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ENVIRONMENTAL ASSESSMENT
OF A WOOD-WASTE-FIRED
INDUSTRIAL FIRETUBE BOILER
Volume II. Data Supplement

Prepared for

Office of Air Quality Planning and Standards

Prepared by

Air and Energy Engineering Research
Laboratory
Research Triangle Park NC 27711

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ENVIRONMENTAL ASSESSMENT OF A WOODWASTE-FIRED INDUSTRIAL FIRETUBE BOILER

Volume II. Data Supplement

by

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TABLE OF CONTENTS

SECTION 1

INTRODUCTION

The purpose of this data supplement is to document data in greater detail than was possible in Volume I (Technical Results) of this report. It is intended to provide sufficient detail for researchers to perform their own analysis of the data obtained. Readers are referred to the technical volume for objectives, description of source emission results, interpretation, and conclusions.

The remaining sections of this data supplement contain the following information:

Section 2 -- Preliminary Tests: stack velocity traverse and gas composition tests

Section 3 -- Boiler Operating Data: steam flow, drum pressure, feedwater pressure, furnace pressure, outlet pressure, collector pressure, stack temperature, and boiler efficiency calculations

Section 4 -- Sampling Data Sheets: continuous emission monitoring data, operating data tables for EPA Method 5 (for particulate mass emissions), controlled condensation (for SO_2 and SO_3 sampling), and SASS (for trace element and organic sampling)

Section 5 -- Analytical Laboratory Results: fuel analysis, Method 5 particulate emissions, SASS particulate emissions, sulfur oxides emissions from controlled condensation samples, trace element

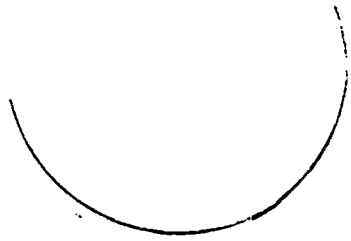
emissions by spark source mass spectrometry (SSMS) analysis and atomic absorption spectroscopy (AAS) analysis; C_1 to C_6 hydrocarbons by gas chromatography; total chromatographable organic (TCO) and gravimetric (GRAV) results; infrared (IR) spectra; determination of organic compounds by gas chromotography/mass spectrometry (GC/MS); radiometric analysis results, and biological assay reports on the SASS train samples.

SECTION 2

PRELIMINARY TESTS

TRAVERSE POINT LOCATION FOR CIRCULAR DUCTS

PLANT Burlington, Phill Potts, Lexington, N.C
DATE 7-29-81
SAMPLING LOCATION STACK
INSIDE OF FAR WALL TO
OUTSIDE OF NIPPLE, (DISTANCE A) 37.75"
INSIDE OF NEAR WALL TO
OUTSIDE OF NIPPLE, (DISTANCE B) 1.75"
STACK I.D., (DISTANCE A - DISTANCE B) 36"
NEAREST UPSTREAM DISTURBANCE 2
NEAREST DOWNSTREAM DISTURBANCE 1
CALCULATOR BEST

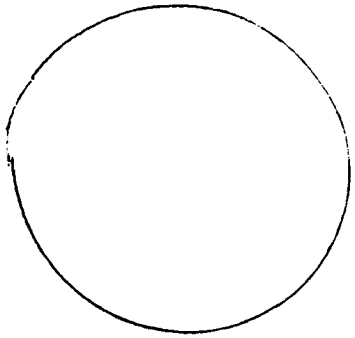


SCHEMATIC OF SAMPLING LOCATION

TRAVERSE POINT NUMBER	FRACTION OF STACK I.D.	STACK I.D.	PRODUCT OF COLUMNS 2 AND 3 (TO NEAREST 1/8 INCH)	DISTANCE B	TRAVERSE POINT LOCATION FROM OUTSIDE OF NIPPLE (SUM OF COLUMNS 4 & 5)
1	.011	36"	0.40 (1.0)	1.75	2.75
2	.032		1.15		2.90
3	.055		2.00		3.75
4	.079		2.84		4.59
5	.105		3.78		5.53
6	.132		4.75		6.50
7	.161		5.80		7.55
8	.194		7.00		8.75
9	.23		8.28		10.03
10	.272		9.80		11.55
11	.323		11.63		13.38
12	.398		14.33		16.08
13	.602		21.67		23.42
14	.677		24.37		26.12
15	.728		26.21		27.96
16	.77		27.72		29.47
17	.806		29.02		30.77
18	.839		30.20		31.95
19	.868		31.25		33.00
20	.895		32.22		33.97
21	.921		33.16		34.91
22	.945		34.0		35.75
23	.968		34.85		36.6
24	.989		35.60 (35.5)		36.75

PRELIMINARY VELOCITY TRAVERSE

PLANT BURLINGTON - PHILLIP MORRIS, LEXINGTON N.C.
DATE 4-29-81
LOCATION STACK
STACK I.D. 36
BAROMETRIC PRESSURE, in. Hg 28.98
STACK GAUGE PRESSURE, in. H_2O
OPERATORS Batt / Farver



SCHEMATIC OF TRAVERSE POINT LAYOUT

West

TRAVERSE POINT NUMBER	VELOCITY HEAD (Δp_s), in. H_2O	STACK TEMPERATURE (T_s), °F
1	.30	204
2	.37	2
3	.40	460
4	.43	460
5	.52	460
6	.53	460
7	.65	466
8	.70	506
9	.75	521
10	.75	525
11	.75	529
12	.75	532
13	.75	538
14	.80	542
15	.75	542
16	.80	542
17	.72	540
18	.75	534
19	.75	530
20	.75	527
21	.70	523
22	.70	519
23	.75	511
24	.75	511
AVERAGE		

TRAVERSE POINT NUMBER	VELOCITY HEAD (Δp_s), in. H_2O	STACK TEMPERATURE (T_s), °F
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		
AVERAGE		

ISOKINECTIC SAMPLING WORKSHEET

Plant Burlington Industries Peformed by Best

Date 4-29-81

Sample Location Outlet

Test No./Type M/S #1

static = -.40

Baron = 28.99

$$K = \frac{782.687\ (Cp)^2\ (1-B_{wo})^2\ P_s\ M_d}{K_o^2\ M_s\ P_m}$$

where: K = Contant of fixed and assumed parameters (dimensionless)

Pitot coefficient (dimensionless)	C_p	.806	
Water vapor in the gas stream (proportion by volume)	B_{wo}	.08	assume
Absolute stack gas pressure (in. Hg)	P_s	28.70	
Molecular weight, stack gas dry (lb/lb-mole)	M_d	29.2	assume
Orifice coefficient (dimensionless)	K_o	.718	
Molecular weight, stack gas wet (lb/lb-mole) $M_d(1-B_{wo}) + 18(B_{wo})$	M_s	28.2	assume
Abolute meter pressure (in. Hg)	P_m	29.10	
$\frac{782.687\ (.806)^2\ (1-.92)^2\ (28.96)\ (29.2)}{(.718)^2\ (28.2)\ (29.10)}$	K	860.249	

ISOKINECTIC NOZZLE CALCULATION
AND
SAMPLING RATE CALCULATION

Plant Burlington Industries Performed by Best

Date 4-29-81

Sample Location Outlet

Test No./Type M5 / #1

$$N_d = \left(\frac{\Delta H \, T_s}{K \, T_m \, \Delta P} \right)^{.25}$$

where: N_d = Nozzel diameter (inches)

Average pressure differential across the orifice meter (in. H_2O)	ΔH	1.4
Temperature stack gas, average (^oF)	T_s	520
Temperature of gas meter, average (^oF)	T_m	85
Stack gas velocity pressure (in H_2O)	ΔP	.70
$\left(\frac{(\quad)\ (\quad + 460)}{(\quad)\ (\quad + 460)(\quad)} \right)^{.25}$	N_d	.271

$$\Delta H = K \, (N_d)^4 \, \frac{T_m}{T_s} \, (\Delta P)$$

where: ΔH = Pressure differential across the orifice meter (in H_2O)

Nozzel diameter, actual (inches)	N_d	.3086
Temperature of gas meter (^oF)	T_m	
Temperature of stack gas (^oF)	T_s	
Stack gas velocity pressure (in H_2O)	ΔP	
$\left((\quad)\ (\quad)^4 \, \frac{(\quad + 460)}{(\quad + 460)} \, (\quad) \right)$	ΔH	
Magic number _____( )^4	$K(N_d)^4$	7.802

ISOKINECTIC SAMPLING WORKSHEET

Plant _____ Peformed by _____

Date _____

Sample Location _____

Test No./Type _____

$$K = \frac{782.687\ (Cp)^2\ (1-B_{wo})^2\ P_s\ M_d}{K_o^2\ M_s\ P_m}$$

where: K = Contant of fixed and assumed parameters (dimensionless)

Pitot coefficient (dimensionless)	C_p	.77
Water vapor in the gas stream (proportion by volume)	B_{wo}	[illegible]
Absolute stack gas pressure (in. Hg)	P_s	[illegible]
Molecular weight, stack gas dry (lb/lb-mole)	M_d	[illegible]
Orifice coefficient (dimensionless)	K_o	[illegible]
Molecular weight, stack gas wet (lb/lb-mole) $M_d(1-B_{wo}) + 18(B_{wo})$	M_s	28.24
Abolute meter pressure (in. Hg)	P_m	28.98
$\frac{782.687\ (\_\_\_)^2\ (1-\_\_\_)^2\ (\_\_\_)\ (\_\_\_)}{(\_\_\_)^2\ (\_\_\_)\ (\_\_\_)}$	K	30.929

ISOKINECTIC NOZZLE CALCULATION
AND
SAMPLING RATE CALCULATION

Plant ________ Performed by P. ________

Date 4-24-81

Sample Location STACK

Test No./Type 1 - SASS

$$N_d = \left(\frac{\Delta H\ T_s}{K\ T_m\ \Delta P}\right)^{.25}$$

where: N_d = Nozzel diameter (inches)

Average pressure differential across the orifice meter (in. H_2O)	ΔH	2.3
Temperature stack gas, average (^oF)	T_s	520
Temperature of gas meter, average (^oF)	T_m	100
Stack gas velocity pressure (in H_2O)	ΔP	.7
$\left(\frac{(\_\_\_)\ (\_\_\_ + 460)}{(\_\_\_)\ (\_\_\_ + 460)(\_\_\_)}\right)^{.25}$	N_d	.650

P-45 .61

$$\Delta H = K\ (N_d)^4\ \frac{T_m}{T_s}\ (\Delta P)$$

where: ΔH = Pressure differential across the orifice meter (in H_2O)

Nozzel diameter, actual (inches)	N_d	
Temperature of gas meter (^oF)	T_m	
Temperature of stack gas (^oF)	T_s	
Stack gas velocity pressure (in H_2O)	ΔP	
$\left((\_\_\_)\ (\_\_\_)^4\ \frac{(\_\_\_ + 460)}{(\_\_\_ + 460)}\ (\_\_\_)\right)$	ΔH	
Magic number ________( )^4	$K(N_d)^4$	

SECTION 3

BOILER OPERATING DATA

3.1 OPERATING DATA

Time:	9:30	10:00	10:30	11:00	11:30	12:00	12:30	1:00	1:30	2:00	2:30	3:00	3:30	4:00	4:30	5:00	Average
Steam flow (1000lb/hr)	9.5	11.2	13.0	13.0	13.7	13.6	13.5	14.5	14.5	14.2	14.6	15.0	14.8	14.8	14.5	14.0	13.6
Drum pressure (psig)	120	120	122	124	122	122	120	124	124	124	121	126	121	122	122	122	122
Feedwater pressure (psig)	162	157	162	165	160	155	155	165	163	162	162	122	165	162	155	160	158
Furnace pressure (in. H_2O)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Outlet pressure (in. H_2O)	1.1	1.0	0.9	1.25	1.0	1.0	0.9	0.9	1.2	1.2	1.0	1.0	1.0	0.8	0.9	1.0	1.0
Collector pressure (in. H_2O)	2.25	2.2	2.2	2.2	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1
Stack temperature (°F)	650	650	650	650	650	650	620	670	600	680	670	620	690	700	630	620	650

3.2 BOILER THERMAL EFFICIENCY CALCULATION

SUMMARY SHEET

ASME TEST FORM FOR ABBREVIATED EFFICIENCY TEST

PTC 4.1-a (1964)

		TEST NO. 1	BOILER NO. 1 DATE 4-29-81
OWNER OF PLANT	Burlington	LOCATION	Lexington, NC
TEST CONDUCTED BY	Aerver / Castellini	OBJECTIVE OF TEST	Emissions Meas. DURATION 6 hr
BOILER MAKE & TYPE	H&T Firetube		RATED CAPACITY 25,000 lb/hr
STOKER, TYPE & SIZE	McBurney		
PULVERIZER, TYPE & SIZE	None		BURNER, TYPE & SIZE
FUEL USED	Wood waste	MINE	COUNTY STATE SIZE AS FIRED

PRESSURES & TEMPERATURES

1	STEAM PRESSURE IN BOILER DRUM	psia	137
2	STEAM PRESSURE AT S. H. OUTLET	psia	
3	STEAM PRESSURE AT R. H. INLET	psia	
4	STEAM PRESSURE AT R. H. OUTLET	psia	
5	STEAM TEMPERATURE AT S. H. OUTLET	F	
6	STEAM TEMPERATURE AT R H INLET	F	
7	STEAM TEMPERATURE AT R. H. OUTLET	F	
8	WATER TEMP. ENTERING (ECON.) (BOILER)	F	125[a]
9	STEAM QUALITY % MOISTURE OR P. P. M.		
10	AIR TEMP. AROUND BOILER (AMBIENT)	F	77
11	TEMP AIR FOR COMBUSTION (This is Reference Temperature) †	F	77
12	TEMPERATURE OF FUEL	F	
13	GAS TEMP. LEAVING (Boiler) (Econ.) (Air Htr.)	F	650
14	GAS TEMP. ENTERING AH (If conditions to be corrected to guarantee)	F	

UNIT QUANTITIES

15	ENTHALPY OF SAT. LIQUID (TOTAL HEAT)	Btu/lb	319
16	ENTHALPY OF (SATURATED) (SUPERHEATED) STM.	Btu/lb	1193
17	ENTHALPY OF SAT. FEED TO (BOILER) (ECON.)	Btu/lb	93
18	ENTHALPY OF REHEATED STEAM R.H. INLET	Btu/lb	
19	ENTHALPY OF REHEATED STEAM R. H. OUTLET	Btu/lb	
20	HEAT ABS/LB OF STEAM (ITEM 16 – ITEM 17)	Btu/lb	1100
21	HEAT ABS/LB R.H. STEAM (ITEM 19 – ITEM 18)	Btu/lb	
22	DRY REFUSE (ASH PIT + FLY ASH) PER LB AS FIRED FUEL	lb/lb	
23	Btu PER LB IN REFUSE (WEIGHTED AVERAGE)	Btu/lb	
24	CARBON BURNED PER LB AS FIRED FUEL	lb/lb	0.45
25	DRY GAS PER LB AS FIRED FUEL BURNED	lb/lb	14.34

HOURLY QUANTITIES

26	ACTUAL WATER EVAPORATED	lb/hr	13,600[b]
27	REHEAT STEAM FLOW	lb/hr	
28	RATE OF FUEL FIRING (AS FIRED wt)	lb/hr	4071
29	TOTAL HEAT INPUT $\frac{(\text{Item } 28 \times \text{Item } 41)}{1000}$	kB/hr	33140
30	HEAT OUTPUT IN BLOW-DOWN WATER	kB/hr	
31	TOTAL HEAT OUTPUT $\frac{(\text{Item } 26 \times \text{Item } 20) + (\text{Item } 27 \times \text{Item } 21) + \text{Item } 30}{1000}$	kB/hr	14960

FLUE GAS ANAL. (BOILER) (ECON) (AIR HTR) OUTLET

32	CO_2	% VOL	7.7
33	O_2	% VOL	13.1
34	CO	% VOL	0.1
35	N_2 (BY DIFFERENCE)	% VOL	79.1
36	EXCESS AIR	%	11.0

FUEL DATA

COAL AS FIRED PROX. ANALYSIS

37	MOISTURE	% wt	5.66
38	VOL MATTER		
39	FIXED CARBON		
40	ASH		0.47
	TOTAL		
41	Btu per lb AS FIRED		8146[d]
42	ASH SOFT TEMP.* ASTM METHOD		

COAL OR OIL AS FIRED ULTIMATE ANALYSIS

43	CARBON		44.91
44	HYDROGEN		5.42
45	OXYGEN		43.33
46	NITROGEN		0.17
47	SULPHUR		0.04
40	ASH		0.47
37	MOISTURE		5.61
	TOTAL		100.05

COAL PULVERIZATION

48	GRINDABILITY INDEX*		
49	FINENESS % THRU 50 M*		
50	FINENESS % THRU 200 M*		

OIL

51	FLASH POINT F°	
52	Sp. Gravity Deg. API°	
53	VISCOSITY AT SSU° BURNER SSF	
44	TOTAL HYDROGEN % wt	
41	Btu per lb	

GAS

			% VOL
54	CO		
55	CH_4 METHANE		
56	C_2H_2 ACETYLENE		
57	C_2H_4 ETHYLENE		
58	C_2H_6 ETHANE		
59	H_2S		
60	CO_2		
61	H_2 HYDROGEN		
	TOTAL		
	TOTAL HYDROGEN % wt		
62	DENSITY 68 F ATM. PRESS.		
63	Btu PER CU FT		
41	Btu PER LB		

44	INPUT-OUTPUT EFFICIENCY OF UNIT %	ITEM 31 × 100 / ITEM 29	45.1

HEAT LOSS EFFICIENCY

		Btu/lb A. F. FUEL	% of A. F. FUEL
65	HEAT LOSS DUE TO DRY GAS	1970	24.2
66	HEAT LOSS DUE TO MOISTURE IN FUEL	74.4	0.9
67	HEAT LOSS DUE TO H_2O FROM COMB. OF H_2	641	7.9
68	HEAT LOSS DUE TO COMBUST. IN REFUSE	—	—
69	HEAT LOSS DUE TO RADIATION		1.0
70	UNMEASURED LOSSES		1.5
71	TOTAL		35.5
72	EFFICIENCY = (100 – Item 71)		64.5

a Assumed
b Average of meter reading over test
c Carbon balance
d 8630 Btu/lb dry basis

* Not Required for Efficiency Testing

† For Point of Measurement See Par. 7.2.8.1-PTC 4.1-1964

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CALCULATION SHEET — ASME TEST FORM FOR ABBREVIATED EFFICIENCY TEST — *Revised September, 1965*

OWNER OF PLANT Burlington TEST NO. 1 BOILER NO. 1 DATE 4-29-81

30 HEAT OUTPUT IN BOILER BLOW-DOWN WATER = LB OF WATER BLOW-DOWN PER HR × [(ITEM 15 − ITEM 17)/1000] = ... lb/hr

24 *If impractical to weigh refuse, this item can be estimated as follows*

DRY REFUSE PER LB OF AS FIRED FUEL = (% ASH IN AS FIRED COAL) / (100 − % COMB. IN REFUSE SAMPLE)

CARBON BURNED PER LB AS FIRED FUEL = (ITEM 43 / 100) − [(ITEM 22 × ITEM 23) / 14,500] = 0.45

NOTE: IF FLUE DUST & ASH PIT REFUSE DIFFER MATERIALLY IN COMBUSTIBLE CONTENT, THEY SHOULD BE ESTIMATED SEPARATELY. SEE SECTION 7, COMPUTATIONS.

