CONTRACT NO. A132-104
FINAL REPORT
JANUARY 1995

NOx and VOC Species Profiles for Gas Fired Stationary Combustion Sources

Volume 2: Field and Sampling Data

CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY

AIR RESOURCES BOARD
Research Division

NOx and VOC Species Profiles for Gas Fired Stationary Combustion Sources

Volume 2: Field and Sampling Data

Contract No. A132-104

Prepared for:

California Air Resources Board
Research Division
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FIELD AND SAMPLING DATA

This report contains field and laboratory data from the VOC and NOx sampling program. Eight appendices are provided including:

Appendix A - Landfill Gas IC Engine
Appendix B - Refinery Gas Process Heater
Appendix C - Natural Gas Steam Generator
Appendix D - Field Gas Process Heater
Appendix E - Natural Gas IC Engine
Appendix F - Natural Gas Turbine
Appendix G - Refinery Gas Process Heater
Appendix H - Natural Gas Utility Boiler

Each appendix is organized as follows:

- CEM Calibrations and Calculations
- Flow Calculations and Run Sheets
- Tedlar Bag Analyses
- Aldehyde/Ketone Calculations, Run Sheets and Analyses
- Fuel Analyses

APPENDIX A - LANDFILL GAS IC ENGINE

Appendix A.1. CEM Calibrations and Calculations

CEM NO AND NOX CALIBRATIONS

PLANT: Landfill Gas ICE
CITY, STATE: Confidential
LOCATION: Stack

TEST DATE: 10/11/93

RUN NUMBER: NO,NO2
RUN START TIME: 9:40
RUN END TIME: 11:04
CEM OPERATOR: Rob Cambell

ANALYTE		O2	CO2	NOx
CONCENTRATION UNIT		%, dry	%, dry	ppmv, dry
HIGH-RANGE GAS FRACTION OF SPAN		1	1	1
SPAN		13	13	230
SPAN GAS CONCENTRATION, Cma	HIGH	13	13	230
	MID	6.5	6.5	105
	ZERO	0	0	0
INITIAL ANALYZER CALIBRATION CHECK, Cai	HIGH	13.03	13	229.5
	MID	6.57	6.47	105.5
	ZERO	0.0	0.0	0.6
INITIAL ANALYZER CALIBRATION ERROR, Ei	HIGH	0.2%	0.0%	-0.2%
Ei = ((Cai - Cma)/Span)x100%	MID	0.5%	-0.2%	0.2%
	ZERO	0.2%	-0.2%	0.2%
INITIAL BIAS CHECK, Cbi	UPSCALE HIGH (H) OR MID (M)?	M	M	M
(SELECT UPSCALE CALIBRATION GAS CLOSEST TO EFFLUENT GAS CONCENTRATION)	UPSCALE	6.50	6.43	105.30
	ZERO	0.0	0.0	0.5
INITITAL SYSTEM CALIBRATION BIAS, Bi	UPSCALE	-0.5%	-0.3%	-0.1%
Bi = ((Cbi-Cai)/Span)x100%	ZERO	-0.2%	0.2%	0.0%
FINAL ANALYZER CALIBRATION CHECK, Caf	HIGH	13.05	12.96	231
	MID	6.55	6.49	106.6
	ZERO	0.0	0.0	0.6
FINAL ANALYZER CALIBRATION ERROR, Ef	HIGH	0.4%	-0.3%	0.4%
Ef = ((Caf - Cma)/Span)x100%	MID	0.4%	-0.1%	0.7%
	ZERO	0.1%	0.2%	0.2%
FINAL BIAS CHECK, Cbf	UPSCALE HIGH (H) OR MID (M)?	M	M	M
(SELECT UPSCALE CALIBRATION GAS CLOSEST TO EFFLUENT GAS CONCENTRATION)	UPSCALE	6.50	6.46	106.40
	ZERO	0.0	0.0	0.8
FINAL SYSTEM CALIBRATION BIAS, Bf	UPSCALE	-0.4%	-0.2%	-0.1%
Bf = ((Cbf-Caf)/Span)x100%	ZERO	0.0%	0.1%	0.1%
ANALYZER DRIFT	HIGH	0.2%	-0.3%	0.7%
D = ((Caf - Cai)/(Span))x100%	MID	-0.2%	0.2%	0.5%
	ZERO	-0.2%	0.3%	0.0%
SYSTEM DRIFT	UPSCALE	0.0%	0.2%	0.5%
D = ((Cbf - Cbi)/(Span))x100%	ZERO	0.1%	0.2%	0.1%

Landfill Gas Internal Combustion Engine						
10/11/93						
Time	O2	CO2	NO	NOx	NO	NOx
	%, Dry	%, Dry	ppmv, Dry	ppmv, Dry	ppmv, Dry 7%O2	ppmv, Dry 7%O2
00:09:42:47.988	8.31	10.59		94.16		103.88
00:09:43:47.980	8.31	10.64		99.19		109.43
00:09:44:48.203	8.31	10.67		91.16		100.57
00:09:45:48.027	8.27	10.71		95.72		105.27
00:09:46:48.020	8.26	10.70		103.91		114.19
00:09:47:48.016	8.26	10.69		103.89		114.16
00:09:48:48.004	8.25	10.70		98.91		108.61
00:09:49:48.000	8.27	10.68		95.70		105.25
00:09:50:47.992	8.26	10.69		98.67		108.43
00:09:51:47.988	8.28	10.69	94.27		103.76	
00:09:52:47.988	8.28	10.69	94.02		103.48	
00:09:53:47.977	8.29	10.68	91.85		101.17	
00:09:54:48.027	8.28	10.70	97.92		107.77	
00:09:55:47.973	8.27	10.70	102.14		112.33	
00:09:56:48.016	8.28	10.70	104.39		114.89	
00:09:57:48.004	8.27	10.71	105.71		116.26	
00:09:58:48.000	8.25	10.72	107.80		118.37	
00:09:59:47.992	8.23	10.74	109.93		120.52	
00:10:00:47.988	8.23	10.74		110.25		120.87
00:10:01:47.980	8.22	10.74		106.26		116.40
00:10:02:47.977	8.25	10.71		104.98		115.27
00:10:03:48.027	8.26	10.70		102.07		112.16
00:10:04:48.020	8.26	10.69		99.79		109.66
00:10:05:48.016	8.26	10.69		99.30		109.12
00:10:06:48.063	8.26	10.69		98.84		108.62
00:10:07:48.000	8.25	10.69		98.74		108.42
00:10:08:47.992	8.25	10.69		97.47		107.03
00:10:09:47.988	8.26	10.69		96.91		106.49
00:10:10:47.988	8.26	10.69	95.28		104.70	

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Landfill Gas Internal Combustion Engine						
10/11/93						
Time	O2	CO2	NO	NOx	NO	NOx
	%, Dry	%, Dry	ppmv, Dry	ppmv, Dry	ppmv, Dry 7%O2	ppmv, Dry 7%O2
00:10:40:48.023	8.26	10.72		87.99		96.69
00:10:41:48.020	8.25	10.73		87.48		96.06
00:10:42:48.004	8.25	10.73		89.48		98.25
00:10:43:48.000	8.26	10.73		88.69		97.46
00:10:44:48.000	8.27	10.71		86.38		95.00
00:10:45:47.992	8.27	10.72		85.37		93.89
00:10:46:47.980	8.24	10.73		86.24		94.62
00:10:47:47.977	8.24	10.72		91.17		100.03
00:10:48:48.027	8.25	10.71		91.68		100.67
00:10:49:48.020	8.26	10.71		89.25		98.08
00:10:50:48.016	8.27	10.70	89.07		97.96	
00:10:51:48.004	8.24	10.72	88.96		97.61	
00:10:52:48.000	8.27	10.70	86.94		95.61	
00:10:53:47.992	8.26	10.70	90.74		99.71	
00:10:54:47.988	8.25	10.71	91.24		100.19	
00:10:55:47.980	8.26	10.70	88.43		97.18	
00:10:56:47.977	8.29	10.69	90.21		99.37	
00:10:57:48.027	8.29	10.69	88.52		97.50	
00:10:58:48.020	8.26	10.70	87.20		95.82	
00:10:59:48.066	8.27	10.70	89.95		98.92	
00:11:00:48.008	8.29	10.69		87.67		96.57
00:11:01:48.000	8.30	10.68		88.05		97.06
00:11:02:47.992	8.28	10.70		88.23		97.11
00:11:03:47.988	8.27	10.71		88.73		97.58
00:11:04:47.980	8.27	10.71		88.65		97.49
00:11:05:47.977	8.27	10.72		89.91		98.88
00:11:06:48.027	8.25	10.73		90.13		98.97
00:11:07:48.020	8.26	10.70		94.27		103.59
00:11:08:48.020	8.28	10.68		91.10		100.27

Landfill Gas Internal Combustion Engine						
10/11/93						
Time	O2	CO2	NO	NOx	NO	NOx
	%, Dry	%, Dry	ppmv, Dry	ppmv, Dry	ppmv, Dry 7%O2	ppmv, Dry 7%O2
00:10:11:47.977	8.24	10.71	96.72		106.12	
00:10:12:48.027	8.25	10.73	95.02		104.34	
00:10:13:48.020	8.24	10.73	94.83		104.05	
00:10:14:48.016	8.26	10.72	93.62		102.88	
00:10:15:48.004	8.25	10.72	94.20		103.44	
00:10:16:48.000	8.26	10.72	93.08		102.29	
00:10:17:47.992	8.27	10.71	93.24		102.54	
00:10:18:47.988	8.28	10.70	92.56		101.87	
00:10:19:47.980	8.28	10.69	91.91		101.16	
00:10:20:47.977	8.27	10.70		92.90		102.17
00:10:21:47.977	8.29	10.69		90.03		99.17
00:10:22:48.020	8.28	10.69		90.53		99.64
00:10:23:48.020	8.29	10.69		87.25		96.11
00:10:24:48.004	8.28	10.72		88.64		97.56
00:10:25:48.000	8.25	10.76		90.15		98.99
00:10:26:47.992	8.26	10.74		92.35		101.48
00:10:27:47.988	8.25	10.73		93.13		102.26
00:10:28:47.980	8.27	10.71		90.24		99.24
00:10:29:47.977	8.27	10.71		89.96		98.93
00:10:30:48.027	8.26	10.72	90.98		99.98	
00:10:31:48.020	8.23	10.74	91.43		100.24	
00:10:32:48.016	8.25	10.72	89.65		98.44	
00:10:33:48.004	8.27	10.71	91.14		100.23	
00:10:34:48.000	8.28	10.70	89.24		98.22	
00:10:35:47.992	8.26	10.72	91.92		101.01	
00:10:36:47.988	8.26	10.71	89.73		98.60	
00:10:37:47.980	8.26	10.73	90.28		99.21	
00:10:38:47.977	8.26	10.73	90.61		99.57	
00:10:39:48.035	8.26	10.72	88.62		97.38	

Appendix A.2. Flow Calculations and Run Sheets

Landfill Gas Internal Combustion Engine						
10/11/93						
Time	O2	CO2	NO	NOx	NO	NOx
	%, Dry	%, Dry	ppmv, Dry	ppmv, Dry	ppmv, Dry 7%O2	ppmv, Dry 7%O2
00:11:09:48.008	8.29	10.69		87.72		96.62
00:11:10:48.000	8.29	10.69		88.05		96.99
00:11:11:47.992	8.28	10.69		87.30		96.08
AVERAGE	8.27	10.71	93.42	93.23	102.68	102.50

FLOW RATE

PLANT: Landfill Gas ICE
CITY: Confidential
RUN NO: 4
SAMPLE LOCATION: STACK

DATE ENTERED: 11/30/93
DATE: 12-Oct-93
OPERATOR: Jon Kawaguchi
ENTERED BY: David Hansell
CHECKED BY:

DATA ENTRY	SYMBOL	UNITS	DATA			
RUN NUMBER	-	-	R1			
ROUND STACK, DIAMETER	ds	inches	17.5			
RECTANGULAR STACK, LENGTH	L	inches				
WIDTH	W	inches				
AVERAGE STACK TEMPERATURE	Fs	degrees F	877.4			
AVERAGE METER TEMPERATURE	Fm	degrees F	108.0			
BAROMETRIC PRESSURE	Pbar	in. Hg	29.89			
STACK STATIC PRESSURE	Pg	in. H20	4.600			
AVG. DELTA H	dH	in. H20	1.900			
AVG. VELOCITY HEAD	dP	in. H20	3.49			
PITOT COEFFICIENT	Cp	-	0.840			
GAS SAMPLE VOLUME	Vm	cubic ft.	22.2			
METER CALIBRATION FACTOR	Y	-	1.000			
TOTAL SAMPLING TIME	min	minutes	30			
STACK GAS OXYGEN CONTENT	Co2,m	%	8.37			
STACK GAS CARBON DIOXIDE CONTENT	Cco2,m	%	10.71			
TOTAL IMPINGER GAIN (WATER & PARTICULATE)	Ww	grams	63.2			

CALCULATED DATA	SYMBOL	UNITS	DATA			
RUN NUMBER	-	-	R1			
STACK AREA, As = 3.14*(ds)**2/576 (ROUND)	As	sq. feet	1.670			
= L * W/144 (RECTANGULAR)			0.000			
AVG. STACK TEMPERATURE, Ts = Fs + 460	Ts	degrees R	1337.4			
AVG. METER TEMPERATURE, Tm = Fm + 460	Tm	degrees R	568.0			
GAS SAMPLE VOLUME AT STANDARD CONDITIONS, VmStd = 17.64Y (Vm/Tm) (Pbar + dH/13.6)	VmStd	cubic ft.	20.7			
VOLUME OF WATER VAPOR, VwStd = 0.04707*Ww	VwStd	cubic ft.	3.0			
MOISTURE FRACTION, Bws = VwStd/(VmStd + VwStd)	Bws	-	0.126			
DRY STACK GAS MOL. WEIGHT, Md = 0.32(Co2,m)+ 0.44(Cco2,m)+0.28[100-(Co2,m)-(Cco2,m)]	Md	g/g-mole	30.05			
WET STACK GAS MOLECULAR WEIGHT, Mw = Md(1-Bws)+18.0(Bws)	Mw	g/g-mole	28.53			
ABSOLUTE STACK PRESSURE, Ps = Pbar + Pg/13.6	Ps	in. Hg	30.23			
STACK GAS VELOCITY vs = 85.49 Cp { sqrt[(dP*Ts) /(Ps*Mw)] }	vs	ft/s	167.1			
vm = 0.3048 * vs	vsm	m/s	50.94			
ACTUAL STACK GAS FLOW RATE, Q = 60*vs*As	Q	acf/min	16750.9			
DRY GAS STACK FLOW RATE (DRY,STP) Qsd = 17.64*Q*(1-Bws)*(Ps/Ts)	Qsd	dscf/min	5838.7			
Qsdm = Qsd/35.32	Qsdm	dscm/min	165.3			

FLOW RATE

PLANT: Landfill Gas ICE
CITY: Confidential
RUN NO: 1,2,3
SAMPLE LOCATION: STACK

DATE ENTERED: 11/21/93
DATE: 11-Oct-93
OPERATOR: Jon Kawaguchi
ENTERED BY: David Hansell
CHECKED BY:

DATA ENTRY	SYMBOL	UNITS	DATA	DATA	DATA	DATA
RUN NUMBER	-	-	R1	R2	R3	Average
ROUND STACK, DIAMETER	ds	inches	17.5	17.5	17.5	17.50
RECTANGULAR STACK, LENGTH	L	inches				
WIDTH	W	inches				
AVERAGE STACK TEMPERATURE	Fs	degrees F	874.4	877.8	876.5	876.2
AVERAGE METER TEMPERATURE	Fm	degrees F	87.0	83.5	86.3	85.6
BAROMETRIC PRESSURE	Pbar	in. Hg	29.80	29.80	29.80	29.800
STACK STATIC PRESSURE	Pg	in. H20	4.700	4.500	6.400	5.200
AVG. DELTA H	dH	in. H20	1.900	1.900	1.900	1.900
AVG. VELOCITY HEAD	dP	in. H20	3.66	3.50	3.55	3.567
PITOT COEFFICIENT	Cp	-	0.840	0.840	0.840	0.840
GAS SAMPLE VOLUME	Vm	cubic ft.	28.2	33.0	29.0	30.077
METER CALIBRATION FACTOR	Y	-	1.000	1.000	1.000	1.000
TOTAL SAMPLING TIME	min	minutes	40	45	40	41.667
STACK GAS OXYGEN CONTENT	Co2,m	%	8.45	8.45	8.45	8.450
STACK GAS CARBON DIOXIDE CONTENT	Cco2,m	%	10.52	10.52	10.52	10.520
TOTAL IMPINGER GAIN (WATER & PARTICULATE)	Ww	grams	81.8	78.0	87.4	82.400

CALCULATED DATA	SYMBOL	UNITS	DATA	DATA	DATA	DATA
RUN NUMBER	-	-	R1	R2	R3	Average
STACK AREA, As = 3.14*(ds)**2/576 (ROUND)	As	sq. feet	1.670	1.670	1.670	1.670
= L * W/144 (RECTANGULAR)			0.000	0.000	0.000	0.000
AVG. STACK TEMPERATURE, Ts = Fs + 460	Ts	degrees R	1334.4	1337.8	1336.5	1336.2
AVG. METER TEMPERATURE, Tm = Fm + 460	Tm	degrees R	547.0	543.5	546.3	545.6
GAS SAMPLE VOLUME AT STANDARD CONDITIONS, VmStd = 17.64Y (Vm/Tm) (Pbar + dH/13.6)	VmStd	cubic ft.	27.3	32.1	28.0	29.1
VOLUME OF WATER VAPOR, VwStd = 0.04707*Ww	VwStd	cubic ft.	3.9	3.7	4.1	3.9
MOISTURE FRACTION, Bws = VwStd/(VmStd + VwStd)	Bws	-	0.124	0.103	0.128	0.118
DRY STACK GAS MOL. WEIGHT, Md = 0.32(Co2,m)+ 0.44(Cco2,m)+0.28[100-(Co2,m)-(Cco2,m)]	Md	g/g-mole	30.02	30.02	30.02	30.02
WET STACK GAS MOLECULAR WEIGHT, Mw = Md(1-Bws)+18.0(Bws)	Mw	g/g-mole	28.53	28.79	28.48	28.60
ABSOLUTE STACK PRESSURE, Ps = Pbar + Pg/13.6	Ps	in. Hg	30.15	30.13	30.27	30.18
STACK GAS VELOCITY vs = 85.49 Cp [sqrt[(dP*Ts) /(Ps*Mw)]]	vs	ft/s	171.0	166.8	168.3	168.7
vm = 0.3048 * vs	vsm	m/s	52.13	50.85	51.31	51.43
ACTUAL STACK GAS FLOW RATE, Q = 60*vs*As	Q	acf/min	17141.0	16719.3	16871.0	16910.4
DRY GAS STACK FLOW RATE (DRY,STP) Qsd = 17.64*Q*(1-Bws)*(Ps/Ts)	Qsd	dscf/min	5985.4	5960.1	5878.0	5941.2
Qsdm = Qsd/35.32	Qsdm	dscm/min	169.5	168.7	166.4	168.2

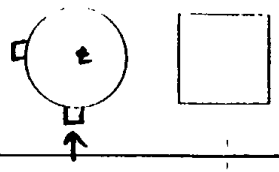
EPA METHOD 4

Plant
City
Location
Operators JJR
Date 10/11/93
Run Number 1
Stack Diam. (in.) 17.5

Sample Box Number Blank
Meter Box Number N1
Meter Calibration (Y) 1.0002
Meter dH @ 1.8512
Pitot Tube No. 162 Cp .84
Probe Length 4 Tc No. 498

Probe Liner Material S/S
Static Pressure (Ps) 14.7 (in. H2O)
Barometric Pressure (Pb) (in. Hg)
Ambient Temperature (°F) 70
Pretest Leak Rate 0.002 cfm @ 10 (in. Hg)
Post Test Leak Rate 0.002 cfm @ 12" (in. Hg)

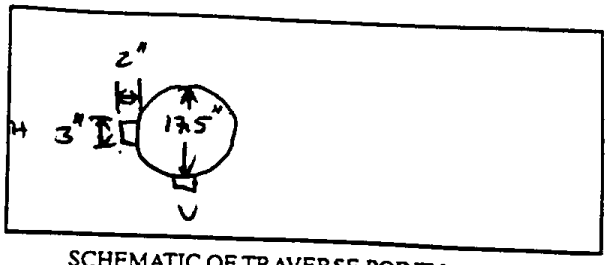
Sheet 1 of 1



Sampling Time, (min)	Clock Time (24 h)	Vacuum (in. Hg)	Pressure Differential Across Orifice dH (in. H2O)	Gas Sample Volume, Vm (cf)	Dry Gas Meter Outlet Temp, Tm (°F)	Impinger Outlet Temp (°F)	Comments
0	0936	7	1.9	763.550	83	2	
5	41	7	1.9	*~~763.550~~	85	50	*767.250
10	46	7	1.9	770.795	88	51	
15	51	7	1.9	774.385	89	51	
20	56	7	1.9	777.965	89	51	
25	1001	7	1.9	781.70	89	52	
30	06	7	1.9	784.56	89	53	
35	10:11	7	1.9	788.15	89	53	
40	10:16	7	1.9	791.780	8	53	
							Fuel 672 SCFM
							KWh 1875
							BTU Level 489
							Fuel is mixture of Landfill
							and Natural Gas
			n9	28.23	87		

PRELIMINARY VELOCITY TRAVERSE

PLANT
DATE 11 OCT 93
LOCATION Horiz. STACK
STACK I.D. 17.5"
PITOT NO./Cp 162 TC# 498
BAROMETRIC PRESSURE, In Hg 29.80
STATIC GAUGE PRESSURE, In H20 +4.7
OPERATORS JON K / BOB Z
PITOT PRE TEST LEAK CHECK GOOD
PITOT POST TEST LEAK CHECK GOOD



SCHEMATIC OF TRAVERSE POINT LAYOUT

Horizontal	TRAVERSE POINT NUMBER	CLOCK 24 HR TIME	VELOCITY HEAD (Ps) In. H20	STACK TEMP (Ts)°F	SWIRL ANGLE
2.6	1	0900	3.1	864	
3.8	2		3.2	866	
5.4	3		3.7	876	
7.7	4		3.7	877	
13.8	5		3.8	878	
16.1	6		3.8	877	
17.6	7		3.6	875	
18.9	8		3.4	870	0
AVERAGE					

Vertical	TRAVERSE POINT NUMBER	CLOCK 24 HR TIME	VELOCITY HEAD (Ps) In. H20	STACK TEMP (Ts)°F	SWIRL ANGLE
	1		3.2	870	
	2		3.9	870	
	3		4.0	874	
	4		4.0	880	
	5		4.0	883	
	6		3.9	884	
	7		3.8	873	
	8		3.5	873	
AVERAGE					

SWIRL ACCEPTANCE LIMITS

Average(abs. value) less than 10°
No points with reverse flow
No more than 4 points above 30°

ΔP MINIMUM LIMITS

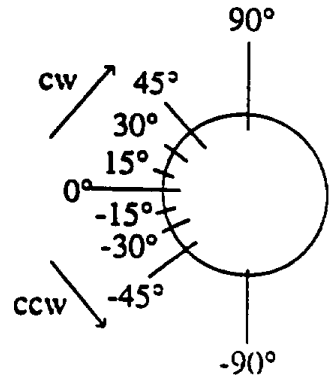
Conditions for more sensitive manometer
1. For 12 or more points on a velocity traverse: 10% of the points's $\Delta p < 0.05"$
2. For <12 points on a velocity traverse more than 1 point's $\Delta p < 0.05"$

Rt Mean Avg Δp =

$$\left[\frac{\sum_{1}(\Delta p_{si})^{1/2}}{N}\right]^2$$

Rt Mean Avg Ts =

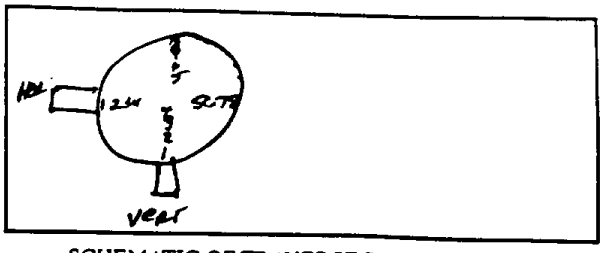
$$\left[\frac{\sum_{1}(T_{si})^{1/2}}{N}\right]^2$$



