716539

HW-64558-T

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COLLECTION General Human Subjects

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1100313

140171

PWN Notebook 1

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Notebook Number HW-6451-T

Date of issuance by Central Files 10-15-53

Title Personal Notes
(Indicate subject content of notebook. Be specific wherever possible)

Period Covered: From ~~10-15-53~~ 23 Oct 53 to 17 Dec 56 Inclusive
(Month, date, and year)

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Division Radiological Sciences Dept. - Biophysics Section

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1. Leave blank 1½" margin on left hand side of all pages.
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HW-65[illegible]T
Copy 1-A
10-15-53

HANFORD TECHNICAL RECORD

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ROUTE TO			FILES ROUTE DATE
		200-W	
P.W. Nicholas	30494	622R	MAR 4 1971
~~RK Hadlock~~	~~31853~~	~~2400~~	~~10/13/82~~
JV Ramsdell	33296	Sig 5	JUL 26 1985

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1100315

23 Oct 53

Lack of settling of pigment 2210 in Tiffa generator tank and consistency of generation rate from same.

Pinch of 2210 in about 8 oz. in SGF #1 fog oil. Shaken thoroughly. Added 8 oz suspension to about 5 gal of SGF #1 oil. Drop samples placed on microscope slides and squeezed to same thickness by covering with cover glass. Particles counted under UV life with aid of microscope.

Samples

Slide	Description	Counts	Remarks
2 A	From 8 oz suspension (original mixture)	20, 2, 0,	12, 10, 21, = $\frac{[illegible]}{6}$ = 10.8 = Mean
2 B		29, 9, 25	4, 33, 32, = $\frac{132}{6}$ = 22.0
3 A	19.8 = $\frac{119}{6}$ = 27, 17, 44	25, 0, 26	~~Only one or two~~
3 B	27.8 = $\frac{129}{5}$ 14, 28, 43,	41, 13	~~indiquishible on whole slide.~~
4 A	From 8 oz added to 5 gal.	0	Only one or two on whole slide
5 A			
4 B			
5 B			
8 B	8 oz gasoline with teaspoon 2210 pigment	Conglomerated as gas evaporated under slide	
8 A	Teaspoon 2210 in 5 gal SGF1	3, 1, 3, 4 / 3, 6, 2, 3 = $3\frac{1}{8}$	Before generation. (43x10 mag)
9 A	"	5, 3, 1, 0 / 4, 2, 5, 4 = 3	"
9 B	"	6, 4, 2, 4 / 1, 5, 4, 3 = $3\frac{5}{8}$	"
11 A	During Generation	8, 8, 6 / 3, 6, 1 = $6\frac{1}{3}$	Gen Began about 1352 Time 1359
11 B		5, 11, 9 / 6, 6 = $7\frac{2}{5}$	" 1359
12 A		3, 1, 13, 16 / 14, 16 many	1407
12 B		many	1407
13 A		9, 8, 8, 7 / 9, 2, 6, 6 = $7\frac{7}{8}$	1415
13 B		9, 11, 2, 6 / 4, 3, 4, 4 = $5\frac{3}{8}$	1415
14 A		13, 3, 9, 4 / 7, 11, 7, 12 = $8\frac{1}{4}$	1423
14 B		3, 2, 6, 5 / 6, 8, 16, 4 = $6\frac{1}{4}$	1423
15 A		4, 3, 2, 10, 13, 4 / 4, 6, 7, 4, 4 = 4.8	1432 } End of Run
15 B		4, 7, 2 / 2, 2, 6 = $3\frac{5}{6}$	1432 }

Remarks

"Thin" oil drop. Cover not stuck all around

Oil too thick

Oil so thick particles moving

" " " "

1100316

Pigment Sampler speeds

Motor gear	Drum Gear	Rotation Rate
24 teeth	24	10 units/5min = 120/hr

Test — 1 "teaspoon" pigment in about 5 gal SEF 1

Vernier*	Time	Remarks
~~+1.5~~	on at	about 15 on vernier
18	1354	
26	1357	Particle size selector from "1" to "2"
36	1403	Oil off — Some air blowing
40	1406	Oil on
47	1409	
60	1417	Oil off Oil Pressure changed from 30 to maximum (ie, 50 lbs)
—	1418	Oil on
76	1432	Oil off. Microswitch had turned motor off prior to conclusion of experiment

*Vernier read at right edge.
Particle size selector on "1"
Oil Pressure - 30 lbs - Increased to 50 lbs at 1417
Particle size selector on "2" at 1357

Sampler placed 3 ft from generator nozzle. Oil channeled thru 2 ft of 18" ~~OD~~ diameter pipe toward sampler. Light wind ideal — kept blowing "used" fog away but not strong enough to ever cause sampler to be out of fog

26 Oct 53
Sampler Speed

Motor gear	Drum Gear	Rotation Rate
11 teeth	37 Teeth	17 units/2 min = 340 units/hr ≈ about 1 rev/18 min

"Test" at top of page gave evidence of uneven deposition of pigment due to uneven movement of sampler drum. Check of sampler at 1 rev/18 min revealed relatively steady rotation of drum. Two samples taken at this drum speed gave too much oil on drum. Particle size selector was set at 6 and 4 for the runs.

1100317

27 Oct 53

Test — Hooping teaspoon pigment in 8 gal SGF1

Vernier	Time	Remarks
70	0917	Formulation Pres-45, Port Size -3 Fuel P-90
—	0920	Fog dropped off prior half minute, then back on as bef.
—	0921	Some pulsating of fog
22	0928	Steady Generation.
59	0933	Fog off.
70	0940	Fog on - second run
28	0949	Good, steady fog
—	0955	Pulsating - less fog.
58	0956	Fog off - little fog last minute

First Run

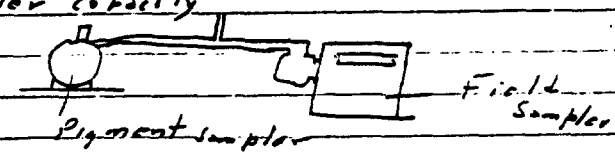
Sampler Speed 1 rev/18 min

Sampler located about 10 ft from jet

Sampler Jet oriented across tape

Suction — ½ of field sampler capacity

Sample on side of tape away from rim.



Second Run

Same as first except:

Sampler jet oriented with tape

Sample on side of tape nearest rim on drum.

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1100322

1100323

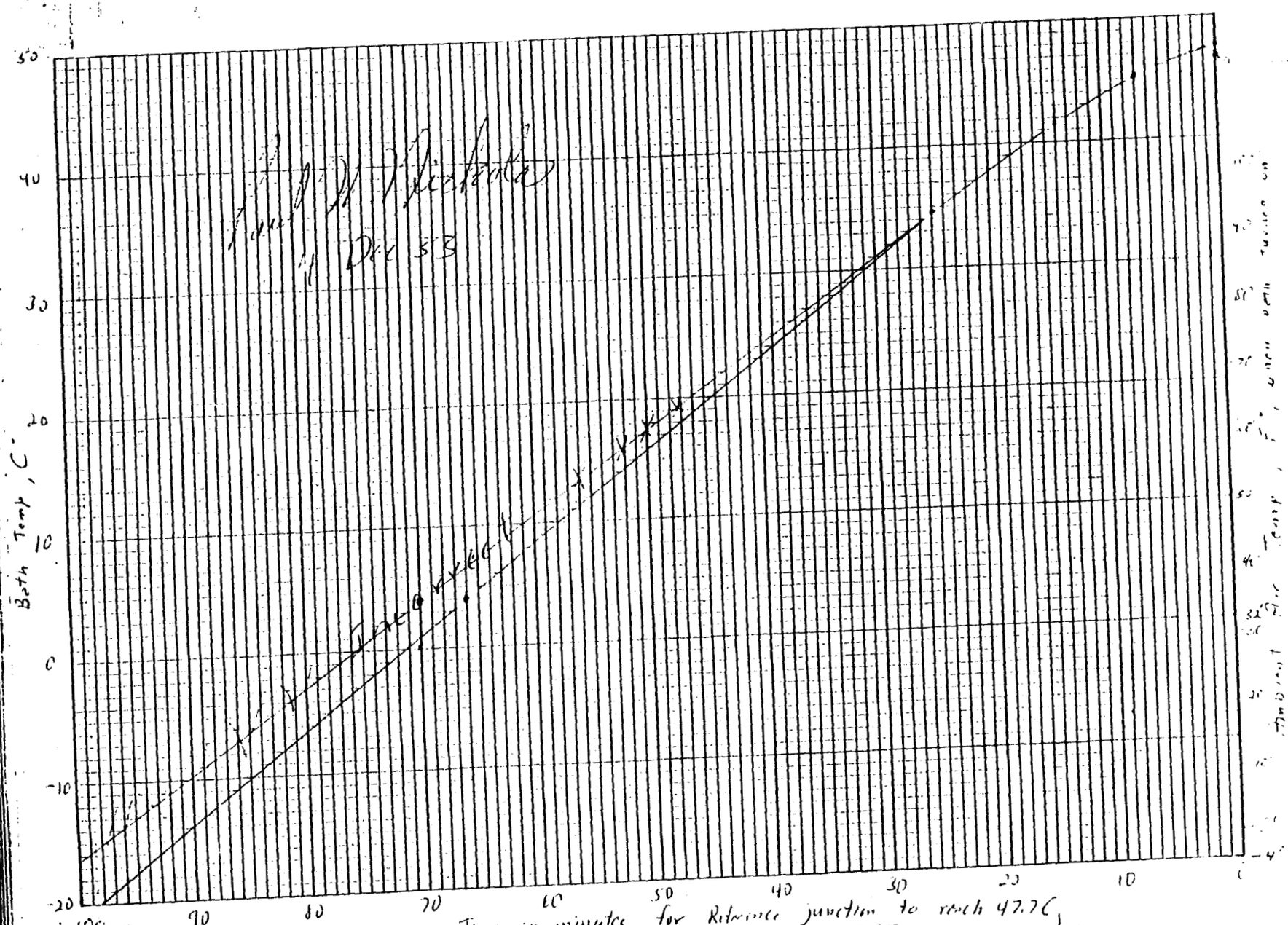
30 Nov 83 [signature]

Setting of Portable Mast Thermocouple Reference ~~Junction~~ Bath

Time	Temp (Kessler 71741 Therm.)	Remarks
0840	off scale - negative end.	Current on.
0905	25.7°C	
0940	45.8°	
0955	48.0	
1000	47.9°	
1001	—	Attempted to turn adjustment ccw
1006	47.7°	
1009	47.6°	
1013	47.6°	
1017	47.70	
1019	47.70	
1021	47.70	
1032	47.70	
1038	47.45	
1042	47.40	
1045	47.40	
1046	—	Adjusted cw
1051	47.90	
1051	—	Adjusted ccw
1100	47.40	Adjusted cw
1106	47.50	
1110	47.45	Adjusted cw
1119	47.40	" cw
1125	47.70	
1129	47.70	
1134	47.65	
1225	48.10	
1243	48.10	Adjusted ccw
1255	48.00	
1317	48.00	" "
1330	47.90	
1350	47.90	" "
~~13~~ 1400	47.60	
1412	47.60	" cw
1434	47.70 -	
1445	47.60	" cw
1507	47.65	
1529	47.70	

1100324

	Time	Temp	Remarks
	1549	47.70 C	
	1610	47.75	
			1 Dec 53 Paul N Nicholas
	1223	47.70	Both "on" overnight
	1310	47.80	
	1350	47.80	
	1452	47.70	
	1545	47.80	
	1049	47.65+	2 Dec 53 Paul N Nicholas
	1214	47.80-	
	1420	47.81+	
	1605	47.70	Power to both off.
3 Dec 53 Paul N. Nicholas	0819	—	Power to bath on.
	0920	47.65	
	1004	47.60	
	1044	47.60	
	1345	47.60-	
	1405	47.60	
	1442	47.60	
	1559	47.60	Power off.
4 Dec 53 Paul N Nicholas	0907	—	Power on.
	0924	<25 C	Surface (3") temp approx 40°F ≈ 4°C
	0948	34.60	
	0959	41.70	Points used on graph, page 11.
	1006	45.10	
	1014	47.60	
	1047	47.50	
	1106	47.50	
	1122	47.50	
	1138	47.50	Power off
	1248	25.00	Power on
	1302	36.70	
	1311	42.30	
	1320	47.00	
	1322	47.50	
	1323	47.60	Heard points within water break for
	1325	47.65	first time.
	1327	47.60	
	1407	47.50-	


Bath Temp, C°
50
40
30
20
10
0
-10
-20
100
90
80
70
60
50
40
30
20
10
Time, in minutes, for Reference junction to reach 47.7C

11

Comments

The information thus far indicates that 1¾ hrs is adequate time to warm the reference bath on the coldest weather. Graph on page 11 estimates time required to heat bath.

Reference temperature settles down to slightly different temperatures after cooling and reheating. More tests should help.

---

7 Dec 53 Paul N Nicholas

Time	Temp	Remarks
0746	—	Bath on
0831	34.40 C	
0900	45.80	
0954	47.50+	
1008	47.50	
1038	47.50 −	Bath off
1237	<25.5	Bath on
1332	47.55	
1507	47.50	Adjusted cw
1512	47.55	
1617	47.75	

---

8 Dec 53 Paul Nicholas

1103	47.65 +	
1237	47.70 −	
1514	47.70 −	Screw driver removed
1620	47.55	

---

9 Dec 53 Paul N Nicholas

0748	47.60	Adjusted cw (perhaps missed adjustment screw)
0942	47.55	Adjusted cw. Possibility exists that screwdriver in place in adjustment screw affects the setting. Will remove after each adjustment hereafter
1009	47.65 +	
1028	47.70 −	
1052	47.70 −	Power off
1233	—	Power on
1422	47.60+	
1653	47.60+	Adjusted cw.

---

10 Dec 53 Paul N Nicholas

0747	47.75
0946	47.70

008321

Time	Temp	Comments
0945	47.70 C	
1005	47.70	About 30 seconds between "clicks" on heating element.
1230	47.70	Power off.
1315	30	Power on.
1345	46.6	
1411	47.80	
1428	47.80+	
1443	47.80+	Power off
1525	29.5	Power on.
1602	47.85+	
//	11 Dec 53	Paul N Nichols
0755	47.75	
0815	47.75	
0845	47.75	
0920	47.70+	
0935	47.70+	Power off
1120	<25	Power on
1239	47.70+	
1334	47.70-	
1348	47.65	
1405	47.40	} Lid open — welders at work. Erroneous reading by observer??
1510	47.65	} Power off
//	14 Dec 53	
1455		Power on.
1611	47.70	
//		Paul N Nichols
0756	47.70+	Power on overnight 15 Dec 53
0820	47.70-	
0845	47.70	Power off.
0945	—	Power on
1050	47.65+	
1126	47.65+	
1134	47.70-	Power off.
1231	—	Power on
1331	47.70-	
1359	47.65+	
1405	47.70-	Power off.
1552	—	Power on
1536	47.65	
1609	47.65+	Power off

Paul N Nichols

1100328

Time	Temp	Remarks
		16 Dec 53
0756		Power on
0920	47.65 C.	
0932	47.65	
0949	47.65-	
1011	47.65-	Power off
1120	< 25	Power on
1225	47.65-	
1250	47.65-	
1342	47.60+	Does variation in plant power give the variation in heating.
1452	47.65-	Power off.

Paul W Nichols

17 Dec 53

Reference bath power ~~remo~~ from Sorenson regulator in van. (Lead to anemometer power supply temporarily disconnected and used for test.) Prior to this date unregulated voltage has been used in supplying power to the bath.

Time	Temp	Remarks
0900		Power on.
1012	47.70-	
1124	47.65	
1129	47.75	
1236	47.80-	
1249	47.75+	Power off
1304	38.8	Power on. Regulated voltage from Hastings supplied regulator (for Air Velocity Measuring System)
1330	47.75+	
1333	47.75	
1341	47.75	
1345	47.70	
1348	47.70	
1400	47.75+	
1402	47.75+	
1405	47.75+	
1417	47.75	
1425	47.75-	
1441	47.75	
1449	47.75	

Time	Temp	Remarks
1508	47.75-	
1536	47.75+	
1551	47.80-	[illegible]
15 Dec 53		
0910	47.70	Bath on overnight
0915	47.70	
0950	47.70	
0909	47.65+	
0934	47.65	
1000	47.65-	Line voltage - 112
1042	47.65-	
1033	47.65	
1229	47.60	
1249	47.60	
1357	47.60+	
1412	47.65+	Line voltage 112
1437	47.70	
1515	47.65+	[illegible]
21 Dec 53		
0750	47.65-	
0851	47.60	
0953	47.65-	
1045	47.60+	
1106	47.60+	
1245		Power on [illegible]
1332	47.50-	
1417	47.60-	[illegible]
1612	47.60+	
22 Dec 53		
0852	47.65	
0948	47.55+	
1100	47.50+	
1140	47.55+	Power off [illegible]
2 Feb 54		

Conclusions - A range of about 0.3 C was observed over a long period (hours) with a much smaller change over shorter periods (3 min). Recordings of thermocouple outputs (when TC is covered with centrifuge tube and plastic bag) were very

1100330

flat trace indicating little change in temperature of reference bath. The bath should serve as a satisfactory reference junction.
Paul W. Nichols

Thermocouple Calibration Check

Thermocouples in mast with tube and bag protectors gave temp indications on Speedomax. Three vertical profiles of temp were constructed from these traces.

Level →	1	2	3	4	5 (TC6)	6 (TC 5)
Scale reading	91.0	90.4	91.4	90.9	91.7	90.1
mv.	1.820	1.808	1.828	1.818	1.834	1.802
Temp, F.	36.2	36.6	35.8	36.1	35.5	37.1

Remarks - 2 Feb 54 0900 Fog, snow cover, no wind

2 Feb 54 1230 Fog, snow cover, low to no wind

Scale	83.6	84.9	87.5	84.7	87.0	82.5
mv	1.672	1.698	1.756	1.694	1.740	1.656
°F	43.1	41.6	39.1	41.9	39.8	43.8

Paul W. Nichols

18 Feb 54

Comparison of TC's on TC lead #1

TC #	Scale Reading (estimated mean)
1	82.7
2	81.9
3	81.9
4	82.0
5	82.2
6	82.1

Indications are that all Thermocouples give same output when used with same lead. However subsequent checks of TC output (with leads and TC's matched) at different patch panel positions showed significant changes in output at different panel positions. Improved contacts necessary at patch panel.
Paul W. Nichols

17 Mar 54

Following of data is for checking of validity (maybe likely ability of T/C output after sanding and cleaning of patch panel receptacles and T/C plugs. The date of the observations was 23 Feb 54

Approx h →	1'2"		5'2"		8'10"		14'10"		24'9"		41'5"	
TC	TC #1		TC #2		TC #3		TC #4		TC #5 *		TC #6 *	
Patch Panel Direction →	10	16	11	17	12	15	13	21	14	22	15	23
Approx Time ↓												
1412	58.8F		60.0F		57.8F		57.4F		57.9F		57.8F	
1420		60.2F	58.2	59.3F	58.2	59.3F	58.5	58.1F	58.3	57.8F	57.9	57.1F
1421	60.8	59.7	58.7	58.9	59.3	58.2	57.9	57.8	58.7	57.9	57.4	58.1
1422	60.2	60.9	59.1	60.1	58.8	59.4	58.6	58.5	58.1	58.5	58.0	58.6
1423	59.6	58.2	58.9	58.5	58.0	59.3	57.9	58.8	58.1	58.2	57.8	57.8
1428-1434	58.5		58.8		58.5		58.4		57.9		58.1	
1434-1436	61.0		60.1		60.0		58.5		58.9		59.0	
1436	~~[illegible]~~	61.1	~~[illegible]~~	59.6		58.1		59.2		59.6		58.3
~~1437~~	~~59.5~~ 59.5		~~59.4~~									
1437	54.5	60.7	59.1	60.2	58.7	59.5	58.2	58.8	58.7	58.9	58.6	58.9
1439	61.8	61.5									59.1	~~[illegible]~~
1440	59.7	62.2		59.8							60.3	
1441						59.1		59.1		60.0		60.3
1441	61.2	61.8	59.7	60.6	58.5	60.0	58.7	60.3	59.0	58.1	59.0	58.4
1442	60.9	59.9	60.3	58.7	59.2	58.2	58.2	58.4	58.0	58.8	[illegible]	59.6
1443	61.1	61.6	59.3	59.8	58.7	58.3	58.0	58.2	58.3	58.3	58.3	58.8
1444-46	59.3		59.3		58.3		59.2		59.8		59.7	
1447	57.8		60.3		58.4		58.2		58.9		59.5	
1512-15		62.5		62.1		60.8		60.4		61.0		60.8
1516	61.9	61.4	61.3	61.2	60.6	60.7	60.4	60.7	61.0	61.0	60.4	60.9
1517	62.4	60.8	62.0	60.8	62.0	60.0	60.1	60.8	60.8	61.1	60.3	61.2
1519	61.7	62.1	62.2	61.9	61.8	60.9	61.2	60.1	62.7	61.4	60.3	60.6
	11	12	12	12	12	13	12	13	12	13	12	13
Σ 4 sec temps	66.71	728.4	719.1	719.6	712.2	771.0	705.9	768.8	710.6	769.6	705.7	769.1
Mean 4 sec Temps	60.6	60.7	59.9	60.0	59.4	59.3	58.8	59.1	59.2	59.2	58.8	59.2
↓	60.7		59.9		59.3		59.0		59.2		59.0	

Paul W Nichols

18 Mar 54

Hasty check of TC reference junction showed it properly functioning. Temps of 47.6 and 47.8C were observed at approximate 5 minute interval

* TC #5 is actually thermocouple #6 and vice versa in this set-up.

1100332

23 Mar 54

Time	Weight	T_5'	T_{50}'	Weighted T_5'	Weighted T_{50}'
1420-23	4	54.9F	58.2F	239.6	232.8
1436-37	2	60.1	58.7	120.2	117.4
1441-43	3	60.4	59.2	181.2	177.6
1447	1	60.9	59.5	60.9	59.5
1516-19	3	61.8	60.3	185.4	180.9
	Σ 13			787.3	768.2
			Mean	60.6F	59.1F

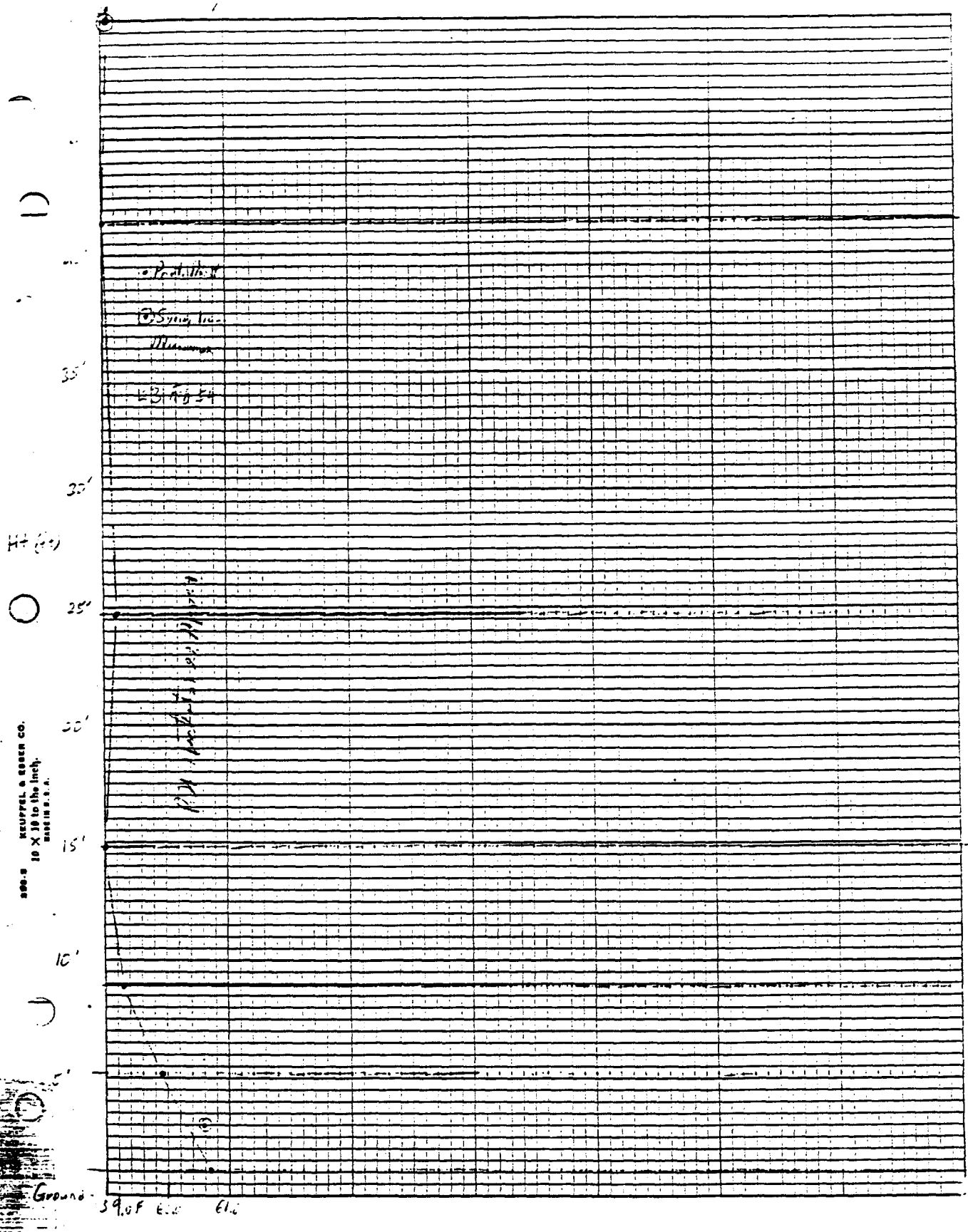
Above data from Synoptic ~~record~~ 23 Feb 54 temp trace for comparison with 23 Feb 54 portable mast temp profile. The "weight" assigned was apportioned by no. of times mast was scanned during the given time period. See graph on p. 19.
Paul H. Nicholas

25 Mar 54

Since TC reference junction failed to heat to more than 32C during attempted field test on 19 Mar, it was removed and checked. It operated satisfactorily in 622 bldg and when reinstalled in instrument cabinet. An attempt at setting temperature at 47.7 seemed in order since the constant temp achieved was about 48.1 C. After first adjustment the temp leveled "low". Checks follow.

Time	Temp	Remarks
0915	47.65	
0929	47.65	
0953	47.60	
1023	47.55	Adjusted upward
1102	47.60	
1130	47.60	
1238	47.60+	
1244	47.80+	
1308	47.70	
1347	47.50	Decided this adjustment as good as any possible.

Paul H. Nicholas


Ht (ft)
35'
30'
25'
20'
15'
10'
5'
Ground
KEUFFEL & ESSER CO.
10 X 10 to the inch.
MADE IN U.S.A.

29 Mar 54

Although ~~anemometers~~ wind speeds were obviously indicated improperly on attempted run of 19 Mar 54, some records of wind speed might be recorded for further verification.

Ht →	1.21'	5.50'	9' 2"	15.17'	41.75'	25.15'
Anemometer →	1	2	3	4	5	6
Approx. Time ↓		~~4.1 mps~~				
0552		4.1 mps	3.4 mps	3.4 mps	4.2 mps	4.2 mps
0554		2.9	2.9	3.9	6.0	5.0
0556		3.5	2.4	3.4	5.4	3.8
0557		4.2	3.2	2.9	4.7	3.4
0559		4.1	4.5	3.8	4.7	3.9
0601		4.2	3.4	2.9	6.1	4.1
0602		4.3	3.5	3.5	5.7	3.7
0603		5.8	4.5	3.7	5.9	5.2
0605		3.7	2.9	3.5	5.9	5.1
0609		3.8	3.6	3.3	5.7	4.0
0611		5.1	4.4	4.1	5.2	4.1
0613		4.9	4.0	3.2	5.1	4.1
0615		~~[illegible]~~ 2.3	2.3	2.0	3.7	2.4
Σ		52.9	45.0	43.6	68.3	53.0
$\bar{x}$		4.1	3.5	3.4	5.2	4.1

Paul W Fedora

1 Apr 54

Comparison of thermocouples at "constant" temperature (buried in ground). All TC's were taped rigidly together by their bases and inserted horizontally at a depth of about 14" in the earth. (They were in a box inside a bag and had their plastic shields on.) The Gier + Dunkle meter was inserted just under the air-contacting TC's. No gradient in of temp was indicated by the heat flow meter. Air temp TC's ~~[illegible]~~ outputs were read with correct templates and also with ~~template~~ #6 to help in determining if the separate calibrations were advisable.