25 DRY GAS PER LB AS FIRED FUEL BURNED = [11CO₂ + 8O₂ + 7(N₂ + CO)] / [3(CO₂ + CO)] × (LB CARBON BURNED PER LB AS FIRED FUEL + (3/8) S)

= 11 × ITEM 32 (7.7) + 8 × ITEM 33 (13.1) + 7 (ITEM 35 (79.1) + ITEM 34 (0.1)) / [3 × (ITEM 32 (7.7) + ITEM 34 (0.1))] × [ITEM 24 (.45) + ITEM 47 (.04)/267] = 19.3

36 EXCESS AIR† = 100 × [O₂ − CO/2] / [.2682N₂ − (O₂ − CO/2)] = 100 × [ITEM 33 − ITEM 34/2] / [.2682 (ITEM 35) − (ITEM 33 − ITEM 34/2)]

= 100 × [13.1 − 0.1/2] / [.2682 (79.1) − (13.1 − 0.1/2)] = .160

	HEAT LOSS EFFICIENCY	Btu/lb AS FIRED FUEL	LOSS/HHV × 100 =	LOSS %
65	HEAT LOSS DUE TO DRY GAS = LB DRY GAS PER LB AS FIRED FUEL × C_p × (t_{avg} − t_{air}) = ITEM 25 (19.3) × 0.24 × (ITEM 13) (650) − (ITEM 11) (77) =	1970	65/41 × 100 =	24.2
66	HEAT LOSS DUE TO MOISTURE IN FUEL = LB H_2O PER LB AS FIRED FUEL × [(ENTHALPY OF VAPOR AT 1 PSIA & T GAS LVG) − (ENTHALPY OF LIQUID AT T AIR)] = ITEM 37 (9.3) / 100 × [(ENTHALPY OF VAPOR AT 1 PSIA & T ITEM 13) (1360) − (ENTHALPY OF LIQUID AT T ITEM 11) (45)] =	744	66/41 × 100 =	0.9
67	HEAT LOSS DUE TO H_2O FROM COMB. OF H_2 = 9H_2 × [(ENTHALPY OF VAPOR AT 1 PSIA & T GAS LVG) − (ENTHALPY OF LIQUID AT T AIR)] = 9 × .0542 × ITEM 44 (1360 − 45) / 100 × [(ENTHALPY OF VAPOR AT 1 PSIA & T ITEM 13) − (ENTHALPY OF LIQUID AT T ITEM 11)] =	641	67/41 × 100 =	7.9
68	HEAT LOSS DUE TO COMBUSTIBLE IN REFUSE = ITEM 22 × ITEM 23 =	—	68/41 × 100 =	0
69	HEAT LOSS DUE TO RADIATION* = TOTAL BTU RADIATION LOSS PER HR / LB AS FIRED FUEL − ITEM 28		69/41 × 100 =	1.0
70	UNMEASURED LOSSES **		70/41 × 100 =	1.5
71	TOTAL			35.5
72	EFFICIENCY = (100 − ITEM 71)			64.5

† For rigorous determination of excess air see Appendix 9.2 — PTC 4.1-1964

* If losses are not measured, use ABMA Standard Radiation Loss Chart, Fig. 8, PTC 4.1-1964

** Unmeasured losses listed in PTC 4.1 but not tabulated above may be provided for by assigning a mutually agreed upon value for Item 70.

SECTION 4

SAMPLING DATA SHEETS

4.1 CONTINUOUS EMISSIONS MONITORING DATA

Time	Dry, Uncorrected			Corrected to 3% O_2		Comments
	O_2 (%)	CO (ppm)	NO (ppm)	CO (ppm)	NO (ppm)	
10:00	12.8	148	145	324	317	
10:03	13.5	118	143	284	343	
10:06	13.3	1,545	143	3,611	332	
10:09	12.0	118	178	236	356	
10:12	11.8	79	148	155	288	
10:15	13.8	216	120	540	299	Start of Method 5 train
10:18	12.8	177	138	388	302	
10:21	13.0	118	144	266	293	
10:24	12.3	235	159	487	327	
10:27	12.3	138	162	285	332	
10:30	12.5	118	154	250	326	
10:33	12.3	89	142	184	291	
10:36	13.0	167	122	375	274	
10:39	16.6	2,248	83	9,196	339	
10:42	14.5	1,105	134	3,059	371	
10:45	12.8	69	124	152	270	
10:48	14.3	274	104	737	277	
10:51	12.5	196	144	415	304	Start of SASS train
10:54	14.5	294	106	814	294	
10:57	12.0	89	163	177	326	
11:00	13.5	98	138	236	332	
11:03	11.0	79	173	142	311	
11:06	14.8	304	136	881	392	
11:09	11.8	59	141	116	273	
11:12	12.3	333	158	689	325	
11:15	13.3	118	130	275	303	CM down for repairs
11:18	13.5	323	130	775	313	CM down for repairs
11:21	12.8	79	130	173	284	CM down for repairs
11:24	12.5	128	157	270	333	CM down for repairs
11:29	14.0	196	116	504	297	CM down for repairs
11:30	16.8	479	142	2,054	603	CM down for repairs
11:33	19.5	108	2.7	1,296	33	CM down for repairs
11:36	12.8	313	140	687	305	
11:39	15.0	743	118	2,229	353	
11:42	13.3	274	140	641	324	
11:45	13.3	98	132	229	307	
11:48	15.3	1,798	105	5,678	329	
11:51	13.5	684	139	1,642	334	
11:54	12.5	69	134	146	285	
11:57	14.5	235	129	650	358	
12:00	13.5	127	125	306	299	
12:03	13.0	69	132	155	296	
12:06	15.3	2,257	93	7,128	290	

4.1 CONTINUED

Time	Dry, Uncorrected			Corrected to 3% O_2		Comments
	O_2 (%)	CO (ppm)	NO (ppm)	CO (ppm)	NO (ppm)	
12:09	12.3	78	124	162	256	
12:12	13.5	332	136	798	327	
12:15	143	723	100	1,943	266	
12:18	12.0	176	139	352	277	
12:21	15.0	1,115	93	3,345	277	
12:24	12.0	88	114	176	228	
12:27	14.0	381	112	980	287	
12:30	12.5	59	112	125	236	
12:33	14.0	303	124	779	318	
12:36	11.8	49	121	96	236	
12:39	12.5	108	143	228	302	
12:42	14.5	440	92	1,218	255	
12:45	11.8	117	140	230	273	
12:48	13.8	469	126	1,173	312	
12:51	14.0	196	109	503	280	
12:54	11.5	59	128	111	242	
12:57	13.0	156	142	352	320	
13:00	15.0	1,104	85	3,312	234	
13:03	11.5	59	154	111	292	
13:06	13.0	117	171	264	384	
13:09	15.3	1,544	125	4,875	392	
13:12	12.0	59	139	117	279	
13:15	11.3	225	178	417	328	
13:18	16.0	1,270	99	4,572	355	
13:21	11.5	59	144	111	273	
13:24	12.0	156	182	313	364	
13:27	16.3	1,710	84	6,548	319	
13:30	11.3	0	120	0	221	
13:33	12.3	117	151	242	310	
13:36	14.3	156	108	420	287	
13:39	15.3	674	0.6	2,128	2	
13:42	14.3	146	103	393	274	
13:45	11.0	78	143	140	258	
13:48	14.3	205	141	551	375	
13:51	12.5	58	138	124	292	
13:54	12.6	78	136	167	292	
13:57	13.5	78	122	187	292	
14:00	12.2	137	121	279	249	
14:03	14.0	117	117	301	300	
14:06	11.5	68	169	129	320	
14:09	13.5	68	135	164	325	
14:12	14.5	205	140	567	388	

4.1 CONTINUED

Time	Dry, Uncorrected			Corrected to 3% O_2		Comments
	O_2 (%)	CO (ppm)	NO (ppm)	CO (ppm)	NO (ppm)	
14:15	9.8	58	171	94	274	
14:18	14.0	68	131	175	336	
14:21	11.5	68	178	129	336	
14:24	13.3	68	133	159	308	
14:27	12.5	107	189	227	400	
14:30	12.5	58	142	123	300	
14:33	15.0	351	123	1,054	369	
14:36	11.0	48	144	87	259	
14:39	14.5	146	135	405	373	
14:42	10.8	48	167	85	294	
14:45	14.4	87	125	239	338	
14:48	9.3	127	174	195	267	
14:51	14.0	78	120	200	310	
14:54	15.0	488	118	1,464	353	
14:57	11.3	48	134	90	248	
15:00	14.3	166	148	445	395	
15:03	12.3	58	125	120	257	
15:06	14.8	136	122	396	352	
15:09	11.4	48	141	91	262	
15:12	14.8	175	122	509	351	
15:15	10.0	38	155	63	253	
15:18	14.3	78	130	208	347	
15:21	10.8	58	164	102	287	
15:24	11.5	78	164	147	310	
15:27	14.8	146	117	424	337	
15:30	11.0	87	177	157	319	
15:33	14.0	77	117	199	300	
15:36	12.0	87	161	174	321	
15:39	13.3	97	114	227	266	
15:42	14.5	234	110	647	304	
15:45	11.8	68	107	132	209	
15:48	14.8	234	91	679	262	
15:51	11.0	97	121	174	218	
15:54	14.5	107	107	295	297	
15:57	10.0	38	142	63	232	
16:00	14.0	77	132	199	340	
16:03	11.3	85	174	158	321	
16:06	14.3	107	116	286	309	
16:09	10.0	97	173	158	284	
16:12	13.3	77	130	181	301	
16:15	13.8	97	157	242	390	
16:18	12.6	68	136	145	292	
16:21	13.8	77	143	193	355	

4.1 CONCLUDED

Time	Dry, Uncorrected			Corrected to 3% O_2		Comments
	O2 (%)	CO (ppm)	NO (ppm)	CO (ppm)	NO (ppm)	
16:24	13.5	146	166	350	398	
16:27	13.0	67	134	152	301	
16:30	15.0	263	120	789	360	
16:33	10.3	77	168	130	281	
16:36	14.5	136	127	376	351	End of SASS train

4.2 FIELD DATA SHEETS FOR EPA METHOD 5, SASS, AND CONTROLLED CONDENSATION

$M.N. = 1.802 + \frac{\Delta}{Ts} \times \Delta p = \Delta H$

FIELD DATA

Plant Burlington Industries
Date 4-29-81
Sample Location Boiler Outlet
Sample Type Method 5
Run Number #1
Operator Bert
Ambient Temperature
Barometric Pressure 28.98
Static Pressure, (H_2O) −.40" H_2O
Filter Number(s) MV-142 206

Impinger Volumes

Initial	Final	
100	165	94 ml
100	118	
0	11	

Silica Gel: 514.2 → 549.5 → 35.4 gr. gain

Probe Length and Type 5' glass
Nozzel I.D. (No.) .3086 P-90
Assumed Moisture 8%
Molecular Weight, Dry, (M_d)
Meter Box Number 038
Meter Coefficient .718
α Factor .992
K = 860.249
$K(Nd)^4 = \frac{\Delta}{\Delta H} \times (.3086)^4 = 1.802$
$\Delta H = K(N_d)^4 \left(\frac{Tm}{Ts}\right) (\Delta P)$

Leak Check; Initial at 10 " Hg, .004 CFM Pitot O.K. (.55; .804)
Final at 11 " Hg, .004 CFM

Traverse Point Number	Clock Time (24-hr) Clock / Sampling Time, min 10/5	Gas Meter Reading (V_m), ft 3 Init. 0	Velocity Head (ΔP_s), in. H_2O	Orifice Pressure Differential (ΔH), in. H_2O Desired	Actual	Temperature °F Stack	Probe	Impinger	Organic Module	Oven	Gas Meter In	Gas Meter Out	Pump Vacuum in. Hg	Avg. $\sqrt{\Delta P}$
1	6.0	425.666	.75		3.20	534	247			272	84	83	4	.866
2	2.5	428.1	.75		3.17	545	267			248	85	84	4	.866
3	5.0	430.5	.80		3.50	512	273			231	86	84	5	.894
4	7.5	433.1	.80		3.50	521	274			229	87	84	5	.894
5	10.0	435.6	.85		3.63	538	275			241	87	84	5	.922
6	12.5	438.2	.90		3.84	532	274			260	88	85	5	.949
7	15.0	440.9	.90		3.86	540	272			274	88	84	5	.949
8	17.5	443.6	.85		3.65	546	275			277	88	85	5	.922
9	20.0	446.2	.85		3.65	538	275			262	88	85	5	.922

4-7

North Wall
Start at farthest point

Comments:

Traverse Point Number	Clock Time (24-hr) Clock / Sampling Time, min	Gas Meter Reading (V_m), ft 3	Velocity Head (ΔP_s), in. H_2O	Orifice Pressure Differential (ΔH), in. H_2O		Temperature °F					Gas Meter		Pump Vacuum in. Hg	Avg. $\sqrt{\Delta P}$
	-	Init.		Desired	Actual	Stack	Probe	Impinger	Organic Module	Oven	In	Out		
10	22.5	448.8	.80		~~2.82~~ 3.41	539	274			243	88	85	5	.894
11	25.0	451.3	.65		2.79	536	273			227	89	85	8	.806
12	27.5	453.5	.65		2.92	491	276			227	88	86	9	.806
13	30.0	455.9	.55		2.36	476	274			235	88	86	8	.742
14	32.5	458.1	.55		2.36	506	275			258	88	86	7	.742
15	35.0	460.2	.50		2.14	528	275			271	88	86	6	.707
16	37.5	462.2	.45		1.93	506	275			277	88	86	5	.671
17	40.0	464.1	.50		2.15	495	275			266	87	86	6	.707
18	42.5	466.1	.45		1.93	542	275			251	88	86	6	.671
19	45.0	468.0	.50		2.15	502	275			239	87	86	6	.707
20	47.5	470.0	.45		1.93	539	275			227	89	86	6	.671
21	50.0	471.9	.45		1.93	514	275			226	87	86	6	.671
22	52.5	473.8	.35		1.50	529	275			243	87	86	5	.592
23	55.0	475.5	.35		1.56	497	275			263	87	86	5	.592
24	57.5	477.3	.35		1.60	475	275			272	87	86	5	.592
	60.0 Stop	479.015												

Run No. 1 Date 4-29-81 Sampling Location Outlet

Comments:

Traverse Point Number	Clock Time (24-hr) Clock / Sampling Time, min	Gas Meter Reading (V_m), ft 3	Velocity Head (ΔP_s), in. H_2O	Orifice Pressure Differential (ΔH), in. H_2O		Temperature °F					Gas Meter		Pump Vacuum in. Hg	Avg. $\sqrt{\Delta P}$
				Desired	Actual	Stack	Probe	Impinger	Organic Module	Oven	In	Out		
	-	Init.												
1	60.0	479.015	.65		2.82	516	268			255	87	86	9	.806
2	62.5	481.3	.65		2.82	534	267			224	86	86	9	.806
3	65.0	483.6	.75		3.26	518	274			220	86	87	11	.866
4	67.5	486.0	.75		3.26	535	274			240	87	86	11	.866
5	70.0	488.5	.70		3.04	522	275			253	87	87	11	.837
6	72.5	490.8	.70		3.04	531	275			273	87	86	11	.837
7	75.0	493.3	.70		3.04	533	275			275	88	87	11	.837
8	77.5	495.7	.75		3.26	511	275			259	89	86	11	.866
9	80.0	498.2	.70		3.04	529	275			241	88	87	11	.837
10	82.5	500.5	.70		3.04	516	262			224	88	87	11	.837
11	85.0	502 9	.70		3.04	527	263			231	98	87	11	.837
12	87.5	505.4	.70		3.04	522	263			240	88	87	11	.837
13	90.0	507.8	.70		3.04	522	262			250	87	87	11	.837
14	92.5	510.2	.75		3.26	510	263			269	89	87	11	.866
15	95.0	512.6	.70		3.04	528	262			276	90	87	11	.837
16	97.5	515.0	.65		2.82	527	263			265	90	87	11	.806
17	100.0	517.3	.65		2.82	516	263			242	90	87	10	.806

First Start of further point

Run No. 1 Date 4-27-81 Sampling Location

Comments:

Traverse Point Number	Clock Time (24-hr) Clock / Sampling Time, min	Gas Meter Reading (V_m), ft 3	Velocity Head (ΔP_s), in. H_2O	Orifice Pressure Differential (ΔH), in. H_2O		Temperature °F					Gas Meter		Pump Vacuum in. Hg	Avg. $\sqrt{\Delta P}$
	-	Init.		Desired	Actual	Stack	Probe	Impinger	Organic Module	Oven	In	Out		
18	102.5	519.16	.65		2.82	524	263			231	91	88	10	.806
19	105.0	521.9	.65		2.82	529	263			234	92	88	10	.806
20	107.5	524.2	.65		2.82	520	263			242	92	88	10	.806
21	110.0	526.5	.65		2.82	512	262			264	91	89	10	.806
22	112.5	528.8	.50		2.17	552	263			281	90	89	7	.707
23	115.0	531.0	.45		2.20	408	263			273	90	89	8	.671
24	117.5	533.0	.45		2.20	408	263			264	88	88	8	.671
	120.0 End	535.070												
avg/total	120	109.404			2.80	516.8					88.0	36.7 (87.1)		.797

4-10

Run No. 1 Date 4-29-81 Sampling Location

Comments:

FIELD DATA

Plant BURLINGTON - PHILPOTT
Date 4-27-81
Sample Location STACK
Sample Type SASS
Run Number 1
Operator KAUFMANN
Ambient Temperature
Barometric Pressure 28.98
Static Pressure, (H_2O) -0.4
Filter Number(s)

Pitot 02; .769
Leak Check; Initial at 05 " Hg, .02 CFM through organics Mod. 10"Hg .051 entire train
Final at ____ " Hg, ____ CFM

Impinger Volumes

Initial	Final
500	530
500	875
500	
Silica Gel	
909.0	1168.6

plus 5 condensate 909 ml.