EER

PRELIMINARY VELOCITY TRAVERSE

PLANT
DATE 11 - OCT - 93
LOCATION STACK
STACK I.D. 17.5"
PITOT NO./Cp 162 TC#
BAROMETRIC PRESSURE, In Hg 29.80
STATIC GAUGE PRESSURE, In H20 +4.5"
OPERATORS Bob Z JON K
PITOT PRE TEST LEAK CHECK GOOD
PITOT POST TEST LEAK CHECK GOOD



SCHEMATIC OF TRAVERSE POINT LAYOUT

TRAVERSE POINT NUMBER	CLOCK 24 HR TIME	VELOCITY HEAD (Ps) In. H20	STACK TEMP (Ts)°F	SWIRL ANGLE
HOR 1	11:25	3.10 ~~3.30~~	880	
2		3.30	880	
3		3.30	879	
4		3.50	880	
5		3.60	880	
6		3.80	880	
7		3.60	880	
HOR 8	11:36	3.10	870	
AVERAGE				

TRAVERSE POINT NUMBER	CLOCK 24 HR TIME	VELOCITY HEAD (Ps) In. H20	STACK TEMP (Ts)°F	SWIRL ANGLE
VERT 1	11:19	3.9	854	
2		4.0	879	
3		4.0	884	
4		4.0	885	
5		3.8	886	
6		3.8	882	
7		3.6	[illegible]	
VERT 8		2.8	868	
AVERAGE				

SWIRL ACCEPTANCE LIMITS

Average(abs. value) less than 10°
No points with reverse flow
No more than 4 points above 30°

ΔP MINIMUM LIMITS

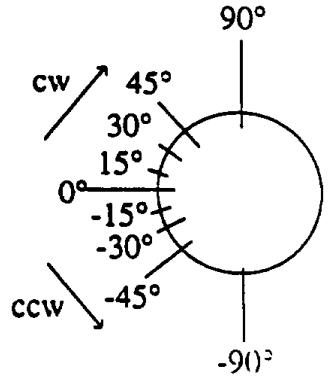
Conditions for more sensitive manometer
1. For 12 or more points on a velocity traverse: 10% of the points's Δp < 0.05"
2. For <12 points on a velocity traverse more than 1 point's Δp <0.05"

Rt Mean Avg Δp =

$$\left[\frac{\sum_{i}(\Delta p_{si})^{1/2}}{N}\right]^2$$

Rt Mean Avg Ts =

$$\left[\frac{\sum_{i}(Ts_i)^{1/2}}{N}\right]^2$$



EER

IMPINGER WEIGHT SHEET

Plant/city:

Location:

Train Set No. Black

Run No.: 1

Operator: JR

Run Time: 30 min

Impinger No.	Solution Used	Solution (ml)	Configuration		Weight (grams)	Inspection Comments
1	DI	800	M	Final	622.9	
				Initial	551.7	
				Wt. gain	71.2	CLEAR
2	DII	100	G.S.	Final	643.1	
				Initial	637.6	
				Wt. gain	5.5	CLEAR
3	Empty	—	M	Final	489.4	
				Initial	488.9	
				Wt. gain	0.5	EMPTY
4	Silica		M	Final	621.5	
				Initial	616.9	
				Wt. gain	4.6	NOT SPENT
5				Final		
				Initial		
				Wt. gain		
6				Final		
				Initial		
				Wt. gain		
Flask				Final		
				Initial		
				Wt. gain		

TOTAL WEIGHT GAIN OF IMPINGERS (grams) 81.8

Train set up: Date: 10/11/93

Signature:

Train recovery: Date: 10/11/93

Signature:

EER

IMPINGER WEIGHT SHEET

Plant/city: _____

Location: _____

Train Set No. Orange

Run No.: 2

Operator: JR

Run Time: 30 min

Impinger No.	Solution Used	Solution (ml)	Configuration		Weight (grams)	Inspection Comments
1	DI	100		Final	633.8	
				Initial	581.2	
				Wt. gain	52.6	CLEAR
2	DI	100		Final	604.6	
				Initial	593.0	
				Wt. gain	11.6	CLEAR
3	Empty	—		Final	482.5	
				Initial	480.8	
				Wt. gain	1.7	EMPTY
4	Silica	300g		Final	733.7	
				Initial	721.6	
				Wt. gain	12.1	NOT SPENT
5				Final		
				Initial		
				Wt. gain		
6				Final		
				Initial		
				Wt. gain		
Flask				Final		
				Initial		
				Wt. gain		

TOTAL WEIGHT GAIN OF IMPINGERS (grams) 78

Train set up: Date: 10/11/93

Signature: [signature]

Train recovery: Date: 11 OCT 93

Signature: [signature]

EER

EPA METHOD 4

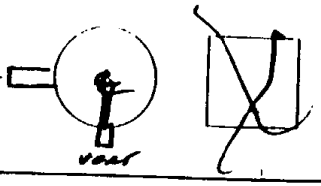
Plant
City
Location
Operators [illegible] 2
Date 11 OCT 93
Run Number 2
Stack Diam. (in.) 175

Sample Box Number
Meter Box Number M
Meter Calibration (Y) 1.0002
Meter dH @ 1.9512
Pitot Tube No. 16" Cp .84
Probe Length 4 Tc No. 498

Probe Liner Material S/S
Static Pressure (Pa) 74.7 (in. H2O)
Barometric Pressure (Pb) 29.80 (in. Hg)
Ambient Temperature (°F) 68
Pretest Leak Rate 0.001 cfm @ 12" (in. Hg)
Post Test Leak Rate 0.005 cfm @ 20" (in. Hg)

Shoot 1 of 1

Hot



Sampling Time, (min)	Clock Time (24 h)	Vacuum (in. Hg)	Pressure Differential Across Orifice dH (in. H2O)	Gas Sample Volume, Vm (cf)	Dry Gas Meter Outlet Temp. Tm (°F)	Impinger Outlet Temp (°F)	Comments
0.0	10:31			791.917			
5.0	10:36	16.0	1.90	794.86	83	56	
10.0	10:41	16.0	1.90	798.45	83	53	
15.0	10:46	16.0	1.90	802.8	83	53	
20.0	10:51	16.0	1.90	806.5	83	53	
25.0	10:56	16.0	1.90	810.14	83	55	
30.0	11:01	16.0	1.90	813.90	84	55	Fuel 670 SCFH
35.0	11:06	16.0	1.90	820.30	84	55	KWh 1875
40.0	11:11	16.0	1.90	824.335	84	56	
45.0	11:16	16.0	1.90	824.335	84	56	

EPA METHOD 4

Plant ____
City ____
Location
Operators [illegible] STONE
Date 11 OCT 93
Run Number #3
Stack Diam. (in.) 72.5"

Sample Box Number BLACK
Meter Box Number N1
Meter Calibration (Y) 1.0002
Meter dH @ 1.9512
Pitot Tube No. 162 Cp .84
Probe Length ____ Tc No. 498

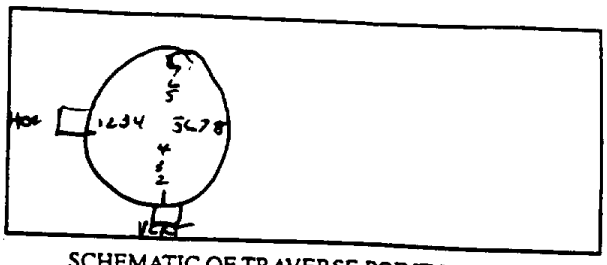
Probe Liner Material S.S
Static Pressure (Pa) ~~[illegible]~~ 64 (in. H2O)
Barometric Pressure (Pb) 29.30 (in. Hg)
Ambient Temperature (°F) ____
Pretest Leak Rate 0.002 cfm @ 23 (in. Hg)
Post Test Leak Rate 0.000 cfm @ 10 (in. Hg)

Sheet 1 of 1

Sampling Time, (min)	Clock Time (24 h)	Vacuum (in. Hg)	Pressure Differential Across Orifice dH (in. H2O)	Gas Sample Volume, Vm (cf)	Dry Gas Meter Outlet Temp. Tm (F)	Impinger Outlet Temp (F)	Comments
0	1341	7	1.9	824.717	83	59	
5	46	6.5	1.9	828.370	83	53	Fuel Flow 667. SCFM
10	51	6.5	1.9	831.950	84	54	KW 1875
15	~~[illegible]~~ 56	6.5	1.9	835.550	85	55	
20	1401	6.5	1.9	839.150	86	55	
25	06	6.5	1.9	842.740	87	56	709 SCFM FUEL FLOW
30	11	7	1.9	846.290	88	58	KW 1975
35	16	7	1.9	849.910	90	58	
40	21	7	1.9	853.546	91	60	

PRELIMINARY VELOCITY TRAVERSE

PLANT
DATE 11 OCT 93
LOCATION
STACK I.D. 12.5"
PITOT NO./Cp 162 / .84 TC# 498
BAROMETRIC PRESSURE, In Hg 29.80
STATIC GAUGE PRESSURE, In H20 + 6.4
OPERATORS Bob Z / JOHN K
PITOT PRE TEST LEAK CHECK 6000
PITOT POST TEST LEAK CHECK 6000



SCHEMATIC OF TRAVERSE POINT LAYOUT

TRAVERSE POINT NUMBER	CLOCK 24 HR TIME	VELOCITY HEAD (Ps) In. H20	STACK TEMP (Ts)°F	SWIRL ANGLE
Hor. 1	14:25	878	2.7	
2		3.3	877	
3		3.5	880	
4		3.6	883	
5		3.6	882	
6		3.5	882	
7		3.5	880	
Hor 8		3.2	870	
AVERAGE				

TRAVERSE POINT NUMBER	CLOCK 24 HR TIME	VELOCITY HEAD (Ps) In. H20	STACK TEMP (Ts)°F	SWIRL ANGLE
Vert 1	14:16	3.1	873	
2		3.1	866	
3		3.7	865	
4		4.1	873	
5		4.1	879	
6		3.9	879	
7		4.0	879	
Vert 8		3.5	878	
AVERAGE				

SWIRL ACCEPTANCE LIMITS

Average(abs. value) less than 10°
No points with reverse flow
No more than 4 points above 30°

ΔP MINIMUM LIMITS

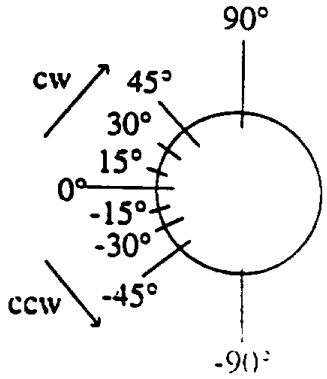
Conditions for more sensitive manometer
1. For 12 or more points on a velocity traverse: 10% of the points's Δp < 0.05"
2. For <12 points on a velocity traverse more than 1 point's Δp <0.05"

Rt Mean Avg Δp =

$$\left[\frac{\sum_{1}(\Delta p_{si})^{1/2}}{N}\right]^2$$

Rt Mean Avg Ts =

$$\left[\frac{\sum_{1}(Ts_i)^{1/2}}{N}\right]^2$$



PRELIMINARY VELOCITY TRAVERSE

PLANT _____
DATE 10/12/98
LOCATION _____
STACK I.D. 17 1/2"
PITOT NO./Cp 162/.84 TC# _____
BAROMETRIC PRESSURE, In Hg _____
STATIC GAUGE PRESSURE, In H20 +4.5
OPERATORS RC, JO
PITOT PRE TEST LEAK CHECK ✓
PITOT POST TEST LEAK CHECK _____

SCHEMATIC OF TRAVERSE POINT LAYOUT

TRAVERSE POINT NUMBER	CLOCK 24 HR TIME	VELOCITY HEAD (Ps) In. H20	STACK TEMP (Ts)°F	SWIRL ANGLE
Horiz 1		3.2	879	
2		3.5	879	
3		3.6	879	
4		3.7	881	
5		3.9	880	
6		3.8	880	
7		3.8	880	
8		2.7	870	
AVERAGE				

TRAVERSE POINT NUMBER	CLOCK 24 HR TIME	VELOCITY HEAD (Ps) In. H20	STACK TEMP (Ts)°F	SWIRL ANGLE
Vert 1		4.2	874	
2		4.2	876	
3		4.1	879	
4		4.1	883	
5		3.9	885	
6		3.8	886	
7		3.6	882	
8		3.4	880	
AVERAGE				

SWIRL ACCEPTANCE LIMITS

Average(abs. value) less than 10°
No points with reverse flow
No more than 4 points above 30°

ΔP MINIMUM LIMITS

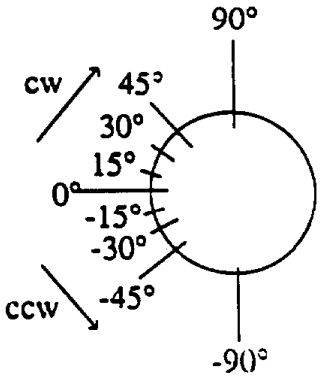
Conditions for more sensitive manometer
1. For 12 or more points on a velocity traverse: 10% of the points's Δp < 0.05"
2. For <12 points on a velocity traverse more than 1 point's Δp <0.05"

Rt Mean Avg Δp =

$$\left[\frac{\sum_{i}(\Delta p_{si})^{1/2}}{N}\right]^2$$

Rt Mean Avg Ts =

$$\left[\frac{\sum_{i}(T_{si})^{1/2}}{N}\right]^2$$



EEF

IMPINGER WEIGHT SHEET

Train Set No. ~~ORANGE~~ BLACK

Plant/city:

Location:

Run No.: 3

Operator: Bob & JONK

Run Time: 13:41 — 17:21

Impinger No.	Solution Used	Solution (ml)	Configuration		Weight (grams)	Inspection Comments
1	D.I. H_2O	100	M	Final	717.4	
				Initial	622.9	
				Wt. gain	94.5	CLEAR
2		100	G.S	Final	629.4	
				Initial	643.1	
				Wt. gain	-13.7	CLEAR
3	EMPTY		M	Final	491.0	
				Initial	489.4	
				Wt. gain	1.6	EMPTY
4	Silica Gel	3"	M	Final	626.5	
				Initial	621.5	
				Wt. gain	5	NOT SPENT
5				Final		
				Initial		
				Wt. gain		
6				Final		
				Initial		
				Wt. gain		
Flask				Final		
				Initial		
				Wt. gain		

TOTAL WEIGHT GAIN OF IMPINGERS (grams)

Train set up: Date: 11 OCT 93
Signature: JON K

Train recovery: Date: 11 OCT 93
Signature: [illegible]

$V = 171 \frac{ft^3}{s}$

$Q_d = \cancel{1744}$ 5784.4 ft^3/min

EER

EPA METHOD 4

Plant ____
City ____
Location ____
Operators JK
Date 10/12/93
Run Number 4
Stack Diam. (in.) 17 1/2"

Sample Box Number Black
Meter Box Number NT
Meter Calibration (Y) 1.0002
Meter dH @ 1.9612
Pilot Tube No. 162 Cp .84
Probe Length 4 Tc No. ____

Probe Liner Material S/S
Static Pressure (Pa) +1.5 (in. H2O)
Barometric Pressure (Pb) ____ (in. Hg)
Ambient Temperature (°F) 70
Pretest Leak Rate 0.00 cfm @ 12 (in. Hg)
Post Test Leak Rate 0.00 cfm @ 10 (in. Hg)

Sheet 1 of 1

Sampling Time, (min)	Clock Time (24 h)	Vacuum (in. Hg)	Pressure Differential Across Orifice dH (in. H2O)	Gas Sample Volume, Vm (cf)	Dry Gas Meter Outlet Temp. Tm (°F)	Impinger Outlet Temp (°F)	Comments
0	1238	7	1.9	953.670	100	61	
5	43	7	1.9	957.365	107	62	
10	48	7	1.9	960.095	108	59	
15	53	7	1.9	964.795	108	60	
20	58	7	1.9	968.375	108	61	
25	1303	7	1.9	972.375	108	61	
30	08	7	1.9	975.940	108	60	

...MMARY VELOCITY TRAVERSE

PLANT
DATE 10/12/93 01
LOCATION
STACK I.D. 12.5
PITOT NO./Cp 162/.84 TC#
BAROMETRIC PRESSURE, In Hg 29.89
STATIC GAUGE PRESSURE, In H20 +4.5
OPERATORS RC, JC
PITOT PRE TEST LEAK CHECK Good
PITOT POST TEST LEAK CHECK

TRAVERSE POINT NUMBER	CLOCK 24 HR TIME	VELOCITY HEAD (Ps) In. H20	STACK TEMP (Ts)°F	SWIRL ANGLE
Horiz 1		3.4	879	
2		3.2	879	
3		3.4	879	
4		3.6	878	
5		3.8	877	
6		3.7	873	
7		3.6	879	
8		2.8	880	
AVERAGE				

SCHEMATIC OF TRAVERSE POINT LAYOUT

TRAVERSE POINT NUMBER	CLOCK 24 HR TIME	VELOCITY HEAD (Ps) In. H20	STACK TEMP (Ts)°F	SWIRL ANGLE
Vert. 1		2.5	879	
2		3.2	882	
3		3.7	882	
4		3.9	882	
5		4.0	880	
6		4.0	881	
7		3.8	880	
8		3.5	878	
AVERAGE				

SWIRL ACCEPTANCE LIMITS

Average(abs. value) less than 10°
No points with reverse flow
No more than 4 points above 30°

ΔP MINIMUM LIMITS

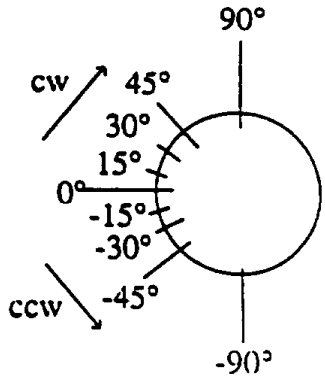
Conditions for more sensitive manometer
1. For 12 or more points on a velocity traverse: 10% of the points's Δp < 0.05"
2. For <12 points on a velocity traverse more than 1 point's Δp <0.05"

Rt Mean Avg Δp =

$$\left[\frac{\sum_{i}(\Delta p_{si})^{1/2}}{N}\right]^2$$

Rt Mean Avg Ts =

$$\left[\frac{\sum_{i}(Ts_i)^{1/2}}{N}\right]^2$$



Appendix A.3. Tedlar Bag Analyses

IMPINGER WEIGHT SHEET

Plant/city: ___

Location: ___

Train Set No. BLACK

Run No.: 4

Operator: JR

Run Time: 30 min

Impinger No.	Solution Used	Solution (ml)	Configuration		Weight (grams)	Inspection Comments
1	D.I. H_2O	100	M	Final	720.0	
				Initial	717.4	
				Wt. gain	2.6	
2	D.I. H_2O	100	G.S	Final	681.4	
				Initial	629.4	
				Wt. gain	52.0	
3	EMPTY			Final	492.8	
				Initial	491.0	
				Wt. gain	1.8	
4	Silica Gel	3"	M	Final	632.8	
				Initial	626.0	
				Wt. gain	6.8	
5				Final		
				Initial		
				Wt. gain		
6				Final		
				Initial		
				Wt. gain		
Flask				Final		
				Initial		
				Wt. gain		

TOTAL WEIGHT GAIN OF IMPINGERS (grams) 63.2

Train set up: Date: 11 OCT 93

Signature: Bob Jones

Train recovery: Date: ___

Signature: ___

EER

Applied P & Ch Laboratory
4066 E. Mission Blvd., Pomona, CA 91766
Tel: (909) 622-5148 Fax: (909) 622-3199

APCL Analytical Report

Submitted to:
Energy and Environmental Research Corporation
Attention: Dave Hansell
8001 Irvine Blvd.
Santa Ana, CA 92706
Tel: (714)552-1803 Fax: (714)857-1943

Service ID #: 801-934329 Received : 10/12/93
Collected by: R. Campbell Tested : 10/14/93
Collected on: 10/11/93 Reported : 10/25/93
Sample description:
Diluted & Undiluted Air Samples from
, Location: Stack (Project#: 6373-020)

Analysis of VOCs in Air

801-934329 Page 1 of 3

Component	Method	Unit	PQL	Concentration						
				154556	1 154557	1 154558	2 154560	2 154561	3 154563	3 154564
				Blank N_2	Diluted	Undiluted	Diluted	Undiluted	Undiluted	Diluted
				93-4329-1	93-4329-2	93-4329-3	93-4329-5	93-4329-6	93-4329-8	93-4329-9
Chlorinated Hydrocarbons										
Chloromethane	TO-14	ppbV	5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Bromomethane	TO-14	ppbV	5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Chloroethane	TO-14	ppbV	5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
1,1-Dichloroethane	TO-14	ppbV	5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Methylene Chloride	TO-14	ppbV	5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
1,1-Dichloroethene	TO-14	ppbV	5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
cis-1,2-Dichloroethene	TO-14	ppbV	5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Chloroform	TO-14	ppbV	5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
1,1,1-Trichloroethane	TO-14	ppbV	5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Carbon Tetrachloride	TO-14	ppbV	5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
1,2-Dichloroethane	TO-14	ppbV	5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Trichloroethene	TO-14	ppbV	5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
1,2-Dichloropropane	TO-14	ppbV	5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
cis-1,3-Dichloropropene	TO-14	ppbV	5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
trans-1,3-Dichloropropene	TO-14	ppbV	5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
1,1,2-Trichloroethane	TO-14	ppbV	5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Tetrachloroethene	TO-14	ppbV	5	N.D.	N.D.	N.D.	N.D.	7	N.D.	N.D.
Ethylene Dibromide	TO-14	ppbV	5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Ethylene Dichloride	TO-14	ppbV	5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Chlorobenzene	TO-14	ppbV	5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
1,1,2,2-Tetrachloroethane	TO-14	ppbV	5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
1,3-Dichlorobenzene	TO-14	ppbV	5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
1,4-Dichlorobenzene	TO-14	ppbV	5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Chlorotoluene	TO-14	ppbV	5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
1,2-Dichlorobenzene	TO-14	ppbV	5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
1,2,4-Trichlorobenzene	TO-14	ppbV	5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Hexachlorobutadiene	TO-14	ppbV	5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
trans-1,2-Dichloroethene	TO-14	ppbV	5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
1,1,1,2-Tetrachloroethane	TO-14	ppbV	5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Carbon Disulfide	TO-14	ppbV	5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.

CADHS ELAP CERTIFICATION NUMBER 1431

Samples diluted 6:1

Energy and
Environmental
Research Corporation

CHAIN OF CUSTODY

Plant

Page 1 of

Location Stack Project No. 6373-020 P.O No.

Sample No.	Test No.	Test Date	Description
154556	0	10-11-93	Blank N_2
154557	1		Dilluted Bag
154558	1		UNDILLUTED BAG
154559	1		CONDENSATE CATCH (UNDILLUTED BAG
154560	2		Dilluted BAG
154561	2		UNDILLUTED BAG
154562	2		CONDENSATE CATCH (UNDILLUTED B
154564	3		Dilluted BAG
154563	3		UNDILLUTED BAG
154565	3		CONDENSATE CATCH (UNDILLUTED B

Sampling system prepared by R. Campbell

Test operator R. Campbell

Sample recovery by R. Campbell

Relinquished By	Recieved By	Time	Date	Reason
Bob Zipperman	D. Jones	6:35Am	10/12/93	SHIP TO LAB
D. Jones	J. Elbana	7:35Am	10/12/93	

Laboratory analysis by Date

4329

Applied P & Ch Laboratory
4066 E. Mission Blvd., Pomona, CA 91766
Tel: (909) 622-5148 Fax: (909) 622-3199

APCL Analytical Report

Analysis of VOCs in Air

Component	Method	Unit	PQL	Concentration						
				154556 Blank 93-4329-1	154557 Diluted 93-4329-2	154558 Undiluted 93-4329-3	154560 Diluted 93-4329-5	154561 Undiluted 93-4329-6	154563 Undiluted 93-4329-8	154564 Diluted 93-4329-9
Acetylenes (C4-C5)										
1-Butyne*	TO-14	ppbV	5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
2-Butyne	TO-14	ppbV	5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
1-Pentyne	TO-14	ppbV	5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
2-Pentyne	TO-14	ppbV	5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Ethers										
MTBE	TO-14	ppbV	5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Dimethyl Ether	TO-14	ppbV	5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Ethyl Methyl Ether*	TO-14	ppbV	5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Diethyl Ether	TO-14	ppbV	5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Ethyl Propyl Ether*	TO-14	ppbV	5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Dipropyl Ether	TO-14	ppbV	5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
VOCs by GC/FIDs										
Methane	TO-14	ppbV	500	–	119,000	1,190,00†	119,000	1,200,000†	1,050,000†	131,000
Ethane	TO-14	ppbV	500	–	2,150	13,200	1,770	12,600	14,000	2,240
Propane	TO-14	ppbV	500	–	545	2,360	N.D.	1,780	1,310	602
Ethene	TO-14	ppbV	500	–	1,680	12,100	1,200	14,800	15,100	1,370
Propene	TO-14	ppbV	500	–	1,010	2,340	N.D.	1,620	1,830	713
Ethyne	TO-14	ppbV	500	–	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Propyne*	TO-14	ppbV	500	–	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.

