _{sd}	Concentration (ng/dscm)	<6.1241E+02	<6.2143E+02	<6.1299E+02	<6.1561E+02
C _{sd}	Concentration (ng/Nm ³ dry)	<6.5722E+02	<6.6690E+02	<6.5784E+02	<6.6066E+02
C _{sd}	Concentration (ug/dscm)	<6.1241E-01	<6.2143E-01	<6.1299E-01	<6.1561E-01
C _{sd}	Concentration (ug/Nm ³ dry)	<6.5722E-01	<6.6690E-01	<6.5784E-01	<6.6066E-01
E _{lb/hr}	Emissions Rate (lb/hr)	<3.0642E-04	<3.0960E-04	<3.0661E-04	<3.0755E-04
Dibenzofuran					
m _n	Net Weight (ng)	2.8500E+03	3.2000E+03	3.3000E+03	
C _{sd}	Concentration (ng/dscm)	6.7130E+02	7.6484E+02	7.7802E+02	7.3805E+02
C _{sd}	Concentration (ng/Nm ³ dry)	7.2042E+02	8.2080E+02	8.3495E+02	7.9206E+02
C _{sd}	Concentration (ug/dscm)	6.7130E-01	7.6484E-01	7.7802E-01	7.3805E-01
C _{sd}	Concentration (ug/Nm ³ dry)	7.2042E-01	8.2080E-01	8.3495E-01	7.9206E-01
E _{lb/hr}	Emissions Rate (lb/hr)	3.3589E-04	3.8105E-04	3.8916E-04	3.6870E-04
α,α-Dimethylphenethylamine					
m _n	Net Weight (ng)	<1.2000E+04	<1.2000E+04	<1.2000E+04	
C _{sd}	Concentration (ng/dscm)	<2.8265E+03	<2.8681E+03	<2.8292E+03	<2.8413E+03
C _{sd}	Concentration (ng/Nm ³ dry)	<3.0333E+03	<3.0780E+03	<3.0362E+03	<3.0492E+03
C _{sd}	Concentration (ug/dscm)	<2.8265E+00	<2.8681E+00	<2.8292E+00	<2.8413E+00
C _{sd}	Concentration (ug/Nm ³ dry)	<3.0333E+00	<3.0780E+00	<3.0362E+00	<3.0492E+00
E _{lb/hr}	Emissions Rate (lb/hr)	<1.4143E-03	<1.4289E-03	<1.4151E-03	<1.4194E-03
1,4-Phenylenediamine					
m _n	Net Weight (ng)	<1.8000E+04	<1.8000E+04	<1.8000E+04	
C _{sd}	Concentration (ng/dscm)	<4.2398E+03	<4.3022E+03	<4.2438E+03	<4.2619E+03
C _{sd}	Concentration (ng/Nm ³ dry)	<4.5500E+03	<4.6170E+03	<4.5543E+03	<4.5738E+03
C _{sd}	Concentration (ug/dscm)	<4.2398E+00	<4.3022E+00	<4.2438E+00	<4.2619E+00
C _{sd}	Concentration (ug/Nm ³ dry)	<4.5500E+00	<4.6170E+00	<4.5543E+00	<4.5738E+00
E _{lb/hr}	Emissions Rate (lb/hr)	<2.1214E-03	<2.1434E-03	<2.1227E-03	<2.1292E-03

USEPA SW-846 Method 0010 SVOC Parameters

Run No.		1	2	3	Average
Date (2011)		Jul 15	Jul 15	Jul 16	
Start Time (approx.)		08:57	15:55	08:36	
Stop Time (approx.)		14:49	20:55	12:59	
Benzidine					
m _n	Net Weight (ng)	<3.8000E+04	<3.8000E+04	<3.8000E+04	
C _{sd}	Concentration (ng/dscm)	<8.9506E+03	<9.0825E+03	<8.9591E+03	<8.9974E+03
C _{sd}	Concentration (ng/Nm ³ dry)	<9.6055E+03	<9.7470E+03	<9.6146E+03	<9.6557E+03
C _{sd}	Concentration (ug/dscm)	<8.9506E+00	<9.0825E+00	<8.9591E+00	<8.9974E+00
C _{sd}	Concentration (ug/Nm ³ dry)	<9.6055E+00	<9.7470E+00	<9.6146E+00	<9.6557E+00
E _{lb/hr}	Emissions Rate (lb/hr)	<4.4785E-03	<4.5250E-03	<4.4812E-03	<4.4949E-03
Dimethylaminobenzene					
m _n	Net Weight (ng)	<2.0000E+03	<2.0000E+03	<2.0000E+03	
C _{sd}	Concentration (ng/dscm)	<4.7108E+02	<4.7802E+02	<4.7153E+02	<4.7355E+02
C _{sd}	Concentration (ng/Nm ³ dry)	<5.0555E+02	<5.1300E+02	<5.0603E+02	<5.0820E+02
C _{sd}	Concentration (ug/dscm)	<4.7108E-01	<4.7802E-01	<4.7153E-01	<4.7355E-01
C _{sd}	Concentration (ug/Nm ³ dry)	<5.0555E-01	<5.1300E-01	<5.0603E-01	<5.0820E-01
E _{lb/hr}	Emissions Rate (lb/hr)	<2.3571E-04	<2.3816E-04	<2.3585E-04	<2.3657E-04
3,3'-Dimethylbenzidine					
m _n	Net Weight (ng)	<2.9000E+04	<2.9000E+04	<2.9000E+04	
C _{sd}	Concentration (ng/dscm)	<6.8307E+03	<6.9314E+03	<6.8372E+03	<6.8664E+03
C _{sd}	Concentration (ng/Nm ³ dry)	<7.3305E+03	<7.4385E+03	<7.3375E+03	<7.3688E+03
C _{sd}	Concentration (ug/dscm)	<6.8307E+00	<6.9314E+00	<6.8372E+00	<6.8664E+00
C _{sd}	Concentration (ug/Nm ³ dry)	<7.3305E+00	<7.4385E+00	<7.3375E+00	<7.3688E+00
E _{lb/hr}	Emissions Rate (lb/hr)	<3.4178E-03	<3.4533E-03	<3.4199E-03	<3.4303E-03
3,3'-Dimethoxybenzidine					
m _n	Net Weight (ng)	<2.9000E+04	<2.9000E+04	<2.9000E+04	
C _{sd}	Concentration (ng/dscm)	<6.8307E+03	<6.9314E+03	<6.8372E+03	<6.8664E+03
C _{sd}	Concentration (ng/Nm ³ dry)	<7.3305E+03	<7.4385E+03	<7.3375E+03	<7.3688E+03
C _{sd}	Concentration (ug/dscm)	<6.8307E+00	<6.9314E+00	<6.8372E+00	<6.8664E+00
C _{sd}	Concentration (ug/Nm ³ dry)	<7.3305E+00	<7.4385E+00	<7.3375E+00	<7.3688E+00
E _{lb/hr}	Emissions Rate (lb/hr)	<3.4178E-03	<3.4533E-03	<3.4199E-03	<3.4303E-03

Marathon Petroleum Company
Clean Air Project No: 11265
FCCU Scrubber Stack

**USEPA SW-846 Method 0010
SVOC Results**

Run #1

Analyte	Lab Data Net Weight (ng)	PAH Conc. (ug/dscm)	PAH Conc. (ng/dscm)	PAH Emissions (lb/hr)
Aniline	<1.80E+03	<4.24E-01	<4.24E+02	<2.12E-04
Phenol	<2.30E+04	<5.42E+00	<5.42E+03	<2.71E-03
2-Methylphenol	<2.10E+03	<4.95E-01	<4.95E+02	<2.47E-04
4-Methylphenol & 3-Methylphenol	<5.60E+03	<1.32E+00	<1.32E+03	<6.60E-04
o-Toluidine	<5.00E+03	<1.18E+00	<1.18E+03	<5.89E-04
Isophorone	<2.20E+03	<5.18E-01	<5.18E+02	<2.59E-04
2,4-Dimethylphenol	<2.60E+03	<6.12E-01	<6.12E+02	<3.06E-04
Dibenzofuran	2.85E+03	6.71E-01	6.71E+02	3.36E-04
α,α -Dimethylphenethylamine	<1.20E+04	<2.83E+00	<2.83E+03	<1.41E-03
1,4-Phenylenediamine	<1.80E+04	<4.24E+00	<4.24E+03	<2.12E-03
Benzidine	<3.80E+04	<8.95E+00	<8.95E+03	<4.48E-03
Dimethylaminobenzene	<2.00E+03	<4.71E-01	<4.71E+02	<2.36E-04
3,3'-Dimethylbenzidine	<2.90E+04	<6.83E+00	<6.83E+03	<3.42E-03
3,3'-Dimethoxybenzidine	<2.90E+04	<6.83E+00	<6.83E+03	<3.42E-03
Total SVOCs*	<1.73E+05	<4.08E+01	<4.08E+04	<2.04E-02

< Denotes that the analyte was not detectable above the stated value.

* Total PAHs are calculated using the full detection limit for results below the detection limit.

Marathon Petroleum Company
Clean Air Project No: 11265
FCCU Scrubber Stack

**USEPA SW-846 Method 0010
SVOC Results**

Run #2

Analyte	Lab Data Net Weight (µg)	PAH Conc. (ug/dscm)	PAH Conc. (ng/dscm)	PAH Emissions (lb/hr)
Aniline	<1.80E+03	<4.30E-01	<4.30E+02	<2.14E-04
Phenol	<2.00E+04	<4.78E+00	<4.78E+03	<2.38E-03
2-Methylphenol	<2.10E+03	<5.02E-01	<5.02E+02	<2.50E-04
4-Methylphenol & 3-Methylphenol	<5.60E+03	<1.34E+00	<1.34E+03	<6.67E-04
o-Toluidine	<5.00E+03	<1.20E+00	<1.20E+03	<5.95E-04
Isophorone	<2.20E+03	<5.26E-01	<5.26E+02	<2.62E-04
2,4-Dimethylphenol	<2.60E+03	<6.21E-01	<6.21E+02	<3.10E-04
Dibenzofuran	3.20E+03	7.65E-01	7.65E+02	3.81E-04
α,α-Dimethylphenethylamine	<1.20E+04	<2.87E+00	<2.87E+03	<1.43E-03
1,4-Phenylenediamine	<1.80E+04	<4.30E+00	<4.30E+03	<2.14E-03
Benzidine	<3.80E+04	<9.08E+00	<9.08E+03	<4.52E-03
Dimethylaminobenzene	<2.00E+03	<4.78E-01	<4.78E+02	<2.38E-04
3,3'-Dimethylbenzidine	<2.90E+04	<6.93E+00	<6.93E+03	<3.45E-03
3,3'-Dimethoxybenzidine	<2.90E+04	<6.93E+00	<6.93E+03	<3.45E-03
Total SVOCs*	<1.71E+05	<4.08E+01	<4.08E+04	<2.03E-02

< Denotes that the analyte was not detectable above the stated value.

Marathon Petroleum Company
Clean Air Project No: 11265
FCCU Scrubber Stack

**USEPA SW-846 Method 0010
SVOC Results**

Run #3

Analyte	Lab Data Net Weight (µg)	PAH Conc. (ug/dscm)	PAH Conc. (ng/dscm)	PAH Emissions (lb/hr)
Aniline	<1.80E+03	<4.24E-01	<4.24E+02	<2.12E-04
Phenol	<8.80E+03	<2.07E+00	<2.07E+03	<1.04E-03
2-Methylphenol	<2.10E+03	<4.95E-01	<4.95E+02	<2.48E-04
4-Methylphenol & 3-Methylphenol	<5.60E+03	<1.32E+00	<1.32E+03	<6.60E-04
o-Toluidine	<5.00E+03	<1.18E+00	<1.18E+03	<5.90E-04
Isophorone	<2.20E+03	<5.19E-01	<5.19E+02	<2.59E-04
2,4-Dimethylphenol	<2.60E+03	<6.13E-01	<6.13E+02	<3.07E-04
Dibenzofuran	3.30E+03	7.78E-01	7.78E+02	3.89E-04
α,α-Dimethylphenethylamine	<1.20E+04	<2.83E+00	<2.83E+03	<1.42E-03
1,4-Phenylenediamine	<1.80E+04	<4.24E+00	<4.24E+03	<2.12E-03
Benzidine	<3.80E+04	<8.96E+00	<8.96E+03	<4.48E-03
Dimethylaminobenzene	<2.00E+03	<4.72E-01	<4.72E+02	<2.36E-04
3,3'-Dimethylbenzidine	<2.90E+04	<6.84E+00	<6.84E+03	<3.42E-03
3,3'-Dimethoxybenzidine	<2.90E+04	<6.84E+00	<6.84E+03	<3.42E-03
Total SVOCs*	<1.59E+05	<3.76E+01	<3.76E+04	<1.88E-02

< Denotes that the analyte was not detectable above the stated value.

Marathon Petroleum Company
Clean Air Project No: 11265
FCCU Scrubber Stack

USEPA SW-846 Method 0010 PAH Parameters

Run No.		1	2	3	Average
Date (2011)		Jul 15	Jul 15	Jul 16	
Start Time (approx.)		08:57	15:55	08:36	
Stop Time (approx.)		14:49	20:55	12:59	
Process Conditions					
R _P	Production rate (bbl/hr)	2,172	2,170	2,153	2,165
P ₁	Coke burn rate (1000 lb/hr)	34.399	34.558	34.425	34.461
Gas Conditions					
O ₂	Oxygen (dry volume %)	4.1000	3.8000	3.4000	3.7667
CO ₂	Carbon dioxide (dry volume %)	13.0000	13.4000	13.9000	13.4333
T _s	Sample temperature (°F)	147.0	147.0	147.0	147.0
B _w	Actual water vapor in gas (% by volume)	23.8960	23.9459	23.8988	23.9136
Gas Flow Rate					
Q _a	Volumetric flow rate, actual (acfm)	205,434	204,717	205,097	205,083
Q _s	Volumetric flow rate, standard (scfm)	175,472	174,835	175,420	175,242
Q _{std}	Volumetric flow rate, dry standard (dscfm)	133,541	132,969	133,497	133,336
Sampling Data					
V _{mstd}	Volume metered, standard (dscf)	149.9093	147.7329	149.7679	149.1367
%I	Isokinetic sampling (%)	97.32	96.32	97.26	96.96
Total PAHs*					
m _n	Net Weight (ng)	<4.2398E+04	<9.1444E+04	<8.7008E+04	
C _{sd}	Concentration (ng/dscm)	<9.9864E+03	<2.1856E+04	<2.0513E+04	<1.7452E+04
C _{sd}	Concentration (ng/Nm ³ dry)	<1.0717E+04	<2.3456E+04	<2.2014E+04	<1.8729E+04
C _{sd}	Concentration (ug/dscm)	<9.9864E+00	<2.1856E+01	<2.0513E+01	<1.7452E+01
C _{sd}	Concentration (ug/Nm ³ dry)	<1.0717E+01	<2.3456E+01	<2.2014E+01	<1.8729E+01
E _{lb/hr}	Emissions Rate (lb/hr)	<4.9968E-03	<1.0889E-02	<1.0261E-02	<8.7154E-03

* Total PAHs are calculated using the full detection limit for results below the detection limit.

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USEPA SW-846 Method 0010 PAH Parameters

Run No.		1	2	3	Average
Date (2011)		Jul 15	Jul 15	Jul 16	
Start Time (approx.)		08:57	15:55	08:36	
Stop Time (approx.)		14:49	20:55	12:59	
Process Conditions					
P ₁	Production rate (bbl/hr)	2,172	2,170	2,153	2,165
P ₂	Coke burn rate (1000 lb/hr)	34.399	34.558	34.425	34.461
Gas Conditions					
O ₂	Oxygen (dry volume %)	4.1000	3.8000	3.4000	3.7667
CO ₂	Carbon dioxide (dry volume %)	13.0000	13.4000	13.9000	13.4333
T _s	Sample temperature (°F)	146.9583	147.0417	147.0208	147.0069
B _w	Actual water vapor in gas (% by volume)	23.8960	23.9459	23.8988	23.9136
Gas Flow Rate					
Q _a	Volumetric flow rate, actual (acfm)	205,434	204,717	205,097	205,083
Q _s	Volumetric flow rate, standard (scfm)	175,472	174,835	175,420	175,242
Q _{std}	Volumetric flow rate, dry standard (dscfm)	133,541	132,969	133,497	133,336
Q _a	Volumetric flow rate, actual (m ³ /hr)	12,326,057	12,283,019	12,305,816	12,304,964
Q _s	Volumetric flow rate, standard (m ³ /hr)	10,528,318	10,490,117	10,525,204	10,514,546
Q _{std}	Volumetric flow rate, dry standard (dry m ³ /hr)	8,012,470	7,978,159	8,009,811	8,000,147
Sampling Data					
V _{mstd}	Volume metered, standard (dscf)	149.9093	147.7329	149.7679	149.1367
%I	Isokinetic sampling (%)	97.32	96.32	97.26	96.96
Naphthalene					
m _n	Net Weight (ng)	3.6100E+04	8.4600E+04	8.0300E+04	
C _{sd}	Concentration (ng/dscm)	8.5031E+03	2.0220E+04	1.8932E+04	1.5885E+04
C _{sd}	Concentration (ng/Nm ³ dry)	9.1253E+03	2.1700E+04	2.0317E+04	1.7047E+04
C _{sd}	Concentration (ug/dscm)	8.5031E+00	2.0220E+01	1.8932E+01	1.5885E+01
C _{sd}	Concentration (ug/Nm ³ dry)	9.1253E+00	2.1700E+01	2.0317E+01	1.7047E+01
E _{lb/hr}	Emissions Rate (lb/hr)	4.2545E-03	1.0074E-02	9.4695E-03	7.9327E-03
2-Methylnaphthalene					
m _n	Net Weight (ng)	2.7600E+02	1.6300E+02	1.8000E+02	
C _{sd}	Concentration (ng/dscm)	6.5010E+01	3.8959E+01	4.2438E+01	4.8802E+01
C _{sd}	Concentration (ng/Nm ³ dry)	6.9767E+01	4.1810E+01	4.5543E+01	5.2373E+01
C _{sd}	Concentration (ug/dscm)	6.5010E-02	3.8959E-02	4.2438E-02	4.8802E-02
C _{sd}	Concentration (ug/Nm ³ dry)	6.9767E-02	4.1810E-02	4.5543E-02	5.2373E-02
E _{lb/hr}	Emissions Rate (lb/hr)	3.2528E-05	1.9410E-05	2.1227E-05	2.4388E-05
Acenaphthylene					
m _n	Net Weight (ng)	7.0000E+01	7.7600E+01	8.8400E+01	
C _{sd}	Concentration (ng/dscm)	1.6488E+01	1.8547E+01	2.0842E+01	1.8626E+01
C _{sd}	Concentration (ng/Nm ³ dry)	1.7694E+01	1.9904E+01	2.2367E+01	1.9989E+01
C _{sd}	Concentration (ug/dscm)	1.6488E-02	1.8547E-02	2.0842E-02	1.8626E-02
C _{sd}	Concentration (ug/Nm ³ dry)	1.7694E-02	1.9904E-02	2.2367E-02	1.9989E-02
E _{lb/hr}	Emissions Rate (lb/hr)	8.2498E-06	9.2405E-06	1.0425E-05	9.3050E-06
Acenaphthene					
m _n	Net Weight (ng)	<1.2000E+02	<3.1000E+01	<3.9000E+01	
C _{sd}	Concentration (ng/dscm)	<2.8265E+01	<7.4094E+00	<9.1948E+00	<1.4956E+01
C _{sd}	Concentration (ng/Nm ³ dry)	<3.0333E+01	<7.9515E+00	<9.8676E+00	<1.6051E+01
C _{sd}	Concentration (ug/dscm)	<2.8265E-02	<7.4094E-03	<9.1948E-03	<1.4956E-02
C _{sd}	Concentration (ug/Nm ³ dry)	<3.0333E-02	<7.9515E-03	<9.8676E-03	<1.6051E-02
E _{lb/hr}	Emissions Rate (lb/hr)	<1.4143E-05	<3.6914E-06	<4.5991E-06	<7.4777E-06

USEPA SW-846 Method 0010 PAH Parameters

Run No.		1	2	3	Average
Date (2011)		Jul 15	Jul 15	Jul 16	
Start Time (approx.)		08:57	15:55	08:36	
Stop Time (approx.)		14:49	20:55	12:59	
Fluorene					
m _n	Net Weight (ng)	<3.0000E+02	<2.8000E+02	<3.1000E+02	
C _{sd}	Concentration (ng/dscm)	<7.0663E+01	<6.6923E+01	<7.3087E+01	<7.0224E+01
C _{sd}	Concentration (ng/Nm ³ dry)	<7.5833E+01	<7.1820E+01	<7.8435E+01	<7.5363E+01
C _{sd}	Concentration (ug/dscm)	<7.0663E-02	<6.6923E-02	<7.3087E-02	<7.0224E-02
C _{sd}	Concentration (ug/Nm ³ dry)	<7.5833E-02	<7.1820E-02	<7.8435E-02	<7.5363E-02
E _{lb/hr}	Emissions Rate (lb/hr)	<3.5356E-05	<3.3342E-05	<3.6557E-05	<3.5085E-05
Phenanthrene					
m _n	Net Weight (ng)	2.3600E+03	2.7800E+03	2.6000E+03	
C _{sd}	Concentration (ng/dscm)	5.5588E+02	6.6445E+02	6.1299E+02	6.1111E+02
C _{sd}	Concentration (ng/Nm ³ dry)	5.9655E+02	7.1307E+02	6.5784E+02	6.5582E+02
C _{sd}	Concentration (ug/dscm)	5.5588E-01	6.6445E-01	6.1299E-01	6.1111E-01
C _{sd}	Concentration (ug/Nm ³ dry)	5.9655E-01	7.1307E-01	6.5784E-01	6.5582E-01
E _{lb/hr}	Emissions Rate (lb/hr)	2.7814E-04	3.3104E-04	3.0661E-04	3.0526E-04
Anthracene					
m _n	Net Weight (ng)	2.5400E+01	2.9800E+01	3.9300E+01	
C _{sd}	Concentration (ng/dscm)	5.9828E+00	7.1226E+00	9.2656E+00	7.4570E+00
C _{sd}	Concentration (ng/Nm ³ dry)	6.4205E+00	7.6437E+00	9.9435E+00	8.0026E+00
C _{sd}	Concentration (ug/dscm)	5.9828E-03	7.1226E-03	9.2656E-03	7.4570E-03
C _{sd}	Concentration (ug/Nm ³ dry)	6.4205E-03	7.6437E-03	9.9435E-03	8.0026E-03
E _{lb/hr}	Emissions Rate (lb/hr)	2.9935E-06	3.5485E-06	4.6345E-06	3.7255E-06
Fluoranthene					
m _n	Net Weight (ng)	3.6700E+02	4.4400E+02	4.3000E+02	
C _{sd}	Concentration (ng/dscm)	8.6444E+01	1.0612E+02	1.0138E+02	9.7981E+01
C _{sd}	Concentration (ng/Nm ³ dry)	9.2769E+01	1.1389E+02	1.0880E+02	1.0515E+02
C _{sd}	Concentration (ug/dscm)	8.6444E-02	1.0612E-01	1.0138E-01	9.7981E-02
C _{sd}	Concentration (ug/Nm ³ dry)	9.2769E-02	1.1389E-01	1.0880E-01	1.0515E-01
E _{lb/hr}	Emissions Rate (lb/hr)	4.3253E-05	5.2871E-05	5.0708E-05	4.8944E-05
Pyrene					
m _n	Net Weight (ng)	<1.8000E+02	<2.4000E+02	<2.1000E+02	
C _{sd}	Concentration (ng/dscm)	<4.2398E+01	<5.7363E+01	<4.9511E+01	<4.9757E+01
C _{sd}	Concentration (ng/Nm ³ dry)	<4.5500E+01	<6.1560E+01	<5.3133E+01	<5.3398E+01
C _{sd}	Concentration (ug/dscm)	<4.2398E-02	<5.7363E-02	<4.9511E-02	<4.9757E-02
C _{sd}	Concentration (ug/Nm ³ dry)	<4.5500E-02	<6.1560E-02	<5.3133E-02	<5.3398E-02
E _{lb/hr}	Emissions Rate (lb/hr)	<2.1214E-05	<2.8579E-05	<2.4765E-05	<2.4852E-05
Benz[a]anthracene					
m _n	Net Weight (ng)	<4.6000E+00	<5.7000E+00	<7.0000E+00	
C _{sd}	Concentration (ng/dscm)	<1.0835E+00	<1.3624E+00	<1.6504E+00	<1.3654E+00
C _{sd}	Concentration (ng/Nm ³ dry)	<1.1628E+00	<1.4621E+00	<1.7711E+00	<1.4653E+00
C _{sd}	Concentration (ug/dscm)	<1.0835E-03	<1.3624E-03	<1.6504E-03	<1.3654E-03
C _{sd}	Concentration (ug/Nm ³ dry)	<1.1628E-03	<1.4621E-03	<1.7711E-03	<1.4653E-03
E _{lb/hr}	Emissions Rate (lb/hr)	<5.4213E-07	<6.7875E-07	<8.2549E-07	<6.8212E-07

USEPA SW-846 Method 0010 PAH Parameters

Run No.	1	2	3	Average
Date (2011)	Jul 15	Jul 15	Jul 16	
Start Time (approx.)	08:57	15:55	08:36	
Stop Time (approx.)	14:49	20:55	12:59	
Chrysene/Triphenylene				
m _n Net Weight (ng)	8.7800E+01	1.1000E+02	1.0900E+02	
C _{sd} Concentration (ng/dscm)	2.0681E+01	2.6291E+01	2.5698E+01	2.4223E+01
C _{sd} Concentration (ng/Nm ³ dry)	2.2194E+01	2.8215E+01	2.7579E+01	2.5996E+01
C _{sd} Concentration (ug/dscm)	2.0681E-02	2.6291E-02	2.5698E-02	2.4223E-02
C _{sd} Concentration (ug/Nm ³ dry)	2.2194E-02	2.8215E-02	2.7579E-02	2.5996E-02
E _{lb/hr} Emissions Rate (lb/hr)	1.0348E-05	1.3099E-05	1.2854E-05	1.2100E-05
Benzo[b]fluoranthene				
m _n Net Weight (ng)	<2.7000E+01	<4.0000E+01	<4.1000E+01	
C _{sd} Concentration (ng/dscm)	<6.3596E+00	<9.5605E+00	<9.6664E+00	<8.5288E+00
C _{sd} Concentration (ng/Nm ³ dry)	<6.8250E+00	<1.0260E+01	<1.0374E+01	<9.1529E+00
C _{sd} Concentration (ug/dscm)	<6.3596E-03	<9.5605E-03	<9.6664E-03	<8.5288E-03
C _{sd} Concentration (ug/Nm ³ dry)	<6.8250E-03	<1.0260E-02	<1.0374E-02	<9.1529E-03
E _{lb/hr} Emissions Rate (lb/hr)	<3.1821E-06	<4.7631E-06	<4.8350E-06	<4.2601E-06
Benzo[k]fluoranthene				
m _n Net Weight (ng)	7.8600E+00	5.0600E+00	<4.8000E+00	
C _{sd} Concentration (ng/dscm)	1.8514E+00	1.2094E+00	<1.1317E+00	<1.3975E+00
C _{sd} Concentration (ng/Nm ³ dry)	1.9868E+00	1.2979E+00	<1.2145E+00	<1.4997E+00
C _{sd} Concentration (ug/dscm)	1.8514E-03	1.2094E-03	<1.1317E-03	<1.3975E-03
C _{sd} Concentration (ug/Nm ³ dry)	1.9868E-03	1.2979E-03	<1.2145E-03	<1.4997E-03
E _{lb/hr} Emissions Rate (lb/hr)	9.2634E-07	6.0254E-07	<5.6605E-07	<6.9831E-07
Benzo[e]pyrene				
m _n Net Weight (ng)	<1.6000E+01	<1.2000E+01	<1.3000E+01	
C _{sd} Concentration (ng/dscm)	<3.7687E+00	<2.8681E+00	<3.0649E+00	<3.2339E+00
C _{sd} Concentration (ng/Nm ³ dry)	<4.0444E+00	<3.0780E+00	<3.2892E+00	<3.4706E+00
C _{sd} Concentration (ug/dscm)	<3.7687E-03	<2.8681E-03	<3.0649E-03	<3.2339E-03
C _{sd} Concentration (ug/Nm ³ dry)	<4.0444E-03	<3.0780E-03	<3.2892E-03	<3.4706E-03
E _{lb/hr} Emissions Rate (lb/hr)	<1.8857E-06	<1.4289E-06	<1.5330E-06	<1.6159E-06
Benzo[a]pyrene				
m _n Net Weight (ng)	<4.0000E+00	<4.0000E+00	<4.0000E+00	
C _{sd} Concentration (ng/dscm)	<9.4217E-01	<9.5605E-01	<9.4306E-01	<9.4709E-01
C _{sd} Concentration (ng/Nm ³ dry)	<1.0111E+00	<1.0260E+00	<1.0121E+00	<1.0164E+00
C _{sd} Concentration (ug/dscm)	<9.4217E-04	<9.5605E-04	<9.4306E-04	<9.4709E-04
C _{sd} Concentration (ug/Nm ³ dry)	<1.0111E-03	<1.0260E-03	<1.0121E-03	<1.0164E-03
E _{lb/hr} Emissions Rate (lb/hr)	<4.7142E-07	<4.7631E-07	<4.7171E-07	<4.7315E-07
Perylene				
m _n Net Weight (ng)	<4.0000E+00	<4.0000E+00	<4.0000E+00	
C _{sd} Concentration (ng/dscm)	<9.4217E-01	<9.5605E-01	<9.4306E-01	<9.4709E-01
C _{sd} Concentration (ng/Nm ³ dry)	<1.0111E+00	<1.0260E+00	<1.0121E+00	<1.0164E+00
C _{sd} Concentration (ug/dscm)	<9.4217E-04	<9.5605E-04	<9.4306E-04	<9.4709E-04
C _{sd} Concentration (ug/Nm ³ dry)	<1.0111E-03	<1.0260E-03	<1.0121E-03	<1.0164E-03
E _{lb/hr} Emissions Rate (lb/hr)	<4.7142E-07	<4.7631E-07	<4.7171E-07	<4.7315E-07

USEPA SW-846 Method 0010 PAH Parameters

Run No.	1	2	3	Average
Date (2011)	Jul 15	Jul 15	Jul 16	
Start Time (approx.)	08:57	15:55	08:36	
Stop Time (approx.)	14:49	20:55	12:59	
Indeno[1,2,3-cd]pyrene				
m _n Net Weight (ng)	<4.0000E+00	<4.0000E+00	<4.0000E+00	
C _{sd} Concentration (ng/dscm)	<9.4217E-01	<9.5605E-01	<9.4306E-01	<9.4709E-01
C _{sd} Concentration (ng/Nm ³ dry)	<1.0111E+00	<1.0260E+00	<1.0121E+00	<1.0164E+00
C _{sd} Concentration (ug/dscm)	<9.4217E-04	<9.5605E-04	<9.4306E-04	<9.4709E-04
C _{sd} Concentration (ug/Nm ³ dry)	<1.0111E-03	<1.0260E-03	<1.0121E-03	<1.0164E-03
E _{lb/hr} Emissions Rate (lb/hr)	<4.7142E-07	<4.7631E-07	<4.7171E-07	<4.7315E-07
Dibenzo[a,h]anthracene				
m _n Net Weight (ng)	<4.0000E+00	<4.0000E+00	<4.0000E+00	
C _{sd} Concentration (ng/dscm)	<9.4217E-01	<9.5605E-01	<9.4306E-01	<9.4709E-01
C _{sd} Concentration (ng/Nm ³ dry)	<1.0111E+00	<1.0260E+00	<1.0121E+00	<1.0164E+00
C _{sd} Concentration (ug/dscm)	<9.4217E-04	<9.5605E-04	<9.4306E-04	<9.4709E-04
C _{sd} Concentration (ug/Nm ³ dry)	<1.0111E-03	<1.0260E-03	<1.0121E-03	<1.0164E-03
E _{lb/hr} Emissions Rate (lb/hr)	<4.7142E-07	<4.7631E-07	<4.7171E-07	<4.7315E-07
Benzo[g,h,i]perylene				
m _n Net Weight (ng)	<4.0000E+00	<4.0000E+00	<4.0000E+00	
C _{sd} Concentration (ng/dscm)	<9.4217E-01	<9.5605E-01	<9.4306E-01	<9.4709E-01
C _{sd} Concentration (ng/Nm ³ dry)	<1.0111E+00	<1.0260E+00	<1.0121E+00	<1.0164E+00
C _{sd} Concentration (ug/dscm)	<9.4217E-04	<9.5605E-04	<9.4306E-04	<9.4709E-04
C _{sd} Concentration (ug/Nm ³ dry)	<1.0111E-03	<1.0260E-03	<1.0121E-03	<1.0164E-03
E _{lb/hr} Emissions Rate (lb/hr)	<4.7142E-07	<4.7631E-07	<4.7171E-07	<4.7315E-07
Biphenyl				
m _n Net Weight (ng)	2.4200E+03	2.5900E+03	2.6000E+03	
C _{sd} Concentration (ng/dscm)	5.7001E+02	6.1904E+02	6.1299E+02	6.0068E+02
C _{sd} Concentration (ng/Nm ³ dry)	6.1172E+02	6.6434E+02	6.5784E+02	6.4463E+02
C _{sd} Concentration (ug/dscm)	5.7001E-01	6.1904E-01	6.1299E-01	6.0068E-01
C _{sd} Concentration (ug/Nm ³ dry)	6.1172E-01	6.6434E-01	6.5784E-01	6.4463E-01
E _{lb/hr} Emissions Rate (lb/hr)	2.8521E-04	3.0841E-04	3.0661E-04	3.0008E-04
7,12-Dimethylbenzo[a]anthracene				
m _n Net Weight (ng)	<4.0000E+00	<4.0000E+00	<4.0000E+00	
C _{sd} Concentration (ng/dscm)	<9.4217E-01	<9.5605E-01	<9.4306E-01	<9.4709E-01
C _{sd} Concentration (ng/Nm ³ dry)	<1.0111E+00	<1.0260E+00	<1.0121E+00	<1.0164E+00
C _{sd} Concentration (ug/dscm)	<9.4217E-04	<9.5605E-04	<9.4306E-04	<9.4709E-04
C _{sd} Concentration (ug/Nm ³ dry)	<1.0111E-03	<1.0260E-03	<1.0121E-03	<1.0164E-03
E _{lb/hr} Emissions Rate (lb/hr)	<4.7142E-07	<4.7631E-07	<4.7171E-07	<4.7315E-07
3-Methylcholanthrene				
m _n Net Weight (ng)	<4.0000E+00	<4.0000E+00	<4.0000E+00	
C _{sd} Concentration (ng/dscm)	<9.4217E-01	<9.5605E-01	<9.4306E-01	<9.4709E-01
C _{sd} Concentration (ng/Nm ³ dry)	<1.0111E+00	<1.0260E+00	<1.0121E+00	<1.0164E+00
C _{sd} Concentration (ug/dscm)	<9.4217E-04	<9.5605E-04	<9.4306E-04	<9.4709E-04
C _{sd} Concentration (ug/Nm ³ dry)	<1.0111E-03	<1.0260E-03	<1.0121E-03	<1.0164E-03
E _{lb/hr} Emissions Rate (lb/hr)	<4.7142E-07	<4.7631E-07	<4.7171E-07	<4.7315E-07

**USEPA SW-846 Method 0010
PAH Parameters**

Run No.	1	2	3	Average
Date (2011)	Jul 15	Jul 15	Jul 16	
Start Time (approx.)	08:57	15:55	08:36	
Stop Time (approx.)	14:49	20:55	12:59	
Dibenzo[a,e]pyrene				
m _n Net Weight (ng)	<4.0000E+00	<4.0000E+00	<4.0000E+00	
C _{sd} Concentration (ng/dscm)	<9.4217E-01	<9.5605E-01	<9.4306E-01	<9.4709E-01
C _{sd} Concentration (ng/Nm ³ dry)	<1.0111E+00	<1.0260E+00	<1.0121E+00	<1.0164E+00
C _{sd} Concentration (ug/dscm)	<9.4217E-04	<9.5605E-04	<9.4306E-04	<9.4709E-04
C _{sd} Concentration (ug/Nm ³ dry)	<1.0111E-03	<1.0260E-03	<1.0121E-03	<1.0164E-03
E _{lb/hr} Emissions Rate (lb/hr)	<4.7142E-07	<4.7631E-07	<4.7171E-07	<4.7315E-07

Marathon Petroleum Company
Clean Air Project No: 11265
FCCU Scrubber Stack

**USEPA SW-846 Method 0010
PAH Results**

Run #1

Analyte	Lab Data Net Weight (ng)	PAH Conc. (ug/dscm)	PAH Conc. (ng/dscm)	PAH Emissions (lb/hr)
Naphthalene	3.61E+04	8.50E+00	8.50E+03	4.25E-03
2-Methylnaphthalene	2.76E+02	6.50E-02	6.50E+01	3.25E-05
Acenaphthylene	7.00E+01	1.65E-02	1.65E+01	8.25E-06
Acenaphthene	<1.20E+02	<2.83E-02	<2.83E+01	<1.41E-05
Fluorene	<3.00E+02	<7.07E-02	<7.07E+01	<3.54E-05
Phenanthrene	2.36E+03	5.56E-01	5.56E+02	2.78E-04
Anthracene	2.54E+01	5.98E-03	5.98E+00	2.99E-06
Fluoranthene	3.67E+02	8.64E-02	8.64E+01	4.33E-05
Pyrene	<1.80E+02	<4.24E-02	<4.24E+01	<2.12E-05
Benz[a]anthracene	<4.60E+00	<1.08E-03	<1.08E+00	<5.42E-07
Chrysene/Triphenylene	8.78E+01	2.07E-02	2.07E+01	1.03E-05
Benzo[b]fluoranthene	<2.70E+01	<6.36E-03	<6.36E+00	<3.18E-06
Benzo[k]fluoranthene	7.86E+00	1.85E-03	1.85E+00	9.26E-07
Benzo[e]pyrene	<1.60E+01	<3.77E-03	<3.77E+00	<1.89E-06
Benzo[a]pyrene	<4.00E+00	<9.42E-04	<9.42E-01	<4.71E-07
Perylene	<4.00E+00	<9.42E-04	<9.42E-01	<4.71E-07
Indeno[1,2,3-cd]pyrene	<4.00E+00	<9.42E-04	<9.42E-01	<4.71E-07
Dibenzo[a,h]anthracene	<4.00E+00	<9.42E-04	<9.42E-01	<4.71E-07
Benzo[g,h,i]perylene	<4.00E+00	<9.42E-04	<9.42E-01	<4.71E-07
Biphenyl	2.42E+03	5.70E-01	5.70E+02	2.85E-04
7,12-Dimethylbenzo[a]anthracene	<4.00E+00	<9.42E-04	<9.42E-01	<4.71E-07
3-Methylcholanthrene	<4.00E+00	<9.42E-04	<9.42E-01	<4.71E-07
Dibenzo[a,e]pyrene	<4.00E+00	<9.42E-04	<9.42E-01	<4.71E-07
Total PAHs*	<4.24E+04	<9.99E+00	<9.99E+03	<5.00E-03

< Denotes that the analyte was not detectable above the stated value.

Marathon Petroleum Company
Clean Air Project No: 11265
FCCU Scrubber Stack

**USEPA SW-846 Method 0010
PAH Results**

Run #2

Analyte	Lab Data Net Weight (ng)	PAH Conc. (ug/dscm)	PAH Conc. (ng/dscm)	PAH Emissions (lb/hr)
Naphthalene	8.46E+04	2.02E+01	2.02E+04	1.01E-02
2-Methylnaphthalene	1.63E+02	3.90E-02	3.90E+01	1.94E-05
Acenaphthylene	7.76E+01	1.85E-02	1.85E+01	9.24E-06
Acenaphthene	<3.10E+01	<7.41E-03	<7.41E+00	<3.69E-06
Fluorene	<2.80E+02	<6.69E-02	<6.69E+01	<3.33E-05
Phenanthrene	2.78E+03	6.64E-01	6.64E+02	3.31E-04
Anthracene	2.98E+01	7.12E-03	7.12E+00	3.55E-06
Fluoranthene	4.44E+02	1.06E-01	1.06E+02	5.29E-05
Pyrene	<2.40E+02	<5.74E-02	<5.74E+01	<2.86E-05
Benz[a]anthracene	<5.70E+00	<1.36E-03	<1.36E+00	<6.79E-07
Chrysene/Triphenylene	1.10E+02	2.63E-02	2.63E+01	1.31E-05
Benzo[b]fluoranthene	<4.00E+01	<9.56E-03	<9.56E+00	<4.76E-06
Benzo[k]fluoranthene	5.06E+00	1.21E-03	1.21E+00	6.03E-07
Benzo[e]pyrene	<1.20E+01	<2.87E-03	<2.87E+00	<1.43E-06
Benzo[a]pyrene	<4.00E+00	<9.56E-04	<9.56E-01	<4.76E-07
Perylene	<4.00E+00	<9.56E-04	<9.56E-01	<4.76E-07
Indeno[1,2,3-cd]pyrene	<4.00E+00	<9.56E-04	<9.56E-01	<4.76E-07
Dibenzo[a,h]anthracene	<4.00E+00	<9.56E-04	<9.56E-01	<4.76E-07
Benzo[g,h,i]perylene	<4.00E+00	<9.56E-04	<9.56E-01	<4.76E-07
Biphenyl	2.59E+03	6.19E-01	6.19E+02	3.08E-04
7,12-Dimethylbenzo[a]anthracene	<4.00E+00	<9.56E-04	<9.56E-01	<4.76E-07
3-Methylcholanthrene	<4.00E+00	<9.56E-04	<9.56E-01	<4.76E-07
Dibenzo[a,e]pyrene	<4.00E+00	<9.56E-04	<9.56E-01	<4.76E-07
Total PAHs*	<9.14E+04	<2.19E+01	<2.19E+04	<1.09E-02

< Denotes that the analyte was not detectable above the stated value.

Marathon Petroleum Company
Clean Air Project No: 11265
FCCU Scrubber Stack

**USEPA SW-846 Method 0010
PAH Results**

Run #3

Analyte	Lab Data Net Weight (ng)	PAH Conc. (ug/dscm)	PAH Conc. (ng/dscm)	PAH Emissions (lb/hr)
Naphthalene	8.03E+04	1.89E+01	1.89E+04	9.47E-03
2-Methylnaphthalene	1.80E+02	4.24E-02	4.24E+01	2.12E-05
Acenaphthylene	8.84E+01	2.08E-02	2.08E+01	1.04E-05
Acenaphthene	<3.90E+01	<9.19E-03	<9.19E+00	<4.60E-06
Fluorene	<3.10E+02	<7.31E-02	<7.31E+01	<3.66E-05
Phenanthrene	2.60E+03	6.13E-01	6.13E+02	3.07E-04
Anthracene	3.93E+01	9.27E-03	9.27E+00	4.63E-06
Fluoranthene	4.30E+02	1.01E-01	1.01E+02	5.07E-05
Pyrene	<2.10E+02	<4.95E-02	<4.95E+01	<2.48E-05
Benz[a]anthracene	<7.00E+00	<1.65E-03	<1.65E+00	<8.25E-07
Chrysene/Triphenylene	1.09E+02	2.57E-02	2.57E+01	1.29E-05
Benzo[b]fluoranthene	<4.10E+01	<9.67E-03	<9.67E+00	<4.83E-06
Benzo[k]fluoranthene	<4.80E+00	<1.13E-03	<1.13E+00	<5.66E-07
Benzo[e]pyrene	<1.30E+01	<3.06E-03	<3.06E+00	<1.53E-06
Benzo[a]pyrene	<4.00E+00	<9.43E-04	<9.43E-01	<4.72E-07
Perylene	<4.00E+00	<9.43E-04	<9.43E-01	<4.72E-07
Indeno[1,2,3-cd]pyrene	<4.00E+00	<9.43E-04	<9.43E-01	<4.72E-07
Dibenzo[a,h]anthracene	<4.00E+00	<9.43E-04	<9.43E-01	<4.72E-07
Benzo[g,h,i]perylene	<4.00E+00	<9.43E-04	<9.43E-01	<4.72E-07
Biphenyl	2.60E+03	6.13E-01	6.13E+02	3.07E-04
7,12-Dimethylbenzo[a]anthracene	<4.00E+00	<9.43E-04	<9.43E-01	<4.72E-07
3-Methylcholanthrene	<4.00E+00	<9.43E-04	<9.43E-01	<4.72E-07
Dibenzo[a,e]pyrene	<4.00E+00	<9.43E-04	<9.43E-01	<4.72E-07
Total PAHs*	<8.70E+04	<2.05E+01	<2.05E+04	<1.03E-02

< Denotes that the analyte was not detectable above the stated value.

Marathon Petroleum Company
CleanAir Project No. 11265
Robinson Refinery
FCCU Scrubber Stack

Continuous Emissions Monitoring Parameters

Run Number	1			
Date (2011)	Jul 14			
Start Time	13:22			
End Time	14:23			
Elapsed Time (hh:mm)	01:01			
Channel	2	3	4	
Parameter	THC	O2	CO2	
	FCCU	FCCU	FCCU	
	Scrubber	Scrubber	Scrubber	
Location	Stack	Stack	Stack	
Measurement Units	ppmwv	%dv	%dv	
Measured Average (drift-corrected)	1.024	3.317	14.236	
Concentration (ppmdv)	1.341			
Concentration (lb/dscf)	1.534E-07			
Mass Rate (lb/hr)	1.234			

Flow and moisture data used in lb/hr calculations obtained from nearly-concurrent SW-846 M-0011, Matrix Spike Run (11:51 to 14:10).

**Marathon Petroleum Company
Clean Air Project No. 11265
Robinson Refinery
FCCU Scrubber Stack**

Continuous Emissions Monitoring Parameters

Run Number	2
Date (2011)	Jul 14
Start Time	15:04
End Time	16:04
Elapsed Time (hh:mm)	01:00

Channel	2	3	4
Parameter	THC	O2	CO2
	FCCU	FCCU	FCCU
	Scrubber	Scrubber	Scrubber
Location	Stack	Stack	Stack
Measurement Units	ppmwv	%dv	%dv
Measured Average (drift-corrected)	1.105	3.295	14.217
Concentration (ppmdv)	1.446		
Concentration (lb/dscf)	1.655E-07		
Mass Rate (lb/hr)	1.332		

Flow and moisture data used in lb/hr calculations obtained from nearly-concurrent SW-846 M-0011, Matrix Spike Run (11:51 to 14:10).

**Marathon Petroleum Company
Clean Air Project No. 11265
Robinson Refinery
FCCU Scrubber Stack**

Continuous Emissions Monitoring Parameters

Run Number	3
Date (2011)	Jul 14
Start Time	16:18
End Time	17:18
Elapsed Time (hh:mm)	01:00

Channel	2	3	4
Parameter	THC	O2	CO2
	FCCU	FCCU	FCCU
	Scrubber	Scrubber	Scrubber
Location	Stack	Stack	Stack
Measurement Units	ppmwv	%dv	%dv
Measured Average (drift-corrected)	1.099	3.346	14.194
Concentration (ppmdv)	1.438		
Concentration (lb/dscf)	1.646E-07		
Mass Rate (lb/hr)	1.325		

Flow and moisture data used in lb/hr calculations obtained from nearly-concurrent SW-846 M-0011, Matrix Spike Run (11:51 to 14:10).

Marathon Petroleum Company
Clean Air Project No: 11265
FCCU Scrubber Stack

USEPA Method 23 (PCDD/PCDF/PCB) Sampling, Velocity and Moisture Parameters

Run No.	1	2	3	Average
Date (2011)	Jul 20	Jul 20	Jul 21	
Start Time (approx.)	07:59	11:50	07:53	
Stop Time (approx.)	11:12	15:22	11:09	
Sampling Conditions				
Y _d Dry gas meter correction factor	0.9992	0.9992	0.9992	
C _p Pitot tube coefficient	0.8200	0.8200	0.8200	
P _g Static pressure (in. H ₂ O)	-0.3000	-0.3000	-0.5000	
A _s Sample location area (ft ²)	70.8822	70.8822	70.8822	
P _{bar} Barometric pressure (in. Hg)	29.30	29.30	29.35	29.3167
D _n Nozzle diameter (in.)	0.2500	0.2500	0.2500	
O ₂ Oxygen (dry volume %)	3.5000	3.7000	3.5000	3.5667
CO ₂ Carbon dioxide (dry volume %)	14.0000	13.5000	13.8000	13.7667
N ₂ +CO Nitrogen plus carbon monoxide (dry volume %)	82.5000	82.8000	82.7000	82.6667
V _{lc} Total Liquid collected (ml)	778.00	758.50	798.80	
V _m Volume metered, meter conditions (ft ³)	125.1500	122.9950	126.1500	
T _m Dry gas meter temperature (°F)	106.2639	112.8056	105.7639	
T _s Sample temperature (°F)	151.0000	150.4167	150.7778	150.7315
ΔH Meter box orifice pressure drop (in. H ₂ O)	1.3500	1.3583	1.4056	
θ Total sampling time (min)	180.0	180.0	180.0	
Flow Results				
V _{wstd} Volume of water collected (ft ³)	36.6127	35.6950	37.5915	36.6331
V _{mstd} Volume metered, standard (dscf)	114.5248	111.2697	115.7545	113.8496
P _s Sample gas pressure, absolute (in. Hg)	29.2779	29.2779	29.3132	29.2897
P _v Vapor pressure, actual (in. Hg)	7.7623	7.6513	7.7199	7.7112
B _{w0} Moisture measured in sample (% by volume)	24.2248	24.2882	24.5142	24.3424
B _{ws} Saturated moisture content (% by volume)	26.5126	26.1333	26.3358	26.3272
B _w Actual water vapor in gas (% by volume)	24.2248	24.2882	24.5142	24.3424
√ΔP Velocity head (√in. H ₂ O)	0.7904	0.7896	0.8043	0.7947
M _d MW of sample gas, dry (lb/lb-mole)	30.3800	30.3080	30.3480	30.3453
M _s MW of sample gas, wet (lb/lb-mole)	27.3810	27.3186	27.3210	27.3402
V _s Velocity of sample (ft/sec)	48.3716	48.3558	49.2362	48.6545
%I Isokinetic sampling (%)	100.4233	97.5893	99.9446	99.3191
Q _a Volumetric flow rate, actual (acfm)	205,721	205,654	209,398	206,924
Q _s Volumetric flow rate, standard (scfm)	173,960	174,070	177,348	175,126
Q _{std} Volumetric flow rate, dry standard (dscfm)	131,819	131,791	133,872	132,494
Q _a Volumetric flow rate, actual (acf/hr)	12,343,254	12,339,233	12,563,883	12,415,457
Q _s Volumetric flow rate, standard (scf/hr)	10,437,616	10,444,187	10,640,860	10,507,555
Q _{std} Volumetric flow rate, dry standard (dscf/hr)	7,909,129	7,907,487	8,032,339	7,949,652

Comments:

Average includes 3 runs.

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USEPA Method 23 Maximum Emissions Parameters (NDs & EMPCs included)
Total Tetra- through Octa-PCDD/F Results (TEQ based on USEPA/INTL 2005 TEFs)

Run No.	1	2	3	Average
Date (2011)	Jul 20	Jul 20	Jul 21	
Start Time (approx.)	07:59	11:50	07:53	
Stop Time (approx.)	11:12	15:22	11:09	
Gas Conditions				
O ₂ Oxygen (dry volume %)	3.5000	3.7000	3.5000	3.5667
CO ₂ Carbon dioxide (dry volume %)	14.0000	13.5000	13.8000	13.7667
T _s Sample temperature (°F)	151.0	150.4	150.8	150.7
B _w Actual water vapor in gas (% by volume)	24.2248	24.2882	24.5142	24.3424
Gas Flow Rate				
Q _a Volumetric flow rate, actual (acfm)	205,721	205,654	209,398	206,924
Q _s Volumetric flow rate, standard (scfm)	173,960	174,070	177,348	175,126
Q _{std} Volumetric flow rate, dry standard (dscfm)	131,819	131,791	133,872	132,494
Q _a Volumetric flow rate, actual (acf/hr)	12,343,254	12,339,233	12,563,883	12,415,457
Q _s Volumetric flow rate, standard (scf/hr)	10,437,616	10,444,187	10,640,860	10,507,555
Q _{std} Volumetric flow rate, dry standard (dscf/hr)	7,909,129	7,907,487	8,032,339	7,949,652
Sampling Data				
V _{mstd} Volume metered, standard (dscf)	114.5248	111.2697	115.7545	113.8496
%I Isokinetic sampling (%)	100.4233	97.5893	99.9446	99.3191
Laboratory Data from USEPA Method 23, including NDs and EMPCs				
Total PCDDs (ng)	0.06330	0.07890	0.07340	
Total PCDFs (ng)	0.05810	0.07020	0.07972	
m _n Total PCDDs & PCDFs (ng)	0.12140	0.14910	0.15312	
Total TEQ PCDDs (ng)	0.01510	0.01989	0.01989	
Total TEQ PCDFs (ng)	0.00429	0.00560	0.00711	
m _n _TEQ Total TEQ PCDDs & PCDFs (ng)	0.01939	0.02549	0.02700	
Total PCDD/F Results (TEF=1)				
C _{sd} PCDD/F Concentration (ng/dscm)	3.7430E-02	4.7315E-02	4.6708E-02	4.3818E-02
C _{sd} PCDD/F Concentration (ng/Nm ³ dry)	4.0169E-02	5.0777E-02	5.0126E-02	4.7024E-02
E _{lb/hr} PCDD/F Rate (lb/hr)	1.8487E-08	2.3364E-08	2.3429E-08	2.1760E-08
Total PCDD/F TEQ Results (using USEPA/INTL 2005 TEFs)				
C _{sdTEQ} TEQ Concentration (ng/dscm)	5.9785E-03	8.0880E-03	8.2371E-03	7.4345E-03
C _{sdTEQ} TEQ Concentration (ng/Nm ³ dry)	6.4160E-03	8.6798E-03	8.8398E-03	7.9785E-03
E _{lb/hrTEQ} TEQ Rate (lb/hr)	2.9528E-09	3.9938E-09	4.1317E-09	3.6928E-09

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USEPA Method 23 Maximum Emissions Results (NDs & EMPCs included)
Total Tetra- through Octa-PCDD/F Results using USEPA/INTL 2005 TEFs

Run #1

		Toxic	Laboratory Data		TEQ Concentration			
Congener		Equivalency Factor (TEF)	Actual Amt. (ng)	TEQ Amt. (ng)	As measured (ng/dscm)	@ 7% O ₂ (ng/dscm)	TEQ Emission Rate (g/sec)	(lb/hr)
PCDDs								
*	2,3,7,8-TCDD	1.00000	5.90E-03	5.90E-03	1.82E-03	1.45E-03	1.13E-10	8.98E-10
*	Other TCDD	0.00000	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
*	1,2,3,7,8-PeCDD	1.00000	7.60E-03	7.60E-03	2.34E-03	1.87E-03	1.46E-10	1.16E-09
*	Other PeCDD	0.00000	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
*	1,2,3,4,7,8-HxCDD	0.10000	5.10E-03	5.10E-04	1.57E-04	1.26E-04	9.78E-12	7.77E-11
*	1,2,3,6,7,8-HxCDD	0.10000	5.00E-03	5.00E-04	1.54E-04	1.23E-04	9.59E-12	7.61E-11
*	1,2,3,7,8,9-HxCDD	0.10000	5.20E-03	5.20E-04	1.60E-04	1.28E-04	9.98E-12	7.92E-11
*	Other HxCDD	0.00000	N/A	N/A	N/A	N/A	N/A	N/A
*	1,2,3,4,6,7,8-HpCDD	0.01000	6.50E-03	6.50E-05	2.00E-05	1.60E-05	1.25E-12	9.90E-12
*	Other HpCDD	0.00000	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
*	1,2,3,4,6,7,8,9-OCDD	0.00030	2.80E-02	8.40E-06	2.59E-06	2.07E-06	1.61E-13	1.28E-12
Total PCDDs			6.33E-02	1.51E-02	4.66E-03	3.72E-03	2.90E-10	2.30E-09
PCDFs								
*	2,3,7,8-TCDF	0.10000	3.60E-03	3.60E-04	1.11E-04	8.87E-05	6.91E-12	5.48E-11
*	Other TCDF	0.00000	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
*	1,2,3,7,8-PeCDF	0.03000	8.00E-03	2.40E-04	7.40E-05	5.91E-05	4.60E-12	3.65E-11
*	2,3,4,7,8-PeCDF	0.30000	7.40E-03	2.22E-03	6.84E-04	5.47E-04	4.26E-11	3.38E-10
*	Other PeCDF	0.00000	N/A	N/A	N/A	N/A	N/A	N/A
*	1,2,3,4,7,8-HxCDF	0.10000	3.40E-03	3.40E-04	1.05E-04	8.37E-05	6.52E-12	5.18E-11
*	1,2,3,6,7,8-HxCDF	0.10000	3.10E-03	3.10E-04	9.56E-05	7.64E-05	5.95E-12	4.72E-11
*	2,3,4,6,7,8-HxCDF	0.10000	3.30E-03	3.30E-04	1.02E-04	8.13E-05	6.33E-12	5.03E-11
*	1,2,3,7,8,9-HxCDF	0.10000	4.10E-03	4.10E-04	1.26E-04	1.01E-04	7.87E-12	6.24E-11
*	Other HxCDF	0.00000	N/A	N/A	N/A	N/A	N/A	N/A
*	1,2,3,4,6,7,8-HpCDF	0.01000	3.10E-03	3.10E-05	9.56E-06	7.64E-06	5.95E-13	4.72E-12
*	1,2,3,4,7,8,9-HpCDF	0.01000	4.10E-03	4.10E-05	1.26E-05	1.01E-05	7.87E-13	6.24E-12
*	Other HpCDF	0.00000	N/A	N/A	N/A	N/A	N/A	N/A
*	1,2,3,4,6,7,8,9-OCDF	0.00030	1.80E-02	5.40E-06	1.66E-06	1.33E-06	1.04E-13	8.22E-13
Total PCDFs			5.81E-02	4.29E-03	1.32E-03	1.06E-03	8.22E-11	6.53E-10
Total PCDDs & PCDFs			1.21E-01	1.94E-02	5.98E-03	4.78E-03	3.72E-10	2.95E-09

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* Indicates that result includes EMPCs and/or NDs.

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USEPA Method 23 Maximum Emissions Results (NDs & EMPCs included)
Total Tetra- through Octa-PCDD/F Results using USEPA/INTL 2005 TEFs

Run #2

		Toxic	Laboratory Data		TEQ Concentration			
Congener		Equivalency Factor (TEF)	Actual Amt. (ng)	TEQ Amt. (ng)	As measured (ng/dscm)	@ 7% O ₂ (ng/dscm)	TEQ Emission Rate (g/sec) (lb/hr)	
PCDDs								
*	2,3,7,8-TCDD	1.00000	5.90E-03	5.90E-03	1.87E-03	1.51E-03	1.16E-10	9.25E-10
*	Other TCDD	0.00000	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
*	1,2,3,7,8-PeCDD	1.00000	1.20E-02	1.20E-02	3.81E-03	3.08E-03	2.37E-10	1.88E-09
*	Other PeCDD	0.00000	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
*	1,2,3,4,7,8-HxCDD	0.10000	6.40E-03	6.40E-04	2.03E-04	1.64E-04	1.26E-11	1.00E-10
*	1,2,3,6,7,8-HxCDD	0.10000	6.30E-03	6.30E-04	2.00E-04	1.62E-04	1.24E-11	9.87E-11
*	1,2,3,7,8,9-HxCDD	0.10000	6.50E-03	6.50E-04	2.06E-04	1.67E-04	1.28E-11	1.02E-10
*	Other HxCDD	0.00000	N/A	N/A	N/A	N/A	N/A	N/A
*	1,2,3,4,6,7,8-HpCDD	0.01000	5.80E-03	5.80E-05	1.84E-05	1.49E-05	1.14E-12	9.09E-12
*	Other HpCDD	0.00000	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
*	1,2,3,4,6,7,8,9-OCDD	0.00030	3.60E-02	1.08E-05	3.43E-06	2.77E-06	2.13E-13	1.69E-12
Total PCDDs			7.89E-02	1.99E-02	6.31E-03	5.10E-03	3.93E-10	3.12E-09
PCDFs								
*	2,3,7,8-TCDF	0.10000	8.00E-03	8.00E-04	2.54E-04	2.05E-04	1.58E-11	1.25E-10
*	Other TCDF	0.00000	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
*	1,2,3,7,8-PeCDF	0.03000	1.00E-02	3.00E-04	9.52E-05	7.69E-05	5.92E-12	4.70E-11
*	2,3,4,7,8-PeCDF	0.30000	9.40E-03	2.82E-03	8.95E-04	7.23E-04	5.57E-11	4.42E-10
*	Other PeCDF	0.00000	N/A	N/A	N/A	N/A	N/A	N/A
*	1,2,3,4,7,8-HxCDF	0.10000	3.70E-03	3.70E-04	1.17E-04	9.49E-05	7.30E-12	5.80E-11
*	1,2,3,6,7,8-HxCDF	0.10000	3.50E-03	3.50E-04	1.11E-04	8.98E-05	6.91E-12	5.48E-11
*	2,3,4,6,7,8-HxCDF	0.10000	3.70E-03	3.70E-04	1.17E-04	9.49E-05	7.30E-12	5.80E-11
*	1,2,3,7,8,9-HxCDF	0.10000	4.50E-03	4.50E-04	1.43E-04	1.15E-04	8.88E-12	7.05E-11
*	Other HxCDF	0.00000	N/A	N/A	N/A	N/A	N/A	N/A
*	1,2,3,4,6,7,8-HpCDF	0.01000	5.70E-03	5.70E-05	1.81E-05	1.46E-05	1.13E-12	8.93E-12
*	1,2,3,4,7,8,9-HpCDF	0.01000	7.70E-03	7.70E-05	2.44E-05	1.97E-05	1.52E-12	1.21E-11
*	Other HpCDF	0.00000	N/A	N/A	N/A	N/A	N/A	N/A
*	1,2,3,4,6,7,8,9-OCDF	0.00030	1.40E-02	4.20E-06	1.33E-06	1.08E-06	8.29E-14	6.58E-13
Total PCDFs			7.02E-02	5.60E-03	1.78E-03	1.44E-03	1.11E-10	8.77E-10
Total PCDDs & PCDFs			1.49E-01	2.55E-02	8.09E-03	6.54E-03	5.03E-10	3.99E-09

* Indicates that result includes EMPCs and/or NDs.

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USEPA Method 23 Maximum Emissions Results (NDs & EMPCs included)
Total Tetra- through Octa-PCDD/F Results using USEPA/INTL 2005 TEFs

Run #3

		Toxic	Laboratory Data		TEQ Concentration			
Congener		Equivalency Factor (TEF)	Actual Amt. (ng)	TEQ Amt. (ng)	As measured (ng/dscm)	@ 7% O ₂ (ng/dscm)	TEQ Emission Rate (g/sec)	(lb/hr)
PCDDs								
*	2,3,7,8-TCDD	1.00000	4.30E-03	4.30E-03	1.31E-03	1.05E-03	8.29E-11	6.58E-10
*	Other TCDD	0.00000	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
*	1,2,3,7,8-PeCDD	1.00000	1.40E-02	1.40E-02	4.27E-03	3.41E-03	2.70E-10	2.14E-09
*	Other PeCDD	0.00000	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
*	1,2,3,4,7,8-HxCDD	0.10000	4.90E-03	4.90E-04	1.49E-04	1.19E-04	9.44E-12	7.50E-11
*	1,2,3,6,7,8-HxCDD	0.10000	4.80E-03	4.80E-04	1.46E-04	1.17E-04	9.25E-12	7.34E-11
*	1,2,3,7,8,9-HxCDD	0.10000	5.00E-03	5.00E-04	1.53E-04	1.22E-04	9.64E-12	7.65E-11
*	Other HxCDD	0.00000	N/A	N/A	N/A	N/A	N/A	N/A
	1,2,3,4,6,7,8-HpCDD	0.01000	1.14E-02	1.14E-04	3.48E-05	2.78E-05	2.20E-12	1.74E-11
	Other HpCDD	0.00000	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
*	1,2,3,4,6,7,8,9-OCDD	0.00030	2.90E-02	8.70E-06	2.65E-06	2.12E-06	1.68E-13	1.33E-12
Total PCDDs			7.34E-02	1.99E-02	6.07E-03	4.85E-03	3.83E-10	3.04E-09
PCDFs								
*	2,3,7,8-TCDF	0.10000	7.00E-03	7.00E-04	2.14E-04	1.71E-04	1.35E-11	1.07E-10
*	Other TCDF	0.00000	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
*	1,2,3,7,8-PeCDF	0.03000	1.20E-02	3.60E-04	1.10E-04	8.77E-05	6.94E-12	5.51E-11
*	2,3,4,7,8-PeCDF	0.30000	1.20E-02	3.60E-03	1.10E-03	8.77E-04	6.94E-11	5.51E-10
*	Other PeCDF	0.00000	N/A	N/A	N/A	N/A	N/A	N/A
*	1,2,3,4,7,8-HxCDF	0.10000	5.00E-03	5.00E-04	1.53E-04	1.22E-04	9.64E-12	7.65E-11
*	1,2,3,6,7,8-HxCDF	0.10000	6.89E-03	6.89E-04	2.10E-04	1.68E-04	1.33E-11	1.05E-10
*	2,3,4,6,7,8-HxCDF	0.10000	4.90E-03	4.90E-04	1.49E-04	1.19E-04	9.44E-12	7.50E-11
*	1,2,3,7,8,9-HxCDF	0.10000	6.10E-03	6.10E-04	1.86E-04	1.49E-04	1.18E-11	9.33E-11
*	Other HxCDF	0.00000	N/A	N/A	N/A	N/A	N/A	N/A
*	1,2,3,4,6,7,8-HpCDF	0.01000	9.23E-03	9.23E-05	2.82E-05	2.25E-05	1.78E-12	1.41E-11
*	1,2,3,4,7,8,9-HpCDF	0.01000	6.60E-03	6.60E-05	2.01E-05	1.61E-05	1.27E-12	1.01E-11
*	Other HpCDF	0.00000	N/A	N/A	N/A	N/A	N/A	N/A
*	1,2,3,4,6,7,8,9-OCDF	0.00030	1.00E-02	3.00E-06	9.15E-07	7.31E-07	5.78E-14	4.59E-13
Total PCDFs			7.97E-02	7.11E-03	2.17E-03	1.73E-03	1.37E-10	1.09E-09
Total PCDDs & PCDFs			1.53E-01	2.70E-02	8.24E-03	6.58E-03	5.20E-10	4.13E-09

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* Indicates that result includes EMPCs and/or NDs.

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USEPA Method 23 Maximum Emissions Results (NDs & EMPCs included)
Total Tetra- through Octa-PCDD/F Results using Worst Case (Full Mass, TEF=1) TEFs

Run #1

		Toxic	Laboratory Data		TEQ Concentration			
Congener		Equivalency Factor (TEF)	Actual Amt. (ng)	TEQ Amt. (ng)	As measured (ng/dscm)	@ 7% O ₂ (ng/dscm)	TEQ Emission Rate	
							(g/sec)	(lb/hr)
PCDDs								
*	2,3,7,8-TCDD	1.0000	5.90E-03	5.90E-03	1.82E-03	1.45E-03	1.13E-10	8.98E-10
*	Other TCDD	1.0000	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
*	1,2,3,7,8-PeCDD	1.0000	7.60E-03	7.60E-03	2.34E-03	1.87E-03	1.46E-10	1.16E-09
*	Other PeCDD	1.0000	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
*	1,2,3,4,7,8-HxCDD	1.0000	5.10E-03	5.10E-03	1.57E-03	1.26E-03	9.78E-11	7.77E-10
*	1,2,3,6,7,8-HxCDD	1.0000	5.00E-03	5.00E-03	1.54E-03	1.23E-03	9.59E-11	7.61E-10
*	1,2,3,7,8,9-HxCDD	1.0000	5.20E-03	5.20E-03	1.60E-03	1.28E-03	9.98E-11	7.92E-10
*	Other HxCDD	1.0000	N/A	N/A	N/A	N/A	N/A	N/A
*	1,2,3,4,6,7,8-HpCDD	1.0000	6.50E-03	6.50E-03	2.00E-03	1.60E-03	1.25E-10	9.90E-10
*	Other HpCDD	1.0000	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
*	1,2,3,4,6,7,8,9-OCDD	1.0000	2.80E-02	2.80E-02	8.63E-03	6.90E-03	5.37E-10	4.26E-09
Total PCDDs			6.33E-02	6.33E-02	1.95E-02	1.56E-02	1.21E-09	9.64E-09
PCDFs								
*	2,3,7,8-TCDF	1.0000	3.60E-03	3.60E-03	1.11E-03	8.87E-04	6.91E-11	5.48E-10
*	Other TCDF	1.0000	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
*	1,2,3,7,8-PeCDF	1.0000	8.00E-03	8.00E-03	2.47E-03	1.97E-03	1.53E-10	1.22E-09
*	2,3,4,7,8-PeCDF	1.0000	7.40E-03	7.40E-03	2.28E-03	1.82E-03	1.42E-10	1.13E-09
*	Other PeCDF	1.0000	N/A	N/A	N/A	N/A	N/A	N/A
*	1,2,3,4,7,8-HxCDF	1.0000	3.40E-03	3.40E-03	1.05E-03	8.37E-04	6.52E-11	5.18E-10
*	1,2,3,6,7,8-HxCDF	1.0000	3.10E-03	3.10E-03	9.56E-04	7.64E-04	5.95E-11	4.72E-10
*	2,3,4,6,7,8-HxCDF	1.0000	3.30E-03	3.30E-03	1.02E-03	8.13E-04	6.33E-11	5.03E-10
*	1,2,3,7,8,9-HxCDF	1.0000	4.10E-03	4.10E-03	1.26E-03	1.01E-03	7.87E-11	6.24E-10
*	Other HxCDF	1.0000	N/A	N/A	N/A	N/A	N/A	N/A
*	1,2,3,4,6,7,8-HpCDF	1.0000	3.10E-03	3.10E-03	9.56E-04	7.64E-04	5.95E-11	4.72E-10
*	1,2,3,4,7,8,9-HpCDF	1.0000	4.10E-03	4.10E-03	1.26E-03	1.01E-03	7.87E-11	6.24E-10
*	Other HpCDF	1.0000	N/A	N/A	N/A	N/A	N/A	N/A
*	1,2,3,4,6,7,8,9-OCDF	1.0000	1.80E-02	1.80E-02	5.55E-03	4.43E-03	3.45E-10	2.74E-09
Total PCDFs			5.81E-02	5.81E-02	1.79E-02	1.43E-02	1.11E-09	8.85E-09
Total PCDDs & PCDFs			1.21E-01	1.21E-01	3.74E-02	2.99E-02	2.33E-09	1.85E-08

* Indicates that result includes EMPCs and/or NDs.

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USEPA Method 23 Maximum Emissions Results (NDs & EMPCs included)
Total Tetra- through Octa-PCDD/F Results using Worst Case (Full Mass, TEF=1) TEFs

Run #2

		Toxic	Laboratory Data		TEQ Concentration		TEQ Emission Rate	
	Congener	Equivalency Factor (TEF)	Actual Amt. (ng)	TEQ Amt. (ng)	As measured (ng/dscm)	@ 7% O ₂ (ng/dscm)	(g/sec)	(lb/hr)
PCDDs								
*	2,3,7,8-TCDD	1.0000	5.90E-03	5.90E-03	1.87E-03	1.51E-03	1.16E-10	9.25E-10
*	Other TCDD	1.0000	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
*	1,2,3,7,8-PeCDD	1.0000	1.20E-02	1.20E-02	3.81E-03	3.08E-03	2.37E-10	1.88E-09
*	Other PeCDD	1.0000	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
*	1,2,3,4,7,8-HxCDD	1.0000	6.40E-03	6.40E-03	2.03E-03	1.64E-03	1.26E-10	1.00E-09
*	1,2,3,6,7,8-HxCDD	1.0000	6.30E-03	6.30E-03	2.00E-03	1.62E-03	1.24E-10	9.87E-10
*	1,2,3,7,8,9-HxCDD	1.0000	6.50E-03	6.50E-03	2.06E-03	1.67E-03	1.28E-10	1.02E-09
*	Other HxCDD	1.0000	N/A	N/A	N/A	N/A	N/A	N/A
*	1,2,3,4,6,7,8-HpCDD	1.0000	5.80E-03	5.80E-03	1.84E-03	1.49E-03	1.14E-10	9.09E-10
*	Other HpCDD	1.0000	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
*	1,2,3,4,6,7,8,9-OCDD	1.0000	3.60E-02	3.60E-02	1.14E-02	9.23E-03	7.11E-10	5.64E-09
Total PCDDs			7.89E-02	7.89E-02	2.50E-02	2.02E-02	1.56E-09	1.24E-08
PCDFs								
*	2,3,7,8-TCDF	1.0000	8.00E-03	8.00E-03	2.54E-03	2.05E-03	1.58E-10	1.25E-09
*	Other TCDF	1.0000	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
*	1,2,3,7,8-PeCDF	1.0000	1.00E-02	1.00E-02	3.17E-03	2.56E-03	1.97E-10	1.57E-09
*	2,3,4,7,8-PeCDF	1.0000	9.40E-03	9.40E-03	2.98E-03	2.41E-03	1.86E-10	1.47E-09
*	Other PeCDF	1.0000	N/A	N/A	N/A	N/A	N/A	N/A
*	1,2,3,4,7,8-HxCDF	1.0000	3.70E-03	3.70E-03	1.17E-03	9.49E-04	7.30E-11	5.80E-10
*	1,2,3,6,7,8-HxCDF	1.0000	3.50E-03	3.50E-03	1.11E-03	8.98E-04	6.91E-11	5.48E-10
*	2,3,4,6,7,8-HxCDF	1.0000	3.70E-03	3.70E-03	1.17E-03	9.49E-04	7.30E-11	5.80E-10
*	1,2,3,7,8,9-HxCDF	1.0000	4.50E-03	4.50E-03	1.43E-03	1.15E-03	8.88E-11	7.05E-10
*	Other HxCDF	1.0000	N/A	N/A	N/A	N/A	N/A	N/A
*	1,2,3,4,6,7,8-HpCDF	1.0000	5.70E-03	5.70E-03	1.81E-03	1.46E-03	1.13E-10	8.93E-10
*	1,2,3,4,7,8,9-HpCDF	1.0000	7.70E-03	7.70E-03	2.44E-03	1.97E-03	1.52E-10	1.21E-09
*	Other HpCDF	1.0000	N/A	N/A	N/A	N/A	N/A	N/A
*	1,2,3,4,6,7,8,9-OCDF	1.0000	1.40E-02	1.40E-02	4.44E-03	3.59E-03	2.76E-10	2.19E-09
Total PCDFs			7.02E-02	7.02E-02	2.23E-02	1.80E-02	1.39E-09	1.10E-08
Total PCDDs & PCDFs			1.49E-01	1.49E-01	4.73E-02	3.82E-02	2.94E-09	2.34E-08

* Indicates that result includes EMPCs and/or NDs.

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USEPA Method 23 Maximum Emissions Results (NDs & EMPCs included)
Total Tetra- through Octa-PCDD/F Results using Worst Case (Full Mass, TEF=1) TEFs

Run #3

		Toxic	Laboratory Data		TEQ Concentration			
		Equivalency	Actual Amt.	TEQ Amt.	As measured	@ 7% O ₂	TEQ Emission Rate	
Congener		Factor (TEF)	(ng)	(ng)	(ng/dscm)	(ng/dscm)	(g/sec)	(lb/hr)
PCDDs								
*	2,3,7,8-TCDD	1.0000	4.30E-03	4.30E-03	1.31E-03	1.05E-03	8.29E-11	6.58E-10
*	Other TCDD	1.0000	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
*	1,2,3,7,8-PeCDD	1.0000	1.40E-02	1.40E-02	4.27E-03	3.41E-03	2.70E-10	2.14E-09
*	Other PeCDD	1.0000	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
*	1,2,3,4,7,8-HxCDD	1.0000	4.90E-03	4.90E-03	1.49E-03	1.19E-03	9.44E-11	7.50E-10
*	1,2,3,6,7,8-HxCDD	1.0000	4.80E-03	4.80E-03	1.46E-03	1.17E-03	9.25E-11	7.34E-10
*	1,2,3,7,8,9-HxCDD	1.0000	5.00E-03	5.00E-03	1.53E-03	1.22E-03	9.64E-11	7.65E-10
*	Other HxCDD	1.0000	N/A	N/A	N/A	N/A	N/A	N/A
	1,2,3,4,6,7,8-HpCDD	1.0000	1.14E-02	1.14E-02	3.48E-03	2.78E-03	2.20E-10	1.74E-09
	Other HpCDD	1.0000	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
*	1,2,3,4,6,7,8,9-OCDD	1.0000	2.90E-02	2.90E-02	8.85E-03	7.07E-03	5.59E-10	4.44E-09
Total PCDDs			7.34E-02	7.34E-02	2.24E-02	1.79E-02	1.41E-09	1.12E-08
PCDFs								
*	2,3,7,8-TCDF	1.0000	7.00E-03	7.00E-03	2.14E-03	1.71E-03	1.35E-10	1.07E-09
*	Other TCDF	1.0000	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
*	1,2,3,7,8-PeCDF	1.0000	1.20E-02	1.20E-02	3.66E-03	2.92E-03	2.31E-10	1.84E-09
*	2,3,4,7,8-PeCDF	1.0000	1.20E-02	1.20E-02	3.66E-03	2.92E-03	2.31E-10	1.84E-09
*	Other PeCDF	1.0000	N/A	N/A	N/A	N/A	N/A	N/A
*	1,2,3,4,7,8-HxCDF	1.0000	5.00E-03	5.00E-03	1.53E-03	1.22E-03	9.64E-11	7.65E-10
*	1,2,3,6,7,8-HxCDF	1.0000	6.89E-03	6.89E-03	2.10E-03	1.68E-03	1.33E-10	1.05E-09
*	2,3,4,6,7,8-HxCDF	1.0000	4.90E-03	4.90E-03	1.49E-03	1.19E-03	9.44E-11	7.50E-10
*	1,2,3,7,8,9-HxCDF	1.0000	6.10E-03	6.10E-03	1.86E-03	1.49E-03	1.18E-10	9.33E-10
*	Other HxCDF	1.0000	N/A	N/A	N/A	N/A	N/A	N/A
*	1,2,3,4,6,7,8-HpCDF	1.0000	9.23E-03	9.23E-03	2.82E-03	2.25E-03	1.78E-10	1.41E-09
*	1,2,3,4,7,8,9-HpCDF	1.0000	6.60E-03	6.60E-03	2.01E-03	1.61E-03	1.27E-10	1.01E-09
*	Other HpCDF	1.0000	N/A	N/A	N/A	N/A	N/A	N/A
*	1,2,3,4,6,7,8,9-OCDF	1.0000	1.00E-02	1.00E-02	3.05E-03	2.44E-03	1.93E-10	1.53E-09
Total PCDFs			7.97E-02	7.97E-02	2.43E-02	1.94E-02	1.54E-09	1.22E-08
Total PCDDs & PCDFs			1.53E-01	1.53E-01	4.67E-02	3.73E-02	2.95E-09	2.34E-08

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* Indicates that result includes EMPCs and/or NDs.

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USEPA Method 23 PCB Parameters

Run No.		1	2	3	Average
Date (2011)		Jul 20	Jul 20	Jul 21	
Start Time (approx.)		07:59	11:50	07:53	
Stop Time (approx.)		11:12	15:22	11:09	
Gas Conditions					
O ₂	Oxygen (dry volume %)	3.5000	3.7000	3.5000	3.5667
CO ₂	Carbon dioxide (dry volume %)	14.0000	13.5000	13.8000	13.7667
T _s	Sample temperature (°F)	151.0	150.4	150.8	150.7
B _w	Actual water vapor in gas (% by volume)	24.2287	24.2921	24.5181	24.3463
Gas Flow Rate					
Q _a	Volumetric flow rate, actual (acfm)	205,723	205,656	209,400	206,926
Q _s	Volumetric flow rate, standard (scfm)	173,962	174,071	177,349	175,127
Q _{std}	Volumetric flow rate, dry standard (dscfm)	131,813	131,786	133,867	132,489
Q _a	Volumetric flow rate, actual (m ³ /hr)	349,571	349,457	355,820	351,616
Q _s	Volumetric flow rate, standard (m ³ /hr)	295,602	295,788	301,358	297,583
Q _{std}	Volumetric flow rate, dry standard (dry m ³ /hr)	223,982	223,935	227,471	225,129
Sampling Data					
V _{mstd}	Volume metered, standard (dscf)	114.5248	111.2697	115.7545	113.8496
%I	Isokinetic sampling (%)	100.43	97.59	99.95	99.32
Total PCB's*					
m _n	Net Weight (ng)	<8.7660E-02	<1.6452E-01	<1.7029E-01	
C _{sd}	Concentration (ng/dscm)	<2.7027E-02	<5.2208E-02	<5.1946E-02	<4.3727E-02
C _{sd12}	Concentration @12% CO ₂ (ng/dscm)	<2.3166E-02	<4.6407E-02	<4.5170E-02	<3.8248E-02
C _{sd}	Concentration (ng/Nm ³ dry)	<2.9005E-02	<5.6028E-02	<5.5747E-02	<4.6927E-02
C _{sd}	Concentration (ug/dscm)	<2.7027E-05	<5.2208E-05	<5.1946E-05	<4.3727E-05
C _{sd12}	Concentration @12% CO ₂ (ug/dscm)	<2.3166E-05	<4.6407E-05	<4.5170E-05	<3.8248E-05
C _{sd}	Concentration (ug/Nm ³ dry)	<2.9005E-05	<5.6028E-05	<5.5747E-05	<4.6927E-05
E _{lb/hr}	Emissions Rate (lb/hr)	<1.3348E-08	<2.5779E-08	<2.6055E-08	<2.1727E-08
PCB TEQs using WHO 2005 TEF Values (Note 1)					
m _n	TEQ Weight (ng)	1.1604E-03	1.1843E-03	8.7399E-04	
C _{sd}	TEQ Concentration (ng/dscm)	3.5779E-04	3.7582E-04	2.6660E-04	3.3340E-04
C _{sd12}	TEQ Concentration @12% CO ₂ (ng/dscm)	3.0667E-04	3.3406E-04	2.3183E-04	2.9085E-04
C _{sd}	TEQ Concentration (ng/Nm ³ dry)	3.8397E-04	4.0332E-04	2.8611E-04	3.5780E-04
C _{sd}	TEQ Concentration (ug/dscm)	3.5779E-07	3.7582E-07	2.6660E-07	3.3340E-07
C _{sd12}	TEQ Concentration @12% CO ₂ (ug/dscm)	3.0667E-07	3.3406E-07	2.3183E-07	2.9085E-07
C _{sd}	TEQ Concentration (ug/Nm ³ dry)	3.8397E-07	4.0332E-07	2.8611E-07	3.5780E-07
E _{lb/hr}	TEQ Emissions Rate (lb/hr)	1.7670E-10	1.8557E-10	1.3372E-10	1.6533E-10

* Total PCBs are calculated using the full detection limit for results below the detection limit.

¹ Toxic Equivalency Factor relative to 2378-TCDD.

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USEPA Method 23 PCB Parameters

Run No.		1	2	3	Average
Date (2011)		Jul 20	Jul 20	Jul 21	
Start Time (approx.)		07:59	11:50	07:53	
Stop Time (approx.)		11:12	15:22	11:09	
Gas Conditions					
O ₂	Oxygen (dry volume %)	3.5000	3.7000	3.5000	3.5667
CO ₂	Carbon dioxide (dry volume %)	14.0000	13.5000	13.8000	13.7667
T _s	Sample temperature (°F)	151.0	150.4	150.8	150.7
B _w	Actual water vapor in gas (% by volume)	24.2287	24.2921	24.5181	24.3463
Gas Flow Rate					
Q _a	Volumetric flow rate, actual (acfm)	205,723	205,656	209,400	206,926
Q _s	Volumetric flow rate, standard (scfm)	173,962	174,071	177,349	175,127
Q _{std}	Volumetric flow rate, dry standard (dscfm)	131,813	131,786	133,867	132,489
Q _a	Volumetric flow rate, actual (m ³ /hr)	349,571	349,457	355,820	351,616
Q _s	Volumetric flow rate, standard (m ³ /hr)	295,602	295,788	301,358	297,583
Q _{std}	Volumetric flow rate, dry standard (dry m ³ /hr)	223,982	223,935	227,471	225,129
Sampling Data					
V _{mstd}	Volume metered, standard (dscf)	114.5248	111.2697	115.7545	113.8496
%I	Isokinetic sampling (%)	100.43	97.59	99.95	99.32
Tetrachlorobiphenyl (77)					
m _n	Net Weight (ng)	6.6600E-03	1.4500E-02	1.7400E-02	
C _{sd}	Concentration (ng/dscm)	2.0534E-03	4.6014E-03	5.3077E-03	3.9875E-03
C _{sd}	Concentration (ng/Nm ³ dry)	2.2036E-03	4.9381E-03	5.6961E-03	4.2793E-03
C _{sd}	Concentration (ug/dscm)	2.0534E-06	4.6014E-06	5.3077E-06	3.9875E-06
C _{sd}	Concentration (ug/Nm ³ dry)	2.2036E-06	4.9381E-06	5.6961E-06	4.2793E-06
E _{lb/hr}	Emissions Rate (lb/hr)	1.0141E-09	2.2721E-09	2.6622E-09	1.9828E-09
Tetrachlorobiphenyl (81)					
m _n	Net Weight (ng)	<2.7000E-03	<2.7000E-03	<3.6000E-03	
C _{sd}	Concentration (ng/dscm)	<8.3246E-04	<8.5681E-04	<1.0982E-03	<9.2914E-04
C _{sd}	Concentration (ng/Nm ³ dry)	<8.9337E-04	<9.1950E-04	<1.1785E-03	<9.9713E-04
C _{sd}	Concentration (ug/dscm)	<8.3246E-07	<8.5681E-07	<1.0982E-06	<9.2914E-07
C _{sd}	Concentration (ug/Nm ³ dry)	<8.9337E-07	<9.1950E-07	<1.1785E-06	<9.9713E-07
E _{lb/hr}	Emissions Rate (lb/hr)	<4.1113E-10	<4.2307E-10	<5.5080E-10	<4.6167E-10

USEPA Method 23 PCB Parameters

Run No.		1	2	3	Average
Date (2011)		Jul 20	Jul 20	Jul 21	
Start Time (approx.)		07:59	11:50	07:53	
Stop Time (approx.)		11:12	15:22	11:09	
Gas Conditions					
O ₂	Oxygen (dry volume %)	3.5000	3.7000	3.5000	3.5667
CO ₂	Carbon dioxide (dry volume %)	14.0000	13.5000	13.8000	13.7667
T _s	Sample temperature (°F)	151.0	150.4	150.8	150.7
B _w	Actual water vapor in gas (% by volume)	24.2287	24.2921	24.5181	24.3463
Gas Flow Rate					
Q _a	Volumetric flow rate, actual (acfm)	205,723	205,656	209,400	206,926
Q _s	Volumetric flow rate, standard (scfm)	173,962	174,071	177,349	175,127
Q _{std}	Volumetric flow rate, dry standard (dscfm)	131,813	131,786	133,867	132,489
Q _a	Volumetric flow rate, actual (m ³ /hr)	349,571	349,457	355,820	351,616
Q _s	Volumetric flow rate, standard (m ³ /hr)	295,602	295,788	301,358	297,583
Q _{std}	Volumetric flow rate, dry standard (dry m ³ /hr)	223,982	223,935	227,471	225,129
Sampling Data					
V _{mstd}	Volume metered, standard (dscf)	114.5248	111.2697	115.7545	113.8496
%I	Isokinetic sampling (%)	100.43	97.59	99.95	99.32
Pentachlorobiphenyl (105)					
m _n	Net Weight (ng)	<1.2000E-02	<1.2000E-02	3.5700E-02	
C _{sd}	Concentration (ng/dscm)	<3.6998E-03	<3.8080E-03	1.0890E-02	<6.1326E-03
C _{sd}	Concentration (ng/Nm ³ dry)	<3.9705E-03	<4.0867E-03	1.1687E-02	<6.5814E-03
C _{sd}	Concentration (ug/dscm)	<3.6998E-06	<3.8080E-06	1.0890E-05	<6.1326E-06
C _{sd}	Concentration (ug/Nm ³ dry)	<3.9705E-06	<4.0867E-06	1.1687E-05	<6.5814E-06
E _{lb/hr}	Emissions Rate (lb/hr)	<1.8273E-09	<1.8803E-09	5.4621E-09	<3.0566E-09
Pentachlorobiphenyl (114)					
m _n	Net Weight (ng)	<1.1000E-02	<1.0000E-02	<7.8000E-03	
C _{sd}	Concentration (ng/dscm)	<3.3915E-03	<3.1734E-03	<2.3793E-03	<2.9814E-03
C _{sd}	Concentration (ng/Nm ³ dry)	<3.6397E-03	<3.4056E-03	<2.5534E-03	<3.1995E-03
C _{sd}	Concentration (ug/dscm)	<3.3915E-06	<3.1734E-06	<2.3793E-06	<2.9814E-06
C _{sd}	Concentration (ug/Nm ³ dry)	<3.6397E-06	<3.4056E-06	<2.5534E-06	<3.1995E-06
E _{lb/hr}	Emissions Rate (lb/hr)	<1.6750E-09	<1.5669E-09	<1.1934E-09	<1.4784E-09

USEPA Method 23 PCB Parameters

Run No.		1	2	3	Average
Date (2011)		Jul 20	Jul 20	Jul 21	
Start Time (approx.)		07:59	11:50	07:53	
Stop Time (approx.)		11:12	15:22	11:09	
Gas Conditions					
O ₂	Oxygen (dry volume %)	3.5000	3.7000	3.5000	3.5667
CO ₂	Carbon dioxide (dry volume %)	14.0000	13.5000	13.8000	13.7667
T _s	Sample temperature (°F)	151.0	150.4	150.8	150.7
B _w	Actual water vapor in gas (% by volume)	24.2287	24.2921	24.5181	24.3463
Gas Flow Rate					
Q _a	Volumetric flow rate, actual (acfm)	205,723	205,656	209,400	206,926
Q _s	Volumetric flow rate, standard (scfm)	173,962	174,071	177,349	175,127
Q _{std}	Volumetric flow rate, dry standard (dscfm)	131,813	131,786	133,867	132,489
Q _a	Volumetric flow rate, actual (m ³ /hr)	349,571	349,457	355,820	351,616
Q _s	Volumetric flow rate, standard (m ³ /hr)	295,602	295,788	301,358	297,583
Q _{std}	Volumetric flow rate, dry standard (dry m ³ /hr)	223,982	223,935	227,471	225,129
Sampling Data					
V _{mstd}	Volume metered, standard (dscf)	114.5248	111.2697	115.7545	113.8496
%I	Isokinetic sampling (%)	100.43	97.59	99.95	99.32
Pentachlorobiphenyl (118)					
m _n	Net Weight (ng)	2.0700E-02	8.1500E-02	7.0000E-02	
C _{sd}	Concentration (ng/dscm)	6.3822E-03	2.5863E-02	2.1353E-02	1.7866E-02
C _{sd}	Concentration (ng/Nm ³ dry)	6.8492E-03	2.7755E-02	2.2915E-02	1.9173E-02
C _{sd}	Concentration (ug/dscm)	6.3822E-06	2.5863E-05	2.1353E-05	1.7866E-05
C _{sd}	Concentration (ug/Nm ³ dry)	6.8492E-06	2.7755E-05	2.2915E-05	1.9173E-05
E _{lb/hr}	Emissions Rate (lb/hr)	3.1520E-09	1.2771E-08	1.0710E-08	8.8775E-09
Pentachlorobiphenyl (123)					
m _n	Net Weight (ng)	<1.1000E-02	<1.0000E-02	<7.5000E-03	
C _{sd}	Concentration (ng/dscm)	<3.3915E-03	<3.1734E-03	<2.2878E-03	<2.9509E-03
C _{sd}	Concentration (ng/Nm ³ dry)	<3.6397E-03	<3.4056E-03	<2.4552E-03	<3.1668E-03
C _{sd}	Concentration (ug/dscm)	<3.3915E-06	<3.1734E-06	<2.2878E-06	<2.9509E-06
C _{sd}	Concentration (ug/Nm ³ dry)	<3.6397E-06	<3.4056E-06	<2.4552E-06	<3.1668E-06
E _{lb/hr}	Emissions Rate (lb/hr)	<1.6750E-09	<1.5669E-09	<1.1475E-09	<1.4631E-09

USEPA Method 23 PCB Parameters

Run No.		1	2	3	Average
Date (2011)		Jul 20	Jul 20	Jul 21	
Start Time (approx.)		07:59	11:50	07:53	
Stop Time (approx.)		11:12	15:22	11:09	
Gas Conditions					
O ₂	Oxygen (dry volume %)	3.5000	3.7000	3.5000	3.5667
CO ₂	Carbon dioxide (dry volume %)	14.0000	13.5000	13.8000	13.7667
T _s	Sample temperature (°F)	151.0	150.4	150.8	150.7
B _w	Actual water vapor in gas (% by volume)	24.2287	24.2921	24.5181	24.3463
Gas Flow Rate					
Q _a	Volumetric flow rate, actual (acfm)	205,723	205,656	209,400	206,926
Q _s	Volumetric flow rate, standard (scfm)	173,962	174,071	177,349	175,127
Q _{std}	Volumetric flow rate, dry standard (dscfm)	131,813	131,786	133,867	132,489
Q _a	Volumetric flow rate, actual (m ³ /hr)	349,571	349,457	355,820	351,616
Q _s	Volumetric flow rate, standard (m ³ /hr)	295,602	295,788	301,358	297,583
Q _{std}	Volumetric flow rate, dry standard (dry m ³ /hr)	223,982	223,935	227,471	225,129
Sampling Data					
V _{mstd}	Volume metered, standard (dscf)	114.5248	111.2697	115.7545	113.8496
%I	Isokinetic sampling (%)	100.43	97.59	99.95	99.32
Pentachlorobiphenyl (126)					
m _n	Net Weight (ng)	<1.1000E-02	<1.1000E-02	<7.8000E-03	
C _{sd}	Concentration (ng/dscm)	<3.3915E-03	<3.4907E-03	<2.3793E-03	<3.0872E-03
C _{sd}	Concentration (ng/Nm ³ dry)	<3.6397E-03	<3.7461E-03	<2.5534E-03	<3.3131E-03
C _{sd}	Concentration (ug/dscm)	<3.3915E-06	<3.4907E-06	<2.3793E-06	<3.0872E-06
C _{sd}	Concentration (ug/Nm ³ dry)	<3.6397E-06	<3.7461E-06	<2.5534E-06	<3.3131E-06
E _{lb/hr}	Emissions Rate (lb/hr)	<1.6750E-09	<1.7236E-09	<1.1934E-09	<1.5307E-09
Hexachlorobiphenyl (156)					
m _n	Net Weight (ng)	<3.0000E-03	1.0400E-02	8.4900E-03	
C _{sd}	Concentration (ng/dscm)	<9.2495E-04	3.3003E-03	2.5898E-03	<2.2717E-03
C _{sd}	Concentration (ng/Nm ³ dry)	<9.9263E-04	3.5418E-03	2.7793E-03	<2.4379E-03
C _{sd}	Concentration (ug/dscm)	<9.2495E-07	3.3003E-06	2.5898E-06	<2.2717E-06
C _{sd}	Concentration (ug/Nm ³ dry)	<9.9263E-07	3.5418E-06	2.7793E-06	<2.4379E-06
E _{lb/hr}	Emissions Rate (lb/hr)	<4.5682E-10	1.6296E-09	1.2990E-09	<1.1285E-09

**USEPA Method 23
PCB Parameters**

Run No.		1	2	3	Average
Date (2011)		Jul 20	Jul 20	Jul 21	
Start Time (approx.)		07:59	11:50	07:53	
Stop Time (approx.)		11:12	15:22	11:09	
Gas Conditions					
O ₂	Oxygen (dry volume %)	3.5000	3.7000	3.5000	3.5667
CO ₂	Carbon dioxide (dry volume %)	14.0000	13.5000	13.8000	13.7667
T _s	Sample temperature (°F)	151.0	150.4	150.8	150.7
B _w	Actual water vapor in gas (% by volume)	24.2287	24.2921	24.5181	24.3463
Gas Flow Rate					
Q _a	Volumetric flow rate, actual (acfm)	205,723	205,656	209,400	206,926
Q _s	Volumetric flow rate, standard (scfm)	173,962	174,071	177,349	175,127
Q _{std}	Volumetric flow rate, dry standard (dscfm)	131,813	131,786	133,867	132,489
Q _a	Volumetric flow rate, actual (m ³ /hr)	349,571	349,457	355,820	351,616
Q _s	Volumetric flow rate, standard (m ³ /hr)	295,602	295,788	301,358	297,583
Q _{std}	Volumetric flow rate, dry standard (dry m ³ /hr)	223,982	223,935	227,471	225,129
Sampling Data					
V _{mstd}	Volume metered, standard (dscf)	114.5248	111.2697	115.7545	113.8496
%I	Isokinetic sampling (%)	100.43	97.59	99.95	99.32
Hexachlorobiphenyl (157)					
m _n	Net Weight (ng)	<2.7000E-03	4.3800E-03	<3.8000E-03	
C _{sd}	Concentration (ng/dscm)	<8.3246E-04	1.3899E-03	<1.1592E-03	<1.1272E-03
C _{sd}	Concentration (ng/Nm ³ dry)	<8.9337E-04	1.4916E-03	<1.2440E-03	<1.2097E-03
C _{sd}	Concentration (ug/dscm)	<8.3246E-07	1.3899E-06	<1.1592E-06	<1.1272E-06
C _{sd}	Concentration (ug/Nm ³ dry)	<8.9337E-07	1.4916E-06	<1.2440E-06	<1.2097E-06
E _{lb/hr}	Emissions Rate (lb/hr)	<4.1113E-10	6.8632E-10	<5.8140E-10	<5.5962E-10
Hexachlorobiphenyl (167)					
m _n	Net Weight (ng)	<3.1000E-03	<3.4000E-03	<3.3000E-03	
C _{sd}	Concentration (ng/dscm)	<9.5578E-04	<1.0789E-03	<1.0066E-03	<1.0138E-03
C _{sd}	Concentration (ng/Nm ³ dry)	<1.0257E-03	<1.1579E-03	<1.0803E-03	<1.0880E-03
C _{sd}	Concentration (ug/dscm)	<9.5578E-07	<1.0789E-06	<1.0066E-06	<1.0138E-06
C _{sd}	Concentration (ug/Nm ³ dry)	<1.0257E-06	<1.1579E-06	<1.0803E-06	<1.0880E-06
E _{lb/hr}	Emissions Rate (lb/hr)	<4.7204E-10	<5.3276E-10	<5.0490E-10	<5.0323E-10

USEPA Method 23 PCB Parameters

Run No.		1	2	3	Average
Date (2011)		Jul 20	Jul 20	Jul 21	
Start Time (approx.)		07:59	11:50	07:53	
Stop Time (approx.)		11:12	15:22	11:09	
Gas Conditions					
O ₂	Oxygen (dry volume %)	3.5000	3.7000	3.5000	3.5667
CO ₂	Carbon dioxide (dry volume %)	14.0000	13.5000	13.8000	13.7667
T _s	Sample temperature (°F)	151.0	150.4	150.8	150.7
B _w	Actual water vapor in gas (% by volume)	24.2287	24.2921	24.5181	24.3463
Gas Flow Rate					
Q _a	Volumetric flow rate, actual (acfm)	205,723	205,656	209,400	206,926
Q _s	Volumetric flow rate, standard (scfm)	173,962	174,071	177,349	175,127
Q _{std}	Volumetric flow rate, dry standard (dscfm)	131,813	131,786	133,867	132,489
Q _a	Volumetric flow rate, actual (m ³ /hr)	349,571	349,457	355,820	351,616
Q _s	Volumetric flow rate, standard (m ³ /hr)	295,602	295,788	301,358	297,583
Q _{std}	Volumetric flow rate, dry standard (dry m ³ /hr)	223,982	223,935	227,471	225,129
Sampling Data					
V _{mstd}	Volume metered, standard (dscf)	114.5248	111.2697	115.7545	113.8496
%I	Isokinetic sampling (%)	100.43	97.59	99.95	99.32
Hexachlorobiphenyl (169)					
m _n	Net Weight (ng)	<1.9000E-03	2.6000E-03	<2.9000E-03	
C _{sd}	Concentration (ng/dscm)	<5.8580E-04	8.2508E-04	<8.8462E-04	<7.6517E-04
C _{sd}	Concentration (ng/Nm ³ dry)	<6.2867E-04	8.8545E-04	<9.4935E-04	<8.2116E-04
C _{sd}	Concentration (ug/dscm)	<5.8580E-07	8.2508E-07	<8.8462E-07	<7.6517E-07
C _{sd}	Concentration (ug/Nm ³ dry)	<6.2867E-07	8.8545E-07	<9.4935E-07	<8.2116E-07
E _{lb/hr}	Emissions Rate (lb/hr)	<2.8932E-10	4.0740E-10	<4.4370E-10	<3.8014E-10
Heptachlorobiphenyl (189)					
m _n	Net Weight (ng)	<1.9000E-03	2.0400E-03	<2.0000E-03	
C _{sd}	Concentration (ng/dscm)	<5.8580E-04	6.4737E-04	<6.1008E-04	<6.1442E-04
C _{sd}	Concentration (ng/Nm ³ dry)	<6.2867E-04	6.9474E-04	<6.5472E-04	<6.5938E-04
C _{sd}	Concentration (ug/dscm)	<5.8580E-07	6.4737E-07	<6.1008E-07	<6.1442E-07
C _{sd}	Concentration (ug/Nm ³ dry)	<6.2867E-07	6.9474E-07	<6.5472E-07	<6.5938E-07
E _{lb/hr}	Emissions Rate (lb/hr)	<2.8932E-10	3.1966E-10	<3.0600E-10	<3.0499E-10

USEPA Method 23
PCB Parameters using WHO 2005 TEF Values

Run No.		1	2	3	Average
Date (2011)		Jul 20	Jul 20	Jul 21	
Start Time (approx.)		07:59	11:50	07:53	
Stop Time (approx.)		11:12	15:22	11:09	
Gas Conditions					
O ₂	Oxygen (dry volume %)	3.5000	3.7000	3.5000	3.5667
CO ₂	Carbon dioxide (dry volume %)	14.0000	13.5000	13.8000	13.7667
T _s	Sample temperature (°F)	151.0	150.4	150.8	150.7
B _w	Actual water vapor in gas (% by volume)	24.2287	24.2921	24.5181	24.3463
Gas Flow Rate					
Q _a	Volumetric flow rate, actual (acfm)	205,723	205,656	209,400	206,926
Q _s	Volumetric flow rate, standard (scfm)	173,962	174,071	177,349	175,127
Q _{std}	Volumetric flow rate, dry standard (dscfm)	131,813	131,786	133,867	132,489
Q _a	Volumetric flow rate, actual (m ³ /hr)	349,571	349,457	355,820	351,616
Q _s	Volumetric flow rate, standard (m ³ /hr)	295,602	295,788	301,358	297,583
Q _{std}	Volumetric flow rate, dry standard (dry m ³ /hr)	223,982	223,935	227,471	225,129
Sampling Data					
V _{mstd}	Volume metered, standard (dscf)	114.5248	111.2697	115.7545	113.8496
%I	Isokinetic sampling (%)	100.43	97.59	99.95	99.32
Tetrachlorobiphenyl (77)					
m _n	TEQ Weight (ng, TEF = 0.0001)	6.6600E-07	1.4500E-06	1.7400E-06	
C _{sd}	TEQ Concentration (ng/dscm)	2.0534E-07	4.6014E-07	5.3077E-07	3.9875E-07
C _{sd}	TEQ Concentration (ng/Nm ³ dry)	2.2036E-07	4.9381E-07	5.6961E-07	4.2793E-07
C _{sd}	TEQ Concentration (ug/dscm)	2.0534E-10	4.6014E-10	5.3077E-10	3.9875E-10
C _{sd}	TEQ Concentration (ug/Nm ³ dry)	2.2036E-10	4.9381E-10	5.6961E-10	4.2793E-10
E _{lb/hr}	TEQ Emissions Rate (lb/hr)	1.0141E-13	2.2721E-13	2.6622E-13	1.9828E-13
Tetrachlorobiphenyl (81)					
m _n	TEQ Weight (ng, TEF = 0.00030)	<8.1000E-07	<8.1000E-07	<1.0800E-06	
C _{sd}	TEQ Concentration (ng/dscm)	<2.4974E-07	<2.5704E-07	<3.2945E-07	<2.7874E-07
C _{sd}	TEQ Concentration (ng/Nm ³ dry)	<2.6801E-07	<2.7585E-07	<3.5355E-07	<2.9914E-07
C _{sd}	TEQ Concentration (ug/dscm)	<2.4974E-10	<2.5704E-10	<3.2945E-10	<2.7874E-10
C _{sd}	TEQ Concentration (ug/Nm ³ dry)	<2.6801E-10	<2.7585E-10	<3.5355E-10	<2.9914E-10
E _{lb/hr}	TEQ Emissions Rate (lb/hr)	<1.2334E-13	<1.2692E-13	<1.6524E-13	<1.3850E-13

USEPA Method 23
PCB Parameters using WHO 2005 TEF Values

Run No.		1	2	3	Average
Date (2011)		Jul 20	Jul 20	Jul 21	
Start Time (approx.)		07:59	11:50	07:53	
Stop Time (approx.)		11:12	15:22	11:09	
Gas Conditions					
O ₂	Oxygen (dry volume %)	3.5000	3.7000	3.5000	3.5667
CO ₂	Carbon dioxide (dry volume %)	14.0000	13.5000	13.8000	13.7667
T _s	Sample temperature (°F)	151.0	150.4	150.8	150.7
B _w	Actual water vapor in gas (% by volume)	24.2287	24.2921	24.5181	24.3463
Gas Flow Rate					
Q _a	Volumetric flow rate, actual (acfm)	205,723	205,656	209,400	206,926
Q _s	Volumetric flow rate, standard (scfm)	173,962	174,071	177,349	175,127
Q _{std}	Volumetric flow rate, dry standard (dscfm)	131,813	131,786	133,867	132,489
Q _a	Volumetric flow rate, actual (m ³ /hr)	349,571	349,457	355,820	351,616
Q _s	Volumetric flow rate, standard (m ³ /hr)	295,602	295,788	301,358	297,583
Q _{std}	Volumetric flow rate, dry standard (dry m ³ /hr)	223,982	223,935	227,471	225,129
Sampling Data					
V _{mstd}	Volume metered, standard (dscf)	114.5248	111.2697	115.7545	113.8496
%I	Isokinetic sampling (%)	100.43	97.59	99.95	99.32
Pentachlorobiphenyl (105)					
m _n	TEQ Weight (ng, TEF = 0.00003)	<3.6000E-07	<3.6000E-07	1.0710E-06	
C _{sd}	TEQ Concentration (ng/dscm)	<1.1099E-07	<1.1424E-07	3.2670E-07	<1.8398E-07
C _{sd}	TEQ Concentration (ng/Nm ³ dry)	<1.1912E-07	<1.2260E-07	3.5061E-07	<1.9744E-07
C _{sd}	TEQ Concentration (ug/dscm)	<1.1099E-10	<1.1424E-10	3.2670E-10	<1.8398E-10
C _{sd}	TEQ Concentration (ug/Nm ³ dry)	<1.1912E-10	<1.2260E-10	3.5061E-10	<1.9744E-10
E _{lb/hr}	TEQ Emissions Rate (lb/hr)	<5.4818E-14	<5.6410E-14	1.6386E-13	<9.1697E-14
Pentachlorobiphenyl (114)					
m _n	TEQ Weight (ng, TEF = 0.00003)	<3.3000E-07	<3.0000E-07	<2.3400E-07	
C _{sd}	TEQ Concentration (ng/dscm)	<1.0174E-07	<9.5201E-08	<7.1380E-08	<8.9442E-08
C _{sd}	TEQ Concentration (ng/Nm ³ dry)	<1.0919E-07	<1.0217E-07	<7.6603E-08	<9.5986E-08
C _{sd}	TEQ Concentration (ug/dscm)	<1.0174E-10	<9.5201E-11	<7.1380E-11	<8.9442E-11
C _{sd}	TEQ Concentration (ug/Nm ³ dry)	<1.0919E-10	<1.0217E-10	<7.6603E-11	<9.5986E-11
E _{lb/hr}	TEQ Emissions Rate (lb/hr)	<5.0250E-14	<4.7008E-14	<3.5802E-14	<4.4353E-14

USEPA Method 23
PCB Parameters using WHO 2005 TEF Values

Run No.		1	2	3	Average
Date (2011)		Jul 20	Jul 20	Jul 21	
Start Time (approx.)		07:59	11:50	07:53	
Stop Time (approx.)		11:12	15:22	11:09	
Gas Conditions					
O ₂	Oxygen (dry volume %)	3.5000	3.7000	3.5000	3.5667
CO ₂	Carbon dioxide (dry volume %)	14.0000	13.5000	13.8000	13.7667
T _s	Sample temperature (°F)	151.0	150.4	150.8	150.7
B _w	Actual water vapor in gas (% by volume)	24.2287	24.2921	24.5181	24.3463
Gas Flow Rate					
Q _a	Volumetric flow rate, actual (acfm)	205,723	205,656	209,400	206,926
Q _s	Volumetric flow rate, standard (scfm)	173,962	174,071	177,349	175,127
Q _{std}	Volumetric flow rate, dry standard (dscfm)	131,813	131,786	133,867	132,489
Q _a	Volumetric flow rate, actual (m ³ /hr)	349,571	349,457	355,820	351,616
Q _s	Volumetric flow rate, standard (m ³ /hr)	295,602	295,788	301,358	297,583
Q _{std}	Volumetric flow rate, dry standard (dry m ³ /hr)	223,982	223,935	227,471	225,129
Sampling Data					
V _{mstd}	Volume metered, standard (dscf)	114.5248	111.2697	115.7545	113.8496
%I	Isokinetic sampling (%)	100.43	97.59	99.95	99.32
Pentachlorobiphenyl (118)					
m _n	TEQ Weight (ng, TEF = 0.00003)	6.2100E-07	2.4450E-06	2.1000E-06	
C _{sd}	TEQ Concentration (ng/dscm)	1.9147E-07	7.7589E-07	6.4059E-07	5.3598E-07
C _{sd}	TEQ Concentration (ng/Nm ³ dry)	2.0547E-07	8.3266E-07	6.8746E-07	5.7520E-07
C _{sd}	TEQ Concentration (ug/dscm)	1.9147E-10	7.7589E-10	6.4059E-10	5.3598E-10
C _{sd}	TEQ Concentration (ug/Nm ³ dry)	2.0547E-10	8.3266E-10	6.8746E-10	5.7520E-10
E _{lb/hr}	TEQ Emissions Rate (lb/hr)	9.4561E-14	3.8312E-13	3.2130E-13	2.6633E-13
Pentachlorobiphenyl (123)					
m _n	TEQ Weight (ng, TEF = 0.00003)	<3.4100E-07	<3.1000E-07	<2.3250E-07	
C _{sd}	TEQ Concentration (ng/dscm)	<1.0514E-07	<9.8375E-08	<7.0922E-08	<9.1478E-08
C _{sd}	TEQ Concentration (ng/Nm ³ dry)	<1.1283E-07	<1.0557E-07	<7.6112E-08	<9.8171E-08
C _{sd}	TEQ Concentration (ug/dscm)	<1.0514E-10	<9.8375E-11	<7.0922E-11	<9.1478E-11
C _{sd}	TEQ Concentration (ug/Nm ³ dry)	<1.1283E-10	<1.0557E-10	<7.6112E-11	<9.8171E-11
E _{lb/hr}	TEQ Emissions Rate (lb/hr)	<5.1925E-14	<4.8575E-14	<3.5573E-14	<4.5357E-14

**USEPA Method 23
PCB Parameters using WHO 2005 TEF Values**

Run No.		1	2	3	Average
Date (2011)		Jul 20	Jul 20	Jul 21	
Start Time (approx.)		07:59	11:50	07:53	
Stop Time (approx.)		11:12	15:22	11:09	
Gas Conditions					
O ₂	Oxygen (dry volume %)	3.5000	3.7000	3.5000	3.5667
CO ₂	Carbon dioxide (dry volume %)	14.0000	13.5000	13.8000	13.7667
T _s	Sample temperature (°F)	151.0	150.4	150.8	150.7
B _w	Actual water vapor in gas (% by volume)	24.2287	24.2921	24.5181	24.3463
Gas Flow Rate					
Q _a	Volumetric flow rate, actual (acfm)	205,723	205,656	209,400	206,926
Q _s	Volumetric flow rate, standard (scfm)	173,962	174,071	177,349	175,127
Q _{std}	Volumetric flow rate, dry standard (dscfm)	131,813	131,786	133,867	132,489
Q _a	Volumetric flow rate, actual (m ³ /hr)	349,571	349,457	355,820	351,616
Q _s	Volumetric flow rate, standard (m ³ /hr)	295,602	295,788	301,358	297,583
Q _{std}	Volumetric flow rate, dry standard (dry m ³ /hr)	223,982	223,935	227,471	225,129
Sampling Data					
V _{mstd}	Volume metered, standard (dscf)	114.5248	111.2697	115.7545	113.8496
%I	Isokinetic sampling (%)	100.43	97.59	99.95	99.32
Pentachlorobiphenyl (126)					
m _n	TEQ Weight (ng, TEF = 0.10000)	<1.1000E-03	<1.1000E-03	<7.8000E-04	
C _{sd}	TEQ Concentration (ng/dscm)	<3.3915E-04	<3.4907E-04	<2.3793E-04	<3.0872E-04
C _{sd}	TEQ Concentration (ng/Nm ³ dry)	<3.6397E-04	<3.7461E-04	<2.5534E-04	<3.3131E-04
C _{sd}	TEQ Concentration (ug/dscm)	<3.3915E-07	<3.4907E-07	<2.3793E-07	<3.0872E-07
C _{sd}	TEQ Concentration (ug/Nm ³ dry)	<3.6397E-07	<3.7461E-07	<2.5534E-07	<3.3131E-07
E _{lb/hr}	TEQ Emissions Rate (lb/hr)	<1.6750E-10	<1.7236E-10	<1.1934E-10	<1.5307E-10
Hexachlorobiphenyl (156)					
m _n	TEQ Weight (ng, TEF = 0.00003)	<9.0000E-08	3.1200E-07	2.5470E-07	
C _{sd}	TEQ Concentration (ng/dscm)	<2.7749E-08	9.9009E-08	7.7694E-08	<6.8151E-08
C _{sd}	TEQ Concentration (ng/Nm ³ dry)	<2.9779E-08	1.0625E-07	8.3379E-08	<7.3137E-08
C _{sd}	TEQ Concentration (ug/dscm)	<2.7749E-11	9.9009E-11	7.7694E-11	<6.8151E-11
C _{sd}	TEQ Concentration (ug/Nm ³ dry)	<2.9779E-11	1.0625E-10	8.3379E-11	<7.3137E-11
E _{lb/hr}	TEQ Emissions Rate (lb/hr)	<1.3704E-14	4.8888E-14	3.8969E-14	<3.3854E-14

USEPA Method 23
PCB Parameters using WHO 2005 TEF Values

Run No.		1	2	3	Average
Date (2011)		Jul 20	Jul 20	Jul 21	
Start Time (approx.)		07:59	11:50	07:53	
Stop Time (approx.)		11:12	15:22	11:09	
Gas Conditions					
O ₂	Oxygen (dry volume %)	3.5000	3.7000	3.5000	3.5667
CO ₂	Carbon dioxide (dry volume %)	14.0000	13.5000	13.8000	13.7667
T _s	Sample temperature (°F)	151.0	150.4	150.8	150.7
B _w	Actual water vapor in gas (% by volume)	24.2287	24.2921	24.5181	24.3463
Gas Flow Rate					
Q _a	Volumetric flow rate, actual (acfm)	205,723	205,656	209,400	206,926
Q _s	Volumetric flow rate, standard (scfm)	173,962	174,071	177,349	175,127
Q _{std}	Volumetric flow rate, dry standard (dscfm)	131,813	131,786	133,867	132,489
Q _a	Volumetric flow rate, actual (m ³ /hr)	349,571	349,457	355,820	351,616
Q _s	Volumetric flow rate, standard (m ³ /hr)	295,602	295,788	301,358	297,583
Q _{std}	Volumetric flow rate, dry standard (dry m ³ /hr)	223,982	223,935	227,471	225,129
Sampling Data					
V _{mstd}	Volume metered, standard (dscf)	114.5248	111.2697	115.7545	113.8496
%I	Isokinetic sampling (%)	100.43	97.59	99.95	99.32
Hexachlorobiphenyl (157)					
m _n	TEQ Weight (ng, TEF = 0.00003)	<8.1000E-08	1.3140E-07	<1.1400E-07	
C _{sd}	TEQ Concentration (ng/dscm)	<2.4974E-08	4.1698E-08	<3.4775E-08	<3.3816E-08
C _{sd}	TEQ Concentration (ng/Nm ³ dry)	<2.6801E-08	4.4749E-08	<3.7319E-08	<3.6290E-08
C _{sd}	TEQ Concentration (ug/dscm)	<2.4974E-11	4.1698E-11	<3.4775E-11	<3.3816E-11
C _{sd}	TEQ Concentration (ug/Nm ³ dry)	<2.6801E-11	4.4749E-11	<3.7319E-11	<3.6290E-11
E _{lb/hr}	TEQ Emissions Rate (lb/hr)	<1.2334E-14	2.0590E-14	<1.7442E-14	<1.6789E-14
Hexachlorobiphenyl (167)					
m _n	TEQ Weight (ng, TEF = 0.00003)	<9.3000E-08	<1.0200E-07	<9.9000E-08	
C _{sd}	TEQ Concentration (ng/dscm)	<2.8674E-08	<3.2368E-08	<3.0199E-08	<3.0414E-08
C _{sd}	TEQ Concentration (ng/Nm ³ dry)	<3.0772E-08	<3.4737E-08	<3.2409E-08	<3.2639E-08
C _{sd}	TEQ Concentration (ug/dscm)	<2.8674E-11	<3.2368E-11	<3.0199E-11	<3.0414E-11
C _{sd}	TEQ Concentration (ug/Nm ³ dry)	<3.0772E-11	<3.4737E-11	<3.2409E-11	<3.2639E-11
E _{lb/hr}	TEQ Emissions Rate (lb/hr)	<1.4161E-14	<1.5983E-14	<1.5147E-14	<1.5097E-14

USEPA Method 23 PCB Parameters using WHO 2005 TEF Values

Run No.		1	2	3	Average
Date (2011)		Jul 20	Jul 20	Jul 21	
Start Time (approx.)		07:59	11:50	07:53	
Stop Time (approx.)		11:12	15:22	11:09	
Gas Conditions					
O ₂	Oxygen (dry volume %)	3.5000	3.7000	3.5000	3.5667
CO ₂	Carbon dioxide (dry volume %)	14.0000	13.5000	13.8000	13.7667
T _s	Sample temperature (°F)	151.0	150.4	150.8	150.7
B _w	Actual water vapor in gas (% by volume)	24.2287	24.2921	24.5181	24.3463
Gas Flow Rate					
Q _a	Volumetric flow rate, actual (acfm)	205,723	205,656	209,400	206,926
Q _s	Volumetric flow rate, standard (scfm)	173,962	174,071	177,349	175,127
Q _{std}	Volumetric flow rate, dry standard (dscfm)	131,813	131,786	133,867	132,489
Q _a	Volumetric flow rate, actual (m ³ /hr)	349,571	349,457	355,820	351,616
Q _s	Volumetric flow rate, standard (m ³ /hr)	295,602	295,788	301,358	297,583
Q _{std}	Volumetric flow rate, dry standard (dry m ³ /hr)	223,982	223,935	227,471	225,129
Sampling Data					
V _{mstd}	Volume metered, standard (dscf)	114.5248	111.2697	115.7545	113.8496
%I	Isokinetic sampling (%)	100.43	97.59	99.95	99.32
Hexachlorobiphenyl (169)					
m _n	TEQ Weight (ng, TEF = 0.03000)	<5.7000E-05	7.8000E-05	<8.7000E-05	
C _{sd}	TEQ Concentration (ng/dscm)	<1.7574E-05	2.4752E-05	<2.6539E-05	<2.2955E-05
C _{sd}	TEQ Concentration (ng/Nm ³ dry)	<1.8860E-05	2.6563E-05	<2.8481E-05	<2.4635E-05
C _{sd}	TEQ Concentration (ug/dscm)	<1.7574E-08	2.4752E-08	<2.6539E-08	<2.2955E-08
C _{sd}	TEQ Concentration (ug/Nm ³ dry)	<1.8860E-08	2.6563E-08	<2.8481E-08	<2.4635E-08
E _{lb/hr}	TEQ Emissions Rate (lb/hr)	<8.6795E-12	1.2222E-11	<1.3311E-11	<1.1404E-11
Heptachlorobiphenyl (189)					
m _n	TEQ Weight (ng, TEF = 0.00003)	<5.7000E-08	6.1200E-08	<6.0000E-08	
C _{sd}	TEQ Concentration (ng/dscm)	<1.7574E-08	1.9421E-08	<1.8303E-08	<1.8433E-08
C _{sd}	TEQ Concentration (ng/Nm ³ dry)	<1.8860E-08	2.0842E-08	<1.9642E-08	<1.9781E-08
C _{sd}	TEQ Concentration (ug/dscm)	<1.7574E-11	1.9421E-11	<1.8303E-11	<1.8433E-11
C _{sd}	TEQ Concentration (ug/Nm ³ dry)	<1.8860E-11	2.0842E-11	<1.9642E-11	<1.9781E-11
E _{lb/hr}	TEQ Emissions Rate (lb/hr)	<8.6795E-15	9.5897E-15	<9.1801E-15	<9.1497E-15

**USEPA Method 23
PCB Results**

Run #1

Analyte	Lab Data Net Weight (ng)	PCB Conc. (ng/dscm)	PCB Emissions (lb/hr)
Tetrachlorobiphenyl (77)	6.66E-03	2.05E-03	1.01E-09
Tetrachlorobiphenyl (81)	<2.70E-03	<8.32E-04	<4.11E-10
Pentachlorobiphenyl (105)	<1.20E-02	<3.70E-03	<1.83E-09
Pentachlorobiphenyl (114)	<1.10E-02	<3.39E-03	<1.67E-09
Pentachlorobiphenyl (118)	2.07E-02	6.38E-03	3.15E-09
Pentachlorobiphenyl (123)	<1.10E-02	<3.39E-03	<1.67E-09
Pentachlorobiphenyl (126)	<1.10E-02	<3.39E-03	<1.67E-09
Hexachlorobiphenyl (156)	<3.00E-03	<9.25E-04	<4.57E-10
Hexachlorobiphenyl (157)	<2.70E-03	<8.32E-04	<4.11E-10
Hexachlorobiphenyl (167)	<3.10E-03	<9.56E-04	<4.72E-10
Hexachlorobiphenyl (169)	<1.90E-03	<5.86E-04	<2.89E-10
Heptachlorobiphenyl (189)	<1.90E-03	<5.86E-04	<2.89E-10
Total PCB's*	<8.77E-02	<2.70E-02	<1.33E-08

< Denotes that the analyte was not detectable above the stated value.

* Total PCBs are calculated using the full detection limit for results below the detection limit.

Marathon Petroleum Company
Clean Air Project No: 11265
FCCU Scrubber Stack

**USEPA Method 23
PCB Results**

Run #2

Analyte	Lab Data Net Weight (pg)	PCB Conc. (ng/dscm)	PCB Emissions (lb/hr)
Tetrachlorobiphenyl (77)	1.45E-02	4.60E-03	2.27E-09
Tetrachlorobiphenyl (81)	<2.70E-03	<8.57E-04	<4.23E-10
Pentachlorobiphenyl (105)	<1.20E-02	<3.81E-03	<1.88E-09
Pentachlorobiphenyl (114)	<1.00E-02	<3.17E-03	<1.57E-09
Pentachlorobiphenyl (118)	8.15E-02	2.59E-02	1.28E-08
Pentachlorobiphenyl (123)	<1.00E-02	<3.17E-03	<1.57E-09
Pentachlorobiphenyl (126)	<1.10E-02	<3.49E-03	<1.72E-09
Hexachlorobiphenyl (156)	1.04E-02	3.30E-03	1.63E-09
Hexachlorobiphenyl (157)	4.38E-03	1.39E-03	6.86E-10
Hexachlorobiphenyl (167)	<3.40E-03	<1.08E-03	<5.33E-10
Hexachlorobiphenyl (169)	2.60E-03	8.25E-04	4.07E-10
Heptachlorobiphenyl (189)	2.04E-03	6.47E-04	3.20E-10
Total PCB's*	<1.65E-01	<5.22E-02	<2.58E-08

< Denotes that the analyte was not detectable above the stated value.

* Total PCBs are calculated using the full detection limit for results below the detection limit.

Marathon Petroleum Company
Clean Air Project No: 11265
FCCU Scrubber Stack

**USEPA Method 23
PCB Results**

Run #3

Analyte	Lab Data Net Weight (pg)	PCB Conc. (ng/dscm)	PCB Emissions (lb/hr)
Tetrachlorobiphenyl (77)	1.74E-02	5.31E-03	2.66E-09
Tetrachlorobiphenyl (81)	<3.60E-03	<1.10E-03	<5.51E-10
Pentachlorobiphenyl (105)	3.57E-02	1.09E-02	5.46E-09
Pentachlorobiphenyl (114)	<7.80E-03	<2.38E-03	<1.19E-09
Pentachlorobiphenyl (118)	7.00E-02	2.14E-02	1.07E-08
Pentachlorobiphenyl (123)	<7.50E-03	<2.29E-03	<1.15E-09
Pentachlorobiphenyl (126)	<7.80E-03	<2.38E-03	<1.19E-09
Hexachlorobiphenyl (156)	8.49E-03	2.59E-03	1.30E-09
Hexachlorobiphenyl (157)	<3.80E-03	<1.16E-03	<5.81E-10
Hexachlorobiphenyl (167)	<3.30E-03	<1.01E-03	<5.05E-10
Hexachlorobiphenyl (169)	<2.90E-03	<8.85E-04	<4.44E-10
Heptachlorobiphenyl (189)	<2.00E-03	<6.10E-04	<3.06E-10
Total PCB's*	<1.70E-01	<5.19E-02	<2.61E-08

* Total PCBs are calculated using the full detection limit for results below the detection limit

Marathon Petroleum Company
Clean Air Project No: 11265
FCCU Scrubber Stack

USEPA Method 23
PCB Results using WHO 2005 TEF Values

Run #1

Analyte	Toxic Equivalency Factor TEF ¹	Laboratory Data		TEQ Conc. (ng/dscm)	TEQ Emissions (lb/hr)
		Net Weight (ng)	TEQ Weight (ng)		
Tetrachlorobiphenyl (77)	0.00010	6.66E-03	6.66E-07	2.05E-07	1.01E-13
Tetrachlorobiphenyl (81)	0.00030	<2.70E-03	<8.10E-07	<2.50E-07	<1.23E-13
Pentachlorobiphenyl (105)	0.00003	<1.20E-02	<3.60E-07	<1.11E-07	<5.48E-14
Pentachlorobiphenyl (114)	0.00003	<1.10E-02	<3.30E-07	<1.02E-07	<5.02E-14
Pentachlorobiphenyl (118)	0.00003	2.07E-02	6.21E-07	1.91E-07	9.46E-14
Pentachlorobiphenyl (123)	0.00003	<1.10E-02	<3.41E-07	<1.05E-07	<5.19E-14
Pentachlorobiphenyl (126)	0.10000	<1.10E-02	<1.10E-03	<3.39E-04	<1.67E-10
Hexachlorobiphenyl (156)	0.00003	<3.00E-03	<9.00E-08	<2.77E-08	<1.37E-14
Hexachlorobiphenyl (157)	0.00003	<2.70E-03	<8.10E-08	<2.50E-08	<1.23E-14
Hexachlorobiphenyl (167)	0.00003	<3.10E-03	<9.30E-08	<2.87E-08	<1.42E-14
Hexachlorobiphenyl (169)	0.03000	<1.90E-03	<5.70E-05	<1.76E-05	<8.68E-12
Heptachlorobiphenyl (189)	0.00003	<1.90E-03	<5.70E-08	<1.76E-08	<8.68E-15
Total PCB's*		<8.77E-02	1.16E-03	3.58E-04	1.77E-10

< Denotes that the analyte was not detectable above the stated value.

* Total PCBs are calculated using the full detection limit for results below the detection limit.

¹ Toxic Equivalency Factor relative to 2378-TCDD.

**USEPA Method 23
PCB Results using WHO 2005 TEF Values**

Run #2

Analyte	Toxic Equivalency Factor TEF ¹	Laboratory Data		TEQ Conc. (ng/dscm)	TEQ Emissions (lb/hr)
		Net Weight (pg)	TEQ Weight (ng)		
Tetrachlorobiphenyl (77)	0.00010	1.45E-02	1.45E-06	4.60E-07	2.27E-13
Tetrachlorobiphenyl (81)	0.00030	<2.70E-03	<8.10E-07	<2.57E-07	<1.27E-13
Pentachlorobiphenyl (105)	0.00003	<1.20E-02	<3.60E-07	<1.14E-07	<5.64E-14
Pentachlorobiphenyl (114)	0.00003	<1.00E-02	<3.00E-07	<9.52E-08	<4.70E-14
Pentachlorobiphenyl (118)	0.00003	8.15E-02	2.45E-06	7.76E-07	3.83E-13
Pentachlorobiphenyl (123)	0.00003	<1.00E-02	<3.10E-07	<9.84E-08	<4.86E-14
Pentachlorobiphenyl (126)	0.10000	<1.10E-02	<1.10E-03	<3.49E-04	<1.72E-10
Hexachlorobiphenyl (156)	0.00003	1.04E-02	3.12E-07	9.90E-08	4.89E-14
Hexachlorobiphenyl (157)	0.00003	4.38E-03	1.31E-07	4.17E-08	2.06E-14
Hexachlorobiphenyl (167)	0.00003	<3.40E-03	<1.02E-07	<3.24E-08	<1.60E-14
Hexachlorobiphenyl (169)	0.03000	2.60E-03	7.80E-05	2.48E-05	1.22E-11
Heptachlorobiphenyl (189)	0.00003	2.04E-03	6.12E-08	1.94E-08	9.59E-15
Total PCB's*		<1.65E-01	1.18E-03	3.76E-04	1.86E-10

< Denotes that the analyte was not detectable above the stated value.

* Total PCBs are calculated using the full detection limit for results below the detection limit.

¹ Toxic Equivalency Factor relative to 2378-TCDD.

**USEPA Method 23
PCB Results using WHO 2005 TEF Values**

Run #3

Analyte	Toxic Equivalency Factor TEF ¹	Laboratory Data		TEQ Conc. (ng/dscm)	TEQ Emissions (lb/hr)
		Net Weight (pg)	TEQ Weight (ng)		
Tetrachlorobiphenyl (77)	0.00010	1.74E-02	1.74E-06	5.31E-07	2.66E-13
Tetrachlorobiphenyl (81)	0.00030	<3.60E-03	<1.08E-06	<3.29E-07	<1.65E-13
Pentachlorobiphenyl (105)	0.00003	3.57E-02	1.07E-06	3.27E-07	1.64E-13
Pentachlorobiphenyl (114)	0.00003	<7.80E-03	<2.34E-07	<7.14E-08	<3.58E-14
Pentachlorobiphenyl (118)	0.00003	7.00E-02	2.10E-06	6.41E-07	3.21E-13
Pentachlorobiphenyl (123)	0.00003	<7.50E-03	<2.33E-07	<7.09E-08	<3.56E-14
Pentachlorobiphenyl (126)	0.10000	<7.80E-03	<7.80E-04	<2.38E-04	<1.19E-10
Hexachlorobiphenyl (156)	0.00003	8.49E-03	2.55E-07	7.77E-08	3.90E-14
Hexachlorobiphenyl (157)	0.00003	<3.80E-03	<1.14E-07	<3.48E-08	<1.74E-14
Hexachlorobiphenyl (167)	0.00003	<3.30E-03	<9.90E-08	<3.02E-08	<1.51E-14
Hexachlorobiphenyl (169)	0.03000	<2.90E-03	<8.70E-05	<2.65E-05	<1.33E-11
Heptachlorobiphenyl (189)	0.00003	<2.00E-03	<6.00E-08	<1.83E-08	<9.18E-15
Total PCB's*		<1.70E-01	8.74E-04	2.67E-04	1.34E-10

< Denotes that the analyte was not detectable above the stated value.

* Total PCBs are calculated using the full detection limit for results below the detection limit.

¹ Toxic Equivalency Factor relative to 2378-TCDD.

¹ Toxic Equivalency Factor relative to 2378-TCDD.

Marathon Petroleum Company
Clean Air Project No: 11265
FCCU Scrubber Stack

USEPA Method 5/202 (FPM / CPM) Sampling, Velocity and Moisture Parameters

Run No.	1	2	3	Average
Date (2011)	Jul 19	Jul 19	Jul 19	
Start Time (approx.)	08:09	11:51	15:22	
Stop Time (approx.)	10:14	14:19	17:36	
Sampling Conditions				
Y _d Dry gas meter correction factor	0.9925	0.9925	0.9925	
C _p Pitot tube coefficient	0.8270	0.8270	0.8270	
P _g Static pressure (in. H ₂ O)	-0.5000	-0.5000	-0.5000	
A _s Sample location area (ft ²)	70.8822	70.8822	70.8822	
P _{bar} Barometric pressure (in. Hg)	29.40	29.40	29.40	29.4000
D _n Nozzle diameter (in.)	0.2500	0.2500	0.2500	
O ₂ Oxygen (dry volume %)	3.7000	3.4000	3.5000	3.5333
CO ₂ Carbon dioxide (dry volume %)	13.4000	13.7000	13.7000	13.6000
N ₂ +CO Nitrogen plus carbon monoxide (dry volume %)	82.9000	82.9000	82.8000	82.8667
V _{lc} Total Liquid collected (ml)	537.30	532.50	518.30	
V _m Volume metered, meter conditions (ft ³)	81.8270	81.7950	82.1200	
T _m Dry gas meter temperature (°F)	103.2500	114.4792	117.7708	
T _s Sample temperature (°F)	148.0000	148.0000	148.0000	148.0000
ΔH Meter box orifice pressure drop (in. H ₂ O)	1.4333	1.4167	1.3858	
θ Total sampling time (min)	120.0	120.0	120.0	
Flow Results				
V _{wstd} Volume of water collected (ft ³)	25.2853	25.0595	24.3912	24.9120
V _{mstd} Volume metered, standard (dscf)	75.0457	73.5470	73.4129	74.0019
P _s Sample gas pressure, absolute (in. Hg)	29.3632	29.3632	29.3632	29.3632
P _v Vapor pressure, actual (in. Hg)	7.2054	7.2054	7.2054	7.2054
B _{wo} Moisture measured in sample (% by volume)	25.2019	25.4136	24.9388	25.1848
B _{ws} Saturated moisture content (% by volume)	24.5390	24.5390	24.5390	24.5390
B _w Actual water vapor in gas (% by volume)	24.5390	24.5390	24.5390	24.5390
√ΔP Velocity head (√in. H ₂ O)	0.7772	0.7718	0.7715	0.7735
M _d MW of sample gas, dry (lb/lb-mole)	30.2920	30.3280	30.3320	30.3173
M _s MW of sample gas, wet (lb/lb-mole)	27.2757	27.3028	27.3059	27.2948
V _s Velocity of sample (ft/sec)	47.8751	47.5218	47.5000	47.6323
%I Isokinetic sampling (%)	99.3657	98.1051	97.9713	98.4807
Q _a Volumetric flow rate, actual (acfm)	203,609	202,107	202,014	202,577
Q _s Volumetric flow rate, standard (scfm)	173,528	172,248	172,169	172,648
Q _{std} Volumetric flow rate, dry standard (dscfm)	130,946	129,980	129,920	130,282
Q _a Volumetric flow rate, actual (acf/hr)	12,216,562	12,126,425	12,120,852	12,154,613
Q _s Volumetric flow rate, standard (scf/hr)	10,411,701	10,334,880	10,330,131	10,358,904
Q _{std} Volumetric flow rate, dry standard (dscf/hr)	7,856,778	7,798,808	7,795,224	7,816,937

Comments:

Average includes 3 runs.

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USEPA Method 5/202 (FPM/CPM) Emission Parameters for FPM

Run No.	1	2	3	Average
Date (2011)	Jul 19	Jul 19	Jul 19	
Start Time (approx.)	08:09	11:51	15:22	
Stop Time (approx.)	10:14	14:19	17:36	
Gas Conditions				
O ₂ Oxygen (dry volume %)	3.7000	3.4000	3.5000	3.5333
CO ₂ Carbon dioxide (dry volume %)	13.4000	13.7000	13.7000	13.6000
T _s Sample temperature (°F)	148.0000	148.0000	148.0000	148.0000
B _w Actual water vapor in gas (% by volume)	24.5390	24.5390	24.5390	24.5390
Gas Flow Rate				
Q _a Volumetric flow rate, actual (acfm)	203,609	202,107	202,014	202,577
Q _s Volumetric flow rate, standard (scfm)	173,528	172,248	172,169	172,648
Q _{std} Volumetric flow rate, dry standard (dscfm)	130,946	129,980	129,920	130,282
Q _a Volumetric flow rate, actual (acf/hr)	12,216,562	12,126,425	12,120,852	12,154,613
Q _s Volumetric flow rate, standard (scf/hr)	10,411,701	10,334,880	10,330,131	10,358,904
Q _{std} Volumetric flow rate, dry standard (dscf/hr)	7,856,778	7,798,808	7,795,224	7,816,937
Sampling Data				
V _{mstd} Volume metered, standard (dscf)	75.0457	73.5470	73.4129	74.0019
%I Isokinetic sampling (%)	99.3657	98.1051	97.9713	98.4807
Laboratory Data				
m _{filter} Matter collected on filter(s) (g)	0.08529	0.08094	0.08526	
m _s Matter collected in solvent rinse(s) (g)	0.01869	0.01586	0.00645	
m _n Total filterable particulate matter (g)	0.10398	0.09680	0.09171	
n _{MDL} Number of non-detectable fractions	N/A	N/A	N/A	
DLC Detection level classification	ADL	ADL	ADL	
Filterable Particulate Matter Results				
C _{sd} Particulate Concentration (lb/dscf)	3.0551E-06	2.9021E-06	2.7546E-06	2.9040E-06
C _a Particulate Concentration (lb/acf)	1.9648E-06	1.8664E-06	1.7715E-06	1.8676E-06
C _{sd} Particulate Concentration (gr/dscf)	0.0214	0.0203	0.0193	0.0203
C _a Particulate Concentration (gr/acf)	0.0137	0.0131	0.0124	0.0131
C _{sd} Particulate Concentration (mg/dscm)	48.9240	46.4738	44.1105	46.5028
C _a Particulate Concentration (mg/m ³ (actual,wet))	31.4642	29.8885	28.3686	29.9071
C _{sd} Particulate Concentration (mg/Nm ³ dry)	52.5038	49.8743	47.3381	49.9054
E _{lb/hr} Particulate Rate (lb/hr)	24.0036	22.6333	21.4724	22.7031

Comments:

Average includes 3 runs.

Detection level classifications are defined as follows:

ADL = Above Detection Level - all fractions are above detection limit

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Marathon Petroleum Company
Clean Air Project No: 11265
FCCU Scrubber Stack

USEPA Method 5/202 (FPM/CPM) Emission Parameters for CPM

Run No.	1	2	3	Average
Date (2011)	Jul 19	Jul 19	Jul 19	
Start Time (approx.)	08:09	11:51	15:22	
Stop Time (approx.)	10:14	14:19	17:36	
Gas Conditions				
O ₂ Oxygen (dry volume %)	3.7000	3.4000	3.5000	3.5333
CO ₂ Carbon dioxide (dry volume %)	13.4000	13.7000	13.7000	13.6000
T _s Sample temperature (°F)	148.0000	148.0000	148.0000	148.0000
B _w Actual water vapor in gas (% by volume)	24.5390	24.5390	24.5390	24.5390
Gas Flow Rate				
Q _a Volumetric flow rate, actual (acfm)	203,609	202,107	202,014	202,577
Q _s Volumetric flow rate, standard (scfm)	173,528	172,248	172,169	172,648
Q _{std} Volumetric flow rate, dry standard (dscfm)	130,946	129,980	129,920	130,282
Q _a Volumetric flow rate, actual (acf/hr)	12,216,562	12,126,425	12,120,852	12,154,613
Q _s Volumetric flow rate, standard (scf/hr)	10,411,701	10,334,880	10,330,131	10,358,904
Q _{std} Volumetric flow rate, dry standard (dscf/hr)	7,856,778	7,798,808	7,795,224	7,816,937
Sampling Data				
V _{mstd} Volume metered, standard (dscf)	75.0457	73.5470	73.4129	74.0019
%I Isokinetic sampling (%)	99.3657	98.1051	97.9713	98.4807
Laboratory Data				
m _{CPMi} Total Inorganic CPM Result (g)	0.03413	0.03567	0.03896	
m _{CPMo} Total Organic CPM Result (g)	0.00047	0.00028	0.00031	
m _{CPM} Total CPM (g)	0.03460	0.03595	0.03927	
n _{MDL} Number of non-detectable fractions	N/A	N/A	N/A	
DLC Detection level classification	ADL	ADL	ADL	
Condensable Particulate Matter Results				
C _{sd} Particulate Concentration (lb/dscf)	1.0166E-06	1.0778E-06	1.1795E-06	1.0913E-06
C _a Particulate Concentration (lb/acf)	6.5380E-07	6.9317E-07	7.5855E-07	7.0184E-07
C _{sd} Particulate Concentration (gr/dscf)	0.0071	0.0075	0.0083	0.0076
C _a Particulate Concentration (gr/acf)	0.0046	0.0049	0.0053	0.0049
C _{sd} Particulate Concentration (mg/dscm)	16.2793	17.2598	18.8877	17.4756
C _a Particulate Concentration (mg/m ³ (actual,wet))	10.4697	11.1002	12.1472	11.2390
C _{sd} Particulate Concentration (mg/Nm ³ dry)	17.4705	18.5227	20.2697	18.7543
E _{lb/hr} Particulate Rate (lb/hr)	7.9872	8.4057	9.1943	8.5291

Comments:

Average includes 3 runs.

Detection level classifications are defined as follows:

ADL = Above Detection Level - all fractions are above detection limit

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Marathon Petroleum Company
Clean Air Project No: 11265
FCCU Scrubber Stack

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USEPA Method 5/202 (FPM/CPM)
Emission Parameters for CPM
Separate Inorganic and Organic Results

Run No.	1	2	3	Average
Date (2011)	Jul 19	Jul 19	Jul 19	
Start Time (approx.)	08:09	11:51	15:22	
Stop Time (approx.)	10:14	14:19	17:36	

Condensable Particulate Matter Results - Inorganic Fraction

C _{sd}	Particulate Concentration (lb/dscf)	1.0027E-06	1.0694E-06	1.1701E-06	1.0807E-06
C _a	Particulate Concentration (lb/acf)	6.4487E-07	6.8777E-07	7.5252E-07	6.9505E-07
C _{sd}	Particulate Concentration (gr/dscf)	0.0070	0.0075	0.0082	0.0076
C _a	Particulate Concentration (gr/acf)	0.0045	0.0048	0.0053	0.0049
C _{sd}	Particulate Concentration (mg/dscm)	16.0570	17.1253	18.7374	17.3066
C _a	Particulate Concentration (mg/m ³ (actual,wet))	10.3267	11.0137	12.0505	11.1303
C _{sd}	Particulate Concentration (mg/Nm ³ dry)	17.2319	18.3784	20.1084	18.5729
E _{lb/hr}	Particulate Rate (lb/hr)	7.8781	8.3402	9.1211	8.4465

Condensable Particulate Matter Results - Organic Fraction

C _{sd}	Particulate Concentration (lb/dscf)	1.3884E-08	8.3946E-09	9.3871E-09	1.0555E-08
C _a	Particulate Concentration (lb/acf)	8.9291E-09	5.3988E-09	6.0371E-09	6.7883E-09
C _{sd}	Particulate Concentration (gr/dscf)	0.0001	0.0001	0.0001	0.0001
C _a	Particulate Concentration (gr/acf)	0.0001	0.0000	0.0000	0.0000
C _{sd}	Particulate Concentration (mg/dscm)	0.2223	0.1344	0.1503	0.1690
C _a	Particulate Concentration (mg/m ³ (actual,wet))	0.1430	0.0865	0.0967	0.1087
C _{sd}	Particulate Concentration (mg/Nm ³ dry)	0.2386	0.1443	0.1613	0.1814
E _{lb/hr}	Particulate Rate (lb/hr)	0.1091	0.0655	0.0732	0.0826

Comments:

Average includes 3 runs.

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USEPA Method 5/202 (FPM/CPM) Emission Parameters for Total Particulate Matter

Run No.	1	2	3	Average
Date (2011)	Jul 19	Jul 19	Jul 19	
Start Time (approx.)	08:09	11:51	15:22	
Stop Time (approx.)	10:14	14:19	17:36	
Gas Conditions				
O ₂ Oxygen (dry volume %)	3.7000	3.4000	3.5000	3.5333
CO ₂ Carbon dioxide (dry volume %)	13.4000	13.7000	13.7000	13.6000
T _s Sample temperature (°F)	148.0000	148.0000	148.0000	148.0000
B _w Actual water vapor in gas (% by volume)	24.5390	24.5390	24.5390	24.5390
Gas Flow Rate				
Q _a Volumetric flow rate, actual (acfm)	203,609	202,107	202,014	202,577
Q _s Volumetric flow rate, standard (scfm)	173,528	172,248	172,169	172,648
Q _{std} Volumetric flow rate, dry standard (dscfm)	130,946	129,980	129,920	130,282
Q _a Volumetric flow rate, actual (acf/hr)	12,216,562	12,126,425	12,120,852	12,154,613
Q _s Volumetric flow rate, standard (scf/hr)	10,411,701	10,334,880	10,330,131	10,358,904
Q _{std} Volumetric flow rate, dry standard (dscf/hr)	7,856,778	7,798,808	7,795,224	7,816,937
Sampling Data				
V _{mstd} Volume metered, standard (dscf)	75.0457	73.5470	73.4129	74.0019
%I Isokinetic sampling (%)	99.3657	98.1051	97.9713	98.4807
Laboratory Data				
m _n Total filterable particulate matter (g)	0.10398	0.09680	0.09171	
m _{CPM} Total condensable particulate matter (g)	0.03460	0.03595	0.03927	
m _{Part} Total particulate matter (g)	0.13858	0.13275	0.13098	
n _{MDL} Number of non-detectable fractions	N/A	N/A	N/A	
DLC Detection level classification	ADL	ADL	ADL	
Total Particulate Matter Results				
C _{sd} Particulate Concentration (lb/dscf)	4.0717E-06	3.9800E-06	3.9340E-06	3.9952E-06
C _a Particulate Concentration (lb/acf)	2.6186E-06	2.5596E-06	2.5301E-06	2.5694E-06
C _{sd} Particulate Concentration (gr/dscf)	0.0285	0.0279	0.0275	0.0280
C _a Particulate Concentration (gr/acf)	0.0183	0.0179	0.0177	0.0180
C _{sd} Particulate Concentration (mg/dscm)	65.2033	63.7336	62.9982	63.9784
C _a Particulate Concentration (mg/m ³ (actual,wet))	41.9339	40.9886	40.5157	41.1461
C _{sd} Particulate Concentration (mg/Nm ³ dry)	69.9743	68.3970	67.6078	68.6597
E _{lb/hr} Particulate Rate (lb/hr)	31.9908	31.0390	30.6667	31.2322

Comments:

Average includes 3 runs.

Detection level classifications are defined as follows:

ADL = Above Detection Level - all fractions are above detection limit

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Marathon Petroleum Company
Clean Air Project No: 11265
FCCU Scrubber Stack

USEPA Mod. CTM-027 (Ammonia) Sampling, Velocity and Moisture Parameters

Run No.	1	2	3	Average
Date (2011)	Jul 19	Jul 19	Jul 19	
Start Time (approx.)	07:56	12:00	15:38	
Stop Time (approx.)	09:38	13:19	17:15	
Sampling Conditions				
Y _d Dry gas meter correction factor	0.9827	0.9827	0.9827	
C _p Pitot tube coefficient	0.8190	0.8190	0.8190	
P _g Static pressure (in. H ₂ O)	-0.5000	-0.5000	-0.5000	
A _s Sample location area (ft ²)	70.8822	70.8822	70.8822	
P _{bar} Barometric pressure (in. Hg)	29.40	29.40	29.40	29.4000
D _n Nozzle diameter (in.)	0.2490	0.2490	0.2490	
O ₂ Oxygen (dry volume %)	3.3000	3.4000	3.5000	3.4000
CO ₂ Carbon dioxide (dry volume %)	13.8000	13.6000	13.7000	13.7000
N ₂ +CO Nitrogen plus carbon monoxide (dry volume %)	82.9000	83.0000	82.8000	82.9000
V _{lc} Total Liquid collected (ml)	270.30	273.70	265.40	
V _m Volume metered, meter conditions (ft ³)	41.3150	41.5350	41.2850	
T _m Dry gas meter temperature (°F)	100.6667	110.7083	114.5417	
T _s Sample temperature (°F)	150.7500	152.0000	152.0000	151.5833
ΔH Meter box orifice pressure drop (in. H ₂ O)	1.5083	1.4417	1.4167	
θ Total sampling time (min)	60.0	60.0	60.0	
Flow Results				
V _{wstd} Volume of water collected (ft ³)	12.7203	12.8803	12.4897	12.6968
V _{mstd} Volume metered, standard (dscf)	37.6969	37.2246	36.7514	37.2243
P _s Sample gas pressure, absolute (in. Hg)	29.3632	29.3632	29.3632	29.3632
P _v Vapor pressure, actual (in. Hg)	7.7146	7.9559	7.9559	7.8755
B _{w0} Moisture measured in sample (% by volume)	25.2301	25.7067	25.3644	25.4338
B _{ws} Saturated moisture content (% by volume)	26.2729	27.0947	27.0947	26.8208
B _w Actual water vapor in gas (% by volume)	25.2301	25.7067	25.3644	25.4338
√ΔP Velocity head (√in. H ₂ O)	0.8011	0.7857	0.7869	0.7912
M _d MW of sample gas, dry (lb/lb-mole)	30.3400	30.3120	30.3320	30.3280
M _s MW of sample gas, wet (lb/lb-mole)	27.2266	27.1470	27.2041	27.1926
V _s Velocity of sample (ft/sec)	49.0256	48.2044	48.2256	48.4852
%I Isokinetic sampling (%)	99.6253	100.9011	99.1179	99.8814
Q _a Volumetric flow rate, actual (acfm)	208,502	205,010	205,100	206,204
Q _s Volumetric flow rate, standard (scfm)	176,898	173,580	173,656	174,712
Q _{std} Volumetric flow rate, dry standard (dscfm)	132,267	128,958	129,609	130,278
Q _a Volumetric flow rate, actual (acf/hr)	12,510,147	12,300,597	12,306,005	12,372,250
Q _s Volumetric flow rate, standard (scf/hr)	10,613,904	10,414,802	10,419,381	10,482,696
Q _{std} Volumetric flow rate, dry standard (dscf/hr)	7,936,002	7,737,500	7,776,565	7,816,689

Comments:

Average includes 3 runs.

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Marathon Petroleum Company
Clean Air Project No: 11265
FCCU Scrubber Stack

USEPA Mod. CTM-027 NH₃ Parameters

Run No.	1	2	3	Average
Date (2011)	Jul 19	Jul 19	Jul 19	
Start Time (approx.)	07:56	12:00	15:38	
Stop Time (approx.)	09:38	13:19	17:15	
Gas Conditions				
O ₂ Oxygen (dry volume %)	3.3000	3.4000	3.5000	3.4000
CO ₂ Carbon dioxide (dry volume %)	13.8000	13.6000	13.7000	13.7000
T _s Sample temperature (°F)	150.7500	152.0000	152.0000	151.5833
B _w Actual water vapor in gas (% by volume)	25.2301	25.7067	25.3644	25.4338
Gas Flow Rate				
Q _a Volumetric flow rate, actual (acfm)	208,502	205,010	205,100	206,204
Q _s Volumetric flow rate, standard (scfm)	176,898	173,580	173,656	174,712
Q _{std} Volumetric flow rate, dry standard (dscfm)	132,267	128,958	129,609	130,278
Q _a Volumetric flow rate, actual (acf/hr)	12,510,147	12,300,597	12,306,005	12,372,250
Q _s Volumetric flow rate, standard (scf/hr)	10,613,904	10,414,802	10,419,381	10,482,696
Q _{std} Volumetric flow rate, dry standard (dscf/hr)	7,936,002	7,737,500	7,776,565	7,816,689
Sampling Data				
V _{mstd} Volume metered, standard (dscf)	37.6969	37.2246	36.7514	37.2243
%I Isokinetic sampling (%)	99.6253	100.9011	99.1179	99.8814
Laboratory Data				
m _n Total NH ₃ collected (mg)	1.2544	1.3106	2.1149	
Ammonia (NH₃) Results				
C _{sd} Ammonia Concentration (lb/dscf)	7.3373E-08	7.7636E-08	1.2689E-07	9.2634E-08
C _a Ammonia Concentration (lb/acf)	4.6545E-08	4.8836E-08	8.0187E-08	5.8523E-08
C _{sd} Ammonia Concentration (ppmdv)	1.6609	1.7574	2.8723	2.0968
C _w Ammonia Concentration (ppmwv)	1.2418	1.3056	2.1437	1.5637
C _{sd} Ammonia Concentration (mg/dscm)	1.1750	1.2432	2.0320	1.4834
C _a Ammonia Concentration (mg/m ³ (actual,wet))	0.7454	0.7820	1.2841	0.9372
C _{sd} Ammonia Concentration (mg/Nm ³ dry)	1.2609	1.3342	2.1807	1.5919
E _{lb/hr} Ammonia Rate (lb/hr)	0.5823	0.6007	0.9868	0.7233

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Marathon Petroleum Company
Clean Air Project No: 11265
FCCU Scrubber Stack

USEPA Method 29 (Non-Mercury Metals) Sampling, Velocity and Moisture Parameters

Run No.	1	2	3	Average
Date (2011)	Jul 19	Jul 19	Jul 19	
Start Time (approx.)	07:42	11:23	15:17	
Stop Time (approx.)	10:52	14:37	18:30	
Sampling Conditions				
Y _d Dry gas meter correction factor	0.9992	0.9992	0.9992	
C _p Pitot tube coefficient	0.8200	0.8200	0.8200	
P _g Static pressure (in. H ₂ O)	-0.5000	-0.5000	-0.5000	
A _s Sample location area (ft ²)	70.8822	70.8822	70.8822	
P _{bar} Barometric pressure (in. Hg)	29.40	29.40	29.40	29.4000
D _n Nozzle diameter (in.)	0.2500	0.2500	0.2500	
O ₂ Oxygen (dry volume %)	3.6000	3.3000	3.4000	3.4333
CO ₂ Carbon dioxide (dry volume %)	13.6000	13.5000	13.7000	13.6000
N ₂ +CO Nitrogen plus carbon monoxide (dry volume %)	82.8000	83.2000	82.9000	82.9667
V _{lc} Total Liquid collected (ml)	858.00	851.30	805.40	
V _m Volume metered, meter conditions (ft ³)	131.1100	132.7500	126.8700	
T _m Dry gas meter temperature (°F)	102.1528	111.5000	114.1667	
T _s Sample temperature (°F)	151.7222	151.4167	151.4167	151.5185
ΔH Meter box orifice pressure drop (in. H ₂ O)	1.5167	1.4833	1.3583	
θ Total sampling time (min)	180.0	180.0	180.0	
Flow Results				
V _{wstd} Volume of water collected (ft ³)	40.3775	40.0622	37.9021	39.4473
V _{mstd} Volume metered, standard (dscf)	121.3177	120.8161	114.8926	119.0088
P _s Sample gas pressure, absolute (in. Hg)	29.3632	29.3632	29.3632	29.3632
P _v Vapor pressure, actual (in. Hg)	7.9017	7.8425	7.8425	7.8622
B _{wo} Moisture measured in sample (% by volume)	24.9714	24.9022	24.8059	24.8931
B _{ws} Saturated moisture content (% by volume)	26.9103	26.7086	26.7086	26.7758
B _w Actual water vapor in gas (% by volume)	24.9714	24.9022	24.8059	24.8931
√ΔP Velocity head (√in. H ₂ O)	0.8123	0.8115	0.7913	0.8051
M _d MW of sample gas, dry (lb/lb-mole)	30.3200	30.2920	30.3280	30.3133
M _s MW of sample gas, wet (lb/lb-mole)	27.2435	27.2310	27.2699	27.2482
V _s Velocity of sample (ft/sec)	49.7977	49.7442	48.4749	49.3389
%I Isokinetic sampling (%)	104.1812	103.7148	101.0827	102.9929
Q _a Volumetric flow rate, actual (acfm)	211,786	211,558	206,160	209,835
Q _s Volumetric flow rate, standard (scfm)	179,399	179,295	174,721	177,805
Q _{std} Volumetric flow rate, dry standard (dscfm)	134,601	134,647	131,380	133,542
Q _a Volumetric flow rate, actual (acf/hr)	12,707,183	12,693,507	12,369,622	12,590,104
Q _s Volumetric flow rate, standard (scf/hr)	10,763,940	10,757,729	10,483,237	10,668,302
Q _{std} Volumetric flow rate, dry standard (dscf/hr)	8,076,037	8,078,821	7,882,775	8,012,545

Comments:

Average includes 3 runs.

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Clean Air Project No: 11265
FCCU Scrubber Stack

USEPA Method 29 Antimony (Sb) Emission Parameters

Run No.	1	2	3	Average
Date (2011)	Jul 19	Jul 19	Jul 19	
Start Time (approx.)	07:42	11:23	15:17	
Stop Time (approx.)	10:52	14:37	18:30	
Gas Conditions				
O ₂ Oxygen (dry volume %)	3.6000	3.3000	3.4000	3.4333
CO ₂ Carbon dioxide (dry volume %)	13.6000	13.5000	13.7000	13.6000
T _s Sample temperature (°F)	151.7222	151.4167	151.4167	151.5185
B _w Actual water vapor in gas (% by volume)	24.9714	24.9022	24.8059	24.8931
Gas Flow Rate				
Q _a Volumetric flow rate, actual (acfm)	211,786	211,558	206,160	209,835
Q _s Volumetric flow rate, standard (scfm)	179,399	179,295	174,721	177,805
Q _{std} Volumetric flow rate, dry standard (dscfm)	134,601	134,647	131,380	133,542
Q _a Volumetric flow rate, actual (acf/hr)	12,707,183	12,693,507	12,369,622	12,590,104
Q _s Volumetric flow rate, standard (scf/hr)	10,763,940	10,757,729	10,483,237	10,668,302
Q _{std} Volumetric flow rate, dry standard (dscf/hr)	8,076,037	8,078,821	7,882,775	8,012,545
Sampling Data				
V _{mstd} Volume metered, standard (dscf)	121.3177	120.8161	114.8926	119.0088
%I Isokinetic sampling (%)	104.1812	103.7148	101.0827	102.9929
Laboratory Data				
m _F Front half corrected for allowable blank (µg)	16.4740	13.9740	13.8740	
m _B Back half corrected for allowable blank (µg)	<0.1000	<0.1000	<0.1000	
m _n Total matter corrected for allowable blanks (µg)	<16.5740	<14.0740	<13.9740	
Antimony Results - Total				
C _{sd} Concentration (lb/dscf)	<3.0124E-10	<2.5686E-10	<2.6819E-10	<2.7543E-10
C _a Concentration (lb/acf)	<1.9145E-10	<1.6348E-10	<1.7091E-10	<1.7528E-10
C _{sd} Concentration (µg/dscm)	<4.8239E+00	<4.1133E+00	<4.2946E+00	<4.4106E+00
C _{sd} Concentration (mg/dscm)	<4.8239E-03	<4.1133E-03	<4.2946E-03	<4.4106E-03
C _a Concentration (µg/m ³ (actual,wet))	<3.0658E+00	<2.6179E+00	<2.7368E+00	<2.8069E+00
C _{sd} Concentration (µg/Nm ³ dry)	<5.1769E+00	<4.4143E+00	<4.6089E+00	<4.7334E+00
E _{lb/hr} Rate (lb/hr)	<2.4328E-03	<2.0751E-03	<2.1141E-03	<2.2073E-03

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Marathon Petroleum Company
Clean Air Project No: 11265
FCCU Scrubber Stack

USEPA Method 29
Antimony (Sb) Emission Parameters (continued)
Separate Front and Back Half Results

Run No.	1	2	3	Average
Date (2011)	Jul 19	Jul 19	Jul 19	
Start Time (approx.)	07:42	11:23	15:17	
Stop Time (approx.)	10:52	14:37	18:30	

Antimony Results - Front Half

C _{sd}	Concentration (lb/dscf)	2.9942E-10	2.5504E-10	2.6627E-10	2.7358E-10
C _a	Concentration (lb/acf)	1.9030E-10	1.6232E-10	1.6968E-10	1.7410E-10
C _{sd}	Concentration (µg/dscm)	4.7948E+00	4.0841E+00	4.2639E+00	4.3809E+00
C _{sd}	Concentration (mg/dscm)	4.7948E-03	4.0841E-03	4.2639E-03	4.3809E-03
C _a	Concentration (µg/m ³ (actual,wet))	3.0473E+00	2.5993E+00	2.7173E+00	2.7880E+00
C _{sd}	Concentration (µg/Nm ³ dry)	5.1457E+00	4.3829E+00	4.5759E+00	4.7015E+00
E _{lb/hr}	Rate (lb/hr)	2.4181E-03	2.0604E-03	2.0989E-03	2.1925E-03

Antimony Results - Back Half

C _{sd}	Concentration (lb/dscf)	<1.8175E-12	<1.8251E-12	<1.9192E-12	<1.8539E-12
C _a	Concentration (lb/acf)	<1.1551E-12	<1.1616E-12	<1.2230E-12	<1.1799E-12
C _{sd}	Concentration (µg/dscm)	<2.9105E-02	<2.9226E-02	<3.0733E-02	<2.9688E-02
C _{sd}	Concentration (mg/dscm)	<2.9105E-05	<2.9226E-05	<3.0733E-05	<2.9688E-05
C _a	Concentration (µg/m ³ (actual,wet))	<1.8498E-02	<1.8601E-02	<1.9585E-02	<1.8895E-02
C _{sd}	Concentration (µg/Nm ³ dry)	<3.1235E-02	<3.1365E-02	<3.2982E-02	<3.1861E-02
E _{lb/hr}	Rate (lb/hr)	<1.4679E-05	<1.4745E-05	<1.5128E-05	<1.4851E-05

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Marathon Petroleum Company
Clean Air Project No: 11265
FCCU Scrubber Stack

USEPA Method 29 Arsenic (As) Emission Parameters

Run No.		1	2	3	Average
Date (2011)		Jul 19	Jul 19	Jul 19	
Start Time (approx.)		07:42	11:23	15:17	
Stop Time (approx.)		10:52	14:37	18:30	
Gas Conditions					
O ₂	Oxygen (dry volume %)	3.6000	3.3000	3.4000	3.4333
CO ₂	Carbon dioxide (dry volume %)	13.6000	13.5000	13.7000	13.6000
T _s	Sample temperature (°F)	151.7222	151.4167	151.4167	151.5185
B _w	Actual water vapor in gas (% by volume)	24.9714	24.9022	24.8059	24.8931
Gas Flow Rate					
Q _a	Volumetric flow rate, actual (acfm)	211,786	211,558	206,160	209,835
Q _s	Volumetric flow rate, standard (scfm)	179,399	179,295	174,721	177,805
Q _{std}	Volumetric flow rate, dry standard (dscfm)	134,601	134,647	131,380	133,542
Q _a	Volumetric flow rate, actual (acf/hr)	12,707,183	12,693,507	12,369,622	12,590,104
Q _s	Volumetric flow rate, standard (scf/hr)	10,763,940	10,757,729	10,483,237	10,668,302
Q _{std}	Volumetric flow rate, dry standard (dscf/hr)	8,076,037	8,078,821	7,882,775	8,012,545
Sampling Data					
V _{mstd}	Volume metered, standard (dscf)	121.3177	120.8161	114.8926	119.0088
%I	Isokinetic sampling (%)	104.1812	103.7148	101.0827	102.9929
Laboratory Data					
m _F	Front half corrected for allowable blank (µg)	1.1900	<1.0000	1.1300	
m _B	Back half corrected for allowable blank (µg)	<0.2000	<0.2000	<0.2000	
m _n	Total matter corrected for allowable blanks (µg)	<1.3900	<1.2000	<1.3300	
Arsenic Results - Total					
C _{sd}	Concentration (lb/dscf)	<2.5264E-11	<2.1901E-11	<2.5525E-11	<2.4230E-11
C _a	Concentration (lb/acf)	<1.6056E-11	<1.3939E-11	<1.6266E-11	<1.5421E-11
C _{sd}	Concentration (µg/dscm)	<4.0457E-01	<3.5071E-01	<4.0875E-01	<3.8801E-01
C _{sd}	Concentration (mg/dscm)	<4.0457E-04	<3.5071E-04	<4.0875E-04	<3.8801E-04
C _a	Concentration (µg/m ³ (actual,wet))	<2.5712E-01	<2.2321E-01	<2.6048E-01	<2.4694E-01
C _{sd}	Concentration (µg/Nm ³ dry)	<4.3417E-01	<3.7638E-01	<4.3866E-01	<4.1640E-01
E _{lb/hr}	Rate (lb/hr)	<2.0403E-04	<1.7693E-04	<2.0121E-04	<1.9406E-04

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Marathon Petroleum Company
Clean Air Project No: 11265
FCCU Scrubber Stack

**USEPA Method 29
Arsenic (As) Emission Parameters (continued)
Separate Front and Back Half Results**

Run No.	1	2	3	Average
Date (2011)	Jul 19	Jul 19	Jul 19	
Start Time (approx.)	07:42	11:23	15:17	
Stop Time (approx.)	10:52	14:37	18:30	

Arsenic Results - Front Half

C _{sd}	Concentration (lb/dscf)	2.1629E-11	<1.8251E-11	2.1687E-11	<2.0522E-11
C _a	Concentration (lb/acf)	1.3746E-11	<1.1616E-11	1.3820E-11	<1.3061E-11
C _{sd}	Concentration (µg/dscm)	3.4635E-01	<2.9226E-01	3.4728E-01	<3.2863E-01
C _{sd}	Concentration (mg/dscm)	3.4635E-04	<2.9226E-04	3.4728E-04	<3.2863E-04
C _a	Concentration (µg/m ³ (actual,wet))	2.2013E-01	<1.8601E-01	2.2131E-01	<2.0915E-01
C _{sd}	Concentration (µg/Nm ³ dry)	3.7170E-01	<3.1365E-01	3.7269E-01	<3.5268E-01
E _{lb/hr}	Rate (lb/hr)	1.7467E-04	<1.4745E-04	1.7095E-04	<1.6436E-04

Arsenic Results - Back Half

C _{sd}	Concentration (lb/dscf)	<3.6351E-12	<3.6502E-12	<3.8384E-12	<3.7079E-12
C _a	Concentration (lb/acf)	<2.3103E-12	<2.3232E-12	<2.4461E-12	<2.3598E-12
C _{sd}	Concentration (µg/dscm)	<5.8211E-02	<5.8452E-02	<6.1466E-02	<5.9376E-02
C _{sd}	Concentration (mg/dscm)	<5.8211E-05	<5.8452E-05	<6.1466E-05	<5.9376E-05
C _a	Concentration (µg/m ³ (actual,wet))	<3.6996E-02	<3.7202E-02	<3.9170E-02	<3.7790E-02
C _{sd}	Concentration (µg/Nm ³ dry)	<6.2470E-02	<6.2729E-02	<6.5964E-02	<6.3721E-02
E _{lb/hr}	Rate (lb/hr)	<2.9357E-05	<2.9489E-05	<3.0257E-05	<2.9701E-05

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Marathon Petroleum Company
Clean Air Project No: 11265
FCCU Scrubber Stack

USEPA Method 29 Beryllium (Be) Emission Parameters

Run No.	1	2	3	Average
Date (2011)	Jul 19	Jul 19	Jul 19	
Start Time (approx.)	07:42	11:23	15:17	
Stop Time (approx.)	10:52	14:37	18:30	
Gas Conditions				
O ₂ Oxygen (dry volume %)	3.6000	3.3000	3.4000	3.4333
CO ₂ Carbon dioxide (dry volume %)	13.6000	13.5000	13.7000	13.6000
T _s Sample temperature (°F)	151.7222	151.4167	151.4167	151.5185
B _w Actual water vapor in gas (% by volume)	24.9714	24.9022	24.8059	24.8931
Gas Flow Rate				
Q _a Volumetric flow rate, actual (acfm)	211,786	211,558	206,160	209,835
Q _s Volumetric flow rate, standard (scfm)	179,399	179,295	174,721	177,805
Q _{std} Volumetric flow rate, dry standard (dscfm)	134,601	134,647	131,380	133,542
Q _a Volumetric flow rate, actual (acf/hr)	12,707,183	12,693,507	12,369,622	12,590,104
Q _s Volumetric flow rate, standard (scf/hr)	10,763,940	10,757,729	10,483,237	10,668,302
Q _{std} Volumetric flow rate, dry standard (dscf/hr)	8,076,037	8,078,821	7,882,775	8,012,545
Sampling Data				
V _{mstd} Volume metered, standard (dscf)	121.3177	120.8161	114.8926	119.0088
%I Isokinetic sampling (%)	104.1812	103.7148	101.0827	102.9929
Laboratory Data				
m _F Front half corrected for allowable blank (µg)	<0.2000	<0.2000	<0.2000	
m _B Back half corrected for allowable blank (µg)	<0.1000	<0.1000	<0.1000	
m _n Total matter corrected for allowable blanks (µg)	<0.3000	<0.3000	<0.3000	
Beryllium Results - Total				
C _{sd} Concentration (lb/dscf)	<5.4526E-12	<5.4753E-12	<5.7575E-12	<5.5618E-12
C _a Concentration (lb/acf)	<3.4654E-12	<3.4847E-12	<3.6691E-12	<3.5398E-12
C _{sd} Concentration (µg/dscm)	<8.7316E-02	<8.7679E-02	<9.2199E-02	<8.9065E-02
C _{sd} Concentration (mg/dscm)	<8.7316E-05	<8.7679E-05	<9.2199E-05	<8.9065E-05
C _a Concentration (µg/m ³ (actual,wet))	<5.5494E-02	<5.5803E-02	<5.8756E-02	<5.6684E-02
C _{sd} Concentration (µg/Nm ³ dry)	<9.3705E-02	<9.4094E-02	<9.8945E-02	<9.5582E-02
E _{lb/hr} Rate (lb/hr)	<4.4036E-05	<4.4234E-05	<4.5385E-05	<4.4552E-05

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Marathon Petroleum Company
Clean Air Project No: 11265
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USEPA Method 29
Beryllium (Be) Emission Parameters (continued)
Separate Front and Back Half Results

Run No.	1	2	3	Average
Date (2011)	Jul 19	Jul 19	Jul 19	
Start Time (approx.)	07:42	11:23	15:17	
Stop Time (approx.)	10:52	14:37	18:30	

Beryllium Results - Front Half

C _{sd}	Concentration (lb/dscf)	<3.6351E-12	<3.6502E-12	<3.8384E-12	<3.7079E-12
C _a	Concentration (lb/acf)	<2.3103E-12	<2.3232E-12	<2.4461E-12	<2.3598E-12
C _{sd}	Concentration (µg/dscm)	<5.8211E-02	<5.8452E-02	<6.1466E-02	<5.9376E-02
C _{sd}	Concentration (mg/dscm)	<5.8211E-05	<5.8452E-05	<6.1466E-05	<5.9376E-05
C _a	Concentration (µg/m ³ (actual,wet))	<3.6996E-02	<3.7202E-02	<3.9170E-02	<3.7790E-02
C _{sd}	Concentration (µg/Nm ³ dry)	<6.2470E-02	<6.2729E-02	<6.5964E-02	<6.3721E-02
E _{lb/hr}	Rate (lb/hr)	<2.9357E-05	<2.9489E-05	<3.0257E-05	<2.9701E-05

Beryllium Results - Back Half

C _{sd}	Concentration (lb/dscf)	<1.8175E-12	<1.8251E-12	<1.9192E-12	<1.8539E-12
C _a	Concentration (lb/acf)	<1.1551E-12	<1.1616E-12	<1.2230E-12	<1.1799E-12
C _{sd}	Concentration (µg/dscm)	<2.9105E-02	<2.9226E-02	<3.0733E-02	<2.9688E-02
C _{sd}	Concentration (mg/dscm)	<2.9105E-05	<2.9226E-05	<3.0733E-05	<2.9688E-05
C _a	Concentration (µg/m ³ (actual,wet))	<1.8498E-02	<1.8601E-02	<1.9585E-02	<1.8895E-02
C _{sd}	Concentration (µg/Nm ³ dry)	<3.1235E-02	<3.1365E-02	<3.2982E-02	<3.1861E-02
E _{lb/hr}	Rate (lb/hr)	<1.4679E-05	<1.4745E-05	<1.5128E-05	<1.4851E-05

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Marathon Petroleum Company
Clean Air Project No: 11265
FCCU Scrubber Stack

USEPA Method 29 Cadmium (Cd) Emission Parameters

Run No.	1	2	3	Average
Date (2011)	Jul 19	Jul 19	Jul 19	
Start Time (approx.)	07:42	11:23	15:17	
Stop Time (approx.)	10:52	14:37	18:30	
Gas Conditions				
O ₂ Oxygen (dry volume %)	3.6000	3.3000	3.4000	3.4333
CO ₂ Carbon dioxide (dry volume %)	13.6000	13.5000	13.7000	13.6000
T _s Sample temperature (°F)	151.7222	151.4167	151.4167	151.5185
B _w Actual water vapor in gas (% by volume)	24.9714	24.9022	24.8059	24.8931
Gas Flow Rate				
Q _a Volumetric flow rate, actual (acfm)	211,786	211,558	206,160	209,835
Q _s Volumetric flow rate, standard (scfm)	179,399	179,295	174,721	177,805
Q _{std} Volumetric flow rate, dry standard (dscfm)	134,601	134,647	131,380	133,542
Q _a Volumetric flow rate, actual (acf/hr)	12,707,183	12,693,507	12,369,622	12,590,104
Q _s Volumetric flow rate, standard (scf/hr)	10,763,940	10,757,729	10,483,237	10,668,302
Q _{std} Volumetric flow rate, dry standard (dscf/hr)	8,076,037	8,078,821	7,882,775	8,012,545
Sampling Data				
V _{mstd} Volume metered, standard (dscf)	121.3177	120.8161	114.8926	119.0088
%I Isokinetic sampling (%)	104.1812	103.7148	101.0827	102.9929
Laboratory Data				
m _F Front half corrected for allowable blank (µg)	0.1800	<0.1000	<0.1000	
m _B Back half corrected for allowable blank (µg)	<0.0500	<0.0500	0.0616	
m _n Total matter corrected for allowable blanks (µg)	<0.2300	<0.1500	<0.1616	
Cadmium Results - Total				
C _{sd} Concentration (lb/dscf)	<4.1803E-12	<2.7376E-12	<3.1014E-12	<3.3398E-12
C _a Concentration (lb/acf)	<2.6568E-12	<1.7424E-12	<1.9764E-12	<2.1252E-12
C _{sd} Concentration (µg/dscm)	<6.6942E-02	<4.3839E-02	<4.9665E-02	<5.3482E-02
C _{sd} Concentration (mg/dscm)	<6.6942E-05	<4.3839E-05	<4.9665E-05	<5.3482E-05
C _a Concentration (µg/m ³ (actual,wet))	<4.2545E-02	<2.7902E-02	<3.1650E-02	<3.4032E-02
C _{sd} Concentration (µg/Nm ³ dry)	<7.1841E-02	<4.7047E-02	<5.3299E-02	<5.7395E-02
E _{lb/hr} Rate (lb/hr)	<3.3761E-05	<2.2117E-05	<2.4448E-05	<2.6775E-05

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Marathon Petroleum Company
Clean Air Project No: 11265
FCCU Scrubber Stack

USEPA Method 29
Cadmium (Cd) Emission Parameters (continued)
Separate Front and Back Half Results

Run No.	1	2	3	Average
Date (2011)	Jul 19	Jul 19	Jul 19	
Start Time (approx.)	07:42	11:23	15:17	
Stop Time (approx.)	10:52	14:37	18:30	

Cadmium Results - Front Half

C _{sd}	Concentration (lb/dscf)	3.2716E-12	<1.8251E-12	<1.9192E-12	<2.3386E-12
C _a	Concentration (lb/acf)	2.0792E-12	<1.1616E-12	<1.2230E-12	<1.4880E-12
C _{sd}	Concentration (µg/dscm)	5.2390E-02	<2.9226E-02	<3.0733E-02	<3.7450E-02
C _{sd}	Concentration (mg/dscm)	5.2390E-05	<2.9226E-05	<3.0733E-05	<3.7450E-05
C _a	Concentration (µg/m ³ (actual,wet))	3.3296E-02	<1.8601E-02	<1.9585E-02	<2.3828E-02
C _{sd}	Concentration (µg/Nm ³ dry)	5.6223E-02	<3.1365E-02	<3.2982E-02	<4.0190E-02
E _{lb/hr}	Rate (lb/hr)	2.6421E-05	<1.4745E-05	<1.5128E-05	<1.8765E-05

Cadmium Results - Back Half

C _{sd}	Concentration (lb/dscf)	<9.0877E-13	<9.1254E-13	1.1822E-12	<1.0012E-12
C _a	Concentration (lb/acf)	<5.7757E-13	<5.8079E-13	7.5339E-13	<6.3725E-13
C _{sd}	Concentration (µg/dscm)	<1.4553E-02	<1.4613E-02	1.8932E-02	<1.6032E-02
C _{sd}	Concentration (mg/dscm)	<1.4553E-05	<1.4613E-05	1.8932E-05	<1.6032E-05
C _a	Concentration (µg/m ³ (actual,wet))	<9.2490E-03	<9.3006E-03	1.2064E-02	<1.0205E-02
C _{sd}	Concentration (µg/Nm ³ dry)	<1.5618E-02	<1.5682E-02	2.0317E-02	<1.7206E-02
E _{lb/hr}	Rate (lb/hr)	<7.3393E-06	<7.3723E-06	9.3191E-06	<8.0102E-06

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Marathon Petroleum Company
Clean Air Project No: 11265
FCCU Scrubber Stack

USEPA Method 29 Chromium (Cr) Emission Parameters

Run No.	1	2	3	Average
Date (2011)	Jul 19	Jul 19	Jul 19	
Start Time (approx.)	07:42	11:23	15:17	
Stop Time (approx.)	10:52	14:37	18:30	
Gas Conditions				
O ₂ Oxygen (dry volume %)	3.6000	3.3000	3.4000	3.4333
CO ₂ Carbon dioxide (dry volume %)	13.6000	13.5000	13.7000	13.6000
T _s Sample temperature (°F)	151.7222	151.4167	151.4167	151.5185
B _w Actual water vapor in gas (% by volume)	24.9714	24.9022	24.8059	24.8931
Gas Flow Rate				
Q _a Volumetric flow rate, actual (acfm)	211,786	211,558	206,160	209,835
Q _s Volumetric flow rate, standard (scfm)	179,399	179,295	174,721	177,805
Q _{std} Volumetric flow rate, dry standard (dscfm)	134,601	134,647	131,380	133,542
Q _a Volumetric flow rate, actual (acf/hr)	12,707,183	12,693,507	12,369,622	12,590,104
Q _s Volumetric flow rate, standard (scf/hr)	10,763,940	10,757,729	10,483,237	10,668,302
Q _{std} Volumetric flow rate, dry standard (dscf/hr)	8,076,037	8,078,821	7,882,775	8,012,545
Sampling Data				
V _{mstd} Volume metered, standard (dscf)	121.3177	120.8161	114.8926	119.0088
%I Isokinetic sampling (%)	104.1812	103.7148	101.0827	102.9929
Laboratory Data				
m _F Front half corrected for allowable blank (µg)	9.6200	7.9800	7.4100	
m _B Back half corrected for allowable blank (µg)	<0.1500	0.7210	<0.1500	
m _n Total matter corrected for allowable blanks (µg)	<9.7700	8.7010	<7.5600	
Chromium Results - Total				
C _{sd} Concentration (lb/dscf)	<1.7757E-10	1.5880E-10	<1.4509E-10	<1.6049E-10
C _a Concentration (lb/acf)	<1.1286E-10	1.0107E-10	<9.2461E-11	<1.0213E-10
C _{sd} Concentration (µg/dscm)	<2.8436E+00	2.5430E+00	<2.3234E+00	<2.5700E+00
C _{sd} Concentration (mg/dscm)	<2.8436E-03	2.5430E-03	<2.3234E-03	<2.5700E-03
C _a Concentration (µg/m ³ (actual,wet))	<1.8072E+00	1.6185E+00	<1.4806E+00	<1.6355E+00
C _{sd} Concentration (µg/Nm ³ dry)	<3.0517E+00	2.7290E+00	<2.4934E+00	<2.7580E+00
E _{lb/hr} Rate (lb/hr)	<1.4341E-03	1.2829E-03	<1.1437E-03	<1.2869E-03

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Marathon Petroleum Company
Clean Air Project No: 11265
FCCU Scrubber Stack

USEPA Method 29
Chromium (Cr) Emission Parameters (continued)
Separate Front and Back Half Results

Run No.	1	2	3	Average
Date (2011)	Jul 19	Jul 19	Jul 19	
Start Time (approx.)	07:42	11:23	15:17	
Stop Time (approx.)	10:52	14:37	18:30	

Chromium Results - Front Half

C _{sd}	Concentration (lb/dscf)	1.7485E-10	1.4564E-10	1.4221E-10	1.5423E-10
C _a	Concentration (lb/acf)	1.1112E-10	9.2694E-11	9.0627E-11	9.8148E-11
C _{sd}	Concentration (µg/dscm)	2.7999E+00	2.3323E+00	2.2773E+00	2.4698E+00
C _{sd}	Concentration (mg/dscm)	2.7999E-03	2.3323E-03	2.2773E-03	2.4698E-03
C _a	Concentration (µg/m ³ (actual,wet))	1.7795E+00	1.4844E+00	1.4513E+00	1.5717E+00
C _{sd}	Concentration (µg/Nm ³ dry)	3.0048E+00	2.5029E+00	2.4440E+00	2.6506E+00
E _{lb/hr}	Rate (lb/hr)	1.4121E-03	1.1766E-03	1.1210E-03	1.2366E-03

Chromium Results - Back Half

C _{sd}	Concentration (lb/dscf)	<2.7263E-12	1.3159E-11	<2.8788E-12	<6.2547E-12
C _a	Concentration (lb/acf)	<1.7327E-12	8.3750E-12	<1.8346E-12	<3.9808E-12
C _{sd}	Concentration (µg/dscm)	<4.3658E-02	2.1072E-01	<4.6100E-02	<1.0016E-01
C _{sd}	Concentration (mg/dscm)	<4.3658E-05	2.1072E-04	<4.6100E-05	<1.0016E-04
C _a	Concentration (µg/m ³ (actual,wet))	<2.7747E-02	1.3411E-01	<2.9378E-02	<6.3746E-02
C _{sd}	Concentration (µg/Nm ³ dry)	<4.6853E-02	2.2614E-01	<4.9473E-02	<1.0749E-01
E _{lb/hr}	Rate (lb/hr)	<2.2018E-05	1.0631E-04	<2.2693E-05	<5.0340E-05

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Marathon Petroleum Company
Clean Air Project No: 11265
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USEPA Method 29 Cobalt (Co) Emission Parameters

Run No.	1	2	3	Average
Date (2011)	Jul 19	Jul 19	Jul 19	
Start Time (approx.)	07:42	11:23	15:17	
Stop Time (approx.)	10:52	14:37	18:30	
Gas Conditions				
O ₂ Oxygen (dry volume %)	3.6000	3.3000	3.4000	3.4333
CO ₂ Carbon dioxide (dry volume %)	13.6000	13.5000	13.7000	13.6000
T _s Sample temperature (°F)	151.7222	151.4167	151.4167	151.5185
B _w Actual water vapor in gas (% by volume)	24.9714	24.9022	24.8059	24.8931
Gas Flow Rate				
Q _a Volumetric flow rate, actual (acfm)	211,786	211,558	206,160	209,835
Q _s Volumetric flow rate, standard (scfm)	179,399	179,295	174,721	177,805
Q _{std} Volumetric flow rate, dry standard (dscfm)	134,601	134,647	131,380	133,542
Q _a Volumetric flow rate, actual (acf/hr)	12,707,183	12,693,507	12,369,622	12,590,104
Q _s Volumetric flow rate, standard (scf/hr)	10,763,940	10,757,729	10,483,237	10,668,302
Q _{std} Volumetric flow rate, dry standard (dscf/hr)	8,076,037	8,078,821	7,882,775	8,012,545
Sampling Data				
V _{mstd} Volume metered, standard (dscf)	121.3177	120.8161	114.8926	119.0088
%I Isokinetic sampling (%)	104.1812	103.7148	101.0827	102.9929
Laboratory Data				
m _F Front half corrected for allowable blank (µg)	1.4000	1.2200	1.2500	
m _B Back half corrected for allowable blank (µg)	<0.1000	<0.1000	<0.1000	
m _n Total matter corrected for allowable blanks (µg)	<1.5000	<1.3200	<1.3500	
Cobalt Results - Total				
C _{sd} Concentration (lb/dscf)	<2.7263E-11	<2.4091E-11	<2.5909E-11	<2.5754E-11
C _a Concentration (lb/acf)	<1.7327E-11	<1.5333E-11	<1.6511E-11	<1.6390E-11
C _{sd} Concentration (µg/dscm)	<4.3658E-01	<3.8579E-01	<4.1490E-01	<4.1242E-01
C _{sd} Concentration (mg/dscm)	<4.3658E-04	<3.8579E-04	<4.1490E-04	<4.1242E-04
C _a Concentration (µg/m ³ (actual,wet))	<2.7747E-01	<2.4553E-01	<2.6440E-01	<2.6247E-01
C _{sd} Concentration (µg/Nm ³ dry)	<4.6853E-01	<4.1401E-01	<4.4525E-01	<4.4260E-01
E _{lb/hr} Rate (lb/hr)	<2.2018E-04	<1.9463E-04	<2.0423E-04	<2.0635E-04

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Marathon Petroleum Company
Clean Air Project No: 11265
FCCU Scrubber Stack

USEPA Method 29
Cobalt (Co) Emission Parameters (continued)
Separate Front and Back Half Results

Run No.	1	2	3	Average
Date (2011)	Jul 19	Jul 19	Jul 19	
Start Time (approx.)	07:42	11:23	15:17	
Stop Time (approx.)	10:52	14:37	18:30	

Cobalt Results - Front Half

C _{sd}	Concentration (lb/dscf)	2.5446E-11	2.2266E-11	2.3990E-11	2.3900E-11
C _a	Concentration (lb/acf)	1.6172E-11	1.4171E-11	1.5288E-11	1.5210E-11
C _{sd}	Concentration (µg/dscm)	4.0748E-01	3.5656E-01	3.8416E-01	3.8273E-01
C _{sd}	Concentration (mg/dscm)	4.0748E-04	3.5656E-04	3.8416E-04	3.8273E-04
C _a	Concentration (µg/m ³ (actual,wet))	2.5897E-01	2.2693E-01	2.4482E-01	2.4357E-01
C _{sd}	Concentration (µg/Nm ³ dry)	4.3729E-01	3.8265E-01	4.1227E-01	4.1074E-01
E _{lb/hr}	Rate (lb/hr)	2.0550E-04	1.7988E-04	1.8911E-04	1.9150E-04

Cobalt Results - Back Half

C _{sd}	Concentration (lb/dscf)	<1.8175E-12	<1.8251E-12	<1.9192E-12	<1.8539E-12
C _a	Concentration (lb/acf)	<1.1551E-12	<1.1616E-12	<1.2230E-12	<1.1799E-12
C _{sd}	Concentration (µg/dscm)	<2.9105E-02	<2.9226E-02	<3.0733E-02	<2.9688E-02
C _{sd}	Concentration (mg/dscm)	<2.9105E-05	<2.9226E-05	<3.0733E-05	<2.9688E-05
C _a	Concentration (µg/m ³ (actual,wet))	<1.8498E-02	<1.8601E-02	<1.9585E-02	<1.8895E-02
C _{sd}	Concentration (µg/Nm ³ dry)	<3.1235E-02	<3.1365E-02	<3.2982E-02	<3.1861E-02
E _{lb/hr}	Rate (lb/hr)	<1.4679E-05	<1.4745E-05	<1.5128E-05	<1.4851E-05

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Marathon Petroleum Company
Clean Air Project No: 11265
FCCU Scrubber Stack

USEPA Method 29 Lead (Pb) Emission Parameters

Run No.	1	2	3	Average
Date (2011)	Jul 19	Jul 19	Jul 19	
Start Time (approx.)	07:42	11:23	15:17	
Stop Time (approx.)	10:52	14:37	18:30	
Gas Conditions				
O ₂ Oxygen (dry volume %)	3.6000	3.3000	3.4000	3.4333
CO ₂ Carbon dioxide (dry volume %)	13.6000	13.5000	13.7000	13.6000
T _s Sample temperature (°F)	151.7222	151.4167	151.4167	151.5185
B _w Actual water vapor in gas (% by volume)	24.9714	24.9022	24.8059	24.8931
Gas Flow Rate				
Q _a Volumetric flow rate, actual (acfm)	211,786	211,558	206,160	209,835
Q _s Volumetric flow rate, standard (scfm)	179,399	179,295	174,721	177,805
Q _{std} Volumetric flow rate, dry standard (dscfm)	134,601	134,647	131,380	133,542
Q _a Volumetric flow rate, actual (acf/hr)	12,707,183	12,693,507	12,369,622	12,590,104
Q _s Volumetric flow rate, standard (scf/hr)	10,763,940	10,757,729	10,483,237	10,668,302
Q _{std} Volumetric flow rate, dry standard (dscf/hr)	8,076,037	8,078,821	7,882,775	8,012,545
Sampling Data				
V _{mstd} Volume metered, standard (dscf)	121.3177	120.8161	114.8926	119.0088
%I Isokinetic sampling (%)	104.1812	103.7148	101.0827	102.9929
Laboratory Data				
m _F Front half corrected for allowable blank (µg)	10.5220	6.8620	5.0420	
m _B Back half corrected for allowable blank (µg)	0.3331	0.4251	0.1561	
m _n Total matter corrected for allowable blanks (µg)	10.8551	7.2871	5.1981	
Lead Results - Total				
C _{sd} Concentration (lb/dscf)	1.9730E-10	1.3300E-10	9.9761E-11	1.4335E-10
C _a Concentration (lb/acf)	1.2539E-10	8.4646E-11	6.3575E-11	9.1204E-11
C _{sd} Concentration (µg/dscm)	3.1594E+00	2.1297E+00	1.5975E+00	2.2956E+00
C _{sd} Concentration (mg/dscm)	3.1594E-03	2.1297E-03	1.5975E-03	2.2956E-03
C _a Concentration (µg/m ³ (actual,wet))	2.0080E+00	1.3555E+00	1.0181E+00	1.4605E+00
C _{sd} Concentration (µg/Nm ³ dry)	3.3906E+00	2.2856E+00	1.7144E+00	2.4635E+00
E _{lb/hr} Rate (lb/hr)	1.5934E-03	1.0745E-03	7.8639E-04	1.1514E-03

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Marathon Petroleum Company
Clean Air Project No: 11265
FCCU Scrubber Stack

USEPA Method 29
Lead (Pb) Emission Parameters (continued)
Separate Front and Back Half Results

Run No.	1	2	3	Average
Date (2011)	Jul 19	Jul 19	Jul 19	
Start Time (approx.)	07:42	11:23	15:17	
Stop Time (approx.)	10:52	14:37	18:30	

Lead Results - Front Half

C _{sd}	Concentration (lb/dscf)	1.9124E-10	1.2524E-10	9.6765E-11	1.3775E-10
C _a	Concentration (lb/acf)	1.2154E-10	7.9708E-11	6.1665E-11	8.7639E-11
C _{sd}	Concentration (µg/dscm)	3.0625E+00	2.0055E+00	1.5496E+00	2.2058E+00
C _{sd}	Concentration (mg/dscm)	3.0625E-03	2.0055E-03	1.5496E-03	2.2058E-03
C _a	Concentration (µg/m ³ (actual,wet))	1.9464E+00	1.2764E+00	9.8749E-01	1.4034E+00
C _{sd}	Concentration (µg/Nm ³ dry)	3.2866E+00	2.1522E+00	1.6629E+00	2.3672E+00
E _{lb/hr}	Rate (lb/hr)	1.5445E-03	1.0118E-03	7.6278E-04	1.1063E-03

Lead Results - Back Half

C _{sd}	Concentration (lb/dscf)	6.0542E-12	7.7584E-12	2.9958E-12	5.6028E-12
C _a	Concentration (lb/acf)	3.8478E-12	4.9379E-12	1.9092E-12	3.5649E-12
C _{sd}	Concentration (µg/dscm)	9.6950E-02	1.2424E-01	4.7974E-02	8.9722E-02
C _{sd}	Concentration (mg/dscm)	9.6950E-05	1.2424E-04	4.7974E-05	8.9722E-05
C _a	Concentration (µg/m ³ (actual,wet))	6.1617E-02	7.9073E-02	3.0573E-02	5.7087E-02
C _{sd}	Concentration (µg/Nm ³ dry)	1.0404E-01	1.3333E-01	5.1485E-02	9.6287E-02
E _{lb/hr}	Rate (lb/hr)	4.8894E-05	6.2679E-05	2.3616E-05	4.5063E-05

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Marathon Petroleum Company
Clean Air Project No: 11265
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USEPA Method 29 Manganese (Mn) Emission Parameters

Run No.	1	2	3	Average
Date (2011)	Jul 19	Jul 19	Jul 19	
Start Time (approx.)	07:42	11:23	15:17	
Stop Time (approx.)	10:52	14:37	18:30	
Gas Conditions				
O ₂ Oxygen (dry volume %)	3.6000	3.3000	3.4000	3.4333
CO ₂ Carbon dioxide (dry volume %)	13.6000	13.5000	13.7000	13.6000
T _s Sample temperature (°F)	151.7222	151.4167	151.4167	151.5185
B _w Actual water vapor in gas (% by volume)	24.9714	24.9022	24.8059	24.8931
Gas Flow Rate				
Q _a Volumetric flow rate, actual (acfm)	211,786	211,558	206,160	209,835
Q _s Volumetric flow rate, standard (scfm)	179,399	179,295	174,721	177,805
Q _{std} Volumetric flow rate, dry standard (dscfm)	134,601	134,647	131,380	133,542
Q _a Volumetric flow rate, actual (acf/hr)	12,707,183	12,693,507	12,369,622	12,590,104
Q _s Volumetric flow rate, standard (scf/hr)	10,763,940	10,757,729	10,483,237	10,668,302
Q _{std} Volumetric flow rate, dry standard (dscf/hr)	8,076,037	8,078,821	7,882,775	8,012,545
Sampling Data				
V _{mstd} Volume metered, standard (dscf)	121.3177	120.8161	114.8926	119.0088
%I Isokinetic sampling (%)	104.1812	103.7148	101.0827	102.9929
Laboratory Data				
m _F Front half corrected for allowable blank (µg)	1.6260	1.3160	1.1560	
m _B Back half corrected for allowable blank (µg)	0.2730	44.1000	0.3030	
m _n Total matter corrected for allowable blanks (µg)	1.8990	45.4160	1.4590	
Manganese Results - Total				
C _{sd} Concentration (lb/dscf)	3.4515E-11	8.2888E-10	2.8001E-11	2.9713E-10
C _a Concentration (lb/acf)	2.1936E-11	5.2754E-10	1.7844E-11	1.8911E-10
C _{sd} Concentration (µg/dscm)	5.5271E-01	1.3273E+01	4.4840E-01	4.7582E+00
C _{sd} Concentration (mg/dscm)	5.5271E-04	1.3273E-02	4.4840E-04	4.7582E-03
C _a Concentration (µg/m ³ (actual,wet))	3.5128E-01	8.4479E+00	2.8575E-01	3.0283E+00
C _{sd} Concentration (µg/Nm ³ dry)	5.9315E-01	1.4245E+01	4.8120E-01	5.1063E+00
E _{lb/hr} Rate (lb/hr)	2.7875E-04	6.6964E-03	2.2072E-04	2.3986E-03

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Clean Air Project No: 11265
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USEPA Method 29
Manganese (Mn) Emission Parameters (continued)
Separate Front and Back Half Results

Run No.	1	2	3	Average
Date (2011)	Jul 19	Jul 19	Jul 19	
Start Time (approx.)	07:42	11:23	15:17	
Stop Time (approx.)	10:52	14:37	18:30	

Manganese Results - Front Half

C _{sd}	Concentration (lb/dscf)	2.9553E-11	2.4018E-11	2.2186E-11	2.5252E-11
C _a	Concentration (lb/acf)	1.8783E-11	1.5286E-11	1.4138E-11	1.6069E-11
C _{sd}	Concentration (µg/dscm)	4.7325E-01	3.8462E-01	3.5527E-01	4.0438E-01
C _{sd}	Concentration (mg/dscm)	4.7325E-04	3.8462E-04	3.5527E-04	4.0438E-04
C _a	Concentration (µg/m ³ (actual,wet))	3.0078E-01	2.4479E-01	2.2641E-01	2.5732E-01
C _{sd}	Concentration (µg/Nm ³ dry)	5.0788E-01	4.1276E-01	3.8127E-01	4.3397E-01
E _{lb/hr}	Rate (lb/hr)	2.3867E-04	1.9404E-04	1.7489E-04	2.0253E-04

Manganese Results - Back Half

C _{sd}	Concentration (lb/dscf)	4.9619E-12	8.0486E-10	5.8151E-12	2.7188E-10
C _a	Concentration (lb/acf)	3.1535E-12	5.1226E-10	3.7058E-12	1.7304E-10
C _{sd}	Concentration (µg/dscm)	7.9458E-02	1.2889E+01	9.3121E-02	4.3538E+00
C _{sd}	Concentration (mg/dscm)	7.9458E-05	1.2889E-02	9.3121E-05	4.3538E-03
C _a	Concentration (µg/m ³ (actual,wet))	5.0499E-02	8.2031E+00	5.9343E-02	2.7710E+00
C _{sd}	Concentration (µg/Nm ³ dry)	8.5272E-02	1.3832E+01	9.9935E-02	4.6724E+00
E _{lb/hr}	Rate (lb/hr)	4.0072E-05	6.5024E-03	4.5839E-05	2.1961E-03

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FCCU Scrubber Stack

USEPA Method 29 Nickel (Ni) Emission Parameters

Run No.	1	2	3	Average
Date (2011)	Jul 19	Jul 19	Jul 19	
Start Time (approx.)	07:42	11:23	15:17	
Stop Time (approx.)	10:52	14:37	18:30	
Gas Conditions				
O ₂ Oxygen (dry volume %)	3.6000	3.3000	3.4000	3.4333
CO ₂ Carbon dioxide (dry volume %)	13.6000	13.5000	13.7000	13.6000
T _s Sample temperature (°F)	151.7222	151.4167	151.4167	151.5185
B _w Actual water vapor in gas (% by volume)	24.9714	24.9022	24.8059	24.8931
Gas Flow Rate				
Q _a Volumetric flow rate, actual (acfm)	211,786	211,558	206,160	209,835
Q _s Volumetric flow rate, standard (scfm)	179,399	179,295	174,721	177,805
Q _{std} Volumetric flow rate, dry standard (dscfm)	134,601	134,647	131,380	133,542
Q _a Volumetric flow rate, actual (acf/hr)	12,707,183	12,693,507	12,369,622	12,590,104
Q _s Volumetric flow rate, standard (scf/hr)	10,763,940	10,757,729	10,483,237	10,668,302
Q _{std} Volumetric flow rate, dry standard (dscf/hr)	8,076,037	8,078,821	7,882,775	8,012,545
Sampling Data				
V _{mstd} Volume metered, standard (dscf)	121.3177	120.8161	114.8926	119.0088
%I Isokinetic sampling (%)	104.1812	103.7148	101.0827	102.9929
Laboratory Data				
m _F Front half corrected for allowable blank (µg)	32.5050	30.8050	28.4050	
m _B Back half corrected for allowable blank (µg)	0.4160	0.7300	0.3480	
m _n Total matter corrected for allowable blanks (µg)	32.9210	31.5350	28.7530	
Nickel Results - Total				
C _{sd} Concentration (lb/dscf)	5.9835E-10	5.7554E-10	5.5182E-10	5.7524E-10
C _a Concentration (lb/acf)	3.8028E-10	3.6631E-10	3.5166E-10	3.6608E-10
C _{sd} Concentration (µg/dscm)	9.5818E+00	9.2165E+00	8.8367E+00	9.2117E+00
C _{sd} Concentration (mg/dscm)	9.5818E-03	9.2165E-03	8.8367E-03	9.2117E-03
C _a Concentration (µg/m ³ (actual,wet))	6.0897E+00	5.8659E+00	5.6313E+00	5.8623E+00
C _{sd} Concentration (µg/Nm ³ dry)	1.0283E+01	9.8909E+00	9.4833E+00	9.8857E+00
E _{lb/hr} Rate (lb/hr)	4.8323E-03	4.6497E-03	4.3499E-03	4.6106E-03

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Marathon Petroleum Company
Clean Air Project No: 11265
FCCU Scrubber Stack

USEPA Method 29
Nickel (Ni) Emission Parameters (continued)
Separate Front and Back Half Results

Run No.	1	2	3	Average
Date (2011)	Jul 19	Jul 19	Jul 19	
Start Time (approx.)	07:42	11:23	15:17	
Stop Time (approx.)	10:52	14:37	18:30	

Nickel Results - Front Half

C _{sd}	Concentration (lb/dscf)	5.9079E-10	5.6222E-10	5.4514E-10	5.6605E-10
C _a	Concentration (lb/acf)	3.7548E-10	3.5783E-10	3.4740E-10	3.6024E-10
C _{sd}	Concentration (µg/dscm)	9.4607E+00	9.0031E+00	8.7297E+00	9.0645E+00
C _{sd}	Concentration (mg/dscm)	9.4607E-03	9.0031E-03	8.7297E-03	9.0645E-03
C _a	Concentration (µg/m ³ (actual,wet))	6.0127E+00	5.7301E+00	5.5632E+00	5.7687E+00
C _{sd}	Concentration (µg/Nm ³ dry)	1.0153E+01	9.6619E+00	9.3685E+00	9.7278E+00
E _{lb/hr}	Rate (lb/hr)	4.7713E-03	4.5421E-03	4.2972E-03	4.5369E-03

Nickel Results - Back Half

C _{sd}	Concentration (lb/dscf)	7.5610E-12	1.3323E-11	6.6788E-12	9.1876E-12
C _a	Concentration (lb/acf)	4.8054E-12	8.4796E-12	4.2562E-12	5.8470E-12
C _{sd}	Concentration (µg/dscm)	1.2108E-01	2.1335E-01	1.0695E-01	1.4713E-01
C _{sd}	Concentration (mg/dscm)	1.2108E-04	2.1335E-04	1.0695E-04	1.4713E-04
C _a	Concentration (µg/m ³ (actual,wet))	7.6951E-02	1.3579E-01	6.8157E-02	9.3632E-02
C _{sd}	Concentration (µg/Nm ³ dry)	1.2994E-01	2.2896E-01	1.1478E-01	1.5789E-01
E _{lb/hr}	Rate (lb/hr)	6.1063E-05	1.0764E-04	5.2647E-05	7.3782E-05

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Marathon Petroleum Company
Clean Air Project No: 11265
FCCU Scrubber Stack

USEPA Method 29 Selenium (Se) Emission Parameters

Run No.	1	2	3	Average
Date (2011)	Jul 19	Jul 19	Jul 19	
Start Time (approx.)	07:42	11:23	15:17	
Stop Time (approx.)	10:52	14:37	18:30	
Gas Conditions				
O ₂ Oxygen (dry volume %)	3.6000	3.3000	3.4000	3.4333
CO ₂ Carbon dioxide (dry volume %)	13.6000	13.5000	13.7000	13.6000
T _s Sample temperature (°F)	151.7222	151.4167	151.4167	151.5185
B _w Actual water vapor in gas (% by volume)	24.9714	24.9022	24.8059	24.8931
Gas Flow Rate				
Q _a Volumetric flow rate, actual (acfm)	211,786	211,558	206,160	209,835
Q _s Volumetric flow rate, standard (scfm)	179,399	179,295	174,721	177,805
Q _{std} Volumetric flow rate, dry standard (dscfm)	134,601	134,647	131,380	133,542
Q _a Volumetric flow rate, actual (acf/hr)	12,707,183	12,693,507	12,369,622	12,590,104
Q _s Volumetric flow rate, standard (scf/hr)	10,763,940	10,757,729	10,483,237	10,668,302
Q _{std} Volumetric flow rate, dry standard (dscf/hr)	8,076,037	8,078,821	7,882,775	8,012,545
Sampling Data				
V _{mstd} Volume metered, standard (dscf)	121.3177	120.8161	114.8926	119.0088
%I Isokinetic sampling (%)	104.1812	103.7148	101.0827	102.9929
Laboratory Data				
m _F Front half corrected for allowable blank (µg)	4.1100	3.6600	3.9500	
m _B Back half corrected for allowable blank (µg)	<1.0000	<1.0000	<1.0000	
m _n Total matter corrected for allowable blanks (µg)	<5.1100	<4.6600	<4.9500	
Selenium Results - Total				
C _{sd} Concentration (lb/dscf)	<9.2876E-11	<8.5049E-11	<9.5000E-11	<9.0975E-11
C _a Concentration (lb/acf)	<5.9028E-11	<5.4130E-11	<6.0540E-11	<5.7899E-11
C _{sd} Concentration (µg/dscm)	<1.4873E+00	<1.3619E+00	<1.5213E+00	<1.4568E+00
C _{sd} Concentration (mg/dscm)	<1.4873E-03	<1.3619E-03	<1.5213E-03	<1.4568E-03
C _a Concentration (µg/m ³ (actual,wet))	<9.4524E-01	<8.6681E-01	<9.6947E-01	<9.2717E-01
C _{sd} Concentration (µg/Nm ³ dry)	<1.5961E+00	<1.4616E+00	<1.6326E+00	<1.5634E+00
E _{lb/hr} Rate (lb/hr)	<7.5007E-04	<6.8710E-04	<7.4886E-04	<7.2868E-04

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Marathon Petroleum Company
Clean Air Project No: 11265
FCCU Scrubber Stack

USEPA Method 29
Selenium (Se) Emission Parameters (continued)
Separate Front and Back Half Results

Run No.	1	2	3	Average
Date (2011)	Jul 19	Jul 19	Jul 19	
Start Time (approx.)	07:42	11:23	15:17	
Stop Time (approx.)	10:52	14:37	18:30	

Selenium Results - Front Half

C _{sd}	Concentration (lb/dscf)	7.4701E-11	6.6798E-11	7.5808E-11	7.2436E-11
C _a	Concentration (lb/acf)	4.7476E-11	4.2514E-11	4.8310E-11	4.6100E-11
C _{sd}	Concentration (µg/dscm)	1.1962E+00	1.0697E+00	1.2140E+00	1.1600E+00
C _{sd}	Concentration (mg/dscm)	1.1962E-03	1.0697E-03	1.2140E-03	1.1600E-03
C _a	Concentration (µg/m ³ (actual,wet))	7.6026E-01	6.8080E-01	7.7362E-01	7.3823E-01
C _{sd}	Concentration (µg/Nm ³ dry)	1.2838E+00	1.1479E+00	1.3028E+00	1.2448E+00
E _{lb/hr}	Rate (lb/hr)	6.0329E-04	5.3965E-04	5.9758E-04	5.8017E-04

Selenium Results - Back Half

C _{sd}	Concentration (lb/dscf)	<1.8175E-11	<1.8251E-11	<1.9192E-11	<1.8539E-11
C _a	Concentration (lb/acf)	<1.1551E-11	<1.1616E-11	<1.2230E-11	<1.1799E-11
C _{sd}	Concentration (µg/dscm)	<2.9105E-01	<2.9226E-01	<3.0733E-01	<2.9688E-01
C _{sd}	Concentration (mg/dscm)	<2.9105E-04	<2.9226E-04	<3.0733E-04	<2.9688E-04
C _a	Concentration (µg/m ³ (actual,wet))	<1.8498E-01	<1.8601E-01	<1.9585E-01	<1.8895E-01
C _{sd}	Concentration (µg/Nm ³ dry)	<3.1235E-01	<3.1365E-01	<3.2982E-01	<3.1861E-01
E _{lb/hr}	Rate (lb/hr)	<1.4679E-04	<1.4745E-04	<1.5128E-04	<1.4851E-04

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Marathon Petroleum Company
Clean Air Project No: 11265
FCCU Scrubber Stack

ASTM D6784-02 (Mercury) **Sampling, Velocity and Moisture Parameters**

Run No.	1	2	3	Average
Date (2011)	Jul 15	Jul 15	Jul 16	
Start Time (approx.)	09:00	13:27	08:40	
Stop Time (approx.)	13:14	16:04	11:07	

Sampling Conditions

Y_d	Dry gas meter correction factor	0.9992	0.9992	0.9992	
C_p	Pitot tube coefficient	0.8200	0.8200	0.8200	
P_g	Static pressure (in. H ₂ O)	-0.3000	-0.3000	-0.4000	
A_s	Sample location area (ft ²)	70.8822	70.8822	70.8822	
P_{bar}	Barometric pressure (in. Hg)	29.40	29.40	29.45	29.4167
D_n	Nozzle diameter (in.)	0.2500	0.2500	0.2500	
O_2	Oxygen (dry volume %)	3.6000	4.0000	3.5000	3.7000
CO_2	Carbon dioxide (dry volume %)	13.4000	13.0000	13.7000	13.3667
N_2+CO	Nitrogen plus carbon monoxide (dry volume %)	83.0000	83.0000	82.8000	82.9333
V_{lc}	Total Liquid collected (ml)	577.30	558.90	552.80	
V_m	Volume metered, meter conditions (ft ³)	90.9700	88.7990	86.8400	
T_m	Dry gas meter temperature (°F)	103.1042	107.7083	102.3958	
T_s	Sample temperature (°F)	149.6250	149.7917	149.8750	149.7639
ΔH	Meter box orifice pressure drop (in. H ₂ O)	1.6333	1.5292	1.4917	
θ	Total sampling time (min)	120.0	120.0	120.0	

Flow Results

V_{wstd}	Volume of water collected (ft ³)	27.1677	26.3018	26.0148	26.4948
V_{mstd}	Volume metered, standard (dscf)	84.0578	81.3652	80.4504	81.9578
P_s	Sample gas pressure, absolute (in. Hg)	29.3779	29.3779	29.4206	29.3922
P_v	Vapor pressure, actual (in. Hg)	7.5027	7.5338	7.5494	7.5286
B_{wo}	Moisture measured in sample (% by volume)	24.4258	24.4289	24.4350	24.4299
B_{ws}	Saturated moisture content (% by volume)	25.5387	25.6444	25.6602	25.6144
B_w	Actual water vapor in gas (% by volume)	24.4258	24.4289	24.4350	24.4299
$\sqrt{\Delta P}$	Velocity head ($\sqrt{\text{in. H}_2\text{O}}$)	0.8306	0.8164	0.8062	0.8178
M_d	MW of sample gas, dry (lb/lb-mole)	30.2880	30.2400	30.3320	30.2867
M_s	MW of sample gas, wet (lb/lb-mole)	27.2866	27.2499	27.3187	27.2850
V_s	Velocity of sample (ft/sec)	50.7781	49.9520	49.2325	49.9875
%I	Isokinetic sampling (%)	105.0057	103.3554	103.5591	103.9734
Q_a	Volumetric flow rate, actual (acfm)	215,956	212,442	209,383	212,594
Q_s	Volumetric flow rate, standard (scfm)	183,652	180,615	178,247	180,838
Q_{std}	Volumetric flow rate, dry standard (dscfm)	138,794	136,493	134,693	136,660
Q_a	Volumetric flow rate, actual (acf/hr)	12,957,346	12,746,545	12,562,955	12,755,615
Q_s	Volumetric flow rate, standard (scf/hr)	11,019,121	10,836,891	10,694,849	10,850,287
Q_{std}	Volumetric flow rate, dry standard (dscf/hr)	8,327,613	8,189,562	8,081,563	8,199,580

Comments:

Average includes 3 runs.

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ASTM D6784-02 Mercury (Hg) Emission Parameters

Run No.		1	2	3	Average
Date (2011)		Jul 15	Jul 15	Jul 16	
Start Time (approx.)		09:00	13:27	08:40	
Stop Time (approx.)		13:14	16:04	11:07	
Gas Conditions					
O ₂	Oxygen (dry volume %)	3.6000	4.0000	3.5000	3.7000
CO ₂	Carbon dioxide (dry volume %)	13.4000	13.0000	13.7000	13.3667
T _s	Sample temperature (°F)	149.6250	149.7917	149.8750	149.7639
B _w	Actual water vapor in gas (% by volume)	24.4258	24.4289	24.4350	24.4299
Gas Flow Rate					
Q _a	Volumetric flow rate, actual (acfm)	215,956	212,442	209,383	212,594
Q _s	Volumetric flow rate, standard (scfm)	183,652	180,615	178,247	180,838
Q _{std}	Volumetric flow rate, dry standard (dscfm)	138,794	136,493	134,693	136,660
Q _a	Volumetric flow rate, actual (acf/hr)	12,957,346	12,746,545	12,562,955	12,755,615
Q _s	Volumetric flow rate, standard (scf/hr)	11,019,121	10,836,891	10,694,849	10,850,287
Q _{std}	Volumetric flow rate, dry standard (dscf/hr)	8,327,613	8,189,562	8,081,563	8,199,580
Sampling Data					
V _{mstd}	Volume metered, standard (dscf)	84.0578	81.3652	80.4504	81.9578
%I	Isokinetic sampling (%)	105.0057	103.3554	103.5591	103.9734
Laboratory Data					
Hg _{particle}	Total Particulate Bound Mercury (µg)	<0.0650	<0.0650	<0.0650	<0.0650
n _{MDL}	Number of non-detectable fractions	2 out of 2	2 out of 2	2 out of 2	
DLC	Detection level classification	BDL	BDL	BDL	
Hg _O	Total Oxidized Mercury (µg)	0.8930	<0.0500	<0.0500	<0.3310
n _{MDL}	Number of non-detectable fractions	N/A	1 out of 1	1 out of 1	
DLC	Detection level classification	ADL	BDL	BDL	
Hg _E	Total Elemental Mercury (µg)	1.2505	0.0655	0.1150	0.4770
n _{MDL}	Number of non-detectable fractions	1 out of 2	1 out of 2	1 out of 2	
DLC	Detection level classification	DLL	DLL	DLL	
m _n	Total Mercury (µg)	<2.2085	<0.1805	<0.2300	<0.8730
n _{MDL}	Number of non-detectable fractions	3 out of 5	4 out of 5	4 out of 5	
DLC	Detection level classification	DLL	DLL	DLL	

Comments:

Detection level classifications are defined as follows:

ADL = Above Detection Level - all fractions are above detection limit

DLL = Detection Level Limited - some fractions are below detection limit

BDL = Below Detection Limit - all fractions are below detection limit

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ASTM D6784-02 **Mercury (Hg) Emission Parameters (continued)**

Run No.	1	2	3	Average
Date (2011)	Jul 15	Jul 15	Jul 16	
Start Time (approx.)	09:00	13:27	08:40	
Stop Time (approx.)	13:14	16:04	11:07	

Total Mercury Results

C _{sd}	Concentration (lb/dscf)	<5.7933E-11	<4.8913E-12	<6.3036E-12	<2.3043E-11
C _a	Concentration (lb/acf)	<3.7233E-11	<3.1426E-12	<4.0550E-12	<1.4810E-11
C _{sd}	Concentration (µg/dscm)	<9.2772E-01	<7.8327E-02	<1.0094E-01	<3.6900E-01
C _{sd}	Concentration (mg/dscm)	<9.2772E-04	<7.8327E-05	<1.0094E-04	<3.6900E-04
C _a	Concentration (µg/m ³ (actual, wet))	<5.9624E-01	<5.0325E-02	<6.4935E-02	<2.3717E-01
C _{sd}	Concentration (µg/Nm ³ dry)	<9.9560E-01	<8.4058E-02	<1.0833E-01	<3.9600E-01
E _{lb/hr}	Rate (lb/hr)	<4.8244E-04	<4.0057E-05	<5.0943E-05	<1.9115E-04

Particulate Bound Mercury Results

C _{sd}	Concentration (lb/dscf)	<1.7051E-12	<1.7615E-12	<1.7815E-12	<1.7494E-12
C _a	Concentration (lb/acf)	<1.0958E-12	<1.1318E-12	<1.1460E-12	<1.1245E-12
C _{sd}	Concentration (µg/dscm)	<2.7304E-02	<2.8208E-02	<2.8529E-02	<2.8014E-02
C _{sd}	Concentration (mg/dscm)	<2.7304E-05	<2.8208E-05	<2.8529E-05	<2.8014E-05
C _a	Concentration (µg/m ³ (actual, wet))	<1.7548E-02	<1.8123E-02	<1.8352E-02	<1.8008E-02
C _{sd}	Concentration (µg/Nm ³ dry)	<2.9302E-02	<3.0272E-02	<3.0616E-02	<3.0063E-02
E _{lb/hr}	Rate (lb/hr)	<1.4199E-05	<1.4426E-05	<1.4398E-05	<1.4341E-05

Oxidized Mercury Results

C _{sd}	Concentration (lb/dscf)	2.3425E-11	<1.3550E-12	<1.3704E-12	<8.7168E-12
C _a	Concentration (lb/acf)	1.5055E-11	<8.7058E-13	<8.8156E-13	<5.6024E-12
C _{sd}	Concentration (µg/dscm)	3.7512E-01	<2.1698E-02	<2.1945E-02	<1.3959E-01
C _{sd}	Concentration (mg/dscm)	3.7512E-04	<2.1698E-05	<2.1945E-05	<1.3959E-04
C _a	Concentration (µg/m ³ (actual, wet))	2.4109E-01	<1.3941E-02	<1.4117E-02	<8.9715E-02
C _{sd}	Concentration (µg/Nm ³ dry)	4.0257E-01	<2.3286E-02	<2.3551E-02	<1.4980E-01
E _{lb/hr}	Rate (lb/hr)	1.9508E-04	<1.1097E-05	<1.1075E-05	<7.2416E-05

Elemental Mercury Results

C _{sd}	Concentration (lb/dscf)	3.2803E-11	1.7748E-12	3.1517E-12	1.2576E-11
C _a	Concentration (lb/acf)	2.1082E-11	1.1403E-12	2.0274E-12	8.0833E-12
C _{sd}	Concentration (µg/dscm)	5.2529E-01	2.8421E-02	5.0470E-02	2.0139E-01
C _{sd}	Concentration (mg/dscm)	5.2529E-04	2.8421E-05	5.0470E-05	2.0139E-04
C _a	Concentration (µg/m ³ (actual, wet))	3.3760E-01	1.8260E-02	3.2466E-02	1.2944E-01
C _{sd}	Concentration (µg/Nm ³ dry)	5.6373E-01	3.0500E-02	5.4162E-02	2.1613E-01
E _{lb/hr}	Rate (lb/hr)	2.7317E-04	1.4535E-05	2.5470E-05	1.0439E-04

Marathon Petroleum Company
Clean Air Project No: 11265
FCCU Scrubber Stack

**USEPA SW-846 Method 0061 (Hexavalent Chromium)
Sampling, Velocity and Moisture Parameters**

Run No.	1	2	3	Average
Date (2011)	Jul 15	Jul 15	Jul 16	
Start Time (approx.)	08:58	14:06	08:36	
Stop Time (approx.)	13:06	17:42	12:21	
Sampling Conditions				
Y _d Dry gas meter correction factor	0.9827	0.9827	0.9827	
C _p Pitot tube coefficient	0.8190	0.8190	0.8190	
P _g Static pressure (in. H ₂ O)	-0.3000	-0.3000	-0.4000	
A _s Sample location area (ft ²)	70.8822	70.8822	70.8822	
P _{bar} Barometric pressure (in. Hg)	29.40	29.40	29.45	29.4167
D _n Nozzle diameter (in.)	0.2500	0.2500	0.2500	
O ₂ Oxygen (dry volume %)	4.2000	3.6000	3.6000	3.8000
CO ₂ Carbon dioxide (dry volume %)	12.9000	13.3000	13.5000	13.2333
N ₂ +CO Nitrogen plus carbon monoxide (dry volume %)	82.9000	83.1000	82.9000	82.9667
V _{lc} Total Liquid collected (ml)	786.10	716.50	783.80	
V _m Volume metered, meter conditions (ft ³)	128.2300	120.8700	124.5750	
T _m Dry gas meter temperature (°F)	103.5833	111.1667	106.7917	
T _s Sample temperature (°F)	150.0556	150.2500	150.0556	150.1204
ΔH Meter box orifice pressure drop (in. H ₂ O)	1.6139	1.4111	1.4944	
θ Total sampling time (min)	180.0	180.0	180.0	
Flow Results				
V _{wstd} Volume of water collected (ft ³)	36.9939	33.7185	36.8856	35.8660
V _{mstd} Volume metered, standard (dscf)	116.4254	108.2312	112.6237	112.4268
P _s Sample gas pressure, absolute (in. Hg)	29.3779	29.3779	29.4206	29.3922
P _v Vapor pressure, actual (in. Hg)	7.5832	7.6198	7.5832	7.5954
B _{w0} Moisture measured in sample (% by volume)	24.1129	23.7538	24.6711	24.1793
B _{ws} Saturated moisture content (% by volume)	25.8126	25.9372	25.7752	25.8417
B _w Actual water vapor in gas (% by volume)	24.1129	23.7538	24.6711	24.1793
√ΔP Velocity head (√in. H ₂ O)	0.8101	0.7821	0.7906	0.7943
M _d MW of sample gas, dry (lb/lb-mole)	30.2320	30.2720	30.3040	30.2693
M _s MW of sample gas, wet (lb/lb-mole)	27.2825	27.3569	27.2685	27.3026
V _s Velocity of sample (ft/sec)	49.4839	47.7183	48.2737	48.4920
%I Isokinetic sampling (%)	99.1552	95.1672	98.9072	97.7432
Q _a Volumetric flow rate, actual (acfm)	210,452	202,943	205,305	206,233
Q _s Volumetric flow rate, standard (scfm)	178,845	172,409	174,724	175,326
Q _{std} Volumetric flow rate, dry standard (dscfm)	135,720	131,455	131,618	132,931
Q _a Volumetric flow rate, actual (acf/hr)	12,627,108	12,176,570	12,318,274	12,373,984
Q _s Volumetric flow rate, standard (scf/hr)	10,730,704	10,344,533	10,483,449	10,519,562
Q _{std} Volumetric flow rate, dry standard (dscf/hr)	8,143,218	7,887,310	7,897,064	7,975,864

Comments:

Average includes 3 runs.

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Marathon Petroleum Company
Clean Air Project No: 11265
FCCU Scrubber Stack

USEPA SW-846 Method 0061 (Hexavalent Chromium) Cr⁺⁶ Parameters

Run No.	1	2	3	Average
Date (2011)	Jul 15	Jul 15	Jul 16	
Start Time (approx.)	08:58	14:06	08:36	
Stop Time (approx.)	13:06	17:42	12:21	
Process Conditions				
R _P Production rate (bbl/hr)	2,173	2,171	2,154	2,166
P ₁ Coke burn rate (1000 lb/hr)	34.452	34.473	34.428	34.451
Gas Conditions				
O ₂ Oxygen (dry volume %)	4.2000	3.6000	3.6000	3.8000
CO ₂ Carbon dioxide (dry volume %)	12.9000	13.3000	13.5000	13.2333
T _s Sample temperature (°F)	150.0556	150.2500	150.0556	150.1204
B _w Actual water vapor in gas (% by volume)	24.1129	23.7538	24.6711	24.1793
Gas Flow Rate				
Q _a Volumetric flow rate, actual (acfm)	210,452	202,943	205,305	206,233
Q _s Volumetric flow rate, standard (scfm)	178,845	172,409	174,724	175,326
Q _{std} Volumetric flow rate, dry standard (dscfm)	135,720	131,455	131,618	132,931
Q _a Volumetric flow rate, actual (acf/hr)	12,627,108	12,176,570	12,318,274	12,373,984
Q _s Volumetric flow rate, standard (scf/hr)	10,730,704	10,344,533	10,483,449	10,519,562
Q _{std} Volumetric flow rate, dry standard (dscf/hr)	8,143,218	7,887,310	7,897,064	7,975,864
Sampling Data				
V _{mstd} Volume metered, standard (dscf)	116.4254	108.2312	112.6237	112.4268
%I Isokinetic sampling (%)	99.1552	95.1672	98.9072	97.7432
Laboratory Data				
m _n Total Cr ⁺⁶ collected (µg)	<0.4860	<0.5340	<0.5400	<0.5200
Hexavalent Chromium (Cr⁺⁶) Results				
C _{sd} Cr ⁺⁶ Concentration (lb/dscf)	<9.2044E-12	<1.0879E-11	<1.0572E-11	<1.0219E-11
C _a Cr ⁺⁶ Concentration (lb/acf)	<5.9359E-12	<7.0470E-12	<6.7778E-12	<6.5869E-12
C _{sd} Cr ⁺⁶ Concentration (gr/dscf)	<6.4410E-08	<7.6130E-08	<7.3983E-08	<7.1508E-08
C _a Cr ⁺⁶ Concentration (gr/acf)	<4.1538E-08	<4.9313E-08	<4.7429E-08	<4.6093E-08
C _{sd} Cr ⁺⁶ Concentration (µg/dscm)	<1.4740E-01	<1.7422E-01	<1.6930E-01	<1.6364E-01
C _a Cr ⁺⁶ Concentration (µg/m ³ (actual,wet))	<9.5056E-02	<1.1285E-01	<1.0854E-01	<1.0548E-01
C _{sd} Cr ⁺⁶ Concentration (µg/Nm ³ dry)	<1.5818E-01	<1.8696E-01	<1.8169E-01	<1.7561E-01
E _{lb/hr} Cr ⁺⁶ Rate (lb/hr)	<7.4954E-05	<8.5808E-05	<8.3491E-05	<8.1417E-05

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Marathon Petroleum Company
Clean Air Project No: 11265
FCCU Scrubber Stack

USEPA Method 26A (Halides / Halogens) Sampling, Velocity and Moisture Parameters

Run No.	1	2	3	Average
Date (2011)	Jul 20	Jul 20	Jul 21	
Start Time (approx.)	09:49	12:50	07:54	
Stop Time (approx.)	12:18	15:10	10:07	
Sampling Conditions				
Y _d Dry gas meter correction factor	0.9925	0.9925	0.9925	
C _p Pitot tube coefficient	0.8270	0.8270	0.8270	
P _g Static pressure (in. H ₂ O)	-0.3000	-0.3000	-0.5000	
A _s Sample location area (ft ²)	70.8822	70.8822	70.8822	
P _{bar} Barometric pressure (in. Hg)	29.30	29.30	29.35	29.3167
D _n Nozzle diameter (in.)	0.2500	0.2500	0.2500	
O ₂ Oxygen (dry volume %)	3.6500	3.7000	3.7000	3.6833
CO ₂ Carbon dioxide (dry volume %)	13.9000	13.7000	13.6500	13.7500
N ₂ +CO Nitrogen plus carbon monoxide (dry volume %)	82.4500	82.6000	82.6500	82.5667
V _{lc} Total Liquid collected (ml)	500.50	507.10	519.30	
V _m Volume metered, meter conditions (ft ³)	78.8300	79.9500	80.9500	
T _m Dry gas meter temperature (°F)	110.0417	115.7708	107.4167	
T _s Sample temperature (°F)	147.0000	147.0000	147.3333	147.1111
ΔH Meter box orifice pressure drop (in. H ₂ O)	1.3500	1.3333	1.4250	
θ Total sampling time (min)	120.0	120.0	120.0	
Flow Results				
V _{wstd} Volume of water collected (ft ³)	23.5535	23.8641	24.4383	23.9520
V _{mstd} Volume metered, standard (dscf)	71.1788	71.4688	73.5698	72.0724
P _s Sample gas pressure, absolute (in. Hg)	29.2779	29.2779	29.3132	29.2897
P _v Vapor pressure, actual (in. Hg)	7.0275	7.0275	7.0864	7.0471
B _{w0} Moisture measured in sample (% by volume)	24.8633	25.0324	24.9349	24.9435
B _{ws} Saturated moisture content (% by volume)	24.0027	24.0027	24.1747	24.0600
B _w Actual water vapor in gas (% by volume)	24.0027	24.0027	24.1747	24.0600
√ΔP Velocity head (√in. H ₂ O)	0.7646	0.7594	0.7809	0.7683
M _d MW of sample gas, dry (lb/lb-mole)	30.3700	30.3400	30.3320	30.3473
M _s MW of sample gas, wet (lb/lb-mole)	27.4009	27.3781	27.3508	27.3766
V _s Velocity of sample (ft/sec)	47.0240	46.7213	48.0525	47.2659
%I Isokinetic sampling (%)	95.3946	96.4038	96.6443	96.1476
Q _a Volumetric flow rate, actual (acfm)	199,990	198,702	204,364	201,019
Q _s Volumetric flow rate, standard (scfm)	170,228	169,133	174,066	171,142
Q _{std} Volumetric flow rate, dry standard (dscfm)	129,369	128,536	131,986	129,964
Q _a Volumetric flow rate, actual (acf/hr)	11,999,391	11,922,148	12,261,830	12,061,123
Q _s Volumetric flow rate, standard (scf/hr)	10,213,706	10,147,959	10,443,937	10,268,534
Q _{std} Volumetric flow rate, dry standard (dscf/hr)	7,762,144	7,712,178	7,919,148	7,797,823

Comments:

Average includes 3 runs.

