United States
Environmental Protection
Agency

EPA-600/R-03/099b
November 2003

Source Sampling Fine Particulate Matter: A Kraft Process Recovery Boiler at a Pulp and Paper Facility: Volume 2, Appendices

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November 2003

Source Sampling Fine Particulate Matter: A Kraft Process Recovery Boiler at a Pulp and Paper Facility: Volume 2, Appendices

by

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Contract No. 68-D7-0001

EPA Project Officer: N. Dean Smith
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National Risk Management and Research Laboratory
Research Triangle Park, NC 27711

Prepared for:
U.S. Environmental Protection Agency
Office of Research and Development
Washington, DC 20460

Abstract

Fine particulate matter of aerodynamic diameter 2.5 μm or less ($PM_{2.5}$) has been implicated in adverse health effects, and a National Ambient Air Quality Standard for $PM_{2.5}$ was promulgated in July 1977 by the U.S. Environmental Protection Agency. A national network of ambient monitoring stations has been established to assist states in determining areas which do not meet the ambient standard for $PM_{2.5}$. For such areas, it is important to determine the major sources of the $PM_{2.5}$ so states can devise and institute a control strategy to attain the ambient concentrations set by the standard.

One of the tools often used by states in apportioning ambient $PM_{2.5}$ to the sources is a source-receptor model. Such a model requires a knowledge of the $PM_{2.5}$ chemical composition emitted from each of the major sources contributing to the ambient $PM_{2.5}$ as well as the chemical composition of the $PM_{2.5}$ collected at the receptor (ambient monitoring) sites. This report provides such a profile for a Recovery Boiler at a pulp and paper facility. Along with the $PM_{2.5}$ emission profile, data are also provided for gas-phase emissions of several organic compounds. Data are provided in a format suitable for inclusion in the EPA source profile database, SPECIATE.

Foreword

The U.S. Environmental Protection Agency (EPA) is charged by Congress with protecting the Nation's land, air, and water resources. Under a mandate of national environmental laws, the Agency strives to formulate and implement actions leading to a compatible balance between human activities and the ability of natural systems to support and nurture life. To meet this mandate, EPA's research program is providing data and technical support for solving environmental problems today and building a science knowledge base necessary to manage our ecological resources wisely, understand how pollutants affect our health, and prevent or reduce environmental risks in the future.

The National Risk Management Research Laboratory (NRMRL) is the Agency's center for investigation of technological and management approaches for preventing and reducing risks from pollution that threaten human health and the environment. The focus of the Laboratory's research program is on methods and their cost-effectiveness for prevention and control of pollution to air, land, water, and subsurface resources; protection of water quality in public water systems; remediation of contaminated sites, sediments and ground water; prevention and control of indoor air pollution; and restoration of ecosystems. NRMRL collaborates with both public and private sector partners to foster technologies that reduce the cost of compliance and to anticipate emerging problems. NRMRL's research provides solutions to environmental problems by: developing and promoting technologies that protect and improve the environment; advancing scientific and engineering information to support regulatory and policy decisions; and providing the technical support and information transfer to ensure implementation of environmental regulations and strategies at the national, state, and community levels.

This publication has been produced as part of the Laboratory's strategic long-term research plan. It is published and made available by EPA's Office of Research and Development to assist the user community and to link researchers with their clients.

Lawrence W. Reiter, Acting Director.
National Risk Management Research Laboratory

EPA Review Notice

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Table of Contents

Volume 1, Report

Table of Contents (continued)

Section **Page**

Table of Contents (continued)

Volume 2, Appendices

Nomenclature

Term	Definition
CMB	chemical mass balance
DNPH	2,4-dinitrophenylhydrazine
EC/OC	elemental carbon and organic carbon
ELPI	electrical low pressure impactor
EPA	U.S. Environmental Protection Agency
ERG	Eastern Research Group
FID	flame ionization detector
GC	gas chromatography analytical technique
GRAV	gravimetric analytical technique
HEPA	high efficiency particulate arresting
HPLC	high performance liquid chromatography analytical technique
IC	ion chromatography analytical technique
MDLs	method detection limits
MOPs	method operating procedures
MS	mass spectrometry analytical technique
MSD	mass selective detector
NH_3	ammonia
NMOCs	nonmethane organic compounds
NO_X	nitrogen oxides
PM	particulate matter
$PM_{2.5}$	particulate matter of aerodynamic diameter 2.5 μm or less
PM_{10}	particulate matter of aerodynamic diameter 10 μm or less
PUF	polyurethane foam
QAPPs	quality assurance project plans
SIPs	State Implementation Plans
SNMOCs	speciated nonmethane organic compounds
SOPs	standard operating procedures
SO_X	sulfur oxides
TMS	trimethylsilyl
TOE	thermal-optical evolution
VOCs	volatile organic compounds
XRF	X-ray fluorescence analytical technique

Appendix A

Table of Unit Conversions

Contents

Table A-1. Unit Conversion Table

Multiply	By	To Obtain
atmospheres	101.3	kilopascals
atmospheres	29.92	inches of mercury
atmospheres	760	mm of mercury
atmospheres	33.94	feet of water
atmospheres	14.70	$lb/in.^2$ (psi)
Btu	1054	joules
Btu	2.982×10^{-4}	kilowatt-hours
centimeters	0.3937	inches
cm/sec	1.969	ft/min
cm/sec	0.03281	ft/sec
cm/sec	0.036	km/hr
cm/sec	0.6	m/min
cm^3	3.53×10^{-2}	ft^3
cm^3	10^{-3}	liters
ft^3	0.02832	m^3
ft^3/min	0.4720	L/sec
$in.^3$	16.39	cm^3
m^3	35.31	ft^3
ft	12	in.
ft	0.3048	m
ft of water	0.8826	in. of mercury
grams	0.03527	ounces
inches	2.540	cm
inches of water	0.07355	in. of mercury
kg	2.20462	lb
km	3280.84	ft
km	0.6214	miles
kilowatts	56.92	Btu/min.
liters	0.03531	ft^3
liters	61.02	$in.^3$
liters	10^{-3}	m^3
liters per minute	5.855×10^{-4}	ft^3/sec
m	3.28084	ft
m	39.37	in.
m^3	0.02832	ft^3
miles	5280	feet
miles	1.6093	km
ounces	28.35	grams

continued

Table A-1. (concluded)

Multiply	By	To Obtain
pounds	453.6	grams
pounds per square inch	703.1	kg/m^2
cm^2	0.1550	$in.^2$
ft^2	929.0	cm^2
ft^2	0.09290	m^2
temperature (°C + 273)	1	absolute temperature (K)
temperature (°C + 17.8)	1.8	temperature (°F)
temperature (°F + 460)	1	temperature (°Rankin)
temperature (°F-32)	5/9	temperature (°C)
watts	0.05692	Btu/min.
watts	44.26	foot-pounds/min.

Appendix B

Recovery Boiler No. 5, Test 1,
Chain of Custody Documentation

Contents

ARCADIS GERAGHTY & MILLER

SUBJECT: ~~IB102901H~~ RM
RB 103001 H
JOB NO: TEST 1

BY: B DATE:
CHKD: DATE:

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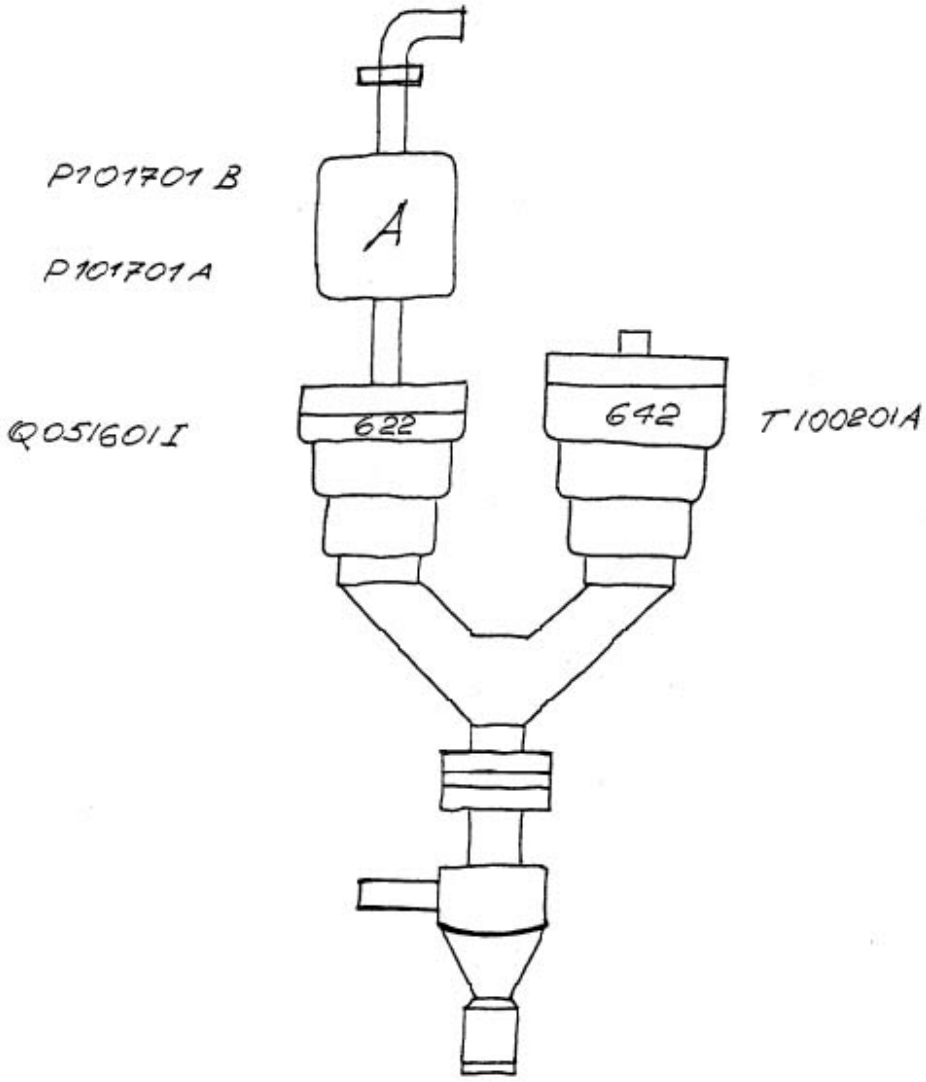

ARCADIS
GERAGHTY & MILLER

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BY: JS DATE:

CHKD: DATE:

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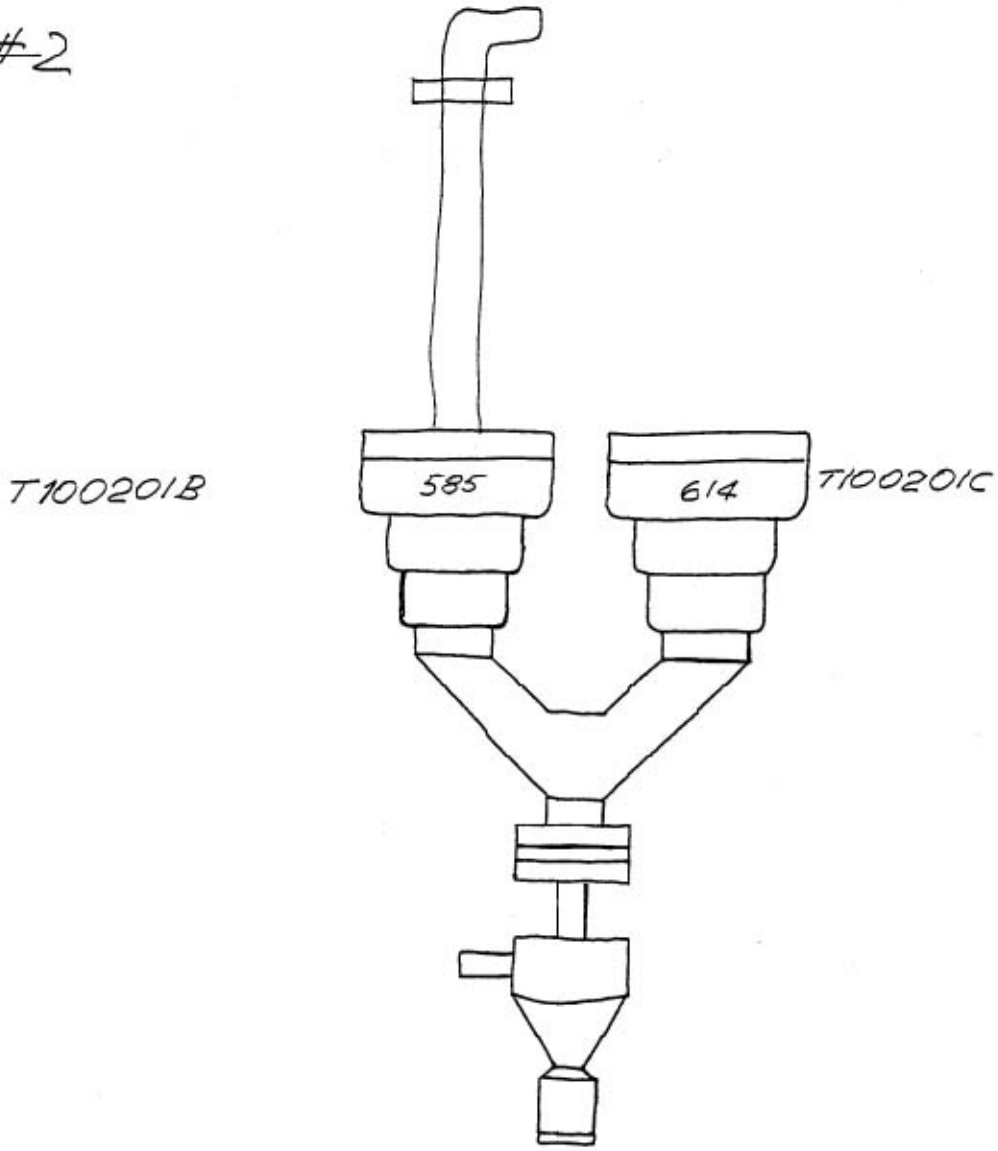

ARCADIS
GERAGHTY & MILLER

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RB 103001 H

JOB NO:

BY: B DATE:

CHKD: DATE:

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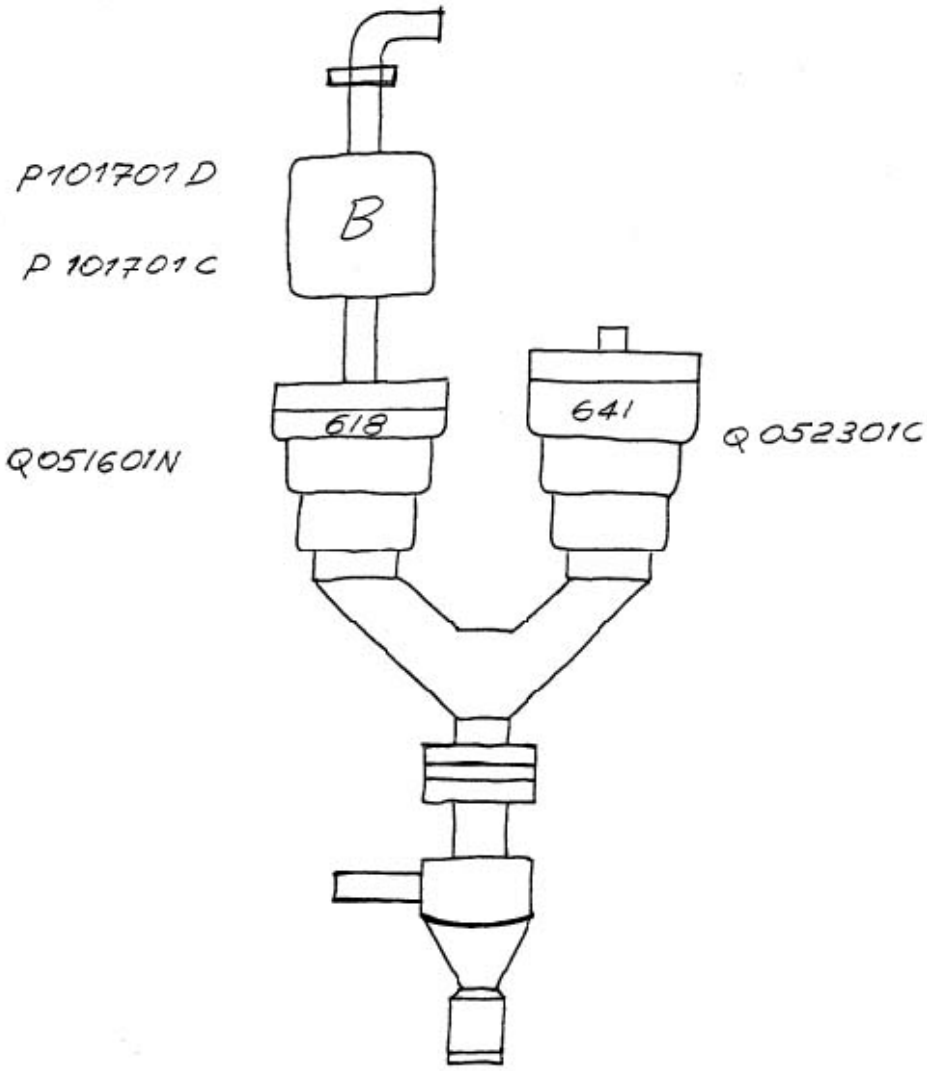

ARCADIS
GERAGHTY & MILLER

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RB 103001H

JOB NO:

BY: JS DATE:

CHKD: DATE:

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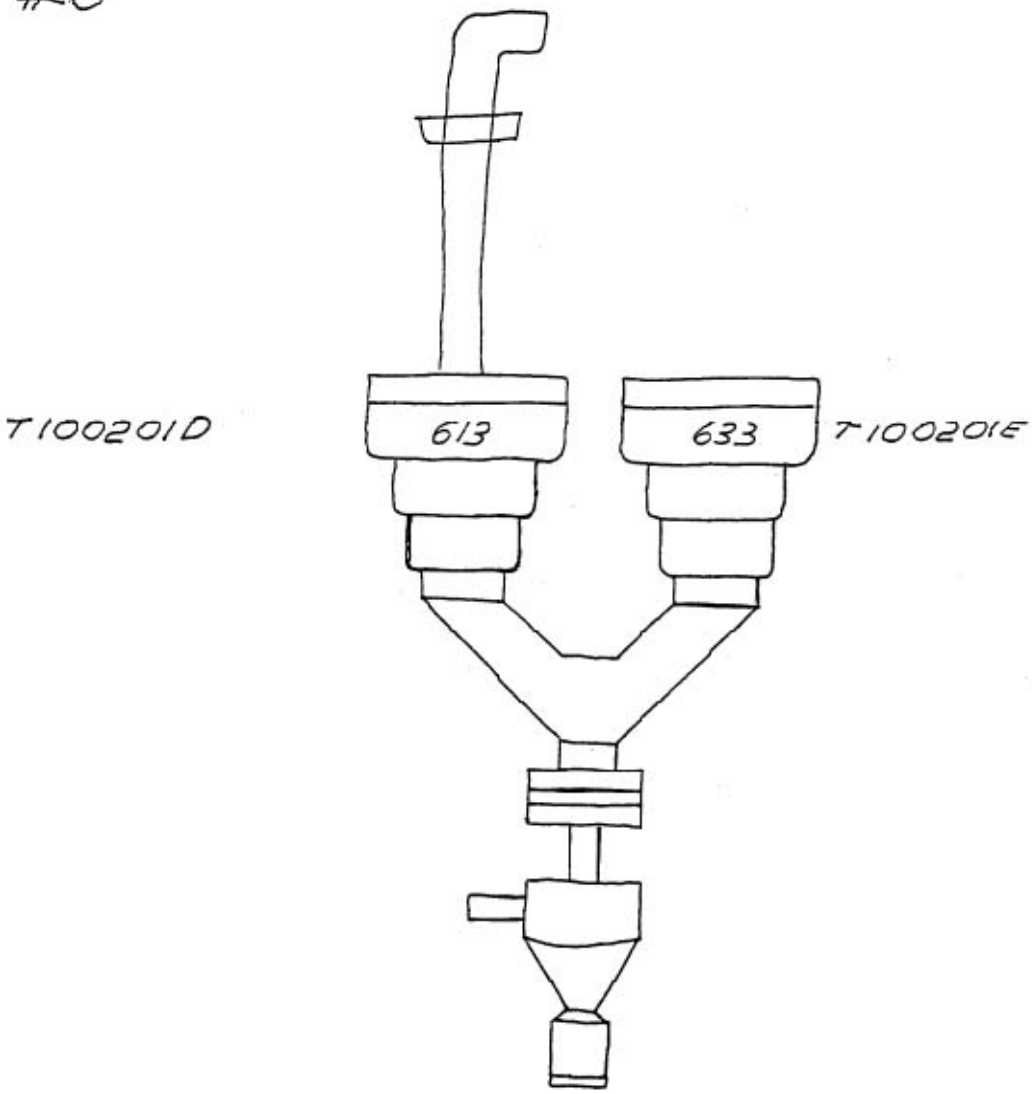

ARCADIS
GERAGHTY & MILLER

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RB 103601 4

JOB NO:

BY: TB DATE:

CHKD: DATE:

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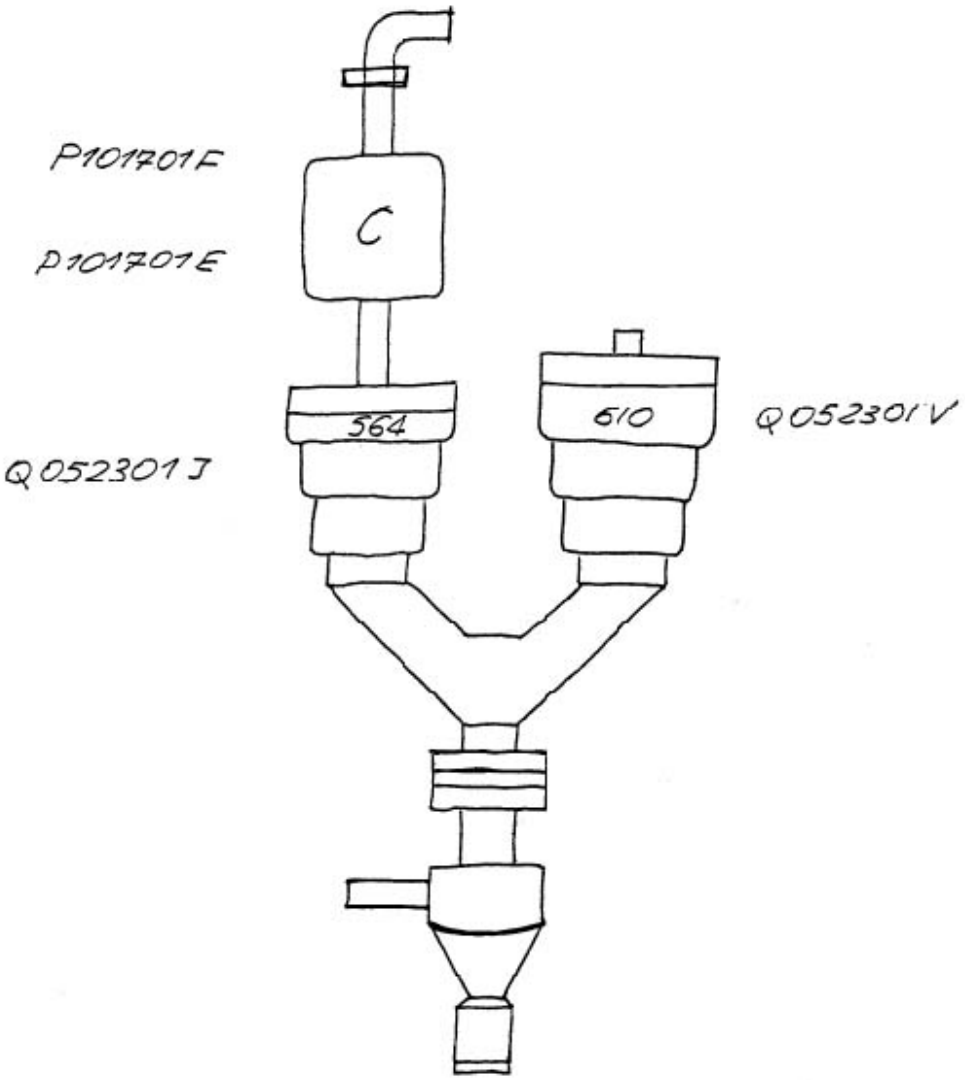

ARCADIS
GERAGHTY & MILLER

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BY: JB DATE:

CHKD: DATE:

JOB NO:

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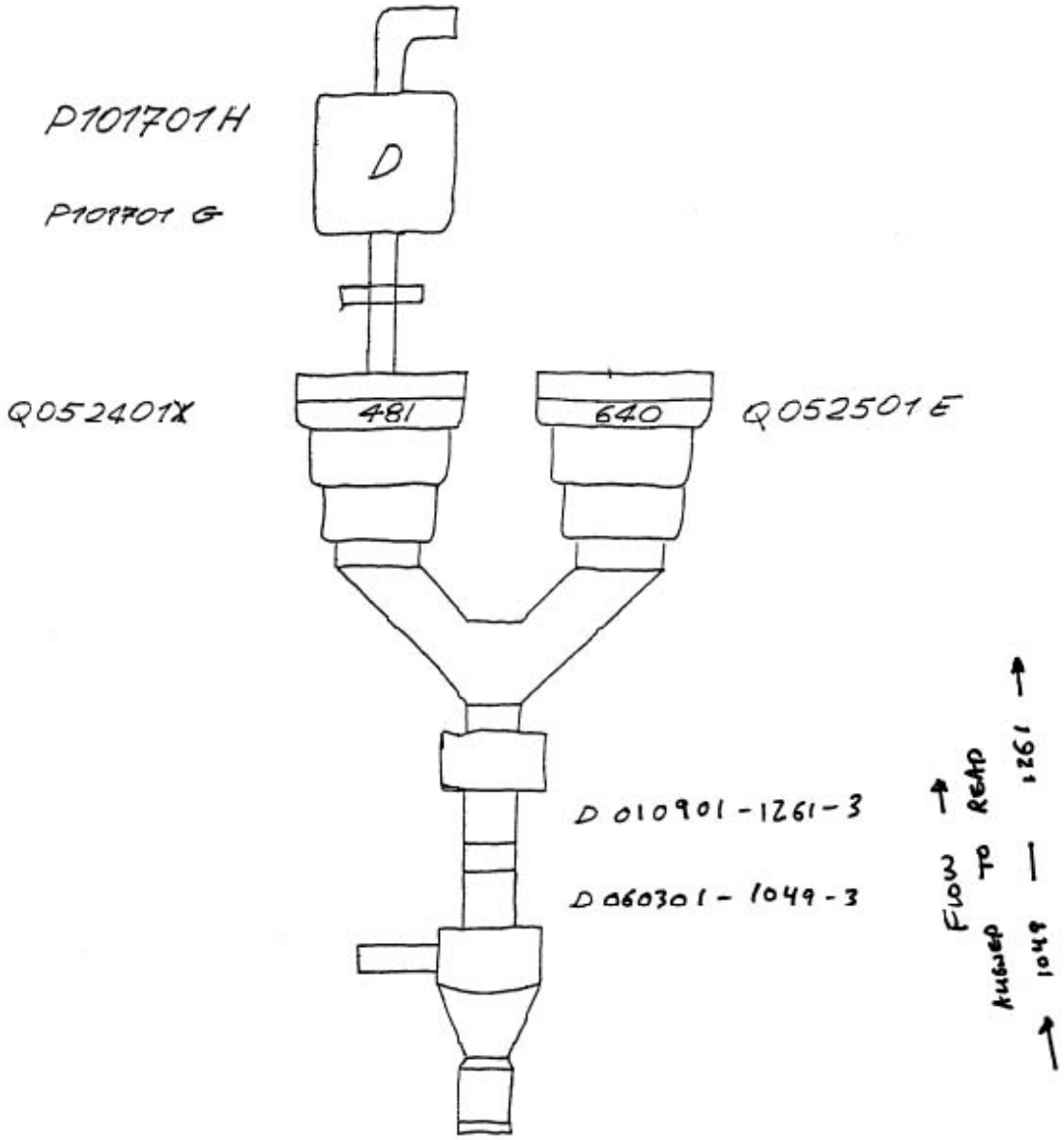

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Chain of Custody Record

Page 1 of 4

PROJECT	WEYERHAUSER REC. BOILER														
SITE	PLYMOUTH, NC														
COLLECTED BY (Signature)	Rob Mentz														
FIELD SAMPLE I.D.	SAMPLE MATRIX	DATE/TIME	NO. OF CONTAINERS	ANALYSES: PUF	QF	TF	DENUDER		SUMMA	CARBONYL		REMARKS	SAM ID NO. (For lab use only)
RB 103001 H	Pd 1A1 A	10/30/01	1	✓								P101701 A	
	Pd 1A2 A			✓								P101701 B	
	Qd 1A1 622				✓							Q051601 I	
	Td 1B1 642					✓						T100201 A	
—	Tr2 A1 585					✓						T100201 B	
	Tr2 B1 614					✓						T100201 C	
—	Qr4 A1 618				✓	✓	RM					Q051601 N	★
	Qr4 B1 641				✓							Q052301 C	
	Pr4 A1 B		1	✓								P101701 C	
	Pr4 A2 B			✓								P101701 D	

REMARKS: TEST # 1 TUESDAY 10/30/01

RELINQUISHED BY:	DATE	TIME
Rob Mentz		

RECEIVED BY:	DATE	TIME	RELINQUISHED BY:	DATE	TIME	RECEIVED BY:	DATE	TIME	RELINQUISHED BY:	DATE	TIME

LAB USE ONLY

RECEIVED FOR LABORATORY BY:	DATE	TIME	AIRBILL NO.	OPENED BY	DATE	TIME	TEMP°C	SEAL #	CONDITION

REMARKS: note ★ Qr4 is QUARTZ FILTER

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Page 2 of 4

PROJECT	WEYERHAUSER REC. BOILER														
SITE	PLYMOUTH, NC														
COLLECTED BY (Signature)	Bob Mentz														
FIELD SAMPLE I.D.	SAMPLE MATRIX	DATE/TIME	NO. OF CONTAINERS	ANALYSES: PUF	QF	TF	DENUDER		SUMMA	CARBONYL		REMARKS	SAM ID NO. (For lab use only)
RB 103001 H	Tr 6 A1 613	10/30/01				✓						T100201D	
	Tr 6 B1 633					✓						T100201E	
	Pr 8 A1 C		1	✓								P101701E	
	Pr 8 A2 C			✓								P101701F	
	Qr 8 A1 584				✓							Q052301J	
	Qr 8 B1 610				✓							Q052301V	
	Pr 10 A1 D		1	✓								P101701G	
	Pr 10 A2 D			✓								P101701H	
	Qr 10 A1 481				✓							Q052401X	
	Qr 10 B1 640				✓							Q052501E	

REMARKS: TEST #1 TUESDAY 10/30/01

RECEIVED BY:	DATE	TIME	RELINQUISHED BY:	DATE	TIME	RECEIVED BY:	DATE	TIME	RELINQUISHED BY: Bob Mentz	DATE	TIME
									RELINQUISHED BY:	DATE	TIME

LAB USE ONLY

RECEIVED FOR LABORATORY BY:	DATE	TIME	AIRBILL NO.	OPENED BY	DATE	TIME	TEMP°C	SEAL #	CONDITION
REMARKS:									

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Chain of Custody Record

Page 3 of 4

PROJECT	WEYERHAUSER REC. BOILER																
SITE	PLYMOUTH, NC																
COLLECTED BY (Signature)	Bob Mont																
FIELD SAMPLE I.D.	SAMPLE MATRIX	DATE/TIME	NO. OF CONTAINERS	ANALYSES: PUF	QF	TF	DENUDER	OTHER	SUMMA	CARBONYLS				REMARKS	SAM ID NO. (For lab use only)
RB 103001 H	Dn 10 A1 1049-3	10/30/01					✓							D060501-1049-3	
	Dn 10 A2 1261-3						✓							D010901-1261-3	
	Qn ϕ A1 BE10				✓									ERG-ϕ7	
	Pn ϕ A1 FBK		1(	✓										P101701M	PUF FBL.
	Pn ϕ A2 FBK			✓										P101701N	PUF FBL.
	BLACK LIQUOR SAMPLE (FUEL)							✓						IN GLASS JAR	
	Qn ϕ A1 FB				✓									Q052501G	QUARTZ FB
	Tn ϕ A1 FB					✓								T100201F	TEFLON FB

REMARKS: TEST #1 TUESDAY 10/30/01

RELINQUISHED BY:	DATE	TIME
Bob Mont		

RECEIVED BY:	DATE	TIME	RELINQUISHED BY:	DATE	TIME	RECEIVED BY:	DATE	TIME	RELINQUISHED BY:	DATE	TIME

LAB USE ONLY

RECEIVED FOR LABORATORY BY:	DATE	TIME	AIRBILL NO.	OPENED BY	DATE	TIME	TEMP°C	SEAL #	CONDITION

REMARKS:

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Chain of Custody Record

Page 4 of 4

PROJECT: WEYERHAUSER REC. BOILER
SITE: PLYMOUTH, NC
COLLECTED BY (Signature): Bob Mentz

FIELD SAMPLE I.D.	SAMPLE MATRIX	DATE/TIME	NO. OF CONTAINERS	ANALYSES: PUF	QF	TF	DENUDER		SUMMA	CARBONYLS		REMARKS	SAM ID NO. (For lab use only)
RB 103001H	Sd 2 A1 S T1	10/30/01							✓			# 1435	
	Hd 3 A1 H1 T1									✓		CARB 1 FR.	
	Hd 3 A2 H2 T1									✓		CARB 2 REAR	
	Sn 5 A1 S T1								✓			# 4010	
	Hn 3 A1 H1 T1									✓		CARB 1 FR	
	Hn 3 A2 H2 T1									✓		CARB 2 REAR	
	BLANK CARB TUBE									✓		FB 10/30 TUBE	
	BLANK SUMMA CAN								✓			FB 10/30 #	4039
	Sφ A1 S T1								✓			# 1892	AMBIENT SUMMA CAN

REMARKS: TEST #1 TUESDAY 10/30/01 T1 for TEST 1 of CARBS/SUMMA

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LAB USE ONLY

RECEIVED FOR LABORATORY BY:	DATE	TIME	AIRBILL NO.	OPENED BY	DATE	TIME	TEMP °C	SEAL #	CONDITION

REMARKS:

ARCADIS
GERAGHTY & MILLER

SUBJECT: RB 10 31 01 H

JOB NO: TEST2

BY: B DATE:

CHKD: DATE:

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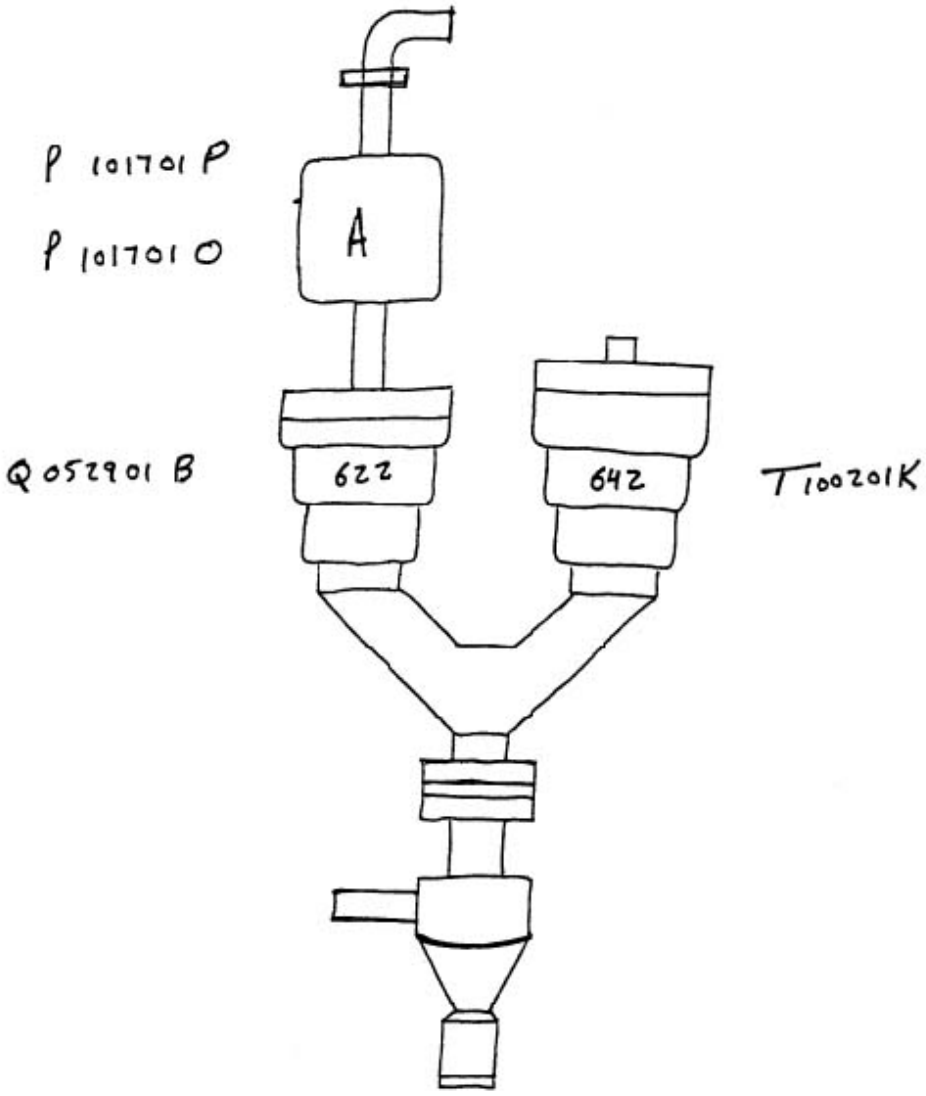

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GERAGHTY & MILLER

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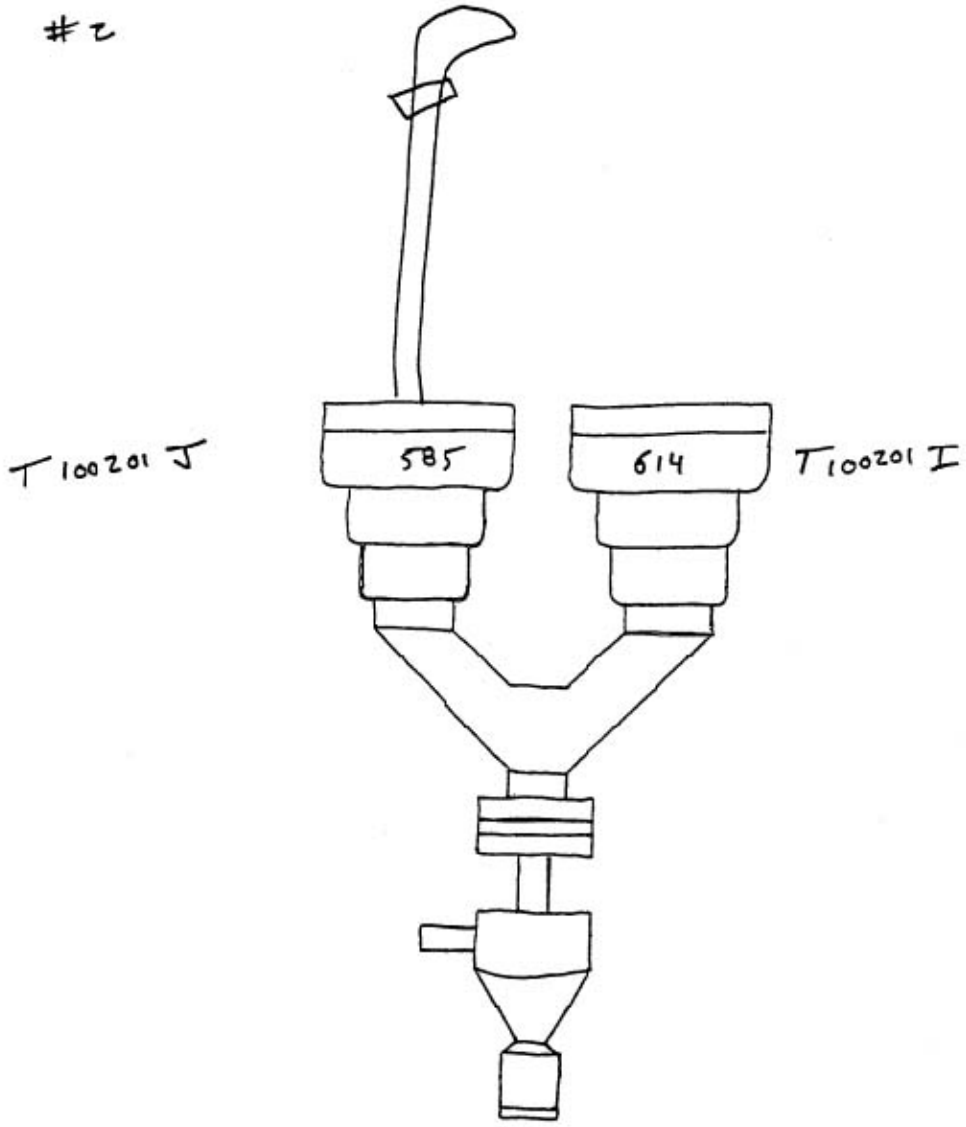