PQL : Practical Quantitation Limit
N.D. : Not Detected or Less Than The Quantitation Limit.
*Standards unavailable.
†Exceeds Calibration Range.

Respectfully submitted,

Shu-Teh Pan
Lab Manager
Applied P & Ch Laboratory

CADHS ELAP CERTIFICATION NUMBER 1431

Applied P & Ch Laboratory
4066 E. Mission Blvd., Pomona, CA 91766
Tel: (909) 622-5148 Fax: (909) 622-3199

APCL Analytical Report

Analysis of VOCs in Air

Component	Method	Unit	PQL	Concentration						
				154556 Blank 93-4329-1	154557 Diluted 93-4329-2	154558 Undiluted 93-4329-3	154560 Diluted 93-4329-5	154561 Undiluted 93-4329-6	154563 Undiluted 93-4329-8	154564 Diluted 93-4329-9
Paraffins (C4-C6)										
n-Butane	TO-14	ppbV	5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Isobutane	TO-14	ppbV	5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
n-Pentane	TO-14	ppbV	5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Isopentane*	TO-14	ppbV	5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Neopentane*	TO-14	ppbV	5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
n-Hexane	TO-14	ppbV	5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
2-Methylpentane	TO-14	ppbV	5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
3-Methylpentane	TO-14	ppbV	5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
2,2-Dimethylbutane	TO-14	ppbV	5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
2,3-Dimethylbutane	TO-14	ppbV	5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Aromatics										
Benzene	TO-14	ppbV	5	N.D.	10	42	12	62	116	12
Toluene	TO-14	ppbV	5	N.D.	17	44	17	78	119	18
Ethyl Benzene	TO-14	ppbV	5	N.D.	N.D.	5	N.D.	12	N.D.	N.D.
m,p-Xylenes	TO-14	ppbV	5	N.D.	N.D.	N.D.	N.D.	9	12	N.D.
o-Xylene	TO-14	ppbV	5	N.D.	N.D.	N.D.	N.D.	5	N.D.	N.D.
Styrene	TO-14	ppbV	5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
1,3,5-Trimethylbenzene	TO-14	ppbV	5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
1,2,4-Trimethylbenzene	TO-14	ppbV	5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Phenol	TO-14	ppbV	5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Naphthalene	TO-14	ppbV	5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Naphthenes										
Cyclopropane	TO-14	ppbV	5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Cyclobutane	TO-14	ppbV	5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Cyclopentane	TO-14	ppbV	5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Cyclohexane	TO-14	ppbV	5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Ketones										
Acetone	TO-14	ppbV	5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Butanone	TO-14	ppbV	5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
1,3-Butadiene	TO-14	ppbV	5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Propadiene	TO-14	ppbV	5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Olefins (C4-C6)										
1-Butene	TO-14	ppbV	5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
cis-2-Butene	TO-14	ppbV	5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
trans-2-Butene	TO-14	ppbV	5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
2-Methylpropene	TO-14	ppbV	5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
1-Pentene	TO-14	ppbV	5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
cis-2-Pentene	TO-14	ppbV	5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
trans-2-Pentene	TO-14	ppbV	5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
2-methyl-2-Butene	TO-14	ppbV	5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
2-methyl-1-Butene	TO-14	ppbV	5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
3-methyl-1-Butene	TO-14	ppbV	5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.

CADHS ELAP CERTIFICATION NUMBER 1431

CARB 430

DATE DATE ENTERED: 11/17/93

PLANT: Landfill Gas ICE
TEST DATE: 10/12/93
CITY: Confidential
OPERATOR: Jon Kawaguchi
RUN #: 1, 2, 3
ENTERED BY: Dave Hansell
SAMPLE LOCATION: STACK
CHECKED BY:

DATA ENTRY	SYMBOL	UNITS		DATA		DATA		DATA			
RUN NUMBER	-	-		R1		R2		R3		AVE	RSD
AVERAGE METER TEMPERATURE	Fm	degree F		93.20		104.00		118.40		105.20	12.02
BAROMETRIC PRESSURE	Pbar	in. Hg		29.89		29.89		29.89		29.89	0.00
AVG. DELTA H	dH	in. H20		0.60		0.60		0.60		0.60	0.00
GAS SAMPLE VOLUME	Vm	cubic ft.		1.09		1.08		1.08		1.08	0.71
METER CALIBRATION FACTOR	Y	-		1.00		1.00		1.00		1.00	0.00
TOTAL SAMPLING TIME	min	minutes		60.00		60.00		60.00		60.00	0.00
SAMPLE 1ST IMPINGER VOLUME	Siwt,1	ml		10.20		10.80		10.40		10.47	2.92
SAMPLE 2ND IMPINGER VOLUME	Siwt,2	ml		9.40		9.40		9.00		9.27	2.49
BLANK 1ST IMPINGER VOLUME	Biwt,1	ml		9.40		9.60		9.20		9.40	2.13
BLANK 2ND IMPINGER VOLUME	Biwt,2	ml		9.60		9.40		9.80		9.60	2.08
SAMPLE WEIGHTS (1ST IMPINGER)											
Formaldehyde	Swt,1	µg		0.21		62.00		78.00		46.74	87.90
Acetaldehyde	Swt,1	µg		0.24	ND	0.10	ND	0.10	<	0.15	55.11
Acrolein	Swt,1	µg		0.59	ND	0.10	ND	0.10	<	0.26	107.43
Propanal	Swt,1	µg	ND	0.10	ND	0.10	ND	0.10	ND	0.10	0.00
Acetone	Swt,1	µg	ND	0.10	ND	0.10	ND	0.10	ND	0.10	0.00
Crotonaldehyde	Swt,1	µg	ND	0.10	ND	0.10	ND	0.10	ND	0.10	0.00
Isobutyraldehyde	Swt,1	µg	ND	0.10	ND	0.10	ND	0.10	ND	0.10	0.00
Methyl Ethyl Ketone	Swt,1	µg		0.18	ND	0.10	ND	0.10	<	0.13	36.46
SAMPLE WEIGHTS (2ND IMPINGER)											
Formaldehyde	Swt,2	µg		3.40		5.10		5.30		4.60	22.70
Acetaldehyde	Swt,2	µg		17.00		13.00		10.00		13.33	26.34
Acrolein	Swt,2	µg		6.10		5.90		5.00		5.67	10.34
Propanal	Swt,2	µg		0.93		0.68		0.48		0.70	32.36
Acetone	Swt,2	µg		4.50		2.60		2.30		3.13	38.08
Crotonaldehyde	Swt,2	µg		1.10		0.78		0.75		0.88	22.13
Isobutyraldehyde	Swt,2	µg	ND	0.10		-0.18	ND	0.10	<	0.13	36.46
Methyl Ethyl Ketone	Swt,2	µg		0.13	ND	0.10		0.17	<	0.13	26.34
BLANK WEIGHTS (1ST IMPINGER)											
Formaldehyde	Bwt,1	µg		0.10	ND	0.10		0.29	<	0.16	67.16
Acetaldehyde	Bwt,1	µg		0.20		0.15		0.20		0.18	15.75
Acrolein	Bwt,1	µg	ND	0.10	ND	0.10	ND	0.10	ND	0.10	0.00
Propanal	Bwt,1	µg	ND	0.10	ND	0.10	ND	0.10	ND	0.10	0.00
Acetone	Bwt,1	µg		0.21		0.30		0.32		0.28	21.18
Crotonaldehyde	Bwt,1	µg	ND	0.10	ND	0.10	ND	0.10	ND	0.10	0.00
Isobutyraldehyde	Bwt,1	µg	ND	0.10	ND	0.10	ND	0.10	ND	0.10	0.00
Methyl Ethyl Ketone	Bwt,1	µg		0.16		0.52	ND	0.10	<	0.26	87.37
BLANK WEIGHTS (2ND IMPINGER)											
Formaldehyde	Bwt,2	µg		0.16		0.15	ND	0.10	<	0.14	23.52
Acetaldehyde	Bwt,2	µg		0.16		0.16		0.13		0.15	11.55
Acrolein	Bwt,2	µg	ND	0.10	ND	0.10	ND	0.10	ND	0.10	0.00
Propanal	Bwt,2	µg	ND	0.10	ND	0.10	ND	0.10	ND	0.10	0.00
Acetone	Bwt,2	µg		0.26		0.26		0.19		0.24	17.08
Crotonaldehyde	Bwt,2	µg	ND	0.10	ND	0.10	ND	0.10	ND	0.10	0.00
Isobutyraldehyde	Bwt,2	µg	ND	0.10	ND	0.10	ND	0.10	ND	0.10	0.00
Methyl Ethyl Ketone	Bwt,2	µg	ND	0.10		0.19		0.45	<	0.25	73.68

Appendix A.4. Aldehyde/Ketone Calculations, Run Sheets and Analyses

CARB 430

	DATE DATE ENTERED: 11/17/93
PLANT: Landfill Gas ICE	TEST DATE: 10/12/93
CITY: Confidential	OPERATOR: Jon Kawaguchi
RUN #: 1, 2, 3	ENTERED BY: Dave Hansell
SAMPLE LOCATION: STACK	CHECKED BY:

CORRECTED SAMPLE CONCENTRATION (ng/ml) Br>5 Cic=Sic-Average(Bic); Br<5 Cic=5*Average(Bic)

RUN NUMBER	-	-		R1		R2		R3		AVE	RSD
SAMPLE											
Formaldehyde	Cic	ng/ml	C	168.39	C	3305.99	C	4278.02	C	2584.14	83.12
Acetaldehyde	Cic	ng/ml	C	862.05	< C	630.97	< C	503.07	< C	665.36	27.34
Acrolein	Cic	ng/ml	NA	341.33	< NA	297.03	< NA	262.89	< NC	300.41	13.09
Propanal	Cic	ng/ml	< NA	52.55	< NA	38.61	< NA	29.90	< NC	40.35	28.32
Acetone	Cic	ng/ml	< C	207.68	RL	135.09	RL	135.09	< C	159.28	26.31
Crotonaldehyde	Cic	ng/ml	< NA	61.22	< NA	43.56	< NA	43.81	< NC	49.53	20.44
Isobutyraldehyde	Cic	ng/ml	ND NA	10.20	< NA	13.86	ND NA	10.31	< NC	11.46	18.17
Methyl Ethyl Ketone	Cic	ng/ml	RL	133.33	ND NA	9.90	RL	133.33	< NC	92.19	77.30

CORRECTED SAMPLE CONCENTRATION 1 (mg/dscm), Cc,1=Cic*(Swt,1+Swt,2)/VmStd/1e06

RUN NUMBER	-	-		R1		R2		R3		AVE	RSD
SAMPLE											
Formaldehyde	Cc,1	mg/dscm	C	0.112	C	2.345	C	2.974	C	1.81	83.08
Acetaldehyde	Cc,1	mg/dscm	C	0.574	< C	0.447	< C	0.350	< C	0.46	24.58
Acrolein	Cc,1	mg/dscm	NA	0.227	< NA	0.211	< NA	0.183	< NC	0.21	10.85
Propanal	Cc,1	mg/dscm	< NA	0.035	< NA	0.027	< NA	0.021	< NC	0.03	25.63
Acetone	Cc,1	mg/dscm	< C	0.138	RL	0.096	RL	0.094	< C	0.11	22.93
Crotonaldehyde	Cc,1	mg/dscm	< NA	0.041	< NA	0.031	< NA	0.030	< NC	0.03	17.10
Isobutyraldehyde	Cc,1	mg/dscm	ND NA	0.007	< NA	0.010	ND NA	0.007	< NC	0.01	20.89
Methyl Ethyl Ketone	Cc,1	mg/dscm	RL	0.089	ND NA	0.007	RL	0.093	< NC	0.06	76.99

CORRECTED SAMPLE CONCENTRATION 2 (ppbv), Cc,2=1000*24.05/Mw

RUN NUMBER	-	-		R1		R2		R3		AVE	RSD
SAMPLE											
Formaldehyde	Cc,2	ppbv	C	90	C	1880	C	2384	C	1451.31	83.08
Acetaldehyde	Cc,2	ppbv	C	314	< C	245	< C	191	< C	249.81	24.58
Acrolein	Cc,2	ppbv	NA	97	< NA	90	< NA	78	< NC	88.74	10.85
Propanal	Cc,2	ppbv	< NA	14	< NA	11	< NA	9	< NC	11.48	25.63
Acetone	Cc,2	ppbv	< C	57	RL	40	RL	39	< C	45.33	22.93
Crotonaldehyde	Cc,2	ppbv	< NA	14	< NA	11	< NA	10	< NC	11.69	17.10
Isobutyraldehyde	Cc,2	ppbv	ND NA	2	< NA	3	ND NA	2	< NC	2.65	20.89
Methyl Ethyl Ketone	Cc,2	ppbv	RL	30	ND NA	2	RL	31	< NC	20.99	76.99

ND - Sample value below detection limit

< - Some sample values below detection limit

C - Blank Corrected

RL - Reporting Limit

NA - Not Available

CARB 430

	DATE DATE ENTERED: 11/17/93
PLANT: Landfill Gas ICE	TEST DATE: 10/12/93
CITY: Confidential	OPERATOR: Jon Kawaguchi
RUN #: 1, 2, 3	ENTERED BY: Dave Hansell
SAMPLE LOCATION: STACK	CHECKED BY:

CALCULATED DATA	SYMBOL	UNITS	DATA		DATA		DATA			
RUN NUMBER	-	-	R1		R2		R3		AVE	RSD
AVG. METER TEMPERATURE, Tm = Fm + 460	Tm	degrees R	553.20		564.00		578.40		565.20	2.24
GAS SAMPLE VOLUME AT STANDARD CONDITIONS, VmStd = 17.64Y (Vm/Tm) (Pbar + dH/13.6)	VmStd	dscm	0.029		0.028		0.028		0.029	2.72

SAMPLE IMPINGER CONCENTRATION (ng/ml), S or Bic= 1000*(S or Bwt,1+S or Bwt,2)/(S or Biwt,1+S or Biwt,2)

RUN NUMBER	-	-		R1		R2		R3		AVE	RSD
SAMPLE											
Formaldehyde	Sic	ng/ml		184.18		3321.78		4293.81		2599.93	82.61
Acetaldehyde	Sic	ng/ml		879.59	<	648.51	<	520.62	<	682.91	26.64
Acrolein	Sic	ng/ml		341.33	<	297.03	<	262.89	<	300.41	13.09
Propanal	Sic	ng/ml	<	52.55	<	38.61	<	29.90	<	40.35	28.32
Acetone	Sic	ng/ml	<	234.69	<	133.66	<	123.71	<	164.02	37.44
Crotonaldehyde	Sic	ng/ml	<	61.22	<	43.56	<	43.81	<	49.53	20.44
Isobutyraldehyde	Sic	ng/ml	ND	10.20	<	13.86	ND	10.31	<	11.46	18.17
Methyl Ethyl Ketone	Sic	ng/ml		15.82	ND	9.90	<	13.92	<	13.21	22.86
BLANK											
Formaldehyde	Bic	ng/ml		13.68	<	13.16	<	20.53	<	15.79	26.03
Acetaldehyde	Bic	ng/ml		18.95		16.32		17.37		17.54	7.55
Acrolein	Bic	ng/ml	ND	10.53	ND	10.53	ND	10.53	ND	10.53	0.00
Propanal	Bic	ng/ml	ND	10.53	ND	10.53	ND	10.53	ND	10.53	0.00
Acetone	Bic	ng/ml		24.74		29.47		26.84		27.02	8.78
Crotonaldehyde	Bic	ng/ml	ND	10.53	ND	10.53	ND	10.53	ND	10.53	0.00
Isobutyraldehyde	Bic	ng/ml	ND	10.53	ND	10.53	ND	10.53	ND	10.53	0.00
Methyl Ethyl Ketone	Bic	ng/ml	<	13.68		37.37	<	28.95	<	26.67	45.02

BLANK TO SAMPLE RATIO, Br=Sic/Average(Bic)

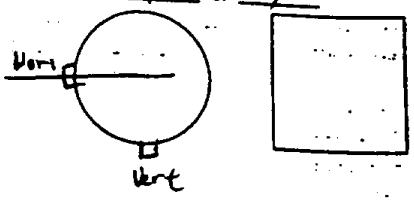
RUN NUMBER	-	-		R1		R2		R3		AVE	RSD
RATIO											
Formaldehyde	Br		C	11.66	C	210.38	C	271.94		164.66	82.61
Acetaldehyde	Br		C	50.14	C	36.97	C	29.68		38.93	26.64
Acrolein	Br		NA	NA	NA	NA	NA	NA		NA	NA
Propanal	Br		NA	NA	NA	NA	NA	NA		NA	NA
Acetone	Br		C	8.69	RL	4.95	RL	4.58		6.07	37.44
Crotonaldehyde	Br		NA	NA	NA	NA	NA	NA		NA	NA
Isobutyraldehyde	Br		NA	NA	NA	NA	NA	NA		NA	NA
Methyl Ethyl Ketone	Br		RL	0.59	NA	NA	RL	0.52		0.56	9.03

CARB 430 RUN SHEET

Plant
City
Location
Operators JR
Date 10/12/93
Run Number 2
Stack Diam. (in.) 17.5"
Static Pressure (Pa) -1.5 (in. H2O)
Barometric Pressure (Pb) 29.89 (in. Hg)
Ambient Temperature (°F) 70

Sample Box Number
Meter Box Number 9SWA
Meter Calibration (Y)
Meter dH @
Probe Length 4'
Probe Liner Material S/S
Pretest Leak Rate 0.00 cfm @ 7 (in. Hg)
Post Test Leak Rate 0.00 cfm @ 7 (in. Hg)

Sheet 1 of 1



Traverse Point No.	Sampling Time, (Min.)	Clock Time (24 h)	Rotameter Reading	Gas Sample Volume, Vm (l)	Flowrate liters/min	Stack Temp (°F)	Dry Gas Meter Outlet Temp, Tm (°C)	ΔH Probe Temp.	Comments
1	0	1022		2897.92					
1	5	27	80	2900.38	.5	N/A	39	06	
	10	32	80	2903.00	.5		39	06	
	15	37	80	2905.60	.5		39	06	Fuel 697 SCFM
	20	42	80	2908.10	.5		39	06	KW 1875 497 Btu
	25	47	80	2910.57	.5		39	06	
	30	52	80	2913.14	.5		39	06	
	35	57	80	2915.72	.5		39	06	Fuel 692 SCFM
	40	1102	80	2918.24	.5		40	06	KW 1875 496 Btu
	45	07	80	2920.80	.5		40	06	
	50	12	80	2923.58	.5		41	06	
	55	17	80	2925.90	.5		41	06	
	60	22	80	2928.34	.5		41	06	
Average/Total									

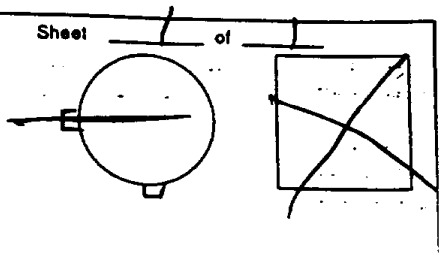
Flowrate at 0.50 liters/min +/- 10%
Pretest Probe Purge with Stack Gas
Pretest leak check with Charcoal Tube
Where gloves when operating train

CARB 430 RUN SHEET

Plant
City
Location
Operators JK
Date 10/12/93
Run Number 1
Stack Diam. (in.) 17.5
Static Pressure (Pa) 44.5 (in. H2O)
Barometric Pressure (Pb) 29.99 (in. Hg)
Ambient Temperature (°F) 70

Sample Box Number
Meter Box Number 195NA
Meter Calibration (Y)
Meter dH @
Probe Length 4'
Probe Liner Material S/S
Pretest Leak Rate 0.00 cfm @ 3 (in. Hg)
Post Test Leak Rate 0.00 cfm @ 2 (in. Hg)

Sheet 1 of 1



Traverse Point No.	Sampling Time, (Min.)	Clock Time (24 h)	Rotameter Reading	Gas Sample Volume, Vm (l)	Flowrate liters/min	Stack Temp (°F)	Dry Gas Meter Outlet Temp, Tm (°C)	ΔH Probe Temp.	Comments
1	0	0827	[illegible]	2866.61					
1	5	32	[illegible]	2869.20	0.5	N/A	31	0.6	Rotometer Reading 80
	10	37	80	2871.75	0.5		32	0.6	
	15	42	80	2874.35	0.5		33	0.6	
	20	47	80	2876.90	.5		35	0.6	Fuel 700 SCFM
	25	52	80	2879.45	.5		36	0.6	RW 1850 486 Btu
	30	57	80	2882.01	.5		37	0.6	
	35	0902	80	2884.55	.5		38	0.6	
	40	07	80	2887.21	.5		40	0.6	
	45	12	80	2889.65	.5		41	06	Fuel 703 SCFM
	50	17	80	2892.25	.5		42	06	1850 KW 485 Btu
	55	22	80	2894.70	.5		42	06	
	60	27	80	2897.37	.5		4	06	
Average/Total									

Flowrate at 0.50 liters/min +/- 10%
Pretest Probe Purge with Stack Gas
Pretest leak check with Charcoal Tube
Where gloves when operating train

Energy and
Environmental
Research Corporation

LAB SAMPLE
TRACKING REPORT
WORK REQUEST

PLANT _____ CHARGE NO. 6373-

ENGINEER _____

REMARKS: Condensate catch & Fuel sample

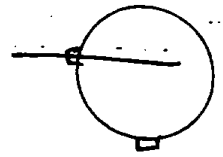
SAMPLE NO.	RUN NO.	SAMPLE DESCRIPTION	ANALYSIS REQUIRED	SAMPLE PREPARATION	DATE DELIVERED	DATE COMPLETE	COMMENTS
154509	Test1 Bag	Fuel sample inlet	Listed	Rob C			
154517	Test1 Front	Aldehyde	Hydrocarbons C3 to C4 Aldehyde C1 to C4	Jon K			
154518	Test1 Back	Aldehyde	Hydrocarbons C3 to C4 Aldehyde C1 to C5	Jon K			
154519	Test1 Front	Blank Aldehyde	Hydrocarbons C3 to C4 Aldehyde C1 to C4	Jon K			
154520	Test1 Back	Blank Aldehyde	Hydrocarbons C3 to C4 Aldehyde C1 to C5	Jon K			
139619	Test2 Front	Aldehyde	Hydrocarbons C3 to C4 Aldehyde C1 to C4	Jon K			
139630	Test2 Back	Aldehyde	↓	Jon K			
139632	Test2 Front	Blank Aldehyde	↓	Jon K			
139629	Test2 Back	Blank Aldehyde	↓	Jon K			
139634	Test3 Front	Aldehyde	Hydrocarbons C3 to C4 Aldehyde C1 to C4	Jon K			
139635	Test3 Back	Aldehyde	Hydrocarbons C3 to C4 Aldehyde C1 to C5	Jon K			
139636	Test3 Front	Blank Aldehyde	↓	Jon K			
139637	Test3 Back	Blank Aldehyde	↓	Jon K			

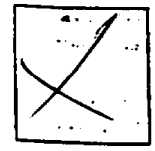
CARB 430 RUN SHEET

Plant
City
Location
Operators JR
Date 10/12/93
Run Number 3
Stack Diam. (in.) 17.5
Static Pressure (Pa) +4.6 (in. H2O)
Barometric Pressure (Pb) 29.89 (in. Hg)
Ambient Temperature (°F) 76

Sample Box Number
Meter Box Number 19SWA
Meter Calibration (Y)
Meter dH @
Probe Length 4'
Probe Liner Material S/S
Pretest Leak Rate 0.00 cfm @ 7 (in. Hg)
Post Test Leak Rate 0.00 cfm @ 5 (in. Hg)

Sheet ____ of ____





Traverse Point No.	Sampling Time, (Min.)	Clock Time (24 h)	Rotameter Reading	Gas Sample Volume, Vm (l)	Flowrate liters/min	Stack Temp (°F)	Dry Gas Meter Outlet Temp, Tm (°C)	ΔH Meter Temp.	Comments
1	0	1232		2929.54					
1	5	37	80	2931.77	.5	N/A	47	06	
	10	42	80	2933.67	.5		47	06	
	15	47	80	2936.15	.5		48	06	
	20	52	80	2938.95	.5		48	06	Fuel 681 SCFM
	25	57	80	2941.35	.5		48	06	1875 KW 488 BTU
	30	1302	80	2943.75	.5		49	06	
	35	07	80	2946.45	.5		49	06	
	40	12	80	2949.06	.5		48	06	
	45	17	80	2951.50	.5		49	06	Fuel 676 SCFM
	50	22	80	2954.11	.5		49	06	1850 KW 486 BTU
	55	27	80	2956.65	.5		49	0.6	
	60	32	80	2959.20	.5		49	06	
									Flowrate at 0.50 liters/min +/- 10%
									Pretest Probe Purge with Stack Gas
									Pretest leak check with Charcoal Tube
									Where gloves when operating train
Average/Total									

Energy and
Environmental
Research Corporation

CHAIN OF CUSTODY

Plant

Page 1 of

Location Stack

Project No. 6373-

P.O No.