TOTAL MOISTURE GAIN = 1273.6 1173.6

Probe Length and Type 4 3ft 0" Glass
Nozzel I.D. (No.)
Assumed Moisture .06
Molecular Weight, Dry, (M_d)
Meter Box Number 088
Meter Coefficient 3.619
α Factor .992
K =
$K(Nd)^4$ = ____ x (____)^4 = ____
$\Delta H = K(N_d)^4 \left(\frac{Tm}{Ts}\right) (\Delta P)$

Traverse Point Number	Clock Time (24-hr) Clock / Sampling Time, min	Gas Meter Reading (V_m), ft 3	Velocity Head (ΔP_s), in. H_2O	Orifice Pressure Differential (ΔH), in. H_2O		Temperature °F							Pump Vacuum in. Hg	Avg. $\sqrt{\Delta P}$
				Desired	Actual	Stack	Probe	Impinger	Organic Module	Oven	Gas Meter In	Gas Meter Out		
	0 / 1050	Init. 127.100												
	10	148.8	0.7	2.2		525	420		64	386	87	87	15/5	.837
stop	20	208.05	0.6	1.8		547	426		62	390	94	88	20/0	.775
	33	260.8	0.5	2.2		524	420		68	400	89	89	15/5	.707
stop	45	306.30	0.5	1.8		533	425		65	402	95	90	20/0	.707
	60	367.9	0.6	2.2		519	417		66	407	94	92	15/5	.775
stop	75	425.28	0.6	2.0		522	421		68	401	99	94	20/0	.775
	91	491.0	0.7	2.2		532	429		64	404	92	94	15/5	.837
stop	105	541.92	0.65	1.6		524	418		65	402	97	94	20/0	.806
	116	594.5	0.7	2.2		532	432		67	401	92	94	15/5	.837

4-11

Filter #2
change filter #3
change filter #4
change filter #5
change filter #6

Comments: Sampling was done 12" into stack

	Traverse Point Number	Clock Time (24-hr) Clock / Sampling Time, min	Gas Meter Reading (V_m), ft 3	Velocity Head (ΔP_s), in. H_2O	Orifice Pressure Differential (ΔH), in. H_2O		Temperature °F					Gas Meter		Pump Vacuum in. Hg	Avg. $\sqrt{\Delta P}$
					Desired	Actual	Stack	Probe	Impinger	Organic Module	Oven	In	Out		
change #7	start	130	679.85	0.65		1.7	536	425		63	410	97	94	20/20	.806
		145	700.0	0.85		2.2	517	413		67	404	92	94	15/15	.592
change F. #8	stop	155	737.95	0.3		1.7	528	422		67	398	97	94	20/20	.548
		165	780.0	0.6		2.2	494	418		68	409	93	93	15/15	.775
change F #9	stop	175	818.21	0.6		1.8	489	417		60	407	96	93	20/20	.775
		190	897.1	0.6		2.2	497	418		62	407	91	92	15/15	.775
change F. #10	stop	205	932.81	0.6		1.5	523	417		62	401	95	93	20/20	.775
		220	996.0	0.6		2.2	524	413		67	406	90	92	15/15	.775
change F. #11	stop	230	1031.01	0.5		1.5	494	422		63	408	96	93	20/20	.707
		241	1077.1	0.3		2.2	534	433		63	405	91	92	15/15	.548
change F. #12	stop	255	1130.12	0.6		1.5	535	411		59	392	95	92	20/20	.775
		265	1172.4	0.65		2.2	503	411		60	405	91	91	15/15	.806
	stop	275	1212.197	0.6		1.8	518	409		57	413	97	93	20/20	.775
average		275	1085.097			1.95	522.3					93.6	92.2 (92.9)		.749

4-12

Run No. SASS-1 Date 4/29/81 Sampling Location Burlington Plant

Comments:

CONTROLLED CONDENSATION SYSTEM (CCS)
FIELD DATA SHEET

Plant BURLINGTON, PHIL POTT
Date 4-29-81
Sample Location STACK
Run No. 1
Operator DuPont

Ambient Temperature ~75-80°F
Barometric Pressure 28.98
Meter Box Number 082
Meter Orifice Coefficient .712
Meter α Factor .988

Clock Time (24-hr) clock / Sampling Time, min	Gas Meter Reading (V_m), ft^3	Temperature (°F)							
				Filter				Dry Gas Meter	
	Init. 202.175	Stack	Probe	Skin	Out	Recirc Water	Exit Coil	In	Out
1255 / 10	206.400	530	550	1343	606	140	124	91	91
1305 / 20	209.900		591	1343	606	140	124	91	91
1315 / 30	213.075		578	N98	680	140	120	91	91
1325 / 40	216.300		591	1378	678	140	122	92	92
1335 / 50	219.100		587	1228	611	140	122	92	92
1345 / 60	221.830	530	588	1281	620	140	122	92	93
Average	19.655	530	580.8	1344.10	635.5	140	122.3	91.5	91.7

(91.6)

BURLINGTON, PHILPOTT, CCS IR-1

CONTROLLED CONDENSATION SYSTEM (CCS)
FIELD CHECKPOINT SHEET

Checkpoint	Initials		Remarks
	Supervisor	QA Inspector	
LABORATORY PREPARATION			
• Inspect and clean CCC. Both filter holder and CCC are cleaned with hot chromic acid solution and D.I. H_2O.	✓		
• Rinse with acetone and air dry CCC.	✓		
• Place Tissuequartz filter in filter housing.	✓		
• Check seal between end of joint and filter.	✓		
• Do not use grease on joints.	✓		
• Inspect and clean all glass joints.	✓		
SITE SETUP			
• Rinse the inside of probe prior to run.	✓		
• Rinse probe with acetone until rinse solution is clear.	✓		
• Perform leak test.	.0015 @ 15" Hg		
• Leak rate must be less than 80 ml/min (0.003 cfm).	✓		
• Thermocouple leads attched to probe and filter.	✓		
• CCC water bath held at 60°C (140°F) ±1°C.	✓		
• Leak test train.	✓		
• Probe temperature maintained at 316°C (600°F) ±17°C.	N/O ~590°F		
• Gas temperature out of filter holder held at 228°C (550°F).	✓		
• Fresh solutions placed in impingers.	✓		
• Fresh absorbent replaced in final impinger.	✓		
• Adjust flowrate in system to 8 lpm.	✓		

BURLINGTON, PHILPOTT R-1 CCS

CONTROLLED CONDENSATION SYSTEM (CCS)
FIELD CHECKPOINT SHEET -- Continued

Checkpoint	Initials		Remarks
	Supervisor	QA Inspector	
SAMPLING RUN			
• Turn vacuum pump on just before inserting probe in stack.	✓		
• Check seal between probe and port to prevent any outside air from entering stack.	✓		
• Run test for 1 hour or until coils are frosted to 1/2 or 2/3 their length.	✓		
• After run, cap both ends of probe and lay in horizontal position.	✓		
• Rinse the CCC coils into the modified Erlenmeyer flask with a maximum of 40 ml D.I. H_2O.	✓		
• Was any of the solution lost (0 ml estimated)?	✓		
• After probe has cooled, it is rinsed with a maximum of 40 ml D.I. H_2O into a 25-ml Erlenmeyer flask.	✓		
- Was any solution lost (0 ml estimated)?	✓		
- Clean support equipment priot to next run.	✓		
- Save filter for titration.	✓		

Comments:

SECTION 5

ANALYTICAL RESULTS

LABORATORY CERTIFICATE

COPY

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SPECIALISTS IN BULK COMMODITIES

Laboratory No. 81h100
Preliminary No. 6487

Reported 8/13/81
Sampled ------
Received 7/07/81

For ACUREX CORPORATION

Report on 5 samples of Fuel Product

Mark Project No. 7734.12, 7/06/81, Blanket Subcontract RB59186A, Release No. 2.

DRY BASIS EXCEPT AS NOTED

	813690		
	1st Test	2nd Test	3rd Test
Carbon (C), % --------	47.60	----	----
Hydrogen (H), % ------	5.75	----	----
Oxygen (O), (by difference),%--------	45.93	----	----
Nitrogen (N), % ------	0.18	0.22	0.15
Sulfur (S), % --------	0.04	0.04	0.03
Heating Value: BTU/Pound ----------	8,630	----	----
Specific Gravity, 75°F (as rec'd) ----	16.25	----	----
Ash, % ----------	0.50	----	----
Moisture,% (as rec'd) ----------	5.66	----	----

5.2 SASS PARTICULATE EMISSIONS

ISOKINETIC PERFORMANCE WORKSHEET & PARTICULATE CALCULATIONS

Plant Burlington Philpott Performed by _____

Date 4-29-81

Sample Location STACK

Test No./Type SASS

Barometric Pressure (in. Hg)	P_b	28.98
Meter volume (std), $17.64 \left(\frac{V_m}{\alpha}\right)\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right)$ $17.64 \left(\frac{(1085.093)}{(0.992)}\right)\left(\frac{(28.98) + \frac{(1.95)}{13.6}}{(92.9) + 460}\right)$	$V_{m\ std}$	1016.367
Volume of liquid collected (grams)	Vl_c	1073.6
Volume of liquid at standard condition (scf) $Vl_c \times 0.04707$	$V_{w\ std}$	50.534
Stack gas proportion of water vapor $\frac{V_{w\ std}}{V_{w\ std} + V_{m\ std}}$, $\frac{(\quad)}{(\quad) + (\quad)}$	B_{wo}	0.0474
Molecular weight, stack gas dry * (lb/lb-mole) (% CO_2 x 0.44) + (% O_2 x 0.32) + (% N_2 + % CO x 0.28) (7.9 x 0.44) + (13.09 x 0.32) + (79.01 + ___ x 0.28)	M_d	29.79
Molecular weight, stack gas wet (lb/lb-mole) $Md(1-B_{wo}) + 18(B_{wo})$, (29.79)(1-0.0474) + 18(0.0474)	M_s	29.23
Absolute stack pressure (in. Hg) $P_b + \frac{P_{stack}\ (\text{in. } H_2O)}{13.6}$, $(28.98) + \frac{(-0.4)}{13.6}$	P_s	28.95

* Calculated from fuel analysis & stack O_2

7602/5/81/Rev 1

Temperature stack gas, average (^{o}F)	T_s	522.3
Stack velocity (fps) $85.49\ (C_p)\ (\sqrt{\Delta P_{s\ avg}})\ \sqrt{\frac{T_s avg + 460}{P_s\ M_s}}$ $85.49\ (0.769)(\sqrt{0.749})\ \sqrt{\frac{(522.3) + 460}{(28.95)(29.23)}}$	$V_{s(avg)}$	53.053
Total sample time (minutes)	θ	275
Nozzle diameter, actual (inches)	N_d	0.6118
Percent isokinetic (%) $\frac{17.33\ (T_s + 460)(V_w\ std + V_m\ std)}{\theta\ \ V_s\ \ P_s\ \ N_d^2}$ $\frac{17.33\ (522.3 + 460)((50.534) + (1016.367))}{(275)(53.053)(28.95)(0.6118)}$	%I	114.9
Area of stack (ft^2) $\pi = 3.1416$ $\pi r^2 \div 144$, $\pi(18)^2 \div 144$	A_s	7.069
Stack gas volume at standard conditions (dscfm) $60\ (1 - B_{wo})Vs_{avg}\ A_s \left(\frac{528}{T_s\ avg + 460}\right) \left(\frac{Ps}{29.92}\right)$ $60\ (1 - 0.0474)(53.05)(7.069)\left(\frac{528}{522.3 + 460}\right) \left(\frac{(28.95)}{(29.92)}\right)$	Q_s	11148
Particulate matter concentration, dry (gr/dscf) $15.432\ \frac{M_p(grams)}{Vm_{std}}$, $15.432\ \frac{(5.458)}{(1016.367)}$	$C_{s(std)}$	0.083
Emission rate of particulate matter (lb/hr) $0.00857\ (Q_s)\ C_{s(std)}$, $0.00857\ (\_\_\_\_\_)(\_\_\_\_\_)$	E_p	

7602/5/81/Rev 1

ACUREX Corporation
ANALYSIS LABORATORIES

DATA REPORTING FORM

CUSTOMER CMEA DATE July 13, 1981

CUSTOMER CONTRACT NO. 307736.22 ACUREX CONTRACT NO. A81-05-031

RESULTS REPORT TO L. Waterland TELEPHONE

ADDRESS

Burlington

SAMPLE ID (CUSTOMER)	Probe	1u	3u	10u	Filter	XAD				
SAMPLE ID (LAB)	761	768	767	766	770	760				
PARAMETER										UNITS
Weight	0.9750	0.5720	0.8459	0.2846	2.7803	130				gram

ANALYST J. Labash

REVIEWER G. Nicoll

Form EED-057 4/80

5.3 EPA METHOD 5 PARTICULATE EMISSIONS

ISOKINETIC PERFORMANCE WORKSHEET & PARTICULATE CALCULATIONS

Plant Burlington Phillpott Performed by R. Best

Date 4-29-81

Sample Location Stack

Test No./Type 1/MS

Barometric Pressure (in. Hg)	P_b	28.98
Meter volume (std), $17.64 \left(\frac{V_m}{\alpha}\right)\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right)$ $17.64 \left(\frac{(109.404)}{(.952)}\right)\left(\frac{(28.98) + \frac{(2.80)}{13.6}}{(82.1) + 460}\right)$	$V_{m\ std}$	103.783
Volume of liquid collected (grams)	Vl_c	129.4
Volume of liquid at standard condition (scf) $Vl_c \times 0.04707$	$V_{w\ std}$	6.091
Stack gas proportion of water vapor $\frac{V_{w\ std}}{V_{w\ std} + V_{m\ std}}$ $\frac{(6.091)}{(6.091) + (103.783)}$	B_{wo}	0.0554
Molecular weight, stack gas dry (lb/lb-mole) $(\%\ CO_2 \times 0.44) + (\%\ O_2 \times 0.32) + (\%\ N_2 + \%\ CO \times 0.28)$ $(7 \times 0.44) + (13 \times 0.32) + (80 + \_\_\_ \times 0.28)$	M_d	29.64
Molecular weight, stack gas wet (lb/lb-mole) $Md(1-B_{wo}) + 18(B_{wo})$, $(29.64)(1-.0554) + 18(.0554)$	M_s	28.99
Absolute stack pressure (in. Hg) $P_b + \frac{P_{stack}\ (in.\ H_2O)}{13.6}$, $(28.98) + \frac{(-.40)}{13.6}$	P_s	28.95

7602/5/81/Rev 1

Temperature stack gas, average (^{o}F)	T_s	516.8
Stack velocity (fps) $85.49\ (C_p)\ (\sqrt{\Delta P_{s\ avg}})\ \sqrt{\frac{T_s avg + 460}{P_s\ M_s}}$ $85.49\ (.84)(0.597)\ \sqrt{\frac{(516.8) + 460}{(28.95)(27.59)}}$	$V_{s(avg)}$	59.10
Total sample time (minutes)	θ	120
Nozzle diameter, actual (inches)	N_d	0.3086
Percent isokinetic (%) $\frac{17.33\ (T_s + 460)(V_w\ std + V_m\ std)}{\theta\ V_s\ P_s\ N_d^2}$ $\frac{17.33\ (516.8 + 460)((\ \ ) + (\ \ ))}{(120)(59.1)(28.95)(.3086)^2}$	%I	95.12
Area of stack (ft^2) $\pi = 3.1416$ $\pi r^2 \div 144$, $\pi(8)^2 \div 144$	A_s	7.069
Stack gas volume at standard conditions (dscfm) $60\ (1 - B_{WO})Vs_{avg}\ A_s \left(\frac{528}{T_s\ avg + 460}\right) \left(\frac{Ps}{29.92}\right)$ $60\ (1 - .034)(59.1)(\ \ )\left(\frac{528}{516.8 + 460}\right) \left(\frac{28.95}{29.92}\right)$	Q_s	12382
Particulate matter concentration, dry (gr/dscf) $15.432\ \frac{M_p(grams)}{Vm_{std}}$ $15.432\ \frac{(.5172)\ .0057}{(23.783)}$	$C_{s(std)}$ Front .007690 Back .000085 Total .007775	
Emission rate of particulate matter (lb/hr) $0.00857\ (Q_s)\ C_{s(std)}$ $0.00857\ (12382)\ \frac{(.07690)}{.0005}$	E_p Front 8.160 Back .090 Total 8.250	

7602/5/B1/Rev 1

7735.22

B.F. Dunlop

CMEA: BURLINGTON
CEMENTON, N.C.

TEST I.D.	$V_{M(STD)}$	FRONT HALF: PROBE & NOZZLE CATCH (Mg) 1/	FRONT HALF: M-5 FILTER (Mg) 1/	BACK HALF: IMPINGER RINSE (acetone) Mg 1/	BACK HALF: IMPINGER CONTENTS: AQUEOUS PHASE (Mg) 1/	BACK HALF: IMPINGER CONTENTS: ORGANIC PHASE (Mg) 1/			
M-5 Test No1	103.783	96.29	42091	2/	.72	5.00			

1/ BLANK CORRECTED

2/ LAB APPARENTLY MIXED IMP. RINSE + PROBE RINSE — TO FORM ONE (1) SAMPLE

ACUREX
ANALYTICAL REPORT

Sample of: Burlington

Sample Date: April 29, 1981

Requested By: Bruce Daros

I.D. Number: 7735.22 / CMEA

Analytical Method: EPA Method 5 Protocol - Ether / Chloroform Extractions

Date of Analysis: September 3, 1981 of Impinger Liquids

Lab I.D. Number	Component	Analytical Result	Unit
813753 - Test 1	481 mls		
- Aqueous Phase		0.72	Net Gain milligrams
- Organic Phase		5.00	

Analysis By J. Sayer / L. Whitmer

5-11 Date September 15, 1981

Form EED-082 5.81

ACUREX
ANALYTICAL REPORT

Sample of: Burlington

Sample Date: April 29, 1981

Requested By: Bruce Dana

I.D. Number: 7735.22/CMEA

Analytical Method: Gravimetric Analysis of Acetone Probe Wash

Date of Analysis: September 1 and 2, 1981

Lab I.D. Number	Component	Analytical Result	Unit
813752 - Test 1	120 mls	96.29 - .24 = 96.05	Net Rain milligrams
813787 - Acetone Blank	330 mls	0.67 .0020 mg/ml	

Analysis By J. Sayer/L. Whitmer

5-12 Date September 16, 1981

Form EED---082 5/81

ACUREX
ANALYTICAL REPORT

Sample of: Burlington

Sample Date: April 29, 1981

Requested By: Bruce Davis

I.D. Number: 7735.22/CMEA

Analytical Method: Gravimetric Analysis of Filter

Date of Analysis: July 30, 1981

Lab I.D. Number	Component	Analytical Result	Unit
813805 - Test 1	MV-142-206	1.41326 - 1.01335 = .39991	Final Filter Weight
813788 - Blank	B-21	1.00995	
		.39991 + .021 =	+20.91 mg.

Note: Due to unavailability of filter tare weight, actual Filter final weight is reported rather than NET WEIGHT GAIN.

Analysis By J. Sayer / L. Whitener

5-13 Date September 15, 1981

Form EED-082 5 81

5.4 SULFUR OXIDES EMISSIONS FROM CONTROLLED CONDENSATION SAMPLES

CONTROLLED CONDENSATION SYSTEM (CCS)
LABORATORY DATA SHEET

Plant Burlington Philpott
Date
Sample Location STACK
Run No. 1

Analyst DAROS
Date Lab Analysis Completed 7-20-81

Titration Data

Method _____ Titrant _____ Normality _____ Indicator _____

Sample Description	Probe, Nozzle and Filter Rinse	G/R Coil Rinse	Impinger Contents and Rinse	H_2O Blank	3% H_2O_2 Blank
Sample No.	813746	813745	813802		813692 ~~813699~~
Vol. of Sample	87	70	314	inc. 0.05 ml 0.02N H_2SO_4	inc. 0.50 ml 0.02N H_2SO_4
Vol. of Aliquot	5	5	5	↓ 5	5
Vol. of Titrant Used	1.65 / 1.55 / 1.60	0.40 / 0.45 / 0.40	1.0 / 1.0 / 1.0	.25 / / .50	0.10 / 0.10 / 0.10
Average Vol. of Titrant Used	1.60	0.42	1.0	inc. 0.10 ml ↑ 0.02 N H_2SO_4	

Calculations

Vol. of Gas Sampled (V_M) 15.45 ft^3, Avg. Meter Temp (T_M) 71.6 °F,
Meter Pressure (P_M) _____ "Hg, Meter α Factor 0.988 dimensionless

$$PPM\ SO_4 = \frac{48.15\ (\_\_\_, MgSO_4)(\_\_\_, T_M+460)}{96\ (\_\_\_\_\_, V_M)(\_\_\_\_\_, P_M)}\ (\_\_\_, \alpha)$$

ppm SO_4 =

$$PPM\ SO_2 = \frac{48.15\ (\_\_\_, MgSO_2)(\_\_\_, T_M+460)}{64\ (\_\_\_\_\_, V_M)(\_\_\_\_\_, P_M)}\ (\_\_\_, \alpha)$$

ppm SO_2 =

CONTROLLED CONDENSATION SYSTEM (CCS)
LABORATORY DATA SHEET

Plant Burlington Philpott
Date
Sample Location S
Run No. 1

Analyst DAROS
Date Lab Analysis Completed 10-20-81

Titration Data

Method _____ Titrant _____ Normality _____ Indicator BARIUM THORIN

Sample Description	Probe, Nozzle and Filter Rinse	G/R Coil Rinse	Impinger Contents and Rinse	H_2O Blank	3% H_2O_2 Blank
Sample No.	813746	813745	813802	813693	813692
Vol. of Sample	87	70	314		
Vol. of Aliquot					
Vol. of Titrant Used	.05 / .05	0.05 / 0.05	.05 / .05	0.05 / 0.05	.05 / .05
Average Vol. of Titrant Used					

Calculations

Vol. of Gas Sampled (V_M) 18.451 ft^3, Avg. Meter Temp (T_M) 91.6 °F,
Meter Pressure (P_M) _____ "Hg, Meter α Factor 0.988 dimensionless

$$PPM_{SO_4} = \frac{48.15\ (\_\_\_,\ MgSO_4)(\_\_\_,\ T_M+460)}{96\ (\_\_\_\_\_,\ V_M)(\_\_\_\_\_,\ P_M)\ (\_\_\_,\alpha)}$$

ppm SO_4 =

$$PPM_{SO_2} = \frac{48.15\ (\_\_\_,\ MgSO_2)(\_\_\_,\ T_M+460)}{64\ (\_\_\_\_\_,\ V_M)(\_\_\_\_\_,\ P_M)\ (\_\_\_,\alpha)}$$

ppm SO_2 =

5.5 TRACE ELEMENT ANALYSIS

COMMERCIAL TESTING & ENGINEERING CO.