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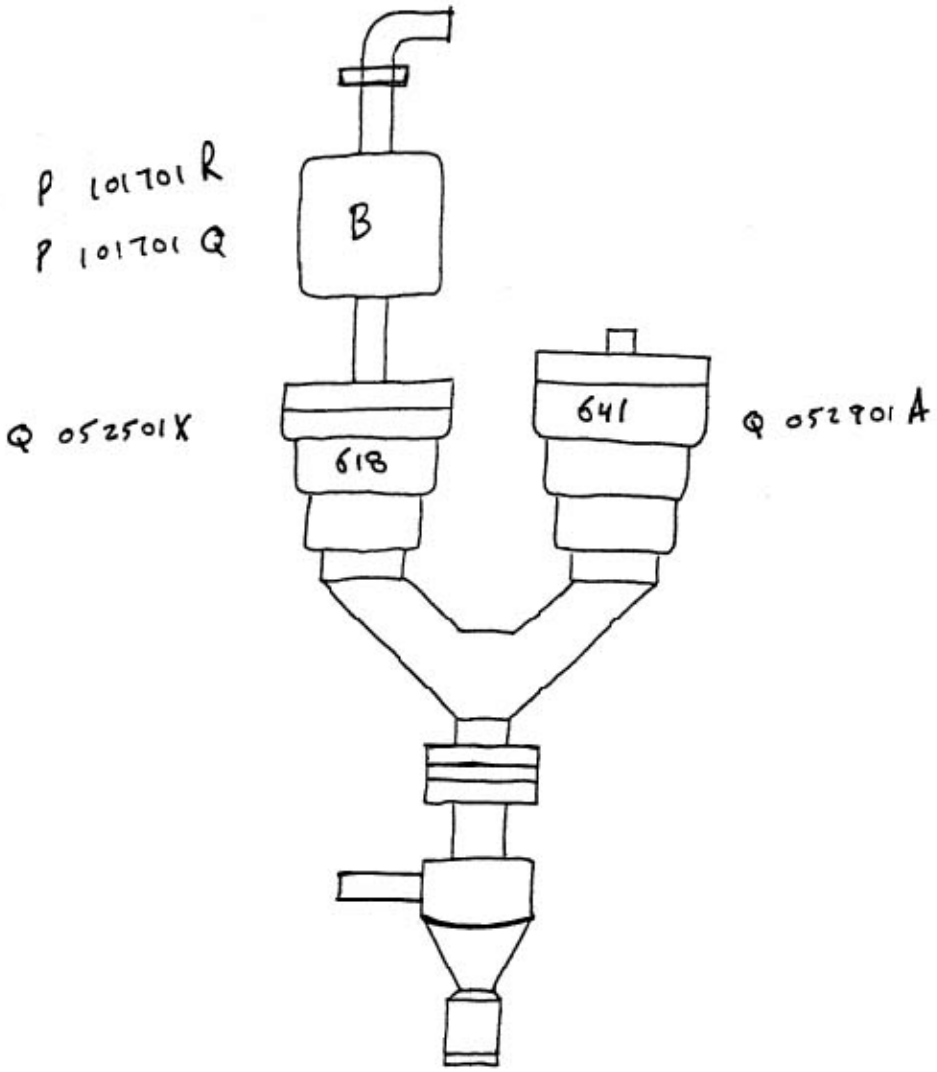

ARCADIS
GERAGHTY & MILLER

SUBJECT: RB 103101 H

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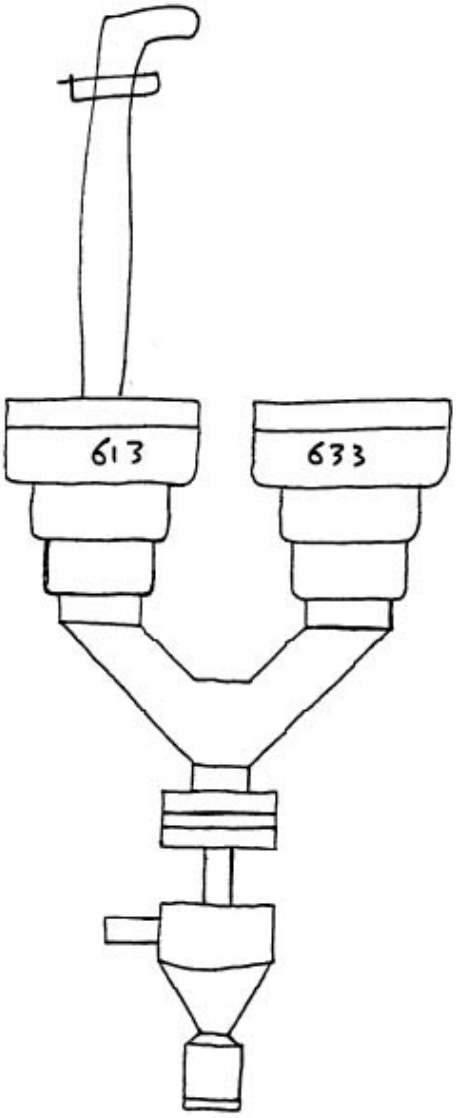

T100201H

T100201G

ARCADIS
GERAGHTY & MILLER

SUBJECT: RB 103101 H

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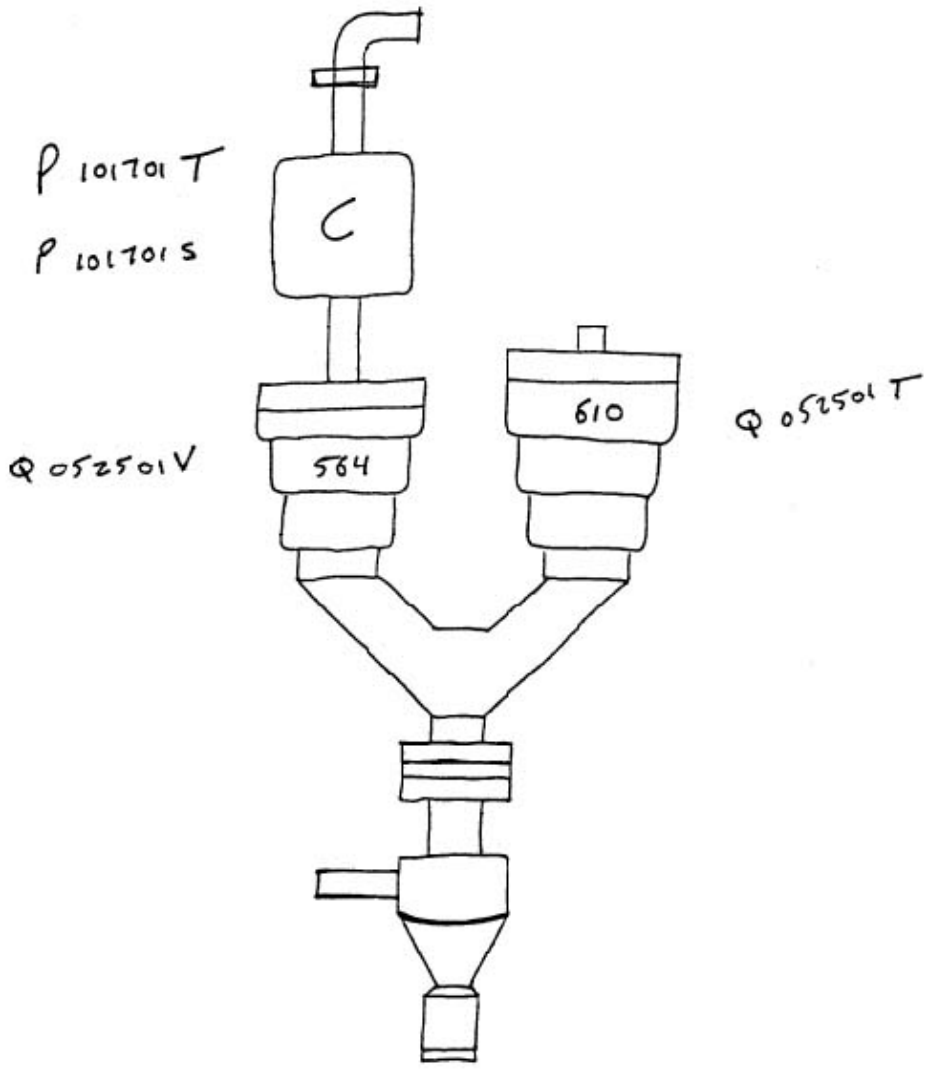

ARCADIS
GERAGHTY & MILLER

SUBJECT: ~~RB 103101 PM~~ RB 103101 H TEST 2

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CHKD: DATE:

JOB NO:

PAGE 6

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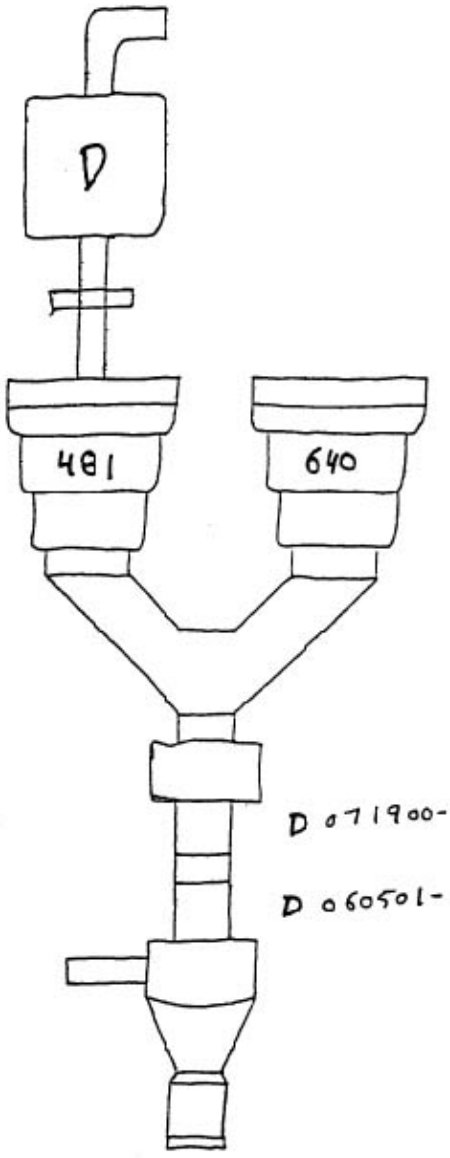
P 101701 V

P 101701 U



Q 052501 R

Q 052501 J

D 071900-995-3

D 060501-1013-2

FLOW ALIGNED TO READ → 1013-2 - 995-3 →

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Chain of Custody Record

Page 1 of 3

PROJECT: WEYERHAUSER REC. BOILER
SITE: PLYMOUTH, NC
COLLECTED BY (Signature): Rob Mantz

FIELD SAMPLE I.D.	SAMPLE MATRIX	DATE/TIME	NO. OF CONTAINERS	PUF	QF	TF	DENUDER		SUMMA	CARBONYL		REMARKS	SAM ID NO. (For lab use only)
RB 103101 H —	Pd 1A1 A	10/31/01	1(	✓								P101701 O	
↓	Pd 1A2 A	↓		✓								P101701 P	
↓	Qd 1A1 622	↓			✓							Q052901 B	
↓	Td 1B1 642	↓				✓						T100201 K	
↓ —	Tr2 A1 585	↓				✓						T100201 J	
↓	Tr2 B1 614	↓				✓						T100201 I	
↓ —	Pr4 A1 B	↓	1(	✓								P101701 Q	
↓	Pr4 A2 B	↓		✓								P101701 R	
↓	Qr4 A1 618	↓			✓							Q052501 X	★
↓	Qr4 B1 641	↓			✓							Q052901 A	

REMARKS: TEST #2 WEDNESDAY 10/31/01

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									Rob Mantz		
									RELINQUISHED BY:	DATE	TIME

LAB USE ONLY

RECEIVED FOR LABORATORY BY:	DATE	TIME	AIRBILL NO.	OPENED BY	DATE	TIME	TEMP°C	SEAL #	CONDITION

REMARKS: note ★ Qr4 A1618 Q052501X
↖ THIS IS AN "A"

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Chain of Custody Record

PROJECT	WEYERHAUSER REC. BOILER														
SITE	PLYMOUTH, NC														
COLLECTED BY (Signature)	Bob Mont														
FIELD SAMPLE I.D.	SAMPLE MATRIX	DATE/TIME	NO. OF CONTAINERS	ANALYSES: PUF	QF	TF	DENUDER		SUMMA	CARBONYL		REMARKS	SAM ID NO. (For lab use only)
RB 103101 H	Tr 6 A1 613	10/31/01				✓						T100201 H	
	Tr 6 B1 633					✓						T100201 G	
	Pr 8 A1 C		1	✓								P101701 S	
	Pr 8 A2 C			✓								P101701 T	
	Qr 8 A1 584				✓							Q052501 V	
	Qr 8 B1 610				✓							Q052501 T	
	Pr 10 A1 D		1	✓								P101701 U	
	Pr 10 A2 D			✓								P101701 V	
	Qr 10 A1 481				✓							Q052501 R	
	Qr 10 B1 640				✓							Q052501 J	

REMARKS: TEST # 2 WEDNESDAY 10/31/01

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									RELINQUISHED BY:	DATE	TIME

LAB USE ONLY

RECEIVED FOR LABORATORY BY:	DATE	TIME	AIRBILL NO.	OPENED BY:	DATE	TIME	TEMP°C	SEAL #	CONDITION
REMARKS:									

ERG
EASTERN RESEARCH GROUP, INC.

Chain of Custody Record

PROJECT: WEYERHAUSER REC. BOILER
SITE: PLYMOUTH, NC
COLLECTED BY (Signature): Bob Mons

FIELD SAMPLE I.D.	SAMPLE MATRIX	DATE/TIME	NO. OF CONTAINERS	ANALYSES: PUF	QF	TF	DENUDER		SUMMA	CARBONYLS		REMARKS	SAM ID NO. (For lab use only)
RB103101 H	Dn 10 A1 1013-2	10/31/01					✓					D060501 –	1013-2
	Dn 10 A2 995-3						✓					D071900 –	995-3
	Dn ϕ A1 FBK						✓					1048-4 or 1261-4	DENUD FIELD BLANK
	Qd ϕ A1 8x10				✓							ERG-06	
	Sd 2 A1 S T2								✓			# 4090	
	Hd 3 A1 H1 T2									✓		CARB 1 FR.	
	Hd 3 A2 H2 T2									✓		CARB 2 REAR	
	Sn 5 A1 S T2								✓			# 1480	
	Hn 3 A1 H1 T2									✓		CARB 1 FR	
	Hn 3 A2 H2 T2									✓		CARB 2 REAR	

REMARKS: TEST # 2 WEDNESDAY 10/31/01 T2 FOR TEST 2 OF CARB/SUMMA

RECEIVED BY:	DATE	TIME	RELINQUISHED BY:	DATE	TIME	RECEIVED BY:	DATE	TIME	RELINQUISHED BY:	DATE	TIME
									Bob Mons		

LAB USE ONLY

RECEIVED FOR LABORATORY BY:	DATE	TIME	AIRBILL NO.	OPENED BY	DATE	TIME	TEMP°C	SEAL #	CONDITION

REMARKS:

ARCADIS
GERAGHTY & MILLER

SUBJECT: RB 110101 H

JOB NO: TEST 3

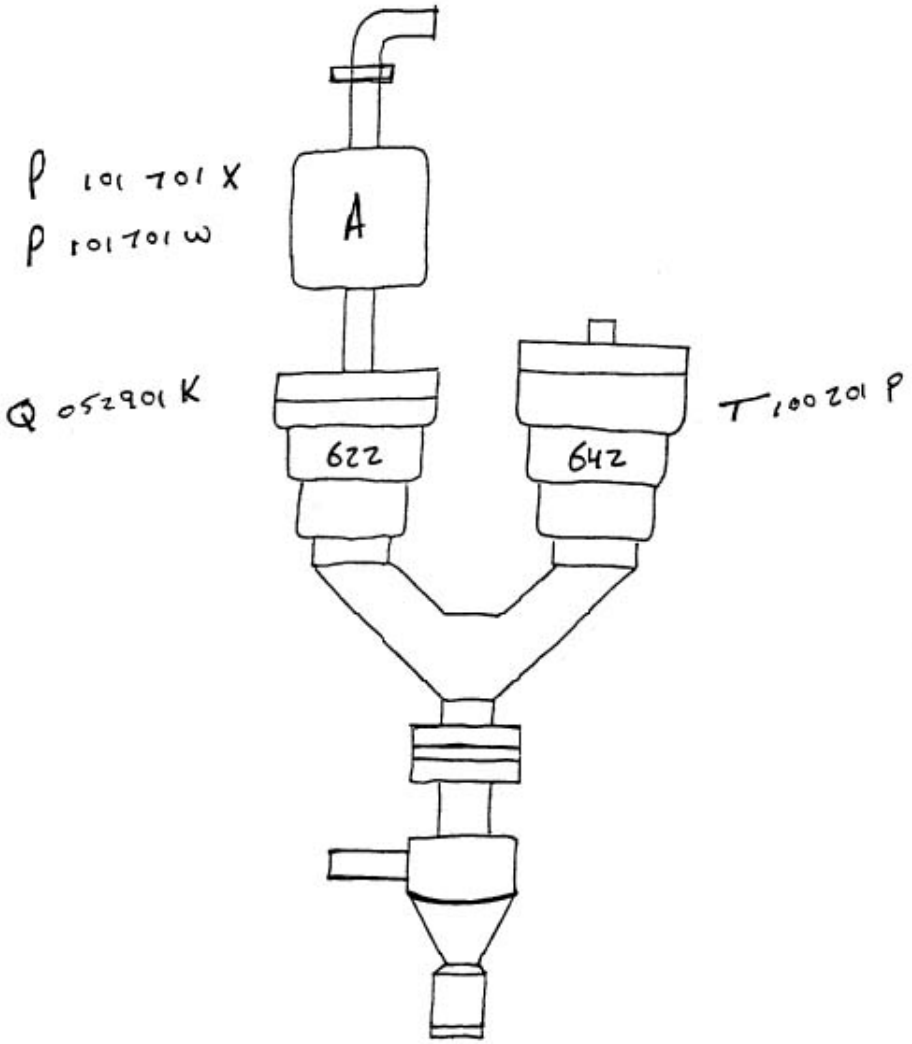
BY: DATE:

CHKD: DATE:

PAGE

SHEET 1

1 DILUTION



ARCADIS
GERAGHTY & MILLER

SUBJECT: RB 110101 H

JOB NO: TEST 3

BY: DATE:

CHKD: DATE:

PAGE

SHEET 1

#10

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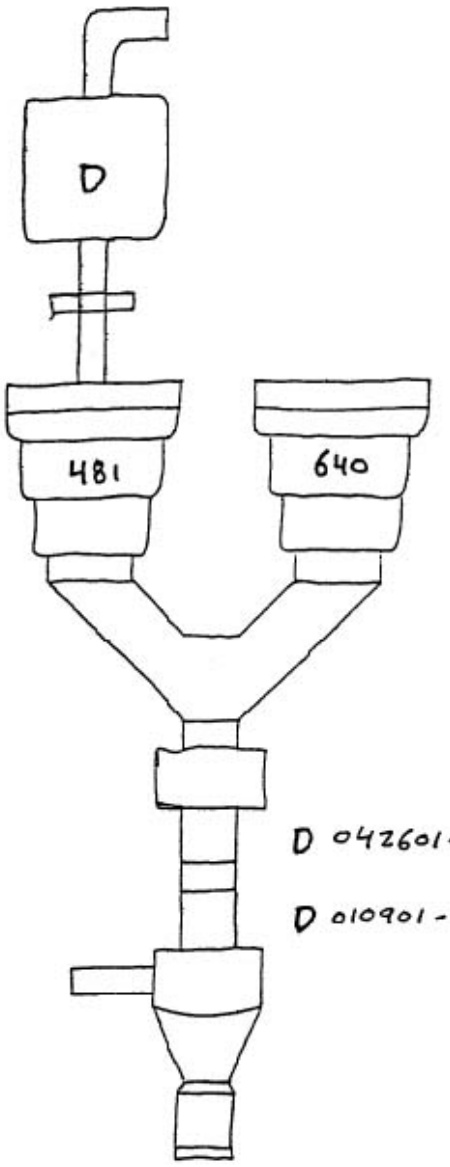
P 101801 E



Q 052901 C

Q 052901 D

D 042601-1551-2

D 010901-1259-4

Flow Aligned to Read

1551-2

1259-4

ARCADIS
GERAGHTY & MILLER

SUBJECT: RB 110101 H

JOB NO: TEST 3

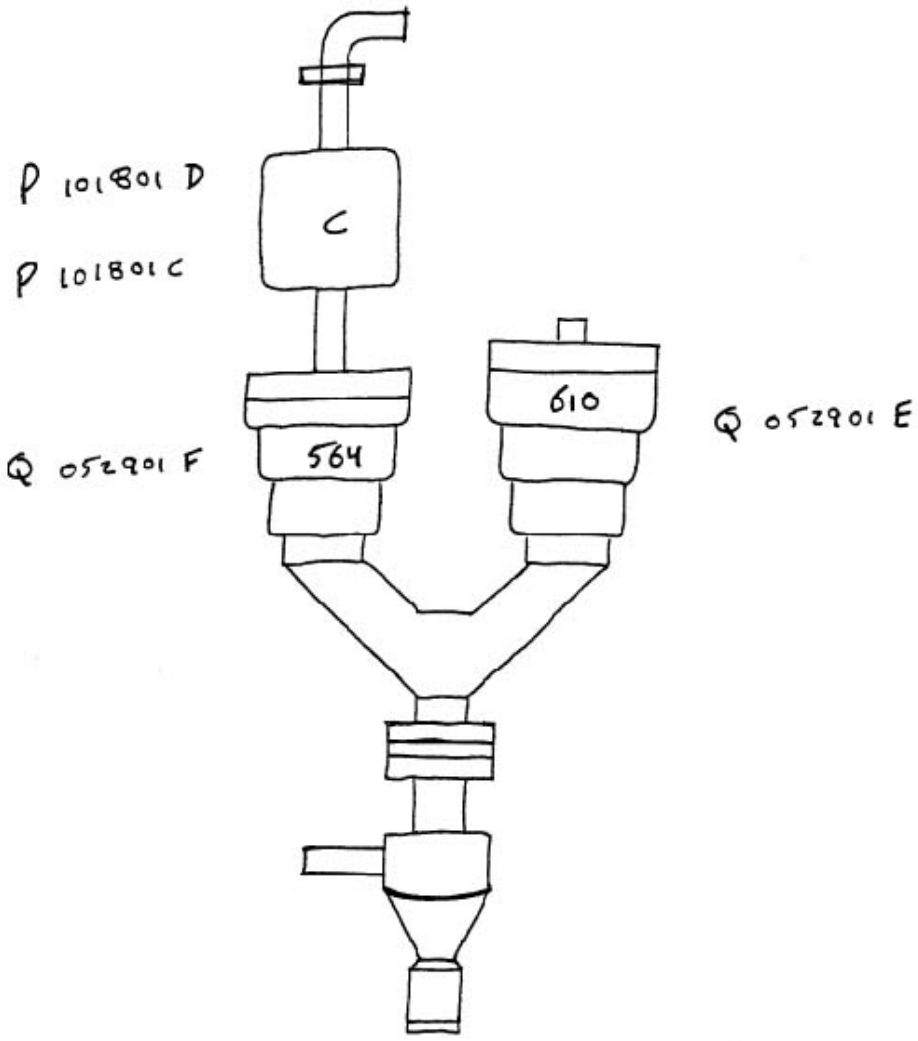
BY: JF DATE:

CHKD: DATE:

PAGE

SHEET 1

#8



ARCADIS
GERAGHTY & MILLER

SUBJECT: RB 110101 H

JOB NO: TEST 3

BY: JB DATE:

CHKD: DATE:

SHEET 1

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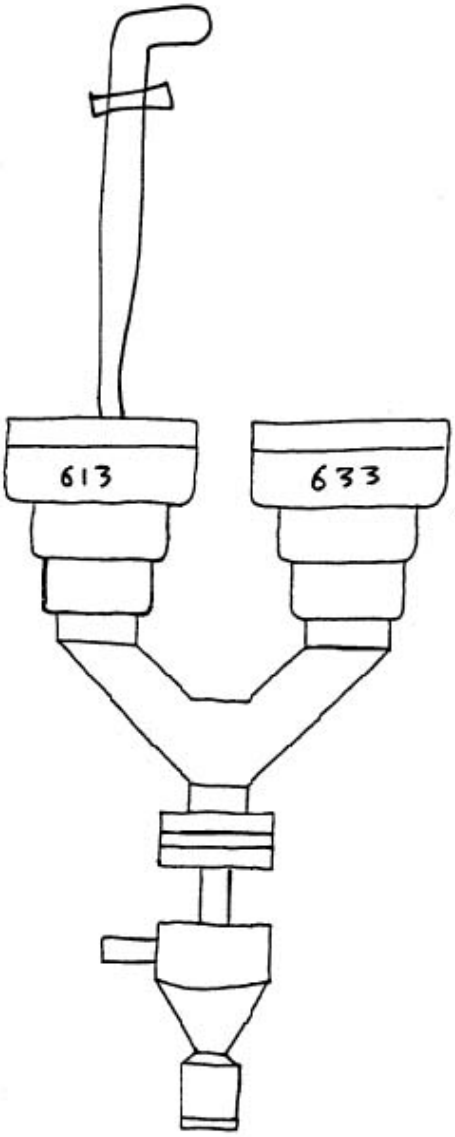


T100201 L

ARCADIS
GERAGHTY & MILLER

SUBJECT: RB 11 01 01 H

JOB NO: TEST 3

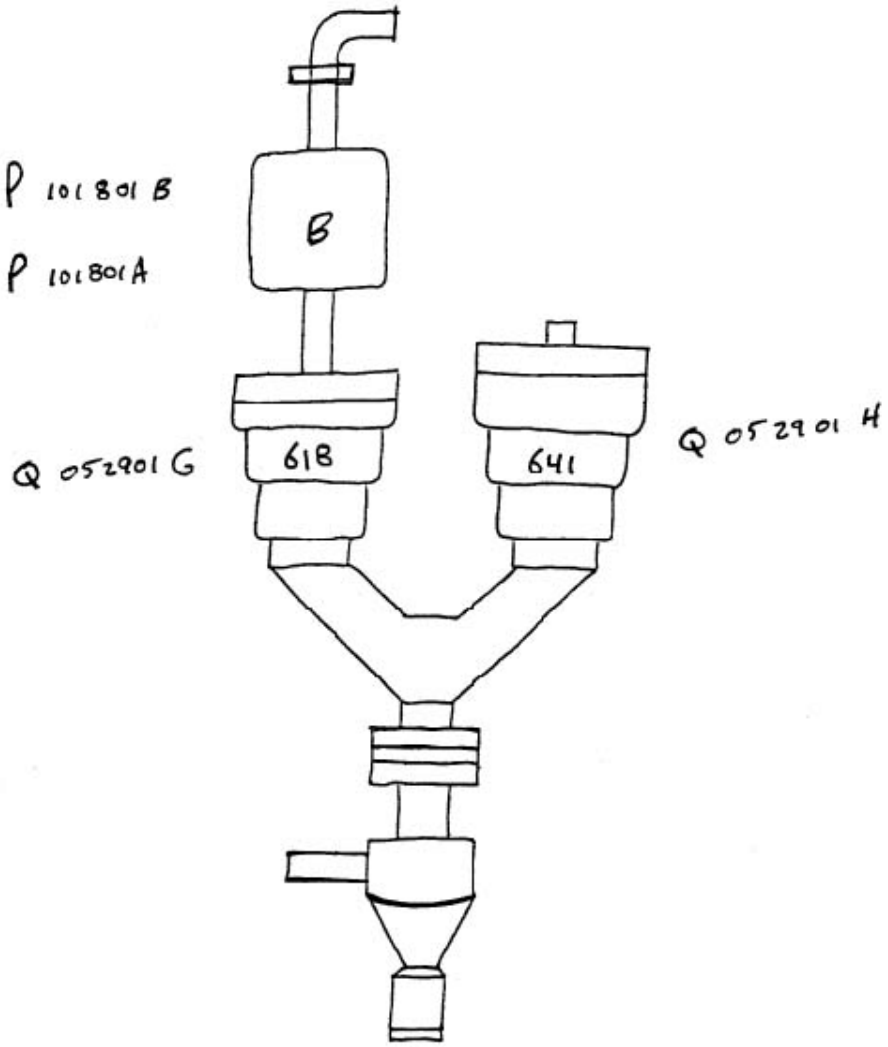
BY: JF DATE:

CHKD: DATE:

PAGE

SHEET 1

4



ARCADIS
GERAGHTY & MILLER

SUBJECT: RB 110101 H

JOB NO: TEST 3

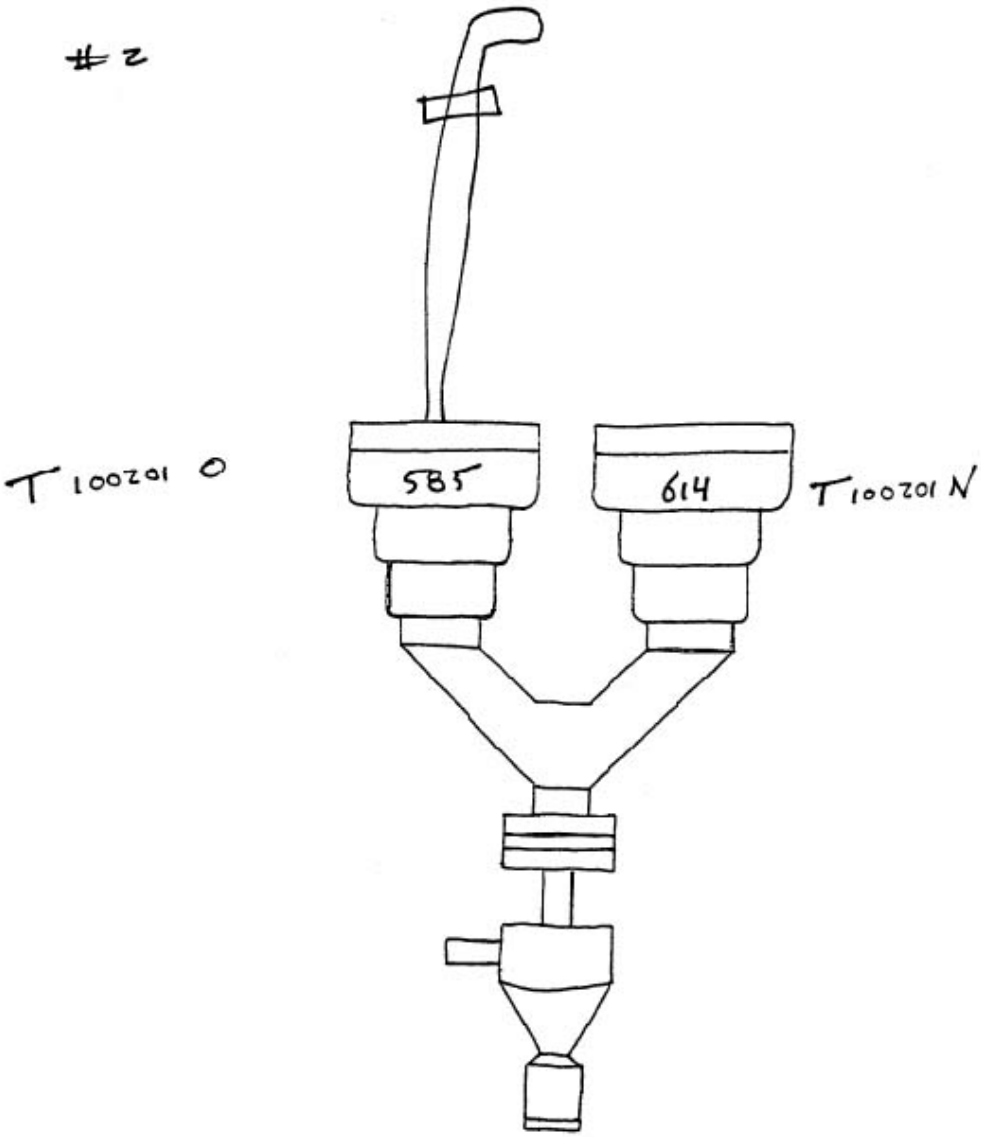
BY: JB DATE:

CHKD: DATE:

PAGE

SHEET 1

#2



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EASTERN RESEARCH GROUP, INC.

Chain of Custody Record

Page 1 of 3

PROJECT	WEYERHAUSER REC. BOILER
SITE	PLYMOUTH, NC
COLLECTED BY (Signature)	Rob Mantz

FIELD SAMPLE I.D.	SAMPLE MATRIX	DATE/TIME	NO. OF CONTAINERS	ANALYSES: PoF	QF	TF	DENUDER		SUMMA	CARBONYL		REMARKS	SAM ID NO. (For lab use only)
RB 110101 H	Pd 1A1 A	11/01/01	1	✓								P101701W	
	Pd 1A2 A			✓								P101701X	
	Qd 1A1 622				✓							Q052901K	
	Td 1B1 642					✓						T100201P	
	Tr 2A1 585					✓						T100201O	
	Tr 2B1 614					✓						T100201N	
	Pr 4A1 B		1	✓								P101801A	
	Pr 4A2 B			✓								P101801B	
	Qr 4A1 618				✓							Q052901G	
	Qr 4B1 641				✓							Q052901H	

REMARKS: TEST # 3 THURSDAY 11/01/01

RELINQUISHED BY:	DATE	TIME
Rob Mantz		
RELINQUISHED BY:	DATE	TIME

RECEIVED BY:	DATE	TIME	RELINQUISHED BY:	DATE	TIME	RECEIVED BY:	DATE	TIME

LAB USE ONLY

RECEIVED FOR LABORATORY BY:	DATE	TIME	AIRBILL NO.	OPENED BY	DATE	TIME	TEMP°C	SEAL #	CONDITION

REMARKS:

ERG
EASTERN RESEARCH GROUP, INC.

Chain of Custody Record

PROJECT: WEYERHAUSER REC. BOILER
SITE: PLYMOUTH, NC
COLLECTED BY (Signature): Rob Mentz

FIELD SAMPLE I.D.	SAMPLE MATRIX	DATE/TIME	NO. OF CONTAINERS	ANALYSES: PoF	QF	TF	DENUDER		SUMMA	CHARCOAL		REMARKS	SAM ID NO. (For lab use only)
RB 110101 H	Tr 6 A1 613	11/01/01				✓						T100201M	
	Tr 6 B1 633					✓						T100201L	
	Pr 8 A1 C		1	✓								P101801C	
	Pr 8 A2 C		(	✓								P101801D	
	Qr 8 A1 564				✓							Q052901F	
	Qr 8 B1 610				✓							Q052901E	
	Pr 10 A1 D		1	✓								P101801E	
	Pr 10 A2 D		(	✓								P101801F	
	Qr 10 A1 481				✓							Q052901C	
	Qr 10 B1 640				✓							Q052901D	

REMARKS: TEST # 3 THURSDAY 11/01/01

RELINQUISHED BY:	DATE	TIME
Rob Mentz		

RECEIVED BY:	DATE	TIME	RELINQUISHED BY:	DATE	TIME	RECEIVED BY:	DATE	TIME	RELINQUISHED BY:	DATE	TIME

LAB USE ONLY

RECEIVED FOR LABORATORY BY:	DATE	TIME	AIRBILL NO.	OPENED BY	DATE	TIME	TEMP°C	SEAL #	CONDITION

REMARKS:

ERG
EASTERN RESEARCH GROUP, INC.

Chain of Custody Record

Page 3 of 3

PROJECT	WEYERHAEUSER REC. BOILER													
SITE	PLYMOUTH, NC													
COLLECTED BY (Signature)	Rob Mauk													
FIELD SAMPLE I.D.	SAMPLE MATRIX	DATE/TIME	NO. OF CONTAINERS	ANALYSES: PUF	QF	TF	DENUDER		SUMMA	CARBONYL		REMARKS	SAM ID NO. (For lab use only)
RB 110101 H	Dr 10 A1 1259-4	11/01/01					✓					D010901-1259-4	
	Dr 10 A2 1551-2						✓					D042601-1551-2	
	Qd ϕ A1 8x10				✓							ERG-05	
	Sd 2 A1 S T3											#	
	Hd 3 A1 H1 T3											CARB 1 FRONT	
	Hd 3 A2 HL T3											CARB 2 REAR	
	Sr 5 A1 S T3											#	
	Hr 3 A1 H1 T3											CARB 1 FRONT	
	Hr 3 A2 HLT3											CARB 2 REAR	

REMARKS: TEST # 3 THURSDAY 11/01/01 T3 for Test 3 for SUMMA/CARB

RECEIVED BY:	DATE	TIME	RELINQUISHED BY:	DATE	TIME	RECEIVED BY:	DATE	TIME	RELINQUISHED BY:	DATE	TIME
									Rob Mauk		

LAB USE ONLY

RECEIVED FOR LABORATORY BY:	DATE	TIME	AIRBILL NO.	OPENED BY	DATE	TIME	TEMP°C	SEAL #	CONDITION

REMARKS:

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EASTERN RESEARCH GROUP, INC.

Chain of Custody Record

Page 1 of 2

PROJECT	WEYERHAEUSER RECOVERY BOILER																
SITE	PLYMOUTH, NC																
COLLECTED BY (Signature)	Bob Mentz																
FIELD SAMPLE I.D.	SAMPLE MATRIX	DATE/TIME	NO. OF CONTAINERS	ANALYSES: ELPI Foils									REMARKS	SAM ID NO. (For lab use only)			
RQ110101 H	Fn 7 A1 Foil 13	11/01/01		✓									A101601 A				
	Fn 7 A1 Foil 12			✓									A101601 C				
	Fn 7 A1 Foil 11			✓									A101601 D				
	Fn 7 A1 Foil 10			✓									A101601 E				
	Fn 7 A1 Foil 9			✓									A101601 F				
	Fn 7 A1 Foil 8			✓									A101601 G				
	Fn 7 A1 Foil 7			✓									A101601 H				
	Fn 7 A1 Foil 6			✓									A101601 I				
	Fn 7 A1 Foil 5			✓									A101601 J				
	Fn 7 A1 Foil 4			✓									A101601 K				

REMARKS: TESTS 1-3 10/30, 31 & 11/1/01

RECEIVED BY:	DATE	TIME	RELINQUISHED BY:	DATE	TIME	RECEIVED BY:	DATE	TIME	RELINQUISHED BY:	DATE	TIME
									Bob Mentz		

LAB USE ONLY

RECEIVED FOR LABORATORY BY:	DATE	TIME	AIRBILL NO.	OPENED BY	DATE	TIME	TEMP °C	SEAL #	CONDITION

REMARKS: FOILS RECOVERED FROM 3 DAY ACCUMULATION IN ELPI IMPACTOR UNIT

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EASTERN RESEARCH GROUP, INC.

