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4/93

Reference 10

Anthracite Coal
Combustion
AP-42 Sect: Chap 4
Reference , Ref 2



Scott
Environmental Technology

SET 1488 01 0475

SOURCE SAMPLING OF ANTHRACITE
COAL FIRED BOILERS

RCA - ELECTRONIC COMPONENTS
LANCASTER, PENNSYLVANIA

FINAL REPORT

Prepared for:

Environmental Protection Agency
National Air Data Branch
Research Triangle Park, North Carolina 27711

April 1975

SCOTT ENVIRONMENTAL TECHNOLOGY, INC.
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1.0 INTRODUCTION

In order to assist in the Compilation of Air Pollution Emission Factors from anthracite coal-fired boilers, the National Air Data Branch of the Environmental Protection Agency contracted Scott Environmental Technology to perform source sampling tests for nitrogen oxides and particulate emissions at the RCA - Electronic Components plant in Lancaster, Pennsylvania.

The power plant at RCA consists of three anthracite coal-fired boilers and one boiler equipped to operate on either gas or oil. The latter is run continuously. In the winter the coal-fired boilers are used intermittently for peak load periods and are otherwise kept banked. They are not in use during the warmer months.

The coal-fired boilers are rated at 12,500 lb/hr (Boiler #1) and 25,000 lb/hr (Boilers #2 and #3), and are fired by Combustion Engineering travelling grate furnaces. The combustion products are ducted through rectangular breechings to a single 150 foot stack. Each duct has a fall-out trap immediately before the stack. In addition, the ducts and the base of the stack are cleaned periodically.

The original task order called for three one-hour (minimum) tests to be performed on Boiler #1 and Boiler #2. However, preliminary traverses conducted on Boiler #1 indicated very low flows ($\Delta P \leq 0.01$ in. H_2O). This raised the problems of suitable nozzle sizes and the possibility of "settling-chamber" effects in the duct (48" x 84"). Hence, in mutual consultation with the EPA Project Officer, it was decided to test Boiler #3 instead.

Three sixty minute tests were conducted in the outlet duct (48" x 84") from Boiler #2 and three one hundred minute tests in the outlet duct (48" x 72") from Boiler #3. The particulate samples were obtained according to the EPA Method 5, "Determination of Particulate Emissions from Stationary Sources". A cyclone assembly was included in the glass train, and water-wash and acetone-wash of the back half of the sampling train was also included in the sample analyses. During each run, two NO_x samples were recovered according to the EPA Method 7, "Determination of Nitrogen Oxide Emissions from Stationary Sources". Also, several grab gas samples were extracted during each test for analysis of carbon dioxide, oxygen, carbon monoxide, excess air and dry molecular weight. The analysis was performed



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using an Orsat apparatus. In addition, carbon monoxide levels were determined using an Ecolyzer Model 2800. However, the gas concentration was greater than the maximum detectable range of the instrument (600 ppm) and no results could be obtained with this unit.

During each test run, four coal samples were taken as the coal entered the travelling grate. A proximate analysis and calorific value of the coal was determined from a composite sample of the coal used in each test run. One ultimate analysis on the coal sample used in each boiler was also determined.

Particle sizing on the samples obtained from each boiler were analyzed thus:

1. Particle sizing on the cyclone catch from a composite of three test runs.
2. Particle sizing on the acetone front wash catch from a composite of three test runs.
3. Particle sizing on the cyclone + acetone wash from a composite of three test runs.

The relative differential and cumulative weight percent versus equivalent spherical diameter graphs for these samples are presented in Appendices D1 and D2. The samples were dispersed by Type IIA dispersant in 50/50 Isoton/Glycerine electrolyte and ultrasoniced for 60 seconds. The analysis used a Model TA Coulter Counter.

During each test run, periodic monitoring of the steam flow rate and coal feed rate was also performed.

The test team was comprised of three Scott employees. Three complete tests were performed on Boiler #2 on February 11, 1975. Boiler #3 was tested on March 11 and 12, 1975.



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2.0 SUMMARY AND DISCUSSION OF RESULTS

A summary of test results on Boiler #2 is presented in Table 1 (British Units) and Table 2 (Metric Units). Results on Boiler #3 are summarized in Table 3 (British Units) and Table 4 (Metric Units). Tables 5 and 6 summarize the carbon monoxide and nitrogen oxides emissions from Boiler #2 and #3 respectively.

Runs 2 and 3 at Boiler #2 showed reasonable replication. However, the particulate catch in Run #1, especially with the cyclone and acetone wash (see Appendix C) was much higher than the corresponding catches for Runs 2 and 3. Visual inspection of the samples indicated no discrepancy in the nature or type of sample collected from one run to another. No conclusive evidence for this variation in Run 1 could be established.

All three runs on Boiler #3 showed good replication of particulate loading. However, during Run 3, the coal feed rate and the steam flow rate were slightly lower than in Runs 1 and 2. This is also reflected in the lower volumetric flow rate obtained in Run 3.

Although both boilers are normally operated at 40-50 percent excess air, Orsat analysis of gas samples obtained at the test points indicated an average excess air value of 108% for Boiler #2 and 74% for Boiler #3. A probable explanation for this could be due to leaks in the breeching of both boilers. The breeching on Boiler #2 is only partially insulated, while the breeching on Boiler #3 is not insulated at all. Both breechings could very likely have ambient leaks into the gas stream.



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TABLE 1 SUMMARY OF PARTICULATE RESULTS - BOILER #2
(British Units)

Run Number:	1	2	3	Average
Date	2/11/75	2/11/75	2/11/75	
Volume of gas sampled - DSCF	41.85	39.89	39.97	40.57
Percent Moisture by Volume	3.2	3.5	4.7	3.8
Average stack Temp. - °F	362	368	359	363
Average Stack Velocity - fpm	837	816	822	825
Stack Volumetric Flow Rate - DSCFM	14540	14010	14110	14220
Stack Volumetric Flow Rate - ACFM	23444	22842	23016	23101
Percent Isokinetic	98.7	97.4	97.3	97.8
Percent Excess Air	105.5	103.5	114.8	107.9
Coal Feed Rate - ton/hr	1.265	1.382	1.368	1.338
Coal Calorific Value - BTU/lb	12145	12332	12382	12286
Coal Ash Content - weight %	8.18	8.68	8.05	8.30
<u>Particulate</u> - probe, cyclone & filter catch				
mg	333.4	135.7	106.8	192.0
gr/DSCF	0.1227	0.0524	0.0412	0.0727*
gr/ACF	0.0761	0.0322	0.0252	0.0447*
lb/hr	15.28	6.29	4.98	8.85
lb/ton feed	12.08	4.55	3.64	6.76
lb/million BTU	0.497	0.185	0.147	0.276
Emission Factor ^(a) - lb/ton	1.48A	0.524A	0.452A	0.819A
<u>Particulate</u> - total catch				
mg	395.9	173.7	126.2	231.9
gr/DSCF	0.1457	0.0671	0.0486	0.0878*
gr/ACF	0.0903	0.0412	0.0298	0.0540*
lb/hr	18.15	8.05	5.88	10.69
lb/ton feed	14.35	5.82	4.30	8.16
lb/million BTU	0.591	0.236	0.174	0.334
Emission Factor ^(a) - lb/ton	1.75A	0.671A	0.534A	0.985A

Standard conditions: 70°F; 29.92 in.Hg.

(a) 'A' is the ash content expressed as weight percent

* Weighted averages



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TABLE 2 SUMMARY OF PARTICULATE RESULTS - BOILER #2
(Metric Units)

Run Number:	1	2	3	Average
Date	2/11/75	2/11/75	2/11/75	
Volume of gas sampled - Nm ³	1.184	1.129	1.131	1.148
Percent Moisture by Volume	3.2	3.5	4.7	3.8
Average Stack Temp. - °C	183	187	182	184
Average Stack Velocity - m/sec	4.32	4.21	4.24	4.26
Stack Volumetric Flow Rate - Nm ³ /min.	411.5	396.5	399.3	402.4
Stack Volumetric Flow Rate - m ³ /min.	663.5	646.4	651.4	653.8
Percent Isokinetic	98.7	97.4	97.3	97.8
Percent Excess Air	105.5	103.5	114.8	107.9
Coal Feed Rate - Mton/hr	1.148	1.253	1.241	1.214
Coal Calorific Value - kcal/kg	6752.6	6856.6	6884.4	6831.2
Coal Ash Content - weight %	8.18	8.68	8.05	8.30

Particulate - probe, cyclone
& filter catch

mg	333.4	135.7	106.8	192.0
mg/Nm ³	280.7	119.9	94.27	166.2*
mg/m ³	174.1	73.67	57.66	102.3*
kg/hr	6.93	2.85	2.26	4.01
kg/Mton feed	6.04	2.27	1.82	3.38
kg/Million kcal	0.895	0.333	0.265	0.498
Emission Factor (a) - kg/Mton	0.738A	0.262A	0.226A	0.409A

Particulate - total catch

mg	395.9	173.7	126.2	231.9
mg/Nm ³	333.4	153.5	111.2	200.8*
mg/m ³	206.6	94.27	68.18	123.6*
kg/hr	8.23	3.65	2.67	4.85
kg/Mton feed	7.17	2.91	2.15	4.08
kg/million kcal	1.062	0.425	0.313	0.600
Emission Factor (a) - kg/Mton	0.877A	0.335A	0.267A	0.493A

Standard Conditions: 21.1°C and 76 mm Hg.

(a) 'A' is the ash content expressed as weight percent

* Weighted averages.



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TABLE 3 SUMMARY OF PARTICULATE RESULTS - BOILER #3
(British Units)

Run Number:	1	2	3	Average
Date	3/11/75	3/12/75	3/12/75	
Volume of gas sampled - DSCF	76.27	79.26	59.68	71.74
Percent Moisture by Volume	3.2	3.7	5.0	3.97
Average stack Temp. - °F	454	440	408	434
Average Stack Velocity - fpm	626	650	481	586
Stack Volumetric Flow Rate - DSCFM	8465	8864	6700	8010
Stack Volumetric Flow Rate - ACFM	15017	15593	11544	14051
Percent Isokinetic	101.4	100.4	100.7	100.8
Percent Excess Air	76.3	71.7	73.5	73.8
Coal Feed Rate - ton/hr	1.587	1.599	1.512	1.566
Coal Calorific Value - BTU/lb	12042	11936	12028	12002
Coal Ash Content - weight %	8.69	8.67	8.50	8.62
<u>Particulate - probe, cyclone & filter catch</u>				
mg	876.2	898.0	541.5	771.9
gr/DSCF	0.1769	0.1745	0.1397	0.1656*
gr/ACF	0.0997	0.0992	0.0811	0.0944*
lb/hr	12.84	13.25	8.02	11.37
lb/ton feed	8.09	8.29	5.30	7.23
lb/million BTU	0.336	0.347	0.220	0.301
Emission Factor ^(a) - lb/ton	0.931A	0.956A	0.624A	0.837A
<u>Particulate - total catch</u>				
mg	895.9	925.7	565.3	795.6
gr/DSCF	0.1809	0.1799	0.1459	0.1708*
gr/ACF	0.1020	0.1023	0.0847	0.0974*
lb/hr	13.12	13.66	8.38	11.72
lb/ton feed	8.27	8.54	5.54	7.45
lb/million BTU	0.343	0.358	0.230	0.310
Emission Factor ^(a) - lb/ton	0.952A	0.985A	0.652A	0.863A

Standard conditions: 70°F; 29.92 in.Hg.

(a) 'A' is the ash content expressed as weight percent

* Weighted averages



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TABLE 4 SUMMARY OF PARTICULATE RESULTS - BOILER #3
(Metric Units)

Run Number:	1	2	3	Average
Date	3/11/75	3/12/75	3/12/75	
Volume of gas sampled - Nm ³	2.158	2.243	1.689	2.030
Percent Moisture by Volume	3.2	3.7	5.0	3.97
Average Stack Temp. - °C	234	227	209	223
Average Stack Velocity - m/sec ₃	3.23	3.36	2.48	3.02
Stack Volumetric Flow Rate - Nm ³ /min.	239.6	250.9	189.6	226.7
Stack Volumetric Flow Rate - m ³ /min.	425.0	441.3	326.7	397.7
Percent Isokinetic	101.4	100.4	100.7	100.8
Percent Excess Air	76.3	71.7	73.5	73.8
Coal Feed Rate - Mton/hr	1.439	1.450	1.372	1.420
Coal Calorific Value - kcal/kg	6695.3	6636.4	6687.6	6673.1
Coal Ash Content - weight %	8.69	8.67	8.50	8.62
<u>Particulate - probe, cyclone & filter catch</u>				
mg	876.2	898.0	541.5	771.9
mg/Nm ³	404.7	399.3	319.6	379.0*
mg/m ³	228.1	227.0	185.6	216.1*
kg/hr	5.82	6.01	3.64	5.16
kg/Mton feed	4.04	4.14	2.65	3.61
kg/Million kcal	0.605	0.625	0.396	0.542
Emission Factor ^(a) - kg/Mton	0.465A	0.478A	0.312A	0.418A
<u>Particulate - total catch</u>				
mg	895.9	925.7	565.3	795.6
mg/Nm ³	413.9	411.6	333.8	390.7*
mg/m ³	233.4	234.1	193.8	222.8*
kg/hr	5.95	6.20	3.80	5.32
kg/Mton feed	4.13	4.28	2.77	3.73
kg/million kcal	0.615	0.644	0.414	0.558
Emission Factor ^(a) - kg/Mton	0.476A	0.493A	0.326A	0.432A

Standard Conditions: 21.1°C and 76 mm Hg.

(a) 'A' is the ash content expressed as weight percent

* Weighted averages.



TABLE 5 SUMMARY OF CARBON MONOXIDE & NITROGEN OXIDES EMISSIONS - BOILER #2

Run	Test Time	Nitrogen Oxides				Carbon Monoxide			
		NOx Sampled@	NOx ppm	NOx (as NO ₂) lb/hr	NOx (as NO ₂) lb/10 ⁶ BTU	NOx (as NO ₂) lb/ton feed	CO %	CO lb/hr	CO lb/10 ⁶ BTU lb/ton feed
1	1116-1245	1150	146.1	15.23	0.496	2.04	0.70	444.0	14.45 351.0
2	1439-1555	1440	163.7	16.44	0.482	1.90	0.27	165.0	4.84 119.4
3	1654-1815	1705	161.0	16.28	0.481	1.90	0.15	92.3	2.72 67.5
Average		1730	224.8	22.74	0.671	6.62	0.37	233.8	7.34 179.3

TABLE 6 SUMMARY OF CARBON MONOXIDE & NITROGEN OXIDES EMISSIONS - BOILER #3

Run	Test Time	Nitrogen Oxides				Carbon Monoxide			
		NOx Sampled@	NOx ppm	NOx (as NO ₂) lb/hr	NOx (as NO ₂) lb/10 ⁶ BTU	NOx (as NO ₂) lb/ton feed	CO %	CO lb/hr	CO lb/10 ⁶ BTU lb/ton feed
1	1537-1732	1643	129.1	7.83	0.205	6.19	0.0	0.0	0.0 0.0
2	0843-1037	0914	156.4	9.94	0.260	7.19	0.0	0.0	0.0 0.0
3	1307-1503	0948	159.3	10.12	0.265	7.32	0.0	0.0	0.0 0.0
Average		1310	159.9	7.68	0.211	5.61	0.0	0.0	0.0 0.0
		1357	156.5	7.52	0.207	5.50	0.0	0.0	0.0 0.0
			152.6	8.74	0.232	6.53	0.0	0.0	0.0 0.0



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3.0 PROCESS DESCRIPTION & OPERATION

The power plant at the RCA Electronic Components plant in Lancaster, Pennsylvania is comprised of three anthracite coal-fired boilers and one boiler equipped to operate on either gas or oil. The coal-fired boilers are rated at 12,500 lb/hr (#1) and 25,000 lb/hr (#2 and #3) of steam, and are fired by Combustion Engineering travelling grate furnaces. They are normally operated at 40-50 percent excess air and are typical of heating plant boilers in use throughout the country. No control devices exist on these units and the combustion products are ducted through rectangular breechings to a single 150 foot stack (see Figure 1). Each duct has a fall-out trap immediately before the stack.

During testing, the coal feed rate and steam flow rate were monitored on integrating counters. In addition, the steam flow rate was also monitored on circular recording charts. Tables 7 and 8 depict the coal feed rates and steam flow rates during the testing of Boilers #2 and #3.



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FIGURE 1 BOILER BREECHING LAYOUT
RCA ELECTRONIC COMPONENTS
Lancaster, Pennsylvania

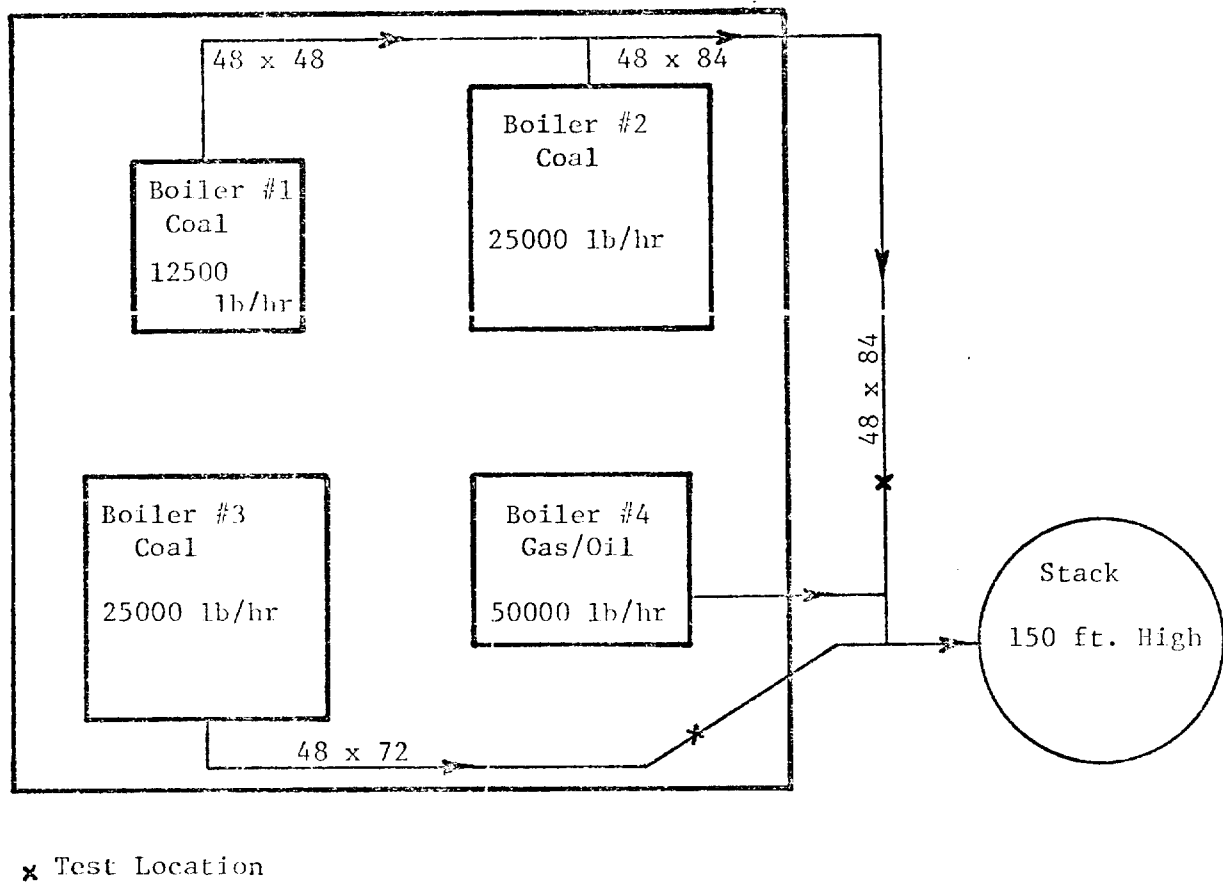


TABLE 7 PROCESS CONDITIONS

RCA Lancaster - Boiler #2 - 2/11/75

Run	Time	Coal Counter(lbs/hr) (Integrating Factor = 6.5)	Steam Flow Counter(lbs/hr) (Integrating Factor = 3500)	Steam Flow Chart (lbs/hr)
1	0945	70083		22500
	1120	70575		24000
	1212	70990		23000
	1235	71186		23166.7 lbs./hr
	Average:	2530.4 lbs/hr		
2	1422	72083	747.5	22000
	1458	72314	749.8	20000
	1525	72530	753.8	23300
	1608	72834	757.5	25500
	Average:	2763.1 lbs/hr	19811.3 lbs/hr	22700 lbs/hr
3	1654	73256	762.2	24000
	1715	73422	764.1	22000
	1739	73577	766.3	22500
	1804	73747	768.6	22000
	Average:	2735.6 lbs/hr	19200.0 lbs/hr	22625 lbs/hr