GENERAL OFFICES: 228 NORTH LA SALLE STREET, CHICAGO, ILLINOIS 60601 · AREA CODE 312 726-8434
Reply to INSTRUMENTAL ANALYSIS DIVISION, 14335 WEST 44TH AVENUE GOLDEN, COLORADO 80401, PHONE 303-278-9521

To: Mr. Roy A. Belletto
Acurex Corporation
485 Clyde Avenue
Mountain View, CA 94942

Date August 24, 1981

Analyst: J. Oldham

Release No. 5
P. O. No.: Subcontract SW59159A

Sample No. A81-05-031-759 SPARK SOURCE MASS SPECTROGRAPHIC ANALYSIS IAD No. 97-G852-116-25
Lexington Filter Blank
CONCENTRATION IN $\mu g/cm^2$

ELEMENT	CONC.	ELEMENT	CONC.	ELEMENT	CONC	ELEMENT	CONC.
Uranium		Terbium		Ruthenium		Vanadium	0.002
Thorium		Gadolinium		Molybdenum	<0.001	Titanium	0.3
Bismuth		Europium		Niobium	0.001	Scandium	<0.001
Lead	0.002	Samarium		Zirconium	0.007	Calcium	6
Thallium		Neodymium		Yttrium	<0.001	Potassium	0.2
Mercury	NR	Praseodymium	<0.001	Strontium	0.008	Chlorine	0.06
Gold		Cerium	0.001	Rubidium	<0.001	Sulfur	0.2
Platinum		Lanthanum	0.001	Bromine	0.04	Phosphorus	0.2
Iridium		Barium	0.03	Selenium		Silicon	>8
Osmium		Cesium		Arsenic	NR	Aluminum	>0.1
Rhenium		Iodine	<0.001	Germanium		Magnesium	5
Tungsten		Tellurium		Gallium	0.002	Sodium	>0.3
Tantalum		Antimony	NR	Zinc	0.007	Fluorine	≈0.2
Hafnium		Tin		Copper	0.002	Oxygen	NR
Lutetium		Indium	STD	Nickel	0.004	Nitrogen	NR
Ytterbium		Cadmium		Cobalt	<0.001	Carbon	NR
Thulium		Silver	0.005	Iron	0.07	Boron	0.7
Erbium		Palladium		Manganese	0.003	Beryllium	<0.001
Holmium		Rhodium		Chromium	0.001	Lithium	<0.001
Dysprosium						Hydrogen	NR

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U S REC'D
ACUREX

STD — Internal Standard
NR — Not Reported
All elements not detected < $0.001 \mu g/cm^2$
MC — Major Component > $10 \mu g/cm^2$
INT — Interference

Approved: M Speeds

COMMERCIAL TESTING & ENGINEERING CO.
GENERAL OFFICES 228 NORTH LA SALLE STREET, CHICAGO ILLINOIS 60601 AREA CODE 312 726-8434
Reply to INSTRUMENTAL ANALYSIS DIVISION 14335 WEST 44TH AVENUE GOLDEN, COLORADO 80401 PHONE 303-278-9521

To: Mr. Roy A. Belletto
Acurex Corporation
485 Clyde Avenue
Mountain View, CA 94942

Date August 25, 1981

Analyst J. Oldham

Release No. 5
P. O. No.: Subcontract SW59159A

Sample No.: A81-05-031-784 SPARK SOURCE MASS SPECTROGRAPHIC ANALYSIS IAD No 97-G852-116-25
Lexington XAD blank

CONCENTRATION IN PPM WEIGHT

ELEMENT	CONC.	ELEMENT	CONC.	ELEMENT	CONC.	ELEMENT	CONC
Uranium		Terbium		Ruthenium		Vanadium	0.1
Thorium		Gadolinium		Molybdenum	0.9	Titanium	2
Bismuth		Europium		Niobium		Scandium	<0.1
Lead	0.3	Samarium		Zirconium	1	Calcium	15
Thallium		Neodymium	0.2	Yttrium	0.3	Potassium	21
Mercury	NR	Praseodymium	0.3	Strontium	0.1	Chlorine	2
Gold		Cerium	1	Rubidium		Sulfur	1
Platinum	4	Lanthanum	2	Bromine	0.7	Phosphorus	0.4
Iridium		Barium	2	Selenium		Silicon	12
Osmium		Cesium		Arsenic	NR	Aluminum	1
Rhenium		Iodine	<0.1	Germanium		Magnesium	7
Tungsten		Tellurium		Gallium	<0.1	Sodium	10
Tantalum		Antimony	NR	Zinc	4	Fluorine	≈0.3
Hafnium		Tin		Copper	3	Oxygen	NR
Lutetium		Indium	STD	Nickel	13	Nitrogen	NR
Ytterbium		Cadmium		Cobalt	<0.1	Carbon	NR
Thulium		Silver		Iron	5	Boron	*0.5
Erbium		Palladium		Manganese	1	Beryllium	
Holmium		Rhodium		Chromium	*3	Lithium	*<0.1
Dysprosium						Hydrogen	NR

RECEIVED
SEP 02 1981
ACUREX

STD – Internal Standard
NR – Not Reported
All elements not detected < 0.1ppm
MC – Major Component
INT – Interference

*Heterogeneous

Approved: M Specht

COMMERCIAL TESTING & ENGINEERING CO.

GENERAL OFFICES: 228 NORTH LA SALLE STREET, CHICAGO, ILLINOIS 60601 · AREA CODE 312 726-8434
Reply to INSTRUMENTAL ANALYSIS DIVISION, 14335 WEST 44TH AVENUE, GOLDEN, COLORADO 80401, PHONE 303-278-9521

To: Mr. Roy A. Belletto
Acurex Corporation
485 Clyde Avenue
Mountain View, CA 94942

Date August 20, 1981

Release No. 5
P. O. No.: Subcontract SW59159A

Analyst: J. Oldham

Sample No.: A81-05-031-754 Lexington Imp 1 Blank

SPARK SOURCE MASS SPECTROGRAPHIC ANALYSIS

IAD No. 97-G852-116-25

CONCENTRATION IN µg/ml

ELEMENT	CONC.	ELEMENT	CONC.	ELEMENT	CONC.	ELEMENT	CONC.
Uranium		Terbium		Ruthenium		Vanadium	<0.001
Thorium		Gadolinium		Molybdenum	0.01	Titanium	0.09
Bismuth		Europium		Niobium		Scandium	<0.001
Lead	0.008	Samarium		Zirconium	0.03	Calcium	MC
Thallium		Neodymium		Yttrium		Potassium	1
Mercury	NR	Praseodymium		Strontium	0.02	Chlorine	0.05
Gold		Cerium	0.001	Rubidium		Sulfur	*0.07
Platinum		Lanthanum		Bromine	0.02	Phosphorus	0.4
Iridium		Barium	3	Selenium		Silicon	1
Osmium		Cesium		Arsenic	NR	Aluminum	0.1
Rhenium		Iodine	0.002	Germanium		Magnesium	0.04
Tungsten		Tellurium		Gallium		Sodium	>2
Tantalum		Antimony	NR	Zinc	0.02	Fluorine	≈3
Hafnium		Tin	0.4	Copper	0.003	Oxygen	NR
Lutetium		Indium	STD	Nickel	0.02	Nitrogen	NR
Ytterbium		Cadmium	0.02	Cobalt	0.002	Carbon	NR
Thulium		Silver		Iron	0.2	Boron	0.004
Erbium		Palladium		Manganese	0.04	Beryllium	
Holmium		Rhodium		Chromium	0.005	Lithium	0.003
Dysprosium		*Heterogeneous				Hydrogen	NR

STD — Internal Standard
NR — Not Reported
All elements not detected < 0.001µg/ml
MC — Major Component > 10µg/ml
INT — Interference

Approved: M.L. Jacobs by P.E. Angle
24 Aug 81

COMMERCIAL TESTING & ENGINEERING CO.

GENERAL OFFICES: 228 NORTH LA SALLE STREET, CHICAGO ILLINOIS 60601 AREA CODE 312 726-8434

Reply to INSTRUMENTAL ANALYSIS DIVISION, 14335 WEST 44TH AVENUE GOLDEN COLORADO 80401 PHONE 303-278-9521

To: Mr. Roy A. Belletto
Acurex Corporation
485 Clyde Avenue
Mountain View, CA 94942

Date August 25, 1981

Analyst J. Oldham

Release No. 5
P. O. No.: Subcontract SW59159A

Sample No.: A81-05-030-690 Lexington fuel

SPARK SOURCE MASS SPECTROGRAPHIC ANALYSIS

IAD No 97-G852-116-25

CONCENTRATION IN PPM WEIGHT

ELEMENT	CONC.	ELEMENT	CONC.	ELEMENT	CONC	ELEMENT	CONC
Uranium		Terbium	<0.01	Ruthenium		Vanadium	0.04
Thorium		Gadolinium	0.01	Molybdenum	0.02	Titanium	3
Bismuth		Europium	<0.01	Niobium	0.01	Scandium	<0.01
Lead	0.2	Samarium	0.05	Zirconium	0.3	Calcium	MC
Thallium		Neodymium	0.02	Yttrium	0.07	Potassium	>62
Mercury	NR	Praseodymium	0.06	Strontium	3	Chlorine	22
Gold		Cerium	0.6	Rubidium	0.4	Sulfur	6
Platinum		Lanthanum	0.5	Bromine	0.2	Phosphorus	57
Iridium		Barium	21	Selenium	0.06	Silicon	17
Osmium		Cesium	<0.01	Arsenic	NR	Aluminum	2
Rhenium		Iodine	0.03	Germanium	0.01	Magnesium	MC
Tungsten		Tellurium	<0.01	Gallium	0.04	Sodium	>13
Tantalum		Antimony	NR	Zinc	3	Fluorine	=0.4
Hafnium		Tin	0.02	Copper	2	Oxygen	NR
Lutetium		Indium	STD	Nickel	0.2	Nitrogen	NR
Ytterbium		Cadmium	0.09	Cobalt	0.09	Carbon	NR
Thulium		Silver	<0.01	Iron	12	Boron	0.2
Erbium		Palladium		Manganese	17	Beryllium	<0.01
Holmium		Rhodium		Chromium	0.03	Lithium	0.07
Dysprosium						Hydrogen	NR

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ACUREX

Note: Sample low temperature oxygen plasma ashed prior to analysis

STD – Internal Standard
NR – Not Reported
All elements not detected < 0.01ppm
MC – Major Component >100ppm
INT – Interference

Approved: M. L. Jacobs

COMMERCIAL TESTING & ENGINEERING CO.
GENERAL OFFICES 228 NORTH LA SALLE STREET, CHICAGO ILLINOIS 60601 AREA CODE 312 726-8434
Reply to INSTRUMENTAL ANALYSIS DIVISION, 14335 WEST 44TH AVENUE GOLDEN, COLORADO 80401 PHONE 303-278-9521

To: Mr. Roy A. Belletto
Acurex Corporation
485 Clyde Avenue
Mountain View, CA 94942

Date August 25, 1981

Release No. 5
P. O. No.: Subcontract SW59159A

Analyst J. Oldham

Sample No.: A81-05-031-765 SPARK SOURCE MASS SPECTROGRAPHIC ANALYSIS IAD No. 97-G852-116-25
Lexington bottom ash

CONCENTRATION IN PPM WEIGHT

ELEMENT	CONC.	ELEMENT	CONC.	ELEMENT	CONC.	ELEMENT	CONC
Uranium	0.4	Terbium	0.9	Ruthenium		Vanadium	15
Thorium	0.9	Gadolinium	2	Molybdenum	13	Titanium	MC
Bismuth		Europium	1	Niobium	1	Scandium	1
Lead	82	Samarium	9	Zirconium	7	Calcium	MC
Thallium		Neodymium	22	Yttrium	15	Potassium	MC
Mercury	NR	Praseodymium	10	Strontium	MC	Chlorine	110
Gold		Cerium	66	Rubidium	260	Sulfur	MC
Platinum		Lanthanum	120	Bromine	4	Phosphorus	MC
Iridium		Barium	MC	Selenium	2	Silicon	MC
Osmium		Cesium	0.7	Arsenic	NR	Aluminum	MC
Rhenium		Iodine	0.5	Germanium	0.3	Magnesium	MC
Tungsten	25	Tellurium	0.3	Gallium	7	Sodium	MC
Tantalum		Antimony	NR	Zinc	240	Fluorine	≈160
Hafnium	0.3	Tin	2	Copper	61	Oxygen	NR
Lutetium	<0.1	Indium	STD	Nickel	75	Nitrogen	NR
Ytterbium	0.5	Cadmium	0.8	Cobalt	3	Carbon	NR
Thulium	<0.1	Silver		Iron	MC	Boron	280
Erbium	0.4	Palladium		Manganese	>460	Beryllium	0.2
Holmium	1	Rhodium		Chromium	52	Lithium	65
Dysprosium	2					Hydrogen	NR

STD — Internal Standard
NR — Not Reported
All elements not detected < 0.1ppm
MC — Major Component > 1000
INT — Interference

RECEIVED
SEP 08 REC'D
ACUREX

Approved: M Y Brooks

COMMERCIAL TESTING & ENGINEERING CO.

GENERAL OFFICES: 228 NORTH LA SALLE STREET, CHICAGO ILLINOIS 60601 · AREA CODE 312 726-8434
Reply to INSTRUMENTAL ANALYSIS DIVISION, 14335 WEST 44TH AVENUE, GOLDEN, COLORADO 80401, PHONE 303-278-9521

To: Mr. Roy A. Belletto
Acurex Corporation
485 Clyde Avenue
Mountain View, CA 94942

Date. August 25, 1981

Release No. 5
P. O. No.: Subcontract SW59159A

Analyst· J. Oldham

Sample No.: A81-05-031-761 SPARK SOURCE MASS SPECTROGRAPHIC ANALYSIS IAD No 97-G852-116-25
Lexington Probe Wash

CONCENTRATION IN PPM WEIGHT

ELEMENT	CONC.	ELEMENT	CONC.	ELEMENT	CONC.	ELEMENT	CONC
Uranium	<0.9	Terbium	1	Ruthenium		Vanadium	25
Thorium	1	Gadolinium	4	Molybdenum	15	Titanium	MC
Bismuth	0.1	Europium	3	Niobium	2	Scandium	0.8
Lead	240	Samarium	12	Zirconium	8	Calcium	MC
Thallium	31	Neodymium	14	Yttrium	19	Potassium	MC
Mercury	NR	Praseodymium	27	Strontium	930	Chlorine	MC
Gold		Cerium	170	Rubidium	110	Sulfur	MC
Platinum		Lanthanum	140	Bromine	11	Phosphorus	MC
Iridium		Barium	MC	Selenium	7	Silicon	MC
Osmium		Cesium	0.9	Arsenic	NR	Aluminum	MC
Rhenium		Iodine	2	Germanium	1	Magnesium	MC
Tungsten	4	Tellurium		Gallium	4	Sodium	MC
Tantalum	≤1	Antimony	NR	Zinc	MC	Fluorine	MC
Hafnium	0.8	Tin	5	Copper	78	Oxygen	NR
Lutetium	0.3	Indium	STD	Nickel	120	Nitrogen	NR
Ytterbium	1	Cadmium	10	Cobalt	10	Carbon	NR
Thulium	0.4	Silver	24	Iron	MC	Boron	310
Erbium	1	Palladium		Manganese	MC	Beryllium	<0.1
Holmium	2	Rhodium		Chromium	120	Lithium	1
Dysprosium	6					Hydrogen	NR

RECEIVED
SEP 08 REC'D
ACUREX

STD — Internal Standard
NR — Not Reported
All elements not detected < 0.1ppm
MC — Major Component > 1000
INT — Interference

Approved: M Spacks

COMMERCIAL TESTING & ENGINEERING CO.

GENERAL OFFICES: 228 NORTH LA SALLE STREET, CHICAGO ILLINOIS 60601 · AREA CODE 312 726-8434
Reply to INSTRUMENTAL ANALYSIS DIVISION 14335 WEST 44TH AVENUE, GOLDEN, COLORADO 80401 PHONE 303-278-9521

To: Mr. Roy A. Belletto
Acurex Corporation
485 Clyde Avenue
Mountain View, CA 94942

Date August 25, 1981

Analyst J. Oldham

Release No. 5
P. O. No.: Subcontract SW59159A

Sample No.: A81-05-031-766 Lexington 10μ + 3μ

SPARK SOURCE MASS SPECTROGRAPHIC ANALYSIS

IAD No.: 97-G852-116-25

CONCENTRATION IN PPM WEIGHT

ELEMENT	CONC.	ELEMENT	CONC.	ELEMENT	CONC.	ELEMENT	CONC
Uranium	<0.6	Terbium	2	Ruthenium		Vanadium	9
Thorium	1	Gadolinium	5	Molybdenum	20	Titanium	MC
Bismuth	0.6	Europium	2	Niobium	2	Scandium	≤0.1
Lead	170	Samarium	19	Zirconium	15	Calcium	MC
Thallium	0.6	Neodymium	25	Yttrium	40	Potassium	MC
Mercury	NR	Praseodymium	21	Strontium	MC	Chlorine	MC
Gold		Cerium	240	Rubidium	520	Sulfur	MC
Platinum		Lanthanum	240	Bromine	21	Phosphorus	MC
Iridium		Barium	MC	Selenium	28	Silicon	MC
Osmium		Cesium	1	Arsenic	NR	Aluminum	MC
Rhenium		Iodine	3	Germanium	2	Magnesium	MC
Tungsten	89	Tellurium	0.7	Gallium	7	Sodium	MC
Tantalum	3	Antimony	NR	Zinc	MC	Fluorine	≈140
Hafnium		Tin	8	Copper	170	Oxygen	NR
Lutetium	0.4	Indium	STD	Nickel	300	Nitrogen	NR
Ytterbium	2	Cadmium	17	Cobalt	17	Carbon	NR
Thulium	0.3	Silver	17	Iron	MC	Boron	570
Erbium	2	Palladium		Manganese	>920	Beryllium	0.2
Holmium	3	Rhodium		Chromium	100	Lithium	3
Dysprosium	4					Hydrogen	NR

RECEIVED
SEP 08 RECD
ACUREX

STD — Internal Standard
NR — Not Reported
All elements not detected < 0.1ppm
MC — Major Component > 1000
INT — Interference

Approved: M. Speeds

COMMERCIAL TESTING & ENGINEERING CO.