Chain of Custody Record

Page 2 of 2

PROJECT	WEYERHAEUSER RECOVERY BOILER															
SITE	PLYMOUTH, NC															
COLLECTED BY (Signature)	Lee Mauk															
FIELD SAMPLE I.D.	SAMPLE MATRIX	DATE/TIME	NO. OF CONTAINERS	ANALYSES: Ni Foils								REMARKS	SMM ID NO. (For lab use only)			
RB 110101 H	Fe 7A1 FOIL 3	11/01/01		✓								A101601 L				
	Fe 7A1 FOIL 2			✓								A101601 M				
	Fe 7A1 FOIL 1			✓								A101601 N				
	Fe ϕA1 FOIL FB			✓								A101601 O	FIELD BLK.			
REMARKS:	TESTS 1-3 10/30, 31 & 11/1/01											RELINQUISHED BY: Lee Mauk	DATE	TIME		
RECEIVED BY:	DATE	TIME	RELINQUISHED BY:	DATE	TIME	RECEIVED BY:	DATE	TIME				RELINQUISHED BY:	DATE	TIME		

LAB USE ONLY

RECEIVED FOR LABORATORY BY:	DATE	TIME	AIRBILL NO.	OPENED BY	DATE	TIME	TEMP °C	SEAL #	CONDITION
REMARKS:									

CLEAN SUBSTRATES

Page 1

Date Substrate Distributed 10/25/01
To Whom Substrate Distributed Tom
FPMCC Lab Personnel Yuanji

No	Type	Substrate ID	Test ID	Sampling Position			
				Chamber	Port	Position	Holder
1	QF	Q051601I	IB102901H	d	1	A1	622
2	QF	Q051601N	IB102901H	r	4	A1	618
3	QF	Q052301C	IB102901H	r	4	B1	641
4	QF	Q052301J	IB102901H	r	8	A1	564
5	QF	Q052301V	IB102901H	r	8	B1	610
6	QF	Q052401X	IB102901H	r	10	A3	481
7	QF	Q052501E	IB102901H	r	10	B3	640
8	QF	Q052501G	IB102901H				FB
9	QF	Q052501J	RB 103101 H	r	10	B1	640
10	QF	Q052501R	RB 103101H	r	10	A1	481
11	QF	Q052501T	RB 103101H	r	8	B1	610
12	QF	Q052501V	RB103101H	r	8	A1	564
13	QF	Q052501X	RB 103101 H	r	4	A1	618
14	QF	Q062901A	RB 103101 H	r	4	B1	641
15	QF	Q052901B	RB103101 H	d	1	A1	622
16	QF	Q052901C	RB 110101 H	r	10	A1	481
17	QF	Q052901D	RB 110101 H	r	10	B1	640
18	QF	Q052901E	RB 110101 H	r	8	B1	610
19	QF	Q052901F	RB 110101 H	r	8	A1	564
20	QF	Q052901G	RB 110101H	r	4	A1	618
21	QF	Q052901H	RB 110101H	r	4	B1	641
22	QF	Q052901K	RB 110101 H	d	1	A1	622
23	QF	Q052901L					
24	QF	Q052901M					
25	QF	Q052901N					
26	QF	Q053001A					
27	QF	Q060401J					
28	QF	Q060401K					
29	QF	Q060401M					
30	QF	Q060401N					
31	QF	Q060401O					
32	QF	Q060401P					
33	QF	Q060401Q					
34	QF	Q060401S					
35	QF	Q060401T					
36	QF	Q060401U					
37	QF	Q060401V					
38	QF	Q060401W					
39	QF	Q060401X					
40	QF	Q060401Y					

CLEAN SUBSTRATES

Date Substrate Distributed 10/25/2001
To Whom Substrate Distributed Tom
FPMCC Lab Personnel Yuanji

No	Type	Substrate ID	Test ID	Sampling Position			
				Chamber	Port	Position	Holder
1	TF	T100201A	IB102901H	d	1	B1	642
2	TF	T100201B	IB102901H	r	2	A1	585
3	TF	T100201C	IB102901H	r	2	B1	614
4	TF	T100201D	IB102901H	r	6	A1	613
5	TF	T100201E	IB102901H	r	6	B1	633
6	TF	T100201F	IB102901H				FB
7	TF	T100201G	RB103101H	r	6	B1	633
8	TF	T100201H	RB103101H	r	6	A1	613
9	TF	T100201I	RB103101H	r	2	B1	614
10	TF	T100201J	RB103101H	r	2	A1	585
11	TF	T100201K	RB103101H	d	1	B1	642
12	TF	T100201L	RB110101H	r	6	B1	633
13	TF	T100201M	RB110101H	r	6	A1	613
14	TF	T100201N	RB110101H	r	2	B1	614
15	TF	T100201O	RB110101H	r	2	A1	585
16	TF	T100201P	RB110101H	d	1	B1	642
17	TF	T100201R					
18	TF	T100201S					
19	TF	T100201T					
20	TF	T100201U					
21	TF	T100201V					
22	TF	T100201W					
23	TF	T100201X					
24	TF	T100201Y					
25	TF	T100201Z					
26	TF	T102201A					
27	TF	T102201B					
28	TF	T102201C					
29	TF	T102201D					
30	TF	T102201E					
31	TF	T102201F					
32	TF	T102201G					
33	TF	T102201H					
34	TF	T102201I					
35	TF	T102201J					
36	TF	T102201K					
37	TF	T102201L					
38	TF	T102201M					
39	TF	T102201N					
40	TF	T102201O					

CLEAN SUBSTRATES

Date Substrate Distributed: 10/25/2001
To Whom Substrate Distributed: Tom
FPMCC Lab Personnel: Yuanji

No	Type	Substrate ID	Test ID	Sampling Position			
				Chamber	Port	Position	Holder
1	Al foil	A101701A	RB 11a101 H	C	7	A1	N/A
2	Al foil	A101701B	Void				
3	Al foil	A101701C	RB 11a101 H	C	7	A1	
4	Al foil	A101701D		C	7		
5	Al foil	A101701E		C	7		
6	Al foil	A101701F		C	7		
7	Al foil	A101701G		C	7		
8	Al foil	A101701H		C	7		
9	Al foil	A1017011		C	7		
10	Al foil	A101701J		C	7		
11	Al foil	A101701K		C	7		
12	Al foil	A101701L		C	7		
13	Al foil	A101701M		C	7		
14	Al foil	A101701N		C	7	A1	↓
15	Al foil	A101701O	RB 11a101 H				FB
16	Al foil	A101701P					
17	Al foil	A101701Q					
18	Al foil	A101701R					
19	Al foil	A101701S					
20	Al foil	A101701T					
21	Al foil	A101701U					
22	Al foil	A101701V					
23	Al foil	A101701W					
24	Al foil	A101701X					
25	Al foil	A101701Y					
26	Al foil	A101601A					
27	Al foil	A101601B					
28	Al foil	A101601C					
29	Al foil	A101601D					
30	Al foil	A101601E					
31	Al foil	A101601F					
32	Al foil	A101601G					
33	Al foil	A101601H					
34	Al foil	A101601I					
35	Al foil	A101601J					
36	Al foil	A101601K					
37	Al foil	A101601L					
38	Al foil	A101601M					
39	Al foil	A101601N					
40	Al foil	A101601O					

BLANK

CLEAN SUBSTRATES

Page 5

Date Substrate Distributed 10/25/2001
To Whom Substrate Distributed Tom
FPMCC Lab Personnel Yuanji

No	Type	Substrate ID	Test ID	Sampling Position			
				Chamber	Port	Position	Holder
1	Denuder	D071900-995-5	RB 103101 H	C	10	A2	481/640
2	Denuder	D060501-1013-2	RB 103101 H	C	10	A1	481/640
3	Denuder	D010901-1201-3	RB 103001 H	C	10	A2	481/640
4	Denuder	D042601-1551-2	RB 110101 H	C	10	A2	481/640
5	Denuder	D060501-1049-3	RB 103001 H	C	10	A1	481/640
6	Denuder	D-10901-1259-4	RB 110101 H	C	10	A1	481/640

CLEAN SUBSTRATES

Page 6

Date Substrate Distributed 10/25/2001
To Whom Substrate Distributed Tom
FPNCC Lab Personnel Yuanji

No	Type	Substrate ID	Test ID	Sampling Position			
				Chamber	Port	Position	Holder
1	PUF	P101701A	102901H			1	A
2	PUF	P101701B	102901H			2	
3	PUF	P101701C	103001H			1	B
4	PUF	P101701D	103001H			2	
5	PUF	P101701E	103001H			1	C
6	PUF	P101701F	103001H			2	
7	PUF	P101701G	103001H			1	D
8	PUF	P101701H	103001H			2	
9	PUF	P101701I	103001H			1	E
10	PUF	P101701J	103001H			2	
11	PUF	P101701K	103001H			1	F
12	PUF	P101701L	103001H			2	
13	PUF	P101701M	103001H			FIELD BLANK	
14	PUF	P101701N	103001H			FIELD BLANK	
15	PUF	P101701O	103101H			1	A
16	PUF	P101701P				2	
17	PUF	P101701Q				1	B
18	PUF	P101701R				2	
19	PUF	P101701S				1	C
20	PUF	P101701T				2	
21	PUF	P101701U				1	D
22	PUF	P101701V	103101H			2	
23	PUF	P101701W	110101H			1	A
24	PUF	P101701X				2	
25	PUF	P101801A				1	B
26	PUF	P101801B				2	
27	PUF	P101801C				1	C
28	PUF	P101801D				2	
29	PUF	P101801E				1	D
30	PUF	P101801F	110101H			2	
31	PUF	P101801G					
32	PUF	P101801H					
33	PUF	P101801I					
34	PUF	P101801J					
35	PUF	P101801K					
36	PUF	P101801L					
37	PUF	P101901A					
38	PUF	P101901B					
39	PUF	P101901C					
40	PUF	P101901D					

Appendix C

Sample Log with Sample IDs

Table C-1. Sample Log, Recovery Boiler

				Test Date:	10/30/01	10/31/01	11/1/01
Chamber	**Port**	**Position**	**Substrate**	**Holder#**	**Substrate ID**	**Substrate ID**	**Substrate ID**
Residence	2	A1	TF	585	T100201B	T100201J	T100201O
		B1	TF	614	T100201C	T100201I	T100201N
	3	M1	DNPH		IB103001HR1M1	IB103101HR1M1	IB110101HR1M1
		M2	DNPH		IB103001HR1M2	IB103101HR1M2	IB110101HR1M2
	4	A1	QF	618	Q051601N	Q052501X[a]	Q052901G[b]
		A2	PUF	B	P101701C	P101701Q	P101801A
		A3	PUF	B	P101701D	P101701R	P101801B
		B1	QF	641	Q052301C	Q052901A[a]	Q052901H[b]
	5	M2	SUMMA		IB103001H-SR5M2	IB103101H-SR5M2	IB110101H-SR5M2
	6	A1	TF	613	T100201D	T100201H	T100201M
		B1	TF	633	T100201E	T100201G	T100201L
	7	M1	ELPI		run time = 303 min	run time = 480 min	run time = 480 min
	8	A1	QF	564	Q052301J	Q052501V[a]	Q052901F[b]
		A2	PUF	C	P101701E	P101701S	P101801C
		A3	PUF	C	P101701F	P101701T	P101801D
		B1	QF	610	Q052301V	Q052501T[a]	Q052901E[b]
	10	M1	Denuder		D060501-1049-3	D060501-1013-2	D010901-1259-4
		M2	Denuder		D010901-1261-3	D071900-995-3	D042601-1551-2
		A3	QF	481	Q052401X	Q052501R[a]	Q052901C[b]
		A4	PUF	D	P101701G	P101701U	P101801E
		A5	PUF	D	P101701H	P101701V	P101801F
		B3	QF	640	Q052501E	Q052501J[a]	Q052901D[b]
Dilution	1	A1	QF	622	Q051601I	Q052901B	Q052901K
		A2	PUF	A	P101701A	P101701O	P101701W
		A3	PUF	A	P101701B	P101701P	P101701X
		B1	TF	642	T100201A	T100201K	T100201P
	2	M2	SUMMA		IB103001H-SD2M2	IB103101H-SD2M2	IB110101H-SD2M2
	3	M1	DNPH		IB103001HD3M1	IB103101HD3M1	IB110101HD3M1
		M2	DNPH		IB103001HD3M2	IB103101HD3M2	IB110101HD3M2
Field Blank			QF		Q052501G		
			TF		T100201F		
			Denuder			D060501-1049-4	
			Denuder			D010901-1261-4	
			PUF	Field	P101701M		
			PUF	Field	P101701N		
			PUF	B-1	P102501L		
			SUMMA		IB103001H-SUMA-FB		
			DNPH		IB103001H-DNPH-FB		

[a] All quartz filter samples in the Residence Chamber for the 10/31/01 test were composited for analysis.
[b] All quartz filter samples in the Residence Chamber for the 11/1/01 test were composited for analysis.

Appendix D

List of ERG SOPs and EPA MOPs by Title

Contents

Table D-1. ERG Standard Operating Procedures by Title

SOP No.	SOP Title
1	Documentation of Field Recovery Activities
2	Gravimetric Determination for Particulate Emissions Measurements
3	Field Procedure for Collecting Ambient Air Toxics and Carbonyl Compounds Samples using the ERG:AT/C Sampling System
3B	Field Procedure for Collecting Ambient Air Toxics and Carbonyl Compounds Samples using the ERG:AT/C Sampling System
4	SOP for Preventive Maintenance in the Gas Chromatography/Mass Spectrometry Laboratory
5	SOP for the Concurrent GC/FID/MS Analysis of Canister Air Toxic Samples
6	SOP for the Analysis of Tenax® Tubes According to EPA Method TO-1/TO-17
7	SOP for the Preparation of Review Packages for Mass Spectrometry Data Sets
8	Procedure for Preparation of Standard Operating Procedures
9	SOP for the Operation of the Documentation System
10	SOP for the Determination of Method Detection Limits in the GC/MS Air Toxics Laboratory
11	SOP for Sample Storage and Checkout from Freezers/Refrigerators at the Laboratory
12	SOP for Basic Training Requirements for Sample Preparation Laboratory Personnel
13	Field Procedure for Collecting Ambient Air Hexavalent Chromium Samples Using the ERG:CR6 Sampling System
14	SOP for Sample Preparation Quality Control
15	SOP for Documentation Procedures for the Sample Preparation Laboratory
16	SOP for the Varian 9000 Series High Performance Liquid Chromatograph (HPLC)
17	SOP for Developing, Documenting, and Evaluating the Accuracy of Spreadsheet Data
18	Maintaining and Recording Data Records
19	SOP for Transferring, Storing, and Using Confidential Business Information (CBI)
20	SOP for Conducting a Laboratory Systems Audit
21	Calibration and Operation of Analytical Balances
22	SOP for the Preparation of Standards in the ERG Organic Preparation Laboratory
23	SOP for the Use of Significant Figures and Rounding Off Numbers When Reporting Data
24	SOP for Preparing Aldehyde Derivatizing Reagents and Extracting Derivatized Samples
25	SOP for the Operation of the Rainin High Performance Liquid Chromatography System
26	SOP for Documentation: Labeling of Samples and Standards Prepared in the Laboratory
27	SOP for the Operation of a Gas Chromatograph
28	SOP for Quality Assurance/Quality Control in Gas Chromatography/Mass Spectrometry
29	SOP for Concentration of Sample Extracts Using the Kuderna-Danish Concentrator
30	SOP for Canister Sampling System Certification Procedures

continued

Table D-1. (continued)

SOP No.	SOP Title
31	SOP for Cleaning Glassware and Syringes for Organic Analysis
32	Statistical Manual Standard Operating Procedure
33	SOP for Solid and Hazardous Waste Disposal
34	Analytical Chemistry Training at PPK Laboratory
35	SOP for Quality Assurance/Quality Control
36	SOP for Laboratory Security
37	SOP for Chemical Inventory
38	SOP for Personal Protective Equipment Program
39	SOP for Maintaining Laboratory Notebooks
40	SOP for Chemical Storage Facilities
41	SOP for Tracer Gas Release and Integrated Bag Sampling for Analysis by FTIR Spectroscopy
42	SOP for the Dionex-300 Ion Chromatograph
43	SOP for the Analysis of Semivolatile Organic Compounds in Gaseous Emissions using the SemiVOST Method
44	SOP for Method 8270C - GC/MS Analysis of Semivolatile Organics
45	SOP for Sample Log-in at the ERG Chemistry Laboratory
46	Field Procedure for Collecting Speciated and/or Total Nonmethane Organic Compounds Ambient Air Samples Using the ERG:S/NMOC Sampling System
47	Field Procedure for Collecting Ambient Carbonyl Compounds Samples Using the ERG:C Sampling System
47B	Field Procedure for Collecting Ambient Carbonyl Compounds Samples Using the ERG:C Sampling System
48	SOP for Cleaning XAD-2® with Quality Control Measures to Assure Cleanliness
49	SOP for the Extraction and Analysis of PAHs from XAD-2® Traps
50	SOP for Separatory Funnel Liquid-Liquid Extraction by EPA SW-846 Method 3510C
51	SOP for Continuous Liquid-Liquid Extraction by EPA SW-846 Method 3520C
52	SOP for Acid-Base Partition Cleanup by EPA SW-846 Method 3650B
53	SOP for Soxhlet Extraction by EPA SW-846 Method 3540C
54	SOP for Preparation, Evaluation, and Shipping of Performance Evaluation Samples for Method 24
55	SOP for Maintenance of NANOPure-A Deionized Water System
56	SOP for Daily Maintenance of Cold Storage Units
57	SOP for Project Peer Review
58	SOP for Preparing Method 25 Audit Samples Using the Transfill System
59	SOP for High Performance Liquid Chromatography
60	SOP for PDFID Sample Analysis
61	SOP for Standard Preparation Using Dynamic Flow Dilution System

continued

Table D-1. (concluded)

SOP No.	SOP Title
62	SOP for UATMP and NMOC Canister Cleaning
63	SOP for the Analysis of Ambient Air for Hexavalent Chromium by IC
64	SOP for Shipping Method 6, 7, 8, and 26 Audit Samples
65	SOP for the ERG Sample Database
66	Cylinder Recycling
67	SOP for Producing Standard Mixtures of Organic Compounds in Air by Liquid Injection
68	SOP for Refrigerator and Freezer Temperature Monitoring
69	SOP for Shipping Method 23 Audit Samples
70	SOP for Storing and Shipping Method 13A, 13B, and 29 Audit Samples
71	SOP for Documentation Requirements for the GC/MS Laboratory and for GC/MS Systems in the VOC Laboratory
72	SOP for Stack Sampling Using FTIR Spectroscopy
73	SOP for the ECD Wipe Test
74	SOP for the Preparation of Spiked Sorbent Samples Using Liquid Spiking into Tenax-GC® Tubes
75	SOP for the Preparation of Spiked Sorbent Samples Using Liquid Spiking onto XAD-2®
76	SOP for the Preparation of Spiked Sorbent Samples Using Flash Evaporation Spiking onto XAD-2®
77	SOP for Method 624
78	SOP for Method 625
79	SOP for Method 1624C
80	SOP for Method 1625C
81	SOP for the Preparation of Spiked Method 8 Samples as Stationary Source Audit Materials

Table D-2. EPA Method Operating Procedures by Title

MOP No.	MOP Title
2501	Preparation of Clean Substrates, Glassware, and Other Materials
2502	Purification of Benzene Solvent
2503	Mass Measurements of Blank and Exposed Sampling Substrates
2504	Solvent Extraction of Samples and Extract Concentration
2505	Diazomethane Preparation and Extract Methylation
2506	Silylation of Methylated Extracts
2507	GC/MS Calibration and Analysis of Extracts
2508	Denuder Coating, Cleanup, and Extraction
2509	PUF Cleanup and Extraction
NIOSH Method 5040	Elemental/Organic Carbon Analysis

Appendix E

Method Detection Limits for Carbonyl Compounds, Air Toxics, and Speciated NMOC

Contents

Table E-1. Method Detection Limits for Carbonyl Compounds Analyzed by High Performance Liquid Chromatography

Compound	CAS No.	Method Detection Limits (µg)
formaldehyde	50-00-0	0.0838
acetaldehyde	75-07-0	0.0916
acetone	67-64-1	0.0428
propionaldehyde	123-38-6	0.0934
crotonaldehyde	4170-30-3	0.1283
butyraldehyde	123-72-8	0.0956
benzaldehyde	100-52-7	0.0959
isovaleraldehyde	590-86-3	0.1076
valeraldehyde	110-62-3	0.1758
o-tolualdehyde	529-20-4	0.1439
m-tolualdehyde	620-23-5	0.1439
p-tolualdehyde	104-87-0	0.1439
hexaldehyde	66-25-1	0.1377
2,5-dimethylbenzaldehyde	5779-94-2	0.1337[a]
diacetyl	432-03-8	0.0154[a]
methacrolein	78-85-3	0.0125[a]
2-butanone	78-93-3	0.0125[a]
glyoxal	107-22-2	0.0412[a]
acetophenone	98-86-2	0.0250[a]
methylglyoxal	78-98-8	0.0244[a]
octanal	124-13-0	0.0100[a]
nonanal	124-19-6	0.0182[a]

[a] Estimated value.

Table E-2. Method Detection Limits for Air Toxics Compounds (Analytical Method TO-15)

Target Compounds	CAS No.	Method Detection Limit[a] ($\mu g/m^3$)
acetylene	74-86-2	0.24
propylene	115-07-1	0.17
dichlorodifluoromethane	75-71-8	0.40
chloromethane	74-87-3	0.24
dichlorotetrafluoroethane	1320-37-2	0.70
vinyl chloride	75-01-4	0.31
1,3-butadiene	106-99-0	0.31
bromomethane	74-83-9	0.70
chloroethane	75-00-3	0.42
acetonitrile	75-05-8	0.84
acetone	67-64-1	1.23
trichlorofluoromethane	75-69-4	0.45
acrylonitrile	107-13-1	0.91
1,1-dichloroethene	75-35-4	0.79
methylene chloride	75-09-2	0.42
trichlorotrifluoroethane	26523-64-8	1.07
trans-1,2-dichloroethylene	56-60-5	0.47
1,1-dichloroethane	75-34-3	0.65
methyl *tert*-butyl ether	1634-04-1	1.29
methyl ethyl ketone	78-93-3	0.88
chloroprene	126-99-8	0.73
cis-1,3-dichloroethylene	156-59-2	0.79
bromochloromethane	74-97-5	1.26
chloroform	67-66-3	0.49
ethyl *tert*-butyl ether	637-92-3	1.25
1,2-dichloroethane	107-06-2	0.48
1,1,1-trichloroethane	71-55-6	0.65
benzene	71-43-2	0.25
carbon tetrachloride	56-23-5	1.01
tert-amyl methyl ether	994-05-8	1.00
1,2-dichloropropane	78-87-5	0.65
ethyl acrylate	140-88-5	1.31
bromodichloromethane	75-27-4	0.80
trichloroethylene	79-01-6	0.75
methyl methacrylate	80-62-6	1.47
cis-1,2-dichloropropene	10061-01-5	0.82

continued

Table E-2. (concluded)

Target Compounds	CAS No.	Method Detection Limit[a] ($\mu g/m^3$)
methyl isobutyl ketone	108-10-1	1.36
trans-1,2-dichloropropene	10061-02-6	1.00
1,1,2-trichloroethane	79-00-5	0.65
toluene	108-88-3	0.45
dibromochloromethane	124-48-1	1.36
1,2-dibromoethane	106-93-4	1.23
n-octane	111-65-9	0.56
tetrachloroethylene	127-18-4	0.81
chlorobenzene	108-90-7	0.55
ethylbenzene	100-41-4	0.35
m-, p-xylene	108-38-3/106-42-3	0.87
bromoform	75-25-2	1.65
styrene	100-42-5	0.59
1,1,2,2-tetrachloroethane	79-34-5	0.82
o-xylene	95-47-6	0.43
1,3,5-trimethylbenzene	108-67-8	0.69
1,2,4-trimethylbenzene	95-63-6	0.69
m-dichlorobenzene	541-73-1	0.60
chloromethylbenzene	100-44-7	0.72
p-dichlorobenzene	106-46-7	1.08
o-dichlorobenzene	95-50-1	0.72
1,2,4-trichlorobenzene	120-82-1	0.89
hexachloro-1,3-butadiene	87-68-3	1.28

[a] MDLs are instrument detection limits based on Fed. Reg., 1984. MDLs reported here are based on nominal injection volume of 200 mL of gas.

Table E-3. Method Detection Limits for Speciated Nonmethane Organic Compounds ("Technical Assistance Document for Sampling and Analysis of Ozone Precursors," U.S. EPA, 1998)

Compound	CAS No.	Method Detection Limits ($\mu g/m^3$)
ethylene	74-85-1	0.50
acetylene	74-86-2	0.47
ethane	74-84-0	0.54
propylene	115-07-1	0.44
propane	74-98-6	0.46
propyne	74-99-7	0.42
isobutane	75-28-5	0.43
isobutene/1-butene	115-11-7/106-98-0	0.21
1,3-butadiene	106-99-0	0.40
n-butane	106-97-8	0.43
trans-2-butene	624-64-6	0.42
cis-2-butene	590-18-1	0.42
3-methyl-1-butene	563-45-1	0.32
isopentane	78-78-4	0.33
1-pentene	109-67-1	0.32
2-methyl-1-butene	563-46-2	0.45
n-pentane	109-66-0	0.33
isoprene	78-79-4	0.31
trans-2-pentene	646-04-8	0.33
cis-2-pentene	627-20-3	0.33
2-methyl-2-butene	513-35-9	0.32
2,2-dimethylbutane	75-83-2	0.46
cyclopentene	142-29-0	0.31
4-methyl-1-pentene	691-37-2	0.45
cyclopentane	287-92-3	0.32
2,3-dimethylbutane	79-29-8	0.46
2-methylpentane	107-83-5	0.46
3-methylpentane	96-14-0	0.46
2-methyl-1-pentene	763-29-1	0.46
1-hexene	592-41-6	0.46
2-ethyl-1-butene	760-21-4	0.45
n-hexane	110-54-3	0.46
trans-2-hexene	4050-45-7	0.46
cis-2-hexene	7688-21-3	0.46
methylcyclopentane	96-37-7	0.45

continued

Table E-3. (continued)

Compound	CAS No.	Method Detection Limits ($\mu g/m^3$)
2,4-dimethylpentane	108-08-7	0.35
benzene	71-43-2	0.42
cyclohexane	110-82-7	0.45
2-methylhexane	591-76-4	0.40
2,3-dimethylpentane	565-59-3	0.40
3-methylhexane	589-34-4	0.40
1-heptene	592-76-7	0.39
2,2,4-trimethylpentane	540-84-1	0.51
n-heptane	142-82-5	0.40
methylcyclohexane	108-87-2	0.39
2,2,3-trimethylpentane	564-02-3	0.51
2,3,4-trimethylpentane	565-75-3	0.51
toluene	108-88-3	0.37
2-methylheptane	592-27-8	0.51
3-methylheptane	589-81-1	0.51
1-octene	111-66-0	0.50
n-octane	111-65-9	0.51
ethylbenzene	100-41-4	0.52
m-, *p*-xylene	108-38-3/106-42-3	0.47
styrene	100-42-5	0.46
o-xylene	95-47-6	0.47
1-nonene	124-11-8	0.40
n-nonane	111-84-2	0.41
isopropylbenzene	98-82-8	0.38
α-pinene	80-56-8	0.39
n-propylbenzene	103-65-1	0.38
m-ethyltoluene	620-14-4	0.38
p-ethyltoluene	622-96-8	0.38
1,3,5-trimethylbenzene	108-67-8	0.38
o-ethyltoluene	611-14-3	0.38
β-pinene	127-91-3	0.39
1,2,4-trimethylbenzene	95-63-6	0.38
1-decene	872-05-9	0.33
n-decane	124-18-5	0.33
1,2,3-trimethylbenzene	526-73-8	0.38
m-diethylbenzene	141-93-5	0.32
p-diethylbenzene	105-05-5	0.32

continued

Table E-3. (concluded)

Compound	CAS No.	Method Detection Limits ($\mu g/m^3$)
1-undecene	821-95-4	0.49
n-undecane	1120-21-4	0.50
1-dodecene	112-41-4	0.49
n-dodecane	112-40-3	0.50
1-tridecene	2437-56-1	0.49
n-tridecane	629-50-5	0.50

Appendix F

Example Calculations

Contents

Table F-1. Calculation of Mass Emission Rates of Speciated Carbonyls, Recovery Boiler No. 5 (10/30/01)

Parameters Required		Units
Mass of Analyte in Total Combustion Air	0.2810	µg
Mass Fuel Consumed	725,707	kg
Combustion Airflow Rate (Average)	212,493.61	sft^3/min[a]
Run Time	482.42	min
Venturi Flow Rate (Average)	20.25	sL/min[b]
Dilution Airflow Rate (Average)	861.48	sL/min
Flow Rate at Sample Collection Unit	1.37	L/min
Calculations		
Total Volume of Air Sampled	2,902,793,349.0000	L
Volume of Combustion Air Sampled	9,769.0050	L
Volume of Dilution Air	415,595.1816	L
Dilution Ratio	43.5422	
Mass Flow Rate of Speciated Carbonyls in Diluted Sample	0.0004	µg/L
Mass Flow Rate of Speciated Carbonyls in Undiluted Sample	0.0185	µg/L
Total Mass of Speciated Carbonyls in Sampled Air	180.8512	µg
Total Speciated Carbonyls in Total Combustion Air	53,738,700.1900	µg
Mass Emission Rate of Total Speciated Carbonyls	74.0501	µg/kg
	0.0741	mg/kg

[a] sft^3/min = cubic feel per minute at standard temperature and pressure.
[b] sL/min = liters per minute at standard temperature and pressure.

Table F-2. Calculation of Mass Emission Rates of Speciated Carbonyls, Recovery Boiler No. 5 (10/31/01)

Parameters Required		Units
Mass of Analyte in Total Combustion Air	5.4830	µg
Mass Fuel Consumed	1,170,190	kg
Combustion Airflow Rate (Average)	212,493.61	sft^3/min[a]
Run Time	480.03	min
Venturi Flow Rate (Average)	18.88	sL/min[b]
Dilution Airflow Rate (Average)	859.33	sL/min
Flow Rate at Sample Collection Unit	1.17	L/min
Calculations		
Total Volume of Combustion Air	2,888,412,361.0000	L
Volume of Combustion Air Sampled	9,062.9664	L
Volume of Dilution Air	412,504.1799	L
Dilution Ratio	46.5154	
Mass Flow Rate of Speciated Carbonyls in Diluted Sample	0.0098	µg/L
Mass Flow Rate of Speciated Carbonyls in Undiluted Sample	0.4541	µg/L
Total Mass of Speciated Carbonyls in Sampled Air	4,115.5773	µg
Total Speciated Carbonyls in Total Combustion Air	1,311,654,904.0000	µg
Mass Emission Rate of Total Speciated Carbonyls	1,120.8905	µg/kg
	1.1209	mg/kg

[a] sft^3/min = cubic feel per minute at standard temperature and pressure.
[b] sL/min = liters per minute at standard temperature and pressure.

Table F-3. Calculation of Mass Emission Rates of Speciated Carbonyls, Recovery Boiler No. 5 (11/01/01)

Parameters Required		Units
Mass of Analyte in Total Combustion Air	2.6310	µg
Mass Fuel Consumed	1,254,201	kg
Combustion Airflow Rate (Average)	212,493.61	sft^3/min[a]
Run Time	479.03	min
Venturi Flow Rate (Average)	18.87	sL/min[b]
Dilution Airflow Rate (Average)	854.46	sL/min
Flow Rate at Sample Collection Unit	1.22	L/min
Calculations		
Total Volume of Combustion Air	2,882,395,211.0000	L
Volume of Combustion Air Sampled	9,039.2961	L
Volume of Dilution Air	409,311.9740	L
Dilution Ratio	46.2814	
Mass Flow Rate of Speciated Carbonyls in Diluted Sample	0.0045	µg/L
Mass Flow Rate of Speciated Carbonyls in Undiluted Sample	0.2084	µg/L
Total Mass of Speciated Carbonyls in Sampled Air	1,883.3863	µg
Total Speciated Carbonyls in Total Combustion Air	600,562,639.0000	µg
Mass Emission Rate of Total Speciated Carbonyls	478.8408	µg/kg
	0.4788	mg/kg

[a] sft^3/min = cubic feel per minute at standard temperature and pressure.
[b] sL/min = liters per minute at standard temperature and pressure.

Table F-4. Calculation of Mass Emission Rates of Total (Speciated + Unspeciated) Carbonyls, Recovery Boiler No. 5 (10/30/01)

Parameters Required		Units
Mass of Analyte in Total Combustion Air	2.1055	µg
Mass Fuel Consumed	725,707	kg
Combustion Airflow Rate (Average)	212,493.61	sft^3/min[a]
Run Time	482.42	min
Venturi Flow Rate (Average)	20.25	sL/min[b]
Dilution Airflow Rate (Average)	861.48	sL/min
Flow Rate at Sample Collection Unit	1.37	L/min
Calculations		
Total Volume of Air Sampled	2,902,793,349.0000	L
Volume of Combustion Air Sampled	9,769.0050	L
Volume of Dilution Air	415,595.1816	L
Dilution Ratio	43.5422	
Mass Flow Rate of Total Carbonyls in Diluted Sample	0.0032	µg/L
Mass Flow Rate of Total Carbonyls in Undiluted Sample	0.1387	µg/L
Total Mass of Total Carbonyls in Sampled Air	1,355.0967	µg
Total Carbonyls in Total Combustion Air	402,657,769.5000	µg
Mass Emission Rate of Total Carbonyls	554.8491	µg/kg
	0.5548	mg/kg

[a] sft^3/min = cubic feel per minute at standard temperature and pressure.
[b] sL/min = liters per minute at standard temperature and pressure.

Table F-5. Calculation of Mass Emission Rates of Total (Speciated + Unspeciated) Carbonyls, Recovery Boiler No. 5 (10/31/01)

Parameters Required		Units
Mass of Analyte in Total Combustion Air	8.5025	µg
Mass Fuel Consumed	1,170,190	kg
Combustion Airflow Rate (Average)	212,493.61	sft^3/min[a]
Run Time	480.03	min
Venturi Flow Rate (Average)	18.88	sL/min[b]
Dilution Airflow Rate (Average)	859.33	sL/min
Flow Rate at Sample Collection Unit	1.17	L/min
Calculations		
Total Volume of Combustion Air	2,888,412,361.0000	L
Volume of Combustion Air Sampled	9,062.9664	L
Volume of Dilution Air	412,504.1799	L
Dilution Ratio	46.5154	
Mass Flow Rate of Total Carbonyls in Diluted Sample	0.0151	µg/L
Mass Flow Rate of Total Carbonyls in Undiluted Sample	0.7042	µg/L
Total Mass of Total Carbonyls in Sampled Air	6,382.0346	µg
Total Carbonyls in Total Combustion Air	2,033,986,106.0000	µg
Mass Emission Rate of Total Carbonyls	1,738.1674	µg/kg
	1.7382	mg/kg

[a] sft^3/min = standard cubic feel per minute at standard temperature and pressure.
[b] sL/min = standard liters per minute at standard temperature and pressure.

Table F-6. Calculations of Mass Emission Rates of Total (Speciated + Unspeciated) Carbonyls, Recovery Boiler No. 5 (11/01/01)

Parameters Required		Units
Mass of Analyte in Total Combustion Air	5.9245	µg
Mass Fuel Consumed	1,254,201	kg
Combustion Airflow Rate (Average)	212,493.61	sft^3/min[a]
Run Time	479.03	min
Venturi Flow Rate (Average)	18.87	sL/min[b]
Dilution Airflow Rate (Average)	854.46	sL/min
Flow Rate at Sample Collection Unit	1.22	L/min
Calculations		
Total Volume of Combustion Air	2,882,395,211.0000	L
Volume of Combustion Air Sampled	9,039.2961	L
Volume of Dilution Air	409,311.9740	L
Dilution Ratio	46.2814	
Mass Flow Rate of Total Carbonyls in Diluted Sample	0.0101	µg/L
Mass Flow Rate of Total Carbonyls in Undiluted Sample	0.4692	µg/L
Total Mass of TotalCarbonyls in Sampled Air	4,241.0193	µg
Total Carbonyls in Total Combµstion Air	1,352,350,192.0000	µg
Mass Emission Rate of Total Carbonyls	1,078.2564	µg/kg
	1.0783	mg/kg

[a] sft^3/min = cubic feel per minute at standard temperature and pressure.
[b] sL/min = liters per minute at standard temperature and pressure.

Table F-7. Calculation of Mass Emission Rates of Speciated NMOC (SNMOC), Recovery Boiler No. 5 (10/30/01)

Parameters Required		Units
Mass of Analyte in Total Combustion Air	0.0994	µg
Mass Fuel Consumed	725,707	kg
Combustion Airflow Rate (Average)	212,493.61	sft^3/min[a]
Run Time	482.42	min
Venturi Flow Rate (Average)	20.25	sL/min[b]
Dilution Airflow Rate (Average)	861.48	sL/min
Flow Rate at Sample Collection Unit	0.0081	L/min
Calculations		
Total Volume of Air Sampled	2.903×10^9	L
Volume of Combustion Air Sampled	9,769.005	L
Volume of Dilution Air	415,595.18	L
Dilution Ratio	43.5422	
Mass Flow Rate of SNMOC in Diluted Sample	0.0254	µg/L
Mass Flow Rate of SNMOC in Undiluted Sample	1.1039	µg/L
Total Mass of Speciated SNMOC in Sampled Air	10,784.265	µg
Speciated NMOC in Total Combustion Air	3.204×10^9	µg
Mass Emission Rate of Speciated NMOC	4,415.6553	µg/kg
	4.4157	mg/kg

[a] sft^3/min = standard cubic feel per minute at standard temperature and pressure.
[b] sL/min = standard liters per minute at standard temperature and pressure.

Table F-8. Calculation of Mass Emission Rates of Speciated NMOC (SMNOC), Recovery Boiler No. 5 (10/31/01)

Parameters Required		Units
Mass of Analyte in Total Combustion Air	0.07295977	µg
Mass Fuel Consumed	1,170,190	kg
Combustion Airflow Rate (Average)	212,493.61	sft^3/min[a]
Run Time	480.03	min
Venturi Flow Rate (Average)	18.88	sL/min[b]
Dilution Airflow Rate (Average)	859.33	sL/min
Flow Rate at Sample Collection Unit	0.008541	L/min
Calculations		
Total Volume of Combustion Air	2,888,412,361.0000	L
Volume of Combustion Air Sampled	9,062.9664	L
Volume of Dilution Air	412,504.1799	L
Dilution Ratio	46.5154	
Mass Flow Rate of SNMOC in Diluted Sample	0.0178	µg/L
Mass Flow Rate of SNMOC in Undiluted Sample	0.8278	µg/L
Total Mass of Speciated NMOC in Sampled Air	7,501.9318	µg
Speciated NMOC in Total Combustion Air	2,390,902,892.0000	µg
Mass Emission Rate of SNMOC	2,043.1756	µg/kg
	2.0432	mg/kg

[a] sft^3/min = cubic feel per minute at standard temperature and pressure.
[b] sL/min = liters per minute at standard temperature and pressure.

Table F-9. Calculation of Mass Emission Rates of Speciated NMOC (SNMOC), Recovery Boiler No. 5 (11/01/01)

Parameters Required		Units
Mass of Analyte in Total Combustion Air	0.0741	µg
Mass Fuel Consumed	1,254,201	kg
Combustion Airflow Rate (Average)	212,493.61	sft^3/min[a]
Run Time	479.03	min
Venturi Flow Rate (Average)	18.87	sL/min[b]
Dilution Airflow Rate (Average)	854.46	sL/min
Flow Rate at Sample Collection Unit	0.0085	L/min
Calculations		
Total Volume of Combustion Air	2.882×10^9	L
Volume of Combustion Air Sampled	9,039.2961	L
Volume of Dilution Air	409,311.97	L
Dilution Ratio	46.2814	
Mass Flow Rate of SNMOC in Diluted Sample	0.0181	µg/L
Mass Flow Rate of SNMOC in Undiluted Sample	0.8383	µg/L
Total Mass of Speciated NMOC in Sampled Air	7,578.0382	µg
Speciated NMOC in Total Combustion Air	2.416×10^9	µg
Mass Emission Rate of Speciated NMOC	1,926.6761	µg/kg
	1.9267	mg/kg

[a] sft^3/min = standard cubic feel per minute at standard temperature and pressure.
[b] sL/min = standard liters per minute at standard temperature and pressure.