@	Sample No.	Test No.	Test Date	Description
09:48	154509	Test 1	11-12-93	Fuel bag sample
09:30	154517	Test 1 Front	11-12-93	Aldehyde
09:30	154518	Test 1 Back	11-12-93	Aldehyde
08:25	154519	Test 1 Blank Front	11-12-93	Aldehyde - (Blank) Front
08:25	154520	Test 1 Blank Back	11-12-93	Aldehyde - (Blank) Back
	139619	Test 2 Front	11-12-93	Aldehyde
	139630	Test 2 Back	11-12-93	Aldehyde
	139632	Test 2 Blank Front	11-12-93	Aldehyde - (Blank) Front
	139629	Test 2 Blank Back	11-12-93	Aldehyde - (Blank) Back
	139634	Test 3 Front	11-12-93	Aldehyde
	139635	Test 3 Back	11-12-93	Aldehyde
	139636	Test 3 Blank Front	11-12-93	Aldehyde - (Blank) Front
	139637	Test 3 Blank Back	11-12-93	Aldehyde (Blank) Back

Sampling system prepared by Jon K

Test operator Jon K

Sample recovery by Jon K

Relinquished By	Recieved By	Time	Date	Reason
D. Jones	[illegible]	9:57	10-14-93	

Laboratory analysis by

Date

Energy and
Environmental
Research Corporation

FIELD SAMPLE
TRACKING REPORT

PROJECT NO. 6373- PAGE 1

PLANT/PROJECT

SAMPLE NO.	RUN NO.	PROCESS STREAM/ LOCATION	SAMPLE DATA				SENT TO:	
			DESCRIPTION	DATE	TIME	SAMPLER	LABORATORY	DATE
154509	Test 1 Bag	Fuel inlet	~~Bk~~ Fuel sample	11-12-93	09:48	Jon K		
154517	Test 1 Front	stack	Aldehyde	11-12-93	09:30	Jon K		
154518	Test 1 Back	stack	Aldehyde	11-12-93	09:30	Jon K		
154519	Test 1 Front	stack	Blank Aldehyde	11-12-93	08:25	Jon K		
154520	Test 1 Back	stack	Blank Aldehyde	11-12-93	08:25	Jon K		
139619	Test 2 Front	stack	Aldehyde	11-12-93	10:22	Jon K		
139630	Test 2 Back	stack	Aldehyde	11-12-93	10:22	Jon K		
139632	Test 2 Blank Front	stack	Aldehyde Blank	11-12-93	10:28	Jon K		
139629	Test 2 Blank Back	stack	Aldehyde Blank	11-12-93	10:28	Jon K		
139634	Test 3 Front	stack	Aldehyde	11-12-93	12:32	Jon K		
139635	Test 3 Back	stack	Aldehyde	11-12-93	12:32	Jon K		
139636	Test 3 Blank Front	stack	Aldehyde Blank	11-12-93	12:28	Jon K		
139637	Test 3 Blank Back	stack	Aldehyde Blank	11-12-93	12:28	Jon K		

AIR TOXICS LTD.

SAMPLE NAME: 154517

ID#: 9310112-01A

Aldehydes and Ketones in Ambient Air
(EPA Method TO-5)
High Pressure Liquid Chromatography

File Name:	**4101821**	**Date of Collection:**	**10/12/93**
Dil. Factor:	**1.0**	**Date of Extraction:**	**10/18/93**
Sample Volume (mL):	**10.2**	**Date of Analysis:**	**10/18/93**

Compound	Det. Limit (uG)	Amount (uG)
Formaldehyde	0.10	0.21
Acetaldehyde	0.10	0.24
Acrolein	0.10	0.61
Propanal	0.10	Not Detected
Acetone	0.10	Not Detected
Crotonaldehyde	0.10	Not Detected
Isobutyraldehyde	0.10	Not Detected
Methyl Ethyl Ketone	0.10	0.22

AIR TOXICS LTD.

AN ENVIRONMENTAL ANALYTICAL LABORATORY

WORK ORDER #: 9310112

Work Order Summary

CLIENT: Mr. Jon Kawaguchi
Energy & Environmental Research
8001 Irvine Blvd.
Santa Ana, CA 92705

BILL TO: Same

PHONE: 714-552-1803
FAX: 714-859-3194
DATE RECEIVED: 10/14/93
DATE COMPLETED: 10/26/93
DATE RE-ISSUED: 10/30/93 To amend reported data.

INVOICE # 2057
P.O. #
PROJECT #
AMOUNT$: $2,873.80

FRACTION #	NAME	TEST	PRICE
01A	154517	TO-5	$225.00
01AA	154517 Duplicate	TO-5	NC
01B	154518	TO-5	$225.00
01BMS	154518 Matrix Spike	TO-5	NC
01C	154519	TO-5	$225.00
01D	154520	TO-5	$225.00
02A	139619	TO-5	$225.00
02B	139630	TO-5	$225.00
02C	139632	TO-5	$225.00
02D	139629	TO-5	$225.00
03A	139634	TO-5	$225.00
03B	139635	TO-5	$225.00
03C	139636	TO-5	$225.00
03D	139637	TO-5	$225.00
04A	Lab Blank	TO-5	NC
05A	Lab Spike	TO-5	NC

Shipping (10/11/93 @ $86.90 and 10/14/93 @ $86.90) $173.80

LAB NARRATIVE:
Trip Blank and Trip Spike not returned from field.
Q = Exceeds Quality Control limits of 70% to 130% due to matrix effects.

CERTIFIED BY: Linda D. Freeman
Laboratory Director

DATE: 12/1/93

180 BLUE RAVINE ROAD, SUITE B • FOLSOM, CA 95630
(916) 985-1000 • FAX (916) 985-1020

AIR TOXICS LTD.

SAMPLE NAME: 154518

ID#: 9310112-01B

Aldehydes and Ketones in Ambient Air
(EPA Method TO-5)
High Pressure Liquid Chromatography

File Name:	**4101823**	**Date of Collection:**	**10/12/93**
Dil. Factor:	**1.0**	**Date of Extraction:**	**10/18/93**
Sample Volume (mL):	**9.4**	**Date of Analysis:**	**10/18/93**

Compound	Det. Limit (uG)	Amount (uG)
Formaldehyde	0.10	3.4
Acetaldehyde	0.10	17
Acrolein	0.10	6.1
Propanal	0.10	0.93
Acetone	0.10	4.5
Crotonaldehyde	0.10	1.1
Isobutyraldehyde	0.10	Not Detected
Methyl Ethyl Ketone	0.10	0.13

AIR TOXICS LTD.

SAMPLE NAME: 154517 Duplicate

ID#: 9310112-01AA

Aldehydes and Ketones in Ambient Air

(EPA Method TO-5)

High Pressure Liquid Chromatography

File Name:	**4101822**	**Date of Collection:**	**10/12/93**
Dil. Factor:	**1.0**	**Date of Extraction:**	**10/18/93**
Sample Volume (mL):	**10.2**	**Date of Analysis:**	**10/18/93**

Compound	Det. Limit (uG)	Amount (uG)
Formaldehyde	0.10	0.20
Acetaldehyde	0.10	0.23
Acrolein	0.10	0.56
Propanal	0.10	Not Detected
Acetone	0.10	Not Detected
Crotonaldehyde	0.10	Not Detected
Isobutyraldehyde	0.10	Not Detected
Methyl Ethyl Ketone	0.10	0.14

AIR TOXICS LTD.

SAMPLE NAME: 154519

ID#: 9310112-01C

Aldehydes and Ketones in Ambient Air
(EPA Method TO-5)
High Pressure Liquid Chromatography

File Name:	**410126**	**Date of Collection:**	**10/12/93**
Dil. Factor:	**1.0**	**Date of Extraction:**	**10/18/93**
Sample Volume (mL):	**9.4**	**Date of Analysis:**	**10/18/93**

Compound	Det. Limit (uG)	Amount (uG)
Formaldehyde	0.10	0.10
Acetaldehyde	0.10	0.20
Acrolein	0.10	Not Detected
Propanal	0.10	Not Detected
Acetone	0.10	0.21
Crotonaldehyde	0.10	Not Detected
Isobutyraldehyde	0.10	Not Detected
Methyl Ethyl Ketone	0.10	0.16

AIR TOXICS LTD.

SAMPLE NAME: 154518 Matrix Spike

ID#: 9310112-01BMS

Aldehydes and Ketones in Ambient Air

(EPA Method TO-5)

High Pressure Liquid Chromatography

File Name:	**4101824**	**Date of Collection:**	**10/12/93**
Dil. Factor:	**1.0**	**Date of Extraction:**	**10/18/93**
Sample Volume (mL):	**9.4**	**Date of Analysis:**	**10/18/93**

Compound	Det. Limit (uG)	% Recovery
Formaldehyde	0.10	69 Q
Acetaldehyde	0.10	41 Q
Acrolein	0.10	78
Propanal	0.10	Not Spiked
Acetone	0.10	Not Spiked
Crotonaldehyde	0.10	Not Spiked
Isobutyraldehyde	0.10	Not Spiked
Methyl Ethyl Ketone	0.10	Not Spiked

Q = Exceeds Quality Control limits of 70% to 130% due to matrix effects.

AIR TOXICS LTD.

SAMPLE NAME: 139619

ID#: 9310112-02A

Aldehydes and Ketones in Ambient Air
(EPA Method TO-5)
High Pressure Liquid Chromatography

File Name:	**4102103**	**Date of Collection:**	**10/12/93**
Dil. Factor:	**1.0**	**Date of Extraction:**	**10/18/93**
Sample Volume (mL):	**10.8**	**Date of Analysis:**	**10/21/93**

Compound	**Det. Limit (uG)**	**Amount (uG)**
Formaldehyde	0.10	62
Acetaldehyde	0.10	Not Detected
Acrolein	0.10	Not Detected
Propanal	0.10	Not Detected
Acetone	0.10	Not Detected
Crotonaldehyde	0.10	Not Detected
Isobutyraldehyde	0.10	Not Detected
Methyl Ethyl Ketone	0.10	Not Detected

AIR TOXICS LTD.

SAMPLE NAME: 154520

ID#: 9310112-01D

Aldehydes and Ketones in Ambient Air
(EPA Method TO-5)
High Pressure Liquid Chromatography

File Name:	**4101826**	**Date of Collection:**	**10/12/93**
Dil. Factor:	**1.0**	**Date of Extraction:**	**10/18/93**
Sample Volume (mL):	**9.6**	**Date of Analysis:**	**10/18/93**

Compound	Det. Limit (uG)	Amount (uG)
Formaldehyde	0.10	0.16
Acetaldehyde	0.10	0.16
Acrolein	0.10	Not Detected
Propanal	0.10	Not Detected
Acetone	0.10	0.26
Crotonaldehyde	0.10	Not Detected
Isobutyraldehyde	0.10	Not Detected
Methyl Ethyl Ketone	0.10	Not Detected

AIR TOXICS LTD.

SAMPLE NAME: 139632

ID#: 9310112-02C

Aldehydes and Ketones in Ambient Air
(EPA Method TO-5)
High Pressure Liquid Chromatography

File Name:	**4101829**	**Date of Collection:**	**10/12/93**
Dil. Factor:	**1.0**	**Date of Extraction:**	**10/18/93**
Sample Volume (mL):	**9.6**	**Date of Analysis:**	**10/18/93**

Compound	Det. Limit (uG)	Amount (uG)
Formaldehyde	0.10	Not Detected
Acetaldehyde	0.10	0.15
Acrolein	0.10	Not Detected
Propanal	0.10	Not Detected
Acetone	0.10	0.30
Crotonaldehyde	0.10	Not Detected
Isobutyraldehyde	0.10	Not Detected
Methyl Ethyl Ketone	0.10	0.52

AIR TOXICS LTD.

SAMPLE NAME: 139630

ID#: 9310112-02B

Aldehydes and Ketones in Ambient Air

(EPA Method TO-5)

High Pressure Liquid Chromatography

File Name:	**4101828**	**Date of Collection:**	**10/12/93**
Dil. Factor:	**1.0**	**Date of Extraction:**	**10/18/93**
Sample Volume (mL):	**9.4**	**Date of Analysis:**	**10/18/93**

Compound	Det. Limit (uG)	Amount (uG)
Formaldehyde	0.10	5.1
Acetaldehyde	0.10	13
Acrolein	0.10	5.9
Propanal	0.10	0.68
Acetone	0.10	2.6
Crotonaldehyde	0.10	0.78
Isobutyraldehyde	0.10	0.18
Methyl Ethyl Ketone	0.10	Not Detected

AIR TOXICS LTD.

SAMPLE NAME: 139634

ID#: 9310112-03A

Aldehydes and Ketones in Ambient Air
(EPA Method TO-5)
High Pressure Liquid Chromatography

File Name:	**4102103**	**Date of Collection:**	**10/12/93**
Dil. Factor:	**1.0**	**Date of Extraction:**	**10/18/93**
Sample Volume (mL):	**10.4**	**Date of Analysis:**	**10/21/93**

Compound	Det. Limit (uG)	Amount (uG)
Formaldehyde	0.10	78
Acetaldehyde	0.10	Not Detected
Acrolein	0.10	Not Detected
Propanal	0.10	Not Detected
Acetone	0.10	Not Detected
Crotonaldehyde	0.10	Not Detected
Isobutyraldehyde	0.10	Not Detected
Methyl Ethyl Ketone	0.10	Not Detected

AIR TOXICS LTD.

SAMPLE NAME: 139629

ID#: 9310112-02D

Aldehydes and Ketones in Ambient Air
(EPA Method TO-5)
High Pressure Liquid Chromatography

File Name:	**4101830**	**Date of Collection:**	**10/12/93**
Dil. Factor:	**1.0**	**Date of Extraction:**	**10/18/93**
Sample Volume (mL):	**9.4**	**Date of Analysis:**	**10/18/93**

Compound	Det. Limit (uG)	Amount (uG)
Formaldehyde	0.10	0.15
Acetaldehyde	0.10	0.16
Acrolein	0.10	Not Detected
Propanal	0.10	Not Detected
Acetone	0.10	0.26
Crotonaldehyde	0.10	Not Detected
Isobutyraldehyde	0.10	Not Detected
Methyl Ethyl Ketone	0.10	0.19

AIR TOXICS LTD.

SAMPLE NAME: 139636

ID#: 9310112-03C

Aldehydes and Ketones in Ambient Air
(EPA Method TO-5)
High Pressure Liquid Chromatography

File Name:	**4101837**	**Date of Collection:**	**10/12/93**
Dil. Factor:	**1.0**	**Date of Extraction:**	**10/18/93**
Sample Volume (mL):	**9.2**	**Date of Analysis:**	**10/18/93**

Compound	Det. Limit (uG)	Amount (uG)
Formaldehyde	0.10	0.29
Acetaldehyde	0.10	0.20
Acrolein	0.10	Not Detected
Propanal	0.10	Not Detected
Acetone	0.10	0.32
Crotonaldehyde	0.10	Not Detected
Isobutyraldehyde	0.10	Not Detected
Methyl Ethyl Ketone	0.10	Not Detected

AIR TOXICS LTD.

SAMPLE NAME: 139635

ID#: 9310112-03B

Aldehydes and Ketones in Ambient Air
(EPA Method TO-5)
High Pressure Liquid Chromatography

File Name:	**4101836**	**Date of Collection:**	**10/12/93**
Dil. Factor:	**1.0**	**Date of Extraction:**	**10/18/93**
Sample Volume (mL):	**9.0**	**Date of Analysis:**	**10/18/93**

Compound	Det. Limit (uG)	Amount (uG)
Formaldehyde	0.10	5.3
Acetaldehyde	0.10	10
Acrolein	0.10	5.0
Propanal	0.10	0.48
Acetone	0.10	2.3
Crotonaldehyde	0.10	0.75
Isobutyraldehyde	0.10	Not Detected
Methyl Ethyl Ketone	0.10	0.17

AIR TOXICS LTD.

SAMPLE NAME: Lab Blank

ID#: 9310112-04A

Aldehydes and Ketones in Ambient Air
(EPA Method TO-5)
High Pressure Liquid Chromatography

File Name:	**4101829**	**Date of Collection:**	**NA**
Dil. Factor:	**1.0**	**Date of Extraction:**	**10/18/93**
Sample Volume (mL):	**10.0**	**Date of Analysis:**	**10/18/93**

Compound	**Det. Limit (uG)**	**Amount (uG)**
Formaldehyde	0.10	Not Detected
Acetaldehyde	0.10	Not Detected
Acrolein	0.10	Not Detected
Propanal	0.10	Not Detected
Acetone	0.10	0.17
Crotonaldehyde	0.10	Not Detected
Isobutyraldehyde	0.10	Not Detected
Methyl Ethyl Ketone	0.10	0.70

AIR TOXICS LTD.

SAMPLE NAME: 139637

ID#: 9310112-03D

Aldehydes and Ketones in Ambient Air
(EPA Method TO-5)
High Pressure Liquid Chromatography

File Name:	**4101838**	**Date of Collection:**	**10/12/93**
Dil. Factor:	**1.0**	**Date of Extraction:**	**10/18/93**
Sample Volume (mL):	**9.8**	**Date of Analysis:**	**10/18/93**

Compound	Det. Limit (uG)	Amount (uG)
Formaldehyde	0.10	Not Detected
Acetaldehyde	0.10	0.13
Acrolein	0.10	Not Detected
Propanal	0.10	Not Detected
Acetone	0.10	0.19
Crotonaldehyde	0.10	Not Detected
Isobutyraldehyde	0.10	Not Detected
Methyl Ethyl Ketone	0.10	0.45

Appendix A.5. Fuel Analyses

AIR TOXICS LTD.

SAMPLE NAME: Lab Spike

ID#: 9310112-05A

Aldehydes and Ketones in Ambient Air

(EPA Method TO-5)

High Pressure Liquid Chromatography

File Name:	**4101840**	**Date of Collection:**	**NA**
Dil. Factor:	**1.0**	**Date of Extraction:**	**10/18/93**
Sample Volume (mL):	**11.0**	**Date of Analysis:**	**10/18/93**

Compound	**Det. Limit (uG)**	**% Recovery**
Formaldehyde	0.10	82
Acetaldehyde	0.10	73
Acrolein	0.10	98
Propanal	0.10	Not Spiked
Acetone	0.10	Not Spiked
Crotonaldehyde	0.10	Not Spiked
Isobutyraldehyde	0.10	Not Spiked
Methyl Ethyl Ketone	0.10	Not Spiked

AIR TOXICS LTD.

SAMPLE NAME: 154509
ID#: 9310111-01A

NATURAL GAS ANALYSIS by ASTM D-1945
GC/TCD/FID

File Name:	**3101405**	**Date of Collection:**	**10/12/93**
Dil. Factor:	**1.0**	**Date of Analysis:**	**10/14/93**

Compound	**Det. Limit (%)**	**Amount (%)**
Oxygen	0.001	0.19
Nitrogen	0.001	0.93
Carbon Monoxide	0.001	Not Detected
Methane	0.001	94
Carbon Dioxide	0.001	1.2
Ethane	0.001	2.8
Propane	0.001	0.76
Isobutane	0.001	0.096
Butane	0.001	0.14
Neopentane	0.001	Not Detected
Isopentane	0.001	0.044
n-Pentane	0.001	0.035
Ethylene	0.001	Not Detected
Propene	0.001	Not Detected
1-Butene	0.001	Not Detected
cis-2-Butene	0.001	Not Detected
trans-2-Butene	0.001	Not Detected
Cyclopentane	0.001	Not Detected
Ethyne	0.001	Not Detected
C6+	0.010	0.075
	Total (%) =	100

BTU/Cu. Ft. = 1000
Specific Gravity (Air = 1.000) = 0.59

Container Type: Tedlar Bag

AIR TOXICS LTD.

AN ENVIRONMENTAL ANALYTICAL LABORATORY

WORK ORDER #: 9310111

Work Order Summary

CLIENT: Mr. Jon Kawaguchi
Energy & Environmental Research
8001 Irvine Blvd.
Santa Ana, CA 92705

BILL TO: Same

PHONE: 714-552-1803
FAX: 714-859-3194
DATE RECEIVED: 10/14/93
DATE COMPLETED: 11/3/93

INVOICE # 2130
P.O. #
PROJECT
AMOUNT$: $175.00

FRACTION #	NAME	TEST	RECEIPT VAC./PRES.	PRICE
01A	154509	ASTM D-1945	Tedlar Bag	$175.00
02A	Lab Blank	ASTM D-1945	NA	NC

CERTIFIED BY: Linda L. Freeman
Laboratory Director

DATE: 11/3/93

180 BLUE RAVINE ROAD, SUITE B • FOLSOM, CA 95630
(916) 985-1000 • FAX (916) 985-1020

APPENDIX B - REFINERY GAS PROCESS HEATER

AIR TOXICS LTD.