GENERAL OFFICES: 228 NORTH LA SALLE STREET, CHICAGO ILLINOIS 60601 AREA CODE 312 726-8434
Reply to INSTRUMENTAL ANALYSIS DIVISION, 14335 WEST 44TH AVENUE GOLDEN, COLORADO 80401 PHONE 303-278-9521

To: Mr. Roy A. Belletto
Acurex Corporation
485 Clyde Avenue
Mountain View, CA 94942

Date August 25, 1981

Analyst J. Oldham

Release No. 5
P. O. No.: Subcontract SW59159A

Sample No.: A81-05-031-768 Lexington 1 μ + filter

SPARK SOURCE MASS SPECTROGRAPHIC ANALYSIS

IAD No 97-G852-116-25

CONCENTRATION IN $\mu g/cm^2$

ELEMENT	CONC.	ELEMENT	CONC.	ELEMENT	CONC	ELEMENT	CONC
Uranium	<0.001	Terbium	<0.001	Ruthenium		Vanadium	0.002
Thorium	<0.001	Gadolinium	<0.001	Molybdenum	0.006	Titanium	0.1
Bismuth	<0.001	Europium	<0.001	Niobium	0.003	Scandium	<0.001
Lead	0.5	Samarium	0.001	Zirconium	0.007	Calcium	MC
Thallium		Neodymium	0.003	Yttrium	0.002	Potassium	>0.3
Mercury	NR	Praseodymium	0.001	Strontium	0.1	Chlorine	3
Gold		Cerium	0.01	Rubidium	0.1	Sulfur	>0.2
Platinum		Lanthanum	0.01	Bromine	0.02	Phosphorus	>0.8
Iridium		Barium	2	Selenium	0.001	Silicon	>2
Osmium		Cesium	<0.001	Arsenic	NR	Aluminum	>0.02
Rhenium		Iodine	0.001	Germanium	0.001	Magnesium	>2
Tungsten	0.04	Tellurium	<0.001	Gallium	0.002	Sodium	>0.06
Tantalum	<0.001	Antimony	NR	Zinc	1	Fluorine	=0.6
Hafnium	<0.001	Tin	0.002	Copper	0.03	Oxygen	NR
Lutetium	<0.001	Indium	STD	Nickel	0.03	Nitrogen	NR
Ytterbium	<0.001	Cadmium	0.002	Cobalt	0.002	Carbon	NR
Thulium	<0.001	Silver	0.01	Iron	0.2	Boron	0.5
Erbium	<0.001	Palladium		Manganese	>0.3	Beryllium	
Holmium	<0.001	Rhodium		Chromium	0.01	Lithium	0.003
Dysprosium	<0.001					Hydrogen	NR

RECEIVED
SEP 08 REC'D
ACUREX

STD — Internal Standard
NR — Not Reported
All elements not detected $< 0.001 \mu g/cm^2$
MC — Major Component $> 10 \mu g/cm^2$
INT — Interference

Approved: M. Y. Brooks

COMMERCIAL TESTING & ENGINEERING CO.

GENERAL OFFICES 228 NORTH LA SALLE STREET, CHICAGO ILLINOIS 60601 · AREA CODE 312 726-8434
Reply to INSTRUMENTAL ANALYSIS DIVISION, 14335 WEST 44TH AVENUE GOLDEN COLORADO 80401, PHONE 303-278-9521

To: Mr. Roy A. Belletto
Acurex Corporation
485 Clyde Avenue
Mountain View, CA 94942

Date. August 25, 1981

Release No. 5
P. O. No.: Subcontract SW59159A

Analyst· J. Oldham

Sample No.:A81-05-031-760 SPARK SOURCE MASS SPECTROGRAPHIC ANALYSIS IAD No.. 97-G852-116-25
Lexington XAD

CONCENTRATION IN PPM WEIGHT

ELEMENT	CONC.	ELEMENT	CONC.	ELEMENT	CONC.	ELEMENT	CONC
Uranium		Terbium		Ruthenium		Vanadium	<0.1
Thorium		Gadolinium		Molybdenum	0.4	Titanium	≤0.9
Bismuth		Europium		Niobium		Scandium	<0.1
Lead		Samarium		Zirconium	2	Calcium	76
Thallium		Neodymium		Yttrium		Potassium	93
Mercury	NR	Praseodymium		Strontium	0.1	Chlorine	34
Gold		Cerium		Rubidium		Sulfur	*6
Platinum	0.3	Lanthanum		Bromine	0.3	Phosphorus	*3
Iridium		Barium	0.8	Selenium		Silicon	57
Osmium		Cesium		Arsenic	NR	Aluminum	2
Rhenium		Iodine	<0.1	Germanium		Magnesium	3
Tungsten		Tellurium		Gallium	<0.1	Sodium	4
Tantalum		Antimony	NR	Zinc	2	Fluorine	≈0.7
Hafnium		Tin		Copper	5	Oxygen	NR
Lutetium		Indium	STD	Nickel	48	Nitrogen	NR
Ytterbium		Cadmium		Cobalt	<0.1	Carbon	NR
Thulium		Silver		Iron	18	Boron	0.3
Erbium		Palladium		Manganese	0.4	Beryllium	
Holmium		Rhodium		Chromium	*4	Lithium	*0.1
Dysprosium						Hydrogen	NR

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SEP 08 REC'D
ACUREX
G-4000

STD — Internal Standard
NR — Not Reported
All elements not detected < 0.1ppm
MC — Major Component
INT — Interference

*Heterogeneous

Approved: M. L. Specter

COMMERCIAL TESTING & ENGINEERING CO.

GENERAL OFFICES: 228 NORTH LA SALLE STREET, CHICAGO, ILLINOIS 60601 · AREA CODE 312 726-8434

Reply to INSTRUMENTAL ANALYSIS DIVISION, 14335 WEST 44TH AVENUE, GOLDEN COLORADO 80401 PHONE 303-278-9521

To: Mr. Roy A. Belletto
Acurex Corporation
485 Clyde Avenue
Mountain View, CA 94942

Date August 25, 1981

Analyst J. Oldham

Release No. 5

P. O. No.: Subcontract SW59159A

Sample No.: A81-05-031-762 SPARK SOURCE MASS SPECTROGRAPHIC ANALYSIS IAD No 97-G852-116-25
Lexington Imp 1

CONCENTRATION IN µg/ml

ELEMENT	CONC.	ELEMENT	CONC.	ELEMENT	CONC.	ELEMENT	CONC.
Uranium		Terbium		Ruthenium		Vanadium	0.002
Thorium		Gadolinium		Molybdenum	0.01	Titanium	0.04
Bismuth		Europium		Niobium	0.002	Scandium	
Lead	0.01	Samarium		Zirconium	0.003	Calcium	0.4
Thallium		Neodymium		Yttrium		Potassium	0.6
Mercury	NR	Praseodymium		Strontium	0.002	Chlorine	0.3
Gold		Cerium		Rubidium	0.003	Sulfur	>8
Platinum		Lanthanum		Bromine	0.01	Phosphorus	0.02
Iridium		Barium	0.01	Selenium	≤0.03	Silicon	0.2
Osmium		Cesium	<0.001	Arsenic	NR	Aluminum	0.03
Rhenium		Iodine	0.003	Germanium		Magnesium	0.06
Tungsten		Tellurium	0.004	Gallium	0.02	Sodium	>3
Tantalum		Antimony	NR	Zinc	0.8	Fluorine	≈0.1
Hafnium		Tin	0.03	Copper	0.2	Oxygen	NR
Lutetium		Indium	STD	Nickel	0.2	Nitrogen	NR
Ytterbium		Cadmium		Cobalt	<0.001	Carbon	NR
Thulium		Silver	0.002	Iron	0.2	Boron	0.001
Erbium		Palladium		Manganese	0.05	Beryllium	
Holmium		Rhodium		Chromium	0.03	Lithium	<0.001
Dysprosium						Hydrogen	NR

RECEIVED
SEP 08 RECD
ACUREX

STD – Internal Standard
NR – Not Reported
All elements not detected < 0.001µg/ml
MC – Major Component >10µg/ml
INT – Interference

Approved:

5.6 C_1 TO C_6 HYDROCARBONS BY GAS CHROMATOGRAPHY

C_1 TO C_6 GC SUMMARY

Run No.	Bulb I.D.	Sample Time	Approximate Bulb Temperature (°F)	Recorder/ Print-Out Reference No.	C_1	C_2	C_3	C_4	C_5	C_6
1	A	1225	518	10	3.1	0.6	2.3	1.2	ND	--
1	A	1225	518	11	4.8	2.0	ND	ND	ND	--
1	B	1235	518	13	4.1	2.0	2.0	0.8	ND	--
2	A	1402	520	14	ND	ND	1.8	ND	ND	--
2	B	1408	520	15	ND	ND	1.6	ND	ND	--
2	A	1402	520	16	ND	ND	1.6	ND	ND	--
2	B	1408	520	17	ND	ND	1.8	ND	ND	--
3	A	1630	517	19	1.9	ND	1.0	ND	ND	--
3	B	1640	508	20	2.1	ND	1.0	ND	ND	--
3	A	1630	517	21	2.0	ND	1.5	ND	ND	--

GAS CHROMATOGRAPH OPERATING CONDITIONS AND FIELD LOG

Client CMEA, Location LEXINGTON, N.C., Job No. 7705.2

Injection Date 4-28-91, Time 19:37:43, Instrument ID VARIAN 3700
Recorder/Printout Reference No. 6, Recorder ID HP 3390A
Purpose of Run DETERMINATION OF C_2 RETENTION TIME

Sample Description SCOTT I 9.8 PPM 1,1-DIFLUOROETHANE ± 10 % IN BAL N_2

GC CONDITIONS

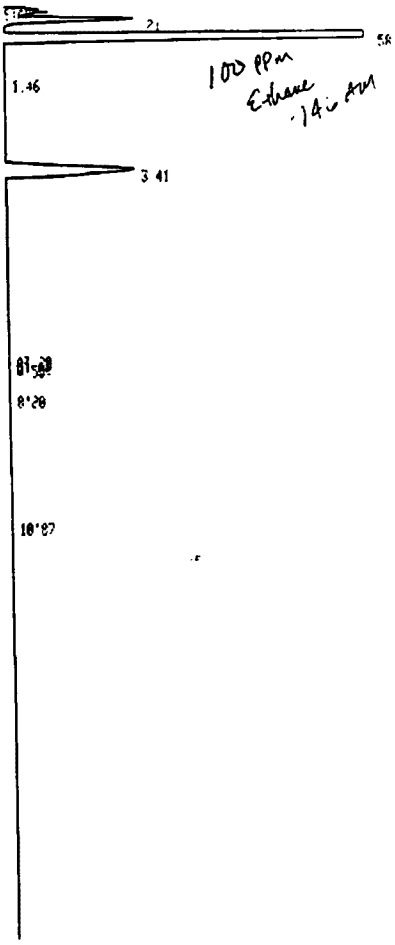
Amount Injected 2 ml, Inj. Port or Sample Loop Used 2 ml LOOP
Detector Used: FID x, ECD ___, FPD ___, TCD ___ (Current ___)
Detector Attenuation 8, Amplifier or Range 10^-11
Column: Liquid Phase ___, Solid Phase PORAPAK Q,
Length 6', O.D. 1/8", I.D. ___, Material SS
Temperature: Injector 120 °C, Oven 120 °C, Detector 300 °C
Temperature Program ISOTHERMAL

SAMPLE RUN

Sampling Method N/A

RT min	Area	Peak Height	Amount (ppm)	Component
0.58	481420		10.4	1,1-C_2

Name of Operator Scott Holm, Date 10-1 1991



Operator T. Hrkm Date 4-28-81
Column No. Length 6' Dia. ¼"
Coating Concn. Mesh 80/100
Support Poapak Q
TEMP: Col: Init. 120 °C Final 120 °C
Rate °C/min. Det. 250 °C Inj °C
CARRIER GAS He Rate 84.4 ml./min.
Pressures: Inlet Outlet
Hydrogen 40 PSI ~~ml/min~~ Air 60 PSI ~~ml/min~~
DETECTOR E.C. T.C. F.I.D. 8 x 10⁻¹¹
Scavenger Rate ml./min.
Sens. Rec.Range mv.
SAMPLE Cal. Gas C2 Size 2 mL
Solvent Concn. 104 ppm

RUN # 6 APR/28/81 19:38:42
ID 1
NO CALIB PEAKS FOUND

AREA%

RT	AREA	TYPE	AR/HT	AREA%
0.21	12933	D BP	0.081	2.014
0.58	481420	D PB	0.886	74.964
1.46	3444	BB	0.270	0.536
3.41	144410	BB	0.373	22.486

TOTAL AREA= 642200
MUL FACTOR= 1.0000E+00

GAS CHROMATOGRAPH OPERATING CONDITIONS AND FIELD LOG

Client CMEA, Location Edmond, N.C. Job No. 7735.2

Injection Date 4-28-81, Time 20:04:22, Instrument ID VARIAN 3700
Recorder/Printout Reference No. 7, Recorder ID HP 3390A
Purpose of Run DETERMINATION OF C_4 RETENTION TIME

Sample Description Scotty I ~ 106 ppm n-BUTANE ± 10% in BAL N_2

GC CONDITIONS

Amount Injected 2ml, Inj. Port or Sample Loop Used 2ml LOOP
Detector Used: FID X, ECD ___, FPD ___, TCD ___ (Current ___)
Detector Attenuation 8, Amplifier or Range 10-11
Column: Liquid Phase ___, Solid Phase PORAPAK Q,
Length 6', O.D. 1/8", I.D. ___, Material S.S.
Temperature: Injector 120 °C, Oven 130 °C, Detector 250 °C
Temperature Program ISOTHERMAL

SAMPLE RUN

Sampling Method N/A

RT min.	Area	Peak Height	Amount (ppm)	Component
4.20	95,690		106	n-C_4

Name of Operator Tom Hoey, Date 10-31 19 81

Operator J. HOLM Date 4-28-81

Column No. Length 6' Dia. 1/8"

Coating Concn.

Support PORAPAK Q Mesh 80/100

TEMP: Col: Init. 120 °C Final 120 °C

Rate °C/min. Det. 250 °C Inj °C

CARRIER GAS H.R. Rate 24 ml/min.

Pressures: Inlet Outlet

Hydrogen 40 PSI ml/min Air 60 PSI ml/min

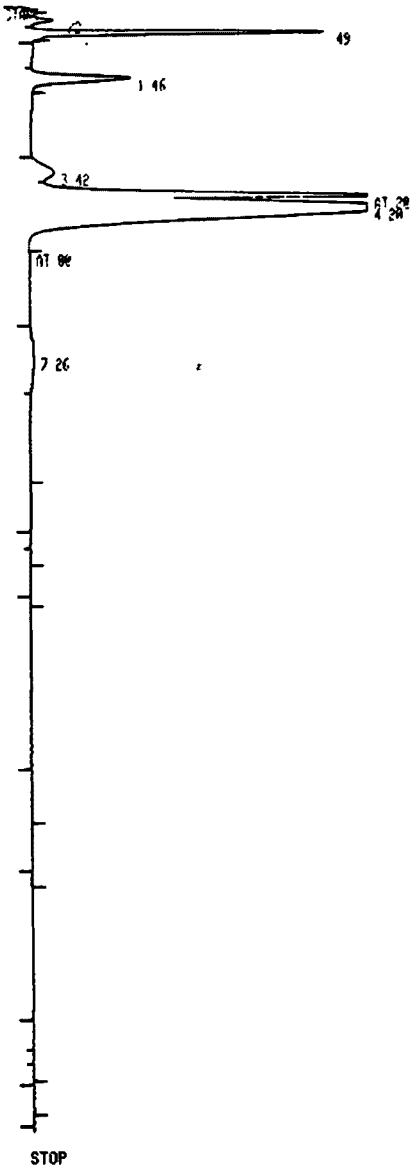
DETECTOR E.C. T.C. F.I.D. X RD-11

Scavenger Rate ml/min.

Sens. Rec.Range mv.

SAMPLE CAL GAS Cyl. Size 2ML

Solvent Concn. 1.06 PPM



RUN 0 7 APR/29/81 20:04:22
ID 1
NO CALIB PEAKS FOUND

AREA%

RT	AREA	TYPE	AR/HT	AREA%
0 22	2669	D BP	0 A92	0.268
0.49	33716	D PB	0 [illegible]1	3 281
1.46	22487	PB	0 162	2 189
3.42	11456	BV	0 345	1.115
4.28	951690	VB	0 431	92 628
7.26	5501	BV	0 917	0.535

GAS CHROMATOGRAPH OPERATING CONDITIONS AND FIELD LOG

Client EMSA, Location LEXINGTON, N.C., Job No. 77352

Injection Date 4-29-81, Time 20:30:06, Instrument ID VARIAN 3700
Recorder/Printout Reference No. 8, Recorder ID HP 3390A
Purpose of Run CALIBRATION (INITIAL)

Sample Description SCOTTY II MULTI-COMPONENT MIXTURE
$C_1 - C_6$ n-PARAFINS ~15 PPM ± 10% in N_2

GC CONDITIONS

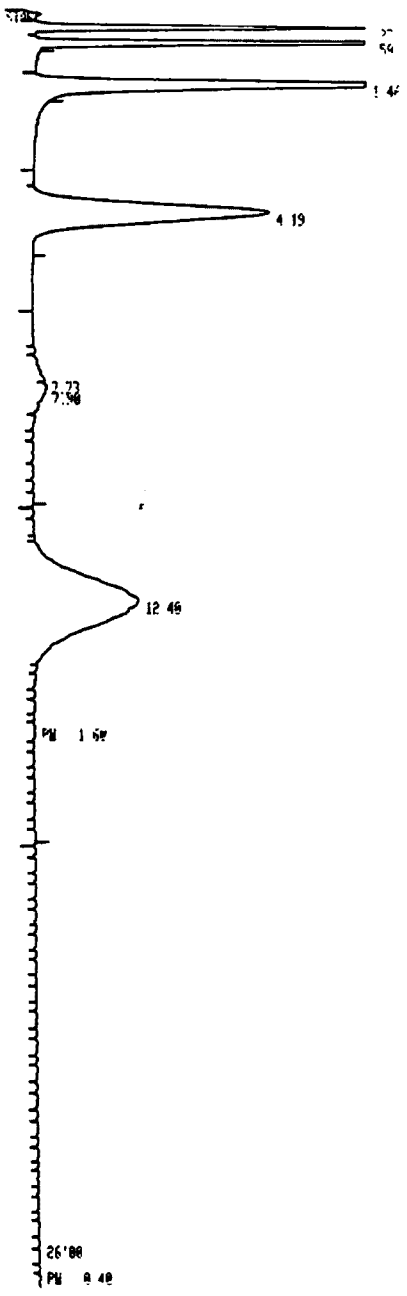
Amount Injected 2ML, Inj. Port or Sample Loop Used 2 ML LOOP
Detector Used: FID X, ECD ___, FPD ___, TCD ___ (Current ___)
Detector Attenuation 8, Amplifier or Range 10^{-11}
Column: Liquid Phase ___, Solid Phase PORAPAK Q,
Length 6', O.D. 1/8", I.D. ___, Material SS
Temperature: Injector 120 °C, Oven 120 °C, Detector 250 °C
Temperature Program ISOTHERMAL

SAMPLE RUN

Sampling Method N/A

RT min.	Area	Peak Height	Amount (PPM)	Component
0.27	41404		15.1	C_1
0.59	71370		14.6	C_2
1.46	124170		15.6	C_3
4.19	145150		15.2	C_4
12.40	180760		15.1	C_5

Name of Operator JOHN HOLM, Date 10-21 1981



Operator J. HOLM Date 4-28-81

Column No. ..... Length 6' ..... Dia. 1/8" .....

Coating ..... Concn. ..... Mesh 80/100 ...

Support P. CHROM. Q ..... Mesh ...

TEMP: Col: Init. 120 °C Final 120 °C

Rate ..... °C/min. Det 250 °C Inj. ..... °C

CARRIER GAS He ..... Rate 84.4 ..... ml./min.

Pressures: Inlet ..... Outlet .....

Hydrogen 40 PSI ~~ml/min.~~ Air 60 PSI ~~ml/min.~~

DETECTOR E.C. ..... T.C. ..... F.I.D. ATI ID-11 .....

Scavenger ..... Rate ..... ml./min.

Sens. ..... Rec.Range ..... mv.

SAMPLE CAL. GAS C4-C6 ..... Size .8 M.L. .....

Solvent ..... Concn. 215 PPM .....