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Marathon Petroleum Company
Clean Air Project No: 11265
FCCU Scrubber Stack

USEPA Method 26A HCl Parameters

Run No.	1	2	3	Average
Date (2011)	Jul 20	Jul 20	Jul 21	
Start Time (approx.)	09:49	12:50	07:54	
Stop Time (approx.)	12:18	15:10	10:07	
Gas Conditions				
O ₂ Oxygen (dry volume %)	3.6500	3.7000	3.7000	3.6833
CO ₂ Carbon dioxide (dry volume %)	13.9000	13.7000	13.6500	13.7500
T _s Sample temperature (°F)	147.0000	147.0000	147.3333	147.1111
B _w Actual water vapor in gas (% by volume)	24.0027	24.0027	24.1747	24.0600
Gas Flow Rate				
Q _a Volumetric flow rate, actual (acfm)	199,990	198,702	204,364	201,019
Q _s Volumetric flow rate, standard (scfm)	170,228	169,133	174,066	171,142
Q _{std} Volumetric flow rate, dry standard (dscfm)	129,369	128,536	131,986	129,964
Q _a Volumetric flow rate, actual (acf/hr)	11,999,391	11,922,148	12,261,830	12,061,123
Q _s Volumetric flow rate, standard (scf/hr)	10,213,706	10,147,959	10,443,937	10,268,534
Q _{std} Volumetric flow rate, dry standard (dscf/hr)	7,762,144	7,712,178	7,919,148	7,797,823
Sampling Data				
V _{mstd} Volume metered, standard (dscf)	71.1788	71.4688	73.5698	72.0724
%I Isokinetic sampling (%)	95.3946	96.4038	96.6443	96.1476
Laboratory Data				
m _n Total HCl collected (mg)	0.1425	0.0944	0.1557	
Hydrogen Chloride (HCl) Results				
C _{sd} HCl Concentration (lb/dscf)	4.4138E-09	2.9116E-09	4.6678E-09	3.9977E-09
C _a HCl Concentration (lb/acf)	2.8552E-09	1.8834E-09	3.0147E-09	2.5844E-09
C _{sd} HCl Concentration (ppmdv)	0.0467	0.0308	0.0494	0.0423
C _w HCl Concentration (ppmwv)	0.0355	0.0234	0.0374	0.0321
C _{sd} HCl Concentration (mg/dscm)	0.0707	0.0466	0.0747	0.0640
C _a HCl Concentration (mg/m ³ (actual,wet))	0.0457	0.0302	0.0483	0.0414
C _{sd} HCl Concentration (mg/Nm ³ dry)	0.0759	0.0500	0.0802	0.0687
E _{lb/hr} HCl Rate (lb/hr)	0.0343	0.0225	0.0370	0.0312

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USEPA Method 26A Cl₂ Parameters

Run No.	1	2	3	Average
Date (2011)	Jul 20	Jul 20	Jul 21	
Start Time (approx.)	09:49	12:50	07:54	
Stop Time (approx.)	12:18	15:10	10:07	
Gas Conditions				
O ₂ Oxygen (dry volume %)	3.6500	3.7000	3.7000	3.6833
CO ₂ Carbon dioxide (dry volume %)	13.9000	13.7000	13.6500	13.7500
T _s Sample temperature (°F)	147.0000	147.0000	147.3333	147.1111
B _w Actual water vapor in gas (% by volume)	24.0027	24.0027	24.1747	24.0600
Gas Flow Rate				
Q _a Volumetric flow rate, actual (acfm)	199,990	198,702	204,364	201,019
Q _s Volumetric flow rate, standard (scfm)	170,228	169,133	174,066	171,142
Q _{std} Volumetric flow rate, dry standard (dscfm)	129,369	128,536	131,986	129,964
Q _a Volumetric flow rate, actual (acf/hr)	11,999,391	11,922,148	12,261,830	12,061,123
Q _s Volumetric flow rate, standard (scf/hr)	10,213,706	10,147,959	10,443,937	10,268,534
Q _{std} Volumetric flow rate, dry standard (dscf/hr)	7,762,144	7,712,178	7,919,148	7,797,823
Sampling Data				
V _{mstd} Volume metered, standard (dscf)	71.1788	71.4688	73.5698	72.0724
%I Isokinetic sampling (%)	95.3946	96.4038	96.6443	96.1476
Laboratory Data				
m _n Total Cl ₂ collected (mg)	<0.0079	<0.0072	<0.0067	
Chlorine (Cl₂) Results				
C _{sd} Chlorine Concentration (lb/dscf)	<2.4535E-10	<2.2214E-10	<1.9961E-10	<2.2237E-10
C _a Chlorine Concentration (lb/acf)	<1.5871E-10	<1.4370E-10	<1.2892E-10	<1.4377E-10
C _{sd} Chlorine Concentration (ppmdv)	<0.0013	<0.0012	<0.0011	<0.0012
C _w Chlorine Concentration (ppmwv)	<0.0010	<0.0009	<0.0008	<0.0009
C _{sd} Chlorine Concentration (mg/dscm)	<0.0039	<0.0036	<0.0032	<0.0036
C _a Chlorine Concentration (mg/m ³ (actual,wet))	<0.0025	<0.0023	<0.0021	<0.0023
C _{sd} Chlorine Concentration (mg/Nm ³ dry)	<0.0042	<0.0038	<0.0034	<0.0038
E _{lb/hr} Chlorine Rate (lb/hr)	<0.0019	<0.0017	<0.0016	<0.0017

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USEPA Method 26A HF Parameters

Run No.	1	2	3	Average
Date (2011)	Jul 20	Jul 20	Jul 21	
Start Time (approx.)	09:49	12:50	07:54	
Stop Time (approx.)	12:18	15:10	10:07	
Gas Conditions				
O ₂ Oxygen (dry volume %)	3.6500	3.7000	3.7000	3.6833
CO ₂ Carbon dioxide (dry volume %)	13.9000	13.7000	13.6500	13.7500
T _s Sample temperature (°F)	147.0000	147.0000	147.3333	147.1111
B _w Actual water vapor in gas (% by volume)	24.0027	24.0027	24.1747	24.0600
Gas Flow Rate				
Q _a Volumetric flow rate, actual (acfm)	199,990	198,702	204,364	201,019
Q _s Volumetric flow rate, standard (scfm)	170,228	169,133	174,066	171,142
Q _{std} Volumetric flow rate, dry standard (dscfm)	129,369	128,536	131,986	129,964
Q _a Volumetric flow rate, actual (acf/hr)	11,999,391	11,922,148	12,261,830	12,061,123
Q _s Volumetric flow rate, standard (scf/hr)	10,213,706	10,147,959	10,443,937	10,268,534
Q _{std} Volumetric flow rate, dry standard (dscf/hr)	7,762,144	7,712,178	7,919,148	7,797,823
Sampling Data				
V _{mstd} Volume metered, standard (dscf)	71.1788	71.4688	73.5698	72.0724
%I Isokinetic sampling (%)	95.3946	96.4038	96.6443	96.1476
Laboratory Data				
m _n Total HF collected (mg)	<0.0083	<0.0086	<0.0085	
Hydrogen Fluoride (HF) Results				
C _{sd} HF Concentration (lb/dscf)	<2.5835E-10	<2.6510E-10	<2.5500E-10	<2.5949E-10
C _a HF Concentration (lb/acf)	<1.6712E-10	<1.7149E-10	<1.6469E-10	<1.6777E-10
C _{sd} HF Concentration (ppmdv)	<0.0050	<0.0051	<0.0049	<0.0050
C _w HF Concentration (ppmwv)	<0.0038	<0.0039	<0.0037	<0.0038
C _{sd} HF Concentration (mg/dscm)	<0.0041	<0.0042	<0.0041	<0.0042
C _a HF Concentration (mg/m ³ (actual,wet))	<0.0027	<0.0027	<0.0026	<0.0027
C _{sd} HF Concentration (mg/Nm ³ dry)	<0.0044	<0.0046	<0.0044	<0.0045
E _{lb/hr} HF Rate (lb/hr)	<0.0020	<0.0020	<0.0020	<0.0020

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Marathon Petroleum Company
Clean Air Project No: 11265
FCCU Scrubber Stack

USEPA OTM-29 (Cyanide) Sampling, Velocity and Moisture Parameters

Run No.	1	2	3	Average
Date (2011)	Jul 20.	Jul 20	Jul 21	
Start Time (approx.)	09:36	12:29	07:56	
Stop Time (approx.)	10:57	14:01	09:15	
Sampling Conditions				
Y _d Dry gas meter correction factor	0.9827	0.9827	0.9827	
C _p Pitot tube coefficient	0.8190	0.8190	0.8190	
P _g Static pressure (in. H ₂ O)	-0.3000	-0.3000	-0.5000	
A _s Sample location area (ft ²)	70.8822	70.8822	70.8822	
P _{bar} Barometric pressure (in. Hg)	29.30	29.30	29.35	29.3167
D _n Nozzle diameter (in.)	0.2330	0.2330	0.2330	
O ₂ Oxygen (dry volume %)	3.8000	3.8000	3.8000	3.8000
CO _{2,out} Carbon dioxide, sample train outlet (dry volume %)	9.8000	9.8000	9.7000	9.7667
CO _{2,in} Carbon dioxide, flue gas (dry volume %) ¹	13.9000	13.7000	13.6500	13.7500
N ₂ +CO Nitrogen plus carbon monoxide (dry volume %)	86.4000	86.4000	86.5000	86.4333
V _{lc} Total Liquid collected (ml)	308.20	301.30	319.60	
V _m Volume metered, meter conditions (ft ³)	35.4550	33.5150	36.2550	
T _m Dry gas meter temperature (°F)	106.4583	111.2500	103.8750	
T _s Sample temperature (°F)	150.4167	151.1667	151.0000	150.8611
ΔH Meter box orifice pressure drop (in. H ₂ O)	1.0025	0.9333	1.0925	
θ Total sampling time (min)	60.0	60.0	60.0	
Flow Results				
V _{wstd} Volume of water collected (ft ³)	14.5039	14.1792	15.0404	14.5745
V _{mstd} Volume metered, standard (dscf)	33.3881	31.2185	34.3025	32.9697
P _s Sample gas pressure, absolute (in. Hg)	29.2779	29.2779	29.3132	29.2897
P _v Vapor pressure, actual (in. Hg)	7.6513	7.7943	7.7623	7.7360
B _{wo} Moisture measured in sample (% by volume) ²	30.2846	31.2333	30.4814	30.6664
B _{ws} Saturated moisture content (% by volume)	26.1333	26.6218	26.4807	26.4119
B _w Actual water vapor in gas (% by volume)	26.1333	26.6218	26.4807	26.4119
√ΔP Velocity head (√in. H ₂ O)	0.7666	0.7507	0.8041	0.7738
M _d MW of sample gas, dry (lb/lb-mole)	31.5240	31.4360	31.4420	31.4673
M _s MW of sample gas, wet (lb/lb-mole)	27.9897	27.8591	27.8825	27.9104
V _s Velocity of sample (ft/sec)	46.3238	45.4983	48.6761	46.8327
%I Isokinetic sampling (%)	108.2095	103.8269	106.2740	106.1035
Q _a Volumetric flow rate, actual (acfm)	197,012	193,501	207,016	199,176
Q _s Volumetric flow rate, standard (scfm)	166,755	163,583	175,266	168,535
Q _{std} Volumetric flow rate, dry standard (dscfm)	123,177	120,034	128,855	124,022
Q _a Volumetric flow rate, actual (acf/hr)	11,820,726	11,610,078	12,420,954	11,950,586
Q _s Volumetric flow rate, standard (scf/hr)	10,005,312	9,814,955	10,515,982	10,112,083
Q _{std} Volumetric flow rate, dry standard (dscf/hr)	7,390,594	7,202,035	7,731,278	7,441,303

Comments:

Average includes 3 runs.

¹ Sample train CO₂ levels biased low due to CO₂ absorption. Actual flue gas CO₂ obtained from concurrent M-26A run.

² Sample train B_{wo} levels biased high due to CO₂ absorption. Actual flue gas B_{wo} obtained from saturation assumption.

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USEPA OTM-29 HCN Parameters

Run No.	1	2	3	Average
Date (2011)	Jul 20	Jul 20	Jul 21	
Start Time (approx.)	09:36	12:29	07:56	
Stop Time (approx.)	10:57	14:01	09:15	
Gas Conditions				
O ₂ Oxygen (dry volume %)	3.8000	3.8000	3.8000	3.8000
CO _{2,in} Carbon dioxide, flue gas (dry volume %) ¹	13.9000	13.7000	13.6500	13.7500
T _s Sample temperature (°F)	150.4167	151.1667	151.0000	150.8611
B _w Actual water vapor in gas (% by volume)	26.1333	26.6218	26.4807	26.4119
Gas Flow Rate				
Q _a Volumetric flow rate, actual (acfm)	197,012	193,501	207,016	199,176
Q _s Volumetric flow rate, standard (scfm)	166,755	163,583	175,266	168,535
Q _{std} Volumetric flow rate, dry standard (dscfm)	123,177	120,034	128,855	124,022
Q _a Volumetric flow rate, actual (acf/hr)	11,820,726	11,610,078	12,420,954	11,950,586
Q _s Volumetric flow rate, standard (scf/hr)	10,005,312	9,814,955	10,515,982	10,112,083
Q _{std} Volumetric flow rate, dry standard (dscf/hr)	7,390,594	7,202,035	7,731,278	7,441,303
Sampling Data				
V _{mstd} Volume metered, standard (dscf)	33.3881	31.2185	34.3025	32.9697
%I Isokinetic sampling (%)	108.2095	103.8269	106.2740	106.1035
Laboratory Data				
m _n Total HCN collected (µg)	2115.6384	4473.1555	5850.3097	
Hydrogen Cyanide (HCN) Results				
C _{sd} HCN Concentration (lb/dscf)	1.3972E-07	3.1594E-07	3.7606E-07	2.7724E-07
C _a HCN Concentration (lb/acf)	8.7356E-08	1.9599E-07	2.3408E-07	1.7247E-07
C _{sd} HCN Concentration (ppmdv)	1.9929	4.5066	5.3641	3.9545
C _{sd} HCN Concentration (mg/dscm)	2.2374	5.0594	6.0221	4.4397
C _a HCN Concentration (mg/m3 (actual,wet))	1.3989	3.1385	3.7484	2.7619
C _{sd} HCN Concentration (mg/Nm3 dry)	2.4011	5.4296	6.4628	4.7645
C _{sd} HCN Concentration (µg/dscm)	2237.4218	5059.4089	6022.1479	4439.6595
C _a HCN Concentration (µg/m3 (actual,wet))	1398.8884	3138.4838	3748.4160	2761.9294
C _{sd} HCN Concentration (µg/Nm3 dry)	2401.1356	5429.6095	6462.7929	4764.5127
E _{lb/hr} HCN Rate (lb/hr)	1.0326	2.2754	2.9075	2.0718

Comments:

¹ Sample train CO₂ levels biased low due to CO₂ absorption. Actual flue gas CO₂ obtained from concurrent M-26A run.

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QA/QC DATA

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I hereby certify that all pages contained within this Appendix have been reviewed and, to the best of my ability, verified accurate.

QA/QC Initials: SB

Date: 9/14



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Clean Air Project No: 11265
FCCU Scrubber Stack

USEPA SW-846 Method 0011 (Aldehydes) QA/QC Results

Run No.	1	2	3	Matrix Spike*
Date (2011)	Jul 13	Jul 13	Jul 14	Jul 14
Start Time (approx.)	09:55	13:16	08:56	11:51
Stop Time (approx.)	12:02	15:36	11:09	14:10
Total Duration of Test Run (min.)	127	140	133	139
Net Sampling Time (min.)	120	120	120	120

Sampling System Calibration Summary

	Nozzle ID No:	250-1	250-1	233-1	233-1
D _n	Nozzle Diameter (in):	0.250	0.250	0.233	0.233
	Probe ID No:	66-4-7	66-4-7	66-4-7	66-4-7
C _p	Pitot Coefficient:	0.8270	0.8270	0.8270	0.8270
	Meter Box ID. No:	66-14	66-14	66-14	66-14
Y _d	Meter Box Yd - Field Sheet	0.9882	0.9882	0.9882	0.9882
	Meter Box Yd - Database	0.9882	0.9882	0.9882	0.9882
	Meter Box ΔH@ - Field Sheet	1.7571	1.7571	1.7571	1.7571
	Meter Box ΔH@ - Database	1.7571	1.7571	1.7571	1.7571

QA/QC

Final Leak Check

(a) 4% of Sampling Rate (cfm)	0.0270	0.0267	0.0242	0.0237
(b) Allowable Rate from Method (cfm)	0.0200	0.0200	0.0200	0.0200
Allowable Limit - minimum of a and b (cfm)	0.0200	0.0200	0.0200	0.0200
Actual Final Leak Rate (cfm)	0.0050	0.0030	0.0030	0.0030

Sample Volume

V _{mstd}	Minimum Volume Required (dscf)	45.90	45.90	45.90	45.90
	Actual Sample Volume (dscf)	74.946	72.831	67.215	64.893

Alternative Method 5 Post-Test Calibration (EPA ALT-009)

√ΔH _{avg}	Average of Square Root of ΔH (in. W.C.)	1.1907	1.1847	1.0694	1.0365
Y _{qa}	Alternative Meter Calibration Factor	1.0086	1.0240	1.0123	1.0100
	Variation from full-test Y _d (average ≤ ±5%)	2.1%	3.6%	2.4%	2.2%
					Average 2.6%

Mean Isokinetic Sampling Rate Variation

	Minimum Allowable (%)	90	90	90	90
	Maximum Allowable (%)	110	110	110	110
%I	Actual Variation (%)	98.48	95.00	96.70	96.60

Point-by-Point Isokinetic Variation

	Number of points <90%	1	4	1	0
	Number of points >110%	0	0	0	0
	Number of points <80%	0	0	0	0
	Number of points >120%	0	0	0	0

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Clean Air Project No: 11265
FCCU Scrubber Stack

**USEPA SW-846 Method 0010 (SVOC / PAH)
QA/QC Results**

Run No.	1	2	3
Date (2011)	Jul 15	Jul 15	Jul 16
Start Time (approx.)	08:57	15:55	08:36
Stop Time (approx.)	14:49	20:55	12:59
Total Duration of Test Run (min.)	352	300	263
Net Sampling Time (min.)	240	240	240

Sampling System Calibration Summary

	Nozzle ID No:	250-1	250-1	250-1
D _n	Nozzle Diameter (in):	0.250	0.250	0.250
	Probe ID No:	66-4-7	66-4-7	66-4-7
C _p	Pitot Coefficient:	0.8270	0.8270	0.8270
	Meter Box ID. No:	66-14	66-14	85-3
Y _d	Meter Box Yd - Field Sheet	0.9882	0.9882	0.9925
	Meter Box Yd - Database	0.9882	0.9882	0.9925
	Meter Box ΔH@ - Field Sheet	1.7571	1.7571	1.7792
	Meter Box ΔH@ - Database	1.7571	1.7571	1.7792

QA/QC

Final Leak Check

(a) 4% of Sampling Rate (cfm)	0.0273	0.0272	0.0275
(b) Allowable Rate from Method (cfm)	0.0200	0.0200	0.0200
Allowable Limit - minimum of a and b (cfm)	0.0200	0.0200	0.0200
Actual Final Leak Rate (cfm)	0.0020	0.0040	0.0030

Sample Volume

	Minimum Volume Required (dscf)	141.00	141.00	141.00
V _{mstd}	Actual Sample Volume (dscf)	149.909	147.733	149.768

Alternative Method 5 Post-Test Calibration (EPA ALT-009)

√ΔH _{avg}	Average of Square Root of ΔH (in. W.C.)	1.2094	1.1899	1.1991
Y _{qa}	Alternative Meter Calibration Factor	1.0202	1.0109	1.0022
	Variation from full-test Y _d (average ≤ ±5%)	3.2%	2.3%	1.0%

**Average
2.2%**

Mean Isokinetic Sampling Rate Variation

	Minimum Allowable (%)	90	90	90
	Maximum Allowable (%)	110	110	110
%I	Actual Variation (%)	97.32	96.32	97.26

Point-by-Point Isokinetic Variation

	Number of points <90%	3	8	1
	Number of points >110%	2	0	1
	Number of points <80%	2	0	1
	Number of points >120%	0	0	1

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Clean Air Project No: 11265
FCCU Scrubber Stack

USEPA Method 23 (PCDD/PCDF/PCB) QA/QC Results

Run No.	1	2	3
Date (2011)	Jul 20	Jul 20	Jul 21
Start Time (approx.)	07:59	11:50	07:53
Stop Time (approx.)	11:12	15:22	11:09
Total Duration of Test Run (min.)	193	212	196
Net Sampling Time (min.)	180	180	180

Sampling System Calibration Summary

	Nozzle ID No:	250-1	250-1	250-1
D _n	Nozzle Diameter (in):	0.250	0.250	0.250
	Probe ID No:	67-4-4	67-4-4	67-4-4
C _p	Pitot Coefficient:	0.8200	0.8200	0.8200
	Meter Box ID. No:	61-5	61-5	61-5
Y _d	Meter Box Yd - Field Sheet	0.9992	0.9992	0.9992
	Meter Box Yd - Database	0.9992	0.9992	0.9992
	Meter Box ΔH@ - Field Sheet	1.7185	1.7185	1.7185
	Meter Box ΔH@ - Database	1.7185	1.7185	1.7185

QA/QC

Final Leak Check

(a) 4% of Sampling Rate (cfm)	0.0278	0.0273	0.0280
(b) Allowable Rate from Method (cfm)	0.0200	0.0200	0.0200
Allowable Limit - minimum of a and b (cfm)	0.0200	0.0200	0.0200
Actual Final Leak Rate (cfm)	0.0010	0.0020	0.0060

Sample Volume

	Minimum Volume Required (dscf)	106.00	106.00	106.00
V _{mstd}	Actual Sample Volume (dscf)	114.525	111.270	115.754

Alternative Method 5 Post-Test Calibration (EPA ALT-009)

√ΔH _{avg}	Average of Square Root of ΔH (in. W.C.)	1.1588	1.1657	1.1835
Y _{qa}	Alternative Meter Calibration Factor	0.9730	1.0029	0.9851
	Variation from full-test Y _d (average ≤ ±5%)	-2.6%	0.4%	-1.4%

**Average
-1.2%**

Mean Isokinetic Sampling Rate Variation

	Minimum Allowable (%)	90	90	90
	Maximum Allowable (%)	110	110	110
%I	Actual Variation (%)	100.42	97.59	99.94

Point-by-Point Isokinetic Variation

	Number of points <90%	2	3	0
	Number of points >110%	0	0	0
	Number of points <80%	0	0	0
	Number of points >120%	0	0	0

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USEPA Method 5/202 (FPM / CPM) QA/QC Results

Run No.	1	2	3
Date (2011)	Jul 19	Jul 19	Jul 19
Start Time (approx.)	08:09	11:51	15:22
Stop Time (approx.)	10:14	14:19	17:36
Total Duration of Test Run (min.)	125	148	134
Net Sampling Time (min.)	120	120	120

Sampling System Calibration Summary

	Nozzle ID No:	250-2	250-2	250-2
D _n	Nozzle Diameter (in):	0.250	0.250	0.250
	Probe ID No:	66-4-7	66-4-7	66-4-7
C _p	Pitot Coefficient:	0.8270	0.8270	0.8270
	Meter Box ID. No:	85-3	85-3	85-3
Y _d	Meter Box Yd - Field Sheet	0.9925	0.9925	0.9925
	Meter Box Yd - Database	0.9925	0.9925	0.9925
	Meter Box ΔH@ - Field Sheet	1.7792	1.7792	1.7792
	Meter Box ΔH@ - Database	1.7792	1.7792	1.7792

QA/QC

Final Leak Check

(a) 4% of Sampling Rate (cfm)	0.0273	0.0273	0.0274
(b) Allowable Rate from Method (cfm)	0.0200	0.0200	0.0200
Allowable Limit - minimum of a and b (cfm)	0.0200	0.0200	0.0200
Actual Final Leak Rate (cfm)	0.0010	0.0020	0.0010

Sample Volume

	Minimum Volume Required (dscf)	70.60	70.60	70.60
V _{mstd}	Actual Sample Volume (dscf)	75.046	73.547	73.413

Alternative Method 5 Post-Test Calibration (EPA ALT-009)

√ΔH _{avg}	Average of Square Root of ΔH (in. W.C.)	1.1946	1.1896	1.1717
Y _{qa}	Alternative Meter Calibration Factor	1.0021	1.0076	0.9914
	Variation from full-test Y _d (average ≤ ±5%)	1.0%	1.5%	-0.1%

**Average
0.8%**

Mean Isokinetic Sampling Rate Variation

	Minimum Allowable (%)	90	90	90
	Maximum Allowable (%)	110	110	110
%I	Actual Variation (%)	99.37	98.11	97.97

Point-by-Point Isokinetic Variation

	Number of points <90%	0	4	0
	Number of points >110%	1	0	0
	Number of points <80%	0	0	0
	Number of points >120%	0	0	0

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Clean Air Project No: 11265
FCCU Scrubber Stack

USEPA Mod. CTM-027 (Ammonia) QA/QC Results

Run No.	1	2	3
Date (2011)	Jul 19	Jul 19	Jul 19
Start Time (approx.)	07:56	12:00	15:38
Stop Time (approx.)	09:38	13:19	17:15
Total Duration of Test Run (min.)	102	79	97
Net Sampling Time (min.)	60	60	60

Sampling System Calibration Summary

	Nozzle ID No:	249-1	249-1	249-1
D _n	Nozzle Diameter (in):	0.249	0.249	0.249
	Probe ID No:	67-4-1	67-4-1	67-4-1
C _p	Pitot Coefficient:	0.8190	0.8190	0.8190
	Meter Box ID. No:	61-7	61-7	61-7
Y _d	Meter Box Yd - Field Sheet	0.9827	0.9827	0.9827
	Meter Box Yd - Database	0.9827	0.9827	0.9827
	Meter Box ΔH@ - Field Sheet	1.8294	1.8294	1.8294
	Meter Box ΔH@ - Database	1.8294	1.8294	1.8294

QA/QC

Final Leak Check

(a) 4% of Sampling Rate (cfm)	0.0275	0.0277	0.0275
(b) Allowable Rate from Method (cfm)	0.0200	0.0200	0.0200
Allowable Limit - minimum of a and b (cfm)	0.0200	0.0200	0.0200
Actual Final Leak Rate (cfm)	0.0030	0.0010	0.0010

Sample Volume

	Minimum Volume Required (dscf)	35.30	35.30	35.30
V _{mstd}	Actual Sample Volume (dscf)	37.697	37.225	36.751

Alternative Method 5 Post-Test Calibration (EPA ALT-009)

√ΔH _{avg}	Average of Square Root of ΔH (in. W.C.)	1.2268	1.1987	1.1888
Y _{qa}	Alternative Meter Calibration Factor	1.0019	0.9829	0.9838
	Variation from full-test Y _d (average ≤ ±5%)	2.0%	0.0%	0.1%

**Average
0.7%**

Mean Isokinetic Sampling Rate Variation

	Minimum Allowable (%)	90	90	90
	Maximum Allowable (%)	110	110	110
%I	Actual Variation (%)	99.63	100.90	99.12

Point-by-Point Isokinetic Variation

	Number of points <90%	0	0	0
	Number of points >110%	0	0	0
	Number of points <80%	0	0	0
	Number of points >120%	0	0	0

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FCCU Scrubber Stack

USEPA Method 29 (Non-Mercury Metals) QA/QC Results

Run No.	1	2	3
Date (2011)	Jul 19	Jul 19	Jul 19
Start Time (approx.)	07:42	11:23	15:17
Stop Time (approx.)	10:52	14:37	18:30
Total Duration of Test Run (min.)	190	194	193
Net Sampling Time (min.)	180	180	180

Sampling System Calibration Summary

	Nozzle ID No:	250-1	250-1	250-1
D _n	Nozzle Diameter (in):	0.250	0.250	0.250
	Probe ID No:	67-4-4	67-4-4	67-4-4
C _p	Pitot Coefficient:	0.8200	0.8200	0.8200
	Meter Box ID. No:	61-5	61-5	61-5
Y _d	Meter Box Yd - Field Sheet	0.9992	0.9992	0.9992
	Meter Box Yd - Database	0.9992	0.9992	0.9992
	Meter Box ΔH@ - Field Sheet	1.7185	1.7185	1.7185
	Meter Box ΔH@ - Database	1.7185	1.7185	1.7185

QA/QC

Final Leak Check

(a) 4% of Sampling Rate (cfm)	0.0291	0.0295	0.0282
(b) Allowable Rate from Method (cfm)	0.0200	0.0200	0.0200
Allowable Limit - minimum of a and b (cfm)	0.0200	0.0200	0.0200
Actual Final Leak Rate (cfm)	0.0010	0.0020	0.0000

Sample Volume

	Minimum Volume Required (dscf)	106.00	106.00	106.00
V _{mstd}	Actual Sample Volume (dscf)	121.318	120.816	114.893

Alternative Method 5 Post-Test Calibration (EPA ALT-009)

√ΔH _{avg}	Average of Square Root of ΔH (in. W.C.)	1.2287	1.2143	1.1621
Y _{qa}	Alternative Meter Calibration Factor	0.9803	0.9653	0.9684
	Variation from full-test Y _d (average ≤ ±5%)	-1.9%	-3.4%	-3.1%

**Average
-2.8%**

Mean Isokinetic Sampling Rate Variation

	Minimum Allowable (%)	90	90	90
	Maximum Allowable (%)	110	110	110
%I	Actual Variation (%)	104.18	103.71	101.08

Point-by-Point Isokinetic Variation

	Number of points <90%	1	1	2
	Number of points >110%	1	5	1
	Number of points <80%	0	1	0
	Number of points >120%	1	2	1

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ASTM D6784-02 (Mercury) QA/QC Results

Run No.	1	2	3
Date (2011)	Jul 15	Jul 15	Jul 16
Start Time (approx.)	09:00	13:27	08:40
Stop Time (approx.)	13:14	16:04	11:07
Total Duration of Test Run (min.)	254	157	147
Net Sampling Time (min.)	120	120	120

Sampling System Calibration Summary

	Nozzle ID No:	250-1	250-1	250-1
D _n	Nozzle Diameter (in):	0.250	0.250	0.250
	Probe ID No:	67-4-4	67-4-4	67-4-4
C _p	Pitot Coefficient:	0.8200	0.8200	0.8200
	Meter Box ID. No:	61-5	61-5	61-5
Y _d	Meter Box Yd - Field Sheet	0.9992	0.9992	0.9992
	Meter Box Yd - Database	0.9992	0.9992	0.9992
	Meter Box ΔH@ - Field Sheet	1.7185	1.7185	1.7185
	Meter Box ΔH@ - Database	1.7185	1.7185	1.7185

QA/QC

Final Leak Check

(a) 4% of Sampling Rate (cfm)	0.0303	0.0296	0.0289
(b) Allowable Rate from Method (cfm)	0.0200	0.0200	0.0200
Allowable Limit - minimum of a and b (cfm)	0.0200	0.0200	0.0200
Actual Final Leak Rate (cfm)	0.0020	0.0040	0.0020

Sample Volume

	Maximum Volume Required (dscf)	88.30	88.30	88.30
V _{mstd}	Actual Sample Volume (dscf)	84.058	81.365	80.450

Alternative Method 5 Post-Test Calibration (EPA ALT-009)

√ΔH _{avg}	Average of Square Root of ΔH (in. W.C.)	1.2762	1.2341	1.2185
Y _{qa}	Alternative Meter Calibration Factor	0.9796	0.9753	0.9778
	Variation from full-test Y _d (average ≤ ±5%)	-2.0%	-2.4%	-2.1%

**Average
-2.2%**

Mean Isokinetic Sampling Rate Variation

	Minimum Allowable (%)	90	90	90
	Maximum Allowable (%)	110	110	110
%I	Actual Variation (%)	105.01	103.36	103.56

Point-by-Point Isokinetic Variation

	Number of points <90%	0	0	0
	Number of points >110%	4	1	0
	Number of points <80%	0	0	0
	Number of points >120%	0	0	0

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Clean Air Project No: 11265
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**USEPA SW-846 Method 0061 (Hexavalent Chromium)
QA/QC Results**

Run No.	1	2	3
Date (2011)	Jul 15	Jul 15	Jul 16
Start Time (approx.)	08:58	14:06	08:36
Stop Time (approx.)	13:06	17:42	12:21
Total Duration of Test Run (min.)	248	216	225
Net Sampling Time (min.)	180	180	180

Sampling System Calibration Summary

	Nozzle ID No:	250-1	250-1	250-1
D _n	Nozzle Diameter (in):	0.250	0.250	0.250
	Probe ID No:	67-4-1	67-4-1	67-4-1
C _p	Pitot Coefficient:	0.8190	0.8190	0.8190
	Meter Box ID. No:	61-7	61-7	61-7
Y _d	Meter Box Yd - Field Sheet	0.9827	0.9827	0.9827
	Meter Box Yd - Database	0.9827	0.9827	0.9827
	Meter Box ΔH@ - Field Sheet	1.8294	1.8294	1.8294
	Meter Box ΔH@ - Database	1.8294	1.8294	1.8294

QA/QC

Final Leak Check

(a) 4% of Sampling Rate (cfm)	0.0285	0.0269	0.0277
(b) Allowable Rate from Method (cfm)	0.0200	0.0200	0.0200
Allowable Limit - minimum of a and b (cfm)	0.0200	0.0200	0.0200
Actual Final Leak Rate (cfm)	0.0030	0.0010	0.0100

Sample Volume

	Minimum Volume Required (dscf)	106.00	106.00	106.00
V _{mstd}	Actual Sample Volume (dscf)	116.425	108.231	112.624

Alternative Method 5 Post-Test Calibration (EPA ALT-009)

√ΔH _{avg}	Average of Square Root of ΔH (in. W.C.)	1.2620	1.1864	1.2214
Y _{qa}	Alternative Meter Calibration Factor	1.0004	1.0040	0.9976
	Variation from full-test Y _d (average ≤ ±5%)	1.8%	2.2%	1.5%
				Average 1.8%

Mean Isokinetic Sampling Rate Variation

	Minimum Allowable (%)	90	90	90
	Maximum Allowable (%)	110	110	110
%I	Actual Variation (%)	99.16	95.17	98.91

Point-by-Point Isokinetic Variation

	Number of points <90%	1	0	0
	Number of points >110%	1	0	0
	Number of points <80%	0	0	0
	Number of points >120%	0	0	0

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USEPA Method 26A (Halides / Halogens) QA/QC Results

Run No.	1	2	3
Date (2011)	Jul 20	Jul 20	Jul 21
Start Time (approx.)	09:49	12:50	07:54
Stop Time (approx.)	12:18	15:10	10:07
Total Duration of Test Run (min.)	149	140	133
Net Sampling Time (min.)	120	120	120

Sampling System Calibration Summary

	Nozzle ID No:	250-2	250-2	250-2
D _n	Nozzle Diameter (in):	0.250	0.250	0.250
	Probe ID No:	66-4-7	66-4-7	66-4-7
C _p	Pitot Coefficient:	0.8270	0.8270	0.8270
	Meter Box ID. No:	85-3	85-3	85-3
Y _d	Meter Box Yd - Field Sheet	0.9925	0.9925	0.9925
	Meter Box Yd - Database	0.9925	0.9925	0.9925
	Meter Box ΔH@ - Field Sheet	1.7792	1.7792	1.7792
	Meter Box ΔH@ - Database	1.7792	1.7792	1.7792

QA/QC

Final Leak Check

(a) 4% of Sampling Rate (cfm)	0.0263	0.0267	0.0270
(b) Allowable Rate from Method (cfm)	0.0200	0.0200	0.0200
Allowable Limit - minimum of a and b (cfm)	0.0200	0.0200	0.0200
Actual Final Leak Rate (cfm)	0.0020	0.0020	0.0030

Sample Volume

	Minimum Volume Required (dscf)	70.60	70.60	70.60
V _{mstd}	Actual Sample Volume (dscf)	71.179	71.469	73.570

Alternative Method 5 Post-Test Calibration (EPA ALT-009)

√ΔH _{avg}	Average of Square Root of ΔH (in. W.C.)	1.1588	1.1524	1.1919
Y _{qa}	Alternative Meter Calibration Factor	1.0156	1.0014	1.0146
	Variation from full-test Y _d (average ≤ ±5%)	2.3%	0.9%	2.2%
				Average 1.8%

Mean Isokinetic Sampling Rate Variation

	Minimum Allowable (%)	90	90	90
	Maximum Allowable (%)	110	110	110
%I	Actual Variation (%)	95.39	96.40	96.64

Point-by-Point Isokinetic Variation

	Number of points <90%	2	0	0
	Number of points >110%	0	0	0
	Number of points <80%	1	0	0
	Number of points >120%	0	0	0

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FCCU Scrubber Stack

USEPA OTM-29 (Cyanide) QA/QC Results

Run No.	1	2	3
Date (2011)	Jul 20	Jul 20	Jul 21
Start Time (approx.)	09:36	12:29	07:56
Stop Time (approx.)	10:57	14:01	09:15
Total Duration of Test Run (min.)	81	92	79
Net Sampling Time (min.)	60	60	60

Sampling System Calibration Summary

	Nozzle ID No:	233-1	233-1	233-1
D _n	Nozzle Diameter (in):	0.233	0.233	0.233
	Probe ID No:	67-4-1	67-4-1	67-4-1
C _p	Pitot Coefficient:	0.8190	0.8190	0.8190
	Meter Box ID. No:	61-7	61-7	61-7
Y _d	Meter Box Yd - Field Sheet	0.9827	0.9827	0.9827
	Meter Box Yd - Database	0.9827	0.9827	0.9827
	Meter Box ΔH@ - Field Sheet	1.8294	1.8294	1.8294
	Meter Box ΔH@ - Database	1.8294	1.8294	1.8294

QA/QC

Final Leak Check

(a) 4% of Sampling Rate (cfm)	0.0236	0.0223	0.0242
(b) Allowable Rate from Method (cfm)	0.0200	0.0200	0.0200
Allowable Limit - minimum of a and b (cfm)	0.0200	0.0200	0.0200
Actual Final Leak Rate (cfm)	0.0010	0.0010	0.0010

Sample Volume

	Maximum Volume Required (dscf)	35.30	35.30	35.30
V _{mstd}	Actual Sample Volume (dscf)	33.388	31.218	34.302

Alternative Method 5 Post-Test Calibration (EPA ALT-009)

√ΔH _{avg}	Average of Square Root of ΔH (in. W.C.)	0.9992	0.9647	1.0442
Y _{qa}	Alternative Meter Calibration Factor	0.9398	0.9654	0.9587
	Variation from full-test Y _d (average ≤ ±5%)	-4.4%	-1.8%	-2.4%

**Average
-2.9%**

Mean Isokinetic Sampling Rate Variation

	Minimum Allowable (%)	90	90	90
	Maximum Allowable (%)	110	110	110
%I	Actual Variation (%)	108.21	103.83	106.27

Point-by-Point Isokinetic Variation

	Number of points <90%	0	0	0
	Number of points >110%	1	0	0
	Number of points <80%	0	0	0
	Number of points >120%	1	0	0

090811 093504
NMN@

Nozzle Calibration Sheet

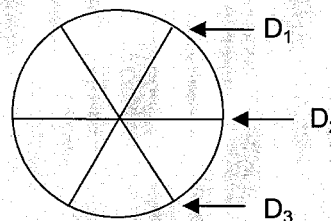
Client	MPC	Project Number	11265
Calibrated by	KPD	Caliper ID	0084536
Date	7/12/2011	Unit / Runs	FCCU scrubber stack - A11

Nozzle Identification	D ₁ (inches)	D ₂ (inches)	D ₃ (inches)	ΔD (inches)	D _{ave} (inches)
250-1	0.250	0.250	0.251	0.001	0.250
250-2	0.249	0.250	0.250	0.001	0.250
233-1	0.234	0.233	0.233	0.001	0.233
233-2	0.233	0.233	0.233	0.000	0.233
250-3	0.250	0.250	0.250	0.000	0.250
250-4	0.251	0.250	0.250	0.001	0.250
249-1	0.250	0.249	0.249	0.002	0.249

D₁, D₂, D₃ = three nozzle diameter measurements

ΔD = maximum difference between any two diameters
ΔD ≤ 0.004 inches*

D_{ave} = average of D₁, D₂, D₃



* (40 CFR 60, Appendix A, Method 5, Section 5.1)

Caliper Calibration Sheet

Calibrated by	<u>D. Zeishman</u>
Date	<u>7-1-11</u>

Caliper ID	<u>0084536</u>
------------	----------------

Standard Caliper ID	<u>101460021</u>
---------------------	------------------

Standard Caliper Setting (in)	Caliper Reading (in)	Deviation (ΔD)
0.150	0.150	0.000
0.300	0.298	0.002
0.500	0.499	0.001

ΔD = maximum deviation between standard and caliper being calibrated
 $\Delta D \leq 0.004$ inch for every reading



Sample Probe Calibration

Probe Type: M5 with S-Type Pitot

I.D. Number: 67-4-1

Project Number: _____

Thermocouple Calibration

Reference Type: Thermocouple Reference I.D. No: 15-078-39 Pyrometer I.D. No: 80512890 Units: °F

Point No.	Target Temp.	Reference Temp.	Indicated Temp.	Temp. Difference	% Difference*	Specification
1	Ambient	70	72	-2	0.38%	%Difference ≤ 1.5
2	200 °F-250 °F	243	244	-1	0.14%	

* Based on Absolute Temperature (Rankine)

Does thermocouple assembly meet specifications? YES

Pitot Tube Calibration (Wind Tunnel Method @ 49 ft/sec)

Reference Pitot I.D. No: Wind Tunnel

Reference Pitot Cp: 0.99

Pitot Side 'A' :

Trial No.	Reference ΔP	Probe ΔP	Probe C _{p(S)} *	Abs. Deviation from Avg. C _{p(A)} **
1	0.528	0.777	0.816	0.001
2	0.541	0.782	0.824	0.006
3	0.532	0.788	0.813	0.004
Side 'A' Average Probe C _{p(A)} =			0.8179	0.0040

Specification
Avg. C_p Deviations ≤ 0.01

Pitot Side 'B' :

Trial No.	Reference ΔP	Probe ΔP	Probe C _{p(S)} *	Abs. Deviation from Avg. C _{p(B)} **
1	0.541	0.787	0.821	0.001
2	0.541	0.790	0.819	0.000
3	0.537	0.786	0.819	0.001
Side 'B' Average Probe C _{p(B)} =			0.8196	0.0008

Specification
Avg. C_p Deviations ≤ 0.01

'A' Average C _p	—	'B' Average C _p	=	Difference	Specification
0.818		0.820		-0.002	Difference ≤ 0.01

Does assembly meet specifications?

YES

If "Yes", C_p= Average of Side 'A' and 'B' Cp values. If "No", Pitot must be replaced.

$$* C_{p(S)} = C_{p(STD)} \sqrt{\frac{\Delta p_{(STD)}}{\Delta p_{(S)}}}$$

$$** Deviation = |C_{p(S)} - \overline{C_{p(A \text{ or } B)}}|$$

All specifications are from EPA-600/9-76-005, section 3.1

Probe Cp= 0.819

Calibrated by: B Arnold

Date: 04/06/2011

Sample Probe Calibration

Probe Type: M5 with S-Type Pitot

I.D. Number: 67-4-4

Project Number: _____

Thermocouple Calibration

Reference Type: Thermocouple Reference I.D. No: 15-078-39 Pyrometer I.D. No: 80512890 Units: °F

Point No.	Target Temp.	Reference Temp.	Indicated Temp.	Temp. Difference	% Difference*	Specification
1	Ambient	70	70	0	0.00%	%Difference ≤ 1.5
2	200 °F-250 °F	226	230	-4	0.58%	

* Based on Absolute Temperature (Rankine)

Does thermocouple assembly meet specifications? YES

Pitot Tube Calibration (Wind Tunnel Method @ 50 ft/sec)

Reference Pitot I.D. No: Wind Tunnel

Reference Pitot Cp: 0.99

Pitot Side 'A' :

Trial No.	Reference ΔP	Probe ΔP	Probe C _{p(S)} *	Abs. Deviation from Avg. C _{p(A)} **
1	0.543	0.809	0.812	0.004
2	0.549	0.803	0.818	0.003
3	0.546	0.804	0.816	0.001
Side 'A' Average Probe C _{p(A)} =			0.8153	0.0025

Specification
Avg. C_p Deviations ≤ 0.01

Pitot Side 'B' :

Trial No.	Reference ΔP	Probe ΔP	Probe C _{p(S)} *	Abs. Deviation from Avg. C _{p(B)} **
1	0.547	0.785	0.826	0.002
2	0.540	0.788	0.820	0.004
3	0.550	0.790	0.826	0.002
Side 'B' Average Probe C _{p(B)} =			0.8241	0.0028

Specification
Avg. C_p Deviations ≤ 0.01

'A' Average C _p	'B' Average C _p	Difference
0.815	0.824	-0.009

Specification
|Difference| ≤ 0.01

Does assembly meet specifications?

YES

If "Yes", C_p = Average of Side 'A' and 'B' C_p values. If "No", Pitot must be replaced.

$$* C_{P(S)} = C_{P(STD)} \sqrt{\frac{\Delta p_{(STD)}}{\Delta p_{(S)}}}$$

$$** Deviation = |C_{P(S)} - \overline{C_{P(A \text{ or } B)}}|$$

All specifications are from EPA-600/9-76-005, section 3.1

Probe Cp= 0.820

Calibrated by: B Arnold

Date: 04/06/2011

Sample Probe Calibration

Probe Type: M5 with S-Type Pitot

I.D. Number: 66-4-7

Project Number: _____

Thermocouple Calibration

Reference Type: Thermocouple Reference I.D. No: 15-078-39 Pyrometer I.D. No: 80512890 Units: °F

Point No.	Target Temp.	Reference Temp.	Indicated Temp.	Temp. Difference	% Difference*	Specification
1	Ambient	74	74	0	0.00%	%Difference ≤ 1.5
2	200°F-250°F	229	233	-4	0.58%	

* Based on Absolute Temperature (Rankine)

Does thermocouple assembly meet specifications? YES

Pitot Tube Calibration (Wind Tunnel Method @ 50 ft/sec)

Reference Pitot I.D. No: Wind Tunnel

Reference Pitot Cp: 0.99

Pitot Side 'A' :				Abs. Deviation from Avg. C _{p(A)} **
Trial No.	Reference ΔP	Probe ΔP	Probe C _{p(S)} *	
1	0.545	0.774	0.831	0.005
2	0.543	0.788	0.822	0.004
3	0.545	0.786	0.824	0.001
Side 'A' Average Probe C _{p(A)} =			0.8256	0.0034

Specification
Avg. C_p Deviations ≤ 0.01

Pitot Side 'B' :				Abs. Deviation from Avg. C _{p(B)} **
Trial No.	Reference ΔP	Probe ΔP	Probe C _{p(S)} *	
1	0.539	0.772	0.827	0.001
2	0.541	0.779	0.825	0.003
3	0.542	0.767	0.832	0.004
Side 'B' Average Probe C _{p(B)} =			0.8283	0.0027

Specification
Avg. C_p Deviations ≤ 0.01

'A' Average C _p	'B' Average C _p	Difference	Specification
0.826	0.828	-0.002	Difference ≤ 0.01

Does assembly meet specifications?

YES

If "Yes", C_p = Average of Side 'A' and 'B' Cp values. If "No", Pitot must be replaced.

$$* C_{P(S)} = C_{P(STD)} \sqrt{\frac{\Delta p_{(STD)}}{\Delta p_{(S)}}}$$

$$** Deviation = |C_{P(S)} - \overline{C_{P(A \text{ or } B)}}|$$


All specifications are from EPA-600/9-76-005, section 3.1

Probe Cp= 0.827

Calibrated by: B ARNOLD

Date: 07/08/2011

Meter Box Full Test Calibration

Meter Box Serial No: 61-7 Calibration Signature: 
 Date of Calibration: 4/15/2011 Meter Box Yd: 0.9827
 Standard Meter Serial No: 11AH6 Meter Box ΔH@: 1.8294
 Date of Calibration: 10/26/2010 Barometer Serial No: W12637
 Calibration Conducted by: Oleg Lavrov Barometric Pressure: 28.94

Q	ΔH	ΔP	Y _{ds}	Standard Meter Gas Volume (ft ³)		Meter Box Gas Volume (ft ³)		Std. Meter Temperature (°F)			Meter Box Temperature (°F)			Time (min.)	Calibration Results	
				Initial	Final	Initial	Final	T _{is}	T _{os}	T _{ds}	T _i	T _o	T _d		Y _d	ΔH@
0.936	3.00	-1.90	1.0000	0.000	10.000	848.912	859.182	69.0	69.0	69.00	85.0	74.0	79.50	10.31	0.9808	1.8420
0.937	3.00	-1.90	1.0000	0.000	10.000	859.182	869.473	69.0	69.0	69.00	87.0	76.0	81.50	10.30	0.9824	1.8316
0.385	0.50	-1.20	1.0000	0.000	5.000	872.020	877.172	69.0	69.0	69.00	80.0	76.0	78.00	12.52	0.9828	1.8042
0.384	0.50	-1.20	1.0000	0.000	5.000	877.172	882.318	69.0	69.0	69.00	80.0	76.0	78.00	12.57	0.9839	1.8186
0.661	1.50	-1.40	1.0000	0.000	10.000	884.864	895.190	69.0	69.0	69.00	84.0	77.0	80.50	14.60	0.9822	1.8366
0.669	1.50	-1.40	1.0000	0.000	10.000	895.190	905.513	69.0	69.0	69.00	85.0	78.0	81.50	14.64	0.9843	1.8433
Averages															0.98272	1.82940

Nomenclature	Equations
<p>P_b Barometric Pressure (in. Hg)</p> <p>Q Flow Rate (cfm)</p> <p>ΔH Orifice Pressure differential (in. H₂O)</p> <p>ΔP Inlet Pressure Differential (in. H₂O)</p> <p>V_d Gas Meter Volume - Dry (ft³)</p> <p>V_{ds} Standard Meter Volume - Dry (ft³)</p> <p>T_d Average Meter Box Temperature (°F)</p> <p>T_o Outlet Meter Box Temperature (°F)</p> <p>T_{ds} Average Standard Meter Temperature (°F)</p> <p>Y_d Meter Correction Factor (unitless), Y_i ≤ Y_{avg} ± 0.02</p> <p>Y_{ds} Standard Meter Correction Factor (unitless)</p> <p>ΔH@ Orifice Pressure Differential giving 0.75 cfm of air at 68°F and 29.92 in. Hg (in. H₂O)</p> <p>ΔH@_i ≤ ΔH@_{avg} ± 0.2</p> <p>Θ Duration of Run (minutes)</p>	$Y_d = (Y_{ds}) \left[\frac{V_{ds}}{V_d} \right] \left[\frac{T_d + 460}{T_{ds} + 460} \right] \left[\frac{P_b + \Delta P / 13.6}{P_b + \Delta H / 13.6} \right]$ $\Delta H@ = \frac{(0.0319)(\Delta H)}{P_b(T_o + 460)} \left[\frac{(T_{ds} + 460)(\Theta)^2}{(V_{ds})(Y_{ds})} \right]$ $Q = \frac{17.64(V_{ds})(P_b)}{(T_{ds} + 460)(\Theta)}$

Vacuum Gauge	
Standard (in. Hg)	Gauge (in. Hg)
5.4	5.0
10.4	10.0
15.0	25.0
19.8	20.0
25.0	25.0

Meter Box - Pyrometer Calibration Sheet

Meter Box No: 61-7

Office: _____

Calibrated by: Oleg Lavrov

Client: _____

Date: 4/15/11

Job No: _____

Temperature Scale Used: Fahrenheit

Type of Calibration: Full-Test

Calibration Reference Settings (°F)	Pyrometer Reading for each Channel (°F)						
	1 Stack	2 Probe	3 Filter	4 Imp Out	5 Aux	6 DGM In	7 DGM Out
50	50	48	49				
100	100	98	99				
150	150	148	149				
200	200	198	199				
250	250	248	249				
300	300	298	299				
350	350	348	349				
400	400	398	399				
450	450	448	449				
500	500	498	499				
550	550	548	549				
600	600	598	599				

Tolerance = $\pm 2^{\circ}\text{F}$ difference from reference setting.

Calibration Reference Information

Reference Used: Omega CL23A

Serial No: T-279500


Calibrated By: JH Metrology

Date Calibrated: 8/17/2010

Calibration Report No: 1000150487

Calibration Due Date: 8/17/2011

Meter Box Full Test Calibration

Meter Box Serial No: 61-5 Calibration Signature: 
 Date of Calibration: 5/2/2011 Meter Box Yd: 0.9992
 Standard Meter Serial No: 11AH6 Meter Box ΔH@: 1.7185
 Date of Calibration: 10/26/2010 Barometer Serial No: W12637
 Calibration Conducted by: Oleg Lavrov Barometric Pressure: 29.39

Q	ΔH	ΔP	Y _{ds}	Standard Meter Gas Volume (ft ³)			Meter Box Gas Volume (ft ³)			Std. Meter Temperature (°F)			Meter Box Temperature (°F)			Time (min.)	Calibration Results		
				Initial	Final	Net	V _{ds}	Initial	Final	Net	V _d	T _{is}	T _{os}	T _{ds}	T _i		T _o	T _d	Y _d
0.980	3.00	-1.80	1.0000	0.000	10.000	10.000	10.000	696.428	706.508	10.080	70.0	70.0	70.00	84.0	76.0	80.00	9.98	0.9987	1.6997
0.979	3.00	-1.80	1.0000	0.000	10.000	10.000	10.000	706.508	716.627	10.119	70.0	70.0	70.00	85.0	77.0	81.00	9.99	0.9967	1.6999
0.389	0.50	-1.00	1.0000	0.000	5.000	5.000	5.000	752.146	757.182	5.036	70.0	70.0	70.00	78.0	76.0	77.00	12.58	1.0022	1.8004
0.389	0.50	-1.00	1.0000	0.000	5.000	5.000	5.000	757.182	762.223	5.041	70.0	70.0	70.00	78.0	76.0	77.00	12.58	1.0012	1.8004
0.703	1.50	-1.40	1.0000	0.000	10.000	10.000	10.000	776.034	786.160	10.126	70.0	70.0	70.00	83.0	76.0	79.50	13.92	0.9980	1.6533
0.701	1.50	-1.40	1.0000	0.000	10.000	10.000	10.000	786.160	796.294	10.134	70.0	70.0	70.00	83.0	77.0	80.00	13.95	0.9981	1.6573
																	Averages	0.99916	1.71849

Nomenclature	Equations
<p> P_b Barometric Pressure (in. Hg) Q Flow Rate (cfm) ΔH Orifice Pressure Differential (in. H₂O) ΔP Inlet Pressure Differential (in. H₂O) V_d Gas Meter Volume - Dry (ft³) V_{ds} Standard Meter Volume - Dry (ft³) T_d Average Meter Box Temperature (°F) T_o Outlet Meter Box Temperature (°F) T_{ds} Average Standard Meter Temperature (°F) Y_d Meter Correction Factor (unitless), $Y_1 \leq Y_{avg} \leq 0.02$ Y_{ds} Standard Meter Correction Factor (unitless) $\Delta H@$ Orifice Pressure Differential giving 0.75 cfm of air at 68°F and 29.92 in. Hg (in. H₂O) $\Delta H@_1 \leq \Delta H@_{avg} \leq 0.2$ Θ Duration of Run (minutes) </p>	$Y_d = (Y_{ds}) \left[\frac{V_{ds}}{V_d} \right] \left[\frac{T_d + 460}{T_{ds} + 460} \right] \left[\frac{P_b + \Delta P / 13.6}{P_b + \Delta H / 13.6} \right]$ $\Delta H@ = \frac{(0.0319)(\Delta H)}{P_b(T_o + 460)} \left[\frac{(T_{ds} + 460)\Theta}{(Y_{ds})(Y_{ds})} \right]^2$ $Q = \frac{17.64(V_{ds})(P_b)}{(T_{ds} + 460)(\Theta)}$

Vacuum Gauge	
Standard	Gauge
(in. Hg)	(in. Hg)
5.1	5.0
10.1	10.0
15.2	15.0
20.2	20.0
25.3	25.0



Meter Box - Pyrometer Calibration Sheet

Meter Box No: 61-5

Office: _____

Calibrated by: Oleg Lavrov

Client: _____

Date: 5/2/11

Job No: _____

Temperature Scale Used: Fahrenheit

Type of Calibration: Full-Test

Calibration Reference Settings (°F)	Pyrometer Reading for each Channel (°F)						
	1	2	3	4	5	6	7
	Stack	Probe	Filter	Imp Out	Aux	DGM In	DGM Out
50	51	51	51				
100	101	101	101				
150	151	151	150				
200	201	201	201				
250	251	251	251				
300	301	301	300				
350	351	351	350				
400	401	401	400				
450	451	451	450				
500	501	501	500				
550	551	551	550				
600	601	601	600				

Tolerance = $\pm 2^{\circ}\text{F}$ difference from reference setting.

Calibration Reference Information

Reference Used: <u>Omega CL23A</u>	Serial No: <u>T-279500</u>
Calibrated By: <u>JH Metrology</u>	Date Calibrated: <u>8/17/2010</u>
Calibration Report No: <u>1000150487</u>	Calibration Due Date: <u>8/17/2011</u>

Meter Box Full Test Calibration

Meter Box Serial No: 85-3 Calibration Signature: Martin Vaquero

Date of Calibration: 5/16/2011 Meter Box Yd: 0.9925

Standard Meter Serial No: 11AH6 Meter Box ΔH@: 1.7792

Date of Calibration: 10/26/2010 Barometer Serial No: W12637

Calibration Conducted by: Martin Vaquero Barometric Pressure: 29.25

Q	ΔH	ΔP	Y _{ds}	Standard Meter Gas Volume (ft ³)			Meter Box Gas Volume (ft ³)			Std. Meter Temperature (°F)			Meter Box Temperature (°F)			Time (min.)	Calibration Results	
				Initial	Final	V _{ds} Net	Initial	Final	V _d Net	T _{is} In	T _{os} Out	T _{ds} Avg.	T _i In	T _o Out	T _d Avg.		Y _d	ΔH@
0.959	3.00	-1.70	1.0000	0.000	10.000	10.000	52.139	62.429	10.290	66.5	66.5	66.50	86.0	79.0	82.50	10.22	0.9896	1.7575
0.960	3.00	-1.70	1.0000	0.000	10.000	10.000	82.429	72.719	10.290	66.5	66.5	66.50	87.0	80.0	83.50	10.21	0.9914	1.7508
0.387	0.50	-0.80	1.0000	0.000	5.000	5.000	74.125	79.278	5.153	66.5	66.5	66.50	81.0	79.0	80.00	12.65	0.9919	1.7951
0.387	0.50	-0.80	1.0000	0.000	5.000	5.000	79.278	84.430	5.152	66.5	66.5	66.50	81.0	79.0	80.00	12.65	0.9921	1.7951
0.672	1.50	-1.30	1.0000	0.000	10.000	10.000	85.517	95.788	10.271	66.5	66.5	66.50	85.0	79.0	82.00	14.58	0.9952	1.7885
0.672	1.50	-1.30	1.0000	0.000	10.000	10.000	95.788	106.065	10.277	66.5	66.5	66.50	85.0	79.0	82.00	14.58	0.9947	1.7885
Averages																	0.99251	1.77923

Nomenclature	Equations
<p>P_b Barometric Pressure (in. Hg)</p> <p>Q Flow Rate (cfm)</p> <p>ΔH Orifice Pressure differential (in. H₂O)</p> <p>ΔP Inlet Pressure differential (in. H₂O)</p> <p>V_d Gas Meter Volume - Dry (ft³)</p> <p>V_{ds} Standard Meter Volume - Dry (ft³)</p> <p>T_d Average Meter Box Temperature (°F)</p> <p>T_o Outlet Meter Box Temperature (°F)</p> <p>T_{ds} Average Standard Meter Temperature (°F)</p> <p>Y_d Meter Correction Factor (unitless), Y_sY_{avg}±0.02</p> <p>Y_{ds} Standard Meter Correction Factor (unitless)</p> <p>ΔH@ Orifice Pressure Differential giving 0.75 cfm of air at 68°F and 29.92 in. Hg (in. H₂O)</p> <p>ΔH@ ≤ ΔH@_{avg}±0.2</p> <p>Θ Duration of Run (minutes)</p>	$Y_d = (Y_{ds}) \left[\frac{V_{ds}}{V_d} \right] \left[\frac{T_d + 460}{T_{ds} + 460} \right] \left[\frac{P_b + \Delta P / 13.6}{P_b + \Delta H / 13.6} \right]$ $\Delta H@ = \frac{(0.0319)(\Delta H)}{P_b(T_o + 460)} \left[\frac{(T_{ds} + 460)(\Theta)}{(V_{ds})(Y_{ds})} \right]^2$ $Q = \frac{17.64(V_{ds})(P_b)}{(T_{ds} + 460)(\Theta)}$

Vacuum Gauge	
Standard Gauge (in.Hg)	Gauge (in.Hg)
4.4	5.0
9.6	10.0
14.4	15.0
19.2	20.0
24.6	25.0

Meter Box - Pyrometer Calibration Sheet

Meter Box No: 85-3

Office: PALATINE

Calibrated by: Martin Vaquero

Client: _____

Date: 5/16/11

Job No: _____

Temperature Scale Used: Fahrenheit

Type of Calibration: Full-Test

Calibration Reference Settings (°F)	Pyrometer Reading for each Channel (°F)						
	1 Stack	2 Probe	3 Filter	4 Imp Out	5 Aux	6 DGM In	7 DGM Out
50	51	50	51				
100	100	100	102				
150	151	151	152				
200	201	201	202				
250	251	251	252				
300	301	301	302				
350	352	351	352				
400	401	401	402				
450	451	450	452				
500	501	500	502				
550	551	550	552				
600	601	600	601				

Tolerance = $\pm 2^{\circ}\text{F}$ difference from reference setting.

Calibration Reference Information

Reference Used: Omega CL23A

Serial No: T-279500

Calibrated By: JH Metrology

Date Calibrated: 8/17/2010

Calibration Report No: 1000150487

Calibration Due Date: 8/17/2011

Meter Box Full Test Calibration

Meter Box No: 66-14

Date of Calibration: 9/14/2010

Meter Box Y_d : 0.9882

Calibration Conducted by: O. Lavrov

Meter Box $\Delta H @$: 1.7571

Barometric Pressure: 29.33

Q	ΔH	ΔP	Y_{ds}	Standard Meter Gas Volume (ft ³)			Meter Box Gas Volume (ft ³)			Std. Meter Temperature (°F)			Meter Box Temperature (°F)			Time (min.)	Calibration Results	
				Initial	Final	V_{ds} Net	Initial	Final	V_d Net	T_{is} In	T_{os} Out	T_{ds} Avg.	T_i In	T_o Out	T_d Avg.		Y_d	$\Delta H @$
0.948	3.00	-1.80	1.0000	0.000	10.000	10.000	229.379	239.467	10.088	76.5	76.5	76.50	86.0	77.0	81.50	10.17	0.9886	1.8089
0.944	3.00	-1.80	1.0000	0.000	10.000	10.000	239.467	249.597	10.130	76.5	76.5	76.50	88.0	79.0	83.50	10.22	0.9881	1.8199
0.393	0.50	-1.10	1.0000	0.000	5.000	5.000	259.861	264.964	5.103	76.5	76.5	76.50	85.0	81.0	83.00	12.28	0.9877	1.7452
0.392	0.50	-1.10	1.0000	0.000	5.000	5.000	264.964	270.058	5.094	76.5	76.5	76.50	85.0	81.0	83.00	12.31	0.9895	1.7537
0.686	1.50	-1.40	1.0000	0.000	10.000	10.000	274.147	284.371	10.224	76.5	76.5	76.50	90.0	82.0	86.00	14.05	0.9882	1.7103
0.687	1.50	-1.40	1.0000	0.000	10.000	10.000	284.371	294.613	10.242	76.5	76.5	76.50	90.0	83.0	86.50	14.04	0.9874	1.7047
Averages																	0.98823	1.75712

Nomenclature	Equations
P_b Barometric Pressure (in. Hg) Q Flow Rate (cfm) ΔH Orifice Pressure Differential (in. H ₂ O) ΔP Inlet Pressure Differential (in. H ₂ O) V_d Gas Meter Volume - Dry (ft ³) V_{ds} Standard Meter Volume - Dry (ft ³) T_d Average Meter Box Temperature (°F) T_o Outlet Meter Box Temperature (°F) T_{ds} Average Standard Meter Temperature (°F) Y_d Meter Correction Factor (unitless), $Y_1 \leq Y_{avg} \pm 0.02$ Y_{ds} Standard Meter Correction Factor (unitless) $\Delta H @$ Orifice Pressure Differential giving 0.75 cfm of air at 68°F and 29.92 in. Hg (in. H ₂ O) $\Delta H @_i \leq \Delta H @_{avg} \pm 0.2$ Θ Duration of Run (minutes)	$Y_d = (Y_{ds}) \left[\frac{V_{ds}}{V_d} \right] \left[\frac{T_d + 460}{T_{ds} + 460} \right] \left[\frac{P_b + \Delta P / 13.6}{P_b + \Delta H / 13.6} \right]$ $\Delta H @ = \frac{(0.0319)(\Delta H)}{P_b (T_o + 460)} \left[\frac{(T_{ds} + 460)(\Theta)}{(Y_{ds})(Y_{ds})} \right]^2$ $Q = \frac{17.64(V_{ds})(P_b)}{(T_{ds} + 460)(\Theta)}$

Vacuum Gauge	
Standard (in. Hg)	Gauge (in. Hg)
5.4	5.0
10.4	10.0
15.6	15.0
20.5	20.0
24.5	25.0

Meter Box - Pyrometer Calibration Sheet

Meter Box No: 66-14

Office: _____

Calibrated by: O. Lavrov

Client: _____

Date: 9/14/10

Job No: _____

Temperature Scale Used: Fahrenheit

Type of Calibration: Full-Test

Calibration Reference Settings (°F)	Pyrometer Reading for each Channel (°F)						
	1	2	3	4	5	6	7
	Stack	Probe	Filter	Imp Out	Aux	DGM In	DGM Out
50	49	52	52				
100	99	102	102				
150	149	152	151				
200	199	202	202				
250	249	252	252				
300	299	302	302				
350	349	352	351				
400	399	402	401				
450	449	452	451				
500	499	502	501				
550	549	552	551				
600	599	602	601				

Tolerance = $\pm 2^{\circ}\text{F}$ difference from reference setting.

Calibration Reference Information

Reference Used: Omega CL23A

Serial No: T-225950

Calibrated By: JH Metrology

Exp.date : 8/17/2011

Calibration Report No: 1000150487

Meter Box Full Calibration

Meter Box No: MET 2

A Side Meter Y_d : 1.0222

B Side Meter Y_d : 0.9950

A Side Calibration

Operator: A.Karony

Date of Calibration: 03/18/11

Digital Counter Value: 01.5200

P_b : 29.42

		Meter Box Gas Volume (L)				Standard Gas Volume (L)			Calibration Results	
Q (Lpm)	Θ Time	Initial	Final	V_d Net	T_{ma} Avg.	Q_s (mL/min)	V_{ds}	V_{dstd}	Y_d	Difference from Average
0.4	16.0	0.000	7.144	7.144	80.67	436.9	6.990	6.858	1.0197	-0.2%
0.9	15.0	0.000	13.370	13.370	85.83	868.5	13.027	12.712	1.0248	0.3%
1.6	15.0	0.000	24.380	24.380	72.17	1,620.1	24.301	23.775	1.0221	0.0%
Average Y_d									1.0222	

B Side Calibration

Operator: A.Karony

Date of Calibration: 03/18/10

Digital Counter Value: 01.5560

P_b : 29.42

		Meter Box Gas Volume (liters)				Standard Gas Volume (liters)			Calibration Results	
Q (Lpm)	Θ Time	Initial	Final	V_d Net	T_{ma} Avg.	Q_s (mL/min)	V_{ds}	V_{dstd}	Y_d	Difference from Average
0.5	16.0	0.000	7.417	7.417	77.83	443.8	7.101	7.157	0.9924	-0.3%
0.9	15.0	0.000	13.950	13.950	81.33	887.6	13.314	13.374	0.9955	0.1%
1.8	15.0	0.000	26.300	26.300	71.67	1,706.3	25.595	25.672	0.9970	0.2%
Average Y_d									0.99498	

Nomenclature		Equations	
Q	Actual Gas Flow Rate through Meter (Lpm)	$Q = \frac{V_d}{\Theta}$	$Y_d = \left[\frac{V_{ds}}{V_{dstd}} \right]$
Θ	Duration of Run (minutes)		
V _d	Gas Meter Volume, Actual (L)	$V_{dstd} = \frac{17.64(V_d)(P_b)}{(T_{ma} + 460)}$	$V_{ds} = \frac{(Q_s)(\Theta)}{1,000}$
T _{ma}	Average Meter Temperature (°F)		
Q _s	Standard Gas Flow Rate through BIOS (mL/min)		
V _{ds}	Gas Volume from BIOS, Standard Conditions (L)		
V _{d std}	Gas Volume from Meter, Standard Conditions (L)		
P _b	Barometric Pressure ("Hg)		
Y _d	Meter Correction Factor (unitless)		

Calibration Reference Information		
	Flow Cell	Base
BIOS Serial No:	109939	106096
Calibration Date:	12/15/10	06/23/10
Certificate No:	5001700	47774

Meter Box - Pyrometer Calibration Sheet

Meter Box No: MET 2 Office: Palatine
 Calibrated by: A. Karony Client: N/A
 Date of Calibration: 03/18/11 Job No: N/A
 Temperature Scale Used: Fahrenheit Type of Calibration: Full-Test

Calibration Reference Settings (°F)	Pyrometer Reading for each Channel (°F)						
	1 Stack	2 Meter A	3 Meter B	4 Traps	5 Htd Line	6 Aux1	7 Aux2
50	48	49	50	49	51	49	50
100	98	99	100	99	99	100	99
150	148	150	150	149	149	150	150
200	198			199	199		
250	248			249	249		
300	298			299	298		
350	348						
400	398						
450	448						
500	498						
550	548						
600	598						

Tolerance = $\pm 2^\circ\text{F}$ difference from reference setting.

Calibration Reference Information	
Reference Used: <u>Tegam 840A Calibrator</u>	Serial No: <u>T-242231</u>
Calibrated By: <u>JAH Meteorology Co. Inc.</u>	Date Calibrated: <u>11/24/10</u>
Calibration Report No: <u>1000125475</u>	

Meter Box Full Calibration

Meter Box No: met-4

A Side Meter Y_d : 1.0061

B Side Meter Y_d : 1.0055

A Side Calibration

Operator: k. sullivan
Date of Calibration: 03/18/11

Digital Counter Value: 01.5570
 P_b : 29.42

		Meter Box Gas Volume (L)				Standard Gas Volume (L)			Calibration Results	
Q (Lpm)	Θ Time	Initial	Final	V_d Net	T_{ma} Avg.	Q_s (mL/min)	V_{ds}	V_{dstd}	Y_d	Difference from Average
0.5	15.0	0.000	7.110	7.110	84.50	449.4	6.741	6.777	0.9948	-1.1%
0.9	15.0	0.000	13.850	13.850	76.17	909.7	13.646	13.406	1.0179	1.2%
1.9	15.0	0.000	28.230	28.230	82.00	1,812.1	27.182	27.030	1.0056	-0.1%
Average Y_d									1.00611	

B Side Calibration

Operator: k. sullivan
Date of Calibration: 03/18/11

Digital Counter Value: 01.5940
 P_b : 29.42

		Meter Box Gas Volume (liters)				Standard Gas Volume (liters)			Calibration Results	
Q (Lpm)	Θ Time	Initial	Final	V_d Net	T_{ma} Avg.	Q_s (mL/min)	V_{ds}	V_{dstd}	Y_d	Difference from Average
0.5	15.0	0.000	7.020	7.020	84.83	446.2	6.692	6.687	1.0009	-0.5%
0.9	15.0	0.000	13.770	13.770	76.17	898.1	13.471	13.328	1.0107	0.5%
1.9	15.0	0.000	28.260	28.260	82.33	1,811.8	27.177	27.043	1.0050	-0.1%
Average Y_d									1.00551	

Nomenclature		Equations	
Q	Actual Gas Flow Rate through Meter (Lpm)	$Q = \frac{V_d}{\Theta}$	$Y_d = \left[\frac{V_{ds}}{V_{dstd}} \right]$
Θ	Duration of Run (minutes)		
V_d	Gas Meter Volume, Actual (L)	$V_{dstd} = \frac{17.64(V_d)(P_b)}{(T_{ma} + 460)}$	$V_{ds} = \frac{(Q_s)(\Theta)}{1,000}$
T_{ma}	Average Meter Temperature (°F)		
Q_s	Standard Gas Flow Rate through BIOS (mL/min)		
V_{ds}	Gas Volume from BIOS, Standard Conditions (L)		
V_{dstd}	Gas Volume from Meter, Standard Conditions (L)		
P_b	Barometric Pressure ("Hg)		
Y_d	Meter Correction Factor (unitless)		

Calibration Reference Information

	Flow Cell	Base
BIOS Serial No:	109939	106096
Calibration Date:	12/15/10	06/23/10
Certificate No:	5001700	47774

Meter Box - Pyrometer Calibration Sheet

Meter Box No: met-4 Office: Palatine
 Calibrated by: k. sullivan Client: N/A
 Date of Calibration: 03/18/11 Job No: N/A
 Temperature Scale Used: Fahrenheit Type of Calibration: Full-Test

Calibration Reference Settings (°F)	Pyrometer Reading for each Channel (°F)						
	1 Stack	2 Meter A	3 Meter B	4 Traps	5 Htd Line	6 Aux1	7 Aux2
50	50	51	51	49	50	51	50
100	100	101	101	99	100	101	100
150	150	152	151	149	149	151	151
200	201			200	199		
250	250			250	250		
300	300			300	300		
350	350						
400	400						
450	450						
500	500						
550	550						
600	600						

Tolerance = $\pm 2^{\circ}\text{F}$ difference from reference setting.

Calibration Reference Information	
Reference Used: <u>Tegam 840A Calibrator</u>	Serial No: <u>T-242231</u>
Calibrated By: <u>JAH Meteorology Company</u>	Date Calibrated: <u>11/24/10</u>
Calibration Report No: <u>1000125475</u>	

Meter Box Critical Orifice Post-Test Calibration Data

Project No.	11265	Meter No.	61-5	Orifice	D-3
Location	wh	Meter Yd	0.9992	Orifice K'	0.5558
Test Date	07/26/11	Meter ΔH@	1.7185	Orifice Cal. Date	06/22/10
Operator	J Amundsen	Full Test Cal. Date	05/02/11		

Barom. Press. (P _b)	29.21	in. Hg	
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Leak Checks

Negative Pressure ☒ Pass
 No movement of manometer in one-minute

Positive Pressure ☒ Pass
 No movement of manometer in one-minute

Important: All leak checks must pass in order for calibration to be valid.

Run	Elapsed Time (minutes)	Meter Volume (dcf)	Meter Temperature		Ambient Temp. - T _{amb} (°F)	Orifice ΔH (in. W.C.)	Vacuum (in. Hg)	Net Run Time - Θ (minutes)	Net Meter Volume for Run - V _m (dcf)	Avg Meter Temp. for Run - T _m (°F)	DGM Calibration Factor - Y _i	Percent Variation - ΔY _i
	0.0	434.51	Inlet (°F)	Outlet (°F)								
	5.0	438.14	80	80	82	1.50	11	5.0	3.63	80.3	1.0036	-0.3%
	10.0	441.76	81	81	82	1.50	11	5.0	3.62	81.3	1.0080	0.1%
	15.0	445.38	83	81	83	1.50	11	5.0	3.62	82.3	1.0092	0.2%
Average Y _i											1.0069	
Cal. Error											0.8%	

Calculations and Specifications

$$Y_i = \frac{K' \times P_b \times (T_m + 460) \times \theta}{17.64 \times V_m \times (P_b + \frac{\Delta H}{13.6}) \times \sqrt{T_{amb} + 460}}$$

$$\Delta Y_i = \frac{Y_i - \bar{Y}}{\bar{Y}} \times 100 \quad \text{Spec.: } \Delta Y_i \leq \pm 2\%$$

$$\text{Cal. Error} = \frac{\bar{Y} - Y_d}{Y_d} \times 100 \quad \text{Spec.: Cal. Error} \leq \pm 5\%$$

Meter Box Critical Orifice Post-Test Calibration Data

Project No. 11265 Meter No. 61-7 Orifice C-5 Leak Checks

Location wh Meter Yd 0.9827 Orifice K' 0.5582 Negative Pressure ☒ Pass

Test Date 07/27/11 Meter ΔH@ 1.8247 Orifice Cal. Date 11/30/10 No movement of manometer in one-minute

Operator J Amundsen Full Test Cal. Date 04/15/10 Positive Pressure ☒ Pass

Barom. Press. (P_b) 29.21 in. Hg No movement of manometer in one-minute

Important: All leak checks must pass in order for calibration to be valid.

Run	Elapsed Time (minutes)	Meter Volume (dcf)	Meter Temperature		Ambient Temp. - T _{amb} (°F)	Orifice ΔH (in. W.C.)	Vacuum (in. Hg)	Net Run Time - θ (minutes)	Net Meter Volume for Run - V _m (dcf)	Avg Meter Temp. for Run T _m (°F)	DGM Calibration Factor - Y _i	Percent Variation - ΔY _i
	0.0	627.75	Inlet (°F)	Outlet (°F)								
	5.0	631.23	80	78								
	10.0	634.73	82	79	80	1.50	9	5.0	3.49	79.8	1.0506	4.6%
	15.0	638.74	85	78	81	1.50	9	5.0	3.50	81.0	1.0475	4.3%
			90	79	82	1.50	9	5.0	4.01	83.0	0.9159	-8.8%
Average Y _i											1.0047	
Cal. Error											2.2%	

Calculations and Specifications

$$Y_i = \frac{K \times P_b \times (T_m + 460) \times \theta}{17.64 \times V_m \times (P_b + \frac{\Delta H}{13.6}) \times \sqrt{T_{amb} + 460}}$$

$$\Delta Y_i = \frac{Y_i - \bar{Y}}{\bar{Y}} \times 100 \quad \text{Spec.: } \Delta Y_i \leq \pm 2\%$$

$$\text{Cal. Error} = \frac{\bar{Y} - Y_d}{Y_d} \times 100 \quad \text{Spec.: } \text{Cal. Error} \leq \pm 5\%$$



Meter Box Critical Orifice Post-Test Calibration Data

Project No.	11265	Meter No.	66-14	Orifice	D-3	
Location	wh	Meter Yd	0.9882	Orifice K'	0.5558	
Test Date	07/26/11	Meter ΔH@	1.7571	Orifice Cal. Date	06/22/10	
Operator	J Amundsen	Full Test Cal. Date	09/14/10			

Barom. Press. (P _b)	29.21	in. Hg	
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Leak Checks

Negative Pressure ☒ Pass

No movement of manometer in one-minute

Positive Pressure ☒ Pass

No movement of manometer in one-minute

Important: All leak checks must pass in order for calibration to be valid.

Run	Elapsed Time (minutes)	Meter Volume (dcf)	Meter Temperature		Ambient Temp. - T _{amb} (°F)	Orifice ΔH (in. W.C.)	Vacuum (in. Hg)	Net Run Time - Θ (minutes)	Net Meter Volume for Run - V _m (dcf)	Avg Meter Temp. for Run T _m (°F)	DGM Calibration Factor - Y _i	Percent Variation - ΔY _i
	0.0	558.84	Inlet (°F)	Outlet (°F)								
	5.0	562.38	76	76	77	1.50	10	5.0	3.54	76.3	1.0257	0.0%
	10.0	565.94	79	76	77	1.50	10	5.0	3.56	77.0	1.0216	-0.4%
	15.0	569.48	81	76	78	1.50	10	5.0	3.54	78.0	1.0286	0.3%
Average Y_i											1.0253	
Cal. Error											3.8%	

Calculations and Specifications

$$Y_i = \frac{K' \times P_b \times (T_m + 460) \times \theta}{17.64 \times V_m \times (P_b + \frac{\Delta H}{13.6}) \times \sqrt{T_{amb} + 460}}$$

$$\Delta Y_i = \frac{Y_i - \bar{Y}_i}{\bar{Y}_i} \times 100 \quad \text{Spec.: } \Delta Y_i \leq \pm 2\%$$

$$\text{Cal. Error} = \frac{\bar{Y}_i - Y_i}{Y_i} \times 100 \quad \text{Spec.: Cal. Error} \leq \pm 5\%$$

Meter Box Critical Orifice Post-Test Calibration Data

Project No.	11265	Meter No.	85-3	Orifice	D-3
Location	wh	Meter Yd	0.9925	Orifice K'	0.5558
Test Date	07/27/11	Meter ΔH@	1.7792	Orifice Cal. Date	06/22/10
Operator	k. sullivan	Full Test Cal. Date	05/16/11		

Barom. Press. (P_b) 29.21 in. Hg

Important: All leak checks must pass in order for calibration to be valid.

Leak Checks

Negative Pressure

No movement of manometer in one-minute ☒ Pass

Positive Pressure

No movement of manometer in one-minute ☒ Pass

Run	Elapsed Time (minutes)	Meter Volume (dcf)	Meter Temperature		Ambient Temp. - T _{amb} (°F)	Orifice ΔH (in. W.C.)	Vacuum (in. Hg)	Net Run Time - Θ (minutes)	Net Meter Volume for Run - V _m (dcf)	Avg Meter Temp. for Run T _m (°F)	DGM Calibration Factor - Y _i	Percent Variation - ΔY _i
	0.0	991.80	Inlet (°F)	Outlet (°F)								
	5.0	995.46	82	80								
	10.0	999.15	81	79	81	1.50	20	5.0	3.66	80.5	0.9965	0.7%
	15.0	1002.83	81	79	84	1.50	20	5.0	3.69	80.0	0.9847	-0.5%
			81	79	85	1.50	20	5.0	3.68	80.0	0.9865	-0.3%
Average Y _i											0.9892	
Cal. Error											-0.3%	

Calculations and Specifications

$$Y_i = \frac{K' \times P_b \times (T_m + 460) \times \theta}{17.64 \times V_m \times (P_b + \frac{\Delta H}{13.6}) \times \sqrt{T_{amb} + 460}}$$

$$\Delta Y_i = \frac{Y_i - \bar{Y}_i}{\bar{Y}_i} \times 100 \quad \text{Spec.: } \Delta Y_i \leq \pm 2\%$$

$$Cal. Error = \frac{\bar{Y}_i - Y_d}{Y_d} \times 100 \quad \text{Spec.: } Cal. Error \leq \pm 5\%$$

Meter Box Critical Orifice Post-Test Calibration Data

Project No. 11265 Meter No. MET 2A Office 34-2-2 Leak Checks

Location warehouse Meter Yd 0.9967 Office K' 0.7047 Negative Pressure

Test Date 7/27/2011 Meter ΔH@ n/a Office Cal. Date 3/24/2011 No movement of manometer in one-minute ☒ Pass

Operator J. Amundsen Full Test Cal. Date 4/26/2011 Min Vac to be Critical n/a Positive Pressure

No movement of manometer in one-minute ☒ Pass

Barom. Press. (P_b) 29.21 in. Hg

Important: All leak checks must pass in order for calibration to be valid.

Run	Elapsed Time (minutes)	Meter Volume (l)	Meter Temperature (°F)	Ambient Temp. - T _{amb} (°F)	Flow Rate (lpm)	Vacuum (in. Hg)	Net Run Time - θ (minutes)	Net Meter Volume for Run - V _m (l)	Avg Meter Temp. for Run T _m (°F)	DGM Calibration Factor - Y _i	Percent Variation - ΔY _i
	0.0	0.00	77								
1	5.0	4.69	79	76	0.90	15	5.0	4.69	78.0	0.9875	0.4%
2	10.0	9.42	81	75	0.90	15	5.0	4.73	80.0	0.9837	0.0%
3	15.0	14.19	83	75	0.90	15	5.0	4.77	82.0	0.9790	-0.4%
Average Y _i										0.9834	
Cal. Error										-1.3%	

Calculations and Specifications

$$Y_i = \frac{K' \times P_b \times (T_m + 460) \times \theta}{17.64 \times V_m \times (P_b) \times \sqrt{T_{amb} + 460}}$$

$$\Delta Y_i = \frac{Y_i - \bar{Y}_i}{\bar{Y}_i} \times 100 \quad \text{Spec.: } \Delta Y_i \leq \pm 2\%$$

$$\text{Cal. Error} = \frac{\bar{Y}_i - Y_d}{Y_d} \times 100 \quad \text{Spec.: } \text{Cal. Error} \leq \pm 5\%$$

Meter Box Critical Orifice Post-Test Calibration Data

Project No.	11265	Meter No.	MET 2B	Orifice	34-1-2	Leak Checks
Location	warehouse	Meter Yd	0.9950	Orifice K'	0.7133	Negative Pressure
Test Date	7/27/2011	Meter ΔH@	n/a	Orifice Cal. Date	3/24/2011	No movement of manometer in one-minute <input checked="" type="checkbox"/> Pass
Operator	J. Amundsen	Full Test Cal. Date	4/26/2011	Min Vac to be Critical	n/a	Positive Pressure
						No movement of manometer in one-minute <input checked="" type="checkbox"/> Pass

Barom. Press. (P_b) 29.21 in. Hg

Important: All leak checks must pass in order for calibration to be valid.

Run	Elapsed Time (minutes)	Meter Volume (l)	Meter Temperature (°F)	Ambient Temp. - T _{amb} (°F)	Flow Rate (lpm)	Vacuum (in. Hg)	Net Run Time - θ (minutes)	Net Meter Volume for Run - V _m (l)	Avg Meter Temp. for Run T _m (°F)	DGM Calibration Factor - Y _i	Percent Variation - ΔY _i
1	0.0	0.00	77								
2	5.0	4.69	78	76	0.90	15	5.0	4.69	77.5	0.9986	0.4%
3	10.0	9.41	79	75	0.90	15	5.0	4.72	78.5	0.9950	0.0%
	15.0	14.16	81	75	0.90	15	5.0	4.75	80.0	0.9915	-0.4%
Average Y _i										0.9950	
Cal. Error										0.0%	

Calculations and Specifications

$$Y_i = \frac{K' \times P_b \times (T_m + 460) \times \theta}{17.64 \times V_m \times (P_b) \times \sqrt{T_{amb} + 460}}$$

$$\Delta Y_i = \frac{Y_i - \bar{Y}_i}{\bar{Y}_i} \times 100 \quad \text{Spec.: } \Delta Y_i \leq \pm 2\%$$

$$\text{Cal. Error} = \frac{\bar{Y}_i - Y_d}{Y_d} \times 100 \quad \text{Spec.: } \text{Cal. Error} \leq \pm 5\%$$

Meter Box Critical Orifice Post-Test Calibration Data

Project No. 11265
 Location warehouse
 Test Date 7/27/2011
 Operator J. Amundsen

Meter No. MET 4A
 Meter Yd 0.9954
 Meter ΔH@ n/a
 Full Test Cal. Date 3/18/2011

Orifice 34-2-2
 Orifice K' 0.7042
 Orifice Cal. Date 3/24/2011
 Min Vac to be Critical n/a

Leak Checks

Negative Pressure
 No movement of manometer in one-minute ☒ Pass

Positive Pressure
 No movement of manometer in one-minute ☒ Pass

Important: All leak checks must pass in order for calibration to be valid.

Barom. Press. (P_b) 29.21 in. Hg

Run	Elapsed Time (minutes)	Meter Volume (l)	Meter Temperature (°F)	Ambient Temp. - T _{amb} (°F)	Flow Rate (lpm)	Vacuum (in. Hg)	Net Run Time - Θ (minutes)	Net Meter Volume for Run - V _m (l)	Avg Meter Temp. for Run - T _m (°F)	DGM Calibration Factor - Y _i	Percent Variation - ΔY _i
	0.0	0.00	78								
1	5.0	4.56	81	77	0.90	15	5.0	4.56	79.5	1.0168	0.1%
2	10.0	9.13	82	77	0.90	15	5.0	4.57	81.5	1.0183	0.3%
3	15.0	13.75	85	77	0.90	15	5.0	4.62	83.5	1.0110	-0.4%

Average Y_i

Cal. Error

Calculations and Specifications

$$Y_i = \frac{K' \times P_b \times (T_m + 460) \times \theta}{17.64 \times V_m \times (P_b) \times \sqrt{T_{amb} + 460}}$$

$$\Delta Y_i = \frac{Y_i - \bar{Y}_i}{\bar{Y}_i} \times 100 \quad \text{Spec.: } \Delta Y_i \leq \pm 2\%$$

$$\text{Cal. Error} = \frac{\bar{Y}_i - Y_d}{Y_d} \times 100 \quad \text{Spec.: Cal. Error} \leq \pm 5\%$$



Meter Box Critical Orifice Post-Test Calibration Data

Project No.	11265	Meter No.	MET 4B	Orifice	34-1-2
Location	warehouse	Meter Yd	1.0055	Orifice K'	0.7133
Test Date	7/27/2011	Meter ΔH@	n/a	Orifice Cal. Date	3/24/2011
Operator	J. Amundsen	Full Test Cal. Date	3/18/2011	Min Vac to be Critical	n/a

Barom. Press. (P _b)	29.21	in. Hg
---------------------------------	-------	--------

Leak Checks

Negative Pressure
No movement of manometer in one-minute ☒ Pass

Positive Pressure
No movement of manometer in one-minute ☒ Pass

Important: All leak checks must pass in order for calibration to be valid.

Run	Elapsed Time (minutes)	Meter Volume (l)	Meter Temperature (°F)	Ambient Temp. - T _{amb} (°F)	Flow Rate (lpm)	Vacuum (in. Hg)	Net Run Time - θ (minutes)	Net Meter Volume for Run - V _m (l)	Avg Meter Temp. for Run T _m (°F)	DGM Calibration Factor - Y _i	Percent Variation - ΔY _i
1	0.0	0.00	78								
2	5.0	4.70	80	77	0.90	15	5.0	4.70	79.0	0.9983	0.1%
3	10.0	9.41	82	77	0.90	15	5.0	4.71	81.0	0.9999	0.3%
	15.0	14.17	85	77	0.90	15	5.0	4.76	83.5	0.9940	-0.3%
Average Y_i										0.9974	
Cal. Error										-0.8%	

Calculations and Specifications

$$Y_i = \frac{K' \times P_b \times (T_m + 460) \times \theta}{17.64 \times V_m \times (P_b) \times \sqrt{T_{amb} + 460}}$$

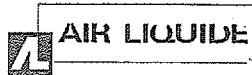
$$\Delta Y_i = \frac{Y_i - \bar{Y}_i}{\bar{Y}_i} \times 100$$

$$\text{Spec.: } \Delta Y_i \leq \pm 2\%$$

$$\text{Cal. Error} = \frac{\bar{Y}_i - Y_d}{Y_d} \times 100$$

$$\text{Spec.: Cal. Error} \leq \pm 5\%$$





Air Liquide America
Specialty Gases LLC



Shipped 1290 COMBERMERE STREET
From: TROY MI 48083
Phone: 248-589-2950 Fax: 248-589-2134
C E R T I F I C A T E O F A N A L Y S I S

ALASG
WAREHOUSE/STOCK/
UNIT A
27 FORESTWOOD COURT
ROMEONVILLE IL 60446

PROJECT #: 05-93929-002
PO#: ROMEONVILLE STOCK
ITEM #: 0501024 AL
DATE: 17Dec2010

CYLINDER #: ALM056950
FILL PRESSURE: 02000 PSIG

PURE MATERIAL: AIR

CAS# 132259-10-0


GRADE: ZERO AIR

PURITY: -

<u>IMPURITY</u>	<u>MAXIMUM CONCENTRATIONS</u>	<u>ACTUAL CONCENTRATIONS</u>
THC	1 PPM	< 1 PPM
O2	20 TO 21%	20.4 %

LOT # AIR121710

ANALYST:


ROBERT LESNIAK



Air Liquide America
Specialty Gases LLC



RATA CLASS

Dual-Analyzed Calibration Standard

1290 COMBERMERE STREET, TROY, MI 48083

Phone: 248-589-2950

Fax: 248-589-2134

CERTIFICATE OF ACCURACY: EPA Protocol Gas

Assay Laboratory

P.O. No.: 58091-71-65000
AIR LIQUIDE AMERICA SPECIALTY GASES LLC Project No.: 05-87129-005
1290 COMBERMERE STREET
TROY, MI 48083

Customer

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

ANALYTICAL INFORMATION

This certification was performed according to EPA Traceability Protocol For Assay & Certification of Gaseous Calibration Standards; Procedure G-1; September, 1997.

Cylinder Number: ALM056961 Certification Date: 04May2010 Exp. Date: 03May2013
Cylinder Pressure***: 2000 PSIG

COMPONENT

PROPANE
AIR

CERTIFIED CONCENTRATION (Moles)

5.13 PPM
BALANCE

ANALYTICAL

ACCURACY**
+/- 1%

TRACEABILITY

Direct NIST and VSL

*** Do not use when cylinder pressure is below 150 psig.

** Analytical accuracy is based on the requirements of EPA Protocol Procedure G1, September 1997.

REFERENCE STANDARD

TYPE/SRM NO.	EXPIRATION DATE	CYLINDER NUMBER	CONCENTRATION	COMPONENT
NTRM 1666	02Oct2012	ALM011480	9.470 PPM	PROPANE

INSTRUMENTATION

INSTRUMENT/MODEL/SERIAL#	DATE LAST CALIBRATED	ANALYTICAL PRINCIPLE
VARIAN/3400/7506	27Apr2010	TCD/FID

ANALYZER READINGS

(Z=Zero Gas R=Reference Gas T=Test Gas r=Correlation Coefficient)

First Triad Analysis

Second Triad Analysis

Calibration Curve

PROPANE

Date: 04May2010 Response Unit:AREA
Z1=0.00000 R1=246648.0 T1=133935.0
R2=246765.0 Z2=0.00000 T2=133353.0
Z3=0.00000 T3=134017.0 R3=247754.0
Avg. Concentration: 5.130 PPM

Concentration = $A + Bx + Cx^2 + Dx^3 + Ex^4$
 $r = 0.999996$
Constants: $A = 0.00404671$
 $B = 3.75408E-05$ $C = 0$
 $D = 0$ $E = 0$

APPROVED BY:

ROBERT LESNIAK



Air Liquide America
Specialty Gases LLC



RATA CLASS

Dual-Analyzed Calibration Standard

1290 COMBERMERE STREET, TROY, MI 48083

Phone: 248-589-2950

Fax: 248-589-2134

CERTIFICATE OF ACCURACY: EPA Protocol Gas

Assay Laboratory

P.O. No.: 58250-71-65000
AIR LIQUIDE AMERICA SPECIALTY GASES LLC Project No.: 05-89250-009
1290 COMBERMERE STREET
TROY, MI 48083

Customer

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

ANALYTICAL INFORMATION

This certification was performed according to EPA Traceability Protocol For Assay & Certification of Gaseous Calibration Standards; Procedure G-1; September, 1997.

Cylinder Number: AAL14628 Certification Date: 12Jul2010 Exp. Date: 11Jul2013
Cylinder Pressure***: 1900 PSIG

COMPONENT

PROPANE
AIR

CERTIFIED CONCENTRATION (Moles)

7.95 PPM
BALANCE

ANALYTICAL

ACCURACY**

+/- 1%

TRACEABILITY

Direct NIST and VSL

*** Do not use when cylinder pressure is below 150 psig.

** Analytical accuracy is based on the requirements of EPA Protocol Procedure G1, September 1997.

REFERENCE STANDARD

TYPE/SRM NO.	EXPIRATION DATE	CYLINDER NUMBER	CONCENTRATION	COMPONENT
NTRM 1668	02Oct2012	ALM029313	98.80 PPM	PROPANE

INSTRUMENTATION

INSTRUMENT/MODEL/SERIAL#	DATE LAST CALIBRATED	ANALYTICAL PRINCIPLE
VARIAN/3400/7506	25Jun2010	TCD/FID

ANALYZER READINGS

(Z=Zero Gas R=Reference Gas T=Test Gas r=Correlation Coefficient)

First Triad Analysis

Second Triad Analysis

Calibration Curve

PROPANE

Date: 12Jul2010 Response Unit: AREA
Z1=0.00000 R1=2625267. T1=212183.0
R2=2625176. Z2=0.00000 T2=211664.0
Z3=0.00000 T3=211613.0 R3=2628865.
Avg. Concentration: 7.950 PPM

Concentration = A + Bx + Cx2 + Dx3 + Ex4
r = 0.999999161
Constants: A = -0.02044045
B = 3.78737E-05 C = 0
D = 0 E = 0

APPROVED BY:

ROBERT LESNIAK



Air Liquide America
Specialty Gases LLC



RATA CLASS

Dual-Analyzed Calibration Standard

1290 COMBERMERE STREET, TROY, MI 48083

Phone: 248-589-2950

Fax: 248-589-2134

CERTIFICATE OF ACCURACY: EPA Protocol Gas

Assay Laboratory

AIR LIQUIDE AMERICA SPECIALTY GASES LLC
1290 COMBERMERE STREET
TROY, MI 48083

P.O. No.: 58278-71-65000

Project No.: 05-89582-007

Customer

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

ANALYTICAL INFORMATION

This certification was performed according to EPA Traceability Protocol For Assay & Certification of Gaseous Calibration Standards; Procedure G-1; September, 1997.

Cylinder Number: ALM065418

Certification Date: 19Jul2010

Exp. Date: 18Jul2013

Cylinder Pressure***: 2000 PSIG

COMPONENT

PROPANE
AIR

CERTIFIED CONCENTRATION (Moles)

15.0 PPM
BALANCE

ACCURACY**

+/- 1%

TRACEABILITY

Direct NIST and VSL

*** Do not use when cylinder pressure is below 150 psig.

** Analytical accuracy is based on the requirements of EPA Protocol Procedure G1, September 1997.

REFERENCE STANDARD

TYPE/SRM NO. EXPIRATION DATE
NTRM 1668 02Oct2012

CYLINDER NUMBER
ALM029313.

CONCENTRATION
98.80 PPM

COMPONENT
PROPANE

INSTRUMENTATION

INSTRUMENT/MODEL/SERIAL#
VARIAN/3400/7506

DATE LAST CALIBRATED
25Jun2010

ANALYTICAL PRINCIPLE
TCD/FID

ANALYZER READINGS

(Z = Zero Gas R = Reference Gas T = Test Gas r = Correlation Coefficient)

First Triad Analysis

PROPANE

Date: 19Jul2010 Response Unit: AREA

Z1 = 0.00000 R1 = 2592960. T1 = 394627.0

R2 = 2592484. Z2 = 0.00000 T2 = 394114.0

Z3 = 0.00000 T3 = 393509.0 R3 = 2604513.

Avg. Concentration: 15.00 PPM

Second Triad Analysis

Calibration Curve

Concentration = A + Bx + Cx² + Dx³ + Ex⁴

r = 0.999999161

Constants: A = -0.02044045

B = 3.78737E-05 C = 0

D = 0 E = 0

APPROVED BY:

ROBERT LESNIAK

CERTIFICATE OF BATCH ANALYSIS

NITROGEN - ULTRA HIGH PURITY-PURE

Part Number:	NI UHP200	Reference Number:	136-105322883-1
Cylinder Analyzed:	TW06306535	Cylinder Volume:	230 Cubic Feet
Laboratory:	NOC - Elk Grove - IL	Cylinder Pressure:	2200 PSIG
Analysis Date:	Jun 25, 2011	Valve Outlet:	580
Lot #:	136-105322883-1		

ANALYTICAL RESULTS

Component	Requested Purity	Certified Concentration
NitrogenUltraHighPurity	99.999%	99.999%
CO + CO2	< 1 PPM	0.98 PPM
Moisture	< 1 PPM	0.521 PPM
Oxygen	< 1 PPM	0.07 PPM
THC	< 0.5 PPM	0.05 PPM

Cylinders in Batch:

2A-2504, 2L41737, 504587, 613627, 80718, 949267, AGAC93658, AGAT52625, C136098, H-79345, H113858X, K235070, LK-334397, N-320475, N533102, TW06306535, W-440651, X160825

Notes:

Impurities verified against analytical standards traceable to NIST by weight and/or analysis.

Signature On File

Approved for Release

Page 1 of 136-105322883-1

**AIR LIQUIDE**Air Liquide America
Specialty Gases LLC**SCOTT™****RATA CLASS***Dual-Analyzed Calibration Standard*

1290 COMBERMERE STREET, TROY, MI 48083

Phone: 248-589-2950

Fax: 248-589-2134

CERTIFICATE OF ACCURACY: EPA Protocol GasAssay LaboratoryP.O. No.: 58250-71-65000
AIR LIQUIDE AMERICA SPECIALTY GASES LLC Project No.: 05-89250-006
1290 COMBERMERE STREET
TROY, MI 48083CustomerCLEAN AIR ENGINEERING
DON ALLEN
500 W. WOOD STREET
PALATINE IL 60067**ANALYTICAL INFORMATION**

This certification was performed according to EPA Traceability Protocol For Assay & Certification of Gaseous Calibration Standards; Procedure G-1; September, 1997.

Cylinder Number: ALM009165 Certification Date: 11Jul2010 Exp. Date: 10Jul2013
Cylinder Pressure***: 2000 PSIGCOMPONENTCERTIFIED CONCENTRATION (Moles)ANALYTICALACCURACY**TRACEABILITY

CARBON DIOXIDE

9.93 %

+/- 1%

Direct NIST and VSL

OXYGEN

10.2 %

+/- 1%

Direct NIST and VSL

NITROGEN

BALANCE

*** Do not use when cylinder pressure is below 150 psig.

** Analytical accuracy is based on the requirements of EPA Protocol Procedure G1, September 1997.

REFERENCE STANDARD

<u>TYPE/SRM NO.</u>	<u>EXPIRATION DATE</u>	<u>CYLINDER NUMBER</u>	<u>CONCENTRATION</u>	<u>COMPONENT</u>
NTRM 2300	01Nov2010	1D002807	23.04 %	CARBON DIOXIDE
NTRM 2350	01Dec2011	K016398	23.20 %	OXYGEN

INSTRUMENTATIONINSTRUMENT/MODEL/SERIAL#DATE LAST CALIBRATEDANALYTICAL PRINCIPLE

PIR/2000/609015

12Jul2010

NDIR

CAI/110P/V03018

12Jul2010

PARAMAGNETIC

ANALYZER READINGS

(Z=Zero Gas R=Reference Gas T=Test Gas r=Correlation Coefficient)

First Triad Analysis

Second Triad Analysis

Calibration Curve

CARBON DIOXIDEDate: 13Jul2010 Response Unit: MV
Z1=0.00000 R1=100.0000 T1=60.33000
R2=100.0000 Z2=0.00000 T2=60.34000
Z3=0.00000 T3=60.34000 R3=100.0000
Avg. Concentration: 9.929 %Concentration = A + Bx + Cx² + Dx³ + Ex⁴
r = 0.999990289
Constants: A = -0.004874463
B = 2 C = 0.1300744691
D = 0 E = 0**OXYGEN**Date: 13Jul2010 Response Unit: %
Z1=0.00000 R1=23.20000 T1=10.17000
R2=23.20000 Z2=0.00000 T2=10.17000
Z3=0.00000 T3=10.17000 R3=23.20000
Avg. Concentration: 10.18 %Concentration = A + Bx + Cx² + Dx³ + Ex⁴
r = 0.999999
Constants: A = -0.00181762
B = 1.001584599 C = 0
D = 0 E = 0

APPROVED BY: _____



Air Liquide America
Specialty Gases LLC



RATA CLASS

Dual-Analyzed Calibration Standard

1290 COMBERMERE STREET, TROY, MI 48083

Phone: 248-589-2950

Fax: 248-589-2134

CERTIFICATE OF ACCURACY: EPA Protocol Gas

Assay Laboratory

AIR LIQUIDE AMERICA SPECIALTY GASES LLC
1290 COMBERMERE STREET
TROY, MI 48083

P.O. No.: 58953-71-65000

Document #: 41867307-014

Customer

CLEAN AIR ENGINEERING

DON ALLEN
500 WEST WOOD STREET
PALATINE IL 60067
US

ANALYTICAL INFORMATION

This certification was performed according to EPA Traceability Protocol For Assay & Certification of Gaseous Calibration Standards; Procedure G-1; September, 1997.

Cylinder Number: **ALM020472**
Cylinder Pressure***: **2000 PSIG**

Certification Date: **07Jun2011**

Exp. Date: **06Jun2014**

COMPONENT	CERTIFIED CONCENTRATION (Moles)		ACCURACY**	TRACEABILITY
OXYGEN	21.1	%	+/- 1%	Direct NIST and VSL
CARBON DIOXIDE	20.8	%	+/- 1%	Direct NIST and VSL
NITROGEN	BALANCE			

*** Do not use when cylinder pressure is below 150 psig.

** Analytical accuracy is based on the requirements of EPA Protocol Procedure G1, September 1997.

REFERENCE STANDARD

TYPE/SRM NO.	EXPIRATION DATE	CYLINDER NUMBER	CONCENTRATION	COMPONENT
NTRM 2350 23	01Dec2011	K024582	23.20 %	OXYGEN
NTRM 2300	17Aug2016	K026052	23.04 %	CARBON DIOXIDE

INSTRUMENTATION

INSTRUMENT/MODEL/SERIAL#	DATE LAST CALIBRATED	ANALYTICAL PRINCIPLE
CAI/110P/V03018	24May2011	PARAMAGNETIC
PIR/2000/609015	31May2011	NDIR

ANALYZER READINGS

(Z = Zero Gas R = Reference Gas T = Test Gas r = Correlation Coefficient)

First Triad Analysis

OXYGEN

Date: 07Jun2011 Response Unit: %
Z1=0.00000 R1=23.20000 T1=21.09000
R2=23.20000 Z2=0.00000 T2=21.09000
Z3=0.00000 T3=21.09000 R3=23.20000
Avg. Concentration: 21.08 %

Second Triad Analysis

Calibration Curve

Concentration = A + Bx + Cx² + Dx³ + Ex⁴
r = 0.999999
Constants: A = -0.01409096
B = 1.000097569 C = 0
D = 0 E = 0

CARBON DIOXIDE

Date: 07Jun2011 Response Unit: MV
Z1=0.00000 R1=100.0000 T1=94.90000
R2=100.0000 Z2=0.00000 T2=94.90000
Z3=0.00000 T3=94.90000 R3=100.0000
Avg. Concentration: 20.80 %

Concentration = A + Bx + Cx² + Dx³ + Ex⁴
r = 0.999996
Constants: A = -0.00179303
B = 0.134633752 C = -0.000327
D = 0.000012834 E = 0

APPROVED BY: _____

3.8.2 Changing The Filter

Check the filter monthly. The filter element is removed by unscrewing the large filter knob on the rear panel of the analyser. Discard the old element if dirty or wet and fit a new filter element (part no. 2377-3608) then check that sample pre-conditioning is adequate. In common with normal instrument practices periodically check all pipework for damage and leaks.

CAUTION

The analyser must not be operated without the filter element in place since dust and other particulates may permanently damage the oxygen measuring cell.

3.9 Effect of Background Gases on Oxygen Reading

The composition of the background gas in the sample may have an effect on the oxygen reading. In high accuracy work this could be significant. For an O₂ unit calibrated on nitrogen and oxygen the errors are as follows:

Argon	-0.2%
Carbon dioxide	-0.3%
Halothane	-2.2%
Helium	+0.3%
Krypton	-0.5%
Methane	-0.2%
Neon	+0.2%
Nitric oxide	+48.36%
Nitrous oxide	-0.2%
Nitrogen dioxide	+20.0%
Xenon	-1.0%

These values assume 100% of the background gas is passing through the unit. Values and examples of calculations for other gases are listed in Servomex applications note 7986-0073.

This error can be compensated for by offsetting the zero by the amount of the error or by using the background gas as the zero calibration gas.

Likewise, the composition of the background gas in the sample may affect the CO₂ reading. In high accuracy work, this might be significant. For a CO₂ unit calibrated on nitrogen for zero and CO₂ in nitrogen for span, the errors are as follows:

2.5% H ₂ O vapour	=	92ppm CO ₂
5% CH ₄	=	13ppm CO ₂
500vpm SO ₂	=	50ppm CO ₂
500vpm CO	=	6ppm CO ₂

5. Data from document 7986-0073

Gas	Formula	Molar mag.sus	Zero Error				
			X_m	20C	50C	60C	110C
		x 10E-6	x 0.01%	x 0.01%	x 0.01%	x 0.01%	x 0.01%
Acetaldehyde	CH3CHO	-22.70	-0.31	-0.34	-0.35	-0.40	
Acetic acid	CH3CO2H	-31.50	-0.56	-0.62	-0.64	-0.74	
Acetone	CH3COCH3	-33.70	-0.63	-0.69	-0.71	-0.82	
Acetylene	HCCH	-20.80	-0.25	-0.28	-0.29	-0.33	
Acrylonitrile	CH2=CHCN	-24.10	-0.35	-0.39	-0.40	-0.46	
Allyl alcohol	CH2CHCH2OH	-36.70	-0.71	-0.79	-0.81	-0.93	
Ammonia	NH3	-18.00	-0.17	-0.19	-0.20	-0.23	
Argon	Ar	-19.60	-0.22	-0.24	-0.25	-0.29	
Benzene	C6H6	-54.84	-1.24	-1.36	-1.41	-1.62	
Boron chloride	BCl3	-59.90	-1.38	-1.53	-1.57	-1.81	
Boron trifluoride	BF3	-19.00	-0.20	-0.22	-0.23	-0.26	
Bromine	Br2	-73.50	-1.78	-1.96	-2.02	-2.32	
1,2 Butadiene	C4H6	-35.60	-0.68	-0.75	-0.77	-0.89	
1,3 Butadiene	C4H6	-30.60	-0.54	-0.59	-0.61	-0.70	
n-Butane	C4H10	-50.30	-1.11	-1.22	-1.26	-1.45	
iso-Butane	(CH3)2CHCH2	-51.70	-1.15	-1.26	-1.30	-1.50	
1 Butene	CH3CH2CH=CH2	-41.10	-0.84	-0.93	-0.96	-1.10	
n-Butyl acetate	CH3COOC4H9	-77.50	-1.89	-2.09	-2.15	-2.47	
iso-Butylene	(CH3)2CH=CH2	-44.40	-0.94	-1.03	-1.06	-1.22	
1 Butyne	CH3C3H2	-43.50	-0.91	-1.00	-1.03	-1.19	
(Ethylacetylene)							
Carbon dioxide	CO2	-21.00	-0.26	-0.29	-0.30	-0.34	
Carbon disulphide	CS2	-42.20	-0.87	-0.96	-0.99	-1.14	
Carbon monoxide	CO	-9.80	0.06	0.07	0.07	0.08	
Carbon tetrachloride	CCl4	-66.60	-1.58	-1.74	-1.79	-2.06	
Carbon tetrafluoride	CF4	-31.20	-0.55	-0.61	-0.63	-0.72	
Chlorine	Cl2	-40.50	-0.82	-0.91	-0.94	-1.08	
Chloro ethanol	ClCH2CH2OH	-51.40	-1.14	-1.25	-1.29	-1.49	
Chloroform	CHCl3	-59.30	-1.37	-1.51	-1.55	-1.78	
Cumene	(CH3)2CHC6H5	-89.53	-2.24	-2.47	-2.55	-2.93	
Cyclohexane	C6H12	-68.13	-1.62	-1.79	-1.84	-2.12	
Cyclopentane	C5H10	-59.18	0.35	0.38	0.39	0.45	
Cyclopropane	C3H6	-39.90	-0.81	-0.89	-0.92	-1.05	
Diacetylene	C4H2	-37.50	-0.74	-0.81	-0.84	-0.96	
Dichloroethylene	(CHCl)2	-49.20	-1.07	-1.18	-1.22	-1.40	
Diethyl ether	(C2H5)2O	-55.10	-1.25	-1.37	-1.41	-1.63	
2,2 Difluoro 1 chloroethane	CClH2CHF2	-52.40	-1.17	-1.29	-1.33	-1.52	
1,2 Difluoro 1,2 dichloroethylene	CFCl=CFCl	-60.00	-1.39	-1.53	-1.58	-1.81	
Difluoro dichloro methane (Freon 12)	CCl2F2	-52.20	-1.16	-1.28	-1.32	-1.52	
Dimethoxy methane	CH2(OCH3)2	-47.30	-1.02	-1.12	-1.16	-1.33	
Dimethylamine	(CH3)2NH	-39.90	-0.81	-0.89	-0.92	-1.05	

Neon	Ne	-6.70	0.15	0.17	0.17	0.20
Nitric oxide	NO	1461.00	42.56	42.96	42.94	41.62
Nitrobenzene	C6H5NO2	-61.80	-1.44	-1.59	-1.63	-1.88
Nitrogen	N2	-12.00	0.00	0.00	0.00	0.00
Nitrogen dioxide	NO2	150.00	5.00	16.00	20.00	35.00
ortho-Nitrotoluene	C6H4CH3NO2	-72.30	-1.74	-1.92	-1.98	-2.28
para-Nitrotoluene	C6H4CH3NO2	-76.90	-1.88	-2.07	-2.13	-2.45
Nitrous oxide	N2O	-18.90	-0.20	-0.22	-0.23	-0.26
n-Nonane	C9H20	-108.13	-2.78	-3.06	-3.16	-3.63
n-Octane	C8H18	-96.63	-2.45	-2.70	-2.78	-3.19
Oxygen	O2	3449.00	100.00	100.00	100.00	100.00
Ozone	O3	6.70	0.54	0.60	0.61	0.71
iso-Pentane	C5H12	-64.40	-1.51	-1.67	-1.72	-1.98
n-Pentane	C5H12	-63.10	-1.48	-1.63	-1.68	-1.93
Phenol	C6H5OH	-60.21	-1.39	-1.54	-1.58	-1.82
Phosphine	PH3	-26.00	-0.40	-0.45	-0.46	-0.53
Phosphorous oxychloride	POCl3	-69.00	-1.65	-1.82	-1.87	-2.15
Propane	C3H8	-38.60	-0.77	-0.85	-0.87	-1.00
iso-Propanol	(CH3)2CHOH	-47.60	-1.03	-1.13	-1.17	-1.34
Propene	CH3CH=CH2	-31.50	-0.56	-0.62	-0.64	-0.74
n-Propyl acetate	CH3COOC3H7	-65.90	-1.56	-1.72	-1.77	-2.03
Propyl amine	C3H7NH2	-52.40	-1.17	-1.29	-1.33	-1.52
Propyl chloride	C3H7Cl	-56.10	-1.27	-1.40	-1.45	-1.66
Propylene	C3H6	-31.50	-0.56	-0.62	-0.64	-0.74
Propylene oxide	OCH2CHCH3	-42.50	-0.88	-0.97	-1.00	-1.15
iso-Propyl ether	(CH3)2CHOCH(CH3)2	-79.40	-1.95	-2.15	-2.21	-2.54
Propyl fluoride	C3H7F	-52.20	-1.16	-1.28	-1.32	-1.52
Pyridine	N(CH)5	-49.21	-1.08	-1.19	-1.22	-1.40
Silane	SiH4	-20.50	-0.25	-0.27	-0.28	-0.32
Silicon tetrachloride	SiCl4	-88.30	-2.20	-2.43	-2.50	-2.88
Styrene	C6H5CH=CH2	-68.20	-1.62	-1.79	-1.85	-2.12
Sulphur dioxide	SO2	-18.20	-0.18	-0.20	-0.20	-0.23
Sulphur hexafluoride	SF6	-44.00	-0.92	-1.02	-1.05	-1.21
Tetrachloroethylene	Cl2C=CCl2	-81.60	-2.01	-2.22	-2.28	-2.63
Tetrahydrofuran	C4H8O	-52.00	-1.16	-1.27	-1.31	-1.51
Toluene	C6H5CH3	-66.11	-1.56	-1.72	-1.78	-2.04
1,1,2 Trichloroethane (Freon 113)	CHCl2CH2Cl	-66.20	-1.57	-1.73	-1.78	-2.05
Trichloroethylene	CHCl=CCl2	-65.80	-1.55	-1.71	-1.77	-2.03
Trifluorochloroethylene	C2F3Cl	-49.10	-1.07	-1.18	-1.22	-1.40
Trimethylamine	(CH3)3N	-51.70	-1.15	-1.26	-1.30	-1.50
Tungsten fluoride	WF6	-40.00	-0.81	-0.89	-0.92	-1.06
Urethane	CO(NH2)OC2H5	-57.00	-1.30	-1.43	-1.48	-1.70
Vacuum	-	0.00	0.35	0.38	0.39	0.45
Vinyl bromide	CH2=CHBr	-44.80	-0.95	-1.04	-1.08	-1.24
Vinyl chloride	CH2=CHCl	-35.60	-0.68	-0.75	-0.77	-0.89
Vinyl fluoride	CH2=CHF	-28.80	-0.49	-0.54	-0.55	-0.63
Water	H2O	-13.00	-0.03	-0.03	-0.03	-0.04
Xenon	Xe	-43.90	-0.92	-1.02	-1.05	-1.20
Xylene	(CH3)2C6H4	-77.78	-1.90	-2.09	-2.16	-2.48

Marathon Petroleum Company
Clean Air Project No: 11265
FCCU Scrubber Stack

Date 7/13/2011

O₂ Stratification Test (12-Point)

Sampled at each point for at least 2 x system response time

Response Time (sec) 60

Deviation Basis % deviation from avg.

Pt.	2-01	2-02	2-03	4-01	4-02	4-03
Concentration	3.308	3.295	3.348	3.342	3.283	3.348
(%dv)	3.337	3.281	3.331	3.307	3.277	3.307
	3.318	3.269	3.310	3.325	3.314	3.309
	2.929	3.247	3.295	3.291	3.305	3.318
	3.349	3.242	3.325	3.267	3.253	3.316
	3.357	3.247	3.324	3.237	3.247	3.323
	3.325	3.249	3.307	3.249	3.254	3.316
	3.308	3.271	3.329	3.250	3.266	3.276
	3.320	3.270	3.327	3.262	3.279	3.320
	3.332	3.278	3.323	3.282	3.329	3.331
Pt. Avg.	3.288	3.265	3.322	3.281	3.281	3.317
% deviation (± 5%)	0.0	-0.7	1.0	-0.2	-0.3	0.8

Pt.	1-01	1-02	1-03	3-01	3-02	3-03
Concentration	3.351	3.286	3.350	3.310	3.278	3.222
(%dv)	3.373	3.248	3.315	3.306	3.263	3.300
	3.369	3.245	3.300	3.292	3.293	3.309
	3.307	3.247	3.277	3.325	3.280	3.298
	3.305	3.250	3.236	3.319	3.253	3.242
	3.289	3.245	3.288	3.303	3.239	3.239
	3.301	3.325	3.262	3.305	3.249	3.261
	3.268	3.316	3.249	3.278	3.297	
	3.244	3.302	3.230	3.297	3.275	
	3.282	3.333	3.290	3.303	3.267	
Pt. Avg.	3.309	3.280	3.280	3.304	3.269	3.267
% deviation (± 5%)	0.6	-0.3	-0.3	0.4	-0.6	-0.7

Run cut short.

Results

Mean (%dv) 3.29

Number of points ± 5% 0

Number of points ± 10% 0

Per USEPA Method 3A (referencing Method 7E), sampling can occur at a single point.

Marathon Petroleum Company
Clean Air Project No: 11265
FCCU Scrubber Stack

Date 7/13/2011

CO₂ Stratification Test (12-Point)

Sampled at each point for at least 2 x system response time

Response Time (sec) 60

Deviation Basis % deviation from avg.

Pt.	2-01	2-02	2-03	4-01	4-02	4-03
Concentration	14.179	14.173	14.129	14.103	14.171	14.120
(%dv)	14.147	14.173	14.145	14.142	14.184	14.136
	14.108	14.184	14.166	14.122	14.139	14.159
	13.843	14.195	14.183	14.129	14.154	14.159
	14.104	14.220	14.161	14.166	14.187	14.145
	14.096	14.221	14.146	14.191	14.210	14.134
	14.120	14.225	14.158	14.199	14.209	14.146
	14.139	14.201	14.142	14.196	14.194	14.172
	14.143	14.216	14.134	14.198	14.184	14.146
	14.131	14.205	14.146	14.173	14.127	14.121
Pt. Avg.	14.101	14.201	14.151	14.162	14.176	14.144
% deviation (± 5%)	-0.4	0.3	-0.1	0.0	0.1	-0.1

Pt.	1-01	1-02	1-03	3-01	3-02	3-03
Concentration	14.102	14.178	14.090	14.139	14.166	14.215
(%dv)	14.077	14.197	14.132	14.156	14.189	14.126
	14.077	14.202	14.151	14.161	14.160	14.132
	14.143	14.205	14.163	14.132	14.165	14.124
	14.148	14.206	14.203	14.136	14.190	14.182
	14.151	14.188	14.167	14.147	14.202	14.200
	14.148	14.120	14.190	14.148	14.194	14.184
	14.176	14.128	14.206	14.174	14.164	Run cut short.
	14.197	14.141	14.210	14.150	14.170	
	14.179	14.091	14.178	14.145	14.182	
Pt. Avg.	14.140	14.165	14.169	14.149	14.178	14.166
% deviation (± 5%)	-0.1	0.1	0.1	-0.1	0.1	0.1

Results

Mean (%dv) 14.16

Number of points ± 5% 0

Number of points ± 10% 0

Per USEPA Method 3A (referencing Method 7E), sampling can occur at a single point.

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FIELD DATA

E

I hereby certify that all pages contained within this Appendix have been reviewed and, to the best of my ability, verified accurate.

QA/QC Initials: SB

Date: 9/14



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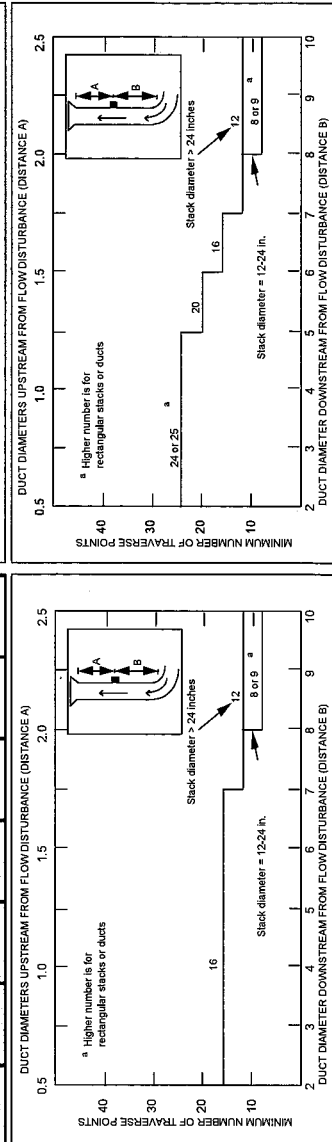
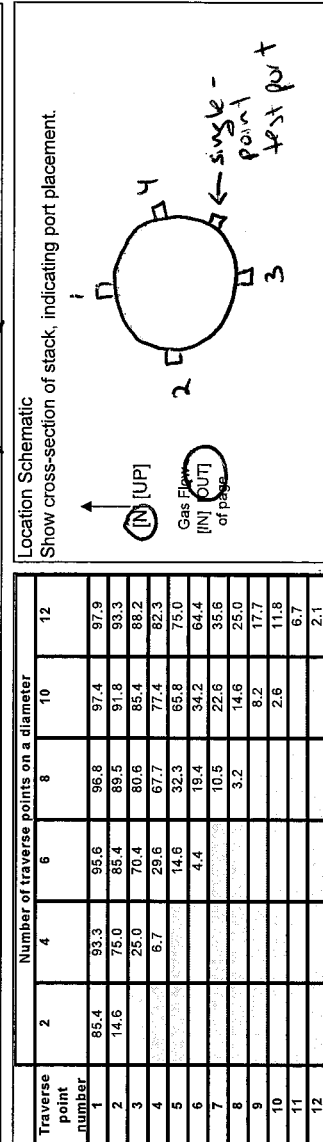
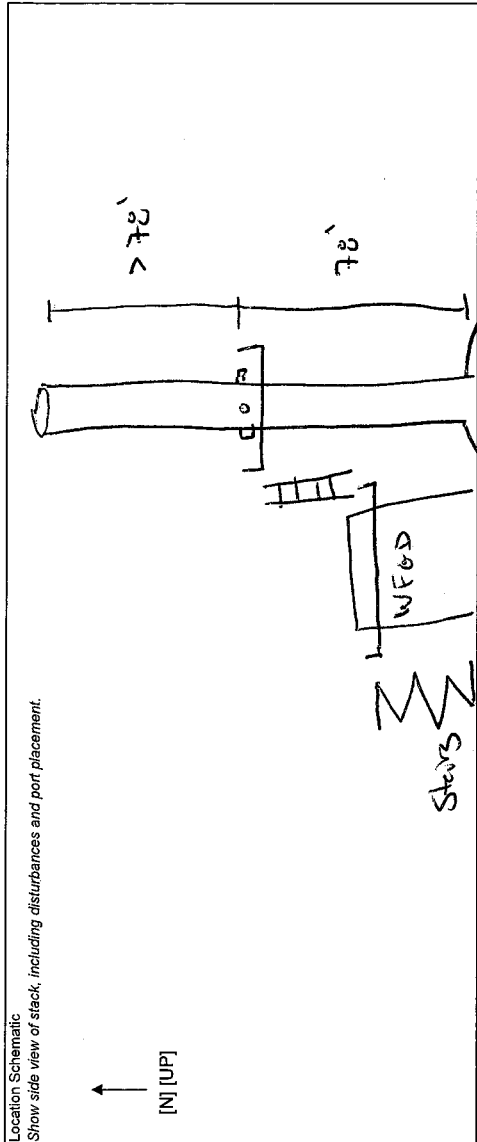
METHOD 1 FIELD DATA SHEET

TEST LOCATION: Scrubber Stack
UNIT: FCCU

Client	MPC	Project No.	11265
Plant	Robinson	Date	7/12/2011
Duct Dimensions	114 (in.)	Area	70.8822 (ft²)
Port Length	6 (in.)	Port Diameter	4 (in.)
Equivalent Diameter (Rectangular Ducts)	Deq=2LW/(L+W) N/A		
Distance to Port Distance Upstream (A)	78' / 78' / 78' / 8.2 x D		
Distance to Port Distance Downstream (B)	72' / 72' / 72' / 8.2 x D		
Number of Points Required	12		
Number of Points / Port Required	3		

Point	% Diameter	Point Distance	Probe Mark
	Round Stacks Only	X	X + Port Depth
1	95.6	109.0	115.0
2	85.4	97.3	103.3
3	70.4	80.3	86.3
4	29.6	33.7	39.7
5	14.6	16.7	22.7
6	4.4	5.0	11.0
<hr/>			
1	29.6	33.7	39.7
2	14.6	16.7	22.7
3	4.4	5.0	11.0

(4 ports @ 90° are used)

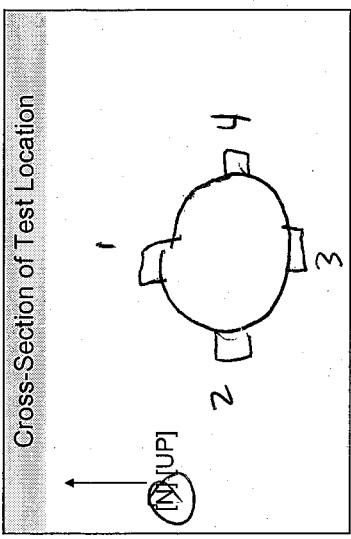


Circle correct bracketed directions on diagrams.

QA/QC KC
Date 7/12/2011

TEST LOCATION: Stack
 UNIT: FCU SCRUBBER

CYCLONIC FLOW CHECK FIELD DATA SHEET



Amb. Temp. (°F)	58.4	Bar. Press.	29.40 [in/Hg] [mbar]
Duct Dimensions (in.)	14 in	Port Len. (in.)	6
Static Press. (in H ₂ O)	-0.5	Gas Flow [In] [Out]	all the way (in) [Out]
Start Time: 13:40		Stop Time: 14:00	

Client	Marathon	Project No.	11265
Plant	Robinson	Date	7/12/11
Meter Operator	S. Donley		
Probe Operator	B. Arnold		

Probe I.D. No.	67-4-1	Pilot Cp	0.819
Pilot Leak Check Before:	<input checked="" type="checkbox"/>	After:	Good <input checked="" type="checkbox"/> Bad <input type="checkbox"/>

Traverse Point Number	Velocity Pressure at 0° (in. H ₂ O)	Rotation Angle α giving 0 v.p.	Traverse Point Number	Velocity Pressure at 0° (in. H ₂ O)	Rotation Angle α giving 0 v.p.	Traverse Point Number	Velocity Pressure at 0° (in. H ₂ O)	Rotation Angle α giving 0 v.p.	Notes
1-1	0.05	10							
1-2	0.0	0							
1-3	-0.02	10.9							
2-1	0.08	5.5							
2-2	0	0							
2-3	-0.02	13.2							
3-1	0	0							
3-2	0	0							
3-3	0	0							
4-1	0.08	9.8							
4-2	0.05	4.4							
4-3	0	0							

Total of absolute values of a 53.80

Average of absolute values of a 4.48

Procedure: Position the pitot perpendicular to the expected direction of gas flow (0 degrees reference). Note the velocity pressure. If zero, acceptable flow condition exists, if not zero, rotate the pitot up to +/- 90 degrees (rotation angle called alpha a). Determine and record the value of the rotation angle (a) to the nearest degree. See Reference Method 1, Section 2.4. Calculate the average of the absolute values of a. Assign values of zero to points which require no rotation. If the average of a is greater than 20 degrees, the overall condition of the flow is unacceptable and an alternative method of velocity and sample traversing must be used.

QA/QC SD
 Date 7/12/11



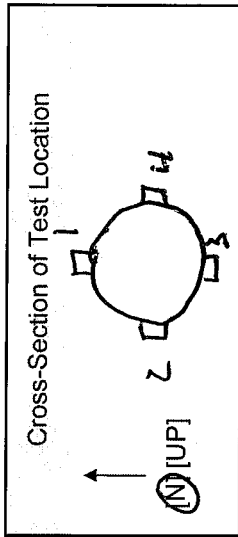
Stack

VELOCITY DETERMINATION FIELD DATA SHEET

PAGE 1 OF

UNIT: FCCU SCRABBER

Client	MPL	Project No.	11265
Plant	BAR ROBINSON	Date	7-12-11
Meter Operator	S ROONEY		
Probe Operator	B AARVOLD		
Source of Moisture and Molecular Weight Data			



Amb. Temp. (°F)	98.4	Bar. Press.	28.40	[in. Hg] [inbar]
Pitot Cp	0819	Probe I.D. No.	67-4-1	
Duct Diameters from Disturbance				
Downstream	8.2 in	Upstream	8.2 in	
First point all the way	Out	Port Len. (in.)	6	
Gas Flow [In]	Out	of page		
Duct Dimensions (in.)	Ø 14 in			

[illegible]

Sum of square roots.

Circle correct bracketed units on data sheet.

LOCATION: Stack RUN: 1-A

FCCU Scrubber

Method 18 - Impingers Field Data Sheet

PAGE 1 OF 2

Client: <u>Marathon Petroleum</u>	Project No.: <u>11265</u>
Plant: <u>Robinson, IL</u>	Unit: <u>FCCU Scrubber</u>
Date: <u>7-13-11</u>	Inlet/Outlet/Stack: <u>(Inlet/Outlet/Stack)</u>
Meter Operator: <u>H. Nguyen</u>	
Meter Box Number: <u>NET 2</u>	
Meter ΔH @ <u>Yd</u>	<u>0.9967</u>

Cross-Section of Test Location	
	Duct Dims. (in.) <u>6x11x</u> Port Lens (in.) <u>6</u> Gas Flow (IN) [OUT] of page

Amb. Temp. (°F)	<u>89</u>
Bar. Press.	<u>29.40</u> (in. Hg) [mbar]
Probe Length	<u>4'</u>
Probe Material	<u>Teflon</u>
IGS Bag ID No.	

Leak Rate Before <u>0.010</u> [cfm] (Lpm) @ <u>7</u> (in. Hg)
Leak Rate After <u>0.010</u> [cfm] (Lpm) @ <u>7</u> (in. Hg)

Start Time: <u>9:36</u>	Stop Time: <u>10:54</u>
-------------------------	-------------------------

Min/pt Elapsed Time	Pump Vacuum (in. Hg)	Stack Temp. (°F)	Orifice Setting (in. H ₂ O)	Gas Sample Volume - V _m		Gas Sample Temperature at Dry Gas Meter		Flow Rate [cfm] (Lpm)	Bath Temp. (°F)	Notes
				Init. Vol.	Imp ³ [L]	Inlet T _{m in.} (°F)	Outlet T _{m out.} (°F)			
5	2	148		0.00	1.242	84		0.25	49	
10	2	148			2.497	84		0.25	47	
15	2	148			3.755	84		0.25	47	
20	2	149			4.978	84		0.25	46	
25	2.5	149			6.252	85		0.25	46	
30	2.5	148			7.510	85		0.25	46	
35	2.5	148			8.757	85		0.25	46	
40	2.5	148			10.051	86		0.25	45	
45	2.5	148			11.257	86		0.25	47	
50	2.5	147			12.509	86		0.25	48	
55	3	147			13.759	87		0.25	48	
Total					20.011					
Average		148.0				85.2125				

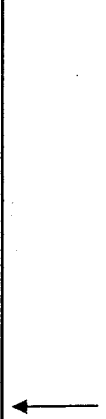
Circle correct bracketed units on data sheet.

QA/QC lw
Date 7/13/11



PAGE 2 OF 2

RUN: 1-A

Cross-Section of Test Location	Port Lens. (in.)	Gas Flow [IN] [OUT] of page
 <p>[N] [UP]</p>	Duct Dims. (in.)	

Amb. Temp. (°F)
Bar. Press. [in Hg] [mbar]
Probe Length
Probe Material
IGS Bag ID No.

Leak Rate Before	[cfm] [Lpm]	@	(in. Hg)
Leak Rate After	[cfm] [Lpm]	@	(in. Hg)

Start Time:	Stop Time:
-------------	------------

[illegible]

Circle correct bracketed units on data sheet.

FCCU Scrubber

LOCATION: STACK RUN: 1-B

Method 18 - Impingers Field Data Sheet

PAGE 1 OF 2

Client	Marathon Petroleum	Project No.	11265
Plant	RAINSAN, IL	Unit	FCCU Scrubber
Date	7-13-11	Inlet/Outlet	Stack
Meter Operator	H. Nguyen		
Meter Box Number	NIST-2		
Meter ΔH		Y_d	0.9950

Cross-Section of Test Location	
	Duct Dims. (in.) 114
Port Lens. (in.)	6
Gas Flow [IN] [OUT]	of page

Amb. Temp. (°F)	89
Bar. Press.	29.40 (in. Hg) [mbar]
Probe Length	4'
Probe Material	Teflon
IGS Bag ID No.	

Leak Rate Before	0.010 [cfm] [Lpm]	@	7 (in. Hg)
Leak Rate After	0.009 [cfm] [Lpm]	@	10 (in. Hg)

Start Time:	9:36	Stop Time:	10:56
-------------	------	------------	-------

Min/pt Elapsed Time	Pump Vacuum (in. Hg)	Stack Temp. (°F)	Orifice Setting (in. H ₂ O)	Gas Sample Volume - V _m		Gas Sample Temperature at Dry Gas Meter		Flow Rate [cfm] [Lpm]	Bath Temp. (°F)	Notes
				Init. Vol.	ft ³ [L]	Inlet T _{m in.} (°F)	Outlet T _{m out.} (°F)			
5	2	148		0.00	1.270	85		0.25	49	
10	2	148			2.501	84		0.25	47	
15	2	148			3.757	84		0.25	47	
20	2	149			4.997	85		0.25	46	
25	2	149			6.262	85		0.25	46	
30	2	148			7.519	86		0.25	46	
35	2.5	148			8.759	86		0.25	46	
40	2.5	148			10.092	86		0.25	45	
45	2.5	148			11.258	87		0.25	47	
50	2.5	147			12.260	87		0.25	48	
55	2.5	147			13.757	87			48	
Total		148.0			20.012					
Average										

Circle correct bracketed units on data sheet.

QA/QC 16
Date 2/1

PAGE 2 OF 2

RUN: 1-B

<p>Cross-Section of Test Location</p>	<p>Gas Flow [IN] [OUT] of page</p>	<p>Port Lens. (in.)</p>	<p>Duct Dims. (in.)</p>
<p>[N] [UP]</p>	<p></p>	<p></p>	<p></p>

Amb. Temp. (°F)
Bar. Press. [in Hg] [mbar]
Probe Length
Probe Material
IGS Bag ID No.

Leak Rate Before	[cfm] [Lpm]	@	(in. Hg)
Leak Rate After	[cfm] [Lpm]	@	(in. Hg)

Start Time:	Stop Time:
-------------	------------

[illegible]

Circle correct bracketed units on data sheet.

Method 18 - Impingers Field Data Sheet

LOCATION: STACIL RUN: Z-A

PAGE 1 OF 2

Client	M. Garthman	Project No.	11265
Plant	Robinson IL	Unit	FCU Scrubber
Date	7-13-11	Inlet/Outlet/Stack	
Meter Operator	W. Nguyen		
Meter Box Number	MET-4		
Meter ΔH @		Y _d	1.0061

Leak Rate Before	.010	[cfm]	[Lpm]	@	10	(in. Hg)
Leak Rate After	0.010	[cfm]	[Lpm]	@	10	(in. Hg)

Cross-Section of Test Location		
Duct Dims. (in.)	Port Lens (in.)	Gas Flow [IN] [OUT] of page
11.4	6	

Diagram: A circular cross-section of a duct with a port lens. Arrows indicate gas flow. Labels include 'ladder', '2.5', '3', '4', 'Test box', and '(IN) [UP]'.

Amb. Temp. (°F)	92
Bar. Press.	29.4 (in Hg) [mbar]
Probe Length	4'
Probe Material	Teflon
IGS Bag ID No.	

Start Time:	1615	Stop Time:	1733
-------------	------	------------	------

Min/pt	Pump Vacuum (in. Hg)	Stack Temp. (°F)	Orifice Setting (in. H ₂ O)	Gas Sample Volume - V _m (ft³) (L)	Gas Sample Temperature at Dry Gas Meter Inlet T _{m in} (°F)	Outlet T _{m out} (°F)	Flow Rate [cfm] [Lpm]	Bath Temp. (°F)	Notes
Elapsed Time				0.00					
5	2	149		1.245	90		0.25	47	90.02
10	2	149		2.502	90		0.25	46	3.6
15	2	148		3.756	91		0.25	46	3.6
20	2	149		5.012	91		0.25	47	3.7
25	2	149		6.257	91		0.25	46	3.7
30	2	149		7.510	91		0.25	45	3.6
35	2	149		8.756	91		0.25	46	3.7
40	2	149		10.05	91		0.25	47	3.7
45	2	149		11.256	90		0.25	47	3.7
50	2	147		12.510	90		0.25	47	3.6
55	2	149		13.760	90		0.25	48	3.6
Total									
Average				20.010	90.375				

Circle correct bracketed units on data sheet.

QA/QC kg
Date 9/1



Method 18 - Impingers

PAGE 2 OF 2

LOCATION: STACK RUN: Z-A

Client	mpc	Project No.	11265
Plant	ROBINSON, IL	Unit	ECU Scrubber
Date	7-13-11	Inlet/Outlet/Stack	Stack
Meter Operator	H. Newgren		
Meter Box Number			
Meter ΔH @		Y _d	1.0061

Leak Rate Before	[cfm] [Lpm]	@	(in. Hg)
Leak Rate After	[cfm] [Lpm]	@	(in. Hg)

<p style="text-align: center;">↑</p> <p style="text-align: center;">[N] [UP]</p>	Cross-Section of Test Location	
	<p style="text-align: center;">Duct Dims. (in.)</p>	<p style="text-align: center;">Port Lens. (in.)</p>
	Gas Flow [IN] [OUT]	of page

Amb. Temp. (°F)
Bar. Press.
Probe Length
Probe Material
IGS Bag ID No.

Start Time: 1350	Stop Time: 17
------------------	---------------

[illegible]

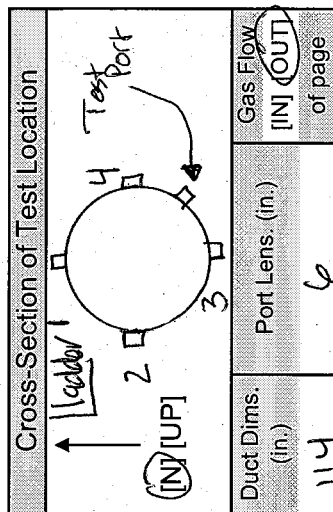
Circle correct bracketed units on data sheet.

Method 18 - Impingers Field Data Sheet

LOCATION: Stack RUN: 2-B

PAGE 1 OF 2

Client	Margallon	Project No.	11265
Plant	Robinson IL	Unit	FCU Scrubber
Date	7-13-11	Inlet/Outlet/Stack	
Meter Operator	H. Nguyen		
Meter Box Number	NET-4		
Meter ΔH @	Y _d	Y _d	1.0055



Amb. Temp. (°F)	92
Bar. Press.	29.40 (in Hg) (mmbar)
Probe Length	4'
Probe Material	Teflon
IGS Bag ID No.	

Leak Rate Before	.010 [cfm] [Lpm]	@	10 (in. Hg)
Leak Rate After	0.008 [cfm] [Lpm]	@	10 (in. Hg)

Start Time:	1615	Stop Time:	1733
-------------	------	------------	------

Min/pt	Pump Vacuum (in. Hg)	Stack Temp. (°F)	Orifice Setting (in. H ₂ O)	Gas Sample Volume - V _m Init. Vol. (ft ³) [L]	Gas Sample Temperature at Dry Gas Meter Inlet T _{m in} (°F)	Outlet T _{m out} (°F)	Flow Rate [cfm] [Lpm]	Bath Temp. (°F)	Notes
Elapsed Time				0.00					
5	2	149		1.257	91		0.25	47	76 O ₂
10	2	149		2.520	91		0.25	46	
15	2	148		3.751	91		0.25	46	
20	2	149		5.022	91		0.25	47	
25	2	149		6.260	90		0.25	46	
30	2	149		7.496	90		0.25	45	
35	2	149		8.756	90		0.25	46	
40	2	149		10.05	90		0.25	47	
45	2	149		11.255	90		0.25	47	
50	2	149		12.511	90		0.25	47	
55	2	149		13.752	90		0.25	46	
Total		148.8125		20.020	90.250				
Average									


Circle correct bracketed units on data sheet.

PAGE 2 OF 2

LOCATION: STACK RUN: ~~3~~ 13

Client	MPC	Project No.	11265
Plant	ROBINSON, IL	Unit	FCLX Scrubber
Date	7-13-11	Inlet/Outlet/Stack	
Meter Operator			
Meter Box Number			
Meter ΔH @		Y _d	1 6655

Leak Rate Before	[cfm] [Lpm]	@	(in. Hg)
Leak Rate After	[cfm] [Lpm]	@	(in. Hg)

Cross-Section of Test Location	Port Lens. (in.)	Gas Flow [IN] [OUT]	of page
 <p>[N] [UP]</p>	Duct Dims. (in.)		

Amb. Temp. (°F)	
Bar. Press.	[In Hg] [mbar]
Probe Length	
Probe Material	
IGS Bag ID No.	

Start Time: 1350	Stop Time:
------------------	------------

[illegible]

Circle correct bracketed units on data sheet.

Method 18 - Impingers Field Data Sheet

LOCATION: STACK RUN: 3-A

PAGE 1 OF 2

Client: <u>Marathon</u>	Project No. <u>11265</u>
Plant: <u>Robinson, IL</u>	Unit: <u>FCCU Scrubber</u>
Date: <u>7-14-11</u>	Inlet/Outlet/Stack: <u>Inlet/Outlet/Stack</u>
Meter Operator: <u>H. Nguyen</u>	
Meter Box Number: <u>NET A</u>	
Meter ΔH @ <u>Y_d</u>	<u>1.0061</u>

Leak Rate Before	<u>0.010</u> [cfm]	[Lpm]	@	<u>10</u>	(in. Hg)
Leak Rate After	<u>0.010</u> [cfm]	[Lpm]	@	<u>10</u>	(in. Hg)

Cross-Section of Test Location		
	Port Lens (in.)	Gas Flow [IN] (OUT) of page
Duct Dims. (in.)	<u>114</u>	

Amb. Temp. (°F)	<u>74</u>
Bar. Press.	<u>29.40</u> [in. Hg] [mbar]
Probe Length	<u>4'</u>
Probe Material	<u>Teflon</u>
IGS Bag ID No.	
Start Time: <u>8:55</u>	Stop Time: <u>10:15</u>

Min/pt	Pump Vacuum (in. Hg)	Stack Temp. (°F)	Orifice Setting (in. H ₂ O)	Gas Sample Volume - V _m (ft ³) (L)	Gas Sample Temperature at Dry Gas Meter Inlet T _{m in} (°F)	Gas Sample Temperature at Dry Gas Meter Outlet T _{m out} (°F)	Flow Rate [cfm] (Lpm)	Bath Temp. (°F)	Notes
Elapsed Time									
5	1	147		0.00	78		0.25	45	9% Oxygen
10	1	147		1.312	79		0.25	45	
15	1	147		2.510	79		0.25	45	
20	1	147		3.749	80		0.25	45	
25	1	147		5.023	80		0.25	45	
30	1	147		6.252	80		0.25	45	
35	1	147		7.509	80		0.25	45	
40	1	147		8.756	80		0.25	46	
45	2	147		10.052	79		0.25	46	
50	2	147		11.252	79		0.25	46	
55	2	147		12.511	79		0.25	47	
				13.760	79		0.25	47	
Total									
Average		147.0		20.056	80.020				

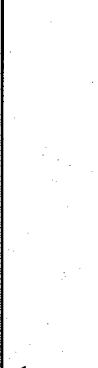
Circle correct bracketed units on data sheet.



QA/QC 10
Date 9/1

PAGE 2 OF 2

RUN: 3-A

Cross-Section of Test Location	Duct Dims. (in.)	Port Lens. (in.)	Gas Flow [IN] [OUT]	of page
 [N] [UP]				

Amb. Temp. (°F)	
Bar. Press.	[in Hg] [mbar]
Probe Length	
Probe Material	
IGS Bag ID No.	
Start Time:	Stop Time:

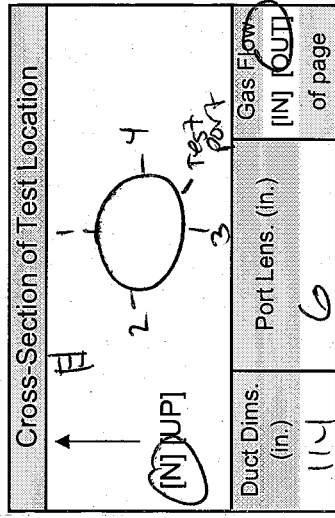
Circle correct bracketed units on data sheet.

Method 18 - Impingers Field Data Sheet

LOCATION: STACK RUN: 3-B

PAGE 1 OF 2

Client	Meredith	Project No.	11265
Plant	Robinson, IL	Unit	FCU Scrubber
Date	7-14-11	Inlet/Outlet/Stack	
Meter Operator	H. NGUYEN		
Meter Box Number	MET 4		
Meter ΔH @		Y _d	1.0055



Amb. Temp. (°F)	74
Bar. Press.	29.40 (in Hg) [mbar]
Probe Length	4'
Probe Material	Teflon
IGS Bag ID No.	

Start Time: 8:55 Stop Time: 10:15

Leak Rate Before	0.010 [cfm] [Lpm]	@	10 (in. Hg)
Leak Rate After	0.010 [cfm] [Lpm]	@	9 (in. Hg)

Min/pt	Pump Vacuum (in. Hg)	Stack Temp. (°F)	Orifice Setting (in. H ₂ O)	Gas Sample Volume - V _m (ft ³) (L)	Gas Sample Temperature at Dry Gas Meter Inlet T _{m in} (°F)	Gas Sample Temperature at Dry Gas Meter Outlet T _{m out} (°F)	Flow Rate [cfm] [Lpm]	Bath Temp. (°F)	Notes
Elapsed Time				0.00					
5	1	147		1.271	80		0.25	46	2% Oxygen
10	1	147		2.501	80		0.25	45	
15	1	147		3.759	80		0.25	45	
20	1	147		5.093	80		0.25	46	
25	1	147		6.255	81		0.25	46	
30	2	147		7.502	81		0.25	45	
35	2	147		8.760	80		0.25	46	
40	2	147		10.025	80		0.25	46	
45	2	147		11.259	80		0.25	46	
50	2	147		12.503	80		0.25	47	
55	2	147		13.754	80		0.25	47	
Total									
Average				20.030	80.9375				

Circle correct bracketed units on data sheet.




QA/QC 60
Date 8/1

LOCATION: *Spell* RUN: 3-13

RUN: 3-B

PAGE 2 OF

Client	Marathon	Project No.	11265
Plant	Robinson, IL	Unit	Full Zandbergen
Date	7-14-11	Inlet/Outlet/Stack	
Meter Operator	H. Nguyen		
Meter Box Number			
Meter ΔH @			

Cross-Section of Test Location	Duct Dims. (in.)	Port Lens. (in.)	Gas Flow [IN] [OUT]	of page
				

Amb. Temp. (°F)	
Bar. Press.	[in Hg] [mbar]
Probe Length	
Probe Material	
IGS Bag ID No.	

Leak Rate Before	[cfm] [Lpm]	@	(in. Hg)
Leak Rate After	[cfm] [Lpm]	@	(in. Hg)

Start Time:	Stop Time:
-------------	------------

[illegible]

Circle correct bracketed units on data sheet.

Full Scrubber

Method 18 - Adsorbing Tubes Field Data Sheet

 LOCATION: Stack RUN: 1-A

 PAGE 4 OF 2

Client	MPC	Project No.	11245
Plant	Robinson, IL	Unit	Full Scrubber
Date	7-13-11	Inlet/Outlet/Stack	
Meter Operator	H. Nguyen		
Meter Box Number	MET-2	MET-#	4
Y _d			1.0061

Cross-Section of Test Location		
	Port Lens. (in.)	Gas Flow [IN] [OUT]
Duct Dims. (in.)	6	of page

Amb. Temp. (°F)	88
Bar. Press.	29.40 [in Hg] [mbar]
Probe Length	6'
Probe Material	Teflon
IGS Bag ID No.	

Tube No. A	6589	Type	Unspiked
Tube No.		Type	
Tube No.		Type	

Leak Rate Before	008	[cfm] [Lpm]	@	10	(in. Hg)
Leak Rate After		[cfm] [Lpm]	@		(in. Hg)

Start Time:	11:53	Stop Time:	13:13
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Min/pt	Pump Vacuum (in. Hg)	Orifice Setting (in. H ₂ O)	Flow Rate [cfm] [Lpm]	Gas Sample Volume - V _m Init. Vol. [ft ³] [L]	Gas Sample Temp. at Dry Gas Meter T _m (°F)	Bath Temp. (°F)	Notes
Elapsed Time				6.00			STACK Temp. % Oxygen
5	2		0.25	1.261	84	50	148 3.8
10	2		0.25	2.510	85	47	148 3.7
15	2		0.25	3.743	86	46	148 3.7
20	2.5		0.25	5.102	86	46	148 3.7
25	2.5		0.25	6.251	86	45	148 3.7
30	2.5		0.25	7.549	87	45	148 3.5
35	2.5		0.25	8.755	86	47	148 3.5
40	2.5		0.25	10.051	86	47	148 3.6
45	3		0.25	11.257	86	47	147 3.4
50	3.5		0.25	12.560	87	47	148 3.4
55	3.5		0.25	13.749	84	48	148 3.4
Total				(26.09)			(147.9375)
Average							

Circle correct bracketed units on data sheet.


 QA/QC to
Date 2/1

PAGE 2 OF 2

LOCATION: *Stack* RUN: *1-A*

Amb. Temp. (°F)	
Bar. Press.	[in Hg] [mbar]
Probe Length	
Probe Material	
IGS Bag ID No.	

Tube No. A 6589	Type	UNSPICED
Tube No.	Type	
Tube No.	Type	

Start Time:	Stop Time:
-------------	------------

Leak Rate Before	[cfm] [Lpm]	@	(in. Hg)
Leak Rate After	[cfm] [Lpm]	@	(in. Hg)

Min/pt	Pump Vacuum (in. Hg)	Orifice Setting (in. H ₂ O)	Flow Rate [cfm] [lpm]	Gas Sample Volume - V _m Init. Vol. [ft³] [L]	Gas Sample Temp. at Dry Gas Meter T _m (°F)	Bath Temp. (°F)	Notes
Elapsed Time							
60	3.5		0.25	15.092	87	49	Satd temp °F 148 % Oxygen 3.3
65	3.5		0.25	16.252	87	49	3.3
70	3.5		0.25	17.512	87	50	3.4
75	3.5		0.25	18.760	89	50	3.4
80	3.5		0.25	20.092	90	50	3.3
Total							
Average							

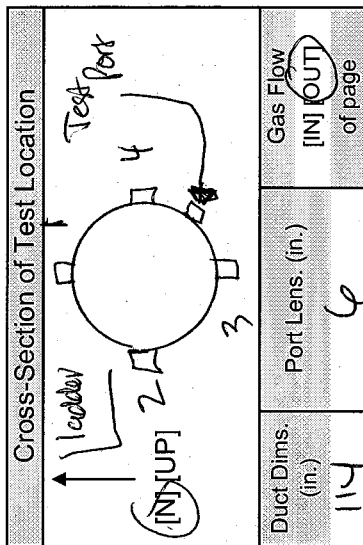
Circle correct bracketed units on data sheet.

Method 18 - Adsorbing Tubes Field Data Sheet

PAGE 1 OF 2

LOCATION: SPAC RUN: 1-B

Client	Marathon	Project No.	11265
Plant	Robinson, IL	Unit	PCU Scrubber
Date	7-13-4	Inlet/Outlet/Stack	
Meter Operator	H. Nguyen		
Meter Box Number	MET 4		
Yd	1.0055		



Amb. Temp. (°F)	88
Bar. Press.	29.40 (in Hg) [mbar]
Probe Length	4'
Probe Material	Teflon
IGS Bag ID No.	

Tube No. <u>B</u>	<u>6685</u>	Type	<u>SPKED</u>
Tube No.		Type	
Tube No.		Type	

Start Time:		Stop Time:	
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Leak Rate Before	.002	[cfm] (Lpm)	@	7	(in. Hg)
Leak Rate After		[cfm] (Lpm)	@		(in. Hg)

Min/pt	Pump Vacuum (in. Hg)	Orifice Setting (in. H ₂ O)	Flow Rate [cfm] (Lpm)	Gas Sample Volume - V _m Init. Vol. [ft ³] (L)	Gas Sample Temp. at Dry Gas Meter T _m (°F)	Bath Temp. (°F)	Notes
Elapsed Time				0.00			Stack Temp °F % Oxygen
5	2		0.25	1.262	84	50	148 3.9
10	2		0.25	2.512	85	47	148 3.9
15	2		0.25	3.761	86	46	148 3.7
20	2.5		0.25	5.019	85	46	148 3.9
25	2.5		0.25	6.257	86	45	148 4.2
30	2.5		0.25	7.530	86	45	148 3.6
35	2.5		0.25	8.741	87	47	148 3.3
40	2.5		0.25	10.051	86	47	148 3.4
45	3.0		0.25	11.255	87	47	148 3.5
50	3.5		0.25	12.537	87	47	148 3.3
55	3.5		0.25	13.755	88	48	148 3.3
Total				20.059			
Average				86.6275			148.0000

Circle correct stacked underline on data sheet.




QA/QC W
Date 8/1

LOCATION: STACK RUN: 1-B

PAGE 2 OF

Client	MPC	Project No.	11265
Plant	Robinson, IL	Unit	Feu Scrubber
Date	7-13-11	Inlet/Outlet/Stack	
Meter Operator	H-N		
Meter Box Number	MET 4		
Yr	1985		

Leak Rate Before	[cfm] [Lpm]	@	(in. Hg)
Leak Rate After	[cfm] [Lpm]	@	(in. Hg)

Cross-Section of Test Location	Duct Dims. (in.)	Port Lens (in.)	Gas Flow [IN] [OUT] of page
 <p>[N] [UP]</p>			

Amb. Temp. (°F)	
Bar. Press.	[in Hg] [mbar]
Probe Length	
Probe Material	
IGS Bag ID No.	

Tube No.	Type
Tube No.	Type
Tube No.	Type

Start Time:	Stop Time: 13:13
-------------	------------------

Min/ppt Elapsed Time	Pump Vacuum (in. Hg)	Orifice Setting (in. H ₂ O)	Flow Rate [cfm] (<u>Lpm</u>)	Gas Sample Volume - V _m Init. Vol. [ft³] (<u>LD</u>)	Gas Sample Temp. at Dry Gas Meter T _m (°F)	Bath Temp. (°F)	Notes
60	3.5		0.25	15.101	87	47	SNAK Temp 9.07
65	3.5		0.25	16.255	87	49	3.3
70	3.5		0.25	17.509	87	49	3.4
75	3.5		0.25	18.752	89	50	3.4
80	3.5		0.25	20.059	90	50	3.3
Total							
Average							

Circle correct bracketed units on data sheet.

QA/QC 140
Date 8/1

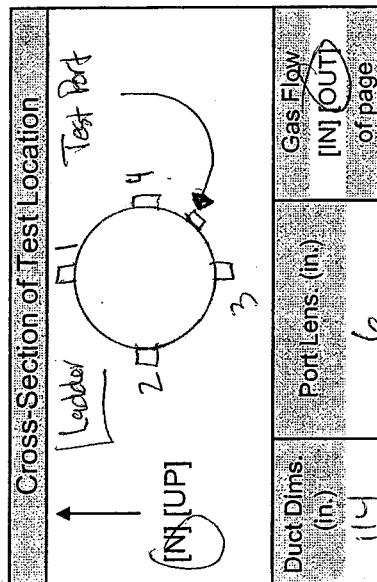
Method 18 - Adsorbing Tubes Field Data Sheet

LOCATION: STACU RUN: 2-A

PAGE 1 OF 2

Client	Marathon	Project No.	11265
Plant	Robinson, IL	Unit	FCCU Scrubber
Date	7-13-11	Inlet/Outlet/Stack	
Meter Operator	H. Nguyen		
Meter Box Number	MET 4		
Yr.	110061		

Leak Rate Before	DO1	[cfm] (Lpm)	@	ID	(in. Hg)
Leak Rate After		[cfm] (Lpm)	@		(in. Hg)



Amb. Temp. (°F)	89
Bar. Press.	29.40 (in. Hg) (mbar)
Probe Length	41'
Probe Material	Teflon
IGS Bag ID No.	65252

Tube No.	65252	Type	Unspiked
Tube No.		Type	
Tube No.		Type	

Start Time:	1440	Stop Time:	1600
-------------	------	------------	------

Min/pt Elapsed Time	Pump Vacuum (in. Hg)	Orifice Setting (in. H ₂ O)	Flow Rate [cfm] (Lpm)	Gas Sample Volume - V _m		Gas Sample Temp. at Dry Gas Meter T _m (°F)	Bath Temp. (°F)	Notes
				Init. Vol.	ft ³ (L)			
5	2		0.25	0.00		92	49	7% O ₂
10	2		0.25	1.257		94	47	3.7
15	2		0.25	2.512		93	47	3.6
20	2		0.25	3.757		93	48	3.6
25	2		0.25	5.052		93	47	3.6
30	2		0.25	6.257		93	46	3.7
35	2.5		0.25	7.509		94	47	3.6
40	2.5		0.25	8.752		94	49	3.6
45	2.5		0.25	10.052		94	47	3.5
50	2.5		0.25	11.256		95	47	3.4
Total				(20.015)				
Average				(93.0625)				

Circle correct bracketed units on data sheet.

QA/QC kw
Date 8/1

PAGE 2 OF 2

RUN: 2-1A

Cross-Section of Test Location	Duct Dims. (in.)	Port Lens (in.)	Gas Flow [IN] [OUT] of page
<p>[N] [UP]</p>			

Amb. Temp (°F)	
Bar. Press.	[in Hg] [mbar]
Probe Length	
Probe Material	
IGS Bag ID No.	

Type No.	Type
Type No.	Type
Type No.	Type

Start Time:	Stop Time:
-------------	------------

Leak Rate Before	D [cfm]	L [Lpm]	@	P (in. Hg)
Leak Rate After			@	

Min./pt. Elapsed Time	Pump Vacuum (in. Hg)	Orifice Setting (in. H ₂ O)	Flow Rate [cfm] [L·pm]	Gas Sample Volume - V _m		Gas Sample Temp. at Dry Gas Meter T _m (°F)	Bath Temp. (°F)	Notes
				Init. Vol.	[ft³] (<u>L</u>)			
55	3		0.25	13.756		93	47	70.0Z
60	3		0.25	15.072		93	49	3.5
65	3		0.25	16.259		93	49	3.6
70	3		0.25	17.561		92	49	3.5
75	3		0.25	18.262		92	50	3.5
80	3		0.25	20.015		91	50	3.5
Total								
Average								

Circle correct bracketed units on data sheet.

PAGE 1 OF 2

RUN: 2-B

Cross-Section of Test Location	Gas Flow [IN] [OUT] of page	Port Lens (in.)	Duct Dims. (in.)
		6	

Tube No.	6682	Type	Spikes
Tube No.		Type	
Tube No.		Type	

Start Time:	1446
Stop Time:	1600

Min/pt Elapsed Time	Pump Vacuum (in. Hg)	Orifice Setting (in. H ₂ O)	Flow Rate [cfm] (Lpm)	Gas Sample Volume - V _m		Gas Sample Temp. at Dry Gas Meter T _m (°F)	Bath Temp. (°F)	Notes
				Init. Vol.	ft ³ (L)			
				0.00				7.02
5	2		0.25	1.249		92	49	3.7
10	2		0.25	2.498		94	47	3.7
15	2		0.25	3.758		94	48	3.6
20	2		0.25	5.026		94	48	3.6
25	2		0.25	6.260		93	48	3.6
30	2		0.25	7.502		93	47	3.6
35	2.5		0.25	8.759		94	47	3.4
40	2.5		0.25	10.102		94	47	3.3
45	2.5		0.25	11.259		94	47	3.3
50	2.5		0.25	12.520		94	46	3.4
				20.076				
Total								
Average						93.0025		

Circle correct bracketed units on data sheet.

QA/QC 62
Date 2/2/21

PAGE 2 OF 2

LOCATION: *Stack* RUN: *2-B*

Client	Project No.	11265
Plant	Unit	FCU Scrubber
Date	Inlet/Outlet Stack	
Meter Operator	H. Nguyen	
Meter Box Number		
Yr		1.0055

Leak Rate Before	Δb	[cfm] [Lpm]	@	[in. Hg]
Leak Rate After		[cfm] [Lpm]	@ <td>[in. Hg]</td>	[in. Hg]

Cross-Section of Test Location	Duct Dims. (in.)	Port Lens (in.)	Gas Flow [IN] [OUT] of page
<p>[N] [UP]</p>			

Amb. Temp. (°F)	
Bar. Press.	[in Hg] [mbar]
Probe Length	
Probe Material	
IGS Bag ID No.	

Tube No.	Type
Tube No.	Type
Tube No.	Type

Start Time:	Stop Time:
-------------	------------

Min/pt Elapsed Time	Pump Vacuum (in. Hg)	Orifice Setting (in. H ₂ O)	Flow Rate [cfm] (Lpm)	Gas Sample Volume - V _m		Gas Sample Temp. at Dry Gas Meter T _m (°F)	Bath Temp (°F)	Notes
				Init. Vol.	[ft³] (L)			
95	2.5		0.25	13.749	93		47	3.4
60	3		0.25	15.102	93		49	3.4
65	3		0.25	16.248	93		49	3.5
70	3		0.25	17.506	92		49	3.5
75	3		0.25	18.752	91		50	3.6
80	3		0.25	20.076	91		50	3.5
Total								
Average								

Circle correct bracketed units on data sheet.

Method 18 - Adsorbing Tubes Field Data Sheet

LOCATION: STACK RUN: 3-A

PAGE 1 OF 2

Client	Marathon	Project No.	11265
Plant	Robinson IL	Unit	FCU Scrubber
Date	7-14-11	Inlet/Outlet/Stack	
Meter Operator	H. NGUYEN		
Meter Box Number	M2T 4		
Yr	10061		

Leak Rate Before	DO1	[cfm] [Lpm]	@	ID	(in. Hg)
Leak Rate After		[cfm] [Lpm]	@		(in. Hg)

Cross-Section of Test Location			
	Port Lens (in.)	Gas Flow	
	6	IN [OUT]	on page
Duct Dims. (in.)	114		

Amb. Temp. (°F)	82
Bar. Press.	29.40 (in. Hg) [mbar]
Probe Length	4'
Probe Material	Teflon
IGS Bag ID No.	6536 (B)
Tube No.	6536
Tube No.	
Tube No.	

Start Time:	10:55	Stop Time:	12:15
-------------	-------	------------	-------

Min/pt	Pump Vacuum (in. Hg)	Orifice Setting (in. H ₂ O)	Flow Rate [cfm] [Lpm]	Gas Sample Volume - V _m Init. Vol. [ft ³] [L]	Gas Sample Temp. at Dry Gas Meter T _m (°F)	Bath Temp (°F)	Notes
Elapsed Time							
5	2		0.25	0.00	88	45	Start Temp. 148 3.6 % Oxygen
10	2		0.25	1.260	88	46	148 3.7
15	2.5		0.25	2.510	88	46	148 3.6
20	2.5		0.25	3.751	88	46	148 3.6
25	2.5		0.25	5.009	88	47	148 3.6
30	3		0.25	6.251	88	47	148 3.6
35	3		0.25	7.504	87	48	148 3.7
40	3		0.25	8.752	87	48	148 3.4
45	3		0.25	10.052	87	49	148 3.5
50	3		0.25	11.252	87	49	148 3.4
55	3		0.25	12.507	86	49	148 3.4
				13.755			
Total				70.057	87.750		148.000
Average							

Circle correct bracketed units on data sheet.

QA/QC ko
Date 8/1

PAGE 2 OF 2

RUN: 3-A

<p>↑</p> <p>[N] [UP]</p>	Cross-Section of Test Location	
	<p>Duct Dims. (in.)</p>	<p>Port Lens (in.)</p>
	<p>Gas Flow [IN] [OUT]</p>	<p>of page</p>

Amb. Temp. (°F)	
Bar. Press.	[in Hg] [mbar]
Probe Length	
Probe Material	
IGS Bag ID No.	

Tube No.	Type
Tube No.	Type
Tube No.	Type

Start Time:	Stop Time:
-------------	------------

Leak Rate Before	[cfm] [Lpm]	@	(in. Hg)
Leak Rate After	[cfm] [Lpm]	@	(in. Hg)

Min/pt Elapsed Time	Pump Vacuum (in. Hg)	Orifice Setting (in. H ₂ O)	Flow Rate [cfm] [Lpm]	Gas Sample Volume - V _m		Gas Sample Temp. at Dry Gas Meter T _m (°F)	Bath Temp (°F)	Notes
				Init. Vol.	[ft ³] [L]			
60	3.5		0.25	15.160		87	49	Snick Temp 148
65	3.5		0.25	16.255		88	50	148
70	3.5		0.25	17.507		88	49	148
75	3.5		0.25	18.753		89	50	148
80	3.5		0.25	20.057		90	51	148
						</		

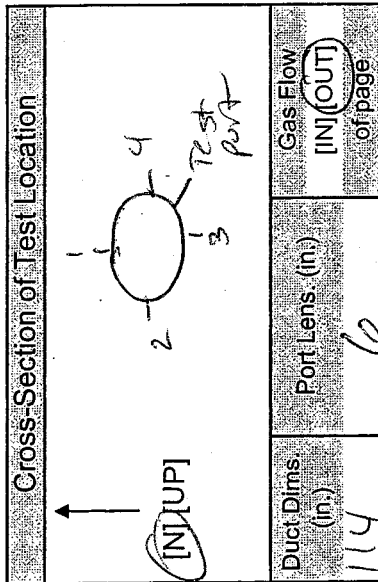
Circle correct bracketed units on data sheet.

Method 18 - Adsorbing Tubes Field Data Sheet

LOCATION: Stack RUN: 3-B

PAGE 1 OF 2

Client	Meredith	Project No.	11265
Plant	Robinson IL	Unit	FCCU Scrubber
Date	7-14-11	Inlet/Outlet/Stack	
Meter Operator	H. Nguyen		
Meter Box Number	NET-4		
Yr	1.0055		



Amb. Temp (°F)	82
Bar. Press.	29.46 (in Hg) (mbar)
Probe Length	4'
Probe Material	Teflon
GS Bag ID No.	

Tube No.	6686	Type	Spiked
Tube No.		Type	
Tube No.		Type	

Leak Rate Before	0.001	cfm	[Lpm]	@	10	(in. Hg)
Leak Rate After		cfm	[Lpm]	@		(in. Hg)

Start Time	10:55	Stop Time	12:15
------------	-------	-----------	-------

Min/pt	Pump Vacuum (in. Hg)	Orifice Setting (in. H ₂ O)	Flow Rate [cfm] [Lpm]	Gas Sample Volume - V _m Init Vol. [ft ³] [L]	Gas Sample Temp. at Dry Gas Meter T _m (°F)	Bath Temp (°F)	Notes
Elapsed Time							
5	2		0.25	0.00	86	45	STACK Temp 148 3.6
10	2		0.25	1.257	86	46	148 3.7
15	2.5		0.25	2.508	87	46	148 3.6
20	2.5		0.25	3.752	87	46	148 3.6
25	2.5		0.25	5.002	87	47	148 3.7
30	2.5		0.25	6.257	87	48	148 3.6
35	3		0.25	7.521	87	48	148 3.5
40	3		0.25	8.751	87	48	148 3.5
45	3		0.25	10.055	87	49	148 3.6
50	3		0.25	11.257	87	49	148 3.6
55	3		0.25	12.510	87	49	148 3.5
				13.755	87		
Total				20.95	87.5000		148.0000
Average							

Circle correct bracketed units on data sheet.

QA/QC to
Date 8/1

PAGE 2 OF 2

LOCATION: Stack RUN: 3-B

Cross-Section of Test Location	Duct Dims. (in.)	Port Lens (in.)	Gas Flow [N] [OUT] of page

Amb. Temp. (°F)	
Bar. Press.	[in Hg] [mbar]
Probe Length	
Probe Material	
IGS Bag ID No.	

Tube No.	Type
Tube No.	Type
Tube No.	Type

Leak Rate Before	[cfm] [Lpm]	@	(in. Hg)
Leak Rate After	[cfm] [Lpm]	@	(in. Hg)

Start Time:	Stop Time:
-------------	------------

Min/pr Elapsed Time	Pump Vacuum (in. Hg)	Orifice Setting (in. H ₂ O)	Flow Rate [cfm] <u>K (pm)</u>	Gas Sample Volume - V _m		Gas Sample Temp. at Dry Gas Meter T _m (°F)	Bath Temp (°F)	Notes
				Init. Vol.	[ft ³] (L)			
60	3.5		0.25	15.110		88	49	Speed Temp 70 Oxygen
65	3.5		0.25	16.252		88	50	3.5
70	3.5		0.25	17.510		89	49	3.4
75	3.5		0.25	18.749		90	50	3.4
80	3.5		0.25	20.015		90	51	3.5

Circle correct bracketed units on data sheet.

TEST LOCATION: StackUNIT: CCU Scrubber RUN: 1

Client	MPC	Project No.	11265
Plant	Robinson	Date	7/13/11
Meter Operator	S. Deoley		
Probe Operator	B. Arnold		

Meter Box	66-14	Sample Box No.	
Meter Yd	0.9882	Meter H ₂ O	1.7571
K Factor	2.55	Pitot C _p	0.823
Leak Rate Before	0.000	[Lpm]	@ 15 (in. Hg)
Leak Rate After	0.005	[Lpm]	@ 20 (in. Hg)
Pitot Leak Check Before:	<input checked="" type="checkbox"/>	After: Good	<input type="checkbox"/> Bad

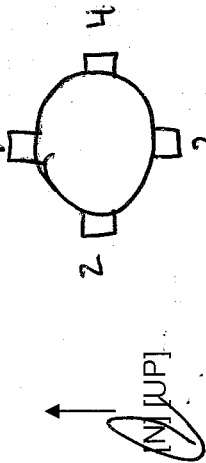
Traverse Point Number	Min/pt	Velocity (ft/min) ΔP (in. H ₂ O)	Orifice Setting ΔH (in. H ₂ O)	Gas Sample V _m (ft ³ /L)	Init. Vol. (ft ³ /L)	Stack Temp. T _s (°F)	Probe T _p (°F)	Filter T _f (°F)	Cond. Temp. T _c (°F)	DGM Inlet T _{m in} (°F)	DGM Outlet T _{m out} (°F)	Pump Vacuum (in. Hg)	XAD Trap Temp. (°F)	Notes
4-1	5	0.65	1.675	911.76	907.113	146	248	251	66	90	91	12.5		02
4-1	10	0.65	1.7	915.36		147	248	245	66	91	91	17.5		3.5
4-2	15	0.60	1.4	918.87		147	249	260	66	92	91	10		3.4
4-2	20	0.60	1.5	922.0		147	250	248	49	93	91	11		3.4
4-3	25	0.58	1.5	925.65		147	250	253	48	96	91	11		3.4
4-3	30	0.58	1.5	929.126		146	250	250	48	96	92	11		3.4
4-1	35	0.60	1.7	932.73		146	249	252	49	96	92	11		3.4
4-1	40	0.65	1.5	936.26		146	250	253	47	96	92	11		3.4
4-2	45	0.61	1.4	939.64		146	250	251	49	96	93	10		3.3
4-2	50	0.61	1.4	943.10		146	250	249	50	98	93	10		3.3
4-3	55	0.54	1.0	946.00		146	250	250	53	99	94	6		3.3
4-3	60	0.50	1.2	949.06		146	250	250	57	101	94	8		3.4
4-1	65	0.69	1.6	952.46		147	250	250	59	100	95	13		3.4
Total		18573	133.200	81,120		351,600				2375.000	2767.000			
Average		0.7739	1.3875			146.500				2321.000				

* NW 6-05-237
Sum of square roots
1.120

TESTING

FIELD DATA SHEET

Cross-Section of Test Location



Duct Dimensions (in.)	114 in	Gas Flow [in] [out] of page	First point all the way [in] [out]
Static Pres (in. H ₂ O)	-0.4	Port Len. (in.)	6

METHOD: SW 846 M-001 PAGE 1 OF 1

Amb. Temp. (°F)	102	Bar. Press.	29.90 [in. Hg] [mbar]
Probe I.D. No.	60-4-7		
Liner Material	Quartz		

Filter No.	N/A		
Thimble No.	F-10		
Nozzle Diameter	0.25	Nozzle I.D.	250-1

Start Time	9:55	Stop Time	12:02
------------	------	-----------	-------

DGM Inlet T _{m in} (°F)	90	DGM Outlet T _{m out} (°F)	91	Pump Vacuum (in. Hg)	12.5	XAD Trap Temp. (°F)		Notes	02
	91		91	17.5					3.5
	92		91	10					3.4
	93		91	11					3.4
	96		91	11					3.4
	96		92	11					3.4
	96		92	11					3.4
	96		92	11					3.4
	96		92	11					3.4
	96		93	10					3.3
	98		93	10					3.3
	99		94	6					3.3
	101		94	8					3.4
	100		95	13					3.4

CleanAir
ENGINEERING

Circle correct bracketed units on data sheet.

QA/QC SD

Date 7/13/11

Aldelhydes

TEST LOCATION: Stack

UNIT: ECU Scrubber RUN: 1

TESTING

METHOD:

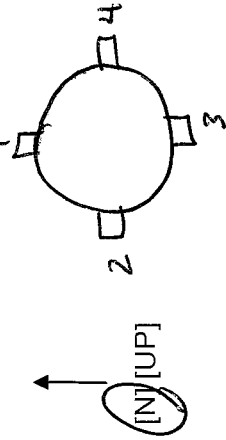
PAGE

2 OF 2

SW 846M-0011

FIELD DATA SHEET

Cross-Section of Test Location



Client	MPC	Project No.	1265
Plant	Robinson	Date	7/13/11
Meter Operator	S. Dooley		
Probe Operator	B. Arnold		

Meter Box	Sample Box No.	
Meter Y _a	Meter ΔH _@	
K Factor	Pitot C _p	
Leak Rate Before	0.004 [dm ³ /Lpm] @ 15 (in. Hg)	
Leak Rate After	0.005 [dm ³ /Lpm] @ 20 (in. Hg)	
Pitot Leak Check Before	After: Good <input checked="" type="checkbox"/> Bad <input type="checkbox"/>	

Amb. Temp. (°F)	Bar. Press	29.40 [in. Hg] [mbar]
Probe I.D. No.		
Liner Material		

Filter No.		
Thimble No.		
Nozzle Diameter		

Start Time: 9:55	Stop Time: 12:02
------------------	------------------

Traverse Point Number	Min/pt	Velocity Head ΔP (in. H ₂ O)	Orifice Setting ΔH (in. H ₂ O)	Gas Sample Volume V _m (ft ³ /L)	Stack Temp. T _s (°F)	Probe T _p (°F)	Filter T _f (°F)	Cond. Temp. T _c (°F)	DGM Inlet T _{m in} (°F)	DGM Outlet T _{m out} (°F)	Pump Vacuum (in. Hg)	XAD Trap Temp. T _t (°F)	Notes
2-1	70	0.68	1.60	956.02	147	250	250	55	101	96	13		3.4
2-2	75	0.58	1.3	959.49	146	250	249	57	101	96	11		3.4
2-3	80	0.57	1.3	962.96	147	249	257	53	101	96	11		3.4
2-3	85	0.47	1.1	966.10	147	250	249	53	103	96	7		3.6
2-3	90	0.47	1.1	969.14	146	250	247	54	103	96	7		3.5
2-1	95	0.52	1.2	972.27	147	250	247	54	103	97	7		3.5
2-1	100	0.46	1.0	975.25	147	250	250	53	104	98	7		3.6
2-2	105	0.55	1.3	978.39	147	250	250	53	104	98	9		3.6
2-2	110	0.80	1.8	982.02	147	250	251	53	105	98	19		3.6
2-3	115	0.80	1.6	985.60	146	250	254	55	104	98	18		3.6
2-3	120	0.76	1.7	989.233	146	250	250	58	102	98	18		3.6
Total		18.513	33.3		3516.000				2375.000	2267.000			
Average		0.7739	1.3875		1416.5000								

Circle correct bracketed units on data sheet.

Sum of square roots.

TEST LOCATION: StackUNIT: Flu scrubber RUN: 2

Client	MPA	Project No.	11265
Plant	Robinson	Date	7/13/11
Meter Operator	S. DOOLEY		
Probe Operator	B. Arnold		

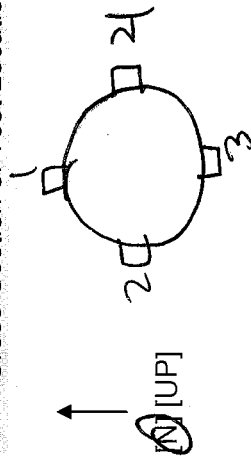
Meter Box	66-14	Sample Box No.	
Meter Yd	0.9882	Meter ΔH@	1.7571
K Factor	2.372	Pilot Cp	0.827
Leak Rate Before	0.004 [cfm]	@ 15 (in. Hg)	
Leak Rate After	0.03 [cfm]	@ 20 (in. Hg)	
Pilot Leak Check Before:	<input checked="" type="checkbox"/>	After: Good	<input checked="" type="checkbox"/>

Traverse Point Number	Min/pt Elapsed Time	Velocity Head ΔP (in. H ₂ O)	Orifice Setting ΔH (in. H ₂ O)	Gas S
3-1	5	0.75	1.7	990
3-1	10	0.75	1.7	990
3-2	15	0.7	1.6	000
3-2	20	0.68	1.5	3
3-3	25	0.53	1.2	5
3-3	30	0.59	1.4	11
2-1	35	0.71	1.6	11
2-1	40	0.7	1.6	1
2-2	45	0.62	1.4	10
2-2	50	0.62	1.4	211
2-3	55	0.53	1.2	2
2-3	60	0.39	0.90	30
			33.9000	80
	Total	*18.7766	1.4255	
	Average	0.7824	1.4125	

Sum of square-roots.

TESTING FIELD DATA SHEET

Cross-Section of Test Location



Duct Dimensions (in.)	114	Gas Flow (in. H ₂ O)	114	First point all the way
Static Pres (in. H ₂ O)	-0.4	Port Len. (in.)	6	all the way
Stack Temp. T _s (°F)	147	Probe T _p (°F)	247	all the way
Filter T _f (°F)	250	Set Points	250 250	all the way

METHOD: sw 8/6-00 11 PAGE 1 OF 2

Amb. Temp. (°F)	100	Bar. Press.	29.40 (in. Hg)
Probe I.D. No.	66-4-7		
Liner Material	Quartz		

Filter No.	N/A		
Thimble No.	F-10-B/S		
Nozzle Diameter	0.25	Nozzle I.D.	250-1

Start Time: 13:16 Stop Time: 15:36

Client	MPC	Project No.	11265
Plant	Robinson	Date	
Meter Operator	S DOOLEY		
Probe Operator	B. ARAUJO		

Meter Box	600-14	Sample Box No.	
Meter Y _d		Meter ΔH _@	
K Factor	2.32	Pitot C _p	
Leak Rate Before	0.001 [cfm]	@ 15 [in. Hg]	
Leak Rate After		@ [in. Hg]	
Pitot Leak Check Before:	<input type="checkbox"/> After: Good <input type="checkbox"/> Bad <input type="checkbox"/>		

Amb. Temp. (°F)	60	Bar. Press.	[in. Hg] [mbar]
Probe I.D. No.			
Liner Material	Quartz		

Filter No.	
Thimble No.	
Nozzle Diameter	0.25



Traverse Point Number	Min/pt Elapsed Time	Velocity Head ΔP (in. H ₂ O)	Orifice Setting ΔH (in. H ₂ O)	Gas Sample Volume V _m (ft ³) [L]	Stack Temp. T _s (°F)	Probe T _p (°F)		Filter T _f (°F)	Cond. Temp. T _c (°F)	DGM Inlet T _{m in} (°F)	DGM Outlet T _{m out} (°F)	Pump Vacuum (in. Hg)	XAD Trap Temp. T _x (°F)	Notes
						Set	Points							
						250	250	250	64	109	102	11	3.3	
1-1	65	0.68	1.6	34.03	147	250	249	247	62	112	104	11	3.3	
1-1	70	0.68	1.6	37.60	147	250	250	251	53	112	104	11	3.4	
1-2	75	0.64	1.5	41.08	147	250	250	252	54	113	104	13	3.3	
1-2	80	0.64	1.5	44.57	147	250	250	256	55	113	104	19	3.3	
1-3	85	0.57	1.3	47.77	147	250	250	251	56	111	104	11	3.3	
1-3	90	0.43	1.0	50.80	147	249	249	252	61	110	105	19	3.3	
4-1	95	0.65	1.5	54.16	147	249	249	252	56	114	107	19	3.3	
4-1	100	0.65	1.5	57.37	147	250	250	250	57	108	105	19	3.3	
4-2	105	0.67	1.5	60.68	147	250	250	259	58	109	106	19	3.3	
4-2	110	0.67	1.5	63.94	147	250	250	250	59	110	106	13	3.4	
4-3	115	0.46	1.1	67.06	147	250	250	250	61	112	107	13	3.4	
4-3	120	0.48	1.1	70.45	147	250	250	250	61					
	Total	*8												
	Average													

Client MPL

Plant Robinson

Meter Operator S Dookey

Probe Operator B. Arnold

Project No. 11265

Date 7/14/11

Meter Box 66-14

Meter γ_a 0.9882

K Factor 2.322

Leak Rate Before 0.002 [cfm]

Leak Rate After 0.003 [cfm]

Pitot Leak Check Before: ☒ After: Good ☐ Bad ☐

Sample Box No.

Meter ΔH @ 1.75

Pitot C_p @ 15 (in. Hg)

Pitot C_p @ 17 (in. Hg)

Static Pres (in. H₂O) -0.5

Port Len. (in.) 6

Duct Dimensions (in.) 114

Gas Flow (In) (Out) of page (In) (Out)

First point all the way (In) (Out)

Cross-Section of Test Location

Traverse Point Number	Min/pt Elapsed Time	Velocity Head ΔP (in. H ₂ O)	Orifice Setting ΔH (in. H ₂ O)	Gas Sample Volume Init. Vol. (in. H ₂ O)	Stack Temp. T_s (°F)	Probe T_p (°F)	Filter T_f (°F)	Cond. Temp. T_c (°F)	DGM Inlet $T_{m in}$ (°F)	DGM Outlet $T_{m out}$ (°F)	Pump Vacuum (in. Hg)	XAD Trap Temp. T_t (°F)	Notes
4-1	5	0.77	1.31	74.17	147	249	254	58	86	85	8	3.6	
4-1	10	0.75	1.3	77.35	146	250	250	51	86	85	8	3.5	
4-2	15	0.69	1.2	80.47	146	250	257	49	88	85	9	3.3	
4-2	20	0.69	1.2	83.55	146	250	249	50	90	86	8	3.4	
4-3	25	0.58	0.91	86.29	146	250	250	53	93	87	6	3.4	
4-3	30	0.52	0.91	89.033	146	250	251	55	94	87	6	3.4	
1-1	35	0.75	1.3	92.15	146	250	250	58	96	89	9	3.5	
1-1	40	0.74	1.3	95.36	146	250	251	55	97	89	9	3.5	
1-2	45	0.69	1.2	98.48	147	250	248	56	98	90	8	3.4	
1-2	50	0.69	1.2	101.57	147	250	250	59	99	90	8	3.4	
1-3	55	0.53	0.92	104.33	147	250	250	61	99	91	7	3.5	
1-3	60	0.53	0.92	107.075	146	250	250	64	100	91	7	3.4	
Total		19.5205	27.5600	72.5970	3517.0000				2362	2264			
Average		0.8134	1.1483		146.5417				95.1250				

Client	MPC	Project No.	11265
Plant	Babinson	Date	7/14/11
Meter Operator	SD		
Probe Operator	BA		

Meter Box		Sample Box No.	
Meter Y _d		Meter ΔH _@	
K Factor		Pitot C _p	
Leak Rate Before	[cfm] [Lpm]	@	(in. Hg)
Leak Rate After	[cfm] [Lpm]	@	(in. Hg)
Pitot Leak Check Before:	<input type="checkbox"/> After: Good <input type="checkbox"/> Bad <input type="checkbox"/>		

Client	MPC	Project No.	11265
Plant	Babinson	Date	7/14/11
Meter Operator	SD		
Probe Operator	BA		

Meter Box		Sample Box No.	
Meter Y _d		Meter ΔH _@	
K Factor		Pitot C _p	
Leak Rate Before	[cfm] [Lpm]	@	(in. Hg)
Leak Rate After	[cfm] [Lpm]	@	(in. Hg)
Pitot Leak Check Before:	<input type="checkbox"/> After: Good <input type="checkbox"/> Bad <input type="checkbox"/>		

Traverse Point Number	Min/pt	Velocity Head ΔP (in. H ₂ O)	Orifice Setting ΔH (in. H ₂ O)	Gas Sample Volume V _m Init. Vol.	Stack Temp. T _s (°F)	Probe T _p (°F)	Filter T _f (°F)	Cond. Temp. T _c (°F)	DGM Inlet T _{m in} (°F)	DGM Outlet T _{m out} (°F)	Pump Vacuum (in. Hg)	XAD/Trap Temp. T _i (°F) 2	Notes
2-1	65	0.74	1.3	110.25	147	249	255	56	98	93	11	3.5	
2-1	70	0.74	1.3	113.48	147	250	250	42	100	93	11	3.5	
2-2	75	0.66	1.1	116.48	147	250	256	41	102	94	9	3.5	
2-2	80	0.67	1.2	119.59	147	250	251	41	102	94	10	3.5	
2-3	85	0.60	1.0	122.52	147	250	254	42	104	95	7	3.6	
2-3	90	0.58	1.0	125.405	147	250	251	44	104	95	7	3.7	
3-1	95	0.75	1.3	128.64	147	249	250	55	101	96	11	3.6	
3-1	100	0.77	1.3	131.94	147	250	254	52	106	100	4	3.6	
3-2	105	0.69	1.2	135.10	147	249	252	53	104	97	10	3.6	
3-2	110	0.65	1.1	138.12	146	250	257	55	105	97	9	3.6	
3-3	115	0.63	1.1	141.11	146	250	258	56	105	97	8	3.6	
3-3	120	0.59	1.0	144.010	146	250	253	97	105	98	8	3.6	
Total	*								2362.0000	2204.0000			
Average							95						

TEST LOCATION: StackUNIT: Fluv Scrubber RUN: 4-14-11AldehydesTESTING
FIELD DATA SHEETMETHOD: SW846M-0011PAGE 1 OF 2

Client	MPC	Project No.	11265
Plant	Robinson	Date	7/14/11
Meter Operator	S. Dooley		
Probe Operator	B. Arnold		
Meter Box	60-14	Sample Box No.	
Meter Y _a	0.9882	Meter ΔH ₀	1.7571
K Factor	1.75	Pitot C _p	0.827
Leak Rate Before	0.005 cfm	[Lpm] @	18 (in. Hg)
Leak Rate After	0.003 cfm	[Lpm] @	20 (in. Hg)
Pitot Leak Check Before	<input checked="" type="checkbox"/>	After: Good	<input checked="" type="checkbox"/> Bad <input type="checkbox"/>

Cross-Section of Test Location			
Duct Dimensions (in.)	Port Len. (in.)	Gas Flow (in. H ₂ O) [In] [Out] of page	First point all the way [In] [Out]
-0.5	6		

Amb. Temp. (°F)	95	Bar. Press.	940 (in. Hg) [mbar]
Probe I.D. No.	(P) 67-4-7		60-4-7
Liner Material	Pynex		

Filter No.	
Thimble No.	F-10
Nozzle Diameter	0.233 Nozzle I.D.
	233-0

Start Time: 11:51	Stop Time: 12:10
-------------------	------------------

Traverse Point Number	Min/pt	Velocity Head ΔP (in. H ₂ O)	Orifice Setting ΔH (in. H ₂ O)	Gas Sample Volume V _m (ft ³) [L]	Stack Temp. T _s (°F)	Probe T _p (°F)	Filter T _f (°F)	Cond. Temp. T _c (°F)	DGM Inlet T _{m in} (°F)	DGM Outlet T _{m out} (°F)	Pump Vacuum (in. Hg)	XAD Trap Temp. (°F)	Notes
3-1	50.77	0.77	1.3	147.90	146	248	255	66	96	97	20	3.5	
3-1	10	0.74	1.3	151.06	146	249	252	66	98	96	20	3.6	
3-2	15	0.67	1.2	154.14	146	249	253	62	98	96	20	3.5	
3-2	20	0.67	1.2	157.22	146	250	250	58	98	95	20	3.5	
3-3	25	0.55	0.962	160.10	146	250	254	55	98	95	11	3.6	
3-3	30	0.40	0.70	162.682	146	250	252	55	100	95	7	3.5	
2-1	35	0.73	1.3	165.72	146	250	250	63	102	97	20	3.8	
2-1	40	0.71	1.3	168.85	146	249	250	58	104	98	20	3.7	
2-2	45	0.65	1.1	171.99	146	249	249	58	103	98	14	3.7	
2-2	50	0.65	1.1	175.00	146	250	249	58	104	98	14	3.8	
2-3	55	0.53	0.93	177.83	146	250	249	64	105	99	9	3.9	
2-3	60	0.45	0.78	180.360	146	250	253	64	106	99	7	3.9	
Total		18.8475	25.9500	76.9540	3514.00				2500.000	2390.000			
Average		0.7853	1.0813		146.4167				1101.8750				

Sum of square roots.

Circle correct bracketed units on data sheet.

QA/QC SDDate 7/14/11

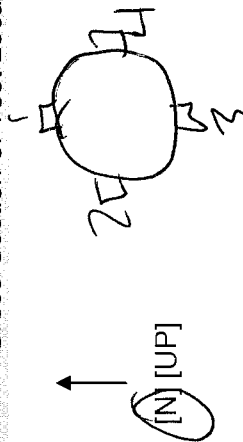
TEST LOCATION: StackUNIT: FCU SuberRUN: 1265
7/14/2011

Client	<u>MRC</u>	Project No.	<u>1265</u>
Plant	<u>Robinson</u>	Date	<u>7/14/2011</u>
Meter Operator	<u>SD</u>		
Probe Operator	<u>BA</u>		

Meter Box		Sample Box No.	
Meter Y _d		Meter ΔH _@	
K Factor		Pitot C _p	
Leak Rate Before	[cfm] [Lpm]	@	(in. Hg)
Leak Rate After	[cfm] [Lpm]	@	(in. Hg)
Pitot Leak Check Before:	<input type="checkbox"/> After: Good <input type="checkbox"/> Bad <input type="checkbox"/>		

Aldehydes TESTING FIELD DATA SHEET

Cross-Section of Test Location



Duct Dimensions (in.)		Gas Flow	First point
Static Pres	Port Len.	[in] [Out]	all the way
<u>0.4</u>	<u>6</u>		(In) [Out]

Amb. Temp. (°F)	Bar. Press.	[in. Hg] [mbar]
Probe I.D. No.		
Liner Material		

Filter No.		
Thimble No.	<u>F-10</u>	
Nozzle Diameter	<u>0.233</u>	Nozzle I.D. <u>233-0</u>

Start Time:	Stop Time:
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Traverse Point Number	Min/pt	Velocity Head ΔP (in. H ₂ O)	Orifice Setting ΔH (in. H ₂ O)	Gas Sample Volume V _m Init. Vol.	Stack Temp. T _s (°F)	Probe T _p (°F)	Filter T _f (°F)	Cond. Temp. T _c (°F)	DGM Inlet T _{min} (°F)	DGM Outlet T _{min} (°F)	Pump Vacuum (in. Hg)	XAD Trap Temp. T _t (°F)	Notes
1-1	65	0.70	1.2	183.38	146	250	250	52	103	100	20	3.7	
1-1	70	0.70	1.2	186.57	147	250	250	52	105	100	20	3.7	
1-2	75	0.65	1.1	189.59	147	251	250	50	105	101	11	3.9	
1-2	80	0.65	1.1	192.55	147	250	250	49	106	102	11	3.8	
1-3	85	0.50	0.88	195.27	147	250	248	49	107	102	9	3.8	
1-3	90	0.50	0.88	197.975	147	250	249	52	107	102	9	3.8	
4-1	95	0.70	1.2	201.05	147	250	251	64	106	103	12	3.8	
4-1	100	0.70	1.2	204.11	147	250	248	52	109	103	12	3.8	
4-2	105	0.62	1.1	207.13	147	250	247	50	109	103	11	3.8	
4-2	110	0.62	1.1	210.15	146	250	258	50	110	104	11	3.9	
4-3	115	0.52	0.91	212.96	147	250	250	53	110	103	9	4.0	
4-3	120	0.56	0.91	215.679	147	250	250	56	111	104	9	4.0	
Total	*												
Average													

* Sum of square roots.

Circle correct bracketed units on data sheet.

QA/QC 142Date 8/1

Impinger Weight Sheet

Client Marathon Petroleum Company		Unit Name/Location FCCU Scrubber Stack	
Plant Robinson Refinery	Job No. 11265	Method USEPA SW-846 M-0011	

499.9g #60151

Run No. 1DL2	Filter Type N/A	Sample Box No. B15
Date 7/13/11	Lot No. N/A	pH N/A
Analyst DL	Filter No. N/A	Rinse

	Contents	Gross Weight (gm)	Tare Weight (gm)	Net Weight Gain (gm)	
Impinger 1	200 mL DNPH	824.3	649.7 ^{DL}	174.4	
Impinger 2	100 mL DNPH	771.9	543.8 ^{DL}	228.0	QA/QC DL
Impinger 3	100 mL DNPH	654.2	566.2 ^{DL}	91.5	Date 7/13/11
Impinger 4	Empty	486.0	483.5	2.5	
Impinger 5	Silica Gel	781.6	760.6	21.0	Total Weight (gm)
					496.4
					517.4

Run No. 2DL1	Filter Type N/A	Sample Box No. B3
Date 7/13/11	Lot No. N/A	pH N/A
Analyst DL	Filter No. N/A	Rinse

	Contents	Gross Weight (gm)	Tare Weight (gm)	Net Weight Gain (gm)	
Impinger 1	200 mL DNPH	763.1	632.9	130.2	
Impinger 2	100 mL DNPH	765.1	551.9	213.2	QA/QC DL
Impinger 3	100 mL DNPH	654.5	530.2	124.3	Date 7/13/11
Impinger 4	Empty	524.0	482.7	41.3	
Impinger 5	Silica Gel	746.4	727.8	18.6	Total Weight (gm)
					509.0
					527.6

Run No. 3	Filter Type N/A	Sample Box No. B3
Date 7/14/11	Lot No. N/A	pH N/A
Analyst DL	Filter No. N/A	Rinse

	Contents	Gross Weight (gm)	Tare Weight (gm)	Net Weight Gain (gm)	
Impinger 1	200 mL DNPH	776.1	635.6	140.5	
Impinger 2	100 mL DNPH	766.4	557.0	231.3 ^{DL}	QA/QC DL
Impinger 3	100 mL DNPH	632.0	535.1	96.9	Date 7/13/11
Impinger 4	Empty	484.5	484.1	0.4	
Impinger 5	Silica Gel	760.9	746.3	14.6	Total Weight (gm)
					447.2
					461.8

Impinger Weight Sheet

Client Marathon Petroleum Company		Unit Name/Location FCCU Scrubber Stack	
Plant Robinson Refinery	Job No. 11265	Method USEPA SW-846 M-0011	

Run No. <i>Matrix Spike</i>	Filter Type N/A	Sample Box No. <i>B15</i>
Date <i>7/14/11</i>	Lot No. N/A	pH N/A
Analyst <i>DL</i>	Filter No. N/A	Rinse

	Contents	Gross Weight (gm)	Tare Weight (gm)	Net Weight Gain (gm)	
Impinger 1	200 mL DNPH	<i>835.5</i>	<i>650.0</i>	<i>185.5</i>	<div style="border: 1px solid black; padding: 2px; margin-bottom: 2px;">QA/QC <i>DL</i></div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 2px;">Date <i>7/14/11</i></div>
Impinger 2	100 mL DNPH	<i>768.4</i>	<i>545.3</i>	<i>223.1</i>	
Impinger 3	100 mL DNPH	<i>587.7</i>	<i>568.4</i>	<i>19.3</i>	
Impinger 4	Empty	<i>487.2</i>	<i>484.7</i>	<i>2.5</i>	
Impinger 5	Silica Gel	<i>798.6</i>	<i>781.4</i>	<i>17.2</i>	
					Total Weight (gm)
					<i>430.4</i>
					<i>447.6</i>

Run No.	Filter Type N/A	Sample Box No.
Date	Lot No. N/A	pH N/A
Analyst	Filter No. N/A	Rinse

	Contents	Gross Weight (gm)	Tare Weight (gm)	Net Weight Gain (gm)	
Impinger 1	200 mL DNPH				<div style="border: 1px solid black; padding: 2px; margin-bottom: 2px;">QA/QC</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 2px;">Date</div>
Impinger 2	100 mL DNPH				
Impinger 3	100 mL DNPH				
Impinger 4	Empty				
Impinger 5	Silica Gel				
					Total Weight (gm)

Run No.	Filter Type N/A	Sample Box No.
Date	Lot No. N/A	pH N/A
Analyst	Filter No. N/A	Rinse

	Contents	Gross Weight (gm)	Tare Weight (gm)	Net Weight Gain (gm)	
Impinger 1	200 mL DNPH				<div style="border: 1px solid black; padding: 2px; margin-bottom: 2px;">QA/QC</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 2px;">Date</div>
Impinger 2	100 mL DNPH				
Impinger 3	100 mL DNPH				
Impinger 4	Empty				
Impinger 5	Silica Gel				
					Total Weight (gm)

TEST LOCATION: StackUNIT: FLU Scrubber RUN: 1

Client	MPC	Project No.	11265
Plant	Robinson	Date	7/11/2011
Meter Operator	S. Dooley		
Probe Operator	B. Arnold		

Meter Box	106-14	Sample Box No.	
Meter Yd	0.9882	Meter ΔH@	1.7571
K Factor	2.35	Pitot Cp	0.827
Leak Rate Before	0.002 [cfm]	[Lpm]	@ 2.35
Leak Rate After	0.002 [cfm]	[Lpm]	@ 1.4
Pitot Leak Check Before		After: Good	<input checked="" type="checkbox"/> Bad <input type="checkbox"/>

Cross-Section of Test Location			
Static Press. (in. H ₂ O)	Port Len. (in.)	Gas Flow (in) [Out] of page	First point all the way
-2.107	6		in [Out]
Duct Dimensions (in.) 114			

TESTING FIELD DATA SHEET

METHOD: 20-10 PAGE 1 OF 4

Amb. Temp. (°F)	82	Bar. Press.	29.40 [in. Hg] [mmbar]
Probe I.D. No.	66-4-7		
Liner Material	6.655		

Filter No.	NA		
Thimble No.	NA		
Nozzle Diameter	0.250	Nozzle I.D.	250-1

Start Time: 8:57	Stop Time: 14:49
------------------	------------------

Traverse Point Number	Min/pt Elapsed Time	Velocity Head ΔP (in. H ₂ O)	Orifice Setting ΔH (in. H ₂ O)	Gas Sample Volume Init. Vol. (ft ³) [L]	Stack Temp. Ts (°F)	Probe T _p (°F)	Filter T _f (°F)	Cond. Temp. T _c (°F)	DGM Inlet T _{m in} (°F)	DGM Outlet T _{m out} (°F)	Pump Vacuum (in. Hg)	XAD Trap Temp. T _t (°F)	Notes
1-1	5	0.74	1.7	219.5	147	250	250	66	89	88	7	54	Below 67°F
1-1	10	0.73	1.7	223.23	147	250	250	61	90	88	7	45	3.7
1-1	15	0.71	1.7	226.89	147	250	250	60	93	89	8	49	3.6
1-1	20	0.7	1.7	230.59	146	250	250	62	95	90	8	52	3.5
1-2	25	0.67	1.6	234.25	147	250	250	61	98	90	7	46	3.8
1-2	30	0.67	1.6	237.86	147	250	250	61	100	91	7	45	3.6
1-2	35	0.66	1.6	241.39	147	250	250	62	102	92	7	48	3.7
1-2	40	0.66	1.6	244.94	147	250	250	61	103	93	7	49	3.6
1-2	45	0.66	1.6	248.35	147	250	250	65	105	95	7	52	3.6
1-3	50	0.55	1.2	251.86	147	250	250	60	106	96	7	54	3.5
1-3	55	0.50	1.2	254.27	147	250	250	66	106	96	6	54	3.5
1-3	60	0.47	1.1	258.09	147	250	250	66	106	97	7	58	3.6
Total		37.835	70.300	163.6280	7055				5036	4793	4703		
Average		0.7256	1.4663	219.5	146.9	250	250		101.4	97.9			

CleanAir®
ENGINEERING

TEST LOCATION: Stack

UNIT: FCW scrub RUN: 1

TESTING

METHOD: 210 PAGE 2 OF 4

Client	MPC	Project No.	11265
Plant	Robinson	Date	3/14/2011
Meter Operator	SD		7/15/2011 60
Probe Operator	BA		

Meter Box		Sample Box No.	
Meter Y _d		Meter ΔH _@	
K Factor	2.38	Pitot C _p	
Leak Rate Before	[cfm] [Lpm]	@	(in. Hg)
Leak Rate After	[cfm] [Lpm]	@	(in. Hg)
Pitot Leak Check Before:	<input type="checkbox"/>	After: Good <input type="checkbox"/> Bad <input type="checkbox"/>	

Cross-Section of Test Location

Duct Dimensions (in.)

Static Pres (in. H ₂ O)	Port Len. (in.)	Gas Flow [In] [Out] of page	First point all the way [In] [Out]

Amb. Temp. (°F)	Bar. Press.	[in. Hg] [mbar]
Probe I.D. No.		
Liner Material		

Filter No.		
Thimble No.		
Nozzle Diameter		Nozzle I.D.

Start Time:	Stop Time:
-------------	------------

Traverse Point Number	Min/pt	Velocity Head ΔP (in. H ₂ O)	Orifice Setting ΔH (in. H ₂ O)	Gas Sample Volume V _m (ft ³) [L]	Stack Temp. T _s (°F)	Probe T _p (°F)	Filter T _f (°F)	Cond. Temp. T _c (°F)	DGM Inlet T _{m in} (°F)	DGM Outlet T _{m out} (°F)	Pump Vacuum (in. Hg)	XAD Trap Temp. T _t (°F)	Notes
3-1	65	0.80	1.88	264.89	146	250	250	59	102	98	10	46	3.9
3-1	70	0.72	1.7	268.69	147			48	106	98	10	48	4.1
3-1	75	0.75	1.8	272.46	147			49	107	99	10	44	4.1
3-1	80	0.75	1.8	276.25	147			52	108	99	11	47	4.0
3-2	85	0.68	1.6	279.98	147			50	109	100	11	44	4.2
3-2	90	0.60	1.4	283.88	147			50	109	100	11	44	4.3
3-2	95	0.65	1.5	286.87	147			54	109	100	11	44	4.3
3-2	100	0.65	1.5	290.77	147			55	109	100	11	46	4.4
3-3	105	0.53	1.2	293.98	147			66	103	100	11	52	3.6
3-3	110	0.54	1.3	297.16	147			66	103	99	11	58	3.6
3-3	115	0.5	1.2	300.34	147			66	104	99	11	60	3.6
3-3	120	0.52	1.2	303.57	147			66	106	99	12	58	3.5
Total	*												
Average													

* Sum of square roots.

Circle correct bracketed units on data sheet.

QA/QC 101
Date 8/1

TEST LOCATION: Stack
UNIT: Flue Sash RUN: 1

TESTING FIELD DATA SHEET

METHOD: 210 PAGE 3 OF 4

Client	MPC	Project No.	11268
Plant	Debinson	Date	7/14/2001
Meter Operator	SD		7/15/2011
Probe Operator	BA		(62)
Meter Box		Sample Box No.	
Meter Y_d		Meter ΔH_d	
K Factor	2.35	Pitot C_p	
Leak Rate Before	[cfm] [Lpm]	@	(in. Hg)
Leak Rate After	[cfm] [Lpm]	@	(in. Hg)
Pitot Leak Check Before:	<input type="checkbox"/> After:	Good	<input type="checkbox"/> Bad

Cross-Section of Test Location

Duct Dimensions (in.)	Port Len. (in.)	Gas Flow [In] [Out] of page	First point all the way [In] [Out]
Static Pres (in. H ₂ O)			

Amb. Temp. (°F)	Bar. Press.	[in. Hg] [mbar]
Probe I.D. No.		
Liner Material		
Filter No.		
Thimble No.		
Nozzle Diameter	0.250	Nozzle I.D. 250-1

Start Time:	Stop Time:
-------------	------------

Traverse Point Number	Min/pt	Velocity Head ΔP (in. H ₂ O)	Orifice Setting ΔH (in. H ₂ O)	Gas Sample Volume V _m (ft ³) [L]	Stack Temp. T _s (°F)	Probe T _p (°F)	Filter T _f (°F)	Cond. Temp. T _c (°F)	DGM Inlet T _{m in} (°F)	DGM Outlet T _{m out} (°F)	Pump Vacuum (in. Hg)	XAD Trap Temp. T _t (°F)	Notes
2-1	125	0.68	1.6	314.07	147	250	250	66	99	98	7	51	3.2 NV=32.83
2-1	130	0.68	1.6	317.62	147			64	101	98	7	52	3.2
2-1	135	0.68	1.6	321.30	147			64	102	98	7	54	3.2
2-1	140	0.68	1.6	324.85	147			66	105	98	7	59	3.3
2-2	145	0.63	1.5	328.35	147			58	106	98	7	52	3.2
2-2	150	0.63	1.5	331.88	147			58	108	99	7	49	3.2
2-2	155	0.63	1.5	335.35	147			60	108	100	7	51	3.3
2-2	160	0.63	1.5	338.85	147			63	109	100	7	55	3.3
2-3	165	0.50	1.2	342.10	147			54	108	100	7	45	3.3
2-3	170	0.55	1.3	345.33	147			54	108	100	7	44	3.4
2-3	175	0.50	1.2	348.52	147			55	108	100	7	44	3.4
2-3	180	0.50	1.2	351.723	147			57	108	101	7	45	3.4
Total	*												
Average													

* Sum of square roots.

Circle correct bracketed units on data sheet.

QA/QC 60
Date 8/1

TEST LOCATION: StackUNIT: Flu Sub RUN: 1

Client	<u>MPC</u>	Project No.	<u>12665</u>
Plant	<u>Edwinson</u>	Date	<u>7/14/2011</u>
Meter Operator	<u>SD</u>		
Probe Operator	<u>BA</u>		

Meter Box		Sample Box No.	
Meter Y_d		Meter $\Delta H_{@}$	
K Factor	<u>2.35</u>	Pitot C_p	
Leak Rate Before	[cfm] [Lpm] @	(in. Hg)	
Leak Rate After	[cfm] [Lpm] @	(in. Hg)	
Pitot Leak Check Before:	<input type="checkbox"/> After: Good <input type="checkbox"/> Bad <input type="checkbox"/>		

Cross-Section of Test Location



Duct Dimensions (in.)		Gas Flow	First point
Static Pres	Port Len.	[In] [Out]	all the way
(in. H ₂ O)	(in.)	of page	[In] [Out]

TESTING
FIELD DATA SHEETMETHOD: SVOC PAGE 4 OF 4

Amb. Temp. (°F)	Bar. Press.	[in. Hg] [mbar]
Probe I.D. No.		
Liner Material		

Filter No.	
Thimble No.	
Nozzle Diameter	Nozzle I.D.

Start Time:	Stop Time:
-------------	------------

Traverse Point Number	Min/pt	Velocity Head ΔP (in. H ₂ O)	Orifice Setting ΔH (in. H ₂ O)	Gas Sample Volume Init. Vol.	Stack Temp. T_s (°F)	Probe T_p (°F)	Filter T_f (°F)	Cond. Temp. T_c (°F)	DGM Inlet T_{min} (°F)	DGM Outlet T_{mout} (°F)	Pump Vacuum (in. Hg)	XAD Trap Temp. T_t (°F)	Notes
4-1	185	0.70	1.7	355.13	147	250	250	65	102	100	7	42	3.3
4-1	190	0.68	1.6	358.80	147			45	102	99	8	41	3.3
4-1	195	0.68	1.6	362.28	147			44	105	100	8	41	3.3
4-1	200	0.68	1.6	365.81	147			45	108	100	8	42	3.2
4-2	205	0.60	1.4	369.19	147			50	109	101	8	46	3.4
4-2	210	0.60	1.4	372.53	147			54	110	101	8	47	3.5
4-2	215	0.60	1.4	375.87	147			47	111	102	8	42	3.4
4-2	220	0.60	1.4	379.22	147			44	110	102	8	42	3.5
4-3	225	0.57	1.3	382.46	147			45	111	103	8	42	3.5
4-3	230	0.52	1.2	385.61	147			46	109	103	8	44	3.6
4-3	235	0.5	1.2	388.70	147			49	110	103	8	43	3.6
4-3	240	0.5	1.2	391.753	147			49	111	103	8	44	3.6
Total		*37.85	70						5036				
Average		0.736											

* Sum of square roots.

Circle correct bracketed units on data sheet.

QA/QC 60Date 8/1

Client	Marathon	Project No.	11265
Plant	Robinson IL	Date	7-15-11
Meter Operator	H. Nguyen		
Probe Operator	B. Arnold / K. Sullivan		

Meter Box	66-14	Sample Box No.	
Meter Y_d	1.7571	Meter $\Delta H @$	0.9882
K Factor	2.32	Pitot C_p	0.827
Leak Rate Before	0.05 (cfm)	@	15 (in. Hg)
Leak Rate After	0.04 (cfm)	@	22 (in. Hg)
Pitot Leak Check Before	<input checked="" type="checkbox"/>	After: Good	<input checked="" type="checkbox"/> Bad

Start Time:	1:55	Stop Time:	20:55
-------------	------	------------	-------

Traverse Point Number	Min/pt Elapsed Time	Velocity Head ΔP (in. H ₂ O)	Orifice Setting ΔH (in. H ₂ O)	Gas Sample Volume V_m Init. Vol. (ft ³) [L]	Stack Temp. T_s (°F)	Probe T_p (°F)	Filter T_f (°F)	Cond. Temp. T_c (°F)	DGM Inlet T_{min} (°F)	DGM Outlet $T_{m out}$ (°F)	Pump Vacuum (in. Hg)	XAD Trap Temp. T_t % O ₂	Notes
						Set Points							
						250	250						
3-1	5	.82	1.8	396.68	150	247	249	57	103	103	6.0	530	3.4
1	10	.82	1.8	400.10	149	248	253	47	103	103	6.0	46	3.4
1	15	.74	1.7	404.12	149	247	250	45	103	103	6.0	48	3.3
1	20	.74	1.7	408.12	149	248	249	47	109	104	6.0	45	3.2
3-2	25	.68	1.6	411.80	149	250	254	48	111	105	6.5	47	3.3
2	30	.68	1.6	415.50	149	249	251	53	112	105	6.5	52	3.5
2	35	.68	1.6	419.20	150	249	250	54	112	106	6.5	53	3.5
2	40	.68	1.6	422.87	150	250	250	57	112	106	6.5	56	3.4
3-3	45	.56	1.3	426.29	150	250	249	57	112	106	6	56	3.5
3	50	.56	1.3	429.64	150	251	248	62	113	107	6	58	3.4
3	55	.56	1.3	432.94	150	247	249	65	114	107	6	60	3.7
3	60	.56	1.3	436.31	150	249	250	66	115	107	6	62	3.4
	Total	4.824	18.6	444.88	1795				1324	1262			
	Average	1.783	1.428	163.419	147.017				108.645	108.645			

Client	WAPC	Project No.	11265
Plant	Robinson, IL	Date	7-15-11
Meter Operator	H. Nguyen		
Probe Operator	BA		

Cross-Section of Test Location



[N] [UPI]

Amb. Temp. (°F)	Bar. Press.	[in. Hg] [mbar]
Probe I.D. No.		
Liner Material		

Filter No.	
Thimble No.	
Nozzle Diameter	Nozzle I.D.

Start Time:	Stop Time:
-------------	------------

Duct Dimensions (in.)	Gas Flow	First point
Static Pres (in. H ₂ O)	[In] [Out] of page	all the way
Port Len. (in.)		[In] [Out]

Traverse Point Number	Min/pt Elapsed Time	Velocity Head ΔP (in. H ₂ O)	Orifice Setting ΔH (in. H ₂ O)	Gas Sample Volume V _m (ft ³ L)	Stack Temp. T _s (°F)	Probe T _p (°F)	Filter T _f (°F)	Cond. Temp. T _c (°F)	DGM Inlet T _{m in} (°F)	DGM Outlet T _{m out} (°F)	Pump Vacuum (in. Hg)	XAD Trap Temp. T _t (°F)	Notes
1-1	65	.62	1.4	439.75	149	249	251	64	112	107	6	49	70 Oxygen
1	70	.62	1.4	443.23	149	249	250	58	112	107	6	51	3.6
1	75	.62	1.4	446.5	148	248	249	55	112	107	6	52	3.5
1	80	.62	1.4	450.1	148	249	247	54	112	107	7	51	3.6
1-2	85	.64	1.5	453.64	146	250	252	62	113	107	7	57	3.5
2	90	.64	1.5	457.15	146	250	249	66	113	107	7	65	3.7
2	95	.64	1.5	460.78	146	250	253	60	113	107	7	60	3.7
2	100	.64	1.5	464.21	146	249	247	56	113	107	7	59	3.6
1-3	105	.50	1.2	467.46	146	249	249	57	112	106	7	53	3.7
3	110	.51	1.2	470.70	146	249	250	58	112	106	7	56	3.8
3	115	.52	1.2	473.86	146	247	251	59	112	106	7	56	3.7
3	120	.52	1.2	476.99	146	248	252	60	112	106	7	57	3.8
Total	*9.231	16.4			1762				1348	1280			
Average	7678								2620				

Circle correct bracketed units on data sheet.

* Sum of square roots.

QA/QC 60

Date 8/1

TEST LOCATION: STACKUNIT: FCCU Scrubber RUN: 2

Spec

TESTING

METHOD: 0010 PAGE 3 OF 4

FIELD DATA SHEET

Cross-Section of Test Location

Client	Project No.		11265
Plant	Date		7-15-11
Meter Operator	Meter		HN
Probe Operator	BR/KS/SD		
Meter Box	Sample Box No.		
Meter Y _a	Meter ΔH _a		
K Factor	2.32	Pitot C _p	
Leak Rate Before	[cfm] [Lpm]	@	(in. Hg)
Leak Rate After	[cfm] [Lpm]	@	(in. Hg)
Pitot Leak Check Before:	<input type="checkbox"/> After:	Good	<input type="checkbox"/> Bad

Amb. Temp. (°F)	Bar. Press.	[in. Hg] [mbar]
Probe I.D. No.		
Liner Material		

Filter No.	
Thimble No.	
Nozzle Diameter	Nozzle I.D.

Start Time:	Stop Time:
-------------	------------

Traverse Point Number	Min/pt	Velocity Head ΔP (in. H ₂ O)	Orifice Setting ΔH (in. H ₂ O)	Gas Sample Volume V _m (ft ³) [L]	Stack Temp. T _s (°F)	Probe T _p (°F)	Filter T _f (°F)	Cond. Temp. T _c (°F)	DGM Inlet T _{m in} (°F)	DGM Outlet T _{m out} (°F)	Pump Vacuum (in. Hg)	XAD Trap Temp. T _t (°F)	Notes
4-1	125	.67	1.6	477.20	146	249	257	63	113	107	9	59	0.21 From
1	130	.67	1.6	480.86	146	249	251	50	115	108	9	52	Final Volume
1	135	.69	1.6	487.95	146	249	245	50	116	108	10	49	Leak ✓ @ 8"
1	140	.70	1.6	491.40	146	249	247	50	117	109	12	50	.002
4-2	145	.73	1.7	494.97	146	249	249	51	116	109	12	51	3.7
2	150	.58	1.3	498.42	146	250	247	51	116	110	13	51	3.8
2	155	.58	1.3	501.50	146	250	250	55	115	110	14	51	3.8
2	160	.58	1.3	504.54	146	250	252	60	112	109	14	54	3.9
4-3	165	.51	1.2	507.50	145	250	251	62	112	108	20	57	4.0
3	170	.51	1.2	510.33	145	249	249	63	112	108	21	58	511.00 Leak ✓
3	175	.51	1.2	513.86	145	249	249	50	111	108	22	49	0.67
3	180	.51	1.2	516.52	145	249	249	50	111	108	22	49	
Total	9,700		16.8		1740				1366	1302			
Average	7,750								2660				

* Sum of square roots.

Circle correct bracketed units on data sheet.

QA/QC FDDate 8/11

TEST LOCATION: STACKUNIT: Focu Scrubber RUN: 2

SVOC

TESTING
FIELD DATA SHEETMETHOD: 0010 PAGE 4 OF 4

Client	MPC	Project No.	11265
Plant	Robinson, IL	Date	7-15-11
Meter Operator	HN		
Probe Operator	B/A		

Meter Box		Sample Box No.	
Meter Y_d		Meter ΔH_d	
K Factor		Pitot C_p	
Leak Rate Before	[cfm] [Lpm]	@	(in. Hg)
Leak Rate After	[cfm] [Lpm]	@	(in. Hg)
Pitot Leak Check Before:	<input type="checkbox"/> After: Good <input type="checkbox"/> Bad <input type="checkbox"/>		

Cross-Section of Test Location



[N] [UPI]

Amb. Temp. (°F)	Bar. Press.	[in. Hg] [mbar]
Probe I.D. No.		
Liner Material		

Filter No.		
Thimble No.		
Nozzle Diameter		

Start Time:	Stop Time:
	20:55

Traverse Point Number	Min/pt	Velocity Head ΔP (in. H ₂ O)	Orifice Setting ΔH (in. H ₂ O)	Gas Sample Volume V_m (ft ³) [L]	Stack Temp. T_s (°F)	Probe T_p (°F)	Filter T_f (°F)		Cond. Temp. T_c (°F)	DGM Inlet $T_{m in}$ (°F)	DGM Outlet $T_{m out}$ (°F)	Pump Vacuum (in. Hg)	XAD Trap Temp. T_t (°F)	Notes
							Set Points							
2-1	185	0.60	1.4	516.80	146	246	244	244	63	105	104	5	49	% Oxygen Leak 150.001 -0.20
1	190	0.6	1.4	520.23	146	248	248	248	60	105	102	6	48	Leak 150.001 -0.20
1	195	0.6	1.4	523.74	146	250	250	250	60	105	102	6	48	Leak 150.001 -0.20
1	200	0.6	1.4	527.27	146	250	253	253	59	105	101	6	49	Leak 150.001 -0.20
2-2	205	0.59	1.3	530.83	147	251	251	251	59	105	101	6	49	Leak 150.001 -0.20
2	210	0.58	1.3	534.14	147	251	251	251	62	114	101	6	50	Leak 150.001 -0.20
2	215	0.59	1.3	537.59	147	251	251	251	64	114	101	6	59	Leak 150.001 -0.20
2	220	0.59	1.3	540.89	147	251	250	250	65	114	101	5	59	Leak 150.001 -0.20
2-3	225	0.60	1.4	544.23	146	251	251	251	57	112	101	5	50	Leak 150.001 -0.20
3	230	0.60	1.4	547.68	145	250	250	250	57	112	101	5	50	Leak 150.001 -0.20
3	235	0.60	1.4	551.15	145	250	251	251	56	112	101	5	51	Leak 150.001 -0.20
3	240	0.60	1.4	554.58	145	250	251	251	56	112	101	5	51	Leak 150.001 -0.20
Total		*9.267	16.4							1331	1217			
Average		.7719			1753					2540				

* Sum of square roots.

Circle correct bracketed units on data sheet.

QA/QC 60Date 8/1CleanAir
ENGINEERING

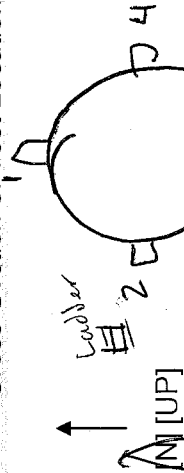
SVOC
Dioxin

METHOD: COLD PAGE 1 OF 4

TESTING

FIELD DATA SHEET

Cross-Section of Test Location



Client	Meredith	Project No.	11265
Plant	Robinson IL	Date	7-16-11
Meter Operator	SD		
Probe Operator	B. Arnold		
Meter Box	85-3	Sample Box No.	D4
Meter Y _a	0.9882	Meter ΔH _a	1.7925
K Factor	2.31	Pitot C _p	0.827
Leak Rate Before	0.012	@ 15 (in. Hg)	
Leak Rate After	0.003	@ 10 (in. Hg)	
Pitot Leak Check Before:	<input checked="" type="checkbox"/>	After: Good	<input type="checkbox"/> Bad

Traverse Point Number	Min/pt Elapsed Time	Velocity Head ΔP (in. H ₂ O)	Orifice Setting ΔH (in. H ₂ O)	Gas Sample Volume V _m (ft ³)	Stack Temp. T _s (°F)	Probe T _p (°F)	Filter T _f (°F)	Cond. Temp. T _c (°F)	DGM Inlet T _{min} (°F)	DGM Outlet T _{out} (°F)	Pump Vacuum (in. Hg)	XAD Trap Temp. T _t (°F)	Notes
3 1	5	0.75	1.7	331.49	147	245	255	66	89	90	7	60	3.6
1 1	10	0.73	1.7	335.06	148	245	251	66	91	90	8	59	3.3
1 1	15	0.73	1.7	338.72	147	245	250	61	90	90	9	55	3.4
1 1	20	0.73	1.7	342.39	147	246	251	59	100	92	9	50	3.4
3 2	25	0.66	1.5	345.98	147	246	250	59	104	93	9	49	3.4
1 2	30	0.63	1.5	349.45	147	247	250	60	106	94	8	50	3.4
1 2	35	0.65	1.5	353.96	147	247	250	56	110	95	8	48	3.4
1 2	40	0.65	1.5	356.48	147	247	251	53	111	96	8	47	3.4
3 3	45	0.52	1.2	359.72	147	247	250	53	113	98	7	44	3.4
1 3	50	0.52	1.2	362.86	147	248	251	58	113	99	7	44	3.4
1 3	55	0.52	1.2	366.01	147	248	250	60	113	100	7	46	3.4
1 3	60	0.52	1.2	369.150	147	248	250	62	114	101	7	47	3.4
Total		3.7369	17.6000	1649.9000	1765			5509	1260	1128	5645		
Average		0.7862	1.4458	164.474	147.008				109.4375	116			



Circle-correct bracketed units on data sheet.

QA/QC

Date: 11/11/11

Sum of square roots.

FD5005 General.xls, Feb. 2002
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TEST LOCATION: StackUNIT: FCU Sumbay RUN: 17

Svbc

TESTING
FIELD DATA SHEETMETHOD: GD PAGE 2 OF 4

Client	<u>MPC</u>	Project No.	<u>11265</u>
Plant	<u>Peterson</u>	Date	<u>7/16/2011</u>
Meter Operator	<u>SD</u>		
Probe Operator	<u>BA</u>		

Meter Box	Sample Box No.	
Meter Y _d	Meter ΔH _@	
K Factor	Pitot C _p	
Leak Rate Before	[cfm] [Lpm] @	(in. Hg)
Leak Rate After	[cfm] [Lpm] @	(in. Hg)
Pitot Leak Check Before:	<input type="checkbox"/> After: Good <input type="checkbox"/> Bad <input type="checkbox"/>	

Cross-Section of Test Location			
<div style="text-align: center;">↑</div> <div style="text-align: center;">[N] [UP]</div>			
Duct Dimensions (in.)		Gas Flow	First point
Static Pres	Port Len.	[In] [Out]	all the way
(in. H ₂ O)	(in.)	of page	[In] [Out]

Amb. Temp. (°F)	Bar. Press.	[in. Hg] [mbar]
Probe I.D. No.	<u>11265</u>	
Liner Material		

Filter No.	
Thimble No.	
Nozzle Diameter	Nozzle I.D.

Start Time:	Stop Time:
-------------	------------

Traverse Point Number	Min/pt Elapsed Time	Velocity Head ΔP (in. H ₂ O)	Orifice Setting ΔH (in. H ₂ O)	Gas Sample Volume V _m Init. Vol.	Stack Temp. T _s (°F)	Probe T _p (°F)	Filter T _f (°F)	Cond. Temp. T _c (°F)	DGM Inlet T _{m in} (°F)	DGM Outlet T _{m out} (°F)	Pump Vacuum (in. Hg)	XAD Trap Temp. T _t (°F)	Notes
4-1	65	0.73	1.7	372.78	147	248	248	66	110	102	9	60	3.5
1-1	70	0.73	1.7	376.38	147	248	250	62	114	103	9	52	3.5
1-1	75	0.72	1.7	379.99	147	249	250	58	116	103	9	50	3.4
1-1	80	0.73	1.7	383.57	147	249	250	57	118	104	9	46	3.4
4-2	85	0.67	1.5	387.10	147	249	250	66	119	105	8	46	3.4
1-2	90	0.68	1.6	390.66	147	249	250	66	120	106	9	53	3.5
1-2	95	0.67	1.5	394.19	147	249	250	66	119	107	9	54	3.6
1-2	100	0.67	1.5	397.75	147	249	250	63	120	107	9	55	3.5
4-3	105	0.48	1.1	400.85	147	249	250	62	120	108	7	56	3.4
1-3	110	0.48	1.1	403.84	147	250	250	61	118	108	7	52	3.5
1-3	115	0.48	1.1	406.85	147	250	250	63	118	108	7	53	3.5
1-3	120	0.48	1.1	409.825	147	250	250	63	118	108	7	55	3.4
Total	*		17.3000		1764				1410	1269			
Average													

* Sum of square roots.

Circle correct bracketed units on data sheet.