TABLE 8 PROCESS CONDITIONS
RCA Lancaster - Boiler #3 - 3/11/75 - 3/12/75

Run	Time	Coal Counter (lb/hr) Integrating Factor = 84	Steam Flow Counter (lb/hr) Integrating Factor = 3500	Steam Flow Chart (lbs/hr)
1	1543	7510	9460.4	20000
	1628	7541	9464.8	23000
	1652	7554	9466.2	22000
	1731	7578	9470.0	22000
	Average:	3173.3 lbs/hr	13666.7 lbs/hr	21750
2	0845	8005	9533.1	22000
	0930	8045	9537.5	21000
	0959	8053	9540.3	20000
	1018	8064	9542.1	20000
	Average:	3197.4 lbs/hr	20322.6 lbs/hr	20750
3	1322	8184	9559.7	18000
	1344	8197	9561.6	19000
	1415	8216	9564.2	19000
	1437	8229	9566.1	20000
	Average:	3024.0 lbs/hr	17919.9 lbs/hr	19000



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4.0 LOCATION OF SAMPLING POINTS

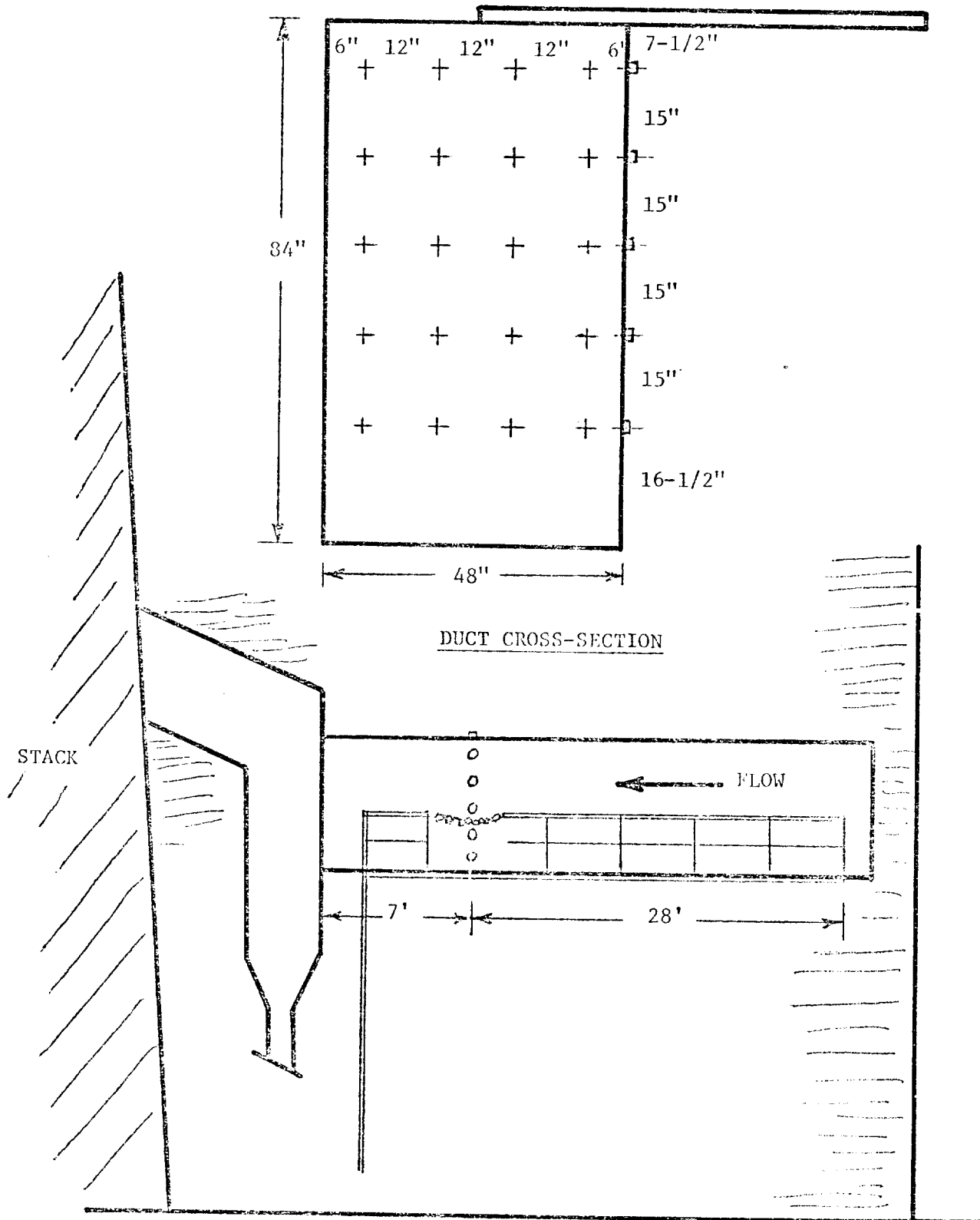
The test location for Boiler #2 was located on a 48" x 84" insulated duct which ran outside the heating plant building, about 15 feet above ground level. The straight portion of the duct is 35 feet long and the testing plane was chosen about 28 feet from the nearest upstream disturbance. Twenty traverse points (5 ports, 4 points each) were selected for testing. Figure 2 depicts the test plane location and duct cross-section for Boiler #2.

The breeching from Boiler #3 runs vertically upward through the plant building to the roof and then through a horizontal duct (48" x 72") to the stack. The test location for Boiler #3 was selected on the longest straight duct section on the roof, about 117 inches from the nearest downstream disturbance. Twenty traverse points (5 ports, 4 points each) were selected for testing. Figure 3 illustrates the test plane location and duct cross-section for Boiler #3.



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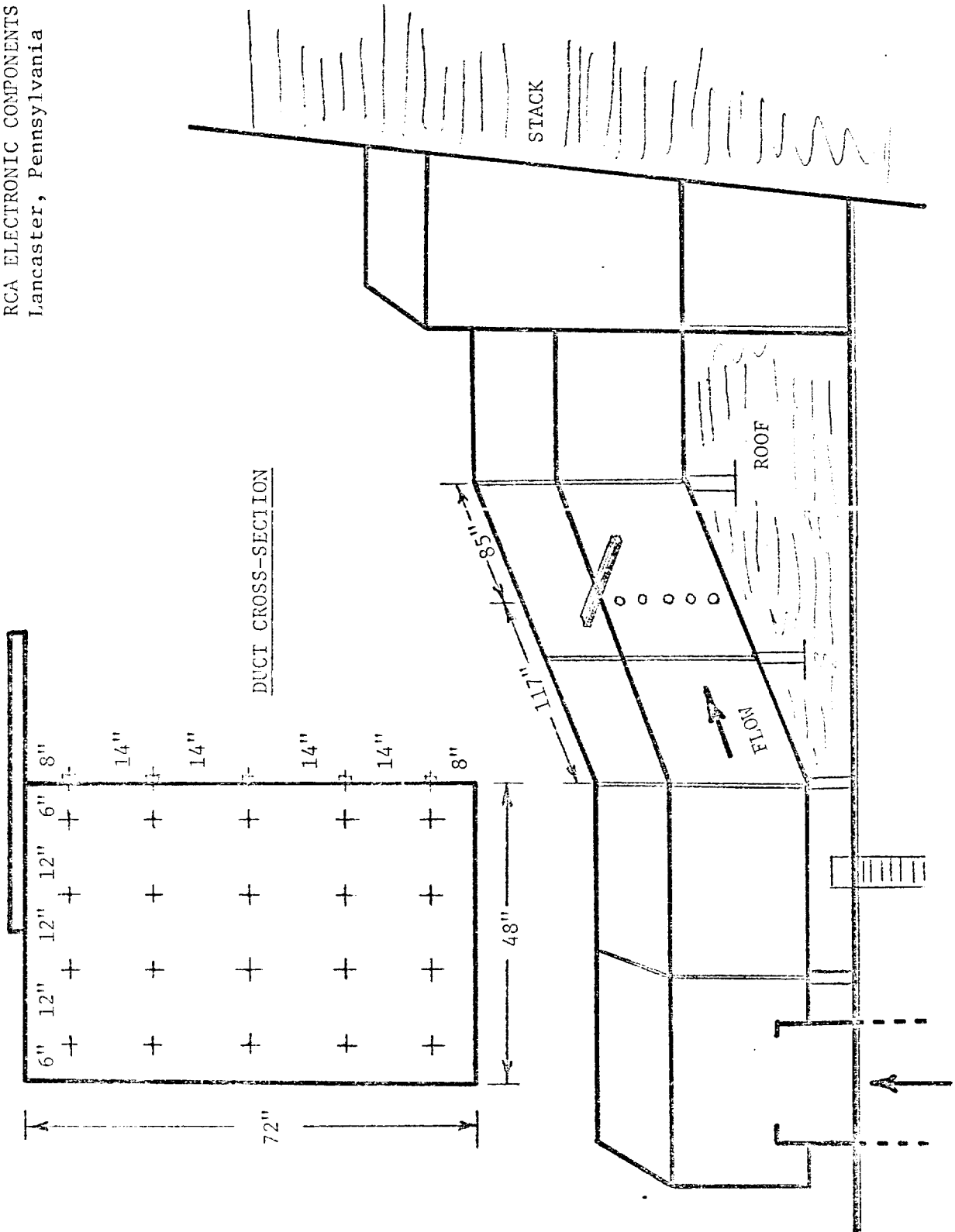
FIGURE 2 SAMPLE PLANE LOCATION - BOILER #2
RCA ELECTRONIC COMPONENTS, Lancaster, Pennsylvania



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FIGURE 3 SAMPLE PLANE LOCATION - BOILER #3

RCA ELECTRONIC COMPONENTS
Lancaster, Pennsylvania



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5.0 SAMPLING AND ANALYTICAL PROCEDURES

The sampling and analytical procedures for particulate emissions were done in accordance with EPA Method 5, "Determination of Particulate Emissions from Stationary Sources," as published in the Federal Register, Volume 36, No. 247, Tuesday, December 23, 1971. The only modification to this procedure was the retention of impinger catches for particulate gravimetric analysis.

Briefly, the method consisted of withdrawing a sample isokinetically from the stack through a heated probe into a filter and impinger train as shown in Figure 4. The sample volume is measured with a dry gas meter and isokinetic conditions were maintained by monitoring the stack gas velocity. After testing was completed, the train was thoroughly washed including the probe. A water and acetone wash were used and collected in separate containers. These washings were evaporated, dried and weighed along with the filter and summed to obtain the total weight of particulate matter collected.

Nitrogen Oxide emissions were sampled according to EPA Method 7, "Determination of Nitrogen Oxide Emissions from Stationary Sources". A two-liter round bottomed flask was filled with 25 ml of absorbing solution and evacuated to about 28 inches of mercury. The flask was then attached to a heated glass lined probe containing a glass-wool filter, and the lines purged prior to extracting a gas sample for about 15 seconds. After collecting a sample, the flask was shaken for about 5 minutes and set aside for at least 16 hours. Final flask pressure was then monitored and the sample analyzed in the laboratory for NO_x concentration.



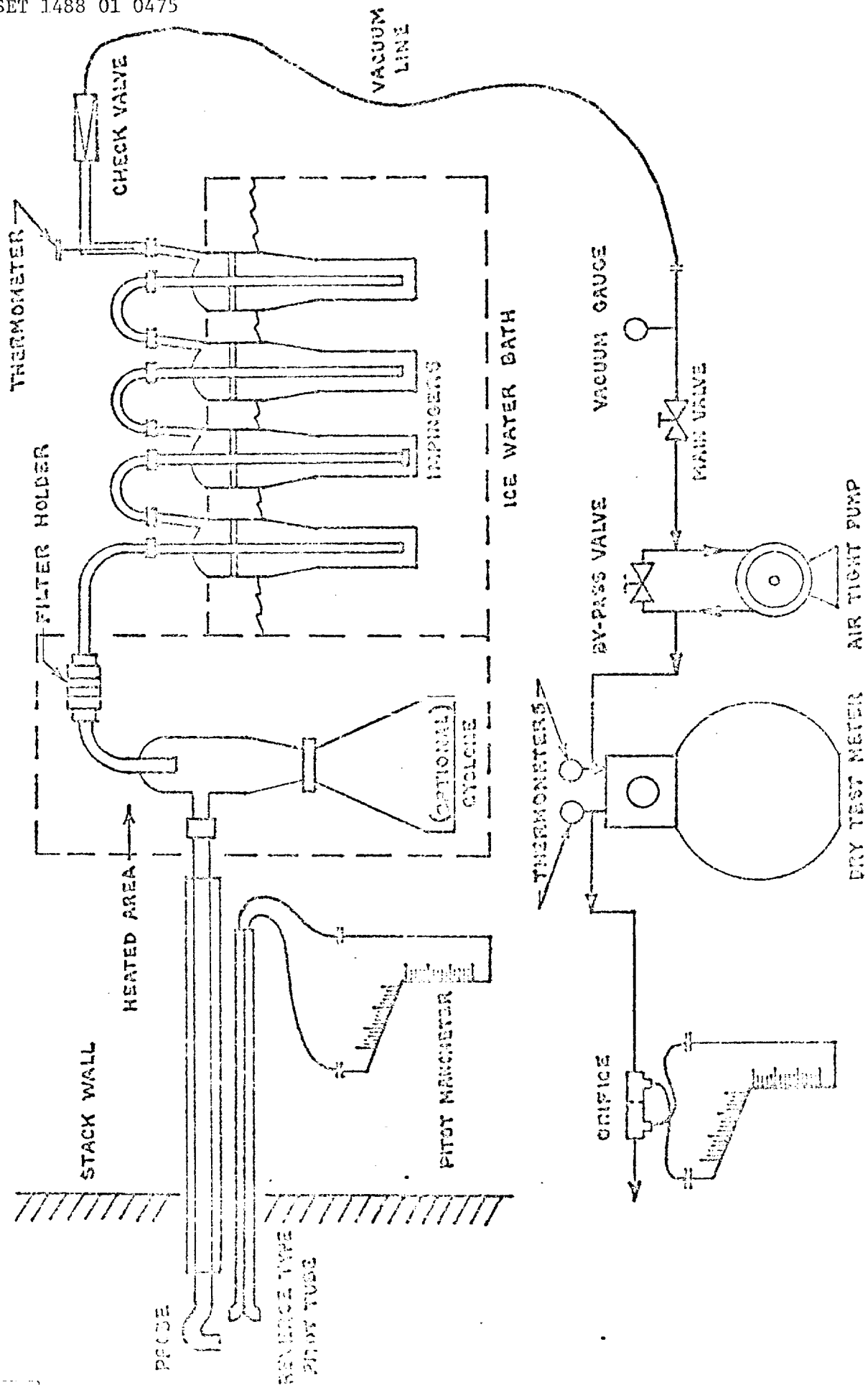


FIG. 4 PARTICULATE SAMPLING TRAIN

APPENDIX A

Complete particulate results with
example calculation.



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SAMPLING DATA - BOILER #2

Run No.		1	2	3
Test Date		2/11/75	2/11/75	2/11/75
Sampling Time, 24 hour clock		1116-1245	1439-1555	1654-1815
D _n	Sampling Nozzle Diameter, in.	0.500	0.500	0.500
T _t	Net Time of Test, Min.	60	60	60
P _b	Barometric Pressure, in. Hg Absolute	29.76	29.75	29.80
P _m	Average Orifice Pressure Drop, in. H ₂ O	1.489	1.387	1.422
V _m	Volume of Dry Gas Sampled at Meter Conditions, DCF	41.02	39.56	39.86
T _m	Average Gas Meter Temperature, °F	58.5	64.5	68.3
V _{m std}	Volume of Dry Gas Sampled at Standard Conditions ^a , DSCF	41.85	39.89	39.97
V _w	Total H ₂ O Collected in Impin- gers and Silica Gel, ml	28.8	30.7	42.0
V _{w gas}	Volume of Water Vapor Collected at Standard Conditions ^b , SCF	1.36	1.45	1.96
% M	% Moisture in Stack Gas, by Volume	3.15	3.51	4.73
M _d	Mole Fraction of Dry Gas	0.969	0.965	0.953
% CO ₂	Volume % Dry	8.57	9.10	8.83
% O ₂	Volume % Dry	10.90	10.80	11.33
% CO	Volume % Dry	0.70	0.27	0.15
% N ₂	Volume % Dry	79.83	79.83	79.69
MW _d	Molecular Weight of Stack Gas, Dry Basis	29.81	29.89	29.87
MW	Molecular Weight of Stack Gas, Wet Basis	29.44	29.47	29.30
C _p	Pitot Tube Coefficient	0.85	0.85	0.85
T _s	Average Stack Temperature °F	362.2	367.6	359.0
N _p	Net Sampling Points	20	20	20
P _{st}	Static Pressure of Stack Gas, in. H ₂ O	0.52	0.52	0.52
P _s	Stack Gas Pressure, in. Hg Absolute	29.72	29.71	29.76

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SAMPLING DATA - BOILER #2 (contd)

Run No.		1	2	3
V _s	Stack Gas Velocity at Stack Conditions, fpm	837.3	815.8	822.0
A _s	Stack Area, in. ²	4032	4032	4032
Q _s	Dry Stack Gas Volumetric Flow Rate at Standard Conditions ^c , DSCFM	14540	14010	14110
Q _a	Stack Gas Volumetric Flow Rate at Stack Conditions, ACFM	23444	22842	23016
% I	Percent Isokinetic	98.7	97.4	97.3
% O	Percent Opacity	-	-	-
T _c	Unit Feed Rate-ton/hr	1.265	1.382	1.368
m _f	Particulate - Probe, Cyclone, and Filter, mg	333.4	135.7	106.8
m _t	Particulate - Total, mg	395.9	173.7	126.2
I _c	% Impinger Catch	15.8	21.9	15.4
C _{an}	Particulate - Probe, Cyclone, and Filter, gr/SCF	0.1227	0.0524	0.0412
C _{ao}	Particulate - Total, gr/SCF	0.1457	0.0671	0.0486
C _{at}	Particulate - Probe, Cyclone, and Filter, gr/ACF	0.0761	0.0322	0.0252
C _{au}	Particulate - Total, gr/ACF	0.0903	0.0412	0.0298
C _{aw}	Particulate - Probe, Cyclone, and Filter, lb/hr	15.28	6.29	4.98
C _{ax}	Particulate - Total, lb/hr	18.15	8.05	5.88
P _{tf}	Particulate - Probe, Cyclone, and Filter, lb/ton feed	12.08	4.55	3.64
P _{tt}	Particulate - Total, lb/ton feed	14.35	5.82	4.30

a Dry standard cubic feet at 70°F, 29.92 in. Hg.

b Standard conditions at 70°F, 29.92 in. Hg.

c Dry standard cubic feet per minute at 70°F, 29.92 in. Hg.



SET 1488 01 0475

SAMPLING DATA - BOILER #3

Run No.		1	2	3
Test Date		3/11/75	3/12/75	3/12/75
Sampling Time, 24 hour clock		1537-1732	0843-1037	1307-1503
D _n	Sampling Nozzle Diameter, in.	0.626	0.626	0.626
T _t	Net Time of Test, Min.	100	100	100
P _b	Barometric Pressure, in. Hg Absolute	30.10	30.03	29.96
P _m	Average Orifice Pressure Drop, in. H ₂ O	2.078	2.205	1.279
V _m	Volume of Dry Gas Sampled at Meter Conditions, DCF	76.14	78.78	59.99
T _m	Average Gas Meter Temperature, °F	75.0	71.6	75.2
V _m ^{std}	Volume of Dry Gas Sampled at Standard Conditions ^a , DSCF	76.27	79.26	59.68
V _w	Total H ₂ O Collected in Impinger ^c and Silica Gel, ml	53.7	65.2	66.6
V _w ^{gas}	Volume of Water Vapor Collected at Standard Conditions ^b , SCF	2.54	3.08	3.14
% M	% Moisture in Stack Gas, by Volume	3.22	3.74	5.00
M _d	Mole Fraction of Dry Gas	0.968	0.963	0.950
% CO ₂	Volume % Dry	11.53	11.70	11.43
% O ₂	Volume % Dry	9.13	8.83	8.97
% CO	Volume % Dry	0.00	0.00	0.00
% N ₂	Volume % Dry	79.34	79.47	79.60
MW _d	Molecular Weight of Stack Gas, Dry Basis	30.21	30.23	30.19
MW	Molecular Weight of Stack Gas, Wet Basis	29.82	29.77	29.58
C _p	Pitot Tube Coefficient	0.85	0.85	0.85
T _s	Average Stack Temperature °F	454.3	439.7	407.6
N _p	Net Sampling Points	20	20	20
P _{st}	Static Pressure of Stack Gas, in. Hg	0.43	0.43	0.43
P _s	Stack Gas Pressure, in. Hg Absolute	30.07	30.00	29.93



SET 1488 01 0475

SAMPLING DATA - BOILER #3 (contd)

Run No.		1	2	3
V _s	Stack Gas Velocity at Stack Conditions, fpm	625.7	649.7	481.0
A _s	Stack Area, in. ²	3456	3456	3456
Q _s	Dry Stack Gas Volumetric Flow Rate at Standard Conditions ^c , DSCFM	8465	8864	6700
Q _a	Stack Gas Volumetric Flow Rate at Stack Conditions, ACMH	15017	15593	11544
% I	Percent Isokinetic	101.4	100.4	100.7
% O	Percent Opacity	-	-	-
T _c	Unit Feed Rate-ton/hr	1.587	1.599	1.512
m _f	Particulate - Probe, Cyclone, and Filter, mg	876.2	898.0	541.5
m _t	Particulate - Total, mg	895.9	925.7	565.3
I _c	% Impinger Catch	2.2	3.0	4.2
C _{an}	Particulate - Probe, Cyclone, and Filter, gr/SCF	0.1769	0.1745	0.1397
C _{ao}	Particulate - Total, gr/SCF	0.1809	0.1799	0.1459
C _{at}	Particulate - Probe, Cyclone, and Filter, gr/ACF	0.0997	0.0992	0.0811
C _{ao}	Particulate - Total, gr/ACF	0.1020	0.1023	0.0847
C _{aw}	Particulate - Probe, Cyclone, and Filter, lb/hr	12.34	13.25	8.02
C _{ax}	Particulate - Total, lb/hr	13.12	13.66	8.38
P _{tf}	Particulate - Probe, Cyclone, and Filter, lb/ ton feed	8.09	8.29	5.30
P _{tt}	Particulate - Total, lb/ton feed	8.27	8.54	5.54

a Dry standard cubic feet at 70°F, 29.92 in. Hg.

b Standard conditions at 70°F, 29.92 in. Hg.

c Dry standard cubic feet per minute at 70°F, 29.92 in. Hg.



