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Research and Development

ENVIRONMENTAL ASSESSMENT
OF A COMMERCIAL BOILER FIRED WITH
A COAL/WASTE PLASTIC MIXTURE

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

RESEARCH REPORTING SERIES

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EPA REVIEW NOTICE

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ENVIRONMENTAL ASSESSMENT OF A COMMERCIAL BOILER FIRED WITH A COAL/WASTE PLASTIC MIXTURE

Volume II
Data Supplement

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For

U.S. ENVIRONMENTAL PROTECTION AGENCY
Office of Research and Development
Washington, DC 20460

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, data interpretation, and conclusions.

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

Section 2 -- Preliminary Tests and Equipment Calibration: stack velocity traverse and nozzle sizing calculations, equipment calibration records

Section 3 -- Boiler Operating Data: pressures, temperatures, and flowrates; efficiency calculations using the ASME heat loss method

Section 4 -- Sampling Data Sheets: continuous monitor data sheets; operating data tables for EPA Method 5/8 (for particulate mass emissions, SO_2 and SO_3 sampling), SASS (for trace element and semi- and nonvolatile organic sampling), HCl train, and VOST (for volatile organic sampling)

Section 5 -- Analytical Results: fuel and ash sample proximate and ultimate analyses; SASS particulate emissions; Method 5 particulate emissions; Method 8 sulfur oxides emissions; HCl emissions; trace element emissions by spark source mass spectrometry (SSMS), atomic absorption spectroscopy (AAS), and other methods, and leachable anions analyses by ion chromatography; total chromatographable organic (TCO) and gravimetric (GRAV) results, determination of semivolatile organic priority pollutants by gas chromatography/mass spectrometry (GC/MS), infrared (IR) spectra of total sample extracts; liquid chromatography (LC) separation results with IR spectra of eluted fractions; analyses of VOST traps by GC/MS; N_2O analyses by gas chromatography/electron capture detector; and biological assay reports.

SECTION 2

PRELIMINARY TESTS AND EQUIPMENT CALIBRATION

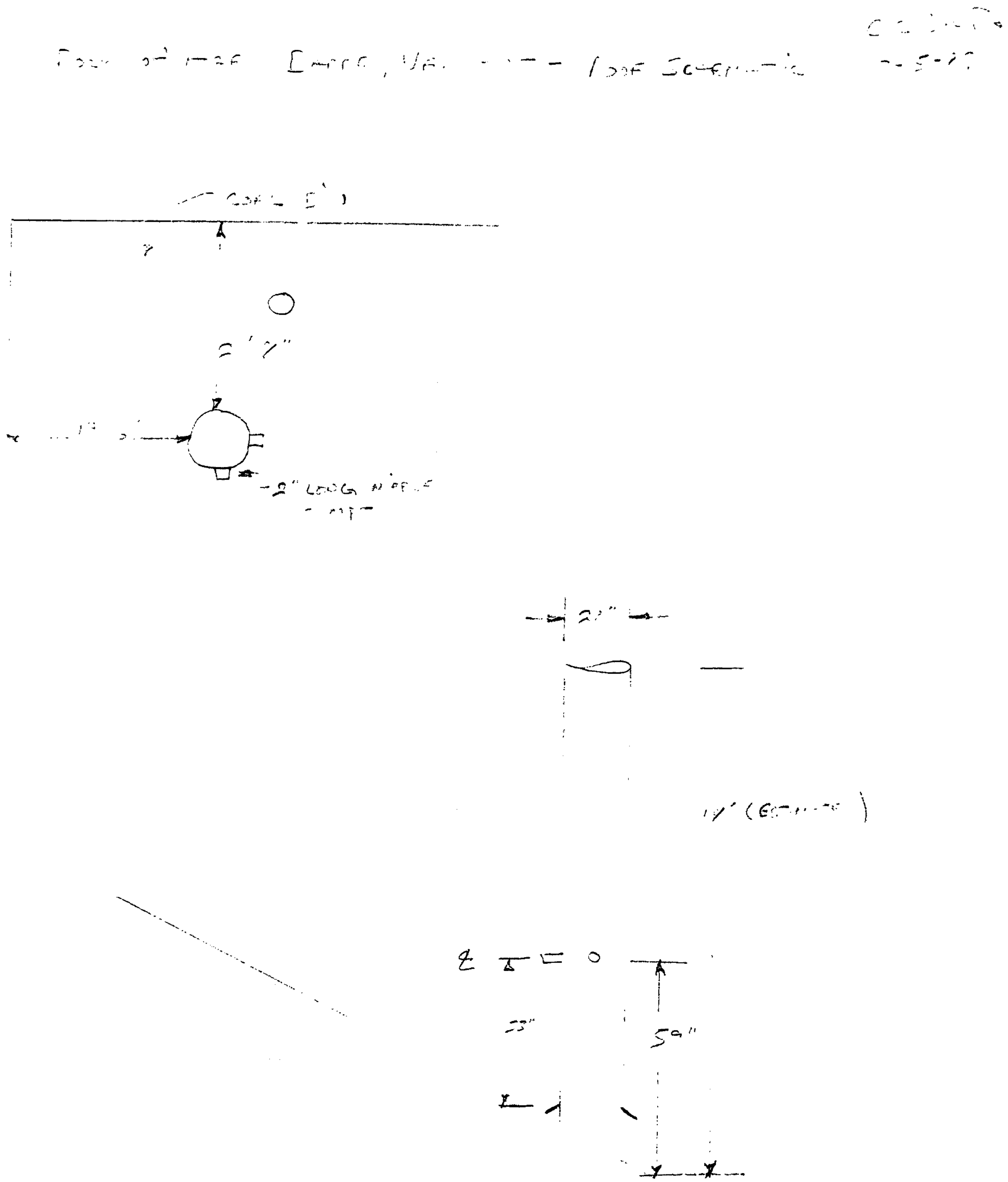
TRAVERSE POINT LOCATION FOR CIRCULAR DUCTS

PLANT ____________________
DATE ____________________
SAMPLING LOCATION ____________________
INSIDE OF FAR WALL TO
OUTSIDE OF NIPPLE, (DISTANCE A) ____________________
INSIDE OF NEAR WALL TO
OUTSIDE OF NIPPLE, (DISTANCE B) ____________________
STACK I.D., (DISTANCE A - DISTANCE B) ____________________
NEAREST UPSTREAM DISTURBANCE ____________________
NEAREST DOWNSTREAM DISTURBANCE ____________________
CALCULATOR ____________________

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)

EPA (Dur) 232
4/72



PRELIMINARY VELOCITY TRAVERSE

PLANT [illegible]
DATE [illegible]
LOCATION [illegible]
STACK I.D. [illegible]
BAROMETRIC PRESSURE, in. Hg [illegible]
STACK GAUGE PRESSURE, in. H_2O –.10
OPERATORS [illegible]

TRAVERSE POINT NUMBER	VELOCITY HEAD (Δp_s), in. H_2O	STACK TEMPERATURE (T_s), °F
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]
	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
AVERAGE	[illegible]	275.8

SCHEMATIC OF TRAVERSE POINT LAYOUT

TRAVERSE POINT NUMBER	VELOCITY HEAD (Δp_s), in. H_2O	STACK TEMPERATURE (T_s), °F
AVERAGE		

EPA (Dur) 233
4/72

ISOKINECTIC NOZZLE CALCULATION
AND
SAMPLING RATE CALCULATION

Plant ROCK CREEK Performed by BARKUS

Date JULY 6, 1983

Sample Location SAW HOUSE

Test No./Type 1-M5-8

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

where: N_d = Nozzel diameter (inches)

Average pressure differential across the orifice meter (in. H_2O)	ΔH	1.5
Temperature stack gas, average (^oF)	T_s	275.8
Temperature of gas meter, average (^oF)	T_m	70
Stack gas velocity pressure (in H_2O)	ΔP	0.055
$\left(\frac{(\_\_\_)\ (\_\_\_ + 460)}{(\_\_\_)\ (\_\_\_ + 460)(\_\_\_)} \right)^{.25}$	N_d	.461

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

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

Nozzel diameter, actual (inches)	N_d	.387
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	$K(N_d)^4$	

ISOKINECTIC SAMPLING WORKSHEET

Plant ROCKOFAGES   Peformed by BAKKUS

Date 7/7/83

Sample Location SAW HOUSE

Test No./Type 1 - M-5-8

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

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

Pitot coefficient (dimensionless)	C_p	.800
Water vapor in the gas stream (proportion by volume)	B_{wo}	.075
Absolute stack gas pressure (in. Hg)	P_s	-.10
Molecular weight, stack gas dry (lb/lb-mole)	M_d	CO_2 13 O_2 7 N_2 83
Orifice coefficient (dimensionless)	K_o	0.725
Molecular weight, stack gas wet (lb/lb-mole) $M_d(1-B_{wo}) + 18(B_{wo})$	M_s	
Abolute meter pressure (in. Hg)	P_m	28.24
$\frac{782.687\ (\_\_\_)^2\ (1-\_\_\_)^2\ (\_\_\_)\ (\_\_\_)}{(\_\_\_)^2\ (\_\_\_)\ (\_\_\_)}$	K	841.373

PRELIMINARY VELOCITY TRAVERSE

PLANT [illegible]
DATE [illegible]
LOCATION [illegible]
STACK I.D. [illegible]
BAROMETRIC PRESSURE, in. Hg [illegible]
STACK GAUGE PRESSURE, in. H_2O [illegible]
OPERATORS

SCHEMATIC OF TRAVERSE POINT LAYOUT

TRAVERSE POINT NUMBER	VELOCITY HEAD (Δp_s), in. H_2O	STACK TEMPERATURE (T_s), °F
	0.06	3[illegible]2
	[illegible]	320
	[illegible]	322
	0.05	316
	0.03	307
	0.03	274
AVERAGE	0.0469	309.2

TRAVERSE POINT NUMBER	VELOCITY HEAD (Δp_s), in. H_2O	STACK TEMPERATURE (T_s), °F
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]
AVERAGE		

EPA (Dur) 233
4/72

.214

ISOKINECTIC NOZZLE CALCULATION
AND
SAMPLING RATE CALCULATION

Plant: Rock of Ages — Performed by: [illegible]

Date: 7/8/83

Sample Location: Saw House

Test No./Type: 2 M-5-8

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

where: N_d = Nozzel diameter (inches)

Average pressure differential across the orifice meter (in. H_2O)	ΔH	1.5
Temperature stack gas, average (^oF)	T_s	300.2
Temperature of gas meter, average (^oF)	T_m	80
Stack gas velocity pressure (in H_2O)	ΔP	.047
$\left(\frac{(\_\_\_)\ (\_\_\_ + 460)}{(\_\_\_)\ (\_\_\_ + 460)(\_\_\_)}\right)^{.25}$	N_d	.482

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

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

Nozzel diameter, actual (inches)	N_d	.387
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 839.439 (.387)^4	$K(N_d)^4$	18.84

ISOKINECTIC SAMPLING WORKSHEET

Plant Roof of Ages — Peformed by [illegible]

Date 7/8/83

Sample Location SMW ~~[illegible]~~ HOUSE

Test No./Type 2-M-5-8

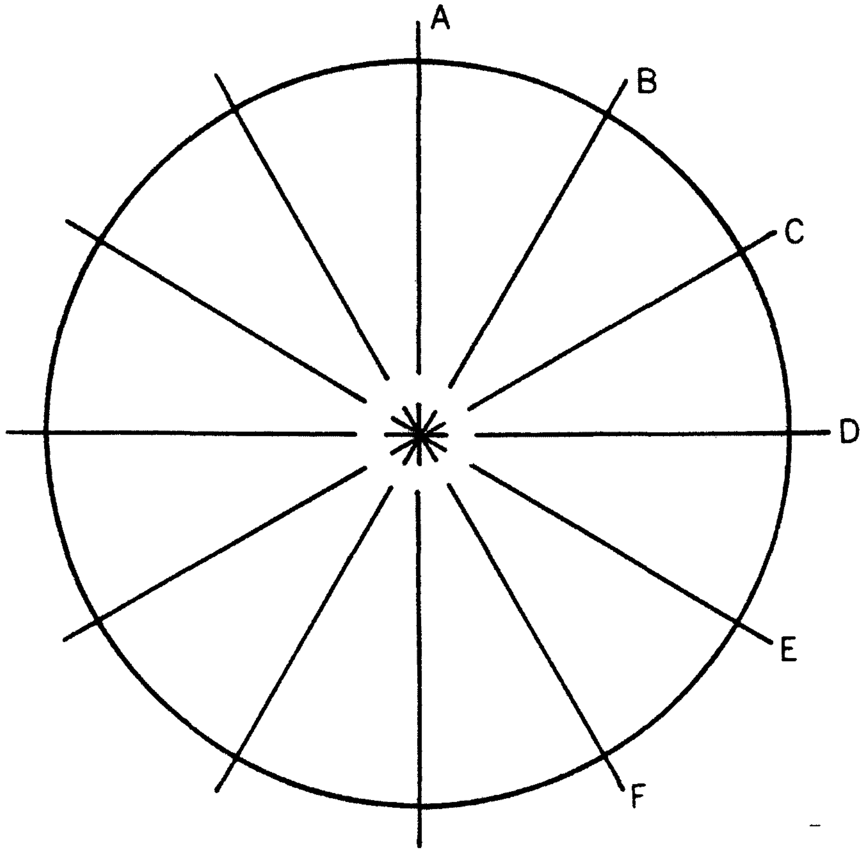
$$K = \frac{782.687\ (Cp)^2\ (1-B_{wo})^2\ P_s\ M_d}{K_o^2\ M_s\ P_m}$$

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

Pitot coefficient (dimensionless)	C_p	.800
Water vapor in the gas stream (proportion by volume)	B_{wo}	.075
Absolute stack gas pressure (in. Hg)	P_s	-.10
Molecular weight, stack gas dry (lb/lb-mole)	M_d	CO_2 - 7 O_2 - 13 N_2 - 80
Orifice coefficient (dimensionless)	K_o	1.02 .725
Molecular weight, stack gas wet (lb/lb-mole) $M_d(1-B_{wo}) + 18(B_{wo})$	M_s	
Abolute meter pressure (in. Hg)	P_m	28.6
782.687 (___)^2 (1-___)^2 (___) (___) / (___)^2 (___) (___)	K	339.939

ACUREX Corporation

NOZZLE MEASUREMENT



DIAMETER
DIMENSION

A ______________

B ______________

C ______________

D ______________

E ______________

F ______________

AVG. ______________

NOZZLE SERIAL

____

DATE

____

RECORDED BY

____

Form AC-268 8 78

CONTROL MODULE CALIBRATION

Module I.D. D-554 Barometric Pressure (in. Hg) 30.12 – 30.16 Ambient Temperature (°F) 70° – 67°

Date 5-13 / 5-16-83 Primary Meter I.D. ______ Operator S. A. Smith

Orifice Size	Orifice Reading ΔH (in H_2O)	Primary Meter Gas Volume V_p (ft^3)	Meter Box Gas Volume V_d (ft^3)	Temperature: Primary Meter: Inlet T_{pi} (°F)	Temperature: Primary Meter: Outlet T_{po} (°F)	Temperature: Primary Meter: Average T_p (°F)	Temperature: Meter Box Meter: Inlet T_{di} (°F)	Temperature: Meter Box Meter: Outlet T_{do} (°F)	Temperature: Meter Box Meter: Average T_d (°F)	Time θ (min)	Meter Correction Factor α	Orifice Coefficient K_o
Small Orifice 0.187												
Medium Orifice 0.281	.5	15.695	16.000	70 / 70	70 / 70	70°	72 / 80	71 / 80	75.8°	32.6	1.010	0.753
	1.0	14.195	14.615	70 / 70	70 / 70	70°	80 / 83	80 / 81	81°	24.4	1.011	0.739
	2.5	10.400	10.720	70 / 70	70 / 70	70°	83 / 87	81 / 81	83°	11.9	1.012	0.701
	4.0	18.710	19.190	67 / 67	67 / 67	67°	79 / 83	73 / 76	77.8°	16.9	1.015	0.705
Large Orifice 0.358												

$$\alpha = \frac{V_d \left(P_B + \frac{\Delta H}{13.6}\right)(T_p + 460)}{V_p\,(P_B)\,(T_d + 460)}$$

$$K_o = \frac{V_p}{\theta \sqrt{\frac{\Delta H\,(T_d + 460)}{P_B\,(28.96)}}}$$

Orifice	Avg. α	Avg. K_o
Small		
Medium	1.012	0.725
Large		

Date 4/13/82
Time
Barometric Pressure 29.88
Ambient Temperature 19.5 °C

Orifice Meter
Orifice Magnehelic 81212 OB 59
Primary Calibration Meter 445598
Control Module D 555

Operators SCHOLTZ
Wet Bulb Temperature

METER CALIBRATION DATA

A-21-81

Orifice Manometer ΔH_{ref} (in. wg.)	Orifice Magnehelic ΔH_C (in. wg.)	Primary Meter ΔH_p (in. wg.)	Dry Test Meter P_{dg} (in. wg.)	Gas Volume Primary Meter V_p (ft.³)	Gas Volume Dry Test Meter V_d (ft.³)	Temperature, Primary Meter, Inlet, T_{pi} (°F)	Primary Meter, Outlet, T_{po} (°F)	Primary Meter, Avg., T_{pa} (°F)	Dry Test Meter, Inlet, T_{di} (°F)	Dry Test Meter, Outlet, T_{do} (°F)	Dry Test Meter, Avg., T_{da} (°F)	Time t (min.)	γ	K_o
	0.2													
	0.4													
#1	0.6 (circled)			964.643	360.315	64	63		73	75		20 min		0.7 sec
	0.8			973.408	369.209	65	64		74	76				
	1.0													
#2	1.2 (circled)			974.081	369.838	64	63		73	74		20 min		0.2 sec
	1.4			[illegible]36.255	382.256	64	64		76	75				
	1.6													
#3	1.8 (circled)			002.675	398.885	64 / 62	64 / 65		75 / 76	75 / 77		20 min		0.9 sec
	2.0			017.839	414.273									
	2.2													
#4	2.4 (circled)			048.407	445.230	65 / 66	65 / 66		79 / 80	77 / 78		20 min		0.7 sec
	2.6			065.610	462.720									
	2.8													
	3.0													
	3.2													
	3.4													
	3.6													
	3.8													
	4.0													
	4.2													
	4.4													
	4.6													
	4.8													
	5.0													
													Average	

$\gamma = 0.9908$

$K_o = 0.7126$

DATE 10-6-82
TIME 10:3[illegible]
BAROMETRIC PRESSURE 30.12
AMBIENT TEMP 73°

TEST PITOT TUBE 3'-399 A
STANDARD PITOT TUBE 3'
TEST SECTION LOCATION
OPERATORS JEO

NOZZLE SIZE
NOZZLE-PITOT SPACING
PITOT-TC SPACING

PITOT TUBE CALIBRATION DATA

Test Pitot Tube ΔP (in. wg.) Upper Leg	Test Pitot Tube ΔP (in. wg.) Lower Leg	Standard Pitot Tube ΔP (in. wg.)	C_p	Static Pressure (in. wg.)	Gas Temp (°F)	Wet Bulb Temp (°F)	Test Section Velocity (fps)
1.35		.99	.848				
1.21		.89	.849				
.99		.72	.84[illegible]				
.80		.56	.847				
.61		.44	.840				
[illegible]		.28	.837				
.30		.21	.842				
.14		.10	.837				
	.14	.10	837				
	[illegible]	[illegible]	834				
	.61	.4[illegible]	831				
	.8[illegible]	.6[illegible]	831				
	1.1	.78	829				
	1.[illegible]	1.0	827				
	1.[illegible]	1.05	828				
	1.6	1.15	839				

A-17406

Average $C_{p,\ upper}$ = 0.843

Average $C_{p,\ lower}$ = 0.834

DATE 10-6-83
TIME 15:0
BAROMETRIC PRESSURE 30.12
AMBIENT TEMP 75°

TEST PITOT TUBE 3'-398 B
STANDARD PITOT TUBE 3'
TEST SECTION LOCATION
OPERATORS JEO

NOZZLE SIZE
NOZZLE-PITOT SPACING
PITOT-TC SPACING

PITOT TUBE CALIBRATION DATA

Test Pitot Tube ΔP (in. wg.) Upper Leg	Test Pitot Tube ΔP (in. wg.) Lower Leg	Standard Pitot Tube ΔP (in. wg.)	C_p	Static Pressure (in. wg.)	Gas Temp (°F)	Wet Bulb Temp (°F)	Test Section Velocity (fps)
1.55		1.1	.834				
1.4		.98	830				
1.05		.74	831				
[illegible]		[illegible]	827				
[illegible]		[illegible]	838				
[illegible]		[illegible]	834				
[illegible] 7		[illegible] 9	831				
[illegible]		[illegible]	832				
	[illegible]	[illegible]	844				
	[illegible]	[illegible]	849				
	[illegible]	[illegible]	847				
	.82	[illegible]	849				
	[illegible]	.71	847				
	1.37	.94	855				
	[illegible]	1.62	851				
	1.55	1.10	842				

A-17406

Average $C_{p,\ upper}$ = 0.833

Average $C_{p,\ lower}$ = 0.847

SECTION 3

BOILER OPERATING DATA

Time	Feedwater flow (total gal)	Feedwater temperature (°F)	Steam pressure (psig)	Fuel flow (lb/hr nominal setting)	Comment
430					Start fuel feed, boiler on
625	20.0	--	--	--	
645	231.1	60	7	300	
705	268.6	60	7	300	
715	281.7	60	7	300	
730	335.0	58	2	300	
750	400.0	56	2	300	
805	457.6	56	2	300	
825	552.4	56	0	300	Increase feedwater flow
840	626.0	56	0	300	
945	1,057.0	56	2	300	
1000	1,151.0	56	2	300	
1030	1,381.1	56	2	300	
1100	1,550.0	54	1.5	300	
1130	1,738.3	56	2	300	
1145	1,846.0	54	2.5	300	
1200	1,939.0	55	2.5	300	SASS start; Method 5/8 start
1215	2,044.8	54	2	300	
1230	2,148.0	54	2	300	
1245	2,217.9	54	2.5	300	
1300	2,311.2	54	3	300	
1315	2,425.7	54	3	300	Method 5/8 stop
1330	2,515.7	54	2	300	
1400	2,710.3	54	2	300	
1415	2,795.1	54	2.5	300	
1430	2,873.5	54	2	300	
1445	2,970.1	54	1.5	300	
1500	3,035.9	54	2	300	
1515	3,120.2	54	2	300	HCl start
1530	3,204.9	54	2.5	300	
1545	3,243.8	54	3	300	HCl stop
1600	3,387.8	54	3	300	
1615	3,487.5	54	2	300	
1630	3,562.1	54	2	300	
1645	3,645.4	54	2	300	SASS stop
1700	3,720.3	54	2	300	
1715	3,802.0	54	2.5	300	
1730	3,890.6	54	2	300	Terminate fuel flow

Total fuel fed = 3,094 lb. Collect 405 lb bottom ash, 12.5 lb cyclone hopper ash

UMMARY SHEET

ASME TEST FORM FOR ABBREVIATED EFFICIENCY TEST

PTC 4.1-a (1964)

	TEST NO. [illegible]	BOILER NO.	DATE [illegible]
OWNER OF PLANT [illegible]	LOCATION		
TEST CONDUCTED BY	OBJECTIVE OF TEST		DURATION
BOILER, MAKE & TYPE		RATED CAPACITY	
STOKER, TYPE & SIZE			
PULVERIZER, TYPE & SIZE		BURNER, TYPE & SIZE	
FUEL USED [illegible] MINE	COUNTY	STATE	SIZE AS FIRED

PRESSURES & TEMPERATURES

1	STEAM PRESSURE IN BOILER DRUM	psia	17.2
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	54
9	STEAM QUALITY % MOISTURE OR P. P. M.		
10	AIR TEMP. AROUND BOILER (AMBIENT)	F	[illegible]
11	TEMP. AIR FOR COMBUSTION (This is Reference Temperature) †	F	[illegible]
12	TEMPERATURE OF FUEL	F	
13	GAS TEMP. LEAVING (Boiler) (Econ.) (Air Htr.)	F	[illegible]
14	GAS TEMP. ENTERING AH (If conditions to be corrected to guarantee)	F	
	UNIT QUANTITIES		
15	ENTHALPY OF SAT. LIQUID (TOTAL HEAT)	Btu/lb	188.1
16	ENTHALPY OF (SATURATED) (SUPERHEATED) STM.	Btu/lb	1153.[illegible]
17	ENTHALPY OF SAT. FEED TO (BOILER) (ECON.)	Btu/lb	22.1
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	1131.2
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	[illegible]
23	Btu PER LB IN REFUSE (WEIGHTED AVERAGE)	Btu/lb	727
24	CARBON BURNED PER LB AS FIRED FUEL	lb/lb	[illegible]
25	DRY GAS PER LB AS FIRED FUEL BURNED	lb/lb	[illegible]
	HOURLY QUANTITIES		
26	ACTUAL WATER EVAPORATED	lb/hr	
27	REHEAT STEAM FLOW	lb/hr	
28	RATE OF FUEL FIRING (AS FIRED wt)	lb/hr	
29	TOTAL HEAT INPUT $\frac{(\text{Item 28} \times \text{Item 41})}{1000}$	kB/hr	
30	HEAT OUTPUT IN BLOW-DOWN WATER	kB/hr	
31	TOTAL HEAT OUTPUT $\frac{(\text{Item 26} \times \text{Item 20}) + (\text{Item 27} \times \text{Item 21})}{1000}$ + Item 30	kB/hr	
	FLUE GAS ANAL. (BOILER) (ECON) (AIR HTR) OUTLET		
32	CO_2	% VOL	12.[illegible]
33	O_2	% VOL	7.[illegible]
34	CO	% VOL	[illegible]
35	N_2 (BY DIFFERENCE)	% VOL	[illegible]
36	EXCESS AIR	%	[illegible]

FUEL DATA

	COAL AS FIRED PROX. ANALYSIS	% wt		OIL	
37	MOISTURE	2.7[illegible]	51	FLASH POINT F*	
38	VOL MATTER	[illegible]	52	Sp. Gravity Deg. API*	
39	FIXED CARBON	[illegible]	53	VISCOSITY AT SSU* BURNER SSF	
40	ASH	8.[illegible]	44	TOTAL HYDROGEN % wt	
	TOTAL		41	Btu per lb	
41	Btu per lb AS FIRED	13[illegible]			
42	ASH SOFT TEMP.* ASTM METHOD			GAS	% VOL
	COAL OR OIL AS FIRED ULTIMATE ANALYSIS		54	CO	
43	CARBON	[illegible]	55	CH_4 METHANE	
44	HYDROGEN	5.2	56	C_2H_2 ACETYLENE	
45	OXYGEN	11.6	57	C_2H_4 ETHYLENE	
46	NITROGEN	1.5	58	C_2H_6 ETHANE	
47	SULPHUR	1.[illegible]	59	H_2S	
40	ASH	[illegible]	60	CO_2	
37	MOISTURE	[illegible]	61	H_2 HYDROGEN	
	TOTAL			TOTAL	
	COAL PULVERIZATION			TOTAL HYDROGEN % wt	
48	GRINDABILITY INDEX*		62	DENSITY 68 F ATM. PRESS.	
49	FINENESS % THRU 50 M*		63	Btu PER CU FT	
50	FINENESS % THRU 200 M*		41	Btu PER LB	

64	INPUT-OUTPUT EFFICIENCY OF UNIT %	$\frac{\text{ITEM 31} \times 100}{\text{ITEM 29}}$

	HEAT LOSS EFFICIENCY	Btu/lb A. F. FUEL	% of A. F. FUEL
65	HEAT LOSS DUE TO DRY GAS		[illegible]
66	HEAT LOSS DUE TO MOISTURE IN FUEL		[illegible]
67	HEAT LOSS DUE TO H_2O FROM COMB. OF H_2		4.0
68	HEAT LOSS DUE TO COMBUST. IN REFUSE		[illegible]
69	HEAT LOSS DUE TO RADIATION		
70	UNMEASURED LOSSES		[illegible]
71	TOTAL		[illegible]
72	EFFICIENCY = (100 – Item 71)		[illegible]

* Not Required for Efficiency Testing

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

CALCULATION SHEET

ASME TEST FORM FOR ABBREVIATED EFFICIENCY TEST

Revised September, 1965

OWNER OF PLANT		TEST NO.	BOILER NO.	DATE

30 HEAT OUTPUT IN BOILER BLOW-DOWN WATER = LB OF WATER BLOW-DOWN PER HR × $\left[\frac{\text{ITEM 15} - \text{ITEM 17}}{1000}\right]$ = ... kB/hr

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

$$\text{DRY REFUSE PER LB OF AS FIRED FUEL} = \frac{\text{\% ASH IN AS FIRED COAL}}{100 - \text{\% COMB. IN REFUSE SAMPLE}}$$

$$\text{CARBON BURNED PER LB AS FIRED FUEL} = \frac{\text{ITEM 43}}{100} - \left[\frac{\text{ITEM 22} \times \text{ITEM 23}}{14{,}500}\right] = \ldots\ldots$$

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*

$$= \frac{11CO_2 + 8O_2 + 7(N_2 + CO)}{3(CO_2 + CO)} \times \left(\text{LB CARBON BURNED PER LB AS FIRED FUEL} + \frac{3}{8}S\right)$$

$$= \frac{11 \times \text{ITEM 32} + 8 \times \text{ITEM 33} + 7(\text{ITEM 35} + \text{ITEM 34})}{3 \times (\text{ITEM 32} + \text{ITEM 34})} \times \left[\text{ITEM 24} + \frac{\text{ITEM 47}}{267}\right] = \ldots\ldots$$

36 EXCESS AIR†

$$= 100 \times \frac{O_2 - \frac{CO}{2}}{.2682N_2 - (O_2 - \frac{CO}{2})} = 100 \times \frac{\text{ITEM 33} - \frac{\text{ITEM 34}}{2}}{.2682(\text{ITEM 35}) - (\text{ITEM 33} - \frac{\text{ITEM 34}}{2})} = \ldots\ldots$$

	HEAT LOSS EFFICIENCY	Btu/lb AS FIRED FUEL	$\frac{\text{LOSS}}{\text{HHV}} \times 100 =$	LOSS %
65	HEAT LOSS DUE TO DRY GAS = LB DRY GAS PER LB AS FIRED FUEL × C_p × ($t_{lvg} - t_{air}$) = ITEM 25 × 0.24 (ITEM 13) − (ITEM 11) = ... Unit	......	$\frac{65}{41}$ × 100 =	......
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)] = $\frac{\text{ITEM 37}}{100}$ × [(ENTHALPY OF VAPOR AT 1 PSIA & T ITEM 13) − (ENTHALPY OF LIQUID AT T ITEM 11)] = ...	......	$\frac{66}{41}$ × 100 =	......
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 × $\frac{\text{ITEM 44}}{100}$ × [(ENTHALPY OF VAPOR AT 1 PSIA & T ITEM 13) − (ENTHALPY OF LIQUID AT T ITEM 11)] = ...	......	$\frac{67}{41}$ × 100 =	......
68	HEAT LOSS DUE TO COMBUSTIBLE IN REFUSE = ITEM 22 × ITEM 23 = ...	......	$\frac{68}{41}$ × 100 =	......
69	HEAT LOSS DUE TO RADIATION* = $\frac{\text{TOTAL BTU RADIATION LOSS PER HR}}{\text{LB AS FIRED FUEL} - \text{ITEM 28}}$	......	$\frac{69}{41}$ × 100 =	......
70	UNMEASURED LOSSES**	......	$\frac{70}{41}$ × 100 =	......
71	TOTAL	......	......	......
2	EFFICIENCY = (100 − ITEM 71)	......	......	......