QA/QC: 16Date: 8/1

TEST LOCATION: StallUNIT: FCW scrub RUN: 7

SVC

TESTING

METHOD: 0610 PAGE 3 OF 4

FIELD DATA SHEET

Cross-Section of Test Location

Client	MPC	Project No.	11265
Plant	Robinson	Date	7/16/2017
Meter Operator	SD		
Probe Operator	BA		

Meter Box	Sample Box No.	
Meter Y ₀	Meter ΔH ₀	
K Factor	Pitot C _p	
Leak Rate Before	[cfm] [Lpm] @	(in. Hg)
Leak Rate After	[cfm] [Lpm] @	(in. Hg)
Pitot Leak Check Before:	<input type="checkbox"/> After: Good <input type="checkbox"/> Bad <input type="checkbox"/>	

Amb. Temp. (°F)	Bar. Press.	[in. Hg] [mbar]
Probe I.D. No.		
Liner Material		

Filter No.		
Thimble No.		
Nozzle Diameter		Nozzle I.D.

Start Time:		Stop Time:
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Traverse Point Number	Min/pt Elapsed Time	Velocity Head ΔP (in. H ₂ O)	Orifice Setting ΔH (in. H ₂ O)	Gas Sample Volume V _m Init. Vol.	Stack Temp. T _s (°F)	Probe T _p (°F)	Filter T _f (°F)	Cond. Temp. T _c (°F)	DGM Inlet T _{m in} (°F)	DGM Outlet T _{m out} (°F)	Pump Vacuum (in. Hg)	XAD Trap Temp. T _t (°F)	Notes
2-1	125	0.7	1.6	413.59	147	249	260	60	110	107	9	60	Post
1-1	130	0.7	1.6	417.31	147	249	246	61	113	107	9	53	3.6 leak check
1-1	135	0.7	1.6	420.91	147	249	250	60	117	107	9	52	3.5 VOL: 09.241
1-1	140	0.7	1.6	424.55	147	250	250	62	119	108	9	53	3.4
1-2	145	0.63	1.5	428.07	147	249	251	63	120	108	8	52	3.5
1-2	150	0.60	1.4	431.53	147	249	251	66	120	109	8	52	3.4
1-2	155	0.60	1.4	434.95	147	249	249	59	121	109	8	50	3.4
1-2	160	0.60	1.4	438.47	147	249	250	58	121	110	7	50	3.4
1-3	165	0.50	1.2	441.68	147	250	251	58	121	110	7	49	3.4
1-3	170	0.50	1.2	444.83	147	250	250	59	121	110	7	47	3.5
1-3	175	0.50	1.2	448.04	147	250	251	60	121	110	7	49	3.4
1-3	180	0.50	1.2	451.168	147	250	250	65	119	110	7	55	3.4
Total	*		16.9		176.9				1423				
Average									1344	1305			

* Sum of square roots.

Circle correct bracketed units on data sheet.

QA/QC WDate 8/1CleanAir
ENGINEERING

Cross-Section of Test Location

Client	<u>APC</u>	Project No.	<u>11265</u>
Plant	<u>Robinson</u>	Date	<u>7/16/2017</u>
Meter Operator	<u>SD</u>		
Probe Operator	<u>BA</u>		

Amb. Temp. (°F)		Bar. Press.	[in. Hg] [mbar]
Probe I.D. No.			
Liner Material			

Meter Box		Sample Box No.	
Meter Y _d		Meter ΔH _@	
K Factor		Pitot C _p	
Leak Rate Before	[cfm] [Lpm]	@	(in. Hg)
Leak Rate After	[cfm] [Lpm]	@	(in. Hg)
Pitot Leak Check Before:	<input type="checkbox"/> After: Good <input type="checkbox"/> Bad <input type="checkbox"/>		

Filter No.			
Thimble No.			
Nozzle Diameter		Nozzle I.D.	

Duct Dimensions (in.)		Gas Flow [In] [Out] of page	First point all the way [In] [Out]
Static Pres (in. H ₂ O)	Port Len. (in.)		

Start Time:		Stop Time:	
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Traverse Point Number	Min/pt Elapsed Time	Velocity Head ΔP (in. H ₂ O)	Orifice Setting ΔH (in. H ₂ O)	Gas Sample Volume V _m		Stack Temp. T _s (°F)	Probe T _p (°F)	Filter T _f (°F)	Cond. Temp. T _c (°F)	DGM Inlet T _{m in} (°F)	DGM Outlet T _{m out} (°F)	Pump Vacuum (in. Hg)	XAD Trap Temp. T _t (°F)	Notes
				Init. Vol.	[ft ³] [L]									
1 -1	185	0.72	1.7	454.82		147	250	250	66	115	110	9	60	3.6
-1	190	0.7	1.7	458.57		147	250	250	66	118	110	9	59	3.5
-1	195	0.7	1.7	462.33		147	251	249	55	121	110	9	48	3.5
-1	200	0.7	1.7	466.07		147	250	248	53	122	110	9	47	3.4
-2	205	0.64	1.5	469.62		147	250	251	51	119	110	8	44	3.4
-2	210	0.64	1.5	473.14		147	250	250	54	120	109	8	44	3.4
-2	215	0.64	1.5	476.63		147	250	250	100	119	109	8	47	3.5
-2	220	0.64	1.5	480.10		147	250	250	63	118	108	8	49	3.4
-3	225	0.52	1.2	483.32		147	250	250	64	118	108	7	52	3.4
-3	230	0.52	1.2	486.50		147	250	251	63	116	108	7	50	3.4
-3	235	0.52	1.2	489.68		147	250	250	61	115	107	7	50	3.3
-3	240	0.52	1.2	492.814		147	250	250	61	115	107	7	51	3.4
						1764				1416	1306			
	Total	*	17.0											
	Average													

Circle correct bracketed units on data sheet.

* Sum of square roots.

QA/QC W
Date 8/1

Impinger Weight Sheet

Client Marathon Petroleum Company		Unit Name/Location FCCU Scrubber Stack	
Plant Robinson Refinery	Job No. 11265	Method	USEPA SW-846 M-0010

Run No. 1	Filter Type Quartz Fiber, Extracted	Sample Box No. D4
Date 7/15/11	Lot No. L1022815	pH N/A
Analyst DL	Filter No. N/A	Rinse

	Contents	Gross Weight (gm)	Tare Weight (gm)	Net Weight Gain (gm)	
Impinger 1	Empty	1647.4	619.5	1027.9	
Impinger 2	100 ml HPLC H2O	534.0	552.8	-18.8	QA/QC DL
Impinger 3	100 ml HPLC H2O	523.7	561.8	-38.1	Date 7/15/11
Impinger 4	Empty	447.5	445.9	1.6	
Impinger 5	Trap # 5 M0010	363.8	350.4	13.4	Total Weight (gm)
Impinger 6	Silica Gel	789.5	757.3	32.2	985.6 986.0
Imp. 6B	Silica Gel HPLC	780.8	757.4 (H)	24.2	1042.0
		756.6		1042.4 (C)	

Run No. 2	Filter Type Quartz Fiber, Extracted	Sample Box No. D1
Date	Lot No.	pH N/A
Analyst	Filter No. N/A	Rinse

	Contents	Gross Weight (gm)	Tare Weight (gm)	Net Weight Gain (gm)	
Impinger 1	Empty 1541.8	1647.4 DL	637.2	904.6	
Impinger 2	100 ml HPLC H2O 451.5	534.0 DL	627.2	2.3	QA/QC DL
Impinger 3	100 ml HPLC H2O 537.0	523.7 DL	534.8	2.2	Date 7/15
Impinger 4	Empty 451.7	447.5 DL	438.7	13.0	
Impinger 5	Trap # 6 404.4	363.8 DL	395.1	9.3	Total Weight (gm)
Impinger 6	Silica Gel 761.0	780.8 DL	732.8	28.2	931.4
	767.4		735.0	32.4	992.6

Run No. 3	Filter Type Quartz Fiber, Extracted	Sample Box No. D4
Date 7/16/11	Lot No.	pH N/A
Analyst DL	Filter No. N/A	Rinse

	Contents	Gross Weight (gm)	Tare Weight (gm)	Net Weight Gain (gm)	
Impinger 1	Empty	1580.9	621.3	959.6	
Impinger 2	100 ml HPLC H2O	462.0	552.1	-90.1	QA/QC DL
Impinger 3	100 ml HPLC H2O	559.2	561.4	-2.2	Date 7/16/11
Impinger 4	Empty	553.2	447.5	105.7	
Impinger 5	Trap # 2	363.3	354.4	8.9	Total Weight (gm)
Impinger 6	Silica Gel	829.1	775.6	53.5	981.9
					1035.4

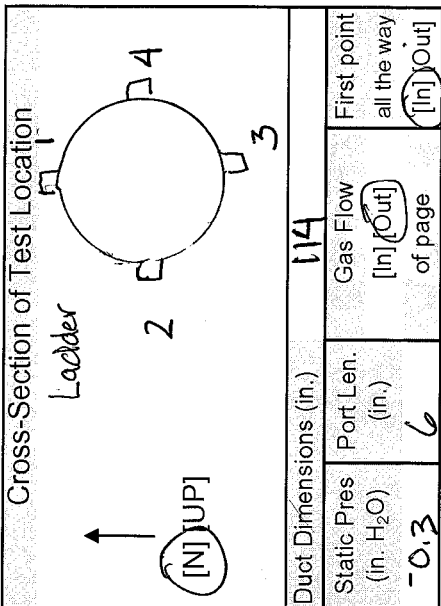
TEST LOCATION: StackUNIT: PCW Scrubber RUN: 1

DIONIS

TESTING
FIELD DATA SHEETMETHOD: 23 PAGE 1 OF 3

Client	<u>Marathon Petroleum Co.</u>	Project No.	<u>11265</u>
Plant	<u>Robinson IL</u>	Date	<u>7-20-11</u>
Meter Operator	<u>Huy Nguyen</u>		
Probe Operator	<u>K. Sullivan / J. Rooney</u>		

Meter Box	<u>61-5</u>	Sample Box No.	<u>DA</u>
Meter Y _d	<u>0.9992</u>	Meter ΔH ₀	<u>1.7185</u>
K Factor	<u>2.17</u>	Pitot C _p	<u>0.820</u>
Leak Rate Before	<u>0.003</u> [Lpm]	@	<u>15</u> (in. Hg)
Leak Rate After	<u>0.001</u> [Lpm]	@	<u>11</u> (in. Hg)
Pitot Leak Check Before:	<input checked="" type="checkbox"/>	After: Good	<input checked="" type="checkbox"/> Bad <input type="checkbox"/>



Traverse Point Number	Min/pt Elapsed Time	Velocity Head ΔP (in. H ₂ O)	Orifice Setting ΔH (in. H ₂ O)	Gas Sample Volume V _m (ft ³)	Stack Temp. T _s (°F)	Probe T _p (°F)	Filter T _f (°F)	Cond. Temp. T _c (°F)	DGM Inlet T _{m in} (°F)	DGM Outlet T _{m out} (°F)	Pump Vacuum (in. Hg)	XAD Trap Temp. T _t (°F)	Notes
1-1	5	0.71	1.5	57.57	151	254	255	66	95	94	8	55	
1	10	0.71	1.5	64.90	151	250	251	65	97	95	8	59	
1	15	0.71	1.5	68.60	151	250	250	64	98	95	8	60	
1-2	20	0.68	1.5	72.20	151	250	250	64	99	95	8	60	Heat Index 117.8 °F
2	25	0.68	1.5	75.83	151	250	250	64	99	95	8	60	② 8.28
2	30	0.68	1.5	79.47	151	246	250	63	100	96	8	59	
1-3	35	0.50	1.1	82.73	151	250	247	64	103	97	7	59	
3	40	0.50	1.1	85.89	151	249	251	60	105	98	7	55	
3	45	0.50	1.1	89.09	151	251	247	63	106	99	7	59	
2-1	50	0.73	1.6	92.90	151	251	249	64	105	99	9	60	
1	55	0.73	1.6	96.73	151	249	248	66	106	99	10	56	
1	60	0.73	1.6	100.52	151	247	248	64	107	99	10	56	
Total		9.6862	17.1	125.1300	1812				1220	1161			
Average		3.004	1.350	151.00									

Sum of square roots.

Circle correct bracketed units on data sheet.

8077

QA/QC 60
Date 3/1

TEST LOCATION: STACKUNIT: Focu ScrubberRUN: 1Dioxins

TESTING

FIELD DATA SHEET

METHOD: 23 PAGE 2 OF 3

Client	<u>MPC</u>	Project No.	<u>11265</u>
Plant	<u>Robberson, IL</u>	Date	<u>7-20-11</u>
Meter Operator	<u>H. Nguyen</u>		
Probe Operator	<u>K. Sullivan / J. Rooney</u>		

Meter Box	Sample Box No.
Meter Y _d	Meter ΔH _@
K Factor	Pitot C _p

Leak Rate Before	[cfm] [Lpm]	@	(in. Hg)
Leak Rate After	[cfm] [Lpm]	@	(in. Hg)
Pitot Leak Check Before:	<input type="checkbox"/> After: Good	<input type="checkbox"/> Bad	

Cross-Section of Test Location			
<div style="text-align: center;">↑</div> [N] [UP]		Duct Dimensions (in.)	114
		Static Pres (in. H ₂ O)	Port Len. (in.)
		Gas Flow [In] [Out] of page	First point all the way
		[In] [Out]	[In] [Out]

Filter No.	
Thimble No.	
Nozzle Diameter	Nozzle I.D.

Start Time:	Stop Time:
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Traverse Point Number	Min/pt Elapsed Time	Velocity Head ΔP (in. H ₂ O)	Office Setting ΔH (in. H ₂ O)	Gas Sample Volume V _m (ft ³) [L]	Stack Temp. T _s (°F)	Probe T _p (°F)	Filter T _f (°F)	Cond. Temp. T _c (°F)	DGM Inlet T _{m in} (°F)	DGM Outlet T _{m out} (°F)	Pump Vacuum (in. Hg)	XAD Trap Temp. T _t (°F)	Notes
2-2	65	0.66	1.4	104.11	151	242	251	62	108	101	9	54	
2	70	0.66	1.4	107.68	151	244	250	61	109	101	9	54	Heat Index 121.8°F
2	75	0.66	1.4	111.24	151	249	250	61	111	102	9	55	9:09
2-3	80	0.51	1.1	114.48	151	244	250	65	112	103	8	58	
3	85	0.52	1.1	117.65	151	240	257	66	113	105	8	59	
3	90	0.50	1.1	120.89	151	247	250	64	113	105	8	57	128°F Heat Index
4-1	95	0.69	1.5	124.48	151	250	248	66	110	106	10	59	9:31
1	100	0.70	1.5	128.28	151	250	253	65	111	106	10	59	
1	105	0.70	1.5	132.09	151	247	251	65	111	106	10	57	
4-2	110	0.67	1.5	135.89	151	249	249	66	112	106	10	60	
2	115	0.67	1.5	139.08	151	250	249	61	113	106	10	55	
2	120	0.68	1.5	142.77	151	250	250	60	113	107	10	55	
Total		9.5452	16.5		1812				1336	1254			
Average		7.9541			151.00				106.2639				

* Sum of square roots.

Circle correct bracketed units on data sheet.

QA/QC: 60Date: 8/1

TEST LOCATION: STACKUNIT: Fcu Scrubber RUN: 1

TESTING FIELD DATA SHEET

METHOD: 23 PAGE 3 OF 3

Client	MPC	Project No.	11265
Plant	ROBINSON PL	Date	7-20-11
Meter Operator			
Probe Operator			

Meter Box	Sample Box No.
Meter Y_d	Meter $\Delta H_{\text{@}}$
K Factor	Pitot C_p

Leak Rate Before	[cfm] [Lpm]	@	(in. Hg)
Leak Rate After	[cfm] [Lpm]	@	(in. Hg)
Pitot Leak Check Before:	<input type="checkbox"/> After: Good <input type="checkbox"/> Bad <input type="checkbox"/>		

Cross-Section of Test Location



[N] [UP]

Duct Dimensions (in.)		
Static Pres (in. H ₂ O)	Port Len. (in.)	Gas Flow [In] [Out] of page
		First point all the way [In] [Out]

Amb. Temp. (°F)	Bar. Press.	[in. Hg] [mbar]
Probe I.D. No.		
Liner Material		

Filter No.		
Thimble No.		
Nozzle Diameter	Nozzle I.D.	11.12

Start Time:	Stop Time:
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Traverse Point Number	Min/pt	Velocity Head ΔP (in. H ₂ O)	Orifice Setting ΔH (in. H ₂ O)	Gas Sample Volume V_m (ft ³ [L])	Stack Temp. T_s (°F)	Probe T_p (°F)	Filter T_f (°F)	Cond. Temp. T_c (°F)	DGM Inlet $T_{m \text{ in}}$ (°F)	DGM Outlet $T_{m \text{ out}}$ (°F)	Pump Vacuum (in. Hg)	XAD Trap Temp. T_t (°F)	Notes
4-3	125	0.48	1.0	145.88	151	250	251	66	112	107	52	8	
3	130	0.48	1.0	148.91	151	250	250	66	113	107	52	8	
3	135	0.48	1.0	151.92	151	250	250	65	114	107	52	8	Heat Index
3-1	140	0.69	1.5	155.79	151	251	251	66	114	108	59	10	131°F @ 10:17
1	145	0.70	1.5	159.24	151	249	249	65	115	108	54	10	
1	150	0.71	1.5	162.87	151	250	250	62	115	108	59	10	
3-2	155	0.62	1.3	166.36	151	249	250	63	116	108	58	9	
2	160	0.62	1.3	169.78	151	250	250	60	116	109	56	9	
2	165	0.62	1.3	172.89	151	250	251	60	116	109	56	9	
3-3	170	0.57	1.2	176.17	151	250	248	62	116	110	58	9	Heat Index
3	175	0.58	1.2	179.43	151	250	247	63	116	110	59	9	128.4°F
3	180	0.57	1.2	182.7200	151	249	250	64	116	110	61	9	@ 11:07
Total		9.224	15.0						1379	1301			
Average		1.685											

* Sum of square roots.

Circle correct bracketed units on data sheet.

QA/QC WDate 8/1

CleanAir
ENGINEERING

TEST LOCATION: StackUNIT: Flem Schaeffer RUN: 2

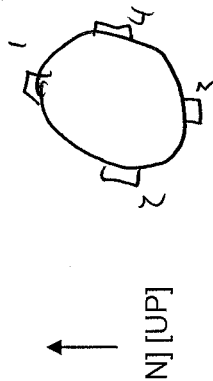
Dioxins TESTING FIELD DATA SHEET

METHOD: 23 PAGE 1 OF 3

Client	<u>MPL</u>	Project No.	<u>11265</u>
Plant	<u>Robinson</u>	Date	<u>7-20-11</u>
Meter Operator	<u>J Rooney</u>		
Probe Operator	<u>K Sullivan / B Arnold</u>		

Meter Box	<u>61-5</u>	Sample Box No.	<u>—</u>
Meter Y _a	<u>0.9992</u>	Meter ΔH ₀	<u>1.7185</u>
K Factor	<u>2.17</u>	Pitot C _p	<u>0.820</u>


Leak Rate Before	<u>0.002</u> [Lpm]	@	<u>15</u> (in. Hg)
Leak Rate After	<u>0.002</u> [Lpm]	@	<u>10</u> (in. Hg)
Pitot Leak Check Before:	<input checked="" type="checkbox"/> After: Good	<input type="checkbox"/> Bad	<input type="checkbox"/>

Cross-Section of Test Location			
			
Duct Dimensions (in.)	<u>114</u>	Gas Flow [In] [Out] of page	First point all the way
Static Pres (in. H ₂ O)	<u>-0.3</u>	Port Len. (in.)	<u>6</u>

Amb. Temp. (°F)	<u>103</u>	Bar. Press.	<u>29.30</u> [in. Hg] [mbar]
Probe I.D. No.	<u>67-4-4</u>		
Liner Material	<u>GLASS</u>		

Filter No.	<u>—</u>		<u>—</u>
Thimble No.	<u>—</u>		<u>—</u>
Nozzle Diameter	<u>0.250</u>	Nozzle I.D.	<u>250-1</u>

Start Time:	<u>11:50</u>	Stop Time:	<u>15:22</u>
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Traverse Point Number	Min/pt Elapsed Time	Velocity Head ΔP (in. H ₂ O)	Orifice Setting ΔH (in. H ₂ O)	Gas Sample Volume V _m [L]	Stack Temp. T _s (°F)	Probe T _p (°F)	Filter T _f (°F)	Cond. Temp. T _c (°F)	DGM Inlet T _{m in} (°F)	DGM Outlet T _{m out} (°F)	Pump Vacuum (in. Hg)	XAD Trap Temp. T _t (°F)	Notes
						Set Points							
	15			183.300		250	250						100%
4-1	5	0.70	1.5	186.96	151	249	248	66	107	106	6.5	49	36
1	10	0.70	1.5	190.27	151	264	262	66	110	107	6.5	45	37
1	15	0.70	1.5	193.55	151	254	256	66	113	107	6.5	48	37
4-2	20	0.65	1.4	197.01	150	250	252	66	114	108	7.0	52	36
2	25	0.65	1.4	200.51	150	251	251	61	115	108	7.0	48	36
2	30	0.65	1.4	204.01	151	250	252	60	115	108	7.0	47	37
4-3	35	0.58	1.3	207.46	150	250	252	61	115	108	7.0	46	37
3	40	0.58	1.3	210.86	150	249	249	66	115	108	7.0	50	36
3	45	0.58	1.3	214.26	150	247	247	67	115	108	7.0	51	36
3-1	50	0.69	1.5	217.89	151	249	249	67	110	110	8.0	57	36
1	55	0.69	1.5	221.52	151	250	247	67	111	109	8.0	63	36
1	60	0.69	1.5	225.16	151	252	250	62	111	110	8.0	54	36
	Total	28.4255	48.9	122.9950	5415				4140	3482			
	Average	0.7896	1.3583		150.4167					112.8056			
													

* Sum of square roots.

Circle correct bracketed units on data sheet.

QA/QC 58Date 7-20-11

TEST LOCATION: StackUNIT: Furn Schugger RUN: 2

TESTING

METHOD: 23 PAGE 2 OF 3

FIELD DATA SHEET

Cross-Section of Test Location

Client	<u>MPC</u>	Project No.	<u>11265</u>
Plant	<u>Robinson</u>	Date	<u>7-20-11</u>
Meter Operator	<u>J Rooney</u>		
Probe Operator	<u>K Sullivan / B Arnold</u>		
Meter Box		Sample Box No.	
Meter Y_d		Meter $\Delta H_{d@}$	
K Factor		Pitot C_p	
Leak Rate Before	[cfm] [Lpm]	@	(in. Hg)
Leak Rate After	[cfm] [Lpm]	@	(in. Hg)
Pitot Leak Check Before:	<input type="checkbox"/> After: Good <input type="checkbox"/> Bad <input type="checkbox"/>		

Amb. Temp. (°F)	Bar. Press.	[in. Hg] [mbar]
Probe I.D. No.		
Liner Material		

Filter No.	
Thimble No.	
Nozzle Diameter	Nozzle I.D.

Start Time:	Stop Time:
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Traverse Point Number	Min/pt Elapsed Time	Velocity Head ΔP (in. H ₂ O)	Orifice Setting ΔH (in. H ₂ O)	Gas Sample Volume V_m (ft ³) [L]	Stack Temp. T_s (°F)	Probe T_p (°F)	Filter T_f (°F)		Cond. Temp. T_c (°F)	DGM Inlet $T_{m in}$ (°F)	DGM Outlet $T_{m out}$ (°F)	Pump Vacuum (in. Hg)	XAD Trap Temp. T_t (°F)	Notes
							Set Points							
3-2	65	0.60	1.3	228.65	151	250	252	252	62	114	109	8.0	52	3.5
2	70	0.60	1.3	232.12	151	251	252	252	65	114	109	8.0	55	3.5
2	75	0.60	1.3	235.58	150	251	249	249	61	115	109	8.0	51	3.6
3-3	80	0.55	1.2	238.88	150	250	250	250	64	116	110	7.5	48	3.7
3	85	0.55	1.2	242.17	150	250	249	249	67	117	111	7.5	49	3.7
3	90	0.55	1.2	245.43	150	251	249	249	67	117	111	7.5	53	3.7
2-1	95	0.68	1.5	249.02	151	251	250	250	66	114	111	8.0	58	3.7
1	100	0.68	1.5	252.63	150	249	250	250	66	116	111	8.5	49	3.8
1	105	0.68	1.5	256.18	150	249	245	245	67	116	111	8.5	50	3.7
2-2	110	0.65	1.4	259.44	151	249	247	247	55	115	112	8.0	48	3.9
2	115	0.65	1.4	262.62	151	249	257	257	50	117	112	8.0	48	3.6
2	120	0.65	1.4	265.89	151	250	251	251	51	117	112	8.0	49	3.6
														3
Total	*													
Average														

* Sum of square roots.

Circle correct bracketed units on data sheet.

QA/QC: JKDate: 7-20-11

Cross-Section of Test Location

↑

[N] [UP]

Duct Dimensions (in.)	Gas Flow [In] [Out] of page	First point all the way
Static Pres (in. H ₂ O)	Port Len. (in.)	[In] [Out]

Client	<u>INPC</u>	Project No.	<u>1265</u>
Plant	<u>ROBINSON IL</u>	Date	<u>7-20-11</u>
Meter Operator	<u>J ROONEY</u>		
Probe Operator	<u>K SURIVAN / B ARVOLD</u>		

Meter Box	Sample Box No.
Meter Y _d	Meter ΔH _d @
K Factor	Pitot C _p
<u>Z.17</u>	

Leak Rate Before	[cfm] [Lpm]	@	(in. Hg)
Leak Rate After	[cfm] [Lpm]	@	(in. Hg)
Pitot Leak Check Before:	<input type="checkbox"/> After: Good	<input type="checkbox"/> Bad	<input type="checkbox"/>

Traverse Point Number	Min/pt Elapsed Time	Velocity Head ΔP (in. H ₂ O)	Orifice Setting ΔH (in. H ₂ O)	Gas Sample Volume Init. Vol. [L]	Stack Temp. T _s (°F)	Probe T _p (°F)	Filter T _f (°F)	Cond. Temp. T _c (°F)	DGM Inlet T _{m in} (°F)	DGM Outlet T _{m out} (°F)	Pump Vacuum (in. Hg)	XAD Trap Temp. T _t (°F)	Notes
4-3	125	0.52	1.1	269.05	150	250	254	57	117	113	7.5	51	7602 HEAT
SR 3	130	0.52	1.1	272.22 272.22	151	250	250	63	115	113	7.5	52	51453
3	135	0.52	1.1	275.28 275.28	150	251	253	64	114	112	7.5	53	39
31-1	140	0.68	1.5	278.15 278.15	150	252	251	63	116	113	8.0	54	38
1	145	0.68	1.5	282.30	150	250	248	64	117	113	8.0	58	38
1	150	0.68	1.5	285.81	150	250	247	66	118	113	8.5	58	3.7
37-2	155	0.66	1.4	289.36	150	252	250	65	119	114	9.0	60	3.7
2	160	0.66	1.4	292.90	151	249	249	68	117	113	9.0	61	3.7
2	165	0.66	1.4	296.40	150	250	255	68	116	113	9.5	58	3.8
37-3	170	0.54	1.2	299.79	150	250	251	67	118	114	10.0	58	3.7
3	175	0.54	1.2	303.13	150	250	251	67	117	113	10.0	58	3.7
3	180	0.54	1.2	306.420	150	252	249	67	117	113	10.0	59	3.7
	Total	*			5415								
	Average				150								

Circle correct bracketed units on data sheet.

QA/QC: SR
Date: 7-20-11



TEST LOCATION: StackUNIT: FCU Scrubber RUN: 3

Dioxins

TESTING

METHOD: 23 PAGE 1 OF 3

FIELD DATA SHEET

Cross-Section of Test Location

Duct Dimensions (in.) 114

Static Pres (in. H ₂ O)	Port Len. (in.)	Gas Flow [In] [Out] of page	First point all the way
<u>-0.5</u>	<u>6</u>	<u>(In) [Out]</u>	<u>(In) [Out]</u>

Client <u>Marathon Petroleum</u>	Project No. <u>11265</u>
Plant <u>Robinson IL</u>	Date <u>7-21-11</u>
Meter Operator <u>Huy Nguyen</u>	
Probe Operator <u>K. Sullivan / B. Arnold</u>	

Meter Box <u>61-5</u>	Sample Box No. <u>D4</u>
Meter Y _a <u>0.9992</u>	Meter ΔH ₀ <u>1.7185</u>
K Factor <u>2.19</u>	Pitot C _p <u>0.820</u>
Leak Rate Before <u>005</u> (cfm) [Lpm]	@ <u>15</u> (in. Hg)
Leak Rate After <u>0.006</u> (cfm) [Lpm]	@ <u>13</u> (in. Hg)
Pitot Leak Check Before: <input checked="" type="checkbox"/> After: Good <input checked="" type="checkbox"/> Bad <input type="checkbox"/>	

Traverse Point Number	Min/pt Elapsed Time	Velocity Head ΔP (in. H ₂ O)	Orifice Setting ΔH (in. H ₂ O)	Gas Sample Volume V _m (ft ³) [L]	Stack Temp. T _s (°F)	Probe T _p (°F) Set Points	Filter T _f (°F)	Cond. Temp. T _c (°F)	DGM Inlet T _{m in} (°F)	DGM Outlet T _{m out} (°F)	Pump Vacuum (in. Hg)	XAD Trap Temp. T _t (°F)	Notes
3-1	5	0.73	1.6	311.51	151	248	255	66	99	95	6	49	
1	10	0.73	1.6	315.20	151	249	251	65	101	96	8	49	
1	15	0.73	1.6	318.93	151	249	250	66	106	97	8	50	
3-2	20	0.70	1.5	322.60	151	250	250	63	106	98	8	54	
2	25	0.70	1.5	326.27	151	249	250	60	108	99	8	57	Heat Exchanger
2	30	0.69	1.5	329.95	151	249	250	60	109	99	8	57	130°F
3-3	35	0.58	1.3	333.40	151	250	249	60	109	100	8	56	
3	40	0.58	1.3	336.84	150	250	247	62	109	100	8	60	
3	45	0.58	1.3	340.26	150	250	248	63	110	100	8	61	
4-1	50	0.70	1.5	343.89	150	251	250	65	108	101	9	59	
1	55	0.70	1.5	347.58	150	250	250	62	109	101	9	58	
1	60	0.70	1.5	351.14	150	251	250	61	110	102	9	57	
Total		9.869	17.7	126.1500	1857				1284	1188			
Average		8042	1.4056	(50.777)	(50.777)				(105.7639)				

Sum of square roots.

Circle-correct bracketed units on data sheet.

QA/QC 10
Date 8/1FDS005 General.xls, Feb. 2002
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8210

TEST LOCATION: STACKUNIT: Fall Scrubber RUN: 3

Dioxins TESTING FIELD DATA SHEET

METHOD: 23 PAGE 2 OF 3

Client	MPC		Project No.	11265
Plant	Robinson, IL		Date	7-21-11
Meter Operator	Huy Nguyen			
Probe Operator	J. Rooney / B. Arnold			
Meter Box	Sample Box No.			
Meter Y _d	Meter ΔH ₀			
K Factor	Pitot C _p			
Leak Rate Before	[cfm] [Lpm]	@	(in. Hg)	
Leak Rate After	[cfm] [Lpm]	@	(in. Hg)	
Pitot Leak Check Before:	<input type="checkbox"/> After: Good	<input type="checkbox"/> Bad	<input type="checkbox"/>	

Cross-Section of Test Location			
	Duct Dimensions (in.)	Gas Flow [In] [Out] of page	First point all the way [In] [Out]
	Static Pres (in. H ₂ O)	Port Len. (in.)	

Amb. Temp. (°F)	Bar. Press.	[in. Hg] [mbar]
Probe I.D. No.		
Liner Material		

Filter No.	
Thimble No.	
Nozzle Diameter	Nozzle I.D.

Start Time:	Stop Time:
-------------	------------

Traverse Point Number	Min/pt	Velocity Head ΔP (in. H ₂ O)	Orifice Setting ΔH (in. H ₂ O)	Gas Sample Volume Init. Vol.	Stack Temp. T _s (°F)	Probe T _p (°F)	Filter T _f (°F)	Cond. Temp. T _c (°F)	DGM Inlet T _{m in} (°F)	DGM Outlet T _{m out} (°F)	Pump Vacuum (in. Hg)	XAD Trap Temp. T _t (°F)	Notes
4-2	65	0.65	1.4	354.67	150	250	248	57	110	101	9	50	
2	70	0.65	1.4	358.20	150	249	249	57	110	102	9	50	
2	75	0.65	1.4	361.98	150	249	247	56	110	102	9	49	
4-3	80	0.70	1.5	365.53	151	249	250	66	110	103	10	49	Heat Index
3	85	0.70	1.5	368.94	151	250	250	66	110	104	10	57	125°F @ 9:15
3	90	0.70	1.5	372.59	151	250	250	65	111	104	10	60	
2-1	95	0.64	1.4	376.10	151	249	250	63	110	103	10	57	
1	100	0.64	1.4	379.60	151	249	250	63	110	103	10	57	
1	105	0.64	1.4	383.10	151	250	250	58	110	103	10	49	
2-2	110	0.66	1.4	386.6	151	248	249	57	111	104	10	50	
2	115	0.66	1.4	390.04	151	247	250	58	111	104	10	50	
2	120	0.66	1.4	393.57	151	250	250	58	111	104	10	50	
Total		9.7659	17.1		1809				1324	1237			
Average		.8138											

* Sum of square roots.

Circle correct bracketed units on data sheet.

QA/QC 62Date 9/1

UNIT: Fuel Scrubber RUN: 3

Client MPC **Project No.** 11265

Plant Robinson IL **Date** 7-21-11

Meter Operator

Probe Operator

Meter Box **Sample Box No.**

Meter Y_d **Meter ΔH₀**

K Factor **Pitot C_p**

Leak Rate Before [cfm] [Lpm] @ (in. Hg)

Leak Rate After [cfm] [Lpm] @ (in. Hg)

Pitot Leak Check Before: ☐ After: Good ☐ Bad ☐

Amb. Temp. (°F) **Bar. Press.** [in. Hg] [mbar]

Probe I.D. No.

Liner Material

Filter No.

Thimble No.

Nozzle Diameter Nozzle I.D.

Start Time: 11:09 **Stop Time:**

Traverse Point Number	Min/pt Elapsed Time	Velocity Head ΔP (in. H ₂ O)	Orifice Setting ΔH (in. H ₂ O)	Gas Sample Volume V _m (ft ³)	Stack Temp. T _s (°F)	Probe T _p (°F)		Filter T _f (°F)	Cond. Temp. T _c (°F)	DGM Inlet T _{m in} (°F)	DGM Outlet T _{m out} (°F)	Pump Vacuum (in. Hg)	XAD Trap Temp. T _t (°F)	Notes
						Set Points								
2-3	125	0.52	1.1	396.63	151	251	250	250	64	111	105	9	60	
3	130	0.52	1.1	399.80	151	250	250	250	65	111	105	9	62	
3	135	0.52	1.1	402.97	151	249	250	250	58	111	105	9	50	
1-1	140	0.73	1.6	406.63	151	249	249	249	59	112	106	11	57	
1	145	0.73	1.6	410.37	151	250	250	250	53	111	104	11	50	
1	150	0.73	1.6	414.09	151	250	250	250	55	111	104	11	50	
1-2	155	0.66	1.4	417.67	151	250	250	250	57	111	104	11	50	
2	160	0.67	1.5	421.23	151	250	251	251	59	111	104	11	51	
2	165	0.67	1.5	424.74	151	249	249	249	66	112	105	11	59	Heat Exchanger
1-3	170	0.52	1.1	427.92	151	249	247	247	53	108	105	10	50	131°F 10:53
3	175	0.51	1.1	431.04	151	249	250	250	53	108	105	10	50	
3	180	0.51	1.1	434.070	151	250	250	250	55	108	105	10	52	
Total		9.3254	15.80		1812					1325	1257			
Average		.7171												

Impinger Weight Sheet

Client Marathon Petroleum Company		Unit Name/Location FCCU Scrubber Stack	
Plant Robinson Refinery	Job No. 11265	Method USEPA M-23	

Run No. 1	Filter Type Quartz Fiber, Extracted	Sample Box No. D1
Date 7/20/11	Lot No.	pH N/A
Analyst DL	Filter No. N/A	Rinse

	Contents	Gross Weight (gm)	Tare Weight (gm)	Net Weight Gain (gm)	
Impinger 1	Empty	1328.3	619.7	708.6	
Impinger 2	100 ml HPLC H2O	627.2	628.4	-1.2	QA/QC DL Date 7/24/11
Impinger 3	100 ml HPLC H2O	521.1	522.4	-1.3	
Impinger 4	Empty	460.7	445.9	14.8	
Impinger 5	Trap # 12	362.5	353.5	9.0	Total Weight (gm)
Impinger 6	Silica Gel	759.6	711.5	48.1	729.9
					778.0

Run No. 2	Filter Type Quartz Fiber, Extracted	Sample Box No.
Date 7/20/11	Lot No.	pH N/A
Analyst DL	Filter No. N/A	Rinse

	Contents	Gross Weight (gm)	Tare Weight (gm)	Net Weight Gain (gm)	
Impinger 1	Empty	1325.7	637.3	688.4	
Impinger 2	100 ml HPLC H2O	556.6	538.7	17.9	QA/QC DL Date 7/26/11
Impinger 3	100 ml HPLC H2O	540.6	541.0	-0.4	
Impinger 4	Empty	436.1	434.7	1.4	
Impinger 5	Trap # 7	356.8	346.3	10.5	Total Weight (gm)
Impinger 6	Silica Gel	805.5	764.8	40.7	717.8
					758.5

Run No. 3	Filter Type Quartz Fiber, Extracted	Sample Box No.
Date 7/21/11	Lot No.	pH N/A
Analyst DL	Filter No. N/A	Rinse

	Contents	Gross Weight (gm)	Tare Weight (gm)	Net Weight Gain (gm)	
Impinger 1	Empty	1352.9	621.5	731.4	
Impinger 2	100 ml HPLC H2O	642.9	629.1	13.8	QA/QC DL Date 7/21/11
Impinger 3	100 ml HPLC H2O	523.7	522.7	1.0	
Impinger 4	Empty	450.0	447.7	2.3	
Impinger 5	Trap # 11	372.9	361.9	11.0	Total Weight (gm)
Impinger 6	Silica Gel	800.7	761.4	39.3	759.5
					798.8

TEST LOCATION: StackUNIT: FCCURUN: 1

Densitometer

TESTING

METHOD: S-202 PAGE 1 OF 2

Client	<u>MPC</u>	Project No.	<u>112GS</u>
Plant	<u>Robinson</u>	Date	<u>7/18/11</u>
Meter Operator	<u>S. Doolley</u>		
Probe Operator	<u>B. Arnold</u>		

Meter Box	<u>85-3</u>	Sample Box No.	
Meter Y_d	<u>0.9925</u>	Meter ΔH	<u>1.7792</u>
K Factor	<u>2.36</u>	Pitot C_p	<u>0.827</u>
Leak Rate Before	<u>0.002</u> [cfm]	@ [15] (in. Hg)	
Leak Rate After	<u>0.001</u> [cfm]	@ [8] (in. Hg)	
Pitot Leak Check Before	<input checked="" type="checkbox"/>	After: Good <input checked="" type="checkbox"/> Bad <input type="checkbox"/>	

Cross-Section of Test Location

Duct Dimensions (in.) 114

Static Pres (in. H ₂ O)	Port Len. (in.)	Gas Flow [In] [Out] of page	First point all the way [In] [Out]
<u>10.5</u>	<u>6</u>	<u>Out</u>	<u>Out</u>

Amb. Temp. (°F)	<u>93</u>	Bar. Press.	<u>29.4</u> [in. Hg] [mbar]
Probe I.D. No.	<u>66-4-7</u>		
Liner Material	<u>6-100</u>		

Filter No.	<u>43891</u>		
Thimble No.	<u>NA</u>		
Nozzle Diameter	<u>0.250</u>	Nozzle I.D.	<u>250-2</u>

Start Time	<u>8:09</u>	Stop Time	<u>10:14</u>
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Traverse Point Number	Min/pt Elapsed Time	Velocity Head ΔP (in. H ₂ O)	Orifice Setting ΔH (in. H ₂ O)	Gas Sample Volume V_m Init. Vol. (L)	Stack Temp. T_s (°F)	Probe T_p (°F)	Filter T_f (°F)	Cond. Temp. T_c (°F)	DGM Inlet T_{min} (°F)	DGM Outlet T_{out} (°F)	Pump Vacuum (in. Hg)	XAD Trap Temp. T_t (°F)	Notes
3-1	5	0.7	1.7	497.43	148	311	318	63	93	92	5	73	65-85
1-1	10	0.7	1.7	501.10	148	312	321	56	95	92	5	72	3.5
2-2	15	0.65	1.5	504.57	148	313	321	55	99	93	5	72	3.4
2-2	20	0.62	1.5	508.09	148	314	320	52	101	93	5	74	3.3
3-3	25	0.52	1.2	511.20	148	317	320	58	103	94	4	76	3.3
3-3	30	0.50	1.2	514.351	148	318	320	60	105	94	4	79	3.2
4-1	35	0.69	1.7	517.87	148	321	320	61	106	96	5	79	3.3
1-1	40	0.69	1.7	521.28	148	317	319	60	107	96	5	80	3.3
2-2	45	0.62	1.5	525.26	148	318	319	60	108	97	5	78	3.4
2-2	50	0.62	1.5	528.94	148	319	321	59	110	97	5	77	3.3
3-3	55	0.50	1.2	532.10	148	320	320	61	109	98	4	77	3.3
3-3	60	0.50	1.2	535.210	148	320	320	63	109	98	4	75	3.4
Total		<u>19.625</u>	<u>17.600</u>	<u>8192.70</u>	<u>176</u>				<u>1245</u>	<u>1140</u>			
Average		<u>0.772</u>	<u>1.467</u>	<u>14333</u>	<u>148.000</u>				<u>103.250</u>				

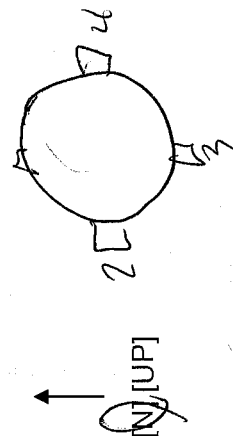
* Sum of square roots.

Circle correct bracketed units on data sheet.

QA/QC SDDate 7/19/11

FIELD DATA SHEET

Cross-Section of Test Location



Client	<u>NAPC</u>			Project No.	<u>11205</u>
Plant	<u>Robinson</u>			Date	<u>7/19/2011</u>
Meter Operator	<u>SD</u>				
Probe Operator	<u>BA</u>				
Meter Box				Sample Box No.	
Meter Y_d				Meter $\Delta H_{@}$	
K Factor	<u>2.36</u>			Pitot C_p	
Leak Rate Before	[cfm] [Lpm]	@	(in. Hg)		
Leak Rate After	[cfm] [Lpm]	@	(in. Hg)		
Pitot Leak Check Before:	<input type="checkbox"/>	After:	Good <input type="checkbox"/> Bad <input type="checkbox"/>		

Amb. Temp. (°F)	Bar. Press.	[in. Hg] [mbar]
Probe I.D. No.		
Liner Material		

Filter No.	
Thimble No.	
Nozzle Diameter	Nozzle I.D.

Start Time:	Stop Time:
-------------	------------

Traverse Point Number	Min/pt Elapsed Time	Velocity Head ΔP (in. H ₂ O)	Orifice Setting ΔH (in. H ₂ O)	Gas Sample Volume Init. Vol.	Stack Temp. T_s (°F)	Probe T_p (°F)	Filter T_f (°F)	Cond. Temp. T_c (°F)	DGM Inlet $T_{m in}$ (°F)	DGM Outlet $T_{m out}$ (°F)	Pump Vacuum (in. Hg)	XAD Trap Temp. T_t (°F)	Notes
1-1	65	0.68	1.6	538.80	148	320	317	59	106	98	5	70	3.4
1-1	70	0.68	1.6	542.28	148	319	321	46	113	99	5	71	3.3
-2	75	0.61	1.4	545.91	148	320	321	46	103	100	5	69	3.4
-2	80	0.61	1.4	549.23	148	320	320	48	114	101	5	70	3.3
-3	85	0.52	1.2	552.40	148	320	320	51	114	101	5	70	3.3
-3	90	0.52	1.2	555.531	148	321	320	51	114	102	5	69	3.3
-1	95	0.68	1.6	559.08	148	321	320	60	112	102	6	71	3.4
-1	100	0.68	1.6	562.65	148	320	320	55	113	102	6	72	3.4
-2	105	0.61	1.4	566.00	148	320	320	57	115	103	6	75	3.3
-2	110	0.61	1.4	569.30	148	321	320	58	114	103	6	76	3.3
-3	115	0.58	1.2	572.44	148	320	320	50	113	103	5	70	3.4
-3	120	0.52	1.2	575.511	148	321	320	51	113	103	5	71	
Total	*								1354	1217			
Average													

* Sum of square roots:

Circle correct bracketed units on data sheet.

QA/QC 60
Date 8/1

TEST LOCATION: StackUNIT: FCCU Scrubber RUN: 2

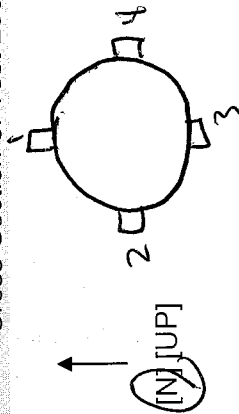
Particulate

TESTING

METHOD: S-202 PAGE 1 OF 2

FIELD DATA SHEET

Cross-Section of Test Location



Client	MPC	Project No.	11265
Plant	Robinson	Date	7/19/11
Meter Operator	S. Doolley		
Probe Operator	K. Sullivan / J. Rooney		

Meter Box	85-3	Sample Box No.	
Meter V_c	0.9925	Meter ΔH	1.7792
K Factor	2.36	Pilot C_p	0.827
Leak Rate Before	0.004 [cfm]	@	15 (in. Hg)
Leak Rate After	0.002 [cfm]	@	8 (in. Hg)
Pilot Leak Check Before:	<input checked="" type="checkbox"/> After: Good	<input checked="" type="checkbox"/> Bad	<input type="checkbox"/>

Traverse Point Number	Min/pt Elapsed Time	Velocity Head ΔP (in. H ₂ O)	Onifice Setting ΔH (in. H ₂ O)	Gas Sample Volume V_m Init. Vol.	Stack Temp. T_s (°F)	Probe T_p (°F)	Filter T_f (°F)	Cond. Temp. T_c (°F)	DGM Inlet $T_{m in}$ (°F)	DGM Outlet $T_{m out}$ (°F)	Pump Vacuum (in. Hg)	XAD Trap Temp. T_t (°F)	Notes
1-1	5	0.609	1.6	578.123	148	313	325	65	109	105	6	70	3.3
1-1	10	0.609	1.6	585.57	148	315	323	64	113	105	0	71	3.3
1-2	15	0.603	1.5	589.52	148	315	323	65	118	106	6	70	3.3
1-2	20	0.603	1.5	593.37	148	316	319	65	113	107	6	69	3.4
1-3	25	0.52	1.2	596.90	148	317	322	64	121	107	5	69	3.3
1-3	30	0.52	1.2	599.729	148	318	321	63	121	109	5	72	3.3
1-1	35	0.607	1.6	603.38	148	318	319	66	116	109	5	70	3.3
1-1	40	0.608	1.6	606.88	148	319	320	65	120	110	5	79	3.3
1-2	45	0.52	1.5	610.37	148	319	319	64	121	110	5	80	3.3
1-2	50	0.602	1.5	613.91	148	319	320	65	123	111	5	80	3.3
1-3	55	0.50	1.2	617.08	148	320	319	55	124	111	5	81	3.3
1-3	60	0.50	1.2	620.210	148	321	318	56	124	112	5	70	3.3
Total		19.5362	172.000	81,7950	1776				1403	1302			
Average		0.7723	1.9167	148,0000					114.4792				

Sum of square roots.

Circle correct bracketed units on data sheet.

QA/QC WDate 8/1CleanAir
ENGINEERING

TEST LOCATION:

Stack

UNIT: Few subor RUN: 2

Particulate TESTING FIELD DATA SHEET

METHOD: 5/2022 PAGE 2 OF 2

Client	MPC	Project No.	112505
Plant	Robinson	Date	7/19/11
Meter Operator	S. Dooley		
Probe Operator	BA ksl		

Meter Box		Sample Box No.	
Meter Y_d		Meter ΔH_d	
K Factor	236	Pitot C_p	
Leak Rate Before	[cfm] [Lpm]	@	(in. Hg)
Leak Rate After	[cfm] [Lpm]	@	(in. Hg)
Pitot Leak Check Before:	<input type="checkbox"/> After: Good	<input type="checkbox"/> Bad	<input type="checkbox"/>

Cross-Section of Test Location			
Duct Dimensions (in.)	Static Pres (in. H ₂ O)	Port Len. (in.)	Gas Flow [In] [Out] of page
			First point all the way [In] [Out]

Amb. Temp. (°F)	Bar. Press.	[in. Hg] [mbar]
Probe I.D. No.		
Liner Material		

Filter No.	
Thimble No.	
Nozzle Diameter	Nozzle I.D.

Start Time:	Stop Time:
-------------	------------

Traverse Point Number	Min/pt Elapsed Time	Velocity Head ΔP (in. H ₂ O)	Orifice Setting ΔH (in. H ₂ O)	Gas Sample Volume Init. Vol.	Stack Temp. T_s (°F)	Probe T_p (°F)	Filter T_f (°F)	Cond. Temp. T_c (°F)	DGM Inlet $T_{m in}$ (°F)	DGM Outlet $T_{m out}$ (°F)	Pump Vacuum (in. Hg)	XAD Trap Temp. T_t (°F)	Notes
1-1	65	0.67	1.6	623.34	148	321	319	65	115	112	5	79	3.5
1-1	70	0.67	1.6	626.44	148	320	319	62	117	112	5	78	3.3
1-2	75	0.60	1.4	629.81	148	321	321	59	117	111	5	71	3.4
1-2	80	0.60	1.4	633.16	148	320	318	60	117	111	5	73	3.4
1-3	85	0.50	1.2	636.31	148	321	322	61	121	111	5	74	3.3
1-3	90	0.50	1.2	639.425	148	322	320	63	119	111	5	78	3.3 639.487
1-1	95	0.67	1.6	643.09	148	321	321	59	117	111	7	81	3.5
1-1	100	0.67	1.6	646.80	148	321	320	60	122	112	7	83	3.3
1-2	105	0.60	1.4	650.30	148	321	322	61	122	112	7	83	3.3
1-2	110	0.60	1.4	653.66	148	321	320	62	122	112	6	82	3.3
1-3	115	0.50	1.2	656.95	148	320	321	61	121	112	6	81	3.3
1-3	120	0.50	1.2	660.220	148	321	320	60	121	112	6	81	3.3
Total	*195362	34.0000		817950	3552				1431	1339			
Average	0.7723	1.4167			148.0000								

Sum of square roots.

Circle correct bracketed units on data sheet.

QA/QC kwDate 8/1

TEST LOCATION: Stack

UNIT: FCW Submitter RUN: 3

FPM/CPM TESTING FIELD DATA SHEET

METHOD: 5/2022 PAGE 1 OF 2

Client	MRC	Project No.	11265
Plant	Robinson	Date	7/19/2011
Meter Operator	V. Sukhwan		
Probe Operator	J. Leonard		

Meter Box	85-3	Sample Box No.	N/A
Meter Y _d	0.9925	Meter ΔH ₀	1.7722
K Factor	0.0022	Pitot C _p	0.827
Leak Rate Before	0.0022 (cfm)	@ 15 (in. Hg)	
Leak Rate After	0.001 (cfm)	@ 6 (in. Hg)	
Pitot Leak Check Before	0	After: Good	<input checked="" type="checkbox"/> Bad <input type="checkbox"/>

Cross-Section of Test Location

Duct Dimensions (in.)	Port Len. (in.)	Gas Flow (In) (Out)	First point all the way (In) (Out)
114	6		

Amb. Temp. (°F)	115	Bar. Press.	29.40 [in. Hg] [mbar]
Probe I.D. No.	4-4-7		
Liner Material	P ₇ v _{ex}		

Filter No.	43834		
Thimble No.	N/A		
Nozzle Diameter	0.350	Nozzle I.D.	250-2

Start Time: 15:22 Stop Time: 17:36

Traverse Point Number	Min/pt Elapsed Time	Velocity Head ΔP (in. H ₂ O)	Orifice Setting ΔH (in. H ₂ O)	Gas Sample Volume V _m (ft ³) [L]	Stack Temp. T _s (°F)	Probe T _p (°F)	Set Points	Filter T _f (°F)	Cond. Temp. T _c (°F)	DGM Inlet T _{m in} (°F)	DGM Outlet T _{m out} (°F)	Pump Vacuum (in. Hg)	Temp. T _t (°F)	Notes
3-1	5	0.65	1.5	661.200	148	320	320	320	65	112	109	4	82	02 KS
1	10	0.75	1.8	664.68	148	321	313	315	62	116	110	5	81	4.0 3.5
2	15	0.85	2.0	672.70	148	322	313	313	62	118	111	6	80	3.4
2	20	0.81	1.9	676.69	148	321	313	313	62	121	111	5	80	3.5
3	25	0.68	1.6	680.43	148	319	314	314	60	125	112	5	76	3.4
3	30	0.70	1.6	684.15	148	320	315	315	58	123	112	5	74	3.5
4-1	35	0.67	1.5	687.68	148	319	318	318	64	117	113	5	78	3.6
1	40	0.65	1.5	691.20	148	321	315	315	58	122	113	5	70	3.4
2	45	0.63	1.4	694.65	148	320	316	316	50	125	113	5	75	3.4
2	50	0.60	1.4	698.07	148	321	317	317	49	125	113	5	75	3.4
3	55	0.47	1.1	701.14	148	320	317	317	49	123	114	4	76	3.3
3	60	0.40	0.92	703.95	148	320	316	316	51	125	114	4	78	3.3
Total		*16.5167	3316	82.120	3552					2930	2723			
Average		0.7715	1.3858	148.0000						117.7708				

* Sum of square roots.

Circle correct bracketed units on data sheet.

QA/QC: KS

Date: 7/19/11

TEST LOCATION: StackUNIT: seam burner RUN: 3

TESTING

METHOD: 5/202 PAGE 2 OF 2

FIELD DATA SHEET

Cross-Section of Test Location

Client	WRC	Project No.	11215
Plant	Robinson	Date	7/19/11
Meter Operator	KS		
Probe Operator	SR		

Meter Box	Sample Box No.
Meter Y _a	Meter ΔH@
K Factor	Pitot C _p
Leak Rate Before [cfm] [Lpm] @	(in. Hg)
Leak Rate After [cfm] [Lpm] @	(in. Hg)
Pitot Leak Check Before: <input type="checkbox"/> After: Good <input type="checkbox"/> Bad <input type="checkbox"/>	


Amb. Temp. (°F)	Bar. Press.	[in. Hg] [mbar]
Probe I.D. No.		
Liner Material		

Filter No.	
Thimble No.	
Nozzle Diameter	

Start Time:	Stop Time:
-------------	------------

Duct Dimensions (in.)				Gas Flow [In] [Out] of page	First point all the way [In] [Out]
Static Pres. (in. H ₂ O)	Port Len. (in.)	Filter T _p (°F)			
		Set Points	Cond. Temp. T _c (°F)		

Traverse Point Number	Min/pt <div>Elapsed Time</div>	Velocity Head ΔP (in. H ₂ O)	Orifice Setting ΔH (in. H ₂ O)	Gas Sample Volume V_m <div>Init. Vol. $\int V^3 [L]$</div>	Stack Temp. T_s (°F)	Probe T_p (°F)		Filter T_f (°F)	Cond. Temp. T_c (°F)	DGM Inlet $T_{m \text{ in}}$ (°F)	DGM Outlet $T_{m \text{ out}}$ (°F)	Pump Vacuum (in. Hg)	XAD Trap Temp. T_t (°F)	Notes
						Set Points	320							
1-1	65	0.60	1.4	703.95	148	320	319	320	63	122	115	5	83	3.5
1	72	0.60	1.4	710.89	148	317	317		50	126	116	5	80	3.3
2	75	0.58	1.3	714.31	148	318	321		54	127	116	5	80	3.4
2	60	0.60	1.4	717.84	148	320	318		56	122	116	5	81	3.4
3	65	0.61	0.94	720.76	148	320	315		53	124	115	5	80	3.3
3	90	0.50	1.1	723.82	148	320	320		50	123	115	4	78	3.3
2-1	95	0.60	1.4	727.20	148	320	321		60	119	113	5	80	3.5
1	100	0.60	1.4	730.68	148	319	318		57	122	114	5	78	3.4
2	85	0.57	1.3	734.03	148	321	319		54	125	114	5	76	3.3
2	110	0.54	1.2	737.20	144	320	319		56	123	114	5	76	3.4
3	115	0.49	1.1	740.25	148	318	319		57	122	115	5	76	3.4
3	120	0.46	1.1	743.320	148	319	320		58	123	115	5	77	3.3
	Total	*												
	Average													

 **Close All**

Circle correct bracketed units on data sheet.

* Sum of square roots.

Sum of square roots. 1452 1345

QA/QC KS
Date 7/19/11

Impinger Weight Sheet

Client Marathon Petroleum Company		Unit Name/Location FCCU Scrubber Stack	
Plant Robinson Refinery	Job No. 11265	Method	USEPA M-5/202

Run No. 1	Filter Type Tared Quartz Fiber	TFE Membrane	Sample Box No.
Date 7/19/11	Lot No.		pH N/A
Analyst DL	Filter No. 43891	N/A	Rinse

	Contents	Gross Weight (gm)	Tare Weight (gm)	Net Weight Gain (gm)	
Impinger 1	Empty	820.2	404.9	415.3	QA/QC DL Date 7/19/11
Impinger 2	Empty	500.4	443.6	56.8	
Impinger 3	100 mL DI H ₂ O	557.0	520.0	37.0	
Impinger 4	Silica Gel	754.7	726.5	28.2	
					Total Weight (gm)
					509.1
					537.3

Run No. 2	Filter Type Tared Quartz Fiber	TFE Membrane	Sample Box No.
Date 7/19/11	Lot No.		pH N/A
Analyst DL	Filter No. 43890	N/A	Rinse

	Contents	Gross Weight (gm)	Tare Weight (gm)	Net Weight Gain (gm)	
Impinger 1	Empty 797.5	832.8 ^{DL}	410.0	387.5	QA/QC DL Date 7/19/11
Impinger 2	Empty	562.6	530.5	32.1	
Impinger 3	100 mL DI H ₂ O	630.0	528.0 ^{DL}	775.3	
Impinger 4	Silica Gel	761.6	724.0	37.6	
					Total Weight (gm)
					494.9
					532.5

Run No. 3	Filter Type Tared Quartz Fiber	TFE Membrane	Sample Box No.
Date 7/19/11	Lot No.		pH N/A
Analyst DL	Filter No. 43834	N/A	Rinse

	Contents	Gross Weight (gm)	Tare Weight (gm)	Net Weight Gain (gm)	
Impinger 1	Empty 833.3	868.9 ^{DL}	450.3	418.6 ^{DL}	QA/QC DL Date 7/19/11
Impinger 2	Empty	500.0	452.1	47.9	
Impinger 3	100 mL DI H ₂ O	604.9	558.6	46.3	
Impinger 4	Silica Gel	772.1	731.0	41.1	
					Total Weight (gm)
					512.8 ^{DL}
					553.9 ^{DL}

TEST LOCATION: StackUNIT: Fcu SCA488ER RUN: 1AmmoniaTESTING
FIELD DATA SHEETMETHOD: 29.40PAGE 1 OF 1

Client	<u>MPL</u>	Project No.	<u>11265</u>
Plant	<u>ROBINSON</u>	Date	<u>7-18-11</u>
Meter Operator	<u>S ROONEY</u>		<u>7-19-11</u>
Probe Operator	<u>B ARNOLD / K SULLIVAN</u>		
Meter Box	<u>61-7</u>	Sample Box No.	<u>NA</u>
Meter Y_d	<u>0.1827</u>	Meter $\Delta H @$	<u>1.8247</u>
K Factor	<u>2.35</u>	Pitot C_p	<u>0.819</u>
Leak Rate Before	<u>0.005</u> [Lpm]	@	<u>15</u> (in. Hg)
Leak Rate After	<u>0.003</u> [Lpm]	@	<u>7</u> (in. Hg)
Pitot Leak Check Before:	<input checked="" type="checkbox"/>	After:	Good <input checked="" type="checkbox"/> Bad <input type="checkbox"/>

Cross-Section of Test Location

Duct Dimensions (in.)	<u>114</u>	Gas Flow	<u>100</u> [In] [Out] of page
Static Pres (in. H ₂ O)	<u>-0.5</u>	Port Len. (in.)	<u>6</u>
First point all the way	<u>10</u> [Out]		

Amb. Temp. (°F)	<u>91</u>	Bar. Press:	<u>29.55</u> [in. Hg] [mbar]
Probe I.D. No.	<u>67-4-1</u>		
Liner Material	<u>GLASS</u>		

Filter No.	<u>027-1</u>		
Thimble No.	<u>—</u>		
Nozzle Diameter	<u>0.250</u>	Nozzle I.D.	<u>0.250</u>

Start Time:	<u>7:56</u>	Stop Time:	<u>9:38</u>
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Traverse Point Number	Min/pt Elapsed Time	Velocity Head ΔP (in. H ₂ O)	Orifice Setting ΔH (in. H ₂ O)	Gas Sample Volume V_m (ft ³) [L]	Stack Temp. T_s (°F)	Probe T_p (°F)	Set Points	Filter T_f (°F)	Cond. Temp. T_c (°F)	DGM Inlet $T_{m in}$ (°F)	DGM Outlet $T_{m out}$ (°F)	Pump Vacuum (in. Hg)	XAD Trap Temp. T_t	Notes
1-1	5	0.71	1.7	384.34	151	250	250	250	67	96	95	5.0	3.3	
2	10	0.68	1.6	387.90	151	244	250	250	67	99	96	5.0	3.2	
3	15	0.54	1.3	391.190	150	250	252	252	66	101	95	4.5	3.2	
1-1	20	0.68	1.6	394.67	151	249	250	250	62	100	96	4.5	3.3	
2	25	0.65	1.5	398.10652	150	250	251	251	56	103	98	4.5	3.2	
3	30	0.55	1.3	401.370	150	251	251	251	58	105	98	4.5	3.2	
2-1	35	0.70	1.6	404.87	151	251	251	249	63	103	99	4.5	3.2	
2	40	0.67	1.6	408.35	151	250	251	251	51	105	100	4.5	3.2	
3	45	0.55	1.3	411.620	151	250	250	250	49	105	100	4.5	3.2	STOP 8:56
3-1	50	0.70	1.6	415.11	151	250	252	252	65	103	101	4.5	3.3	START 9:23
2	55	0.69	1.6	418.48	151	249	250	250	57	106	101	4.5	3.2	
3	60	0.60	1.4	421.965	151	250	250	250	59	108	103	4.5	3.2	
Total		*9.6133	18.1	(41.3150)	1809					1234	1182			
Average		(0.8011)	(1.5083)		(150.7500)					(100.6667)				

Sum of square roots.

Circle correct bracketed units on data sheet.

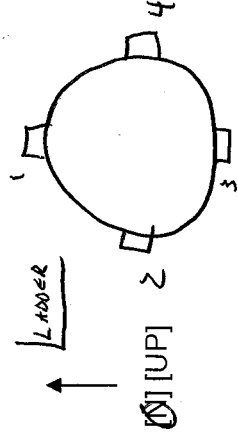
QA/QC SRDate 7-19-11

TEST LOCATION: STACKUNIT: FCCU SCHLAGER RUN: 2AmmoniaTESTING
FIELD DATA SHEETMETHOD: 027PAGE 1 OF 1

Client	MPC	Project No.	11265
Plant	ROBINSON	Date	7-19-11
Meter Operator	KE ROBERT BARNES		
Probe Operator	K Sullivan / S. Ammonia		

Meter Box	61-7	Sample Box No.	NA
Meter Y _a	0.9827	Meter ΔH _@	1.0247
K Factor	2.35	Pilot C _p	0.019
Leak Rate Before	0.004 [Lpm]	@	15 (in. Hg)
Leak Rate After	0.001 [Lpm]	@	8 (in. Hg)
Pilot Leak Check Before:	<input checked="" type="checkbox"/>	After:	Good <input checked="" type="checkbox"/> Bad <input type="checkbox"/>

Cross-Section of Test Location



Duct Dimensions (in.)	114	Gas Flow [in] [Out]	of page
Static Pres (in. H ₂ O)	-0.5	Port Len. (in.)	6
First point all the way			

Amb. Temp. (°F)	107	Bar. Press.	29.40 [in. Hg]
Probe I.D. No.	67-4-1		
Liner Material	GLASS		

Filter No.	027-2		
Thimble No.			
Nozzle Diameter	0.250	Nozzle I.D.	250-1-JR
	0249		244-1

Start Time:	12:00	Stop Time:	13:19
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Traverse Point Number	Min/pt Elapsed Time	Velocity Head ΔP (in. H ₂ O)	Orifice Setting ΔH (in. H ₂ O)	Gas Sample Volume V _m (ft ³) [L]	Stack Temp. T _s (°F)	Probe T _p (°F)	Filter T _f (°F)	Cond. Temp. T _c (°F)	DGM Inlet T _{m in} (°F)	DGM Outlet T _{m out} (°F)	Pump Vacuum (in. Hg)	XAD Trap Temp. T _{tr} (°F)	Notes
2-1	5	0.64	1.5	429.76	152	252	251	64	107	106	4.5	3.3	
2	10	0.64	1.5	433.22	152	249	258	63	108	107	4.5	3.3	
3	15	0.56	1.3	436.55	152	249	252	60	110	106	4.5	3.2	
4-1	20	0.72	1.7	440.24	152	249	250	64	111	108	5.0	3.2	
2	25	0.65	1.5	443.83	152	250	250	60	114	109	5.0	3.2	
3	30	0.52	1.2	447.06	152	250	251	56	114	109	5.0	3.2	
4-1	35	0.64	1.5	450.57	152	251	248	65	112	109	4.5	3.3	
2	40	0.68	1.6	454.17	152	250	249	55	115	110	5.0	3.2	
3	45	0.53	1.2	457.34	152	250	251	55	115	110	4.0	3.2	
3-1	50	0.68	1.6	460.98	152	250	247	66	114	111	5.0	3.3	
2	55	0.72	1.5	464.57	152	250	250	62	115	111	5.0	3.3	
3	60	0.52	1.2	467.735	152	250	251	62	115	111	4.0	3.3	
Total		9.4288	15.1000	41.535									
Average		0.7857	1.4416										

Sum of square roots.

Circle correct bracketed units on data sheet.

QA/QC: SA
Date: 7/11/11

TEST LOCATION: StackUNIT: Furn. ScavengerRUN: 3AmmoniaTESTING
FIELD DATA SHEETMETHOD: CTM-027PAGE 1 OF 1

Client	<u>MPL</u>	Project No.	<u>11265</u>
Plant	<u>Robinson</u>	Date	<u>7-19-11</u>
Meter Operator	<u>Bo-J Kover B. Arnold</u>		
Probe Operator	<u>K Sullivan / B Arnold</u>		
Meter Box	<u>61-7</u>	Sample Box No.	<u>N/A</u>
Meter Y_4	<u>0.9827</u>	Meter $\Delta H @$	<u>1.8247</u>
K Factor	<u>2.35</u>	Pilot C_p	<u>0.819</u>
Leak Rate Before	<u>0.003</u>	[Lpm] @	<u>15</u> (in. Hg)
Leak Rate After	<u>0.00</u>	[Lpm] @	<u>8</u> (in. Hg)
Pilot Leak Check Before:	<input checked="" type="checkbox"/>	After:	Good <input type="checkbox"/> Bad <input type="checkbox"/>

Cross-Section of Test Location

Duct Dimensions (in.)	<u>114</u>
Static Pres. (in. H ₂ O)	<u>-0.5</u>
Port Len. (in.)	<u>6</u>
Gas Flow [In] [Out]	<u>Out</u>
First point all the way	<u>Out</u>

Traverse Point Number	Min/pt Elapsed Time	Velocity Head ΔP (in. H ₂ O)	Orifice Setting ΔH (in. H ₂ O)	Gas Sample Volume Init. Vol. V_m [L]	Stack Temp. T_s (°F)	Probe T_p (°F)	Filter T_1 (°F)		Cond. Temp. T_c (°F)	DGM Inlet $T_{m in}$ (°F)	DGM Outlet $T_{m out}$ (°F)	Pump Vacuum (in. Hg)	XAD Trap Temp. T_1 (°F)	Notes
							Set Points							
4-1	5	0.66	1.5	469.300	152	250	250	250	65	113	112	5.0	3.5	
2	10	0.66	1.5	476.34	152	249	251	251	62	113	113	4.5	3.2	
3	15	0.53	1.2	479.62	152	250	251	251	57	114	113	4.5	3.2	
1-1	20	0.64	1.5	483.12	152	250	249	249	61	115	113	4.5	3.4	
2	25	0.64	1.5	486.67	152	250	250	249	59	114	113	4.5	3.3	
3	30	0.52	1.2	489.87	152	250	250	250	59	117	113	4.5	3.2	
2-1	35	0.65	1.5	493.35	152	250	248	248	63	116	113	4.5	3.3	
2	40	0.61	1.4	496.78	152	250	249	249	56	118	114	4.5	3.2	
3	45	0.52	1.2	500.01	152	250	250	250	54	119	114	4.5	3.3	
3-1	50	0.72	1.6	503.61	152	250	250	250	66	115	114	5.0	3.5	
2	55	0.68	1.5	507.15	152	249	249	249	61	116	114	5.5	3.2	
3	60	0.62	1.4	510.585	152	250	250	250	60	117	114	5.5	3.3	
Total		9.4928	17.000	41.285										
Average		0.7869	1.4166	152.000						114.5419				

Sum of square roots.

Circle correct bracketed units on data sheet.

QA/QC BADate 7/19/11

Impinger Weight Sheet

Client Marathon Petroleum Company		Unit Name/Location FCCU Scrubber Stack	
Plant Robinson Refinery	Job No. 11265	Method USEPA CTM-027	

Run No. 1	Filter Type Quartz Fiber	Sample Box No. 3
Date 7/19/11	Lot No.	pH N/A
Analyst DL	Filter No. N/A	Rinse

	Contents	Gross Weight (gm)	Tare Weight (gm)	Net Weight Gain (gm)	
Impinger 1	100 mL 0.1N H ₂ SO ₄	753.0	560.6	192.4	
Impinger 2	100 mL 0.1N H ₂ SO ₄	593.5	546.8	46.7	
Impinger 3	100 mL 0.1N H ₂ SO ₄	547.2	531.6	15.6	
Impinger 4	Silica Gel	739.2	723.6	15.6	
					Total Weight (gm)
					254.7
					270.3

QA/QC DL
Date 7/19/11

Run No. 2	Filter Type Quartz Fiber	Sample Box No. 15
Date 7/19/11	Lot No.	pH N/A
Analyst DL	Filter No. N/A	Rinse

	Contents	Gross Weight (gm)	Tare Weight (gm)	Net Weight Gain (gm)	
Impinger 1	100 mL 0.1N H ₂ SO ₄	748.7	561.2	205.4	
Impinger 2	100 mL 0.1N H ₂ SO ₄	576.9	534.7	42.2	
Impinger 3	100 mL 0.1N H ₂ SO ₄	535.0	527.5	7.5	
Impinger 4	Silica Gel	765.3	733.7	18.6	
					Total Weight (gm)
					255.1
					273.7

QA/QC DL
Date 7/19/11

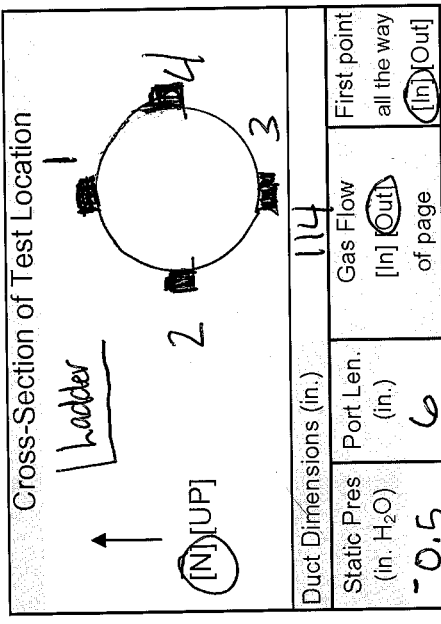
Run No. 3	Filter Type Quartz Fiber	Sample Box No. 3
Date 7/19/11	Lot No.	pH N/A
Analyst DL	Filter No. N/A	Rinse

	Contents	Gross Weight (gm)	Tare Weight (gm)	Net Weight Gain (gm)	
Impinger 1	100 mL 0.1N H ₂ SO ₄	766.5	561.2	205.3	
Impinger 2	100 mL 0.1N H ₂ SO ₄	589.5	548.6	41.9	
Impinger 3	100 mL 0.1N H ₂ SO ₄	538.4	531.0	7.4	
Impinger 4	Silica Gel	749.9	739.1	10.8	
					Total Weight (gm)
					254.6
					265.4

QA/QC DL
Date 7/19/11

FIELD DATA SHEET

UNIT: FCCU Scrubber RUN: 1



Amb. Temp. (°F)	89	Bar. Press.	29.40 [in. Hg]
Probe I.D. No.	67-4-4		
Liner Material	Glass		

Filter No.	-		
Thimble No.	-		
Nozzle Diameter	0.250	Nozzle I.D.	250-1

Start Time:	7:42	Stop Time:	10:52
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Traverse Point Number	Min/pt Elapsed Time	Velocity Head ΔP (in. H ₂ O)	Orifice Setting ΔH (in. H ₂ O)	Gas Sample Volume V _m		Stack Temp. T _s (°F)	Probe T _p (°F)		Filter T _f (°F)	Cond. Temp. T _c (°F)
				Init. Vol.	(ft ³)		Set Points			
	15			665.65			250	250		
2-1	5	.78	1.7	669.59		150	251	255		62
1	10	.78	1.7	673.60		150	250	251		60
1	15	.78	1.7	677.62		152	251	250		58
2-2	20	.71	1.7	681.50		152	249	250		58
2	25	.71	1.7	685.39		152	251	252		57
2	30	.71	1.7	689.26		151	248	250		57
2-3	35	.56	1.3	692.60		151	250	249		56
3	40	.56	1.3	695.94		152	250	249		56
3	45	.58	1.3	699.27		152	250	249		58
3-1	50	.75	1.7	703.13		152	249	250		59
1	55	.73	1.7	706.98		152	249	250		58
1	60	.74	1.7	710.12		152	248	251		56
	Total	10.163	19.5	131.11		151.7				
	Average	1.0123	1.5167			151.7224				

Circle correct bracketed units on data sheet.

Sum of square roots.

8347

QA/QC Date 2/11

65.4861

100.7679

202.1523



TEST LOCATION: STACK

UNIT: Faw Scrubber RUN: 1

FIELD DATA SHEET

Cross-Section of Test Location

Client	MPC	Project No.	11265
Plant	ROBINSON, IL	Date	7-19-11
Meter Operator	HUY NGUYEN		
Probe Operator	B. ARNOLD / K. SULLIVAN		

Meter Box	61-5	Sample Box No.	
Meter Y _d	1.7185	Meter ΔH@	0.9922
K Factor		Pitot C _p	0.820
Leak Rate Before	[cfm] [Lpm]	@	(in. Hg)
Leak Rate After	[cfm] [Lpm]	@	(in. Hg)
Pitot Leak Check Before:	<input type="checkbox"/> After: Good <input type="checkbox"/> Bad <input type="checkbox"/>		

Duct Dimensions (in.)			114
Static Pres (in. H ₂ O)	Port Len. (in.)	Gas Flow [In] [Out] of page	First point all the way [In] [Out]
[N] [UP]			

Amb. Temp. (°F)	92	Bar. Press.	29.40 (in. Hg) [inbar]
Probe I.D. No.			
Liner Material			

Filter No.	
Thimble No.	
Nozzle Diameter	Nozzle I.D.

Start Time:	Stop Time:
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Traverse Point Number	Min/pt Elapsed Time	Velocity Head ΔP (in. H ₂ O)	Orifice Setting ΔH (in. H ₂ O)	Gas Sample Volume V _m (ft ³) [L]	Stack Temp. T _s (°F)	Probe T _p (°F)	Filter T _f (°F)	Cond. Temp. T _c (°F)	DGM Inlet T _{m in} (°F)	DGM Outlet T _{m out} (°F)	Pump Vacuum (in. Hg)	XAB Trap Temp. T _f (°F)	Notes
3-2	65	.71	1.6	714.66	152	250	251	48	106	98	5	3.3	
2	70	.70	1.6	718.50	152	249	250	47	104	97	5	3.4	
2	75	.70	1.6	722.15	152	251	251	47	104	98	5	3.4	
3-3	80	.62	1.4	725.72	152	250	249	53	104	98	5	3.4	
3	85	.61	1.4	729.27	152	250	247	54	105	98	5	3.4	
3	90	.62	1.4	732.79	152	250	249	57	106	98	5	3.4	
4-1	95	.75	1.7	736.64	152	249	249	58	106	100	6	3.4	
1	100	.74	1.7	740.52 #	152	250	251	58	106	100	6	3.5	
1	105	.74	1.7	744.40	152	250	251	58	108	100	6	3.4	
4-2	110	.68	1.5	748.04	152	250	250	58	107	100	6	3.4	
2	115	.68	1.5	751.65	152	251	250	59	108	101	6	3.4	
2	120	.68	1.5	755.23	152	249	249	59	109	101	6	3.4	
Total		*9.9321	18.6		1824				1273	1089			
Average		9.9277											

* Sum of square roots.

Circle correct bracketed units on data sheet.

QA/QC W

Date 8/1

TEST LOCATION: STACYUNIT: Flow Scrubber RUN: 1

TESTING

METHALS

FIELD DATA SHEET

METHOD: 29 PAGE 3 OF 3

Cross-Section of Test Location

Client	<u>MPC</u>	Project No.	<u>11265</u>
Plant	<u>Robinson IL</u>	Date	<u>7-19-11</u>
Meter Operator			
Probe Operator			

Meter Box		Sample Box No.	
Meter Y_d		Meter $\Delta H @$	
K Factor		Pitot C_p	<u>0.820</u>
Leak Rate Before	[cfm] [Lpm]	@	(in. Hg)
Leak Rate After	[cfm] [Lpm]	@	(in. Hg)
Pitot Leak Check Before:	<input type="checkbox"/> After: Good	<input type="checkbox"/> Bad	<input type="checkbox"/>

Amb. Temp. (°F)		Bar. Press.		[in. Hg] [mbar]
Probe I.D. No.				
Liner Material				

Filter No.			
Thimble No.			
Nozzle Diameter		Nozzle I.D.	

Start Time:		Stop Time:	<u>10:52</u>
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Duct Dimensions (in.)			Gas Flow		First point all the way [In] [Out]	
Static Pres (in. H ₂ O)	Port Len. (in.)		[In] [Out]	of page		

Traverse Point Number	Min/pt	Velocity Head ΔP (in. H ₂ O)	Orifice Setting ΔH (in. H ₂ O)	Gas Sample Volume V_m Init. Vol. (ft ³) [L]	Stack Temp. T_s (°F)	Probe T_p (°F)	Filter T_f (°F)	Cond. Temp. T_c (°F)	DGM Inlet $T_{m in}$ (°F)	DGM Outlet $T_{m out}$ (°F)	Pump Vacuum (in. Hg)	XAD-Trap Temp. T_t (°F)	Notes
						Set Points							
4-3	125	.52	1.2	758.65	152	250	250	65	108	101	5	3.2	
3	130	.52	1.2	761.84	152	249	252	57	108	102	5	3.2	
3	135	.52	1.2	765.04	152	247	250	54	109	102	5	3.2	
1-1	140	.77	1.7	768.86	152	251	251	54	109	102	7	3.3	
1	145	.77	1.7	772.59	151	250	250	46	109	102	7	3.3	
1	150	.77	1.7	776.41	151	250	250	47	109	102	8	3.3	
1-2	155	.60	1.4	779.94	151	249	249	53	109	102	8	3.2	
2	160	.61	1.4	783.42	151	250	250	54	109	103	7	3.2	
2	165	.61	1.4	786.88	152	250	249	56	110	103	7	3.3	
1-3	170	.52	1.2	790.26	152	250	251	60	109	104	7	3.3	
3	175	.52	1.2	793.51	152	250	251	61	110	104	7	3.2	
3	180	.52	1.2	796.76	152	250	251	62	110	104	7	3.2	
	Total	* 9.2958	16.5		1820				1309	1231			
	Average	7.746											

* Sum of square roots.

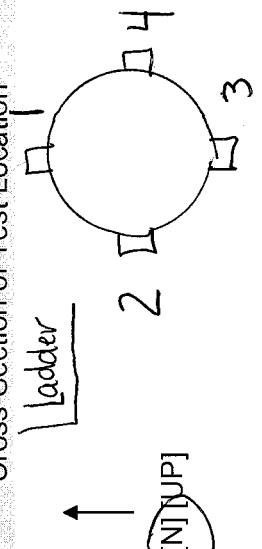
Circle correct bracketed units on data sheet.

QA/QC 10Date 7/11

TEST LOCATION: STACKUNIT: Fly Scrubber RUN: 2MetalsTESTING
FIELD DATA SHEETMETHOD: 29 PAGE 1 OF 3

Client <u>Marathon Petroleum Co.</u>	Project No. <u>11265</u>
Plant <u>Robinson, IL</u>	Date <u>7-19-11</u>
Meter Operator <u>Huy Nguyen</u>	
Probe Operator <u>J. Rooney / K. Sullivan</u>	

Meter Box <u>61-5</u>	Sample Box No. <u>B-1</u>
Meter <u>Y₉</u>	Meter ΔH @ <u>1.7183</u>
K Factor <u>2.25</u>	Pitot C_p @ <u>0.826</u>
Leak Rate Before <u>.001</u> (cfm) [Lpm]	@ <u>15</u> (in. Hg)
Leak Rate After <u>.002</u> (cfm) [Lpm]	@ <u>7</u> (in. Hg)
Pitot Leak Check Before: <input checked="" type="checkbox"/> After: Good <input checked="" type="checkbox"/> Bad <input type="checkbox"/>	

Cross-Section of Test Location			
			
Duct Dimensions (in.)	114	Gas Flow [In] [Out]	First point all the way (In) [Out]
Static Pres. (in. H ₂ O)	-0.5	Port Len. (in.)	6

Amb. Temp. (°F)	93	Bar. Press.	29.40 (in. Hg) [mbar]
Probe I.D. No.	67-4-4		
Liner Material	Glass		

Filter No.	—		
Thimble No.	—		
Nozzle Diameter	0.250	Nozzle I.D.	250-1

Start Time: 11:23 Stop Time: 14:37

Traverse Point Number	Min/pt Elapsed Time	Velocity Head ΔP (in. H ₂ O)	Orifice Setting ΔH (in. H ₂ O)	Gas Sample Volume V_m Init. Vol. (ft ³) [L]	Stack Temp. T_s (°F)	Probe T_p (°F)	Filter T_f (°F)		Cond. Temp. T_c (°F)	DGM Inlet $T_{m in}$ (°F)	DGM Outlet $T_{m out}$ (°F)	Pump Vacuum (in. Hg)	XAD Trap Temp. T_{tr} (°F)	Notes
							Set Points							
				797.30		250	250	250					% Oxygen	
4-1	5	.72	1.6	801.08	152	253	255	256	65	106	104	4	3.2	
1	10	.73	1.6	804.83	152	257	254		64	107	104	4	3.2	
1	15	.73	1.6	808.59	152	253	253		65	107	104	4	3.3	
4-2	20	.77	1.7	812.44	152	250	250		60	109	104	5	3.3	
2	25	.77	1.7	816.30	152	250	251		60	111	104	5	3.2	
2	30	.75	1.7	820.27	151	251	250		62	113	105	5	3.3	
4-3	35	.49	1.1	824.21	151	250	249		63	113	106	4	3.3	
3	40	.51	1.1	827.50	151	250	249		64	113	106	4	3.3	
-3	45	.51	1.1	830.67	152	250	250		65	113	106	4	3.3	
3-1	50	.69	1.6	834.51	151	248	247		66	113	107	5	3.3	
1	55	.71	1.6	838.37	151	249	252		60	116	108	5	3.3	
1	60	.72	1.6	842.26	151	250	251		58	116	108	5	3.3	
					1818									
	Total	*9.8284	18.0		827					1766	1337			
	Average	(8.15)	(1.4873)		(151.4167)					(111.500)				

Circle correct bracketed units on data sheet.

QA/QC 21
Date 21

Sum of square roots.

FIELD DATA SHEET

Client MPC Project No. 11265

Plant ROBINSON, IL Date 7-19-11

Meter Operator _____

Probe Operator _____

Meter Box _____ Sample Box No. _____

Meter Y_d _____ Meter ΔH_d @ _____

K Factor _____ Pitot C_p _____

Leak Rate Before [cfm] [Lpm] @ _____ (in. Hg)

Leak Rate After [cfm] [Lpm] @ _____ (in. Hg)

Pitot Leak Check Before: ☐ After: Good ☐ Bad ☐

↑

[N] [UP]

Duct Dimensions (in.)

Static Pres (in. H₂O)

Port Len. (in.)

Gas Flow [In] [Out] of page

First point all the way [In] [Out]

Amb. Temp. (°F) 95 Bar. Press. _____ [in. Hg] [mbar]

Probe I.D. No. _____

Liner Material _____

Filter No. _____

Thimble No. _____

Nozzle Diameter _____ Nozzle I.D. _____

Start Time: _____ Stop Time: _____

Traverse Point Number	Min/pt Elapsed Time	Velocity Head ΔP (in. H ₂ O)	Orifice Setting ΔH (in. H ₂ O)	Gas Sample Volume Init. Vol. (ft ³)	Stack Temp. T _s (°F)	Probe T _p (°F)	Filter T _f (°F)	Cond. Temp. T _c (°F)	DGM Inlet T _{m in} (°F)	DGM Outlet T _{m out} (°F)	Pump Vacuum (in. Hg)	XAD Trap Temp. % Oxygen	Notes
3-2	65	.71	1.6	846.13	151	249	250	59	117	108	5	3.3	
2	70	.70	1.4	849.93	152	250	250	62	116	109	5	3.3	
2	75	.70	1.6	853.76	152	250	250	65	116	109	5	3.3	12:09
3-3	80	.60	1.4	857.71	152	250	250	66	116	110	5	3.3	133°F Heat Exchanger
3	85	.61	1.4	861.17	151	249	250	66	118	111	5	3.3	
3	90	.60	1.4	864.79	151	249	250	65	118	111	5	3.3	
1-1	95	.73	1.4	868.63	151	249	249	64	116	111	5	3.3	
1	100	.72	1.6	872.47	151	250	249	60	116	111	5	3.4	
1	105	.72	1.6	876.32	151	250	249	61	116	110	5	3.3	
1-2	110	.74	1.7	880.18	152	250	250	59	115	110	6	3.3	
2	115	.74	1.7	884.15	152	250	249	59	115	110	6	3.3	
2	120	.74	1.7	888.01	152	250	250	57	115	110	6	3.3	
Total		*9.9703	18.9		1818				1394	1320			
Average		.8315											

* Sum of square roots.

Circle correct bracketed units on data sheet.

QA/QC 6 Date 7/1



TEST LOCATION: StackUNIT: FULL Scrubber RUN: 2MetalsTESTING
FIELD DATA SHEETMETHOD: 29 PAGE 3 OF 3

Client	<u>MPC</u>	Project No.	<u>11265</u>
Plant	<u>Robinson IL</u>	Date	<u>7-19-11</u>
Meter Operator			
Probe Operator			

Meter Box		Sample Box No.	
Meter Y_d		Meter ΔH_d	
K Factor		Pitot C_p	
Leak Rate Before	[cfm] [Lpm]	@	(in. Hg)
Leak Rate After	[cfm] [Lpm]	@	(in. Hg)
Pitot Leak Check Before:	<input type="checkbox"/> After: Good <input type="checkbox"/> Bad <input type="checkbox"/>		

Cross-Section of Test Location




[N] [UP]

Duct Dimensions (in.)		Gas Flow [In] [Out] of page	First point all the way [In] [Out]
Static Pres (in. H ₂ O)	Port Len. (in.)		

Amb. Temp. (°F)	Bar. Press.	[in. Hg] [mbar]
Probe I.D. No.		
Liner Material		

Filter No.		
Thimble No.		
Nozzle Diameter	Nozzle I.D.	

Start Time: 1437 Stop Time: 1437

Traverse Point Number	Min/pt Elapsed Time	Velocity Head ΔP (in. H ₂ O)	Orifice Setting ΔH (in. H ₂ O)	Gas Sample Volume V_m Init. Vol. (ft ³)	Stack Temp. T_s (°F)	Probe T_p (°F)		Filter T_f (°F)	Cond. Temp. T_c (°F)	DGM Inlet $T_{m\ in}$ (°F)	DGM Outlet $T_{m\ out}$ (°F)	Pump Vacuum (in. Hg)	XAD Temp. T_r (°F)	Notes
						Set Points								
1-3	125	0.52	1.2	898.1.2	151	250	250	250	60	114	109	5	3.4	
3	130	0.54	1.2	894.78	151	250	250	250	60	115	110	5	3.4	
3	135	0.54	1.2	898.10	151	249	250	250	61	115	110	5	3.4	
2-1	140	0.75	1.7	901.09	152	249	250	250	58	115	110	6	3.3	14:00 Heat Index @ 138°F
1	145	0.75	1.7	905.36	152	249	250	250	56	116	111	6	3.4	
1	150	0.76	1.7	909.66	152	249	250	250	54	118	112	6	3.4	
2-2	155	0.66	1.5	913.30	151	250	250	250	58	116	110	6	3.4	1409 Heat Index
2	160	0.67	1.5	916.90	151	250	249	249	63	115	110	6	3.4	@ 126°F
2	165	0.68	1.5	920.59	151	249	249	249	63	116	111	7	3.4	
2-3	170	0.51	1.1	923.81	151	249	250	250	64	115	111	6	3.4	
3	175	0.52	1.1	927.00	151	249	249	249	64	115	110	6	3.4	1440 Heat Index
3	180	0.52	1.1	930.050	151	250	250	250	66	115	110	6	3.4	Index @ 140°F
	Total	9.4064	4.5		1815			250		1387	1324			
	Average	1.7839												

* Sum of square roots.

Circle correct bracketed units on data sheet.

QA/QC 16
Date 8/1CleanAir
ENGINEERING

TEST LOCATION: StackUNIT: Feet RUN: 3

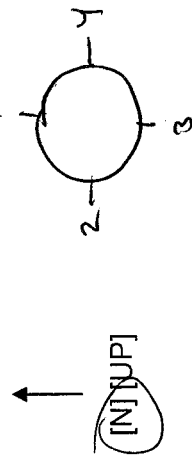
TESTING

METHOD: 29 PAGE 1 OF 3

FIELD DATA SHEET

Cross-Section of Test Location

Client <u>Martinez Petroleum Co.</u>	Project No. <u>11265</u>
Plant <u>Robinson IL</u>	Date <u>7-19-11</u>
Meter Operator <u>H. Nguyen</u>	
Probe Operator <u>S. Dotley / J. Rooney</u>	
Meter Box <u>61-5</u>	Sample Box No.
Meter <u>Y_a 0.9952</u>	Meter ΔH @ <u>1.7185</u>
K Factor <u>2.25/2.18</u>	Pitot C _p @ <u>0.826</u>
Leak Rate Before, <u>103 (cfm)</u> [Lpm]	@ <u>15</u> (in. Hg)
Leak Rate After, <u>100 (cfm)</u> [Lpm]	@ <u>27</u> (in. Hg)
Pitot Leak Check Before: <input checked="" type="checkbox"/> After: Good <input checked="" type="checkbox"/> Bad <input type="checkbox"/>	



Filter No.	
Thimble No.	
Nozzle Diameter	<u>0.250</u> Nozzle I.D. <u>250-1</u>

Start Time:	<u>15:17</u>	Stop Time:	<u>1830</u>
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Traverse Point Number	Min/pt Elapsed Time	Velocity Head ΔP (in. H ₂ O)	Orifice Setting ΔH (in. H ₂ O)	Gas Sample Volume V_m Init. Vol. (ft ³) [L]	Stack Temp. T_s (°F)	Probe T_p (°F)	Filter T_f (°F)	Cond. Temp. T_c (°F)	DGM Inlet $T_{m in}$ (°F)	DGM Outlet $T_{m out}$ (°F)	Pump Vacuum (in. Hg)	XAD Trap Temp. T_{trap} (°F)	Notes
2-1	5	0.72	1.6	934.38	151	248	250	67	109	108	4	3.5	
1	10	0.70	1.6	938.27	151	249	250	66	113	110	4	3.5	
1	15	0.71	1.6	942.17	151	250	250	63	114	111	4	3.5	
2-2	20	0.62	1.4	945.82	151	250	250	65	115	110	4	3.5	
2	25	0.63	1.3	949.14	151	250	250	66	116	110	4	3.5	
2	30	0.63	1.3	952.62	151	250	250	56	117	111	4	3.5	
2-3	35	0.56	1.2	955.84	151	250	250	56	117	111	4	3.5	
3	40	0.54	1.2	959.05	151	250	250	55	117	111	4	3.5	
3	45	0.54	1.2	962.25	151	250	250	54	118	112	4	3.5	
3-1	50	0.75	1.6	965.65	151	251	252	57	116	112	5	3.5	
1	55	0.72	1.6	970.29	151	250	252	49	117	112	5	3.5	
1	60	0.71	1.5	974.00	151	251	251	47	118	112	5	3.5	
Total		9.6778	17.1	126.87	1812				1387	1330			
Average		7.9133	1.3583	151.4167					114.1667				

Circle correct bracketed units on data sheet.

Sum of square roots.

8065

QA/QC: 16Date 9/1

TEST LOCATION: Stack

TESTING

METHOD: 2.9 PAGE 2 OF 3UNIT: Full Scrubber RUN: 3

FIELD DATA SHEET

Cross-Section of Test Location

Client	MPC	Project No.	11265
Plant	Robinson IL	Date	7-19-11
Meter Operator			
Probe Operator			

Meter Box		Sample Box No.	
Meter Y _d		Meter ΔH _@	
K Factor		Pitot C _p	
Leak Rate Before	[cfm] [Lpm]	@	(in. Hg)
Leak Rate After	[cfm] [Lpm]	@	(in. Hg)
Pitot Leak Check Before:	<input type="checkbox"/> After: Good <input type="checkbox"/> Bad <input type="checkbox"/>		

Amb. Temp. (°F)	Bar. Press.	[in. Hg] [mbar]
Probe I.D. No.		
Liner Material		

Filter No.		
Thimble No.		
Nozzle Diameter		Nozzle I.D.

Start Time:		Stop Time:	
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Traverse Point Number	Min/pt Elapsed Time	Velocity Head ΔP (in. H ₂ O)	Orifice Setting ΔH (in. H ₂ O)	Gas Sample Volume V _m Init. Vol. (ft ³)	Stack Temp. T _s (°F)	Probe T _p (°F)	Filter T _f (°F)	Cond. Temp. T _c (°F)	DGM Inlet T _{m in} (°F)	DGM Outlet T _{m out} (°F)	Pump Vacuum (in. Hg)	XAD-Trap Temp. T _{tr} (°F)	Notes
3-2	65	0.65	1.4	977.60	152	251	250	46	120	113	4	3.4	
2	70	0.66	1.4	981.19	152	250	250	46	120	113	4	3.4	
2	75	0.66	1.4	984.85	152	251	250	47	120	114	4	3.4	
3-3	80	0.51	1.1	988.10	152	251	250	48	120	114	4	3.4	
3	85	0.50	1.1	991.31	152	251	250	49	120	114	4	3.4	
3	90	0.51	1.1	994.50	152	251	250	49	120	114	4	3.4	
4-1	95	0.68	1.5	998.20	152	249	250	66	116	113	5	3.6	
1	100	0.68	1.5	1001.90	152	249	251	63	116	113	5	3.6	
1	105	0.68	1.5	1005.63	152	249	250	62	118	113	5	3.4	
4-2	110	0.66	1.4	1009.47	151	250	250	56	118	112	5	3.5	
2	115	0.66	1.4	1012.84	151	250	250	54	118	112	5	3.5	
2	120	0.66	1.4	1016.67	151	250	250	53	118	112	5	3.5	
Total		*9.4775	16.2		1821				1424	1357			
Average		.7848											

* Sum of square roots.

Circle correct bracketed units on data sheet.

QA/QC 16Date 7/11/11

TEST LOCATION: SPRUEUNIT: Fuel Scrubber RUN: 3MetersTESTING
FIELD DATA SHEETMETHOD: 29 PAGE 3 OF 3

Cross-Section of Test Location

Client	<u>WPC</u>	Project No.	<u>41265</u>
Plant	<u>Polysulfone P1</u>	Date	<u>7-19-4</u>
Meter Operator			
Probe Operator			

Meter Box		Sample Box No.	
Meter Y_d		Meter $\Delta H_{d@}$	
K Factor		Pitot C_p	
Leak Rate Before	[cfm] [Lpm]	@	(in. Hg)
Leak Rate After	[cfm] [Lpm]	@	(in. Hg)
Pitot Leak Check Before:	<input type="checkbox"/> After: Good <input type="checkbox"/> Bad <input type="checkbox"/>		

Amb. Temp. (°F)	Bar. Press.	[in. Hg] [mbar]
Probe I.D. No.		
Liner Material		

Filter No.	
Thimble No.	
Nozzle Diameter	Nozzle I.D.

Start Time:	Stop Time:
	<u>18:30</u>

Traverse Point Number	Min/pt Elapsed Time	Velocity Head ΔP (in. H ₂ O)	Orifice Setting ΔH (in. H ₂ O)	Gas Sample Volume Init. Vol.	Stack Temp. T_s (°F)	Probe T_p (°F)	Set Points	Filter T_f (°F)	Cond. Temp. T_c (°F)	DGM Inlet $T_{m in}$ (°F)	DGM Outlet $T_{m out}$ (°F)	Pump Vacuum (in. Hg)	XAD Trap Temp. T_t (°F)	Notes
4-3	125	0.48	1.0	1019.40	152	251	249	249	57	117	111	5	3.5	
3	136	0.49	1.0	1022.45	152	250	249	249	58	117	112	5	3.5	
3	135	0.48	1.0	1025.43	152	250	249	249	58	117	112	5	3.5	
1-1	140	0.75	1.6	1029.24	151	249	249	249	62	115	111	7	3.6	
1	145	0.75	1.6	1033.02	151	250	249	249	62	115	111	7	3.7	
1	150	0.75	1.6	1036.76	151	250	250	250	60	116	111	7	3.7	
1-2	153	0.71	1.5	1040.40	152	248	251	251	54	116	111	7	3.6	
2	160	0.71	1.5	1044.04	152	249	251	251	54	115	110	7	3.6	
2	165	0.71	1.5	1047.77	152	249	251	251	55	116	111	7	3.6	
1-3	170	0.50	1.1	1051.11	151	251	250	250	56	116	110	8	3.6	
3	175	0.50	1.1	1054.19	151	250	249	249	57	116	110	8	3.6	
3	180	0.50	1.1	1057.370	151	250	250	250	59	116	110	8	3.6	
Total		9.73729	15.4		151.8					1092	1330			
Average		.7777												

* Sum of square roots.

Circle correct bracketed units on data sheet.

QA/QC 40Date 8/1

Impinger Weight Sheet

Client Marathon Petroleum Company		Unit Name/Location FCCU Scrubber Stack	
Plant Robinson Refinery	Job No. 11265	Method	USEPA M-29

Run No. 1	Filter Type Quartz Fiber	Sample Box No. 24
Date 7/19/11	Lot No.	pH N/A
Analyst DL	Filter No. N/A	Rinse

	Contents	Gross Weight (gm)	Tare Weight (gm)	Net Weight Gain (gm)	
Impinger 1	Empty	850.9	431.02	413.4	QA/QC DL Date 7/19/11
Impinger 2	100 mL 5% HNO ₃ / 10% H ₂ O ₂	838.1	538.6	299.5	
Impinger 3	100 mL 5% HNO ₃ / 10% H ₂ O ₂	658.4	542.3	116.1	
Impinger 4	Silica Gel	757.1	728.1	29.0	
					Total Weight (gm)
					829.0
					858.0

Run No. 2	Filter Type Quartz Fiber	Sample Box No. 131
Date 7/19/11	Lot No.	pH N/A
Analyst DL	Filter No. N/A	Rinse

	Contents	Gross Weight (gm)	Tare Weight (gm)	Net Weight Gain (gm)	
Impinger 1	Empty	853.2	445.0	408.2	QA/QC DL Date 7/19/11
Impinger 2	100 mL 5% HNO ₃ / 10% H ₂ O ₂	876.4	539.9	336.5	
Impinger 3	100 mL 5% HNO ₃ / 10% H ₂ O ₂	601.1	531.5	69.6	
Impinger 4	Silica Gel	713.5	676.5	37.0	
					Total Weight (gm)
					814.3
					851.3

Run No. 3	Filter Type Quartz Fiber	Sample Box No. 24
Date 7/19/11	Lot No.	pH N/A
Analyst DL	Filter No. N/A	Rinse

	Contents	Gross Weight (gm)	Tare Weight (gm)	Net Weight Gain (gm)	
Impinger 1	Empty	848.1	439.3	408.8	QA/QC DL Date 7/19/11
Impinger 2	100 mL 5% HNO ₃ / 10% H ₂ O ₂	840.4	539.3	301.1	
Impinger 3	100 mL 5% HNO ₃ / 10% H ₂ O ₂	614.7	543.9	70.8	
Impinger 4	Silica Gel	755.8	731.1	24.7	
					Total Weight (gm)
					780.7
					805.4

TEST LOCATION:

STACK

TESTING

METHOD: 6784 PAGE

2
OF

UNIT: Fcoo Schreiber

■ ■

FIELD DATA SHEET

Cross-Section of Test Location



Client	MPC	Project No.	11265
Plant	ROBINSON	Date	7-14-11 5R
Meter Operator	JACQUEY 7-15-11		
Probe Operator	R ARNOLD		

Meter Box	61-5	Sample Box No.
Meter Y _d	0.9942	Meter ΔH _@
K Factor	2.36	Pilot C _{0.9942}
Leak Rate Before	0.006 [cpm]	@ 15' (in. Hg)
Leak Rate After	0.002 [cpm]	@ 0' (in. Hg)
Pilot Leak Check Before:	W	After: Good <input checked="" type="checkbox"/> Rad <input type="checkbox"/>

Amb. Temp. (°F)	94	Bar. Press.	29.40	(In. Hg) [mbar]
Probe I.D. No.	67-465-443-67-4-4			
Liner Material	GLASS			

Filter No.	D6784-1	—	—
Thimble No.	—	—	—
Nozzle Diameter	0.250	Nozzle I.D.	250-1

Start Time:	9:00	Stop Time:	13:14
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Traverse Point Number	Min/pt Elapsed Time	Velocity Head ΔP (in. H ₂ O)	Orifice Setting ΔH (in. H ₂ O)	Gas Sample Volume V_m		Stack Temp. T_s (°F)	Probe T_p (°F)	Filter T_f (°F)	Cond. Temp. T_c (°F)	DGM Inlet $T_{m\ in}$ (°F)	DGM Outlet $T_{m\ out}$ (°F)	Pump Vacuum (in. Hg)	XAD Trap Temp. T_t (°F)	Notes
				Init. Vol.	(ft) ³ /L									
	10			397.030 342.765 JL			250	250						%O ₂
Z-1	5	0.74	1.7	406.09	149	242	241	84	95	94	5.5			5.0
1	10	0.72	1.7	404.92	144	244	242	82	100	94	5.0			3.5
Z-2	15	0.72	1.7	408.72	150	248	247	82	103	95	5.0			3.4
2	20	0.74	1.7	412.52	154	250	250	84	106	96	5.0			3.4
Z-3	25	0.60	1.4	416.01	150	250	251	83	107	97	4.5			3.4
3	30	0.60	1.4	419.48	149	251	251	84	107	98	2.55			3.5
A-1	35	.80	1.9	423.43	149	251	251	60	104	98	3.55			3.5
1	40	.80	1.9	427.37	148	251	250	61	106	99	5			3.5
A-2	45	.72	1.7	431.45	150	250	250	61	108	99	5			3.5
2	50	.72	1.7	435.43	149	251	250	61	109	99	5			3.5
A-3	55	.55	1.3	438.86	148	249	251	63	109	101	5			3.4
3	60	.55	1.3	442.260	150	247	251	61	109	101	5			3.4
	Total	*	1.4	90.970	1795					1263	1171			
	Average	.8206	1.6333		149.625					103.1042				

☒ Circle correct bracketed units on data sheet.

11

99359 19.4

09359

QA/QC 160

QA/Q



UNIT: FLOW SCAVER

TESTING

FIELD DATA SHEET

Client	MPL	Project No.	11265
Plant	ROBINSON	Date	7-4-11
Meter Operator	J. ROONEY		7-15-11
Probe Operator	B. ARNOLD		

Meter Box	Sample Box No.
Meter Y _d	Meter ΔH _@
K Factor	Pilot C _p
Leak Rate Before	[cfm] [Lpm] @ (in. Hg)
Leak Rate After	[cfm] [Lpm] @ (in. Hg)
Pilot Leak Check Before:	<input type="checkbox"/> After: Good <input type="checkbox"/> Bad <input type="checkbox"/>

Amb. Temp. (°F)	Bar. Press.	[in. Hg] [mbar]
Probe I.D. No.		
Liner Material		

Filter No.	
Thimble No.	
Nozzle Diameter	Nozzle I.D.

Start Time:	Stop Time:
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Traverse Point Number	Min/pt Elapsed Time	Velocity Head ΔP (in. H ₂ O)	Orifice Setting ΔH (in. H ₂ O)	Gas Sample Volume V _m (ft ³) [L]	Stack Temp. T _s (°F)	Probe T _p (°F)	Filter T _f (°F)		Cond. Temp. T _c (°F)	DGM Inlet T _{m in} (°F)	DGM Outlet T _{m out} (°F)	Pump Vacuum (in. Hg)	XAD Trap Temp. T _t (°F)	Notes
							Set Points							
1-1	65	0.71	1.7	446.17	150	249	249	246	65	105	102	6	NA	3.5
1	70	0.71	1.7	450.07	149	250	250	250	60	106	102	6		3.4
1-2	75	0.70	1.7	453.58	149	251	251	251	50	108	102	6		3.4
2	80	0.70	1.7	457.100	150	247	247	250	50	104	101	6		3.4
1-3	85	0.68	1.6	461.291	150	247	247	249	50	104	101	6		3.4
3	90	0.68	1.6	464.93	149	249	249	245	51	107	102	6		3.4
3-1	95	0.72	1.7	469.29	149	249	249	249	45	108	102	7		3.4
1	100	0.72	1.7	473.19	150	250	250	251	45	109	103	7		3.4
3-2	105	0.75	1.8	477.33	150	249	249	250	46	110	103	8		3.4
2	110	0.75	1.8	481.13	150	249	249	250	47	109	103	8		3.5
3-3	115	0.61	1.4	484.65	150	250	250	250	47	109	103	7		3.5
3	120	0.61	1.4	488.000	150	250	250	250	47	109	103	7		3.5
	Total	* 9.9489	19.80		1794					1288	1227			
	Average	0.737												

TESTING FIELD DATA SHEET

Mercury

TEST LOCATION: SRAU
UNIT: Fcu Scrubber RUN: 2

Client	MPC	Project No.	11265
Plant	Robinson IL	Date	7-15-11
Meter Operator	A. Neuen		
Probe Operator	B. Arnold / K. Sullivan		
Meter Box	61-5	Sample Box No.	
Meter Y _d	0.9992	Meter ΔH ₀	1.7185
K Factor	2.28	Pilot C ₀	0.8320
Leak Rate Before	0.05 (cfm)	@	15 (in. Hg)
Leak Rate After	0.004 (cfm)	@	8 (in. Hg)
Pilot Leak Check Before:	<input checked="" type="checkbox"/>	After:	Good <input checked="" type="checkbox"/> Bad <input type="checkbox"/>

Cross-Section of Test Location

Port Dimensions (in.) 114

Static Pres. (in. H ₂ O)	Port Len. (in.)	Gas Flow (In) (Out) of page	First point all the way (In) (Out)
-0.3	6		

Amb. Temp. (°F)	92	Bar. Press.	29.40 (in. Hg)
Probe I.D. No.	67-MS-13		67-4-4
Liner Material	Glass		

Filter No.	N/A
Thimble No.	N/A
Nozzle Diameter	0.250 Nozzle I.D.

Start Time:	13:27	Stop Time:	16:04
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Traverse Point Number	Min/pt	Velocity Head ΔP (in. H ₂ O)	Orifice Setting ΔH (in. H ₂ O)	Gas Sample Volume V _m Init. Vol.	Stack Temp. T _s (°F)	Probe T _p (°F)	Filter T _f (°F)	Cond. Temp. T _c (°F)	DGM Inlet T _{m in} (°F)	DGM Outlet T _{m out} (°F)	Pump Vacuum (in. Hg)	*AD-Trap Temp. T _i	Notes
3-1	5	.76	1.70	488.66	150	247	249	62	102	100	6	3.7	
1	10	.76	1.7	496.62	149	250	251	47	104	100	6	3.6	
3-2	15	.72	1.6	500.38	150	250	250	47	104	101	6	3.5	
2	20	.72	1.6	504.14	149	250	253	49	107	101	5	3.7	
3-3	25	.55	1.3	507.60	150	250	250	51	108	102	5	3.5	
3	30	.55	1.3	511.00	150	249	250	52	109	102	5	3.4	
2-1	35	.68	1.6	514.82	150	248	250	58	107	103	5	3.3	
1	40	.68	1.6	518.52	150	248	249	57	108	103	5	3.4	
2-2	45	.63	1.4	522.11	150	249	250	50	109	103	5	3.4	
2	50	.63	1.4	525.69	149	249	249	42	111	103	5	3.4	
2-3	55	.59	1.3	529.21	149	250	249	42	111	105	5	3.4	
3	60	.59	1.3	532.60	149	250	249	42	111	105	5	3.4	Stop Port Conflict w/
		19.504							1291	1288			
Total		4.6108	17.8	88.7990	179.5				1091	1020			
Average		0.8163	1.5792		149.7917				110				

Circle correct bracketed units on data sheet.

QA/QC 160
Date 8/1

Sum of square roots.

9.081

TESTING
FIELD DATA SHEET

Mercury

UNIT: Flow Scrubber RUN: 2

Client	<u>MPC</u>	Project No.	<u>1265</u>
Plant	<u>Robinson II</u>	Date	<u>7-15-11</u>
Meter Operator	<u>HN</u>		
Probe Operator	<u>BA</u>		

Meter Box	Sample Box No.
Meter Y_d	Meter ΔH_a
K Factor	Pitot C_p
Leak Rate Before	[cfm] [Lpm] @ (in. Hg)
Leak Rate After	[cfm] [Lpm] @ (in. Hg)
Pitot Leak Check Before:	<input type="checkbox"/> After: Good <input type="checkbox"/> Bad <input type="checkbox"/>

Cross-Section of Test Location			
<p>↑</p> <p>[N] [UP]</p>			
Duct Dimensions (in.)	Static Pres (in. H ₂ O)	Port Len. (in.)	Gas Flow [In] [Out] of page
			First point all the way [In] [Out]

Amb. Temp. (°F)	Bar. Press.	[in. Hg] [mbar]
Probe I.D. No.		
Liner Material		

Filter No.	
Thimble No.	
Nozzle Diameter	Nozzle I.D.

Start Time:	Stop Time:
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Traverse Point Number	Min/pt	Velocity Head ΔP (in. H ₂ O)	Orifice Setting ΔH (in. H ₂ O)	Gas Sample Volume Init. Vol.	Stack Temp. T_s (°F)	Probe T_p (°F)	Filter T_f (°F)	Cond. Temp. T_c (°F)	DGM Inlet $T_{m in}$ (°F)	DGM Outlet $T_{m out}$ (°F)	Pump Vacuum (in. Hg)	XAD-Trap Temp. T_t	Notes
4-1	65	.68	1.6	536.29	150	248	250	59	108	107	5.0	3.4	Residual 1455
1	70	.68	1.6	540.00	150	249	250	46	109	107	5	3.4	Stimer
4-2	75	.74	1.7	543.98	150	250	250	42	113	108	6	3.4	
2	80	.74	1.7	547.84	150	250	250	42	115	108	6	3.4	
4-3	85	.56	1.3	551.29	150	249	247	44	116	109	5	3.4	
3	90	.54	1.3	554.69	150	248	249	46	118	109	5	3.4	
1-1	95	0.72	1.6	558.33	150	250	253	60	110	109	6	3.5	
1	100	0.80	1.8	562.28	150	248	248	47	109	109	6	3.5	
1-2	105	0.79	1.8	566.26	150	250	250	45	112	108	6	3.5	
2	110	0.82	1.9	570.32	150	250	252	47	113	108	6	3.4	
1-3	115	0.56	1.3	573.96	150	250	245	50	114	108	6	3.5	
3	120	0.55	1.3	577.459	150	250	251	54	114	108	6	3.5	
Total	*		18.9		1800				1353	1298			
Average									110.4583				

Circle correct bracketed units on data sheet.

* Sum of square roots.

QA/QC 16
Date 2/1



TEST LOCATION: StackUNIT: Flow ScrubberRUN: 3

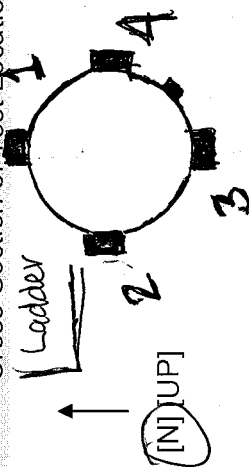
Mercury

TESTING

METHOD: D6784 PAGE 1 OF 2

FIELD DATA SHEET

Cross-Section of Test Location



Client	Martinez Petroleum	Project No.	11265
Plant	Robinson IL	Date	7-16-11
Meter Operator	H. Nguyen		
Probe Operator	B. Arnold / K. Sullivan		

Meter Box	61-5	Sample Box No.	M5
Meter Y _a	0.9992	Meter ΔH ₀	1.7185
K Factor	2.3	Pitot C _p	0.820
Leak Rate Before	0.063 cfm	@	15 (in. Hg)
Leak Rate After	0.062 cfm	@	7 (in. Hg)
Pitot Leak Check Before:	<input checked="" type="checkbox"/>	After:	Good <input checked="" type="checkbox"/> Bad <input type="checkbox"/>

Duct Dimensions (in.)	114	Gas Flow	[In] [Out]	First point all the way
Static Pres (in. H ₂ O)	-0.4	Port Len. (in.)	6	[In] [Out]

Amb. Temp. (°F)	89	Bar. Press.	29.45	(in. Hg)
Probe I.D. No.	67-4-4			
Liner Material	Glass			

Filter No.	NA			
Thimble No.	NA			
Nozzle Diameter				Nozzle I.D.

Start Time:	8:40	Stop Time:	11:07
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Traverse Point Number	Min/pt	Velocity Head ΔP (in. H ₂ O)	Orifice Setting ΔH (in. H ₂ O)	Gas Sample Volume V _m (ft ³ /L)	Stack Temp. T _s (°F)	Probe T _p (°F)	Filter T _f (°F)	Cond. Temp. T _c (°F)	DGM Inlet T _{m in} (°F)	DGM Outlet T _{m out} (°F)	Pump Vacuum (in. Hg)	XAD Trap Temp. T _{tr}	Notes
				Init. Vol.		Set Points							
4-1	5	0.78	1.8	577.800	150	250	250	66	94	93	5	3.5	
1	10	0.75	1.7	585.5	150	248	249	65	94	93	5	3.4	
4-2	15	0.71	1.6	589.38	150	250	249	66	96	94	5	3.4	
2	20	0.71	1.6	593.08	150	250	249	65	99	94	5	3.4	
4-3	25	0.53	1.2	596.38	150	250	251	65	100	95	4	3.4	
3	30	0.50	1.2	599.65	150	248	251	66	102	95	4	3.4	
1-1	35	0.67	1.5	603.30	150	249	250	59	103	96	5	3.4	
1	40	0.67	1.5	606.97	150	255	246	50	103	97	5	3.4	
1-2	45	0.64	1.5	610.60	150	251	250	50	105	97	5	3.4	
2	50	0.64	1.5	614.24	150	250	251	47	107	98	5	3.3	
1-3	55	0.50	1.2	617.56	150	250	249	47	107	99	4	3.3	
3	60	0.50	1.2	620.74	150	250	250	48	107	99	4	3.3	
Total		9.5208	17.5	86.84	3597				1217	1150			
Average		0.8063	1.4917		149.819				102.3958				

Circle correct bracketed units on data sheet.

QA/QC 16Date 8/1

Sum of square roots.

.7984

CleanAir®

ENGINEERING

Mercury TESTING
FIELD DATA SHEET

TEST LOCATION: Stack RUN: 3
UNIT: Full Stack

Amb. Temp. (°F)	Bar. Press.	[in. Hg] [mbar]
Probe I.D. No.		
Liner Material		

Filter No.	
Thimble No.	
Nozzle Diameter	Nozzle I.D.

Start Time:	Stop Time:
	<u>W05</u>

Cross-Section of Test Location

↑

[IN] [UP]

Duct Dimensions (in.)		Gas Flow	First point
Static Pres (in. H ₂ O)	Port Len. (in.)	[In] [Out]	all the way [In] [Out]
		of page	

Client	Marathon	Project No.	11265
Plant	Robinson, IL	Date	7-16-11
Meter Operator	H. Nguyen		
Probe Operator	B. Arnold / K. Sullivan		

Meter Box	Sample Box No.
Meter Y _d	Meter ΔH _@
K Factor	Pitot C _p

Leak Rate Before	[cfm] [Lpm]	@	(in. Hg)
Leak Rate After	[cfm] [Lpm]	@	(in. Hg)
Pitot Leak Check Before:	<input type="checkbox"/> After: Good <input type="checkbox"/> Bad <input type="checkbox"/>		

Traverse Point Number	Min/pt Elapsed Time	Velocity Head ΔP (in. H ₂ O)	Orifice Setting ΔH (in. H ₂ O)	Gas Sample Volume V _m Init. Vol. (ft ³) [L]	Stack Temp. T _s (°F)	Probe T _p (°F) Set Points	Filter T _f (°F)	Cond. Temp. T _c (°F)	DGM Inlet T _{min} (°F)	DGM Outlet T _{max} (°F)	Pump Vacuum (in. Hg)	Notes
2-1	65	.79	1.8	624.87	150	250	250	55	105	101	5	3.4
1	70	.79	1.8	628.70	150	249	249	54	108	101	5	3.4
2-2	75	.66	1.5	632.33	150	250	250	50	109	102	5	3.3
2	80	.66	1.5	635.92	150	247	251	47	109	102	5	3.4
2-3	85	.64	1.5	639.65	150	250	249	46	110	103	5	3.4
3	90	.63	1.4	643.28	150	248	249	45	111	103	5	3.3
3-1	95	.76	1.7	647.15	150	248	250	54	107	104	6	3.4
1	100	.76	1.7	651.02	149	249	248	54	110	105	6	3.4
3-2	105	.65	1.5	654.60	149	250	249	57	111	104	6	3.3
2	110	.65	1.5	658.18	149	249	250	47	110	104	6	3.3
3-3	115	.55	1.2	661.42	150	249	250	48	110	104	6	3.4
3	120	.54	1.2	664.640	150	249	250	49	111	104	6	3.4
Total		*9.826	18.3						1311	1237		
Average		2191										

Circle correct bracketed units on data sheet.

* Sum of square roots.



Impinger Weight Sheet

Client Marathon Petroleum Company		Unit Name/Location FCCU Scrubber Stack	
Plant Robinson Refinery	Job No. 11265	Method ASTM D6784-02	

Run No. <u>DL Field Blank</u>	Filter Type Quartz Fiber	Sample Box No. <u>M 11</u>
Date	Lot No.	pH NA
Analyst	Filter No. N/A	Rinse

	Contents	Gross Weight (gm)	Tare Weight (gm)	Net Weight Gain (gm)	
Impinger 1	100 mL 1M KCl		548.1		<div style="border: 1px solid black; padding: 2px;">QA/QC</div> <div style="border: 1px solid black; padding: 2px;">Date</div>
Impinger 2	100 mL 1M KCl		537.7		
Impinger 3	100 mL 1M KCl		569.9		
Impinger 4	100 mL 5% HNO ₃ / 10% H ₂ O ₂		537.3		
Impinger 5	100 mL 4% KMnO ₄ / 10% H ₂ SO ₄		550.2		<div style="border: 1px solid black; padding: 2px;">Total Weight (gm)</div>
Impinger 6	100 mL 4% KMnO ₄ / 10% H ₂ SO ₄		531.6		
Impinger 7	100 mL 4% KMnO ₄ / 10% H ₂ SO ₄		539.3		
Impinger 8	Silica Gel		730.4		

Run No. <u>DL 1</u>	Filter Type Quartz Fiber	Sample Box No. <u>M 5</u>
Date <u>7/15/11</u>	Lot No.	pH NA
Analyst <u>DL</u>	Filter No. N/A	Rinse

	Contents	Gross Weight (gm)	Tare Weight (gm)	Net Weight Gain (gm)	
Impinger 1	100 mL 1M KCl	821.1	533.3	287.8	<div style="border: 1px solid black; padding: 2px;">QA/QC <u>DL</u></div> <div style="border: 1px solid black; padding: 2px;">Date <u>7/15/11</u></div>
Impinger 2	100 mL 1M KCl	765.6	538.0	227.6	
Impinger 3	100 mL 1M KCl	569.4	541.5	27.9	
Impinger 4	100 mL 5% HNO ₃ / 10% H ₂ O ₂	543.3	537.2	6.1	
Impinger 5	100 mL 4% KMnO ₄ / 10% H ₂ SO ₄	541.3	541.9	-0.6	<div style="border: 1px solid black; padding: 2px;">Total Weight (gm)</div>
Impinger 6	100 mL 4% KMnO ₄ / 10% H ₂ SO ₄	552.9	548.3	4.6	
Impinger 7	100 mL 4% KMnO ₄ / 10% H ₂ SO ₄	616.6	614.7	1.9	
Impinger 8	Silica Gel	731.5	709.5	22.0	

Run No. <u>DL 2</u>	Filter Type Quartz Fiber	Sample Box No. <u>M 11</u>
Date <u>7/15/11</u>	Lot No.	pH NA
Analyst <u>DL</u>	Filter No. N/A	Rinse

	Contents	Gross Weight (gm)	Tare Weight (gm)	Net Weight Gain (gm)	
Impinger 1	100 mL 1M KCl	800.8	549.3	251.5	<div style="border: 1px solid black; padding: 2px;">QA/QC <u>DL</u></div> <div style="border: 1px solid black; padding: 2px;">Date <u>7/15/11</u></div>
Impinger 2	100 mL 1M KCl	806.5	539.7	266.8	
Impinger 3	100 mL 1M KCl	590.5	571.1	19.4	
Impinger 4	100 mL 5% HNO ₃ / 10% H ₂ O ₂	540.3	538.0	2.3	
Impinger 5	100 mL 4% KMnO ₄ / 10% H ₂ SO ₄	551.3	551.2	0.1	<div style="border: 1px solid black; padding: 2px;">Total Weight (gm)</div>
Impinger 6	100 mL 4% KMnO ₄ / 10% H ₂ SO ₄	535.2	533.8	1.4	
Impinger 7	100 mL 4% KMnO ₄ / 10% H ₂ SO ₄	541.0	540.6	0.4	
Impinger 8	Silica Gel	750.1	733.1	17.0	

Impinger Weight Sheet

Client Marathon Petroleum Company		Unit Name/Location FCCU Scrubber Stack	
Plant Robinson Refinery	Job No. 11265	Method ASTM D6784-02	

Run No. 3	Filter Type Quartz Fiber	Sample Box No. M5
Date 7/16/11	Lot No.	pH NA
Analyst DL	Filter No. N/A	Rinse

	Contents	Gross Weight (gm)	Tare Weight (gm)	Net Weight Gain (gm)	
Impinger 1	100 mL 1M KCl	846.7	800.8	534.5	312.2
Impinger 2	100 mL 1M KCl	745.7	806.5	539.4	206.3
Impinger 3	100 mL 1M KCl	556.0	590.5	542.2	13.8
Impinger 4	100 mL 5% HNO ₃ / 10% H ₂ O ₂	540.3	541.0	538.5	2.5
Impinger 5	100 mL 4% KMnO ₄ / 10% H ₂ SO ₄	551.3	540.9	540.9	0.0
Impinger 6	100 mL 4% KMnO ₄ / 10% H ₂ SO ₄	535.2	552.9	551.2	1.7
Impinger 7	100 mL 4% KMnO ₄ / 10% H ₂ SO ₄	616.1	616.3	-0.1	536.4
Impinger 8	Silica Gel	771.3	754.9	16.4	553.7

QA/QC DL
Date 7/16/11

Run No.	Filter Type Quartz Fiber	Sample Box No.
Date	Lot No.	pH NA
Analyst	Filter No. N/A	Rinse

	Contents	Gross Weight (gm)	Tare Weight (gm)	Net Weight Gain (gm)	
Impinger 1	100 mL 1M KCl				
Impinger 2	100 mL 1M KCl				
Impinger 3	100 mL 1M KCl				
Impinger 4	100 mL 5% HNO ₃ / 10% H ₂ O ₂				
Impinger 5	100 mL 4% KMnO ₄ / 10% H ₂ SO ₄				
Impinger 6	100 mL 4% KMnO ₄ / 10% H ₂ SO ₄				
Impinger 7	100 mL 4% KMnO ₄ / 10% H ₂ SO ₄				
Impinger 8	Silica Gel				

QA/QC
Date

Run No.	Filter Type Quartz Fiber	Sample Box No.
Date	Lot No.	pH NA
Analyst	Filter No. N/A	Rinse

	Contents	Gross Weight (gm)	Tare Weight (gm)	Net Weight Gain (gm)	
Impinger 1	100 mL 1M KCl				
Impinger 2	100 mL 1M KCl				
Impinger 3	100 mL 1M KCl				
Impinger 4	100 mL 5% HNO ₃ / 10% H ₂ O ₂				
Impinger 5	100 mL 4% KMnO ₄ / 10% H ₂ SO ₄				
Impinger 6	100 mL 4% KMnO ₄ / 10% H ₂ SO ₄				
Impinger 7	100 mL 4% KMnO ₄ / 10% H ₂ SO ₄				
Impinger 8	Silica Gel				

QA/QC
Date

TEST LOCATION: StackUNIT: FCU Scrubber RUN: 1Hex/Cr TESTING
FIELD DATA SHEETMETHOD: 0261 PAGE 1 OF 3

Client	MPC	Project No.	11265
Plant	Robinson	Date	7-14-11 SR
Meter Operator	J. Rooney		7-15-11
Probe Operator	B. Arnold		

Meter Box	361-7	Sample Box No.	UT
Meter Y	0.94250.9281	Meter ΔH	@ 177421.3294
K Factor	SR 2.37	Pilot C_p	0.819
Leak Rate Before	2005	[Lpm]	@ 10 (in. Hg)
Leak Rate After	2003	[Lpm]	@ 8 (in. Hg)
Pitot Leak Check Before		After: Good	<input checked="" type="checkbox"/> Bad <input type="checkbox"/>

Cross-Section of Test Location

Duct Dimensions (in.) 114

Static Pres (in. H₂O) -0.3

Port Len. (in.) 6

Gas Flow [In] [Out] of page

First point all the way [In] [Out]

Traverse Point Number	Min/pt Elapsed Time	Velocity Head ΔP (in. H ₂ O)	Orifice Setting ΔH (in. H ₂ O)	Gas Sample Volume V_m (L)	Stack Temp. T_s (°F)	Probe T_p (°F)	Filter T_f (°F)	Cond. Temp. T_c (°F)	DGM Inlet $T_{m in}$ (°F)	DGM Outlet $T_{m out}$ (°F)	Pump Vacuum (in. Hg)	XAD Trap Temp. T_t (°F)	Notes
3-1	5	0.69	1.7	5.57	149			66	92	89	2.0		602
1	10	0.65	1.6	9.00	149			67	95	90	2.0		3.6
1	15	0.70	1.7	12.62	150			67	100	90	2.0		3.5
2	20	0.69	1.7	16.29	150			67	102	92	2.0		3.4
2	25	0.68	1.7	19.95	150			67	104	93	2.0		3.4
2	30	0.71	1.7	23.60	149			67	105	94	2.0		3.5
3	35	0.55	1.3	27.30	149			66	106	95	2.0		3.5
3	40	0.55	1.3	30.53	150			66	107	96	2.0		3.5
3	45	0.62	1.5	33.74	151			67	107	97	2.0		3.5
2-1	50	0.50	1.2	36.98	150			67	104	99	1.5		leak check
1	55	0.60	1.5	40.42	150			66	104	101	2.0		3.5
1	60	0.62	1.5	43.86	150			64	106	100	2.0		3.4
2	65	0.60	1.5	47.34	151			57	107	101	2.0		3.5
Total		29.1632	58.1000	128.3100	5402				3854	3604			
Average		0.8101	1.6139	128.330	150.056				103.5833				

* Sum of square roots.

Circle correct bracketed units on data sheet.

QA/QC SRDate 7-15-11

Client	MPL	Project No.	11265
Plant	Robinson	Date	7-14-11 SA
Meter Operator	J. Rowley		7-15-11
Probe Operator	B. Arnold		
Meter Box		Sample Box No.	
Meter Y _d		Meter ΔH _@	
K Factor	2.44	Pitot C _p	
Leak Rate Before	[cfm] [Lpm] @ (in. Hg)		
Leak Rate After	[cfm] [Lpm] @ (in. Hg)		
Pitot Leak Check Before:	<input type="checkbox"/> After: Good <input type="checkbox"/> Bad <input type="checkbox"/>		

Cross-Section of Test Location

↑

[N] [UP]

Amb. Temp. (°F)	Bar. Press.	[in. Hg] [mbar]
Probe I.D. No.		
Liner Material		
Filter No.		
Thimble No.		
Nozzle Diameter		Nozzle I.D.

Traverse Point Number	Min/pt Elapsed Time	Velocity Head ΔP (in. H ₂ O)	Orifice Setting ΔH (in. H ₂ O)	Gas Sample Volume V _m (L)	Stack Temp. T _s (°F)	Probe T _p (°F)	Filter T _f (°F)	Cond. Temp. T _c (°F)	DGM Inlet T _{m in} (°F)	DGM Outlet T _{m out} (°F)	Pump Vacuum (in. Hg)	XAD Trap Temp. T _t (°F)	Notes
2	70	0.60	1.5	50.80	151			56	109	102	2.0		9002
2	75	0.60	1.5	54.29	150			57	110	102	2.5		3.5
3	80	0.55	1.3	57.56	150			58	110	102	2.0		3.5
3	85	0.55	1.3	60.80	150			59	109	102	2.0		3.6
3	90	0.55	1.3	64.01	150			59	109	102	2.0		3.6
1-1	95	0.60	1.5	67.46	150			59	103	102	2.5		3.7
1	100	0.62	1.5	70.94	150			63	107	102	2.5		3.5
1	105	0.62	1.5	74.40	151			63	108	103	2.5		3.4
2	110	0.62	1.5	77.85	151			66	108	103	2.5		3.5
2	115	0.62	1.5	81.31	150			67	110	103	2.5		3.5
2	120	0.64	1.6	84.85	150			66	110	102	2.5		3.5
3	125	0.62	1.5	88.35	150			66	110	103	2.5		3.5
3	130	0.64	1.6	91.84	151			63	110	104	2.5		3.6
Total	*												
Average													

Start Time: Stop Time:

TEST LOCATION: STACKUNIT: FLU SCHUBBER RUN: ZH_{ex}/CAT

TESTING

METHOD: 0061 PAGE 1 OF 3

FIELD DATA SHEET

Cross-Section of Test Location



Client	<u>APL</u>	Project No.	<u>11265</u>
Plant	<u>ROBINSON</u>	Date	<u>7-15-11</u>
Meter Operator	<u>J ROONEY</u>		
Probe Operator	<u>B ARNOLD</u>		

Meter Box	<u>61-7</u>	Sample Box No.	<u>N4</u>
Meter Y _d	<u>0.9827</u>	Meter ΔH _@	<u>1.8247</u>
K Factor	<u>2.47231</u>	Pitot C _p	<u>0.819</u>
Leak Rate Before	<u>0.003</u>	[Lpm] @	<u>10</u> (in. Hg)
Leak Rate After	<u>0.001</u>	[Lpm] @	<u>5</u> (in. Hg)
Pitot Leak Check Before:	<input checked="" type="checkbox"/>	After: Good	<input checked="" type="checkbox"/> Bad <input type="checkbox"/>

Duct Dimensions (in.)	<u>114</u>	Gas Flow [In] [Out]	<u>100</u>
Static Pres (in. H ₂ O)	<u>-0.3</u>	Port Len. (in.)	<u>6</u>
First point all the way			

Amb. Temp. (°F)	<u>94</u>	Bar. Press.	<u>29.40</u> (in. Hg) [mbar]
Probe I.D. No.	<u>67-4-1</u>		
Liner Material	<u>TFE</u>		

Filter No.	<u>0061-2</u>		
Thimble No.	<u>---</u>		
Nozzle Diameter	<u>0.250</u>	Nozzle I.D.	<u>250-1</u>

Start Time:	<u>14:06</u>	Stop Time:	<u>17:42</u>
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Traverse Point Number	Min/pt Elapsed Time	Velocity Head ΔP (in. H ₂ O)	Orifice Setting ΔH (in. H ₂ O)	Gas Sample Volume V _m Init. Vol. (L)	Stack Temp. T _s (°F)	Probe T _p (°F)	Filter T _f (°F)	Cond. Temp. T _c (°F)	DGM Inlet T _{m in} (°F)	DGM Outlet T _{m out} (°F)	Pump Vacuum (in. Hg)	XAD Trap Temp. T _t	Notes
1-1	5	0.67	1.5	132.170	150			66	103	103	2.0	3.6	
1	10	0.67	1.5	139.19	150			65	105	103	2.0	3.6	
1	15	0.67	1.5	142.62	150			66	108	103	2.0	3.5	
2	20	0.65	1.5	146.03	150			67	108	103	2.0	3.5	
2	25	0.65	1.5	149.39	150			67	110	103	2.0	3.5	
2	30	0.65	1.5	152.72	150			66	111	104	2.0	3.6	
3	35	0.52	1.2	156.01	150			66	111	105	2.0	3.5	
3	40	0.54	1.2	159.14	150			65	112	105	2.0	3.5	
3	45	0.52	1.2	162.21	150			62	112	106	2.0	3.5	
3-1	50	0.72	1.7	165.86	150			61	108	106	2.0	3.6	
1	55	0.72	1.7	169.55	150			60	113	108	2.5	3.7	
1	60	0.68	1.6	173.16	150			56	116	109	2.5	3.5	
2	65	0.65	1.5	176.63	152			56	115	109	2.5	3.5	
Total		*28.1565	52.8000	120.8700	5409				4089	3915			
Average		0.7821	1.4111	150.2500					111.6667				

Circle correct bracketed units on data sheet.

* Sum of square roots.

QA/QC JRDate 7-15-11CleanAir
ENGINEERING

Cross-Section of Test Location

↑

[N] [UP]

Duct Dimensions (in.)		Gas Flow	First point
Static Pres (in. H ₂ O)	Port Len. (in.)	[In] [Out]	all the way
-0.3		of page	[In] [Out]

Client	MPC	Project No.	11265
Plant	Robinson	Date	7-15-11
Meter Operator	J KOONEY		
Probe Operator	B AANOLD		

Meter Box	Sample Box No.
Meter Y _d	Meter ΔH _@
K Factor	Pitot C _p
Leak Rate Before	[cfm] [Lpm] @ (in. Hg)
Leak Rate After	[cfm] [Lpm] @ (in. Hg)
Pitot Leak Check Before:	<input type="checkbox"/> After: Good <input type="checkbox"/> Bad <input type="checkbox"/>

Amb. Temp. (°F)	Bar. Press.	[in. Hg] [mbar]
Probe I.D. No.		
Liner Material		

Filter No.	
Thimble No.	
Nozzle Diameter	Nozzle I.D.

Start Time:	Stop Time:
-------------	------------

Traverse Point Number	Min/pt Elapsed Time	Velocity Head ΔP (in. H ₂ O)	Orifice Setting ΔH (in. H ₂ O)	Gas Sample Volume V _m Init. Vol. (L)	Stack Temp. T _s (°F)	Probe T _p (°F)	Filter T _f (°F)	Cond. Temp. T _c (°F)	DGM Inlet T _{min} (°F)	DGM Outlet T _{max} (°F)	Pump Vacuum (in. Hg)	XAD Trap Temp. T _{trap}	Notes
2	70	0.68	1.6	180.21	152			59	116	110	2.5	3.5	
2	75	0.68	1.6	183.78	151			59	118	110	2.5	3.5	
3	80	0.50	1.2	186.95	150			59	117	110	2.0	3.5	
3	85	0.53	1.2	190.05	151			60	117	111	2.0	3.6	
3	90	0.60	1.4	193.35	150			61	107	111	2.5	3.6	
4-1	95	0.60	1.4	196.68	150			62	111	110	2.5	3.7	
1	100	0.62	1.4	199.99	150			57	113	110	2.5	3.7	
1	105	0.62	1.4	203.34	150			54	115	111	2.5	3.6	
2	110	0.60	1.4	206.70	150			54	116	110	2.5	3.6	
2	115	0.60	1.4	210.00	150			55	116	111	2.5	3.5	
2	120	0.65	1.5	213.31	150			55	117	111	2.5	3.6	
3	125	0.60	1.4	216.63	150			56	118	112	2.5	3.6	
3	130	0.62	1.4	219.94	150			57	118	112	2.5	3.6	
Total													
Average													

Circle correct bracketed units on data sheet.

* Sum of square roots.

QA/QC: SR
Date: 7-15-11

TEST LOCATION:

STACK

HexCR⁺

TESTING

METHOD:

PAGE

OF
3

UNIT: FCCU SCRUBBER

RUN: 2

2

FIELD DATA SHEET

Cross-Section of Test Location

[N] [UP]

Client	MPL	Project No.	11265
Plant	ROBINSON	Date	7-15-11
Meter Operator	J ADNEY		
Probe Operator	B ARNOLD		

Meter Box	Sample Box No.
Meter Y_d	Meter $\Delta H_{@}$
K Factor	Pitot C_p

Leak Rate Before	[cfm] [L-pm]	@	(in. Hg)
Leak Rate After	[cfm] [L-pm]	@	(in. Hg)
Pitot Leak Check Before: <input type="checkbox"/> After: Good <input type="checkbox"/> Bad <input type="checkbox"/>			

Amb. Temp. (°F)	Bar. Press.	[in. Hg] [mbar]
Probe I.D. No.		
Liner Material		

Filter No.	
Thimble No.	
Nozzle Diameter	Nozzle I.D.

Start Time:	Stop Time:
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[illegible]

Sum of square roots.

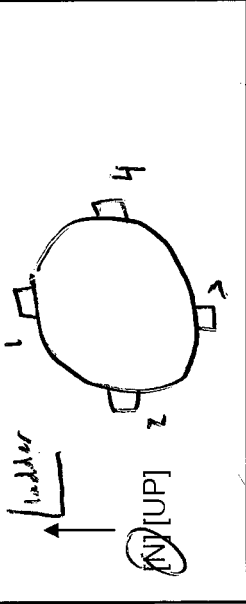
Circle correct bracketed units on data sheet.

QA/QC SRDate 7-15-11

DS005-General.xls, Feb 2002
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TESTING
FIELD DATA SHEET

Cross-Section of Test Location



Duct Dimensions (in.)	114	Gas Flow [In] [Out] of page	First point all the way
Static Pres (in. H ₂ O)	-0.4	Port Len. (in.)	6

Client	MPL	Project No.	11265
Plant	ROBINSON	Date	7-16-11
Meter Operator	J ROONEY		
Probe Operator	B ARNOLD		

Meter Box	61-7	Sample Box No.	NA
Meter Y _d	0.9827	Meter ΔH _@	1.8247
K Factor	2.37	Pitot C _p	0.819
Leak Rate Before	0.005 [Lpm]	@	10 (in. Hg)
Leak Rate After	0.010 [Lpm]	@	5 (in. Hg)
Pitot Leak Check Before:	<input checked="" type="checkbox"/> After: Good	<input checked="" type="checkbox"/> Bad	<input type="checkbox"/>

Traverse Point Number	Min/pt Elapsed Time	Velocity Head ΔP (in. H ₂ O)	Orifice Setting ΔH (in. H ₂ O)	Gas Sample Volume V _m Init. Vol.	Stack Temp. T _s (°F)	Probe T _p (°F) Set Points	Filter T _f (°F)	Cond. Temp. T _c (°F)	DGM Inlet T _{m in} (°F)	DGM Outlet T _{m out} (°F)	Pump Vacuum (in. Hg)	XAD Trap Temp. T _t (°F)	Notes
2-1	5	0.666	1.6	254.445	150	NA	NA	67	96	95	2.0	3.7	
1	10	0.66	1.6	262.13	150			60	100	96	2.0	3.7	
1	15	0.66	1.6	265.65	150			55	104	97	2.0	3.6	
2	20	0.62	1.5	269.15	150			53	106	98	2.0	3.7	
2	25	0.62	1.5	272.59	150			53	107	98	2.0	3.6	
2	30	0.65	1.6	276.09	150			53	108	99	2.0	3.6	
3	35	0.56	1.3	279.59	150			53	108	99	2.0	3.6	
3	40	0.53	1.3	283.03	150			53	109	99	2.0	3.6	
3	45	0.56	1.3	286.115	150			53	108	101	2.0	3.6	
3-1	50	0.70	1.7	289.75	150			62	103	102	2.5	3.7	
1	55	0.70	1.7	293.37	150			48	106	102	2.5	3.6	
1	60	0.70	1.7	296.96	150			45	108	102	2.5	3.6	
2	65	0.65	1.6	300.50	150			48	110	103	2.5	3.6	
Total		32.4033	53.8	124.5750	5402				3951	3738			
Average		0.9670	1.4944	150.0556					106.7917				

Circle correct bracketed units on data sheet.

QA/QC JA

Date 7-16-11

Sum of square roots.
0.7906



Cross-Section of Test Location

Client APC Project No. 11265
 Plant Robinson Date 7-16-11
 Meter Operator J Rooney
 Probe Operator B Aquino

Amb. Temp. (°F) Bar. Press. [in. Hg] [mbar]
 Probe I.D. No.
 Liner Material

Meter Box Sample Box No.
 Meter Y_d Meter ΔH_@
 K Factor 2.37 Pitot C_p
 Leak Rate Before [cfm] [Lpm] @ (in. Hg)
 Leak Rate After [cfm] [Lpm] @ (in. Hg)
 Pitot Leak Check Before: ☐ After: Good ☐ Bad ☐

Filter No.
 Thimble No.
 Nozzle Diameter Nozzle I.D.

Start Time: Stop Time:

Traverse Point Number	Min/pt	Velocity Head ΔP (in. H ₂ O)	Orifice Setting ΔH (in. H ₂ O)	Gas Sample Volume V _m (L)	Stack Temp. T _s (°F)	Probe T _p (°F)	Filter T _f (°F)	Cond. Temp. T _c (°F)	DGM Inlet T _{m in} (°F)	DGM Outlet T _{m out} (°F)	Pump Vacuum (in. Hg)	XAD Trap Temp. T _t (°F)	Notes
2	70	0.65	1.6	304.03	150			50	110	103	2.5	3.5	
2	75	0.65	1.6	307.58	150			51	110	103	2.5	3.6	
3	80	0.55	1.3	311.09	150			53	112	103	2.5	3.7	
3	85	0.55	1.3	314.60	150			54	112	103	2.5	3.6	
3	90	0.59	1.4	317.960	150			57	111	103	2.5	3.6	
1-14	95	0.67	1.6	321.49	150			67	106	104	2.5	3.7	
1	100	0.67	1.6	324.99	150			59	109	104	2.5	3.6	
1	105	0.67	1.6	328.59	150			60	111	105	2.5	3.6	
2	110	0.64	1.5	331.99	150			64	111	106	2.5	3.6	
2	115	0.64	1.5	335.46	150			60	112	106	2.5	3.5	
2	120	0.64	1.5	338.89	150			59	113	106	2.5	3.5	
3	125	0.57	1.4	342.23	150			58	114	108	2.5	3.6	
3	130	0.55	1.3	345.57	150			58	114	108	2.5	3.6	
Total		* 32.6536											
Average		2.970											

Circle correct bracketed units on data sheet.

Sum of square roots.

QA/QC JA
 Date 7-16-11

STACK

Hex/Dr

EX/CR TESTING
FIELD DATA SHEET

METHOD: 0061 PAGE 3 OF 3

UNIT: Few Schuber RUN: 3

RUN: 3

Client	MPL	Project No.	11265
Plant	ROBINSON	Date	7-16-11
Meter Operator	J Rooney		
Probe Operator	B Arnold		

Meter Box	Sample Box No.
Meter Y_d	Meter ΔH_a
\angle Factor	Pilot C_p
Leak Rate Before	[cfm] [Lpm] @ (in. Hg)
Leak Rate After	[cfm] [Lpm] @ (in. Hg)
Pilot Leak Check Before:	<input type="checkbox"/> After: Good <input type="checkbox"/> Bad <input type="checkbox"/>

Amb. Temp. (°F)	Bar. Press.	[in. Hg] [mbar]
Probe I.D. No.		
Liner Material		

Filter No.	
Thimble No.	
Nozzle Diameter	Nozzle I.D.

Start Time:	Stop Time:
-------------	------------

[illegible]

Sum of square roots.

Circle correct bracketed units on data sheet.

QA/QC JK

Date 7-16-11

Impinger Weight Sheet

Client Marathon Petroleum Company		Unit Name/Location FCCU Scrubber Stack	
Plant Robinson Refinery	Job No. 11265	Method USEPA SW-846 M-0061	

Run No. 1	Filter Type N/A	Sample Box No. <u>SP117</u>
Date <u>7/15/2011</u>	Lot No. N/A	pH <u>(2) 11.0</u>
Analyst <u>KRD</u>	Filter No. N/A	Rinse <u>100 mL</u>

	Contents	Gross Weight (gm)	Tare Weight (gm)	Net Weight Gain (gm)	
Impinger 1	140 mL 0.5M KOH	<u>632.2</u>	<u>664.6</u>	<u>-32.4</u>	
Impinger 2	80 mL 0.5M KOH	<u>663.9</u>	<u>575.3</u>	<u>88.6</u>	
Impinger 3	80 mL 0.5M KOH	<u>706.2</u>	<u>581.7</u>	<u>124.5</u>	
Impinger 4	Empty ^{weigh w/ + heavy silica gel}	<u>716.0</u>	<u>566.8</u>	<u>149.2</u>	
Impinger 5	Silica Gel ^{DL Empty}	<u>862.0</u>	<u>419.0</u>	<u>443.0</u>	QA/QC <u>7/15</u> Date <u>kw</u>
Imp. 6	Silica Gel	<u>737.8</u>	<u>728.8</u>	<u>9.0</u>	Total Weight (gm) <u>672.9</u> ⁽²⁾
	Silica Gel	<u>870.5</u>	<u>766.3</u>	<u>104.2</u>	<u>705.3</u> 672.9 <u>786.1</u>

Run No. 2	Filter Type N/A	Sample Box No. <u>M1</u>
Date <u>7/15/2011</u>	Lot No. N/A	pH <u>(2) 11.0</u>
Analyst <u>KRD</u>	Filter No. N/A	Rinse <u>100 mL</u>

	Contents	Gross Weight (gm)	Tare Weight (gm)	Net Weight Gain (gm)	
Impinger 1	140 mL 0.5M KOH	<u>694.6</u>	<u>659.3</u>	<u>35.3</u>	
Impinger 2	80 mL 0.5M KOH	<u>688.2</u>	<u>582.6</u>	<u>105.6</u>	
Impinger 3	80 mL 0.5M KOH	<u>690.9</u>	<u>581.4</u>	<u>109.5</u>	
Impinger 4	Empty	<u>728.4</u>	<u>580.6</u>	<u>147.8</u>	
Impinger 5	Silica Gel ^{DL Empty}	<u>820.0</u>	<u>436.5</u>	<u>383.5</u>	QA/QC <u>kw</u> Date <u>7/15</u>
Imp. 6	Silica Gel	<u>752.4</u>	<u>724.3</u>	<u>28.1</u>	Total Weight (gm) <u>681.7</u>
		<u>698.6</u>	<u>691.9</u>	<u>6.7</u>	<u>716.5</u>

Run No. 3	Filter Type N/A	Sample Box No. <u>M9</u>
Date <u>7/16/2011</u>	Lot No. N/A	pH
Analyst	Filter No. N/A	Rinse <u>100 mL</u>

	Contents	Gross Weight (gm)	Tare Weight (gm)	Net Weight Gain (gm)	
Impinger 1	140 mL 0.5M KOH	<u>693.5</u>	<u>660.4</u>	<u>33.1</u>	
Impinger 2	80 mL 0.5M KOH	<u>670.8</u>	<u>578.0</u>	<u>92.8</u>	
Impinger 3	80 mL 0.5M KOH	<u>703.3</u>	<u>585.4</u>	<u>117.9</u>	
Impinger 4	Empty	<u>756.1</u>	<u>576.8</u>	<u>179.3</u>	
Impinger 5	Silica Gel ^{DL Empty}	<u>1030.1</u>	<u>420.5</u>	<u>609.6</u>	QA/QC <u>kw</u> Date <u>7/15</u>
6	Silica Gel	<u>797.6</u>	<u>764.1</u>	<u>33.5</u>	Total Weight (gm) <u>750.3</u> ⁽²⁾
					<u>783.7</u> ⁽²⁾ <u>783.8</u>

TEST LOCATION: StackUNIT: FCCU Scrubber RUN: 1

TESTING

METHOD: M-26A PAGE 1 OF 2

FIELD DATA SHEET

Cross-Section of Test Location

Client	MPC	Project No.	11265
Plant	Robinson	Date	7/20/11
Meter Operator	S. DOOLEY		
Probe Operator	K. Sullivan / J. Roney		

Meter Box	85-3	Sample Box No.	
Meter Y _d	0.9925	Meter ΔH@	1.7792
K Factor	2.29	Pitot C _p	0.827
Leak Rate Before	0.03 [cfm]	[Lpm]	@ 15 [in. Hg]
Leak Rate After	0.002 [cfm]	[Lpm]	@ 24 [in. Hg]
Pitot Leak Check Before:	<input checked="" type="checkbox"/>	After:	Good <input checked="" type="checkbox"/> Bad <input type="checkbox"/>

Duct Dimensions (in.)	114	Gas Flow	[In] [Out]	First point
Static Pres.	(in. H ₂ O)	Port Len.	(in.)	all the way
-0.3	6			at the way

Amb. Temp. (°F)	100	Bar. Press.	29.30 [in. Hg]
Probe I.D. No.	66-4-7		
Liner Material	glass		

Filter No.	NA		
Thimble No.	NA		
Nozzle Diameter	0.250	Nozzle I.D.	250-2

Start Time:	9:49	Stop Time:	11:09
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Traverse Point Number	Min/pt Elapsed Time	Velocity Head ΔP (in. H ₂ O)	Orifice Setting ΔH (in. H ₂ O)	Gas Sample Volume V _m Init. Vol. [L]	Stack Temp. T _s (°F)	Probe T _p (°F)	Filter T _f (°F)	Cond. Temp. T _c (°F)	DGM Inlet T _{m in} (°F)	DGM Outlet T _{m out} (°F)	Pump Vacuum (in. Hg)	XAD Trap Temp. T _{tr} (°F)	Notes
1-1	5	0.7	1.6	748.74	147	269	284	65	101	99	5		3.7
1-1	10	0.7	1.6	752.30	147	270	273	55	104	99	5		3.6
1-2	15	0.58	1.3	755.55	147	271	273	56	106	99	5		3.7
1-2	26	0.58	1.3	758.67	147	272	272	59	107	99	5		3.6
1-3	25	0.50	1.1	761.71	147	272	274	65	111	100	5		3.5
1-3	30	0.50	1.1	764.69	147	273	273	52	113	102	5		3.6
2-1	35	0.66	1.6	767.53	147	274	273	61	107	102	12		3.6
2-1	40	0.66	1.6	771.10	147	273	273	52	103	103	12		3.5
2-2	45	0.58	1.3	773.925	147	274	273	52	116	104	24		3.5
2-2	50	0.58	1.3	778.07	147	274	280	61	108	105	5		3.5
2-3	55	0.50	1.1	781.21	147	274	279	62	110	105	5		3.5
2-3	60	0.50	1.1	784.225	147	275	276	63	119	106	5		3.5
					1764				1321	1223			
Total		18.7514	16.000	78.8360	3678.000								
Average		0.7646	1.3500	147									

Sum of square roots.

Circle correct bracketed units on data sheet.

QA/QC

Date 7/20/11

CleanAir
ENGINEERING

TEST LOCATION: StackUNIT: FCW Sanitary RUN: 1

HCL/HF

TESTING

METHOD: 26A PAGE 2 OF 2

FIELD DATA SHEET

Cross-Section of Test Location

Client	MPC	Project No.	11205
Plant	Robinson	Date	7/20/11
Meter Operator	SD		
Probe Operator	KS		

Meter Box		Sample Box No.	
Meter Y_d		Meter $\Delta H @$	
K Factor	2.29	Pitot C_p	
Leak Rate Before	[cfm] [Lpm]	@	(in. Hg)
Leak Rate After	[cfm] [Lpm]	@	(in. Hg)
Pitot Leak Check Before:	<input type="checkbox"/> After: Good <input type="checkbox"/> Bad <input type="checkbox"/>		

Amb. Temp. (°F)		Bar. Press.	[in. Hg] [mbar]
Probe I.D. No.			
Liner Material			

Filter No.			
Thimble No.			
Nozzle Diameter		Nozzle I.D.	

Start Time: Stop Time:

Duct Dimensions (in.)			Gas Flow		First point all the way [In] [Out] of page
Static Pres (in. H ₂ O)	Port Len. (in.)		[In] [Out]		



Traverse Point Number	Min/pt Elapsed Time	Velocity Head ΔP (in. H ₂ O)	Orifice Setting ΔH (in. H ₂ O)	Gas Sample Volume		Stack Temp. T_s (°F)	Probe T_p (°F)	Filter T_f (°F)	Cond. Temp. T_c (°F)	DGM Inlet $T_{m in}$ (°F)	DGM Outlet $T_{m out}$ (°F)	Pump Vacuum (in. Hg)	XAD Trap Temp. T_t (°F)	Notes
				Init. Vol.	V_m ft ³ [L]		Set Points							
3-1	65	0.70	1.6	787.85		147	274	273	63	120	108	6		3.7
3-1	70	0.70	1.6	791.44		147	274	274	62	121	108	6		3.7
3-2	75	0.55	1.3	794.78		147	275	276	60	122	108	5		3.7
3-2	80	0.55	1.3	798.04		147	275	274	52	121	109	5		3.7
3-3	85	0.47	1.1	801.08		147	276	274	54	120	109	5		3.8
3-3	90	0.47	1.1	804.093		147	276	273	54	118	109	5		3.8
4-1	95	0.70	1.6	807.64		147	279	273	60	111	108	6		3.7
4-1	100	0.70	1.6	811.06		147	275	273	60	118	108	6		3.7
4-2	105	0.60	1.4	814.55		147	276	272	62	120	109	6		3.8
4-2	110	0.60	1.4	817.83		147	276	273	62	121	109	6		3.8
4-3	115	0.51	1.2	821.12		147	276	273	65	121	109	6		
4-3	120	0.51	1.2	824.934		147	275	274	65	121	110	6		
			16.4000			1764				1434	1304			
	Total	15				1								
	Average													

* Sum of square roots.

Circle correct bracketed units on data sheet.

QA/QC: KSDate: 2/1

HA1-HF TESTING FIELD DATA SHEET

Cross-Section of Test Location

Client MPC

Project No. 11265

Plant Robinson

Date 7/20/11

Meter Operator S. Decker

Probe Operator K. Sullivan / B. Arnold

Meter Box 85-3

Sample Box No.

Meter Y_d 0.9925

Meter ΔH_0 1.7792

K Factor 2.29

Pitot C_p 0.827

Leak Rate Before 0.002 (in. Hg) @ 16 (in. Hg)

Leak Rate After 0.002 (in. Hg) @ 8 (in. Hg)

Pitot Leak Check Before: ☒ After: Good ☒ Bad ☐

Duct Dimensions (in.) 11.4

Static Pres (in. H₂O) -0.3

Port Len. (in.) 6

Gas Flow [In] [Out] of page

First point all the way [In] [Out]

Amb. Temp. (°F)

Bar. Press. 29.38 (in. Hg) [mbar]

Probe I.D. No. 66-4-7

Liner Material less

Filter No. NA

Thimble No. NA

Nozzle Diameter 0.250

Nozzle I.D. 250-3

Start Time: 12:50

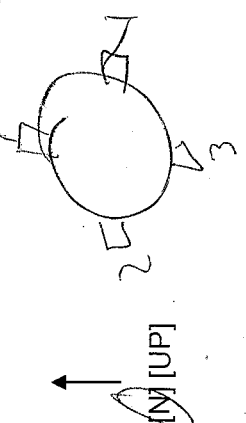
Stop Time: 16:07

Traverse Point Number	Min/pt Elapsed Time	Velocity Head ΔP (in. H ₂ O)	Orifice Setting ΔH (in. H ₂ O)	Gas Sample Volume V_m (ft ³) [L]	Stack Temp. T_s (°F)	Probe T_p (°F)		Cond. Temp. T_c (°F)	DGM Inlet $T_{m, in}$ (°F)	DGM Outlet $T_{m, out}$ (°F)	Pump Vacuum (in. Hg)	XAD Trap Temp. T_{1, O_2} (°F)	Notes
						Set	Filter T_f						
1 <u>12</u>	<u>5</u>	<u>0.65</u>	<u>1.5</u>	<u>828.32</u>	<u>147</u>	<u>270</u>	<u>270</u>	<u>65</u>	<u>112</u>	<u>108</u>	<u>5</u>	<u>3.8</u>	
<u>23</u>	<u>10</u>	<u>0.65</u>	<u>1.5</u>	<u>831.79</u>	<u>147</u>	<u>269</u>	<u>275</u>	<u>65</u>	<u>116</u>	<u>108</u>	<u>5</u>	<u>3.6</u>	
<u>24</u>	<u>15</u>	<u>0.60</u>	<u>1.4</u>	<u>835.20</u>	<u>147</u>	<u>264</u>	<u>271</u>	<u>65</u>	<u>119</u>	<u>108</u>	<u>5</u>	<u>3.5</u>	
<u>3</u>	<u>20</u>	<u>0.60</u>	<u>1.4</u>	<u>838.65</u>	<u>147</u>	<u>265</u>	<u>270</u>	<u>64</u>	<u>121</u>	<u>109</u>	<u>5</u>	<u>3.6</u>	
<u>3</u>	<u>25</u>	<u>0.50</u>	<u>1.1</u>	<u>841.80</u>	<u>147</u>	<u>265</u>	<u>267</u>	<u>63</u>	<u>123</u>	<u>110</u>	<u>5</u>	<u>3.6</u>	
<u>3</u>	<u>30</u>	<u>0.50</u>	<u>1.1</u>	<u>844.88</u>	<u>147</u>	<u>268</u>	<u>269</u>	<u>64</u>	<u>121</u>	<u>110</u>	<u>5</u>	<u>3.6</u>	
<u>1</u>	<u>35</u>	<u>0.65</u>	<u>1.5</u>	<u>848.24</u>	<u>147</u>	<u>267</u>	<u>270</u>	<u>65</u>	<u>122</u>	<u>112</u>	<u>5</u>	<u>3.6</u>	
<u>1</u>	<u>40</u>	<u>0.64</u>	<u>1.5</u>	<u>851.74</u>	<u>147</u>	<u>269</u>	<u>269</u>	<u>64</u>	<u>122</u>	<u>112</u>	<u>5</u>	<u>3.5</u>	
<u>2</u>	<u>45</u>	<u>0.57</u>	<u>1.3</u>	<u>855.04</u>	<u>147</u>	<u>267</u>	<u>272</u>	<u>51</u>	<u>122</u>	<u>111</u>	<u>5</u>	<u>3.5</u>	
<u>2</u>	<u>50</u>	<u>0.57</u>	<u>1.3</u>	<u>858.34</u>	<u>147</u>	<u>269</u>	<u>270</u>	<u>51</u>	<u>122</u>	<u>111</u>	<u>5</u>	<u>3.5</u>	
<u>3</u>	<u>55</u>	<u>0.44</u>	<u>1.0</u>	<u>861.40</u>	<u>147</u>	<u>268</u>	<u>271</u>	<u>51</u>	<u>122</u>	<u>112</u>	<u>5</u>	<u>3.5</u>	
<u>3</u>	<u>60</u>	<u>0.44</u>	<u>1.0</u>	<u>864.196</u>	<u>147</u>	<u>269</u>	<u>271</u>	<u>53</u>	<u>122</u>	<u>112</u>	<u>5</u>	<u>3.5</u>	
			<u>15.6</u>		<u>1764</u>				<u>1441.000</u>	<u>1323.000</u>			
Total		<u>18.1024</u>	<u>2.0000</u>	<u>79.950</u>									
Average		<u>0.5764</u>	<u>1.3333</u>		<u>147.500</u>								

TEST LOCATION: StackUNIT: RCW scrubber RUN: 2HCL/HF TESTING
FIELD DATA SHEETMETHOD: 26-H PAGE 2 OF 2

Client	<u>WPL</u>	Project No.	<u>11265</u>
Plant	<u>Robinson</u>	Date	<u>7/20/11</u>
Meter Operator	<u>SD</u>		
Probe Operator	<u>ICS</u>		

Meter Box	Sample Box No.
Meter Y_d	Meter $\Delta H_{@}$
K Factor <u>2.29</u>	Pitot C_p
Leak Rate Before [cfm] [Lpm] @ (in. Hg)	
Leak Rate After [cfm] [Lpm] @ (in. Hg)	
Pitot Leak Check Before: <input type="checkbox"/> After: Good <input type="checkbox"/> Bad <input type="checkbox"/>	

Cross-Section of Test Location			
			
Duct Dimensions (in.)		Gas Flow	First point
Static Pres	Port Len.	[In] [Out]	all the way
(in. H ₂ O)	(in.)	of page	[In] [Out]

Amb. Temp. (°F)	Bar. Press.	[in. Hg] [mbar]
Probe I.D. No.		
Liner Material		

Filter No.	
Thimble No.	
Nozzle Diameter	Nozzle I.D.

Start Time:	Stop Time:
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Traverse Point Number	Min/pt Elapsed Time	Velocity Head ΔP (in. H ₂ O)	Orifice Setting ΔH (in. H ₂ O)	Gas Sample Volume V_m (ft ³) [L]	Stack Temp. T_s (°F)	Probe T_p (°F)	Filter T_f (°F)	Cond. Temp. T_c (°F)	DGM Inlet $T_{m in}$ (°F)	DGM Outlet $T_{m out}$ (°F)	Pump Vacuum (in. Hg)	XAD Trap Temp. T_{1, O_2} (°F)	Notes
32 -1	65	0.67	4.65	867.81	147	268	273	65	118	113	6	3.7	
-1	70	0.67	4.65	871.43	147	269	270	60	121	113	6	3.6	
-2	75	0.59	1.4	874.97	147	267	267	51	123	113	6	3.5	
-2	80	0.59	1.4	878.39	147	269	270	53	124	114	6	3.6	
-3	85	0.52	1.2	881.54	147	270	272	55	124	114	5	3.6	
-3	90	0.52	1.2	884.67	147	270	271	56	123	114	5	3.5	
-1	95	0.64	1.5	888.12	147	269	272	61	111	111	6	3.6	
-1	100	0.64	1.5	891.64	147	270	271	60	113	111	6	3.5	
-2	105	0.60	1.4	895.06	147	269	270	54	119	112	6	3.5	
-2	110	0.60	1.4	898.42	147	269	271	55	120	112	6	3.6	
-3	115	0.52	1.2	901.57	147	270	271	57	122	113	6	3.6	
-3	120	0.52	1.2	904.71	147	270	271	59	120	112	6	3.5	
			16.400		151.01				1438	1352			
	Total	*											
	Average												

* Sum of square roots.

Circle correct bracketed units on data sheet.

QA/QC 10Date 8/1

TEST LOCATION: Stack
 UNIT: Few Scrubber RUN: 3

HC1-HF TESTING FIELD DATA SHEET

METHOD: 26-A PAGE 1 OF 2

Client	NRC		Project No.	11265
Plant	Robinson		Date	7/21/11
Meter Operator	S Dealey			
Probe Operator	J Runney / B Arnold			
Meter Box	85-3	Sample Box No.		
Meter Yd	0.9925	Meter ΔH@	1.7792	
K Factor	2.31	Pilot Cp	0.627	
Leak Rate Before	0.003 (cfm)	@	15 (in. Hg)	
Leak Rate After	0.003 (cfm)	@	7 (in. Hg)	
Pilot Leak Check Before:	<input checked="" type="checkbox"/>	After:	Good <input checked="" type="checkbox"/> Bad <input type="checkbox"/>	

Cross-Section of Test Location

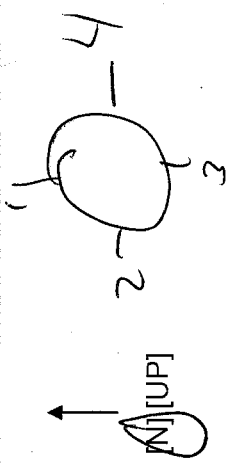
Duct Dimensions (in.)	114
Static Pres. (in. H ₂ O)	-0.5
Port Len. (in.)	6
Gas Flow (in. Hg)	114
First point at the way out	

Traverse Point Number	Min/pt Elapsed Time	Velocity Head ΔP (in. H ₂ O)	Orifice Setting ΔH (in. H ₂ O)	Gas Sample Volume V _m (ft ³ /L)	Stack Temp. T _s (°F)	Probe T _p (°F)	Filter T _f (°F)	Cond. Temp. T _c (°F)	DGM Inlet T _{m in} (°F)	DGM Outlet T _{m out} (°F)	Pump Vacuum (in. Hg)	XAD Tap Temp. (°F)	Notes
1-1	5	0.7	1.6	908.86	148	264	265	65	96	93	6	3.4	
1-1	10	0.73	1.7	912.49	150	265	272	60	98	93	6	3.4	
1-2	15	0.85	1.9	916.23	149	265	269	52	105	95	7	3.4	
1-2	20	0.76	1.7	920.06	148	266	269	52	108	96	7	3.4	
1-3	25	0.75	1.7	923.74	147	267	268	51	111	97	7	3.5	
1-3	30	0.75	1.7	927.01	147	268	268	53	110	98	5	3.5	
1-1	35	0.68	1.6	930.53	147	268	280	60	107	99	6	3.6	
1-1	40	0.65	1.5	933.99	148	268	263	58	112	99	6	3.4	
1-2	45	0.60	1.4	937.34	147	268	273	58	114	101	6	3.4	
1-2	50	0.59	1.4	940.69	147	268	270	61	114	101	6	3.5	
1-3	55	0.52	1.3	943.86	147	269	274	63	116	102	5	3.5	
1-3	60	0.48	1.1	946.99	147	269	270	48	116	103	5	3.5	
			1.1	946.89	172				1307	1177			
Total		* 14.247	1.4250	809.500	147.333				107.9167				
Average		0.7809	1.4250										

Sum of square roots.

FIELD DATA SHEET

Cross-Section of Test Location



Client	Project No. 112605
Plant	Date 7/21/11
Meter Operator	
Probe Operator	

Meter Box	Sample Box No.
Meter Y _d	Meter ΔH _@
K Factor 2.31	Pitot C _p

Leak Rate Before	[cfm] [Lpm]	@	(in. Hg)
Leak Rate After	[cfm] [Lpm]	@	(in. Hg)

Pitot Leak Check Before:	<input type="checkbox"/> After: Good	<input type="checkbox"/> Bad
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Filter No.	
Thimble No.	
Nozzle Diameter	Nozzle I.D.

Start Time:	Stop Time:
-------------	------------

Traverse Point Number	Min/pt Elapsed Time	Velocity Head ΔP (in. H ₂ O)	Orifice Setting ΔH (in. H ₂ O)	Gas Sample Volume V _m (ft ³) [L]	Stack Temp. T _s (°F)	Probe T _p (°F)	Filter T _f (°F)		Cond. Temp. T _c (°F)	DGM Inlet T _{m in} (°F)	DGM Outlet T _{m out} (°F)	Pump Vacuum (in. Hg)	XAD Trap Temp. T _f (°F)	Notes
							Set Points							
3 -1	65	0.67	1.6	950.34	147	268	270	274	46	117	104	6	3.5	
-1	70	0.64	1.5	953.83	147	268	270	268	48	118	104	6	3.5	
-2	75	0.58	1.3	957.12	147	269	270	272	50	119	105	6	3.5	
-2	80	0.58	1.3	960.32	147	269	270	270	51	119	105	6	3.5	
-3	85	0.50	1.2	963.33	147	270	270	268	59	116	105	6	3.5	
-3	90	0.50	1.2	966.35	147	270	270	270	62	116	105	6	3.5	
-1	95	0.65	1.5	970.03	147	270	270	271	65	112	105	6	3.6	96798-96826
-1	100	0.65	1.5	973.56	147	270	270	273	61	117	106	6	3.5	
-2	105	0.59	1.4	976.92	147	269	270	271	61	117	106	6	3.5	
-2	110	0.59	1.4	980.20	147	270	270	269	63	118	106	7	3.5	
-3	115	0.50	1.2	983.33	147	270	270	272	64	119	107	7	3.5	
-3	120	0.50	1.2	986.43	147	270	270	271	65	119	107	7	3.4	
			167.100							1407	1265			
Total	*													
Average														

Circle correct bracketed units on data sheet.

* Sum of square roots.

QA/QC 120

Date 8/1



Impinger Weight Sheet

Client Marathon Petroleum Company		Unit Name/Location FCCU Scrubber Stack	
Plant Robinson Refinery	Job No. 11265	Method	USEPA M-26A

Run No. 1	Filter Type TFE Mat	Sample Box No. M5
Date 7/20/11	Lot No.	pH N/A
Analyst DL	Filter No. N/A	Rinse

	Contents	Gross Weight (gm)	Tare Weight (gm)	Net Weight Gain (gm)	
Impinger 1	50 mL 0.1N H ₂ SO ₄	686.5	491.6	194.9	
Impinger 2	100 mL 0.1N H ₂ SO ₄	713.5	541.6	171.9	
Impinger 3	100 mL 0.1N H ₂ SO ₄	693.8	622.7	71.1	
Impinger 4	100 mL 0.1N NaOH	573.2	542.6	30.6	
Impinger 5	100 mL 0.1 N NaOH	568.2	559.0	9.2	Total Weight (gm)
Impinger 6	Silica Gel	744.3	721.5	22.8	477.7
					500.5

QA/QC DL
Date 7/20/11

Run No. 2	Filter Type TFE Mat	Sample Box No. M11
Date 7/20/11	Lot No.	pH N/A
Analyst DL	Filter No. N/A	Rinse

	Contents	Gross Weight (gm)	Tare Weight (gm)	Net Weight Gain (gm)	
Impinger 1	50 mL 0.1N H ₂ SO ₄ DL	826.7	782.3	44.4	
Impinger 2	100 mL 0.1N H ₂ SO ₄ DL	739.1	650.5	88.6	
Impinger 3	100 mL 0.1N H ₂ SO ₄ DL	643.9	538.1	105.8	
Impinger 4	100 mL 0.1N NaOH	566.1	563.4	2.7	
Impinger 5	100 mL 0.1 N NaOH	550.2	545.6	4.6	Total Weight (gm)
Impinger 6	Silica Gel	744.2	723.0	21.2	485.9
					507.1

QA/QC DL
Date 7/20/11

Run No. 3	Filter Type TFE Mat	Sample Box No. M5
Date 7/21/11	Lot No.	pH N/A
Analyst DL	Filter No. N/A	Rinse

	Contents	Gross Weight (gm)	Tare Weight (gm)	Net Weight Gain (gm)	
Impinger 1	50 mL 0.1N H ₂ SO ₄	873.4	493.1	380.3	
Impinger 2	100 mL 0.1N H ₂ SO ₄	645.5	543.4	102.1	
Impinger 3	100 mL 0.1N H ₂ SO ₄	638.0	625.1	12.9	
Impinger 4	100 mL 0.1N NaOH	548.9	544.8	4.1	
Impinger 5	100 mL 0.1 N NaOH	565.1	563.5	1.6	Total Weight (gm)
Impinger 6	Silica Gel	797.8	779.5	18.3	501.0
					519.3

QA/QC DL
Date 7/21/11

TEST LOCATION: STACIC

UNIT: FCCU

RUN: 1

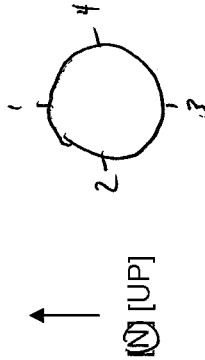
TESTING FIELD DATA SHEET

METHOD: ORM 29 PAGE 1 OF 1

Client	MRD	Project No.	11265
Plant	Robinson	Date	7/20/11
Meter Operator	B. ARNOLD		
Probe Operator	J. Peony / K. Sullivan		

Meter Box	61-7	Sample Box No.	182294
Meter Y ₀	0.9827	Meter ΔH @	1.8227
K Factor	0.7777	Pitot C _p	6.819
Leak Rate Before	0.004 [cfm]	[Lpm]	@ 15 (in. Hg)
Leak Rate After	0.001 [cfm]	[Lpm]	@ 5 (in. Hg)
Pitot Leak Check Before:	<input checked="" type="checkbox"/>	After: Good	<input checked="" type="checkbox"/> Bad <input type="checkbox"/>

Cross-Section of Test Location



Duct Dimensions (in.)	6.50-114	First point all the way
Static Pres (in. H ₂ O)	-0.3	Gas Flow [in] [out] of page
Port Len. (in.)	4	

Amb. Temp. (°F)	90	Bar. Press.	29.30 [in. Hg] [mbar]
Probe I.D. No.	67-4-1		
Liner Material	GLASS		

Filter No.	NA		
Thimble No.	NA		
Nozzle Diameter	0.233	Nozzle I.D.	233-1

Start Time:	0936	Stop Time:	1057
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Traverse Point Number	Min/pt S Elapsed Time	Velocity Head ΔP (in. H ₂ O)	Orifice Setting ΔH (in. H ₂ O)	Gas Sample Volume Init. Vol. [ft ³] [L]	Stack Temp. T _s (°F)	Probe T _p (°F)	Filter T _f (°F)	Cond. Temp. T _c (°F)	DGM Inlet T _{m in} (°F)	DGM Outlet T _{m out} (°F)	Pump Vacuum (in. Hg)	XAD Trap Temp. T _t (°F)	Notes
3-1	5	0.70	1.2	511.175	150	250	250	60	105	105	2	3.0	
2	10	0.64	1.1	514.22	150	250	249	62	105	105	2	3.0	
3	15	0.57	0.97	520.10	150	250	250	49	104	103	2	3.0	
2-1	20	0.66	1.1	523.11	151	250	250	53	105	104	2	3.7	
2	25	0.57	0.97	525.97	150	250	251	52	106	103	2	3.7	
3	30	0.45	0.70	528.50	150	250	249	53	108	104	2	3.7	
1-1	35	0.64	1.1	531.46	151	250	250	63	107	105	2	3.8	
2	40	0.60	1.0	534.35	151	250	250	60	110	105	2	3.8	
3	45	0.55	0.77	537.25	151	250	250	60	112	106	2	3.6	
4-1	50	0.63	1.1	540.21	150	250	249	59	109	106	2	3.0	
2	55	0.61	1.0	543.10	150	250	248	40	112	107	2	3.7	
3	60	0.46	0.79	546.630	151	250	250	60	112	107	2	3.0	
Total		9.1991	12.030	35.455	1205				2555				
Average		0.7400	1.0025		150.4167				102.2				

* Sum of square roots.

Circle correct bracketed units on data sheet.

QA/QC 10Date 8/1

TEST LOCATION:

STACK

TESTING

METHOD:

PAGE

OF

UNIT:

FCCV

RUN:

2

Client	MALD	Project No.	11265
Plant	Robinson	Date	7/10/11
Meter Operator	B. Atwood		VO
Probe Operator	VS/BA/HN		

Meter Box	61-7	Sample Box No.	12294
Meter Yd	0.9827	Meter ΔH@	1.8247
K Factor	1.44-1.65	Pitot Cp	0.819
Leak Rate Before	0.002 [dpm]	@	15 (in. Hg)
Leak Rate After	0.02 [dpm]	@	5 (in. Hg)
Pitot Leak Check Before:	<input checked="" type="checkbox"/> After: Good	<input type="checkbox"/> Bad	<input type="checkbox"/>

Cross-Section of Test Location



Duct Dimensions (in.)	114
Static Pres (in. H ₂ O)	-0.3
Port Len. (in.)	6
Gas Flow [In] [Out] of page	
First point all the way	

Amb. Temp. (°F)	95	Bar. Press.	29.70	[in. Hg] [mbar]
Probe I.D. No.	67-4-1			
Liner Material	GLASS			

Filter No.	N/A			
Thimble No.	N/A			
Nozzle Diameter	0.233	Nozzle I.D.	2.33	-1

Start Time:	1229	Stop Time:	1401
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Traverse Point Number	Min/pt Elapsed Time	Velocity Head ΔP (in. H ₂ O)	Orifice Setting ΔH (in. H ₂ O)	Gas Sample Volume V _m (ft ³)	Stack Temp. T _s (°F)	Probe T _p (°F)	Filter T _f (°F)	Cond. Temp. T _c (°F)	DGM Inlet T _{m in} (°F)	DGM Outlet T _{m out} (°F)	Pump Vacuum (in. Hg)	XAD Trap Temp. T _t (°F)	Notes
1-1	5	0.65	1.1	545.200	151	251	250	65	109	108	2	3.8	
2	10	0.59	0.97	551.42	151	251	250	63	109	108	2	3.7	
3	15	0.56	0.92	554.42	151	250	251	60	110	108	2	3.7	
2-1	20	0.63	1.0	557.30	151	251	250	60	111	109	2	3.7	
2	25	0.56	0.92	560.12	151	250	251	64	113	110	2	3.7	
3	30	0.52	0.84	562.423	151	250	250	62	114	110	2	3.6	
1-5	35	0.57	0.94	565.59	151	250	250	64	113	110	2	3.7	
2	40	0.55	0.90	562.34	151	250	251	58	114	110	2	3.6	
3	45	0.42	0.79	570.91	151	250	251	60	114	110	2	3.5	
3-1	50	0.64	1.1	573.95	151	250	251	63	114	112	2	3.7	
2	55	0.57	0.94	576.79	152	250	250	60	115	112	2	3.5	
3	60	0.46	0.76	579.35	152	250	250	55	116	112	2	3.5	
Total		9.0085	11.2	33.515	151.4				2670				
Average		0.7507	0.9333		151.6667				11.2500				

* Sum of square roots.

Circle correct bracketed units on data sheet.

QA/QC

60

Date

2/1

METHOD: OTM-20 PAGE 1 OF 1

Cyanide (HCN) TESTING FIELD DATA SHEET

TEST LOCATION: Stack
UNIT: FCCU RUN: 3

Cross-Section of Test Location

Duct Dimensions (in.) 114

Static Pres (in. H₂O) -0.5

Port Len. (in.) 6

Gas Flow (In/Out) of page (In/Out)

First point all the way (In/Out) (In/Out)

Client MPL Project No. 11265

Plant Robinson Date 7/24/11

Meter Operator V. Smith

Probe Operator B. Arnold

Meter Box 61-7 Sample Box No. 11265

Meter Y_a 0.9927 Meter ΔH₀ 1.0244

K Factor 1.65 Pitot C_p 0.219

Leak Rate Before 0.002 (cfm) Lpm] @ 15 (in. Hg)

Leak Rate After 0.001 (cfm) Lpm] @ 4 (in. Hg)

Pitot Leak Check Before: ☒ After: Good ☒ Bad ☐

Amb. Temp. (°F) 98 Bar. Press. 29.35 [in. Hg] [mbar]

Probe I.D. No. 67-4-1

Liner Material 6-655

Filter No. N/A

Thimble No. N/A

Nozzle Diameter 0.233 Nozzle I.D. 233-1

Start Time: 7:56 Stop Time: 9:15

Traverse Point Number	Min/pt Elapsed Time	Velocity Head ΔP (in. H ₂ O)	Orifice Setting ΔH (in. H ₂ O)	Gas Sample Volume V _m (ft ³) [L]	Stack Temp. T _s (°F)	Probe T _p (°F)	Set Points	Filter T _f (°F)	Cond. Temp. T _c (°F)	DGM Inlet T _{m in} (°F)	DGM Outlet T _{m out} (°F)	Pump Vacuum (in. Hg)	XAD Trap Temp. T _i (°F)	Notes
4-1	5	0.70	1.2	582.84	152	255	250	250	55	101	98	3	3.6	
2	10	0.65	1.1	585.92	150	246	246	261	53	103	98	3	3.6	
3	15	0.60	1.0	588.84	151	247	247	253	52	103	98	3	3.5	
2-1	20	0.70	1.2	591.97	151	249	249	258	63	105	100	3	3.6	
2	25	0.65	1.1	594.96	151	249	249	251	62	106	101	3	3.5	
3	30	0.55	0.91	597.71	151	250	250	251	65	107	101	3	3.5	
3-1	35	0.72	1.2	600.95	151	251	251	248	65	106	102	3	3.5	
2	40	0.65	1.1	603.91	151	250	250	251	59	108	103	3	3.4	
3	45	0.60	1.0	606.78	151	250	250	249	52	109	104	3	3.5	
1-1	50	0.70	1.2	609.97	151	251	251	251	57	108	103	3	3.5	
2	55	0.65	1.1	612.94	151	250	250	251	58	110	104	3	3.4	
3	60	0.60	1.0	615.865	151	251	251	251	59	111	104	3	3.4	
Total		*9.6486	13.11	36.255						1277	1216			
Average		0.8041	1.0925	157.0002						103.8750				

Circle correct bracketed units on data sheet.

QA/QC KS
Date 7/24/11

Sum of square roots.



Impinger Weight Sheet

Client Marathon Petroleum Company		Unit Name/Location FCCU Scrubber Stack	
Plant Robinson Refinery	Job No. 11265	Method USEPA OTM-29	

Run No. 1	Filter Type Quartz Fiber	Sample Box No. B13
Date 7/20/11	Lot No.	pH 13
Analyst DL	Filter No. N/A	Rinse

	Contents	Gross Weight (gm)	Tare Weight (gm)	Net Weight Gain (gm)	
Impinger 1	200 mL 6N NaOH	858.5	641.6	216.9	
Impinger 2	200 mL 6N NaOH	681.4	639.3	42.1	
Impinger 3	200 mL 6N NaOH	649.8	640.7	9.1	
Impinger 4	100 mL 6N NaOH	594.4	564.8	29.6	
Impinger 5	Silica Gel	717.7	707.2	10.5	Total Weight (gm)
					297.7
					308.2

QA/QC DL
Date 7/20/11

Run No. 2	Filter Type Quartz Fiber	Sample Box No. 24
Date 7/20/11	Lot No.	pH 14
Analyst DL	Filter No. N/A	Rinse

	Contents	Gross Weight (gm)	Tare Weight (gm)	Net Weight Gain (gm)	
Impinger 1	200 mL 6N NaOH	826.7	639.1	187.6	
Impinger 2	200 mL 6N NaOH	739.1	667.4	71.7	
Impinger 3	200 mL 6N NaOH	643.9	622.8	21.1	
Impinger 4	100 mL 6N NaOH	547.8	536.4	11.4	
Impinger 5	Silica Gel	745.7	736.2	9.5	Total Weight (gm)
					291.8
					301.3

QA/QC DL
Date 7/20/11

Run No. 3	Filter Type Quartz Fiber	Sample Box No. B13
Date 7/21/11	Lot No.	pH 13
Analyst DL	Filter No. N/A	Rinse

	Contents	Gross Weight (gm)	Tare Weight (gm)	Net Weight Gain (gm)	
Impinger 1	200 mL 6N NaOH	858.7	643.8	214.9	
Impinger 2	200 mL 6N NaOH	700.6	639.8	60.8	
Impinger 3	200 mL 6N NaOH	667.5	642.1	25.4	
Impinger 4	100 mL 6N NaOH	578.8	567.2	11.6	
Impinger 5	Silica Gel	724.4	717.5	6.9	Total Weight (gm)
					312.7
					319.6

QA/QC DL
Date 7/21/11

Instrumental O₂ / CO₂ Data

TEST LOCATION: Scrubber Stack

PAGE 1 OF 7

Client	MPC	Project Number	11265	$F_o = \frac{20.9 - \%O_2}{\%CO_2}$
Plant	Robinson	Unit	FCCU	
Asset No.	207361/207364	Fuel Type	N/A	Leak Check Passed <input checked="" type="checkbox"/>

Gas	Cylinder ID No.	Gas Concentration (%dv)	Expiration Date
Zero	K235070	0.0 / 0.0	6/26/2013 6/24/2014
O ₂ / CO ₂	ALM 9165	10.2 / 9.93	7/10/2013
O ₂ / CO ₂	ALM 20472	21.1 / 20.8	6/6/2014

Pre-Test Calibration Response

Calibration	Percent O ₂ Response	Percent CO ₂ Response
Zero	0	0
High High	21.2	20.8
Low Low	10.1	9.9

Field Data

Run Number	Method Number		Percent O ₂	Percent CO ₂	F _o	Analyst	Analysis	
							Date	Time
1	0011		3.9	13.1		KS	7/13	1617
2	0011		3.9	13.2		KS	7/13	1623

Post-Test Calibration Response

Calibration	Percent O ₂ Response	Percent CO ₂ Response
Zero	0	0
High High	10.2	10.6
Low Low	21.2	20.9

Calculate F_o to verify results.

Acceptable ranges for F_o:

Coal: Anthracite and Lignite	1.016-1.130	Gas: Natural	1.600-1.836
Bituminous	1.083-1.230	Propane	1.434-1.586
Oil: Distillate	1.260-1.413	Butane	1.405-1.553
Residual	1.210-1.370	Wood	1.000-1.120
Municipal Solid Waste	1.030-1.300	Wood Bark	1.003-1.130

Instrumental O₂ / CO₂ Data

TEST LOCATION: Scrubber Stack

PAGE 2 OF 7

Client	MPK	Project Number	11265	$F_o = \frac{20.9 - \%O_2}{\%CO_2}$
Plant	Robinson	Unit	FCCU	
Asset No.		Fuel Type	N/A	Leak Check Passed <input checked="" type="checkbox"/>

Gas	Cylinder ID No.	Gas Concentration (%dv)	Expiration Date
Zero			
O ₂ / CO ₂			
O ₂ / CO ₂			

Pre-Test Calibration Response

Calibration	Percent O ₂ Response	Percent CO ₂ Response
Zero	0.0	0.0
High	21.1	20.8
Low	10.2	10.0

Field Data

Run Number	Method Number		Percent O ₂	Percent CO ₂	Fo	Analyst	Analysis	
							Date	Time
R3	0011		4.6	12.5		ICS	7/14	151730
R4	0011		4.7	12.5		ICS	7/14	1730

Post-Test Calibration Response

Calibration	Percent O ₂ Response	Percent CO ₂ Response
Zero	0.0	0.0
High	21.1	20.8
Low	10.2	10.0

Calculate Fo to verify results.

Acceptable ranges for F_o:

Coal: Anthracite and Lignite	1.016-1.130	Gas: Natural	1.600-1.836
Bituminous	1.083-1.230	Propane	1.434-1.586
Oil: Distillate	1.260-1.413	Butane	1.405-1.553
Residual	1.210-1.370	Wood	1.000-1.120
Municipal Solid Waste	1.030-1.300	Wood Bark	1.003-1.130

Instrumental O₂ / CO₂ Data

TEST LOCATION: Scrubber Stack

PAGE 3 OF 7

Client	MPC	Project Number	11265	$F_o = \frac{20.9 - \%O_2}{\%CO_2}$
Plant	Robinson	Unit	FCCU	
Asset No.		Fuel Type	N/A	Leak Check Passed <input checked="" type="checkbox"/>

Gas	Cylinder ID No.	Gas Concentration (%dv)	Expiration Date
Zero			
O ₂ / CO ₂			
O ₂ / CO ₂			

Pre-Test Calibration Response

Calibration	Percent O ₂ Response	Percent CO ₂ Response
Zero	0.0	0.0
High	21.1	20.9
Low	10.2	10.0

Field Data

Run Number	Method Number		Percent O ₂	Percent CO ₂	Fo	Analyst	Analysis	
							Date	Time
1	6784		3.6	13.4		KRD	7/15	1531
1	0010		4.1	13.0		KRD	7/15	1536
1	0061		4.2	12.9		KRD	7/15	1542
2	6784		4.0	13.0		KRD	7/15	2107
2	0010		3.8	13.4		KRD	7/15	2111
2	0061		3.6	13.3		KRD	7/15	2115

Post-Test Calibration Response

Calibration	Percent O ₂ Response	Percent CO ₂ Response
Zero	0.0	0.1
High	21.1	20.9
Low	10.1	9.9

Calculate Fo to verify results.

Acceptable ranges for F_o:

Coal: Anthracite and Lignite	1.016-1.130	Gas: Natural	1.600-1.836
Bituminous	1.083-1.230	Propane	1.434-1.586
Oil: Distillate	1.260-1.413	Butane	1.405-1.553
Residual	1.210-1.370	Wood	1.000-1.120
Municipal Solid Waste	1.030-1.300	Wood Bark	1.003-1.130

Instrumental O₂ / CO₂ Data

TEST LOCATION: Scrubber Stack

PAGE 4 OF 7

Client	<u>MPL</u>	Project Number	<u>11265</u>	$F_o = \frac{20.9 - \%O_2}{\%CO_2}$
Plant	<u>Robinson</u>	Unit	<u>FCCU</u>	
Asset No.		Fuel Type	<u>N/A</u>	Leak Check Passed <input checked="" type="checkbox"/>

Gas	Cylinder ID No.	Gas Concentration (%dv)	Expiration Date
Zero			
O ₂ / CO ₂			
O ₂ / CO ₂			

Pre-Test Calibration Response

Calibration	Percent O ₂ Response	Percent CO ₂ Response
Zero	<u>0.0</u>	<u>0.0</u>
High	<u>21.1</u>	<u>20.8</u>
Low	<u>10.2</u>	<u>9.9</u>

Field Data

Run Number	Method Number		Percent O ₂	Percent CO ₂	Fo	Analyst	Analysis	
							Date	Time
<u>3</u>	<u>6784</u>		<u>3.5</u>	<u>13.7</u>		<u>KS</u>	<u>7/16</u>	<u>1331</u>
<u>3</u>	<u>0010</u>		<u>3.4</u>	<u>13.9</u>		<u>KS</u>	<u>7/16</u>	<u>1334</u>
<u>3</u>	<u>0061</u>		<u>3.6</u>	<u>13.5</u>		<u>KS</u>	<u>7/16</u>	<u>1338</u>

Post-Test Calibration Response

Calibration	Percent O ₂ Response	Percent CO ₂ Response
Zero	<u>0.0</u>	<u>0.0</u>
High	<u>21.1</u>	<u>20.8</u>
Low	<u>10.2</u>	<u>9.9</u>

Calculate Fo to verify results.

Acceptable ranges for F_o:

Coal: Anthracite and Lignite	1.016-1.130	Gas: Natural	1.600-1.836
Bituminous	1.083-1.230	Propane	1.434-1.586
Oil: Distillate	1.260-1.413	Butane	1.405-1.553
Residual	1.210-1.370	Wood	1.000-1.120
Municipal Solid Waste	1.030-1.300	Wood Bark	1.003-1.130

Instrumental O₂ / CO₂ Data

TEST LOCATION: Scrubber Stack

PAGE 5 OF 7

Client	<u>MPC</u>	Project Number	<u>11265</u>	$F_o = \frac{20.9 - \%O_2}{\%CO_2}$
Plant	<u>Robinson</u>	Unit	<u>FCCU</u>	
Asset No.	<u>207361/207364</u>	Fuel Type	<u>N/A</u>	Leak Check Passed <input checked="" type="checkbox"/>

Gas	Cylinder ID No.	Gas Concentration (%dv)	Expiration Date
Zero	<u>K235070</u>	<u>0.0 / 0.0</u>	<u>6/24/2014</u>
O ₂ / CO ₂	<u>ALM 9165</u>	<u>10.2 / 9.93</u>	<u>7/10/2013</u>
O ₂ / CO ₂	<u>ALM 20472</u>	<u>21.1 / 20.5</u>	<u>6/6/2014</u>

Pre-Test Calibration Response

Calibration	Percent O ₂ Response	Percent CO ₂ Response
Zero	<u>0.0</u>	<u>0.0</u>
High	<u>21.1</u>	<u>20.8</u>
Low	<u>10.1</u>	<u>10.0</u>

Field Data

Run Number	Method Number		Percent O ₂	Percent CO ₂	F _o	Analyst	Analysis	
							Date	Time
<u>1</u>	<u>29</u>		<u>3.6</u>	<u>13.6</u>		<u>KRO</u>	<u>7/19</u>	<u>1121</u>
<u>1</u>	<u>5/202</u>		<u>3.7</u>	<u>13.4</u>		<u>KRO</u>	<u>7/19</u>	<u>1129</u>
<u>1</u>	<u>LTM-027</u>		<u>3.3</u>	<u>13.8</u>		<u>KRO</u>	<u>7/19</u>	<u>1136</u>
<u>2</u>	<u>29</u>		<u>3.3</u>	<u>13.5</u>		<u>KS</u>	<u>7/19</u>	<u>1745</u>
<u>2</u>	<u>5/202</u>		<u>3.4</u>	<u>13.7</u>		<u>KRO</u>	<u>7/19</u>	<u>1437</u>
<u>2</u>	<u>LTM-027</u>		<u>3.4</u>	<u>13.6</u>		<u>KRO</u>	<u>7/19</u>	<u>1442</u>
<u>3</u>	<u>5/202</u>		<u>3.5</u>	<u>13.6</u>		<u>KS</u>	<u>7/19</u>	<u>1749</u>
<u>3</u>	<u>LTM-027</u>		<u>3.5</u>	<u>13.7</u>		<u>KS</u>	<u>7/19</u>	<u>1752</u>
<u>3</u>	<u>29</u>		<u>3.4</u>	<u>13.7</u>		<u>KS</u>	<u>7/19</u>	<u>1849</u>

Post-Test Calibration Response

Calibration	Percent O ₂ Response	Percent CO ₂ Response
Zero	<u>0.0</u>	<u>0.0</u>
High	<u>21.0</u>	<u>20.7</u>
Low	<u>10.1</u>	<u>9.9</u>

Calculate F_o to verify results.

Acceptable ranges for F_o:

Coal: Anthracite and Lignite	1.016-1.130	Gas: Natural	1.600-1.836
Bituminous	1.083-1.230	Propane	1.434-1.586
Oil: Distillate	1.260-1.413	Butane	1.405-1.553
Residual	1.210-1.370	Wood	1.000-1.120
Municipal Solid Waste	1.030-1.300	Wood Bark	1.003-1.130

Instrumental O₂ / CO₂ Data

TEST LOCATION: Scrubber Stack

PAGE 10 OF 7

Client	MPL	Project Number	11265	$F_o = \frac{20.9 - \%O_2}{\%CO_2}$
Plant	Robinson	Unit	FCCU	
Asset No.	207361/207364	Fuel Type	N/A	Leak Check Passed <input checked="" type="checkbox"/>

Gas	Cylinder ID No.	Gas Concentration (%dv)	Expiration Date
Zero	<u>Q-0</u>		
O ₂ / CO ₂			
O ₂ / CO ₂			

Pre-Test Calibration Response

Calibration	Percent O ₂ Response	Percent CO ₂ Response
Zero	0.0	0.0
High	21.1	20.8
Low	10.1	10.0

Field Data

Run Number	Method Number		Percent O ₂	Percent CO ₂	Fo	Analyst	Analysis	
							Date	Time
1	DTM-29		3.8	9.8		KRO	7/20	1100
1	26A (1/2)		4.1	13.6		KRO	7/20	1106
1	26A (2/2)		3.8	13.8		KRO	7/20	1415
1	23		3.5	14.0		KRO	7/20	1421
2	DTM-29		3.8	9.8		KRO	7/20	1426
2	26A (1/2)		3.8	9.8 13.5		KRO	7/20	1430
2	26A (2/2)		3.6	13.9		KRO	7/20	1549
2	23		3.7	13.5		KRO	7/20	1555

Post-Test Calibration Response

Calibration	Percent O ₂ Response	Percent CO ₂ Response
Zero	0.0	0.1
High	21.0	20.8
Low	10.1	10.0

Calculate Fo to verify results.

Acceptable ranges for F_o:

Coal: Anthracite and Lignite	1.016-1.130	Gas: Natural	1.600-1.836
Bituminous	1.083-1.230	Propane	1.434-1.586
Oil: Distillate	1.260-1.413	Butane	1.405-1.553
Residual	1.210-1.370	Wood	1.000-1.120
Municipal Solid Waste	1.030-1.300	Wood Bark	1.003-1.130

Instrumental O₂ / CO₂ Data

TEST LOCATION: Scrubber stack

PAGE 7 OF 7

Client	MPC	Project Number	11265	$F_o = \frac{20.9 - \%O_2}{\%CO_2}$
Plant	Robinson	Unit	FCCU	
Asset No.	207361 / 207364	Fuel Type	N/A	Leak Check Passed <input checked="" type="checkbox"/>

Gas	Cylinder ID No.	Gas Concentration (%dv)	Expiration Date
Zero			
O ₂ / CO ₂			
O ₂ / CO ₂			

Pre-Test Calibration Response

Calibration	Percent O ₂ Response	Percent CO ₂ Response
Zero	0.0	0.0
High	21.1	20.8
Low	10.2	10.0

Field Data

Run Number	Method Number		Percent O ₂	Percent CO ₂	Fo	Analyst	Analysis	
							Date	Time
3	DTM-21		3.8	9.7		KR	7/21	1129
3	26A (1/2)		3.6	13.6		KR	7/21	1132
3	26A (2/2)		3.8	13.7		KR	7/21	1136
3	23		3.5	13.8		KR	7/21	1140

Post-Test Calibration Response

Calibration	Percent O ₂ Response	Percent CO ₂ Response
Zero	0.0	0.1
High	21.1	20.8
Low	10.1	10.0

Calculate Fo to verify results.

Acceptable ranges for F_O:

Coal: Anthracite and Lignite	1.016-1.130	Gas: Natural	1.600-1.836
Bituminous	1.083-1.230	Propane	1.434-1.586
Oil: Distillate	1.260-1.413	Butane	1.405-1.553
Residual	1.210-1.370	Wood	1.000-1.120
Municipal Solid Waste	1.030-1.300	Wood Bark	1.003-1.130

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FIELD DATA PRINTOUTS

F

I hereby certify that all pages contained within this Appendix have been reviewed and, to the best of my ability, verified accurate.

QA/QC Initials: SB

Date: 9/14



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Field Data Printout

Test Method: USEPA Mod. Method 18

Analyte: VOCs

Location: FCCU Scrubber Stack

Test Run: 1A

Client: Marathon Petroleum Company

Project No: 11265

Source Area (ft²): 70.88218

Meter Operator: H. Nguyen 429

Probe Operator: H. Nguyen 429

Test Date: 7/13/11

Start Time: 09:36

Stop Time: 10:56

Leak Rate Before: 0.010 lpm @ 7 "Hg

Leak Rate After: 0.010 lpm @ 7 "Hg

Bar. Press. (in. Hg): 29.40

Static P: NA

O₂ (dry volume %): 3.9

CO₂ (dry volume %): NA

N₂+CO (dry volume %): NA

Nozzle ID No: NA

Nozzle Diameter (D_n): NA

Probe ID No: NA

Pitot C_p: NA

Pitot Leak Check: NA

Q_{std} (dscfm)¹: 131,944

H₂O (condensate, ml or gm): NA

H₂O (silica, g): NA

Actual Moisture (%): 23.6

Meter Box ID. No: MET2

Meter ΔH@: NA

Meter Y_d: 0.99670

Traverse Point	Run Time 5.0 min/read	Pitot ΔP _s (in. H ₂ O)	Sample ΔH (in. H ₂ O)	Metered (liters)	Stack T _s (°F)	Dry Gas Meter		√ΔP _s (calculated) (√in. H ₂ O)	Volume (calculated) (liters)	Isokinetics (calculated) (%)
	0.0			0.000		T _{m-in} (°F)	T _{m-out} (°F)			
1-01	5.0	NA	NA	1.242	148	84	NA	NA	1.24	NA
1-01	10.0	NA	NA	2.497	148	84	NA	NA	1.26	NA
1-01	15.0	NA	NA	3.755	148	84	NA	NA	1.26	NA
1-01	20.0	NA	NA	4.978	149	84	NA	NA	1.22	NA
1-01	25.0	NA	NA	6.252	149	85	NA	NA	1.27	NA
1-01	30.0	NA	NA	7.510	148	85	NA	NA	1.26	NA
1-01	35.0	NA	NA	8.757	148	85	NA	NA	1.25	NA
1-01	40.0	NA	NA	10.051	148	86	NA	NA	1.29	NA
1-01	45.0	NA	NA	11.257	148	86	NA	NA	1.21	NA
1-01	50.0	NA	NA	12.509	147	86	NA	NA	1.25	NA
1-01	55.0	NA	NA	13.759	147	87	NA	NA	1.25	NA
1-01	60.0	NA	NA	15.052	148	87	NA	NA	1.29	NA
1-01	65.0	NA	NA	16.255	148	87	NA	NA	1.20	NA
1-01	70.0	NA	NA	17.512	148	87	NA	NA	1.26	NA
1-01	75.0	NA	NA	18.760	148	88	NA	NA	1.25	NA
1-01	80.0	NA	NA	20.011	148	88	NA	NA	1.25	NA
Final	80.0			20.01100	148.00000	85.81250			20.01100	

Sq.Rt.ΔP

QC-Check: Field Averages

		20.0110	148.0000	85.8125
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☐ Avg. OK ☐ Avg. OK ☒ Avg. OK ☒ Avg. OK ☒ Avg. OK

¹ Data obtained from SW-846 0011, Run 1

Field Data Printout

Test Method: USEPA Mod. Method 18
Analyte: VOCs

Location: FCCU Scrubber Stack

Test Run: 1B

Client: Marathon Petroleum Company

Project No: 11265

Source Area (ft²) 70.88218

Meter Operator: H. Nguyen 429

Probe Operator: H. Nguyen 429

Test Date: 7/13/11

Start Time: 09:36

Stop Time: 10:56

Leak Rate Before: 0.010 lpm @ 7 "Hg

Leak Rate After: 0.009 lpm @ 10 "Hg

Bar. Press. (in. Hg): 29.40

Static P: NA

O₂ (dry volume %): 3.9

CO₂ (dry volume %): NA

N₂+CO (dry volume %): NA

Nozzle ID No: NA

Nozzle Diameter (D_n): NA

Probe ID No: NA

Pitot C_p: NA

Pitot Leak Check: NA

Q_{std} (dscfm)¹ 131,944

H₂O (condensate, ml or gm): NA

H₂O (silica, g): NA

Actual Moisture (%)¹: 23.6

Meter Box ID. No: MET2

Meter ΔH@: NA

Meter Y_d: 0.99500

Traverse Point	Run Time 5.0 min/read	Pitot ΔP _s (in. H ₂ O)	Sample ΔH (in. H ₂ O)	Metered (liters)	Stack T _s (°F)	Dry Gas Meter		√ΔP _s (calculated) (√in. H ₂ O)	Volume (calculated) (liters)	Isokinetics (calculated) (%)
	0.0			0.000		T _{m-in} (°F)	T _{m-out} (°F)			
1-01	5.0	NA	NA	1.270	148	85	NA	NA	1.27	NA
1-01	10.0	NA	NA	2.501	148	84	NA	NA	1.23	NA
1-01	15.0	NA	NA	3.757	148	84	NA	NA	1.26	NA
1-01	20.0	NA	NA	4.997	149	85	NA	NA	1.24	NA
1-01	25.0	NA	NA	6.262	149	85	NA	NA	1.27	NA
1-01	30.0	NA	NA	7.519	148	86	NA	NA	1.26	NA
1-01	35.0	NA	NA	8.759	148	86	NA	NA	1.24	NA
1-01	40.0	NA	NA	10.092	148	86	NA	NA	1.33	NA
1-01	45.0	NA	NA	11.258	148	87	NA	NA	1.17	NA
1-01	50.0	NA	NA	12.260	147	87	NA	NA	1.00	NA
1-01	55.0	NA	NA	13.757	147	87	NA	NA	1.50	NA
1-01	60.0	NA	NA	15.097	148	88	NA	NA	1.34	NA
1-01	65.0	NA	NA	16.260	148	88	NA	NA	1.16	NA
1-01	70.0	NA	NA	17.512	148	88	NA	NA	1.25	NA
1-01	75.0	NA	NA	18.749	148	89	NA	NA	1.24	NA
1-01	80.0	NA	NA	20.012	148	89	NA	NA	1.26	NA
Final	80.0			20.01200	148.00000		86.50000		20.01200	

Sq.Rt.ΔP

QC-Check: Field Averages

		20.0120	148.0000	86.5000
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☐ Avg. OK ☐ Avg. OK ☒ Avg. OK ☒ Avg. OK ☒ Avg. OK

¹ Oxygen data obtained from SW-846 0011, Run 1

Field Data Printout

Test Method: USEPA Mod. Method 18
Analyte: VOCs

Location: FCCU Scrubber Stack

Test Run: 2A

Client: Marathon Petroleum Company

Project No: 11265

Source Area (ft²) 70.88218

Meter Operator: H. Nguyen 429

Probe Operator: H. Nguyen 429

Test Date: 7/13/11

Start Time: 16:15

Stop Time: 17:35

Leak Rate Before: 0.010 lpm @ 10 "Hg

Leak Rate After: 0.010 lpm @ 10 "Hg

Bar. Press. (in. Hg): 29.40

Static P: NA

O₂ (dry volume %): 3.9

CO₂ (dry volume %): NA

N₂+CO (dry volume %): NA

Nozzle ID No: NA

Nozzle Diameter (D_n): NA

Probe ID No: NA

Pitot C_p: NA

Pitot Leak Check: NA

Q_{std} (dscfm)¹ 132,914

H₂O (condensate, ml or gm): NA

H₂O (silica, g): NA

Actual Moisture (%): 23.9

Meter Box ID. No: MET4

Meter ΔH@: NA

Meter Y_g: 1.00610

Traverse Point	Run Time 5.0 min/read	Pitot ΔP _s (in. H ₂ O)	Sample ΔH (in. H ₂ O)	Metered (liters)	Stack T _s (°F)	Dry Gas Meter		√ΔP _s (calculated) (√in. H ₂ O)	Volume (calculated) (liters)	Isokinetics (calculated) (%)
						T _{m-in} (°F)	T _{m-out} (°F)			
	0.0			0.000						
1-01	5.0	NA	NA	1.245	149	90	NA	NA	1.25	NA
1-01	10.0	NA	NA	2.502	149	90	NA	NA	1.26	NA
1-01	15.0	NA	NA	3.756	148	91	NA	NA	1.25	NA
1-01	20.0	NA	NA	5.012	149	91	NA	NA	1.26	NA
1-01	25.0	NA	NA	6.257	149	91	NA	NA	1.25	NA
1-01	30.0	NA	NA	7.510	149	91	NA	NA	1.25	NA
1-01	35.0	NA	NA	8.756	149	91	NA	NA	1.25	NA
1-01	40.0	NA	NA	10.050	149	91	NA	NA	1.29	NA
1-01	45.0	NA	NA	11.256	149	90	NA	NA	1.21	NA
1-01	50.0	NA	NA	12.510	149	90	NA	NA	1.25	NA
1-01	55.0	NA	NA	13.760	149	90	NA	NA	1.25	NA
1-01	60.0	NA	NA	15.012	148	90	NA	NA	1.25	NA
1-01	65.0	NA	NA	16.251	148	90	NA	NA	1.24	NA
1-01	70.0	NA	NA	17.509	149	90	NA	NA	1.26	NA
1-01	75.0	NA	NA	18.751	149	90	NA	NA	1.24	NA
1-01	80.0	NA	NA	20.010	149	90	NA	NA	1.26	NA
Final	80.0			20.01000	148.81250	90.37500			20.01000	

Sq.Rt.ΔP

QC-Check: Field Averages

		20.0100	148.8125	90.3750
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☐ Avg. OK ☐ Avg. OK ☒ Avg. OK ☒ Avg. OK ☒ Avg. OK

¹ Oxygen data obtained from SW-846 0011, Run 2

Field Data Printout

Test Method: USEPA Mod. Method 18
Analyte: VOCs

Location: FCCU Scrubber Stack

Test Run: 2B

Client: Marathon Petroleum Company

Project No: 11265

Source Area (ft²) 70.88218

Meter Operator: H. Nguyen 429

Probe Operator: H. Nguyen 429

Test Date: 7/13/11

Start Time: 16:15

Stop Time: 17:35

Leak Rate Before: 0.010 lpm @ 10 "Hg

Leak Rate After: 0.008 lpm @ 10 "Hg

Bar. Press. (in. Hg): 29.40

Static P: NA

O₂ (dry volume %): 3.9

CO₂ (dry volume %): NA

N₂+CO (dry volume %): NA

Nozzle ID No: NA

Nozzle Diameter (D_n): NA

Probe ID No: NA

Pitot C_p: NA

Pitot Leak Check: NA

Q_{std} (dscfm)¹ 132,914

H₂O (condensate, ml or gm): NA

H₂O (silica, g): NA

Actual Moisture (%): 23.9

Meter Box ID. No: MET4

Meter ΔH@: NA

Meter Y_g: 1.00550

Traverse Point	Run Time 5.0 min/read	Pitot ΔP _s (in. H ₂ O)	Sample ΔH (in. H ₂ O)	Metered (liters)	Stack T _s (°F)	Dry Gas Meter		√ΔP _s (calculated) (√in. H ₂ O)	Volume (calculated) (liters)	Isokinetics (calculated) (%)
						T _{m-in} (°F)	T _{m-out} (°F)			
1-01	5.0	NA	NA	1.257	149	91	NA	NA	1.26	NA
1-01	10.0	NA	NA	2.520	149	91	NA	NA	1.26	NA
1-01	15.0	NA	NA	3.751	148	91	NA	NA	1.23	NA
1-01	20.0	NA	NA	5.022	149	91	NA	NA	1.27	NA
1-01	25.0	NA	NA	6.260	149	90	NA	NA	1.24	NA
1-01	30.0	NA	NA	7.496	149	90	NA	NA	1.24	NA
1-01	35.0	NA	NA	8.756	149	90	NA	NA	1.26	NA
1-01	40.0	NA	NA	10.050	149	90	NA	NA	1.29	NA
1-01	45.0	NA	NA	11.255	149	90	NA	NA	1.21	NA
1-01	50.0	NA	NA	12.511	149	90	NA	NA	1.26	NA
1-01	55.0	NA	NA	13.752	149	90	NA	NA	1.24	NA
1-01	60.0	NA	NA	15.022	148	90	NA	NA	1.27	NA
1-01	65.0	NA	NA	16.255	148	90	NA	NA	1.23	NA
1-01	70.0	NA	NA	17.512	149	90	NA	NA	1.26	NA
1-01	75.0	NA	NA	18.750	149	90	NA	NA	1.24	NA
1-01	80.0	NA	NA	20.020	149	90	NA	NA	1.27	NA
Final	80.0			20.02000	148.81250	90.25000			20.02000	

Sq.Rt.ΔP

QC-Check: Field Averages

		20.0200	148.8125	90.2500
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☐ Avg. OK ☐ Avg. OK ☒ Avg. OK ☒ Avg. OK ☒ Avg. OK

¹ Oxygen data obtained from SW-846 0011, Run 2

Field Data Printout

Test Method: USEPA Mod. Method 18
Analyte: VOCs

Location: FCCU Scrubber Stack

Test Run: 3A

Client: Marathon Petroleum Company

Project No: 11265

Source Area (ft²) 70.88218

Meter Operator: H. Nguyen 429
Probe Operator: H. Nguyen 429

Test Date: 7/14/11

Start Time: 08:55

Stop Time: 10:15

Leak Rate Before: 0.010 lpm @ 10 "Hg

Leak Rate After: 0.010 lpm @ 10 "Hg

Bar. Press. (in. Hg): 29.40

Static P: NA

O₂ (dry volume %): 4.6

CO₂ (dry volume %): NA

N₂+CO (dry volume %): NA

Nozzle ID No: NA

Nozzle Diameter (D_n): NA

Probe ID No: NA

Pitot C_p: NA

Pitot Leak Check: NA

Q_{std} (dscfm)¹ 138,738

H₂O (condensate, ml or gm): NA

H₂O (silica, g): NA

Actual Moisture (%)¹: 23.7

Meter Box ID. No: MET4

Meter ΔH@: NA

Meter Y_d: 1.00610

Traverse Point	Run Time 5.0 min/read	Pitot ΔP _s (in. H ₂ O)	Sample ΔH (in. H ₂ O)	Metered (liters)	Stack T _s (°F)	Dry Gas Meter		√ΔP _s (calculated) (√in. H ₂ O)	Volume (calculated) (liters)	Isokinetics (calculated) (%)
	0.0					T _{m-in} (°F)	T _{m-out} (°F)			
1-01	5.0	NA	NA	1.312	147	78	NA	NA	1.31	NA
1-01	10.0	NA	NA	2.510	147	79	NA	NA	1.20	NA
1-01	15.0	NA	NA	3.749	147	79	NA	NA	1.24	NA
1-01	20.0	NA	NA	5.023	147	80	NA	NA	1.27	NA
1-01	25.0	NA	NA	6.252	147	80	NA	NA	1.23	NA
1-01	30.0	NA	NA	7.509	147	80	NA	NA	1.26	NA
1-01	35.0	NA	NA	8.756	147	80	NA	NA	1.25	NA
1-01	40.0	NA	NA	10.052	147	79	NA	NA	1.30	NA
1-01	45.0	NA	NA	11.252	147	79	NA	NA	1.20	NA
1-01	50.0	NA	NA	12.511	147	79	NA	NA	1.26	NA
1-01	55.0	NA	NA	13.760	147	79	NA	NA	1.25	NA
1-01	60.0	NA	NA	15.025	147	81	NA	NA	1.27	NA
1-01	65.0	NA	NA	16.257	147	81	NA	NA	1.23	NA
1-01	70.0	NA	NA	17.503	147	82	NA	NA	1.25	NA
1-01	75.0	NA	NA	18.759	147	82	NA	NA	1.26	NA
1-01	80.0	NA	NA	20.056	147	82	NA	NA	1.30	NA
Final	80.0			20.05600	147.00000	80.00000			20.05600	

Sq.Rt.ΔP

QC-Check: Field Averages

		20.0560	147.0000	80.0000
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☐ Avg. OK ☐ Avg. OK ☒ Avg. OK ☒ Avg. OK ☒ Avg. OK

¹ Oxygen data obtained from SW-846 0011, Run 3

Field Data Printout

Test Method: USEPA Mod. Method 18
Analyte: VOCs

Location: FCCU Scrubber Stack

Test Run: 3B

Client: Marathon Petroleum Company

Project No: 11265

Source Area (ft²): 70.88218

Meter Operator: H. Nguyen 429

Probe Operator: H. Nguyen 429

Test Date: 7/14/11

Start Time: 08:55

Stop Time: 10:15

Leak Rate Before: 0.010 lpm @ 10 "Hg

Leak Rate After: 0.010 lpm @ 9 "Hg

Bar. Press. (in. Hg): 29.40

Static P: NA

O₂ (dry volume %): 4.6

CO₂ (dry volume %): NA

N₂+CO (dry volume %): NA

Nozzle ID No: NA

Nozzle Diameter (D_n): NA

Probe ID No: NA

Pitot C_p: NA

Pitot Leak Check: NA

Q_{std} (dscfm)¹: 138,738

H₂O (condensate, ml or gm): NA

H₂O (silica, g): NA

Actual Moisture (%): 23.7

Meter Box ID. No: MET4

Meter ΔH@: NA

Meter Y_d: 1.00550

Traverse Point	Run Time 5.0 min/read	Pitot ΔP _s (in. H ₂ O)	Sample ΔH (in. H ₂ O)	Metered (liters)	Stack T _s (°F)	Dry Gas Meter		√ΔP _s (calculated) (√in. H ₂ O)	Volume (calculated) (liters)	Isokinetics (calculated) (%)
						T _{m-in} (°F)	T _{m-out} (°F)			
1-01	0.0	NA	NA	0.000	147	80	NA	NA	1.27	NA
1-01	5.0	NA	NA	1.270	147	80	NA	NA	1.23	NA
1-01	10.0	NA	NA	2.501	147	80	NA	NA	1.26	NA
1-01	15.0	NA	NA	3.759	147	80	NA	NA	1.33	NA
1-01	20.0	NA	NA	5.093	147	81	NA	NA	1.16	NA
1-01	25.0	NA	NA	6.255	147	81	NA	NA	1.25	NA
1-01	30.0	NA	NA	7.502	147	80	NA	NA	1.26	NA
1-01	35.0	NA	NA	8.760	147	80	NA	NA	1.27	NA
1-01	40.0	NA	NA	10.025	147	80	NA	NA	1.23	NA
1-01	45.0	NA	NA	11.259	147	80	NA	NA	1.24	NA
1-01	50.0	NA	NA	12.503	147	80	NA	NA	1.25	NA
1-01	55.0	NA	NA	13.756	147	82	NA	NA	1.28	NA
1-01	60.0	NA	NA	15.031		82	NA	NA	1.23	NA
1-01	65.0	NA	NA	16.260		83	NA	NA	1.24	NA
1-01	70.0	NA	NA	17.503		83	NA	NA	1.25	NA
1-01	75.0	NA	NA	18.754		83	NA	NA	1.28	NA
1-01	80.0	NA	NA	20.033			NA	NA		NA
Final	80.0			20.03300	147.00000	80.93750			20.03300	

Sq.Rt.ΔP

QC-Check: Field Averages

20.0330 147.0000 80.9375

☐ Avg. OK ☐ Avg. OK ☒ Avg. OK ☒ Avg. OK ☒ Avg. OK

¹ Oxygen data obtained from SW-846 0011, Run 3

Field Data Printout

Test Method: USEPA Method 18
Analyte: Methanol

Location: FCCU Scrubber Stack

Test Run: 1A

Client: Marathon Petroleum Company

Project No: 11265

Source Area (ft²): 70.88218

Meter Operator: H. Nguyen 429

Probe Operator: H. Nguyen 429

Test Date: 7/13/11

Start Time: 11:53

Stop Time: 13:13

Leak Rate Before: 0.008

Leak Rate After:

lpm @ 10 "Hg

Bar. Press. (in. Hg): 29.40

Static P: NA

O₂ (dry volume %): 3.9

CO₂ (dry volume %): NA

N₂+CO (dry volume %): NA

Nozzle ID No: NA

Nozzle Diameter (D_n): NA

Probe ID No: NA

Pitot C_p: NA

Pitot Leak Check: NA

Q_{std} (dscfm)¹ 131,944

H₂O (condensate, ml or gm): NA

H₂O (silica, g): NA

Actual Moisture (%): 23.6

Meter Box ID. No: MET-4

Meter ΔH@: NA

Meter Y_d: 1.00610

Traverse Point	Run Time 5.0 min/read	Pitot ΔP _s (in. H ₂ O)	Sample ΔH (in. H ₂ O)	Metered (liters)	Stack T _s (°F)	Dry Gas Meter T _{m-in} (°F)	T _{m-out} (°F)	√ΔP _s (calculated) (√in. H ₂ O)	Volume (calculated) (liters)	Isokinetics (calculated) (%)
	0.0			0.000						
1-01	5.0	NA	NA	1.261	148	84	NA	NA	1.26	NA
1-01	10.0	NA	NA	2.510	148	85	NA	NA	1.25	NA
1-01	15.0	NA	NA	3.743	148	86	NA	NA	1.23	NA
1-01	20.0	NA	NA	5.102	148	86	NA	NA	1.36	NA
1-01	25.0	NA	NA	6.251	148	86	NA	NA	1.15	NA
1-01	30.0	NA	NA	7.549	148	87	NA	NA	1.30	NA
1-01	35.0	NA	NA	8.755	148	86	NA	NA	1.21	NA
1-01	40.0	NA	NA	10.051	148	86	NA	NA	1.30	NA
1-01	45.0	NA	NA	11.257	147	86	NA	NA	1.21	NA
1-01	50.0	NA	NA	12.560	148	87	NA	NA	1.30	NA
1-01	55.0	NA	NA	13.749	148	86	NA	NA	1.19	NA
1-01	60.0	NA	NA	15.092	148	87	NA	NA	1.34	NA
1-01	65.0	NA	NA	16.252	148	87	NA	NA	1.16	NA
1-01	70.0	NA	NA	17.512	148	87	NA	NA	1.26	NA
1-01	75.0	NA	NA	18.760	148	89	NA	NA	1.25	NA
1-01	80.0	NA	NA	20.092	148	90	NA	NA	1.33	NA
Final	80.0			20.09200	147.93750	86.56250			20.09200	

Sq.Rt.ΔP

QC-Check: Field Averages

20.0920	147.9375	86.5625
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☐ Avg. OK ☐ Avg. OK ☒ Avg. OK ☒ Avg. OK ☒ Avg. OK

¹ Data obtained from SW-846 0011, Run 1

Field Data Printout

Test Method: USEPA Method 18

Analyte: Methanol

Location: FCCU Scrubber Stack

Test Run: 1B

Client: Marathon Petroleum Company

Project No: 11265

Source Area (ft²) 70.88218

Meter Operator: H. Nguyen 429

Probe Operator: H. Nguyen 429

Test Date: 7/13/11

Start Time: 11:53

Stop Time: 13:13

Leak Rate Before: 0.002 lpm @ 7 "Hg

Leak Rate After:

Bar. Press. (in. Hg): 29.40

Static P: NA

O₂ (dry volume %): 3.9

CO₂ (dry volume %): NA

N₂+CO (dry volume %): NA

Nozzle ID No: NA

Nozzle Diameter (D_n): NA

Probe ID No: NA

Pitot C_p: NA

Pitot Leak Check: NA

Q_{std} (dscfm)¹ 131,944

H₂O (condensate, ml or gm): NA

H₂O (silica, g): NA

Actual Moisture (%)¹: 23.6

Meter Box ID. No: MET-4

Meter ΔH@: NA

Meter Y_d: 1.00550

Traverse Point	Run Time 5.0 min/read	Pitot ΔP _s (in. H ₂ O)	Sample ΔH (in. H ₂ O)	Metered (liters)	Stack T _s (°F)	Dry Gas Meter		√ΔP _s (calculated) (√in. H ₂ O)	Volume (calculated) (liters)	Isokinetics (calculated) (%)
						T _{m-in} (°F)	T _{m-out} (°F)			
1-01	0.0	NA	NA	0.000	148	84	NA	NA	1.26	NA
1-01	5.0	NA	NA	1.262	148	85	NA	NA	1.25	NA
1-01	10.0	NA	NA	2.512	148	86	NA	NA	1.25	NA
1-01	15.0	NA	NA	3.761	148	85	NA	NA	1.26	NA
1-01	20.0	NA	NA	5.019	148	86	NA	NA	1.24	NA
1-01	25.0	NA	NA	6.257	148	86	NA	NA	1.27	NA
1-01	30.0	NA	NA	7.530	148	87	NA	NA	1.21	NA
1-01	35.0	NA	NA	8.741	148	86	NA	NA	1.31	NA
1-01	40.0	NA	NA	10.051	148	87	NA	NA	1.20	NA
1-01	45.0	NA	NA	11.255	148	87	NA	NA	1.28	NA
1-01	50.0	NA	NA	12.537	148	88	NA	NA	1.22	NA
1-01	55.0	NA	NA	13.755	148	87	NA	NA	1.35	NA
1-01	60.0	NA	NA	15.101	148	87	NA	NA	1.15	NA
1-01	65.0	NA	NA	16.255	148	87	NA	NA	1.25	NA
1-01	70.0	NA	NA	17.509	148	89	NA	NA	1.24	NA
1-01	75.0	NA	NA	18.752	148	90	NA	NA	1.31	NA
1-01	80.0	NA	NA	20.059	148			NA		NA
Final	80.0			20.05900	148.00000	86.68750			20.05900	

Sq.Rt.ΔP

QC-Check: Field Averages

		20.0590	148.0000	86.6875
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☐ Avg. OK ☐ Avg. OK ☒ Avg. OK ☒ Avg. OK ☒ Avg. OK

¹ Oxygen data obtained from SW-846 0011, Run 1

Field Data Printout

Test Method: USEPA Method 18
Analyte: Methanol

Location: FCCU Scrubber Stack

Test Run: 2A

Client: Marathon Petroleum Company

Project No: 11265

Source Area (ft²): 70.88218

Meter Operator: H. Nguyen 429

Probe Operator: H. Nguyen 429

Test Date: 7/13/11

Start Time: 14:40

Stop Time: 16:00

Leak Rate Before: 0.001 lpm @ 10 "Hg

Leak Rate After:

Bar. Press. (in. Hg): 29.40

Static P: NA

O₂ (dry volume %): 3.9

CO₂ (dry volume %): NA

N₂+CO (dry volume %): NA

Nozzle ID No: NA

Nozzle Diameter (D_n): NA

Probe ID No: NA

Pitot C_p: NA

Pitot Leak Check: NA

Q_{std} (dscfm)¹: 132,914

H₂O (condensate, ml or gm): NA

H₂O (silica, g): NA

Actual Moisture (%): 23.9

Meter Box ID. No: MET-4

Meter ΔH@: NA

Meter Y_c: 1.00610

Traverse Point	Run Time 5.0 min/read	Pitot ΔP _s (in. H ₂ O)	Sample ΔH (in. H ₂ O)	Metered (liters)	Stack T _s (°F)	Dry Gas Meter		√ΔP _s (calculated) (√in. H ₂ O)	Volume (calculated) (liters)	Isokinetics (calculated) (%)
						T _{m-in} (°F)	T _{m-out} (°F)			
1-01	5.0	NA	NA	1.255		92	NA	NA	1.25	NA
1-01	10.0	NA	NA	2.512		94	NA	NA	1.26	NA
1-01	15.0	NA	NA	3.757		93	NA	NA	1.25	NA
1-01	20.0	NA	NA	5.052		93	NA	NA	1.30	NA
1-01	25.0	NA	NA	6.257		93	NA	NA	1.21	NA
1-01	30.0	NA	NA	7.509		93	NA	NA	1.25	NA
1-01	35.0	NA	NA	8.752		94	NA	NA	1.24	NA
1-01	40.0	NA	NA	10.052		94	NA	NA	1.30	NA
1-01	45.0	NA	NA	11.256		94	NA	NA	1.20	NA
1-01	50.0	NA	NA	12.512		95	NA	NA	1.26	NA
1-01	55.0	NA	NA	13.756		93	NA	NA	1.24	NA
1-01	60.0	NA	NA	15.072		93	NA	NA	1.32	NA
1-01	65.0	NA	NA	16.259		93	NA	NA	1.19	NA
1-01	70.0	NA	NA	17.501		92	NA	NA	1.24	NA
1-01	75.0	NA	NA	18.262		92	NA	NA	0.76	NA
1-01	80.0	NA	NA	20.015		91	NA	NA	1.75	NA
Final	80.0			20.01500	N/A		93.06250		20.01500	

Sq.Rt.ΔP

QC-Check: Field Averages

20.0150 93.0625

☐ Avg. OK ☐ Avg. OK ☒ Avg. OK ☐ Avg. OK ☒ Avg. OK

¹ Oxygen data obtained from SW-846 0011, Run 2

Field Data Printout

Test Method: USEPA Method 18
Analyte: Methanol

Location: FCCU Scrubber Stack

Test Run: 2B

Client: Marathon Petroleum Company

Project No: 11265

Source Area (ft²) 70.88218

Meter Operator: H. Nguyen 429

Probe Operator: H. Nguyen 429

Test Date: 7/13/11

Start Time: 14:40

Stop Time: 16:00

Leak Rate Before: 0.001 lpm @ 10 "Hg

Leak Rate After:

Bar. Press. (in. Hg): 29.40

Static P: NA

O₂ (dry volume %): 3.9

CO₂ (dry volume %): NA

N₂+CO (dry volume %): NA

Nozzle ID No: NA

Nozzle Diameter (D_n): NA

Probe ID No: NA

Pitot C_p: NA

Pitot Leak Check: NA

Q_{std} (dscfm)¹ 132,914

H₂O (condensate, ml or gm): NA

H₂O (silica, g): NA

Actual Moisture (%)¹: 23.9

Meter Box ID. No: MET-4

Meter ΔH@: NA

Meter Y_d: 1.00550

Traverse Point	Run Time 5.0 min/read	Pitot ΔP _s (in. H ₂ O)	Sample ΔH (in. H ₂ O)	Metered (liters)	Stack T _s (°F)	Dry Gas Meter		√ΔP _s (calculated) (√in. H ₂ O)	Volume (calculated) (liters)	Isokinetics (calculated) (%)
						T _{m-in} (°F)	T _{m-out} (°F)			
1-01	5.0	NA	NA	1.249		92	NA	NA	1.25	NA
1-01	10.0	NA	NA	2.498		94	NA	NA	1.25	NA
1-01	15.0	NA	NA	3.758		94	NA	NA	1.26	NA
1-01	20.0	NA	NA	5.026		94	NA	NA	1.27	NA
1-01	25.0	NA	NA	6.260		93	NA	NA	1.23	NA
1-01	30.0	NA	NA	7.502		93	NA	NA	1.24	NA
1-01	35.0	NA	NA	8.759		94	NA	NA	1.26	NA
1-01	40.0	NA	NA	10.102		94	NA	NA	1.34	NA
1-01	45.0	NA	NA	11.259		94	NA	NA	1.16	NA
1-01	50.0	NA	NA	12.520		94	NA	NA	1.26	NA
1-01	55.0	NA	NA	13.749		93	NA	NA	1.23	NA
1-01	60.0	NA	NA	15.102		93	NA	NA	1.35	NA
1-01	65.0	NA	NA	16.248		93	NA	NA	1.15	NA
1-01	70.0	NA	NA	17.500		92	NA	NA	1.25	NA
1-01	75.0	NA	NA	18.752		91	NA	NA	1.25	NA
1-01	80.0	NA	NA	20.076		91	NA	NA	1.32	NA
Final	80.0			20.07600	N/A	93.06250			20.07600	

Sq.Rt. ΔP

QC-Check: Field Averages

		20.0760		93.0625
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☐ Avg. OK ☐ Avg. OK ☒ Avg. OK ☐ Avg. OK ☒ Avg. OK

¹ Oxygen data obtained from SW-846 0011, Run 2

Field Data Printout

Test Method: USEPA Method 18

Analyte: Methanol

Location: FCCU Scrubber Stack

Test Run: 3A

Client: Marathon Petroleum Company

Project No: 11265

Source Area (ft²): 70.88218

Meter Operator: H. Nguyen 429

Probe Operator: H. Nguyen 429

Test Date: 7/14/11

Start Time: 10:55

Stop Time: 12:15

Leak Rate Before: 0.001 lpm @ 10 "Hg

Leak Rate After:

Bar. Press. (in. Hg): 29.40

Static P: NA

O₂ (dry volume %): 4.6

CO₂ (dry volume %): NA

N₂+CO (dry volume %): NA

Nozzle ID No: NA

Nozzle Diameter (D_n): NA

Probe ID No: NA

Pitot C_p: NA

Pitot Leak Check: NA

Q_{std} (dscfm)¹: 138,738

H₂O (condensate, ml or gm): NA

H₂O (silica, g): NA

Actual Moisture (%): 23.7

Meter Box ID. No: MET-4

Meter ΔH@: NA

Meter Y_d: 1.00610

Traverse Point	Run Time 5.0 min/read	Pitot ΔP _s (in. H ₂ O)	Sample ΔH (in. H ₂ O)	Metered (liters)	Stack T _s (°F)	Dry Gas Meter		√ΔP _s (calculated) (√in. H ₂ O)	Volume (calculated) (liters)	Isokinetics (calculated) (%)
						T _{m-in} (°F)	T _{m-out} (°F)			
1-01	0.0	NA	NA	0.000	148	88	NA	NA	1.26	NA
1-01	5.0	NA	NA	1.260	148	88	NA	NA	1.25	NA
1-01	10.0	NA	NA	2.510	148	88	NA	NA	1.24	NA
1-01	15.0	NA	NA	3.751	148	88	NA	NA	1.26	NA
1-01	20.0	NA	NA	5.009	148	88	NA	NA	1.24	NA
1-01	25.0	NA	NA	6.251	148	88	NA	NA	1.25	NA
1-01	30.0	NA	NA	7.504	148	87	NA	NA	1.25	NA
1-01	35.0	NA	NA	8.752	148	87	NA	NA	1.30	NA
1-01	40.0	NA	NA	10.052	148	87	NA	NA	1.20	NA
1-01	45.0	NA	NA	11.252	148	87	NA	NA	1.26	NA
1-01	50.0	NA	NA	12.507	148	86	NA	NA	1.25	NA
1-01	55.0	NA	NA	13.755	148	87	NA	NA	1.35	NA
1-01	60.0	NA	NA	15.100	148	88	NA	NA	1.16	NA
1-01	65.0	NA	NA	16.255	148	88	NA	NA	1.25	NA
1-01	70.0	NA	NA	17.507	148	89	NA	NA	1.25	NA
1-01	75.0	NA	NA	18.753	148	90	NA	NA	1.30	NA
1-01	80.0	NA	NA	20.057	148			NA		NA
Final	80.0			20.05700	148.00000	87.75000			20.05700	

Sq.Rt.ΔP

QC-Check: Field Averages

		20.0570	148.0000	87.7500
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☐ Avg. OK ☐ Avg. OK ☒ Avg. OK ☒ Avg. OK ☒ Avg. OK

¹ Oxygen data obtained from SW-846 0011, Run 3

Field Data Printout

Test Method: USEPA Method 18
Analyte: Methanol

Location: FCCU Scrubber Stack

Test Run: 3B

Client: Marathon Petroleum Company

Project No: 11265

Source Area (ft²): 70.88218

Meter Operator: H. Nguyen 429

Probe Operator: H. Nguyen 429

Test Date: 7/14/11

Start Time: 10:55

Stop Time: 12:15

Leak Rate Before: 0.001 lpm @ 10 "Hg

Leak Rate After:

Bar. Press. (in. Hg): 29.40

Static P: NA

O₂ (dry volume %): 4.60

CO₂ (dry volume %): NA

N₂+CO (dry volume %): NA

Nozzle ID No: NA

Nozzle Diameter (D_n): NA

Probe ID No: NA

Pitot C_p: NA

Pitot Leak Check: NA

Q_{std} (dscfm)¹: 138,738

H₂O (condensate, ml or gm): NA

H₂O (silica, g): NA

Actual Moisture (%): 23.7

Meter Box ID. No: MET-4

Meter ΔH@: NA

Meter Y_d: 1.00550

Traverse Point	Run Time 5.0 min/read	Pitot ΔP _s (in. H ₂ O)	Sample ΔH (in. H ₂ O)	Metered (liters)	Stack T _s (°F)	Dry Gas Meter		√ΔP _s (calculated) (√in. H ₂ O)	Volume (calculated) (liters)	Isokinetics (calculated) (%)
						T _{m-in} (°F)	T _{m-out} (°F)			
1-01	0.0	NA	NA	0.000	148	86	NA	NA	1.26	NA
1-01	5.0	NA	NA	1.257	148	86	NA	NA	1.25	NA
1-01	10.0	NA	NA	2.508	148	87	NA	NA	1.24	NA
1-01	15.0	NA	NA	3.752	148	87	NA	NA	1.25	NA
1-01	20.0	NA	NA	5.002	148	87	NA	NA	1.26	NA
1-01	25.0	NA	NA	6.257	148	87	NA	NA	1.26	NA
1-01	30.0	NA	NA	7.521	148	87	NA	NA	1.23	NA
1-01	35.0	NA	NA	8.751	148	87	NA	NA	1.30	NA
1-01	40.0	NA	NA	10.055	148	87	NA	NA	1.20	NA
1-01	45.0	NA	NA	11.257	148	87	NA	NA	1.25	NA
1-01	50.0	NA	NA	12.510	148	87	NA	NA	1.25	NA
1-01	55.0	NA	NA	13.755	148	87	NA	NA	1.36	NA
1-01	60.0	NA	NA	15.110	148	88	NA	NA	1.14	NA
1-01	65.0	NA	NA	16.252	148	88	NA	NA	1.26	NA
1-01	70.0	NA	NA	17.510	148	89	NA	NA	1.24	NA
1-01	75.0	NA	NA	18.749	148	90	NA	NA	1.27	NA
1-01	80.0	NA	NA	20.015	148	90	NA	NA		NA
Final	80.0			20.01500	148.00000	87.50000			20.01500	

Sq.Rt.ΔP

QC-Check: Field Averages

20.0150 148.0000 87.5000

☐ Avg. OK ☐ Avg. OK ☒ Avg. OK ☒ Avg. OK ☒ Avg. OK

¹ Oxygen data obtained from SW-846 0011, Run 3

TEST LOG

Client: Marathon Petroleum Company
Project No: 11265

Run Number	Location	Method	Analyte	Date	Start Time	End Time	Notes
1	FCCU Scrubber Stack	USEPA SW-846 Method 0011	Aldehydes	07/13/11	09:55	12:02	
2	FCCU Scrubber Stack	USEPA SW-846 Method 0011	Aldehydes	07/13/11	13:16	15:36	
3	FCCU Scrubber Stack	USEPA SW-846 Method 0011	Aldehydes	07/14/11	08:56	11:09	
Matrix Spike	FCCU Scrubber Stack	USEPA SW-846 Method 0011	Aldehydes	07/14/11	11:51	14:10	

Notes:

None

090711 153150

USEPA Method 3 Laboratory Data

Location: FCCU Scrubber Stack
 Client: Marathon Petroleum Company
 Project No: 11265
 Method: EPA Method 3A
 Fuel Type: Non-Combustion
 F_o for Fuel: N/A

Test Method: USEPA SW-846 Method 0011
 Analyte: Aldehydes

Analyst: K. Sullivan
 Analyst Emp No: 579

Run Number	Trial	Percent CO ₂	Percent O ₂ +CO ₂	Percent O ₂	Percent N ₂	Dry Mol. Weight	F _o	Method of Analysis: CEM
1	1							
	2							
	3							
	Avg.							
CEM or Other Avg:		13.10000		3.90000	83.00000	30.25200	1.29771	<input type="checkbox"/> Fo value within expected range.
2	1							
	2							
	3							
	Avg.							
CEM or Other Avg:		13.20000		3.90000	82.90000	30.26800	1.28788	<input type="checkbox"/> Fo value within expected range.
3	1							
	2							
	3							
	Avg.							
CEM or Other Avg:		12.50000		4.60000	82.90000	30.18400	1.30400	<input type="checkbox"/> Fo value within expected range.
Matrix Spike	1							
	2							
	3							
	Avg.							
CEM or Other Avg:		12.50000		4.70000	82.80000	30.18800	1.29600	<input type="checkbox"/> Fo value within expected range.