PARTICULATE CALCULATIONS
(Example for Run #1 - Boiler #3)

1. Volume of dry gas sampled at standard conditions - 70°F, 29.92" Hg, ft.³

$$V_{m_{std}} = \frac{17.7 \times V_m \left(\frac{P_B + P_m}{13.6} \right)}{(T_m + 460)} = \text{Ft.}^3 = \frac{17.714 \times 76.14 \left(30.10 + \frac{2.078}{13.6} \right)}{(75 + 460)} = \underline{76.27 \text{ cu. ft.}}$$

2. Volume of water vapor at 70°F & 29.92" Hg, Ft.³

$$V_{w_{gas}} = 0.0474 \times V_w = \text{Ft.}^3 = 0.0474 \times 53.7 = \underline{2.54 \text{ cu. ft.}}$$

3. % Moisture in stack gas

$$\%M = \frac{100 \times V_{w_{gas}}}{V_{m_{std}} + V_{w_{gas}}} = \% = \frac{100 \times 2.54}{76.27 + 2.54} = \underline{3.22 \%}$$

4. Mole fraction of dry gas

$$M_d = \frac{100 - \%M}{100} = \frac{100 - 3.22}{100} = \underline{0.9678}$$

5. Average molecular weight of dry stack gas

$$M W_d = (\%CO_2 \times \frac{44}{100}) + (\%O_2 \times \frac{32}{100}) + (\%N_2 \times \frac{28}{100}) + (\%CO \times \frac{28}{100}) \\ = (11.53 \times 0.44) + (9.13 \times 0.32) + (79.34 \times 0.28) + (-0.01) = \underline{30.21}$$

6. Molecular weight of stack gas

$$M W = M W_d \times M_d + 18 (1 - M_d) \\ = 30.21 \times 0.9678 + 18 (1 - 0.9678) = \underline{29.82}$$



SET 1488 01 0475

7. Stack velocity & Stack conditions, fpm

$$V_s = 4350 \times \sqrt{\frac{\Delta P_s}{P_s} \times \frac{(T_s + 460)}{T_s}} \left[\frac{1}{P_s \times M \times W} \right]^{1/2} = \text{fpm} = \underline{625.7} \text{ fpm}$$

(Averaged over 20 points)

8. Stack gas volume @ standard conditions, SCFM

$$Q_s = \frac{0.123 \times V_s \times A_s \times M_d \times P_s}{(T_s + 460)} = \text{SCFM} = \frac{0.123 \times 625.7 \times 3456 \times 0.9678 \times 30.01}{914.3}$$

= 8465 SCFM

9. Per cent isokinetic

$$\%I = \frac{1032 \times (T_s + 460) \times V_{m \text{ std}}}{V_s \times T_t \times P_s \times M_d \times (D_n)^2} = \% = \underline{101.4} \% \text{ (Averaged over 20 points)}$$

10. Particulate - probe, cyclone, & filter, gr/SCF

$$C_{an} = 0.0154 \times \frac{M_f}{V_{m \text{ std}}} = \text{gr/SCF} = \frac{0.0154 \times 8762.2}{76.27} = \underline{0.1769} \text{ gr/SCF}$$

11. Particulate total, gr/SCF

$$C_{ao} = 0.0154 \times \frac{M_t}{V_{m \text{ std}}} = \text{gr/SCF} = \frac{0.0154 \times 875.7}{76.27} = \underline{0.1809} \text{ gr/SCF}$$

12. Particulate - probe, cyclone & filter, gr/CF at stack conditions.

$$C_{at} = \frac{17.7 \times C_{an} \times P_s \times M_d}{(T_s + 460)} = \text{gr/CF} = \frac{17.714 \times 0.1769 \times 30.01 \times 0.9678}{914.3}$$

= 0.0797 gr/CF



SET 1488 01 0475

13. Particulate - total, gr/CF @ stack conditions

$$C_{au} = \frac{17.7 \times C_{ao} \times P_s \times M_d}{(T_s + 460)} = \text{gr/CF} = \frac{17.714 \times 0.1809 \times 30.07 \times 0.9678}{914.3} = \underline{0.1020 \text{ gr/CF}}$$

14. Particulate - probe, cyclone, & filter, lb/hr.

$$C_{aw} = 0.00857 \times C_{an} \times Q_s = \text{lb/hr.} = \frac{0.00857 \times 0.1769 \times 8465}{1} = \underline{12.84 \text{ lb/hr}}$$

15. Particulate - total, lb/hr.

$$C_{ax} = 0.00857 \times C_{ao} \times Q_s = \text{lb/hr.} = \frac{0.00857 \times 0.1809 \times 8465}{1} = \underline{13.12 \text{ lb/hr}}$$

16. % excess air at sampling point

$$\% \text{ FA} = \frac{100 \times \% \text{ O}_2}{0.266 \times \% \text{ N}_2 - \% \text{ O}_2} = \% = \frac{100 \times 9.13}{0.266 \times 79.34 - 9.13} = \underline{76.3 \%}$$

17. Particulate - probe, cyclone, and filter, lb/ton feed.

$$P_{tf} = \frac{C_{aw}}{T_c} = \text{lb/ton feed} = \frac{12.84}{1.587} = \underline{8.09 \text{ lb/ton feed}}$$

18. Particulate - total, lb/ton feed.

$$P_{tt} = \frac{C_{ax}}{T_c} = \text{lb/ton feed} = \frac{13.12}{1.587} = \underline{8.27 \text{ lb/ton feed}}$$



SET 1488 01 0475

APPENDIX B1

Field Data - Boiler #2



SCOTT ENVIRONMENTAL TECHNOLOGY, INC.

SET 1488.01.0475

TRAVERSE POINT LOCATION & VELOCITY DATA BY

TRAVERSE POINT NUMBER	A=FRACTION OF I.D.	B=A x I.D. ID= 10 2 1/4	C=B+NIPPLE NIPPLE= 4	VELOCITY HEAD (C_p), in. H ₂ O	STACK TEMPERATURE (T_s), °F
A 1			10	1.03	350
2			12	1.04	360
3			12	1.04	365
4			12	1.04	365
B 5				1.04	345
6				1.04	355
7				1.04	365
8				1.05	365
C 9				1.02	360
10				1.03	365
11				1.03	330
12				1.04	340
D 13				1.02	365
14				1.03	337
15				1.03	350
16				1.04	350
E 17				1.02	365
18				1.05	340
19				1.03	345
20				1.03	350
21					
22					
23					
24				1.035	345
25					
26					
27					
28					
29					
30					
31					
32					
33					
34					
35					
36					
37					
38					
39					
40					
41					
42					
43					
44					
45					
46					
47					
48					
AVERAGE					

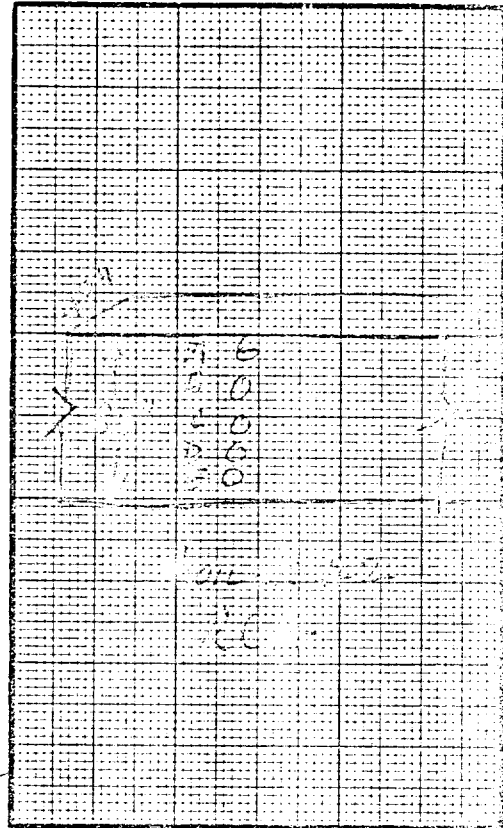


DIAGRAM OF STACK, PORTS, & TRAVERSE
POINTS (indicate direction of flow)

INSIDE DIMENSIONS OF SAMPLE PLANE

94" x 48"

STACK GAUGE PRESSURE in. H₂O .52

NEAREST UPSTREAM DISTURBANCE

NEAREST DOWNSTREAM DISTURBANCE

PROCESS & CONTROL EQUIPMENT
DESCRIPTION

Dry 330°F

Wet 120°F



SCOTT ENVIRONMENTAL TECHNOLOGY, INC.



SCOTT ENVIRONMENTAL TECHNOLOGY, INC.

SIGNED _____ DATE _____
WITNESS _____ DATE _____

PROJECT NO. _____
ANALYST NAME _____

DATE _____
TIME _____
LOCATION _____
EQUIPMENT _____
ANALYST _____
WITNESS _____

SET 1488 01 0475

PROJECT NUMBER 1488 TEST NUMBER 1 FIELD DATA SHEET

SCOTT ENVIRONMENTAL TECHNOLOGY, INC.

FYRITE ANALYSIS

CO₂ 02PROBE LENGTH & TYPE 60" gpNOZZLE I.D. .50SAMPLE BOX NUMBER Scott 1METER BOX NUMBER Scott 3PROBE HEATER SETTING 5FILTER HEATER SETTING 5REFERENCE AP .05READ AND RECORD ALL DATA EVERY 3 MINUTESPROJECT NUMBER 1488 TEST NUMBER 1 FIELD DATA SHEETPLANT PCADATE 2/11/75SAMPLING LOCATION Power Plant DrillerSAMPLE TYPE 5RUN NUMBER 1OPERATORS JW JZ JSWIND DIRECTION 37BAROMETER 29.76 75.94

TRAVEL POINT NUMBER	CLOCK TIME (24 hr clock)	GAS METER READING (W.A. #)	VELOCITY HEAD (ft. in H ₂ O)	ORIFICE PRESSURE DIFFERENTIAL (W.A. in H ₂ O)	STACK TEMPERATURE (T _g) °F	DRY GAS METER TEMPERATURE INLET (T _g) °F OUTLET (T _g) °F	PUMP VACUUM in. Hg	IMPINGER TEMPERATURE °F	COMMENTS
1	3 1116	INITIAL: 672.138	1.032	1.08	355	40	4.0	4.0	0.00
2	6	672.562	1.041	1.09	375	40	4.0	4.0	
3	9	673.038	1.040	1.09	375	45	4.0	4.0	
4	12	673.524	1.050	1.09	360	45	4.1	4.0	
5	15	674.041	1.030	1.02	345	42	4.1	4.0	
6	18	674.592	1.012	1.01	350	57	4.5	3.8	
7	21	675.174	1.012	1.01	350	60	4.6	4.0	
8	24	675.723	1.010	1.01	370	65	4.8	4.0	
9	27	676.285	1.037	1.08	370	65	5.2	3.5	
10	30	676.834	1.040	1.04	393	68	5.4	4.0	
11	33	677.393	1.045	1.02	395	68	5.4	4.0	
12	36	677.956	1.052	1.08	397	72	5.6	5.0	
13	39	678.519	1.030	1.02	363	73	5.8	3.5	
14	42	679.078	1.030	1.02	380	75	5.9	4.0	
15	45	701.125	1.042	1.04	373	77	6.0	5.0	
16	48	703.204	1.042	1.04	373	79	6.1	5.0	
17	51	704.999	1.025	1.01	327	75	6.1	3.5	
18	54	706.9215	1.010	1.01	361	76	6.2	5.0	
19	57	709.038	1.010	1.01	370	78	6.3	5.0	
20	60	711.154	1.012	1.02	370	80	6.4	5.0	

58.5

41.016

SET-1488 01 0475

NOMOGRAPH DATA BY

CALIBRATED PRESSURE DIFFERENTIAL ACROSS GROUPEL IN H ₂ O	ΔH_0	1.67
AVERAGE METER TEMPERATURE (AMBIENT + 20°F), °F	T_{avg}	60
PERCENT MOISTURE IN GAS STREAM BY VOLUME	B_{vol}	4
BAROMETRIC PRESSURE AT METER, in. Hg	P_m	30.05
STATIC PRESSURE IN STACK, in. Hg	P_s	30.04
$P_m - 2(0.073 \times \text{STACK GAUGE PRESSURE in in. H}_2\text{O})$	P_s/P_m	30.08
RATIO OF STATIC PRESSURE TO METER PRESSURE	T_{avg}	.998
AVERAGE STACK TEMPERATURE, °F	ΔP_{avg}	342
AVERAGE VELOCITY HEAD, in. H ₂ O	ΔP_{max}	.03
MAXIMUM VELOCITY HEAD, in. H ₂ O	C FACTOR	.05
C FACTOR	CALCULATED NOZZLE DIAMETER, in.	1.86
CALCULATED NOZZLE DIAMETER, in.	ACTUAL NOZZLE DIAMETER, in.	.58
ACTUAL NOZZLE DIAMETER, in.	REFERENCE ΔP , in. H ₂ O	.50
REFERENCE ΔP , in. H ₂ O		.05

DRY MOLECULAR WEIGHT DETERMINATION BY

SAMPLING TIME (24-HR CLOCK)

SAMPLING LOCATION

SAMPLE TYPE (BAG, INTEGRATED, CONTINUOUS)

ANALYTICAL METHOD

AMBIENT TEMPERATURE

GAS	1		2		3		AVERAGE NET VOLUME
	ACTUAL READING	NET	ACTUAL READING	NET	ACTUAL READING	NET	
CO ₂	91.6	8.4	91.3	8.7	88.5	8.6	8.57
O ₂ (NET IS ACTUAL O ₂ READING MINUS ACTUAL CO ₂ READING)	80.2	11.4	80.9	12.4	80.5	10.9	10.90
CO (NET IS ACTUAL CO READING MINUS ACTUAL O ₂ READING)	80.1	10.1	80.8	10.1	80.3	10.2	10.13
N ₂ (NET IS 100 MINUS ACTUAL CO READING)							8.70

MOISTURE

SILICA GEL
FINAL WEIGHT 509.4 g
INITIAL WEIGHT 498.6 g
NET WEIGHT 10.8 g
TOTAL MOISTURE 3.8 %

DISPENSERS

FINAL VOLUME 218 ml
INITIAL VOLUME 200 ml
NET VOLUME 18 ml

ANALYTICAL DATA BY

ACETONE FRONT WASH

FINAL 60.8318 mg
TARE 50.6266 mg
NET 0.2052 mg

FILTER NUMBER 1

FINAL 0.4048 mg
TARE 0.4368 mg
NET 0.0580 mg

FILTER NUMBER 2

FINAL 57.4793 mg
TARE 87.1567 mg
NET 0.0326 mg

FILTER NUMBER 3

FINAL 0.0625 mg
TARE 0.0625 mg
NET 0.0000 mg

CYCLONE

FINAL 1.1375 mg
TARE 1.3673 mg
NET 0.0702 mg
TOTAL FRONT 0.3354 mg

ACETONE BACK WASH

FINAL 105.5086 mg
TARE 105.4687 mg
NET 0.0399 mg

ETHER-CHLOROFORM EXTRACT

FINAL 0.0399 mg
TARE 0.0399 mg
NET 0.0000 mg

WATER EVAPORATION

FINAL 57.4793 mg
TARE 87.1567 mg
NET 0.0326 mg

TOTAL BACK

0.0625 (0.3959)
I CERTIFY THAT THE SAMPLES DESCRIBED
BY THIS DATA SHEET WERE COLLECTED IN
ACCORDANCE WITH METHODS OUTLINED BY

I FURTHER CERTIFY THAT THE SAMPLES
WERE IN THE POSSESSION OF, OR HEALED
FOR SHIPMENT BY COMMON CARRIER BY,
MYSELF UNTIL DELIVERY TO A LABORATORY
FOR ANALYSIS.

SIGNED _____ DATE _____
WITNESS _____
I CERTIFY THAT I RECEIVED THE SAMPLES
DESCRIBED BY THIS DATA SHEET FROM THE
PERSON NAMED INDIVIDUAL AND ANALYZED
THEM IN ACCORDANCE WITH THE ABOVE
NAMED PROCEDURE.

SIGNED _____ DATE _____
WITNESS _____ DATE _____

SCOTT ENVIRONMENTAL TECHNOLOGY, INC.



PROJECT NUMBER 1488 TEST NUMBER 1 FIELD DATA SHEET

SCOTT ENVIRONMENTAL TECHNOLOGY, INC.

PLANT RC ADATE 2/11/75SAMPLING LOCATION Boiler # 2SAMPLE TYPE 5RUN NUMBER 2OPERATORS J.W. J. J. J.AMBIENT TEMPERATURE 37BAROMETER 29.75 755.65PROBE LENGTH & TYPE 60 g/lNOZZLE I.D. 1.50SAMPLE BOX NUMBER 50002METER BOX NUMBER 3PROBE HEATER SETTING 4-5

FILTER HEATER SETTING

REFERENCE AP 0.0READ AND RECORD ALL DATA EVERY 3 MINUTES

FYRITE ANALYSIS

CO₂ 0₂

TRANSVERSE POINT NUMBER	CLOCK TIME SAMPLING TIME-PM CLOCK	GAS METER READING (VOL. #)	VELOCITY FEET PER MINUTE	ORIFICE PRESSURE DIFFERENTIAL (IN. H ₂ O)	ORIFICE PRESSURE CORRECTION (IN. H ₂ O)	STACK TEMPERATURE (°F)	DRY GAS METER TEMPERATURE (°F)	PUMP VACUUM (in. H ₂ O)	INPINGER TEMPERATURE (°F)	COMMENTS
		INITIAL: 711.5023		RECORDED	ACTUAL					
A 1	3	1451	713.015	1025	1.93	1.93	350	445	44	7
2	6		714.044	1032	1.20	1.20	350	443	45	2.5
3	9		716.924	1040	1.16	1.16	360	52	44	3.0
4	12		719.033	1044	1.16	1.16	360	56	47	3.0
5	15	1454	720.694	1025	1.92	1.93	355	62	49	2.0
6	18		722.710	1040	1.45	1.48	370	65	51	3.0
7	21		724.739	1040	1.48	1.48	370	69	52	3.0
8	24		727.007	1050	1.55	1.55	380	72	54	3.5
9	27	1509	728.512	1030	1.42	1.42	367	74	56	2.7
10	30		730.859	1040	1.48	1.48	380	76	57	3.0
11	33		733.028	1046	1.70	1.70	400	78	58	3.2
12	36		735.413	1050	2.06	2.06	465	81	60	3.9
13	39	1520	737.110	1025	1.93	1.93	385	80	62	2.5
14	42		738.947	1032	1.20	1.20	370	80	63	3.0
15	45		740.982	1040	1.48	1.48	385	81	64	3.2
16	48		743.275	1050	1.85	1.85	390	82	65	4.0
17	51	1543	744.957	1025	1.93	1.93	355	82	66	2.7
18	54		746.800	1030	1.12	1.12	365	83	67	3.0
19	57		748.053	1040	1.48	1.48	360	84	68	3.5
20	60	1555	750.864	1036	1.32	1.32	360	86	69	3.3

64.5

39.667

SET 1488.01 0475

NOMOGRAPH DATA BY

CALIBRATED PRESSURE DIFFERENTIAL ACROSS ORIFICE, in. H ₂ O	Δh_g
AVERAGE METER TEMPERATURE (AMBIENT + 20°F), °F	$T_{m,avg}$
PERCENT MOISTURE IN GAS STREAM BY VOLUME	B_{vol}
DYNAMOMETRIC PRESSURE AT METER, in. Hg	P_m
STATIC PRESSURE IN STACK, in. Hg	P_s
$P_m - 16.073 \times$ STACK GAUGE PRESSURE (in in. H ₂ O)	P_s/P_m
RATIO OF STATIC PRESSURE TO METER PRESSURE	$T_{s,avg}$
AVERAGE STACK TEMPERATURE, °F	ΔP_{avg}
AVERAGE VELOCITY HEAD, in. H ₂ O	ΔP_{max}
MAXIMUM VELOCITY HEAD, in. H ₂ O	
C FACTOR	
CALCULATED NOZZLE DIAMETER, in.	
ACTUAL NOZZLE DIAMETER, in.	
REFERENCE AQ, in. H ₂ O	

DRY MOLECULAR WEIGHT DETERMINATION BY

SAMPLING TIME (24-hr CLOCK)

SAMPLING LOCATION

SAMPLE TYPE (BAG, INTEGRATED, CONTINUOUS)

ANALYTICAL METHOD

AMBIENT TEMPERATURE

GAS	1		2		3	
	ACTUAL READING	NET	ACTUAL READING	NET	ACTUAL READING	NET
SO ₂	91.0	9.0	90.9	9.1	90.8	9.2
CO ₂	80.0	14.0	80.2	10.7	80.1	10.7
CO ₂ IS ACTUAL CO ₂ BEING PLUS ACTUAL CO ₂ LOSS	79.7	1	79.2	2.0	79.1	2.0
CO ₂ IS ACTUAL CO ₂ BEING PLUS ACTUAL CO ₂ LOSS						
AVERAGE NET VOLUME						

MOISTURE

SILICA GEL
FINAL WEIGHT 520.0 g
INITIAL WEIGHT 503.3 g
NET WEIGHT 16.7 g
TOTAL MOISTURE 30.7 %

WIPERS

FINAL VOLUME 214 ml
INITIAL VOLUME 200 ml
NET VOLUME 14 ml

ANALYTICAL DATA BY

ACETONE FRONT WASH

FINAL 83.9618 mg
TARE 13.8903 mg
NET 0.0715 mg

FILTER NUMBER 1

FINAL 0.5035 mg
TARE 1.4029 mg
NET 0.0456 mg

FILTER NUMBER 2

FINAL 1.3928 mg
TARE 1.2745 mg
NET 0.0183 mg

CYCLOPHONE

FINAL 1.3928 mg
TARE 1.2745 mg
NET 0.0183 mg

FINAL 1.3928 mg
TARE 1.2745 mg
NET 0.0183 mg

FINAL 1.3928 mg
TARE 1.2745 mg
NET 0.0183 mg

ACETONE BACK WASH

FINAL 88.4905 mg
TARE 88.4846 mg
NET 0.0059 mg

ETHER-CHLOROFORM EXTRACT

FINAL 99.0214 mg
TARE 98.9843 mg
NET 0.0371 mg

WATER EVAPORATION

FINAL 6.1380 mg
TARE 6.1737 mg
NET 0.0357 mg

TOTAL BACK 6.1380 mg
I CERTIFY THAT THE SAMPLES RECEIVED BY THIS METHOD WERE COLLECTED IN ACCORDANCE WITH METHODS OUTLINED BY

I FURTHER CERTIFY THAT THE SAMPLES WERE IN THE POSSESSION OF, OR SEALED FOR SHIPMENT BY, COMPANY CARRIER FOR ANALYSIS UNTIL DELIVERY TO A LABORATORY FOR ANALYSIS.