Table F-10. Calculation of Mass Emission Rates of Total (Speciated + Unspeciated) NMOC, Recovery Boiler No. 5 (10/30/01)

Parameters Required		Units
Mass of Analyte in Total Combustion Air	0.2032	µg
Mass Fuel Consumed	725,707	kg
Combustion Airflow Rate (Average)	212,493.61	sft^3/min[a]
Run Time	482.42	min
Venturi Flow Rate (Average)	20.25	sL/min[b]
Dilution Airflow Rate (Average)	861.48	sL/min
Flow Rate at Sample Collection Unit	0.0081	L/min
Calculations		
Total Volume of Air Sampled	2,902,793,349	L
Volume of Combustion Air Sampled	9,769.005	L
Volume of Dilution Air	415,595.182	L
Dilution Ratio	43.5422	
Mass Flow Rate of Total NMOC in Diluted Sample	0.0518	µg/L
Mass Flow Rate of Total NMOC in Undiluted Sample	2.2567	µg/L
Total Mass of Total NMOC in Sampled Air	22,045.4201	µg
Total NMOC in Total Combustion Air	6,550,646,557	µg
Mass Emission Rate of Total NMOC	9,026.5721	µg/kg
	9.0266	mg/kg

[a] sft^3/min = cubic feel per minute at standard temperature and pressure.
[b] sL/min = liters per minute at standard temperature and pressure.

Table F-11. Calculation of Mass Emission Rates of Total (Speciated + Unspeciated) NMOC, Recovery Boiler No. 5 (10/31/01)

Parameters Required		Units
Mass of Analyte in Total Combustion Air	0.1570	µg
Mass Fuel Consumed	1,170,190	kg
Combustion Airflow Rate (Average)	212,493.61	sft^3/min[a]
Run Time	480.03	min
Venturi Flow Rate (Average)	18.88	sL/min[b]
Dilution Airflow Rate (Average)	859.33	sL/min
Flow Rate at Sample Collection Unit	0.0085	L/min
Calculations		
Total Volume of Combustion Air	2.888×10^9	L
Volume of Combustion Air Sampled	9,062.9664	L
Volume of Dilution Air	412,504.18	L
Dilution Ratio	46.5154	
Mass Flow Rate of Total NMOC in Diluted Sample	0.0383	µg/L
Mass Flow Rate of Total NMOC in Undiluted Sample	1.7814	µg/L
Total Mass of Total NMOC in Sampled Air	16,144.741	µg
Total NMOC in Total Combustion Air	5.145×10^9	µg
Mass Emission Rate of Total NMOC	4,397.0729	µg/kg
	4.3971	mg/kg

[a] sft^3/min = cubic feel per minute at standard temperature and pressure.
[b] sL/min = liters per minute at standard temperature and pressure.

Table F-12. Calculation of Mass Emission Rates to Total (Speciated + Unspeciated) NMOC, Recovery Boiler No. 5 (11/01/01)

Parameters Required		Units
Mass of Analyte in Total Combustion Air	0.1665	µg
Mass Fuel Consumed	1,254,201	kg
Combustion Airflow Rate (Average)	212,493.61	sft^3/min[a]
Run Time	479.03	min
Venturi Flow Rate (Average)	18.87	sL/min[b]
Dilution Airflow Rate (Average)	854.46	sL/min
Flow Rate at Sample Collection Unit	0.0085	L/min
Calculations		
Total Volume of Combustion Air	2,882,395,211	L
Volume of Combustion Air Sampled	9,039.2961	L
Volume of Dilution Air	409,311.974	L
Dilution Ratio	46.2814	
Mass Flow Rate of Total NMOC in Diluted Sample	0.0407	µg/L
Mass Flow Rate of Total NMOC in Undiluted Sample	1.8838	µg/L
Total Mass of Total NMOC in Sampled Air	17,028.3297	µg
Total NMOC in Total Combustion Air	5,429,889,183	µg
Mass Emission Rate of Total NMOC	4,329.3612	µg/kg
	4.3294	mg/kg

[a] sft^3/min = cubic feel per minute at standard temperature and pressure.
[b] sL/min = liters per minute at standard temperature and pressure.

Appendix G

PM Emission Factor Calculations

Contents

Table G-1. Calculation of PM Emission Factors (10/30/01)

	Test	10/30/2001 (ave)			
1	Sampling time (min)	482.42			
2	TF sample	T100201B	T100201C	T100201D	T100201E
3	PM mass on filter (mg)	1.206	1.13	1.226	1.17
4	Array flow (sL/min[a])	8.843	8.843	8.843	8.843
5	PM conc at filter (mg/L)	0.0003	0.0003	0.0003	0.0003
6a	avg. PM conc at filter (mg/L)	0.0003			
6b	PM mass on dilution chamber filter (mg)	0.069			
6c	Array flow (sL/min)	8.539			
6d	PM conc at dilution air (mg/L)	ND[b]			
6e	Net PM mass conc after dilution (mg/L)	0.0003			
7	Probe flow (sL/min)	20.25			
8	Probe flow (m^3)	9.77			
9	Dilution air (sL/min)	861.78			
10	Dilution air (m^3)	415.74			
11	Dilution ratio	43.56			
12	PM conc at stack (mg/L)	0.0113			
13	Stack gas velocity (ft/min)	2,745.8			
14	Stack temperature (°F)	367.7			
15	Stack pressure (in. Hg)	30.248			
16	Stack area (ft^2)	120			
17	Stack flow (sft^3/min[c])	212,493.8			
18	Stack flow (sL/min)	6,017,823.4			
19	PM emission rate from stack (mg/min)	68,296.7			
20	Fuel type	Black liquor		#2 Oil	
21	Fuel volumetric feed (gal/min)	265.43		41.31	
22	Fuel density (lb/gal)	11.4			
23	Fuel density (kg/gal)	5.17		3.19	
24	Fuel mass feed rate (kg/min)	1,372.3		131.8	
25	Fuel mass feed rate (lb/min)	3,025.9		290.6	
26	Fuel heating value (Btu/lb)	4,208		19,374	
27	Fuel heat feed rate (Btu/min)	12,732,995.6		5,629,551.1	
28	Total fuel mass feed rate (kg/min)	1,504.1			
29	**Emission factor (mg/kg)**	45.41			
30	Total fuel heat feed rate (Btu/min)	18,362,546.74			
31	**Emission factor (µg/kJ)**	**3.53**			

[a] sL/min = liters per minute at standard temperature and pressure.
[b] ND = not detected.
[c] sft^3/min = cubic feel per minute at standard temperature and pressure.

Table G-2. Calculation of PM Emission Factors (10/31/01)

	Test	10/31/2001 (ave)			
1	Sampling time (min)	480.03			
2	TF sample	T100201J	T100201I	T100201H	T100201G
3	PM mass on filter (mg)	0.429	0.377	0.411	0.405
4	Array flow (sL/min[a])	8.902	8.902	8.825	8.825
5	PM conc at filter (mg/L)	0.0001	0.0001	0.0001	0.0001
6a	avg. PM conc at filter (mg/L)	0.0001			
6b	PM mass on dilution chamber filter (mg)	0.014			
6c	Array flow (sL/min)	8.825			
6d	PM conc at dilution air (mg/L)	ND[b]			
6e	Net PM mass conc after dilution (mg/L)	0.0001			
7	Probe flow (sL/min)	18.88			
8	Probe flow (m^3)	9.06			
9	Dilution air (sL/min)	859.33			
10	Dilution air (m^3)	412.50			
11	Dilution ratio	46.52			
12	PM conc at stack (mg/L)	0.0043			
13	Stack gas velocity (ft/min)	2745.8			
14	Stack temperature (°F)	367.7			
15	Stack pressure (in. Hg)	30.248			
16	Stack area (ft^2)	120			
17	Stack flow (sft^3/min[c])	212,493.8			
18	Stack flow (sL/min)	6,017,823.4			
19	PM emission rate from stack (mg/min)	25,754.1			
20	Fuel type	Black liquor		#2 Oil	
21	Fuel volumetric feed (gal/min)	471.43		ND	
22	Fuel density (lb/gal)	11.4			
23	Fuel density (kg/gal)	5.17		3.19	
24	Fuel mass feed rate (kg/min)	2,437.3		ND	
25	Fuel mass feed rate (lb/min)	5,374.3		ND	
26	Fuel heating value (Btu/lb)	4,208		19,374	
27	Fuel heat feed rate (Btu/min)	22,615,062.8		ND	
28	Total fuel mass feed rate (kg/min)	2,437.3			
29	**Emission factor (mg/kg)**	**1,0.57**			
30	Total fuel heat feed rate (Btu/min)	22,615,062.82			
31	**Emission factor (µg/kJ)**	**1.08**			

[a] sL/min = liters per minute at standard temperature and pressure.
[b] ND = not detected.
[c] sft^3/min = cubic feel per minute at standard temperature and pressure.

Table G-3. Calculation of PM Emission Factors (11/01/01)

	Test	11/01/2001 (ave)			
1	Sampling time (min)	479.03			
2	TF sample	T100201O	T100201N	T100201M	T100201L
3	PM mass on filter (mg)	0.57	0.53	0.574	0.57
4	Array flow (sL/min[a])	8.891	8.891	8.853	8.853
5	PM conc at filter (mg/L)	0.0001	0.0001	0.0001	0.0001
6a	avg. PM conc at filter (mg/L)	0.0001			
6b	PM mass on dilution chamber filter (mg)	0.005			
6c	Array flow (sL/min)	8.815			
6d	PM conc at dilution air (mg/L)	ND[b]			
6e	Net PM mass conc after dilution (mg/L)	0.0001			
7	Probe flow (sL/min)	18.87			
8	Probe flow (m^3)	9.04			
9	Dilution air (sL/min)	854.46			
10	Dilution air (m^3)	409.31			
11	Dilution ratio	46.28			
12	PM conc at stack (mg/L)	0.0061			
13	Stack gas velocity (ft/min)	2,745.8			
14	Stack temperature (°F)	367.7			
15	Stack pressure (in. Hg)	30.248			
16	Stack area (ft^2)	120			
17	Stack flow (sft^3/min[c])	212,493.8			
18	Stack flow (sL/min)	6,017,823.4			
19	PM emission rate from stack (mg/min)	36,436.1			
20	Fuel type	Black liquor		#2 Oil	
21	Fuel volumetric feed (gal/min)	506.33		ND	
22	Fuel density (lb/gal)	11.4			
23	Fuel density (kg/gal)	5.17		3.19	
24	Fuel mass feed rate (kg/min)	2,617.8		ND	
25	Fuel mass feed rate (lb/min)	5,772.2		ND	
26	Fuel heating value (Btu/lb)	4,208		19,374	
27	Fuel heat feed rate (Btu/min)	24,289,257.7		ND	
28	Total fuel mass feed rate (kg/min)	2,617.8			
29	**Emission factor (mg/kg)**	**13.92**			
30	Total fuel heat feed rate (Btu/min)	24,289,257.70			
31	**Emission factor (µg/kJ)**	**1.42**			

[a] sL/min = liters per minute at standard temperature and pressure.
[b] ND = not detected.
[c] sft^3/min = cubic feel per minute at standard temperature and pressure

Table G-4. Calculation of Individual Filter Emission Factors (10/30/01)

	Test	10/30/2001 (individual filters)			
1	Sampling time (min)	482.42			
2	TF sample	T100201B	T100201C	T100201D	T100201E
3	PM mass on filter (mg)	1.206	1.13	1.226	1.17
4	Array flow (sL/min[a])	8.843	8.843	8.843	8.843
5	PM conc at filter (mg/L)	0.0003	0.0003	0.0003	0.0003
6b	PM mass on dilution chamber filter (mg)	0.069			
6c	Array flow (sL/min)	8.539			
6d	PM conc at dilution air (mg/L)	ND[b]			
6e	Net PM mass conc after dilution (mg/L)	0.0003	0.0002	0.0003	0.0003
7	Probe flow (sL/min)	20.25			
8	Probe flow (m^3)	9.77			
9	Dilution air (sL/min)	861.78			
10	Dilution air (m^3)	415.74			
11	Dilution ratio	43.56			
12	PM conc at stack (mg/L)	0.0116	0.0108	0.0118	0.0112
13	Stack gas velocity (ft/min)	2,745.8			
14	Stack temperature (°F)	367.7			
15	Stack pressure (in. Hg)	30.248			
16	Stack area (ft^2)	120			
17	Stack flow (sft^3/min[c])	212,493.8			
18	Stack flow (sL/min)	6,017,823.4			
19	PM emission rate from stack (mg/min)	69,709.9	65,040.2	70,938.7	67,497.9
20	Fuel type	Black liquor		#2 Oil	
21	Fuel volumetric feed (gal/min)	265.43		41.31	
22	Fuel density (lb/gal)	11.4			
23	Fuel density (kg/gal)	5.17		3.19	
24	Fuel mass feed rate (kg/min)	1,372.3		131.8	
25	Fuel mass feed rate (lb/min)	3,025.9		290.6	
26	Fuel heating value (Btu/lb)	4,208		19374	
27	Fuel heat feed rate (Btu/min)	12,732,995.6		5,629,551.1	
28	Total fuel mass feed rate (kg/min)	1,504.1			
29	**Emission factor (mg/kg)**	**46.35**	**43.24**	**47.16**	**44.88**
30	Total fuel heat feed rate (Btu/min)	18,362,546.74			
31	**Emission factor (µg/kJ)**	**3.60**	**3.36**	**3.66**	**3.48**
32	**Ave. Emission factor (mg/kg)**	**45.41**			
33	**Ave. Emission factor (µg/kJ)**	**3.53**			

[a] sL/min = liters per minute at standard temperature and pressure.
[b] ND = not detected.
[c] sft^3/min = cubic feel per minute at standard temperature and pressure

Table G-5. Calculation of Individual Filter Emission Factors (10/31/01)

	Test	10/31/2001 (individual filters)			
1	Sampling time (min)	480.03			
2	TF sample	T100201J	T100201I	T100201H	T100201G
3	PM mass on filter (mg)	0.429	0.377	0.411	0.405
4	Array flow (sL/min[a])	8.902	8.902	8.825	8.825
5	PM conc at filter (mg/L)	0.0001	0.0001	0.0001	0.0001
6b	PM mass on dilution chamber filter (mg)	0.014			
6c	Array flow (sL/min)	8.825			
6d	PM conc at dilution air (mg/L)	ND[b]			
6e	Net PM mass conc after dilution (mg/L)	0.0001	0.0001	0.0001	0.0001
7	Probe flow (sL/min)	18.88			
8	Probe flow (m^3)	9.06			
9	Dilution air (sL/min)	859.33			
10	Dilution air (m^3)	412.50			
11	Dilution ratio	46.52			
12	PM conc at stack (mg/L)	0.0045	0.0040	0.0044	0.0043
13	Stack gas velocity (ft/min)	2,745.8			
14	Stack temperature (°F)	367.7			
15	Stack pressure (in. Hg)	30.248			
16	Stack area (ft^2)	120			
17	Stack flow (sft^3/min[c])	212,493.8			
18	Stack flow (sL/min)	6,017,823.4			
19	PM emission rate from stack (mg/min)	27,176.9	23,770.6	26,232.7	25,836.3
20	Fuel type	Black liquor		#2 Oil	
21	Fuel volumetric feed (gal/min)	471.43		ND	
22	Fuel density (lb/gal)	11.4			
23	Fuel density (kg/gal)	5.17		3.19	
24	Fuel mass feed rate (kg/min)	2,437.3		ND	
25	Fuel mass feed rate (lb/min)	5,374.3		0.0	
26	Fuel heating value (Btu/lb)	4,208		19,374	
27	Fuel heat feed rate (Btu/min)	22,615,062.8		ND	
28	Total fuel mass feed rate (kg/min)	2,437.3			
29	**Emission factor (mg/kg)**	**11.15**	**9.75**	**10.76**	**10.60**
30	Total fuel heat feed rate (Btu/min)	22,615,062.82			
31	**Emission factor (µg/kJ)**	**1.14**	**1.00**	**1.10**	**1.08**
32	**Ave. Emission factor (mg/kg)**	**10.57**			
33	**Ave. Emission factor (µg/kJ)**	**1.08**			

[a] sL/min = liters per minute at standard temperature and pressure.
[b] ND = not detected.
[c] sft^3/min = cubic feel per minute at standard temperature and pressure

Table G-6. Calculation of Individual Filter Emission Factors (11/01/01)

	Test	11/01/2001 (individual filters)			
1	Sampling time (min)	479.03			
2	TF sample	T100201O	T100201N	T100201M	T100201L
3	PM mass on filter (mg)	0.57	0.53	0.574	0.57
4	Array flow (sL/min[a])	8.891	8.891	8.853	8.853
5	PM conc at filter (mg/L)	0.0001	0.0001	0.0001	0.0001
6b	PM mass on dilution chamber filter (mg)	0.005			
6c	Array flow (sL/min)	8.815			
6d	PM conc at dilution air (mg/L)	ND[b]			
6e	Net PM mass conc after dilution (mg/L)	0.0001	0.0001	0.0001	0.0001
7	Probe flow (sL/min)	18.87			
8	Probe flow (m^3)	9.04			
9	Dilution air (sL/min)	854.46			
10	Dilution air (m^3)	409.31			
11	Dilution ratio	46.28			
12	PM conc at stack (mg/L)	0.0061	0.0057	0.0062	0.0062
13	Stack gas velocity (ft/min)	2,745.8			
14	Stack temperature (°F)	367.7			
15	Stack pressure (in. Hg)	30.248			
16	Stack area (ft^2)	120			
17	Stack flow (sft^3/min[c])	212,493.8			
18	Stack flow (sL/min)	6,017,823.4			
19	PM emission rate from stack (mg/min)	36,944.3	34,328.6	37,367.0	37,104.3
20	Fuel type	Black liquor		#2 Oil	
21	Fuel volumetric feed (gal/min)	506.33		ND	
22	Fuel density (lb/gal)	11.4			
23	Fuel density (kg/gal)	5.17		3.19	
24	Fuel mass feed rate (kg/min)	2,617.8		ND	
25	Fuel mass feed rate (lb/min)	5,772.2		ND	
26	Fuel heating value (Btu/lb)	4,208		19,374	
27	Fuel heat feed rate (Btu/min)	24,289,257.7		ND	
28	Total fuel mass feed rate (kg/min)	2,617.8			
29	**Emission factor (mg/kg)**	**14.11**	**13.11**	**14.27**	**14.17**
30	Total fuel heat feed rate (Btu/min)	24,289,257.70			
31	**Emission factor (µg/kJ)**	**1.44**	**1.34**	**1.46**	**1.45**
32	**Ave. Emission factor (mg/kg)**	**13.92**			
33	**Ave. Emission factor (µg/kJ)**	**1.42**			

[a] sL/min = standard liters per minute at standard temperature and pressure.
[b] ND = not detected.
[c] sft^3/min = standard cubic feel per minute at standard temperature and pressure

Appendix H

Data Tables for Individual $PM_{2.5}$ Mass Measurements

Contents

Table H-1. Recovery Boiler, $PM_{2.5}$ Mass Samples, Gravimetric Measurements of Electric Low-Pressure Impactor (ELPI) Stages

ID		Initial Weight mg	Final Weight mg	PM Mass mg
A101601A	IB110101H ELPI 13	32.7	32.707	0.007
A101601C	IB110101H ELPI 12	33.871	33.872	0.001
A101601D	IB110101H ELPI 11	33.216	33.237	0.021
A101601E	IB110101H ELPI 10	33.077	33.142	0.065
A101601F	IB110101H ELPI 9	32.992	33.163	0.171
A101601G	IB110101H ELPI 8	32.645	33.205	0.56
A101601H	IB110101H ELPI 7	33.404	33.83	0.426
A101601I	IB110101H ELPI 6	33.984	34.09	0.106
A101601J	IB110101H ELPI 5	33.493	33.514	0.021
A101601K	IB110101H ELPI 4	32.593	32.592	-0.001
A101601L	IB110101H ELPI 3	33.529	33.535	0.006
A101601M	IB110101H ELPI 2	33.292	33.296	0.004
A101601N	IB110101H ELPI 1	33.736	33.74	0.004
A101601O	IB110101H ELPI FB	33.883	33.885	0.002

Table H-2. Recovery Boiler, $PM_{2.5}$ Mass Samples, Gravimetric Measurements of Teflon Filters

ID		Initial Weight	Final Weight	PM Mass g	PM Mass mg
T100201A	IB103001HD1B1	0.195007	0.195076	6.9×10^{-5}	0.069
T100201B	IB103001HR2A1	0.190933	0.192139	0.001206	1.206
T100201C	IB103001HR2B1	0.189077	0.190207	0.00113	1.13
T100201D	IB103001HR6A1	0.189015	0.190241	0.001226	1.226
T100201E	IB103001HR6B1	0.188268	0.189438	0.00117	1.17
T100201F	IB103001H-FB	0.185403	0.189399	0.003996	3.996
T100201G	IB103101HR6B1	0.152951	0.153356	0.000405	0.405
T100201H	IB103101HR6A1	0.188192	0.188603	0.000411	0.411
T100201I	IB103101HR2B1	0.154084	0.154461	0.000377	0.377
T100201J	IB103101HR2A1	0.152429	0.152858	0.000429	0.429
T100201K	IB103101HD1B1	0.197521	0.197535	1.4×10^{-5}	0.014
T100201L	IB110101HR6B1	0.192915	0.193485	0.00057	0.57
T100201M	IB110101HR6A1	0.197837	0.198411	0.000574	0.574
T100201N	IB110101HR2B1	0.186827	0.187358	0.000531	0.531
T100201O	IB110101HR2A1	0.186442	0.187012	0.00057	0.57
T100201P	IB110101HD1B1	0.189353	0.189358	$5. \times 10^{-6}$	0.005
T100201R	BT111301H	0.18307	0.183077	$7. \times 10^{-6}$	0.007

Appendix I

Supporting Data for Carbonyl Analysis

Contents

Table I-1. Carbonyls, Individual Tube Results, Blanks, Test Dates: 10/30/01 to 11/01/01

Compound	CAS No.	Method Blank (μg)	Field Blank (μg)
formaldehyde	50-00-0	0.0200	0.0235
acetaldehyde	75-07-0	0.0700	0.0760
acetone	67-64-1	0.2000	0.1965
propionaldehyde	123-38-6	ND[a]	ND
crotonaldehyde	4170-30-0	ND	ND
butyr/isobutyraldehyde	123-72-8	0.0500	0.0460
benzaldehyde	100-52-7	ND	ND
isovaleraldehyde	590-86-3	ND	ND
valeraldehyde	110-62-3	ND	0.0065
o-tolualdehyde	529-20-4	ND	ND
m-tolualdehyde	620-23-5	ND	ND
p-tolualdehyde	104-87-0	0.0400	0.0365
hexaldehyde	66-25-1	0.0200	0.0170
2,5-dimethylbenzaldehyde	5779-94-2	ND	ND
diacetyl	431-03-8	ND	ND
methacrolein	78-85-3	ND	ND
2-butanone	78-93-3	0.0100	0.0230
glyoxal	107-22-2	0.0800	0.0900
acetophenone	98-86-2	ND	ND
methylglyoxal	78-98-8	0.0400	0.0420
octanal	124-13-0	ND	ND
nonanal	124-19-6	0.1000	0.0990
Sum, Speciated		**0.6300**	**0.6560**
Sum, Unspeciated		**0.8170**	**0.7885**
Total (speciated + unspeciated)		**1.4470**	**1.4445**

[a] ND = not detected.

Table I-2A. Carbonyls, Recovery Boiler #5 Individual Tube Results for Field Samples (10/30/01)

Site ID	WRB#5	WRB#5	WRB#5	WRB#5	
Field ID	Hd3A1	Hd3A2	Hr3A1	Hr3A2	
Volume Sampled	603.83	603.83	717.15	717.5	
ERG ID	23733	23734	23735	23736	
Sampling Date	10/30/01	10/30/01	10/30/01	10/30/01	
Analysis Date	12/21/01	12/21/01	12/21/01	12/21/01	
Data File	F1LU007	F1LU008	F1LU009	F1LU010	

Compound	CAS No.	DA[a], front	DA, back	DA (front + back)	RC[b], front	RC, back	RC (front + back)	Carbonyls RC-DA
		µg	µg	µg	µg	µg	µg	µg
formaldehyde	50-00-0	0.0850	0.0425	0.1275	0.8995	0.0480	0.9475	0.8200
acetaldehyde	75-07-0	0.2920	0.0730	0.3650	0.7360	0.0880	0.8240	0.4590
acetone	67-64-1	0.7155	0.4455	1.1610	0.4355	0.3845	0.8200	ND[c]
propionaldehyde	123-38-6	0.0215	0.0085	0.0215	0.0255	ND	ND	ND
crotonaldehyde	4170-30-0	ND	ND	ND	ND	ND	ND	ND
butyr/isobutyraldehyde	123-72-8	0.0810	0.0565	0.1375	0.1030	0.0635	0.1665	0.0290
benzaldehyde	100-52-7	0.0110	0.0010	0.0120	0.0210	0.0050	0.0260	0.0140
isovaleraldehyde	590-86-3	ND	ND	ND	ND	ND	ND	ND
valeraldehyde	110-62-3	0.0250	ND	0.0250	0.0170	ND	0.0170	ND
o-tolualdehyde	529-20-4	ND	ND	ND	0.0155	ND	0.0155	0.0155
m-tolualdehyde	620-23-5	ND	ND	ND	ND	ND	ND	ND
p-tolualdehyde	104-87-0	0.0310	ND	0.0310	0.0545	ND	0.0545	0.0235
hexaldehyde	66-25-1	0.0415	0.0140	0.0555	0.0335	0.0305	0.0640	0.0085
2,5-dimethylbenzaldehyde	5779-94-2	ND	ND	ND	ND	ND	ND	ND
diacetyl	431-03-8	ND	ND	ND	ND	ND	ND	ND

continued

Table I-2A. (concluded)

Site ID		WRB#5	WRB#5		WRB#5	WRB#5		
Field ID		Hd3A1	Hd3A2		Hr3A1	Hr3A2		
Volume Sampled		603.83	603.83		717.15	717.5		
ERG ID		23733	23734		23735	23736		
Sampling Date		10/30/01	10/30/01		10/30/01	10/30/01		
Analysis Date		12/21/01	12/21/01		12/21/01	12/21/01		
Data File		F1LU007	F1LU008		F1LU009	F1LU010		
Compound	**CAS No.**	**DA[a], front**	**DA, back**	**DA (front + back)**	**RC[b], front**	**RC, back**	**RC (front + back)**	**Carbonyls RC-DA**
		µg	**µg**	**µg**	**µg**	**µg**	**µg**	**µg**
methacrolein	78-85-3	ND	ND	ND	ND	ND	ND	ND
2-butanone	78-93-3	1.0100	0.0380	1.0480	0.2040	0.0460	0.2500	ND
glyoxal	107-22-2	0.0800	0.0790	0.1590	0.1510	0.0910	0.2420	0.0830
acetophenone	98-86-2	0.0600	ND	0.0600	0.0420	ND	0.0420	ND
methylglyoxal	78-98-8	0.0510	0.0440	0.0950	0.0730	0.0690	0.1420	0.0470
octanal	124-13-0	0.0160	ND	0.0160	0.0430	ND	0.0430	0.0270
nonanal	124-19-6	0.3130	0.1290	0.4420	0.2540	0.1120	0.3660	ND
Sum, Speciated		**2.8335**	**0.9310**	**3.7645**	**3.1080**	**0.9375**	**4.0455**	**0.2810**
Sum, Unspeciated		**1.8250**	**1.1670**	**2.9920**	**3.6875**	**1.1290**	**4.8165**	**1.8245**
Total (speciated + unspeciated)		**4.6585**	**2.0980**	**6.7565**	**6.7955**	**2.0665**	**8.8620**	**2.1055**

[a] DA = dilution air.
[b] RC = residence chamber;
[c] ND = not detected.

Table I-2B. Carbonyls, Recovery Boiler #5 Individual Tube Results for Field Samples (10/31/01)

Site ID	WRB#5	WRB#5		WRB#5	WRB#5	
Field ID	Hd3A1	Hd3A2		Hr3A1	Hr3A2	
Volume Sampled	556.21	556.21		567.56	567.56	
ERG ID	23737	23738		23739	23739	
Sampling Date	10/31/01	10/31/01		10/31/01	10/31/01	
Analysis Date	12/21/01	12/21/01		12/21/01	12/21/01	
Data File	F1LU011	F1LU011		F1LU013	F1LU14	

Compound	CAS No.	DA[a], front µg	DA, back µg	DA (front + back) µg	RC[b], front µg	RC, back µg	RC (front + back) µg	Carbonyls RC-DA µg
formaldehyde	50-00-0	0.0625	0.0525	0.1150	1.3095	0.0605	1.3700	1.2550
acetaldehyde	75-07-0	0.2195	0.1595	0.3790	3.2355	0.5450	3.7805	3.4015
acetone	67-64-1	0.4535	0.3190	0.7725	0.3275	0.8510	1.1785	0.4060
propionaldehyde	123-38-6	0.0080	0.0075	0.0155	0.0350	ND[c]	0.0350	0.0195
crotonaldehyde	4170-30-0	ND	ND	ND	ND	ND	ND	ND
butyr/isobutyraldehyde	123-72-8	0.0755	0.0695	0.1450	0.0830	0.0815	0.1645	0.0195
benzaldehyde	100-52-7	0.0055	0.0005	0.0060	0.0130	0.0030	0.0160	0.0100
isovaleraldehyde	590-86-3	ND	ND	ND	ND	ND	ND	ND
valeraldehyde	110-62-3	ND	0.0055	0.0055	0.0115	ND	0.1150	0.1095
o-tolualdehyde	529-20-4	ND	ND	ND	ND	ND	ND	ND
m-tolualdehyde	620-23-5	ND	ND	ND	ND	ND	ND	ND
p-tolualdehyde	104-87-0	ND	ND	ND	ND	ND	ND	ND
hexaldehyde	66-25-1	0.0210	0.0180	0.0390	0.0360	0.0235	0.0595	0.0205
2,5-dimethylbenzaldehyde	5779-94-2	ND	ND	ND	ND	ND	ND	ND
diacetyl	431-03-8	ND	ND	ND	ND	ND	ND	ND
methacrolein	78-85-3	ND	ND	ND	0.0210	ND	0.0210	0.0210

continued

Table I-2B. (concluded)

Site ID		WRB#5	WRB#5		WRB#5	WRB#5		
Field ID		Hd3A1	Hd3A2		Hr3A1	Hr3A2		
Volume Sampled		556.21	556.21		567.56	567.56		
ERG ID		23737	23738		23739	23739		
Sampling Date		10/31/01	10/31/01		10/31/01	10/31/01		
Analysis Date		12/21/01	12/21/01		12/21/01	12/21/01		
Data File		F1LU011	F1LU011		F1LU013	F1LU14		
Compound	**CAS No.**	**DA[a], front**	**DA, back**	**DA (front + back)**	**RC[b], front**	**RC, back**	**RC (front + back)**	**Carbonyls RC-DA**
		µg	**µg**	**µg**	**µg**	**µg**	**µg**	**µg**
2-butanone	78-93-3	0.0350	0.0540	0.0890	0.1460	0.1050	0.2510	0.1620
glyoxal	107-22-2	0.0970	0.0950	0.1920	0.1860	0.0780	0.2640	0.0720
acetophenone	98-86-2	0.0260	ND	0.0260	0.0300	ND	0.0300	0.0040
methylglyoxal	78-98-8	0.0450	0.0450	0.0900	0.0680	0.0540	0.1220	0.0320
octanal	124-13-0	0.0380	ND	0.0380	0.0700	ND	0.0700	0.0320
nonanal	124-19-6	0.2440	0.1110	0.3550	0.2730	0.1040	0.3770	0.0220
Sum, Speciated		**1.3305**	**0.9370**	**2.2675**	**5.8450**	**1.9055**	**7.7505**	**5.4830**
Sum, Unspeciated		**1.2695**	**0.9855**	**2.2550**	**3.9465**	**1.3280**	**5.2745**	**3.0195**
Total (speciated + unspeciated)		**2.6000**	**1.9225**	**4.5225**	**9.7915**	**3.2335**	**13.0250**	**8.5025**

[a] DA = dilution air.
[b] RC = residence chamber;
[c] ND = not detected.

Table I-2C. Carbonyls, Recovery Boiler #5 Individual Tube Results for Field Samples (11/01/01)

Site ID		WRB#5	WRB#5		WRB#5	WRB#5		
Field ID		Hd3A1	Hd3A2		Hr3A1	Hr3A2		
Volume Sampled		543.08	543.08		625.85	625.85		
ERG ID		23741	23742		23743	23744		
Sampling Date		1/11/01	1/11/01		1/11/01	1/11/01		
Analysis Date		12/22/01	12/22/01		12/22/01	12/22/01		
Data File		F1LU015	F1LU016		FLU017	FLU018		
Compound	**CAS No.**	**DA[a], front**	**DA, back**	**DA (front + back)**	**RC[b], front**	**RC, back**	**RC (front + back)**	**Carbonyls RC-DA**
		µg	**µg**	**µg**	**µg**	**µg**	**µg**	**µg**
formaldehyde	50-00-0	0.0630	0.0435	0.1065	1.8100	0.0460	1.8560	1.7495
acetaldehyde	75-07-0	0.5085	0.1180	0.6265	0.8085	0.143	0.9515	0.3250
acetone	67-64-1	0.2270	0.2785	0.5055	0.3670	0.4475	0.8145	0.3090
propionaldehyde	123-38-6	0.0070	ND[c]	0.0070	0.0325	ND	0.0325	0.0255
crotonaldehyde	4170-30-0	ND	ND	ND	ND	ND	ND	ND
butyr/isobutyraldehyde	123-72-8	0.0775	0.0730	0.1505	0.0790	0.1075	0.1865	0.0360
benzaldehyde	100-52-7	0.0045	0.0015	0.0060	0.0205	ND	0.0205	0.0145
isovaleraldehyde	590-86-3	ND	ND	ND	ND	ND	ND	ND
valeraldehyde	110-62-3	ND	ND	ND	0.0165	ND	0.0165	ND
o-tolualdehyde	529-20-4	ND	ND	ND	ND	ND	ND	ND
m-tolualdehyde	620-23-5	ND	ND	ND	ND	ND	ND	ND
p-tolualdehyde	104-87-0	0.0395	0.0395	0.0790	ND	ND	ND	ND
hexaldehyde	66-25-1	0.0265	0.0200	0.0465	0.0335	0.0200	0.0535	0.0070
2,5-dimethylbenzaldehyde	5779-94-2	ND	ND	ND	ND	ND	ND	ND
diacetyl	431-03-8	0.0060	ND	0.0060	0.0050	ND	0.0050	ND
methacrolein	78-85-3	ND	ND	ND	0.0090	ND	0.0090	ND

continued

Table I-2C. (concluded)

Site ID		WRB#5	WRB#5		WRB#5	WRB#5		
Field ID		Hd3A1	Hd3A2		Hr3A1	Hr3A2		
Volume Sampled		543.08	543.08		625.85	625.85		
ERG ID		23741	23742		23743	23744		
Sampling Date		1/11/01	1/11/01		1/11/01	1/11/01		
Analysis Date		12/22/01	12/22/01		12/22/01	12/22/01		
Data File		F1LU015	F1LU016		FLU017	FLU018		
Compound	**CAS No.**	**DA[a], front**	**DA, back**	**DA (front + back)**	**RC[b], front**	**RC, back**	**RC (front + back)**	**Carbonyls RC-DA**
		µg	**µg**	**µg**	**µg**	**µg**	**µg**	**µg**
2-butanone	78-93-3	0.0520	0.0510	0.1030	0.0990	0.1890	0.2880	0.1850
glyoxal	107-22-2	0.1150	0.1080	0.2230	0.2190	0.0910	0.3100	0.0870
acetophenone	98-86-2	ND	ND	ND	0.0230	ND	0.0230	ND
methylglyoxal	78-98-8	0.0750	0.0550	0.1300	0.0720	0.0520	0.1240	ND
octanal	124-13-0	0.0460	0.0330	0.0790	0.0330	ND	0.0330	ND
nonanal	124-19-6	0.2820	0.0890	0.3710	0.2500	0.0970	0.3470	ND
Sum, Speciated		**1.5295**	**0.9100**	**2.4395**	**3.8775**	**1.1930**	**5.0705**	**2.6310**
Sum, Unspeciated		**1.2995**	**1.0195**	**2.3190**	**4.2480**	**1.3645**	**5.6125**	**3.2935**
Total (speciated + unspeciated)		**2.8290**	**1.9295**	**4.7585**	**8.1255**	**2.5575**	**10.6830**	**5.9245**

[a] DA = dilution air.
[b] RC = residence chamber;
[c] ND = not detected.

Table I-3A. Carbonyls from Recovery Boiler #5 for Test Day 10/30/01

Compound	CAS No.	RC-DA[a] 10/30/01 µg	Uncertainty Plus/Minus	% Total	Uncertainty Plus/Minus
formaldehyde	50-00-0	0.82	0.0904	38.946	4.292
acetaldehyde	75-07-0	0.4590	0.0052	21.800	0.249
acetone	67-64-1	ND[b]			
propionaldehyde	123-38-6	ND			
crotonaldehyde	4170-30-0	ND			
butyr/isobutyraldehyde	123-72-8	0.0290	0.0017	1.377	0.080
benzaldehyde	100-52-7	0.0140	0.0004	0.665	0.020
isovaleraldehyde	590-86-3	ND			
valeraldehyde	110-62-3	ND			
o-tolualdehyde	529-20-4	0.0155	0.0002	0.736	0.010
m-tolualdehyde	620-23-5	ND			
p-tolualdehyde	104-87-0	0.0235	0.0013	1.116	0.063
hexaldehyde	66-25-1	0.0085	0.0008	0.404	0.038
2,5-dimethylbenzaldehyde	5779-94-2	ND			
diacetyl	431-03-8	ND			
methacrolein	78-85-3	ND			
2-butanone	78-93-3	ND			
glyoxal	107-22-2	0.0830	0.0023	3.942	0.108
acetophenone	98-86-2	ND			
methylglyoxal	78-98-8	0.0470	0.0058	2.232	0.274
octanal	124-13-0	0.0270	0.0022	1.282	0.103
nonanal	124-19-6	ND			
Sum, Speciated		**0.2810**			
Sum, Unspeciated		**1.8245**			
Total (speciated + unspeciated)		**2.1055**			

[a] RC = residence chamber; DA = dilution air.
[b] ND = not detected.

Table I-3B. Carbonyls from Recovery Boiler #5 for Test Day 10/31/01

Compound	CAS No.	RC-DA[a] µg	Uncertainty Plus/Minus	% Total	Uncertainty Plus/Minus
formaldehyde	50-00-0	1.2550	0.1383	14.5828	1.6070
acetaldehyde	75-07-0	3.4015	0.0388	39.5248	0.4506
acetone	67-64-1	0.406	0.0172	43.8682	1.8556
propionaldehyde	123-38-6	0.0195	0.0001	0.2266	0.0000
crotonaldehyde	4170-30-0	ND[b]			
butyr/isobutyraldehyde	123-72-8	0.0195	0.0011	0.2266	0.0132
benzaldehyde	100-52-7	0.0100	0.0003	0.1162	0.0036
isovaleraldehyde	590-86-3	ND			
valeraldehyde	110-62-3	0.1095	0.0105	1.2724	0.1219
o-tolualdehyde	529-20-4	ND			
m-tolualdehyde	620-23-5	ND			
p-tolualdehyde	104-87-0	ND			
hexaldehyde	66-25-1	0.0205	0.0019	0.2382	0.0222
2,5-dimethylbenzaldehyde	5779-94-2	ND			
diacetyl	431-03-8	ND			
methacrolein	78-85-3	0.021	0.0012	0.0143	0.0008
2-butanone	78-93-3	0.1620	0.0132	1.8824	0.1530
glyoxal	107-22-2	0.0720	0.0020	0.8366	0.0228
acetophenone	98-86-2	0.0040	0.0002	0.0465	0.0022
methylglyoxal	78-98-8	0.0320	0.0039	0.3718	0.0457
octanal	124-13-0	0.0320	0.0026	0.3718	0.0300
nonanal	124-19-6	0.0220	0.0018	0.2556	0.0206
Sum, Speciated		**5.5865**			
Sum, Unspeciated		**3.0195**			
Total (speciated + unspeciated)		**8.6060**			

[a] RC = residence chamber; DA = dilution air.
[b] ND = not detected.