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USEPA Method 4 Laboratory Data

Location: FCCU Scrubber Stack
Client: Marathon Petroleum Company
Project No: 11265

Test Method: USEPA SW-846 Method 0011

Analyte: Aldehydes

Analyst: D. Luckhard

Analyst Emp No: 568

Test Run: 1

	Contents	Gross (gm)	Tare (gm)	Net (gm)
Impinger 1	DNPH	763.1	632.9	130.2
Impinger 2	DNPH	765.1	551.9	213.2
Impinger 3	DNPH	654.5	530.2	124.3
Impinger 4	Empty	524.0	482.7	41.3
Impinger 5	Silica Gel	746.4	727.8	18.6
Impinger 6				
Impinger 7				
Impinger 8				

509.0 Liquid (gm)

Field Data Check

0.0 less rinse (gm)

509.0 Net Liquid (gm)

509.0

☒ QA/QC OK

+ 18.6 Silica Gel (gm)

18.6

☒ QA/QC OK

527.6 Total Vlc (gm)

527.6

☒ QA/QC OK

Rinse: (ml or gm)

Test Run: 2

	Contents	Gross (gm)	Tare (gm)	Net (gm)
Impinger 1	DNPH	824.3	649.9	174.4
Impinger 2	DNPH	771.9	543.9	228.0
Impinger 3	DNPH	654.2	562.7	91.5
Impinger 4	Empty	486.0	483.5	2.5
Impinger 5	Silica Gel	781.6	760.6	21.0
Impinger 6				
Impinger 7				
Impinger 8				

496.4 Liquid (gm)

Field Data Check

0.0 less rinse (gm)

496.4 Net Liquid (gm)

496.4

☒ QA/QC OK

+ 21.0 Silica Gel (gm)

21.0

☒ QA/QC OK

517.4 Total Vlc (gm)

517.4

☒ QA/QC OK

Rinse: (ml or gm)

Test Run: 3

	Contents	Gross (gm)	Tare (gm)	Net (gm)
Impinger 1	DNPH	776.1	635.6	140.5
Impinger 2	DNPH	766.4	557.0	209.4
Impinger 3	DNPH	632.0	535.1	96.9
Impinger 4	Empty	484.5	484.1	0.4
Impinger 5	Silica Gel	760.9	746.3	14.6
Impinger 6				
Impinger 7				
Impinger 8				

447.2 Liquid (gm)

Field Data Check

0.0 less rinse (gm)

447.2 Net Liquid (gm)

447.2

☒ QA/QC OK

+ 14.6 Silica Gel (gm)

14.6

☒ QA/QC OK

461.8 Total Vlc (gm)

461.8

☒ QA/QC OK

Rinse: (ml or gm)

Test Run: Matrix Spike

	Contents	Gross (gm)	Tare (gm)	Net (gm)
Impinger 1	DNPH	835.5	650.0	185.5
Impinger 2	DNPH	768.4	545.3	223.1
Impinger 3	DNPH	587.7	568.4	19.3
Impinger 4	Empty	487.2	484.7	2.5
Impinger 5	Silica Gel	798.6	781.4	17.2
Impinger 6				
Impinger 7				
Impinger 8				

430.4 Liquid (gm)

Field Data Check

0.0 less rinse (gm)

430.4 Net Liquid (gm)

430.4

☒ QA/QC OK

+ 17.2 Silica Gel (gm)

17.2

☒ QA/QC OK

447.6 Total Vlc (gm)

447.6

☒ QA/QC OK

Rinse: (ml or gm)

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Field Data Printout

Test Method: USEPA SW-846 Method 0011

Analyte: Aldehydes

Location: FCCU Scrubber Stack

Test Run: 1

Client: Marathon Petroleum Company

Project No: 11265

Source Area (ft²): 70.88218

Meter Operator: S. Dooley 593

Probe Operator: B. Arnold 770

Test Date: 7/13/11

Start Time: 09:55

Stop Time: 12:02

Leak Rate Before: 0.004 cfm @ 15 "Hg

Leak Rate After: 0.005 cfm @ 20 "Hg

Bar. Press. (in. Hg): 29.40

Static P: -0.4

O₂ (dry volume %): 3.90

CO₂ (dry volume %): 13.10

N₂+CO (dry volume %): 83.00

Nozzle ID No: 250-1

Nozzle Diameter (D_n): 0.250

Probe ID No: 66-4-7

Pitot C_p: 0.827

Pitot Leak Check: ☒ Pass ☐ Fail

H₂O (condensate, ml or gm): 509.0

H₂O (silica, g): 18.6

Actual Moisture (%): 23.63

Meter Box ID. No: 66-14

Meter ΔH@: 1.75710

Meter Y_d: 0.98820

Traverse Point	Run Time 5.0 min/read	Pitot ΔP _s (in. H ₂ O)	Sample ΔH (in. H ₂ O)	Metered (dcf)	Stack T _s (°F)	Dry Gas Meter T _{m-in} (°F)	T _{m-out} (°F)	√ΔP _s (calculated) (√in. H ₂ O)	Volume (calculated) (ft ³)	Isokinetics (calculated) (%)
	0.0			908.111						
4-01	5.0	0.65	1.68	911.760	146	90	91	0.81	3.65	103.2
4-01	10.0	0.65	1.70	915.360	147	91	91	0.81	3.60	101.8
4-02	15.0	0.60	1.40	918.870	147	92	91	0.77	3.51	103.2
4-02	20.0	0.60	1.50	922.200	147	93	91	0.77	3.33	97.8
4-03	25.0	0.58	1.50	925.650	147	96	91	0.76	3.45	102.8
4-03	30.0	0.58	1.50	929.126	146	96	92	0.76	3.48	103.4
1-01	35.0	0.66	1.70	932.730	146	96	92	0.81	3.60	100.5
1-01	40.0	0.65	1.50	936.260	146	96	92	0.81	3.53	99.2
1-02	45.0	0.61	1.40	939.640	146	96	93	0.78	3.38	97.9
1-02	50.0	0.61	1.40	943.100	146	98	93	0.78	3.46	100.1
1-03	55.0	0.44	1.00	946.000	146	99	94	0.66	2.90	98.5
1-03	60.0	0.50	1.20	949.060	146	101	94	0.71	3.06	97.3
2-01	65.0	0.69	1.60	952.460	147	100	95	0.83	3.40	92.2
2-01	70.0	0.68	1.60	956.020	147	101	96	0.82	3.56	97.1
2-02	75.0	0.58	1.30	959.490	146	101	96	0.76	3.47	102.3
2-02	80.0	0.57	1.30	962.960	147	101	96	0.75	3.47	103.3
2-03	85.0	0.47	1.10	966.100	147	103	96	0.69	3.14	102.7
2-03	90.0	0.47	1.10	969.140	146	103	96	0.69	3.04	99.4
3-01	95.0	0.52	1.20	972.270	147	103	97	0.72	3.13	97.3
3-01	100.0	0.45	1.00	975.250	147	104	98	0.67	2.98	99.3
3-02	105.0	0.55	1.30	978.390	147	104	98	0.74	3.14	94.7
3-02	110.0	0.80	1.80	982.020	147	105	98	0.89	3.63	90.9
3-03	115.0	0.80	1.80	985.600	146	104	98	0.89	3.58	89.6*
3-03	120.0	0.76	1.70	989.233	146	102	98	0.87	3.63	93.4
Final	120.0		1.42813	81.12200	146.50000		96.70833	0.77388	81.12200	

12 points sampled

Sq.Rt.ΔP

QC-Check: Field Averages

0.7739	1.4281	81.1220	146.5000	96.7053
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☒ Avg. OK ☒ Avg. OK ☒ Avg. OK ☒ Avg. OK ☒ Avg. OK

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Field Data Printout

Test Method: USEPA SW-846 Method 0011

Analyte: Aldehydes

Location: FCCU Scrubber Stack

Test Run: 2

Client: Marathon Petroleum Company

Project No: 11265

Source Area (ft²): 70.88218

Meter Operator: S. Dooley 593

Probe Operator: B. Arnold 770

Test Date: 7/13/11

Start Time: 13:16

Stop Time: 15:36

Leak Rate Before: 0.004 cfm @ 15 "Hg

Leak Rate After: 0.003 cfm @ 20 "Hg

Bar. Press. (in. Hg): 29.40

Static P: -0.4

O₂ (dry volume %): 3.90

CO₂ (dry volume %): 13.20

N₂+CO (dry volume %): 82.90

Nozzle ID No: 250-1

Nozzle Diameter (D_n): 0.250

Probe ID No: 66-4-7

Pitot C_p: 0.827

Pitot Leak Check: ☒ Pass ☐ Fail

H₂O (condensate, ml or gm): 496.4

H₂O (silica, g): 21.0

Actual Moisture (%): 23.90

Meter Box ID. No: 66-14

Meter ΔH@: 1.75710

Meter Y_d: 0.98820

Traverse Point	Run Time 5.0 min/read	Pitot ΔP _s (in. H ₂ O)	Sample ΔH (in. H ₂ O)	Metered (dcf)	Stack T _s (°F)	Dry Gas Meter		√ΔP _s (calculated) (√in. H ₂ O)	Volume (calculated) (ft ³)	Isokinetics (calculated) (%)
						T _{m-in} (°F)	T _{m-out} (°F)			
3-01	5.0	0.75	1.70	993.370	147	100	98	0.87	3.36	87.5*
3-01	10.0	0.75	1.70	996.980	146	102	98	0.87	3.61	93.8
3-02	15.0	0.70	1.60	1000.430	147	104	98	0.84	3.45	92.6
3-02	20.0	0.68	1.50	1003.920	147	105	99	0.82	3.49	94.9
3-03	25.0	0.53	1.20	1007.140	147	107	100	0.73	3.22	98.8
3-03	30.0	0.59	1.40	1010.468	147	108	101	0.77	3.33	96.7
2-01	35.0	0.71	1.60	1014.070	147	107	101	0.84	3.60	95.5
2-01	40.0	0.70	1.60	1017.620	147	109	102	0.84	3.55	94.6
2-02	45.0	0.62	1.40	1020.980	147	110	102	0.79	3.36	95.0
2-02	50.0	0.62	1.40	1024.350	147	111	102	0.79	3.37	95.2
2-03	55.0	0.53	1.20	1027.610	147	111	103	0.73	3.26	99.4
2-03	60.0	0.39	0.90	1030.575	147	111	103	0.62	2.97	105.4
1-01	65.0	0.68	1.60	1034.030	147	109	102	0.82	3.45	93.4
1-01	70.0	0.68	1.60	1037.600	147	112	104	0.82	3.57	96.1
1-02	75.0	0.64	1.50	1041.080	147	112	104	0.80	3.48	96.5
1-02	80.0	0.64	1.50	1044.570	147	113	104	0.80	3.49	96.7
1-03	85.0	0.57	1.30	1047.770	147	113	104	0.75	3.20	93.9
1-03	90.0	0.43	1.00	1050.801	147	111	104	0.66	3.03	102.5
4-01	95.0	0.65	1.50	1054.100	147	110	105	0.81	3.30	90.9
4-01	100.0	0.65	1.50	1057.370	147	114	107	0.81	3.27	89.6*
4-02	105.0	0.67	1.50	1060.680	147	108	105	0.82	3.31	89.9*
4-02	110.0	0.67	1.50	1063.940	147	109	106	0.82	3.26	88.4*
4-03	115.0	0.46	1.10	1067.060	147	110	106	0.68	3.12	101.9
4-03	120.0	0.48	1.10	1070.145	147	112	107	0.69	3.09	98.4
Final	120.0		1.41250	80.13600	146.95833	105.89583		0.78236	80.13600	

12 points sampled
QC-Check: Field Averages

Sq.Rt.ΔP				
0.7824	1.4125	80.1360	146.9583	105.8958

☒ Avg. OK ☒ Avg. OK ☒ Avg. OK ☒ Avg. OK ☒ Avg. OK

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Field Data Printout

Test Method: USEPA SW-846 Method 0011

Analyte: Aldehydes

Location: FCCU Scrubber Stack

Test Run: 3

Client: Marathon Petroleum Company

Project No: 11265

Source Area (ft²): 70.88218

Meter Operator: S. Dooley 593

Probe Operator: B. Arnold 770

Test Date: 7/14/11

Start Time: 08:56

Stop Time: 11:09

Leak Rate Before: 0.002 cfm

Leak Rate After: 0.003 cfm

@ 15 "Hg

@ 17 "Hg

Bar. Press. (in. Hg): 29.40

Static P: -0.5

O₂ (dry volume %): 4.60

CO₂ (dry volume %): 12.50

N₂+CO (dry volume %): 82.90

Nozzle ID No: 233-1

Nozzle Diameter (D_n): 0.233

Probe ID No: 66-4-7

Pitot C_p: 0.827

Pitot Leak Check: ☒ Pass ☐ Fail

H₂O (condensate, ml or gm): 447.2

H₂O (silica, g): 14.6

Actual Moisture (%): 23.66

Meter Box ID. No: 66-14

Meter ΔH@: 1.75710

Meter Y_d: 0.98820

Traverse Point	Run Time 5.0 min/read	Pitot ΔP _s (in. H ₂ O)	Sample ΔH (in. H ₂ O)	Metered (dcf)	Stack T _s (°F)	Dry Gas Meter		√ΔP _s (calculated) (√in. H ₂ O)	Volume (calculated) (ft ³)	Isokinetics (calculated) (%)
						T _{m-in} (°F)	T _{m-out} (°F)			
4-01	0.0	0.77	1.30	71.413	147	86	85	0.88	2.76	83.2*
4-01	5.0	0.75	1.30	74.170	146	86	85	0.87	3.18	97.2
4-02	10.0	0.69	1.20	77.350	146	88	85	0.83	3.12	99.2
4-02	15.0	0.69	1.20	80.470	146	90	86	0.83	3.08	97.6
4-03	20.0	0.52	0.91	83.550	146	93	87	0.72	2.74	99.6
4-03	25.0	0.52	0.91	86.290	146	94	87	0.72	2.74	99.6
1-01	30.0	0.75	1.30	89.033	146	96	89	0.87	3.12	94.0
1-01	35.0	0.74	1.30	92.150	146	97	89	0.86	3.21	97.4
1-02	40.0	0.69	1.20	95.360	146	98	90	0.83	3.12	97.9
1-02	45.0	0.69	1.20	98.480	147	99	90	0.83	3.09	96.9
1-03	50.0	0.53	0.92	101.570	147	99	91	0.73	2.76	98.6
1-03	55.0	0.53	0.92	104.330	146	100	91	0.73	2.75	97.9
2-01	60.0	0.74	1.30	107.075	146	98	93	0.86	3.18	96.0
2-01	65.0	0.74	1.30	110.250	147	100	93	0.86	3.23	97.5
2-02	70.0	0.66	1.10	113.480	147	102	94	0.81	3.00	95.5
2-02	75.0	0.67	1.20	116.480	147	102	94	0.82	3.11	98.3
2-03	80.0	0.60	1.00	119.590	147	104	95	0.77	2.93	97.6
2-03	85.0	0.58	1.00	122.520	147	104	95	0.76	2.89	97.7
3-01	90.0	0.75	1.30	125.405	147	101	96	0.87	3.23	96.6
3-01	95.0	0.77	1.30	128.640	147	106	100	0.88	3.30	96.5
3-02	100.0	0.69	1.20	131.940	147	104	97	0.83	3.16	98.0
3-02	105.0	0.65	1.10	135.100	146	105	97	0.81	3.02	96.3
3-03	110.0	0.63	1.10	138.120	146	105	97	0.79	2.99	96.9
3-03	115.0	0.59	1.00	141.110	146	105	98	0.77	2.90	97.0
3-03	120.0			144.010	146					
Final	120.0		1.14833	72.59700	146.54167	95.12500		0.81335	72.59700	

12 points sampled

Sq.Rt.ΔP

QC-Check: Field Averages

0.8134	1.1483	72.5970	146.5417	95.1250
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☒ Avg. OK ☒ Avg. OK ☒ Avg. OK ☒ Avg. OK ☒ Avg. OK

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Field Data Printout

Test Method: USEPA SW-846 Method 0011

Analyte: Aldehydes

Location: FCCU Scrubber Stack

Test Run: Matrix Spike

Client: Marathon Petroleum Company

Project No: 11265

Source Area (ft²): 70.88218

Meter Operator: S. Dooley 593

Probe Operator: B. Arnold 770

Test Date: 7/14/11

Start Time: 11:51

Stop Time: 14:10

Leak Rate Before: 0.005 cfm @ 18 "Hg

Leak Rate After: 0.003 cfm @ 20 "Hg

Bar. Press. (in. Hg): 29.40

Static P: -0.4

O₂ (dry volume %): 4.70

CO₂ (dry volume %): 12.50

N₂+CO (dry volume %): 82.80

Nozzle ID No: 233-1

Nozzle Diameter (D_n): 0.233

Probe ID No: 66-4-7

Pitot C_p: 0.827

Pitot Leak Check: ☒ Pass ☐ Fail

H₂O (condensate, ml or gm): 430.4

H₂O (silica, g): 17.2

Actual Moisture (%): 23.58

Meter Box ID. No: 66-14

Meter ΔH@: 1.75710

Meter Y_d: 0.98820

Traverse Point	Run Time 5.0 min/read	Pitot ΔP _s (in. H ₂ O)	Sample ΔH (in. H ₂ O)	Metered (dcf)	Stack T _s (°F)	Dry Gas Meter		√ΔP _s (calculated) (√in. H ₂ O)	Volume (calculated) (ft ³)	Isokinetics (calculated) (%)
						T _{m-in} (°F)	T _{m-out} (°F)			
3-01	5.0	0.77	1.30	147.900	146	96	97	0.88	3.18	93.8
3-01	10.0	0.74	1.30	151.060	146	98	96	0.86	3.16	95.1
3-02	15.0	0.67	1.20	154.140	146	98	96	0.82	3.08	97.4
3-02	20.0	0.67	1.20	157.220	146	98	95	0.82	3.08	97.5
3-03	25.0	0.55	0.96	160.100	146	98	95	0.74	2.88	100.5
3-03	30.0	0.40	0.70	162.682	146	100	95	0.63	2.58	105.4
2-01	35.0	0.73	1.30	165.720	146	102	97	0.85	3.04	91.6
2-01	40.0	0.71	1.30	168.850	146	104	98	0.84	3.13	95.5
2-02	45.0	0.65	1.10	171.990	146	103	98	0.81	3.14	100.1
2-02	50.0	0.65	1.10	175.000	146	104	98	0.81	3.01	95.9
2-03	55.0	0.53	0.93	177.830	146	105	99	0.73	2.83	99.6
2-03	60.0	0.45	0.78	180.360	146	106	99	0.67	2.53	96.6
1-01	65.0	0.70	1.20	183.380	146	103	100	0.84	3.02	92.7
1-01	70.0	0.70	1.20	186.570	147	105	100	0.84	3.19	97.8
1-02	75.0	0.65	1.10	189.590	147	105	101	0.81	3.02	96.0
1-02	80.0	0.65	1.10	192.550	147	106	102	0.81	2.96	93.9
1-03	85.0	0.50	0.88	195.270	147	107	102	0.71	2.72	98.2
1-03	90.0	0.50	0.88	197.975	147	107	102	0.71	2.70	97.7
4-01	95.0	0.70	1.20	201.050	147	106	103	0.84	3.08	93.9
4-01	100.0	0.70	1.20	204.110	147	109	103	0.84	3.06	93.2
4-02	105.0	0.62	1.10	207.130	147	109	103	0.79	3.02	97.7
4-02	110.0	0.62	1.10	210.150	146	110	104	0.79	3.02	97.5
4-03	115.0	0.52	0.91	212.960	147	110	103	0.72	2.81	99.2
4-03	120.0	0.52	0.91	215.679	147	111	104	0.72	2.72	95.8
Final	120.0		1.08133	70.95400	146.41667	101.87500		0.78531	70.95400	

12 points sampled

Sq.Rt.ΔP

QC-Check: Field Averages

0.7853 1.0813 70.9540 146.4167 101.8750

☒ Avg. OK ☒ Avg. OK ☒ Avg. OK ☒ Avg. OK ☒ Avg. OK

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TEST LOG

Client: Marathon Petroleum Company
Project No: 11265

Run Number	Location	Method	Analyte	Date	Start Time	End Time	Notes
1	FCCU Scrubber Stack	USEPA SW-846 Method 0010	SVOC / PAH	07/15/11	08:57	14:49	
2	FCCU Scrubber Stack	USEPA SW-846 Method 0010	SVOC / PAH	07/15/11	15:55	20:55	
3	FCCU Scrubber Stack	USEPA SW-846 Method 0010	SVOC / PAH	07/16/11	08:36	12:59	

Notes:

None

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USEPA Method 3 Laboratory Data

Location: FCCU Scrubber Stack

Client: Marathon Petroleum Company

Project No: 11265

Method: EPA Method 3A

Fuel Type: Non-Combustion

F_o for Fuel: N/A

Test Method: USEPA SW-846 Method 0010
Analyte: SVOC / PAH

Analyst: K. O'Halloren
Analyst Emp No: 478

Run Number	Trial	Percent CO ₂	Percent O ₂ +CO ₂	Percent O ₂	Percent N ₂	Dry Mol. Weight	F _o	Method of Analysis: CEM
1	1							
	2							
	3							
	Avg.							
CEM or Other Avg:		13.00000		4.10000	82.90000	30.24400	1.29231	<input type="checkbox"/> Fo value within expected range.
2	1							
	2							
	3							
	Avg.							
CEM or Other Avg:		13.40000		3.80000	82.80000	30.29600	1.27612	<input type="checkbox"/> Fo value within expected range.
3	1							
	2							
	3							
	Avg.							
CEM or Other Avg:		13.90000		3.40000	82.70000	30.36000	1.25899	<input type="checkbox"/> Fo value within expected range.
	1							
	2							
	3							
	Avg.							
CEM or Other Avg:								<input type="checkbox"/> Fo value within expected range.

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USEPA Method 4 Laboratory Data

Location: FCCU Scrubber Stack
Client: Marathon Petroleum Company

Project No: 11265

Test Method: USEPA SW-846 Method 0010
Analyte: SVOC / PAH

Analyst: D. Luckhard
Analyst Emp No: 568

Test Run: 1

	Contents	Gross (gm)	Tare (gm)	Net (gm)		
Impinger 1	Empty	1647.4	619.5	1027.9		
Impinger 2	HPLC Water	534.0	552.8	-18.8		
Impinger 3	HPLC Water	523.7	561.8	-38.1		
Impinger 4	Empty	447.5	445.9	1.6		
Impinger 5	XAD Trap	363.8	350.4	13.4		
Impinger 6	Silica Gel	789.5	757.3	32.2	986.0 Liquid (gm)	Field Data Check
Impinger 7	Silica Gel	780.8	756.6	24.2	0.0 less rinse (gm)	
Impinger 8					986.0 Net Liquid (gm)	986.0 <input checked="" type="checkbox"/> QA/QC OK
					+ 56.4 Silica Gel (gm)	56.4 <input checked="" type="checkbox"/> QA/QC OK
					1042.4 Total Vlc (gm)	1042.4 <input checked="" type="checkbox"/> QA/QC OK
	Rinse:		(ml or gm)			

Test Run: 2

	Contents	Gross (gm)	Tare (gm)	Net (gm)		
Impinger 1	Empty	1541.8	637.2	904.6		
Impinger 2	HPLC Water	629.5	627.2	2.3		
Impinger 3	HPLC Water	537.0	534.8	2.2		
Impinger 4	Empty	451.7	438.7	13.0		
Impinger 5	XAD Trap	404.4	395.1	9.3		
Impinger 6	Silica Gel	761.6	732.8	28.8	931.4 Liquid (gm)	Field Data Check
Impinger 7	Silica Gel	767.4	735.0	32.4	0.0 less rinse (gm)	
Impinger 8					931.4 Net Liquid (gm)	931.4 <input checked="" type="checkbox"/> QA/QC OK
					+ 61.2 Silica Gel (gm)	61.2 <input checked="" type="checkbox"/> QA/QC OK
					992.6 Total Vlc (gm)	992.6 <input checked="" type="checkbox"/> QA/QC OK
	Rinse:		(ml or gm)			

Test Run: 3

	Contents	Gross (gm)	Tare (gm)	Net (gm)		
Impinger 1	Empty	1580.9	621.3	959.6		
Impinger 2	HPLC Water	462.0	552.1	-90.1		
Impinger 3	HPLC Water	559.2	561.4	-2.2		
Impinger 4	Empty	553.2	447.5	105.7		
Impinger 5	XAD Trap	363.3	354.4	8.9		
Impinger 6	Silica Gel	829.1	775.6	53.5	981.9 Liquid (gm)	Field Data Check
Impinger 7					0.0 less rinse (gm)	
Impinger 8					981.9 Net Liquid (gm)	981.9 <input checked="" type="checkbox"/> QA/QC OK
					+ 53.5 Silica Gel (gm)	53.5 <input checked="" type="checkbox"/> QA/QC OK
					1035.4 Total Vlc (gm)	1035.4 <input checked="" type="checkbox"/> QA/QC OK
	Rinse:		(ml or gm)			

Test Run:

	Contents	Gross (gm)	Tare (gm)	Net (gm)		
Impinger 1	Empty					
Impinger 2	HPLC Water					
Impinger 3	HPLC Water					
Impinger 4	Empty					
Impinger 5	XAD Trap					
Impinger 6	Silica Gel				Liquid (gm)	Field Data Check
Impinger 7					less rinse (gm)	
Impinger 8					Net Liquid (gm)	
					Silica Gel (gm)	
					Total Vlc (gm)	
	Rinse:		(ml or gm)			

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Field Data Printout

Test Method: USEPA SW-846 Method 0010

Analyte: SVOC / PAH

Location: FCCU Scrubber Stack

Test Run: 1

Client: Marathon Petroleum Company

Project No: 11265

Source Area (ft²): 70.88218

Meter Operator: S. Dooley 593

Probe Operator: B. Arnold 770

Test Date: 7/15/11

Start Time: 08:57

Stop Time: 14:49

Leak Rate Before: 0.003

Leak Rate After: 0.002

cfm @ 20 "Hg

cfm @ 14 "Hg

Bar. Press. (in. Hg): 29.40

Static P: -0.3

O₂ (dry volume %): 4.10

CO₂ (dry volume %): 13.00

N₂+CO (dry volume %): 82.90

Nozzle ID No: 250-1

Nozzle Diameter (D_n): 0.250

Probe ID No: 66-4-7

Pitot C_p: 0.827

Pitot Leak Check: ☒ Pass ☐ Fail

H₂O (condensate, ml or gm): 986.0

H₂O (silica, g): 56.4

Actual Moisture (%): 23.90

Meter Box ID. No: 66-14

Meter ΔH@: 1.75710

Meter Y_G: 0.98820

Traverse Point	Run Time 5.0 min/read	Pitot ΔP _s (in. H ₂ O)	Sample ΔH (in. H ₂ O)	Metered (dcf)	Stack T _s (°F)	Dry Gas Meter T _{m-in} (°F)	T _{m-out} (°F)	√ΔP _s (calculated) (√in. H ₂ O)	Volume (calculated) (ft ³)	Isokinetics (calculated) (%)
	0.0			219.591						
1-01	5.0	0.74	1.70	223.230	147	89	88	0.86	3.64	97.2
1-01	10.0	0.73	1.70	226.890	147	90	88	0.85	3.66	98.3
1-01	15.0	0.71	1.70	230.590	147	93	89	0.84	3.70	100.4
1-01	20.0	0.70	1.70	234.250	146	95	90	0.84	3.66	99.7
1-02	25.0	0.67	1.60	237.860	147	98	90	0.82	3.61	100.3
1-02	30.0	0.67	1.60	241.390	147	100	91	0.82	3.53	97.8
1-02	35.0	0.66	1.60	244.940	147	102	92	0.81	3.55	98.8
1-02	40.0	0.66	1.60	248.350	147	103	93	0.81	3.41	94.8
1-03	45.0	0.55	1.30	251.880	147	105	95	0.74	3.53	107.0
1-03	50.0	0.50	1.20	254.940	147	106	96	0.71	3.06	97.1
1-03	55.0	0.50	1.20	258.090	147	106	96	0.71	3.15	99.9
1-03	60.0	0.47	1.10	261.106	147	106	97	0.69	3.02	98.6
3-01	65.0	0.80	1.88	264.890	146	102	98	0.89	3.78	95.2
3-01	70.0	0.72	1.70	268.690	147	106	98	0.85	3.80	100.4
3-01	75.0	0.75	1.80	272.460	147	107	99	0.87	3.77	97.4
3-01	80.0	0.75	1.80	276.250	147	108	99	0.87	3.79	97.9
3-02	85.0	0.68	1.60	279.980	147	109	100	0.82	3.73	100.9
3-02	90.0	0.60	1.40	283.380	147	109	100	0.77	3.40	97.9
3-02	95.0	0.65	1.50	286.870	147	109	100	0.81	3.49	96.6
3-02	98.0	0.65	1.50	289.241	147	109	100	0.81	2.37	109.3
LEAK CHECK	98.0			289.620						
3-02	100.0	0.65	1.50	290.270	147	109	100	0.81	0.65	45.0*
3-03	105.0	0.53	1.20	293.980	147	103	100	0.73	3.71	114.2*
3-03	110.0	0.54	1.30	297.160	147	103	99	0.73	3.18	97.1
3-03	115.0	0.50	1.20	300.340	147	104	99	0.71	3.18	100.8
3-03	120.0	0.52	1.20	303.570	147	106	99	0.72	3.23	100.2
2-01	121.5	0.68	1.60	304.675	147	99	98	0.82	1.11	100.7
LEAK CHECK	121.5			312.830						
2-01	125.0	0.68	1.60	314.070	147	99	98	0.82	1.24	48.5*
2-01	130.0	0.68	1.60	317.620	147	101	98	0.82	3.55	96.9
2-01	135.0	0.68	1.60	321.300	147	102	98	0.82	3.68	100.4
2-01	140.0	0.68	1.60	324.850	147	105	98	0.82	3.55	96.6
2-02	145.0	0.63	1.50	328.350	147	106	98	0.79	3.50	98.8
2-02	150.0	0.63	1.50	331.880	147	108	99	0.79	3.53	99.4
2-02	155.0	0.63	1.50	335.850	147	108	100	0.79	3.97	111.7*
2-02	160.0	0.63	1.50	338.850	147	109	100	0.79	3.00	84.3*
2-03	165.0	0.50	1.20	342.100	147	108	100	0.71	3.25	102.6
2-03	170.0	0.55	1.30	345.330	147	108	100	0.74	3.23	97.2
2-03	175.0	0.50	1.20	348.520	147	108	100	0.71	3.19	100.7
2-03	180.0	0.50	1.20	351.723	147	108	101	0.71	3.20	101.0
4-01	185.0	0.70	1.70	355.130	147	102	100	0.84	3.41	91.5
4-01	190.0	0.68	1.60	358.800	147	102	99	0.82	3.67	100.0
4-01	195.0	0.68	1.60	362.280	147	105	100	0.82	3.48	94.5
4-01	200.0	0.68	1.60	365.810	147	108	100	0.82	3.53	95.6
4-02	205.0	0.60	1.40	369.190	147	109	101	0.77	3.38	97.2
4-02	210.0	0.60	1.40	372.530	147	110	101	0.77	3.34	96.0
4-02	215.0	0.60	1.40	375.870	147	111	102	0.77	3.34	95.8
4-02	220.0	0.60	1.40	379.220	147	110	102	0.77	3.35	96.2
4-03	225.0	0.57	1.30	382.460	147	111	103	0.75	3.24	95.3
4-03	230.0	0.52	1.20	385.610	147	109	103	0.72	3.15	97.1
4-03	235.0	0.50	1.20	388.700	147	110	103	0.71	3.09	97.1
4-03	240.0	0.50	1.20	391.753	147	111	103	0.71	3.05	95.8
Final	240.0		1.46625	163.62800	146.95833	101.44792		0.78563	163.62800	

12 points sampled	Sq.Rt.ΔP			
QC-Check: Field Averages	0.7856	1.4663	163.6280	101.4479

☒ Avg. OK ☒ Avg. OK ☒ Avg. OK ☒ Avg. OK ☒ Avg. OK

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Field Data Printout

Test Method: USEPA SW-846 Method 0010

Analyte: SVOC / PAH

Location: FCCU Scrubber Stack

Test Run: 2

Client: Marathon Petroleum Company

Project No: 11265

Source Area (ft²): 70.88218

Meter Operator: H. Nguyen 429

Probe Operator: B. Arnold 770

Test Date: 7/15/11

Start Time: 15:55

Stop Time: 20:55

Leak Rate Before: 0.005

Leak Rate After: 0.004

cfm @ 15 "Hg

cfm @ 22 "Hg

Bar. Press. (in. Hg): 29.40

Static P: -0.3

O₂ (dry volume %): 3.80

CO₂ (dry volume %): 13.40

N₂+CO (dry volume %): 82.80

Nozzle ID No: 250-1

Nozzle Diameter (D_n): 0.250

Probe ID No: 66-4-7

Pitot C_p: 0.827

Pitot Leak Check: ☒ Pass ☐ Fail

H₂O (condensate, ml or gm): 931.4

H₂O (silica, g): 61.2

Actual Moisture (%): 23.95

Meter Box ID. No: 66-14

Meter ΔH@: 1.75710

Meter Y_d: 0.98820

Traverse Point	Run Time 5.0 min/read	Pitot ΔP _s (in. H ₂ O)	Sample ΔH (in. H ₂ O)	Metered (dcf)	Stack T _s (°F)	Dry Gas Meter T _{m-in} (°F)	T _{m-out} (°F)	√ΔP _s (calculated) (√in. H ₂ O)	Volume (calculated) (ft³)	Isokinetics (calculated) (%)
	0.0			393.421						
3-01	5.0	0.82	1.80	396.680	150	103	103	0.91	3.26	80.9*
3-01	10.0	0.82	1.80	400.100	149	103	103	0.91	3.42	84.8*
3-01	15.0	0.74	1.70	404.120	149	105	103	0.86	4.02	104.7
3-01	20.0	0.74	1.70	408.120	149	109	104	0.86	4.00	103.7
3-02	25.0	0.68	1.60	411.800	149	111	105	0.82	3.68	99.3
3-02	30.0	0.68	1.60	415.500	149	112	105	0.82	3.70	99.7
3-02	35.0	0.68	1.60	419.200	150	112	106	0.82	3.70	99.7
3-02	40.0	0.68	1.60	422.870	150	112	106	0.82	3.67	98.9
3-03	45.0	0.56	1.30	426.290	150	112	106	0.75	3.42	101.5
3-03	50.0	0.56	1.30	429.640	150	113	107	0.75	3.35	99.2
3-03	55.0	0.56	1.30	432.940	150	114	107	0.75	3.30	97.7
3-03	60.0	0.56	1.30	436.310	150	115	107	0.75	3.37	99.6
1-01	65.0	0.62	1.40	439.750	149	112	107	0.79	3.44	96.9
1-01	70.0	0.62	1.40	443.230	149	112	107	0.79	3.48	98.0
1-01	75.0	0.62	1.40	446.500	148	112	107	0.79	3.27	92.0
1-01	80.0	0.62	1.40	450.100	148	112	107	0.79	3.60	101.3
1-02	85.0	0.64	1.50	453.640	146	113	107	0.80	3.54	97.8
1-02	90.0	0.64	1.50	457.150	146	113	107	0.80	3.51	97.0
1-02	95.0	0.64	1.50	460.780	146	113	107	0.80	3.63	100.3
1-02	100.0	0.64	1.50	464.210	146	113	107	0.80	3.43	94.8
1-03	105.0	0.50	1.20	467.460	146	112	106	0.71	3.25	101.7
1-03	110.0	0.51	1.20	470.700	146	112	106	0.71	3.24	100.4
1-03	115.0	0.52	1.20	473.860	146	112	106	0.72	3.16	97.0
1-03	120.0	0.52	1.20	476.990	146	112	106	0.72	3.13	96.0
LEAK CHECK	120.0			477.200						
4-01	125.0	0.67	1.60	480.860	146	113	107	0.82	3.66	98.9
4-01	130.0	0.67	1.60	484.430	146	115	108	0.82	3.57	96.2
4-01	135.0	0.69	1.60	487.950	146	116	108	0.83	3.52	93.4
4-01	140.0	0.70	1.60	491.480	146	117	109	0.84	3.53	92.8
4-02	145.0	0.73	1.70	494.970	146	116	109	0.85	3.49	89.9*
4-02	150.0	0.58	1.30	498.420	146	116	110	0.76	3.45	99.6
4-02	155.0	0.58	1.30	501.500	146	115	110	0.76	3.08	89.0*
4-02	160.0	0.58	1.30	504.540	146	112	109	0.76	3.04	88.1*
4-03	165.0	0.51	1.20	507.500	145	112	108	0.71	2.96	91.5
4-03	170.0	0.51	1.20	510.330	145	112	108	0.71	2.83	87.5*
LEAK CHECK	170.0			511.000						
4-03	175.0	0.51	1.20	513.860	145	111	108	0.71	2.86	88.5*
4-03	180.0	0.51	1.20	516.520	145	111	108	0.71	2.66	82.3*
LEAK CHECK	180.0			516.800						
2-01	185.0	0.60	1.40	520.230	146	115	104	0.77	3.43	97.9
2-01	190.0	0.60	1.40	523.740	146	114	102	0.77	3.51	100.5
2-01	195.0	0.60	1.40	527.270	146	114	102	0.77	3.53	101.1
2-01	200.0	0.60	1.40	530.830	146	114	101	0.77	3.56	102.0
2-02	205.0	0.59	1.30	534.140	147	114	101	0.77	3.31	95.7
2-02	210.0	0.58	1.30	537.590	147	114	101	0.76	3.45	100.6
2-02	215.0	0.59	1.30	540.890	147	114	101	0.77	3.30	95.4
2-02	220.0	0.59	1.30	544.230	146	114	101	0.77	3.34	96.5
2-03	225.0	0.60	1.40	547.680	146	112	101	0.77	3.45	99.0
2-03	230.0	0.60	1.40	551.150	145	112	101	0.77	3.47	99.5
2-03	235.0	0.60	1.40	554.580	145	112	101	0.77	3.43	98.4
2-03	240.0	0.60	1.40	558.000	146	112	101	0.77	3.42	98.2
Final	240.0		1.42083	163.41900	147.04167	108.92708		0.78332	163.41900	

12 points sampled

Sq.Rt.ΔP

QC-Check: Field Averages

0.7833 1.4208 163.4190 147.0417 108.9271

☒ Avg. OK ☒ Avg. OK ☒ Avg. OK ☒ Avg. OK ☒ Avg. OK

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Field Data Printout

Test Method: USEPA SW-846 Method 0010

Analyte: SVOC / PAH

Location: FCCU Scrubber Stack

Test Run: 3

Client: Marathon Petroleum Company

Project No: 11265

Source Area (ft²): 70.88218

Meter Operator: S. Dooley 593

Probe Operator: B. Arnold 770

Test Date: 7/16/11

Start Time: 08:36

Stop Time: 12:59

Leak Rate Before: 0.002

Leak Rate After: 0.003

cfm @ 15 "Hg

cfm @ 10 "Hg

Bar. Press. (in. Hg): 29.45

Static P: -0.4

O₂ (dry volume %): 3.40

CO₂ (dry volume %): 13.90

N₂+CO (dry volume %): 82.70

Nozzle ID No: 250-1

Nozzle Diameter (D_n): 0.250

Probe ID No: 66-4-7

Pitot C_p: 0.827

Pitot Leak Check: ☒ Pass ☐ Fail

H₂O (condensate, ml or gm): 981.9

H₂O (silica, g): 53.5

Actual Moisture (%): 23.90

Meter Box ID. No: 85-3

Meter ΔH@: 1.77920

Meter Y_d: 0.99250

Traverse Point	Run Time 5.0 min/read	Pitot ΔP _s (in. H ₂ O)	Sample ΔH (in. H ₂ O)	Metered (dcf)	Stack T _s (°F)	Dry Gas Meter T _{m-in} (°F)	T _{m-out} (°F)	√ΔP _s (calculated) (√in. H ₂ O)	Volume (calculated) (ft³)	Isokinetics (calculated) (%)
3-01	5.0	0.75	1.70	327.824	147	89	90	0.87	3.67	97.7
3-01	10.0	0.73	1.70	331.490	148	91	90	0.85	3.57	96.4
3-01	15.0	0.73	1.70	335.060	147	96	90	0.85	3.66	98.3
3-01	20.0	0.73	1.70	338.720	147	100	92	0.85	3.67	98.0
3-02	25.0	0.66	1.50	342.390	147	104	93	0.81	3.59	100.3
3-02	30.0	0.63	1.50	345.980	147	106	94	0.79	3.47	99.0
3-02	35.0	0.65	1.50	349.450	147	110	95	0.81	4.51	126.1*
3-02	40.0	0.65	1.50	353.960	147	111	96	0.81	2.52	70.3*
3-03	45.0	0.52	1.20	356.480	147	113	98	0.72	3.24	100.7
3-03	50.0	0.52	1.20	359.720	147	113	99	0.72	3.14	97.5
3-03	55.0	0.52	1.20	362.860	147	113	100	0.72	3.15	97.7
3-03	60.0	0.52	1.20	366.010	147	114	101	0.72	3.14	97.2
4-01	65.0	0.73	1.70	369.150	147	110	102	0.85	3.63	95.2
4-01	70.0	0.73	1.70	372.780	147	114	103	0.85	3.60	94.0
4-01	75.0	0.72	1.70	376.380	147	116	103	0.85	3.61	94.8
4-01	80.0	0.74	1.70	379.990	147	118	104	0.86	3.58	92.7
4-02	85.0	0.67	1.50	383.570	147	119	105	0.82	3.53	95.6
4-02	90.0	0.68	1.60	387.100	147	120	106	0.82	3.56	95.6
4-02	95.0	0.67	1.50	390.660	147	119	107	0.82	3.53	95.4
4-02	100.0	0.67	1.50	394.190	147	120	107	0.82	3.56	96.2
4-03	105.0	0.48	1.10	397.750	147	120	108	0.69	3.10	98.8
4-03	110.0	0.48	1.10	400.850	147	118	108	0.69	2.99	95.4
4-03	115.0	0.48	1.10	403.840	147	118	108	0.69	3.01	96.1
4-03	120.0	0.48	1.10	406.850	147	118	108	0.69	2.97	94.9
LEAK CHECK	120.0			409.825	147	118	108	0.69		
2-01	120.0			409.941						
2-01	125.0	0.70	1.60	413.590	147	110	107	0.84	3.65	97.3
2-01	130.0	0.70	1.60	417.310	147	113	107	0.84	3.72	98.9
2-01	135.0	0.70	1.60	420.910	147	117	107	0.84	3.60	95.4
2-01	140.0	0.70	1.60	424.550	147	119	108	0.84	3.64	96.2
2-02	145.0	0.63	1.50	428.070	147	120	108	0.79	3.52	98.0
2-02	150.0	0.60	1.40	431.530	147	121	109	0.77	3.46	98.6
2-02	155.0	0.60	1.40	434.950	147	121	109	0.77	3.42	97.4
2-02	160.0	0.60	1.40	438.470	147	121	110	0.77	3.52	100.1
2-03	165.0	0.50	1.20	441.680	147	121	110	0.71	3.21	100.0
2-03	170.0	0.50	1.20	444.830	147	121	110	0.71	3.15	98.1
2-03	175.0	0.50	1.20	448.010	147	121	110	0.71	3.18	99.0
2-03	180.0	0.50	1.20	451.168	147	119	110	0.71	3.16	98.5
1-01	185.0	0.72	1.70	454.820	147	115	110	0.85	3.65	95.4
1-01	190.0	0.70	1.70	458.570	147	118	110	0.84	3.75	99.1
1-01	195.0	0.70	1.70	462.330	147	121	110	0.84	3.76	99.1
1-01	200.0	0.70	1.70	466.070	147	122	110	0.84	3.74	98.5
1-02	205.0	0.64	1.50	469.620	147	119	110	0.80	3.55	98.0
1-02	210.0	0.64	1.50	473.140	147	120	109	0.80	3.52	97.1
1-02	215.0	0.64	1.50	476.630	147	119	109	0.80	3.49	96.4
1-02	220.0	0.64	1.50	480.100	147	118	108	0.80	3.47	96.0
1-03	225.0	0.52	1.20	483.320	147	118	108	0.72	3.22	98.8
1-03	230.0	0.52	1.20	486.500	147	116	108	0.72	3.18	97.7
1-03	235.0	0.52	1.20	489.680	147	115	107	0.72	3.18	97.9
1-03	240.0	0.52	1.20	492.814	147	115	107	0.72	3.13	96.5
Final	240.0		1.44583	164.87400	147.02083	109.65625		0.78614	164.87400	

12 points sampled

Sq.RLΔP

QC-Check: Field Averages

0.7862 1.4458 164.8740 147.0208 109.6563

☒ Avg. OK ☒ Avg. OK ☒ Avg. OK ☒ Avg. OK ☒ Avg. OK

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TEST LOG

Client: Marathon Petroleum Company
Project No: 11265

Run Number	Location	Method	Analyte	Date	Start Time	End Time	Notes
1	FCCU Scrubber Stack	USEPA Method 23	PCDD/PCDF/PCB	07/20/11	07:59	11:12	
2	FCCU Scrubber Stack	USEPA Method 23	PCDD/PCDF/PCB	07/20/11	11:50	15:22	
3	FCCU Scrubber Stack	USEPA Method 23	PCDD/PCDF/PCB	07/21/11	07:53	11:09	

Notes:

None

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USEPA Method 3 Laboratory Data

Location: FCCU Scrubber Stack

Client: Marathon Petroleum Company

Project No: 11265

Method: EPA Method 3A

Fuel Type: Non-Combustion

F_o for Fuel: N/A

Test Method:

USEPA Method 23

Analyte:

PCDD/PCDF/PCB

Analyst: K. O'Halloren

Analyst Emp No: 478

Run Number	Trial	Percent CO ₂	Percent O ₂ +CO ₂	Percent O ₂	Percent N ₂	Dry Mol. Weight	F _o	Method of Analysis: CEM
1	1							
	2							
	3							
	Avg.							
CEM or Other Avg:		14.00000		3.50000	82.50000	30.38000	1.24286	<input type="checkbox"/> Fo value within expected range.
2	1							
	2							
	3							
	Avg.							
CEM or Other Avg:		13.50000		3.70000	82.80000	30.30800	1.27407	<input type="checkbox"/> Fo value within expected range.
3	1							
	2							
	3							
	Avg.							
CEM or Other Avg:		13.80000		3.50000	82.70000	30.34800	1.26087	<input type="checkbox"/> Fo value within expected range.
	1							
	2							
	3							
	Avg.							
CEM or Other Avg:								<input type="checkbox"/> Fo value within expected range.

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USEPA Method 4 Laboratory Data

Location: FCCU Scrubber Stack
Client: Marathon Petroleum Company
Project No: 11265

Test Method: USEPA Method 23
Analyte: PCDD/PCDF/PCB
Analyst: D. Luckhard
Analyst Emp No: 568

Test Run: **1**

	Contents	Gross (gm)	Tare (gm)	Net (gm)		
Impinger 1	Empty	1328.3	619.7	708.6		
Impinger 2	HPLC Water	627.2	628.4	-1.2		
Impinger 3	HPLC Water	521.1	522.4	-1.3		
Impinger 4	Empty	460.7	445.9	14.8		
Impinger 5	XAD Trap	362.5	353.5	9.0		
Impinger 6	Silica Gel	759.6	711.5	48.1	729.9 Liquid (gm)	Field Data Check
Impinger 7					0.0 less rinse (gm)	
Impinger 8					729.9 Net Liquid (gm)	729.9 <input checked="" type="checkbox"/> QA/QC OK
					+ 48.1 Silica Gel (gm)	48.1 <input checked="" type="checkbox"/> QA/QC OK
					778.0 Total Vlc (gm)	778.0 <input checked="" type="checkbox"/> QA/QC OK
	Rinse:		(ml or gm)			

Test Run: **2**

	Contents	Gross (gm)	Tare (gm)	Net (gm)		
Impinger 1	Empty	1325.7	637.3	688.4		
Impinger 2	HPLC Water	556.6	538.7	17.9		
Impinger 3	HPLC Water	540.6	541.0	-0.4		
Impinger 4	Empty	436.1	434.7	1.4		
Impinger 5	XAD Trap	356.8	346.3	10.5		
Impinger 6	Silica Gel	805.5	764.8	40.7	717.8 Liquid (gm)	Field Data Check
Impinger 7					0.0 less rinse (gm)	
Impinger 8					717.8 Net Liquid (gm)	717.8 <input checked="" type="checkbox"/> QA/QC OK
					+ 40.7 Silica Gel (gm)	40.7 <input checked="" type="checkbox"/> QA/QC OK
					758.5 Total Vlc (gm)	758.5 <input checked="" type="checkbox"/> QA/QC OK
	Rinse:		(ml or gm)			

Test Run: **3**

	Contents	Gross (gm)	Tare (gm)	Net (gm)		
Impinger 1	Empty	1352.9	621.5	731.4		
Impinger 2	HPLC Water	642.9	629.1	13.8		
Impinger 3	HPLC Water	523.7	522.7	1.0		
Impinger 4	Empty	450.0	447.7	2.3		
Impinger 5	XAD Trap	372.9	361.9	11.0		
Impinger 6	Silica Gel	800.7	761.4	39.3	759.5 Liquid (gm)	Field Data Check
Impinger 7					0.0 less rinse (gm)	
Impinger 8					759.5 Net Liquid (gm)	759.5 <input checked="" type="checkbox"/> QA/QC OK
					+ 39.3 Silica Gel (gm)	39.3 <input checked="" type="checkbox"/> QA/QC OK
					798.8 Total Vlc (gm)	798.8 <input checked="" type="checkbox"/> QA/QC OK
	Rinse:		(ml or gm)			

Test Run:

	Contents	Gross (gm)	Tare (gm)	Net (gm)		
Impinger 1	Empty					
Impinger 2	HPLC Water					
Impinger 3	HPLC Water					
Impinger 4	Empty					
Impinger 5	XAD Trap					
Impinger 6	Silica Gel				Liquid (gm)	Field Data Check
Impinger 7					less rinse (gm)	
Impinger 8					Net Liquid (gm)	
					Silica Gel (gm)	
					Total Vlc (gm)	
	Rinse:		(ml or gm)			

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Field Data Printout

Test Method:

USEPA Method 23

Analyte:

PCDD/PCDF/PCB

Location: FCCU Scrubber Stack

Test Run: 1

Client: Marathon Petroleum Company

Project No: 11265

Source Area (ft²): 70.88218

Meter Operator: H. Nguyen 429

Probe Operator: K. Sullivan 579

Test Date: 7/20/11

Start Time: 07:59

Stop Time: 11:12

Leak Rate Before: 0.003 cfm @ 15 "Hg

Leak Rate After: 0.001 cfm @ 11 "Hg

Bar. Press. (in. Hg): 29.30

Static P: -0.3

O₂ (dry volume %): 3.50

CO₂ (dry volume %): 14.00

N₂+CO (dry volume %): 82.50

Nozzle ID No: 250-1

Nozzle Diameter (D_n): 0.250

Probe ID No: 67-4-4

Pitot C_p: 0.820

Pitot Leak Check: ☒ Pass ☐ Fail

H₂O (condensate, ml or gm): 729.9

H₂O (silica, g): 48.1

Actual Moisture (%): 24.22

Meter Box ID. No: 61-5

Meter ΔH@: 1.71850

Meter Y_d: 0.99920

Traverse Point	Run Time 5.0 min/read	Pitot ΔP _s (in. H ₂ O)	Sample ΔH (in. H ₂ O)	Metered (dcf)	Stack T _s (°F)	Dry Gas Meter T _{m-in} (°F)	T _{m-out} (°F)	√ΔP _s (calculated) (√in. H ₂ O)	Volume (calculated) (ft ³)	Isokinetics (calculated) (%)
	0.0			57.570						
1-01	5.0	0.71	1.50	61.000	151	95	94	0.84	3.43	94.9
1-01	10.0	0.71	1.50	64.900	151	97	95	0.84	3.90	107.7
1-01	15.0	0.71	1.50	68.600	151	98	95	0.84	3.70	102.1
1-02	20.0	0.68	1.50	72.200	151	99	95	0.82	3.60	101.4
1-02	25.0	0.68	1.50	75.830	151	99	95	0.82	3.63	102.2
1-02	30.0	0.68	1.50	79.470	151	100	96	0.82	3.64	102.3
1-03	35.0	0.50	1.10	82.730	151	103	97	0.71	3.26	106.4
1-03	40.0	0.50	1.10	85.890	151	105	98	0.71	3.16	102.8
1-03	45.0	0.50	1.10	89.090	151	106	99	0.71	3.20	104.0
2-01	50.0	0.73	1.60	92.900	151	105	99	0.85	3.81	102.6
2-01	55.0	0.73	1.60	96.730	151	106	99	0.85	3.83	103.1
2-01	60.0	0.73	1.60	100.520	151	107	99	0.85	3.79	101.9
2-02	65.0	0.66	1.40	104.110	151	108	101	0.81	3.59	101.2
2-02	70.0	0.66	1.40	107.680	151	109	101	0.81	3.57	100.6
2-02	75.0	0.66	1.40	111.240	151	111	102	0.81	3.56	100.0
2-03	80.0	0.51	1.10	114.480	151	112	103	0.71	3.24	103.3
2-03	85.0	0.52	1.10	117.650	151	113	105	0.72	3.17	99.8
2-03	90.0	0.50	1.10	120.890	151	113	105	0.71	3.24	104.0
4-01	95.0	0.69	1.50	124.480	151	110	106	0.83	3.59	98.4
4-01	100.0	0.70	1.50	128.280	151	111	106	0.84	3.80	103.3
4-01	105.0	0.70	1.50	132.090	151	111	106	0.84	3.81	103.6
4-02	110.0	0.67	1.50	135.890	151	112	106	0.82	3.80	105.5
4-02	115.0	0.67	1.50	139.080	151	113	106	0.82	3.19	88.5*
4-02	120.0	0.68	1.50	142.770	151	113	107	0.82	3.69	101.5
4-03	125.0	0.48	1.00	145.880	151	112	107	0.69	3.11	101.8
4-03	130.0	0.48	1.00	148.910	151	113	107	0.69	3.03	99.1
4-03	135.0	0.48	1.00	151.920	151	114	107	0.69	3.01	98.4
3-01	140.0	0.69	1.50	155.790	151	114	108	0.83	3.87	105.5
3-01	145.0	0.70	1.50	159.240	151	115	108	0.84	3.45	93.3
3-01	150.0	0.71	1.50	162.870	151	115	108	0.84	3.63	97.5
3-02	155.0	0.62	1.30	166.360	151	116	108	0.79	3.49	100.2
3-02	160.0	0.62	1.30	169.780	151	116	109	0.79	3.42	98.1
3-02	165.0	0.62	1.30	172.890	151	116	109	0.79	3.11	89.2*
3-03	170.0	0.57	1.20	176.170	151	116	110	0.75	3.28	98.0
3-03	175.0	0.58	1.20	179.430	151	116	110	0.76	3.26	96.5
3-03	180.0	0.57	1.20	182.720	151	116	110	0.75	3.29	98.3
Final	180.0		1.35000	125.15000	151.00000	106.26389		0.79038	125.15000	

12 points sampled

Sq.Rt.ΔP

QC-Check: Field Averages

0.7904 1.3500 125.1500 151.0000 106.2639

☒ Avg. OK

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Field Data Printout

Test Method:

USEPA Method 23

Analyte:

PCDD/PCDF/PCB

Location: FCCU Scrubber Stack

Test Run: 2

Client: Marathon Petroleum Company

Project No: 11265

Source Area (ft²): 70.88218

Meter Operator: J. Rooney 591

Probe Operator: K. Sullivan 579

Test Date: 7/20/11

Start Time: 11:50

Stop Time: 15:22

Leak Rate Before: 0.000 cfm @ 15 "Hg

Leak Rate After: 0.002 cfm @ 10 "Hg

Bar. Press. (in. Hg): 29.30

Static P: -0.3

O₂ (dry volume %): 3.70

CO₂ (dry volume %): 13.50

N₂+CO (dry volume %): 82.80

Nozzle ID No: 250-1

Nozzle Diameter (D_n): 0.250

Probe ID No: 67-4-4

Pitot C_p: 0.820

Pitot Leak Check: ☒ Pass ☐ Fail

H₂O (condensate, ml or gm): 717.8

H₂O (silica, g): 40.7

Actual Moisture (%): 24.29

Meter Box ID. No: 61-5

Meter ΔH@: 1.71850

Meter Y_d: 0.99920

Traverse Point	Run Time 5.0 min/read	Pitot ΔP _s (in. H ₂ O)	Sample ΔH (in. H ₂ O)	Metered (dcf)	Stack T _s (°F)	Dry Gas Meter T _{m-in} (°F)	T _{m-out} (°F)	√ΔP _s (calculated) (√in. H ₂ O)	Volume (calculated) (ft ³)	Isokinetics (calculated) (%)
	0.0			183.300						
4-01	5.0	0.70	1.50	186.960	151	107	106	0.84	3.66	99.8
4-01	10.0	0.70	1.50	190.270	151	110	107	0.84	3.31	90.0*
4-01	15.0	0.70	1.50	193.550	151	113	107	0.84	3.28	88.9*
4-02	20.0	0.65	1.40	197.010	150	114	108	0.81	3.46	97.1
4-02	25.0	0.65	1.40	200.510	150	115	108	0.81	3.50	98.1
4-02	30.0	0.65	1.40	204.010	151	115	108	0.81	3.50	98.2
4-03	35.0	0.58	1.30	207.460	150	115	108	0.76	3.45	102.4
4-03	40.0	0.58	1.30	210.860	150	115	108	0.76	3.40	100.9
4-03	45.0	0.58	1.30	214.260	150	115	108	0.76	3.40	100.9
3-01	50.0	0.69	1.50	217.890	151	110	110	0.83	3.63	99.1
3-01	55.0	0.69	1.50	221.520	151	111	109	0.83	3.63	99.1
3-01	60.0	0.69	1.50	225.160	151	111	110	0.83	3.64	99.3
3-02	65.0	0.60	1.30	228.650	151	114	109	0.77	3.49	101.9
3-02	70.0	0.60	1.30	232.120	151	114	109	0.77	3.47	101.3
3-02	75.0	0.60	1.30	235.580	150	115	109	0.77	3.46	100.8
3-03	80.0	0.55	1.20	238.880	150	116	110	0.74	3.30	100.3
3-03	85.0	0.55	1.20	242.170	150	117	111	0.74	3.29	99.8
3-03	90.0	0.55	1.20	245.430	150	117	111	0.74	3.26	98.9
2-01	95.0	0.68	1.50	249.020	151	114	111	0.82	3.59	98.3
2-01	100.0	0.68	1.50	252.630	150	116	111	0.82	3.61	98.6
2-01	102.0	0.68	1.50	253.965	150	116	111	0.82	1.34	91.2
LEAK CHECK	102.0			254.090						
2-01	105.0	0.68	1.50	256.180	150	116	111	0.82	2.09	95.2
2-02	110.0	0.65	1.40	259.440	151	115	112	0.81	3.26	91.1
2-02	115.0	0.65	1.40	262.620	151	117	112	0.81	3.18	88.7*
2-02	120.0	0.65	1.40	265.890	151	117	112	0.81	3.27	91.3
2-03	125.0	0.52	1.10	269.050	150	117	113	0.72	3.16	98.4
2-03	130.0	0.52	1.10	272.220	151	115	113	0.72	3.17	98.9
2-03	135.0	0.52	1.10	275.280	150	114	112	0.72	3.06	95.6
1-01	140.0	0.68	1.50	278.750	150	116	113	0.82	3.47	94.6
1-01	145.0	0.68	1.50	282.300	150	117	113	0.82	3.55	96.7
1-01	150.0	0.68	1.50	285.810	150	118	113	0.82	3.51	95.6
1-02	155.0	0.66	1.40	289.360	150	119	114	0.81	3.55	97.9
1-02	160.0	0.66	1.40	292.900	151	117	113	0.81	3.54	98.0
1-02	165.0	0.66	1.40	296.400	150	116	113	0.81	3.50	96.9
1-03	170.0	0.54	1.20	299.790	150	118	114	0.73	3.39	103.4
1-03	175.0	0.54	1.20	303.130	150	117	113	0.73	3.34	102.0
1-03	180.0	0.54	1.20	306.420	150	117	113	0.73	3.29	100.5
Final	180.0		1.35833	122.99500	150.41667	112.80556		0.78960	122.99500	

12 points sampled
QC-Check: Field Averages

Sq.Rt.ΔP	0.7896	1.3583	122.9950	150.4167	112.8056
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☒ Avg. OK ☒ Avg. OK ☒ Avg. OK ☒ Avg. OK ☒ Avg. OK

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Field Data Printout

Test Method:

USEPA Method 23

Analyte:

PCDD/PCDF/PCB

Location: FCCU Scrubber Stack

Test Run: 3

Client: Marathon Petroleum Company

Project No: 11265

Source Area (ft²): 70.88218

Meter Operator: H. Nguyen 429

Probe Operator: K. Sullivan 579

Test Date: 7/21/11

Start Time: 07:53

Stop Time: 11:09

Leak Rate Before: 0.005 cfm @ 15 "Hg

Leak Rate After: 0.006 cfm @ 13 "Hg

Bar. Press. (in. Hg): 29.35

Static P: -0.5

O₂ (dry volume %): 3.50

CO₂ (dry volume %): 13.80

N₂+CO (dry volume %): 82.70

Nozzle ID No: 250-1

Nozzle Diameter (D_n): 0.250

Probe ID No: 67-4-4

Pitot C_p: 0.820

Pitot Leak Check: ☒ Pass ☐ Fail

H₂O (condensate, ml or gm): 759.5

H₂O (silica, g): 39.3

Actual Moisture (%): 24.51

Meter Box ID. No: 61-5

Meter ΔH@: 1.71850

Meter Y_d: 0.99920

Traverse Point	Run Time 5.0 min/read	Pitot ΔP _s (in. H ₂ O)	Sample ΔH (in. H ₂ O)	Metered (dcf)	Stack T _s (°F)	Dry Gas Meter T _{m-in} (°F)	T _{m-out} (°F)	√ΔP _s (calculated) (√in. H ₂ O)	Volume (calculated) (ft ³)	Isokinetics (calculated) (%)
	0.0			307.920						
3-01	5.0	0.73	1.60	311.510	151	99	95	0.85	3.59	98.0
3-01	10.0	0.73	1.60	315.200	151	101	96	0.85	3.69	100.4
3-01	15.0	0.73	1.60	318.930	151	106	97	0.85	3.73	101.0
3-02	20.0	0.70	1.50	322.600	151	106	98	0.84	3.67	101.3
3-02	25.0	0.70	1.50	326.270	151	108	99	0.84	3.67	101.1
3-02	30.0	0.69	1.50	329.950	151	109	99	0.83	3.68	102.0
3-03	35.0	0.58	1.30	333.400	151	109	100	0.76	3.45	104.1
3-03	40.0	0.58	1.30	336.840	150	109	100	0.76	3.44	103.8
3-03	45.0	0.58	1.30	340.260	150	110	100	0.76	3.42	103.1
4-01	50.0	0.70	1.50	343.890	150	108	101	0.84	3.63	99.7
4-01	55.0	0.70	1.50	347.580	150	109	101	0.84	3.69	101.3
4-01	60.0	0.70	1.50	351.140	150	110	102	0.84	3.56	97.5
4-02	65.0	0.65	1.40	354.670	150	110	101	0.81	3.53	100.4
4-02	70.0	0.65	1.40	358.200	150	110	102	0.81	3.53	100.3
4-02	75.0	0.65	1.40	361.980	150	110	102	0.81	3.78	107.4
4-03	80.0	0.70	1.50	365.530	151	110	103	0.84	3.55	97.2
4-03	85.0	0.70	1.50	368.940	151	110	104	0.84	3.41	93.3
4-03	90.0	0.70	1.50	372.590	151	111	104	0.84	3.65	99.8
2-01	95.0	0.64	1.40	376.100	151	110	103	0.80	3.51	100.5
2-01	100.0	0.64	1.40	379.600	151	110	103	0.80	3.50	100.2
2-01	105.0	0.64	1.40	383.100	151	110	103	0.80	3.50	100.2
2-02	110.0	0.66	1.40	386.600	151	111	104	0.81	3.50	98.5
2-02	115.0	0.66	1.40	390.040	151	111	104	0.81	3.44	96.8
2-02	120.0	0.66	1.40	393.570	151	111	104	0.81	3.53	99.4
2-03	125.0	0.52	1.10	396.630	151	111	105	0.72	3.06	96.9
2-03	130.0	0.52	1.10	399.800	151	111	105	0.72	3.17	100.4
2-03	135.0	0.52	1.10	402.970	151	111	105	0.72	3.17	100.4
1-01	140.0	0.73	1.60	406.630	151	112	106	0.85	3.66	97.8
1-01	145.0	0.73	1.60	410.370	151	111	104	0.85	3.74	100.2
1-01	150.0	0.73	1.60	414.090	151	111	104	0.85	3.72	99.6
1-02	155.0	0.66	1.40	417.670	151	111	104	0.81	3.58	100.8
1-02	160.0	0.67	1.50	421.230	151	111	104	0.82	3.56	99.5
1-02	165.0	0.67	1.50	424.740	151	112	105	0.82	3.51	97.9
1-03	170.0	0.52	1.10	427.920	151	108	105	0.72	3.18	101.0
1-03	175.0	0.51	1.10	431.040	151	108	105	0.71	3.12	100.0
1-03	180.0	0.51	1.10	434.070	151	108	105	0.71	3.03	97.1
Final	180.0		1.40556	126.15000	150.77778	105.76389		0.80425	126.15000	
12 points sampled		Sq.Rt.ΔP								
QC-Check: Field Averages		0.8042	1.4056	126.1500	150.7770	105.7639				
		<input checked="" type="checkbox"/> Avg. OK	<input checked="" type="checkbox"/> Avg. OK	<input checked="" type="checkbox"/> Avg. OK	<input checked="" type="checkbox"/> Avg. OK	<input checked="" type="checkbox"/> Avg. OK				

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TEST LOG

Client: Marathon Petroleum Company
Project No: 11265

Run Number	Location	Method	Analyte	Date	Start Time	End Time	Notes
1	FCCU Scrubber Stack	USEPA Method 5/202	FPM / CPM	07/19/11	08:09	10:14	
2	FCCU Scrubber Stack	USEPA Method 5/202	FPM / CPM	07/19/11	11:51	14:19	
3	FCCU Scrubber Stack	USEPA Method 5/202	FPM / CPM	07/19/11	15:22	17:36	

Notes:

None

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USEPA Method 3 Laboratory Data

Location: FCCU Scrubber Stack
 Client: Marathon Petroleum Company
 Project No: 11265
 Method: EPA Method 3A
 Fuel Type: Non-Combustion
 F_o for Fuel: N/A

Test Method: USEPA Method 5/202
 Analyte: FPM / CPM

Analyst: K. O'Halloren
 Analyst Emp No: 478

Run Number	Trial	Percent CO ₂	Percent O ₂ +CO ₂	Percent O ₂	Percent N ₂	Dry Mol. Weight	F _o	Method of Analysis: CEM
1	1							
	2							
	3							
	Avg.							
CEM or Other Avg:		13.40000		3.70000	82.90000	30.29200	1.28358	<input type="checkbox"/> Fo value within expected range.
2	1							
	2							
	3							
	Avg.							
CEM or Other Avg:		13.70000		3.40000	82.90000	30.32800	1.27737	<input type="checkbox"/> Fo value within expected range.
3	1							
	2							
	3							
	Avg.							
CEM or Other Avg:		13.70000		3.50000	82.80000	30.33200	1.27007	<input type="checkbox"/> Fo value within expected range.
	1							
	2							
	3							
	Avg.							
CEM or Other Avg:								<input type="checkbox"/> Fo value within expected range.

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USEPA Method 4 Laboratory Data

Location: FCCU Scrubber Stack
Client: Marathon Petroleum Company
Project No: 11265

Test Method: USEPA Method 5/202
Analyte: FPM / CPM

Analyst: D. Luckhard
Analyst Emp No: 568

Test Run: 1

	Contents	Gross (gm)	Tare (gm)	Net (gm)
Impinger 1	Empty	820.2	404.9	415.3
Impinger 2	Empty	500.4	443.6	56.8
Impinger 3	DI Water	557.0	520.0	37.0
Impinger 4	Silica Gel	754.7	726.5	28.2
Impinger 5				
Impinger 6				
Impinger 7				
Impinger 8				

509.1 Liquid (gm) Field Data Check

0.0 less rinse (gm)

509.1 Net Liquid (gm)

+ 28.2 Silica Gel (gm)

537.3 Total Vlc (gm)

509.1

28.2

537.3

☒ QA/QC OK

☒ QA/QC OK

☒ QA/QC OK

Rinse: (ml or gm)

Test Run: 2

	Contents	Gross (gm)	Tare (gm)	Net (gm)
Impinger 1	Empty	797.5	410.0	387.5
Impinger 2	Empty	562.6	530.5	32.1
Impinger 3	DI Water	630.0	554.7	75.3
Impinger 4	Silica Gel	761.6	724.0	37.6
Impinger 5				
Impinger 6				
Impinger 7				
Impinger 8				

494.9 Liquid (gm) Field Data Check

0.0 less rinse (gm)

494.9 Net Liquid (gm)

+ 37.6 Silica Gel (gm)

532.5 Total Vlc (gm)

494.9

37.6

532.5

☒ QA/QC OK

☒ QA/QC OK

☒ QA/QC OK

Rinse: (ml or gm)

Test Run: 3

	Contents	Gross (gm)	Tare (gm)	Net (gm)
Impinger 1	Empty	833.3	450.3	383.0
Impinger 2	Empty	500.0	452.1	47.9
Impinger 3	DI Water	604.9	558.6	46.3
Impinger 4	Silica Gel	772.1	731.0	41.1
Impinger 5				
Impinger 6				
Impinger 7				
Impinger 8				

477.2 Liquid (gm) Field Data Check

0.0 less rinse (gm)

477.2 Net Liquid (gm)

+ 41.1 Silica Gel (gm)

518.3 Total Vlc (gm)

477.2

41.1

518.3

☒ QA/QC OK

☒ QA/QC OK

☒ QA/QC OK

Rinse: (ml or gm)

Test Run:

	Contents	Gross (gm)	Tare (gm)	Net (gm)
Impinger 1	Empty			
Impinger 2	Empty			
Impinger 3	DI Water			
Impinger 4	Silica Gel			
Impinger 5				
Impinger 6				
Impinger 7				
Impinger 8				

Liquid (gm) Field Data Check

less rinse (gm)

Net Liquid (gm)

Silica Gel (gm)

Total Vlc (gm)

☐ QA/QC OK

☐ QA/QC OK

☐ QA/QC OK

Rinse: (ml or gm)

Field Data Printout

Test Method: USEPA Method 5/202

Analyte: FPM / CPM

Location: FCCU Scrubber Stack

Test Run: 1

Client: Marathon Petroleum Company

Project No: 11265

Source Area (ft²): 70.88218

Meter Operator: S. Dooley 593

Probe Operator: B. Arnold 770

Test Date: 7/19/11

Start Time: 08:09

Stop Time: 10:14

Leak Rate Before: 0.002 cfm @ 15 "Hg

Leak Rate After: 0.001 cfm @ 8 "Hg

Bar. Press. (in. Hg): 29.40

Static P: -0.5

O₂ (dry volume %): 3.70

CO₂ (dry volume %): 13.40

N₂+CO (dry volume %): 82.90

Nozzle ID No: 250-2

Nozzle Diameter (D_n): 0.250

Probe ID No: 66-4-7

Pitot C_p: 0.827

Pitot Leak Check: ☒ Pass ☐ Fail

H₂O (condensate, ml or gm): 509.1

H₂O (silica, g): 28.2

Actual Moisture (%): 24.54

Meter Box ID. No: 85-3

Meter ΔH@: 1.77920

Meter Y_d: 0.99250

Traverse Point	Run Time 5.0 min/read	Pitot ΔP _s (in. H ₂ O)	Sample ΔH (in. H ₂ O)	Metered (dcf)	Stack T _s (°F)	Dry Gas Meter T _{m-in} (°F)	T _{m-out} (°F)	√ΔP _s (calculated) (√in. H ₂ O)	Volume (calculated) (ft ³)	Isokinetics (calculated) (%)
	0.0			493.684						
3-01	5.0	0.70	1.70	497.430	148	93	92	0.84	3.75	103.5
3-01	10.0	0.70	1.70	501.100	148	95	92	0.84	3.67	101.2
3-02	15.0	0.65	1.50	504.570	148	99	93	0.81	3.47	98.8
3-02	20.0	0.62	1.50	508.090	148	101	93	0.79	3.52	102.4
3-03	25.0	0.52	1.20	511.200	148	103	94	0.72	3.11	98.5
3-03	30.0	0.50	1.20	514.351	148	105	94	0.71	3.15	101.6
4-01	35.0	0.69	1.70	517.870	148	106	96	0.83	3.52	96.4
4-01	40.0	0.69	1.70	521.280	148	107	96	0.83	3.41	93.3
4-02	45.0	0.62	1.50	525.260	148	108	97	0.79	3.98	114.7*
4-02	50.0	0.62	1.50	528.940	148	110	97	0.79	3.68	105.8
4-03	55.0	0.50	1.20	532.100	148	109	98	0.71	3.16	101.1
4-03	60.0	0.50	1.20	535.210	148	109	98	0.71	3.11	99.5
1-01	65.0	0.68	1.60	538.800	148	106	98	0.82	3.59	98.9
1-01	70.0	0.68	1.60	542.280	148	113	99	0.82	3.48	95.2
1-02	75.0	0.61	1.40	545.910	148	113	100	0.78	3.63	104.7
1-02	80.0	0.61	1.40	549.230	148	114	101	0.78	3.32	95.6
1-03	85.0	0.52	1.20	552.400	148	114	101	0.72	3.17	98.8
1-03	90.0	0.52	1.20	555.531	148	114	102	0.72	3.13	97.5
2-01	95.0	0.68	1.60	559.080	148	112	102	0.82	3.55	96.9
2-01	100.0	0.68	1.60	562.650	148	113	102	0.82	3.57	97.4
2-02	105.0	0.61	1.40	566.000	148	115	103	0.78	3.35	96.2
2-02	110.0	0.61	1.40	569.300	148	114	103	0.78	3.30	94.8
2-03	115.0	0.52	1.20	572.440	148	113	103	0.72	3.14	97.7
2-03	120.0	0.52	1.20	575.511	148	113	103	0.72	3.07	95.6
Final	120.0		1.43333	81.82700	148.00000	103.25000		0.77719	81.82700	
12 points sampled		Sq.Rt.ΔP								
QC-Check: Field Averages		0.7772	1.4333	81.8270	148.0000	103.2500				

☒ Avg. OK ☒ Avg. OK ☒ Avg. OK ☒ Avg. OK ☒ Avg. OK

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Field Data Printout

Test Method: USEPA Method 5/202
Analyte: FPM / CPM

Location: FCCU Scrubber Stack

Test Run: 2

Client: Marathon Petroleum Company

Project No: 11265

Source Area (ft²): 70.88218

Meter Operator: S. Dooley 593
Probe Operator: K. Sullivan 579

Test Date: 7/19/11

Start Time: 11:51

Stop Time: 14:19

Leak Rate Before: 0.004 cfm @ 15 "Hg
Leak Rate After: 0.002 cfm @ 8 "Hg

Bar. Press. (in. Hg): 29.40

Static P: -0.5

O₂ (dry volume %): 3.40

CO₂ (dry volume %): 13.70

N₂+CO (dry volume %): 82.90

Nozzle ID No: 250-2

Nozzle Diameter (D_n): 0.250

Probe ID No: 66-4-7

Pitot C_p: 0.827

Pitot Leak Check: ☒ Pass ☐ Fail

H₂O (condensate, ml or gm): 494.9

H₂O (silica, g): 37.6

Actual Moisture (%): 24.54

Meter Box ID. No: 85-3

Meter ΔH@: 1.77920

Meter Y_d: 0.99250

Traverse Point	Run Time 5.0 min/read	Pitot ΔP _s (in. H ₂ O)	Sample ΔH (in. H ₂ O)	Metered (dcf)	Stack T _s (°F)	Dry Gas Meter T _{m-in} (°F)	T _{m-out} (°F)	√ΔP _s (calculated) (in. H ₂ O)	Volume (calculated) (ft ³)	Isokinetics (calculated) (%)
	0.0			578.123						
1-01	5.0	0.69	1.60	581.990	148	109	105	0.83	3.87	104.8
1-01	10.0	0.69	1.60	585.570	148	113	105	0.83	3.58	96.7
1-02	14.5	0.63	1.50	588.965	148	118	106	0.79	3.39	106.1
LEAK CHECK	14.5			589.205						
1-02	15.0	0.63	1.50	589.520	148	118	106	0.79	0.31	88.6*
1-02	20.0	0.63	1.50	593.370	148	113	107	0.79	3.85	108.6
1-03	25.0	0.52	1.20	596.900	148	121	107	0.72	3.53	108.8
1-03	30.0	0.52	1.20	599.729	148	121	109	0.72	2.83	87.0*
2-01	35.0	0.67	1.60	603.387	148	116	109	0.82	3.66	99.7
2-01	40.0	0.68	1.60	606.880	148	120	110	0.82	3.49	94.1
2-02	45.0	0.62	1.50	610.370	148	121	110	0.79	3.49	98.3
2-02	50.0	0.62	1.50	613.910	148	123	111	0.79	3.54	99.5
2-03	55.0	0.50	1.20	617.080	148	124	111	0.71	3.17	99.0
2-03	60.0	0.50	1.20	620.210	148	124	112	0.71	3.13	97.7
4-01	65.0	0.67	1.60	623.340	148	115	112	0.82	3.13	85.1*
4-01	70.0	0.67	1.60	626.440	148	117	112	0.82	3.10	84.2*
4-02	75.0	0.60	1.40	629.810	148	117	111	0.77	3.37	96.7
4-02	80.0	0.60	1.40	633.160	148	117	111	0.77	3.35	96.2
4-03	85.0	0.50	1.20	636.310	148	121	111	0.71	3.15	98.7
4-03	90.0	0.50	1.20	639.425	148	119	111	0.71	3.12	97.7
LEAK CHECK	90.0			639.487						
4-01	95.0	0.67	1.60	643.090	148	117	111	0.82	3.60	97.9
4-01	100.0	0.67	1.60	646.800	148	122	112	0.82	3.71	100.3
4-02	105.0	0.60	1.40	650.300	148	122	112	0.77	3.50	99.9
4-02	110.0	0.60	1.40	653.660	148	122	112	0.77	3.36	96.0
4-03	115.0	0.50	1.20	656.950	148	121	112	0.71	3.29	103.0
4-03	120.0	0.50	1.20	660.220	148	121	112	0.71	3.27	102.3
Final	120.0		1.41667	81.79500	148.00000	114.47917		0.77184	81.79500	

12 points sampled

Sq.Rt.ΔP

QC-Check: Field Averages

0.7723 1.4167 81.7950 148.0000 114.4792

☒ Avg. OK ☒ Avg. OK ☒ Avg. OK ☒ Avg. OK ☒ Avg. OK

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Field Data Printout

Test Method: USEPA Method 5/202
Analyte: FPM / CPM

Location: FCCU Scrubber Stack

Test Run: 3

Client: Marathon Petroleum Company

Project No: 11265

Source Area (ft²): 70.88218

Meter Operator: K. Sullivan 579

Probe Operator: J. Rooney 591

Test Date: 7/19/11

Start Time: 15:22

Stop Time: 17:36

Leak Rate Before: 0.002 cfm @ 15 "Hg

Leak Rate After: 0.001 cfm @ 6 "Hg

Bar. Press. (in. Hg): 29.40

Static P: -0.5

O₂ (dry volume %): 3.50

CO₂ (dry volume %): 13.70

N₂+CO (dry volume %): 82.80

Nozzle ID No: 250-2

Nozzle Diameter (D_n): 0.250

Probe ID No: 66-4-7

Pitot C_p: 0.827

Pitot Leak Check: ☒ Pass ☐ Fail

H₂O (condensate, ml or gm): 477.2

H₂O (silica, g): 41.1

Actual Moisture (%): 24.54

Meter Box ID. No: 85-3

Meter ΔH@: 1.77920

Meter Y_d: 0.99250

Traverse Point	Run Time 5.0 min/read	Pitot ΔP _s (in. H ₂ O)	Sample ΔH (in. H ₂ O)	Metered (dcf)	Stack T _s (°F)	Dry Gas Meter T _{m-in} (°F)	T _{m-out} (°F)	√ΔP _s (calculated) (√in. H ₂ O)	Volume (calculated) (ft³)	Isokinetics (calculated) (%)
	0.0			661.200						
3-01	5.0	0.65	1.50	664.680	148	112	109	0.81	3.48	96.6
3-01	10.0	0.75	1.80	668.570	148	116	110	0.87	3.89	100.2
3-02	15.0	0.85	2.00	672.700	148	118	111	0.92	4.13	99.7
3-02	20.0	0.81	1.90	676.690	148	121	111	0.90	3.99	98.4
3-03	25.0	0.68	1.60	680.430	148	125	112	0.82	3.74	100.1
3-03	30.0	0.70	1.60	684.150	148	123	112	0.84	3.72	98.3
4-01	35.0	0.67	1.50	687.680	148	117	113	0.82	3.53	95.8
4-01	40.0	0.65	1.50	691.200	148	122	113	0.81	3.52	96.5
4-02	45.0	0.63	1.40	694.650	148	125	113	0.79	3.45	95.8
4-02	50.0	0.60	1.40	698.070	148	125	113	0.77	3.42	97.3
4-03	55.0	0.47	1.10	701.140	148	123	114	0.69	3.07	98.7
4-03	60.0	0.40	0.92	703.950	148	125	114	0.63	2.81	97.7
1-01	65.0	0.60	1.40	707.430	148	122	115	0.77	3.48	99.1
1-01	70.0	0.60	1.40	710.890	148	126	116	0.77	3.46	98.1
1-02	75.0	0.58	1.30	714.310	148	127	116	0.76	3.42	98.5
1-02	80.0	0.60	1.40	717.840	148	122	116	0.77	3.53	100.5
1-03	85.0	0.41	0.94	720.760	148	124	115	0.64	2.92	100.3
1-03	90.0	0.50	1.10	723.820	148	123	115	0.71	3.06	95.3
2-01	95.0	0.60	1.40	727.200	148	119	113	0.77	3.38	96.7
2-01	100.0	0.60	1.40	730.680	148	122	114	0.77	3.48	99.2
2-02	105.0	0.57	1.30	734.030	148	125	114	0.75	3.35	97.7
2-02	110.0	0.54	1.20	737.200	148	123	114	0.73	3.17	95.1
2-03	115.0	0.49	1.10	740.280	148	122	115	0.70	3.08	97.0
2-03	120.0	0.46	1.10	743.320	148	123	115	0.68	3.04	98.7
Final	120.0		1.38583	82.12000	148.00000	117.77083		0.77153	82.12000	

12 points sampled
QC-Check: Field Averages

Sq.Rt.ΔP	0.7715	1.3858	82.1200	148.0000	117.7708
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☒ Avg. OK ☒ Avg. OK ☒ Avg. OK ☒ Avg. OK ☒ Avg. OK

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TEST LOG

Client: Marathon Petroleum Company
Project No: 11265

Run Number	Location	Method	Analyte	Date	Start Time	End Time	Notes
1	FCCU Scrubber Stack	USEPA Mod. CTM-027	Ammonia	07/19/11	07:56	09:38	
2	FCCU Scrubber Stack	USEPA Mod. CTM-027	Ammonia	07/19/11	12:00	13:19	
3	FCCU Scrubber Stack	USEPA Mod. CTM-027	Ammonia	07/19/11	15:38	17:15	

Notes:

None

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USEPA Method 3 Laboratory Data

Location: FCCU Scrubber Stack

Client: Marathon Petroleum Company

Project No: 11265

Method: EPA Method 3A

Fuel Type: Non-Combustion

F_o for Fuel: N/A

Test Method: USEPA Mod. CTM-027

Analyte: Ammonia

Analyst: K. O'Halloren

Analyst Emp No: 478

Run Number	Trial	Percent CO ₂	Percent O ₂ +CO ₂	Percent O ₂	Percent N ₂	Dry Mol. Weight	F _o	Method of Analysis: CEM
1	1							
	2							
	3							
Avg.								
CEM or Other Avg:		13.80000		3.30000	82.90000	30.34000	1.27536	<input type="checkbox"/> Fo value within expected range.
2	1							
	2							
	3							
Avg.								
CEM or Other Avg:		13.60000		3.40000	83.00000	30.31200	1.28676	<input type="checkbox"/> Fo value within expected range.
3	1							
	2							
	3							
Avg.								
CEM or Other Avg:		13.70000		3.50000	82.80000	30.33200	1.27007	<input type="checkbox"/> Fo value within expected range.
	1							
	2							
	3							
Avg.								
CEM or Other Avg:								<input type="checkbox"/> Fo value within expected range.

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USEPA Method 4 Laboratory Data

Location: FCCU Scrubber Stack
Client: Marathon Petroleum Company

Project No: 11265

Test Method: USEPA Mod. CTM-027
Analyte: Ammonia

Analyst: D. Luckhard

Analyst Emp No: 568

Test Run: 1

	Contents	Gross (gm)	Tare (gm)	Net (gm)
Impinger 1	100 ml 0.1N H2SO4	753.0	560.6	192.4
Impinger 2	100 ml 0.1N H2SO4	593.5	546.8	46.7
Impinger 3	100 ml 0.1N H2SO4	547.2	531.6	15.6
Impinger 4	Silica Gel	739.2	723.6	15.6
Impinger 5				
Impinger 6				
Impinger 7				
Impinger 8				

Rinse: (ml or gm)

254.7 Liquid (gm)
0.0 less rinse (gm)
254.7 Net Liquid (gm)
+ 15.6 Silica Gel (gm)
270.3 Total Vlc (gm)

Field Data Check

254.7	<input checked="" type="checkbox"/> QA/QC OK
15.6	<input checked="" type="checkbox"/> QA/QC OK
270.3	<input checked="" type="checkbox"/> QA/QC OK

Test Run: 2

	Contents	Gross (gm)	Tare (gm)	Net (gm)
Impinger 1	100 ml 0.1N H2SO4	748.7	543.3	205.4
Impinger 2	100 ml 0.1N H2SO4	576.9	534.7	42.2
Impinger 3	100 ml 0.1N H2SO4	535.0	527.5	7.5
Impinger 4	Silica Gel	752.3	733.7	18.6
Impinger 5				
Impinger 6				
Impinger 7				
Impinger 8				

Rinse: (ml or gm)

255.1 Liquid (gm)
0.0 less rinse (gm)
255.1 Net Liquid (gm)
+ 18.6 Silica Gel (gm)
273.7 Total Vlc (gm)

Field Data Check

255.1	<input checked="" type="checkbox"/> QA/QC OK
18.6	<input checked="" type="checkbox"/> QA/QC OK
273.7	<input checked="" type="checkbox"/> QA/QC OK

Test Run: 3

	Contents	Gross (gm)	Tare (gm)	Net (gm)
Impinger 1	100 ml 0.1N H2SO4	766.5	561.2	205.3
Impinger 2	100 ml 0.1N H2SO4	590.5	548.6	41.9
Impinger 3	100 ml 0.1N H2SO4	538.4	531.0	7.4
Impinger 4	Silica Gel	749.9	739.1	10.8
Impinger 5				
Impinger 6				
Impinger 7				
Impinger 8				

Rinse: (ml or gm)

254.6 Liquid (gm)
0.0 less rinse (gm)
254.6 Net Liquid (gm)
+ 10.8 Silica Gel (gm)
265.4 Total Vlc (gm)

Field Data Check

254.6	<input checked="" type="checkbox"/> QA/QC OK
10.8	<input checked="" type="checkbox"/> QA/QC OK
265.4	<input checked="" type="checkbox"/> QA/QC OK

Test Run:

	Contents	Gross (gm)	Tare (gm)	Net (gm)
Impinger 1	100 ml 0.1N H2SO4			
Impinger 2	100 ml 0.1N H2SO4			
Impinger 3	100 ml 0.1N H2SO4			
Impinger 4	Silica Gel			
Impinger 5				
Impinger 6				
Impinger 7				
Impinger 8				

Rinse: (ml or gm)

Liquid (gm)
less rinse (gm)
Net Liquid (gm)
Silica Gel (gm)
Total Vlc (gm)

Field Data Check

	<input type="checkbox"/> QA/QC OK
	<input type="checkbox"/> QA/QC OK
	<input type="checkbox"/> QA/QC OK

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Field Data Printout

Test Method: USEPA Mod. CTM-027

Analyte: Ammonia

Location: FCCU Scrubber Stack

Test Run: 1

Client: Marathon Petroleum Company

Project No: 11265

Source Area (ft²): 70.88218

Meter Operator: J. Rooney 591

Probe Operator: B. Arnold 770

Test Date: 7/19/11

Start Time: 07:56

Stop Time: 09:38

Leak Rate Before: 0.005 cfm @ 15 "Hg

Leak Rate After: 0.003 cfm @ 7 "Hg

Bar. Press. (in. Hg): 29.40

Static P: -0.5

O₂ (dry volume %): 3.30

CO₂ (dry volume %): 13.80

N₂+CO (dry volume %): 82.90

Nozzle ID No: 249-1

Nozzle Diameter (D_n): 0.249

Probe ID No: 67-4-1

Pitot C_p: 0.819

Pitot Leak Check: ☒ Pass ☐ Fail

H₂O (condensate, ml or gm): 254.7

H₂O (silica, g): 15.6

Actual Moisture (%): 25.23

Meter Box ID. No: 61-7

Meter ΔH@: 1.82940

Meter Y_d: 0.98270

Traverse Point	Run Time 5.0 min/read	Pitot ΔP _s (in. H ₂ O)	Sample ΔH (in. H ₂ O)	Metered (dcf)	Stack T _s (°F)	Dry Gas Meter T _{m-in} (°F)	T _{m-out} (°F)	√ΔP _s (calculated) (√in. H ₂ O)	Volume (calculated) (ft ³)	Isokinetics (calculated) (%)
	0.0			380.650						
4-01	5.0	0.71	1.70	384.340	151	96	95	0.84	3.69	102.5
4-02	10.0	0.68	1.60	387.900	151	99	96	0.82	3.56	100.7
4-03	15.0	0.54	1.30	391.190	150	101	95	0.73	3.29	104.2
1-01	20.0	0.68	1.60	394.670	151	100	96	0.82	3.48	98.3
1-02	25.0	0.65	1.50	398.100	150	103	98	0.81	3.43	98.6
1-03	30.0	0.55	1.30	401.370	150	105	98	0.74	3.27	101.9
2-01	35.0	0.70	1.60	404.870	151	103	99	0.84	3.50	97.0
2-02	40.0	0.67	1.60	408.350	151	105	100	0.82	3.48	98.3
2-03	45.0	0.55	1.30	411.620	151	105	100	0.74	3.27	101.8
3-01	50.0	0.70	1.60	415.110	151	103	101	0.84	3.49	96.5
3-02	55.0	0.69	1.60	418.480	151	106	101	0.83	3.37	93.6
3-03	60.0	0.60	1.40	421.965	151	108	103	0.77	3.48	103.4
Final	60.0		1.50833	41.31500	150.75000	100.66667		0.80111	41.31500	

12 points sampled

Sq.Rt.ΔP

QC-Check: Field Averages

0.8011 1.5083 41.3150 150.7500 100.6667

☒ Avg. OK

☒ Avg. OK

☒ Avg. OK

☒ Avg. OK

☒ Avg. OK

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Field Data Printout

Test Method: USEPA Mod. CTM-027
Analyte: Ammonia

Location: FCCU Scrubber Stack

Test Run: 2

Client: Marathon Petroleum Company

Project No: 11265

Source Area (ft²): 70.88218

Meter Operator: B. Arnold 770

Probe Operator: K. Sullivan 579

Test Date: 7/19/11

Start Time: 12:00

Stop Time: 13:19

Leak Rate Before: 0.004 cfm @ 15 "Hg

Leak Rate After: 0.001 cfm @ 8 "Hg

Bar. Press. (in. Hg): 29.40

Static P: -0.5

O₂ (dry volume %): 3.40

CO₂ (dry volume %): 13.60

N₂+CO (dry volume %): 83.00

Nozzle ID No: 249-1

Nozzle Diameter (D_n): 0.249

Probe ID No: 67-4-1

Pitot C_p: 0.819

Pitot Leak Check: ☒ Pass ☐ Fail

H₂O (condensate, ml or gm): 255.1

H₂O (silica, g): 18.6

Actual Moisture (%): 25.71

Meter Box ID. No: 61-7

Meter ΔH@: 1.82940

Meter Y_d: 0.98270

Traverse Point	Run Time 5.0 min/read	Pitot ΔP _s (in. H ₂ O)	Sample ΔH (in. H ₂ O)	Metered (dcf)	Stack T _s (°F)	Dry Gas Meter T _{m-in} (°F)	T _{m-out} (°F)	√ΔP _s (calculated) (√in. H ₂ O)	Volume (calculated) (ft ³)	Isokinetics (calculated) (%)
	0.0			426.200						
2-01	5.0	0.64	1.50	429.760	152	107	106	0.80	3.56	102.7
2-02	10.0	0.64	1.50	433.220	152	108	107	0.80	3.46	99.6
2-03	15.0	0.56	1.30	436.550	152	110	106	0.75	3.33	102.4
4-01	20.0	0.72	1.70	440.240	152	111	108	0.85	3.69	99.9
4-02	25.0	0.65	1.50	443.830	152	114	109	0.81	3.59	101.9
4-03	30.0	0.52	1.20	447.060	152	114	109	0.72	3.23	102.4
1-01	35.0	0.64	1.50	450.570	152	112	109	0.80	3.51	100.5
1-02	40.0	0.68	1.60	454.170	152	115	110	0.82	3.60	99.7
1-03	45.0	0.53	1.20	457.340	152	115	110	0.73	3.17	99.4
3-01	50.0	0.68	1.60	460.980	152	114	111	0.82	3.64	100.8
3-02	55.0	0.65	1.50	464.540	152	115	111	0.81	3.56	100.8
3-03	60.0	0.52	1.20	467.735	152	115	111	0.72	3.19	101.0
Final	60.0		1.44167	41.53500	152.00000	110.70833		0.78573	41.53500	

12 points sampled

Sq.Rt.ΔP

QC-Check: Field Averages

0.7857 1.4416 41.5350 152.0000 110.7083

☒ Avg. OK ☒ Avg. OK ☒ Avg. OK ☒ Avg. OK ☒ Avg. OK

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Field Data Printout

Test Method: USEPA Mod. CTM-027
Analyte: Ammonia

Location: FCCU Scrubber Stack

Test Run: 3

Client: Marathon Petroleum Company

Project No: 11265

Source Area (ft²): 70.88218

Meter Operator: B. Arnold 770
Probe Operator: K. Sullivan 579

Test Date: 7/19/11

Start Time: 15:38

Stop Time: 17:15

Leak Rate Before: 0.003 cfm @ 15 "Hg
Leak Rate After: 0.001 cfm @ 8 "Hg

Bar. Press. (in. Hg): 29.40
Static P: -0.5

O₂ (dry volume %): 3.50
CO₂ (dry volume %): 13.70
N₂+CO (dry volume %): 82.80

Nozzle ID No: 249-1
Nozzle Diameter (D_n): 0.249
Probe ID No: 67-4-1
Pitot C_p: 0.819
Pitot Leak Check: ☒ Pass ☐ Fail

H₂O (condensate, ml or gm): 254.6

H₂O (silica, g): 10.8

Actual Moisture (%): 25.36

Meter Box ID. No: 61-7

Meter ΔH@: 1.82940

Meter Y_d: 0.98270

Traverse Point	Run Time 5.0 min/read	Pitot ΔP _s (in. H ₂ O)	Sample ΔH (in. H ₂ O)	Metered (dcf)	Stack T _s (°F)	Dry Gas Meter		√ΔP _s (calculated) (√in. H ₂ O)	Volume (calculated) (ft ³)	Isokinetics (calculated) (%)
	0.0			469.300		T _{m-in} (°F)	T _{m-out} (°F)			
4-01	5.0	0.66	1.50	472.850	152	113	112	0.81	3.55	99.4
4-02	10.0	0.66	1.50	476.340	152	113	113	0.81	3.49	97.7
4-03	15.0	0.53	1.20	479.620	152	114	113	0.73	3.28	102.3
1-01	20.0	0.64	1.50	483.120	152	115	113	0.80	3.50	99.3
1-02	25.0	0.64	1.50	486.670	152	116	113	0.80	3.55	100.6
1-03	30.0	0.52	1.20	489.870	152	117	113	0.72	3.20	100.5
2-01	35.0	0.65	1.50	493.350	152	116	113	0.81	3.48	97.9
2-02	40.0	0.61	1.40	496.780	152	118	114	0.78	3.43	99.3
2-03	45.0	0.52	1.20	500.010	152	119	114	0.72	3.23	101.1
3-01	50.0	0.72	1.60	503.610	152	115	114	0.85	3.60	96.2
3-02	55.0	0.68	1.50	507.150	152	116	114	0.82	3.54	97.3
3-03	60.0	0.62	1.40	510.585	152	117	114	0.79	3.44	98.7
Final	60.0		1.41667	41.28500	152.00000	114.54167		0.78690	41.28500	

12 points sampled

Sq.Rt.ΔP

QC-Check: Field Averages

0.7869 1.4166 41.2850 152.0000 114.5416

☒ Avg. OK ☒ Avg. OK ☒ Avg. OK ☒ Avg. OK ☒ Avg. OK

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TEST LOG

Client: Marathon Petroleum Company
Project No: 11265

Run Number	Location	Method	Analyte	Date	Start Time	End Time	Notes
1	FCCU Scrubber Stack	USEPA Method 29	Non-Mercury Metals	07/19/11	07:42	10:52	
2	FCCU Scrubber Stack	USEPA Method 29	Non-Mercury Metals	07/19/11	11:23	14:37	
3	FCCU Scrubber Stack	USEPA Method 29	Non-Mercury Metals	07/19/11	15:17	18:30	

Notes:

None

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USEPA Method 3 Laboratory Data

Location: FCCU Scrubber Stack

Client: Marathon Petroleum Company

Project No: 11265

Method: EPA Method 3A

Fuel Type: Non-Combustion

F_o for Fuel: N/A

Test Method: USEPA Method 29
Analyte: Non-Mercury Metals

Analyst: K. O'Halloren
Analyst Emp No: 478

Run Number	Trial	Percent CO ₂	Percent O ₂ +CO ₂	Percent O ₂	Percent N ₂	Dry Mol. Weight	F _o	Method of Analysis: CEM
1	1							
	2							
	3							
Avg.								
CEM or Other Avg:		13.60000		3.60000	82.80000	30.32000	1.27206	<input type="checkbox"/> Fo value within expected range.
2	1							
	2							
	3							
Avg.								
CEM or Other Avg:		13.50000		3.30000	83.20000	30.29200	1.30370	<input type="checkbox"/> Fo value within expected range.
3	1							
	2							
	3							
Avg.								
CEM or Other Avg:		13.70000		3.40000	82.90000	30.32800	1.27737	<input type="checkbox"/> Fo value within expected range.
	1							
	2							
	3							
Avg.								
CEM or Other Avg:								<input type="checkbox"/> Fo value within expected range.

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USEPA Method 4 Laboratory Data

Location: FCCU Scrubber Stack

Client: Marathon Petroleum Company

Project No: 11265

Test Method:

USEPA Method 29

Analyte:

Non-Mercury Metals

Analyst:

D. Luckhard

Analyst Emp No:

568

Test Run: 1

	Contents	Gross (gm)	Tare (gm)	Net (gm)
Impinger 1	Empty	850.9	437.5	413.4
Impinger 2	5%HNO3/10%H2O2	838.1	538.6	299.5
Impinger 3	5%HNO3/10%H2O2	658.4	542.3	116.1
Impinger 4	Silica Gel	757.1	728.1	29.0
Impinger 5				
Impinger 6				
Impinger 7				
Impinger 8				

829.0 Liquid (gm)

Field Data Check

0.0 less rinse (gm)

829.0 Net Liquid (gm)

829.0

☒ QA/QC OK

+ 29.0 Silica Gel (gm)

29.0

☒ QA/QC OK

858.0 Total Vlc (gm)

858.0

☒ QA/QC OK

Rinse: (ml or gm)

Test Run: 2

	Contents	Gross (gm)	Tare (gm)	Net (gm)
Impinger 1	Empty	853.2	445.0	408.2
Impinger 2	5%HNO3/10%H2O2	876.4	539.9	336.5
Impinger 3	5%HNO3/10%H2O2	601.1	531.5	69.6
Impinger 4	Silica Gel	713.5	676.5	37.0
Impinger 5				
Impinger 6				
Impinger 7				
Impinger 8				

814.3 Liquid (gm)

Field Data Check

0.0 less rinse (gm)

814.3 Net Liquid (gm)

814.3

☒ QA/QC OK

+ 37.0 Silica Gel (gm)

37.0

☒ QA/QC OK

851.3 Total Vlc (gm)

851.3

☒ QA/QC OK

Rinse: (ml or gm)

Test Run: 3

	Contents	Gross (gm)	Tare (gm)	Net (gm)
Impinger 1	Empty	848.1	439.3	408.8
Impinger 2	5%HNO3/10%H2O2	840.4	539.3	301.1
Impinger 3	5%HNO3/10%H2O2	614.7	543.9	70.8
Impinger 4	Silica Gel	755.8	731.1	24.7
Impinger 5				
Impinger 6				
Impinger 7				
Impinger 8				

780.7 Liquid (gm)

Field Data Check

0.0 less rinse (gm)

780.7 Net Liquid (gm)

780.7

☒ QA/QC OK

+ 24.7 Silica Gel (gm)

24.7

☒ QA/QC OK

805.4 Total Vlc (gm)

805.4

☒ QA/QC OK

Rinse: (ml or gm)

Test Run:

	Contents	Gross (gm)	Tare (gm)	Net (gm)
Impinger 1	Empty			
Impinger 2	5%HNO3/10%H2O2			
Impinger 3	5%HNO3/10%H2O2			
Impinger 4	Silica Gel			
Impinger 5				
Impinger 6				
Impinger 7				
Impinger 8				

Liquid (gm)

Field Data Check

less rinse (gm)

Net Liquid (gm)

Silica Gel (gm)

Total Vlc (gm)

☐ QA/QC OK☐ QA/QC OK☐ QA/QC OK

Rinse: (ml or gm)

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Field Data Printout

Test Method: USEPA Method 29
Analyte: Non-Mercury Metals

Location: FCCU Scrubber Stack

Test Run: 1

Client: Marathon Petroleum Company

Project No: 11265

Source Area (ft²): 70.88218

Meter Operator: H. Nguyen 429

Probe Operator: B. Arnold 770

Test Date: 7/19/11

Start Time: 07:42

Stop Time: 10:52

Leak Rate Before: 0.003 cfm @ 15 "Hg

Leak Rate After: 0.001 cfm @ 8 "Hg

Bar. Press. (in. Hg): 29.40

Static P: -0.5

O₂ (dry volume %): 3.60

CO₂ (dry volume %): 13.60

N₂+CO (dry volume %): 82.80

Nozzle ID No: 250-1

Nozzle Diameter (D_n): 0.250

Probe ID No: 67-4-4

Pitot C_p: 0.820

Pitot Leak Check: ☒ Pass ☐ Fail

H₂O (condensate, ml or gm): 829.0

H₂O (silica, g): 29.0

Actual Moisture (%): 24.97

Meter Box ID. No: 61-5

Meter ΔH@: 1.71850

Meter Y_d: 0.99920

Traverse Point	Run Time 5.0 min/read	Pitot ΔP _s (in. H ₂ O)	Sample ΔH (in. H ₂ O)	Metered (dcf)	Stack T _s (°F)	Dry Gas Meter T _{m-in} (°F)	T _{m-out} (°F)	√ΔP _s (calculated) (in. H ₂ O)	Volume (calculated) (ft ³)	Isokinetics (calculated) (%)
	0.0			665.650						
2-01	5.0	0.78	1.80	669.590	150	94	93	0.88	3.94	105.2
2-01	10.0	0.78	1.80	673.600	150	97	94	0.88	4.01	106.7
2-01	15.0	0.78	1.80	677.620	152	99	94	0.88	4.02	106.9
2-02	20.0	0.71	1.70	681.500	152	99	94	0.84	3.88	108.2
2-02	25.0	0.71	1.70	685.390	152	99	94	0.84	3.89	108.4
2-02	30.0	0.71	1.70	689.260	151	100	95	0.84	3.87	107.6
2-03	35.0	0.56	1.30	692.600	151	102	95	0.75	3.34	104.3
2-03	40.0	0.56	1.30	695.940	152	102	95	0.75	3.34	104.4
2-03	45.0	0.58	1.30	699.270	152	103	96	0.76	3.33	102.1
3-01	50.0	0.75	1.70	703.130	152	104	97	0.87	3.86	104.0
3-01	55.0	0.73	1.70	706.980	152	105	97	0.85	3.85	105.0
3-01	60.0	0.74	1.70	710.120	152	107	98	0.86	3.14	84.8*
3-02	65.0	0.71	1.60	714.660	152	106	98	0.84	4.54	125.3*
3-02	70.0	0.70	1.60	718.500	152	104	97	0.84	3.84	107.0
3-02	75.0	0.70	1.60	722.150	152	104	98	0.84	3.65	101.6
3-03	80.0	0.62	1.40	725.720	152	104	98	0.79	3.57	105.6
3-03	85.0	0.61	1.40	729.270	152	105	98	0.78	3.55	105.7
3-03	90.0	0.62	1.40	732.790	152	106	98	0.79	3.52	103.9
4-01	95.0	0.75	1.70	736.640	152	106	100	0.87	3.85	103.2
4-01	100.0	0.74	1.70	740.520	152	106	100	0.86	3.88	104.7
4-01	105.0	0.74	1.70	744.400	152	108	100	0.86	3.88	104.5
4-02	110.0	0.68	1.50	748.040	152	107	100	0.82	3.64	102.3
4-02	115.0	0.68	1.50	751.650	152	108	101	0.82	3.61	101.3
4-02	120.0	0.68	1.50	755.230	152	109	101	0.82	3.58	100.4
4-03	125.0	0.52	1.20	758.650	152	108	101	0.72	3.42	109.7
4-03	130.0	0.52	1.20	761.840	152	108	102	0.72	3.19	102.2
4-03	135.0	0.52	1.20	765.040	152	109	102	0.72	3.20	102.5
1-01	140.0	0.77	1.70	768.860	152	109	102	0.88	3.82	100.6
1-01	145.0	0.77	1.70	772.590	151	109	102	0.88	3.73	98.2
1-01	150.0	0.77	1.70	776.410	151	109	102	0.88	3.82	100.5
1-02	155.0	0.60	1.40	779.940	151	109	102	0.77	3.53	105.2
1-02	160.0	0.61	1.40	783.420	151	109	103	0.78	3.48	102.7
1-02	165.0	0.61	1.40	786.880	152	110	103	0.78	3.46	102.1
1-03	170.0	0.52	1.20	790.260	152	109	104	0.72	3.38	108.0
1-03	175.0	0.52	1.20	793.510	152	110	104	0.72	3.25	103.8
1-03	180.0	0.52	1.20	796.760	152	110	104	0.72	3.25	103.8
Final	180.0		1.51667	131.11000	151.72222	102.15278		0.81234	131.11000	

12 points sampled

Sq.Rt.ΔP

QC-Check: Field Averages

0.8123 1.5167 131.1100 151.7222 102.1528

☒ Avg. OK

☒ Avg. OK

☒ Avg. OK

☒ Avg. OK

☒ Avg. OK

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Field Data Printout

Test Method: USEPA Method 29
Analyte: Non-Mercury Metals

Location: FCCU Scrubber Stack

Test Run: 2

Client: Marathon Petroleum Company

Project No: 11265

Source Area (ft²): 70.88218

Meter Operator: H. Nguyen 429

Probe Operator: J. Rooney 591

Test Date: 7/19/11

Start Time: 11:23

Stop Time: 14:37

Leak Rate Before: 0.001 cfm @ 15 "Hg

Leak Rate After: 0.002 cfm @ 7 "Hg

Bar. Press. (in. Hg): 29.40

Static P: -0.5

O₂ (dry volume %): 3.30

CO₂ (dry volume %): 13.50

N₂+CO (dry volume %): 83.20

Nozzle ID No: 250-1

Nozzle Diameter (D_n): 0.250

Probe ID No: 67-4-4

Pitot C_p: 0.820

Pitot Leak Check: ☒ Pass ☐ Fail

H₂O (condensate, ml or gm): 814.3

H₂O (silica, g): 37.0

Actual Moisture (%): 24.90

Meter Box ID. No: 61-5

Meter ΔH@: 1.71850

Meter Y_d: 0.99920

Traverse Point	Run Time 5.0 min/read	Pitot ΔP _s (in. H ₂ O)	Sample ΔH (in. H ₂ O)	Metered (dcf)	Stack T _s (°F)	Dry Gas Meter T _{m-in} (°F)	T _{m-out} (°F)	√ΔP _s (calculated) (√in. H ₂ O)	Volume (calculated) (ft ³)	Isokinetics (calculated) (%)
	0.0			797.300						
4-01	5.0	0.72	1.60	801.080	152	106	104	0.85	3.78	102.9
4-01	10.0	0.73	1.60	804.830	152	107	104	0.85	3.75	101.3
4-01	15.0	0.73	1.60	808.590	152	107	104	0.85	3.76	101.6
4-02	20.0	0.77	1.70	812.440	152	109	104	0.88	3.85	101.1
4-02	25.0	0.77	1.70	816.300	152	111	104	0.88	3.86	101.2
4-02	30.0	0.75	1.70	820.270	151	113	105	0.87	3.97	105.1
4-03	35.0	0.49	1.10	824.210	151	113	106	0.70	3.94	128.7*
4-03	40.0	0.51	1.10	827.500	151	113	106	0.71	3.29	105.4
4-03	45.0	0.51	1.10	830.670	152	113	106	0.71	3.17	101.6
3-01	50.0	0.69	1.60	834.510	151	113	107	0.83	3.84	105.8
3-01	55.0	0.71	1.60	838.370	151	116	108	0.84	3.86	104.5
3-01	60.0	0.72	1.60	842.260	151	116	108	0.85	3.89	104.5
3-02	65.0	0.71	1.60	846.130	151	117	108	0.84	3.87	104.6
3-02	70.0	0.70	1.60	849.930	152	116	109	0.84	3.80	103.6
3-02	75.0	0.70	1.60	853.760	152	116	109	0.84	3.83	104.4
3-03	80.0	0.60	1.40	857.710	152	116	110	0.77	3.95	116.1*
3-03	85.0	0.61	1.40	861.170	151	118	111	0.78	3.46	100.5
3-03	90.0	0.60	1.40	864.790	151	118	111	0.77	3.62	106.0
1-01	95.0	0.73	1.60	868.630	151	116	111	0.85	3.84	102.2
1-01	100.0	0.72	1.60	872.470	151	116	111	0.85	3.84	102.9
1-01	105.0	0.72	1.60	876.320	151	116	110	0.85	3.85	103.3
1-02	110.0	0.74	1.70	880.180	152	115	110	0.86	3.86	102.3
1-02	115.0	0.74	1.70	884.150	152	115	110	0.86	3.97	105.3
1-02	120.0	0.74	1.70	888.010	152	115	110	0.86	3.86	102.3
1-03	125.0	0.52	1.20	891.820	151	116	109	0.72	3.81	120.3*
1-03	130.0	0.54	1.20	894.780	151	115	110	0.73	2.96	91.7
1-03	135.0	0.54	1.20	898.100	151	115	110	0.73	3.32	102.8
2-01	140.0	0.75	1.70	901.090	152	115	110	0.87	2.99	78.7*
2-01	145.0	0.75	1.70	905.360	152	116	111	0.87	4.27	112.3*
2-01	150.0	0.76	1.70	909.660	152	118	112	0.87	4.30	112.0*
2-02	155.0	0.66	1.50	913.300	151	116	110	0.81	3.64	102.0
2-02	160.0	0.67	1.50	916.900	151	115	110	0.82	3.60	100.2
2-02	165.0	0.68	1.50	920.590	151	116	111	0.82	3.69	101.7
2-03	170.0	0.51	1.10	923.810	151	115	111	0.71	3.22	102.5
2-03	175.0	0.52	1.10	927.000	151	115	110	0.72	3.19	100.7
2-03	180.0	0.52	1.10	930.050	151	115	110	0.72	3.05	96.2
Final	180.0		1.48333	132.75000	151.41667	111.50000		0.81148	132.75000	

12 points sampled

Sq.Rt.ΔP

QC-Check: Field Averages

0.8115	1.4833	132.7500	151.4167	111.5000
<input checked="" type="checkbox"/> Avg. OK	<input checked="" type="checkbox"/> Avg. OK	<input checked="" type="checkbox"/> Avg. OK	<input checked="" type="checkbox"/> Avg. OK	<input checked="" type="checkbox"/> Avg. OK

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Field Data Printout

Test Method: USEPA Method 29
Analyte: Non-Mercury Metals

Location: FCCU Scrubber Stack

Test Run: 3

Client: Marathon Petroleum Company

Project No: 11265

Source Area (ft²): 70.88218

Meter Operator: H. Nguyen 429

Probe Operator: S. Dooley 593

Test Date: 7/19/11

Start Time: 15:17

Stop Time: 18:30

Leak Rate Before: 0.003 cfm @ 15 "Hg

Leak Rate After: 0.000 cfm @ 8 "Hg

Bar. Press. (in. Hg): 29.40

Static P: -0.5

O₂ (dry volume %): 3.40

CO₂ (dry volume %): 13.70

N₂+CO (dry volume %): 82.90

Nozzle ID No: 250-1

Nozzle Diameter (D_n): 0.250

Probe ID No: 67-4-4

Pitot C_p: 0.820

Pitot Leak Check: ☒ Pass ☐ Fail

H₂O (condensate, ml or gm): 780.7

H₂O (silica, g): 24.7

Actual Moisture (%): 24.81

Meter Box ID. No: 61-5

Meter ΔH@: 1.71850

Meter Y_d: 0.99920

Traverse Point	Run Time 5.0 min/read	Pitot ΔP _s (in. H ₂ O)	Sample ΔH (in. H ₂ O)	Metered (dcf)	Stack T _s (°F)	Dry Gas Meter T _{m-in} (°F)	T _{m-out} (°F)	√ΔP _s (calculated) (√in. H ₂ O)	Volume (calculated) (ft ³)	Isokinetics (calculated) (%)
	0.0			930.500						
2-01	5.0	0.72	1.60	934.380	151	109	108	0.85	3.88	104.9
2-01	10.0	0.70	1.60	938.270	151	113	110	0.84	3.89	106.1
2-01	15.0	0.71	1.60	942.170	151	114	111	0.84	3.90	105.4
2-02	20.0	0.62	1.40	945.820	151	115	110	0.79	3.65	105.5
2-02	25.0	0.63	1.30	949.140	151	116	110	0.79	3.32	95.1
2-02	30.0	0.63	1.30	952.620	151	117	111	0.79	3.48	99.5
2-03	35.0	0.56	1.20	955.840	151	117	111	0.75	3.22	97.6
2-03	40.0	0.54	1.20	959.050	151	117	111	0.73	3.21	99.1
2-03	45.0	0.54	1.20	962.250	151	118	112	0.73	3.20	98.6
3-01	50.0	0.75	1.60	965.650	151	116	112	0.87	3.40	89.2*
3-01	55.0	0.72	1.60	970.290	151	117	112	0.85	4.64	124.1*
3-01	60.0	0.71	1.50	974.000	151	118	112	0.84	3.71	99.8
3-02	65.0	0.65	1.40	977.600	152	120	113	0.81	3.60	101.0
3-02	70.0	0.66	1.40	981.190	152	120	113	0.81	3.59	100.0
3-02	75.0	0.66	1.40	984.850	152	120	114	0.81	3.66	101.8
3-03	80.0	0.51	1.10	988.100	152	120	114	0.71	3.25	102.8
3-03	85.0	0.50	1.10	991.310	152	120	114	0.71	3.21	102.5
3-03	90.0	0.51	1.10	994.500	152	120	114	0.71	3.19	100.9
4-01	95.0	0.68	1.50	998.200	152	116	113	0.82	3.70	101.9
4-01	100.0	0.68	1.50	1001.900	152	116	113	0.82	3.70	101.9
4-01	105.0	0.68	1.50	1005.630	152	118	113	0.82	3.73	102.5
4-02	110.0	0.66	1.40	1009.470	151	118	112	0.81	3.84	107.1
4-02	115.0	0.66	1.40	1012.840	151	118	112	0.81	3.37	94.0
4-02	120.0	0.66	1.40	1016.670	151	118	112	0.81	3.83	106.8
4-03	125.0	0.48	1.00	1019.400	152	117	111	0.69	2.73	89.4*
4-03	130.0	0.49	1.00	1022.450	152	117	112	0.70	3.05	98.8
4-03	135.0	0.48	1.00	1025.430	152	117	112	0.69	2.98	97.5
1-01	140.0	0.75	1.60	1029.240	151	115	111	0.87	3.81	100.1
1-01	145.0	0.75	1.60	1033.020	151	115	111	0.87	3.78	99.3
1-01	150.0	0.75	1.60	1036.760	151	116	111	0.87	3.74	98.2
1-02	155.0	0.71	1.50	1040.400	152	116	111	0.84	3.64	98.2
1-02	160.0	0.71	1.50	1044.040	152	115	110	0.84	3.64	98.4
1-02	165.0	0.71	1.50	1047.770	152	116	111	0.84	3.73	100.7
1-03	170.0	0.50	1.10	1051.110	151	116	110	0.71	3.34	107.3
1-03	175.0	0.50	1.10	1054.190	151	116	110	0.71	3.08	99.0
1-03	180.0	0.50	1.10	1057.370	151	116	110	0.71	3.18	102.2
Final	180.0		1.35833	126.87000	151.41667	114.16667		0.79134	126.87000	

12 points sampled

Sq.Rt.ΔP

QC-Check: Field Averages

0.7913 1.3583 126.8700 151.4167 114.1667

☒ Avg. OK ☒ Avg. OK ☒ Avg. OK ☒ Avg. OK ☒ Avg. OK

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TEST LOG

Client: Marathon Petroleum Company
Project No: 11265

Run Number	Location	Method	Analyte	Date	Start Time	End Time	Notes
1	FCCU Scrubber Stack	ASTM D6784-02	Mercury	07/15/11	09:00	13:14	
2	FCCU Scrubber Stack	ASTM D6784-02	Mercury	07/15/11	13:27	16:04	
3	FCCU Scrubber Stack	ASTM D6784-02	Mercury	07/16/11	08:40	11:07	

Notes:

None

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USEPA Method 3 Laboratory Data

Location: FCCU Scrubber Stack

Client: Marathon Petroleum Company

Project No: 11265

Method: EPA Method 3A

Fuel Type: Non-Combustion

F_o for Fuel: N/A

Test Method:

ASTM D6784-02

Analyte:

Mercury

Analyst: K. O'Halloren

Analyst Emp No: 478

Run Number	Trial	Percent CO ₂	Percent O ₂ +CO ₂	Percent O ₂	Percent N ₂	Dry Mol. Weight	F _o	Method of Analysis: CEM
1	1							
	2							
	3							
	Avg.							
CEM or Other Avg:		13.40000		3.60000	83.00000	30.28800	1.29104	<input type="checkbox"/> Fo value within expected range.
2	1							
	2							
	3							
	Avg.							
CEM or Other Avg:		13.00000		4.00000	83.00000	30.24000	1.30000	<input type="checkbox"/> Fo value within expected range.
3	1							
	2							
	3							
	Avg.							
CEM or Other Avg:		13.70000		3.50000	82.80000	30.33200	1.27007	<input type="checkbox"/> Fo value within expected range.
	1							
	2							
	3							
	Avg.							
CEM or Other Avg:								<input type="checkbox"/> Fo value within expected range.

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USEPA Method 4 Laboratory Data

Location: FCCU Scrubber Stack

Client: Marathon Petroleum Company

Project No: 11265

Test Method:

ASTM D6784-02

Analyte:

Mercury

Analyst: D. Luckhard

Analyst Emp No: 568

Test Run: 1

	Contents	Gross (gm)	Tare (gm)	Net (gm)		
Impinger 1	1.0 M KCl	821.1	533.3	287.8		
Impinger 2	1.0 M KCl	765.6	538.0	227.6		
Impinger 3	1.0 M KCl	569.4	541.5	27.9		
Impinger 4	5% HNO ₃ /10% H ₂ O ₂	543.3	537.2	6.1		
Impinger 5	4% KMnO ₄ /10% H ₂ SO ₄	541.3	541.9	-0.6		
Impinger 6	4% KMnO ₄ /10% H ₂ SO ₄	552.9	548.3	4.6	555.3 Liquid (gm)	Field Data Check
Impinger 7	4% KMnO ₄ /10% H ₂ SO ₄	616.6	614.7	1.9	0.0 less rinse (gm)	
Impinger 8	Silica Gel	731.5	709.5	22.0	555.3 Net Liquid (gm)	555.3
					+ 22.0 Silica Gel (gm)	22.0
					577.3 Total Vlc (gm)	577.3
	Rinse:		(ml or gm)			

☒ QA/QC OK
☒ QA/QC OK
☒ QA/QC OK

Test Run: 2

	Contents	Gross (gm)	Tare (gm)	Net (gm)		
Impinger 1	1.0 M KCl	800.8	549.3	251.5		
Impinger 2	1.0 M KCl	806.5	539.7	266.8		
Impinger 3	1.0 M KCl	590.5	571.1	19.4		
Impinger 4	5% HNO ₃ /10% H ₂ O ₂	540.3	538.0	2.3		
Impinger 5	4% KMnO ₄ /10% H ₂ SO ₄	551.3	551.2	0.1		
Impinger 6	4% KMnO ₄ /10% H ₂ SO ₄	535.2	533.8	1.4	541.9 Liquid (gm)	Field Data Check
Impinger 7	4% KMnO ₄ /10% H ₂ SO ₄	541.0	540.6	0.4	0.0 less rinse (gm)	
Impinger 8	Silica Gel	750.1	733.1	17.0	541.9 Net Liquid (gm)	541.9
					+ 17.0 Silica Gel (gm)	17.0
					558.9 Total Vlc (gm)	558.9
	Rinse:		(ml or gm)			

☒ QA/QC OK
☒ QA/QC OK
☒ QA/QC OK

Test Run: 3

	Contents	Gross (gm)	Tare (gm)	Net (gm)		
Impinger 1	1.0 M KCl	846.7	534.5	312.2		
Impinger 2	1.0 M KCl	745.7	539.4	206.3		
Impinger 3	1.0 M KCl	556.0	542.2	13.8		
Impinger 4	5% HNO ₃ /10% H ₂ O ₂	541.0	538.5	2.5		
Impinger 5	4% KMnO ₄ /10% H ₂ SO ₄	540.9	540.9	0.0		
Impinger 6	4% KMnO ₄ /10% H ₂ SO ₄	552.9	551.2	1.7	536.4 Liquid (gm)	Field Data Check
Impinger 7	4% KMnO ₄ /10% H ₂ SO ₄	616.1	616.2	-0.1	0.0 less rinse (gm)	
Impinger 8	Silica Gel	771.3	754.9	16.4	536.4 Net Liquid (gm)	536.4
					+ 16.4 Silica Gel (gm)	16.4
					552.8 Total Vlc (gm)	552.8
	Rinse:		(ml or gm)			

☒ QA/QC OK
☒ QA/QC OK
☒ QA/QC OK

Test Run:

	Contents	Gross (gm)	Tare (gm)	Net (gm)		
Impinger 1	1.0 M KCl					
Impinger 2	1.0 M KCl					
Impinger 3	1.0 M KCl					
Impinger 4	5% HNO ₃ /10% H ₂ O ₂					
Impinger 5	4% KMnO ₄ /10% H ₂ SO ₄					
Impinger 6	4% KMnO ₄ /10% H ₂ SO ₄				Liquid (gm)	Field Data Check
Impinger 7	4% KMnO ₄ /10% H ₂ SO ₄				less rinse (gm)	
Impinger 8	Silica Gel				Net Liquid (gm)	
					Silica Gel (gm)	
					Total Vlc (gm)	
	Rinse:		(ml or gm)			

☐ QA/QC OK
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Field Data Printout

Test Method:

ASTM D6784-02

Analyte:

Mercury

Location: FCCU Scrubber Stack

Test Run: 1

Client: Marathon Petroleum Company

Project No: 11265

Source Area (ft²): 70.88218

Meter Operator: J. Rooney 591

Probe Operator: B. Arnold 770

Test Date: 7/15/11

Start Time: 09:00

Stop Time: 13:14

Leak Rate Before: 0.006 cfm @ 15 "Hg

Leak Rate After: 0.002 cfm @ 8 "Hg

Bar. Press. (in. Hg): 29.40

Static P: -0.3

O₂ (dry volume %): 3.60

CO₂ (dry volume %): 13.40

N₂+CO (dry volume %): 83.00

Nozzle ID No: 250-1

Nozzle Diameter (D_n): 0.250

Probe ID No: 67-4-4

Pitot C_p: 0.820

Pitot Leak Check: ☒ Pass ☐ Fail

H₂O (condensate, ml or gm): 555.3

H₂O (silica, g): 22.0

Actual Moisture (%): 24.43

Meter Box ID. No: 61-5

Meter ΔH@: 1.71850

Meter Y_d: 0.99920

Traverse Point	Run Time 5.0 min/read	Pitot ΔP _s (in. H ₂ O)	Sample ΔH (in. H ₂ O)	Metered (dcf)	Stack T _s (°F)	Dry Gas Meter		√ΔP _s (calculated) (√in. H ₂ O)	Volume (calculated) (ft ³)	Isokinetics (calculated) (%)
						T _{m-in} (°F)	T _{m-out} (°F)			
2-01	5.0	0.74	1.70	401.090	149	95	94	0.86	4.06	110.2*
2-01	10.0	0.72	1.70	404.920	149	100	94	0.85	3.83	105.0
2-02	15.0	0.72	1.70	408.720	150	103	95	0.85	3.80	103.9
2-02	20.0	0.74	1.70	412.520	154	106	96	0.86	3.80	102.4
2-03	25.0	0.60	1.40	416.010	150	107	97	0.77	3.49	103.9
2-03	30.0	0.60	1.40	419.480	149	107	98	0.77	3.47	103.1
4-01	35.0	0.80	1.90	423.430	149	104	98	0.89	3.95	102.0
4-01	40.0	0.80	1.90	427.370	148	106	99	0.89	3.94	101.4
4-02	45.0	0.72	1.70	431.450	150	108	99	0.85	4.08	110.6*
4-02	50.0	0.72	1.70	435.430	149	109	99	0.85	3.98	107.7
4-03	55.0	0.55	1.30	438.860	148	109	101	0.74	3.43	105.8
4-03	60.0	0.55	1.30	442.260	150	109	101	0.74	3.40	105.1
1-01	65.0	0.71	1.70	446.170	150	105	102	0.84	3.91	106.8
1-01	70.0	0.71	1.70	450.070	149	106	102	0.84	3.90	106.3
1-02	75.0	0.70	1.70	453.580	149	108	102	0.84	3.51	96.2
1-02	80.0	0.70	1.70	457.100	150	104	101	0.84	3.52	97.0
1-03	85.0	0.68	1.60	461.291	150	104	101	0.82	4.19	117.1*
1-03	90.0	0.68	1.60	464.930	149	107	102	0.82	3.64	101.2
3-01	95.0	0.72	1.70	469.290	149	108	102	0.85	4.36	117.8*
3-01	100.0	0.72	1.70	473.190	150	109	103	0.85	3.90	105.3
3-02	105.0	0.75	1.80	477.350	150	110	103	0.87	4.16	109.9
3-02	110.0	0.75	1.80	481.130	150	109	103	0.87	3.78	100.0
3-03	115.0	0.61	1.40	484.650	150	109	103	0.78	3.52	103.1
3-03	120.0	0.61	1.40	488.000	150	109	103	0.78	3.35	98.2
Final	120.0		1.63333	90.97000	149.62500	103.10417		0.83062	90.97000	

12 points sampled
QC-Check: Field Averages

Sq.Rt.ΔP	0.8306	1.6333	90.9700	149.6250	103.1042
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☒ Avg. OK ☒ Avg. OK ☒ Avg. OK ☒ Avg. OK ☒ Avg. OK

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Field Data Printout

Test Method:

ASTM D6784-02

Analyte:

Mercury

Location: FCCU Scrubber Stack

Test Run: 2

Client: Marathon Petroleum Company

Project No: 11265

Source Area (ft²): 70.88218

Meter Operator: H. Nguyen 429

Probe Operator: B. Arnold 770

Test Date: 7/15/11

Start Time: 13:27

Stop Time: 16:04

Leak Rate Before: 0.005 cfm @ 15 "Hg

Leak Rate After: 0.004 cfm @ 8 "Hg

Bar. Press. (in. Hg): 29.40

Static P: -0.3

O₂ (dry volume %): 4.00

CO₂ (dry volume %): 13.00

N₂+CO (dry volume %): 83.00

Nozzle ID No: 250-1

Nozzle Diameter (D_n): 0.250

Probe ID No: 67-4-4

Pitot C_p: 0.820

Pitot Leak Check: ☒ Pass ☐ Fail

H₂O (condensate, ml or gm): 541.9

H₂O (silica, g): 17.0

Actual Moisture (%): 24.43

Meter Box ID. No: 61-5

Meter ΔH@: 1.71850

Meter Y_d: 0.99920

Traverse Point	Run Time 5.0 min/read	Pitot ΔP _s (in. H ₂ O)	Sample ΔH (in. H ₂ O)	Metered (dcf)	Stack T _s (°F)	Dry Gas Meter T _{m-in} (°F)	T _{m-out} (°F)	√ΔP _s (calculated) (√in. H ₂ O)	Volume (calculated) (ft ³)	Isokinetics (calculated) (%)
	0.0			488.660						
3-01	5.0	0.76	1.70	492.500	150	102	100	0.87	3.84	101.7
3-01	10.0	0.76	1.70	496.620	149	104	100	0.87	4.12	108.9
3-02	15.0	0.72	1.60	500.380	150	104	101	0.85	3.76	102.0
3-02	20.0	0.72	1.60	504.140	149	107	101	0.85	3.76	101.7
3-03	25.0	0.55	1.30	507.600	150	108	102	0.74	3.46	106.9
3-03	30.0	0.55	1.30	511.000	150	109	102	0.74	3.40	104.9
2-01	35.0	0.68	1.60	514.820	150	107	103	0.82	3.82	106.2
2-01	40.0	0.68	1.60	518.520	150	108	103	0.82	3.70	102.8
2-02	45.0	0.63	1.40	522.110	150	109	103	0.79	3.59	103.4
2-02	50.0	0.63	1.40	525.690	149	111	103	0.79	3.58	102.9
2-03	55.0	0.59	1.30	529.210	149	111	105	0.77	3.52	104.3
2-03	60.0	0.59	1.30	532.600	149	111	105	0.77	3.39	100.5
4-01	65.0	0.69	1.60	536.290	150	108	107	0.83	3.69	101.6
4-01	70.0	0.68	1.60	540.000	150	109	107	0.82	3.71	102.6
4-02	75.0	0.74	1.70	543.980	150	113	108	0.86	3.98	105.1
4-02	80.0	0.74	1.70	547.860	150	115	108	0.86	3.88	102.2
4-03	85.0	0.56	1.30	551.290	150	116	109	0.75	3.43	103.6
4-03	90.0	0.56	1.30	554.690	150	118	109	0.75	3.40	102.5
1-01	95.0	0.72	1.60	558.330	150	110	109	0.85	3.64	97.6
1-01	100.0	0.80	1.80	562.280	150	111	109	0.89	3.95	100.4
1-02	105.0	0.79	1.80	566.260	150	112	108	0.89	3.98	101.8
1-02	110.0	0.82	1.90	570.320	150	113	108	0.91	4.06	101.9
1-03	115.0	0.56	1.30	573.960	150	114	108	0.75	3.64	110.3*
1-03	120.0	0.55	1.30	577.459	150	114	108	0.74	3.50	106.9
Final	120.0		1.52917	88.79900	149.79167	107.70833		0.81644	88.79900	

12 points sampled
QC-Check: Field Averages

Sq.Rt.ΔP

0.8163 1.5292 88.7990 149.7917 107.7083

☒ Avg. OK

☒ Avg. OK

☒ Avg. OK

☒ Avg. OK

☒ Avg. OK

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Field Data Printout

Test Method:

ASTM D6784-02

Analyte:

Mercury

Location: FCCU Scrubber Stack

Test Run: 3

Client: Marathon Petroleum Company

Project No: 11265

Source Area (ft²): 70.88218

Meter Operator: H. Nguyen 429

Probe Operator: B. Arnold 770

Test Date: 7/16/11

Start Time: 08:40

Stop Time: 11:07

Leak Rate Before: 0.003 cfm @ 15 "Hg

Leak Rate After: 0.002 cfm @ 7 "Hg

Bar. Press. (in. Hg): 29.45

Static P: -0.4

O₂ (dry volume %): 3.50

CO₂ (dry volume %): 13.70

N₂+CO (dry volume %): 82.80

Nozzle ID No: 250-1

Nozzle Diameter (D_n): 0.250

Probe ID No: 67-4-4

Pitot C_p: 0.820

Pitot Leak Check: ☒ Pass ☐ Fail

H₂O (condensate, ml or gm): 536.4

H₂O (silica, g): 16.4

Actual Moisture (%): 24.43

Meter Box ID. No: 61-5

Meter ΔH@: 1.71850

Meter Y_d: 0.99920

Traverse Point	Run Time 5.0 min/read	Pitot ΔP _s (in. H ₂ O)	Sample ΔH (in. H ₂ O)	Metered (dcf)	Stack T _s (°F)	Dry Gas Meter		√ΔP _s (calculated) (√in. H ₂ O)	Volume (calculated) (ft ³)	Isokinetics (calculated) (%)
						T _{m-in} (°F)	T _{m-out} (°F)			
	0.0			577.800						
4-01	5.0	0.78	1.80	581.800	150	94	93	0.88	4.00	106.3
4-01	10.0	0.75	1.70	585.500	150	94	93	0.87	3.70	100.2
4-02	15.0	0.71	1.60	589.380	150	96	94	0.84	3.88	107.7
4-02	20.0	0.71	1.60	593.080	150	99	94	0.84	3.70	102.4
4-03	25.0	0.53	1.20	596.380	150	100	95	0.73	3.30	105.4
4-03	30.0	0.50	1.20	599.650	150	102	95	0.71	3.27	107.4
1-01	35.0	0.67	1.50	603.300	150	103	96	0.82	3.65	103.4
1-01	40.0	0.67	1.50	606.970	150	103	97	0.82	3.67	103.9
1-02	45.0	0.64	1.50	610.600	150	105	97	0.80	3.63	105.0
1-02	50.0	0.64	1.50	614.240	150	107	98	0.80	3.64	105.0
1-03	55.0	0.50	1.20	617.560	150	107	99	0.71	3.32	108.2
1-03	60.0	0.50	1.20	620.740	150	107	99	0.71	3.18	103.6
2-01	65.0	0.79	1.80	624.870	150	105	101	0.89	4.13	107.2
2-01	70.0	0.79	1.80	628.700	150	108	101	0.89	3.83	99.1
2-02	75.0	0.66	1.50	632.330	150	109	102	0.81	3.63	102.5
2-02	80.0	0.66	1.50	635.920	150	109	102	0.81	3.59	101.4
2-03	85.0	0.64	1.50	639.650	150	110	103	0.80	3.73	106.8
2-03	90.0	0.63	1.40	643.280	150	111	103	0.79	3.63	104.7
3-01	95.0	0.76	1.70	647.150	150	107	104	0.87	3.87	101.9
3-01	100.0	0.76	1.70	651.020	149	110	105	0.87	3.87	101.5
3-02	105.0	0.65	1.50	654.600	149	111	104	0.81	3.58	101.5
3-02	110.0	0.65	1.50	658.180	149	110	104	0.81	3.58	101.6
3-03	115.0	0.55	1.20	661.420	150	110	104	0.74	3.24	99.9
3-03	120.0	0.54	1.20	664.640	150	111	104	0.73	3.22	100.1
Final	120.0		1.49167	86.84000	149.87500	102.39583		0.80623	86.84000	

12 points sampled

Sq.Rt.ΔP

QC-Check: Field Averages

0.8063 1.4917 86.8400 149.8750 102.3958

☒ Avg. OK ☒ Avg. OK ☒ Avg. OK ☒ Avg. OK ☒ Avg. OK

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TEST LOG

Client: Marathon Petroleum Company
Project No: 11265

Run Number	Location	Method	Analyte	Date	Start Time	End Time	Notes
1	FCCU Scrubber Stack	USEPA SW-846 Method 0061	Hexavalent Chromium	07/15/11	08:58	13:06	
2	FCCU Scrubber Stack	USEPA SW-846 Method 0061	Hexavalent Chromium	07/15/11	14:06	17:42	
3	FCCU Scrubber Stack	USEPA SW-846 Method 0061	Hexavalent Chromium	07/16/11	08:36	12:21	

Notes:

None

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USEPA Method 3 Laboratory Data

Location: FCCU Scrubber Stack

Client: Marathon Petroleum Company

Project No: 11265

Method: EPA Method 3A

Fuel Type: Non-Combustion

F_o for Fuel: N/A

Test Method: USEPA SW-846 Method 0061
Analyte: Hexavalent Chromium

Analyst: K. O'Halloren

Analyst Emp No: 478

Run Number	Trial	Percent CO ₂	Percent O ₂ +CO ₂	Percent O ₂	Percent N ₂	Dry Mol. Weight	F _o	Method of Analysis: CEM
1	1							
	2							
	3							
	Avg.							
CEM or Other Avg:		12.90000		4.20000	82.90000	30.23200	1.29457	<input type="checkbox"/> Fo value within expected range.
2	1							
	2							
	3							
	Avg.							
CEM or Other Avg:		13.30000		3.60000	83.10000	30.27200	1.30075	<input type="checkbox"/> Fo value within expected range.
3	1							
	2							
	3							
	Avg.							
CEM or Other Avg:		13.50000		3.60000	82.90000	30.30400	1.28148	<input type="checkbox"/> Fo value within expected range.
	1							
	2							
	3							
	Avg.							
CEM or Other Avg:								<input type="checkbox"/> Fo value within expected range.

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USEPA Method 4 Laboratory Data

Location: FCCU Scrubber Stack

Client: Marathon Petroleum Company

Project No: 11265

Test Method: USEPA SW-846 Method 0061

Analyte: Hexavalent Chromium

Analyst: K. O'Halloren

Analyst Emp No: 478

Test Run: 1

	Contents	Gross (gm)	Tare (gm)	Net (gm)		
Impinger 1	0.5 M KOH	632.2	664.6	-32.4		
Impinger 2	0.5 M KOH	663.9	575.3	88.6		
Impinger 3	0.5 M KOH	706.2	581.7	124.5		
Impinger 4	Empty	716.0	566.8	149.2		
Impinger 5	Empty	862.0	419.0	443.0		
Impinger 6	Silica Gel	737.8	728.8	9.0	772.9 Liquid (gm)	Field Data Check
Impinger 7	Silica Gel	870.5	766.3	104.2	-100.0 less rinse (gm)	
Impinger 8					672.9 Net Liquid (gm)	672.9
					+ 113.2 Silica Gel (gm)	104.2
					786.1 Total Vlc (gm)	786.1
	Rinse:	100.0	(ml or gm)			

☒ QA/QC OK

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☒ QA/QC OK

Test Run: 2

Contents		Gross (gm)	Tare (gm)	Net (gm)		
Impinger 1	0.5 M KOH	694.6	659.3	35.3		
Impinger 2	0.5 M KOH	688.2	582.6	105.6		
Impinger 3	0.5 M KOH	690.9	581.4	109.5		
Impinger 4	Empty	728.4	580.6	147.8		
Impinger 5	Empty	820.0	436.5	383.5		
Impinger 6	Silica Gel	752.4	724.3	28.1	781.7 Liquid (gm)	Field Data Check
Impinger 7		698.6	691.9	6.7	-100.0 less rinse (gm)	
Impinger 8					681.7 Net Liquid (gm)	681.7
					+ 34.8 Silica Gel (gm)	34.8
					716.5 Total Vlc (gm)	716.5
	Rinse:	100.0	(ml or gm)			

☒ QA/QC OK
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 ☒ QA/QC OK

Test Run: 3

Contents		Gross (gm)	Tare (gm)	Net (gm)		
Impinger 1	0.5 M KOH	693.5	660.4	33.1		
Impinger 2	0.5 M KOH	670.8	578.0	92.8		
Impinger 3	0.5 M KOH	703.3	585.4	117.9		
Impinger 4	Empty	756.1	576.8	179.3		
Impinger 5	Empty	1030.1	602.9	427.2		
Impinger 6	Silica Gel	797.6	764.1	33.5	850.3 Liquid (gm)	Field Data Check
Impinger 7					-100.0 less rinse (gm)	
Impinger 8					750.3 Net Liquid (gm)	750.3
					+ 33.5 Silica Gel (gm)	33.5
					783.8 Total Vlc (gm)	783.8
	Rinse:	100.0	(ml or gm)			

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☒ QA/QC OK

Test Run:

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Field Data Printout

Test Method: USEPA SW-846 Method 0061

Analyte: Hexavalent Chromium

Location: FCCU Scrubber Stack

Test Run: 1

Client: Marathon Petroleum Company

Project No: 11265

Source Area (ft²): 70.88218

Meter Operator: J. Rooney 591

Probe Operator: B. Arnold 770

Test Date: 7/15/11

Start Time: 08:58

Stop Time: 13:06

Leak Rate Before: 0.005 cfm @ 10 "Hg

Leak Rate After: 0.003 cfm @ 8 "Hg

Bar. Press. (in. Hg): 29.40

Static P: -0.3

O₂ (dry volume %): 4.20

CO₂ (dry volume %): 12.90

N₂+CO (dry volume %): 82.90

Nozzle ID No: 250-1

Nozzle Diameter (D_n): 0.250

Probe ID No: 67-4-1

Pitot C_p: 0.819

Pitot Leak Check: ☒ Pass ☐ Fail

H₂O (condensate, ml or gm): 672.9

H₂O (silica, g): 113.2

Actual Moisture (%): 24.11

Meter Box ID. No: 61-7

Meter ΔH@: 1.82940

Meter Y_d: 0.98270

Traverse Point	Run Time 5.0 min/read	Pitot ΔP _s (in. H ₂ O)	Sample ΔH (in. H ₂ O)	Metered (dcf)	Stack T _s (°F)	Dry Gas Meter T _{m-in} (°F)	T _{m-out} (°F)	√ΔP _s (calculated) (√in. H ₂ O)	Volume (calculated) (ft³)	Isokinetics (calculated) (%)
	0.0			1.840						
3-01	5.0	0.69	1.70	5.570	149	92	89	0.83	3.73	103.6
3-01	10.0	0.65	1.60	9.000	149	95	90	0.81	3.43	97.8
3-01	15.0	0.70	1.70	12.620	150	100	90	0.84	3.62	99.1
3-02	20.0	0.69	1.70	16.290	150	102	92	0.83	3.67	100.8
3-02	25.0	0.68	1.70	19.950	150	104	93	0.82	3.66	101.0
3-02	30.0	0.71	1.70	23.600	149	105	94	0.84	3.65	98.3
3-03	35.0	0.55	1.30	27.300	149	106	95	0.74	3.70	112.9*
3-03	40.0	0.55	1.30	30.530	150	107	96	0.74	3.23	98.5
3-03	45.0	0.62	1.50	33.740	151	107	97	0.79	3.21	92.2
2-01	47.5	0.50	1.20	35.290	150	104	99	0.71	1.55	99.1
LEAK CHECK	47.5			35.370						
2-01	50.0	0.50	1.20	36.980	150	104	99	0.71	1.61	103.0
2-01	55.0	0.60	1.50	40.420	150	104	101	0.77	3.44	100.3
2-01	60.0	0.62	1.50	43.860	150	106	100	0.79	3.44	98.6
2-02	65.0	0.60	1.50	47.340	151	107	101	0.77	3.48	101.3
2-02	70.0	0.60	1.50	50.800	151	109	102	0.77	3.46	100.4
2-02	75.0	0.60	1.50	54.280	150	110	102	0.77	3.48	100.8
2-03	80.0	0.55	1.30	57.560	150	110	102	0.74	3.28	99.2
2-03	85.0	0.55	1.30	60.800	150	109	102	0.74	3.24	98.1
2-03	90.0	0.55	1.30	64.010	150	109	102	0.74	3.21	97.2
1-01	95.0	0.60	1.50	67.460	150	103	102	0.77	3.45	100.6
1-01	100.0	0.62	1.50	70.940	150	107	102	0.79	3.48	99.5
1-01	105.0	0.62	1.50	74.400	151	108	103	0.79	3.46	98.8
1-02	110.0	0.62	1.50	77.850	151	108	103	0.79	3.45	98.5
1-02	115.0	0.62	1.50	81.310	150	110	103	0.79	3.46	98.6
1-02	120.0	0.64	1.60	84.850	150	110	102	0.80	3.54	99.4
1-03	125.0	0.62	1.50	88.350	150	110	103	0.79	3.50	99.7
1-03	130.0	0.64	1.60	91.840	151	110	104	0.80	3.49	97.9
1-03	135.0	0.55	1.30	95.090	150	110	103	0.74	3.25	98.2
4-01	140.0	0.79	1.90	99.000	150	103	102	0.89	3.91	99.5
4-01	145.0	0.76	1.90	102.890	150	107	103	0.87	3.89	100.4
4-01	150.0	0.85	2.10	106.950	150	110	103	0.92	4.06	98.9
4-02	155.0	0.95	2.30	111.020	150	111	103	0.97	4.07	93.8
4-02	160.0	0.78	1.90	114.930	150	111	103	0.88	3.91	99.3
4-02	165.0	0.76	1.90	118.830	150	112	104	0.87	3.90	100.2
4-03	170.0	0.76	1.90	122.710	150	112	104	0.87	3.88	99.7
4-03	175.0	0.76	1.90	126.550	150	113	105	0.87	3.84	98.5
4-03	180.0	0.80	2.00	130.150	150	113	105	0.89	3.60	90.0*
Final	180.0		1.61389	128.23000	150.05556	103.58333		0.81009	128.23000	

12 points sampled

Sq.Rt.ΔP

QC-Check: Field Averages

0.8101 1.6139 128.2300 150.0556 103.5833

☒ Avg. OK ☒ Avg. OK ☒ Avg. OK ☒ Avg. OK ☒ Avg. OK

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Field Data Printout

Test Method: USEPA SW-846 Method 0061

Analyte: Hexavalent Chromium

Location: FCCU Scrubber Stack

Test Run: 2

Client: Marathon Petroleum Company

Project No: 11265

Source Area (ft²): 70.88218

Meter Operator: J. Rooney 591

Probe Operator: B. Arnold 770

Test Date: 7/15/11

Start Time: 14:06

Stop Time: 17:42

Leak Rate Before: 0.003

Leak Rate After: 0.001

cfm @ 10 "Hg

cfm @ 5 "Hg

Bar. Press. (in. Hg): 29.40

Static P: -0.3

O₂ (dry volume %): 3.60

CO₂ (dry volume %): 13.30

N₂+CO (dry volume %): 83.10

Nozzle ID No: 250-1

Nozzle Diameter (D_n): 0.250

Probe ID No: 67-4-1

Pitot C_p: 0.819

Pitot Leak Check: ☒ Pass ☐ Fail

H₂O (condensate, ml or gm): 681.7

H₂O (silica, g): 34.8

Actual Moisture (%): 23.75

Meter Box ID. No: 61-7

Meter ΔH@: 1.82940

Meter Y_d: 0.98270

Traverse Point	Run Time 5.0 min/read	Pitot ΔP _s (in. H ₂ O)	Sample ΔH (in. H ₂ O)	Metered (dcf)	Stack T _s (°F)	Dry Gas Meter T _{m-in} (°F)	T _{m-out} (°F)	√ΔP _s (calculated) (√in. H ₂ O)	Volume (calculated) (ft ³)	Isokinetics (calculated) (%)
	0.0			132.170						
1-01	5.0	0.67	1.50	135.710	150	103	103	0.82	3.54	97.3
1-01	10.0	0.67	1.50	139.190	150	105	103	0.82	3.48	95.5
1-01	15.0	0.67	1.50	142.620	150	108	103	0.82	3.43	93.8
1-02	20.0	0.65	1.50	146.030	150	108	103	0.81	3.41	94.7
1-02	25.0	0.65	1.50	149.390	150	110	103	0.81	3.36	93.2
1-02	30.0	0.65	1.50	152.720	150	111	104	0.81	3.33	92.2
1-03	35.0	0.52	1.20	156.010	150	111	105	0.72	3.29	101.6
1-03	40.0	0.54	1.20	159.140	150	112	105	0.73	3.13	94.8
1-03	45.0	0.52	1.20	162.210	150	112	106	0.72	3.07	94.7
3-01	50.0	0.72	1.70	165.860	150	108	106	0.85	3.65	96.1
3-01	55.0	0.72	1.70	169.550	150	113	108	0.85	3.69	96.6
3-01	60.0	0.68	1.60	173.160	150	116	109	0.82	3.61	96.9
3-02	65.0	0.65	1.50	176.630	152	115	109	0.81	3.47	95.4
3-02	70.0	0.68	1.60	180.210	152	116	110	0.82	3.58	96.1
3-02	75.0	0.68	1.60	183.780	151	118	110	0.82	3.57	95.6
3-03	80.0	0.50	1.20	186.950	150	117	110	0.71	3.17	98.9
3-03	85.0	0.53	1.20	190.050	151	117	111	0.73	3.10	93.9
3-03	90.0	0.60	1.40	193.350	150	117	111	0.77	3.30	94.0
4-01	95.0	0.60	1.40	196.680	150	111	110	0.77	3.33	95.4
4-01	100.0	0.62	1.40	199.990	150	113	110	0.79	3.31	93.1
4-01	105.0	0.62	1.40	203.340	150	115	111	0.79	3.35	94.0
4-02	110.0	0.60	1.40	206.700	150	116	110	0.77	3.36	95.8
4-02	115.0	0.60	1.40	210.000	150	116	111	0.77	3.30	94.0
4-02	120.0	0.65	1.50	213.310	150	117	111	0.81	3.31	90.6
4-03	125.0	0.60	1.40	216.630	150	118	112	0.77	3.32	94.4
4-03	130.0	0.62	1.40	219.940	150	118	112	0.79	3.31	92.5
4-03	135.0	0.60	1.40	223.300	151	117	112	0.77	3.36	95.7
LEAK CHECK	135.0			223.360						
2-01	140.0	0.66	1.50	226.880	151	112	112	0.81	3.52	96.0
2-01	145.0	0.60	1.40	230.290	150	115	112	0.77	3.41	97.2
2-01	150.0	0.58	1.30	233.530	151	115	111	0.76	3.24	94.0
2-02	155.0	0.60	1.40	237.020	150	113	111	0.77	3.49	99.7
2-02	160.0	0.60	1.40	240.340	150	115	111	0.77	3.32	94.7
2-02	165.0	0.60	1.40	243.610	150	115	110	0.77	3.27	93.3
2-03	170.0	0.54	1.20	246.900	150	116	110	0.73	3.29	98.9
2-03	175.0	0.54	1.20	250.000	150	115	110	0.73	3.10	93.2
2-03	180.0	0.54	1.20	253.100	150	115	110	0.73	3.10	93.2
Final	180.0		1.41111	120.87000	150.25000	111.16667		0.78213	120.87000	
12 points sampled										
QC-Check: Field Averages		Sq.Rt.ΔP								
		0.7821	1.4111	120.8700	150.2500	111.1667				
		<input checked="" type="checkbox"/> Avg. OK	<input checked="" type="checkbox"/> Avg. OK	<input checked="" type="checkbox"/> Avg. OK	<input checked="" type="checkbox"/> Avg. OK	<input checked="" type="checkbox"/> Avg. OK				

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Field Data Printout

Test Method: USEPA SW-846 Method 0061

Analyte: Hexavalent Chromium

Location: FCCU Scrubber Stack

Test Run: 3

Client: Marathon Petroleum Company

Project No: 11265

Source Area (ft²): 70.88218

Meter Operator: J. Rooney 591

Probe Operator: B. Arnold 770

Test Date: 7/16/11

Start Time: 08:36

Stop Time: 12:21

Leak Rate Before: 0.005 cfm @ 10 "Hg

Leak Rate After: 0.010 cfm @ 5 "Hg

Bar. Press. (in. Hg): 29.45

Static P: -0.4

O₂ (dry volume %): 3.60

CO₂ (dry volume %): 13.50

N₂+CO (dry volume %): 82.90

Nozzle ID No: 250-1

Nozzle Diameter (D_n): 0.250

Probe ID No: 67-4-1

Pitot C_p: 0.819

Pitot Leak Check: ☒ Pass ☐ Fail

H₂O (condensate, ml or gm): 750.3

H₂O (silica, g): 33.5

Actual Moisture (%): 24.67

Meter Box ID. No: 61-7

Meter ΔH@: 1.82940

Meter Y_d: 0.98270

Traverse Point	Run Time 5.0 min/read	Pitot ΔP _s (in. H ₂ O)	Sample ΔH (in. H ₂ O)	Metered (dcf)	Stack T _s (°F)	Dry Gas Meter		√ΔP _s (calculated) (√in. H ₂ O)	Volume (calculated) (ft ³)	Isokinetics (calculated) (%)
						T _{m-in} (°F)	T _{m-out} (°F)			
2-01	5.0	0.66	1.60	258.580	150	96	95	0.81	3.63	103.2
2-01	10.0	0.66	1.60	262.130	150	100	96	0.81	3.55	100.3
2-01	15.0	0.66	1.60	265.650	150	104	97	0.81	3.52	99.0
2-02	20.0	0.62	1.50	269.150	150	106	98	0.79	3.50	101.3
2-02	25.0	0.62	1.50	272.590	150	107	98	0.79	3.44	99.5
2-02	30.0	0.65	1.60	276.090	150	108	99	0.81	3.50	98.7
2-03	35.0	0.56	1.30	279.590	150	108	99	0.75	3.50	106.3
2-03	40.0	0.53	1.30	283.030	150	109	99	0.73	3.44	107.3
2-03	45.0	0.56	1.30	286.115	150	108	101	0.75	3.09	93.5
3-01	50.0	0.70	1.70	289.750	150	103	102	0.84	3.63	99.0
3-01	55.0	0.70	1.70	293.370	150	106	102	0.84	3.62	98.3
3-01	60.0	0.70	1.70	296.960	150	108	102	0.84	3.59	97.3
3-02	65.0	0.65	1.60	300.500	150	110	103	0.81	3.54	99.3
3-02	70.0	0.65	1.60	304.030	150	110	103	0.81	3.53	99.0
3-02	75.0	0.65	1.60	307.580	150	110	103	0.81	3.55	99.6
3-03	80.0	0.55	1.30	311.090	150	112	103	0.74	3.51	106.8
3-03	85.0	0.55	1.30	314.600	150	112	103	0.74	3.51	106.8
3-03	90.0	0.59	1.40	317.960	150	111	105	0.77	3.36	98.6
1-01	95.0	0.67	1.60	321.490	150	106	104	0.82	3.53	97.8
1-01	100.0	0.67	1.60	324.990	150	109	104	0.82	3.50	96.7
1-01	105.0	0.67	1.60	328.590	150	111	105	0.82	3.60	99.2
1-02	110.0	0.64	1.50	331.990	150	111	106	0.80	3.40	95.8
1-02	115.0	0.64	1.50	335.460	150	112	106	0.80	3.47	97.6
1-02	120.0	0.64	1.50	338.890	150	113	106	0.80	3.43	96.4
1-03	125.0	0.57	1.40	342.230	150	114	108	0.75	3.34	99.2
1-03	130.0	0.55	1.30	345.570	150	114	108	0.74	3.34	101.0
1-03	135.0	0.55	1.30	348.790	151	115	108	0.74	3.22	97.3
4-01	140.0	0.69	1.60	352.230	150	111	108	0.83	3.44	93.2
4-01	145.0	0.65	1.50	355.730	150	112	109	0.81	3.50	97.5
4-01	150.0	0.65	1.50	359.190	150	113	108	0.81	3.46	96.4
4-02	155.0	0.65	1.50	362.630	150	113	108	0.81	3.44	95.8
4-02	160.0	0.65	1.50	366.090	150	114	108	0.81	3.46	96.3
4-02	165.0	0.65	1.50	369.550	150	116	109	0.81	3.46	96.0
4-03	170.0	0.58	1.40	372.890	151	114	108	0.76	3.34	98.4
4-03	175.0	0.58	1.40	376.220	150	113	108	0.76	3.33	98.1
4-03	180.0	0.58	1.40	379.520	150	112	109	0.76	3.30	97.3
Final	180.0		1.49444	124.57500	150.0556	106.79167		0.79065	124.57500	

12 points sampled

Sq.Rt.ΔP

QC-Check: Field Averages

0.7906 1.4944 124.5750 150.0556 106.7917

☒ Avg. OK ☒ Avg. OK ☒ Avg. OK ☒ Avg. OK ☒ Avg. OK

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TEST LOG

Client: Marathon Petroleum Company
Project No: 11265

Run Number	Location	Method	Analyte	Date	Start Time	End Time	Notes
1	FCCU Scrubber Stack	USEPA Method 26A	Halides / Halogens	07/20/11	09:49	12:18	
2	FCCU Scrubber Stack	USEPA Method 26A	Halides / Halogens	07/20/11	12:50	15:10	
3	FCCU Scrubber Stack	USEPA Method 26A	Halides / Halogens	07/21/11	07:54	10:07	

Notes:

None

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USEPA Method 3 Laboratory Data

Location: FCCU Scrubber Stack

Client: Marathon Petroleum Company

Project No: 11265

Method: EPA Method 3A

Fuel Type: Non-Combustion

F_o for Fuel: N/A

Test Method:

USEPA Method 26A

Analyte:

Halides / Halogens

Analyst: K. O'Halloren

Analyst Emp No: 478

Run Number	Trial	Percent CO ₂	Percent O ₂ +CO ₂	Percent O ₂	Percent N ₂	Dry Mol. Weight	F _o	Method of Analysis: CEM
1	1							
	2							
	3							
	Avg.							
CEM or Other Avg:		13.90000		3.65000	82.45000	30.37000	1.24101	<input type="checkbox"/> Fo value within expected range.
2	1							
	2							
	3							
	Avg.							
CEM or Other Avg:		13.70000		3.70000	82.60000	30.34000	1.25547	<input type="checkbox"/> Fo value within expected range.
3	1							
	2							
	3							
	Avg.							
CEM or Other Avg:		13.65000		3.70000	82.65000	30.33200	1.26007	<input type="checkbox"/> Fo value within expected range.
	1							
	2							
	3							
	Avg.							
CEM or Other Avg:								<input type="checkbox"/> Fo value within expected range.

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Field Data Printout

Test Method: USEPA Method 26A
Analyte: Halides / Halogens

Location: FCCU Scrubber Stack

Test Run: 1

Client: Marathon Petroleum Company

Project No: 11265

Source Area (ft²): 70.88218

Meter Operator: S. Dooley 593
Probe Operator: K. Sullivan 579

Test Date: 7/20/11

Start Time: 09:49

Stop Time: 12:18

Leak Rate Before: 0.003 cfm @ 15 "Hg
Leak Rate After: 0.002 cfm @ 24 "Hg

Bar. Press. (in. Hg): 29.30
Static P: -0.3

O₂ (dry volume %): 3.65
CO₂ (dry volume %): 13.90
N₂+CO (dry volume %): 82.45

Nozzle ID No: 250-2
Nozzle Diameter (D_n): 0.250
Probe ID No: 66-4-7
Pitot C_p: 0.827
Pitot Leak Check: ☒ Pass ☐ Fail

H₂O (condensate, ml or gm): 477.7

H₂O (silica, g): 22.8

Actual Moisture (%): 24.00

Meter Box ID. No: 85-3
Meter ΔH@: 1.77920
Meter Y_d: 0.99250

Traverse Point	Run Time 5.0 min/read	Pitot ΔP _s (in. H ₂ O)	Sample ΔH (in. H ₂ O)	Metered (dcf)	Stack T _s (°F)	Dry Gas Meter		√ΔP _s (calculated) (√in. H ₂ O)	Volume (calculated) (ft ³)	Isokinetics (calculated) (%)
						T _{m-in} (°F)	T _{m-out} (°F)			
	0.0			744.984						
1-01	5.0	0.70	1.60	748.740	147	101	99	0.84	3.76	101.5
1-01	10.0	0.70	1.60	752.300	147	104	99	0.84	3.56	96.0
1-02	15.0	0.58	1.30	755.550	147	106	99	0.76	3.25	96.0
1-02	20.0	0.58	1.30	758.670	147	107	99	0.76	3.12	92.1
1-03	25.0	0.50	1.10	761.710	147	111	100	0.71	3.04	96.2
1-03	30.0	0.50	1.10	764.691	147	113	102	0.71	2.98	94.0
2-01	35.0	0.66	1.60	767.530	147	107	102	0.81	2.84	78.4*
2-01	40.0	0.66	1.60	771.100	147	113	103	0.81	3.57	98.0
2-02	45.0	0.58	1.30	773.925	147	116	104	0.76	2.82	82.4*
LEAK CHECK	45.0			774.565						
2-02	50.0	0.58	1.30	778.070	147	108	105	0.76	3.51	102.8
2-03	55.0	0.50	1.10	781.210	147	116	105	0.71	3.14	98.5
2-03	60.0	0.50	1.10	784.225	147	119	106	0.71	3.01	94.2
3-01	65.0	0.70	1.60	787.850	147	120	108	0.84	3.63	95.6
3-01	70.0	0.70	1.60	791.440	147	121	108	0.84	3.59	94.6
3-02	75.0	0.55	1.30	794.780	147	122	108	0.74	3.34	99.1
3-02	80.0	0.55	1.30	798.040	147	121	109	0.74	3.26	96.8
3-03	85.0	0.47	1.10	801.080	147	120	109	0.69	3.04	97.6
3-03	90.0	0.47	1.10	804.093	147	118	109	0.69	3.01	97.0
4-01	95.0	0.70	1.60	807.640	147	111	108	0.84	3.55	94.3
4-01	100.0	0.70	1.60	811.060	147	118	108	0.84	3.42	90.4
4-02	105.0	0.60	1.40	814.550	147	120	109	0.77	3.49	99.3
4-02	110.0	0.60	1.40	817.830	147	121	109	0.77	3.28	93.2
4-03	115.0	0.51	1.20	821.120	147	121	109	0.71	3.29	101.4
4-03	120.0	0.51	1.20	824.454	147	121	110	0.71	3.33	102.7
Final	120.0		1.35000	78.83000	147.00000	110.04167		0.76464	78.83000	

12 points sampled
QC-Check: Field Averages

Sq.Rt.ΔP	0.7646	1.3500	78.8300	147.0000	110.0417
<input checked="" type="checkbox"/> Avg. OK	<input checked="" type="checkbox"/> Avg. OK	<input checked="" type="checkbox"/> Avg. OK	<input checked="" type="checkbox"/> Avg. OK	<input checked="" type="checkbox"/> Avg. OK	<input checked="" type="checkbox"/> Avg. OK

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Field Data Printout

Test Method: USEPA Method 26A
Analyte: Halides / Halogens

Location: FCCU Scrubber Stack

Test Run: 2

Client: Marathon Petroleum Company

Project No: 11265

Source Area (ft²): 70.88218

Meter Operator: S. Dooley 593

Probe Operator: K. Sullivan 579

Test Date: 7/20/11

Start Time: 12:50

Stop Time: 15:10

Leak Rate Before: 0.002 cfm @ 16 "Hg

Leak Rate After: 0.002 cfm @ 8 "Hg

Bar. Press. (in. Hg): 29.30

Static P: -0.3

O₂ (dry volume %): 3.70

CO₂ (dry volume %): 13.70

N₂+CO (dry volume %): 82.60

Nozzle ID No: 250-2

Nozzle Diameter (D_n): 0.250

Probe ID No: 66-4-7

Pitot C_p: 0.827

Pitot Leak Check: ☒ Pass ☐ Fail

H₂O (condensate, ml or gm): 485.9

H₂O (silica, g): 21.2

Actual Moisture (%): 24.00

Meter Box ID. No: 85-3

Meter ΔH@: 1.77920

Meter Y_d: 0.99250

Traverse Point	Run Time 5.0 min/read	Pitot ΔP _s (in. H ₂ O)	Sample ΔH (in. H ₂ O)	Metered (dcf)	Stack T _s (°F)	Dry Gas Meter		√ΔP _s (calculated) (√in. H ₂ O)	Volume (calculated) (ft ³)	Isokinetics (calculated) (%)
	0.0					T _{m-in} (°F)	T _{m-out} (°F)			
1-01	5.0	0.65	1.50	828.320	147	112	108	0.81	3.56	98.1
1-01	10.0	0.65	1.50	831.790	147	116	108	0.81	3.47	95.3
1-02	15.0	0.60	1.40	835.200	147	119	108	0.77	3.41	97.1
1-02	20.0	0.60	1.40	838.650	147	121	109	0.77	3.45	98.0
1-03	25.0	0.50	1.10	841.800	147	123	110	0.71	3.15	97.7
1-03	30.0	0.50	1.10	844.888	147	121	110	0.71	3.09	96.0
4-01	35.0	0.65	1.50	848.240	147	122	112	0.81	3.35	91.2
4-01	40.0	0.64	1.50	851.740	147	122	112	0.80	3.50	96.0
4-02	45.0	0.57	1.30	855.060	147	122	111	0.75	3.32	96.5
4-02	50.0	0.57	1.30	858.340	147	122	111	0.75	3.28	95.3
4-03	55.0	0.44	1.00	861.400	147	122	112	0.66	3.06	101.1
4-03	60.0	0.44	1.00	864.190	147	122	112	0.66	2.79	92.2
3-01	65.0	0.67	1.50	867.810	147	118	113	0.82	3.62	97.3
3-01	70.0	0.67	1.50	871.430	147	121	113	0.82	3.62	97.0
3-02	75.0	0.59	1.40	874.970	147	123	113	0.77	3.54	100.9
3-02	80.0	0.59	1.40	878.390	147	124	114	0.77	3.42	97.3
3-03	85.0	0.52	1.20	881.540	147	124	114	0.72	3.15	95.4
3-03	90.0	0.52	1.20	884.673	147	123	114	0.72	3.13	95.0
2-01	95.0	0.64	1.50	888.120	147	111	111	0.80	3.45	95.5
2-01	100.0	0.64	1.50	891.640	147	113	111	0.80	3.52	97.4
2-02	105.0	0.60	1.40	895.060	147	119	112	0.77	3.42	97.1
2-02	110.0	0.60	1.40	898.420	147	120	112	0.77	3.36	95.3
2-03	115.0	0.52	1.20	901.570	147	122	113	0.72	3.15	95.7
2-03	120.0	0.52	1.20	904.710	147	120	112	0.72	3.14	95.6
Final	120.0		1.33333	79.95000	147.00000	115.77083		0.75940	79.95000	

12 points sampled
QC-Check: Field Averages

Sq.Rt.ΔP	0.7594	1.3333	79.9500	147.0000	115.7708
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☒ Avg. OK ☒ Avg. OK ☒ Avg. OK ☒ Avg. OK ☒ Avg. OK

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Field Data Printout

Test Method: USEPA Method 26A
Analyte: Halides / Halogens

Location: FCCU Scrubber Stack

Test Run: 3

Client: Marathon Petroleum Company

Project No: 11265

Source Area (ft²): 70.88218

Meter Operator: S. Dooley 593

Probe Operator: J. Rooney 591

Test Date: 7/21/11

Start Time: 07:54

Stop Time: 10:07

Leak Rate Before: 0.003 cfm @ 15 "Hg

Leak Rate After: 0.003 cfm @ 9 "Hg

Bar. Press. (in. Hg): 29.35

Static P: -0.5

O₂ (dry volume %): 3.70

CO₂ (dry volume %): 13.65

N₂+CO (dry volume %): 82.65

Nozzle ID No: 250-2

Nozzle Diameter (D_n): 0.250

Probe ID No: 66-4-7

Pitot C_p: 0.827

Pitot Leak Check: ☒ Pass ☐ Fail

H₂O (condensate, ml or gm): 501.0

H₂O (silica, g): 18.3

Actual Moisture (%): 24.17

Meter Box ID. No: 85-3

Meter ΔH@: 1.77920

Meter Y_d: 0.99250

Traverse Point	Run Time 5.0 min/read	Pitot ΔP _s (in. H ₂ O)	Sample ΔH (in. H ₂ O)	Metered (dcf)	Stack T _s (°F)	Dry Gas Meter T _{m-in} (°F)	T _{m-out} (°F)	√ΔP _s (calculated) (√in. H ₂ O)	Volume (calculated) (ft ³)	Isokinetics (calculated) (%)
	0.0			905.200						
1-01	5.0	0.70	1.60	908.860	148	96	93	0.84	3.66	100.3
1-01	10.0	0.73	1.70	912.490	150	98	93	0.85	3.63	97.4
1-02	15.0	0.85	1.90	916.230	149	105	95	0.92	3.74	92.2
1-02	20.0	0.75	1.70	920.060	148	108	96	0.87	3.83	100.0
1-03	25.0	0.75	1.70	923.740	147	111	97	0.87	3.68	95.7
1-03	30.0	0.46	1.10	927.010	147	110	98	0.68	3.27	108.4
2-01	35.0	0.68	1.60	930.530	147	107	99	0.82	3.52	96.3
2-01	40.0	0.65	1.50	933.990	148	112	99	0.81	3.46	96.4
2-02	45.0	0.60	1.40	937.340	147	114	101	0.77	3.35	96.7
2-02	50.0	0.59	1.40	940.690	147	114	101	0.77	3.35	97.5
2-03	55.0	0.52	1.20	943.860	147	116	102	0.72	3.17	98.0
2-03	60.0	0.48	1.10	946.890	147	116	103	0.69	3.03	97.4
3-01	65.0	0.69	1.60	950.340	147	117	104	0.83	3.45	92.4
3-01	70.0	0.64	1.50	953.830	147	118	104	0.80	3.49	97.0
3-02	75.0	0.58	1.30	957.120	147	119	105	0.76	3.29	95.8
3-02	80.0	0.58	1.30	960.320	147	119	105	0.76	3.20	93.2
3-03	85.0	0.50	1.20	963.330	147	116	105	0.71	3.01	94.7
3-03	90.0	0.50	1.20	966.350	147	116	105	0.71	3.02	95.0
4-01	92.5	0.65	1.50	967.980	147	112	105	0.81	1.63	90.3
LEAK CHECK	92.5			968.260						
4-01	95.0	0.65	1.50	970.050	147	112	105	0.81	1.79	99.2
4-01	100.0	0.65	1.50	973.560	147	117	106	0.81	3.51	96.7
4-02	105.0	0.59	1.40	976.920	147	117	106	0.77	3.36	97.1
4-02	110.0	0.59	1.40	980.200	147	118	106	0.77	3.28	94.7
4-03	115.0	0.50	1.20	983.330	147	119	107	0.71	3.13	98.0
4-03	120.0	0.50	1.20	986.430	147	119	107	0.71	3.10	97.1
Final	120.0		1.42500	80.95000	147.33333	107.41667		0.78090	80.95000	

12 points sampled

QC-Check: Field Averages

Sq.Rt.ΔP

0.7809	1.4250	80.9500	147.3333	107.4167
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☒ Avg. OK ☒ Avg. OK ☒ Avg. OK ☒ Avg. OK ☒ Avg. OK

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TEST LOG

Client: Marathon Petroleum Company
Project No: 11265

Run Number	Location	Method	Analyte	Date	Start Time	End Time	Notes
1	FCCU Scrubber Stack	USEPA OTM-29	Cyanide	07/20/11	09:36	10:57	
2	FCCU Scrubber Stack	USEPA OTM-29	Cyanide	07/20/11	12:29	14:01	
3	FCCU Scrubber Stack	USEPA OTM-29	Cyanide	07/21/11	07:56	09:15	

Notes:

None

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USEPA Method 3 Laboratory Data

Location: FCCU Scrubber Stack

Client: Marathon Petroleum Company

Project No: 11265

Method: EPA Method 3A

Fuel Type: Non-Combustion

F_o for Fuel: N/A

Test Method:

Analyte:

USEPA OTM-29

Cyanide

Analyst: K. O'Halloren

Analyst Emp No: 478

Run Number	Trial	Percent CO ₂	Percent O ₂ +CO ₂	Percent O ₂	Percent N ₂	Dry Mol. Weight	F _o	Method of Analysis: CEM
1	1							
	2							
	3							
	Avg.							
CEM or Other Avg:		9.80000		3.80000	86.40000	29.72000	1.74490	<input type="checkbox"/> Fo value within expected range.
2	1							
	2							
	3							
	Avg.							
CEM or Other Avg:		9.80000		3.80000	86.40000	29.72000	1.74490	<input type="checkbox"/> Fo value within expected range.
3	1							
	2							
	3							
	Avg.							
CEM or Other Avg:		9.70000		3.80000	86.50000	29.70400	1.76289	<input type="checkbox"/> Fo value within expected range.
	1							
	2							
	3							
	Avg.							
CEM or Other Avg:								<input type="checkbox"/> Fo value within expected range.

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USEPA Method 4 Laboratory Data

Location: FCCU Scrubber Stack

Client: Marathon Petroleum Company

Project No: 11265

Test Method:

USEPA OTM-29

Analyte:

Cyanide

Analyst: D. Luckhard

Analyst Emp No: 568

Test Run: 1

	Contents	Gross (gm)	Tare (gm)	Net (gm)
Impinger 1	6.0 N NaOH	858.5	641.6	216.9
Impinger 2	6.0 N NaOH	681.4	639.3	42.1
Impinger 3	6.0 N NaOH	649.8	640.7	9.1
Impinger 4	6.0 N NaOH	594.4	564.8	29.6
Impinger 5	Silica Gel	717.7	707.2	10.5
Impinger 6				
Impinger 7				
Impinger 8				

Rinse: (ml or gm)

297.7 Liquid (gm)

Field Data Check

0.0 less rinse (gm)

297.7 Net Liquid (gm)

297.7

☒ QA/QC OK

+ 10.5 Silica Gel (gm)

10.5

☒ QA/QC OK

308.2 Total Vlc (gm)

308.2

☒ QA/QC OK

Test Run: 2

	Contents	Gross (gm)	Tare (gm)	Net (gm)
Impinger 1	6.0 N NaOH	826.7	639.1	187.6
Impinger 2	6.0 N NaOH	739.1	667.4	71.7
Impinger 3	6.0 N NaOH	643.9	622.8	21.1
Impinger 4	6.0 N NaOH	547.8	536.4	11.4
Impinger 5	Silica Gel	745.7	736.2	9.5
Impinger 6				
Impinger 7				
Impinger 8				

Rinse: (ml or gm)

291.8 Liquid (gm)

Field Data Check

0.0 less rinse (gm)

291.8 Net Liquid (gm)

291.8

☒ QA/QC OK

+ 9.5 Silica Gel (gm)

9.5

☒ QA/QC OK

301.3 Total Vlc (gm)

301.3

☒ QA/QC OK

Test Run: 3

	Contents	Gross (gm)	Tare (gm)	Net (gm)
Impinger 1	6.0 N NaOH	858.7	643.8	214.9
Impinger 2	6.0 N NaOH	700.6	639.8	60.8
Impinger 3	6.0 N NaOH	667.5	642.1	25.4
Impinger 4	6.0 N NaOH	578.8	567.2	11.6
Impinger 5	Silica Gel	724.4	717.5	6.9
Impinger 6				
Impinger 7				
Impinger 8				

Rinse: (ml or gm)

312.7 Liquid (gm)

Field Data Check

0.0 less rinse (gm)

312.7 Net Liquid (gm)

312.7

☒ QA/QC OK

+ 6.9 Silica Gel (gm)

6.9

☒ QA/QC OK

319.6 Total Vlc (gm)

319.6

☒ QA/QC OK

Test Run:

	Contents	Gross (gm)	Tare (gm)	Net (gm)
Impinger 1	6.0 N NaOH			
Impinger 2	6.0 N NaOH			
Impinger 3	6.0 N NaOH			
Impinger 4	6.0 N NaOH			
Impinger 5	Silica Gel			
Impinger 6				
Impinger 7				
Impinger 8				

Rinse: (ml or gm)

Liquid (gm)

Field Data Check

less rinse (gm)

Net Liquid (gm)

Silica Gel (gm)

Total Vlc (gm)

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NMN@

Field Data Printout

Test Method:

USEPA OTM-29

Analyte:

Cyanide

Location: FCCU Scrubber Stack

Test Run: 1

Client: Marathon Petroleum Company

Project No: 11265

Source Area (ft²): 70.88218

Meter Operator: B. Arnold 770

Probe Operator: J. Rooney 591

Test Date: 7/20/11

Start Time: 09:36

Stop Time: 10:57

Leak Rate Before: 0.004 cfm @ 15 "Hg

Leak Rate After: 0.001 cfm @ 5 "Hg

Bar. Press. (in. Hg): 29.30

Static P: -0.3

O₂ (dry volume %): 3.80

CO₂ (dry volume %): 9.80

N₂+CO (dry volume %): 86.40

Nozzle ID No: 233-1

Nozzle Diameter (D_n): 0.233

Probe ID No: 67-4-1

Pitot C_p: 0.819

Pitot Leak Check: ☒ Pass ☐ Fail

H₂O (condensate, ml or gm): 297.7

H₂O (silica, g): 10.5

Actual Moisture (%): 26.13

Meter Box ID. No: 61-7

Meter ΔH@: 1.82940

Meter Y_d: 0.98270

Traverse Point	Run Time 5.0 min/read	Pitot ΔP _s (in. H ₂ O)	Sample ΔH (in. H ₂ O)	Metered (dcf)	Stack T _s (°F)	Dry Gas Meter T _{m-in} (°F)	T _{m-out} (°F)	√ΔP _s (calculated) (√in. H ₂ O)	Volume (calculated) (ft ³)	Isokinetics (calculated) (%)
	0.0			511.175						
3-01	5.0	0.70	1.20	514.220	150	105	105	0.84	3.05	95.4
3-02	10.0	0.64	1.10	517.200	150	105	105	0.80	2.98	97.7
3-03	15.0	0.57	0.97	520.100	150	104	103	0.75	2.90	100.9
2-01	20.0	0.66	1.10	523.110	151	105	104	0.81	3.01	97.3
2-02	25.0	0.57	0.97	525.970	150	106	103	0.75	2.86	99.4
2-03	30.0	0.45	0.76	528.500	150	108	104	0.67	2.53	98.6
1-01	35.0	0.64	1.10	531.460	151	107	105	0.80	2.96	96.9
1-02	40.0	0.60	1.00	534.350	151	110	105	0.77	2.89	97.4
1-03	45.0	0.55	0.94	537.250	151	112	106	0.74	2.90	101.8
4-01	50.0	0.63	1.10	540.210	150	109	106	0.79	2.96	97.3
4-02	55.0	0.61	1.00	543.100	150	112	107	0.78	2.89	96.2
4-03	60.0	0.46	0.79	546.630	151	112	107	0.68	3.53	135.4*
Final	60.0		1.00250	35.45500	150.41667	106.45833		0.76659	35.45500	

12 points sampled
QC-Check: Field Averages

Sq.Rt.ΔP

0.7666 1.0025 35.4550 150.4167 106.4583

☒ Avg. OK ☒ Avg. OK ☒ Avg. OK ☒ Avg. OK ☒ Avg. OK

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Field Data Printout

Test Method:

USEPA OTM-29

Analyte:

Cyanide

Location: FCCU Scrubber Stack

Test Run: 2

Client: Marathon Petroleum Company

Project No: 11265

Source Area (ft²): 70.88218

Meter Operator: K. O'Halloren 478

Probe Operator: K. Sullivan 579

Test Date: 7/20/11

Start Time: 12:29

Stop Time: 14:01

Leak Rate Before: 0.002 cfm @ 15 "Hg

Leak Rate After: 0.001 cfm @ 5 "Hg

Bar. Press. (in. Hg): 29.30

Static P: -0.3

O₂ (dry volume %): 3.80

CO₂ (dry volume %): 9.80

N₂+CO (dry volume %): 86.40

Nozzle ID No: 233-1

Nozzle Diameter (D_n): 0.233

Probe ID No: 67-4-1

Pitot C_p: 0.819

Pitot Leak Check: ☒ Pass ☐ Fail

H₂O (condensate, ml or gm): 291.8

H₂O (silica, g): 9.5

Actual Moisture (%): 26.62

Meter Box ID. No: 61-7

Meter ΔH@: 1.82940

Meter Y_d: 0.98270

Traverse Point	Run Time 5.0 min/read	Pitot ΔP _s (in. H ₂ O)	Sample ΔH (in. H ₂ O)	Metered (dcf)	Stack T _s (°F)	Dry Gas Meter		√ΔP _s (calculated) (√in. H ₂ O)	Volume (calculated) (ft ³)	Isokinetics (calculated) (%)
						T _{m-in} (°F)	T _{m-out} (°F)			
1-01	5.0	0.65	1.10	548.800	151	108	108	0.81	3.00	97.7
1-02	10.0	0.59	0.97	551.620	151	109	108	0.77	2.82	96.2
1-03	15.0	0.56	0.92	554.420	151	110	108	0.75	2.80	98.0
2-01	20.0	0.63	1.00	557.300	151	111	109	0.79	2.88	94.9
2-02	25.0	0.56	0.92	560.120	151	113	110	0.75	2.82	98.3
2-03	30.0	0.52	0.86	562.830	151	114	110	0.72	2.71	97.9
4-01	35.0	0.57	0.94	565.590	151	113	110	0.75	2.76	95.3
4-02	40.0	0.55	0.90	568.340	151	114	110	0.74	2.75	96.6
4-03	45.0	0.48	0.79	570.910	151	114	110	0.69	2.57	96.6
3-01	50.0	0.64	1.10	573.950	151	114	112	0.80	3.04	98.9
3-02	55.0	0.57	0.94	576.790	152	115	112	0.75	2.84	97.8
3-03	60.0	0.46	0.76	579.315	152	116	112	0.68	2.53	96.7
Final	60.0		0.93333	33.51500	151.16667	111.25000		0.75071	33.51500	

12 points sampled

Sq.Rt.ΔP

QC-Check: Field Averages

0.7507 0.9333 33.5150 151.1667 111.2500

☒ Avg. OK ☒ Avg. OK ☒ Avg. OK ☒ Avg. OK ☒ Avg. OK

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Field Data Printout

Test Method:

USEPA OTM-29

Analyte:

Cyanide

Location: FCCU Scrubber Stack

Test Run: 3

Client: Marathon Petroleum Company

Project No: 11265

Source Area (ft²): 70.88218

Meter Operator: K. Sullivan 579

Probe Operator: B. Arnold 770

Test Date: 7/21/11

Start Time: 07:56

Stop Time: 09:15

Leak Rate Before: 0.002 cfm @ 15 "Hg

Leak Rate After: 0.001 cfm @ 4 "Hg

Bar. Press. (in. Hg): 29.35

Static P: -0.5

O₂ (dry volume %): 3.80

CO₂ (dry volume %): 9.70

N₂+CO (dry volume %): 86.50

Nozzle ID No: 233-1

Nozzle Diameter (D_n): 0.233

Probe ID No: 67-4-1

Pitot C_p: 0.819

Pitot Leak Check: ☒ Pass ☐ Fail

H₂O (condensate, ml or gm): 312.7

H₂O (silica, g): 6.9

Actual Moisture (%): 26.48

Meter Box ID. No: 61-7

Meter ΔH@: 1.82940

Meter Y_d: 0.98270

Traverse Point	Run Time 5.0 min/read	Pitot ΔP _s (in. H ₂ O)	Sample ΔH (in. H ₂ O)	Metered (dcf)	Stack T _s (°F)	Dry Gas Meter		√ΔP _s (calculated) (in. H ₂ O)	Volume (calculated) (ft ³)	Isokinetics (calculated) (%)
						T _{m-in} (°F)	T _{m-out} (°F)			
4-01	5.0	0.70	1.20	582.840	152	101	98	0.84	3.23	102.9
4-02	10.0	0.65	1.10	585.920	150	103	98	0.81	3.08	101.5
4-03	15.0	0.60	1.00	588.840	151	103	98	0.77	2.92	100.2
2-01	20.0	0.70	1.20	591.970	151	105	100	0.84	3.13	99.1
2-02	25.0	0.65	1.10	594.960	151	106	101	0.81	2.99	98.0
2-03	30.0	0.55	0.91	597.710	151	107	101	0.74	2.75	97.9
3-01	35.0	0.72	1.20	600.950	151	106	102	0.85	3.24	100.9
3-02	40.0	0.65	1.10	603.910	151	108	103	0.81	2.96	96.7
3-03	45.0	0.60	1.00	606.780	151	109	104	0.77	2.87	97.4
1-01	50.0	0.70	1.20	609.970	151	108	103	0.84	3.19	100.5
1-02	55.0	0.65	1.10	612.940	151	110	104	0.81	2.97	96.8
1-03	60.0	0.60	1.00	615.865	151	111	104	0.77	2.92	99.1
Final	60.0		1.09250	36.25500	151.00000	103.87500		0.80407	36.25500	

12 points sampled

Sq.Rt.ΔP

QC-Check: Field Averages

0.8041 1.0925 36.2550 151.0000 103.8750

☒ Avg. OK ☒ Avg. OK ☒ Avg. OK ☒ Avg. OK ☒ Avg. OK

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LABORATORY DATA

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The following pages from the laboratory reports are reserved to reduce the total size of this document:

- Clean Air Analytical Services – “Laboratory Analysis for Particulate Matter”: Pages 46-82 (Manual Records, Laboratory Ambient Temperature Log, Daily Balance Calibration Log, Sample Pictures)
- Clean Air Analytical Services – “Laboratory Analysis for Cations” (Ammonium Report): Pages 44-151 (Raw chromatograms for calibrations and samples)
- Clean Air Analytical Services – “Laboratory Analysis for Anions” (Chloride Report): Pages 46-195 (Raw chromatograms for calibrations and samples)
- Clean Air Analytical Services – “Laboratory Analysis for Anions” (Fluoride Report): Pages 46-195 (Raw chromatograms for calibrations and samples)
- Enthalpy Analytical, Inc. “EPA OTM-29” (Cyanide Report): Pages 18-103 (Raw chromatograms for calibrations and samples)

The full laboratory reports are archived in digital format and available upon request.

I hereby certify that all pages contained within this Appendix have been reviewed and, to the best of my ability, verified accurate.

QA/QC Initials: KTB

Date: 10/5/2011



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USEPA Mod. Method 18 Laboratory Data Summary for VOCs

Run No.	1A			1B		
Date (2011)	Jul 13			Jul 13		
Start Time (approx.)	09:36			09:36		
Stop Time (approx.)	10:56			10:56		
Laboratory Results	Condensate + Impinger			Condensate + Impinger		
	1&2	Impinger 3	Impinger 4	1&2	Impinger 3	Impinger 4
1,3-Butadiene	<6.7	<2.6	<1.8	<4.7	<2.0	<2.1
Pentane	<6.7	<2.6	<1.8	<4.7	<2.0	<2.1
Acrolein	<6.7	<2.6	<1.8	3524.6	643.8	62.0
Acetone	112.8	21.0	13.6	43.1	13.7	12.7
Acetonitrile	<6.7	<2.6	<1.8	5038.9	344.9	24.7
Carbon disulfide	<6.7	<2.6	<1.8	<4.7	<2.0	<2.1
Methylene chloride	9.6	3.3	2.4	6.5	2.5	2.7
Acrylonitrile	<6.7	<2.6	<1.8	<4.7	<2.0	<2.1
Methyl t-butyl ether	<6.7	<2.6	<1.8	<4.7	<2.0	<2.1
Hexane	<6.7	<2.6	<1.8	<4.7	<2.0	<2.1
2,2,4 Trimethylpentane	<6.7	<2.6	<1.8	<4.7	<2.0	<2.1
Benzene	<6.7	<2.6	<1.8	<4.7	<2.0	<2.1
Trichloroethene	<6.7	<2.6	<1.8	6339.5	366.0	33.7
2-Nitropropane	<6.7	<2.6	<1.8	<4.7	<2.0	<2.1
Methyl isobutyl ketone	<6.7	<2.6	<1.8	5937.7	76.7	8.8
Toluene	<6.7	<2.6	<1.8	2366.9	114.6	10.3
Tetrachloroethene	<6.7	<2.6	<1.8	<4.7	<2.0	<2.1
1,2-Dibromoethane	<6.7	<2.6	<1.8	<4.7	<2.0	<2.1
Chlorobenzene	<6.7	<2.6	<1.8	<4.7	<2.0	<2.1
Ethylbenzene	<6.7	<2.6	<1.8	<4.7	<2.0	<2.1
m,p-Xylenes	<6.7	<2.6	<1.8	<4.7	<2.0	<2.1
o-Xylene	<6.7	<2.6	<1.8	<4.7	<2.0	<2.1
Styrene	<6.7	<2.6	<1.8	<4.7	<2.0	<2.1
Cumene	<6.7	<2.6	<1.8	<4.7	<2.0	<2.1
Nitrobenzene	<33.5	<13.0	<9.0	<23.5	<10.0	<10.5

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**USEPA Mod. Method 18
Laboratory Data Summary for VOCs**

Run No.	2A			2B		
Date (2011)	Jul 13			Jul 13		
Start Time (approx.)	16:15			16:15		
Stop Time (approx.)	17:35			17:35		
Laboratory Results	Condensate + Impinger			Condensate + Impinger		
	1&2	Impinger 3	Impinger 4	1&2	Impinger 3	Impinger 4
1,3-Butadiene	<6.1	<2.1	<1.8	<6.1	<2.0	<1.9
Pentane	<6.1	<2.1	<1.8	<6.1	<2.0	<1.9
Acrolein	<6.1	<2.1	<1.8	2062.0	799.5	191.5
Acetone	31.2	15.4	15.5	57.7	14.5	13.8
Acetonitrile	<6.1	<2.1	<1.8	5690.0	616.6	80.9
Carbon disulfide	<6.1	<2.1	<1.8	<6.1	<2.0	<1.9
Methylene chloride	6.8	2.8	2.3	7.5	2.6	2.5
Acrylonitrile	<6.1	<2.1	<1.8	<6.1	<2.0	<1.9
Methyl t-butyl ether	<6.1	<2.1	<1.8	<6.1	<2.0	<1.9
Hexane	<6.1	<2.1	<1.8	<6.1	<2.0	<1.9
2,2,4 Trimethylpentane	<6.1	<2.1	<1.8	<6.1	<2.0	<1.9
Benzene	<6.1	<2.1	<1.8	<6.1	<2.0	<1.9
Trichloroethene	<6.1	<2.1	<1.8	5897.8	1075.3	109.3
2-Nitropropane	<6.1	<2.1	<1.8	<6.1	<2.0	<1.9
Methyl isobutyl ketone	<6.1	<2.1	<1.8	6824.9	185.9	13.5
Toluene	<6.1	<2.1	<1.8	2440.3	312.4	28.4
Tetrachloroethene	<6.1	<2.1	<1.8	<6.1	<2.0	<1.9
1,2-Dibromoethane	<6.1	<2.1	<1.8	<6.1	<2.0	<1.9
Chlorobenzene	<6.1	<2.1	<1.8	<6.1	<2.0	<1.9
Ethylbenzene	<6.1	<2.1	<1.8	<6.1	<2.0	<1.9
m,p-Xylenes	<6.1	<2.1	<1.8	<6.1	<2.0	<1.9
o-Xylene	<6.1	<2.1	<1.8	<6.1	<2.0	<1.9
Styrene	<6.1	<2.1	<1.8	<6.1	<2.0	<1.9
Cumene	<6.1	<2.1	<1.8	<6.1	<2.0	<1.9
Nitrobenzene	<30.5	<10.5	<9.0	<30.5	<10.0	<9.5

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**USEPA Mod. Method 18
Laboratory Data Summary for VOCs**

Run No.	3A			3B		
Date (2011)	Jul 14			Jul 14		
Start Time (approx.)	08:55			08:55		
Stop Time (approx.)	10:15			10:15		
Laboratory Results	Condensate + Impinger	Impinger 3	Impinger 4	Condensate + Impinger	Impinger 3	Impinger 4
	1&2			1&2		
1,3-Butadiene	<6.6	<2.5	<2.2	<6.5	<2.3	<2.3
Pentane	<6.6	<2.5	<2.2	<6.5	<2.3	<2.3
Acrolein	<6.6	<2.5	<2.2	5114.3	674.2	117.0
Acetone	50.2	50.0	15.4	61.8	27.3	17.2
Acetonitrile	<6.6	<2.5	<2.2	4714.6	452.1	59.9
Carbon disulfide	<6.6	<2.5	<2.2	<6.5	<2.3	<2.3
Methylene chloride	7.4	4.0	3.0	8.3	3.3	2.5
Acrylonitrile	<6.6	<2.5	<2.2	<6.5	<2.3	<2.3
Methyl t-butyl ether	<6.6	<2.5	<2.2	<6.5	<2.3	<2.3
Hexane	<6.6	<2.5	<2.2	<6.5	<2.3	<2.3
2,2,4 Trimethylpentane	<6.6	<2.5	<2.2	<6.5	<2.3	<2.3
Benzene	<6.6	<2.5	<2.2	<6.5	<2.3	<2.3
Trichloroethene	<6.6	<2.5	<2.2	5566.1	636.6	81.7
2-Nitropropane	<6.6	<2.5	<2.2	<6.5	<2.3	<2.3
Methyl isobutyl ketone	<6.6	<2.5	<2.2	5536.2	105.3	7.2
Toluene	<6.6	<2.5	<2.2	2327.1	186.8	18.7
Tetrachloroethene	<6.6	<2.5	<2.2	<6.5	<2.3	<2.3
1,2-Dibromoethane	<6.6	<2.5	<2.2	<6.5	<2.3	<2.3
Chlorobenzene	<6.6	<2.5	<2.2	<6.5	<2.3	<2.3
Ethylbenzene	<6.6	<2.5	<2.2	<6.5	<2.3	<2.3
m,p-Xylenes	<6.6	<2.5	<2.2	<6.5	<2.3	<2.3
o-Xylene	<6.6	<2.5	<2.2	<6.5	<2.3	<2.3
Styrene	<6.6	<2.5	<2.2	<6.5	<2.3	<2.3
Cumene	<6.6	<2.5	<2.2	<6.5	<2.3	<2.3
Nitrobenzene	<33.0	<12.5	<11.0	<32.5	<11.5	<11.5

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USEPA Mod. Method 18 Laboratory Data Summary for VOCs

Run No.

Field Blank A

Field Blank B

Date (2011)

Start Time (approx.)

Stop Time (approx.)

Laboratory Results	Condensate + Impinger			Condensate + Impinger		
	1&2	Impinger 3	Impinger 4	1&2	Impinger 3	Impinger 4
1,3-Butadiene	<6.8	<2.1	<2.2	<3.6	<1.5	<2.4
Pentane	<6.8	<2.1	<2.2	<3.6	<1.5	<2.4
Acrolein	17.7	<2.1	<2.2	2404.2	358.2	217.8
Acetone	56.1	15.6	15.4	41.7	10.8	18.9
Acetonitrile	<6.8	<2.1	<2.2	5642.2	555.0	153.8
Carbon disulfide	<6.8	<2.1	<2.2	<3.6	<1.5	<2.4
Methylene chloride	14.0	3.1	3.7	7.1	2.7	4.4
Acrylonitrile	<6.8	<2.1	<2.2	<3.6	<1.5	<2.4
Methyl t-butyl ether	<6.8	<2.1	<2.2	<3.6	<1.5	<2.4
Hexane	<6.8	<2.1	<2.2	<3.6	<1.5	<2.4
2,2,4 Trimethylpentane	<6.8	<2.1	<2.2	<3.6	<1.5	<2.4
Benzene	<6.8	<2.1	<2.2	<3.6	<1.5	<2.4
Trichloroethene	<6.8	<2.1	<2.2	5276.6	1068.6	262.3
2-Nitropropane	<6.8	<2.1	<2.2	<3.6	<1.5	<2.4
Methyl isobutyl ketone	<6.8	<2.1	<2.2	6806.7	160.1	17.7
Toluene	<6.8	<2.1	<2.2	2014.3	322.3	60.5
Tetrachloroethene	<6.8	<2.1	<2.2	<3.6	<1.5	<2.4
1,2-Dibromoethane	<6.8	<2.1	<2.2	<3.6	<1.5	<2.4
Chlorobenzene	<6.8	<2.1	<2.2	<3.6	<1.5	<2.4
Ethylbenzene	<6.8	<2.1	<2.2	<3.6	<1.5	<2.4
m,p-Xylenes	<6.8	<2.1	<2.2	<3.6	<1.5	<2.4
o-Xylene	<6.8	<2.1	<2.2	<3.6	<1.5	<2.4
Styrene	<6.8	<2.1	<2.2	<3.6	<1.5	<2.4
Cumene	<6.8	<2.1	<2.2	<3.6	<1.5	<2.4
Nitrobenzene	<34.0	<10.5	<11.0	<18.0	<7.5	<12.0

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Certificate of Analysis

ALS Project Contact: Ron McLeod

ALS Project ID: CLE150

ALS WO#: L1037258

Date of Report 21-Aug-11

Date of Sample Receipt 27-Jul-11

Client Name: Clean Air Engineering

Client Address: 500 West Wood Street
Palatine IL, 60067

Client Contact: Kevin O'Halloran

Client Project ID: 11265 - Robinson Refinery

COMMENTS: VOCs via modified method 18 - Chilled Methanol Impingers - GC/MS Selected Ion Monitoring

Limits of Reporting have been defined by the level equivalent to the low instrument calibration point and sensitivity standard.

Nitrobenzene quantification suffered from instrument related run-to-run carry-over. Reporting limits for nitrobenzene has been raised to account for uncertainty from this run-to-run carry-over. Alternative nitrobenzene data is available from the 0010 train.

Data are not blank corrected.

For native spike recoveries in the composite data, the Imp1/2 recoveries were obtained from the dilution runs due to peak saturation in the undiluted instrument runs.

Where there are nil recoveries for butadiene-d6 and pentane-d12 on the composite data, the corresponding native target is reported as not available (n/a).

Summary of the Method:

The sampling train consisted of 4 midjet impingers. The 1st impinger was a moisture knock-out. The 2nd, 3rd and 4th impinger contained approximately 15mL each of methanol. Impingers 1 and 2 were recovered combined. Impingers 3 and 4 were each recovered separately. The methanolic impinger solutions were diluted 100-fold into water and analyzed by purge and trap GC/MS (i.e via SW846 5030B/8260B) using selected ion monitoring technique.

Certified by:

Ron McLeod, Ph.D.

General Manager and Technical Director

Results in this certificate relate only to the samples as submitted to the laboratory.

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ALS Environmental

COMPOSITE SPIKE RECOVERY DATA

Sample Name	FCCU SCRUBBER STACK RUN 1A D-SPIKED	FCCU SCRUBBER STACK RUN 2A D-SPIKED	FCCU SCRUBBER STACK RUN 3A D-SPIKED	FCCU SCRUBBER STACK RUN FB-A D-SPIKED	FCCU SCRUBBER STACK RUN 1B N-SPIKED	FCCU SCRUBBER STACK RUN 2B N-SPIKED	FCCU SCRUBBER STACK RUN 3B N-SPIKED	FCCU SCRUBBER STACK RUN FB-A N-SPIKED
ALS Sample ID	L1037258-4/2/3	L1037258-7/8/9	L1037258-13/14/15	L1037258-19/20/21	L1037258-4/5/6	L1037258-10/11/12	L1037258-16/17/18	L1037258-22/23/24
Matrix Sampling Date Date of Receipt	Impinger 13-Jul-11 27-Jul-11	Impinger 13-Jul-11 27-Jul-11	Impinger 14-Jul-11 27-Jul-11	Impinger 13-Jul-11 27-Jul-11	Impinger 13-Jul-11 27-Jul-11	Impinger 13-Jul-11 27-Jul-11	Impinger 14-Jul-11 27-Jul-11	Impinger 13-Jul-11 27-Jul-11
VOC via Modified Method 18	Amount Spiked ug	Data % Rec Qualifier Source	Data % Rec Qualifier Source	Data % Rec Qualifier Source	Data % Rec Qualifier Source	Data % Rec Qualifier Source	Data % Rec Qualifier Source	Data % Rec Qualifier Source
Labelled Analyte Recoveries								
1,3-Butadiene-d6	4000	18 UI1-4	3 UI1-4	0 UI1-4	0 UI1-4	- UI1-4	- UI1-4	- UI1-4
Pentane-d12	2000	24 UI1-4	4 UI1-4	0 UI1-4	3 UI1-4	- UI1-4	- UI1-4	- UI1-4
acrylonitrile-d3	1250	115 UI1-4	76 UI1-4	98 UI1-4	102 UI1-4	- UI1-4	- UI1-4	- UI1-4
MTBE-d12	1000	88 UI1-4	74 UI1-4	81 UI1-4	83 UI1-4	- UI1-4	- UI1-4	- UI1-4
n-Hexane-d14	2000	57 UI1-4	23 UI1-4	26 UI1-4	23 UI1-4	- UI1-4	- UI1-4	- UI1-4
2,2,4-Trimethylpentane-d18	1000	73 UI1-4	58 UI1-4	66 UI1-4	61 UI1-4	- UI1-4	- UI1-4	- UI1-4
Benzene-d6	1000	83 UI1-4	87 UI1-4	82 UI1-4	97 UI1-4	- UI1-4	- UI1-4	- UI1-4
2-Nitropropane-d6	1000	100 UI1-4	60 UI1-4	85 UI1-4	82 UI1-4	- UI1-4	- UI1-4	- UI1-4
1,2-Dibromoethane-d4	1000	90 UI1-4	77 UI1-4	96 UI1-4	96 UI1-4	- UI1-4	- UI1-4	- UI1-4
Ethylbenzene-d10	1000	87 UI1-4	97 UI1-4	96 UI1-4	116 UI1-4	- UI1-4	- UI1-4	- UI1-4
Styrene-d8	1000	83 UI1-4	88 UI1-4	86 UI1-4	105 UI1-4	- UI1-4	- UI1-4	- UI1-4
Nitrobenzene-d5	4000	31 UI1-4	16 UI1-4	16 UI1-4	23 UI1-4	- UI1-4	- UI1-4	- UI1-4
Native Analyte Recoveries								
Acrolein		-	-	-	-	46 UI1-4	33 UI1-4	37 UI1-4
Acetonitrile		-	-	-	-	73 UI1-4	81 UI1-4	87 UI1-4
Trichloroethene		-	-	-	-	92 UI1-4	100 UI1-4	114 UI1-4
Methyl iso-Butyl Ketone		-	-	-	-	65 UI1-4	83 UI1-4	90 UI1-4
Toluene		-	-	-	-	95 UI1-4	102 UI1-4	115 UI1-4

INT = Interference

UI# = Impinger Number from the Unspiked Train
SI# = Impinger Number from the Spiked Train

ALS Environmental

COMPOSITE TARGET ANALYTE DATA

Sample Name	FCCU SCRUBBER STACK RUN 1A D-SPIKED	FCCU SCRUBBER STACK RUN 2A D-SPIKED	FCCU SCRUBBER STACK RUN 3A D-SPIKED	FCCU SCRUBBER STACK RUN FB-A D-SPIKED	METHANOL TRIP BLANK
ALS Sample ID Matrix Sampling Date Date of Receipt	L1037258-1/2/3 Impinger 13-Jul-11 27-Jul-11	L1037258-7/8/9 Impinger 13-Jul-11 27-Jul-11	L1037258-13/14/15 Impinger 14-Jul-11 27-Jul-11	L1037258-19/20/21 Impinger 13-Jul-11 27-Jul-11	L1037258-25 Impinger 13-Jul-11 27-Jul-11
VOC via Modified Method 18	ug	ug	ug	ug	ug
1,3-Butadiene	<11	<10	n/a	n/a	<10
Pentane	<11	<10	n/a	<11	<10
Acrolein	<11	<10	<11	<11	<10
Acetone	147	62.1	116	87.1	62.3
Acetonitrile	<11	<10	<11	<11	<10
Carbon Disulfide	<11	<10	<11	<11	<10
Methylene Chloride	15.2	11.8	14.4	20.8	16.5
Acrylonitrile	<11	<10	<11	<11	<10
Methyl t-Butyl Ether (MTBE)	<11	<10	<11	<11	<10
Hexane	<11	<10	<11	<11	<10
2,2,4-Trimethylpentane	<11	<10	<11	<11	<10
Benzene	<11	<10	<11	<11	<10
Trichloroethene	<11	<10	<11	<11	<10
2-Nitropropane	<11	<10	<11	<11	<10
Methyl Iso-Butyl Ketone	<11	<10	<11	<11	<10
Toluene	<11	<10	<11	<11	<10
Tetrachloroethene	<11	<10	<11	<11	<10
1,2-Dibromoethane	<11	<10	<11	<11	<10
Chlorobenzene	<11	<10	<11	<11	<10
Ethylbenzene	<11	<10	<11	<11	<10
m,p-Xylenes	<11	<10	<11	<11	<10
o-Xylene	<11	<10	<11	<11	<10
Styrene	<11	<10	<11	<11	<10
Cumene (Isopropylbenzene)	<11	<10	<11	<11	<10
Nitrobenzene	<56	<50	<57	<56	<50

ADL = Below Detection Limit
BDL = Below Detection Limit
DIL = Composite data where at least one data point (but not all data points) is above the detection limit
INT = Interference; Detection Limit Raised
U1# = Impinger Number from the Unspiked Train
S1# = Impinger Number from the Spiked Train
* Results based upon a methanol volume equivalent to the composite U1-4 sample volumes in the columns to the left
B = Observed in the Field Blank at similar levels to the field run samples
C = Response likely GC/MS instrument carry-over from the prior sample injection

ALS Environmental

Instrument Run Date: 04-Aug-11

ANALYTICAL DATA FROM INDIVIDUAL GC/MS INSTRUMENT RUNS

Client Container ID:	Laboratory Method Blank	FCCU SCRUBBER STACK RUN 1A PROBE, IMP 1-2 D-SPIKED	FCCU SCRUBBER STACK RUN 1A IMP 3 D-SPIKED	FCCU SCRUBBER STACK RUN 1A IMP 4 D-SPIKED	FCCU SCRUBBER STACK RUN 1B PROBE, IMP 1-2 N-SPIKED	FCCU SCRUBBER STACK RUN 1B IMP 3 N-SPIKED	FCCU SCRUBBER STACK RUN 1B IMP 4 N-SPIKED	FCCU SCRUBBER STACK RUN 2A PROBE, IMP 1-2 D-SPIKED
ALS Sample ID	method blk	L1037258-1;Ext1	L1037258-2;Ext1	L1037258-3;Ext1	L1037258-4;Ext1	L1037258-5;Ext1	L1037258-6;Ext1	L1037258-7;Ext1
Instrument File #	0901009.D	5001008.D	5101009.D	5201010.D	5301011.D	5401012.D	5501013.D	5601014.D
Sample Volume (mL)	20	67	26	18	47	20	21	61
Dilution Factor	1	1	1	1	1	1	1	1
VOC via Modified Method 18								
	ug	ug	ug	ug	ug	ug	ug	ug
1,3-Butadiene	<2	<6.7	<2.6	<1.8	<4.7	<2	<2.1	<6.1
Pentane	<2	<6.7	<2.6	<1.8	<4.7	<2	<2.1	<6.1
Acrolein	<2	<6.7	<2.6	<1.8	3525	644	62	<6.1
Acetone	<2	113	21.0	13.6	43.1	13.7	12.7	31.2
Acetonitrile	<2	<6.7	<2.6	<1.8	5039	345	25	<6.1
Carbon Disulfide	<2	<6.7	<2.6	<1.8	<4.7	<2	<2.1	<6.1
Methylene Chloride	<2	10	3.3	2.4	6.5	2.5	2.7	6.8
Acrylonitrile	<2	<6.7	<2.6	<1.8	<4.7	<2	<2.1	<6.1
Methyl t-Butyl Ether (MTBE)	<2	<6.7	<2.6	<1.8	<4.7	<2	<2.1	<6.1
Hexane	<2	<6.7	<2.6	<1.8	<4.7	<2	<2.1	<6.1
2,2,4-Trimethylpentane	<2	<6.7	<2.6	<1.8	<4.7	<2	<2.1	<6.1
Benzene	<2	<6.7	<2.6	<1.8	<4.7	<2	<2.1	<6.1
Trichloroethene	<2	<6.7	<2.6	<1.8	6340	366	34	<6.1
2-Nitropropane	<2	<6.7	<2.6	<1.8	<4.7	<2	<2.1	<6.1
Methyl iso-Butyl Ketone	<2	<6.7	<2.6	<1.8	5938	77	8.8	<6.1
Toluene	<2	<6.7	<2.6	<1.8	2367	115	10	<6.1
Tetrachloroethene	<2	<6.7	<2.6	<1.8	<4.7	<2	<2.1	<6.1
1,2-Dibromoethane	<2	<6.7	<2.6	<1.8	<4.7	<2	<2.1	<6.1
Chlorobenzene	<2	<6.7	<2.6	<1.8	<4.7	<2	<2.1	<6.1
Ethylbenzene	<2	<6.7	<2.6	<1.8	<4.7	<2	<2.1	<6.1
m&p-Xylenes	<2	<6.7	<2.6	<1.8	<4.7	<2	<2.1	<6.1
o-Xylene	<2	<6.7	<2.6	<1.8	<4.7	<2	<2.1	<6.1
Styrene	<2	<6.7	<2.6	<1.8	<4.7	<2	<2.1	<6.1
Cumene (Isopropylbenzene)	<2	<6.7	<2.6	<1.8	<4.7	<2	<2.1	<6.1
Nitrobenzene	<10	<33.5	<13	<9	<23.5	<10	<10.5	<30.5
Labeled Analyte Recoveries								
	% Rec	% Rec	% Rec	% Rec	% Rec	% Rec	% Rec	% Rec
1,3-Butadiene-d6	0	9	6	3	0	0	0	3
Pentane-d12	0	13	8	3	0	0	0	3
acrylonitrile-d3	0	112	3	0	0	0	0	68
MTBE-d12	0	82	4	1	0	0	0	62
n-Hexane-d14	0	44	11	3	0	0	0	15
2,2,4-Trimethylpentane-d18	0	65	7	1	0	0	0	41
Benzene-d6	0	79	3	0	0	0	0	76
2-Nitropropane-d6	0	100	1	0	0	0	0	59
1,2-Dibromoethane-d4	0	90	1	0	0	0	0	74
Ethylbenzene-d10	0	86	1	0	0	0	0	94
Styrene-d8	0	82	0	0	0	0	0	87
Nitrobenzene-d5	0	30	1	0	0	0	0	16
Native Analyte Recoveries								
	% Rec	% Rec	% Rec	% Rec	% Rec	% Rec	% Rec	% Rec
Acrolein	-	-	-	-	51	9	-	-
Acetonitrile	-	-	-	-	88	6	-	-
Trichloroethene	-	-	-	-	157	9	-	-
Methyl iso-Butyl Ketone	-	-	-	-	99	1	-	-
Toluene	-	-	-	-	150	7	-	-
P&T Surrogate Recoveries								
	% Rec	% Rec	% Rec	% Rec	% Rec	% Rec	% Rec	% Rec
1,2-Dichloroethane-d4	104	92	102	106	105	101	93	80
Toluene-d8	103	76	100	101	111	103	100	76
4-Fluorobenzene	109	116	119	119	114	119	117	112

INT = Interference
 *Response likely GC/MS instrument carry-over from the prior sample

ALS Environmental

Instrument Run Date: 04-Aug-11

ANALYTICAL DATA FROM INDIVIDUAL GC/MS INSTRUMENT RUNS

Client Container ID:	FCCU SCRUBBER STACK RUN 2A IMP 3 D- SPIKED	FCCU SCRUBBER STACK RUN 2A IMP 4 D- SPIKED	FCCU SCRUBBER STACK RUN 2B PROBE, IMP 1- 2 N-SPIKED	FCCU SCRUBBER STACK RUN 2B IMP 3 N- SPIKED	FCCU SCRUBBER STACK RUN 2B IMP 4 N- SPIKED	FCCU SCRUBBER STACK RUN 3A PROBE, IMP 1- 2 D-SPIKED	FCCU SCRUBBER STACK RUN 3A IMP 3 D- SPIKED	FCCU SCRUBBER STACK RUN 3A IMP 4 D- SPIKED
ALS Sample ID	L1037258- 8;Ext1	L1037258- 9;Ext1	L1037258- 10;Ext1	L1037258- 11;Ext1	L1037258- 12;Ext1	L1037258- 13;Ext1	L1037258- 14;Ext1	L1037258- 15;Ext1
Instrument File #	5701015.D	5801016.D	5901017.D	6001018.D	6101019.D	6401022.D	6501023.D	6601024.D
Sample Volume (mL)	21	18	61	20	19	66	25	22
Dilution Factor	1	1	1	1	1	1	1	1
VOC via Modified Method 18								
	ug	ug	ug	ug	ug	ug	ug	ug
1,3-Butadiene	<2.1	<1.8	<6.1	<2	<1.9	<6.6	<2.5	<2.2
Pentane	<2.1	<1.8	<6.1	<2	<1.9	<6.6	<2.5	<2.2
Acrolein	<2.1	<1.8	2062	799	192	<6.6	<2.5	<2.2
Acetone	15.4	15.5	57.7	14.5	13.8	50.2	50.0	15.4
Acetonitrile	<2.1	<1.8	5690	617	81	<6.6	<2.5	<2.2
Carbon Disulfide	<2.1	<1.8	<6.1	<2	<1.9	<6.6	<2.5	<2.2
Methylene Chloride	2.8	2.3	7.5	2.6	2.5	7.4	4.0	3.0
Acrylonitrile	<2.1	<1.8	<6.1	<2	<1.9	<6.6	<2.5	<2.2
Methyl t-Butyl Ether (MTBE)	<2.1	<1.8	<6.1	<2	<1.9	<6.6	<2.5	<2.2
Hexane	<2.1	<1.8	<6.1	<2	<1.9	<6.6	<2.5	<2.2
2,2,4-Trimethylpentane	<2.1	<1.8	<6.1	<2	<1.9	<6.6	<2.5	<2.2
Benzene	<2.1	<1.8	<6.1	<2	<1.9	<6.6	<2.5	<2.2
Trichloroethene	<2.1	<1.8	5898	1075	109	<6.6	<2.5	<2.2
2-Nitropropane	<2.1	<1.8	<6.1	<2	<1.9	<6.6	<2.5	<2.2
Methyl iso-Butyl Ketone	<2.1	<1.8	6825	186	14	<6.6	<2.5	<2.2
Toluene	<2.1	<1.8	2440	312	28	<6.6	<2.5	<2.2
Tetrachloroethene	<2.1	<1.8	<6.1	<2	<1.9	<6.6	<2.5	<2.2
1,2-Dibromoethane	<2.1	<1.8	<6.1	<2	<1.9	<6.6	<2.5	<2.2
Chlorobenzene	<2.1	<1.8	<6.1	<2	<1.9	<6.6	<2.5	<2.2
Ethylbenzene	<2.1	<1.8	<6.1	<2	<1.9	<6.6	<2.5	<2.2
m&p-Xylenes	<2.1	<1.8	<6.1	<2	<1.9	<6.6	<2.5	<2.2
o-Xylene	<2.1	<1.8	<6.1	<2	<1.9	<6.6	<2.5	<2.2
Styrene	<2.1	<1.8	<6.1	<2	<1.9	<6.6	<2.5	<2.2
Cumene (Isopropylbenzene)	<2.1	<1.8	<6.1	<2	<1.9	<6.6	<2.5	<2.2
Nitrobenzene	<10.5	<9	<30.5	<10	<9.5	<33	<12.5	<11
Labeled Analyte Recoveries	% Rec	% Rec	% Rec	% Rec	% Rec	% Rec	% Rec	% Rec
1,3-Butadiene-d6	0	0	0	0	0	0	0	0
Pentane-d12	0	0	0	0	0	0	0	0
acrylonitrile-d3	6	1	0	0	0	86	11	1
MTBE-d12	8	3	0	0	0	60	17	4
n-Hexane-d14	4	4	0	0	0	7	9	9
2,2,4-Trimethylpentane-d18	10	7	0	0	0	37	20	9
Benzene-d6	8	3	0	0	0	71	14	3
2-Nitropropane-d6	1	0	0	0	0	80	2	0
1,2-Dibromoethane-d4	2	0	0	0	0	82	3	0
Ethylbenzene-d10	2	0	0	0	0	93	3	0
Styrene-d8	1	0	0	0	0	84	1	0
Nitrobenzene-d5	0	0	0	0	0	15	1	0
Native Analyte Recoveries	% Rec	% Rec	% Rec	% Rec	% Rec	% Rec	% Rec	% Rec
Acrolein	-	-	30	11	3	-	-	-
Acetonitrile	-	-	99	11	1	-	-	-
Trichloroethene	-	-	146	27	3	-	-	-
Methyl iso-Butyl Ketone	-	-	114	3	-	-	-	-
Toluene	-	-	155	20	2	-	-	-
P&T Surrogate Recoveries	% Rec	% Rec	% Rec	% Rec	% Rec	% Rec	% Rec	% Rec
1,2,-Dichloroethane-d4	91	98	109	96	101	86	109	107
Toluene-d8	96	98	109	104	101	75	98	102
4-Fluorobenzene	116	117	110	113	118	113	116	116
INT = Interference *Response likely GC/MS instrument carry-over from the prior sample								

ALS Environmental

Instrument Run Date: 04-Aug-11

ANALYTICAL DATA FROM INDIVIDUAL GC/MS INSTRUMENT RUNS

Client Container ID:	FCCU SCRUBBER STACK RUN 3B PROBE, IMP 1- 2 N-SPIKED	FCCU SCRUBBER STACK RUN 3B IMP 3 N- SPIKED	FCCU SCRUBBER STACK RUN 3B IMP 4 N- SPIKED	FCCU SCRUBBER STACK RUN FB- A PROBE, IMP 1-2 D-SPIKED	FCCU SCRUBBER STACK RUN FB- A IMP 3 D- SPIKED	FCCU SCRUBBER STACK RUN FB- A IMP 4 D- SPIKED	FCCU SCRUBBER STACK RUN FB- B PROBE, IMP 1-2 N-SPIKED	FCCU SCRUBBER STACK RUN FB- B IMP 3 N- SPIKED
ALS Sample ID	L1037258- 16;Ext1	L1037258- 17;Ext1	L1037258- 18;Ext1	L1037258- 19;Ext1	L1037258- 20;Ext1	L1037258- 21;Ext1	L1037258- 22;Ext1	L1037258- 23;Ext1
Instrument File #	6701025.D	6801026.D	6901027.D	7001028.D	7101029.D	7201030.D	7301031.D	7401032.D
Sample Volume (mL)	65	23	23	68	21	22	36	15
Dilution Factor	1	1	1	1	1	1	1	1
VOC via Modified Method 18								
	ug	ug	ug	ug	ug	ug	ug	ug
1,3-Butadiene	<6.5	<2.3	<2.3	<6.8	<2.1	<2.2	<3.6	<1.5
Pentane	<6.5	<2.3	<2.3	<6.8	<2.1	<2.2	<3.6	<1.5
Acrolein	5114	674	117	18*	<2.1	<2.2	2404	358
Acetone	61.8	27.3	17.2	56.1	15.6	15.4	41.7	10.8
Acetonitrile	4715	452	60	<6.8	<2.1	<2.2	5642	555
Carbon Disulfide	<6.5	<2.3	<2.3	<6.8	<2.1	<2.2	<3.6	<1.5
Methylene Chloride	8.3	3.3	2.5	14.0	3.1	3.7	7.1	2.7
Acrylonitrile	<6.5	<2.3	<2.3	<6.8	<2.1	<2.2	<3.6	<1.5
Methyl t-Butyl Ether (MTBE)	<6.5	<2.3	<2.3	<6.8	<2.1	<2.2	<3.6	<1.5
Hexane	<6.5	<2.3	<2.3	<6.8	<2.1	<2.2	<3.6	<1.5
2,2,4-Trimethylpentane	<6.5	<2.3	<2.3	<6.8	<2.1	<2.2	<3.6	<1.5
Benzene	<6.5	<2.3	<2.3	<6.8	<2.1	<2.2	<3.6	<1.5
Trichloroethene	5566	637	82	<6.8	<2.1	<2.2	5277	1069
2-Nitropropane	<6.5	<2.3	<2.3	<6.8	<2.1	<2.2	<3.6	<1.5
Methyl iso-Butyl Ketone	5536	105	7.2	<6.8	<2.1	<2.2	6807	160
Toluene	2327	187	19	<6.8	<2.1	<2.2	2014	322
Tetrachloroethene	<6.5	<2.3	<2.3	<6.8	<2.1	<2.2	<3.6	<1.5
1,2-Dibromoethane	<6.5	<2.3	<2.3	<6.8	<2.1	<2.2	<3.6	<1.5
Chlorobenzene	<6.5	<2.3	<2.3	<6.8	<2.1	<2.2	<3.6	<1.5
Ethylbenzene	<6.5	<2.3	<2.3	<6.8	<2.1	<2.2	<3.6	<1.5
m&p-Xylenes	<6.5	<2.3	<2.3	<6.8	<2.1	<2.2	<3.6	<1.5
o-Xylene	<6.5	<2.3	<2.3	<6.8	<2.1	<2.2	<3.6	<1.5
Styrene	<6.5	<2.3	<2.3	<6.8	<2.1	<2.2	<3.6	<1.5
Cumene (Isopropylbenzene)	<6.5	<2.3	<2.3	<6.8	<2.1	<2.2	<3.6	<1.5
Nitrobenzene	<32.5	<11.5	<11.5	<34	<10.5	<11	<18	<7.5
Labelled Analyte Recoveries	% Rec	% Rec	% Rec	% Rec	% Rec	% Rec	% Rec	% Rec
1,3-Butadiene-d6	0	0	0	0	0	0	0	0
Pentane-d12	0	0	0	3	0	0	0	0
acrylonitrile-d3	0	0	0	91	9	2	0	0
MTBE-d12	0	0	0	68	10	5	0	0
n-Hexane-d14	0	0	0	20	2	2	0	0
2,2,4-Trimethylpentane-d18	0	0	0	49	7	5	0	0
Benzene-d6	0	0	0	81	10	5	0	0
2-Nitropropane-d6	0	0	0	79	2	0	0	0
1,2-Dibromoethane-d4	0	0	0	92	3	1	0	0
Ethylbenzene-d10	0	0	0	111	4	1	0	0
Styrene-d8	0	0	0	103	2	0	0	0
Nitrobenzene-d5	0	0	0	22	1	0	0	0
Native Analyte Recoveries	% Rec	% Rec	% Rec	% Rec	% Rec	% Rec	% Rec	% Rec
Acrolein	73	10	2	-	-	-	34	5
Acetonitrile	82	8	1	-	-	-	98	10
Trichloroethene	138	16	2	-	-	-	131	26
Methyl iso-Butyl Ketone	92	2	-	-	-	-	114	3
Toluene	147	12	1	-	-	-	128	20
P&T Surrogate Recoveries	% Rec	% Rec	% Rec	% Rec	% Rec	% Rec	% Rec	% Rec
1,2,-Dichloroethane-d4	106	98	103	81	100	98	114	98
Toluene-d8	108	103	102	72	96	101	111	106
4-Fluorobenzene	114	115	119	112	121	117	118	116
INT = Interference *Response likely GC/MS instrument carry-over from the prior sample								

ALS Environmental

Instrument Run Date: 04-Aug-11

ANALYTICAL DATA FROM INDIVIDUAL GC/MS INSTRUMENT RUNS

Client Container ID:	FCCU SCRUBBER STACK RUN FB- B IMP 4 N- SPIKED	METHANOL TRIP BLANK	FCCU SCRUBBER STACK RUN 1B PROBE, IMP 1- 2 N-SPIKED	FCCU SCRUBBER STACK RUN 1B IMP 3 N- SPIKED	FCCU SCRUBBER STACK RUN 2B PROBE, IMP 1- 2 N-SPIKED	FCCU SCRUBBER STACK RUN 2B IMP 3 N- SPIKED	FCCU SCRUBBER STACK RUN 2B IMP 4 N- SPIKED	FCCU SCRUBBER STACK RUN 3B PROBE, IMP 1- 2 N-SPIKED
ALS Sample ID	L1037258- 24;Ext1	L1037258- 25;Ext1	L1037258- 4;Rep50x	L1037258- 5;Rep10x	L1037258- 10;Rep20x	L1037258- 11;Rep10x	L1037258- 12;Rep10x	L1037258- 16;Rep20x
Instrument File #	7501033.D	7601034.D	8601008.D	8701009.D	8801010.D	8901011.D	9101013.D	9201014.D
Sample Volume (mL)	24	37	47	20	61	20	19	65
Dilution Factor	1	1	50	10	20	10	10	20
VOC via Modified Method 18								
	ug	ug	ug	ug	ug	ug	ug	ug
1,3-Butadiene	<2.4	<10	<235	<20	<122	<20	<19	<130
Pentane	<2.4	<10	<235	<20	<122	<20	<19	<130
Acrolein	218	<10	2507	416	2089	488	128	4817
Acetone	18.9	62.3	<235	59.0	265	67.4	66.1	283.4
Acetonitrile	154	<10	3946	282	5890	481	69	4638
Carbon Disulfide	<2.4	<10	<235	<20	<122	<20	<19	<130
Methylene Chloride	4.4	17	<235	<20	<122	<20	<19	<130
Acrylonitrile	<2.4	<10	<235	<20	<122	<20	<19	<130
Methyl t-Butyl Ether (MTBE)	<2.4	<10	<235	<20	<122	<20	<19	<130
Hexane	<2.4	<10	<235	<20	<122	<20	<19	<130
2,2,4-Trimethylpentane	<2.4	<10	<235	<20	<122	<20	<19	<130
Benzene	<2.4	<10	<235	<20	<122	<20	<19	<130
Trichloroethene	262	<10	4832	304	4213	649	83	4866
2-Nitropropane	<2.4	<10	<235	<20	<122	<20	<19	<130
Methyl iso-Butyl Ketone	18	<10	3908	54	6414	131	<19	4941
Toluene	61	<10	2526	100	2384	219	23	2584
Tetrachloroethene	<2.4	<10	<235	<20	<122	<20	<19	<130
1,2-Dibromoethane	<2.4	<10	<235	<20	<122	<20	<19	<130
Chlorobenzene	<2.4	<10	<235	<20	<122	<20	<19	<130
Ethylbenzene	<2.4	<10	<235	<20	<122	<20	<19	<130
m&p-Xylenes	<2.4	<10	<235	<20	<122	<20	<19	<130
o-Xylene	<2.4	<10	<235	<20	<122	<20	<19	<130
Styrene	<2.4	<10	<235	<20	<122	<20	<19	<130
Cumene (Isopropylbenzene)	<2.4	<10	<235	<20	<122	<20	<19	<130
Nitrobenzene	<12	<50	<1175	<100	<610	<100	<95	<650
Labelled Analyte Recoveries	% Rec	% Rec	% Rec	% Rec	% Rec	% Rec	% Rec	% Rec
1,3-Butadiene-d6	0	0	0	0	0	0	0	0
Pentane-d12	0	0	0	0	0	0	0	0
acrylonitrile-d3	0	0	0	0	0	0	0	0
MTBE-d12	0	0	0	0	0	0	0	0
n-Hexane-d14	0	0	0	0	0	0	0	0
2,2,4-Trimethylpentane-d18	0	0	0	0	0	0	0	0
Benzene-d6	0	0	0	0	0	0	0	0
2-Nitropropane-d6	0	0	0	0	0	0	0	0
1,2-Dibromoethane-d4	0	0	0	0	0	0	0	0
Ethylbenzene-d10	0	0	0	0	0	0	0	0
Styrene-d8	0	0	0	0	0	0	0	0
Nitrobenzene-d5	0	0	1	0	0	0	0	0
Native Analyte Recoveries	% Rec	% Rec	% Rec	% Rec	% Rec	% Rec	% Rec	% Rec
Acrolein	3	-	36	6	30	7	2	69
Acetonitrile	3	-	66	5	99	8	1	78
Trichloroethene	6	-	82	5	71	11	1	82
Methyl iso-Butyl Ketone	-	-	64	-	105	2	-	81
Toluene	4	-	87	3	82	8	-	89
P&T Surrogate Recoveries	% Rec	% Rec	% Rec	% Rec	% Rec	% Rec	% Rec	% Rec
1,2-Dichloroethane-d4	108	100	102	104	110	103	105	105
Toluene-d8	102	103	106	104	104	105	105	106
4-Fluorobenzene	121	118	113	113	114	114	114	114
INT = Interference *Response likely GC/MS instrument carry-over from the prior sample								

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ANALYTICAL DATA FROM INDIVIDUAL GC/MS INSTRUMENT RUNS			
Instrument Run Date: 04-Aug-11			
Client Container ID:	FCCU SCRUBBER STACK RUN 3B IMP 3 N-SPIKED	FCCU SCRUBBER STACK RUN FB B PROBE, IMP 1-2 N-SPIKED	FCCU SCRUBBER STACK RUN FB B IMP 3 N-SPIKED
ALS Sample ID	L1037258-17;Rep10x	L1037258-22;Rep50x	L1037258-23;Rep10x
Instrument File #	9301015.D	9401016.D	9501017.D
Sample Volume (mL)	23	36	15
Dilution Factor	10	50	10
VOC via Modified Method 18			
	ug	ug	ug
1,3-Butadiene	<23	<180	<15
Pentane	<23	<180	<15
Acrolein	660	2009	410
Acetone	88.3	<180	53.7
Acetonitrile	455	4433	633
Carbon Disulfide	<23	<180	<15
Methylene Chloride	30	<180	16
Acrylonitrile	<23	<180	<15
Methyl t-Butyl Ether (MTBE)	<23	<180	<15
Hexane	<23	<180	<15
2,2,4-Trimethylpentane	<23	<180	<15
Benzene	<23	<180	<15
Trichloroethene	403	4784	707
2-Nitropropane	<23	<180	<15
Methyl iso-Butyl Ketone	96	4716	167
Toluene	135	2632	257
Tetrachloroethene	<23	<180	<15
1,2-Dibromoethane	<23	<180	<15
Chlorobenzene	<23	<180	<15
Ethylbenzene	<23	<180	<15
m&p-Xylenes	<23	<180	<15
o-Xylene	<23	<180	<15
Styrene	<23	<180	<15
Cumene (Isopropylbenzene)	<23	<180	<15
Nitrobenzene	<115	<900	<75
Labeled Analyte Recoveries	% Rec	% Rec	% Rec
1,3-Butadiene-d6	0	0	0
Pentane-d12	0	0	0
acrylonitrile-d3	0	0	0
MTBE-d12	0	0	0
n-Hexane-d14	0	0	0
2,2,4-Trimethylpentane-d18	0	0	0
Benzene-d6	0	0	0
2-Nitropropane-d6	0	0	0
1,2-Dibromoethane-d4	0	0	0
Ethylbenzene-d10	0	0	0
Styrene-d8	0	0	0
Nitrobenzene-d5	0	0	0
Native Analyte Recoveries	% Rec	% Rec	% Rec
Acrolein	9	29	6
Acetonitrile	8	74	11
Trichloroethene	7	81	12
Methyl iso-Butyl Ketone	2	77	3
Toluene	5	91	9
P&T Surrogate Recoveries	% Rec	% Rec	% Rec
1,2-Dichloroethane-d4	103	104	108
Toluene-d8	104	105	103
4-Fluorobenzene	115	114	115
INT = Interference *Response likely GC/MS instrument carry-over from the prior sample			

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Analyte Quantitation References

VOC via Modified Method 18		
Target VOCs	Corresponding Purge & Trap Internal Standard ²	Corresponding Field Spike ¹
1,3-Butadiene	Fluorobenzene	1,3-Butadiene-d6
Pentane	Fluorobenzene	Pentane-d12
Acrolein	Fluorobenzene	Benzene-d6
Acetone	Fluorobenzene	Acrylonitrile-d3
Acetonitrile	Fluorobenzene	Acrylonitrile-d3
Carbon Disulfide	Fluorobenzene	Benzene-d6
Methylene Chloride	Fluorobenzene	Benzene-d6
Acrylonitrile	Fluorobenzene	Acrylonitrile-d3
Methyl t-Butyl Ether (MTBE)	Fluorobenzene	MTBE-d12
Hexane	Fluorobenzene	n-Hexane-d14
2,2,4-Trimethylpentane	Chlorobenzene-d5	2,2,4-Trimethylpentane-d18
Benzene	Chlorobenzene-d5	Benzene-d6
Trichloroethene	Chlorobenzene-d5	Benzene-d6
2-Nitropropane	Chlorobenzene-d5	2-Nitropropane-d6
Methyl iso-Butyl Ketone	Chlorobenzene-d5	Ethylbenzene-d10
Toluene	Chlorobenzene-d5	Ethylbenzene-d10
Tetrachloroethene	Chlorobenzene-d5	Ethylbenzene-d10
1,2-Dibromoethane	Chlorobenzene-d5	1,2-Dibromoethane-d4
Chlorobenzene	Chlorobenzene-d5	Ethylbenzene-d10
Ethylbenzene	1,4-Dichlorobenzene-d4	Ethylbenzene-d10
m&p-Xylenes	1,4-Dichlorobenzene-d4	Ethylbenzene-d10
o-Xylene	1,4-Dichlorobenzene-d4	Ethylbenzene-d10
Styrene	1,4-Dichlorobenzene-d4	Styrene-d8
Cumene (Isopropylbenzene)	1,4-Dichlorobenzene-d4	Ethylbenzene-d10
Nitrobenzene	1,4-Dichlorobenzene-d4	Nitrobenzene-d5
Labelled Field Standards¹		
1,3-Butadiene-d6	Fluorobenzene	-
Pentane-d12	Fluorobenzene	-
Acrylonitrile-d3	Fluorobenzene	-
MTBE-d12	Fluorobenzene	-
n-Hexane-d14	Fluorobenzene	-
2,2,4-Trimethylpentane-d18	Chlorobenzene-d5	-
Benzene-d6	Chlorobenzene-d5	-
2-Nitropropane-d6	Chlorobenzene-d5	-
1,2-Dibromoethane-d4	Chlorobenzene-d5	-
Ethylbenzene-d10	1,4-Dichlorobenzene-d4	-
Styrene-d8	1,4-Dichlorobenzene-d4	-
Nitrobenzene-d5	1,4-Dichlorobenzene-d4	-
Purge & Trap Surrogate Standards²		
1,2-Dichloroethane-d4	Chlorobenzene-d5	-
Toluene-d8	Chlorobenzene-d5	-
4-Fluorobenzene	1,4-Dichlorobenzene-d4	-

All target analyte and surrogate data are reported corrected for the corresponding P&T internal standard responses.
Target analyte data including the native spike recoveries are reported uncorrected for corresponding labelled field spike recoveries.