SIGNED _____ DATE _____
WITNESSES _____
I CERTIFY THAT THE SAMPLES RECEIVED BY THIS METHOD WERE COLLECTED IN ACCORDANCE WITH METHODS OUTLINED BY

SIGNED _____ DATE _____
WITNESSES _____

COAST GUARD VESSEL NO. 1488.01 0475

PROJECT NUMBER 1488

$$\frac{CO_2}{CO_2}$$

Q51
NOI 3722CN

METER BOX NUMBER

PROFESSIONAL

REFERENCE AP

READ AND RECORD ALL DATA EVENT _____ MINUTES

[illegible][illegible]

7	6	5	4	3	2	1
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155

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
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[illegible]

149	609	375	77	68	32
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1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9
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14	14	14	14
15	15	15	15
16	16	16	16
17	17	17	17
18	18	18	18
19	19	19	19
20	20	20	20
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62	62	62	62
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88	88	88	88
89	89	89	89
90	90	90	90
91	91	91	91
92	92	92	92
93	93	93	93
94	94	94	94
95	95	95	95
96	96	96	96
97	97	97	97
98	98	98	98
99	99	99	99
100	100	100	100

1,824	1,824	380	77	62	35
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[illegible]

1.12	1.12	335	79	65	3.2
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[illegible]

190	190	270	52	66	3.0
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0.4	73	5.65	811	3474
7	73	5.65	811	3474

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99
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SET 1488-01 0475

NOMOGRAPH DATA BY

CALCULATED PRESSURE DIFFERENTIAL ACROSS ORIFICE, in. H ₂ O	ΔH_0
AVERAGE METER TEMPERATURE (AMBIENT + 20°F), °F	$T_{m, avg.}$
PERCENT HUMIDITY IN GAS STREAM BY VOLUME	$\phi_{g, 2}$
BAROMETRIC PRESSURE AT METER, in. Hg	P_m
STATIC PRESSURE IN STACK, in. Hg	P_s
$P_m \pm (.073 \times \text{STACK GAUGE PRESSURE in in. H}_2\text{O})$	P_s / P_m
RATIO OF STATIC PRESSURE TO METER PRESSURE	
AVERAGE STACK TEMPERATURE, °F	$T_{s, avg.}$
AVERAGE VELOCITY HEAD, in. H ₂ O	$\Delta P_{s, g.}$
MAXIMUM VELOCITY HEAD, in. H ₂ O	$\Delta P_{m, g.}$
C FACTOR	
CALCULATED NOZZLE DIAMETER, in.	
ACTUAL NOZZLE DIAMETER, in.	
REFERENCE ΔP , in. H ₂ O	

DRY MOLECULAR WEIGHT DETERMINATION BY

SAMPLING TIME (24 hr CLOCK) _____

SAMPLING LOCATION _____

SAMPLE TYPE (BAG, INTEGRATED, CONTINUOUS) _____

ANALYTICAL METHOD _____

AMBIENT TEMPERATURE _____

GAS	1		2		3		AVERAGE NET VOLUME
	ACTUAL READING	NET	ACTUAL READING	NET	ACTUAL READING	NET	
CO ₂	91.2	8.8	91.2	8.8	91.1	8.9	8.83
O ₂ (NET IS ACTUAL O ₂ READING MINUS ACTUAL CO ₂ READING)	79.8	11.4	79.9	11.3	79.8	11.3	11.33
CO (NET IS ACTUAL CO READING MINUS ACTUAL O ₂ READING)	72.8	27.0	72.8	27.0	72.8	27.0	27.03
NO ₂ (NET IS ACTUAL NO ₂ READING MINUS ACTUAL CO ₂ READING)							

MOISTURE

WIPINGERS
FINAL VOLUME 225 ml
INITIAL VOLUME 200 ml
NET VOLUME 25 ml

SILICAGEL
FINAL WEIGHT 529.5 g
INITIAL WEIGHT 512.5 g
NET WEIGHT 17.0 g
TOTAL MOISTURE 13.20 %

ANALYTICAL DATA BY

ACETONE FRONT WASH
FINAL 86.7560 mg
TARE 86.7131 mg
NET 0.0429 mg

ACETONE BACK WASH
FINAL 86.0386 mg
TARE 86.0367 mg
NET 0.0019 mg

ETHER-CHLOROFORM EXTRACT
FINAL 6.5124 mg
TARE 4.605 mg
NET 0.0519 mg

WATER EVAPORATION
FINAL 94.6460 mg
TARE 94.6285 mg
NET 0.0175 mg

FILTER NUMBER 1
FINAL 1.381 mg
TARE 1.3691 mg
NET 0.0120 mg

FILTER NUMBER 2
FINAL 0.0120 mg
TARE 0.0120 mg
NET 0.0000 mg

FILTER NUMBER 3
FINAL 0.1668 mg
TARE 0.1668 mg
NET 0.0000 mg



SCOTT ENVIRONMENTAL TECHNOLOGY, INC.

SIGNED _____ DATE _____
WITNESS _____ DATE _____
I CERTIFY THAT I RECEIVED THE SAMPLES DESCRIBED BY THIS DATA SHEET FROM THE ABOVE NAMED INDIVIDUAL AND ANALYZED THEM IN ACCORDANCE WITH THE ABOVE ANALYTICAL PROCEDURE.

I FURTHER CERTIFY THAT THE SAMPLES WERE IN THE POSSESSION OF, OR SEALED FOR SHIPMENT BY COMMON CARRIER BY, MYSELF UNTIL DELIVERY TO A LABORATORY FOR ANALYSIS.

CERTIFY THAT THE SAMPLES DESCRIBED BY THIS DATA SHEET WERE COLLECTED IN ACCORDANCE WITH METHOD'S COLLATED BY

TOTAL BACK 0.0194 mg

SET 1488 01 0475

FIELD DATA

NO. _X FLASKProject No. 1488 Run # 1aLocation: ORCA Boiler #2Date: 2/11/75 Time: 1150Initial flask vacuum "Hg 25.6Initial flask temp. °F 37°F 15Initial Barometric Pressure 29.76Flask volume Heads C 2039.2 ccFinal Flask Vacuum "Hg 1.2Final flask temp. °F 70Final Barometric Pressure 29.42Operator JL

SET 1488 01 0475

FIELD DATA

NO _X FLASKProject No. 1488 Run # 16Location: LCA Boiler #2Date: 2/11/75 Time: 1225Initial flask vacuum "Hg 24.5Initial flask temp. °F 390 F 60Initial Barometric Pressure 29.76Flask volume D 2049.8Final Flask Vacuum "Hg 0.7Final flask temp. °F 70Final Barometric Pressure 29.42Operator J

SET 1488 01 0475

FIELD DATA

NO_x FLASK

Project No. 1488 Run # 2a

Location: RCA Boiler #2

Date: 2/1/78 Time: 1440

Initial flask vacuum "Hg 25.5

Initial flask temp. °F 37°F 45

Initial Barometric Pressure 29.75

Flask volume E 2033.0 CC

Final Flask Vacuum "Hg 1.1

Final flask temp. °F 70

Final Barometric Pressure 29.42

Operator gg



SET 1488 01 0475

FIELD DATA

NO_x FLASKProject No. 1488 Run # 26Location: RCA Boiler #2Date: 2/11/75 Time: 15:45Initial flask vacuum "Hg 25.5Initial flask temp. °F 37 45Initial Barometric Pressure 29.75Flask volume F 2043.0Final Flask Vacuum "Hg 1.0Final flask temp. °F 70Final Barometric Pressure 29.42Operator JP

SET 1488 01 0475

FIELD DATA

NO_X FLASK

Project No. 1488 Run # 3a

Location: LCA Boiler #2

Date: 2/11/75 Time: 1705

Initial flask vacuum "Hg 24.4

Initial flask temp. °F 37.45

Initial Barometric Pressure 29.80

Flask volume G 2016.94

Final Flask Vacuum "Hg 0.0

Final flask temp. °F 70

Final Barometric Pressure 29.42

Operator JP



SET 1488 01 0475

FIELD DATA

NO. _X FLASKProject No. 1488 Run # 36Location: RCA Mailer #2Date: 2/11/75 Time: 1730Initial flask vacuum "Hg 25.3Initial flask temp. °F 37 45Initial Barometric Pressure 29.80Flask volume lt 1982.76Final Flask Vacuum "Hg 0.1Final flask temp. °F 70Final Barometric Pressure 29.42Operator M

SET 1488 01 0475

APPENDIX B2

Field Data - Boiler #3



SET 1488 01 0475

SCOTT ENVIRONMENTAL TECHNOLOGY, INC.



FIELD DATA SHEET

PROJECT NUMBER 1488-23 TEST NUMBER 1

FYRITE ANALYSIS

PROBE LENGTH & TYPE 5 ft - 9 ft

DCA

TRAVERSE POINT LOCATION & VELOCITY DATA BY

TRAVERSE POINT NUMBER	A=FRACTION OF I.D.	B=AXI.D. ID=	C=B+NIPPLE NIPPLE=	VELOCITY HEAD (h _p), in H ₂ O	STACK TEMPERATURE (t _s), °F
1				.027	425
2				.020	438
3				.010	440
4				.010	440
5				.027	425
6				.020	441
7				.020	445
8				.017	440
9				.030	430
10				.020	431
11				.020	436
12				.015	440
13				.020	430
14				.020	430
15				.012	422
16				.010	420
17				.020	400
18				.020	400
19				.015	400
20				.015	400
21					
22				.0184	426.9
23					
24					
25					
26					
27					
28					
29					
30					
31					
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33					
34					
35					
36					
37					
38					
39					
40					
41					
42					
43					
44					
45					
46					
47					
48					
AVERAGE					

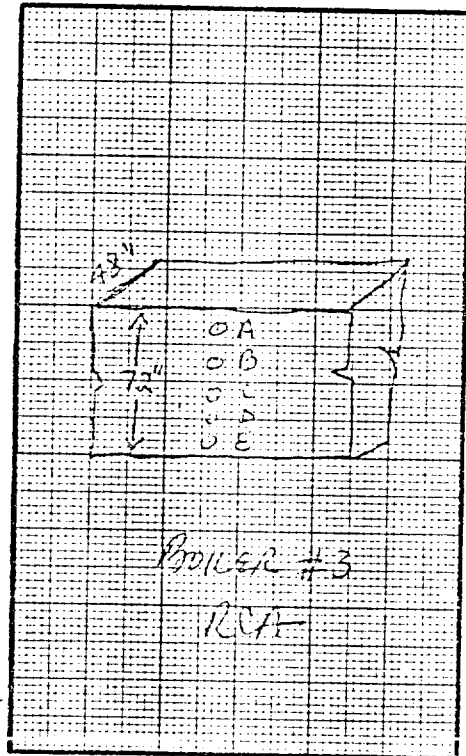


DIAGRAM OF STACK, PORTS, & TRAVERSE POINTS (indicate direction of flow)

INSIDE DIMENSIONS OF SAMPLE PLANE

45 X 72

STACK GAUGE PRESSURE in. H₂O .43

NEAREST UPSTREAM DISTURBANCE

NEAREST DOWNSTREAM DISTURBANCE

PROCESS & CONTROL EQUIPMENT DESCRIPTION



SCOTT ENVIRONMENTAL TECHNOLOGY, INC.

SET 1488 01 0475

PROJECT NUMBER 1488-23 TEST NUMBER 1 FIELD DATA SHEET

SCOTT ENVIRONMENTAL TECHNOLOGY, INC.

PLANT POH PROBE LENGTH & TYPE 5 ft. 12 ft. FYRITE ANALYSIS CO₂ O₂

DATE 3/11/75 NOZZLE I.D. 0.26

SAMPLING LOCATION Boiler #3 SAMPLE BOX NUMBER 8001

SAMPLE TYPE 5 METER BOX NUMBER RAC

RUN NUMBER 1 PROBE HEATER SETTING 37

OPERATORS JCL RLB FILTER HEATER SETTING 250

AMBIENT TEMPERATURE 42 REFERENCE LP 0.187

BAROMETER 30.1 READ AND RECORD ALL DATA EVERY 5 MINUTES

TRAVERSE POINT NUMBER	CLOCK TIME SAMPLING TIME, min	CLOCK TIME (24 hr CLOCK)	GAS METER READING (V _g), ft ³	VELOCITY HEAD (W _g), in. H ₂ O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H ₂ O	STACK TEMPERATURE (T _s), °F	DRY GAS METER TEMPERATURE (T _m), °F	PUMP VACUUM in. Hg	INPINGER TEMPERATURE °F	COMMENTS
			INITIAL: 650.912		DESIRED ACTUAL		INLET OUTLET (T _m), °F			
1	5	131	655.931	0.30	2.95 2.45	450	51 49	4		
2	10		659.995	0.30	2.95 2.45	460	68 50	4		
3	15		664.119	0.25	2.45 2.45	475	78 53	3.5		
4	20		667.911	0.20	2.00 2.00	470	84 58	3.2		
5	25		672.805	0.36	3.50 3.50	465	81 60	5.0		
6	30		677.421	0.30	2.95 2.95	490	90 63	4.5		
7	35		681.298	0.20	2.00 2.00	485	92 65	3.3		
8	40		684.743	0.17	1.68 1.68	470	91 67	3.0		
9	45		689.132	0.28	2.79 2.79	452	86 68	4.1		
10	50		693.326	0.24	2.35 2.35	465	90 68	3.8		
11	55		697.084	0.20	2.00 2.00	470	92 69	3.1		
12	60		700.300	0.14	1.40 1.40	470	92 70			
13	65		704.558	0.30	2.95 2.95	450	87 70	4.5		
14	70	2056	709.045	0.20	2.00 2.00	450	92 71	3.2		
15	75	2056	711.664	0.10	1.00 1.00	440	88 71	2.0		
16	80		713.694	0.05	0.70 0.70	415	86 71	2.0		

TRAVERSE POINT NUMBER	CLOCK TIME SAMPLING TIME, min	CLOCK TIME (24 hr CLOCK)	GAS METER READING (V _g), ft ³	VELOCITY HEAD (W _g), in. H ₂ O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H ₂ O	STACK TEMPERATURE (T _s), °F	DRY GAS METER TEMPERATURE (T _m), °F	PUMP VACUUM in. Hg	INPINGER TEMPERATURE °F	COMMENTS
					DESIRED ACTUAL		INLET OUTLET			
17	55		717.5168	0.20	2.00 2.00	420	80 70	3.2		
18	90		720.9707	0.17	1.70 1.70	435	88 71	3.0		
19	95		724.226	0.14	1.40 1.40	435	84 71	2.5		
20	100	132	727.051	0.10	1.00 1.00	420	84 71	2.0		

PROJECT NUMBER 1488-23 TEST NUMBER 1 FIELD DATA SHEET

SCOTT ENVIRONMENTAL TECHNOLOGY, INC.

PLANT RCA PROBE LENGTH & TYPE 6 ft. g FRYTE ANALYSIS
 DATE 3/2/75 NOZZLE I.D. 1/2 CO₂ 02
 SAMPLING LOCATION Bldg J3 SAMPLE BOX NUMBER Scott #1
 SAMPLE TYPE 5 METER BOX NUMBER RAC
 RUN NUMBER 2 PROBE HEATER SETTING
 OPERATORS JW RB FILTER HEATER SETTING
 AMBIENT TEMPERATURE 40 REFERENCE Δ 0.187
 BAROMETER 30.05 3003 762.762 READ AND RECORD ALL DATA EVERY 5 MINUTES

TRAVERSE POINT NUMBER	CLOCK TIME (24 hr CLOCK)	GAS METER READING (V _g , in ³)	VELOCITY HEAD (V _g , in. H ₂ O)	ORIFICE PRESSURE DIFFERENTIAL (ΔH, in. H ₂ O)	STACK TEMPERATURE (T _s , °F)	DRY GAS METER TEMPERATURE (T _m , in. H ₂ O)	PUMP VACUUM, in. Hg	IMPINGER TEMPERATURE, °F	COMMENTS
		INITIAL: 722.128		DESIRED ACTUAL		INLET (T _m , in. H ₂ O) OF (T _m , in. H ₂ O) OF			
1	5	732.973	1.130	2.95 2.95	450	49 45	5		
2	10	736.471	1.031	3.05 3.05	460	63 46	4.5		
3	15	740.535	1.021	2.02 2.02	468	72 48	3.8		
4	20	744.230	1.020	2.00 2.00	460	76 51	3.0		
5	25	748.938	1.033	3.25 3.25	450	76 55	4.5		
6	30	753.485	1.030	2.95 2.95	464	84 57	4.5		
7	35	757.429	1.023	2.12 2.12	461	87 60	3.5		
8	40	760.916	1.017	1.70 1.70	460	87 63	3.0		
9	45	765.549	1.051	3.05 3.05	440	79 64	4.5		
10	50	769.636	1.021	2.02 2.02	448	86 65	3.0		
11	55	773.316	1.020	2.00 2.00	450	88 66	3.0		
12	60	776.995	1.020	2.00 2.00	443	86 66			
13	65	781.579	1.030	2.95 2.95	430	84 64	4.8		
14	70	785.544	1.021	2.02 2.02	435	90 68	3.5		
15	75	789.072	1.018	1.80 1.80	430	90 68	3.0		
16	80	791.982	1.012	1.20 1.20	420	86 69	2.5		

TRAVERSE POINT NUMBER	CLOCK TIME (24 hr CLOCK)	GAS METER READING (V _g , in ³)	VELOCITY HEAD (V _g , in. H ₂ O)	ORIFICE PRESSURE DIFFERENTIAL (ΔH, in. H ₂ O)	STACK TEMPERATURE (T _s , °F)	DRY GAS METER TEMPERATURE (T _m , in. H ₂ O)	PUMP VACUUM, in. Hg	IMPINGER TEMPERATURE, °F	COMMENTS
				DESIRED ACTUAL		INLET (T _m , in. H ₂ O) OF (T _m , in. H ₂ O) OF			
17	85	795.687	1.021	2.02 2.02	415	86 69	4.6	41	
18	90	799.100	1.020	2.00 2.00	420	87 69	4.0	41	
19	95	803.107	1.020	2.00 2.00	410	88 69	4.0	7	
20	100	805.909	1.010	1.00 1.00	380	86 69	5	5	

SET 1488 01 0475

MOISTURE

SILICA GEL
 FINAL WEIGHT 541.8 g
 INITIAL WEIGHT 519.6 g
 NET WEIGHT 22.2 g
 TOTAL MOISTURE 65.2

IMPINGERS

FINAL VOLUME 245 ml
 INITIAL VOLUME 240 ml
 NET VOLUME 43 ml

ANALYTICAL DATA BY _____ACETONE FRONT WASH

FINAL 106.3298 mg
 TARE 105.9060 mg
 NET 0.4238 mg

FILTER NUMBER 1

FINAL 0.6137 mg
 TARE 0.4499 mg
 NET 0.1633 mg

FILTER NUMBER 2

FINAL 101.3465 mg
 TARE 101.3232 mg
 NET 0.0233 mg

FILTER NUMBER 3

FINAL 225.7 mg
 TARE 225.7 mg
 NET 0 mg

CYCLONE

FINAL 1.6925 mg
 TARE 1.3816 mg
 NET 0.3109 mg
 TOTAL FRONT 898.0 mg

ACETONE BACK WASH

FINAL 64.5297 mg
 TARE 64.5253 mg
 NET 0.0044 mg

ETHER-CHLOROFORM EXTRACT

FINAL 0 mg
 TARE 0 mg
 NET 0 mg

WATER EVAPORATION

FINAL 101.3465 mg
 TARE 101.3232 mg
 NET 0.0233 mg

TOTAL BACK 27.7 mg
225.7 mg

I CERTIFY THAT THE SAMPLES DESCRIBED
 BY THIS DATA SHEET WERE COLLECTED IN
 ACCORDANCE WITH METHODS OUTLINED BY

I FURTHER CERTIFY THAT THE SAMPLES
 WERE IN THE POSSESSION OF OR SEALED
 FOR SHIPMENT BY COMMON CARRIER BY
 MYSELF UNTIL DELIVERY TO A LABORATORY
 FOR ANALYSIS.