Paul W Fedora

1 Apr 54

Observation	Thermocouple 1 Overlay 1 Temp °F	T_1-T_4	Overlay 6 Temp	T_1-T_4	TC 2 Overlay 2 Temp	T_2-T_4	Overlay 6 Temp	T_2-T_4	TC 3 Overlay 3 T	T_3-T_4	Overlay 6 T	T_3-T_4	TC 4 Overlay 4 T	Sunset Time	Overlay 6 T	Sunset Time	TC 5 Overlay 5 T	T_5-T_4	Overlay 6 T	T_5-T_4	Thermocouple 6 Overlay 6 Temp	T_6-T_4	Overlay 6 T_6-T_4
1	52.9	.3	52.8	0	~~52.7~~		~~52.7~~		52.8	.1	52.7	-.1	52.8	1315	52.8	~~52.8~~	52.8	.2	53.0	.2	52.9	.2	0
2	52.3	.3	52.2	0					52.2	.2	52.3	+.1	52.0	1358	52.2		52.3	.1	52.5	.3	52.4	.4	.2
3	52.4	.4	52.3	.2					52.2	.2	52.3	.2	52.0	1359	52.1		52.3	.3	52.5	.4	52.5	.5	.4
4	52.4	.3	52.3	.1					52.2	.1	52.3	.1	52.1	1401	52.2		52.3	.2	52.5	.3	52.4	.3	.2
5	52.8	.3	52.6	-.2	52.9	.4	53.1	.3	52.5	0	52.6	-.2	52.5	1423	52.9		53.0	.5	53.0	.2	52.8	.3	0
6	52.8	.2	52.7	-.1	53.0	.4	53.2	.4	52.6	0	52.7	-.1	52.6	1425	52.8		53.0	.4	53.1	.3	52.8	.2	0
7	51.2	.2	51.1	.1	51.3	.3	51.7	.7	51.0	0	51.1	.1	51.0		51.0	1029	51.3	.3	51.4	.4	51.2	.2	.2
8	51.2	.2	51.1	.1	51.4	.4	51.7	.7	51.0	0	51.0	0	51.0		51.0	1030	51.3	.3	51.4	.4	51.2	.2	.2
9	51.2	.2	51.0	0	51.3	.3	51.7	.7	51.0	0	51.0	0	51.0		51.0	1031	51.3	.3	51.4	.4	51.2	.2	.2
10	51.2	.2	51.1	.1	51.3	.3	51.6	.6	51.0	0	51.0	0	51.0		51.0	1032	51.3	.3	51.4	.4	51.2	.2	.2
11	51.9	.2	51.8	0	52.1	.4	52.5 ~~52.5~~	.7	51.8	.1	51.8	0	51.7		51.8	1045	52.1	.4	52.3	.5	51.9	.2	.1
12	51.9	.3	51.8	0	52.0	.4	52.3	.5	51.6	0	51.7	-.1	51.6		51.8	1045	52.1	.5	52.2	.4	51.9	.3	.1
13	51.3	.2	51.2	0	51.6	.5	51.8	.6	51.1	0	51.1	-.2	51.1		51.2	1052	51.5	.4	51.8	.6	51.4	.3	.2
	[Σ]	3.3		.9		3.4		6.2		.7		1.2		–		–		4.2		4.8		2.5	2.0
	Mean	.25		.07 ~~.069~~		.38		.58		.05		.09						.32		.37		.27	.15

Paul H. Nichols

2 Apr 54

Observation	Temp by "Correct" Template (°F)													Temp by Template #6 (°F)												
			52.0	52.1	52.2	52.3	52.4	52.5	52.6	52.7	52.8	52.9	53.0	Temp		52.0	52.1	52.2	52.3	52.4	52.5	52.6	52.7	52.8	52.9	53.0	53.1
1									4	3	6 5	1		.3	.3								3	4 6 1		5	
2			4		3	5 1	6							.4	.3			4 1	3	6	5						
3			4		3	5	1	6						.5	.4				2 1		6 5						
4				4	3	5	6 1							.3	.3			4	3 1	6	5						
5								4 3	S		6 1	2	5	.5	.5							3 1		6 4		5	2
6									4 3 S		6 1		5 2	.4	.5								3 1	6 4			5
		51.0	51.1	51.2	51.3	51.4	51.5	51.6	51.7	51.8	51.9	52.0	52.1	.40	.38	51.0	51.1	51.2	51.3	51.4	51.5	51.6	51.7	51.8	51.9	52.0	52.1
7		4 3		6 1	5 2	5								.3	.7	4	3 1	6		5			2				
8		4 3		6 1	5	2								.4	.7	4 3	1	6		5			2				
9		4 3		6 1	5 2		5							.3	.7	4 3 1		6		5	5		2				
10		4 3		6 1	5 2									.3	.6	4 3	1	6		5		2					
11									4	3	6 1		5 2 5	.4	.7						4 3 1	6		S		5	
12								4 3			6 1	2	5	.5	.6					3	4 1	6			5	2	
13			4 3		1	6	5	5 2						.5	.7		2	4 1		6		S		5 2			
											Mean			~~.39~~	.67												

Paul H. Nichols

S = Soil Thermocouple (Lower Vanes)

1100336

2 Apr 54

Ob #	Time of Observation (2 Apr 54)	Temp (F) by correct template: 51.7	50.8	50.4	51.0	51.1	51.2	51.3	51.4	51.5	Range	Range	Temperature by Template 6: 51.4	51.0	51.1	51.2	51.3	51.4	51.5	51.6	51.7	51.8	51.9
14	1029				4 3	6	1	5 2	5		.3	.8		3	6 14			5	5			2	
15	1029				4 3	6	1	5 2			.3	.7		134	6				5		2		
16	1030				4 3	6	2 1 S	5			.3	.7		134	6	S			5		2		
17	1030				4 3	6	1	5 2			.3	.8		4	6 13			5				2	
18	1031				4 3	6	1	5 2 S			.3	.8		3	6 14		S			5		2	
19	1032				4 3	6	1	5 2			.3	.7		3	6 14					5	2		
20	1033				4 3	6 1	S	5 2			.3	.8		34	16	S			5			2	
21	1033				4 3	6	2 1	5			.3	.6		3[illegible]	46	1		5		2			
22	1122	4	3	6 1	5 2 S						.3	.3	46 13	S	5	2							
23	1122	4	3	1	5 26						.3	.4	4 13	6	X 5		2						
24	1123			4	26 13	S 5					.2	.4	4	6 13	S	X 5	2						
25	1124			4	3 16	5 2					.2	.4	4	6 13		5	2						
26	1125			4	3 16	5	5 2				.3	.5		46 13		5 S			2				
27	1125				46 14		5 2				.2	.5		46 13	5				2				
28	1226	4		5 3	2 16		S				.3	.3	5 34	11		2 S							
29	1227	4	3	5	2 16						.3	.3	4 13	56		2							
30	1228	4	3	6 5	2 1		S				.3	.3	6 34	15		2 S							
31	1228	4		5 3	2 16						.3	.3	4 13	56		2							
32	1229		4		35 16	2		S			.2	.5	34	156			S	2					
33	1230		4		23 156						.2	.5	4	6 135				2					
	Mean										.28	.53											

S = Soil (Grass Sample) Tc

Paul W. Nichols

5 Apr 54

In the temperature range in which the checks were made (data pp 21 & 22) the individual templates generally gave a smaller range of temps than one template for all TCs. Altho the range of testing temp is very limited, it seems advisable to use the individual templates. Drift of temperature in the reference bath (or in buried TCs - can't distinguish) is small. Greatest indicated is in period from observation 22 to 27 - about .2 F in 3 minutes.

Paul W. Nichols

20 Apr 54

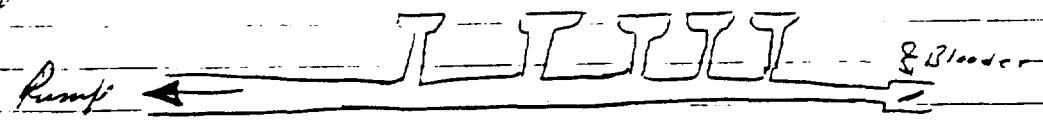
Check of flow thru Bulk Samplers

(in estimate of the mean flow thru the bulk samplers can be made with the hot wire probes. A check of the consistancy

110033T

[redacted]

of these ~~[illegible]~~ hot wire outputs was made as follows:



Recorder indication as probes were cycled (#6 probe not attached)

Time	Probe #	#	#	#	#	# 6	# Open	Remarks
	38	12	100	0	0	0		Blower on 0905
					-12	0		Circuit breaker out 0915
	66	53	53	50	-9	0	0	0925 On
0929	~~[illegible]~~ 70	53	56	50	-7	0		
0930	70	53	56	50	-6	0	0	
	68	53	53	50	-6	0		
	73	55	55	50	-6	0	0	
0932	70	55	55	53	+5	0		0935 - Circuit off
0934	70	55	55			Blower pressure 23 inches H_2O		

Blower motor will not run at -23 inches pressure. Heater kicks out. Heater element is P 29 — 5.43 F.LAMPS. Motor rated at 8.8 Amps. Seems could use a larger heating element. Steady enough flow indicated above.

Paul Nickola

21 Apr 54 Miscellaneous Observations on Generator Loading

Large Roots-Connersville blower motor draws 8.8 amps when vacuum guage reads -30 inches of H_2O. Motor rated at 8.8 Amps full load.

With all equipment on mast "on", portable generator gave 59 cycles, 109 volts, and 40 amps. All includes — anemometer power supply + CRM, thermocouple reference junction, hot wire probes and voltage regulator, both blowers (large blower full "load" of -30 cm H_2O and small blower not loaded), both pumps (with "load" of -27" Hg), van voltage regulator, recorder, Panascan unit, frequency and voltmeters, and one van incandescent lamp.

Paul W Nickola

26 Apr 54 Pumps - Current Drawn

New heater (9.6 amps) installed in large Roots-Connersville blower starter. Ran this blower for 1 continuous hour at 29" gage pressure — no overload. Drew about 8 amps.

Also ran large Gast pump for 40 minutes ~~with~~ at 25" gage pressure. Drew about 16 amps.

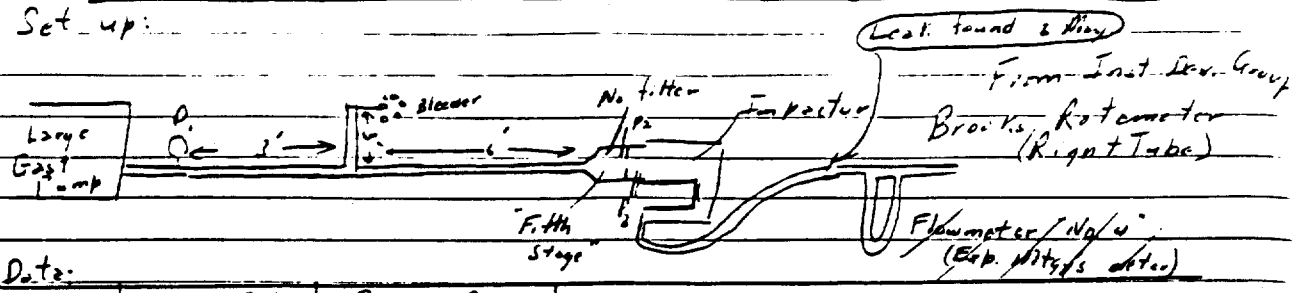
Paul W Nickola

1100338

29 Apr 54

Determination of Critical Flow Thru Impactor Orifices (#54 drill)

Set up:



Data:

Stage #	Critical Flow* Rotameter =	cfm	Critical Pressure P_1	P_2	Remarks
1	57.8	.48	23"	20½"	P_1 oscillating about 2" on gage
2	56.0	.45	23"	20"	" " " " "
3	58.0 ~~57.0~~	.48	23½	~~[illegible]~~ 19"	~~P_1 oscillating [illegible] on gage~~ Steady P_1 critical flow [illegible]
4	56.8	.46	22-25"	20½"	oscillating P_1
5	56.1	.45	21-23	19"	" P_1
6	57.6	.48	22-24 ~~[illegible]~~	~~[illegible]~~ 20"	" P_1 $\boxed{P_2 = 3\frac{1}{2}"}$

(Completion of above data table delayed because Flow meter "No. 4" not sensitive enough. 27 Apr 54)

Could press fit orifice plates be allowing leakage?

With W41 filter paper in orifice stage #3, $P_1 = 23\frac{1}{2}$ at critical pressure ($P_2 = 19"$)

Stage #3, flow at various P_2's - P_1's; no filter paper:

P_1	P_2	Flow Rotameter	cfm	Remarks
23½	19"	58.0	~~.48~~	critical flow (P_1 fairly steady)
22-24"	18"	57.8	.48	
21½-23	17"	57.7	.48	
20½-22"	16"	57.5	.47	
19-21	14"	57.0	.47	
18-19½	12"	56.0	.45	

Comment:

The critical flow point is not clear cut with the flowmeter used (Brooks). At any rate the change of flow with lowered P_1 (and P_2) is not ~~exceptional~~ great - as indicated by second data table above. *Note: Leak found in hose 3 May 54 (see diagram). May have been here at this time.

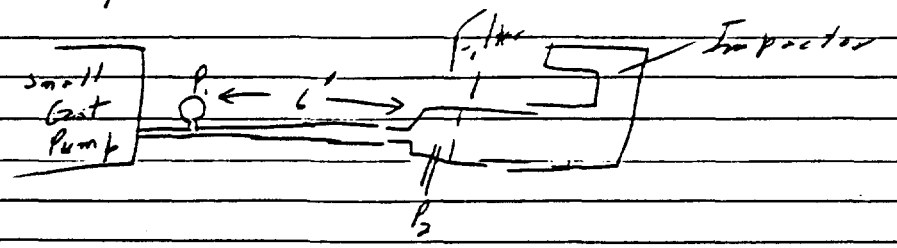
Paul W. Nichols

1100339

27 Apr 54

Check of ~~flow thru~~ vacuums possible with small Gast pump.

Set up:



Data:

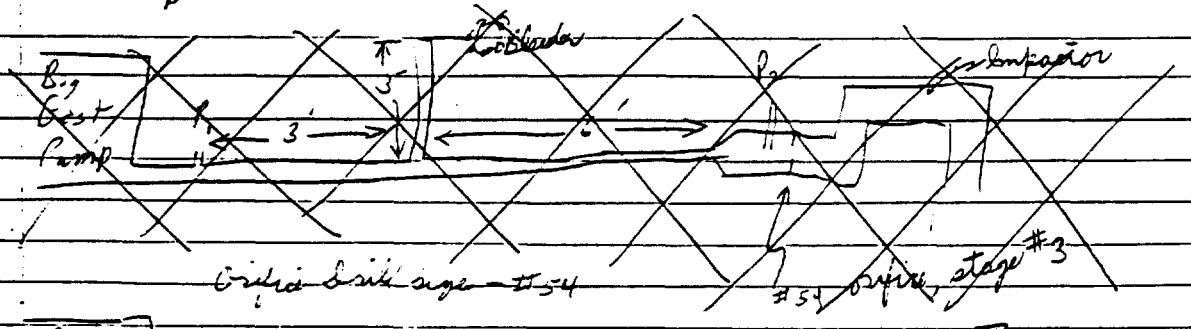
Orifice size	P_1	P_2	Remarks
54	-27" Hg	-26 2/3"	Without filter
54	-27" slightly more fluctuation	-22 1/3	With filter

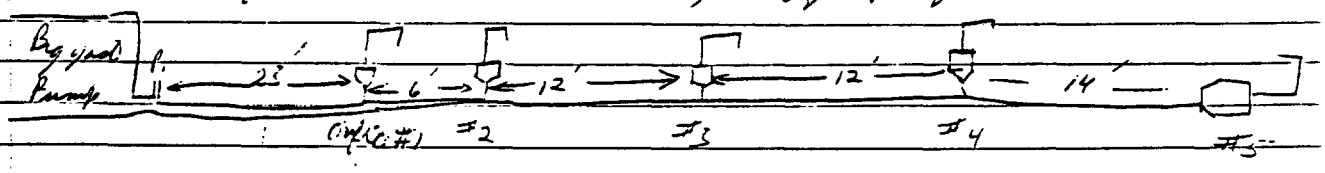
Paul M Nickola

29 Apr 54

Determining of big Gast pump capacity in terms of no. of impactors and orifices in critical flow range.

Set-up:





~~Orifice~~ P_1 = 24"

Orifice	P_2	Remarks	Breaks Flow = cfm
1	17½"	No filter	
2	17½"	No "	
3	14½"	Filter	
4	16"	No "	
5	16"	No	55

P_1 = 24 +"

With Filters

Orifice	P_2	Breaks Flow	P_F
1	16"	56.7	19½"
2	15¼	54.5	18½
3	14¼		
4	14-	54.8	17¾
5	1++	54½	

1100340

P_F = pressure measured by putting gage on intake of impactor (instead of flowmeter).
Pump was drawing 16 Amps at 130 V during these experiments.

Paul W. Nichols

30 Apr 54

Comparison of Flow Measured by Exp Met and Brooks Flow Measuring Devices

Inst. Development.

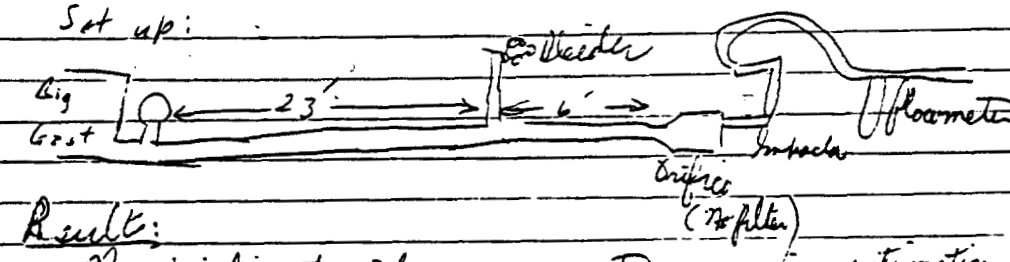
Pump #	Exp Met "Flowmeter No 4"	Exp Met cfm	Brooks Rotameter	Brooks cfm
8	+4.5 −4.9	off scale	~~[illegible]~~	1.1
38	+4.5 −5.0	"	99	
23	+4.0 −4.5	"	93½	
		"		

Pump No.	"Flowmeter No 4"				Brooks	
	L	R	Δp	cfm	Tube	cfm
23	+2.0	−2.8	4.8	.74	75	.71
38	+2.2	−3.3	5.5	.79	77	.73
8	+2.0	−3.0	5.0	.76	76	.72

Effect of Sealing Press Fit Orifice Plate

Purpose: The discernment of the change from constant (critical) to non constant flow with pressure change has been difficult. Perhaps leaks around edge of press fit orifice plate are a factor. — A #54 drill orifice was ~~glued~~ sealed in proper position in orifice-filter stage #3. The sealer was Duco Household cement

Set up:



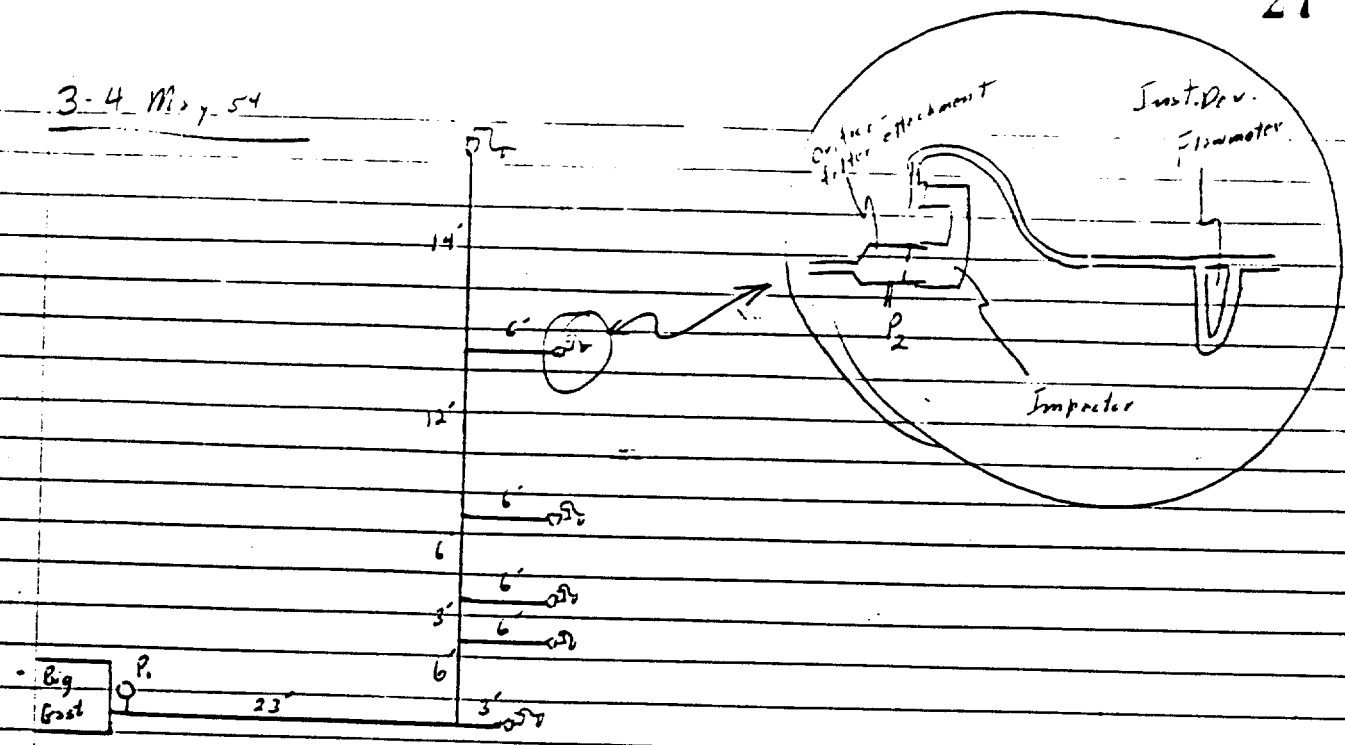
Result:

No significant — if any — greater ease in estimating critical pressure than with probed only orifice plate

Paul W. Nichols

1100341

3-4 May 54



Calibration of Cascade Impactor Flow. – Pump Vacuum vs Flow

Since it is apparent that the impactor system is not capable of being operated to obtain critical flow (see table at bottom of page 25), calibration of flow thru each impactor for various pump pressures (P_1) seems necessary. Drill in orifice was #54. Setup sketched above.

P_1	1 P_2	1 meter	1 cfm	2 P_2	2 meter	2 cfm	3 P_2	3 meter	3 cfm	4 P_2	4 meter	4 cfm	5 P_2	5 meter	5 cfm	6 P_2	6 meter	6 cfm	Remarks	Vol. Hg
~~23½~~				Take Th			With 27 mm			4 1		Pa Filter	except						With Whatman #41 Filter paper	
23½	16½	34.0		13½	51.7	leak	13	51.3	leak	12½	57.0		12¼	57.0		14¼	58.0			124
22⅔							13	51.3								No Filter #6			Flowmeter not touched	106
23½	14¾	60.0		13½	56.1		12¾	59.2		12½	57.0		12¼	57.0		14¼	58.0		Dirt block of the stage on final attempt #13	124
~~14~~	Paul W Nichols																			
	4 May 54			No Filter Paper																
24½"				16¼	57.8	.50														
24"	17"	59½	.50				15+	54.8	.50	14⅔	58.0	.50	14¼	58.0	.50	14+	58.0	.50		
				With Filter Paper Whatman 41																
23½	14½	60	.50	13⅔	56.4	.50	12⅔	59.0	.50											
23¾									1"	13+	57.4	.50	12½	57.8	.50	12½	57.0	.49		
~~14~~	Paul W Nichols																			
	14 May 54 #1				#2			#7			#8			#9			#10		No #3 Drill Hole	
22½	15			12½			12¾			12¼			12¾	12"		11¾	11⅞		Without Filters	120
23"	12¾			11⅞			11⅓			10¼			10¼			10⅞			With Filters	120

P W Nichols

Generator Voltmeter

— 100 — 2 —

3 May 54

Comparison of flow measuring devices

Methods Group 2L150			Methods Group 01-N-15			Instrument Dev's Right Tube		Exp Met's Flow meter No 4			
Reading (broken tube)	cc/min	cfm	Reading	cc/min	cfm	Reading	cfm*	l	r	Δp	cfm
92.0	23,950	.85	off scale	—	—	92.5	.93	—	—	—	—
39.0	9400	.33 .28	122	9200	.32	52.0	.40	—	—	—	—
38	9050 7600	.32 .27	121	9050	.32	55.5	.45	—	—	—	—
43	10700 8900	.38 (.37) .31	133	10400	.37	60.8	.52	+.45	-.70	1.15	.33
98	25,600	.90	off scale	—	—	99.0	1.02	+3.3	-5.7	9.0	.96 (extrapolated)
70	17,600	.62	" "	—	—	76.5	.72	1.1	-3.3	4.1	.68
26	6000	.21	92	6100	.22	41.0	.26	-.95	-1.10	.15	.10 (extrapolated)
51	12500	.44	147	11950	.42	61.0	.52	-.2	-1.9	1.7	.43
44	10900	.385	122	9200	.32	53.5	.42	-.70	-1.35	.65	.23
44	12050	.43	139	11050	.39	54.5	.50	-.4	-1.7	1.3	.37

(oval) From curve "uncorrected for broken tube."

* From calibration curve drawn by me Feb 53. Calibrated against Ind. Hyg. Flowrate

H Paul W Hickola

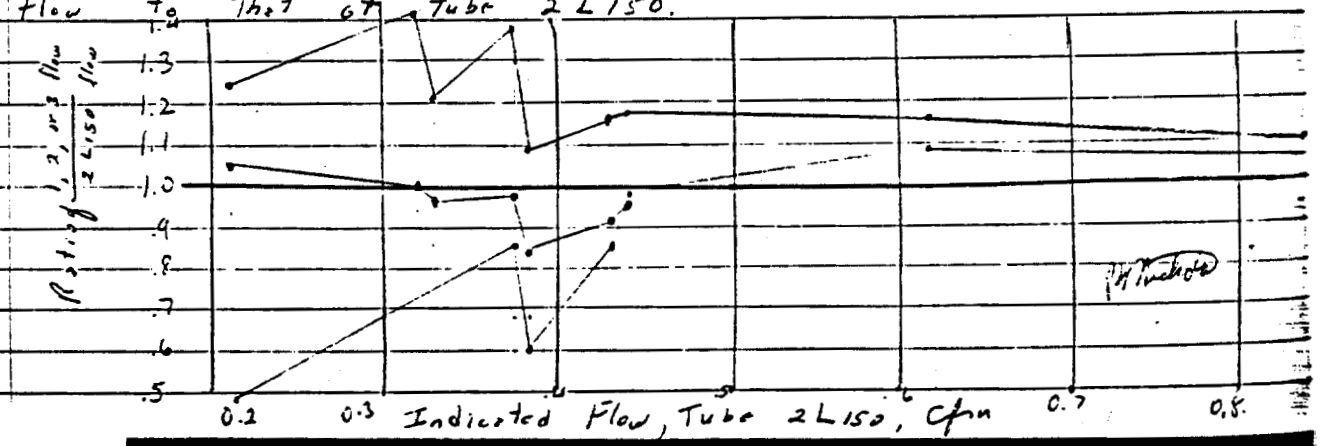
3 May 54 "Calibration of Impactors" - cont'd.

With the set up diagrammed on the prior page, a varying of the big Gast pump speed by varying the voltage (change generator regulator set - turned on KC blower, van lights) from 106 V to 124 volts did not change the indicated vacuum or flow at impactor number 3 a detectable amount. Since prior tests with all mast equipment on showed generator output of 109 V ac, the one calibration of the impactors with filters and one without filters seems sufficient. The decrease of flow with loading of filters has not been investigated yet.

Paul W Hickola

4 May 54

Comparison of Flow Measuring Devices (from data above) Ratio of (1) Tube 01-N-15, (2) Instrument Development's meter and (3) Exp Met's indicated flow to that of tube 2L150.



1100343

Conclusion: Things ain't good. Which tube is right? Should recalibrate whichever tube I use (Inst Dev's) against one of Industrial Hygiene's good flowrators.
Paul W Nichols.

6 May 54 Comparison of flow measuring devices

Vacuum source was 329 bldg piped vacuum. Method was to insert each flowmeter in turn on the vacuum fixture and take a reading before proceeding with a new fixture (or valve) setting.

Industrial Hygiene's B4A-25 Tube	Inst Dev. Right Tube	Exp Mets Flowmeter No. 4 L	R	Δp
.36 2	47.7			
.55 1	61.0	-.6	-1.55	.95
.60 0	65.1	+.05	-2.25	2.30
		+.3	-2.5	2.80
.76 6	78.8	1.2	-3.5	4.70
.92 8	90.8	2.3	-4.65	6.95
~~1.4~~ 1.09 9	102.0	3.6	-6.0	9.60
1.33 6	124.7	5.75	-8.45	14.20
1.71 0	149 (read fluctuating)	9.5	-12.55	22.05
.45 6	54.8	-.25	-2.0	1.75
.48 0	57.0	-.20	-2.0	1.80
.51 7	60.0	0	-2.2	2.20
.58 6 Started shaking tube	62.6	+.20	-2.5	2.70
.64 9	69.0	+.5	-2.8	3.30
.50 7	57.0	-.1	-2.1	2.00
.44 8	53.0	-.3	-1.9	1.60
.20 0	36.3	-.9	-1.3	.40

Paul W Nichols

7 May 54

Reexamination of indicated flows in light of new calibration. Scale readings for corresponding flows are taken from table at top p. 28.