Table I-3C. Carbonyls from Recovery Boiler #5 for Test Day 11/01/01

Compound	CAS No.	RC-DA[a] µg	Uncertainty Plus/Minus	% Total	Uncertainty Plus/Minus
formaldehyde	50-00-0	1.7495	0.1928	29.5299	3.2542
acetaldehyde	75-07-0	0.325	0.0037	5.4857	0.0625
acetone	67-64-1	0.3090	0.0131	5.2156	0.2206
propionaldehyde	123-38-6	0.0255	0.0002	0.4304	0.0028
crotonaldehyde	4170-30-0	ND[b]	ND	ND	ND
butyr/isobutyraldehyde	123-72-8	0.036	0.0021	0.6076	0.0355
benzaldehyde	100-52-7	0.0145	0.0004	0.2447	0.0075
isovaleraldehyde	590-86-3	ND	ND	ND	ND
valeraldehyde	110-62-3	ND	ND	ND	ND
o-tolualdehyde	529-20-4	ND	ND	ND	ND
m-tolualdehyde	620-23-5	ND	ND	ND	ND
p-tolualdehyde	104-87-0	ND	ND	ND	ND
hexaldehyde	66-25-1	0.007	0.0007	0.1182	0.0110
2,5-dimethylbenzaldehyde	5779-94-2	ND	ND	ND	ND
diacetyl	431-03-8	ND	ND	ND	ND
methacrolein	78-85-3	ND	ND	ND	ND
2-butanone	78-93-3	0.1850	0.0150	3.1226	0.2539
glyoxal	107-22-2	0.0870	0.0024	1.4685	0.0401
acetophenone	98-86-2	ND	ND	ND	ND
methylglyoxal	78-98-8	ND	ND	ND	ND
octanal	124-13-0	ND	ND	ND	ND
nonanal	124-19-6	ND	ND	ND	ND
Sum, Speciated		**2.6310**			
Sum, Unspeciated		**3.2935**			
Total (speciated + unspeciated)		**5.9245**			

[a] RC = residence chamber; DA = dilution air.
[b] ND = not detected.

Table I-4. Carbonyls from Recovery Boiler #5, 10/30/01 to 11/01/01

Compound	CAS No.	Field Blank µg	RC-DA[a] 10/30/01 µg	RC-DA 10/31/01 µg	RC-DA 11/01/01 µg
formaldehyde	50-00-0	0.0235	0.8200	1.2550	1.7495
acetaldehyde	75-07-0	0.0760	0.4590	3.4015	0.3250
acetone	67-64-1	0.1965	ND[b]	0.4060	0.3090
propionaldehyde	123-38-6	ND	ND	0.0195	0.0255
crotonaldehyde	4170-30-0	ND	ND	ND	ND
butyr/isobutyraldehyde	123-72-8	0.0460	0.0290	0.0195	0.0360
benzaldehyde	100-52-7	ND	0.0140	0.01	0.0145
isovaleraldehyde	590-86-3	ND	ND	ND	ND
valeraldehyde	110-62-3	0.0065	ND	0.1095	ND
o-tolualdehyde	529-20-4	ND	0.0155	ND	ND
m-tolualdehyde	620-23-5	ND	ND	ND	ND
p-tolualdehyde	104-87-0	0.0365	0.0235	ND	ND
hexaldehyde	66-25-1	0.0170	0.0085	0.0205	0.0070
2,5-dimethylbenzaldehyde	5779-94-2	ND	ND	ND	ND
diacetyl	431-03-8	ND	ND	ND	ND
methacrolein	78-85-3	ND	ND	0.0210	ND
2-butanone	78-93-3	0.0230	ND	0.1620	0.1850
glyoxal	107-22-2	0.0900	0.0830	0.0720	0.0870
acetophenone	98-86-2	ND	ND	0.0040	ND
methylglyoxal	78-98-8	0.0420	0.0470	0.0320	ND
octanal	124-13-0	ND	0.0270	0.0320	ND
nonanal	124-19-6	0.0990	ND	0.0220	ND
Sum, Speciated		**0.6560**	**0.2810**	**5.4830**	**2.6310**
Sum, Unspeciated		**0.7885**	**1.8245**	**3.0195**	**3.2935**
Total (speciated + unspeciated)		**1.4445**	**2.1055**	**8.5025**	**5.9245**

[a] RC = residence chamber; DA = dilution air.
[b] ND = not detected.

Appendix J

Supporting Data for Air Toxics Analysis

Contents

Table J-1. Air Toxics for Recovery Boiler #5, Field Test—Laboratory Blank and Ambient Air (10/30/01)

Compound	CAS No.	Laboratory Blank µg/m³	Ambient Air µg/m³
acetylene	74-86-2	ND[a]	0.71
propylene	115-07-1	ND	0.26
dichlorodifluoromethane	75-71-8	ND	2.85
chloromethane	74-87-3	ND	1.11
dichlorotetrafluoroethane	1320-37-2	ND	ND
vinyl chloride	75-01-4	ND	ND
1,3-butadiene	106-99-0	ND	ND
bromomethane	74-83-9	ND	ND
chloroethane	75-00-3	ND	ND
acetonitrile	75-05-8	ND	ND
acetone	67-64-1	ND	ND
trichlorofluoromethane	75-69-4	ND	1.41
acrylonitrile	107-13-1	ND	ND
1,1-dichloroethene	75-35-4	ND	ND
methylene chloride	75-09-2	ND	0.15
trichlorotrifluoroethane	26523-64-8	ND	0.65
trans-1,2-dichloroethylene	56-60-5	ND	ND
1,1-dichloroethane	75-34-3	ND	ND
methyl *tert*-butyl ether	1634-04-1	ND	ND
methyl ethyl ketone	78-93-3	ND	ND
chloroprene	126-99-8	ND	ND
cis-1,3-dichloroethylene	156-59-2	ND	ND
bromochloromethane	74-97-5	ND	ND
chloroform	67-66-3	ND	ND
erthyl *tert*-butyl ether	637-92-3	ND	ND
1,2-dichloroethane	107-06-2	ND	ND
1,1,1-trichloroethane	71-55-6	ND	0.16
benzene	71-43-2	0.07	0.74
carbon tetrachloride	56-23-5	ND	0.65
tert-amyl methyl ether	994-05-8	ND	ND
1,2-dichloropropane	78-87-5	ND	ND
ethyl acrylate	140-88-5	ND	ND
bromodichloromethane	75-27-4	ND	ND
trichloroethylene	79-01-6	ND	ND
methyl methacrylate	80-62-6	ND	ND

continued

Table J-1. (concluded)

Compound	CAS No.	Laboratory Blank µg/m^3	Ambient Air µg/m^3
cis-1,2-dichloropropene	10061-01-5	ND	ND
methyl isobutyl ketone	108-10-1	ND	ND
trans-1,2-dichloropropene	10061-02-6	ND	ND
1,1,2-trichloroethane	79-00-5	ND	ND
toluene	108-88-3	0.06	1.11
dibromochloromethane	124-48-1	ND	ND
1,2-dibromoethane	106-93-4	ND	ND
n-octane	111-65-9	ND	ND
tetrachloroethylene	127-18-4	ND	ND
chlorobenzene	108-90-7	ND	ND
ethylbenzene	100-41-4	ND	0.30
m-, *p*-xylene	108-38-3/106-42-3	ND	1.40
bromoform	75-25-2	ND	ND
styrene	100-42-5	ND	ND
1,1,2,2-tetrachloroethane	79-34-5	ND	ND
o-xylene	95-47-6	ND	0.35
1,3,5-trimethylbenzene	108-67-8	ND	0.08
1,2,4-trimethylbenzene	95-63-6	ND	0.31
m-dichlorobenzene	541-73-1	ND	ND
chloromethylbenzene	100-44-7	ND	ND
p-dichlorobenzene	106-46-7	ND	ND
o-dichlorobenzene	95-50-1	ND	ND
1,2,4-trichlorobenzene	120-82-1	ND	ND
hexachloro-1,3-butadiene	87-68-3	ND	ND

[a] ND = not detected.

Table J-2A. Air Toxics from Recovery Boiler #5 for Test Day 10/30/01

Compounds	CAS No.	Residence Chamber µg/m³	Dilution Air µg/m³	Air Toxics RC-DA[a] µg/m³	Ambient µg/m³
acetylene	74-86-2	2.60	0.65	1.95	0.71
propylene	115-07-1	0.80	0.42	0.38	0.26
dichlorodifluoromethane	75-71-8	1.74	1.65	0.09	2.85
chloromethane	74-87-3	0.85	0.83	0.02	1.11
dichlorotetrafluoroethane	1320-37-2	ND[b]	ND	ND	ND
vinyl chloride	75-01-4	ND	ND	ND	ND
1,3-butadiene	106-99-0	ND	ND	ND	ND
bromomethane	74-83-9	ND	ND	ND	ND
chloroethane	75-00-3	ND	ND	ND	ND
acetonitrile	75-05-8	ND	ND	ND	ND
acetone	67-64-1	ND	ND	ND	ND
trichlorofluoromethane	75-69-4	ND	ND	ND	1.41
acrylonitrile	107-13-1	ND	ND	ND	ND
1,1-dichloroethene	75-35-4	ND	ND	ND	ND
methylene chloride	75-09-2	ND	ND	ND	0.15
trichlorotrifluoroethane	26523-64-8	ND	ND	ND	0.65
trans-1,2-dichloroethylene	56-60-5	ND	ND	ND	ND
1,1-dichloroethane	75-34-3	ND	ND	ND	ND
methyl *tert*-butyl ether	1634-04-1	ND	ND	ND	ND
methyl ethyl ketone	78-93-3	ND	ND	ND	ND
chloroprene	126-99-8	ND	ND	ND	ND
cis-1,3-dichloroethylene	156-59-2	ND	ND	ND	ND
bromochloromethane	74-97-5	ND	ND	ND	ND
chloroform	67-66-3	ND	ND	ND	ND
erthyl *tert*-butyl ether	637-92-3	ND	ND	ND	ND
1,2-dichloroethane	107-06-2	ND	ND	ND	ND
1,1,1-trichloroethane	71-55-6	ND	ND	ND	0.16
benzene	71-43-2	0.73	0.13	0.60	0.74
carbon tetrachloride	56-23-5	ND	ND	ND	0.65
tert-amyl methyl ether	994-05-8	ND	ND	ND	ND
1,2-dichloropropane	78-87-5	ND	ND	ND	ND
ethyl acrylate	140-88-5	ND	ND	ND	ND
bromodichloromethane	75-27-4	ND	ND	ND	ND
trichloroethylene	79-01-6	ND	ND	ND	ND
methyl methacrylate	80-62-6	ND	ND	ND	ND

continued

Table J-2A. (concluded)

Compounds	CAS No.	Residence Chamber µg/m^3	Dilution Air µg/m^3	Air Toxics RC-DA[a] µg/m^3	Ambient µg/m^3
cis-1,2-dichloropropene	10061-01-5	ND	ND	ND	ND
methyl isobutyl ketone	108-10-1	ND	ND	ND	ND
trans-1,2-dichloropropene	10061-02-6	ND	ND	ND	ND
1,1,2-trichloroethane	79-00-5	ND	ND	ND	ND
toluene	108-88-3	0.95	0.24	0.71	1.11
dibromochloromethane	124-48-1	ND	ND	ND	ND
1,2-dibromoethane	106-93-4	ND	ND	ND	ND
n-octane	111-65-9	ND	ND	ND	ND
tetrachloroethylene	127-18-4	ND	ND	ND	ND
chlorobenzene	108-90-7	ND	ND	ND	ND
ethylbenzene	100-41-4	0.39	0.11	0.28	0.30
m-, *p*-xylene	108-38-3/106-42-3	1.03	0.34	0.69	1.40
bromoform	75-25-2	ND	ND	ND	ND
styrene	100-42-5	ND	0.10	ND	ND
1,1,2,2-tetrachloroethane	79-34-5	ND	ND	ND	ND
o-xylene	95-47-6	0.37	ND	ND	0.35
1,3,5-trimethylbenzene	108-67-8	ND	0.09	ND	0.08
1,2,4-trimethylbenzene	95-63-6	0.41	0.12	0.29	0.31
m-dichlorobenzene	541-73-1	ND	ND	ND	ND
chloromethylbenzene	100-44-7	ND	ND	ND	ND
p-dichlorobenzene	106-46-7	ND	ND	ND	ND
o-dichlorobenzene	95-50-1	ND	ND	ND	ND
1,2,4-trichlorobenzene	120-82-1	ND	ND	ND	ND
hexachloro-1,3-butadiene	87-68-3	ND	ND	ND	ND

[a] RC = residence chamber; DA = dilution air.
[b] ND = not detected.

Table J-2B. Air Toxics from Recovery Boiler #5 for Test Day 10/31/01

Compounds	CAS No.	Residence Chamber µg/m^3	Dilution Air µg/m^3	Air Toxics RC-DA[a] µg/m^3
acetylene	74-86-2	0.87	0.50	0.37
propylene	115-07-1	0.89	0.60	0.29
dichlorodifluoromethane	75-71-8	1.44	1.93	-0.49
chloromethane	74-87-3	1.35	1.41	-0.06
dichlorotetrafluoroethane	1320-37-2	ND[b]	ND	ND
vinyl chloride	75-01-4	ND	ND	ND
1,3-butadiene	106-99-0	ND	ND	ND
bromomethane	74-83-9	ND	ND	ND
chloroethane	75-00-3	ND	ND	ND
acetonitrile	75-05-8	ND	ND	ND
acetone	67-64-1	ND	ND	ND
trichlorofluoromethane	75-69-4	ND	ND	ND
acrylonitrile	107-13-1	ND	ND	ND
1,1-dichloroethene	75-35-4	ND	ND	ND
methylene chloride	75-09-2	ND	ND	ND
trichlorotrifluoroethane	26523-64-8	ND	ND	ND
trans-1,2-dichloroethylene	56-60-5	ND	ND	ND
1,1-dichloroethane	75-34-3	ND	ND	ND
methyl *tert*-butyl ether	1634-04-1	ND	ND	ND
methyl ethyl ketone	78-93-3	ND	ND	ND
chloroprene	126-99-8	ND	ND	ND
cis-1,3-dichloroethylene	156-59-2	ND	ND	ND
bromochloromethane	74-97-5	ND	ND	ND
chloroform	67-66-3	ND	ND	ND
erthyl *tert*-butyl ether	637-92-3	ND	ND	ND
1,2-dichloroethane	107-06-2	ND	ND	ND
1,1,1-trichloroethane	71-55-6	ND	ND	ND
benzene	71-43-2	0.90	0.14	0.76
carbon tetrachloride	56-23-5	ND	ND	ND
tert-amyl methyl ether	994-05-8	ND	ND	ND
1,2-dichloropropane	78-87-5	ND	ND	ND
ethyl acrylate	140-88-5	ND	ND	ND
bromodichloromethane	75-27-4	ND	ND	ND
trichloroethylene	79-01-6	ND	ND	ND
methyl methacrylate	80-62-6	ND	ND	ND

continued

Table J-2B. (concluded)

Compounds	CAS No.	Residence Chamber µg/m^3	Dilution Air µg/m^3	Air Toxics RC-DA[a] µg/m^3
cis-1,2-dichloropropene	10061-01-5	ND	ND	ND
methyl isobutyl ketone	108-10-1	ND	ND	ND
trans-1,2-dichloropropene	10061-02-6	ND	ND	ND
1,1,2-trichloroethane	79-00-5	ND	ND	ND
toluene	108-88-3	0.87	0.18	0.69
dibromochloromethane	124-48-1	ND	ND	ND
1,2-dibromoethane	106-93-4	ND	ND	ND
n-octane	111-65-9	ND	ND	ND
tetrachloroethylene	127-18-4	ND	ND	ND
chlorobenzene	108-90-7	ND	ND	ND
ethylbenzene	100-41-4	0.33	0.08	0.25
m-, *p*-xylene	108-38-3/106-42-3	1.20	0.20	1
bromoform	75-25-2	ND	ND	ND
styrene	100-42-5	ND	ND	ND
1,1,2,2-tetrachloroethane	79-34-5	ND	ND	ND
o-xylene	95-47-6	0.33	0.08	0.25
1,3,5-trimethylbenzene	108-67-8	ND	ND	ND
1,2,4-trimethylbenzene	95-63-6	0.36	0.11	0.25
m-dichlorobenzene	541-73-1	ND	ND	ND
chloromethylbenzene	100-44-7	ND	ND	ND
p-dichlorobenzene	106-46-7	ND	ND	ND
o-dichlorobenzene	95-50-1	ND	ND	ND
1,2,4-trichlorobenzene	120-82-1	ND	ND	ND
hexachloro-1,3-butadiene	87-68-3	ND	ND	ND

[a] RC = residence chamber; DA = dilution air.
[b] ND = not detected.

Table J-2C. Air Toxics from Recovery Boiler #5 for Test Day 11/01/01

Compounds	CAS No.	Residence Chamber µg/m^3	Dilution Air µg/m^3	Air Toxics RC-DA[a] µg/m^3
acetylene	74-86-2	0.98	0.68	0.3
propylene	115-07-1	1.32	1.05	0.27
dichlorodifluoromethane	75-71-8	2.14	2.31	ND[b]
chloromethane	74-87-3	1.16	2.12	ND
dichlorotetrafluoroethane	1320-37-2	ND	ND	ND
vinyl chloride	75-01-4	ND	ND	ND
1,3-butadiene	106-99-0	ND	ND	ND
bromomethane	74-83-9	ND	ND	ND
chloroethane	75-00-3	ND	ND	ND
acetonitrile	75-05-8	ND	ND	ND
acetone	67-64-1	ND	ND	ND
trichlorofluoromethane	75-69-4	ND	0.08	ND
acrylonitrile	107-13-1	ND	ND	ND
1,1-dichloroethene	75-35-4	ND	ND	ND
methylene chloride	75-09-2	ND	0.54	ND
trichlorotrifluoroethane	26523-64-8	ND	ND	ND
trans-1,2-dichloroethylene	56-60-5	ND	ND	ND
1,1-dichloroethane	75-34-3	ND	ND	ND
methyl *tert*-butyl ether	1634-04-1	ND	ND	ND
methyl ethyl ketone	78-93-3	ND	ND	ND
chloroprene	126-99-8	ND	ND	ND
cis-1,3-dichloroethylene	156-59-2	ND	ND	ND
bromochloromethane	74-97-5	ND	ND	ND
chloroform	67-66-3	ND	ND	ND
erthyl *tert*-butyl ether	637-92-3	ND	ND	ND
1,2-dichloroethane	107-06-2	ND	ND	ND
1,1,1-trichloroethane	71-55-6	ND	ND	ND
benzene	71-43-2	1.21	0.13	1.08
carbon tetrachloride	56-23-5	ND	ND	ND
tert-amyl methyl ether	994-05-8	ND	ND	ND
1,2-dichloropropane	78-87-5	ND	ND	ND
ethyl acrylate	140-88-5	ND	ND	ND
bromodichloromethane	75-27-4	ND	ND	ND
trichloroethylene	79-01-6	ND	ND	ND
methyl methacrylate	80-62-6	ND	ND	ND

continued

Table J-2C. (concluded)

Compounds	CAS No.	Residence Chamber µg/m^3	Dilution Air µg/m^3	Air Toxics RC-DA[a] µg/m^3
cis-1,2-dichloropropene	10061-01-5	ND	ND	ND
methyl isobutyl ketone	108-10-1	ND	ND	ND
trans-1,2-dichloropropene	10061-02-6	ND	ND	ND
1,1,2-trichloroethane	79-00-5	ND	ND	ND
toluene	108-88-3	0.86	0.17	0.69
dibromochloromethane	124-48-1	ND	ND	ND
1,2-dibromoethane	106-93-4	ND	ND	ND
n-octane	111-65-9	ND	ND	ND
tetrachloroethylene	127-18-4	ND	ND	ND
chlorobenzene	108-90-7	ND	ND	ND
ethylbenzene	100-41-4	0.27	0.05	0.22
m-, *p*-xylene	108-38-3/106-42-3	1.39	0.28	1.11
bromoform	75-25-2	ND	ND	ND
styrene	100-42-5	ND	ND	ND
1,1,2,2-tetrachloroethane	79-34-5	ND	ND	ND
o-xylene	95-47-6	0.32	0.09	0.23
1,3,5-trimethylbenzene	108-67-8	ND	ND	ND
1,2,4-trimethylbenzene	95-63-6	0.39	0.09	0.3
m-dichlorobenzene	541-73-1	ND	ND	ND
chloromethylbenzene	100-44-7	ND	ND	ND
p-dichlorobenzene	106-46-7	ND	ND	ND
o-dichlorobenzene	95-50-1	ND	ND	ND
1,2,4-trichlorobenzene	120-82-1	ND	ND	ND
hexachloro-1,3-butadiene	87-68-3	ND	ND	ND

[a] RC = residence chamber; DA = dilution air.
[b] ND = not detected.

Table J-3. Daily Air Toxics from Recovery Boiler #5 Compared to Ambient

Compounds	CAS No.	Ambient 10/30/01 µg/m³	Air Toxics RC-DA[a] 10/30/01 µg/m³	Air Toxics RC-DA 10/31/01 µg/m³	Air Toxics RC-DA 11/01/01 µg/m³
acetylene	74-86-2	0.71	1.95	0.37	0.3
propylene	115-07-1	0.26	0.38	0.29	0.27
dichlorodifluoromethane	75-71-8	2.85	0.09	ND[b]	ND
chloromethane	74-87-3	1.11	0.02	ND	ND
dichlorotetrafluoroethane	1320-37-2	ND	ND	ND	ND
vinyl chloride	75-01-4	ND	ND	ND	ND
1,3-butadiene	106-99-0	ND	ND	ND	ND
bromomethane	74-83-9	ND	ND	ND	ND
chloroethane	75-00-3	ND	ND	ND	ND
acetonitrile	75-05-8	ND	ND	ND	ND
acetone	67-64-1	ND	ND	ND	ND
trichlorofluoromethane	75-69-4	1.41	ND	ND	ND
acrylonitrile	107-13-1	ND	ND	ND	ND
1,1-dichloroethene	75-35-4	ND	ND	ND	ND
methylene chloride	75-09-2	0.15	ND	ND	ND
trichlorotrifluoroethane	26523-64-8	0.65	ND	ND	ND
trans-1,2-dichloroethylene	56-60-5	ND	ND	ND	ND
1,1-dichloroethane	75-34-3	ND	ND	ND	ND
methyl *tert*-butyl ether	1634-04-1	ND	ND	ND	ND
methyl ethyl ketone	78-93-3	ND	ND	ND	ND
chloroprene	126-99-8	ND	ND	ND	ND
cis-1,3-dichloroethylene	156-59-2	ND	ND	ND	ND
bromochloromethane	74-97-5	ND	ND	ND	ND
chloroform	67-66-3	ND	ND	ND	ND
erthyl *tert*-butyl ether	637-92-3	ND	ND	ND	ND
1,2-dichloroethane	107-06-2	ND	ND	ND	ND
1,1,1-trichloroethane	71-55-6	0.16	ND	ND	ND
benzene	71-43-2	0.74	0.6	0.76	1.08
carbon tetrachloride	56-23-5	0.65	ND	ND	ND
tert-amyl methyl ether	994-05-8	ND	ND	ND	ND
1,2-dichloropropane	78-87-5	ND	ND	ND	ND
ethyl acrylate	140-88-5	ND	ND	ND	ND
bromodichloromethane	75-27-4	ND	ND	ND	ND
trichloroethylene	79-01-6	ND	ND	ND	ND
methyl methacrylate	80-62-6	ND	ND	ND	ND

continued

Table J-3. (concluded)

Compounds	CAS No.	Ambient 10/30/01 μg/m³	Air Toxics RC-DA[a] 10/30/01 μg/m³	Air Toxics RC-DA 10/31/01 μg/m³	Air Toxics RC-DA 11/01/01 μg/m³
cis-1,2-dichloropropene	10061-01-5	ND	ND	ND	ND
methyl isobutyl ketone	108-10-1	ND	ND	ND	ND
trans-1,2-dichloropropene	10061-02-6	ND	ND	ND	ND
1,1,2-trichloroethane	79-00-5	ND	ND	ND	ND
toluene	108-88-3	1.11	0.71	0.69	0.69
dibromochloromethane	124-48-1	ND	ND	ND	ND
1,2-dibromoethane	106-93-4	ND	ND	ND	ND
n-octane	111-65-9	ND	ND	ND	ND
tetrachloroethylene	127-18-4	ND	ND	ND	ND
chlorobenzene	108-90-7	ND	ND	ND	ND
ethylbenzene	100-41-4	0.30	0.28	0.25	0.22
m-, *p*-xylene	108-38-3/106-42-3	1.40	0.69	1.00	1.11
bromoform	75-25-2	ND	ND	ND	ND
styrene	100-42-5	ND	ND	ND	ND
1,1,2,2-tetrachloroethane	79-34-5	ND	ND	ND	ND
o-xylene	95-47-6	0.35	0.37	0.25	0.23
1,3,5-trimethylbenzene	108-67-8	0.08	ND	ND	ND
1,2,4-trimethylbenzene	95-63-6	0.31	0.29	0.25	0.3
m-dichlorobenzene	541-73-1	ND	ND	ND	ND
chloromethylbenzene	100-44-7	ND	ND	ND	ND
p-dichlorobenzene	106-46-7	ND	ND	ND	ND
o-dichlorobenzene	95-50-1	ND	ND	ND	ND
1,2,4-trichlorobenzene	120-82-1	ND	ND	ND	ND
hexachloro-1,3-butadiene	87-68-3	ND	ND	ND	ND

[a] RC = residence chamber; DA = dilution air.
[b] ND = not detected.

Table J-4. Summary of Air Toxics from Recovery Boiler #5

Compounds Detected	CAS No.	Ambient µg/m³	RC-DA[a] 10/30/01 µg/m³	RC-DA 10/31/01 µg/m³	RC-DA 11/01/01 µg/m³
acetylene	74-86-2	0.71	1.95	0.37	0.3
propylene	115-07-1	0.26	0.38	0.29	0.27
dichlorodifluoromethane	75-71-8	2.85	0.09	ND[b]	ND
chloromethane	74-87-3	1.11	0.02	ND	ND
trichlorofluoromethane	75-69-4	1.41	ND	ND	ND
methylene chloride	75-09-2	0.15	ND	ND	ND
trichlorotrifluoroethane	26253-64-8	0.65	ND	ND	ND
1,1,1-trichloroethane	71-55-6	0.16	ND	ND	ND
benzene	71-43-2	0.74	0.6	0.76	1.08
carbon tetrachloride	56-23-5	0.65	ND	ND	ND
toluene	108-88-3	1.11	0.71	0.69	0.69
ethylbenzene	100-41-4	0.30	0.28	0.25	0.22
m-, *p*-xylene	108-38-3/106-42-3	1.4	0.69	1.00	1.11
o-xylene	95-47-6	0.35	0.37	0.25	0.23
1,3,5-trimethylbenzene	108-67-8	0.08	ND	ND	ND
1,2,4-trimethylbenzene	95-63-6	0.31	0.29	0.25	0.3

[a] RC = residence chamber; DA = dilution air.
[b] ND = not detected.

Appendix K

Supporting Data for Speciated and Unspeciated Nonmethane Organic Compounds

Contents

Table K-1. Recovery Boiler #5 Field Test Laboratory Blank and Ambient SNMOCs[a] on 10/30/01

Compound	CAS No.	Laboratory Blank µg/m³	Ambient ERG #23725 µg/m³
ethylene	74-85-1	0.12	1.03
acetylene	74-86-2	0.14	1.00
ethane	74-84-0	0.12	5.19
propylene	115-07-1	ND[b]	0.37
propane	74-98-6	0.08	4.16
propyne	74-99-7	ND	ND
isobutane	75-28-5	ND	1.00
isobutene/1-butene	115-11-7/106-98-0	ND	0.33
1,3-butadiene	106-99-0	ND	ND
n-butane	106-97-8	ND	2.23
trans-2-butene	624-64-6	ND	0.12
cis-2-butene	590-18-1	ND	0.17
3-methyl-1-butene	563-45-1	ND	ND
isopentane	78-78-4	0.09	1.70
1-pentene	109-67-1	ND	0.18
2-methyl-1-butene	563-46-2	ND	0.09
n-pentane	109-66-0	ND	0.93
isoprene	78-79-4	ND	0.21
trans-2-pentene	646-04-8	ND	1.25
cis-2-pentene	627-20-3	0.09	0.15
2-methyl-2-butene	513-35-9	ND	ND
2,2-dimethylbutane	75-83-2	0.10	0.30
cyclopentene	142-29-0	ND	ND
4-methyl-1-pentene	691-37-2	ND	ND
cyclopentane	287-92-3	ND	0.19
2,3-dimethylbutane	79-29-8	0.08	0.37
2-methylpentane	107-83-5	0.57	0.67
3-methylpentane	96-14-0	0.08	0.50
2-methyl-1-pentene	763-29-1	ND	ND
1-hexene	592-41-6	0.10	0.26
2-ethyl-1-butene	760-21-4	ND	ND
n-hexane	110-54-3	ND	0.62
trans-2-hexene	4050-45-7	ND	ND
cis-2-hexene	7688-21-3	ND	ND

continued

Table K-1. (continued)

Compound	CAS No.	Laboratory Blank µg/m³	Ambient ERG #23725 µg/m³
methylcyclopentane	96-37-7	ND	0.30
2,4-dimethylpentane	108-08-7	0.07	0.22
benzene	71-43-2	0.07	0.69
cyclohexane	110-82-7	0.08	0.22
2-methylhexane	591-76-4	ND	0.25
2,3-dimethylpentane	565-59-3	0.14	0.35
3-methylhexane	589-34-4	0.10	0.34
1-heptene	592-76-7	ND	ND
2,2,4-trimethylpentane	540-84-1	ND	0.36
n-heptane	142-82-5	ND	0.30
methylcyclohexane	108-87-2	0.08	0.27
2,2,3-trimethylpentane	564-02-3	ND	ND
2,3,4-trimethylpentane	565-75-3	ND	0.17
toluene	108-88-3	0.09	0.98
2-methylheptane	592-27-8	ND	0.13
3-methylheptane	589-81-1	ND	0.15
1-octene	111-66-0	ND	0.00
n-octane	111-65-9	ND	0.26
ethylbenzene	100-41-4	ND	0.28
m-xylene/*p*-xylene	108-38-3/106-42-3	ND	0.61
styrene	100-42-5	ND	0.26
o-xylene	95-47-6	ND	0.27
1-nonene	124-11-8	ND	ND
n-nonane	111-84-2	ND	0.21
isopropylbenzene	98-82-8	ND	0.16
alpha-pinene	80-56-8	ND	0.58
n-propylbenzene	103-65-1	ND	0.13
m-ethyltoluene	620-14-4	ND	0.20
p-ethyltoluene	622-96-8	ND	0.17
1,3,5-trimethylbenzene	108-67-8	ND	0.12
o-ethyltoluene	611-14-3	ND	0.17
beta-pinene	127-91-3	ND	0.29
1,2,4-trimethylbenzene	95-63-6	0.07	0.29
1-decene	872-05-9	ND	ND
n-decane	124-18-5	0.08	0.26
1,2,3-trimethylbenzene	526-73-8	ND	0.08

continued

Table K-1. (concluded)

Compound	CAS No.	Laboratory Blank µg/m³	Ambient ERG #23725 µg/m³
m-diethylbenzene	141-93-5	ND	0.13
p-diethylbenzene	105-05-5	ND	ND
1-undecene	821-95-4	ND	ND
n-undecane	1120-21-4	0.13	0.39
1-dodecene	112-41-4	ND	ND
n-dodecane	112-40-3	0.34	0.85
1-tridecene	2437-56-1	ND	ND
n-tridecane	629-50-5	ND	0.16
Total Speciated		**2.82**	**33.62**
Total Unspeciated		**6.18**	**40.36**
Total (speciated + unspeciated)[c]		**9.00**	**73.98**

[a] SNMOCs = speciated nonmethane organic compounds.
[b] ND = not detected.
[c] Total NMOC with unknowns in µg/m³ is an estimate based on propane only.

Table K-2A. SNMOCs[a] Collected in Canisters from Recovery Boiler #5 on Test Day 10/30/01

Compound	CAS No.	Residence Chamber V=3.920L µg/m³	Residence Chamber µg	Dilution Air V=3.920L µg/m³	Dilution Air µg	SNMOC RC-DA[b] µg	SNMOC RC-DA (no negs)[c] µg
ethylene	74-85-1	2.23	0.0087	1.38	0.0054	0.0033	0.0033
acetylene	74-86-2	2.99	0.0117	1.01	0.0040	0.0078	0.0078
ethane	74-84-0	6.31	0.0247	5.80	0.0227	0.0020	0.0020
propylene	115-07-01	0.94	0.0037	0.50	0.0020	0.0017	0.0017
propane	74-98-6	3.01	0.0118	2.39	0.0094	0.0024	0.0024
propyne	74-99-7	ND[d]	ND	ND	ND	ND	ND
isobutane	75-28-5	0.50	0.0020	0.19	0.0007	0.0012	0.0012
isobutene/1-butene	115-11-7/106-98-0	0.50	0.0020	0.24	0.0009	0.0010	0.0010
1,3-butadiene	106-99-0	ND	ND	ND	ND	ND	ND
n-butane	106-97-8	0.94	0.0037	0.32	0.0013	0.0024	0.0024
trans-2-butene	624-64-6	0.46	0.0018	0.11	0.0004	0.0014	0.0014
cis-2-butene	590-18-1	0.64	0.0025	0.16	0.0006	0.0019	0.0019
3-methyl-1-butene	563-45-1	ND	ND	ND	ND	ND	ND
isopentane	78-78-4	0.85	0.0033	0.26	0.0010	0.0023	0.0023
1-pentene	109-67-1	0.49	0.0019	0.13	0.0005	0.0014	0.0014
2-methyl-1-butene	563-46-2	ND	ND	0.65	0.0025	-0.0025	ND
n-pentane	109-66-0	0.57	0.0022	0.16	0.0006	0.0016	0.0016
isoprene	78-79-4	0.43	0.0017	0.11	0.0004	0.0013	0.0013
trans-2-pentene	646-04-8	ND	ND	0.43	0.0017	-0.0017	ND
cis-2-pentene	627-20-3	0.61	0.0024	0.18	0.0007	0.0017	0.0017
2-methyl-2-butene	513-35-9	ND	ND	ND	ND	ND	ND
2,2-dimethylbutane	75-83-2	0.84	0.0033	0.27	0.0011	0.0022	0.0022

continued

Table K-2A. (continued)

Compound	CAS No.	Residence Chamber V=3.920L µg/m³	Residence Chamber µg	Dilution Air V=3.920L µg/m³	Dilution Air µg	SNMOC RC-DA[b] µg	SNMOC RC-DA (no negs)[c] µg
cyclopentene	142-29-0	ND	ND	ND	ND	ND	ND
4-methyl-1-pentene	691-37-2	ND	ND	ND	ND	ND	ND
cyclopentane	287-92-3	0.60	0.0024	0.20	0.0008	0.0016	0.0016
2,3-dimethylbutane	79-29-8	0.98	0.0038	0.27	0.0011	0.0028	0.0028
2-methylpentane	107-83-5	1.43	0.0056	0.21	0.0008	0.0048	0.0048
3-methylpentane	96-14-0	0.82	0.0032	0.23	0.0009	0.0023	0.0023
2-methyl-1-pentene	763-29-1	ND	ND	ND	ND	ND	ND
1-hexene	592-41-6	1.04	0.0041	0.26	0.0010	0.0031	0.0031
2-ethyl-1-butene	760-21-4	ND	ND	ND	ND	ND	ND
n-hexane	110-54-3	0.73	0.0029	0.19	0.0007	0.0021	0.0021
trans-2-hexene	4050-45-7	ND	ND	ND	ND	ND	ND
cis-2-hexene	7688-21-3	ND	ND	ND	ND	ND	ND
methylcyclopentane	96-37-7	0.63	0.0025	0.16	0.0006	0.0018	0.0018
2,4-dimethylpentane	108-08-7	0.67	0.0026	0.16	0.0006	0.0020	0.0020
benzene	71-43-2	0.68	0.0027	0.16	0.0006	0.0020	0.0020
cyclohexane	110-82-7	0.62	0.0024	0.22	0.0009	0.0016	0.0016
2-methylhexane	591-76-4	0.43	0.0017	0.13	0.0005	0.0012	0.0012
2,3-dimethylpentane	565-59-3	1.19	0.0047	0.29	0.0011	0.0035	0.0035
3-methylhexane	589-34-4	0.75	0.0029	0.08	0.0003	0.0026	0.0026
1-heptene	592-76-7	ND	ND	ND	ND	ND	ND
2,2,4-trimethylpentane	540-84-1	0.81	0.0032	0.16	0.0006	0.0025	0.0025
n-heptane	142-82-5	0.51	0.0020	0.12	0.0005	0.0015	0.0015

continued

Table K-2A. (continued)

Compound	CAS No.	Residence Chamber V=3.920L µg/m³	Residence Chamber µg	Dilution Air V=3.920L µg/m³	Dilution Air µg	SNMOC RC-DA[b] µg	SNMOC RC-DA (no negs)[c] µg
methylcyclohexane	108-87-2	0.72	0.0028	0.16	0.0006	0.0022	0.0022
2,2,3-trimethylpentane	564-02-3	ND	ND	ND	ND	ND	ND
2,3,4-trimethylpentane	565-75-3	0.51	0.0020	0.13	0.0005	0.0015	0.0015
toluene	108-88-3	0.84	0.0033	0.25	0.0010	0.0023	0.0023
2-methylheptane	592-27-8	0.42	0.0016	0.11	0.0004	0.0012	0.0012
3-methylheptane	589-81-1	0.47	0.0018	0.12	0.0005	0.0014	0.0014
1-octene	111-66-0	ND	ND	ND	ND	ND	ND
n-octane	111-65-9	0.56	0.0022	0.11	0.0004	0.0018	0.0018
ethylbenzene	100-41-4	0.39	0.0015	0.09	0.0004	0.0012	0.0012
m-xylene/*p*-xylene	108-38-3/106-42-3	0.57	0.0022	0.16	0.0006	0.0016	0.0016
styrene	100-42-5	ND	ND	0.08	0.0003	-0.0003	ND
o-xylene	95-47-6	0.42	0.0016	0.12	0.0005	0.0012	0.0012
1-nonene	124-11-8	ND	ND	ND	ND	ND	ND
n-nonane	111-84-2	0.35	0.0014	0.11	0.0004	0.0009	0.0009
isopropylbenzene	98-82-8	0.55	0.0022	0.11	0.0004	0.0017	0.0017
alpha-pinene	80-56-8	ND	ND	0.25	0.0010	-0.0010	ND
n-propylbenzene	103-65-1	0.34	0.0013	0.09	0.0004	0.0010	0.0010
m-ethyltoluene	620-14-4	0.32	0.0013	0.10	0.0004	0.0009	0.0009
p-ethyltoluene	622-96-8	0.57	0.0022	0.13	0.0005	0.0017	0.0017
1,3,5-trimethylbenzene	108-67-8	0.33	0.0013	0.07	0.0003	0.0010	0.0010
o-ethyltoluene	611-14-3	0.41	0.0016	0.09	0.0004	0.0013	0.0013
beta-pinene	127-91-3	0.46	0.0018	0.16	0.0006	0.0012	0.0012

continued

Table K-2A. (concluded)

Compound	CAS No.	Residence Chamber V=3.920L µg/m³	Residence Chamber µg	Dilution Air V=3.920L µg/m³	Dilution Air µg	SNMOC RC-DA[b] µg	SNMOC RC-DA (no negs)[c] µg
1,2,4-trimethylbenzene	95-63-6	0.45	0.0018	0.15	0.0006	0.0012	0.0012
1-decene	872-05-9	ND	ND	ND	ND	ND	ND
n-decane	124-18-5	0.44	0.0017	0.16	0.0006	0.0011	0.0011
1,2,3-trimethylbenzene	526-73-8	ND	ND	ND	ND	ND	ND
m-diethylbenzene	141-93-5	0.36	0.0014	0.07	0.0003	0.0011	0.0011
p-diethylbenzene	105-05-5	ND	ND	ND	ND	ND	ND
1-undecene	821-95-4	ND	ND	ND	ND	ND	ND
n-undecane	1120-21-4	0.59	0.0023	0.29	0.0011	0.0012	0.0012
1-dodecene	112-41-4	ND	ND	ND	ND	ND	ND
n-dodecane	112-40-3	0.55	0.0022	0.63	0.0025	-0.0003	0.0000
1-tridecene	2437-56-1	ND	ND	ND	0.0000	0.0000	0.0000
n-tridecane	629-50-5	ND	ND	ND	0.0000	0.0000	0.0000
Total Speciated		**44.82**	**0.1757**	**20.87**	**0.0818**	**0.0939**	**0.0997**
Total Unspeciated		**51.00**	**0.1999**	**23.12**	**0.0906**	**0.1093**	**0.1093**
Total (speciated + unspeciated)[e]		**95.82**	**0.3756**	**43.99**	**0.1724**	**0.2032**	**0.2090**

[a] SNMOCs = speciated nonmethane organic compounds.
[b] RC = residence chamber; DA = dilution air.
[c] compounds for which DA>RC are listed as ND or zero.
[d] ND = not detected.
[e] Total NMOC with unknowns in µg/m³ is an estimate based on propane only.