SIGNED _____ DATE _____

WITNESS
 I CERTIFY THAT I RECEIVED THE SAMPLES
 DESCRIBED BY THIS DATA SHEET FROM THE
 ABOVE NAMED INDIVIDUAL AND ANALYZED
 THEM IN ACCORDANCE WITH THE ABOVE
 NAMED PROCEDURE.

SIGNED _____ DATE _____
 WITNESS _____ DATE _____

SCOTT ENVIRONMENTAL TECHNOLOGY, INC.

NOMOGRAPH DATA BY _____

CALIBRATED PRESSURE DIFFERENTIAL ACROSS ORIFICE, in. H ₂ O	ΔH _g	
AVERAGE METER TEMPERATURE (AMBIENT + 20°F), °F	T _{avg.}	
PERCENT MOISTURE IN GAS STREAM BY VOLUME	P _{mo}	
BAROMETRIC PRESSURE AT METER, in. Hg	P _m	
STATIC PRESSURE IN STACK, in. Hg	P _s	
P _m - 16.073 × STACK GAUGE PRESSURE (in. H ₂ O)	P _s /P _m	
RATIO OF STATIC PRESSURE TO METER PRESSURE	T _{s,avg.}	
AVERAGE STACK TEMPERATURE, °F	ΔP _{avg.}	
AVERAGE VELOCITY HEAD, in. H ₂ O	ΔP _{max.}	
MAXIMUM VELOCITY HEAD, in. H ₂ O		
C FACTOR		
CALCULATED NOZZLE DIAMETER, in.		
ACTUAL NOZZLE DIAMETER, in.		
REFERENCE ΔP, in. H ₂ O		

DRY MOLECULAR WEIGHT DETERMINATION BY _____

SAMPLING TIME (24-hr CLOCK) _____

SAMPLING LOCATION _____

SAMPLE TYPE (BAG, INTEGRATED, CONTINUOUS) _____

ANALYTICAL METHOD _____

AMBIENT TEMPERATURE _____

RUN	1		2		3	
	ACTUAL READING	NET	ACTUAL READING	NET	ACTUAL READING	NET
GAS						
CO ₂	88.3	11.7	88.4	11.6	88.3	11.7
O ₂ (NET IS ACTUAL O ₂ READING MINUS ACTUAL CO ₂ READING)	79.4	8.9	79.6	8.8	79.5	8.8
CO (NET IS ACTUAL CO READING MINUS ACTUAL O ₂ READING)	79.4	0.0	79.6	0.0	79.5	0.0
N ₂ (NET IS 100 MINUS ACTUAL CO READING)						
AVERAGE NET VOLUME						

PROJECT NUMBER 1188-23 TEST NUMBER 1

FIELD DATA SHEET

SCOTT ENVIRONMENTAL TECHNOLOGY, INC.

B2-6

SET 1488 01 0475

PLANT RC A PROBE LENGTH & TYPE 6 ft fl FVRITE ANALYSIS
 DATE 3/12/75 NOZZLE I.D. 1.626" CO₂ O₂
 SAMPLING LOCATION area #3 SAMPLE BOX NUMBER Scott #2
 SAMPLE TYPE 5 METER BOX NUMBER RAC
 RUN NUMBER 3 PROBE HEATER SETTING 40
 OPERATORS GU RB FILTER HEATER SETTING
 AMBIENT TEMPERATURE 45 REFERENCE LP 0.187
 BAROMETER 29.96 READ AND RECORD ALL DATA EVERY 5 MINUTES

TRAVEL POINT NUMBER	CLOCK TIME SAMPLING TIME, min	CLOCK TIME (GMT) CLOCK	GAS METER READING (V _g), in ³	VELOCITY HEAD (V _g), in. H ₂ O	ORIFICE PRESSURE DIFFERENTIAL (ΔP), in. H ₂ O	STACK TEMPERATURE (T _s), °F	DRY GAS METER TEMPERATURE (T _m), °F	PUMP VACUUM, in. Hg	IMPINGER TEMPERATURE, °F	COMMENTS
			INITIAL: 506.302		DES. ACTUAL		INLET, (T _m), °F	OUTLET, (T _m), °F		
1	5	1307	810.052	.018	1.80 1.80	410	72	53	3.2	
2	10		813.714	.021	2.08 2.08	435	68	54	3.1	
3	15		816.974	.015	1.50 1.50	457	74	55	3.1	
4	20		819.744	.010	1.00 1.00	420	78	57	2.0	
5	25		823.312	.019	1.80 1.80	416	78	60	3.1	
6	30		826.611	.015	1.50 1.50	416	84	63	3.0	
7	35		829.478	.011	1.10 1.10	422	86	65	2.2	
8	40		832.265	.010	1.00 1.00	420	86	67	2.0	
9	45		835.558	.015	1.50 1.50	420	84	68	3.0	
10	50		838.774	.015	1.50 1.50	410	85	69	3.0	
11	55		841.717	.011	1.10 1.10	425	90	71	3.0	
12	60		844.225	.008	.80 .80	420	89	71	3.0	
13	65		847.709	.020	2.00 2.00	410	86	72	4.0	
14	70		850.951	.018	1.80 1.80	410	90	72	5.1	
15	75		853.758	.011	1.00 1.00	390	91	73	18	
16	80		855.852	.005	.50 .50	385	91	74	6	

TRAVEL POINT NUMBER	CLOCK TIME SAMPLING TIME, min	CLOCK TIME (GMT) CLOCK	GAS METER READING (V _g), in ³	VELOCITY HEAD (V _g), in. H ₂ O	ORIFICE PRESSURE DIFFERENTIAL (ΔP), in. H ₂ O	STACK TEMPERATURE (T _s), °F	DRY GAS METER TEMPERATURE (T _m), °F	PUMP VACUUM, in. Hg	IMPINGER TEMPERATURE, °F	COMMENTS
			INITIAL: 857.600		DES. ACTUAL		INLET, (T _m), °F	OUTLET, (T _m), °F		
17	85		858.518	.012	1.2 1.2	390	86	74	14548	
18	90		861.891	.012	1.2 1.2	398	82	72	14448	
19	95		864.379	.008	.80 .80	380	86	76		
20	100	1503	866.293	.004	.40 .40	350	85	72		

SET 1488 01 0475

NOMOGRAPH DATA BY

CALIBRATED PRESSURE DIFFERENTIAL ACROSS ORIFICE, in. H ₂ O	ΔH_0
AVERAGE METER TEMPERATURE (AMBIENT + 20°F), °F	$T_m, \text{avg.}$
PERCENT MOISTURE IN GAS STREAM BY VOLUME	B_{vol}
BAROMETRIC PRESSURE AT METER, in. Hg	P_m
STATIC PRESSURE IN STACK, in. Hg	P_s
$P_m \pm 0.013 \times \text{STACK GAUGE PRESSURE (in. H}_2\text{O)}$	P_m/P_m
RATIO OF STATIC PRESSURE TO METER PRESSURE	$T_{s, \text{avg.}}$
AVERAGE STACK TEMPERATURE, °F	$\Delta P_{s, \text{avg.}}$
AVERAGE VELOCITY HEAD, in. H ₂ O	$\Delta P_{\text{max.}}$
MAXIMUM VELOCITY HEAD, in. H ₂ O	
C FACTOR	
CALCULATED NOZZLE DIAMETER, in.	
ACTUAL NOZZLE DIAMETER, in.	
REFERENCE Sp. in. H ₂ O	

DRY MOLECULAR WEIGHT DETERMINATION BY

SAMPLING TIME (24 hr CLOCK)

SAMPLING LOCATION

SAMPLE TYPE (BAG, INTEGRATED, CONTINUOUS)

ANALYTICAL METHOD

AMBIENT TEMPERATURE

RUN	1		2		3		AVERAGE NET VOLUME
	ACTUAL READING	NET	ACTUAL READING	NET	ACTUAL READING	NET	
GAS							
CO ₂	88.4	11.6	88.0	12.0	84.3	15.7	11.43
O ₂ (NET IS ACTUAL O ₂ READING MINUS ACTUAL CO ₂ READING)	79.9	8.6	79.4	8.6	74.9	9.7	8.97
CO (NET IS ACTUAL CO READING MINUS ACTUAL O ₂ READING)	79.8	0.0	79.4	0.0	79.0	0.0	
N ₂ (NET IS 100 MINUS ACTUAL CO READING)							

MOISTURE

SILICA GEL

FINAL WEIGHT 529.6

INITIAL WEIGHT 517.2

NET WEIGHT 12.4

TOTAL MOISTURE 66.4

BIMPHINGERS

FINAL VOLUME 24.9 ml

INITIAL VOLUME 20.0 ml

NET VOLUME 4.9 ml

ANALYTICAL DATA BY

ACETONE FRONT WASH

FINAL 90.4583 mg

TARE 90.1814 mg

NET 0.2769 mg

FILTER NUMBER 1

FINAL 0.5658 mg

TARE 0.4548 mg

NET 0.1110 mg

FILTER NUMBER 2

FINAL 0.4654 mg

TARE 0.4418 mg

NET 0.0236 mg

FILTER NUMBER 3

FINAL 1.5062 mg

TARE 1.3762 mg

NET 0.1300 mg

TOTAL FRONT 541.5 mg

ACETONE BACK WASH

FINAL 64.7427 mg

TARE 64.7418 mg

NET 0.0009 mg

ETHER-CHLOROFORM EXTRACT

FINAL 23.8 mg

TARE 23.3 mg

NET 0.5 mg

WATER EVAPORATION

FINAL 83.8727 mg

TARE 83.8498 mg

NET 0.0229 mg

TOTAL BACK 23.8 mg

I CERTIFY THAT THE SAMPLES DESCRIBED BY THIS DATA SHEET WERE COLLECTED IN ACCORDANCE WITH METHODS OUTLINED BY

I FURTHER CERTIFY THAT THE SAMPLES WERE IN THE POSSESSION OF, OR SEALED FOR SHIPMENT BY COMMON CARRIER BY, MYSELF UNTIL DELIVERY TO A LABORATORY FOR ANALYSIS.

SIGNED

DATE

WITNESS

I CERTIFY THAT I RECEIVED THE SAMPLES DESCRIBED BY THIS DATA SHEET FROM THE ABOVE NAMED INDIVIDUAL AND ANALYZED THEM IN ACCORDANCE WITH THE AEDNE NAMED PROCEDURE.

SIGNED

DATE

WITNESS

SIGNED

DATE

WITNESS

SIGNED

DATE

WITNESS

SIGNED

DATE

WITNESS

SIGNED

DATE

WITNESS



SCOTT ENVIRONMENTAL TECHNOLOGY, INC.

SET 1488 01 0475

FIELD DATA

NO_x FLASK

Project No. 1488 Run # 1A

Location: RCA #3 LANCASTER, PA.

Date: 3-11-75 Time: 1643

Initial flask vacuum "Hg 25.5

Initial flask temp. °F 55

Initial Barometric Pressure 30.1 "Hg

Flask volume A 2040.4 cc

Final Flask Vacuum "Hg 11.25

Final flask temp. °F 68.5

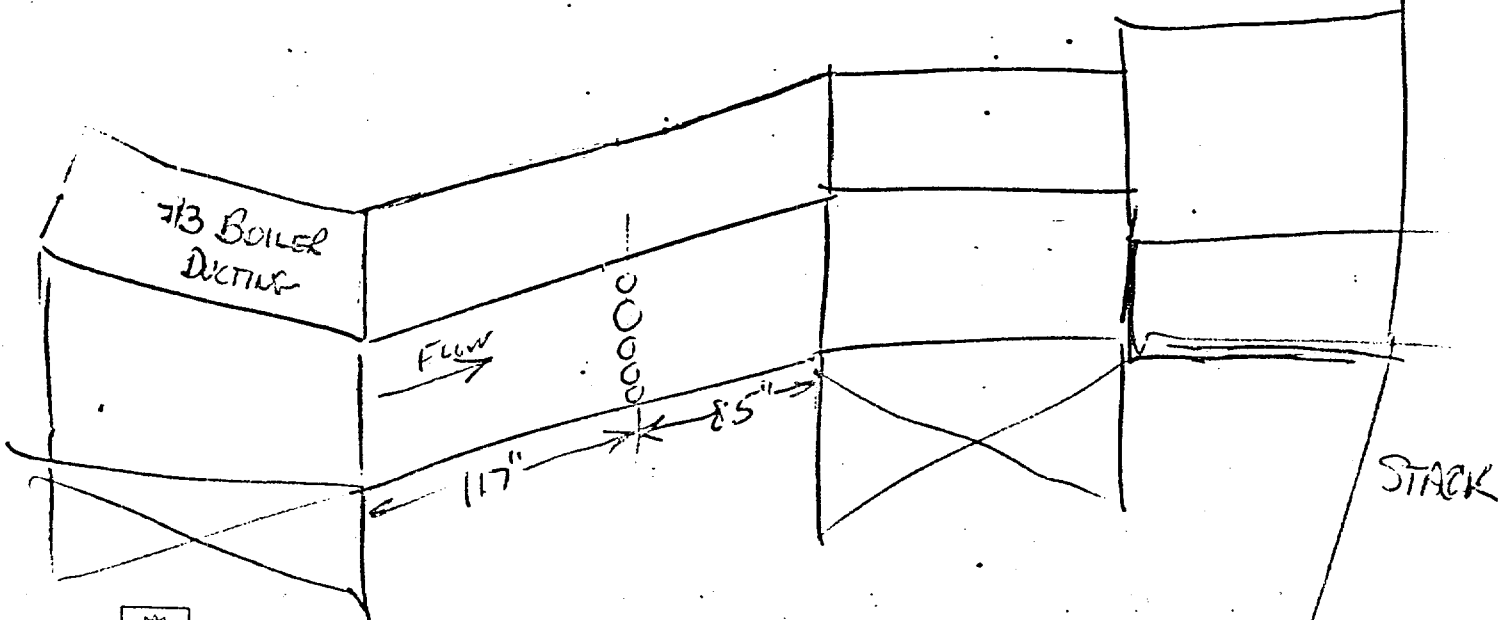
Final Barometric Pressure 29.44

Operator JOE SPENCER



SET 1488 01 0475

FIELD DATA

NO. _X FLASKProject No. 1488 Run # 1BLocation: RCA #3 LANCASTER, PA.Date: 3-11-75 Time: 1741Initial flask vacuum "Hg 28.5Initial flask temp. °F 55Initial Barometric Pressure 30.95" HgFlask volume EB 2042.5 ccFinal Flask Vacuum "Hg 130Final flask temp. °F 70.Final Barometric Pressure 29.45Operator John K. Kyrush

SET 1488 01 0475

FIELD DATA

NO_x FLASKProject No. 1488 Run # 2 ALocation: RCA #3 LANCASTER Pa.Date: 3-12-75 Time: 0914Initial flask vacuum "Hg 27Initial flask temp. °F 48Initial Barometric Pressure 30.03 "HgFlask volume G 2016.94 ccFinal Flask Vacuum "Hg .15Final flask temp. °F 10Final Barometric Pressure 29.47Operator John V. Lynch

SET 1488 01 0475

FIELD DATA

NO. X FLASKProject No. 1488 Run # 2 BLocation: RCA #3 LANCASTER, PA.Date: 3-12-75 Time: 0948Initial flask vacuum "Hg 28Initial flask temp. °F 50Initial Barometric Pressure 30.05 "HgFlask volume # 1982.76 ccFinal Flask Vacuum "Hg 1075Final flask temp. °F 70Final Barometric Pressure 29.45Operator John W. D. [Signature]

SET 1488 01 0475

FIELD DATA

NO. _X FLASKProject No. 1488 Run # 3ALocation: RCA #3 LANCASTER, PA.Date: 3-12-75 Time: 1310Initial flask vacuum "Hg 27.5"Initial flask temp. °F 48Initial Barometric Pressure 29.94" HgFlask volume C 2039.2 ccFinal Flask Vacuum "Hg .66Final flask temp. °F 70°Final Barometric Pressure 29.214Operator John H. Repel

SET 1488 01 0475

FIELD DATA

NO. _X FLASKProject No. 1488 Run # 3BLocation: RCA #3 LANCASTER, PA.Date: 3-12-75 Time: 1357Initial flask vacuum "Hg 27.5Initial flask temp. °F 55Initial Barometric Pressure 29.85Flask volume D 2049.8 ccFinal Flask Vacuum "Hg .25Final flask temp. °F 70.00Final Barometric Pressure 29.44Operator John W. Repach

SET 1488 01 0475

APPENDIX C

Laboratory Report



SCOTT ENVIRONMENTAL TECHNOLOGY, INC.

SET 1488 01 0475

TABLE C1
PARTICULATE WEIGHTS SUMMARY (milligrams)

RCA Lancaster - Boiler #2 - 2/11/75

	Run 1			Run 2			Run 3		
	Catch	Front %	Total %	Catch	Front %	Total %	Catch	Front %	Total %
Cyclone	70.2	21.1	17.7	18.6	13.7	10.7	12.0	11.2	9.5
Acetone Front	205.2	61.5	51.8	71.5	52.7	41.2	42.9	40.2	34.0
Filter	58.0	17.4	14.7	45.6	33.6	26.3	51.9	48.6	41.1
Front Total	333.4	100.0	84.2	135.7	100.0	78.1	106.8	100.0	84.6
		Back %			Back %			Back %	
Acetone Back	39.9	63.8	10.1	5.9	15.5	3.4	1.9	9.8	1.5
Water Back	22.6	36.2	5.7	32.1	84.5	18.5	17.5	90.2	13.9
Back Total	62.5	100.0	15.8	38.0	100.0	21.9	19.4	100.0	15.4
Total	395.9		100.0	173.7		100.0	126.2		100.0



SET 1488 01 0475

TABLE C2
PARTICULATE WEIGHTS SUMMARY (milligrams)
 RCA Lancaster - Boiler #3 - 3/11/75 - 3/12/75

	Run #1			Run #2			Run #3		
	Catch	Front %	Total %	Catch	Front %	Total %	Catch	Front %	Total %
Cyclone	267.2	30.5	29.8	310.9	34.6	33.6	130.0	24.0	23.0
Acetone Front	449.6	51.3	50.2	423.8	47.2	45.8	276.9	51.1	49.0
Filter	159.4	18.2	17.8	163.3	18.2	17.6	134.6	24.9	23.8
Front Total	876.2	100.0	97.8	898.0	100.0	97.0	541.5	100.0	95.8
		Back %			Back %			Back %	
Acetone Back	1.0	5.1	0.1	4.4	15.9	0.5	0.9	3.8	0.2
Water Back	18.7	94.9	2.1	23.3	84.1	2.5	22.9	96.2	4.0
Back Total	19.7	100.0	2.2	27.7	100.0	3.0	23.8	100.0	4.2
Total	895.9		100.0	925.7		100.0	565.3		100.0



SET 1488 01 0475

TABLE C3 COAL SAMPLE PROXIMATE ANALYSIS
BOILER #2

Run No:	1		2		3	
	<u>Wet %</u>	<u>Dry %</u>	<u>Wet %</u>	<u>Dry %</u>	<u>Wet %</u>	<u>Dry %</u>
Moisture	9.40	-	7.60	-	8.10	-
Vol. Comb. Matter	4.57	5.04	4.61	4.99	4.58	4.98
Fixed Carbon	77.85	85.93	79.11	85.62	79.27	86.26
Ash	8.18	9.03	8.68	9.39	8.05	8.76
Sulfur	0.57	0.63	0.59	0.64	0.58	0.63
BTU/lb	12145	13405	12332	13346	12382	13473



SET 1488 01 0475

TABLE C4 COAL SAMPLE ULTIMATE ANALYSIS
BOILER #2

(Analysis Performed on Composite of Samples from Runs 1, 2 & 3).