Methods Group's 2L150	Methods Group's 01-N-15	Inst Dev's Brooks (Rt Tube)	Exp Mets Flowmeter #4	Methods Group's 2L130	Methods Group's 01-N-15	Inst Dev's Brooks Rt. Tube	Exp Mets Flo. #4
.85	—	.95	—	.62	—	.75	.71
.33	.32	.42	—	.21	.22	.27	.16 extrap. [illegible]
.32	.32	.47	—	.44	.42	.54	.47
.38	.37	.54	.39	.38	.32	.44	.30
.90	—	1.04	1.06	.43	.39	.52	.41

0.9

The comparative flows are nearly as bad as with old calibrations. This is discouraging in view of the fact that both Inst. Dev's. meter and air flowmeter were calibrated against the same standard (2nd Hyg. BHA - 25).

Possible source of error:

1. Leaks in hose ~~or changes in flow~~ attached to Erp Metz meter during experiment at top of page 28.

2. A lower vacuum just downstream of meter when Erp Metz is used (in contrast to ~~that~~ Inst Dev)

3. Fluctuations in ~~[illegible]~~ efficiency of pumps. This seems unlikely since it would require a selective fluctuation — at low flow when Dr Metz's meter checked, hi flow when Inst Dev's meter checked.

4. Insofar as the two methods involve instruments are concerned, a poor calibration on any of the above 3 situations might exist

Paul W Nichols

10 May 54

Comparison of Collectors on impactor slides under Same Sampling Conditions

The hose and orifices were set up as ~~described~~ diagrammed on the top of page 27. Instead of measuring flow, all four impactor stages were used and prepared slides used. The impactors were mounted with intakes approximately 14 inches above the surface. The intakes were pointed perpindicular to the boom, ie to the southeast. The pump was turned on at ~~about~~ 1332. Suction at impactor number 5 seemed to be less than the others as judged by covering impactor intake with the finger. P_1 at 1332 was 24" Generator indicated 118 V with pump motor drawing 18 amps

At 1410 - 116 V, 16 amps; P_1 = 23 (oscillating 22-24)

Noted pump vapors blowing toward impactors.

At 1432 - 116 V 15 amps P_1 = 23

Off 1432

All impactors except numbers 6 and 5 were "cleaned" prior to this by blowing (by mouth) on dismantled impactor and wiping cups.

Slides Numbered as follows:

	Impactor #1	#2	#3	#4	#5	#6
Stage #1	11	21	31	41	51	61
2	12	22	32	42	52	62
3	13	23	33	43	53	63
4	14	24	34	44	54	64

Paul W Nichols

1100345

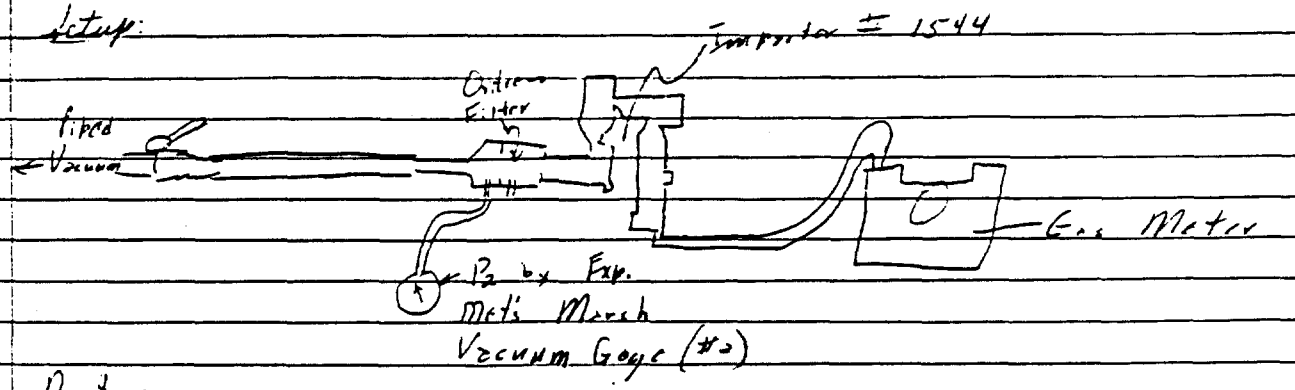
[redacted]

13 May 54

Calibration of Orifices for Impactors with Gas Meter

Purpose: To ascertain with more certainty the flow thru various orifices with impactors attached by means of Industrial Hygiene's gas meter Model 30-600, serial No S 570410, mfgr American Meter Co.

Setup:



Data:

~~With W. M. Wheelman H filter in impactor attachment~~

Orifice Attachment No	Hole Size	P_2	Duration of Flow	Meter Reading Start	Stop	Δ	Flow cfm		Remarks
1	54	19½" Hg	5 min	0.01	2.68	2.67	0.534 cfm		With filter
	.05	14½"	5	3.00	5.54	2.54	0.518	.52	
		10"		6.00	8.38	2.38	0.476	.48	
		19½		7.00	9.68	2.68	0.536	.54	Without filter
		14½		2.00	4.63	2.63	0.526	.53	
		23 [redacted] 24"		5.00	7.64	2.64	0.528	.53	Max vacuum available
		10"		8.00	10.42	2.42	0.484	.48	
		18"		1.20	3.89	2.69	0.538	.54	
		17"		4.00	6.63	2.63	.526	.53	
2	54	23 to 24"		7.10	9.62	2.52	0.504	.50	So little difference with or without filters all run without from here on.
		16¼		0.00	2.47	2.47	0.494	.49	
		12⅔		2.80	5.38	2.58	0.516	.52	
3		23-24"	7 min	5.00	9.31	3.71	0.53	.53	~~0.05 min~~ 14283 D
		15⅛	5	9.80	12.44	2.64	0.528	.53	
		12⅔		~~[illegible]~~	6.97	2.57	0.514	.51	
4		23-24		7.10	9.70	2.60	0.52	.52	
		14⅔		0.00	2.57	2.57	0.514	.51	
		13⅛		3.00	5.48	2.48	.496	.50	
5		23-24		5.70	8.23	2.53	.506	.51	
		14¼		8.70	11.27	2.57	0.514	.51	
		12½		2.40	4.86	2.46	0.492	.49	
6		23-24		~~3.20~~ 1.20	3.83	2.53	0.506	.51	
		14¼		5.40	7.91	2.51	0.502	.50	
		12½		4.10	6.54	2.44	0.488	.49	

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May 54

Orifice Attachment No.	Drill Hole Size	P_2	Duration of Flow	Meter Reading Start	Stop	Δ	Flow Rate	Remarks
1 = 1	53	22½ to 23½	10 min	8.70	14.69	5.99	.59 0.60 cfm	No filters
		15	10	5.00	10.82	5.82	0.58	
		12 3/4	5	1.40	4.28	2.88	0.58	
2 = 6		22½ to 23½	10	4.50	10.63	6.13	0.61	
		14½	10	1.20	7.28	6.08	0.61	
		11½		7.50	13.37	5.87	0.59	
7 = 4		22½ to 23½		3.50	9.68	6.18	0.62	
		12 3/4		0.30	6.38	6.08	0.61	
		11½		7.10	13.00	5.90	0.59	
8 = 5		22½ to 23½		3.30	9.31	6.01	0.60	
		12¼		9.80	15.59	5.79	0.58	
		10¼		5.80	11.33	5.53	0.55	
9 = 2		22½ to 23½		1.50	7.57	6.07	0.61	[illegible]
		12		8.00	13.82	5.82	0.58	17 May 54
		10⅛		4.60	10.10	5.50	0.55	
10 = 3		19½	6 min	4.90	7.50	7.60	.60 0.60 cfm	With filter (only one w filter)
		22½ to 23½	10	0.30	6.34	6.04	0.60	
		11⅞	10	6.70	12.36	5.66	0.57	

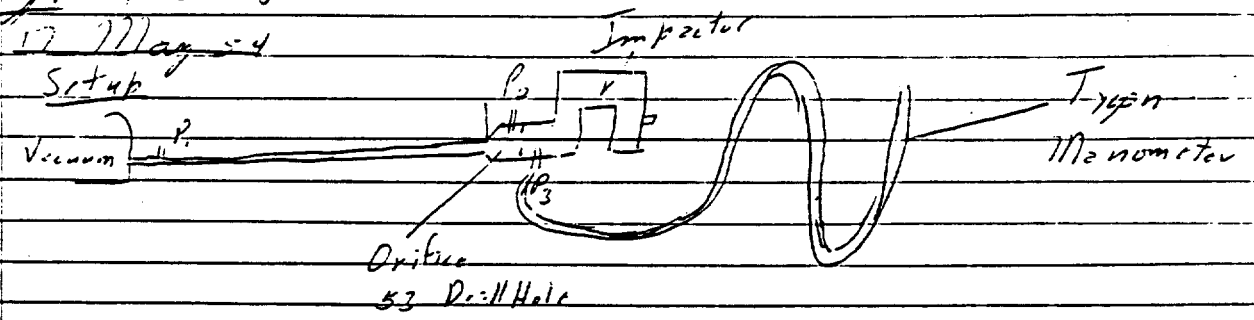
See page 27 bottom for reason for choice of P_2's.

10	53	10½	10	3.00	8.43	5.43	0.54	without filter
1	53	15	10	9.70	14.61	5.91	0.59	* Renumbered Orifice 18 May 54

Paul W Nichols

17 May 54

Setup



Determination of Critical Pressures for 53 Orifices

Purpose - To determine critical pressure for 53 drill orifice so as to be able to draw calibration curve (flow vs. P_2 pressure). This should complete necessary flow data on impactors.

Equipment - Large gast Pump, Orifices (53) 1, 2, 7, 8, 9, 10; impactors 1-6, Tygon tube open end manometer to determine first change in P_3 with decreasing P_2. (Water filled manometer)

Exp. Met's Marsh Vacuum Gage #2.

1100347

[redacted]

Impactor and Orifice - Filter Attachment 1	Gal/Impactor*	P_2 (critical)	Remarks
1 = 1	1543	19"	
2 = 6	1547		
7 = 4	1441	19"	Assumed others would be 19" also since tried orifices with highest and lowest flows. ~~Theoretically~~
8 = 5	1425		
9 - -	1559		
10 - -	1544		* Reanalyzed 10 May 54

Paul M Fichola

25 May 54 Results of 10 May 54 Impactor run (see page 30, bottom)

Side	Impactor 1				Impactor 2				Impactor 3			
	cfm	ft^3 air			cfm	ft^3			cfm	ft^3		
1												
2												
3												
4												

	Impactor 4				Impactor 5				Impactor 6			
	cfm	ft^3			cfm	ft^3			cfm	ft^3		
1												
2												
3												
4												

Incorrect table. P M Fichola

1100348

10 Jun 54

Sides loaded in impactors and numbered as follows:

Stage #	Impactor 1	Impactor 2	3	4	5	6
1	211	221	231	241	251	261
2	212	222	232	242	252	262
3	213	223	233	243	253	263
4	214	224	234	244	254	264

Here, as ~~th~~ always henceforth, the orifice attachments (and hence the flow thru the impactor) ~~[illegible] are numbered~~ coupled to each impactor are numbered as ~~that~~ in red on page 36.

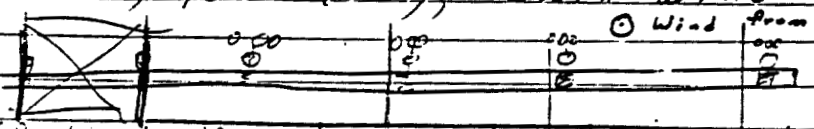
The impactors were not run this day, but merely set up in anticipation of a run in the near future. & those contaminated with sand after few days. Not used. PWN 6 Jul 54

Paul W Nickola

14 Jun 54

Comparison of unmodified Casella anemometers

Boom mounted at about 5', 4 anemometers side by side, spaced evenly, South wind at start.



Mean Speed	Duration	No	Dial Count	Speed	No	Count	Speed	No	Count	Fps	No	Count	Fps	Remarks
15.4	3 min.	732	349	14.9	733	365	15.4	734	368	15.8	738	362	15.7	Wind turned SW [illegible] anemometers ←
13.4	About 1400 3	↓	298	12.8	↓	314	13.3	↓	316	13.6	↓	318	13.9	
20.5	3	738	478	20.2	↓	494	20.7	↓	496	20.8	732	485	20.3	
16.8	1445 3	↓	390	16.7	↓	395	16.6	↓	399	17.1	↓	392	16.7	Whole boom moved 5' →
16.6	3	↓	355	16.5	↓	Mis fire	×	↓	395	16.9	↓	387	16.5	Spread anemoms forth
	3	↓	248	10.9	↓	258	11.0	↓	264	11.5	↓	276	12.0	
	4	733	369	11.8	738	387	12.7	732	392	12.7	734	402	13.1	
	Totals			103.8			89.7			108.4			108.2	
	Mean Speed			14.8			15.0			15.5			15.5	

Anem # →	732	733	734	738
Total	1059	88.8	1088	1066
Mean Speed	15.1	14.8	15.5	15.2

Paul W Nickola

1100349

35A

HANFORD ATOMIC PRODUCTS OPERATION
GENERAL ELECTRIC
RICHLAND, WASHINGTON

August 6, 1954

P. W. Nickola
622 Bldg.
200 W Area

Correlation of Controlled Wind Speed Measurements

Statistical calculations have recently been completed by Control Services of data collected in an experiment designed to define the differences in measured wind speed found by using four anemometers simultaneously. A series of measurements were made using an experimental apparatus where all instruments were tested while in each of four positions on a boom.

Primary analyses of the data were accomplished to determine if there were significant variations between the four instrument readings in the same position on the boom, and between readings in the four boom positions for one instrument. The results of these tests revealed that when the effects of instruments and boom positions were removed separately, the residual variation or "interaction" was significant; that is, the variation was greater than would be expected if all measured values were from the same statistical population.

Since the presence of another uncontrolled factor could produce this significant variation, further analyses were made to define this variable. It was judged likely that actual differences in wind speed had occurred during the experiment and a method was devised to adjust the data for these differences. The average wind speed at any time measured by instruments in each of the four boom positions was determined. The value measured by each anemometer at that time was then expressed as a ratio of the average.

An analysis of variance was completed using these computed ratios in a second attempt to define differences in wind speed between instruments in one position and between boom positions for one instrument. In this case, the "interaction" was not significant, indicating that the adjustment for actual variations in wind speed was successful. Furthermore, the results of these tests showed that significant differences were found to exist between instruments and between boom positions.

Using these data, indexes were computed to define the relationship between the measurements of the four anemometers as follows:

35B

HANFORD ATOMIC PRODUCTS OPERATION
GENERAL ELECTRIC
RICHLAND, WASHINGTON

ANEMOMETER NO.	INDEX
732	1.006
733	1.000
734	1.020
738	1.023

The error in the above indexes was found to be ± 0.0054 for the individual measurements.

In the same manner, indexes were calculated to define the relationships between the measurements of the boom positions used in this experiment, as follows:

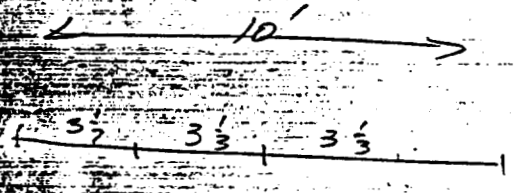
POSITION NO.	INDEX
1	1.000
2	1.015
3	1.026
4	1.035

The error associated with the above ratios was found to be ± 0.0074 for the individual measurements.

G. E. Pilcher
G. E. Pilcher

C. N. Knudsen
C. N. Knudsen

cc: ZE Carey
GE Pilcher
CN Knudsen



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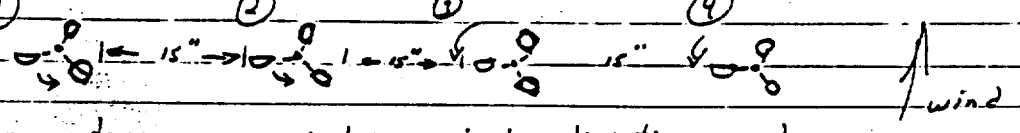
15 Jun 54

Continuing Cecelia comparisons.

Position	1 No.	1 Count	1 C/m	1 Speed fps	2 No	2 Count	2 C/m	2 fps	3 No.	3 C	3 C/m	3 fps	4 No.	4 Count	4 C/m	4 fps	Mean Speed fps	Wind into book
3'	732	361	120	15.4	733	376	125	15.7	734	360	127	16.2	738	378	126	16.3	15.9	NW
3	732	356	119	15.3	733	366	122	15.4	738	370	123	15.9	734	368	123	15.8	15.6	↓
3	732	337	112	14.4	738	349	116	15.1	734	352	117	15.1	733	351	117	14.8	14.8	↓
3'10"	732	329	109	13.4	738	344	114	14.3	733	348	109	13.8	734	351	111	14.3	13.9	WNW
3	732	539	180	22.4	734	559	186	23.2	733	564	187	23.1	738	561	187	23.3	23.0	NW
3	732	593	198	24.5	734	616	205	25.4	738	625	208	25.7	733	642	214	26.2	25.4	WNW
3	733	516	172	21.5	732	522	174	21.7	738	538	179	22.4	734	504	181	22.7	22.0	Mounted on chain
3	733	490	163	20.4	732	493	164	20.6	734	500	167	21.1	738	513	171	21.6	20.9	
3	733	491	164	20.6	734	501	167	21.1	732	507	169	21.1	738	520	173	21.7	21.1	
3	733	476	159	19.9	734	478	159	20.1	738	485	161	20.4	732	485	162	20.3	20.2	
3	733	434	145	18.2	738	443	148	18.9	734	449	150	19.2	732	450	150	19.0	18.8	
3	733	419	140	17.6	738	433	144	18.4	732	437	146	18.5	734	447	149	19.0	18.4	
3	734	533	178	22.3	738	542	181	22.7	732	534	178	22.2	733	533	178	22.1	22.3	
3	734	405	135	17.3	738	402	134	17.2	733	411	137	17.2	732	415	138	17.6	17.3	
3	734	495	165	20.8	733	500	167	20.9	738	516	172	21.6	732	529	176	21.9	21.3	
3	734	582	194	24.1	733	577	192	23.7	732	586	195	24.1	739	597	199	24.7	24.15	
3	734	519	173	21.7	732	518	173	21.6	733	524	175	21.8	738	536	179	22.4	21.6	
3	734	595	198	24.6	732	599	200	24.7	739	613	204	25.3	733	611	204	25.0	24.9	
3	738	472	157	19.9	732	470	157	19.8	734	474	158	20.0	733	477	159	19.9	19.9	
3	738	540	180	22.6	732	543	181	22.5	733	545	182	22.6	734	555	185	23.1	22.7	
3	738	425	142	18.1	733	432	144	18.1	732	438	146	18.5	734	451	150	19.2	18.5	
3	738	600	200	24.8	733	590	197	24.2	734	604	201	24.9	732	607	202	24.9	24.7	
3	738	399	133	17.1	734	408	136	17.4	733	408	136	17.1	732	416	139	17.7	17.3	
3	738	674	225	27.7	734	685	228	28.0	732	689	230	28.2	733	690	230	28.0	28.0	
Totals				4946				4987				4961				4938	20.58	
Mean Indicated Speed				20.2				20.4				20.7				20.9		

Deviation of Individual Anemometers for Group Mean

Position (1) (2) (3) (4)



Looking down on cups, wind direction up.

After 6 observations, anemometers were set up so as to be oriented mounting boom ⊥ to wind direction.

17 Jun 54

Anemometer 732

Position	Speed, fps	Group mean Speed	% Diff.	Pos.	Speed fps	Group mean	% Diff.	Pos.	Speed	Group mean	% Diff.	Pos.	Speed	Group mean	% Diff.
1	15.4	15.9	-3.1	2	21.7	22.0	-1.4	3	21.1	21.1	0	4	20.3	20.2	+0.5
1	15.3	15.6	-1.9	2	20.6	20.9	-1.4	3	18.5	18.4	+0.5		19.0	18.8	+1.1
1	14.4	14.8^5	-3.0	2	21.6	21.6	0	3	22.2	22.3	-0.4		17.6	17.3	+1.7
1	13.4	13.9^5	-3.9	2	24.7	24.9	-0.8	3	24.1	24.1^5	-0.2		21.9	21.3	+2.8
1	22.4	23.0	-2.6	2	19.8	19.9	-0.5	3	18.5	18.5	0		24.9	24.7	+0.8
1	24.5	25.4^5	-3.7	2	22.5	22.7	-0.9	3	28.2	28.0	+0.7		17.7	17.3	+2.3
	Σ		-18.2				-5.0				+0.6				+9.2
	% diff		-3.3				-0.8				+0.1				+1.5

Σ % diff = -2.5 Mean % diff = -0.6 %

Anemometer 733

1	21.5	22.0	-2.3	2	15.7	15.9	+1.3	3	13.8	13.9^5	-1.1	4	14.8	14.8^5	-0.3
1	20.4	20.9	-2.4		15.4	15.6	-1.3		23.1	23.0	+0.4		26.2	25.4^5	+2.9
1	20.6	21.1	-2.4		20.9	21.3	-1.9		17.2	17.3	-0.6		22.1	22.3	-0.9
1	19.9	20.2	-1.5		23.7	24.1^5	-1.9		21.8	21.6	+0.9		25.0	24.9	+0.4
1	18.2	18.8	-3.2		18.1	18.5	-2.2		22.6	22.7	-0.4		19.9	19.9	0
1	17.6	18.4	-4.3		24.2	24.7	-2.0		17.1	17.3	-1.2		28.0	28.0	0
	Σ		-16.1				-8.0				-2.0				+2.1
	Mean % Dif.		-2.7				-1.3				-0.3				+0.4

Σ % Diff. = -3.9 Mean of mean % Diff = -1.0 %

Anemometer 734

1	22.3	22.3	0	2	23.2	23.0	+0.9	3	16.3	15.9	+2.5	4	15.8	15.6	+1.3
	17.3	17.3	0		25.4	25.4^5	-0.2		15.1	14.8^5	+1.7		14.3	13.9^5	+2.5
	20.8	21.3	-2.3		21.1	21.1	0		21.1	20.9	+1.0		22.7	22.0	+3.2
	24.1	24.1^5	-0.2		20.1	20.2	-0.5		19.2	18.8	+2.1		19.0	18.4	+3.3
	21.7	21.6	+0.5		17.4	17.3	+0.6		20.0	19.9	+0.5		23.1	22.7	+1.8
	24.6	24.9	-1.2		28.0	28.0	0		24.9	24.7	+0.8		19.2	18.5	+3.8
	Σ		-3.2				+0.8				+8.6				+15.9
	Mean % Dif. =		-0.5				+0.1				+1.4				+2.6

Σ % Diff = +3.6 Mean of mean % Diff. = +0.9 %

Anemometer 738

Pos.	Speed	Group Mean	% Diff.	Pos.	Speed	Group Mean	% Diff.	Pos.	Speed	Group Mean	% Diff.	Pos.	Speed	Group Mean	% Diff.
1	19.4	19.4	0	2	15.1	14.8^5	+1.7	3	15.9	15.6	+1.9	4	16.3	15.9	+2.5
	22.6	22.7	-0.4		14.3	13.9^5	+2.5		25.7	25.4^5	+1.0		23.3	23.0	+1.3
	18.1	18.5	-2.2		18.9	18.8	+0.5		22.4	22.0	+1.8		21.6	20.9	+1.4
	24.8	24.7	+0.4		18.4	18.4	0		20.4	20.2	+1.0		21.7	21.1	+2.8
	17.1	17.3	-1.2		22.7	22.3	+1.8		21.6	21.3	+1.4		24.7	24.1^5	+2.3
	27.7	28.0	-1.1		17.2	17.3	-0.6		25.3	24.9	+1.6		22.4	21.6	+3.7
	Σ		-4.5				+5.9				+8.7				+14.0
	% Diff		-0.8				+1.0				+1.4				+2.3

Σ % Diff = +3.9 Mean of mean % Diff = +1.0 %

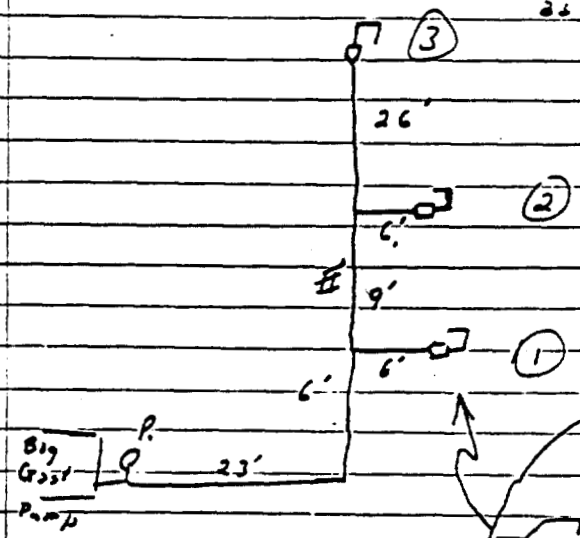
Conclusions: The indication is that there is an effect of anemometer position on boom. The differences between anemometers by the method above (how good?) are less than 2%. ~~off [illegible]~~

Paul W. Nichols

6 Jul 54

Determination of Flow with Three Impactors on Mast

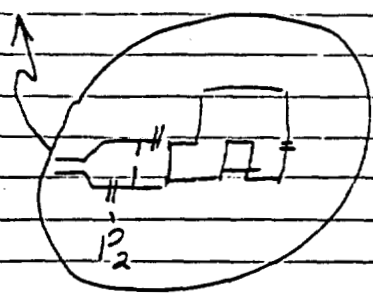
Three impactors and individual vacuum leads were removed from the mast set up as diagrammed on page 27, and their "T"s were plugged. The mast impactor setup becomes as diagrammed — hose lengths indicated:



P_1 = (oscillating) 24" to 26"

Orifice No.	P_2	Flow (from calib. curve)
1	20" Hg	0.60 cfm
2	19¼"	0.61
3	19"	0.60

All impactors in critical region (19")



Paul W. Nichols

8 Jul 54 **Totalizing Anemometer – Analysis of Variance**

By use of the technique of analysis of variance, Gordon Pilcher's Control Services showed that, ~~by use~~ (with the data on anemometers on p 35) the ratio of speeds indicated by the 4 anemometers are as follows:

Anem.	733	732	734	738
Ratio	1.000	1.006	1.020	1.023

The effect of boom position was eliminated in determining these ratios. Similarly, the variance introduced by boom position after anemometer difference ~~positions~~ were eliminated were:

Position —	1	2	3	4
Ratio —	1.000	1.015	1.026	1.035

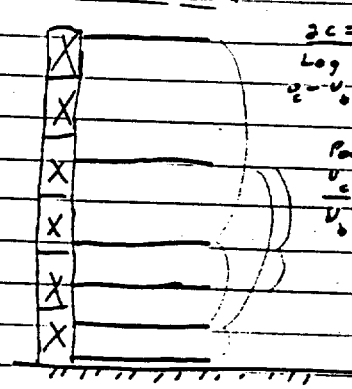
Since the errors introduced by differences in anemometers is less than 2½ % (at the speeds involved during the test run) and no investigation has been made in other wind speed ranges, it would seem best to stick strictly to the calibration curves for the anemometers and neglect any "correcting" to the calibration curves. Note that the worst indicated error (1.023) is observed with the anemometer for which the calibration curve for the totalizer was inferred from the calibration of the pulse generator.