SAMPLE NAME: Lab Blank
ID#: 9310111-02A

NATURAL GAS ANALYSIS by ASTM D-1945
GC/TCD/FID

File Name:	**3101404**	**Date of Collection:**	**NA**
Dil. Factor:	**1.0**	**Date of Analysis:**	**10/14/93**

Compound	Det. Limit (%)		Amount (%)
Oxygen	0.001		Not Detected
Nitrogen	0.001		100
Carbon Monoxide	0.001		Not Detected
Methane	0.001		Not Detected
Carbon Dioxide	0.001		Not Detected
Ethane	0.001		Not Detected
Propane	0.001		Not Detected
Isobutane	0.001		Not Detected
Butane	0.001		Not Detected
Neopentane	0.001		Not Detected
Isopentane	0.001		Not Detected
n-Pentane	0.001		Not Detected
Ethylene	0.001		Not Detected
Propene	0.001		Not Detected
1-Butene	0.001		Not Detected
cis-2-Butene	0.001		Not Detected
trans-2-Butene	0.001		Not Detected
Cyclopentane	0.001		Not Detected
Ethyne	0.001		Not Detected
C6+	0.010		Not Detected
		Total (%) =	100

BTU/Cu. Ft. = NA
Specific Gravity (Air = 1.000) = NA

Container Type: NA

CEM NO AND NOX CALIBRATIONS

PLANT: Refinery Gas Process Heater
CITY, STATE: Confidential
LOCATION: Stack

TEST DATE: 10/13/93

RUN NUMBER: NO,NO2 Run 1
RUN START TIME: 17:00
RUN END TIME: 18:40
CEM OPERATOR: Rob Cambell

ANALYTE		O2	CO2	NOx
CONCENTRATION UNIT		%, dry	%, dry	ppmv, dry
HIGH-RANGE GAS FRACTION OF SPAN		1	1	1
SPAN		13	13	55
SPAN GAS CONCENTRATION, Cma	HIGH	13	13	55
	MID	6.5	6.5	25
	ZERO	0	0	0
INITIAL ANALYZER CALIBRATION CHECK, Cai	HIGH	13.01	13.02	55.03
	MID	6.49	6.56	25.13
	ZERO	0.0	0.0	0.8
INITIAL ANALYZER CALIBRATION ERROR, Ei	HIGH	0.1%	0.2%	0.1%
Ei = ((Cai - Cma)/Span)x100%	MID	-0.1%	0.5%	0.2%
	ZERO	-0.1%	0.2%	1.4%
INITIAL BIAS CHECK, Cbi — UPSCALE HIGH (H) OR MID (M)?		M	M	M
(SELECT UPSCALE CALIBRATION GAS CLOSEST TO EFFLUENT GAS CONCENTRATION)	UPSCALE	6.52	6.51	24.99
	ZERO	0.1	0.0	0.8
INITITAL SYSTEM CALIBRATION BIAS, Bi	UPSCALE	0.2%	-0.4%	-0.3%
Bi = ((Cbi-Cai)/Span)x100%	ZERO	0.5%	0.1%	0.1%
FINAL ANALYZER CALIBRATION CHECK, Caf	HIGH	13	13.02	54.83
	MID	6.48	6.56	24.97
	ZERO	0.0	0.0	0.7
FINAL ANALYZER CALIBRATION ERROR, Ef	HIGH	0.0%	0.2%	-0.3%
Ef = ((Caf - Cma)/Span)x100%	MID	-0.2%	0.5%	-0.1%
	ZERO	0.1%	0.2%	1.2%
FINAL BIAS CHECK, Cbf — UPSCALE HIGH (H) OR MID (M)?		M	M	M
(SELECT UPSCALE CALIBRATION GAS CLOSEST TO EFFLUENT GAS CONCENTRATION)	UPSCALE	6.50	6.53	24.86
	ZERO	0.0	0.0	0.8
FINAL SYSTEM CALIBRATION BIAS, Bf	UPSCALE	0.2%	-0.2%	-0.2%
Bf = ((Cbf-Caf)/Span)x100%	ZERO	0.2%	0.0%	0.2%
ANALYZER DRIFT	HIGH	-0.1%	0.0%	-0.4%
D = ((Caf - Cai)/(Span))x100%	MID	-0.1%	0.0%	-0.3%
	ZERO	0.2%	0.1%	-0.2%
SYSTEM DRIFT	UPSCALE	-0.2%	0.2%	-0.2%
D = ((Cbf - Cbi)/(Span))x100%	ZERO	-0.1%	0.0%	-0.1%

Appendix B.1. CEM Calibrations and Calculations

RFG Process Heater						
10/13/93						
Time	O2	CO2	NO	NOx	NO	NOx
	%, Dry	%, Dry	ppmv, Dry	ppmv, Dry	ppmv, Dry 7%O2	ppmv, Dry 7%O2
00:17:00:42.004	9.80	6.97		28.97		36.21
00:17:01:41.996	9.84	6.96		28.45		35.69
00:17:02:41.992	9.88	6.95		28.55		35.94
00:17:03:41.984	9.90	6.94		29.40		37.08
00:17:04:41.980	9.76	7.01		28.27		35.21
00:17:05:41.973	10.01	6.86		27.88		35.52
00:17:06:41.969	9.78	6.99		27.14		33.86
00:17:07:41.957	9.81	6.97		27.91		34.92
00:17:08:42.008	9.90	6.92		27.80		35.06
00:17:09:42.004	9.64	7.08		27.59		34.00
00:17:10:42.051	9.87	6.95	27.70		34.84	
00:17:11:41.996	9.72	7.04	28.21		35.01	
00:17:12:41.984	9.90	6.93	27.65		34.87	
00:17:13:41.980	10.02	6.87	27.73		35.36	
00:17:14:41.973	9.65	7.08	28.10		34.66	
00:17:15:41.969	9.87	6.95	28.42		35.75	
00:17:16:41.969	9.62	7.09	27.83		34.24	
00:17:17:42.008	9.78	7.00	28.11		35.07	
00:17:18:42.004	9.69	7.05	28.44		35.20	
00:17:19:41.996	9.86	6.94	28.33		35.60	
00:17:20:41.992	9.74	7.02		28.04		34.86
00:17:21:41.984	9.75	7.01		27.79		34.58
00:17:22:41.980	9.88	6.95		28.17		35.47
00:17:23:41.973	9.76	7.01		27.67		34.46
00:17:24:41.969	9.82	6.97		27.41		34.32
00:17:25:41.957	9.79	6.99		27.58		34.44
00:17:26:42.008	9.91	6.92		26.98		34.06
00:17:27:41.953	9.97	6.89		27.02		34.30
00:17:28:41.996	9.99	6.86		26.11		33.20
00:17:29:41.992	9.89	6.93		26.25		33.08
00:17:30:41.992	9.92	6.91	25.38		32.07	
00:17:31:41.980	9.91	6.91	24.09		30.41	
00:17:32:41.973	9.84	6.94	24.83		31.15	

CEM NO AND NOX CALIBRATIONS

PLANT: Refinery Gas Process Heater
CITY, STATE: Confidential
LOCATION: Stack

TEST DATE: 10/13/93

RUN NUMBER: NO,NO2 Run 2
RUN START TIME: 19:24
RUN END TIME: 20:51
CEM OPERATOR: Rob Cambell

ANALYTE		O2	CO2	NOx
CONCENTRATION UNIT		%, dry	%, dry	ppmv, dry
HIGH-RANGE GAS FRACTION OF SPAN		1	1	1
SPAN		13	13	55
SPAN GAS CONCENTRATION, Cma	HIGH	13	13	55
	MID	6.5	6.5	25
	ZERO	0	0	0
INITIAL ANALYZER CALIBRATION CHECK, Cai	HIGH	13	13.02	54.83
	MID	6.48	6.56	24.97
	ZERO	0.0	0.0	0.7
INITIAL ANALYZER CALIBRATION ERROR, Ei	HIGH	0.0%	0.2%	-0.3%
Ei = ((Cai - Cma)/Span)x100%	MID	-0.2%	0.5%	-0.1%
	ZERO	0.1%	0.2%	1.2%
INITIAL BIAS CHECK, Cbi	UPSCALE HIGH (H) OR MID (M)?	M	M	M
(SELECT UPSCALE CALIBRATION GAS CLOSEST TO EFFLUENT GAS CONCENTRATION)	UPSCALE	6.50	6.53	24.86
	ZERO	0.0	0.0	0.8
INITITAL SYSTEM CALIBRATION BIAS, Bi	UPSCALE	0.2%	-0.2%	-0.2%
Bi = ((Cbi-Cai)/Span)x100%	ZERO	0.2%	0.0%	0.2%
FINAL ANALYZER CALIBRATION CHECK, Caf	HIGH	13	13.02	54.02
	MID	6.48	6.57	24.56
	ZERO	0.0	0.0	0.6
FINAL ANALYZER CALIBRATION ERROR, Ef	HIGH	0.0%	0.2%	-1.8%
Ef = ((Caf - Cma)/Span)x100%	MID	-0.2%	0.5%	-0.8%
	ZERO	-0.1%	0.2%	1.1%
FINAL BIAS CHECK, Cbf	UPSCALE HIGH (H) OR MID (M)?	M	M	M
(SELECT UPSCALE CALIBRATION GAS CLOSEST TO EFFLUENT GAS CONCENTRATION)	UPSCALE	6.47	6.51	24.66
	ZERO	0.0	0.0	0.7
FINAL SYSTEM CALIBRATION BIAS, Bf	UPSCALE	-0.1%	-0.5%	0.2%
Bf = ((Cbf-Caf)/Span)x100%	ZERO	0.2%	0.0%	0.2%
ANALYZER DRIFT	HIGH	0.0%	0.0%	-1.5%
D = ((Caf - Cai)/(Span))x100%	MID	0.0%	0.1%	-0.7%
	ZERO	-0.2%	-0.1%	-0.1%
SYSTEM DRIFT	UPSCALE	-0.2%	-0.2%	-0.4%
D = ((Cbf - Cbi)/(Span))x100%	ZERO	-0.2%	-0.1%	-0.1%

RFG Process Heater						
10/13/93						
Time	O2	CO2	NO	NOx	NO	NOx
	%, Dry	%, Dry	ppmv, Dry	ppmv, Dry	ppmv, Dry 7%O2	ppmv, Dry 7%O2
00:18:06:41.984	9.65	7.03		22.02		27.16
00:18:07:41.984	9.66	7.03		23.05		28.46
00:18:08:41.977	9.95	6.87		21.42		27.14
00:18:09:41.969	9.90	6.89		21.57		27.21
00:18:10:41.961	9.97	6.85	21.32		27.06	
00:18:11:42.016	9.77	6.96	22.51		28.06	
00:18:12:42.055	9.88	6.87	21.50		27.07	
00:18:13:41.992	9.98	6.82	21.41		27.20	
00:18:14:41.992	9.80	6.90	21.40		26.75	
00:18:15:41.984	9.86	6.86	17.93		22.53	
00:18:16:41.977	9.83	6.87	19.02		23.84	
00:18:17:41.969	9.82	6.88	20.55		25.73	
00:18:18:41.969	9.88	6.84	19.59		24.66	
00:18:19:41.961	9.65	7.02	22.18		27.36	
00:18:20:42.008	9.81	6.93		21.01		26.29
00:18:21:42.000	9.96	6.86		20.68		26.22
00:18:22:41.992	9.89	6.90		19.53		24.61
00:18:23:41.992	9.86	6.94		21.22		26.67
00:18:24:41.984	9.78	6.97		22.09		27.56
00:18:25:41.977	10.01	6.83		22.34		28.46
00:18:26:41.969	9.78	6.95		21.24		26.50
00:18:27:41.969	9.88	6.92		21.59		27.18
00:18:28:41.961	9.62	7.10		22.47		27.64
00:18:29:41.961	9.94	6.90		20.70		26.20
00:18:30:42.000	9.99	6.87	21.71		27.61	
00:18:31:41.992	9.74	7.01	21.96		27.30	
00:18:32:41.992	9.79	7.01	21.12		26.38	
00:18:33:41.984	9.85	6.96	22.55		28.31	
00:18:34:41.984	10.06	6.84	22.54		28.84	
00:18:35:41.969	10.01	6.87	22.25		28.34	
00:18:36:41.969	10.27	6.70	20.87		27.23	
00:18:37:41.969	10.02	6.86	21.71		27.68	
00:18:38:42.008	10.08	6.83	22.78		29.21	

RFG Process Heater						
10/13/93						
Time	O2	CO2	NO	NOx	NO	NOx
	%, Dry	%, Dry	ppmv, Dry	ppmv, Dry	ppmv, Dry 7%O2	ppmv, Dry 7%O2
00:17:33:41.969	9.97	6.86	25.24		32.04	
00:17:34:41.961	9.92	6.91	25.82		32.62	
00:17:35:42.008	9.98	6.87	25.49		32.38	
00:17:36:42.004	10.02	6.84	24.87		31.71	
00:17:37:42.000	10.05	6.83	24.73		31.62	
00:17:38:41.992	10.08	6.81	24.94		31.97	
00:17:39:41.984	10.05	6.83	25.10		32.09	
00:17:40:41.980	10.14	6.77		24.80		31.97
00:17:41:41.973	10.08	6.80		24.26		31.10
00:17:42:41.969	10.01	6.83		23.89		30.43
00:17:43:41.961	9.94	6.89		22.34		28.28
00:17:44:41.953	9.91	6.91		23.12		29.19
00:17:45:42.004	9.88	6.93		22.99		28.94
00:17:46:42.000	9.93	6.90		22.14		28.00
00:17:47:41.992	9.86	6.95		23.15		29.09
00:17:48:41.992	9.88	6.93		20.83		26.22
00:17:49:41.980	10.00	6.84		22.53		28.67
00:17:50:41.980	9.80	6.95	22.19		27.74	
00:17:51:41.969	9.79	6.95	22.05		27.54	
00:17:52:41.961	9.89	6.88	22.29		28.09	
00:17:53:42.008	9.78	6.92	21.17		26.42	
00:17:54:42.004	9.87	6.87	21.36		26.87	
00:17:55:42.000	9.87	6.88	21.95		27.61	
00:17:56:41.992	9.71	6.97	18.91		23.45	
00:17:57:41.996	9.87	6.88	21.71		27.31	
00:17:58:41.980	9.75	6.94	21.77		27.09	
00:17:59:41.973	9.96	6.83	22.06		27.97	
00:18:00:41.969	9.80	6.91		20.69		25.86
00:18:01:41.961	9.89	6.86		20.27		25.54
00:18:02:42.008	9.84	6.89		21.13		26.51
00:18:03:42.008	9.86	6.88		19.76		24.83
00:18:04:41.996	9.78	6.93		20.41		25.47
00:18:05:41.992	9.89	6.86		21.95		27.66

RFG Process Heater						
10/13/93						
Time	O2	CO2	NO	NOx	NO	NOx
	%, Dry	%, Dry	ppmv, Dry	ppmv, Dry	ppmv, Dry 7%O2	ppmv, Dry 7%O2
00:19:56:12.016	9.80	7.00	24.45		30.56	
00:19:57:12.008	9.86	6.98	24.74		31.09	
00:19:58:12.000	9.80	7.02	24.04		30.05	
00:19:59:12.000	10.05	6.87	23.98		30.66	
00:20:00:11.992	9.90	6.96	23.34		29.44	
00:20:01:12.047	10.05	6.85	22.17		28.35	
00:20:02:12.039	9.81	7.00	21.72		27.17	
00:20:03:12.039	9.87	6.97	22.83		28.72	
00:20:04:12.016	9.81	7.01	22.04		27.57	
00:20:05:12.016	10.01	6.88	21.24		27.06	
00:20:06:12.008	10.07	6.84	22.42		28.72	
00:20:07:12.000	9.88	6.95	22.46		28.28	
00:20:08:12.000	10.04	6.86	22.83		29.16	
00:20:09:11.992	9.84	6.99	21.94		27.52	
00:20:10:12.047	9.95	6.91	21.85		27.68	
00:20:11:12.039	10.07	6.85	20.33		26.04	
00:20:12:12.031	9.93	6.92	22.04		27.87	
00:20:13:12.016	9.94	6.92	22.32		28.25	
00:20:14:12.016	9.82	7.00	22.46		28.13	
00:20:15:12.008	9.89	6.96	22.09		27.84	
00:20:16:12.000	9.99	6.91	22.41		28.50	
00:20:17:12.000	9.88	6.96	22.13		27.86	
00:20:18:11.992	10.03	6.88	22.02		28.10	
00:20:19:12.047	9.91	6.95	21.90		27.65	
00:20:20:12.039	9.87	6.97	21.98		27.65	
00:20:21:12.031	10.04	6.87	22.38		28.59	
00:20:22:12.016	9.88	6.96	22.11		27.84	
00:20:23:12.016	10.03	6.86	21.64		27.62	
00:20:24:12.008	9.92	6.93	21.37		27.00	
00:20:25:12.000	9.84	6.98		22.19		27.84
00:20:26:12.000	10.03	6.88		22.41		28.60
00:20:27:11.992	9.89	6.95		22.36		28.18
00:20:28:12.047	10.08	6.83		21.87		28.04

RFG Process Heater						
10/13/93						
Time	O2	CO2	NO	NOx	NO	NOx
	%, Dry	%, Dry	ppmv, Dry	ppmv, Dry	ppmv, Dry 7%O2	ppmv, Dry 7%O2
00:18:39:42.000	10.06	6.86	21.85		27.96	
00:19:24:12.000	9.80	6.96		25.26		31.58
00:19:25:12.047	9.88	6.91		24.70		31.10
00:19:26:12.039	9.78	7.00		25.57		31.91
00:19:27:12.023	9.77	7.00		25.41		31.68
00:19:28:12.016	9.95	6.89		24.60		31.17
00:19:29:12.016	9.88	6.94		24.38		30.69
00:19:30:12.008	9.85	6.96		23.43		29.42
00:19:31:12.000	9.87	6.95		24.71		31.08
00:19:32:12.000	9.76	7.02		25.14		31.31
00:19:33:11.992	9.89	6.94		24.61		31.01
00:19:34:12.047	9.92	6.93		24.77		31.30
00:19:35:12.039	9.91	6.94		24.75		31.24
00:19:36:12.031	9.91	6.94		25.10		31.69
00:19:37:12.016	9.87	6.96		26.08		32.81
00:19:38:12.016	9.84	6.98		25.89		32.48
00:19:39:12.008	9.89	6.95		25.48		32.11
00:19:40:12.000	9.95	6.92		25.66		32.51
00:19:41:12.063	9.88	6.96		25.79		32.47
00:19:42:12.000	9.96	6.92		24.53		31.11
00:19:43:12.047	9.96	6.91		23.32		29.57
00:19:44:12.039	9.94	6.92		24.80		31.39
00:19:45:12.031	9.95	6.91		25.04		31.72
00:19:46:12.016	9.90	6.95		25.32		31.94
00:19:47:12.016	9.80	7.01		25.51		31.89
00:19:48:12.008	9.86	6.98		24.68		31.02
00:19:49:12.000	10.00	6.89		24.64		31.36
00:19:50:12.000	10.00	6.88		24.45		31.12
00:19:51:11.992	9.90	6.94		25.39		32.02
00:19:52:12.047	9.79	7.01		24.46		30.55
00:19:53:12.039	9.84	6.99		25.41		31.88
00:19:54:12.031	9.90	6.94	24.71		31.17	
00:19:55:12.016	10.07	6.85	24.72		31.66	

Appendix B.2. Flow Calculations and Run Sheets

RFG Process Heater						
10/13/93						
Time	O2	CO2	NO	NOx	NO	NOx
	%, Dry	%, Dry	ppmv, Dry	ppmv, Dry	ppmv, Dry 7%O2	ppmv, Dry 7%O2
00:20:29:12.039	9.96	6.91		22.06		27.97
00:20:30:12.031	9.93	6.93		21.85		27.63
00:20:31:12.016	10.01	6.88		22.04		28.08
00:20:32:12.016	10.00	6.89		19.21		24.45
00:20:33:12.016	10.04	6.85		20.49		26.17
00:20:34:12.000	10.06	6.86		20.87		26.71
00:20:35:12.000	9.92	6.95		21.41		27.05
00:20:36:11.992	10.09	6.83		20.18		25.90
00:20:37:12.047	10.00	6.89		21.48		27.34
00:20:38:12.039	9.95	6.91		21.04		26.66
00:20:39:12.031	9.95	6.92		21.79		27.61
00:20:40:12.023	9.79	7.02		20.60		25.73
00:20:41:12.023	10.09	6.84		21.78		27.95
00:20:42:12.008	9.98	6.90		20.44		25.97
00:20:43:12.070	9.99	6.88		20.99		26.69
00:20:44:12.000	10.01	6.88		21.68		27.62
00:20:45:11.992	9.82	7.00		21.08		26.40
00:20:46:12.047	10.06	6.86		19.62		25.11
00:20:47:12.039	9.97	6.92		20.49		26.01
00:20:48:12.031	10.00	6.88		20.42		25.99
00:20:49:12.023	9.97	6.89		20.67		26.24
00:20:50:12.023	9.90	6.94		21.27		26.83
00:20:51:12.008	9.91	6.95		21.67		27.36
AVERAGE	9.90	6.92	23.11	23.65	29.16	29.82

PRELIMINARY VELOCITY TRAVERSE

PLANT
DATE 10/25/93
LOCATION
STACK I.D. 98"
PITOT NO./Cp 162/.84 TC# 57
BAROMETRIC PRESSURE, In Hg 30.01
STATIC GAUGE PRESSURE, In H20 -0.12
OPERATORS FF, JK
PITOT PRE TEST LEAK CHECK Good
PITOT POST TEST LEAK CHECK

TRAVERSE POINT NUMBER	CLOCK 24 HR TIME	VELOCITY HEAD (Ps) In. H20	STACK TEMP (Ts)°F	SWIRL ANGLE
1	1408	07	458	
2		08	461	
3		09	462	
4		07	459	
5		06	461	
6		05	460	
AVERAGE				

SCHEMATIC OF TRAVERSE POINT LAYOUT

TRAVERSE POINT NUMBER	CLOCK 24 HR TIME	VELOCITY HEAD (Ps) In. H20	STACK TEMP (Ts)°F	SWIRL ANGLE
1		07	460	
2		09	459	
3		09	458	
4		09	461	
5		08	461	
6		06	459	
AVERAGE				

SWIRL ACCEPTANCE LIMITS

Average(abs. value) less than 10°
No points with reverse flow
No more than 4 points above 30°

ΔP MINIMUM LIMITS

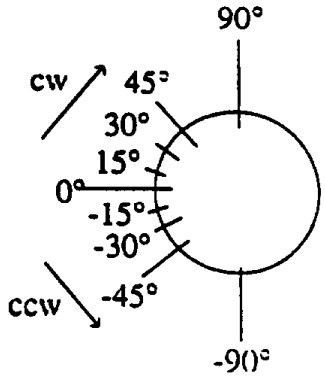
Conditions for more sensitive manometer
1. For 12 or more points on a velocity traverse: 10% of the points's Δp < 0.05"
2. For <12 points on a velocity traverse more than 1 point's Δp <0.05"

Rt Mean Avg Δp =

$$\left[\frac{\sum_{1}(\Delta p_{si})^{1/2}}{N}\right]^2$$

Rt Mean Avg Ts =

$$\left[\frac{\sum_{1}(T_{si})^{1/2}}{N}\right]^2$$



EER

FLOW RATE

PLANT: RFG Process Heater
CITY: Confidential
RUN NO: 1,2
SAMPLE LOCATION: STACK

DATE ENTERED: 11/30/93
DATE: 11/13,14/93
OPERATOR: Jon Kawaguchi
ENTERED BY: David Hansell
CHECKED BY:

DATA ENTRY	SYMBOL	UNITS	DATA	DATA	DATA	DATA
RUN NUMBER	-	-	R1	R2		Average
ROUND STACK, DIAMETER	ds	inches	98.0	98.0		98.00
RECTANGULAR STACK, LENGTH	L	inches				
WIDTH	W	inches				
AVERAGE STACK TEMPERATURE	Fs	degrees F	453.6	482.5		468.0
AVERAGE METER TEMPERATURE	Fm	degrees F	74.0	85.0		79.5
BAROMETRIC PRESSURE	Pbar	in. Hg	30.01	30.01		30.010
STACK STATIC PRESSURE	Pg	in. H20	-0.120	-0.130		-0.125
AVG. DELTA H	dH	in. H20	1.000	1.900		1.450
AVG. VELOCITY HEAD	dP	in. H20	0.06	0.09		0.076
PITOT COEFFICIENT	Cp	-	0.840	0.840		0.840
GAS SAMPLE VOLUME	Vm	cubic ft.	31.3	28.5		29.900
METER CALIBRATION FACTOR	Y	-	1.000	1.000		1.000
TOTAL SAMPLING TIME	min	minutes	60	40		50.000
STACK GAS OXYGEN CONTENT	Co2,m	%	9.88	9.88		9.880
STACK GAS CARBON DIOXIDE CONTENT	Cco2,m	%	6.92	6.92		6.920
TOTAL IMPINGER GAIN (WATER & PARTICULATE)	Ww	grams	82.4	77.7		80.050

CALCULATED DATA	SYMBOL	UNITS	DATA	DATA	DATA	DATA
RUN NUMBER	-	-	R1	R2		Average
STACK AREA, As = 3.14*(ds)**2/576 (ROUND)	As	sq. feet	52.382	52.382		52.382
= L * W/144 (RECTANGULAR)			0.000	0.000		0.000
AVG. STACK TEMPERATURE, Ts = Fs + 460	Ts	degrees R	913.6	942.5		928.0
AVG. METER TEMPERATURE, Tm = Fm + 460	Tm	degrees R	534.0	545.0		539.5
GAS SAMPLE VOLUME AT STANDARD CONDITIONS, VmStd = 17.64Y (Vm/Tm) (Pbar + dH/13.6)	VmStd	cubic ft.	31.1	27.8		29.5
VOLUME OF WATER VAPOR, VwStd = 0.04707*Ww	VwStd	cubic ft.	3.9	3.7		3.8
MOISTURE FRACTION, Bws = VwStd/(VmStd + VwStd)	Bws	-	0.111	0.116		0.114
DRY STACK GAS MOL. WEIGHT, Md = 0.32(Co2,m)+ 0.44(Cco2,m)+0.28[100-(Co2,m)-(Cco2,m)]	Md	g/g-mole	29.50	29.50		29.50
WET STACK GAS MOLECULAR WEIGHT, Mw = Md(1-Bws)+18.0(Bws)	Mw	g/g-mole	28.23	28.17		28.20
ABSOLUTE STACK PRESSURE, Ps = Pbar + Pg/13.6	Ps	in. Hg	30.00	30.00		30.00
STACK GAS VELOCITY vs = 85.49 Cp { sqrt[(dP*Ts) /(Ps*Mw)] }	vs	ft/s	18.7	22.6		20.7
vm = 0.3048 * vs	vsm	m/s	5.70	6.90		6.30
ACTUAL STACK GAS FLOW RATE, Q = 60*vs*As	Q	acf/min	58776.4	71145.1		64960.8
DRY GAS STACK FLOW RATE (DRY,STP) Qsd = 17.64*Q*(1-Bws)*(Ps/Ts)	Qsd	dscf/min	30273.2	35304.9		32789.0
Qsdm = Qsd/35.32	Qsdm	dscm/min	857.1	999.6		928.3

EPA METHOD 4

Plant _____
City _____
Location _____
Operators F. Fernandez
Date 10-13-93
Run Number ~~#~~ 1
Stack Diam. (in.) 98"

Sample Box Number N4
Meter Box Number N1
Meter Calibration (Y) 1.0002
Meter dH @ 1.9512
Pitot Tube No. ____ Cp _____
Probe Length 48" Tc No. _____