† 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 by provided for by assigning a mutually agreed upon value for Item 70.

Time	Feedwater flow (total gal)	Feedwater temperature (°F)	Steam pressure (psig)	Fuel flow (lb/hr nominal setting)	Comment
530					Start fuel feed, boiler on
830	4,733.5	55	2	300	
845	4,799.4	55	2.5	300	
900	4,860.9	56	2	400	SASS start; increase fuel flow
915	4,924.8	54	3	400	Method 5/8-2 start
930	5,012.7	54	2	400	
945	5,097.8	55	2.5	400	
1000	5,185.3	55	2	400	
1015	5,278.0	54	2.5	400	
1030	5,363.0	54	3.5	400	Method 5/8-2 stop
1045	5,473.6	54	2.5	400	
1100	5,555.1	54	4	400	
1115	5,660.8	54	3	400	
1130	5,785.9	54	3	400	
1145	5,892.1	55	3.5	400	HCl-2 start
1215	6,093.0	55	3	400	HCl-2 stop
1230	6,196.4	55	3	400	
1245	6,287.5	55	4	400	
1300	6,391.6	54	4	400	
1315	6,483.5	54	4	400	
1330	6,603.1	54	4	400	HCl-3 start
1345	6,708.1	54	3.5	400	
1400	6,816.5	54	3.5	400	SASS stop, HCl-3 stop
1415	6,922.7	54	3.5	400	
1430	7,003.8	54	3.5	400	
1445	7,111.2	54	3	400	
1500	7,237.2	54	4.5	400	
1515	7,320.0	54	3.5	400	
1530	7,417.7	54	4	300	
1545	7,503.8	54	7	200	VOST start
1600	7,585.2	55	7	200	
1615	7,670.0	55	7.5	200	VOST stop
1630	7,747.0	54	4.5	200	Method 5/8-3 start
1645	7,815.6	56	2	200	
1700	7,887.0	56	1	200	
1715	7,948.1	57	1	200	
1730	7,976.1	57	1	200	
1745	8,018.6	57	(0.5)	200	Method 4/8-3 stop
1752	8,032.0	57	0	200	Terminate fuel flow

Total fuel feed = 2,976.5 lb = 2,489 lb coal + 487.5 lb PET. Collect 237.5 lb bottom ash, 8 lb cyclone hopper ash.

MMARY SHEET

ASME TEST FORM
FOR ABBREVIATED EFFICIENCY TEST

PTC 4.1-a (1964)

	TEST NO. 2	BOILER NO.	DATE [illegible]
W..R OF PLANT [illegible]	LOCATION		
E. CONDUCTED BY	OBJECTIVE OF TEST		DURATION
OILER, MAKE & TYPE		RATED CAPACITY	
TOKER, TYPE & SIZE			
ULVERIZER, TYPE & SIZE		BURNER, TYPE & SIZE	
UEL USED [illegible] MINE	COUNTY	STATE	SIZE AS FIRED

PRESSURES & TEMPERATURES

No.	Item	Unit	Value
1	STEAM PRESSURE IN BOILER DRUM	psia	17.7
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	55
9	STEAM QUALITY % MOISTURE OR P. P. M.		
0	AIR TEMP. AROUND BOILER (AMBIENT)	F	[illegible]
1	TEMP. AIR FOR COMBUSTION (This is Reference Temperature) †	F	[illegible]
2	TEMPERATURE OF FUEL	F	
3	GAS TEMP. LEAVING (Boiler) (Econ.) (Air Htr.)	F	[illegible]
4	GAS TEMP. ENTERING AH (If conditions to be corrected to guarantee)	F	
	UNIT QUANTITIES		
5	ENTHALPY OF SAT. LIQUID (TOTAL HEAT)	Btu/lb	[illegible]
6	ENTHALPY OF (SATURATED) (SUPERHEATED) STM.	Btu/lb	[illegible]
7	ENTHALPY OF SAT. FEED TO (BOILER) (ECON.)	Btu/lb	23.1
8	ENTHALPY OF REHEATED STEAM R. H. INLET	Btu/lb	
9	ENTHALPY OF REHEATED STEAM R. H. OUTLET	Btu/lb	
20	HEAT ABS/LB OF STEAM (ITEM 16 – ITEM 17)	Btu/lb	113[illegible]
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	[illegible]
23	Btu PER LB IN REFUSE (WEIGHTED AVERAGE)	Btu/lb	[illegible]
24	CARBON BURNED PER LB AS FIRED FUEL	lb/lb	.703
25	DRY GAS PER LB AS FIRED FUEL BURNED	lb/lb	13.7[illegible]
	HOURLY QUANTITIES		
26	ACTUAL WATER EVAPORATED	lb/hr	
27	REHEAT STEAM FLOW	lb/hr	
28	RATE OF FUEL FIRING (AS FIRED wt)	lb/hr	
29	TOTAL HEAT INPUT $\frac{(\text{Item 28} \times \text{Item 41})}{1000}$	kB/hr	
30	HEAT OUTPUT IN BLOW-DOWN WATER	kB/hr	
31	TOTAL HEAT OUTPUT $\frac{(\text{Item 26} \times \text{Item 20}) + (\text{Item 27} \times \text{Item 21})}{1000} + \text{Item 30}$	kB/hr	
	FLUE GAS ANAL. (BOILER) (ECON) (AIR HTR) OUTLET		
32	CO_2	% VOL	12.9
33	O_2	% VOL	[illegible]
34	CO	% VOL	[illegible]
35	N_2 (BY DIFFERENCE)	% VOL	[illegible]
36	EXCESS AIR	%	77

FUEL DATA

No.	COAL AS FIRED PROX. ANALYSIS	% wt
37	MOISTURE	
38	VOL MATTER	
39	FIXED CARBON	
40	ASH	
	TOTAL	
41	Btu per lb AS FIRED	[illegible]
42	ASH SOFT TEMP.* ASTM METHOD	
	COAL OR OIL AS FIRED ULTIMATE ANALYSIS	
43	CARBON	[illegible]
44	HYDROGEN	[illegible]
45	OXYGEN	[illegible]
46	NITROGEN	[illegible]
47	SULPHUR	[illegible]
40	ASH	[illegible]
37	MOISTURE	[illegible]
	TOTAL	[illegible]
	COAL PULVERIZATION	
48	GRINDABILITY INDEX*	
49	FINENESS % THRU 50 M*	
50	FINENESS % THRU 200 M*	

No.	OIL	
51	FLASH POINT F*	
52	Sp. Gravity Deg. API*	
53	VISCOSITY AT SSU* BURNER SSF	
44	TOTAL HYDROGEN % wt	
41	Btu per lb	

No.	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	

No.	Item		
64	INPUT-OUTPUT EFFICIENCY OF UNIT %	$\frac{\text{ITEM 31} \times 100}{\text{ITEM 29}}$	

No.	HEAT LOSS EFFICIENCY	Btu/lb A. F. FUEL	% of A. F. FUEL
65	HEAT LOSS DUE TO DRY GAS		7.5
66	HEAT LOSS DUE TO MOISTURE IN FUEL		[illegible]
67	HEAT LOSS DUE TO H_2O FROM COMB. OF H_2		[illegible]
68	HEAT LOSS DUE TO COMBUST. IN REFUSE		[illegible]
69	HEAT LOSS DUE TO RADIATION		
70	UNMEASURED LOSSES		
71	TOTAL		[illegible]
72	EFFICIENCY = (100 – Item 71)		[illegible]

3-7

* Not Required for Efficiency Testing

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

ASME TEST FORM FOR ABBREVIATED EFFICIENCY TEST

CALCULATION SHEET

Revised September, 1965

OWNER OF PLANT | TEST NO. | BOILER NO. | DATE

Item	Calculation
30	HEAT OUTPUT IN BOILER BLOW-DOWN WATER = LB OF WATER BLOW-DOWN PER HR × $\left[\frac{\text{ITEM 15} - \text{ITEM 17}}{1000}\right]$ = ... kB/hr
24	*If impractical to weigh refuse, this item can be estimated as follows* DRY REFUSE PER LB OF AS FIRED FUEL = $\frac{\text{\% ASH IN AS FIRED COAL}}{100 - \text{\% COMB. IN REFUSE SAMPLE}}$ CARBON BURNED PER LB AS FIRED FUEL = $\frac{\text{ITEM 43}}{100} - \left[\frac{\text{ITEM 22} \times \text{ITEM 23}}{14{,}500}\right]$ = ... 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 = $\frac{11CO_2 + 8O_2 + 7(N_2 + CO)}{3(CO_2 + CO)}$ × (LB CARBON BURNED PER LB AS FIRED FUEL + $\frac{3}{8}$ S) = $\frac{11 \times \text{ITEM 32} + 8 \times \text{ITEM 33} + 7(\text{ITEM 35} + \text{ITEM 34})}{3 \times (\text{ITEM 32} + \text{ITEM 34})} \times \left[\text{ITEM 24} + \frac{\text{ITEM 47}}{267}\right]$ = ...
36	EXCESS AIR† = 100 × $\frac{O_2 - \frac{CO}{2}}{.2682N_2 - (O_2 - \frac{CO}{2})}$ = 100 × $\frac{\text{ITEM 33} - \frac{\text{ITEM 34}}{2}}{.2682\ (\text{ITEM 35}) - (\text{ITEM 33} - \frac{\text{ITEM 34}}{2})}$ = ...

Item	HEAT LOSS EFFICIENCY	Btu/lb AS FIRED FUEL	$\frac{\text{LOSS}}{\text{HHV}}$ × 100 =	LOSS %
65	HEAT LOSS DUE TO DRY GAS = LB DRY GAS PER LB AS FIRED FUEL × C_p × ($t_{lvg} - t_{air}$) = ITEM 25 × 0.24 (ITEM 13) − (ITEM 11) = ...	......	$\frac{65}{41}$ × 100 =	7.3
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)] = $\frac{\text{ITEM 37}}{100}$ × [(ENTHALPY OF VAPOR AT 1 PSIA & T ITEM 13) − (ENTHALPY OF LIQUID AT T ITEM 11)] = ...	......	$\frac{66}{41}$ × 100 =	......
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 × $\frac{\text{ITEM 44}}{100}$ × [(ENTHALPY OF VAPOR AT 1 PSIA & T ITEM 13) − (ENTHALPY OF LIQUID AT T ITEM 11)] = ...	......	$\frac{67}{41}$ × 100 =	......
68	HEAT LOSS DUE TO COMBUSTIBLE IN REFUSE = ITEM 22 × ITEM 23 = ...	......	$\frac{68}{41}$ × 100 =	1.2
69	HEAT LOSS DUE TO RADIATION* = $\frac{\text{TOTAL BTU RADIATION LOSS PER HR}}{\text{LB AS FIRED FUEL} - \text{ITEM 28}}$	......	$\frac{69}{41}$ × 100 =	......
70	UNMEASURED LOSSES **	......	$\frac{70}{41}$ × 100 =	......
71	TOTAL	......	......	......
72	EFFICIENCY = (100 − ITEM 71)	......	......	......

† 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 by provided for by assigning a mutually agreed upon value for Item 70.

SECTION 4

SAMPLING DATA SHEETS

4.1 CONTINUOUS MONITOR EMISSION DATA

4.2 FIELD DATA SHEETS FOR EPA METHOD 5/8, SASS, HCl, AND VOST TRAINS

4.1 CONTINUOUS MONITOR EMISSION DATA

Plant [illegible]

Location [illegible]

Date [illegible]

CONTINUOUS MONITOR FIELD DATA

Time (24-hr clock)	Ambient Temperature (°F) WBT	Ambient Temperature (°F) DBT	Barometric Pressure (in. Hg)	Instrument Van Temperature (°F)	Heated Sample Line Analysis (Wet): Sample Location Specify: Inlet or Outlet	NO^a (ppm)	$NO_x+NH_3{}^b$ (ppm)	$NO_x{}^c$ (ppm)	$NO_2{}^d$ (ppm)	$NH_3{}^e$ (ppm)	Sample Gas Temperature (°F)	Cold Sample Line Analysis (Dry): Sample Location Specify: Inlet or Outlet	NO (ppm)	NO_x (ppm)	NO_2 (ppm)	O_2 (%)	CO_2 (%)	CO (%)	CO (ppm)	TUHC (ppm)	Sample Gas Temperature (°F)
1150				75										210		6.5	[illegible]		[illegible]	16	
1155				[illegible]										[illegible]		6.6	12.3		130	[illegible]	
1200														[illegible]		[illegible]	12.2		[illegible]	16	
1205				[illegible]										210		[illegible]	[illegible]		[illegible]	[illegible]	
1210				[illegible]										205		7.5	11.6		120	14	
1215														205		7.5	11.7		120	[illegible]	
1220														[illegible]		[illegible]	12.0		[illegible]	16	
1225														210		6.9	12.3		[illegible]	[illegible]	
1230						Ambient								[illegible]							
1235						Ambient															
1240						Stack								[illegible]		13.6	7.8		50	6	
1245														[illegible]		12.5	7.1		[illegible]	6	
1250														150		[illegible]	[illegible]		[illegible]	6	

[a] NO = direct sample measurement (no conversion)
[b] $NO_x + NH_3$ = sample path through stainless steel converter
[c] NO_x = sample path through molybdenum converter

[d] $NO_2 = NO_x - NO$
[e] $NH_3 = (NO_x + NH_3) - NO_x$

Notes:

CONTINUOUS MONITOR FIELD DATA

Plant [illegible]

Location [illegible]

Date [illegible]

Time (24-hr clock)	Ambient Temperature (°F) WBT	Ambient Temperature (°F) DBT	Barometric Pressure (in. Hg)	Instrument Van Temperature (°F)	Heated Sample Line Analysis (Wet): Sample Location Specify: Inlet or Outlet	NO^a (ppm)	$NO_x+NH_3{}^b$ (ppm)	$NO_x{}^c$ (ppm)	$NO_2{}^d$ (ppm)	$NH_3{}^e$ (ppm)	Sample Gas Temperature (°F)	Cold Sample Line Analysis (Dry): Sample Location Specify: Inlet or Outlet	NO (ppm)	NO_x (ppm)	NO_2 (ppm)	O_2 (%)	CO_2 (%)	CO (%)	CO (ppm)	TUHC (ppm)	Sample Gas Temperature (°F)
1255														155		[illegible]	8.4	8.3	[illegible]	[illegible]	
1300														[illegible]		[illegible]	8.4	8.3	95	[illegible]	
1305														160		[illegible]	8.6		120	[illegible]	
1310							[illegible]							205		[illegible]	12.1		170	[illegible]	
1315														220		6.5	12.4		[illegible]	[illegible]	
1320														210		6.5	12.1		[illegible]	11	
1325														200		7.0	12.2		175	12	
1330														195		6.5	12.5		[illegible]	[illegible]	
1335													170	[illegible]		6.5	12.6		170	9	
1340														185		6.8	12.6		[illegible]	9	
1345														185		6.8	12.5		190	6	
1350														[illegible]		6.5	12.7		200	[illegible]	
1355														[illegible]		7.0	12.4		[illegible]	[illegible]	

$^a NO$ = direct sample measurement (no conversion)

$^b NO_x + NH_3$ = sample path through stainless steel converter

$^c NO_x$ = sample path through molybdenum converter

$^d NO_2 = NO_x - NO$

$^e NH_3 = (NO_x + NH_3) - NO_x$

Notes:

Plant Rock of Ages

Location Sandhouse Boiler

Date 7-6-83

CONTINUOUS MONITOR FIELD DATA

Time (24-hr clock)	Ambient Temperature (°F) WBT	Ambient Temperature (°F) DBT	Barometric Pressure (in. Hg)	Instrument Van Temperature (°F)	Heated Sample Line Analysis (Wet): Sample Location Specify: Inlet or Outlet	NO^a (ppm)	NO_x+NH_3 [b] (ppm)	NO_x [c] (ppm)	NO_2 [d] (ppm)	NH_3 [e] (ppm)	Sample Gas Temperature (°F)	Cold Sample Line Analysis (Dry): Sample Location Specify: Inlet or Outlet	NO (ppm)	NO_x (ppm)	NO_2 (ppm)	O_2 (%)	CO_2 (%)	CO (%)	CO (ppm)	TUHC (ppm)	Sample Gas Temperature (°F)
1400														200		6.5	129		210	10	
1405														200		6.0	134		210	8	
1410														205		6.0	132		210	10	
1415														210		6.3	124		210	10	
1420														195		6 7	11.3		200	12	
1425														200		7.2	11.6		200	12	
1430														195		7.5	10 9		200	13	
1435														190		8.5	10 1		201	15	
1440														195		7.2	9.7		210	14	
1445														125		9 1	9.7		200	14	
1450														190		8 5	10.3		200	13	
1455														200		7.8	10.6		190	11	
1500														200		7 0	11.5		190	11	

a NO = direct sample measurement (no conversion)
b $NO_x + NH_3$ = sample path through stainless steel converter
c NO_x = sample path through molybdenum converter

d $NO_2 = NO_x - NO$
e $NH_3 = (NO_x + NH_3) - NO_x$

Notes:

Plant Rock of Ages

Location [illegible]

Date 1-6-83

CONTINUOUS MONITOR FIELD DATA

Time (24-hr clock)	Ambient Temperature (°F)		Barometric Pressure (in. Hg)	Instrument Van Temperature (°F)	Heated Sample Line Analysis (Wet)							Cold Sample Line Analysis (Dry)									
	WBT	DBT			Sample Location Specify: Inlet or Outlet	NO[a] (ppm)	NO_x+NH_3[b] (ppm)	NO_x[c] (ppm)	NO_2[d] (ppm)	NH_3[e] (ppm)	Sample Gas Temperature (°F)	Sample Location Specify: Inlet or Outlet	NO (ppm)	NO_x (ppm)	NO_2 (ppm)	O_2 (%)	CO_2 (%)	CO (%)	CO (ppm)	TUHC (ppm)	Sample Gas Temperature (°F)
1505														200		7.0	11.6		160	11	
1510														200		7.0	11.6		170	13	
1515							STACK							130		12.7	6.5		110	1	
1520														110		12.7	6.5		100	0	
1525														130		12.5	6.1		100	0	
1530														130		12.6	6.3		90	0	
1535														130		12.5	6.3		90	0	
1540														130		12.3	6.5		90	0	
1545							BOILER (10 MIN)									6.2	12.5		150	7	
1550														190		6.2	12.5		150	1	
1555														190		6.1	12.9		150	0	
1600														200		6.6	12.5		150	3	
1605														200		6.5	12.3		150		

[a] NO = direct sample measurement (no conversion)
[b] $NO_x + NH_3$ = sample path through stainless steel converter
[c] NO_x = sample path through molybdenum converter
[d] $NO_2 = NO_x - NO$
[e] $NH_3 = (NO_x + NH_3) - NO_x$

Notes:

CONTINUOUS MONITOR FIELD DATA

Plant Rock of Ages

Location Shed House Boiler

Date 7-6-83

Time (24-hr clock)	Ambient Temperature (°F)		Barometric Pressure (in. Hg)	Instrument Van Temperature (°F)	Heated Sample Line Analysis (Wet)							Cold Sample Line Analysis (Dry)									
	WBT	DBT			Sample Location Specify: Inlet or Outlet	NO^a (ppm)	NO_x+NH_3 [b] (ppm)	NO_x [c] (ppm)	NO_2 [d] (ppm)	NH_3 [e] (ppm)	Sample Gas Temperature (°F)	Sample Location Specify: Inlet or Outlet	NO (ppm)	NO_x (ppm)	NO_2 (ppm)	O_2 (%)	CO_2 (%)	CO (%)	CO (ppm)	TUHC (ppm)	Sample Gas Temperature (°F)
1610														185		6.9	12.2		150	8	
1615														185		7.2	12.2		160	7	
1620														185		7.4	12.1		160	11	
1625														195		6.9	12.3		170	13	
1630														200		6.5	12.3		180	11	
1635														200		7.0	11.9		190		
1640														200		7.3	11.5		200		
1645														210		7.5	11.2		220		
1650														210		7.3	11.4		260		
1655														210		7.2	11.5		230		
1700														210		7.0	11.6		210		
1705																					
1710																					

[a] NO = direct sample measurement (no conversion)
[b] $NO_x + NH_3$ = sample path through stainless steel converter
[c] NO_x = sample path through molybdenum converter
[d] $NO_2 = NO_x - NO$
[e] $NH_3 = (NO_x + NH_3) - NO_x$

Notes:

CONTINUOUS MONITOR FIELD DATA

Plant [illegible]

Location [illegible]

Date 7-7-83

Time (24-hr clock)	Ambient Temperature (°F) WBT	Ambient Temperature (°F) DBT	Barometric Pressure (in. Hg)	Instrument Van Temperature (°F)	Heated Sample Line Analysis (Wet): Sample Location Specify: Inlet or Outlet	NO^a (ppm)	$NO_x+NH_3{}^b$ (ppm)	$NO_x{}^c$ (ppm)	$NO_2{}^d$ (ppm)	$NH_3{}^e$ (ppm)	Sample Gas Temperature (°F)	Cold Sample Line Analysis (Dry): Sample Location Specify: Inlet or Outlet	NO (ppm)	NO_x (ppm)	NO_2 (ppm)	O_2 (%)	CO_2 (%)	CO (%)	CO (ppm)	TUHC (ppm)	Sample Gas Temperature (°F)
0900			28.60											165		10.5	8.2		230	3	
0905														200		7.6	11.1		210	3	
0910														200		7.0	11.4		200	3	
0915														[illegible]		6.1	12.2		200	3	
0920														210		6.5	12.0		210	3	
0925														200		6.6	11.5		200	3	
0930														*145		6.3	11.1		260	3	
0935														190		6.0	12.6		230	3	
0940														200		6.4	12.0		170	3	
0945														200		6.7	11.4		165	3	
0950														200		7.1	11.0		165	3	
0955									[illegible]		(transition)			165		*10.1	*7.3		125	3	
1000														165		7.8	8.4		70	2	

aNO = direct sample measurement (no conversion)
bNOx + NH_3 = sample path through stainless steel converter
cNO_x = sample path through molybdenum converter

d$NO_2 = NO_x - NO$
e$NH_3 = (NOx + NH_3) - NO_x$

Notes:

CONTINUOUS MONITOR FIELD DATA

Plant: Rock of Ages

Location: Saw House Boiler

Date: 7-1-83

Time (24-hr clock)	Ambient Temperature (°F)		Barometric Pressure (in. Hg)	Instrument Van Temperature (°F)	Heated Sample Line Analysis (Wet)							Cold Sample Line Analysis (Dry)									
	WBT	DBT			Sample Location Specify: Inlet or Outlet	NO^a (ppm)	$NO_x+NH_3{}^b$ (ppm)	$NO_x{}^c$ (ppm)	$NO_2{}^d$ (ppm)	$NH_3{}^e$ (ppm)	Sample Gas Temperature (°F)	Sample Location Specify: Inlet or Outlet	NO (ppm)	NO_x (ppm)	NO_2 (ppm)	O_2 (%)	CO_2 (%)	CO (%)	CO (ppm)	TUHC (ppm)	Sample Gas Temperatur (°F)
1005														160		8.8	8.2		70	70.2	
1010														160		8.7	8.4		55	2	
1015														160		8.3	8.9		60	1	
1020														175		7.9	9.2		50	1	
1025														195		7.3	9.9		65	1	
1030							Boiler							200		5.1	12.6		100	3	
1035													195	195		6.3	12.00		85	3	
1040													195			6.3	12.0		95	3	
1045													195			6.3	11.9		85	3	
1050														200		5.4	12.9		95	2	
1055														195		4.5	13.3		105	1	
1100														155		6.0	11.1		70	1	
1105														115		7.4	9.3		55	2	

[a]NO = direct sample measurement (no conversion)
[b]$NO_x + NH_3$ = sample path through stainless steel converter
[c]NO_x = sample path through molybdenum converter
[d]$NO_2 = NO_x - NO$
[e]$NH_3 = (NO_x + NH_3) - NO_x$

Notes:

CONTINUOUS MONITOR FIELD DATA

Plant *Rock of Ages*

Location *Smokehouse Boiler*

Date *1-7-83*

Time (24-hr clock)	Ambient Temperature (°F) WBT	Ambient Temperature (°F) DBT	Barometric Pressure (in. Hg)	Instrument Van Temperature (°F)	Heated Sample Line Analysis (Wet): Sample Location Specify: Inlet or Outlet	NO^a (ppm)	$NO_x+NH_3{}^b$ (ppm)	$NO_x{}^c$ (ppm)	$NO_2{}^d$ (ppm)	$NH_3{}^e$ (ppm)	Sample Gas Temperature (°F)	Cold Sample Line Analysis (Dry): Sample Location Specify: Inlet or Outlet	NO (ppm)	NO_x (ppm)	NO_2 (ppm)	O_2 (%)	CO_2 (%)	CO (%)	CO (ppm)	TUHC (ppm)	Sample Gas Temperature (°F)
1110														135		6.8	10.1		40	1	
1115														120		7.8	8.8		20	2	
1120														120		7.8	8.7		15	2	
1125							changed filter														
1130								"		"											
1135							adjusted air flow on boiler							195		4.7	13.4		70	3	
1140														185		4.2	13.1		85	3	
1145														135		3.2	14.8		150	2	
1150														200		3.7	14.5		65	2	
1155														200		3.6	14.6		20	2	
1200														185		4.3	13.8		85	2	
1205														190		4.3	13.6		75	2	
1210														195		4.4	13.6		60	2	

[a] NO = direct sample measurement (no conversion)
[b] $NO_x + NH_3$ = sample path through stainless steel converter
[c] NO_x = sample path through molybdenum converter

[d] $NO_2 = NO_x - NO$
[e] $NH_3 = (NO_x + NH_3) - NO_x$

Notes:

Plant Rock of Ages

Location Gas House Boiler

Date 7-7-83

CONTINUOUS MONITOR FIELD DATA

Time (24-hr clock)	Ambient Temperature (°F)		Barometric Pressure (in. Hg)	Instrument Van Temperature (°F)	Heated Sample Line Analysis (Wet)							Cold Sample Line Analysis (Dry)									
	WBT	DBT			Sample Location Specify: Inlet or Outlet	NO^a (ppm)	$NO_x+NH_3{}^b$ (ppm)	$NO_x{}^c$ (ppm)	$NO_2{}^d$ (ppm)	$NH_3{}^e$ (ppm)	Sample Gas Temperature (°F)	Sample Location Specify: Inlet or Outlet	NO (ppm)	NO_x (ppm)	NO_2 (ppm)	O_2 (%)	CO_2 (%)	CO (%)	CO (ppm)	TUHC (ppm)	Sample Gas Temperature (°F)
1215														205		4.0	14.1		75	2	
1220														200		3.5	14.7		120	2	
1225														190		3.4	14.4		130	3	
1230														176		2.6	15.8		145	4	
1235														95		2.4	14.6		120 x	3	
1240														190		3.2	15.1		105	3	
1245														200		3.4	14.6		100	3	
1250														175		3.1	15.0		135	2	
1255														185		3.8	14.3		125	2	
1300														195		3.8	14.2		115	2	
1305														205		3.2	14.1		90	3	
1310														175		4.0	13.9		90	2	
1315						Stack traverse –						Cold	dry								

^{a}NO = direct sample measurement (no conversion)
^{b}$NO_x + NH_3$ = sample path through stainless steel converter
^{c}NO_x = sample path through molybdenum converter

^{d}$NO_2 = NO_x - NO$
^{e}$NH_3 = (NO_x + NH_3) - NO_x$

Notes:

CONTINUOUS MONITOR FIELD DATA

Plant: Rock of Ages

Location: Saw House Boiler

Date: 2-1-83

Time (24-hr clock)	Ambient Temperature (°F) WBT	Ambient Temperature (°F) DBT	Barometric Pressure (in. Hg)	Instrument Van Temperature (°F)	Heated Sample Line Analysis (Wet): Sample Location Specify: Inlet or Outlet	NO[a] (ppm)	$NO_x + NH_3$[b] (ppm)	NO_x[c] (ppm)	NO_2[d] (ppm)	NH_3[e] (ppm)	Sample Gas Temperature (°F)	Cold Sample Line Analysis (Dry): Sample Location Specify: Inlet or Outlet	NO (ppm)	NO_x (ppm)	NO_2 (ppm)	O_2 (%)	CO_2 (%)	CO (%)	CO (ppm)	TUHC (ppm)	Sample Gas Temperature (°F)
1320								STACK DATA						150		9.6	5.6		40	3	
1325														11[illegible]		9.6	5.8		25	3	
1330														95		9.5	5.6		35	3	
1335														90		10.0	4.9		[illegible]	4	
1340								BOILER DATA						195		3.4	13.8		80	150	
1345														185		3.5	13.4		115	40	
1350														180		4.0	12.8		110	38	
1355														185		4.1	12.5		125	28	
1400														115		3.4	13.3		140	20	
1405														190		3.5	13.2		190	15	
1410														205		3.4	13.5		175	12	
1415														200		3.5	13.5		[illegible]	9	
1420														190		3.2	13.7		455*	12	

[a]NO = direct sample measurement (no conversion)
[b]$NO_x + NH_3$ = sample path through stainless steel converter
[c]NO_x = sample path through molybdenum converter
[d]$NO_2 = NO_x - NO$
[e]$NH_3 = (NO_x + NH_3) - NO_x$

Notes:

Plant Rock of Ages

Location Saw House Boiler

Date 7-1-83

CONTINUOUS MONITOR FIELD DATA

Time (24-hr clock)	Ambient Temperature (°F)		Barometric Pressure (in. Hg)	Instrument Van Temperature (°F)	Heated Sample Line Analysis (Wet)							Cold Sample Line Analysis (Dry)									
	WBT	DBT			Sample Location Specify: Inlet or Outlet	NO[a] (ppm)	NO_x+NH_3[b] (ppm)	NO_x[c] (ppm)	NO_2[d] (ppm)	NH_3[e] (ppm)	Sample Gas Temperature (°F)	Sample Location Specify: Inlet or Outlet	NO (ppm)	NO_x (ppm)	NO_2 (ppm)	O_2 (%)	CO_2 (%)	CO (%)	CO (ppm)	TUHC (ppm)	Sample Gas Temperature (°F)
1425														175		3.4	14.1		425	13	
1430														185		3.4	14.7		375	1	
1435														175		3.1	14.4		500	10	
1440														175		2.9	14.4		720	19	
1445														200		4.1	13.7		265	5	
1450														190		3.1	14.7		265	4	
1455														190		2.5	15.0		235	3	
1500														190		2.5	15.0		285	3	
1505														195		3.0	14.0		215	2	
1510														190		3.9	13.1		195	3	
1515														190		4.1	12.9		205	3	
1520														180		4.0	12.9		195	3	
1525														185		3.9	12.8		200	3	

[a]NO = direct sample measurement (no conversion)
[b]$NO_x + NH_3$ = sample path through stainless steel converter
[c]NO_x = sample path through molybdenum converter
[d]$NO_2 = NO_x - NO$
[e]$NH_3 = (NO_x + NH_3) - NO_x$

Notes:

CONTINUOUS MONITOR FIELD DATA

Plant: Rock of Ages

Location: Saw Mill Boiler

Date: 7-1-83

Time (24-hr clock)	Ambient Temperature (°F) WBT	Ambient Temperature (°F) DBT	Barometric Pressure (in. Hg)	Instrument Van Temperature (°F)	Heated Sample Line Analysis (Wet): Sample Location Specify: Inlet or Outlet	NO^a (ppm)	$NO_x + NH_3{}^b$ (ppm)	$NO_x{}^c$ (ppm)	$NO_2{}^d$ (ppm)	$NH_3{}^e$ (ppm)	Sample Gas Temperature (°F)	Cold Sample Line Analysis (Dry): Sample Location Specify: Inlet or Outlet	NO (ppm)	NO_x (ppm)	NO_2 (ppm)	O_2 (%)	CO_2 (%)	CO (%)	CO (ppm)	TUHC (ppm)	Sample Gas Temperature (°F)
1530														185		3.2	13.3		195	4	
1535														165		3.6	12.2		125	4	
1540														100		2.4	13.2		1050	150	
1545														110		3.1	12.6		565	22	
1550														115		2.9	13.3		630	15	
1555														135		3.6	13.5		305	4	
1600														175		5.1	12.1		170	0	
1605																					
1610																					
1615																					
1620													WATER CONTAMINATION								
1625																					
1630																					

VOID DATA

^{a}NO = direct sample measurement (no conversion)
^{b}NOx + NH_3 = sample path through stainless steel converter
^{c}NO_x = sample path through molybdenum converter
^{d}NO_2 = NO_x - NO
^{e}NH_3 = (NOx + NH_3) - NO_x

Notes:

CONTINUOUS MONITOR FIELD DATA

Plant ______________________

Location ______________________

Date ______________________

Time (24-hr clock)	Ambient Temperature (°F)		Barometric Pressure (in. Hg)	Instrument Van Temperature (°F)	Heated Sample Line Analysis (Wet)							Cold Sample Line Analysis (Dry)									
	WBT	DBT			Sample Location Specify: Inlet or Outlet	NO[a] (ppm)	NO_x+NH_3[b] (ppm)	NO_x[c] (ppm)	NO_2[d] (ppm)	NH_3[e] (ppm)	Sample Gas Temperature (°F)	Sample Location Specify: Inlet or Outlet	NO (ppm)	NO_x (ppm)	NO_2 (ppm)	O_2 (%)	CO_2 (%)	CO (%)	CO (ppm)	TUHC (ppm)	Sample Gas Temperature (°F)
1635						VOID DATA - WATER CONTAMINATION															
1640														145		x 25 2.8	9.2		190		
1645														140		x 35 2.8	8.8		210		
1650														140		x 25 3.1	8.6		225		
1655														146		8.7	8.7		225		
1700														150		8.4	8.3				
1705														135							
1710																					
1715																					
1720																					
1725																					
1730																					
1735																					

[a] NO = direct sample measurement (no conversion)
[b] $NO_x + NH_3$ = sample path through stainless steel converter
[c] NO_x = sample path through molybdenum converter
[d] $NO_2 = NO_x - NO$
[e] $NH_3 = (NO_x + NH_3) - NO_x$

Notes:

4.2 FIELD DATA SHEETS FOR EPA METHOD 5/8, SASS, HCl, AND VOST TRAINS

FIELD DATA

Plant Rock of Ages
Date 7-6-[illegible]
Sample Location [illegible] House
Sample Type [illegible]
Run Number 1
Operator V. [illegible]
Ambient Temperature ~60°F
Barometric Pressure 28.24 (1130)
Static Pressure, (H_2O) -.10
Filter Number(s) 96-266

Impinger Volumes		
Initial	Final	Net Gain
506.5	495.1	-11.4
[illegible]	[illegible]	32.0
526.7	540.2	13.5

Silica Gel

Initial	Final	Net Gain
688.7	702.7	14.0

SASS Condensate

Total Volume 54.1

* Probe Length and Type 5' [illegible]
Nozzel Size & I.D. .387
Pitot Coefficient & I.D. 0.850
Assumed Moisture .075
Molecular Weight, Dry, (M_d)
Meter Box Number NAPP-[illegible]
Meter Coefficient .735
α Factor 1.012
K = 841.377
$K(Nd)^4$ = 841.4 x $(.387)^4$ = 18.873
$\Delta H = K(N_d)^4 \left(\frac{Tm}{Ts}\right) (P)$

Leak Check: Initial at 15 " Hg, .05 CFM
Final at 12 " Hg, .025 CFM
Pitot Leak Check: ok

Traverse Point Number	Sampling Time, min	Clock Time (24-hr) Clock	Gas Meter Reading (V_m), ft³	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. $\sqrt{\Delta P}$
	0	1120	Init. 593.941												
A-1	5		596.1	0.055	.21	.21	[illegible]		62		[illegible]	66	[illegible]	[illegible]	[illegible]
2	10		[illegible]	.055	.22	.22	[illegible]		55		180	[illegible]	[illegible]		
3	15		601.49	[illegible]	.21	.21	[illegible]		56		[illegible]	[illegible]	[illegible]		[illegible]
4	20		[illegible]	[illegible]	[illegible]	.22	[illegible]		54		195	[illegible]	[illegible]	12	[illegible]
5	[illegible]		[illegible]	.05	[illegible]	[illegible]	275		[illegible]		[illegible]	70	61	9.5	[illegible]
6	[illegible]		604.015	.05	[illegible]	.61	26[illegible]		[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]		608.605 [illegible]	.07	[illegible]	[illegible]	[illegible]		—		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
8			614.11	[illegible]	.12	[illegible]	[illegible]		—		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9	45		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		—		175	[illegible]	70	[illegible]	[illegible]

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Comments: * [illegible]

Traverse Point Number	Sampling Time, min	Clock Time (24-hr) Clock	Gas Meter Reading (V_m), ft^3 Init.	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. $\sqrt{\Delta P}$
B-10	50		619.558	.045	.59	.51	30[illegible]		—		175	71	71	[illegible]	.21
B-11	55		6[illegible].725	.045	[illegible]	.51	292		—		[illegible]	71	71	6	[illegible]
B-12	60	1315	624.071	.045	.51	.51	280		—		[illegible]	71	71	6	[illegible]
			[illegible]			.703	295.2					69.8	69.2		.221

69.5

Run No. [illegible]

Date [illegible]

Sampling Location [illegible]

Comments:

FIELD DATA

Plant: Rock of Ages
Date: 7-6-82
Sample Location: Saw House
Sample Type: SASS
Run Number: 1
Operator: R. W. Kaufmann
Ambient Temperature: ___
Barometric Pressure: 28.24
Static Pressure, (H_2O): -.10
Filter Number(s): ___

Leak Check: Initial at 18 " Hg, .03 CFM OM. + Imp
Initial ~~Final~~ at 10 " Hg, .05 CFM entire train
Pitot Leak Check: ok

Impinger Volumes Initial	Final	Net Gain
500	[illegible]	40
500	[illegible]	-4
500	[illegible]	4
Silica Gel		
[illegible]	[illegible]	156
[illegible]	[illegible]	131.7

SASS Condensate: [illegible]
Total Volume: 964.7

Probe Length and Type: 3' stainless
Nozzel Size & I.D.: 1.140
Pitot Coefficient & I.D.: assume .82
Assumed Moisture: 7.5%
Molecular Weight, Dry, (M_d): ___
Meter Box Number: 016
Meter Coefficient: 3.514
α Factor: 0.973
K = N/A
$K(Nd)^4$ = ___ x (___)^4 = ___
$\Delta H = K(N_d)^4 \left(\frac{Tm}{Ts}\right)$ (P)

Traverse Point Number	Sampling Time, min / Clock Time (24-hr) Clock	Gas Meter Reading (V_m), ft^3	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	Out	Pump Vacuum in. Hg	Avg. $\sqrt{\Delta P}$
	0 / 1149	Init. 787.728												
	10	825.61	0.05	2.14	2.1	259	398		60	405	65	65	15	
	20	865.0	0.05	2.14	2.1	281	378		56	402	41	65	15	
	30	903.01	0.045	2.15	2.0	276	385		58	401	71	66	15	
	40	941.852	.045	2.15	2.1	270	382		57	399	73	67	15	
	50	980.7	.055	[illegible]	[illegible]	273	403		56	405	[illegible]	[illegible]	14	
	60	1018.8	.06	2.15	2.1	279	406		57	400	72	66	17	
	70	58.1	.06	2.17	2.0	288	37[illegible]		58	397	76	67	17	
	80		.06	2.17	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
	90				[illegible]					[illegible]			[illegible]	

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Comments: 40 min [illegible] 3 cfg [illegible] change [illegible] restart 12:37

Traverse Point Number	Sampling Time, min / Clock Time (24-hr) Clock	Gas Meter Reading (V_m), ft^3 Init.	Velocity Head (ΔP_s), in. H_2O	Orifice Pressure Differential (ΔH), in. H_2O Desired	Orifice Pressure Differential (ΔH), in. H_2O Actual	Temperature °F Stack	Temperature °F Probe	Temperature °F Impinger	Temperature °F Organic Module	Temperature °F Oven	Temperature °F Gas Meter In	Temperature °F Gas Meter Out	Pump Vacuum in. Hg	Avg. $\sqrt{\Delta P}$
	260	192.884			2012						66.6			0.234
					274.3									

Run No. 1   Date 7/6/83   Sampling Location [illegible]

Comments:

'ICAL DATA

Plant Rock of Ages 7735.61 Sample No. 5+55-1

Sampling Location ______ Run No. 1

Recovered By ______ Recovery Date 7/6/83 Run Date 7/6/83

Comments ______

Analyst Responsible ______

Calculations and Report Reviewed By ______ Report Date ______

FILTERS USED

No. ______

CYCLONES

	Used (yes/no)	Pretared Container (No.)
10μ		
3μ		
1μ		

IMPINGER VOLUMES

	Initial	Final
First (H_2O_2)	500 mℓ	540 mℓ
Second (APS + $AgNO_3$)	500 mℓ	458 mℓ
Third (APS + $AgNO_3$)	500 mℓ	504 mℓ
TOTALS	1500 mℓ	1502 mℓ

Gain 02 mℓ

SILICA GEL WEIGHTS

	Initial	Final
	800.0 g	956.0 g
	800.0 g	931.7 g
	g	g
TOTALS	1600.0 g	1887.7 g

Gain 287.7 g

CONDENSATE

TOTAL VOLUME COLLECTED ______ mℓ

Volume Neat ______ mℓ

Volume Extracted ______ mℓ

Volume $CH_2C\ell_2$ Extract (3 x ____ mℓ) ______ mℓ

Extracted Condensate: pH Neat ______

Amount 96% HNO_3 added ______

pH Final ______

TOTAL GAIN ______ mℓ

FIELD DATA

Plant [illegible]
Date [illegible]
Sample Location [illegible]
Sample Type HCL
Run Number 1
Operator [illegible]
Ambient Temperature 56
Barometric Pressure 25.21
Static Pressure, (H_2O) -.10
Filter Number(s) N/A

Impinger Volumes Initial	Final	Net Gain
100		
100		
M/T		
Silica Gel		
[illegible]	[illegible]	

SASS Condensate ______
Total Volume [illegible]

Probe Length and Type [illegible]
Nozzel Size & I.D. [illegible]
Pitot Coefficient & I.D. [illegible]
Assumed Moisture .075
Molecular Weight, Dry, (M_d) ______
Meter Box Number D554 [illegible]
Meter Coefficient 1725
α Factor 1.013
K = 341313
$\cdot K(Nd)^4$ = ___ x (___)^4 = ___
$\Delta H = K(N_d)^4 \left(\frac{Tm}{Ts}\right)$ (P)

Leak Check: Initial at 13 " Hg, .013 CFM
Final at 5 " Hg, .008 CFM
Pitot Leak Check: ______

Traverse Point Number	Sampling Time, min / Clock Time (24-hr) Clock	Gas Meter Reading (V_m), ft 3	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	Out	Pump Vacuum in. Hg	Avg. $\sqrt{\Delta P}$
	0 / 1520	Init. 632.203												
B-9	5	634.37	.045	.74		270					55	60	3.0	
	10	637.49	.045	.74		279					63	63	3.0	
	15	640.14	.045	.74		278					64	65	3.0	
	20	642.[illegible]4	.050	.74		284					66	66	3.0	
	25	645.56	.045	.74		283					67	68	3.0	
	30	648.348	.045	.74		277					69	69	3.0	
		[illegible]		[illegible]	[illegible]	[illegible]					[illegible]			

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Comments:

ISOKINETIC CALCULATIONS - USEPA: M/5 BASIS

ROCK OF AGES - NO. 1

RUN NUMBER	1-SASS	1-M5/8	1-HCL
DATE OF TEST	7-6-83	7-6-83	7-6-83
OPERATOR	PWK	VB	VB
METER VOLUME, CF	992.884	30.22	16.145
METER COEF	0.973	1.012	1.012
BAROMETRIC PRES, HG	28.24	28.24	28.21
DELTA H, IN H2O	2.012	0.703	0.74
METER TEMP, DEG F	68.6	69.5	64.8
STACK TEMP, DEG F	274.3	295.3	279
CONDENSATE, ML	964.7	54.1	11.3
PERCENT CO2	7.1	7.1	7.1
PERCENT O2	12.2	12.2	12.2
PERCENT CO	0	0	0
PERCENT N2	80.7	80.7	80.7
STATIC PRES, IN H2O	-0.1	-0.1	-0.1
PITOT COEF	0.79	0.79	0
SQRT DELTA P, IN H2O	0.234	0.231	0
STACK AREA, SQ FT	2.405	2.405	0
NOZZLE DIAM, IN	1.24	0.387	0
TEST TIME, MIN	260	60	30
MASS PARTICULATE, G	0	0	0
F-FACTOR, DSCF/MBTU	0		
VOLUME, DSCF	967.246	28.161	15.165
WATER VAPOR, SCF	45.408	2.546	0.532
PERCENT MOISTURE	0.045	0.083	0.034
MOLECULAR WT DRY, LB/LB	29.624	29.624	29.624
MOLECULAR WT WET, LB/LB	29.10	28.66	29.23
STACK PRES, IN HG	28.23	28.23	28.20
STACK VELOCITY, FT/SEC	14.94	15.07	0.00
MASS FLOW, DSCFM	1,397	1,316	0
MASS FLOW, ACFM	2,156	2,175	0
PERCENT EXCESS AIR			
PERCENT ISOKINETIC	76.421	105.109	#DIV/0!
GRAIN LOADING, GR/DSCF	0.00000	0.00000	0.00000
GRAIN LOADING, GR/ACF	0.00000	0.00000	0.00000
EMISSION RATE, LB/HR-STD	0.00000	0.00000	0.00000
EMISSION RATE, LB/MBTU			

FIELD DATA

Plant ______

Date ______

Sample Location ______

Sample Type ______

Run Number ______

Operator ______

Ambient Temperature ______

Barometric Pressure 28.60

Static Pressure, (H_2O) -0.10

Filter Number(s) ______

Impinger Volumes

Initial	Final	Net Gain
501.9	501.8	19.9
538.4	570.0	31.6
538.6	551.3	12.7
—	—	

Silica Gel

Initial	Final	Net Gain
646.6	661.2	14.5

SASS Condensate ______

Total Volume 79.2

Probe Length and Type ______

Nozzel Size & I.D. ______

Pitot Coefficient & I.D. ______

Assumed Moisture ______

Molecular Weight, Dry, (M_d) ______

Meter Box Number ______

Meter Coefficient ______

α Factor ______

K = 839.839

$K(Nd)^4$ = 839.839 (.337)^4 = 18.54

$\Delta H = K(N_d)^4 \left(\frac{Tm}{Ts}\right)$ (P)

Leak Check: Initial at 15 " Hg, .0__ CFM
Final at 11 " Hg, .013 CFM

Pitot Leak Check: ✓

Traverse Point Number	Sampling Time, min / Clock Time (24-hr Clock)	Gas Meter Reading (V_m), ft^3	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. $\sqrt{\Delta P}$
	ø / 0915	Init. 648.735												
B-1	5	651.53	.07	.90	.90	338		79		250	53	56	7	
2	10	653.815	.095	.58	.[illegible]	338		79		250	86	86	5	
3	15	656.40	.06	.76	.76	351		76		250	86	86	6	
4	20	658.78	.05	.64	.64	338		76		247	86	85	5	
5	25	661.01	.05	.65	.64	327		78		249	86	88	5	
6	30	663.487	.05	.66	.66	325		76		247	87	87	5	
	* / 0935													
A-1	35 / 0954	666.35	.07	.92	.92	319		71			84	85	7	
A-2	40	669.18	.07	.93	.93	33[illegible]		69		242	99	88	7	

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Comments: * changed ports

Traverse Point Number	Clock Time (24-hr) Clock / Sampling Time, min	Gas Meter Reading (V_m), ft^3 Init.	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. $\sqrt{\Delta P}$
A 3		672.11	.075	.99	.99	333		70		240	94	95	7	~~7~~
4		675.03	.07	.92	.94	334		69		240	96	96	7	~~7~~
5		677.91	.07	.96	.96	301		70		240	92	92	7	~~7~~
6		680.588	.06	.82	.82	312		68		235	97	97	6	~~6~~
	STOP 1024													

Run No. ______________ Date ______________ Sampling Location ______________

Comments:

FIELD DATA

Plant: [illegible]
Date: 7/7/83
Sample Location: [illegible]
Sample Type: SASS #2
Run Number: # 2
Operator: [illegible]
Ambient Temperature: 70
Barometric Pressure: 28.60
Static Pressure, (H_2O): -0.10
Filter Number(s): ____

Impinger Volumes Initial	Final	Net Gain
500		
500		
500		
Silica Gel		
800		

SASS Condensate: [illegible]
Total Volume: ____

Probe Length and Type: [illegible]
Nozzel Size & I.D. ____
Pitot Coefficient & I.D. [illegible] .82
Assumed Moisture: 7.5 %
Molecular Weight, Dry, (M_d) ____
Meter Box Number: 6
Meter Coefficient: 3.514
α Factor: 0.973
K = N/A
$K(Nd)^4 = \_\_\_ \times (\_\_\_)^4 =$ N/A
$\Delta H = K(N_d)^4 \left(\frac{Tm}{Ts}\right) (P)$

$\Delta H = Tm * .004$

Leak Check: Initial at ____" Hg, .035 CFM
~~Final~~ Initial at ____" Hg, .020 CFM
Pitot Leak Check: ____

Traverse Point Number	Sampling Time, min	Clock Time (24-hr) Clock	Gas Meter Reading (V_m), ft^3	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. $\sqrt{\Delta P}$
	0	0905	Init. 783.600												
	10	0915	822.0	.065	2.23	2.2	279	410		70	411	93	95	15	
	20	0925	860.0	.07	2.23	2.1	292	410		69	410	103	98	15	
	30	0935	897.9	.065	2.23	2.1	296	408		68	412	114	106	15	
	40	0945	936.2	.065	2.28	2.2	311	406		67	414	118	109	19	
	50	RESTART 0952	974.5	.065	2.28	2.0	292	405		67	414	109	109	19	
	60	1002	012.6	.06	2.28	2.0	289	411		69	415	114	107	19	
	70	1012	049.3	.065	2.28	2.0	269	41[illegible]		61	418	113	107	19	
	80	1022	085.8	.06	2.28	1.9	304	409		63	421	113	108	19	
	90	1032	------	.06	2.28	1.85	298	404		63	422	115	110	20	

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Comments: STOP AT MIN 40 to CHANGE FROM PORT A to PORT B

Traverse Point Number	Clock Time (24-hr) Clock / Sampling Time, min	Gas Meter Reading (V_m), ft³ Init.	Velocity Head (ΔP_s), in. H_2O	Orifice Pressure Differential (ΔH), in. H_2O Desired	Orifice Pressure Differential Actual	Temperature °F Stack	Probe	Impinger	Organic Module	Oven	Gas Meter In	Gas Meter Out	Pump Vacuum in. Hg	Avg. $\sqrt{\Delta P}$
	1032 / 90													
	100	156.5	.055	2.28	1.8	303	415		65	426	113	111	20	
	110	190.637	.055	2.28	1.7	321	415		68	419	109	109	20	
	120	230.5	.06	2.24	2.25	283	309		70	412	99	103	15	
	130	269.0	.06	2.24	2.25	292	391		87	415	114	106	15	
	140	306.7	.06	2.24	2.2	295	402		67	417	117	109	15	
	150	344.8	.065	2.29	2.1	290	414		71	420	113	112	19	
	160	382.2	.065	2.29	1.9	295	390		71	412	111	111	19	
	170	418.4	.07	2.29	1.9	288	406		77	413	111	110	20	
	180	453.2	.065	2.29	1.8	290	402		75	402	105	107	20	
	RESTART 1255 190	492.2	.06	2.26	2.2	297	405		71	409	106	103	15	
	200	530.8	.06	2.26	2.1	292	295		71	410	103	103	15	
	210	568.5	.065	2.26	2.1	280	401		68	411	103	107	19	
	220	606.0	.065	2.28	2.0	292	414		71	414	105	106	19	
	230	641.5	.065	2.28	1.9	272	399		73	410	105	105	19	
	240	676.2	.065	2.26	1.8	257	400		73	415	109	109	20	
	250	710.6	.065	2.26	1.75	271	410		69	407	105	106	20	
	260	743.509	.065	2.26	1.7	275	415		71	414	106	105	20	

Run No. 2-SASS Date 7-1-83 Sampling Location SAW HOUSE

Comments: STOP AT MIN 110 TO Change Filter & Silica GEL. Restart 11:[illegible]
STOP AT MIN 180 to change Filter & SilicA Gel. Restart 12:55
Final leak check [illegible] .04 @ 10"
[illegible]

SASS ANALYTICAL DATA

Plant Rock-of Ages 773561 Sample No. SASS-2

Sampling Location ______ Run No. 2

Recovered By ______ Recovery Date 7/7/83 Run Date 7/7/83

Comments ______

Analyst Responsible ______

Calculations and Report Reviewed By ______ Report Date ______

FILTERS USED

No. 380, 357, 346

CYCLONES

	Used (yes/no)	Pretared Container (No.)
10μ		
3μ		
1μ		

IMPINGER VOLUMES

	Initial	Final
First (H_2O_2)	500 ml	570.0 ml
Second (APS + $AgNO_3$)	500 ml	452.6 ml
Third (APS + $AgNO_3$)	500 ml	405.0 ml
TOTALS	ml	ml

Gain ______ ml

SILICA GEL WEIGHTS

	Initial	Final
	800.0 g	989.9 g
	800.0 g	998.8 g
	800.0 g	914.2 g
TOTALS	g	g

Gain ______ g

CONDENSATE

TOTAL VOLUME COLLECTED ______ ml

Volume Neat ______ ml

Volume Extracted ______ ml

Volume CH_2Cl_2 Extract (3 x ____ ml) ______ ml

Extracted Condensate: pH Neat ______

Amount 96% HNO_3 added ______

pH Final ______

TOTAL GAIN ______ ml

FIELD DATA

Plant ROCKDFNGES
Date 7/7/83
Sample Location SAW HOUSE
Sample Type HCL
Run Number 2
Operator GORRUS
Ambient Temperature 75
Barometric Pressure
Static Pressure, (H_2O) -.10
Filter Number(s) NA

Impinger Volumes Initial	Final	Net Gain
100		
100	190	-10
Silica Gel 561.8	520	42

SASS Condensate
Total Volume -58

Probe Length and Type 5 PYREX
Nozzel Size & I.D. .387
Pitot Coefficient & I.D. .8500
Assumed Moisture .075
Molecular Weight, Dry, (M_d)
Meter Box Number NAPP - 0254
Meter Coefficient .985
α Factor 1.012
K = 841.373
$K(Nd)^4$ = ___ x (___)^4 = 18.873
$\Delta H = K(N_d)^4 \left(\frac{Tm}{Ts}\right)$ (P)

Leak Check: Initial at 12 " Hg, .003 CFM
Final at 12 " Hg, .010 CFM
Pitot Leak Check:

Traverse Point Number	Sampling Time, min / Clock Time (24-hr) Clock	Gas Meter Reading (V_m), ft^3	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. $\sqrt{\Delta P}$
	0 / 1148	Init. 692.515												
A	5	695.06	.055	.74	.74	330		74			93	96	5	.2345
	10	697.51	.05	.74	.74	330		73			94	94	6	.2236
	15	699.96	.06	.74	.74	327		71			95	94	6	.2449
	20	702.43	.06	.74	.74	326		70			94	93	6	.2449
	25	704.92	.07	.74	.74	324		70			94	94	6	.2646
	30	707.356	.065	.74	.74	324		70			94	94	6	.2550
		[illegible]			[illegible]	[illegible]					[illegible]			.2447

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Comments:

ISOKINETIC CALCULATIONS - USEPA: M/5 BASIS

ROCK OF AGES - NO. 2

RUN NUMBER	2-SASS	2-M5/8	2-HCL
DATE OF TEST	7-7-83	7-7-83	7-7-83
OPERATOR	PWK	VB	VB
METER VOLUME, CF	960.049	31.853	14.871
METER COEF	0.973	1.012	1.012
BAROMETRIC PRES, HG	28.6	28.6	28.6
DELTA H, IN H2O	1.988	0.813	0.74
METER TEMP, DEG F	107.7	90	94.5
STACK TEMP, DEG F	290.5	329	324.7
CONDENSATE, ML	1097.9	39.2	15.7
PERCENT CO2	7.5	7.5	7.5
PERCENT O2	8.8	8.8	8.8
PERCENT CO	0	0	0
PERCENT N2	83.7	83.7	83.7
STATIC PRES, IN H2O	-0.1	-0.1	-0.1
PITOT COEF	0.79	0.79	0.79
SQRT DELTA P, IN H2O	0.251	0.248	0.245
STACK AREA, SQ FT	2.405	2.405	2.405
NOZZLE DIAM, IN	1.24	0.387	0.387
TEST TIME, MIN	260	60	30
MASS PARTICULATE, G	0	0	0
F-FACTOR, DSCF/MBTU			
VOLUME, DSCF	881.833	28.948	13.403
WATER VAPOR, SCF	51.678	1.845	0.739
PERCENT MOISTURE	0.055	0.060	0.052
MOLECULAR WT DRY, LB/LB	29.552	29.552	29.552
MOLECULAR WT WET, LB/LB	28.91	28.86	28.95
STACK PRES, IN HG	28.59	28.59	28.59
STACK VELOCITY, FT/SEC	16.15	16.38	16.11
MASS FLOW, DSCFM	1,480	1,421	1,417
MASS FLOW, ACFM	2,331	2,363	2,325
PERCENT EXCESS AIR			
PERCENT ISOKINETIC	65.762	100.057	92.915
GRAIN LOADING, GR/DSCF	0.00000	0.00000	0.00000
GRAIN LOADING, GR/ACF	0.00000	0.00000	0.00000
EMISSION RATE, LB/HR-STD	0.00000	0.00000	0.00000
EMISSION RATE, LB/MBTU			

4-35

Plant ROCK OF AGES
Date 2/1/83
Sample Location SAW HOUSE
Sample Type M-5 8
Run Number 3
Operator BARKUS
Ambient Temperature 70
Barometric Pressure 28.60
Static Pressure, (H_2O) -.10
Filter Number(s) ______

Impinger Volumes

Initial	Final	Net Gain
520.0	487.1	-32.9
545.8	585.1	39.3
542.2	652.4	10.2
671.4	687.5	
Silica Gel		
		16.1

SASS Condensate ______

Total Volume 32.7

Probe Length and Type 5" PYREX
Nozzel Size & I.D. .387 / 905
Pitot Coefficient & I.D. .820
Assumed Moisture .075
Molecular Weight, Dry, (M_d) ______
Meter Box Number 0554
Meter Coefficient .985
α Factor 1.012
K = 834.939
$K(Nd)^4$ = 834.939 $(.387)^4$ = 18.84
$\Delta H = K(N_d)^4 \left(\frac{Tm}{Ts}\right)$ (P)

Leak Check: Initial at 20 " Hg, .024 CFM
Final at 13 " Hg, .015 CFM
Pitot Leak Check: ✓

Traverse Point Number	Sampling Time, min / Clock Time (24-hr) Clock	Gas Meter Reading (V_m), ft^3	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. $\sqrt{\Delta P}$
	0 / 1639	Init. 724.608												
A-1	5	727.64	.07	.94	.94	310		61		245	81	88	7.5	
2	10	730.409	.07	.94	.94	300		62		245	91	87	7.5	
3	15	733.49	.07	.96	.96	293		65		244	88	86	7.5	
4	20	736.43	.07	.97	.97	288		78		230	88	88	7.5	
5	25	739.37	.07	.98	.98	280		68		255	88	85	7.5	
6	30	742.252	.065	.91	.91	278		68		238	88	88	7.5	
	~~*~~ ~~1709~~	~~745.74~~	~~.09~~	~~1.27~~	~~1.27~~	~~276~~		~~66~~		~~240~~	~~88~~	~~90~~	~~7.5~~	
B-1	35 / 1719	745.74	.09	1.27	1.27	276		66		240	88	90	7.5	
2	40	748.68	.09	1.29	1.29	265		66			95	90	9.0	

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Comments: * changed

Traverse Point Number	Sampling Time, min / Clock Time (24-hr) Clock	Gas Meter Reading (V_m), ft^3 Init.	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	Out	Pump Vacuum in. Hg	Avg. $\sqrt{\Delta P}$
B-3	45	751.79	.075	1.08	1.08	262		64		265	91	88	8.0	
B-4	50	754.64	.06	.85	.06	266		66		250	90	87	7.0	
B-5	55	757.35	.055	.80	.80	250		60		260	88	86	7.0	
B-6	60	760.991	.05	.72	.72	252		61		265	87	85	6.0	
	1749													
	60													

Run No. 3 M-5S Date 7/7/83 Sampling Location SAWHOUSE

Comments:

FIELD DATA

Plant ROCK OF AGES
Date 1/7/83
Sample Location SAW HOUSE
Sample Type HCL
Run Number .5
Operator BACKUS
Ambient Temperature 75
Barometric Pressure
Static Pressure, (H_2O) -.10
Filter Number(s) NA

Impinger Volumes Initial	Final	Net Gain
100		
100	211	11
Silica Gel		
561.8	568	6.2
SASS Condensate		
Total Volume		17.2

Probe Length and Type
Nozzel Size & I.D. .387
Pitot Coefficient & I.D. 0.800
Assumed Moisture
Molecular Weight, Dry, (M_d)
Meter Box Number NAPP-D554
Meter Coefficient .726
α Factor 1.012
K = 541.373
$K(Nd)^4$ = ___ x (___)^4 = 18873
$\Delta H = K(N_d)^4 \left(\frac{Tm}{Ts}\right)$ (P)

Leak Check: Initial at 13 " Hg, .003 CFM
Final at 25 " Hg, .007 CFM
Pitot Leak Check:

Traverse Point Number	Sampling Time, min / Clock Time (24-hr) Clock	Gas Meter Reading (V_m), ft^3	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	Out	Pump Vacuum in. Hg	Avg. $\sqrt{\Delta P}$
	0 / 1325	Init. 707.547												
A-3	5	710.99	.07	.74	.74	318		82		241	96	96	10	
	10	712.65	.065	.74	.74	335		74		250	93	93	18	
	15	714.75	.065	.74	.70	328		70		241	91	91	20	
	20	717.04	.06	.74	.60	328		66		260	88	88	20	
	25	719.23	.06	.74	.55	326		74		[illegible]	88	88	20	
	30	721.403	.06	.74	.55	326		74		[illegible]	90	90	20	
		[illegible]			[illegible]	[illegible]					[illegible]			[illegible]

7602/5/81/Rev 1

Comments:

ISOKINETIC CALCULATIONS - USEPA: M/5 BASIS

ROCK OF AGES - NO. 3

RUN NUMBER	3-M5/8	3-HCL
DATE OF TEST	7-7-83	7-7-83
OPERATOR	VB	VB
METER VOLUME, CF	36.383	13.856
METER COEF	1.012	1.012
BAROMETRIC PRES, HG	28.6	28.6
DELTA H, IN H2O	0.976	0.647
METER TEMP, DEG F	88.4	91
STACK TEMP, DEG F	276.7	326.8
CONDENSATE, ML	32.7	17.2
PERCENT CO2	7.5	7.5
PERCENT O2	8.8	8.8
PERCENT CO	0	0
PERCENT N2	83.7	83.7
STATIC PRES, IN H2O	-0.1	-0.1
PITOT COEF	0.79	0.79
SQRT DELTA P, IN H2O	0.263	0.257
STACK AREA, SQ FT	2.405	2.405
NOZZLE DIAM, IN	0.387	0.387
TEST TIME, MIN	60	30
MASS PARTICULATE, G	0	0
F-FACTOR, DSCF/MBTU	0	0
VOLUME, DSCF	33.176	12.564
WATER VAPOR, SCF	1.539	0.810
PERCENT MOISTURE	0.044	0.061
MOLECULAR WT DRY, LB/LB	29.552	29.552
MOLECULAR WT WET, LB/LB	29.04	28.85
STACK PRES, IN HG	28.59	28.59
STACK VELOCITY, FT/SEC	16.73	16.95
MASS FLOW, DSCFM	1,580	1,474
MASS FLOW, ACFM	2,414	2,446
PERCENT EXCESS AIR		
PERCENT ISOKINETIC	103.100	83.741
GRAIN LOADING, GR/DSCF	0.00000	0.00000
GRAIN LOADING, GR/ACF	0.00000	0.00000
EMISSION RATE, LB/HR-STD	0.00000	0.00000
EMISSION RATE, LB/MBTU		

ACUREX CORPORATION

~~AMBIENT AIR / PERSONNEL MONITORING~~ LOG (VOST FIELD)

COMPANY [illegible] LOCATION [illegible] PROJECT NO. [illegible] RECORDED BY [illegible]

DATE	RUN NO.	LOCATION AND/OR PERSON	POLLUTANT	CLOCK TIME (24-HOUR) START	CLOCK TIME (24-HOUR) FINISH	ELAPSED TIME (MIN)	FLOW RATE (UNITS ____) START	FLOW RATE STOP	AVERAGE FLOW	~~TOTAL VOLUME SAMPLED (UNITS ___)~~ TEMPERATURE	SAMPLE I.D.	COMMENTS/NOTES: BAROMETRIC PRESSURE, RELATIVE HUMIDITY, AMBIENT TEMP., ETC.
7/6/?	2	1-2	VOST	1553			77			70°F	-2" Hg	(METER TEMP) 77°F
				1558			77			70°F	-2	7?°F
				1603			77			69°F	-2	79°F
				1608			75.5			70°F	-2	81°F
				1612			75.5			71°F	-2	83°F
		4F + 5'										

SECTION 5

ANALYTICAL RESULTS

5.1 FUEL AND ASH SAMPLE PROXIMATE AND ULTIMATE ANALYSES

5.2 PARTICULATE EMISSIONS FROM SASS SAMPLES

5.3 PARTICULATE AND SULFUR OXIDES EMISSIONS FROM EPA METHOD 5/8 SAMPLES

5.4 HCl EMISSIONS FROM HCl TRAIN SAMPLES

5.5 TRACE ELEMENT AND LEACHABLE ANION ANALYSES

5.6 TOTAL CHROMATOGRAPHABLE ORGANICS (TCO), GRAVIMETRIC ORGANICS (GRAV), GAS CHROMATOGRAPHY/MASS SPECTROMETRY (GC/MS), AND INFRARED SPECTRA (IR) OF TOTAL SAMPLE EXTRACTS

5.7 LIQUID CHROMATOGRAPHY (LC) SEPARATION AND IR SPECTRA OF LC FRACTIONS

5.8 GC/MS ANALYSES OF VOST TRAPS

5.9 N_2O ANALYSES BY GC/ECD

5.10 BIOASSAY RESULTS

5.1 FUEL AND ASH SAMPLE PROXIMATE AND ULTIMATE ANALYSES

In the following, the sample denoted cyclone ash test 3 is a blind duplicate of the cyclone ash test 1 sample.