Paul W Nichols

9 Jul 54

Boom Mount Heights* for wind profile investigations

Boom Level	Anemometer Heights for $ac = b^2$ relationship	Boom Mount Height (Pulse Generator Anemometers)	Boom Mount Ht. for 4 totalizing anemoms. at levels 1, 2, 4, 6
1	1.2' = 1' 2½"	Adjust by measurement to cups	
2	5.5' = 5' 6"	3' 9¾"	4' ~~3' 7¾"~~
3	9.2' = 9' 2"	7' 5¾"	← Same
4	15.2' = 15' 2"	13' 5¾"	← " ‡
5	25.1' = 25' 1 3/16"	23' 4 15/16"	← "
6	41.8' = 41' 9"	40' ¾"	← " ‡



$ac = b^2$

Log law $u_c - u_b = u_b - u_d$

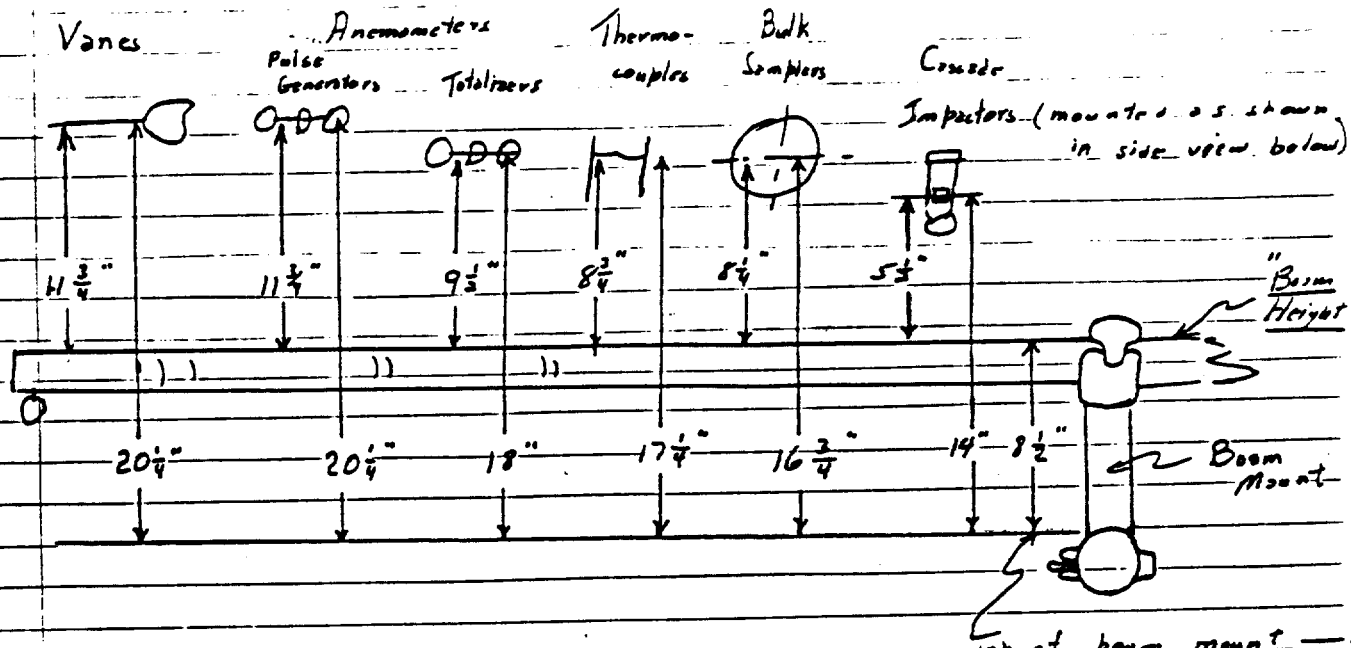
Power Law $\frac{u_c}{u_b} = \frac{u_b}{u_d}$

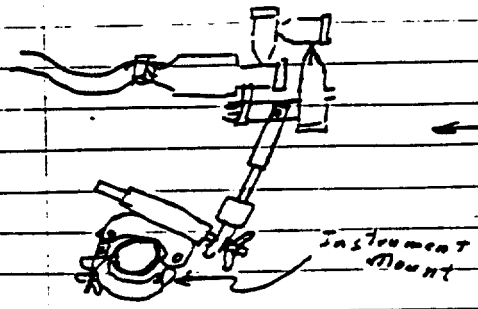
‡ Boom Mount Ht was not changed for levels 4 + 6 for the totalizers since the vertical gradient of wind speed should introduce only very small errors due to 2¼" misplaced cups at those ht

* Defined on diagram on next page.

1100355

Height of Portable Mast Instruments Above Booms and Boom Mounts





← Instrument ~~Boom~~ mount mounted at an angle so that impactor is level when torque (supplied by weight of hose) is applied.

Side View of Mounted Cascade Impactors

Paul W. Nickols

12 Jul 54

Drying Whatman 41 Filters to Constant Weight. (Adley Balance)

Date	Time	7 (1) Level	8 (2) Level	9 (3)	10 (4)	11 (5)	12 (6)	Remarks
12 Jul	1230-1250	0.8667 g	0.8552	0.8664	0.8705	0.8685	0.8738	t_0 = first weighing
	t_0 + 2 min						.8751	Bath temp
	t_0 + 4						.8756	100°C
	t_0 + 6						.8762	All wts to
	t_0 + 85				.8720		.8743	here prior to
26 Jul	9 to 12	0.8293	0.8215	0.8332	0.8305	0.8325	0.8360	In oven 12 Jul
28 Jul	0830-9	0.8225	.8072	0.8168	0.8241	0.8204	0.8280	Exposed 13 F
	Disk#	3	2	8	15	[illegible]	6	In oven 19 F
10 Sep 54		0.8218	0.8118	0.8235	0.8279	0.8194	0.8295	In Ind Hygiene 27 Aug 54
Δ		-0.0007	+0.0046	+0.0067	+0.0038	-0.0010	+0.0015	

(x) Filter Head No.

1100356

Effect of Filter Holder on Weight of Filter paper

Two pieces of whatman 41 filter paper were removed from their box and exposed to room atmosphere for 3/4 hour. Then weighed, then inserted in filter holder, then reweighed. Paper was handled with tweezers except where noted.

Filter paper A

0.8708 g – original weight
0.8705 – after first insertion, removal from filter holder
.8711 – " second " " " " "
.8717 – Touched paper with fingers while still on scale
.8712 – t_0 – Handled paper w/fingers during this third insertion, removal from filter holder
.8720 t_0 + 2 min
.8725 t_0 + 3 min
.8730 t_0 + 4 min

Filter Paper B

	Time	
0.8804	1536	Original Weight
.8820	1547	Did not disturb – remained on balance.
.8805	1551	Put in filter holder and removed, then weighed .8805
.8812	1553	Did not disturb – remained on balance
.8814	1556	"
.8800	1559	"
.8807	1602	"
.8797	1605	"
.8807	1607	"
.8813	1610	"
Paul H Nichols	0945 (one day later) – .8843	"

Conclusions to above:

Weight varies too much to ascertain precisely the change in paper weight due to insertion in the filter holder. The changes in weight from previous weighings after insertion and removal from filter holders were as follows: –0.003 g, +0.006, and –0.0015

Paul H Nichols

1100357

Oven Dising of Xylene-Resin coated slides

Slides were coated on 12 Jul 54 (by putting drop of mixture on one slide, then touching and sliding face to face with another slide). Edges of slides were wiped free of xylene-resin by use of a cloth moistened with xylene. The resulting deposit on the slide was [illegible].

Date	Weighing Time	First Dish 1 (1 hr)	2	3	4	Second Dish 1 (4 hr)	2	3	4	Third Dish 1	2 Waved
12 Jul	1300	6.1136	3.2047	3.2546	3.0318	6.2029	3.1593	3.1404	2.9655	4.5671	2.7702
	1410	6.1137									
13 Jul	0945	6.1133	3.2045	3.2543	3.0317	6.2025	3.1590	3.1403	2.9655	4.5670	2.7702
	1020	6.1136									
15 Jul	0830	6.1126	3.2042	3.2542	3.0315	6.2022	3.1591	3.1402	2.9653	4.5665	2.7698
26 Jul	0930	6.1132	3.2044	3.2544	3.0317	6.2023	3.1592	3.1404	2.9657	4.5669	2.7704

Discarded.

Conclusion There is essentially no difference in weights before and after drying.

26 Jul 54 Paul Dr. Nichols

Date	Time	Dish 4 1	2	3	4	Dish 5 1	2	3	4	Dish 6 1
12 Jul	1300	6.5717	3.3132	3.2902	3.0406	6.2110	3.2374	3.1626	3.1503	4.4143

Discarded

1100358

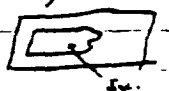
15 Jul 54

Whatman filter papers numbered in pencil from 1 to 24 were inserted in Industrial Hygiene's oven at about 0930.

Paul W Nichols (Oven setting - 28)

16 Jul 54

Effect of isertion of coated slides in impactors on Their weights



Weight prior to insertion: 4.4831 g

Sides of slide not wiped clean in wide enough strips — some "stickum" rubbed on slide mounts. Handled slide edge w/fingers.

Weight after insertion in impactor: 4.4827 g

" " Second similar insertion: 4.4825 g

" " Third " " : 4.4825 g (brass shaving fell on slide)

Fingered slide heavily - greasy prints obvious.

Weight after fingering: 4.4825 g.

Blew little dust from table top on slide: 4.4828 g

Change in wt. of "untouched" slides when not in oven.

Slide →	631	621	611
Date-Time	~~4.6~~		
16 Jul-1530	4.5444	4.7745	4.3856
21 Jul-1100	4.5435	4.7743	4.3849
21 Jul-1500	4.5435	4.7743	4.3848

Paul W Nichols

Invalid. Slides wiped at edges with xylene 20 Jul 54

Paul W Nichols

21 Jul 54

Rough determination of weight of particles deposited on Impactor Slides during typical run.

Four slides were coated and weighed, and then inserted in impactor. The impactor was exposed normally and the slides removed and reweighed. Stickum was wiped from edges of slide to avoid errors due to loss of stickum on slide mounts.

	Stage 1 Slide	2	3	4
Unexposed Wt.	4.5060 g.	~~3.0~~ 3.1109 g.	3.2330	3.1724
After exposure	4.5055	3.1110	3.2324	3.1726

Mean 7' wind speed - 8 mph Length of exposure 60 min

Impactor ht above ground - 8" On 1320 Off 1420

The slides were examined roughly to see if the density of particles ~~were~~ was suitable for counting. Slides for stages 1 and 2 could have had 3 time as much of a deposit and still have been countable. Slide 3 was half of ~~that~~ the mass which could have been tolerated. Slide 4 was O.K. — actually would have been better with fewer particles.

Conclusions: Gravimetric technique is valueless because we can't get enough to weigh and count at same time. The loss in weight noted after exposure could be explained by (1) the chipping of glass slides in insertion or removal from impactor, or (2) the evaporation or eroding of the stickum by the air blast.

Paul W. Nichols

22 Jul 54

Estimation of Mass of Particles Impacted on an Impactor Slide when Density is in Counting Range

Data used in the estimation are those of slides analyzed from run of 10 May 54.

Total Mass = (Volume)(ρ)

~~Individual particle size Mass~~ (Volume size x)(No. particles size x)(ρ) = Mass of particles of size x

ρ = 1.4 g/cc (by PWN rough measurement)

ρ = 2.5 g/cc (says Soil Science)

Volume (cc) per particle $\frac{4}{3}\pi$ (part. size in μ)^3 $(10^{-4})^3$		No. particles (Slide 2)	Total Volume	No. particles (Slide 1)	Total Volume
$(4.2 \times 10^{-12})(1.1)^3$ = (4.2) 1.3 (10^{-12})		$3.5 \times 10^{+3}$	1.9×10^{-8}		
" $(1.5)^3$ = " 3.4 x "		$4.8 \times 10^{+3}$	6.8×10^{-8}		
" $(2.2)^3$ = " 1.1 x 10 "		9.2 "	4.3×10^{-7}		
" $(3.1)^3$ = " 3.0 x 10 "		10.5 "	1.3×10^{-6}		
" (4.3) = " 8 x 10^1 "		19 "	6.4×10^{-6}	2.2×10^3	7.4×10^{-7}
" $(6.1)^3$ = " 2.3 x 10^2		15 "	1.4×10^{-5}	3.6 "	[illegible]
" $(8.6)^3$	6.5×10^2	7.5 "	2.0×10^{-5}	3.5 "	9.4×10^{-6}
" 12^3	1.7×10^3	4.8 "	3.4×10^{-5}	2.8 "	[illegible]
" 17^3	4.9×10^3	1.7 "	3.5×10^{-5}	3.4 "	[illegible]
" 24^3	1.4×10^4	7.4×10^2	4.3×10^{-5}	2.5 "	0.2 $1.5 \times 10^{-}$
" 35^3	4.3×10^4	7.4 "	1.3×10^{-4}	1.5 "	$2.7 \times$
" 49^3	1.2×10^5	3.7 "	1.9×10^{-4}	1.1 "	9.05 "
" 69^3	3.3×10^5		—	8.0×10^2	2.4 11 "
" 98^3	9.4×10^5	1.8×10^2	7.1×10^{-4}	6.2×10^1	0.6 24 "
" 138^3	2.6×10^6		≈	1.2×10^2	3.2 13 "
" 196^3	7.5×10^6		11.8×10^{-4} cc	6.2×10	4.6 19.5 "
			≈		13.1×10^{-4} cc
			0.00309	0.0140 g.	$54.9 \times$

1100360

Slide 3 would have a mass of particles deposited on the order of ~~0.0004~~ 0.0010 g.
Slide 4. - on the order of 0.00002 g

Conclusions:

Assuming first that the experiment performed and then written up at bottom of page 42 gives erroneous indications, the possibility of weighing deposits on the first two — and possibly the first three — slides exists. Grave doubts about the possibility of reducing "background weight changes to the degree where confidence can be assigned to results exist.

Paul W. Nichols

22 Jul 54

Could it be that the density of particles collected (see bottom page 42) is much less than the 2.5 used in computations directly preceding.

Paul W. Nichols

23 Jul 54

Weighing of Coated Impactor Slides.

All slides except those encircled were weighed on balance at right in 222U balance room. The cirled were weighed on the left balance (51194.)

Slide	211	221	231	311	321	331
Prior to exposure	6.1550 g.	6.2583	6.0902 g	6.4493	6.0734	6.1813
After "			6.0900			
Δ			-0.0002			
Slide	212	222	232*	312	322	332
Prior	3.0491	2.8084	2.9978	3.0761	3.0000	3.1069
After			~~2.9965~~ 2.9977			
Δ			~~0.0013~~			
Slide	213	223	233	313	323	333
Prior	2.9393	3.2116	3.2681	3.2235	3.1155	3.1585
After						
Δ						
Slide	411	421	431	511	521	531
Prior	5.2875	5.7284	5.7388	5.2285	4.4200	~~5.7388~~ 4.5661
After	Unexposed Wt 7 Sept 54 5.2870					
Δ	-0.0005					

* Slide mis numbered 231

1100361

26 Jul 54

Weight Determinations on Whatman 41 Filter Paper

This paper was inserted in oven on 15 Jul 54. Oven set at 28. Oven used was Industrial Hygiene's. Balance — Industrial Hygienes Lab Balance. Numbers pencilled on paper.

Date	1	2	3	4	5	8	9	10	11	12	23
26 Jul 54	0.8450g	.8301	.8390	.8218	.8380	.8461	.8428	.8531	.8442	.8446	.8440
28 Jul	.8347	.8172	.8297	.8118	.8254	.8354	.8382	.8444	.8471	.8381	.8343

Discarded

Date	13	14	15	16	17	18	19	20	21	22	24
26 Jul 54	.8414	.8463	.8393	.8262	.8200	.8423	.8300	.8434	.8410	.8532	.8195
28 Jul	.8303	.8346	.8328	.8140	.8115	7950*	.8241	.8340	.8328	.8417	.8044

Discarded

* Misread

Paul H Nichols

1100362

30 Jul 54

Anemometer Readings, Portable Mast, Field Test 1

Anemometer / Time	1506-1516	1518 - 1533	1535 - 1545
732 (A1)	Dist 243 ... 3.4 fps	390 - 3.6 fps	306 - 4.2 fps
733 (A2)	360 - 4.9	602 - 5.1	400 - 5.4
734 (A3)	375 - 5.3	697 - 6.4	429 - 5.9
738 (A4)	460 - 6.4	786 - 7.0	439 - 5.9

Paul M Stickels

13 Jul 54

Field Test 2 — Portable Mast

Equipment - Anemometers 732, 733, 734, 738
Vanes 1 — 4
Thermocouples 1, 2, 3, 4, 6
Soil Meter
Bulk Sampler 1-6
Impactors 1, 2, 3

Scanning Cycle

1 - Zero Ref.	6 - C_6	11 - Probes	16 - C_3	21 - V_1
2 - C_1	7 - V_1	12 - 50 Ref.	17 - C_4	22 - V_2
3 - C_2	8 - V_2	13 - Zero Re.	18 - C_6	23 - V_3
4 - C_3	9 - V_3	14 - C_1	19 - Soil Temp	24 - V_4
5 - C_4	10 - V_4	15 - C_2	20 - Soil Heat Flow	25 - Probes

Miscellaneous

No bucking or adding cmts to any signal
Booms at same height as ~~test~~ required in last column at bottom of page 38

Anemometers

On	Off	A_1 (732)	A_2 (733)	A_3 (734)	A_4 (738)
1642	1712	389	622	654	709
1713	1738	251	401	-	526

Bulk Sampler Vacuum — 20" H_2O
Impactor Vacuum — 25" Hg

"Slips" — Neglected to remove tape from intake impactors 1 & 2.
Mistire in starting anemometer 734 on second run.
Probes ceased to function halfway thru run.

Run was halted on sprinkle of rain and impending thunderstorm.

	Boom	Anemoms.	Vanes	TC's	Impactors	Bulk Samplers
Ground	1	732	1	1	211 212	1
	2	733	2	2	1 212 217	2
	3			3		3
	4	734	3	4	2 221-224	4
	5					5
	6	738	4	6	3 231-234	6

Paul W Nichols

19 Aug 54

Filter Papers in Oven (110 F.)

Exposed – 6 Unnumbered filters (see page 39, bottom) (See immed. below)

Unexposed – No's. 26 thru 40 inclusive.

Inserted 1400, 19 Aug 54.

PWNichols

Filter papers in Oven 27 Aug 54

The Six exposed filters described immediately above were transferred to Industrial Hygienes oven This date.

Paul W Nichols

#

7 Sep 54

Dry Filter Paper Weights (in oven 19 Aug 54) - Whatman 41 paper

Balance used – HEW 51194

Paper No.	37	36	40	39	38
Unexposed Dry Wt	0.8050 g	0.8148	0.8147	0.8163	0.7960
24 Sep Exposed Dry Wt.	.7964 .7912 .7913	.8126 .8126 .8117	.8160 .8148 .8110	0.8158 .8139 .8137	.7961 .7916 .7920
Δ	–.0086	–.0022	+.0013	–.0005	+.0001

Paper No	43
Unexposed	0.8459
24 Sep Exposed	.8490
Δ	+.0031

Numbers to right were weights as found on 28 Sep 54.

Rec wt. made on 7 Oct 54

.8281 – Charred

Paper No. | @ 160° – since 28 Sep.

Unexposed

Exposed

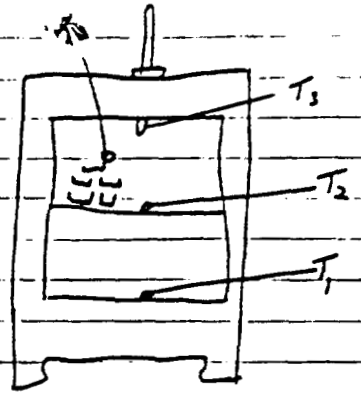
Δ

1100364

14 Sep 54

Temperature Gradient in Exp. Met. Oven

HEW 431675



T_1	T_2	T_3
135 C		90 C
	105 C	84 C
	105 C	87 C

Large Hole was plugged with stopper (and Thermometer). Small Hole unplugged. Twenty petri dishes on top shelf.

[signature]

14 Sep 54

Exposed Filter Papers 36, 37, 38, 39, 40 and 43 in oven.
Unexposed " #20 and under also in oven.

[signature]

15 Sep 54

Temp Gradient in Exp Met Oven

Three thermometers (mercury) in roughly the positions shown above. ~~The~~ T_3 taken by therm. inserted thru small hole. T_1 and T_2 taken on therms supported on wire stands ¼" above shelf level. Ventilation thru small crack in ~~sliding~~ adjustable hole at top.

Twenty petri dishes on top shelf - 4 on bottom.

Time	T_1	T_2	T_3	Remarks
0840		105 C	91 C	Oven on over previous note. (Small hole open - T_3 thru large hole)
0913	128 C	110	71	Conditions as described
0924	129	109	72	
0932				Asbestos sheet on bottom shelf.
0943	112	109	69	
1015	114	110	71	
1019				Adjusted for higher temp. On overnite
16 Sep 54 1005		120	78	
1014	113	121	77	
1042	115	121	78	
1043				Ventilation hole opened to position "A"
1124	117	123	78	

1100365

Time	T_1	T_2	T_3	Remarks
1128				Opened top vent as far as possible (w/screw in)
1133	112	118	74	113°C closed top vent till screw stopped closing.
1338	115	122	78	
1420	116	122	78	
1423				Oven off
1457				Dishes arranged 12 on bottom, 12 on top shelf. Oven on.
1543	145	115	72	Thermometer #1 now on top dishes on shelf.
12 Sep 54 1438	~~145~~ 75	115	75	Temperature called T_4
1445				All 24 dishes on top shelf.
1458				
1504	~~145~~	145	100	
1507				Four dishes placed on bottom shelf (blanks)
1513	93	130	94	
1521	94	136	96	
20 Sep 54				
0845	98	~~98~~ 139	99	
0870				Inserted larger asbestos sheet on bottom shelf, and removed 4 dishes.
0906	88	118	84	
0917	91	127	87	
21	96	129	93	Scoggins readings
Sep	96	130	93	
22 Sep 1105	95	128	91	
24 Sep 54	95	129	93	Paul Mitchell
28 Sep 54	89	105	89	
7 Oct 54	170	120	91	← T_1 T_2 & T_3 again

1100366

24 Sep 54

Filter Paper Weights

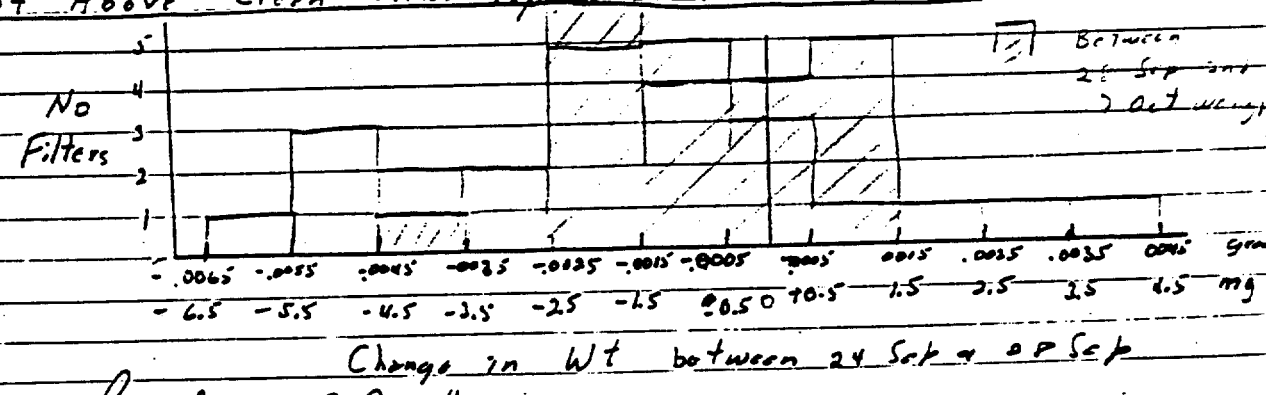
Balance - HEW 51194 — Paper in oven 14 Sep 54 (See p 48)

Paper No	18	20	12	17	16
Unexposed Dry Wt	0.8322 g	.8382 (.8399) (.8342)	.8363	.8153	.8155
28 Sep — ~~Exposed Dry Wt~~	.8323	.8365	.8346	.8102	.8188
7 Oct — Unexposed " "			.8154 *	.8115	.8189
△					
No.	14	13	8	4	3
Clean	.8351	.8338	.8393	.8131	.8323
Clean (28 Sep)	.8341	.8348	.8377	.8114	.8293
~~Exposed~~	.8370	.8341	.8381	.8129	[illegible]
△					
No	5	6	15 *	19	10
Clean	.8258	.8437	.8388	.8260	.8501
Clean (28 Sep)	.8253	.8402	.8329	.8222	.8451
~~Exposed~~	.8259	.8384	.8313	.8230	.8433
△					
No.	11	2	1		
Clean	.8479	.8221	.8358		
Clean (28 Sep)	.8469	.8211	.8333		
~~Exposed~~	.8452	.8196	.8323		
△					

* [illegible] appearance [illegible] 7 Oct.

28 Sep 54

Change in Wt Between 24 Sep 54 and 28 Sep 54 Weighings of Above Clean Filter Papers and Those on p. 47.



Paul W Rutkola

29 Sep 54

Cascade Impactors Exposed During Field Test 1 P — Fluorescent Pigment Seeded in Specified Location

Impactors were located as follows:

Auxiliary mast: Impactor 1, Height – 1 ft.
Main Mast: Impactor 4, Height – 1 ft.
" 5, Height – 10 ft.
" 6, Height – 41 ft.

100 x magnification used in examination of slide.

Date – 29 Sep 54 Exposure Time – 1143 to 1543

Stage	Impactor 1 Slide No	Particle Count	#4 Slide	Count	#5 Slide	Count	#6 Slide	Count
1	28	86	7	6*	17	4	25	4
2	169	183	166	13	163	11	170	2
3	168	60	165	2	162	4	171	0
4	167	37	164	1	161	0	172	1
Total count		366		22		19		7

Slide 7 – One opaque 70 micron particle with at least 5 small particles attach. Green – Count made during size analysis.

Pressures are small that flow is in critical range for orifices used.

Part/ft³ – 2.46 0.15 0.13 0.049 ~~0.016~~

Date – 30 Sep 54 Exposure – 1025 to 1525

Stage	Impactor 1 Slide	Count	#4 Slide	Count	#5 Slide	Count	#6 Slide	Count
1	87	21	84	5	27	0	23	0
2	238	58	225	7	201	2	206	1
3	222	7	252	0	198	1	255	1
4	245	6	177	1	224	0	209	1
Total		92		13		3		3

Red circle indicate blocks [illegible] of [illegible]

Part/ft³ 0.49 ~~0.040~~ 0.072 0.016 0.017

Date 1 Oct 54 Exposure – 0950 to 1500 6 ½ hr

Stage	Impactor 1 Slide	Count	#4 Slide	Count	#5 Slide	Count	#6 Slide	Count
1	24	3	21	1	26	0	–	3
2	227	8	235	0	193	0	254	0
3	189	0	101	1	112	0	150	0
4	263	0	205	0	291	0	249	0
Total		11		2		0		3

First stage – fiberous black material. Fourth stage – Black in appearance. 26 & other – particles with glow around [illegible] Seem to be dissol[illegible] and the fluid flo[illegible] oscil[illegible]

All stages have black fiberous material Thoron. Fourth stage is a solid mass of black.

Part/ft³ 0.044 0.0083 0 0.0124

1100368

1 Oct 54

Recalibration of Hastings Hot Wire Probes

Purpose: Since adjustment of the "calibration adjust" on the mast hot wire system does not simultaneously put all probes into the proper calibration, it was decided to ~~recalibrate~~ set the calibrating current correctly for probe number one, and then recalibrate the other probes for whatever calibrating current occurred for these probes.

Procedure:

Flow was adjusted by means of the gate valve downstream of the bulk sampling device. Then, without touching the valve, the probe output was measured ~~for~~ with (1) the particular calibration ~~signal~~ setting for the probe used, and (2) with the prescribed (by Hastings) calibration setting for that probe. Thus, for a given flow the outputs could be compared and a flow assigned to the "newly" calibrated probe.

It was ~~fis~~ first necessary to determine if the calibration signals would repeat as the stepping cycle was repeated.

Data:

Recorder and Hot wire system warmed up for longer than ½ hour.

Calibration signals:

Probe	1	2	3	4	5	6	Blank
	74.5	76.5	74.7	76.8	75.3	61.1	
	74.3	76.6	74.6	76.8	75.4	61.1	8.8
	75.1	77.0	75.0	77.0	75.9	61.3	
	74.6	76.9	74.9	76.9	75.7	61.1	8.8
	74.7	76.8	74.8	76.9	75.3	60.9	
Deduced ~~Accepted~~ calibration signals →	74.5	76.7	74.7	76.8	75.5	61.1	8.8
	74.5	76.6	74.7	76.8	75.3	61.0	

Comparison of outputs:

Erred in setting calibration signal. Should be 7.

Probe	1		2			3			4			5			6		
Calib. set	74.5	Flow Speed	74.5	76.6	Speed	74.5	74.7	Speed	74.5	76.8	Speed	74.5	75.4	Speed	81	61	Speed
			2.64 mv	1.37 mv	[illegible]	1.86	1.82		2.82	1.48		1.55	0.95	560	0.18	>6.00	
No +			1.96	0.80	686	Not enough change. Use original calibration curve.			1.76	0.50	639	1.04	0.52	451			
			1.72	0.52	613				1.06	-0.27	471	2.03	1.54	711			
Necessary			1.20	-0.02	478				1.42	0.23	549	0.55	0.03	371			
			0.68	-0.62	387				0.54	-0.76	378	0.22	-0.40	327			

Paul W Bichola

1100369 [redacted]

Result:

Closer examination of the data shows that the change in output is about -0.60 mv per meter unit (calibration meter). Thus the calibration curves should be displaced 0.60 mv per meter unit difference between Hastings specified and actual calibration meter reading. Concluded as follows:

Probe 2			Probe 4			Probe –		
Setting 74.5	76.6	Δ	74.5	76.8	Δ	74.5	75.4	Δ
2.64 mv	1.37	1.27 mv	2.82	1.48	1.34	1.55	0.95	0.60
1.96	0.80	1.16	1.76	0.50	1.26	1.04	0.52	.52
1.72	0.52	1.20	1.06	-0.27	1.33	2.03	1.54	.49
1.20	-0.02	1.22	1.42	0.23	1.19	0.55	0.03	.52
0.68	-0.62	1.30	0.54	-0.76	1.30	0.22	-0.40	.62
Mean —		1.23 mv			1.284			0.55

Δ mv/Δ calibration set = 1.23/2.1 — 1.284/2.3 — 0.55/0.9

mv/cal. set. unit = 0.54 — 0.59 — 0.61

Mean = -0.60 mv/cal. set. unit (The negative sign indicates increased output with decreased calibration set.)