¹ Spiked into impinger 2 just prior to sampling in the field.
² Spiked into the purge water just prior to instrumental analysis.

Marathon Petroleum Company
 CleanAir Project No: 11265
 FCCU Scrubber Stack

USEPA Method 18 Laboratory Data Summary for Methanol

Run No.		1A			1B		
Date (2011)		Jul 13			Jul 13		
Start Time (approx.)		11:53			11:53		
Stop Time (approx.)		13:13			13:13		
		Adsorbent Tube Section			Adsorbent Tube Section		
Laboratory Results		Condensate	1	2	Condensate	1	2
Methanol (µg)		< 200.0000	10.800	14.000	760.000	582.000	474.000
Reporting Limit		Tube = 5.00					
		Condensate = 200					

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Marathon Petroleum Company
 CleanAir Project No: 11265
 FCCU Scrubber Stack

USEPA Method 18 Laboratory Data Summary for Methanol

Run No.		2A			2B		
Date (2011)		Jul 13			Jul 13		
Start Time (approx.)		14:40			14:40		
Stop Time (approx.)		16:00			16:00		
		Condensate	Adsorbent Tube Section 1	Adsorbent Tube Section 2	Condensate	Adsorbent Tube Section 1	Adsorbent Tube Section 2
Laboratory Results	Reporting Limit						
Methanol (µg)	Tube = 5.00	< 200.0000	30.500	24.900	784.000	596.000	419.000
	Condensate = 200						

090711 152541

Marathon Petroleum Company
CleanAir Project No: 11265
FCCU Scrubber Stack

USEPA Method 18
Laboratory Data Summary for Methanol

Run No.		3A			3B		
Date (2011)		Jul 14			Jul 14		
Start Time (approx.)		10:55			10:55		
Stop Time (approx.)		12:15			12:15		
		Condensate	Adsorbent Tube Section 1	Adsorbent Tube Section 2	Condensate	Adsorbent Tube Section 1	Adsorbent Tube Section 2
Laboratory Results	Reporting Limit						
Methanol (µg)	Tube = 5.00	< 200.0000	122.000	63.300	703.000	215.000	323.000
	Condensate = 200						

090711 152541

Marathon Petroleum Company
CleanAir Project No: 11265
FCCU Scrubber Stack

USEPA Method 18 Laboratory Data Summary for Methanol

Run No.

Field Blank A

Field Blank B

Date (2011)

Start Time (approx.)

Stop Time (approx.)

Laboratory Results	Reporting Limit	Field Blank A			Field Blank B		
		Condensate	Adsorbent Tube Section 1	Adsorbent Tube Section 2	Condensate	Adsorbent Tube Section 1	Adsorbent Tube Section 2
Methanol (µg)	Tube = 5.00 Condensate = 200	< 200.0000	< 5.0000	< 5.0000	814.000	1240.000	7.900

090711 152541



CLEAN AIR ENGINEERING
ATTN: KEVIN O'HALLORAN
500 WEST WOOD STREET
PALATINE IL

Date Received: 27-JUL-11
Report Date: 31-AUG-11 14:06 (MT)
Version: FINAL

Client Phone: 800-627-0033

Certificate of Analysis

Lab Work Order #: L1037383
Project P.O. #: NOT SUBMITTED
Job Reference: 11265 - ROBINSON REFINERY
C of C Numbers:
Legal Site Desc:

Ron McLeod, Ph.D.
General Manager, Burlington

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ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1037383-2 FCCU SCRUBBER STACK RUN 1A ADSORBENT TUBE 6589 UNSPIKED Sampled By: CLIENT on 13-JUL-11 Matrix: STACK							
Methanol							
FRONT Methanol	10.8		5.0	ug		10-AUG-11	R2234264
BACK Methanol	14.0		5.0	ug		10-AUG-11	R2234264
L1037383-4 FCCU SCRUBBER STACK RUN 1B ADSORBENT TUBE 6685 SPIKED Sampled By: CLIENT on 13-JUL-11 Matrix: STACK							
Methanol							
FRONT Methanol	582		5.0	ug		10-AUG-11	R2234264
BACK Methanol	474		5.0	ug		10-AUG-11	R2234264
L1037383-6 FCCU SCRUBBER STACK RUN 2A ADSORBENT TUBE 6585 UNSPIKED Sampled By: CLIENT on 13-JUL-11 Matrix: STACK							
Methanol							
FRONT Methanol	30.5		5.0	ug		10-AUG-11	R2234264
BACK Methanol	24.9		5.0	ug		10-AUG-11	R2234264
L1037383-8 FCCU SCRUBBER STACK RUN 2B ADSORBENT TUBE 6682 SPIKED Sampled By: CLIENT on 13-JUL-11 Matrix: STACK							
Methanol							
FRONT Methanol	596		5.0	ug		10-AUG-11	R2234264
BACK Methanol	419		5.0	ug		10-AUG-11	R2234264
L1037383-10 FCCU SCRUBBER STACK RUN 3A ADSORBENT TUBE 6586 UNSPIKED Sampled By: CLIENT on 14-JUL-11 Matrix: STACK							
Methanol							
FRONT Methanol	122		5.0	ug		10-AUG-11	R2234264
BACK Methanol	63.3		5.0	ug		10-AUG-11	R2234264
L1037383-12 FCCU SCRUBBER STACK RUN 3B ADSORBENT TUBE 6686 SPIKED Sampled By: CLIENT on 14-JUL-11 Matrix: STACK							
Methanol							
FRONT Methanol	215		5.0	ug		10-AUG-11	R2234264
BACK Methanol	323		5.0	ug		10-AUG-11	R2234264
L1037383-14 FCCU SCRUBBER STACK RUN FB-A ADSORBENT TUBE 6591 UNSPIKED Sampled By: CLIENT on 13-JUL-11 Matrix: STACK							
Methanol							
FRONT Methanol	<5.0		5.0	ug		10-AUG-11	R2234264
BACK Methanol	<5.0		5.0	ug		10-AUG-11	R2234264
L1037383-16 FCCU SCRUBBER STACK RUN FB-B ADSORBENT TUBE 6691 SPIKED Sampled By: CLIENT on 13-JUL-11 Matrix: STACK							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1037383-16 FCCU SCRUBBER STACK RUN FB-B ADSORBENT TUBE 6691 SPIKED Sampled By: CLIENT on 13-JUL-11 Matrix: STACK Methanol FRONT Methanol BACK Methanol	1240 7.9		5.0 5.0	ug ug		10-AUG-11 10-AUG-11	R2234264 R2234264
L1037383-18 TRIP BLANK ADSORBENT TUBE 6590 Sampled By: CLIENT on 13-JUL-11 Matrix: STACK Methanol FRONT Methanol BACK Methanol	<5.0 <5.0		5.0 5.0	ug ug		10-AUG-11 10-AUG-11	R2234264 R2234264

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Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
AIR VOLUME-ED	Misc.	Air volume (L)	HYGIENE METHOD
NOTE: When air concentrations of analytes are reported, they are based on air sampling information (air volume, sampling time, sampling flow rate) supplied by the client.			
METHANOL-ED	Tube	Methanol	NIOSH 2000-GC FID
Samples are not field blank corrected.			

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
ED	ALS ENVIRONMENTAL - EDMONTON, ALBERTA, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

mg/kg - milligrams per kilogram based on dry weight of sample

mg/kg wwt - milligrams per kilogram based on wet weight of sample

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight

mg/L - unit of concentration based on volume, parts per million.

< - Less than.

D.L. - The reporting limit.

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



Quality Control Report

Workorder: L1037383

Report Date: 31-AUG-11

Page 1 of 2

Client: CLEAN AIR ENGINEERING
500 WEST WOOD STREET
PALATINE IL 60067
Contact: KEVIN O'HALLORAN

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
METHANOL-ED	Tube							
Batch	R2234264							
WG1327588-2	LCS							
Methanol			80		%		69-135	10-AUG-11
WG1327588-3	LCSD	WG1327588-2						
Methanol		80	73		%	8.1	36	10-AUG-11
Methanol		N/A			%			10-AUG-11
WG1327588-1	MB							
Methanol			<5.0		ug		5	10-AUG-11
Methanol			<5.0		ug		5	10-AUG-11

Quality Control Report

Workorder: L1037383

Report Date: 31-AUG-11

Page 2 of 2

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

ALS LABORATORY GROUP CHEMICAL ANALYSIS REPORT

TEST: Methanol in Condensate/GCFID

Lab Sample I.D.	Client I.D.	Results	
		(ug/mL)	(ug/Sample)
L1037383-1	FCCU SCRUBBER STACK RUN 1A IMP C & R UNSPIKED	<5.0	<200
L1037383-3	FCCU SCRUBBER STACK RUN 1B IMP C & R SPIKED	17.5	760
L1037383-5	FCCU SCRUBBER STACK RUN 2A IMP C & R UNSPIKED	<5.0	<200
L1037383-7	FCCU SCRUBBER STACK RUN 2B IMP C & R SPIKED	18.1	784
L1037383-9	FCCU SCRUBBER STACK RUN 3A IMP C & R UNSPIKED	<5.0	<200
L1037383-11	FCCU SCRUBBER STACK RUN 3B IMP C & R SPIKED	16.2	703
L1037383-13	FCCU SCRUBBER STACK RUN FB-A IMP C & R UNSPIKED	<5.0	<200
L1037383-15	FCCU SCRUBBER STACK RUN FB-B IMP C & R SPIKED	18.8	814
L1037383-17	TRIP BLANK DI H2O	<5.0	<200
Reporting Limit: (ug)		5.0	200
Method: HSOP 27.14 modified, GC-FID			

Quality Control

Method Blank		<5.0	<200
		Results (%)	
Matrix Spike	L1037383-1	124	
Matrix Spike Duplicate	L1037383-1	105	

ALS LABORATORY GROUP CHEMICAL ANALYSIS REPORT

TEST: Methanol on Silica Gel Tubes /GCFID

Lab Sample I.D.	Client I.D.	Total Methanol	Results	
			Expected	% Recovery
L1037383-4	FCCU SCRUBBER STACK RUN 1B ADSORBENT TUBE 6685 SPIKED	1055	871	121
L1037383-8	FCCU SCRUBBER STACK RUN 2B ADSORBENT TUBE 6682 SPIKED	1015	808	126
L1037383-12	FCCU SCRUBBER STACK RUN 3B ADSORBENT TUBE 6686 SPIKED	538	926	58
L1037383-16	FCCU SCRUBBER STACK RUN FB-B ADSORBENT TUBE 6691 SPIKED	1247	958	130

Method: HSOP 27 modified, GC-FID

[illegible]

18c 13:15

52

[illegible]

18°C 13:15

50

[illegible]

18°C 13:15

35

ALS Laboratory Group

ANALYTICAL CHEMISTRY & TESTING SERVICES



Environmental Division

Sample Integrity FormDate: 27-JUL-11Client: CLEAN AIR

ALS Contact: _____

COC #: _____

Phone #: _____

Work Order #: L1037383

Please note the following observations that prevent your samples from being processed.

ALS is attempting to contact you for further instructions.

If our attempts fail, please contact us as soon as possible to ensure your analytical needs are met.

Observation**Details**

<input type="checkbox"/>	Temperature < freezing point	actual temp. (breakdown by cooler):
<input checked="" type="checkbox"/>	Temperature ≥ 10 Celsius	actual temp. (breakdown by cooler): <u>18°C</u>
<input type="checkbox"/>	Containers broken in transit	details:
<input type="checkbox"/>	Sample integrity compromised	details:
<input type="checkbox"/>	Regulatory non-compliance	details:
<input type="checkbox"/>	No COC with shipment	details:
<input type="checkbox"/>	Discrepancy between COC and label	details:
<input type="checkbox"/>	COC incomplete or unclear	details:
<input type="checkbox"/>	Container incompatible with test	details:
<input type="checkbox"/>	Volume is insufficient for test	details:
<input type="checkbox"/>	Preservation incompatible with test	details:
<input type="checkbox"/>	No preservation	details:
<input type="checkbox"/>	Other observation	details:

Additional Information (list all affected sample portions):

Marathon Petroleum Company
 Clean Air Project No: 11265
 FCCU Scrubber Stack

USEPA SW-846 Method 0011 Formaldehyde Laboratory Data Summary

Run No.	1	2	3
Date (2011)	Jul 13	Jul 13	Jul 14
Start Time (approx.)	09:55	13:16	08:56
Stop Time (approx.)	12:02	15:36	11:09

☐ DRAFT LAB DATA

Formaldehyde (CH₂O) Laboratory Results

m_{MDL}	Minimum detectable limit (μg)	0.50000
B_i	Blank amount ($\mu\text{g CH}_2\text{O}$)	2.36000

m_i	Total Formaldehyde collected (μg)	9.13000	11.80000	4.32000
m_b	Allowable blank subtraction (μg) - See Note Below	0.00000	0.00000	0.00000
m_{nb}	Allowable blank subtraction (μg)	9.13000	11.80000	4.32000
m_n	Formaldehyde used in emission calculations (mg)	0.00913	0.01180	0.00432

Quality Control Data

Sample I.D.

m_{ns}	Total Formaldehyde in sample (μg)
m_s	Amount of Formaldehyde spiked (μg)

Field Spike	Matrix Spike
701.00000	504.00000
802.00000	802.00000

Marathon Petroleum Company
Clean Air Project No: 11265
FCCU Scrubber Stack

USEPA SW-846 Method 0011
Acetaldehyde Laboratory Data Summary

Run No.	1	2	3
Date (2011)	Jul 13	Jul 13	Jul 14
Start Time (approx.)	09:55	13:16	08:56
Stop Time (approx.)	12:02	15:36	11:09

☐ DRAFT LAB DATA

Acetaldehyde (CH₃CHO) Laboratory Results

m_{MDL}	Minimum detectable limit (μg)	0.50000
B_i	Blank amount (μg CH ₃ CHO)	0.68000

m_i	Total Acetaldehyde collected (μg)	14.20000	19.10000	10.80000
m_b	Allowable blank subtraction (μg)	0.00000	0.00000	0.00000
m_{nb}	Acetaldehyde collected minus blank (μg)	14.20000	19.10000	10.80000
m_n	Acetaldehyde used in emission calculations (mg)	0.01420	0.01910	0.01080

Marathon Petroleum Company
Clean Air Project No: 11265
FCCU Scrubber Stack

USEPA SW-846 Method 0011 Propanal Laboratory Data Summary

Run No.	1	2	3
Date (2011)	Jul 13	Jul 13	Jul 14
Start Time (approx.)	09:55	13:16	08:56
Stop Time (approx.)	12:02	15:36	11:09

☐ DRAFT LAB DATA

Propanal (CH₃CH₂CHO) Laboratory Results

m_{MDL}	Minimum detectable limit (μ g)	0.50000
B_i	Blank amount (μ g CH ₃ CH ₂ CHO)	<0.50000

m_i	Total Propanal collected (μ g)	8.32000	15.10000	10.60000
m_b	Allowable blank subtraction (μ g)	0.00000	0.00000	0.00000
m_{nb}	Propanal collected minus blank (μ g)	8.32000	15.10000	10.60000
m_n	Propanal used in emission calculations (mg)	0.00832	0.01510	0.01060

Marathon Petroleum Company
Clean Air Project No: 11265
FCCU Scrubber Stack

**USEPA SW-846 Method 0011
Formaldehyde QA/QC Parameters**

Sample		Field Spike	Matrix Spike
Date (2011)		Jul 14	Jul 14
Start Time (approx.)		N/A	11:51
Stop Time (approx.)		N/A	14:10
Sampling Data			
$V_{\text{mstd-QC}}$	Volume metered for spiked run, standard (dscf)	N/A	64.8934
$V_{\text{mstd-avg}}$	Average volume metered for run samples, standard (dscf)	N/A	71.6638
Laboratory Data			
m_{ns}	Total Formaldehyde in sample (μg)	701.00000	504.00000
m_{s}	Amount of Formaldehyde spiked (μg)	802.00000	802.00000
$m_{\text{n-avg}}$	Average amount of Formaldehyde in run samples (μg)	N/A	8.41667
Spike Recovery			
R	Spike Recovery (%)	87.41%	61.89%

090711 153150



CLEAN AIR ENGINEERING
ATTN: KEVIN O'HALLORAN
500 WEST WOOD STREET
PALATINE IL

Date Received: 27-JUL-11
Report Date: 31-AUG-11 14:08 (MT)
Version: FINAL

Client Phone: 800-627-0033

Certificate of Analysis

Lab Work Order #: L1039764
Project P.O. #: NOT SUBMITTED
Job Reference: 11265 - ROBINSON REFINERY
C of C Numbers:
Legal Site Desc:

Ron McLeod, Ph.D.
General Manager, Burlington

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ADDRESS: 5420 Mainway Drive, Unit 5, Burlington, ON, L7L 6A4 Canada | Phone: +1 905 331 3111 | Fax: +1 905 331 4567
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Environmental

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ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1039764-1 FCCU SCRUBBER STACK RUN 1 PROBE RINSE, IMP. C & R Sampled By: CLIENT on 13-JUL-11 Matrix: STACK							
Aldehyde Screen							
Formaldehyde	9.13	RAMB	0.50	ug	20-AUG-11	23-AUG-11	R2241435
Acetaldehyde	14.2	RAMB	0.50	ug	20-AUG-11	23-AUG-11	R2241435
Propionaldehyde	8.32	RAMB	0.50	ug	20-AUG-11	23-AUG-11	R2241435
L1039764-2 FCCU SCRUBBER STACK RUN 2 PROBE RINSE, IMP. C & R Sampled By: CLIENT on 13-JUL-11 Matrix: STACK							
Aldehyde Screen							
Formaldehyde	11.8	RAMB	0.50	ug	20-AUG-11	23-AUG-11	R2241435
Acetaldehyde	19.1	RAMB	0.50	ug	20-AUG-11	23-AUG-11	R2241435
Propionaldehyde	15.1	RAMB	0.50	ug	20-AUG-11	23-AUG-11	R2241435
L1039764-3 FCCU SCRUBBER STACK RUN 3 PROBE RINSE, IMP. C & R Sampled By: CLIENT on 14-JUL-11 Matrix: STACK							
Aldehyde Screen							
Formaldehyde	4.32	RAMB	0.50	ug	20-AUG-11	23-AUG-11	R2241435
Acetaldehyde	10.8	RAMB	0.50	ug	20-AUG-11	23-AUG-11	R2241435
Propionaldehyde	10.6	RAMB	0.50	ug	20-AUG-11	23-AUG-11	R2241435
L1039764-4 FCCU SCRUBBER STACK MATRIX SPIKE PROBE RINSE, IMP. C & R Sampled By: CLIENT on 14-JUL-11 Matrix: STACK							
Aldehyde Screen							
Formaldehyde	504		0.50	ug	20-AUG-11	23-AUG-11	R2241435
Acetaldehyde	7.98	RAMB	0.50	ug	20-AUG-11	23-AUG-11	R2241435
Propionaldehyde	19.6	RAMB	0.50	ug	20-AUG-11	23-AUG-11	R2241435
Note: Recovery of Formaldehyde Field Native Spike 63%							
L1039764-5 REAGENT BLANK ACIDIFIED DNPH Sampled By: CLIENT on 13-JUL-11 Matrix: STACK							
Aldehyde Screen							
Formaldehyde	<0.50		0.50	ug	20-AUG-11	23-AUG-11	R2241435
Acetaldehyde	0.68		0.50	ug	20-AUG-11	23-AUG-11	R2241435
Propionaldehyde	<0.50		0.50	ug	20-AUG-11	23-AUG-11	R2241435
L1039764-6 REAGENT BLANK DICHLOROMETHANE Sampled By: CLIENT on 13-JUL-11 Matrix: STACK							
Aldehyde Screen							
Formaldehyde	<0.50		0.50	ug	20-AUG-11	23-AUG-11	R2241435
Acetaldehyde	<0.50		0.50	ug	20-AUG-11	23-AUG-11	R2241435
Propionaldehyde	<0.50		0.50	ug	20-AUG-11	23-AUG-11	R2241435
L1039764-7 REAGENT BLANK DI WATER Sampled By: CLIENT on 13-JUL-11 Matrix: STACK							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1039764-7 REAGENT BLANK DI WATER Sampled By: CLIENT on 13-JUL-11 Matrix: STACK Aldehyde Screen Formaldehyde Acetaldehyde Propionaldehyde	<0.50 <0.50 <0.50		0.50 0.50 0.50	ug ug ug	20-AUG-11 20-AUG-11 20-AUG-11	23-AUG-11 23-AUG-11 23-AUG-11	R2241435 R2241435 R2241435
L1039764-8 SAMPLE BLANK DNPH, DICHLOR. (~C1 VOL.) Sampled By: CLIENT on 14-JUL-11 Matrix: STACK Aldehyde Screen Formaldehyde Acetaldehyde Propionaldehyde	2.36 <0.50 <0.50	RAMB RAMB	0.50 0.50 0.50	ug ug ug	20-AUG-11 20-AUG-11 20-AUG-11	23-AUG-11 23-AUG-11 23-AUG-11	R2241435 R2241435 R2241435
L1039764-9 FIELD SPIKE ACIDIFIED DNPH FROM IMP. 1 Sampled By: CLIENT on 14-JUL-11 Matrix: STACK Aldehyde Screen Formaldehyde Acetaldehyde Propionaldehyde Note: Recovery of Formaldehyde Field Native Spike 87%	701 0.80 3.16	RAMB RAMB	0.50 0.50 0.50	ug ug ug	20-AUG-11 20-AUG-11 20-AUG-11	23-AUG-11 23-AUG-11 23-AUG-11	R2241435 R2241435 R2241435

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Reference Information

Sample Parameter Qualifier Key:

Qualifier	Description
A	Method Blank exceeds ALS DQO. Refer to narrative comments for further information.
RAMB	Result Adjusted For Method Blank

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
AIR VOLUME-ED	Misc.	Air volume (L)	HYGIENE METHOD
NOTE: When air concentrations of analytes are reported, they are based on air sampling information (air volume, sampling time, sampling flow rate) supplied by the client.			
ALDEHYDE-SCREEN-ED	Impinger	Aldehyde Screen	CARB 430, EPA TO-5 MOD

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
ED	ALS ENVIRONMENTAL - EDMONTON, ALBERTA, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

mg/kg - milligrams per kilogram based on dry weight of sample

mg/kg wwt - milligrams per kilogram based on wet weight of sample

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight

mg/L - unit of concentration based on volume, parts per million.

< - Less than.

D.L. - The reporting limit.

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



Quality Control Report

Workorder: L1039764

Report Date: 31-AUG-11

Page 1 of 2

Client: CLEAN AIR ENGINEERING
500 WEST WOOD STREET
PALATINE IL 60067
Contact: KEVIN O'HALLORAN

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
ALDEHYDE-SCREEN-ED Impinger								
Batch R2241435								
WG1334098-2 LCS								
Formaldehyde			92		%		50-150	23-AUG-11
Acetaldehyde			94		%		50-150	23-AUG-11
Propionaldehyde			92		%		50-150	23-AUG-11
WG1334098-3 LCSD WG1334098-2								
Formaldehyde		92	90		%	2.1	50	23-AUG-11
Propionaldehyde		92	104		%	12	50	23-AUG-11
WG1334098-1 MB								
Formaldehyde			5.56	A	ug		0.5	23-AUG-11
Acetaldehyde			4.18	A	ug		0.5	23-AUG-11
Propionaldehyde			2.14	A	ug		0.5	23-AUG-11

COMMENTS: High reagent background for analytes likely due to long storage time (>5 days). Results corrected for method blank as appropriate.

Quality Control Report

Workorder: L1039764

Report Date: 31-AUG-11

Page 2 of 2

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
A	Method Blank exceeds ALS DQO. Refer to narrative comments for further information.

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

[illegible]

see Login Book for more info. 13:15 10°C

[illegible]

16°C 13:15



Sample Integrity Form

Date: 04-AUG-11

Client: CLEAN AIR

ALS Contact: _____

COC #: _____

Phone #: _____

Work Order #: L1039764

Please note the following observations that prevent your samples from being processed.

ALS is attempting to contact you for further instructions.

If our attempts fail, please contact us as soon as possible to ensure your analytical needs are met.

	Observation	Details
<input type="checkbox"/>	Temperature < freezing point	actual temp. (breakdown by cooler):
<input checked="" type="checkbox"/>	Temperature ≥ 10 Celsius	actual temp. (breakdown by cooler): <u>Some Samples Received at 16°C</u>
<input type="checkbox"/>	Containers broken in transit	details:
<input type="checkbox"/>	Sample integrity compromised	details:
<input type="checkbox"/>	Regulatory non-compliance	details:
<input type="checkbox"/>	No COC with shipment	details:
<input type="checkbox"/>	Discrepancy between COC and label	details:
<input type="checkbox"/>	COC incomplete or unclear	details:
<input type="checkbox"/>	Container incompatible with test	details:
<input type="checkbox"/>	Volume is insufficient for test	details:
<input type="checkbox"/>	Preservation incompatible with test	details:
<input type="checkbox"/>	No preservation	details:
<input checked="" type="checkbox"/>	Other observation	details: <u>See Below</u>

Additional Information (list all affected sample portions):

Hold Time is past on arrival.

[illegible]

Marathon Petroleum Company
Clean Air Project No: 11265
FCCU Scrubber Stack

USEPA SW-846 Method 0010 SVOC Laboratory Data

Run No.	1	2	3
Date (2011)	Jul 15	Jul 15	Jul 16
Start Time (approx.)	08:57	15:55	08:36
Stop Time (approx.)	14:49	20:55	12:59

Index	Analyte Name	Reporting Limit (µg)	Field Blank (µg)	Gross Weight (µg)	Gross Weight (µg)	Gross Weight (µg)
1	Aniline	1.8000	<1.8000	<1.8000	<1.8000	<1.8000
2	Phenol	2.0000	<2.0000	<23.0000	<20.0000	<8.8000
3	2-Methylphenol	2.1000	<2.1000	<2.1000	<2.1000	<2.1000
4	4-Methylphenol&3-Methylphenol	5.6000	<5.6000	<5.6000	<5.6000	<5.6000
5	o-Toluidine	5.0000	<5.0000	<5.0000	<5.0000	<5.0000
6	Isophorone	2.2000	<2.2000	<2.2000	<2.2000	<2.2000
7	2,4-Dimethylphenol	2.6000	<2.6000	<2.6000	<2.6000	<2.6000
8	Dibenzofuran	2.3000	<2.3000	2.8500	3.2000	3.3000
9	α,α-Dimethylphenethylamine	12.0000	<12.0000	<12.0000	<12.0000	<12.0000
10	1,4-Phenylenediamine	18.0000	<18.0000	<18.0000	<18.0000	<18.0000
11	Benzidine	38.0000	<38.0000	<38.0000	<38.0000	<38.0000
12	Dimethylaminobenzene	2.0000	<2.0000	<2.0000	<2.0000	<2.0000
13	3,3'-Dimethylbenzidine	29.0000	<29.0000	<29.0000	<29.0000	<29.0000
14	3,3'-Dimethoxybenzidine	29.0000	<29.0000	<29.0000	<29.0000	<29.0000

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Marathon Petroleum Company
Clean Air Project No: 11265
FCCU Scrubber Stack

USEPA SW-846 Method 0010 SVOC Laboratory Calculations

Run No.	1			2			3		
Date (2011)	Jul 15			Jul 15			Jul 16		
Start Time (approx.)	08:57			15:55			08:36		
Stop Time (approx.)	14:49			20:55			12:59		
Index Analyte Name	Detection Limit (µg)	Field Blank (µg)	Gross Weight (µg)	Net Weight (µg)	Gross Weight (µg)	Net Weight (µg)	Gross Weight (µg)	Net Weight (µg)	
1 Aniline	1.800E+00	<1.8000	<1.8000	<1.8000	<1.8000	<1.8000	<1.8000	<1.8000	
2 Phenol	2.000E+00	<2.0000	<23.0000	<23.0000	<20.0000	<20.0000	<8.8000	<8.8000	
3 2-Methylphenol	2.100E+00	<2.1000	<2.1000	<2.1000	<2.1000	<2.1000	<2.1000	<2.1000	
4 4-Methylphenol&3-Methylpher	5.600E+00	<5.6000	<5.6000	<5.6000	<5.6000	<5.6000	<5.6000	<5.6000	
5 o-Toluidine	5.000E+00	<5.0000	<5.0000	<5.0000	<5.0000	<5.0000	<5.0000	<5.0000	
6 Isophorone	2.200E+00	<2.2000	<2.2000	<2.2000	<2.2000	<2.2000	<2.2000	<2.2000	
7 2,4-Dimethylphenol	2.600E+00	<2.6000	<2.6000	<2.6000	<2.6000	<2.6000	<2.6000	<2.6000	
8 Dibenzofuran	2.300E+00	<2.3000	2.8500	2.8500	3.2000	3.2000	3.3000	3.3000	
9 α,α-Dimethylphenethylamine	1.200E+01	<12.0000	<12.0000	<12.0000	<12.0000	<12.0000	<12.0000	<12.0000	
10 1,4-Phenylenediamine	1.800E+01	<18.0000	<18.0000	<18.0000	<18.0000	<18.0000	<18.0000	<18.0000	
11 Benzidine	3.800E+01	<38.0000	<38.0000	<38.0000	<38.0000	<38.0000	<38.0000	<38.0000	
12 Dimethylaminobenzene	2.000E+00	<2.0000	<2.0000	<2.0000	<2.0000	<2.0000	<2.0000	<2.0000	
13 3,3'-Dimethylbenzidine	2.900E+01	<29.0000	<29.0000	<29.0000	<29.0000	<29.0000	<29.0000	<29.0000	
14 3,3'-Dimethoxybenzidine	2.900E+01	<29.0000	<29.0000	<29.0000	<29.0000	<29.0000	<29.0000	<29.0000	
16 Total SVOCs			<173.1500	<173.1500	<29.0000	<29.0000	<29.0000	<29.0000	<159.4000

< Denotes that the analyte was not detectable above the stated value. The stated value was used to calculate the results.
Total PAHs are calculated using the full detection limit for results below the detection limit.

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SCC (ISO 17025:2005) Accreditation Lab ID: 1003-15/779 Ont DW License #: 2285
NELAC Primary Accreditation, NJ DEP ID# CANA003: Secondary Accreditation, TX Cert# T104704433-08-TX

Certificate of Analysis

ALS Project Contact: Ron McLeod
ALS Project ID: CLE 150
ALS WO#: L1037050
Date of Report: 19-Aug-11
Date of Sample Receipt: 27-Jul-11

Client Name: Clean Air Engineering
Client Address: 500 West Wood Street
Palatine, IL
60067
Client Contact: Kevin O'Halloren
Client Project ID: 11265

COMMENTS: 8270 By LRGCMS

The sample FCCU SCRUBBER STACK FIELD BLANK M0010 was not submitted with an impinger catch. However, a back-half rinse was submitted and included in the extraction.

Method Summary:

The 0010 train samples were extracted by SW846 Method 3542. For each train, the front half solids and the XAD2 sorbent were extracted together in a single soxhlet. The extraction standards for 8270D and PAH analyses were spiked into the solids/sorbent media just prior to extraction. The condensates were extracted by B/N/A liquid/liquid extraction technique using separatory funnels and dichloromethane as the extracting solvent. The extract from the soxhlet and the condensates for each train were combined for each train and reduced to a 5mL final volume. A 1/2 portion was removed and concentrated to 1mL for analysis of PAHs via isotope dilution and selected ion monitoring GC/LRMS analysis. A portion of the remaining extract was removed for analysis of semi-volatile organics via SW846 method 8270D.

Certified by: 

Steve Kennedy
Laboratory Manager

Results in this certificate relate only to the samples as submitted to the laboratory.

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ALS Environmental

Sample Analysis Summary Report

Sample Name	Method Blank	FCCU SCRUBBER STACK REAGENT BLANK M0010	FCCU SCRUBBER STACK FIELD BLANK M0010	FCCU SCRUBBER STACK RUN 1 M0010	FCCU SCRUBBER STACK RUN 2 M0010	FCCU SCRUBBER STACK RUN 3 M0010	Control Limits
ALS Sample ID	WG1321413-1	L1037050-5	L1037050-4	L1037050-1	L1037050-2	L1037050-3	
Sample Size	1	1	1	1	1	1	
Sample units	sample	sample	sample	sample	sample	sample	
Moisture Content	n/a	n/a	n/a	n/a	n/a	n/a	
Matrix	QC	Stack	Stack	Stack	Stack	Stack	
Sampling Date	n/a	14-Jul-11	16-Jul-11	15-Jul-11	15-Jul-11	16-Jul-11	
Extraction Date	29-Jul-11	29-Jul-11	29-Jul-11	29-Jul-11	29-Jul-11	29-Jul-11	
Target Analytes	ug/sample	ug/sample	ug/sample	ug/sample	ug/sample	ug/sample	
Aniline	<1.8 U	<1.8 U	<1.8 U	<1.8 U	<1.8 U	<1.8 U	
Phenol	<2.0 U	<2.0 U	<2.0 U	<2.3 MR	<2.0 R	<8.8 R	
2-Methylphenol	<2.1 U	<2.1 U	<2.1 U	<2.1 U	<2.1 U	<2.1 U	
4-Methylphenol&3-Methylphenol	<5.6 U	<5.6 U	<5.6 U	<5.6 U	<5.6 U	<5.6 U	
o-Toluidine	<5.0 U	<5.0 U	<5.0 U	<5.0 U	<5.0 U	<5.0 U	
Isophorone	<2.2 U	<2.2 U	<2.2 U	<2.2 U	<2.2 U	<2.2 U	
2,4-Dimethylphenol	<2.6 U	<2.6 U	<2.6 U	<2.6 U	<2.6 U	<2.6 U	
Dibenzofuran	<2.3 U	<2.3 U	<2.3 U	2.85	3.20	3.30	
a,a-Dimethylphenethylamine	<12 U	<12 U	<12 U	<12 U	<12 U	<12 U	
1,4-Phenylenediamine	<18 U	<18 U	<18 U	<18 U	<18 U	<18 U	
Benzidine	<38 U	<38 U	<38 U	<38 U	<38 U	<38 U	
Dimethylaminobenzene	<2.0 U	<2.0 U	<2.0 U	<2.0 U	<2.0 U	<2.0 U	
3,3'-Dimethylbenzidine	<29 U	<29 U	<29 U	<29 U	<29 U	<29 U	
3,3'-Dimethoxybenzidine	<29 U	<29 U	<29 U	<29 U	<29 U	<29 U	
Extraction Standards	% Rec	% Rec	% Rec	% Rec	% Rec	% Rec	
2-Fluorophenol	59	56	56	63 M	61 M	58 M	25-121
d5-Phenol	58	55	55	61	57	58	24-113
d5-Nitrobenzene	86	81 M	80	87	81	83	23-120
2-Fluorobiphenyl	85	83	81	97	92	94	30-115
2,4,6-Tribromophenol	34	47 M	46	73	69	70	19-122

U Indicates that this compound was not detected above the LOD.

M Indicates that a peak has been manually integrated.

R Indicates ratio failure on confirming ion due to interference

ALS Environmental

ICR Petroleum Sector LCS Data for 0010/3542/8270D on 8270D LCS Performance Compounds

Sample Name	Laboratory Control Sample (LCS) #1	Target Solids Recovery Acceptance Limits
ALS Sample ID	WG1321413-2	
Sample Size	1	
ALS WO#	L1037050	
Extraction Date	29-Jul-11	

Target Analytes	% Recovery	% Recovery
Phenol	95	26-90
2-Chlorophenol	63	25-102
1,4-Dichlorobenzene	65	n/a
N-Nitrosodi-n-propylamine	77	41-126
1,2,4-Trichlorobenzene	71	n/a
4-Chloro-3-methylphenol	66	26-103
2,4-Dinitrotoluene	65	28-89
4-Nitrophenol	33	11-114
Acenaphthene	61	31-137
Pentachlorophenol	2*	17-109
Pyrene	57	35-142
Extraction Standards	% Rec	% Rec
2-Fluorophenol	52	25-121
d5-Phenol	49	24-113
d5-Nitrobenzene	82	23-120
2-Fluorobiphenyl	80	30-115
2,4,6-Tribromophenol	46	19-122

* A bias to low recoveries on non-acidified resin media is common for acidic compounds and is most commonly observed for the more acidic components such as PCP. Note that field 'run' samples do not often show this bias since these samples are usually acidified by the source stack gases.

Marathon Petroleum Company
Clean Air Project No: 11265
FCCU Scrubber Stack

USEPA SW-846 Method 0010 PAH Laboratory Data

Run No.	1	2	3
Date (2011)	Jul 15	Jul 15	Jul 16
Start Time (approx.)	08:57	15:55	08:36
Stop Time (approx.)	14:49	20:55	12:59

Index	Analyte Name	Reporting Limit (ng)	Field Blank (ng)	Gross Weight (ng)	Gross Weight (ng)	Gross Weight (ng)
1	Naphthalene	227.0000	365.0000	36100.0000	84600.0000	80300.0000
2	2-Methylnaphthalene	9.3000	24.2000	276.0000	163.0000	180.0000
3	Acenaphthylene	4.0000	<4.0000	70.0000	77.6000	88.4000
4	Acenaphthene	4.0000	9.2200	<120.0000	<31.0000	<39.0000
5	Fluorene	4.0000	6.2400	<300.0000	<280.0000	<310.0000
6	Phenanthrene	5.8800	9.8800	2360.0000	2780.0000	2600.0000
7	Anthracene	4.0000	<4.0000	25.4000	29.8000	39.3000
8	Fluoranthene	4.0000	<4.0000	367.0000	444.0000	430.0000
9	Pyrene	5.1600	6.5000	<180.0000	<240.0000	<210.0000
10	Benz[a]anthracene	4.0000	<4.0000	<4.6000	<5.7000	<7.0000
11	Chrysene/Triphenylene	4.0000	<4.0000	87.8000	110.0000	109.0000
12	Benzo[b]fluoranthene	4.0000	<4.0000	<27.0000	<40.0000	<41.0000
13	Benzo[k]fluoranthene	4.0000	<4.0000	7.8600	5.0600	<4.8000
14	Benzo[e]pyrene	4.0000	<4.0000	<16.0000	<12.0000	<13.0000
15	Benzo[a]pyrene	4.0000	<4.0000	<4.0000	<4.0000	<4.0000
16	Perylene	4.0000	<4.0000	<4.0000	<4.0000	<4.0000
17	Indeno[1,2,3-cd]pyrene	4.0000	<4.0000	<4.0000	<4.0000	<4.0000
18	Dibenzo[a,h]anthracene	4.0000	<4.0000	<4.0000	<4.0000	<4.0000
19	Benzo[g,h,i]perylene	4.0000	<4.0000	<4.0000	<4.0000	<4.0000
20	2-Chloronaphthalene	4.0000	<4.0000	<4.0000	<4.0000	<4.0000
21	Biphenyl	198.0000	208.0000	2420.0000	2590.0000	2600.0000
22	7,12-Dimethylbenzo[a]anthracene	4.0000	<4.0000	<4.0000	<4.0000	<4.0000
23	3-Methylcholanthrene	4.0000	<4.0000	<4.0000	<4.0000	<4.0000
24	Dibenzo[a,e]pyrene	4.0000	<4.0000	<4.0000	<4.0000	<4.0000

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Marathon Petroleum Company
Clean Air Project No: 11265
FCCU Scrubber Stack

USEPA SW-846 Method 0010 PAH Laboratory Calculations

Run No.	Date (2011)	Start Time (approx.)	Stop Time (approx.)	1	2	3
	Jul 15	08:57	14:49	Jul 15	15:55	Jul 16
					20:55	08:36
						12:59
Index Analyte Name	Detection Limit (ng)	Field Blank (ng)	Gross Weight (ng)	Net Weight (ng)	Gross Weight (ng)	Net Weight (ng)
1 Naphthalene	2.270E+02	365.0000	36100.0000	36100.0000	84600.0000	80300.0000
2 2-Methylnaphthalene	9.300E+00	24.2000	276.0000	276.0000	163.0000	180.0000
3 Acenaphthylene	4.000E+00	<4.0000	70.0000	70.0000	77.6000	88.4000
4 Acenaphthene	4.000E+00	9.2200	<120.0000	<120.0000	<31.0000	<39.0000
5 Fluorene	4.000E+00	6.2400	<300.0000	<300.0000	<280.0000	<310.0000
6 Phenanthrene	5.880E+00	9.8800	2360.0000	2360.0000	2780.0000	2600.0000
7 Anthracene	4.000E+00	<4.0000	25.4000	25.4000	29.8000	39.3000
8 Fluoranthene	4.000E+00	<4.0000	367.0000	367.0000	444.0000	430.0000
9 Pyrene	5.160E+00	6.5000	<180.0000	<180.0000	<240.0000	<210.0000
10 Benz[a]anthracene	4.000E+00	<4.0000	<4.6000	<4.6000	<5.7000	<7.0000
11 Chrysene/Triphenylene	4.000E+00	<4.0000	87.8000	87.8000	110.0000	109.0000
12 Benzo[b]fluoranthene	4.000E+00	<4.0000	<27.0000	<27.0000	<40.0000	<41.0000
13 Benzo[k]fluoranthene	4.000E+00	<4.0000	7.8600	7.8600	5.0600	<4.8000
14 Benzo[e]pyrene	4.000E+00	<4.0000	<16.0000	<16.0000	<12.0000	<13.0000
15 Benzo[a]pyrene	4.000E+00	<4.0000	<4.0000	<4.0000	<4.0000	<4.0000
16 Perylene	4.000E+00	<4.0000	<4.0000	<4.0000	<4.0000	<4.0000
17 Indeno[1,2,3-cd]pyrene	4.000E+00	<4.0000	<4.0000	<4.0000	<4.0000	<4.0000
18 Dibenzo[a,h]anthracene	4.000E+00	<4.0000	<4.0000	<4.0000	<4.0000	<4.0000
19 Benzo[g,h,i]perylene	4.000E+00	<4.0000	<4.0000	<4.0000	<4.0000	<4.0000
20 2-Chloronaphthalene	4.000E+00	<4.0000	<4.0000	<4.0000	<4.0000	<4.0000
21 Biphenyl	1.980E+02	208.0000	2420.0000	2420.0000	2590.0000	2600.0000
22 7,12-Dimethylbenzo[a]anthracene	4.000E+00	<4.0000	<4.0000	<4.0000	<4.0000	<4.0000
23 3-Methylcholanthrene	4.000E+00	<4.0000	<4.0000	<4.0000	<4.0000	<4.0000
24 Dibenzo[a,e]pyrene	4.000E+00	<4.0000	<4.0000	<4.0000	<4.0000	<4.0000
25 Total PAHs			<42397.6600	<91444.1600		<87007.5000

< Denotes that the analyte was not detectable above the stated value. The stated value was used to calculate the results.
Total PAHs are calculated using the full detection limit for results below the detection limit.



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SCC Accredited Lab ID# 1003-15/779 Ont DW License #: 2285
NELAC Primary Accreditation, NJ DEP ID# CANA003: Secondary Accreditation, TX Cert# T104704433-08-TX

Certificate of Analysis

ALS Project Contact: Ron McLeod
ALS Project ID: CLE150
ALS WO#: L1037050
Date of Report: 19-Aug-11
Date of Sample Receipt: 27-Jul-11

Client Name: Clean Air Engineering
Client Address: 500 West Wood Street
Palatine, IL
60067
Client Contact: Kevin O'Halloren
Client Project ID: 11265

COMMENTS: PAH by CARB method 429

The results for naphthalene have been reported from the analysis of a diluted sample extract for selected samples due to target levels

The recovery of Acenaphthylene exceeds method control limits for the laboratory control sample. The LCS contains high levels of acenaphthene from the 8270 spiking solution that likely contains trace levels of acenaphthylene.

No negative impact to data quality is expected.

Method Summary:

The 0010 train samples were extracted by SW846 Method 3542. For each train, the front half solids and the XAD2 sorbent were extracted together in a single soxhlet. The extraction standards for 8270D and PAH analyses were spiked into the solids/sorbent media just prior to extraction. The condensates were extracted by B/N/A liquid/liquid extraction technique using separatory funnels and dichloromethane as the extracting solvent. The extract from the soxhlet and the condensates for each train were combined for each train and reduced to a 5mL final volume. A 1/2 portion was removed and concentrated to 1mL for analysis of PAHs via isotope dilution and selected ion monitoring GC/LRMS analysis. A portion of the remaining extract was removed for analysis of semi-volatile organics via SW846 method 8270D.

Certified by: 

Ron McLeod, PhD
Laboratory Manager

Results in this certificate relate only to the samples as submitted to the laboratory.

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ALS Environmental

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Sample Analysis Summary Report									
Sample Name	Method Blank	FCCU SCRUBBER STACK REAGENT BLANK M0010	FCCU SCRUBBER STACK M0010	FCCU SCRUBBER STACK RUN 1 M0010	FCCU SCRUBBER STACK RUN 2 M0010	FCCU SCRUBBER STACK RUN 3 M0010	Laboratory Control Sample	Control Limits	
ALS Sample ID	WG1321413-1	L1037050-5	L1037050-4	L1037050-1	L1037050-2	L1037050-3	WG1321413-2		
Sample Size	1	1	1	1	1	1	1		
Sample units	sample	sample	sample	sample	sample	sample	n/a	n/a	
Moisture Content	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Matrix	QC	Stack	Stack	Stack	Stack	Stack	QC		
Sampling Date	n/a	14-Jul-11	16-Jul-11	15-Jul-11	15-Jul-11	16-Jul-11	n/a		
Extraction Date	29-Jul-11	29-Jul-11	29-Jul-11	29-Jul-11	29-Jul-11	29-Jul-11	29-Jul-11		
Target Analytes	ng/sample	ng/sample	ng/sample	ng/sample	ng/sample	ng/sample	% Recovery		
Naphthalene	227	35.2	365	36100	84600	80300	109		50-150
2-Methylnaphthalene	9.30	26.2	24.2	276	163	180	n/s		50-150
Acenaphthylene	<4.0	U	<4.0	U	77.6	88.4	R		50-150
Acenaphthene	<4.0	U	9.22	<120	R	<39	R		50-150
Fluorene	<4.0	U	6.24	<300	R	<310	R		50-150
Phenanthrene	5.88	7.80	9.88	2360	2780	2600	111		50-150
Anthracene	<4.0	U	<4.0	U	29.8	39.3	117		50-150
Fluoranthene	<4.0	U	<4.0	U	444	430	124		50-150
Pyrene	5.16	5.70	6.50	<180	R	<210	R		50-150
Benzo(a)anthracene	<4.0	U	<4.0	U	<5.7	<7.0	R		50-150
Chrysene/Triphenylene	<4.0	U	<4.0	U	110	109	104		50-150
Benzo(b)fluoranthene	<4.0	U	<4.0	U	<40	<41	R		50-150
Benzo(k)fluoranthene	<4.0	U	<4.0	U	7.86	<4.8	R		50-150
Benzo(e)pyrene	<4.0	U	<4.0	U	<16	<13	R		50-150
Benzo(a)pyrene	<4.0	U	<4.0	U	<4.0	<4.0	U		50-150
Perylene	<4.0	U	<4.0	U	<4.0	<4.0	U		50-150
Indeno(1,2,3-cd)pyrene	<4.0	U	<4.0	U	<4.0	<4.0	U		50-150
Dibenzo(a,h)anthracene	<4.0	U	<4.0	U	<4.0	<4.0	U		50-150
Benzo(g,h,i)perylene	<4.0	U	<4.0	U	<4.0	<4.0	U		50-150
Additional Analytes									
2-Chloronaphthalene	<4.0	U	<4.0	U	<4.0	<4.0	U		n/s
Biphenyl	198	197	208	2420	2590	2600	n/s		n/s
7,12-Dimethylbenzo(a)anthracene	<4.0	U	<4.0	U	<4.0	<4.0	U		n/s
3-Methylcholanthrene	<4.0	U	<4.0	U	<4.0	<4.0	U		n/s
Dibenzo(a,e)pyrene	<4.0	U	<4.0	U	<4.0	<4.0	U		n/s
Field Sampling Standards	% Rec	% Rec	% Rec	% Rec	% Rec	% Rec	% Rec		
d10-Fluorene	n/s	n/s	99	131	115	107	n/s		50-150
d14-Terphenyl	n/s	n/s	117	119	113	115	n/s		50-150
Extraction Standards	% Rec	% Rec	% Rec	% Rec	% Rec	% Rec	% Rec		
d8-Naphthalene	66	81	75	68	68	71	78		50-150
d10-2-Methylnaphthalene	70	85	81	75	74	71	79		50-150
d8-Acenaphthylene	82	98	100	146	146	140	95		50-150
d10-Phenanthrene	75	84	77	72	75	74	74		50-150
d10-Anthracene	79	90	85	82	84	80	80		50-150
d10-Fluoranthene	90	100	93	88	92	89	90		50-150
d12-Benzo(a)anthracene	126	141	97	114	112	111	138		50-150
d12-Chrysene	89	102	98	93	95	98	98		50-150
d12-Benzo(b)fluoranthene	111	116	112	112	113	114	113		50-150
d12-Benzo(k)fluoranthene	91	102	98	96	97	98	102		50-150
d12-Benzo(a)pyrene	113	110	127	129	134	130	131		50-150
d12-Perylene	110	120	135	141	104	100	118		50-150
d12-Indeno(1,2,3-c-d)pyrene	104	129	120	128	134	135	120		50-150
d14-Dibenz(a,h)anthracene	92	109	96	101	103	105	101		50-150
d12-Benzo(ghi)perylene	85	98	85	84	87	84	87		50-150
U Indicates that this compound was not detected above the LOD. R Indicates that the ion abundance ratio does not meet method control limits. Value represents estimated maximum. n/s Indicates that this standard has not been spiked									

U Indicates that this compound was not detected above the LOD.

R Indicates that the ion abundance ratio does not meet method control limits. Value represents estimated maximum.

n/s Indicates that this standard has not been spiked

Marathon Petroleum Company
Clean Air Project No: 11265
FCCU Scrubber Stack

USEPA Method 23
PCDD/PCDF Laboratory Data

Run No.	Field Blank	1				2				3			
Date (2011)		Jul 20				Jul 20				Jul 21			
Start Time (approx.)		07:59				11:50				07:53			
Stop Time (approx.)		11:12				15:22				11:09			
Index	Analyte Name	Field Blank (pg)	FB ND (pg)	FB EMPC (pg)	Run #1 Gross Wt. (pg)	Run #1 ND (pg)	Run #1 EMPC (pg)	Run #2 Gross Wt. (pg)	Run #2 ND (pg)	Run #2 EMPC (pg)	Run #3 Gross Wt. (pg)	Run #3 ND (pg)	Run #3 EMPC (pg)
1	2,3,7,8-TCDD	nd	5.7000		nd	5.9000		nd	5.9000		nd	4.3000	
2	1,2,3,7,8-PeCDD	nd	10.0000		nd	7.6000		nd	12.0000		nd	14.0000	
3	1,2,3,4,7,8-HxCDD	nd	3.8000		nd	5.1000		nd	6.4000		nd	4.9000	
4	1,2,3,6,7,8-HxCDD	nd	3.8000		nd	5.0000		nd	6.3000		nd	4.8000	
5	1,2,3,7,8,9-HxCDD	nd	3.9000		nd	5.2000		nd	6.5000		nd	5.0000	
6	1,2,3,4,6,7,8-HpCDD	nd	7.8000		nd	6.5000		nd	5.8000		11.4000		
7	1,2,3,4,6,7,8,9-OCDD	nd	40.0000		nd	28.0000		nd	36.0000		nd	29.0000	
8	2,3,7,8-TCDF	nd	7.1000		nd	3.6000		nd	8.0000		nd	7.0000	
9	1,2,3,7,8-PeCDF	nd	7.8000		nd	8.0000		nd	10.0000		nd	12.0000	
10	2,3,4,7,8-PeCDF	nd	7.3000		nd	7.4000		nd	9.4000		nd	12.0000	
11	1,2,3,4,7,8-HxCDF	nd	4.9000		nd	3.4000		nd	3.7000		nd	5.0000	
12	1,2,3,6,7,8-HxCDF	nd	4.5000		nd	3.1000		nd	3.5000		6.8900		
13	2,3,4,6,7,8-HxCDF	nd	4.8000		nd	3.3000		nd	3.7000		nd	4.9000	
14	1,2,3,7,8,9-HxCDF	nd	5.9000		nd	4.1000		nd	4.5000		nd	6.1000	
15	1,2,3,4,6,7,8-HpCDF	nd	3.4000		nd	3.1000		nd	5.7000		nd	9.2300	
16	1,2,3,4,7,8,9-HpCDF	nd	4.6000		nd	4.1000		nd	7.7000		nd	6.6000	
17	1,2,3,4,6,7,8,9-OCDF	nd	19.0000		nd	18.0000		nd	14.0000		nd	10.0000	
18	Total TCDD	nd	5.7000		nd	5.9000		nd	5.9000		nd	4.3000	
19	Total PeCDD	nd	10.0000		nd	7.6000		nd	12.0000		nd	14.0000	
20	Total HxCDD	nd	3.9000		nd	5.2000		nd	6.5000		nd	5.0000	
21	Total HpCDD	nd	7.8000		nd	6.5000		nd	5.8000		11.4000		
22	Total TCDF	nd	7.1000		nd	3.6000		nd	8.0000		nd	7.0000	
23	Total PeCDF	nd	7.8000		nd	8.0000		nd	10.0000		nd	12.0000	
24	Total HxCDF	nd	5.9000		nd	4.1000		nd	4.5000		6.8900		
25	Total HpCDF	nd	4.6000		nd	4.1000		nd	7.7000		9.2300		



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NELAC Primary Accreditation, NJ DEP ID# CANA003: Secondary Accreditation, TX Cert# T104704433-08-TX

Certificate of Analysis

ALS Project Contact: Steve Kennedy
ALS Project ID: CLE150
ALS WO#: L1037089
Date of Report: 19-Aug-11
Date of Sample Receipt: 27-Jul-11

Client Name: Clean Air Engineering
Client Address: 500 West Wood St.
Palatine, IL, 60067

Client Contact: Kevin O'Halloren
Client Project ID: 11265

COMMENTS:

PCDD/F via EPA Method 23

The ion abundance ratio for the labeled extraction standard 13C12-1,2,3,4,6,7,8-HpCDF does not meet the method control limits for the method blank. No negative impact to overall data quality is expected.

Certified by: _____

Steve Kennedy
Laboratory Manager

Results in this certificate relate only to the samples as submitted to the laboratory.

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ALS Environmental

Sample Analysis Summary Report

Sample Name	Method Blank	FCCU SCRUBBER STACK RUN 1 M23	FCCU SCRUBBER STACK RUN 2 M23	FCCU SCRUBBER STACK RUN 3 M23	FCCU SCRUBBER STACK FIELD BLANK M23	FCCU SCRUBBER STACK REAGENT BLANK M23
ALS Sample ID	WG1328222-1	L1037089-1	L1037089-2	L1037089-3	L1037089-4	L1037089-5
Sample Size	1	1	1	1	1	1
Sample units	Train	Train	Train	Train	Train	Train
Moisture Content	n/a	n/a	n/a	n/a	n/a	n/a
Matrix	QC	STACK	STACK	STACK	STACK	STACK
Sampling Date	n/a	20-Jul-11	20-Jul-11	21-Jul-11	21-Jul-11	20-Jul-11
Extraction Date	12-Aug-11	12-Aug-11	12-Aug-11	12-Aug-11	12-Aug-11	12-Aug-11
Target Analytes	pg	pg	pg	pg	pg	pg
2,3,7,8-TCDD	<4.0	<5.9	<5.9	<4.3	<5.7	<6.4
1,2,3,7,8-PeCDD	<9.3	<7.6	<12	<14	<10	<11
1,2,3,4,7,8-HxCDD	<11	<5.1	<6.4	<4.9	<3.8	<4.7
1,2,3,6,7,8-HxCDD	<11	<5.0	<6.3	<4.8	<3.8	<4.6
1,2,3,7,8,9-HxCDD	<11	<5.2	<6.5	<5.0	<3.9	<4.7
1,2,3,4,6,7,8-HpCDD	<6.4	<6.5	<5.8	11.4	<7.8	<5.8
OCDD	<31	<28	<36	<29	<40	<21
2,3,7,8-TCDF	<5.2	<3.6	<8.0	<7.0	<7.1	<3.8
1,2,3,7,8-PeCDF	<11	<8.0	<10	<12	<7.8	<11
2,3,4,7,8-PeCDF	<10	<7.4	<9.4	<12	<7.3	<10
1,2,3,4,7,8-HxCDF	<4.1	<3.4	<3.7	<5.0	<4.9	<4.5
1,2,3,6,7,8-HxCDF	<3.8	<3.1	<3.5	6.89	<4.5	<4.2
2,3,4,6,7,8-HxCDF	<4.1	<3.3	<3.7	<4.9	<4.8	<4.4
1,2,3,7,8,9-HxCDF	<5.0	<4.1	<4.5	<6.1	<5.9	<5.4
1,2,3,4,6,7,8-HpCDF	<10	<3.1	<5.7	9.23	<3.4	<2.8
1,2,3,4,7,8,9-HpCDF	<5.1	<4.1	<7.7	<6.6	<4.6	<3.7
OCDF	<18	<18	<14	<10	<19	<11
Field Spike Standards	% Rec	% Rec	% Rec	% Rec	% Rec	% Rec
37Cl4-2,3,7,8-TCDD	n/s	93	95	98	100	n/s
13C12-1,2,3,4,7,8-HxCDD	n/s	88	83	107	100	n/s
13C12-2,3,4,7,8-PeCDF	n/s	100	105	95	87	n/s
13C12-1,2,3,4,7,8-HxCDF	n/s	103	102	104	108	n/s
13C12-1,2,3,4,7,8,9-HpCDF	n/s	93	94	100	89	n/s
Extraction Standards						
13C12-2,3,7,8-TCDD	69	82	92	75	87	89
13C12-1,2,3,7,8-PeCDD	57	61	75	52	60	62
13C12-1,2,3,6,7,8-HxCDD	53	65	73	54	68	63
13C12-1,2,3,4,6,7,8-HpCDD	51	50	59	50	45	61
13C12-OCDD	37	33	40	36	25	44
13C12-2,3,7,8-TCDF	63	74	83	72	82	79
13C12-1,2,3,7,8-PeCDF	53	61	68	56	73	63
13C12-1,2,3,6,7,8-HxCDF	54	62	69	57	73	66
13C12-1,2,3,4,6,7,8-HpCDF	47	48	53	46	49	57
Cleanup Standards						
13C12-1,2,3,7,8,9-HxCDF	60	65	71	57	66	75
Homologue Group Totals	pg	pg	pg	pg	pg	pg
Total-TCDD	<4.0	<5.9	<5.9	<4.3	<5.7	<6.4
Total-PeCDD	<9.3	<7.6	<12	<14	<10	<11
Total-HxCDD	<11	<5.2	<6.5	<5.0	<3.9	<4.7
Total-HpCDD	<6.4	<6.5	<5.8	11.4	<7.8	<5.8
Total-TCDF	<5.2	<3.6	<8.0	<7.0	<7.1	<3.8
Total-PeCDF	<11	<8.0	<10	<12	<7.8	<11
Total-HxCDF	<5.0	<4.1	<4.5	6.89	<5.9	<5.4
Total-HpCDF	<5.1	<4.1	<7.7	9.23	<4.6	<3.7
Toxic Equivalency WHO (2005)						
Lower Bound PCDD/F TEQ	0.00	0.00	0.00	0.895	0.00	0.00
Upper Bound PCDD/F TEQ	22.4	19.4	25.5	27.0	22.2	24.5

ALS Environmental

Laboratory Method Blank Analysis Report

Sample Name	Method Blank	Sampling Date	n/a
ALS Sample ID	WG1328222-1	Extraction Date	12-Aug-11
Analysis Method	EPA M23	Sample Size	1 Train
Analysis Type	Blank	Percent Moisture	n/a
Sample Matrix	QC	Split Ratio	2

Approved:
C. de Haan
--e-signature--
19-Aug-2011

Run Information **Run 1**

Filename 1-110818A S:5
Run Date 18-Aug-11 12:05
Final Volume 45 uL
Dilution Factor 1
Analysis Units pg
Instrument - Column HRMS-1 DB5ms #USB176531H

Target Analytes	Ret. Time	Conc. pg	EDL pg	Flags	TEF WHO (2005)
2,3,7,8-TCDD	NotFnd	<4.0	4.0	U	1
1,2,3,7,8-PeCDD	NotFnd	<9.3	9.3	U	1
1,2,3,4,7,8-HxCDD	NotFnd	<11	11	U	0.1
1,2,3,6,7,8-HxCDD	NotFnd	<11	11	U	0.1
1,2,3,7,8,9-HxCDD	NotFnd	<11	11	U	0.1
1,2,3,4,6,7,8-HpCDD	NotFnd	<6.4	6.4	U	0.01
OCDD	NotFnd	<31	31	U	0.0003
2,3,7,8-TCDF	NotFnd	<5.2	5.2	U	0.1
1,2,3,7,8-PeCDF	NotFnd	<11	11	U	0.03
2,3,4,7,8-PeCDF	NotFnd	<10	10	U	0.3
1,2,3,4,7,8-HxCDF	NotFnd	<4.1	4.1	U	0.1
1,2,3,6,7,8-HxCDF	NotFnd	<3.8	3.8	U	0.1
2,3,4,6,7,8-HxCDF	NotFnd	<4.1	4.1	U	0.1
1,2,3,7,8,9-HxCDF	NotFnd	<5.0	5.0	U	0.1
1,2,3,4,6,7,8-HpCDF	35:58	<10	3.8	M J R	0.01
1,2,3,4,7,8,9-HpCDF	NotFnd	<5.1	5.1	U	0.01
OCDF	NotFnd	<18	18	U	0.0003

Field Spike Standards	% Rec
37Cl4-2,3,7,8-TCDD	n/s
13C12-1,2,3,4,7,8-HxCDD	n/s
13C12-2,3,4,7,8-PeCDF	n/s
13C12-1,2,3,4,7,8-HxCDF	n/s
13C12-1,2,3,4,7,8,9-HpCDF	n/s

Extraction Standards	% Rec	Limits
13C12-2,3,7,8-TCDD	27:52 69	40-130
13C12-1,2,3,7,8-PeCDD	32:30 57	40-130
13C12-1,2,3,6,7,8-HxCDD	34:42 53	40-130
13C12-1,2,3,4,6,7,8-HpCDD	36:36 51	25-130
13C12-OCDD	38:28 37	25-130
13C12-2,3,7,8-TCDF	26:31 63	40-130
13C12-1,2,3,7,8-PeCDF	31:40 53	40-130
13C12-1,2,3,6,7,8-HxCDF	34:13 54	40-130
13C12-1,2,3,4,6,7,8-HpCDF	35:58 47	R 25-130

Cleanup Standard	% Rec	Limits
13C12-1,2,3,7,8,9-HxCDF	35:06 60	40-130

Homologue Group Totals	# peaks	Conc pg	EDL pg
Total-TCDD	0	<4.0	4.0
Total-PeCDD	0	<9.3	9.3
Total-HxCDD	0	<11	11
Total-HpCDD	0	<6.4	6.4
Total-TCDF	0	<5.2	5.2
Total-PeCDF	0	<11	11
Total-HxCDF	0	<5.0	5.0
Total-HpCDF	0	<5.1	5.1

Toxic Equivalency WHO (2005)	pg
Lower Bound PCDD/F TEQ	0.00
Upper Bound PCDD/F TEQ	22.4

EDL Indicates the Estimated Detection Limit, based on the measured background noise for this target in this sample.
TEF Indicates the Toxic Equivalency Factor TEQ Indicates the Toxic Equivalency
M Indicates that a peak has been manually integrated.
U Indicates that this compound was not detected above the MDL.
n/s Indicates that this compound was not spiked.
J Indicates that a target analyte was detected below the LQL.
R Indicates that the ion abundance ratio for this compound did not meet the acceptance criterion.

ALS Environmental

Sample Analysis Report

Sample Name FCCU SCRUBBER STACK RUN 1 M23
ALS Sample ID L1037089-1
Analysis Method EPA M23
Analysis Type Sample
Sample Matrix STACK

Sampling Date 20-Jul-11
Extraction Date 12-Aug-11
Sample Size 1 Train
Percent Moisture n/a
Split Ratio 2

Approved:
C. de Haan
 --e-signature--
 19-Aug-2011

Run Information

Run 1

Filename 1-110818A S:10
Run Date 18-Aug-11 15:39
Final Volume 45 uL
Dilution Factor 1
Analysis Units pg
Instrument - Column HRMS-1 DB5ms #USA137845H

Target Analytes	Ret. Time	Conc. pg	EDL pg	Flags	TEF WHO (2005)
2,3,7,8-TCDD	NotFnd	<5.9	5.9	U	1
1,2,3,7,8-PeCDD	NotFnd	<7.6	7.6	U	1
1,2,3,4,7,8-HxCDD	NotFnd	<5.1	5.1	U	0.1
1,2,3,6,7,8-HxCDD	NotFnd	<5.0	5.0	U	0.1
1,2,3,7,8,9-HxCDD	NotFnd	<5.2	5.2	U	0.1
1,2,3,4,6,7,8-HpCDD	NotFnd	<6.5	6.5	U	0.01
OCDD	NotFnd	<28	28	U	0.0003
2,3,7,8-TCDF	NotFnd	<3.6	3.6	U	0.1
1,2,3,7,8-PeCDF	NotFnd	<8.0	8.0	U	0.03
2,3,4,7,8-PeCDF	NotFnd	<7.4	7.4	U	0.3
1,2,3,4,7,8-HxCDF	NotFnd	<3.4	3.4	U	0.1
1,2,3,6,7,8-HxCDF	NotFnd	<3.1	3.1	U	0.1
2,3,4,6,7,8-HxCDF	NotFnd	<3.3	3.3	U	0.1
1,2,3,7,8,9-HxCDF	NotFnd	<4.1	4.1	U	0.1
1,2,3,4,6,7,8-HpCDF	NotFnd	<3.1	3.1	U	0.01
1,2,3,4,7,8,9-HpCDF	NotFnd	<4.1	4.1	U	0.01
OCDF	NotFnd	<18	18	U	0.0003

Field Spike Standards

% Rec

Limits

37Cl4-2,3,7,8-TCDD	27:54	93	70-130
13C12-1,2,3,4,7,8-HxCDD	34:38	88	70-130
13C12-2,3,4,7,8-PeCDF	32:18	100	70-130
13C12-1,2,3,4,7,8-HxCDF	34:08	103	70-130
13C12-1,2,3,4,7,8,9-HpCDF	36:57	93	70-130

Extraction Standards

% Rec

Limits

13C12-2,3,7,8-TCDD	27:52	82	40-130
13C12-1,2,3,7,8-PeCDD	32:29	61	40-130
13C12-1,2,3,6,7,8-HxCDD	34:42	65	40-130
13C12-1,2,3,4,6,7,8-HpCDD	36:35	50	25-130
13C12-OCDD	38:27	33	25-130
13C12-2,3,7,8-TCDF	26:31	74	40-130
13C12-1,2,3,7,8-PeCDF	31:40	61	40-130
13C12-1,2,3,6,7,8-HxCDF	34:13	62	40-130
13C12-1,2,3,4,6,7,8-HpCDF	35:57	48	25-130

Cleanup Standard

% Rec

Limits

13C12-1,2,3,7,8,9-HxCDF	35:05	65	40-130
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Homologue Group Totals	# peaks	Conc pg	EDL pg
Total-TCDD	0	<5.9	5.9
Total-PeCDD	0	<7.6	7.6
Total-HxCDD	0	<5.2	5.2
Total-HpCDD	0	<6.5	6.5
Total-TCDF	0	<3.6	3.6
Total-PeCDF	0	<8.0	8.0
Total-HxCDF	0	<4.1	4.1
Total-HpCDF	0	<4.1	4.1

Toxic Equivalency WHO (2005)

pg

Lower Bound PCDD/F TEQ

0.00

Upper Bound PCDD/F TEQ

19.4

EDL Indicates the Estimated Detection Limit, based on the measured background noise for this target in this sample.
 TEF Indicates the Toxic Equivalency Factor TEQ Indicates the Toxic Equivalency
 U Indicates that this compound was not detected above the MDL.

ALS Environmental

Sample Analysis Report

Sample Name FCCU SCRUBBER STACK RUN 2 M23
ALS Sample ID L1037089-2
Analysis Method EPA M23
Analysis Type Sample
Sample Matrix STACK

Sampling Date 20-Jul-11
Extraction Date 12-Aug-11
Sample Size 1 Train
Percent Moisture n/a
Split Ratio 2

Approved:
C. de Haan
--e-signature--
19-Aug-2011

Run Information

Run 1

Filename 1-110818A S:11
Run Date 18-Aug-11 16:22
Final Volume 45 uL
Dilution Factor 1
Analysis Units pg
Instrument - Column HRMS-1 DB5ms #USA137845H

Target Analytes	Ret. Time	Conc. pg	EDL pg	Flags	TEF WHO (2005)
2,3,7,8-TCDD	NotFnd	<5.9	5.9	U	1
1,2,3,7,8-PeCDD	NotFnd	<12	12	U	1
1,2,3,4,7,8-HxCDD	NotFnd	<6.4	6.4	U	0.1
1,2,3,6,7,8-HxCDD	NotFnd	<6.3	6.3	U	0.1
1,2,3,7,8,9-HxCDD	NotFnd	<6.5	6.5	U	0.1
1,2,3,4,6,7,8-HpCDD	NotFnd	<5.8	5.8	U	0.01
OCDD	NotFnd	<36	36	U	0.0003
2,3,7,8-TCDF	NotFnd	<8.0	8.0	U	0.1
1,2,3,7,8-PeCDF	NotFnd	<10	10	U	0.03
2,3,4,7,8-PeCDF	NotFnd	<9.4	9.4	U	0.3
1,2,3,4,7,8-HxCDF	NotFnd	<3.7	3.7	U	0.1
1,2,3,6,7,8-HxCDF	NotFnd	<3.5	3.5	U	0.1
2,3,4,6,7,8-HxCDF	NotFnd	<3.7	3.7	U	0.1
1,2,3,7,8,9-HxCDF	NotFnd	<4.5	4.5	U	0.1
1,2,3,4,6,7,8-HpCDF	NotFnd	<5.7	5.7	U	0.01
1,2,3,4,7,8,9-HpCDF	NotFnd	<7.7	7.7	U	0.01
OCDF	NotFnd	<14	14	U	0.0003

Field Spike Standards

% Rec

Limits

37Cl4-2,3,7,8-TCDD	27:55	95	70-130
13C12-1,2,3,4,7,8-HxCDD	34:38	83	70-130
13C12-2,3,4,7,8-PeCDF	32:18	105	70-130
13C12-1,2,3,4,7,8-HxCDF	34:08	102	70-130
13C12-1,2,3,4,7,8,9-HpCDF	36:57	94	70-130

Extraction Standards

% Rec

Limits

13C12-2,3,7,8-TCDD	27:52	92	40-130
13C12-1,2,3,7,8-PeCDD	32:29	75	40-130
13C12-1,2,3,6,7,8-HxCDD	34:42	73	40-130
13C12-1,2,3,4,6,7,8-HpCDD	36:35	59	25-130
13C12-OCDD	38:27	40	25-130
13C12-2,3,7,8-TCDF	26:31	83	40-130
13C12-1,2,3,7,8-PeCDF	31:40	68	40-130
13C12-1,2,3,6,7,8-HxCDF	34:12	69	40-130
13C12-1,2,3,4,6,7,8-HpCDF	35:57	53	25-130

Cleanup Standard

% Rec

13C12-1,2,3,7,8,9-HxCDF	35:05	71	40-130
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Homologue Group Totals	# peaks	Conc pg	EDL pg
Total-TCDD	0	<5.9	5.9
Total-PeCDD	0	<12	12
Total-HxCDD	0	<6.5	6.5
Total-HpCDD	0	<5.8	5.8
Total-TCDF	0	<8.0	8.0
Total-PeCDF	0	<10	10
Total-HxCDF	0	<4.5	4.5
Total-HpCDF	0	<7.7	7.7

Toxic Equivalency WHO (2005)

pg

Lower Bound PCDD/F TEQ

0.00

Upper Bound PCDD/F TEQ

25.5

EDL Indicates the Estimated Detection Limit, based on the measured background noise for this target in this sample.
 TEF Indicates the Toxic Equivalency Factor TEQ Indicates the Toxic Equivalency
 U Indicates that this compound was not detected above the MDL.

ALS Environmental

Sample Analysis Report

Sample Name FCCU SCRUBBER STACK RUN 3 M23
ALS Sample ID L1037089-3
Analysis Method EPA M23
Analysis Type Sample
Sample Matrix STACK

Sampling Date 21-Jul-11
Extraction Date 12-Aug-11
Sample Size 1 Train
Percent Moisture n/a
Split Ratio 2

Approved:
C. de Haan
 --e-signature--
 19-Aug-2011

Run Information

Run 1

Filename 1-110818A S:12
Run Date 18-Aug-11 17:05
Final Volume 45 uL
Dilution Factor 1
Analysis Units pg
Instrument - Column HRMS-1 DB5ms #USA137845H

Target Analytes	Ret. Time	Conc. pg	EDL pg	Flags	TEF WHO (2005)
2,3,7,8-TCDD	NotFnd	<4.3	4.3	U	1
1,2,3,7,8-PeCDD	NotFnd	<14	14	U	1
1,2,3,4,7,8-HxCDD	NotFnd	<4.9	4.9	U	0.1
1,2,3,6,7,8-HxCDD	NotFnd	<4.8	4.8	U	0.1
1,2,3,7,8,9-HxCDD	NotFnd	<5.0	5.0	U	0.1
1,2,3,4,6,7,8-HpCDD	36:36	11.4	6.8	M J	0.01
OCDD	NotFnd	<29	29	U	0.0003
2,3,7,8-TCDF	NotFnd	<7.0	7.0	U	0.1
1,2,3,7,8-PeCDF	NotFnd	<12	12	U	0.03
2,3,4,7,8-PeCDF	NotFnd	<12	12	U	0.3
1,2,3,4,7,8-HxCDF	NotFnd	<5.0	5.0	U	0.1
1,2,3,6,7,8-HxCDF	34:12	6.89	4.7	M J	0.1
2,3,4,6,7,8-HxCDF	NotFnd	<4.9	4.9	U	0.1
1,2,3,7,8,9-HxCDF	NotFnd	<6.1	6.1	U	0.1
1,2,3,4,6,7,8-HpCDF	35:58	9.23	4.9	M J	0.01
1,2,3,4,7,8,9-HpCDF	NotFnd	<6.6	6.6	U	0.01
OCDF	38:36	<10	10	U	0.0003

Field Spike Standards

% Rec

Limits

37C14-2,3,7,8-TCDD	27:53	98	70-130
13C12-1,2,3,4,7,8-HxCDD	34:38	107	70-130
13C12-2,3,4,7,8-PeCDF	32:18	95	70-130
13C12-1,2,3,4,7,8-HxCDF	34:08	104	70-130
13C12-1,2,3,4,7,8,9-HpCDF	36:56	100	70-130

Extraction Standards

% Rec

Limits

13C12-2,3,7,8-TCDD	27:51	75	40-130
13C12-1,2,3,7,8-PeCDD	32:29	52	40-130
13C12-1,2,3,6,7,8-HxCDD	34:41	54	40-130
13C12-1,2,3,4,6,7,8-HpCDD	36:35	50	25-130
13C12-OCDD	38:27	36	25-130
13C12-2,3,7,8-TCDF	26:31	72	40-130
13C12-1,2,3,7,8-PeCDF	31:40	56	40-130
13C12-1,2,3,6,7,8-HxCDF	34:12	57	40-130
13C12-1,2,3,4,6,7,8-HpCDF	35:57	46	25-130

Cleanup Standard

% Rec

Limits

13C12-1,2,3,7,8,9-HxCDF	35:05	57	40-130
-------------------------	-------	----	--------

Homologue Group Totals

# peaks	Conc pg	EDL pg
Total-TCDD	0	<4.3
Total-PeCDD	0	<14
Total-HxCDD	0	<5.0
Total-HpCDD	1	11.4
Total-TCDF	0	<7.0
Total-PeCDF	0	<12
Total-HxCDF	1	6.89
Total-HpCDF	1	9.23

Toxic Equivalency WHO (2005)

pg

Lower Bound PCDD/F TEQ	0.895
Upper Bound PCDD/F TEQ	27.0

EDL Indicates the Estimated Detection Limit, based on the measured background noise for this target in this sample.
 TEF Indicates the Toxic Equivalency Factor
 M Indicates that a peak has been manually integrated.
 U Indicates that this compound was not detected above the MDL.
 J indicates that a target analyte was detected below the LQL.

ALS Environmental

Sample Analysis Report

Sample Name FCCU SCRUBBER STACK FIELD BLANK M23
ALS Sample ID L1037089-4
Analysis Method EPA M23
Analysis Type Sample
Sample Matrix STACK

Sampling Date 21-Jul-11
Extraction Date 12-Aug-11
Sample Size 1 Train
Percent Moisture n/a
Split Ratio 2

Approved:
C. de Haan
--e-signature--
19-Aug-2011

Run Information

Run 1

Filename 1-110818A S:13
Run Date 18-Aug-11 17:48
Final Volume 45 uL
Dilution Factor 1
Analysis Units pg
Instrument - Column HRMS-1 DB5ms #USA137845H

Target Analytes	Ret. Time	Conc. pg	EDL pg	Flags	TEF NHO (2005)
2,3,7,8-TCDD	NotFnd	<5.7	5.7	U	1
1,2,3,7,8-PeCDD	NotFnd	<10	10	U	1
1,2,3,4,7,8-HxCDD	NotFnd	<3.8	3.8	U	0.1
1,2,3,6,7,8-HxCDD	NotFnd	<3.8	3.8	U	0.1
1,2,3,7,8,9-HxCDD	NotFnd	<3.9	3.9	U	0.1
1,2,3,4,6,7,8-HpCDD	36:35	<7.8	7.8	M U	0.01
OCDD	NotFnd	<40	40	U	0.0003
2,3,7,8-TCDF	NotFnd	<7.1	7.1	U	0.1
1,2,3,7,8-PeCDF	NotFnd	<7.8	7.8	U	0.03
2,3,4,7,8-PeCDF	NotFnd	<7.3	7.3	U	0.3
1,2,3,4,7,8-HxCDF	NotFnd	<4.9	4.9	U	0.1
1,2,3,6,7,8-HxCDF	NotFnd	<4.5	4.5	U	0.1
2,3,4,6,7,8-HxCDF	NotFnd	<4.8	4.8	U	0.1
1,2,3,7,8,9-HxCDF	NotFnd	<5.9	5.9	U	0.1
1,2,3,4,6,7,8-HpCDF	35:57	<3.4	3.4	M U	0.01
1,2,3,4,7,8,9-HpCDF	NotFnd	<4.6	4.6	U	0.01
OCDF	NotFnd	<19	19	U	0.0003

Field Spike Standards

% Rec

Limits

37Cl4-2,3,7,8-TCDD	27:54	100	70-130
13C12-1,2,3,4,7,8-HxCDD	34:38	100	70-130
13C12-2,3,4,7,8-PeCDF	32:19	87	70-130
13C12-1,2,3,4,7,8-HxCDF	34:08	108	70-130
13C12-1,2,3,4,7,8,9-HpCDF	36:57	89	70-130

Extraction Standards

% Rec

Limits

13C12-2,3,7,8-TCDD	27:52	87	40-130
13C12-1,2,3,7,8-PeCDD	32:30	60	40-130
13C12-1,2,3,6,7,8-HxCDD	34:42	68	40-130
13C12-1,2,3,4,6,7,8-HpCDD	36:35	45	25-130
13C12-OCDD	38:27	25	25-130
13C12-2,3,7,8-TCDF	26:31	82	40-130
13C12-1,2,3,7,8-PeCDF	31:40	73	40-130
13C12-1,2,3,6,7,8-HxCDF	34:12	73	40-130
13C12-1,2,3,4,6,7,8-HpCDF	35:57	49	25-130

Cleanup Standard

% Rec

13C12-1,2,3,7,8,9-HxCDF	35:05	66	40-130
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Homologue Group Totals

peaks

Conc pg
EDL pg

Total-TCDD	0	<5.7	5.7
Total-PeCDD	0	<10	10
Total-HxCDD	0	<3.9	3.9
Total-HpCDD	0	<7.8	7.8
Total-TCDF	0	<7.1	7.1
Total-PeCDF	0	<7.8	7.8
Total-HxCDF	0	<5.9	5.9
Total-HpCDF	0	<4.6	4.6

Toxic Equivalency WHO (2005)

pg

Lower Bound PCDD/F TEQ

0.00

Upper Bound PCDD/F TEQ

22.2

EDL Indicates the Estimated Detection Limit, based on the measured background noise for this target in this sample.
 TEF Indicates the Toxic Equivalency Factor
 M Indicates that a peak has been manually integrated.
 U Indicates that this compound was not detected above the MDL.

ALS Environmental

Sample Analysis Report

Sample Name FCCU SCRUBBER STACK REAGENT BLANK M23
ALS Sample ID L1037089-5
Analysis Method EPA M23
Analysis Type Sample
Sample Matrix STACK

Sampling Date 20-Jul-11
Extraction Date 12-Aug-11
Sample Size 1 Train
Percent Moisture n/a
Split Ratio 2

Approved:
C. de Haan
--e-signature--
19-Aug-2011

Run Information

Run 1

Filename 1-110818A S:14
Run Date 18-Aug-11 18:31
Final Volume 45 uL
Dilution Factor 1
Analysis Units pg
Instrument - Column HRMS-1 DB5ms #USA137845H

Target Analytes	Ret. Time	Conc. pg	EDL pg	Flags	TEF NHO (2005)
2,3,7,8-TCDD	NotFnd	<6.4	6.4	U	1
1,2,3,7,8-PeCDD	NotFnd	<11	11	U	1
1,2,3,4,7,8-HxCDD	NotFnd	<4.7	4.7	U	0.1
1,2,3,6,7,8-HxCDD	NotFnd	<4.6	4.6	U	0.1
1,2,3,7,8,9-HxCDD	NotFnd	<4.7	4.7	U	0.1
1,2,3,4,6,7,8-HpCDD	NotFnd	<5.8	5.8	U	0.01
OCDD	NotFnd	<21	21	U	0.0003
2,3,7,8-TCDF	NotFnd	<3.8	3.8	U	0.1
1,2,3,7,8-PeCDF	NotFnd	<11	11	U	0.03
2,3,4,7,8-PeCDF	NotFnd	<10	10	U	0.3
1,2,3,4,7,8-HxCDF	NotFnd	<4.5	4.5	U	0.1
1,2,3,6,7,8-HxCDF	NotFnd	<4.2	4.2	U	0.1
2,3,4,6,7,8-HxCDF	NotFnd	<4.4	4.4	U	0.1
1,2,3,7,8,9-HxCDF	NotFnd	<5.4	5.4	U	0.1
1,2,3,4,6,7,8-HpCDF	NotFnd	<2.8	2.8	U	0.01
1,2,3,4,7,8,9-HpCDF	NotFnd	<3.7	3.7	U	0.01
OCDF	NotFnd	<11	11	U	0.0003

Field Spike Standards

% Rec

37C14-2,3,7,8-TCDD
 13C12-1,2,3,4,7,8-HxCDD
 13C12-2,3,4,7,8-PeCDF
 13C12-1,2,3,4,7,8-HxCDF
 13C12-1,2,3,4,7,8,9-HpCDF

n/s
 n/s
 n/s
 n/s
 n/s

Extraction Standards

% Rec

Limits

13C12-2,3,7,8-TCDD
 13C12-1,2,3,7,8-PeCDD
 13C12-1,2,3,6,7,8-HxCDD
 13C12-1,2,3,4,6,7,8-HpCDD
 13C12-OCDD
 13C12-2,3,7,8-TCDF
 13C12-1,2,3,7,8-PeCDF
 13C12-1,2,3,6,7,8-HxCDF
 13C12-1,2,3,4,6,7,8-HpCDF

27:51
 32:29
 34:41
 36:35
 38:27
 26:31
 31:40
 34:12
 35:57

89
 62
 63
 61
 44
 79
 63
 66
 57

40-130
 40-130
 40-130
 25-130
 25-130
 40-130
 40-130
 40-130
 25-130

Cleanup Standard

% Rec

13C12-1,2,3,7,8,9-HxCDF

35:05

75

40-130

Homologue Group Totals

peaks

Conc pg

EDL pg

Total-TCDD
 Total-PeCDD
 Total-HxCDD
 Total-HpCDD
 Total-TCDF
 Total-PeCDF
 Total-HxCDF
 Total-HpCDF

0
 0
 0
 0
 0
 0
 0
 0

<6.4
 <11
 <4.7
 <5.8
 <3.8
 <11
 <5.4
 <3.7

6.4
 11
 4.7
 5.8
 3.8
 11
 5.4
 3.7

Toxic Equivalency WHO (2005)

pg

Lower Bound PCDD/F TEQ

0.00

Upper Bound PCDD/F TEQ

24.5

EDL Indicates the Estimated Detection Limit, based on the measured background noise for this target in this sample.
 TEF Indicates the Toxic Equivalency Factor
 TEQ Indicates the Toxic Equivalency
 U Indicates that this compound was not detected above the MDL.
 n/s Indicates that this compound was not spiked.

ALS Environmental

Laboratory Control Sample Analysis Report

Sample Name
ALS Sample ID
Analysis Method
Analysis Type
Sample Matrix

Laboratory Control Sample
WG1328222-2
EPA M23
LCS
QC

Sampling Date
Extraction Date
Sample Size
Percent Moisture
Split Ratio

n/a
12-Aug-11
1 n/a
n/a
2

Approved:
C. de Haan
--e-signature--
19-Aug-2011

Run Information

Run 1

Filename 1-110818A S:3
Run Date 18-Aug-11 10:39
Final Volume 45 uL
Dilution Factor 1
Analysis Units % Rec
Instrument - Column HRMS-1 DB5ms #USA137845H

Target Analytes	Ret. Time	% Rec	Flags	Limits
2,3,7,8-TCDD	27:56	100		70-130
1,2,3,7,8-PeCDD	32:30	97		70-130
1,2,3,4,7,8-HxCDD	34:39	86		70-130
1,2,3,6,7,8-HxCDD	34:43	107		70-130
1,2,3,7,8,9-HxCDD	34:53	106		70-130
1,2,3,4,6,7,8-HpCDD	36:36	103		70-130
OCDD	38:28	100		70-130
2,3,7,8-TCDF	26:33	102		70-130
1,2,3,7,8-PeCDF	31:41	100		70-130
2,3,4,7,8-PeCDF	32:19	91		70-130
1,2,3,4,7,8-HxCDF	34:09	110		70-130
1,2,3,6,7,8-HxCDF	34:13	113		70-130
2,3,4,6,7,8-HxCDF	34:34	112		70-130
1,2,3,7,8,9-HxCDF	35:06	108		70-130
1,2,3,4,6,7,8-HpCDF	35:58	104		70-130
1,2,3,4,7,8,9-HpCDF	36:58	101		70-130
OCDF	38:38	104		70-130

Field Spike Standards

% Rec

37Cl4-2,3,7,8-TCDD
13C12-1,2,3,4,7,8-HxCDD
13C12-2,3,4,7,8-PeCDF
13C12-1,2,3,4,7,8-HxCDF
13C12-1,2,3,4,7,8,9-HpCDF

n/s
n/s
n/s
n/s
n/s

Extraction Standards

% Rec

Limits

13C12-2,3,7,8-TCDD
13C12-1,2,3,7,8-PeCDD
13C12-1,2,3,6,7,8-HxCDD
13C12-1,2,3,4,6,7,8-HpCDD
13C12-OCDD

13C12-2,3,7,8-TCDF
13C12-1,2,3,7,8-PeCDF
13C12-1,2,3,6,7,8-HxCDF
13C12-1,2,3,4,6,7,8-HpCDF

71
52
56
43
31

64
60
54
45

40-130
40-130
40-130
25-130
25-130

40-130
40-130
40-130
25-130

Cleanup Standard

% Rec

13C12-1,2,3,7,8,9-HxCDF

35:05 61

40-130

n/s Indicates that this compound was not spiked.

USEPA Method 23 PCB Laboratory Data

Run No.	1	2	3
Date (2011)	Jul 20	Jul 20	Jul 21
Start Time (approx.)	07:59	11:50	07:53
Stop Time (approx.)	11:12	15:22	11:09

Index	Analyte Name	Detection Limit (pg)	Field Blank (pg)	Gross Weight (pg)	Gross Weight (pg)	Gross Weight (pg)
1	Tetrachlorobiphenyl (77)	0.0000	9.8100	6.6600	14.5000	17.4000
2	Tetrachlorobiphenyl (81)	0.0000	<5.2000	<2.7000	<2.7000	<3.6000
3	Pentachlorobiphenyl (105)	0.0000	<37.0000	<12.0000	<12.0000	35.7000
4	Pentachlorobiphenyl (114)	0.0000	<6.1000	<11.0000	<10.0000	<7.8000
5	Pentachlorobiphenyl (118)	0.0000	70.2000	20.7000	81.5000	70.0000
6	Pentachlorobiphenyl (123)	0.0000	<5.7000	<11.0000	<10.0000	<7.5000
7	Pentachlorobiphenyl (126)	0.0000	<6.0000	<11.0000	<11.0000	<7.8000
8	Hexachlorobiphenyl (156)	0.0000	<5.7000	<3.0000	10.4000	8.4900
9	Hexachlorobiphenyl (157)	0.0000	10.2000	<2.7000	4.3800	<3.8000
10	Hexachlorobiphenyl (167)	0.0000	6.0400	<3.1000	<3.4000	<3.3000
11	Hexachlorobiphenyl (169)	0.0000	<11.0000	<1.9000	2.6000	<2.9000
12	Heptachlorobiphenyl (189)	0.0000	<5.5000	<1.9000	2.0400	<2.0000

090811 081105

N

Marathon Petroleum Compa
Clean Air Project No: 11265
FCCU Scrubber Stack

USEPA Method 23
PCB Laboratory Calculations

Run No.	1	2	3
Date (2011)	Jul 20	Jul 20	Jul 21
Start Time (approx.)	07:59	11:50	07:53
Stop Time (approx.)	11:12	15:22	11:09
Index Analyte Name	Field Blank (pg)	Gross Weight (pg)	Net Weight (pg)
1 Tetrachlorobiphenyl (77)	9.8100	14.5000	17.4000
2 Tetrachlorobiphenyl (81)	<5.2000	<2.7000	<3.6000
3 Pentachlorobiphenyl (105)	<37.0000	<12.0000	35.7000
4 Pentachlorobiphenyl (114)	<6.1000	<10.0000	<7.8000
5 Pentachlorobiphenyl (118)	70.2000	81.5000	70.0000
6 Pentachlorobiphenyl (123)	<5.7000	<10.0000	<7.5000
7 Pentachlorobiphenyl (126)	<6.0000	<11.0000	<7.8000
8 Hexachlorobiphenyl (156)	<5.7000	10.4000	8.4900
9 Hexachlorobiphenyl (157)	10.2000	4.3800	<3.8000
10 Hexachlorobiphenyl (167)	6.0400	<3.4000	<3.3000
11 Hexachlorobiphenyl (169)	<11.0000	2.6000	<2.9000
12 Heptachlorobiphenyl (189)	<5.5000	2.0400	<2.0000
13 Total PCB's*	<87.6600	<164.5200	<170.2900

< Denotes that the analyte was not detectable above the stated value.

* Total PCBs are calculated using the full detection limit for results below the detection limit.



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SCC Accredited Lab ID# 1003-15779 Ont DW License #: 2285
NELAC Primary Accreditation, NJ DEP ID# CANA003: Secondary Accreditation, TX Cert# T104704433-08-TX

Certificate of Analysis


ALS Project Contact: Steve Kennedy
ALS Project ID: CLE150
ALS WO#: L1037089
Date of Report: 19-Aug-11
Date of Sample Receipt: 27-Jul-11

Client Name: Clean Air Engineering
Client Address: 500 West Wood St
Palatine, IL
60067
Client Contact: Kevin O'Halloren
Client Project ID: 11265

COMMENTS:

Toxic PCB Congeners by EPA Method 1668A

Certified by: _____


Steve Kennedy
Laboratory Manager

Results in this certificate relate only to the samples as submitted to the laboratory.

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ALS Environmental

Sample Analysis Summary Report

Sample Name	Method Blank	FCCU SCRUBBER STACK RUN 1 M23	FCCU SCRUBBER STACK RUN 2 M23	FCCU SCRUBBER STACK RUN 3 M23	FCCU SCRUBBER STACK FIELD BLANK M23	FCCU SCRUBBER STACK REAGENT BLANK M23
ALS Sample ID	WG1328222-1	L1037089-1	L1037089-2	L1037089-3	L1037089-4	L1037089-5
Sample Size	1	1	1	1	1	1
Sample units	train	train	train	train	train	train
Lipid Content	n/a	n/a	n/a	n/a	n/a	n/a
Matrix	QC	STACK	STACK	STACK	STACK	STACK
Sampling Date	n/a	20-Jul-11	20-Jul-11	21-Jul-11	21-Jul-11	20-Jul-11
Extraction Date	12-Aug-11	12-Aug-11	12-Aug-11	12-Aug-11	12-Aug-11	12-Aug-11
Target Analytes	pg/train	pg/train	pg/train	pg/train	pg/train	pg/train
PCB 81	<5.1	<2.7	<2.7	<3.6	<5.2	<3.9
PCB 77	<3.9	6.66	14.5	17.4	9.81	<4.0
PCB 123	<12	<11	<10	<7.5	<5.7	<8.9
PCB 118	<12	20.7	81.5	70.0	70.2	<9.1
PCB 114	<13	<11	<10	<7.8	<6.1	<9.8
PCB 105	<15	<12	<12	35.7	<37	<10
PCB 126	<14	<11	<11	<7.8	<6.0	<9.5
PCB 167	<4.2	<3.1	<3.4	<3.3	6.04	<3.3
PCB 156	<2.5	<3.0	10.4	8.49	<5.7	<2.2
PCB 157	<12	<2.7	4.38	<3.8	10.2	<2.0
PCB 169	<3.4	<1.9	2.60	<2.9	<11	4.63
PCB 189	<4.1	<1.9	2.04	<2.0	<5.5	<2.0
Extraction Standards	% Rec	% Rec	% Rec	% Rec	% Rec	% Rec
13C12-PCB 81	82	107	114	94	117	111
13C12-PCB 77	83	110	116	100	116	118
13C12-PCB 123	92	118	134	108	127	129
13C12-PCB 118	91	121	135	109	127	127
13C12-PCB 114	90	125	140	110	127	128
13C12-PCB 105	93	131	142	117	136	141
13C12-PCB 126	100	145	144	133	151	156
13C12-PCB 167	56	69	76	67	83	77
13C12-PCB 156	81	105	115	101	119	114
13C12-PCB 157	80	103	114	97	120	116
13C12-PCB 169	83	98	110	95	117	117
13C12-PCB 189	73	77	87	73	92	96
Cleanup Standards						
13C12-PCB 28	71	80	86	82	81	78
13C12-PCB 111	127	124	126	119	134	123
13C12-PCB 178	80	82	90	78	95	98
Toxic Equivalency WHO 2005						
Lower Bound PCB TEQ	0.00	0.00129	0.0824	0.00517	0.00357	0.139
Upper Bound PCB TEQ	1.51	1.16	1.18	0.874	0.937	1.09

ALS Environmental

Laboratory Method Blank Analysis Report

Sample Name
ALS Sample ID
Analysis Method
Analysis Type
Sample Matrix

Method Blank
WG1328222-1
EPA 1668A
Blank
QC

Sampling Date
Extraction Date
Sample Size
Lipid Content
Split Ratio

12-Aug-11
1 train
n/a
1

Approved:
R. Saxon
--e-signature--
19-Aug-2011

Run Information

Run 1

Filename 2-110818B S:6
Run Date 18-Aug-11 13:20
Final Volume 45 uL
Dilution Factor 1
Analysis Units pg/train
Instrument - Column HRMS-2 DB5MS USA380744H

Target Analytes	Ret. Time	Conc. pg/train	EDL pg/tra	Flags	TEF WHO 2005
PCB 81	20:09	<5.1	3.6	J R	0.0003
PCB 77	NotFnd	<3.9	3.9	U	0.0001
PCB 123	NotFnd	<12	12	U	0.00003
PCB 118	NotFnd	<12	12	U	0.00003
PCB 114	NotFnd	<13	13	U	0.00003
PCB 105	NotFnd	<15	15	U	0.00003
PCB 126	NotFnd	<14	14	U	0.1
PCB 167	NotFnd	<4.2	4.2	U	0.00003
PCB 156	NotFnd	<2.5	2.5	U	0.00003
PCB 157	31:25	<12	2.4	R	0.00003
PCB 169	32:35	<3.4	2.2	J R	0.03
PCB 189	33:38	<4.1	3.2	J R	0.00003

Extraction Standards		% Rec	Limits
13C12-PCB 81	20:09	82	25-150
13C12-PCB 77	20:54	83	25-150
13C12-PCB 123	22:28	92	25-150
13C12-PCB 118	22:47	91	25-150
13C12-PCB 114	23:45	90	25-150
13C12-PCB 105	25:14	93	25-150
13C12-PCB 126	29:01	100	25-150
13C12-PCB 167	30:13	56	25-150
13C12-PCB 156	31:13	81	25-150
13C12-PCB 157	31:24	80	25-150
13C12-PCB 169	32:33	83	25-150
13C12-PCB 189	33:37	73	25-150

Cleanup Standards		% Rec	Limits
13C12-PCB 28	13:06	71	30-135
13C12-PCB 111	19:45	127	30-135
13C12-PCB 178	28:17	80	30-135

Toxic Equivalency WHO 2005 pg/train

Lower Bound PCB TEQ 0.00
Upper Bound PCB TEQ 1.51

EDL Indicates the Estimated Detection Limit, based on the measured background noise for this target in this sample.
TEF Indicates the Toxic Equivalency Factor TEQ Indicates the Toxic Equivalency
U Indicates that this compound was not detected above the MDL.
M Indicates this compound was manually modified.
J Indicates that a target analyte was detected below the LQL.
R Indicates that the ion abundance ratio for this compound did not meet the acceptance criterion.

ALS Environmental

Sample Analysis Report

Sample Name FCCU SCRUBBER STACK RUN 1 M23
ALS Sample ID L1037089-1
Analysis Method EPA 1668A
Analysis Type Sample
Sample Matrix STACK

Sampling Date 20-Jul-11
Extraction Date 12-Aug-11
Sample Size 1 train
Lipid Content n/a
Split Ratio 1

Approved:
R. Saxon
 --e-signature--
 19-Aug-2011

Run Information

Run 1

Filename 2-110818B S:13
Run Date 18-Aug-11 18:20
Final Volume 45 uL
Dilution Factor 1
Analysis Units pg/train
Instrument - Column HRMS-2 DB5MS USA380744H

Target Analytes	Ret. Time	Conc. pg/train	EDL pg/train	Flags	TEF WHO 2005
PCB 81	20:09	<2.7	2.7	M U	0.0003
PCB 77	20:55	6.66	2.8	M J	0.0001
PCB 123	NotFnd	<11	11	U	0.00003
PCB 118	22:49	20.7	10		0.00003
PCB 114	NotFnd	<11	11	U	0.00003
PCB 105	NotFnd	<12	12	U	0.00003
PCB 126	NotFnd	<11	11	U	0.1
PCB 167	NotFnd	<3.1	3.1	U	0.00003
PCB 156	31:14	<3.0	1.8	M J R	0.00003
PCB 157	31:25	<2.7	1.8	M J R	0.00003
PCB 169	32:33	<1.9	1.8	M J R	0.03
PCB 189	33:37	<1.9	1.9	M U	0.00003

Extraction Standards		% Rec	Limits
13C12-PCB 81	20:08	107	25-150
13C12-PCB 77	20:54	110	25-150
13C12-PCB 123	22:28	118	25-150
13C12-PCB 118	22:47	121	25-150
13C12-PCB 114	23:45	125	25-150
13C12-PCB 105	25:14	131	25-150
13C12-PCB 126	29:01	145	25-150
13C12-PCB 167	30:13	69	25-150
13C12-PCB 156	31:13	105	25-150
13C12-PCB 157	31:24	103	25-150
13C12-PCB 169	32:33	98	25-150
13C12-PCB 189	33:37	77	25-150

Cleanup Standards		% Rec	Limits
13C12-PCB 28	13:06	80	30-135
13C12-PCB 111	19:45	124	30-135
13C12-PCB 178	28:17	82	30-135

Toxic Equivalency	WHO 2005	pg/train
Lower Bound PCB TEQ		0.00129
Upper Bound PCB TEQ		1.16

EDL Indicates the Estimated Detection Limit, based on the measured background noise for this target in this sample.
 TEF Indicates the Toxic Equivalency Factor
 U Indicates that this compound was not detected above the MDL.
 M Indicates this compound was manually modified.
 J Indicates that a target analyte was detected below the LQL.
 R Indicates that the Ion abundance ratio for this compound did not meet the acceptance criterion.
 B Indicates that this target was detected in the blank at greater than 10% of the sample concentration.

ALS Environmental

Sample Analysis Report

Sample Name FCCU SCRUBBER STACK RUN 2 M23
ALS Sample ID L1037089-2
Analysis Method EPA 1668A
Analysis Type Sample
Sample Matrix STACK

Sampling Date 20-Jul-11
Extraction Date 12-Aug-11
Sample Size 1 train
Lipid Content n/a
Split Ratio 1

Approved:
R. Saxon
--e-signature--
19-Aug-2011

Run Information

Run 1

Filename 2-110818B S:14
Run Date 18-Aug-11 19:03
Final Volume 45 uL
Dilution Factor 1
Analysis Units pg/train
Instrument - Column HRMS-2 DB5MS USA380744H

Target Analytes	Ret. Time	Conc. pg/train	EDL pg/tra	Flags	TEF WHO 2005
PCB 81	NotFnd	<2.7	2.7	U	0.0003
PCB 77	20:54	14.5	2.9	M	0.0001
PCB 123	NotFnd	<10	10	U	0.00003
PCB 118	22:48	81.5	10		0.00003
PCB 114	NotFnd	<10	10	U	0.00003
PCB 105	NotFnd	<12	12	U	0.00003
PCB 126	NotFnd	<11	11	U	0.1
PCB 167	30:13	<3.4	2.8	J R	0.00003
PCB 156	31:14	10.4	1.6	M	0.00003
PCB 157	31:24	4.38	1.6	M J	0.00003
PCB 169	32:32	2.60	1.4	M J	0.03
PCB 189	33:37	2.04	1.7	J	0.00003

Extraction Standards	% Rec	Limits
13C12-PCB 81	20:08 114	25-150
13C12-PCB 77	20:53 116	25-150
13C12-PCB 123	22:28 134	25-150
13C12-PCB 118	22:47 135	25-150
13C12-PCB 114	23:45 140	25-150
13C12-PCB 105	25:13 142	25-150
13C12-PCB 126	29:00 144	25-150
13C12-PCB 167	30:13 76	25-150
13C12-PCB 156	31:13 115	25-150
13C12-PCB 157	31:24 114	25-150
13C12-PCB 169	32:32 110	25-150
13C12-PCB 189	33:36 87	25-150

Cleanup Standards	% Rec	Limits
13C12-PCB 28	13:06 86	30-135
13C12-PCB 111	19:45 126	30-135
13C12-PCB 178	28:16 90	30-135

Toxic Equivalency	WHO 2005	pg/train
Lower Bound PCB TEQ		0.0824
Upper Bound PCB TEQ		1.18

EDL	Indicates the Estimated Detection Limit, based on the measured background noise for this target in this sample.
TEF	Indicates the Toxic Equivalency Factor
U	Indicates that this compound was not detected above the MDL.
M	Indicates this compound was manually modified.
J	Indicates that a target analyte was detected below the LQL.
R	Indicates that the ion abundance ratio for this compound did not meet the acceptance criterion.
B	Indicates that this target was detected in the blank at greater than 10% of the sample concentration.

ALS Environmental

Sample Analysis Report

Sample Name FCCU SCRUBBER STACK RUN 3 M23
ALS Sample ID L1037089-3
Analysis Method EPA 1668A
Analysis Type Sample
Sample Matrix STACK

Sampling Date 21-Jul-11
Extraction Date 12-Aug-11
Sample Size 1 train
Lipid Content n/a
Split Ratio 1

Approved:
R. Saxon
--e-signature--
19-Aug-2011

Run Information

Run 1

Filename 2-110818B S:15
Run Date 18-Aug-11 19:46
Final Volume 45 uL
Dilution Factor 1
Analysis Units pg/train
Instrument - Column HRMS-2 DB5MS USA380744H

Target Analytes	Ret. Time	Conc. pg/train	EDL pg/train	Flags	TEF WHO 2005
PCB 81	NotFnd	<3.6	3.6	U	0.0003
PCB 77	20:54	17.4	3.5		0.0001
PCB 123	NotFnd	<7.5	7.5	U	0.00003
PCB 118	22:48	70.0	7.7	M	0.00003
PCB 114	NotFnd	<7.8	7.8	U	0.00003
PCB 105	25:14	35.7	8.5	M	0.00003
PCB 126	NotFnd	<7.8	7.8	U	0.1
PCB 167	30:14	<3.3	2.5	J R	0.00003
PCB 156	31:13	8.49	2.5	M J	0.00003
PCB 157	31:24	<3.8	2.5	M J R	0.00003
PCB 169	32:32	<2.9	2.3	J R	0.03
PCB 189	33:36	<2.0	2.0	M U	0.00003

Extraction Standards		% Rec	Limits
13C12-PCB 81	20:08	94	25-150
13C12-PCB 77	20:53	100	25-150
13C12-PCB 123	22:27	108	25-150
13C12-PCB 118	22:46	109	25-150
13C12-PCB 114	23:44	110	25-150
13C12-PCB 105	25:13	117	25-150
13C12-PCB 126	29:00	133	25-150
13C12-PCB 167	30:13	67	25-150
13C12-PCB 156	31:12	101	M 25-150
13C12-PCB 157	31:23	97	25-150
13C12-PCB 169	32:32	95	M 25-150
13C12-PCB 189	33:36	73	25-150

Cleanup Standards		% Rec	Limits
13C12-PCB 28	13:05	82	30-135
13C12-PCB 111	19:44	119	30-135
13C12-PCB 178	28:16	78	30-135

Toxic Equivalency	WHO 2005	pg/train
Lower Bound PCB TEQ		0.00517
Upper Bound PCB TEQ		0.874

EDL Indicates the Estimated Detection Limit, based on the measured background noise for this target in this sample.
 TEF Indicates the Toxic Equivalency Factor
 U Indicates that this compound was not detected above the MDL.
 M Indicates this compound was manually modified.
 J indicates that a target analyte was detected below the LQL.
 R Indicates that the ion abundance ratio for this compound did not meet the acceptance criterion.

ALS Environmental

Sample Analysis Report

Sample Name FCCU SCRUBBER STACK FIELD BLANK M23
ALS Sample ID L1037089-4
Analysis Method EPA 1668A
Analysis Type Sample
Sample Matrix STACK

Sampling Date 21-Jul-11
Extraction Date 12-Aug-11
Sample Size 1 train
Lipid Content n/a
Split Ratio 1

Approved:
R. Saxon
 --e-signature--
 19-Aug-2011

Run Information

Run 1

Filename 2-110818B S:8
Run Date 18-Aug-11 14:46
Final Volume 45 uL
Dilution Factor 1
Analysis Units pg/train
Instrument - Column HRMS-2 DB5MS USA380744H

Target Analytes

Ret. Time	Conc. pg/train	EDL pg/tra	Flags	TEF WHO 2005
PCB 81	20:09	<5.2	4.2 M J R	0.0003
PCB 77	20:54	9.81	4.4 M	0.0001
PCB 123	NotFnd	<5.7	5.7 U	0.00003
PCB 118	22:49	70.2	5.8	0.00003
PCB 114	NotFnd	<6.1	6.1 U	0.00003
PCB 105	25:15	<37	6.3 M R	0.00003
PCB 126	NotFnd	<6.0	6.0 U	0.1
PCB 167	30:13	6.04	2.9 M J	0.00003
PCB 156	31:14	<5.7	1.8 J R	0.00003
PCB 157	31:25	10.2	1.7	0.00003
PCB 169	32:34	<11	1.5 M R	0.03
PCB 189	33:38	<5.5	1.5 M J R	0.00003

Extraction Standards

% Rec

Limits

Standard	Ret. Time	% Rec	Limits
13C12-PCB 81	20:08	117	25-150
13C12-PCB 77	20:54	116	25-150
13C12-PCB 123	22:28	127	25-150
13C12-PCB 118	22:47	127	25-150
13C12-PCB 114	23:45	127	25-150
13C12-PCB 105	25:13	136	25-150
13C12-PCB 126	29:00	151	25-150
13C12-PCB 167	30:13	83	25-150
13C12-PCB 156	31:13	119	25-150
13C12-PCB 157	31:24	120	25-150
13C12-PCB 169	32:34	117	25-150
13C12-PCB 189	33:38	92	25-150

Cleanup Standards

% Rec

Standard	Ret. Time	% Rec	Limits
13C12-PCB 28	13:06	81	30-135
13C12-PCB 111	19:45	134	30-135
13C12-PCB 178	28:16	95	30-135

Toxic Equivalency WHO 2005

pg/train

Lower Bound PCB TEQ 0.00357
Upper Bound PCB TEQ 0.937

EDL Indicates the Estimated Detection Limit, based on the measured background noise for this target in this sample.
 TEF Indicates the Toxic Equivalency Factor
 U Indicates that this compound was not detected above the MDL.
 M Indicates this compound was manually modified.
 J Indicates that a target analyte was detected below the LQL.
 R Indicates that the ion abundance ratio for this compound did not meet the acceptance criterion.
 B Indicates that this target was detected in the blank at greater than 10% of the sample concentration.

ALS Environmental

Sample Analysis Report

Sample Name	FCCU SCRUBBER STACK REAGENT BLANK M23	Sampling Date	20-Jul-11
ALS Sample ID	L1037089-5	Extraction Date	12-Aug-11
Analysis Method	EPA 1668A	Sample Size	1 train
Analysis Type	Sample	Lipid Content	n/a
Sample Matrix	STACK	Split Ratio	1

Approved:
R. Saxon
--e-signature--
19-Aug-2011

Run Information

Run 1

Filename 2-110818B S:9
Run Date 18-Aug-11 15:29
Final Volume 45 uL
Dilution Factor 1
Analysis Units pg/train
Instrument - Column HRMS-2 DB5MS USA380744H

Target Analytes	Ret. Time	Conc. pg/train	EDL pg/train	Flags	TEF WHO 2005
PCB 81	20:09	<3.9	3.9	M U R	0.0003
PCB 77	NotFnd	<4.0	4.0	U	0.0001
PCB 123	NotFnd	<8.9	8.9	U	0.00003
PCB 118	NotFnd	<9.1	9.1	U	0.00003
PCB 114	NotFnd	<9.8	9.8	U	0.00003
PCB 105	NotFnd	<10	10	U	0.00003
PCB 126	NotFnd	<9.5	9.5	U	0.1
PCB 167	NotFnd	<3.3	3.3	U	0.00003
PCB 156	NotFnd	<2.2	2.2	U	0.00003
PCB 157	31:23	<2.0	2.0	M U R	0.00003
PCB 169	32:33	4.63	1.8	M J	0.03
PCB 189	33:38	<2.0	2.0	M U R	0.00003

Extraction Standards		% Rec	Limits
13C12-PCB 81	20:08	111	25-150
13C12-PCB 77	20:53	118	25-150
13C12-PCB 123	22:27	129	25-150
13C12-PCB 118	22:47	127	25-150
13C12-PCB 114	23:45	128	25-150
13C12-PCB 105	25:13	141	25-150
13C12-PCB 126	28:60	156	25-150
13C12-PCB 167	30:12	77	25-150
13C12-PCB 156	31:12	114	25-150
13C12-PCB 157	31:23	116	25-150
13C12-PCB 169	32:33	117	25-150
13C12-PCB 189	33:37	96	25-150

Cleanup Standards		% Rec	Limits
13C12-PCB 28	13:06	78	30-135
13C12-PCB 111	19:44	123	30-135
13C12-PCB 178	28:15	98	30-135

Toxic Equivalency	WHO 2005	pg/train
Lower Bound PCB TEQ		0.139
Upper Bound PCB TEQ		1.09

EDL Indicates the Estimated Detection Limit, based on the measured background noise for this target in this sample.
TEF Indicates the Toxic Equivalency Factor
U Indicates that this compound was not detected above the MDL.
M Indicates this compound was manually modified.
J Indicates that a target analyte was detected below the LQL.
R Indicates that the ion abundance ratio for this compound did not meet the acceptance criterion.

ALS Environmental

Laboratory Control Sample Analysis Report

Sample Name
ALS Sample ID
Analysis Method
Analysis Type
Sample Matrix

Laboratory Control Sample
WG1328222-2
EPA 1668A
LCS
QC

Sampling Date
Extraction Date
Sample Size
Lipid Content
Split Ratio

12-Aug-11
1 n/a
n/a
1

Approved:
R. Saxon
--e-signature--
19-Aug-2011

Run Information

Run 1

Filename 2-110818B S:3
Run Date 18-Aug-11 11:12
Final Volume 45 uL
Dilution Factor 1
Analysis Units % Rec
Instrument - Column HRMS-2 DB5MS USA380744H

Target Analytes	Ret. Time	% Rec	Limits
PCB 81	20:10	92	50-150
PCB 77	20:55	92	50-150
PCB 123	22:30	88	50-150
PCB 118	22:49	88	50-150
PCB 114	23:47	86	50-150
PCB 105	25:16	88	50-150
PCB 126	29:02	85	50-150
PCB 167	30:14	116	50-150
PCB 156	31:14	105	50-150
PCB 157	31:25	103	50-150
PCB 169	32:35	106	50-150
PCB 189	33:38	98	50-150

Extraction Standards		% Rec	Limits
13C12-PCB 81	20:09	78	30-140
13C12-PCB 77	20:54	83	30-140
13C12-PCB 123	22:28	90	30-140
13C12-PCB 118	22:48	89	30-140
13C12-PCB 114	23:45	91	30-140
13C12-PCB 105	25:14	95	30-140
13C12-PCB 126	29:01	105	30-140
13C12-PCB 167	30:13	60	30-140
13C12-PCB 156	31:13	85	30-140
13C12-PCB 157	31:24	91	30-140
13C12-PCB 169	32:33	89	30-140
13C12-PCB 189	33:37	84	30-140

Cleanup Standards		% Rec	Limits
13C12-PCB 28	13:06	63	40-125
13C12-PCB 111	19:45	126	40-125
13C12-PCB 178	28:17	80	40-125

Toxic Equivalency WHO 2005

Lower Bound PCB TEQ
Upper Bound PCB TEQ

M Indicates this compound was manually modified.

USEPA Method 5/202 (FPM/CPM) Gravimetric Laboratory Data Summary for FPM

Run No.	<input type="checkbox"/> Draft Lab Data	Blank	1	2	3
Date (2011)			Jul 19	Jul 19	Jul 19
Start Time (approx.)			08:09	11:51	15:22
Stop Time (approx.)			10:14	14:19	17:36
Analytical Detection Limits					
MDL _f	Minimum detection limit for filter (g)	0.00016			
MDL _s	Minimum detection limit for solvent rinse (g)	0.00027			
Filter(s)					
m _{f1}	Filter No. 1 residue mass (g)	0.08529	0.08094	0.08526	
m _{filter}	Total filter residue (g)	0.08529	0.08094	0.08526	
First Solvent Rinse					
<u>Acetone</u>					
ρ ₁	Density (g/mL)	0.785			
V _{s1}	Sample volume (mL)		152	127	119
V _{a1}	Aliquot volume (mL)	158	152	127	119
r _{a1}	Aliquot residue mass (g)	< 0.00027	0.01869	0.01586	0.00645
r _{s1}	Sample residue mass (g)		0.01869	0.01586	0.00645
m _{b1}	Allowable blank correction (g)		0.00000	0.00000	0.00000
m ₁	Net residue mass (g)		0.01869	0.01586	0.00645
Second Solvent Rinse					
<u>N/A</u>					
m ₂	Net residue mass (g)		0.00000	0.00000	0.00000
Third Solvent Rinse					
<u>N/A</u>					
m ₃	Net residue mass (g)		0.00000	0.00000	0.00000
m _s	Total Solvent Residue (g)		0.01869	0.01586	0.00645
m _T	Total Gravimetric Result (g)		0.10398	0.09680	0.09171
m _D	Total Gravimetric Detection Limit (g)		0.00043	0.00043	0.00043
m _n	Total Filterable Particulate Matter (g)		0.10398	0.09680	0.09171
n _{MDL}	Number of Non-Detectable Fractions		N/A	N/A	N/A
DLC	Detection Level Classification		ADL	ADL	ADL

Comments:

For analytical results below detection limits:

Run samples are treated as the entire value of the MDL in calculations.

Reagent blank samples are treated as zero in calculations.

Detection level classifications are defined as follows:

ADL = Above Detection Level - all fractions are above detection limit

DLL = Detection Level Limited - some fractions are below detection limit

BDL = Below Detection Limit - all fractions are below detection limit

090811 082108

USEPA Method 5/202 (FPM/CPM) Gravimetric Laboratory Data Summary for CPM

☐ Draft Lab Data

Run No.	Field Blank	1	2	3
Date (2011)		Jul 19	Jul 19	Jul 19
Start Time (approx.)		08:09	11:51	15:22
Stop Time (approx.)		10:14	14:19	17:36

Analytical Detection Limits

MDL _i	Minimum detection limit for inorganic fraction (g)	0.00034
MDL _o	Minimum detection limit for organic fraction (g)	0.00028

Inorganic Fraction

Water

Gravimetric Extraction Data

ρ _i	Density (g/ml)	1.000			
V _{si}	Sample volume (mL)		771	770	791
V _{ai}	Aliquot volume (mL)	438	771	770	791
r _{ai}	Aliquot residue mass (g)	0.00190	0.03899	0.04058	0.04433
r _i	Inorganic sample residue mass (g)		0.03899	0.04058	0.04433

Ammonium Titration Analysis

pH	Reconstituted sample starting pH	7.61	2.58	2.46	2.45
N	Normality of titrant (meq/ml)		0.054422	0.054422	0.054422
V _t	Volume of titrant added (mL)		3.95	4.00	4.50
m _c	Mass of NH ₃ added to form ammonium sulfate (g)	0.00000	0.00366	0.00371	0.00417
r _i - m _c	Inorganic sample residue mass, less NH ₃ mass (g)	0.00190	0.03533	0.03687	0.04016

Organic Fraction

Acetone/Hexane

Gravimetric Extraction Data

ρ _o	Density (g/ml)	0.701			
V _{so}	Sample volume (mL)		458	441	426
V _{ao}	Aliquot volume (mL)	454	458	441	426
r _{ao}	Aliquot residue mass (g)	0.00126	0.00127	0.00087	0.00111
r _o	Organic sample residue mass (g)		0.00127	0.00087	0.00111

m _{bi}	Maximum Allowable Inorganic Blank Correction (g)	0.00120	0.00120	0.00120
m _{ri}	Net Inorganic Residue (g)	0.03413	0.03567	0.03896
m _{CPMi}	Total Inorganic CPM (g)	0.03413	0.03567	0.03896
m _{bo}	Maximum Allowable Organic Blank Correction (g)	0.00080	0.00080	0.00080
m _{ro}	Net Organic Residue (g)	0.00047	0.00007	0.00031
m _{CPMo}	Total Organic CPM (g)	0.00047	0.00028	0.00031
m _T	Total Gravimetric Result (g)	0.03460	0.03595	0.03927
MDL _C	Minimum Detection Limit for Combined Fractions (g)	0.00062	0.00062	0.00062
m _{CPM}	Total CPM (g)	0.03460	0.03595	0.03927
n _{MDL}	Number of Non-Detectable Fractions	N/A	N/A	N/A
DLC	Detection Level Classification	ADL	ADL	ADL

Comments:

For analytical results below detection limits:

Run samples are treated as the entire value of the MDL in calculations.

Reagent blank samples are treated as zero in calculations.

Detection level classifications are defined as follows:

ADL = Above Detection Level - all fractions are above detection limit

DLL = Detection Level Limited - some fractions are below detection limit

BDL = Below Detection Limit - all fractions are below detection limit

CleanAir Engineering
500 W. Wood Street
Palatine, IL 60067-4975
800-627-0033
www.cleanair.com



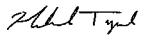
Laboratory Analysis for Particulate Matter

Performed For:
Palatine Engineering Group
500 West Wood Street
Palatine, IL 60067

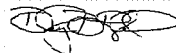
Laboratory Report No: 64-28745_Grav_V0
Customer Reference No: 11265

Revision 0 - Dated: 08/10/2011

To the best of our knowledge, the data presented in this report are accurate, complete, error free, legible and representative of the samples received by the laboratory.


Digitally signed
by Michael Tuegel
Date: 2011.08.10
15:20:23 -05'00'

Michael Tuegel
Title: Analyst
email: mtuegel@cleanair.com
Ph: 847-654-4557


Digitally signed by
Douglas D. Rhoades
Date: 2011.08.10
16:56:27 -05'00'

Douglas D. Rhoades
Title: Team Leader
email: drhoades@cleanair.com
Ph: 847-654-4504



Certificate of Analysis Gravimetrics Analysis

Customer:	Palatine Engineering Group	Lab Project No:	28745	Analyst:	Michael Tuegel
Plant:	Marathon	Customer Reference No:	11265	Received:	7/26/11

Laboratory Sample Identification Number	Tared Media Identification Number	Matrix Type	Sample Location	Run Number	Requested Analysis Method	Calculated Sample Matrix Evaporated (mL)	Net Weight (g)	Method Detection Limit (g)
28745-001	43891	F1/2 Filter	FCCU Scrub Stack	1	U.S. EPA Method 5		0.08529	0.00016
28745-002	43890	F1/2 Filter	FCCU Scrub Stack	2	U.S. EPA Method 5		0.08094	0.00016
28745-003	43834	F1/2 Filter	FCCU Scrub Stack	3	U.S. EPA Method 5		0.08526	0.00016
28745-004	9143	F1/2 Acetone Rinse	All	RB	U.S. EPA Method 5	158	<	0.00027
28745-005	9130	F1/2 Acetone Rinse	FCCU Scrub Stack	1	U.S. EPA Method 5	152	0.01869	0.00027
28745-006	9132	F1/2 Acetone Rinse	FCCU Scrub Stack	2	U.S. EPA Method 5	127	0.01586	0.00027
28745-007	9142	F1/2 Acetone Rinse	FCCU Scrub Stack	3	U.S. EPA Method 5	119	0.00645	0.00027
28745-008	9191	B1/2 Acetone Rinse	All	RB	U.S. EPA Method 202	263	<	0.00027
28745-009	9173	B1/2 Inorganic Rinse	All	RB	U.S. EPA Method 202	223	0.00097	0.00034
28745-010	9172	B1/2 Inorganic Rinse	All	FB	U.S. EPA Method 202	438	0.00190	0.00034
28745-011	9194	B1/2 Inorganic Rinse	FCCU Scrub Stack	1	U.S. EPA Method 202	771	0.03899	0.00034
28745-012	9195	B1/2 Inorganic Rinse	FCCU Scrub Stack	2	U.S. EPA Method 202	770	0.04058	0.00034
28745-013	9183	B1/2 Inorganic Rinse	FCCU Scrub Stack	3	U.S. EPA Method 202	791	0.04433	0.00034
28745-014	9180	B1/2 Organic Rinse	All	RB	U.S. EPA Method 202	254	0.00032	A 0.00028
28745-015	9193	B1/2 Organic Rinse	All	FB	U.S. EPA Method 202	454	0.00126	0.00028
28745-016	9179	B1/2 Organic Rinse	FCCU Scrub Stack	1	U.S. EPA Method 202	458	0.00127	0.00028
28745-017	9145	B1/2 Organic Rinse	FCCU Scrub Stack	2	U.S. EPA Method 202	441	0.00087	A 0.00028
28745-018	9186	B1/2 Organic Rinse	FCCU Scrub Stack	3	U.S. EPA Method 202	426	0.00111	0.00028
28745-001a	43891	F1/2 Filter	FCCU Scrub Stack	1	U.S. EPA Method 5B		0.08523	0.00016
28745-002a	43890	F1/2 Filter	FCCU Scrub Stack	2	U.S. EPA Method 5B		0.08084	0.00016
28745-003a	43834	F1/2 Filter	FCCU Scrub Stack	3	U.S. EPA Method 5B		0.08511	0.00016
28745-004a	9143	F1/2 Acetone Rinse	All	RB	U.S. EPA Method 5B	158	<	0.00027
28745-005a	9130	F1/2 Acetone Rinse	FCCU Scrub Stack	1	U.S. EPA Method 5B	152	0.01836	0.00027
28745-006a	9132	F1/2 Acetone Rinse	FCCU Scrub Stack	2	U.S. EPA Method 5B	127	0.01483	0.00027
28745-007a	9142	F1/2 Acetone Rinse	FCCU Scrub Stack	3	U.S. EPA Method 5B	119	0.00543	0.00027

A: The net weights are considered to be readily quantifiable, therefore these values are believed to be accurate. But the weights fall below the Method Reporting Limit (MRL) value of 0.5mg. These net weights should probably be used with some discretion.

Analysis Case Narrative

Gravimetrics Analysis

Customer:	Palatine Engineering Group	Lab Project No:	28745	Analyst:	Michael Tuegel
Plant:	Marathon	Cust Ref No:	11265	Received:	7/26/11

Summary of Analysis

This report summarizes the results of analysis performed on samples received on: 07/26/11
 All analyses were performed in accordance with the applicable EPA method requirements along with all NELAP quality requirements as outlined and described below. For the exact reference method(s) used please contact the laboratory.

Detection Limits

Method Detection limits have been determined in accordance with procedures in 40 CFR 136, Appendix B, and Documentation showing the determination of Method Detection Limits are included with this report.
 The Method Reporting Limit has been determined in accordance with standard gravimetric method practice of defining a stable weight as being plus or minus 0.5mg. Due to this method requirement it is the laboratories opinion that data showing weights of 0.5mg or less may be questionable. The use of the "<" symbol refers to a data point that is less than the calculated MDL for that matrix.

Sample Preparation

EPA Method 5

Filter Catches

- 1 Placed in a desiccator for a minimum of twenty-four hours prior to analysis.

Front Half Probe Rinses

- 1 Quantitatively transferred into a clean, individually numbered and tared Teflon® beaker liner
- 2 Evaporated under a hood at ambient conditions
- 3 Any residual moisture was heated at 60C for a minimum of 6 hours
- 4 Placed in a desiccator for a minimum of twenty-four hours prior to analysis.

Accreditation Through (As of reported date)

- 1 Texas (TCEQ)
- 2 New Jersey (NJDEP)
- 3 Louisiana (LELAP)

EPA Method 5B

Filter Catches

- 1 Baked in oven at 160C for a minimum of 6 hours in a clean, numbered glass Petri dish
- 2 Placed in a desiccator for a minimum of twenty-four hours prior to analysis.

Front Half Probe Rinses

- 1 Quantitatively transferred into a clean, individually numbered and tared Teflon® beaker liner
- 2 Evaporated under a hood at ambient conditions
- 3 Any residual moisture was heated at 60C for a minimum of 6 hours
- 4 Baked in oven at 160C for a minimum of 6 hours
- 5 Placed in a desiccator for a minimum of twenty-four hours prior to analysis.

Accreditation Through (As of reported date)

- 1 Texas (TCEQ)
- 2 New Jersey (NJDEP)
- 3 Louisiana (LELAP)

EPA Method 202

Zeflour® Membrane Filter

- 1 Carefully folded and placed into a 40 mL (VOA) vial.
- 2 Added sufficient DI water to the vial to cover the filter
- 3 The VOA vial was loaded into a proprietary flotation device and placed into a ultrasonic bath for a minimum of 2 minutes
- 4 This was repeated twice more for a total of three extractions, these extractions are combined with the back half inorganic rinse
- 5 Added sufficient Hexane to the vial to cover the filter

Analysis Case Narrative

Gravimetrics Analysis

Customer:	Palatine Engineering Group	Lab Project No:	28745	Analyst:	Michael Tuegel
Plant:	Marathon	Cust Ref No:	11265	Received:	7/26/11

- 6 The VOA vial was loaded into a proprietary flotation device and placed into a ultrasonic bath for a minimum of 2 minutes
- 7 This was repeated twice more for a total of three extractions, these extractions are combined with the back half organic rinse

Inorganic Rinse

- 1 Sample pH was measured
- 2 Sample was combined with 3 additional DI water rinses used to extract Ambient Zeflour® Membrane Filter
- 3 The sample was extracted three times in a separatory funnel with Hexane (30 mL each)
 - The solution was well mixed prior to the removal of the added Hexane
 - Care was taken to ensure that no water exits the funnel upon draining the Hexane
- 4 Quantitatively transferred into a clean, individually numbered and tared Teflon® beaker liner
- 5 Evaporate in an oven at 105C until just prior to dryness and evaporated fully at ambient temperature
- 6 The sample was redissolved with 100 mL of deionized water, then titrated with ammonium hydroxide until a pH of 7
- 7 Evaporated in an oven at 105C until just prior to dryness and evaporated fully at ambient temperature
- 8 Placed in a desiccator for a minimum of twenty-four hours prior to analysis.

Organic Rinse

- 1 Sample combined with 3 additional Hexane rinses used to extract Inorganic Rinse (30 mL each)
- 2 Sample combined with 3 additional Hexane rinses used to extract Zeflour® Membrane Filter
- 3 Quantitatively transferred into a clean, individually numbered and tared Teflon® beaker liner
- 4 Evaporated under a hood at ambient conditions
- 5 Placed in a desiccator for a minimum of twenty-four hours prior to analysis.

Accreditation Through (As of reported date)

- 1 Texas (TCEQ)
- 2 New Jersey (NJDEP)
- 3 Louisiana (LELAP)

Analytical Procedures Common To All Methods

Sample Volumes

- 1 All sample volumes were determined gravimetrically at laboratory temperature.
- 2 The Certificate of Analysis page shows volumes calculated from those values
 - Calculations assumed standard temperature (20C) and pressure (1 atm)
 - The exact laboratory temperature over the course of this analysis is provided in the appendix of this report
- 3 Liquid density values used referenced from page 15-25 of the CRC Handbook, 91st Edition
 - Water: 0.9982 g/mL
 - Acetone: 0.7902 g/mL
 - Methylene Chloride: 1.326 g/mL
 - Hexane: 0.6594 g/mL
- 4 All volumes reported are not corrected for any aliquot taken for further separate analysis (i.e. Ion Chromatography)

Sample Analysis

- 1 Each sample is removed from the desiccator and placed on the balance pan after 24 hours of desiccation
- 2 Sample weights were computer recorded using the laboratory's proprietary data acquisition system
- 3 Samples were placed back into the desiccator for a minimum of six hours before the next weight was measured.
- 4 This continued until a constant weight was attained.
 - Constant weight: A difference of no more than 0.5 mg or one percent of total weight less tare weight whichever is greater, between two consecutive weighings, with no less than six hours of desiccation time between weighings
- 5 The final weight acquired meeting the above criteria is used for the final weight, all weights reported are net weights.
 - Net weights reported for liquid samples represent the residue left after total evaporation plus container rinses
 - Net weights reported for filter samples represent the particulate caught in and on the filter.
- 6 Any net weight reported is not corrected for any aliquot taken for further separate analysis (i.e. Ion Chromatography)
- 7 Reported net weights for Inorganic rinses are not corrected for the amount of ammonium hydroxide added during the acidic component neutralization step. The corrected values are shown on the "Corrected Values" page within this report.

Analysis Case Narrative Gravimetrics Analysis

Customer: Palatine Engineering Group	Lab Project No: 28745	Analyst: Michael Tuegel
Plant: Marathon	Cust Ref No: 11265	Received: 7/26/11

Quality Control Procedures

Clean Air adheres to QA/QC procedures that both meet and exceed EPA requirements.

- 1 Each analytical balance was calibrated and certified as accurate by an ISO 17025 calibration service on an annual basis. A copy of this calibration data is available on request.
- 2 Each balance is also calibrated prior to use on a daily basis using a minimum of three Class 1 weights. These daily calibrations must match the Class 1 weight values within ± 0.2 mg in order to proceed. Periodic calibrations are also performed throughout the day if the analyst believes they are required. A copy of pertinent daily balance calibration data are included as an appendix to this report.
- 3 Each sample's respective tare and gross weights are acquired with a minimum desiccation time of six hours between consecutive weights.
- 4 For a final weight to be considered, it must agree within 0.5 mg (or 1% of the net weight, whichever is greater) of the previously recorded weight for that sample.
- 5 A minimum of three tare weights are acquired on Teflon® beaker liners to show a minimal effect of static. All three tare weights must be within 0.5mg of each other. All three weights are provided along with a calculated precision for each Teflon® beaker liner on the QC Criteria Sheet.
- 6 For every set of ten samples per matrix, a matrix blank, and a matrix spike is created to ensure that no effect from either the laboratory environment or chemical has adversely effected the results of the measurement.
- 7 All the lot numbers of any chemical used during this analysis was recorded. This information is available upon request.
- 8 A Teflon® FEP beaker liner was used for evaporation and measure of all liquid fractions. Through out this report they will be referred to as Teflon® beaker liners. "Teflon" is a registered trademark of DuPont.

Project Archival

- 1 A copy of this report and all associated supporting records will be archived and stored for at least 20 years
 - 2 All samples are archived for a period of one year from the date of receipt in our facility
 - 3 The archival facility is a controlled access storage facility that does not incorporate any environmental controls
 - 4 Gravimetrics samples are archived in the following manner
 - All filters are resealed inside the originally provided Petri-dishes
 - All other residues are stored within the Teflon® beaker liner in which they were evaporated to dryness.
- These Teflon® beaker liners are sealed inside a polyethylene sample container (cup) prior to archival

Reporting Abbreviations

- 1 RB: Reagent Blank
- 2 FB: Field Blank
- 3 TP: Train Proof

Additional Comments

This report shall in no way be reproduced except in full without the prior written approval of Clean Air Analytical Laboratory management.

Clean Air Laboratory Services is accredited by NELAC in the following states. Please visit the NELAP website to view our current status and a comprehensive list of our accredited services.

Table 1: Specific NELAC Accreditation and Expiration Date

State	Certificate Number	Expiration Date
Texas	T104704431-11-2	6/30/2012
New Jersey	IL004	6/30/2012
Louisiana	169249	6/30/2012

Analysis Case Narrative
Gravimetrics Analysis

Customer:	Palatine Engineering Group	Lab Project No:	28745	Analyst:	Michael Tuegel
Plant:	Marathon	Cust Ref No:	11265	Received:	7/26/11

Table 2 below, shows the average particulate matter found, the standard deviation, and percent relative standard deviation for each sample fraction. This data does not include any corrections for plant conditions

Table 2: Statistical Description of the Particulate Matter Catches.

Method	Location	Matrix	Average Net Weight (mg)	Standard Deviation of Net Weights (mg)	Relative Standard Deviation of Net Weights (%)
U.S. EPA Method 5	FCCU Scrub Stack	F1/2 Filter	83.83	2.50	3.0%
		F1/2 Acetone Rinse	13.67	6.41	46.9%
		Total FPM	97.50	6.16	6.3%
U.S. EPA Method 5E	FCCU Scrub Stack	F1/2 Filter	83.73	2.50	3.0%
		F1/2 Acetone Rinse	12.87	6.68	51.9%
		Total FPM	96.60	6.57	6.8%
J.S. EPA Method 20:	FCCU Scrub Stack	B1/2 Inorganic Rinse	41.30	2.74	6.6%
		B1/2 Organic Rinse	1.08	0.20	18.6%
		Total CPM	42.38	2.71	6.4%

Table 3 below, is a list of photographs along with sample identification for each of the figures on the following pages.

Table 3: List of Samples and Accompanying Photographs that Illustrate the Condition and the Amount of Particulate Matter Present on the Samples.

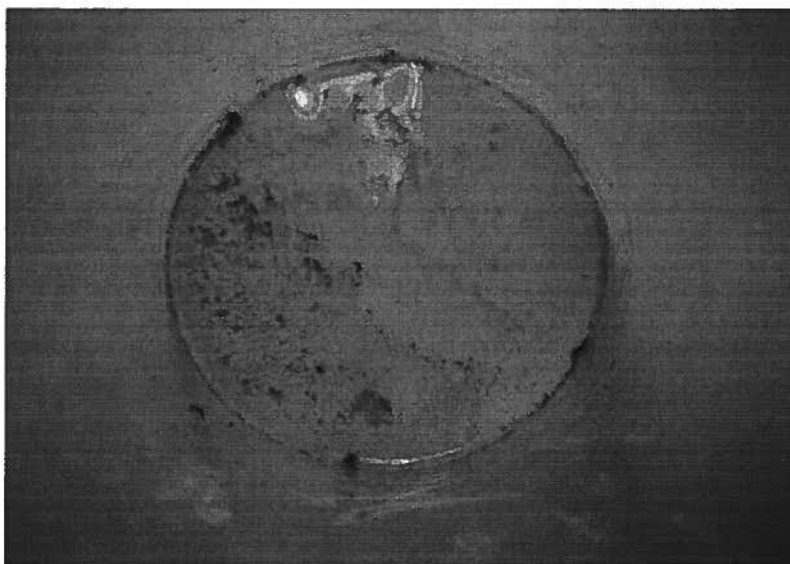
Figure Number	Laboratory Sample Identification Number	Tared Media Identification Number	Sample Location	Run Number
1	28745-006	9132	FCCU Scrub Stack	2
2	28745-007	9142	FCCU Scrub Stack	3

On the following pages are some photographs that illustrate the condition and amount of the particulate matter present on the samples.

Analysis Case Narrative
Gravimetrics Analysis

Customer:	Palatine Engineering Group	Lab Project No:	28745	Analyst:	Michael Tuegel
Plant:	Marathon	Cust Ref No:	11265	Received:	7/26/11

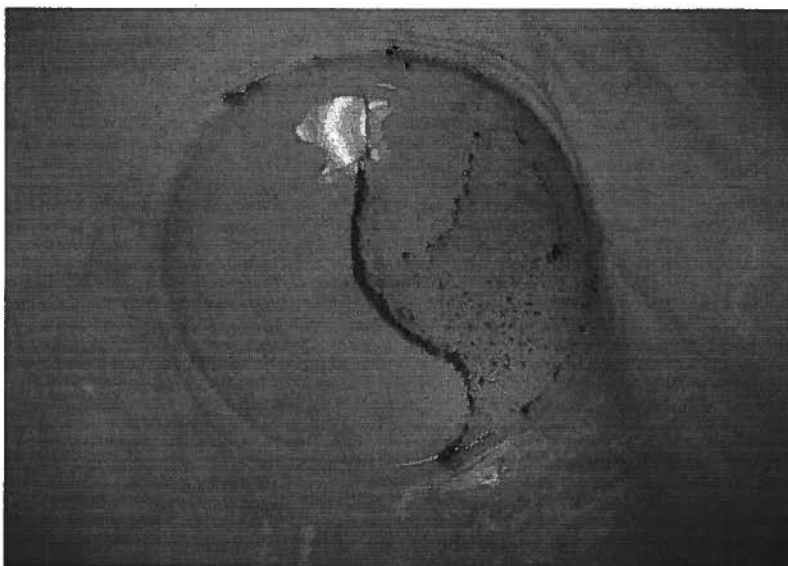
Figure 1: Photograph Illustrating the Residue found in Laboratory Sample No: 28745-006.
Sample Location: FCCU Scrub Stack
Run Number: 2



Analysis Case Narrative
Gravimetrics Analysis

Customer:	Palatine Engineering Group	Lab Project No:	28745	Analyst:	Michael Tuegel
Plant:	Marathon	Cust Ref No:	11265	Received:	7/26/11

Figure 2: Photograph Illustrating the Residue found in Laboratory Sample No: 28745-007.
Sample Location: FCCU Scrub Stack
Run Number: 3



Particulate Testing

Customer:	Palatine Engineering Group	Lab Project No:	28745	Analyst:	Michael Tuegel
Plant:	Marathon	Cust. Ref. No:	11265		

Description		Gross Weight Date/Time		Gross Weight (g)	Tare Weight (g)	Tare Weight Date/Time		Net Weight (g)
Method:	U.S. EPA Method 5	7/27/11	10:42	0.44255	0.35734	6/17/11	15:02	
Type	F1/2 Filter	Media ID	43891	7/28/11	10:21	0.44287	0.35758	6/20/11 11:52
Run	1	Sample ID	28745-001		0.44287	0.35758		0.08529
Location	FCCU Scrub Stack	Media Type	8.26cm Quartz Fiber	Comments:				
Recovery Date	7/19/2011	Field Tech	DL					
Method:	U.S. EPA Method 5	7/27/11	10:40	0.44394	0.36301	6/17/11	15:02	
Type	F1/2 Filter	Media ID	43890	7/28/11	10:21	0.44421	0.36327	6/20/11 11:52
Run	2	Sample ID	28745-002		0.44421	0.36327		0.08094
Location	FCCU Scrub Stack	Media Type	8.26cm Quartz Fiber	Comments:				
Recovery Date	7/19/2011	Field Tech	DL					
Method:	U.S. EPA Method 5	7/27/11	10:40	0.41770	0.33309	5/16/11	13:53	
Type	F1/2 Filter	Media ID	43834	7/28/11	10:20	0.41793	0.33267	5/17/11 10:44
Run	3	Sample ID	28745-003		0.41793	0.33267		0.08526
Location	FCCU Scrub Stack	Media Type	8.26cm Quartz Fiber	Comments:				
Recovery Date	7/19/2011	Field Tech	DL					
Method:	U.S. EPA Method 5	7/27/11	16:39	3.86200	3.86187	7/11/11	13:22	
Type	F1/2 Acetone Rinse	Media ID	9143	7/28/11	10:07	3.86178	3.86187	7/12/11 13:02
Run	RB	Sample ID	28745-004		3.86178	3.86186	7/13/11	11:04
Location	All	Media Type	Teflon Beaker Liner	Comments:				
Recovery Date	7/19/2011	Field Tech	DL					
Method:	U.S. EPA Method 5	7/28/11	10:08	4.11349	4.09461	7/11/11	13:23	
Type	F1/2 Acetone Rinse	Media ID	9130	7/29/11	8:51	4.11302	4.09447	7/12/11 13:06
Run	1	Sample ID	28745-005		4.11302	4.09433	7/13/11	11:02
Location	FCCU Scrub Stack	Media Type	Teflon Beaker Liner	Comments:				
Recovery Date	7/19/2011	Field Tech	DL					
Method:	U.S. EPA Method 5	7/28/11	10:08	4.12673	4.11126	7/11/11	13:19	
Type	F1/2 Acetone Rinse	Media ID	9132	7/29/11	8:46	4.12689	4.11128	7/12/11 13:06
Run	2	Sample ID	28745-006		4.12689	4.11103	7/13/11	10:59
Location	FCCU Scrub Stack	Media Type	Teflon Beaker Liner	Comments:				
Recovery Date	7/19/2011	Field Tech	DL					
Method:	U.S. EPA Method 5	7/28/11	10:14	3.52485	3.51881	7/11/11	13:27	
Type	F1/2 Acetone Rinse	Media ID	9142	7/29/11	8:47	3.52526	3.51878	7/12/11 12:59
Run	3	Sample ID	28745-007		3.52526	3.51881	7/13/11	11:00
Location	FCCU Scrub Stack	Media Type	Teflon Beaker Liner	Comments:				
Recovery Date	7/19/2011	Field Tech	DL					
Method:	U.S. EPA Method 202	7/27/11	16:42	3.98702	3.98693	7/11/11	13:06	
Type	B1/2 Acetone Rinse	Media ID	9191	7/28/11	10:14	3.98662	3.98682	7/12/11 11:10
Run	RB	Sample ID	28745-008		3.98662	3.98678	7/13/11	10:48
Location	All	Media Type	Teflon Beaker Liner	Comments:				
Recovery Date	7/19/2011	Field Tech	DL					
Method:	U.S. EPA Method 202	8/8/11	9:41	4.08925	4.08846	7/11/11	13:10	
Type	B1/2 Inorganic Rinse	Media ID	9173	8/8/11	16:35	4.08925	4.08821	7/12/11 11:06
Run	RB	Sample ID	28745-009		4.08925	4.08828	7/13/11	10:51
Location	All	Media Type	Teflon Beaker Liner	Comments:				
Recovery Date	7/19/2011	Field Tech	DL					
Method:	U.S. EPA Method 202	8/8/11	9:40	4.07889	4.07700	7/11/11	13:16	
Type	B1/2 Inorganic Rinse	Media ID	9172	8/8/11	16:35	4.07898	4.07734	7/12/11 11:05
Run	FB	Sample ID	28745-010		4.07898	4.07708	7/13/11	10:52
Location	All	Media Type	Teflon Beaker Liner	Comments:				
Recovery Date	7/19/2011	Field Tech	DL					
Method:	U.S. EPA Method 202	8/8/11	9:35	4.10249	4.06351	7/11/11	13:18	
Type	B1/2 Inorganic Rinse	Media ID	9194	8/8/11	16:38	4.10251	4.06353	7/12/11 11:03

Particulate Testing

Customer:	Palatine Engineering Group	Lab Project No:	28745	Analyst:	Michael Tuegel
Plant:	Marathon	Cust. Ref. No:	11265		

Description		Gross Weight Date/Time	Gross Weight (g)	Tare Weight (g)	Tare Weight Date/Time	Net Weight (g)
Run	1 Sample ID 28745-011		4.10251	4.06352	7/13/11 10:53	0.03899
Location	FCCU Scrub Stack	Media Type Teflon Beaker Liner	Comments:			
Recovery Date	7/19/2011	Field Tech DL				
Method:	U.S. EPA Method 202	8/8/11 9:35	4.06753	4.02723	7/11/11 13:23	
Type	B1/2 Inorganic Rinse	Media ID 9195	8/8/11 16:35	4.06772	4.02711	7/12/11 13:03
Run	2 Sample ID 28745-012		4.06772	4.02714	7/13/11 10:56	0.04058
Location	FCCU Scrub Stack	Media Type Teflon Beaker Liner	Comments:			
Recovery Date	7/19/2011	Field Tech DL				
Method:	U.S. EPA Method 202	8/8/11 9:36	4.03966	3.99564	7/11/11 13:13	
Type	B1/2 Inorganic Rinse	Media ID 9183	8/8/11 16:38	4.03959	3.99537	7/12/11 11:02
Run	3 Sample ID 28745-013		4.03959	3.99526	7/13/11 10:55	0.04433
Location	FCCU Scrub Stack	Media Type Teflon Beaker Liner	Comments:			
Recovery Date	7/19/2011	Field Tech DL				
Method:	U.S. EPA Method 202	7/29/11 9:20	4.00667	4.00661	7/11/11 13:15	
Type	B1/2 Organic Rinse	Media ID 9180	7/29/11 15:37	4.00689	4.00643	7/12/11 11:06
Run	RB Sample ID 28745-014		4.00689	4.00657	7/13/11 10:48	0.00032
Location	All	Media Type Teflon Beaker Liner	Comments:			
Recovery Date	7/19/2011	Field Tech DL				
Method:	U.S. EPA Method 202	7/29/11 9:20	3.98112	3.98031	7/11/11 13:11	
Type	B1/2 Organic Rinse	Media ID 9193	7/29/11 15:38	3.98141	3.98016	7/12/11 11:07
Run	FB Sample ID 28745-015		3.98141	3.98015	7/13/11 10:48	0.00126
Location	All	Media Type Teflon Beaker Liner	Comments:			
Recovery Date	7/19/2011	Field Tech DL				
Method:	U.S. EPA Method 202	7/29/11 9:19	4.07057	4.06988	7/11/11 13:04	
Type	B1/2 Organic Rinse	Media ID 9179	7/29/11 15:38	4.07091	4.06979	7/12/11 11:14
Run	1 Sample ID 28745-016		4.07091	4.06964	7/13/11 10:42	0.00127
Location	FCCU Scrub Stack	Media Type Teflon Beaker Liner	Comments:			
Recovery Date	7/19/2011	Field Tech DL				
Method:	U.S. EPA Method 202	7/29/11 9:25	4.01938	4.01879	7/11/11 13:10	
Type	B1/2 Organic Rinse	Media ID 9145	7/29/11 15:42	4.01972	4.01858	7/12/11 11:11
Run	2 Sample ID 28745-017		4.01972	4.01885	7/13/11 10:43	0.00087
Location	FCCU Scrub Stack	Media Type Teflon Beaker Liner	Comments:			
Recovery Date	7/19/2011	Field Tech DL				
Method:	U.S. EPA Method 202	7/29/11 9:24	3.97931	3.97860	7/11/11 13:07	
Type	B1/2 Organic Rinse	Media ID 9186	7/29/11 15:42	3.97959	3.97847	7/12/11 11:11
Run	3 Sample ID 28745-018		3.97959	3.97848	7/13/11 10:44	0.00111
Location	FCCU Scrub Stack	Media Type Teflon Beaker Liner	Comments:			
Recovery Date	7/19/2011	Field Tech DL				
Method:	U.S. EPA Method 5B	8/8/11 9:26	0.44249	0.35734	6/17/11 15:02	
Type	F1/2 Filter	Media ID 43891	8/8/11 16:30	0.44281	0.35758	6/20/11 11:52
Run	1 Sample ID 28745-001a		0.44281	0.35758		0.08523
Location	FCCU Scrub Stack	Media Type 8.26cm Quartz Fiber	Comments:			
Recovery Date	7/19/2011	Field Tech DL				
Method:	U.S. EPA Method 5B	8/8/11 9:24	0.44443	0.36301	6/17/11 15:02	
Type	F1/2 Filter	Media ID 43890	8/8/11 16:27	0.44411	0.36327	6/20/11 11:52
Run	2 Sample ID 28745-002a		0.44411	0.36327		0.08084
Location	FCCU Scrub Stack	Media Type 8.26cm Quartz Fiber	Comments:			
Recovery Date	7/19/2011	Field Tech DL				
Method:	U.S. EPA Method 5B	8/8/11 9:26	0.41742	0.33309	5/16/11 13:53	
Type	F1/2 Filter	Media ID 43834	8/8/11 16:32	0.41778	0.33267	5/17/11 10:44
Run	3 Sample ID 28745-003a		0.41778	0.33267		0.08511
Location	FCCU Scrub Stack	Media Type 8.26cm Quartz Fiber	Comments:			

Particulate Testing

Customer:	Palatine Engineering Group	Lab Project No:	28745	Analyst:	Michael Tuegel
Plant:	Marathon	Cust. Ref. No:	11265		

Description		Gross Weight Date/Time		Gross Weight (g)	Tare Weight (g)	Tare Weight Date/Time		Net Weight (g)
Recovery Date	7/19/2011	Field Tech	DL					
Method:	U.S. EPA Method 5B			8/8/11	9:20	3.86196	3.86187	7/11/11 13:22
Type	F1/2 Acetone Rinse	Media ID	9143	8/8/11	16:24	3.86210	3.86187	7/12/11 13:02
Run	RB	Sample ID	28745-004a			3.86210	3.86186	7/13/11 11:04
Location	All	Media Type	Teflon Beaker Liner	Comments:				
Recovery Date	7/19/2011	Field Tech	DL					
Method:	U.S. EPA Method 5B			8/8/11	9:19	4.11265	4.09461	7/11/11 13:23
Type	F1/2 Acetone Rinse	Media ID	9130	8/8/11	16:24	4.11269	4.09447	7/12/11 13:06
Run	1	Sample ID	28745-005a			4.11269	4.09433	7/13/11 11:02
Location	FCCU Scrub Stack	Media Type	Teflon Beaker Liner	Comments:				
Recovery Date	7/19/2011	Field Tech	DL					
Method:	U.S. EPA Method 5B			8/8/11	9:12	4.12579	4.11126	7/11/11 13:19
Type	F1/2 Acetone Rinse	Media ID	9132	8/8/11	16:20	4.12586	4.11128	7/12/11 13:06
Run	2	Sample ID	28745-006a			4.12586	4.11103	7/13/11 10:59
Location	FCCU Scrub Stack	Media Type	Teflon Beaker Liner	Comments:				
Recovery Date	7/19/2011	Field Tech	DL					
Method:	U.S. EPA Method 5B			8/8/11	9:14	3.52413	3.51881	7/11/11 13:27
Type	F1/2 Acetone Rinse	Media ID	9142	8/8/11	16:21	3.52424	3.51878	7/12/11 12:59
Run	3	Sample ID	28745-007a			3.52424	3.51881	7/13/11 11:00
Location	FCCU Scrub Stack	Media Type	Teflon Beaker Liner	Comments:				
Recovery Date	7/19/2011	Field Tech	DL					

Particulate Testing Sample Volume Data

Customer: Palatine Engineering Group	Lab Project Number: 28745	Analyst: Michael Tuegel
Plant: Marathon	Cust. Ref. Number: 11265	

Sample ID	Matrix	Volume Received from Field Lab	Vol as Received (g)	Sample Matrix Evaporated(g)	Volume added for Container Rinse(g)	Volume added for Sample Extraction(g)	Volume added for Filter Extraction(g)	Volume added for Sample Titration(g)
28745-004	F1/2 Acetone Rinse		112.0	124.7	12.7			
28745-005	F1/2 Acetone Rinse		108.4	120.4	12.0			
28745-006	F1/2 Acetone Rinse		88.6	100.0	11.5			
28745-007	F1/2 Acetone Rinse		81.4	93.9	12.5			
28745-008	B1/2 Acetone Rinse		185.8	208.0	22.2			
28745-009	B1/2 Inorganic Rinse		198.7	222.6	24.0			100.0
28745-010	B1/2 Inorganic Rinse		256.9	436.9	31.0		49.0	100.0
28745-011	B1/2 Inorganic Rinse		593.1	769.2	31.8		44.3	100.0
28745-012	B1/2 Inorganic Rinse		588.6	768.6	32.6		47.4	100.0
28745-013	B1/2 Inorganic Rinse		609.5	789.4	28.5		51.4	100.0
28745-014	B1/2 Organic Rinse		154.0	167.7	13.7			
28745-015	B1/2 Organic Rinse		204.3	299.3	11.2	52.0	31.9	
28745-016	B1/2 Organic Rinse		204.6	301.7	12.3	52.3	32.5	
28745-017	B1/2 Organic Rinse		198.5	291.0	10.0	52.2	30.3	
28745-018	B1/2 Organic Rinse		189.4	281.2	10.8	50.1	30.9	

Acidic Component Neutralization

Titrimetric Analysis Using 0.1 N Ammonium Hydroxide

Customer:	Palatine Engineering Group	Lab Project Number:	28745	Analyst:	Michael Tuegel
Plant:	Marathon	Cust. Ref. Number:	11265	N _t :	0.054422

Sample Number	Tared Media Identification Number	Test Location	Run Number	Original Sample pH	Reconstituted Sample Starting pH	Reconstituted Sample Neutralized pH	V _t
n/a	0.02 N Standard H ₂ SO ₄	n/a	n/a	n/a	2.45	7.05	7.35
28745-009	9173	All	RB	7.03	7.80		
28745-010	9172	All	FB	6.40	7.61		
28745-011	9194	FCCU Scrub Stack	1	2.96	2.58	7.05	3.95
28745-012	9195	FCCU Scrub Stack	2	3.00	2.46	7.08	4.00
28745-013	9183	FCCU Scrub Stack	3	2.95	2.45	7.05	4.50

Acidic Component Neutralization Corrected Values
Gravimetrics Analysis

Customer:	Palatine Engineering Group	Lab Project No:	28745	Analyst:	Michael Tuegel
Plant:	Marathon	Customer Reference No:	11265		

Laboratory Sample Identification Number	Tared Media Identification Number	Sample Location	Run Number	Observed Final Weight (mg)	Calculated Correction Value (mg)	Corrected Final Weight (mg)
28745-009	9173	All	RB	0.97	0.00	0.97
28745-010	9172	All	FB	1.90	0.00	1.90
28745-011	9194	FCCU Scrub Stack	1	38.99	3.71	35.28
28745-012	9195	FCCU Scrub Stack	2	40.58	3.71	36.87
28745-013	9183	FCCU Scrub Stack	3	44.33	3.71	40.62

Individual Sample Quality Control Criteria

Gravimetrics Analysis

Customer:	Palatine Engineering Group	Lab Project No:	28745	Analyst:	Michael Tuegel
Plant:	Marathon	Customer Ref No:	11265		

Laboratory Sample Identification Number	Net Weight Time Difference (hr)	Pass/Fail	Net Weight Difference (mg)	Pass/Fail	Tare Weight Time Difference (hr)	Pass/Fail	Tare Weight Difference (mg)	Pass/Fail
28745-001	24	Pass	0.00032	Pass	69	Pass	0.00024	Pass
28745-002	24	Pass	0.00027	Pass	69	Pass	0.00026	Pass
28745-003	24	Pass	0.00023	Pass	21	Pass	-0.00042	Pass
28745-004	17	Pass	-0.00022	Pass	24	Pass	0.00001	Pass
28745-005	23	Pass	-0.00047	Pass	24	Pass	0.00028	Pass
28745-006	23	Pass	0.00016	Pass	24	Pass	0.00025	Pass
28745-007	23	Pass	0.00041	Pass	24	Pass	0.00003	Pass
28745-008	18	Pass	-0.00040	Pass	22	Pass	0.00015	Pass
28745-009	7	Pass	0.00000	Pass	22	Pass	0.00025	Pass
28745-010	7	Pass	0.00009	Pass	22	Pass	0.00034	Pass
28745-011	7	Pass	0.00002	Pass	22	Pass	0.00002	Pass
28745-012	7	Pass	0.00019	Pass	24	Pass	0.00012	Pass
28745-013	7	Pass	-0.00007	Pass	22	Pass	0.00038	Pass
28745-014	6	Pass	0.00022	Pass	22	Pass	0.00018	Pass
28745-015	6	Pass	0.00029	Pass	22	Pass	0.00016	Pass
28745-016	6	Pass	0.00034	Pass	22	Pass	0.00024	Pass
28745-017	6	Pass	0.00034	Pass	22	Pass	0.00027	Pass
28745-018	6	Pass	0.00028	Pass	22	Pass	0.00013	Pass
28745-001a	7	Pass	0.00032	Pass	69	Pass	0.00024	Pass
28745-002a	7	Pass	-0.00032	Pass	69	Pass	0.00026	Pass
28745-003a	7	Pass	0.00036	Pass	21	Pass	-0.00042	Pass
28745-004a	7	Pass	0.00014	Pass	24	Pass	0.00001	Pass
28745-005a	7	Pass	0.00004	Pass	24	Pass	0.00028	Pass
28745-006a	7	Pass	0.00007	Pass	24	Pass	0.00025	Pass
28745-007a	7	Pass	0.00011	Pass	24	Pass	0.00003	Pass

Individual Sample Quality Control Criteria Gravimetrics Analysis

Customer:	Palatine Engineering Group	Lab Project No:	28745	Analyst:	Michael Tuegel
Plant:	Marathon	Customer Ref No:	11265		

Laboratory Sample Identification Number	Tared Media Identification Number	Sample Matrix	Tare Weight Trial 2 (g)	Gross Weight Trial 2 (g)	Net Weight (g)	Mass Volume (g)	Percent Residue by Mass	Is Residue less than 0.001% by weight?
28732-N	8635	Acetone	3.92731	3.92704	-0.00027	155.1	0.00000	Yes
28734-N	8692	Acetone	3.95493	3.95471	-0.00022	146.7	0.00000	Yes
28736-N	8744	Acetone	3.75766	3.75740	-0.00026	157.9	0.00000	Yes
28739-N	9138	Acetone	4.02769	4.02779	0.00010	269.6	0.00004	Yes
136	9176	Acetone	4.05124	4.05137	0.00013	172.2	0.00008	Yes
137	9182	Acetone	4.05243	4.05227	-0.00016	172.2	0.00000	Yes
138	9099	Acetone	3.86416	3.86401	-0.00015	186.4	0.00000	Yes
139	9095	Acetone	3.85930	3.85935	0.00005	171.3	0.00003	Yes
140	8819	Acetone	3.95097	3.95133	0.00036	371.8	0.00010	Yes
141	8830	Acetone	4.06034	4.06077	0.00043	479.5	0.00009	Yes
28719-H	8516	DI Water	3.88066	3.88057	-0.00009	497.2	0.00000	Yes
28728-H	8142	DI Water	3.56838	3.56875	0.00037	433.5	0.00009	Yes
28729-T	8390	DI Water	4.05807	4.05810	0.00003	435.9	0.00001	Yes
28727-H	8229	DI Water	3.75008	3.74969	-0.00039	721.0	0.00000	Yes
28732-H	8536	DI Water	3.87660	3.87638	-0.00022	722.9	0.00000	Yes
28734-H	8563	DI Water	3.83594	3.83580	-0.00014	721.0	0.00000	Yes
28736-H	8694	DI Water	3.91934	3.91960	0.00026	722.9	0.00004	Yes
118	9115	DI Water	4.03824	4.03844	0.00020	223.6	0.00009	Yes
119	9146	DI Water	4.16541	4.16584	0.00043	525.6	0.00008	Yes
120	9187	DI Water	4.07930	4.07970	0.00040	419.6	0.00010	Yes
28714-O	8384	Hexane	3.95480	3.95476	-0.00004	208.8	0.00000	Yes
28716-T	8355	Hexane	4.02310	4.02279	-0.00031	298.3	0.00000	Yes
28716-O	8439	Hexane	4.06075	4.06075	0.00000	500.0	0.00000	Yes
28728-T	8465	Hexane	4.07614	4.07639	0.00025	339.6	0.00007	Yes
28729-O	8391	Hexane	3.98409	3.98417	0.00008	153.8	0.00005	Yes
28727-T	8235	Hexane	3.92685	3.92677	-0.00008	258.1	0.00000	Yes
28732-O	8530	Hexane	3.95833	3.95815	-0.00018	253.6	0.00000	Yes
28734-T	8571	Hexane	3.87787	3.87773	-0.00014	258.1	0.00000	Yes
28736-O	8557	Hexane	3.78029	3.78005	-0.00024	253.6	0.00000	Yes
36	8867	Hexane	3.84604	3.84644	0.00040	459.9	0.00009	Yes

Laboratory Blank Samples Weight Sheet

Customer:	Palatine Engineering Group	Lab Project Number:	28745	Analyst:	Michael Tuegel
Plant:	Marathon	Cust. Ref. Number:	11265		

Description			Date/Time	Gross Weight (g)	Tare Weight (g)	Date/Time	Net Weight (g)
Matrix	8.26cm QF Filter	Media ID 43739	6/16/11 11:10	0.36726	0.36712	4/22/11 10:22	
Replicate	63	Sample ID 28721-A	6/17/11 9:11	0.36727	0.36729	4/26/11 10:12	
		Total Volume (g)		0.36727	0.36729		<
Matrix	8.26cm QF Filter	Media ID 43745	6/16/11 11:10	0.36788	0.36721	4/21/11 11:15	
Replicate	64	Sample ID 28723-Q	6/17/11 9:12	0.36805	0.36770	4/22/11 10:12	
		Total Volume (g)		0.36805	0.36770		0.00035
Matrix	8.26cm QF Filter	Media ID 43744	6/16/11 11:09	0.37352	0.37325	4/20/11 10:32	
Replicate	65	Sample ID 28724-A	6/17/11 9:12	0.37324	0.37305	4/21/11 11:09	
		Total Volume (g)		0.37324	0.37305		0.00019
Matrix	8.26cm QF Filter	Media ID 43812	6/28/11 8:55	0.34734	0.34792	5/12/11 9:28	
Replicate	66	Sample ID 28729-A	6/29/11 10:28	0.34768	0.34791	5/13/11 9:32	
		Total Volume (g)		0.34768	0.34791		-0.00023
Matrix	8.26cm QF Filter	Media ID 43830	6/28/11 8:59	0.41365	0.41348	5/12/11 9:25	
Replicate	67	Sample ID 28727-Q	6/29/11 10:24	0.41345	0.41316	5/13/11 9:37	
		Total Volume (g)		0.41345	0.41316		0.00029
Matrix	8.26cm QF Filter	Media ID 43829	6/28/11 8:54	0.40720	0.40726	5/12/11 9:25	
Replicate	68	Sample ID 28732-A	6/29/11 10:29	0.40700	0.40686	5/13/11 9:37	
		Total Volume (g)		0.40700	0.40686		<
Matrix	8.26cm QF Filter	Media ID 43828	7/8/11 10:01	0.42058	0.42072	5/12/11 9:26	
Replicate	69	Sample ID 28734-A	7/8/11 10:01	0.42058	0.42035	5/13/11 9:38	
		Total Volume (g)		0.42058	0.42035		0.00023
Matrix	8.26cm QF Filter	Media ID 43970	7/15/11 16:02	0.41224	0.41244	7/1/11 13:25	
Replicate	70	Sample ID 28739-A	7/18/11 8:55	0.41229	0.41222	7/7/11 14:12	
		Total Volume (g)		0.41229	0.41222		<
Matrix	8.26cm QF Filter	Media ID 43975	7/26/11 13:56	0.40814	0.40706	7/1/11 13:31	
Replicate	71	Total Volume (g)	7/27/11 11:12	0.40779	0.40697	7/7/11 14:22	
				0.40779	0.40697		0.00082
Matrix	8.26cm QF Filter	Media ID 43831	8/8/11 10:50	0.40937	0.40940	5/12/11 10:03	
Replicate	72	Total Volume (g)	8/8/11 17:00	0.40917	0.40918	5/13/11 10:36	
				0.40917	0.40918		<

Laboratory Blank Samples Weight Sheet

Customer:	Palatine Engineering Group	Lab Project Number:	28745	Analyst:	Michael Tuegel
Plant:	Marathon	Cust. Ref. Number:	11265		

Description			Date/Time	Gross Weight (g)	Tare Weight (g)	Date/Time	Net Weight (g)
Matrix	Acetone	Media ID	8635	6/28/11 8:48	3.92728	3.92755	6/15/11 14:07
Replicate	132	Sample ID	28732-N	6/29/11 10:55	3.92704	3.92715	6/16/11 13:16
		Total Volume (g)	155.11		3.92704	3.92731	6/17/11 13:07
							-0.00027
Matrix	Acetone	Media ID	8692	7/7/11 15:34	3.95486	3.95506	6/30/11 17:10
Replicate	133	Sample ID	28734-N	7/8/11 9:49	3.95471	3.95481	7/1/11 9:09
		Total Volume (g)	146.7		3.95471	3.95493	7/1/11 15:59
							<
Matrix	Acetone	Media ID	8744	7/7/11 15:35	3.75766	3.75770	6/30/11 16:36
Replicate	134	Sample ID	28736-N	7/8/11 9:49	3.75740	3.75753	7/1/11 9:24
		Total Volume (g)	157.91		3.75740	3.75766	7/1/11 15:54
							<
Matrix	Acetone	Media ID	9138	7/15/11 16:02	4.02777	4.02775	7/11/11 13:54
Replicate	135	Sample ID	28739-N	7/18/11 8:55	4.02779	4.02789	7/12/11 13:19
		Total Volume (g)	269.61		4.02779	4.02769	7/13/11 11:21
							<
Matrix	Acetone	Media ID	9176	7/26/11 14:02	4.05168	4.05143	7/11/11 13:31
Replicate	136			7/27/11 11:18	4.05137	4.05128	7/12/11 12:58
		Total Volume (g)	172.15		4.05137	4.05124	7/13/11 11:12
							<
Matrix	Acetone	Media ID	9182	7/26/11 14:01	4.05267	4.05256	7/11/11 13:44
Replicate	137			7/27/11 11:17	4.05227	4.05247	7/12/11 12:54
		Total Volume (g)	172.15		4.05227	4.05243	7/13/11 11:08
							<
Matrix	Acetone	Media ID	9099	7/26/11 14:18	3.86436	3.86413	7/15/11 9:22
Replicate	138			7/27/11 11:08	3.86401	3.86390	7/18/11 9:12
		Total Volume (g)	186.39		3.86401	3.86416	7/19/11 10:41
							<
Matrix	Acetone	Media ID	9095	7/26/11 14:15	3.85938	3.85922	7/15/11 9:30
Replicate	139			7/27/11 11:07	3.85935	3.85912	7/18/11 9:05
		Total Volume (g)	171.27		3.85935	3.85930	7/19/11 10:50
							<
Matrix	Acetone	Media ID	8819	8/8/11 9:56	3.95118	3.95115	7/11/11 12:58
Replicate	140			8/8/11 17:05	3.95133	3.95101	7/12/11 10:51
		Total Volume (g)	371.78		3.95133	3.95097	7/13/11 10:39
							0.00036
Matrix	Acetone	Media ID	8830	8/8/11 10:26	4.06055	4.06042	7/11/11 13:03
Replicate	141			8/8/11 16:59	4.06077	4.06035	7/12/11 11:14
		Total Volume (g)	479.5		4.06077	4.06034	7/13/11 10:39
							0.00043

Laboratory Blank Samples Weight Sheet

Customer:	Palatine Engineering Group	Lab Project Number:	28745	Analyst:	Michael Tuegel
Plant:	Marathon	Cust. Ref. Number:	11265		

Description			Date/Time	Gross Weight (g)	Tare Weight (g)	Date/Time	Net Weight (g)
Matrix	DI Water	Media ID	8516	6/16/11 10:57	3.88053	3.88073	6/6/11 16:03
Replicate	111	Sample ID	28719-H	6/17/11 8:58	3.88057	3.88075	6/8/11 14:50
		Total Volume (g)	497.18	3.88057	3.88066	6/9/11 15:20	<
Matrix	DI Water	Media ID	8142	6/28/11 8:40	3.56896	3.56809	5/6/11 14:15
Replicate	112	Sample ID	28728-H	6/29/11 10:49	3.56875	3.56799	5/12/11 17:36
		Total Volume (g)	433.52	3.56875	3.56838	5/23/11 15:34	
Matrix	DI Water	Media ID	8390	6/28/11 8:36	4.05832	4.05815	5/20/11 10:00
Replicate	113	Sample ID	28729-T	6/29/11 10:45	4.05810	4.05803	5/20/11 16:26
		Total Volume (g)	435.85	4.05810	4.05807	5/23/11 15:23	<
Matrix	DI Water	Media ID	8229	6/28/11 9:15	3.74989	3.74975	6/6/11 15:27
Replicate	114	Sample ID	28727-H	6/29/11 10:40	3.74969	3.74997	6/8/11 15:40
		Total Volume (g)	720.95	3.74969	3.75008	6/9/11 14:51	
Matrix	DI Water	Media ID	8536	6/28/11 9:12	3.87669	3.87663	6/16/11 11:41
Replicate	115	Sample ID	28732-H	6/29/11 10:38	3.87638	3.87648	6/17/11 11:52
		Total Volume (g)	722.88	3.87638	3.87660	6/20/11 13:15	<
Matrix	DI Water	Media ID	8563	7/7/11 15:32	3.83626	3.83620	6/10/11 13:06
Replicate	116	Sample ID	28734-H	7/8/11 9:44	3.83580	3.83594	6/14/11 14:05
		Total Volume (g)	720.95	3.83580	3.83594	6/15/11 16:51	<
Matrix	DI Water	Media ID	8694	7/7/11 15:31	3.91976	3.91907	6/22/11 8:59
Replicate	117	Sample ID	28736-H	7/8/11 9:45	3.91960	3.91976	6/23/11 13:06
		Total Volume (g)	722.88	3.91960	3.91934	6/27/11 11:44	<
Matrix	DI Water	Media ID	9115	7/26/11 14:12	4.03871	4.03794	7/15/11 9:26
Replicate	118		7/27/11 11:03	4.03844	4.03803	7/18/11 9:08	
		Total Volume (g)	223.56	4.03844	4.03824	7/19/11 10:46	<
Matrix	DI Water	Media ID	9146	8/8/11 10:34	4.16572	4.16547	7/11/11 12:56
Replicate	119		8/8/11 16:51	4.16584	4.16538	7/12/11 10:55	
		Total Volume (g)	525.56	4.16584	4.16541	7/13/11 10:34	
Matrix	DI Water	Media ID	9187	8/8/11 10:33	4.07978	4.07923	7/11/11 12:52
Replicate	120		8/8/11 16:50	4.07970	4.07951	7/12/11 10:58	
		Total Volume (g)	419.6	4.07970	4.07930	7/13/11 10:30	

Laboratory Blank Samples Weight Sheet

Customer:	Palatine Engineering Group	Lab Project Number:	28745	Analyst:	Michael Tuegel
Plant:	Marathon	Cust. Ref. Number:	11265		

Description			Date/Time	Gross Weight (g)	Tare Weight (g)	Date/Time	Net Weight (g)
Matrix	Hexane	Media ID	8384	6/16/11 11:23	3.95500	3.95497	5/20/11 10:16
Replicate	27	Sample ID	28714-O	6/17/11 9:23	3.95476	3.95468	5/20/11 16:10
		Total Volume (g)	208.78	3.95476	3.95480	5/23/11 13:35	<
Matrix	Hexane	Media ID	8355	6/16/11 11:19	4.02278	4.02267	5/23/11 16:28
Replicate	28	Sample ID	28716-T	6/17/11 9:20	4.02279	4.02274	5/24/11 10:23
		Total Volume (g)	298.26	4.02279	4.02310	5/25/11 14:19	<
Matrix	Hexane	Media ID	8439	6/16/11 11:22	4.06075	4.06072	5/24/11 10:13
Replicate	29	Sample ID	28716-O	6/17/11 9:22	4.06075	4.06083	5/25/11 14:26
		Total Volume (g)	499.95	4.06075	4.06075	5/26/11 16:53	<
Matrix	Hexane	Media ID	8465	6/28/11 8:59	4.07660	4.07596	5/20/11 10:04
Replicate	30	Sample ID	28728-T	6/29/11 10:24	4.07639	4.07603	5/20/11 16:21
		Total Volume (g)	339.63	4.07639	4.07614	5/23/11 15:30	<
Matrix	Hexane	Media ID	8391	6/28/11 8:58	3.98442	3.98455	5/20/11 10:02
Replicate	31	Sample ID	28729-O	6/29/11 10:32	3.98417	3.98433	5/20/11 16:20
		Total Volume (g)	153.84	3.98417	3.98409	5/23/11 15:19	<
Matrix	Hexane	Media ID	8235	6/28/11 9:10	3.92699	3.92681	6/6/11 15:28
Replicate	32	Sample ID	28727-T	6/29/11 10:32	3.92677	3.92688	6/8/11 15:40
		Total Volume (g)	258.07	3.92677	3.92685	6/9/11 14:51	<
Matrix	Hexane	Media ID	8530	6/28/11 8:55	3.95848	3.95828	6/16/11 13:34
Replicate	33	Sample ID	28732-O	6/29/11 10:21	3.95815	3.95839	6/17/11 11:26
		Total Volume (g)	253.6	3.95815	3.95833	6/20/11 13:18	<
Matrix	Hexane	Media ID	8571	7/7/11 15:32	3.87791	3.87780	6/10/11 13:25
Replicate	34	Sample ID	28734-T	7/8/11 9:45	3.87773	3.87770	6/14/11 13:37
		Total Volume (g)	258.07	3.87773	3.87787	6/15/11 16:49	<
Matrix	Hexane	Media ID	8557	7/7/11 15:36	3.78022	3.78060	6/10/11 11:28
Replicate	35	Sample ID	28736-O	7/8/11 9:49	3.78005	3.78025	6/13/11 14:40
		Total Volume (g)	253.6	3.78005	3.78029	6/15/11 14:10	<
Matrix	Hexane	Media ID	8867	8/8/11 9:55	3.84620	3.84576	7/11/11 10:15
Replicate	36	Sample ID		8/8/11 17:00	3.84644	3.84583	7/12/11 9:48
		Total Volume (g)	459.9	3.84644	3.84604	7/13/11 10:23	

Laboratory Blank Samples Weight Sheet

Customer:	Palatine Engineering Group	Lab Project Number:	28745	Analyst:	Michael Tuegel
Plant:	Marathon	Cust. Ref. Number:	11265		

Description		Date/Time	Gross Weight (g)	Tare Weight (g)	Date/Time	Net Weight (g)
Matrix	Teflon® beaker liner	Media ID 4611	12/28/09 15:39	3.72583	3.72606	11/12/09 11:10
Replicate	16	Sample ID 28543-bj	12/29/09 8:43	3.72606	3.72623	11/13/09 8:17
		Total Volume (g)		3.72606	3.72601	11/13/09 15:33
						<
Matrix	Teflon® beaker liner	Media ID 4658	12/28/09 16:10	3.88817	3.88813	11/12/09 11:19
Replicate	17	Sample ID 28543-bk	12/29/09 9:13	3.88814	3.88832	11/13/09 8:13
		Total Volume (g)		3.88814	3.88808	11/13/09 15:37
						<
Matrix	Teflon® beaker liner	Media ID 4385	1/8/10 9:09	3.78956	3.78956	11/11/09 14:11
Replicate	18	Sample ID 28544-bi	1/11/10 8:51	3.78937	3.78955	11/12/09 10:12
		Total Volume (g)		3.78937	3.78959	11/12/09 16:24
						<
Matrix	Teflon® beaker liner	Media ID 4375	1/11/10 8:18	3.73793	3.73796	11/11/09 14:07
Replicate	19	Sample ID 28544-bj	1/11/10 15:04	3.73795	3.73796	11/12/09 10:15
		Total Volume (g)		3.73795	3.73806	11/12/09 16:17
						<
Matrix	Teflon® beaker liner	Media ID 4303	1/25/10 15:24	3.71937	3.71912	11/9/09 13:36
Replicate	20	Sample ID 28543-bl	1/26/10 9:36	3.71921	3.71920	11/10/09 9:44
w/ Ace		Total Volume (g)		3.71921	3.71928	11/10/09 15:48
						<
Matrix	Teflon® beaker liner	Media ID 4317	1/25/10 15:19	3.83594	3.83599	11/9/09 14:31
Replicate	21	Sample ID 28543-bm	1/26/10 8:28	3.83582	3.83599	11/10/09 10:17
w/ MeCl		Total Volume (g)		3.83582	3.83596	11/10/09 16:17
						<
Matrix	Teflon® beaker liner	Media ID 4300	1/25/10 15:31	3.88965	3.88931	11/9/09 13:36
Replicate	22	Sample ID 28543-bn	1/26/10 9:43	3.88954	3.88943	11/10/09 9:44
w/ DI		Total Volume (g)		3.88954	3.88950	11/10/09 15:49
						<
Matrix	Teflon® beaker liner	Media ID 3420	2/15/10 9:54	3.52820	3.52813	1/19/10 9:49
Replicate	23	Sample ID 28548-bi	2/15/10 16:12	3.52821	3.52796	1/20/10 9:32
w/ Ace		Total Volume (g)		3.52821	3.52805	1/21/10 10:14
						<
Matrix	Teflon® beaker liner	Media ID 3329	2/15/10 9:54	3.49504	3.49535	1/19/10 10:34
Replicate	24	Sample ID 28548-bj	2/15/10 16:12	3.49495	3.49501	1/21/10 10:35
w/ MeCl		Total Volume (g)		3.49495	3.49491	1/22/10 10:15
						<
Matrix	Teflon® beaker liner	Media ID 3314	2/15/10 9:55	3.54831	3.54871	1/19/10 10:30
Replicate	25	Sample ID 28548-bk	2/15/10 16:12	3.54829	3.54865	1/21/10 10:41
w/ DI		Total Volume (g)		3.54829	3.54853	1/22/10 10:18
						<

Laboratory Spiked Samples Weight Sheet

Customer:	Palatine Engineering Group	Lab Project Number:	28745	Analyst:	Michael Tuegel
Plant:	Marathon	Cust. Ref. Number:	11265		

Description			Date/Time	Gross Weight (g)	Tare Weight (g)	Date/Time	Net Weight (g)
Matrix	8.26cm QF Filter	Media ID 43701	6/16/11 11:15	0.37034	0.36907	4/18/11 13:11	
Replicate	72	Sample ID 28705-H	6/17/11 9:16	0.37017	0.36909	4/19/11 9:04	
		Total Volume (g)		0.37017	0.36909		0.00108
Matrix	8.26cm QF Filter	Media ID 43702	6/16/11 11:15	0.37469	0.37335	4/18/11 13:10	
Replicate	73	Sample ID 28705-H	6/17/11 9:15	0.37434	0.37335	4/19/11 9:04	
		Total Volume (g)		0.37434	0.37335		0.00099
Matrix	8.26cm QF Filter	Media ID 43677	6/16/11 11:14	0.35747	0.35634	4/18/11 13:03	
Replicate	74	Sample ID 28705-H	6/17/11 9:15	0.35752	0.35643	4/19/11 9:11	
		Total Volume (g)		0.35752	0.35643		0.00109
Matrix	8.26cm QF Filter	Media ID 43825	6/28/11 9:03	0.40560	0.40509	5/12/11 9:32	
Replicate	75	Sample ID 28705-H	6/29/11 10:25	0.40576	0.40476	5/13/11 9:30	
		Total Volume (g)		0.40576	0.40476		0.00100
Matrix	8.26cm QF Filter	Media ID 43810	6/29/11 10:20	0.33846	0.33751	5/12/11 9:29	
Replicate	76	Sample ID 28705-H	6/29/11 10:20	0.33846	0.33750	5/13/11 9:33	
		Total Volume (g)		0.33846	0.33750		0.00096
Matrix	8.26cm QF Filter	Media ID 43811	6/28/11 9:06	0.34037	0.34000	5/12/11 9:29	
Replicate	77	Sample ID 28705-H	6/29/11 10:20	0.34086	0.33982	5/13/11 9:33	
		Total Volume (g)		0.34086	0.33982		0.00104
Matrix	8.26cm QF Filter	Media ID 43892	7/7/11 15:50	0.34830	0.34729	6/17/11 15:03	
Replicate	78	Sample ID 28705-H	7/8/11 10:02	0.34860	0.34745	6/20/11 11:51	
		Total Volume (g)		0.34860	0.34745		0.00115
Matrix	8.26cm QF Filter	Media ID 43973	7/15/11 16:05	0.41101	0.40987	7/1/11 13:30	
Replicate	79	Sample ID 28705-H	7/18/11 8:58	0.41061	0.40956	7/7/11 14:22	
		Total Volume (g)		0.41061	0.40956		0.00105
Matrix	8.26cm QF Filter	Media ID 43974	7/26/11 13:57	0.40962	0.40829	7/1/11 13:30	
Replicate	80	Total Volume (g)	7/27/11 11:13	0.40938	0.40837	7/7/11 14:16	
				0.40938	0.40837		0.00101
Matrix	8.26cm QF Filter	Media ID 43832	8/8/11 10:50	0.40914	0.40878	5/13/11 10:35	
Replicate	81	Total Volume (g)	8/8/11 17:00	0.40944	0.40836	5/16/11 13:50	
				0.40944	0.40836		0.00108

Laboratory Spiked Samples Weight Sheet

Customer:	Palatine Engineering Group	Lab Project Number:	28745	Analyst:	Michael Tuegel
Plant:	Marathon	Cust. Ref. Number:	11265		

Description			Date/Time	Gross Weight (g)	Tare Weight (g)	Date/Time	Net Weight (g)
Matrix	Acetone	Media ID 8626	6/28/11 8:45	4.03875	4.03702	6/13/11 15:40	
Replicate	129	Sample ID 28732-N	6/29/11 10:46	4.03886	4.03695	6/14/11 16:58	
		Total Volume (g) 196.0		4.03886	4.03680	6/16/11 13:21	0.00206
Matrix	Acetone	Media ID 8785	7/7/11 15:43	3.87362	3.87153	6/30/11 16:37	
Replicate	130	Sample ID 28734-N	7/8/11 9:57	3.87338	3.87144	7/1/11 9:29	
		Total Volume (g) 195.0		3.87338	3.87147	7/1/11 16:09	0.00191
Matrix	Acetone	Media ID 8684	7/7/11 15:43	3.88009	3.87788	6/30/11 16:43	
Replicate	131	Sample ID 28736-N	7/8/11 9:57	3.87981	3.87766	7/1/11 9:17	
		Total Volume (g) 196.0		3.87981	3.87777	7/1/11 16:05	0.00204
Matrix	Acetone	Media ID 9177	7/15/11 16:02	4.01855	4.01645	7/11/11 13:54	
Replicate	132	Sample ID 28739-N	7/18/11 8:55	4.01849	4.01642	7/12/11 13:23	
		Total Volume (g) 159.1		4.01849	4.01639	7/13/11 11:15	0.00210
Matrix	Acetone	Media ID 9140	7/26/11 13:57	4.02446	4.02226	7/11/11 13:55	
Replicate	133		7/27/11 11:13	4.02467	4.02212	7/12/11 13:24	
		Total Volume (g) 164.7		4.02467	4.02244	7/13/11 11:11	0.00223
Matrix	Acetone	Media ID 9184	7/26/11 14:02	4.12856	4.12650	7/11/11 13:27	
Replicate	134		7/27/11 11:18	4.12839	4.12636	7/12/11 12:59	
		Total Volume (g) 171.0		4.12839	4.12633	7/13/11 11:11	0.00206
Matrix	Acetone	Media ID 9093	7/26/11 14:11	3.65458	3.65219	7/15/11 9:22	
Replicate	135		7/27/11 11:02	3.65433	3.65214	7/18/11 9:12	
		Total Volume (g) 176.8		3.65433	3.65217	7/19/11 10:42	0.00216
Matrix	Acetone	Media ID 9094	7/26/11 14:15	3.75750	3.75524	7/15/11 9:29	
Replicate	136		7/27/11 11:06	3.75745	3.75531	7/18/11 9:04	
		Total Volume (g) 177.7		3.75745	3.75540	7/19/11 10:50	0.00205
Matrix	Acetone	Media ID 9185	8/8/11 9:55	3.96662	3.96501	7/11/11 13:06	
Replicate	137		8/8/11 17:00	3.96697	3.96479	7/12/11 11:13	
		Total Volume (g) 163.2		3.96697	3.96478	7/13/11 10:39	0.00219
Matrix	Acetone	Media ID 8818	8/8/11 10:27	3.94950	3.94752	7/11/11 12:59	
Replicate	138		8/8/11 16:56	3.94948	3.94731	7/12/11 10:51	
		Total Volume (g) 161.1		3.94948	3.94727	7/13/11 10:35	0.00221

Laboratory Spiked Samples Weight Sheet

Customer:	Palatine Engineering Group	Lab Project Number:	28745	Analyst:	Michael Tuegel
Plant:	Marathon	Cust. Ref. Number:	11265		

Description				Date/Time	Gross Weight (g)	Tare Weight (g)	Date/Time	Net Weight (g)
Matrix	DI Water	Media ID	8200	6/16/11 10:58	3.81221	3.80982	6/8/11 11:22	
Replicate	105	Sample ID	28719-T	6/17/11 8:59	3.81188	3.80980	6/9/11 9:13	
		Total Volume (g)	100.0		3.81188	3.80997	6/9/11 15:41	0.00191
Matrix	DI Water	Media ID	8515	6/28/11 9:02	3.89641	3.89428	6/13/11 14:55	
Replicate	106	Sample ID	28728-T	6/29/11 10:28	3.89606	3.89441	6/15/11 14:52	
		Total Volume (g)	199.7		3.89606	3.89410	6/16/11 13:15	0.00196
Matrix	DI Water	Media ID	8677	6/28/11 9:08	3.91287	3.91129	6/20/11 14:20	
Replicate	107	Sample ID	28729-L	6/29/11 10:32	3.91275	3.91105	6/21/11 10:57	
		Total Volume (g)	208.8		3.91275	3.91079	6/22/11 9:40	0.00196
Matrix	DI Water	Media ID	8581	6/28/11 8:37	3.79263	3.79048	6/10/11 13:24	
Replicate	108	Sample ID	28727-H	6/29/11 10:36	3.79233	3.79052	6/14/11 13:37	
		Total Volume (g)	211.0		3.79233	3.79015	6/16/11 13:00	0.00218
Matrix	DI Water	Media ID	8592	6/28/11 8:40	4.03134	4.02981	6/14/11 16:39	
Replicate	109	Sample ID	28732-T	6/29/11 10:39	4.03177	4.02972	6/16/11 13:19	
		Total Volume (g)	219.4		4.03177	4.02975	6/17/11 11:40	0.00202
Matrix	DI Water	Media ID	8790	7/7/11 15:39	4.03679	4.03449	6/30/11 16:43	
Replicate	110	Sample ID	28734-H	7/8/11 9:53	4.03654	4.03430	7/1/11 9:26	
		Total Volume (g)	211.0		4.03654	4.03438	7/1/11 16:13	0.00216
Matrix	DI Water	Media ID	8680	7/7/11 15:40	3.94353	3.94127	6/30/11 16:43	
Replicate	111	Sample ID	28736-T	7/8/11 9:53	3.94321	3.94111	7/1/11 9:19	
		Total Volume (g)	219.4		3.94321	3.94114	7/1/11 16:13	0.00207
Matrix	DI Water	Media ID	9097	7/26/11 14:12	3.76966	3.76702	7/15/11 9:30	
Replicate	112	Sample ID		7/27/11 11:03	3.76926	3.76672	7/18/11 9:04	
		Total Volume (g)	213.4		3.76926	3.76698	7/19/11 10:50	0.00228
Matrix	DI Water	Media ID	9134	8/8/11 10:32	3.99945	3.99742	7/11/11 13:19	
Replicate	113	Sample ID		8/8/11 16:55	3.99942	3.99722	7/12/11 10:52	
		Total Volume (g)	215.8		3.99942	3.99722	7/13/11 10:35	0.00220
Matrix	DI Water	Media ID	9189	8/8/11 10:42	4.03248	4.03007	7/11/11 12:56	
Replicate	114	Sample ID		8/8/11 16:49	4.03234	4.03013	7/12/11 10:56	
		Total Volume (g)	227.7		4.03234	4.03016	7/13/11 10:31	0.00218

Laboratory Spiked Samples Weight Sheet

Customer:	Palatine Engineering Group	Lab Project Number:	28745	Analyst:	Michael Tuegel
Plant:	Marathon	Cust. Ref. Number:	11265		

Description				Date/Time	Gross Weight (g)	Tare Weight (g)	Date/Time	Net Weight (g)
Matrix	Hexane	Media ID	8353	6/16/11 10:57	3.81539	3.81408	5/20/11 10:39	
Replicate	26	Sample ID	28714-H	6/17/11 8:58	3.81580	3.81410	5/21/11 9:23	
		Total Volume (g)	59.4		3.81580	3.81377	5/25/11 14:31	0.00203
Matrix	Hexane	Media ID	8382	6/17/11 8:52	3.90073	3.89839	5/23/11 13:43	
Replicate	27	Sample ID	28716-B	6/17/11 8:52	3.90073	3.89872	5/24/11 10:52	
		Total Volume (g)	99.99		3.90073	3.89860	5/25/11 14:06	0.00213
Matrix	Hexane	Media ID	8376	6/16/11 11:01	3.97810	3.97651	5/20/11 15:39	
Replicate	28	Sample ID	28716-H	6/17/11 9:02	3.97846	3.97652	5/23/11 10:43	
		Total Volume (g)	103.51		3.97846	3.97632	5/24/11 9:55	0.00214
Matrix	Hexane	Media ID	8630	6/28/11 9:06	3.80362	3.80167	6/15/11 15:30	
Replicate	29	Sample ID	28728-B	6/29/11 10:35	3.80342	3.80133	6/16/11 13:24	
		Total Volume (g)	57.2405		3.80342	3.80143	6/17/11 11:36	0.00199
Matrix	Hexane	Media ID	8629	6/28/11 9:10	3.93479	3.93295	6/15/11 15:17	
Replicate	30	Sample ID	28729-H	6/29/11 10:39	3.93464	3.93264	6/16/11 13:26	
		Total Volume (g)	58.1906		3.93464	3.93266	6/17/11 11:32	0.00198
Matrix	Hexane	Media ID	8687	6/28/11 8:36	4.01533	4.01350	6/20/11 14:16	
Replicate	31	Sample ID	28727-B	6/29/11 10:45	4.01524	4.01341	6/21/11 11:01	
		Total Volume (g)	58.1406		4.01524	4.01316	6/22/11 9:44	0.00208
Matrix	Hexane	Media ID	8703	6/28/11 8:39	3.86856	3.86671	6/20/11 14:15	
Replicate	32	Sample ID	28732-H	6/29/11 10:48	3.86830	3.86650	6/21/11 11:01	
		Total Volume (g)	133.9014		3.86830	3.86633	6/22/11 9:37	0.00197
Matrix	Hexane	Media ID	8734	7/7/11 15:38	3.77055	3.76839	6/30/11 16:33	
Replicate	33	Sample ID	28734-B	7/8/11 9:52	3.77038	3.76840	7/1/11 9:31	
		Total Volume (g)	58.1406		3.77038	3.76849	7/1/11 16:05	0.00189
Matrix	Hexane	Media ID	8757	7/7/11 15:42	4.01652	4.01446	6/30/11 17:03	
Replicate	34	Sample ID	28736-H	7/8/11 9:56	4.01626	4.01419	7/1/11 9:21	
		Total Volume (g)	133.9014		4.01626	4.01423	7/1/11 15:47	0.00203
Matrix	Hexane	Media ID	8825	8/8/11 10:27	3.98318	3.98100	7/11/11 12:58	
Replicate	35			8/8/11 17:01	3.98320	3.98098	7/12/11 10:55	
		Total Volume (g)	147.39		3.98320	3.98098	7/13/11 10:32	0.00222

Determination of Method Detection Limit

Sampling Media Fraction: Filter

Customer:	Palatine Engineering Group	Lab Project No:	28745	Analyst:	Michael Tuegel
Plant:	Marathon	Customer Ref. No:	11265		

Non-Iterative Study

MDL Reference	40 CFR 136, Appendix B	No. of Replicates	$t_{(n-1, 0.99)}$
CleanAir Reference	SOP EPA5-11	7	3.143
		8	2.998
Matrix	Filter	9	2.896
Container	Petri Dish	10	2.821
		11	2.764
		16	2.602
Spike Solution	2.01 mg/ml NaCl	21	2.528
Spike Amount	0.5 ml		
Residue Added	1.01 mg		

Spiked Filters		Spike Result (mg)
Sample Number (i)		Net ($m_{f,i}$)
43701	28705-H	1.08
43702	28705-H	0.99
43677	28705-H	1.09
43825	28705-H	1.00
43810	28705-H	0.96
43811	28705-H	1.04
43892	28705-H	1.15
43973	28705-H	1.05
43974	80	1.01
43832	81	1.08

Average Net ($m_{f,i}$)	1.05	Is the spike level higher than the MDL?	Yes
Recovery (R_f)	103.9%	Is the spike level less than 10 times the MDL	Yes
Standard Deviation ($\sigma_{f,i}$)	0.06	Is the Avg Recovery between 90% < R_a < 110% ?	Yes
Variance ($V_{f,i}$)	3.23E-03		
RMS Deviation ($RMS_{f,i}$)	5.4%		
$t_{(n-1, 0.99)}$	2.821		
MDL _f	0.00016 g		
MDL _f	0.16 mg		

All data pertaining to this study are located on the pages labeled
Laboratory Spike for the matrix listed above.

Determination of Method Detection Limit

Sampling Media Fraction: Front Half Catch

Customer:	Palatine Engineering Group	Lab Project No:	28745	Analyst:	Michael Tuegel
Plant:	Marathon	Customer Ref. No:	11265		

		Non-Iterative Study	
MDL Reference	40 CFR 136, Appendix B	No. of Replicates	$t_{(n-1,0.99)}$
CleanAir Reference	SOP EPA5-11	7	3.143
		8	2.998
Matrix	Acetone	9	2.896
Container	250 ml Teflon® Beaker Liner	10	2.821
		11	2.764
		16	2.602
		21	2.528
Spike Solution	0.40 mg/ml NaCl		
Spike Amount	5.0 ml		
Residue Added	2.01 mg		

Blank Aliquots				Blank Result (mg/g)
	Blank Number (i)	Mass Volume (g)	Blank Result (mg)	Net ($r_{s,i}$)
	8635	28732-N	155.1	-0.27
				-0.00174
	8692	28734-N	146.7	-0.22
				-0.00150
	8744	28736-N	157.9	-0.26
				-0.00165
	9138	28739-N	269.6	0.10
				0.00037
	9176	136	172.2	0.13
				0.00076
	9182	137	172.2	-0.16
				-0.00093
	9099	138	186.4	-0.15
				-0.00080
	9095	139	171.3	0.05
				0.00029
	8819	140	371.8	0.36
				0.00097
	8830	141	479.5	0.43
				0.00090

Average Blank Conc (mg/g): -0.00033

Spike Aliquots				Spike Result (mg/g)	Blank	Spike Result
	Sample Number (i)	Mass Volume (g)	Spike Result (mg)	Net ($r_{s,i}$)	Corrected ($m_{a,i}$)	Net ($r_{s,i}$)
	8626	28732-N	196.0	2.06	0.01051	0.01085
				1.91	0.00979	0.01013
	8785	28734-N	195.0	2.04	0.01041	0.01074
				2.10	0.01320	0.01353
	8684	28736-N	196.0	2.23	0.01354	0.01388
				2.06	0.01205	0.01238
	9177	28739-N	159.1	2.16	0.01222	0.01255
				2.05	0.01154	0.01187
	9140	133	164.7	2.19	0.01342	0.01375
				2.21	0.01372	0.01405
	9184	134	171.0			
	9093	135	176.8			
	9094	136	177.7			
	9185	137	163.2			
	8818	138	161.1			

Average Blank Corrected ($m_{a,i}$): 2.16Recovery (R_a): 107.4%Standard Deviation (S_a): 0.09

RMS Deviation: 4.4%

 $t_{(n-1,0.99)}$: 2.821MDL_a: 0.00027 gMDL_a: 0.27 mg

Is the spike level higher than the MDL? Yes

Is the spike level less than 10 times the MDL? Yes

Is the Avg Recovery between 90% < R_a < 110%? Yes

All data pertaining to this study are located on the pages labeled
Laboratory Blank and Laboratory Spike for the matrix listed above.

Determination of Method Detection Limit

Sampling Media Fraction: BH DI H₂O Catch

Customer:	Palatine Engineering Group	Lab Project No:	28745	Analyst:	Michael Tuegel
Plant:	Marathon	Customer Ref. No:	11265		

MDL Reference	40 CFR 136, Appendix B	Non-Iterative Study	
CleanAir Reference	SOP EPA5-11	No. of Replicates	$t_{(n-1,0.99)}$
		7	3.143
		8	2.998
Matrix	DI Water	9	2.896
Container	250 ml Teflon® Beaker Liner	10	2.821
		11	2.764
		16	2.602
Spike Solution	0.40 mg/ml NaCl	21	2.528
Spike Amount	5.0 ml		
Residue Added	2.01 mg		

Blank Aliquots				Blank Result (mg/g)
	Blank Number (i)	Mass Volume (g)	Blank Result (mg)	Net ($r_{ab,i}$)
8516	28719-H	497.2	-0.09	-0.00018
8142	28728-H	433.5	0.37	0.00085
8390	28729-T	435.9	0.03	0.00007
8229	28727-H	721.0	-0.39	-0.00054
8536	28732-H	722.9	-0.22	-0.00030
8563	28734-H	721.0	-0.14	-0.00019
8694	28736-H	722.9	0.26	0.00036
9115	118	223.6	0.20	0.00089
9146	119	525.6	0.43	0.00082
9187	120	419.6	0.40	0.00095

Average Blank Conc: 0.00027

Spike Aliquots				Spike Result (mg/g)	Blank	Spike Res
	Sample Number (i)	Mass Volume (g)	Spike Result (mg)	Net ($r_{s,i}$)	Corrected ($m_{s,i}$)	Net ($r_{s,i}$)
8200	28719-T	100.0	1.91	0.01910	0.01883	1.88
8515	28728-T	199.7	1.96	0.00982	0.00954	1.91
8677	28729-L	208.8	1.96	0.00939	0.00911	1.90
8581	28727-H	211.0	2.18	0.01033	0.01006	2.12
8592	28732-T	219.4	2.02	0.00921	0.00893	1.96
8790	28734-H	211.0	2.16	0.01024	0.00997	2.10
8680	28736-T	219.4	2.07	0.00944	0.00916	2.01
9097	112	213.4	2.28	0.01068	0.01041	2.22
9134	113	215.8	2.20	0.01020	0.00992	2.14
9189	114	227.7	2.18	0.00957	0.00930	2.12

Average Blank Corrected ($m_{a,i}$): 2.04Recovery (R_a): 101.3%Standard Deviation (S_a): 0.12

RMS Deviation: 5.9%

 $t_{(n-1,0.99)}$: 2.821MDL_a: 0.00034 gMDL_s: 0.34 mg

Is the spike level higher than the MDL? Yes

Is the spike level less than 10 times the MDL? Yes

Is the Avg Recovery between 90% < R_a < 110%? Yes

All data pertaining to this study are located on the pages labeled
Laboratory Blank and Laboratory Spike for the matrix listed above.

Determination of Method Detection Limit

Sampling Media Fraction: BH Hexane Catch

Customer:	Palatine Engineering Group	Lab Project No:	28745	Analyst:	Michael Tuegel
Plant:	Marathon	Customer Ref. No:	11265		

MDL Reference	40 CFR 136, Appendix B	Non-Iterative Study	
CleanAir Reference	SOP EPA5-11	No. of Replicates	$t_{(n-1,0.99)}$
CleanAir Reference		7	3.143
Matrix	Hexane	8	2.998
Container	250 ml Teflon® Beaker Liner	9	2.896
		10	2.821
		11	2.764
		16	2.602
Spike Solution	0.40 mg/ml NaCl	21	2.528
Spike Amount	5.0 ml		
Residue Added	2.01 mg		

Blank Aliquots				Blank Result (mg/g)
	Blank Number (i)	Mass Volume (g)	Blank Result (mg)	Net (r_{ab})
8384	28714-O	208.8	-0.04	-0.00019
8355	28716-T	298.3	-0.31	-0.00104
8439	28716-O	500.0	0.00	0.00000
8465	28728-T	339.6	0.25	0.00074
8391	28729-O	153.8	0.08	0.00052
8235	28727-T	258.1	-0.08	-0.00031
8530	28732-O	253.6	-0.18	-0.00071
8571	28734-T	258.1	-0.14	-0.00054
8557	28736-O	253.6	-0.24	-0.00095
8867	36	459.9	0.40	0.00087

Average Blank Conc: -0.00016

Spike Aliquots				Spike Result (mg/g)	Blank	Spike Res
	Sample Number (I)	Mass Volume (g)	Spike Result (mg)	Net (r_{ab})	Corrected (m_{ab})	Net (r_{ab})
8353	28714-H	59.4	2.03	0.03418	0.03434	2.04
8382	28716-B	100.0	2.13	0.02130	0.02146	2.15
8376	28716-H	103.5	2.14	0.02067	0.02084	2.16
8630	28728-B	57.2	1.99	0.03477	0.03493	2.00
8629	28729-H	58.2	1.98	0.03403	0.03419	1.99
8687	28727-B	58.1	2.08	0.03578	0.03594	2.09
8703	28732-H	133.9	1.97	0.01471	0.01487	1.99
8734	28734-B	58.1	1.89	0.03251	0.03267	1.90
8757	28736-H	133.9	2.03	0.01516	0.01532	2.05
8825	35	147.4	2.22	0.01506	0.01522	2.24

Average Blank Corrected (m_{ab}): 2.06Recovery (R_a): 102.5%Standard Deviation (S_a): 0.10

RMS Deviation: 4.9%

 $t_{(n-1,0.99)}$: 2.821MDL_a: 0.00028 gMDL_b: 0.28 mg

Is the spike level higher than the MDL? Yes

Is the spike level less than 10 times the MDL? Yes

Is the Avg Recovery between 90% < R_a < 110%? Yes

All data pertaining to this study are located on the pages labeled
Laboratory Blank and Laboratory Spike for the matrix listed above.

Sample Calculations

Customer:	Palatine Engineering Group	Lab Project No:	28745	Analyst	Michael Tuegel
Plant:	Marathon	Customer Ref No:	11265		

Sample No: 28745-002
Sample Location: FCCU Scrub Stack
Run No: 02

1. Determination of sample tare weight.

$$TW_s = TW_{Trial2}$$

Where:

TW_s = Tare weight of sample (g)
 TW_{Trial2} = Final Tare weight of consecutive weights (g)

TW_s = 0.36327
 TW_{Trial2} = 0.36327

2. Determination of difference between two consecutive weights (sample tare weight).

$$TW_{Difference} = 1000|TW_2 - TW_1|$$

Where:

$TW_{Difference}$ = Difference between two consecutive tare weights (mg)
 TW_{Trial2} = Tare weight Trial 2 of consecutive weights (g)
 TW_{Trial1} = Tare weight Trial 1 of consecutive weights (g)
1000 = Constant (mg/g)

$TW_{Difference}$ = 0.26
 TW_{Trial2} = 0.36327
 TW_{Trial1} = 0.36301

3. Determination of sample gross weight.

$$GW_s = GW_{Trial2}$$

Where:

GW_s = Gross weight of sample (g)
 GW_{Trial2} = Gross weight Trial 2 of consecutive weights (g)

GW_s = 0.44421
 GW_{Trial2} = 0.44421

Sample Calculations

Customer:	Palatine Engineering Group	Lab Project No:	28745	Analyst	Michael Tuegel
Plant:	Marathon	Customer Ref No:	11265		

Sample No: 28745-002
Sample Location: FCCU Scrub Stack
Run No: 02

4. Determination of difference between two consecutive weights (sample gross weight).

$$GW_{Difference} = 1000|GW_2 - GW_1|$$

Where:

$GW_{Difference}$ = Difference between two consecutive gross weights (mg)

GW_2 = Gross weight Trial 2 of consecutive weights (g)

GW_1 = Gross weight Trial 1 of consecutive weights (g)

1000 = Constant (mg/g)

$$GW_{Difference} = 0.27$$

$$GW_2 = 0.44421$$

$$GW_1 = 0.44394$$

5. Determination of sample net weight.

$$NW_s = GW_s - TW_s$$

Where:

NW_s = Net weight of sample (g)

GW_s = Gross weight of sample (g)

TW_s = Tare weight of sample (g)

$$NW_s = 0.08094$$

$$GW_s = 0.44421$$

$$TW_s = 0.36327$$

Sample Calculations

Customer:	Palatine Engineering Group	Lab Project No:	28745	Analyst	Michael Tuegel
Plant:	Marathon	Customer Ref No:	11265		

Sample No: 28745-002
Sample Location: FCCU Scrub Stack
Run No: 02

6. Determination of Method Detection Limits (MDL) for filters.

6a. Determination of spike amount of residue added (total mg).

$$RA = \frac{(SA)(SSC)}{1000}$$

Where:

RA = Amount of spike residue added (g)
SSC = Spike solution concentration of NaCl (mg/ml)
SA = Amount of spike solution added to filter (ml)
1000 = Conversion factor (mg/g)

RA = 0.00101
SSC = 2.01
SA = 0.5

6b. Determination of average spike result.

$$AvgM_{f-i} = \frac{\sum_{i=1}^n M_{f-i}}{n}$$

Where:

AvgM_{f-i} = Average of spike result net weights (mg)
M_{f-i} = Net weights recorded for each iteration (mg)
n = Number of iterations.
i = Placeholder for iteration.

AvgM_{f-i} = 1.05
M_{f-2} = 0.99
n = 10

Sample Calculations

Customer:	Palatine Engineering Group	Lab Project No:	28745	Analyst	Michael Tuegel
Plant:	Marathon	Customer Ref No:	11265		

Sample No: 28745-002
Sample Location: FCCU Scrub Stack
Run No: 02

6c. Determination of standard deviation of spike result.

$$\sigma_{f-i} = \sqrt{\frac{\sum_{i=1}^n (M_{f-i} - \text{Avg}M_{f-i})^2}{(n-1)}}$$

Where:

σ_{f-i} = Standard deviation of spike result.
 $\text{Avg}M_{f-i}$ = Average of spike result net weights (mg)
 M_{f-i} = Net weights recorded for each iteration (mg)
 n = Number of iterations.
 i = Placeholder for iteration.

σ_{f-i} = 0.06
 $\text{Avg}M_{f-i}$ = 1.05
 M_{f-2} = 0.99
 n = 10

6d. Determination of variance of spike result.

$$V_{f-i} = (\sigma_{f-i})^2$$

Where:

V_{f-i} = Variance of spike result.
 σ_{f-i} = Standard deviation of spike result.

V_{f-i} = 0.0032
 σ_{f-i} = 0.05681

Sample Calculations

Customer:	Palatine Engineering Group	Lab Project No:	28745	Analyst	Michael Tuegel
Plant:	Marathon	Customer Ref No:	11265		

Sample No: 28745-002
Sample Location: FCCU Scrub Stack
Run No: 02

6e. Determination of RMS deviation of spike result.

$$RMS_{f-i} = 100 \frac{\sigma_{f-i}}{AvgM_{f-i}}$$

Where:

RMS_{f-i} = RMS deviation of spike results (%).
 σ_{f-i} = Standard deviation of spike result.
 $AvgM_{f-i}$ = Average of spike result net weights (mg)
100 = Conversion constant (fraction to percent)

RMS_{f-i} = 5.4%
 σ_{f-i} = 0.06
 $AvgM_{f-i}$ = 1.05

6f. Determination of average spike recovery.

$$R_f = 100 \frac{AvgM_{f-i}}{RA}$$

Where:

R_f = Average spike recovery (%)
 $AvgM_{f-i}$ = Average of spike result net weights (mg)
RA = Amount of spike residue added (mg)
100 = Conversion constant (fraction to percent)

R_f = 103.9%
 $AvgM_{f-i}$ = 1.05
RA = 1.01

Sample Calculations

Customer:	Palatine Engineering Group	Lab Project No:	28745	Analyst	Michael Tuegel
Plant:	Marathon	Customer Ref No:	11265		

Sample No: 28745-002
Sample Location: FCCU Scrub Stack
Run No: 02

6g. Determination of $t_{(n-1, 0.99)}$.

Value taken from the following Table:

n	$t_{(n-1, 0.99)}$
7	3.143
8	2.998
9	2.896
10	2.821
11	2.764
16	2.602
21	2.528

Where:

$t_{(n-1, 0.99)}$ = Students' t value appropriate for a 99% confidence level and a standard deviation estimate with n-1 degrees of freedom.

n = Number of iterations.

$t_{(n-1, 0.99)}$ = 2.821

n = 10

6h. Determination of Method Detection Limit (MDL).

$$MDL = \sigma_{f,i} t_{(n-1, 0.99)}$$

Where:

MDL = Method detection limit (g)

$t_{(n-1, 0.99)}$ = Students' t value appropriate for a 99% confidence level and a standard deviation estimate with n-1 degrees of freedom.

$\sigma_{f,i}$ = Standard deviation of spike result.