	<u>As Received</u> (%)	<u>Dry Basis</u> (%)
Moisture	8.30	-
Carbon	77.72	84.75
Hydrogen	1.86	2.03
Oxygen	2.45	2.68
Nitrogen	0.77	0.84
Sulfur	0.59	0.64
Ash	8.31	9.06
BTU/lb	12313	13428



SET 1488 01 0475

TABLE C5 COAL SAMPLE PROXIMATE ANALYSIS
BOILER #3

Run No:	1		2		3	
	<u>Wet %</u>	<u>Dry %</u>	<u>Wet %</u>	<u>Dry %</u>	<u>Wet %</u>	<u>Dry %</u>
Moisture	9.60	-	9.70	-	9.30	-
Vol. Comb. Matter	4.42	4.89	4.73	5.24	4.64	5.12
Fixed Carbon	77.29	85.50	76.90	85.16	77.56	85.51
Ash	8.69	9.61	8.67	9.60	8.50	9.37
Sulfur	0.58	0.64	0.56	0.62	0.56	0.62
BTU/lb	12042	13321	11936	13218	12028	13261



SET 1488 01 0475

TABLE C6 COAL SAMPLE ULTIMATE ANALYSIS
BOILER # 3

(Analysis Performed on Composite of Samples from Runs 1, 2 & 3).

	<u>As Received</u> (%)	<u>Dry Basis</u> (%)
Moisture	9.50	-
Carbon	76.54	84.57
Hydrogen	1.86	2.05
Oxygen	2.13	2.36
Nitrogen	0.77	0.85
Sulfur	0.57	0.63
Ash	8.63	9.54
BTU/lb	12013	13274



SET 1488 01 0475

APPENDIX D1

Particle Sizing Analysis - Boiler #2



SCOTT ENVIRONMENTAL TECHNOLOGY, INC.



COULTER COUNTER® Model T & T_A Worksheet

SAMPLE #1488-021 Acetone Wash								
ELECTROLYTE Isoton			DISPERSANT IIA					
EQUIPMENT TA	SERIAL 1180	Aper. Dia.	Ser. No.	CALIBRATION DATA	Part. Dia.	W	± 1A	A
ORGANIZATION Scott Res. Labs								
OPERATOR E.H.	DATE 3/10/75	400	21382	Micros.	18.04	6	3.2	143
Boiler #2 - Composite of Acetone Wash		100	22105	Micros.	9.53	10	3.2	190
catches from Runs 1, 2 & 3								

$$k = d \sqrt[3]{\frac{2W}{A}}$$

FOR MODEL T

± 1A	3.2	3.2		
CALIB. A	105	160.5		
APERTURE DIA.	400	100		

$\frac{A_2}{A_1} = \left(\frac{d_2}{d_1}\right)^3 2^{(W_2 - W_1)}$ For Model T
 $\frac{A_2}{A_1} = \left(\frac{d_1}{d_2}\right)^3 2^{(W_2 - W_1)}$ For Model T_A

SAMPLE DATA

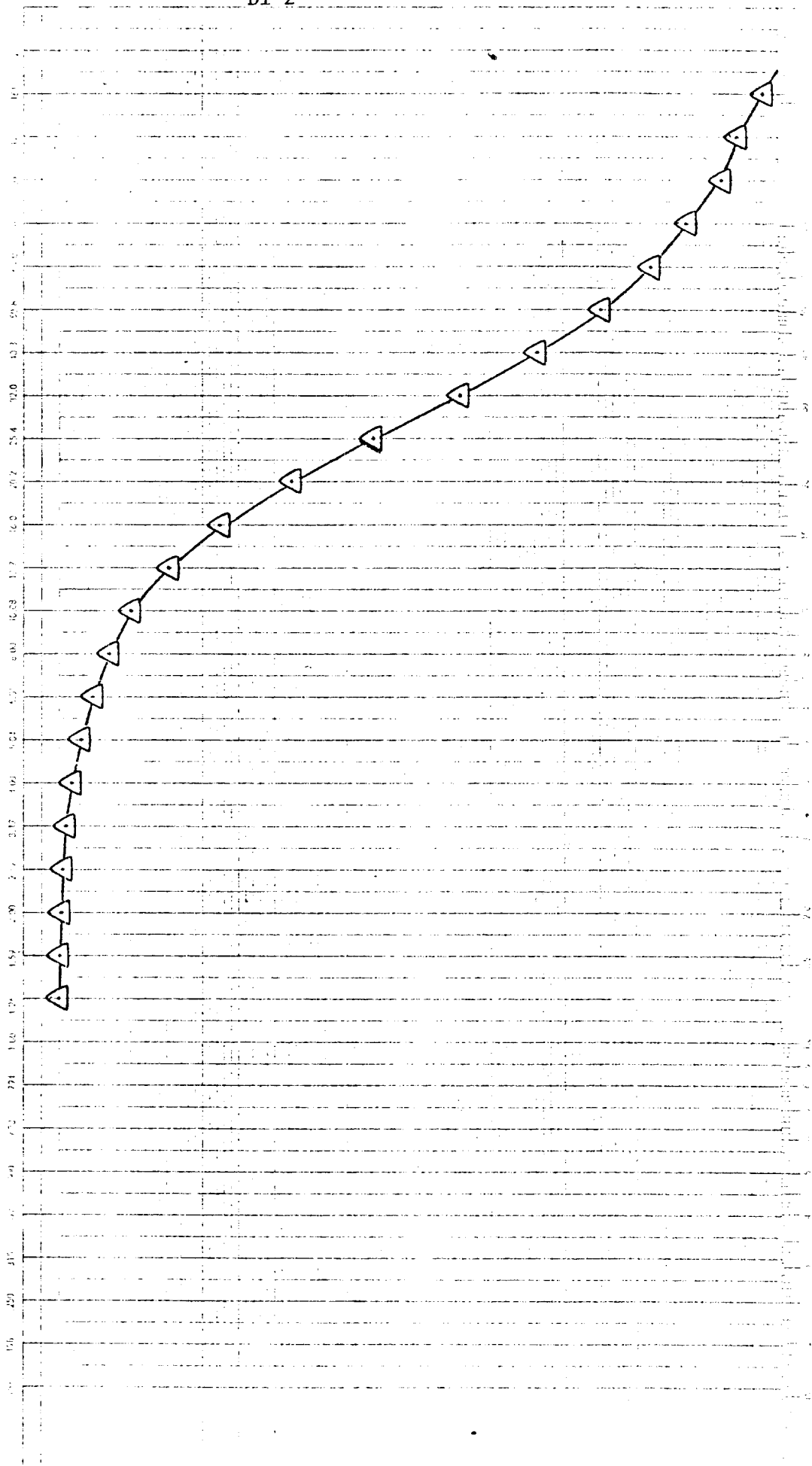
Geometric Mean μ^3	Volume μ^3	Diameter μ	Channel (W)						Cum. %	Dif. %
.00575	.004091	.198								
.0115	.008181	.250								
.0231	.01636	.315								
.0462	.03272	.397								
.0925	.06545	.500								
.1851	.1309	.630								
.3702	.2618	.794								
.7405	.5236	1.00								
1.481	1.047	1.26							100.0	.06
2.962	2.094	1.59							99.9	.09
5.924	4.189	2.00							99.8	.3
11.85	8.378	2.52							99.6	.5
23.70	16.76	3.17							99.1	.8
47.39	33.51	4.00							98.3	1.2
94.78	67.02	5.04							97.1	1.7
189.6	134.0	6.35							95.4	2.3
379.1	268.1	8.00							93.1	3.2
758.3	536.2	10.08							89.9	5.1
1516.	1072.	12.7							84.8	7.1
3033.	2145.	16.0							77.7	10.0
6066.	4289.	20.2							67.7	11.5
12.13×10^3	8579.	25.4							56.2	12.1
24.27×10^3	17.16×10^3	32.0							44.0	10.5
48.54×10^3	34.31×10^3	40.3							33.6	8.8
97.18×10^3	68.63×10^3	50.8							24.7	7.0
194.4×10^3	137.3×10^3	64.0							17.7	4.9
388.7×10^3	274.5×10^3	80.6							12.8	4.9
777.4×10^3	549.0×10^3	101.6							7.8	2.1
1.555×10^6	1.098×10^6	128.							5.7	3.6
3.109×10^6	2.196×10^6	161.							2.1	2.1
6.219×10^6	4.392×10^6	203.								
12.44×10^6	8.784×10^6	256.								
24.88×10^6	17.57×10^6	322.								
49.75×10^6	35.14×10^6	406.								
99.50×10^6	70.27×10^6	512.								
199.0×10^6	140.6×10^6	645.								
398.0×10^6	281.1×10^6	812.								
796.0×10^6	562.2×10^6	1024.								

CE#2133A

SET 1488 01 0475

D1-2

COULTER COUNTER Model T & TA		PARTICLE SIZE ANALYSIS		COULTER ELECTRONICS INC.	
Scott Res. Labs Ed Hoff		TA		COULTER ELECTRONICS INC.	
#1488-021 Acetone Wash Isoton IIA		Boiler # 2 - Composite of Acetone wash catches from Runs 1, 2 & 3		COULTER ELECTRONICS INC.	
400	21382	Microspheres	18.04	6	3.214820.2 6 3.2105
100	22105	Microspheres	9.53	10	3.219010.03103.2160.



MICRON RADIUS

SECRET

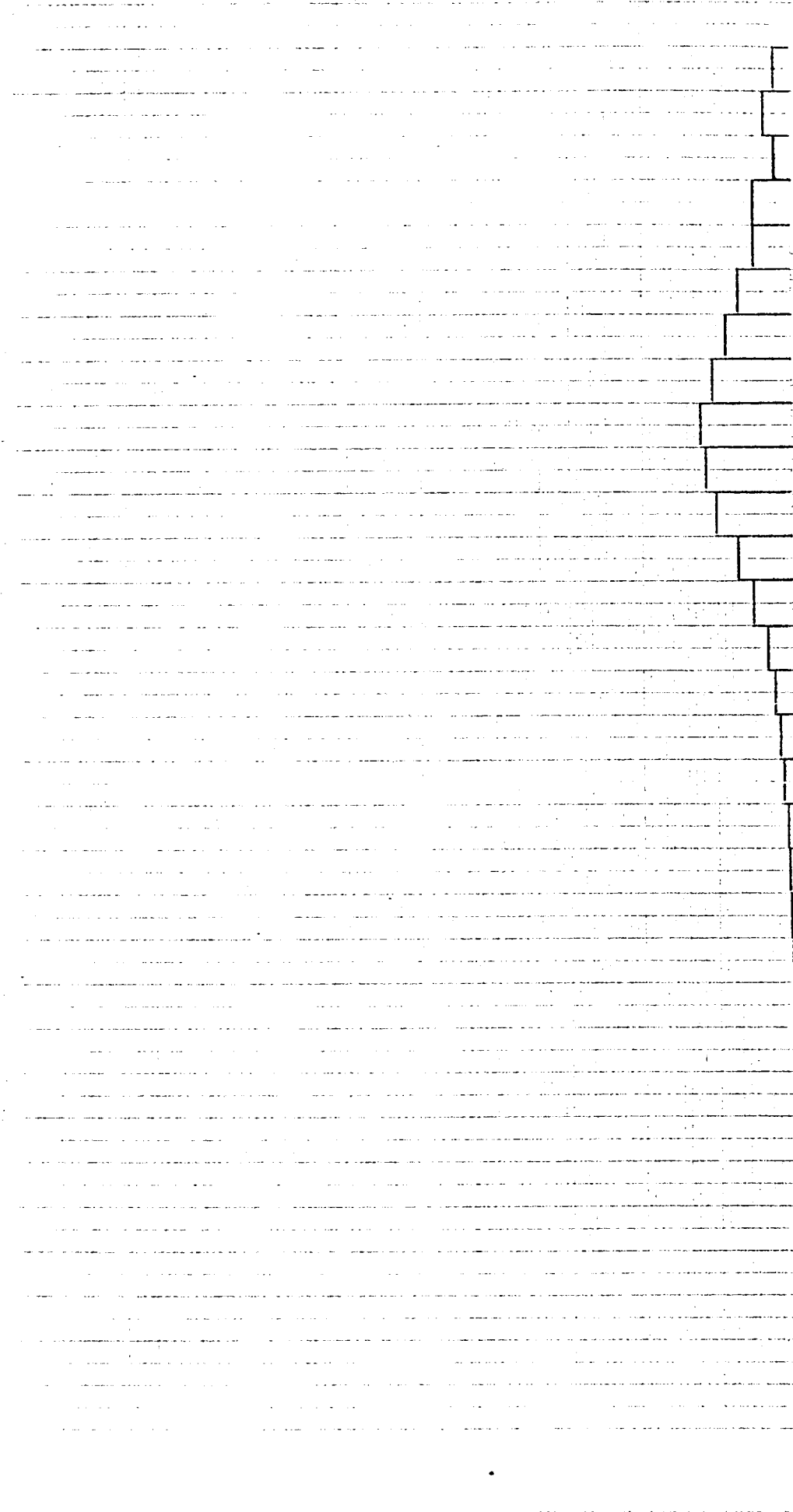
Scott Res. Labs

Ed Hof

TA

#1468-021 Acetone Wash Isoton IIA
Boiler # 2 - Composite of Acetone wash catches
from Runs 1, 2 & 3

QTY	ITEM	UNIT	PRICE	TOTAL	TAX	NET	GROSS
400	21392	Microspheres	18.04	6	3.214820.2	6	3.2105
100	22105	Microspheres	9.53	10	3.2190.10	3	103.2160.



1. The first step is to identify the problem or question that needs to be answered. This involves understanding the context and the specific requirements of the task.



COULTER COUNTER® Model T & T_A Worksheet

SAMPLE #1488-02 Cyclone

ELECTROLYTE Isoton/Glycerine

DISPERSANT

IIA

EQUIPMENT	TA	SERIAL	1180	Aper. Dia.		Ser. No.		CALIBRATION DATA		Part. Dia.		W	± I A	A
ORGANIZATION	Scott Res. Labs.													
OPERATOR	E.H.	DATE	3/10/75	800				Latex		89		10	3.2	125.5
Boiler # 2 - Composite of cyclone dry														
catches from Runs 1, 2 & 3														

$$k = d \sqrt[3]{\frac{2W}{A}}$$

FOR MODEL T

± I A	3.2			
CALIB. A	169			
APERTURE DIA.	800			

$$\frac{A_2}{A_1} = \left(\frac{d_2}{d_1}\right)^3 2 (W_2 - W_1) \text{ For Model T}$$

$$\frac{A_2}{A_1} = \left(\frac{d_1}{d_2}\right)^3 2 (W_2 - W_1) \text{ For Model T}_A$$

SAMPLE DATA

Geometric Mean μ^3	Volume μ^3	Diameter μ	Channel (W)					Cum. %	Dif. %
.00575	.004091	.158							
.0115	.008181	.250							
.0231	.01636	.315							
.0462	.03272	.397							
.0925	.06545	.500							
.1851	.1309	.630							
.3702	.2618	.794							
.7405	.5236	1.00							
1.481	1.047	1.26							
2.962	2.094	1.50							
5.924	4.189	2.00							
11.85	8.378	2.52							
23.70	16.76	3.17							
47.39	33.51	4.00							
94.78	67.02	5.04							
189.5	134.0	6.35							
379.1	268.1	8.00							
758.3	536.2	10.08							
1516.	1072.	12.7							
3033.	2145.	16.0						100.0	.9
6066.	4289.	20.2						99.1	2.2
12.13×10^3	8579.	25.4						97.0	3.7
24.27×10^3	17.16×10^3	32.0						93.3	9.8
48.54×10^3	34.31×10^3	40.3						83.5	16.8
97.18×10^3	68.63×10^3	50.8						66.7	19.7
194.4×10^3	137.3×10^3	64.0						46.9	16.1
388.7×10^3	274.5×10^3	80.6						30.8	11.5
777.4×10^3	549.0×10^3	101.6						19.3	9.2
1.555×10^6	1.098×10^6	128.						10.1	6.8
3.109×10^6	2.196×10^6	161.						3.2	3.2
6.219×10^6	4.392×10^6	203.							
12.44×10^6	8.784×10^6	256.							
24.88×10^6	17.57×10^6	322.							
49.75×10^6	35.14×10^6	406.							
99.50×10^6	70.27×10^6	512.							
199.0×10^6	140.6×10^6	645.							
398.0×10^6	281.1×10^6	812.							
795.0×10^6	562.2×10^6	1024.							

CE 2/33 B

COULTER COUNTER Model T & 1A

PARTICLE SIZE ANALYSIS

Scott Res. Labs
Edward Hoff

TA

#1488-02

Isoton/Glycerine

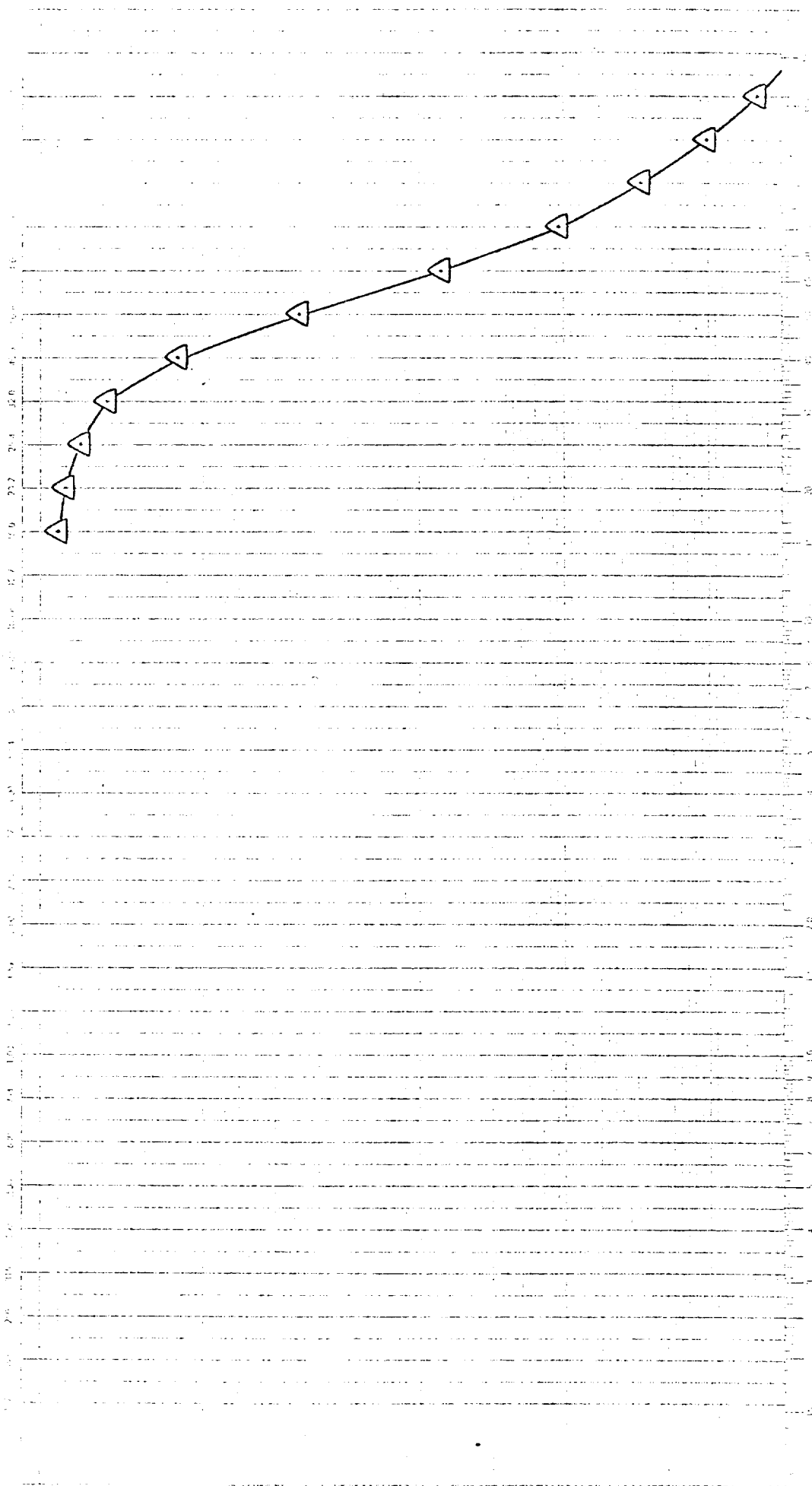
IIA

Boiler #2 - Composite of cyclone dry catches
from Runs 1, 2 & 3

800

Latex

89 10 3.2125.5806 103.2 169



MICRON DIAMETER Log Scale

D1-6

Coulter Counter

PARTICLE SIZE ANALYSIS

Model T & TA

Scott Res. Labs
Edward Hoff

TA

#1488-02 Isoton/Glycerine IIA

Boiler #2 - Composite of cyclone dry catches
from Runs 1, 2 & 3

300

Latex

89

10

3.2

125.5

103.2

169



Model T & TA



COULTER COUNTER® Model T & T_A Worksheet

SAMPLE Mixture (1-1)									
ELECTROLYTE Isoton/Glycerine					DISPERSANT IIA				
EQUIPMENT TA	SERIAL 1180	Aper. Dia.	Ser. No.	CALIBRATION DATA	Part. Dia.	W	± I A	A	
ORGANIZATION Scott Res. Labs.									
OPERATOR E.H.	DATE 3/10/75	800		Latex	89	10	3.2	125.5	
Boiler #2 - Composite of acetone wash		140	23856	Micros.	18.04	11	3.2	158	
& cyclone catches from Runs 1, 2 & 3									
$k = d \sqrt[3]{\frac{2W}{A}}$ FOR MODEL T		± I A		3.2	3.2				
		CALIB. A		169	112.5				
		APERTURE DIA.		800	140				
		$\frac{A_2}{A_1} = \left(\frac{d_2}{d_1}\right)^3 2^{(W_2 - W_1)}$ For Model T $\frac{A_2}{A_1} = \left(\frac{d_1}{d_2}\right)^3 2^{(W_2 - W_1)}$ For Model T _A							
		SAMPLE DATA							