LABORATORY CERTIFICATE

CURTIS & TOMPKINS, LTD.

ESTABLISHED 1878

Bulk Oil & Chemical Surveyors, Samplers & Weighers
Analytical & Consulting Chemists

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FOOD TECHNOLOGISTS

ENVIRONMENTAL ANALYSTS

MEMBERS, OFFICIAL CHEMISTS
AND/OR SAMPLERS FOR GOVERNMENT
AGENCIES AND TRADE ORGANIZATIONS

Laboratory No. 83n160
Preliminary No. 4625

Reported 12/14/83
Sampled --------
Received 11/22/83

For ACUREX CORPORATION

Report on 11 samples of Products

Mark

1) 819449, RA Coal, Test 1
2) 819485, RA Pet, Test 2
3) 819478, RA Coal, Pet, Test 2
4) 900209, DM Coal Water Slurry
5) 819498, RA Bottom Ash, Test 1
6) 819498, RA Bottom Ash, Test 2
7) 819476, RA Cyclone Ash, Test 1
8) 819504, RA Cyclone Ash, Test 2
9) 819457, RA Cyclone Ash, Test 3
10) 819475, RA Composite Particulate, Test 1
11) 819475, RA Composite Particulate, Test 2

P.O. RB59186A Rel 7

SEE ATTACHED FOR RESULTS

Curtis & Tompkins Ltd.

SAMPLES DISCARDED 30 DAYS AFTER RECEIPT UNLESS OTHERWISE REQUESTED

ULTIMATE ANALYSIS - Dry Basis,%	1	2	3	4	5	6	7	8	9	10	11
Carbon ----------------------	71.50	73.80	73.10	83.50	16.70	21.20	30.90	33.60	30.90	14.50	21.10
Hydrogen----------------------	5.30	10.30	5.60	5.30	0.14	0.17	1.40	0.92	1.07	1.54	1.10
Nitrogen (1st Test) ----------	1.51	0.08	1.27	1.52	0.20	0.35	1.00	1.20	1.06	1.00	0.48
Nitrogen (2nd Test) ----------	1.53	0.16	1.48	1.62							
Nitrogen (3rd Test) ----------	1.58	0.20	1.40	1.66							
Sulfur (1st Test) ------------	0.092[a]	0.07	0.63	0.84	0.24	0.18	4.50	2.90	4.60		
Sulfur (2nd Test) ------------	0.055[a]	0.10	0.65	0.90							
Sulfur (3rd Test) ------------	0.098[a]	0.08	0.68	0.95							
Ash --------------------------	8.78	1.66	7.02	4.41	81.59	0.54	51.06	51.04	48.39	61.40	42.71
Oxygen(by Difference)---------	12.50	13.93	12.29	4.09	1.08	77.48	10.94	10.08	13.79	21.56	34.61
Chloride ---------------------	0.20	0.07	0.23	0.20	0.05	0.08	0.20	0.26	0.19		
PROXIMATE ANALYSIS - Dry Basis,%											
Gross Heating Value BTU per Lb. --------------	13,825	12,870	13,670	15,020	600	1,600	4,940	5,340	4,700		
Volatile Matter ------------	34.14	92.92	42.33	30.69							
Fixed Carbon ---------------	57.08	5.42	50.65	64.90							
Ash ------------------------	8.78	1.66	7.02	4.41	81.59	0.54	51.06	51.04	48.39	61.40	42.71
Moisture (as Rec'd) --------	2.73	0.53	1.43	44.07	0.15	0.14	8.73	3.99	8.97		

[a]J. Vale of Curtis and Thompkins reported by phone to H. Lips of Acurex on March 23, 1984, that the sulfur analyses for sample 1 were 0.92, 0.95, and 0.98 for the three tests, respectively (authors)

Curtis & Tompkins Ltd.

5.2 PARTICULATE EMISSIONS FROM SASS SAMPLES

ACUREX
ANALYTICAL REPORT

Sample of: CMEA/Rock of Ages

Sample Date: 7-6-83

Requested By: L. Waterland

I.D. Number: 307735.62

Analytical Method: SASS-1 Particulate Weights

Date of Analysis: 7/19 - 7/22-83

Lab I.D. Number	Component	Analytical Result	Unit
819461	SASS probe wash	1.5993 1.4276 tare 0.1717 net	g
819456	10 μ cyclone	0.0877	
819457	3 μ cyclone	0.2156	
819458	1 μ cyclone	0.0793	
819463	Filter 354 (#1)	1.3160 1.0341 tare 0.2819 net	
819464	Filter 360 (#2)	1.1973 1.1419 tare 0.0554 net	

Analysis By Brewster

Date 7-22-83

Form EED--052 5/81

ISOKINETIC PERFORMANCE WORKSHEET & PARTICULATE CALCULATIONS

Plant Rock of Ages

Performed by DaRos

Date 7-6-83

Sample Location Saw House

Test No./Type 1 - SASS

Barometric Pressure (in. Hg)	P_b	28.24
Meter volume (std), $17.64 \left(\frac{V_m}{\alpha}\right)\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right)$ $17.64 \left(\frac{(992.884)}{(.972)}\right)\left(\frac{(28.24) + \frac{(2.012)}{13.6}}{(68.6) + 460}\right)$	$V_{m\ std}$	967.246
Volume of liquid collected (grams)	Vl_c	964.7
Volume of liquid at standard condition (scf) Vl_c x 0.04707	$V_{w\ std}$	45.408
Stack gas proportion of water vapor $\frac{V_{w\ std}}{V_{w\ std} + V_{m\ std}}$, $\frac{(45.408)}{(45.408) + (967.246)}$	B_{wo}	0.045
Molecular weight, stack gas dry (lb/lb-mole) (% CO_2 x 0.44) + (% O_2 x 0.32) + (% N_2 + % CO x 0.28) (7.1 x 0.44) + (12.2 x 0.32) + (80.7 + ____ x 0.28)	M_d From MPR Avg.	29.624
Molecular weight, stack gas wet (lb/lb-mole) $Md(1-B_{wo}) + 18(B_{wo})$, (29.624)(1-.045) + 18(.045)	M_s	29.10
Absolute stack pressure (in. Hg) $P_b + \frac{P_{stack}\ (\text{in. } H_2O)}{13.6}$, $(28.24) + \frac{(-.01)}{13.6}$	P_s	28.23

Temperature stack gas, average (^{o}F)	T_s	274.3
Stack velocity (fps) $85.49\ (C_p)\ (\sqrt{\Delta P_{s\ avg}})\ \sqrt{\frac{T_s avg + 460}{P_s\ M_s}}$ $85.49\ (.79)(\sqrt{.234})^2\ \sqrt{\frac{(274.3) + 460}{(28.23)(29.10)}}$	$V_{s(avg)}$	14.94
Total sample time (minutes)	θ	260
Nozzle diameter, actual (inches)	N_d	1.240
Percent isokinetic (%) $\frac{17.33\ (T_s + 460)(V_w\ std + V_m\ std)}{\theta\quad V_s\quad P_s\quad N_d^2}$ $\frac{17.33\ (\_\_\_ + 460)((\_\_\_) + (\_\_\_))}{(\_\_\_)(\_\_\_)(\_\_\_)(\_\_\_)^2}$	%I	76.421
Area of stack (ft^2) $\pi = 3.1416$ $\pi r^2 \div 144$, $\pi(10.5'')^2 \div 144$	A_s	2.405
Stack gas volume at standard conditions (dscfm) $60\ (1 - B_{wo})Vs_{avg}\ A_s \left(\frac{528}{T_s\ avg + 460}\right)\left(\frac{Ps}{29.92}\right)$ $60\ (1 - \_\_\_)(\_\_\_)(\_\_\_)\left(\frac{528}{\_\_\_ + 460}\right)\left(\frac{(\_\_\_)}{(29.92)}\right)$	ACFM Q_s	2,156 1,397
Particulate matter concentration, dry (gr/dscf) $15.432\ \frac{M_p(grams)}{Vm_{std}}$, $15.432\ \frac{(0.8156)}{(962.246)}$	$C_{s(std)}$	0.01308
Emission rate of particulate matter (lb/hr) $0.00857\ (Q_s)\ C_{s(std)}$, $0.00857\ (\_\_\_)(\_\_\_)$	E_p	

ACUREX
ANALYTICAL REPORT

Sample of: CMEA/Rock of Ages

Sample Date: 7-7-83

Requested By: L. Waterland

I.D. Number: 307735-62

Analytical Method: SASS-2 Particulate Weights

Date of Analysis: 7/19 - 7/22/83

Lab I.D. Number	Component	Analytical Result	Unit
819482	Probe wash	1.5820 1.4321 tin 0.1499 net	g
819492	10µ cyclone	0.1181	
819493	3µ cyclone	0.3160	
819494	1µ cyclone	broken	
819475	Filter 346	1.3105 1.1292 tare 0.1813 net	
819495	Filter 357	1.2937 1.1488 tare 0.1449 net	
819486	Filter 380	1.2947 1.1560 tare 0.1387 net	

Analysis By Brewster

Date 7-22-83

Form EED--082 5/81

ISOKINETIC PERFORMANCE WORKSHEET & PARTICULATE CALCULATIONS

Plant Rock of Ages Performed by DaRos

Date 7-7-83

Sample Location Saw House

Test No./Type 2-SASS

Barometric Pressure (in. Hg)	P_b	28.60
Meter volume (std), $17.64\left(\frac{V_m}{\alpha}\right)\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right)$ $17.64\left(\frac{(960.049)}{(.973)}\right)\left(\frac{(28.60) + \frac{(1.988)}{13.6}}{(107.7) + 460}\right)$	$V_{m\ std}$	881.833
Volume of liquid collected (grams)	Vl_c	1097.9
Volume of liquid at standard condition (scf) $Vl_c \times 0.04707$	$V_{w\ std}$	51.678
Stack gas proportion of water vapor $\frac{V_{w\ std}}{V_{w\ std} + V_{m\ std}}$, $\frac{(51.678)}{(51.678) + (881.833)}$	B_{wo}	0.055
Molecular weight, stack gas dry (lb/lb-mole) $(\%\ CO_2 \times 0.44) + (\%\ O_2 \times 0.32) + (\%\ N_2 + \%\ CO \times 0.28)$ $(7.5 \times 0.44) + (8.8 \times 0.32) + (83.7 + \_\_\_ \times 0.28)$	M_d From MPR Avg	29.552
Molecular weight, stack gas wet (lb/lb-mole) $Md(1-B_{wo}) + 18(B_{wo})$, $(29.552)(1-.055) + 18(.055)$	M_s	28.91
Absolute stack pressure (in. Hg) $P_b + \frac{P_{stack}\ (in.\ H_2O)}{13.6}$, $(28.60) + \frac{(-0.1)}{13.6}$	P_s	28.59

Temperature stack gas, average (^{o}F)	T_s	290.5
Stack velocity (fps) $85.49\ (C_p)\ (\sqrt{\Delta P_{s\ avg}})\ \sqrt{\dfrac{T_s avg + 460}{P_s\ \ M_s}}$ $85.49\ (.79)(.251)\ \sqrt{\dfrac{(290.5) + 460}{(28.59)(28.91)}}$	$V_{s(avg)}$	16.15
Total sample time (minutes)	θ	260
Nozzle diameter, actual (inches)	N_d	1.240
Percent isokinetic (%) $\dfrac{17.33\ (T_s + 460)(V_w\ std + V_m\ std)}{\theta\quad V_s\quad P_s\quad N_d^2}$ $\dfrac{17.33\ (\_\_\_\_ + 460)((\_\_\_\_) + (\_\_\_\_))}{(\_\_\_\_)(\_\_\_\_)(\_\_\_\_)(\_\_\_\_)^2}$	%I	65.762
Area of stack (ft^2) π= 3.1416 $\pi r^2 \div 144$, $\pi(10.5)^2 \div 144$	A_s	2.405
Stack gas volume at standard conditions (dscfm) $60\ (1 - B_{wo})Vs_{avg}\ A_s \left(\dfrac{528}{T_s\ avg + 460}\right)\left(\dfrac{Ps}{29.92}\right)$ $60\ (1 - \_\_\_)(\_\_\_)(\_\_\_)\left(\dfrac{528}{\_\_\_\_ + 460}\right)\left(\dfrac{(\_\_\_)}{(29.92)}\right)$	Acfm Q_s	2,331 1,480
Particulate matter concentration, dry (gr/dscf) $15.432\ \dfrac{M_p(grams)}{Vm_{std}}$, $15.432\ \dfrac{(\_\_\_\_)}{(\_\_\_\_)}$	$C_{s(std)}$ ϕ	
Emission rate of particulate matter (lb/hr) $0.00857\ (Q_s)\ C_{s(std)}$, $0.00857\ (\_\_\_\_)(\_\_\_\_)$	E_p	

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ϕ/μ cyclone lost

5.3 PARTICULATE AND SULFUR OXIDES EMISSIONS FROM EPA METHOD 5/8 SAMPLES

ACUREX
ANALYTICAL REPORT

Sample of: CMEA/Rock of Ages

Sample Date: 7/6 - 7/7/83

Requested By: L. Waterland

I.D. Number: 307735.62

Analytical Method: M/5 Filter Weights

Date of Analysis: 7-22-83

Lab I.D. Number	Component	Analytical Result	Unit
819571	Filter Blank	0.47655 0.47385 tare 0.00270 net	g
819566	M/5 Filter, test 1	0.52386 0.47819 tare 0.04567 net	↓
819472	M/5 Filter, test 2	0.53376 0.47424 tare 0.05952 net	↓
819490	M/5 Filter, test 3	0.50041 0.47654 tare 0.02387 net	↓

Analysis By Murray

 Date 7-22-83

Form EED-082 5/81

ACUREX
ANALYTICAL REPORT

Sample of: CMEA/Rock of Ages

Sample Date: 7/6-7/7/83

Requested By: L Waterland

I.D. Number: 307735-62

Analytical Method: Sulfate analyses of Method 8 impingers

Date of Analysis: 7-25-83

Lab I.D. Number	Component	Analytical Result	Unit
819569	80% IPA blank	0.5	mg SO_3
819567	MS/8-1 1st impinger	5.7	↓
819470	MS/8-2 1st impinger	4.6	↓
819491	MS/8-3 1st impinger	2.5	↓
819570	6% H_2O_2 blank	3.2	mg SO_2
819568	MS/8-1 2+3 impinger	963.4	↓
819471	MS/8-2 2+3 impinger	946.9	↓
819487	MS/8-3 2+3 impingers	490.8	↓
Lot 0282 audit Samples : 4xxx		355.4	mg SO_2/dscm
8xxx		2345.4	↓
9xxx		873.5	↓

Analysis By: Murray

Date: 7-25-83

Form EED--082 5/81

ISOKINETIC PERFORMANCE WORKSHEET & PARTICULATE CALCULATIONS

Plant ROCK OF AGES Performed by [illegible]

Date 7-6-83

Sample Location Saw House

Test No./Type 1 - M5/8

Barometric Pressure (in. Hg)	P_b	28.24
Meter volume (std), $17.64 \left(\frac{V_m}{\alpha}\right)\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right)$ $17.64 \left(\frac{(30.22)}{(1.012)}\right)\left(\frac{(28.24) + \frac{(.703)}{13.6}}{(69.5) + 460}\right)$	$V_{m\ std}$	28.161
Volume of liquid collected (grams)	Vl_c	54.1
Volume of liquid at standard condition (scf) $Vl_c \times 0.04707$	$V_{w\ std}$	2.546
Stack gas proportion of water vapor $\frac{V_{w\ std}}{V_{w\ std} + V_{m\ std}}$, $\frac{(2.546)}{(2.546) + (28.161)}$	B_{wo}	0.083
Molecular weight, stack gas dry (lb/lb-mole) $(\%\ CO_2 \times 0.44) + (\%\ O_2 \times 0.32) + (\%\ N_2 + \%\ CO \times 0.28)$ $(7.1 \times 0.44) + (12.2 \times 0.32) + (80.7 + \_\_\_\_ \times 0.28)$	M_d From MPR AVG.	29.624
Molecular weight, stack gas wet (lb/lb-mole) $Md(1-B_{wo}) + 18(B_{wo})$, $(29.624)(1-.083) + 18(.083)$	M_s	28.66
Absolute stack pressure (in. Hg) $P_b + \frac{P_{stack}\ (in.\ H_2O)}{13.6}$, $(28.24) + \frac{(-0.1)}{13.6}$	P_s	28.23

Temperature stack gas, average (^{o}F)	T_s	295.3
Stack velocity (fps) $85.49\ (C_p)\ (\sqrt{\Delta P_{s\ avg}})\ \sqrt{\frac{T_s avg + 460}{P_s\ \ M_s}}$ $85.49\ (\underline{.79})(.231\ \ )\ \sqrt{\frac{(295.3) + 460}{(28.23)(28.66)}}$	$V_{s(avg)}$	15.07
Total sample time (minutes)	θ	60
Nozzle diameter, actual (inches)	N_d	0.387
Percent isokinetic (%) $\frac{17.33\ (T_s + 460)(V_w\ std + V_m\ std)}{\theta\ \ V_s\ \ P_s\ \ N_d^2}$ $\frac{17.33\ (\_\_\_ + 460)((\_\_\_) + (\_\_\_))}{(\_\_\_)(\_\_\_)(\_\_\_)(\_\_\_)^2}$	%I	105.109
Area of stack (ft^2) $\pi = 3.1416$ $\pi r^2 \div 144$, $\pi(\underline{10.5''})^2 \div 144$	A_s	2.405
Stack gas volume at standard conditions (dscfm) $60\ (1 - B_{wo}) Vs_{avg}\ A_s \left(\frac{528}{T_s\ avg + 460}\right)\left(\frac{Ps}{29.92}\right)$ $60\ (1 - \_\_\_)(\_\_\_)(\_\_\_)\left(\frac{528}{\_\_\_ + 460}\right)\left(\frac{(\_\_\_)}{(29.92)}\right)$	ACFM Q_s	2,175 1,316
Particulate matter concentration, dry (gr/dscf) $15.432\ \frac{M_p(grams)}{Vm_{std}}$, $15.432\ \frac{(0.0429)}{(28.161)}$	$C_{s(std)}$	0.02355
~~Emission rate of particulate matter (lb/hr)~~ ~~$0.00857\ (Q_s)\ C_{s(std)}$~~, 0.00857 (___)(___)	SO_2 ~~E_p~~	$= \frac{963.4}{28.161} = 34.2\ \frac{mg}{dscf}$

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$SO_3 = \frac{5.7}{28.161} = 0.202$ mg/dscf

ISOKINETIC PERFORMANCE WORKSHEET & PARTICULATE CALCULATIONS

Plant Rock of Ages   Performed by DMR

Date 7-7-83

Sample Location Saw House

Test No./Type 2 - M5/8

Barometric Pressure (in. Hg)	P_b	28.60
Meter volume (std), $17.64 \left(\frac{V_m}{\alpha}\right)\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right)$ $17.64 \left(\frac{(31.853)}{(1.012)}\right)\left(\frac{(28.60) + \frac{(0.813)}{13.6}}{(90) + 460}\right)$	$V_{m\ std}$	28.948
Volume of liquid collected (grams)	Vl_c	39.2
Volume of liquid at standard condition (scf) $Vl_c \times 0.04707$	$V_{w\ std}$	1.845
Stack gas proportion of water vapor $\frac{V_{w\ std}}{V_{w\ std} + V_{m\ std}}$, $\frac{(1.845)}{(1.845) + (28.948)}$	B_{wo}	0.060
Molecular weight, stack gas dry (lb/lb-mole) (% CO_2 x 0.44) + (% O_2 x 0.32) + (% N_2 + % CO x 0.28) (7.5 x 0.44) + (8.8 x 0.32) + (83.7 + ____ x 0.28)	M_d	29.552
Molecular weight, stack gas wet (lb/lb-mole) $Md(1-B_{wo}) + 18(B_{wo})$, (29.552)(1-0.060) + 18(0.060)	M_s	28.86
Absolute stack pressure (in. Hg) $P_b + \frac{P_{stack}\ (\text{in. } H_2O)}{13.6}$, $(28.60) + \frac{(-0.1)}{13.6}$	P_s	28.59

Temperature stack gas, average (^{o}F)	T_s	329
Stack velocity (fps) $85.49\ (C_p)\ (\sqrt{\Delta P_{s\ avg}})\ \sqrt{\frac{T_s avg + 460}{P_s\ M_s}}$ $85.49\ (.79)(.248)\ \sqrt{\frac{(329) + 460}{(28.59)(28.86)}}$	$V_{s(avg)}$	16.38
Total sample time (minutes)	θ	60
Nozzle diameter, actual (inches)	N_d	0.387
Percent isokinetic (%) $\frac{17.33\ (T_s + 460)(V_w\ std + V_m\ std)}{\theta\ V_s\ P_s\ N_d^2}$ $\frac{17.33\ (\_\_\_ + 460)((\_\_\_) + (\_\_\_))}{(\_\_\_)(\_\_\_)(\_\_\_)(\_\_\_)^2}$	%I	100.057
Area of stack (ft^2) $\pi = 3.1416$ $\pi r^2 \div 144$, $\pi(\_\_\_)^2 \div 144$	A_s	2.405
Stack gas volume at standard conditions (dscfm) $60\ (1 - B_{wo})Vs_{avg}\ A_s \left(\frac{528}{T_s\ avg + 460}\right)\left(\frac{Ps}{29.92}\right)$ $60\ (1 - \_\_)(\_\_)(\_\_)\left(\frac{528}{\_\_\_ + 460}\right)\left(\frac{(\_\_)}{(29.92)}\right)$	ACFM Q_s	2,363 1,421
Particulate matter concentration, dry (gr/dscf) $15.432\ \frac{M_p(grams)}{Vm_{std}}$, $15.432\ \frac{(0.05682)}{(28.948)}$	$C_{s(std)}$	0.03029
~~Emission rate of particulate matter (lb/hr) $0.00857\ (Q_s)\ C_{s(std)}$, $0.00857\ (\_\_\_)(\_\_\_)$ E_p~~	SO_2 =	$\frac{946.9}{28.948}$ = 32.7 mg/dscf

7602/5/81/Rev 1

$SO_3 = \frac{4.6}{28.948} = 0.159$ mg/dscf

ISOKINETIC PERFORMANCE WORKSHEET & PARTICULATE CALCULATIONS

Plant Rock of Ages   Performed by DiaRos
Date 7-7-83
Sample Location Saw House
Test No./Type 3 - M5/8

Barometric Pressure (in. Hg)	P_b	28.60
Meter volume (std), $17.64\left(\frac{V_m}{\alpha}\right)\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right)$ $17.64\left(\frac{(36.388)}{(1.012)}\right)\left(\frac{(28.60) + \frac{(.976)}{13.6}}{(88.4) + 460}\right)$	$V_{m\ std}$	33.176
Volume of liquid collected (grams)	Vl_c	32.7
Volume of liquid at standard condition (scf) $Vl_c \times 0.04707$	$V_{w\ std}$	1.539
Stack gas proportion of water vapor $\frac{V_{w\ std}}{V_{w\ std} + V_{m\ std}}$, $\frac{(1.539)}{(1.539) + (33.176)}$	B_{wo}	0.044
Molecular weight, stack gas dry (lb/lb-mole) (% CO_2 x 0.44) + (% O_2 x 0.32) + (% N_2 + % CO x 0.28) (7.5 x 0.44) + (8.8 x 0.32) + (83.7 + ____ x 0.28)	M_d From MPR AVG	29.552
Molecular weight, stack gas wet (lb/lb-mole) $Md(1-B_{wo}) + 18(B_{wo})$, (29.552)(1-0.044) + 18(0.044)	M_s	29.04
Absolute stack pressure (in. Hg) $P_b + \frac{P_{stack}\ (in.\ H_2O)}{13.6}$, $(28.60) + \frac{(-0.1)}{13.6}$	P_s	28.59

7602/5/81/Rev 1

Temperature stack gas, average (^oF)	T_s	276.7
Stack velocity (fps) $85.49\ (C_p)\ (\sqrt{\Delta P_{s\ avg}})\ \sqrt{\dfrac{T_s avg + 460}{P_s\ \ M_s}}$ $85.49\ (.79)(.263)\ \sqrt{\dfrac{(276.7) + 460}{(28.59)(29.04)}}$	$V_{s(avg)}$	16.73
Total sample time (minutes)	θ	60
Nozzle diameter, actual (inches)	N_d	0.387
Percent isokinetic (%) $\dfrac{17.33\ (T_s + 460)(V_w\ std + V_m\ std)}{\theta\ \ V_s\ \ P_s\ \ N_d^2}$ $\dfrac{17.33\ (\_\_\_ + 460)((\_\_\_) + (\_\_\_))}{(\_\_\_)(\_\_\_)(\_\_\_)(\_\_\_)^2}$	%I	103.100
Area of stack (ft^2) $\pi = 3.1416$ $\pi r^2 \div 144$, $\pi(10.5)^2 \div 144$	A_s	2.405
Stack gas volume at standard conditions (dscfm) $60\ (1 - B_{wo}) Vs_{avg}\ A_s \left(\dfrac{528}{T_s\ avg + 460}\right) \left(\dfrac{Ps}{29.92}\right)$ $60\ (1 - \_\_)(\_\_)(\_\_)\left(\dfrac{528}{\_\_\_ + 460}\right)\left(\dfrac{(\_\_)}{(29.92)}\right)$	ACFM Q_s	2,414 1,580
Particulate matter concentration, dry (gr/dscf) $15.432\ \dfrac{M_p (grams)}{Vm_{std}}$, $15.432\ \dfrac{(0.02117)}{(33.126)}$	$C_{s(std)}$	0.00985
~~Emission rate of particulate matter (lb/hr)~~ ~~$0.00857\ (Q_s)\ C_{s(std)}$, $0.00857\ (\_\_\_)(\_\_\_)$~~	~~E_p~~ SO_2 =	$\dfrac{450.8}{33.126}$ = 14.8 mg/dscf

7602/5/81/Rev 1

$SO_3 = \dfrac{2.5}{33.126} = 0.0754$ mg/dscf

5.4 HCl EMISSIONS FROM HCl TRAIN SAMPLES

ACUREX Corporation

Energy & Environmental Division

Acurex

Attention: Larry Waterland

October 6, 1983
Acurex ID#: 8309-035
Customer PO#: 307736.62

Subject: Vermont Chloride Determinations; received 7/7/83

The above samples were analyzed for chloride by argentometric titration.