STOP

RUN 0 8 APR/28/81 20:30:06
ID 1
NO CALIB PEAKS FOUND

AREA%

RT	AREA	TYPE	AR/HT	AREA%
0 27	41484	D BP	0 886	7.176
0 59	71398	D PB	0.885	12 373
1 46	124170	PB	0.177	21.520
4 19	145150	VB	0 432	25 157
7 73	5714	VV	0.343	0 990
7.90	8386	VV	0 438	1 454
12 40	180768	VV	1.207	31.329

TOTAL AREA= 576970
MUL FACTOR= 1.0000E+00

GAS CHROMATOGRAPH OPERATING CONDITIONS AND FIELD LOG

Client CMSA, Location LEXINGTON, NC, Job No. 7755.21

Injection Date 4-28-81, Time 21:05:57, Instrument ID VARIAN 3300
Recorder/Printout Reference No. 9, Recorder ID HP 3390A
Purpose of Run CALIBRATION (INITIAL)

Sample Description SCOTTY II MULTI-COMPONENT MIXTURE
C_1-C_6 UN-PARAFFINS ~150ppm ±10%. (GAS)

GC CONDITIONS

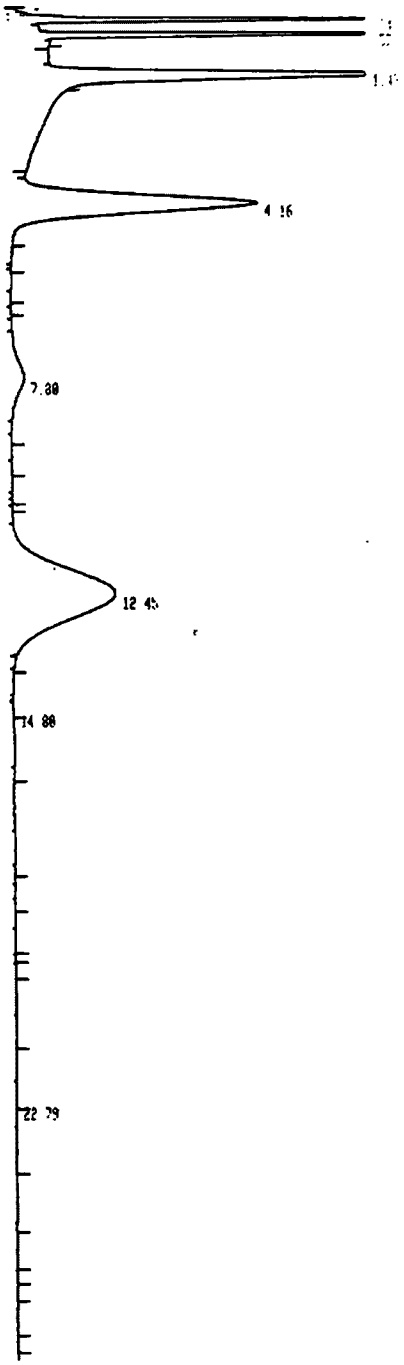
Amount Injected 2ML, Inj. Port or Sample Loop Used 2ML LOOP
Detector Used: FID X, ECD ___, FPD ___, TCD ___ (Current ___)
Detector Attenuation 8, Amplifier or Range 10^{-11}
Column: Liquid Phase ___, Solid Phase POROPAK Q,
Length 6', O.D. 1/8", I.D. ___, Material SS
Temperature: Injector 120 °C, Oven 120 °C, Detector 350 °C
Temperature Program ISOTHERMAL

SAMPLE RUN

Sampling Method N/A

RT min.	Area	Peak Height	Amount (ppm)	Component
0.24	45013		15.1	C_1
0.57	74852		14.6	C_2
1.43	123540		15.6	C_3
4.16	142600		15.2	C_4
12.45	170670		15.6	C_5

Name of Operator [illegible], Date 10-21 19 81



Operator J. HOLM Date 4-28-81

Column No. Length 6' Dia. 1/8"

Coating Concn. %

Support POAPAK Q Mesh 80/100

TEMP: Col: Init. 120 °C Final 120 °C

Rate °C/min. Det. °C Inj. 250 °C

CARRIER GAS He Rate 24 ml/min.

Pressures: Inlet Outlet ml/min

Hydrogen 40PSI ml/min Air 60PSI ml/min

DETECTOR E.C. T.C. F.I.D. 8 X 10-11

Scavenger Rate ml/min.

Sens. Rec. Range mv.

SAMPLE CAL. GAS C1-C6 Size 2 mL

Solvent Concn. 2.15 PPM Gas

STOP

RUN # 9 APR/28/81 21:05:59
ID 1
NO CALIB PEAKS FOUND

AREA%

RT	AREA	TYPE	AR/HT	AREA%
0.24	45613	BV	0.077	7.845
0.57	74852	VV	0.067	12.875
1.43	123540	PB	0.166	21.248
4.16	142660	PB	0.424	24.538
7.80	16030	VP	0.867	2.757
12.45	176640	PV	1.211	30.382
14.80	742	PB	0.177	0.128
22.79	1320	BB	0.286	0.227

TOTAL AREA= 581488
MUL FACTOR= 1.0000E+00

GAS CHROMATOGRAPH OPERATING CONDITIONS AND FIELD LOG

Client [illegible], Location [illegible], Job No. [illegible]

Injection Date 4-27-[illegible], Time 12:57:48, Instrument ID [illegible]
Recorder/Printout Reference No. 10, Recorder ID HP3390A
Purpose of Run C_1-C_6 HYDROCARBON ANALYSIS

Sample Description [illegible] NO 1 BOX 9 1225

GC CONDITIONS

Amount Injected [illegible], Inj. Port or Sample Loop Used [illegible]
Detector Used: FID X, ECD ___, FPD ___, TCD ___ (Current ___)
Detector Attenuation [illegible], Amplifier or Range [illegible]
Column: Liquid Phase ___, Solid Phase [illegible],
Length 6', O.D. 1/8", I.D. ___, Material SS.
Temperature: Injector 120 °C, Oven 120 °C, Detector 250 °C
Temperature Program ISOTHERMAL

SAMPLE RUN

Sampling Method GAS SYR. (SYRGE)

RT	Area	Peak Height	Amount (ppm)	Component
.26	8256		3.1	C1
.47	2615		0.6	C2
[illegible]	11410		2.3	C3
[illegible]	4005		1.2	C4
3.80	1458			
7.32	742870		—	CONTAMINANTS

Name of Operator [illegible], Date 11-21 19[illegible]

Operator J. HAAM Date 4-29-81

Column No. Length 6' Dia. 1/8"

Coating Concn. Mesh 80/100

Support PORAPAK Q

TEMP: Col: Init 120 °C Final 180 °C

Rate °C/min. Det. 250 °C Inl. 120 °C

CARRIER GAS He Rate 8.4 ml./min.

Pressures: Inlet Outlet

Hydrogen 40 PSI ~~ml/min.~~ Air 60 PSI ~~ml/min.~~

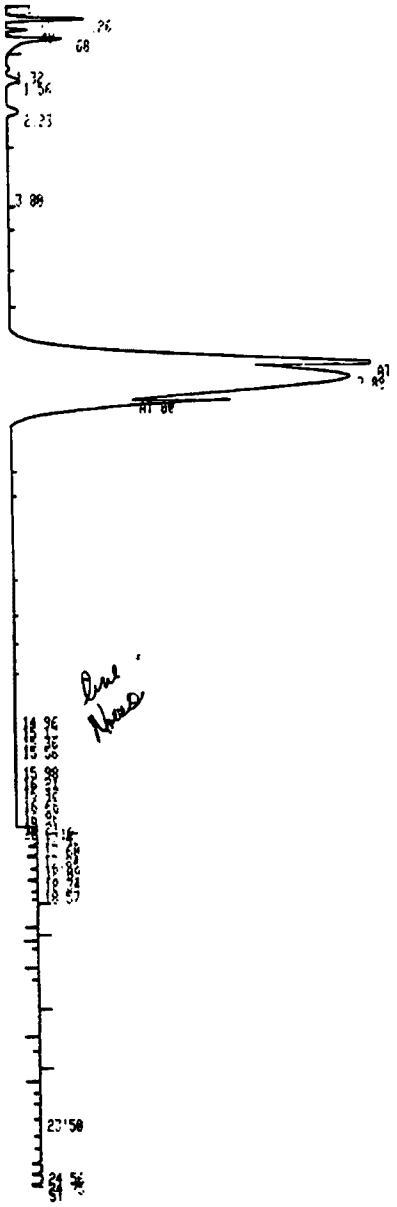
DETECTOR E.C. T.C. F.I.D. 8×10^{-11}

Scavenger Rate ml./min.

Sens. Rec.Range mv.

SAMPLE 1 BULB A 12.25 Size 20 ml

Solvent Concn.



RUN # 10 APR/29/81 12:57:49
ID 1

ESTD

RT	AREA	TYPE	CAL#	AMOUNT
0.19	1385	BV		0.000
0.26	8256	VV	1R	7.4183E+00
0.49	2615	VB		0.000
0.68	11410	BB		0.000
1.32	850	PV		0.000
1.56	4085	VP		0.000
2.23	5510	PP		0.000
3.86	1458	PV		0.000
7.88	742890	VV		0.000
14.96	892	PV		0.000
15.13	1183	VP		0.000
15.36	764	PV		0.000
15.56	1419	VV		0.000
15.98	1386	VV		0.000
16.21	1216	VV		0.000
16.42	1289	VV		0.000
16.68	1092	VV		0.000
16.96	1321	VV		0.000
17.21	1075	VV		0.000
17.43	1174	VV		0.000
17.68	1374	VV		0.000
17.84	1178	VV		0.000
18.09	1447	PV		0.000
18.34	1207	VV		0.000
18.57	861	PV		0.000
24.56	901	VP		0.000
24.75	1096	PP		0.000

TOTAL AREA= 799840
MUL FACTOR= 1.0000E+00

GAS CHROMATOGRAPH OPERATING CONDITIONS AND FIELD LOG

Client CMEA, Location LEXINGTON, N.C., Job No. 7735.21

Injection Date 4-29-81, Time 13:30:57, Instrument ID VARIAN 3700
Recorder/Printout Reference No. 11, Recorder ID HP339DA
Purpose of Run C_1-C_6 HYDROCARBON ANALYSIS

Sample Description SAMPLE No 1 BULB 1335

GC CONDITIONS

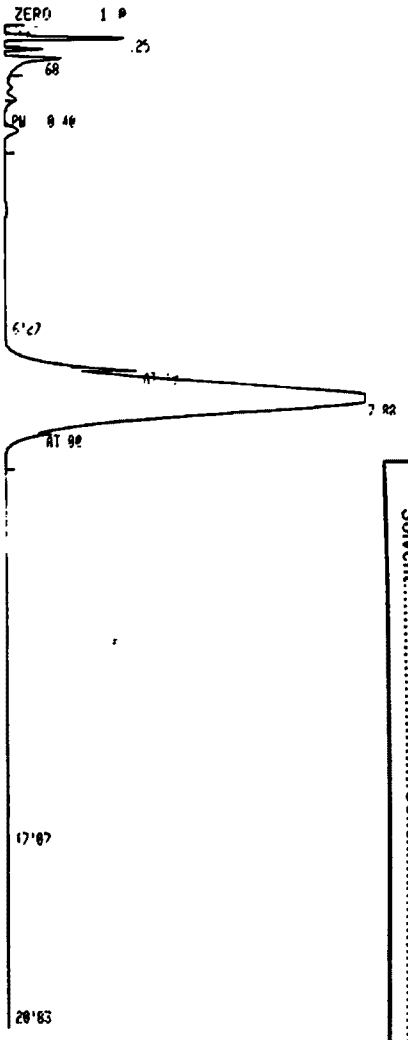
Amount Injected 2 ML, Inj. Port or Sample Loop Used 2mL Loop
Detector Used: FID X, ECD ___, FPD ___, TCD ___ (Current _____)
Detector Attenuation 8, Amplifier or Range 10^{-11}
Column: Liquid Phase _____, Solid Phase PORAPAK Q,
Length 6', O.D. 1/8", I.D. _____, Material S.S.
Temperature: Injector 120 °C, Oven 120 °C, Detector 250 °C
Temperature Program ISOTHERMAL

SAMPLE RUN

Sampling Method GRAB 300mL (5.1°F)

RT	Area	Peak Height	Amount (ppm)	Component
.35	12.15%		4.8	C_1
.69	1.00 57		2.0	C_2
7.1%	71.000 0		—	[illegible]

Name of Operator JOHN HOLM, Date 10-21 1981



Operator T. HOLM Date 4-29-81

Column No. Length 6' Dia. 1/8"

Coating Conen. %

Support POROPAK Q Mesh 80/100

TEMP: Col: Init 120 °C Final 120 °C

Rate °C/min. Det. 250 °C Inj. 120 °C

CARRIER GAS H2 Rate 24 ml./min.

Pressures: Inlet Outlet

Hydrogen 40 PSI ~~ml/min~~ Air 60 PSI ~~ml/min~~

DETECTOR E.C. T.C. F.I.D. 2×10^{-11}

Scavenger Rate ml./min.

Sens. Rec.Range mv.

SAMPLE 1 SOLBA Size 2.0 µl

Solvent Conen.

RUN # 11 APR/29/81 13:38:57
ID 1

ESTD

RT	AREA	TYPE	CAL #	AMOUNT
0.25	12758	PB	1R 5	2.823E+00
0.68	10059	PB		0.000
7.98	776660	BB		0.000

TOTAL AREA= 799470
MUL FACTOR= 1.0000E+00

GAS CHROMATOGRAPH OPERATING CONDITIONS AND FIELD LOG

Client CMEA, Location LEXINGTON, N.C., Job No. 7735.21

Injection Date 4-29-81, Time 17:07:53, Instrument ID VARIAN 3700
Recorder/Printout Reference No. 13, Recorder ID HP339DA
Purpose of Run C_1-C_6 HYDROCARBON ANALYSIS
Sample Description SAMPLE FROM BULB R 1235

GC CONDITIONS

Amount Injected 2 ML, Inj. Port or Sample Loop Used 2mL Loop
Detector Used: FID X, ECD ___, FPD ___, TCD ___ (Current ___)
Detector Attenuation 8, Amplifier or Range 10^{-11}
Column: Liquid Phase ___, Solid Phase PORAPAK Q,
Length 6', O.D. 1/8", I.D. ___, Material S.S.
Temperature: Injector 120 °C, Oven 120 °C, Detector 250 °C
Temperature Program ISOTHERMAL

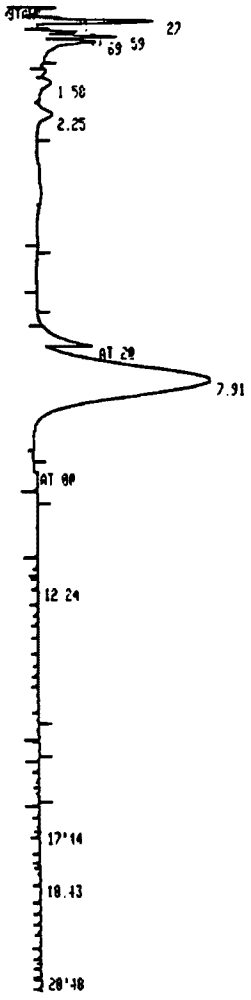
SAMPLE RUN

Sampling Method GRAB 300ML (5.8°F)

RT	Area	Peak Height	Amount (ppm)	Component
.27	10747		4.1	C_1
.51	5321		2.0	C_2
.59				
.67	10437		3.0	C_3
1.53	2700		0.8	C_4
2.35	4740			
7.7	792140			CONTAMINANT
				1

Name of Operator JOHN HOLM, Date 10-21 1981

TOTAL AREA= 401620
MUL FACTOR= 1.0000E+00



STOP

Operator J. HOLM Date 4-29-81
Column No. Length 6' Dia. 1/8"
Coating Concn. Mesh 80/100
Support P.D.R.A.PAK Q
TEMP: Col: Init. 180 °C Final 220 °C
Rate °C/min. Det. 250 °C Inj. 220 °C
CARRIER GAS H2 Rate 24.4 ml./min.
Pressures: Inlet Outlet
Hydrogen 40 PSI ~~ml/min.~~ Air 60 PSI ~~ml/min.~~
DETECTOR E.C. T.C. F.I.D. 8x10-11
Scavenger Rate ml/min.
Sens. Rec.Range 1255 Size 20mV
SAMPLE Nal Bulb 15
Solvent Concn.

RUN # 13 APR/29/81 14:07:53
ID 1

ESTD

RT	AREA	TYPE	CAL#	AMOUNT
0.59	6208	VV	2	4.4319E+08

TOTAL AREA= 6208
MUL FACTOR= 1.0000E+00

RUN # 13 APR/29/81 14:07:53
ID 1

AREA%

RT	AREA	TYPE	AR/HT	AREA%
0.21	1253	PV	0.035	0.150
0.27	10741	VB	0.065	1.285
0.51	3031	PV	0.056	0.363
0.59	6208	VV	0.056	0.743
0.69	10439	VB	0.136	1.249
1.58	2900	VP	0.180	0.347
2.25	4748	PB	0.221	0.567
7.91	792140	BV	0.786	94.748
12.24	2409	PV	0.224	0.288
18.43	2185	PV	0.309	0.261

TOTAL AREA= 836950
MUL FACTOR= 1.0000E+00

GAS CHROMATOGRAPH OPERATING CONDITIONS AND FIELD LOG

Client CMEA, Location LEXINGTON, N.C., Job No. 7735.21

Injection Date 4-29-81, Time 18:21:36, Instrument ID VARIAN 3700
Recorder/Printout Reference No. 14, Recorder ID HP339DA
Purpose of Run C_1-C_6 HYDROCARBON ANALYSIS

Sample Description [illegible]

GC CONDITIONS

Amount Injected 2 ML, Inj. Port or Sample Loop Used 2ML LOOP
Detector Used: FID X, ECD ___, FPD ___, TCD ___ (Current ___)
Detector Attenuation 8, Amplifier or Range 10^{-11}
Column: Liquid Phase ___, Solid Phase PORAPAK Q,
Length 6', O.D. 1/8", I.D. ___, Material S.S.
Temperature: Injector 120 °C, Oven 120 °C, Detector 250 °C
Temperature Program ISOTHERMAL

SAMPLE RUN

Sampling Method GRAB 300ML (520 °F)

RT	Area	Peak Height	Amount (ppm)	Component
...	9177		1.8	C_7

Name of Operator JOHN HOLM, Date 10-21 1981

Operator J.HOLM Date 4-29-81

Column No. Length 6' Dia. 1/8"

Coating Conch. Mesh 80/100

Support POROPAK Q

TEMP: Col: Init. 180 °C Final 220 °C

Rate °C/min. Det 250 °C Inj. 220 °C

CARRIER GAS N2 Rate 84.4 ml./min.

Pressures: Inlet Outlet

Hydrogen 40 P.S.I. ~~ml/min.~~ Air 60 P.S.I. ~~ml/min.~~

DETECTOR E.C. T.C. F.I.D. 8 x 10 -11

Scavenger Rate ml/min.

Sens. Rec.Range mv.

SAMPLE 2 RUN A 14.02 Size 2.0 nL

Solvent Concn.

STOP

RUN # 14 APR/29/81 14:31:36
ID 1
NO CALIB PEAKS FOUND

AREA% RT	AREA	TYPE	AR/HT	AREA%
0.20	2084	PV	0.052	18.503
0.68	9179	PB	0.122	81.497

TOTAL AREA= 11263
MUL FACTOR= 1.0000E+00

GAS CHROMATOGRAPH OPERATING CONDITIONS AND FIELD LOG

Client CMEA, Location LEXINGTON, N.C., Job No. 7735.31

Injection Date 4-29-81, Time 15:02:30, Instrument ID VARIAN 3700
Recorder/Printout Reference No. 15, Recorder ID HP339DA
Purpose of Run C_1-C_6 HYDROCARBON ANALYSIS

Sample Description STACK NO 2 BOILER [illegible]

GC CONDITIONS

Amount Injected 2 ML, Inj. Port or Sample Loop Used 2mL Loop
Detector Used: FID X, ECD ___, FPD ___, TCD ___ (Current ___)
Detector Attenuation 8, Amplifier or Range 10^{-11}
Column: Liquid Phase ___, Solid Phase PORAPAK Q,
Length 6', O.D. 1/8", I.D. ___, Material S.S.
Temperature: Injector 120 °C, Oven 120 °C, Detector 250 °C
Temperature Program ISOTHERMAL

SAMPLE RUN

Sampling Method GRAB 300ML (530°F)

RT	Area	Peak Height	Amount (ppm)	Component
.67	9536		104	C3

Name of Operator JOHN HOLM, Date 10-21 1981

Operator J. HOLM Date 4-29-81

Column No. Length 6' Dia. 1/8"

Coating Concn.