Paul H. Nickola

4 Oct 54

Cascade Impactors Exposed During FT 1 P (cont'd from p51)

Date - 4 Oct 54 — Exposure 4, 5, 6 On ~~0840~~ 0840 off - 1240; On 0840 off - 1200

Imp.	1		4		5		6		Pump on Impactor 1 stopped at about 1200.
Stage	Slide	Count	Slide	Count	Slide	Count	Slide	Count	
1	15	0	14	0	22	1	9	0	
2	160	5	278	0	255	0	179	0	
3	279	2	215	0	109	0	173	0	
4	197	0	259	0	246	0	260	0	
Total -		7		0		1		0	
Part/ft³ -		0.056		0		0.0068		0	

5 Oct 54 — Exposure - On 0915 Off 1545

Imp.	1		4		5		6		Black fourth stage deposits again.
Stage	Slide	Count	Slide	Count	Slide	Count	Slide	Count	
1	4	2	12	1	3	0	8	0	
2	192	2	204	1	221	0	218	0	
3	107	0	182	0	213	0	216	0	
4	207	0	229	0	234	0	187	0	◯ = Black appearing deposit
Total		4		2		0		0	
Part/ft³		.018		.0092		0		0	

P. H. Nickola

1100370 [redacted]

7 Oct 54 — Exposure On 0930 Off 1515 — Δt = 5.75

Stage	Slide No.	Count	Slide	Count	Slide	Count	Slide	Count
	1		4		5		6	
1	10	4	35	0	5	1	42	0
2	181	2	200	0	254	0	195	0
3	175	1	274	0	212	0	268	0
4	214	0	239	1	276	0	242	0
Total	-	7		1		1		0
Part./ft3	-	0.033		0.0048		0.0048		0

○ - blanks appearing deposit

Date - 8 Oct 54 — Exposure On 0840 Off - 1530 Δt = 6.8

1	43	0	82	0	85	0	86	0
2	290	0	228	0	178	0	241	0
3	285	0	266	0	196	0	211	0
4	280	0	230	0	190	0	237	0
Σ		0		0		0		0
P/ft3		0		0		0		0

Date 11 Oct 54 — On - 0855 Off 1205 — Δt = 3.17

1	19	3	46	0	33	0	18	1
2	261	1	157	0	154	0	150	0
3	159	0	156	0	153	0	149	0
4	158	0	155	1	151	0	147	0
Σ		4		1		0		1
P/ft3		0.034		0.0088		0		0.0088

Date 12 Oct 54 — On 0830 Off 1530 — Δt = 7.0 hr

1	60	0	59	3	29	0	58	0
2	136	0	140	0	148	1	143	0
3	138	0	141	0	146	0	142	0
4	137	0	139	0	145	0	144	0
Σ		0		3		1		0
P/ft3		0		0.012		0.0039		0

Date 13 Oct 54 — On 0920 Off - 1450 — Δt = 5.50

1	61	0	62	1	64	1	63	0
2	210	0	220	0	256	0	253	0
3	225	0	194	0	231	0	273	0
4	205	0	251	0	195	0	214	0
Σ		0		1		1		0
Part./ft3		0		0.0050		0.0050		0

1100371

Filter Paper Weighings

7 Oct 54

Clean filter papers 44 – 59 inclusive in Exp Met oven. All on top shelf. Temp at oven top about 93 C.

Filters 1, 3, 5, 6, 11, 14, 36 and 39 (previously dried and weighed) inserted in oven after being clamped in filter holder but not exposed in field. Purpose is to determine wt. change introduced by inserting filters in holders.

One-room weight Reading	44	45 (Fractured)	46	47	48	49	DATES	
							7 Oct 54	In oven
	.8427	.8615	.8318	.8273	.8104	[illegible]	20 Oct 54	Dry wt.
0.9998	.8427	.8599	.8313	.8253	.8086	.8182	25 Oct 54	[illegible]
0.9998	.8413	.8614	.8309	.8246	.8084	.8160	28 Oct 54	Out of oven
1.0003	.8420 *	.8599	.8315	.8231	.8089	.8162	2 Nov - In out of holders; in oven	
0.9999	.8405	.8610	.8322	.8240	.8091	.8160	15 Nov	
1.0000	.8410	.8589	.8296	.8236	.8102	.8159	19 Nov	
							23 Nov	

	50	51	52	53	54	55		
							7 Oct	In oven
	.8141	.8142	.8153	.8009	.7870	.7999	20 Oct	Filing
	.8133	.8146	.8173	.8022	.7835	.8020	2[illegible] Oct	2nd -
	.8132	.8141	.8155	.8024	.7819	.8014	28 Oct	3rd -
	.8117	.8128	.8179	.8018	.7843	.8044	2 Nov 54 See above	
	.8122	.8133	.8177	.8019	.7824	.8015	15 Nov	
	.8119	.8142	.8177	.8020	.7864	.8016	19 Nov	
							23 Nov	

	56	57	58	59			
						7 Oct	In oven
	.7982	[illegible]	[illegible]	.8150		20 Oct	Filing
	.7962	.8130	.8041	.8146		2[illegible] Oct	2nd ..
	.7957 *	.8143 *	.8031	.8145		28 Oct	3rd -
	[illegible]	.8167	[illegible]	.8149		2 Nov 54 - See above	
	.7973	.8156	[illegible]	.8141		15 Nov	
	.7967	.8142	.8033	.8142		19 Nov	
						23 Nov	

Nos. 52 – 59 never in holders. Nos. 44 – 51 in-out holders 2 Nov 54

See page 62 for analysis of weighings on #44 to #59.

	1	3	5	6	11	14		
							In oven	14 Se[illegible]
from p 50	.8358	.8323	.8258	.8437	.8479	.8131	Dry wt	24 Se[illegible]
	.8333	.8293	.8253	.8402	.8464	.8114	" "	28 Se[illegible]
	.8323	.8282	.8259	.8384	.8452	.8129	" "	7 Oc[illegible]
	.8316	.8267	.8240	.8357	.8410	.8356	In oven after clamped in filter holder	8 Oc[illegible]

Note: A brass shaving off filter holder 1/4" long weighed 0.0003 g.

	36	39		
			In oven	19 A[illegible]
Hdr	.8126	.8158	Dry wt	24 S[illegible]
	.8126	.8139	" "	28 [illegible]
	.8117	.8137	" "	7 O[illegible]
	.8101	.8114	" "	20 O[illegible]

Filter No. 14 on 28 Oct 54 had no apparent dirt or brass filings.

21 Oct 54 Mean difference between 7 Oct 54 and 20 Oct 54 weighings was −2.1 mg (#14 excluded) σ = 1.1 mg

For papers on page 47 – 50, the mean difference between 28 Oct and 7 Oct weighings was −0.7 mg. σ = 1.3 mg. [illegible]

* Out of oven since 28 Oct 54 – wts. follows on 2 Nov 54.

44 – .8824 41.1 57 – .8583

46 – .8756 44.7 56 – .8375

1100372

25 Oct 54

Size Distribution of Flourescent Pigment Particles (2210) Collected by Cascade Impactor during Field Test 1P.

~~Counts~~ Sizings were made using 430 X magnification except for slide 1 when 100 X magnification was used. Only particles visible under 100 X magnification were sized. Where it was believed that an agglomerate or group of particles were the result of one shattered particle, the size of the parent was estimated, and that only sized and counted

Particle Size	Slide 1		Slide 2		Slide 3		Slide 4		Total Count	Total Agglom.	%
	Count	Agglom.	Count including agglom.		Count	Agg	Count	Agg.			
1.1 μ			21		4		17		42		9.8
1.5			29		13		13		55		12.9
2.2	2		46	2	23		16		87	2	20.4
3.1	3		47	1	12		3		65	1	15.3
4.3	33	1	43	5	9		3	1	88	7	20.7
6.1	18	1	21	1	2		1		42	2	9.8
8.6	15	2	13	3	1		2		31	5	7.3
12.2	10		2				1		13	00	3.1
17.3	2	1							2	1	0.5
24	1	1							1	1	0.2
	84	6	222	12	64		56	1	426	~~14~~ 9	100.0

Paul W Nichols

28 Oct 54

Size Distribution of Particles of Top ¼ inch of Soil Surface.

Soil samples were collected by means of a flat bottomed scoop. An attempt was made (unless otherwise noted) to collect only the top ¼ inch of the soil.

Samples (by can number in which they were weighed):

3 1. Between pibal shed and solvent storage – bare ground.

1 2. " 42' mast and pump cabinet – " "

1 20. 15' NW of portable mast – cheat grass generally covers area.

1 4. 100' NW " " " – " " and "burr bushes"

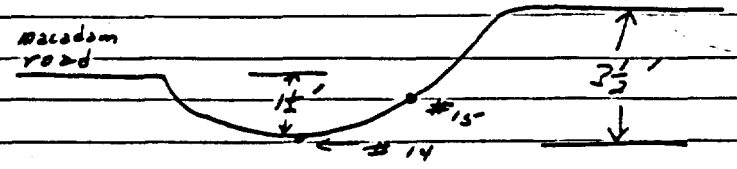
2 5. Near field position H-7 – ~~Amidst sage, etc but 6 ft² clear spot~~ A 6 ft diameter clear spot amidst sage & other vegetation.

6. Near H-7 – Amidst cheat grass

1 19. " H-7 – Relatively unvegetated area 1 ft from sage and 2 inches from thick cheat grass.

1100373

8. Fld position AA 10 — Clear spot amidst sage, etc. — First ¼"
9. " " " — " " " " " — Next ½" depth.
10. From seeded pigment source (Field Test 2 P)
11. Bladed area SE of redox — outside 200 W fence.
12. Outside T exclusion area — bladed surface — 20 ft from road — SE of T stack.
13. At 200 W fence due west of 234-5 bldg — natural surface — bare spot amidst cheat, sparse sage.
14. In ditch along road in area of drifting sand — due west of 202 S bldg at 200 W fence.
15. Two feet from #14 on side of ditch



16. Bladed area 200 ft west of redox badge house — outside exclusion area by fence.
17. 15' from old soil science bldg in U area.
18. Same as #17

Weight Determinations:

0.98 = Wt of Paper on Torsion Balance (0.955 on lab balance for #2 — 60 Thru cup)

Sample No →		2				1				20				4			
Size Range	Nomenclature	Total Wt, g	Net	%		Σ Wt	Net	%		Σ Wt	Net	%		Σ Wt	Net	%	
>1000 μ	1	15.70	14.72	18.7	X	25.94	24.96	31.2	X	8.51	7.53	12.4	X	11.43	10.95	22.2	X
1000-500	½	7.36	6.38	8.1	10.0	17.38	16.40	20.5	29.8	4.02	3.04	5.0	5.7	4.14	3.16	6.7	8.7
500-250	60	6.303	5.34	6.8	8.3	6.80	5.82	7.3	10.6	4.56	3.58	5.9	6.8	3.68	2.70	5.8	7.4
250-105	140	19.449	18.49	23.5	28.8	13.43	12.45	15.6	22.7	18.25	17.27	28.5	32.6	10.92	9.94	21.2	27.2
105-50	300	31.182	30.23	38.4	47.2	18.09	17.11	21.4	31.1	27.28	26.30	43.4	49.7	18.85	17.87	38.1	49.0
<50	Cup	4.607	3.65	4.6	5.7	4.28	3.30	4.1	6.0	3.78	2.80	4.6	5.3	3.74	2.76	5.9	7.6
Total Sample wt		[illegible]	78.81	100.1	[illegible]	52.08	80.04	100.1	100.2	52.99	60.52	99.8	100.1	36.43	46.88	99.9	99.9

Wt excluding particles >1000 μ

		5				6		19				8			
>1000	1	15.81	14.83	18.1	X	Spilled		6.41	5.43	9.4	X	15.28	14.30	19.0	X
500-1000	½	11.98	11.00	13.4	16.3			6.73	5.75	10.0	11.0	17.54	16.56	22.0	27.2
250-500	60	7.86	6.88	8.4	10.2			4.86	3.88	6.8	7.4	9.64	8.66	11.5	14.2
105-250	140	20.22	19.24	23.5	28.5			16.90	15.92	27.7	30.6	14.93	13.95	18.6	22.4
50-105	300	27.77	26.79	32.7	39.6			25.11	24.13	42.0	46.3	19.57	18.59	24.7	30.5
<50	Cup	4.45	3.47	4.2	5.1			3.45	2.47	4.3	4.7	4.15	3.17	4.2	5.2
		67.38	82.21	100.3	99.7			52.15	57.58	100.2	100.0	60.93	75.23	100.0	100.0

Drying period => 4 days at 105 C. Then stored in dessicator.
All material agitated in cascade of sieves for 5 minutes before weighing.
Agitator — Ro-tap in soil science lab.

1100374

Sample No →		9				10				11				12			
Size Range	Nomenclature	Σ wt (g)	Net	%		Σ wt	Net	%		Σ wt	Net	%		Σ wt	Net	%	
>1000μ	1	7.77	6.75	10.0	X	17.04	16.06	20.1	X	7.43	6.45	8.0	X	7.35	6.37	9.6	X
500-1000	½	14.49	13.51	20.0	22.2	15.10	14.12	18.2	22.9	29.60	28.62	35.5	38.6	13.02	12.04	18.1	20.0
250-500	60	8.71	7.73	11.4	12.7	8.39	7.41	9.6	12.0	13.52	12.54	15.5	16.9	6.65	5.67	8.5	9.4
105-250	140	16.02	15.04	22.3	24.7	20.92	19.94	25.7	32.3	19.62	18.64	23.1	25.2	17.23	16.25	23.4	27.0
50-105	300	22.21	21.23	31.4	34.8	19.32	18.34	23.7	29.7	13.37	12.39	15.4	16.7	24.74	23.76	35.6	39.4
<50μ	Cup	4.29	3.31	4.9	5.4	2.91	1.93	2.5	3.1	2.81	1.83	2.3	2.5	3.52	2.54	3.8	4.2
		60.82	67.57	100.0	99.8	61.74	77.80	99.7	100.0	74.02	80.47	99.8	99.9	60.26	66.63	100.0	100.0

Wt excluding >1000 etc

		13				14				15				16			
>1000	1	2.19	1.21	1.8	X	9.37	8.39	10.7	X	3.10	2.12	3.0	X	16.98	16.00	22.6	X
500-1000	½	8.43	7.45	11.2	11.4	26.17	25.19	32.2	36.0	6.98	6.00	8.5	8.8	17.19	16.21	22.9	29.5
250-500	60	8.85	7.87	11.9	12.0	12.45	11.47	14.7	16.4	9.09	8.11	11.4	11.8	9.17	8.19	11.5	14.9
105-250	140	24.45	23.47	35.4	35.9	25.23	24.25	31.0	34.7	38.99	38.01	53.6	55.5	16.22	15.24	21.5	27.7
50-105	300	25.24	24.26	36.6	37.1	9.43	8.45	10.8	12.1	16.53	15.55	21.9	22.7	11.95	10.97	15.5	20.0
<50	Cup	3.09	2.11	3.2	3.2	1.60	0.62	0.8	0.9	1.93	0.95	1.3	1.4	5.30	4.32	6.1	7.9
		65.16	66.37	100.1	99.8	69.98	78.37	100.2	100.7	68.62	70.74	99.7	100.2	54.93	70.93	100.1	100.0

No large stones even in >1000μ

		17				18			
>1000	1	3.96	2.98	5.6	X	3.90	2.92	4.6	X
500-1000	½	6.16	5.18	9.8	10.4	8.47	7.49	11.9	12.5
250-500	60	5.56	4.58	8.7	9.2	7.55	6.57	10.4	11.0
105-250	140	19.03	18.05	34.1	36.3	23.78	22.80	36.2	38.1
50-105	300	19.26	18.28	34.5	36.7	20.29	19.31	30.7	32.2
<50	Cup	4.76	3.78	7.1	7.6	4.81	3.83	6.1	6.4
		49.87	52.85	99.8	100.2	60.00	62.92	99.9	100.2

Much vegetable matter in >1000

Paul W [illegible]

Field Test PPU 2 – Cascade Impactors – Flow Rates, Slide Numbers, Particle Counts

Check of Flow Thru Impactors:

15 Nov 54

Impactor #	Pump	Flowmeter #4 Left	Right	Δ	Flow
1	30	2.3	2.5	4.8	0.77 cfm
2	24	2.0	2.2	4.2	.72
3	27	1.9	2.1	4.0	.70
4 4	8 8	2.2 2.3	2.4 2.5	4.6 4.8	.75 .77
5	~~15~~ On	2.0	2.2	4.2	.72
6	~~25~~	1.5	1.7	3.2	.63
1426	~~6~~	2.2	2.4	4.6	.75

Date – 22 Nov 54 Time on = off = Δt =

Impactor	1 ✓		2 ✓		3 ✓		4 ✓		5 ✓		6 ✓		1426 ✓	
Stage ↓	Slide	Count	Slide	Count	Slide	Count	Slide	Count	Slide	Count	Slide	Count	Slide	Count
1	3	2	5	6 C1	7	0	8	6	9	E 50	10	1	12	2
2	175	0	112	5	164	0	163	0	268	272	139	1	156	7
3	218	1	204	2	273	0	227	0 F1	209	256 C1	224	0	266 F2	2
4	241	3	229	0	136	0	256	0	211	*63	258	1	157	0
Total	[illegible]	6	[illegible] C1	13	[illegible]	0	[illegible] F1	6	[illegible] C1	641	[illegible]	3	[illegible] F2	11
Part/ft³	0.05		0.12		0		0.07		3.96		0.02 †		0.10 †	

22 Nov 54

~~On~~

~~Off~~

Location	Impactor	On	Off
C-2-12	1	[illegible]	1545
F-2-12	2	[illegible]	"
S-2-12	3	[illegible]	"
R-2-12	4	[illegible]	"

4 ✓	
4	3
230	1
141	0
142	0
[illegible]	4
0.05	

Date – 23 Nov 54

Time on – 1100

Time off – 1445

Locations	Impactor	Remarks
C-10-2	4	Dead wh[illegible] picked [illegible]
F-10-2	5	–
S-10-2	5	–
R-10-2	1426	– Weak wh[illegible] picked [illegible]

† Approximations due to uncertainty of operating time.

C = Bl[illegible] [illegible]

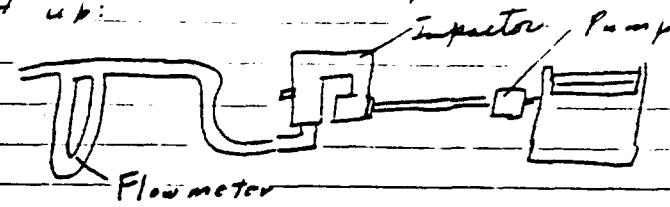
F = [illegible] typical number of forces [illegible] slide.

*Of the 63 particles visible at 100 x magnification (sizes 0.4 to 8.6 μ) only 36 were discernable at a reasonable scanning rate with the 32x magnification train

(continued middle of page 60)

26 Nov 54 - Flow Thru Pump - Impactors.

Set up:



Hold finger over regular impactor intake orifice during flow check.

Pump No.	L	R	Δ	cfm
25	1.5	2.7	4.2	.72
24	1.7	2.9	4.6	.75
27	1.3	2.5	3.8	.68
30	2.0	3.2	5.2	.80

PPU 2 - Particle Counts on Impactor Samples (cont'd from p 59)

Pump + Impactor No.	27-4		24-3		6		25-2		30-5	
Date -	27 Nov 54		27 Nov 54		28 Nov 54		27 Nov		27 Nov	
Time on -	0915		0935		0850		0935		0915	
" off -	1445		1447		1552		1447		1445 Pump Low	
Course Location	C-4-8		R-4-8		S-2-2		R-4-2		C-4-2	
~~Stage~~	Slide No.	Count	Slide	Count	Slide	Count	Slide	Count	Slide	Count
Stage 1	21	1 F1	14	1	22	5 F1	15	2	16	2
" 2	109	2	155	0	138	14 *	221	1	223	4
" 3	7	0 F1	263	0	194	1	185	slide in backwards 5	135	2
" 4	165	3	106	2	212	0	200	2 F1	34	2
Total Count	F2 6		3		F1 20		F1 10		F3 10	
Part/ft³	0.03		0.01		0.09		0.04		0.06 #	

○ = Black deposit on slide

* Most particles within 2 mm length of deposit.

\# Approximations due to weak pump

Impactor No.	1426		5							
Date	28 Nov		28 Nov 54							
Time on	~~276~~ 0905		~~0850~~ 0905							
" off	1556		~~1552~~ 1556							
Course Location	C-2-2		C-5-2 - Edge of source							
St	Slide	Count	Slide	Count	Slide	Count	Slide	Count	Slide	Count
Stage 1	17	4 F2	20	26 F3						
" 2	276	8 F11	193	37 F3						
" 3	105	2 F2	234	18 F7						
" 4	[illegible]	1	219	0 F1						
	F16 15		S2 F14 81							
	0.05		0.27							

Pump - Impactor No												
Date												
On												
Off												
Course Location												
////	Slide	Count	Slide	Count	Slide	Count	Slide					
Stage 1												
" 2												
" 3												
" 4												

Pump - Imp. No												
Date												
On												
Off												
Course Location												
////												
Stage 1												
" 2												
" 3												
" 4												

Pump - Imp No.												
Date												
On												
Off.												
Course Location												
////												
Stage 1												
" 2												
" 3												
" 4												

28 Nov 54 — Flow Thru Impactors exposed 20 Nov 54

Impactor No.	L.	R.	Δ	Cfm
1426	+1.6	2.4	4.0	.70
5	-1.8	2.6	4.4	.73
6	0.7	1.5	2.2	.53

Paul W Nichols

2 Dec 54

Effect on Bulk Sampler Filter Weights of Inserting Filters in Filter Holders.

Procedure: ~~Eight~~ Sixteen bulk sampler filter papers (Whatman #1) were dried and weighed in the following manner: In oven 13 days; weighed; in oven 5 days more; weighed; in oven 3 more days; final dry weight.

The filter papers were then exposed to room atmosphere for 5 days. Then 8 of them were inserted in bulk sampler filter holders and removed after about 5 minutes. All sixteen filters were then reinserted in the oven and dried in the same manner as described in the preceeding paragraph. This ~~[illegible]~~ gave 8 controls and 8 filters for checking the wt change due to insertion in the filter holders.

The difference in weight between that noted after the first 18 day drying period and after the second 18 day period ~~were~~ was noted for each paper. A mean and a ~~also~~ σ for the controls and for the mounted filters were computed.

Data:

Data on weighings on page 55.

~~Papers in filter holders:~~

wt change between first & second drying for mounted filters = X ~~[illegible]~~ mg wt change for controls = Y

Paper No.	X	$\lvert\bar{x}-x\rvert$	$(\bar{x}-x)^2$	Paper No.	Y	$\lvert\bar{y}-y\rvert$	$(\bar{y}-y)^2$
44	0.3 mg	0.275	.08	52	-2.2 mg	1.775	3.15
45	2.5	1.925	3.71	53	0.4	.825	.68
46	1.3	0.725	.53	54	-0.6	.175	.03
47	1.0	.425	.18	55	-0.2	.225	.05
48	-1.8	2.375	5.64	56	-1.0	.575	.33
49	0.1	.475	.23	57	0.1	.525	.28
50	1.3	.275	.08	58	-0.2	.225	.05
51	-0.1	.675	.46	59	0.3	.725	.52
Total =	4.6		10.91		-3.4		5.09

$\bar{x} = 0.575$ $\bar{y} = -.425$

~~$\sigma_x = \sqrt{\frac{10.91}{7}} = \sqrt{\frac{3.2}{7}} = 0.6$ mg~~ ~~$\sigma_y = \sqrt{\frac{5.09}{7}} = \sqrt{\frac{2.3}{7}} = 0.13$ mg~~

$\sigma_x = \sqrt{\frac{10.91}{7}} = \sqrt{1.56} = 1.25$ mg $\sigma_y = \sqrt{\frac{5.09}{7}} = \sqrt{.727} = 0.87$ mg

Conclusions.

Considering the mass of particles which should be picked up (per F. Adley - Dec 50) per hour at the flow rates employed with

the ~~impactors~~ bulk samplers, the errors introduced due to either the filter holder or loss of wt. on second drying are small. For example:

Flow thru the ~~impactors~~ bulk samplers is on the order of 13 cfm. Assuming a flow of 10 cfm, the following mass of particle should be picked up per hour:

Wind Speed	Mg/hr at 10 cfm
0-6 mph	16 mg
8	32
10	75
12	150
14	280
16	480
18	800
19	1040

The T test specifies that a confidence level of 95% can be attached to the statement that the error introduced by the insertion of a filter paper and a holder and redrying is 0.6 ± 4.0 mg.

Example:

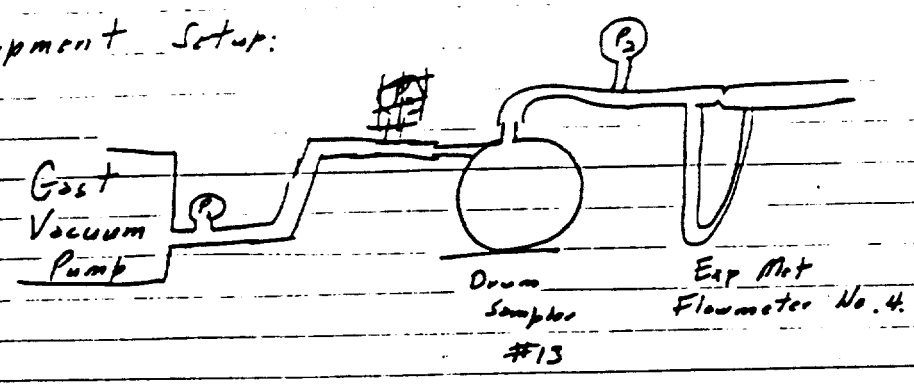
Wt of unexposed dry filter	-	0.8250 g
Wt of filter after exposure	-	0.9810 g
Exposure	Δ	0.1560 g
Correction	———	.0006 g
Wt of collected particles		0.1554 ± 0.0040 g

Actually the correction is so small compared to the predicted mass of particles to be collected that it could well be ignored for the matter of expediency in computation.

Paul H. Pickett

10 Dec 54 - Drum Sampler — Flow Rate Tests

Equipment Setup:

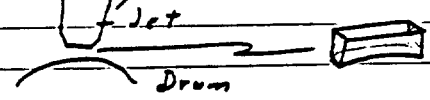


Data:

	P_1	P_2	Flowmeter L.	Flowmeter R.	Δ	Remarks
1.	-5" H_2O	~~[illegible]~~	1.4	-0.4	1.8	On Trico-Vac pump. Jet 0.5 mm from drum. (Normal)
2.	-27" Hg	$5\frac{1}{4}$" H_2O	1.4	-0.5	1.9	Jet about 0.5 mm from drum
3.	-27" Hg	$12\frac{1}{3}$"	3.0	-2.0	5.0	Jet moved away from drum — maximum flow obtainable.
4.	—	—	0.5	0.5	0	Jet on drum.

Conclusions: 1. There is a pronounced effect of jet position (with respect to drum) on flow rate.

2. Flow with a normal jet setting (< ½ mm from drum) is controlled mainly by the effective area between jet and drum. This flow is close to critical.



3. Critical flow as controlled by jet opening is found when jet is moved further from drum.

4. Until further investigation the difference between the ~~error in~~ flow indicated by the flowmeter and the increased flow when the flowmeter is removed is not known.

Further data:

Measurement of P_1 with a U-Tygon tube filled with water, it was found that a Trico-pump pulled a vacuum of 5 ft of water under conditions (1) in above data.

Paul N. Nichols

15 Dec 54

Field Test PPU2 – Size Analysis of Fluorescent Particles Collected on Cascade Impactors

Purpose: To determine size distribution of airborne particles of pigments 2200 (blue-white on courses C & R), 2210 (green on course F) and 2525 (yellow on course S), during Field Test PPU2. Further data on pages 59 - 61.

Course Location	C-12-2					F-12-2					S-12-2					R-12-2					C-4-8				
Date	22 Nov 54					22 Nov					22 Nov					22 Nov					27 Nov				
Period of Operation	1310 - 1545					1320 - 1545					1340 - 1545					1350 - 1545					0915 - 1445				
Impactor Stage No.	1	2	3	4	$T_{0\frac{1}{2}}$	1	2	3	4	Σ	1	2	3	4	Σ	1	2	3	4	Σ	1	2	3	4	Σ
Slide No.	3	175	218	241	$\frac{1}{2}$	5	112	204	229		7	164	273	136		8	163	237	256		21	109	7	165	
Diameter, μ 1.1																									
1.5																								1	1
2.2							1	1		2															
3.1						1	2			3						1				1					
4.3						1	1	1		3						1				1	F1		F1		F2
6.1	1			1	2	1				1						1				1		1			1
8.6	1				1	1	1			2								F1				1			1
12				1	1	2				2						3				3				1	1
17				1	1																1			1	2
24																									
36			1		1																				
Totals	2	0	1	3	6	6	5	2	0	13	0	0	0	0	0	6	0	F1 0	0	6	F1 1	2	0 F1	3	6
Particles/ft3	0.05					0.12					0*					0.07					0.03				

Location on Course	C-10-2					F-10-2					S-10-2					R-10-2					R-4-8				
Date	23 Nov					23 Nov					23 Nov					23 Nov					27 Nov				
Period of Operation	1100 - 1445 Pump Dead					1100 - 1445					1100 - 1445					1100 - 1445 Pump weak					0935 - 1447				
Impactor Stage No.	1	2	3	4	$T_{0\frac{1}{2}}$	1	2	3	4	$T_{0\frac{1}{2}}$	1	2	3	4	$T_{0\frac{1}{2}}$	1	2	3	4	$T_{0\frac{1}{2}}$	1	2	3	4	Σ
Slide No.	4	230	148	142	$\frac{1}{2}$	9	268	209	211	$\frac{1}{2}$	10	139	224	258	$\frac{1}{2}$	12	156	246	157	$\frac{1}{2}$	14	155	263	106	
Diameter, μ 1.1							19	15	4	38															
1.5						-	32	46	5	83															
2.2						6	54	54	14	128															
3.1						3	49	45	12	109								F2							
4.3	1			1		10	51	42	19	122							1			1					
6.1						10	31	34	6	81			1	1			2	1		3				1	1
8.6	2			2		9	24	13	3	49							3	1		4					
12						9	5	5		19	1	1			2		1			1				1	1
17		1		1		2	7	2		11						1				1	1				1
24						1				1						1				1					
Totals	3	1	0	0	4	50	272	256	63	641	1	1	0	1	3	2	7	F2 2	0	11	1	0	0	2	3
Particles/ft3	0.05					3.96					0.02					0.10					0.01				

1100382

* Approximation due to weak pump when picked up.