Geometric Mean μ^3	Volume μ^3	Diameter μ	Channel (W)						Cum. %	Dif. %
.00575	.004091	.198								
.0115	.008181	.250								
.0231	.01636	.315								
.0462	.03272	.397								
.0925	.06545	.500								
.1851	.1309	.630								
.3702	.2618	.794								
.7405	.5236	1.00								
1.481	1.047	1.26								
2.962	2.094	1.50								
5.924	4.189	2.00							100.0	.3
11.85	8.378	2.52							99.7	.6
23.70	16.76	3.17							99.1	1.1
47.39	33.51	4.00							97.9	1.5
94.78	67.02	5.04							96.4	2.2
189.6	134.0	6.35							94.2	2.8
379.1	268.1	8.00							91.4	3.6
758.3	536.2	10.08							87.7	4.5
1516.	1072.	12.7							83.2	4.9
3033.	2145.	16.0							78.3	5.7
6066.	4289.	20.2							72.6	6.6
12.13 x 10 ³	8579.	25.4							66.0	6.6
24.27 x 10 ³	17.16 x 10 ³	32.0							59.3	8.7
48.54 x 10 ³	34.31 x 10 ³	40.3							50.7	11.6
97.18 x 10 ³	68.63 x 10 ³	50.8							39.1	12.9
194.4 x 10 ³	137.3 x 10 ³	64.0							26.2	11.9
388.7 x 10 ³	274.5 x 10 ³	80.6							14.3	8.0
777.4 x 10 ³	549.0 x 10 ³	101.6							6.3	3.9
1.555 x 10 ⁶	1.098 x 10 ⁶	128.							2.4	2.1
3.109 x 10 ⁶	2.196 x 10 ⁶	161.							.3	.3
6.219 x 10 ⁶	4.392 x 10 ⁶	203.								
12.44 x 10 ⁶	8.784 x 10 ⁶	256.								
24.88 x 10 ⁶	17.57 x 10 ⁶	322.								
49.75 x 10 ⁶	35.14 x 10 ⁶	406.								
99.50 x 10 ⁶	70.27 x 10 ⁶	512.								
199.0 x 10 ⁶	140.6 x 10 ⁶	645.								
398.0 x 10 ⁶	281.1 x 10 ⁶	812.								
796.0 x 10 ⁶	562.2 x 10 ⁶	1024.								

CE# 2133 C

SET 1488 01 0475

D1-8

COUNTING COUNTER MODEL T-1A PARTICLE SIZE ANALYSIS

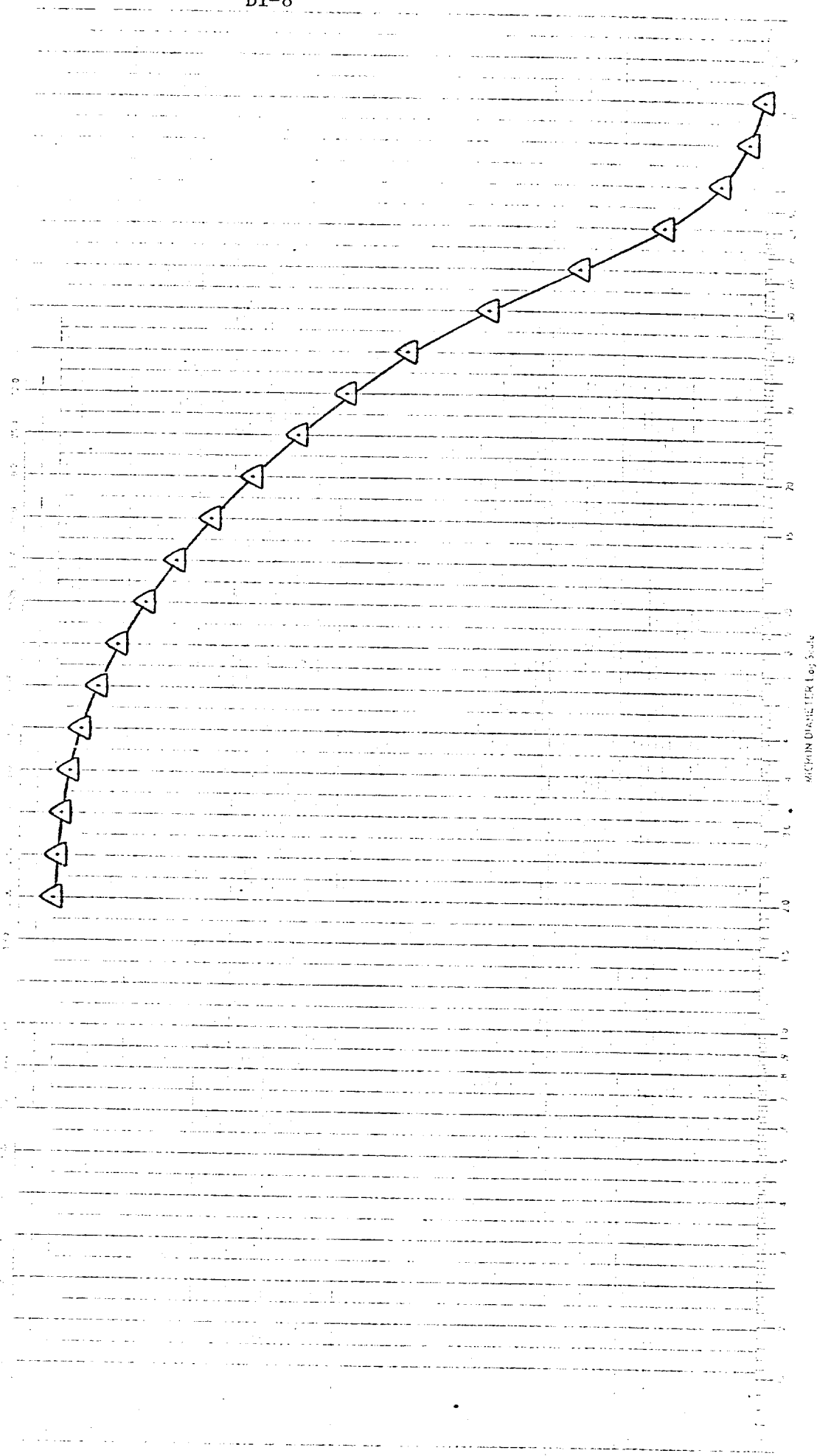
Scott Res. Labs.

E. Hoff

TA

Mixture (1-1) Isoton/Glycerine IIA
Boiler #2 - Composite of acetone wash & cyclone catches from Runs 1, 2 & 3

APR. 1971	800	140 23856	Latex	Microspheres	18.04	11	3.2158	20.211	3.2112	5
APR. 1971	800	140 23856	Latex	Microspheres	18.04	11	3.2158	20.211	3.2112	5
APR. 1971	800	140 23856	Latex	Microspheres	18.04	11	3.2158	20.211	3.2112	5



CE-433 C

COULTER COUNTER Model T & TA

PARTICLE SIZE ANALYSIS

Scott Res. Labs.

E. Hoff

TA

Mixture (1-1) Isoton/Glycerine
Boiler #2 - Composite of acetone wash & cyclone
catches from Runs 1, 2 & 3

800

140 23856

Latex

Microspheres

89

10

11

18.04

10

11

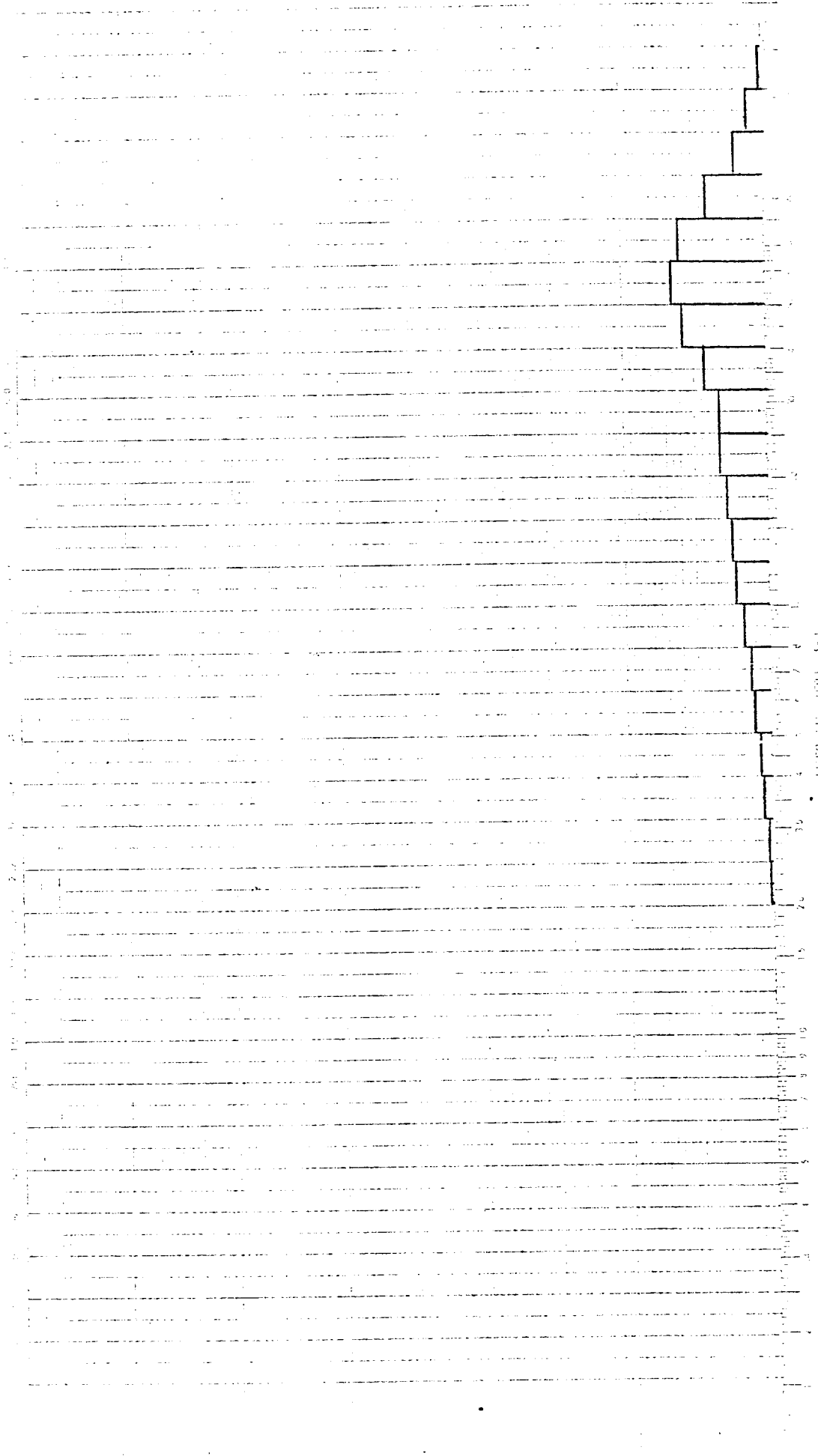
3.2125580610

3.215820.211

3.2169

3.2112

5



SC-RO 4-14-68 11:00 Log Mode

APPENDIX D2

Particle Sizing Analysis - Boiler #3





COULTER COUNTER® Model T & T_A Worksheet

SAMPLE 1488-031

ELECTROLYTE 70% Isoton/30% Glycerol DISPERSANT Type IIA, 1 min. ultrasonics

EQUIPMENT	SERIAL	Aper. Dia.	Ser. No.	CALIBRATION DATA	Part. Dia.	W	± 1A	A
TA	1180							
ORGANIZATION	Scott Research	560		Micros.	18.04	6	3.2	345
OPERATOR	M.B.	200	34921	Micros.	18.04	10	3.2	231
Boiler #3 - Composite of acetone wash								
catches from Runs 1, 2 & 3								

$$k = d \sqrt[3]{\frac{2^W}{A}}$$

FOR MODEL T

± 1A	3.2	3.2		
CALIB. A	124	164.5		
APERTURE DIA.	560	200		

$$\frac{A_2}{A_1} = \left(\frac{d_2}{d_1}\right)^3 2^{(W_2 - W_1)} \text{ For Model T}$$

$$\frac{A_2}{A_1} = \left(\frac{d_1}{d_2}\right)^3 2^{(W_2 - W_1)} \text{ For Model T}_A$$

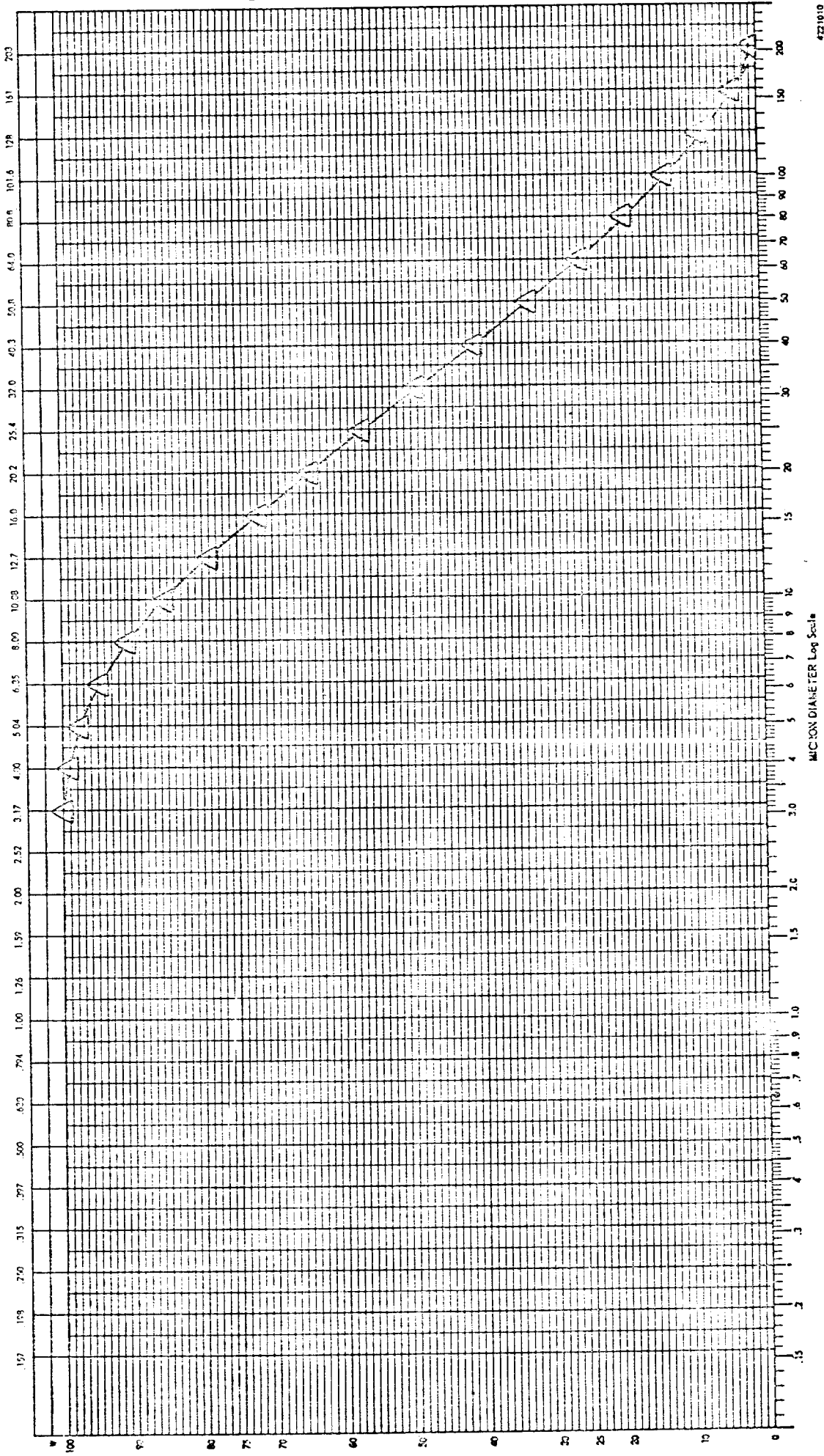
SAMPLE DATA

Geometric Mean μ^3	Volume μ^3	Diameter μ	Channel (W)				Cum. %	Dif. %
.00575	.004091	.198						
.0115	.008181	.250						
.0231	.01636	.315						
.0462	.03272	.397						
.0925	.06545	.500						
.1851	.1309	.630						
.3702	.2618	.794						
.7405	.5236	1.00						
1.481	1.047	1.26						
2.962	2.094	1.59						
5.924	4.189	2.00						
11.85	8.378	2.52						
23.70	16.76	3.17					100.0	.9
47.39	33.51	4.00					99.1	1.7
94.78	67.02	5.04					97.4	2.6
189.6	134.0	6.35					94.8	4.1
379.1	268.1	8.00					90.7	5.4
758.3	536.2	10.08					85.3	6.4
1516.	1072.	12.7					78.9	7.1
3033.	2145.	16.0					71.9	7.3
6066.	4289.	20.2					64.6	7.5
12.13 x 10 ³	8579.	25.4					57.0	7.8
24.27 x 10 ³	17.16 x 10 ³	32.0					49.2	8.3
48.54 x 10 ³	34.31 x 10 ³	40.3					40.9	7.8
97.18 x 10 ³	68.63 x 10 ³	50.8					33.1	7.3
194.4 x 10 ³	137.3 x 10 ³	64.0					25.8	6.6
388.7 x 10 ³	274.5 x 10 ³	80.6					19.2	5.9
777.4 x 10 ³	549.0 x 10 ³	101.6					13.3	5.1
1.555 x 10 ⁶	1.098 x 10 ⁶	128.					8.3	4.9
3.109 x 10 ⁶	2.196 x 10 ⁶	161.					3.4	2.3
6.219 x 10 ⁶	4.392 x 10 ⁶	203.					1.0	1.0
12.44 x 10 ⁶	8.784 x 10 ⁶	256.					0	0
24.88 x 10 ⁶	17.57 x 10 ⁶	322.						
49.75 x 10 ⁶	35.14 x 10 ⁶	405.						
99.50 x 10 ⁶	70.27 x 10 ⁶	512.						
199.0 x 10 ⁶	140.6 x 10 ⁶	645.						
398.0 x 10 ⁶	281.1 x 10 ⁶	812.						
796.0 x 10 ⁶	562.2 x 10 ⁶	1024.						