Support PRAPAK Q Mesh 80/100

TEMP: Col: Init. 120 °C Final 120 °C

Rate °C/min. Det. 250 °C Inj. 120 °C

CARRIER GAS He Rate 84 ml./min.

Pressures: Inlet Outlet

Hydrogen 40 PSI ~~ml/min~~ Air 60 PSI ~~ml/min~~

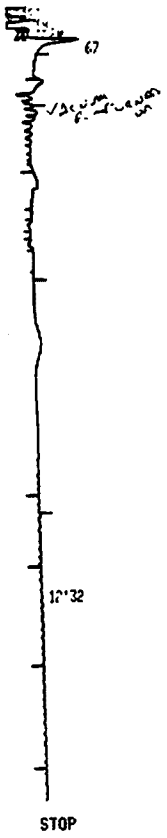
DETECTOR E.C. T.C. F.I.D. FXID-11

Scavenger Rate ml./min.

Sens. Rec.Range mV.

SAMPLE 2 BOILS Size 2.0 ml.

Solvent Concn



RUN # 15 APR/29/81 15:02:30
ID 1
NO CALIB PEAKS FOUND

AREA% RT	AREA	TYPE	AR/HT	AREA%
0.19	99	PB	0.006	1.217
0.67	8036	PB	0.115	98.783

TOTAL AREA= 8135
MUL FACTOR= 1.0000E+00

GAS CHROMATOGRAPH OPERATING CONDITIONS AND FIELD LOG

Client CMEA, Location LEXINGTON, N.C., Job No. 7735.21

Injection Date 4-29-81, Time [illegible], Instrument ID VARIAN 3700
Recorder/Printout Reference No. [illegible], Recorder ID HP3390A
Purpose of Run $C_1 - C_6$ HYDROCARBON ANALYSIS

Sample Description [illegible]

GC CONDITIONS

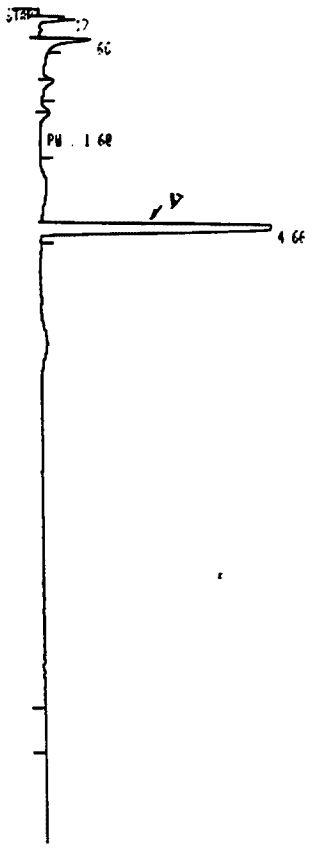
Amount Injected 2 ML, Inj. Port or Sample Loop Used 2ML LOOP
Detector Used: FID X, ECD ___, FPD ___, TCD ___ (Current ___)
Detector Attenuation 8, Amplifier or Range 10^{-11}
Column: Liquid Phase ___, Solid Phase PORAPAK Q,
Length 6', O.D. 1/8", I.D. ___, Material S.S.
Temperature: Injector 120 °C, Oven 120 °C, Detector 250 °C
Temperature Program ISOTHERMAL

SAMPLE RUN

Sampling Method GRAB 300ML (520°F)

RT	Area	Peak Height	Amount (ppm)	Component
.66	5176		1.6	C_3

Name of Operator JOHN HOLM, Date 10-21 1981



Operator V. HAAM Date 4-29-81
Column No. Length 6' Dia. 1/8"
Coating Concn. Mesh 80/100
Support PORAPAK Q
TEMP: Col: Init 120 °C Final 120 °C
Rate °C/min. Det. 250 °C Inj 120 °C
CARRIER GAS He Rate 8.4.4 ml./min.
Pressures: Inlet Outlet
Hydrogen 40 PSI ~~ml/min~~ Air 60 PSI ~~ml/min~~
DETECTOR E.C. T.C. F.I.D. 8 x 10⁻¹¹
Scavenger Rate ml./min.
Sens. Rec.Range mv.
SAMPLE 2 BULB A 1402 Size 20 M.M.
Solvent Concn.

RUN 8 16 APR/29/81 15:22:10
ID 1
NO CALIB PEAKS FOUND

AREA%

RT	AREA	TYPE	AR/HT	AREA%
0.17	943	PB	0.042	1.269
0.66	8176	PB	0.115	10.999
4.66	65213	PB	0.200	87.732

TOTAL AREA= 74332
MUL FACTOR= 1.0000E+00

GAS CHROMATOGRAPH OPERATING CONDITIONS AND FIELD LOG

Client CMEA, Location LEXINGTON, N.C., Job No. 7735.21

Injection Date 4-29-81, Time 15:[illegible], Instrument ID VARIAN 3700
Recorder/Printout Reference No. 17, Recorder ID HP339DA
Purpose of Run C_1-C_6 HYDROCARBON ANALYSIS

Sample Description [illegible]

GC CONDITIONS

Amount Injected 2 ML, Inj. Port or Sample Loop Used 2mL Loop
Detector Used: FID X, ECD ___, FPD ___, TCD ___ (Current ___)
Detector Attenuation 8, Amplifier or Range 10^{-11}
Column: Liquid Phase ___, Solid Phase PORAPAK Q,
Length 6', O.D. 1/8", I.D. ___, Material S.S.
Temperature: Injector 120 °C, Oven 120 °C, Detector 250 °C
Temperature Program ISOTHERMAL

SAMPLE RUN

Sampling Method GRAB 300mL (520°F)

RT	Area	Peak Height	Amount (ppm)	Component
.68	9050		1.8	C_3

Name of Operator JOHN HOLM, Date 10-21 1981

Operator T. HOLM Date 4-29-81

Column No. Length 6' Dia. 1/8"

Coating Concn. Mesh 80/100

Support PORAPAK Q

TEMP: Col: Init. 120 °C Final 120 °C

Rate °C/min. Det. 250 °C Inj. 120 °C

CARRIER GAS He Rate 84.4 ml/min.

Pressures: Inlet Outlet

Hydrogen 40 P.S.I. ~~ml/min.~~ Air 60 P.S.I. ~~ml/min.~~

DETECTOR E.C. T.C. F.I.D. 8 X 10-11

Scavenger Rate ml/min.

Sens. Rec. Range mv.

SAMPLE 2 RUN A 1408 Size 2.0 ml

Solvent Concn.


```
RUN #   17              APR/29/81  15:43:05
ID    1
NO CALIB PEAKS FOUND

AREA%
   RT          AREA TYPE   AR/HT      AREA%
  0.68         9050 D PB   0.143    100.000

TOTAL AREA=       9050
MUL FACTOR= 1.0000E+00
```

GAS CHROMATOGRAPH OPERATING CONDITIONS AND FIELD LOG

Client CMEA, Location LEXINGTON, N.C., Job No. 7735.21

Injection Date 4-29-81, Time 17:54:50, Instrument ID VARIAN 3700
Recorder/Printout Reference No. 19, Recorder ID HP339DA
Purpose of Run C_1-C_6 HYDROCARBON ANALYSIS

Sample Description SAMPLE No. 3 BAG A

GC CONDITIONS

Amount Injected 2 ML, Inj. Port or Sample Loop Used 2ML LOOP
Detector Used: FID X, ECD ___, FPD ___, TCD ___ (Current ___)
Detector Attenuation 8, Amplifier or Range 10^{-11}
Column: Liquid Phase ___, Solid Phase POROPAK Q,
Length 6', O.D. 1/8", I.D. ___, Material S.S.
Temperature: Injector 120 °C, Oven 120 °C, Detector 250 °C
Temperature Program ISOTHERMAL

SAMPLE RUN

Sampling Method GRAB 300ML (517 °F)

RT min	Area	Peak Height	Amount (ppm)	Component
.24	4994		1.9	C_1
.69	5376		1.0	C_2

Name of Operator JOHN HOLM, Date 10-21 1981

Operator J. Holm Date 4-29-81

Column No. Length 6' Dia. 1/8"

Coating Concn. Mesh 80/100

Support PORAPAK Q

TEMP: Col: Init. 120 °C Final 120 °C

Rate °C/min. Det. 250 °C Inj. 120 °C

CARRIER GAS He Rate 45 ml/min.

Pressures: Inlet Outlet

Hydrogen 40 PSI ml/min. Air 60 PSI ml/min.

DETECTOR E.C. T.C. F.I.D. & N. ID-11

Scavenger Rate ml/min.

Sens. Rec.Range mv.

SAMPLE No. BWB 1630 Size 2.0 µl

Solvent Concn.

RUN # 19 APR/29/81 17:04:50
ID 1

ESTD

RT	AREA	TYPE	CAL#	AMOUNT
0.24	4994	PB	1R	2.0677E+08

TOTAL AREA= 4994
MUL FACTOR= 1.0000E+00

RUN # 19 APR/29/81 17:04:50
ID 1

AREA%

RT	AREA	TYPE	AR/HT	AREA%
0.24	4994	PB	0.120	48.158
0.69	5376	PB	0 139	51.842

TOTAL AREA= 10370
MUL FACTOR= 1.0000E+00

GAS CHROMATOGRAPH OPERATING CONDITIONS AND FIELD LOG

Client CMEA, Location LEXINGTON, N.C., Job No. 7735.21

Injection Date 4-29-81, Time [illegible], Instrument ID VARIAN 3700
Recorder/Printout Reference No. [illegible], Recorder ID HP339DA
Purpose of Run C_1-C_6 HYDROCARBON ANALYSIS

Sample Description [illegible]

GC CONDITIONS

Amount Injected 2 ML, Inj. Port or Sample Loop Used 2ML LOOP
Detector Used: FID X, ECD ___, FPD ___, TCD ___ (Current ___)
Detector Attenuation 8, Amplifier or Range 10^{-11}
Column: Liquid Phase ___, Solid Phase PORAPAK Q,
Length 6', O.D. 1/8", I.D. ___, Material S.S.
Temperature: Injector 120 °C, Oven 120 °C, Detector 250 °C
Temperature Program ISOTHERMAL

SAMPLE RUN

Sampling Method GRAB 300ML (77 °F)

RT	Area	Peak Height	Amount (ppm)	Component
.36	5612		2.1	C_1
.68	4481		1.0	C_2

Name of Operator JOHN HOLM, Date 10-21 1981

Operator J. HOLM Date 4-29-81

Column No. Length 6' Dia. 1/8"

Coating Concn Mesh 80/100

Support PORAPAK Q Mesh 80/100

TEMP: Col: Init 120 °C Final 120 °C

Rate °C/min. Det 250 °C Inj 120 °C

CARRIER GAS H2 Rate 24 ml./min.

Pressures: Inlet Outlet

Hydrogen 40 PSI ~~ml/min.~~ Air 60 PSI ~~ml/min.~~

DETECTOR E.C. T.C. F.I.D. 8 X 10 -11

Scavenger Rate ml./min.

Sens. Rec.Range mv.

SAMPLE 2 BWB 8 1640 Size 2.0 mL

Solvent Concn

STOP

RUN # 20 APR/29
ID 1
NO CALIB PEAKS FOUND

AREA%

RT	AREA	TYPE	AR/HT	AREA%
0 26	5612	BB	0.105	53.483
0 68	4881	PB	0.103	46.517

TOTAL AREA= 10493
MUL FACTOR= 1.0000E+00

GAS CHROMATOGRAPH OPERATING CONDITIONS AND FIELD LOG

Client EMSA, Location LEXINGTON, N.C., Job No. 7735.3

Injection Date 4-29-91, Time 17:45:45, Instrument ID VARIAN 3700
Recorder/Printout Reference No. 31, Recorder ID HP 3390A
Purpose of Run $C_1 - C_2$ HYDROCARBON ANALYSIS

Sample Description SAMPLE NO. 3 BULB A 1631

GC CONDITIONS

Amount Injected 2 mL, Inj. Port or Sample Loop Used 2mL LOOP
Detector Used: FID X, ECD ___, FPD ___, TCD ___ (Current ___)
Detector Attenuation 8, Amplifier or Range 10^11
Column: Liquid Phase ___, Solid Phase PORAPAK Q,
Length 6', O.D. 1/8", I.D. ___, Material S.S.
Temperature: Injector 120 °C, Oven 120 °C, Detector 250 °C
Temperature Program ISOTHERMAL

SAMPLE RUN

Sampling Method GRAB 200mL (517 °F)

RT	Area	Peak Height	Amount (ppm)	Component
.24	5322		2.0	C_1
.67	7818		1.5	C_2

Name of Operator [illegible], Date 5-21 19[illegible]

Operator T. HOLM Date 4-29-81

Column No. Length 6' Dia. 1/8"

Coating Concn. Mesh 80/100

Support PORAPAK Q

TEMP: Col: Init 120 °C Final 120 °C

Rate °C/min. Det. 250 °C Inj 120 °C

CARRIER GAS He Rate 8.4 ml./min.

Pressures: Inlet Outlet

Hydrogen 40 P.S.I. ~~ml/min.~~ Air 60 P.S.I. ~~ml/min.~~

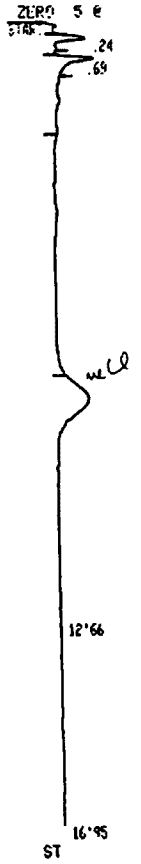
DETECTOR E.C T.C F.I.D. 2×10^{-11}

Scavenger Rate ml./min.

Sens. Rec. Range mv.

SAMPLE 3 RUN B 1430 Size 2.0 mL

Solvent Concn.

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RUN #   21              APR/29/81  17:45:45
ID   1

ESTD
   RT          AREA TYPE  CAL#        AMOUNT
  0.24         5322   BB    1R   2.2035E+00

TOTAL AREA=       5322
MUL FACTOR= 1.0000E+00
```

```
RUN #   21              APR/29/81  17:45:45
ID   1

AREA%
   RT          AREA TYPE   AR/HT       AREA%
  0.24         5322   BB   0.119      40.502
  0.69         7818   BB   0.144      59.498