MDL = 0.00016

$t_{(n-1, 0.99)}$ = 2.821

$\sigma_{f,i}$ = 0.05681

7. Determination of volume (mL) from sample mass (g)

$$V_{mL} = \frac{M_{sample}}{D_{liquid}}$$

Where:

V_{mL} = Sample volume (mL)

M_{sample} = Sample mass (g)

D_{liquid} = Density of Liquid (g/mL)

V_{mL} = 142

M_{sample} = 112.0

D_{liquid} = 0.7902

CleanAir Engineering
500 W. Wood Street
Palatine, IL 60067-4975
800-627-0033
www.cleanair.com



CLEANAIR ENGINEERING LABORATORY SERVICES

REPORT APPENDIX

APPENDIX A: Sample Chain of Custody

APPENDIX B: Manual Records

APPENDIX C: Laboratory Ambient Temperature Log

APPENDIX D: Daily Balance Calibration Log

APPENDIX E: Sample Pictures

APPENDIX A: Sample Chain of Custody

CleanAir Laboratory Services

Sample(s) # 1-3Lab Proj# 28745Cust Proj# 11265Oven 3Start Date/Time 7/24/11 1701Tech WSTEnd Date/Time 8/1/11 120Tech CAHood Start Date/Time Tech End Date/Time Tech Desiccator 14Date/Time 7/26/11 1630Tech WSTDesiccator 14Date/Time 7/27/11 1643Tech WSTDesiccator 14Date/Time 7/29/11 1012Tech WSTDesiccator 20Date/Time 8/5/11 920Tech WST

CleanAir Laboratory Services

Sample(s) # 4-8Lab Proj# 28745Cust Proj# 11265Oven 3Start Date/Time 7/29/11 1701Tech WSTEnd Date/Time 8/1/11 120Tech CAHood 12Start Date/Time 7/26/11 1600Tech WSTEnd Date/Time 7/27/11 900Tech WSTDesiccator 14Date/Time 7/27/11 900Tech WSTDesiccator 14Date/Time 7/28/11 1920Tech WSTDesiccator 14Date/Time 7/28/11 1020Tech WSTDesiccator 14Date/Time 7/29/11 1532Tech WST20Date/Time 8/8/11 929Tech WST

CleanAir Laboratory Services

Sample(s) # 9-13Lab Proj# 28745Cust Proj# 11265Oven 3Start Date/Time 7/26/11 1627Tech WSTEnd Date/Time 7/29/11 1700Tech WSTHood Start Date/Time Tech End Date/Time Tech Desiccator 23Date/Time 8/8/11 942Tech WSTDesiccator 23Date/Time 8/8/11 1640Tech WSTDesiccator Date/Time Tech Desiccator Date/Time Tech


CleanAir Laboratory Services

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Sample(s) # 14-18Lab Proj# 28745Cust Proj# 11265Oven Start Date/Time Tech End Date/Time Tech Hood 7Start Date/Time 7/26/11 1627Tech WSTEnd Date/Time 7/27/11 1600Tech WSTDesiccator 18Date/Time 7/28/11 1600Tech WSTDesiccator 18Date/Time 7/29/11 926Tech WSTDesiccator 12Date/Time 7/29/11 1543Tech WSTDesiccator Date/Time Tech

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CLIENT	Marathon Petroleum Company		PROJECT	11265	66-11265-32
PLANT	Robinson Refinery		DEPT.	66	
PROJECT MANAGER	K. O'Halloren		 CleanAir[®] ENGINEERING 500 West Wood Street Palatine, IL 60067 800-627-0033 (phone) 847-991-3385 (fax)		
ANALYTICAL METHOD	CONTAINER NUMBER	SAMPLE FRACTION	FORWARDING LAB		
USEPA M-202	1	BACK HALF CATCH AND INORGANIC RINSE 950 mL Amber Glass	CleanAir Analytical Services 500 West Wood Street Palatine, IL 60067 800-627-0033 (phone) Doug Rhoades		
LAB ID			ADDITIONAL INFORMATION		
NUMBER	DATE (2011)	TEST LOCATION	RUN NUMBER	NUMBER OF CONTAINERS	CONTAINER SEaled?
1	7/19	FCCU Scrubber Stack	1	1	X
2	7/19	FCCU Scrubber Stack	2	1	X
3	7/19	FCCU Scrubber Stack	3	1	X
4	7/19	FCCU Scrubber Stack	4	1	X
5	7/19	FCCU Scrubber Stack	5	1	X
6	7/19	FCCU Scrubber Stack	6	1	X
7	7/19	FCCU Scrubber Stack	7	1	X
8	7/19	FCCU Scrubber Stack	8	1	X
9	7/19	FCCU Scrubber Stack	9	1	X
10	7/19	FCCU Scrubber Stack	10	1	X
11	7/19	FCCU Scrubber Stack	11	1	X
12	7/19	FCCU Scrubber Stack	12	1	X
13	7/19	FCCU Scrubber Stack	13	1	X
14	7/19	FCCU Scrubber Stack	14	1	X
15	7/19	FCCU Scrubber Stack	15	1	X
16	7/19	FCCU Scrubber Stack	16	1	X
17	7/19	FCCU Scrubber Stack	17	1	X
18	7/19	FCCU Scrubber Stack	18	1	X
19	7/19	FCCU Scrubber Stack	19	1	X
20	7/19	FCCU Scrubber Stack	20	1	X
21	7/19	FCCU Scrubber Stack	21	1	X
22	7/19	FCCU Scrubber Stack	22	1	X
23	7/19	FCCU Scrubber Stack	23	1	X
24	7/19	FCCU Scrubber Stack	24	1	X
25	7/19	FCCU Scrubber Stack	25	1	X
26	7/19	FCCU Scrubber Stack	26	1	X
27	7/19	FCCU Scrubber Stack	27	1	X
28	7/19	FCCU Scrubber Stack	28	1	X
29	7/19	FCCU Scrubber Stack	29	1	X
30	7/19	FCCU Scrubber Stack	30	1	X
31	7/19	FCCU Scrubber Stack	31	1	X
32	7/19	FCCU Scrubber Stack	32	1	X
33	7/19	FCCU Scrubber Stack	33	1	X
34	7/19	FCCU Scrubber Stack	34	1	X
35	7/19	FCCU Scrubber Stack	35	1	X
36	7/19	FCCU Scrubber Stack	36	1	X
37	7/19	FCCU Scrubber Stack	37	1	X
38	7/19	FCCU Scrubber Stack	38	1	X
39	7/19	FCCU Scrubber Stack	39	1	X
40	7/19	FCCU Scrubber Stack	40	1	X
41	7/19	FCCU Scrubber Stack	41	1	X
42	7/19	FCCU Scrubber Stack	42	1	X
43	7/19	FCCU Scrubber Stack	43	1	X
44	7/19	FCCU Scrubber Stack	44	1	X
45	7/19	FCCU Scrubber Stack	45	1	X
46	7/19	FCCU Scrubber Stack	46	1	X
47	7/19	FCCU Scrubber Stack	47	1	X
48	7/19	FCCU Scrubber Stack	48	1	X
49	7/19	FCCU Scrubber Stack	49	1	X
50	7/19	FCCU Scrubber Stack	50	1	X
51	7/19	FCCU Scrubber Stack	51	1	X
52	7/19	FCCU Scrubber Stack	52	1	X
53	7/19	FCCU Scrubber Stack	53	1	X
54	7/19	FCCU Scrubber Stack	54	1	X
55	7/19	FCCU Scrubber Stack	55	1	X
56	7/19	FCCU Scrubber Stack	56	1	X
57	7/19	FCCU Scrubber Stack	57	1	X
58	7/19	FCCU Scrubber Stack	58	1	X
59	7/19	FCCU Scrubber Stack	59	1	X
60	7/19	FCCU Scrubber Stack	60	1	X
61	7/19	FCCU Scrubber Stack	61	1	X
62	7/19	FCCU Scrubber Stack	62	1	X
63	7/19	FCCU Scrubber Stack	63	1	X

[illegible]

Laboratory Analysis for Particulate Matter

Performed For:

Palatine Engineering Group
500 West Wood Street
Palatine, IL 60067

Laboratory Report No: 64-28756_ASTMD5907_V1.

Customer Reference No: 11265

Revision 0 - Dated: 08/19/2011

To the best of our knowledge, the data presented in this report are accurate, complete, error free, legible and representative of the samples received by the laboratory.



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by Michael Tuegel
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Laboratory Report Certificate of Analysis

<i>Client</i>	Palatine Engineering Group	Lab Proj No.	28756	Analyst	Michael Tuegel
<i>Plant</i>	MPC - Robinson	Cust Ref No.	11265	Method	ASTM D5907

Sample ID	Location	Run No.	Sample Matrix	Sample Volume (mL)	Filter Net Weight (mg)	Beaker Net Weight (mg)	TSS (mg/L)	TDS (mg/L)
28756-001	FCCU Scrubber	1	Brine Water	100	193.80	7901.4	1,934	78,832
28756-002	FCCU Scrubber	2	Brine Water	101	187.18	7993.2	1,846	78,820
28756-003	FCCU Scrubber	3	Brine Water	104	196.82	8235.2	1,891	79,116

Average 1890 78923
Standard Deviation 44 168
RM Standard Deviation 2% 0.2%

Laboratory Report Analysis Narrative

<i>Client</i>	Palatine Engineering Group	<i>Project Number</i>	28756	<i>Analyst</i>	Michael Tuegel
<i>Plant</i>	MPC - Robinson	<i>Method</i>	ASTM D5907	<i>Received</i>	8/17/11

ASTM D5907

Filterable Matter (Total Dissolved Solids) and Nonfilterable Matter (Total Suspended Solids) in Water

Total Suspended Solids

- 1 Mixed sample throughly
- 2 Filtered 100 mL of sample through a tared and heated 4.7 cm quartz fiber filter
- 3 Rinsed the filter and funnel with 3 portions of water
- 4 Heated the filter at 105°C for 4 hours
- 5 After cooling in a desiccator, a weight was taken
- 6 The heating and cooling process was repeated until the recorded weight loss is less than 4% of the previously recorded weight.

Total Dissolved Solids

- 1 The contents of the filtering flask was quantitatively transferred into a cleaned and tared FEP beaker liner.
- 2 The sample was evaporated at 105°C until dry
- 3 The sample was baked at 180°C for 1 hour
- 4 After cooling in a desiccator, a weight was taken
- 5 The heating and cooling process was repeated until the recorded weight loss is less than 4% of the previously recorded weight.

Additional Quality Control

- 1 Each balanced used during the analysis is calibrated internally using class 1 weights each day before use
- 2 Each balance used is independantly verified annually by a 3rd party
- 3 A method blank was created and carried through the analysis with the samples
 - Filters must be -0.2 ± 2 mg
 - Beakers must be ± 0.5 mg
- 4 A duplicate was performed on 10% of the samples received. The data is compared in Table 1 below.

Table 1: Sample Duplicate Precision

Sample ID	Replicate	TSS (mg/L)	Precision	TDS (mg/L)	Precision
28758-001	1	1,934		78,832	
	2	1,897	2%	78,958	0.2%

Sample Data Sheet

Total Suspended Solids

<i>Client</i>	Palatine Engineering Group	<i>Project Number</i>	28756	<i>Analyst</i>	Michael Tuegel
<i>Plant</i>	MPC - Robinson	<i>Method</i>	ASTM D5907		

Sample ID	Media ID	Sample Volume (mL)	Gross Date/Time	Gross Weight (g)	Tare Weight (g)	Tare Date/Time	Net Weight (mg)
28756-001	111162	100.23	8/19/11 9:10	0.30606	0.11215	5/12/11 8:43	
			8/19/11 15:20	0.30602	0.11222	5/13/11 8:56	
				0.30602	0.11222		193.80
28756-001	111161	105.77	8/19/11 9:10	0.31100	0.11041	5/12/11 8:48	
(Duplicate)			8/19/11 15:20	0.31112	0.11051	5/13/11 9:00	
				0.31112	0.11051		200.61
28756-002	111163	101.41	8/19/11 9:10	0.30115	0.11383	5/12/11 8:44	
			8/19/11 15:20	0.30111	0.11393	5/13/11 8:56	
				0.30111	0.11393		187.18
28756-003	111160	104.09	8/19/11 9:10	0.30851	0.11157	5/12/11 8:47	
			8/19/11 15:20	0.30847	0.11165	5/13/11 8:59	
				0.30847	0.11165		196.82
BLANK	111159	N/A	8/19/11 9:12	0.11315	0.11347	5/12/11 8:47	
			8/19/11 15:21	0.11324	0.11350	5/13/11 8:59	
				0.11324	0.11350		-0.26

Sample Data Sheet Total Dissolved Solids

<i>Client</i>	Palatine Engineering Group	<i>Project Number</i>	28756	<i>Analyst</i>	Michael Tuegel
<i>Plant</i>	MPC - Robinson	<i>Method</i>	ASTM D5907		

Sample ID	Media ID	Sample Volume (mL)	Gross Date/Time	Gross Weight (g)	Tare Weight (g)	Tare Date/Time	Net Weight (mg)
28756-001	7834	100.23	8/19/11 9:13	12.00671	4.10526	4/12/11 8:38	
			8/19/11 9:13	12.00653	4.10519	4/13/11 15:19	
				12.00653	4.10516	4/14/11 10:42	7901.37
28756-001	8820	105.77	8/19/11 9:13	12.37867	4.02767	7/11/11 10:58	
(Duplicate)			8/19/11 9:13	12.37882	4.02752	7/12/11 9:31	
				12.37882	4.02748	7/13/11 10:00	8351.34
28756-002	7915	101.41	8/19/11 9:13	12.05657	4.06350	4/1/11 13:53	
			8/19/11 9:13	12.05662	4.06341	4/4/11 16:51	
				12.05662	4.06346	4/6/11 11:01	7993.16
28756-003	7930	104.09	8/19/11 9:13	12.17227	3.93694	4/1/11 12:31	
			8/19/11 9:13	12.17235	3.93716	4/5/11 8:55	
				12.17235	3.93714	4/6/11 15:24	8235.21
BLANK	7944	N/A	8/19/11 9:14	3.97765	3.97772	4/1/11 13:41	
			8/19/11 9:14	3.97777	3.97770	4/4/11 16:56	
				3.97777	3.97774	4/6/11 10:45	0.03

Marathon Petroleum Company
Clean Air Project No: 11265
FCCU Scrubber Stack

USEPA Mod. CTM-027 Ammonium Laboratory Data Summary

Run No.	Blank	1	2	3
Date (2011)		Jul 19	Jul 19	Jul 19
Start Time (approx.)		07:56	12:00	15:38
Stop Time (approx.)		09:38	13:19	17:15

☐ DRAFT LAB DATA

MDL Min. detectable limit (mg NH₄⁺/liter) 0.0110

NH₃ as Total Ammonium (NH₄⁺)

B_{NH4} Blank concentration (mg NH₄⁺/liter) <0.0110

S _{NH4-1}	Fraction 1 concentration (mg NH ₄ ⁺ /liter)	3.1400	4.1300	5.6800
S _{NH4-2}	Fraction 2 concentration (mg NH ₄ ⁺ /liter)	0.1800	0.1500	0.1200
v ₁	Fraction 1 sample volume (ml)	410.0	330.0	390.0
v ₂	Fraction 2 sample volume (ml)	230.0	170.0	210.0
m _{NH3}	NH ₃ collected before blank subtraction (mg)	1.2544	1.3106	2.1149
m _b	Allowable blank subtraction (mg)	0.0000	0.0000	0.0000
m _{nb}	NH ₃ collected after blank subtraction (mg)	1.2544	1.3106	2.1149
m _{MDL}	Minimum detectable NH ₃ (mg)	0.0066	0.0052	0.0062
m _n	Total NH ₃ used in emission calculations (mg)	1.2544	1.3106	2.1149
EFF	Collection QC Check (% collected in Fraction 2)	3.12%	1.84%	1.12%

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Laboratory Analysis for Cations

Performed For:
Palatine Engineering Group
500 West Wood Street
Palatine, IL 60067

Laboratory Report No: 64-28745_IC_NH4_V1
Customer Reference No: 11265

Revision 0 - Dated: 08/02/2011

To the best of our knowledge, the data presented in this report are accurate, complete, error free,
legible and representative of the samples received by the laboratory.

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CERTIFICATE OF ANALYSIS
Ion Chromatography Analysis

Customer:	Palatine Engineering Group	Lab Project No:	28745	Analyst:	Eric Ewing
Plant:	Marathon	Customer Reference No:	11265	Received:	7/26/11
Applicable Analytical Method:	U.S. EPA Conditional Test Method 027			Analyte:	Ammonium

Laboratory Sample Identification Number	Sample Identification	Sample Volume (mL)	Ammonium Sample Conc. (mg/L)	Method Detection Limit (mg/L)	Method Reporting Limit (mg/L)
Reagent Blanks					
28745-32	DI H2O Blank	200	<	0.011	0.053
28745-33	0.1N H2SO4 Blank	200	<	0.011	0.053
Field Blank					
28745-34	Field Blank	160	<	0.011	0.053
FCCU Scrub. Stack					
28745-35	Imp 1 R1	410	3.14	0.011	0.053
28745-36	Imp 1 R2	330	4.13	0.011	0.053
28745-37	Imp 1 R3	390	5.68	0.011	0.053
28745-38	Imp 2 R1	230	0.18	0.011	0.053
28745-39	Imp 2 R2	170	0.15	0.011	0.053
28745-40	Imp 2 R3	210	0.12	0.011	0.053

Analysis Case Narrative

Ion Chromatography Analysis

Customer:	Palatine Engineering Group	Lab Project No:	28745	Analyst:	Eric Ewing
Plant:	Marathon	Customer Reference No:	11265	Received:	7/26/11
Applicable Analytical Method:	U.S. EPA Conditional Test Method 027			Analyte:	Ammonium

Summary of Analysis

This report summarizes the results of the analysis performed on samples received on: 07/26/11
 The samples were analyzed in accordance with NELAC and procedures found in U.S. EPA Conditional Test Method 027 and U.S. EPA Method 300.1 (Modified for Cations).

Please Note: Method 300.1 is written for analysis of anions, however it is readily applicable for cations

All analysis was carried out using a Dionex ICS-90, Dionex CS12A column, 20 mM methanesulfonic acid eluent, and 0.1M tetrabutylammonium hydroxide regenerant.

Detection Limits

Method Detection Limits have been determined in accordance with procedures in 40 CFR 136, Appendix B. Documentation showing the determination of detection limits are included with this report. The Method Reporting Limit (MRL) was determined by multiplying the Method Detection Limit (MDL) by a factor of 5. Values between these limits were quantified, but should be used with discretion as they were below the MRL. Values that were below the MDL are indicated by a "<" where appropriate.

Sample Preparation

Samples were prepared according to the procedures listed in the EPA Method above. Each sample was analyzed at full strength and a dilution was prepared if necessary to achieve a concentration that was within calibration range limits.

Standard and Reagent Traceability

Each calibration standard has been prepared in accordance with US EPA Method 300.1 and US EPA Method 26 and has been designated an original lot number. This number can be used to trace back to the original dry salts used in the preparation of these standards. This number is included on the calibration page of this report and may also be found in Table 1 below. In addition, the dilution scheme used for the preparation of standards has been included in this report

Table 1: Standard Lot Numbers Used For Analysis

Standard Type	Lot Number	Concentration of Analyte
Stock Standard	07221102-64-00000-01	2502.16 mg/L
QC Standard	07221102-64-00000-02	126.81 mg/L

In suppressed ion chromatography, eluent is defined as the carrier that moves chemicals through the column and regenerant is defined as a reagent used to remove ions opposite in charge of the specific analyte. Regenerant also reduces the overall conductivity of the eluent. A table displaying the lot numbers of these reagents used for each day of analysis is displayed below in Table 2.

Table 2: Eluent and Regenerant Lot Numbers Used for Each Day of Analysis

Analysis Date	Eluent Lot Number	Regenerant Lot Number
7/28/2011	1105-64-00000-02	1027-64-00000-01
7/29/2011	1105-64-00000-02	1027-64-00000-01

Instrument Calibration

Instrument calibration followed regulations found in US EPA Method 300.1 and U.S. EPA Conditional Test Method 027. Calibration standards were prepared from ACS grade dry salts as per section 7.3 of US EPA Method 300.1. As per section 4.2.2 of US EPA CTM-027, a series of 6 diluted standards are prepared from the original calibration standard and run through the column in duplicate from lowest concentration to highest. The average peak area for each calibration point is gathered and plotted against the expected solution concentration. In accordance with section 7.2.3 of EPA Method 9057, a least-squares regression with an r^2 value of .995 or greater must be produced from the resulting curve. In accordance with US EPA Method 26 a full post-test calibration is performed. The pre test calibration and post test calibration average peak area for any standard must agree within $\pm 5\%$ of any observed area.

Analysis Case Narrative

Ion Chromatography Analysis

Customer:	Palatine Engineering Group	Lab Project No:	28745	Analyst:	Eric Ewing
Plant:	Marathon	Customer Reference No:	11265	Received:	7/26/11
Applicable Analytical Method:	U.S. EPA Conditional Test Method 027			Analyte:	Ammonium

Chromatograms

Chromatograms were generated using Dionex Chromeleon software. All chromatograms are included as an appendix of this report. Please note: Chromatograms marked as "End" are place markers meant to signify the end of a batch run and are purposely left blank as no data was acquired for that run.

Analysis QA/QC

Many elements of various EPA methods have been combined and are adhered to:

EPA Method 300.1 quality procedures:

- 1 Before the first sample was analyzed and every twenty samples thereafter (and before the post-test calibration) a laboratory blank and a Continuing Calibration Verification (CCV) were analyzed. The CCV is prepared from the same calibration standard as used to create the 7 diluted standards that make up the calibration curve. The laboratory blank must show a regression concentration of zero, and the CCV must show a regression concentration within 10 percent of the expected concentration.
- 2 After the first ten samples and every twenty there after, a Quality Control (QC) sample was analyzed. The QC sample was created using ACS grade dry salts from a different manufacturer and or lot number than for the salts used to create the calibration standards. The QC must meet the same acceptance criteria as noted for the CCV above.
- 3 A matrix spike analysis was performed on ten percent of the total number of samples. This sample was prepared with equal amounts of a sample and a calibration standard whose concentration was known to be larger than that of the sample. The matrix spike is acceptable when the recovery is found to be 100 ± 10 percent.
- 4 As a measure of precision, all matrix spikes were prepared and analyzed in duplicate. The average area count of two identical matrix spikes may not have a relative percent difference of more than 10 percent.

EPA Method 26 quality procedure:

- 1 As per section 11.1.3, every sample was analyzed in duplicate and the mean area count used to determine the concentration. The duplicate area counts must have a relative percent difference of no greater than five percent. If this was the case, a third injection was made and the average of the three injections was used to determine the concentration.

EPA Method 7E quality procedures:

- 1 Each point on the calibration curve should be within ± 2 percent of the calibration span of the curve used.

Other CleanAir quality procedures:

- 1 The observed concentration value of each point on the calibration curve should have a relative percent difference of no more than 10 percent from its expected concentration.

Analysis Case Narrative

Ion Chromatography Analysis

Customer:	Palatine Engineering Group	Lab Project No:	28745	Analyst:	Eric Ewing
Plant:	Marathon	Customer Reference No:	11265	Received:	7/26/11
Applicable Analytical Method:	U.S. EPA Conditional Test Method 027			Analyte:	Ammonium

Additional Comments

This report shall in no way be reproduced except in full without the prior written approval of Clean Air Analytical Laboratory management.

A copy of this report and all associated supporting records will be archived and stored for at least 20 years. All samples are archived for a period of one year from date of receipt in a non-temperature controlled facility. All samples are stored in the original container, any digestates or reconstitutions are stored in a adequately sized Nalgene container.

As ammonium follows a nonlinear regression, the laboratory uses the Excel function Linest to calculate the regression constants. The Linest function uses the least squares method to calculate a line that best fits the data. The syntax used for the calculation is as follows: "=LINEST(Known_Yvalues, Known_Xvalues, 1, 1)". The known area counts and the square of the known area counts were both used as the known x values and the known concentrations of each calibration point were used for the known y values. It should be noted that the Linest function must be entered as an array function which is done by highlighting a 3x3 group of cells prior to entering the formula and using Ctrl+Shift+Enter once entered.

Table 3 below shows the average analyte concentration found, the standard deviation, and percent relative standard deviation for each sample fraction. This data does not include any corrections for plant conditions. In addition, no sample concentrations reported were corrected for any blanks.

Table 3: Statistical Description of the Ion Chromatography Results

Sample Fraction	Location	Average Concentration (mg/L)	Standard Deviation of Concentration (mg/L)	Relative Standard Deviation of Concentration (%)
Impinger 1	FCCU Scrub. Stack	4.32	1.28	29.67%
Impinger 2	FCCU Scrub. Stack	0.15	0.03	19.87%

Clean Air Laboratory Services is accredited by NELAC in the following states. Please visit the NELAP website to view our current status and a comprehensive list of our accredited services.

Table 4: Specific NELAC Accreditation and Expiration Date

State	Certificate Number	Expiration Date
Texas	T104704431-11-2	6/30/2012
New Jersey	IL004	6/30/2012
Louisiana	169249	6/30/2012

Analysis Case Narrative

Ion Chromatography Analysis

Customer:	Palatine Engineering Group	Lab Project No:	28745	Analyst:	Eric Ewing
Plant:	Marathon	Customer Reference No:	11265	Received:	7/26/11
Applicable Analytical Method:	U.S. EPA Conditional Test Method 027			Analyte:	Ammonium

The samples were received at a temperature of 4C as directed in US EPA Conditional Test Method 027. It is the laboratory's opinion that the samples should not need refrigeration so long as the pH of the samples are less than 4.5 (the pH of a 0.1N solution of (NH₄)₂SO₄). The pHs of the samples are shown in Table 5 below.

Table 5: Sample pH Data

Sample Identification	Sample ID	pH
DI H ₂ O Blank	28745-32	7.23
0.1N H ₂ SO ₄ Blank	28745-33	1.75
Field Blank	28745-34	1.83
Imp 1 R1	28745-35	2.00
Imp 1 R2	28745-36	1.97
Imp 1 R3	28745-37	1.98
Imp 2 R1	28745-38	1.91
Imp 2 R2	28745-39	1.83
Imp 2 R3	28745-40	1.85

At the request of the customer, the samples collected from the third impinger of each run were not analyzed as the breakthrough from impinger 1 to impinger 2 was less than 10%. Table 6 below shows the breakthrough percentages for each run.

Table 6: Sample Breakthrough

Run Number	mg Ammonium in Impinger 1	mg Ammonium in Impinger 2	Breakthrough (%)
1	1.29	0.04	3.03%
2	1.36	0.02	1.79%
3	2.22	0.02	1.10%

CHROMATOGRAPHIC DATA REDUCTION
Ion Chromatography Analysis

Customer:	Palatine Engineering Group	Lab Project No:	28745	Analyst:	Eric Ewing
Plant:	Marathon	Customer Reference No:	11265	Received:	7/26/11
Applicable Analytical Method:	U.S. EPA Conditional Test Method 027			Analyte:	Ammonium

Stock Standard: 2502.16 mg/L
 Working Stock Conc.: 25.0216 mg/L
 CCV: 0.80 mg/L
 QC: 126.81 mg/L

Analyte:

		Ammonium Standards Calibration Data								
Calibration Point Conc. (mg/L)	Date of Injection	1	2	3	4	5	6	7	8	9
		0.0000	0.1001	0.2502	0.5004	1.0009	1.5013	2.0017	3.0026	5.0043
Cal 1 Trial 1	07/28/2011	0.0000	0.0716	0.1733	0.3299	0.5885	0.8134	1.0403	1.4095	2.0448
Cal 1 Trial 2		0.0000	0.0711	0.1754	0.3288	0.5862	0.8134	1.0393	1.4065	2.0462
Cal 2 Trial 1	07/29/2011			0.1676	0.3309					
Cal 2 Trial 2				0.1679	0.3301					
Cal 3 Trial 1	07/29/2011		0.0739	0.1713	0.3284	0.6000	0.8362	1.0504	1.4168	2.0638
Cal 3 Trial 2			0.0716	0.1716	0.3289	0.6007	0.8333	1.0479	1.4137	2.0717
n		2	4	6	6	4	4	4	4	4
Average		0.0000	0.0721	0.1712	0.3295	0.5939	0.8241	1.0445	1.4116	2.0566
Standard Deviation		0.0000	0.0013	0.0030	0.0010	0.0076	0.0124	0.0055	0.0045	0.0133
%RSD		0.00	1.74	1.77	0.29	1.27	1.50	0.53	0.32	0.64

Quality Control Checks							
Measured Area Counts (Counts)	Area Count Squared (mg/L)	Actual Concentration (mg/L)	Regression Concentration (mg/L)	Difference pt-Line (% Scale)	Is Difference Less Than 2% of Scale?	Difference pt-Line (Relative %)	Is Relative Difference Less Than 10%?
0.0000	0.000	0.000	-0.007	0.14%	Yes	0.00%	Yes
0.0721	0.005	0.100	0.097	0.06%	Yes	2.92%	Yes
0.1712	0.029	0.250	0.249	0.02%	Yes	0.40%	Yes
0.3295	0.109	0.500	0.512	-0.24%	Yes	-2.39%	Yes
0.5939	0.353	1.001	1.008	-0.14%	Yes	-0.68%	Yes
0.8241	0.679	1.501	1.496	0.11%	Yes	0.35%	Yes
1.0445	1.091	2.002	2.013	-0.23%	Yes	-0.57%	Yes
1.4116	1.993	3.003	2.982	0.41%	Yes	0.68%	Yes
2.0566	4.230	5.004	5.011	-0.13%	Yes	-0.13%	Yes
Linest Coefficients							
Value	a	b	c	Is Coefficient of Regression > 0.995? Yes			
Std. Error Values	0.4997	1.4122	-0.0072				
R ²	0.0099	0.0202	0.0075				
	1.0000	0.012					

Stock Solution Standard Mixing Recipe (Cations)

Ion Chromatography Analysis

Customer:	Palatine Engineering Group	Lab Project No:	28745	Analyst:	Eric Ewing
Plant:	Marathon	Customer Reference No:	11265	Received:	7/26/11
Applicable Analytical Method:	U.S. EPA Conditional Test Method 027			Analyte:	Ammonium

Order of Elution

Analyte	1	2	3	4	5	6
Analyte Weight (g/g-mole)	Lithium 6.94	Sodium 22.99	Ammonium 18.05	Potassium 39.1	Magnesium 24.31	Calcium 40.08
Solid Formula	LiCl	NaCl	NH ₄ Cl	KCl	MgCl ₂ ·6H ₂ O	CaCl ₂ ·2H ₂ O
Number of ions/Formula	1	1	1	1	1	1
Formula Weight (g/g-mole)	42.39	58.44	53.49	74.55	203.3	147.02
% Analyte in Solid	16.37%	39.34%	33.74%	52.45%	11.96%	27.26%

Recommended Analyte

Concentration (mg/l)	500	1,200	2,500	2,500	2,500	3,500
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Amount of Solid Required to Achieve the Above Stock Solution Concentration In The Listed Volumetric Flask:

500 ml	1.5270	1.5252	3.7043	2.3833	10.4535	6.4193
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Size of Flask

500 ml

Amount of Solid Used

		3.7075 g			
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Actual Concentration (mg/l)

2502.16

Concentration in the Five Cal Flasks (mg/L)

Stock (1 liter Flask) Solution Concentrations

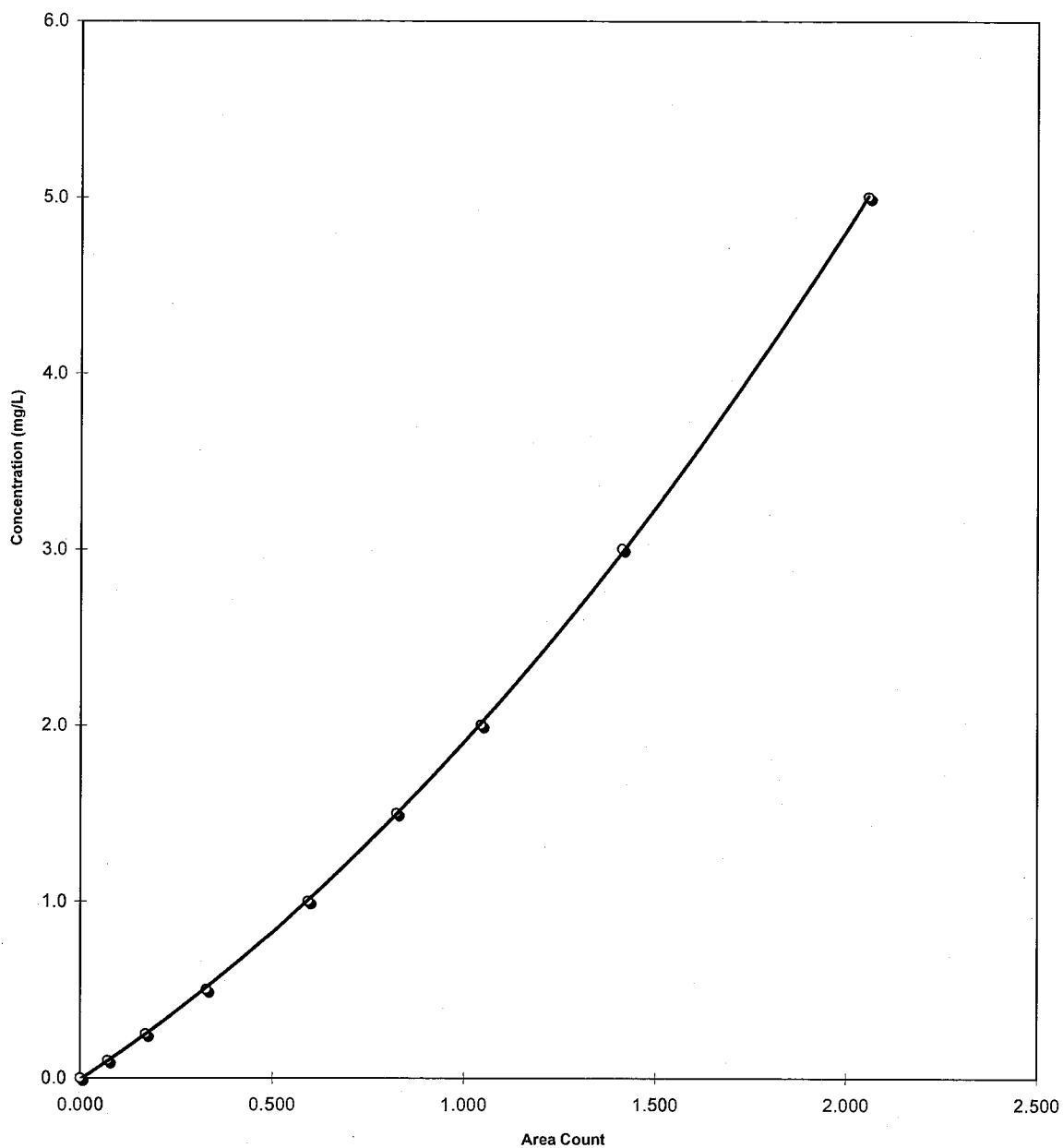
10 ml Original Solution Used 25.0216

Dilution Flask Size	Aliquot	Stock	
500	2	0.1001	1
500	5	0.2502	2
500	10	0.5004	3
250	8	0.8007	CCV
250	10	1.0009	4
500	30	1.5013	5
250	20	2.0017	6
250	30	3.0026	7
100	20	5.0043	8

CHROMATOGRAPHIC DATA REDUCTION
Ion Chromatography Analysis

Customer:	Palatine Engineering Group	Lab Project No:	28745	Analyst:	Eric Ewing
Plant:	Marathon	Customer Reference No:	11265	Received:	7/26/11
Applicable Analytical Method:	U.S. EPA Conditional Test Method 027			Analyte:	Ammonium

Ammonium Calibration Curve



Sample Information

Customer:	Palatine Engineering Group	Lab Project No:	28745	Analyst:	Eric Ewing
Plant:	Marathon	Customer Reference No:	11265	Received:	7/26/11
Applicable Analytical Method:	U.S. EPA Conditional Test Method 027			Analyte:	Ammonium

Sample Identification Number	Sample Location	Run No.	Sample Identification	Sample Recovery Date	Field Tech	Sample Volume (mL)
28745-32	Reagent Blank	RB	DI H2O Blank	7/19/2011	DL	200
28745-33	Reagent Blank	RB	0.1N H2SO4 Blank	7/19/2011	DL	200
28745-34	FCCU Scrub. Stack	FB	Field Blank	7/19/2011	DL	160
28745-35	FCCU Scrub. Stack	1	Imp 1 R1	7/19/2011	DL	410
28745-36	FCCU Scrub. Stack	2	Imp 1 R2	7/19/2011	DL	330
28745-37	FCCU Scrub. Stack	3	Imp 1 R3	7/19/2011	DL	390
28745-38	FCCU Scrub. Stack	1	Imp 2 R1	7/19/2011	DL	230
28745-39	FCCU Scrub. Stack	2	Imp 2 R2	7/19/2011	DL	170
28745-40	FCCU Scrub. Stack	3	Imp 2 R3	7/19/2011	DL	210

CHROMATOGRAPHIC DATA REDUCTION
Ion Chromatography Analysis

Customer:	Palatine Engineering Group	Lab Project No:	28745	Analyst:	Eric Ewing
Plant:	Marathon	Customer Reference No:	11265	Received:	7/26/11
Applicable Analytical Method:	U.S. EPA Conditional Test Method 027				Analyte: Ammonium

MDL=	0.011 mg/L	Average Flow Rate 0.60 mL/min
MRL=	0.053 mg/L	

Sample Location	Sample Identification Number	Sample Identification	Date of Injection	Area Counts Trial 1	Area Counts Trial 2	Area Count Average	DF (Analysis Dilution Factor)	V _{soln} (Total Sample Volume, mL)	C _{reg} (Concentration, mg/L from Reg Curve)	M _{analyte} Total Amount of Analyte (mg)
Reagent Blank	28745-32	DI H2O Blank	07/28/11	0.0000	0.0000	0.0000	1	200.0	<	<0.011
Reagent Blank	28745-33	0.1N H2SO4 Blank	07/28/11	0.0000	0.0000	0.0000	1	200.0	<	<0.011
FCCU Scrub. Stack	28745-34	Field Blank	07/28/11	0.0000	0.0000	0.0000	1	160.0	<	<0.008
FCCU Scrub. Stack	28745-35	Imp 1 R1	07/28/11	1.4658	1.4663	1.4661	1	410.0	3.14	1.29
FCCU Scrub. Stack	28745-36	Imp 1 R2	07/28/11	1.7934	1.7942	1.7938	1	330.0	4.13	1.36
FCCU Scrub. Stack	28745-37	Imp 1 R3	07/29/11	0.6538	0.6598	0.6568	5	390.0	5.68	2.22
FCCU Scrub. Stack	28745-38	Imp 2 R1	07/29/11	0.1238	0.1234	0.1236	1	230.0	0.18	0.04
FCCU Scrub. Stack	28745-39	Imp 2 R2	07/29/11	0.1046	0.1046	0.1046	1	170.0	0.15	0.02
FCCU Scrub. Stack	28745-40	Imp 2 R3	07/29/11	0.0854	0.0853	0.0854	1	210.0	0.12	0.02

CHROMATOGRAPHIC DATA REDUCTION
Ion Chromatography Analysis

Customer:	Palatine Engineering Group	Lab Project No:	28745	Analyst:	Eric Ewing
Plant:	Marathon	Customer Reference No:	11265	Received:	7/26/11
Applicable Analytical Method:	U.S. EPA Conditional Test Method 027			Analyte:	Ammonium

QUALITY CONTROL CHECKS

Sample Location	Sample Identification Number	Sample Identification	Date of Injection	Area Counts Trial 1	Area Counts Trial 2	Area Count Average	Area Count Duplicate Difference	Duplicate Relative Difference (%)	Is Duplicate Difference < 5%?
Reagent Blank	28745-32	DI H2O Blank	07/28/11	0.0000	0.0000	0.0000	na	na	Yes
Reagent Blank	28745-33	0.1N H2SO4 Blank	07/28/11	0.0000	0.0000	0.0000	na	na	Yes
FCCU Scrub. Stack	28745-34	Field Blank	07/28/11	0.0000	0.0000	0.0000	na	na	Yes
FCCU Scrub. Stack	28745-35	Imp 1 R1	07/28/11	1.4658	1.4663	1.4661	0.0005	0.0%	Yes
FCCU Scrub. Stack	28745-36	Imp 1 R2	07/28/11	1.7934	1.7942	1.7938	0.0008	0.0%	Yes
FCCU Scrub. Stack	28745-37	Imp 1 R3	07/29/11	0.6538	0.6598	0.6568	0.0060	0.9%	Yes
FCCU Scrub. Stack	28745-38	Imp 2 R1	07/29/11	0.1238	0.1234	0.1236	0.0004	0.3%	Yes
FCCU Scrub. Stack	28745-39	Imp 2 R2	07/29/11	0.1046	0.1046	0.1046	0.0000	0.0%	Yes
FCCU Scrub. Stack	28745-40	Imp 2 R3	07/29/11	0.0854	0.0853	0.0854	0.0001	0.1%	Yes

CHROMATOGRAPHIC DATA REDUCTION

Customer:	Palatine Engineering Group	Lab Project No:	28745	Analyst:	Eric Ewing
Plant:	Marathon	Customer Reference No:	11265	Received:	7/26/11
Applicable Analytical Method:	U.S. EPA Conditional Test Method 027			Analyte:	Ammonium

CCV Concentration: 0.80 mg/L
 QC Concentration: 126.81 mg/L

MDL=	0.011 mg/L
MRL=	0.053 mg/L

QC Dilution Factor
100

QUALITY CONTROL CHECKS (CONT)

Sample Location	Sample Identification Number	Sample Identification	Date of Injection	Area Counts Trial 1	Area Counts Trial 2	Area Count Average	Area Count Duplicate Difference	Duplicate Relative Difference (%)	C _{Reg} (Concentration, mg/L from Reg Curve)	Percent Difference from Actual Value (%)	Is Percent Difference from Actual Value <10%?
CleanAir	28745-00	CCB	07/28/11	0.0000	0.0000	0.0000	na	na	<		
CleanAir	28745-990	CCV	07/28/11	0.4779	0.4787	0.4783	0.0008	0.2%	0.78	2.26%	Yes
CleanAir	28745-991	QC	07/29/11	0.7036	0.7038	0.7037	0.0002	0.0%	123.41	2.68%	Yes
CleanAir	28745-00	CCB	07/29/11	0.0000	0.0000	0.0000	na	na	<		
CleanAir	28745-992	CCV	07/29/11	0.4854	0.4883	0.4869	0.0029	0.6%	0.80	0.23%	Yes

Sample Duplicate Analysis Area Count Check

									Precision	Is Precision within ±5% Tolerance?
FCCU Scrub. Stack	28745-37	Imp 1 R3	07/29/11	0.6538	0.6598	0.6568	0.0060	0.9%		
FCCU Scrub. Stack	28745-37	Imp 1 R3	07/29/11	0.6798	0.6799	0.6799	0.0001	0.0%	3.4%	Yes

Matrix Spike Recoveries

									Precision	Spike Recovery	Is Spike Recovery Between 90-110%
Matrix Spike	28745-38	Imp 2 R1	07/29/11	1.1886	1.1992	1.1939	0.0106	0.9%		92.3%	Yes
Matrix Spike	28745-38	Imp 2 R1	07/29/11	1.1875	1.1906	1.1891	0.0031	0.3%	0.4%	91.8%	Yes

Determination of Method Detection Limit Ion Chromatography Analysis

Customer:	Palatine Engineering Group	Lab Project No:	28745	Analyst:	Eric Ewing
Plant:	Marathon	Customer Reference No:	11265	Received:	7/26/11
Applicable Analytical Method:	U.S. EPA Conditional Test Method 027			Analyte:	Ammonium

MDL Reference 40 CFR 136, Appendix B
CleanAir Reference SOP EPA5-11

Matrix Deionized Water

Analyte Ammonium
Spike Concentration 0.1001 mg/L
X-squared Coefficient 0.4997
X Coefficient 1.4122
Intercept -0.0072
Coefficient of Corr. 0.0000

Non-Iterative Study

No. of Replicates	t _(n-1,0.99)
7	3.143
8	2.998
9	2.896
10	2.821
11	2.764
16	2.602
21	2.528

Spike Aliquots	Spike Result Area Count	Measured Concentration (mg/L)
1	0.0695	0.093
2	0.0674	0.090
3	0.0716	0.097
4	0.0711	0.096
5	0.0678	0.091
6	0.0676	0.091
7	0.0739	0.100
8	0.0716	0.097

Average Spike Concentration: 0.094
Recovery (R_s): 94.14%
Standard Deviation (S_d): 0.00350
RMS Deviation: 3.7%
t_(n-1,0.99): 2.998
MDL: 0.011
MRL: 0.053

Is the spike level higher than the MDL? Yes
Is the spike level less than ten times the MDL? Yes
Is the Avg Recovery between 90% < R_s < 110%? Yes

Sample Calculations

Ion Chromatography Analysis

Customer: Palatine Engineering Group	Lab Project No: 28745	Analyst: Eric Ewing
Plant: Marathon	Customer Reference No: 11265	Received: 7/26/11
Applicable Analytical Method: U.S. EPA Conditional Test Method 027	Analyte: Ammonium	

Calibration Point No: 3
Sample No: 28745-37
Sample Location: FCCU Scrub. Stack

1. Difference between duplicate injections for pre-test calibration (Pre Cal 1).

$$\Delta_{Injection} = |Area_{Trial\ 2} - Area_{Trial\ 1}|$$

Where:

$\Delta_{Injection}$ = Area count difference between duplicate injections

$Area_{Trial2}$ = Area count for injection Trial 2

$Area_{Trial1}$ = Area count for injection Trial 1

$\Delta_{Injection}$ = 0.0021

$Area_{Trial2}$ = 0.1754

$Area_{Trial1}$ = 0.1733

2. Average area count value for duplicate injections for pre-test calibration (Pre Cal 1).

$$Avg_{PreInj} = \frac{(Area_{Trial1} + Area_{Trial2})}{2}$$

Where:

Avg_{PreInj} = Average of duplicate injection area counts

$Area_{Trial2}$ = Area count for injection Trial 2

$Area_{Trial1}$ = Area count for injection Trial 1

2 = Constant (number of values)

Avg_{inj} = 0.1744

$Area_{Trial2}$ = 0.1754

$Area_{Trial1}$ = 0.1733

Sample Calculations

Ion Chromatography Analysis

Customer: Palatine Engineering Group	Lab Project No: 28745	Analyst: Eric Ewing
Plant: Marathon	Customer Reference No: 11265	Received: 7/26/11
Applicable Analytical Method: U.S. EPA Conditional Test Method 027	Analyte: Ammonium	

Calibration Point No: 3
Sample No: 28745-37
Sample Location: FCCU Scrub. Stack

3. Difference between individual injection and average area count for pre-test calibration.

$$\Delta_{PreMean\%} = \frac{|Area_{Trial2} - Avg_{PreInj}|}{Avg_{PreInj}} 100$$

Where:

$\Delta_{PreMean\%}$ = Difference between individual injection and average area count (%).

Avg_{PreInj} = Average of duplicate injection area counts

$Area_{Trial2}$ = Area count for injection Trial 2

100 = Constant (conversion factor for percentage)

$\Delta_{PreMean\%}$ = 0.5986

Avg_{PreInj} = 0.1744

$Area_{Trial2}$ = 0.1754

Note: EPA Method 26 requires $\Delta_{PreMean\%}$ to be less than 5%.

Sample Calculations

Ion Chromatography Analysis

Customer: Palatine Engineering Group	Lab Project No: 28745	Analyst: Eric Ewing
Plant: Marathon	Customer Reference No: 11265	Received: 7/26/11
Applicable Analytical Method: U.S. EPA Conditional Test Method 027	Analyte: Ammonium	

Calibration Point No: 3
Sample No: 28745-37
Sample Location: FCCU Scrub. Stack

4. Least-squares regression of calibration curve performed using MS Excel Linest Function.

Linest calculates the statistics for a curve using the "least-squares" method for a polynomial series. Ammonium ions fit a quadratic equation well. A quadratic equation is a polynomial equation of the second degree. The general form is:

$$y = ax^2 + bx + c$$

where x represents a variable, and a, b and c, constants, with $a \neq 0$.

For this project, the following data were used as input for the Linest Function:

Measured Area Counts (Counts)	Area Count Squared (mg/L)	Actual Concentration (mg/L)
0.0000	0.0000	0.0000
0.0721	0.0052	0.1001
0.1712	0.0293	0.2502
0.3295	0.1086	0.5004
0.5939	0.3527	1.0009
0.8241	0.6791	1.5013
1.0445	1.0909	2.0017
1.4116	1.9927	3.0026
2.0566	4.2297	5.0043

The Linest Function then generated the following data as an output:

Linest Coefficients	a	b	c
Value	0.49974	1.41223	-0.00718
Std. Error Values	0.0099	0.0202	0.0075
	<u>Value</u>	<u>Std. Error Value</u>	
R ²	0.99996	0.0120	

Sample Calculations

Ion Chromatography Analysis

Customer: Palatine Engineering Group	Lab Project No: 28745	Analyst: Eric Ewing
Plant: Marathon	Customer Reference No: 11265	Received: 7/26/11
Applicable Analytical Method: U.S. EPA Conditional Test Method 027	Analyte: Ammonium	

Calibration Point No: 3
Sample No: 28745-37
Sample Location: FCCU Scrub. Stack

5. Determination of average sample area counts from duplicate injections.

$$Avg_{Sample} = \frac{(Area_{Trial1} + Area_{Trial2})}{2}$$

Where:

Avg_{Sample} = Average of duplicate injection area counts
 $Area_{Trial2}$ = Area count for injection Trial 2
 $Area_{Trial1}$ = Area count for injection Trial 1
2 = Constant (number of injections)

Avg_{Inj} = 0.6568
 $Area_{Trial2}$ = 0.6598
 $Area_{Trial1}$ = 0.6538

6. Difference between duplicate injections for the sample.

$$\Delta_{Injection} = |Area_{Trial2} - Area_{Trial1}|$$

Where:

$\Delta_{Injection}$ = Area count difference between duplicate injections
 $Area_{Trial2}$ = Area count for injection Trial 2
 $Area_{Trial1}$ = Area count for injection Trial 1

$\Delta_{Injection}$ = 0.0060
 $Area_{Trial2}$ = 0.6598
 $Area_{Trial1}$ = 0.6538

Sample Calculations

Ion Chromatography Analysis

Customer: Palatine Engineering Group	Lab Project No: 28745	Analyst: Eric Ewing
Plant: Marathon	Customer Reference No: 11265	Received: 7/26/11
Applicable Analytical Method: U.S. EPA Conditional Test Method 027	Analyte: Ammonium	

Calibration Point No: 3
Sample No: 28745-37
Sample Location: FCCU Scrub. Stack

7. Difference between individual injection and average area count for the sample.

$$\Delta_{Injection} = \frac{|Area_{Trial2} - Avg_{Inj}|}{Avg_{Inj}} 100$$

Where:

$\Delta_{Injection}$ = Difference between individual injection and average area count (%).
 Avg_{Inj} = Average of duplicate injection area counts
 $Area_{Trial2}$ = Area count for injection Trial 2
100 = Constant (conversion factor for percentage)

$\Delta_{Injection}$ = 0.5%
 Avg_{Inj} = 0.6568
 $Area_{Trial2}$ = 0.6598

Note: EPA Method 26 requires $\Delta_{Injection}$ to be less than 5%.

8. Determination of sample concentration from least-squares regression curve (mg/L).

$$C_{Reg} = DF \left[a(Avg_{Inj})^2 + b(Avg_{Inj}) + c \right]$$

Where:

C_{Reg} = Sample concentration determined using the regression curve (mg/L)
DF = Sample dilution factor
 Avg_{Inj} = Average of duplicate injection area counts.
a = Coefficient of the x-squared term of the regression curve.
b = Coefficient of the x term of the regression curve.
c = Y-intercept of the regression curve

C_{Reg} = 5.68
DF = 5
 Avg_{Inj} = 0.6568
a = 0.4997
b = 1.4122
c = -0.0072

Sample Calculations

Ion Chromatography Analysis

Customer: Palatine Engineering Group	Lab Project No: 28745	Analyst: Eric Ewing
Plant: Marathon	Customer Reference No: 11265	Received: 7/26/11
Applicable Analytical Method: U.S. EPA Conditional Test Method 027	Analyte: Ammonium	

Calibration Point No: 3
Sample No: 28745-37
Sample Location: FCCU Scrub. Stack

9. Determination of total amount of analyte in sample (total mg).

$$M_{Analyte} = \frac{(C_{Reg})(V_{Soln})}{1000}$$

Where:

$M_{Analyte}$ = Amount of analyte in sample (total mg)
 C_{Reg} = Sample concentration determined using the response factor (mg/L)
 V_{Soln} = Sample volume (ml)
1000 = Conversion constant (ml to L)

$M_{Analyte}$ = 2.22
 C_{Reg} = 5.68
 V_{Soln} = 390.0

10. Determination of Detection Limits.

10a. Determination of average spike result.

$$AvgM_{f-i} = \frac{\sum_{i=1}^n M_{f-i}}{n}$$

Where:

$AvgM_{f-i}$ = Average of spike result (mg/L)
 M_{f-i} = Net results recorded for each iteration (mg/L)
n = Number of iterations.
i = Placeholder for iteration.

$AvgM_{f-i}$	=	0.094			
M_{f-1}	=	0.093	M_{f-5}	=	0.091
M_{f-2}	=	0.090	M_{f-6}	=	0.091
M_{f-3}	=	0.097	M_{f-7}	=	0.100
M_{f-4}	=	0.096	M_{f-8}	=	0.097
n	=	8			

Sample Calculations

Ion Chromatography Analysis

Customer: Palatine Engineering Group	Lab Project No: 28745	Analyst: Eric Ewing
Plant: Marathon	Customer Reference No: 11265	Received: 7/26/11
Applicable Analytical Method: U.S. EPA Conditional Test Method 027	Analyte: Ammonium	

Calibration Point No: 3
Sample No: 28745-37
Sample Location: FCCU Scrub. Stack

10b. Determination of standard deviation of spike result.

$$\sigma_{f-i} = \sqrt{\frac{\sum_{i=1}^n (M_{f-i} - \text{Avg}M_{f-i})^2}{(n-1)}}$$

Where:

σ_{f-i} = Standard deviation of spike result.
 $\text{Avg}M_{f-i}$ = Average spike result (mg/L)
 M_{f-i} = Concentration recorded for each iteration (mg/L)
 n = Number of iterations.
 i = Placeholder for iteration.

σ_{f-i}	=	0.0035		
$\text{Avg}M_{f-i}$	=	0.094		
M_{f-1}	=	0.093	M_{f-5}	= 0.091
M_{f-2}	=	0.090	M_{f-6}	= 0.091
M_{f-3}	=	0.097	M_{f-7}	= 0.100
M_{f-4}	=	0.096	M_{f-8}	= 0.097
n	=	8		

10c. Determination of variance of spike result.

$$V_{f-i} = (\sigma_{f-i})^2$$

Where:

V_{f-i} = Variance of spike result.
 σ_{f-i} = Standard deviation of spike result.

V_{f-i}	=	1.23E-05
σ_{f-i}	=	0.0035

Sample Calculations

Ion Chromatography Analysis

Customer: Palatine Engineering Group	Lab Project No: 28745	Analyst: Eric Ewing
Plant: Marathon	Customer Reference No: 11265	Received: 7/26/11
Applicable Analytical Method: U.S. EPA Conditional Test Method 027	Analyte: Ammonium	

Calibration Point No: 3
Sample No: 28745-37
Sample Location: FCCU Scrub. Stack

10d. Determination of RMS deviation of spike result.

$$RMS_{f-i} = 100 \frac{\sigma_{f-i}}{AvgM_{f-i}}$$

Where:

RMS_{f-i} = RMS deviation of spike results (%).
 σ_{f-i} = Standard deviation of spike result.
 $AvgM_{f-i}$ = Average spike result (mg/L)
100 = Conversion constant (fraction to percent)

RMS_{f-i} = 0.0372
 σ_{f-i} = 0.0035
 $AvgM_{f-i}$ = 0.0942

10e. Determination of average spike recovery.

$$R_f = 100 \frac{AvgM_{f-i}}{RA}$$

Where:

R_f = Average spike recovery (%)
 $AvgM_{f-i}$ = Average spike result (mg/L)
RA = Spike concentration added (mg/L)
100 = Conversion constant (fraction to percent)

R_f = 94.14%
 $AvgM_{f-i}$ = 0.09422
RA = 0.10009

Sample Calculations

Ion Chromatography Analysis

Customer: Palatine Engineering Group	Lab Project No: 28745	Analyst: Eric Ewing
Plant: Marathon	Customer Reference No: 11265	Received: 7/26/11
Applicable Analytical Method: U.S. EPA Conditional Test Method 027	Analyte: Ammonium	

Calibration Point No: 3
Sample No: 28745-37
Sample Location: FCCU Scrub. Stack

10f. Determination of $t_{(n-1, 0.99)}$.

Value taken from the following Table:

n	$t_{(n-1, 0.99)}$
7	3.143
8	2.998
9	2.896
10	2.821
11	2.764
16	2.602
21	2.528

Where:

$t_{(n-1, 0.99)}$ = Students' t value appropriate for a 99% confidence level and a standard deviation estimate with n-1 degrees of freedom.

n = Number of iterations.

$t_{(n-1, 0.99)}$ = 2.998

n = 8

10g. Determination of Method Detection Limit (MDL).

$$MDL = \sigma_{f-i} t_{(n-1, 0.99)}$$

Where:

MDL = Method detection limit (mg/L)

$t_{(n-1, 0.99)}$ = Students' t value appropriate for a 99% confidence level and a standard deviation estimate with n-1 degrees of freedom.

σ_{f-i} = Standard deviation of spike result.

MDL = 0.011

$t_{(n-1, 0.99)}$ = 2.998

σ_{f-i} = 0.0035

Sample Calculations
Ion Chromatography Analysis

Customer: Palatine Engineering Group	Lab Project No: 28745	Analyst: Eric Ewing
Plant: Marathon	Customer Reference No: 11265	Received: 7/26/11
Applicable Analytical Method: U.S. EPA Conditional Test Method 027	Analyte: Ammonium	

Calibration Point No: 3
Sample No: 28745-37
Sample Location: FCCU Scrub. Stack

10h. Determination of Method Reporting Limit (MRL).

$$MRL = 5(MDL)$$

Where:

MRL = Method reporting limit (mg/L)

MDL = Method detection Limit (mg/L)

5 = Constant

MRL = 0.053

MDL = 0.011

AS40 Log Sheet

Date Received: 12/22/11
Shipping Person: K.O. Williams

Analyte(s): MTA

Customer: 66
Plant: Washington
Customer Project No: 11265
Lab Project No: 28745
Date: 7/28/11
Analyst: Eric Ewing

Serial Dilution Data

Inj / Vial: 10 3

Inj Mode: Prop / Const

Inj Type: Loop Conc

Cartridge ID: 1C

Pipet Serial No.	Pipet Size	Flask Serial No.	Flask Size
9402	2	0480	500
2777	5	0412	500
4823	10	0257	500
4823	10	1037	250

Cartridge ID: 2C

Pipet Serial No.	Pipet Size	Flask Serial No.	Flask Size
4331	30	0710	500
9515	20	0206	250
4331	30	4467	250
7417	50	4268	250
5430	8	4296	250

Cartridge ID: 3C

Pipet Serial No.	Pipet Size	Flask Serial No.	Flask Size

Pos	Sample #	Identification	Volume	Dilution Ratio
1	Blank			
2	Cal 01			
3	Cal 01			
4	Cal 02			
5	Cal 03			
6	Cal 04			

Pos	Sample #	Identification	Volume	Dilution Ratio
1	Cal 05			
2	Cal 06			
3	Cal 07			
4	Cal 08			
5	Blank			
6	Cal			

Pos	Sample #	Identification	Volume	Dilution Ratio
1	Blank			
2	-32	DE H2O Blank	200	1
3	-33	0.1 M H2SO4 Blank	200	1
4	-34	Flow Temp Check Field Blank	160	1
5	-35	Flow Temp Check Field 1	410	1
6	-36	Flow Temp Check Field 2	380	1

Analyst Signature

Eric Ewing

AS40 Log Sheet

Date Received: _____
Shipping Person: _____

Customer: 56 Analyte(s): NH₄
Plant: Wheaton
Customer Project No: 4265
Lab Project No: 25745
Date: 7/28/11
Analyst: Eric Boring

Inj Type: Loop Conc Inj Mode: Prop Const Inj / Vial: 1 2 3

Cartridge ID: 4C

Serial Dilution Data

Pipet Serial No.	Pipet Size	Flask Serial No.	Flask Size
4832	10	4874	1000

Pos	Sample #	Identification	Volume	Dilution Ratio
1	-37	ECU End Steel Day 1 R3	370	1
2	-38	ECU End Steel Day 2 R1	380	1
3	-39	" " " R2	170	1
4	-40	" " " R3	20	1
5	Blank			
6	QC			100

Cartridge ID: 5C

Pipet Serial No.	Pipet Size	Flask Serial No.	Flask Size

Pos	Sample #	Identification	Volume	Dilution Ratio
1	Blank			
2	Blank			
3	Blank			
4	Blank			
5	Blank			
6	Blank			

Cartridge ID: 1C

Pipet Serial No.	Pipet Size	Flask Serial No.	Flask Size

Pos	Sample #	Identification	Volume	Dilution Ratio
1	Blank			
2	Blank			
3	Blank			
4	Blank			
5	Blank			
6	-37			5

Analyst Signature

Eric Boring

AS40 Log Sheet

Date Received:
 Shipping Person:

Customer: 66 Analyte(s): NH4
 Plant: Parathon
 Customer Project No: 11665
 Lab Project No: 28745
 Date: 7/29/11
 Analyst: Eric Switz

Inj Type: Loop / Conc Inj Mode: Prop / Crst Inj / Vial: 12/3

Serial Dilution Data

Cartridge ID: 2C

Pos	Sample #	Identification	Volume	Dilution Ratio
1	<u>37</u>			<u>5</u>
2	<u>Blank</u>			
3		<u>CCV</u>		
4	<u>Blank</u>			
5	<u>38</u>	<u>Matrix Spike</u>		
6	<u>38</u>	<u>Matrix Spike</u>		

Cartridge ID: 3C

Pos	Sample #	Identification	Volume	Dilution Ratio
1	<u>Blank</u>			
2		<u>Cal 01</u>		
3		<u>Cal 01</u>		
4		<u>Cal 02</u>		
5		<u>Cal 03</u>		
6		<u>Cal 04</u>		

Cartridge ID: 4C

Pos	Sample #	Identification	Volume	Dilution Ratio
1		<u>Cal 05</u>		
2		<u>Cal 06</u>		
3		<u>Cal 07</u>		
4		<u>Cal 08</u>		
5	<u>Blank</u>			
6				

Analyst Signature Eric Switz

Lab Project No.: 28745

Date Received: 7/26/2011

CleanAir No.: 11265

66

Customer : 66

Contact : Kevin O'halloren

Phone :

Fax :

Email : kohalloren@cleanair.com

Requested Analysis

Due	Analyst	Status	Sample Type		Container	Method
8/9/2011	MT	In Queue	1-3	8.26 GF Filter	Petri Dish	EPA Method 5
8/9/2011	MT	In Queue	1-3	8.26 GF Filter	Petri Dish	US EPA Method 5B
8/9/2011	MT	In Queue	4-7	F 1/2 Acetone	Glass Jars	EPA Method 5
8/9/2011	MT	In Queue	4-7	F 1/2 Acetone	Glass Jars	US EPA Method 5B
8/9/2011	MT	In Queue	8-8	F 1/2 Acetone	amber glass jar	US EPA Method 202
8/9/2011	MT	In Queue	9-13	B 1/2 H2O	amber glass jar	US EPA Method 202
8/9/2011	MT	In Queue	14-18	Back half rinse	amber glass jar	US EPA Method 202
8/9/2011	MT	In Queue	19-22	Filter	Petri Dish	US EPA Method 202
8/9/2011	EE	In Queue	23-27	Imp C&R	Nalgene	EPA Method 26A Fluoride, Chloride
8/9/2011	EE	In Queue	28-31	Imp C&R	Nalgene	EPA Method 26A Chloride
8/9/2011	EE	In Queue	32-40	Imp C&R	Nalgene	EPA CTM-027
8/9/2011	EE	In Queue	41-44	Imp C&R	Nalgene	Archive
8/9/2011	EE	In Queue	45-47	Tedlar Bags	Tedlar Bag	EPA Method 18 Methane, Ethane
8/9/2011	EE	In Queue	51-51	F 1/2 Acetone	Glass Jars	Archive
8/9/2011	EE	In Queue	48-50	Tedlar Bags	Tedlar Bag	Archive

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Metals Laboratory Data - Data Entry Sheet

Notes:

All results are reported in micrograms.

"<" indicates result below reported minimum detection limit.

	Detection Limit		Blank		Run 1		Run 2		Run 3	
	Front Half	Back Half	Front Half	Back Half	Front Half	Back Half	Front Half	Back Half	Front Half	Back Half
<input type="checkbox"/> DRAFT LAB DATA										
Antimony	0.2000	0.1000	0.2260	<0.1000	16.7000	<0.1000	14.2000	<0.1000	14.1000	<0.1000
Arsenic	1.0000	0.2000	<1.0000	<0.2000	1.1900	<0.2000	<1.0000	<0.2000	1.1300	<0.2000
Beryllium	0.2000	0.1000	<0.2000	<0.1000	<0.2000	<0.1000	<0.2000	<0.1000	<0.2000	<0.1000
Cadmium	0.1000	0.0500	<0.1000	<0.0500	0.1800	<0.0500	<0.1000	<0.0500	<0.1000	0.0616
Chromium	1.0000	0.1500	1.3800	0.2760	11.0000	0.3520	9.3600	0.9970	8.7900	0.3850
Cobalt	0.2000	0.1000	<0.2000	<0.1000	1.4000	<0.1000	1.2200	<0.1000	1.2500	<0.1000
Lead	0.5000	0.0500	0.5780	0.0899	11.1000	0.4230	7.4400	0.5150	5.6200	0.2460
Manganese	0.5000	0.1500	0.9640	<0.1500	2.5900	0.2730	2.2800	44.1000	2.1200	0.3030
Nickel	0.2000	0.1000	0.6950	<0.1000	33.2000	0.4160	31.5000	0.7300	29.1000	0.3480
Selenium	2.0000	1.0000	<2.0000	<1.0000	4.1100	<1.0000	3.6600	<1.0000	3.9500	<1.0000

Note - for values in bold:

1. A detectable amount of the compound was measured in the reagent blank.
2. The amount measured in the sample is less than 5 x the amount measured in the reagent blank.

Marathon Petroleum Company
Clean Air Project No: 11265
FCCU Scrubber Stack

USEPA Method 29 Antimony (Sb) Laboratory Parameters

Run No.		1	2	3
Date (2011)		Jul 19	Jul 19	Jul 19
Start Time (approx.)		07:42	11:23	15:17
Stop Time (approx.)		10:52	14:37	18:30
Front Half Analysis				
m _{F-DL}	Front half detection limit (µg)	0.2000	0.2000	0.2000
m _{FS}	Matter collected in front half sample (µg)	16.7000	14.2000	14.1000
m _{FB}	Matter collected in front half blank (µg)	0.2260	0.2260	0.2260
m _{FB-allow}	Allowable front half blank correction (µg)	0.2260	0.2260	0.2260
m _F	Front half corrected for allowable blank (µg)	16.4740	13.9740	13.8740
Back Half Analysis				
m _{B-DL}	Back half detection limit (µg)	0.1000	0.1000	0.1000
m _{BS}	Matter collected in back half sample (µg)	<0.1000	<0.1000	<0.1000
m _{BB}	Matter collected in back half blank (µg)	<0.1000	<0.1000	<0.1000
m _{BB-allow}	Allowable back half blank correction (µg)	0.0000	0.0000	0.0000
m _B	Back half corrected for allowable blank (µg)	<0.1000	<0.1000	<0.1000
m _h	Total matter corrected for allowable blanks (µg)	<16.5740	<14.0740	<13.9740

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Marathon Petroleum Company
Clean Air Project No: 11265
FCCU Scrubber Stack

USEPA Method 29 Arsenic (As) Laboratory Parameters

Run No.		1	2	3
Date (2011)		Jul 19	Jul 19	Jul 19
Start Time (approx.)		07:42	11:23	15:17
Stop Time (approx.)		10:52	14:37	18:30
Front Half Analysis				
m _{F-DL}	Front half detection limit (µg)	1.0000	1.0000	1.0000
m _{FS}	Matter collected in front half sample (µg)	1.1900	<1.0000	1.1300
m _{FB}	Matter collected in front half blank (µg)	<1.0000	<1.0000	<1.0000
m _{FB-allow}	Allowable front half blank correction (µg)	0.0000	0.0000	0.0000
m _F	Front half corrected for allowable blank (µg)	1.1900	<1.0000	1.1300
Back Half Analysis				
m _{B-DL}	Back half detection limit (µg)	0.2000	0.2000	0.2000
m _{BS}	Matter collected in back half sample (µg)	<0.2000	<0.2000	<0.2000
m _{BB}	Matter collected in back half blank (µg)	<0.2000	<0.2000	<0.2000
m _{BB-allow}	Allowable back half blank correction (µg)	0.0000	0.0000	0.0000
m _B	Back half corrected for allowable blank (µg)	<0.2000	<0.2000	<0.2000
m _n	Total matter corrected for allowable blanks (µg)	<1.3900	<1.2000	<1.3300

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Marathon Petroleum Company
Clean Air Project No: 11265
FCCU Scrubber Stack

USEPA Method 29 Beryllium (Be) Laboratory Parameters

Run No.	1	2	3
Date (2011)	Jul 19	Jul 19	Jul 19
Start Time (approx.)	07:42	11:23	15:17
Stop Time (approx.)	10:52	14:37	18:30
Front Half Analysis			
m _{F-DL} Front half detection limit (µg)	0.2000	0.2000	0.2000
m _{FS} Matter collected in front half sample (µg)	<0.2000	<0.2000	<0.2000
m _{FB} Matter collected in front half blank (µg)	<0.2000	<0.2000	<0.2000
m _{FB-allow} Allowable front half blank correction (µg)	0.0000	0.0000	0.0000
m _F Front half corrected for allowable blank (µg)	<0.2000	<0.2000	<0.2000
Back Half Analysis			
m _{B-DL} Back half detection limit (µg)	0.1000	0.1000	0.1000
m _{BS} Matter collected in back half sample (µg)	<0.1000	<0.1000	<0.1000
m _{BB} Matter collected in back half blank (µg)	<0.1000	<0.1000	<0.1000
m _{BB-allow} Allowable back half blank correction (µg)	0.0000	0.0000	0.0000
m _B Back half corrected for allowable blank (µg)	<0.1000	<0.1000	<0.1000
m _n Total matter corrected for allowable blanks (µg)	<0.3000	<0.3000	<0.3000

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Marathon Petroleum Company
Clean Air Project No: 11265
FCCU Scrubber Stack

USEPA Method 29 Cadmium (Cd) Laboratory Parameters

Run No.	1	2	3
Date (2011)	Jul 19	Jul 19	Jul 19
Start Time (approx.)	07:42	11:23	15:17
Stop Time (approx.)	10:52	14:37	18:30
Front Half Analysis			
m _{F-DL} Front half detection limit (µg)	0.1000	0.1000	0.1000
m _{FS} Matter collected in front half sample (µg)	0.1800	<0.1000	<0.1000
m _{FB} Matter collected in front half blank (µg)	<0.1000	<0.1000	<0.1000
m _{FB-allow} Allowable front half blank correction (µg)	0.0000	0.0000	0.0000
m _F Front half corrected for allowable blank (µg)	0.1800	<0.1000	<0.1000
Back Half Analysis			
m _{B-DL} Back half detection limit (µg)	0.0500	0.0500	0.0500
m _{BS} Matter collected in back half sample (µg)	<0.0500	<0.0500	0.0616
m _{BB} Matter collected in back half blank (µg)	<0.0500	<0.0500	<0.0500
m _{BB-allow} Allowable back half blank correction (µg)	0.0000	0.0000	0.0000
m _B Back half corrected for allowable blank (µg)	<0.0500	<0.0500	0.0616
m _n Total matter corrected for allowable blanks (µg)	<0.2300	<0.1500	<0.1616

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Marathon Petroleum Company
Clean Air Project No: 11265
FCCU Scrubber Stack

USEPA Method 29 Chromium (Cr) Laboratory Parameters

Run No.	1	2	3
Date (2011)	Jul 19	Jul 19	Jul 19
Start Time (approx.)	07:42	11:23	15:17
Stop Time (approx.)	10:52	14:37	18:30
Front Half Analysis			
m _{F-DL} Front half detection limit (µg)	1.0000	1.0000	1.0000
m _{FS} Matter collected in front half sample (µg)	11.0000	9.3600	8.7900
m _{FB} Matter collected in front half blank (µg)	1.3800	1.3800	1.3800
m _{FB-allow} Allowable front half blank correction (µg)	1.3800	1.3800	1.3800
m _F Front half corrected for allowable blank (µg)	9.6200	7.9800	7.4100
Back Half Analysis			
m _{B-DL} Back half detection limit (µg)	0.1500	0.1500	0.1500
m _{BS} Matter collected in back half sample (µg)	0.3520	0.9970	0.3850
m _{BB} Matter collected in back half blank (µg)	0.2760	0.2760	0.2760
m _{BB-allow} Allowable back half blank correction (µg)	0.2760	0.2760	0.2760
m _B Back half corrected for allowable blank (µg)	<0.1500	0.7210	<0.1500
m _n Total matter corrected for allowable blanks (µg)	<9.7700	8.7010	<7.5600

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Marathon Petroleum Company
Clean Air Project No: 11265
FCCU Scrubber Stack

USEPA Method 29 Cobalt (Co) Laboratory Parameters

Run No.		1	2	3
Date (2011)		Jul 19	Jul 19	Jul 19
Start Time (approx.)		07:42	11:23	15:17
Stop Time (approx.)		10:52	14:37	18:30
Front Half Analysis				
m_{F-DL}	Front half detection limit (μg)	0.2000	0.2000	0.2000
m_{FS}	Matter collected in front half sample (μg)	1.4000	1.2200	1.2500
m_{FB}	Matter collected in front half blank (μg)	<0.2000	<0.2000	<0.2000
$m_{FB-allow}$	Allowable front half blank correction (μg)	0.0000	0.0000	0.0000
m_F	Front half corrected for allowable blank (μg)	1.4000	1.2200	1.2500
Back Half Analysis				
m_{B-DL}	Back half detection limit (μg)	0.1000	0.1000	0.1000
m_{BS}	Matter collected in back half sample (μg)	<0.1000	<0.1000	<0.1000
m_{BB}	Matter collected in back half blank (μg)	<0.1000	<0.1000	<0.1000
$m_{BB-allow}$	Allowable back half blank correction (μg)	0.0000	0.0000	0.0000
m_B	Back half corrected for allowable blank (μg)	<0.1000	<0.1000	<0.1000
m_n	Total matter corrected for allowable blanks (μg)	<1.5000	<1.3200	<1.3500

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Marathon Petroleum Company
Clean Air Project No: 11265
FCCU Scrubber Stack

USEPA Method 29 Lead (Pb) Laboratory Parameters

Run No.	1	2	3
Date (2011)	Jul 19	Jul 19	Jul 19
Start Time (approx.)	07:42	11:23	15:17
Stop Time (approx.)	10:52	14:37	18:30
Front Half Analysis			
m_{F-DL} Front half detection limit (μg)	0.5000	0.5000	0.5000
m_{FS} Matter collected in front half sample (μg)	11.1000	7.4400	5.6200
m_{FB} Matter collected in front half blank (μg)	0.5780	0.5780	0.5780
$m_{FB-allow}$ Allowable front half blank correction (μg)	0.5780	0.5780	0.5780
m_F Front half corrected for allowable blank (μg)	10.5220	6.8620	5.0420
Back Half Analysis			
m_{B-DL} Back half detection limit (μg)	0.0500	0.0500	0.0500
m_{BS} Matter collected in back half sample (μg)	0.4230	0.5150	0.2460
m_{BB} Matter collected in back half blank (μg)	0.0899	0.0899	0.0899
$m_{BB-allow}$ Allowable back half blank correction (μg)	0.0899	0.0899	0.0899
m_B Back half corrected for allowable blank (μg)	0.3331	0.4251	0.1561
m_n Total matter corrected for allowable blanks (μg)	10.8551	7.2871	5.1981

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Marathon Petroleum Company
Clean Air Project No: 11265
FCCU Scrubber Stack

USEPA Method 29 Manganese (Mn) Laboratory Parameters

Run No.		1	2	3
Date (2011)		Jul 19	Jul 19	Jul 19
Start Time (approx.)		07:42	11:23	15:17
Stop Time (approx.)		10:52	14:37	18:30
Front Half Analysis				
m _{F-DL}	Front half detection limit (µg)	0.5000	0.5000	0.5000
m _{FS}	Matter collected in front half sample (µg)	2.5900	2.2800	2.1200
m _{FB}	Matter collected in front half blank (µg)	0.9640	0.9640	0.9640
m _{FB-allow}	Allowable front half blank correction (µg)	0.9640	0.9640	0.9640
m _F	Front half corrected for allowable blank (µg)	1.6260	1.3160	1.1560
Back Half Analysis				
m _{B-DL}	Back half detection limit (µg)	0.1500	0.1500	0.1500
m _{BS}	Matter collected in back half sample (µg)	0.2730	44.1000	0.3030
m _{BB}	Matter collected in back half blank (µg)	<0.1500	<0.1500	<0.1500
m _{BB-allow}	Allowable back half blank correction (µg)	0.0000	0.0000	0.0000
m _B	Back half corrected for allowable blank (µg)	0.2730	44.1000	0.3030
m _n	Total matter corrected for allowable blanks (µg)	1.8990	45.4160	1.4590

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Marathon Petroleum Company
Clean Air Project No: 11265
FCCU Scrubber Stack

USEPA Method 29 Nickel (Ni) Laboratory Parameters

Run No.		1	2	3
Date (2011)		Jul 19	Jul 19	Jul 19
Start Time (approx.)		07:42	11:23	15:17
Stop Time (approx.)		10:52	14:37	18:30
Front Half Analysis				
m _{F-DL}	Front half detection limit (µg)	0.2000	0.2000	0.2000
m _{FS}	Matter collected in front half sample (µg)	33.2000	31.5000	29.1000
m _{FB}	Matter collected in front half blank (µg)	0.6950	0.6950	0.6950
m _{FB-allow}	Allowable front half blank correction (µg)	0.6950	0.6950	0.6950
m _F	Front half corrected for allowable blank (µg)	32.5050	30.8050	28.4050
Back Half Analysis				
m _{B-DL}	Back half detection limit (µg)	0.1000	0.1000	0.1000
m _{BS}	Matter collected in back half sample (µg)	0.4160	0.7300	0.3480
m _{BB}	Matter collected in back half blank (µg)	<0.1000	<0.1000	<0.1000
m _{BB-allow}	Allowable back half blank correction (µg)	0.0000	0.0000	0.0000
m _B	Back half corrected for allowable blank (µg)	0.4160	0.7300	0.3480
m _n	Total matter corrected for allowable blanks (µg)	32.9210	31.5350	28.7530

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Marathon Petroleum Company
Clean Air Project No: 11265
FCCU Scrubber Stack

USEPA Method 29 Selenium (Se) Laboratory Parameters

Run No.		1	2	3
Date (2011)		Jul 19	Jul 19	Jul 19
Start Time (approx.)		07:42	11:23	15:17
Stop Time (approx.)		10:52	14:37	18:30
Front Half Analysis				
m _{F-DL}	Front half detection limit (µg)	2.0000	2.0000	2.0000
m _{FS}	Matter collected in front half sample (µg)	4.1100	3.6600	3.9500
m _{FB}	Matter collected in front half blank (µg)	<2.0000	<2.0000	<2.0000
m _{FB-allow}	Allowable front half blank correction (µg)	0.0000	0.0000	0.0000
m _F	Front half corrected for allowable blank (µg)	4.1100	3.6600	3.9500
Back Half Analysis				
m _{B-DL}	Back half detection limit (µg)	1.0000	1.0000	1.0000
m _{BS}	Matter collected in back half sample (µg)	<1.0000	<1.0000	<1.0000
m _{BB}	Matter collected in back half blank (µg)	<1.0000	<1.0000	<1.0000
m _{BB-allow}	Allowable back half blank correction (µg)	0.0000	0.0000	0.0000
m _B	Back half corrected for allowable blank (µg)	<1.0000	<1.0000	<1.0000
m _n	Total matter corrected for allowable blanks (µg)	<5.1100	<4.6600	<4.9500

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Phone: 905-331-3111, FAX: 905-331-4567

SCC Accredited Lab ID# 1003-15/779 Ont DW License #: 2285
NELAC Primary Accreditation, NJ DEP ID# CANA003: Secondary Accreditation, TX Cert# T104704433-08-TX

Certificate of Analysis

ALS Project Contact: Ron McLeod
ALS Project ID: CLE150
ALS WO#: L1038813
Date of Report: 19-Aug-11
Date of Sample Receipt: 28-Jul-11

Client Name: Clean Air Engineering
Client Address: 500 West Wood Street
Palatine, IL, 60067
United States
Client Contact: Kevin O'Halloren
Client Project ID: 11265 - Robinson Refinery

COMMENTS:

Metals analysed via ICP-MS Method USEPA 6020A (MC 16-Aug-2011)
Sample Preparation via USEPA Method 29 (MB 15-Aug-2011)

Front Half HF Fraction 1A

There were detectable levels of antimony, chromium, manganese, and nickel in the laboratory control blank. However, sample levels for Sb, Cr and Ni are all at least five-fold higher. No significant bias is expected for these elements. Sample levels of Mn are 3 times higher than the blank concentration. Reported data may be biased somewhat high as a result.

Back Half (HNO₃ / H₂O₂) Fraction 2A

The recovery of selenium exceeds method control limits for the laboratory control sample and duplicate. However, this element has not been detected in the associated samples.

The result for Manganese for the sample FCCU SCRUBBER STACK RUN 2 M-29 has been confirmed on reanalysis of the sample digestate.

LCB = Laboratory Control Blank
LCS = Laboratory Control Sample
LCSD = Laboratory Control Sample Duplicate
LOR = Limit of Reporting

Certified by: 

Steve Kennedy
Laboratory Manager

Results in this certificate relate only to the samples as submitted to the laboratory.

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ALS Environmental

Sample Analysis Summary Report

Sample Name	FCCU SCRUBBER STACK RUN 1 M-29	FCCU SCRUBBER STACK RUN 2 M-29	FCCU SCRUBBER STACK RUN 3 M-29	REAGENT BLANK M-29
ALS Sample ID	L1038813-1	L1038813-2	L1038813-3	L1038813-4
Matrix	STACK	STACK	STACK	STACK
Analysis Type	Sample	Sample	Sample	Sample
Sampling Date	19-Jul-11	19-Jul-11	19-Jul-11	19-Jul-11
Date of Receipt	28-Jul-11	28-Jul-11	28-Jul-11	28-Jul-11

Multi-Metals via ICP-MS		LOR				
		ug	ug	ug	ug	ug
Front Half HF Fraction 1A						
Antimony	0.2	16.7	14.2	14.1	0.226	
Arsenic	1	1.19	<	1.13	<	
Beryllium	0.2	<	<	<	<	
Cadmium	0.1	0.180	<	<	<	
Chromium	1	11.0	9.36	8.79	1.38	
Cobalt	0.2	1.40	1.22	1.25	<	
Lead	0.5	11.1	7.44	5.62	0.578	
Manganese	0.5	2.59	2.28	2.12	0.964	
Nickel	0.2	33.2	31.5	29.1	0.695	
Selenium	2	4.11	3.66	3.95	<	
Back Half (HNO3 / H2O2) Fraction 2A						
Antimony	0.1	<	<	<	<	
Arsenic	0.2	<	<	<	<	
Beryllium	0.1	<	<	<	<	
Cadmium	0.05	<	<	0.0616	<	
Chromium	0.15	0.352	0.997	0.385	0.276	
Cobalt	0.1	<	<	<	<	
Lead	0.05	0.423	0.515	0.246	0.0899	
Manganese	0.15	0.273	44.1	0.303	<	
Nickel	0.1	0.416	0.730	0.348	<	
Selenium	1	<	<	<	<	

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Sample QC Summary Report

Sample Name		LCB	LCS	LCS	LCSD	LCSD
ALS Sample ID		LCB	LCS	LCS	LCSD	LCSD
Matrix		STACK	STACK	STACK	STACK	STACK
Analysis Type		Blank	LCS	LCS	LCS	LCS
Sampling Date		n/a	n/a	n/a	n/a	n/a
Date of Receipt		n/a	n/a	n/a	n/a	n/a

Multi-Metals via ICP-MS		LOR					
		ug	ug	ug	% Rec	ug	% Rec
Front Half HF Fraction 1A							
Antimony	0.2	1.39	12.4	92	13.2	98	
Arsenic	1	<	61.5	102	67.2	111	
Beryllium	0.2	<	58.5	97	64.1	107	
Cadmium	0.1	<	30.0	100	32.1	107	
Chromium	1	1.05	61.0	100	66.6	109	
Cobalt	0.2	<	58.6	98	64.7	108	
Lead	0.5	<	59.3	98	63.4	105	
Manganese	0.5	0.774	59.2	97	64.4	106	
Nickel	0.2	0.549	58.3	96	64.7	107	
Selenium	2	<	59.3	100	66.2	111	
Back Half (HNO3 / H2O2) Fraction 2A							
Antimony	0.1	<	6.18	103	6.70	111	
Arsenic	0.2	<	34.9	117	36.4	122	
Beryllium	0.1	<	33.1	110	34.9	117	
Cadmium	0.05	<	15.8	106	17.6	117	
Chromium	0.15	<	33.7	112	35.5	118	
Cobalt	0.1	<	33.3	111	34.8	116	
Lead	0.05	<	32.4	108	34.9	116	
Manganese	0.15	<	32.6	110	35.4	119	
Nickel	0.1	<	33.6	112	35.9	120	
Selenium	1	<	36.5	122	37.8	126	

ALS Environmental

Sample QC Summary Report

Sample Name	FCCU SCRUBBER STACK RUN 1 M-29	FCCU SCRUBBER STACK RUN 1 M-29	FCCU SCRUBBER STACK RUN 1 M-29	FCCU SCRUBBER STACK RUN 1 M-29	FCCU SCRUBBER STACK RUN 1 M-29	FCCU SCRUBBER STACK RUN 1 M-29
ALS Sample ID	L1038813-1	L1038813-1	MS	MS	MSD	MSD
Matrix	STACK	STACK	STACK	STACK	STACK	STACK
Analysis Type	Sample	Duplicate	Matrix Spike	Matrix Spike	Matrix Spike Dup	Matrix Spike Dup
Sampling Date	19-Jul-11	19-Jul-11	19-Jul-11	19-Jul-11	19-Jul-11	19-Jul-11
Date of Receipt	28-Jul-11	28-Jul-11	28-Jul-11	28-Jul-11	28-Jul-11	28-Jul-11

Multi-Metals via ICP-MS		LOR					
		ug	ug	ug	% Rec	ug	% Rec
Front Half HF Fraction 1A							
Antimony	0.2	16.7	16.1	41.2	102	41.0	101
Arsenic	1	1.19	<	129	107	130	108
Beryllium	0.2	<	<	121	101	126	105
Cadmium	0.1	0.180	0.173	62.8	104	62.9	105
Chromium	1	11.0	10.8	138	106	137	105
Cobalt	0.2	1.40	1.32	124	102	125	103
Lead	0.5	11.1	10.4	134	103	134	102
Manganese	0.5	2.59	2.54	125	102	125	102
Nickel	0.2	33.2	31.5	156	102	157	103
Selenium	2	4.11	3.87	130	105	133	107
Back Half (HNO3 / H2O2) Fraction 2A							
Antimony	0.1	<	<	12.1	101	13.0	108
Arsenic	0.2	<	<	64.8	108	67.6	113
Beryllium	0.1	<	<	61.2	102	64.8	108
Cadmium	0.05	<	<	31.1	104	32.9	109
Chromium	0.15	0.352	0.390	65.2	108	68.2	113
Cobalt	0.1	<	<	63.5	106	67.4	112
Lead	0.05	0.423	0.410	63.1	105	65.6	109
Manganese	0.15	0.273	0.296	65.6	109	68.0	113
Nickel	0.1	0.416	0.436	65.5	108	68.5	113
Selenium	1	<	<	63.5	106	67.4	112

Marathon Petroleum Company
Clean Air Project No: 11265
FCCU Scrubber Stack

ASTM D6784-02 Mercury Laboratory Data - Data Entry Sheet

☐ DRAFT LAB DATA

Mercury	Units	Detection Limit	Blank (as-rcvd)	Run 1	Run 2	Run 3
Hg _{ash} -Filter Fraction	µg	0.0150		<0.0150	<0.0150	<0.0150
Hg _{pr} -Probe Rinse Fraction	µg	0.0500		<0.0500	<0.0500	<0.0500
Hg _{KCl} -KCl Fraction	µg	0.0050		0.8930	<0.0500	<0.0500
Hg _{H2O2} -HNO3-H2O2 Fraction	µg	0.0250		<0.0250	<0.0250	<0.0250
Hg _{KMnO4} -KMnO4 Fraction	µg	0.0250		1.2300	0.0450	0.0945
V _{3a} -As-received Volume of KCl Blank	ml		50.0			
V _{5a} -As-received volume of HNO3-H2O2 Blank	ml		50.0			
V _{7a} -As-received volume of H2SO4-KMnO4 Blank	ml		50.0			
V ₃ -Volume of KCl charged to impingers	ml			300.0	300.0	300.0
V ₅ -Volume of HNO3-H2O2 charged to impingers	ml			100.0	100.0	100.0
V ₇ -Volume of H2SO4-KMnO4 charged to impingers	ml			300.0	300.0	300.0
Hg _{fb} -Filter Blank	µg		<0.0150			
Hg _{Ob} -KCl Solution Blank	µg		<0.0050			
Hg _{Eb1} -HNO3-H2O2 Blank	µg		<0.0250			
Hg _{Eb2} -KMnO4 Blank	µg		0.0045			

Notes:

"<" indicates result below reported minimum detection limit.

Solution blank values are derived by multiplying the as-received blank value by the ratio of the impinger charge volume to the as-received volume.

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ASTM D6784-02 **Mercury (Hg) Laboratory Parameters**

Detection Limits

DL _{ash}	Filter Fraction (µg)	0.0150
DL _{pr}	Probe Rinse Fraction (µg)	0.0500
DL _{KCl}	KCl Fraction (µg)	0.0050
DL _{H2O2}	HNO3-H2O2 Fraction (µg)	0.0250
DL _{KMnO4}	KMnO4 Fraction (µg)	0.0250

Run No.	1	2	3
Date (2011)	Jul 15	Jul 15	Jul 16
Start Time (approx.)	09:00	13:27	08:40
Stop Time (approx.)	13:14	16:04	11:07

Sample Analysis

Particulate Bound Mercury

Hg _{ash}	Filter Fraction (µg)	<0.0150	<0.0150	<0.0150
Hg _{pr}	Probe Rinse Fraction (µg)	<0.0500	<0.0500	<0.0500
Hg _{fb}	Filter Blank (µg)	<0.0150	<0.0150	<0.0150
Hg _{fb-allow}	Allowable Filter Blank (µg)	0.0000	0.0000	0.0000
Hg _{particle}	Particulate Sample Corrected for Blank (µg)	<0.0650	<0.0650	<0.0650

Oxidized Mercury

Hg _{KCl}	KCl Fraction (µg)	0.8930	<0.0500	<0.0500
Hg _{Ob}	KCl Blank (µg)	<0.0050	<0.0050	<0.0050
Hg _{Ob-allow}	Allowable KCl Blank (µg)	0.0000	0.0000	0.0000
Hg _O	KCl Sample Corrected for Blank (µg)	0.8930	<0.0500	<0.0500

Elemental Mercury

Hg _{H2O2}	HNO3-H2O2 Fraction	<0.0250	<0.0250	<0.0250
Hg _{Eb1}	HNO3-H2O2 Blank (µg)	<0.0250	<0.0250	<0.0250
Hg _{Eb1-allow}	Allowable HNO3-H2O2 Blank (µg)	0.0000	0.0000	0.0000
Hg _{KMnO4}	KMnO4 Fraction	1.2300	0.0450	0.0945
Hg _{Eb2}	KMnO4 Blank (µg)	0.0045	0.0045	0.0045
Hg _{Eb2-allow}	Allowable KMnO4 Blank (µg)	0.0045	0.0045	0.0045
Hg _E	HNO3-H2O2 and KMnO4 Sample Corrected for Blank (µg)	1.2505	0.0655	0.1150

Total Mercury

Hg _{particle}	Total Particulate Bound Mercury Corrected for Blank (µg)	<0.0650	<0.0650	<0.0650
n _{MDL}	Number of non-detectable fractions	2 out of 2	2 out of 2	2 out of 2
DLC	Detection level classification	BDL	BDL	BDL
Hg _O	Total Oxidized Mercury Corrected for Blank (µg)	0.8930	<0.0500	<0.0500
n _{MDL}	Number of non-detectable fractions	N/A	1 out of 1	1 out of 1
DLC	Detection level classification	ADL	BDL	BDL
Hg _E	Total Elemental Mercury Corrected for Blank (µg)	1.2505	0.0655	0.1150
n _{MDL}	Number of non-detectable fractions	1 out of 2	1 out of 2	1 out of 2
DLC	Detection level classification	DLL	DLL	DLL
m _n	Total Mercury Corrected for Blank (µg)	<2.2085	<0.1805	<0.2300
n _{MDL}	Number of non-detectable fractions	3 out of 5	4 out of 5	4 out of 5
DLC	Detection level classification	DLL	DLL	DLL

Comments:

Detection level classifications are defined as follows:

ADL = Above Detection Level - all fractions are above detection limit

DLL = Detection Level Limited - some fractions are below detection limit

BDL = Below Detection Limit - all fractions are below detection limit

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SCC Accredited Lab ID# 1003-15/779 Ont DW License #: 2285
NELAC Primary Accreditation, NJ DEP ID# CANA003: Secondary Accreditation, TX Cert# T104704433-08-TX

Certificate of Analysis

ALS Project Contact: Ron McLeod
ALS Project ID: CLE150
ALS WO#: L1038720
Date of Report: 19-Aug-11
Date of Sample Receipt: 28-Jul-11


Client Name: Clean Air Engineering
Client Address: 500 West Wood Street
Palatine, IL 60067
800 627 0033
Client Contact: Kevin O'Halloren
Client Project ID: 11265

COMMENTS:

Mercury Analysis via CVAA Method USEPA 7470A (MC1 11/08/19)
Sample Preparation via ASTM D6784-02 (MC1 11/08/19)

LCB = Laboratory Control Blank
LCS = Laboratory Control Sample
LCSD = Laboratory Control Sample Duplicate
LOR = Limit of Reporting

Certified by: _____


Steve Kennedy
Laboratory Manager

Results in this certificate relate only to the samples as submitted to the laboratory.

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ALS Environmental

Sample Analysis Summary Report

Sample Name	FCCU SCRUBBER STACK RUN 1	FCCU SCRUBBER STACK RUN 2	FCCU SCRUBBER STACK RUN 3	FCCU SCRUBBER STACK FIELD BLANK	REAGENT BLANK
ALS Sample ID	L1038720-1	L1038720-2	L1038720-3	L1038720-4	L1038720-5
Matrix	STACK	STACK	STACK	STACK	STACK
Analysis Type	Sample	Sample	Sample	Sample	Sample
Sampling Date	15-Jul-11	15-Jul-11	16-Jul-11	15-Jul-11	15-Jul-11
Date of Receipt	28-Jul-11	28-Jul-11	28-Jul-11	28-Jul-11	28-Jul-11

Mercury via FIMS CVAA	LOR ug	ug	ug	ug	ug	ug
Analytical Fraction 1B	0.015	<	<	<	<	<
Analytical Fraction 2C	0.050	<	<	<	<	<
Analytical Fraction 3D	0.005	0.893	<0.0500	<0.0500	1.08	<
Analytical Fraction 4E	0.025	<	<	<	<	<
Analytical Fraction 5F	0.025	1.23	0.0450	0.0945	0.101	0.00451
Analytical Fraction HYDROXYLAMINE BLANK	0.025	n/a	n/a	n/a	n/a	<

ALS Environmental

Sample QC Summary Report

Sample Name	LCB	LCS	LCS	LCSD	LCSD
ALS Sample ID	LCB	LCS	LCS	LCSD	LCSD
Matrix	STACK	STACK	STACK	STACK	STACK
Analysis Type	Blank	LCS	LCS	LCS	LCS
Sampling Date	n/a	n/a	n/a	n/a	n/a
Date of Receipt	n/a	n/a	n/a	n/a	n/a
Mercury via FIMS CVAA					
	LOR				
	ug	ug	ug	% Rec	% Rec
Analytical Fraction 1B 0.02	<	0.304	102	0.309	103
Analytical Fraction 2C 0.050	<	0.0950	97	0.0941	96
Analytical Fraction 3D 0.01	<	0.482	98	0.495	100
Analytical Fraction 4E 0.03	<	0.917	93	0.981	99
Analytical Fraction 5F 0.03	<	0.485	98	0.496	101

ALS Environmental

Sample QC Summary Report

Sample Name	FCCU SCRUBBER STACK RUN 1	FCCU SCRUBBER STACK RUN 1	FCCU SCRUBBER STACK RUN 1	FCCU SCRUBBER STACK RUN 1	FCCU SCRUBBER STACK RUN 1	FCCU SCRUBBER STACK RUN 1
ALS Sample ID	L1038720-1	L1038720-1	MS	MS	MSD	MSD
Matrix	STACK	STACK	STACK	STACK	STACK	STACK
Analysis Type	Sample	Duplicate	Matrix Spike	Matrix Spike	Matrix Spike Dup	Matrix Spike Dup
Sampling Date	15-Jul-11	15-Jul-11	15-Jul-11	15-Jul-11	15-Jul-11	15-Jul-11
Date of Receipt	28-Jul-11	28-Jul-11	28-Jul-11	28-Jul-11	28-Jul-11	28-Jul-11

Mercury via FIMS CVAA	LOR ug	ug	ug	ug	% Rec	ug	% Rec
Analytical Fraction 1B 0.02	<	<	0.155	103	0.152	101	
Analytical Fraction 2C 0.050	<	<	0.141	97	0.142	97	
Analytical Fraction 3D 0.01	0.893	0.875	1.96	97	2.19	118	
Analytical Fraction 4E 0.03	<	<	1.33	85	1.38	88	
Analytical Fraction 5F 0.03	1.23	1.27	1.88	108	1.78	91	

Marathon Petroleum Company
Clean Air Project No: 11265
FCCU Scrubber Stack

USEPA SW-846 Method 0061 (Hexavalent Chromium) **Hexavalent Chromium Laboratory Data Summary**

Run No.	Blank	1	2	3
Date (2011)		Jul 15	Jul 15	Jul 16
Start Time (approx.)		08:58	14:06	08:36
Stop Time (approx.)		13:06	17:42	12:21

☐ DRAFT LAB DATA

MDL Min. detectable limit (µg/ml) 0.0006

Cr⁺⁶ from IC/PCR Analysis
B Blank concentration (µg/ml) 0.0013

S	Sample concentration (µg/ml)	<0.0006	<0.0006	<0.0006
V _{fs}	Sample volume after filtration (ml)	810.0000	890.0000	900.0000
d	Dilution factor (1 if not diluted)	1.0	1.0	1.0
m _{Cr+6}	Cr ⁺⁶ collected before blank subtraction (µg)	<0.4860	<0.5340	<0.5400
m _b	Allowable blank subtraction (µg)	0.0000	0.0000	0.0000
m _{nb}	Cr ⁺⁶ collected after blank subtraction (µg)	<0.4860	<0.5340	<0.5400
m _{MDL}	Minimum detectable Cr ⁺⁶ (µg)	0.4860	0.5340	0.5400
m _n	Total Cr ⁺⁶ used in emission calculations (µg)	<0.4860	<0.5340	<0.5400

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NELAC Primary Accreditation, NJ DEP ID# CANA003: Secondary Accreditation, TX Cert# T104704433-08-TX

Certificate of Analysis

ALS Project Contact: Ron McLeod

ALS Project ID: CLE150

ALS WO#: L1034451

Date of Report: 3-Aug-11

Date of Sample Receipt: 21-Jul-11

Client Name: Clean Air Engineering

Client Address: 500 West Wood Street
Palatine, IL
60067

Client Contact: Kevin O'Halloran

Client Project ID: 11265 - ROBINSON REFINERY

COMMENTS: Hexavalent Chromium via SW846 Method 7199 on samples collected via 0061

Samples were received in good condition at 26 deg C.
All field samples except the water reagent blank was received at a strongly basic pH.

Certified by:

Ron McLeod, Ph.D.
General Manager and Technical Director

Results in this certificate relate only to the samples as submitted to the laboratory.

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ALS Environmental

Sample Analysis Summary Report

Sample Name	FCCU SCRUBBER STACK RUN 1	FCCU SCRUBBER STACK RUN 2	FCCU SCRUBBER STACK RUN 3	REAGENT BLANK 0.5M KOH	REAGENT BLANK DI H2O	Laboratory Method Blank	Laboratory Control Sample
ALS Sample ID	L1034451-1	L1034451-2	L1034451-3	L1034451-4	L1034451-5	WG1321338-1	WG1321338-2
Matrix	QC	STACK	STACK	STACK	STACK	QC	QC
Sampling Date	15-Jul-11	15-Jul-11	16-Jul-11	14-Jul-11	14-Jul-11	n/a	n/a
Analysis Date	28-Jul-11	28-Jul-11	28-Jul-11	28-Jul-11	28-Jul-11	28-Jul-11	28-Jul-11
Target Analytes	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
Cr (VI) via 7199	<0.6	<0.6	<0.6	1.40	<0.6	<0.6	50.3
Cr (VI) via 7199 - Duplicate	<0.6	<0.6	<0.6	1.24	<0.6	-	-
	ug/Sample	ug/Sample	ug/Sample	ug/Sample	ug/Sample	ug/Sample	% Rec
Cr (VI) via 7199	<0.5	<0.5	<0.5	0.421	<0.2	-	101
Cr (VI) via 7199 - Duplicate	<0.5	<0.5	<0.5	0.372	<0.2	-	-
	mL	mL	mL	mL	mL	mL	mL
Sample Volume Received	810	890	900	300	205	-	-
	pH	10	10	14	7		

Marathon Petroleum Company
Clean Air Project No: 11265
FCCU Scrubber Stack

USEPA Method 26A Chloride Laboratory Data Summary

Run No.	Blank	1	2	3
Date (2011)		Jul 20	Jul 20	Jul 21
Start Time (approx.)		09:49	12:50	07:54
Stop Time (approx.)		12:18	15:10	10:07

☐ DRAFT LAB DATA

MDL Min. detectable limit (mg Cl⁻/liter) 0.0180

HCl as Total Chloride

B_{Cl} Blank concentration (mg Cl⁻/liter) <0.0180

S _{Cl-1}	Fraction 1 concentration (mg Cl ⁻ /liter)	0.1400	0.0900	0.1500
v ₁	Fraction 1 sample volume (ml)	990.0	1020.0	1010.0
m _{HCl}	HCl collected before blank subtraction (mg)	0.1425	0.0944	0.1557
m _b	Allowable blank subtraction (mg)	0.0000	0.0000	0.0000
m _{nb}	HCl collected after blank subtraction (mg)	0.1425	0.0944	0.1557
m _{MDL}	Minimum detectable HCl (mg)	0.0183	0.0189	0.0187
m _n	Total HCl used in emission calculations (mg)	0.1425	0.0944	0.1557

Cl₂ as Total Chloride

B_{Cl} Blank concentration (mg Cl⁻/liter) <0.0180

S _{Cl-1}	Fraction 1 concentration (mg Cl ⁻ /liter)	<0.0180	<0.0180	<0.0180
v ₁	Fraction 1 sample volume (ml)	440.0	400.0	370.0
m _b	Allowable blank subtraction (mg)	0.0000	0.0000	0.0000
m _{nb}	Cl ₂ collected after blank subtraction (mg)	<0.0079	<0.0072	<0.0067
m _{MDL}	Minimum detectable Cl ₂ (mg)	0.0079	0.0072	0.0067
m _n	Total Cl ₂ used in emission calculations (mg)	<0.0079	<0.0072	<0.0067

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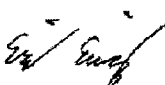
Laboratory Analysis for Anions

Performed For:
Palatine Engineering Group
500 West Wood Street
Palatine, IL 60067

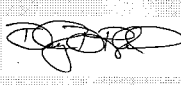
Laboratory Report No: 64-28745_IC_CI_V0
Customer Reference No: 11265

Revision 0 - Dated: 08/02/2011

To the best of our knowledge, the data presented in this report are accurate, complete, error free, legible and representative of the samples received by the laboratory.

 Digitally signed
by Eric Ewing
Date: 2011.08.02
15:42:10 -05'00'

Eric Ewing
Title: Analyst
email: eewing@cleanair.com
Ph: 847-654-4519

 Digitally signed by
Douglas D. Rhoades
Date: 2011.08.02
15:57:18 -05'00'

Douglas D. Rhoades
Title: Team Leader
email: drhoades@cleanair.com
Ph: 847-654-4504



CERTIFICATE OF ANALYSIS
Ion Chromatography Analysis

Customer:	Palatine Engineering Group	Lab Project No:	28745	Analyst:	Eric Ewing
Plant:	Marathon	Customer Reference No:	11265	Received:	7/26/11
Applicable Analytical Method:	U.S. EPA Method 26A			Analyte:	Chloride

Laboratory Sample Identification Number	Sample Identification	Sample Volume (mL)	Chloride Sample Conc. (mg/L)	Method Detection Limit (mg/L)	Method Reporting Limit (mg/L)
Reagent Blanks					
28745-23	DI H2O Blank	200	<	0.018	0.091
28745-24	0.1N H2SO4 Blank	200	<	0.018	0.091
FCCU Scrub. Stack					
28745-25	Acid Imp C&R R1	990	0.14	0.018	0.091
28745-26	Acid Imp C&R R2	1020	0.09 †	0.018	0.091
28745-27	Acid Imp C&R R3	1010	0.15	0.018	0.091
Reagent Blank					
28745-28	0.1N NaOH Blank	200	<	0.018	0.091
FCCU Scrub. Stack					
28745-29	Alk Imp C&R R1	440	<	0.018	0.091
28745-30	Alk Imp C&R R2	400	<	0.018	0.091
28745-31	Alk Imp C&R R3	370	<	0.018	0.091

† Values were quantified using the calibration curve. The peak areas are considered to be readily quantifiable, therefore these values are believed to be accurate. But as the concentrations are below the Method Reporting Limit (MRL) value of 0.091 mg/L, they should probably be used with some discretion.

Analysis Case Narrative

Ion Chromatography Analysis

Customer:	Palatine Engineering Group	Lab Project No:	28745	Analyst:	Eric Ewing
Plant:	Marathon	Customer Reference No:	11265	Received:	7/26/11
Applicable Analytical Method:	U.S. EPA Method 26A			Analyte:	Chloride

Summary of Analysis

This report summarizes the results of the analysis performed on samples received on: 07/26/11
The samples were analyzed in accordance with NELAC and procedures found in U.S. EPA Method 26A and U.S. EPA Method 300.1.

All analysis was carried out using a Dionex ICS-90, Dionex AS22 column, 4.5mM/1.4mM sodium carbonate/bicarbonate eluent, and 50mN sulfuric acid regenerant.

Detection Limits

Method Detection Limits have been determined in accordance with procedures in 40 CFR 136, Appendix B. Documentation showing the determination of detection limits are included with this report. The Method Reporting Limit (MRL) was determined by multiplying the Method Detection Limit (MDL) by a factor of 5. Values between these limits were quantified, but should be used with discretion as they were below the MRL. Values that were below the MDL are indicated by a "<" where appropriate.

Sample Preparation

Samples were prepared according to the procedures listed in the EPA Method above. Each sample was analyzed at full strength and a dilution was prepared if necessary to achieve a concentration that was within calibration range limits.

Standard and Reagent Traceability

Each calibration standard has been prepared in accordance with US EPA Method 300.1 and US EPA Method 26 and has been designated an original lot number. This number can be used to trace back to the original dry salts used in the preparation of these standards. This number is included on the calibration page of this report and may also be found in Table 1 below. In addition, the dilution scheme used for the preparation of standards has been included in this report

Table 1: Standard Lot Numbers Used For Analysis

Standard Type	Lot Number	Concentration of Analyte
Stock Standard	07221102-64-00000-03	1010.97 mg/L
QC Standard	07221102-64-00000-04	187.56 mg/L

In suppressed ion chromatography, eluent is defined as the carrier that moves chemicals through the column and regenerant is defined as a reagent used to remove ions opposite in charge of the specific analyte. Regenerant also reduces the overall conductivity of the eluent. A table displaying the lot numbers of these reagents used for each day of analysis is displayed below in Table 2.

Table 2: Eluent and Regenerant Lot Numbers Used for Each Day of Analysis

Analysis Date	Eluent Lot Number	Regenerant Lot Number
7/28/2011	1067-64-00000-01	1058-64-00000-02
7/29/2011	1067-64-00000-01	1058-64-00000-02
8/1/2011	1067-64-00000-01	1058-64-00000-02

Instrument Calibration

Instrument calibration followed regulations found in US EPA Method 300.1 and U.S. EPA Method 26A. Calibration standards were prepared from ACS grade dry salts as per section 7.3 of US EPA Method 300.1. As per section 4.2.2 of US EPA CTM-027, a series of 6 diluted standards are prepared from the original calibration standard and run through the column in duplicate from lowest concentration to highest. The average peak area for each calibration point is gathered and plotted against the expected solution concentration. In accordance with section 7.2.3 of EPA Method 9057, a least-squares regression with an r^2 value of .995 or greater must be produced from the resulting curve. In accordance with US EPA Method 26 a full post-test calibration is performed. The pre test calibration and post test calibration average peak area for any standard must agree within $\pm 5\%$ of any observed area.

Analysis Case Narrative

Ion Chromatography Analysis

Customer:	Palatine Engineering Group	Lab Project No:	28745	Analyst:	Eric Ewing
Plant:	Marathon	Customer Reference No:	11265	Received:	7/26/11
Applicable Analytical Method:	U.S. EPA Method 26A			Analyte:	Chloride

Chromatograms

Chromatograms were generated using Dionex Chromeleon software. All chromatograms are included as an appendix of this report. Please note: Chromatograms marked as "End" are place markers meant to signify the end of a batch run and are purposely left blank as no data was acquired for that run.

Analysis QA/QC

Many elements of various EPA methods have been combined and are adhered to:

EPA Method 300.1 quality procedures:

- 1 Before the first sample was analyzed and every twenty samples thereafter (and before the post-test calibration) a laboratory blank and a Continuing Calibration Verification (CCV) were analyzed. The CCV is prepared from the same calibration standard as used to create the 7 diluted standards that make up the calibration curve. The laboratory blank must show a regression concentration of zero, and the CCV must show a regression concentration within 10 percent of the expected concentration.
- 2 After the first ten samples and every twenty there after, a Quality Control (QC) sample was analyzed. The QC sample was created using ACS grade dry salts from a different manufacturer and or lot number than for the salts used to create the calibration standards. The QC must meet the same acceptance criteria as noted for the CCV above.
- 3 A matrix spike analysis was performed on ten percent of the total number of samples. This sample was prepared with equal amounts of a sample and a calibration standard whose concentration was known to be larger than that of the sample. The matrix spike is acceptable when the recovery is found to be 100 ± 10 percent.
- 4 As a measure of precision, all matrix spikes were prepared and analyzed in duplicate. The average area count of two identical matrix spikes may not have a relative percent difference of more than 10 percent.

EPA Method 26 quality procedure:

- 1 As per section 11.1.3, every sample was analyzed in duplicate and the mean area count used to determine the concentration. The duplicate area counts must have a relative percent difference of no greater than five percent. If this was the case, a third injection was made and the average of the three injections was used to determine the concentration.

EPA Method 7E quality procedures:

- 1 Each point on the calibration curve should be within ± 2 percent of the calibration span of the curve used.

Other CleanAir quality procedures:

- 1 The observed concentration value of each point on the calibration curve should have a relative percent difference of no more than 10 percent from its expected concentration.

Analysis Case Narrative

Ion Chromatography Analysis

Customer:	Palatine Engineering Group	Lab Project No:	28745	Analyst:	Eric Ewing
Plant:	Marathon	Customer Reference No:	11265	Received:	7/26/11
Applicable Analytical Method:	U.S. EPA Method 26A			Analyte:	Chloride

Additional Comments

This report shall in no way be reproduced except in full without the prior written approval of Clean Air Analytical Laboratory management.

A copy of this report and all associated supporting records will be archived and stored for at least 20 years. All samples are archived for a period of one year from date of receipt in a non-temperature controlled facility. All samples are stored in the original container, any digestates or reconstitutions are stored in a adequately sized Nalgene container.

Sample volumes were determined volumetrically using an appropriately sized graduated cylinder calibrated TD @ 20C.

Table 3 below shows the average analyte concentration found, the standard deviation, and percent relative standard deviation for each sample fraction. This data does not include any corrections for plant conditions. In addition, no sample concentrations reported were corrected for any blanks.

Table 3: Statistical Description of the Ion Chromatography Results

Sample Fraction	Location	Average Concentration (mg/L)	Standard Deviation of Concentration (mg/L)	Relative Standard Deviation of Concentration (%)
Acid Imp C&R	FCCU Scrub. Stack	0.15	0.01	7.74%

Clean Air Laboratory Services is accredited by NELAP in the following states. Please visit the NELAP website to view our current status and a comprehensive list of our accredited services.

Table 4: Specific NELAC Accreditation and Expiration Date

State	Certificate Number	Expiration Date
Texas	T104704431-11-2	6/30/2012
New Jersey	IL004	6/30/2012
Louisiana	169249	6/30/2012

Sample 28745-30 did not have sodium thiosulfate added prior to analysis. Sodium thiosulfate was added to the sample and the sample was reanalyzed. No detectable amount of chloride was found during either analysis.

In accordance with laboratory procedures, the pH was taken for each alkaline impinger catch. Those pHs are shown in Table 5 below.

Table 5: Sample pH Data

Sample Identification	Sample ID	pH
0.1N NaOH Blank	28745-28	12.81
Alk Imp C&R R1	28745-29	7.81
Alk Imp C&R R2	28745-30	7.68
Alk Imp C&R R3	28745-31	7.93

All three of the alkaline impinger catches were found to have a pH 7 or higher. It is known that as the pH of the sodium hydroxide solution becomes acidic, the capture efficiency of Chlorine gas drops off.

CHROMATOGRAPHIC DATA REDUCTION
Ion Chromatography Analysis

Customer:	Palatine Engineering Group	Lab Project No:	28745	Analyst:	Eric Ewing
Plant:	Marathon	Customer Reference No:	11265	Received:	7/26/11
Applicable Analytical Method:	U.S. EPA Method 26A			Analyte:	Chloride

Stock Standard: 1010.97 mg/L
Working Stock Conc.: 10.1097 mg/L
CCV: 1.01 mg/L
QC: 187.56 mg/L

Analyte:

		Chloride Standards Calibration Data						
Calibration Point	Date of Injection	1	2	3	4	5	6	7
Conc. (mg/L)		0.0000	0.1516	0.4044	0.8088	1.2637	2.5274	5.0548
Cal 1 Trial 1	07/28/2011	0.0000	0.0963	0.2548	0.5131	0.8086	1.6088	3.2797
Cal 1 Trial 2		0.0000	0.0933	0.2557	0.5035	0.8018	1.6213	3.2936
Cal 2 Trial 1	07/29/2011			0.2507	0.5145			
Cal 2 Trial 2				0.2472	0.5082			
Cal 3 Trial 1	07/29/2011		0.0948	0.2525	0.5255	0.8058	1.6445	3.2870
Cal 3 Trial 2			0.0928	0.2545	0.5199	0.8102	1.6270	3.2960

n	2	4	6	6	4	4	4
Average	0.0000	0.0943	0.2526	0.5141	0.8066	1.6254	3.2891
Standard Deviation	0.0000	0.0016	0.0032	0.0079	0.0037	0.0148	0.0073
%RSD	0.00	1.68	1.26	1.54	0.46	0.91	0.22

Quality Control Checks							
Measured Area Counts (Counts)	Actual Concentration (mg/L)	Regression Concentration (mg/L)	Difference pt-Line (% Scale)	Is Difference Less Than 2% of Scale?	Difference pt-Line (Relative %)	Is Relative Difference Less Than 10%?	
0.0000	0.000	0.014	-0.29%	Yes	0.00%	Yes	
0.0943	0.152	0.159	-0.15%	Yes	-5.06%	Yes	
0.2526	0.404	0.402	0.04%	Yes	0.49%	Yes	
0.5141	0.809	0.804	0.09%	Yes	0.58%	Yes	
0.8066	1.264	1.253	0.21%	Yes	0.82%	Yes	
1.6254	2.527	2.511	0.33%	Yes	0.65%	Yes	
3.2891	5.055	5.066	-0.22%	Yes	-0.22%	Yes	
Regression Constants			Is Coefficient of Regression > 0.995?				
Slope	m =	1.5359					
Intercept	b =	0.0145					
Coeff.	R ² =	0.99996	Yes				

Stock Solution Standard Mixing Recipe (Anions)
Ion Chromatography Analysis

Customer:	Palatine Engineering Group	Lab Project No:	28745	Analyst:	Eric Ewing
Plant:	Marathon	Customer Reference No:	11265	Received:	7/26/11
Applicable Analytical Method:	U.S. EPA Method 26A				
				Analyte:	Chloride

Order of Elution	8	9	10	11	12	13	14	15
Analyte	Fluoride	Chloride	Nitrite	Bromide	Nitrate	Phosphate	Sulfate	Iodide
Analyte Weight (g/g-mole)	19.00	35.45	46.01	79.90	62.01	94.97	96.07	126.91
Solid Formula	NaF	NaCl	NaNO ₂	NaBr	NaNO ₃	Na ₂ HPO ₄	Na ₂ SO ₄	NaI
Number of ions/Formula	1	1	1	1	1	1	1	1
Formula Weight (g/g-mole)	41.99	58.44	69.00	102.89	85.00	141.96	142.04	149.90
% Analyte in Solid	45.25%	60.66%	66.68%	77.66%	72.95%	66.90%	67.63%	84.66%

Recommended Analyte Concentration (mg/L)	500	1007.21	2000	3000	3000	5000	5000	7000
--	-----	---------	------	------	------	------	------	------

Amount of Solid Required to Achieve the Above Stock Solution Concentration In The Listed Volumetric Flask:								
500 ml	0.5525	0.8302	1.4997	1.9316	2.0561	3.7370	3.6964	4.1341

Size of Flask	500 ml							
Amount of Solid Used	0.5526 g	0.8333 g		1.9338 g				
Actual Concentration (mg/L)	500.09	1010.97		3003.41				

Concentration in the Five Cal Flasks (mg/L)

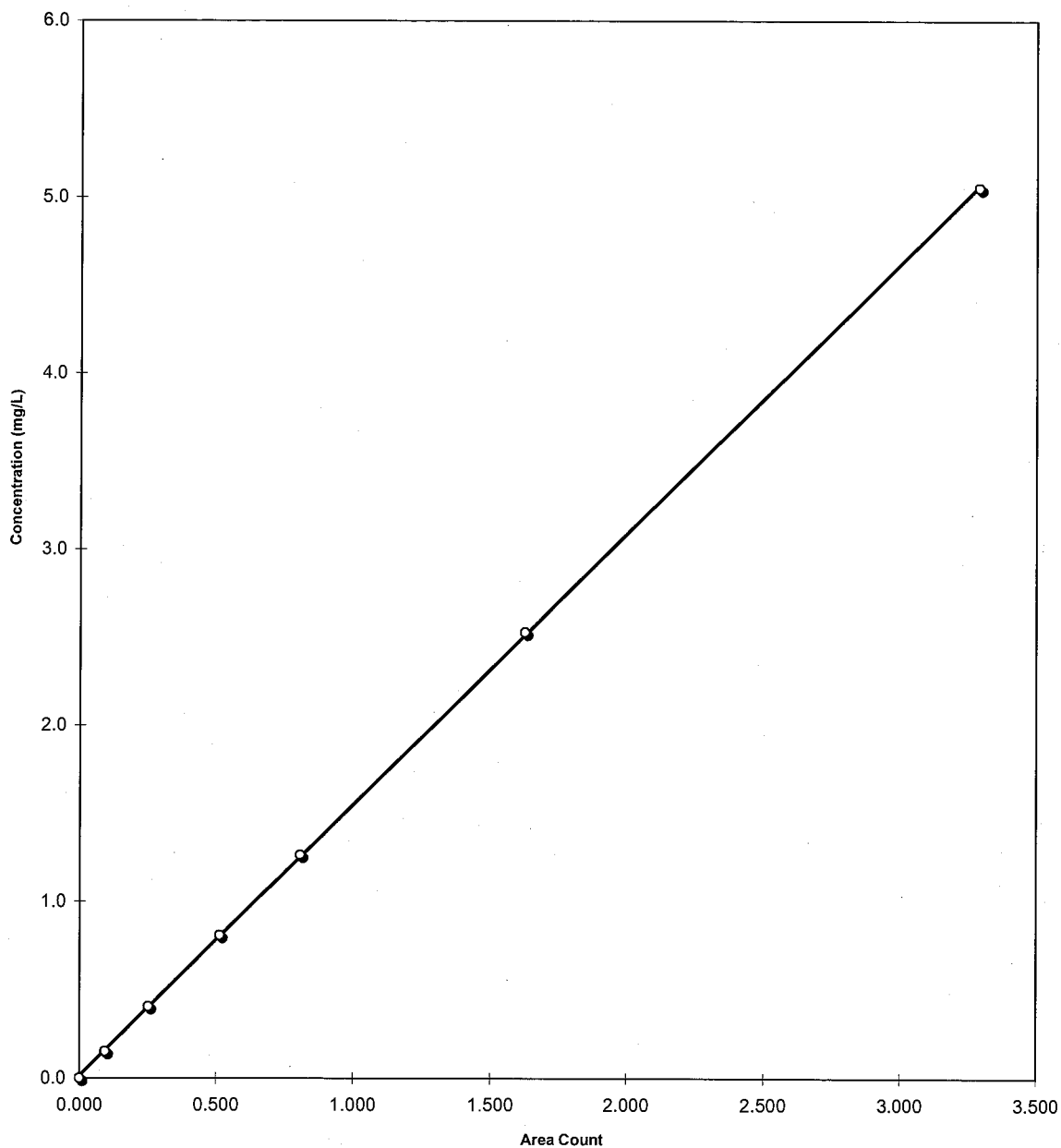
Stock (1 liter Flask) Solution Concentrations
10 ml Original Solution Used

Dilution Flask Size	Aliquot Stock				
200	3	0.0750	0.1516	0.4505	1
250	10	0.2000	0.4044	1.2014	2
250	20	0.4001	0.8088	2.4027	3
200	20	0.5001	1.0110	3.0034	CCV
200	25	0.6251	1.2637	3.7543	4
200	50	1.2502	2.5274	7.5085	5
100	50	2.5005	5.0548	15.0171	6

CHROMATOGRAPHIC DATA REDUCTION
Ion Chromatography Analysis

Customer:	Palatine Engineering Group	Lab Project No:	28745	Analyst:	Eric Ewing
Plant:	Marathon	Customer Reference No:	11265	Received:	7/26/11
Applicable Analytical Method:	U.S. EPA Method 26A			Analyte:	Chloride

Chloride Calibration Curve



Sample Information

Customer:	Palatine Engineering Group	Lab Project No:	28745	Analyst:	Eric Ewing
Plant:	Marathon	Customer Reference No:	11265	Received:	7/26/11
Applicable Analytical Method:	U.S. EPA Method 26A			Analyte:	Chloride

Sample Identification Number	Sample Location	Run No.	Sample Identification	Sample Recovery Date	Field Tech	Sample Volume (mL)
28745-23	Reagent Blank	RB	DI H2O Blank	7/20/2011	DL	200
28745-24	Reagent Blank	RB	0.1N H2SO4 Blank	7/20/2011	DL	200
28745-25	FCCU Scrub. Stack	1	Acid Imp C&R R1	7/20/2011	DL	990
28745-26	FCCU Scrub. Stack	2	Acid Imp C&R R2	7/20/2011	DL	1020
28745-27	FCCU Scrub. Stack	3	Acid Imp C&R R3	7/21/2011	DL	1010
28745-28	Reagent Blank	RB	0.1N NaOH Blank	7/20/2011	DL	200
28745-29	FCCU Scrub. Stack	1	Alk Imp C&R R1	7/20/2011	na	440
28745-30	FCCU Scrub. Stack	2	Alk Imp C&R R2	7/20/2011	DL	400
28745-31	FCCU Scrub. Stack	3	Alk Imp C&R R3	7/21/2011	DL	370

CHROMATOGRAPHIC DATA REDUCTION
Ion Chromatography Analysis

Customer:	Palatine Engineering Group	Lab Project No:	28745	Analyst:	Eric Ewing
Plant:	Marathon	Customer Reference No:	11265	Received:	7/26/11
Applicable Analytical Method:	U.S. EPA Method 26A			Analyte:	Chloride

MDL=	0.018 mg/L	Average Flow Rate 0.80 mL/min
MRL=	0.091 mg/L	

Sample Location	Sample Identification Number	Sample Identification	Date of Injection	Area Counts Trial 1	Area Counts Trial 2	Area Count Average	DF (Analysis Dilution Factor)	V _{soln} (Total Sample Volume, mL)	C _{Reg} (Concentration, mg/L from Reg Curve)	M _{analyte} Total Amount of Analyte (mg)
Reagent Blank	28745-23	DI H2O Blank	07/28/11	0.0000	0.0000	0.0000	1	200.0	<	<0.018
Reagent Blank	28745-24	0.1N H2SO4 Blank	07/29/11	0.0000	0.0000	0.0000	1	200.0	<	<0.018
FCCU Scrub. Stack	28745-25	Acid Imp C&R R1	07/29/11	0.0791	0.0826	0.0809	1	990.0	0.14	0.14
FCCU Scrub. Stack	28745-26	Acid Imp C&R R2	07/29/11	0.0494	0.0486	0.0490	1	1020.0	0.09 †	0.09
FCCU Scrub. Stack	28745-27	Acid Imp C&R R3	07/29/11	0.0933	0.0893	0.0913	1	1010.0	0.15	0.16
Reagent Blank	28745-28	0.1N NaOH Blank	07/28/11	0.0000	0.0000	0.0000	1	200.0	<	<0.018
FCCU Scrub. Stack	28745-29	Alk Imp C&R R1	07/28/11	0.0000	0.0000	0.0000	1	440.0	<	<0.040
FCCU Scrub. Stack	28745-30	Alk Imp C&R R2	07/29/11	0.0000	0.0000	0.0000	1	400.0	<	<0.036
FCCU Scrub. Stack	28745-31	Alk Imp C&R R3	07/28/11	0.0000	0.0000	0.0000	1	370.0	<	<0.034

† Values were quantified using the calibration curve. The peak areas are considered to be readily quantifiable, therefore these values are believed to be accurate. But as the concentrations are below the Method Reporting Limit (MRL) value of 0.091 mg/L, they should probably be used with some discretion.

CHROMATOGRAPHIC DATA REDUCTION
Ion Chromatography Analysis

Customer:	Palatine Engineering Group	Lab Project No:	28745	Analyst:	Eric Ewing
Plant:	Marathon	Customer Reference No:	11265	Received:	7/26/11
Applicable Analytical Method:	U.S. EPA Method 26A			Analyte:	Chloride

QUALITY CONTROL CHECKS

Sample Location	Sample Identification Number	Sample Identification	Date of Injection	Area Counts Trial 1	Area Counts Trial 2	Area Count Average	Area Count Duplicate Difference	Duplicate Relative Difference (%)	Is Duplicate Difference < 5%?
Reagent Blank	28745-23	DI H2O Blank	07/28/11	0.0000	0.0000	0.0000	na	na	Yes
Reagent Blank	28745-24	0.1N H2SO4 Blank	07/29/11	0.0000	0.0000	0.0000	na	na	Yes
FCCU Scrub. Stack	28745-25	Acid Imp C&R R1	07/29/11	0.0791	0.0826	0.0809	0.0035	4.3%	Yes
FCCU Scrub. Stack	28745-26	Acid Imp C&R R2	07/29/11	0.0494	0.0486	0.0490	0.0008	1.6%	Yes
FCCU Scrub. Stack	28745-27	Acid Imp C&R R3	07/29/11	0.0933	0.0893	0.0913	0.0040	4.4%	Yes
Reagent Blank	28745-28	0.1N NaOH Blank	07/28/11	0.0000	0.0000	0.0000	na	na	Yes
FCCU Scrub. Stack	28745-29	Alk Imp C&R R1	07/28/11	0.0000	0.0000	0.0000	na	na	Yes
FCCU Scrub. Stack	28745-30	Alk Imp C&R R2	07/29/11	0.0000	0.0000	0.0000	na	na	Yes
FCCU Scrub. Stack	28745-31	Alk Imp C&R R3	07/28/11	0.0000	0.0000	0.0000	na	na	Yes

CHROMATOGRAPHIC DATA REDUCTION

Customer:	Palatine Engineering Group	Lab Project No:	28745	Analyst:	Eric Ewing
Plant:	Marathon	Customer Reference No:	11265	Received:	7/26/11
Applicable Analytical Method:	U.S. EPA Method 26A			Analyte:	Chloride

CCV Concentration: 1.01 mg/L
QC Concentration: 187.56 mg/L

MDL=	0.018 mg/L
MRL=	0.091 mg/L

QC Dilution Factor
200

QUALITY CONTROL CHECKS (CONT)

Sample Location	Sample Identification Number	Sample Identification	Date of Injection	Area Counts Trial 1	Area Counts Trial 2	Area Count Average	Area Count Duplicate Difference	Duplicate Relative Difference (%)	C _{Reg} (Concentration, mg/L from Reg Curve)	Percent Difference from Actual Value (%)	Is Percent Difference from Actual Value <10%?
CleanAir	28745-00	CCB	07/28/11	0.0000	0.0000	0.0000	na	na	<		
CleanAir	28745-990	CCV	07/28/11	0.6311	0.6440	0.6376	0.0129	2.0%	0.99	1.71%	Yes
CleanAir	28745-991	QC	07/29/11	0.5910	0.5797	0.5854	0.0113	1.9%	182.70	2.59%	Yes
CleanAir	28745-00	CCB	07/29/11	0.0000	0.0000	0.0000	na	na	<		
CleanAir	28745-992	CCV	07/29/11	0.6434	0.6478	0.6456	0.0044	0.7%	1.01	0.49%	Yes

Sample Duplicate Analysis Area Count Check

									Precision	Is Precision within ±5% Tolerance?
FCCU Scrub. Stack	28745-27	Acid Imp C&R R3	07/29/11	0.0933	0.0893	0.0913	0.0040	4.4%		
FCCU Scrub. Stack	28745-27	Acid Imp C&R R3	07/29/11	0.0904	0.0930	0.0917	0.0026	2.8%	0.4%	Yes

Matrix Spike Recoveries

									Precision	Spike Recovery	Is Spike Recovery Between 90-110%
Matrix Spike	28745-25	Acid Imp C&R R1	08/01/11	1.6540	1.6507	1.6524	0.0033	0.2%		98.3%	Yes
Matrix Spike	28745-25	Acid Imp C&R R1	08/01/11	1.6574	1.6356	1.6465	0.0218	1.3%	0.4%	97.9%	Yes

Determination of Method Detection Limit

Ion Chromatography Analysis

Customer:	Palatine Engineering Group	Lab Project No:	28745	Analyst:	Eric Ewing
Plant:	Marathon	Customer Reference No:	11265	Received:	7/26/11
Applicable Analytical Method:	U.S. EPA Method 26A			Analyte:	Chloride

MDL Reference 40 CFR 136, Appendix B
 CleanAir Reference SOP EPA5-11

Matrix Deionized Water

Analyte Chloride
 Spike Concentration 0.1516 mg/L
 Slope 1.5359
 Intercept 0.0145
 Coefficient of Corr. 1.0000

Non-Iterative Study

No. of Replicates	$t_{(n-1, 0.99)}$
7	3.143
8	2.998
9	2.896
10	2.821
11	2.764
16	2.602
21	2.528

Spike Aliquots	Spike Result Area Count	Measured Concentration (mg/L)
1	0.0963	0.162
2	0.0933	0.158
3	0.0962	0.162
4	0.0953	0.161
5	0.0948	0.160
6	0.0928	0.157
7	0.0882	0.150
8	0.0855	0.146

Average Spike Concentration: 0.157
 Recovery (R_s): 103.54%
 Standard Deviation (S_d): 0.00605
 RMS Deviation: 3.9%
 $t_{(n-1, 0.99)}$: 2.998
 MDL: 0.018
 MRL: 0.091

Is the spike level higher than the MDL? Yes
 Is the spike level less than ten times the MDL? Yes
 Is the Avg Recovery between 90% < R_s < 110%? Yes

Sample Calculations

Ion Chromatography Analysis

Customer: Palatine Engineering Group	Lab Project No: 28745	Analyst: Eric Ewing
Plant: Marathon	Customer Reference No: 11265	Received: 7/26/11
Applicable Analytical Method: U.S. EPA Method 26A	Analyte: Chloride	

Calibration Point No: 3
Sample No: 28745-25
Sample Location: FCCU Scrub. Stack

1. Difference between duplicate injections for pre-test calibration (Pre Cal 1).

$$\Delta_{Injection} = |Area_{Trial\ 2} - Area_{Trial\ 1}|$$

Where:

$\Delta_{Injection}$ = Area count difference between duplicate injections

$Area_{Trial2}$ = Area count for injection Trial 2

$Area_{Trial1}$ = Area count for injection Trial 1

$\Delta_{Injection}$ = 0.0009

$Area_{Trial2}$ = 0.2557

$Area_{Trial1}$ = 0.2548

2. Average area count value for duplicate injections for pre-test calibration (Pre Cal 1).

$$Avg_{PreInj} = \frac{(Area_{Trial1} + Area_{Trial2})}{2}$$

Where:

Avg_{PreInj} = Average of duplicate injection area counts

$Area_{Trial2}$ = Area count for injection Trial 2

$Area_{Trial1}$ = Area count for injection Trial 1

2 = Constant (number of values)

Avg_{Inj} = 0.2553

$Area_{Trial2}$ = 0.2557

$Area_{Trial1}$ = 0.2548

Sample Calculations

Ion Chromatography Analysis

Customer:	Palatine Engineering Group	Lab Project No:	28745	Analyst:	Eric Ewing
Plant:	Marathon	Customer Reference No:	11265	Received:	7/26/11
Applicable Analytical Method:	U.S. EPA Method 26A			Analyte:	Chloride

Calibration Point No: 3
Sample No: 28745-25
Sample Location: FCCU Scrub. Stack

3. Difference between individual injection and average area count for pre-test calibration.

$$\Delta_{PreMean\%} = \frac{|Area_{Trial2} - Avg_{PreInj}|}{Avg_{PreInj}} 100$$

Where:

$\Delta_{PreMean\%}$ = Difference between individual injection and average area count (%).
 Avg_{PreInj} = Average of duplicate injection area counts
 $Area_{Trial2}$ = Area count for injection Trial 2
100 = Constant (conversion factor for percentage)

$\Delta_{PreMean\%}$ = 0.1760
 Avg_{PreInj} = 0.2553
 $Area_{Trial2}$ = 0.2557

Note: EPA Method 26 requires $\Delta_{PreMean\%}$ to be less than 5%.

4. Average of all area count values for a given calibration point.

$$\bar{X} = \frac{\sum_{i=1}^n x_i}{n}$$

Where:

\bar{X} = Average of all area count values for a given calibration point.
 x_i = Individual area count values for each individual injection.
i = Iteration value.
n = Number of injections for the calibration point under question.

\bar{X} = 0.2526
 x_1 = 0.2548
 x_2 = 0.2557
n = 6

Sample Calculations

Ion Chromatography Analysis

Customer: Palatine Engineering Group	Lab Project No: 28745	Analyst: Eric Ewing
Plant: Marathon	Customer Reference No: 11265	Received: 7/26/11
Applicable Analytical Method: U.S. EPA Method 26A	Analyte: Chloride	

Calibration Point No: 3
Sample No: 28745-25
Sample Location: FCCU Scrub. Stack

5. Average of all concentration values used for generating calibration curve.

$$\overline{Y}_{All} = \frac{\sum_{i=1}^n y_i}{n}$$

Where:

\overline{Y}_{All} = Average of all area concentration values.
 y_i = Individual concentration values for each individual injection.
 n = Number of injections.

\overline{Y}_{All} = 1.4587
 y_1 = 0.0000
 y_2 = 0.1516
 n = 7

6. Average of all area count values for the calibration curve.

$$\overline{X}_{All} = \frac{\sum_{i=1}^n x_i}{n}$$

Where:

\overline{X}_{All} = Average of all area count values.
 x_i = Individual area count values.
 i = Iteration value.
 n = Number of injections.

\overline{X}_{All} = 0.9287
 x_1 = 0.2548
 x_2 = 0.2557
 n = 30

Sample Calculations

Ion Chromatography Analysis

Customer:	Palatine Engineering Group	Lab Project No:	28745	Analyst:	Eric Ewing
Plant:	Marathon	Customer Reference No:	11265	Received:	7/26/11
Applicable Analytical Method:	U.S. EPA Method 26A			Analyte:	Chloride

Calibration Point No: 3
Sample No: 28745-25
Sample Location: FCCU Scrub. Stack

7. Determination of slope (least-squares regression) value for calibration curve.

$$m = \frac{\sum_{i=1}^n (x_i - \bar{x})(y_i - \bar{y})}{\sum_{i=1}^n (x_i - \bar{x})^2}$$

Where:

m = Slope of least-squares regression curve.
 x_i = Individual area count values for each individual injection.
 \bar{x} = Average of all area count values = \bar{X}_{All}
 y_i = Actual area concentration values for each individual injection.
 \bar{y} = Average of all concentration values = \bar{Y}_{All}
 i = Iteration value.
 n = Number of injections.

m = 1.53591
 x_1 = 0.2548
 x_2 = 0.2557
 \bar{x} = 0.9287
 y_1 = 0.0000
 y_2 = 0.1516
 \bar{y} = 1.4587
 n = 30

8. Determination of y-intercept (least-squares regression) value for calibration curve.

$$b = \bar{y} - m \bar{x}$$

Where:

b = Y-axis intercept.
 \bar{x} = Average of all area count values = \bar{X}_{All}
 \bar{y} = Average of all concentration values = \bar{Y}_{All}

b = 0.01448
 m = 1.53591
 \bar{x} = 0.9287
 \bar{y} = 1.4587

Sample Calculations

Ion Chromatography Analysis

Customer:	Palatine Engineering Group	Lab Project No:	28745	Analyst:	Eric Ewing
Plant:	Marathon	Customer Reference No:	11265	Received:	7/26/11
Applicable Analytical Method:	U.S. EPA Method 26A			Analyte:	Chloride

Calibration Point No: 3
Sample No: 28745-25
Sample Location: FCCU Scrub. Stack

9. Determination of coefficient of correlation (least-squares regression) value for calibration curve.

$$r = \frac{\sum_{i=1}^n (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum_{i=1}^n (x_i - \bar{x})^2 \sum_{i=1}^n (y_i - \bar{y})^2}}$$

Where:

- r^2 = Square of the Pearson product moment correlation coefficient through data points in known y's and known x's.
- r = Pearson product moment correlation coefficient through data points in known y's and known x's.
- x_i = Individual area count values for each individual injection.
- y_i = Actual area concentration values for each individual injection.
- \bar{x} = Average of all area count values = \bar{X}_{All}
- \bar{y} = Average of all concentration values = \bar{Y}_{All}
- i = Iteration value.
- n = Number of injections.

r^2	=	0.99996
r	=	0.99998
x_1	=	0.2548
x_2	=	0.2557
\bar{x}	=	0.9287
y_1	=	0.0000
y_2	=	0.1516
\bar{y}	=	1.4587
n	=	30

Sample Calculations

Ion Chromatography Analysis

Customer:	Palatine Engineering Group	Lab Project No:	28745	Analyst:	Eric Ewing
Plant:	Marathon	Customer Reference No:	11265	Received:	7/26/11
Applicable Analytical Method:	U.S. EPA Method 26A			Analyte:	Chloride

Calibration Point No: 3
Sample No: 28745-25
Sample Location: FCCU Scrub. Stack

10. Determination of average sample area counts from duplicate injections.

$$Avg_{Sample} = \frac{(Area_{Trial1} + Area_{Trial2})}{2}$$

Where:

Avg_{Sample} = Average of duplicate injection area counts
 $Area_{Trial2}$ = Area count for injection Trial 2
 $Area_{Trial1}$ = Area count for injection Trial 1
2 = Constant (number of injections)

Avg_{Inj} = 0.0809
 $Area_{Trial2}$ = 0.0826
 $Area_{Trial1}$ = 0.0791

11. Difference between duplicate injections for the sample.

$$\Delta_{Injection} = |Area_{Trial2} - Area_{Trial1}|$$

Where:

$\Delta_{Injection}$ = Area count difference between duplicate injections
 $Area_{Trial2}$ = Area count for injection Trial 2
 $Area_{Trial1}$ = Area count for injection Trial 1

$\Delta_{Injection}$ = 0.0035
 $Area_{Trial2}$ = 0.0826
 $Area_{Trial1}$ = 0.0791

Sample Calculations

Ion Chromatography Analysis

Customer:	Palatine Engineering Group	Lab Project No:	28745	Analyst:	Eric Ewing
Plant:	Marathon	Customer Reference No:	11265	Received:	7/26/11
Applicable Analytical Method:	U.S. EPA Method 26A			Analyte:	Chloride

Calibration Point No: 3
Sample No: 28745-25
Sample Location: FCCU Scrub. Stack

12. Difference between individual injection and average area count for the sample.

$$\Delta_{Injection} = \frac{|Area_{Trial2} - Avg_{Inj}|}{Avg_{Inj}} 100$$

Where:

$\Delta_{Injection}$ = Difference between individual injection and average area count (%).
 Avg_{Inj} = Average of duplicate injection area counts
 $Area_{Trial2}$ = Area count for injection Trial 2
100 = Constant (conversion factor for percentage)

$\Delta_{Injection}$ = 2.2%
 Avg_{Inj} = 0.0809
 $Area_{Trial2}$ = 0.0826

Note: EPA Method 26 requires $\Delta_{Injection}$ to be less than 5%.

13. Determination of sample concentration from least-squares regression curve (mg/L).

$$C_{Reg} = DF [m(Avg_{Inj}) + b]$$

Where:

C_{Reg} = Sample concentration determined using the regression curve (mg/L)
DF = Sample dilution factor
 Avg_{Inj} = Average of duplicate injection area counts.
m = Slope of least-squares regression curve.
b = Y-intercept of least-squares regression curve.

C_{Reg} = 0.14
DF = 1
 Avg_{Inj} = 0.0809
m = 1.5359
b = 0.0145

Sample Calculations

Ion Chromatography Analysis

Customer: Palatine Engineering Group	Lab Project No: 28745	Analyst: Eric Ewing
Plant: Marathon	Customer Reference No: 11265	Received: 7/26/11
Applicable Analytical Method: U.S. EPA Method 26A	Analyte: Chloride	

Calibration Point No: 3
Sample No: 28745-25
Sample Location: FCCU Scrub. Stack

14. Determination of total amount of analyte in sample (total mg).

$$M_{Analyte} = \frac{(C_{Reg})(V_{Soln})}{1000}$$

Where:

$M_{Analyte}$ = Amount of analyte in sample (total mg)
 C_{Reg} = Sample concentration determined using the response factor (mg/L)
 V_{Soln} = Sample volume (ml)
1000 = Conversion constant (ml to L)

$M_{Analyte}$ = 0.14
 C_{Reg} = 0.1387
 V_{Soln} = 990.0

15. Determination of Detection Limits.

15a. Determination of average spike result.

$$AvgM_{f-i} = \frac{\sum_{i=1}^n M_{f-i}}{n}$$

Where:

$AvgM_{f-i}$ = Average of spike result (mg/L)
 M_{f-i} = Net results recorded for each iteration (mg/L)
n = Number of iterations.
i = Placeholder for iteration.

$AvgM_{f-i}$	=	0.157		
M_{f-1}	=	0.162	M_{f-5}	= 0.160
M_{f-2}	=	0.158	M_{f-6}	= 0.157
M_{f-3}	=	0.162	M_{f-7}	= 0.150
M_{f-4}	=	0.161	M_{f-8}	= 0.146
n	=	8		

Sample Calculations

Ion Chromatography Analysis

Customer: Palatine Engineering Group	Lab Project No: 28745	Analyst: Eric Ewing
Plant: Marathon	Customer Reference No: 11265	Received: 7/26/11
Applicable Analytical Method: U.S. EPA Method 26A	Analyte: Chloride	

Calibration Point No: 3
Sample No: 28745-25
Sample Location: FCCU Scrub. Stack

15b. Determination of standard deviation of spike result.

$$\sigma_{f-i} = \sqrt{\frac{\sum_{i=1}^n (M_{f-i} - \text{Avg}M_{f-i})^2}{(n-1)}}$$

Where:

σ_{f-i} = Standard deviation of spike result.
 $\text{Avg}M_{f-i}$ = Average spike result (mg/L)
 M_{f-i} = Concentration recorded for each iteration (mg/L)
n = Number of iterations.
i = Placeholder for iteration.

σ_{f-i}	=	0.0061		
$\text{Avg}M_{f-i}$	=	0.157		
M_{f-1}	=	0.162	M_{f-5}	= 0.160
M_{f-2}	=	0.158	M_{f-6}	= 0.157
M_{f-3}	=	0.162	M_{f-7}	= 0.150
M_{f-4}	=	0.161	M_{f-8}	= 0.146
n	=	8		

15c. Determination of variance of spike result.

$$V_{f-i} = (\sigma_{f-i})^2$$

Where:

V_{f-i} = Variance of spike result.
 σ_{f-i} = Standard deviation of spike result.

V_{f-i}	=	3.67E-05
σ_{f-i}	=	0.0061

Sample Calculations

Ion Chromatography Analysis

Customer: Palatine Engineering Group	Lab Project No: 28745	Analyst: Eric Ewing
Plant: Marathon	Customer Reference No: 11265	Received: 7/26/11
Applicable Analytical Method: U.S. EPA Method 26A	Analyte: Chloride	

Calibration Point No: 3
Sample No: 28745-25
Sample Location: FCCU Scrub. Stack

15d. Determination of RMS deviation of spike result.

$$RMS_{f-i} = 100 \frac{\sigma_{f-i}}{AvgM_{f-i}}$$

Where:

RMS_{f-i} = RMS deviation of spike results (%).
 σ_{f-i} = Standard deviation of spike result.
 $AvgM_{f-i}$ = Average spike result (mg/L)
100 = Conversion constant (fraction to percent)

RMS_{f-i} = 0.0386
 σ_{f-i} = 0.0061
 $AvgM_{f-i}$ = 0.1570

15e. Determination of average spike recovery.

$$R_f = 100 \frac{AvgM_{f-i}}{RA}$$

Where:

R_f = Average spike recovery (%)
 $AvgM_{f-i}$ = Average spike result (mg/L)
RA = Spike concentration added (mg/L)
100 = Conversion constant (fraction to percent)

R_f = 103.5%
 $AvgM_{f-i}$ = 0.15701
RA = 0.15165

Sample Calculations

Ion Chromatography Analysis

Customer: Palatine Engineering Group	Lab Project No: 28745	Analyst: Eric Ewing
Plant: Marathon	Customer Reference No: 11265	Received: 7/26/11
Applicable Analytical Method: U.S. EPA Method 26A	Analyte: Chloride	

Calibration Point No: 3
Sample No: 28745-25
Sample Location: FCCU Scrub. Stack

15f. Determination of $t_{(n-1, 0.99)}$.

Value taken from the following Table:

n	$t_{(n-1, 0.99)}$
7	3.143
8	2.998
9	2.896
10	2.821
11	2.764
16	2.602
21	2.528

Where:

$t_{(n-1, 0.99)}$ = Students' t value appropriate for a 99% confidence level and a standard deviation estimate with n-1 degrees of freedom.

n = Number of iterations.

$t_{(n-1, 0.99)}$ = 2.998

n = 8

15g. Determination of Method Detection Limit (MDL).

$$MDL = \sigma_{f_i} t_{(n-1, 0.99)}$$

Where:

MDL = Method detection limit (mg/L)

$t_{(n-1, 0.99)}$ = Students' t value appropriate for a 99% confidence level and a standard deviation estimate with n-1 degrees of freedom.

σ_{f_i} = Standard deviation of spike result.

MDL = 0.018

$t_{(n-1, 0.99)}$ = 2.998

σ_{f_i} = 0.0061

Sample Calculations
Ion Chromatography Analysis

Customer:	Palatine Engineering Group	Lab Project No:	28745	Analyst:	Eric Ewing
Plant:	Marathon	Customer Reference No:	11265	Received:	7/26/11
Applicable Analytical Method:	U.S. EPA Method 26A			Analyte:	Chloride

Calibration Point No: 3
Sample No: 28745-25
Sample Location: FCCU Scrub. Stack

15h. Determination of Method Reporting Limit (MRL).

$$MRL = 5(MDL)$$

Where:

MRL = Method reporting limit (mg/L)
MDL = Method detection Limit (mg/L)
5 = Constant

MRL = 0.091
MDL = 0.018

AS40 Log Sheet

Customer: 66 Plant: Margisha Analyte(s): F
 Customer Project No: 11265 Lab Project No: 28743 Date: 7/28/11 Analyst: Fric Gwiny
 Inj Type: Loop Conc Inj Mode: Prop/Const Inj / Vial: 1/23

Date Received: 7/26/11
 Shipping Person: K. O'Hara

Serial Dilution Data

Cartridge ID: 1B

Pos	Sample #	Identification	Volume	Dilution Ratio
1	Blank			
2		Cal 01		
3		Cal 01		
4		Cal 02		
5		Cal 03		
6		Cal 04		

Pipet Serial No.	Pipet Size	Flask Serial No.	Flask Size
2835	3	1234	200
4825	10	1072	250
4816	20	4224	250
1236	25	6776	200

Cartridge ID: 0B

Pos	Sample #	Identification	Volume	Dilution Ratio
1		Cal 05		
2		Cal 06		
3	Blank			
4		Cal		
5	Blank			
6	-83	DI H2O Blank	200	1

Pipet Serial No.	Pipet Size	Flask Serial No.	Flask Size
7417	50	0726	200
7417	50	5630	100
9815	200	1248	200

Cartridge ID: 3B

Pos	Sample #	Identification	Volume	Dilution Ratio
1	-28	0.1 N NaOH Blank	200	1
2	-29	PCV H2O Sample	400	1
3	-30	" " " R1	400	1
4	-31	" " " R2	370	1
5	Blank			
6	-34	0.1 N H2SO4 Blank	200	1

Pipet Serial No.	Pipet Size	Flask Serial No.	Flask Size

Analyst Signature

[Signature]

AS40 Log Sheet

Customer: CE Analyte(s): F
 Plant: Monrovia 01
 Customer Project No: 1265
 Lab Project No: 2770
 Date: 7/29/11
 Analyst: Eric Ewing

Date Received: _____
 Shipping Person: _____

Inj Type: Loop Conc _____ Inj Mode: Prop Const Inj / Vial: 1/2 3

Cartridge ID: 48

Pos	Sample #	Identification	Volume	Dilution Ratio
1	-25	Flow Stop	1000	1
2	-26	"	1000	1
3	-27	"	1000	1
4	Blank	"	1000	1
5	Blank	"	1000	1
6	Blank	"	1000	1

Cartridge ID: 58

Pos	Sample #	Identification	Volume	Dilution Ratio
1	1	Cal 02		
2	Blank			
3				
4				
5				
6				

Cartridge ID: 10

Pos	Sample #	Identification	Volume	Dilution Ratio
1	Blank			
2	Cal 03			
3	Blank			
4	QC			200
5	Blank			
6	Blank			

Analyst Signature

Eric Ewing

AS40 Log Sheet

Customer: 66 Analyte(s): F
 Plant: Non-then Cr
 Customer Project No: 11265
 Lab Project No: 28745
 Date: 7/24/11
 Analyst: Erin Furing

Date Received: _____
 Shipping Person: _____

Inj Type: Loop/Conc Inj Mode: Prop Const Inj / Vial: 1/23

Serial Dilution Data

Cartridge ID: 28

Pos	Sample #	Identification	Volume	Dilution Ratio
1	<u>Blank</u>			
2	<u>25</u>			
3	<u>Blank</u>			
4		<u>CC</u>		
5	<u>Blank</u>			
6	<u>25</u>	<u>Matrix Soln</u>		

Cartridge ID: 31

Pos	Sample #	Identification	Volume	Dilution Ratio
1	<u>25</u>	<u>Matrix Soln</u>		
2	<u>Blank</u>			
3		<u>Cal 01</u>		
4		<u>Cal 01</u>		
5		<u>Cal 02</u>		
6		<u>Cal 03</u>		

Cartridge ID: 48

Pos	Sample #	Identification	Volume	Dilution Ratio
1		<u>Cal 04</u>		
2		<u>Cal 05</u>		
3		<u>Cal 06</u>		
4		<u>Blank</u>		
5				
6				

Erin Furing

Analyst Signature

AS40 Log Sheet

Customer: 66 Analyte(s): P
 Plant: North
 Customer Project No: 11265
 Lab Project No: 28741
 Date: 8/1/14
 Analyst: Eric Gwilym

Date Received:
 Shipping Person:

Inj Type: Loop Conc Inj Mode: Prp / Cnst Inj / Vial: 1 @ 3

Cartridge ID: 10


Pos	Sample #	Identification	Volume	Dilution Ratio
1	<u>Blank</u>			
2	<u>-25</u>	<u>Matrix Spike</u>		<u>1</u>
3	<u>-25</u>	<u>Matrix Spike</u>		<u>1</u>
4	<u>Blank</u>			
5				
6				

Cartridge ID:

Pos	Sample #	Identification	Volume	Dilution Ratio
1				
2				
3				
4				
5				
6				

Cartridge ID:

Pos	Sample #	Identification	Volume	Dilution Ratio
1				
2				
3				
4				
5				
6				

Analyst Signature 

Serial Dilution Data

Pipet Serial No.	Pipet Size	Flask Serial No.	Flask Size

Pipet Serial No.	Pipet Size	Flask Serial No.	Flask Size

Pipet Serial No.	Pipet Size	Flask Serial No.	Flask Size

Lab Project No.: 28745

Date Received: 7/26/2011

CleanAir No.: 11265

66

Customer : 66

Contact : Kevin O'halloren

Phone :

Fax :

Email : kohalloren@cleanair.com

Requested Analysis

Due	Analyst	Status	Sample Type		Container	Method
8/9/2011	MT	In Queue	1-3	8.26 GF Filter	Petri Dish	EPA Method 5
8/9/2011	MT	In Queue	1-3	8.26 GF Filter	Petri Dish	US EPA Method 5B
8/9/2011	MT	In Queue	4-7	F 1/2 Acetone	Glass Jars	EPA Method 5
8/9/2011	MT	In Queue	4-7	F 1/2 Acetone	Glass Jars	US EPA Method 5B
8/9/2011	MT	In Queue	8-8	F 1/2 Acetone	amber glass jar	US EPA Method 202
8/9/2011	MT	In Queue	9-13	B 1/2 H ₂ O	amber glass jar	US EPA Method 202
8/9/2011	MT	In Queue	14-18	Back half rinse	amber glass jar	US EPA Method 202
8/9/2011	MT	In Queue	19-22	Filter	Petri Dish	US EPA Method 202
8/9/2011	EE	In Queue	23-27	Imp C&R	Nalgene	EPA Method 26A Fluoride, Chloride
8/9/2011	EE	In Queue	28-31	Imp C&R	Nalgene	EPA Method 26A Chloride
8/9/2011	EE	In Queue	32-40	Imp C&R	Nalgene	EPA CTM-027
8/9/2011	EE	In Queue	41-44	Imp C&R	Nalgene	Archive
8/9/2011	EE	In Queue	45-47	Tedlar Bags	Tedlar Bag	EPA Method 18 Methane, Ethane
8/9/2011	EE	In Queue	51-51	F 1/2 Acetone	Glass Jars	Archive
8/9/2011	EE	In Queue	48-50	Tedlar Bags	Tedlar Bag	Archive

Printed 2011/07/26 09:48:27

Marathon Petroleum Company
Clean Air Project No: 11265
FCCU Scrubber Stack

USEPA Method 26A Fluoride Laboratory Data Summary

Run No.	Blank	1	2	3
Date (2011)		Jul 20	Jul 20	Jul 21
Start Time (approx.)		09:49	12:50	07:54
Stop Time (approx.)		12:18	15:10	10:07

☐ DRAFT LAB DATA

MDL Min. detectable limit (mg F⁻/liter) 0.0080

HF as Total Fluoride

B_F Blank concentration (mg F⁻/liter) <0.0080

S _{F-1}	Fraction 1 concentration (mg F ⁻ /liter)	<0.0080	<0.0080	<0.0080
v ₁	Fraction 1 sample volume (ml)	990.0	1020.0	1010.0
m _{HF}	HF collected before blank subtraction (mg)	<0.0083	<0.0086	<0.0085
m _b	Allowable blank subtraction (mg)	0.0000	0.0000	0.0000
m _{nb}	HF collected after blank subtraction (mg)	<0.0083	<0.0086	<0.0085
m _{MDL}	Minimum detectable HF (mg)	0.0083	0.0086	0.0085
m _n	Total HF used in emission calculations (mg)	<0.0083	<0.0086	<0.0085

090811 092840
H



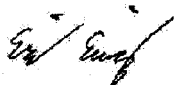
Laboratory Analysis for Anions

Performed For:
Palatine Engineering Group
500 West Wood Street
Palatine, IL 60067

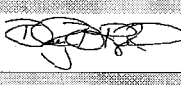
Laboratory Report No: 64-28745_IC_F_V0
Customer Reference No: 11265

Revision 0 - Dated: 08/02/2011

To the best of our knowledge, the data presented in this report are accurate, complete, error free, legible and representative of the samples received by the laboratory.

 Digitally signed
by Eric Ewing
Date: 2011.08.02
15:45:29 -05'00'

Eric Ewing
Title: Analyst
email: eewing@cleanair.com
Ph: 847-654-4519

 Digitally signed by
Douglas D. Rhoades
Date: 2011.08.02
15:58:03 -05'00'

Douglas D. Rhoades
Title: Team Leader
email: drhoades@cleanair.com
Ph: 847-654-4504



CERTIFICATE OF ANALYSIS
Ion Chromatography Analysis

Customer:	Palatine Engineering Group	Lab Project No:	28745	Analyst:	Eric Ewing
Plant:	Marathon	Customer Reference No:	11265	Received:	7/26/11
Applicable Analytical Method:	U.S. EPA Method 26A			Analyte:	Fluoride

Laboratory Sample Identification Number	Sample Identification	Sample Volume (mL)	Fluoride Sample Conc. (mg/L)	Method Detection Limit (mg/L)	Method Reporting Limit (mg/L)
Reagent Blanks					
28745-23	DI H2O Blank	200	<	0.008	0.040
28745-24	0.1N H2SO4 Blank	200	<	0.008	0.040
FCCU Scrub. Stack					
28745-25	Acid Imp C&R R1	990	<	0.008	0.040
28745-26	Acid Imp C&R R2	1020	<	0.008	0.040
28745-27	Acid Imp C&R R3	1010	<	0.008	0.040

Analysis Case Narrative

Ion Chromatography Analysis

Customer:	Palatine Engineering Group	Lab Project No:	28745	Analyst:	Eric Ewing
Plant:	Marathon	Customer Reference No:	11265	Received:	7/26/11
Applicable Analytical Method:	U.S. EPA Method 26A			Analyte:	Fluoride

Summary of Analysis

This report summarizes the results of the analysis performed on samples received on: 07/26/11
The samples were analyzed in accordance with NELAC and procedures found in U.S. EPA Method 26A and U.S. EPA Method 300.1.

All analysis was carried out using a Dionex ICS-90, Dionex AS22 column, 4.5mM/1.4mM sodium carbonate/bicarbonate eluent, and 50mN sulfuric acid regenerant.

Detection Limits

Method Detection Limits have been determined in accordance with procedures in 40 CFR 136, Appendix B. Documentation showing the determination of detection limits are included with this report. The Method Reporting Limit (MRL) was determined by multiplying the Method Detection Limit (MDL) by a factor of 5. Values between these limits were quantified, but should be used with discretion as they were below the MRL. Values that were below the MDL are indicated by a "<" where appropriate.

Sample Preparation

Samples were prepared according to the procedures listed in the EPA Method above. Each sample was analyzed at full strength and a dilution was prepared if necessary to achieve a concentration that was within calibration range limits.

Standard and Reagent Traceability

Each calibration standard has been prepared in accordance with US EPA Method 300.1 and US EPA Method 26 and has been designated an original lot number. This number can be used to trace back to the original dry salts used in the preparation of these standards. This number is included on the calibration page of this report and may also be found in Table 1 below. In addition, the dilution scheme used for the preparation of standards has been included in this report

Table 1: Standard Lot Numbers Used For Analysis

Standard Type	Lot Number	Concentration of Analyte
Stock Standard	07221102-64-00000-03	500.09 mg/L
QC Standard	07221102-64-00000-04	126.43 mg/L

In suppressed ion chromatography, eluent is defined as the carrier that moves chemicals through the column and regenerant is defined as a reagent used to remove ions opposite in charge of the specific analyte. Regenerant also reduces the overall conductivity of the eluent. A table displaying the lot numbers of these reagents used for each day of analysis is displayed below in Table 2.

Table 2: Eluent and Regenerant Lot Numbers Used for Each Day of Analysis

Analysis Date	Eluent Lot Number	Regenerant Lot Number
7/28/2011	1067-64-00000-01	1058-64-00000-02
7/29/2011	1067-64-00000-01	1058-64-00000-02
8/1/2011	1067-64-00000-01	1058-64-00000-02

Instrument Calibration

Instrument calibration followed regulations found in US EPA Method 300.1 and U.S. EPA Method 26A. Calibration standards were prepared from ACS grade dry salts as per section 7.3 of US EPA Method 300.1. As per section 4.2.2 of US EPA CTM-027, a series of 6 diluted standards are prepared from the original calibration standard and run through the column in duplicate from lowest concentration to highest. The average peak area for each calibration point is gathered and plotted against the expected solution concentration. In accordance with section 7.2.3 of EPA Method 9057, a least-squares regression with an r^2 value of .995 or greater must be produced from the resulting curve. In accordance with US EPA Method 26 a full post-test calibration is performed. The pre test calibration and post test calibration average peak area for any standard must agree within $\pm 5\%$ of any observed area.

Analysis Case Narrative

Ion Chromatography Analysis

Customer:	Palatine Engineering Group	Lab Project No:	28745	Analyst:	Eric Ewing
Plant:	Marathon	Customer Reference No:	11265	Received:	7/26/11
Applicable Analytical Method:	U.S. EPA Method 26A			Analyte:	Fluoride

Chromatograms

Chromatograms were generated using Dionex Chromeleon software. All chromatograms are included as an appendix of this report. Please note: Chromatograms marked as "End" are place markers meant to signify the end of a batch run and are purposely left blank as no data was acquired for that run.

Analysis QA/QC

Many elements of various EPA methods have been combined and are adhered to:

EPA Method 300.1 quality procedures:

- 1 Before the first sample was analyzed and every twenty samples thereafter (and before the post-test calibration) a laboratory blank and a Continuing Calibration Verification (CCV) were analyzed. The CCV is prepared from the same calibration standard as used to create the 7 diluted standards that make up the calibration curve. The laboratory blank must show a regression concentration of zero, and the CCV must show a regression concentration within 10 percent of the expected concentration.
- 2 After the first ten samples and every twenty there after, a Quality Control (QC) sample was analyzed. The QC sample was created using ACS grade dry salts from a different manufacturer and or lot number than for the salts used to create the calibration standards. The QC must meet the same acceptance criteria as noted for the CCV above.
- 3 A matrix spike analysis was performed on ten percent of the total number of samples. This sample was prepared with equal amounts of a sample and a calibration standard whose concentration was known to be larger than that of the sample. The matrix spike is acceptable when the recovery is found to be 100 ± 10 percent.
- 4 As a measure of precision, all matrix spikes were prepared and analyzed in duplicate. The average area count of two identical matrix spikes may not have a relative percent difference of more than 10 percent.

EPA Method 26 quality procedure:

- 1 As per section 11.1.3, every sample was analyzed in duplicate and the mean area count used to determine the concentration. The duplicate area counts must have a relative percent difference of no greater than five percent. If this was the case, a third injection was made and the average of the three injections was used to determine the concentration.

EPA Method 7E quality procedures:

- 1 Each point on the calibration curve should be within ± 2 percent of the calibration span of the curve used.

Other CleanAir quality procedures:

- 1 The observed concentration value of each point on the calibration curve should have a relative percent difference of no more than 10 percent from its expected concentration.

Analysis Case Narrative
Ion Chromatography Analysis

Customer:	Palatine Engineering Group	Lab Project No:	28745	Analyst:	Eric Ewing
Plant:	Marathon	Customer Reference No:	11265	Received:	7/26/11
Applicable Analytical Method:	U.S. EPA Method 26A			Analyte:	Fluoride

Additional Comments

This report shall in no way be reproduced except in full without the prior written approval of Clean Air Analytical Laboratory management.

A copy of this report and all associated supporting records will be archived and stored for at least 20 years. All samples are archived for a period of one year from date of receipt in a non-temperature controlled facility. All samples are stored in the original container, any digestates or reconstitutions are stored in a adequately sized Nalgene container.

Sample volumes were determined volumetrically using an appropriately sized graduated cylinder calibrated TD @ 20C.

Clean Air Laboratory Services is accredited by NELAC in the following states. Please visit the NELAP website to view our current status and a comprehensive list of our accredited services.

Table 3: Specific NELAC Accreditation and Expiration Date

State	Certificate Number	Expiration Date
Texas	T104704431-11-2	6/30/2012
New Jersey	IL004	6/30/2012
Louisiana	169249	6/30/2012

CHROMATOGRAPHIC DATA REDUCTION
Ion Chromatography Analysis

Customer:	Palatine Engineering Group	Lab Project No:	28745	Analyst:	Eric Ewing
Plant:	Marathon	Customer Reference No:	11265	Received:	7/26/11
Applicable Analytical Method:	U.S. EPA Method 26A			Analyte:	Fluoride

Stock Standard: 500.09 mg/L
 Working Stock Conc.: 5.0009 mg/L
 CCV: 0.50 mg/L
 QC: 126.43 mg/L

Analyte:

		Fluoride Standards Calibration Data						
Calibration Point Conc. (mg/L)	Date of Injection	1 0.0000	2 0.0750	3 0.2000	4 0.4001	5 0.6251	6 1.2502	7 2.5005
Cal 1 Trial 1	07/28/2011	0.0000	0.0605	0.1661	0.3345	0.5614	1.1078	2.1979
Cal 1 Trial 2		0.0000	0.0602	0.1604	0.3428	0.5482	1.1306	2.1835
Cal 2 Trial 1	07/29/2011			0.1602	0.3373			
Cal 2 Trial 2				0.1607	0.3363			
Cal 3 Trial 1	07/29/2011		0.0610	0.1640	0.3371	0.5515	1.1298	2.1930
Cal 3 Trial 2			0.0604	0.1655	0.3388	0.5530	1.1202	2.2024

n	2	4	6	6	4	4	4
Average	0.0000	0.0605	0.1628	0.3378	0.5535	1.1221	2.1942
Standard Deviation	0.0000	0.0003	0.0027	0.0028	0.0056	0.0106	0.0081
%RSD	0.00	0.56	1.66	0.84	1.02	0.95	0.37

Quality Control Checks						
Measured Area Counts (Counts)	Actual Concentration (mg/L)	Regression Concentration (mg/L)	Difference pt-Line (% Scale)	Is Difference Less Than 2% of Scale?	Difference pt-Line (Relative %)	Is Relative Difference Less Than 10%?
0.0000	0.000	0.005	-0.20%	Yes	0.00%	Yes
0.0605	0.075	0.074	0.06%	Yes	1.98%	Yes
0.1628	0.200	0.189	0.43%	Yes	5.36%	Yes
0.3378	0.400	0.387	0.51%	Yes	3.17%	Yes
0.5535	0.625	0.632	-0.26%	Yes	-1.04%	Yes
1.1221	1.250	1.275	-1.00%	Yes	-2.00%	Yes
2.1942	2.500	2.489	0.47%	Yes	0.47%	Yes
<u>Regression Constants</u>			Is Coefficient of Regression > 0.995?			
Slope	m =	1.1320	Yes			
Intercept	b =	0.0050				
Coeff.	R ² =	0.9998				

Stock Solution Standard Mixing Recipe (Anions)

Ion Chromatography Analysis

Customer:	Palatine Engineering Group	Lab Project No:	28745	Analyst:	Eric Ewing
Plant:	Marathon	Customer Reference No:	11265	Received:	7/26/11
Applicable Analytical Method:	U.S. EPA Method 26A			Analyte:	Fluoride

Order of Elution	8	9	10	11	12	13	14	15
Analyte	Fluoride	Chloride	Nitrite	Bromide	Nitrate	Phosphate	Sulfate	Iodide
Analyte Weight (g/g-mole)	19.00	35.45	46.01	79.90	62.01	94.97	96.07	126.91
Solid Formula	NaF	NaCl	NaNO ₂	NaBr	NaNO ₃	Na ₂ HPO ₄	Na ₂ SO ₄	NaI
Number of ions/Formula	1	1	1	1	1	1	1	1
Formula Weight (g/g-mole)	41.99	58.44	69.00	102.89	85.00	141.96	142.04	149.90
% Analyte in Solid	45.25%	60.66%	66.68%	77.66%	72.95%	66.90%	67.63%	84.66%

Recommended Analyte Concentration (mg/L)	500	1007.21	2000	3000	3000	5000	5000	7000
--	-----	---------	------	------	------	------	------	------

Amount of Solid Required to Achieve the Above Stock Solution Concentration In The Listed Volumetric Flask:

500 ml	0.5525	0.8302	1.4997	1.9316	2.0561	3.7370	3.6964	4.1341
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Size of Flask

500 ml ▼

Amount of Solid Used

0.5526 g	0.8333 g		1.9338 g				
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Actual Concentration (mg/L)

500.09	1010.97	3003.41
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Concentration in the Five Cal Flasks (mg/L)

Stock (1 liter Flask) Solution Concentrations

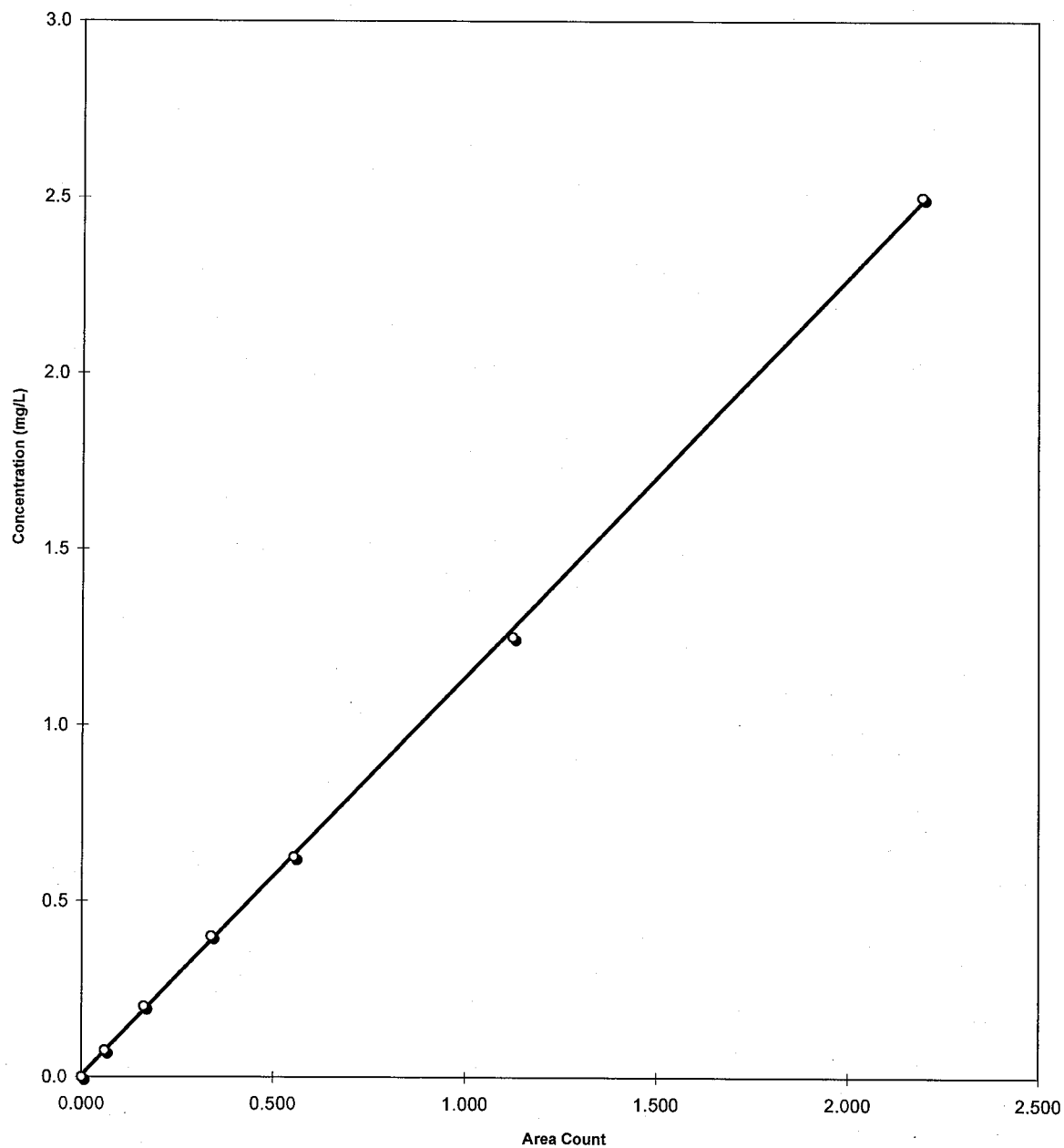
10 ml Original Solution Used	5.0009	10.1097	30.0341
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Dilution Flask Size	Aliquot Stock				
200	3	0.0750	0.1516	0.4505	1
250	10	0.2000	0.4044	1.2014	2
250	20	0.4001	0.8088	2.4027	3
200	20	0.5001	1.0110	3.0034	CCV
200	25	0.6251	1.2637	3.7543	4
200	50	1.2502	2.5274	7.5085	5
100	50	2.5005	5.0548	15.0171	6

CHROMATOGRAPHIC DATA REDUCTION
Ion Chromatography Analysis

Customer:	Palatine Engineering Group	Lab Project No:	28745	Analyst:	Eric Ewing
Plant:	Marathon	Customer Reference No:	11265	Received:	7/26/11
Applicable Analytical Method:	U.S. EPA Method 26A			Analyte:	Fluoride

Fluoride Calibration Curve



Sample Information

Customer:	Palatine Engineering Group	Lab Project No:	28745	Analyst:	Eric Ewing
Plant:	Marathon	Customer Reference No:	11265	Received:	7/26/11
Applicable Analytical Method:	U.S. EPA Method 26A			Analyte:	Fluoride

Sample Identification Number	Sample Location	Run No.	Sample Identification	Sample Recovery Date	Field Tech	Sample Volume (mL)
28745-23	Reagent Blank	RB	DI H2O Blank	7/20/2011	DL	200
28745-24	Reagent Blank	RB	0.1N H2SO4 Blank	7/20/2011	DL	200
28745-25	FCCU Scrub. Stack	1	Acid Imp C&R R1	7/20/2011	DL	990
28745-26	FCCU Scrub. Stack	2	Acid Imp C&R R2	7/20/2011	DL	1020
28745-27	FCCU Scrub. Stack	3	Acid Imp C&R R3	7/21/2011	DL	1010

CHROMATOGRAPHIC DATA REDUCTION
Ion Chromatography Analysis

Customer:	Palatine Engineering Group	Lab Project No:	28745	Analyst:	Eric Ewing
Plant:	Marathon	Customer Reference No:	11265	Received:	7/26/11
Applicable Analytical Method:	U.S. EPA Method 26A			Analyte:	Fluoride

MDL=	0.008 mg/L	Average Flow Rate 0.80 mL/min
MRL=	0.040 mg/L	

Sample Location	Sample Identification Number	Sample Identification	Date of Injection	Area Counts Trial 1	Area Counts Trial 2	Area Count Average	DF (Analysis Dilution Factor)	V _{total} (Total Sample Volume, mL)	C _{Reg} (Concentration, mg/L from Reg Curve)	M _{Analyte} Total Amount of Analyte (mg)
Reagent Blank	28745-23	DI H2O Blank	07/28/11	0.0000	0.0000	0.0000	1	200.0	<	<0.008
Reagent Blank	28745-24	0.1N H2SO4 Blank	07/29/11	0.0000	0.0000	0.0000	1	200.0	<	<0.008
FCCU Scrub. Stack	28745-25	Acid Imp C&R R1	07/29/11	0.0000	0.0000	0.0000	1	990.0	<	<0.039
FCCU Scrub. Stack	28745-26	Acid Imp C&R R2	07/29/11	0.0000	0.0000	0.0000	1	1020.0	<	<0.041
FCCU Scrub. Stack	28745-27	Acid Imp C&R R3	07/29/11	0.0000	0.0000	0.0000	1	1010.0	<	<0.040

CHROMATOGRAPHIC DATA REDUCTION
Ion Chromatography Analysis

Customer:	Palatine Engineering Group	Lab Project No:	28745	Analyst:	Eric Ewing
Plant:	Marathon	Customer Reference No:	11265	Received:	7/26/11
Applicable Analytical Method:	U.S. EPA Method 26A			Analyte:	Fluoride

QUALITY CONTROL CHECKS

Sample Location	Sample Identification Number	Sample Identification	Date of Injection	Area Counts		Area Count Average	Area Count Duplicate Difference	Duplicate Relative Difference		Is Duplicate Difference < 5%?
				Trial 1	Trial 2			(%)		
Reagent Blank	28745-23	DI H2O Blank	07/28/11	0.0000	0.0000	0.0000	na	na		Yes
Reagent Blank	28745-24	0.1N H2SO4 Blank	07/29/11	0.0000	0.0000	0.0000	na	na		Yes
FCCU Scrub. Stack	28745-25	Acid Imp C&R R1	07/29/11	0.0000	0.0000	0.0000	na	na		Yes
FCCU Scrub. Stack	28745-26	Acid Imp C&R R2	07/29/11	0.0000	0.0000	0.0000	na	na		Yes
FCCU Scrub. Stack	28745-27	Acid Imp C&R R3	07/29/11	0.0000	0.0000	0.0000	na	na		Yes

CHROMATOGRAPHIC DATA REDUCTION

Customer:	Palatine Engineering Group	Lab Project No:	28745	Analyst:	Eric Ewing
Plant:	Marathon	Customer Reference No:	11265	Received:	7/26/11
Applicable Analytical Method:	U.S. EPA Method 26A			Analyte:	Fluoride

CCV Concentration: 0.50 mg/L
 QC Concentration: 126.43 mg/L

MDL=	0.008 mg/L
MRL=	0.040 mg/L

QC Dilution Factor
200

QUALITY CONTROL CHECKS (CONT)

Sample Location	Sample Identification Number	Sample Identification	Date of Injection	Area Counts Trial 1	Area Counts Trial 2	Area Count Average	Area Count Duplicate Difference	Duplicate Relative Difference (%)	C _{Reg} (Concentration, mg/L from Reg Curve)	Percent Difference from Actual Value (%)	Is Percent Difference from Actual Value <10%?
CleanAir	28745-00	CCB	07/28/11	0.0000	0.0000	0.0000	na	na	<		
CleanAir	28745-990	CCV	07/28/11	0.4334	0.4242	0.4288	0.0092	2.1%	0.49	1.94%	Yes
CleanAir	28745-991	QC	07/29/11	0.5658	0.5769	0.5714	0.0111	1.9%	130.36	3.10%	Yes
CleanAir	28745-00	CCB	07/29/11	0.0000	0.0000	0.0000	na	na	<		
CleanAir	28745-992	CCV	07/29/11	0.4421	0.4315	0.4368	0.0106	2.4%	0.50	0.12%	Yes

Sample Duplicate Analysis Area Count Check

									Precision	Is Precision within ±5% Tolerance?
FCCU Scrub. Stack	28745-27	Acid Imp C&R R3	07/29/11	0.0000	0.0000	0.0000	na	na		
FCCU Scrub. Stack	28745-27	Acid Imp C&R R3	07/29/11	0.0000	0.0000	0.0000	na	na	0.0%	Yes

Matrix Spike Recoveries

									Precision	Spike Recovery	Is Spike Recovery Between 90-110%?
Matrix Spike	28745-25	Acid Imp C&R R1	08/01/11	1.1049	1.1095	1.1072	0.0046	0.4%		100.4%	Yes
Matrix Spike	28745-25	Acid Imp C&R R1	08/01/11	1.0969	1.1203	1.1086	0.0234	2.1%	0.1%	100.6%	Yes

Determination of Method Detection Limit Ion Chromatography Analysis

Customer:	Palatine Engineering Group	Lab Project No:	28745	Analyst:	Eric Ewing
Plant:	Marathon	Customer Reference No:	11265	Received:	7/26/11
Applicable Analytical Method:	U.S. EPA Method 26A				Analyte: Fluoride

MDL Reference 40 CFR 136, Appendix B
CleanAir Reference SOP EPA5-11

Matrix Deionized Water

Analyte Fluoride
Spike Concentration 0.0750 mg/L
Slope 1.1320
Intercept 0.0050
Coefficient of Corr. 0.9998

Non-Iterative Study

No. of Replicates	$t_{(n-1,0.99)}$
7	3.143
8	2.998
9	2.896
10	2.821
11	2.764
16	2.602
21	2.528

Spike Aliquots	Spike Result Area Count	Measured Concentration (mg/L)
1	0.0605	0.074
2	0.0602	0.073
3	0.0566	0.069
4	0.0570	0.070
5	0.0550	0.067
6	0.0566	0.069
7	0.0610	0.074
8	0.0604	0.073

Average Spike Concentration: 0.071
Recovery (R_a): 94.84%
Standard Deviation (S_a): 0.00265
RMS Deviation: 3.7%
 $t_{(n-1,0.99)}$: 2.998
MDL: 0.008
MRL: 0.040

Is the spike level higher than the MDL? Yes
Is the spike level less than ten times the MDL? Yes
Is the Avg Recovery between 90% < R_a < 110%? Yes

Sample Calculations

Ion Chromatography Analysis

Customer: Palatine Engineering Group	Lab Project No: 28745	Analyst: Eric Ewing
Plant: Marathon	Customer Reference No: 11265	Received: 7/26/11
Applicable Analytical Method: U.S. EPA Method 26A	Analyte: Fluoride	

Calibration Point No: 3
Sample No: 28745-25
Sample Location: FCCU Scrub. Stack

1. Difference between duplicate injections for pre-test calibration (Pre Cal 1).

$$\Delta_{Injection} = |Area_{Trial\ 2} - Area_{Trial\ 1}|$$

Where:

$\Delta_{Injection}$ = Area count difference between duplicate injections

$Area_{Trial2}$ = Area count for injection Trial 2

$Area_{Trial1}$ = Area count for injection Trial 1

$\Delta_{Injection}$ = 0.0057

$Area_{Trial2}$ = 0.1604

$Area_{Trial1}$ = 0.1661

2. Average area count value for duplicate injections for pre-test calibration (Pre Cal 1).

$$Avg_{PreInj} = \frac{(Area_{Trial1} + Area_{Trial2})}{2}$$

Where:

Avg_{PreInj} = Average of duplicate injection area counts

$Area_{Trial2}$ = Area count for injection Trial 2

$Area_{Trial1}$ = Area count for injection Trial 1

2 = Constant (number of values)

Avg_{Inj} = 0.1633

$Area_{Trial2}$ = 0.1604

$Area_{Trial1}$ = 0.1661

Sample Calculations

Ion Chromatography Analysis

Customer:	Palatine Engineering Group	Lab Project No:	28745	Analyst:	Eric Ewing
Plant:	Marathon	Customer Reference No:	11265	Received:	7/26/11
Applicable Analytical Method:	U.S. EPA Method 26A			Analyte:	Fluoride

Calibration Point No: 3
Sample No: 28745-25
Sample Location: FCCU Scrub. Stack

3. Difference between individual injection and average area count for pre-test calibration.

$$\Delta_{PreMean\%} = \frac{|Area_{Trial2} - Avg_{PreInj}|}{Avg_{PreInj}} 100$$

Where:

- $\Delta_{PreMean\%}$ = Difference between individual injection and average area count (%).
- Avg_{PreInj} = Average of duplicate injection area counts
- $Area_{Trial2}$ = Area count for injection Trial 2
- 100 = Constant (conversion factor for percentage)

$$\begin{aligned}\Delta_{PreMean\%} &= 1.7768 \\ Avg_{PreInj} &= 0.1633 \\ Area_{Trial2} &= 0.1604\end{aligned}$$

Note: EPA Method 26 requires $\Delta_{PreMean\%}$ to be less than 5%.

4. Average of all area count values for a given calibration point.

$$\bar{X} = \frac{\sum_{i=1}^n x_i}{n}$$

Where:

- \bar{X} = Average of all area count values for a given calibration point.
- x_i = Individual area count values for each individual injection.
- i = Iteration value.
- n = Number of injections for the calibration point under question.

$$\begin{aligned}\bar{X} &= 0.1628 \\ x_1 &= 0.1661 \\ x_2 &= 0.1604 \\ n &= 6\end{aligned}$$

Sample Calculations

Ion Chromatography Analysis

Customer: Palatine Engineering Group	Lab Project No: 28745	Analyst: Eric Ewing
Plant: Marathon	Customer Reference No: 11265	Received: 7/26/11
Applicable Analytical Method: U.S. EPA Method 26A	Analyte: Fluoride	

Calibration Point No: 3
Sample No: 28745-25
Sample Location: FCCU Scrub. Stack

5. Average of all concentration values used for generating calibration curve.

$$\overline{Y}_{All} = \frac{\sum_{i=1}^n y_i}{n}$$

Where:

\overline{Y}_{All} = Average of all area concentration values.
 y_i = Individual concentration values for each individual injection.
 n = Number of injections.

\overline{Y}_{All} = 0.7216
 y_1 = 0.0000
 y_2 = 0.0750
 n = 7

6. Average of all area count values for the calibration curve.

$$\overline{X}_{All} = \frac{\sum_{i=1}^n x_i}{n}$$

Where:

\overline{X}_{All} = Average of all area count values.
 x_i = Individual area count values.
 i = Iteration value.
 n = Number of injections.

\overline{X}_{All} = 0.6242
 x_1 = 0.1661
 x_2 = 0.1604
 n = 30

Sample Calculations

Ion Chromatography Analysis

Customer:	Palatine Engineering Group	Lab Project No:	28745	Analyst:	Eric Ewing
Plant:	Marathon	Customer Reference No:	11265	Received:	7/26/11
Applicable Analytical Method:	U.S. EPA Method 26A			Analyte:	Fluoride

Calibration Point No: 3
Sample No: 28745-25
Sample Location: FCCU Scrub. Stack

7. Determination of slope (least-squares regression) value for calibration curve.

$$m = \frac{\sum_{i=1}^n (x_i - \bar{x})(y_i - \bar{y})}{\sum_{i=1}^n (x_i - \bar{x})^2}$$

Where:

m = Slope of least-squares regression curve.
 x_i = Individual area count values for each individual injection.
 \bar{x} = Average of all area count values = \bar{X}_{All}
 y_i = Actual area concentration values for each individual injection.
 \bar{y} = Average of all concentration values = \bar{Y}_{All}
i = Iteration value.
n = Number of injections.

m = 1.13199
 x_1 = 0.1661
 x_2 = 0.1604
 \bar{x} = 0.6242
 y_1 = 0.0000
 y_2 = 0.0750
 \bar{y} = 0.7216
n = 30

8. Determination of y-intercept (least-squares regression) value for calibration curve.

$$b = \bar{y} - m \bar{x}$$

Where:

b = Y-axis intercept.
 \bar{x} = Average of all area count values = \bar{X}_{All}
 \bar{y} = Average of all concentration values = \bar{Y}_{All}

b = 0.00502
m = 1.13199
 \bar{x} = 0.6242
 \bar{y} = 0.7216

Sample Calculations

Ion Chromatography Analysis

Customer:	Palatine Engineering Group	Lab Project No:	28745	Analyst:	Eric Ewing
Plant:	Marathon	Customer Reference No:	11265	Received:	7/26/11
Applicable Analytical Method:	U.S. EPA Method 26A			Analyte:	Fluoride

Calibration Point No: 3
Sample No: 28745-25
Sample Location: FCCU Scrub. Stack

9. Determination of coefficient of correlation (least-squares regression) value for calibration curve.

$$r = \frac{\sum_{i=1}^n (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum_{i=1}^n (x_i - \bar{x})^2 \sum_{i=1}^n (y_i - \bar{y})^2}}$$

Where:

- r^2 = Square of the Pearson product moment correlation coefficient through data points in known y's and known x's.
- r = Pearson product moment correlation coefficient through data points in known y's and known x's.
- x_i = Individual area count values for each individual injection.
- y_i = Actual area concentration values for each individual injection.
- \bar{x} = Average of all area count values = \bar{X}_{All}
- \bar{y} = Average of all concentration values = \bar{Y}_{All}
- i = Iteration value.
- n = Number of injections.

r^2	=	0.99977
r	=	0.99988
x_1	=	0.1661
x_2	=	0.1604
\bar{x}	=	0.6242
y_1	=	0.0000
y_2	=	0.0750
\bar{y}	=	0.7216
n	=	30

Sample Calculations

Ion Chromatography Analysis

Customer:	Palatine Engineering Group	Lab Project No:	28745	Analyst:	Eric Ewing
Plant:	Marathon	Customer Reference No:	11265	Received:	7/26/11
Applicable Analytical Method:	U.S. EPA Method 26A			Analyte:	Fluoride

Calibration Point No: 3
Sample No: 28745-25
Sample Location: FCCU Scrub. Stack

10. Determination of average sample area counts from duplicate injections.

$$Avg_{Sample} = \frac{(Area_{Trial1} + Area_{Trial2})}{2}$$

Where:

Avg_{Sample} = Average of duplicate injection area counts
 $Area_{Trial2}$ = Area count for injection Trial 2
 $Area_{Trial1}$ = Area count for injection Trial 1
2 = Constant (number of injections)

Avg_{Inj} = 0.0000
 $Area_{Trial2}$ = 0.0000
 $Area_{Trial1}$ = 0.0000

11. Difference between duplicate injections for the sample.

$$\Delta_{Injection} = |Area_{Trial2} - Area_{Trial1}|$$

Where:

$\Delta_{Injection}$ = Area count difference between duplicate injections
 $Area_{Trial2}$ = Area count for injection Trial 2
 $Area_{Trial1}$ = Area count for injection Trial 1

$\Delta_{Injection}$ = 0.0000
 $Area_{Trial2}$ = 0.0000
 $Area_{Trial1}$ = 0.0000

Sample Calculations

Ion Chromatography Analysis

Customer:	Palatine Engineering Group	Lab Project No:	28745	Analyst:	Eric Ewing
Plant:	Marathon	Customer Reference No:	11265	Received:	7/26/11
Applicable Analytical Method:	U.S. EPA Method 26A			Analyte:	Fluoride

Calibration Point No: 3
Sample No: 28745-25
Sample Location: FCCU Scrub. Stack

12. Difference between individual injection and average area count for the sample.

$$\Delta_{Injection} = \frac{|Area_{Trial2} - Avg_{Inj}|}{Avg_{Inj}} 100$$

Where:

$\Delta_{Injection}$ = Difference between individual injection and average area count (%).
 Avg_{Inj} = Average of duplicate injection area counts
 $Area_{Trial2}$ = Area count for injection Trial 2
100 = Constant (conversion factor for percentage)

$\Delta_{Injection}$ = na
 Avg_{Inj} = 0.0000
 $Area_{Trial2}$ = 0.0000

Note: EPA Method 26 requires $\Delta_{Injection}$ to be less than 5%.

13. Determination of sample concentration from least-squares regression curve (mg/L).

$$C_{Reg} = DF [m(Avg_{Inj}) + b]$$

Where:

C_{Reg} = Sample concentration determined using the regression curve (mg/L)
DF = Sample dilution factor
 Avg_{Inj} = Average of duplicate injection area counts.
m = Slope of least-squares regression curve.
b = Y-intercept of least-squares regression curve.

C_{Reg} = <
DF = 1
 Avg_{Inj} = 0.0000
m = 1.1320
b = 0.0050

Sample Calculations

Ion Chromatography Analysis

Customer:	Palatine Engineering Group	Lab Project No:	28745	Analyst:	Eric Ewing
Plant:	Marathon	Customer Reference No:	11265	Received:	7/26/11
Applicable Analytical Method:	U.S. EPA Method 26A			Analyte:	Fluoride

Calibration Point No: 3
Sample No: 28745-25
Sample Location: FCCU Scrub. Stack

14. Determination of total amount of analyte in sample (total mg).

$$M_{Analyte} = \frac{(C_{Reg})(V_{Soln})}{1000}$$

Where:

$M_{Analyte}$ = Amount of analyte in sample (total mg)
 C_{Reg} = Sample concentration determined using the response factor (mg/L)
 V_{Soln} = Sample volume (ml)
1000 = Conversion constant (ml to L)

$M_{Analyte}$ = <0.039
 C_{Reg} = <
 V_{Soln} = 990.0

15. Determination of Detection Limits.

15a. Determination of average spike result.

$$AvgM_{f_i} = \frac{\sum_{i=1}^n M_{f_i}}{n}$$

Where:

$AvgM_{f_i}$ = Average of spike result (mg/L)
 M_{f_i} = Net results recorded for each iteration (mg/L)
n = Number of iterations.
i = Placeholder for iteration.

$AvgM_{f_i}$	=	0.071			
M_{f_1}	=	0.074	M_{f_5}	=	0.067
M_{f_2}	=	0.073	M_{f_6}	=	0.069
M_{f_3}	=	0.069	M_{f_7}	=	0.074
M_{f_4}	=	0.070	M_{f_8}	=	0.073
n	=	8			

Sample Calculations

Ion Chromatography Analysis

Customer:	Palatine Engineering Group	Lab Project No:	28745	Analyst:	Eric Ewing
Plant:	Marathon	Customer Reference No:	11265	Received:	7/26/11
Applicable Analytical Method:	U.S. EPA Method 26A			Analyte:	Fluoride

Calibration Point No: 3
Sample No: 28745-25
Sample Location: FCCU Scrub. Stack

15b. Determination of standard deviation of spike result.

$$\sigma_{f-i} = \sqrt{\frac{\sum_{i=1}^n (M_{f-i} - \text{Avg}M_{f-i})^2}{(n-1)}}$$

Where:

σ_{f-i} = Standard deviation of spike result.
 $\text{Avg}M_{f-i}$ = Average spike result (mg/L)
 M_{f-i} = Concentration recorded for each iteration (mg/L)
n = Number of iterations.
i = Placeholder for iteration.

σ_{f-i}	=	0.0027			
$\text{Avg}M_{f-i}$	=	0.071			
M_{f-1}	=	0.074	M_{f-5}	=	0.067
M_{f-2}	=	0.073	M_{f-6}	=	0.069
M_{f-3}	=	0.069	M_{f-7}	=	0.074
M_{f-4}	=	0.070	M_{f-8}	=	0.073
n	=	8			

15c. Determination of variance of spike result.

$$V_{f-i} = (\sigma_{f-i})^2$$

Where:

V_{f-i} = Variance of spike result.
 σ_{f-i} = Standard deviation of spike result.

V_{f-i}	=	7.03E-06
σ_{f-i}	=	0.0027

Sample Calculations

Ion Chromatography Analysis

Customer:	Palatine Engineering Group	Lab Project No:	28745	Analyst:	Eric Ewing
Plant:	Marathon	Customer Reference No:	11265	Received:	7/26/11
Applicable Analytical Method:	U.S. EPA Method 26A			Analyte:	Fluoride

Calibration Point No: 3
Sample No: 28745-25
Sample Location: FCCU Scrub. Stack

15d. Determination of RMS deviation of spike result.

$$RMS_{f-i} = 100 \frac{\sigma_{f-i}}{AvgM_{f-i}}$$

Where:

RMS_{f-i} = RMS deviation of spike results (%)
 σ_{f-i} = Standard deviation of spike result.
 $AvgM_{f-i}$ = Average spike result (mg/L)
100 = Conversion constant (fraction to percent)

RMS_{f-i} = 0.0373
 σ_{f-i} = 0.0027
 $AvgM_{f-i}$ = 0.0711

15e. Determination of average spike recovery.

$$R_f = 100 \frac{AvgM_{f-i}}{RA}$$

Where:

R_f = Average spike recovery (%)
 $AvgM_{f-i}$ = Average spike result (mg/L)
RA = Spike concentration added (mg/L)
100 = Conversion constant (fraction to percent)

R_f = 94.8%
 $AvgM_{f-i}$ = 0.07114
RA = 0.07501

Sample Calculations

Ion Chromatography Analysis

Customer:	Palatine Engineering Group	Lab Project No:	28745	Analyst:	Eric Ewing
Plant:	Marathon	Customer Reference No:	11265	Received:	7/26/11
Applicable Analytical Method:	U.S. EPA Method 26A			Analyte:	Fluoride

Calibration Point No: 3
Sample No: 28745-25
Sample Location: FCCU Scrub. Stack

15f. Determination of $t_{(n-1, 0.99)}$.

Value taken from the following Table:

n	$t_{(n-1, 0.99)}$
7	3.143
8	2.998
9	2.896
10	2.821
11	2.764
16	2.602
21	2.528

Where:

$t_{(n-1, 0.99)}$ = Students' t value appropriate for a 99% confidence level and a standard deviation estimate with n-1 degrees of freedom.

n = Number of iterations.

$t_{(n-1, 0.99)}$ = 2.998

n = 8

15g. Determination of Method Detection Limit (MDL).

$$MDL = \sigma_{f_i} t_{(n-1, 0.99)}$$

Where:

MDL = Method detection limit (mg/L)

$t_{(n-1, 0.99)}$ = Students' t value appropriate for a 99% confidence level and a standard deviation estimate with n-1 degrees of freedom.

σ_{f_i} = Standard deviation of spike result.

MDL = 0.008

$t_{(n-1, 0.99)}$ = 2.998

σ_{f_i} = 0.0027

Sample Calculations
Ion Chromatography Analysis

Customer:	Palatine Engineering Group	Lab Project No:	28745	Analyst:	Eric Ewing
Plant:	Marathon	Customer Reference No:	11265	Received:	7/26/11
Applicable Analytical Method:	U.S. EPA Method 26A			Analyte:	Fluoride

Calibration Point No: 3
Sample No: 28745-25
Sample Location: FCCU Scrub. Stack

15h. Determination of Method Reporting Limit (MRL).

$$MRL = 5(MDL)$$

Where:

MRL = Method reporting limit (mg/L)
MDL = Method detection Limit (mg/L)
5 = Constant

MRL = 0.040
MDL = 0.008

AS40 Log Sheet

Customer: 66 Analyte(s): F
 Plant: Merriman
 Customer Project No: 11265
 Lab Project No: 28743
 Date: 7/28/11
 Analyst: Kyle Goring

Date Received: 7/26/11
 Shipping Person: K. O'Hara

Inj Type: Loop Conc 100 Inj Mode: Prop (Cnst) Inj / Vial: 100

Serial Dilution Data

Cartridge ID: 1B

Pos	Sample #	Identification	Volume	Dilution Ratio
1	Blank			
2	Cal 01			
3	Cal 01			
4	Cal 02			
5	Cal 03			
6	Cal 04			

Pipet Serial No.	Pipet Size	Flask Serial No.	Flask Size
2835	3	1234	200
4827	10	1072	250
4818	20	4224	250
1236	25	6776	200

Cartridge ID: 2B

Pos	Sample #	Identification	Volume	Dilution Ratio
1	Cal 05			
2	Cal 06			
3	Blank			
4	Cal			
5	Blank			
6	-23	DI Flow Blank	200	1

Pipet Serial No.	Pipet Size	Flask Serial No.	Flask Size
7417	30	0726	200
7417	30	5630	100
9815	20	1248	200

Cartridge ID: 3B

Pos	Sample #	Identification	Volume	Dilution Ratio
1	-28	0.1 N NaOH Blank	200	1
2	-29	PCV Ins Stock Aik Sing R1	440	1
3	-30	1.1111111111111111 R2	400	1
4	-31	1.1111111111111111 R3	370	1
5	Blank			
6	-24	0.1 N H2SO4 Blank	200	1

Pipet Serial No.	Pipet Size	Flask Serial No.	Flask Size

Analyst Signature

Kyle Goring

Page:

1 of 4

AS40 Log Sheet

Customer: CE
 Plant: Hamden
 Customer Project No: 1265
 Lab Project No: 2775
 Date: 7/28/01
 Analyst: OTC Ewing

Date Received: _____
 Shipping Person: _____

Analyte(s):
F
61

Inj Type: Loop Conc 1
 Inj Mode: Prop / Const
 Inj / Viat: 1 2 3

Cartridge ID: 48

Pos	Sample #	Identification	Volume	Dilution Ratio
1	25	Flow Start Blank	990	1
2	26	" "	1020	1
3	27	" "	1010	1
4	Blank	" "		
5	QC			200
6	Blank			

Cartridge ID: 58

Pos	Sample #	Identification	Volume	Dilution Ratio
1		Cal 02		
2	Blank			
3				
4				
5				
6				

Cartridge ID: 10

Pos	Sample #	Identification	Volume	Dilution Ratio
1	Blank			
2		Cal 03		
3	Blank			
4		QC		200
5	Blank			
6	100	These 100s added		1

Analyst Signature

Ewing

Page:

2 of 4

AS40 Log Sheet

Customer: 66 Plant: Non-then Analyte(s): F
 Customer Project No: 11265 Lab Project No: 28745 CI
 Date: 7/19/11
 Analyst: Gr.2 Fungus

Date Received: _____
 Shipping Person: _____

Inj Type: Loop Conc: _____ Inj Mode: Prop Const Inj / Vial: 123

Serial Dilution Data

Cartridge ID: 2B

Pos	Sample #	Identification	Volume	Dilution Ratio
1	<u>Blank</u>			
2	<u>-27</u>			<u>1</u>
3	<u>Blank</u>			
4		<u>CC</u>		
5	<u>Blank</u>			
6	<u>-25</u>	<u>Martix Soln</u>		

Cartridge ID: 3B

Pos	Sample #	Identification	Volume	Dilution Ratio
1	<u>-35</u>	<u>Martix Soln</u>		
2	<u>Blank</u>			
3		<u>Cal 01</u>		
4		<u>Cal 01</u>		
5		<u>Cal 02</u>		
6		<u>Cal 01</u>		

Cartridge ID: 4B

Pos	Sample #	Identification	Volume	Dilution Ratio
1		<u>Cal 04</u>		
2		<u>Cal 05</u>		
3		<u>Cal 05</u>		
4		<u>Blank</u>		
5				
6				

Analyst Signature: [Signature]

AS40 Log Sheet

Customer: 66 Plant: North Analyte(s): F
 Customer Project No: 1265 Lab Project No: 28743 CI
 Date: 8/1/14
 Analyst: Eric Swiney

Date Received: _____
 Shipping Person: _____

Inj Type: Loop Conc 12 Inj Mode: Prop / Crst Inj / Vial: 12 3

Serial Dilution Data

Cartridge ID: 10

Pos	Sample #	Identification	Volume	Dilution Ratio
1	<u>Blank</u>			
2	<u>-25</u>	<u>North 50%</u>		<u>1</u>
3	<u>-25</u>	<u>North 50%</u>		<u>1</u>
4	<u>Blank</u>			
5				
6				

Pipet Serial No.	Pipet Size	Flask Serial No.	Flask Size

Cartridge ID: _____

Pos	Sample #	Identification	Volume	Dilution Ratio
1				
2				
3				
4				
5				
6				

Pipet Serial No.	Pipet Size	Flask Serial No.	Flask Size

Cartridge ID: _____

Pos	Sample #	Identification	Volume	Dilution Ratio
1				
2				
3				
4				
5				
6				

Pipet Serial No.	Pipet Size	Flask Serial No.	Flask Size

Eric Swiney

Analyst Signature

Lab Project No.: 28745

Date Received: 7/26/2011

CleanAir No.: 11265

66

Customer : 66

Contact : Kevin O'halloren

Phone :

Fax :

Email : kohalloren@cleanair.com

Requested Analysis

Due	Analyst	Status	Sample Type		Container	Method
8/9/2011	MT	In Queue	1-3	8.26 GF Filter	Petri Dish	EPA Method 5
8/9/2011	MT	In Queue	1-3	8.26 GF Filter	Petri Dish	US EPA Method 5B
8/9/2011	MT	In Queue	4-7	F 1/2 Acetone	Glass Jars	EPA Method 5
8/9/2011	MT	In Queue	4-7	F 1/2 Acetone	Glass Jars	US EPA Method 5B
8/9/2011	MT	In Queue	8-8	F 1/2 Acetone	amber glass jar	US EPA Method 202
8/9/2011	MT	In Queue	9-13	B 1/2 H ₂ O	amber glass jar	US EPA Method 202
8/9/2011	MT	In Queue	14-18	Back half rinse	amber glass jar	US EPA Method 202
8/9/2011	MT	In Queue	19-22	Filter	Petri Dish	US EPA Method 202
8/9/2011	EE	In Queue	23-27	Imp C&R	Nalgene	EPA Method 26A Fluoride, Chloride
8/9/2011	EE	In Queue	28-31	Imp C&R	Nalgene	EPA Method 26A Chloride
8/9/2011	EE	In Queue	32-40	Imp C&R	Nalgene	EPA CTM-027
8/9/2011	EE	In Queue	41-44	Imp C&R	Nalgene	Archive
8/9/2011	EE	In Queue	45-47	Tedlar Bags	Tedlar Bag	EPA Method 18 Methane, Ethane
8/9/2011	EE	In Queue	51-51	F 1/2 Acetone	Glass Jars	Archive
8/9/2011	EE	In Queue	48-50	Tedlar Bags	Tedlar Bag	Archive

Printed 2011/07/26 09:48:27

Marathon Petroleum Company
Clean Air Project No: 11265
FCCU Scrubber Stack

USEPA OTM-29 Cyanide Laboratory Data Summary

Run No.	Blank	1	2	3
Date (2011)		Jul 20	Jul 20	Jul 21
Start Time (approx.)		09:36	12:29	07:56
Stop Time (approx.)		10:57	14:01	09:15

☐ DRAFT LAB DATA

MDL Min. detectable limit ($\mu\text{g HCN/mL}$) 0.0227

HCN as Total Cyanide

B_i Blank concentration ($\mu\text{g HCN/mL}$) 0.0399

S _{i-1}	Fraction 1 concentration ($\mu\text{g HCN/mL}$)	0.4286	0.8876	1.0982
DF ₁	Dilution factor for Fraction 1	5.0000	5.0000	5.0000
S _{i-2}	Fraction 2 concentration ($\mu\text{g HCN/mL}$)	<0.0227	0.0396	0.0389
DF ₂	Dilution factor for Fraction 1	5.0000	5.0000	5.0000
v ₁	Fraction 1 sample volume (mL)	1010.0	1010.0	1068.0
v ₂	Fraction 2 sample volume (mL)	210.0	197.0	185.0
m _a	HCN collected before blank subtraction (μg)	2164.3164	4521.3148	5900.3044
m _b	Allowable blank subtraction (μg)	48.6780	48.1593	49.9947
m _{nb}	HCN collected after blank subtraction (μg)	2115.6384	4473.1555	5850.3097
m _{MDL}	Minimum detectable HCN (μg)	27.6940	27.3989	28.4431
m _n	Total HCN used in emission calculations (μg)	2115.6384	4473.1555	5850.3097
EFF	Collection QC Check (% collected in Fraction 2)	<0.22%	0.17%	0.12%

090811 093504

L

Clean Air Engineering

500 West Wood Street
Palatine, IL 60067

Marathon Petroleum Company
Robinson Refinery

Client #11265
PO #25616-66-11265

Analytical Report
(0611-171R)

EPA OTM-29

Hydrogen cyanide



Enthalpy Analytical, Inc.

Phone: (919) 850 - 4392 / Fax: (919) 850 - 9012 / www.enthalpy.com
2202 Ellis Road Durham, NC 27703 - 5518

I certify that to the best of my knowledge all analytical data presented in this report:

- Have been checked for completeness
- Are accurate, error-free, and legible
- Have been conducted in accordance with approved protocol, and that all deviations and analytical problems are summarized in the appropriate narrative(s)

This analytical report was prepared in Portable Document Format (.PDF) and contains 130 pages.

Michael Steven Schapira

QA Review Performed by: Michael Steven Schapira

Report Issued: 9/27/11



Company	Clean Air Engineering
Analyst	KHB / AMP
Parameters	EPA OTM-29

Client #	11265
Job #	0611-171
# Samples	3 runs, 3 blks, 1 spk

Compound	Sample ID / Catch Weight (ug)		
	Run 1	Run 2	Run 3
Hydrogen cyanide	2,164	4,521	5,900
	FB	Field Spike	0.1N NaOH Blank
Hydrogen cyanide	39.2 ND	1,014	2.27 ND
	6N NaOH Blank		
Hydrogen cyanide	16.7 J		

Summary of Results



Results



Company Analyst Parameters	Clean Air Engineering KHB / AMP EPA OTM-29	Client # Job # # Samples	11265 0611-171 3 runs, 3 blks, 1 spk
----------------------------	--	--------------------------------	--

MDL 0.0227 (ug/mL)
LOQ 0.103 (ug/mL)
Compound Hydrogen cyanide

Lower Curve Limit 0.103 (ug/mL)
Upper Curve Limit 2.08 (ug/mL)

Sample ID	Lab ID # 1	Lab ID # 2	Analysis Method	Ret Time (min)	Ret Time (min)	% Diff Ret	Conc # 1 (ug/mL)	Conc # 2 (ug/mL)	% Diff Conc	Avg Conc (ug/mL)	DF	Vol (mL)	Catch Weight (ug)	Qual
Run 1 Imp 1-3	057-6501.D	057-6502.D	1000.M	8.26	8.27	0.2	0.429	0.429	0.0	0.429	5	1,010	2,164	
Run 1 Imp 4	060-6801.D	060-6802.D	1000.M	NA	NA	NA	0.0227	0.0227	0.0	0.0227	5	210	23.8	ND
													2,164	
Run 2 Imp 1-3	061-6901.D	061-6902.D	1000.M	8.20	8.26	0.8	0.902	0.873	1.6	0.888	5	1,010	4,482	
Run 2 Imp 4	062-7901.D	062-7902.D	1000.M	8.29	8.24	0.7	0.0384	0.0407	3.0	0.0396	5	197	39.0	J
													4,521	
Run 3 Imp 1-3	063-8001.D	063-8002.D	1000.M	8.23	8.19	0.4	1.13	1.06	3.2	1.10	5	1,068	5,864	
Run 3 Imp 4	064-8101.D	064-8102.D	1000.M	8.27	8.22	0.6	0.0374	0.0404	3.9	0.0389	5	185	36.0	J
													5,900	
FB Imp 1-3	hplc60pg27#20	hplc60pg27#21	HCN-METHOD.M	NA	NA	NA	0.0227	0.0227	0.0	0.0227	5	345	39.2	ND
FB Imp 4	066-8301.D	066-8302.D	1000.M	8.24	8.26	0.2	0.0440	0.0442	0.3	0.0441	5	154	33.9	J
													33.9	J
Field Spike	069-9501.D	069-9502.D	1000.M	8.23	8.20	0.4	0.573	0.554	1.7	0.563	10	180	1,014	
													Spike Amount (ug)	
													1,016	
													Spike Recovery (%)	
													99.8%	

Company Analyst Parameters	Clean Air Engineering KHB / AMP EPA OTM-29	Client # Job # # Samples	11265 0611-171 3 runs, 3 blks, 1 spk
----------------------------	--	--------------------------------	--

MDL 0.0227 (ug/mL)
LOQ 0.103 (ug/mL)
Compound Hydrogen cyanide

Lower Curve Limit 0.103 (ug/mL)
Upper Curve Limit 2.08 (ug/mL)

Sample ID	Lab ID # 1	Lab ID # 2	Analysis Method	Ret Time (min)	Ret Time (min)	% Diff Ret	Conc # 1 (ug/mL)	Conc # 2 (ug/mL)	% Diff Conc	Avg Conc (ug/mL)	DF	Vol (mL)	Catch Weight (ug)	Qual
0.1N NaOH Blank	067-9301.D	067-9302.D	1000.M	NA	NA	NA	0.0227	0.0227	0.0	0.0227	1	100	2.27	ND
6N NaOH Blank	068-9401.D	068-9402.D	1000.M	8.26	8.21	0.5	0.0393	0.0404	1.3	0.0399	5	84.0	16.7	J
MB / 0.1N NaOH	007-5001.D	007-5002.D	1000.M	8.22	NA	NA	0.0246	0.0227	4.0	0.0237	1	1.00	0.0237	J
MB / 0.1N NaOH	007-7801.D	007-7802.D	1000.M	8.28	8.28	0.0	0.0551	0.0534	1.6	0.0542	1	1.00	0.0542	J
MB / 0.1N NaOH	007-9201.D	007-9202.D	1000.M	8.24	8.26	0.2	0.0496	0.0521	2.4	0.0509	1	1.00	0.0509	J
MS / R1 Imp 1-3	058-6601.D	058-6602.D	1000.M	8.23	8.25	0.3	1.46	1.35	4.0	1.41	1	0.525	0.740	
Spike Amount (ug)														0.520
Native Amount (ug)														0.214
Spike Recovery (%)														101%
MSD / R1 Imp 1-3	059-6701.D	059-6702.D	1000.M	8.23	8.26	0.4	1.45	1.44	0.3	1.44	1	0.525	0.758	
Spike Amount (ug)														0.520
Native Amount (ug)														0.214
Spike Recovery (%)														105%
LCS 2	071-9701.D	071-9702.D	1000.M	8.18	8.24	0.7	0.537	0.574	3.3	0.556	200	10.0	1.112	
Spike Amount (ug)														1.016
Spike Recovery (%)														109%

Company Analyst Parameters	Clean Air Engineering KHB / AMP EPA OTM-29	Client # 11265 Job # 0611-171 # Samples 3 runs, 3 blks, 1 spk
----------------------------	--	---

MDL 0.0227 (ug/mL)
LOQ 0.103 (ug/mL)
Compound Hydrogen cyanide

Lower Curve Limit 0.103 (ug/mL)
Upper Curve Limit 2.08 (ug/mL)

Sample ID	Lab ID # 1	Lab ID # 2	Analysis Method	Ret Time (min)	Ret Time (min)	% Diff Ret	Conc # 1 (ug/mL)	Conc # 2 (ug/mL)	% Diff Conc	Avg Conc (ug/mL)	DF	Vol (mL)	Catch Weight (ug)	Qual
hplc56pg59 #SS	006-6301.D	006-6302.D	1000.M	8.23	8.25	0.2	0.547	0.509	3.6	0.528	1	1.00	0.528	
Tag Amount (ug)														
Recovery (%)														120%
hplc56pg59 #SS	006-7701.D	006-7702.D	1000.M	8.29	8.23	0.6	0.452	0.410	4.9	0.431	1	1.00	0.431	
Tag Amount (ug)														
Recovery (%)														97.9%
hplc56pg59 #SS	006-9101.D	006-9102.D	1000.M	8.23	8.17	0.7	0.397	0.443	5.5	0.420	1	1.00	0.420	
Tag Amount (ug)														
Recovery (%)														95.6%
Reagent Blank	hplc60pg27#14	hplc60pg27#15	HCN-METHOD.M	NA	NA	NA	0.0227	0.0227	0.0	0.0227	1	1	0.0227	ND

Narrative Summary



Enthalpy Analytical Narrative Summary

Company	Clean Air Engineering
Analyst	KHB
Parameters	EPA OTM-29

Client #	11265
Job #	0611-171
# Samples	3 runs, 3 blanks, 1 spike

Custody

Heather Tarjeft received the samples on 7/27/11 after being relinquished by Clean Air Engineering. The samples were received at 6.6°C in good condition. The pH values of the samples **Run 1 Imp 1-3** and **Run 3 Imp 1-3** were both 12. The pH values for all the remaining samples were 14. Prior to, during, and after analysis, the samples were kept under lock with access only to authorized personnel by Enthalpy Analytical, Inc.

Analysis

The samples were analyzed for hydrogen cyanide using the analytical procedures in OTM-29, Sampling and Analysis of Hydrogen Cyanide Emissions from Stationary Sources.

The DIONEX Model 500, High Performance Liquid Chromatograph ("Grandmama") was with a Dionex ED40 Electrochemical Detector and a Dionex Ion Pac AS7, 4 x 250 mm (S/N 012759) column, for the initial analyses of these samples.

It was determined that the analyst initially analyzed two aliquots of the **Field Spike**, one as the **Field Blank** and one as the **Field Spike**. A fresh aliquot of the **Field Blank** was prepared and analyzed, and the new results have replaced the initial date.

An ICS-3000 Ion Chromatograph ("Flanders") was equipped with a detector (S/N 06060340) and a Dionex Ion Pac AS7, 4 x 250 mm (S/N 011640) was used for the reanalysis of the **Field Blank**.

Calibration

The calibration curves are included in the Calibration Curve Chromatograms section of this report and referenced in the Analysis Method column on the Detailed Results page.

For each calibration curve used, the first page of the curve contains all method specific parameters (i.e., curve type, origin, weight, etc.) used to quantify the samples. The calibration curve section also includes a table with the Retention Time (RetTime), Level (Lvl), Amount (corresponding units), Area, Response Factor (Amt/Area) and the analyte Name. The calibration table is used to identify (by retention time) and quantify each target compound.



Enthalpy Analytical Narrative Summary (continued)

Chromatographic Conditions

Copies of the acquisition methods (1000.M and HCN-Back) are included in the Calibration Curve Chromatograms sections of this report.

QC Notes

The analyses of the laboratory reagent blanks contained hydrogen cyanide at concentrations less than the LOQ.

One of the field reagent blanks contained hydrogen cyanide at a concentration lower than the LOQ. The other field reagent blank did not contain measurable levels (above the MDL) of hydrogen cyanide.

Laboratory Method Blanks analyzed on the instrument "Grandmama" contained hydrogen cyanide at a concentration lower than the LOQ.

The laboratory reagent blank analyzed with the Field Blank on "Flanders" did not contain a measurable level of hydrogen cyanide.

Five spikes were prepared for these samples of which three were provided to the client, prior to sample collection. Two spikes were retained by the lab to be analyzed as Laboratory Control Samples (LCS).

The recovery value for the field spike was 99.8%.

One of the LCSs was analyzed, and the recovery value was 109%.

Seconds source standards were analyzed after each calibration curve. The first one had a high recovery value (120%). The other second source standards met criteria (90-110% recovery).

Reporting Notes

The results presented in this report are representative of the samples as provided to the laboratory.



General Reporting Notes

The following are general reporting notes that are applicable to all Enthalpy Analytical, Inc. data reports, unless specifically noted otherwise.

- The acronym **MDL** represents the Minimum Detection Limit. Below this value the laboratory cannot determine the presence of the analyte of interest reliably.
- The acronym **LOQ** represents the Limit of Quantification. Below this value the laboratory cannot quantitate the analyte of interest within the criteria of the method.
- The acronym **ND** following a value indicates a non-detect or analytical result below the MDL.
- The letter **J** following a value indicates an analytical result between the MDL and the LOQ. A J flag indicates that the laboratory can positively identify the analyte of interest as present, but the value should be considered an estimate.
- The letter **E** following a value indicates an analytical result exceeding 100% of the highest calibration point. The associated value should be considered as an estimate.
- The acronym **DF** represents Dilution Factor. This number represents dilution of the sample during the preparation and/or analysis process. The analytical result taken from a laboratory instrument is multiplied by the DF to determine the final undiluted sample results.
- The addition of **MS** to the Sample ID represents a Matrix Spike. An aliquot of an actual sample is spiked with a known amount of analyte so that a percent recovery value can be determined. This shows what effect the sample matrix may have on the target analyte, i.e. whether or not anything in the sample matrix interferes with the analysis of the analyte(s).
- The addition of **MSD** to the Sample ID represents a Matrix Spike Duplicate. Prepared in the same manner as an MS, the use of duplicate matrix spikes allows further confirmation of laboratory quality by showing the consistency of results gained by performing the same steps multiple times.
- The addition of **LD** to the Sample ID represents a Laboratory Duplicate. The analyst prepares an additional aliquot of sample for testing and the results of the duplicate analysis are compared to the initial result. The result should have a difference value of within 10% of the initial result (if the results of the original analysis are greater than the LOQ).
- The addition of **AD** to the Sample ID represents an Alternate Dilution. The analyst prepares an additional aliquot at a different dilution factor (usually double the initial factor). This analysis helps confirm that no additional compound is present and coeluting or sharing absorbance with the analyte of interest, as they would have a different response/absorbance than the analyte of interest.
- The Sample ID **LCS** represents a Laboratory Control Sample. Clean matrix, similar to the client sample matrix, prepared and analyzed by the laboratory using the same reagents, spiking standards and procedures used for the client samples. The LCS is used to assess the control of the laboratory's analytical system. Whenever spikes are prepared for our client projects, two extra spikes are prepared. The extras (randomly chosen) are labeled with the associated project number and kept in-house at the appropriate temperature conditions. When the project samples are received for analysis, the LCSs are analyzed to confirm that the analyte could be recovered from the media, separate from the samples which were used on the project and which may have been affected by source matrix, sample collection and/or sample transport.



General Reporting Notes

(continued)

- **Significant Figures:** Where the reported value is much greater than unity (1.00) in the units expressed, the number is rounded to a whole number of units, rather than to 3 significant figures. For example, a value of 10,456.45 ug catch is rounded to 10,456 ug. There are five significant digits displayed, but no confidence should be placed on more than two significant digits.
- **Manual Integration:** The data systems used for processing will flag manually integrated peaks with an "M". There are several reasons a peak may be manually integrated. These reasons will be identified by the following two letter designations. The peak was *not integrated* by the software "NI", the peak was *integrated incorrectly* by the software "II" or the *wrong peak* was integrated by the software "WP". These codes will accompany the analyst's manual integration stamp placed next to the compound name.



Sample Custody



PLANT DATA

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I herby certify that all pages contained within this Appendix have been reviewed and, to the best of my ability, verified accurate.

QA/QC Initials: SB

Date: 9/14



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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
RESEARCH TRIANGLE PARK, NC 27711

DEC 17 2003

RECEIVED: 12/22/03
ENVIRONMENTAL DEPARTMENT
MARATHON ASHLAND PETROLEUM LLC
ILLINOIS REFINING DIVISION
ROBINSON, ILLINOIS

OFFICE OF
AIR QUALITY PLANNING
AND STANDARDS

Mr. Alan Mayo
Environmental Coordinator
Marathon Ashland Petroleum LLC
P.O. Box 1200
Robinson, Illinois 62454

Dear Mr. Mayo:

This is in response to your letter dated October 10, 2003 that was submitted through Mr. Shaun Burke of EPA Region 5. In the letter, you requested to use an alternative method to calculate the coke burn-off rate in the fluid catalytic cracking unit (FCCU) catalyst regenerator at your Robinson, Illinois refinery during stack testing for particulate emissions. The FCCU is subject to the requirements of 40 CFR Part 60, Subpart J - Standards of Performance for Petroleum Refineries and is required to comply with the particulate emission level specified in 60.102(a)(1) which includes the following:

- Recording the daily average coke burn rate and hours of operation as specified in 60.105(c);
- Determining the particulate matter emission rate using either Method 5B or Method 5F as specified in 60.106(b)(2); and
- Determining the coke burn-off rate during a stack test using the prescribed equation and methods in 60.106(b)(3).

In 60.106(b)(3), the coke burn-off rate is determined using the regenerator exhaust gas flow rate as measured by Method 2, the air blower rate as reported by the FCCU control room instrumentation, and regenerator exhaust gas carbon monoxide (CO), carbon dioxide (CO₂), and oxygen (O₂) concentrations as measured by Method 3. Regenerator exhaust gas measurements must be made at a point prior to any emission control device.

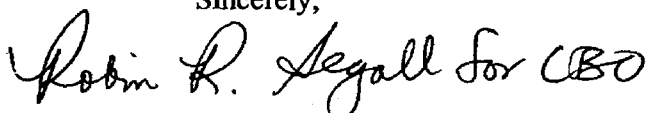
You propose to use an alternative method described in "Appendix A - Alternate Method for FCCU Coke Burn-off Rate Determination - NSPS Subpart J," that was included in your proposal, to determine the coke burn-off rate during particulate emissions testing. This alternative method is summarized in the following steps:

1. Calculate the percent dry air from the ambient temperature and relative humidity by the equations provided.
2. Measure the air rate to the regenerator by flow meter.
3. Collect a sample of the flue gas from the regenerator to the CO boiler by the existing process sampling system.
4. Analyze the sample for CO, CO₂, and O₂ using Method 3C.
5. Back out argon from the analysis using the equations provided.
6. Calculate the regenerator flue gas rate by nitrogen balance using the dry air rate and flue gas analysis. The procedure is described in "Guide to Fluid Catalytic Cracking" Part 1, published in 1993 by Grace Davison Catalyst Company.
7. Calculate the individual component flows of the flue gas by the given equations.
8. Calculate the moles of water/hr by oxygen balance using the given equations.
9. Calculate the individual coke constituents of carbon, hydrogen, and sulfur.
10. Determine the coke burn rate by summing the coke constituents from step 9.

We hereby approve your request to calculate coke burn-off rate during stack tests using the air rate input to the regenerator and a measured flue gas analysis CO, CO₂ and O₂ exiting the regenerator. If during the stack test, the concentration of CO, CO₂ or O₂ deviates from the most recent monthly sampling by more than 15 percent, at least one additional flue gas sample will be taken and the average concentrations will be used for the calculation of coke burn-off.

This is a site-specific method approval and applies only to the FCCU catalyst regenerator at the Marathon Ashland Petroleum facility in Robinson, Illinois. This approval does not waive the right of EPA or another regulating agency to require additional monitoring or testing at any time for determining compliance. If you have questions or would like to discuss the matter further, please call Foston Curtis at (919) 541-1063, or you may e-mail him at curtis.foston@epa.gov.