	Sample #	Volume, mL	Total Chloride, mg/L	Total Chloride, mg
Test 2	819474	405	310	130
Blank 2	819447	143	13	2

Prepared by: Stephen Guinnane
Stephen Guinnane
Analyst

Approved by: Greg Nicoll
Greg Nicoll
Operations Manager

SG/GN/ats

555 Clyde Avenue, P.O. Box 7555, Mountain View, CA 94039 (415) 964-3200 Telex: 34-6391 TWX: 910-7796593

ISOKINETIC PERFORMANCE WORKSHEET & PARTICULATE CALCULATIONS

Plant____________________ Performed by____________________

Date____________________

Sample Location____________________

Test No./Type____________________

Barometric Pressure (in. Hg)	P_b	
Meter volume (std), $17.64 \left(\frac{V_m}{\alpha}\right)\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right)$ $17.64 \left(\frac{(\_\_\_)}{(\_\_\_)}\right)\left(\frac{(\_\_\_) + \frac{(\_\_\_)}{13.6}}{(\_\_\_) + 460}\right)$	$V_{m\ std}$	[illegible]
Volume of liquid collected (grams)	Vl_c	
Volume of liquid at standard condition (scf) $Vl_c \times 0.04707$	$V_{w\ std}$	[illegible]
Stack gas proportion of water vapor $\frac{V_{w\ std}}{V_{w\ std} + V_{m\ std}}$, $\frac{(\_\_\_)}{(\_\_\_) + (\_\_\_)}$	B_{wo}	[illegible]
Molecular weight, stack gas dry (lb/lb-mole) (% CO_2 x 0.44) + (% O_2 x 0.32) + (% N_2 + % CO x 0.28) (____ x 0.44) + (____ x 0.32) + (____ + ____ x 0.28)	M_d	[illegible]
Molecular weight, stack gas wet (lb/lb-mole) $Md(1-B_{wo}) + 18(B_{wo})$, (____)(1-____) + 18(____)	M_s	[illegible]
Absolute stack pressure (in. Hg) $P_b + \frac{P_{stack}\ (in.\ H_2O)}{13.6}$, (____) + $\frac{(\_\_\_\_)}{13.6}$	P_s	[illegible]

Temperature stack gas, average (^oF)	T_s	
Stack velocity (fps) $85.49\ (C_p)\ (\sqrt{\Delta P_{s\ avg}})\ \sqrt{\frac{T_s avg + 460}{P_s\ M_s}}$ $85.49\ (\_\_\_)(\sqrt{\quad})\ \sqrt{\frac{(\_\_\_) + 460}{(\_\_\_)(\_\_\_)}}$	$V_{s(avg)}$	N/A
Total sample time (minutes)	θ	
Nozzle diameter, actual (inches)	N_d	N/A
Percent isokinetic (%) $\frac{17.33\ (T_s + 460)(V_w\ std + V_m\ std)}{\theta\ \ V_s\ \ P_s\ \ N_d^2}$ $\frac{17.33\ (\_\_\_ + 460)((\_\_\_) + (\_\_\_))}{(\_\_\_)(\_\_\_)(\_\_\_)(\_\_\_^2)}$	%I	N/A
Area of stack (ft^2) $\pi = 3.1416$ $\pi r^2 \div 144$, $\pi(\_\_\_)^2 \div 144$	A_s	
Stack gas volume at standard conditions (dscfm) $60\ (1 - B_{wo}) Vs_{avg}\ A_s \left(\frac{528}{T_s\ avg + 460}\right)\left(\frac{Ps}{29.92}\right)$ $60\ (1 - \_\_\_)(\_\_\_)(\_\_\_)\left(\frac{528}{\_\_\_ + 460}\right)\left(\frac{(\_\_\_)}{(29.92)}\right)$	Q_s	
Particulate matter concentration, dry (gr/dscf) $15.432\ \frac{M_p (grams)}{Vm_{std}}$, $15.432\ \frac{(\_\_\_)}{(\_\_\_)}$	$C_{s(std)}$	— *
Emission rate of particulate matter (lb/hr) $0.00857\ (Q_s)\ C_{s(std)}$, $0.00857\ (\_\_\_)(\_\_\_)$	E_p	

7602/5/81/Rev 1

* Impinger solution destroyed in transit

ISOKINETIC PERFORMANCE WORKSHEET & PARTICULATE CALCULATIONS

Plant ____________________ Performed by ____________________

Date ____________________

Sample Location ____________________

Test No./Type ____________________

Barometric Pressure (in. Hg)	P_b	
Meter volume (std), $17.64 \left(\frac{V_m}{\alpha}\right)\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right)$ $17.64 \left(\frac{(\_\_\_)}{(\_\_\_)}\right)\left(\frac{(\_\_\_) + \frac{(\_\_\_)}{13.6}}{(\_\_\_) + 460}\right)$	V_m std	
Volume of liquid collected (grams)	Vl_c	
Volume of liquid at standard condition (scf) $Vl_c \times 0.04707$	V_w std	
Stack gas proportion of water vapor $\frac{V_{w\ std}}{V_{w\ std} + V_{m\ std}}$, $\frac{(\_\_\_)}{(\_\_\_) + (\_\_\_)}$	B_{wo}	
Molecular weight, stack gas dry (lb/lb-mole) (% CO_2x 0.44) + (% O_2x 0.32) + (% N_2+ % CO x 0.28) (___ x 0.44) + (___ x 0.32) + (___ + ___ x 0.28)	M_d	27.552
Molecular weight, stack gas wet (lb/lb-mole) $Md(1-B_{wo}) + 18(B_{wo})$, (27.552)(1-.0523) + 18(.0523)	M_s	28.15
Absolute stack pressure (in. Hg) $P_b + \frac{P_{stack}\ (\text{in. } H_2O)}{13.6}$, $(\_\_\_) + \frac{(\_\_\_)}{13.6}$	P_s	28.57

Temperature stack gas, average (°F)	T_s	[illegible]
Stack velocity (fps) $85.49\ (C_p)\ (\sqrt{\Delta P}_{s\ avg}) \sqrt{\frac{T_s avg + 460}{P_s\ M_s}}$ $85.49\ (\_\_\_)(\sqrt{[illegible]}) \sqrt{\frac{([illegible]) + 460}{([illegible])([illegible])}}$	$V_{s(avg)}$	[illegible]
Total sample time (minutes)	θ	
Nozzle diameter, actual (inches)	N_d	[illegible]
Percent isokinetic (%) $\frac{17.33\ (T_s + 460)(V_w\ std + V_m\ std)}{\theta\ \ V_s\ \ P_s\ \ N_d^2}$ $\frac{17.33\ (\_\_\_ + 460)((\_\_\_) + (\_\_\_))}{(\_\_\_)(\_\_\_)(\_\_\_)(\_\_\_^2)}$	%I	[illegible]
Area of stack (ft^2) $\pi = 3.1416$ $\pi r^2 \div 144$, $\pi(\_\_\_)^2 \div 144$	A_s	[illegible]
Stack gas volume at standard conditions (dscfm) $60\ (1 - B_{wo}) Vs_{avg}\ A_s \left(\frac{528}{T_s\ avg + 460}\right)\left(\frac{Ps}{29.92}\right)$ $60\ (1 - \_\_\_)(\_\_\_)(\_\_\_)\left(\frac{528}{\_\_\_ + 460}\right)\left(\frac{(\_\_\_)}{(29.92)}\right)$	ACFM Q_s	[illegible] [illegible]
Particulate matter concentration, dry (gr/dscf) $15.432\ \frac{M_p (grams)}{Vm_{std}}$, $15.432\ \frac{(\ -\ )}{(\_\_\_)}$	$C_{s(std)}$	— *
Emission rate of particulate matter (lb/hr) $0.00857\ (Q_s)\ C_{s(std)}$, $0.00857\ (\_\_\_)(\_\_\_)$	E_p	

7602/5/81/Rev 1

* Impinger solution destroyed in transit

ISOKINETIC PERFORMANCE WORKSHEET & PARTICULATE CALCULATIONS

Plant __________ Performed by __________

Date __________

Sample Location __________

Test No./Type __________

Barometric Pressure (in. Hg)	P_b	[illegible]
Meter volume (std), $17.64 \left(\frac{V_m}{\alpha}\right)\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right)$, $17.64 \left(\frac{(\_\_\_)}{(\_\_\_)}\right)\left(\frac{(\_\_\_) + \frac{(\_\_\_)}{13.6}}{(\_\_\_) + 460}\right)$	$V_{m\ std}$	[illegible]
Volume of liquid collected (grams)	Vl_c	[illegible]
Volume of liquid at standard condition (scf) $Vl_c \times 0.04707$	$V_{w\ std}$	[illegible]
Stack gas proportion of water vapor $\frac{V_{w\ std}}{V_{w\ std} + V_{m\ std}}$, $\frac{(\_\_\_)}{(\_\_\_) + (\_\_\_)}$	B_{wo}	[illegible]
Molecular weight, stack gas dry (lb/lb-mole) (% CO_2 x 0.44) + (% O_2 x 0.32) + (% N_2 + % CO x 0.28) (____ x 0.44) + (____ x 0.32) + (____ + ____ x 0.28)	M_d	[illegible]
Molecular weight, stack gas wet (lb/lb-mole) $M_d(1-B_{wo}) + 18(B_{wo})$, (____)(1-____) + 18(____)	M_s	[illegible]
Absolute stack pressure (in. Hg) $P_b + \frac{P_{stack}\ (\text{in. } H_2O)}{13.6}$, $(\_\_\_) + \frac{(\_\_\_)}{13.6}$	P_s	[illegible]

7602/5/81/Rev 1

Temperature stack gas, average (^{o}F)	T_s	[illegible]
Stack velocity (fps) $85.49\ (C_p)\ (\sqrt{\Delta P_s}\ avg)\ \sqrt{\frac{T_s avg + 460}{P_s\ \ M_s}}$ $85.49\ ([illegible])(\sqrt{[illegible]})\ \sqrt{\frac{([illegible]) + 460}{([illegible])([illegible])}}$	$V_{s(avg)}$	[illegible]
Total sample time (minutes)	θ	
Nozzle diameter, actual (inches)	N_d	
Percent isokinetic (%) $\frac{17.33\ (T_s + 460)(V_w\ std + V_m\ std)}{\theta\ \ V_s\ \ P_s\ \ N_d^2}$ $\frac{17.33\ (\_\_\_ + 460)((\_\_\_) + (\_\_\_))}{(\_\_\_)(\_\_\_)(\_\_\_)(\_\_\_^2)}$	%I	[illegible]
Area of stack (ft^2) $\pi = 3.1416$ $\pi r^2 \div 144$, $\pi([illegible])^2 \div 144$	A_s	[illegible]
Stack gas volume at standard conditions (dscfm) $60\ (1 - B_{wo}) Vs_{avg}\ A_s \left(\frac{528}{T_s\ avg + 460}\right)\left(\frac{Ps}{29.92}\right)$ $60\ (1 - \_\_\_)(\_\_\_)(\_\_\_)\left(\frac{528}{\_\_\_ + 460}\right)\left(\frac{(\_\_\_)}{(29.92)}\right)$	[illegible] Q_s	[illegible] [illegible]
~~Particulate matter~~ HCl concentration, dry (~~gr~~ mg/dscf) ~~15.432~~ $\frac{M_p (grams)}{Vm_{std}}$, ~~15.432~~ $\frac{(.120)}{(12.5[illegible])}$	$C_{s(std)}$	9.55
Emission rate of particulate matter (lb/hr) $0.00857\ (Q_s)\ C_{s(std)}$, $0.00857\ (\_\_\_)(\_\_\_)$	E_p	

5.5 TRACE ELEMENT AND LEACHABLE ANION ANALYSES

In the following, the botton ash test 3 sample is a blind duplicate of the bottom ash test 2 sample and the cyclone ash test 3 sample is a blind audit sample consisting of NBS 1633a flyash.

COMMERCIAL TESTING & ENGINEERING CO.

SINCE 1908

Reply to
Instrument Analysis Division
490 Orchard Street
Golden, CO 80401

Phone: 303-278-9521

January 9, 1983

Mr. Christopher Mann
Acurex Corporation
555 Clyde Avenue
P.O. Box 7555
Mountian View, CA 94042

RE: IAD #97-N182-116-28
Subcontract #SW59159A
Release #11

Analytical Report

Twenty-eight samples were received for analysis on November 30, 1983. These samples were assigned our IAD identification #97-N182-116-28.

Trace element determinations using Spark Source Mass Spectrometry per EPA level 1 protocol will be reported in separate reports upon completion of analysis.

Arsenic and Antimony were determined on four of the samples using hydride generation atomic absorption spectrophotometry. Mercury was determined on all twenty-eight samples using flameless cold vapor atomic absorption spectrophotometry.

The results of these determinations are presented in Table No. I and No. II and are reported in parts per million (ppm) by weight on an "as received" basis.

GENERAL OFFICES: 1919 SOUTH HIGHLAND AVE., SUITE 210-B, LOMBARD, IL 60148 AREA CODE 312 953-9300

Table No. I
(ppm by Weight)

Sample ID	Arsenic (As)	Antimony (Sb)
819454 RA Imp 2 and 3, Test 1	≤0.001	0.003
819455 RA Imp 2 and 3, Blank, Test 1	≤0.001	≤0.001
819467 RA Imp 2 and 3, Test 2	0.001	0.002
819469 RA Imp 2 and 3, Blank, Test 2	≤0.001	≤0.001

Table No. II
(ppm by Weight)

Sample ID	Mercury (Hg)
819463 RA Filter + 1μ, Test 1	0.09
819475 RA Filter, Test 2	0.11
819458 RA Filter Blank	0.03
819456 RA 10μ + 3μ, Test 1	5.0
819492 RA 10μ + 3μ, Test 2	6.0
819459 RA XAD-2, Test 1	0.23
819465 RA XAD-2, Test 2	0.24
819461 RA XAD-2, Blank	0.03
819452 RA Imp 1, Test 1	0.002
819466 RA Imp 1, Test 2	0.010
819448 RA Imp 1, Blank	≤0.001
819449 RA Coal, Test 1	0.09
819485 RA PET, Test 2	0.35
819478 RA Coal/PET, Test 2	0.20
819488 RA Bottom Ash, Test 1	≤0.01
819495 RA Bottom Ash Leachate, Test 1	0.002
819498 RA Bottom Ash, Test 2	≤0.01
819496 RA Bottom Ash Leachate, Test 2	≤0.001
819493 RA Bottom Ash, Test 3	0.02
819476 RA Cyclone Ash, Test 1	0.78
819482 RA Cyclone Ash Leachate, Test 1	≤0.001
819504 RA Cyclone Ash, Test 2	1.15
819486 RA Cyclone Ash Leachate, Test 2	≤0.001
819464 RA Cyclone Ash, Test 3	0.11
819454 RA Imp 2 and 3, Test 1	0.008
819455 RA Imp 2 and 3 Blank, Test 1	≤0.001
819467 RA Imp 2 and 3, Test 2	0.011
819469 RA Imp 2 and 3 Blank, Test 2	≤0.001

If you have any questions concerning these results, please call.

Harold A. Connell
Assistant Laboratory Manager

Robert L. Taylor, Ph.D., Manager
Instrumental Analysis Division

HAC/gh

COMMERCIAL TESTING & ENGINEERING CO.

GENERAL OFFICES: 1919 SOUTH HIGHLAND AVE., SUITE 210-B, LOMBARD, ILLINOIS 60148 AREA CODE 312 953-9300

Reply to

INSTRUMENTAL ANALYSIS DIVISION, 490 ORCHARD STREET, GOLDEN, COLORADO 80401, PHONE: 303 278-9521

To: Mr. Christopher Mann
Acurex Corporation
555 Clyde Avenue
Mountain View, CA 94039

Date: January 4, 1984

Analyst: G. Meagher

P. O. No.: Subcontract #SW59159A
Release #11

Sample No.: 819449
RA coal, test 1

SPARK SOURCE MASS SPECTROGRAPHIC ANALYSIS
CONCENTRATION IN PPM WEIGHT

IAD No.: 97-N182-116-28

ELEMENT	CONC.	ELEMENT	CONC.	ELEMENT	CONC.	ELEMENT	CONC.
Uranium	2	Terbium	0.2	Ruthenium		Vanadium	40
Thorium	5	Gadolinium	0.7	Molybdenum	27	Titanium	MC
Bismuth		Europium	0.3	Niobium	*12	Scandium	35
Lead	3	Samarium	1	Zirconium	31	Calcium	MC
Thallium		Neodymium	7	Yttrium	10	Potassium	MC
Mercury	NR	Praseodymium	3	Strontium	110	Chlorine	270
Gold		Cerium	18	Rubidium	5	Sulfur	590
Platinum		Lanthanum	25	Bromine	21	Phosphorus	100
Iridium		Barium	100	Selenium	*130	Silicon	MC
Osmium		Cesium	0.5	Arsenic	11	Aluminum	MC
Rhenium		Iodine	1	Germanium	1	Magnesium	MC
Tungsten		Tellurium		Gallium	16	Sodium	MC
Tantalum		Antimony	≤1	Zinc	53	Fluorine	≈830
Hafnium		Tin	0.5	Copper	14	Oxygen	NR
Lutetium		Indium	STD	Nickel	2	Nitrogen	NR
Ytterbium		Cadmium	1	Cobalt	8	Carbon	NR
Thulium		Silver		Iron	MC	Boron	30
Erbium		Palladium		Manganese	8	Beryllium	9
Holmium		Rhodium		Chromium	120	Lithium	74
Dysprosium						Hydrogen	NR

*Heterogeneous

STD — Internal Standard
NR — Not Reported
All elements not detected < 0.2 ppm
MC — Major Component >1000 ppm
INT — Interference

Approved: Robert L. Taylor
3 Feb-84

5-40

COMMERCIAL TESTING & ENGINEERING CO.

GENERAL OFFICES: 1919 SOUTH HIGHLAND AVE., SUITE 210-B, LOMBARD, ILLINOIS 60148 AREA CODE 312 953-9300

Reply to INSTRUMENTAL ANALYSIS DIVISION, 490 ORCHARD STREET, GOLDEN, COLORADO 80401, PHONE: 303 278-9521

SINCE 1908

To: Mr. Christopher Mann
Acurex Corporation
555 Clyde Avenue
Mountain View, CA 94039

Date: January 4, 1984

Analyst: G. Meagher

P. O. No.: Subcontract #SW59159A
Release #11

Sample No.: 819488
RA bottom ash, test 1

IAD No.: 97-N182-116-28

SPARK SOURCE MASS SPECTROGRAPHIC ANALYSIS

CONCENTRATION IN PPM WEIGHT

ELEMENT	CONC.	ELEMENT	CONC.	ELEMENT	CONC.	ELEMENT	CONC.
Uranium	9	Terbium	0.8	Ruthenium		Vanadium	44
Thorium	14	Gadolinium	3	Molybdenum	6	Titanium	MC
Bismuth		Europium	2	Niobium	9	Scandium	30
Lead	9	Samarium	7	Zirconium	34	Calcium	MC
Thallium	1	Neodymium	14	Yttrium	11	Potassium	MC
Mercury	NR	Praseodymium	7	Strontium	210	Chlorine	98
Gold		Cerium	22	Rubidium	8	Sulfur	320
Platinum		Lanthanum	30	Bromine	4	Phosphorus	740
Iridium		Barium	350	Selenium	13	Silicon	MC
Osmium		Cesium	2	Arsenic	4	Aluminum	MC
Rhenium		Iodine	2	Germanium	1	Magnesium	MC
Tungsten	1	Tellurium	≤0.2	Gallium	10	Sodium	MC
Tantalum	0.9	Antimony	4	Zinc	11	Fluorine	MC
Hafnium	3	Tin	0.8	Copper	18	Oxygen	NR
Lutetium	0.3	Indium	STD	Nickel	160	Nitrogen	NR
Ytterbium	1	Cadmium	0.4	Cobalt	22	Carbon	NR
Thulium	0.2	Silver	0.5	Iron	MC	Boron	31
Erbium	2	Palladium		Manganese	13	Beryllium	22
Holmium	2	Rhodium		Chromium	50	Lithium	120
Dysprosium	3					Hydrogen	NR

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

5- 41

Approved: Robert C. Taylor
3 Feb 84

COMMERCIAL TESTING & ENGINEERING CO.

GENERAL OFFICES: 1919 SOUTH HIGHLAND AVE., SUITE 210-B, LOMBARD, ILLINOIS 60148 AREA CODE 312 953-9300
Reply to INSTRUMENTAL ANALYSIS DIVISION, 490 ORCHARD STREET, GOLDEN, COLORADO 80401, PHONE: 303 278-9521

To: Mr. Christopher Mann
Acurex Corporation
555 Clyde Avenue
Mountain View, CA 94039

Date: January 4, 1984

Subcontract #SW59159A
P. O. No.: Release #11

Analyst: G. Meagher

Sample No.: 819495
RA bottom ash
leachate, test 1

SPARK SOURCE MASS SPECTROGRAPHIC ANALYSIS

CONCENTRATION IN µg/mL

IAD No.: 97-N182-116-28

ELEMENT	CONC.	ELEMENT	CONC.	ELEMENT	CONC.	ELEMENT	CONC.
Uranium		Terbium		Ruthenium		Vanadium	0.02
Thorium		Gadolinium		Molybdenum	0.1	Titanium	0.3
Bismuth		Europium		Niobium	≤0.001	Scandium	≤0.001
Lead	≤0.004	Samarium		Zirconium	0.003	Calcium	MC
Thallium		Neodymium		Yttrium	0.001	Potassium	MC
Mercury	NR	Praseodymium		Strontium	0.6	Chlorine	0.5
Gold		Cerium	0.001	Rubidium	0.008	Sulfur	MC
Platinum		Lanthanum		Bromine	0.03	Phosphorus	0.1
Iridium		Barium	0.06	Selenium	0.1	Silicon	4
Osmium		Cesium		Arsenic	0.03	Aluminum	0.5
Rhenium		Iodine	0.002	Germanium	0.002	Magnesium	4
Tungsten		Tellurium		Gallium	0.01	Sodium	MC
Tantalum		Antimony	≤0.004	Zinc	0.03	Fluorine	≈4
Hafnium		Tin		Copper	0.01	Oxygen	NR
Lutetium		Indium	STD	Nickel	0.01	Nitrogen	NR
Ytterbium		Cadmium		Cobalt	≤0.001	Carbon	NR
Thulium		Silver	≤0.002	Iron	0.06	Boron	0.2
Erbium		Palladium		Manganese	0.002	Beryllium	
Holmium		Rhodium		Chromium	0.02	Lithium	3
Dysprosium						Hydrogen	NR

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

Approved: Robert G. Jaycox [signature]
3 Feb 84

COMMERCIAL TESTING & ENGINEERING CO.

GENERAL OFFICES: 1919 SOUTH HIGHLAND AVE., SUITE 210-B, LOMBARD, ILLINOIS 60148 AREA CODE 312 953-9300
Reply to INSTRUMENTAL ANALYSIS DIVISION, 490 ORCHARD STREET, GOLDEN, COLORADO 80401, PHONE: 303 278-9521

SINCE 1908

To: Acurex Corporation
555 Clyde Avenue
P.O. Box 7555
Mountain View, CA 94039

Date: February 3, 1984

Analyst: G. Meagher

P. O. No.: Subcontract SW 59159A Release Number 11 Project 7601

Sample No.: 819476
RA cylcone ash,
test 1

SPARK SOURCE MASS SPECTROGRAPHIC ANALYSIS

CONCENTRATION IN PPM WEIGHT

IAD No.: 97-N182-116-28

ELEMENT	CONC.	ELEMENT	CONC.	ELEMENT	CONC.	ELEMENT	CONC.
Uranium	2	Terbium	0.2	Ruthenium		Vanadium	85
Thorium	2	Gadolinium	0.9	Molybdenum	8	Titanium	MC
Bismuth	0.4	Europium	0.4	Niobium	4	Scandium	26
Lead	14	Samarium	3	Zirconium	8	Calcium	MC
Thallium	2	Neodymium	3	Yttrium	5	Potassium	MC
Mercury	NR	Praseodymium	1	Strontium	90	Chlorine	250
Gold		Cerium	4	Rubidium	2	Sulfur	MC
Platinum		Lanthanum	6	Bromine	49	Phosphorus	MC
Iridium		Barium	130	Selenium	170	Silicon	MC
Osmium		Cesium	0.4	Arsenic	52	Aluminum	MC
Rhenium		Iodine	3	Germanium	4	Magnesium	MC
Tungsten	0.5	Tellurium	0.4	Gallium	19	Sodium	MC
Tantalum	0.4	Antimony	6	Zinc	37	Fluorine	≃260
Hafnium	0.3	Tin	1	Copper	34	Oxygen	NR
Lutetium	<0.1	Indium	STD	Nickel	79	Nitrogen	NR
Ytterbium	0.5	Cadmium	0.4	Cobalt	6	Carbon	NR
Thulium	0.2	Silver	0.5	Iron	MC	Boron	110
Erbium	0.5	Palladium		Manganese	11	Beryllium	7
Holmium	0.7	Rhodium		Chromium	51	Lithium	79
Dysprosium	1					Hydrogen	NR

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

Approved: Robert L. Taylor
3 Feb-84

COMMERCIAL TESTING & ENGINEERING CO.

GENERAL OFFICES: 1919 SOUTH HIGHLAND AVE., SUITE 210-B, LOMBARD, ILLINOIS 60148 AREA CODE 312 953-9300
Reply to INSTRUMENTAL ANALYSIS DIVISION, 490 ORCHARD STREET, GOLDEN, COLORADO 80401, PHONE: 303 278-9521

To: Acurex Corporation
555 Clyde Avenue
P.O. Box 7555
Mountain View, CA 94039

Date: February 3, 1984

Analyst: G. Meagher

P. O. No.: Subcontract #SW59159A
Release #11 Project #7601

Sample No.: 819482 SPARK SOURCE MASS SPECTROGRAPHIC ANALYSIS IAD No.: 97-N182-116-28

RA cyclone ash, leachate
Test 1

CONCENTRATION IN μg/ml

ELEMENT	CONC.	ELEMENT	CONC.	ELEMENT	CONC.	ELEMENT	CONC.
Uranium	0.69	Terbium	0.06	Ruthenium		Vanadium	7.4
Thorium	0.31	Gadolinium	0.23	Molybdenum	0.22	Titanium	MC
Bismuth	0.005	Europium	0.09	Niobium	0.19	Scandium	0.85
Lead	0.27	Samarium	0.76	Zirconium	0.95	Calcium	MC
Thallium	0.21	Neodymium	0.72	Yttrium	1.2	Potassium	MC
Mercury	NR	Praseodymium	0.34	Strontium	MC	Chlorine	6.6
Gold		Cerium	0.85	Rubidium	0.63	Sulfur	MC
Platinum		Lanthanum	1.2	Bromine	0.51	Phosphorus	MC
Iridium		Barium	2.1	Selenium	0.80	Silicon	MC
Osmium		Cesium	0.05	Arsenic	4.1	Aluminum	MC
Rhenium		Iodine	0.008	Germanium	0.22	Magnesium	MC
Tungsten	0.03	Tellurium	0.01	Gallium	6.5	Sodium	MC
Tantalum	0.03	Antimony	0.15	Zinc	MC	Fluorine	MC
Hafnium	0.03	Tin	0.02	Copper	MC	Oxygen	NR
Lutetium	0.03	Indium	STD	Nickel	4.0	Nitrogen	NR
Ytterbium	0.27	Cadmium	0.17	Cobalt	7.4	Carbon	NR
Thulium	0.04	Silver	0.008	Iron	MC	Boron	1.8
Erbium	0.30	Palladium		Manganese	MC	Beryllium	0.32
Holmium	0.40	Rhodium		Chromium	3.7	Lithium	>4.1
Dysprosium	0.63					Hydrogen	NR

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

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Approved: Robert L. Dayler
3 Feb-84

COMMERCIAL TESTING & ENGINEERING CO.

GENERAL OFFICES: 1919 SOUTH HIGHLAND AVE., SUITE 210-B, LOMBARD, ILLINOIS 60148 AREA CODE 312 953-9300
Reply to INSTRUMENTAL ANALYSIS DIVISION, 490 ORCHARD STREET, GOLDEN, COLORADO 80401, PHONE: 303 278-9521

To: Mr. Christopher Mann
Acurex Corporation
555 Clyde Avenue
Mountain View, CA 94039

Date: January 4, 1984

Analyst: G. Meagher

P. O. No.: Subcontract #SW59159A
Release #11

Sample No.: 819456

SPARK SOURCE MASS SPECTROGRAPHIC ANALYSIS

IAD No.: 97-N182-116-28

RA 10μ + 3μ, test 1

CONCENTRATION IN PPM WEIGHT

ELEMENT	CONC.	ELEMENT	CONC.	ELEMENT	CONC.	ELEMENT	CONC.
Uranium	9	Terbium	2	Ruthenium		Vanadium	940
Thorium	20	Gadolinium	6	Molybdenum	84	Titanium	MC
Bismuth	6	Europium	3	Niobium	48	Scandium	73
Lead	460	Samarium	17	Zirconium	240	Calcium	MC
Thallium	40	Neodymium	28	Yttrium	82	Potassium	MC
Mercury	NR	Praseodymium	24	Strontium	MC	Chlorine	850
Gold		Cerium	150	Rubidium	72	Sulfur	MC
Platinum		Lanthanum	87	Bromine	220	Phosphorus	MC
Iridium		Barium	MC	Selenium	MC	Silicon	MC
Osmium		Cesium	11	Arsenic	MC	Aluminum	MC
Rhenium		Iodine	29	Germanium	56	Magnesium	MC
Tungsten	8	Tellurium	3	Gallium	830	Sodium	MC
Tantalum	2	Antimony	150	Zinc	MC	Fluorine	≈880
Hafnium	2	Tin	43	Copper	722	Oxygen	NR
Lutetium	0.4	Indium	STD	Nickel	830	Nitrogen	NR
Ytterbium	3	Cadmium	14	Cobalt	64	Carbon	NR
Thulium	0.8	Silver	35	Iron	MC	Boron	MC
Erbium	4	Palladium		Manganese	MC	Beryllium	31
Holmium	6	Rhodium		Chromium	MC	Lithium	>530
Dysprosium	9					Hydrogen	NR

STD — Internal Standard
NR — Not Reported
All elements not detected < 0.2 ppm
MC — Major Component >1000 ppm
INT — Interference

Approved: Robert L. Taylor
3 Feb 84

COMMERCIAL TESTING & ENGINEERING CO.

GENERAL OFFICES: 1919 SOUTH HIGHLAND AVE., SUITE 210-B, LOMBARD, ILLINOIS 60148 AREA CODE 312 953-9300
Reply to INSTRUMENTAL ANALYSIS DIVISION, 490 ORCHARD STREET, GOLDEN, COLORADO 80401, PHONE: 303 278-9521

To: Acurex Corporation
555 Clyde Avenue
P.O. Box 7555
Mountain View, CA 94039

Date: February 3, 1984

Analyst: G. Meagher

P. O. No.: Subcontract SW59159A Release 11 Project 7601

Sample No.: 819463
RA filter + 1μ, test 1

SPARK SOURCE MASS SPECTROGRAPHIC ANALYSIS
CONCENTRATION IN PPM WEIGHT

IAD No.: 97-N182-116-28

ELEMENT	CONC.	ELEMENT	CONC.	ELEMENT	CONC.	ELEMENT	CONC.
Uranium	62	Terbium	1	Ruthenium		Vanadium	66
Thorium	25	Gadolinium	4	Molybdenum	65	Titanium	MC
Bismuth	20	Europium	3	Niobium	14	Scandium	10
Lead	600	Samarium	12	Zirconium	68	Calcium	MC
Thallium	31	Neodymium	32	Yttrium	58	Potassium	MC
Mercury	NR	Praseodymium	14	Strontium	420	Chlorine	470
Gold		Cerium	61	Rubidium	15	Sulfur	MC
Platinum		Lanthanum	61	Bromine	250	Phosphorus	MC
Iridium		Barium	940	Selenium	400	Silicon	MC
Osmium		Cesium	4	Arsenic	550	Aluminum	MC
Rhenium		Iodine	6	Germanium	39	Magnesium	MC
Tungsten	12	Tellurium	2	Gallium	350	Sodium	MC
Tantalum	2	Antimony	51	Zinc	860	Fluorine	MC
Hafnium	1	Tin	30	Copper	440	Oxygen	NR
Lutetium	0.3	Indium	STD	Nickel	210	Nitrogen	NR
Ytterbium	2	Cadmium	77	Cobalt	100	Carbon	NR
Thulium	0.4	Silver	12	Iron	MC	Boron	MC
Erbium	1	Palladium		Manganese	67	Beryllium	29
Holmium	2	Rhodium		Chromium	150	Lithium	>370
Dysprosium	3					Hydrogen	NR

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

Approved: Robert C. Taylor 3 Feb 84

COMMERCIAL TESTING & ENGINEERING CO.