Probe Liner Material SS
Static Pressure (Ps) _____ (in. H2O)
Barometric Pressure (Pb) 30.0 (in. Hg)
Ambient Temperature (°F)
Pretest Leak Rate 0.00 cfm @ 10 (in. Hg)
Post Test Leak Rate 0.00 cfm @ 14 (in. Hg)

Sheet ____ of ____

Sampling Time, (min)	Clock Time (24 h)	Vacuum (in. Hg)	Pressure Differential Across Orifice dH (in. H2O)	Gas Sample Volume, Vm (cf)	Dry Gas Meter Outlet Temp, Tm (°F)	Impinger Outlet Temp (°F)	Comments
0	6:30			876.03			
5	6:35	10	1.0	878.70	74	52	Had to pull less Sample vacuum to high
10	6:40	10	1.0	880.29	74	53	
15	6:45	10	1.0	883.90	74	55	
20	6:50	10	1.0	886.50	74	57	
25	6:55	10	1.0	889.10	74	57	
30	7:00	10	1.0	891.69	74	58	
35	7:05	10	1.0	894.30	74	57	
40	7:10	10	1.0	896.91	74	56	
45	7:15	10	1.0	899.52	73	56	
50	7:20	10	1.0	902.10	73	57	
55	7:25	10	1.0	904.70	73	57	
60	7:30	10	1.0	907.33	73	57	
				31.3	74		

PRELIMINARY VELOCITY TRAVERSE

PLANT
DATE 10/13
LOCATION
STACK I.D.
PITOT NO./Cp 162/.84 TC#
BAROMETRIC PRESSURE, In Hg 30.01
STATIC GAUGE PRESSURE, In H20 -.12
OPERATORS FF, JO
PITOT PRE TEST LEAK CHECK Good
PITOT POST TEST LEAK CHECK Good

SCHEMATIC OF TRAVERSE POINT LAYOUT

TRAVERSE POINT NUMBER	CLOCK 24 HR TIME	VELOCITY HEAD (Ps) In. H20	STACK TEMP (Ts)°F	SWIRL ANGLE
1	1830	05	466	
2		07	469	
3	~~470~~	07	470	
4		07	451	
5		07	448	
6		07	442	
1				
AVERAGE				

TRAVERSE POINT NUMBER	CLOCK 24 HR TIME	VELOCITY HEAD (Ps) In. H20	STACK TEMP (Ts)°F	SWIRL ANGLE
1		05	451	
2		06	447	
3		07	439	
4		07	448	
5		07	455	
6		07	457	
AVERAGE				

SWIRL ACCEPTANCE LIMITS

Average(abs. value) less than 10°
No points with reverse flow
No more than 4 points above 30°

ΔP MINIMUM LIMITS

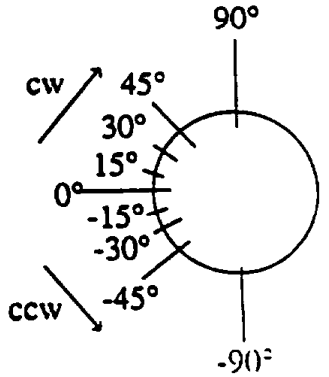
Conditions for more sensitive manometer
1. For 12 or more points on a velocity traverse: 10% of the points's $\Delta p < 0.05"$
2. For <12 points on a velocity traverse more than 1 point's $\Delta p < 0.05"$

Rt Mean Avg Δp =

$$\left[\frac{\sum_{1}(\Delta p_{si})^{1/2}}{N}\right]^2$$

Rt Mean Avg Ts =

$$\left[\frac{\sum_{1}(Ts_i)^{1/2}}{N}\right]^2$$



PRELIMINARY VELOCITY TRAVERSE

PLANT
DATE 10/14/93
LOCATION
STACK I.D. 96"
PITOT NO./Cp 162/.84 TC# 5,6
BAROMETRIC PRESSURE, In Hg 30.11
STATIC GAUGE PRESSURE, In H20 -0.13
OPERATORS FF, JC
PITOT PRE TEST LEAK CHECK Good
PITOT POST TEST LEAK CHECK

TRAVERSE POINT NUMBER	CLOCK 24 HR TIME	VELOCITY HEAD (Ps) In. H20	STACK TEMP (Ts)°F	SWIRL ANGLE
1		06	490	
2		0.10	494	
3	~~490~~	0.12	490	
4		0.1	47 61	
5		09	486	
6		07	486	
AVERAGE				

SCHEMATIC OF TRAVERSE POINT LAYOUT

TRAVERSE POINT NUMBER	CLOCK 24 HR TIME	VELOCITY HEAD (Ps) In. H20	STACK TEMP (Ts)°F	SWIRL ANGLE
1		07	480	
2		09	481	
3		.10	480	
4		.11 ~~47~~	481	
5		.10	4780	
6		.07	470	
AVERAGE				

SWIRL ACCEPTANCE LIMITS

Average(abs. value) less than 10°
No points with reverse flow
No more than 4 points above 30°

ΔP MINIMUM LIMITS

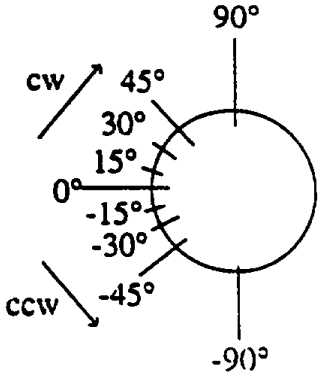
Conditions for more sensitive manometer
1. For 12 or more points on a velocity traverse: 10% of the points's Δp < 0.05"
2. For <12 points on a velocity traverse more than 1 point's Δp <0.05"

Rt Mean Avg Δp =

$$\left[\frac{\sum_{i}(\Delta p_{si})^{1/2}}{N}\right]^2$$

Rt Mean Avg Ts =

$$\left[\frac{\sum_{i}(Ts_i)^{1/2}}{N}\right]^2$$



IMPINGER WEIGHT SHEET

Plant/city: _____

Location: _____

Train Set No. Orange

Run No.: 1

Operator: _____

Run Time: 40 min

Impinger No.	Solution Used	Solution (ml)	Configuration		Weight (grams)	Inspection Comments
1	DI	100	Modified	Final	769.2	
				Initial	633.5	
				Wt. gain	75.7	Clear
2	DI	100	GS	Final	606.2	
				Initial	604.3	
				Wt. gain	1.9	Clear
3	Empty	—	Mod.	Final	482.8	
				Initial	482.0	
				Wt. gain	0.8	Empty
4	Silica	300g	Mod	Final	740.0	
				Initial	736.0	
				Wt. gain	4.0	Good 25% used
5				Final		
				Initial		
				Wt. gain		
6				Final		
				Initial		
				Wt. gain		
Flask				Final		
				Initial		
				Wt. gain		

TOTAL WEIGHT GAIN OF IMPINGERS (grams) 82.4

Train set up: Date: _____
Signature: _____

Train recovery: Date: _____
Signature: _____

EER

IMPINGER WEIGHT SHEET

Plant/city: _____

Location: _____

Train Set No. Black

Run No.: 2

Operator: F. Fernandez

Run Time: 40 min

Impinger No.	Solution Used	Solution (ml)	Configuration		Weight (grams)	Inspection Comments
1	DI	100	mod	Final	692.0	
				Initial	680.0	
				Wt. gain	12.0	
2	DI	100	GS	Final	779.0	
				Initial	720.0	
				Wt. gain	59.0	
3	Empty		mod	Final	493.7	
				Initial	492.0	
				Wt. gain	1.7	
4	Silica	300g	mod	Final	680.0	
				Initial	675.0	
				Wt. gain	5.0	
5				Final		
				Initial		
				Wt. gain		
6				Final		
				Initial		
				Wt. gain		
Flask				Final		
				Initial		
				Wt. gain		

TOTAL WEIGHT GAIN OF IMPINGERS (grams) _____

Train set up: Date: 10-13-93

Signature: Feliciano Fernandez

Train recovery: Date: 10-14-93

Signature: Feliciano Fernandez

EER

Black

EPA METHOD 4

Plant
City
Location
Operators F. Fernandez
Date 10-14-93
Run Number 2
Stack Diam. (in.) 98"

Sample Box Number N4
Meter Box Number N1
Meter Calibration (Y) 1.0002
Meter dH @ 1.9512
Pitot Tube No. ____ Cp ____
Probe Length 48" Tc No. ____

Probe Liner Material SS
Static Pressure (Pa) ____ (in. H2O)
Barometric Pressure (Pb) ____ (in. Hg)
Ambient Temperature (°F) ____
Pretest Leak Rate 0.00 cfm @ 14 (in. Hg)
Post Test Leak Rate 0.00 cfm @ 15 (in. Hg)

Sheet ____ of ____

Sampling Time, (min)	Clock Time (24 h)	Vacuum (in. Hg)	Pressure Differential Across Orifice dH (in. H2O)	Gas Sample Volume, Vm (cf)	Dry Gas Meter Outlet Temp. Tm (°F)	Impinger Outlet Temp. (°F)	Comments
0	2:20			907.50			
5	2:25	10	1.9	910.950	82	79	
10	2:30	10	1.9	914.51	83	80	
15	2:35	10	1.9	918.05	84	80	
20	2:40	10	1.9	921.64	85	80	
25	2:45	10	1.8	925.20	86	77	
30	2:50	10	1.85	928.75	88	77	
35	2:55	10	1.9	932.39	89	79	
40	3:00	10	1.9	936.00	90	79	
45							
50							
55							
60							

Energy and
Environmental
Research Corporation

Diluted Ratio 5.4:1

CHAIN OF CUSTODY

Plant
Unit
Location Stack Project No. 6373-020 P.O No.

Page 1 of 2

Sample No.	Test No.	Test Date	Description
154566	1	10/14/93	Diluted
154567	1		Un Diluted
154574	2		Diluted
154573	2		Undiluted
154577	3		Diluted
~~154577~~	~~3~~		
154576	3		Undiluted
154579	4		System blank (N_2)

Sampling system prepared by RC
Test operator RC
Sample recovery by RC

4395

Relinquished By	Recieved By	Time	Date	Reason

Laboratory analysis by Date

Appendix B.3. Tedlar Bag Analyses

Applied P & Ch Laboratory
4066 E. Mission Blvd., Pomona, CA 91766
Tel: (909) 622-5148 Fax: (909) 622-3199

APCL Analytical Report

Analysis of VOCs in Air

Component Analyzed	Method	Unit	PQL	Concentration 154566 Diluted 93-4395-1	154567 Undiluted 93-4395-2	154573 Undiluted 93-4395-3	154574 Diluted 93-4395-4	154576 Undiluted 93-4395-5	154577 Diluted 93-4395-6	154579 Blank 93-4395-7
Paraffins (C4-C6)										
n-Butane	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
Isobutane	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
n-Pentane	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
Isopentane [2-methylbutane]*	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
Neopetane [2,2-dimethylpropane]*	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
n-Hexane	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
2-Methylpentane	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
3-Methylpentane	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
2,2-Dimethylbutane	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
2,3-Dimethylbutane	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
Aromatics										
Benzene	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
Toluene	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
Ethyl Benzene	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
m,p-Xylenes	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
o-Xylene	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
Styrene	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
1,3,5-Trimethylbenzene	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
1,2,4-Trimethylbenzene	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
Phenol	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
Naphthalene	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
Naphthenes										
Cyclopropane	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
Cyclobutane	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
Cyclopentane	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
Cyclohexane	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
Ketones										
Acetone	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
Butanone	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
1,3-Butadiene	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
Propadiene	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
Olefins										
1-Butene	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
cis-2-Butene	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
trans-2-Butene	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
2-Methylpropene	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
1-Pentene	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
cis-2-Pentene	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
trans-2-Pentene	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
2-methyl-2-Butene	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
2-methyl-1-Butene	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
3-methyl-1-Butene	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.

CADHS ELAP CERTIFICATION NUMBER 1431

Applied P & Ch Laboratory
4066 E. Mission Blvd., Pomona, CA 91766
Tel: (909) 622-5148 Fax: (909) 622-3199

APCL Analytical Report

Submitted to:
Energy and Environmental Research Corporation
Attention: Dave Hansell
8001 Irvine Blvd.
Santa Ana, CA 92706
Tel: (714)552-1803 Fax: (714)857-1943

Service ID #: 801-934395
Collected by: Walied E.
Collected on: 10/15/93
Sample description:
Air Samples
Plant:

Received : 10/15/93
Tested : 10/16-17/93
Reported : 10/26/93

Analysis of Volatiles in Air

801-934395 Page 1 of 3

Component Analyzed	Method	Unit	PQL	Concentration 154566 Diluted 93-4395-1	154567 Undiluted 93-4395-2	154573 Undiluted 93-4395-3	154574 Diluted 93-4395-4	154576 Undiluted 93-4395-5	154577 Diluted 93-4395-6	154579 Blank 93-4395-7
Chlorinated Hydrocarbons										
Chloromethane	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
Bromomethane	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
Chloroethane	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
1,1-Dichloroethene	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
Methylene Chloride	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
1,1-Dichloroethene	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
cis-1,2-Dichloroethene	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
Chloroform	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
1,1,1-Trichloroethane	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
Carbon Tetrachloride	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
1,2-Dichloroethane	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
Trichloroethene	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
1,2-Dichloropropane	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
cis-1,3-Dichloropropene	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
trans-1,3-Dichloropropene	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
1,1,2-Trichloroethane	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
Tetrachloroethene	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
Ethylene Dibromide	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
Ethylene Dichloride	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
Chlorobenzene	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
1,1,2,2-Tetrachloroethane	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
1,3-Dichlorobenzene	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
1,4-Dichlorobenzene	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
Chlorotoluene	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
1,2-Dichlorobenzene	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
1,2,4-Trichlorobenzene	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
Hexachlorobutadiene	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
trans-1,2-Dichloroethene	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
1,1,1,2-Tetrachloroethane	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
Carbon Disulfide	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.

CADHS ELAP CERTIFICATION NUMBER 1431

Applied P & Ch Laboratory
4066 E. Mission Blvd., Pomona, CA 91766
Tel: (909) 622-5148 Fax: (909) 622-3199

APCL Analytical Report

Analysis of VOCs in Air

Component Analysed	Method	Unit	PQL	Concentration						
				154566 Diluted 93-4395-1	154567 Undiluted 93-4395-2	154573 Undiluted 93-4395-3	154574 Diluted 93-4395-4	154576 Undiluted 93-4395-5	154577 Diluted 93-4395-6	154579 Blank 93-4395-7
Acetylenes (C4-C5)										
1-Butyne*	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
2-Butyne	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
1-Pentyne	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
2-Pentyne	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
Ethers										
MTBE	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
Dimethyl Ether	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
Ethyl Methyl Ether*	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
Diethyl Ether	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
Ethyl Propyl Ether*	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
Dipropyl Ether	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
VOCs by GC/FIDs										
Methane	TO-14/FID	ppbV	500	–	11,000	9,000	–	9,500	–	–
Ethane	TO-14/FID	ppbV	500	–	N.D.	N.D.	–	N.D.	–	–
Propane	TO-14/FID	ppbV	500	–	N.D.	N.D.	–	N.D.	–	–
Ethene	TO-14/FID	ppbV	500	–	N.D.	N.D.	–	N.D.	–	–
Propene	TO-14/FID	ppbV	500	–	N.D.	N.D.	–	N.D.	–	–
Ethyne	TO-14/FID	ppbV	500	–	N.D.	N.D.	–	N.D.	–	–
Propyne*	TO-14/FID	ppbV	500	–	N.D.	N.D.	–	N.D.	–	–

PQL : Practical Quantitation Limit
N.D. : Not Detected or Less Than The Quantitation Limit.
* Standards not available

Respectfully submitted,

Shu-Teh Pan
Lab Manager
Applied P & Ch Laboratory

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Applied P & Ch Laboratory
4066 E. Mission Blvd., Pomona, CA 91766
Tel: (909) 622-5148 Fax: (909) 622-3199

APCL Analytical Report

Analysis of VOCs in Air

Component Analyzed	Method	Unit	PQL	Concentration 154566 Diluted 93-4395-1	154567 Undiluted 93-4395-2	154573 Undiluted 93-4395-3	154574 Diluted 93-4395-4	154576 Undiluted 93-4395-5	154577 Diluted 93-4395-6	154579 Blank 93-4395-7
Paraffins (C4-C6)										
n-Butane	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
Isobutane	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
n-Pentane	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
Isopentane [2-methylbutane]*	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
Neopetane [2,2-dimethylpropane]*	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
n-Hexane	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
2-Methylpentane	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
3-Methylpentane	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
2,2-Dimethylbutane	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
2,3-Dimethylbutane	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
Aromatics										
Benzene	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
Toluene	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
Ethyl Benzene	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
m,p-Xylenes	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
o-Xylene	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
Styrene	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
1,3,5-Trimethylbenzene	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
1,2,4-Trimethylbenzene	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
Phenol	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
Naphthalene	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
Naphthenes										
Cyclopropane	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
Cyclobutane	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
Cyclopentane	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
Cyclohexane	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
Ketones										
Acetone	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
Butanone	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
1,3-Butadiene	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
Propadiene	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
Olefins										
1-Butene	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
cis-2-Butene	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
trans-2-Butene	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
2-Methylpropene	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
1-Pentene	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
cis-2-Pentene	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
trans-2-Pentene	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
2-methyl-2-Butene	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
2-methyl-1-Butene	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.
3-methyl-1-Butene	TO-14	ppbV	5	N.D.	–	–	N.D.	–	N.D.	N.D.

CADHS ELAP CERTIFICATION NUMBER 1431

CARB 430

DATE DATE ENTERED: 11/20/93

PLANT: RFG Process Heater
TEST DATE: 10/13/93
CITY: Confidential
OPERATOR: Jon Kawaguchi
RUN #: 1, 2, 3
ENTERED BY: Dave Hansell
SAMPLE LOCATION: STACK
CHECKED BY:

DATA ENTRY	SYMBOL	UNITS		DATA		DATA		DATA			
RUN NUMBER	-	-		R1		R2		R3		AVE	RSD
AVERAGE METER TEMPERATURE	Fm	degree F		73.40							
BAROMETRIC PRESSURE	Pbar	in. Hg		30.01							
AVG. DELTA H	dH	in. H20		0.06							
GAS SAMPLE VOLUME	Vm	cubic ft.		1.04							
METER CALIBRATION FACTOR	Y	-		1.00							
TOTAL SAMPLING TIME	min	minutes		60.00							
SAMPLE 1ST IMPINGER VOLUME	Siwt,1	ml		11.80							
SAMPLE 2ND IMPINGER VOLUME	Siwt,2	ml		9.40							
BLANK 1ST IMPINGER VOLUME	Biwt,1	ml		9.60							
BLANK 2ND IMPINGER VOLUME	Biwt,2	ml		9.40							
SAMPLE WEIGHTS (1ST IMPINGER)											
Formaldehyde	Swt,1	µg		1.60							
Acetaldehyde	Swt,1	µg		0.28							
Acrolein	Swt,1	µg	ND	0.10							
Propanal	Swt,1	µg	ND	0.10							
Acetone	Swt,1	µg	ND	0.10							
Crotonaldehyde	Swt,1	µg	ND	0.10							
Isobutyraldehyde	Swt,1	µg	ND	0.10							
Methyl Ethyl Ketone	Swt,1	µg	ND	0.10							
SAMPLE WEIGHTS (2ND IMPINGER)											
Formaldehyde	Swt,2	µg		0.12							
Acetaldehyde	Swt,2	µg		0.19							
Acrolein	Swt,2	µg	ND	0.10							
Propanal	Swt,2	µg	ND	0.10							
Acetone	Swt,2	µg		0.43							
Crotonaldehyde	Swt,2	µg	ND	0.10							
Isobutyraldehyde	Swt,2	µg	ND	0.10							
Methyl Ethyl Ketone	Swt,2	µg	ND	0.10							
BLANK WEIGHTS (1ST IMPINGER)											
Formaldehyde	Bwt,1	µg		0.15							
Acetaldehyde	Bwt,1	µg		0.14							
Acrolein	Bwt,1	µg	ND	0.10							
Propanal	Bwt,1	µg	ND	0.10							
Acetone	Bwt,1	µg	ND	0.10							
Crotonaldehyde	Bwt,1	µg	ND	0.10							
Isobutyraldehyde	Bwt,1	µg	ND	0.10							
Methyl Ethyl Ketone	Bwt,1	µg	ND	0.10							
BLANK WEIGHTS (2ND IMPINGER)											
Formaldehyde	Bwt,2	µg		0.12							
Acetaldehyde	Bwt,2	µg		0.17							
Acrolein	Bwt,2	µg	ND	0.10							
Propanal	Bwt,2	µg	ND	0.10							
Acetone	Bwt,2	µg	ND	0.10							
Crotonaldehyde	Bwt,2	µg	ND	0.10							
Isobutyraldehyde	Bwt,2	µg	ND	0.10							
Methyl Ethyl Ketone	Bwt,2	µg	ND	0.10							

Appendix B.4. Aldehyde/Ketone Calculations, Run Sheets and Analyses

CARB 430

	DATE DATE ENTERED: 11/20/93
PLANT: RFG Process Heater	TEST DATE: 10/13/93
CITY: Confidential	OPERATOR: Jon Kawaguchi
RUN #: 1, 2, 3	ENTERED BY: Dave Hansell
SAMPLE LOCATION: STACK	CHECKED BY:

CORRECTED SAMPLE CONCENTRATION (ng/ml) Br>5 Cic=Sic-Average(Bic); Br<5 Cic=5*Average(Bic)

RUN NUMBER	-	-		R1		R2		R3		AVE	RSD
SAMPLE											
Formaldehyde	Cic	ng/ml	C	66.92							
Acetaldehyde	Cic	ng/ml	RL	81.58							
Acrolein	Cic	ng/ml	ND NA	9.43							
Propanal	Cic	ng/ml	ND NA	9.43							
Acetone	Cic	ng/ml	< NA	25.00							
Crotonaldehyde	Cic	ng/ml	ND NA	9.43							
Isobutyraldehyde	Cic	ng/ml	ND NA	9.43							
Methyl Ethyl Ketone	Cic	ng/ml	ND NA	9.43							

CORRECTED SAMPLE CONCENTRATION 1 (mg/dscm). Cc,1=Cic*(Swt,1+Swt,2)/VmStd/1e06

RUN NUMBER	-	-		R1		R2		R3		AVE	RSD
SAMPLE											
Formaldehyde	Cc,1	mg/dscm	C	0.048							
Acetaldehyde	Cc,1	mg/dscm	RL	0.059							
Acrolein	Cc,1	mg/dscm	ND NA	0.007							
Propanal	Cc,1	mg/dscm	ND NA	0.007							
Acetone	Cc,1	mg/dscm	< NA	0.018							
Crotonaldehyde	Cc,1	mg/dscm	ND NA	0.007							
Isobutyraldehyde	Cc,1	mg/dscm	ND NA	0.007							
Methyl Ethyl Ketone	Cc,1	mg/dscm	ND NA	0.007							

CORRECTED SAMPLE CONCENTRATION 2 (ppbv). Cc,2=1000*24.05/Mw

RUN NUMBER	-	-		R1		R2		R3		AVE	RSD
SAMPLE											
Formaldehyde	Cc,2	ppbv	C	39							
Acetaldehyde	Cc,2	ppbv	RL	32							
Acrolein	Cc,2	ppbv	ND NA	3							
Propanal	Cc,2	ppbv	ND NA	3							
Acetone	Cc,2	ppbv	< NA	8							
Crotonaldehyde	Cc,2	ppbv	ND NA	2							
Isobutyraldehyde	Cc,2	ppbv	ND NA	2							
Methyl Ethyl Ketone	Cc,2	ppbv	ND NA	2							

ND - Sample value below detection limit

< - Some sample values below detection limit

C - Blank Corrected

RL - Reporting Limit

NA - Not Available

CARB 430

	DATE DATE ENTERED: 11/20/93
PLANT: RFG Process Heater	TEST DATE: 10/13/93
CITY: Confidential	OPERATOR: Jon Kawaguchi
RUN #: 1, 2, 3	ENTERED BY: Dave Hansell
SAMPLE LOCATION: STACK	CHECKED BY:

CALCULATED DATA	SYMBOL	UNITS	DATA		DATA		DATA			
RUN NUMBER	-	-	R1		R2		R3		AVE	RSD
AVG. METER TEMPERATURE. Tm = Fm + 460	Tm	degrees R	533.40							
GAS SAMPLE VOLUME AT STANDARD CONDITIONS. VmStd = 17.64Y (Vm/Tm) (Pbar + dH/13.6)	VmStd	dscm	0.029							

SAMPLE IMPINGER CONCENTRATION (ng/ml). S or Bic= 1000*(S or Bwt,1+S or Bwt,2)/(S or Biwt,1+S or Biwt,2)

RUN NUMBER	-	-		R1		R2		R3		AVE	RSD
SAMPLE											
Formaldehyde	Sic	ng/ml		81.13							
Acetaldehyde	Sic	ng/ml		22.17							
Acrolein	Sic	ng/ml	ND	9.43							
Propanal	Sic	ng/ml	ND	9.43							
Acetone	Sic	ng/ml	<	25.00							
Crotonaldehyde	Sic	ng/ml	ND	9.43							
Isobutyraldehyde	Sic	ng/ml	ND	9.43							
Methyl Ethyl Ketone	Sic	ng/ml	ND	9.43							
BLANK											
Formaldehyde	Bic	ng/ml		14.21							
Acetaldehyde	Bic	ng/ml		16.32							
Acrolein	Bic	ng/ml	ND	10.53							
Propanal	Bic	ng/ml	ND	10.53							
Acetone	Bic	ng/ml	ND	10.53							
Crotonaldehyde	Bic	ng/ml	ND	10.53							
Isobutyraldehyde	Bic	ng/ml	ND	10.53							
Methyl Ethyl Ketone	Bic	ng/ml	ND	10.53							

BLANK TO SAMPLE RATIO. Br=Sic/Average(Bic)

RUN NUMBER	-	-		R1		R2		R3		AVE	RSD
RATIO											
Formaldehyde	Br		C	5.71							
Acetaldehyde	Br		RL	1.36							
Acrolein	Br		NA	NA							
Propanal	Br		NA	NA							
Acetone	Br		NA	NA							
Crotonaldehyde	Br		NA	NA							
Isobutyraldehyde	Br		NA	NA							
Methyl Ethyl Ketone	Br		NA	NA							

Energy and
Environmental
Research Corporation

CHAIN OF CUSTODY

Plant
Unit
Location

Page 1 of 3

Project No. 6373-020

P.O No.