TOTAL AREA=      13140
MUL FACTOR= 1.0000E+00
```

GAS CHROMATOGRAPH OPERATING CONDITIONS AND FIELD LOG

Client CMEA, Location LEXINGTON, N.C., Job No. 7735.21

Injection Date 4-29-81, Time 18:04:30, Instrument ID UNICAM 3300
Recorder/Printout Reference No. 22, Recorder ID HP 3390A
Purpose of Run CALIBRATION (FINAL)

Sample Description SCOTTY II MULTI-COMPONENT MIXTURE
C_1-C_6 n-PARAFINS ~15 PPM ± 10% IN N_2

GC CONDITIONS

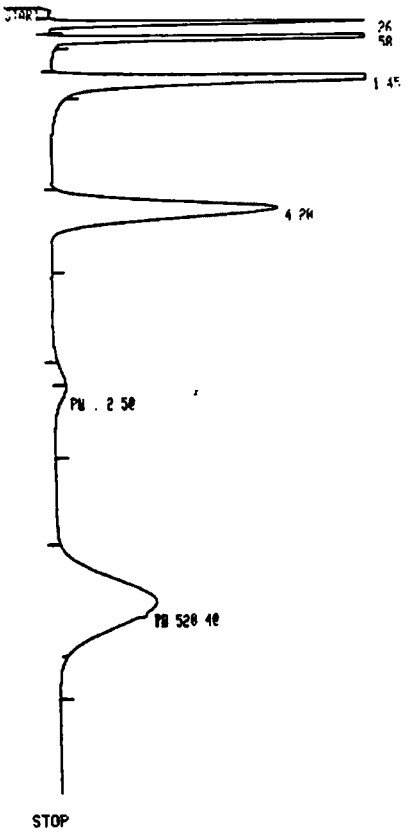
Amount Injected 2ml, Inj. Port or Sample Loop Used 2ml LOOP
Detector Used: FID X, ECD ___, FPD ___, TCD ___ (Current ___)
Detector Attenuation 8, Amplifier or Range 10 -11
Column: Liquid Phase ___, Solid Phase PORAPAK Q,
Length 6', O.D. 1/8", I.D. ___, Material SS
Temperature: Injector 120 °C, Oven 120 °C, Detector 250 °C
Temperature Program ISOTHERMAL

SAMPLE RUN

Sampling Method N/A

RT Min.	Area	Peak Height	Amount (ppm)	Component
0.26	37575		15.1	C_1
0.58	68114		14.6	C_2
1.45	116060		15.6	C_3
4.20	138750		15.2	C_4
12.52	171960		15.6	C_5

Name of Operator JOHN HOLM, Date 10-21 1981



Operator T. HOLM ..... Date 4-29-81 .....
Column No. ..... Length 6' ..... Dia. 1/8" .....
Coating ..... Concn. ..... Mesh 80/100 .....
Support CHROMOSORB Q ..... °C ..... °C
TEMP: Col: Init. 120 ..... °C Final 120 ..... °C
Rate ..... °C/min. Det. 250 °C Inj. ..... °C
CARRIER GAS He ..... Rate 25 ml/min. ..... ml/min.
Pressures: Inlet ..... Outlet .....
Hydrogen 40 P.S.I. ~~ml/min.~~ Air 60 P.S.I. ~~ml/min.~~
DETECTOR E.C. ..... T.C. ..... F.I.D. ATTN 11 .....
Scavenger ..... Rate ..... ml/min.
Sens. ..... Rec.Range ..... mv.
SAMPLE CAL GAS C1-C6 ..... Size 2 ml .....
Solvent ..... Concn. 1.15 PPM Each .....

RUN # 22 APR/29/81 18:04:30
ID 1

ESTD

RT	AREA	TYPE	CAL#	AMOUNT
0.58	68114	D PB	2	4.8627E+09
1 45	116060	PB	3	1.4412E+10
4.20	138750	BB	4	2 0139E+10

TOTAL AREA= 322930
MUL FACTOR= 1.0000E+00

GAS CHROMATOGRAPH OPERATING CONDITIONS AND FIELD LOG

Client CMCA, Location LEXINGTON, N.C., Job No. 7735.21

Injection Date 4-29-81, Time 16:24:50, Instrument ID VARIAN 3700
Recorder/Printout Reference No. 23, Recorder ID HP3390A
Purpose of Run CALIBRATING (FINAL)

Sample Description Scotty I multi-component mixture
C1-C5 n-paraffins 0.15ppm ± 10% in N2

GC CONDITIONS

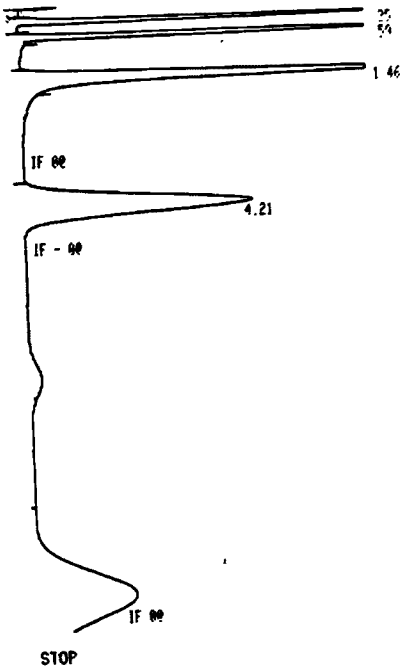
Amount Injected 2ml, Inj. Port or Sample Loop Used 2ml LTP
Detector Used: FID X, ECD ___, FPD ___, TCD ___ (Current ___)
Detector Attenuation 8, Amplifier or Range 10-11
Column: Liquid Phase ___, Solid Phase P-PAPACK Q,
Length 6', O.D. 1/8", I.D. ___, Material SS
Temperature: Injector 120 °C, Oven 120 °C, Detector 150 °C
Temperature Program ISOTHERMAL

SAMPLE RUN

Sampling Method N/A

RT min.	Area	Peak Height	Amount (ppm)	Component
0.36	395.4		15.1	C1
0.59	68146		14.6	C2
1.46	115630		15.6	C3
4.21	138910		15.2	C4
			15.6	C5

Name of Operator J. HELM, Date 10-21 19 81



Operator J. HOLM Date 4-29-81
Column No. Length 6' Dia. 1/8"
Coating Concn. Mesh 80/100
Support P.O.RAPAK Q
TEMP: Col: Init. 120 °C Final 120 °C
Rate °C/min. Det. 250 °C Inj. °C
CARRIER GAS He Rate 84.4 ml/min.
Pressures: Inlet Outlet
Hydrogen 40 PSI ~~ml/min.~~ Air 60 PSI ~~ml/min.~~
DETECTOR E.C. T.C. F.I.D. 8 x ID=11
Scavenger Rate ml/min.
Sens. Rec.Range mv.
SAMPLE CAL GAS Size 2 ML
Solvent Concn. ~~N~~ 15 PPM ~~conc~~

RUN # 23 APR/29/81 18:24:50
ID 1

ESTD RT	AREA	TYPE	CAL#	AMOUNT
0 59	68146	PB	2	4.8649E+09
1 46	115638	PB	3	1.4358E+10

TOTAL AREA= 183770
MUL FACTOR= 1.0000E+00

RUN # 23 APR/29/81 18:24:50
ID 1

AREA% RT	AREA	TYPE	AR/HT	AREA%
0 25	39514	BB	0.071	10.909
0 59	68146	PB	0 065	18 815
1 46	115636	PB	0 166	71.924
4.21	138918	I PB	0 427	38.352

TOTAL AREA= 362200
MUL FACTOR= 1.0000E+00

5.7 TOTAL CHROMOTOGRAPHABLE ORGANICS (TCO), GRAVIMETRIC ORGANICS (GRAV), IR SPECTRA, AND GAS CHROMATOGRAPHY/MASS SPECTROMETRY (GC/MS)

ACUREX Corporation
ANALYSIS LABORATORIES

DATA REPORTING FORM

CUSTOMER CMEA DATE July 31, 1981
CUSTOMER CONTRACT NO. 307736.22 ACUREX CONTRACT NO. A81-05-031
RESULTS REPORT TO L. Waterland TELEPHONE
ADDRESS
Burlington 28.78 dscm

SAMPLE ID (CUSTOMER)	Probe	10u + 3u	1u+Filter	XAD	OMC	Imp I	Imp 2+3	Bottom Ash	Fuel	
SAMPLE ID (LAB)	761	766	768	760	780	762	763	765	690	
PARAMETER										UNITS
GRAV Aliquot	< 4	< 4	6	7	< 4	-	-	-	-	mg
GRAV (Blank)	< 4	< 4	< 4	< 4	< 4	-	-	-	-	mg
GRAV	< 0.2	< 0.2	0.4	0.3	< 0.1	-	-	-	-	mg/dscm
TCO Aliquot	-	-	-	(120) 1.7*	< 0.1	-	-	-	-	mg
TCO (Blank)	-	-	-	(120) 1.4*	< 0.1	-	-	-	-	mg
TCO	-	-	-	< 0.01	< 0.003	-	-	-	-	mg/dscm
Mercury Aliquot	< 1	< 1	< 1	< 1	-	< 1	< 1	< 1	< 1	ug/l
Mercury (Blank)	< 1	< 1	< 1	< 1	-	< 1	< 1	< 1	< 1	mg/dscm
Mercury	< 0.00003	< 0.00004	< 0.00005	< 0.0002	-	< 0.00006	< 0.00004	< 0.05mg/kg	< 0.05mg/kg	ug/l
Antimony Aliquot	-	-	-	-	-	-	< 10	-	-	ug/l
Antimony	-	-	-	-	-	-	< 0.0004	-	-	mg/dscm
Arsenic Aliquot	-	-	-	-	-	-	< 10	-	-	ug/l
Arsenic	-	-	-	-	-	-	< 0.0004	-	-	mg/dscm

*Corrected for resin contamination -- uncorrected value in parentheses

ANALYST
REVIEWER

Form EED-057 4/80

IR REPORT

SAMPLE: 761 Burlington Probe

Wave Number (cm^{-1})	Intensity	Assignment	Comments
		No Peaks	

IR REPORT

SAMPLE: 766 Burlington 10u & 3u

Wave Number (cm^{-1})	Intensity	Assignment Comments
		No Peaks

IR REPORT

SAMPLE: 768 Burlington lu & Filter

Wave Number (cm^{-1})	Intensity	Assignment	Comments
2900	S	C-H Alkane	

IR REPORT

SAMPLE: 759 Burlington Filter Blank

Wave Number (cm^{-1})	Intensity	Assignment	Comments
		No Peaks	

IR REPORT

SAMPLE: 760 Burlington XAD

Wave Number (cm^{-1})	Intensity	Assignment	Comments
2900	S	C-H Alkane	
2820	S	C-H Alkane	

IR REPORT

SAMPLE: 780 Burlington OMC

Wave Number (cm^{-1})	Intensity	Assignment	Comments
		No Peaks	

ACUREX Corporation
ANALYSIS LABORATORIES

DATA REPORTING FORM

CUSTOMER CMEA DATE July 31, 1981

CUSTOMER CONTRACT NO. 307736.22 ACUREX CONTRACT NO. A81-05-031

RESULTS REPORT TO L. Waterland TELEPHONE

ADDRESS

Burlington 28.78 dscm

SAMPLE ID (CUSTOMER)	Probe	10u + 3u	1u+Filter	XAD	OMC					
SAMPLE ID (LAB)	761	766	768	760	780					
PARAMETER										UNITS
Naphthalene Aliquot	< 1	<1	<1	87	< 1					ng
Acenaphthylene Aliquot	< 1	<1	<1	8	< 1					ng
Phenanthrene Aliquot	< 1	<1	<1	7	< 1					ng
Fluoranthene Aliquot	< 1	<1	<1	2	< 1					ng
Pyrene Aliquot	< 1	<1	<1	4	< 1					ng
Phenol Aliquot	< 1	<1	<1	10	15					ng
Napthalene :	< 40	<60	<70	3300	<30					ng/dscm
Acenapthylene	<40	<60	<70	300	<30					ng/dscm
Phenanthrene	<40	<60	<70	300	<30					ng/dscm
Fluoranthene	<40	<60	<70	80	<30					ng/dscm
Pyrene	<40	<60	<70	200	<30					ng/dscm
Phenol	<40	<60	<70	380	520					ng/dscm
Others with a detection limit of 1 ng	<40	<60	<70	< 40	<30					ng

ANALYST

REVIEWER

Form EED-057 4 80

5.8 RADIOMETRIC ANALYSIS RESULTS

SAFETY SPECIALISTS, Inc.

3284 F Edward Avenue, Santa Clara, California 95050 · Telephone (408) 988-1111

ASSAY REPORT

Acurex Corporation
Attn: Mr. Larry Waterland
485 Clyde Avenue
Mountain View, California 94042

Date: August 13, 1981

Date Samples Received: 6/29/81

Customer Order No.: RB59185A, Rel. 15

SSI No.	Client Description	Activity* Gross Alpha pCi/g	Activity* Gross Beta pCi/g
81228H	A81-05-030-766	53.3 ± 37.2	328.1 ± 98.3

Analyst: Pamela S. Shreve

Approved: T. C. Noble, Director
Safety and Health Services Division

*The ± values are the two sigma Poisson standard deviation of the counting error.
The ≤ values are equal to or less than three sigma of the counting error.

SAFETY SPECIALISTS, Inc.

3284 F Edward Avenue, Santa Clara, California 95050 · Telephone (408) 988-1111

ASSAY REPORT

Acurex Corporation
Attn: Mr. Larry Waterland
485 Clyde Avenue
Mountain View, California 94042

Date: August 13, 1981

Date Samples Received: 6/29/81

Customer Order No.: RB59185A, Rel. 15

SSI No.	Client Description	Activity* Gross Gamma pCi/L	Activity* Gross Gamma pCi/g
81228H	A81-05-030-766		530 ± 1761

Analyst: Pamela S. Shreve

Approved: T. C. Noble, Director
Safety and Health Services Division

*The ± values are the two sigma Poisson standard deviation of the counting error.
The ≤ values are equal to or less than three sigma of the counting error.

5.9 BIOASSAY REPORTS

Litton BIONETICS

5516 Nicholson Lane, Kensington, Maryland 20795 301 881-5600 • Telex 89-8369

November 20, 1981

Mr. Roy Belletto
Acurex Corporation
485 Clyde Avenue
Mountain View, CA 94042

Dear Mr. Belletto:

Enclosed are five copies each of the final reports for the three samples from the "Burl" sampling site submitted for testing and evaluation in IERL-EPA Level 1 environmental assessment bioassays. All studies were conducted and evaluated under IERL-EPA Level 1 guidelines. Reports for the "EA-1" and "EA-2" sampling sites will be sent the week of November 23, 1981.

No technical or interpretative problems were encountered with these samples except for an insufficient amount of the XAD extract sample to assay up to the recommended maximum applicable dose (MAD) based upon weight of organics per plate. Ames testing was modified by eliminating less responsive tester strains. Adequate evaluations were achieved using this modified testing strategy.

If you have any questions or comments concerning the reports, please feel free to contact me at (301)881-5600, extension 536.

Sincerely,

Robert R. Young
Environmental Assessment Section
Department of Molecular Toxicology

RRY/mg
Enclosures: Reports:

Ames	5881, 5885, 5888
CHO	5881
RAM	5885, 5888
Rodent	5888

BIOASSAY SUMMARY TABLE

Technical Directive or Project No. LBI PROJECT NUMBER 22064

Contract No. ACUREX SUBCONTRACT RB59178A, RELEASE NUMBER 3, 'BURL' SITE

	Health Effects Tests				Ecological Effects Tests									
					Aquatic						Terrestrial			
					Fresh Water			Marine						
Sample Identification	AMES Salmonella*	RAM Cytotoxicity	CHO Cytotoxicity	Rodent Toxicity	Fish	Invertebrate	Algal	Fish	Invertebrate	Algal	Plant Stress Ethylene	Root Elongation	Insect Toxicity	Notes
A81-05-031-760 (BURL XAD EXTRACT)	M		M											
A81-05-031-766 (BURL 10+3+1+FILTER)	ND	L												
A81-05-031-765 (BURL FLYASH)	ND	L/ND		ND										

ND = No Detectable Toxicity
L = Low Toxicity
M = Moderate Toxicity
H = High Toxicity
* Evaluation of Ames Salmonella test is based upon mutagenicity and not toxicity.

LBI-0468 R 11/80

DEFINITION OF TOXICITY CATEGORIES FOR HEALTH EFFECTS ASSAYS

Assay[a]	Activity Measured[b]	Sample Type[c]	MAD[d]	Units	Range of Concentration or Dosage			
					High	Moderate	Low	Not Detectable (ND)
Ames	MEC (mutagenesis)	S	5	mg/plate	<0.05	0.05-0.5	0.5-5	ND at >5
		AL,NAL	200	µl/plate	<2	2-20	20-200	ND at >200
		E	5000	L/plate	<50	50-500	500-5000	ND at >5000
RAM	EC_{50} (lethality)	S	1	mg/ml	<0.01	0.01-0.1	0.1-1	ND at >1
		AL	600	µl/ml	<6	6-60	60-600	ND at >600
		NAL	20	µl/ml	<0.2	0.2-2	2-20	ND at >20
		E	1000	L/ml	<10	10-100	100-1000	ND at >1000
CHO	EC_{50} (lethality)	S	1	mg/ml	<0.01	0.01-0.1	0.1-1	ND at >1
		AL	600	µl/ml	<6	6-60	60-600	ND at >600
		NAL	20	µl/ml	<0.2	0.2-2	2-20	ND at >20
		E	1000	L/ml	<10	10-100	100-1000	ND at >1000
WAT	LD_{50} (lethality and toxic signs)	S	5	gm/kg	<0.05	0.05-0.5	0.5-5	ND at >5
		AL,NAL	5	ml/kg	<0.05	0.05-0.5	0.5-5	ND at >5

[a]Standard test abbreviations are as follows:
- Ames: Ames Salmonella/microsome mutagenesis assay
- RAM: Rabbit alveolar macrophage cytotoxicity assay
- CHO: Rodent cell clonal toxicity assay
- WAT: Acute in vivo test in rodents (whole animal test)

[b]Standard abbreviations for measured endpoints are as follows:
- MEC: Minimum effective concentration
- EC_{50}: Calculated concentration expected to produce effect in 50 percent of population
- LD_{50}: Calculated dose expected to kill 50 percent of population

[c]S = Solid, AL = Aqueous liquid, NAL = Nonaqueous liquid, E = Extract and/or concentrate of unknown organic content (use equivalent volume of SASS train gas)

[d]MAD = Maximum applicable dose

TABLE

HEALTH EFFECTS CRITICAL DATA SUMMARY FORM[a]

Contract No. ACUREX SUBCONTRACT Technical Directive or Project No. LBI PROJECT NO. 22064 Site Sampled BURL
RB59178A, RELEASE 3

Sample Identification	Ames Mutagenicity [MEC]b	CHO Clonal Toxicity [EC_{50}]c	RAM Cytotoxicity [EC50]c				Rodent Toxicity	
			Viability	Viability Index	ATP	ATP/Per 10^6 Cells	LD_{50}d	Toxic Signs e
A81-05-031-760	80 µg	18.4 µg						
(BURL XAD EXTRACT)								
A81-05-031-766	> 5 mg		>1000 µg	500 µg	360 µg	~1000 µg		
(BURL 10+3+1+FILTER)								
A81-05-031-765	> 5 mg		>1000 µg	>1000 µg	~1000 µg	>1000 µg	>5 g	
(BURL FLYASH)								

[a]The assays, observed parameters and evaluation criteria are presented in IERL-RTP Procedures Manual; Level 1 Environmental Assessment Biological Tests, [EPA Contract No. 68-02-2681, Litton Bionetics, Inc., Kensington, Md., September 1980, in press.]

[b]MEC: Minimum Effective Concentration - Lowest concentration for any tester strain giving a mutagenic response.

[c]EC_{50}: Effective concentration that reduces the observed parameter to 50 percent of the appropriate negative control.

[d]LD_{50}: The dose lethal to 50 percent of treated animals.

[e]Toxic signs are identified in a numbered list in the Level 1 manual. Only the number is reported here.

NOTE: Doses reported as per plate for the Ames assay, per ml for the CHO and RAM assays, and per kg for the Rodent Toxicity assay.

EG&G BIONOMICS

EG&G BIONOMICS, 790 MAIN STREET, WAREHAM, MASSACHUSETTS 02571 • TEL. (617) 295-2550

September 2, 1981

Ms. Teri Lannon
Acurex Corporation
485 Clyde Avenue
Mountain View, CA 94042

Dear Ms. Lannon:

Enclosed please find three (3) copies of our report:

"The Acute Toxicity of Five Samples To Freshwater Organisms" - Report #BW-81-7-966

I trust you shall find this report both complete and satisfactory. If you should have any questions or comments, please contact me.

Sincerely,

Gerald A. LeBlanc
Aquatic Toxicologist

GAL:jeb

Enclosure

Estimated LC50 values, confidence intervals and no discernible effect concentrations for D. magna and P. promelas exposed to Acurex samples.

Sample	Species	LC50 (95% confidence interval)[a] 24 hour	48 hour	72 hour	96 hour	No discernible effect concentration (mg/ℓ)
A81-05-031-765 (bottom ash)	D. magna	>1000	740[b] (620-940)	-	-	220
	P. promelas	≥1000	>1000	>1000	>1000	1000

[a] mg/ℓ.

[b] Estimated by the moving average angle method.

Calculated 5-day EC50's and EC95's for Selenastrum capricornutum exposed to the five samples provided by the Acurex Corporation. The EC values were based on decrease of cell numbers on exposed cultures as compared to the control. (The 95% confidence limits are in parentheses). Concentrations were based on microliters of A80-09-023-24 per liter of algal growth medium and milligrams of the other samples per liter of algal growth medium.

Sample	EC50	EC95
A81-05-031-765	169(118-242)	314(195-506)

TECHNICAL REPORT DATA
(Please read Instructions on the reverse before completing)

1. REPORT NO.	2.	3. RECIPIENT'S ACCESSION NO.
EPA-600/7-87-010b		

4. TITLE AND SUBTITLE	5. REPORT DATE
Environmental Assessment of a Wood-Waste-Fired Industrial Firetube Boiler; Volume II. Data Supplement	March 1987
	6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S)	8. PERFORMING ORGANIZATION REPORT NO.
R. DeRosier and L. R. Waterland	TR-83-123/ESD
9. PERFORMING ORGANIZATION NAME AND ADDRESS	10. PROGRAM ELEMENT NO.
Acurex Corporation P.O. Box 7555 Mountain View, California 94039	11. CONTRACT/GRANT NO. 68-02-3188
12. SPONSORING AGENCY NAME AND ADDRESS	13. TYPE OF REPORT AND PERIOD COVERED
EPA, Office of Research and Development Air and Energy Engineering Research Laboratory Research Triangle Park, NC 27711	Final; 1/81 - 3/84 14. SPONSORING AGENCY CODE EPA/600/13

15. SUPPLEMENTARY NOTES AEERL project officer is Robert E. Hall, Mail Drop 65, 919/541-2477. Volume I contains the technical results of the study.

16. ABSTRACT The report gives emission results from field tests of a wood-waste-fired industrial firetube boiler. Emission measurements included: continuous monitoring of flue gas emissions; source assessment sampling system (SASS) sampling of the flue gas with subsequent laboratory analysis of samples to give total flue gas organics in two boiling point ranges, compound category information within these ranges, specific quantitation of the semivolatile organic priority pollutants, and flue gas concentrations of 65 trace elements; Method 5 sampling for particulates; controlled condensation system (CSS) sampling for SO2 and SO3; and grab sampling of boiler bottom ash for trace element content determinations. Flue gas CO emissions were quite variable during the tests, and often quite high (attributed to the high excess air level at which the unit operated). NOx emissions were relatively high for a wood-fired boiler, although the fuel nitrogen content was relatively high for a wood fuel. SO2 and SO3 emissions were less than 10 ppm, in keeping with the low sulfur content of the wood-waste fuel. Total organic emissions from the boiler were 5.7 mg/dscm, about 90% of which consisted of volatile compounds. Emission levels of five polycyclic organic matter species and phenol were quantitated: except for naphthalene, all were emitted at less than 0.4 microgram/dscm.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS		b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group	
Pollution	Sulfur Oxides	Pollution Control	13B	07B
Wood Wastes	Nitrogen Oxides	Stationary Sources	11L	
Fire Tube Boilers	Trace Elements	Environmental Assessment	13A	06A
Flue Gases	Carbon Monoxide		21B	
Assessments	Organic Compounds	Particulate	14B	07C
Particles	Polycyclic Compounds		14G	
	Phenols			

18. DISTRIBUTION STATEMENT	19. SECURITY CLASS (This Report)	21. NO. OF PAGES
Release to Public	Unclassified	114
	20. SECURITY CLASS (This page)	22. PRICE
	Unclassified	

EPA Form 2220-1 (9-73)