Reply to

GENERAL OFFICES: 1919 SOUTH HIGHLAND AVE., SUITE 210-B, LOMBARD, ILLINOIS 60148 AREA CODE 312 953-9300
INSTRUMENTAL ANALYSIS DIVISION, 490 ORCHARD STREET, GOLDEN, COLORADO 80401, PHONE: 303 278-9521

SINCE 1908

To: Acurex Corporation
555 Clyde Avenue
P.O. Box 7555
Mountain View, CA 94039

Date: February 3, 1984

Analyst: G. Meagher

P. O. No.: Subcontract SW 59159A Release Number 11 Project 7601

Sample No.: 819459
RA XAD-2,
test 1

IAD No.: 97-N182-116-28

SPARK SOURCE MASS SPECTROGRAPHIC ANALYSIS

CONCENTRATION IN PPM WEIGHT

ELEMENT	CONC.	ELEMENT	CONC.	ELEMENT	CONC.	ELEMENT	CONC.
Uranium		Terbium		Ruthenium		Vanadium	0.1
Thorium		Gadolinium		Molybdenum	0.4	Titanium	5
Bismuth		Europium		Niobium		Scandium	≤0.04
Lead	0.3	Samarium		Zirconium	0.05	Calcium	10
Thallium		Neodymium		Yttrium		Potassium	8
Mercury	NR	Praseodymium		Strontium	0.1	Chlorine	13
Gold		Cerium		Rubidium	0.1	Sulfur	20
Platinum	*0.1	Lanthanum		Bromine	0.3	Phosphorus	2
Iridium		Barium	0.8	Selenium	0.5	Silicon	10
Osmium		Cesium	0.2	Arsenic	0.07	Aluminum	3
Rhenium		Iodine	0.07	Germanium	≤0.07	Magnesium	27
Tungsten		Tellurium	0.05	Gallium	0.1	Sodium	40
Tantalum		Antimony		Zinc	2	Fluorine	≈22
Hafnium		Tin	0.07	Copper	0.6	Oxygen	NR
Lutetium		Indium	STD	Nickel	2	Nitrogen	NR
Ytterbium		Cadmium		Cobalt	0.1	Carbon	NR
Thulium		Silver		Iron	12	Boron	0.07
Erbium		Palladium		Manganese	0.4	Beryllium	
Holmium		Rhodium		Chromium	1	Lithium	1
Dysprosium						Hydrogen	NR

*Probable Contamination from sample prep

STD — Internal Standard
NR — Not Reported
All elements not detected < 0.001 μg/mL
MC — Major Component > 100 μg/mL
INT — Interference

Approved: 3 Feb 84

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COMMERCIAL TESTING & ENGINEERING CO.

GENERAL OFFICES: 1919 SOUTH HIGHLAND AVE., SUITE 210-B, LOMBARD, ILLINOIS 60148 AREA CODE 312 953-9300
Reply to INSTRUMENTAL ANALYSIS DIVISION, 490 ORCHARD STREET, GOLDEN, COLORADO 80401, PHONE: 303 278-9521

To: Acurex Corporation
555 Clyde Avenue
P.O. Box 7555
Mountain View, CA 94039

Date: February 3, 1984

Analyst: G. Meagher

P. O. No.: Subcontract SW 59159A Release Number 11 Project 7601

Sample No.: 819461
RA XAD-2, blank

IAD No.: 97-N182-116-28

SPARK SOURCE MASS SPECTROGRAPHIC ANALYSIS
CONCENTRATION IN PPM WEIGHT

ELEMENT	CONC.	ELEMENT	CONC.	ELEMENT	CONC.	ELEMENT	CONC.
Uranium		Terbium		Ruthenium		Vanadium	0.02
Thorium		Gadolinium		Molybdenum	0.1	Titanium	0.3
Bismuth		Europium		Niobium		Scandium	≤0.01
Lead	0.3	Samarium		Zirconium	0.02	Calcium	42
Thallium		Neodymium		Yttrium		Potassium	3
Mercury	NR	Praseodymium		Strontium	0.1	Chlorine	6
Gold		Cerium		Rubidium		Sulfur	4
Platinum	*0.1	Lanthanum		Bromine	0.1	Phosphorus	0.6
Iridium		Barium	0.3	Selenium	0.04	Silicon	14
Osmium		Cesium		Arsenic	<0.01	Aluminum	0.5
Rhenium		Iodine	0.05	Germanium	<0.01	Magnesium	11
Tungsten		Tellurium		Gallium	0.1	Sodium	28
Tantalum		Antimony		Zinc	0.8	Fluorine	≃13
Hafnium		Tin		Copper	0.3	Oxygen	NR
Lutetium		Indium	STD	Nickel	1	Nitrogen	NR
Ytterbium		Cadmium	≤0.02	Cobalt	≤0.02	Carbon	NR
Thulium		Silver		Iron	1	Boron	0.04
Erbium		Palladium		Manganese	0.1	Beryllium	
Holmium		Rhodium		Chromium	0.3	Lithium	0.3
Dysprosium						Hydrogen	NR

*Probable contamination from sample preparation.

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

Approved: Robert L. Taylor
3 Feb 84

COMMERCIAL TESTING & ENGINEERING CO.

Reply to

GENERAL OFFICES: 1919 SOUTH HIGHLAND AVE., SUITE 210-B, LOMBARD, ILLINOIS 60148 AREA CODE 312 953-9300

INSTRUMENTAL ANALYSIS DIVISION, 490 ORCHARD STREET, GOLDEN, COLORADO 80401, PHONE: 303 278-9521

SINCE 1908

To: Mr. Christopher Mann
Acurex Corporation
555 Clyde Avenue
Mountain View, CA 94039

Date: January 4, 1984

Subcontract #SW59159A

P. O. No.: Release #11

Analyst: G. Meagher

Sample No.: 819452
RA Imp 1, test 1

SPARK SOURCE MASS SPECTROGRAPHIC ANALYSIS

CONCENTRATION IN µg/mL

IAD No.: 97-N182-116-28

ELEMENT	CONC.	ELEMENT	CONC.	ELEMENT	CONC.	ELEMENT	CONC.
Uranium		Terbium		Ruthenium		Vanadium	0.006
Thorium		Gadolinium		Molybdenum	*0.02	Titanium	0.2
Bismuth		Europium		Niobium		Scandium	0.004
Lead	0.6	Samarium		Zirconium	0.01	Calcium	1
Thallium	0.07	Neodymium		Yttrium		Potassium	*1
Mercury	NR	Praseodymium		Strontium	0.04	Chlorine	0.1
Gold		Cerium		Rubidium		Sulfur	4
Platinum		Lanthanum		Bromine	0.02	Phosphorus	0.3
Iridium		Barium	0.3	Selenium	0.1	Silicon	6
Osmium		Cesium		Arsenic	≤0.004	Aluminum	0.2
Rhenium		Iodine		Germanium		Magnesium	4
Tungsten		Tellurium		Gallium	0.06	Sodium	1
Tantalum		Antimony		Zinc	2	Fluorine	≃0.3
Hafnium		Tin	0.3	Copper	0.5	Oxygen	NR
Lutetium		Indium	STD	Nickel	0.2	Nitrogen	NR
Ytterbium		Cadmium	0.05	Cobalt	0.01	Carbon	NR
Thulium		Silver	0.08	Iron	1	Boron	0.005
Erbium		Palladium		Manganese	0.04	Beryllium	
Holmium		Rhodium		Chromium	0.2	Lithium	0.05
Dysprosium						Hydrogen	NR

*Heterogeneous

STD — Internal Standard
NR — Not Reported
All elements not detected < 0.006 µg/mL
MC — Major Component > 10 µg/mL
INT — Interference

Approved: [signature]
3 Feb 84

COMMERCIAL TESTING & ENGINEERING CO.

GENERAL OFFICES: 1919 SOUTH HIGHLAND AVE., SUITE 210-B, LOMBARD, ILLINOIS 60148 AREA CODE 312 953-9300
Reply to INSTRUMENTAL ANALYSIS DIVISION, 490 ORCHARD STREET, GOLDEN, COLORADO 80401, PHONE: 303 278-9521

To: Mr. Christopher Mann
Acurex Corporation
555 Clyde Avenue
Mountain View, CA 94039

Date: January 4, 1984

Subcontract #SW59159A
P. O. No.: Release #11

Analyst: G. Meagher

Sample No.: 819448
RA Imp 1 blank

SPARK SOURCE MASS SPECTROGRAPHIC ANALYSIS
CONCENTRATION IN µg/mL

IAD No.: 97-N182-116-28

ELEMENT	CONC.	ELEMENT	CONC.	ELEMENT	CONC.	ELEMENT	CONC.
Uranium		Terbium		Ruthenium		Vanadium	<0.001
Thorium		Gadolinium		Molybdenum	0.1	Titanium	0.03
Bismuth		Europium		Niobium		Scandium	0.001
Lead		Samarium		Zirconium	0.02	Calcium	0.2
Thallium		Neodymium		Yttrium		Potassium	0.1
Mercury	NR	Praseodymium		Strontium	0.006	Chlorine	0.1
Gold		Cerium		Rubidium		Sulfur	0.2
Platinum		Lanthanum		Bromine	0.03	Phosphorus	0.2
Iridium		Barium	0.03	Selenium	0.006	Silicon	0.4
Osmium		Cesium		Arsenic	0.002	Aluminum	0.1
Rhenium		Iodine	0.005	Germanium		Magnesium	0.3
Tungsten		Tellurium		Gallium	0.007	Sodium	0.8
Tantalum		Antimony	≤0.01	Zinc	0.05	Fluorine	≃0.2
Hafnium		Tin	0.2	Copper	0.004	Oxygen	NR
Lutetium		Indium	STD	Nickel	0.01	Nitrogen	NR
Ytterbium		Cadmium		Cobalt	0.07	Carbon	NR
Thulium		Silver		Iron	0.7	Boron	
Erbium		Palladium		Manganese	0.01	Beryllium	
Holmium		Rhodium		Chromium	0.03	Lithium	0.004
Dysprosium						Hydrogen	NR

STD — Internal Standard
NR — Not Reported
All elements not detected < 0.002 µg/mL
MC — Major Component >10 µg/mL
INT — Interference

Approved: Robert C. Taylor
3 Feb '84

COMMERCIAL TESTING & ENGINEERING CO.

GENERAL OFFICES: 1919 SOUTH HIGHLAND AVE., SUITE 210-B, LOMBARD, ILLINOIS 60148 AREA CODE 312 953-9300
Reply to INSTRUMENTAL ANALYSIS DIVISION, 490 ORCHARD STREET, GOLDEN, COLORADO 80401, PHONE: 303 278-9521

SINCE 1908

To: Acurex Corporation
555 Clyde Avenue
P.O. Box 7555
Mountain View, CA 94039

Date: February 3, 1984

Analyst: G. Meagher

P. O. No.: Subcontract SW59159A Release 11 Project 7601

Sample No.: 819478
RA coal/PET, test 2

SPARK SOURCE MASS SPECTROGRAPHIC ANALYSIS

CONCENTRATION IN PPM WEIGHT

IAD No.: 97-N182-116-28

ELEMENT	CONC.	ELEMENT	CONC.	ELEMENT	CONC.	ELEMENT	CONC.
Uranium	2	Terbium		Ruthenium		Vanadium	11
Thorium	4	Gadolinium		Molybdenum	17	Titanium	MC
Bismuth	2	Europium		Niobium	2	Scandium	9
Lead	28	Samarium	1	Zirconium	8	Calcium	MC
Thallium		Neodymium	4	Yttrium	4	Potassium	MC
Mercury	NR	Praseodymium	2	Strontium	24	Chlorine	110
Gold		Cerium	4	Rubidium	2	Sulfur	MC
Platinum		Lanthanum	6	Bromine	10	Phosphorus	170
Iridium		Barium	41	Selenium	4	Silicon	MC
Osmium		Cesium	0.9	Arsenic	3	Aluminum	MC
Rhenium		Iodine	0.9	Germanium	≤0.1	Magnesium	MC
Tungsten		Tellurium		Gallium	5	Sodium	MC
Tantalum	3	Antimony	24	Zinc	10	Fluorine	≈71
Hafnium		Tin	0.9	Copper	27	Oxygen	NR
Lutetium		Indium	STD	Nickel	340	Nitrogen	NR
Ytterbium		Cadmium	2	Cobalt	9	Carbon	NR
Thulium		Silver		Iron	MC	Boron	14
Erbium		Palladium		Manganese	17	Beryllium	0.8
Holmium		Rhodium		Chromium	43	Lithium	5
Dysprosium						Hydrogen	NR

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

Approved: Robert E. Taylor
3 Feb-84

COMMERCIAL TESTING & ENGINEERING CO.

GENERAL OFFICES: 1919 SOUTH HIGHLAND AVE., SUITE 210-B, LOMBARD, ILLINOIS 60148 AREA CODE 312 953-9300
Reply to INSTRUMENTAL ANALYSIS DIVISION, 490 ORCHARD STREET, GOLDEN, COLORADO 80401, PHONE: 303 278-9521

SINCE 1908

To: Acurex Corporation
555 Clyde Avenue
P.O. Box 7555
Mountain View, CA 94039

Date: February 3, 1984

Analyst: G. Meagher

P. O. No.: Subcontract No. SW59159A Release 11 Project 7601

Sample No.: 819485 RA PET, test #2

IAD No.: 97-N182-116-28

SPARK SOURCE MASS SPECTROGRAPHIC ANALYSIS

CONCENTRATION IN PPM WEIGHT

ELEMENT	CONC.	ELEMENT	CONC.	ELEMENT	CONC.	ELEMENT	CONC.
Uranium		Terbium		Ruthenium		Vanadium	0.4
Thorium		Gadolinium		Molybdenum	8	Titanium	84
Bismuth	0.5	Europium		Niobium		Scandium	<0.1
Lead	32	Samarium		Zirconium	0.2	Calcium	53
Thallium	0.3	Neodymium		Yttrium	<0.1	Potassium	11
Mercury	NR	Praseodymium		Strontium	<0.1	Chlorine	99
Gold		Cerium	<0.1	Rubidium	<0.1	Sulfur	15
Platinum		Lanthanum		Bromine		Phosphorus	53
Iridium		Barium	17	Selenium		Silicon	530
Osmium		Cesium		Arsenic	<0.1	Aluminum	MC
Rhenium		Iodine	<0.1	Germanium	<0.1	Magnesium	40
Tungsten	0.8	Tellurium		Gallium	3	Sodium	180
Tantalum		Antimony	22	Zinc	6	Fluorine	≈200
Hafnium		Tin		Copper	38	Oxygen	NR
Lutetium		Indium	STD	Nickel	290	Nitrogen	NR
Ytterbium		Cadmium	2	Cobalt	13	Carbon	NR
Thulium		Silver		Iron	22	Boron	0.7
Erbium		Palladium		Manganese	4	Beryllium	
Holmium		Rhodium		Chromium	11	Lithium	22
Dysprosium						Hydrogen	NR

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

Approved: Robert G. Taylor 3 Feb 84

COMMERCIAL TESTING & ENGINEERING CO.

GENERAL OFFICES: 1919 SOUTH HIGHLAND AVE., SUITE 210-B, LOMBARD, ILLINOIS 60148 AREA CODE 312 953-9300
Reply to INSTRUMENTAL ANALYSIS DIVISION, 490 ORCHARD STREET, GOLDEN, COLORADO 80401, PHONE: 303 278-9521

SINCE 1908

To: Mr. Christopher Mann
Acurex Corporation
555 Clyde Avenue
Mountain View, CA 94039

Date: January 4, 1984

Subcontract #SW59159A
P. O. No.: Release #11

Analyst: G. Meagher

Sample No.: 819498
RA bottom ash,
test 2

SPARK SOURCE MASS SPECTROGRAPHIC ANALYSIS
CONCENTRATION IN PPM WEIGHT

IAD No.: 97-N182-116-28

ELEMENT	CONC.	ELEMENT	CONC.	ELEMENT	CONC.	ELEMENT	CONC.
Uranium	22	Terbium	3	Ruthenium		Vanadium	24
Thorium	31	Gadolinium	8	Molybdenum	16	Titanium	MC
Bismuth		Europium	4	Niobium	15	Scandium	41
Lead	52	Samarium	15	Zirconium	92	Calcium	MC
Thallium	4	Neodymium	32	Yttrium	62	Potassium	MC
Mercury	NR	Praseodymium	10	Strontium	510	Chlorine	36
Gold		Cerium	42	Rubidium	25	Sulfur	270
Platinum		Lanthanum	66	Bromine	5	Phosphorus	MC
Iridium		Barium	MC	Selenium	17	Silicon	MC
Osmium		Cesium	5	Arsenic	7	Aluminum	MC
Rhenium		Iodine	0.7	Germanium	4	Magnesium	MC
Tungsten	4	Tellurium	0.3	Gallium	63	Sodium	MC
Tantalum	5	Antimony	15	Zinc	23	Fluorine	≈250
Hafnium	5	Tin	2	Copper	48	Oxygen	NR
Lutetium	0.9	Indium	STD	Nickel	150	Nitrogen	NR
Ytterbium	7	Cadmium	4	Cobalt	110	Carbon	NR
Thulium	1	Silver	0.6	Iron	MC	Boron	130
Erbium	4	Palladium		Manganese	72	Beryllium	24
Holmium	5	Rhodium		Chromium	220	Lithium	>400
Dysprosium	8					Hydrogen	NR

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

Approved: Robert E. Taylor
3 Feb 84

COMMERCIAL TESTING & ENGINEERING CO.

GENERAL OFFICES: 1919 SOUTH HIGHLAND AVE., SUITE 210-B, LOMBARD, ILLINOIS 60148 AREA CODE 312 953-9300
Reply to INSTRUMENTAL ANALYSIS DIVISION, 490 ORCHARD STREET, GOLDEN, COLORADO 80401, PHONE: 303 278-9521

SINCE 1908

To: Mr. Christopher Mann
Acurex Corporation
555 Clyde Avenue
Mountain View, CA 94039

Date: January 4, 1984

Analyst: G. Meagher

Subcontract #SW59159A
P. O. No.: Release #11

Sample No.: 819496
RA bottom ash
leachate, test 2

SPARK SOURCE MASS SPECTROGRAPHIC ANALYSIS

CONCENTRATION IN µg/mL

IAD No.: 97-N182-116-28

ELEMENT	CONC.	ELEMENT	CONC.	ELEMENT	CONC.	ELEMENT	CONC.
Uranium		Terbium		Ruthenium		Vanadium	0.05
Thorium		Gadolinium		Molybdenum	0.5	Titanium	0.2
Bismuth		Europium		Niobium	0.003	Scandium	≤0.002
Lead	0.009	Samarium		Zirconium	0.01	Calcium	MC
Thallium		Neodymium		Yttrium	0.009	Potassium	MC
Mercury	NR	Praseodymium		Strontium	3	Chlorine	3
Gold		Cerium		Rubidium	0.02	Sulfur	MC
Platinum		Lanthanum		Bromine	0.08	Phosphorus	0.3
Iridium		Barium	0.3	Selenium	0.1	Silicon	5
Osmium		Cesium		Arsenic	0.01	Aluminum	MC
Rhenium		Iodine	0.01	Germanium	0.01	Magnesium	0.9
Tungsten	0.02	Tellurium		Gallium	0.09	Sodium	MC
Tantalum		Antimony	0.2	Zinc	0.06	Fluorine	≈7
Hafnium		Tin		Copper	0.03	Oxygen	NR
Lutetium		Indium	STD	Nickel	0.02	Nitrogen	NR
Ytterbium		Cadmium	0.004	Cobalt	≤0.003	Carbon	NR
Thulium		Silver	≤0.004	Iron	0.6	Boron	0.4
Erbium		Palladium		Manganese	0.005	Beryllium	
Holmium		Rhodium		Chromium	0.06	Lithium	0.07
Dysprosium						Hydrogen	NR

STD — Internal Standard
NR — Not Reported
All elements not detected < 0.002 µg/mL
MC — Major Component > 10 µg/mL
INT — Interference

Approved: Robert L. Taylor 3 Feb 84

COMMERCIAL TESTING & ENGINEERING CO.

GENERAL OFFICES: 1919 SOUTH HIGHLAND AVE., SUITE 210-B, LOMBARD, ILLINOIS 60148 AREA CODE 312 953-9300
Reply to INSTRUMENTAL ANALYSIS DIVISION, 490 ORCHARD STREET, GOLDEN, COLORADO 80401, PHONE: 303 278-9521

To: Acurex Corporation
555 Clyde Avenue
P.O. Box 7555
Mountain View, CA 94039

Date: February 3, 1984

Analyst: G. Meagher

P. O. No.: Subcontract SW 59159A Release Number 11 Project 7601

Sample No.: 819504 RA cyclone ash, test 2

SPARK SOURCE MASS SPECTROGRAPHIC ANALYSIS

CONCENTRATION IN PPM WEIGHT

IAD No.: 97-N182-116-28

ELEMENT	CONC.	ELEMENT	CONC.	ELEMENT	CONC.	ELEMENT	CONC.
Uranium	12	Terbium	0.6	Ruthenium		Vanadium	45
Thorium	11	Gadolinium	2	Molybdenum	20	Titanium	MC
Bismuth	1	Europium	0.8	Niobium	9	Scandium	8
Lead	70	Samarium	4	Zirconium	19	Calcium	MC
Thallium	14	Neodymium	15	Yttrium	11	Potassium	MC
Mercury	NR	Praseodymium	7	Strontium	170	Chlorine	250
Gold		Cerium	22	Rubidium	5	Sulfur	MC
Platinum		Lanthanum	35	Bromine	77	Phosphorus	MC
Iridium		Barium	360	Selenium	130	Silicon	MC
Osmium		Cesium	2	Arsenic	70	Aluminum	MC
Rhenium		Iodine	8	Germanium	8	Magnesium	MC
Tungsten	2	Tellurium	0.4	Gallium	22	Sodium	MC
Tantalum	1	Antimony	26	Zinc	88	Fluorine	≈380
Hafnium	≤0.7	Tin	5	Copper	45	Oxygen	NR
Lutetium	0.2	Indium	STD	Nickel	39	Nitrogen	NR
Ytterbium	1	Cadmium	8	Cobalt	10	Carbon	NR
Thulium	0.4	Silver	1	Iron	MC	Boron	840
Erbium	2	Palladium		Manganese	27	Beryllium	10
Holmium	3	Rhodium		Chromium	68	Lithium	380
Dysprosium	5					Hydrogen	NR

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

Approved: Robert L. Taylor
3 Feb 84

COMMERCIAL TESTING & ENGINEERING CO.

GENERAL OFFICES: 1919 SOUTH HIGHLAND AVE., SUITE 210-B, LOMBARD, ILLINOIS 60148 AREA CODE 312 953-9300
Reply to INSTRUMENTAL ANALYSIS DIVISION, 490 ORCHARD STREET, GOLDEN, COLORADO 80401, PHONE: 303 278-9521

To: Acurex Corporation
555 Clyde Avenue
P.O. Box 7555
Mountian View, CA 94039

Date: February 3, 1984

Analyst: G. Meagher

P. O. No.: Subcontract SW 59159A Release Number 11 Project 7601

Sample No.: 819486 RA cyclone ash leachate, test 2

SPARK SOURCE MASS SPECTROGRAPHIC ANALYSIS

IAD No.: 97-N182-116-28

CONCENTRATION IN µg/ml

ELEMENT	CONC.	ELEMENT	CONC.	ELEMENT	CONC.	ELEMENT	CONC.
Uranium	0.05	Terbium	0.007	Ruthenium		Vanadium	0.3
Thorium	0.01	Gadolinium	0.03	Molybdenum	0.02	Titanium	MC
Bismuth		Europium	0.01	Niobium	0.005	Scandium	0.1
Lead	0.1	Samarium	0.06	Zirconium	0.01	Calcium	MC
Thallium	0.09	Neodymium	0.2	Yttrium	0.5	Potassium	MC
Mercury	NR	Praseodymium	0.08	Strontium	4	Chlorine	0.7
Gold		Cerium	0.2	Rubidium	0.1	Sulfur	MC
Platinum		Lanthanum	0.3	Bromine	0.08	Phosphorus	MC
Iridium		Barium	0.05	Selenium	0.2	Silicon	MC
Osmium		Cesium	0.02	Arsenic	0.2	Aluminum	MC
Rhenium		Iodine	0.001	Germanium	0.07	Magnesium	MC
Tungsten	≤0.003	Tellurium	0.001	Gallium	5	Sodium	MC
Tantalum	0.005	Antimony	0.05	Zinc	12	Fluorine	MC
Hafnium	0.004	Tin	0.003	Copper	6	Oxygen	NR
Lutetium	0.002	Indium	STD	Nickel	0.8	Nitrogen	NR
Ytterbium	0.03	Cadmium	0.1	Cobalt	1	Carbon	NR
Thulium	0.002	Silver		Iron	MC	Boron	0.2
Erbium	0.008	Palladium		Manganese	MC	Beryllium	0.07
Holmium	0.01	Rhodium		Chromium	1	Lithium	>2
Dysprosium	0.02					Hydrogen	NR

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

Approved: Robert C. Taylor 3 Feb-84

COMMERCIAL TESTING & ENGINEERING CO.

GENERAL OFFICES: 1919 SOUTH HIGHLAND AVE., SUITE 210-B, LOMBARD, ILLINOIS 60148 AREA CODE 312 953-9300

Reply to INSTRUMENTAL ANALYSIS DIVISION, 490 ORCHARD STREET, GOLDEN, COLORADO 80401, PHONE: 303 278-9521

To: Mr. Christopher Mann
Acurex Corporation
555 Clyde Avenue
Mountain View, CA 94039

Date: January 4, 1984

Analyst: G. Meagher

P. O. No.: Subcontract #SW59159A
Release #11

Sample No.: 819492
RA 10µ + 3µ, test 2

SPARK SOURCE MASS SPECTROGRAPHIC ANALYSIS

CONCENTRATION IN PPM WEIGHT

IAD No.: 97-N182-116-28

ELEMENT	CONC.	ELEMENT	CONC.	ELEMENT	CONC.	ELEMENT	CONC.
Uranium	9	Terbium	2	Ruthenium		Vanadium	320
Thorium	8	Gadolinium	8	Molybdenum	140	Titanium	MC
Bismuth	20	Europium	3	Niobium	29	Scandium	50
Lead	890	Samarium	20	Zirconium	56	Calcium	MC
Thallium	42	Neodymium	48	Yttrium	64	Potassium	MC
Mercury	NR	Praseodymium	22	Strontium	690	Chlorine	MC
Gold		Cerium	75	Rubidium	22	Sulfur	MC
Platinum		Lanthanum	90	Bromine	220	Phosphorus	MC
Iridium		Barium	830	Selenium	680	Silicon	MC
Osmium		Cesium	4	Arsenic	810	Aluminum	MC
Rhenium		Iodine	12	Germanium	44	Magnesium	MC
Tungsten	19	Tellurium	6	Gallium	290	Sodium	MC
Tantalum	4	Antimony	680	Zinc	MC	Fluorine	≈340
Hafnium	3	Tin	35	Copper	650	Oxygen	NR
Lutetium	1	Indium	STD	Nickel	MC	Nitrogen	NR
Ytterbium	10	Cadmium	67	Cobalt	74	Carbon	NR
Thulium	0.8	Silver	36	Iron	MC	Boron	MC
Erbium	4	Palladium		Manganese	200	Beryllium	43
Holmium	6	Rhodium		Chromium	MC	Lithium	>540
Dysprosium	9					Hydrogen	NR

STD — Internal Standard
NR — Not Reported
All elements not detected < 0.2 ppm
MC — Major Component >1000 ppm
INT — Interference

Approved: Robert E. [signature]
3 Feb-84

COMMERCIAL TESTING & ENGINEERING CO.

Reply to

GENERAL OFFICES: 1919 SOUTH HIGHLAND AVE., SUITE 210-B, LOMBARD, ILLINOIS 60148 AREA CODE 312 953-9300

INSTRUMENTAL ANALYSIS DIVISION, 490 ORCHARD STREET, GOLDEN, COLORADO 80401, PHONE: 303 278-9521

SINCE 1909

To: Acurex Corporation
555 Clyde Avenue
P.O. Box 7555
Mountain View, CA 94039

Date: February 3, 1984

Analyst: G. Meagher

P. O. No.: Subcontract SW 59159A Release Number 11 Project 7601

Sample No.: 819475 RA Filter, test 2

SPARK SOURCE MASS SPECTROGRAPHIC ANALYSIS

CONCENTRATION IN PPM WEIGHT

IAD No.: 97-N182-116-28

ELEMENT	CONC.	ELEMENT	CONC.	ELEMENT	CONC.	ELEMENT	CONC.
Uranium	78	Terbium	0.2	Ruthenium		Vanadium	170
Thorium	2	Gadolinium	1	Molybdenum	170	Titanium	110
Bismuth	86	Europium	0.3	Niobium	2	Scandium	13
Lead	MC	Samarium	2	Zirconium	6	Calcium	MC
Thallium	96	Neodymium	4	Yttrium	7	Potassium	MC
Mercury	NR	Praseodymium	1	Strontium	71	Chlorine	MC
Gold		Cerium	3	Rubidium	96	Sulfur	MC
Platinum		Lanthanum	3	Bromine	240	Phosphorus	MC
Iridium		Barium	53	Selenium	300	Silicon	MC
Osmium		Cesium	16	Arsenic	MC	Aluminum	MC
Rhenium		Iodine	7	Germanium	330	Magnesium	MC
Tungsten	33	Tellurium	8	Gallium	MC	Sodium	MC
Tantalum	4	Antimony	MC	Zinc	MC	Fluorine	≃310
Hafnium		Tin	250	Copper	MC	Oxygen	NR
Lutetium		Indium	STD	Nickel	MC	Nitrogen	NR
Ytterbium		Cadmium	700	Cobalt	240	Carbon	NR
Thulium		Silver	19	Iron	MC	Boron	MC
Erbium	≤0.2	Palladium		Manganese	MC	Beryllium	25
Holmium	≤0.3	Rhodium		Chromium	MC	Lithium	>312
Dysprosium	≤0.5					Hydrogen	NR

STD — Internal Standard
NR — Not Reported
All elements not detected < 0.1 ppm
MC — Major Component > 500 ppm
INT — Interference

Approved: 3 Feb-84

COMMERCIAL TESTING & ENGINEERING CO.