Sample No.	Test No.	Test Date	Description
139638	1	10/13/93	Aldehyde Blank Front
139639	1		Aldehyde Blank Back
139640	1		Aldehyde Front
139641	1		Aldehyde Back
158534			Sorbent blank
158535			Trip Blank
158536			Trip Spike
154570		10/14/93	Fuel Sample
	Blanks	10/13/93	DNPH Blanks (3 vials)

Sampling system prepared by JO
Test operator JO
Sample recovery by JO

Relinquished By	Recieved By	Time	Date	Reason
[signature]	[signature]	0952	10/15/93	
			10/16/93	Analysis

Laboratory analysis by

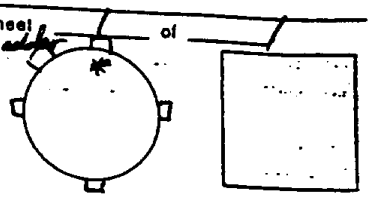
Date

CARB 430 RUN SHEET

Plant
City
Location
Operators JR
Date 10/13/93
Run Number 1
Stack Diam. (in.)
Static Pressure (Pa) -0.12 (in. H2O)
Barometric Pressure (Pb) 30.01 (in. Hg)
Ambient Temperature (°F) 71

Sample Box Number
Meter Box Number 195NA
Meter Calibration (Y)
Meter dH @
Probe Length 4'
Probe Liner Material S/S
Pretest Leak Rate 0.00 cfm @ 7 (in. Hg)
Post Test Leak Rate 0.00 cfm @ 6 (in. Hg)

Sheet 1 of 1



Traverse Point No.	Sampling Time, (Min.)	Clock Time (24 h)	Rotameter Reading	Gas Sample Volume, Vm (l)	Flowrate liters/min	Stack Temp (°F)	Dry Gas Meter Outlet Temp, Tm (°C)	Δ H Probe Temp.	Comments
1	0	1853		2959.43	0.6		25		2966.87 Repair box
1	5	58	N/A	2969.82	0.6	N/A	23	.06	before start-restart
	10	1903		2972.10	0.6		23	.06	
	15	08		2974.40	0.6		23	.06	
	20	13		2977.25	0.6		23	.06	
	25	18		2980.24	0.6		23	.06	
	30	23		2982.35	.6		23	.06	
	35	28		2987.65	.6		23	.06	
	40	33							Missed point.
	45	38		2990.25	.6		23	.06	
	50	43		2992.80	.6		23	.06	
	55	48		2995.15	.6		23	.06	
	60	53		2998.96	.6		22	.06	
Average/Total									

Flowrate at 0.50 liters/min +/- 10%
Pretest Probe Purge with Stack Gas
Pretest leak check with Charcoal Tube
Where gloves when operating train

AIR TOXICS LTD.

SAMPLE NAME: 139638

ID#: 9310145A-01A

Aldehydes and Ketones in Ambient Air

(EPA Method TO-5)

High Pressure Liquid Chromatography

File Name:	**4102105**	**Date of Collection:**	**10/13/93**
Dil. Factor:	**1.0**	**Date of Extraction:**	**10/20/93**
Sample Volume (mL):	**9.6**	**Date of Analysis:**	**10/21/93**

Compound	**Det. Limit (uG)**	**Amount (uG)**
Formaldehyde	0.10	0.16
Acetaldehyde	0.10	0.14
Acrolein	0.10	Not Detected
Propanal	0.10	Not Detected
Acetone	0.10	Not Detected
Crotonaldehyde	0.10	Not Detected
Isobutyraldehyde	0.10	Not Detected
Methyl Ethyl Ketone	0.10	Not Detected

AIR TOXICS LTD.

AN ENVIRONMENTAL ANALYTICAL LABORATORY

WORK ORDER #: 9310145A

Work Order Summary

CLIENT: Mr. Jon Kawaguchi
Energy & Environmental Research
8001 Irvine Blvd.
Santa Ana, CA 92705

BILL TO: Accounts Payable
EER Corporation
18 Mason
Irvine, CA 92718

PHONE: 714-552-1803
FAX: 714-859-3194
DATE RECEIVED: 10/16/93
DATE COMPLETED: 11/8/93

INVOICE # 2150
P.O. #
PROJECT
AMOUNT$: $938.82

FRACTION #	NAME	TEST	PRICE
01A	139638	TO-5	$875.00
01AA	139638 Duplicate	TO-5	
01B	139639	TO-5	
01BMS	139639 Matrix Spike	TO-5	
02A	139640	TO-5	
02B	139641	TO-5	
03A	158534	TO-5	
04A	158535 Trip Blank	TO-5	
05A	158536 Trip Spike	TO-5	
06A	Lab Blank	TO-5	
07A	Lab Spike	TO-5	
Misc. Charges	Shipping (10/18/93)		$63.82

LAB NARRATIVE:
B = Compound present in laboratory blank, background subtraction not performed.

CERTIFIED BY: Linda L. Freeman
Laboratory Director

DATE: 11/8/93

180 BLUE RAVINE ROAD, SUITE B • FOLSOM, CA 95630
(916) 985-1000 • FAX (916) 985-1020

AIR TOXICS LTD.

SAMPLE NAME: 139639

ID#: 9310145A-01B

Aldehydes and Ketones in Ambient Air
(EPA Method TO-5)
High Pressure Liquid Chromatography

File Name:	**4102107**	**Date of Collection:**	**10/13/93**
Dil. Factor:	**1.0**	**Date of Extraction:**	**10/20/93**
Sample Volume (mL):	**9.4**	**Date of Analysis:**	**10/21/93**

Compound	**Det. Limit (uG)**	**Amount (uG)**
Formaldehyde	0.10	0.12
Acetaldehyde	0.10	0.17
Acrolein	0.10	Not Detected
Propanal	0.10	Not Detected
Acetone	0.10	Not Detected
Crotonaldehyde	0.10	Not Detected
Isobutyraldehyde	0.10	Not Detected
Methyl Ethyl Ketone	0.10	Not Detected

AIR TOXICS LTD.

SAMPLE NAME: 139638 Duplicate

ID#: 9310145A-01AA

Aldehydes and Ketones in Ambient Air

(EPA Method TO-5)

High Pressure Liquid Chromatography

File Name:	**4102106**	**Date of Collection:**	**10/13/93**
Dil. Factor:	**1.0**	**Date of Extraction:**	**10/20/93**
Sample Volume (mL):	**9.6**	**Date of Analysis:**	**10/21/93**

Compound	Det. Limit (uG)	Amount (uG)
Formaldehyde	0.10	0.14
Acetaldehyde	0.10	0.14
Acrolein	0.10	Not Detected
Propanal	0.10	Not Detected
Acetone	0.10	Not Detected
Crotonaldehyde	0.10	Not Detected
Isobutyraldehyde	0.10	Not Detected
Methyl Ethyl Ketone	0.10	Not Detected

AIR TOXICS LTD.

SAMPLE NAME: 139640

ID#: 9310145A-02A

Aldehydes and Ketones in Ambient Air
(EPA Method TO-5)
High Pressure Liquid Chromatography

File Name:	**4102109**	**Date of Collection:**	**10/13/93**
Dil. Factor:	**1.0**	**Date of Extraction:**	**10/20/93**
Sample Volume (mL):	**11.8**	**Date of Analysis:**	**10/21/93**

Compound	Det. Limit (uG)	Amount (uG)
Formaldehyde	0.10	1.6
Acetaldehyde	0.10	0.28
Acrolein	0.10	Not Detected
Propanal	0.10	Not Detected
Acetone	0.10	Not Detected
Crotonaldehyde	0.10	Not Detected
Isobutyraldehyde	0.10	Not Detected
Methyl Ethyl Ketone	0.10	Not Detected

AIR TOXICS LTD.

SAMPLE NAME: 139639 Matrix Spike

ID#: 9310145A-01BMS

Aldehydes and Ketones in Ambient Air
(EPA Method TO-5)
High Pressure Liquid Chromatography

File Name:	**4102108**	**Date of Collection:**	**10/13/93**
Dil. Factor:	**1.0**	**Date of Extraction:**	**10/20/93**
Sample Volume (mL):	**9.4**	**Date of Analysis:**	**10/21/93**

Compound	**Det. Limit (uG)**	**% Recovery**
Formaldehyde	0.10	80
Acetaldehyde	0.10	77
Acrolein	0.10	94
Propanal	0.10	Not Spiked
Acetone	0.10	Not Spiked
Crotonaldehyde	0.10	Not Spiked
Isobutyraldehyde	0.10	Not Spiked
Methyl Ethyl Ketone	0.10	Not Spiked

AIR TOXICS LTD.

SAMPLE NAME: 158534

ID#: 9310145A-03A

Aldehydes and Ketones in Ambient Air
(EPA Method TO-5)
High Pressure Liquid Chromatography

File Name:	**4102111**	**Date of Collection:**	**10/13/93**
Dil. Factor:	**1.0**	**Date of Extraction:**	**10/20/93**
Sample Volume (mL):	**10.0**	**Date of Analysis:**	**10/21/93**

Compound	Det. Limit (uG)	Amount (uG)
Formaldehyde	0.10	Not Detected
Acetaldehyde	0.10	Not Detected
Acrolein	0.10	Not Detected
Propanal	0.10	Not Detected
Acetone	0.10	0.14 B
Crotonaldehyde	0.10	Not Detected
Isobutyraldehyde	0.10	Not Detected
Methyl Ethyl Ketone	0.10	Not Detected

B = Compound present in laboratory blank, background subtraction not performed.

AIR TOXICS LTD.

SAMPLE NAME: 139641

ID#: 9310145A-02B

Aldehydes and Ketones in Ambient Air
(EPA Method TO-5)
High Pressure Liquid Chromatography

File Name:	**4102110**	**Date of Collection:**	**10/13/93**
Dil. Factor:	**1.0**	**Date of Extraction:**	**10/20/93**
Sample Volume (mL):	**9.4**	**Date of Analysis:**	**10/21/93**

Compound	Det. Limit (uG)	Amount (uG)
Formaldehyde	0.10	0.12
Acetaldehyde	0.10	0.19
Acrolein	0.10	Not Detected
Propanal	0.10	Not Detected
Acetone	0.10	0.43 B
Crotonaldehyde	0.10	Not Detected
Isobutyraldehyde	0.10	Not Detected
Methyl Ethyl Ketone	0.10	Not Detected

B = Compound present in laboratory blank, background subtraction not performed.

AIR TOXICS LTD.

SAMPLE NAME: 158536 Trip Spike

ID#: 9310145A-05A

Aldehydes and Ketones in Ambient Air

(EPA Method TO-5)

High Pressure Liquid Chromatography

File Name:	**4102113**	**Date of Collection:**	**10/13/93**
Dil. Factor:	**1.0**	**Date of Extraction:**	**10/20/93**
Sample Volume (mL):	**11.0**	**Date of Analysis:**	**10/21/93**

Compound	**Det. Limit (uG)**	**% Recovery**
Formaldehyde	0.10	93
Acetaldehyde	0.10	104
Acrolein	0.10	Not Spiked
Propanal	0.10	Not Spiked
Acetone	0.10	Not Spiked
Crotonaldehyde	0.10	Not Spiked
Isobutyraldehyde	0.10	Not Spiked
Methyl Ethyl Ketone	0.10	Not Spiked

AIR TOXICS LTD.

SAMPLE NAME: 158535 Trip Blank

ID#: 9310145A-04A

Aldehydes and Ketones in Ambient Air
(EPA Method TO-5)
High Pressure Liquid Chromatography

File Name:	**4102112**	**Date of Collection:**	**10/13/93**
Dil. Factor:	**1.0**	**Date of Extraction:**	**10/20/93**
Sample Volume (mL):	**10.0**	**Date of Analysis:**	**10/21/93**

Compound	**Det. Limit (uG)**	**Amount (uG)**
Formaldehyde	0.10	Not Detected
Acetaldehyde	0.10	0.19
Acrolein	0.10	Not Detected
Propanal	0.10	Not Detected
Acetone	0.10	0.43 B
Crotonaldehyde	0.10	Not Detected
Isobutyraldehyde	0.10	Not Detected
Methyl Ethyl Ketone	0.10	Not Detected

B = Compound present in laboratory blank, background subtraction not performed.

AIR TOXICS LTD.

SAMPLE NAME: Lab Spike

ID#: 9310145A-07A

Aldehydes and Ketones in Ambient Air

(EPA Method TO-5)

High Pressure Liquid Chromatography

File Name:	**4102117**	**Date of Collection:**	**NA**
Dil. Factor:	**1.0**	**Date of Extraction:**	**10/20/93**
Sample Volume (mL):	**11.0**	**Date of Analysis:**	**10/21/93**

Compound	**Det. Limit (uG)**	**% Recovery**
Formaldehyde	0.10	82
Acetaldehyde	0.10	79
Acrolein	0.10	75
Propanal	0.10	Not Spiked
Acetone	0.10	Not Spiked
Crotonaldehyde	0.10	Not Spiked
Isobutyraldehyde	0.10	Not Spiked
Methyl Ethyl Ketone	0.10	Not Spiked

AIR TOXICS LTD.

SAMPLE NAME: Lab Blank

ID#: 9310145A-06A

Aldehydes and Ketones in Ambient Air
(EPA Method TO-5)
High Pressure Liquid Chromatography

File Name:	**4102116**	**Date of Collection:**	**NA**
Dil. Factor:	**1.0**	**Date of Extraction:**	**10/20/93**
Sample Volume (mL):	**10.0**	**Date of Analysis:**	**10/21/93**

Compound	**Det. Limit (uG)**	**Amount (uG)**
Formaldehyde	0.10	Not Detected
Acetaldehyde	0.10	Not Detected
Acrolein	0.10	Not Detected
Propanal	0.10	Not Detected
Acetone	0.10	0.73
Crotonaldehyde	0.10	Not Detected
Isobutyraldehyde	0.10	Not Detected
Methyl Ethyl Ketone	0.10	Not Detected

AIR TOXICS LTD.

AN ENVIRONMENTAL ANALYTICAL LABORATORY

WORK ORDER #: 9310145B

Work Order Summary

CLIENT: Mr. Jon Kawaguchi
Energy & Environmental Research
8001 Irvine Blvd.
Santa Ana, CA 92705

BILL TO: Accounts Payable
EER Corporation
18 Mason
Irvine, CA 92718

PHONE: 714-552-1803
FAX: 714-859-3194
DATE RECEIVED: 10/16/93
DATE COMPLETED: 11/8/93

INVOICE # 2150
P.O. #
PROJECT
AMOUNT$: $175.00

FRACTION #	NAME	TEST	RECEIPT VAC./PRES.	PRICE
01A	154570	ASTM D-1945	NA	$175.00
02A	Lab Blank	ASTM D-1945	NA	NC

LAB NARRATIVE:
Sample contained water condensation. Contents of the bomb were transferred to a tedlar bag and analyzed.

CERTIFIED BY: Linda J. Fuson
Laboratory Director

DATE: 11/8/93

180 BLUE RAVINE ROAD, SUITE B • FOLSOM, CA 95630
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Appendix B.5. Fuel Analyses

AIR TOXICS LTD.

SAMPLE NAME: Lab Blank
ID#: 9310145B-02A

NATURAL GAS ANALYSIS by ASTM D-1945
GC/TCD/FID

File Name:	**3102303**	**Date of Collection:**	**NA**
Dil. Factor:	**1.0**	**Date of Analysis:**	**10/23/93**

Compound	Det. Limit (%)	Amount (%)
Oxygen	0.001	Not Detected
Nitrogen	0.001	100
Carbon Monoxide	0.001	Not Detected
Methane	0.001	Not Detected
Carbon Dioxide	0.001	Not Detected
Ethane	0.001	Not Detected
Propane	0.001	Not Detected
Isobutane	0.001	Not Detected
Butane	0.001	Not Detected
Neopentane	0.001	Not Detected
Isopentane	0.001	Not Detected
n-Pentane	0.001	Not Detected
Ethylene	0.001	Not Detected
Propene	0.001	Not Detected
1-Butene	0.001	Not Detected
cis-2-Butene	0.001	Not Detected
trans-2-Butene	0.001	Not Detected
Cyclopentane	0.001	Not Detected
Ethyne	0.001	Not Detected
C6+	0.010	Not Detected
	Total (%) =	100

BTU/Cu. Ft. = NA
Specific Gravity (Air = 1.000) = NA

Container Type: NA

AIR TOXICS LTD.

SAMPLE NAME: 154570
ID#: 9310145B-01A

NATURAL GAS ANALYSIS by ASTM D-1945
GC/TCD/FID

File Name:	**3102304**	**Date of Collection:**	**10/14/93**
Dil. Factor:	**1.0**	**Date of Analysis:**	**10/23/93**

Compound	**Det. Limit (%)**	**Amount (%)**
Oxygen	0.001	0.84
Nitrogen	0.001	7.0
Carbon Monoxide	0.001	0.55
Methane	0.001	34
Carbon Dioxide	0.001	0.16
Ethane	0.001	17
Propane	0.001	23
Isobutane	0.001	5.8
Butane	0.001	3.4
Neopentane	0.001	0.004
Isopentane	0.001	0.70
n-Pentane	0.001	0.42
Ethylene	0.001	6.6
Propene	0.001	Not Detected
1-Butene	0.001	Not Detected
cis-2-Butene	0.001	Not Detected
trans-2-Butene	0.001	Not Detected
Cyclopentane	0.001	Not Detected
Ethyne	0.001	0.027
C4 Unknown	0.001	0.083
C6+	0.010	0.48
	Total (%) =	100

BTU/Cu. Ft. = 1700
Specific Gravity (Air = 1.000) = 1.1

Container Type: Sample Bomb

Appendix C.1. CEM Calibrations and Calculations

APPENDIX C - NATURAL GAS STEAM GENERATOR

NG Steam Generator

10/20/93

Time	O2 %, Dry	CO2 %, Dry	NO ppmv, Dry	NOx ppmv, Dry	NO ppmv, Dry 7%O2	NOx ppmv, Dry 7%O2
00:13:42:16.004	2.52	12.90		24.05		18.22
00:13:43:15.992	2.33	13.07		23.27		17.45
00:13:44:15.988	2.43	12.98		22.51		16.97
00:13:45:15.977	2.57	12.88		22.64		17.20
00:13:46:16.031	2.55	12.88		22.54		17.10
00:13:47:16.031	2.32	13.05		22.04		16.52
00:13:48:16.027	2.43	12.99		21.82		16.45
00:13:49:16.020	2.46	13.00	21.71		16.39	
00:13:50:16.012	2.58	12.91	21.86		16.61	
00:13:51:16.008	2.47	13.02	22.06		16.67	
00:13:52:15.992	2.33	13.13	21.75		16.31	
00:13:53:15.988	2.72	12.82	22.13		16.95	
00:13:54:15.977	2.50	12.95	22.25		16.84	
00:13:55:16.035	2.49	12.97	22.28		16.85	
00:13:56:16.020	2.48	13.00		22.28		16.84
00:13:57:16.016	2.43	13.02		22.07		16.64
00:13:58:16.070	2.49	12.96		22.20		16.79
00:13:59:16.004	2.52	12.93		22.30		16.89
00:14:00:15.996	2.51	12.93		22.43		16.98
00:14:01:15.992	2.22	13.12		22.35		16.66
00:14:02:15.988	2.62	12.81		22.51		17.15
00:14:03:15.988	2.50	12.91	22.79		17.25	
00:14:04:16.027	2.48	12.93	22.71		17.17	
00:14:05:16.020	2.44	12.96	22.66		17.09	
00:14:06:16.027	2.47	12.93	22.68		17.14	
00:14:07:16.012	2.46	12.93	22.72		17.16	
00:14:08:16.004	2.47	12.93	22.89		17.29	
00:14:09:15.996	2.34	13.03	22.73		17.05	
00:14:10:15.992	2.41	12.98		22.64		17.05
00:14:11:15.988	2.46	12.94		22.79		17.21
00:14:12:15.977	2.48	12.92		22.92		17.33
00:14:22:56.004	2.52	12.82		23.77		18.01
00:14:23:55.996	2.48	12.86		23.83		18.01

CEM NO AND NOX CALIBRATIONS

PLANT: Natural Gas Steam Generator
CITY, STATE: Confidential
LOCATION: Stack

TEST DATE: 10/20/94

RUN NUMBER: NO,NO2
RUN START TIME: 13:42
RUN END TIME: 15:28
CEM OPERATOR: Rob Cambell

ANALYTE		O2	CO2	NOx
CONCENTRATION UNIT		%, dry	%, dry	ppmv, dry
HIGH-RANGE GAS FRACTION OF SPAN		1	1	1
SPAN		4.5	17.7	45
SPAN GAS CONCENTRATION, Cma	HIGH	4.5	17.7	45
	MID	2.5	9	25
	ZERO	0	0	0
INITIAL ANALYZER CALIBRATION CHECK, Cai	HIGH	4.5	17.68	44.63
	MID	2.5	9.06	24.98
	ZERO	0.0	0.0	0.5
INITIAL ANALYZER CALIBRATION ERROR, Ei	HIGH	0.0%	-0.1%	-0.8%
Ei = ((Cai - Cma)/Span)x100%	MID	0.0%	0.3%	0.0%
	ZERO	0.0%	0.0%	1.2%
INITIAL BIAS CHECK, Cbi	UPSCALE HIGH (H) OR MID (M)?	M	M	M
(SELECT UPSCALE CALIBRATION GAS CLOSEST TO EFFLUENT GAS CONCENTRATION)	UPSCALE	2.49	9.01	24.13
	ZERO	0.0	0.0	0.5
INITITAL SYSTEM CALIBRATION BIAS, Bi	UPSCALE	-0.2%	-0.3%	-1.9%
Bi = ((Cbi-Cai)/Span)x100%	ZERO	0.0%	0.2%	0.0%
FINAL ANALYZER CALIBRATION CHECK, Caf	HIGH	4.48	17.58	43.96
	MID	2.49	9.07	24.39
	ZERO	0.0	0.0	0.0
FINAL ANALYZER CALIBRATION ERROR, Ef	HIGH	-0.4%	-0.7%	-2.3%
Ef = ((Caf - Cma)/Span)x100%	MID	-0.2%	0.4%	-1.4%
	ZERO	0.0%	0.2%	0.0%
FINAL BIAS CHECK, Cbf	UPSCALE HIGH (H) OR MID (M)?	M	M	M
(SELECT UPSCALE CALIBRATION GAS CLOSEST TO EFFLUENT GAS CONCENTRATION)	UPSCALE	2.48	9.00	24.10
	ZERO	0.0	0.1	0.1
FINAL SYSTEM CALIBRATION BIAS, Bf	UPSCALE	-0.2%	-0.4%	-0.6%
Bf = ((Cbf-Caf)/Span)x100%	ZERO	0.2%	0.1%	0.2%
ANALYZER DRIFT	HIGH	-0.4%	-0.6%	-1.5%
D = ((Caf - Cai)/(Span))x100%	MID	-0.2%	0.1%	-1.3%
	ZERO	0.0%	0.2%	-1.2%
SYSTEM DRIFT	UPSCALE	-0.2%	-0.1%	-0.1%
D = ((Cbf - Cbi)/(Span))x100%	ZERO	0.2%	0.1%	-1.0%