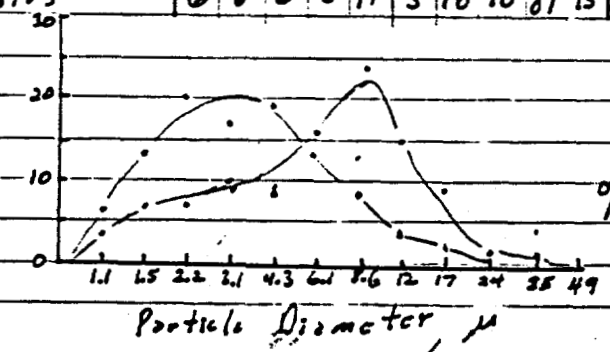
Location on Course	C-4-2					R-4-2					C-2-5 (Edge of course)					C-2-2					S-2-2				
Date	27 Nov					27 Nov					28 Nov					28 Nov					28 Nov				
Period of Operation	0915-1445					0935-1447					~~0930-1552~~ 0905-1556					0405-1556					~~[illegible]~~				
Impactor Stage	1 ~~1445~~ (Pump Low)					1	2	3	4		1	2	3	4		1	2	3	4		1	2	3	4	
Slide No	16	22	31	38	34	15	22	18	20	Σ	20	19	23	29	Σ	17	27	10	14	Σ	22	13	14	21	Σ
Diameter, μ 1.1													3	F1	3		1			1					
1.5		2			2			2		2		1	4		5		F3								
2.2								3	1	4		F2 2	F3 4		6		F1								
3.1		F1		1	1				F1 1	1		S1 8	F2 3		11	F1	F4 1	F1		1		2	X		2
4.3			F1								F1 1	F1 6	F2 1		8		F1 1			1	R1	1	1		2
6.1			F1				1			1	S1 5	S1 9			14	F2	F1	F1 2		2		8	X		8
8.6	1	1	1		3	2				2	12	7	2		21		F1 2			2	2	1	X		3
12	1		1	1	3						4	3	1		8	3	2			5	1	1	X		2
17											F1 4	1			5	1	1		1	3	1	1	X		2
24																									
35		1			1																1				1
Totals	2	F1 4	F2 2	2	10	2	1	5	F1 2	10	F2 26	F2 37	F7 18	F1 0	F14 81	4	F11 8	F2 2	1	F14 15	5	14	1	0	20
Particles/ft³	0.06					0.04					0.27					0.05					0.09				

F12 15

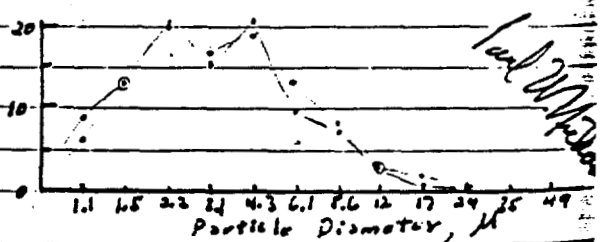
* Approximation due to weak pump.

Size distribution of all particles counted – separated by pigment type: 2200 ~~[illegible]~~ | 2210 ~~[illegible]~~ | 2525 | S_{2_2} | Σ

Diameter ↓ / Location →	C_{12_2}	R_{12_2}	C_{4_p}	C_{10_2}	R_{10_2}	R_{4_p}	C_{4_2}	R_{4_2}	C_{2_5}	C_{2_3}	Σ	%	F_{12_2}	F_{10_2}	Σ	%	S_{12_2}	S_{10_2}	S_{2_2}	Σ	%	%
1.1 μ									3	1	4	3		38	38	6			/			
1.5			1				2	2	5		10	7		83	83	13			/			
2.2								4	6		10	7	2	128	130	20			/			
3.1		1					1	1	11	1	15	10	3	104	112	17			/	2	2	9
4.3		1		1	1				8	1	12	8	3	122	125	19			/	2	2	9
6.1	2	1	1		3	1		1	14	2	25	16	1	81	82	13		1	/	8	9	39
8.6	1		1	2	4		3	2	21	2	36	24	2	49	51	8			/	3	3	13
12	1	3	1		1	1	3		8	5	23	15	2	19	21	3		2	/	2	4	17
17	1		2		1	1			5	3	13	9		11	11	2			/	2	2	9
24					1						1	1		1	1	0.2			/			
35	1						1				2	1							/	1	1	4
Totals	6	6	6	3	11	3	10	10	81	15	151	101%	13	64	654	101	0	3	/	20	23	100



Comparison Size Frequency Pigment 2210 found in FT 1P and FT PPU2



23 Dec 54

Determination of Radiation effects on 5 mil and 1 mil thermocouples.

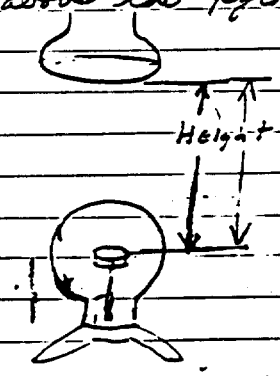
Procedure:

1. Approximate the maximum intensity of solar and sky radiation that could be expected when averaged over short periods or taken instantaneously.
2. Determination of radiation intensity from incandescent lites at various ~~distributions~~ distances from the radiating lamps.
3. Expose 1 mil and 5 mil thermocouples to lites at various distances.

1. Examination of synoptic records and actual pyrheliometer traces revealed the following max values (approximately):

Time period	Mean radiation intensity
instantaneous	> 2 gm cal / cm² min.
5 min	1.6 gm cal / cm² min
1 hour	1.45 " " "

2. Incandescent lamps were held at various heights above the synoptic meteorology pyrheliometer. Two lamps were used — a Sylvania 150 Watt Birdseye Spot, and a Photoflood #2. The maximum radiation rate obtained while holding a lamp at a given height above the pyrheliometer was noted. Height is defined as the distance between the disc on the pyrheliometer and the lowest point on the lamp. Lamps were held nearly above the pyrheliometer. - (See graphs on page 68.)



Test 1 (Spot)

Background Start - 0.08 End - 0.16

Lamp Height	Total	Net
	gm cal/cm² min	
18½"	1.9	1.8
12"	>2.00	>2.00
21"	1.57	1.45
24"	1.24	1.12
27"	1.18	1.06
6'	0.27	0.15
4½'	0.37	0.25
5½'	0.25	0.17
50"	0.38	.30
36"	.72	.64
30"	.95	.87
24"	1.33	1.25
21"	1.46	1.38
20"	1.63	1.55
19"	1.85	1.77

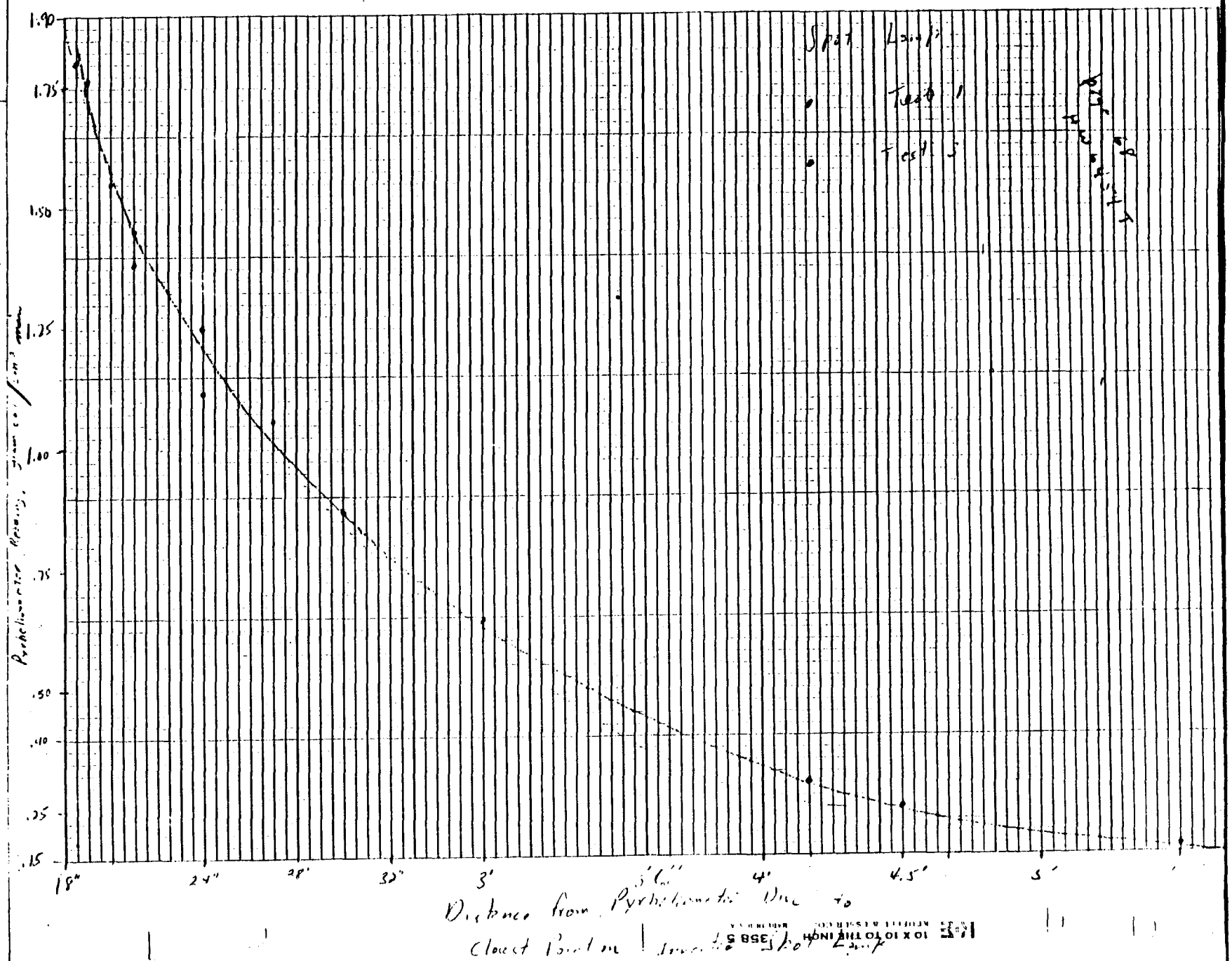
Test 2 (Flood)

Ht	gm cal/cm² min Total	Net
Background 0.10		
16"	0.33	0.23
14"	0.41	0.31
12"	0.52	0.42
10"	0.64	0.54
8"	0.92	0.82
6"	1.40	1.30
5"	1.74	1.64
4"	2.00+	—

Test 3 (Spot)

Background Start 0.07 End 0.08

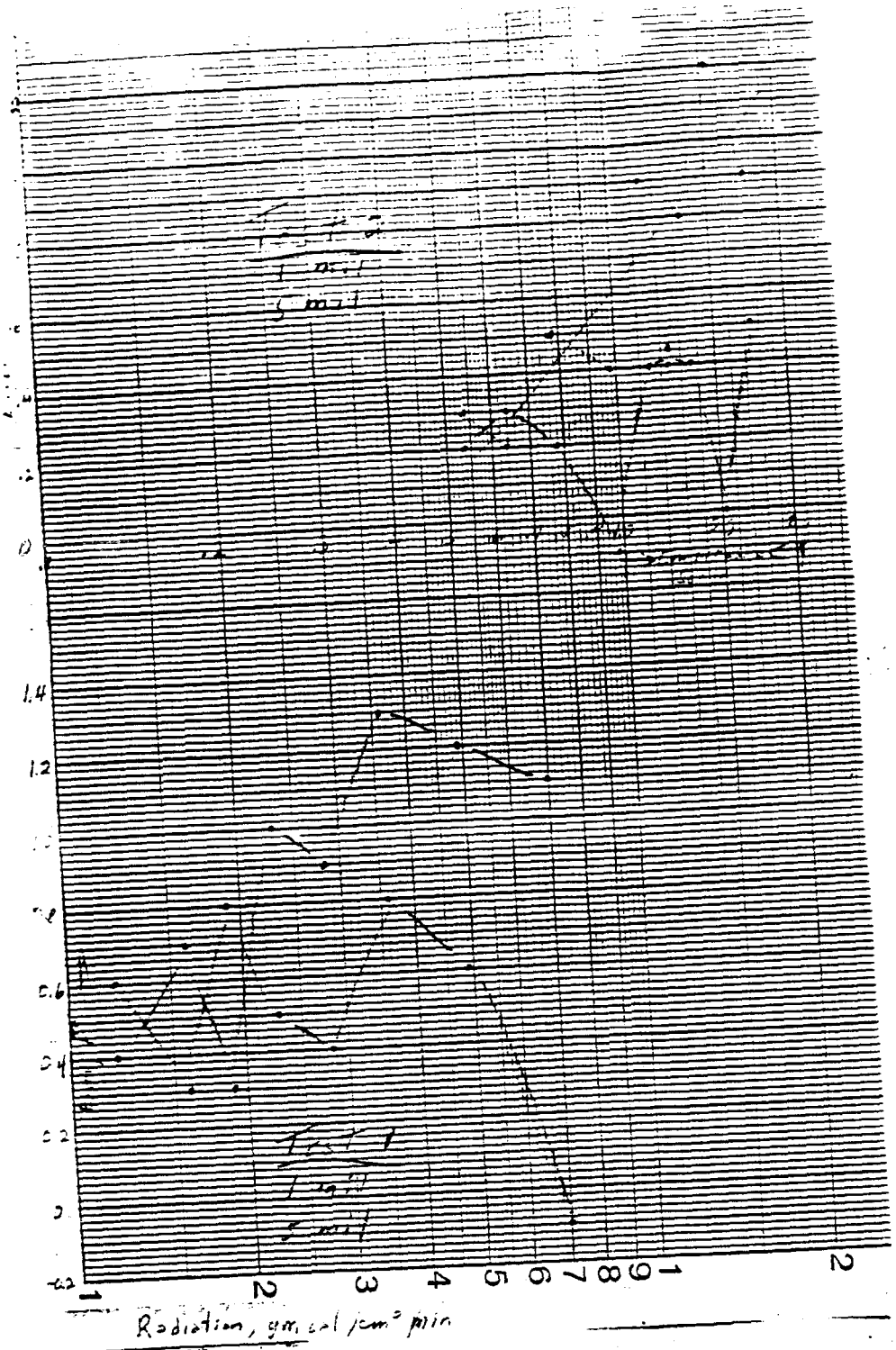
1100384


Spot Lamp
Test 1
Test 3
1.90
1.75
1.50
1.25
1.00
.75
.50
.40
.25
.15
18"
24"
28"
32"
3'
4'
4.5'
5'
Distance from Pyrheliometer Disc to
Closest Position Inverted Spot Lamp
10 X 10 TO THE INCH 358 5

68A

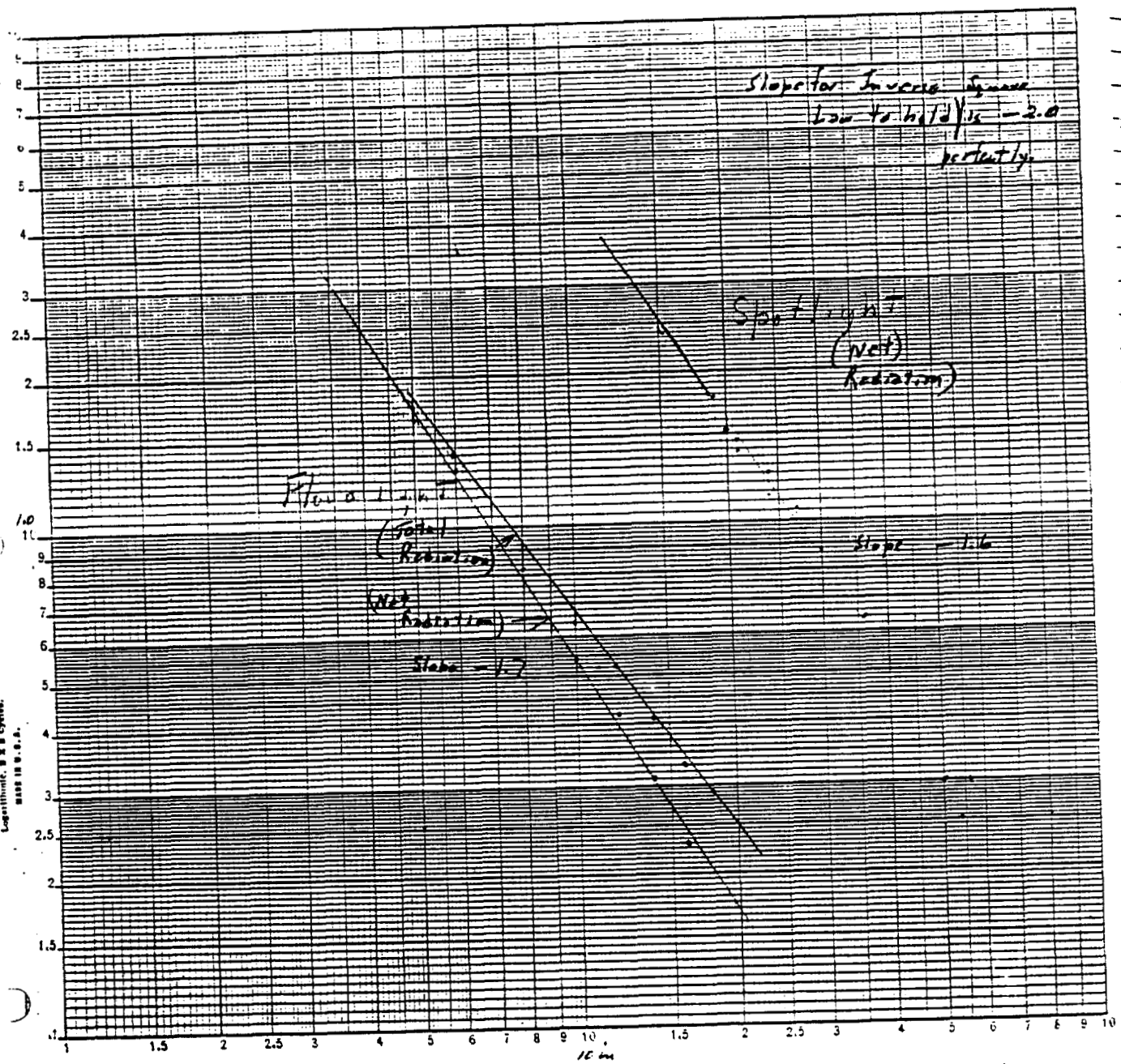
1100385

68B

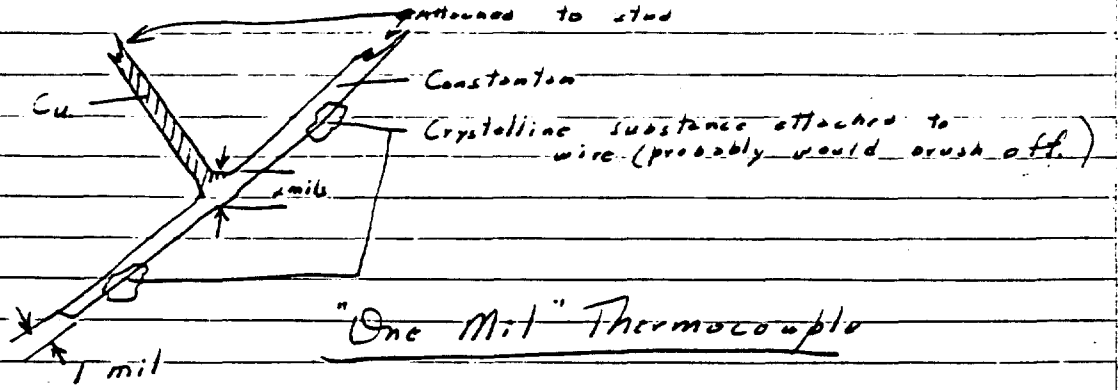


1100386

Page 68
HW 6454 T

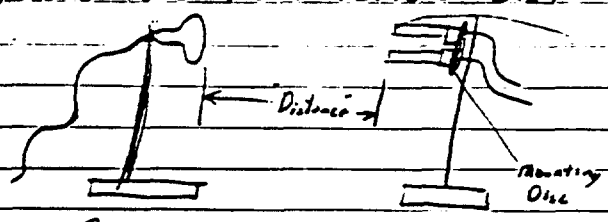


3. Thermocouples used were numbers 1 and 5. Thermocouple No. 1 was ~~[illegible]~~ fabricated of 1 mil wire. TC No. 5 was fabricated of 5 mil wire. Thermocouple No 1 was examined under 100 X magnification. A rough sketch of the couple with dimensions follows:



"One Mil" Thermocouple

The Thermocouples were exposed to spotlight and floodlight radiations from various distances. Setup is sketched below.



Thermocouples (projecting toward lamp in tests 1 & 2. Extending from page in test 3 — to avoid excessive heating of mounting disc)

The mounting disc consisted of a 6 inch diameter cardboard backed by aluminum.

Test 1 – Spot lite				Test 1 ~~2 Floodlite~~		Test 2 Flood lite					
						1 Mil TC →				5 Mil TC	
Radiation ~~Error~~	Distance	Δ_R	Error	Δ_R	Error	Rad.	Distance	Δ_R	Error	Δ_R	Error
1.20 gm cal/cm² min	24"	0.7	0.6°F	0.4	0.4 F°	0.54	10"	+0.2	0.2°F	0.3	0.3F°
1.60	20"	0.3	0.3	0.8	0.7	0.64	9"	0.3	0.3	0.2	0.2
1.90	18"	0.9	0.8	0.3	0.3	.78	8"	0.2	0.2	0.6	0.5
2.31	16"	0.6	0.5	1.1	1.0	.98	7"	-0.1	-0.1	0.4	0.4
2.84	14"	0.4	0.4	1.0	0.9	1.27	6"	0.5	0.4	1.0	0.9
3.61	12"	0.9	0.8	1.5	1.3	1.46	5½"	0.4	0.4	0.5	0.4
4.9	10"	0.7	0.6	1.4	1.2	1.73	5"	0.4	0.4	0.9	0.8
7.0	8"	-0.1	-0.1	1.2	1.1	2.05	4½"	0.0	0	1.4	1.2
	One mil TC			5 mil TC		2.50	4"	0.6	0.5	1.0	0.9

Δ_R = Diff. in scale reading on speedomax between lite on & lite off readings.

Tests 1 & 2 were considered unreliable because (1) reradiation and convection from mounting disc are possible sources of large error, and (2) only one reading at each distance for each TC gave erratic curve.

4 Jan 54

Test 8 — Spotlite

Distance = 17½" Equivalent Radiation — 2 gm cal/cm² min

Date [illegible] Wind Speed < 3 mph

One Mil TC			5 mil TC	
Lite on	Lite off		Lite on	Lite off
.8	.7		1.2	1.1
.7	.7		1.4	.8
.9	.8		1.7	1.0
1.0	.4		1.5	.6
0.7	.7		1.5	.9
.8	.8		1.4	.7
.9	.5		1.3	.7
1.1	.7		1.2	1.0
1.0	.7		1.9	1.1
1.0	1.0		1.8	1.1
1.1	.9		1.6	1.0
1.0	1.2		1.7	.8
1.0	1.1		1.7	1.0
1.0			1.6	.5
13.0	10.2	= Σ	1.5	1.0
0.93	0.78	= $\bar{X}$	1.1	1.0
0.14 scale units		: Δ on-off	1.2	.8
0.12 F° difference		lite on-off	1.5	1.0
			1.4	
			28.2	16.1
		Mean	1.48	0.89
		Δ on-off	0.59	Speedomax scale units
		or	0.53	F°

Conclusions:

Step 1 of the procedure was more or less superflous. The records produced by the pyrheliometer are for a perfectly horizontal surface. The radiation to which the thermocouple can be exposed is not limited to these levels.

The errors introduced by exposing the 5 and 1 mil TC's to a radiation intensity of 2 gm cal/cm² min are as follows: 5 mil TC — 0.5 F°; and 1 mil TC — 0.1 F°.

A further check of the thermocouples exposed side by side to actual strong solar radiation — then shaded — should be carried out.

Paul M. Nicholas

Effect of Solar Radiation on 5 mil Thermocouples.

Procedure: 5 mil thermocouple exposed to direct sunlight and then shaded artificially. ΔT noted.

Data:

Date	Diff. in shaded-unshaded scale readings	Equivalent indicated temp. difference	

1100390

Determination of Differences in Output of Portable Meat Thermocouples when Exposed to the Same Temperature.

Purpose: To determine the difference in output of 5 mil thermocouples when exposed to the same temperature. This is in effect a recalibration of 5 thermocouples against a 6 th (arbitrarily chosen) standard thermocouple.

To compare thermocouple indicated temperatures with those of a mercury thermometer under the same conditions.

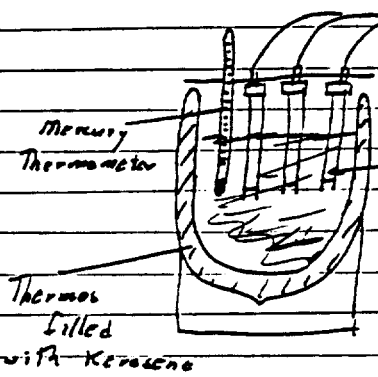
Procedure:

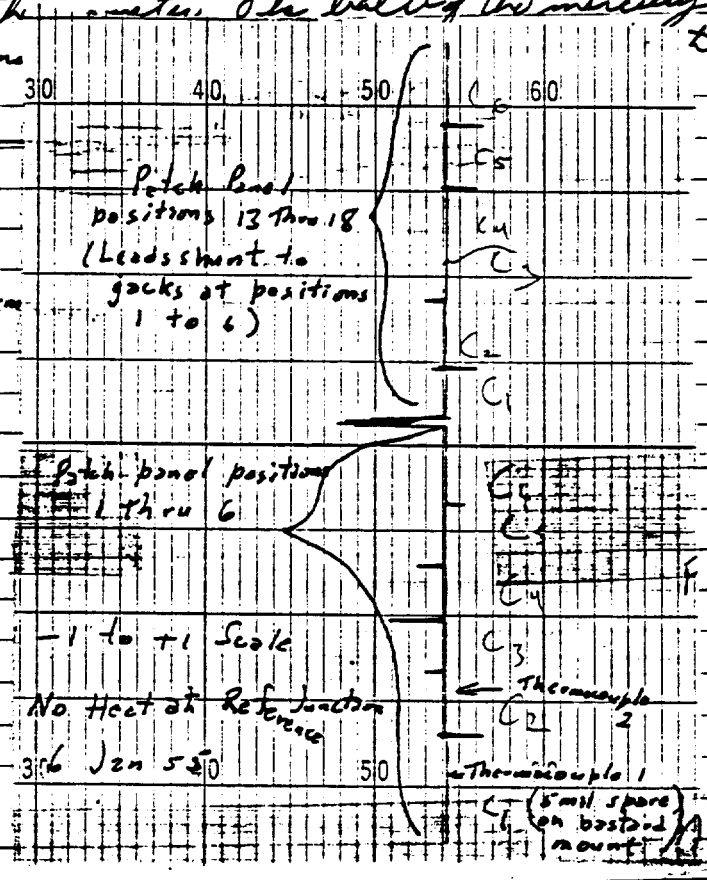
(1) Immerse thermocouples in kerosene which has a temperature in approximate equilibrium with ambient in temperature — (kerosene outside for days preceding experiment)

(2) Note difference in output of TC's with unheated reference junction

(3) Note difference in TC outputs with heated reference junction

(4) Compare temperatures indicated by thermocouples and mercury thermometer. The bulb of the mercury thermometer is as TC's.





Data

(2) Portion of chart to right indicates near identical output of different thermocouple when reference junction is unheated (and thus essentially no temp gradient in reference junction well.) Also demonstrated is the ~~lack of~~ good conditions of stepping contacts and feasibility of shunting signals at patch panel.

1100391

[redacted]

Determination of Differences in Output of Portable Mast Thermocouples when Exposed to the Same Temperature.