Sincerely,



Conniesue B. Oldham, Ph.D., Group Leader
Source Measurement Technology Group

cc: Shaun Burke, Region 5
Foston Curtis (D205-02)
Kevin Mattison, Illinois EPA
Chris Romaine, Illinois EPA
Jason Schnepf, Illinois EPA

Rolling Daily Averages
NOx (ppm) O2 (ppm) CO (ppm)

01-Jul-11 00:00:00	39.3	3.6	122.5
01-Jul-11 01:00:00	38.7	3.6	123.3
01-Jul-11 02:00:00	38.3	3.6	124.1
01-Jul-11 03:00:00	37.8	3.6	124.6
01-Jul-11 04:00:00	37.3	3.6	124.8
01-Jul-11 05:00:00	37.1	3.6	124.9
01-Jul-11 06:00:00	37.0	3.6	125.0
01-Jul-11 07:00:00	39.0	3.5	125.6
01-Jul-11 08:00:00	37.1	3.6	126.7
01-Jul-11 09:00:00	37.1	3.6	125.9
01-Jul-11 10:00:00	37.1	3.6	126.5
01-Jul-11 11:00:00	37.1	3.6	126.6
01-Jul-11 12:00:00	37.1	3.6	127.5
01-Jul-11 13:00:00	37.1	3.5	127.9
01-Jul-11 14:00:00	37.1	3.5	129.0
01-Jul-11 15:00:00	37.0	3.5	130.3
01-Jul-11 16:00:00	36.9	3.5	131.6
01-Jul-11 17:00:00	36.8	3.5	132.7
01-Jul-11 18:00:00	36.7	3.5	134.3
01-Jul-11 19:00:00	36.6	3.5	135.1
01-Jul-11 20:00:00	36.5	3.5	136.0
01-Jul-11 21:00:00	36.5	3.5	136.9
01-Jul-11 22:00:00	36.5	3.5	137.9
01-Jul-11 23:00:00	36.5	3.5	139.0
02-Jul-11 00:00:00	36.8	3.4	139.7
02-Jul-11 01:00:00	37.2	3.4	140.9
02-Jul-11 02:00:00	37.8	3.4	140.7
02-Jul-11 03:00:00	38.4	3.4	140.5
02-Jul-11 04:00:00	38.9	3.4	141.1
02-Jul-11 05:00:00	39.3	3.4	141.0
02-Jul-11 06:00:00	39.8	3.4	141.2
02-Jul-11 07:00:00	42.0	3.3	141.6
02-Jul-11 08:00:00	40.2	3.3	142.1
02-Jul-11 09:00:00	40.2	3.3	141.4
02-Jul-11 10:00:00	40.3	3.3	141.1
02-Jul-11 11:00:00	40.3	3.3	140.9
02-Jul-11 12:00:00	40.2	3.3	140.8
02-Jul-11 13:00:00	40.2	3.3	140.3
02-Jul-11 14:00:00	40.0	3.3	140.4
02-Jul-11 15:00:00	40.0	3.2	139.8
02-Jul-11 16:00:00	39.9	3.2	139.5
02-Jul-11 17:00:00	39.9	3.2	139.2
02-Jul-11 18:00:00	39.9	3.2	139.2
02-Jul-11 19:00:00	39.9	3.2	139.1
02-Jul-11 20:00:00	39.8	3.2	139.3
02-Jul-11 21:00:00	39.7	3.2	139.4
02-Jul-11 22:00:00	39.6	3.2	139.7
02-Jul-11 23:00:00	39.6	3.2	139.7
03-Jul-11 00:00:00	39.4	3.2	140.3
03-Jul-11 01:00:00	39.2	3.2	140.2
03-Jul-11 02:00:00	39.3	3.2	137.7
03-Jul-11 03:00:00	39.1	3.2	137.0
03-Jul-11 04:00:00	39.0	3.2	137.2

Rolling Daily Averages
NOx (ppm) O2 (ppm) CO (ppm)

03-Jul-11 05:00:00	38.8	3.2	136.7
03-Jul-11 06:00:00	38.7	3.2	136.9
03-Jul-11 07:00:00	40.5	3.2	137.4
03-Jul-11 08:00:00	38.4	3.3	138.1
03-Jul-11 09:00:00	38.2	3.3	138.0
03-Jul-11 10:00:00	38.2	3.3	138.7
03-Jul-11 11:00:00	38.0	3.3	139.5
03-Jul-11 12:00:00	37.9	3.3	140.2
03-Jul-11 13:00:00	37.8	3.3	140.9
03-Jul-11 14:00:00	37.7	3.3	141.5
03-Jul-11 15:00:00	37.8	3.3	141.8
03-Jul-11 16:00:00	37.7	3.3	142.4
03-Jul-11 17:00:00	37.7	3.3	142.1
03-Jul-11 18:00:00	37.7	3.3	142.0
03-Jul-11 19:00:00	37.8	3.3	141.8
03-Jul-11 20:00:00	37.8	3.3	141.0
03-Jul-11 21:00:00	37.9	3.3	140.5
03-Jul-11 22:00:00	38.0	3.3	140.2
03-Jul-11 23:00:00	38.0	3.3	140.0
04-Jul-11 00:00:00	38.1	3.3	139.8
04-Jul-11 01:00:00	38.2	3.3	138.8
04-Jul-11 02:00:00	38.3	3.3	139.0
04-Jul-11 03:00:00	38.3	3.3	140.4
04-Jul-11 04:00:00	38.4	3.3	141.5
04-Jul-11 05:00:00	38.4	3.3	141.4
04-Jul-11 06:00:00	38.5	3.3	141.8
04-Jul-11 07:00:00	40.6	3.3	142.5
04-Jul-11 08:00:00	38.6	3.3	143.2
04-Jul-11 09:00:00	38.6	3.3	142.6
04-Jul-11 10:00:00	38.6	3.3	142.4
04-Jul-11 11:00:00	38.6	3.3	141.9
04-Jul-11 12:00:00	38.7	3.3	141.7
04-Jul-11 13:00:00	38.7	3.3	141.2
04-Jul-11 14:00:00	38.8	3.3	141.1
04-Jul-11 15:00:00	38.8	3.3	141.1
04-Jul-11 16:00:00	38.9	3.3	141.3
04-Jul-11 17:00:00	38.9	3.3	141.3
04-Jul-11 18:00:00	39.1	3.3	140.6
04-Jul-11 19:00:00	39.2	3.3	139.9
04-Jul-11 20:00:00	39.3	3.3	139.7
04-Jul-11 21:00:00	39.2	3.3	139.9
04-Jul-11 22:00:00	39.3	3.3	140.2
04-Jul-11 23:00:00	39.3	3.3	140.2
05-Jul-11 00:00:00	39.3	3.3	139.9
05-Jul-11 01:00:00	39.3	3.3	139.6
05-Jul-11 02:00:00	39.3	3.3	140.1
05-Jul-11 03:00:00	39.2	3.3	140.1
05-Jul-11 04:00:00	39.2	3.3	140.1
05-Jul-11 05:00:00	39.1	3.3	140.3
05-Jul-11 06:00:00	39.2	3.3	140.6
05-Jul-11 07:00:00	41.1	3.3	140.8
05-Jul-11 08:00:00	39.1	3.3	141.0
05-Jul-11 09:00:00	39.1	3.3	140.4

Rolling Daily Averages
NOx (ppm) O2 (ppm) CO (ppm)

05-Jul-11 10:00:00	39.2	3.3	140.4
05-Jul-11 11:00:00	39.2	3.3	140.1
05-Jul-11 12:00:00	39.3	3.3	140.0
05-Jul-11 13:00:00	39.3	3.3	139.7
05-Jul-11 14:00:00	39.3	3.3	139.6
05-Jul-11 15:00:00	39.3	3.4	139.3
05-Jul-11 16:00:00	39.3	3.4	139.1
05-Jul-11 17:00:00	39.3	3.4	138.6
05-Jul-11 18:00:00	39.3	3.4	138.4
05-Jul-11 19:00:00	39.3	3.4	138.7
05-Jul-11 20:00:00	39.3	3.4	139.1
05-Jul-11 21:00:00	39.3	3.4	138.8
05-Jul-11 22:00:00	39.4	3.4	138.9
05-Jul-11 23:00:00	39.6	3.4	138.5
06-Jul-11 00:00:00	39.7	3.4	138.0
06-Jul-11 01:00:00	39.9	3.4	137.6
06-Jul-11 02:00:00	40.0	3.4	137.5
06-Jul-11 03:00:00	40.0	3.4	137.0
06-Jul-11 04:00:00	40.1	3.4	136.6
06-Jul-11 05:00:00	40.1	3.4	136.6
06-Jul-11 06:00:00	40.2	3.4	136.4
06-Jul-11 07:00:00	42.2	3.3	136.5
06-Jul-11 08:00:00	40.3	3.4	137.1
06-Jul-11 09:00:00	40.3	3.3	136.4
06-Jul-11 10:00:00	40.4	3.3	135.7
06-Jul-11 11:00:00	40.4	3.3	135.3
06-Jul-11 12:00:00	40.5	3.3	135.0
06-Jul-11 13:00:00	40.5	3.3	134.7
06-Jul-11 14:00:00	40.5	3.3	134.7
06-Jul-11 15:00:00	40.6	3.3	135.2
06-Jul-11 16:00:00	40.6	3.3	135.3
06-Jul-11 17:00:00	40.6	3.3	135.1
06-Jul-11 18:00:00	40.6	3.3	135.3
06-Jul-11 19:00:00	40.6	3.3	135.4
06-Jul-11 20:00:00	40.7	3.3	135.3
06-Jul-11 21:00:00	40.6	3.3	135.5
06-Jul-11 22:00:00	40.6	3.3	135.8
06-Jul-11 23:00:00	40.5	3.3	135.6
07-Jul-11 00:00:00	40.5	3.3	136.0
07-Jul-11 01:00:00	40.3	3.3	136.7
07-Jul-11 02:00:00	40.3	3.3	137.0
07-Jul-11 03:00:00	40.2	3.3	137.4
07-Jul-11 04:00:00	40.3	3.2	137.3
07-Jul-11 05:00:00	40.2	3.2	137.4
07-Jul-11 06:00:00	40.3	3.2	137.4
07-Jul-11 07:00:00	42.2	3.2	137.8
07-Jul-11 08:00:00	40.1	3.2	138.4
07-Jul-11 09:00:00	40.1	3.2	137.1
07-Jul-11 10:00:00	40.2	3.2	136.7
07-Jul-11 11:00:00	40.2	3.2	137.1
07-Jul-11 12:00:00	40.2	3.2	137.3
07-Jul-11 13:00:00	40.1	3.2	137.9
07-Jul-11 14:00:00	40.1	3.2	138.2

Rolling Daily Averages
NOx (ppm) O2 (ppm) CO (ppm)

07-Jul-11 15:00:00	40.1	3.2	138.5
07-Jul-11 16:00:00	40.1	3.2	138.6
07-Jul-11 17:00:00	40.0	3.2	139.3
07-Jul-11 18:00:00	40.0	3.2	139.4
07-Jul-11 19:00:00	40.0	3.2	139.8
07-Jul-11 20:00:00	40.1	3.2	140.0
07-Jul-11 21:00:00	40.1	3.2	140.9
07-Jul-11 22:00:00	40.1	3.2	141.6
07-Jul-11 23:00:00	40.2	3.2	141.6
08-Jul-11 00:00:00	40.3	3.2	141.9
08-Jul-11 01:00:00	40.2	3.2	141.9
08-Jul-11 02:00:00	40.3	3.2	142.1
08-Jul-11 03:00:00	40.4	3.2	142.7
08-Jul-11 04:00:00	40.4	3.2	143.4
08-Jul-11 05:00:00	40.4	3.2	143.3
08-Jul-11 06:00:00	40.6	3.2	143.1
08-Jul-11 07:00:00	42.5	3.2	143.4
08-Jul-11 08:00:00	40.7	3.2	142.8
08-Jul-11 09:00:00	40.8	3.2	142.1
08-Jul-11 10:00:00	40.8	3.2	142.4
08-Jul-11 11:00:00	40.8	3.2	142.1
08-Jul-11 12:00:00	40.7	3.2	142.1
08-Jul-11 13:00:00	40.7	3.2	141.8
08-Jul-11 14:00:00	40.8	3.2	142.0
08-Jul-11 15:00:00	40.9	3.2	142.4
08-Jul-11 16:00:00	40.9	3.2	142.8
08-Jul-11 17:00:00	40.9	3.2	142.9
08-Jul-11 18:00:00	41.0	3.2	142.5
08-Jul-11 19:00:00	41.0	3.2	142.6
08-Jul-11 20:00:00	41.1	3.2	142.2
08-Jul-11 21:00:00	41.1	3.2	141.8
08-Jul-11 22:00:00	41.2	3.2	141.3
08-Jul-11 23:00:00	41.3	3.2	140.6
09-Jul-11 00:00:00	41.3	3.2	140.9
09-Jul-11 01:00:00	41.3	3.2	141.1
09-Jul-11 02:00:00	41.3	3.2	141.6
09-Jul-11 03:00:00	41.3	3.2	141.7
09-Jul-11 04:00:00	41.2	3.2	141.6
09-Jul-11 05:00:00	41.2	3.2	141.4
09-Jul-11 06:00:00	41.2	3.2	142.3
09-Jul-11 07:00:00	42.9	3.2	143.5
09-Jul-11 08:00:00	41.0	3.2	143.2
09-Jul-11 09:00:00	40.9	3.2	142.9
09-Jul-11 10:00:00	40.9	3.2	142.5
09-Jul-11 11:00:00	40.9	3.2	142.2
09-Jul-11 12:00:00	40.9	3.2	142.5
09-Jul-11 13:00:00	40.9	3.2	142.1
09-Jul-11 14:00:00	41.0	3.2	141.9
09-Jul-11 15:00:00	41.0	3.2	141.3
09-Jul-11 16:00:00	41.1	3.2	140.5
09-Jul-11 17:00:00	41.1	3.2	139.5
09-Jul-11 18:00:00	41.2	3.2	138.9
09-Jul-11 19:00:00	41.2	3.2	138.2

Rolling Daily Averages
NOx (ppm) O2 (ppm) CO (ppm)

09-Jul-11 20:00:00	41.2	3.2	137.6
09-Jul-11 21:00:00	41.2	3.2	137.0
09-Jul-11 22:00:00	41.2	3.2	136.7
09-Jul-11 23:00:00	41.3	3.2	136.6
10-Jul-11 00:00:00	41.3	3.2	136.3
10-Jul-11 01:00:00	41.2	3.2	135.7
10-Jul-11 02:00:00	41.2	3.2	135.1
10-Jul-11 03:00:00	41.2	3.2	134.3
10-Jul-11 04:00:00	41.2	3.2	133.4
10-Jul-11 05:00:00	41.1	3.2	131.7
10-Jul-11 06:00:00	41.3	3.2	131.0
10-Jul-11 07:00:00	43.1	3.2	130.7
10-Jul-11 08:00:00	41.2	3.2	130.0
10-Jul-11 09:00:00	41.3	3.2	129.7
10-Jul-11 10:00:00	41.3	3.2	129.9
10-Jul-11 11:00:00	41.4	3.2	129.9
10-Jul-11 12:00:00	41.5	3.2	129.8
10-Jul-11 13:00:00	41.5	3.2	129.6
10-Jul-11 14:00:00	41.6	3.2	130.3
10-Jul-11 15:00:00	41.7	3.2	130.9
10-Jul-11 16:00:00	41.7	3.2	131.2
10-Jul-11 17:00:00	41.7	3.2	131.3
10-Jul-11 18:00:00	41.8	3.2	131.2
10-Jul-11 19:00:00	41.8	3.2	131.1
10-Jul-11 20:00:00	41.8	3.2	131.0
10-Jul-11 21:00:00	41.8	3.2	130.7
10-Jul-11 22:00:00	41.9	3.2	130.7
10-Jul-11 23:00:00	41.9	3.2	131.1
11-Jul-11 00:00:00	41.8	3.2	131.1
11-Jul-11 01:00:00	41.7	3.2	131.0
11-Jul-11 02:00:00	41.8	3.2	131.1
11-Jul-11 03:00:00	41.8	3.2	131.0
11-Jul-11 04:00:00	41.8	3.2	130.8
11-Jul-11 05:00:00	41.9	3.2	130.8
11-Jul-11 06:00:00	42.1	3.2	131.7
11-Jul-11 07:00:00	44.0	3.2	132.0
11-Jul-11 08:00:00	42.2	3.2	131.9
11-Jul-11 09:00:00	42.2	3.2	130.6
11-Jul-11 10:00:00	42.2	3.2	130.4
11-Jul-11 11:00:00	42.2	3.2	130.7
11-Jul-11 12:00:00	42.0	3.2	130.5
11-Jul-11 13:00:00	41.9	3.2	130.3
11-Jul-11 14:00:00	41.7	3.2	130.1
11-Jul-11 15:00:00	41.5	3.2	129.2
11-Jul-11 16:00:00	41.3	3.2	128.9
11-Jul-11 17:00:00	41.0	3.2	128.7
11-Jul-11 18:00:00	40.9	3.2	128.8
11-Jul-11 19:00:00	40.6	3.2	129.0
11-Jul-11 20:00:00	40.4	3.2	129.2
11-Jul-11 21:00:00	40.2	3.2	129.6
11-Jul-11 22:00:00	40.1	3.2	130.3
11-Jul-11 23:00:00	39.9	3.2	130.8
12-Jul-11 00:00:00	39.7	3.2	131.2

Rolling Daily Averages
NOx (ppm) O2 (ppm) CO (ppm)

12-Jul-11 01:00:00	39.6	3.2	131.7
12-Jul-11 02:00:00	39.5	3.2	132.1
12-Jul-11 03:00:00	39.3	3.2	132.8
12-Jul-11 04:00:00	39.1	3.2	133.5
12-Jul-11 05:00:00	38.9	3.2	134.5
12-Jul-11 06:00:00	40.7	3.2	135.3
12-Jul-11 07:00:00	40.5	3.2	136.4
12-Jul-11 08:00:00	38.4	3.3	136.6
12-Jul-11 09:00:00	38.2	3.3	136.6
12-Jul-11 10:00:00	38.1	3.3	137.2
12-Jul-11 11:00:00	38.0	3.3	137.5
12-Jul-11 12:00:00	37.9	3.3	137.5
12-Jul-11 13:00:00	38.0	3.3	138.0
12-Jul-11 14:00:00	38.0	3.3	139.3
12-Jul-11 15:00:00	38.1	3.3	140.3
12-Jul-11 16:00:00	38.2	3.3	141.2
12-Jul-11 17:00:00	38.3	3.3	141.8
12-Jul-11 18:00:00	38.4	3.3	143.0
12-Jul-11 19:00:00	38.6	3.3	143.4
12-Jul-11 20:00:00	38.7	3.3	143.9
12-Jul-11 21:00:00	38.9	3.3	144.1
12-Jul-11 22:00:00	39.0	3.3	144.8
12-Jul-11 23:00:00	39.1	3.3	144.9
13-Jul-11 00:00:00	39.2	3.3	145.0
13-Jul-11 01:00:00	39.4	3.3	145.0
13-Jul-11 02:00:00	39.5	3.3	144.9
13-Jul-11 03:00:00	39.7	3.3	145.1
13-Jul-11 04:00:00	39.8	3.4	144.4
13-Jul-11 05:00:00	40.0	3.4	144.1
13-Jul-11 06:00:00	42.3	3.3	143.6
13-Jul-11 07:00:00	40.5	3.4	143.9
13-Jul-11 08:00:00	40.6	3.4	143.6
13-Jul-11 09:00:00	40.8	3.4	143.6
13-Jul-11 10:00:00	41.0	3.4	143.5
13-Jul-11 11:00:00	41.1	3.4	143.8
13-Jul-11 12:00:00	41.0	3.4	143.9
13-Jul-11 13:00:00	41.0	3.4	144.0
13-Jul-11 14:00:00	40.9	3.4	144.0
13-Jul-11 15:00:00	40.9	3.4	143.6
13-Jul-11 16:00:00	40.8	3.4	144.0
13-Jul-11 17:00:00	40.7	3.4	144.2
13-Jul-11 18:00:00	40.6	3.4	143.9
13-Jul-11 19:00:00	40.5	3.4	143.3
13-Jul-11 20:00:00	40.4	3.4	143.2
13-Jul-11 21:00:00	40.2	3.4	143.0
13-Jul-11 22:00:00	40.1	3.4	143.0
13-Jul-11 23:00:00	40.0	3.4	142.8
14-Jul-11 00:00:00	39.9	3.4	142.6
14-Jul-11 01:00:00	39.8	3.4	142.3
14-Jul-11 02:00:00	39.7	3.4	142.1
14-Jul-11 03:00:00	39.6	3.4	142.0
14-Jul-11 04:00:00	39.5	3.4	141.8
14-Jul-11 05:00:00	39.4	3.4	142.2

Rolling Daily Averages
NOx (ppm) O2 (ppm) CO (ppm)

14-Jul-11 06:00:00	41.3	3.3	142.5
14-Jul-11 07:00:00	39.1	3.4	143.1
14-Jul-11 08:00:00	38.9	3.4	142.4
14-Jul-11 09:00:00	38.8	3.4	142.0
14-Jul-11 10:00:00	38.7	3.4	141.7
14-Jul-11 11:00:00	38.6	3.4	141.2
14-Jul-11 12:00:00	38.5	3.4	140.8
14-Jul-11 13:00:00	38.4	3.4	141.0
14-Jul-11 14:00:00	38.4	3.4	140.9
14-Jul-11 15:00:00	38.3	3.4	140.8
14-Jul-11 16:00:00	38.3	3.4	140.5
14-Jul-11 17:00:00	38.3	3.4	140.0
14-Jul-11 18:00:00	38.3	3.4	139.8
14-Jul-11 19:00:00	38.3	3.4	139.8
14-Jul-11 20:00:00	38.3	3.4	139.4
14-Jul-11 21:00:00	38.4	3.4	139.7
14-Jul-11 22:00:00	38.4	3.4	139.8
14-Jul-11 23:00:00	38.3	3.4	140.0
15-Jul-11 00:00:00	38.3	3.4	140.4
15-Jul-11 01:00:00	38.3	3.4	140.6
15-Jul-11 02:00:00	38.4	3.4	140.5
15-Jul-11 03:00:00	38.4	3.4	140.3
15-Jul-11 04:00:00	38.4	3.4	140.0
15-Jul-11 05:00:00	38.4	3.4	139.8
15-Jul-11 06:00:00	40.5	3.3	139.8
15-Jul-11 07:00:00	38.4	3.4	140.1
15-Jul-11 08:00:00	38.5	3.3	139.4
15-Jul-11 09:00:00	38.5	3.3	139.0
15-Jul-11 10:00:00	38.6	3.3	138.7
15-Jul-11 11:00:00	38.6	3.3	138.4
15-Jul-11 12:00:00	38.5	3.3	138.2
15-Jul-11 13:00:00	38.6	3.3	137.9
15-Jul-11 14:00:00	38.6	3.3	137.3
15-Jul-11 15:00:00	38.7	3.3	137.0
15-Jul-11 16:00:00	38.7	3.3	136.4
15-Jul-11 17:00:00	38.9	3.3	136.3
15-Jul-11 18:00:00	38.9	3.3	136.0
15-Jul-11 19:00:00	38.9	3.3	135.9
15-Jul-11 20:00:00	39.0	3.3	135.2
15-Jul-11 21:00:00	39.0	3.3	135.1
15-Jul-11 22:00:00	39.1	3.3	134.7
15-Jul-11 23:00:00	39.1	3.3	134.4
16-Jul-11 00:00:00	39.1	3.3	133.9
16-Jul-11 01:00:00	39.2	3.3	133.2
16-Jul-11 02:00:00	39.3	3.3	133.1
16-Jul-11 03:00:00	39.2	3.3	133.2
16-Jul-11 04:00:00	39.2	3.3	133.2
16-Jul-11 05:00:00	39.2	3.3	133.2
16-Jul-11 06:00:00	41.3	3.3	133.5
16-Jul-11 07:00:00	39.2	3.3	134.0
16-Jul-11 08:00:00	39.2	3.3	133.4
16-Jul-11 09:00:00	39.2	3.3	133.3
16-Jul-11 10:00:00	39.2	3.3	133.4

Rolling Daily Averages
NOx (ppm) O2 (ppm) CO (ppm)

16-Jul-11 11:00:00	39.2	3.3	133.5
16-Jul-11 12:00:00	39.2	3.3	133.6
16-Jul-11 13:00:00	39.3	3.3	133.7
16-Jul-11 14:00:00	39.3	3.3	134.0
16-Jul-11 15:00:00	39.3	3.3	134.4
16-Jul-11 16:00:00	39.2	3.3	135.1
16-Jul-11 17:00:00	39.2	3.3	136.2
16-Jul-11 18:00:00	39.1	3.3	136.8
16-Jul-11 19:00:00	39.1	3.3	137.5
16-Jul-11 20:00:00	39.0	3.3	137.7
16-Jul-11 21:00:00	39.0	3.3	138.6
16-Jul-11 22:00:00	38.9	3.3	139.8
16-Jul-11 23:00:00	38.9	3.3	141.0
17-Jul-11 00:00:00	38.8	3.3	141.9
17-Jul-11 01:00:00	38.8	3.3	143.0
17-Jul-11 02:00:00	38.7	3.3	144.2
17-Jul-11 03:00:00	38.6	3.3	145.3
17-Jul-11 04:00:00	38.5	3.3	146.3
17-Jul-11 05:00:00	38.4	3.3	147.4
17-Jul-11 06:00:00	40.4	3.3	148.4
17-Jul-11 07:00:00	38.3	3.3	149.5
17-Jul-11 08:00:00	38.3	3.3	149.3
17-Jul-11 09:00:00	38.3	3.3	149.9
17-Jul-11 10:00:00	38.3	3.3	150.6
17-Jul-11 11:00:00	38.2	3.3	151.4
17-Jul-11 12:00:00	38.1	3.3	151.9
17-Jul-11 13:00:00	38.1	3.3	152.2
17-Jul-11 14:00:00	38.0	3.3	152.7
17-Jul-11 15:00:00	37.9	3.3	153.2
17-Jul-11 16:00:00	37.9	3.3	153.5
17-Jul-11 17:00:00	37.8	3.3	153.2
17-Jul-11 18:00:00	37.8	3.3	152.7
17-Jul-11 19:00:00	37.8	3.3	152.3
17-Jul-11 20:00:00	37.7	3.3	151.7
17-Jul-11 21:00:00	37.8	3.3	151.5
17-Jul-11 22:00:00	37.8	3.3	151.3
17-Jul-11 23:00:00	37.8	3.3	150.7
18-Jul-11 00:00:00	37.9	3.3	149.9
18-Jul-11 01:00:00	38.0	3.3	149.7
18-Jul-11 02:00:00	38.0	3.3	149.5
18-Jul-11 03:00:00	38.0	3.2	148.8
18-Jul-11 04:00:00	38.1	3.2	148.0
18-Jul-11 05:00:00	38.1	3.2	147.5
18-Jul-11 06:00:00	40.2	3.2	147.2
18-Jul-11 07:00:00	38.2	3.2	147.1
18-Jul-11 08:00:00	38.2	3.2	145.9
18-Jul-11 09:00:00	38.2	3.2	145.2
18-Jul-11 10:00:00	38.2	3.2	144.7
18-Jul-11 11:00:00	38.2	3.2	144.1
18-Jul-11 12:00:00	38.2	3.2	143.4
18-Jul-11 13:00:00	38.2	3.2	143.1
18-Jul-11 14:00:00	38.1	3.2	143.2
18-Jul-11 15:00:00	38.1	3.2	143.2

Rolling Daily Averages
NOx (ppm) O2 (ppm) CO (ppm)

18-Jul-11 16:00:00	38.0	3.2	142.7
18-Jul-11 17:00:00	38.1	3.2	142.6
18-Jul-11 18:00:00	38.1	3.2	142.5
18-Jul-11 19:00:00	38.0	3.2	142.4
18-Jul-11 20:00:00	38.0	3.2	142.3
18-Jul-11 21:00:00	38.1	3.2	142.3
18-Jul-11 22:00:00	38.0	3.2	142.4
18-Jul-11 23:00:00	38.0	3.2	142.3
19-Jul-11 00:00:00	37.9	3.2	142.2
19-Jul-11 01:00:00	37.9	3.2	142.1
19-Jul-11 02:00:00	37.9	3.2	141.7
19-Jul-11 03:00:00	37.8	3.2	141.1
19-Jul-11 04:00:00	37.8	3.2	140.8
19-Jul-11 05:00:00	37.8	3.2	140.7
19-Jul-11 06:00:00	39.8	3.2	140.6
19-Jul-11 07:00:00	37.8	3.2	140.6
19-Jul-11 08:00:00	37.8	3.2	139.7
19-Jul-11 09:00:00	37.8	3.2	139.7
19-Jul-11 10:00:00	37.7	3.2	139.4
19-Jul-11 11:00:00	37.7	3.2	138.9
19-Jul-11 12:00:00	37.6	3.1	138.3
19-Jul-11 13:00:00	37.5	3.1	138.0
19-Jul-11 14:00:00	37.2	3.1	137.4
19-Jul-11 15:00:00	37.1	3.1	136.9
19-Jul-11 16:00:00	37.0	3.2	136.4
19-Jul-11 17:00:00	37.0	3.2	136.5
19-Jul-11 18:00:00	36.9	3.2	136.6
19-Jul-11 19:00:00	36.9	3.2	136.3
19-Jul-11 20:00:00	36.8	3.2	136.0
19-Jul-11 21:00:00	36.8	3.2	136.3
19-Jul-11 22:00:00	36.7	3.2	136.9
19-Jul-11 23:00:00	36.7	3.2	137.3
20-Jul-11 00:00:00	36.6	3.2	137.6
20-Jul-11 01:00:00	36.6	3.2	137.7
20-Jul-11 02:00:00	36.6	3.2	137.9
20-Jul-11 03:00:00	36.6	3.2	138.2
20-Jul-11 04:00:00	36.5	3.1	138.5
20-Jul-11 05:00:00	36.6	3.1	138.5
20-Jul-11 06:00:00	39.1	3.1	137.1
20-Jul-11 07:00:00	38.0	3.2	135.7
20-Jul-11 08:00:00	39.3	3.2	131.5
20-Jul-11 09:00:00	40.1	3.2	129.1
20-Jul-11 10:00:00	41.3	3.2	125.1
20-Jul-11 11:00:00	42.2	3.2	124.2
20-Jul-11 12:00:00	42.6	3.2	123.8
20-Jul-11 13:00:00	43.3	3.2	122.5
20-Jul-11 14:00:00	44.2	3.2	120.4
20-Jul-11 15:00:00	45.6	3.2	117.9
20-Jul-11 16:00:00	46.5	3.2	116.2
20-Jul-11 17:00:00	47.5	3.2	114.0
20-Jul-11 18:00:00	48.3	3.3	111.9
20-Jul-11 19:00:00	49.2	3.3	109.3
20-Jul-11 20:00:00	49.8	3.3	107.6

Rolling Daily Averages
NOx (ppm) O2 (ppm) CO (ppm)

20-Jul-11 21:00:00	50.6	3.3	106.1
20-Jul-11 22:00:00	51.1	3.3	104.7
20-Jul-11 23:00:00	51.7	3.3	103.6
21-Jul-11 00:00:00	52.1	3.3	102.6
21-Jul-11 01:00:00	52.7	3.3	100.7
21-Jul-11 02:00:00	53.2	3.3	100.2
21-Jul-11 03:00:00	53.7	3.3	99.2
21-Jul-11 04:00:00	54.1	3.3	98.7
21-Jul-11 05:00:00	54.5	3.3	98.1
21-Jul-11 06:00:00	56.6	3.3	98.0
21-Jul-11 07:00:00	54.5	3.4	99.8
21-Jul-11 08:00:00	54.0	3.3	100.7
21-Jul-11 09:00:00	53.1	3.3	103.9
21-Jul-11 10:00:00	52.5	3.3	106.7
21-Jul-11 11:00:00	51.6	3.3	110.5
21-Jul-11 12:00:00	51.1	3.3	111.9
21-Jul-11 13:00:00	50.9	3.3	112.4
21-Jul-11 14:00:00	50.5	3.3	113.7
21-Jul-11 15:00:00	50.0	3.3	115.3
21-Jul-11 16:00:00	49.1	3.3	119.0
21-Jul-11 17:00:00	48.6	3.3	121.2
21-Jul-11 18:00:00	48.0	3.3	124.0
21-Jul-11 19:00:00	47.5	3.3	126.2
21-Jul-11 20:00:00	47.0	3.3	128.3
21-Jul-11 21:00:00	46.5	3.3	131.2
21-Jul-11 22:00:00	46.2	3.3	133.1
21-Jul-11 23:00:00	45.9	3.3	134.9
22-Jul-11 00:00:00	45.8	3.3	135.1
22-Jul-11 01:00:00	45.7	3.3	136.6
22-Jul-11 02:00:00	45.4	3.3	138.2
22-Jul-11 03:00:00	45.1	3.3	139.0
22-Jul-11 04:00:00	44.9	3.3	139.7
22-Jul-11 05:00:00	44.8	3.2	140.5
22-Jul-11 06:00:00	46.6	3.2	141.1
22-Jul-11 07:00:00	44.5	3.2	142.4
22-Jul-11 08:00:00	44.3	3.2	142.2
22-Jul-11 09:00:00	44.1	3.2	142.9
22-Jul-11 10:00:00	43.9	3.2	143.7
22-Jul-11 11:00:00	43.7	3.2	143.7
22-Jul-11 12:00:00	43.7	3.2	143.6
22-Jul-11 13:00:00	43.5	3.2	143.8
22-Jul-11 14:00:00	43.4	3.2	143.8
22-Jul-11 15:00:00	43.3	3.2	144.3
22-Jul-11 16:00:00	43.1	3.2	144.9
22-Jul-11 17:00:00	43.1	3.2	144.1
22-Jul-11 18:00:00	43.0	3.2	144.2
22-Jul-11 19:00:00	43.0	3.2	144.1
22-Jul-11 20:00:00	42.9	3.2	144.3
22-Jul-11 21:00:00	42.7	3.2	145.0
22-Jul-11 22:00:00	42.7	3.2	144.1
22-Jul-11 23:00:00	42.6	3.2	144.0
23-Jul-11 00:00:00	42.4	3.2	143.7
23-Jul-11 01:00:00	42.2	3.2	144.2

Rolling Daily Averages
NOx (ppm) O2 (ppm) CO (ppm)

23-Jul-11 02:00:00	42.2	3.2	143.2
23-Jul-11 03:00:00	42.2	3.2	143.2
23-Jul-11 04:00:00	42.2	3.2	142.7
23-Jul-11 05:00:00	42.1	3.2	142.6
23-Jul-11 06:00:00	44.1	3.2	142.3
23-Jul-11 07:00:00	42.1	3.2	142.9
23-Jul-11 08:00:00	42.2	3.2	141.4
23-Jul-11 09:00:00	42.3	3.2	141.0
23-Jul-11 10:00:00	42.4	3.2	140.7
23-Jul-11 11:00:00	42.4	3.2	140.0
23-Jul-11 12:00:00	42.5	3.2	140.1
23-Jul-11 13:00:00	42.5	3.2	140.0
23-Jul-11 14:00:00	42.6	3.2	139.7
23-Jul-11 15:00:00	42.7	3.2	139.6
23-Jul-11 16:00:00	42.8	3.2	139.3
23-Jul-11 17:00:00	42.9	3.2	139.5
23-Jul-11 18:00:00	42.9	3.2	139.4
23-Jul-11 19:00:00	43.0	3.2	139.0
23-Jul-11 20:00:00	43.1	3.2	138.6
23-Jul-11 21:00:00	43.2	3.2	138.1
23-Jul-11 22:00:00	43.4	3.2	137.8
23-Jul-11 23:00:00	43.5	3.2	137.5
24-Jul-11 00:00:00	43.6	3.2	137.4
24-Jul-11 01:00:00	43.7	3.2	137.4
24-Jul-11 02:00:00	43.9	3.2	137.1
24-Jul-11 03:00:00	43.9	3.2	137.4
24-Jul-11 04:00:00	43.9	3.2	137.0
24-Jul-11 05:00:00	44.0	3.2	137.3
24-Jul-11 06:00:00	46.0	3.2	137.1
24-Jul-11 07:00:00	44.1	3.3	137.5
24-Jul-11 08:00:00	44.1	3.3	136.8
24-Jul-11 09:00:00	44.2	3.3	137.0
24-Jul-11 10:00:00	44.2	3.3	137.3
24-Jul-11 11:00:00	44.2	3.2	137.5
24-Jul-11 12:00:00	44.0	3.3	139.0
24-Jul-11 13:00:00	44.2	3.3	138.1
24-Jul-11 14:00:00	44.1	3.3	138.5
24-Jul-11 15:00:00	44.2	3.3	138.1
24-Jul-11 16:00:00	44.2	3.3	138.2
24-Jul-11 17:00:00	44.3	3.3	138.2
24-Jul-11 18:00:00	44.4	3.3	137.9
24-Jul-11 19:00:00	44.4	3.3	138.2
24-Jul-11 20:00:00	44.4	3.3	137.9
24-Jul-11 21:00:00	44.4	3.3	138.3
24-Jul-11 22:00:00	44.4	3.3	138.5
24-Jul-11 23:00:00	44.4	3.3	138.2
25-Jul-11 00:00:00	44.3	3.3	138.2
25-Jul-11 01:00:00	44.4	3.3	137.7
25-Jul-11 02:00:00	44.4	3.3	136.9
25-Jul-11 03:00:00	44.5	3.3	136.3
25-Jul-11 04:00:00	44.5	3.3	135.4
25-Jul-11 05:00:00	44.6	3.3	135.0
25-Jul-11 06:00:00	46.6	3.2	134.6

Rolling Daily Averages
NOx (ppm) O2 (ppm) CO (ppm)

25-Jul-11 07:00:00	44.7	3.3	134.1
25-Jul-11 08:00:00	44.8	3.3	133.2
25-Jul-11 09:00:00	44.9	3.3	132.3
25-Jul-11 10:00:00	44.9	3.3	132.1
25-Jul-11 11:00:00	44.9	3.3	131.7
25-Jul-11 12:00:00	44.8	3.3	130.6
25-Jul-11 13:00:00	44.9	3.3	128.3
25-Jul-11 14:00:00	44.6	3.3	128.6
25-Jul-11 15:00:00	44.5	3.3	128.0
25-Jul-11 16:00:00	44.2	3.3	127.9
25-Jul-11 17:00:00	44.0	3.3	127.6
25-Jul-11 18:00:00	43.8	3.3	127.1
25-Jul-11 19:00:00	43.7	3.3	126.5
25-Jul-11 20:00:00	43.5	3.3	125.7
25-Jul-11 21:00:00	43.4	3.3	125.3
25-Jul-11 22:00:00	43.2	3.3	124.4
25-Jul-11 23:00:00	43.1	3.3	123.8
26-Jul-11 00:00:00	42.9	3.3	123.4
26-Jul-11 01:00:00	42.8	3.3	123.0
26-Jul-11 02:00:00	42.6	3.3	123.0
26-Jul-11 03:00:00	42.4	3.3	122.8
26-Jul-11 04:00:00	42.1	3.3	122.8
26-Jul-11 05:00:00	41.9	3.4	123.0
26-Jul-11 06:00:00	43.6	3.3	123.3
26-Jul-11 07:00:00	41.3	3.4	123.5
26-Jul-11 08:00:00	40.9	3.4	123.7
26-Jul-11 09:00:00	40.6	3.4	123.4
26-Jul-11 10:00:00	40.3	3.4	123.5
26-Jul-11 11:00:00	39.9	3.4	123.2
26-Jul-11 12:00:00	39.6	3.4	122.8
26-Jul-11 13:00:00	39.4	3.4	123.2
26-Jul-11 14:00:00	39.2	3.4	123.7
26-Jul-11 15:00:00	39.1	3.4	124.0
26-Jul-11 16:00:00	39.0	3.3	123.5
26-Jul-11 17:00:00	39.0	3.3	123.5
26-Jul-11 18:00:00	38.9	3.3	123.3
26-Jul-11 19:00:00	38.7	3.3	123.4
26-Jul-11 20:00:00	38.5	3.3	123.8
26-Jul-11 21:00:00	38.4	3.3	123.8
26-Jul-11 22:00:00	38.3	3.3	123.9
26-Jul-11 23:00:00	38.2	3.3	124.4
27-Jul-11 00:00:00	38.0	3.3	124.3
27-Jul-11 01:00:00	37.9	3.3	124.3
27-Jul-11 02:00:00	37.7	3.3	124.3
27-Jul-11 03:00:00	37.5	3.3	124.0
27-Jul-11 04:00:00	37.3	3.3	123.8
27-Jul-11 05:00:00	37.2	3.3	123.8
27-Jul-11 06:00:00	39.1	3.3	123.9
27-Jul-11 07:00:00	37.0	3.3	123.7
27-Jul-11 08:00:00	36.8	3.3	123.0
27-Jul-11 09:00:00	36.8	3.3	122.2
27-Jul-11 10:00:00	36.7	3.3	121.7
27-Jul-11 11:00:00	36.6	3.3	121.4

Rolling Daily Averages
NOx (ppm) O2 (ppm) CO (ppm)

27-Jul-11 12:00:00	36.4	3.3	120.7
27-Jul-11 13:00:00	35.5	3.3	119.6
27-Jul-11 14:00:00	37.4	3.3	119.7
27-Jul-11 15:00:00	37.2	3.3	118.6
27-Jul-11 16:00:00	37.0	3.3	117.1
27-Jul-11 17:00:00	36.7	3.3	116.2
27-Jul-11 18:00:00	36.4	3.3	114.8
27-Jul-11 19:00:00	36.2	3.3	113.8
27-Jul-11 20:00:00	35.9	3.3	112.7
27-Jul-11 21:00:00	35.7	3.3	111.4
27-Jul-11 22:00:00	35.5	3.3	110.5
27-Jul-11 23:00:00	35.3	3.3	109.8
28-Jul-11 00:00:00	35.1	3.3	108.5
28-Jul-11 01:00:00	35.0	3.3	107.6
28-Jul-11 02:00:00	34.9	3.3	106.8
28-Jul-11 03:00:00	34.8	3.3	105.8
28-Jul-11 04:00:00	34.7	3.3	104.8
28-Jul-11 05:00:00	34.6	3.3	104.3
28-Jul-11 06:00:00	36.6	3.3	105.0
28-Jul-11 07:00:00	34.5	3.3	105.9
28-Jul-11 08:00:00	34.5	3.3	106.2
28-Jul-11 09:00:00	34.5	3.3	107.0
28-Jul-11 10:00:00	34.4	3.4	107.8
28-Jul-11 11:00:00	34.4	3.4	108.8
28-Jul-11 12:00:00	34.3	3.4	109.5
28-Jul-11 13:00:00	34.4	3.4	110.6
28-Jul-11 14:00:00	35.2	3.4	112.1
28-Jul-11 15:00:00	33.2	3.3	112.4
28-Jul-11 16:00:00	33.4	3.3	114.0
28-Jul-11 17:00:00	33.6	3.3	115.2
28-Jul-11 18:00:00	33.9	3.3	116.8
28-Jul-11 19:00:00	34.1	3.3	118.3
28-Jul-11 20:00:00	34.2	3.3	119.6
28-Jul-11 21:00:00	34.5	3.3	121.3
28-Jul-11 22:00:00	34.7	3.3	122.9
28-Jul-11 23:00:00	34.9	3.3	124.8
29-Jul-11 00:00:00	35.0	3.3	126.1
29-Jul-11 01:00:00	35.2	3.3	127.8
29-Jul-11 02:00:00	35.4	3.3	129.5
29-Jul-11 03:00:00	35.5	3.3	131.0
29-Jul-11 04:00:00	35.5	3.2	132.5
29-Jul-11 05:00:00	35.7	3.2	133.9
29-Jul-11 06:00:00	37.8	3.2	135.4
29-Jul-11 07:00:00	35.8	3.2	136.0
29-Jul-11 08:00:00	36.0	3.2	135.4
29-Jul-11 09:00:00	36.1	3.2	135.5
29-Jul-11 10:00:00	36.2	3.2	135.4
29-Jul-11 11:00:00	36.2	3.2	135.6
29-Jul-11 12:00:00	36.2	3.2	135.1
29-Jul-11 13:00:00	36.4	3.1	135.2
29-Jul-11 14:00:00	36.4	3.1	134.8
29-Jul-11 15:00:00	36.4	3.1	134.3
29-Jul-11 16:00:00	36.4	3.1	133.6

Rolling Daily Averages
NOx (ppm) O2 (ppm) CO (ppm)

29-Jul-11 17:00:00	36.4	3.1	133.0
29-Jul-11 18:00:00	36.4	3.1	133.0
29-Jul-11 19:00:00	36.4	3.1	132.9
29-Jul-11 20:00:00	36.4	3.2	132.5
29-Jul-11 21:00:00	36.5	3.2	133.5
29-Jul-11 22:00:00	36.4	3.2	133.5
29-Jul-11 23:00:00	36.4	3.2	133.0
30-Jul-11 00:00:00	36.4	3.2	132.3
30-Jul-11 01:00:00	36.5	3.2	132.6
30-Jul-11 02:00:00	36.5	3.2	133.2
30-Jul-11 03:00:00	36.5	3.2	133.5
30-Jul-11 04:00:00	36.5	3.2	134.1
30-Jul-11 05:00:00	36.6	3.2	134.0
30-Jul-11 06:00:00	38.7	3.2	134.3
30-Jul-11 07:00:00	36.7	3.2	134.6
30-Jul-11 08:00:00	36.7	3.2	133.8
30-Jul-11 09:00:00	36.8	3.2	133.6
30-Jul-11 10:00:00	36.8	3.2	133.3
30-Jul-11 11:00:00	36.8	3.2	133.0
30-Jul-11 12:00:00	36.9	3.2	132.4
30-Jul-11 13:00:00	36.9	3.2	132.6
30-Jul-11 14:00:00	36.9	3.2	132.3
30-Jul-11 15:00:00	37.0	3.2	132.4
30-Jul-11 16:00:00	37.0	3.2	132.9
30-Jul-11 17:00:00	37.0	3.2	133.3
30-Jul-11 18:00:00	37.0	3.2	133.3
30-Jul-11 19:00:00	37.0	3.2	133.5
30-Jul-11 20:00:00	37.0	3.2	133.3
30-Jul-11 21:00:00	37.1	3.2	133.5
30-Jul-11 22:00:00	37.0	3.2	132.4
30-Jul-11 23:00:00	37.1	3.2	132.3
31-Jul-11 00:00:00	37.1	3.2	132.6
31-Jul-11 01:00:00	37.1	3.2	133.1
31-Jul-11 02:00:00	37.0	3.2	132.6
31-Jul-11 03:00:00	37.0	3.2	131.8
31-Jul-11 04:00:00	37.0	3.2	131.2
31-Jul-11 05:00:00	37.0	3.2	130.3
31-Jul-11 06:00:00	38.9	3.2	130.7
31-Jul-11 07:00:00	36.9	3.2	130.8
31-Jul-11 08:00:00	36.9	3.2	130.1
31-Jul-11 09:00:00	37.0	3.2	130.3
31-Jul-11 10:00:00	37.0	3.2	130.4
31-Jul-11 11:00:00	37.0	3.2	130.8
31-Jul-11 12:00:00	37.0	3.2	130.9
31-Jul-11 13:00:00	37.1	3.2	131.2
31-Jul-11 14:00:00	37.2	3.2	131.7
31-Jul-11 15:00:00	37.2	3.2	132.4
31-Jul-11 16:00:00	37.1	3.2	132.6
31-Jul-11 17:00:00	37.2	3.2	132.1
31-Jul-11 18:00:00	37.3	3.2	133.1
31-Jul-11 19:00:00	37.3	3.2	134.1
31-Jul-11 20:00:00	37.4	3.2	135.1
31-Jul-11 21:00:00	37.5	3.2	136.2

Rolling Daily Averages

	NOx (ppm)	O2 (ppm)	CO (ppm)
31-Jul-11 22:00:00	37.6	3.2	137.1
31-Jul-11 23:00:00	37.7	3.2	138.3

TEST REPORT

ANNUAL 2010 CEMS RATA PROGRAM

SO₂, NO_x AND CO CEMS

FCCU FLUE GAS SCRUBBER EXHAUST

**MARATHON PETROLEUM COMPANY LP
ROBINSON, ILLINOIS**

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ARI Project No. 708-364
ARI Test Plan No. 708-348 Revision 1
ARI Proposal No. 39709 Revision 2
Marathon Purchase Order No. CN00062464-1
Test Date: November 10, 2010



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Marathon Petroleum Company LP: Robinson, IL
FCCU Flue Gas Scrubber
Test Date: 11/10/10
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REPORT CERTIFICATION

STATEMENT OF CONFORMANCE AND TEST REPORT CERTIFICATION

I certify, to the best of my knowledge, that this test program was conducted in a manner conforming to the criteria set forth in ASTM D 7036-04: Standard Practice for Competence of Air Emission Testing Bodies, and that project management and supervision of all project related activities were performed by qualified individuals as defined by this practice.

I further certify that this test report and all attachments were prepared under my direction or supervision in accordance with the ARI Environmental, Inc. quality management system designed to ensure that qualified personnel gathered and evaluated the test information submitted. Based on my inquiry of the person or persons who performed the sampling and analysis relating to this performance test, the information submitted in this test report is, to the best of my knowledge and belief, true, accurate and complete.

A handwritten signature in black ink, appearing to read "Steve Flaherty", is written over a horizontal line.

Steve Flaherty, QSTI
Senior Project Manager, Source Testing Division
ARI Environmental, Inc.

A handwritten signature in black ink, appearing to read "Hank Taylor", is written over a horizontal line.

Hank Taylor, QI
Quality Assurance Manager, Source Testing Division
ARI Environmental, Inc.



SECTION ONE

Introduction and Summary

ARI Environmental, Inc. (ARI) was retained by Marathon Petroleum Company LP (Marathon) to conduct the annual 2010 relative accuracy test audit (RATA) program on the continuous emission monitoring system (CEMS) serving the FCCU Flue Gas Scrubber exhaust stack located at their refinery in Robinson, Illinois.

The test program was conducted in accordance with the sampling and analytical procedures presented in the test plan dated July 12, 2010 (ARI Project No. 708-348 Revision 1). Specifically, sampling and analysis methodologies followed the procedural requirements as detailed in the Code of Federal Regulations, Title 40, Part 60 (40 CFR 60), Appendix A, USEPA Methods 3A, 6C, 7E and 10; Appendix B, Performance Specifications (PS) 2 and 4; Appendix F, Quality Assurance Procedures; 40 CFR 51, Appendix M, USEPA Method 205; the Quality Assurance Handbook for Air Pollution Measurement Systems, Volume III, Stationary Source Specific Methods; and the requirements specified in the Marathon Illinois Environmental Protection Agency (IEPA) Construction Permit No. 99020080.

The test program was performed on the following CEMS:

Scrubber Exhaust Stack

Manufacturer : Rosemount
Model No. : NGA 2000 MLT3T-UV-IR-PO2-CLD
Serial Number : 40050345908
Analyzer/span : Sulfur Dioxide (SO₂) Monitor (UV) / 0-600 ppmv db
Oxygen (O₂) Monitor (PO₂) / 0-10% O₂ db
Nitrogen Oxides (NO_x) Monitor (CL) / 0-500 ppmv db
Carbon Monoxide (CO) Monitor (NDIR) / 0-1,000 ppmv db

The RATA program was performed on November 10, 2010 by Messrs. Steve Flaherty, Bill Flaherty and Ryan Mahoney of ARI. Ms. Stacey Stephens of Marathon monitored process operations and coordinated the test program.

The results of the RATA program were within the relative accuracy (RA) requirements specified in 40 CFR 60, Appendix B and F. The results are summarized in Table 1-1.

TABLE 1-1. SUMMARY OF CEMS RATA PROGRAM

CEMS	RA, %	RA Allowable
SO ₂ ppmv db corrected to 0% O ₂	0.43	10% based on the Applicable Standard of 50 ppmv db O ₂ free
NO _x ppmv db	1.06	20% based on the average Reference Method (RM) value
CO ppmv db	2.02	5% based on the Applicable Standard of 500 ppmv db

O₂ is used to correct the SO₂ readings to an O₂ free basis. A separate RA calculation was not reported for O₂.



SECTION TWO

Testing and Analytical Procedures

2.1 OVERVIEW

A RATA program was conducted on the CEMS located on the FCCU Flue Gas Scrubber exhaust stack location in accordance with the requirements specified in 40 CFR 60, Appendix A, USEPA Methods 3A, 6C, 7E and 10; Appendix B, PS-2 and 4; Appendix F, Quality Assurance Procedures; 40 CFR 51, Appendix M, USEPA Method 205; the Quality Assurance Handbook for Air Pollution Measurement Systems, Volume III, Stationary Source Specific Methods; and the requirements specified in the Marathon IEPA Construction Permit No. 99020080.

The RM monitors were calibrated with applicable range gases as specified in the USEPA methods. The calibration gases were generated from calibration gases using an EnviroNics Model 4040 Gas Dilution System. The dilution system was verified on-site in strict accordance with USEPA Method 205. The gases met the calibration gas protocols as specified in USEPA Method 7E, Section 7.1. Nine (9) 21-minute test runs were performed and used to calculate the CEMS RA.

The RM sampling system used by ARI consisted of a heated probe equipped with an in-stack filter followed by a calibration tee assembly connected to a heated Teflon sample line. The Teflon line was connected to an electronic sample conditioner to remove moisture from the gas stream followed by a Teflon lined pump. Intake lines for ARI's analyzers were connected to a sample manifold located on the exhaust side of the pump. A schematic of ARI's RM sampling system is shown in Figure 2-1.

A calibration error test was performed prior to testing and a pre/post calibration drift test was conducted on each monitor. The average zero and calibration drift values were used to correct the raw monitor data for each respective test run. Response time tests were conducted for each monitor. The highest response time was 180 seconds. Interference test data are provided in Appendix E for each of ARI's RM monitors.

The RM data were collected at 15-second intervals and one-minute averages were calculated by ARI's data acquisition system. The data acquisition system consisted of a datalogger connected to a computer for digital data archiving and data reduction. Excel spreadsheet computer software was used for RA calculations.

2.2 SAMPLING LOCATION (PERFORMANCE SPECIFICATION 2)

The sampling point locations were determined following PS-2 procedures. The sampling location and number of sample points were as follows:

<u>Sampling Location</u>	<u>Stack Diameter (inches)</u>	<u>Port Location Upstream from Disturbance (diameters)</u>	<u>Port Location Downstream from Disturbance (diameters)</u>	<u>No. of Ports</u>	<u>Total Sampling Points</u>
Scrubber Exhaust Stack	114	6.3	8.8	1	3

SECTION TWO

Testing and Analytical Procedures

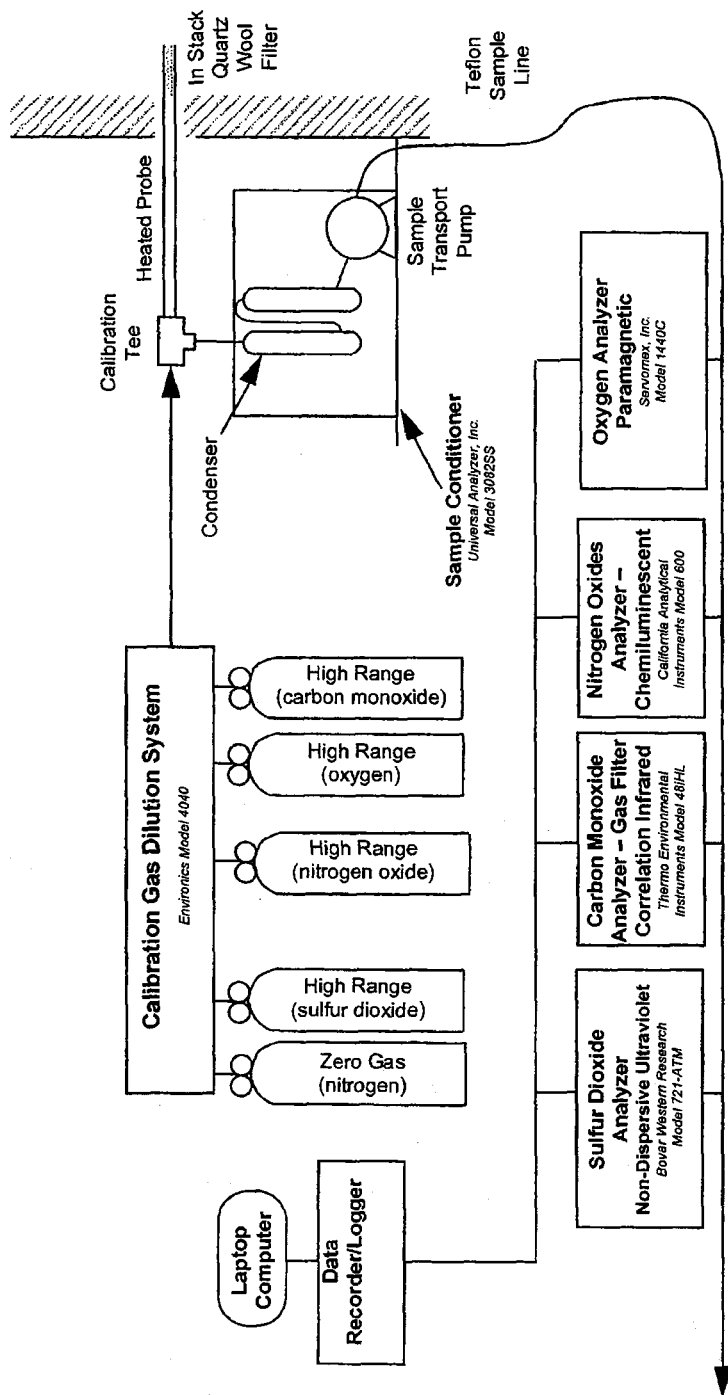


FIGURE 2-1. ARI REFERENCE METHOD O_2 , SO_2 , NO_x AND CO SAMPLING SYSTEM



SECTION TWO

Testing and Analytical Procedures

A three point traverse was used following the procedural requirements of PS-2. Three (3) sample points located at 16.7%, 50% and 83.3% of the 114-inch ID stack were selected for the gaseous measurements. Sampling at the first point commenced after twice the response time was achieved at the sampling location. Sampling was conducted at each point for 7 minutes during each 21-minute sample run.

2.3 STACK GAS O₂ DETERMINATION (USEPA METHOD 3A)

Continuous O₂ sampling was performed in accordance with USEPA Method 3A using ARI's Servomex Model 1440 O₂ monitor set at a span value of 10%. Zero and calibration drift test results were within the 3% span allowed for the monitor. The average zero and calibration drift values were used to drift correct the data for each test run. The final average O₂ concentrations for each run were then used to correct ARI's average SO₂ concentrations to a ppmv db O₂ free basis.

The Marathon Rosemount paramagnetic O₂ monitor measures the flue gas on a dry basis after the gas goes through a Sample Conditioning Unit (dryer). That data is used by Marathon to correct the SO₂ CEMS readings to a ppmv db O₂ free basis.

2.4 SULFUR DIOXIDE DETERMINATION (USEPA METHOD 6C)

SO₂ measurements were conducted in accordance with USEPA Method 6C using ARI's Bovar Western Research Model 721-ATM SO₂ monitor with a span of 50 ppmv. Zero and calibration drift test results were within the 3% span allowed for the monitor. The average zero and calibration drift values were used to drift correct the data for each test run.

SO₂ concentrations corrected to a 0% O₂ basis were compared with the Rosemount NGA 2000 UV SO₂ ppmv db O₂ free concentrations for calculation of the CEMS RA. The allowable RA is 20% based on the mean RM value or 10% when the RM is <50% of the applicable 50 ppmv db O₂ free standard, as specified in PS-2 and Appendix F. The applicable allowable NSPS emission rate specified in 60.104(b)(1) is 50 ppmv db O₂ free.

2.5 NITROGEN OXIDES DETERMINATION (USEPA METHOD 7E)

NO_x sampling was conducted in accordance with USEPA Method 7E using ARI's California Analytical Instruments Model 600 chemiluminescent analyzer. The instrument span was 100 ppmv during the testing. Prior to testing, a NO_x converter check was performed on ARI's low temperature NO_x converter in accordance with Method 7E, Section 16.2.2. The NO_x converter efficiency was 91.8%, which is greater than the minimum 90% requirement.

The NO_x concentrations (ppmv db) measured by ARI during each run were directly compared to the Rosemount NGA 2000 CL NO_x monitor (ppmv db) for determining the RA of this analyzer. The allowable RA is 20% based on the mean RM value, as specified in PS-2 and Appendix F.



SECTION TWO

Testing and Analytical Procedures

2.6 CARBON MONOXIDE DETERMINATION (USEPA METHOD 10)

CO measurements were conducted in accordance with USEPA Method 10 using ARI's Thermo Environmental Instruments Model 48CHL gas filter correlation analyzer. This monitor is specific for CO and has a 6 million to 1 interference ratio to carbon dioxide (CO₂); therefore an ascarite scrubber to remove CO₂ is not required for this monitor. The instrument span was 100 ppmv during the testing.

The CO concentrations (ppmv db) measured by ARI during each run were directly compared to the Rosemount NGA 2000 NDIR CO monitor (ppmv db) for determining the RA of this analyzer. The allowable RA is 10% based on the mean RM value or 5% when the RM is <50% of the applicable standard, as specified in PS-4 and Appendix F. The allowable NSPS CO standard specified in 60.103(a) is 500 ppmv db.

2.7 VALIDATION OF GAS DILUTION SYSTEM (USEPA METHOD 205)

All diluted calibration standards were prepared using an Environics Model 4040 Gas Dilution System that was verified by a field evaluation at the job site prior to testing following the requirements of USEPA Method 205 (40 CFR 51, Appendix M).

ARI's Servomex Model 1440 paramagnetic O₂ gas analyzer was calibrated following USEPA Method 3A procedures. After the calibration procedure was complete, diluted standards of 9.00% and 18.00% and a mid-range EPA Protocol 1 standard of 12.61% were alternately introduced in triplicate and an average instrument response was calculated for each standard. No single response differed by more than ±2% from the average response for each standard. The difference between the instrument average and the predicted concentration was less than ±2% for each diluted standard. The difference between the certified gas concentration and the average instrument response for the mid-range EPA Protocol 1 standard was less than ±2%.

2.8 RA CALCULATIONS

The RA was calculated by directly comparing the RM results with the actual CEMS readings, using the following equations:

- a) Effluent gas concentration; calculated from pre-test and post-test calibration bias checks:

$$C_{REF} = \left[\bar{C} - C_o \right] \frac{C_{ma}}{C_m - C_o}$$

Where:

- C_{REF} = Drift corrected effluent gas concentration, dry basis
 \bar{C} = Average gas concentration indicated by gas analyzer, dry basis
 C_o = Average of initial and final system calibration bias check responses for the zero gas
 C_m = Average of initial and final system calibration bias check responses for the upscale calibration gas
 C_{ma} = Actual concentration of the upscale calibration gas



SECTION TWO

Testing and Analytical Procedures

- b) RM SO₂ concentration corrected to an O₂ free basis (C_{REF SO2 @ 0% O2}):

$$C_{\text{REFSO2@0\%O2}} = C_{\text{REFSO2}} \left(\frac{20.9}{20.9 - C_{\text{REFO2}}} \right)$$

Where:

C_{REF SO2 @ 0% O2} = RM SO₂ concentration, ppmv db O₂ free
 C_{REF SO2} = Drift corrected RM measured SO₂ concentration, ppmv db
 C_{REF O2} = Drift corrected RM measured O₂ concentration, % db

- c) Arithmetic mean; calculated arithmetic mean of the difference between the RM data and the CEMS:

$$\bar{d} = \frac{1}{n} \sum_{i=1}^n d_i$$

Where:

n = Number of data points

$\sum_{i=1}^n d_i$ = Algebraic sum of the individual differences d_i

- d) Standard deviation

$$S_d = \left[\frac{\sum_{i=1}^n d_i^2 - \frac{\left(\sum_{i=1}^n d_i \right)^2}{n}}{n-1} \right]^{1/2}$$

- e) Confidence coefficient; 2.5% error confidence coefficient (one-tailed)

$$CC = t_{0.975} \frac{S_d}{\sqrt{n}}$$



SECTION TWO

Testing and Analytical Procedures

Where:

$t_{0.975}$ = t- value as below

n^a	$t_{0.975}$	n^a	$t_{0.975}$	n^a	$t_{0.975}$
2	12.706	7	2.447	12	2.201
3	4.303	8	2.365	13	2.179
4	3.182	9	2.306	14	2.160
5	2.776	10	2.262	15	2.145
6	2.571	11	2.228	16	2.131

^a The values in this table are already corrected for n-1 degrees of freedom. Use n equal to the number of individual values.

f) Relative accuracy:

$$RA = \frac{|d| + |CC|}{RM}$$

Where:

$|d|$ = Absolute value of the mean difference (from equation c)

$|CC|$ = Absolute value of the confidence coefficient (from equation e)

RM = Average reference method value or applicable standard



SECTION THREE

Process Description

Flue gas from the FCCU regenerator contains a mixture of CO, CO₂, N₂, O₂, NO_x, and SO₂. This mixture flows to the CO Boiler, where most of the CO is combusted into CO₂, and an SNCR system uses Ammonia to destroy some NO_x. The Boiler Flue gas then travels to the Flue Gas Scrubber, where a solution of water and soda ash contacts the flue gas, chemically reducing the SO₂ in the flue gas before it goes to the stack.

Coming out of the regenerator, the dry CO content is approximately 1-2%, with NO_x approximately 70-80 ppm. SO₂ going into the scrubber is approximately 1500-2000 ppm. At the stack, CO is around 100 ppm, SO₂ <10 ppm, NO_x around 50 ppm. The CEMS give important data for the operation. If CO coming out of the stack starts rising, Operations will increase combustion in the CO Boiler to destroy more CO. If NO_x at the stack is high, Operations can increase the ammonia rate to destroy more NO_x. If SO₂ at the stack is rising, the pH of the scrubber is raised to reduce more SO₂.



SECTION FOUR

Test Results

This section details the results of the RATA program conducted on the SO₂, NO_x and CO CEMS serving the FCCU Flue Gas Scrubber exhaust located at the Marathon refinery in Robinson, Illinois.

The results of the RATA program are presented in Tables 4-1 through 4-3.

Table 4-1 presents the Rosemount NGA 2000 UV SO₂ RA results on a ppmv db O₂ free basis. The CEMS RA was 0.43% compared to the allowable of 10% when the RM is less than 50% of the 50 ppmv db O₂ free standard or 4 ppmv difference, whichever is less restrictive.

Table 4-2 presents the Rosemount NGA 2000 CL NO_x RA results on a ppmv db basis. The CEMS RA was 1.06% compared to the allowable of 20% based on the mean RM value.

Table 4-3 presents the Rosemount NGA 2000 NDIR CO RA results on a ppmv db basis. The CEMS RA was 2.02% compared to the allowable of 5% when the RM is less than 50% of the 500 ppmv db standard.

The results of the RATA program were within the RA requirements specified in 40 CFR 60, Appendix B and F.

The calculation summaries, field data, ARI reference method monitoring data, Marathon CEMS data, test equipment calibration data and test program qualifications are included in the appendices.



SECTION FOUR

Test Results

TABLE 4-1. SO₂ RATA RESULTS
 (ppmv db O₂ free)

COMPANY : Marathon Petroleum Company LP
 LOCATION : Robinson, Illinois
 SOURCE : FCCU Scrubber Stack
 APPLICABLE STANDARD : 50 ppmv db O₂ free

Test Run Number	Date	Time	Reference Method Samples	CEMS Output	(RM _i -CEM _i) Difference (d _i)
			RM _i SO ₂ ppmv O ₂ free dry basis	CEM _i SO ₂ ppmv O ₂ free dry basis	
1	11/10/10	09:15-09:36	0.45	0.65	-0.20
2	11/10/10	09:36-09:57	-0.02	0.00	-0.02
3	11/10/10	09:57-10:18	0.05	0.00	0.05
4	11/10/10	11:41-12:02	0.44	0.23	0.21
5	11/10/10	12:02-12:23	0.37	0.23	0.14
6	11/10/10	12:23-12:44	0.34	0.23	0.11
7	11/10/10	13:15-13:36	0.64	0.23	0.41
8	11/10/10	13:36-13:57	0.33	0.23	0.10
9	11/10/10	13:57-14:18	0.20	0.23	-0.03

Mean Reference Method Value: 0.3 ppmv db O₂ free
 Mean CEMS Value: 0.2 ppmv db O₂ free
 average d: 0.08 ppmv db O₂ free
 n: 9
 t_{0.975}: 2.306
 Sd_i: 0.755
 Sd_i²: 0.295
 standard deviation: 0.170
 confidence coefficient (one-tailed): 0.131

Relative Accuracy: 0.43% based on the Applicable Standard
 (50 ppmv db O₂ free)
 Allowable: 10% based on the Applicable Standard



SECTION FOUR

Test Results

TABLE 4-2. NO_x RATA RESULTS
 (ppmv db)

COMPANY : Marathon Petroleum Company LP
 LOCATION : Robinson, Illinois
 SOURCE : FCCU Scrubber Stack

Test Run Number	Date	Time	Reference Method Samples	CEMS Output	(RM _i -CEM _i) Difference (d _i)
			RM _i NO _x ppmv dry basis	CEM _i NO _x ppmv dry basis	
1	11/10/10	09:15-09:36	44.73	44.99	-0.26
2	11/10/10	09:36-09:57	44.16	44.08	0.08
3	11/10/10	09:57-10:18	43.49	43.24	0.25
4	11/10/10	11:41-12:02	40.98	41.30	-0.32
5	11/10/10	12:02-12:23	40.59	41.20	-0.61
6	11/10/10	12:23-12:44	41.46	42.02	-0.56
7	11/10/10	13:15-13:36	42.32	41.50	0.82
8	11/10/10	13:36-13:57	41.39	40.71	0.68
9	11/10/10	13:57-14:18	41.28	40.93	0.35

Mean Reference Method Value: 42.3 ppmv db
 Mean CEMS Value: 42.2 ppmv db
 average d: 0.049 ppmv db
 n: 9
 t_{0.975}: 2.306
 Sd_i: 0.442
 Sd_i²: 2.195
 standard deviation: 0.521
 confidence coefficient (one-tailed): 0.401

Relative Accuracy: 1.06% based on the mean RM value
 Allowable: 20% based on the mean RM value



Marathon Petroleum Company LP: Robinson, IL
 FCCU Flue Gas Scrubber
 Test Date: 11/10/10
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SECTION FOUR

Test Results

TABLE 4-3. CO RATA RESULTS
 (ppmv db)

COMPANY : Marathon Petroleum Company LP
 LOCATION : Robinson, Illinois
 SOURCE : FCCU Scrubber Stack
 APPLICABLE STANDARD : 500 ppmv db – NSPS CO standard specified in 60.103(a)

Test Run Number	Date	Time	Reference Method Samples	CEMS Output	(RM _i -CEM _i) Difference (d _i)
			RM _i CO ppmv db	CEM _i CO ppmv db	
1	11/10/10	09:15-09:36	2.77	11.89	-9.12
2	11/10/10	09:36-09:57	2.53	11.89	-9.36
3	11/10/10	09:57-10:18	2.39	11.89	-9.50
4	11/10/10	11:41-12:02	2.64	11.89	-9.25
5	11/10/10	12:02-12:23	2.46	11.89	-9.43
6	11/10/10	12:23-12:44	2.48	11.89	-9.41
7	11/10/10	13:15-13:36	1.94	12.00	-10.06
8	11/10/10	13:36-13:57	2.15	12.51	-10.36
9	11/10/10	13:57-14:18	2.04	12.78	-10.74

Mean Reference Method Value: 2.38 ppmv db
 Mean CEMS Value: 12.07 ppmv db
 average d: -9.69 ppmv db
 n: 9
 t_{0.975}: 2.306
 Sd_i: -87.237
 Sd_i²: 848.085
 standard deviation: 0.558
 confidence coefficient (one-tailed): 0.429

Relative Accuracy: 2.02% based on the Applicable Standard
 (500 ppmv db)
 Allowable: 5% based on the Applicable Standard



Marathon Petroleum Company LP: Robinson, IL
FCCU Flue Gas Scrubber
Test Date: 11/10/10

APPENDIX A

Calculation Summaries

SUMMARY OF ONE-MINUTE AVERAGE REFERENCE METHOD CEM DATA

Monitor Data			One-Minute Averages (Uncorrected for Drift)						
COMPANY : SOURCE : REPETITION : TEST DATE : TEST TIME	MPC LP FCCU Scrubber Stack RA-1 11/10/2010 09:15-09:36		Clock	Elapsed	FCCU Scrubber Exhaust				
			Time	Time	O ₂ %	CO ₂ %	SO ₂ ppmv	NOx ppmv	CO ppmv
FCCU SCRUBBER EXHAUST			09 : 15	0					
GAS ANALYZER OXYGEN (O ₂)			09 : 16	1	4.7	11.9	0.7	44.9	3.9
SCALE (%) :	10.0		09 : 17	2	4.9	12.0	0.8	45.2	3.3
PRETEST CAL DRIFT (%) :	4.95		09 : 18	3	5.2	11.8	0.8	45.9	2.9
POSTTEST CAL DRIFT (%) :	4.95		09 : 19	4	5.2	12.0	0.7	46.1	3.2
PRETEST ZERO DRIFT (%) :	-0.04		09 : 20	5	5.2	12.0	0.7	46.0	3.0
POSTTEST ZERO DRIFT (%) :	-0.06		09 : 21	6	5.2	11.9	0.7	44.9	3.0
CALIBRATION GAS :	PROTOCOL 1 OXYGEN		09 : 22	7	5.2	11.9	0.7	45.9	3.2
CALIBRATION % :	5.0		09 : 23	8	5.3	11.9	0.6	44.8	3.0
UNCORRECTED AVERAGE:	5.19		09 : 24	9	5.2	11.9	0.6	46.0	3.4
DRIFT CORRECTED AVG.	5.24		09 : 25	10	5.3	11.9	0.5	44.2	2.8
GAS ANALYZER CARBON DIOXIDE (CO ₂)			09 : 26	11	5.2	11.9	0.5	45.5	2.9
SCALE (%) :	20.00		09 : 27	12	5.3	11.9	0.3	43.6	3.1
PRETEST CAL DRIFT (%) :	9.87		09 : 28	13	5.2	11.9	0.2	44.8	2.8
POSTTEST CAL DRIFT (%) :	9.89		09 : 29	14	5.3	11.9	0.1	44.2	2.8
PRETEST ZERO DRIFT (%) :	0.04		09 : 30	15	5.2	11.9	0.0	44.3	2.7
POSTTEST ZERO DRIFT (%) :	0.07		09 : 31	16	5.2	11.9	(0.0)	45.0	2.9
CALIBRATION GAS :	PROTOCOL 1 CO ₂		09 : 32	17	5.2	11.9	0.0	45.6	3.0
CALIBRATION % :	10.0		09 : 33	18	5.3	11.9	(0.0)	44.7	2.7
UNCORRECTED AVERAGE:	11.91		09 : 34	19	5.2	12.0	0.0	45.1	3.0
DRIFT CORRECTED AVG.	12.06		09 : 35	20	5.3	11.9	0.0	44.2	2.9
GAS ANALYZER SULFUR DIOXIDE (SO ₂)			09 : 36	21	5.2	11.9	(0.0)	43.7	3.0
SCALE (ppm):	50.00		Average: 5.19 11.91 0.38 44.97 3.02						
PRETEST CAL DRIFT (ppm) :	24.9								
POSTTEST CAL DRIFT (ppm):	24.9								
PRETEST ZERO DRIFT (ppm) :	-0.1								
POSTTEST ZERO DRIFT (ppm):	0.2								
CALIBRATION GAS :	PROTOCOL 1 SO ₂								
CALIBRATION ppm :	25.0								
UNCORRECTED AVERAGE:	0.38								
DRIFT CORRECTED AVG.	0.33								
SO2 (0% Oxygen Correction)	0.45								
GAS ANALYZER NITROGEN OXIDES (NOx)									
SCALE (ppm):	100.0								
PRETEST CAL DRIFT (ppm) :	50.5								
POSTTEST CAL DRIFT (ppm):	50.1								
PRETEST ZERO DRIFT (ppm) :	-0.5								
POSTTEST ZERO DRIFT (ppm):	-0.3								
CALIBRATION GAS :	PROTOCOL 1 NOx								
CALIBRATION ppm :	50.0								
UNCORRECTED AVERAGE:	44.97								
DRIFT CORRECTED AVG.	44.73								
GAS ANALYZER CARBON MONOXIDE (CO)									
SCALE (ppm):	100.0								
PRETEST CAL DRIFT (ppm) :	49.8								
POSTTEST CAL DRIFT (ppm):	48.8								
PRETEST ZERO DRIFT (ppm) :	0.5								
POSTTEST ZERO DRIFT (ppm):	0.2								
CALIBRATION GAS :	PROTOCOL 1 CO								
CALIBRATION ppm :	50.0								
UNCORRECTED AVERAGE:	3.02								
DRIFT CORRECTED AVG.	2.77								

SUMMARY OF ONE-MINUTE AVERAGE REFERENCE METHOD CEM DATA

Monitor Data		One-Minute Averages (Uncorrected for Drift)						
COMPANY :	MPC LP	Clock	Elapsed	FCCU Scrubber Exhaust				
		Time	Time	O ₂ %	CO ₂ %	SO ₂ ppmv	NOx ppmv	CO ppmv
SOURCE :	FCCU Scrubber Stack	09 : 36	0					
REPETITION :	RA-2	09 : 37	1	5.1	12.0	0.0	43.2	2.7
TEST DATE :	11/10/2010	09 : 38	2	5.1	12.0	0.0	44.6	2.7
TEST TIME	09:36-09:57	09 : 39	3	5.2	11.9	0.0	43.9	2.8
FCCU SCRUBBER EXHAUST		09 : 40	4	5.2	12.0	0.0	44.6	3.1
GAS ANALYZER OXYGEN (O ₂)		09 : 41	5	5.2	12.0	(0.0)	44.0	2.9
SCALE (%) :	10.0	09 : 42	6	5.2	11.9	0.0	45.7	3.0
PRETEST CAL DRIFT (%) :	4.9	09 : 43	7	5.3	11.8	0.0	45.7	3.0
POSTTEST CAL DRIFT (%) :	4.9	09 : 44	8	5.3	11.9	0.1	43.6	3.0
PRETEST ZERO DRIFT (%) :	0.0	09 : 45	9	5.2	12.0	0.1	44.1	3.0
POSTTEST ZERO DRIFT (%) :	-0.1	09 : 46	10	5.2	11.9	0.1	45.0	2.8
CALIBRATION GAS :	PROTOCOL 1 OXYGEN	09 : 47	11	5.2	12.0	0.0	45.0	2.7
CALIBRATION % :	5.0	09 : 48	12	5.3	11.9	0.1	45.3	2.9
UNCORRECTED AVERAGE:	5.23	09 : 49	13	5.3	11.8	0.1	44.4	2.7
DRIFT CORRECTED AVG.	5.28	09 : 50	14	5.3	11.9	0.1	45.4	2.9
GAS ANALYZER CARBON DIOXIDE (CO ₂)		09 : 51	15	5.3	11.9	0.0	43.6	2.6
SCALE (%) :	20.00	09 : 52	16	5.1	12.0	0.0	44.5	2.6
PRETEST CAL DRIFT (%) :	9.9	09 : 53	17	5.2	11.9	0.0	43.0	2.6
POSTTEST CAL DRIFT (%) :	9.9	09 : 54	18	5.2	11.9	0.1	44.4	2.6
PRETEST ZERO DRIFT (%) :	0.0	09 : 55	19	5.2	12.0	(0.0)	44.4	2.5
POSTTEST ZERO DRIFT (%) :	0.1	09 : 56	20	5.2	11.9	0.0	43.7	2.9
CALIBRATION GAS :	PROTOCOL 1 CO ₂	09 : 57	21	5.2	11.9	0.0	44.1	2.5
CALIBRATION % :	10.0	Average:		5.23	11.92	0.04	44.39	2.79
UNCORRECTED AVERAGE:	11.92							
DRIFT CORRECTED AVG.	12.08							
GAS ANALYZER SULFUR DIOXIDE (SO ₂)								
SCALE (ppm):	50.00							
PRETEST CAL DRIFT (ppm) :	24.9							
POSTTEST CAL DRIFT (ppm):	24.9							
PRETEST ZERO DRIFT (ppm) :	-0.1							
POSTTEST ZERO DRIFT (ppm):	0.2							
CALIBRATION GAS :	PROTOCOL 1 SO ₂							
CALIBRATION ppm :	25.0							
UNCORRECTED AVERAGE:	0.04							
DRIFT CORRECTED AVG.	-0.02							
SO2 (0% Oxygen Correction)	-0.02							
GAS ANALYZER NITROGEN OXIDES (NOx)								
SCALE (ppm):	100.0							
PRETEST CAL DRIFT (ppm) :	50.5							
POSTTEST CAL DRIFT (ppm):	50.1							
PRETEST ZERO DRIFT (ppm) :	-0.5							
POSTTEST ZERO DRIFT (ppm):	-0.3							
CALIBRATION GAS :	PROTOCOL 1 NOx							
CALIBRATION ppm :	50.0							
UNCORRECTED AVERAGE:	44.39							
DRIFT CORRECTED AVG.	44.16							
GAS ANALYZER CARBON MONOXIDE (CO)								
SCALE (ppm):	100.0							
PRETEST CAL DRIFT (ppm) :	49.8							
POSTTEST CAL DRIFT (ppm):	48.8							
PRETEST ZERO DRIFT (ppm) :	0.5							
POSTTEST ZERO DRIFT (ppm):	0.2							
CALIBRATION GAS :	PROTOCOL 1 CO							
CALIBRATION ppm :	50.0							
UNCORRECTED AVERAGE:	2.79							
DRIFT CORRECTED AVG.	2.53							

SUMMARY OF ONE-MINUTE AVERAGE REFERENCE METHOD CEM DATA

Monitor Data		One-Minute Averages (Uncorrected for Drift)								
COMPANY :	MPC LP	Clock	Elapsed	FCCU Scrubber Exhaust						
SOURCE :	FCCU Scrubber Stack	Time	Time	O ₂ %	CO ₂ %	SO ₂ ppmv	NOx ppmv	CO ppmv		
REPETITION :	RA-3									
TEST DATE :	11/10/2010									
TEST TIME	09:57-10:18									
FCCU SCRUBBER EXHAUST										
GAS ANALYZER		OXYGEN (O ₂)								
SCALE (%) :	10.0	10 : 01	4	5.2	12.0	0.0	43.5	2.9		
PRETEST CAL DRIFT (%) :	4.9	10 : 02	5	5.2	11.9	0.0	43.3	3.0		
POSTTEST CAL DRIFT (%) :	4.9	10 : 03	6	5.2	12.0	0.0	43.2	2.8		
PRETEST ZERO DRIFT (%) :	0.0	10 : 04	7	5.2	11.9	0.0	44.7	2.9		
POSTTEST ZERO DRIFT (%) :	-0.1	10 : 05	8	5.3	11.9	0.1	43.3	2.7		
CALIBRATION GAS :	PROTOCOL 1 OXYGEN	10 : 06	9	5.3	11.9	0.1	43.4	2.6		
CALIBRATION % :	5.0	10 : 07	10	5.2	11.9	0.1	43.1	2.3		
UNCORRECTED AVERAGE:	5.26	10 : 08	11	5.2	11.9	0.1	45.0	2.8		
DRIFT CORRECTED AVG.	5.32	10 : 09	12	5.4	11.8	0.1	43.3	2.2		
		10 : 10	13	5.2	12.0	0.1	42.0	3.2		
GAS ANALYZER		CARBON DIOXIDE (CO ₂)		10 : 11	14	5.2	12.0	0.1	42.8	2.5
SCALE (%) :	20.00	10 : 12	15	5.2	12.0	0.1	43.6	2.8		
PRETEST CAL DRIFT (%) :	9.9	10 : 13	16	5.3	11.9	0.1	45.1	2.4		
POSTTEST CAL DRIFT (%) :	9.9	10 : 14	17	5.4	11.8	0.2	44.4	2.7		
PRETEST ZERO DRIFT (%) :	0.0	10 : 15	18	5.4	11.8	0.1	42.1	2.5		
POSTTEST ZERO DRIFT (%) :	0.1	10 : 16	19	5.2	11.9	0.2	44.0	2.7		
CALIBRATION GAS :	PROTOCOL 1 CO ₂	10 : 17	20	5.4	11.8	0.1	44.6	2.3		
CALIBRATION % :	10.0	10 : 18	21	5.4	11.9	0.2	43.2	2.7		
UNCORRECTED AVERAGE:	11.90	Average:		5.26	11.90	0.09	43.72	2.65		
DRIFT CORRECTED AVG.	12.06									
GAS ANALYZER		SULFUR DIOXIDE (SO ₂)								
SCALE (ppm):	50.00									
PRETEST CAL DRIFT (ppm) :	24.9									
POSTTEST CAL DRIFT (ppm):	24.9									
PRETEST ZERO DRIFT (ppm) :	-0.1									
POSTTEST ZERO DRIFT (ppm):	0.2									
CALIBRATION GAS :	PROTOCOL 1 SO ₂									
CALIBRATION ppm :	25.0									
UNCORRECTED AVERAGE:	0.09									
DRIFT CORRECTED AVG.	0.04									
SO ₂ (0% Oxygen Correction)	0.06									
GAS ANALYZER		NITROGEN OXIDES (NOx)								
SCALE (ppm):	100.0									
PRETEST CAL DRIFT (ppm) :	50.5									
POSTTEST CAL DRIFT (ppm):	50.1									
PRETEST ZERO DRIFT (ppm) :	-0.5									
POSTTEST ZERO DRIFT (ppm):	-0.3									
CALIBRATION GAS :	PROTOCOL 1 NOx									
CALIBRATION ppm :	50.0									
UNCORRECTED AVERAGE:	43.72									
DRIFT CORRECTED AVG.	43.49									
GAS ANALYZER		CARBON MONOXIDE (CO)								
SCALE (ppm):	100.0									
PRETEST CAL DRIFT (ppm) :	49.8									
POSTTEST CAL DRIFT (ppm):	48.8									
PRETEST ZERO DRIFT (ppm) :	0.5									
POSTTEST ZERO DRIFT (ppm):	0.2									
CALIBRATION GAS :	PROTOCOL 1 CO									
CALIBRATION ppm :	50.0									
UNCORRECTED AVERAGE:	2.65									
DRIFT CORRECTED AVG.	2.39									

SUMMARY OF ONE-MINUTE AVERAGE REFERENCE METHOD CEM DATA

Monitor Data		One-Minute Averages (Uncorrected for Drift)						
COMPANY :	MPC LP	Clock	Elapsed	FCCU Scrubber Exhaust				
SOURCE :	FCCU Scrubber Stack	Time	Time	O ₂ %	CO ₂ %	SO ₂ ppmv	NOx ppmv	CO ppmv
REPETITION :	RA-4							
TEST DATE :	11/10/2010							
TEST TIME	11:41-12:02							
FCCU SCRUBBER EXHAUST								
<u>GAS ANALYZER</u> <u>OXYGEN (O₂)</u>								
SCALE (%):	10.0	11 : 41	0					
PRETEST CAL DRIFT (%) :	4.9	11 : 42	1	5.1	11.6	0.8	42.2	2.3
POSTTEST CAL DRIFT (%) :	5.0	11 : 43	2	5.2	11.7	0.8	40.8	2.8
PRETEST ZERO DRIFT (%) :	-0.1	11 : 44	3	5.1	11.7	0.8	40.7	2.2
POSTTEST ZERO DRIFT (%) :	0.0	11 : 45	4	5.0	11.8	0.7	41.2	2.6
CALIBRATION GAS :	PROTOCOL 1 OXYGEN	11 : 46	5	5.1	11.7	0.8	42.2	2.4
CALIBRATION % :	5.0	11 : 47	6	5.1	11.7	0.7	41.8	3.0
UNCORRECTED AVERAGE:	5.14	11 : 48	7	5.1	11.7	0.8	40.7	2.9
DRIFT CORRECTED AVG.	5.18	11 : 49	8	5.2	11.7	0.8	40.6	2.7
		11 : 50	9	5.2	11.6	0.8	39.9	2.8
		11 : 51	10	5.2	11.7	0.7	40.0	2.6
		11 : 52	11	5.1	11.7	0.8	40.7	2.6
		11 : 53	12	5.2	11.6	0.8	40.1	2.7
		11 : 54	13	5.1	11.6	0.8	41.0	2.6
		11 : 55	14	5.2	11.6	0.8	41.0	2.6
		11 : 56	15	5.2	11.6	0.7	40.8	2.4
		11 : 57	16	5.2	11.7	0.7	41.0	2.2
		11 : 58	17	5.1	11.7	0.8	40.1	2.8
		11 : 59	18	5.0	11.8	0.7	40.0	2.7
		12 : 00	19	5.1	11.7	0.7	40.2	2.8
		12 : 01	20	5.1	11.7	0.7	40.8	2.5
		12 : 02	21	5.2	11.6	0.7	41.0	2.7
		Average:		5.14	11.67	0.75	40.80	2.60
<u>GAS ANALYZER</u> <u>CARBON DIOXIDE (CO₂)</u>								
SCALE (%):	20.00							
PRETEST CAL DRIFT (%) :	9.9							
POSTTEST CAL DRIFT (%) :	9.8							
PRETEST ZERO DRIFT (%) :	0.1							
POSTTEST ZERO DRIFT (%) :	0.1							
CALIBRATION GAS :	PROTOCOL 1 CO ₂							
CALIBRATION % :	10.0							
UNCORRECTED AVERAGE:	11.67							
DRIFT CORRECTED AVG.	11.83							
<u>GAS ANALYZER</u> <u>SULFUR DIOXIDE (SO₂)</u>								
SCALE (ppm):	50.00							
PRETEST CAL DRIFT (ppm) :	24.9							
POSTTEST CAL DRIFT (ppm):	24.9							
PRETEST ZERO DRIFT (ppm) :	0.2							
POSTTEST ZERO DRIFT (ppm):	0.7							
CALIBRATION GAS :	PROTOCOL 1 SO ₂							
CALIBRATION ppm :	25.0							
UNCORRECTED AVERAGE:	0.76							
DRIFT CORRECTED AVG.	0.33							
SO ₂ (0% Oxygen Correction)	0.44							
<u>GAS ANALYZER</u> <u>NITROGEN OXIDES (NOx)</u>								
SCALE (ppm):	100.0							
PRETEST CAL DRIFT (ppm) :	50.1							
POSTTEST CAL DRIFT (ppm):	49.4							
PRETEST ZERO DRIFT (ppm) :	-0.3							
POSTTEST ZERO DRIFT (ppm):	0.6							
CALIBRATION GAS :	PROTOCOL 1 NOx							
CALIBRATION ppm :	50.0							
UNCORRECTED AVERAGE:	40.80							
DRIFT CORRECTED AVG.	40.98							
<u>GAS ANALYZER</u> <u>CARBON MONOXIDE (CO)</u>								
SCALE (ppm):	100.0							
PRETEST CAL DRIFT (ppm) :	48.8							
POSTTEST CAL DRIFT (ppm):	48.6							
PRETEST ZERO DRIFT (ppm) :	0.2							
POSTTEST ZERO DRIFT (ppm):	-0.1							
CALIBRATION GAS :	PROTOCOL 1 CO							
CALIBRATION ppm :	50.0							
UNCORRECTED AVERAGE:	2.60							
DRIFT CORRECTED AVG.	2.64							

SUMMARY OF ONE-MINUTE AVERAGE REFERENCE METHOD CEM DATA

Monitor Data		One-Minute Averages (Uncorrected for Drift)						
COMPANY : MPC LP SOURCE : FCCU Scrubber Stack REPETITION : RA-5 TEST DATE : 11/10/2010 TEST TIME 12:02-12:23		Clock	Elapsed	FCCU Scrubber Exhaust				
		Time	Time	O ₂ %	CO ₂ %	SO ₂ ppmv	NOx ppmv	CO ppmv
FCCU SCRUBBER EXHAUST		12 : 02	0					
GAS ANALYZER OXYGEN (O ₂)		12 : 03	1	5.2	11.6	0.7	41.3	2.3
SCALE (%) :	10.0	12 : 04	2	5.1	11.7	0.7	40.2	2.8
PRETEST CAL DRIFT (%) :	4.9	12 : 05	3	5.0	11.7	0.7	40.3	2.5
POSTTEST CAL DRIFT (%) :	5.0	12 : 06	4	5.1	11.7	0.7	40.8	2.6
PRETEST ZERO DRIFT (%) :	-0.1	12 : 07	5	5.1	11.6	0.7	41.7	2.7
POSTTEST ZERO DRIFT (%) :	0.0	12 : 08	6	5.3	11.6	0.8	41.9	2.5
CALIBRATION GAS : PROTOCOL 1 OXYGEN		12 : 09	7	5.3	11.5	0.7	41.4	2.1
CALIBRATION % :	5.0	12 : 10	8	5.1	11.7	0.7	40.5	2.9
UNCORRECTED AVERAGE :	5.15	12 : 11	9	5.1	11.7	0.7	39.8	2.3
DRIFT CORRECTED AVG.	5.19	12 : 12	10	5.1	11.7	0.7	39.4	3.0
GAS ANALYZER CARBON DIOXIDE (CO ₂)		12 : 13	11	5.0	11.7	0.7	39.1	2.4
SCALE (%) :	20.00	12 : 14	12	5.1	11.7	0.7	39.8	2.6
PRETEST CAL DRIFT (%) :	9.9	12 : 15	13	5.1	11.7	0.7	40.2	2.3
POSTTEST CAL DRIFT (%) :	9.8	12 : 16	14	5.1	11.7	0.7	40.7	2.2
PRETEST ZERO DRIFT (%) :	0.1	12 : 17	15	5.3	11.6	0.7	40.4	2.4
POSTTEST ZERO DRIFT (%) :	0.1	12 : 18	16	5.1	11.7	0.7	40.5	2.4
CALIBRATION GAS : PROTOCOL 1 CO ₂		12 : 19	17	5.2	11.6	0.7	41.1	2.3
CALIBRATION % :	10.0	12 : 20	18	5.4	11.5	0.7	40.4	2.3
UNCORRECTED AVERAGE :	11.65	12 : 21	19	5.1	11.7	0.7	40.2	2.1
DRIFT CORRECTED AVG.	11.82	12 : 22	20	5.2	11.6	0.7	40.0	2.0
GAS ANALYZER SULFUR DIOXIDE (SO ₂)		12 : 23	21	5.1	11.7	0.7	39.2	2.3
SCALE (ppm) :	50.00	Average:		5.15	11.65	0.71	40.42	2.43
PRETEST CAL DRIFT (ppm) :	24.9							
POSTTEST CAL DRIFT (ppm) :	24.9							
PRETEST ZERO DRIFT (ppm) :	0.2							
POSTTEST ZERO DRIFT (ppm) :	0.7							
CALIBRATION GAS : PROTOCOL 1 SO ₂								
CALIBRATION ppm :	25.0							
UNCORRECTED AVERAGE :	0.71							
DRIFT CORRECTED AVG.	0.28							
SO2 (0% Oxygen Correction)	0.37							
GAS ANALYZER NITROGEN OXIDES (NOx)								
SCALE (ppm) :	100.0							
PRETEST CAL DRIFT (ppm) :	50.1							
POSTTEST CAL DRIFT (ppm) :	49.4							
PRETEST ZERO DRIFT (ppm) :	-0.3							
POSTTEST ZERO DRIFT (ppm) :	0.6							
CALIBRATION GAS : PROTOCOL 1 NOx								
CALIBRATION ppm :	50.0							
UNCORRECTED AVERAGE :	40.42							
DRIFT CORRECTED AVG.	40.69							
GAS ANALYZER CARBON MONOXIDE (CO)								
SCALE (ppm) :	100.0							
PRETEST CAL DRIFT (ppm) :	48.8							
POSTTEST CAL DRIFT (ppm) :	48.6							
PRETEST ZERO DRIFT (ppm) :	0.2							
POSTTEST ZERO DRIFT (ppm) :	-0.1							
CALIBRATION GAS : PROTOCOL 1 CO								
CALIBRATION ppm :	50.0							
UNCORRECTED AVERAGE :	2.43							
DRIFT CORRECTED AVG.	2.46							

SUMMARY OF ONE-MINUTE AVERAGE REFERENCE METHOD CEM DATA

Monitor Data		One-Minute Averages (Uncorrected for Drift)						
COMPANY : MPC LP		Clock	Elapsed	FCCU Scrubber Exhaust				
SOURCE : FCCU Scrubber Stack		Time	Time	O ₂ %	CO ₂ %	SO ₂ ppmv	NOx ppmv	CO ppmv
REPETITION : RA-6		12 : 23	0					
TEST DATE : 11/10/2010		12 : 24	1	5.2	11.6	0.7	39.5	2.1
TEST TIME : 12:23-12:44		12 : 25	2	5.3	11.6	0.7	39.4	2.3
FCCU SCRUBBER EXHAUST		12 : 26	3	5.2	11.6	0.7	39.5	2.5
GAS ANALYZER OXYGEN (O ₂)		12 : 27	4	5.1	11.7	0.7	40.1	2.6
SCALE (%): 10.0		12 : 28	5	5.2	11.6	0.6	40.5	2.5
PRETEST CAL DRIFT (%): 4.9		12 : 29	6	5.2	11.6	0.7	40.5	2.6
POSTTEST CAL DRIFT (%): 5.0		12 : 30	7	5.1	11.7	0.6	40.1	2.3
PRETEST ZERO DRIFT (%): -0.1		12 : 31	8	5.1	11.8	0.7	40.2	2.5
POSTTEST ZERO DRIFT (%): 0.0		12 : 32	9	5.0	11.7	0.7	42.8	2.3
CALIBRATION GAS : PROTOCOL 1 OXYGEN		12 : 33	10	5.1	11.7	0.7	42.5	2.5
CALIBRATION % : 5.0		12 : 34	11	5.0	11.8	0.7	42.2	2.3
UNCORRECTED AVERAGE: 5.09		12 : 35	12	5.0	11.8	0.7	41.9	2.8
DRIFT CORRECTED AVG. 5.13		12 : 36	13	5.0	11.8	0.8	41.4	2.4
GAS ANALYZER CARBON DIOXIDE (CO ₂)		12 : 37	14	4.9	11.8	0.7	42.1	2.7
SCALE (%): 20.00		12 : 38	15	5.1	11.7	0.7	43.1	2.2
PRETEST CAL DRIFT (%): 9.9		12 : 39	16	5.1	11.7	0.7	43.3	2.6
POSTTEST CAL DRIFT (%): 9.8		12 : 40	17	5.2	11.6	0.7	42.5	2.3
PRETEST ZERO DRIFT (%): 0.1		12 : 41	18	5.0	11.8	0.7	41.8	2.8
POSTTEST ZERO DRIFT (%): 0.1		12 : 42	19	5.1	11.7	0.7	40.5	2.4
CALIBRATION GAS : PROTOCOL 1 CO ₂		12 : 43	20	5.0	11.8	0.6	41.5	2.6
CALIBRATION % : 10.0		12 : 44	21	5.0	11.8	0.7	41.6	2.1
UNCORRECTED AVERAGE: 11.70		Average:		5.09	11.70	0.69	41.27	2.44
DRIFT CORRECTED AVG. 11.87								
GAS ANALYZER SULFUR DIOXIDE (SO ₂)								
SCALE (ppm): 50.00								
PRETEST CAL DRIFT (ppm): 24.9								
POSTTEST CAL DRIFT (ppm): 24.9								
PRETEST ZERO DRIFT (ppm): 0.2								
POSTTEST ZERO DRIFT (ppm): 0.7								
CALIBRATION GAS : PROTOCOL 1 SO ₂								
CALIBRATION ppm : 25.0								
UNCORRECTED AVERAGE: 0.69								
DRIFT CORRECTED AVG. 0.25								
SO ₂ (0% Oxygen Correction) 0.34								
GAS ANALYZER NITROGEN OXIDES (NOx)								
SCALE (ppm): 100.0								
PRETEST CAL DRIFT (ppm): 50.1								
POSTTEST CAL DRIFT (ppm): 49.4								
PRETEST ZERO DRIFT (ppm): -0.3								
POSTTEST ZERO DRIFT (ppm): 0.6								
CALIBRATION GAS : PROTOCOL 1 NOx								
CALIBRATION ppm : 50.0								
UNCORRECTED AVERAGE: 41.27								
DRIFT CORRECTED AVG. 41.46								
GAS ANALYZER CARBON MONOXIDE (CO)								
SCALE (ppm): 100.0								
PRETEST CAL DRIFT (ppm): 48.8								
POSTTEST CAL DRIFT (ppm): 48.6								
PRETEST ZERO DRIFT (ppm): 0.2								
POSTTEST ZERO DRIFT (ppm): -0.1								
CALIBRATION GAS : PROTOCOL 1 CO								
CALIBRATION ppm : 50.0								
UNCORRECTED AVERAGE: 2.44								
DRIFT CORRECTED AVG. 2.48								

SUMMARY OF ONE-MINUTE AVERAGE REFERENCE METHOD CEM DATA

Monitor Data		One-Minute Averages (Uncorrected for Drift)						
COMPANY : SOURCE : REPETITION : TEST DATE : TEST TIME	MPC LP FCCU Scrubber Stack RA-7 11/10/2010 13:15-13:36	Clock	Elapsed	FCCU Scrubber Exhaust				
		Time	Time	O ₂ %	CO ₂ %	SO ₂ ppmv	NOx ppmv	CO ppmv
FCCU SCRUBBER EXHAUST		13 : 15	0					
GAS ANALYZER		13 : 16	1	5.2	12.0	1.4	42.6	2.3
SCALE (%):		13 : 17	2	5.1	12.0	1.3	42.0	2.3
PRETEST CAL DRIFT (%) :		13 : 18	3	5.0	12.1	1.3	42.6	2.4
POSTTEST CAL DRIFT (%) :		13 : 19	4	5.2	11.9	1.3	44.2	1.9
PRETEST ZERO DRIFT (%) :		13 : 20	5	5.3	11.9	1.2	41.6	2.3
POSTTEST ZERO DRIFT (%) :		13 : 21	6	5.0	12.1	1.2	42.9	2.4
CALIBRATION GAS :		13 : 22	7	5.2	12.0	1.1	40.6	2.2
CALIBRATION % :		13 : 23	8	5.1	12.1	1.2	41.1	2.2
UNCORRECTED AVERAGE:		13 : 24	9	5.1	12.1	1.1	42.7	2.2
DRIFT CORRECTED AVG.		13 : 25	10	5.1	12.0	1.1	43.6	2.2
GAS ANALYZER		13 : 26	11	5.2	11.9	1.1	43.1	1.9
SCALE (%):		13 : 27	12	5.3	11.9	1.0	42.6	2.0
PRETEST CAL DRIFT (%) :		13 : 28	13	5.3	11.9	1.1	42.3	2.1
POSTTEST CAL DRIFT (%) :		13 : 29	14	5.2	11.9	1.0	40.4	2.3
PRETEST ZERO DRIFT (%) :		13 : 30	15	5.1	12.1	1.0	40.5	2.5
POSTTEST ZERO DRIFT (%) :		13 : 31	16	5.1	12.0	1.0	41.3	2.0
CALIBRATION GAS :		13 : 32	17	5.1	12.0	1.0	41.4	2.2
CALIBRATION % :		13 : 33	18	5.2	12.0	1.0	41.4	2.1
UNCORRECTED AVERAGE:		13 : 34	19	5.2	11.9	1.0	42.3	2.1
DRIFT CORRECTED AVG.		13 : 35	20	5.2	12.0	1.1	42.4	2.0
GAS ANALYZER		13 : 36	21	5.2	12.0	1.0	41.0	2.4
SCALE (%):		Average:		5.16	11.99	1.13	42.03	2.20
PRETEST CAL DRIFT (%) :								
POSTTEST CAL DRIFT (%) :								
PRETEST ZERO DRIFT (%) :								
POSTTEST ZERO DRIFT (%) :								
CALIBRATION GAS :								
CALIBRATION % :								
UNCORRECTED AVERAGE:								
DRIFT CORRECTED AVG.								
GAS ANALYZER								
SCALE (ppm):								
PRETEST CAL DRIFT (ppm) :								
POSTTEST CAL DRIFT (ppm) :								
PRETEST ZERO DRIFT (ppm) :								
POSTTEST ZERO DRIFT (ppm) :								
CALIBRATION GAS :								
CALIBRATION ppm :								
UNCORRECTED AVERAGE:								
DRIFT CORRECTED AVG.								
SO ₂ (0% Oxygen Correction)								
GAS ANALYZER								
SCALE (ppm):								
PRETEST CAL DRIFT (ppm) :								
POSTTEST CAL DRIFT (ppm) :								
PRETEST ZERO DRIFT (ppm) :								
POSTTEST ZERO DRIFT (ppm) :								
CALIBRATION GAS :								
CALIBRATION ppm :								
UNCORRECTED AVERAGE:								
DRIFT CORRECTED AVG.								
GAS ANALYZER								
SCALE (ppm):								
PRETEST CAL DRIFT (ppm) :								
POSTTEST CAL DRIFT (ppm) :								
PRETEST ZERO DRIFT (ppm) :								
POSTTEST ZERO DRIFT (ppm) :								
CALIBRATION GAS :								
CALIBRATION ppm :								
UNCORRECTED AVERAGE:								
DRIFT CORRECTED AVG.								
GAS ANALYZER								
SCALE (ppm):								
PRETEST CAL DRIFT (ppm) :								
POSTTEST CAL DRIFT (ppm) :								
PRETEST ZERO DRIFT (ppm) :								
POSTTEST ZERO DRIFT (ppm) :								
CALIBRATION GAS :								
CALIBRATION ppm :								
UNCORRECTED AVERAGE:								
DRIFT CORRECTED AVG.								
GAS ANALYZER								
SCALE (ppm):								
PRETEST CAL DRIFT (ppm) :								
POSTTEST CAL DRIFT (ppm) :								
PRETEST ZERO DRIFT (ppm) :								
POSTTEST ZERO DRIFT (ppm) :								
CALIBRATION GAS :								
CALIBRATION ppm :								
UNCORRECTED AVERAGE:								
DRIFT CORRECTED AVG.								

SUMMARY OF ONE-MINUTE AVERAGE REFERENCE METHOD CEM DATA

Monitor Data		One-Minute Averages (Uncorrected for Drift)						
		Clock	Elapsed	FCCU Scrubber Exhaust				
		Time	Time	O ₂ %	CO ₂ %	SO ₂ ppmv	NOx ppmv	CO ppmv
COMPANY :	MPC LP	13 : 36	0					
SOURCE :	FCCU Scrubber Stack	13 : 37	1	5.0	12.2	1.0	40.5	2.9
REPETITION :	RA-8	13 : 38	2	5.0	12.0	1.0	42.2	2.1
TEST DATE :	11/10/2010	13 : 39	3	5.3	11.9	1.0	41.9	2.2
TEST TIME	13:36-13:57	13 : 40	4	5.2	12.0	1.0	41.3	2.0
FCCU SCRUBBER EXHAUST		13 : 41	5	5.3	11.9	0.9	42.7	2.5
GAS ANALYZER		13 : 42	6	5.4	11.8	0.9	40.8	1.9
SCALE (%) :		13 : 43	7	5.1	12.1	0.9	41.2	2.7
PRETEST CAL DRIFT (%) :		13 : 44	8	5.2	12.0	1.0	40.4	2.7
POSTTEST CAL DRIFT (%) :		13 : 45	9	5.2	11.9	1.0	40.3	2.7
PRETEST ZERO DRIFT (%) :		13 : 46	10	5.2	12.0	0.9	40.0	2.5
POSTTEST ZERO DRIFT (%) :		13 : 47	11	5.1	12.0	0.9	40.7	2.6
CALIBRATION GAS :		13 : 48	12	5.3	11.9	0.9	40.6	2.4
CALIBRATION % :		13 : 49	13	5.2	12.0	0.9	42.2	2.7
UNCORRECTED AVERAGE:		13 : 50	14	5.2	11.9	0.8	41.8	2.2
DRIFT CORRECTED AVG.		13 : 51	15	5.3	11.8	0.8	41.3	2.5
GAS ANALYZER		13 : 52	16	5.4	11.9	0.8	41.1	1.9
SCALE (%) :		13 : 53	17	5.3	11.9	0.8	40.6	2.4
PRETEST CAL DRIFT (%) :		13 : 54	18	5.1	12.0	0.9	41.4	2.4
POSTTEST CAL DRIFT (%) :		13 : 55	19	5.3	11.9	0.8	40.7	2.6
PRETEST ZERO DRIFT (%) :		13 : 56	20	5.3	11.9	0.9	41.2	2.3
POSTTEST ZERO DRIFT (%) :		13 : 57	21	5.3	11.8	0.9	40.3	2.2
CALIBRATION GAS :		Average:		5.23	11.94	0.90	41.11	2.40
CALIBRATION % :								
UNCORRECTED AVERAGE:								
DRIFT CORRECTED AVG.								
GAS ANALYZER								
SCALE (ppm):								
PRETEST CAL DRIFT (ppm) :								
POSTTEST CAL DRIFT (ppm):								
PRETEST ZERO DRIFT (ppm) :								
POSTTEST ZERO DRIFT (ppm):								
CALIBRATION GAS :								
CALIBRATION ppm :								
UNCORRECTED AVERAGE:								
DRIFT CORRECTED AVG.								
SO2 (0% Oxygen Correction)								
GAS ANALYZER								
SCALE (ppm):								
PRETEST CAL DRIFT (ppm) :								
POSTTEST CAL DRIFT (ppm):								
PRETEST ZERO DRIFT (ppm) :								
POSTTEST ZERO DRIFT (ppm):								
CALIBRATION GAS :								
CALIBRATION ppm :								
UNCORRECTED AVERAGE:								
DRIFT CORRECTED AVG.								
GAS ANALYZER								
SCALE (ppm):								
PRETEST CAL DRIFT (ppm) :								
POSTTEST CAL DRIFT (ppm):								
PRETEST ZERO DRIFT (ppm) :								
POSTTEST ZERO DRIFT (ppm):								
CALIBRATION GAS :								
CALIBRATION ppm :								
UNCORRECTED AVERAGE:								
DRIFT CORRECTED AVG.								
GAS ANALYZER								
SCALE (ppm):								
PRETEST CAL DRIFT (ppm) :								
POSTTEST CAL DRIFT (ppm):								
PRETEST ZERO DRIFT (ppm) :								
POSTTEST ZERO DRIFT (ppm):								
CALIBRATION GAS :								
CALIBRATION ppm :								
UNCORRECTED AVERAGE:								
DRIFT CORRECTED AVG.								
GAS ANALYZER								
SCALE (ppm):								
PRETEST CAL DRIFT (ppm) :								
POSTTEST CAL DRIFT (ppm):								
PRETEST ZERO DRIFT (ppm) :								
POSTTEST ZERO DRIFT (ppm):								
CALIBRATION GAS :								
CALIBRATION ppm :								
UNCORRECTED AVERAGE:								
DRIFT CORRECTED AVG.								

SUMMARY OF ONE-MINUTE AVERAGE REFERENCE METHOD CEM DATA

Monitor Data		One-Minute Averages (Uncorrected for Drift)						
COMPANY :	MPC LP	Clock	Elapsed	FCCU Scrubber Exhaust				
SOURCE :	FCCU Scrubber Stack	Time	Time	O ₂ %	CO ₂ %	SO ₂ ppmv	NO _x ppmv	CO ppmv
REPETITION :	RA-9							
TEST DATE :	11/10/2010							
TEST TIME	13:57-14:18							
FCCU SCRUBBER EXHAUST								
GAS ANALYZER								
	OXYGEN (O ₂)							
SCALE (%):	10.0	13 : 57	0					
PRETEST CAL DRIFT (%) :	5.0	13 : 58	1	5.2	12.0	0.8	40.7	2.5
POSTTEST CAL DRIFT (%) :	5.0	13 : 59	2	5.3	11.8	0.9	41.3	2.3
PRETEST ZERO DRIFT (%) :	0.0	14 : 00	3	5.4	11.9	0.8	41.1	2.3
POSTTEST ZERO DRIFT (%) :	0.0	14 : 01	4	5.3	12.0	0.8	40.8	2.4
CALIBRATION GAS :	PROTOCOL 1 OXYGEN	14 : 02	5	5.2	11.9	0.8	42.1	2.3
CALIBRATION % :	5.0	14 : 03	6	5.3	11.9	0.8	42.5	2.1
UNCORRECTED AVERAGE:	5.29	14 : 04	7	5.4	11.8	0.8	40.9	2.6
DRIFT CORRECTED AVG.	5.30	14 : 05	8	5.2	12.0	0.8	39.9	2.5
		14 : 06	9	5.2	11.9	0.8	40.8	2.6
		14 : 07	10	5.3	11.8	0.8	41.5	2.1
		14 : 08	11	5.5	11.8	0.9	39.5	2.4
		14 : 09	12	5.2	12.0	0.8	40.1	2.1
		14 : 10	13	5.1	12.0	0.8	42.1	2.4
		14 : 11	14	5.3	11.8	0.8	41.9	1.9
		14 : 12	15	5.4	11.8	0.8	40.9	2.2
		14 : 13	16	5.3	11.9	0.8	41.1	2.2
		14 : 14	17	5.3	11.9	0.8	40.2	2.5
		14 : 15	18	5.3	11.9	0.8	40.1	2.2
		14 : 16	19	5.2	12.0	0.8	41.5	2.5
		14 : 17	20	5.3	11.8	0.8	41.8	1.9
		14 : 18	21	5.4	11.8	0.8	40.3	2.4
		Average:		5.29	11.90	0.81	41.00	2.30
GAS ANALYZER								
	CARBON DIOXIDE (CO ₂)							
SCALE (%):	20.00							
PRETEST CAL DRIFT (%) :	9.8							
POSTTEST CAL DRIFT (%) :	9.9							
PRETEST ZERO DRIFT (%) :	0.1							
POSTTEST ZERO DRIFT (%) :	0.1							
CALIBRATION GAS :	PROTOCOL 1 CO ₂							
CALIBRATION % :	10.0							
UNCORRECTED AVERAGE:	11.90							
DRIFT CORRECTED AVG.	12.06							
GAS ANALYZER								
	SULFUR DIOXIDE (SO ₂)							
SCALE (ppm):	50.00							
PRETEST CAL DRIFT (ppm) :	24.9							
POSTTEST CAL DRIFT (ppm):	24.1							
PRETEST ZERO DRIFT (ppm) :	0.7							
POSTTEST ZERO DRIFT (ppm):	0.7							
CALIBRATION GAS :	PROTOCOL 1 SO ₂							
CALIBRATION ppm :	25.0							
UNCORRECTED AVERAGE:	0.81							
DRIFT CORRECTED AVG.	0.15							
SO ₂ (0% Oxygen Correction)	0.20							
GAS ANALYZER								
	NITROGEN OXIDES (NO _x)							
SCALE (ppm):	100.0							
PRETEST CAL DRIFT (ppm) :	49.4							
POSTTEST CAL DRIFT (ppm):	49.9							
PRETEST ZERO DRIFT (ppm) :	0.6							
POSTTEST ZERO DRIFT (ppm):	-0.3							
CALIBRATION GAS :	PROTOCOL 1 NO _x							
CALIBRATION ppm :	50.0							
UNCORRECTED AVERAGE:	41.00							
DRIFT CORRECTED AVG.	41.28							
GAS ANALYZER								
	CARBON MONOXIDE (CO)							
SCALE (ppm):	100.0							
PRETEST CAL DRIFT (ppm) :	48.6							
POSTTEST CAL DRIFT (ppm):	48.1							
PRETEST ZERO DRIFT (ppm) :	-0.1							
POSTTEST ZERO DRIFT (ppm):	0.8							
CALIBRATION GAS :	PROTOCOL 1 CO							
CALIBRATION ppm :	50.0							
UNCORRECTED AVERAGE:	2.30							
DRIFT CORRECTED AVG.	2.04							



Marathon Petroleum Company LP: Robinson, IL
FCCU Flue Gas Scrubber
Test Date: 11/10/10

APPENDIX B

Field Data



ISKAVERSE

STACKS AND DUCTS

Facility MPC-Robinson, IL
Date 11-10-10
Sampling Location FCCU Exhaust
Inside of Far Wall to
Outside of Port (Distance C) 120.5 in.
Inside of Near Wall to
Outside of Port (Distance D) 6.5 in.
Stack ID (Distance C-Distance D) 114 in.
Port Distance Downstream From Disturbance (B) 100.8 in.
Port Distance Upstream From Disturbance (A) 720 in.
Equivalent Diameters Downstream From Disturbance (B) 8.8 (≥ 2.0)
Equivalent Diameters Upstream From Disturbance (A) 6.3 (≥ 0.5)
Number of Ports Used 1 Traverse Points / Port 3

1 2 3 4 5 6

Port Traverse Point Number	Fractional % of Stack I.D. (frac. %)	Stack I.D. (inches)	Product of Columns 2 and 3 (inches)	Port Depth (inches)	Traverse Point Location From Outside of Port (Sum of 4 and 5 in inches)
1	16.7	114	19.0	6.5	25.5
2	50.0	↓	57.0	↓	63.5
3	83.3	↓	95.0	↓	101.5
4					
5					
6					
7					
8					
9					
10					
11					
12					

For Stacks / Ducts ≤ 24 inches ID - No traverse point shall be located less than 0.5 inches from stack wall

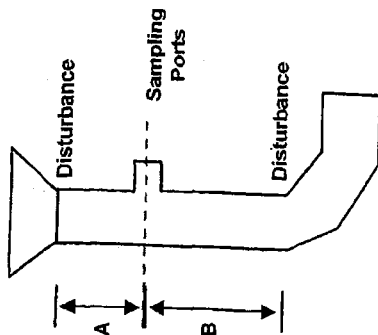
For Stacks / Ducts > 24 inches ID - No traverse point shall be located less than 1.0 inches from stack wall

QA/QC Check:

Completeness 94% Legibility 50% Accuracy 50% Specifications 50%

Method 1 Calculator Signature/Date RM

Field Supervisor Signature/Date Sam M. Dwyer 11-10-10



Note: Sketch Stack/Ports/Control Device on Back of Form

Equivalent Diameters Downstream From Disturbance (B) =
[Distance B / Stack ID]

Equivalent Diameters Upstream From Disturbance (A) =
[Distance A / Stack ID]

Equivalent Diameter For a Square or Rectangular Stack =
[(2 x L x W) / (L + W)]

Port ID 6 in. (for monorail bracket specs.)
Port Length Outside of Stack 5.5 in. (for monorail bracket specs.)

LOCATION OF TRAVERSE POINTS IN CIRCULAR STACKS

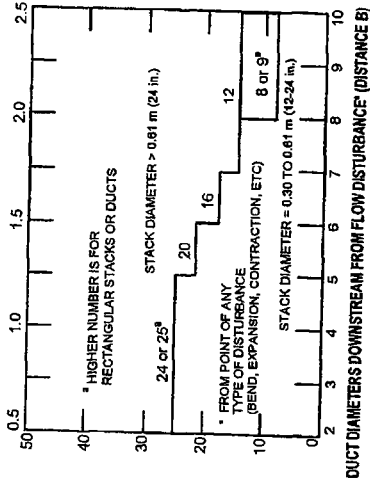
Pts	4	6	8	10	12
1	6.7	4.4	3.2	2.6	2.1
2	25.0	14.6	10.5	8.2	6.7
3	75.0	29.6	18.4	14.6	11.8
4	93.3	70.4	32.3	22.6	17.7
5	85.4	67.7	34.2	26.0	21.7
6	56.6	60.6	65.8	35.6	35.6
7	88.5	77.4	64.4	64.4	64.4
8	96.8	85.4	76.0	82.3	82.3
9	91.8	81.8	82.3	82.3	82.3
10	97.4	88.2	93.3	93.3	93.3
11	93.3	93.3	93.3	93.3	93.3
12	97.9	97.9	97.9	97.9	97.9

LOCATION OF TRAVERSE POINTS IN RECTANGULAR STACKS

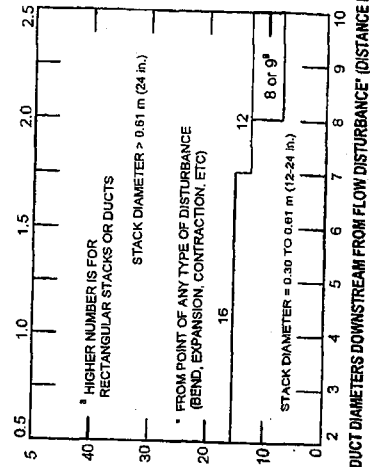
Pts	2	3	4	5	6	7	8	9
1	25.0	16.7	12.5	10.0	8.3	7.1	6.3	5.6
2	75.0	50.0	37.5	30.0	25.0	21.4	18.8	16.7
3	83.3	62.5	50.0	41.7	35.7	31.3	27.8	25.0
4	87.5	70.0	56.3	50.0	43.8	38.9	34.4	30.0
5	90.0	75.0	64.3	56.3	50.0	43.8	38.9	34.4
6	91.7	78.6	68.8	61.1	54.5	48.1	42.2	36.7
7	92.9	81.3	72.2	64.3	56.3	50.0	43.8	38.9
8	93.8	83.3	74.4	66.7	58.3	51.4	45.0	39.6
9	94.4	84.4	75.0	67.5	60.0	53.3	47.2	41.1

*3 point CEMS DATA traverse point locations (valid for rectangular and round stacks)

DUCT DIAMETERS UPSTREAM FROM FLOW DISTURBANCE* (DISTANCE A)



DUCT DIAMETERS DOWNSTREAM FROM FLOW DISTURBANCE* (DISTANCE B)





Marathon Petroleum Company LP: Robinson, IL
FCCU Flue Gas Scrubber
Test Date: 11/10/10

APPENDIX C

ARI Reference Method Monitoring Data

MPC LP FCCU SCRUBBER STACK ANNUAL RATA PROGRAM

Scale Units	0-10 %v db	0-17.44 %v db	0-100 ppmv db	0-200 ppmv db	0-200 ppmv db	
Date / Time	O ₂ Outlet	CO ₂ Outlet	SO ₂ Outlet	NO _x Outlet	CO Outlet	Comments
11/10/2010 7:39:00	-0.03	0.05	1.54	-0.51	-3.76	
11/10/2010 7:39:15	-0.03	0.05	1.51	-0.47	-2.78	
11/10/2010 7:39:30	-0.03	0.05	1.55	-0.50	-0.05	
11/10/2010 7:39:45	-0.04	0.05	0.74	-0.52	-0.10	
11/10/2010 7:40:00	-0.04	0.05	-0.08	-0.53	-0.31	
11/10/2010 7:40:15	-0.04	0.05	-0.11	-0.51	0.16	
11/10/2010 7:40:30	-0.05	0.05	-0.09	-0.53	0.42	
11/10/2010 7:40:45	-0.05	0.05	-0.16	-0.53	0.43	Calibration Error
11/10/2010 7:41:00	-0.05	0.05	-0.08	-0.51	0.44	Zero Nitrogen Injection
11/10/2010 7:41:15	-0.06	0.05	-0.09	-0.50	0.46	-0.06 % Oxygen
11/10/2010 7:41:30	-0.06	0.05	-0.01	-0.53	0.30	0.05 % CO ₂
11/10/2010 7:41:45	-0.06	0.05	-0.07	-0.52	0.11	-0.06 ppm SO ₂
11/10/2010 7:42:00	-0.06	0.05	-0.11	-0.48	0.19	-0.51 ppm NO _x
11/10/2010 7:42:15	-0.06	0.05	-0.05	0.17	0.42	0.33 ppm CO
11/10/2010 7:42:30	-0.07	0.13	-0.07	-0.21	0.60	
11/10/2010 7:42:45	0.38	3.55	-0.12	-0.45	-0.40	
11/10/2010 7:43:00	4.00	7.80	-0.12	-0.46	-1.65	
11/10/2010 7:43:15	7.66	9.50	-0.15	-0.48	-2.08	
11/10/2010 7:43:30	9.35	9.73	-0.15	-0.48	-2.30	
11/10/2010 7:43:45	9.83	9.74	-0.18	-0.47	-2.17	
11/10/2010 7:44:00	9.96	9.73	-0.15	-0.47	-1.89	Calibration Error
11/10/2010 7:44:15	9.99	9.73	-0.12	-0.49	-1.87	10.0% Oxygen Injection
11/10/2010 7:44:30	10.01	9.73	-0.11	-0.47	-1.92	10.01 % Oxygen
11/10/2010 7:44:45	10.01	9.74	-0.14	-0.48	-1.99	
11/10/2010 7:45:00	10.02	9.76	-0.11	-0.48	-2.15	
11/10/2010 7:45:15	10.03	9.64	-0.13	-0.49	-2.07	
11/10/2010 7:45:30	9.71	7.27	-0.11	-0.49	-1.47	
11/10/2010 7:45:45	7.59	5.24	-0.19	-0.51	-1.22	
11/10/2010 7:46:00	5.73	4.94	-0.17	-0.53	-1.14	
11/10/2010 7:46:15	5.16	4.92	-0.16	-0.50	-1.22	Calibration Error
11/10/2010 7:46:30	5.03	4.93	-0.17	-0.51	-1.26	5.0% Oxygen Injection
11/10/2010 7:46:45	5.01	4.93	-0.10	-0.50	-1.43	5.01 % Oxygen
11/10/2010 7:47:00	5.00	4.92	-0.11	-0.53	-1.53	
11/10/2010 7:47:15	5.00	4.92	-0.28	-0.51	-1.43	
11/10/2010 7:47:30	4.99	5.19	-0.36	-0.47	-1.80	
11/10/2010 7:47:45	5.65	10.94	-0.23	-0.51	-2.80	
11/10/2010 7:48:00	10.51	16.39	-0.27	-0.53	-3.10	
11/10/2010 7:48:15	15.86	19.12	-0.21	-0.53	-3.03	
11/10/2010 7:48:30	18.89	19.76	-0.21	-0.53	-3.23	
11/10/2010 7:48:45	19.93	19.82	-0.23	-0.53	-3.27	
11/10/2010 7:49:00	20.18	19.84	-0.21	-0.53	-3.05	
11/10/2010 7:49:15	20.24	19.85	-0.21	-0.53	-2.93	
11/10/2010 7:49:30	20.27	19.85	-0.20	-0.53	-2.86	
11/10/2010 7:49:45	20.27	19.98	-0.23	-0.52	-2.91	Calibration Error
11/10/2010 7:50:00	20.28	19.96	-0.24	-0.52	-3.02	20.0% CO ₂ Injection
11/10/2010 7:50:15	20.28	19.96	-0.20	-0.52	-3.21	19.96 % CO ₂
11/10/2010 7:50:30	20.29	19.96	-0.17	-0.53	-3.19	
11/10/2010 7:50:45	20.29	19.96	-0.13	-0.53	-2.97	
11/10/2010 7:51:00	20.29	19.91	-0.17	-0.49	-2.70	
11/10/2010 7:51:15	20.07	16.46	-0.26	-0.49	-2.38	
11/10/2010 7:51:30	17.14	12.10	-0.33	-0.53	-2.04	
11/10/2010 7:51:45	13.04	10.21	-0.24	-0.52	-1.99	
11/10/2010 7:52:00	10.90	9.99	-0.24	-0.53	-2.30	
11/10/2010 7:52:15	10.32	10.00	-0.28	-0.53	-2.21	
11/10/2010 7:52:30	10.22	9.99	-0.25	-0.53	-1.98	
11/10/2010 7:52:45	10.19	9.99	-0.23	-0.52	-1.90	Calibration Error
11/10/2010 7:53:00	10.19	9.99	-0.23	-0.52	-1.92	10.0% CO ₂ Injection
11/10/2010 7:53:15	10.18	9.98	-0.30	-0.52	-1.99	9.98 % CO ₂
11/10/2010 7:53:30	10.18	9.98	-0.28	-0.53	-2.07	
11/10/2010 7:53:45	10.18	9.96	-0.19	-0.48	-2.37	
11/10/2010 7:54:00	10.18	9.96	0.25	-0.49	-2.15	
11/10/2010 7:54:15	10.18	9.98	17.98	-0.53	-1.93	
11/10/2010 7:54:30	10.20	9.97	50.73	-0.53	-1.68	
11/10/2010 7:54:45	10.27	9.72	77.79	-0.48	-1.50	
11/10/2010 7:55:00	10.55	9.09	85.02	-0.52	-1.20	
11/10/2010 7:55:15	11.20	8.24	94.67	-0.49	-0.98	
11/10/2010 7:55:30	12.04	7.50	98.02	-0.47	-0.73	
11/10/2010 7:55:45	12.88	6.71	97.81	-0.47	-0.23	
11/10/2010 7:56:00	13.75	6.07	99.69	-0.48	0.52	
11/10/2010 7:56:15	14.46	5.38	50.89	0.16	0.99	
11/10/2010 7:56:30	15.23	4.80	41.30	1.42	0.54	
11/10/2010 7:56:45	15.08	4.04	48.30	-0.29	0.34	
11/10/2010 7:57:00	9.34	1.19	49.53	-0.28	0.34	
11/10/2010 7:57:15	3.28	0.18	50.02	-0.10	0.39	
11/10/2010 7:57:30	0.76	0.09	50.13	0.08	0.40	
11/10/2010 7:57:45	0.15	0.08	50.11	0.21	0.57	
11/10/2010 7:58:00	0.02	0.08	50.22	0.32	0.75	
11/10/2010 7:58:15	-0.01	0.07	50.40	0.22	0.74	
11/10/2010 7:58:30	-0.02	0.07	50.41	0.10	0.60	Calibration Error
11/10/2010 7:58:45	-0.02	0.07	50.41	-0.06	0.55	50.0 ppm SO ₂ Injection
11/10/2010 7:59:00	-0.03	0.07	50.36	-0.14	0.37	50.37 ppm SO ₂

MPC LP FCCU SCRUBBER STACK ANNUAL RATA PROGRAM

Scale Units	0-10 %v db	0-17.44 %v db	0-100 ppmv db	0-200 ppmv db	0-200 ppmv db	
Date / Time	O ₂ Outlet	CO ₂ Outlet	SO ₂ Outlet	NO _x Outlet	CO Outlet	Comments
11/10/2010 7:59:15	-0.03	0.07	50.35	-0.19	0.44	
11/10/2010 7:59:30	-0.04	0.07	50.36	-0.24	0.66	
11/10/2010 7:59:45	-0.04	0.07	50.36	-0.35	0.68	
11/10/2010 8:00:00	-0.05	0.06	36.11	-0.36	0.63	
11/10/2010 8:00:15	-0.05	0.06	25.35	-0.37	0.51	
11/10/2010 8:00:30	-0.05	0.06	25.22	-0.37	0.45	
11/10/2010 8:00:45	-0.06	0.06	25.08	-0.37	0.28	
11/10/2010 8:01:00	-0.06	0.06	25.11	-0.38	0.37	
11/10/2010 8:01:15	-0.06	0.06	25.13	-0.36	0.57	
11/10/2010 8:01:30	-0.07	0.06	25.15	-0.37	0.66	
11/10/2010 8:01:45	-0.07	0.06	25.05	-0.36	0.62	Calibration Error
11/10/2010 8:02:00	-0.07	0.06	24.88	-0.36	0.48	25.0 ppm SO ₂ Injection
11/10/2010 8:02:15	-0.07	0.06	24.94	-0.36	0.34	24.95 ppm SO ₂
11/10/2010 8:02:30	-0.07	0.06	24.92	-0.37	0.31	
11/10/2010 8:02:45	-0.08	0.06	24.94	-0.38	0.50	
11/10/2010 8:03:00	-0.08	0.06	24.96	-0.36	0.57	
11/10/2010 8:03:15	-0.08	0.06	13.04	16.84	0.72	
11/10/2010 8:03:30	-0.08	0.08	2.28	100.84	0.69	
11/10/2010 8:03:45	-0.05	0.13	0.73	105.30	0.57	
11/10/2010 8:04:00	-0.01	0.07	0.25	106.57	0.34	
11/10/2010 8:04:15	-0.05	0.06	0.09	106.80	0.31	
11/10/2010 8:04:30	-0.07	0.06	-0.01	106.84	0.54	
11/10/2010 8:04:45	-0.08	0.06	-0.13	106.99	0.60	
11/10/2010 8:05:00	-0.09	0.05	-0.18	107.08	0.63	
11/10/2010 8:05:15	-0.09	0.05	-0.27	107.09	0.60	
11/10/2010 8:05:30	-0.09	0.05	-0.29	103.92	0.42	
11/10/2010 8:05:45	-0.09	0.05	-0.34	101.10	0.28	
11/10/2010 8:06:00	-0.09	0.05	-0.31	101.06	0.40	Calibration Error
11/10/2010 8:06:15	-0.09	0.05	-0.34	100.18	0.53	100 ppm NO _x Injection
11/10/2010 8:06:30	-0.10	0.05	-0.33	100.15	0.63	100.08 ppm NO _x
11/10/2010 8:06:45	-0.10	0.05	-0.30	100.02	0.63	
11/10/2010 8:07:00	-0.10	0.05	-0.31	99.96	0.60	
11/10/2010 8:07:15	-0.10	0.05	-0.29	88.43	0.47	
11/10/2010 8:07:30	-0.10	0.05	-0.30	50.04	0.25	
11/10/2010 8:07:45	-0.10	0.05	-0.33	49.66	0.38	
11/10/2010 8:08:00	-0.10	0.05	-0.32	49.86	0.54	Calibration Error
11/10/2010 8:08:15	-0.10	0.05	-0.42	49.82	0.58	50 ppm NO _x Injection
11/10/2010 8:08:30	-0.11	0.05	-0.35	49.92	0.63	49.89 ppm NO _x
11/10/2010 8:08:45	-0.11	0.05	-0.40	49.90	0.57	
11/10/2010 8:09:00	-0.11	0.05	-0.44	49.92	0.30	
11/10/2010 8:09:15	-0.11	0.05	-0.43	49.92	0.23	
11/10/2010 8:09:30	-0.11	0.05	-0.36	51.88	0.42	
11/10/2010 8:09:45	-0.11	0.05	-0.12	59.95	0.63	
11/10/2010 8:10:00	-0.11	0.06	-0.01	56.00	0.63	
11/10/2010 8:10:15	-0.10	0.06	0.06	51.25	0.65	
11/10/2010 8:10:30	-0.08	0.06	1.84	45.17	0.54	
11/10/2010 8:10:45	0.03	0.08	1.80	42.25	0.39	
11/10/2010 8:11:00	0.68	0.12	0.72	34.49	0.34	
11/10/2010 8:11:15	1.26	0.07	0.54	38.90	0.50	
11/10/2010 8:11:30	1.10	0.05	0.36	41.31	0.60	
11/10/2010 8:11:45	0.98	0.05	0.25	42.74	0.56	
11/10/2010 8:12:00	0.94	0.05	0.23	43.54	0.57	
11/10/2010 8:12:15	0.94	0.05	0.27	44.09	0.45	
11/10/2010 8:12:30	0.93	0.05	0.26	44.40	0.22	
11/10/2010 8:12:45	0.93	0.05	0.25	44.61	0.32	
11/10/2010 8:13:00	0.93	0.05	0.20	44.84	0.51	
11/10/2010 8:13:15	0.93	0.05	0.23	44.99	0.60	
11/10/2010 8:13:30	0.93	0.05	0.27	45.01	0.60	
11/10/2010 8:13:45	0.94	0.05	0.28	45.10	0.56	
11/10/2010 8:14:00	0.94	0.05	0.27	45.14	0.43	
11/10/2010 8:14:15	0.94	0.05	0.31	45.13	0.27	
11/10/2010 8:14:30	0.93	0.05	0.27	45.17	0.40	
11/10/2010 8:14:45	0.94	0.05	0.23	45.18	0.53	
11/10/2010 8:15:00	0.94	0.05	0.21	45.17	0.60	
11/10/2010 8:15:15	0.94	0.05	0.19	45.15	0.55	NO _x Converter Check
11/10/2010 8:15:30	0.94	0.05	0.19	45.14	0.42	Cylinder Injected = ALM045275 - 49.17 ppm
11/10/2010 8:15:45	0.94	0.05	0.25	45.15	0.23	45.14 ppm NO _x
11/10/2010 8:16:00	0.94	0.05	0.20	45.16	0.25	49.17 ppm NO ₂ Injection
11/10/2010 8:16:15	0.94	0.05	0.19	45.12	0.39	91.8 % Conversion
11/10/2010 8:16:30	0.93	0.05	0.16	45.02	0.57	
11/10/2010 8:16:45	0.94	0.05	0.05	28.52	0.65	
11/10/2010 8:17:00	0.94	0.05	-0.33	0.48	22.23	
11/10/2010 8:17:15	0.83	0.07	-0.40	-0.01	62.11	
11/10/2010 8:17:30	0.37	0.05	-0.49	-0.17	92.52	
11/10/2010 8:17:45	0.03	0.05	-0.54	-0.23	96.42	
11/10/2010 8:18:00	-0.08	0.05	-0.50	-0.26	97.27	
11/10/2010 8:18:15	-0.11	0.05	-0.54	-0.31	97.40	
11/10/2010 8:18:30	-0.11	0.05	-0.63	-0.32	100.06	
11/10/2010 8:18:45	-0.11	0.05	-0.57	-0.35	100.11	
11/10/2010 8:19:00	-0.11	0.05	-0.60	-0.37	99.91	Calibration Error
11/10/2010 8:19:15	-0.11	0.05	-0.55	-0.39	99.69	100 ppm CO Injection

MPC LP FCCU SCRUBBER STACK ANNUAL RATA PROGRAM

Scale Units	0-10 %v db	0-17.44 %v db	0-100 ppmv db	0-200 ppmv db	0-200 ppmv db	
Date / Time	O ₂ Outlet	CO ₂ Outlet	SO ₂ Outlet	NO ₂ Outlet	CO Outlet	Comments
11/10/2010 8:19:30	-0.11	0.05	-0.57	-0.42	99.76	99.85 ppm CO
11/10/2010 8:19:45	-0.12	0.05	-0.57	-0.42	99.88	
11/10/2010 8:20:00	-0.12	0.05	-0.56	-0.44	100.06	
11/10/2010 8:20:15	-0.12	0.05	-0.59	-0.43	100.06	
11/10/2010 8:20:30	-0.12	0.05	-0.59	-0.14	100.06	
11/10/2010 8:20:45	-0.12	0.05	-0.51	0.38	99.42	
11/10/2010 8:21:00	-0.12	0.05	0.34	0.61	97.93	
11/10/2010 8:21:15	-0.10	0.05	19.79	0.59	97.28	
11/10/2010 8:21:30	-0.09	0.05	55.73	0.39	94.59	
11/10/2010 8:21:45	0.05	0.05	83.95	0.16	90.79	
11/10/2010 8:22:00	0.70	0.06	99.04	-0.03	83.46	
11/10/2010 8:22:15	1.79	0.06	99.70	-0.14	75.49	
11/10/2010 8:22:30	3.37	0.07	99.69	-0.21	61.64	
11/10/2010 8:22:45	5.82	0.08	99.69	-0.24	52.62	
11/10/2010 8:23:00	8.43	0.08	99.69	-0.24	43.60	
11/10/2010 8:23:15	10.59	0.09	99.70	-0.26	38.73	
11/10/2010 8:23:30	12.27	0.09	99.70	-0.27	33.34	
11/10/2010 8:23:45	13.57	0.10	99.70	-0.32	30.21	
11/10/2010 8:24:00	14.60	0.10	99.70	-0.33	26.69	
11/10/2010 8:24:15	15.44	0.10	99.70	-0.33	24.47	
11/10/2010 8:24:30	16.11	0.10	99.70	-0.32	21.96	
11/10/2010 8:24:45	16.68	0.10	99.70	-0.32	20.70	
11/10/2010 8:25:00	17.16	0.10	99.70	-0.32	19.23	
11/10/2010 8:25:15	17.56	0.10	99.70	-0.32	18.19	
11/10/2010 8:25:30	17.91	0.10	99.70	-0.36	16.94	
11/10/2010 8:25:45	18.22	0.11	99.70	-0.35	16.05	
11/10/2010 8:26:00	18.47	0.11	99.70	-0.38	14.86	
11/10/2010 8:26:15	18.70	0.11	99.70	-0.34	14.30	
11/10/2010 8:26:30	18.90	0.11	99.69	-0.38	13.88	
11/10/2010 8:26:45	19.08	0.11	99.70	-0.37	13.50	
11/10/2010 8:27:00	19.24	0.11	99.70	-0.37	12.85	
11/10/2010 8:27:15	19.38	0.11	99.70	-0.38	12.40	
11/10/2010 8:27:30	19.51	0.11	99.70	-0.37	11.87	
11/10/2010 8:27:45	19.62	0.11	99.70	-0.38	11.38	
11/10/2010 8:28:00	19.73	0.11	99.70	-0.38	11.02	
11/10/2010 8:28:15	19.82	0.11	99.70	-0.37	10.93	
11/10/2010 8:35:00	20.15	0.10	-0.27	-0.49	34.22	
11/10/2010 8:35:00	12.05	0.07	-0.37	-0.49	46.27	
11/10/2010 8:35:00	3.57	0.05	-0.35	-0.49	49.48	
11/10/2010 8:35:00	0.81	0.05	-0.34	-0.48	49.75	
11/10/2010 8:35:00	0.21	0.05	-0.36	-0.49	50.04	
11/10/2010 8:35:00	0.08	0.04	-0.38	-0.49	50.15	
11/10/2010 8:35:00	0.04	0.05	-0.41	-0.48	50.22	
11/10/2010 8:35:00	0.03	0.05	-0.34	-0.49	50.22	
11/10/2010 8:35:00	0.02	0.05	-0.40	-0.48	50.12	
11/10/2010 8:35:15	0.01	0.04	-0.39	-0.48	49.86	Calibration Error
11/10/2010 8:35:30	0.00	0.04	-0.40	-0.49	49.94	50 ppm CO Injection
11/10/2010 8:35:45	0.00	0.04	-0.44	-0.49	50.13	50.16 ppm CO
11/10/2010 8:36:00	-0.01	0.04	-0.46	-0.50	50.28	
11/10/2010 8:36:15	-0.01	0.04	-0.46	-0.49	50.29	
11/10/2010 8:36:30	-0.02	0.04	-0.51	-0.48	50.25	
11/10/2010 8:36:45	-0.02	0.04	-0.53	-0.48	50.16	
11/10/2010 8:37:00	-0.03	0.04	-0.59	-0.49	49.88	
11/10/2010 8:37:15	-0.03	0.04	-0.54	-0.26	49.83	
11/10/2010 8:37:30	-0.03	0.04	-0.47	-0.08	47.78	
11/10/2010 8:37:45	-0.01	0.07	-0.43	-0.22	35.47	
11/10/2010 8:45:15	16.86	0.10	99.70	-0.50	12.46	
11/10/2010 8:45:30	17.32	0.10	99.70	-0.49	11.70	
11/10/2010 8:45:45	17.70	0.10	93.55	-0.49	11.17	
11/10/2010 8:46:00	18.03	0.10	2.37	-0.45	10.00	
11/10/2010 8:46:15	18.32	0.10	0.28	-0.45	5.49	
11/10/2010 8:46:30	18.86	0.10	-0.11	-0.46	1.89	
11/10/2010 8:46:45	20.10	0.10	-0.22	-0.46	1.05	
11/10/2010 8:47:00	20.76	0.10	5.55	2.87	2.35	
11/10/2010 8:47:15	20.74	0.10	23.33	-0.04	3.20	
11/10/2010 8:47:30	16.51	0.08	32.04	-0.27	1.73	
11/10/2010 8:47:45	6.99	0.05	36.47	-0.12	0.84	
11/10/2010 8:48:00	1.79	0.05	38.96	0.24	0.85	
11/10/2010 8:48:15	0.46	0.05	40.27	0.84	0.86	
11/10/2010 8:48:30	0.17	0.05	40.85	1.56	0.83	
11/10/2010 8:48:45	0.09	0.05	41.38	1.92	0.74	
11/10/2010 8:49:00	0.07	0.05	42.38	1.38	0.59	
11/10/2010 8:49:15	0.05	0.05	43.58	0.66	0.50	
11/10/2010 8:49:30	0.04	0.05	44.54	0.20	0.63	
11/10/2010 8:49:45	0.03	0.05	45.25	-0.05	0.81	
11/10/2010 8:50:00	0.02	0.05	45.83	-0.19	0.84	
11/10/2010 8:50:15	0.01	0.04	46.22	-0.22	0.84	
11/10/2010 8:50:30	0.01	0.05	46.51	-0.27	0.77	
11/10/2010 8:50:45	0.00	0.04	46.77	-0.29	0.68	

MPC LP FCCU SCRUBBER STACK ANNUAL RATA PROGRAM

Scale Units	0-10 %v db	0-17.44 %v db	0-100 ppmv db	0-200 ppmv db	0-200 ppmv db	
Date / Time	O ₂ Outlet	CO ₂ Outlet	SO ₂ Outlet	NO _x Outlet	CO Outlet	Comments
11/10/2010 8:51:00	0.00	0.04	46.96	-0.33	0.44	
11/10/2010 8:51:15	-0.01	0.04	47.21	-0.36	0.57	
11/10/2010 8:51:30	-0.01	0.05	45.89	-0.40	0.81	
11/10/2010 8:51:45	-0.02	0.04	33.87	-0.45	0.86	
11/10/2010 8:52:00	-0.02	0.05	28.43	-0.45	0.81	
11/10/2010 8:52:15	-0.02	0.04	26.59	-0.45	0.72	
11/10/2010 8:52:30	-0.03	0.04	25.56	-0.45	0.57	
11/10/2010 8:52:45	-0.03	0.05	25.03	-0.49	0.31	System Bias
11/10/2010 8:53:00	-0.03	0.04	24.92	-0.45	0.29	25.0 ppm SO ₂ Injection
11/10/2010 8:53:15	-0.04	0.04	24.84	-0.45	0.21	24.89 ppm SO ₂
11/10/2010 8:53:30	-0.04	0.04	24.91	-0.44	0.21	-0.04 % Oxygen
11/10/2010 8:53:45	-0.04	0.04	24.91	-0.45	0.25	0.04 % CO ₂
11/10/2010 8:54:00	-0.04	0.04	24.93	-0.45	0.21	
11/10/2010 8:54:15	-0.05	0.04	25.38	5.63	0.22	SO ₂ Upscale = 180 sec
11/10/2010 8:54:30	-0.05	0.20	23.59	12.42	0.22	
11/10/2010 8:54:45	0.10	2.94	12.62	-0.33	0.58	SO ₂ Downscale = 150 sec
11/10/2010 8:55:00	0.94	3.33	6.67	-0.50	0.19	Oxygen Upscale=90 sec.
11/10/2010 8:55:15	2.10	4.26	4.29	-0.50	-0.75	
11/10/2010 8:55:30	3.87	4.77	3.14	-0.50	-0.94	
11/10/2010 8:55:45	4.67	4.80	2.46	-0.51	-0.99	
11/10/2010 8:56:00	4.88	4.79	1.92	-0.50	-1.12	
11/10/2010 8:56:15	4.94	4.79	1.54	-0.50	-1.31	
11/10/2010 8:56:30	4.95	4.82	1.28	-0.50	-1.47	
11/10/2010 8:56:45	4.95	4.84	1.05	-0.50	-1.29	System Bias
11/10/2010 8:57:00	4.95	4.87	0.90	-0.50	-1.10	5.0% Oxygen Injection
11/10/2010 8:57:15	4.95	4.88	0.74	-0.50	-1.06	4.95 % Oxygen
11/10/2010 8:57:30	4.95	4.90	0.59	-0.47	-1.07	
11/10/2010 8:57:45	4.95	4.90	0.58	-0.49	-1.15	
11/10/2010 8:58:00	4.95	4.90	0.52	-0.50	-1.28	
11/10/2010 8:58:15	4.94	4.91	0.46	-0.50	-1.49	
11/10/2010 8:58:30	4.95	4.92	0.37	-0.50	-1.58	
11/10/2010 8:58:45	5.02	6.45	0.34	-0.52	-1.89	O ₂ Downscale = 45 sec.
11/10/2010 8:59:00	6.46	8.98	0.27	-0.51	-2.02	
11/10/2010 8:59:15	8.64	9.74	0.29	-0.50	-1.88	
11/10/2010 8:59:30	9.65	9.83	0.21	-0.50	-1.94	
11/10/2010 8:59:45	9.93	9.85	0.22	-0.49	-1.99	CO ₂ Upscale = 90 sec.
11/10/2010 9:00:00	9.99	9.86	0.22	-0.52	-2.26	System Bias
11/10/2010 9:00:15	10.01	9.87	0.21	-0.50	-2.30	10.0% CO ₂ Injection
11/10/2010 9:00:30	10.02	9.87	0.17	-0.53	-2.03	9.87 % CO ₂
11/10/2010 9:00:45	10.03	9.88	0.14	-0.50	-1.94	
11/10/2010 9:01:00	10.03	9.88	0.10	-0.50	-1.94	
11/10/2010 9:01:15	10.03	9.88	0.46	10.78	-1.99	
11/10/2010 9:01:30	10.04	9.91	1.32	10.38	-1.11	
11/10/2010 9:01:45	9.87	10.39	1.20	33.73	-0.23	CO ₂ Downscale = 90 sec.
11/10/2010 9:02:00	8.56	6.54	0.85	47.59	-0.15	
11/10/2010 9:02:15	5.60	2.06	0.55	47.87	0.03	
11/10/2010 9:02:30	2.17	0.35	0.36	47.92	0.36	
11/10/2010 9:02:45	0.53	0.17	0.19	48.03	0.41	
11/10/2010 9:03:00	0.11	0.14	0.15	48.48	0.36	
11/10/2010 9:03:15	0.02	0.13	0.12	49.94	0.41	
11/10/2010 9:03:30	-0.01	0.11	0.09	50.10	0.32	NO _x Upscale = 135 sec.
11/10/2010 9:03:45	-0.02	0.11	0.07	50.19	0.10	
11/10/2010 9:04:00	-0.03	0.10	0.05	50.21	0.22	System Bias
11/10/2010 9:04:15	-0.03	0.09	0.05	50.40	0.40	50 ppm NO _x Injection
11/10/2010 9:04:30	-0.04	0.09	0.01	50.39	0.53	50.48 ppm NO _x
11/10/2010 9:04:45	-0.04	0.08	-0.10	50.49	0.48	0.46 ppm CO
11/10/2010 9:05:00	-0.04	0.08	-0.09	50.66	0.45	
11/10/2010 9:05:15	-0.05	0.07	-0.06	50.79	0.33	
11/10/2010 9:05:30	-0.05	0.07	-0.01	51.20	0.15	
11/10/2010 9:05:45	-0.06	0.07	0.29	50.62	-0.12	
11/10/2010 9:06:00	-0.02	1.87	0.39	29.52	0.94	
11/10/2010 9:06:15	0.63	2.64	0.26	0.87	15.23	
11/10/2010 9:06:30	0.87	0.67	0.14	0.28	38.16	CO Upscale = 165 sec.
11/10/2010 9:06:45	0.35	0.15	0.05	-0.05	48.01	NO _x Downscale = 75 sec.
11/10/2010 9:07:00	0.05	0.08	-0.03	-0.15	49.47	
11/10/2010 9:07:15	-0.04	0.07	-0.04	-0.24	49.60	
11/10/2010 9:07:30	-0.06	0.07	-0.05	-0.30	49.44	
11/10/2010 9:07:45	-0.06	0.06	-0.02	-0.34	49.62	
11/10/2010 9:08:00	-0.07	0.06	-0.05	-0.39	49.81	
11/10/2010 9:08:15	-0.07	0.06	-0.04	-0.39	49.96	System Bias
11/10/2010 9:08:30	-0.07	0.06	-0.06	-0.42	49.92	50 ppm CO Injection
11/10/2010 9:08:45	-0.07	0.06	-0.11	-0.54	49.92	49.83 ppm CO
11/10/2010 9:09:00	-0.08	0.06	-0.15	-0.54	49.87	-0.12 ppm SO ₂
11/10/2010 9:09:15	-0.08	0.06	-0.14	-0.44	49.60	-0.48 ppm NO _x
11/10/2010 9:09:30	-0.08	0.06	-0.10	-0.44	49.57	
11/10/2010 9:09:45	-0.08	0.06	-0.12	-0.44	49.84	
11/10/2010 9:10:00	-0.08	0.06	-0.12	-0.44	50.03	
11/10/2010 9:10:15	-0.08	0.06	-0.08	-0.44	50.04	CO Downscale = 90 sec.
11/10/2010 9:10:30	-0.09	0.05	-0.15	-0.49	49.92	
11/10/2010 9:10:45	-0.09	0.05	-0.15	-0.49	49.88	
11/10/2010 9:11:00	-0.09	0.05	-0.16	1.43	49.89	

MPC LP FCCU SCRUBBER STACK ANNUAL RATA PROGRAM

Scale Units	0-10 %v db	0-17.44 %v db	0-100 ppmv db	0-200 ppmv db	0-200 ppmv db	
Date / Time	O ₂ Outlet	CO ₂ Outlet	SO ₂ Outlet	NO _x Outlet	CO Outlet	Comments
11/10/2010 9:11:15	-0.09	0.06	0.08	35.19	44.52	
11/10/2010 9:11:30	-0.02	3.56	0.54	42.76	23.68	
11/10/2010 9:11:45	1.24	8.97	0.73	45.32	9.15	
11/10/2010 9:12:00	3.04	11.48	0.78	46.90	4.87	System Response Time = 180 seconds
11/10/2010 9:12:15	4.09	11.87	0.83	46.26	4.43	
11/10/2010 9:12:30	4.54	11.77	0.84	45.07	4.23	
11/10/2010 9:12:45	4.76	11.76	0.79	44.96	4.32	
11/10/2010 9:13:00	4.81	11.82	0.75	44.78	4.31	
11/10/2010 9:13:15	4.76	11.90	0.80	45.06	4.04	
11/10/2010 9:13:30	4.72	11.92	0.72	44.86	3.82	
11/10/2010 9:13:45	4.72	11.85	0.68	44.25	3.77	
11/10/2010 9:14:00	4.77	11.87	0.73	44.35	3.98	
11/10/2010 9:14:15	4.76	11.76	0.79	44.96	4.32	
11/10/2010 9:14:30	4.81	11.82	0.75	44.78	4.31	
11/10/2010 9:14:45	4.76	11.90	0.80	45.06	4.04	
11/10/2010 9:15:00	4.72	11.92	0.72	44.86	3.82	Start RA-1 Point 1
11/10/2010 9:15:15	4.72	11.85	0.68	44.25	3.77	
11/10/2010 9:15:30	4.77	11.87	0.73	44.35	3.98	
11/10/2010 9:15:45	4.76	11.94	0.70	46.02	3.98	
11/10/2010 9:16:00	4.71	12.01	0.67	44.91	3.53	
11/10/2010 9:16:15	4.76	11.97	0.74	44.41	3.08	
11/10/2010 9:16:30	4.99	11.91	0.92	44.84	3.11	
11/10/2010 9:16:45	5.13	11.93	1.03	46.65	3.42	
11/10/2010 9:17:00	5.16	11.92	0.95	47.04	2.96	
11/10/2010 9:17:15	5.20	11.81	0.86	46.01	2.70	
11/10/2010 9:17:30	5.30	11.80	0.81	45.49	2.95	
11/10/2010 9:17:45	5.32	11.88	0.75	45.23	3.13	
11/10/2010 9:18:00	5.25	11.98	0.77	45.72	3.39	
11/10/2010 9:18:15	5.15	11.99	0.71	46.15	3.35	
11/10/2010 9:18:30	5.13	11.94	0.74	46.22	3.10	
11/10/2010 9:18:45	5.17	11.91	0.69	46.21	2.82	
11/10/2010 9:19:00	5.20	11.94	0.74	46.19	2.65	
11/10/2010 9:19:15	5.18	11.91	0.69	44.79	2.96	
11/10/2010 9:19:30	5.21	11.92	0.70	46.58	3.16	
11/10/2010 9:19:45	5.17	12.04	0.66	46.50	3.16	
11/10/2010 9:20:00	5.09	11.95	0.70	45.89	3.07	
11/10/2010 9:20:15	5.18	11.84	0.74	44.97	2.89	
11/10/2010 9:20:30	5.29	11.77	0.74	43.37	3.08	Point 1 Average Concentrations
11/10/2010 9:20:45	5.35	11.86	0.68	45.42	3.13	
11/10/2010 9:21:00	5.28	12.01	0.75	45.68	3.02	
11/10/2010 9:21:15	5.16	11.94	0.68	45.37	3.02	
11/10/2010 9:21:30	5.21	11.87	0.66	46.06	3.38	
11/10/2010 9:21:45	5.26	11.85	0.68	46.48	3.42	
11/10/2010 9:22:00	5.29	11.84	0.69	45.70	3.29	Point 2
11/10/2010 9:22:15	5.31	11.84	0.67	45.00	3.07	
11/10/2010 9:22:30	5.30	11.88	0.64	44.79	2.71	
11/10/2010 9:22:45	5.26	11.92	0.59	43.88	2.98	
11/10/2010 9:23:00	5.22	11.97	0.60	45.29	3.39	
11/10/2010 9:23:15	5.18	11.98	0.61	46.11	3.79	
11/10/2010 9:23:30	5.15	11.94	0.59	46.99	3.32	
11/10/2010 9:23:45	5.21	11.84	0.59	45.58	2.91	
11/10/2010 9:24:00	5.31	11.76	0.54	44.74	2.75	
11/10/2010 9:24:15	5.39	11.78	0.57	43.91	2.84	
11/10/2010 9:24:30	5.37	11.91	0.52	43.42	2.86	
11/10/2010 9:24:45	5.25	12.00	0.55	44.59	2.81	
11/10/2010 9:25:00	5.15	12.04	0.59	46.55	2.76	
11/10/2010 9:25:15	5.11	11.96	0.64	46.41	2.90	
11/10/2010 9:25:30	5.18	11.86	0.49	44.91	2.93	
11/10/2010 9:25:45	5.28	11.77	0.37	44.02	2.97	
11/10/2010 9:26:00	5.36	11.84	0.28	45.16	3.14	
11/10/2010 9:26:15	5.31	11.91	0.27	42.88	3.31	
11/10/2010 9:26:30	5.26	11.92	0.25	42.70	3.18	
11/10/2010 9:26:45	5.23	12.03	0.21	43.73	2.91	
11/10/2010 9:27:00	5.12	12.04	0.17	43.94	2.70	
11/10/2010 9:27:15	5.12	11.96	0.22	45.53	2.78	
11/10/2010 9:27:30	5.18	11.93	0.17	45.27	2.82	Point 2 Average Concentrations
11/10/2010 9:27:45	5.22	11.87	0.10	44.28	2.87	
11/10/2010 9:28:00	5.29	11.82	0.08	44.27	2.84	
11/10/2010 9:28:15	5.33	11.85	0.12	44.55	2.88	
11/10/2010 9:28:30	5.29	11.96	0.06	44.31	2.93	
11/10/2010 9:28:45	5.19	11.95	0.02	43.64	2.71	
11/10/2010 9:29:00	5.19	11.87	0.02	43.09	2.49	Point 3
11/10/2010 9:29:15	5.25	11.90	0.03	44.28	2.75	
11/10/2010 9:29:30	5.23	11.98	0.04	44.90	2.79	
11/10/2010 9:29:45	5.17	11.93	-0.03	45.06	2.79	
11/10/2010 9:30:00	5.21	11.89	-0.05	43.93	2.88	
11/10/2010 9:30:15	5.25	11.89	-0.05	45.13	2.98	
11/10/2010 9:30:30	5.26	11.95	-0.05	45.77	2.97	
11/10/2010 9:30:45	5.21	11.92	-0.01	44.99	2.67	
11/10/2010 9:31:00	5.23	11.90	-0.03	45.69	2.65	
11/10/2010 9:31:15	5.24	11.95	0.00	45.79	3.13	

MPC LP FCCU SCRUBBER STACK ANNUAL RATA PROGRAM

Scale Units	0-10 %v db	0-17.44 %v db	0-100 ppmv db	0-200 ppmv db	0-200 ppmv db	
Date / Time	O ₂ Outlet	CO ₂ Outlet	SO ₂ Outlet	NO _x Outlet	CO Outlet	Comments
11/10/2010 9:31:30	5.20	11.98	0.05	45.27	3.15	
11/10/2010 9:31:45	5.17	11.93	0.02	46.58	2.93	
11/10/2010 9:32:00	5.21	11.87	-0.02	46.25	2.75	<u>Mean - Three Points</u>
11/10/2010 9:32:15	5.27	11.86	0.01	45.47	2.75	5.19 % Oxygen
11/10/2010 9:32:30	5.30	11.88	-0.03	44.27	2.61	11.91 % CO ₂
11/10/2010 9:32:45	5.28	11.89	0.03	42.74	2.61	0.38 ppm SO ₂
11/10/2010 9:33:00	5.26	11.95	0.01	43.40	2.74	44.97 ppm NO _x
11/10/2010 9:33:15	5.20	12.02	0.01	45.02	3.05	3.02 ppm CO
11/10/2010 9:33:30	5.13	12.02	0.02	45.37	3.13	
11/10/2010 9:33:45	5.12	11.99	0.02	46.58	3.17	
11/10/2010 9:34:00	5.15	11.88	0.00	45.53	3.07	
11/10/2010 9:34:15	5.27	11.74	0.02	42.91	2.93	
11/10/2010 9:34:30	5.40	11.81	0.08	44.30	2.73	<u>Point 3 Average Concentrations</u>
11/10/2010 9:34:45	5.32	12.00	0.04	43.86	2.78	5.23 % Oxygen
11/10/2010 9:35:00	5.17	11.97	0.02	44.69	2.79	11.91 % CO ₂
11/10/2010 9:35:15	5.17	11.89	0.00	44.24	2.84	0.00 ppm SO ₂
11/10/2010 9:35:30	5.25	11.84	-0.02	42.82	3.08	44.64 ppm NO _x
11/10/2010 9:35:45	5.30	11.89	0.00	42.92	3.17	2.87 ppm CO
11/10/2010 9:36:00	5.25	11.99	0.02	42.57	2.98	Start RA-2
11/10/2010 9:36:15	5.16	12.04	0.00	42.89	2.71	Point 1
11/10/2010 9:36:30	5.10	12.06	0.00	43.87	2.60	
11/10/2010 9:36:45	5.06	12.09	0.02	43.62	2.64	
11/10/2010 9:37:00	5.06	12.00	0.02	44.10	2.67	
11/10/2010 9:37:15	5.14	11.95	0.01	44.31	2.67	
11/10/2010 9:37:30	5.19	11.95	0.02	45.62	2.75	
11/10/2010 9:37:45	5.19	11.97	-0.02	44.45	2.79	
11/10/2010 9:38:00	5.19	11.87	0.00	43.38	2.89	
11/10/2010 9:38:15	5.27	11.86	0.02	45.07	2.67	
11/10/2010 9:38:30	5.28	11.91	0.00	43.72	2.56	
11/10/2010 9:38:45	5.25	11.93	0.00	43.33	2.96	
11/10/2010 9:39:00	5.23	11.98	0.04	45.02	3.24	
11/10/2010 9:39:15	5.18	12.02	0.03	44.94	3.16	
11/10/2010 9:39:30	5.15	11.97	0.01	44.48	3.05	
11/10/2010 9:39:45	5.20	11.90	-0.02	44.07	2.96	
11/10/2010 9:40:00	5.26	11.88	0.01	43.98	2.77	
11/10/2010 9:40:15	5.26	11.94	-0.06	43.13	2.69	
11/10/2010 9:40:30	5.23	11.97	-0.05	43.78	2.99	
11/10/2010 9:40:45	5.20	12.01	-0.03	45.17	3.25	
11/10/2010 9:41:00	5.16	12.02	0.02	45.92	3.08	
11/10/2010 9:41:15	5.14	11.98	0.03	45.58	3.03	
11/10/2010 9:41:30	5.19	11.86	0.03	44.96	3.08	
11/10/2010 9:41:45	5.28	11.86	0.02	46.51	2.99	
11/10/2010 9:42:00	5.29	11.90	-0.02	46.85	2.87	
11/10/2010 9:42:15	5.29	11.82	-0.02	46.21	2.78	
11/10/2010 9:42:30	5.35	11.77	0.03	45.22	3.05	
11/10/2010 9:42:45	5.40	11.80	0.03	44.38	3.32	
11/10/2010 9:43:00	5.37	11.87	0.05	43.59	3.10	Point 2
11/10/2010 9:43:15	5.30	11.88	0.08	42.93	2.82	
11/10/2010 9:43:30	5.28	11.89	0.13	44.28	3.00	
11/10/2010 9:43:45	5.26	11.94	0.11	43.57	3.18	
11/10/2010 9:44:00	5.23	11.92	0.11	43.27	3.04	
11/10/2010 9:44:15	5.22	12.01	0.05	43.39	2.81	
11/10/2010 9:44:30	5.14	12.03	0.05	43.90	2.95	
11/10/2010 9:44:45	5.12	11.97	0.06	46.03	3.08	
11/10/2010 9:45:00	5.16	11.95	0.05	45.70	2.83	
11/10/2010 9:45:15	5.20	11.87	0.06	44.41	2.73	
11/10/2010 9:45:30	5.28	11.82	0.04	44.99	2.76	
11/10/2010 9:45:45	5.33	11.86	0.05	44.78	2.76	
11/10/2010 9:46:00	5.30	11.94	0.02	43.33	2.43	
11/10/2010 9:46:15	5.22	11.99	0.03	44.95	2.57	
11/10/2010 9:46:30	5.15	12.01	0.05	45.95	3.04	
11/10/2010 9:46:45	5.15	11.89	0.05	45.80	2.94	
11/10/2010 9:47:00	5.27	11.79	0.05	44.66	2.81	
11/10/2010 9:47:15	5.35	11.87	0.08	44.64	2.99	
11/10/2010 9:47:30	5.28	12.00	0.13	46.10	3.01	
11/10/2010 9:47:45	5.18	11.88	0.10	45.76	2.75	
11/10/2010 9:48:00	5.27	11.76	0.06	45.51	2.77	
11/10/2010 9:48:15	5.38	11.82	0.05	45.34	2.60	
11/10/2010 9:48:30	5.34	11.86	0.06	43.45	2.55	
11/10/2010 9:48:45	5.32	11.83	0.10	43.15	2.86	
11/10/2010 9:49:00	5.34	11.86	0.08	45.39	3.19	
11/10/2010 9:49:15	5.30	11.91	0.09	45.80	3.14	
11/10/2010 9:49:30	5.25	11.88	0.10	44.71	2.83	
11/10/2010 9:49:45	5.29	11.84	0.07	45.51	2.43	
11/10/2010 9:50:00	5.32	11.86	0.07	45.08	2.31	Point 3
11/10/2010 9:50:15	5.31	11.82	0.03	43.44	2.40	
11/10/2010 9:50:30	5.34	11.83	0.04	43.16	2.71	
11/10/2010 9:50:45	5.31	11.96	0.05	42.63	2.84	
11/10/2010 9:51:00	5.19	12.01	0.04	43.09	2.85	
11/10/2010 9:51:15	5.13	12.07	0.05	44.63	2.81	
11/10/2010 9:51:30	5.07	12.06	0.04	45.44	2.58	

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Scale Units	0-10 %v db	0-17.44 %v db	0-100 ppmv db	0-200 ppmv db	0-200 ppmv db	
Date / Time	O ₂ Outlet	CO ₂ Outlet	SO ₂ Outlet	NO _x Outlet	CO Outlet	Comments
11/10/2010 9:51:45	5.08	11.92	0.01	44.71	2.31	
11/10/2010 9:52:00	5.21	11.85	0.03	43.22	2.15	
11/10/2010 9:52:15	5.28	11.92	0.03	41.65	2.37	
11/10/2010 9:52:30	5.24	11.98	0.02	42.45	2.78	
11/10/2010 9:52:45	5.17	12.02	0.00	44.87	2.92	
11/10/2010 9:53:00	5.13	12.00	0.02	45.18	2.81	
11/10/2010 9:53:15	5.16	11.90	0.05	44.01	2.60	
11/10/2010 9:53:30	5.24	11.82	0.09	44.10	2.52	
11/10/2010 9:53:45	5.33	11.80	0.08	44.34	2.56	
11/10/2010 9:54:00	5.36	11.91	0.06	44.39	2.50	
11/10/2010 9:54:15	5.25	12.01	-0.02	43.70	2.55	
11/10/2010 9:54:30	5.15	12.04	-0.05	45.82	2.55	
11/10/2010 9:54:45	5.11	12.00	-0.02	43.77	2.46	
11/10/2010 9:55:00	5.15	11.92	0.06	43.18	2.77	
11/10/2010 9:55:15	5.21	11.96	0.05	43.75	3.08	
11/10/2010 9:55:30	5.18	11.96	0.05	44.30	2.94	
11/10/2010 9:55:45	5.20	11.90	0.01	43.74	2.64	
11/10/2010 9:56:00	5.24	11.95	0.02	44.05	2.26	
11/10/2010 9:56:15	5.21	11.95	-0.04	44.40	2.44	
11/10/2010 9:56:30	5.22	11.87	0.03	44.37	2.67	
11/10/2010 9:56:45	5.28	11.88	0.07	43.59	2.71	
11/10/2010 9:57:00	5.27	11.90	0.03	43.90	2.77	Start RA-3 Point 1
11/10/2010 9:57:15	5.25	11.92	0.03	43.85	2.64	
11/10/2010 9:57:30	5.24	11.88	0.01	44.96	2.56	
11/10/2010 9:57:45	5.28	11.85	-0.02	46.03	2.47	
11/10/2010 9:58:00	5.30	11.87	-0.02	45.68	2.10	
11/10/2010 9:58:15	5.30	11.87	0.01	45.35	2.15	
11/10/2010 9:58:30	5.29	11.95	0.03	44.43	2.70	
11/10/2010 9:58:45	5.20	12.05	0.02	43.28	2.96	
11/10/2010 9:59:00	5.11	11.97	0.05	44.13	2.77	
11/10/2010 9:59:15	5.18	11.94	0.02	44.53	2.55	
11/10/2010 9:59:30	5.20	11.96	0.03	43.87	2.38	
11/10/2010 9:59:45	5.20	11.95	0.03	44.24	2.43	
11/10/2010 10:00:00	5.20	11.98	0.03	43.73	2.52	
11/10/2010 10:00:15	5.18	11.96	0.02	42.29	2.66	
11/10/2010 10:00:30	5.20	11.95	0.03	43.90	3.05	
11/10/2010 10:00:45	5.21	11.94	0.00	44.14	3.27	
11/10/2010 10:01:00	5.22	11.93	-0.02	43.24	3.20	
11/10/2010 10:01:15	5.23	11.92	0.03	43.07	3.02	
11/10/2010 10:01:30	5.22	11.96	0.01	43.13	2.88	
11/10/2010 10:01:45	5.19	11.99	-0.01	43.66	2.79	
11/10/2010 10:02:00	5.15	11.99	-0.01	43.01	2.41	
11/10/2010 10:02:15	5.17	11.95	0.02	43.63	2.50	
11/10/2010 10:02:30	5.20	11.98	0.06	43.48	3.08	
11/10/2010 10:02:45	5.17	11.99	0.06	42.74	3.39	
11/10/2010 10:03:00	5.16	11.98	0.01	44.31	3.21	
11/10/2010 10:03:15	5.17	11.95	0.00	45.08	2.77	
11/10/2010 10:03:30	5.20	11.88	0.01	45.01	2.76	
11/10/2010 10:03:45	5.27	11.84	0.02	44.49	2.81	
11/10/2010 10:04:00	5.32	11.80	0.07	43.40	2.62	Point 2
11/10/2010 10:04:15	5.36	11.83	0.10	43.41	2.35	
11/10/2010 10:04:30	5.34	11.91	0.11	43.21	2.82	
11/10/2010 10:04:45	5.26	11.97	0.08	43.15	3.18	
11/10/2010 10:05:00	5.20	11.96	0.06	44.49	3.08	
11/10/2010 10:05:15	5.22	11.85	0.06	44.13	2.73	
11/10/2010 10:05:30	5.32	11.81	0.07	43.05	2.38	
11/10/2010 10:05:45	5.35	11.92	0.12	42.03	2.38	
11/10/2010 10:06:00	5.26	11.98	0.07	42.50	2.37	
11/10/2010 10:06:15	5.19	12.00	0.12	42.85	2.10	
11/10/2010 10:06:30	5.16	11.95	0.11	43.65	2.27	
11/10/2010 10:06:45	5.20	11.86	0.09	43.25	2.58	
11/10/2010 10:07:00	5.28	11.87	0.08	43.82	2.87	
11/10/2010 10:07:15	5.28	11.96	0.08	45.49	2.96	
11/10/2010 10:07:30	5.21	11.98	0.08	46.28	2.86	
11/10/2010 10:07:45	5.21	11.87	0.10	44.58	2.46	
11/10/2010 10:08:00	5.29	11.81	0.07	44.20	2.15	
11/10/2010 10:08:15	5.35	11.79	0.04	44.08	2.15	
11/10/2010 10:08:30	5.38	11.75	0.11	42.54	2.28	
11/10/2010 10:08:45	5.42	11.76	0.15	42.22	2.41	
11/10/2010 10:09:00	5.40	11.89	0.13	41.26	2.84	
11/10/2010 10:09:15	5.27	12.03	0.08	41.48	3.38	
11/10/2010 10:09:30	5.14	12.08	0.05	42.02	3.50	
11/10/2010 10:09:45	5.08	12.01	0.07	43.23	2.96	
11/10/2010 10:10:00	5.14	11.93	0.12	42.92	2.64	
11/10/2010 10:10:15	5.21	11.93	0.17	43.20	2.41	
11/10/2010 10:10:30	5.23	11.97	0.15	41.88	2.32	
11/10/2010 10:10:45	5.19	12.00	0.14	43.07	2.60	
11/10/2010 10:11:00	5.16	12.02	0.11	44.47	3.05	Point 3
11/10/2010 10:11:15	5.14	11.94	0.13	42.64	3.01	
11/10/2010 10:11:30	5.21	11.89	0.11	43.38	2.66	
11/10/2010 10:11:45	5.26	11.97	0.11	43.74	2.52	

MPC LP FCCU SCRUBBER STACK ANNUAL RATA PROGRAM

Scale Units	0-10 %v db	0-17.44 %v db	0-100 ppmv db	0-200 ppmv db	0-200 ppmv db	
Date / Time	O ₂ Outlet	CO ₂ Outlet	SO ₂ Outlet	NO _x Outlet	CO Outlet	Comments
11/10/2010 10:12:00	5.20	11.96	0.11	44.11	2.61	
11/10/2010 10:12:15	5.21	11.88	0.07	44.97	2.52	
11/10/2010 10:12:30	5.29	11.80	0.13	46.53	2.18	
11/10/2010 10:12:45	5.37	11.77	0.22	44.91	2.13	
11/10/2010 10:13:00	5.41	11.76	0.24	44.22	2.43	
11/10/2010 10:13:15	5.43	11.81	0.21	44.87	2.74	
11/10/2010 10:13:30	5.39	11.83	0.14	45.69	2.90	
11/10/2010 10:13:45	5.37	11.76	0.17	42.79	2.68	
11/10/2010 10:14:00	5.45	11.66	0.13	41.44	2.54	
11/10/2010 10:14:15	5.53	11.75	0.10	41.68	2.58	
11/10/2010 10:14:30	5.44	11.89	0.12	42.22	2.48	
11/10/2010 10:14:45	5.30	12.04	0.16	43.15	2.48	
11/10/2010 10:15:00	5.14	12.12	0.16	44.03	2.85	
11/10/2010 10:15:15	5.05	12.01	0.17	44.48	2.99	
11/10/2010 10:15:30	5.16	11.85	0.20	43.71	2.58	
11/10/2010 10:15:45	5.31	11.78	0.20	43.57	2.49	
11/10/2010 10:16:00	5.39	11.80	0.13	44.35	2.54	
11/10/2010 10:16:15	5.38	11.81	0.14	44.46	2.31	
11/10/2010 10:16:30	5.38	11.80	0.17	44.77	2.09	
11/10/2010 10:16:45	5.40	11.80	0.16	44.68	2.26	
11/10/2010 10:17:00	5.40	11.77	0.15	43.50	2.31	
11/10/2010 10:17:15	5.42	11.81	0.20	42.54	2.58	
11/10/2010 10:17:30	5.36	11.93	0.20	42.53	2.84	
11/10/2010 10:17:45	5.24	11.98	0.20	44.09	3.07	
11/10/2010 10:18:00	5.19	11.93	0.17	45.24	2.83	
11/10/2010 10:18:15	5.24	11.82	0.24	43.86	2.48	
11/10/2010 10:18:30	5.37	11.72	0.23	42.04	2.33	
11/10/2010 10:18:45	5.47	11.72	0.32	9.66	3.43	
11/10/2010 10:19:00	5.54	9.24	0.22	0.46	13.28	
11/10/2010 10:19:15	6.74	4.48	0.24	0.00	10.61	
11/10/2010 10:19:30	6.10	4.45	0.22	-0.09	3.92	
11/10/2010 10:19:45	5.16	4.88	0.24	-0.15	0.85	
11/10/2010 10:20:00	4.99	4.90	0.22	-0.20	0.32	
11/10/2010 10:20:15	4.95	4.87	0.23	-0.25	0.14	
11/10/2010 10:20:30	4.94	4.87	0.21	-0.25	-0.06	
11/10/2010 10:20:45	4.94	4.88	0.21	-0.26	0.06	
11/10/2010 10:21:00	4.94	4.89	0.27	-0.27	0.24	
11/10/2010 10:21:15	4.94	4.91	0.24	-0.28	0.34	
11/10/2010 10:21:30	4.94	4.92	0.27	-0.30	0.37	System Bias
11/10/2010 10:21:45	4.94	4.93	0.19	-0.31	0.28	5.0% Oxygen Injection
11/10/2010 10:22:00	4.94	4.93	0.18	-0.30	0.22	4.95 % Oxygen
11/10/2010 10:22:15	4.95	4.94	0.24	-0.32	0.13	0.22 ppm SO2
11/10/2010 10:22:30	4.95	4.93	0.26	-0.36	-0.01	-0.32 ppm NOx
11/10/2010 10:22:45	4.95	4.94	0.24	-0.36	-0.10	0.15 ppm CO
11/10/2010 10:23:00	4.95	4.94	0.21	-0.37	0.05	
11/10/2010 10:23:15	4.95	4.94	0.14	-0.36	0.18	
11/10/2010 10:23:30	4.95	4.95	0.14	-0.36	0.10	
11/10/2010 10:23:45	5.02	6.42	0.17	-0.39	-0.49	
11/10/2010 10:24:00	6.43	8.93	0.21	-0.38	-0.64	
11/10/2010 10:24:15	8.59	9.73	0.21	-0.36	-0.64	
11/10/2010 10:24:30	9.62	9.84	0.23	-0.36	-0.83	
11/10/2010 10:24:45	9.91	9.86	0.21	-0.35	-0.96	
11/10/2010 10:25:00	9.98	9.87	0.24	-0.26	-0.78	
11/10/2010 10:25:15	10.01	9.88	0.21	-0.34	-0.60	
11/10/2010 10:25:30	10.02	9.88	0.20	-0.36	-0.48	System Bias
11/10/2010 10:25:45	10.02	9.89	0.16	-0.36	-0.47	10.0% CO2 Injection
11/10/2010 10:26:00	10.03	9.89	0.21	-0.37	-0.57	9.89 % CO2
11/10/2010 10:26:15	10.03	9.89	0.23	-0.37	-0.61	
11/10/2010 10:26:30	10.03	9.89	0.21	-0.35	-0.72	
11/10/2010 10:26:45	10.03	9.90	0.19	-0.30	-0.93	
11/10/2010 10:27:00	10.04	9.90	0.24	10.63	-0.86	
11/10/2010 10:27:15	10.04	9.96	0.33	2.48	-0.14	
11/10/2010 10:27:30	9.81	9.78	1.51	0.64	0.47	
11/10/2010 10:27:45	8.48	5.11	8.94	0.51	1.00	
11/10/2010 10:28:00	4.90	1.38	19.02	0.28	-0.48	
11/10/2010 10:28:15	1.65	0.30	26.85	0.09	-0.30	
11/10/2010 10:28:30	0.39	0.20	32.36	-0.01	-0.36	
11/10/2010 10:28:45	0.10	0.17	36.25	-0.18	-0.49	
11/10/2010 10:29:00	0.03	0.15	28.93	-0.25	-0.61	
11/10/2010 10:29:15	0.00	0.14	26.04	-0.33	-0.34	
11/10/2010 10:29:30	-0.01	0.12	25.40	-0.41	-0.25	System Bias
11/10/2010 10:29:45	-0.02	0.12	24.98	-0.42	-0.16	25.0 ppm SO2 Injection
11/10/2010 10:30:00	-0.02	0.11	24.96	-0.42	-0.18	24.93 ppm SO2
11/10/2010 10:30:15	-0.03	0.10	24.92	-0.48	-0.22	
11/10/2010 10:30:30	-0.03	0.10	24.87	-0.48	-0.31	
11/10/2010 10:30:45	-0.04	0.09	24.83	-0.47	-0.45	
11/10/2010 10:31:00	-0.04	0.09	24.94	6.96	-0.63	
11/10/2010 10:31:15	-0.04	0.27	24.98	5.60	-0.99	
11/10/2010 10:31:30	0.10	2.02	22.45	36.43	-0.17	
11/10/2010 10:31:45	0.60	1.01	17.02	49.11	0.45	
11/10/2010 10:32:00	0.36	0.19	13.13	49.45	0.02	

MPC LP FCCU SCRUBBER STACK ANNUAL RATA PROGRAM

Scale Units	0-10 %v db	0-17.44 %v db	0-100 ppmv db	0-200 ppmv db	0-200 ppmv db	
Date / Time	O ₂ Outlet	CO ₂ Outlet	SO ₂ Outlet	NO _x Outlet	CO Outlet	Comments
11/10/2010 10:32:15	0.07	0.10	10.63	49.62	-0.20	
11/10/2010 10:32:30	-0.02	0.08	8.73	49.73	-0.36	
11/10/2010 10:32:45	-0.05	0.08	7.32	49.83	-0.45	
11/10/2010 10:33:00	-0.05	0.08	6.29	49.89	-0.54	
11/10/2010 10:33:15	-0.05	0.07	5.42	49.96	-0.72	System Bias
11/10/2010 10:33:30	-0.06	0.07	4.72	50.03	-0.73	50 ppm NOx Injection
11/10/2010 10:33:45	-0.06	0.07	4.10	50.11	-0.51	50.15 ppm NOx
11/10/2010 10:34:00	-0.06	0.07	3.66	50.18	-0.33	-0.06 % Oxygen
11/10/2010 10:34:15	-0.06	0.07	3.28	50.26	-0.28	0.07 % CO2
11/10/2010 10:34:30	-0.07	0.07	2.94	50.32	-0.29	
11/10/2010 10:34:45	-0.07	0.07	2.60	50.38	-0.28	
11/10/2010 10:35:00	-0.07	0.07	2.34	50.43	-0.37	
11/10/2010 10:35:15	-0.07	0.06	2.03	49.27	-0.60	
11/10/2010 10:35:30	-0.07	0.94	2.02	48.33	-0.51	
11/10/2010 10:35:45	0.35	3.27	1.96	7.36	4.82	
11/10/2010 10:36:00	0.99	1.30	1.84	0.36	26.40	
11/10/2010 10:36:15	0.52	0.23	1.67	0.05	44.06	
11/10/2010 10:36:30	0.10	0.09	1.60	-0.11	48.36	
11/10/2010 10:36:45	-0.03	0.07	1.50	-0.19	48.85	System Bias
11/10/2010 10:37:00	-0.06	0.07	1.38	-0.25	48.85	50 ppm CO Injection
11/10/2010 10:37:15	-0.07	0.07	1.29	-0.31	48.67	48.82 ppm CO
11/10/2010 10:37:30	-0.08	0.06	1.21	-0.35	48.75	
11/10/2010 10:37:45	-0.08	0.06	1.15	-0.36	49.02	
11/10/2010 10:38:00	-0.08	0.06	1.07	-0.41	49.14	
11/10/2010 10:38:15	-0.08	0.06	1.03	-0.42	49.19	
11/10/2010 10:38:30	-0.08	0.06	0.95	1.30	49.20	
11/10/2010 10:38:45	-0.08	0.07	0.80	35.88	44.27	
11/10/2010 10:39:00	-0.02	3.17	0.88	44.74	24.05	
11/10/2010 10:39:15	1.21	8.52	0.97	44.01	9.40	
11/10/2010 10:39:30	3.13	11.08	1.01	42.85	4.95	
11/10/2010 10:39:45	4.26	11.72	1.09	43.02	4.37	
11/10/2010 11:35:15	5.04	11.76	0.73	41.82	2.79	
11/10/2010 11:35:30	5.05	11.67	0.75	41.45	2.57	
11/10/2010 11:35:45	5.14	11.62	0.78	42.06	2.54	
11/10/2010 11:36:00	5.17	11.67	0.76	41.20	2.60	
11/10/2010 11:36:15	5.13	11.70	0.81	41.13	2.71	
11/10/2010 11:36:30	5.09	11.72	0.79	42.10	2.71	
11/10/2010 11:36:45	5.07	11.64	0.80	41.64	2.51	
11/10/2010 11:37:00	5.16	11.55	0.80	41.33	2.59	
11/10/2010 11:37:15	5.25	11.58	0.81	41.72	2.92	
11/10/2010 11:37:30	5.21	11.71	0.80	40.40	2.71	
11/10/2010 11:37:45	5.10	11.74	0.76	40.32	2.51	
11/10/2010 11:38:00	5.06	11.76	0.77	40.67	2.80	
11/10/2010 11:38:15	5.02	11.80	0.84	40.84	3.49	
11/10/2010 11:38:30	4.98	11.80	0.82	41.33	3.37	
11/10/2010 11:38:45	5.00	11.72	0.84	41.11	2.75	
11/10/2010 11:39:00	5.08	11.64	0.77	40.70	2.48	
11/10/2010 11:39:15	5.14	11.66	0.70	40.35	2.58	
11/10/2010 11:39:30	5.14	11.72	0.73	40.12	2.66	
11/10/2010 11:39:45	5.09	11.77	0.75	40.73	2.57	
11/10/2010 11:40:00	5.03	11.81	0.75	40.97	2.51	
11/10/2010 11:40:15	4.99	11.80	0.75	41.12	2.49	
11/10/2010 11:40:30	4.99	11.77	0.74	41.83	2.45	
11/10/2010 11:40:45	5.02	11.72	0.76	41.94	2.42	
11/10/2010 11:41:00	5.06	11.69	0.78	41.74	2.39	Start RA-4
11/10/2010 11:41:15	5.09	11.65	0.78	42.55	2.28	Point 1
11/10/2010 11:41:30	5.13	11.60	0.74	42.38	2.12	
11/10/2010 11:41:45	5.19	11.58	0.75	42.08	2.30	
11/10/2010 11:42:00	5.23	11.62	0.80	41.38	2.68	
11/10/2010 11:42:15	5.19	11.69	0.79	40.52	2.80	
11/10/2010 11:42:30	5.13	11.70	0.83	40.62	2.80	
11/10/2010 11:42:45	5.10	11.74	0.83	40.48	2.75	
11/10/2010 11:43:00	5.06	11.75	0.80	40.92	2.48	
11/10/2010 11:43:15	5.06	11.70	0.80	41.08	2.18	
11/10/2010 11:43:30	5.09	11.70	0.76	40.51	2.03	
11/10/2010 11:43:45	5.10	11.70	0.80	40.42	2.24	
11/10/2010 11:44:00	5.08	11.78	0.72	40.67	2.54	
11/10/2010 11:44:15	5.01	11.81	0.71	40.82	2.61	
11/10/2010 11:44:30	4.98	11.76	0.77	41.32	2.57	
11/10/2010 11:44:45	5.03	11.71	0.77	41.94	2.49	
11/10/2010 11:45:00	5.06	11.76	0.79	42.63	2.39	
11/10/2010 11:45:15	5.04	11.72	0.80	42.25	2.39	
11/10/2010 11:45:30	5.09	11.65	0.79	41.97	2.36	
11/10/2010 11:45:45	5.15	11.67	0.79	42.01	2.47	
11/10/2010 11:46:00	5.14	11.70	0.75	42.46	2.92	
11/10/2010 11:46:15	5.11	11.68	0.74	42.21	3.02	
11/10/2010 11:46:30	5.12	11.64	0.76	41.34	2.98	
11/10/2010 11:46:45	5.16	11.67	0.74	41.24	2.99	
11/10/2010 11:47:00	5.13	11.68	0.78	40.81	2.92	
11/10/2010 11:47:15	5.12	11.66	0.82	40.88	3.01	

MPC LP FCCU SCRUBBER STACK ANNUAL RATA PROGRAM

Scale Units	0-10 %v db	0-17.44 %v db	0-100 ppmv db	0-200 ppmv db	0-200 ppmv db	
Date / Time	O ₂ Outlet	CO ₂ Outlet	SO ₂ Outlet	NO _x Outlet	CO Outlet	Comments
11/10/2010 11:47:30	5.13	11.65	0.83	40.49	2.98	
11/10/2010 11:47:45	5.14	11.62	0.80	40.42	2.62	
11/10/2010 11:48:00	5.18	11.63	0.76	40.82	2.48	Point 2
11/10/2010 11:48:15	5.18	11.66	0.80	40.98	2.64	
11/10/2010 11:48:30	5.16	11.68	0.78	40.51	2.86	
11/10/2010 11:48:45	5.14	11.66	0.76	40.04	2.96	
11/10/2010 11:49:00	5.16	11.65	0.74	40.03	2.95	
11/10/2010 11:49:15	5.16	11.68	0.77	40.00	2.90	
11/10/2010 11:49:30	5.15	11.64	0.80	39.66	2.83	
11/10/2010 11:49:45	5.18	11.63	0.80	39.99	2.57	
11/10/2010 11:50:00	5.18	11.66	0.74	40.05	2.30	
11/10/2010 11:50:15	5.17	11.62	0.75	39.73	2.48	
11/10/2010 11:50:30	5.20	11.65	0.71	39.85	2.68	
11/10/2010 11:50:45	5.16	11.73	0.71	40.38	2.84	
11/10/2010 11:51:00	5.08	11.76	0.77	40.41	2.82	
11/10/2010 11:51:15	5.05	11.72	0.75	40.84	2.59	
11/10/2010 11:51:30	5.07	11.68	0.78	40.88	2.60	
11/10/2010 11:51:45	5.14	11.58	0.78	40.73	2.40	
11/10/2010 11:52:00	5.24	11.57	0.70	40.22	2.21	
11/10/2010 11:52:15	5.26	11.59	0.77	39.98	2.55	
11/10/2010 11:52:30	5.23	11.66	0.81	40.04	2.95	
11/10/2010 11:52:45	5.17	11.69	0.84	40.29	3.01	
11/10/2010 11:53:00	5.14	11.70	0.81	40.58	2.74	
11/10/2010 11:53:15	5.12	11.70	0.80	41.06	2.58	
11/10/2010 11:53:30	5.13	11.63	0.75	41.16	2.60	
11/10/2010 11:53:45	5.20	11.56	0.74	41.06	2.49	
11/10/2010 11:54:00	5.26	11.57	0.79	41.29	2.27	
11/10/2010 11:54:15	5.25	11.58	0.76	41.13	2.42	
11/10/2010 11:54:30	5.23	11.60	0.80	40.84	2.80	
11/10/2010 11:54:45	5.22	11.64	0.79	40.58	2.83	
11/10/2010 11:55:00	5.18	11.64	0.73	40.66	2.63	Point 3
11/10/2010 11:55:15	5.17	11.59	0.77	40.72	2.37	
11/10/2010 11:55:30	5.23	11.54	0.71	40.84	2.26	
11/10/2010 11:55:45	5.27	11.57	0.76	40.89	2.25	
11/10/2010 11:56:00	5.24	11.66	0.76	41.33	2.18	
11/10/2010 11:56:15	5.17	11.68	0.75	40.97	2.07	
11/10/2010 11:56:30	5.15	11.63	0.72	40.65	2.15	
11/10/2010 11:56:45	5.18	11.65	0.75	41.10	2.39	
11/10/2010 11:57:00	5.16	11.68	0.78	40.52	2.60	
11/10/2010 11:57:15	5.13	11.65	0.80	40.20	2.83	
11/10/2010 11:57:30	5.15	11.63	0.80	39.64	2.98	
11/10/2010 11:57:45	5.15	11.73	0.77	40.05	2.83	
11/10/2010 11:58:00	5.06	11.80	0.72	39.98	2.57	
11/10/2010 11:58:15	5.00	11.74	0.69	39.75	2.64	
11/10/2010 11:58:30	5.05	11.72	0.68	40.26	2.80	
11/10/2010 11:58:45	5.06	11.75	0.70	40.15	2.70	
11/10/2010 11:59:00	5.03	11.75	0.74	39.89	2.68	
11/10/2010 11:59:15	5.04	11.75	0.72	40.22	2.75	
11/10/2010 11:59:30	5.05	11.70	0.71	40.27	2.80	
11/10/2010 11:59:45	5.10	11.64	0.71	40.58	2.87	
11/10/2010 12:00:00	5.16	11.64	0.74	40.93	2.68	
11/10/2010 12:00:15	5.15	11.70	0.74	40.71	2.36	
11/10/2010 12:00:30	5.11	11.71	0.70	40.66	2.27	
11/10/2010 12:00:45	5.10	11.69	0.66	41.02	2.51	
11/10/2010 12:01:00	5.11	11.65	0.68	41.47	2.68	
11/10/2010 12:01:15	5.14	11.61	0.68	41.09	2.76	
11/10/2010 12:01:30	5.19	11.58	0.68	40.63	2.83	
11/10/2010 12:01:45	5.22	11.60	0.75	40.86	2.64	
11/10/2010 12:02:00	5.20	11.61	0.73	41.25	2.44	Start RA-5 Point 1
11/10/2010 12:02:15	5.19	11.58	0.68	41.45	2.18	
11/10/2010 12:02:30	5.23	11.57	0.68	41.45	2.09	
11/10/2010 12:02:45	5.25	11.62	0.67	40.89	2.33	
11/10/2010 12:03:00	5.20	11.63	0.71	40.61	2.57	
11/10/2010 12:03:15	5.18	11.66	0.71	39.93	2.75	
11/10/2010 12:03:30	5.14	11.74	0.73	39.76	2.98	
11/10/2010 12:03:45	5.04	11.84	0.77	40.30	2.96	
11/10/2010 12:04:00	4.95	11.85	0.77	40.60	2.74	
11/10/2010 12:04:15	4.96	11.71	0.74	40.20	2.40	
11/10/2010 12:04:30	5.08	11.63	0.70	40.08	2.27	
11/10/2010 12:04:45	5.16	11.64	0.68	40.40	2.52	
11/10/2010 12:05:00	5.17	11.68	0.72	40.61	2.68	
11/10/2010 12:05:15	5.14	11.70	0.73	40.33	2.57	
11/10/2010 12:05:30	5.11	11.70	0.74	40.79	2.56	
11/10/2010 12:05:45	5.09	11.78	0.71	41.29	2.74	
11/10/2010 12:06:00	5.02	11.78	0.73	41.50	2.74	
11/10/2010 12:06:15	5.04	11.66	0.75	41.55	2.64	
11/10/2010 12:06:30	5.14	11.59	0.75	41.79	2.60	
11/10/2010 12:06:45	5.22	11.53	0.74	42.00	2.68	
11/10/2010 12:07:00	5.29	11.51	0.76	41.89	2.57	
11/10/2010 12:07:15	5.30	11.57	0.80	41.67	2.55	
11/10/2010 12:07:30	5.24	11.59	0.76	42.08	2.54	

MPC LP FCCU SCRUBBER STACK ANNUAL RATA PROGRAM

Scale Units	0-10 %v db	0-17.44 %v db	0-100 ppmv db	0-200 ppmv db	0-200 ppmv db	
Date / Time	O ₂ Outlet	CO ₂ Outlet	SO ₂ Outlet	NO _x Outlet	CO Outlet	Comments
11/10/2010 12:07:45	5.22	11.58	0.76	42.06	2.39	
11/10/2010 12:08:00	5.24	11.52	0.75	41.87	2.20	
11/10/2010 12:08:15	5.30	11.51	0.75	41.82	2.01	
11/10/2010 12:08:30	5.31	11.54	0.73	41.10	1.91	
11/10/2010 12:08:45	5.29	11.57	0.74	40.92	2.19	
11/10/2010 12:09:00	5.25	11.64	0.73	40.14	2.68	Point 2
11/10/2010 12:09:15	5.17	11.71	0.74	40.65	2.95	
11/10/2010 12:09:30	5.09	11.74	0.77	40.92	2.98	
11/10/2010 12:09:45	5.05	11.69	0.71	40.14	2.89	
11/10/2010 12:10:00	5.10	11.66	0.71	39.94	2.62	
11/10/2010 12:10:15	5.11	11.73	0.72	39.96	2.31	
11/10/2010 12:10:30	5.05	11.73	0.71	39.32	2.03	
11/10/2010 12:10:45	5.04	11.72	0.71	40.03	2.31	
11/10/2010 12:11:00	5.04	11.74	0.71	39.96	2.82	
11/10/2010 12:11:15	5.04	11.73	0.70	39.34	2.96	
11/10/2010 12:11:30	5.06	11.71	0.73	39.25	3.13	
11/10/2010 12:11:45	5.08	11.76	0.74	39.13	2.90	
11/10/2010 12:12:00	5.03	11.80	0.71	39.58	2.56	
11/10/2010 12:12:15	4.99	11.76	0.71	38.97	2.41	
11/10/2010 12:12:30	5.04	11.67	0.74	38.79	2.23	
11/10/2010 12:12:45	5.12	11.67	0.76	38.88	2.22	
11/10/2010 12:13:00	5.11	11.74	0.74	39.04	2.32	
11/10/2010 12:13:15	5.05	11.78	0.72	39.64	2.56	
11/10/2010 12:13:30	5.01	11.74	0.67	39.95	2.76	
11/10/2010 12:13:45	5.04	11.69	0.73	40.49	2.75	
11/10/2010 12:14:00	5.08	11.72	0.73	40.54	2.47	
11/10/2010 12:14:15	5.06	11.71	0.69	40.42	2.22	
11/10/2010 12:14:30	5.08	11.63	0.74	40.13	2.18	
11/10/2010 12:14:45	5.16	11.58	0.78	39.85	2.32	
11/10/2010 12:15:00	5.20	11.67	0.74	40.08	2.32	
11/10/2010 12:15:15	5.12	11.74	0.71	40.39	2.15	
11/10/2010 12:15:30	5.06	11.69	0.71	40.97	2.08	
11/10/2010 12:15:45	5.12	11.60	0.69	41.17	2.24	
11/10/2010 12:16:00	5.21	11.54	0.63	40.97	2.50	Point 3
11/10/2010 12:16:15	5.27	11.49	0.62	40.08	2.55	
11/10/2010 12:16:30	5.32	11.56	0.71	40.23	2.41	
11/10/2010 12:16:45	5.23	11.74	0.67	40.24	2.28	
11/10/2010 12:17:00	5.07	11.75	0.67	40.30	2.50	
11/10/2010 12:17:15	5.05	11.70	0.68	40.51	2.55	
11/10/2010 12:17:30	5.08	11.66	0.64	40.43	2.38	
11/10/2010 12:17:45	5.13	11.61	0.62	40.66	2.35	
11/10/2010 12:18:00	5.17	11.65	0.66	41.16	2.50	
11/10/2010 12:18:15	5.14	11.70	0.68	41.11	2.49	
11/10/2010 12:18:30	5.12	11.62	0.73	41.17	2.20	
11/10/2010 12:18:45	5.19	11.48	0.71	41.07	1.96	
11/10/2010 12:19:00	5.34	11.41	0.71	40.60	2.14	
11/10/2010 12:19:15	5.42	11.43	0.71	40.55	2.34	
11/10/2010 12:19:30	5.40	11.49	0.68	40.23	2.47	
11/10/2010 12:19:45	5.34	11.58	0.68	40.30	2.28	
11/10/2010 12:20:00	5.24	11.65	0.69	39.71	2.18	
11/10/2010 12:20:15	5.17	11.66	0.65	40.06	2.21	
11/10/2010 12:20:30	5.13	11.74	0.66	40.41	2.09	
11/10/2010 12:20:45	5.06	11.71	0.64	40.70	1.86	
11/10/2010 12:21:00	5.09	11.60	0.64	40.97	1.67	
11/10/2010 12:21:15	5.19	11.54	0.63	40.24	1.80	
11/10/2010 12:21:30	5.25	11.53	0.68	39.52	2.27	
11/10/2010 12:21:45	5.26	11.62	0.71	39.35	2.44	
11/10/2010 12:22:00	5.17	11.68	0.71	39.19	2.35	
11/10/2010 12:22:15	5.13	11.67	0.69	39.12	2.28	
11/10/2010 12:22:30	5.14	11.69	0.69	38.98	2.35	
11/10/2010 12:22:45	5.11	11.71	0.67	39.41	2.34	
11/10/2010 12:23:00	5.09	11.69	0.67	39.53	2.05	Start RA-6 Point 1
11/10/2010 12:23:15	5.10	11.63	0.65	39.50	1.98	
11/10/2010 12:23:30	5.17	11.54	0.65	39.49	2.15	
11/10/2010 12:23:45	5.26	11.50	0.65	39.37	2.26	
11/10/2010 12:24:00	5.30	11.51	0.67	39.04	2.44	
11/10/2010 12:24:15	5.30	11.53	0.68	39.26	2.40	
11/10/2010 12:24:30	5.26	11.63	0.67	39.44	2.27	
11/10/2010 12:24:45	5.19	11.66	0.71	39.76	2.16	
11/10/2010 12:25:00	5.16	11.58	0.70	39.31	2.11	
11/10/2010 12:25:15	5.23	11.56	0.62	39.45	2.31	
11/10/2010 12:25:30	5.25	11.65	0.67	39.27	2.66	
11/10/2010 12:25:45	5.17	11.69	0.67	39.89	2.76	
11/10/2010 12:26:00	5.12	11.71	0.69	40.00	2.60	
11/10/2010 12:26:15	5.10	11.71	0.71	40.01	2.57	
11/10/2010 12:26:30	5.10	11.67	0.68	40.14	2.54	
11/10/2010 12:26:45	5.13	11.68	0.63	40.36	2.50	
11/10/2010 12:27:00	5.12	11.70	0.61	40.51	2.41	
11/10/2010 12:27:15	5.11	11.60	0.67	40.27	2.29	
11/10/2010 12:27:30	5.21	11.47	0.68	40.25	2.44	
11/10/2010 12:27:45	5.32	11.54	0.62	40.89	2.69	

MPC LP FCCU SCRUBBER STACK ANNUAL RATA PROGRAM

Scale Units	0-10 %v db	0-17.44 %v db	0-100 ppmv db	0-200 ppmv db	0-200 ppmv db	
Date / Time	O ₂ Outlet	CO ₂ Outlet	SO ₂ Outlet	NO _x Outlet	CO Outlet	Comments
11/10/2010 12:28:00	5.26	11.65	0.68	41.03	2.71	
11/10/2010 12:28:15	5.19	11.60	0.68	40.25	2.68	
11/10/2010 12:28:30	5.23	11.57	0.67	40.45	2.62	
11/10/2010 12:28:45	5.25	11.63	0.64	40.10	2.46	
11/10/2010 12:29:00	5.19	11.70	0.63	40.05	2.35	
11/10/2010 12:29:15	5.10	11.74	0.63	40.22	2.27	
11/10/2010 12:29:30	5.04	11.72	0.65	39.88	2.26	
11/10/2010 12:29:45	5.08	11.68	0.62	40.06	2.35	
11/10/2010 12:30:00	5.11	11.72	0.68	39.84	2.38	Point 2
11/10/2010 12:30:15	5.07	11.75	0.70	39.47	2.51	
11/10/2010 12:30:30	5.04	11.77	0.70	40.46	2.63	
11/10/2010 12:30:45	5.00	11.78	0.68	41.01	2.53	
11/10/2010 12:31:00	4.99	11.74	0.64	42.26	2.50	
11/10/2010 12:31:15	5.02	11.76	0.65	42.75	2.31	
11/10/2010 12:31:30	5.02	11.72	0.68	42.70	2.23	
11/10/2010 12:31:45	5.08	11.65	0.65	43.36	2.31	
11/10/2010 12:32:00	5.14	11.61	0.66	42.62	2.32	
11/10/2010 12:32:15	5.19	11.62	0.65	42.75	2.46	
11/10/2010 12:32:30	5.17	11.70	0.70	42.54	2.60	
11/10/2010 12:32:45	5.10	11.71	0.72	42.29	2.50	
11/10/2010 12:33:00	5.08	11.77	0.68	42.23	2.57	
11/10/2010 12:33:15	5.00	11.84	0.73	42.61	2.27	
11/10/2010 12:33:30	4.94	11.79	0.72	42.17	2.09	
11/10/2010 12:33:45	4.99	11.70	0.74	41.67	2.38	
11/10/2010 12:34:00	5.06	11.74	0.78	42.14	2.71	
11/10/2010 12:34:15	5.04	11.78	0.72	41.90	2.71	
11/10/2010 12:34:30	5.01	11.75	0.69	41.68	2.79	
11/10/2010 12:34:45	5.05	11.75	0.71	41.73	2.85	
11/10/2010 12:35:00	5.05	11.81	0.81	42.03	2.59	
11/10/2010 12:35:15	4.99	11.84	0.76	41.17	2.28	
11/10/2010 12:35:30	4.96	11.80	0.77	41.12	2.32	
11/10/2010 12:35:45	4.97	11.83	0.71	41.43	2.53	
11/10/2010 12:36:00	4.95	11.86	0.66	41.50	2.71	
11/10/2010 12:36:15	4.91	11.88	0.65	41.95	2.72	
11/10/2010 12:36:30	4.89	11.84	0.68	42.10	2.71	
11/10/2010 12:36:45	4.94	11.75	0.75	43.02	2.47	
11/10/2010 12:37:00	5.02	11.73	0.72	42.78	2.27	Point 3
11/10/2010 12:37:15	5.06	11.68	0.73	43.48	2.09	
11/10/2010 12:37:30	5.11	11.64	0.74	43.38	2.15	
11/10/2010 12:37:45	5.16	11.61	0.73	42.61	2.33	
11/10/2010 12:38:00	5.19	11.65	0.70	42.84	2.51	
11/10/2010 12:38:15	5.15	11.72	0.73	43.03	2.66	
11/10/2010 12:38:30	5.09	11.74	0.68	43.70	2.66	
11/10/2010 12:38:45	5.08	11.64	0.67	43.67	2.60	
11/10/2010 12:39:00	5.17	11.55	0.68	43.78	2.63	
11/10/2010 12:39:15	5.25	11.55	0.71	42.59	2.42	
11/10/2010 12:39:30	5.27	11.57	0.70	41.89	2.09	
11/10/2010 12:39:45	5.23	11.70	0.75	41.75	2.17	
11/10/2010 12:40:00	5.09	11.82	0.76	41.85	2.50	
11/10/2010 12:40:15	4.97	11.88	0.71	42.13	2.83	
11/10/2010 12:40:30	4.91	11.83	0.68	41.86	3.00	
11/10/2010 12:40:45	4.97	11.71	0.71	41.27	2.80	
11/10/2010 12:41:00	5.07	11.63	0.73	40.67	2.60	
11/10/2010 12:41:15	5.17	11.70	0.74	40.67	2.37	
11/10/2010 12:41:30	5.10	11.82	0.67	40.09	2.32	
11/10/2010 12:41:45	4.98	11.83	0.67	40.67	2.34	
11/10/2010 12:42:00	4.95	11.81	0.64	41.43	2.47	
11/10/2010 12:42:15	4.97	11.76	0.60	41.97	2.63	
11/10/2010 12:42:30	5.02	11.74	0.60	41.48	2.66	
11/10/2010 12:42:45	5.04	11.77	0.65	41.01	2.52	
11/10/2010 12:43:00	5.00	11.84	0.67	41.21	2.35	
11/10/2010 12:43:15	4.93	11.85	0.70	41.57	2.26	
11/10/2010 12:43:30	4.92	11.79	0.70	41.73	1.91	
11/10/2010 12:43:45	4.99	11.72	0.75	41.73	1.84	
11/10/2010 12:44:00	5.07	11.68	0.75	41.93	2.17	
11/10/2010 12:44:15	5.12	11.65	0.68	41.80	2.49	
11/10/2010 12:44:30	5.15	11.63	0.66	41.90	2.65	
11/10/2010 12:44:45	5.17	11.66	0.71	42.42	2.54	
11/10/2010 12:45:00	5.15	11.65	0.77	41.35	2.20	
11/10/2010 12:45:15	5.17	11.59	0.77	25.56	4.00	
11/10/2010 12:45:30	5.29	9.37	0.71	18.77	11.11	
11/10/2010 12:45:45	6.57	4.73	0.73	13.06	9.59	
11/10/2010 12:46:00	6.21	4.30	0.72	9.74	4.21	
11/10/2010 12:46:15	5.03	4.84	0.71	7.48	0.89	
11/10/2010 12:46:30	5.07	4.90	0.68	5.95	0.21	
11/10/2010 12:46:45	4.99	4.88	0.66	4.58	0.11	
11/10/2010 12:47:00	4.97	4.88	0.70	3.66	0.06	
11/10/2010 12:47:15	4.96	4.88	0.71	2.84	-0.07	
11/10/2010 12:47:30	4.96	4.90	0.66	2.34	-0.23	
11/10/2010 12:47:45	4.96	4.91	0.67	1.89	-0.35	
11/10/2010 12:48:00	4.97	4.92	0.70	1.57	-0.26	

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MPC LP FCCU SCRUBBER STACK ANNUAL RATA PROGRAM

Scale Units	0-10 %v db	0-17.44 %v db	0-100 ppmv db	0-200 ppmv db	0-200 ppmv db	
Date / Time	O ₂ Outlet	CO ₂ Outlet	SO ₂ Outlet	NO _x Outlet	CO Outlet	Comments
11/10/2010 12:48:15	4.97	4.92	0.74	1.31	-0.07	
11/10/2010 12:48:30	4.97	4.92	0.69	1.08	0.01	System Bias
11/10/2010 12:48:45	4.97	4.92	0.64	0.88	-0.01	5.0% Oxygen Injection
11/10/2010 12:49:00	4.97	4.92	0.68	0.72	-0.05	4.97 % Oxygen
11/10/2010 12:49:15	4.97	4.92	0.67	0.56	-0.08	0.66 ppm SO ₂
11/10/2010 12:49:30	4.97	4.92	0.65	0.44	-0.23	0.65 ppm NO _x
11/10/2010 12:49:45	4.97	4.92	0.64	0.29	-0.40	-0.09 ppm CO
11/10/2010 12:50:00	4.97	4.92	0.62	0.22	-0.38	
11/10/2010 12:50:15	4.97	4.92	0.61	0.13	-0.16	
11/10/2010 12:50:30	4.97	4.92	0.60	0.07	-0.02	
11/10/2010 12:50:45	4.97	4.92	0.61	0.02	0.03	
11/10/2010 12:51:00	4.97	4.92	0.66	-0.03	-0.11	
11/10/2010 12:51:15	4.99	5.71	0.68	-0.08	-0.64	
11/10/2010 12:51:30	5.88	8.22	0.68	-0.13	-0.94	
11/10/2010 12:51:45	8.03	9.50	0.61	-0.12	-1.08	
11/10/2010 12:52:00	9.40	9.73	0.65	-0.17	-1.12	
11/10/2010 12:52:15	9.85	9.78	0.65	-0.20	-0.92	
11/10/2010 12:52:30	9.96	9.80	0.65	-0.23	-0.81	
11/10/2010 12:52:45	10.00	9.81	0.64	-0.25	-0.76	
11/10/2010 12:53:00	10.01	9.82	0.63	-0.30	-0.75	
11/10/2010 12:53:15	10.01	9.81	0.62	-0.32	-0.76	
11/10/2010 12:53:30	10.00	9.82	0.67	-0.32	-0.84	System Bias
11/10/2010 12:53:45	10.02	9.84	0.70	-0.32	-1.01	10.0% CO ₂ Injection
11/10/2010 12:54:00	10.03	9.85	0.67	-0.32	-1.10	9.85 % CO ₂
11/10/2010 12:54:15	10.04	9.85	0.71	-0.31	-0.93	
11/10/2010 12:54:30	10.04	9.85	0.68	-0.36	-0.78	
11/10/2010 12:54:45	10.04	9.85	0.71	-0.38	-0.70	
11/10/2010 12:55:00	10.04	9.85	0.65	-0.37	-0.66	
11/10/2010 12:55:15	10.04	9.86	0.67	-0.32	-0.67	
11/10/2010 12:55:30	10.04	9.86	0.67	2.96	-0.77	
11/10/2010 12:55:45	10.04	9.91	0.71	0.24	-0.62	
11/10/2010 12:56:00	9.89	8.87	0.71	0.17	-0.08	
11/10/2010 12:56:15	8.26	4.16	0.77	0.11	0.84	
11/10/2010 12:56:30	4.27	1.09	1.25	-0.20	1.58	
11/10/2010 12:56:45	1.37	0.36	3.03	-0.21	-0.31	
11/10/2010 12:57:00	0.38	0.26	6.36	-0.26	-0.31	
11/10/2010 12:57:15	0.14	0.22	9.22	-0.28	-0.37	
11/10/2010 12:57:30	0.07	0.19	10.93	-0.32	-0.49	
11/10/2010 12:57:45	0.05	0.17	31.99	-0.32	-0.70	
11/10/2010 12:58:00	0.04	0.16	25.83	-0.32	-0.58	
11/10/2010 12:58:15	0.03	0.15	24.99	-0.34	-0.31	System Bias
11/10/2010 12:58:30	0.02	0.14	24.85	-0.37	-0.25	25.0 ppm SO ₂ Injection
11/10/2010 12:58:45	0.01	0.13	24.87	-0.37	-0.31	24.88 ppm SO ₂
11/10/2010 12:59:00	0.00	0.12	24.97	-0.37	-0.34	
11/10/2010 12:59:15	0.00	0.11	24.82	-0.37	-0.45	
11/10/2010 12:59:30	-0.01	0.11	24.83	0.97	-0.58	
11/10/2010 12:59:45	-0.01	0.17	24.22	4.49	-0.75	
11/10/2010 13:00:00	0.03	0.49	22.27	32.42	-0.25	
11/10/2010 13:00:15	0.12	0.28	15.50	38.44	0.07	
11/10/2010 13:00:30	0.08	0.13	14.09	41.88	-0.13	
11/10/2010 13:00:45	0.02	0.10	12.74	45.10	-0.25	
11/10/2010 13:01:00	-0.01	0.09	11.28	46.16	-0.31	
11/10/2010 13:01:15	-0.02	0.09	10.08	47.02	-0.42	
11/10/2010 13:01:30	-0.02	0.09	8.99	47.53	-0.55	
11/10/2010 13:01:45	-0.02	0.08	8.05	47.85	-0.73	
11/10/2010 13:02:00	-0.03	0.08	7.30	48.07	-0.79	
11/10/2010 13:02:15	-0.03	0.08	6.56	48.26	-0.57	
11/10/2010 13:02:30	-0.03	0.08	6.01	48.49	-0.43	
11/10/2010 13:02:45	-0.03	0.08	5.45	48.69	-0.37	
11/10/2010 13:03:00	-0.04	0.08	5.01	48.89	-0.43	System Bias
11/10/2010 13:03:15	-0.04	0.08	4.56	49.11	-0.49	50 ppm NO _x Injection
11/10/2010 13:03:30	-0.04	0.08	4.17	49.27	-0.61	49.35 ppm NO _x
11/10/2010 13:03:45	-0.04	0.08	3.87	49.45	-0.67	-0.04 % Oxygen
11/10/2010 13:04:00	-0.04	0.07	3.64	49.56	-0.82	0.08 % CO ₂
11/10/2010 13:04:15	-0.04	0.07	3.42	49.67	-0.81	
11/10/2010 13:04:30	-0.04	0.07	3.16	49.77	-0.64	
11/10/2010 13:04:45	-0.04	0.07	3.01	49.87	-0.51	
11/10/2010 13:05:00	-0.04	0.07	2.79	50.15	-0.49	
11/10/2010 13:05:15	-0.05	0.10	2.65	47.73	-0.40	
11/10/2010 13:05:30	-0.03	0.37	2.50	16.45	4.99	
11/10/2010 13:05:45	0.06	0.27	2.30	9.38	25.45	
11/10/2010 13:06:00	0.05	0.13	2.14	6.86	42.66	
11/10/2010 13:06:15	0.00	0.08	2.05	3.29	47.12	
11/10/2010 13:06:30	-0.03	0.07	2.01	2.28	47.99	
11/10/2010 13:06:45	-0.05	0.07	1.95	1.60	48.44	
11/10/2010 13:07:00	-0.05	0.07	1.86	0.88	48.73	
11/10/2010 13:07:15	-0.05	0.07	1.65	-0.29	48.69	
11/10/2010 13:07:30	-0.05	0.06	1.50	-0.37	48.80	System Bias
11/10/2010 13:07:45	-0.05	0.08	1.37	-0.42	48.79	50 ppm CO Injection
11/10/2010 13:08:00	-0.07	0.06	1.32	-0.42	48.56	48.62 ppm CO
11/10/2010 13:08:15	-0.08	0.06	1.25	-0.42	48.51	

MPC LP FCCU SCRUBBER STACK ANNUAL RATA PROGRAM

Scale Units	0-10 %v db	0-17.44 %v db	0-100 ppmv db	0-200 ppmv db	0-200 ppmv db	
Date / Time	O ₂ Outlet	CO ₂ Outlet	SO ₂ Outlet	NO _x Outlet	CO Outlet	Comments
11/10/2010 13:08:30	-0.09	0.06	1.18	-0.42	48.61	
11/10/2010 13:08:45	-0.09	0.06	1.15	-0.44	48.84	
11/10/2010 13:09:00	-0.09	0.06	1.08	-0.44	48.91	
11/10/2010 13:09:15	-0.08	0.06	1.03	0.30	48.89	
11/10/2010 13:09:30	-0.05	0.06	0.91	32.32	44.37	
11/10/2010 13:09:45	-0.01	2.87	1.10	43.13	25.40	
11/10/2010 13:10:00	1.05	8.49	1.25	42.86	9.60	
11/10/2010 13:10:15	2.90	11.24	1.32	40.40	4.53	
11/10/2010 13:10:30	4.09	11.81	1.35	41.14	3.48	
11/10/2010 13:10:45	4.51	11.91	1.45	40.78	3.53	
11/10/2010 13:11:00	4.59	11.92	1.50	40.90	3.72	
11/10/2010 13:11:15	4.59	12.01	1.53	40.08	3.80	
11/10/2010 13:11:30	4.52	12.04	1.54	41.57	3.80	
11/10/2010 13:11:45	4.48	12.04	1.62	43.04	3.61	
11/10/2010 13:12:00	4.50	11.97	1.68	42.39	3.21	
11/10/2010 13:12:15	4.58	11.91	1.67	42.72	3.38	
11/10/2010 13:12:30	4.64	11.92	1.66	41.19	3.42	
11/10/2010 13:12:45	4.66	11.91	1.64	40.80	3.21	
11/10/2010 13:13:00	4.66	11.96	1.60	41.46	2.89	
11/10/2010 13:13:15	4.69	11.98	1.52	42.46	2.67	
11/10/2010 13:13:30	4.91	12.01	1.57	42.09	2.51	
11/10/2010 13:13:45	5.01	12.04	1.53	41.64	2.16	
11/10/2010 13:14:00	5.03	12.06	1.49	42.20	1.88	
11/10/2010 13:14:15	5.01	12.09	1.53	43.86	1.77	
11/10/2010 13:14:30	4.99	12.04	1.54	43.78	1.82	
11/10/2010 13:14:45	5.07	11.86	1.49	42.51	1.92	
11/10/2010 13:15:00	5.24	11.85	1.48	42.78	2.09	Start RA-7 Point 1
11/10/2010 13:15:15	5.25	11.97	1.42	41.34	2.27	
11/10/2010 13:15:30	5.17	11.99	1.39	42.18	2.48	
11/10/2010 13:15:45	5.13	12.05	1.35	44.12	2.51	
11/10/2010 13:16:00	5.06	12.08	1.35	43.58	2.35	
11/10/2010 13:16:15	5.05	12.00	1.34	42.46	2.22	
11/10/2010 13:16:30	5.12	12.00	1.33	41.03	2.23	
11/10/2010 13:16:45	5.12	12.03	1.29	40.78	2.34	
11/10/2010 13:17:00	5.08	12.09	1.28	40.77	2.47	
11/10/2010 13:17:15	5.03	12.07	1.35	41.22	2.50	
11/10/2010 13:17:30	5.04	12.09	1.35	44.00	2.44	
11/10/2010 13:17:45	5.02	12.08	1.35	44.29	2.11	
11/10/2010 13:18:00	5.05	11.93	1.32	43.58	1.93	
11/10/2010 13:18:15	5.20	11.84	1.26	43.72	1.99	
11/10/2010 13:18:30	5.28	11.93	1.26	45.34	1.90	
11/10/2010 13:18:45	5.22	11.92	1.25	44.01	1.71	
11/10/2010 13:19:00	5.25	11.80	1.25	42.77	1.96	
11/10/2010 13:19:15	5.34	11.85	1.25	41.87	2.21	
11/10/2010 13:19:30	5.30	11.97	1.20	40.69	2.35	
11/10/2010 13:19:45	5.20	12.03	1.25	41.10	2.59	
11/10/2010 13:20:00	5.11	12.12	1.20	41.81	2.66	
11/10/2010 13:20:15	5.01	12.11	1.26	42.59	2.58	
11/10/2010 13:20:30	5.01	12.07	1.16	43.37	2.39	
11/10/2010 13:20:45	5.05	11.97	1.16	43.76	1.95	
11/10/2010 13:21:00	5.16	11.92	1.17	42.59	1.81	
11/10/2010 13:21:15	5.22	11.91	1.12	40.31	2.12	
11/10/2010 13:21:30	5.23	11.97	1.10	40.13	2.39	
11/10/2010 13:21:45	5.17	12.03	1.13	39.56	2.64	
11/10/2010 13:22:00	5.11	12.06	1.21	40.51	2.68	Point 2
11/10/2010 13:22:15	5.08	12.11	1.17	41.31	2.37	
11/10/2010 13:22:30	5.03	12.08	1.13	41.85	2.00	
11/10/2010 13:22:45	5.07	12.01	1.11	40.53	1.79	
11/10/2010 13:23:00	5.12	12.07	1.10	41.17	2.06	
11/10/2010 13:23:15	5.07	12.11	1.14	43.51	2.31	
11/10/2010 13:23:30	5.03	12.09	1.17	43.48	2.26	
11/10/2010 13:23:45	5.04	12.06	1.16	42.52	2.35	
11/10/2010 13:24:00	5.08	12.04	1.15	43.05	2.54	
11/10/2010 13:24:15	5.10	12.08	1.12	43.26	2.43	
11/10/2010 13:24:30	5.07	12.06	1.13	43.72	2.14	
11/10/2010 13:24:45	5.10	12.00	1.14	44.58	1.74	
11/10/2010 13:25:00	5.15	11.97	1.07	44.05	1.61	
11/10/2010 13:25:15	5.19	11.90	1.06	43.22	1.71	
11/10/2010 13:25:30	5.26	11.86	1.09	42.55	2.08	
11/10/2010 13:25:45	5.31	11.83	1.07	42.63	2.31	
11/10/2010 13:26:00	5.34	11.86	1.03	42.06	2.35	
11/10/2010 13:26:15	5.31	11.94	1.01	42.42	2.24	
11/10/2010 13:26:30	5.23	11.95	1.02	43.16	1.90	
11/10/2010 13:26:45	5.23	11.81	0.98	42.73	1.52	
11/10/2010 13:27:00	5.35	11.75	1.09	41.72	1.55	
11/10/2010 13:27:15	5.41	11.82	1.09	41.81	2.09	
11/10/2010 13:27:30	5.35	11.95	1.05	42.63	2.53	
11/10/2010 13:27:45	5.21	12.02	1.06	43.06	2.41	
11/10/2010 13:28:00	5.16	11.94	1.02	42.11	2.38	
11/10/2010 13:28:15	5.22	11.90	1.03	41.10	2.55	
11/10/2010 13:28:30	5.25	11.93	0.96	39.92	2.35	

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MPC LP FCCU SCRUBBER STACK ANNUAL RATA PROGRAM

Scale Units	0-10 %v db	0-17.44 %v db	0-100 ppmv db	0-200 ppmv db	0-200 ppmv db	
Date / Time	O ₂ Outlet	CO ₂ Outlet	SO ₂ Outlet	NO _x Outlet	CO Outlet	Comments
11/10/2010 13:28:45	5.24	11.94	1.00	38.64	2.07	
11/10/2010 13:29:00	5.21	12.06	1.05	39.30	2.08	Point 3
11/10/2010 13:29:15	5.09	12.13	1.00	40.49	2.34	
11/10/2010 13:29:30	5.00	12.17	1.03	40.92	2.71	
11/10/2010 13:29:45	4.96	12.17	1.00	41.31	2.84	
11/10/2010 13:30:00	4.96	12.09	1.00	42.91	2.56	
11/10/2010 13:30:15	5.05	11.95	1.03	42.20	2.08	
11/10/2010 13:30:30	5.19	11.86	1.03	40.29	1.75	
11/10/2010 13:30:45	5.29	11.95	1.04	39.86	1.68	
11/10/2010 13:31:00	5.20	12.10	1.01	41.22	1.96	
11/10/2010 13:31:15	5.07	12.10	1.01	42.25	2.12	
11/10/2010 13:31:30	5.06	12.01	1.01	40.50	2.20	
11/10/2010 13:31:45	5.14	11.91	1.00	41.51	2.34	
11/10/2010 13:32:00	5.23	11.93	1.03	40.78	2.26	
11/10/2010 13:32:15	5.23	11.96	1.03	41.79	2.20	
11/10/2010 13:32:30	5.21	11.96	1.00	41.44	2.08	
11/10/2010 13:32:45	5.20	11.98	0.99	41.72	1.93	
11/10/2010 13:33:00	5.18	12.01	1.03	42.41	1.99	
11/10/2010 13:33:15	5.17	11.94	1.01	42.83	2.08	
11/10/2010 13:33:30	5.22	11.91	1.02	42.04	2.21	
11/10/2010 13:33:45	5.27	11.89	1.10	41.83	2.21	
11/10/2010 13:34:00	5.28	11.96	1.14	42.56	2.21	
11/10/2010 13:34:15	5.20	12.02	1.15	43.10	2.09	Start RA-8 Point 1
11/10/2010 13:34:30	5.14	12.02	1.08	42.41	1.91	
11/10/2010 13:34:45	5.15	11.99	1.00	41.72	1.77	
11/10/2010 13:35:00	5.18	11.98	0.95	42.14	2.02	
11/10/2010 13:35:15	5.18	11.99	0.95	41.48	2.41	
11/10/2010 13:35:30	5.18	12.00	0.98	40.82	2.50	
11/10/2010 13:35:45	5.16	12.03	1.03	39.76	2.56	
11/10/2010 13:36:00	5.12	12.07	1.03	38.58	2.97	
11/10/2010 13:36:15	5.09	12.13	1.00	38.94	3.19	
11/10/2010 13:36:30	5.00	12.25	1.00	41.79	2.85	
11/10/2010 13:36:45	4.88	12.27	1.03	42.82	2.59	
11/10/2010 13:37:00	4.84	12.17	0.99	42.72	2.05	
11/10/2010 13:37:15	4.94	12.06	0.98	43.02	1.99	
11/10/2010 13:37:30	5.07	11.97	0.97	41.56	2.21	
11/10/2010 13:37:45	5.18	11.89	1.01	41.45	2.28	
11/10/2010 13:38:00	5.28	11.84	1.00	41.68	2.27	
11/10/2010 13:38:15	5.34	11.86	1.02	42.04	2.13	
11/10/2010 13:38:30	5.32	11.95	1.00	42.36	2.20	
11/10/2010 13:38:45	5.24	12.01	0.96	41.66	2.06	
11/10/2010 13:39:00	5.18	11.98	0.97	42.06	1.75	Point 2
11/10/2010 13:39:15	5.20	11.97	0.97	41.75	1.76	
11/10/2010 13:39:30	5.20	11.99	0.96	40.71	2.14	
11/10/2010 13:39:45	5.20	11.94	0.91	40.71	2.41	
11/10/2010 13:40:00	5.23	11.95	0.93	41.71	2.54	
11/10/2010 13:40:15	5.23	11.93	0.90	42.22	2.68	
11/10/2010 13:40:30	5.25	11.87	0.87	43.05	2.57	
11/10/2010 13:40:45	5.31	11.83	0.91	43.69	2.13	
11/10/2010 13:41:00	5.35	11.83	0.94	42.95	1.55	
11/10/2010 13:41:15	5.38	11.78	0.91	40.41	1.56	
11/10/2010 13:41:30	5.42	11.78	0.96	39.38	2.14	
11/10/2010 13:41:45	5.40	11.95	0.96	40.49	2.49	
11/10/2010 13:42:00	5.24	12.08	0.96	41.08	2.63	
11/10/2010 13:42:15	5.11	12.07	0.95	41.47	2.72	
11/10/2010 13:42:30	5.09	12.06	0.94	40.95	2.71	
11/10/2010 13:42:45	5.10	12.03	0.93	41.33	2.59	
11/10/2010 13:43:00	5.15	11.97	0.93	41.05	2.38	
11/10/2010 13:43:15	5.20	11.93	0.93	40.40	2.49	
11/10/2010 13:43:30	5.24	11.94	0.97	39.83	2.80	
11/10/2010 13:43:45	5.23	11.98	0.99	40.33	3.21	
11/10/2010 13:44:00	5.20	12.01	0.97	40.78	2.97	
11/10/2010 13:44:15	5.17	11.99	0.95	40.11	2.59	
11/10/2010 13:44:30	5.20	11.91	0.97	39.94	2.53	
11/10/2010 13:44:45	5.27	11.87	0.92	40.54	2.54	
11/10/2010 13:45:00	5.30	11.91	0.87	40.14	2.44	
11/10/2010 13:45:15	5.27	11.95	0.94	39.82	2.55	
11/10/2010 13:45:30	5.23	12.01	0.94	40.34	2.60	
11/10/2010 13:45:45	5.16	12.08	0.93	39.77	2.58	
11/10/2010 13:46:00	5.10	12.02	0.93	39.14	2.79	
11/10/2010 13:46:15	5.13	12.03	0.94	42.06	2.81	
11/10/2010 13:46:30	5.12	12.04	0.84	41.36	2.57	
11/10/2010 13:46:45	5.16	11.84	0.82	40.11	2.28	
11/10/2010 13:47:00	5.33	11.79	0.86	40.55	2.18	
11/10/2010 13:47:15	5.38	11.85	0.90	40.28	2.34	
11/10/2010 13:47:30	5.34	11.92	0.88	40.83	2.45	
11/10/2010 13:47:45	5.27	11.97	0.92	40.77	2.51	
11/10/2010 13:48:00	5.22	11.98	0.95	42.33	2.59	
11/10/2010 13:48:15	5.19	12.00	0.90	42.47	2.60	
11/10/2010 13:48:30	5.17	11.99	0.89	41.86	2.77	
11/10/2010 13:48:45	5.18	11.96	0.85	41.96	2.77	

MPC LP FCCU SCRUBBER STACK ANNUAL RATA PROGRAM

Scale Units	0-10 %v db	0-17.44 %v db	0-100 ppmv db	0-200 ppmv db	0-200 ppmv db	
Date / Time	O ₂ Outlet	CO ₂ Outlet	SO ₂ Outlet	NO _x Outlet	CO Outlet	Comments
11/10/2010 13:49:00	5.20	11.93	0.84	41.67	2.42	
11/10/2010 13:49:15	5.23	11.91	0.84	42.26	1.92	
11/10/2010 13:49:30	5.27	11.93	0.83	41.59	1.97	
11/10/2010 13:49:45	5.25	11.94	0.81	41.66	2.37	
11/10/2010 13:50:00	5.25	11.92	0.84	42.09	2.63	Point 3
11/10/2010 13:50:15	5.27	11.85	0.80	42.27	2.61	
11/10/2010 13:50:30	5.35	11.80	0.82	41.13	2.45	
11/10/2010 13:50:45	5.40	11.79	0.79	39.77	2.21	
11/10/2010 13:51:00	5.41	11.82	0.80	40.16	1.97	
11/10/2010 13:51:15	5.37	11.87	0.80	41.53	1.76	
11/10/2010 13:51:30	5.33	11.88	0.81	42.06	1.79	
11/10/2010 13:51:45	5.31	11.85	0.82	40.79	1.95	
11/10/2010 13:52:00	5.35	11.78	0.77	39.47	2.15	
11/10/2010 13:52:15	5.41	11.83	0.81	39.99	2.48	
11/10/2010 13:52:30	5.35	11.99	0.80	41.29	2.66	
11/10/2010 13:52:45	5.22	12.07	0.77	41.77	2.48	
11/10/2010 13:53:00	5.12	12.02	0.83	40.78	2.32	
11/10/2010 13:53:15	5.14	12.00	0.84	41.75	2.24	
11/10/2010 13:53:30	5.17	12.02	0.90	41.85	2.41	
11/10/2010 13:53:45	5.16	11.97	0.85	41.01	2.80	
11/10/2010 13:54:00	5.20	11.93	0.84	42.17	2.71	
11/10/2010 13:54:15	5.25	11.91	0.86	40.94	2.46	
11/10/2010 13:54:30	5.28	11.83	0.90	40.22	2.51	
11/10/2010 13:54:45	5.36	11.77	0.79	39.66	2.57	
11/10/2010 13:55:00	5.41	11.84	0.84	40.29	2.54	
11/10/2010 13:55:15	5.34	11.95	0.86	41.02	2.40	
11/10/2010 13:55:30	5.24	11.96	0.94	41.05	2.27	
11/10/2010 13:55:45	5.23	11.92	0.89	42.32	2.16	
11/10/2010 13:56:00	5.26	11.84	0.87	41.40	2.03	
11/10/2010 13:56:15	5.34	11.79	0.88	40.55	2.08	
11/10/2010 13:56:30	5.40	11.83	0.89	40.52	2.38	
11/10/2010 13:56:45	5.37	11.91	0.84	38.73	2.46	
11/10/2010 13:57:00	5.29	12.03	0.81	38.46	2.51	Start RA-9 Point 1
11/10/2010 13:57:15	5.16	12.09	0.79	41.22	2.67	
11/10/2010 13:57:30	5.09	12.09	0.80	41.99	2.48	
11/10/2010 13:57:45	5.08	11.99	0.85	41.09	2.18	
11/10/2010 13:58:00	5.18	11.88	0.87	42.52	2.21	
11/10/2010 13:58:15	5.30	11.81	0.84	42.14	2.21	
11/10/2010 13:58:30	5.37	11.75	0.86	40.46	2.30	
11/10/2010 13:58:45	5.44	11.73	0.84	40.09	2.46	
11/10/2010 13:59:00	5.46	11.77	0.89	40.94	2.41	
11/10/2010 13:59:15	5.43	11.81	0.84	40.45	2.33	
11/10/2010 13:59:30	5.39	11.90	0.85	41.07	2.39	
11/10/2010 13:59:45	5.31	11.96	0.80	42.00	2.18	
11/10/2010 14:00:00	5.25	11.92	0.79	41.70	2.00	
11/10/2010 14:00:15	5.28	11.87	0.80	40.10	2.19	
11/10/2010 14:00:30	5.31	11.94	0.86	40.14	2.62	
11/10/2010 14:00:45	5.23	12.09	0.84	41.37	2.82	
11/10/2010 14:01:00	5.10	12.09	0.82	42.50	2.74	
11/10/2010 14:01:15	5.11	11.93	0.87	42.60	2.36	
11/10/2010 14:01:30	5.24	11.85	0.82	41.79	2.15	
11/10/2010 14:01:45	5.33	11.86	0.74	41.55	2.15	
11/10/2010 14:02:00	5.32	11.93	0.71	41.90	2.12	
11/10/2010 14:02:15	5.25	11.97	0.78	42.86	2.03	
11/10/2010 14:02:30	5.23	11.92	0.84	42.42	2.06	
11/10/2010 14:02:45	5.28	11.85	0.84	42.69	2.37	
11/10/2010 14:03:00	5.33	11.77	0.82	43.23	2.50	
11/10/2010 14:03:15	5.41	11.78	0.85	39.71	2.66	
11/10/2010 14:03:30	5.42	11.88	0.84	40.33	2.57	
11/10/2010 14:03:45	5.32	11.97	0.80	40.19	2.55	
11/10/2010 14:04:00	5.22	11.97	0.84	39.58	2.47	Point 2
11/10/2010 14:04:15	5.22	11.98	0.81	39.25	2.34	
11/10/2010 14:04:30	5.20	12.02	0.82	40.26	2.45	
11/10/2010 14:04:45	5.15	12.01	0.84	40.42	2.59	
11/10/2010 14:05:00	5.17	11.88	0.81	39.40	2.77	
11/10/2010 14:05:15	5.28	11.88	0.86	40.43	2.70	
11/10/2010 14:05:30	5.28	11.98	0.83	41.14	2.53	
11/10/2010 14:05:45	5.21	12.00	0.85	42.14	2.40	
11/10/2010 14:06:00	5.19	11.94	0.78	41.60	2.17	
11/10/2010 14:06:15	5.26	11.81	0.78	40.88	1.96	
11/10/2010 14:06:30	5.38	11.77	0.78	41.88	2.09	
11/10/2010 14:06:45	5.42	11.76	0.78	41.51	2.37	
11/10/2010 14:07:00	5.45	11.71	0.82	40.41	2.47	
11/10/2010 14:07:15	5.51	11.72	0.86	39.18	2.40	
11/10/2010 14:07:30	5.48	11.84	0.87	38.81	2.38	
11/10/2010 14:07:45	5.37	11.95	0.88	39.50	2.28	
11/10/2010 14:08:00	5.24	12.01	0.82	40.50	2.11	
11/10/2010 14:08:15	5.17	12.02	0.78	39.38	1.85	
11/10/2010 14:08:30	5.14	12.06	0.77	39.05	1.93	
11/10/2010 14:08:45	5.12	12.07	0.74	41.43	2.34	
11/10/2010 14:09:00	5.09	12.06	0.77	41.70	2.47	