NG Steam Generator						
10/20/93						
Time	O2	CO2	NO	NOx	NO	NOx
	%, Dry	%, Dry	ppmv, Dry	ppmv, Dry	ppmv, Dry 7%O2	ppmv, Dry 7%O2
00:14:57:56.008	2.41	13.01		23.72		17.86
00:14:58:56.004	2.44	12.98		23.59		17.79
00:14:59:55.996	2.47	12.95		23.52		17.77
00:15:00:56.043	2.49	12.93	23.56		17.82	
00:15:01:55.984	2.49	12.91	23.31		17.63	
00:15:02:55.980	2.50	12.91	23.46		17.75	
00:15:03:55.969	2.42	12.98	23.37		17.61	
00:15:04:55.965	2.45	12.94	23.44		17.69	
00:15:05:56.016	2.46	12.92	23.77		17.95	
00:15:06:56.008	2.46	12.93	23.58		17.81	
00:15:07:56.004	2.54	12.88		23.79		18.04
00:15:08:55.996	2.57	12.87		23.88		18.14
00:15:09:55.992	2.38	13.01		23.87		17.95
00:15:10:55.984	2.28	13.07		23.49		17.57
00:15:11:55.980	2.36	13.02		23.40		17.58
00:15:12:55.969	2.36	13.00		23.52		17.67
00:15:13:55.965	2.32	13.02		23.41		17.54
00:15:14:56.016	2.28	13.06	23.52		17.59	
00:15:15:56.008	2.28	13.02	23.50		17.57	
00:15:16:56.004	2.55	12.83	23.69		17.98	
00:15:17:56.004	2.41	12.94	23.53		17.72	
00:15:18:55.992	2.40	12.95	23.61		17.77	
00:15:19:55.984	2.47	12.91	23.51		17.76	
00:15:20:55.980	2.49	12.89	23.70		17.93	
00:15:21:55.969	2.48	12.88		23.49		17.76
00:15:22:55.965	2.46	12.90		23.36		17.64
00:15:23:56.016	2.53	12.85		23.55		17.85
00:15:24:56.008	2.52	12.86		23.47		17.78
00:15:25:56.012	2.54	12.84		23.47		17.80
00:15:26:55.996	2.54	12.85		23.23		17.62
00:15:27:55.992	2.58	12.81		23.50		17.86
00:15:28:55.996	2.51	12.88		23.48		17.78
AVERAGE	2.46	12.94	23.13	23.24	17.46	17.56

NG Steam Generator						
10/20/93						
Time	O2	CO2	NO	NOx	NO	NOx
	%, Dry	%, Dry	ppmv, Dry	ppmv, Dry	ppmv, Dry 7%O2	ppmv, Dry 7%O2
00:14:24:55.992	2.42	12.92		23.27		17.53
00:14:25:55.988	2.46	12.89		23.43		17.69
00:14:26:55.977	2.47	12.87		23.32		17.62
00:14:27:55.969	2.51	12.85		23.52		17.81
00:14:28:55.965	2.47	12.90		23.42		17.69
00:14:29:56.016	2.52	12.88	23.52		17.82	
00:14:30:56.008	2.51	12.89	23.43		17.74	
00:14:31:56.004	2.52	12.90	23.50		17.80	
00:14:32:55.996	2.45	12.96	23.38		17.65	
00:14:33:55.992	2.43	12.96	23.29		17.56	
00:14:34:55.984	2.42	12.97	23.32		17.57	
00:14:35:55.977	2.43	12.96	23.52		17.73	
00:14:36:55.969	2.49	12.91		23.30		17.62
00:14:37:55.965	2.53	12.89		23.43		17.76
00:14:38:56.188	2.52	12.90		23.66		17.92
00:14:39:56.008	2.50	12.91		23.65		17.90
00:14:40:56.004	2.55	12.87		23.81		18.07
00:14:41:55.996	2.53	12.88		23.82		18.06
00:14:42:55.992	2.46	12.92		23.52		17.76
00:14:43:55.984	2.43	12.96	23.29		17.56	
00:14:44:55.980	2.47	12.93	23.55		17.79	
00:14:45:55.969	2.41	12.98	23.66		17.82	
00:14:46:55.965	2.39	12.99	23.46		17.65	
00:14:47:56.016	2.47	12.94	23.53		17.78	
00:14:48:56.008	2.49	12.93	23.55		17.81	
00:14:49:56.004	2.49	12.96	23.51		17.78	
00:14:50:55.996	2.50	12.94		23.47		17.76
00:14:51:55.992	2.52	12.93		23.74		17.98
00:14:52:55.984	2.49	12.97		23.41		17.71
00:14:53:55.980	2.46	12.99		23.46		17.72
00:14:54:55.969	2.42	13.00		23.59		17.78
00:14:55:55.965	2.46	12.97		23.45		17.71
00:14:56:56.016	2.42	13.00		23.65		17.82

FLOW RATE

PLANT: NG Steam Generator
CITY: Confidential
RUN NO: 1,2,3
SAMPLE LOCATION: STACK

DATE ENTERED: 11/30/93
DATE: 20-Oct-93
OPERATOR: Jon Kawaguchi
ENTERED BY: David Hansell
CHECKED BY:

DATA ENTRY	SYMBOL	UNITS	DATA	DATA	DATA	DATA
RUN NUMBER	-	-	R1	R2	R3	Average
ROUND STACK, DIAMETER	ds	inches	35.0	35.0	35.0	35.00
RECTANGULAR STACK, LENGTH	L	inches				
WIDTH	W	inches				
AVERAGE STACK TEMPERATURE	Fs	degrees F	346.6	347.1	330.6	341.4
AVERAGE METER TEMPERATURE	Fm	degrees F	86.0	87.0	82.0	85.0
BAROMETRIC PRESSURE	Pbar	in. Hg	29.92	29.92	29.92	29.920
STACK STATIC PRESSURE	Pg	in. H20	-0.240	-0.225	-0.230	-0.232
AVG. DELTA H	dH	in. H20	1.900	1.900	1.900	1.900
AVG. VELOCITY HEAD	dP	in. H20	0.37	0.35	0.39	0.370
PITOT COEFFICIENT	Cp	-	0.840	0.840	0.840	0.840
GAS SAMPLE VOLUME	Vm	cubic ft.	28.6	28.5	28.9	28.677
METER CALIBRATION FACTOR	Y	-	1.000	1.000	1.000	1.000
TOTAL SAMPLING TIME	min	minutes	40	40	40	40.000
STACK GAS OXYGEN CONTENT	Co2,m	%	2.50	2.50	2.50	2.500
STACK GAS CARBON DIOXIDE CONTENT	Cco2,m	%	12.90	12.90	12.90	12.900
TOTAL IMPINGER GAIN (WATER & PARTICULATE)	Ww	grams	119.2	117.2	113.5	116.633

CALCULATED DATA	SYMBOL	UNITS	DATA	DATA	DATA	DATA
RUN NUMBER	-	-	R1	R2	R3	Average
STACK AREA, As = 3.14*(ds)**2/576 (ROUND)	As	sq. feet	6.681	6.681	6.681	6.681
= L * W/144 (RECTANGULAR)			0.000	0.000	0.000	0.000
AVG. STACK TEMPERATURE, Ts = Fs + 460	Ts	degrees R	806.6	807.1	790.6	801.4
AVG. METER TEMPERATURE, Tm = Fm + 460	Tm	degrees R	546.0	547.0	542.0	545.0
GAS SAMPLE VOLUME AT STANDARD CONDITIONS, VmStd = 17.64Y (Vm/Tm) (Pbar + dH/13.6)	VmStd	cubic ft.	27.8	27.7	28.2	27.9
VOLUME OF WATER VAPOR, VwStd = 0.04707*Ww	VwStd	cubic ft.	5.6	5.5	5.3	5.5
MOISTURE FRACTION, Bws = VwStd/(VmStd + VwStd)	Bws	-	0.168	0.166	0.159	0.164
DRY STACK GAS MOL. WEIGHT, Md = 0.32(Co2,m)+ 0.44(Cco2,m)+0.28[100-(Co2,m)-(Cco2,m)]	Md	g/g-mole	30.16	30.16	30.16	30.16
WET STACK GAS MOLECULAR WEIGHT, Mw = Md(1-Bws)+18.0(Bws)	Mw	g/g-mole	28.12	28.14	28.23	28.16
ABSOLUTE STACK PRESSURE, Ps = Pbar + Pg/13.6	Ps	in. Hg	29.90	29.90	29.90	29.90
STACK GAS VELOCITY vs = 85.49 Cp { sqrt[(dP*Ts) /(Ps*Mw)] }	vs	ft/s	42.6	41.6	43.6	42.6
vm = 0.3048 * vs	vsm	m/s	12.98	12.69	13.29	12.98
ACTUAL STACK GAS FLOW RATE, Q = 60*vs*As	Q	acf/min	17070.0	16688.1	17475.9	17078.0
DRY GAS STACK FLOW RATE (DRY,STP) Qsd = 17.64*Q*(1-Bws)*(Ps/Ts)	Qsd	dscf/min	9289.6	9093.3	9804.7	9395.8
Qsdm = Qsd/35.32	Qsdm	dscm/min	263.0	257.5	277.6	266.0

Appendix C.2. Flow Calculations and Run Sheets

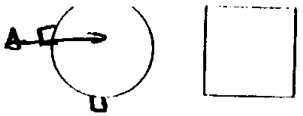
EPA METHOD 4

Plant
City
Locat
Operators JIC
Date 10/20/93
Run Number 1
Stack Diam. (in.) 35

Sample Box Number
Meter Box Number N1
Meter Calibration (Y) 1.0002
Meter dH @ 1.9512
Pitot Tube No. 142 Cp .84
Probe Length 4 Tc No. 50

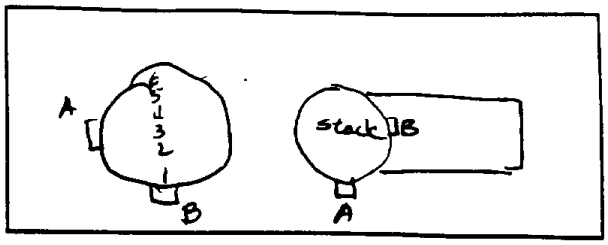
Probe Liner Material S/S
Static Pressure (Pa) −0.24 (in. H2O)
Barometric Pressure (Pb) 29.92 (in. Hg)
Ambient Temperature (°F) 80
Prelest Leak Rate .002 cfm @ [illegible] (in. Hg)
Post Test Leak Rate .005 cfm @ 16 (in. Hg)

Sheet 1 of 1



Sampling Time, (min)	Clock Time (24 h)	Vacuum (in. Hg)	Pressure Differential Across Orifice dH (in. H2O)	Gas Sample Volume, Vm (cf)	Dry Gas Meter Outlet Temp. Tm (°F)	Impinger Outlet Temp (°F)	Comments
0	1341			969.420			
5	46	12	1.9	972.025	82	62	
10	51	12	1.9	975.625	83	60	
15	56	12	1.9	979.225	85	58	
20	1401	12	1.9	982.715	87	59	
25	06	12	1.9	986.400	96	58	
30	11	12	1.9	989.270	97	58	
35	16	12	1.9	993.540	98	58	
40	21	12	1.9	997.060	98	58	
				29.64	85.8		

PLANT
DATE 10/20/10
LOCATION
STACK I.D. 35"
PITOT NO./Cp 162 / .84 TC# 50
BAROMETRIC PRESSURE, In Hg
STATIC GAUGE PRESSURE, In H20 - .24
OPERATORS RC / JC
PITOT PRE TEST LEAK CHECK ✓ Good
PITOT POST TEST LEAK CHECK



SCHEMATIC OF TRAVERSE POINT LAYOUT

A

TRAVERSE POINT NUMBER	CLOCK 24 HR TIME	VELOCITY HEAD (Ps) In. H20	STACK TEMP (Ts)°F	SWIRL ANGLE
1	12:26	.356	345	
2	12:27	.356	348	0
3	12:28	.37	350	
4	12:28	.38	351	0
5	12:29	.385	350	0
6	12:30	.38	346	
7	12:31	.38	344	
8	12:32	.355	342	0
AVERAGE				

change points

B

TRAVERSE POINT NUMBER	CLOCK 24 HR TIME	VELOCITY HEAD (Ps) In. H20	STACK TEMP (Ts)°F	SWIRL ANGLE
1	12:42	.34	345	0
2	12:43	.356	347	
3	12:44	.35	348	0
4	12:45	.37	349	
5	12:46	.390	348	0 @90'
6	12:47	.385	346	
7	12:48	.375	345	0
8	12:49	.340	341	
AVERAGE				

SWIRL ACCEPTANCE LIMITS

Average(abs. value) less than 10°
No points with reverse flow
No more than 4 points above 30°

ΔP MINIMUM LIMITS

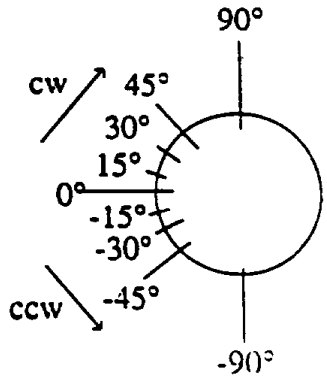
Conditions for more sensitive manometer
1. For 12 or more points on a velocity traverse: 10% of the points's Δp < 0.05"
2. For <12 points on a velocity traverse more than 1 point's Δp <0.05"

Rt Mean Avg Δp =

$$\left[\frac{\sum_{1}(\Delta p_{si})^{1/2}}{N}\right]^2$$

Rt Mean Avg Ts =

$$\left[\frac{\sum_{1}(Ts_i)^{1/2}}{N}\right]^2$$



PRELIMINARY VELOCITY TRAVERSE

PLANT
DATE 10-20-93
LOCATION
STACK I.D.
PITOT NO./Cp TC#
BAROMETRIC PRESSURE, In Hg
STATIC GAUGE PRESSURE, In H20 - .225
OPERATORS Robert Campbell / Jon M
PITOT PRE TEST LEAK CHECK OK
PITOT POST TEST LEAK CHECK

Port B

TRAVERSE POINT NUMBER	CLOCK 24 HR TIME	VELOCITY HEAD (Ps) In. H20	STACK TEMP (Ts)°F	SWIRL ANGLE
1	17:10	.29	344	
2	17:11	.256	345	
3	17:12	.34	351	
4	17:13	.38	351	0
5	17:14	.40	351	
6	17:15	.395	351	
7	17:16	.37	349	
8	17:16	.285	339	
AVERAGE				

Port A

SCHEMATIC OF TRAVERSE POINT LAYOUT

TRAVERSE POINT NUMBER	CLOCK 24 HR TIME	VELOCITY HEAD (Ps) In. H20	STACK TEMP (Ts)°F	SWIRL ANGLE
1	17:18	.33	333	
2	17:19	.345	342	
3	17:20	.357	348	0
4	17:21	.385	352	
5	17:22	.391	351	
6	17:23	.38	350	
7	17:24	.38	349	
8	17:25	.35	348	
AVERAGE				

SWIRL ACCEPTANCE LIMITS

Average(abs. value) less than 10°
No points with reverse flow
No more than 4 points above 30°

ΔP MINIMUM LIMITS

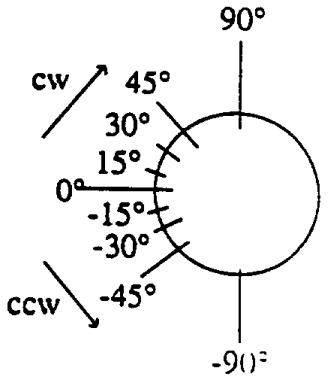
Conditions for more sensitive manometer
1. For 12 or more points on a velocity traverse: 10% of the points's Δp < 0.05"
2. For <12 points on a velocity traverse more than 1 point's Δp <0.05"

Rt Mean Avg Δp =

$$\left[\frac{\sum_{1}(\Delta p_{si})^{1/2}}{N}\right]^2$$

Rt Mean Avg Ts =

$$\left[\frac{\sum_{1}(T_{si})^{1/2}}{N}\right]^2$$



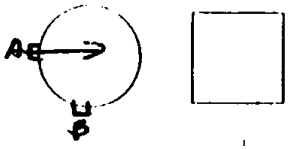
EPA METHOD 4

Plant ____
City ____
Location ____
Operators JK
Date 10/20/93
Run Number 2
Stack Diam. (in.) 35

Sample Box Number Black
Meter Box Number H1
Meter Calibration (Y) 1.0002
Meter dH @ 1.9512
Pitot Tube No. 162 Cp .84
Probe Length 4 Tc No. 58

Probe Liner Material S/S
Static Pressure (Pa) -.225 (in. H2O)
Barometric Pressure (Pb) 29.92 (in. Hg)
Ambient Temperature (°F) 80
Pretest Leak Rate 0.002 cfm @ 16 (in. Hg)
Post Test Leak Rate 0.000 cfm @ 15 (in. Hg)

Sheet 1 of 1



Sampling Time, (min)	Clock Time (24 h)	Vacuum (in. Hg)	Pressure Differential Across Orifice dH (in. H2O)	Gas Sample Volume, Vm (cf)	Dry Gas Meter Outlet Temp. Tm (°F)	Impinger Outlet Temp (°F)	Comments
0	1804			997.255			
5	09	13	1.9	1000.825	82	57	
10	14	13	1.9	4.400	84	57	
15	19	13	1.9	7.985	85	57	
20	24	13	1.9	11.540	86	58	
25	29	13	1.9	15.100	87	58	
30	34	13	1.9	18.640	88	58	
35	39	13	1.9	22.230	89	58	
40	44	13	1.9	25.790	89	58	

IMPINGER WEIGHT SHEET

Plant/city: _____

Location: _____

Train Set No. Black

Run No.: 2

Operator: JK

Run Time: 40 min

Impinger No.	Solution Used	Solution (ml)	Configuration		Weight (grams)	Inspection Comments
1	DI	100	Mod	Final	725.5	
				Initial	617.6	
				Wt. gain		clear
2	DI	100	GS	Final	602.5	
				Initial	600.2	
				Wt. gain		clear
3	Empty	—	Mod	Final	491.6	
				Initial	489.8	
				Wt. gain		Some moisture
4	Silica	300g	Mod	Final	685.1	
				Initial	679.9	
				Wt. gain		¼ spent
5				Final		
				Initial		
				Wt. gain		
6				Final		
				Initial		
				Wt. gain		
Flask				Final		
				Initial		
				Wt. gain		

TOTAL WEIGHT GAIN OF IMPINGERS (grams) _____

Train set up: Date: 10/19/93

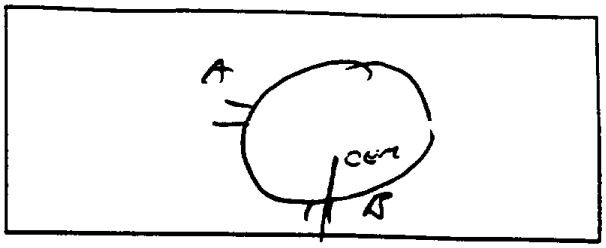
Signature: [signature]

Train recovery: Date: 10-20-93

Signature: Robert Campbell

EER

PLANT
DATE 10/20/93
LOCATION
STACK I.D. 35
PITOT NO./Cp 162/.84 TC# 50
BAROMETRIC PRESSURE, In Hg 29.92
STATIC GAUGE PRESSURE, In H20
OPERATORS RC, JK
PITOT PRE TEST LEAK CHECK
PITOT POST TEST LEAK CHECK



SCHEMATIC OF TRAVERSE POINT LAYOUT

A

TRAVERSE POINT NUMBER	CLOCK 24 HR TIME PM HRS	VELOCITY HEAD (Ps) In. H20	STACK TEMP (Ts)°F	SWIRL ANGLE
1	09:32	.345	329	
2	09:33	.380	330	
3	09:33	.385	331	
4	09:34	.410	333	
5	09:35	.425	335	
6	09:36	.410	334	
7	09:37	.40	331	
8	09:38	.35	327	
AVERAGE				

port change

B

TRAVERSE POINT NUMBER	CLOCK 24 HR TIME AM HRS	VELOCITY HEAD (Ps) In. H20	STACK TEMP (Ts)°F	SWIRL ANGLE
1	09:40	.43	329	
2	09:40	.41	329	
3	09:41	.385	331	
4	09:41	.40	332	
5	9:42	.415	336	
6	9:43	.401	331	
7	9:43	.40	328	
8	9:44	.356	323	
AVERAGE				

SWIRL ACCEPTANCE LIMITS

Average(abs. value) less than 10°
No points with reverse flow
No more than 4 points above 30°

ΔP MINIMUM LIMITS

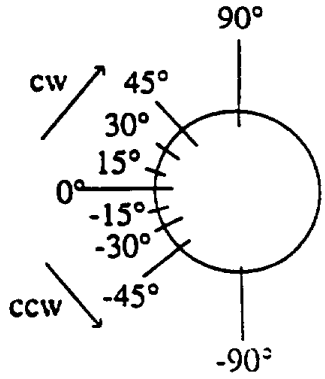
Conditions for more sensitive manometer
1. For 12 or more points on a velocity traverse: 10% of the points's Δp < 0.05"
2. For <12 points on a velocity traverse more than 1 point's Δp <0.05"

Rt Mean Avg Δp =

$$\left[\frac{\sum_{1}(\Delta p_{si})^{1/2}}{N}\right]^2$$

Rt Mean Avg Ts =

$$\left[\frac{\sum_{1}(T_{si})^{1/2}}{N}\right]^2$$



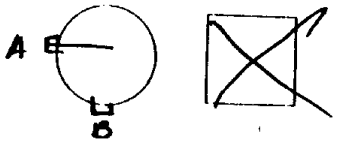
EPA METHOD 4

Plant
City
Location
Operators JR
Date 10/20/93
Run Number 3
Stack Diam. (in.) 35

Sample Box Number Orange
Meter Box Number N1
Meter Calibration (Y) 1.0002
Meter dH @ 1.9512
Pitot Tube No. 162 Cp .84
Probe Length 4' Tc No. 50

Probe Liner Material 316
Static Pressure (Pa) _____ (in. H2O)
Barometric Pressure (Pb) 29.92 (in. Hg)
Ambient Temperature (°F) 80
Pretest Leak Rate .002 cfm @ 16 (in. Hg)
Post Test Leak Rate .002 cfm @ 15 (in. Hg)

Sheet 1 of 1



Sampling Time, (min)	Clock Time (24 h)	Vacuum (in. Hg)	Pressure Differential Across Orifice dH (in. H2O)	Gas Sample Volume, Vm (cf)	Dry Gas Meter Outlet Temp, Tm (°F)	Impinger Outlet Temp (°F)	Comments
0	2003			26.020			
5	08	13	1.9	* ~~26.020~~	80	54	* ~~[illegible]~~ 29.950
10	13	13	1.9	33.580	81	57	
15	18	13	1.9	36.950	81	58	
20	23	13	1.9	40.485	82	59	
25	28	13	1.9	44.025	83	60	
30	33	13	1.9	48.240	84	60	
35	38	13	1.9	51.065	84	61	
40	43	13	1.9	54.600	84	62	

IMPINGER WEIGHT SHEET

Plant/city: _____

Location: _____

Train Set No. Orange

Run No.: _____

Operator: _____

Run Time: _____

Impinger No.	Solution Used	Solution (ml)	Configuration		Weight (grams)	Inspection Comments
1	DI			Final	806.2	
				Initial	696.9	
				Wt. gain		Clear
2	DI			Final	612.1	
				Initial	611.0	
				Wt. gain		Clear
3	EMPTY			Final	483.4	
				Initial	483.2	
				Wt. gain		Some Moisture
4	SILICA			Final	681.0	
				Initial	678.1	
				Wt. gain		½ spent
5				Final		
				Initial		
				Wt. gain		
6				Final		
				Initial		
				Wt. gain		
Flask				Final		
				Initial		
				Wt. gain		

TOTAL WEIGHT GAIN OF IMPINGERS (grams) _____

Train set up: Date: _____
Signature: _____

Train recovery: Date: 10-20-93
~~[illegible]~~ 21:00 Signature: R. Campbell

EER