Table K-2B. SNMOCs[a] Collected in Canisters from Recovery Boiler #5 on Test Day 10/31/01

Compound	CAS No.	Residence Chamber V=3.9L µg/m³	Residence Chamber µg	Dilution Air 10/31/01 µg/m³	Dilution Air µg	SNMOC RC-DA[b] µg	SNMOC RC-DA (no negs)[c] µg
ethylene	74-85-1	2.84	0.0111	2.03	0.0087	0.0023	0.0023
acetylene	74-86-2	0.91	0.0035	0.73	0.0031	0.0004	0.0004
ethane	74-84-0	7.59	0.0296	7.41	0.0319	-0.0023	ND[d]
propylene	115-07-01	1.01	0.0039	0.70	0.0030	0.0009	0.0009
propane	74-98-6	3.49	0.0136	2.95	0.0127	0.0009	0.0009
propyne	74-99-7	ND	ND	ND	ND	ND	ND
isobutane	75-28-5	0.50	0.0020	0.23	0.0010	0.0010	0.0010
isobutene/1-butene	115-11-7/106-98-0	0.73	0.0028	0.25	0.0011	0.0018	0.0018
1,3-butadiene	106-99-0	ND	ND	ND	ND	ND	ND
n-butane	106-97-8	0.91	0.0035	0.36	0.0015	0.0020	0.0020
trans-2-butene	624-64-6	0.47	0.0018	0.13	0.0006	0.0013	0.0013
cis-2-butene	590-18-1	0.61	0.0024	0.19	0.0008	0.0016	0.0016
3-methyl-1-butene	563-45-1	ND	ND	ND	ND	ND	ND
isopentane	78-78-4	0.82	0.0032	0.24	0.0010	0.0022	0.0022
1-pentene	109-67-1	0.43	0.0017	0.13	0.0006	0.0011	0.0011
2-methyl-1-butene	563-46-2	ND	ND	ND	ND	ND	ND
n-pentane	109-66-0	0.47	0.0018	0.17	0.0007	0.0011	0.0011
isoprene	78-79-4	0.35	0.0014	0.12	0.0005	0.0008	0.0008
trans-2-pentene	646-04-8	ND	ND	0.12	0.0005	-0.0005	ND
cis-2-pentene	627-20-3	0.57	0.0022	0.16	0.0007	0.0015	0.0015
2-methyl-2-butene	513-35-9	ND	ND	ND	ND	ND	ND
2,2-dimethylbutane	75-83-2	1.01	0.0039	0.20	0.0009	0.0031	0.0031

continued

Table K-2B. (continued)

Compound	CAS No.	Residence Chamber V=3.9L µg/m³	Residence Chamber µg	Dilution Air 10/31/01 µg/m³	Dilution Air µg	SNMOC RC-DA[b] µg	SNMOC RC-DA (no negs)[c] µg
cyclopentene	142-29-0	ND	ND	ND	ND	ND	ND
4-methyl-1-pentene	691-37-2	ND	ND	ND	ND	ND	ND
cyclopentane	287-92-3	0.50	0.0020	0.11	0.0005	0.0015	0.0015
2,3-dimethylbutane	79-29-8	0.92	0.0036	0.25	0.0011	0.0025	0.0025
2-methylpentane	107-83-5	1.32	0.0051	0.12	0.0005	0.0046	0.0046
3-methylpentane	96-14-0	0.77	0.0030	0.21	0.0009	0.0021	0.0021
2-methyl-1-pentene	763-29-1	ND	ND	ND	ND	ND	ND
1-hexene	592-41-6	0.95	0.0037	0.23	0.0010	0.0027	0.0027
2-ethyl-1-butene	760-21-4	ND	ND	ND	ND	ND	ND
n-hexane	110-54-3	0.60	0.0023	0.17	0.0007	0.0016	0.0016
trans-2-hexene	4050-45-7	ND	ND	ND	ND	ND	ND
cis-2-hexene	7688-21-3	ND	ND	ND	ND	ND	ND
methylcyclopentane	96-37-7	0.52	0.0020	0.13	0.0006	0.0015	0.0015
2,4-dimethylpentane	108-08-7	0.61	0.0024	0.17	0.0007	0.0016	0.0016
benzene	71-43-2	1.08	0.0042	0.16	0.0007	0.0035	0.0035
cyclohexane	110-82-7	0.73	0.0028	0.19	0.0008	0.0020	0.0020
2-methylhexane	591-76-4	0.40	0.0016	0.11	0.0005	0.0011	0.0011
2,3-dimethylpentane	565-59-3	1.02	0.0040	0.24	0.0010	0.0029	0.0029
3-methylhexane	589-34-4	0.52	0.0020	0.24	0.0010	0.0010	0.0010
1-heptene	592-76-7	0.41	0.0016	ND	ND	0.0016	0.0016
2,2,4-trimethylpentane	540-84-1	0.71	0.0028	0.17	0.0007	0.0020	0.0020
n-heptane	142-82-5	0.48	0.0019	0.12	0.0005	0.0014	0.0014

continued

Table K-2B. (continued)

Compound	CAS No.	Residence Chamber V=3.9L µg/m³	Residence Chamber µg	Dilution Air 10/31/01 µg/m³	Dilution Air µg	SNMOC RC-DA[b] µg	SNMOC RC-DA (no negs)[c] µg
methylcyclohexane	108-87-2	0.54	0.0021	0.15	0.0006	0.0015	0.0015
2,2,3-trimethylpentane	564-02-3	ND	ND	ND	ND	ND	ND
2,3,4-trimethylpentane	565-75-3	0.47	0.0018	0.11	0.0005	0.0014	0.0014
toluene	108-88-3	0.66	0.0026	0.09	0.0004	0.0022	0.0022
2-methylheptane	592-27-8	0.40	0.0016	0.09	0.0004	0.0012	0.0012
3-methylheptane	589-81-1	0.44	0.0017	0.09	0.0004	0.0013	0.0013
1-octene	111-66-0	ND	ND	ND	ND	ND	ND
n-octane	111-65-9	0.43	0.0017	0.14	0.0006	0.0011	0.0011
ethylbenzene	100-41-4	0.35	0.0014	0.08	0.0003	0.0010	0.0010
m-xylene/*p*-xylene	108-38-3/106-42-3	ND	ND	0.15	0.0006	-0.0007	ND
styrene	100-42-5	ND	ND	ND	ND	ND	ND
o-xylene	95-47-6	0.45	0.0018	0.08	0.0003	0.0014	0.0014
1-nonene	124-11-8	ND	ND	ND	ND	ND	ND
n-nonane	111-84-2	0.40	0.0016	0.10	0.0004	0.0011	0.0011
isopropylbenzene	98-82-8	0.54	0.0021	0.15	0.0006	0.0015	0.0015
alpha-pinene	80-56-8	ND	ND	ND	ND	ND	ND
n-propylbenzene	103-65-1	0.37	0.0014	0.08	0.0003	0.0011	0.0011
m-ethyltoluene	620-14-4	0.31	0.0012	0.07	0.0003	0.0009	0.0009
p-ethyltoluene	622-96-8	0.61	0.0024	0.10	0.0004	0.0019	0.0019
1,3,5-trimethylbenzene	108-67-8	0.28	0.0011	0.09	0.0004	0.0007	0.0007
o-ethyltoluene	611-14-3	0.42	0.0016	0.09	0.0004	0.0013	0.0013
beta-pinene	127-91-3	ND	ND	ND	ND	ND	ND

continued

Table K-2B. (concluded)

Compound	CAS No.	Residence Chamber V=3.9L µg/m³	Residence Chamber µg	Dilution Air 10/31/01 µg/m³	Dilution Air µg	SNMOC RC-DA[b] µg	SNMOC RC-DA (no negs)[c] µg
1,2,4-trimethylbenzene	95-63-6	0.36	0.0014	0.12	0.0005	0.0009	0.0009
1-decene	872-05-9	ND	ND	ND	ND	ND	ND
n-decane	124-18-5	0.39	0.0015	0.14	0.0006	0.0009	0.0009
1,2,3-trimethylbenzene	526-73-8	ND	ND	ND	ND	ND	ND
m-diethylbenzene	141-93-5	ND	ND	0.08	0.0003	-0.0003	0.0000
p-diethylbenzene	105-05-5	ND	ND	ND	ND	ND	ND
1-undecene	821-95-4	ND	ND	ND	ND	ND	ND
n-undecane	1120-21-4	0.36	0.0014	0.17	0.0007	0.0007	0.0007
1-dodecene	112-41-4	ND	ND	ND	ND	ND	ND
n-dodecane	112-40-3	ND	ND	0.24	0.0010	-0.0010	ND
1-tridecene	2437-56-1	ND	ND	ND	ND	ND	ND
n-tridecane	629-50-5	ND	ND	ND	ND	ND	ND
Total Speciated		**42.03**	**0.1639**	**21.15**	**0.0909**	**0.0730**	**0.0778**
Total Unspeciated		**47.29**	**0.1844**	**23.34**	**0.1004**	**0.0841**	**0.0841**
Total (speciated + unspeciated)*		**89.32**	**0.3483**	**44.49**	**0.1913**	**0.1570**	**0.1618**

[a] SNMOCs = speciated nonmethane organic compounds.
[b] RC = residence chamber; DA = dilution air.
[c] compounds for which DA>RC are listed as ND or zero.
[d] ND = not detected.
[e] Total NMOC with unknowns in µg/m³ is an estimate based on propane only.

Table K-2C. SNMOCs[a] Collected in Canisters from Recovery Boiler #5 on Test Day 11/01/01

Compound	CAS No.	Residence Chamber V=3.892L µg/m³	Residence Chamber µg	Dilution Air V=4.291L µg/m³	Dilution Air µg	SNMOC RC-DA[b] µg	SNMOC RC-DA (no negs)[c] µg
ethylene	74-85-1	1.76	0.0069	0.95	0.0041	0.0028	0.0028
acetylene	74-86-2	1.08	0.0042	1.03	0.0044	-0.0002	ND[d]
ethane	74-84-0	3.35	0.0130	2.98	0.0128	0.0003	0.0003
propylene	115-07-01	1.37	0.0053	1.14	0.0049	0.0004	0.0004
propane	74-98-6	5.81	0.0226	5.19	0.0223	0.0003	0.0003
propyne	74-99-7	ND	ND	ND	ND	ND	ND
isobutane	75-28-5	0.43	0.0017	0.22	0.0009	0.0007	0.0007
isobutene/1-butene	115-11-7/106-98-0	0.65	0.0025	0.27	0.0012	0.0014	0.0014
1,3-butadiene	106-99-0	ND	ND	ND	ND	ND	ND
n-butane	106-97-8	0.88	0.0034	0.40	0.0017	0.0017	0.0017
trans-2-butene	624-64-6	0.51	0.0020	0.13	0.0006	0.0014	0.0014
cis-2-butene	590-18-1	0.57	0.0022	0.16	0.0007	0.0015	0.0015
3-methyl-1-butene	563-45-1	ND	ND	ND	ND	ND	ND
isopentane	78-78-4	0.80	0.0031	0.28	0.0012	0.0019	0.0019
1-pentene	109-67-1	0.41	0.0016	0.10	0.0004	0.0012	0.0012
2-methyl-1-butene	563-46-2	ND	ND	ND	ND	ND	ND
n-pentane	109-66-0	0.57	0.0022	0.17	0.0007	0.0015	0.0015
isoprene	78-79-4	0.38	0.0015	0.12	0.0005	0.0010	0.0010
trans-2-pentene	646-04-8	ND	ND	0.12	0.0005	-0.0005	ND
cis-2-pentene	627-20-3	0.69	0.0027	0.16	0.0007	0.0020	0.0020
2-methyl-2-butene	513-35-9	ND	ND	ND	ND	ND	ND
2,2-dimethylbutane	75-83-2	0.97	0.0038	0.23	0.0010	0.0028	0.0028

continued

Table K-2C. (continued)

Compound	CAS No.	Residence Chamber V=3.892L µg/m³	Residence Chamber µg	Dilution Air V=4.291L µg/m³	Dilution Air µg	SNMOC RC-DA[b] µg	SNMOC RC-DA (no negs)[c] µg
cyclopentene	142-29-0	ND	ND	ND	ND	ND	ND
4-methyl-1-pentene	691-37-2	ND	ND	ND	ND	ND	ND
cyclopentane	287-92-3	0.61	0.0024	0.13	0.0006	0.0018	0.0018
2,3-dimethylbutane	79-29-8	0.91	0.0035	0.24	0.0010	0.0025	0.0025
2-methylpentane	107-83-5	0.35	0.0014	0.26	0.0011	0.0002	0.0002
3-methylpentane	96-14-0	0.92	0.0036	0.21	0.0009	0.0027	0.0027
2-methyl-1-pentene	763-29-1	ND	ND	ND	ND	ND	ND
1-hexene	592-41-6	0.97	0.0038	0.24	0.0010	0.0027	0.0027
2-ethyl-1-butene	760-21-4	ND	ND	ND	ND	ND	ND
n-hexane	110-54-3	0.75	0.0029	0.40	0.0017	0.0012	0.0012
trans-2-hexene	4050-45-7	ND	ND	ND	ND	ND	ND
cis-2-hexene	7688-21-3	ND	ND	ND	ND	ND	ND
methylcyclopentane	96-37-7	0.63	0.0025	0.20	0.0009	0.0016	0.0016
2,4-dimethylpentane	108-08-7	0.68	0.0026	0.17	0.0007	0.0019	0.0019
benzene	71-43-2	1.22	0.0047	0.15	0.0006	0.0041	0.0041
cyclohexane	110-82-7	0.72	0.0028	0.16	0.0007	0.0021	0.0021
2-methylhexane	591-76-4	0.44	0.0017	0.12	0.0005	0.0012	0.0012
2,3-dimethylpentane	565-59-3	1.15	0.0045	0.31	0.0013	0.0031	0.0031
3-methylhexane	589-34-4	0.66	0.0026	0.17	0.0007	0.0018	0.0018
1-heptene	592-76-7	0.61	0.0024	ND	ND	0.0024	0.0024
2,2,4-trimethylpentane	540-84-1	0.52	0.0020	0.15	0.0006	0.0014	0.0014
n-heptane	142-82-5	0.51	0.0020	0.12	0.0005	0.0015	0.0015

continued

Table K-2C. (continued)

Compound	CAS No.	Residence Chamber V=3.892L µg/m³	Residence Chamber µg	Dilution Air V=4.291L µg/m³	Dilution Air µg	SNMOC RC-DA[b] µg	SNMOC RC-DA (no negs)[c] µg
methylcyclohexane	108-87-2	0.60	0.0023	0.16	0.0007	0.0016	0.0016
2,2,3-trimethylpentane	564-02-3	ND	ND	ND	ND	ND	ND
2,3,4-trimethylpentane	565-75-3	0.50	0.0019	0.19	0.0008	0.0011	0.0011
toluene	108-88-3	0.78	0.0030	0.17	0.0007	0.0023	0.0023
2-methylheptane	592-27-8	0.42	0.0016	0.09	0.0004	0.0012	0.0012
3-methylheptane	589-81-1	0.45	0.0018	0.11	0.0005	0.0013	0.0013
1-octene	111-66-0	ND	ND	ND	ND	ND	ND
n-octane	111-65-9	0.52	0.0020	0.14	0.0006	0.0014	0.0014
ethylbenzene	100-41-4	0.37	0.0014	0.09	0.0004	0.0011	0.0011
m-xylene/*p*-xylene	108-38-3/106-42-3	0.60	0.0023	0.11	0.0005	0.0019	0.0019
styrene	100-42-5	ND	ND	0.10	0.0004	-0.0004	ND
o-xylene	95-47-6	0.60	0.0023	0.10	0.0004	0.0019	0.0019
1-nonene	124-11-8	ND	ND	ND	ND	ND	ND
n-nonane	111-84-2	0.37	0.0014	0.10	0.0004	0.0010	0.0010
isopropylbenzene	98-82-8	0.56	0.0022	0.09	0.0004	0.0018	0.0018
alpha-pinene	80-56-8	ND	ND	ND	ND	ND	ND
n-propylbenzene	103-65-1	0.35	0.0014	ND	ND	0.0014	0.0014
m-ethyltoluene	620-14-4	0.29	0.0011	0.08	0.0003	0.0008	0.0008
p-ethyltoluene	622-96-8	0.44	0.0017	0.11	0.0005	0.0012	0.0012
1,3,5-trimethylbenzene	108-67-8	0.28	0.0011	0.10	0.0004	0.0007	0.0007
o-ethyltoluene	611-14-3	0.39	0.0015	0.07	0.0003	0.0012	0.0012
beta-pinene	127-91-3	ND	ND	ND	ND	ND	ND

continued

Table K-2C. (concluded)

Compound	CAS No.	Residence Chamber V=3.892L µg/m³	Residence Chamber µg	Dilution Air V=4.291L µg/m³	Dilution Air µg	SNMOC RC-DA[b] µg	SNMOC RC-DA (no negs)[c] µg
1,2,4-trimethylbenzene	95-63-6	0.46	0.0018	0.12	0.0005	0.0013	0.0013
1-decene	872-05-9	ND	ND	ND	ND	ND	ND
n-decane	124-18-5	0.41	0.0016	0.20	0.0009	0.0007	0.0007
1,2,3-trimethylbenzene	526-73-8	ND	ND	0.07	0.0003	-0.0003	ND
m-diethylbenzene	141-93-5	0.41	0.0016	0.10	0.0004	0.0012	0.0012
p-diethylbenzene	105-05-5	ND	ND	ND	ND	ND	ND
1-undecene	821-95-4	ND	ND	ND	ND	ND	ND
n-undecane	1120-21-4	0.38	0.0015	0.54	0.0023	-0.0008	ND
1-dodecene	112-41-4	ND	ND	ND	ND	ND	ND
n-dodecane	112-40-3	ND	ND	0.45	0.0019	-0.0019	ND
1-tridecene	2437-56-1	ND	ND	ND	ND	ND	ND
n-tridecane	629-50-5	ND	ND	ND	ND	ND	ND
Total Speciated		**41.06**	**0.1598**	**19.97**	**0.0857**	**0.0741**	**0.0783**
Total Unspeciated		**48.51**	**0.1888**	**22.46**	**0.0964**	**0.0924**	**0.0924**
Total (speciated + unspeciated)[e]		**89.57**	**0.3486**	**42.43**	**0.1821**	**0.1665**	**0.1708**

[a] SNMOCs = speciated nonmethane organic compounds.
[b] RC = residence chamber; DA = dilution air.
[c] compounds for which DA>RC are listed as ND or zero.
[d] ND = not detected.
[e] Total NMOC with unknowns in µg/m³ is an estimate based on propane only.

Table K-3. Summary of SNMOCs[a] Collected in Canisters from Recovery Boiler #5 for Tests 10/30/01 through 11/01/01

Compound	CAS No.	No Negs[b] SNMOC RC-DA[c] 10/30/01 µg	No Negs SNMOC RC-DA 10/31/01 µg	No Negs SNMOC RC-DA 11/01/01 µg
ethylene	74-85-1	0.0033	0.0023	0.0028
acetylene	74-86-2	0.0078	0.0004	ND[d]
ethane	74-84-0	0.0020	ND	0.0003
propylene	115-07-1	0.0017	0.0009	0.0004
propane	74-98-6	0.0024	0.0009	0.0003
propyne	74-99-7	ND	ND	ND
isobutane	75-28-5	0.0012	0.0010	0.0007
isobutene/1-butene	115-11-7/106-98-0	0.0010	0.0018	0.0014
1,3-butadiene	106-99-0	ND	ND	ND
n-butane	106-97-8	0.0024	0.0020	0.0017
trans-2-butene	624-64-6	0.0014	0.0013	0.0014
cis-2-butene	590-18-1	0.0019	0.0016	0.0015
3-methyl-1-butene	563-45-1	ND	ND	ND
isopentane	78-78-4	0.0023	0.0022	0.0019
1-pentene	109-67-1	0.0014	0.0011	0.0012
2-methyl-1-butene	563-46-2	ND	ND	ND
n-pentane	109-66-0	0.0016	0.0011	0.0015
isoprene	78-79-4	0.0013	0.0008	0.0010
trans-2-pentene	646-04-8	ND	ND	ND
cis-2-pentene	627-20-3	0.0017	0.0015	0.0020
2-methyl-2-butene	513-35-9	ND	ND	ND
2,2-dimethylbutane	75-83-2	0.0022	0.0031	0.0028
cyclopentene	142-29-0	ND	ND	ND
4-methyl-1-pentene	691-37-2	ND	ND	ND
cyclopentane	287-92-3	0.0016	0.0015	0.0018
2,3-dimethylbutane	79-29-8	0.0028	0.0025	0.0025
2-methylpentane	107-83-5	0.0048	0.0046	0.0002
3-methylpentane	96-14-0	0.0023	0.0021	0.0027
2-methyl-1-pentene	763-29-1	ND	ND	ND
1-hexene	592-41-6	0.0031	0.0027	0.0027
2-ethyl-1-butene	760-21-4	ND	ND	ND
n-hexane	110-54-3	0.0021	0.0016	0.0012
trans-2-hexene	4050-45-7	ND	ND	ND

continued

Table K-3. (continued)

Compound	CAS No.	No Negs[b] SNMOC RC-DA[c] 10/30/01 µg	No Negs SNMOC RC-DA 10/31/01 µg	No Negs SNMOC RC-DA 11/01/01 µg
cis-2-hexene	7688-21-3	ND	ND	ND
methylcyclopentane	96-37-7	0.0018	0.0015	0.0016
2,4-dimethylpentane	108-08-7	0.0020	0.0016	0.0019
benzene	71-43-2	0.0020	0.0035	0.0041
cyclohexane	110-82-7	0.0016	0.0020	0.0021
2-methylhexane	591-76-4	0.0012	0.0011	0.0012
2,3-dimethylpentane	565-59-3	0.0035	0.0029	0.0031
3-methylhexane	589-34-4	0.0026	0.0010	0.0018
1-heptene	592-76-7	ND	0.0016	0.0024
2,2,4-trimethylpentane	540-84-1	0.0025	0.0020	0.0014
n-heptane	142-82-5	0.0015	0.0014	0.0015
methylcyclohexane	108-87-2	0.0022	0.0015	0.0016
2,2,3-trimethylpentane	564-02-3	ND	ND	ND
2,3,4-trimethylpentane	565-75-3	0.0015	0.0014	0.0011
toluene	108-88-3	0.0023	0.0022	0.0023
2-methylheptane	592-27-8	0.0012	0.0012	0.0012
3-methylheptane	589-81-1	0.0014	0.0013	0.0013
1-octene	111-66-0	ND	ND	ND
n-octane	111-65-9	0.0018	0.0011	0.0014
ethylbenzene	100-41-4	0.0012	0.0010	0.0011
m-xylene/*p*-xylene	108-38-3/106-42-3	0.0016	ND	0.0019
styrene	100-42-5	ND	ND	ND
o-xylene	95-47-6	0.0012	0.0014	0.0019
1-nonene	124-11-8	ND	ND	ND
n-nonane	111-84-2	0.0009	0.0011	0.0010
isopropylbenzene	98-82-8	0.0017	0.0015	0.0018
alpha-pinene	80-56-8	ND	ND	ND
n-propylbenzene	103-65-1	0.0010	0.0011	0.0014
m-ethyltoluene	620-14-4	0.0009	0.0009	0.0008
p-ethyltoluene	622-96-8	0.0017	0.0019	0.0012
1,3,5-trimethylbenzene	108-67-8	0.0010	0.0007	0.0007
o-ethyltoluene	611-14-3	0.0013	0.0013	0.0012
beta-pinene	127-91-3	0.0012	ND	ND
1,2,4-trimethylbenzene	95-63-6	0.0012	0.0009	0.0013

continued

Table K-3. (concluded)

Compound	CAS No.	No Negs[b] SNMOC RC-DA[c] 10/30/01 µg	No Negs SNMOC RC-DA 10/31/01 µg	No Negs SNMOC RC-DA 11/01/01 µg
1-decene	872-05-9	ND	ND	ND
n-decane	124-18-5	0.0011	0.0009	0.0007
1,2,3-trimethylbenzene	526-73-8	ND	ND	ND
m-diethylbenzene	141-93-5	0.0011	ND	0.0012
p-diethylbenzene	105-05-5	ND	ND	ND
1-undecene	821-95-4	ND	ND	ND
n-undecane	1120-21-4	0.0012	0.0007	ND
1-dodecene	112-41-4	ND	ND	ND
n-dodecane	112-40-3	ND	ND	ND
1-tridecene	2437-56-1	ND	ND	ND
n-tridecane	629-50-5	ND	ND	ND
Total Speciated		**0.0997**	**0.0778**	**0.0783**
Total Unspeciated		**0.1093**	**0.0841**	**0.0924**
Total (speciated + unspeciated)[e]		**0.2090**	**0.1618**	**0.1708**

[a] SNMOCs = speciated nonmethane organic compounds.
[b] compounds for which DA>RC are listed as ND or zero.
[c] RC = residence chamber; DA = dilution air.
[d] ND = not detected.
[e] Total NMOC with unknowns in $\mu g/m^3$ is an estimate based on propane only.

Table K-4A. Total SNMOCs[a] Collected from Recovery Boiler #5 on Test Day 10/30/01

Compound	CAS No.	Residence Chamber Canister (V=3.920L) µg/m³	Residence Chamber Total Collected µg	Dilution Air Canister (V=3.920L) µg/m³	Dilution Air Total Collected µg	RC-DA[b] µg	RC-DA (no negs)[c] µg
ethylene	74-85-1	2.23	948.5621	1.38	573.5213	375.0408	375.0408
acetylene	74-86-2	2.99	1271.8389	1.01	419.7511	852.0878	852.0878
ethane	74-84-0	6.31	2684.0480	5.8	2410.4520	273.5960	273.5960
propylene	115-07-1	0.94	399.8423	0.5	207.7976	192.0447	192.0448
propane	74-98-6	3.01	1280.3462	2.39	993.2725	287.0737	287.0737
propyne	74-99-7	ND[d]	ND	ND	ND	ND	ND
isobutane	75-28-5	0.5	212.6821	0.19	78.9631	133.7190	133.7190
isobutene/1-butene	115-11-7/106-98-0	0.5	212.6821	0.24	99.7428	112.9393	112.9393
1,3-butadiene	106-99-0	ND	ND	ND	ND	ND	ND
n-butane	106-97-8	0.94	399.8423	0.32	132.9905	266.8519	266.8519
trans-2-butene	624-64-6	0.46	195.6675	0.11	45.7155	149.9521	149.9521
cis-2-butene	590-18-1	0.64	272.2331	0.16	66.4952	205.7379	205.7379
3-methyl-1-butene	563-45-1	ND	ND	ND	ND	ND	ND
isopentane	78-78-4	0.85	361.5596	0.26	108.0547	253.5048	253.5048
1-pentene	109-67-1	0.49	208.4285	0.13	54.0274	154.4011	154.4011
2-methyl-1-butene	563-46-2	ND	0.0000	0.65	270.1369	-270.1369	ND
n-pentane	109-66-0	0.57	242.4576	0.16	66.4952	175.9624	175.9624
isoprene	78-79-4	0.43	182.9066	0.11	45.7155	137.1911	137.1911
trans-2-pentene	646-04-8	ND	ND	0.43	178.7059	-178.7059	ND
cis-2-pentene	627-20-3	0.61	259.4722	0.18	74.8071	184.6650	184.6650
2-methyl-2-butene	513-35-9	ND	ND	ND	ND	ND	ND

continued

Table K-4A. (continued)

Compound	CAS No.	Residence Chamber Canister (V=3.920L) µg/m³	Residence Chamber Total Collected µg	Dilution Air Canister (V=3.920L) µg/m³	Dilution Air Total Collected µg	RC-DA[b] µg	RC-DA (no negs)[c] µg
2,2-dimethylbutane	75-83-2	0.84	357.3059	0.27	112.2107	245.0952	245.0952
cyclopentene	142-29-0	ND	ND	ND	ND	ND	ND
4-methyl-1-pentene	691-37-2	ND	ND	ND	ND	ND	ND
cyclopentane	287-92-3	0.6	255.2185	0.2	83.1190	172.0995	172.0995
2,3-dimethylbutane	79-29-8	0.98	416.8569	0.27	112.2107	304.6462	304.6462
2-methylpentane	107-83-5	1.43	608.2708	0.21	87.2750	520.9958	520.9958
3-methylpentane	96-14-0	0.82	348.7986	0.23	95.5869	253.2117	253.2117
2-methyl-1-pentene	763-29-1	ND	ND	ND	ND	ND	ND
1-hexene	592-41-6	1.04	442.3788	0.26	108.0547	334.3240	334.3240
2-ethyl-1-butene	760-21-4	ND	ND	ND	ND	ND	ND
n-hexane	110-54-3	0.73	310.5159	0.19	78.9631	231.5528	231.5528
trans-2-hexene	4050-45-7	ND	ND	ND	ND	ND	ND
cis-2-hexene	7688-21-3	ND	ND	ND	ND	ND	ND
methylcyclopentane	96-37-7	0.63	267.9794	0.16	66.4952	201.4842	201.4842
2,4-dimethylpentane	108-08-7	0.67	284.9940	0.16	66.4952	218.4988	218.4988
benzene	71-43-2	0.68	289.2476	0.16	66.4952	222.7524	222.7524
cyclohexane	110-82-7	0.62	263.7258	0.22	91.4309	172.2949	172.2949
2-methylhexane	591-76-4	0.43	182.9066	0.13	54.0274	128.8792	128.8792
2,3-dimethylpentane	565-59-3	1.19	506.1834	0.29	120.5226	385.6608	385.6608
3-methylhexane	589-34-4	0.75	319.0231	0.08	33.2476	285.7755	285.7755
1-heptene	592-76-7	ND	ND	ND	ND	ND	ND
2,2,4-trimethylpentane	540-84-1	0.81	344.5450	0.16	66.4952	278.0498	278.0498

continued

Table K-4A. (continued)

Compound	CAS No.	Residence Chamber Canister (V=3.920L) µg/m³	Residence Chamber Total Collected µg	Dilution Air Canister (V=3.920L) µg/m³	Dilution Air Total Collected µg	RC-DA[b] µg	RC-DA (no negs)[c] µg
n-heptane	142-82-5	0.51	216.9357	0.12	49.8714	167.0643	167.0643
methylcyclohexane	108-87-2	0.72	306.2622	0.16	66.4952	239.7670	239.7670
2,2,3-trimethylpentane	564-02-3	ND	ND	ND	ND	ND	ND
2,3,4-trimethylpentane	565-75-3	0.51	216.9357	0.13	54.0274	162.9084	162.9084
toluene	108-88-3	0.84	357.3059	0.25	103.8988	253.4071	253.4071
2-methylheptane	592-27-8	0.42	178.6530	0.11	45.7155	132.9375	132.9375
3-methylheptane	589-81-1	0.47	199.9212	0.12	49.8714	150.0497	150.0498
1-octene	111-66-0	ND	ND	ND	ND	ND	ND
n-octane	111-65-9	0.56	238.2039	0.11	45.7155	192.4885	192.4885
ethylbenzene	100-41-4	0.39	165.8920	0.09	37.4036	128.4885	128.4885
m-xylene/*p*-xylene	108-38-3/106-42-3	0.57	242.4576	0.16	66.4952	175.9624	175.9624
styrene	100-42-5	ND	ND	0.08	33.2476	-33.2476	ND
o-xylene	95-47-6	0.42	178.6530	0.12	49.8714	128.7815	128.7815
1-nonene	124-11-8	ND	ND	ND	ND	ND	ND
n-nonane	111-84-2	0.35	148.8775	0.11	45.7155	103.1620	103.1620
isopropylbenzene	98-82-8	0.55	233.9503	0.11	45.7155	188.2348	188.2348
alpha-pinene	80-56-8	ND	ND	0.25	103.8988	-103.8988	ND
n-propylbenzene	103-65-1	0.34	144.6238	0.09	37.4036	107.2203	107.2203
m-ethyltoluene	620-14-4	0.32	136.1165	0.1	41.5595	94.5570	94.5570
p-ethyltoluene	622-96-8	0.57	242.4576	0.13	54.0274	188.4302	188.4302
1,3,5-trimethylbenzene	108-67-8	0.33	140.3702	0.07	29.0917	111.2785	111.2785
o-ethyltoluene	611-14-3	0.41	174.3993	0.09	37.4036	136.9958	136.9958

continued

Table K-4A. (concluded)

Compound	CAS No.	Residence Chamber Canister (V=3.920L) µg/m³	Residence Chamber Total Collected µg	Dilution Air Canister (V=3.920L) µg/m³	Dilution Air Total Collected µg	RC-DA[b] µg	RC-DA (no negs)[c] µg
beta-pinene	127-91-3	0.46	195.6675	0.16	66.4952	129.1723	129.1723
1,2,4-trimethylbenzene	95-63-6	0.45	191.4139	0.15	62.3393	129.0746	129.0746
1-decene	872-05-9	ND	ND	ND	ND	ND	ND
n-decane	124-18-5	0.44	187.1602	0.16	66.4952	120.6650	120.6650
1,2,3-trimethylbenzene	526-73-8	ND	ND	ND	ND	ND	ND
m-diethylbenzene	141-93-5	0.36	153.1311	0.07	29.0917	124.0394	124.0395
p-diethylbenzene	105-05-5	ND	ND	ND	ND	ND	ND
1-undecene	821-95-4	ND	ND	ND	ND	ND	ND
n-undecane	1120-21-4	0.59	250.9649	0.29	120.5226	130.4423	130.4423
1-dodecene	112-41-4	ND	ND	ND	ND	ND	ND
n-dodecane	112-40-3	0.55	233.9503	0.63	261.8250	-27.8747	0.0000
1-tridecene	2437-56-1	ND	ND	ND	ND	ND	ND
n-tridecane	629-50-5	ND	ND	ND	ND	ND	ND
Total Speciated		**44.82**	**19,064.8230**	**20.87**	**8,673.4714**	**10,391.3516**	**11,005.2150**
Total Unspeciated		**51**	**21,693.5737**	**23.12**	**9,608.5606**	**12,085.0131**	**12,085.0130**
Total (speciated + unspeciated)[e]		**95.82**	**40,758.3967**	**43.99**	**18,282.0320**	**22,476.3647**	**23,090.2290**

[a] SNMOCs = speciated nonmethane organic compounds.
[b] RC = residence chamber; DA = dilution air.
[c] compounds for which DA>RC are listed as ND or zero.
[d] ND = not detected.
[e] Total NMOC with unknowns in µg/m³ is an estimate based on propane only.

Table K-4B. Total SNMOCs[a] Collected from Recovery Boiler #5 on Test Day 10/31/01

Compound	CAS No.	Residence Chamber Canister V=3.9L µg/m³	Residence Chamber Total Collected µg	Dilution Air Canister V=4.3L µg/m³	Dilution Air Total Collected µg	RC-DA[b] µg	RC-DA (no negs)[c] µg
ethylene	74-85-1	2.84	1197.2507	2.03	837.3835	359.8672	359.8672
acetylene	74-86-2	0.91	383.6261	0.73	301.1281	82.4981	82.4981
ethane	74-84-0	7.59	3199.6946	7.41	3056.6560	143.0387	143.0387
propylene	115-07-1	1.01	425.7828	0.7	288.7529	137.0299	137.0299
propane	74-98-6	3.49	1471.2693	2.95	1216.8873	254.3820	254.3820
propyne	74-99-7	ND[d]	ND	ND	ND	ND	ND
isobutane	75-28-5	0.50	210.7836	0.23	94.8760	115.9076	115.9076
isobutene/1-butene	115-11-7/106-98-0	0.73	307.7440	0.25	103.1260	204.6180	204.6180
1,3-butadiene	106-99-0	ND	ND	ND	ND	ND	ND
n-butane	106-97-8	0.91	383.6261	0.36	148.5015	235.1246	235.1246
trans-2-butene	624-64-6	0.47	198.1366	0.13	53.6255	144.5110	144.5110
cis-2-butene	590-18-1	0.61	257.1560	0.19	78.3758	178.7802	178.7802
3-methyl-1-butene	563-45-1	ND	ND	ND	ND	ND	ND
isopentane	78-78-4	0.82	345.6851	0.24	99.0010	246.6841	246.6841
1-pentene	109-67-1	0.43	181.2739	0.13	53.6255	127.6483	127.6483
2-methyl-1-butene	563-46-2	ND	ND	ND	ND	ND	ND
n-pentane	109-66-0	0.47	198.1366	0.17	70.1257	128.0108	128.0108
isoprene	78-79-4	0.35	147.5485	0.12	49.5005	98.0480	98.0480
trans-2-pentene	646-04-8	ND	ND	0.12	49.5005	-49.5005	ND
cis-2-pentene	627-20-3	0.57	240.2933	0.16	66.0007	174.2926	174.2926
2-methyl-2-butene	513-35-9	ND	ND	ND	ND	ND	ND

continued

Table K-4B. (continued)

Compound	CAS No.	Residence Chamber Canister V=3.9L µg/m³	Residence Chamber Total Collected µg	Dilution Air Canister V=4.3L µg/m³	Dilution Air Total Collected µg	RC-DA[b] µg	RC-DA (no negs)[c] µg
2,2-dimethylbutane	75-83-2	1.01	425.7828	0.2	82.5008	343.2820	343.2820
cyclopentene	142-29-0	ND	ND	ND	ND	ND	ND
4-methyl-1-pentene	691-37-2	ND	ND	ND	ND	ND	ND
cyclopentane	287-92-3	0.5	210.7836	0.11	45.3755	165.4081	165.4081
2,3-dimethylbutane	79-29-8	0.92	387.8418	0.25	103.1260	284.7157	284.7157
2-methylpentane	107-83-5	1.32	556.4686	0.12	49.5005	506.9681	506.9681
3-methylpentane	96-14-0	0.77	324.6067	0.21	86.6259	237.9808	237.9808
2-methyl-1-pen-tene	763-29-1	ND	ND	ND	ND	ND	ND
1-hexene	592-41-6	0.95	400.4888	0.23	94.8760	305.6128	305.6128
2-ethyl-1-butene	760-21-4	ND	ND	ND	ND	ND	ND
n-hexane	110-54-3	0.6	252.9403	0.17	70.1257	182.8146	182.8146
trans-2-hexene	4050-45-7	ND	ND	ND	ND	ND	ND
cis-2-hexene	7688-21-3	ND	ND	ND	ND	ND	ND
methylcyclopen-tane	96-37-7	0.52	219.2149	0.13	53.6255	165.5894	165.5894
2,4-dimethylpen-tane	108-08-7	0.61	257.1560	0.17	70.1257	187.0302	187.0302
benzene	71-43-2	1.08	455.2925	0.16	66.0007	389.2918	389.2918
cyclohexane	110-82-7	0.73	307.7440	0.19	78.3758	229.3682	229.3682
2-methylhexane	591-76-4	0.4	168.6269	0.11	45.3755	123.2514	123.2514
2,3-dimethylpen-tane	565-59-3	1.02	429.9985	0.24	99.0010	330.9975	330.9975
3-methylhexane	589-34-4	0.52	219.2149	0.24	99.0010	120.2139	120.2139
1-heptene	592-76-7	0.41	172.8425	0	0.0000	172.8425	172.8425
2,2,4-trimethyl-pentane	540-84-1	0.71	299.3127	0.17	70.1257	229.1870	229.1870

continued

Table K-4B. (continued)

Compound	CAS No.	Residence Chamber Canister V=3.9L µg/m³	Residence Chamber Total Collected µg	Dilution Air Canister V=4.3L µg/m³	Dilution Air Total Collected µg	RC-DA[b] µg	RC-DA (no negs)[c] µg
n-heptane	142-82-5	0.48	202.3522	0.12	49.5005	152.8517	152.8517
methylcyclohex-ane	108-87-2	0.54	227.6463	0.15	61.8756	165.7706	165.7706
2,2,3-trimethyl-pentane	564-02-3	ND	ND	ND	ND	ND	ND
2,3,4-trimethyl-pentane	565-75-3	0.47	198.1366	0.11	45.3755	152.7611	152.7611
toluene	108-88-3	0.66	278.2343	0.09	37.1254	241.1089	241.1089
2-methylheptane	592-27-8	0.4	168.6269	0.09	37.1254	131.5015	131.5015
3-methylheptane	589-81-1	0.44	185.4895	0.09	37.1254	148.3642	148.3642
1-octene	111-66-0	ND	ND	ND	ND	ND	ND
n-octane	111-65-9	0.43	181.2739	0.14	57.7506	123.5233	123.5233
ethylbenzene	100-41-4	0.35	147.5485	0.08	33.0003	114.5482	114.5482
m-xylene/*p*-xylene	108-38-3/106-42-3	ND	ND	0.15	61.8756	-61.8756	ND
styrene	100-42-5	ND	ND	ND	ND	ND	ND
o-xylene	95-47-6	0.45	189.7052	0.08	33.0003	156.7049	156.7049
1-nonene	124-11-8	ND	ND	ND	ND	ND	ND
n-nonane	111-84-2	0.4	168.6269	0.1	41.2504	127.3764	127.3764
isopropylbenzene	98-82-8	0.54	227.6463	0.15	61.8756	165.7706	165.7706
alpha-pinene	80-56-8	ND	ND	ND	ND	ND	ND
n-propylbenzene	103-65-1	0.37	155.9798	0.08	33.0003	122.9795	122.9795
m-ethyltoluene	620-14-4	0.31	130.6858	0.07	28.8753	101.8105	101.8105
p-ethyltoluene	622-96-8	0.61	257.1560	0.1	41.2504	215.9055	215.9055
1,3,5-trimethyl-benzene	108-67-8	0.28	118.0388	0.09	37.1254	80.9134	80.9134
o-ethyltoluene	611-14-3	0.42	177.0582	0.09	37.1254	139.9328	139.9328

continued

Table K-4B. (concluded)

Compound	CAS No.	Residence Chamber Canister V=3.9L µg/m³	Residence Chamber Total Collected µg	Dilution Air Canister V=4.3L µg/m³	Dilution Air Total Collected µg	RC-DA[b] µg	RC-DA (no negs)[c] µg
beta-pinene	127-91-3	ND	ND	ND	ND	ND	ND
1,2,4-trimethyl-benzene	95-63-6	0.36	151.7642	0.12	49.5005	102.2637	102.2637
1-decene	872-05-9	ND	ND	ND	ND	ND	ND
n-decane	124-18-5	0.39	164.4112	0.14	57.7506	106.6606	106.6606
1,2,3-trimethyl-benzene	526-73-8	ND	ND	ND	ND	ND	ND
m-diethylbenzene	141-93-5	ND	ND	0.08	33.0003	-33.0003	ND
p-diethylbenzene	105-05-5	ND	ND	ND	ND	ND	ND
1-undecene	821-95-4	ND	ND	ND	ND	ND	ND
n-undecane	1120-21-4	0.36	151.7642	0.17	70.1257	81.6385	81.6385
1-dodecene	112-41-4	ND	ND	ND	ND	ND	ND
n-dodecane	112-40-3	ND	ND	0.24	99.0010	-99.0010	ND
1-tridecene	2437-56-1	ND	ND	ND	ND	ND	ND
n-tridecane	629-50-5	ND	ND	ND	ND	ND	ND
Total Speciated		**42.03**	**17,718.4672**	**21.15**	**8,724.4634**	**8,994.0038**	**9,237.3812**
Total Unspeciated		**47.29**	**19,935.9104**	**23.34**	**9,627.8476**	**10,308.0628**	**10,308.0628**
Total (speciated + unspeciated)[e]		**89.32**	**37,654.3775**	**44.49**	**18,352.3110**	**19,302.0665**	**19,545.4440**

[a] SNMOCs = speciated nonmethane organic compounds.
[b] RC = residence chamber; DA = dilution air.
[c] compounds for which DA>RC are listed as ND or zero.
[d] ND = not detected.
[e] Total NMOC with unknowns in µg/m³ is an estimate based on propane only.