GENERAL OFFICES: 1919 SOUTH HIGHLAND AVE., SUITE 210-B, LOMBARD, ILLINOIS 60148 AREA CODE 312 953-9300
Reply to INSTRUMENTAL ANALYSIS DIVISION, 490 ORCHARD STREET, GOLDEN, COLORADO 80401, PHONE: 303 278-9521

To: Acurex Corporation
555 Clyde Avenue
P.O. Box 7555
Mountain View, CA 94039

Date: February 3, 1984

Analyst: G. Meagher

P. O. No.: Subcontract SW 59159A Release Number 11 Project 7601

Sample No.: 819465 RA XAD-2, test 2

SPARK SOURCE MASS SPECTROGRAPHIC ANALYSIS

CONCENTRATION IN PPM WEIGHT

IAD No.: 97-N182-116-28

ELEMENT	CONC.	ELEMENT	CONC.	ELEMENT	CONC.	ELEMENT	CONC.
Uranium		Terbium		Ruthenium		Vanadium	0.03
Thorium		Gadolinium		Molybdenum	2	Titanium	1
Bismuth		Europium		Niobium		Scandium	<0.01
Lead	0.2	Samarium		Zirconium	≤0.04	Calcium	2
Thallium		Neodymium		Yttrium		Potassium	2
Mercury	NR	Praseodymium		Strontium	0.08	Chlorine	49
Gold		Cerium		Rubidium	≤0.01	Sulfur	21
Platinum	*0.2	Lanthanum		Bromine	0.4	Phosphorus	7
Iridium		Barium	0.4	Selenium	0.5	Silicon	33
Osmium		Cesium	0.2	Arsenic	0.03	Aluminum	2
Rhenium		Iodine	0.09	Germanium	0.02	Magnesium	4
Tungsten		Tellurium		Gallium	0.06	Sodium	6
Tantalum		Antimony		Zinc	0.8	Fluorine	≃91
Hafnium		Tin		Copper	0.2	Oxygen	NR
Lutetium		Indium	STD	Nickel	0.3	Nitrogen	NR
Ytterbium		Cadmium		Cobalt	0.1	Carbon	NR
Thulium		Silver		Iron	6	Boron	0.1
Erbium		Palladium		Manganese	0.1	Beryllium	
Holmium		Rhodium		Chromium	1	Lithium	0.1
Dysprosium						Hydrogen	NR

*Probable contamination from sample preparation.

STD — Internal Standard
NR — Not Reported
All elements not detected < 0.02 ppm
MC — Major Component > 100 ppm
INT — Interference

Approved: Robert G. Jayl[illegible] 3 Feb-84

COMMERCIAL TESTING & ENGINEERING CO.

GENERAL OFFICES: 1919 SOUTH HIGHLAND AVE., SUITE 210-B, LOMBARD, ILLINOIS 60148 AREA CODE 312 953-9300
Reply to INSTRUMENTAL ANALYSIS DIVISION, 490 ORCHARD STREET, GOLDEN, COLORADO 80401, PHONE: 303 278-9521

SINCE 1908

To: Acurex Corporation
555 Clyde Avenue
P.O. Box 7555
Mountian View, CA 94039

Date: February 3, 1984

Analyst: G. Meagher

P. O. No.: Subcontract SW59159A Release 11 Project 7601

Sample No.: 819466
RA Imp 1, test 2

SPARK SOURCE MASS SPECTROGRAPHIC ANALYSIS
CONCENTRATION IN μg/mL

IAD No.: 97-N182-116-28

ELEMENT	CONC.	ELEMENT	CONC.	ELEMENT	CONC.	ELEMENT	CONC.
Uranium		Terbium		Ruthenium		Vanadium	0.02
Thorium		Gadolinium		Molybdenum	0.3	Titanium	0.4
Bismuth		Europium		Niobium	0.002	Scandium	≤0.002
Lead		Samarium		Zirconium	0.003	Calcium	MC
Thallium		Neodymium		Yttrium		Potassium	0.5
Mercury	NR	Praseodymium		Strontium	0.02	Chlorine	MC
Gold		Cerium		Rubidium	0.006	Sulfur	MC
Platinum		Lanthanum		Bromine	0.1	Phosphorus	0.4
Iridium		Barium	0.03	Selenium	0.3	Silicon	MC
Osmium		Cesium	0.007	Arsenic	0.009	Aluminum	0.6
Rhenium		Iodine	*0.2	Germanium	0.001	Magnesium	2
Tungsten		Tellurium	0.003	Gallium	0.03	Sodium	MC
Tantalum		Antimony	0.007	Zinc	0.3	Fluorine	MC
Hafnium		Tin	0.01	Copper	0.3	Oxygen	NR
Lutetium		Indium	STD	Nickel	MC	Nitrogen	NR
Ytterbium		Cadmium		Cobalt	0.7	Carbon	NR
Thulium		Silver	0.02	Iron	MC	Boron	0.006
Erbium		Palladium		Manganese	2	Beryllium	
Holmium	≤0.1	Rhodium		Chromium	MC	Lithium	0.04
Dysprosium						Hydrogen	NR

*Heterogeneous

STD — Internal Standard
NR — Not Reported
All elements not detected < 0.002 μg/mL
MC — Major Component > 10 μg/mL
INT — Interference

Approved: Robert C. Taylor
3 Feb 84

COMMERCIAL TESTING & ENGINEERING CO.

GENERAL OFFICES: 1919 SOUTH HIGHLAND AVE., SUITE 210-B, LOMBARD, ILLINOIS 60148 AREA CODE 312 953-9300
Reply to INSTRUMENTAL ANALYSIS DIVISION, 490 ORCHARD STREET, GOLDEN, COLORADO 80401, PHONE: 303 278-9521

SINCE 1908

To: Acurex Corporation
555 Clyde Avenue
P.O. Box 7555
Mountain View, CA 94039

Date: February 3, 1984

Analyst: G. Meagher

P. O. No.: Subcontract No. SW59159A Release 11 Project 7601

Sample No.: 819493
RA Bottom Ash
test #3

IAD No.: 97-N182-116-28

SPARK SOURCE MASS SPECTROGRAPHIC ANALYSIS
CONCENTRATION IN PPM WEIGHT

ELEMENT	CONC.	ELEMENT	CONC.	ELEMENT	CONC.	ELEMENT	CONC.
Uranium	16	Terbium	2	Ruthenium		Vanadium	140
Thorium	32	Gadolinium	5	Molybdenum	9	Titanium	MC
Bismuth		Europium	2	Niobium	39	Scandium	73
Lead	17	Samarium	11	Zirconium	270	Calcium	MC
Thallium	≤0.4	Neodymium	42	Yttrium	41	Potassium	MC
Mercury	NR	Praseodymium	22	Strontium	400	Chlorine	230
Gold		Cerium	49	Rubidium	22	Sulfur	MC
Platinum		Lanthanum	56	Bromine	6	Phosphorus	MC
Iridium		Barium	890	Selenium	18	Silicon	MC
Osmium		Cesium		Arsenic	8	Aluminum	MC
Rhenium		Iodine	3	Germanium	3	Magnesium	MC
Tungsten	2	Tellurium		Gallium	28	Sodium	MC
Tantalum	2	Antimony	29	Zinc	55	Fluorine	MC
Hafnium	3	Tin	2	Copper	110	Oxygen	NR
Lutetium	0.4	Indium	STD	Nickel	220	Nitrogen	NR
Ytterbium	4	Cadmium	0.6	Cobalt	64	Carbon	NR
Thulium	1	Silver	0.3	Iron	MC	Boron	78
Erbium	3	Palladium		Manganese	42	Beryllium	10
Holmium	5	Rhodium		Chromium	430	Lithium	>530
Dysprosium	7					Hydrogen	NR

STD — Internal Standard
NR — Not Reported
All elements not detected < 0.2 ppm
MC — Major Component > 1000 ppm
INT — Interference

Approved: Robert L. Jaylor
3 Feb 84

COMMERCIAL TESTING & ENGINEERING CO.

GENERAL OFFICES: 1919 SOUTH HIGHLAND AVE., SUITE 210-B, LOMBARD, ILLINOIS 60148 AREA CODE 312 953-9300
Reply to INSTRUMENTAL ANALYSIS DIVISION, 490 ORCHARD STREET, GOLDEN, COLORADO 80401, PHONE: 303 278-9521

To: Acurex Corporation
555 Clyde Avenue
P.O. Box 7555
Mountain View, CA 94039

Date: February 3, 1984

Analyst: G. Meagher

P. O. No.: Subcontract SW 59159A Release Number 11 Project: 7601

Sample No.: 319464 RA cyclone ash, test 3

SPARK SOURCE MASS SPECTROGRAPHIC ANALYSIS

CONCENTRATION IN PPM WEIGHT

IAD No.: 97-N182-116-28

ELEMENT	CONC.	ELEMENT	CONC.	ELEMENT	CONC.	ELEMENT	CONC.
Uranium	9	Terbium	0.6	Ruthenium		Vanadium	44
Thorium	14	Gadolinium	2	Molybdenum	6	Titanium	MC
Bismuth		Europium	1	Niobium	13	Scandium	15
Lead	32	Samarium	5	Zirconium	28	Calcium	MC
Thallium	3	Neodymium	10	Yttrium	12	Potassium	MC
Mercury	NR	Praseodymium	9	Strontium	210	Chlorine	13
Gold		Cerium	30	Rubidium	28	Sulfur	220
Platinum		Lanthanum	34	Bromine	5	Phosphorus	MC
Iridium		Barium	310	Selenium	13	Silicon	MC
Osmium		Cesium	4	Arsenic	18	Aluminum	MC
Rhenium		Iodine	0.2	Germanium	7	Magnesium	MC
Tungsten	1	Tellurium	0.2	Gallium	19	Sodium	MC
Tantalum	1	Antimony	5	Zinc	24	Fluorine	≃610
Hafnium	1	Tin	2	Copper	14	Oxygen	NR
Lutetium	0.2	Indium	STD	Nickel	31	Nitrogen	NR
Ytterbium	1	Cadmium	0.8	Cobalt	10	Carbon	NR
Thulium	0.4	Silver	0.2	Iron	MC	Boron	27
Erbium	0.8	Palladium		Manganese	9	Beryllium	5
Holmium	1	Rhodium		Chromium	42	Lithium	>370
Dysprosium	2					Hydrogen	NR

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

Approved: Robert L. Taylor
3 Feb 84

COMMERCIAL TESTING & ENGINEERING CO.
GENERAL OFFICES: 1919 SOUTH HIGHLAND AVE., SUITE 210-B, LOMBARD, ILLINOIS 60148 • (312) 953-9300

ROBERT L. TAYLOR, Ph.D.
MANAGER
INSTRUMENTAL ANALYSIS DIVISION

SINCE 1908

PLEASE ADDRESS ALL CORRESPONDENCE TO.
490 ORCHARD ST., GOLDEN, CO 80401
OFFICE TEL. (303) 278-9521

June 8, 1984

Mr. Christopher Mann
Acurex Corporation
P.O. Box 7555
Mountain View, CA 94039

RE: IAD #97-N815-116-18
Subcontract #SW 59159A
Release #13

Analytical Report

Eighteen samples, previously analyzed for trace elements by spark source mass spectrometry under our IAD identification #97-N182-116-28, were logged in under our IAD identification #97-N815-116-18 on February 22, 1984.

Chlorine and Fluorine were determined using specific ion electrode methodology. Boron and Phosphorus were determined colorimetrically.

Depending on sample type and the amount of sample available, Sulfur was determined turbidimetrically or by X-ray fluorescence spectrometry while the remaining elemental analysis was performed using either atomic absorption/emission spectrophotometry or X-ray fluorescence spectrometry.

The results of these determinations are presented in the following tables. Samples #1, 2, 3, 4, 6, 7, 8, 10, 12, 13, 15, 17 and 18 are reported in weight per cent (Wt.%) on an "as received" basis. Samples #5, 9, 11, 14 and 16 are reported in micrograms per millilitres (μg/mL) on an "as received" basis.

If you have any questions concerning these results, please call.

Harold A. Connell
Assistant Lab Manager

Charles R. Wilson for
Robert L. Taylor, Ph.D., Mngr.
Instrumental Analysis Div.

as

AMERICAN COUNCIL OF INDEPENDENT LABORATORIES, INC.
Charter Member

Table No. I
(Wt.%-As Received)

Parameter	819463 RA Filter + 1μ, Test 1
Aluminum (Al)	5.39
Boron (B)	*
Calcium (Ca)	11.05
Fluorine (F)	*
Iron (Fe)	8.21
Potassium (K)	4.39
Lithium (Li)	*
Magnesium (Mg)	1.54
Sodium (Na)	3.37
Phosphorus (P)	12.20
Sulfur (S)	3.31
Silicon (Si)	**
Titanium (Ti)	0.51

* Insufficient sample for analysis.

** Unable to analyze due to contamination from the fiberglass filter.

Table No. II
(Wt.%-As Received)

Parameter	819475 RA Filter, Test 2
Aluminum (Al)	1.30
Arsenic (As)	0.13
Boron (B)	*
Calcium (Ca)	0.25
Chlorine (Cl)	0.03 (300 µg/g)
Chromium (Cr)	0.02 (200 µg/g)
Copper (Cu)	0.02 (180 µg/g)
Iron (Fe)	3.94
Potassium (K)	2.86
Lithium (Li)	*
Magnesium (Mg)	≤0.1
Manganese (Mn)	0.04 (400 µg/g)
Sodium (Na)	0.57
Nickel (Ni)	0.03 (250 µg/g)
Phosphorus (P)	3.93
Lead (Pb)	4.69
Sulfur (S)	2.58
Antimony (Sb)	≤0.01 (≤100 µg/g)
Silicon (Si)	3.89
Zinc (Zn)	0.10

* Insufficient sample for analysis.

Table No. III
(Wt.%-As Received)

Parameter	319456 RA 10μ + 3μ, Test 1
Aluminum (Al)	7.58
Arsenic (As)	0.05 (490 μg/g)
Boron (B)	0.02 (230 μg/g)
Barium (Ba)	0.19
Calcium (Ca)	1.32
Chromium (Cr)	0.004 (40 μg/g)
Iron (Fe)	10.79
Potassium (K)	1.17
Lithium (Li)	0.10 (950 μg/g)
Magnesium (Mg)	0.43
Manganese (Mn)	0.09 (900 μg/g)
Sodium (Na)	0.45
Phosphorus (P)	1.67
Sulfur (S)	1.59
Selenium (Se)	≤0.001 (≤10 μg/g)
Silicon (Si)	12.81
Strontium (Sr)	0.12
Titanium (Ti)	0.68
Zinc (Zn)	0.06 (610 μg/g)

Table No. IV
(Wt.%-As Received)

Parameter	819492 RA 10µ+ 3µ, Test 2
Aluminum (Al)	9.03
Boron (B)	≤0.008 (≤80 µg/g)
Calcium (Ca)	1.37
Chlorine (Cl)	0.42
Chromium (Cr)	0.14
Iron (Fe)	11.22
Potassium (K)	1.22
Lithium (Li)	0.02 (200 µg/g)
Magnesium (Mg)	0.40
Sodium (Na)	0.52
Nickel (Ni)	0.03 (250 µg/g)
Phosphorus (P)	1.71
Sulfur (S)	3.06
Silicon (Si)	14.97
Titanium (Ti)	0.83
Zinc (Zn)	0.07 (680 µg/g)

Table No. V
(μg/mL-As Received)

Parameter	819466 RA Imp I, Test 2	
Calcium (Ca)	2.2	
Chlorine (Cl)	4,500	(0.45%)
Chromium (Cr)	96	
Fluorine (F)	42	
Iron (Fe)	450	
Sodium (Na)	2,000	(0.20%)
Nickel (Ni)	71	
Sulfur (S)	7,700	(0.77%)
Silicon (Si)	12	

Table No. VI
(Wt.%-As Received)

Parameter	819449 RA Coal, Test 1	
Aluminum (Al)	1.19	
Calcium (Ca)	0.19	
Iron (Fe)	0.34	
Potassium (K)	0.12	
Magnesium (Mg)	0.05	(480 μg/g)
Sodium (Na)	0.05	(520 μg/g)
Silicon (Si)	1.87	
Titanium (Ti)	0.05	(540 μg/g)

Table No. VII
(Wt.%-As Received)

Parameter	819485 RA PET, Test 2
Silicon (Si)	0.07

Table No. VIII
(Wt.%-As Received)

Parameter	819488 RA Bottom Ash, Test 1
Aluminum (Al)	12.89
Calcium(Ca)	1.19
Fluorine (F)	$\leq$0.01
Iron (Fe)	4.75
Potassium (K)	1.24
Magnesium (Mg)	0.46
Sodium (Na)	0.56
Silicon (Si)	21.16
Titanium (Ti)	0.68

Table No. IX
(µg/mL-As Received)

Parameter	819495 RA Bottom Ash Leachate, Test 1
Calcium (Ca)	110
Potassium (K)	7.3
Magnesium (Mg)	4.7
Sulfur (S)	110

Table No. X
(Wt.%-As Received)

Parameter	819498 RA Bottom Ash, Test 2
Aluminum (Al)	16.43
Barium (Ba)	0.10 (985 μg/g)
Calcium (Ca)	2.59
Fluorine (F)	≤0.01
Iron (Fe)	3.86
Potassium (K)	1.14
Lithium (Li)	0.005(54 μg/g)
Magnesium (Mg)	0.47
Sodium (Na)	0.52
Phosphorus (P)	0.10
Sulfur (S)	0.54
Silicon (Si)	21.27
Titanium (Ti)	0.74

Table No. XI
(μg/mL-As Received)

Parameter	319496 RA Bottom Ash Leachate, Test 2
Aluminum (Al)	14
Calcium (Ca)	53
Potassium (K)	5.1
Sodium (Na)	7.1
Sulfur (S)	90

Table No. XII
(Wt.% -As Received)

Parameter	819493 RA Bottom Ash, Test 3
Aluminum (Al)	16.84
Barium (Ba)	0.10
Calcium (Ca)	1.14
Fluorine (F)	≤0.01
Iron (Fe)	3.94
Potassium (K)	1.20
Lithium (Li)	0.008 (75 µg/g)
Magnesium (Mg)	0.34
Sodium (Na)	0.42
Phosphorus (P)	0.09
Silicon (Si)	20.88
Sulfur (S)	0.11
Titanium (Ti)	0.74

Table No. XIII
(Wt.%-As Received)

Parameter	819476 RA Cyclone Ash, Test 1
Aluminum (Al)	5.62
Calcium (Ca)	0.67
Iron (Fe)	9.52
Potassium (K)	0.51
Magnesium (Mg)	0.15
Sodium (Na)	0.26
Phosphorus (P)	0.27
Sulfur (S)	4.05
Silicon (Si)	8.20
Titanium (Ti)	0.35

Table No. XIV
(µg/mL-As Received)

Parameter	819482 RA Cyclone Ash Leachate, Test 1
Aluminum (Al)	1,500 (0.15%)
Calcium (Ca)	1.8
Copper (Cu)	18
Fluorine (F)	42
Iron (Fe)	1,100 (0.11%)
Potassium (K)	140
Lithium (Li)	4.7
Magnesium (Mg)	110
Manganese (Mn)	24
Sodium (Na)	170
Phosphorus (P)	0.02
Sulfur (S)	15,300 (1.53%)
Silicon (Si)	89
Strontium (Sr)	24
Titanium (Ti)	4.4
Zinc (Zn)	44

Table No. XV
(Wt.%-As Received)

Parameter	819504 RA Cyclone Ash, Test 2
Aluminum (Al)	6.66
Calcium (Ca)	2.27
Iron (Fe)	11.27
Potassium (K)	0.64
Magnesium (Mg)	0.43
Sodium (Na)	0.27
Phosphorus (P)	0.33
Sulfur (S)	2.81
Silicon (Si)	9.84
Titanium (Ti)	0.45

Table No. XIV
(µg/mL-As Received)

Parameter	819486 RA Cyclone Ash Leachate, Test 2
Aluminum (Al)	1,100 (0.11%)
Calcium (Ca)	1.9
Fluorine (F)	38
Iron (Fe)	540
Potassium (K)	56
Lithium (Li)	4.4
Magnesium (Mg)	96
Manganese (Mn)	18
Sodium (Na)	170
Phosphorus (P)	≤0.01
Sulfur (S)	3,900 (0.39%)
Silicon (Si)	210
Titanium (Ti)	0.5

Table No. XVII
(Wt.%-As Received)

Parameter	819464 RA Cyclone Ash, Test 3
Aluminum (Al)	13.57
Calcium (Ca)	1.28
Iron (Fe)	9.35
Potassium (K)	1.75
Lithium (Li)	0.01 (110 µg/g)
Magnesium (Mg)	0.47
Sodium (Na)	0.24
Phosphorus (P)	0.16
Silicon (Si)	21.43
Titanium (Ti)	0.76

Table No. XVIII
(Wt.%-As Received)

Parameter	819478 RA Coal/PET, Test 2
Aluminum (Al)	1.56
Calcium (Ca)	0.09 (930 µg/g)
Iron (Fe)	0.38
Potassium (K)	0.09 (910 µg/g)
Magnesium (Mg)	0.04 (370 µg/g)
Sodium (Na)	0.04 (370 µg/g)
Silicon (Si)	1.37
Titanium (Ti)	0.05 (480 µg/g)

ACUREX Corporation
ANALYSIS LABORATORIES

DATA REPORTING FORM

CUSTOMER: CMEA
DATE: January 13, 1984
CUSTOMER CONTRACT NO.: 307736.62
ACUREX CONTRACT NO.: 8311-030
RESULTS REPORT TO: L. Waterland
TELEPHONE:
ADDRESS:
Vermont

SAMPLE ID (CUSTOMER)	Bottom Ash Test 1	Cyclone Ash Test 1	Bottom Ash Test 2	Cyclone Ash Test 2						
SAMPLE ID (LAB)	488	476	498	504						
PARAMETER										UNITS
NO_2^-	<1	<10	<1	<10						mg/L
NO_3^-	<1	<10	<1	<10						mg/L
PO_4^{-3}	<1	<10	<1	<10						↓
F^-	0.25	0.46	0.10	1.8						↓
Cl^-	2.6	300	1.3	180						↓
SO_4^{-2}	300	19,000	220	12,000						↓
SO_4^{-2} and SO_3^{-2}	320	24,000	240	17,000						↓

ANALYST: C. McMillen

REVIEWER: [signature]

Form EED-057 4/80

5.6 TOTAL CHROMATOGRAPHABLE ORGANICS (TCO), GRAVIMETRIC ORGANICS (GRAV), GAS CHROMATOGRAPHY/MASS SPECTROMETRY (GC/MS), AND INFRARED SPECTRA (IR) OF TOTAL SAMPLE EXTRACTS

ACUREX Corporation

Energy & Environmental Division

Acurex/ES

January 16, 1984
Acurex ID#: 8310-003
8311-030
Client PO#: 307736.62

Attention: Larry Waterland

Sample: Vermont, Rock of Ages, 2 SASS Trains;
Received 7/12/83

The above samples were analyzed by Level 1 protocol. The XAD and OMC extracts were combined per your instruction. Organic extracts were also analyzed for the semivolatile priority pollutants by gas chromatography/mass spectrometry employing a J&W SE-54 30 meter capillary column. The column was held at 30°C for 2 minutes, then ramped at 10°C per minute to 270°C. In addition to the priority pollutants, other organics including benzo(c)phenanthrene, dibenzo(c,g)carbazole, 7,12-dimethylbenzo(a)anthracene, 3-methylcholanthrene, and perylene were sought employing the computerized library search and manual interpretation. The assignment and quantitation of these organics is tentative since analytical standards of these compounds were not available for analysis. Benzo(c)phenanthrene, dibenzo(c,g)carbazole, 7,12-dimethylbenzo(a)anthracene, 3-methylcholanthrene and perylene were not detected in any of the samples at levels above 400 μg per 10 mL of extract.

Submitted by: Greg Nicoll
Greg Nicoll
Operations Manager

Viorica Lopez-Avila
Viorica Lopez-Avila, Ph.D.
Technical Director

GN/VLA/ats

555 Clyde Avenue, P.O. Box 7555, Mountain View, CA 94039 (415) 964-3200 Telex: 34-6391 TWX: 910-7796593

ACUREX Corporation
ANALYSIS LABORATORIES

DATA REPORTING FORM

CUSTOMER CMEA DATE January 16, 1984

CUSTOMER CONTRACT NO. 307736.62 ACUREX CONTRACT NO. 8310-003

RESULTS REPORT TO L. Waterland TELEPHONE

ADDRESS
Vermont

5-86

SAMPLE ID (CUSTOMER)	XAD I	XAD II	XAD Blk	Front I	Front II	Bottom Ash I	Cyclone Ash I	Bottom Ash II	Cyclone Ash II	
SAMPLE ID (LAB)	8	23	14	6	20	28	29	32	33	
PARAMETER										UNITS
GRAV	24	27	<4	<8	<9	<80*	1100*	220*	500*	mg/train
TCO	2.0	3.5; 2.8**	<0.2	--	--	--	--	--	--	mg/train
PAH - Naphthalene	0.06	0.35;0.44**	<0.01	--	--	--	--	--	--	mg/train
- Phenol	<0.01	0.45;0.54**	<0.01	--	--	--	--	--	--	mg/train
- Phenanthrene	<0.01	0.07;0.08**	<0.01	--	--	--	--	--	--	mg/train
- Fluoranthene	<0.01	0.05;0.06**	<0.01	--	--	--	--	--	--	mg/train
- Bis(2-ethylhexyl) phthalate ***	0.12	0.14;0.07**	<0.01	--	--	--	--	--	--	mg/train
- Diethyl phthalate***	<0.01	0.15;0.15**	<0.01	--	--	--	--	--	--	mg/train

* mg/Kg
** Duplicate injection

*** Normally found in laboratory blanks at this leval

ANALYST U. Spannagel, C. Beeman, S. Kraska

REVIEWER [signature]

Form EED-057 4 80

IR REPORT

SAMPLE: 8310-03-6 Front Half Rinse

Wave Number (cm^{-1})	Intensity	Assignment	Comments
2920	S	C-H Alkane	Weak spectrum
2840	S	C-H Alkane	Weak spectrum

IR REPORT

SAMPLE: 8310-03-8 XAD Test I

Wave Number (cm⁻¹)	Intensity	Assignment	Comments
3650-2350	M	O-H Stretch	
2970	S	C-H Alkane	
2920	S	C-H Alkane	
2860	M	C-H Alkane	
1740	M	C=O	
1600	W	Not Assigned	
1580	W	Not Assigned	
1450	M	C-H	
1370	W	CH	
1260	M	C-O	
1160	M	C-O	
1090	M	C-O	
810	M	Not Assigned	
770	W	Not Assigned	
750	W	Not Assigned	
710	W	Not Assigned	
630	W	Not Assigned	
			Aliphatic
			Carboxylic Acid

IR REPORT

SAMPLE: 8310-03-14 XAD Blk

Wave Number (cm^{-1})	Intensity	Assignment	Comments
2920	S	C-H Stretch	weak spectrum

IR REPORT

SAMPLE: 8310-03-28 Bottom Ash I

Wave Number (cm^{-1})	Intensity	Assignment	Comments
2920	S	C-H Alkane	Weak Spectrum
2840	M	C-H Alkane	

IR REPORT

SAMPLE: 8310-03-29 Cyclone Ash I

Wave Number (cm⁻¹)	Intensity	Assignment	Comments
3650-2300	W	OH Stretch	broad
2940	S	C-H Alkane	
2860	M	C-H Alkane	
1770	M	Not Assigned	
1740	S	C=O	
1600	M	Not Assigned	
1460	M	CH	
1380	W	CH	
1270	W	C-O	
1120	W	Not Assigned	
760	M	Not Assigned	
			Aliphatic
			Carboxylic Acid

IR REPORT

SAMPLE: 8310-03-20 Front Half Rinse Test II

Wave Number (cm^{-1})	Intensity	Assignment	Comments
2920	S	C-H Alkane	Weak Spectrum
2860	M	C-H Alkane	
1730	M	C=O	Tentative assignment

SAMPLE: 8310-03-23 XAD Test II

Wave Number (cm⁻¹)	Intensity	Assignment	Comments
3650-2[illegible]00	W	O-H Stretch	broad
2960	M	C-H Alkane	
2920	M	C-H Alkane	
2860	M	C-H Alkane	
1770	W	Not Assigned	
1740	S	C=O	
1600	W	Not Assigned	
1450	M	CH	
1370	W	CH	
1250	M	C-O	
1080	M	C-O	
800	M	Not Assigned	
720	W	Not Assigned	
			Aliphatic
			Carboxylic Acid

IR REPORT

SAMPLE: 8310-03-32 Bottom Ash II

Wave Number (cm^{-1})	Intensity	Assignment	Comments
2930	S	C-H Alkane	Very Weak Spectrum
			Tentative Assignment

IR REPORT

SAMPLE: 8310-03-33 Cyclone Ash II

Wave Number (cm^{-1})	Intensity	Assignment	Comments
2920	S	C-H Stretch	
2860	M	C-H Stretch	
1770	M	No Assignment	
1740-1680	M	C=O Broad	Assignment Tentative
1600	M	No Assignment	
1460	M	CH	
1380	W	CH	
			Aliphatic

GC/MS Detection Limits

	ACID COMPOUND	ng
21A	2,4,6-trichlorophenol	5
22A	p-chloro-m-cresol	5
24A	2-chlorophenol	5
31A	2,4-dichlorophenol	5
34A	2,4-dimethylphenol	5
57A	2-nitrophenol	5
58A	4-nitrophenol	20
59A	2,4-dinitrophenol	20
60A	4,6-dinitro-o-cresol	20
64A	pentachlorophenol	5
65A	phenol	1

	BASE/NEUTRAL COMPOUNDS	ng
1B	acenaphthene	1
5B	benzidine	20
8B	1,2,4-trichlorobenzene	1
9B	hexachlorobenzene	1
12B	hexachloroethane	1
18B	bis(2-chloroethyl)ether	1
20B	2-chloronaphthalene	1
25B	1,2-dichlorobenzene	1
26B	1,3-dichlorobenzene	1
27B	1,4-dichlorobenzene	1
28B	3,3'-dichlorobenzidine	5
35B	2,4-dinitrotoluene	1
36B	2,6-dinitrotoluene	1
37B	1,2-diphenylhydrazine (as azobenzene)	1
39B	fluoranthene	1
40B	4-chlorophenyl phenyl ether	1

	BASE/NEUTRAL COMPOUNDS	ng
41B	4-bromophenyl phenyl ether	1
42B	bis(2-chloroisopropyl)ether	1
43B	bis(2-chloroethoxy)methane	1
52B	hexachlorobutadiene	1
53B	hexachlorocyclopentadiene	1
54B	isophorone	1
55B	naphthalene	1
56B	nitrobenzene	1
61B	N-nitrosodimethylamine	NA
62B	N-nitrosodiphenylamine	1
63B	N-nitrosodi-n-propylamine	5
66B	bis(2-ethylhexyl)phthalate	1
67B	butylbenzyl phthalate	1
68B	di-n-butyl phthalate	1
69B	di-n-octyl phthalate	1
70B	diethyl phthalate	1
71B	dimethyl phthalate	1
72B	benzo(a)anthracene	1
73B	benzo(a)pyrene	1
74B	3,4-benzofluoranthene	1
75B	benzo(k)fluoranthene	1
76B	chrysene	1
77B	acenaphthylene	1
78B	anthracene	1
79B	benzo(ghi)perylene	5
80B	fluorene	1
81B	phenanthrene	1
82B	dibenzo(a,h)anthracene	5
83B	indeno(1,2,3-cd)pyrene	5
84B	pyrene	1

Units are ng/injection

Greg Nicoll
1/19/84

5.7 LIQUID CHROMATOGRAPHY (LC) SEPARATION AND IR SPECTRA OF LC FRACTIONS

ACUREX
Corporation

Energy & Environmental Division

Acurex/ES (CMEA)
MS 2-2260

March 12, 1984
Acurex ID#: 8402-020
Client PO#: 307736.62

Attention: Larry Waterland

Sample: Cyclone Ash, Rock of Ages; Received 2/10/84

The above samples were subjected to liquid chromatography followed by gravimetric measurement and infrared spectrophotometry according to Level 1 protocol.