Purpose: To determine the difference in output of 5 mil thermocouples when exposed to the same temperature. This is in effect a recalibration of 5 thermocouples against a ~~6 th~~ (arbitrarily chosen) standard thermocouple.

To compare thermocouple indicated temperatures with those of a mercury thermometer under the same conditions.

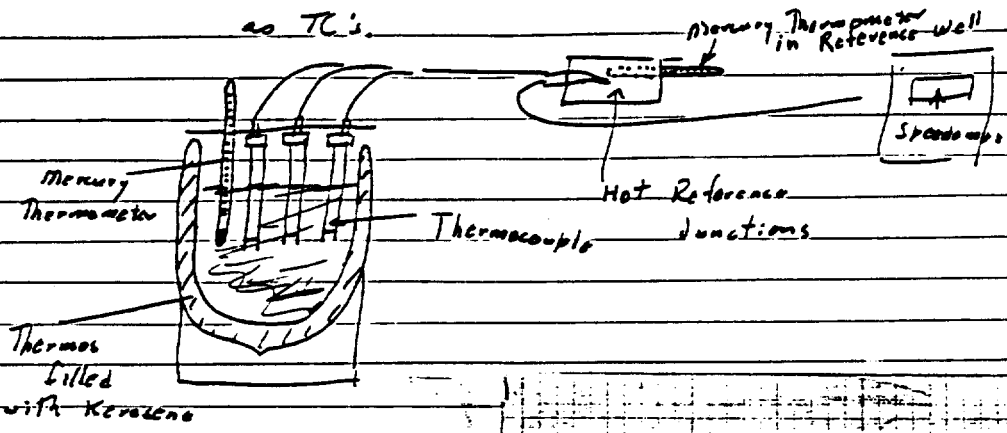
Procedure:

(1) Immerse thermocouples in kerosene which has a temperature in approximate equilibrium with ~~st~~ ambient ~~in~~ temperature — (kerosene outside for days preceding experiment)

(2) Note differences in output of TC's with unheated reference junction

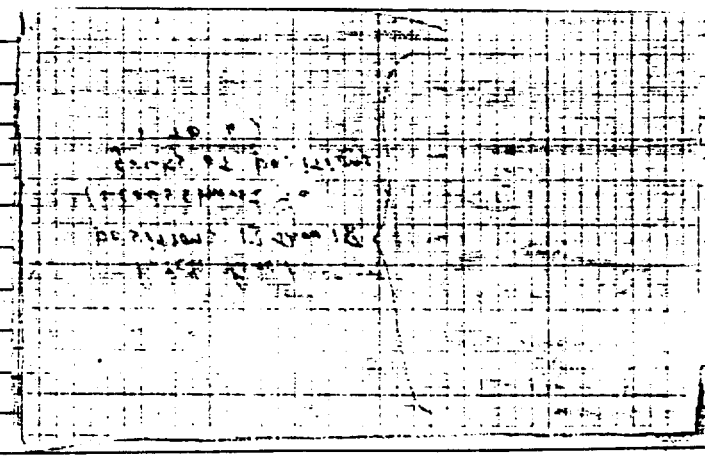
(3) Note differences in TC outputs ~~also~~ with heated reference junction

(4) Compare temperatures indicated by thermocouple and mercury thermometer. Place bulb of the mercury thermometer immersed in kerosene at same depth as TC's.



Data

(2) Portion of chart to right indicates near identical output of different thermocouples when reference junction is unheated (and thus essentially no temp gradient in reference junction well.) Also demonstrated is the ~~fact of~~ good condition of stepping contacts and feasability of shunting signals at patch panel.



1100392

3 & 4 ~~2 & 3~~. Heated reference junction.

Date Recorded	Reference Well Temp	Kerosene Temp. Mercury Therm.	Kerosene Temp. C_1	C_2-C_1	C_3-C_1	C_4-C_1	C_5-C_1	C_6-C_1	
17 Dec 54	—	—	47.3 F	0.7 Spreadsheet scale units	0.1 units	0.1 units	0.6 units	0.2 units	
..	-	—	47.2	0.8	.2	.2	.6	.2	
..	-	—	104.9	0.8	0.0	.1	.8	0.0	
..	—	—	104.9	.5	-0.1	+0.1	.9	~~0.0~~ 0.0	
..	—	—	104.7	.6	0	.1	.9	0	
..	—	—	104.3	.8	-0.1	.1	.8	-0.1	
..	—	—	102.5	.9	—	.2	.9	—	
..	—	—	102.5	.9	—	0.0	.8	—	
..	—	—	102.1	.9	—	.1	.9	—	
..	—	—	100.0	.9	—	.2	.9	—	
..	-	—	95.0	.8	—	.1	.9	—	
..	—	—	85.9	.8	—	—	—	—	
..	—	—	85.9	.9	—	.2	1.0	—	
..	—	—	80.3	.8	—	.1	.9	—	
..	—	—	77.8	.9	—	.1	.9	—	
..	—	—	77.7	.9	-	.1	1.0	—	
..	—	—	72.6	1.0	—	.1	.9	-	
..	—	—	64.8	1.0	—	.3	1.0	—	
..	—	—	57.7	1.0	—	.3	.9	-	
..	—	—	52.1	.9	-	.2	.9	-	
..	—	—	47.9	.8	—	.2	.8	—	
17 Dec 54	—	—	43.3	.9	—	.2	.9	—	
.				18.5 [illegible]	0.1 [illegible]	3.1 [illegible]	18.2 [illegible]	0.3 [illegible]	Σ
				.84	.02	.15	.87	.05	$\bar{X}$
6 Jan 55	48.2 C	29.2 F	28.1 F	1.0	0	.3	.9	.2	
7 Jan 55	48.3	~~27.5~~ 28.2*	~~28.2~~ 27.5	.8	.3	~~[illegible]~~	1.2	1.1	
..	..	..	27.4	.9	1.0	—	1.4	1.2	
..	..	..	27.7	.7	.2	.3	1.1	1.0	
..	..	..	27.5	1.0	.5	.7	1.4	1.2	
..	—	—	29.2	.7	.5	.5	1.2	1.0	
..	-	-	29.0	.5	0	.2	.8	.7	
..	-	-	28.6	.9	.4	.5	1.3	1.2	
..	-	-	28.7	.9	.4	.6	1.2	1.1	
..	-	-	28.8	.8	.5	.6	1.3	1.1	
..	-	-	28.8	.8	.4	.6	1.2	1.0	
				8.0 [10]	4.2 [10]	4.0 [8]	12.1 [10]	10.6 [10]	Σ
				.80	.42	.50	1.21 ~~[illegible]~~	1.06	$\bar{X}$

* See 5. in "Conclusions and Recommendations"

Date Recorded	Reference Well ~~Junction~~ Temp.	Kerosene Temp Mercury Therm	Kerosene Temp C_1	$C_2 - C_1$ (Spectrometer Scale units)	$C_3 - C_1$	$C_4 - C_1$	$C_5 - C_1$	$C_6 - C_1$	Patch Panel Positions
11 Jan 55	48.3 C	28.1 F	26.8 F	1.0	0.5	0.7	1.4	1.2	1 to 6
"	"	"	26.7	1.0	.7	—	1.5	1.2	13 to 18
"	"	"	27.5	0.2	-0.4	-0.1	0.5	0.3	1 to 6
"	"	"	26.8	1.0	.6	.8	1.4	1.1	13 - 18
"	"	"	26.9	.8	.4	.6	1.1	1.0	1 - 6
"	48.2	29.2*	27.1	.9	.6	.7	1.5	1.3	1 - 6
"	"	"	27.1	.9	.6	—	1.5	1.3	13 - 18
"	"	"	27.4	.6	.2	.3	1.1	1.0	1 - 6
"	48.1	28.6*	27.8	.8	.4	.6	1.1	1.1	1 - 6
"	"	"	27.8	.9	.5	—	1.2	1.1	13 - 18
"	"	"	28.0	.7	.3	.5	1.1	.9	1 - 6
"	48.1	29.2*	28.1	.9	.5	.7	1.3	1.2	1 - 6
"	"	"	28.3	.6	.3	—	1.1	.9	13 - 18
11 Jan 55	"	"	28.5	.5	0	.2	.8	.7	1 - 6
	Mean Values $C_2 - C_1$		Σ	10.8	5.2	5.0	16.6	14.3	
for →		11 Jan 55	$\bar{x}$	.77	.37	.50	1.19	1.02	
		7 Jan 55		.80	.42	.50	1.21	1.06	
		6 Jan 55		1.0	0.0	0.3	0.9	0.2	
		17 Dec 54		.84	.02	.15	.87	.05	
		Mean of all readings →		.81	.31	.31	1.02	.82	
				18.5	0.1	3.1	18.2	0.3	
				1.0	0.0	.3	.9	.2	
				8.0	4.2	4.0	12.1	10.6	
				10.8	5.2	5.0	16.6	14.3	
			Σ	38.3	9.5	12.4	47.8	25.4	

17 ~~Jan 55~~ A

Conclusions and Recommendations

1. The differences in output of thermocouples is entirely due to differences in the temperature of the reference junctions in the hot reference bath.
2. It is recommended that the thermocouple system be converted to give one reference temperature and then temperature differences with respect to the reference temperature. Temperature differences can be determined with an accuracy of about ±0.1 F — as demonstrated by the record on page 72.
3. The difference in output between thermocouples with the present system varies somewhat from day to day — altho there is a tendency for this difference to be consistent

* See 5 under Conclusions and Recommendations

[redacted]

for a given day. The variation is assumed to stem from vagaries in the hot reference bath heating.

4. Until the recommended temperature difference system is installed (hardware required is on order) corrections to lessen inter-thermocouple discrepancies are in order. Thus the following number of scale units should be added to the thermocouple output for thermocouple 2, 3, 4, 5 and 6:

Thermocouple No.	Scale units to be added.
2	0.8
3	0.3
4	0.3
5	1.0
6	0.8

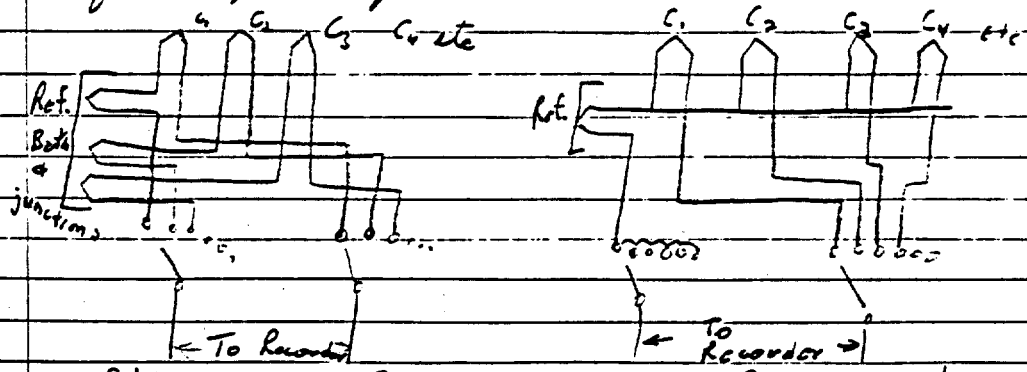
5. ~~The thermocouples are give~~ Thermocouple #1 indicated a temperature which was within 1.3F° of the temperature indicated by the kerosene immersed mercury thermometer. (The "mercury thermometer" was found to indicate 0.8F° higher than Synoptic's standard thermometer. Thus 0.8 F° should be subtracted from the "mercury thermometer" readings listed on pages 73 and 74.)

Paul M. Nicholas

2 May 55

Conversion of Portable Mast Thermocouple System from Series to Parallel (constantan leads) and Check of Effects of Earth's Electric Field on Thermocouple Output.

Purpose: To obviate errors in thermocouple indicated temps introduced by small differences in reference junction temperatures (see immediately previous experiment) by conversion of TC system from series to parallel. Also to determine if



Old series System New Parallel System

the potential atmospheric electric gradient (about ±V/cm near the surface) be any effect on the emf produced by the thermocouples in parallel.

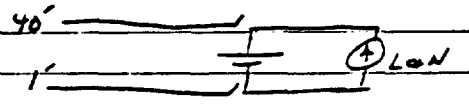
Procedure:

The constantan leads were joined at their ~~tow~~ receptacles inside the instrument cabinet — the connection being completed by use of constantan wire and special low emf solder. Insulated copper wire (#19, solid) was strung on the mast ~~the~~ and extended out booms 1 and 6. The ends were stripped of about 4 inches of insulation and left protruding into the atmosphere.

Effects of the electric gradient were checked as follows:

1. The 40' and 1' ~~leads~~ leads were put across the L&N potentiometer and the polarity reversed by switching the lead back and forth. The drifting pen made averaging of any tendency difficult. No definite gradient was in evidence.

2. An approximate 1 mV signal was placed across the recorder and the 40' + 1' leads (described above) were alternately inserted and removed with absolutely no change in signal at the L&N.



3. The above (2) experiment was repeated with the only change being the insertion of a thermocouple (immersed in kerosene) instead of the battery. Again no change in signal.

4. Three thermocouples were used. Those at 40' and 1' were used merely as (possible) probes in the atmospheric potential gradient. They were inserted in and removed from their respective receptacles (at the instrument cabinet) while the third TC monitored kerosene temp. No effect was in evidence from the "probe" thermocouples.

~~#5~~

The 6 thermocouple leads were removed from the tower and thermocouples were placed on each at the surface. The thermocouples were then immersed — singly or 3 at a time — in kerosene and their outputs recorded on the Speedomax. Unfortunately fractional degree differences were indicated.

Conclusions:

The effect of the earth's electric field is negligible.

The disturbing differences noted in the last Procedure paragraph

may be due to poorly soldered joints where the constantan lead were soldered together with the "L + N low emf" solder. These soldered joints should be rechecked and the comparison of immersed TC's redone under more careful conditions — ie, all TC's immersed together at same depth in kerosene, lid on kerosene container.

Paul W. Nicholas

2 May 55

Note on Temperature Differences Noted Directly Above

Perhaps it is impossible to get all TC's to give the same emf when exposed to the same temp. when that temp differs by more than a few degrees from the reference junction temp. — The trace displayed on page 72 occurred when the ~~difference~~ ~~inter~~ whole TC system — reference junction, lead, and TC's — were at about the same temperature.

P.W.N.

14 Jun 55 Determination of Background pigment for PPU experiment

Sticky paper sample cards were exposed on all four PPU2 courses at about 1330. The locations were as follows:

Azimuth	Distance
~~365°~~ 90°	20'
270°	20'
90°	40'
0	0 (ie Course center)

Paul W Nicholas

15 Jun 55

All above background samplers except those on R course erroneously removed and discarded.

Paul W Nicholas

21 Jun 55

The above R course ~~samples~~ cards were examined under the standard (about 35) power microscope for about 2 minutes each. No particles were found. (Flourescent)

PWNicholas

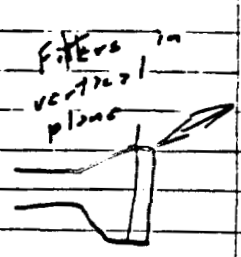
15 Jun 55

Comparison of ~~[illegible]~~ atmospheric dusts collected on Electro-lux and Exp Met. Bulk Samplers.

Purpose: Stated in title. Also To aid in determining whether flow as indicated by Hastings probes is correct... if leaks in bulk sampler filter holder assembly are excessive.

Procedure:

Bulk sampler #2 and an Industrial Hygiene Electro-lux "hi-vol" sampler were suspended side by side at an elevation of about 3 ft. Periodic flow rate readings were taken from ~~[illegible]~~ rotameter on rear of Electro-lux sampler and from probe output in van. Beckman and Whitley anemometer and vane were run at a distance of about 150' from the samplers.



Data:

Samplers on at 0815 Off - 1520

Vane and anemometer on at 0900

~~Bulk Sampler~~ Hi-Vol Flow Rates	
0815	8 cfm
0900	10
1000	10
1100	~8
1210	~8
1320	~7
1420	~6
1520	~5

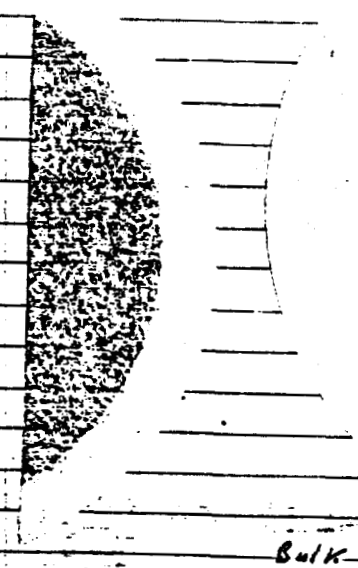
Bulk Sampler Flow Rates (74.5 Cal. set)

Time	Scale	mv	Ft/min	cfm
0915	59	1.18	474	7.9 cfm
1000	58	1.16	470	7.8
1100	52	1.04	448	7.4
1210	46	.92	426	7.1
1320	46	.92	426	7.1
1420	48	.96	433	7.2
1520	48	.96	433	7.2

Wind Data

Time	~~Speed~~ Den	Speed
0900	115°	2.2 4.4
0930	145	~~2.9~~ 4.8
1000	200	~~2.8~~ 5.6
1030	135	~~3.5~~ 7.0
1100	235	~~2.7~~ 5.4
1130	50	5.8 ~~2.9~~ Test 3 Jun
1200	180	~~3.6~~ 7.2
1230	215	~~2.8~~ 5.6
1300	230	~~4.3~~ 8.6
1330	225	~~4.8~~ 9.6
1400	220	~~4.5~~ 9.0
1430	230	~~3.8~~ 7.6

Filters used were not dried to constant wt. Tried for rough determination. Filter "F" in Hi-Vol gained ~ 5 mg. (Bulk Sampler) gained ~3 mg. "Control 3 Jun" gained ~ 2 mg. (See page 121) ← Filters show that Hi-Vol definitely picked up more, but certainly not enough more to weigh with confidence. Should use dried and precisely weighed filters. [illegible]



Hi-vol filter

Bulk sampler Filter.

1100398

15 Jun 55

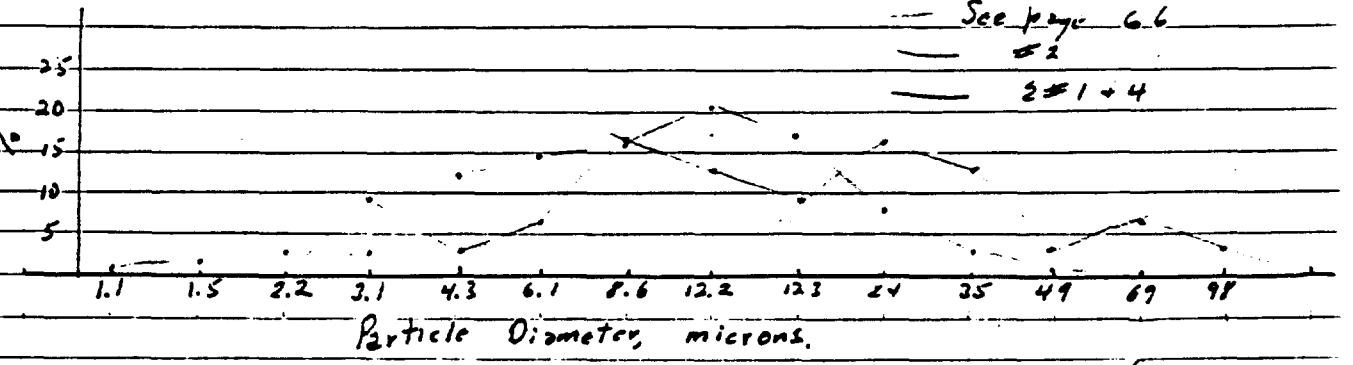
Size Analysis of Pigment 2525

Purpose: To size flourescent pigment 2525 particles collected on cascade impactors after generated in TIFA generator.

Procedure: Impactors 1 and 4 were stationary during "cold" fog generation. Impactor 2 was moved once to keep it in the fog. The fog generated during the running of impactor 2 was "hot" fog — ie generator burner was on. No impactor flow measurements were made.

Data: [redacted]

Size	Impactor 2		Impactor 1		Impactor 4		[redacted] Sum 1 & 4	
	No. particles	%	No. Particles	%	No. Particles	%	No.	%
1.1 μ	11	0.6						
1.5	22	1.2						
2.2	57	3.1						
3.1	55	3.0			3	13.0	3	9.7
4.3	219	12.0			1	4.3	1	3.2
6.1	272	14.9	1	12	1	4.3	2	6.5
8.6	290	15.8			5	21.7	5	16.1
12.2	376	20.5	1	12	3	13.0	4	12.9
17.3	312	17.0			3	13.0	3	9.7
24	145	7.9	1	12	4	17.4	5	16.1
35	50	2.7	1	12	3	13.0	4	12.9
49	17	0.9	1	12			1	3.2
69	5	0.3	2	25			2	6.5
			1	12			1	3.2
Green Pig 2210?	143			45	213			
Blue 2200?	32			8	19			
	Σ %	99.9 %		97 %		99.7 %		100.0



Conclusions are hazardous due to the sparsity of "cold generation" particles. The suggestion is that the heating process fractionates some of the larger particles. However the data from PPU 2 (page 66) tends to refute this, (yellow curve).

Paul W. Ruckels

29 Jun 55

Comparison of Atmospheric Dusts Collected on Electro-Lab and Experimental Meteorology Bulk Samplers

Purposes and Procedure: Similar to test on page 78. Filter again in vertical plane and at an elevation of about 1 ft. No Buchman & Whitley wind instrument was used. Filters used were dried and weighed prior to exposure (p 122). The seam and old wing nut holes on the bulk sampler were taped shut with masking tape. Bulk sampler (probe) #1 used.

Data:

29 Jun – Samplers on 0830 Samplers off 1530

Hi-Vol (Filter J)		Bulk Sampler (Filter 13)				
Time	Flow Rate	Time	Scale Reading	Mv.	Ft/Min	Cfm
0830	13 cfm	0840	41	0.82	415	6.9
0930	9 cfm	0930	39	0.78	408	6.8
1100	10 cfm	1100	28	0.56	371	6.2
1230	9 cfm	1230	24	0.48	357	6.0
1530	7 cfm	–				

1 Jul 55 Samplers on 0900 Off – 1430

Hi Vol (Filter K)		Bulk Sampler (Filter 2)
0900	13 cfm	0910 Bad contact somewhere
1300	10 cfm	between probe and recorder.

All filters (J, K, 13, 2) in oven 1 Jul 55

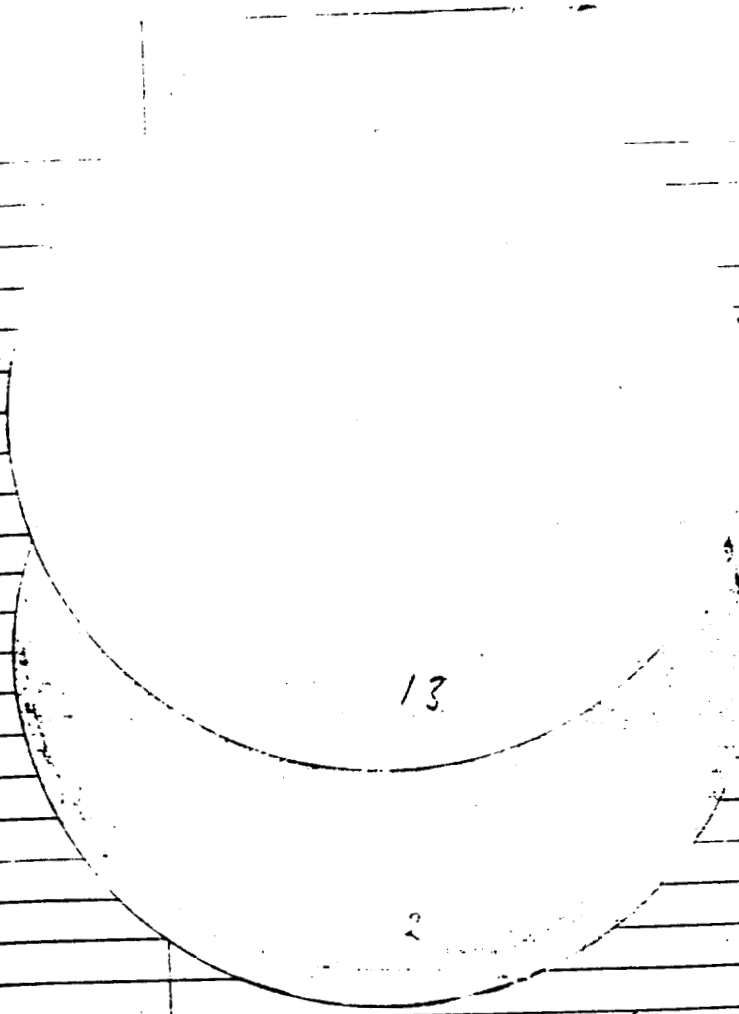
Samplers K and 2 were thoroughly wet by a shower while in operation, but were turned off before they dried again.

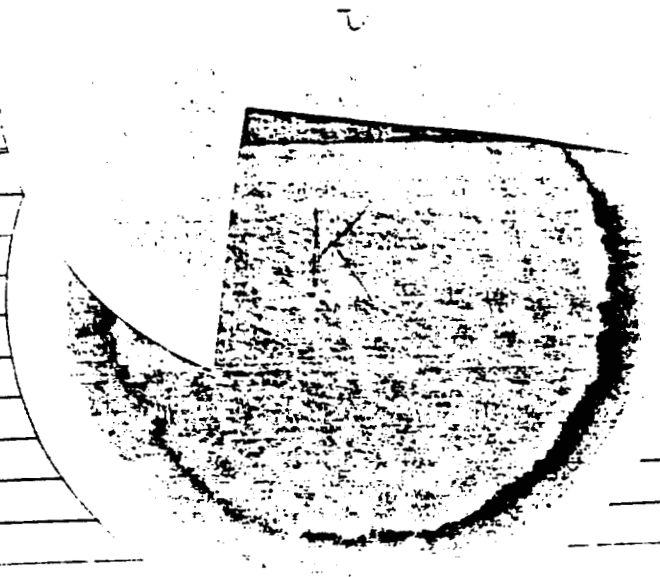
Samplers were exposed toward the NW

Wind Speed and Direction (Synoptic Daily Hourly Winds)

29 Jun 55			1 Jul 55	
Time	Dir	Speed	Dir	Speed
0830	WNW	17	WSW	13
0930	NW	14	WSW	12
1030	WNW	9	WSW	12
1130	WNW	7	WSW	14
1230	SW	8	WSW	11
1330	W	6	NNW	12
1430	NW	13	N	10
1530	NW	14	WSW	5

1104400





Increases in weight of exposed filters (see page 122)

Exposed on 29 Jun 55		Exposed on 1 Jul 55	
Hi Vol	Bulk Sampler	Hi Vol	Bulk-sampler
(J) 0.003 g	(13) — 0.004	(K) 0.013	(2) 0.007

Conclusions

(1) Not enough matter collected to feel sure of any results. Thus flow rate must be too low.

(2) Better flow measuring devices required — ie, better than hot wire probes.

Paul H. Nichols 27 Jul 55

7 Jul 55

Examination of Profiles Indicated by Mast Thermocouples indicates – or rather suggests – a change in calibration with time. The data examined were recorded on 7 and 10 Jun 55 and are filed under Thermocouple Profiles, 7 Jun 55 in the Portable Mast file. The two tests made on 7 Jun 55 showed temperatures too ~~high~~ low at level 3 (TC3) and perhaps a bit high at level 4 (TC4). However the test run on 10 Jun 55 gave a "good" profile with no temperature discrepancies. Application of corrections which could be deduced from the kerosene bath calibrations of 23-25 May 55 did not help the profile troubles mentioned for 7 Jun 55.

Conclusion: The thermocouples should be used without any attempt to correct the readings indicated since when and if a correction is required the ~~direction~~ sign and magnitude of the correction at any given time is indeterminate. Also the corrections dictated by the 25 May 55 calibration are at most only 0.3 F°, less than the suspected discrepancy in the 7 June test even if they could have been applied to "offending" TCs.

Paul H. Nicholas

5 Aug 55

~~The~~ Bleeding action of Xylene-resin thickum on Yellow Flourescent Pigment was discovered in the process of recounting some impactor samples. Tale is told in following table:

Sample Taken on 22 Jul 55

Slide 1				Slide 2		Slide 3		
~~Date Slide Counted~~	~~No. Particles~~							
Date Slide Counted	No. Particles	Date Slide Counted	No. Particles	Date	No.	Date	No.	Date	No.
22 Jul 55	407	5 Aug 55	0	27 Jul 55	186	5 Aug	7	27 Jul 55	271	5 Aug	125

Slide 4

27 Jul 55	530	5 Aug 55	380

Conclusion: A different thickum is required in ~~bleeding~~ pigment 2025.

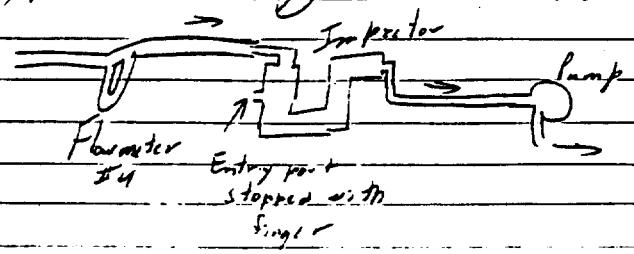
Paul H. Nicholas

11 Aug 53

Distribution of Natural Particles in Vertical During Period of High Winds

Purpose: To determine the vertical distribution of natural windblown particles with respect to size and concentration.