2143 B

PARTICLE SIZE ANALYSIS

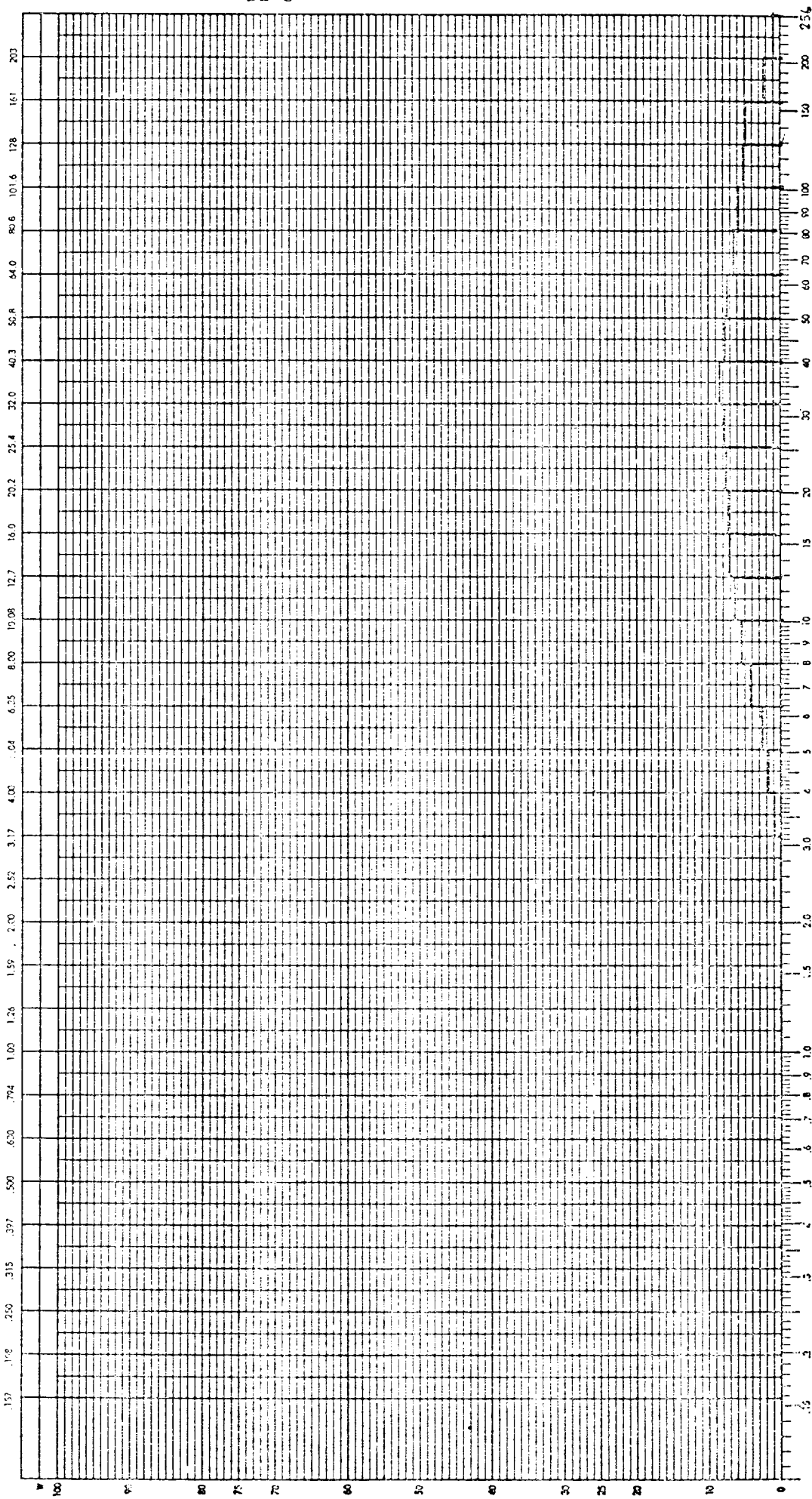
COULTER COUNTER Model T & TA		COULTER ELECTRONICS INC. 595 W 20 ST. MIALEAN, FLA. 33010	
ORGANIZATION Scott Research		.15 - 20% X PERCENT	
OPERATOR Mayra Bisnow		FOR MODEL TA	
EQUIPMENT TA		FOR MODEL T	
SAMPLE 1488-031		APERTURE 560	
70% ELECTROLYTE Isoton/30% Glycerol		SERIAL 34921	
Dispersant: IIA, 1 min. U.S.		PART DIA.	
Boiler #3 - Composite of acetone wash catches from Runs 1, 2 & 3		A ₂ = (d ₂) ³ when W ₂ = W ₁ A ₁	
		A ₂ = (d ₁) ³ when W ₂ = W ₁ A ₁	
		SAMPLE SETTINGS	
		DIA. W ± 1A A	
		25.4 6 3.2124	
		20.2 103.2164	



MICRON DIAMETER Log Scale

2143 B

COULTER COUNTER Model TATA				PARTICLE SIZE ANALYSIS				COULTER ELECTRONICS INC. 390 W 20 ST. MILWAUKEE, WIS. 53206			
ORGANIZATION Scott Research				115 - 255A X PERCENT							
OPERATOR Mayra Bisnow				FOR MODEL T				FOR MODEL TA			
SAMPLE				APR SIZE				SIGNAL			
1488-031				500				Microspheres			
70% Isoton/30% Glycerol								18.04 6 3.2845 25.4 6 3.2124			
Dispersant: IIA, 1 min. U.S.				200				34921 Microspheres			
								18.04 10 3.2231 20.2 103.2 164			
Boiler #3 - Composite of acetone wash catches from Runs 1, 2 & 3											



MICRO-DIALECTER Log Scale

COULTER COUNTER® Model T & T_A Worksheet

SAMPLE 1488-03

ELECTROLYTE 50% Isoton/50% Glycerol

DISPERSANT Type IIA, 1 min. ultrasonics

EQUIPMENT	SERIAL	Aper. Dia.	Ser. No.	CALIBRATION DATA	Part. Dia.	W	± 1A	A
TA	1180							
ORGANIZATION	Scott Research	800		Latex	89	10	3.2	139
OPERATOR	DATE							
Mayra Bisnow	3/25/75							
Boiler #3 - Composite of cyclone dry								
catches from Runs 1, 2 & 3								

$$k = d \sqrt[3]{\frac{2W}{A}}$$

FOR MODEL T

± 1A	3.2			
CALIB. A	187			
APERTURE DIA.	800			

$$\frac{A_2}{A_1} = \left(\frac{d_2}{d_1}\right)^3 2(W_2 - W_1) \text{ For Model T}$$

$$\frac{A_2}{A_1} = \left(\frac{d_1}{d_2}\right)^3 2(W_2 - W_1) \text{ For Model T}_A$$

SAMPLE DATA

Geometric Mean μ^3	Volume μ^3	Diameter μ	Channel (W)					Cum. %	Dif. %
.00575	.004091	.198							
.0115	.008181	.250							
.0231	.01636	.315							
.0462	.03272	.397							
.0925	.06545	.500							
.1851	.1309	.630							
.3702	.2618	.794							
.7405	.5236	1.00							
1.481	1.047	1.26							
2.962	2.094	1.59							
5.924	4.189	2.00							
11.85	8.378	2.52							
23.70	16.76	3.17							
47.39	33.51	4.00							
94.78	67.02	5.04							
189.6	134.0	6.35							
379.1	268.1	8.00							
758.3	536.2	10.08							
1516.	1072.	12.7						100.0	.8
3033.	2145.	16.0						99.2	1.8
6066.	4289.	20.2						97.4	1.9
12.13 x 10 ³	8579.	25.4						95.4	1.9
24.27 x 10 ³	17.16 x 10 ³	32.0						93.5	3.9
48.54 x 10 ³	34.31 x 10 ³	40.3						89.7	6.9
97.18 x 10 ³	68.63 x 10 ³	50.8						82.8	10.7
194.4 x 10 ³	137.3 x 10 ³	64.0						72.1	11.9
388.7 x 10 ³	274.5 x 10 ³	80.6						60.2	17.9
777.4 x 10 ³	549.0 x 10 ³	101.6						42.2	18.8
1.555 x 10 ⁶	1.098 x 10 ⁶	128.						23.5	15.2
3.109 x 10 ⁶	2.196 x 10 ⁶	161.						8.3	5.8
6.219 x 10 ⁶	4.392 x 10 ⁶	203.						2.5	2.5
12.44 x 10 ⁶	8.784 x 10 ⁶	256.						0	0
24.88 x 10 ⁶	17.57 x 10 ⁶	322.							
49.75 x 10 ⁶	35.14 x 10 ⁶	406.							
99.50 x 10 ⁶	70.27 x 10 ⁶	512.							
199.0 x 10 ⁶	140.6 x 10 ⁶	645.							
398.0 x 10 ⁶	281.1 x 10 ⁶	812.							
796.0 x 10 ⁶	562.2 x 10 ⁶	1024.							

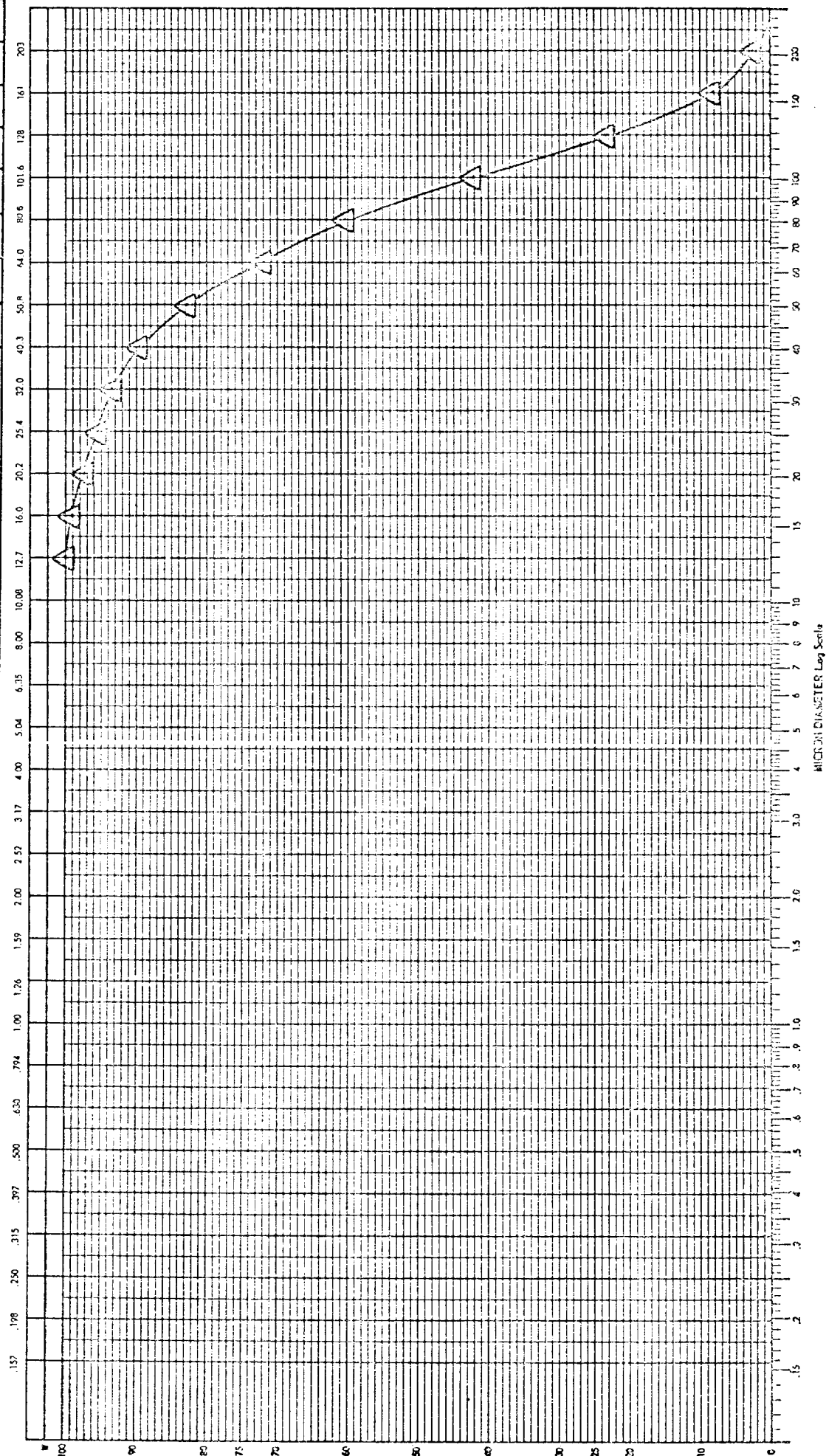
2143A

COULTER COUNTER Model T & TA

COULTER ELECTRONICS INC.
970 W 20 ST.
MILWAUKEE, WIS. 53010

.15 - 200 μ
X PERCENT

OCCUPATION		Scott Research		FOR MODEL T		FOR MODEL TA		SAMPLE SETTINGS	
OPERATOR		Mayra Bismow		PART DIA.		V		A	
EQUIPMENT		TA		SERIAL		V		A	
SAMPLE		1488-03		800		89		103.2	
DISPERSANT		50% Isofon/50% Glycerol		Latex		103.2		139	
DISPERSANT: IIA, 1 min. U.S.						80.6		103.2	
Boiler #3 - Composite of cyclone dry catches									
from Runs 1, 2 & 3									





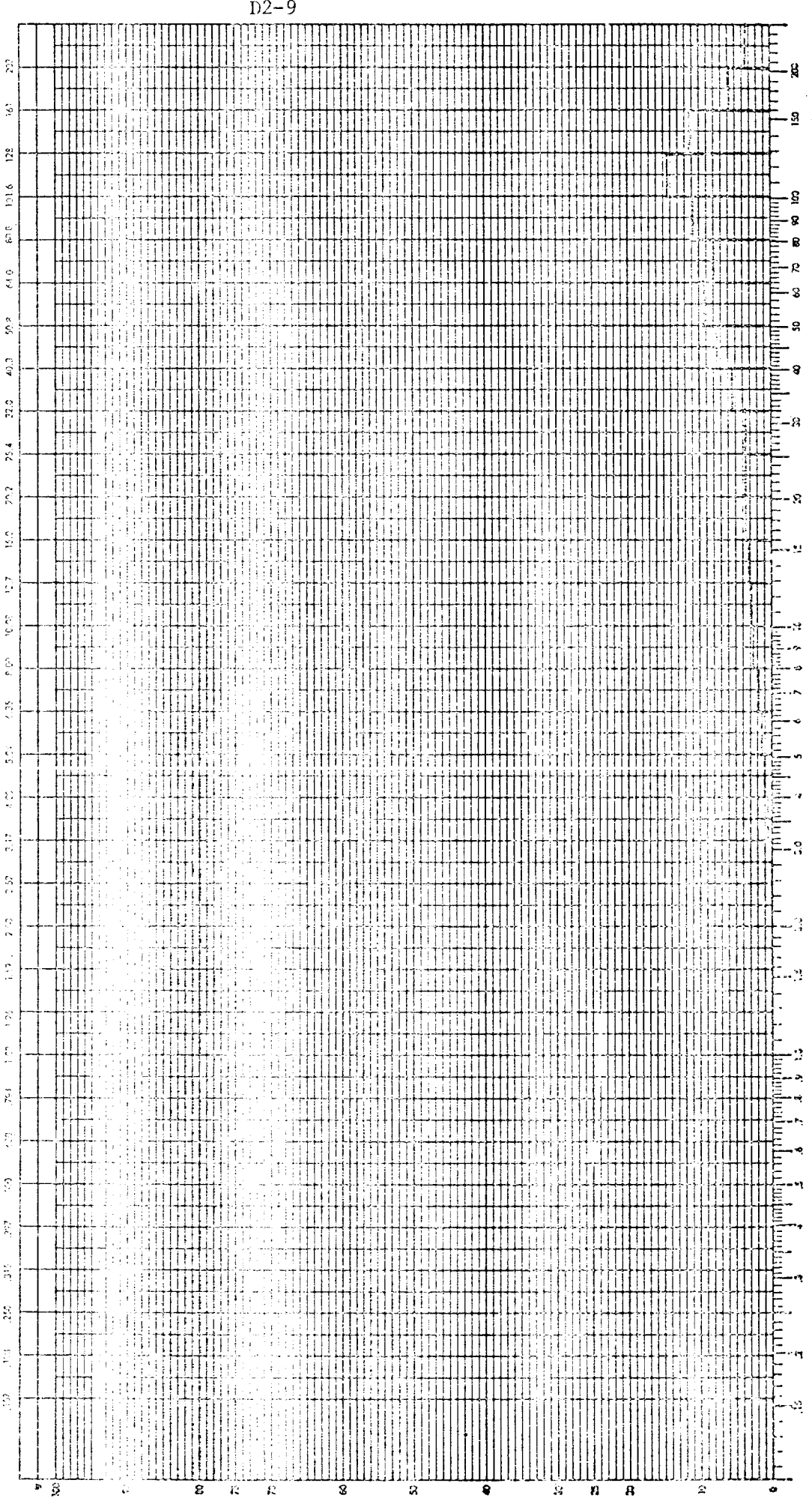
COULTER COUNTER® Model T & T_A Worksheet

SAMPLE Mixture									
ELECTROLYTE 50% Isoton/50% Glycerol					DISPERSANT Type IIA, 60 sec. ultrasonics				
EQUIPMENT	SERIAL	Aper. Dia.	Ser. No.	CALIBRATION DATA	Part. Dia.	W	± I A	A	
TA	1180								
ORGANIZATION Scott Research		800		Latex	89	10	3.2	139	
OPERATOR M.B.	DATE 3/26/75	200	34921	Micros.	18.04	10	3.2	231	
Boiler #3 -- Composite of acetone wash &									
cyclone catches from Runs 1, 2 & 3									
$k = d \sqrt[3]{\frac{2W}{A}}$ FOR MODEL T		± I A	3.2	3.2	$\frac{A_2}{A_1} = \left(\frac{d_2}{d_1}\right)^3 2^{(W_2 - W_1)}$ For Model T				
		CALIB. A	187	164.5	$\frac{A_2}{A_1} = \left(\frac{d_1}{d_2}\right)^3 2^{(W_2 - W_1)}$ For Model T _A				
		APERTURE DIA.	800	200	SAMPLE DATA				

Geometric Mean μ^3	Volume μ^3	Diameter μ	Channel (W)						Cum. %	Dif. %
.00575	.004091	.198								
.0115	.008181	.250								
.0231	.01636	.315								
.0462	.03272	.397								
.0925	.06545	.500								
.1851	.1309	.630								
.3702	.2618	.794								
.7405	.5236	1.00								
1.481	1.047	1.26								
2.962	2.094	1.59								
5.924	4.189	2.00								
11.85	8.378	2.52								
23.70	16.76	3.17						100.0	.6	
47.39	33.51	4.00						99.4	1.0	
94.78	67.02	5.04						98.4	1.4	
189.6	134.0	6.35						97.0	1.9	
379.1	268.1	8.00						95.1	2.5	
758.3	536.2	10.08						92.6	2.8	
1516.	1072.	12.7						89.8	3.1	
3033.	2145.	16.0						86.7	3.6	
6066.	4289.	20.2						83.1	3.6	
12.13×10^3	8579.	25.4						79.5	3.6	
24.27×10^3	17.16×10^3	32.0						75.9	5.3	
48.54×10^3	34.31×10^3	40.3						70.6	7.5	
97.18×10^3	68.63×10^3	50.8						63.1	9.2	
194.4×10^3	137.3×10^3	64.0						53.9	8.0	
388.7×10^3	274.5×10^3	80.6						45.9	10.9	
777.4×10^3	549.0×10^3	101.6						35.0	14.4	
1.555×10^6	1.098×10^6	128.						20.6	11.2	
3.109×10^6	2.196×10^6	161.						9.4	5.9	
6.219×10^6	4.392×10^6	203.						3.5	3.4	
12.44×10^6	8.784×10^6	256.						.1	.1	
24.88×10^6	17.57×10^6	322.						0	0	
49.75×10^6	35.14×10^6	406.								
99.50×10^6	70.27×10^6	512.								
199.0×10^6	140.6×10^6	645.								
398.0×10^6	281.1×10^6	812.								
796.0×10^6	562.2×10^6	1024.								

24102

COULTER COUNTER Model T-1A		PARTICLE SIZE ANALYSIS		COULTER ELECTRONICS INC. 990 N. 70 ST. MIAMI, FLA. 33136	
OPERATOR: Scott Research		.15 - 200 % PERCENT		SAMPLE SETTINGS	
SAMPLE: Mixture		$\frac{A_2}{A_1} = \left(\frac{d_2}{d_1}\right)^3$ when $W_2 = W_1$		$\frac{A_2}{A_1} = \left(\frac{d_2}{d_1}\right)^3$ when $W_2 = W_1$	
Dispersant: IIA, 60 sec. U.S.		FOR MODEL T		FOR MODEL T-1A	
Boiler #3 - Composite of acetone wash & cyclone		SERIAL		NO. OF DIV.	
Catches from Runs 1, 2 & 3		PER DIV.		NO. OF DIV.	
500		800		89	
200		34921		18.0	
Latex		10		3.2139	
Microspheres		10		3.2187	
10		10		3.2164	



COULTER COUNTER LOG LOG

SET 1488 01 0475

APPENDIX E

Test Log



SCOTT ENVIRONMENTAL TECHNOLOGY, INC.

SET 1488 01 0475

TEST LOG

On February 10, 1975, the Scott test team arrived at the RCA-Electronic Components plant in Lancaster, Pennsylvania and set up the necessary equipment for EPA Method 5 and Method 7 testing on Boiler #2. No testing could be performed on this day due to some changes that had to be done on the traverse railing. However, an initial traverse of the stack was conducted for stack velocity and temperature conditions.

On February 11, 1975, three EPA Method 5 tests, each for a duration of sixty minutes, were conducted. In addition, NO_x samples, Orsat bag samples and process conditions were obtained. No critical problems were encountered during the three tests. Preparations for testing Boiler #1 the next day were made.

On February 12, 1975, a quick preliminary traverse of Boiler #1 showed negligible or almost undetectable flow in the stack. In addition, a severe snowstorm prevented any testing possible. In mutual consultation with the Project Officer, it was decided to test Boiler #3 instead on a later date. The Scott team returned to Plumsteadville on February 12, 1975.

On March 11, 1975, the Scott team returned to RCA to conduct tests on Boiler #3. Test equipment was set up, a preliminary traverse performed and the first test conducted. On March 12, 1975, two more tests were conducted. No undue problems occurred during these tests, except that a high line vacuum near the end of Run 3 required a filter replacement. The Scott team returned to Plumsteadville on March 12, 1975.



APPENDIX F

Project Participants