Results are enclosed.

Submitted by: John S. Labash
Chemist

Approved by: Greg Nicoll
Manager, Inorganic Chemistry

JSL/GN/ats

Enclosures

555 Clyde Avenue, P.O. Box 7555, Mountain View, CA 94039 (415) 964-3200 Telex: 34-6391 TWX: 910-7796593

SAMPLE: Rock of Ages Cyclone Ash Test 1 #819476 8402-020-1

	TCO mg	GRAV mg	TCO + GRAV Total mg	Concentration mg/Kg
Total Sample[1]		55		1100
Taken for LC[2]		22		440
Recovered[3]		28		560

Fraction	TCO in mg				GRAV in mg				TCO + GRAV Total mg	Concentration mg/Kg
	Found in Fraction	Blank	Corrected	Total[4]	Found in Fraction	Blank	Corrected	Total[4]		
1					5.0	<0.5	5.0	12		240
2					0.8	<0.4	0.8	2		40
3					2.2	<0.4	2.2	6		120
4					1.8	<0.4	1.8	4		80
5					2.2	<0.4	2.2	6		120
6					11.6	<0.4	11.6	29		580
7					4.6	0.6	4.0	10		200
Sum					28.2	0.6	27.6	69		1400

1. Quantity in entire sample, determined before LC
2. Portion of whole sample used for LC, actual mg
3. Quantity recovered from LC column, actual mg
4. Total mg computed back to total sample

IR REPORT

SAMPLE: 2-20-1 LCF 1 Cyclone Ash Test 1

Wave Number (cm^{-1})	Intensity	Assignment	Comments
2940	S	CH Alkane	
1468	M	CH_2	
1384	W	Unassigned	

IR REPORT

SAMPLE: 2-20-1 LCF 2

Wave Number (cm^{-1})	Intensity	Assignment	Comments
2940	S	CH Alkane	
			Weak Spectrum

IR REPORT

SAMPLE: 2-20-1 LCF 3

Wave Number (cm^{-1})	Intensity	Assignment	Comments
2939	S	CH Alkane	
1462	M	CH_2	

IR REPORT

SAMPLE: 2-20-1 LCF 4

Wave Number (cm^{-1})	Intensity	Assignment	Comments
2940	S	CH Alkane	
1460	M	CH_2	

IR REPORT

SAMPLE 2-20-1 LCF 5

Wave Number (cm^{-1})	Intensity	Assignment	Comments
2940	S	CH Alkane	
1783	M	Unassigned	
1710	S	C=O (tentative)	
1600	M	Unassigned	
1465	M	CH_2	
			Weak spectrum

IR REPORT

SAMPLE: 2-20-1 LCF 6

Wave Number (cm^{-1})	Intensity	Assignment	Comments
3300	W	OH	Broad
2941	S	CH Alkane	
1780	M	Unassigned	
1730	S	C=O	
1600	M	Unassigned	
1455	M	CH_2	
1290	M	C-O	

IR REPORT

SAMPLE: 2-20-1 LCF 7

Wave Number (cm^{-1})	Intensity	Assignment	Comments
3350	S	OH	Broad
2943	S	CH Alkane	
1725	S	C=O	
1600	S	Unassigned	
1460	W	CH_2	
1285	W	C-O	Broad

SAMPLE: Rock of Ages Cyclone Ash Test 2 #819504 8402-020-2

	TCO mg	GRAV mg	TCO + GRAV Total mg	Concentration mg/Kg
Total Sample[1]		25		500
Taken for LC[2]		22		440
Recovered[3]		27		540

Fraction	TCO in mg				GRAV in mg				TCO + GRAV Total mg	Concentration mg/Kg
	Found in Fraction	Blank	Corrected	Total[4]	Found in Fraction	Blank	Corrected	Total[4]		
1					5.0	<0.5	5.0	5.6		110
2					1.8	<0.4	1.8	2.0		40
3					3.4	<0.4	3.4	3.8		76
4					2.4	<0.4	2.4	2.7		54
5					2.6	<0.4	2.6	2.9		58
6					8.4	<0.4	8.4	9.3		190
7					3.6	0.6	3.0	3.3		66
Sum					27.2	0.6	26.6	29.6		590

1. Quantity in entire sample, determined before LC
2. Portion of whole sample used for LC, actual mg
3. Quantity recovered from LC column, actual mg
4. Total mg computed back to total sample

IR REPORT

SAMPLE: 2-20-2 LCF 1 Cyclone Ash Test 2

Wave Number (cm^{-1})	Intensity	Assignment	Comments
2940	S	CH Alkane	
1460	W	CH_2	

IR REPORT

SAMPLE: 2-20-2 LCF 2

Wave Number (cm^{-1})	Intensity	Assignment	Comments
2940	S	CH Stretch Alkane	

IR REPORT

SAMPLE: 2-20-2 LCF 3

Wave Number (cm^{-1})	Intensity	Assignment	Comments
2941	S	CH Alkane	
1460	M	CH_2	
			Weak spectrum

IR REPORT

SAMPLE: 2-20-2 LCF 4

Wave Number (cm^{-1})	Intensity	Assignment	Comments
2940	S	CH Alkane	
1775	W	Unassigned	
1705	M	C=O (tentative)	
1460	M	CH_2	
			Weak spectrum

IR REPORT

SAMPLE: 2-20-2 LCF 5

Wave Number (cm^{-1})	Intensity	Assignment	Comments
2940	S	CH Alkane	
1780	S	Not Assigned	
1718	S	C=O	
1600	S	Not Assigned	
1460	M	CH_2	
1300	M	C-O	

IR REPORT

SAMPLE: 2-20-2 LCF 6

Wave Number (cm^{-1})	Intensity	Assignment	Comments
3300	W	OH	Broad
2945	S	CH Alkane	
1782	M	Unassigned	
1735	S	C=O Tentative	
1600	M	Unassigned	
1460	M	CH_2	

SAMPLE: 2-20-2 LCF 7

Wave Number (cm^{-1})	Intensity	Assignment	Comments
3400	S	OH	Broad
2943	S	CH Alkane	
1725	S	C=0	
1600	S	Unassigned	
1458	M	CH_2	
1275	W	C-0	Broad

ACUREX Corporation

Energy & Environmental Division

Acurex/ES (CMEA)
MS 2-2260

March 13, 1984
Acurex ID#: 8401-029
Client PO#: 307736.62

Attention: Larry Waterland

Sample: Honor Rancho Inlet XAD, Rock of Ages XADs;
Received 1/20/84

The above samples were subjected to liquid chromatography followed by TCO, gravimetric measurement, and infrared spectrophotometry according to Level 1 protocol.

Results are enclosed.

Prepared by: John S. Labash
Chemist

Approved by: Greg Nicoll
Manager, Inorganic Chemistry

JSL/GN/ats

555 Clyde Avenue, P.O. Box 7555, Mountain View, CA 94039 (415) 964-3200 Telex: 34-6391 TWX: 910-7796593

SAMPLE: 819459 Rock of Ages Test 1 XAD-2

	TCO mg	GRAV mg	TCO + GRAV Total mg	Concentration mg/dscm
Total Sample[1]	2.0	24	26	
Taken for LC[2]	1.1	14	15	
Recovered[3]	0.6	7.9	8.5	

Fraction	TCO in mg				GRAV in mg				TCO + GRAV Total mg	Concentration mg/dscm
	Found in Fraction	Blank	Corrected	Total[4]	Found in Fraction	Blank	Corrected	Total[4]		
1	0.6	<0.2	0.6	1.1	1.5	<0.5	1.5	2.6	3.7	
2	<0.1	<0.1	<0.1	<0.2	<0.4	<0.4	<0.4	<0.7	<0.9	
3	<0.1	<0.1	<0.1	<0.2	<0.4	<0.4	<0.4	<0.7	<0.9	
4	<0.1	0.2	<0.1	<0.2	<0.4	<0.4	<0.4	<0.7	<0.9	
5	<0.1	<0.1	<0.1	<0.2	0.8	<0.4	0.8	1.4	1.4	
6	<0.1	<0.1	<0.1	<0.2	2.6	<0.4	2.6	4.6	4.6	
7	<0.1	<0.1	<0.1	<0.2	3.6	0.6	3.0	5.3	5.3	
Sum	0.6	<0.9	0.6	1.1	8.5	0.6	7.9	13.9	15	

1. Quantity in entire sample, determined before LC
2. Portion of whole sample used for LC, actual mg
3. Quantity recovered from LC column, actual mg
4. Total mg computed back to total sample

IR REPORT

SAMPLE: 1-29-2 LCF 1

Wave Number (cm^{-1})	Intensity	Assignment	Comments
2930	S	CH Alkane	
			Weak spectrum

IR REPORT

SAMPLE: 1-29-2 LCF 2

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

IR REPORT

SAMPLE: 1-29-2 LCF 3

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

IR REPORT

SAMPLE: 1-29-2 LCF 4

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

IR REPORT

SAMPLE: 1-29-2 LCF 5

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

IR REPORT

SAMPLE: 1-29-2 LCF 6

Wave Number (cm^{-1})	Intensity	Assignment	Comments
2935	S	CH Alkane	
1745	S	C=0 *	
		* Tentative assignment	

IR REPORT

SAMPLE: 1-29-2 LCF 7

Wave Number (cm^{-1})	Intensity	Assignment	Comments
2950	S	CH Alkane	

SAMPLE: 819465 Rock of Ages Test 2 XAD-2

	TCO mg	GRAV mg	TCO + GRAV Total mg	Concentration mg/dscm
Total Sample[1]	3.2	27	30	
Taken for LC[2]	1.6	13	15	
Recovered[3]	<0.8	13.6	14	

Fraction	TCO in mg				GRAV in mg				TCO + GRAV Total mg	Concentration mg/dscm
	Found in Fraction	Blank	Corrected	Total[4]	Found in Fraction	Blank	Corrected	Total[4]		
1	<0.2	<0.2	<0.2	<0.4	3.2	<0.5	3.2	6.5	6.5	
2	<0.1	<0.1	<0.1	<0.2	<0.4	<0.4	<0.4	<0.8	<1	
3	<0.1*	<0.1	<0.1	<0.2	1.2	<0.4	1.2	2.4	2.4	
4	<0.1	0.2	<0.1	<0.2	1.0	<0.4	1.0	2.0	2.0	
5	<0.1	<0.1	<0.1	<0.2	0.6	<0.4	0.6	1.2	1.2	
6	<0.1	<0.1	<0.1	<0.2	3.8	<0.4	3.8	7.8	7.8	
7	<0.1	<0.1	<0.1	<0.2	4.4	0.6	3.8	7.8	7.8	
Sum	<0.8	<0.9	<0.8	<2	14.2	0.6	13.6	27.7	27.7	

1. Quantity in entire sample, determined before LC
2. Portion of whole sample used for LC, actual mg
3. Quantity recovered from LC column, actual mg
4. Total mg computed back to total sample

*Duplicate injection gave <0.1

IR REPORT

SAMPLE: 1-29-3 LCF 1

Wave Number (cm^{-1})	Intensity	Assignment	Comments
2930	S	CH Alkane	

IR REPORT

SAMPLE: 1-29-3 LCF 2

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

IR REPORT

SAMPLE: 1-29-3 LCF 3

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

IR REPORT

SAMPLE: 1-29-3 LCF 4

Wave Number (cm^{-1})	Intensity	Assignment	Comments
2915	S	CH Alkane	
			Weak spectrum

IR REPORT

SAMPLE: 1-29-3 LCF 5

Wave Number (cm^{-1})	Intensity	Assignment	Comments
2940	S	CH Alkane	
			Weak spectrum

IR REPORT

SAMPLE: 1-29-3 LCF 6

Wave Number (cm^{-1})	Intensity	Assignment	Comments
2940	S	CH Alkane	
1725	S	C=O *	
		* Tentative Assignment	

IR REPORT

SAMPLE: 1-29-3 LCF 7

Wave Number (cm^{-1})	Intensity	Assignment	Comments
2940	S	CH Alkane	
			Weak spectrum

IR REPORT

SAMPLE: 1-29-BLK LCF-1

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

IR REPORT

SAMPLE: 1-29-BLK LCF 2

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

IR REPORT

SAMPLE: 1-29-BLK LCF 3

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

IR REPORT

SAMPLE: 1-29-BLK LCF 4

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

IR REPORT

SAMPLE: 1-29-BLK LCF 5

Wave Number (cm^{-1})	Intensity	Assignment	Comments
2935	S	CH Alkane	
			Weak spectrum

IR REPORT

SAMPLE: 1-29-BLK LCF 6

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

IR REPORT

SAMPLE: 1-29-BLK LCF 7

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

5.8 GC/MS ANALYSES OF VOST TRAPS

ACUREX Corporation

Energy & Environmental Division

Acurex/E.S.

Attention: Larry Waterland

November 1, 1983
Acurex ID#: 8307-010
Customer PO#: 307736.62
Page 1 of 2

Subject: Analysis of Two VOST Sample Sets by GC/MS.

The above referenced samples were analyzed according to the latest revisions of the EPA VOST Protocol for Volatile Priority Pollutants and Xylenes. An attempt was also made to identify ethylene oxide, propylene oxide, 2-nitropropane and allyl chloride, but due to the lack of analytical standards for these compounds, it proved impossible.

Results are listed in Table 1.

Please call if you have any questions.

Prepared by: William G. Hellier
Staff Chemist

Approved by: Viorica Lopez-Avila, Ph.D.
Technical Director

WGH/VLA/ats

555 Clyde Avenue, P.O. Box 7555, Mountain View, CA 94039 (415) 964-3200 Telex: 34-6391 TWX: 910-7796593

Table 1. Volatile Organics Results

Trap ID / Lab ID	Concentration (ng/trap)				
Trap ID	Tenax/C 819501	Tenax 819501	Tenax/C 819502	Tenax 819502	Tenax/C 819503
Lab ID	-1	-2[a]	-3	-4	-5[a]
Compound					
Chloromethane	12	10	ND	ND	ND
Bromomethane	ND	ND	ND	ND	ND
Vinyl chloride	ND	ND	ND	ND	ND
Chloroethane	ND	ND	ND	ND	ND
Dichloromethane	65	>1,100	1,600	115	102
1,1-Dichloroethylene	98	ND	90	80	ND
1,1-Dichloroethane	ND	ND	ND	ND	ND
Trans-1,2-dichloroethylene	ND	ND	ND	ND	ND
Chloroform	22	67	ND	ND	8
1,2-Dichloroethane	ND	ND	37	ND	ND
1,1,1-Trichloroethane	ND	ND	ND	ND	ND
Carbon tetrachloride	ND	ND	ND	ND	ND
Dichlorobromomethane	ND	ND	ND	ND	ND
1,2-Dichloropropane	ND	ND	ND	ND	ND
1,3-Dichloropropene(trans)	ND	ND	ND	ND	ND
Trichloroethylene	3	483	5	ND	17
Chlorodibromomethane	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	ND	ND	72	ND	21
1,3-Dichloropropene(cis)	ND	ND	ND	ND	ND
Benzene	7	ND	69	ND	26
2-Chloroethyl vinyl ether	ND	ND	ND	ND	ND
Bromoform	ND	ND	213	ND	ND
Tetrachloroethylene	ND	51	ND	ND	ND
1,1,2,2-Tetrachloroethane	ND	ND	173	ND	ND
Toluene	140	146	5	ND	36
Chlorobenzene	ND	152	15	ND	7
Ethylbenzene	ND	14	10	ND	7
Xylenes	ND	ND	ND	ND	ND
Dichlorodifluoromethane	ND	ND	ND	ND	ND
Trichlorofluoromethane	28	ND	ND	335	ND
Percent Surrogate Recovery					
Toluene-d_8	95	57	88	50	88

a - Transferred Trap

5.9 N_2O ANALYSES BY GC/ECD

ACUREX Corporation

Energy & Environmental Division

Acurex/E.S.

September 2, 1983
Acurex ID#: 8308-012
Client PO#: 307736.62
Page 1 of 1

Attention: Larry Waterland

Subject: Analysis of 2 Gas Bombs for Nitrous Oxide by GC/ECD

The above referenced samples were analyzed by GC/ECD according to previously reported method.

Results are listed in the table below:

Sample ID	N_2O (ppm)
812714	27
812715	58

If you have any questions, please call.

Submitted by: William G. Hellier
Staff Chemist

Approved by: Viorica Lopez-Avila, Ph.D.
Technical Director

WGH/VLA/ats

555 Clyde Avenue, P.O. Box 7555, Mountain View, CA 94039 (415) 964-3200 Telex: 34-6391 TWX: 910-7796593

5.10 BIOASSAY RESULTS

In the following, samples with the prefix "RA" are for these tests; samples with prefixes "HR", or "DM" are for other tests performed.

Litton BIONETICS 5516 Nicholson Lane, Kensington, Maryland 20895 301 881-5600 • Telex 89-8369

April 18, 1984

Dr. Larry Waterland
Acurex Corporation
485 Clyde Avenue
Mountain View, California 94042

RE: Acurex Subcontract No. RB59178A
Release No. 6

Dear Larry:

Enclosed are three bound, and one unbound, copies of the final reports for the five XAD resin extract samples and six ash samples submitted for testing and evaluation in IERL-EPA Level 1 Ames/*Salmonella* mutagenesis and CHO cytotoxicity bioassays. All studies were conducted and evaluated under IERL-EPA Level 1 guidelines.

Bioassay of the samples took slightly longer than normal because a phased testing approach was used with the XAD-2 resin extract samples. This phased approach involved initial CHO cytotoxicity testing, then preliminary range-finding Ames tests with only one strain, followed by one or more definitive Ames assays. By using this approach, we were able to adequately test and evaluate all samples.

The summary of the bioassay data, the criteria used to evaluate the results, the critical data upon which the evaluations were based, and a graphic display of the relative ranking of the samples are presented in the attached tables and figures.

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

Sincerely,

LITTON BIONETICS, INC.

Robert R. Young
Environmental Assessment Section
Department of Molecular Toxicology

RRY/mg

Enclosures: Ames and CHO 7330-7346 Reports.

cc: Contracts, LBI No. 20993, 20988

TABLE 1
BIOASSAY SUMMARY TABLE

Technical Directive or Project No. LBI Project No. 20988 and 20993.

Contract No. EPA No. 68-02-3188; ACUREX Subcontract No. RB 59178A Release No. 6.

	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
HR XAD-2 EXTRACT, INLET (819369)	H		M/H											
HR XAD-2 EXTRACT, OUTLET (819370)	M		M											
RA XAD-2 EXTRACT, TEST 1 (819459)	H		M											
RA XAD-2 EXTRACT, TEST 2 (819465)	M		H/M											
DM XAD-2 EXTRACT (900206)	M		M											
RA BOTTOM ASH, TEST 1 (819488)	ND		ND											
RA BOTTOM ASH, TEST 2 (819498)	ND		ND											
RA CYCLONE ASH, TEST 1 (819476)	M/H		ND											
RA CYCLONE ASH, TEST 2 (819504)	L/M		ND											
DM FILTER + 1 μm PART. (900204)	ND		L											
DM 10 μm + 3 μm PART. (900218)	ND		L											

ND = No Detectable Toxicity
L = Low Toxicity
M = Moderate Toxicity
H = High Toxicity

TABLE 2

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 3

TABLE 3

HEALTH EFFECTS CRITICAL DATA SUMMARY FORM[a]

Contract No. EPA No. 68-02-3188 **Technical Directive or Project No.** LBI No. 20988 and 20993 **Site Sampled** HR, RA and DM

Acurex Subcontract No. RB 59178A
Release No. 6

Sample Identification	Ames Mutagenicity [MEC]b	CHO Clonal Toxicity [EC50]c	RAM Cytotoxicity [EC50]c				Rodent Toxicity	
			Viability	Viability Index	ATP	ATP/Per 10^6 Cells	LD_{50}d	Toxic Signs e
HR XAD-2 EXTRACT, INLET 819369	25 f	11.5 f						
HR XAD-2 EXTRACT, OUTLET 819370	100	18.4						
RA XAD-2 EXTRACT, TEST 1 819459	20	35.2						
RA XAD-2 EXTRACT, TEST 2 819465	137.5	9.35						
DM XAD-2 EXTRACT 900206	200	16.0						
RA BOTTOM ASH, TEST 1 819488	>10000	>1000 (4000)						
RA BOTTOM ASH, TEST 2 819498	>10000	1400						
RA CYCLONE ASH, TEST 1 819476	50	>1000 (5000)						
RA CYCLONE ASH, TEST 2 819504	500	>1000 (1200)						
DM FILTER + 1 μm PART. 900204	>10000	140						
DM 10 μm + 3 μm PART. 900218	>10000	450						

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

[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.

[f]Concentrations are μg organics per plate for Ames assay and per ml of culture medium for the CHO assay. Values in parenthesis are extrapolated values.

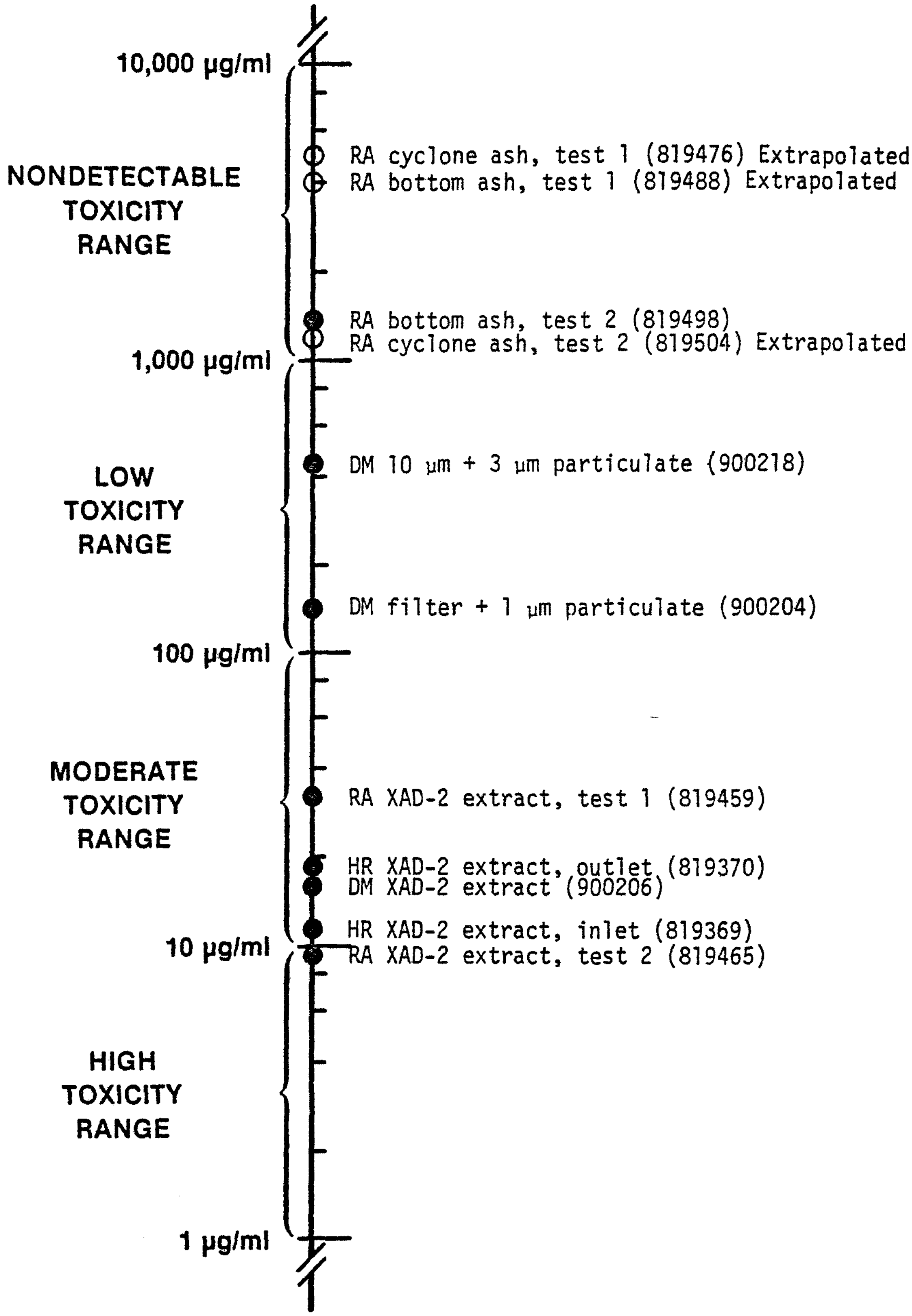

Figure 1. Ranking of test material toxicity using EC_{50} in EPA level 1 CHO clonal toxicity assay.

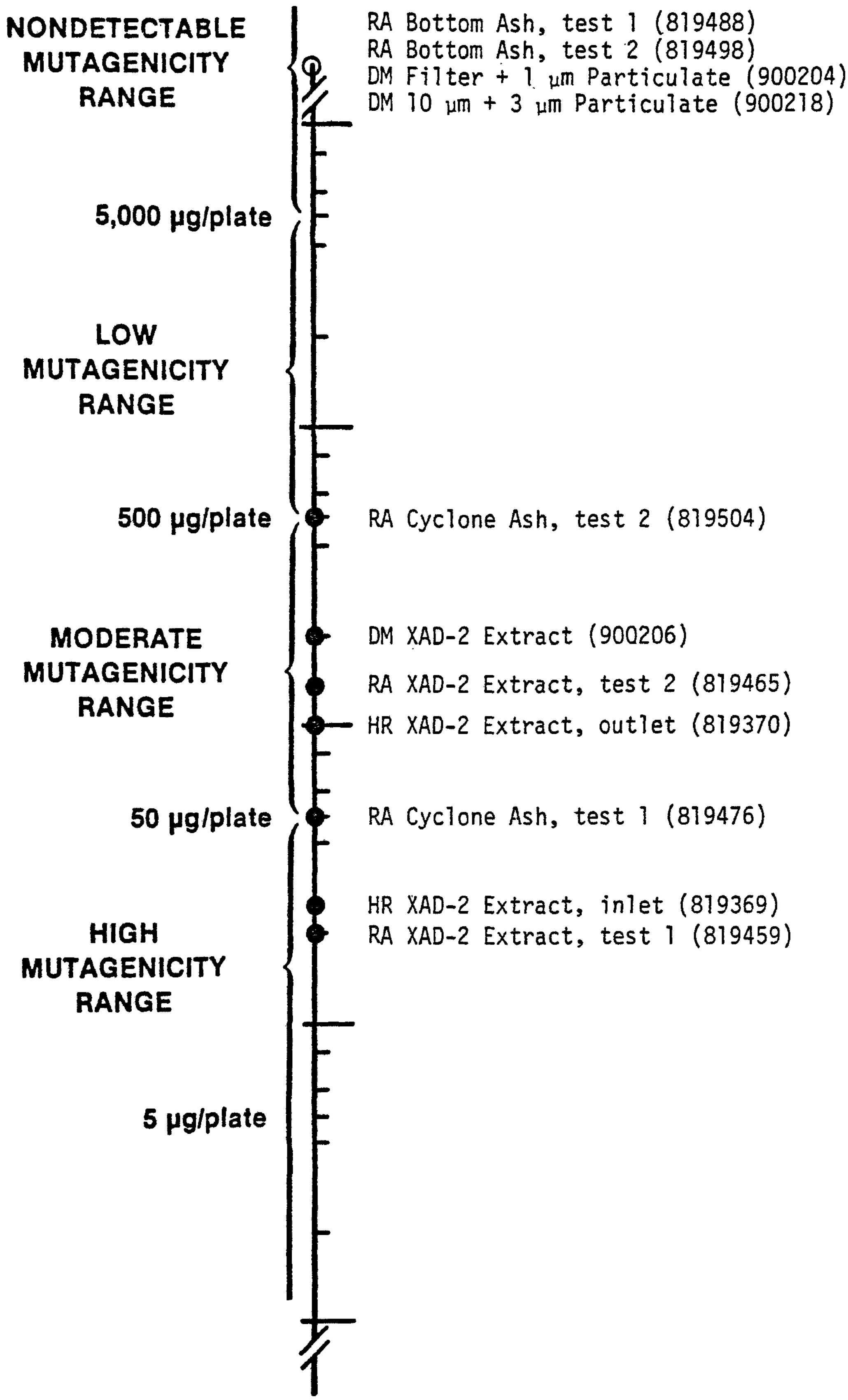

Figure 2. Ranking of test material mutagenicity using minimum effective concentration in EPA level 1 Ames mutagenesis assay.

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

1. REPORT NO. EPA-600/7-86-011b	2.	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE Environmental Assessment of a Commercial Boiler Fired with a Coal/Waste Plastic Mixture; Volume II. Data Supplement		5. REPORT DATE April 1986 6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) R. DeRosier, H.I. Lips, and L.R. Waterland		8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS Acurex Corporation Energy and Environmental Division P.O. Box 7044 Mountain View, California 94039		10. PROGRAM ELEMENT NO. 11. CONTRACT/GRANT NO. 68-02-3188
12. SPONSORING AGENCY NAME AND ADDRESS EPA, Office of Research and Development Air and Energy Engineering Research Laboratory Research Triangle Park, NC 27711		13. TYPE OF REPORT AND PERIOD COVERED Final; 7/83 - 7/84 14. SPONSORING AGENCY CODE EPA/600/13

15. SUPPLEMENTARY NOTES AEERL project officer is Joseph A. McSorley, Mail Drop 65, 919/541-2920. Volume I contains the technical results.

16. ABSTRACT The report gives results of comprehensive emissions testing and laboratory analyses of a stoker-fired commercial boiler firing a coal/waste plastic mixture. In one test, the unit fired its typical coal fuel; in the other, shredded waste polyethylene terephthalate (PET) beverage bottles were added to the coal to about 16% by weight in the mixed fuel. NOx, total unburned hydrocarbon, and solid particulate were relatively unchanged for the two tests, as was the emitted particle size distribution. SOx emissions decreased with the coal/PET fuel in keeping with its lowered sulfur content; average CO emissions were also decreased. Flue gas emissions of most trace elements were comparable for both tests, as were the trace element compositions of corresponding ash streams. However, lead emissions were significantly increased for the coal/PET fuel, reflecting an increased lead content of the mixed fuel. The cyclone hopper ash for the coal/PET test had consistently lower leachable trace element and anion content than for the coal fuel test. Total flue gas organic emissions were comparable for both tests, in the 1 mg/dscm range; although levels of several semivolatile priority pollutants were higher for the mixed fuel.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Pollution Assessments Combustion Coal Plastics Polyethylene Terephthalate	Pollution Control Stationary Sources Environmental Assessment Coal/Waste Fuel	13B 14B 21B 21D 11I

18. DISTRIBUTION STATEMENT Release to Public	19. SECURITY CLASS *(This Report)* Unclassified	21. NO. OF PAGES 203
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