Table K-4C. Total SNMOCs[a] Collected from Recovery Boiler #5 on Test Day 11/01/01

Compound	CAS No.	Residence Chamber Canister V=3.892L µg/m³	Residence Chamber Total Collected µg	Dilution Air Canister V=4.291L µg/m³	Dilution Air Total Collected µg	RC-DA[b] Total µg	RC-DA (no negs)[c] Total µg
ethylene	74-85-1	1.76	736.2982	0.95	388.8460	347.4520	347.4519
acetylene	74-86-2	1.08	451.8194	1.03	421.5910	30.2280	30.2280
ethane	74-84-0	3.35	1401.4768	2.98	1219.7500	181.7270	181.7271
propylene	115-07-1	1.37	573.1412	1.14	466.6160	106.5260	106.5256
propane	74-98-6	5.81	2430.6209	5.19	2124.3300	306.2920	306.2917
propyne	74-99-7	ND[d]	ND	ND	ND	ND	ND
isobutane	75-28-5	0.43	179.8910	0.22	90.0486	89.8424	89.8424
isobutene/1-butene	115-11-7/106-98-0	0.65	271.9283	0.27	110.5140	161.4140	161.4141
1,3-butadiene	106-99-0	ND	ND	ND	ND	ND	ND
n-butane	106-97-8	0.88	368.1491	0.4	163.7250	204.4240	204.4243
trans-2-butene	624-64-6	0.51	213.3591	0.13	53.2106	160.1490	160.1486
cis-2-butene	590-18-1	0.57	238.4602	0.16	65.4899	172.9700	172.9703
3-methyl-1-butene	563-45-1	ND	ND	ND	ND	ND	ND
isopentane	78-78-4	0.8	334.6810	0.28	114.6070	220.0740	220.0737
1-pentene	109-67-1	0.41	171.5240	0.1	40.9312	130.5930	130.5928
2-methyl-1-butene	563-46-2	ND	ND	ND	ND	ND	ND
n-pentane	109-66-0	0.57	238.4602	0.17	69.5830	168.8770	168.8772
isoprene	78-79-4	0.38	158.9735	0.12	49.1174	109.8560	109.8560
trans-2-pentene	646-04-8	ND	ND	0.12	49.1174	-49.1174	ND
cis-2-pentene	627-20-3	0.69	288.6624	0.16	65.4899	223.1720	223.1725
2-methyl-2-butene	513-35-9	ND	ND	ND	ND	ND	ND
2,2-dimethylbutane	75-83-2	0.97	405.8007	0.23	94.1418	311.6590	311.6590

Table K-4C. (continued)

Compound	CAS No.	Residence Chamber Canister V=3.892L µg/m³	Residence Chamber Total Collected µg	Dilution Air Canister V=4.291L µg/m³	Dilution Air Total Collected µg	RC-DA[b] Total µg	RC-DA (no negs)[c] Total µg
cyclopentene	142-29-0	ND	ND	ND	ND	ND	ND
4-methyl-1-pentene	691-37-2	ND	ND	ND	ND	ND	ND
cyclopentane	287-92-3	0.61	255.1943	0.13	53.2106	201.9840	201.9837
2,3-dimethylbutane	79-29-8	0.91	380.6997	0.24	98.2349	282.4650	282.4648
2-methylpentane	107-83-5	0.35	146.4229	0.26	106.4210	40.0018	40.0018
3-methylpentane	96-14-0	0.92	384.8832	0.21	85.9555	298.9280	298.9277
2-methyl-1-pentene	763-29-1	ND	ND	ND	ND	ND	ND
1-hexene	592-41-6	0.97	405.8007	0.24	98.2349	307.5660	307.5659
2-ethyl-1-butene	760-21-4	ND	ND	ND	ND	ND	ND
n-hexane	110-54-3	0.75	313.7635	0.4	163.7250	150.0390	150.0387
trans-2-hexene	4050-45-7	ND	ND	ND	ND	ND	ND
cis-2-hexene	7688-21-3	ND	ND	ND	ND	ND	ND
methylcyclopentane	96-37-7	0.63	263.5613	0.2	81.8624	181.6990	181.6989
2,4-dimethylpentane	108-08-7	0.68	284.4789	0.17	69.5830	214.8960	214.8958
benzene	71-43-2	1.22	510.3885	0.15	61.3968	448.9920	448.9918
cyclohexane	110-82-7	0.72	301.2129	0.16	65.4899	235.7230	235.7230
2-methylhexane	591-76-4	0.44	184.0746	0.12	49.1174	134.9570	134.9571
2,3-dimethylpentane	565-59-3	1.15	481.1040	0.31	126.8870	354.2170	354.2172
3-methylhexane	589-34-4	0.66	276.1118	0.17	69.5830	206.5290	206.5288
1-heptene	592-76-7	0.61	255.1943	ND	ND	255.1940	255.1943
2,2,4-trimethylpentane	540-84-1	0.52	217.5427	0.15	61.3968	156.1460	156.1459
n-heptane	142-82-5	0.51	213.3591	0.12	49.1174	164.2420	164.2417

continued

Table K-4C. (continued)

Compound	CAS No.	Residence Chamber Canister V=3.892L µg/m³	Residence Chamber Total Collected µg	Dilution Air Canister V=4.291L µg/m³	Dilution Air Total Collected µg	RC-DA[b] Total µg	RC-DA (no negs)[c] Total µg
methylcyclohexane	108-87-2	0.6	251.0108	0.16	65.4899	185.5210	185.5208
2,2,3-trimethylpentane	564-02-3	ND	ND	ND	ND	ND	ND
2,3,4-trimethylpentane	565-75-3	0.50	209.1756	0.19	77.7693	131.4060	131.4064
toluene	108-88-3	0.78	326.3140	0.17	69.5830	256.7310	256.7310
2-methylheptane	592-27-8	0.42	175.7075	0.09	36.8381	138.8690	138.8695
3-methylheptane	589-81-1	0.45	188.2581	0.11	45.0243	143.2340	143.2338
1-octene	111-66-0	0	0.0000	0	0.0000	0.0000	0.0000
n-octane	111-65-9	0.52	217.5427	0.14	57.3037	160.2390	160.2390
ethylbenzene	100-41-4	0.37	154.7900	0.09	36.8381	117.9520	117.9519
m-xylene/*p*-xylene	108-38-3/106-42-3	0.6	251.0108	0.11	45.0243	205.9860	205.9864
styrene	100-42-5	ND	ND	0.1	40.9312	-40.9312	ND
o-xylene	95-47-6	0.6	251.0108	0.1	40.9312	210.0800	210.0796
1-nonene	124-11-8	ND	ND	ND	ND	ND	ND
n-nonane	111-84-2	0.37	154.7900	0.1	40.9312	113.8590	113.8588
isopropylbenzene	98-82-8	0.56	234.2767	0.09	36.8381	197.4390	197.4386
alpha-pinene	80-56-8	ND	ND	ND	ND	ND	ND
n-propylbenzene	103-65-1	0.35	146.4229	ND	ND	146.4230	146.4229
m-ethyltoluene	620-14-4	0.29	121.3219	0.08	32.7450	88.5769	88.5769
p-ethyltoluene	622-96-8	0.44	184.0746	0.11	45.0243	139.0500	139.0502
1,3,5-trimethylbenzene	108-67-8	0.28	117.1384	0.1	40.9312	76.2072	76.2072
o-ethyltoluene	611-14-3	0.39	163.1570	0.07	28.6518	134.5050	134.5052
beta-pinene	127-91-3	ND	ND	ND	ND	ND	ND

continued

Table K-4C. (concluded)

Compound	CAS No.	Residence Chamber Canister V=3.892L µg/m³	Residence Chamber Total Collected µg	Dilution Air Canister V=4.291L µg/m³	Dilution Air Total Collected µg	RC-DA[b] Total µg	RC-DA (no negs)[c] Total µg
1,2,4-trimethylbenzene	95-63-6	0.46	192.4416	0.12	49.1174	143.3240	143.3241
1-decene	872-05-9	ND	ND	ND	ND	ND	ND
n-decane	124-18-5	0.41	171.5240	0.2	81.8624	89.6616	89.6616
1,2,3-trimethylbenzene	526-73-8	ND	ND	0.07	28.6518	-28.6518	ND
m-diethylbenzene	141-93-5	0.41	171.5240	0.1	40.9312	130.5930	130.5928
p-diethylbenzene	105-05-5	ND	ND	ND	ND	ND	ND
1-undecene	821-95-4	ND	ND	ND	ND	ND	ND
n-undecane	1120-21-4	0.38	158.9735	0.54	221.0280	-62.0550	0.0000
1-dodecene	112-41-4	ND	ND	ND	ND	ND	ND
n-dodecane	112-40-3	ND	ND	0.45	184.1900	-184.1900	ND
1-tridecene	2437-56-1	ND	ND	ND	ND	ND	ND
n-tridecane	629-50-5	ND	ND	ND	ND	ND	ND
Total Speciated		**41.06**	**17,177.5031**	**19.97**	**8,173.9600**	**9,003.5400**	**9,368.4890**
Total Unspeciated		**48.51**	**20,294.2201**	**22.46**	**9,193.1500**	**11,101.1000**	**11,101.0700**
Total (speciated + unspeciated)[e]		**89.57**	**37,471.7233**	**42.43**	**17,367.1000**	**20,104.6000**	**20,469.5600**

[a] SNMOCs = speciated nonmethane organic compounds.
[b] RC = residence chamber; DA = dilution air.
[c] compounds for which DA>RC are listed as ND or zero.
[d] ND = not detected.
[e] Total NMOC with unknowns in µg/m³ is an estimate based on propane only.

Table K-5A. SNMOC[a] Values for 10/30/01 in SPECIATE Format

Compound	CAS No.	RC-DA[b] µg	Uncertainty µg	RC-DA % Total	Uncertainty % Total
ethylene	74-85-1	375.0408	11.4297	1.6242	0.0495
acetylene	74-86-2	852.0878	10.5505	3.6903	0.0457
ethane	74-84-0	273.5960	9.5736	1.1849	0.0415
propylene	115-07-1	192.0447	6.0568	0.8317	0.0262
propane	74-98-6	287.0737	10.7459	1.2433	0.0465
propyne	74-99-7	ND[c]	9.7690	ND	
isobutane	75-28-5	133.7190	5.4706	0.5791	0.0237
isobutene/1-butene	115-11-7/106-98-0	112.9393	3.5168	0.4891	0.0152
1,3-butadiene	106-99-0	ND	5.1776	ND	ND
n-butane	106-97-8	266.8519	9.8667	1.1557	0.0427
trans-2-butene	624-64-6	149.9521	6.3499	0.6494	0.0275
cis-2-butene	590-18-1	205.7379	9.4759	0.8910	0.0410
3-methyl-1-butene	563-45-1	ND	13.7743	ND	ND
isopentane	78-78-4	253.5048	14.1651	1.0979	0.0613
1-pentene	109-67-1	154.4011	7.9129	0.6687	0.0343
2-methyl-1-butene	563-46-2	0.0000	7.9129	0.0000	0.0000
n-pentane	109-66-0	175.9624	9.8667	0.7621	0.0427
isoprene	78-79-4	137.1911	1.1723	0.5942	ND
trans-2-pentene	646-04-8	ND	8.0106	ND	ND
cis-2-pentene	627-20-3	184.6650	11.8205	0.7998	0.0512
2-methyl-2-butene	513-35-9	ND	11.4297	ND	ND
2,2-dimethylbutane	75-83-2	245.0952	14.4581	1.0615	0.0626
cyclopentene	142-29-0	ND	13.6766	ND	ND
4-methyl-1-pentene	691-37-2	ND	14.0674	ND	ND
cyclopentane	287-92-3	172.0995	6.7406	0.7453	0.0292
2,3-dimethylbutane	79-29-8	304.6462	16.7050	1.3194	0.0000
2-methylpentane	107-83-5	520.9958	7.7175	2.2563	0.0334
3-methylpentane	96-14-0	253.2117	14.7512	1.0966	0.0639
2-methyl-1-pentene	763-29-1	ND	14.7512	ND	ND
1-hexene	592-41-6	334.3240	14.9466	1.4479	0.0647
2-ethyl-1-butene	760-21-4	ND	14.6535	ND	ND
n-hexane	110-54-3	231.5528	11.3320	1.0028	0.0491
trans-2-hexene	4050-45-7	ND	11.3320	ND	ND
cis-2-hexene	7688-21-3	ND	11.3320	ND	ND
methylcyclopentane	96-37-7	201.4842	9.3782	0.8726	0.0406
2,4-dimethylpentane	108-08-7	218.4988	11.7228	0.9463	0.0508

continued

Table K-5A. (continued)

Compound	CAS No.	RC-DA[b] µg	Uncertainty µg	RC-DA % Total	Uncertainty % Total
benzene	71-43-2	222.7524	7.4244	0.9647	0.0322
cyclohexane	110-82-7	172.2949	16.6073	0.7462	ND
2-methylhexane	591-76-4	128.8792	1.9538	0.5582	0.0085
2,3-dimethylpentane	565-59-3	385.6608	9.7690	1.6702	0.0423
3-methylhexane	589-34-4	285.7755	8.2060	1.2376	ND
1-heptene	592-76-7	ND	8.1083	ND	ND
2,2,4-trimethylpentane	540-84-1	278.0498	9.8667	1.2042	0.0427
n-heptane	142-82-5	167.0643	4.9822	0.7235	0.0216
methylcyclohexane	108-87-2	239.7670	9.4759	1.0384	0.0410
2,2,3-trimethylpentane	564-02-3	ND	9.8667	ND	ND
2,3,4-trimethylpentane	565-75-3	162.9084	6.8383	0.7055	0.0296
toluene	108-88-3	253.4071	3.9076	1.0975	0.0169
2-methylheptane	592-27-8	132.9375	3.8099	0.5757	ND
3-methylheptane	589-81-1	150.0497	3.7122	0.6498	0.0161
1-octene	111-66-0	ND	3.6145	ND	ND
n-octane	111-65-9	192.4885	1.9538	0.8336	0.0085
ethylbenzene	100-41-4	128.4885	2.6376	0.5565	ND
m-xylene/*p*-xylene	108-38-3/106-42-3	175.9624	4.1030	0.7621	ND
styrene	100-42-5	ND	6.7406	ND	ND
o-xylene	95-47-6	128.7815	2.6376	0.5577	0.0114
1-nonene	124-11-8	ND	2.0515	ND	ND
n-nonane	111-84-2	103.1620	2.0515	0.4468	0.0089
isopropylbenzene	98-82-8	188.2348	3.9076	0.8152	ND
alpha-pinene	80-56-8	ND	2.0515	ND	ND
n-propylbenzene	103-65-1	107.2203	1.9538	0.4644	0.0085
m-ethyltoluene	620-14-4	94.5570	4.4937	0.4095	0.0195
p-ethyltoluene	622-96-8	188.4302	5.1776	0.8161	0.0224
1,3,5-trimethylbenzene	108-67-8	111.2785	2.8330	0.4819	0.0123
o-ethyltoluene	611-14-3	136.9958	3.0284	0.5933	0.0131
beta-pinene	127-91-3	129.1723	2.0515	0.5594	ND
1,2,4-trimethylbenzene	95-63-6	129.0746	2.8330	0.5590	0.0123
1-decene	872-05-9	ND	2.1492	ND	ND
n-decane	124-18-5	120.6650	2.1492	0.5226	ND
1,2,3-trimethylbenzene	526-73-8	ND	2.3446	ND	ND
m-diethylbenzene	141-93-5	124.0394	1.2700	0.5372	0.0055
p-diethylbenzene	105-05-5	ND	1.4654	ND	ND

continued

Table K-5A. (concluded)

Compound	CAS No.	RC-DA[b] µg	Uncertainty µg	RC-DA % Total	Uncertainty % Total
1-undecene	821-95-4	ND	1.8561	ND	ND
n-undecane	1120-21-4	130.4423	1.8561	0.5649	0.0080
1-dodecene	112-41-4	ND	4.1030	ND	ND
n-dodecane	112-40-3	ND	4.2007	ND	ND
1-tridecene	2437-56-1	ND	4.1030	ND	ND
n-tridecane	629-50-5	ND	4.2007		ND
Total Speciated		**11,005.22**			
Total Unspeciated		**12,085.01**			
Total (speciated + unspeciated)[d]		**23,090.23**			

[a] SNMOC = speciated nonmethane organic compound.
[b] RC = residence chamber; DA = dilution air.
[c] ND = not detected.
[d] Total NMOC with unknowns in $\mu g/m^3$ is an estimate based on propane only.

Table K-5B. SNMOC[a] Values for 10/31/01 in SPECIATE Format

Compound	CAS No.	RC-DA[b] µg	Uncertainty µg	RC-DA % Total	Uncertainty % Total
ethylene	74-85-1	359.8672	10.6037	1.8412	0.0543
acetylene	74-86-2	82.4981	9.7880	0.4221	0.0501
ethane	74-84-0	143.0387	8.8817	0.7318	0.0454
propylene	115-07-1	137.0299	5.6190	0.7011	0.0287
propane	74-98-6	254.3820	9.9693	1.3015	0.0510
propyne	74-99-7	ND[c]	9.0630	ND	
isobutane	75-28-5	115.9076	5.0753	0.5930	0.0260
isobutene/1-butene	115-11-7/106-98-0	204.6180	3.2627	1.0469	0.0167
1,3-butadiene	106-99-0	ND	4.8034	ND	
n-butane	106-97-8	235.1246	9.1536	1.2030	0.0468
trans-2-butene	624-64-6	144.5110	5.8909	0.7394	0.0301
cis-2-butene	590-18-1	178.7802	8.7911	0.9147	0.0450
3-methyl-1-butene	563-45-1	ND	12.7788	ND	
isopentane	78-78-4	246.6841	13.1413	1.2621	0.0672
1-pentene	109-67-1	127.6483	7.3410	0.6531	0.0376
2-methyl-1-butene	563-46-2	ND	7.3410	ND	
n-pentane	109-66-0	128.0108	9.1536	0.6549	0.0468
isoprene	78-79-4	98.0480	1.0876	0.5016	0.0056
trans-2-pentene	646-04-8	ND	7.4316	ND	ND
cis-2-pentene	627-20-3	174.2926	10.9662	0.8917	0.0561
2-methyl-2-butene	513-35-9	ND	10.6037	ND	
2,2-dimethylbutane	75-83-2	343.2820	13.4132	1.7563	0.0686
cyclopentene	142-29-0	ND	12.6882	ND	ND
4-methyl-1-pentene	691-37-2	ND	13.0507	ND	
cyclopentane	287-92-3	165.4081	6.2534	0.8463	0.0320
2,3-dimethylbutane	79-29-8	284.7157	15.4977	1.4567	0.0793
2-methylpentane	107-83-5	506.9681	7.1597	2.5938	0.0366
3-methylpentane	96-14-0	237.9808	13.6851	1.2176	0.0700
2-methyl-1-pentene	763-29-1	ND	13.6851	ND	
1-hexene	592-41-6	305.6128	13.8663	1.5636	0.0709
2-ethyl-1-butene	760-21-4	ND	13.5945	ND	
n-hexane	110-54-3	182.8146	10.5130	0.9353	0.0538
trans-2-hexene	4050-45-7	ND	10.5130	ND	
cis-2-hexene	7688-21-3	ND	10.5130	ND	
methylcyclopentane	96-37-7	165.5894	8.7004	0.8472	0.0445
2,4-dimethylpentane	108-08-7	187.0302	10.8756	0.9569	0.0556

continued

Table K-5B. (continued)

Compound	CAS No.	RC-DA[b] µg	Uncertainty µg	RC-DA % Total	Uncertainty % Total
benzene	71-43-2	389.2918	6.8879	1.9917	0.0352
cyclohexane	110-82-7	229.3682	15.4070	1.1735	
2-methylhexane	591-76-4	123.2514	1.8126	0.6306	0.0093
2,3-dimethylpentane	565-59-3	330.9975	9.0630	1.6935	0.0464
3-methylhexane	589-34-4	120.2139	7.6129	0.6150	0.0390
1-heptene	592-76-7	172.8425	7.5223	0.8843	
2,2,4-trimethylpentane	540-84-1	229.1870	9.1536	1.1726	0.0468
n-heptane	142-82-5	152.8517	4.6221	0.7820	0.0236
methylcyclohexane	108-87-2	165.7706	8.7911	0.8481	0.0450
2,2,3-trimethylpentane	564-02-3	ND	9.1536	ND	
2,3,4-trimethylpentane	565-75-3	152.7611	6.3441	0.7816	0.0325
toluene	108-88-3	241.1089	3.6252	1.2336	0.0185
2-methylheptane	592-27-8	131.5015	3.5346	0.6728	0.0181
3-methylheptane	589-81-1	148.3642	3.4439	0.7591	0.0176
1-octene	111-66-0	ND	3.3533	ND	
n-octane	111-65-9	123.5233	1.8126	0.6320	0.0093
ethylbenzene	100-41-4	114.5482	2.4470	0.5861	0.0125
m-xylene/*p*-xylene	108-38-3/106-42-3	ND	3.8064	ND	ND
styrene	100-42-5	ND	6.2534	ND	ND
o-xylene	95-47-6	156.7049	2.4470	0.8017	0.0125
1-nonene	124-11-8	ND	1.9032	ND	
n-nonane	111-84-2	127.3764	1.9032	0.6517	0.0097
isopropylbenzene	98-82-8	165.7706	3.6252	0.8481	0.0185
alpha-pinene	80-56-8	ND	1.9032	ND	
n-propylbenzene	103-65-1	122.9795	1.8126	0.6292	0.0093
m-ethyltoluene	620-14-4	101.8105	4.1690	0.5209	0.0213
p-ethyltoluene	622-96-8	215.9055	4.8034	1.1046	0.0246
1,3,5-trimethylbenzene	108-67-8	80.9134	2.6283	0.4140	0.0134
o-ethyltoluene	611-14-3	139.9328	2.8095	0.7159	0.0144
beta-pinene	127-91-3	ND	1.9032	ND	ND
1,2,4-trimethylbenzene	95-63-6	102.2637	2.6283	0.5232	0.0134
1-decene	872-05-9	ND	1.9939	ND	
n-decane	124-18-5	106.6606	1.9939	0.5457	0.0102
1,2,3-trimethylbenzene	526-73-8	ND	2.1751	ND	ND
m-diethylbenzene	141-93-5	ND	1.1782	ND	ND
p-diethylbenzene	105-05-5	ND	1.3594	ND	ND

continued

Table K-5B. (concluded)

Compound	CAS No.	RC-DA[b] µg	Uncertainty µg	RC-DA % Total	Uncertainty % Total
1-undecene	821-95-4	ND	1.7220	ND	
n-undecane	1120-21-4	81.6385	1.7220	0.4177	0.0088
1-dodecene	112-41-4	ND	3.8064	ND	ND
n-dodecane	112-40-3	ND	3.8971	ND	ND
1-tridecene	2437-56-1	ND	3.8064	ND	ND
n-tridecane	629-50-5	ND	3.8971	ND	ND
Total Speciated		**9,237.3810**			
Total Unspeciated		**10,308.0600**			
Total (speciated + unspeciated)[d]		**19,545.4400**			

[a] SNMOC = speciated nonmethane organic compound.
[b] RC = residence chamber; DA = dilution air.
[c] ND = not detected.
[d] Total NMOC with unknowns in $\mu g/m^3$ is an estimate based on propane only.

Table K-5C. SNMOC[a] Values for 11/01/01 in SPECIATE Format

Compound	CAS No.	RC-DA[b] µg	Uncertainty µg	RC-DA % Total	Uncertainty % Total
ethylene	74-85-1	347.4519	10.5760	1.6974	0.0517
acetylene	74-86-2	30.2280	9.7624	0.1477	0.0477
ethane	74-84-0	181.7271	8.8585	0.8878	0.0433
propylene	115-07-1	106.5256	5.6044	0.5204	0.0274
propane	74-98-6	306.2917	9.9432	1.4963	0.0486
propyne	74-99-7	ND[c]	9.0393	ND	ND
isobutane	75-28-5	89.8424	5.0620	0.4389	0.0247
isobutene/1-butene	115-11-7/106-98-0	161.4141	3.2541	0.7886	0.0159
1,3-butadiene	106-99-0	ND	4.7908	ND	ND
n-butane	106-97-8	204.4243	9.1297	0.9987	0.0446
trans-2-butene	624-64-6	160.1486	5.8755	0.7824	0.0287
cis-2-butene	590-18-1	172.9703	8.7681	0.8450	0.0428
3-methyl-1-butene	563-45-1	ND	12.7454	ND	ND
isopentane	78-78-4	220.0737	13.1070	1.0751	0.0640
1-pentene	109-67-1	130.5928	7.3218	0.6380	0.0358
2-methyl-1-butene	563-46-2	ND	7.3218	ND	ND
n-pentane	109-66-0	168.8772	9.1297	0.8250	0.0446
isoprene	78-79-4	109.8560	1.0847	0.5367	0.0053
trans-2-pentene	646-04-8	ND	7.4122	ND	ND
cis-2-pentene	627-20-3	223.1725	10.9375	1.0903	0.0534
2-methyl-2-butene	513-35-9	ND	10.5760	ND	ND
2,2-dimethylbutane	75-83-2	311.6590	13.3782	1.5225	0.0654
cyclopentene	142-29-0	ND	12.6550	ND	ND
4-methyl-1-pentene	691-37-2	ND	13.0166	ND	ND
cyclopentane	287-92-3	201.9837	6.2371	0.9868	0.0305
2,3-dimethylbutane	79-29-8	282.4648	15.4572	1.3799	0.0755
2-methylpentane	107-83-5	40.0018	7.1410	0.1954	0.0349
3-methylpentane	96-14-0	298.9277	13.6493	1.4604	0.0667
2-methyl-1-pentene	763-29-1	ND	13.6493	ND	ND
1-hexene	592-41-6	307.5659	13.8301	1.5026	0.0676
2-ethyl-1-butene	760-21-4	ND	13.5589	ND	ND
n-hexane	110-54-3	150.0387	10.4856	0.7330	0.0512
trans-2-hexene	4050-45-7	ND	10.4856	ND	ND
cis-2-hexene	7688-21-3	ND	10.4856	ND	ND
methylcyclopentane	96-37-7	181.6989	8.6777	0.8877	0.0424
2,4-dimethylpentane	108-08-7	214.8958	10.8472	1.0498	0.0530

continued

Table K-5C. (continued)

Compound	CAS No.	RC-DA[b] µg	Uncertainty µg	RC-DA % Total	Uncertainty % Total
benzene	71-43-2	448.9918	6.8699	2.1935	0.0336
cyclohexane	110-82-7	235.7230	15.3668	1.1516	0.0751
2-methylhexane	591-76-4	134.9571	1.8079	0.6593	0.0088
2,3-dimethylpentane	565-59-3	354.2172	9.0393	1.7305	0.0442
3-methylhexane	589-34-4	206.5288	7.5930	1.0090	0.0371
1-heptene	592-76-7	255.1943	7.5026	1.2467	0.0367
2,2,4-trimethylpentane	540-84-1	156.1459	9.1297	0.7628	0.0446
n-heptane	142-82-5	164.2417	4.6100	0.8024	0.0225
methylcyclohexane	108-87-2	185.5208	8.7681	0.9063	0.0428
2,2,3-trimethylpentane	564-02-3	ND	9.1297	ND	ND
2,3,4-trimethylpentane	565-75-3	131.4064	6.3275	0.6420	0.0309
toluene	108-88-3	256.7310	3.6157	1.2542	0.0177
2-methylheptane	592-27-8	138.8695	3.5253	0.6784	0.0172
3-methylheptane	589-81-1	143.2338	3.4349	0.6997	0.0168
1-octene	111-66-0	ND	3.3445	ND	ND
n-octane	111-65-9	160.2390	1.8079	0.7828	0.0088
ethylbenzene	100-41-4	117.9519	2.4406	0.5762	0.0119
m-xylene/*p*-xylene	108-38-3/106-42-3	205.9864	3.7965	1.0063	0.0185
styrene	100-42-5	ND	6.2371	ND	ND
o-xylene	95-47-6	210.0796	2.4406	1.0263	0.0119
1-nonene	124-11-8	ND	1.8983	ND	ND
n-nonane	111-84-2	113.8588	1.8983	0.5562	0.0093
isopropylbenzene	98-82-8	197.4386	3.6157	0.9645	0.0177
alpha-pinene	80-56-8	ND	1.8983	ND	ND
n-propylbenzene	103-65-1	146.4229	1.8079	0.7153	0.0088
m-ethyltoluene	620-14-4	88.5769	4.1581	0.4327	0.0203
p-ethyltoluene	622-96-8	139.0502	4.7908	0.6793	0.0234
1,3,5-trimethylbenzene	108-67-8	76.2072	2.6214	0.3723	0.0128
o-ethyltoluene	611-14-3	134.5052	2.8022	0.6571	0.0137
beta-pinene	127-91-3	ND	1.8983	ND	ND
1,2,4-trimethylbenzene	95-63-6	143.3241	2.6214	0.7002	0.0128
1-decene	872-05-9	ND	1.9886	ND	ND
n-decane	124-18-5	89.6616	1.9886	0.4380	0.0097
1,2,3-trimethylbenzene	526-73-8	ND	2.1694	ND	ND
m-diethylbenzene	141-93-5	130.5928	1.1751	0.6380	0.0057
p-diethylbenzene	105-05-5	ND	1.3559	ND	ND

continued

Table K-5C. (concluded)

Compound	CAS No.	RC-DA[b] µg	Uncertainty µg	RC-DA % Total	Uncertainty % Total
1-undecene	821-95-4	ND	1.7175	ND	ND
n-undecane	1120-21-4	ND	1.7175	ND	ND
1-dodecene	112-41-4	ND	3.7965	ND	ND
n-dodecane	112-40-3	ND	3.8869	ND	ND
1-tridecene	2437-56-1	ND	3.7965	ND	ND
n-tridecane	629-50-5	ND	3.8869	ND	ND
Total Speciated		**9,368.4890**			
Total Unspeciated		**11,101.0700**			
Total (speciated + unspeciated)*		**20,469.5600**			

[a] SNMOC = speciated nonmethane organic compound.
[b] RC = residence chamber; DA = dilution air.
[c] ND = not detected.
[d] Total NMOC with unknowns in µg/m^3 is an estimate based on propane only.

Table K-6A. Calculation of Mass of SNMOCs Collected on 10/30/01

Calculation of Mass of Speciated NMOC Collected

Volume Canister = flow rate into canister × test duration				
Test Duration	482.42	min		
Flow Rate, Dilution Air Canister	0.0081	L/min	3.9201	L
Flow Rate, Residence Chamber Air Canister	0.0081	L/min	3.9201	L
Mass Total SNMOC Collected = [SNMOC Conc. Res. Ch. - SNMOC Conc. Dil. Air]×Volume Canister				
SNMOC RC = 44.82 µg/m^3 = 44.82 ng/L = 0.044482 µg/L	0.1744	µg		
SNMOC DA = 20.87 µg/m^3 = 20.87 ng/L = 0.02087 µg/L	0.0818	µg		
Mass Total SNMOC Collected	0.0926	µg		

Calculation of Mass of Total (Speciated + Unspeciated) NMOC Collected

Volume Canister = flow rate into canister × test duration				
Test Duration	482.42	min		
Flow Rate, dilution Air Canister	0.0081	L/min	3.9201	L
Flow Rate, Residence Chamber Air Canister	0.0081	L/min	3.9201	L
Mass Total NMOC Collected = [NMOC Conc. Res. Ch. - NMOC Conc. Dil. Air]×Volume Canister				
NMOC RC = 95.82 µg/m^3 = 95.82 ng/L = 0.09582 µg/L	0.3756	µg		
NMOC DA = 43.997 µg/m^3 = 43.99 ng/L = 0.04399 µg/L	0.1724	µg		
Mass Total NMOC (Speciated + Unspeciated) Collected	0.2032	µg		

Table K-6B. Calculation of Mass of SNMOCs Collected on 10/31/01

Calculation of Mass of Speciated NMOC Collected

Volume Canister = flow rate into canister × test duration				
Test Duration	480.03	min		
Flow Rate, Dilution Air Canister	0.0090	L/min	4.3001	L
Flow Rate, Residence Chamber Air Canister	0.0081	L/min	3.8998	L
Mass Total SNMOC Collected = [SNMOC Conc. Res. Ch. - SNMOC Conc. Dil. Air]×Volume Canister				
SNMOC RC = 42.03 µg/m^3 = 42.03 ng/L = 0.04203 µg/L	0.1639	µg		
SNMOC DA = 21.15 µg/m^3 = 21.15 ng/L = 0.02115 µg/L	0.0909	µg		
Mass Total SNMOC Collected	0.0730	µg		

Calculation of Mass of Total (Speciated + Unspeciated) NMOC Collected

Volume Canister = flow rate into canister × test duration				
Test Duration	480.03	min		
Flow Rate, dilution Air Canister	0.0090	L/min	4.3001	L
Flow Rate, Residence Chamber Air Canister	0.0081	L/min	3.8998	L
Mass Total NMOC Collected = [NMOC Conc. Res. Ch. - NMOC Conc. Dil. Air]×Volume Canister				
NMOC RC = 89.32 µg/m^3 = 89.32 ng/L = 0.08932 µg/L	0.3483	µg		
NMOC DA = 44.49 µg/m^3 = 44.49 ng/L = 0.04449 µg/L	0.1913	µg		
Mass Total NMOC (Speciated + Unspeciated) Collected	0.1570	µg		

Table K-6C. Calculation of Mass of SNMOCs Collected (11/01/01)

Calculation of Mass of Speciated NMOC Collected

Volume Canister = flow rate into canister × test duration				
Test Duration	479.03	min		
Flow Rate, Dilution Air Canister	0.0090	L/min	4.2912	L
Flow Rate, Residence Chamber Air Canister	0.0081	L/min	3.8921	L
Mass Total SNMOC Collected = [SNMOC Conc. Res. Ch. - SNMOC Conc. Dil. Air]×Volume Canister				
SNMOC RC = 41.06 µg/m^3 = 41.06 ng/L = 0.04106 µg/L	0.1598	µg		
SNMOC DA = 19.97 µg/m^3 = 19.97 ng/L = 0.01997 µg/L	0.0857	µg		
Mass Total SNMOC Collected	0.0741	µg		

Calculation of Mass of (Speciated + Unspeciated) NMOC Collected

Volume Canister = flow rate into canister × test duration				
Test Duration	482.42	min		
Flow Rate, dilution Air Canister	0.0081	L/min	3.9201	L
Flow Rate, Residence Chamber Air Canister	0.0081	L/min	3.9201	L
Mass Total NMOC Collected = [NMOC Conc. Res. Ch. - NMOC Conc. Dil. Air]×Volume Canister				
NMOC RC = 44.82 µg/m^3 = 44.82 ng/L = 0.044482 µg/L	0.1744	µg		
NMOC DA = 20.87 µg/m^3 = 20.87 ng/L = 0.02087 µg/L	0.0818	µg		
Mass Total NMOC (Speciated + Unspeciated) Collected	0.0926	µg		

Table K-7. Summary of SNMOCs[a] from Recovery Boiler #5 for All Test Days as Weight Percent of Total

Compound	CAS No.	10/30/01 RC-DA[b] µg	Percent Total	10/31/01 RC-DA µg	Percent Total	11/01/01 RC-DA µg	Percent Total
ethylene	74-85-1	375.0408	1.6242	359.8672	1.8412	347.4519	1.6974
acetylene	74-86-2	852.0878	3.6903	82.4981	0.4221	30.2280	0.1477
ethane	74-84-0	273.5960	1.1849	143.0387	0.7318	181.7271	0.8878
propylene	115-07-1	192.0447	0.8317	137.0299	0.7011	106.5256	0.5204
propane	74-98-6	287.0737	1.2433	254.3820	1.3015	306.2917	1.4963
propyne	74-99-7	ND[c]	ND	ND	ND	ND	ND
isobutane	75-28-5	133.7190	0.5791	115.9076	0.5930	89.8424	0.4389
isobutene/1-butene	115-11-7/106-98-0	112.9393	0.4891	204.6180	1.0469	161.4141	0.7886
1,3-butadiene	106-99-0	ND	ND	ND	ND	ND	ND
n-butane	106-97-8	266.8519	1.1557	235.1246	1.2030	204.4243	0.9987
trans-2-butene	624-64-6	149.9521	0.6494	144.5110	0.7394	160.1486	0.7824
cis-2-butene	590-18-1	205.7379	0.8910	178.7802	0.9147	172.9703	0.8450
3-methyl-1-butene	563-45-1	ND	ND	ND	ND	ND	ND
isopentane	78-78-4	253.5048	1.0979	246.6841	1.2621	220.0737	1.0751
1-pentene	109-67-1	154.4011	0.6687	127.6483	0.6531	130.5928	0.6380
2-methyl-1-butene	563-46-2	ND	ND	ND	ND	ND	ND
n-pentane	109-66-0	175.9624	0.7621	128.0108	0.6549	168.8772	0.8250
isoprene	78-79-4	137.1911	0.5942	98.0480	0.5016	109.8560	0.5367
trans-2-pentene	646-04-8	ND	ND	ND	ND	ND	ND
cis-2-pentene	627-20-3	184.6650	0.7998	174.2926	0.8917	223.1725	1.0903
2-methyl-2-butene	513-35-9	ND	ND	ND	ND	ND	ND
2,2-dimethylbutane	75-83-2	245.0952	1.0615	343.2820	1.7563	311.6590	1.5225

continued

Table K-7. (continued)