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MPC LP FCCU SCRUBBER STACK ANNUAL RATA PROGRAM

Scale Units	0-10 %v db	0-17.44 %v db	0-100 ppmv db	0-200 ppmv db	0-200 ppmv db	
Date / Time	O ₂ Outlet	CO ₂ Outlet	SO ₂ Outlet	NO _x Outlet	CO Outlet	Comments
11/10/2010 14:09:15	5.09	12.04	0.80	42.14	2.44	
11/10/2010 14:09:30	5.11	12.01	0.77	42.39	2.29	
11/10/2010 14:09:45	5.16	11.93	0.80	42.05	2.28	
11/10/2010 14:10:00	5.24	11.86	0.81	41.39	2.15	
11/10/2010 14:10:15	5.33	11.82	0.78	41.81	1.97	
11/10/2010 14:10:30	5.37	11.83	0.82	42.26	1.82	
11/10/2010 14:10:45	5.38	11.77	0.83	42.06	1.84	
11/10/2010 14:11:00	5.45	11.71	0.81	40.24	1.99	Point 3
11/10/2010 14:11:15	5.50	11.77	0.80	41.69	2.16	
11/10/2010 14:11:30	5.43	11.86	0.79	40.69	2.32	
11/10/2010 14:11:45	5.35	11.89	0.71	40.93	2.43	
11/10/2010 14:12:00	5.32	11.87	0.80	41.31	2.41	
11/10/2010 14:12:15	5.33	11.86	0.86	41.17	2.25	
11/10/2010 14:12:30	5.34	11.93	0.84	41.49	2.03	
11/10/2010 14:12:45	5.27	11.95	0.84	40.59	2.10	
11/10/2010 14:13:00	5.25	11.89	0.83	40.41	2.42	
11/10/2010 14:13:15	5.29	11.88	0.80	40.24	2.65	
11/10/2010 14:13:30	5.31	11.90	0.81	40.01	2.51	
11/10/2010 14:13:45	5.29	11.93	0.81	40.23	2.36	
11/10/2010 14:14:00	5.26	11.89	0.77	39.65	2.29	
11/10/2010 14:14:15	5.30	11.86	0.72	39.43	2.22	
11/10/2010 14:14:30	5.33	11.95	0.79	40.07	2.12	
11/10/2010 14:14:45	5.24	11.99	0.84	41.13	2.16	
11/10/2010 14:15:00	5.21	11.91	0.81	40.82	2.30	
11/10/2010 14:15:15	5.26	11.93	0.80	41.45	2.58	
11/10/2010 14:15:30	5.24	12.04	0.79	41.61	2.63	
11/10/2010 14:15:45	5.16	12.00	0.77	41.97	2.40	
11/10/2010 14:16:00	5.17	11.95	0.80	43.61	2.21	
11/10/2010 14:16:15	5.23	11.84	0.87	42.85	1.88	
11/10/2010 14:16:30	5.36	11.70	0.84	40.13	1.58	
11/10/2010 14:16:45	5.50	11.70	0.81	40.64	1.77	
11/10/2010 14:17:00	5.51	11.81	0.80	40.58	2.11	
11/10/2010 14:17:15	5.42	11.83	0.81	40.86	2.41	
11/10/2010 14:17:30	5.39	11.84	0.83	40.32	2.57	
11/10/2010 14:17:45	5.38	11.80	0.79	39.51	2.55	
11/10/2010 14:18:00	5.41	11.79	0.82	39.44	2.32	
11/10/2010 14:18:15	5.42	11.84	0.79	38.44	2.56	
11/10/2010 14:18:30	5.37	11.90	0.79	39.58	2.65	
11/10/2010 14:18:45	5.30	11.99	0.78	40.60	2.19	
11/10/2010 14:19:00	5.20	12.03	0.78	40.74	1.90	
11/10/2010 14:19:15	5.15	12.02	0.77	41.64	2.04	
11/10/2010 14:19:30	5.15	11.94	0.75	41.20	2.24	
11/10/2010 14:19:45	5.24	11.84	0.77	40.23	2.44	
11/10/2010 14:20:00	5.34	11.85	0.74	41.14	2.44	
11/10/2010 14:20:15	5.33	11.92	0.76	42.03	2.37	
11/10/2010 14:20:30	5.29	11.88	0.82	41.76	2.17	
11/10/2010 14:20:45	5.33	11.80	0.90	40.97	2.04	
11/10/2010 14:21:00	5.41	11.75	0.89	12.77	2.94	
11/10/2010 14:21:15	5.51	9.71	0.77	0.93	10.22	
11/10/2010 14:21:30	6.76	4.75	0.75	0.18	10.16	
11/10/2010 14:21:45	6.42	4.33	0.71	0.05	5.68	
11/10/2010 14:22:00	5.33	4.87	0.71	-0.02	1.70	
11/10/2010 14:22:15	5.06	4.91	0.76	-0.03	1.15	
11/10/2010 14:22:30	5.01	4.88	0.73	-0.07	0.98	
11/10/2010 14:22:45	4.99	4.87	0.71	-0.12	1.11	
11/10/2010 14:23:00	4.99	4.89	0.71	-0.14	0.82	
11/10/2010 14:23:15	4.99	4.90	0.62	-0.15	0.60	
11/10/2010 14:23:30	4.99	4.92	0.68	-0.19	0.64	
11/10/2010 14:23:45	5.00	4.93	0.69	-0.20	0.84	
11/10/2010 14:24:00	5.00	4.93	0.73	-0.25	0.98	
11/10/2010 14:24:15	5.00	4.94	0.73	-0.25	1.06	
11/10/2010 14:24:30	5.00	4.94	0.68	-0.24	0.98	System Bias
11/10/2010 14:24:45	5.00	4.94	0.72	-0.25	0.92	5.0% Oxygen Injection
11/10/2010 14:25:00	5.00	4.94	0.71	-0.28	0.79	5.00 % Oxygen
11/10/2010 14:25:15	5.00	4.94	0.64	-0.31	0.66	0.68 ppm SO2
11/10/2010 14:25:30	5.00	4.94	0.65	-0.37	0.70	-0.30 ppm NOx
11/10/2010 14:25:45	5.00	4.94	0.66	-0.37	0.84	0.77 ppm CO
11/10/2010 14:26:00	4.99	4.94	0.66	-0.37	0.95	
11/10/2010 14:26:15	4.99	4.94	0.63	-0.37	0.94	
11/10/2010 14:26:30	4.99	4.94	0.59	-0.38	0.95	
11/10/2010 14:26:45	4.99	5.15	0.60	-0.42	0.56	
11/10/2010 14:27:00	5.35	7.53	0.55	-0.42	0.09	
11/10/2010 14:27:15	7.38	9.42	0.57	-0.42	-0.16	
11/10/2010 14:27:30	9.18	9.81	0.62	-0.42	-0.23	
11/10/2010 14:27:45	9.83	9.86	0.65	-0.42	-0.18	
11/10/2010 14:28:00	9.99	9.87	0.61	-0.42	-0.04	
11/10/2010 14:28:15	10.03	9.88	0.60	-0.42	-0.04	
11/10/2010 14:28:30	10.05	9.89	0.56	-0.43	-0.04	
11/10/2010 14:28:45	10.05	9.89	0.51	-0.42	-0.09	
11/10/2010 14:29:00	10.06	9.90	0.52	-0.44	-0.23	
11/10/2010 14:29:15	10.06	9.90	0.49	-0.48	-0.37	

MPC LP FCCU SCRUBBER STACK ANNUAL RATA PROGRAM

Scale Units	0-10 %v db	0-17.44 %v db	0-100 ppmv db	0-200 ppmv db	0-200 ppmv db	
Date / Time	O ₂ Outlet	CO ₂ Outlet	SO ₂ Outlet	NO _x Outlet	CO Outlet	Comments
11/10/2010 14:29:30	10.06	9.90	0.53	-0.48	-0.50	
11/10/2010 14:29:45	10.07	9.90	0.52	-0.48	-0.36	System Bias
11/10/2010 14:30:00	10.07	9.90	0.52	-0.48	-0.17	10.0% CO ₂ Injection
11/10/2010 14:30:15	10.07	9.90	0.49	-0.48	-0.07	9.91 % CO ₂
11/10/2010 14:30:30	10.07	9.91	0.54	-0.48	-0.08	
11/10/2010 14:30:45	10.07	9.91	0.55	-0.48	-0.12	
11/10/2010 14:31:00	10.08	9.91	0.47	1.08	-0.17	
11/10/2010 14:31:15	10.08	9.91	0.49	15.53	0.15	
11/10/2010 14:31:30	10.06	10.18	0.84	0.11	0.58	
11/10/2010 14:31:45	9.39	8.63	6.97	-0.15	0.76	
11/10/2010 14:32:00	7.21	3.48	18.57	-0.26	-1.88	
11/10/2010 14:32:15	3.44	0.72	27.60	-0.37	-1.22	
11/10/2010 14:32:30	0.99	0.23	32.97	-0.42	-1.06	
11/10/2010 14:32:45	0.25	0.17	36.70	-0.42	-1.06	
11/10/2010 14:33:00	0.09	0.15	39.40	-0.42	-1.12	
11/10/2010 14:33:15	0.05	0.14	41.06	-0.42	-1.20	
11/10/2010 14:33:30	0.03	0.13	37.65	-0.44	-1.35	
11/10/2010 14:33:45	0.02	0.12	31.35	-0.48	-1.52	
11/10/2010 14:34:00	0.02	0.11	28.22	-0.48	-1.38	
11/10/2010 14:34:15	0.01	0.11	26.59	-0.47	-1.15	
11/10/2010 14:34:30	0.01	0.10	25.70	-0.45	-1.06	
11/10/2010 14:34:45	0.00	0.10	25.10	-0.45	-1.07	
11/10/2010 14:35:00	0.00	0.09	24.76	-0.48	-1.11	
11/10/2010 14:35:15	0.00	0.09	24.47	-0.48	-1.14	System Bias
11/10/2010 14:35:30	-0.01	0.08	24.26	-0.48	-1.26	25.0 ppm SO ₂ Injection
11/10/2010 14:35:45	-0.01	0.08	24.09	-0.48	-1.43	24.10 ppm SO ₂
11/10/2010 14:36:00	-0.01	0.08	24.01	-0.48	-1.47	
11/10/2010 14:36:15	-0.02	0.08	24.02	0.84	-1.23	
11/10/2010 14:36:30	-0.02	0.08	25.64	10.86	-1.17	
11/10/2010 14:36:45	0.01	1.62	22.08	20.21	-0.99	
11/10/2010 14:37:00	0.54	1.93	15.63	48.56	-0.22	
11/10/2010 14:37:15	0.60	0.40	11.68	49.18	-0.59	
11/10/2010 14:37:30	0.19	0.11	9.19	49.40	-1.18	
11/10/2010 14:37:45	0.03	0.08	7.46	49.51	-1.46	
11/10/2010 14:38:00	-0.01	0.08	6.22	49.61	-1.38	
11/10/2010 14:38:15	-0.02	0.08	5.33	49.65	-1.18	
11/10/2010 14:38:30	-0.03	0.07	4.58	49.71	-1.11	
11/10/2010 14:38:45	-0.03	0.07	3.99	49.73	-1.04	
11/10/2010 14:39:00	-0.03	0.07	3.53	49.75	-1.11	System Bias
11/10/2010 14:39:15	-0.03	0.07	3.12	49.84	-1.15	50 ppm NO _x Injection
11/10/2010 14:39:30	-0.03	0.07	2.83	49.85	-1.23	49.89 ppm NO _x
11/10/2010 14:39:45	-0.03	0.07	2.53	49.90	-1.37	-0.03 % Oxygen
11/10/2010 14:40:00	-0.04	0.07	2.33	49.97	-1.50	0.07 % CO ₂
11/10/2010 14:40:15	-0.04	0.07	2.15	50.07	-1.33	
11/10/2010 14:40:30	-0.04	0.07	1.92	48.93	-1.14	
11/10/2010 14:40:45	-0.04	0.59	1.96	41.87	-0.71	
11/10/2010 14:41:00	0.22	2.15	1.85	2.35	8.12	
11/10/2010 14:41:15	0.59	0.72	1.76	0.21	27.76	
11/10/2010 14:41:30	0.28	0.15	1.84	-0.02	44.94	
11/10/2010 14:41:45	0.05	0.08	1.54	-0.17	47.32	
11/10/2010 14:42:00	-0.02	0.07	1.46	-0.21	47.57	
11/10/2010 14:42:15	-0.04	0.07	1.38	-0.29	47.73	
11/10/2010 14:42:30	-0.04	0.07	1.31	-0.33	48.05	
11/10/2010 14:42:45	-0.04	0.06	1.26	-0.37	48.17	
11/10/2010 14:43:00	-0.05	0.06	1.15	-0.39	48.23	System Bias
11/10/2010 14:43:15	-0.05	0.06	1.14	-0.39	48.18	50 ppm CO Injection
11/10/2010 14:43:30	-0.05	0.06	1.05	-0.42	48.17	48.12 ppm CO
11/10/2010 14:43:45	-0.05	0.06	0.98	-0.44	48.12	
11/10/2010 14:44:00	-0.05	0.06	0.94	-0.42	47.99	
11/10/2010 14:44:15	-0.05	0.06	0.88	-0.42	47.79	
11/10/2010 14:44:30	-0.05	0.06	0.90	-0.48	47.99	
11/10/2010 14:44:45	-0.05	0.06	0.93	-0.48	47.30	



Marathon Petroleum Company LP: Robinson, IL
FCCU Flue Gas Scrubber
Test Date: 11/10/10

APPENDIX D

Marathon CEMS Data

MPC-Robinson, IL - FCCU Exhaust Stack CEMS

	60coflue	82fc0060	60AI6131	60SO2OTY	60AI6132	60AI0040	60COCORR	60AI614Y
	CO BOILER FLUE GAS FLOW	TOTAL FRESH CHARGE	SCRUBBER OUTLET SO2	SCRUBBER OUTLET SO2 CORCTD	SCRUBBER OUTLET O2	NOx	CO CORR TO 50% XS AIR	OUTLET CO VALUE W/O CALIB
Run 1	MSCFH	MBPD	ppm	ppm	Pct	ppm	ppm	ppm
11/10/2010 9:15	6,011.39	35.98	1.34	1.39	5.00	44.55	11.37	11.89
11/10/2010 9:16	5,959.78	36.01	1.21	1.31	4.99	44.73	11.37	11.89
11/10/2010 9:17	6,047.84	36.03	1.09	1.23	5.10	46.71	11.37	11.89
11/10/2010 9:18	5,952.77	35.99	0.97	1.16	4.93	45.80	11.37	11.89
11/10/2010 9:19	5,982.18	35.94	0.84	1.08	4.90	45.48	11.37	11.89
11/10/2010 9:20	6,030.98	35.93	0.72	1.01	5.18	45.83	11.37	11.89
11/10/2010 9:21	5,981.60	35.96	0.60	0.93	5.00	45.71	11.37	11.89
11/10/2010 9:22	6,007.01	36.01	0.48	0.85	4.94	45.60	11.37	11.89
11/10/2010 9:23	5,934.92	36.06	0.35	0.78	4.96	46.09	11.37	11.89
11/10/2010 9:24	6,034.43	36.06	0.23	0.70	4.87	44.58	11.37	11.89
11/10/2010 9:25	5,965.00	36.00	0.11	0.63	5.02	46.79	11.37	11.89
11/10/2010 9:26	5,969.08	35.94	(0.02)	0.55	4.95	43.89	11.37	11.89
11/10/2010 9:27	5,973.17	35.98	(0.14)	0.23	4.96	44.55	11.37	11.89
11/10/2010 9:28	6,011.19	35.98	(0.26)	0.23	4.80	44.04	11.37	11.89
11/10/2010 9:29	5,977.94	35.98	(0.14)	0.23	4.84	43.22	11.37	11.89
11/10/2010 9:30	6,002.67	35.99	(0.07)	0.23	4.84	44.12	11.37	11.89
11/10/2010 9:31	5,964.97	35.99	(0.06)	0.23	4.83	45.11	11.37	11.89
11/10/2010 9:32	6,019.11	35.99	(0.06)	0.23	4.98	45.92	11.37	11.89
11/10/2010 9:33	5,929.97	35.99	(0.07)	0.23	4.88	45.11	11.37	11.89
11/10/2010 9:34	6,086.49	36.00	(0.07)	0.23	4.84	42.99	11.37	11.89
11/10/2010 9:35	6,000.41	36.00	(0.08)	0.23	5.04	44.07	11.37	11.89
AVERAGE	5,992.52	35.99	0.33	0.65	4.94	44.99	11.37	11.89

	60cofflue	82fc0060	60AI6131	60SO2OTY	60AI6132	60AI0040	60COCORR	60AI614Y
	CO BOILER FLUE GAS FLOW MSCFH	TOTAL FRESH CHARGE MBPD	SCRUBBER OUTLET SO2 ppm	SCRUBBER OUTLET SO2 CORCTD ppm	SCRUBBER OUTLET O2 Pct	NOx ppm	CO CORR TO 50% XS AIR ppm	OUTLET CO VALUE W/O CALIB ppm
Run 2								
11/10/2010 9:36	5,905.76	35.99	0.10	(0.18)	4.69	42.66	11.37	11.89
11/10/2010 9:37	5,953.19	35.98	0.13	(0.23)	4.83	44.26	11.37	11.89
11/10/2010 9:38	6,007.19	35.97	0.16	(0.27)	4.95	44.93	11.37	11.89
11/10/2010 9:39	5,924.56	35.97	0.18	(0.31)	4.92	44.84	11.37	11.89
11/10/2010 9:40	5,929.56	35.96	0.21	(0.35)	4.86	42.87	11.37	11.89
11/10/2010 9:41	5,934.55	35.95	0.24	(0.40)	5.05	45.64	11.37	11.89
11/10/2010 9:42	6,022.75	36.02	0.27	(0.44)	5.15	46.82	11.37	11.89
11/10/2010 9:43	5,969.04	36.01	0.30	(0.48)	4.90	42.81	11.37	11.89
11/10/2010 9:44	5,917.47	36.01	0.33	(0.52)	4.83	43.25	11.37	11.89
11/10/2010 9:45	6,014.40	36.01	(0.28)	(1.13)	5.01	44.61	11.37	11.89
11/10/2010 9:46	5,919.35	36.01	(0.26)	(1.09)	4.84	43.89	11.37	11.89
11/10/2010 9:47	5,969.82	36.00	(0.24)	(1.05)	4.83	43.79	11.37	11.89
11/10/2010 9:48	5,965.61	36.00	(0.22)	(1.00)	5.06	45.35	11.37	11.89
11/10/2010 9:49	5,961.40	35.99	(0.20)	(0.96)	5.04	45.62	11.37	11.89
11/10/2010 9:50	6,030.85	35.99	(0.18)	(0.92)	4.87	43.73	11.37	11.89
11/10/2010 9:51	5,890.41	35.97	(0.16)	(0.87)	4.86	44.28	11.37	11.89
11/10/2010 9:52	5,953.58	35.97	(0.14)	(0.83)	4.79	41.79	11.37	11.89
11/10/2010 9:53	5,975.98	36.00	(0.12)	(0.79)	5.05	43.90	11.37	11.89
11/10/2010 9:54	5,909.37	36.00	(0.11)	(0.75)	4.69	42.84	11.37	11.89
11/10/2010 9:55	5,902.38	36.00	(0.09)	(0.70)	4.97	43.66	11.37	11.89
11/10/2010 9:56	5,939.14	35.97	(0.07)	(0.66)	4.99	44.17	11.37	11.89
AVERAGE	5,952.21	35.99	(0.01)	(0.66)	4.91	44.08	11.37	11.89

	60coflue	82fc0060	60AI6131	60SO2OTY	60AI6132	60AI0040	60COCORR	60AI614Y
	CO BOILER FLUE GAS FLOW	TOTAL FRESH CHARGE	SCRUBBER OUTLET SO2	SCRUBBER OUTLET SO2 CORCTD	SCRUBBER OUTLET O2	NOx	CO CORR TO 50% XS AIR	OUTLET CO VALUE W/O CALIB
Run 3	MSCFH	MBPD	ppm	ppm	Pct	ppm	ppm	ppm
11/10/2010 9:57	5,931.69	36.06	(0.05)	(0.62)	5.01	43.51	11.37	11.89
11/10/2010 9:58	5,986.73	36.06	(0.03)	(0.57)	4.67	44.83	11.37	11.89
11/10/2010 9:59	5,938.13	36.05	(0.01)	(0.53)	4.90	44.36	11.37	11.89
11/10/2010 10:00	5,962.54	36.05	0.01	(0.49)	4.91	41.71	11.37	11.89
11/10/2010 10:01	5,939.53	36.00	0.03	(0.44)	4.80	42.47	11.37	11.89
11/10/2010 10:02	5,938.13	35.99	0.05	(0.40)	4.78	42.94	11.37	11.89
11/10/2010 10:03	5,936.72	35.99	0.07	(0.36)	5.03	44.48	11.37	11.89
11/10/2010 10:04	5,988.43	35.99	0.08	(0.32)	4.85	42.47	11.37	11.89
11/10/2010 10:05	6,017.99	35.99	0.10	(0.27)	4.92	43.25	11.37	11.89
11/10/2010 10:06	5,901.46	35.99	0.12	(0.23)	4.94	42.32	11.37	11.89
11/10/2010 10:07	5,909.24	35.99	0.14	(0.19)	4.96	44.93	11.37	11.89
11/10/2010 10:08	5,990.91	35.99	0.16	(0.14)	5.15	43.79	11.37	11.89
11/10/2010 10:09	5,884.85	35.99	0.18	(0.10)	4.79	41.18	11.37	11.89
11/10/2010 10:10	5,944.67	35.96	0.20	0.23	4.79	42.32	11.37	11.89
11/10/2010 10:11	5,965.77	36.02	0.22	0.23	4.79	42.28	11.37	11.89
11/10/2010 10:12	5,957.89	36.03	0.23	0.23	5.02	44.63	11.37	11.89
11/10/2010 10:13	5,950.01	36.03	0.23	0.23	4.97	44.63	11.37	11.89
11/10/2010 10:14	5,981.62	36.02	0.23	0.23	4.71	41.62	11.37	11.89
11/10/2010 10:15	5,940.34	36.01	0.23	0.23	5.01	43.92	11.37	11.89
11/10/2010 10:16	5,981.80	36.00	0.23	0.23	4.98	44.22	11.37	11.89
11/10/2010 10:17	5,957.39	36.00	0.23	0.23	4.73	42.19	11.37	11.89
AVERAGE	5,952.66	36.01	0.12	(0.13)	4.89	43.24	11.37	11.89

	60coflue	82fc0060	60AI6131	60SO2OTY	60AI6132	60AI0040	60COCORR	60AI614Y
	CO BOILER FLUE GAS FLOW	TOTAL FRESH CHARGE	SCRUBBER OUTLET SO2	SCRUBBER OUTLET SO2 CORCTD	SCRUBBER OUTLET O2	NOx	CO CORR TO 50% XS AIR	OUTLET CO VALUE W/O CALIB
Run 4	MSCFH	MBPD	ppm	ppm	Pct	ppm	ppm	ppm
11/10/2010 11:41	5,989.57	36.01	0.01	0.23	4.90	42.97	11.37	11.89
11/10/2010 11:42	5,893.60	36.01	0.01	0.23	4.73	40.92	11.37	11.89
11/10/2010 11:43	5,893.71	36.01	0.01	0.23	4.67	40.03	11.37	11.89
11/10/2010 11:44	5,893.82	36.01	0.01	0.23	4.69	42.74	11.37	11.89
11/10/2010 11:45	5,926.23	36.01	0.02	0.23	4.84	42.38	11.37	11.89
11/10/2010 11:46	5,925.11	36.01	0.02	0.23	4.88	40.95	11.37	11.89
11/10/2010 11:47	5,952.91	35.99	0.02	0.23	4.84	40.97	11.37	11.89
11/10/2010 11:48	5,905.97	35.97	0.02	0.23	4.81	40.30	11.37	11.89
11/10/2010 11:49	5,944.47	35.95	0.03	0.23	4.85	40.26	11.37	11.89
11/10/2010 11:50	5,874.20	35.93	0.03	0.23	4.73	40.98	11.37	11.89
11/10/2010 11:51	5,961.87	35.97	0.03	0.23	4.98	41.40	11.37	11.89
11/10/2010 11:52	5,885.02	36.00	0.03	0.23	4.77	40.99	11.37	11.89
11/10/2010 11:53	5,968.06	36.03	0.04	0.23	4.92	42.01	11.37	11.89
11/10/2010 11:54	5,929.86	36.03	0.04	0.23	4.91	41.44	11.37	11.89
11/10/2010 11:55	5,961.96	35.98	0.04	0.23	4.76	42.00	11.37	11.89
11/10/2010 11:56	5,932.39	35.97	0.04	0.23	4.77	41.25	11.37	11.89
11/10/2010 11:57	5,900.44	35.98	0.05	0.23	4.69	39.58	11.37	11.89
11/10/2010 11:58	5,869.63	36.01	0.05	0.23	4.78	41.82	11.37	11.89
11/10/2010 11:59	5,915.10	36.03	0.05	0.23	4.81	41.77	11.37	11.89
11/10/2010 12:00	5,908.29	36.03	0.05	0.23	4.88	41.43	11.37	11.89
11/10/2010 12:01	5,944.97	36.03	0.06	0.23	4.91	41.20	11.37	11.89
AVERAGE	5,922.72	36.00	0.03	0.23	4.81	41.30	11.37	11.89

	60coflue	82fc0060	60AI6131	60SO2OTY	60AI6132	60AI0040	60COCORR	60AI614Y
	CO BOILER FLUE GAS FLOW	TOTAL FRESH CHARGE	SCRUBBER OUTLET SO2	SCRUBBER OUTLET SO2 CORCTD	SCRUBBER OUTLET O2	NOx	CO CORR TO 50% XS AIR	OUTLET CO VALUE W/O CALIB
Run 5	MSCFH	MBPD	ppm	ppm	Pct	ppm	ppm	ppm
11/10/2010 12:02	5,939.04	36.04	0.06	0.23	4.88	41.63	11.37	11.89
11/10/2010 12:03	5,846.96	36.04	0.06	0.23	4.66	40.01	11.37	11.89
11/10/2010 12:04	5,929.52	36.04	0.06	0.23	4.75	40.91	11.37	11.89
11/10/2010 12:05	5,837.81	36.04	0.07	0.23	4.77	43.23	11.37	11.89
11/10/2010 12:06	5,985.58	36.04	0.07	0.23	4.98	42.87	11.37	11.89
11/10/2010 12:07	5,952.61	36.04	0.07	0.23	5.04	43.52	11.37	11.89
11/10/2010 12:08	5,957.00	36.04	0.07	0.23	4.77	40.92	11.37	11.89
11/10/2010 12:09	5,895.30	36.03	0.08	0.23	4.84	41.29	11.37	11.89
11/10/2010 12:10	5,920.32	36.03	0.08	0.23	4.74	39.67	11.37	11.89
11/10/2010 12:11	5,885.23	35.98	0.08	0.23	4.63	39.12	11.37	11.89
11/10/2010 12:12	5,928.22	36.01	0.08	0.23	4.71	39.19	11.37	11.89
11/10/2010 12:13	5,919.79	36.01	0.09	0.23	4.77	41.80	11.37	11.89
11/10/2010 12:14	5,953.48	36.01	0.09	0.23	4.77	40.35	11.37	11.89
11/10/2010 12:15	5,923.84	36.01	0.09	0.23	4.97	43.22	11.37	11.89
11/10/2010 12:16	5,857.80	36.00	0.09	0.23	4.76	41.07	11.37	11.89
11/10/2010 12:17	5,955.02	36.00	0.09	0.23	4.76	41.87	11.37	11.89
11/10/2010 12:18	6,005.47	35.99	0.10	0.23	5.11	42.01	11.37	11.89
11/10/2010 12:19	5,942.60	35.99	0.10	0.23	4.80	41.08	11.37	11.89
11/10/2010 12:20	5,886.90	35.99	0.10	0.23	4.86	42.36	11.37	11.89
11/10/2010 12:21	5,862.84	35.98	0.10	0.23	4.75	38.93	11.37	11.89
11/10/2010 12:22	5,857.58	35.98	0.11	0.23	4.79	40.20	11.37	11.89
AVERAGE	5,916.33	36.01	0.08	0.23	4.82	41.20	11.37	11.89

	60coflue	82fc0080	60AI6131	60SO2OTY	60AI6132	60AI0040	60COCORR	60AI614Y
	CO BOILER FLUE GAS FLOW	TOTAL FRESH CHARGE	SCRUBBER OUTLET SO2	SCRUBBER OUTLET SO2 CORCTD	SCRUBBER OUTLET O2	NOx	CO CORR TO 50% XS AIR	OUTLET CO VALUE W/O CALIB
Run 6	MSCFH	MBPD	ppm	ppm	Pct	ppm	ppm	ppm
11/10/2010 12:23	5,961.99	35.97	0.11	0.23	4.97	39.90	11.37	11.89
11/10/2010 12:24	5,888.07	35.97	0.11	0.23	4.96	42.28	11.37	11.89
11/10/2010 12:25	5,884.11	35.97	0.11	0.23	4.63	41.90	11.37	11.89
11/10/2010 12:26	5,880.15	35.97	0.12	0.23	4.79	41.65	11.37	11.89
11/10/2010 12:27	5,886.70	36.04	0.12	0.23	4.75	41.79	11.37	11.89
11/10/2010 12:28	5,923.23	36.00	0.12	0.23	4.84	40.17	11.37	11.89
11/10/2010 12:29	5,924.47	35.97	0.12	0.23	4.76	39.91	11.37	11.89
11/10/2010 12:30	5,854.97	35.98	0.13	0.23	4.80	41.41	11.37	11.89
11/10/2010 12:31	5,934.24	35.99	0.13	0.23	4.90	43.58	11.37	11.89
11/10/2010 12:32	5,899.38	35.99	0.13	0.23	4.83	42.83	11.37	11.89
11/10/2010 12:33	5,901.08	36.00	0.13	0.23	4.77	42.46	11.37	11.89
11/10/2010 12:34	5,902.78	36.01	0.14	0.23	4.68	41.75	11.37	11.89
11/10/2010 12:35	5,851.01	36.01	0.14	0.23	4.59	41.43	11.37	11.89
11/10/2010 12:36	5,852.03	36.01	0.14	0.23	4.75	42.98	11.37	11.89
11/10/2010 12:37	5,931.56	36.01	0.14	0.23	4.92	44.32	11.37	11.89
11/10/2010 12:38	5,871.23	36.01	0.15	0.23	5.02	44.77	11.37	11.89
11/10/2010 12:39	5,948.19	36.00	0.15	0.23	4.70	41.61	11.37	11.89
11/10/2010 12:40	5,889.32	36.00	0.15	0.23	4.86	42.17	11.37	11.89
11/10/2010 12:41	5,836.91	35.99	0.15	0.23	4.65	40.39	11.37	11.89
11/10/2010 12:42	5,899.13	36.00	0.16	0.23	4.62	42.04	11.37	11.89
11/10/2010 12:43	5,856.96	36.04	0.16	0.23	4.85	43.16	11.37	11.89
AVERAGE	5,894.17	36.00	0.13	0.23	4.79	42.02	11.37	11.89

	60cofflue	82fc0060	60AJ6131	60SO2OTY	60AJ6132	60AJ0040	60COCORR	60AJ614Y
	CO BOILER FLUE GAS FLOW	TOTAL FRESH CHARGE	SCRUBBER OUTLET SO2	SCRUBBER OUTLET SO2 CORCTD	SCRUBBER OUTLET O2	NOx	CO CORR TO 50% XS AIR	OUTLET CO VALUE W/O CALIB
Run7	MSCFH	MBPD	ppm	ppm	Pct	ppm	ppm	ppm
11/10/2010 13:15	6,657.91	36.00	0.23	0.23	4.70	41.85	11.35	12.00
11/10/2010 13:16	6,490.17	35.99	0.23	0.23	4.79	43.19	11.35	12.00
11/10/2010 13:17	6,519.57	35.98	0.23	0.23	4.73	40.51	11.35	12.00
11/10/2010 13:18	6,590.61	35.97	0.23	0.23	4.98	43.42	11.35	12.00
11/10/2010 13:19	6,664.27	35.95	0.23	0.23	4.85	42.64	11.35	12.00
11/10/2010 13:20	6,496.74	35.93	0.23	0.23	4.64	41.24	11.35	12.00
11/10/2010 13:21	6,618.03	36.06	0.23	0.23	4.88	43.60	11.35	12.00
11/10/2010 13:22	6,559.52	36.05	0.23	0.23	4.59	39.06	11.35	12.00
11/10/2010 13:23	6,564.57	36.03	0.23	0.23	4.62	39.93	11.35	12.00
11/10/2010 13:24	6,569.62	36.00	0.23	0.23	4.64	41.99	11.35	12.00
11/10/2010 13:25	6,574.68	35.97	0.23	0.23	4.93	43.60	11.35	12.00
11/10/2010 13:26	6,636.33	35.97	0.23	0.23	4.73	41.58	11.35	12.00
11/10/2010 13:27	6,710.19	36.02	0.23	0.23	4.92	41.86	11.35	12.00
11/10/2010 13:28	6,582.96	36.08	0.23	0.23	4.84	41.83	11.35	12.00
11/10/2010 13:29	6,506.41	35.99	0.23	0.23	4.58	38.62	11.35	12.00
11/10/2010 13:30	6,506.65	36.02	0.23	0.23	4.87	41.00	11.35	12.00
11/10/2010 13:31	6,498.03	36.02	0.23	0.23	4.66	40.01	11.35	12.00
11/10/2010 13:32	6,584.64	36.01	0.23	0.23	4.80	40.86	11.35	12.00
11/10/2010 13:33	6,533.00	35.99	0.23	0.23	4.80	41.76	11.35	12.00
11/10/2010 13:34	6,554.36	35.97	0.23	0.23	4.67	41.66	11.35	12.00
11/10/2010 13:35	6,552.11	35.95	0.23	0.23	4.72	41.24	11.35	12.00
AVERAGE	6,570.02	36.00	0.23	0.23	4.76	41.50	11.35	12.00

	60coflue	82fc0060	60AI6131	60SO2OTY	60AI6132	60AI0040	60COCORR	60AI614Y
	CO BOILER FLUE GAS FLOW	TOTAL FRESH CHARGE	SCRUBBER OUTLET SO2	SCRUBBER OUTLET SO2 CORCTD	SCRUBBER OUTLET O2	NOx	CO CORR TO 50% XS AIR	OUTLET CO VALUE W/O CALIB
Run 8	MSCFH	MBPD	ppm	ppm	Pct	ppm	ppm	ppm
11/10/2010 13:36	6,518.08	35.94	0.23	0.23	4.48	38.46	11.35	12.00
11/10/2010 13:37	6,467.50	35.93	0.23	0.23	4.72	42.47	11.35	12.00
11/10/2010 13:38	6,638.51	35.96	0.23	0.23	4.85	41.49	11.35	12.00
11/10/2010 13:39	6,559.98	35.98	0.23	0.23	4.70	41.52	11.35	12.00
11/10/2010 13:40	6,559.28	36.01	0.23	0.23	4.85	41.11	11.35	12.00
11/10/2010 13:41	6,623.04	36.03	0.23	0.23	5.05	42.40	11.35	12.00
11/10/2010 13:42	6,477.86	36.06	0.23	0.23	4.63	40.59	10.22	12.99
11/10/2010 13:43	6,557.53	36.08	0.23	0.23	4.83	40.30	11.06	13.11
11/10/2010 13:44	6,530.79	36.06	0.23	0.23	4.79	40.10	10.45	12.79
11/10/2010 13:45	6,561.47	36.03	0.23	0.23	4.74	39.69	10.63	12.89
11/10/2010 13:46	6,554.77	36.00	0.23	0.23	4.54	38.87	11.27	13.28
11/10/2010 13:47	6,622.86	35.97	0.23	0.23	4.82	39.80	11.07	12.39
11/10/2010 13:48	6,548.40	35.91	0.23	0.23	4.69	41.87	11.86	12.69
11/10/2010 13:49	6,553.09	35.95	0.23	0.23	4.77	41.55	10.75	12.69
11/10/2010 13:50	6,557.77	35.99	0.23	0.23	4.92	42.10	10.28	12.99
11/10/2010 13:51	6,590.66	36.03	0.23	0.23	4.83	39.98	10.46	12.59
11/10/2010 13:52	6,663.54	36.02	0.23	0.23	4.67	39.58	10.49	12.49
11/10/2010 13:53	6,530.99	36.01	0.23	0.23	4.64	40.67	11.27	12.79
11/10/2010 13:54	6,564.21	35.99	0.23	0.23	4.86	41.52	10.73	12.30
11/10/2010 13:55	6,568.57	35.98	0.23	0.23	4.72	40.04	10.18	12.79
11/10/2010 13:56	6,625.47	35.97	0.23	0.23	4.86	40.89	10.76	12.00
AVERAGE	6,565.45	36.00	0.23	0.23	4.76	40.71	10.93	12.51

	60coflue	82fc0060	60AI6131	60SO2OTY	60AI6132	60AI0040	60COCORR	60AI614Y
	CO BOILER FLUE GAS FLOW	TOTAL FRESH CHARGE	SCRUBBER OUTLET SO2	SCRUBBER OUTLET SO2 CORCTD	SCRUBBER OUTLET O2	NOx	CO CORR TO 50% XS AIR	OUTLET CO VALUE W/O CALIB
Run 9	MSCFH	MBPD	ppm	ppm	Pct	ppm	ppm	ppm
11/10/2010 13:57	6,473.55	35.95	0.23	0.23	4.52	38.97	10.56	13.18
11/10/2010 13:58	6,600.10	35.98	0.23	0.23	4.97	42.80	11.46	12.59
11/10/2010 13:59	6,622.68	36.03	0.23	0.23	4.77	40.34	10.17	12.69
11/10/2010 14:00	6,591.90	36.03	0.23	0.23	4.76	41.28	10.54	12.79
11/10/2010 14:01	6,512.44	36.03	0.23	0.23	4.87	42.28	10.56	12.69
11/10/2010 14:02	6,513.27	36.02	0.23	0.23	4.75	41.82	10.69	13.08
11/10/2010 14:03	6,635.70	36.02	0.23	0.23	4.78	41.76	10.38	13.67
11/10/2010 14:04	6,516.74	36.01	0.23	0.23	4.62	39.50	11.15	12.99
11/10/2010 14:05	6,583.44	36.00	0.23	0.23	4.58	39.30	11.04	13.18
11/10/2010 14:06	6,586.98	35.99	0.23	0.23	4.87	40.58	11.15	12.49
11/10/2010 14:07	6,653.31	35.98	0.23	0.23	4.76	39.52	10.50	12.69
11/10/2010 14:08	6,513.69	35.97	0.23	0.23	4.55	40.58	10.84	12.00
11/10/2010 14:09	6,487.61	35.97	0.23	0.23	4.60	41.52	10.44	12.40
11/10/2010 14:10	6,585.41	35.98	0.23	0.23	4.81	41.75	10.41	12.39
11/10/2010 14:11	6,626.41	35.98	0.23	0.23	4.76	41.08	10.56	12.98
11/10/2010 14:12	6,586.10	35.99	0.23	0.23	4.66	40.79	10.46	12.79
11/10/2010 14:13	6,584.38	35.99	0.23	0.23	4.71	40.13	10.81	13.18
11/10/2010 14:14	6,582.66	36.00	0.23	0.23	4.61	40.13	10.61	12.49
11/10/2010 14:15	6,580.94	36.00	0.23	0.23	4.55	41.43	10.79	13.38
11/10/2010 14:16	6,579.22	36.01	0.23	0.23	5.07	43.70	11.08	12.00
11/10/2010 14:17	6,577.50	36.01	0.23	0.23	4.79	40.20	10.13	12.79
AVERAGE	6,571.14	36.00	0.23	0.23	4.73	40.93	10.68	12.78



Marathon Petroleum Company LP: Robinson, IL
FCCU Flue Gas Scrubber
Test Date: 11/10/10

APPENDIX E

Calibration Data

RESPONSE TIME TEST AND CONVERTOR EFFICIENCY CHECK

Company: MPC LP
Location: Robinson, IL
Source: FCCU Scrubber Stack
Test Date: 11/10/2010

RESPONSE TIME CHECK		
Component	Upscale Response Time	Downscale Response Time
	(seconds)	(seconds)
O2	90	45
CO2	90	90
SO2	180	150
NOx	135	75
CO	165	90

System Response Time = 180 seconds

CONVERTOR EFFICIENCY CHECK ---CA NOX MONITOR 600 SERIES V04052			
Date	Expected	Measured	Efficiency, %
11/10/2010	49.17	45.14	91.81
Must be >90 % Efficiency			Pass



STRATIFICATION CHECK

Company: MPC LP
 Location: Robinson, IL
 Source: FCCU Scrubber Stack
 Test Date: 11/10/2010

	POINT 1				POINT 2				POINT 3				AVERAGE	
	Reading	%	Difference from average	% Diff from ave.	Reading	%	Difference from average	% Diff from ave.	Reading	%	Difference from average	% Diff from ave.	Reading	%
O ₂ AVERAGE	5.10	%	-0.09	-1.75	5.25	%	0.05	1.03	5.23	%	0.04	0.72	5.19	%
CO ₂ AVERAGE	11.91	%	0.00	0.01	11.91	%	0.00	-0.04	11.91	%	0.00	0.03	11.91	%
SO ₂ AVERAGE	0.75	ppmv	0.36	94.50	0.40	ppmv	0.02	ppmv	0.00	ppmv	-0.38	-98.74	0.38	ppmv
NO _x AVERAGE	45.56	ppmv	0.59	1.30	44.72	ppmv	-0.26	ppmv	44.64	ppmv	-0.33	-0.74	44.97	ppmv
CO AVERAGE	3.21	ppmv	0.19	6.40	2.98	ppmv	-0.04	ppmv	2.87	ppmv	-0.15	-4.96	3.02	ppmv

Stratification Criteria Per Part 60 Appendix b:

Show that the concentration at each individual traverse point differs by no more than ± 10.0 percent from the arithmetic average concentration for all traverse points.
 The results are also acceptable if the concentration at each individual traverse point differs by no more than ± 5 ppm or ± 0.5 percent CO₂ (or O₂) from the arithmetic average concentration for all traverse points.

**ARI REFERENCE METHOD CEMS DATA
USEPA METHOD 205
DILUTION SYSTEM VERIFICATION**

Company: MPC LP
Location: Robinson, IL
Dilution System ID: 2635
Dilution Flow Rate: 5.0 LPM
Verification date: 11/9/2010

Analyzer Info
Monitor type: Servomex Oxygen
Monitor range: 22.60 %
Monitor Serial No.: 01440D1/4213

Initial Calibration Data

<u>Calibration Concentration</u>	<u>Calibration results</u>	<u>% Difference</u>
Zero: 0.00	Zero: -0.01	Zero: 0.00
Mid: 11.30	Mid: 11.38	Mid: 0.71
High: 22.60	High: 22.66	High: 0.27

Dilution System Verification

Mid level gas type: <u>USEPA Protocol 1</u>	High level dilution gas type: <u>USEPA Protocol 1</u>
Mid level concentration: <u>12.61</u>	High level concentration: <u>22.60</u>
Mid level tank serial #: <u>ALM-014480</u>	High level tank serial #: <u>ALM-008601</u>
	Target concentration No. 1: <u>18.00</u>
	Target concentration No. 2: <u>9.00</u>

Dilution System Results

<u>Target Concentration No. 1</u>			<u>Target Concentration No. 2</u>		
	<u>Instrument Response</u>	<u>% difference from average*</u>		<u>Instrument Response</u>	<u>% difference from average*</u>
Trial No. 1:	18.11	0.04	Trial No. 1:	9.06	0.14
Trial No. 2:	18.10	0.02	Trial No. 2:	9.04	0.05
Trial No. 3:	18.10	0.02	Trial No. 3:	9.04	0.08
Average:	18.107		Average:	9.047	

% Difference from target concentration: 0.59% % Difference from target concentration: 0.53%

Mid Level Calibration Gas Results

<u>Instrument Response</u>	
Trial No. 1: 12.60	Mid Level calibration gas concentration: 12.61
Trial No. 2: 12.60	Average analyzer response: 12.601
Trial No. 3: 12.60	Percent difference: 0.07 *

* Must be less than 2 %

MPC LP - Robinson, Illinois
FCCU Scrubber Stack
USEPA Method 205 - Dilution System Verification

Scale	22.60	
Units	%v db	
Time, s	Oxygen	Comments
11/9/2010 17:14:00	0.00	
11/9/2010 17:14:15	0.00	Calibration Error
11/9/2010 17:14:30	-0.01	Zero Nitrogen Injection
11/9/2010 17:14:45	-0.01	-0.01 % Oxygen
11/9/2010 17:15:00	-0.02	
11/9/2010 17:15:15	-0.02	
11/9/2010 17:15:30	-0.02	
11/9/2010 17:15:45	0.01	
11/9/2010 17:16:00	3.80	
11/9/2010 17:16:15	11.75	
11/9/2010 17:16:30	17.90	
11/9/2010 17:16:45	21.15	
11/9/2010 17:17:00	22.27	
11/9/2010 17:17:15	22.55	
11/9/2010 17:17:30	22.62	
11/9/2010 17:17:45	22.64	
11/9/2010 17:18:00	22.65	Calibration Error
11/9/2010 17:18:15	22.65	22.6% Oxygen Injection
11/9/2010 17:18:30	22.66	22.66 % Oxygen
11/9/2010 17:18:45	22.66	
11/9/2010 17:19:00	22.67	
11/9/2010 17:19:15	22.67	
11/9/2010 17:19:30	22.67	
11/9/2010 17:19:45	22.68	
11/9/2010 17:20:00	22.68	
11/9/2010 17:20:15	22.26	
11/9/2010 17:20:30	18.59	
11/9/2010 17:20:45	14.24	
11/9/2010 17:21:00	12.11	
11/9/2010 17:21:15	11.55	
11/9/2010 17:21:30	11.43	
11/9/2010 17:21:45	11.40	Calibration Error
11/9/2010 17:22:00	11.39	11.3% Oxygen Injection
11/9/2010 17:22:15	11.38	11.38 % Oxygen
11/9/2010 17:22:30	11.38	
11/9/2010 17:22:45	11.38	
11/9/2010 17:23:00	11.37	
11/9/2010 17:23:15	11.45	
11/9/2010 17:23:30	13.18	
11/9/2010 17:23:45	16.03	
11/9/2010 17:24:00	17.54	
11/9/2010 17:24:15	17.98	
11/9/2010 17:24:30	18.08	
11/9/2010 17:24:45	18.10	
11/9/2010 17:25:00	18.11	Target 1: Trial 1
11/9/2010 17:25:15	18.11	18.0% Oxygen Injection
11/9/2010 17:25:30	18.11	18.11 % Oxygen
11/9/2010 17:25:45	18.11	
11/9/2010 17:26:00	18.12	

11/9/2010 17:26:15	18.12	
11/9/2010 17:26:30	18.12	
11/9/2010 17:26:45	18.12	
11/9/2010 17:27:00	17.82	
11/9/2010 17:27:15	14.83	
11/9/2010 17:27:30	11.20	
11/9/2010 17:27:45	9.58	
11/9/2010 17:28:00	9.19	
11/9/2010 17:28:15	9.10	Target 2: Trial 1
11/9/2010 17:28:30	9.07	9.0% Oxygen Injection
11/9/2010 17:28:45	9.06	9.06 % Oxygen
11/9/2010 17:29:00	9.05	
11/9/2010 17:29:15	9.05	
11/9/2010 17:29:30	9.05	
11/9/2010 17:29:45	9.04	
11/9/2010 17:30:00	9.27	
11/9/2010 17:30:15	10.40	
11/9/2010 17:30:30	10.78	
11/9/2010 17:30:45	11.21	
11/9/2010 17:31:00	12.00	
11/9/2010 17:31:15	12.40	
11/9/2010 17:31:30	12.53	
11/9/2010 17:31:45	12.57	
11/9/2010 17:32:00	12.59	Accuracy 1
11/9/2010 17:32:15	12.60	12.61% Oxygen Injection
11/9/2010 17:32:30	12.60	12.60 % Oxygen
11/9/2010 17:32:45	12.60	
11/9/2010 17:33:00	12.60	
11/9/2010 17:33:15	12.60	
11/9/2010 17:33:30	12.61	
11/9/2010 17:33:45	13.66	
11/9/2010 17:34:00	15.95	
11/9/2010 17:34:15	17.41	
11/9/2010 17:34:30	17.95	
11/9/2010 17:34:45	18.08	
11/9/2010 17:35:00	18.10	Target 1: Trial 2
11/9/2010 17:35:15	18.10	18.0% Oxygen Injection
11/9/2010 17:35:30	18.10	18.10 % Oxygen
11/9/2010 17:35:45	18.10	
11/9/2010 17:36:00	18.10	
11/9/2010 17:36:15	18.10	
11/9/2010 17:36:30	18.10	
11/9/2010 17:36:45	17.94	
11/9/2010 17:37:00	15.34	
11/9/2010 17:37:15	11.56	
11/9/2010 17:37:30	9.68	
11/9/2010 17:37:45	9.19	
11/9/2010 17:38:00	9.08	
11/9/2010 17:38:15	9.06	Target 2: Trial 2
11/9/2010 17:38:30	9.05	9.0% Oxygen Injection
11/9/2010 17:38:45	9.04	9.04 % Oxygen
11/9/2010 17:39:00	9.04	
11/9/2010 17:39:15	9.04	
11/9/2010 17:39:30	9.03	
11/9/2010 17:39:45	9.05	
11/9/2010 17:40:00	9.98	

11/9/2010 17:40:15	11.63	
11/9/2010 17:40:30	12.34	
11/9/2010 17:40:45	12.52	
11/9/2010 17:41:00	12.57	
11/9/2010 17:41:15	12.59	Accuracy 2
11/9/2010 17:41:30	12.60	12.61% Oxygen Injection
11/9/2010 17:41:45	12.60	12.60 % Oxygen
11/9/2010 17:42:00	12.60	
11/9/2010 17:42:15	12.60	
11/9/2010 17:42:30	12.60	
11/9/2010 17:42:45	12.61	
11/9/2010 17:43:00	13.70	
11/9/2010 17:43:15	15.90	
11/9/2010 17:43:30	17.37	
11/9/2010 17:43:45	17.94	
11/9/2010 17:44:00	18.08	
11/9/2010 17:44:15	18.10	
11/9/2010 17:44:30	18.11	
11/9/2010 17:44:45	18.11	
11/9/2010 17:45:00	18.10	Target 1: Trial 3
11/9/2010 17:45:15	18.10	18.0% Oxygen Injection
11/9/2010 17:45:30	18.10	18.10 % Oxygen
11/9/2010 17:45:45	18.11	
11/9/2010 17:46:00	18.10	
11/9/2010 17:46:15	18.10	
11/9/2010 17:46:30	18.11	
11/9/2010 17:46:45	17.77	
11/9/2010 17:47:00	14.72	
11/9/2010 17:47:15	11.12	
11/9/2010 17:47:30	9.54	
11/9/2010 17:47:45	9.16	
11/9/2010 17:48:00	9.08	
11/9/2010 17:48:15	9.06	Target 2: Trial 3
11/9/2010 17:48:30	9.05	9.0% Oxygen Injection
11/9/2010 17:48:45	9.04	9.04 % Oxygen
11/9/2010 17:49:00	9.03	
11/9/2010 17:49:15	9.03	
11/9/2010 17:49:30	9.03	
11/9/2010 17:49:45	9.03	
11/9/2010 17:50:00	9.20	
11/9/2010 17:50:15	10.73	
11/9/2010 17:50:30	12.02	
11/9/2010 17:50:45	12.45	
11/9/2010 17:51:00	12.55	
11/9/2010 17:51:15	12.59	
11/9/2010 17:51:30	12.60	Accuracy 3
11/9/2010 17:51:45	12.60	12.61% Oxygen Injection
11/9/2010 17:52:00	12.60	12.60 % Oxygen
11/9/2010 17:52:15	12.60	
11/9/2010 17:52:30	12.60	
11/9/2010 17:52:45	12.60	



CEM Calibration Error Data Sheet

Analyzer Response

Plant Name:	MPC LP	ANALYZER SPAN VALUE (% or ppm)
Sampling Location:	FCCU Scrubber Stack	SO ₂ : 50
Date:	11/10/2010	O ₂ : 10.0
Plant Rep.:	Stacey Stephens	CO ₂ : 20.0
Team Leader:	Steve Flaherty	CO: 100
CEM Operator:	Steve Flaherty	NO _x : 100
Time:	Pre-Test Cals	

	CYLINDER NUMBER	CYLINDER VALUE (% or ppm)	ANALYZER CALIBRATION RESPONSE	DIFFERENCE (% OF GAS/SPAN)
SO ₂ Zero	ALM-038190: N2	0.00	-0.06	-0.12
SO ₂ Mid	ALM-038130: 91.60ppm	25.00	24.95	-0.11
SO ₂ High	ALM-038130: 91.60ppm	50.00	50.37	0.74

O ₂ Zero	ALM-038190: N2	0.00	-0.06	-0.57
O ₂ Mid	ALM-008601: 22.6%	5.00	5.01	0.11
O ₂ High	ALM-008601: 22.6%	10.00	10.01	0.07

CO ₂ Zero	ALM-038190: N2	0.00	0.05	0.24
CO ₂ Mid	ALM-008601: 22.4%	10.00	9.98	-0.02
CO ₂ High	ALM-008601: 22.4%	20.00	19.96	-0.21

CO Zero	ALM-038190: N2	0.00	0.33	0.33
CO Mid	ALM-054584: 898.7 ppm	50.00	50.16	0.16
CO High	ALM-054584: 898.7 ppm	100.00	99.85	-0.15

NO _x Zero	ALM-038190: N2	0.00	-0.51	-0.51
NO _x Mid	ALM-053896: 890.1 ppm	50.00	49.89	-0.11
NO _x High	ALM-053896: 890.1 ppm	100.00	100.08	0.08

Additional cylinders used:

NO ₂ Cylinder	ALM-045275	49.17 ppm
Method 205 (oxygen)	ALM-014480	12.61%

CEM CALIBRATION DATA System Bias and Drift

Plant Name: MPC LP
 Sampling Location: FCOU Scrubber Stack
 CEM Operator: Steve Flaherty

Plant Rep: Stacey Stephens
 Proj. Mgr.: Steve Flaherty

Analyzer Span Value (% or ppm)
 SO₂ 50 ppm
 CO 100 ppm
 O₂ 10 %
 CO₂ 20 %
 NOx 100 ppm

	RA-1				RA-2				RA-3				RA-4				RA-5				RA-6			
	11/10/2010				11/10/2010				11/10/2010				11/10/2010				11/10/2010				11/10/2010			
	Pretest	Posttest	Drift		Pretest	Posttest	Drift		Pretest	Posttest	Drift		Pretest	Posttest	Drift		Pretest	Posttest	Drift		Pretest	Posttest	Drift	
SO ₂	-0.12	0.22	0.34		-0.12	0.22	0.34		-0.12	0.22	0.34		0.22	0.66	0.44		0.22	0.66	0.44		0.22	0.66	0.44	
Zero Bias, % of Span	-0.23	0.44	0.67		-0.23	0.44	0.67		-0.23	0.44	0.67		0.44	1.32	0.88		0.44	1.32	0.88		0.44	1.32	0.88	
Cal. Error Response, ppm	24.95	24.95			24.95	24.95			24.95	24.95			24.95	24.95			24.95	24.95			24.95	24.95		
System Response, ppm	24.89	24.93	0.04		24.89	24.93	0.04		24.89	24.93	0.04		24.89	24.93	0.04		24.89	24.93	0.04		24.89	24.93	0.04	
Cal Bias, % of Span	-0.10	-0.03	0.08		-0.10	-0.03	0.08		-0.10	-0.03	0.08		-0.03	-0.13	-0.10		-0.03	-0.13	-0.10		-0.03	-0.13	-0.10	
O ₂	-0.04	-0.06	-0.02		-0.04	-0.06	-0.02		-0.04	-0.06	-0.02		-0.06	-0.04	0.02		-0.06	-0.04	0.02		-0.06	-0.04	0.02	
Zero Bias, % of Span	-0.39	-0.62	-0.23		-0.39	-0.62	-0.23		-0.39	-0.62	-0.23		-0.39	-0.62	-0.23		-0.39	-0.62	-0.23		-0.39	-0.62	-0.23	
Cal. Error Response, %	5.01	5.01			5.01	5.01			5.01	5.01			5.01	5.01			5.01	5.01			5.01	5.01		
System Response, %	4.95	4.95	0.00		4.95	4.95	0.00		4.95	4.95	0.00		4.95	4.97	0.02		4.95	4.97	0.02		4.95	4.97	0.02	
Cal Bias, % of Span	-0.64	-0.65	-0.01		-0.64	-0.65	-0.01		-0.64	-0.65	-0.01		-0.65	-0.41	0.24		-0.65	-0.41	0.24		-0.65	-0.41	0.24	
CO ₂	0.04	0.07	0.03		0.04	0.07	0.03		0.04	0.07	0.03		0.07	0.08	0.01		0.07	0.08	0.01		0.07	0.08	0.01	
Zero Bias, % of Span	0.22	0.35	0.13		0.22	0.35	0.13		0.22	0.35	0.13		0.35	0.38	0.03		0.35	0.38	0.03		0.35	0.38	0.03	
Cal. Error Response, %	9.98	9.98			9.98	9.98			9.98	9.98			9.98	9.98			9.98	9.98			9.98	9.98		
System Response, %	9.87	9.89	0.02		9.87	9.89	0.02		9.87	9.89	0.02		9.89	9.85	-0.04		9.89	9.85	-0.04		9.89	9.85	-0.04	
Cal Bias, % of Span	-0.51	-0.42	0.09		-0.51	-0.42	0.09		-0.51	-0.42	0.09		-0.42	-0.64	-0.22		-0.42	-0.64	-0.22		-0.42	-0.64	-0.22	
CO	0.46	0.15	-0.31		0.46	0.15	-0.31		0.46	0.15	-0.31		0.15	-0.09	-0.24		0.15	-0.09	-0.24		0.15	-0.09	-0.24	
Zero Bias, % of Span	0.46	0.15	-0.31		0.46	0.15	-0.31		0.46	0.15	-0.31		0.15	-0.09	-0.24		0.15	-0.09	-0.24		0.15	-0.09	-0.24	
Cal. Error Response, ppm	50.16	50.16			50.16	50.16			50.16	50.16			50.16	50.16			50.16	50.16			50.16	50.16		
System Response, ppm	49.83	48.82	-1.01		49.83	48.82	-1.01		49.83	48.82	-1.01		48.82	48.62	-0.20		48.82	48.62	-0.20		48.82	48.62	-0.20	
Cal Bias, % of Span	-0.33	-1.34	-1.01		-0.33	-1.34	-1.01		-0.33	-1.34	-1.01		-1.34	-1.54	-0.20		-1.34	-1.54	-0.20		-1.34	-1.54	-0.20	
NO _x	-0.48	-0.32	0.16		-0.48	-0.32	0.16		-0.48	-0.32	0.16		-0.32	0.65	0.97		-0.32	0.65	0.97		-0.32	0.65	0.97	
Zero Bias, % of Span	-0.48	-0.32	0.16		-0.48	-0.32	0.16		-0.48	-0.32	0.16		-0.32	0.65	0.97		-0.32	0.65	0.97		-0.32	0.65	0.97	
Cal. Error Response, ppm	49.89	49.89			49.89	49.89			49.89	49.89			49.89	49.89			49.89	49.89			49.89	49.89		
System Response, %	50.48	50.15	-0.34		50.48	50.15	-0.34		50.48	50.15	-0.34		50.15	49.35	-0.80		50.15	49.35	-0.80		50.15	49.35	-0.80	
Cal Bias, % of Span	0.60	0.26	-0.34		0.60	0.26	-0.34		0.60	0.26	-0.34		0.26	-0.54	-0.80		0.26	-0.54	-0.80		0.26	-0.54	-0.80	

CEM CALIBRATION DATA (cont.) System Bias and Drift

Plant Name:		MPC LP	
Sampling Location:		FCCU Scrubber Stack	
CEM Operator		Steve Flaherty	
Plant Rep: Stacey Stephens		Proj. Mgr.: Steve Flaherty	
Analyzer Span Value (% or ppm)		20 %	
SO ₂	50 ppm	NOx	100 ppm
CO	100 ppm		
O ₂	10 %		

	RA-7				RA-8				RA-9			
	11/10/2010				11/10/2010				11/10/2010			
	Pretest	Posttest	Drift		Pretest	Posttest	Drift		Pretest	Posttest	Drift	
SO ₂	0.66	0.68	0.02		0.66	0.68	0.02		0.66	0.68	0.02	
Zero Bias, % of Span	1.32	1.36	0.04		1.32	1.36	0.04		1.32	1.36	0.04	
Cal. Error Response, ppm	24.95	24.95			24.95	24.95			24.95	24.95		
System Response, ppm	24.88	24.10	-0.78		24.88	24.10	-0.78		24.88	24.10	-0.78	
Cal Bias, % of Span	-0.13	-1.70	-1.57		-0.13	-1.70	-1.57		-0.13	-1.70	-1.57	
Zero, %	-0.04	-0.03	0.00		-0.04	-0.03	0.00		-0.04	-0.03	0.00	
Zero Bias, % of Span	-0.38	-0.35	0.03		-0.38	-0.35	0.03		-0.38	-0.35	0.03	
Cal. Error Response, %	5.01	5.01			5.01	5.01			5.01	5.01		
System Response, %	4.97	5.00	0.03		4.97	5.00	0.03		4.97	5.00	0.03	
Cal Bias, % of Span	-0.41	-0.09	0.32		-0.41	-0.09	0.32		-0.41	-0.09	0.32	
Zero, %	0.08	0.07	-0.01		0.08	0.07	-0.01		0.08	0.07	-0.01	
Zero Bias, % of Span	0.38	0.34	-0.04		0.38	0.34	-0.04		0.38	0.34	-0.04	
Cal. Error Response, %	9.98	9.98			9.98	9.98			9.98	9.98		
System Response, %	9.85	9.91	0.06		9.85	9.91	0.06		9.85	9.91	0.06	
Cal Bias, % of Span	-0.64	-0.36	0.28		-0.64	-0.36	0.28		-0.64	-0.36	0.28	
Zero, ppm	-0.09	0.77	0.86		-0.09	0.77	0.86		-0.09	0.77	0.86	
Zero Bias, % of Span	-0.09	0.77	0.86		-0.09	0.77	0.86		-0.09	0.77	0.86	
Cal. Error Response, ppm	50.16	50.16			50.16	50.16			50.16	50.16		
System Response, ppm	48.62	48.12	-0.50		48.62	48.12	-0.50		48.62	48.12	-0.50	
Cal Bias, % of Span	-1.54	-2.04	-0.50		-1.54	-2.04	-0.50		-1.54	-2.04	-0.50	
Zero, %	0.65	-0.30	-0.95		0.65	-0.30	-0.95		0.65	-0.30	-0.95	
Zero Bias, % of Span	0.65	-0.30	-0.95		0.65	-0.30	-0.95		0.65	-0.30	-0.95	
Cal. Error Response, ppm	49.89	49.89			49.89	49.89			49.89	49.89		
System Response, %	49.35	49.89	0.54		49.35	49.89	0.54		49.35	49.89	0.54	
Cal Bias, % of Span	-0.54	0.00	0.54		-0.54	0.00	0.54		-0.54	0.00	0.54	

Interference Response

Analyzer Type: Oxygen (O₂)
 Manufacturer: Servomex
 Detector Type: Paramagnetic
 Model No.: 1440
 Serial No.: 1420C/2765
 Calibration Span (%): 11.27

Test Gas	Test Gas Conc.	High Standard		Zero		Maximum % Interference
		O ₂ without Interferent	O ₂ with Interferent	Zero without Interferent	Zero with Interferent	
NH ₃	10 ppm	11.27	11.27	0.03	0.01	0.18
SO ₂	20 ppm	11.25	11.25	0.01	0.01	0.00
CH ₄	50 ppm	11.24	11.25	0.02	0.04	0.18
CO	50 ppm	11.23	11.24	0.00	0.01	0.09
CO ₂	5%	11.23	11.26	0.00	-0.01	0.27
CO ₂	12.55%	11.25	11.27	0.03	-0.02	0.44
NO ₂	15 ppm	11.22	11.24	0.01	0.00	0.18
NO _x	15 ppm	11.22	11.25	0.01	0.01	0.27
H ₂	1,020 ppm	11.24	11.23	0.02	0.01	0.09
HCl	10 ppm	11.29	11.31	0.00	-0.01	0.18

Sum of the highest absolute value obtained with and without the pollutant present: 1.88 %
 Allowable interference response: 2.5 %

Certification Date: 8/9/2006

Operator: 

Interference Response

Analyzer Type: Carbon Dioxide (CO₂)
 Manufacturer: Servomex
 Detector Type: NDIR
 Model No.: 1440
 Serial No.: 1415C
 Calibration Span (%): 11.41

Test Gas	Test Gas Conc.	High Standard			Zero			Maximum % Interference
		CO ₂ without interferent	CO ₂ with interferent	% Interference	Zero without interferent	Zero with interferent	% Interference	
NH ₃	10 ppm	11.41	11.39	-0.18	0.01	0.01	0.00	0.18
SO ₂	20 ppm	11.37	11.37	0.00	0.01	0.01	0.00	0.00
CH ₄	50 ppm	11.37	11.37	0.00	0.01	0.01	0.00	0.00
CO	50 ppm	11.41	11.41	0.00	0.01	0.01	0.00	0.00
NO ₂	15 ppm	11.37	11.37	0.00	0.01	0.01	0.00	0.00
NO _x	15 ppm	11.37	11.37	0.00	0.01	0.01	0.00	0.00
H ₂	1,020 ppm	11.37	11.37	0.00	0.01	0.01	0.00	0.00
HCl	10 ppm	11.41	11.38	-0.26	0.01	0.01	0.00	0.26

Sum of the highest absolute value obtained with and without the pollutant present: 0.44 %
 Allowable interference response: 2.5 %

Certification Date: 8/9/2006
 Operator: *[Signature]*


Interference Response

Analyzer Type: Sulfur Dioxide (SO₂)
 Manufacturer: Bivar Engineered Products (Western Research)
 Detector Type: Pulsed Fluorescence
 Model No.: 721-ATM
 Serial No.: 92-721ATM-7947-1-1
 Calibration Span (%): 100

Test Gas	Test Gas Conc.	High Standard		Zero		Maximum % Interference
		SO ₂ without interferent	SO ₂ with interferent	Zero without interferent	Zero with interferent	
NH ₃	10 ppm	100.1	100.1	0.1	0.1	0.0
CH ₄	50 ppm	102.6	103.1	0.1	0.3	0.5
CO	50 ppm	100.5	100.5	0.3	0.3	0.0
CO ₂	5%	100.9	101.1	0.1	0.1	0.2
CO ₂	12.55%	100.9	101.2	0.1	0.2	0.3
NO ₂	15 ppm	101.6	102.2	0.3	0.5	0.6
NO _x	15 ppm	101.4	101.4	0.3	0.3	0.0
H ₂	1020 ppm	100.6	100.6	0.4	0.4	0.0
HCl	10 ppm	100.8	100.6	0.1	0.3	0.2

Sum of the highest absolute value obtained with and without the pollutant present: 1.80 %
 Allowable interference response: 2.5 %

Certification Date: 8/9/2006

Operator: 


Interference Response

Analyzer Type: Carbon Monoxide (CO)
 Manufacturer: Thermo Electron Corporation
 Detector Type: Non-Dispersive Infrared (NDIR)
 Model No.: 48C
 Serial No.: 506610701
 Calibration Span (ppm): 100

Test Gas	Test Gas Conc.	High Standard		Zero		Maximum % Interference
		CO without interferent	CO with interferent	Zero without interferent	Zero with interferent	
NH ₃	10 ppm	100.0	100.0	0.0	0.0	0.0
SO ₂	20 ppm	100.0	100.0	0.0	0.3	0.3
CH ₄	50 ppm	100.0	100.0	0.0	0.1	0.1
CO ₂	5%	100.0	99.8	0.0	0.2	0.2
CO ₂	12.55%	100.0	99.6	0.0	-0.1	0.4
NO ₂	15 ppm	100.0	100.0	0.0	0.2	0.2
NO _x	15 ppm	100.0	100.0	0.0	0.2	0.2
H ₂	1020 ppm	100.0	100.0	0.0	0.1	0.1
HCl	10 ppm	100.0	100.0	0.0	0.1	0.1

Sum of the highest absolute value obtained with and without the pollutant present: 1.6 %
 Allowable interference response: 2.5 %

Certification Date: 8/10/2006

Operator: 



Model 600 HCLD NO Interference Data

Interference Response

Date of Test 7/26/2006
 Analyzer Type NO
 Model No. 600-HCLD
 Serial No. S050301
 Calibration Span 3000ppm

Test Gas Type	Concentration (ppm)	Analyzer Response	
		Wet	Dry
H2O	2.5%	0	0
CO2	5%	0	0
CO2	15%	0	0
CO	50	0	0
CH4	50	0	0
SO2	504	0	0
NH3	15	0	0
NO	N/A	N/A	N/A
N2O	9	0	0
NO2	N/A	N/A	N/A

**AIR LIQUIDE**Air Liquide America
Specialty Gases LLC**Scott™****RATA CLASS***Dual-Analyzed Calibration Standard*

1290 COMBERMERE STREET, TROY, MI 48083

Phone: 248-589-2950

Fax: 248-589-2134

CERTIFICATE OF ACCURACY: EPA Protocol Gas**Assay Laboratory**AIR LIQUIDE AMERICA SPECIALTY GASES LLC
1290 COMBERMERE STREET
TROY, MI 48083

P.O. No.: IL-273-10

Project No.: 05-90624-005

Customer

ARI ENVIRONMENTAL

951 OLD RAND ROAD #106
WAUCONDA IL 60084**ANALYTICAL INFORMATION**

This certification was performed according to EPA Traceability Protocol For Assay & Certification of Gaseous Calibration Standards; Procedure G-1; September, 1997.

Cylinder Number: ALM038130**Certification Date:** 23Aug2010**Exp. Date:** 22Aug2012**Cylinder Pressure***:** 1963 PSIG**COMPONENT**SULFUR DIOXIDE *
NITROGEN**CERTIFIED CONCENTRATION (Moles)**91.60 PPM
BALANCE**ACCURACY****

+/- 1%

TRACEABILITY

Direct NIST and VSL

*** Do not use when cylinder pressure is below 150 psig.

** Analytical accuracy is based on the requirements of EPA Protocol Procedure G1, September 1997.

REFERENCE STANDARD**TYPE/SRM NO.**

NTRM 0260 SO

EXPIRATION DATE

15Jan2012

CYLINDER NUMBER

KAL003926

CONCENTRATION

255.5 PPM

COMPONENT

SULFUR DIOXIDE

INSTRUMENTATION**INSTRUMENT/MODEL/SERIAL#**

FTIR/0928621

DATE LAST CALIBRATED

06Aug2010

ANALYTICAL PRINCIPLE

FTIR

ANALYZER READINGS

(Z = Zero Gas R = Reference Gas T = Test Gas r = Correlation Coefficient)

First Triad Analysis**Second Triad Analysis****Calibration Curve****SULFUR DIOXIDE ***

Date: 16Aug2010 Response Unit: PPM

Z1 = -0.03218 R1 = 252.5571 T1 = 90.64027

R2 = 252.9064 Z2 = -0.02211 T2 = 90.69066

Z3 = 0.04766 T3 = 90.71506 R3 = 253.2169

Avg. Concentration: 91.62 PPM

Date: 23Aug2010 Response Unit: PPM

Z1 = -0.02022 R1 = 252.6083 T1 = 90.57540

R2 = 252.6875 Z2 = -0.00592 T2 = 90.58352

Z3 = 0.06214 T3 = 90.66555 R3 = 253.0079

Avg. Concentration: 91.58 PPM

Concentration = A + Bx + Cx2 + Dx3 + Ex4

r = 9.99984E-1

Constants: A = 0.00000E+0

B = 1.00400E+0 C = 0.00000E+0

D = 0.00000E+0 E = 0.00000E+0

APPROVED BY:

JEFF CROTEAU

E-15



Air Liquide America
Specialty Gases LLC



RATA CLASS

Dual-Analyzed Calibration Standard

1290 COMBERMERE STREET, TROY, MI 48083

Phone: 248-589-2950

Fax: 248-589-2134

CERTIFICATE OF ACCURACY: EPA Protocol Gas

Assay Laboratory

AIR LIQUIDE AMERICA SPECIALTY GASES LLC
1290 COMBERMERE STREET
TROY, MI 48083

P.O. No.: IL-273-10

Project No.: 05-90624-003

Customer

ARI ENVIRONMENTAL

951 OLD RAND ROAD #106
WAUCONDA IL 60084

ANALYTICAL INFORMATION

This certification was performed according to EPA Traceability Protocol For Assay & Certification of Gaseous Calibration Standards; Procedure G-1; September, 1997.

Cylinder Number: ALM054584

Certification Date: 24Aug2010

Exp. Date: 23Aug2013

Cylinder Pressure***: 1987 PSIG

COMPONENT

CARBON MONOXIDE
NITROGEN

CERTIFIED CONCENTRATION (Moles)

898.7

PPM

BALANCE

ACCURACY**

+/- 1%

TRACEABILITY

Direct NIST and VSL

*** Do not use when cylinder pressure is below 150 psig.

** Analytical accuracy is based on the requirements of EPA Protocol Procedure G1, September 1997.

REFERENCE STANDARD

TYPE/SRM NO.

NTRM 1681

EXPIRATION DATE

02Oct2010

CYLINDER NUMBER

KAL003258

CONCENTRATION

970.1 PPM

COMPONENT

CARBON MONOXIDE

INSTRUMENTATION

INSTRUMENT/MODEL/SERIAL#

FTIR/0928621

DATE LAST CALIBRATED

23Aug2010

ANALYTICAL PRINCIPLE

FTIR

ANALYZER READINGS

(Z = Zero Gas R = Reference Gas T = Test Gas r = Correlation Coefficient)

First Triad Analysis

CARBON MONOXIDE

Date: 17Aug2010 Response Unit: PPM

Z1=0.00957 R1=970.1845 T1=897.8650

R2=970.3716 Z2=2.67084 T2=897.9047

Z3=2.81003 T3=899.5566 R3=971.0784

Avg. Concentration: 897.9 PPM

Second Triad Analysis

Date: 24Aug2010 Response Unit: PPM

Z1=-0.01462 R1=968.3855 T1=898.0323

R2=968.4412 Z2=0.69656 T2=898.7898

Z3=0.71456 T3=898.8516 R3=970.1933

Avg. Concentration: 899.5 PPM

Calibration Curve

Concentration = A + Bx + Cx² + Dx³ + Ex⁴
r = 9.99959E-1

Constants: A = 0.00000E+0

B = 9.94910E-1 C = 1.00600E-3

D = 0.00000E+0 E = 0.00000E+0

APPROVED BY:

E-16

JEFF CROTEAU

**AIR LIQUIDE**Air Liquide America
Specialty Gases LLC**Scott™****RATA CLASS***Dual-Analyzed Calibration Standard*

1290 COMBERMERE STREET, TROY, MI 48083

Phone: 248-589-2950

Fax: 248-589-2134

CERTIFICATE OF ACCURACY: EPA Protocol GasAssay LaboratoryAIR LIQUIDE AMERICA SPECIALTY GASES LLC
1290 COMBERMERE STREET
TROY, MI 48083

P.O. No.: IL-226-10

Project No.: 05-88255-001

Customer

ARI ENVIRONMENTAL, INC.

951 OLD RAND ROAD #106
WAUCONDA IL 60084**ANALYTICAL INFORMATION**

This certification was performed according to EPA Traceability Protocol For Assay & Certification of Gaseous Calibration Standards; Procedure G-1; September, 1997.

Cylinder Number: ALM053896 Certification Date: 04Jun2010 Exp. Date: 03Jun2012
Cylinder Pressure***: 1969 PSIG

COMPONENT	CERTIFIED CONCENTRATION (Moles)		ANALYTICAL ACCURACY**	TRACEABILITY
NITRIC OXIDE	890.1	PPM	+/- 1%	Direct NIST and VSL
NITROGEN - OXYGEN FREE		BALANCE		
TOTAL OXIDES OF NITROGEN	890.1	PPM		Reference Value Only

*** Do not use when cylinder pressure is below 150 psig.

** Analytical accuracy is based on the requirements of EPA Protocol Procedure G1, September 1997.

REFERENCE STANDARD

TYPE/SRM NO.	EXPIRATION DATE	CYLINDER NUMBER	CONCENTRATION	COMPONENT
NTRM 1687	02Oct2012	AAL070213	970:3 PPM	NITRIC OXIDE

INSTRUMENTATION

INSTRUMENT/MODEL/SERIAL#	DATE LAST CALIBRATED	ANALYTICAL PRINCIPLE
FTIR//0928621	13May2010	FTIR

ANALYZER READINGS

(Z = Zero Gas R = Reference Gas T = Test Gas r = Correlation Coefficient)

First Triad Analysis

Second Triad Analysis

Calibration Curve

NITRIC OXIDE

Date: 26May2010 Response Unit: PPM
Z1 = -0.06709 R1 = 247.9816 T1 = 887.6229
R2 = 248.3739 Z2 = 0.32330 T2 = 889.5824
Z3 = 1.67236 T3 = 890.2706 R3 = 248.8992
Avg. Concentration: 886.1 PPM

Date: 04Jun2010 Response Unit: PPM
Z1 = -0.27555 R1 = 963.0996 T1 = 886.4562
R2 = 963.2219 Z2 = 1.86365 T2 = 887.4162
Z3 = 1.95754 T3 = 889.2317 R3 = 963.4948
Avg. Concentration: 894.1 PPM

Concentration = A + Bx + Cx2 + Dx3 + Ex4
r = 9.99996E-1
Constants: A = 0.00000E+0
B = 5.99879E-1 C = 5.10000E-5
D = 0.00000E+0 E = 0.00000E+0

APPROVED BY:

Rob McCrandall

E-17

**AIR LIQUIDE**Air Liquide America
Specialty Gases LLC

Scott

COMPLIANCE CLASS*Dual-Analyzed Calibration Standard*

1290 COMBERMERE STREET, TROY, MI 48083

Phone: 248-589-2950

Fax: 248-589-2134

CERTIFICATE OF ACCURACY: EPA Protocol GasAssay LaboratoryP.O. No.: IL-181-10
AIR LIQUIDE AMERICA SPECIALTY GASES LLC Project No.: 05-88011-003
1290 COMBERMERE STREET
TROY, MI 48083CustomerARI ENVIRONMENTAL, INC.
951 OLD RAND ROAD #106
WAUCONDA IL 60084**ANALYTICAL INFORMATION**

This certification was performed according to EPA Traceability Protocol For Assay & Certification of Gaseous Calibration Standards; Procedure G-1; September, 1997.

Cylinder Number: ALM045275 Certification Date: 12May2010 Exp. Date: 10May2012
Cylinder Pressure***: 1200 PSIGCOMPONENTCERTIFIED CONCENTRATION (Moles)ANALYTICALACCURACY**TRACEABILITYNITROGEN DIOXIDE
NITROGEN49.17 PPM
BALANCE

+/- 2%

NIST and VSL

*** Do not use when cylinder pressure is below 150 psig.

** Analytical accuracy is based on the requirements of EPA Protocol procedures, September 1997.

REFERENCE STANDARD

<u>TYPE/SRM NO.</u>	<u>EXPIRATION DATE</u>	<u>CYLINDER NUMBER</u>	<u>CONCENTRATION</u>	<u>COMPONENT</u>
NTRM 2654	02Oct2012	AAL069467	487.0 PPM	NITROGEN DIOXIDE

INSTRUMENTATIONINSTRUMENT/MODEL/SERIAL#

AMETEK 921/921 CE NO2/AW-921-S281

DATE LAST CALIBRATED

14Apr2010

ANALYTICAL PRINCIPLE

UV

APPROVED BY:

HILARY THATCHER

E-18

Page 1 of 1

**AIR LIQUIDE**Air Liquide America
Specialty Gases LLC

Scott™

RATA CLASS*Dual-Analyzed Calibration Standard*

1290 COMBERMERE STREET, TROY, MI 48083

Phone: 248-589-2950

Fax: 248-589-2134

CERTIFICATE OF ACCURACY: EPA Protocol GasAssay LaboratoryAIR LIQUIDE AMERICA SPECIALTY GASES LLC Project No.: 05-86904-002
1290 COMBERMERE STREET
TROY, MI 48083

P.O. No.: IL-182-10

Customer

ARI ENVIRONMENTAL

951 OLD RAND ROAD #106
WAUCONDA IL 60084**ANALYTICAL INFORMATION**

This certification was performed according to EPA Traceability Protocol For Assay & Certification of Gaseous Calibration Standards; Procedure G-1; September, 1997.

Cylinder Number: ALM014480 Certification Date: 19Apr2010 Exp. Date: 18Apr2013
Cylinder Pressure***: 2000 PSIGCOMPONENTCERTIFIED CONCENTRATION (Moles)ANALYTICALACCURACY**TRACEABILITY

OXYGEN

12.61 %

+/- 1%

Direct NIST and VSL

NITROGEN

BALANCE

*** Do not use when cylinder pressure is below 150 psig.

** Analytical accuracy is based on the requirements of EPA Protocol Procedure G1, September 1997.

REFERENCE STANDARD

TYPE/SRM NO.	EXPIRATION DATE	CYLINDER NUMBER	CONCENTRATION	COMPONENT
NTRM 2350	01Dec2011	K016398	23.20 %	OXYGEN

INSTRUMENTATIONINSTRUMENT/MODEL/SERIAL#

CAI/110P/V03018

DATE LAST CALIBRATED

15Apr2010

ANALYTICAL PRINCIPLE

PARAMAGNETIC

ANALYZER READINGS

(Z=Zero Gas R=Reference Gas T=Test Gas r=Correlation Coefficient)

First Triad Analysis

Second Triad Analysis

Calibration Curve

OXYGEN

Date:	20Apr2010	Response Unit:	%
Z1=0.00000	R1=23.20000	T1=12.63000	
R2=23.20000	Z2=0.00000	T2=12.63000	
Z3=0.00000	T3=12.63000	R3=23.19000	
Avg. Concentration:	12.61	%	

Concentration = A + Bx + Cx ² + Dx ³ + Ex ⁴	
r = 0.999999356	
Constants:	A = -0.01127386
B = 1.012790021	C = 0
D = 0	E = 0

APPROVED BY: _____

E-19



Air Liquide America
Specialty Gases LLC



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

C E R T I F I C A T E O F A N A L Y S I S

ALASG
WAREHOUSE/STOCK/
UNIT A
27 FORESTWOOD COURT
ROMEDEVILLE

IL 60446

PROJECT #: 05-89539-001
PO#: GENERAL STOCK
ITEM #: 0501813 AL
DATE: 07Jul2010

CYLINDER #: ALM038190
FILL PRESSURE: 02000 PSIG

PURE MATERIAL: NITROGEN

CAS# 7727-37-9

GRADE: ZERO GAS

PURITY: 99.998%

<u>IMPURITY</u>	<u>MAXIMUM</u> <u>CONCENTRATIONS</u>	<u>ACTUAL</u> <u>CONCENTRATIONS</u>
THC	0.5 PPM	< 0.5 PPM

QC BATCH : NITFILL070710

ANALYST: SAJAD HYDER

E-20

**AIR LIQUIDE**Air Liquide America
Specialty Gases LLC**Scott™****RATA CLASS***Dual-Analyzed Calibration Standard*

1290 COMBERMERE STREET, TROY, MI 48083

Phone: 248-589-2950

Fax: 248-589-2134

CERTIFICATE OF ACCURACY: EPA Protocol Gas**Assay Laboratory**AIR LIQUIDE AMERICA SPECIALTY GASES LLC
1290 COMBERMERE STREET
TROY, MI 48083

P.O. No.: IL-273-10

Project No.: 05-90624-001

Customer

ARI ENVIRONMENTAL

951 OLD RAND ROAD #106
WAUCONDA IL 60084**ANALYTICAL INFORMATION**

This certification was performed according to EPA Traceability Protocol For Assay & Certification of Gaseous Calibration Standards; Procedure G-1; September, 1997.

Cylinder Number: ALM008601**Certification Date:** 20Aug2010**Exp. Date:** 19Aug2013**Cylinder Pressure***:** 2015 PSIG

COMPONENT	CERTIFIED CONCENTRATION (Moles)	ACCURACY**	TRACEABILITY
CARBON DIOXIDE	22.4 %	+/- 1%	Direct NIST and VSL
OXYGEN	22.6 %	+/- 1%	Direct NIST and VSL
NITROGEN	BALANCE		

*** Do not use when cylinder pressure is below 150 psig.

** Analytical accuracy is based on the requirements of EPA Protocol Procedure G1, September 1997.

REFERENCE STANDARD

TYPE/SRM NO.	EXPIRATION DATE	CYLINDER NUMBER	CONCENTRATION	COMPONENT
NTRM 2300	01Nov2010	K026052	23.04 %	CARBON DIOXIDE
NTRM 2350	01Dec2011	K016398	23.20 %	OXYGEN

INSTRUMENTATION**INSTRUMENT/MODEL/SERIAL#**PIR/2000/609015
CAI/110P/V03018**DATE LAST CALIBRATED**09Aug2010
12Aug2010**ANALYTICAL PRINCIPLE**NDIR
PARAMAGNETIC**ANALYZER READINGS**

(Z=Zero Gas R=Reference Gas T=Test Gas r=Correlation Coefficient)

First Triad Analysis**Second Triad Analysis****Calibration Curve****CARBON DIOXIDE**

Date: 20Aug2010 Response Unit: MV

Z1=0.00000 R1=100.0000 T1=98.62000

R2=100.0000 Z2=0.00000 T2=98.62000

Z3=0.00000 T3=98.62000 R3=100.0000

Avg. Concentration: 22.41 %

Concentration = A + Bx + Cx2 + Dx3 + Ex4
r = 0.999999

Constants: A = -0.004875

B = 0.130077 C = -0.000089

D = 0.000011 E = 0.000000

OXYGEN

Date: 20Aug2010 Response Unit: MV

Z1=0.00000 R1=23.20000 T1=22.61000

R2=23.20000 Z2=0.00000 T2=22.61000

Z3=0.00000 T3=22.61000 R3=23.20000

Avg. Concentration: 22.61 %

Concentration = A + Bx + Cx2 + Dx3 + Ex4
r = 0.999999

Constants: A = 0.004953

B = 0.999856 C = 0.000000

D = 0.000000 E = 0.000000

APPROVED BY:

ROBERT MCCRANDALL

E-21



Marathon Petroleum Company LP: Robinson, IL
FCCU Flue Gas Scrubber
Test Date: 11/10/10

APPENDIX F

Test Program Qualifications



Test Program Qualifications

ARI Environmental's offices in Wauconda, Illinois and Pasadena, Texas specialize in conducting stack emission, fugitive leak detection, ambient air and in-plant OSHA type testing for industrial clients.

ARI is organized so that its facilities and resources meet the requirements of ASTM D7036, Standard Practice for Competence of Air Emission Testing Bodies. ARI's laboratories in Pasadena, Texas and Wauconda, Illinois hold TCEQ NELAP Certificate No. T104704428-8A-TX.

During the past 27 years, ARI personnel have conducted over 5,000 separate stack emission tests for a variety of industrial clients throughout North America for the determination of degree of source compliance and to yield emissions data and control equipment performance data for in-house engineering purposes.

ARI presently has over 80 trained personnel for conducting source emission sampling, fugitive leak detection monitoring, ambient air monitoring and OSHA sampling programs. All test programs are supervised and conducted by onsite Qualified Individuals (QI) and/or Qualified Source Testing Individuals (QSTI) pursuant to ASTM D7036.

The key personnel involved in the test program were as follows:

Steven Flaherty

Mr. Flaherty is a Senior Project Manager with ARI. His 10 years experience includes emission compliance and CEM certification testing for a wide variety of industries including petrochemical, steel mills, electric utilities, cement plants, asphalt plants and general manufacturing plants. Mr. Flaherty is presently certified as a QSTI by the Source Evaluation Society (SES) pursuant to the requirements of ASTM D7036-04.

Ryan Mahoney

Mr. Mahoney is a field technician specializing in sampling equipment preparation, maintenance and calibration, equipment setup, field sampling, sample recovery, and posttest equipment clean up.

Bill Flaherty

Mr. Flaherty is a field technician specializing in sampling equipment preparation, maintenance and calibration, equipment setup, field sampling, sample recovery, and posttest equipment clean up.

SOURCE EVALUATION SOCIETY



Qualified Source Testing Individual


LET IT BE KNOWN THAT

STEVEN M. FLAHERTY

HAS SUCCESSFULLY PASSED A COMPREHENSIVE EXAMINATION AND SATISFIED
EXPERIENCE REQUIREMENTS IN ACCORDANCE WITH THE GUIDELINES
ISSUED BY THE SES QUALIFIED SOURCE TEST INDIVIDUAL REVIEW BOARD FOR

**MANUAL GAS VOLUME MEASUREMENTS AND ISOKINETIC PARTICULATE
SAMPLING METHODS**

ISSUED THIS 26TH DAY OF NOVEMBER 2008 AND EFFECTIVE UNTIL NOVEMBER 25TH, 2013

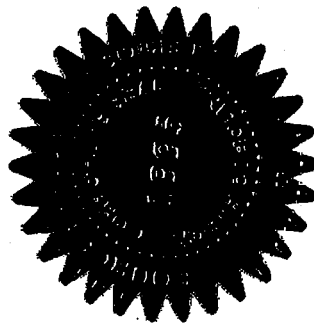

Peter R. Westlin, QSTI/QSTO Review Board


Peter S. Pakalnis, QSTI/QSTO Review Board

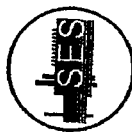

C. David Bagwell, QSTI/QSTO Review Board


John R. Smith, QSTI/QSTO Review Board

APPLICATION
NO.
2008-237



SOURCE EVALUATION SOCIETY



Qualified Source Testing Individual

LET IT BE KNOWN THAT


STEVEN M. FLAHERTY


HAS SUCCESSFULLY PASSED A COMPREHENSIVE EXAMINATION AND SATISFIED
EXPERIENCE REQUIREMENTS IN ACCORDANCE WITH THE GUIDELINES
ISSUED BY THE SES QUALIFIED SOURCE TEST INDIVIDUAL REVIEW BOARD FOR

MANUAL GASEOUS POLLUTANTS SOURCE SAMPLING METHODS

ISSUED THIS 26TH DAY OF NOVEMBER 2008 AND EFFECTIVE UNTIL NOVEMBER 25TH, 2013

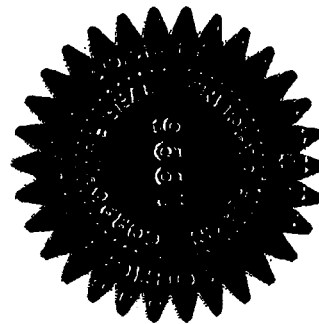

Peter R. Westlin, QST/IQSTO Review Board


Peter S. Pakalnis, QST/IQSTO Review Board

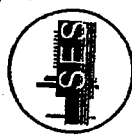

C. David Bagwell, QST/IQSTO Review Board


John R. Smith, QST/IQSTO Review Board

APPLICATION
NO.
2008-237



SOURCE EVALUATION SOCIETY



Qualified Source Testing Individual


LET IT BE KNOWN THAT


STEVEN M. FLAHERTY


HAS SUCCESSFULLY PASSED A COMPREHENSIVE EXAMINATION AND SATISFIED
EXPERIENCE REQUIREMENTS IN ACCORDANCE WITH THE GUIDELINES
ISSUED BY THE SES QUALIFIED SOURCE TEST INDIVIDUAL REVIEW BOARD FOR


GASEOUS POLLUTANTS INSTRUMENTAL SAMPLING METHODS

ISSUED THIS 26TH DAY OF NOVEMBER 2008 AND EFFECTIVE UNTIL NOVEMBER 25TH, 2013

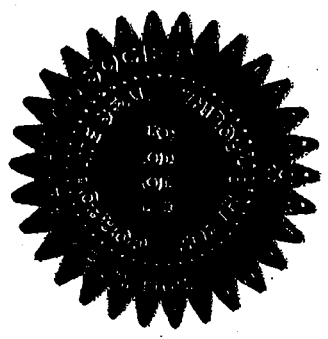

Peter R. Westlin, QSTI/QSTO Review Board


Peter S. Pakainis, QSTI/QSTO Review Board


C. David Bagwell, QSTI/QSTO Review Board


John R. Smith, QSTI/QSTO Review Board

APPLICATION
NO.
2008-237



MONITOR DATA

I

I hereby certify that all pages contained within this Appendix have been reviewed and, to the best of my ability, verified accurate.

QA/QC Initials: SB

Date: 9/14



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Marathon Petroleum Company
CleanAir Project No. 11265
Robinson Refinery
FCCU Scrubber Stack

Date: **July 13, 2011**
Start Time 7:13
Stop Time 9:22

CALIBRATION ERROR

Channel 3	Channel 4
O2	CO2
FCCU	FCCU
Scrubber	Scrubber
%dv	%dv

Instrument Information

Manufacturer:	M&C	Servomex
Model:	PMA22	1415B
Detection:	Paramagn.	NDIR
Asset or Serial No:	207361	207364

Calibration Span Value (CS)

21.100	20.800
--------	--------

System Response Time (seconds)

60	60
----	----

Manufacturer Certified Cylinder Value (C_v)

Zero	0.000	0.000
Low		
Mid	10.200	9.930
High	21.100	20.800

Actual gas to be used for bias checks

10.200	9.930
--------	-------

Cylinder ID

Zero		
Low		
Mid	ALM9165	ALM9165
High	ALM20472	ALM20472

Analyzer Calibration Response (C_{Dir})

Zero	-0.021	0.004
Low		
Mid	10.125	9.943
High	21.115	20.826

Analyzer Calibration Error (ACE) (Limit = 2%, Method 25A limit = 5% of gas value)

Zero	-0.1%	0.0%
Low	N/A	N/A
Mid	-0.4%	0.1%
High	0.1%	0.1%

Calibration Error Status

Zero	OK	OK
Low	N/A	N/A
Mid	OK	OK
High	OK	OK

090911 135030

07:13:29	0.053	-0.007
07:13:29	0.053	-0.007
07:13:44	0.053	-0.008
07:13:59	0.040	-0.002
07:14:14	-0.045	0.004
07:14:29	-0.032	0.012
07:14:44	-0.005	0.007

Marathon Petroleum Company
CleanAir Project No. 11265
Robinson Refinery
FCCU Scrubber Stack

Date: **July 13, 2011**
Start Time 7:13
Stop Time 9:22

CALIBRATION ERROR

	Channel 3	Channel 4	
	O2	CO2	
	FCCU	FCCU	
	Scrubber	Scrubber	
	%dv	%dv	
07:14:59	5.853	2.967	
07:15:14	20.547	19.858	
07:15:29	21.111	20.947	
07:15:44	21.130	20.980	
07:15:59	21.136	20.998	
07:16:14	21.136	21.002	
07:16:29	21.153	20.872	
07:16:44	21.203	20.863	
07:16:59	21.200	20.865	
07:17:14	21.202	20.869	
07:17:29	21.171	20.856	
07:17:44	21.162	20.815	
07:17:59	21.166	20.818	
07:18:14	21.152	20.821	
07:18:29	21.135	20.825	
07:18:44	21.109	20.826	high o2 co2
07:18:59	21.115	20.826	
07:19:14	21.120	20.826	
07:19:29	19.085	19.324	
07:19:44	10.955	10.884	
07:19:59	10.155	9.980	
07:20:14	10.131	9.953	
07:20:29	10.128	9.950	
07:20:44	9.515	9.774	
07:20:59	9.844	9.521	
07:21:14	10.126	9.943	
07:21:29	10.126	9.945	low o2 co2
07:21:44	10.126	9.943	
07:21:59	10.124	9.942	
07:22:14	10.123	9.941	
07:22:29	9.177	9.757	
07:22:44	10.124	9.941	
07:22:59	10.122	9.941	
07:23:14	9.549	9.756	
07:23:29	1.479	2.028	
07:23:44	0.021	0.080	
07:23:59	-0.009	0.019	
07:24:14	-0.013	0.022	
07:24:29	-0.016	0.018	
07:24:44	-0.017	0.009	
07:24:59	-0.017	0.013	
07:25:14	-0.018	0.022	
07:25:29	-0.020	0.014	zero o2 co2
07:25:44	-0.021	-0.003	
07:25:59	-0.021	0.002	
07:26:14	-0.020	0.007	
07:26:29	-0.015	0.012	
07:26:44	-0.023	-0.005	
07:26:59	-0.023	-0.018	

Marathon Petroleum Company
CleanAir Project No. 11265
Robinson Refinery
FCCU Scrubber Stack

Date: **July 13, 2011**
Start Time 7:13
Stop Time 9:22

CALIBRATION ERROR

	Channel 3	Channel 4
	O2	CO2
	FCCU	FCCU
	Scrubber	Scrubber
	%dv	%dv
07:27:14	-0.024	0.015
07:27:29	-0.023	0.003
07:27:44	-0.022	0.002
07:27:59	-0.024	0.003
07:28:14	-0.024	0.002
07:28:29	-0.023	-0.004
07:28:44	-0.024	0.013
07:28:59	-0.024	-0.004
07:29:14	-0.024	0.007
07:29:29	-0.024	-0.004
07:29:44	-0.024	0.007
07:29:59	-0.023	0.001
07:30:14	0.107	0.001
07:30:29	15.166	12.749
07:30:44	20.974	20.582
07:30:59	21.112	20.790
07:31:14	21.119	20.809
07:31:29	21.124	20.815
07:31:44	21.124	20.824
07:31:59	21.125	20.830
07:32:14	21.129	20.829
07:32:29	21.135	20.834
07:32:44	21.131	20.835
07:32:59	21.132	20.834
07:33:14	21.131	20.838
07:33:29	21.128	20.837
07:33:44	21.130	20.840
07:33:59	21.135	20.842
07:34:14	21.129	20.841
07:34:29	20.952	20.840
07:34:44	4.973	6.865
07:34:59	0.071	0.219
07:35:14	-0.002	0.065
07:35:29	-0.010	0.030
07:35:44	-0.013	0.022
07:35:59	-0.017	0.034
07:36:14	-0.018	0.024
07:36:29	-0.018	0.026
07:36:44	-0.018	0.002
07:36:59	-0.018	0.029
07:37:14	0.162	0.126
07:37:29	0.015	0.055
07:37:44	-0.019	0.019
07:37:59	-0.022	0.024
07:38:14	-0.022	0.013
07:38:29	-0.024	0.012
07:38:44	-0.023	0.011
07:38:59	-0.022	0.005
07:39:14	-0.024	0.010

Marathon Petroleum Company
CleanAir Project No. 11265
Robinson Refinery
FCCU Scrubber Stack

Date: **July 13, 2011**
Start Time 7:13
Stop Time 9:22

CALIBRATION ERROR

	Channel 3	Channel 4
	O2	CO2
	FCCU	FCCU
	Scrubber	Scrubber
	%dv	%dv
07:39:29	-0.024	0.010
07:39:44	-0.025	-0.003
07:39:59	5.217	0.013
07:40:14	19.543	0.066
07:40:29	20.685	0.067
07:40:44	19.812	0.060
07:40:59	20.339	0.024
07:41:14	20.371	0.017
08:42:53	20.317	0.012
08:43:08	20.315	0.005
09:16:34	20.452	0.007
09:16:49	20.454	0.007
09:17:04	20.454	-0.004
09:17:19	20.456	0.001
09:17:34	20.456	0.001
09:17:49	20.566	0.013
09:18:04	20.783	0.007
09:18:19	20.801	-0.010
09:18:34	20.802	0.002
09:18:49	20.804	0.013
09:19:04	20.804	0.014
09:19:19	20.787	0.008
09:19:34	20.696	0.008
09:19:49	20.663	-0.002
09:20:04	20.669	0.008
09:20:19	20.658	0.008
09:20:34	20.657	-0.009
09:20:49	20.663	0.009
09:21:04	20.660	-0.007
09:21:19	20.597	-0.008
09:21:34	20.489	0.014
09:21:49	20.479	-0.004
09:22:04	20.496	-0.002
09:22:19	20.507	0.010
09:22:34	20.513	0.003
09:22:49	20.529	0.004

Marathon Petroleum Company
CleanAir Project No. 11265
Robinson Refinery
FCCU Scrubber Stack

July 13, 2011
Start Time 8:34
Stop Time 9:22

CALIBRATION BIAS 00

Channel 3	Channel 4
O2	CO2
FCCU	FCCU
Scrubber	Scrubber
%dv	%dv

System Response to Calibration Gasses (C_s)

C _{of} Zero gas	0.013	0.005
C _{uf} Upscale gas	10.128	9.862

Analyzer Calibration Error Responses (C_{Dir})

C _{oce} Zero gas	-0.021	0.004
C _{mce} Upscale gas	10.125	9.943

Actual Upscale Gas Value (C_{MA})

C _{ma} Upscale gas	10.200	9.930
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Calibration Span Value (CS)

21.100	20.800
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System Bias as Percent of Calibration Span Value (SB) (5%)

Zero gas	0.2%	0.0%
Upscale gas	0.0%	-0.4%

System Bias Status

Zero gas	OK	OK
Upscale gas	OK	OK

Previous System Response to Calibration Gases (C_s)

C _{oi} Zero gas	N/A	N/A
C _{ui} Upscale gas	N/A	N/A

Drift Assessment as Percent of Calibration Span Value (D) (3%)

Zero gas	N/A	N/A
Upscale gas	N/A	N/A

Drift Assessment Status

Zero gas	N/A	N/A
Upscale gas	N/A	N/A

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08:34:38	19.824	0.062
08:34:53	19.052	0.046
08:34:38	19.824	0.062
08:34:53	19.052	0.046
08:35:08	5.765	0.018
08:35:23	0.271	0.003
08:35:38	0.113	-0.015
08:35:53	0.080	0.012
08:36:08	0.065	-0.005
08:36:23	0.048	0.012
08:36:38	0.055	0.001

Marathon Petroleum Company
CleanAir Project No. 11265
Robinson Refinery
FCCU Scrubber Stack

July 13, 2011
Start Time 8:34
Stop Time 9:22

CALIBRATION BIAS 00

	Channel 3	Channel 4
	O2	CO2
	FCCU	FCCU
	Scrubber	Scrubber
	%dv	%dv
08:36:53	-1.691	-3.341
08:37:08	-0.402	-10.006
08:37:23	-0.456	-15.010
08:37:38	-0.297	-10.005
08:37:53	0.014	0.012
08:38:08	0.014	0.013
08:38:23	0.010	0.002
08:38:38	0.019	0.013
08:38:53	0.006	0.007
08:39:08	0.024	0.002
08:39:23	0.012	0.008
08:39:38	0.015	0.002
08:39:53	0.016	0.003
08:40:08	0.019	-0.004
08:40:23	0.008	0.009
08:40:38	0.013	0.009
08:40:53	-0.007	0.009
08:41:08	0.013	0.009
08:41:23	3.394	-0.001
08:41:38	18.325	0.005
08:41:53	20.184	0.005
08:42:08	20.261	0.010
08:42:23	20.289	0.016
08:42:38	20.296	0.010
08:42:53	20.317	0.012
08:43:08	20.315	0.005
08:43:23	20.323	0.007
08:43:38	20.335	0.018
08:43:53	20.336	0.011
08:44:08	20.340	0.006
08:44:23	20.338	-0.005
08:44:38	20.288	0.012
08:44:53	20.077	0.006
08:45:08	20.689	0.001
08:45:23	20.708	0.012
08:45:38	20.697	0.012
08:45:53	20.706	0.006
08:46:08	20.706	-0.010
08:46:23	20.705	0.007
08:46:38	20.712	0.006
08:46:53	20.710	0.012

zero o2 co2

Marathon Petroleum Company
CleanAir Project No. 11265
Robinson Refinery
FCCU Scrubber Stack

July 13, 2011
Start Time 8:34
Stop Time 9:22

CALIBRATION BIAS 00

	Channel 3	Channel 4
	O2	CO2
	FCCU	FCCU
	Scrubber	Scrubber
	%dv	%dv
08:47:08	20.708	0.000
08:47:23	20.704	0.005
08:47:38	20.618	-0.011
08:47:53	20.530	0.007
08:48:08	20.527	0.005
08:48:23	20.533	-0.001
08:48:38	20.538	0.010
08:48:53	17.872	-0.387
08:49:08	19.510	-0.186
08:49:23	20.965	10.509
08:49:38	21.060	19.963
08:49:53	17.772	17.980
08:50:08	10.671	10.518
08:50:23	10.161	9.893
08:50:38	10.144	9.866
08:50:53	10.134	9.862
08:51:08	10.128	9.861
08:51:23	10.122	9.863
08:51:38	10.119	9.864
08:51:53	10.116	9.866
08:52:08	10.116	9.868
08:52:23	6.105	6.922
08:52:38	0.396	0.639
08:52:53	0.095	0.163
08:53:08	0.070	0.116
08:53:23	0.052	0.094
08:53:38	0.040	0.071
08:53:53	0.024	0.060
08:54:08	0.034	0.057
08:54:23	0.023	0.047
08:54:38	0.001	0.039
08:54:53	-0.007	0.007
08:55:08	-0.024	0.026
08:55:23	0.002	0.028
08:55:38	-0.010	0.014
08:55:53	0.005	0.013
09:16:34	20.452	0.007
09:16:49	20.454	0.007
09:17:04	20.454	-0.004
09:17:19	20.456	0.001
09:17:34	20.456	0.001

low o2 co2

Marathon Petroleum Company
CleanAir Project No. 11265
Robinson Refinery
FCCU Scrubber Stack

July 13, 2011
Start Time 8:34
Stop Time 9:22

CALIBRATION BIAS 00

	Channel 3	Channel 4
	O2	CO2
	FCCU	FCCU
	Scrubber	Scrubber
	%dv	%dv
09:17:49	20.566	0.013
09:18:04	20.783	0.007
09:18:19	20.801	-0.010
09:18:34	20.802	0.002
09:18:49	20.804	0.013
09:19:04	20.804	0.014
09:19:19	20.787	0.008
09:19:34	20.696	0.008
09:19:49	20.663	-0.002
09:20:04	20.669	0.008
09:20:19	20.658	0.008
09:20:34	20.657	-0.009
09:20:49	20.663	0.009
09:21:04	20.660	-0.007
09:21:19	20.597	-0.008
09:21:34	20.489	0.014
09:21:49	20.479	-0.004
09:22:04	20.496	-0.002
09:22:19	20.507	0.010
09:22:34	20.513	0.003
09:22:49	20.529	0.004

Marathon Petroleum Company
CleanAir Project No. 11265
Robinson Refinery
FCCU Scrubber Stack

July 13, 2011
Start Time 9:50
Stop time 12:05

REFERENCE METHOD RUN 1

	Channel 3	Channel 4
	O2	CO2
	FCCU	FCCU
	Scrubber	Scrubber
	%dv	%dv
Calibration Checks		
C _{oi} Initial zero	0.013	0.005
C _{ui} Initial upscale	10.128	9.862
C _{of} Final zero	0.023	0.128
C _{uf} Final upscale	10.103	9.797
C _{ma} Actual gas value	10.200	9.930
Analyzer Averages (concentrations)		
C _{Avg} Average conc.	3.292	14.157
C _{Gas} Bias adjusted	3.307	14.332

Clock Time (at end of sample period)

090911 135030

09:51	3.332	14.142
09:52	3.296	14.160
09:53	3.410	14.089
09:54	3.360	14.120
09:55	3.335	14.137
09:56	3.308	14.179
09:57	3.337	14.147
09:58	3.318	14.108
09:59	2.929	13.843
10:00	3.349	14.104
10:01	3.357	14.096
10:02	3.325	14.120
10:03	3.308	14.139
10:04	3.320	14.143
10:05	3.332	14.131
10:06	3.295	14.173
10:07	3.281	14.173
10:08	3.269	14.184
10:09	3.247	14.195
10:10	3.242	14.220
10:11	3.247	14.221
10:12	3.249	14.225
10:13	3.271	14.201
10:14	3.270	14.216

O2 / CO2 Strat Check

Official start time
Port 2
2-1

2-2

Marathon Petroleum Company
CleanAir Project No. 11265
Robinson Refinery
FCCU Scrubber Stack

July 13, 2011
Start Time 9:50
Stop time 12:05

REFERENCE METHOD RUN 1

	Channel 3 O2 FCCU Scrubber %dv	Channel 4 CO2 FCCU Scrubber %dv	
10:15	3.278	14.205	
10:16	3.348	14.129	2-3
10:17	3.331	14.145	
10:18	3.310	14.166	
10:19	3.295	14.183	
10:20	3.325	14.161	
10:21	3.324	14.146	
10:22	3.307	14.158	
10:23	3.329	14.142	
10:24	3.327	14.134	
10:25	3.323	14.146	
10:26	3.294	14.176	
10:27	3.313	14.160	
10:28	3.328	14.144	
10:29	3.340	14.114	
10:30	3.294	14.161	
10:31	3.323	14.131	
10:32	18.418	2.497	
10:33	12.614	6.308	
10:34	3.336	14.092	Port 4
10:35	3.342	14.103	4-1
10:36	3.307	14.142	
10:37	3.325	14.122	
10:38	3.291	14.129	
10:39	3.267	14.166	
10:40	3.237	14.191	
10:41	3.249	14.199	
10:42	3.250	14.196	
10:43	3.262	14.198	
10:44	3.282	14.173	
10:45	3.283	14.171	4-2
10:46	3.277	14.184	
10:47	3.314	14.139	
10:48	3.305	14.154	
10:49	3.253	14.187	
10:50	3.247	14.210	
10:51	3.254	14.209	
10:52	3.266	14.194	

Marathon Petroleum Company
CleanAir Project No. 11265
Robinson Refinery
FCCU Scrubber Stack

July 13, 2011
Start Time 9:50
Stop time 12:05

REFERENCE METHOD RUN 1

	Channel 3 O2 FCCU Scrubber %dv	Channel 4 CO2 FCCU Scrubber %dv	
10:53	3.279	14.184	
10:54	3.329	14.127	
10:55	3.348	14.120	4-3
10:56	3.307	14.136	
10:57	3.309	14.159	
10:58	3.318	14.159	
10:59	3.316	14.145	
11:00	3.323	14.134	
11:01	3.316	14.146	
11:02	3.276	14.172	
11:03	3.320	14.146	
11:04	3.331	14.121	
11:05	12.027	7.614	
11:06	5.565	11.960	Port 1
11:07	3.351	14.102	1-1
11:08	3.373	14.077	
11:09	3.369	14.077	
11:10	3.307	14.143	
11:11	3.305	14.148	
11:12	3.289	14.151	
11:13	3.301	14.148	
11:14	3.268	14.176	
11:15	3.244	14.197	
11:16	3.282	14.179	
11:17	3.286	14.178	1-2
11:18	3.248	14.197	
11:19	3.245	14.202	
11:20	3.247	14.205	
11:21	3.250	14.206	
11:22	3.245	14.188	
11:23	3.325	14.120	
11:24	3.316	14.128	
11:25	3.302	14.141	
11:26	3.333	14.091	
11:27	3.350	14.090	1-3
11:28	3.315	14.132	
11:29	3.300	14.151	
11:30	3.277	14.163	

Marathon Petroleum Company
CleanAir Project No. 11265
Robinson Refinery
FCCU Scrubber Stack

July 13, 2011
Start Time 9:50
Stop time 12:05

REFERENCE METHOD RUN 1

	Channel 3 O2 FCCU Scrubber %dv	Channel 4 CO2 FCCU Scrubber %dv
11:31	3.236	14.203
11:32	3.288	14.167
11:33	3.262	14.190
11:34	3.249	14.206
11:35	3.230	14.210
11:36	3.290	14.178
11:37	9.230	9.883
11:38	6.788	10.996
11:39	3.310	14.139
11:40	3.306	14.156
11:41	3.292	14.161
11:42	3.325	14.132
11:43	3.319	14.136
11:44	3.303	14.147
11:45	3.305	14.148
11:46	3.278	14.174
11:47	3.297	14.150
11:48	3.303	14.145
11:49	3.278	14.166
11:50	3.263	14.189
11:51	3.293	14.160
11:52	3.280	14.165
11:53	3.253	14.190
11:54	3.239	14.202
11:55	3.249	14.194
11:56	3.297	14.164
11:57	3.275	14.170
11:58	3.267	14.182
11:59	3.222	14.215
12:00	3.300	14.126
12:01	3.309	14.132
12:02	3.298	14.124
12:03	3.242	14.182
12:04	3.239	14.200
12:05	3.261	14.184

Port 3
3-1

3-2
120 min

3-3

Run cut short

Marathon Petroleum Company
CleanAir Project No. 11265
Robinson Refinery
FCCU Scrubber Stack

July 13, 2011
Start Time 12:08
Stop Time 12:29

CALIBRATION BIAS 01

Channel 3	Channel 4
O2	CO2
FCCU	FCCU
Scrubber	Scrubber
%dv	%dv

System Response to Calibration Gasses (C_s)

C _{of} Zero gas	0.023	0.128
C _{uf} Upscale gas	10.103	9.797

Analyzer Calibration Error Responses (C_{Dir})

C _{oce} Zero gas	-0.021	0.004
C _{mce} Upscale gas	10.125	9.943

Actual Upscale Gas Value (C_{MA})

C _{ma} Upscale gas	10.200	9.930
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Calibration Span Value (CS)

21.100	20.800
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System Bias as Percent of Calibration Span Value (SB) (5%)

Zero gas	0.2%	0.6%
Upscale gas	-0.1%	-0.7%

System Bias Status

Zero gas	OK	OK
Upscale gas	OK	OK

Previous System Response to Calibration Gases (C_s)

C _{oi} Zero gas	0.013	0.005
C _{ui} Upscale gas	10.128	9.862

Drift Assessment as Percent of Calibration Span Value (D) (3%)

Zero gas	0.0%	0.6%
Upscale gas	-0.1%	-0.3%

Drift Assessment Status

Zero gas	OK	OK
Upscale gas	OK	OK

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12:08:54	8.095	8.473
12:09:09	0.632	0.364
12:09:24	0.039	0.158
12:09:39	0.021	0.123
12:09:54	0.008	0.105
12:10:09	5.727	0.099
12:10:24	19.794	0.073
12:10:39	20.305	0.058
12:10:54	20.338	0.058
12:11:09	20.352	0.068
12:11:24	20.355	0.058

Zero

Marathon Petroleum Company
CleanAir Project No. 11265
Robinson Refinery
FCCU Scrubber Stack

July 13, 2011
Start Time 12:08
Stop Time 12:29

CALIBRATION BIAS 01

	Channel 3	Channel 4
	O2	CO2
	FCCU	FCCU
	Scrubber	Scrubber
	%dv	%dv
12:11:39	20.361	0.033
12:11:54	20.368	0.037
12:12:09	20.371	0.051
12:12:24	20.399	0.050
12:12:39	20.706	0.042
12:12:54	20.706	0.028
12:13:09	20.704	0.039
12:13:24	20.710	0.032
12:13:39	20.712	0.037
12:13:54	20.714	0.023
12:14:09	20.709	0.033
12:14:24	20.014	-1.700
12:14:39	20.249	-1.716
12:14:54	20.714	0.031
12:15:09	20.715	0.026
12:15:24	20.719	0.013
12:15:39	20.715	0.023
12:15:54	20.718	0.023
12:16:09	20.711	0.017
12:16:24	20.713	0.022
12:16:39	20.705	0.011
12:16:54	20.416	0.014
12:17:09	20.337	0.034
12:17:24	20.338	0.033
12:17:39	20.345	0.017
12:17:54	20.344	0.022
12:18:09	20.341	0.022
12:18:24	19.993	-6.760
12:18:39	20.340	0.015
12:18:54	18.057	2.349
12:19:09	10.674	9.269
12:19:24	10.125	9.762
12:19:39	10.097	9.801
12:19:54	10.088	9.828
12:20:09	9.680	9.727
12:20:24	9.492	9.332
12:20:39	10.087	9.855
12:20:54	10.088	9.860
12:21:09	10.087	9.864
12:21:24	10.087	9.868
12:21:39	10.084	9.870

O2/CO2 Mid

Marathon Petroleum Company
CleanAir Project No. 11265
Robinson Refinery
FCCU Scrubber Stack

July 13, 2011
Start Time 12:08
Stop Time 12:29

CALIBRATION BIAS 01

	Channel 3	Channel 4
	O2	CO2
	FCCU	FCCU
	Scrubber	Scrubber
	%dv	%dv
12:21:54	10.084	9.872
12:22:09	10.084	9.875
12:22:24	10.082	9.876
12:22:39	10.086	9.877
12:22:54	10.086	9.878
12:23:09	10.082	9.880
12:23:24	10.083	9.879
12:23:39	10.059	9.778
12:23:54	9.976	9.707
12:24:09	8.448	8.328
12:24:24	9.712	9.227
12:24:39	10.082	9.884
12:24:54	10.084	9.884
12:25:09	10.082	9.885
12:25:24	10.082	9.884
12:25:39	5.314	6.328
12:25:54	0.206	0.462
12:26:09	0.039	0.164
12:26:24	-0.005	0.124
12:26:39	0.001	0.104
12:26:54	-0.009	0.091
12:27:09	0.005	0.084
12:27:24	0.006	0.063
12:27:39	0.000	0.064
12:27:54	-0.009	0.063
12:28:09	-0.015	0.049
12:28:24	-0.011	0.040
12:28:39	-0.005	0.044
12:28:54	0.000	0.041
12:29:09	-0.006	0.033

Marathon Petroleum Company
CleanAir Project No. 11265
Robinson Refinery
FCCU Scrubber Stack

Date: **July 14, 2011**
Start Time 12:07
Stop Time 13:03

CALIBRATION ERROR

	Channel 2	Channel 3	Channel 4
	THC	O2	CO2
	FCCU	FCCU	FCCU
	Scrubber	Scrubber	Scrubber
	ppmwv	%dv	%dv
Instrument Information			
Manufacturer:	Thermo	Servomex	Servomex
Model:	51i	1420B	1415B
Detection:	FID	Paramagn.	NDIR
Asset or Serial No:	205963	207361	207364

Calibration Span Value (CS)

15.000	21.100	20.800
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System Response Time (seconds)

60	60	60
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Manufacturer Certified Cylinder Value (C_v)

Zero	0.000	0.000	0.000
Low	5.130		
Mid	7.950	10.200	9.930
High	15.000	21.100	20.800

Actual gas to be used for bias checks

7.950	10.200	9.930
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Cylinder ID

Zero	ALM56950	K235070	K235070
Low	ALM56961		
Mid	AAL14628	ALM9165	ALM9165
High	ALM65418	ALM20472	ALM20472

Analyzer Calibration Response (C_{Dir})

Zero	-0.003	0.030	0.066	THC data from Bias 00
Low	5.041			
Mid	7.989	10.157	9.957	
High	14.954	21.110	20.792	

Analyzer Calibration Error (ACE) (Limit = 2%, Method 25A limit = 5% of gas value)

Zero	0.0%	0.1%	0.3%
Low	-1.7%	N/A	N/A
Mid	0.5%	-0.2%	0.1%
High	-0.3%	0.0%	0.0%

Calibration Error Status

Zero	OK	OK	OK
Low	OK	N/A	N/A
Mid	OK	OK	OK
High	OK	OK	OK

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Marathon Petroleum Company
CleanAir Project No. 11265
Robinson Refinery
FCCU Scrubber Stack

Date: **July 14, 2011**
Start Time 12:07
Stop Time 13:03

CALIBRATION ERROR

	Channel 2	Channel 3	Channel 4	
	THC	O2	CO2	
	FCCU	FCCU	FCCU	
	Scrubber	Scrubber	Scrubber	
	ppmwv	%dv	%dv	
12:07:05	11.082	0.030	0.019	
12:07:20	10.754	0.021	0.019	
12:07:35	10.532	-0.013	0.025	
12:07:50	10.249	-0.004	0.025	
12:08:05	10.236	0.007	0.024	
12:08:20	9.898	0.006	0.025	
12:08:35	9.587	0.001	0.035	
12:08:50	9.442	8.843	4.632	
12:09:05	9.342	20.588	18.145	
12:09:20	9.070	21.048	20.584	
12:09:35	9.142	21.088	20.702	
12:09:50	8.769	21.104	20.733	
12:10:05	8.582	21.107	20.763	
12:10:20	8.537	21.119	20.772	
12:10:35	8.564	21.128	20.778	
12:10:50	8.526	21.130	20.779	
12:11:05	8.453	21.146	20.781	
12:11:20	8.490	21.150	20.783	
12:11:35	8.406	21.114	20.789	High O2/CO2
12:11:50	8.096	21.111	20.793	
12:12:05	7.989	21.105	20.794	
12:12:20	7.760	19.708	20.097	
12:12:35	7.821	10.940	10.776	
12:12:50	8.013	10.188	9.957	
12:13:05	7.622	10.165	9.959	Mid O2/CO2
12:13:20	7.749	10.152	9.959	
12:13:35	7.459	10.153	9.953	
12:13:50	7.401	10.114	9.950	
12:14:05	7.285	3.193	3.991	
12:14:20	7.154	0.157	0.231	
12:14:35	7.187	0.058	0.114	
12:14:50	7.040	0.038	0.074	Zero O2/CO2
12:15:05	7.046	0.037	0.064	
12:15:20	6.784	0.014	0.059	
12:54:25	-0.048	20.337	0.044	

Marathon Petroleum Company
CleanAir Project No. 11265
Robinson Refinery
FCCU Scrubber Stack

July 14, 2011

Start Time 12:52
Stop Time 13:08

CALIBRATION BIAS 00

Channel 2	Channel 3	Channel 4
THC	O2	CO2
FCCU	FCCU	FCCU
Scrubber	Scrubber	Scrubber
ppmwv	%dv	%dv

System Response to Calibration Gasses (C_s)

C _{of} Zero gas	-0.003	0.092	0.022
C _{uf} Upscale gas	7.989	10.074	9.787

Analyzer Calibration Error Responses (C_{Dir})

C _{oce} Zero gas	-0.003	0.030	0.066
C _{mce} Upscale gas	7.989	10.157	9.957

Actual Upscale Gas Value (C_{MA})

C _{ma} Upscale gas	7.950	10.200	9.930
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Calibration Span Value (CS)

15.000	21.100	20.800
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System Bias as Percent of Calibration Span Value (SB) (5%)

Zero gas	0.0%	0.3%	-0.2%
Upscale gas	0.0%	-0.4%	-0.8%

System Bias Status

Zero gas	OK	OK	OK
Upscale gas	OK	OK	OK

Previous System Response to Calibration Gasses (C_s)

C _{oi} Zero gas	N/A	N/A	N/A
C _{ui} Upscale gas	N/A	N/A	N/A

Drift Assessment as Percent of Calibration Span Value (D) (3%)

Zero gas	N/A	N/A	N/A
Upscale gas	N/A	N/A	N/A

Drift Assessment Status

Zero gas	N/A	N/A	N/A
Upscale gas	N/A	N/A	N/A

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12:52:40	-0.815	20.342	0.059
12:52:40	-0.815	20.342	0.059
12:52:55	-0.850	20.346	0.060
12:53:10	-0.910	20.353	0.033
12:53:25	-0.554	20.347	0.051
12:53:40	-0.006	20.342	0.049
12:53:55	-0.026	20.342	0.049
12:54:10	-0.028	20.344	0.039
12:54:25	-0.048	20.337	0.044
12:54:40	-0.071	20.341	0.031
12:54:55	9.658	20.341	0.039
12:55:10	17.474	20.335	0.022
12:55:25	17.492	20.334	0.026
12:55:40	17.628	20.325	0.037
12:55:55	17.569	20.329	0.037
12:56:10	17.696	20.331	0.031
12:56:25	17.615	20.328	0.042

Marathon Petroleum Company
CleanAir Project No. 11265
Robinson Refinery
FCCU Scrubber Stack

July 14, 2011
Start Time 12:52
Stop Time 13:08

CALIBRATION BIAS 00

	Channel 2 THC FCCU Scrubber ppmwv	Channel 3 O2 FCCU Scrubber %dv	Channel 4 CO2 FCCU Scrubber %dv	
12:56:40	17.544	20.326	0.034	
12:56:55	14.899	20.330	0.029	
12:57:10	14.953	20.327	0.028	High THC
12:57:25	14.991	20.316	0.023	
12:57:40	14.917	20.327	0.039	
12:57:55	14.972	20.327	0.028	
12:58:10	14.926	20.330	0.039	
12:58:25	14.980	20.331	0.028	
12:58:40	10.443	20.326	0.032	
12:58:55	8.036	20.453	0.016	
12:59:10	8.016	20.643	0.015	
12:59:25	8.010	20.665	0.033	Mid THC
12:59:40	7.957	20.674	0.028	
12:59:55	7.999	20.674	0.028	
13:00:10	7.953	20.675	0.038	
13:00:25	5.821	20.666	0.015	
13:00:40	5.052	20.548	0.022	
13:00:55	5.095	20.511	0.027	
13:01:10	5.030	20.512	0.032	Low THC
13:01:25	5.051	20.509	0.028	
13:01:40	5.042	20.509	0.037	
13:01:55	4.004	20.507	0.011	
13:02:10	0.063	20.481	0.032	
13:02:25	0.005	20.383	0.011	Zero THC
13:02:40	-0.003	20.342	0.033	
13:02:55	-0.011	20.342	0.039	
13:03:10	-0.009	20.333	0.027	
13:03:25	-0.030	20.342	0.021	
13:03:40	-0.002	20.334	0.016	
13:03:55	-0.452	19.439	0.026	
13:04:10	-0.616	7.491	0.037	
13:04:25	-0.620	0.959	0.026	
13:04:40	-0.631	0.245	0.036	
13:04:55	-0.614	0.165	0.021	
13:05:10	-0.614	0.136	0.031	
13:05:25	-0.637	0.119	0.026	
13:05:40	-0.624	0.108	0.037	
13:05:55	-0.620	0.098	0.020	Zero O2/CO2
13:06:10	-0.627	0.092	0.020	
13:06:25	-0.627	0.087	0.026	
13:06:40	-0.590	0.096	0.033	
13:06:55	-0.650	4.092	2.951	
13:07:10	-0.661	9.217	8.578	
13:07:25	-0.657	9.994	9.622	
13:07:40	-0.659	10.057	9.740	
13:07:55	-0.654	10.068	9.772	Mid O2/CO2

Marathon Petroleum Company
CleanAir Project No. 11265
Robinson Refinery
FCCU Scrubber Stack

July 14, 2011

Start Time 12:52

Stop Time 13:08

CALIBRATION BIAS 00

	Channel 2	Channel 3	Channel 4
	THC	O2	CO2
	FCCU	FCCU	FCCU
	Scrubber	Scrubber	Scrubber
	ppmwv	%dv	%dv
13:08:10	-0.653	10.074	9.785
13:08:25	-0.652	10.079	9.804

Marathon Petroleum Company
CleanAir Project No. 11265
Robinson Refinery
FCCU Scrubber Stack

July 14, 2011
Start Time 13:22
Stop time 14:23

REFERENCE METHOD RUN 1

	Channel 2	Channel 3	Channel 4
	THC	O2	CO2
	FCCU	FCCU	FCCU
	Scrubber	Scrubber	Scrubber
	ppmwv	%dv	%dv
Calibration Checks			
C _{oi} Initial zero	-0.003	0.092	0.022
C _{ui} Initial upscale	7.989	10.074	9.787
C _{of} Final zero	-0.369	0.124	0.054
C _{uf} Final upscale	7.426	10.070	9.755
C _{ma} Actual gas value	7.950	10.200	9.930
Analyzer Averages (concentrations)			
C _{Avg} Average conc.	0.831	3.348	13.991
C _{Gas} Bias adjusted	1.024	3.317	14.236

Clock Time (at end of sample period)

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13:23	1.100	3.439	13.917
13:24	0.956	3.405	13.940
13:25	1.100	3.439	13.917
13:26	0.956	3.405	13.940
13:27	0.996	3.387	13.970
13:28	0.894	3.357	13.990
13:29	0.966	3.372	13.965
13:30	0.901	3.377	13.979
13:31	0.861	3.380	13.979
13:32	0.838	3.376	13.985
13:33	0.945	3.364	13.998
13:34	0.866	3.337	14.017
13:35	0.924	3.317	14.023
13:36	0.989	3.349	14.008
13:37	0.695	3.289	13.901
13:38	0.700	-0.547	12.321
13:39	0.906	3.364	13.976
13:40	0.771	3.362	13.970
13:41	0.970	3.375	13.975
13:42	0.899	3.352	13.997
13:43	0.740	3.339	14.000
13:44	0.861	3.310	14.031
13:45	0.783	3.311	14.042
13:46	0.791	3.343	14.011
13:47	0.777	3.346	14.003
13:48	0.864	3.324	14.011
13:49	0.847	3.314	14.032
13:50	0.829	3.334	14.025
13:51	0.814	3.343	14.015

Port 4 single point

*Radio interference;
removed from average.

Marathon Petroleum Company
CleanAir Project No. 11265
Robinson Refinery
FCCU Scrubber Stack

July 14, 2011
Start Time 13:22
Stop time 14:23

REFERENCE METHOD RUN 1

	Channel 2	Channel 3	Channel 4
	THC	O2	CO2
	FCCU	FCCU	FCCU
	Scrubber	Scrubber	Scrubber
	ppmwv	%dv	%dv
13:52	1.049	3.326	14.022
13:53	0.843	3.367	13.996
13:54	0.793	3.384	13.990
13:55	0.700	3.349	14.010
13:56	0.951	3.365	14.009
13:57	0.969	3.395	13.978
13:58	0.866	3.366	13.996
13:59	0.842	3.325	14.032
14:00	0.866	3.376	14.008
14:01	0.783	3.361	14.006
14:02	0.952	3.361	14.012
14:03	1.137	3.387	13.991
14:04	0.800	3.349	14.005
14:05	0.745	3.345	14.019
14:06	0.678	2.844	13.699
14:07	0.688	3.361	14.009
14:08	0.869	3.357	14.006
14:09	0.771	3.387	13.988
14:10	0.895	3.366	13.985
14:11	0.854	3.318	14.032
14:12	0.698	3.359	14.006
14:13	0.706	3.360	13.989
14:14	0.719	3.352	13.996
14:15	0.680	3.348	14.002
14:16	0.634	3.347	13.995
14:17	0.767	3.317	14.034
14:18	0.623	3.328	14.015
14:19	0.694	3.302	14.049
14:20	0.739	3.352	14.012
14:21	0.584	3.397	13.972
14:22	0.565	3.385	13.979
14:23	0.569	3.342	14.000

Marathon Petroleum Company
CleanAir Project No. 11265
Robinson Refinery
FCCU Scrubber Stack

July 14, 2011
Start Time 14:26
Stop Time 14:32

CALIBRATION BIAS 01

Channel 2	Channel 3	Channel 4
THC	O2	CO2
FCCU	FCCU	FCCU
Scrubber	Scrubber	Scrubber
ppmwv	%dv	%dv

System Response to Calibration Gasses (C_s)

C _{of} Zero gas	-0.369	0.124	0.054	O2/CO2 data from Bias 03
C _{uf} Upscale gas	7.426	10.070	9.755	

Analyzer Calibration Error Responses (C_{Dir})

C _{oce} Zero gas	-0.003	0.030	0.066
C _{mce} Upscale gas	7.989	10.157	9.957

Actual Upscale Gas Value (C_{MA})

C _{ma} Upscale gas	7.950	10.200	9.930
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Calibration Span Value (CS)

15.000	21.100	20.800
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System Bias as Percent of Calibration Span Value (SB) (5%)

Zero gas	-2.4%	0.4%	-0.1%
Upscale gas	-3.8%	-0.4%	-1.0%

System Bias Status

Zero gas	OK	OK	OK
Upscale gas	OK	OK	OK

Previous System Response to Calibration Gasses (C_s)

C _{oi} Zero gas	-0.003	0.092	0.022
C _{ui} Upscale gas	7.989	10.074	9.787

Drift Assessment as Percent of Calibration Span Value (D) (3%)

Zero gas	-2.4%	0.1%	0.2%
Upscale gas	-3.8%	0.0%	-0.2%

Drift Assessment Status

Zero gas	OK	OK	OK
Upscale gas	FAIL	OK	OK

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14:26:47	-0.413	20.207	0.247	Zero THC
14:27:02	-0.406	20.253	0.185	
14:27:17	-0.353	20.266	0.155	
14:27:32	-0.353	20.292	0.133	
14:27:47	-0.355	20.301	0.118	
14:28:02	-0.363	20.306	0.108	
14:28:17	-0.390	20.311	0.099	
14:28:32	-0.220	20.310	0.085	
14:28:47	6.381	20.333	0.073	Mid THC
14:29:02	7.306	20.559	0.075	
14:29:17	7.311	20.653	0.073	
14:29:32	7.320	20.655	0.070	
14:29:47	7.384	20.657	0.061	
14:30:02	7.431	20.660	0.056	
14:30:17	7.444	20.667	0.061	
14:30:32	7.403	20.674	0.059	
14:30:47	7.412	20.677	0.057	

Marathon Petroleum Company
CleanAir Project No. 11265
Robinson Refinery
FCCU Scrubber Stack

July 14, 2011
Start Time 14:26
Stop Time 14:32

CALIBRATION BIAS 01

	Channel 2 THC FCCU Scrubber ppmwv	Channel 3 O2 FCCU Scrubber %dv	Channel 4 CO2 FCCU Scrubber %dv
14:31:02	7.449	20.672	0.050
14:31:17	4.856	20.675	0.050
14:31:32	-0.327	20.599	0.036
14:31:47	-0.398	20.374	0.051
14:32:02	-0.429	20.328	0.045
14:32:17	-0.436	20.325	0.049
14:32:32	-0.482	20.334	0.033

Marathon Petroleum Company
CleanAir Project No. 11265
Robinson Refinery
FCCU Scrubber Stack

Date: **July 14, 2011**
Start Time 12:07
Stop Time 13:03

CALIBRATION ERROR 02

	Channel 2	Channel 3	Channel 4	Channel 5	Channel 6	Channel 7
	THC	O2	CO2			
	FCCU	FCCU	FCCU			
	Scrubber	Scrubber	Scrubber			
	ppmwv	%dv	%dv			
Instrument Information						
Manufacturer:	Thermo	Servomex	Servomex			
Model:	51i	1420B	1415B			
Detection:	FID	Paramagn.	NDIR			
Asset or Serial No:	205963	207361	207364			
Calibration Span Value (CS)						
	15.000	21.100	20.800			
System Response Time (seconds)						
	60	60	60			
Manufacturer Certified Cylinder Value (C _v)						
Zero	0.000	0.000	0.000			
Low	5.130					
Mid	7.950	10.200	9.930			
High	15.000	21.100	20.800			
Actual gas to be used for bias checks						
	7.950	10.200	9.930			
Cylinder ID						
Zero	ALM56950	K235070	K235070			
Low	ALM56961					
Mid	AAL14628	ALM9165	ALM9165			
High	ALM65418	ALM20472	ALM20472			
Analyzer Calibration Response (C _{Dir})						
Zero	-0.006	0.030	0.066	THC data from Bias 01b		
Low	5.087					
Mid	8.114	10.157	9.957			
High	14.994	21.110	20.792			
Analyzer Calibration Error (ACE) (Limit = 2%, Method 25A limit = 5% of gas value)						
Zero	0.0%	0.1%	0.3%			
Low	-0.8%	NA	NA			
Mid	2.1%	-0.2%	0.1%			
High	0.0%	0.0%	0.0%			
Calibration Error Status						
Zero	OK	OK	OK			
Low	OK	NA	NA			
Mid	OK	OK	OK			
High	OK	OK	OK			

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Marathon Petroleum Company
CleanAir Project No. 11265
Robinson Refinery
FCCU Scrubber Stack

July 14, 2011

Start Time 14:32

Stop Time 14:56

Calibration Bias 01b

	Channel 2	Channel 3	Channel 4	Channel 5	Channel 6	Channel 7
	THC	O2	CO2			
FCCU Scrubber Stack						
ubber Stack						
ubber Stack						
	ppmwv	%dv	%dv			

System Response to Calibration Gasses (C_s)

C_{of} Zero gas	-0.006	0.124	0.054	O2/CO2 data from Bias 03
C_{uf} Upscale gas	8.114	10.070	9.755	

Analyzer Calibration Error Responses (C_{Dir})

C_{oce} Zero gas	-0.006	0.030	0.066
C_{mce} Upscale gas	8.114	10.157	9.957

Actual Upscale Gas Value (C_{MA})

C_{ma} Upscale gas	7.950	10.200	9.930
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Calibration Span Value (CS)

15.000	21.100	20.800
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System Bias as Percent of Calibration Span Value (SB) (5%)

Zero gas	0.0%	0.4%	-0.1%
Upscale gas	0.0%	-0.4%	-1.0%

System Bias Status

Zero gas	OK	OK	OK
Upscale gas	OK	OK	OK

Previous System Response to Calibration Gases (C_s)

C_{oi} Zero gas	N/A	N/A	N/A
C_{ui} Upscale gas	N/A	N/A	N/A

Drift Assessment as Percent of Calibration Span Value (D) (3%)

Zero gas	N/A	N/A	N/A
Upscale gas	N/A	N/A	N/A

Drift Assessment Status

Zero gas	N/A	N/A	N/A
Upscale gas	N/A	N/A	N/A

090711 160607

14:32:47	-0.360	20.329	0.053	Re-cal THC
14:33:02	-0.002	20.330	0.037	
14:33:17	-0.007	20.336	0.041	Zero THC
14:33:32	-0.008	20.330	0.045	
14:33:47	2.038	20.331	0.051	
14:34:02	14.412	20.327	0.045	
14:34:17	14.803	20.322	0.046	
14:34:32	14.770	20.319	0.045	
14:34:47	14.878	20.324	0.033	
14:35:02	14.876	20.319	0.038	
14:35:17	14.876	20.310	0.042	
14:35:32	14.969	20.325	0.036	
14:35:47	14.949	20.321	0.042	High THC
14:36:02	15.023	20.314	0.030	
14:36:17	15.011	20.312	0.029	
14:36:32	15.100	20.306	0.044	
14:36:47	10.033	20.321	0.036	

Marathon Petroleum Company
 CleanAir Project No. 11265
 Robinson Refinery
 FCCU Scrubber Stack

July 14, 2011

Start Time 14:32

Stop Time 14:56

Calibration Bias 01b

	Channel 2 THC	Channel 3 O2	Channel 4 CO2	Channel 5	Channel 6	Channel 7
FCCU Scrubber Stack	ppmwv	%dv	%dv			
14:37:02	8.141	20.525	0.040		Mid THC	
14:37:17	8.116	20.659	0.036			
14:37:32	8.085	20.668	0.030			
14:37:47	8.082	20.663	0.041			
14:55:55	5.101	20.482	0.033		Low THC	
14:56:10	5.077	20.481	0.053			
14:56:25	5.105	20.484	0.059			
14:56:40	5.079	20.487	0.050			

Marathon Petroleum Company
CleanAir Project No. 11265
Robinson Refinery
FCCU Scrubber Stack

July 14, 2011
Start Time 15:04
Stop time 16:04

REFERENCE METHOD RUN 2

	Channel 2	Channel 3	Channel 4	Channel 5	Channel 6	Channel 7
	THC	O2	CO2			
	FCCU	FCCU	FCCU			
	Scrubber	Scrubber	Scrubber			
	ppmwv	%dv	%dv			
Calibration Checks						
C _{oi} Initial zero	-0.006	0.124	0.054			
C _{ui} Initial upscale	8.114	10.070	9.755			
C _{of} Final zero	-0.064	0.124	0.054			
C _{uf} Final upscale	7.847	10.070	9.755			
C _{ma} Actual gas value	7.950	10.200	9.930			
Analyzer Averages (concentrations)						
C _{Avg} Average conc.	1.079	3.337	13.942			
C _{Gas} Bias adjusted	1.105	3.295	14.217			

Clock Time (at end of sample period)

090711 160607

15:05	1.112	3.372	13.949	Port 4 Single point
15:06	1.056	3.352	13.958	
15:07	1.210	3.354	13.901	
15:08	1.088	3.349	13.969	
15:09	1.077	3.386	13.953	
15:10	0.985	3.382	13.954	
15:11	1.154	3.391	13.964	
15:12	1.000	3.396	13.952	
15:13	1.079	3.421	13.929	
15:14	0.986	3.482	13.863	
15:15	1.015	3.372	13.948	
15:16	1.094	3.353	13.976	
15:17	1.059	3.347	13.994	
15:18	1.514	3.318	14.002	
15:19	1.174	3.317	14.037	
15:20	1.213	3.411	13.955	
15:21	1.032	3.428	13.930	
15:22	1.194	3.367	13.913	
15:23	0.841	3.025	13.715	
15:24	0.965	3.004	13.833	
15:25	1.004	3.466	13.889	
15:26	0.971	3.404	13.900	
15:27	1.198	3.434	13.895	
15:28	1.237	3.382	13.938	
15:29	1.030	3.341	13.970	
15:30	1.033	3.313	13.987	
15:31	1.137	3.181	13.897	
15:32	1.017	3.301	14.011	
15:33	1.066	3.323	13.995	

Marathon Petroleum Company
CleanAir Project No. 11265
Robinson Refinery
FCCU Scrubber Stack

July 14, 2011
Start Time 15:04
Stop time 16:04

REFERENCE METHOD RUN 2

	Channel 2	Channel 3	Channel 4	Channel 5	Channel 6	Channel 7
	THC	O2	CO2			
	FCCU	FCCU	FCCU			
	Scrubber	Scrubber	Scrubber			
	ppmwv	%dv	%dv			
15:34	1.128	3.352	13.993			
15:35	1.348	3.376	13.949			
15:36	1.237	3.365	13.967			
15:37	1.268	3.402	13.934			
15:38	1.171	3.313	14.001			
15:39	0.961	3.332	13.993			
15:40	1.005	3.385	13.954			
15:41	1.141	3.362	13.968			
15:42	1.072	3.371	13.974			
15:43	0.863	2.327	13.702			
15:44	1.034	3.181	13.847			
15:45	0.987	3.486	13.837			
15:46	1.012	3.437	13.907			
15:47	1.118	3.407	13.935			
15:48	0.938	3.446	13.898			
15:49	1.024	3.423	13.907			
15:50	1.374	3.373	13.936			
15:51	1.168	3.382	13.954			
15:52	1.084	3.328	13.991			
15:53	1.168	3.325	14.016			
15:54	1.169	3.405	13.944			
15:55	1.172	3.398	13.938			
15:56	1.025	3.385	13.942			
15:57	1.026	3.364	13.950			
15:58	0.957	3.356	13.949			
15:59	0.819	3.350	13.979			
16:00	1.090	3.353	13.963			
16:01	0.914	3.332	13.992			
16:02	1.078	3.295	14.025			
16:03	0.890	3.317	14.029			
16:04	0.980	3.346	13.981			

Marathon Petroleum Company
CleanAir Project No. 11265
Robinson Refinery
FCCU Scrubber Stack

July 14, 2011
Start Time 16:05
Stop Time 16:13

CALIBRATION BIAS 02

Channel 2	Channel 3	Channel 4	Channel 5	Channel 6	Channel 7
THC	O2	CO2			
FCCU	FCCU	FCCU			
Scrubber	Scrubber	Scrubber			
ppmwv	%dv	%dv			

System Response to Calibration Gasses (C_s)

C _{of} Zero gas	-0.064	0.124	0.054	O2/CO2 data from Bias 03
C _{uf} Upscale gas	7.847	10.070	9.755	

Analyzer Calibration Error Responses (C_{Dir})

C _{oce} Zero gas	-0.006	0.030	0.066
C _{mce} Upscale gas	8.114	10.157	9.957

Actual Upscale Gas Value (C_{MA})

C _{ma} Upscale gas	7.950	10.200	9.930
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Calibration Span Value (CS)

15.000	21.100	20.800
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System Bias as Percent of Calibration Span Value (SB) (5%)

Zero gas	-0.4%	0.4%	-0.1%
Upscale gas	-1.8%	-0.4%	-1.0%

System Bias Status

Zero gas	OK	OK	OK
Upscale gas	OK	OK	OK

Previous System Response to Calibration Gasses (C_s)

C _{oi} Zero gas	-0.006	0.124	0.054
C _{ui} Upscale gas	8.114	10.070	9.755

Drift Assessment as Percent of Calibration Span Value (D) (3%)

Zero gas	-0.4%	0.0%	0.0%
Upscale gas	-1.8%	0.0%	0.0%

Drift Assessment Status

Zero gas	OK	OK	OK
Upscale gas	OK	OK	OK

090711 160607

16:05:36	0.556	7.030	11.913	Zero
16:05:51	-0.005	16.611	4.056	
16:06:06	-0.053	19.652	0.858	
16:06:21	-0.064	20.114	0.350	
16:06:36	-0.074	20.203	0.215	
16:06:51	-0.069	20.239	0.192	
16:07:06	-0.052	20.251	0.172	
16:07:21	0.161	20.257	0.154	
16:07:36	5.368	20.273	0.138	
16:07:51	6.304	20.435	0.126	
16:08:06	7.009	20.617	0.114	
16:08:21	7.303	20.648	0.108	
16:08:36	7.395	20.656	0.101	
16:08:51	7.525	20.653	0.096	
16:09:06	7.528	20.660	0.091	
16:09:21	7.597	20.660	0.082	
16:09:36	7.656	20.658	0.068	

Marathon Petroleum Company
CleanAir Project No. 11265
Robinson Refinery
FCCU Scrubber Stack

July 14, 2011

Start Time 16:05
Stop Time 16:13

CALIBRATION BIAS 02

	Channel 2	Channel 3	Channel 4	Channel 5	Channel 6	Channel 7
	THC	O2	CO2			
	FCCU	FCCU	FCCU			
	Scrubber	Scrubber	Scrubber			
	ppmwv	%dv	%dv			
16:09:51	7.660	20.661	0.072			
16:10:06	7.675	20.664	0.077			
16:10:21	7.733	20.657	0.065			
16:10:36	7.735	20.662	0.077			
16:10:51	7.724	20.664	0.074			
16:11:06	7.777	20.665	0.070			
16:11:21	7.751	20.665	0.058			
16:11:36	7.779	20.666	0.039			
16:11:51	7.811	20.663	0.067			
16:12:06	7.789	20.663	0.054			
16:12:21	7.837	20.662	0.052			
16:12:36	7.812	20.659	0.046		Mid THC	
16:12:51	7.857	20.663	0.055			
16:13:06	7.871	20.658	0.050			

Marathon Petroleum Company
CleanAir Project No. 11265
Robinson Refinery
FCCU Scrubber Stack

July 14, 2011
Start Time 16:18
Stop time 17:18

REFERENCE METHOD RUN 3

	Channel 2	Channel 3	Channel 4	Channel 5	Channel 6	Channel 7
	THC	O2	CO2			
	FCCU	FCCU	FCCU			
	Scrubber	Scrubber	Scrubber			
	ppmwv	%dv	%dv			
Calibration Checks						
C _{oi} Initial zero	-0.064	0.124	0.054			
C _{ui} Initial upscale	7.847	10.070	9.755			
C _{of} Final zero	0.028	0.124	0.054			
C _{uf} Final upscale	7.732	10.070	9.755			
C _{ma} Actual gas value	7.950	10.200	9.930			
Analyzer Averages (concentrations)						
C _{Avg} Average conc.	1.062	3.387	13.920			
C _{Gas} Bias adjusted	1.099	3.346	14.194			

Clock Time (at end of sample period)

090711 160607

16:19	1.286	3.361	13.887	Port 4 single point
16:20	1.437	3.403	13.898	
16:21	1.095	3.332	13.960	
16:22	1.170	3.343	13.984	
16:23	1.086	3.380	13.942	
16:24	0.999	3.434	13.900	
16:25	1.057	3.409	13.912	
16:26	1.125	3.411	13.931	
16:27	1.115	3.409	13.917	
16:28	1.003	3.381	13.932	
16:29	0.993	3.350	13.967	
16:30	1.017	3.339	13.979	
16:31	1.127	3.350	13.979	
16:32	0.845	3.361	13.978	
16:33	0.986	3.409	13.930	
16:34	1.010	3.423	13.906	
16:35	0.917	3.455	13.875	
16:36	1.077	3.433	13.895	
16:37	0.917	3.385	13.924	
16:38	0.959	3.401	13.920	
16:39	0.962	3.368	13.949	
16:40	1.043	3.345	13.968	
16:41	0.969	3.371	13.952	
16:42	0.925	3.355	13.963	
16:43	1.057	3.301	14.006	
16:44	1.171	3.356	13.968	
16:45	1.346	3.431	13.900	
16:46	1.067	3.356	13.871	
16:47	0.990	3.430	13.903	

Marathon Petroleum Company
CleanAir Project No. 11265
Robinson Refinery
FCCU Scrubber Stack

July 14, 2011
Start Time 16:18
Stop time 17:18

REFERENCE METHOD RUN 3

	Channel 2 THC FCCU Scrubber ppmwv	Channel 3 O2 FCCU Scrubber %dv	Channel 4 CO2 FCCU Scrubber %dv	Channel 5	Channel 6	Channel 7
16:48	1.069	3.476	13.864			
16:49	1.093	3.431	13.900			
16:50	1.063	2.739	13.826			
16:51	0.925	3.450	13.888			
16:52	0.961	3.471	13.865			
16:53	1.206	3.380	13.911			
16:54	1.130	3.372	13.957			
16:55	0.850	3.389	13.936			
16:56	0.846	3.377	13.945			
16:57	0.908	3.420	13.913			
16:58	0.834	3.439	13.895			
16:59	1.009	3.430	13.903			
17:00	1.238	3.443	13.877			
17:01	1.033	3.425	13.883			
17:02	0.957	3.383	13.923			
17:03	1.034	3.367	13.922			
17:04	1.020	3.332	13.926			
17:05	0.943	3.377	13.935			
17:06	0.997	3.421	13.922			
17:07	1.073	3.466	13.877			
17:08	1.275	3.439	13.883			
17:09	1.368	3.460	13.865			
17:10	1.137	3.449	13.883			
17:11	1.458	3.414	13.908			
17:12	1.067	3.395	13.939			
17:13	1.327	3.405	13.936			
17:14	1.028	3.357	13.951			
17:15	1.164	3.327	13.978			
17:16	1.032	3.440	13.908			
17:17	0.942	3.449	13.881			
17:18	0.949	3.389	13.934			

Marathon Petroleum Company
CleanAir Project No. 11265
Robinson Refinery
FCCU Scrubber Stack

July 14, 2011
Start Time 17:18
Stop Time 17:32

CALIBRATION BIAS 03

Channel 2	Channel 3	Channel 4
THC	O2	CO2
FCCU	FCCU	FCCU
Scrubber	Scrubber	Scrubber
ppmwv	%dv	%dv

System Response to Calibration Gasses (C_s)

C _{of} Zero gas	0.028	0.124	0.054
C _{uf} Upscale gas	7.732	10.070	9.755

Analyzer Calibration Error Responses (C_{Dir})

C _{oce} Zero gas	-0.006	0.030	0.066
C _{mce} Upscale gas	8.114	10.157	9.957

Actual Upscale Gas Value (C_{MA})

C _{ma} Upscale gas	7.950	10.200	9.930
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Calibration Span Value (CS)

15.000	21.100	20.800
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System Bias as Percent of Calibration Span Value (SB) (5%)

Zero gas	0.2%	0.4%	-0.1%
Upscale gas	-2.5%	-0.4%	-1.0%

System Bias Status

Zero gas	OK	OK	OK
Upscale gas	OK	OK	OK

Previous System Response to Calibration Gasses (C_s)

C _{oi} Zero gas	-0.064	0.124	0.054
C _{ui} Upscale gas	7.847	10.070	9.755

Drift Assessment as Percent of Calibration Span Value (D) (3%)

Zero gas	0.6%	0.0%	0.0%
Upscale gas	-0.8%	0.0%	0.0%

Drift Assessment Status

Zero gas	OK	OK	OK
Upscale gas	OK	OK	OK

090711 160607

17:18:46	2.646	3.603	13.870
17:19:01	0.070	9.878	9.831
17:19:16	-0.021	17.403	3.223
17:19:31	-0.076	19.613	0.899
17:19:46	-0.056	20.067	0.404
17:20:01	-0.063	20.160	0.273
17:20:16	-0.071	20.204	0.213
17:20:31	-0.072	20.227	0.191
17:20:46	-0.040	20.242	0.176
17:21:01	-0.036	20.247	0.160
17:21:16	-0.012	20.250	0.149
17:21:31	0.010	20.250	0.136
17:21:46	0.038	20.253	0.128
17:22:01	0.035	20.256	0.121
17:22:16	0.039	20.260	0.113
17:22:31	0.943	20.264	0.108
17:22:46	7.200	20.268	0.103

Zero THC

Marathon Petroleum Company
CleanAir Project No. 11265
Robinson Refinery
FCCU Scrubber Stack

July 14, 2011
Start Time 17:18
Stop Time 17:32

CALIBRATION BIAS 03

	Channel 2 THC FCCU Scrubber ppmwv	Channel 3 O2 FCCU Scrubber %dv	Channel 4 CO2 FCCU Scrubber %dv	
17:23:01	7.560	20.393	0.100	
17:23:16	7.587	20.566	0.097	
17:23:31	7.620	20.627	0.093	
17:23:46	7.703	20.627	0.090	Mid THC
17:24:01	7.715	20.638	0.082	
17:24:16	7.779	20.635	0.066	
17:24:31	7.117	20.633	0.077	
17:24:46	0.026	20.490	0.080	
17:25:01	-0.435	14.117	0.080	
17:25:16	-0.466	4.223	0.073	
17:25:31	-0.491	1.024	0.066	
17:25:46	-0.486	0.363	0.066	
17:26:01	-0.507	0.225	0.070	
17:26:16	-0.504	0.180	0.069	
17:26:31	-0.504	0.162	0.061	
17:26:46	-0.515	0.158	0.054	
17:27:01	-0.519	0.156	0.049	
17:27:16	-0.537	0.146	0.058	
17:27:31	-0.519	0.130	0.062	Zero O2/CO2
17:27:46	-0.518	0.124	0.051	
17:28:01	-0.518	0.118	0.050	
17:28:16	-0.503	0.116	0.067	
17:28:31	-0.462	0.259	0.100	
17:28:46	-0.474	3.960	2.939	
17:29:01	-0.478	8.373	7.625	
17:29:16	-0.470	9.694	9.231	
17:29:31	-0.465	9.974	9.589	
17:29:46	-0.478	10.047	9.681	
17:30:01	-0.472	10.056	9.717	
17:30:16	-0.477	10.055	9.737	
17:30:31	-0.476	10.055	9.750	
17:30:46	-0.481	9.648	9.030	
17:31:01	-0.481	10.062	9.762	
17:31:16	-0.472	10.061	9.754	
17:31:31	-0.474	10.076	9.219	
17:31:46	-0.483	10.071	9.707	Mid O2/CO2
17:32:01	-0.477	10.071	9.775	
17:32:16	-0.482	10.069	9.782	

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PROTOCOL

J

I hereby certify that all pages contained within this Appendix have been reviewed and, to the best of my ability, verified accurate.

QA/QC Initials: SB

Date: 7/14



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Marathon Petroleum Company
400 South Marathon Avenue
Robinson, IL 62454

PROTOCOL ON REFINERY ICR TESTING

Prepared for:
MARATHON PETROLEUM COMPANY
FCCU SCRUBBER STACK
ROBINSON REFINERY

Client Reference No: CN00072225
CleanAir Project No: 11265
Revision 0: June 24, 2011

To the best of our knowledge, the test plan and any state and federal regulations presented in this protocol have met all pre-determined program requirements. Modifications to the test plan or methodology presented in this original protocol will be performed only at the discretion of CleanAir and in accordance with all applicable parties involved. CleanAir operates in conformance with the requirements of ASTM D7036-04 Standard Practice for Competence of Air Emission Testing Bodies.

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REVISION HISTORY

ii

PROTOCOL ON REFINERY ICR TESTING**DRAFT PROTOCOL REVISION HISTORY**

Revision:	Date	Pages	Comments
D0a	06/09/2011	All	Draft version of original document.

FINAL PROTOCOL REVISION HISTORY

Revision:	Date	Pages	Comments
0	06/24/2011	1-2	Table 1-1: Added contact information for Enthalpy Analytical (page numbers shifted as a result)
		1-5	Table 1-2: Changed analytical laboratory for methane and ethane
		1-6	Table 1-2: Changed analytical laboratory for HCN
		1-9 to 1-10	Table 1-6: Broke out methane and ethane into a separate sample train (page numbers shifted as a result)
		3-3	Table 3-1: Broke out methane and ethane into a separate sample train
		4-6	Changed test methodology and analytical laboratory for methane and ethane
		4-12	Changed analytical laboratory for HCN
		A-3	Broke out methane and ethane into a separate sample train
		C-15 to C-16	Added new test specifications for methane and ethane (page numbers shifted as a result)
		C-29 to C-31	Removed out methane and ethane from CEMs test specifications.

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PROJECT OVERVIEW

1-1

INTRODUCTION

Marathon Petroleum Company (MPC) contracted Clean Air Engineering (CleanAir) to perform emission measurements at the Robinson Refinery (Facility ID IL2A0420), located in Robinson, Illinois, to provide data for the Refinery Information Collection Request (ICR) conducted by the Environmental Protection Agency (EPA) Office of Air and Radiation (OAR).

This protocol describes the safety, sampling, analytical, quality assurance (QA) and quality control (QC) procedures that CleanAir will follow in this test program. The test program is designed to collect the highest quality data in the safest, most efficient manner possible, for the constituents specified in the ICR website (<https://refineryicr.rti.org>).

Key Project Participants

Individuals responsible for coordinating and conducting the test program are listed below in Table 1-1 on the following page.

MARATHON PETROLEUM COMPANY
ROBINSON REFINERY

Client Reference No: CN00072225
CleanAir Project No: 11265

PROJECT OVERVIEW

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**Table 1-1:
Project Contact Information**

Client Contact	CleanAir Contact
Susan Hawkins Marathon Petroleum Company Robinson Refinery 400 South Marathon Avenue Robinson, IL 62454 Phone: 618-544-2121 x5379 Email: SHawkins@MarathonOil.com	Kevin O'Halloren Clean Air Engineering Midwest Engineering Group 500 West Wood Street Palatine, IL 60067 Phone: 847-654-4661 Email: kohalloren@cleanair.com
Laboratory Contact	Laboratory Contact
Douglas Rhoades Clean Air Analytical Services 500 West Wood Street Palatine, IL 60067 Phone: 847-654-4504 Email: drhoades@cleanair.com	Dr. Ron McLeod ALS Laboratory Group 5420 Mainway Drive, Unit 5 Burlington, ON L7M 6A4 Phone: 950-331-3111 x222 Email: ron.mcleod@alsglobal.com
Laboratory Contact	
Bryan Tyler Enthalpy Analytical, Inc. 2202 Ellis Road Durham, NC 27703 Phone: 919-850-4392 Email: bryan.tyler@enthalpy.com	

PROJECT OVERVIEW**1-3****INTRODUCTION (CONTINUED)*****Background***

On February 2, 2011, the United States Environmental Protection Agency (EPA), under authority of Section 114 of the Clean Air Act (CAA), issued an Information Collection Request (ICR) for petroleum refinery process units in support of its efforts to develop National Emission Standards for Hazardous Air Pollutants (NESHAP). Included in the ICR were requirements for sampling and analysis of stack gases, scrubber water, fuel gas systems, cooling water and wastewater treatment from a variety of emission sources at a large number of petroleum refineries throughout the United States.

This information will be used by EPA to:

- assess whether additional control strategies are necessary for these sources, and if so, evaluate which are the most effective,
- evaluate compliance options during start-up and shutdown periods,
- consolidate monitoring, reporting and recordkeeping requirements, and
- review other rules specific to petroleum refineries (such as the Benzene NESHAPs in Subparts BB and FF).

MPC received a Section 114 letter on March 31, 2011, detailing the required testing at the Robinson Refinery. The FCCU Scrubber Stack has been selected to provide a complete set of gaseous emissions data and scrubber water data for the hazardous air pollutants (HAPs) and criteria pollutants specified in the ICR.

Site Safety Procedures

All members of the test crew will be active in the plant's security database (DISA) and have TWIC cards. Crew members will be clean-shaven. Crew members will wear Nomex suits and carry H₂S monitors and goggles at all times while working at this facility.

All members of the test crew will need to attend site-specific contractor orientation for the facility. This orientation is offered daily prior to 2:30 PM.

PROJECT OVERVIEW**1-4****INTRODUCTION (CONTINUED)**

Field recovery of select sample trains will require use of acetone, dichloromethane, toluene, hexane, methanol, 2-4-dinitrophenylhydrazine solution, concentrated acids (sulfuric and nitric), concentrated bases (sodium hydroxide) and hydrogen peroxide.

- acetone is very flammable
- dichloromethane is a regulated toxic compound and a suspected human carcinogen
- toluene is very flammable and known to be toxic
- hexane is extremely flammable
- methanol is very flammable known to be toxic
- 2-4-dinitrophenylhydrazine is a known human carcinogen
- sulfuric acid, nitric acid and sodium hydroxide are corrosive
- hydrogen peroxide is an oxidizing agent

Nitrile rubber gloves, safety glasses and long sleeve clothing are mandatory PPE when handling these chemicals. Use of these chemicals in the field laboratory will only occur under a portable fume hood (supplied by CleanAir).

Daily toolbox meetings will be conducted prior to commencing work each morning of the test program. Upon arriving at the job site, the CleanAir Field Test Leader will review the safety considerations for the project with the crew and promote safety awareness. A reminder of the facility's safety policies and specific hazards will be given, particularly if problems or questions arise. The CleanAir daily toolbox meeting form will be used to document such meetings.

Work permits will be obtained daily, prior to initiating any work.

All additional safety requirements required by the Robinson Refinery will also be followed.

PROJECT OVERVIEW

1-5

INTRODUCTION (CONTINUED)**Test Program Parameters**

Required testing for the gaseous parameters will be performed at the FCCU Scrubber Stack and will include the following emissions measurements, organized by HAPs categories defined in the ICR.

**Table 1-2:
ICR Test Parameters – FCCU Scrubber Stack**

Parameter ¹	Abbr.	Sampling Method (EPA)	Analytical Method (EPA)	Analytical Laboratory	ICR Group	Notes
Speciated volatile organic HAP – all but methanol ¹	VOC	Mod. M-18	M-18	ALS	A1	1
Methanol	CH ₃ OH	M-18	M-18	ALS	A1	
Aldehydes		SW-846 M-0011	SW-846 M-8315A	ALS	A1	2
Speciated semi-volatile organic HAP	SVOC	SW-846 M-0010	SW-846 M-8270C	ALS	A2	3
Total hydrocarbons	THC	M-25A	M-25A	N/A	A3	
Methane	CH ₄	M-18	M-18	CleanAir	A3	
Ethane	C ₂ H ₆	M-18	M-18	CleanAir	A3	
Carbon monoxide	CO	M-10	M-10	N/A	A3	
Polychlorinated dibenzo-p-dioxins	PCDD	M-23	SW-846 M-8290	ALS	B	
Polychlorinated dibenzofurans	PCDF	M-23	SW-846 M-8290	ALS	B	
Polychlorinated biphenyls	PCB	M-23	SW-846 M-1668B	ALS	B	4

Notes

1. Target volatile analytes are listed in Table 1-3 on page 1-6.
2. Target aldehyde analytes are listed in Table 1-4 on page 7.
3. Target semi-volatile analytes are listed in Table 1-5 on page 7.
4. Only the 12 "dioxin-like" PCB congeners (IUPAC Numbers PCB-77, PCB-81, PCB-105, PCB-114, PCB-118, PCB-123, PCB-126, PCB-156, PCB-157, PCB-167, PCB-169 and PCB-189).

PROJECT OVERVIEW

1-6

**Table 1-2, Continued:
ICR Test Parameters – FCCU Scrubber Stack**

Parameter ¹	Abbr.	Sampling Method (EPA)	Analytical Method (EPA)	Analytical Laboratory	ICR Group	Notes
Filterable particulate matter	FPM	M-5	M-5	CleanAir	D1	
Condensable particulate matter	CPM	M-202	M-202	CleanAir	D1	
Total dissolved solids, total suspended solids from wet scrubber recirculation liquid	TDS, TSS	Grab	ASTM D5907	CleanAir	D1	
Ammonia	NH ₃	Mod. CTM-027	CTM-027	CleanAir	D1	
Other metals		M-29	M-29	ALS	D1	1
Particle-bound mercury	Hg _p	ASTM D6784	ASTM D6784	ALS	D2	
Oxidized mercury	Hg ²⁺	ASTM D6784	ASTM D6784	ALS	D2	
Elemental mercury	Hg ⁰	ASTM D6784	ASTM D6784	ALS	D2	
Hexavalent chromium	Cr ⁶⁺	SW-846 M-0061	SW-846 M-0061	ALS	D3	
Nitrogen oxides	NO _x	Facility CEMs		N/A	D4	
Sulfur dioxide	SO ₂	Facility CEMs		N/A	D4	
Hydrogen chloride	HCl	M-26A	M-26	CleanAir	E	
Chlorine	Cl ₂	M-26A	M-26	CleanAir	E	
Hydrogen fluoride	HF	M-26A	M-26	CleanAir	E	
Hydrogen cyanide (HCN)	HCN	OTM-29	OTM-29	Enthalpy	E	
Flow rate	Flow	M-2	M-2	N/A	All	2
Oxygen	O ₂	M-3 or M-3A	M-3A	N/A	All	2
Carbon dioxide	CO ₂	M-3 or M-3A	M-3A	N/A	All	2
Moisture	H ₂ O	M-4	M-4	N/A	All	2

Notes

1. Metals to be tested include antimony (Sb), arsenic (As), beryllium (Be), cadmium (Cd), chromium (Cr), cobalt (Co), lead (Pb), manganese (Mn), nickel (Ni) and selenium (Se).
2. Flow, O₂, CO₂ and H₂O measurements will be performed with each pollutant measurement.

MARATHON PETROLEUM COMPANY
ROBINSON REFINERY

Client Reference No: CN00072225
CleanAir Project No: 11265

PROJECT OVERVIEW

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**Table 1-3:
Target Volatile Analytes**

Compound	CAS Number	Compound	CAS Number
Acetone	67-64-1	Methyl isobutyl ketone	108-10-1
Acetonitrile	75-05-8	Methyl t-butyl ether	91-20-3
Acrolein	107-05-8	Methylene chloride	75-09-2
Acrylonitrile	107-13-1	Nitrobenzene	98-95-3
Benzene	71-43-2	2-Nitropropane	79-46-9
1,3-Butadiene	106-99-0	Pentane	109-66-0
Carbon disulfide	75-15-0	Styrene	100-42-5
Chlorobenzene	108-90-7	Tetrachloroethene	127-18-4
Cumene (isopropylbenzene)	98-82-8	Toluene	108-88-3
1,2-Dibromoethane	106-93-4	Trichloroethene	79-01-6
Ethylbenzene	100-41-4	2,2,4 Trimethylpentane	540-84-1
Hexane	110-54-3	Xylenes (mixed isomers)	1330-20-7
Methanol	67-56-1		

MARATHON PETROLEUM COMPANY
ROBINSON REFINERY

Client Reference No: CN00072225
CleanAir Project No: 11265

PROJECT OVERVIEW

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**Table 1-4:
Target Semi-Volatile Analytes**

Compound	CAS Number	Compound	CAS Number
Acenaphthene	83-32-9	Dimethylaminobenzene	60-11-7
Acenaphthylene	208-96-8	7,12-Dimethylbenz(a)anthracene	57-97-6
Aniline	62-53-3	3,3'-Dimethylbenzidine	119-93-7
Anthracene	120-12-7	α,α -Dimethylphenethylamine	122-09-8
Benzidine	92-87-5	2,4-Dimethylphenol	105-67-9
Benz[a]anthracene	56-55-3	Fluoranthene	206-44-0
Benzo[b]fluoranthene	205-99-2	Fluorene	86-73-7
Benzo[k]fluoranthene	207-08-9	Indeno(1,2,3-cd)pyrene	193-39-5
Benzo[g,h,i]perylene	191-24-2	Isophorone	78-59-1
Benzo[a]pyrene	50-32-8	3-Methylcholanthrene	56-49-5
Benzo[e]pyrene	192-97-2	2-Methylnaphthalene	91-57-6
Biphenyl	92-52-4	Naphthalene	91-20-3
Cresol (mixed isomers)	1319-77-3	Perylene	198-55-0
Chrysene	218-01-9	Phenanthrene	85-01-8
Dibenz[a,h]anthracene	53-70-3	Phenol	108-95-2
Dibenzofuran	132-64-9	1,4-Phenylenediamine	106-50-3
Dibenzo(a,e)pyrene	192-65-4	Pyrene	129-00-0
3,3'-Dimethoxybenzidine	119-90-4	o-Toluidine	95-53-4

**Table 1-5:
Target Aldehyde Analytes**

Compound	CAS Number
Formaldehyde	100-41-4
Acetaldehyde	106-99-0
Propanal (Propionaldehyde)	123-38-6

Test Schedule

The anticipated on-site schedule to be followed during the test program is outlined in Table 1-6 on pages 1-9 and 1-10. A visual timeline of this schedule is included in Appendix A.

MARATHON PETROLEUM COMPANY
ROBINSON REFINERY

Client Reference No: CN00072225
CleanAir Project No: 11265

PROJECT OVERVIEW

1-9

**Table 1-6:
Schedule of Activities**

Day	Activity	Location	Start Time ¹	End Time ¹	Run No.	Constituent	Test Method (USEPA)	ICR Group	Sampling Time (min)
1	Mobilization		07:00	13:00					
(Mon)	Safety Training		13:00	15:00					
	Equipment Setup ²	FCCU Scrub. Stack	15:00	17:00					
2	Toolbox Safety Meeting		07:00	07:30					
(Tue)	Equipment Setup	FCCU Scrub. Stack	07:30	13:00					
	Site Evaluation	FCCU Scrub. Stack	13:00	14:00		Cyclonic Flow	M-1		
	Equipment Setup	FCCU Scrub. Stack	14:00	14:30					
	Emissions Testing	FCCU Scrub. Stack	14:30	15:50	1	VOC (all but CH ₃ OH)	Mod. M-18	A1	80
			16:20	17:40	1	CH ₃ OH	M-18	A1	80
			14:30	17:15	1	Aldehydes	M-0011	A1	120
			14:45	17:00	1	O ₂ / CO ₂ / CO / THC	M-3A / 10 / 25A	A3	60
			14:30	15:30	1	CH ₄ / C ₂ H ₆	M-18	A3	60
	Sample Recovery	FCCU Scrub. Stack	17:00	18:45					
	Discussion of Test Day		18:45	19:15					
3	Toolbox Safety Meeting		07:00	07:30					
(Wed)	Equipment Setup	FCCU Scrub. Stack	07:30	08:00					
	Emissions Testing	FCCU Scrub. Stack	08:00	09:20	2	VOC (all but CH ₃ OH)	Mod. M-18	A1	80
			09:50	11:10	2	CH ₃ OH	M-18	A1	80
			08:00	10:45	2	Aldehydes	M-0011	A1	120
			08:15	10:30	2	O ₂ / CO ₂ / CO / THC	M-3A / 10 / 25A	A3	60
			08:00	09:00	2	CH ₄ / C ₂ H ₆	M-18	A3	60
	Sample Recovery	FCCU Scrub. Stack	10:30	12:15					
	Emissions Testing	FCCU Scrub. Stack	12:15	13:35	3	VOC (all but CH ₃ OH)	Mod. M-18	A1	80
			14:05	15:25	3	CH ₃ OH	M-18	A1	80
			12:15	15:00	3	Aldehydes	M-0011	A1	120
			12:30	14:45	3	O ₂ / CO ₂ / CO / THC	M-3A / 10 / 25A	A3	60
			12:15	13:15	3	CH ₄ / C ₂ H ₆	M-18	A3	60
	Sample Recovery	FCCU Scrub. Stack	14:45	16:30					
	Test Equipment Switch	FCCU Scrub. Stack	16:30	17:30					
	Discussion of Test Day		17:30	18:00					
4	Toolbox Safety Meeting		07:00	07:30					
(Thu)	Equipment Setup	FCCU Scrub. Stack	07:30	08:00					
	Emissions Testing	FCCU Scrub. Stack	08:00	12:45	1	SVOC	M-0010	A2	240
		FCCU Scrub. Stack	08:15	12:30	1	Cr ⁶⁺	M-0061	D3	180
			08:30	12:15	1	Hg ₀ / Hg ²⁺ / Hg ⁰	ASTM D6784	D2	120
	Sample Recovery	FCCU Scrub. Stack	12:15	13:45					
	Emissions Testing	FCCU Scrub. Stack	13:45	18:30	2	SVOC	M-0010	A2	240
		FCCU Scrub. Stack	14:00	18:15	2	Cr ⁶⁺	M-0061	D3	180
			14:15	18:00	2	Hg ₀ / Hg ²⁺ / Hg ⁰	ASTM D6784	D2	120
	Sample Recovery	FCCU Scrub. Stack	18:00	19:30					
	Discussion of Test Day		19:30	20:00					

¹ Start and stop times estimated.

² Assistance from electrician requested at specified location and start time.

MARATHON PETROLEUM COMPANY
ROBINSON REFINERYClient Reference No: CN00072225
CleanAir Project No: 11265

PROJECT OVERVIEW

1-10

Table 1-6, Continued:
Schedule of Activities

Day	Activity	Location	Start Time ¹	End Time ¹	Run No.	Constituent	Test Method (USEPA)	ICR Group	Sampling Time (min)
5	Toolbox Safety Meeting		07:00	07:30					
(Fri)	Equipment Setup	FCCU Scrub. Stack	07:30	08:00					
	Emissions Testing	FCCU Scrub. Stack	08:00	12:45	3	SVOC	M-0010	A2	240
		FCCU Scrub. Stack	08:15	12:30	3	Cr ⁶⁺	M-0061	D3	180
		FCCU Scrub. Stack	08:30	12:15	3	Hg ₀ / Hg ²⁺ / Hg ⁰	ASTM D6784	D2	120
	Sample Recovery	FCCU Scrub. Stack	12:15	13:45					
	Test Equipment Switch	FCCU Scrub. Stack	13:45	14:45					
	Emissions Testing	FCCU Scrub. Stack	14:45	18:30	1	Other Metals	M-29	D1	180
			15:00	18:15	1	FPM / CPM	M-5/202	D1	120
			15:15	18:00	1	NH ₃	Mod CTM-027	D1	60
	Sample Recovery		18:00	19:30					
	Discussion of Test Day		19:30	20:00					
6	Toolbox Safety Meeting		07:00	07:30					
(Sat)	Equipment Setup	FCCU Scrub. Stack	07:30	08:00					
	Emissions Testing	FCCU Scrub. Stack	08:00	11:45	2	Other Metals	M-29	D1	180
			08:15	11:30	2	FPM / CPM	M-5/202	D1	120
			08:30	11:15	2	NH ₃	Mod CTM-027	D1	60
	Sample Recovery		11:15	12:45					
	Emissions Testing	FCCU Scrub. Stack	12:45	16:30	3	Other Metals	M-29	D1	180
			13:00	16:15	3	FPM / CPM	M-5/202	D1	120
			13:15	16:00	3	NH ₃	Mod CTM-027	D1	60
	Sample Recovery	FCCU Scrub. Stack	16:00	17:30					
	Test Equipment Switch	FCCU Scrub. Stack	17:30	18:30					
	Discussion of Test Day		18:30	19:00					
7	Day Off								
(Sun)									
8	Toolbox Safety Meeting		07:00	07:30					
(Mon)	Equipment Setup	FCCU Scrub. Stack	07:30	08:00					
	Emissions Testing	FCCU Scrub. Stack	08:00	11:45	1	PCDD / PCDF / PCB	M-23	B	180
			08:15	11:30	1	HCl / Cl ₂ / HF	M-26A	E	120
			08:45	11:15	1	HCN	OTM-29	E	60
	Sample Recovery	FCCU Scrub. Stack	11:15	12:45					
	Emissions Testing	FCCU Scrub. Stack	12:45	16:30	2	PCDD / PCDF / PCB	M-23	B	180
			13:00	16:15	2	HCl / Cl ₂ / HF	M-26A	E	120
			13:30	16:00	2	HCN	OTM-29	E	60
	Sample Recovery	FCCU Scrub. Stack	16:00	17:30					
	Discussion of Test Day		17:30	18:00					
9	Toolbox Safety Meeting		07:00	07:30					
(Tue)	Equipment Setup	FCCU Scrub. Stack	07:30	08:00					
	Emissions Testing	FCCU Scrub. Stack	08:00	11:45	3	PCDD / PCDF / PCB	M-23	B	180
			08:15	11:30	3	HCl / Cl ₂ / HF	M-26A	E	120
			08:45	11:15	3	HCN	OTM-29	E	60
	Sample Recovery	FCCU Scrub. Stack	11:15	12:45					
	Discussion of Test Day	FCCU Scrub. Stack	12:45	13:45					
	Equipment Breakdown ²	FCCU Scrub. Stack	13:45	19:15					
10	Demobilization		07:00	13:00					
(Wed)									

¹ Start and stop times estimated.² Assistance from electrician requested at specified location and start time.

PROJECT OVERVIEW**1-11****INTRODUCTION (CONTINUED)**

The anticipated test schedule is based on predicted set-up, sampling and recovery times, taking into account the need to execute a large variety of test methods in the most efficient manner possible. Due to the complexity of the test program, the actual length of days and order that the test methods are performed is subject to change based on unforeseen events in the field.

A day off is included in the schedule in order to comply with Department of Transportation (DOT) limits on hours of service for operators of commercial motor vehicles. The day off listed in the schedule was selected between completing one test method group and starting another; the actual date is flexible.

Discussion of Test Program**General Considerations**

The primary goal of the test program is to obtain a complete set of gaseous emissions data and scrubber water data for the HAPs and criteria pollutants specified in the ICR.

Per EPA Method 1 requirements, a verification of the absence of cyclonic flow will be performed at the FCCU Scrubber Stack prior to sampling.

Test runs for constituents in the same Group as defined in Table 1.1 of EPA's "Instructions for Component 4 Emissions Source Testing" will be performed at concurrent or overlapping times. If a test run for a single constituent is voided and must be repeated (due to sample loss, leak check failures, non-isokinetic sampling, QA/QC failure, etc.), repeating only the invalidated test run rather than repeating all of the test methods is acceptable for the purposes of this test program. The following procedure will be followed:

- the test run will be repeated in as close proximity as possible to the other testing for that ICR Group,
- any resulting changes in the test schedule will be clearly documented,
- data from the invalidated test run (up to the point of invalidation) will be collected, analyzed, and included in the report, and
- any required process conditions and process samples will be collected by MPC during the repeated test and clearly documented in order to compare with the earlier operating condition.

All gaseous emissions tests will be comprised of three (3) test runs and will meet or exceed the minimum sampling times and volumes specified by Table 1.2 of EPA's "Instructions for Component 4 Emissions Source Testing. The results of gaseous emissions testing will be expressed in units specified by these tables as well. A summary of the test program parameters, units to be reported, sampling methodology and targeted sampling times are detailed in Table 2-1 on pages 2-1 and 2-2.

PROJECT OVERVIEW**1-12****INTRODUCTION (CONTINUED)**

O₂ and CO₂ data (units of dry volume percent, %_{dv}) used in molecular weight calculations, O₂ correction and calculation of F_d-based emissions (units of lb/MMBtu) will be obtained in the following manner during the test program:

- For non-instrumental (wet) sampling methods, a modified version of EPA M-3B will be utilized.
 - Multi-point, integrated gas samples (IGS) will be continuously collected at a constant rate from a slipstream of the exhaust of the sample trains into a flexible vinyl bag (IGS bag) per M-3B specifications.
 - A calibrated paramagnetic/IR analyzer will be used in place of a traditional Orsat analyzer to measure drift-corrected O₂ and CO₂ concentrations of the IGS bags per M-3A specifications.
 - Multiple IGS bags may be collected during lengthy sample runs to ensure sample train integrity. If so, an average O₂ and CO₂ result for the test run will be calculated.
 - Documentation of preliminary instrument calibrations and post-analysis calibration checks will be included in the appendices of the final report.
- For instrumental (continuous) test methods, O₂ and CO₂ data will be obtained from a continuous paramagnetic / non-dispersive infrared (NDIR) analyzer operated concurrently and in parallel with the other analyzers.

H₂O data (units of volume percent, %_v) used for moisture correction of concentration data will be obtained in the following manner during the test program:

- For non-instrumental (wet) sampling methods, EPA M-4 measurements are incorporated into the sampling and recovery procedures.
- For M-18 and Modified M-18, H₂O data will be obtained from an overlapping SW-846 0010 or SW-846 0011 test run.
- For instrumental (continuous) sampling methods using FTIR analyzers, H₂O data obtained from the FTIR is approved for use.
- For instrumental (continuous) sampling methods using traditional CEM analyzers, H₂O data will be obtained from another overlapping test run with an incorporated moisture measurement.

Unit Operating Conditions

All testing will be performed with the unit at a normal, representative operating condition (suggested criterion: $\pm 10\%$ of historical data). All air pollution control (APC) devices should be in service and fully operational for this test program; the facility should refrain from any maintenance activities for the duration of each test run. To the nearest extent possible, operating set points should be the same as those used during annual compliance testing.

PROJECT OVERVIEW**1-13****INTRODUCTION (CONTINUED)****Preliminary Test Preparation**

Prior to the week of the test program, CleanAir will arrange to have a portable mobile trailer (henceforth referred to as the "laboratory trailer") delivered to the Robinson Refinery for use as laboratory space during the test program. The approximate footprint of the laboratory trailer will be 56 feet by 12 feet. The trailer will require a single 240V power source to provide lighting and air conditioning (not anticipated to exceed 40 amps).

MPC personnel will determine a suitable location for the laboratory trailer in advance of the delivery date. The ideal location would be as near to the base of the stack as possible. CleanAir will coordinate delivery and pick up times between the trailer supply company and MPC in the days leading up to the test program. A MPC electrician will connect the trailer to a nearby 240V power supply (welder's outlet or equivalent) upon delivery of the trailer and disconnect it at the end of the test program.

Assistance from MPC personnel with opening of sample ports and cleaning out accumulated debris prior to the week of the test program is requested. All sample ports to be used during the test program should be inspected to verify that they are unobstructed and as clean as possible. Bolts should be loosened to hand-tight to avoid delay during set-up.

Mobilization, Safety Orientation and Equipment Set-up

The test crew will tentatively mobilize to the Robinson Refinery on Monday, July 11, 2011, and arrive at the refinery around 1:00 PM. The crew will attend site-specific safety training at this time. Orientation is anticipated to last until 3:00 PM.

Upon completion of safety orientation, the crew will obtain vehicle passes and enter the facility to meet with on-site representatives. The crew will then proceed to the Unit 82 Control Room to obtain a work permit.

The crew will familiarize themselves with the location of the Unit 82 Control Room and provide operators with a radio for communication during the test program. The crew will also perform a walk-down of the test location prior to setting up equipment.

PROJECT OVERVIEW**1-14****INTRODUCTION (CONTINUED)**

CleanAir will be arriving with an additional trailer (henceforth referred to as the "CEMs trailer") for housing the portable continuous emissions monitoring systems, gas chromatograph (GC) and calibration gases required for the test program. The approximate footprint of the CEMs trailer is 16 feet by 8 feet. The trailer has a single-phase 480V transformer with about 100 feet of cord that steps power down to 240V for the air conditioner and 110V for lighting and several electrical outlets (not expected to exceed 40 amps).

The power requirements for the proposed emissions testing program exceed the current capacity of the available electrical outlets at the FCCU Scrubber Stack test platform. CleanAir will therefore bring an additional (portable) single-phase 480V transformer with about 100 feet of cord and stage it at grade level near the test location. The transformer will step down power to 110V; the additional power required will be supplied to the test platform using shielded extension cords. The transformer is anticipated to draw less than 40 amps of current.

Once equipment set-up commences and CleanAir and MPC representatives locate a suitable site for staging the CleanAir CEMs trailer and portable transformer, a facility electrician will connect the transformers to nearby 480V power supplies (welder's outlet or equivalent). Detailed instructions for wiring CleanAir transformers are included in Appendix B.

Equipment will be brought up to the test location with the assistance of a crane during initial set-up. Set-up is anticipated to continue through Tuesday, July 12, 2011.

Gaseous Emissions Testing Outline

As currently scheduled in Table 1-6, CleanAir will attempt to begin testing on the afternoon of Tuesday, July 12, when set-up has been completed. Unanticipated delays may push back the start of the test program.

Emissions testing will commence with concurrent ICR Group A1 and A3 testing at the FCCU Scrubber Stack. This phase of the test program is anticipated to last 1.5 days.

Upon completion, concurrent ICR Group A2, D2 and D3 testing will be performed. This phase of the test program is anticipated to last 1.5 days.

Upon completion, ICR Group D1 testing will be performed. This phase of the test program is anticipated to last 1.5 days.

Following a day off, concurrent ICR Group B and E testing will be performed. This phase of the test program is anticipated to last 1.5 days.

PROJECT OVERVIEW**1-15****INTRODUCTION (CONTINUED)****Process Samples**

MPC representatives will be responsible for collecting required wet scrubber recirculation liquid samples during ICR Group D1 testing. One (1) sample must be collected during each ICR Group D1 test run (total of 3 samples). Samples should be clearly labeled with a collection date, collection time and run number upon collection. After all of the required samples have been collected, they should be delivered to the CleanAir laboratory trailer with complete chain of custody documentation.

The required TDS / TSS analysis will be performed by CleanAir Analytical Services.

Process Data

MPC representatives will be responsible for collecting the process data required for inclusion in the final report. During a 30-day period (including the date of emission testing), the following process information should be collected and reported as daily averages:

- Total heat input (MMBtu/hr)
- Material description
- Material composition
- Feed rate (barrels per day, or BPD)
- Coke burn rate (lb/hr)
- Emissions control devices in use during the test
- Control device operating or monitoring parameters, such as (where applicable):
 - Flue gas flow rate
 - Pressure drop
 - Scrubber liquor pH
 - Scrubber liquor flow rate
 - Sorbent type
 - Sorbent injection rate
 - Primary voltage
 - Secondary voltage
 - Primary current
 - Secondary current
 - Temperature
- Process parameters, such as:
 - Type of crude
 - Oxygen concentration
 - Temperature
- Any pollution prevention or other hazardous air pollutant emission reduction approaches being implemented during the test program

PROJECT OVERVIEW**1-16****INTRODUCTION (CONTINUED)**

In lieu of conducting stack testing for SO₂ and NO_x, at least 30 days of daily average data from the FCCU Scrubber Stack continuous emissions monitoring system (CEMs) for these constituents will instead be collected. A portion of the CEMs data will contain emissions data collected while performing the emissions test program. Hourly O₂ concentrations will also be reported for the 30-day period. Each CEMs must meet the requirements of the applicable Performance Specification.

All process data can be submitted to CleanAir subsequent to demobilization from the site.

Equipment Breakdown and Demobilization

As currently scheduled in Table 1-6, completion of the test program is estimated to occur on Tuesday, July 18, 2011, around 12:45 PM. A short discussion of the test program will occur at this time, including confirmation of the following:

- all required gaseous emissions test runs have been completed and are valid,
- all samples from gaseous emissions tests have been recovered (or are in the process of being recovered),
- all required process samples have been collected by MPC and received by CleanAir, and
- all continuous data has been backed up and archived.

Upon confirmation of the above, CleanAir will begin equipment breakdown on the afternoon of Tuesday, July 18. Power supply to the CEMs trailer and portable transformer can be disconnected by a MPC electrician at this time. CleanAir will replace all sample port covers and secure bolts to a "snug" level of tightness using wrenches.

The laboratory trailer will require power until sample recovery is completed; barring any unforeseen delays, this is estimated to be complete on the afternoon of Tuesday, July 18. Assistance with powering down the laboratory trailer from a MPC electrician is requested around this approximate time. This can be delayed if necessary as the trailer may not be picked up by the trailer supply company for up to a week after the test program is completed. CleanAir will coordinate delivery and pick up times between the trailer supply company and MPC in the days following the test program.

End of Section 1 – Project Overview

RESULTS**2-1**

Table 2-1 outlines the parameters of the test program, units to be reported, sampling methodology and targeted sampling times and volumes.

**Table 2-1:
Presentation of Final Results**

Source	Category	Constituent	Units	Sampling Method (USEPA)	ICR Group	Sample Time (min)	Sample Volume ¹
	FCCU Scrubber Stack						
	VOC (all but CH ₃ OH)	lb/hr µg/dscm	Mod. M-18	A1	80	20 L	
	CH ₃ OH	lb/hr µg/dscm	M-18	A1	80	20 L	
	Aldehydes	lb/hr µg/dscm	SW-846 M-0011	A1	120	1.3 dscm / 45.9 dscf	
	SVOC	lb/hr µg/dscm	SW-846 M-0010	A2	240	4 dscm / 141 dscf	
	THC	lb/hr ppmdv as C ₃ H ₈	M-25A	A3	60	N/A	
	CH ₄	lb/hr ppmdv	M-18	A3	60	N/A	
	C ₂ H ₆	lb/hr ppmdv	M-18	A3	60	N/A	
	CO	lb/hr ppmdv	M-10	A3	60	60 L	
	PCDD	lb/hr pg/dscm	M-23	B	180	3 dscm / 106 dscf	
	PCDF	lb/hr pg/dscm	M-23	B	180	3 dscm / 106 dscf	
	PCB	lb/hr pg/dscm	M-23	B	180	3 dscm / 106 dscf	

¹ Minimum sample volume requirement, unless otherwise noted.

MARATHON PETROLEUM COMPANY
ROBINSON REFINERY

Client Reference No: CN00072225
CleanAir Project No: 11265

RESULTS

2-2

Table 2-1, Continued:
Presentation of Final Results

Source	Category	Constituent	Units	Sampling Method (USEPA)	ICR Group	Sample Time (min)	Sample Volume ¹
<u>FCCU Scrubber Stack</u>							
	FPM		lb/hr gr/dscf	M-5	D1	120	2 dscm / 70.6 dscf
	CPM		lb/hr gr/dscf	M-202	D1	120	2 dscm / 70.6 dscf
	NH ₃		lb/hr ppmdv	Mod. CTM-027	D1	60	N/A
	Other Metals		lb/hr mg/dscm	M-29	D1	180	3 dscm / 106 dscf
	Hg _p		lb/hr μg/dscm	ASTM D6784	D2	120	< 2.5 dscm / 88.3 dscf
	Hg ²⁺		lb/hr μg/dscm	ASTM D6784	D2	120	< 2.5 dscm / 88.3 dscf
	Hg ⁰		lb/hr μg/dscm	ASTM D6784	D2	120	< 2.5 dscm / 88.3 dscf
	Cr ⁶⁺		lb/hr μg/dscm	SW-846 0061	D3	180	3 dscm / 106 dscf
	HCl		lb/hr mg/dscm	M-26A	E	120	2 dscm / 70.6 dscf
	Cl ₂		lb/hr mg/dscm	M-26A	E	120	2 dscm / 70.6 dscf
	HF		lb/hr mg/dscm	M-26A	E	120	2 dscm / 70.6 dscf
	HCN		lb/hr μg/dscm	OTM-29	E	60	< 0.9 dscm / 31.8 dscf
	Flow		acfm scfm dscfm	M-2	All	Various	N/A
	O ₂		% _{dv}	M-3 or M-3A	All	Various	N/A
	CO ₂		% _{dv}	M-3 or M-3A	All	Various	N/A
	H ₂ O		% _v	M-4	All	Various	N/A

¹ Minimum sample volume requirement, unless otherwise noted.

End of Section 2 – Results

DESCRIPTION OF INSTALLATION**3-1****PROCESS DESCRIPTION**

The fluidized catalytic cracking unit (FCCU) at the Robinson Refinery uses hydrotreated gas oil as its primary raw material and produces fuel gas, mixed C3/C4 hydrocarbons, gasoline, light and heavy cycle oil, slurry and coke as its products.

The FCCU charges a combined stream of light and heavy vacuum and atmospheric gas oil from the Crude Unit and tank farm. Fluid catalytic cracking is a low pressure, high temperature method of cracking a wide variety of gas oils by using a powdered catalyst which boosts the cracking reaction in the direction of higher octane gasoline and more aromatic products. Carbon deposits on the catalyst are burned off to regenerate the catalyst in the unit's regenerator vessel.

The partially-combusted flue gas from the regenerator has a high content of carbon monoxide (CO), and this additional fuel value is recovered in a CO boiler, which also fires refinery fuel gas. The CO boiler produces 600# steam and superheats 150# steam. Flue gases leaving the CO boiler enter the Flue Gas Scrubber. The hot flue gas contains sulfur gases and catalyst fines and is cooled to its saturation temperature in the Flue Gas Scrubber. Sulfur gases and catalyst fines are removed.

A small amount of soda ash solution is added to control pH. A purge stream from the Flue Gas Scrubber is sent to the Purge Treatment Unit (PTU). At the PTU, solids contained in the purge stream settle out and are run through a filter press. Liquid remaining after the solids are removed is aerated to oxidize sodium salts present and then disposed off-site. Soda ash solution is injected into the PTU to control pH.

Finished products (gas and gasoline) from the main fractionator leaving the unit are sent to the light ends plant. Additional products leaving the process include slurry oil and light/heavy cycle oil. The unit employs one (1) gas/oil-fired feed preheater (82F-2) and a waste heat CO boiler (60F-1), various chemical and fuel/oil storage tanks and a unit sump system.

The Peabody Heater (82F-1) remains idle for the most part. This heater is used only as a standby unit. When the FCCU has an extended downtime, this heater is used to bring the unit back on-line.

The testing reported in this document was performed at the FCCU Scrubber Stack. An outline of the FCCU process is shown in Figure 3-1 on the following page.

DESCRIPTION OF INSTALLATION
PROCESS DESCRIPTION (CONTINUED)

3-2

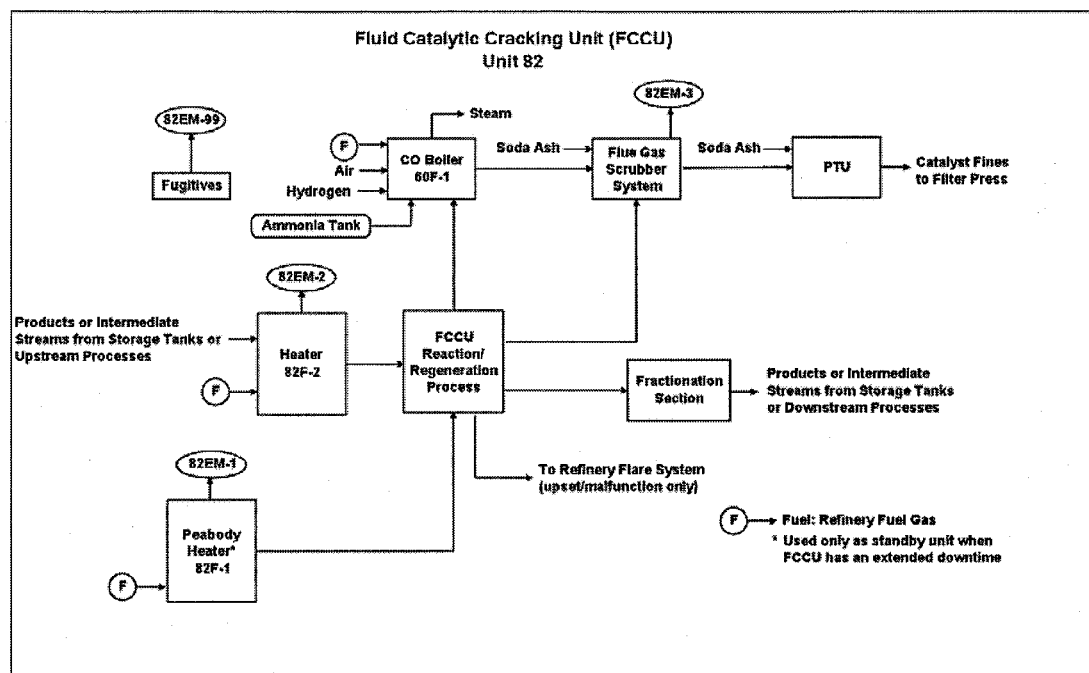


Figure 3-1: Process Schematic

MARATHON PETROLEUM COMPANY
ROBINSON REFINERY

Client Reference No: CN00072225
CleanAir Project No: 11265

DESCRIPTION OF INSTALLATION

3-3

DESCRIPTION OF SAMPLING LOCATION

Sampling point locations were determined according to EPA Method 1.

Table 3-1 outlines the sampling point configurations. Figure 3-2 on the following page illustrates the sampling points and orientation of sampling ports for each of the sources tested in the program.

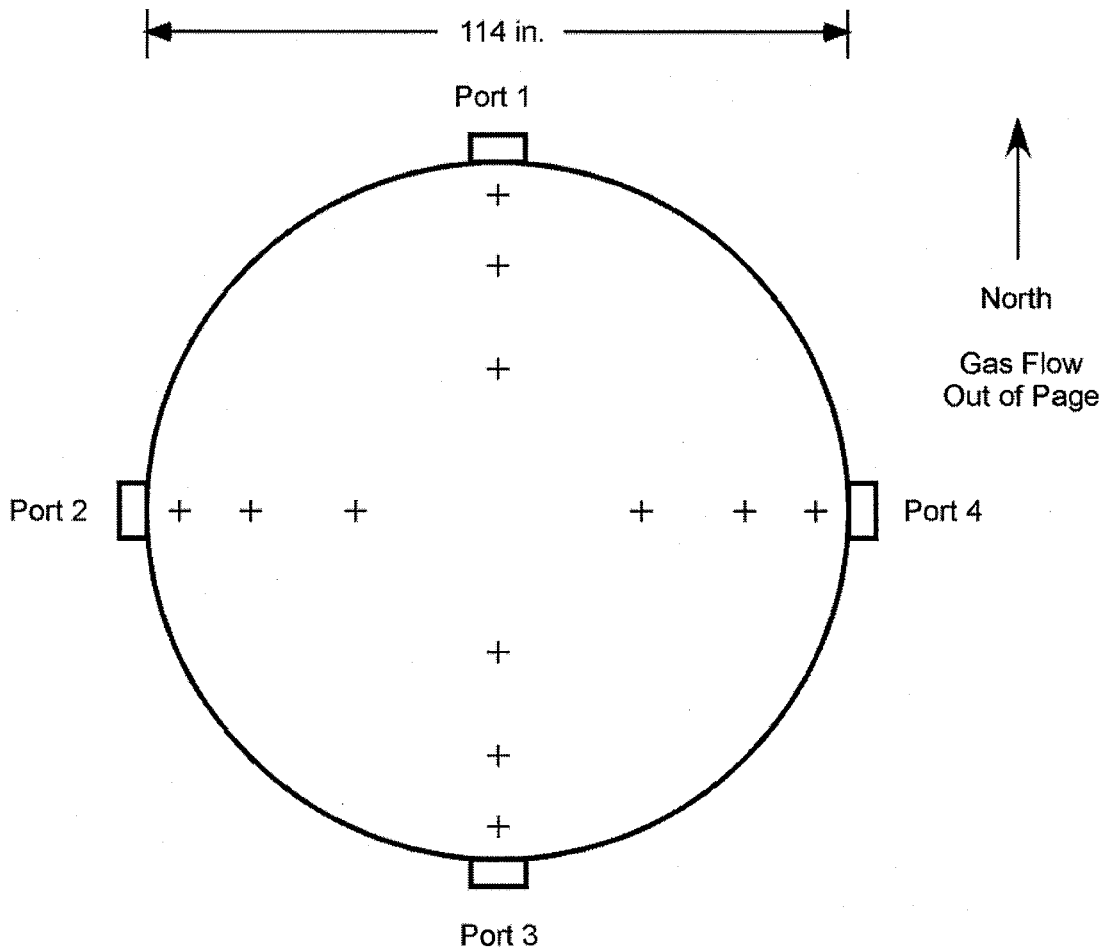
**Table 3-1:
Sampling Points**

Source		Run		Points	Minutes	Total	
Constituent	Method	No.	Ports	per Port	per Point	Minutes	Figure
FCCU Scrubber Stack							
VOC (all but CH ₃ OH)	Mod. M-18	1-3	1	1	80	80	NA ¹
CH ₃ OH	M-18	1-3	1	1	80	80	NA ¹
Aldehydes	SW-846 M-0011	1-3	4	3	10	120	3-2
SVOC	SW-846 M-0010	1-3	4	3	20	240	3-2
O ₂ / CO ₂ / CO / THC	M-3A / 10 / 25A	1-3	4	3	5	60	3-2
CH ₄ / C ₂ H ₆	M-18	1-3	1	1	60	60	NA ¹
PCDD / PCDF / PCB	M-23	1-3	4	3	15	180	3-2
FPM / CPM	M-5 / 202	1-3	4	3	10	120	3-2
NH ₃	Mod. CTM-027	1-3	4	3	5	60	3-2
Other Metals	M-29	1-3	4	3	15	180	3-2
Hg _p / Hg ²⁺ / Hg ⁰	ASTM D6784	1-3	4	3	10	120	3-2
Cr ⁶⁺	SW-846 M-0061	1-3	4	3	15	180	3-2
HCl / Cl ₂ / HF	M-26A	1-3	4	3	10	120	3-2
HCN	OTM-29	1-3	4	3	5	60	3-2
Flow	M-2	1-3	4	3	Various	Various	3-2
O ₂	M-3 or M-3A	1-3	4	3	Various	Various	3-2
CO ₂	M-3 or M-3A	1-3	4	3	Various	Various	3-2
H ₂ O	M-4	1-3	4	3	Various	Various	3-2

¹ Sampling will be performed at a single point no closer than 1 meter to the stack wall.

DESCRIPTION OF INSTALLATION**DESCRIPTION OF SAMPLING LOCATION (CONTINUED)**

3-4



<u>Sampling Point</u>	<u>Point Distance (in.)</u>	<u>Point plus Port Length Distance (in.)</u>
1	33.7	39.7
2	16.6	22.6
3	5.0	11.0

Duct diameters upstream from flow disturbance (A):	8.2	Limit: 0.5
Duct diameters downstream from flow disturbance (B):	8.2	Limit: 2.0

Figure 3-2: FCCU Scrubber Stack Sampling Point Determination (EPA Method 1)*End of Section 3 – Description of Installation*

METHODOLOGY

4-1

Clean Air Engineering will follow reference procedures as detailed in EPA Methods 1, 2, 3, 3A, 4, 5, 10, 18, 23, 25A, 29, 202, SW-846 0010, SW-846 0011, SW-846 0061, CTM-027, and OTM-29, as well as ASTM-D6784 and the modified version of M-18 posted on the Petroleum ICR website. The following table summarizes the methods and their respective sources.

**Table 4-1:
Summary of Sampling Procedures**

Title 40 CFR Part 60 Appendix A

Method 1	"Sample and Velocity Traverses for Stationary Sources"
Method 2	"Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S Pitot Tube)"
Method 3	"Gas Analysis for the Determination of Dry Molecular Weight"
Method 3A	"Determination of Oxygen and Carbon Dioxide Concentrations in Emissions from Stationary Sources (Instrumental Analyzer Procedure)"
Method 4	"Determination of Moisture Content in Stack Gases"
Method 5	"Determination of Particulate Matter Emissions from Stationary Sources"
Method 10	"Determination of Carbon Monoxide Emissions from Stationary Sources"
Method 18	"Measurement of Gaseous Organic Compound Emissions by Gas Chromatography"
Method 23	"Determination of Polychlorinated Dibenzo-p-Dioxins and Polychlorinated Dibenzofurans from Municipal Waste Conductors"
Method 25A	"Determination of Total Gaseous Organic Concentration Using a Flame Ionization Analyzer"
Method 29	"Determination of Metals Emissions from Stationary Sources"

Title 40 CFR Part 51 Appendix M

Method 202	"Dry Impinger Method for Determining Condensable Particulate Emissions from Stationary Sources"
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SW-846 Methods

Method 0010	"Modified Method 5 Sampling Train"
Method 0011	"Sampling for Selected Aldehyde and Ketone Emissions from Stationary Sources"
Method 0061	"Determination of Hexavalent Chromium Emissions from Stationary Sources"

Conditional Test Methods (CTM)

CTM-027	"Procedure for Collection and Analysis of Ammonia in Stationary Sources"
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American Society for Testing and Materials (ASTM) Methods

ASTM D6784-02	"Standard Test Method for Elemental, Oxidized, Particle-Bound and Total Mercury in Flue Gas Generated from Coal-Fired Stationary Sources (Ontario HYDRO Method)"
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Other Test Methods

OTM-29	"Sampling and Analysis for Hydrogen Cyanide Emissions from Stationary Sources"
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Petroleum ICR Test Methods

Mod. Method 18	"Midget Impinger Method for Determining Volatile Organic Emissions in Elevated Concentrations of Stack Gas"
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METHODOLOGY

4-2

These methods appear in detail in Title 40 of the Code of Federal Regulations (CFR) and on the World Wide Web at <http://ecfr.gpoaccess.gov>, <http://www.astm.org>, and <https://refineryicr.rti.org/>.

Diagrams of the sampling apparatus and major specifications of the sampling, recovery and analytical procedures are summarized for each method in Appendix C.

CleanAir will follow specific quality assurance and quality control (QA/QC) procedures as outlined in the individual methods and as prescribed in CleanAir's internal Quality Manual.

Gaseous Emissions Testing – ICR Group A1**VOC – all but CH₃OH**

Emissions of all VOCs except CH₃OH will be determined using a modified version of M-18 posted on the Refinery ICR website and two (2) co-located, constant rate (non-isokinetic), single-point sample trains. Each sampling train consists of a heated probe, TFE jumper, water-jacketed condenser and a midjet impinger train in a dry ice/methanol bath. The VOC-collecting midjet impingers are charged with purge grade methanol.

In order to facilitate co-located sampling trains, the glass probe liner specified in the method will be replaced with a TFE probe liner.

The modified method specifies a final midjet impinger containing silica gel in an ice water bath. It is assumed that the majority of the moisture in the sample gas will have been removed by the water-jacketed condenser and the impinger train in the dry ice/methanol bath. Additionally, moisture data required for molecular weight calculations will be obtained from another concurrent sample train. Therefore, the silica gel impinger will be replaced by a Drierite tube at ambient temperatures.

Each paired sampling train will be pre-spiked with the following isotopically-labeled recovery surrogates required by EPA:

- 1,3-Butadiene-d6
- Benzene-d6
- Acrylonitrile-d3
- Nitrobenzene-d5
- 2,2,4-Trimethylpentane-d18
- Ethylbenzene-d10

METHODOLOGY**4-3**

Since not all of the required recovery surrogates are available as stable isotopically-labeled spikes, one (1) of the paired sampling trains will be pre-spiked with the following native recovery surrogates required by EPA:

- Acrolein
- Acetonitrile
- Trichloroethene
- Toluene
- Methyl isobutyl ketone

During sampling, approximately 20 L of sample gas will be drawn through each sample train at rate of 0.25 liter per minute (lpm) for a total of 80 minutes per run. Sampling will occur from a single point in the stack in an unoccupied port.

Each sample train is recovered separately in the following manner:

- The probe rinse, jumper rinse, condenser rinse, and Impingers #1 and #2 are recovered in a combined fraction.
- Impinger #3 and Impinger #4 are each recovered in a separate fraction.

A field train blank will be assembled, transported to the location, heated, leak-checked, left to sit for an equivalent amount of time (or greater) as the test runs and recovered as if it were an actual test sample. Reagent blanks (identified in this particular method as a "trip blank") will be collected to quantify background contamination. All samples will be stored under refrigeration or on ice or cold packs prior to analysis.

Sample rinses and blanks will be shipped to ALS Laboratory Group in Burlington, Ontario, who will perform the analysis using gas chromatography/mass spectroscopy (GC/MS). The laboratory will follow all specifications in SW-846 8260 when conducting the requisite surrogate spiking, sample, and blank analyses and reporting results.

CH₃OH

CH₃OH emissions will be determined using M-18 (adsorbent tube procedure) and two (2) co-located, constant rate (non-isokinetic), single-point sample trains. Each sampling train consists of a heated probe, TFE jumper, a single midget impinger in an ice bath (for moisture removal), an adsorbent tube and a dry gas meter. The midget impinger is charged with distilled organic-free water (Type II); the adsorbent tubes are charged with silica.

In order to facilitate co-located sampling trains, the glass probe liner specified in the method will be replaced with a TFE probe liner.

METHODOLOGY**4-4**

During each run, one (1) of the paired sampling trains will be pre-spiked with methanol in both the midjet impinger and adsorbent tube in order to demonstrate recovery.

Reagent blanks (water and adsorbent tubes) will be collected to quantify background contamination. All samples will be stored under refrigeration or on ice or cold packs prior to analysis.

Sample rinses and blanks will be shipped to ALS Laboratory Group in Burlington, Ontario, who will perform the analysis using gas chromatography/mass spectroscopy (GC/MS). The laboratory will follow all specifications in SW-846 8260 when conducting the requisite surrogate spiking, sample, and blank analyses and reporting results.

Aldehydes

Aldehyde emissions will be determined using SW-846 M-0011 and an isokinetic, multi-point sample train. The sampling system consists of a nozzle, heated glass-lined probe, impinger train (for aldehyde collection and H₂O removal/measurement) and a dry gas meter. The aldehyde-collecting impingers are charged with 2,4-dinitrophenylhydrazine (DNPH) solution.

The sampling system will traverse all of the M-1 points during each run. A minimum volume of 1.3 dry standard cubic meters (dscm), or 45.9 dry standard cubic feet (dscf), will be sampled during each 2-hour run. The probe rinse and impinger train catch and rinse are recovered together.

A "matrix spike" (for formaldehyde only, per SW-846 0011) will be collected by operating a sample train pre-spiked with formaldehyde for the same duration as the actual runs and recovering the sample. A field spike sample (for formaldehyde only, per SW-846 0011) will also be performed by introducing a spike standard into a single impinger containing absorbing reagent and recovering the impinger following standard procedures. Reagent blanks will be collected to quantify background contamination. All samples will be stored under refrigeration or on ice or cold packs prior to analysis.

Sample rinses and blanks will be shipped to ALS Laboratory Group in Burlington, Ontario, who will perform the required high performance liquid chromatography (HPLC) analysis. The laboratory will follow all specifications in SW846 M-8315A when conducting the requisite sample and blank analyses and reporting results.

METHODOLOGY**4-5****Gaseous Emissions Testing – ICR Group A2****SVOC**

SVOC emissions will be determined using SW-846 M-0010 and an isokinetic, multi-point sample train. The sampling system consists of a nozzle, heated glass-lined probe, heated pre-cleaned filter, water-jacketed condenser and XAD trap (packed with an SVOC-adsorbing resin), impinger train (for additional SVOC collection and H₂O removal/measurement) and a dry gas meter. The SVOC-collecting impingers are charged with distilled organic-free water (Type II).

The sampling system will traverse all of the M-1 points during each run. A minimum volume of 4 dry standard cubic meters (dscm), or 141 dry standard cubic feet (dscf), will be sampled during each 4-hour run. The probe rinse, filter, XAD trap and impinger train catch and rinse are recovered.

A field train blank will be assembled, transported to the location, heated, leak-checked and recovered as if it were an actual test sample. Reagent blanks will be collected to quantify background contamination. All samples will be stored under refrigeration or on ice or cold packs prior to analysis.

Sample traps, rinses, and blanks will be shipped to ALS Laboratory Group in Burlington, Ontario, who will perform the analysis. The laboratory will follow all specifications in SW-846 M-8270D when conducting the requisite surrogate spiking, sample, and blank analyses and reporting results.

Gaseous Emissions Testing – ICR Group A3**THC**

THC emissions will be determined using a flame ionization analyzer (FIA) per M-25A specifications. Sample gas will be extracted at a constant rate and delivered at 250°F to a FIA which measures concentration expressed in terms of propane (C₃H₈) on an actual (wet) basis.

Analyzer calibration will be performed by introducing zero air, high, mid- and low-range C₃H₈ calibration gases to the inlet of the sampling system's heated filter. Bias checks will be performed before and after each sampling run in a similar manner.

During each run, minute-average data points for THC concentration (as propane, wet basis) will be collected over a period of one (1) hour. Since M-10 will be performed simultaneously using the same sampling system (see Page 4-6), data will be collected from all of the M-1 points rather than from the centroid of the duct as specified by the method.

METHODOLOGY**4-6**CH₄ and C₂H₆

CH₄ and C₂H₆ emissions will be determined using M-18 (integrated bag sampling – direct pump interface sampling procedure) and a gas chromatograph (GC). Sample gas will be extracted and delivered through an unheated probe, TFE line, gas conditioner (for moisture removal), TFE-coated diaphragm pump, and mass flow meter into a Kynar bag. The condensate will not be collected for analysis as CH₄ and C₂H₆ are insoluble in water. Each bag will be filled at a constant rate over a period of one (1) hour for each test run.

Analysis for CH₄ and C₂H₆ will be performed off-site by CleanAir Analytical Services using gas chromatography (GC). Since moisture will have been removed from the sample prior to collection, the GC analyzer will measure concentration on a dry basis. At least five (5) sample injections will be analyzed for each run.

Analyzer calibration will be performed by generating a calibration curve from triplicate injections of three (3) distinct CH₄ and C₂H₆ concentrations introduced directly into the GC. Upon completion of calibration, a recovery study will be performed by spiking one of the bag samples with a known concentration of CH₄ and C₂H₆, storing the bags for the same period of time prior to analysis as the field samples, and analyzing the bags to determine percent recovery.

CO

CO emissions will be determined by infrared (IR) absorbance per M-10 specifications. Sample gas will be extracted at a constant rate, conditioned to remove moisture and delivered to an IR analyzer which measures concentration on a dry basis.

Calibration error checks will be performed by introducing zero nitrogen (N₂), high-range CO and mid-range CO calibration gases to the inlet of the analyzer during calibration error checks. Bias checks will be performed before and after each sampling run by introducing calibration gas to the inlet of the sampling system's heated filter. Documentation of interference checks will be included in the appendices of the final report.

During each run, minute-average data points for CO concentration (dry basis) will be collected over a period of one (1) hour. The sampling system will traverse all of the M-1 points during each run; therefore, no stratification check is necessary. Per M-10, the average results will be drift-corrected.

METHODOLOGY**4-7****Gaseous Emissions Testing – ICR Group B****PCDD, PCDF, and PCB**

PCDD, PCDF, and PCB emissions will be determined using M-23 and an isokinetic, multi-point sample train. The sampling system consists of a nozzle, heated glass-lined probe, heated pre-cleaned filter, water-jacketed condenser and XAD trap (packed with a PCDD/PCDF/PCB-adsorbing resin), impinger train (for additional PCB collection and H₂O removal/measurement) and a dry gas meter. The PCB-collecting impingers are charged with distilled organic-free water (Type II).

The sampling system will traverse all of the M-1 points during each run. A minimum volume of three (3) dry standard cubic meters (dscm), or 106 dry standard cubic feet (dscf), will be sampled during each 3-hour run. The probe rinse, filter, XAD trap, and impinger train catch and rinse are recovered.

A field train blank will be assembled, transported to the location, leak-checked and recovered as if it were an actual test sample. Reagent blanks will be collected to quantify background contamination. All samples will be stored under refrigeration or on ice or cold packs prior to analysis.

Sample traps, rinses and blanks will be shipped to ALS Laboratory Group in Burlington, Ontario, who will perform the analysis. The laboratory will follow all specifications in SW-846 M-8290 and 1668B when conducting the requisite surrogate spiking, sample, and blank analyses and reporting results.

Gaseous Emissions Testing – ICR Group D1**FPM and CPM**

FPM and CPM emissions will be determined using a combined M-5/202 isokinetic, multi-point sample train. The sampling system consists of a nozzle, heated glass-lined probe, tared heated quartz filter, water-jacketed condenser, impinger train, a TFE membrane filter (for additional CPM collection) and dry gas meter. The CPM-collecting impingers are kept empty prior to testing.

The probe and heated filter will be heated to 320±25°F (rather than 248±25°F) during sampling (to facilitate both a FPM and a non-sulfate FPM analytical result).

The sampling system will traverse all of the M-1 points during each run. A minimum volume of two (2) dry standard cubic meters (dscm), or 70.6 dry standard cubic feet (dscf), will be sampled during each 2-hour run.

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The front-half portion of the sample train (nozzle, probe and heated filter) will be recovered per M-5 requirements; the back-half of the sample train (heated filter outlet, condenser, dry impingers and TFE membrane filter) will be recovered per M-202 requirements. The impinger train will be purged with nitrogen at a rate of 14 liters per minute (lpm) for one (1) hour following each test run and prior to recovery.

A field train blank will be assembled, purged and recovered as if it were an actual test sample. Reagent blanks will be collected to quantify background contamination. Samples and blanks will be returned to CleanAir Analytical Services for gravimetric analysis. Samples will be maintained at a temperature <85°F during transport to the laboratory.

If requested by MPC, the FPM fraction can be baked and re-analyzed per M-5B specification upon completion of the M-5 FPM analysis. NSFPM results, while not required by the ICR, can be used to fulfill annual compliance testing requirements.

NH₃

NH₃ emissions will be determined using a modified version of CTM-027 and an isokinetic, multi-point sample train. The sampling system consists of a nozzle, heated probe, high-efficiency heated quartz filter, impinger train (for NH₃ collection and H₂O removal/measurement) and a dry gas meter. The NH₃-collecting impingers are charged with 0.1 N sulfuric acid (H₂SO₄) solution.

Due to saturated flue gas conditions, the in-stack filter will be replaced with an external filter heated to 248±25°F.

The sampling system will traverse all of the M-1 points during each run. No sample time or volume requirement is specified in the ICR. Based on past data, approximately one (1) dry standard cubic meters (dscm), or 35.3 dry standard cubic feet (dscf), sampled during each 1-hour run should be sufficient to obtain a detectable result.

The front-half portion of the sample train (nozzle, probe and heated filter) will not be recovered or analyzed. The three (3) NH₃-collecting impingers will be recovered separately per CTM-027 requirements. The back-half of the sample train prior to Impinger #1 (heated filter outlet and connecting glassware) will be recovered into Impinger #1.

A field blank will be collected by charging an impinger with reagent for one (1) hour and recovering it as if it were an actual test sample. Reagent blanks will be collected to quantify background contamination.

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Samples and blanks will be returned to CleanAir Analytical Services for ion chromatography (IC) analysis. Impinger #3 fractions will only be analyzed if analysis of the Impinger #1 and Impinger #2 fractions from corresponding runs indicate NH_3 breakthrough levels above 10%.

Other Metals

Metals emissions (excluding mercury) will be determined using M-29 and an isokinetic, multi-point sample train. The sampling system consists of a nozzle, heated probe, heated quartz filter, impinger train (for metals collection and H_2O removal/measurement) and a dry gas meter. The metals-collecting impingers are charged with 0.1 N nitric acid (HNO_3) solution.

The sampling system will traverse all of the M-1 points during each run. A minimum volume of three (3) dry standard cubic meters (dscm), or 106 dry standard cubic feet (dscf), will be sampled during each 3-hour run.

The front-half (nozzle, probe, and filter) and back-half (impingers) of the sample train will be recovered separately per M-29 requirements.

Reagent blanks will be collected to quantify background contamination.

Samples and blanks will be shipped to ALS Laboratory Group in Burlington, Ontario, who will perform the analysis. Separate front-half and back-half analyses will be performed in order to quantify particulate-bound and gaseous metals emissions. The sample fractions will be combined into front- and back-half fractions, separately reduced to near dryness, digested and analyzed for metals using inductively-coupled plasma emission spectroscopy (ICPMS).

 Hg_p , Hg^{2+} , and Hg^0

Hg_p , Hg^{2+} , and Hg^0 emissions will be determined using ASTM D6784 and an isokinetic, multi-point sample train. The sampling system consists of a nozzle, heated probe, heated quartz filter, impinger train (for mercury collection and H_2O removal/measurement) and a dry gas meter. The Hg^{2+} -collecting impingers are charged with either 1 M potassium chloride (KCl) or 5% nitric acid (HNO_3) / 10% hydrogen peroxide (H_2O_2) solution; the Hg^0 -collecting impingers are charged with 4% potassium permanganate (KMnO_4) / 10% sulfuric acid (H_2SO_4) solution.

The sampling system will traverse all of the M-1 points during each run. A maximum volume of 2.5 dry standard cubic meters (dscm), or 88.3 dry standard cubic feet (dscf), will be sampled during each 2-hour run.

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The front-half (nozzle, probe, and filter) and back-half (impingers) of the sample train will be recovered per ASTM D6784 requirements.

A field train blank will be assembled, transported to the location, leak-checked and recovered as if it were an actual test sample. Reagent blanks will be collected to quantify background contamination.

Samples and blanks will be shipped to ALS Laboratory Group in Burlington, Ontario, who will perform the analysis. Separate analyses of the front-half (Hg_p), Hg^{2+} impingers and Hg^0 impingers will be performed in order to quantify Hg_p , Hg^{2+} and Hg^0 emissions. The sample fractions will be separately reduced to near dryness, digested and analyzed for Hg using inductively-coupled plasma emission spectroscopy (ICPMS).

Cr^{6+}
 Cr^{6+} emissions will be determined using SW-846 M-0061 and an isokinetic, multi-point sample train. The sampling system consists of a TFE nozzle, TFE sample line, TFE impinger train (for Cr^{6+} collection and H_2O removal/measurement), TFE pump/sprayer assembly with a TFE recirculation line (to continuously recirculate the impinger absorbing reagent to the probe tip) and a dry gas meter. The Cr^{6+} -collecting impingers are charged with 0.5 N potassium hydroxide (KOH) solution.

The sampling system will traverse all of the M-1 points during each run. A minimum volume of three (3) dry standard cubic meters (dscm), or 106 dry standard cubic feet (dscf), will be sampled during each 3-hour run.

At the end of each test run and prior to recovery, the pH of the reagent in Impinger #1 will be verified to be > 8.5 , and the impinger train will be purged with nitrogen at a rate of 10 liters per minute (lpm) for one (1) hour. The entire sample train (nozzle, sample line and impinger train) will then be rinsed, filtered and recovered into a combined fraction per SW-846 0061 requirements.

Reagent blanks will be collected to quantify background contamination.

Samples and blanks will be shipped to ALS Laboratory Group in Burlington, Ontario, who will perform the analysis. The sample fractions will be filtered, pre-concentrated and analyzed for Cr^{6+} using ion chromatography (IC) coupled with a post column reactor (ICPCR).

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HCl, Cl₂, and HF

HCl, Cl₂ and HF emissions will be determined using M-26A and an isokinetic, multi-point sample train. The sampling system consists of a nozzle, heated probe, heated TFE mat filter, impinger train (for HCl, Cl₂, and HF collection and H₂O removal/measurement) and a dry gas meter. The HCl/HF-collecting impingers are charged with 0.1 N sulfuric acid (H₂SO₄) solution; the Cl₂-collecting impingers are charged with 0.1 N sodium hydroxide (NaOH) solution.

The sampling system will traverse all of the M-1 points during each run. A minimum volume of two (2) dry standard cubic meters (dscm), or 70.6 dry standard cubic feet (dscf), will be sampled during each 2-hour run.

Immediately after sampling, the filter will be visually inspected. If condensed moisture is visible in on the filter, the sample train will be purged with conditioned ambient air for 15 minutes at a low flow rate (e.g. $\Delta H = 1$ in. w.c.) while maintaining the heated components at temperatures of $>248^{\circ}\text{F}$ in order to vaporize and collect the liquid in the impingers. Purging will continue until there is no visible liquid on the filter.

The front-half portion of the sample train (nozzle, probe, and heated filter) will not be recovered or analyzed. The back-half of the sample train (heated filter outlet and HCl/HF impinger fraction, Cl₂ impinger fraction) will be recovered separately per M-26A requirements. The Cl₂ fraction will be preserved with sodium thiosulfate as part of the recovery process.

Reagent blanks will be collected to quantify background contamination.

Samples and blanks will be returned to CleanAir Analytical Services for ion chromatography (IC) analysis. Separate analyses of the halide and halogen-collecting fractions will be performed in order to quantify HCl, Cl₂ and HF emissions.

HCN

HCN emissions will be determined using OTM-29 and an isokinetic, multi-point sample train. The sampling system consists of a nozzle, heated probe, heated quartz filter, impinger train (for metals collection and H₂O removal/measurement) and a dry gas meter. The HCN-collecting impingers are charged with 6.0 N sodium hydroxide (NaOH) solution.

OTM-29 calls for the use of multiple Greenburg-Smith impingers with the standard (restricted) stems. In practice, the 6.0 N NaOH absorbing solution in the impingers can form a slurry (and occasionally solidify) as it absorbs carbon dioxide (CO₂) from the flue gas. This can cause complete plugging of the impinger train and severely delay testing. In order to reduce the chance of plugging, all impingers will instead be of the modified Greenburg-Smith design with unrestricted stems.

METHODOLOGY**4-12**

The sampling system will traverse all of the M-1 points during each run. A maximum volume of 0.9 dry standard cubic meters (dscm), or 31.8 dry standard cubic feet (dscf), will be sampled during each 1-hour run. CO₂ concentrations in both the flue gas and sample train exhaust will be monitored continuously throughout the test. The pH in the final impinger containing absorbing solution will be monitored continuously during the test and maintained >12.0.

The front-half portion of the sample train (nozzle, probe and heated filter) will not be recovered or analyzed. The back-half of the heated filter outlet is also not recovered or analyzed per the method. Prior to recovery, the pH of each impinger preceding the final impinger with continuous pH monitoring will be measured and adjusted to > 12.0 if necessary. The impinger fractions will then be combined or recovered separately per OTM-29 requirements (Impingers #1 and #2 recovered together, Impinger #3 recovered separately).

A field train blank will be assembled, transported to the location, heated, leak-checked and recovered as if it were an actual test sample. A field spike sample will be performed by introducing a spike standard into a single impinger containing absorbing reagent and recovering the impinger following standard procedures. Reagent blanks will be collected to quantify background contamination. All samples will be stored under refrigeration or on ice or cold packs prior to analysis.

Samples and blanks will be shipped to Enthalpy Analytical in Durham, North Carolina, who will perform the analysis. The sample fractions will be filtered, pre-concentrated and analyzed for CN⁻ using ion chromatography (IC).

End of Section 4 – Methodology

MARATHON PETROLEUM COMPANY
ROBINSON REFINERY

Client Reference No: CN00072225
CleanAir Project No: 11265

APPENDIX

5-1

SCHEDULE TIMELINE	A
TRAILER WIRING DIAGRAM.....	B
TEST METHOD SPECIFICATIONS	C
SAMPLE FIELD DATA SHEETS	D

Appendices reserved.