Compound	CAS No.	10/30/01 RC-DA[b] µg	Percent Total	10/31/01 RC-DA µg	Percent Total	11/01/01 RC-DA µg	Percent Total
cyclopentene	142-29-0	ND	ND	ND	ND	ND	ND
4-methyl-1-pentene	691-37-2	ND	ND	ND	ND	ND	ND
cyclopentane	287-92-3	172.0995	0.7453	165.4081	0.8463	201.9837	0.9868
2,3-dimethylbutane	79-29-8	304.6462	1.3194	284.7157	1.4567	282.4648	1.3799
2-methylpentane	107-83-5	520.9958	2.2563	506.9681	2.5938	40.0018	0.1954
3-methylpentane	96-14-0	253.2117	1.0966	237.9808	1.2176	298.9277	1.4604
2-methyl-1-pentene	763-29-1	ND	ND	ND	ND	ND	ND
1-hexene	592-41-6	334.3240	1.4479	305.6128	1.5636	307.5659	1.5026
2-ethyl-1-butene	760-21-4	ND	ND	ND	ND	ND	ND
n-hexane	110-54-3	231.5528	1.0028	182.8146	0.9353	150.0387	0.7330
trans-2-hexene	4050-45-7	ND	ND	ND	ND	ND	ND
cis-2-hexene	7688-21-3	ND	ND	ND	ND	ND	ND
methylcyclopentane	96-37-7	201.4842	0.8726	165.5894	0.8472	181.6989	0.8877
2,4-dimethylpentane	108-08-7	218.4988	0.9463	187.0302	0.9569	214.8958	1.0498
benzene	71-43-2	222.7524	0.9647	389.2918	1.9917	448.9918	2.1935
cyclohexane	110-82-7	172.2949	0.7462	229.3682	1.1735	235.7230	1.1516
2-methylhexane	591-76-4	128.8792	0.5582	123.2514	0.6306	134.9571	0.6593
2,3-dimethylpentane	565-59-3	385.6608	1.6702	330.9975	1.6935	354.2172	1.7305
3-methylhexane	589-34-4	285.7755	1.2376	120.2139	0.6150	206.5288	1.0090
1-heptene	592-76-7	ND	ND	172.8425	0.8843	255.1943	1.2467
2,2,4-trimethylpentane	540-84-1	278.0498	1.2042	229.1870	1.1726	156.1459	0.7628
n-heptane	142-82-5	167.0643	0.7235	152.8517	0.7820	164.2417	0.8024
methylcyclohexane	108-87-2	239.7670	1.0384	165.7706	0.8481	185.5208	0.9063

continued

Table K-7. (continued)

Compound	CAS No.	10/30/01 RC-DA[b] µg	Percent Total	10/31/01 RC-DA µg	Percent Total	11/01/01 RC-DA µg	Percent Total
2,2,3-trimethylpentane	564-02-3	ND	ND	ND	ND	ND	ND
2,3,4-trimethylpentane	565-75-3	162.9084	0.7055	152.7611	0.7816	131.4064	0.6420
toluene	108-88-3	253.4071	1.0975	241.1089	1.2336	256.7310	1.2542
2-methylheptane	592-27-8	132.9375	0.5757	131.5015	0.6728	138.8695	0.6784
3-methylheptane	589-81-1	150.0497	0.6498	148.3642	0.7591	143.2338	0.6997
1-octene	111-66-0	ND	ND	ND	ND	ND	ND
n-octane	111-65-9	192.4885	0.8336	123.5233	0.6320	160.2390	0.7828
ethylbenzene	100-41-4	128.4885	0.5565	114.5482	0.5861	117.9519	0.5762
m-xylene/*p*-xylene	108-38-3/106-42-3	175.9624	0.7621	ND	ND	205.9864	1.0063
styrene	100-42-5	ND	ND	ND	ND	ND	ND
o-xylene	95-47-6	128.7815	0.5577	156.7049	0.8017	210.0796	1.0263
1-nonene	124-11-8	ND	ND	ND	ND	ND	ND
n-nonane	111-84-2	103.1620	0.4468	127.3764	0.6517	113.8588	0.5562
isopropylbenzene	98-82-8	188.2348	0.8152	165.7706	0.8481	197.4386	0.9645
alpha-pinene	80-56-8	ND	ND	ND	ND	ND	ND
n-propylbenzene	103-65-1	107.2203	0.4644	122.9795	0.6292	146.4229	0.7153
m-ethyltoluene	620-14-4	94.5570	0.4095	101.8105	0.5209	88.5769	0.4327
p-ethyltoluene	622-96-8	188.4302	0.8161	215.9055	1.1046	139.0502	0.6793
1,3,5-trimethylbenzene	108-67-8	111.2785	0.4819	80.9134	0.4140	76.2072	0.3723
o-ethyltoluene	611-14-3	136.9958	0.5933	139.9328	0.7159	134.5052	0.6571
beta-pinene	127-91-3	129.1723	0.5594	ND	ND	ND	ND
1,2,4-trimethylbenzene	95-63-6	129.0746	0.5590	102.2637	0.5232	143.3241	0.7002
1-decene	872-05-9	ND	ND	ND	ND	ND	ND

continued

Table K-7. (concluded)

Compound	CAS No.	10/30/01 RC-DA[b] µg	Percent Total	10/31/01 RC-DA µg	Percent Total	11/01/01 RC-DA µg	Percent Total
n-decane	124-18-5	120.6650	0.5226	106.6606	0.5457	89.6616	0.4380
1,2,3-trimethylbenzene	526-73-8	ND	ND	ND	ND	ND	ND
m-diethylbenzene	141-93-5	124.0394	0.5372	ND	ND	130.5928	0.6380
p-diethylbenzene	105-05-5	ND	ND	ND	ND	ND	ND
1-undecene	821-95-4	ND	ND	ND	ND	ND	ND
n-undecane	1120-21-4	130.4423	0.5649	81.6385	0.4177	ND	ND
1-dodecene	112-41-4	ND	ND	ND	ND	ND	ND
n-dodecane	112-40-3	ND	ND	ND	ND	ND	ND
1-tridecene	2437-56-1	ND	ND	ND	ND	ND	ND
n-tridecane	629-50-5	ND	ND	ND	ND	ND	ND
Total Speciated		**11005.22**		**9237.381**		**9368.489**	
Total Unspeciated		**12085.01**		**10308.06**		**11101.07**	
Total (Speciated + Unspeciated)[d]		**23090.23**		**19545.44**		**20469.56**	

[a] SNMOC = speciated nonmethane organic compound.
[b] RC = residence chamber; DA = dilution air.
[c] ND = not detected.
[d] Total NMOC with unknowns in µg/m^3 is an estimate based on propane only.

Appendix L

Data Tables for Individual $PM_{2.5}$ EC/OC Samples

Table L-1. Recovery Boiler, Organic/Elemental Carbon Samples—NIOSH Method 5040 (Thermal-Optical Transmittance)

OC/EC Data (wt.% of PM mass) by Sample

Filter ID	OC	EC
Q051601N IB103001HR4A1	-3.0	0.5
Q052301C IB103001HR4B1	-3.0	0.4
Q052301J IB103001HR8A1	-2.9	0.4
Q052301V IB103001HR8B1	-3.0	0.6
Q052401X IB103001HR10A3	-3.2	0.5
Q052301E IB103001HR10B3	-4.1	0.2
Q052501X IB103101HR4A1	-0.2	0.0
Q052901A IB103101HR4B1	-0.3	0.0
Q052501V IB103101HR8A1	-0.4	0.0
Q052501T IB103101HR8B1	-0.2	0.1
Q052501 IB103101HR10A3	-0.4	0.1
Q052501J IB103101HR10B3	-0.4	0.0
Q052901G IB110101HR4A1	-0.2	0.1
Q052901H IB110101HR4B1	-0.2	0.0
Q052901F IB110101HR8A1	-0.1	0.0
Q052901E IB110101HR8B1	-0.3	0.0
Q052901C IB110101HR10A3	-0.3	0.3
Q052901D IB110101HR10B3	-0.3	0.2

Appendix M

Data Tables for Individual $PM_{2.5}$ Elemental Samples

Contents

Table M-1. Recovery Boiler, $PM_{2.5}$ Elemental Analysis, XRF Elemental Analysis Results from Sample IB103001HR2A1

	IB103001HR2A1					
	EDXRF	WDXRF	WD2	% diff	% diff	% diff
XRF	229004	T100201B		ED/WD	ED/WD2	WD/WD2
Na	27.42	28.36	28.2	-3.4	-2.8	0.6
Mg		0.025	0.0236			5.6
Si						
S	16.93	15.2	15.06	10.2	11.0	0.9
Cl	1.94	2.05	2.08	-5.5	-7.0	-1.5
K	2.56	2.79	2.7	-8.9	-5.4	3.2
Ca						
Ti						
Br						
Rb	0.02					

Table M-2. Recovery Boiler, $PM_{2.5}$ Elemental Analysis, XRF Elemental Analysis Results from Sample IB103001HR2B1

	IB103001HR2B1		
XRFID	EDXRF	WDXRF	% diff
	229005	T100201C	ED/WD
Na	28.78	30.67	-6.6
Mg		0.0262	
Si			
S	17.12	15.92	7.0
Cl	1.93	2.09	-8.4
K	2.56	2.79	-9.0
Ca			
Ti			
Br			
Rb			

Table M-3. Recovery Boiler, $PM_{2.5}$ Elemental Analysis, XRF Elemental Analysis Results from Sample IB103101HR2A1

	IB103101HR2A1					
	EDXRF	WDXRF	WD2	% diff	% diff	% diff
XRF	229007	T100201J		ED/WD	ED/WD2	WD/WD2
Na	28.52	30	29.48	-5.2	-3.4	1.7
Mg		0.0248	0.0307			-23.8
Si						
S	19.07	17.45	17.38	8.5	8.9	0.4
Cl	1.84	2.07	1.98	-12.6	-7.7	4.3
K	2.44	2.59	2.64	-6.0	-8.1	-1.9
Ca						
Ti						
Br						
Rb						

Table M-4. Recovery Boiler, $PM_{2.5}$ Elemental Analysis, XRF Elemental Analysis Results from Sample IB103101HR2B1

	IB103101HR2B1					
	EDXRF	WDXRF	WD2	% diff	% diff	% diff
XRF	229008	T100201I		ED/WD	ED/WD2	WD/WD2
Na	28.16	29.2	28.37	-3.7	-0.8	2.8
Mg		0.0266	0.0296			-11.3
Si						
S	19.01	17.45	16.61	8.2	12.6	4.8
Cl	1.84	2.07	2.16	-12.4	-17.3	-4.3
K	2.44	2.59	2.58	-4.6	-4.2	-0.4
Ca						
Ti						
Br						
Rb						

Table M-5. Recovery Boiler, $PM_{2.5}$ Elemental Analysis, XRF Elemental Analysis Results from Sample IB110101HR2A1

	IB110101HR2A1					
	EDXRF	WDXRF	WD2	% diff	% diff	% diff
XRF	229010	T100201O		ED/WD	ED/WD2	WD/WD2
Na	28.39	29.79	30.15	-4.9	-6.2	-1.2
Mg		0.0232	0.0285			-22.8
Si						
S	19.85	17.83	17.48	10.2	11.9	2.0
Cl	1.90	2.08	2.09	-9.6	-10.1	-0.5
K	2.61	2.85	2.74	-9.3	-5.1	3.9
Ca	0.02					
Ti						
Br	0.02					
Rb	0.02					

Table M-6. Recovery Boiler, $PM_{2.5}$ Elemental Analysis, XRF Elemental Analysis Results from Sample IB110101HR2B1

	IB110101HR2B1					
	EDXRF	WDXRF	WD2	% diff	% diff	% diff
XRF	229011	T100201N		ED/WD	ED/WD2	WD/WD2
Na	28.45	29.5	29.94	-3.7	-5.2	-1.5
Mg		0.0202	0.0358			-77.2
Si						
S	19.37	17.32	17.44	10.6	10.0	-0.7
Cl	1.94	2.25	2.14	-15.9	-10.2	4.9
K	2.52	2.79	2.63	-10.9	-4.5	5.7
Ca						
Ti	0.02					
Br	0.02					
Rb						

Appendix N

Data Tables for Individual $PM_{2.5}$ Inorganic Ion Samples

Table N-1. Recovery Boiler, Calibration Ranges for $PM_{2.5}$ Inorganic Ion Analyses

Inorganic Ions by Ion Chromatography

Ion	High Concentration ppm	Low Concentration ppm
chloride	1.3	0.6
nitrate	1.3	0.6
sulfate	1.3	0.6
ammonium	2.9	0.6
potassium	3.1	0.6
magnesium	3.1	0.7
calcium	2.9	0.6

Table N-2. Recovery Boiler, Inorganic Ion Samples, Ion Chromatography Results (wt% of PM mass) by Sample

	Filter ID					
Ion	**T100201D**	**T100201E**	**T100201H**	**T100201G**	**T100201M**	**T100201L**
	IB103001HR6A1	IB103001HR6B1	IB103101HR6A1	IB103101HR6B1	IB110101HR6A1	IB110101HR6B1
NH_4	ND[a]	ND	ND	ND	ND	ND
K	2.40	2.38	2.68	2.70	2.57	2.55
Mg	ND	ND	ND	ND	ND	ND
Ca	ND	ND	ND	ND	ND	ND
Cl	2.01	1.91	2.17	1.85	1.93	1.93
NO_3	NQ[b]	NQ	NQ	NQ	NQ	NQ
SO_4	44.95	45.62	50.49	50.62	50.81	50.44
S_2O_3	ND	ND	ND	ND	ND	ND

[a] ND = not detected.
[b] NQ = not quantified.

Appendix O

Calibration Data Tables for Individual Semivolatile Organic Compounds

Contents

Table O-1. Calibration Ranges for PM Speciated Organic Compounds, Standard Suite #1

Compound	High Calibration Concentration µg/mL	Low Calibration Concentration µg/mL
dimethyl phthalate	19	0.8
diethyl phthalate	19	0.8
naphthalene	10	0.8
2-methylnaphthalene	21.28	0.968
1-methylnaphthalene	21.28	0.896
2,7-dimethylnaphthalene	18.24	0.768
1,3-dimethylnaphthalene	18.24	0.768
2,6-dimethylnaphthalene	18.24	0.768
acenaphthylene	38	1.6
acenaphthene	19	0.8
fluorene	3.8	0.16
1-methylfluorene	9.5	0.4
phenanthrene	1.9	0.08
anthracene	1.9	0.08
9-methylanthracene	18.62	0.784
octylcyclohexane	9.5	0.4
norpristane	9.5	0.4
decylcyclohexane	9.5	0.4
pristane	9.5	0.4
phytane	9.5	0.4
tridecylcyclohexane	9.5	0.4
dibutyl phthalate	19	0.8
butylbenzyl phthalate	19	0.8
*bis(*2-ethylhexyl) phthalate	19	0.8
dioctyl phthalate	19	0.8
fluoranthene	3.8	0.16
pyrene	1.9	0.08
chrysene	1.9	0.08
benzo[a]anthracene	1.9	0.08
benzo[k]fluoranthene	1.9	0.08
benzo[b]fluoranthene	3.8	0.16
benzo[a]pyrene	1.9	0.08
nonadecylcyclohexane	9.5	0.4
squalane	19.855	0.836
indeno[1,2,3-cd]pyrene	1.9	0.08

continued

Table O-1. (concluded)

Compound	High Calibration Concentration µg/mL	Low Calibration Concentration µg/mL
dibenzo[a,h]anthracene	3.8	0.16
benzo[ghi]perylene	3.8	0.16
coronene	2.375	0.1
cholestane 1	0.95	0.04
cholestane 2	0.95	0.04
cholestane 3	0.95	0.04
cholestane 4	0.95	0.04
ABB-20R-24S-methylcholestane	0.95	0.04
ABB-20R-ethylcholestane	0.95	0.04
17A(H)-22,29,30-trisnorhopane	0.95	0.04
17B(H)-21A(H)-norhopane	0.95	0.04
17B(H)-21B(H)-hopane	0.95	0.04
17B(H)-21A(H)-hopane	0.95	0.04
17A(H)-21B(H)-hopane	0.95	0.04

Table O-2. Calibration Ranges for PM Speciated Organic Compounds, Standard Suite #2

Compound	High Calibration Concentration µg/mL	Low Calibration Concentration µg/mL
n-decane (n-C10)	8.2	0.41
n-undecane (n-C11)	8.2	0.41
n-dodecane (n-C12)	8.2	0.41
n-tridecane (n-C13)	8.2	0.41
9h-fluoren-9-one	8.68	0.434
n-tetradecane (n-C14)	8.2	0.41
n-pentadecane (n-C15)	8.2	0.41
n-hexadecane (n-16)	8.2	0.41
n-heptadecane (n-C17)	8.2	0.41
1-octadecene	15.32	0.766
n-octadecane (n-C18)	8.2	0.41
2-methylnonadecane (*iso*-C20)	1.96	0.098
3-methylnonadecane (*anteiso*-C20)	1.96	0.098
n-nonadecane (n-C19)	8.2	0.41
n-eicosane (n-C20)	8.2	0.41
n-heneicosane (n-C21)	8.2	0.41
n-docosane (n-C22)	8.2	0.41
n-tricosane (n-C23)	8.2	0.41
iso-docosane (C23)	8.2	0.41
anteiso-docosane (C23)	8.2	0.41
pyrene	0.4	0.02
anthraquinone	4.72	0.236
naphthalic anhydride	8.16	0.408
methylfluoranthene	0.4	0.02
retene	1.96	0.098
acepyrene (cyclopenta[c,d]pyrene)	1.96	0.098
benzanthraquinone	8.28	0.414
1-methylchrysene	0.4	0.02
benzo[a]pyrene	3.92	0.196
n-tetracosane (n-C24)	8.2	0.41
iso-tricosane (C24)	8.2	0.41
anteiso-tricosane (C24)	8.2	0.41
n-pentacosane (n-C25)	8.2	0.41
iso-tetracosane (C25)	8.2	0.41
anteiso-tetracosane (C25)	8.2	0.41

continued

Table O-2. (concluded)

Compound	High Calibration Concentration µg/mL	Low Calibration Concentration µg/mL
n-hexacosane (n-C26)	8.2	0.41
iso-pentacosane (C26)	8.2	0.41
anteiso-pentacosane (C26)	8.2	0.41
heptacosane (*n*-C27)	8.2	0.41
iso-hexacosane (C27)	8.2	0.41
anteiso-hexacosane (C27)	8.2	0.41
iso-heptacosane (C28)	8.2	0.41
anteiso-heptacosane (C28)	8.2	0.41
iso-octacosane (C29)	8.2	0.41
anteiso-octacosane (C29)	8.2	0.41
octacosane (*n*-C28)	8.2	0.41
nonacosane (*n*-C29)	8.2	0.41
iso-nonacosane (C30)	8.2	0.41
anteiso-nonacosane (C30)	8.2	0.41
squalene	16.56	0.828
dibenzo[a,e]pyrene	0.4	0.02
hexatriacontane-d74	10.15	10.15
n-triacontane (n-C30)	17.2	0.86
n-hentriacontane (*n*-C31)	17.2	0.86
iso-triacontane (C31)	17.2	0.86
anteiso-triacontane (C31)	17.2	0.86
iso-hentriacontane (C32)	8.2	0.41
anteiso-hentriacontane (C32)	8.2	0.41
iso-dotriacontane (C33)	8.2	0.41
anteiso-dotriacontane (C33)	8.2	0.41
dotriacontane (*n*-C32)	8.2	0.41
tritriacontane (*n*-C33)	8.2	0.41
tetratriacontane (*n*-C34)	8.2	0.41
iso-tritriacontane (C34)	8.2	0.41
anteiso-tritriacontane (C34)	8.2	0.41
pentatriacontane (*n*-C35)	8.2	0.41
hexatriacontane (*n*-C36)	8.2	0.41
tetracontane (*n*-C40)	8.2	0.41

Table O-3. Calibration Ranges for Speciated PM Organic Compounds, Standard Suite #3

Compound	High Calibration µg/mL	Low Calibration µg/mL
Caproic or Hexanoic acid, methyl ester	18.68	0.75
Succinic or butanedioic acid, methyl ester	6.13	0.25
Caprylic or Octanoic acid, methyl ester	18.53	0.74
Glutaric or Pentanedioic acid, dimethyl ester	7.25	0.29
Nonanoic acid, methyl ester	14.66	0.59
Adipic or Hexanedioic acid, dimethyl ester	6.27	0.25
Capric or Decanoic acid, methyl ester	14.66	0.59
Undecanoic acid, methyl ester	14.66	0.59
Pimelic or Heptanedioic acid, dimethyl ester	6.32	0.25
Suberic or Octanedioic acid, dimethyl ester	6.32	0.25
Dodecanoic acid, methyl ester	17.16	0.69
Azelaic or Nonanedioic acid, dimethyl ester	5.64	0.23
Tridecanoic acid, methyl ester	17.16	0.69
Pinonic Acid (methyl ester)	22.11	0.88
Dimethyl phthalate	6.18	0.25
1,4-Benzenedicarboxylic acid, methyl ester	6.08	0.24
1,3-Benzenedicarboxylic acid, methyl ester	6.42	0.26
1,2-Benzenedicarboxylic acid, 4-methyl,	6.27	0.25
1,2,4-Benzenetricarboxylic acid, trimethyl ester	6.03	0.24
Benzenetetracarboxylic acid, methyl ester	5.93	0.24
Abietic acid, methyl ester	17.16	0.71
Pimaric acid, methyl ester (secondary)	17.16	0.71
sandaracopimaric acid, methyl ester (secondary std)	17.16	0.69
Isopimaric acid, methyl ester (secondary std)	17.16	0.71
6,18,11,13-Abetatetraen-18-oic acid, methyl ester	17.16	0.71
Dehydroabietic acid, methyl ester (secondary std)	17.16	0.71
Sebacic or Decanedioic Acid, dimethyl ester	5.74	0.23
Tetradecanoic acid, methyl ester	15.05	0.6
Pentadecanoic acid, methyl ester	15.05	0.6
Palmitoleic or 9-Hexadecenoic acid, methyl ester	15.74	0.63
Hexadecanoic acid, methyl ester	14.71	0.59
Heptadecanoic acid, methyl ester	14.71	0.59
Linoleic or 8,11-Octadecadienoic acid, methyl ester	14.07	0.56
Oleic or 9-Octadecenoic acid, methyl ester	16.52	0.66
Linolenic 9,12,15-Octadecatrienoic acid, methyl ester	17.6	0.7
Octadecanoic acid, methyl ester	11.67	0.47

continued

Table O-3. (concluded)

Compound	High Calibration µg/mL	Low Calibration µg/mL
Nonadecanoic acid, methyl ester	11.67	0.47
Eicosanoic acid, methyl ester	12.06	0.48
Heneicosanoic acid, methyl ester	12.06	0.48
Docosanoic acid, methyl ester	12.21	0.49
Tricosanoic acid, methyl ester	12.21	0.49
Tetracosanoic acid, methyl ester	13.73	0.55
Pentacosanoic acid, methyl ester	13.73	0.55
Hexacosanoic acid, methyl ester	13.73	0.55
Heptacosanoic Acid, methyl ester	14.85	0.59
Octacosanoic acid, methyl ester	14.85	0.59
Nonacosanoic acid, methyl ester	14.85	0.59
Triacontanoic acid, methyl ester	14.85	0.58

Table O-4. Emission Factors (mg/kg fuel) for *n*-Alkanes from Recovery Boiler #5 as obtained from PUF Samples (WRP#1)

	Ports R4 & R8						Port R10					
***n*-Alkanes**	**10/30/01**	**10/31/01**	**11/01/01**	**Average**	**S.D.[a]**	**RSD[b]**	**10/30/01**	**10/31/01**	**11/01/01**	**Average**	**S.D.**	**RSD**
n-C10	ND[c]	ND	ND	ND	ND	—	ND	ND	ND	ND	ND	—
n-C11	5.6×10^{-5}	4×10^{-6}	-9×10^{-5}	-0.0000	7.4×10^{-5}	-740	0.0002	1×10^{-5}	ND	5×10^{-5}	1×10^{-5}	198.8738
n-C12	0.0008	-3×10^{-5}	0.0015	0.0007	0.0008	101.259	0.0010	ND	0.002	0.001	7×10^{-5}	74.53288
n-C13	1.7×10^{-5}	-4×10^{-5}	0.0002	4.9×10^{-5}	0.0001	221.624	4.1×10^{-6}	ND	1×10^{-4}	3×10^{-5}	7×10^{-5}	195.4223
n-C14	4.7×10^{-5}	7×10^{-7}	0.0001	5.3×10^{-5}	5.5×10^{-5}	104.367	9.1×10^{-6}	1×10^{-7}	1×10^{-4}	4×10^{-5}	6×10^{-5}	176.5824
n-C15	7.2×10^{-5}	1×10^{-6}	5.1×10^{-5}	4.1×10^{-5}	3.6×10^{-5}	88.2429	3.7×10^{-5}	1×10^{-7}	6×10^{-5}	3×10^{-5}	2×10^{-5}	50.24755
n-C16	6.1×10^{-5}	1×10^{-6}	1.6×10^{-5}	2.6×10^{-5}	3.1×10^{-5}	120.096	3.5×10^{-5}	6×10^{-7}	2×10^{-6}	1×10^{-5}	2×10^{-5}	186.1797
n-C17	6.4×10^{-5}	8×10^{-5}	0.0003	0.0001	0.0001	124.832	5.2×10^{-5}	4×10^{-7}	3×10^{-4}	0.0001	2×10^{-4}	149.287
n-C18	4.7×10^{-5}	6×10^{-7}	-1×10^{-5}	1.3×10^{-5}	3×10^{-5}	241.882	-2×10^{-5}	ND	ND	-7×10^{-6}	1×10^{-5}	-212.132
n-C19	0.0001	7×10^{-7}	3.4×10^{-5}	3.8×10^{-5}	4×10^{-5}	104.148	4.7×10^{-5}	5×10^{-7}	2×10^{-5}	2×10^{-5}	2×10^{-5}	84.85281
n-C20	0.0004	9×10^{-7}	1.7×10^{-5}	0.0001	0.0002	161.336	7.3×10^{-5}	4×10^{-7}	ND	2×10^{-5}	5×10^{-5}	210.976
n-C21	0.0001	7×10^{-7}	-3×10^{-6}	4.3×10^{-5}	7.6×10^{-5}	177.938	0.0002	1×10^{-6}	ND	6×10^{-5}	1×10^{-4}	210.8915
n-C22	8.3×10^{-5}	2×10^{-6}	-9×10^{-6}	2.5×10^{-5}	5×10^{-5}	198.327	0.0001	2×10^{-6}	ND	4×10^{-5}	9×10^{-5}	208.9179
n-C23	0.0017	2×10^{-5}	0.00011	0.0006	0.0009	154.725	0.0016	2×10^{-5}	ND	0.0005	0.001	209.4804
n-C24	0.00013	3×10^{-6}	-0.0005	-0.0001	0.0003	-272.35	0.0003	2×10^{-6}	ND	0.0001	2×10^{-5}	210.7272
n-C25	0.00454	7×10^{-5}	-0.0009	0.0012	0.0029	234.63	0.0048	6×10^{-5}	ND	0.0016	0.003	209.5292
n-C26	0.00226	0.0044	-0.0016	0.0017	0.0030	180.285	0.0016	2×10^{-6}	ND	0.0005	0.001	211.8688
n-C27	0.00091	6×10^{-6}	-0.0021	-0.0004	0.0015	-391.34	0.0010	8×10^{-6}	ND	0.0003	7×10^{-4}	210.5127
n-C28	0.0008	1×10^{-5}	-0.0015	-0.0002	0.0012	-508.1	0.0007	6×10^{-6}	ND	0.0002	5×10^{-4}	210.1918
n-C29	0.00071	9×10^{-6}	-0.0016	-0.0003	0.0012	-403.3	0.0007	0.001	ND	0.0006	5×10^{-4}	83.56717
n-C30	ND	8×10^{-6}	-1×10^{-5}	-6.7×10^{-7}	9×10^{-6}	-1352.8	ND	7×10^{-6}	ND	2×10^{-6}	ND	ND
n-C31	ND	ND	-0.0002	-6.7×10^{-5}	0.0001	-173.21	ND	ND	ND	ND	ND	—
n-C32	ND	ND	5.5×10^{-7}	1.8×10^{-7}	3.2×10^{-7}	173.205	ND	ND	7×10^{-7}	2×10^{-7}	5×10^{-7}	212.132

continued

Table O-4. (concluded)

	Ports R4 & R8						Port R10					
***n*-Alkanes**	**10/30/01**	**10/31/01**	**11/01/01**	**Average**	**S.D.[a]**	**RSD[b]**	**10/30/01**	**10/31/01**	**11/01/01**	**Average**	**S.D.**	**RSD**
n-C33	ND	ND	-7×10^{-7}	-2.3×10^{-7}	4×10^{-7}	-173.21	ND	ND	ND	ND	ND	—
n-C34	ND	ND	5.2×10^{-5}	1.7×10^{-5}	3×10^{-5}	173.205	ND	ND	ND	ND	ND	—
n-C35	ND	ND	-3×10^{-7}	-1×10^{-7}	1.7×10^{-7}	-173.21	ND	ND	ND	ND	ND	—
n-C36	ND	ND	-3×10^{-6}	-1×10^{-6}	1.7×10^{-6}	-173.21	ND	ND	ND	ND	ND	
n-C40	ND	ND	ND	ND	ND		ND	ND	ND	ND	ND	
SUM	0.01284	0.0045	-0.0062									

[a] S.D. = standard deviation.
[b] RSD = relative standard deviation.
[c] ND = not detected.

Table O-5. Emission Factors (mg/kg fuel) for PAHs[a] from Recovery Boiler #5 as obtained from PUF Samples (WRP#2)

	Ports R4 & R8						Port R10					
PAH	**10/30/01**	**10/31/01**	**11/01/01**	**Average**	**S.D.[b]**	**RSD[c]**	**10/30/01**	**10/31/01**	**11/01/01**	**Average**	**S.D.**	**RSD**
dimethyl phthalate	2.6×10^{-5}	5.4×10^{-7}	9.5×10^{-7}	9×10^{-6}	1×10^{-5}	159.1	1×10^{-5}	7×10^{-7}	-4×10^{-6}	2×10^{-6}	1×10^{-5}	443.3
diethyl phthalate	0.0003	2.2×10^{-6}	6.2×10^{-5}	0.0001	1×10^{-4}	123.5	0.0001	2×10^{-6}	2×10^{-5}	4×10^{-5}	6×10^{-5}	139.1
naphthalene	ND[d]	6.8×10^{-7}	1.1×10^{-5}	1×10^{-5}	1×10^{-5}	107	3×10^{-5}	1×10^{-6}	2×10^{-5}	2×10^{-5}	7×10^{-6}	41.59
2-methylnaphthalene	3.2×10^{-5}	7×10^{-7}	-7×10^{-6}	9×10^{-6}	2×10^{-5}	241.1	2×10^{-5}	8×10^{-7}	-7×10^{-6}	5×10^{-6}	2×10^{-5}	415
1-methylnaphthalene	ND	5×10^{-7}	-7×10^{-6}	8×10^{-6}	2×10^{-5}	249.7	2×10^{-5}	5×10^{-7}	-7×10^{-6}	5×10^{-6}	2×10^{-5}	424.3
dibutyl phthalate	-2×10^{-5}	3×10^{-6}	5.4×10^{-5}	1×10^{-5}	4×10^{-5}	307.1	0.0012	4×10^{-7}	7×10^{-5}	0.0004	8×10^{-4}	188.7
butyl benzyl phthalate	-0.0008	3.5×10^{-6}	-7×10^{-5}	-3×10^{-4}	4×10^{-4}	-154	0.0006	-2×10^{-7}	-1×10^{-5}	0.0002	4×10^{-4}	219.4
bis-2-ethylhexyl phthalate	0.0001	1.4×10^{-5}	7.6×10^{-5}	7×10^{-5}	6×10^{-5}	79.15	0.0003	1×10^{-6}	8×10^{-5}	0.0001	2×10^{-4}	122.5

[a] PAHs = polycyclic aromatic hydrocarbons.
[b] S.D. = standard deviation.
[c] RSD = relative standard deviation.
[d] ND = not detected.

Table O-6. Emission Factors (mg/kg fuel) for *n*-Alkanoic Acids from Recovery Boiler #5 as obtained from PUF Samples (WRP#3)

n-Alkanoic Acid	Ports R4 & R8						Port R10					
	10/30/01	10/31/01	11/01/01	Average	S.D.[a]	RSD[b]	10/30/01	10/31/01	11/01/01	Average	S.D.	RSD
C8	0.0004	-8.7×10^{-7}	ND[c]	0.0001	0.0002	173.13	0.0003	2.3×10^{-7}	9×10^{-8}	1×10^{-4}	2×10^{-4}	173
C9	0.0005	ND	ND	0.0002	0.0003	173.16	0.0001	-1.7×10^{-6}	ND	3×10^{-5}	6×10^{-5}	168
C10	0.0002	ND	ND	6.5×10^{-5}	0.0001	177.97	ND	-7.4×10^{-7}	ND	8×10^{-6}	1×10^{-5}	126
C11	ND	ND	ND	7.4×10^{-6}	2×10^{-5}	265.14	ND	1.79×10^{-6}	ND	-0	5×10^{-6}	-267
C12	ND	ND	ND	1×10^{-5}	3×10^{-5}	256.26	ND	1.4×10^{-6}	ND	-0	5×10^{-6}	-231
C13	ND	-1.6×10^{-7}	ND	4.4×10^{-6}	1×10^{-5}	311.19	ND	-2.6×10^{-8}	ND	-0	4×10^{-6}	-172
C14	0.0003	ND	0.0001	0.0002	0.0001	98.674	0.0005	2.5×10^{-6}	0.0001	2×10^{-4}	3×10^{-4}	141
C15	0.0004	ND	0.0002	0.0002	0.0002	99.724	0.0007	2.64×10^{-6}	ND	2×10^{-4}	4×10^{-4}	169
C16	0.0009	0.0004	0.0458	0.0157	0.0261	166.45	0.0590	0.000122	0.0148	0.025	0.031	124
C17	0.0024	ND	0.0002	0.0009	0.0013	155.15	0.0006	2.56×10^{-8}	0.0001	2×10^{-4}	3×10^{-4}	150
C18	0.0032	0.0003	0.0112	0.0049	0.0057	115.63	0.0090	4.13×10^{-5}	0.0012	0.003	0.005	143

[a] S.D. = standard deviation.
[b] RSD = relative standard deviation.
[c] ND = not detected.

Table O-7. Emission Factors (mg/kg fuel) for *n*-Alkanes from Recovery Boiler #5 as obtained from Quartz Filter Samples (WRQ#1)

n-Alkanes	Average of 3 Days	RSD[a]
n-C10	2.7×10^{-6}	87.338
n-C11	0.0002	173.21
n-C12	5×10^{-6}	132.43
n-C13	ND[b]	
n-C14	-3×10^{-5}	-22.22
n-C15	4.8×10^{-6}	316.49
n-C16	2.9×10^{-6}	173.21
n-C17	5.4×10^{-6}	118.26
n-C18	2.9×10^{-6}	107.7
n-C19	ND	
n-C20	-2×10^{-5}	-12.13
n-C21	-6×10^{-5}	-12.15
n-C22	-4×10^{-5}	-81.97
n-C23	-0.0002	-36.82
n-C24	4.9×10^{-5}	248.44
n-C25	-0.0002	-89.76
n-C26	-0.0002	-116.6
n-C27	-0.0003	-79.66
n-C28	-0.0002	-148.2
n-C29	-0.0005	-55.57
n-C30	2.9×10^{-6}	166.08
n-C31	-4×10^{-5}	-278
n-C32	4×10^{-6}	172.6
n-C33	4.2×10^{-7}	173.21
n-C34	9.9×10^{-5}	97.56
n-C35	ND	ND
n-C36	ND	ND
n-C40		

[a] RSD = relative standard deviation.
[b] ND = not detected.

Table O-8. Emission Factors (mg/kg fuel) for PAHs[a] from Recovery Boiler #5 as obtained from Quartz Filter Samples (WRQ2)

PAH	Average of 3 Days	RSD[b]
dimethyl phthalate	1×10^{-6}	317.5
diethyl phthalate	3.6×10^{-6}	217.5
naphthalene	1.4×10^{-6}	151.7
2-methylnaphthalene	0	0
1-methylnaphthalene	0	0
dibutylphthalate	8.2×10^{-5}	69.06
butylbenzylphthalate	4.1×10^{-5}	63.19
bis-2-ethylhexylphth	2.5×10^{-5}	65.63

Table O-9. Emission Factors (mg/kg fuel) for *n*-Alkanoic Acids from Recovery Boiler #5 as obtained from Quartz Filter Samples (WRQ3)

No data due to low recovery of internal standard

TECHNICAL REPORT DATA

1. REPORT NO.	2.	3. RECIPIENT'S ACCESSION NO.
EPA-600/R-03/099b		

4. TITLE AND SUBTITLE	5. REPORT DATE
Source Sampling Fine Particulate Matter: A Kraft Process Recovery Boiler at a Pulp and Paper Facility: Volume 2 Appendices	November 2003
	6. PERFORMING ORGANIZATION CODE

7. AUTHORS	8. PERFORMING ORGANIZATION REPORT NO.
Joan T. Bursey and Dave-Paul Dayton	

9. PERFORMING ORGANIZATION NAME AND ADDRESS	10. PROGRAM ELEMENT NO.
Eastern Research Group, Inc. 1600 Perimeter Park Drive Morrisville, NC 27560	11. CONTRACT/GRANT NO. Contract No. 68-D7-001

12. SPONSORING AGENCY NAME AND ADDRESS	13. TYPE OF REPORT AND PERIOD COVERED
U. S. EPA, Office of Research and Development Air Pollution Prevention and Control Division Research Triangle Park, North Carolina 27711	Final; 02/05/01 – 05/30/03
	14. SPONSORING AGENCY CODE EPA/600/13

15. SUPPLEMENTARY NOTES

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16. ABSTRACT

The report provides a profile of the chemical composition of particulate matter (PM) with aerodynamic diameter 2.5 μm or less ($PM_{2.5}$) emitted from a recovery boiler at a pulp and paper facility using the Kraft pulping process. Recovery boilers, common to nearly all pulp and paper mills, are usually one of the major contributors to atmospheric emissions from the mill. Processing wood chips in a pulp mill utilizing the Kraft process involves digesting the wood in a solution of sodium sulfide and sodium hydroxide. The spent digestion liquor combined with water used to wash the resulting pulp is called “black liquor.” After undergoing concentration by evaporation to about 65% solids, the black liquor is fed to the recovery boiler as fuel. Dissolved organics in the concentrated black liquor are combusted in the recovery boiler to yield heat to generate process steam and to convert sodium sulfate formed in the process back to sodium sulfide which can be recycled to the digestion step as a reactant. The recovery boiler tested here was equipped with two parallel electrostatic precipitators with 169,194 linear feet of plate area per precipitator, installed in the flue gas exhaust ducting. The data obtained during this research will assist States in determining the major sources of $PM_{2.5}$ so they can devise and institute a control strategy to attain the ambient concentrations set by the National Ambient Air Quality Standard for $PM_{2.5}$ that was promulgated in July 1977 by the U.S. EPA. Along with the $PM_{2.5}$ emission profile, data are also provided for gas-phase emissions of several organic compounds. Data are provided in a format suitable to be included in the EPA source profile database, SPECIATE.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Air Pollution	Pollution Control	13B
Paper Industry	Stationary Sources	11L
Wood Pulp		
Fine Particulate Matter		14G
Chemical Composition		07D
Organic Compounds		07C
Volatility		20M

18. DISTRIBUTION STATEMENT	19. SECURITY CLASS *(This Report)*	21. NO. OF PAGES
	Unclassified	98
Release to Public	20. SECURITY CLASS *(This Page)*	22. PRICE
	Unclassified	