Procedure: Five cascade impactors were coupled to 6 volt Electro-vac pumps at 4 met. tower levels and one ground position. The impactors were faced into the wind and samples varying from 10 minutes (ground impactor) to 45 minutes in duration were taken. Flow rates were measured with the Experimental Mfg "Flowmeter No 4" as per following sketch.



The "ground" sample (15 inches above surface) was placed near ~~[illegible]~~ recording rain gage.

Data:

Sampler Location	Impactor No	Time On	Time Off	Minutes of Operation	Pump No	Flowmeter No 4 Readings L	R	Flow Rate cfm	Ft³ of air sampled
"Ground" (15 inches)	1	1714	1724	10	38	2.2	-2.1	0.73	7.3
50' ht.	2	1711	1731	20	33	1.6	-1.4	0.61	12.2
120'	4	1710	1735	25	53	2.2	-2.1	0.73	18.2
200'	5	1706	1741 ‡	35	27	2.3	-2.2	0.74	25.9
400'	6	1702	1747 *	45	58	2.2	-2.1	0.73	32.8

‡ Misoriented by about 30° when picked up.

* Misoriented at time of pickup. Intake Blown to face ~~position~~ normal to wind direction

Impactor Slide numbers

Impactor	Stage 1	2	3	4
1	23	279	242	143
2	85	167	260	112
4	87	118	278	227
5	24	219	125	246
6	19	179	196	245

Sizing and counting of slides to be performed at later date.

Paul W. Nichols

22 May 55

D. Test Anemometer Linearity – Check of Zero Stability and Symptoms of Low Power Supply Voltage.

The anemometers and associated power supply and CRM as prepared by L D Test were run during the day shift for 4 days in order to (1) observe the fluctuations in zero of the individual anemometer channels; (2) to observe the symptoms of low power supply voltage in the output of the system; and (3) to observe the trace of anemometer for failure to record properly during a fairly extended test.

Note – Time constant setting 1 sec. Range 1 (Low)

Log of observations from Speedomax Chart.

	Date-Time	Zero Scale Readings (Speedomax) A1	A2	A3	A4	A5	A6	Power Supply Load Voltage	Hours Batteries in Use	Remarks
										Batteries charged overnight on 12 Aug; Run about 4 hrs on 15 Aug. Recharged on night of 15 Aug.
Chart 1	16 Aug ~0920	-0.9	0.0	-1.0	-0.6	+1.3	-0.8			Batteries on
	~1130								2.00	Batteries off
	~1300	-1.1	-0.1	-1.6	-1.4	+1.2	-1.1			Batteries on
Chart 2	1325	-0.9	+0.1	-1.2	-1.3	+1.4	-1.0			
	1350	-1.1	+0.3	-0.7	-1.0	+2.0	-0.5			
	1415	-1.7	0.0	-1.2	-1.5	+1.9	-0.6			
	1445	-1.3	0.0	-1.2	-1.6	+1.7	-0.4			Inst. Cabs. lid closed from 1445 to 1515
	1515	-1.3	-0.1	-1.3	-1.6	+1.9	-0.8		2.25	Batteries off
	17 Aug 0920									Batteries on
	0942	-0.9	+0.1	-1.0	-0.8	+1.8	-0.7			
	0959	-0.8	+0.3	-0.8	-0.8	+1.7	-0.8			
	1035	-0.7	+0.5	-0.5	-1.0	+2.0	-0.1			#6 trace – bad erratically
	1106	-0.7	+0.2	-0.6	-1.0	+1.9	+0.2		1.75	Batteries off
Chart 3	1300									Batteries on
	1317	-1.0	+0.2	-1.1	-1.2	+1.7	0.0			
	1354	-1.3	+0.1	-1.3	-1.3	+2.0	+0.1			
	1418	-1.4	-0.1	-1.3	-1.2	+2.2	+0.1			
	1431	-1.4	-0.1	-1.3	-1.3	+2.0	+0.7			
	1450	-1.0	+0.1	-1.2	-1.3	+1.7	+1.9			
	1505	-1.2	-0.2	-1.5	-1.6	+1.7	+0.1			
	1520	-1.1	-0.1	-1.3	-1.2	+1.4	+0.3			
	1534	-1.0	0.0	-1.0	-1.3	+1.2	+0.3		2.50	Batteries off

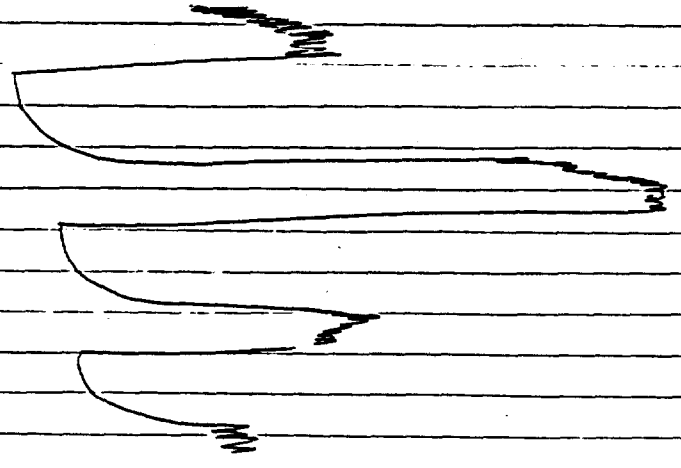
[redacted]

	Date - Time	Zero Scale Readings A_1	A_2	A_3	A_4	A_5	A_6	Power Supply Voltage	Hours in Use	Remarks
	18 May 0910								On	Battery on
	0931	-1.1	+0.7	-0.9	-0.8	+1.7	+0.2			No. 2 will not record revolution while trouble.
	0946	-1.2	+0.6	-1.0	-0.9	+1.7	+1.0			
	1010	-1.1	+0.5	-0.9	-0.9	+1.9	$\boxed{+2.0}$			
	1013	-1.1	+0.4	-1.1	-1.0	+1.9	+0.5			
	1017	-1.2	+0.3	-1.1	-1.1	+1.9	+0.2			
										No. 6 may be operating erroneously
	1113	-0.6	+0.6	-0.7	-0.4	+2.6	+0.2			
	1240	0.0	+0.1	-0.8	$\boxed{-0.1}$	+2.6	+0.4	5.7		
	1258	0.0	+0.3	-0.9	+1.3	$\boxed{+2.7}$	—			A_6 giving trace with cups off.
	1310	+0.1	+0.3	-0.9	+2.6	$\boxed{+2.7}$	+0.6			A_4 a bit unsteady (cup higher)
										A_2 has had connection with cup
Chart 4	1400	-0.5	+0.8	-0.8	+3.4	+2.3	+0.7	5.7		A_4 unsteady
	1449	-0.3	+0.8	-0.8	+1.8	+2.1	+0.4		6.20	A_4 "drifting"
	1522	-0.3	+0.9	-0.8	+1.9	+2.0	+1.1	5.7	off	Battery off
		1.3				1.				
	19 May 55 0830								on	Battery on
	0856	-1.2	+0.3	-1.1	+0.8	+1.3	-0.4	5.6		A_4 still prone to drift.
	0922	-1.0	+0.4	-0.9	+0.3	+1.4	-0.3			A_4 steady
	0933	-1.2	+0.3	-1.1	+1.2	+1.3	-0.4			
	1006	-1.0	+0.7	-1.0	+3.5	+1.6	-0.3			
	1118	-1.0	+0.6	-1.0	+1.8	+1.6	-0.3			
	1131	-1.0	+0.6	-1.0	+2.0	+1.8	-1.1	5.58		A_4 wavering
	1118	-0.8	+0.7	-0.8	~+1.5	+1.9	0.0	5.55		A_4 unsteady
	1130	-0.7	+0.5	-0.8	+1.4	+1.9	+0.1			
	1145	-0.5	+0.8	-0.6	+1.7	+2.0	0.0			
	1200	-0.1	+0.8	-0.8	+2.1	+2.0	0.0			A_4 Unsteady
	1215	-0.4	+0.8	-0.7	+3.9	+2.1	-0.1			A_4 "
	1230	-0.4	+0.8	-0.7	+3.1	+2.1	0.0			A_4 "
	1237	-0.3	+0.9	-0.6	+3.1	+2.2	+0.1	5.50		A_4 "
	1300									All but A_2 recording wind well
Chart 5	1319	-0.3	+0.4	-0.9	+0.2	+1.7	-0.3	5.46		
	1328	-0.2	+0.6	-0.8	+0.8	+1.8	0.0			
	1347	0.0	+0.5	-0.6	+1.4	+2.1	+0.2	5.43		A_4 still unsteady
	1408	$\boxed{+0.7}$	+0.7	$\boxed{-0.2}$	+1.7	+2.3	+0.5	5.41		A_4 stopped recording pulses. Chart stopped on A_2 zero. Also 0.2 units variation among P
	1413-1432									
	~1435								6.7	First signs of recording trouble. A cutting in and out.
	1441	+0.5	$\boxed{+1.0}$	-0.3	+1.4	+2.4	0.9	5.39	off	A_4 unsteady now. Cutting
		1.5	1.1	1.1	1.5	1.5	2.8			
		2.0	1.2	1.1	.5	1.5	2.8		t = 21.4 hrs	

Conclusions:

(1) If (a) the (suggested) vagaries in the zero point for each anemometer ~~due to~~ during the last few minutes of battery operation, and (b) if the malfunctioning of A_4 after 1240 are ignored, then the maximum variation in zero during the 20 hour run was 2.1 units. Further, if A_6 is not included, the variation in zero is less than 2.0 Speedomax scale units.

(2) The first symptom of dwindling power supply was the cutting in and out of the output of a few channels. Since no calibration was made before the run, it is impossible at this time to state whether low battery voltage indicates the trace in any other way. Trace appeared as below when battery voltage (as measured by Exr Mat's Simpson meter) reached about 5.4 volts



(3) Failure of channel 4 is unexplained. Channel 2 trouble was diagnosed as cable trouble - bad connector at anemometer. The other 4 channels operated well ~~at~~ until the power supply dwindled.

Paul N Nichols

1100406

Investigation into Stability of Hewlett-Packard and Panascan Pulse Generators and the Stability of Anemometer Calibration — See [illegible] p 110.

24 Aug 55

Pulses were fed into the mast anemometer CRM alternately from 2 sources: (1) Panascan unit (associated with the mast) and (2) Instrument Development Hewlett Packard Low Frequency Function Generator (HW 414400). These units were both located in the van and signals were "piped" to CRM in instrument cabinet. Zero checks were made ~~to~~ on the anemometer channels in an attempt to subtract the effect of zero drift from the CRM output. The instrument cabinet lid was open a crack. CRM range two used. Time constant 1 sec. Freshly charged batteries used in power supply about 2 hrs on 23 Aug 55. H-P = Hewlett Packard Pan = Panascan. H P setting 6 2/3 pulses/sec. Panascan -150 range (equals 6 2/3) sec. ~~[illegible]~~ H-P setting never touched.

Date Time	A-3					A 5					A					Power supply Voltage	Remarks
				corrected					corrected					corrected			
	H-P	Pan	Zero	H-P	Pan	H-P	Pan	Zero	H-P	Pan	H-P	Pan	Zero	H-P	Pan		
24 Aug. 1300																	Power on
1420	82.3	90.4															
1430						75.7	83.1									6.00	
1438											85.8	89.5					Zeros all wandering
1446											85.5	89.5					when H-P on
1450											85.2	89.3					channel 6 - not so with Pan
1500	82.7	90.7															on A6.
1505						75.7	83.4										
1517						74.9	83.1										
1525											84.4	88.1					
1530																	Power off
25 Aug 0805																	Power on
0835	79.3	88.7															
0844						71.7	84.2									5.85	
0850											82.8	87.5					
1147											83.9	86.1	-1.1	85.0	87.2	5.85	
1155	79.1	87.2	-1.0	80.1	88.2												
1200						75.0	81.2	+2.1	72.9	79.1							
1207-1314								+1.3 to +2.1									Chart stile. Extreme in zero
1315						74.0	81.0	+1.9	72.1	79.1							
1322											84.6	86.8	-0.7	85.3	87.5	5.82	
1331	80.6	87.6	-1.6	82.2	89.2												

Trace not consistent

Date	Time	A3 HP	A3 Pan	A3 Zero	A3 Corrected HP	A3 Corrected Pan	A5 HP	A5 Pan	A5 Zero	A5 Corrected HP	A5 Corrected Pan	A6 HP	A6 Pan	A6 Zero	A6 Corrected HP	A6 Corrected Pan	Power Supply Voltage	Remarks
25 Aug	1412	79.5	87.3	-1.8	81.3	89.1												
	1442	80.0	87.3	-1.7	81.7	89.0												
	1523	79.9	87.3	-1.7	81.6	89.0											5.74	
	1525						77.1	81.4	+1.9	75.2	79.5	~~80.~~ 82.8	86.4	-1.1	84.7	88.0		Power off
	MAX	82.7	90.7	-1.8	82.2	89.2	77.1	84.2	2.1	75.2	79.5	85.8	89.5	-1.1	85.3	88.0		Batteries in
	MIN	79.1	87.2	-1.0?	80.1	88.2	74.0 71.7?	81.0	1.3?	72.1	79.1	82.8	86.1	-0.7?	84.9	87.2		1600 to 1130 8-25-55
	Δ	3.6	3.5	0.8?	2.1	1.0 3.1	5.4?	3.2	0.8?	3.1	0.4	3.0	3.4	.4?	0.4	0.8		
26 Aug	0954		85.1	-1				79.2	2.1			80.2	86.0	+0.5			5.4	Power on 0954
	1045							78.8	2.6				86.7	+0.5			5.4	
	1058		88.6	-1				82.1	2.0				88.0	-0.2			5.6	Batteries changed

29 Aug Calibration and Zero Checks During Field Test 10-5

Wind Speed (range) →	32 mph	17	9	4.5	2½	Zero	Inst. Cab. Temp		Power Supply Voltage	Pan Mag Not Zero
Inches/sec →	20	10	5	2½	1½	0				
All Pressure Settling →	50	100	200	400	800	None				
Anemometer No.										
26 Aug 55 A1	53.0	27.8	13.5	5.3	1.7	-2.0			6V	
A2	53.0	28.5	14.5	6.5	3.3	-0.5				
A3	53.0	28.3	14.1	5.9	2.4	-1.4				
A4	53.0	27.9	13.7	5.7	2.3	-1.3				
A5	53.0	29.5	16.1	8.6	6.5	+2.0				
A6	53.3	28.4	14.3	6.3	2.9	-0.8				
Mean A1,2,3,4,6	53.1	28.2	14.0	5.9	2.5	-1.2				
30 Aug 1730 A1	51.9	X				-1.0				
A2	51.4					-0.4				
A3	51.3					-1.6				
A4	51.6					-1.1				
A5	51.0					+2.5				
A6	51.8					-1.3				
31 Aug 1100 A1	52.9	27.7	13.3	4.9	1.7	-2.1		49C	6 V.	-2.1 to -1.0
A2	51.3	27.4	13.6	5.5	2.6	-1.1				-1.1 to -0.5
A3	51.2	27.2	13.3	5.3	2.0	-1.5				-1.5 to -1.0?
A4	50.9	26.9	13.3	5.5	2.4	-1.5				-1.5 to -1.1
A5	52.9	25.4	15.5	8.3	5.3	+2.0				+1.3 to +2.6
A6	51.3	27.4	13.6	5.8	2.5	-1.1				-1.3 to -0.2
						-1.3 to -0.2				

H. T. Nichols

9 Sep 55

Ranges of Wind Speed on Mast Anemometer — CRM System.

Range ↓	Full Scale c/s	Full Scale mph	Calibration: 100 Panascan Setting	Calibration: 50 Panascan Setting
1	~ 12	~ 20	83 scale units	—
2	~ 38	~ 60	—	53 scale units

Paul W Nichols
#

9 Sep 55

Maximum Wind Speed at Which Mast Anemometers Operate Normally — See Post Mast Notebook, p 36.

Anemometer	CRM Range 1 Scale	CRM Range 1 Equivalent mph	CRM Range 2 Scale	CRM Range 2 Equivalent mph
1	100+	20+	62	37
2	100+	20+	83	50
3	100+	20+	* 100 (45+)	60
4	100+	20+	84	50
5	100+	20+	* 100 (94+)	60
6	100+	20+	58	35

* Anemometer still functioning at the scale readings indicated in parentheses. No higher rotation rates attempted

Paul W Nichols
#

12 Sep 55

4	—	—	65	39
6	—	—	102	60+

Adjusted pots. No. 6 improved. No 4 - couldn't get to previous 84 scale units.

[illegible] : 3 [illegible]
2.1 to +0.1 (2.2)
.1 to +0.9 (2.0)
.8 to −0.7 (1.1)
to −1.1 (0.5)
2 to +2.7 (1.5)
.3 to +2.0 (3.3)

Paul W Nichols

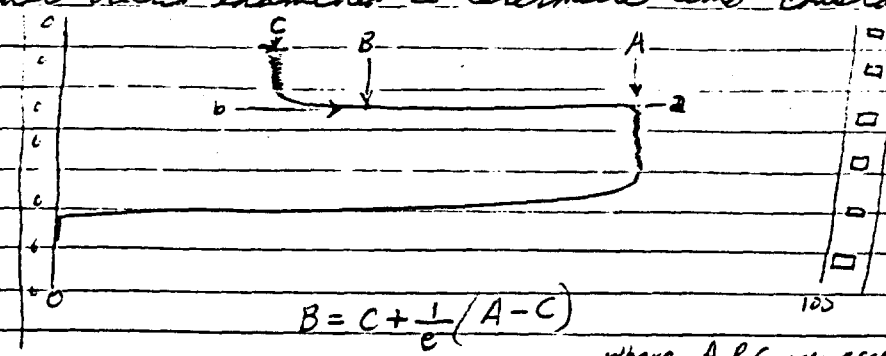
1100409

15 Sep 55

Determination of Time Constants of Anemometer CPMs

CRM

Procedure: Pulses from Panoscan were piped to CRM and the recorder traces examined to determine time constants.



$$B = C + \frac{1}{e}(A - C)$$

where A, B, C are scale units

$$\tau = t_b - t_a$$

where t is time and τ is time const.

Data:

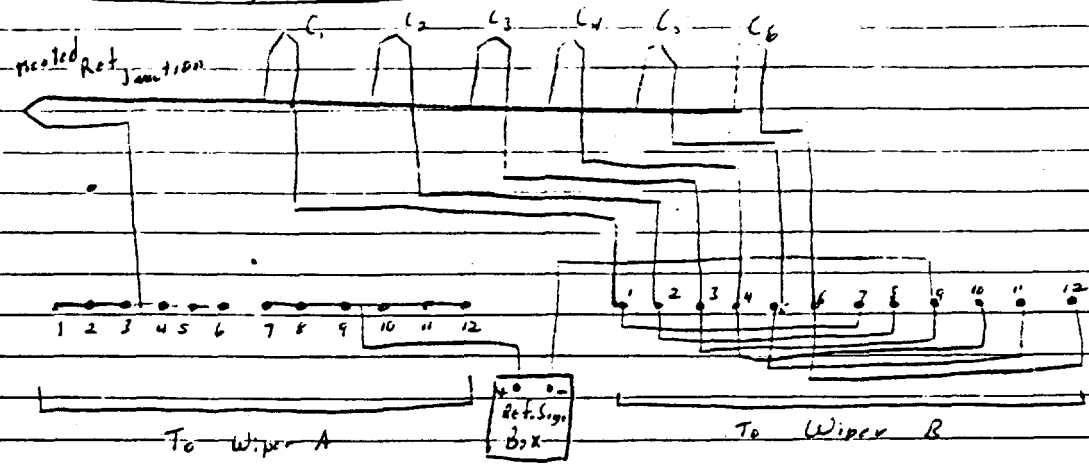
Time Constants (Label Designation) / Channel used in determination	1 S	$\frac{1}{2}$ S	$\frac{1}{4}$ S
A_4	1.3 sec	0.8 sec	0.4 sec
A_4	1.6		
A_2	1.3	0.8	0.3
A_3	1.3		
Mean	1.4	0.8	0.4

Paul H Nichols

18 Oct 55

Portable Unit – Direct Measure of Temp. Differences and Temps.

Patch Panel – Wiring Diagram



~~Record~~

Patch Panel Position	Records	Patch Panel Position	Records
1	Temp of C_1	7	Temp of C_3 – Temp of C_1
2	C_2	8	$C_3 - C_2$
3	C_3	9	"Zero" Reference Signal
4	C_4	10	$C_3 - C_4$
5	C_5	11	$C_3 - C_5$
6	C_6	12	$C_3 - C_6$

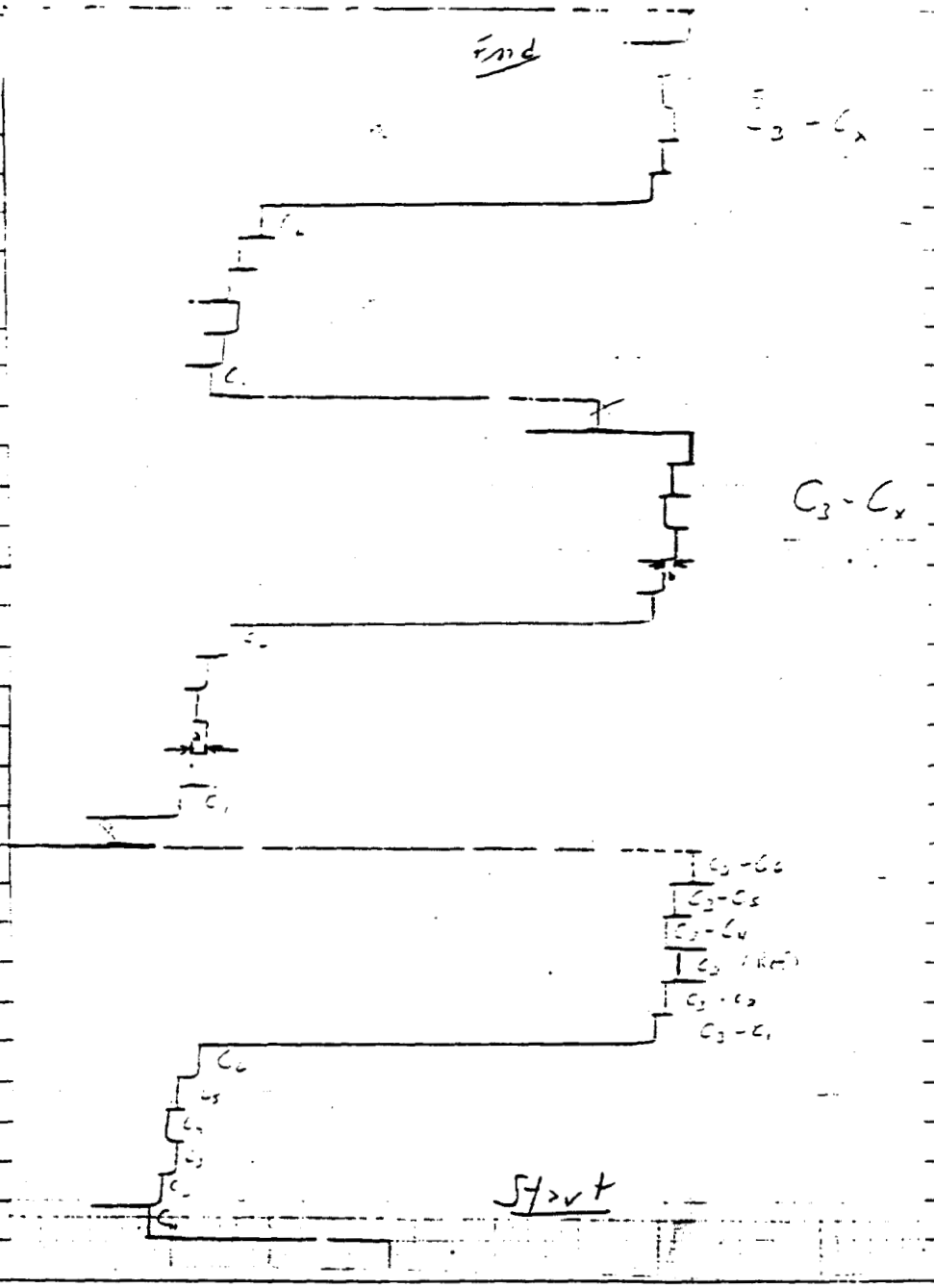
Discussion and Conclusion

The recorder trace displayed on pg 2 shows the signals of both temps and temp differences. The caps were on the thermocouples, hence their temperature remained essentially constant over this sampling period. The heated reference junction was in the process of warming while the trace was made. This is indicated by the trace upward on an individual temp trace as well as the trace indicated made by (say) C_1 on the first, second, and third scans. However the temperature differences remained constant thru the three scanning cycle. Also the temp differences as indicated between (say) C_2 and C_3 on the individual temp trace equals (as it should) the temp difference between C_2 and C_3 as indicated directly (2 = 0 on trace)

The conclusion is the method of measuring temp difference directly is feasible.

Neal H. Nichols

1100411



Portable Mast – Direct Measure of Temperature Differences

See discussion on page 91.

26 Oct 55

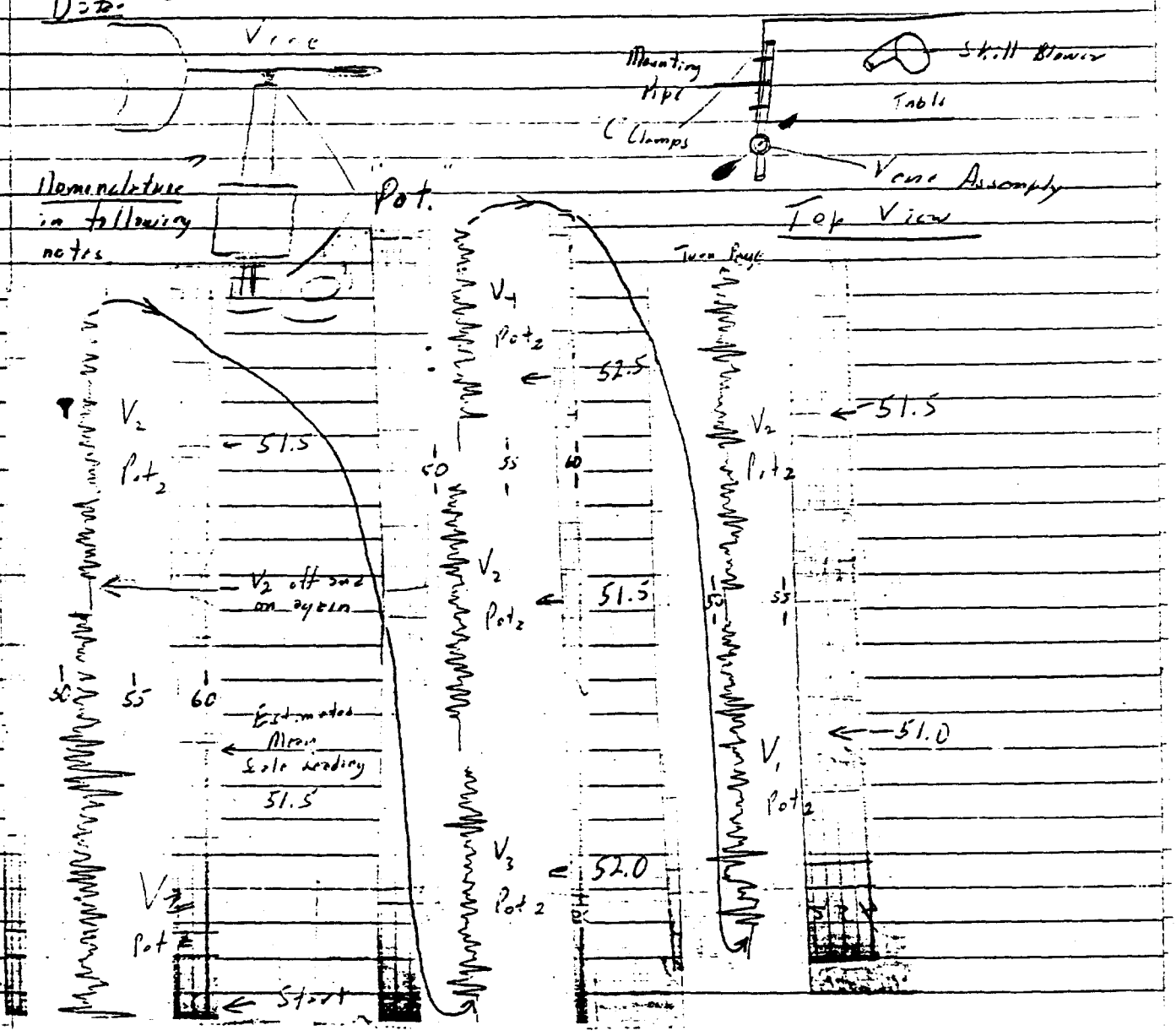
Portable Mast Orienting of Vanes by Insertion in "Constant" Air Stream

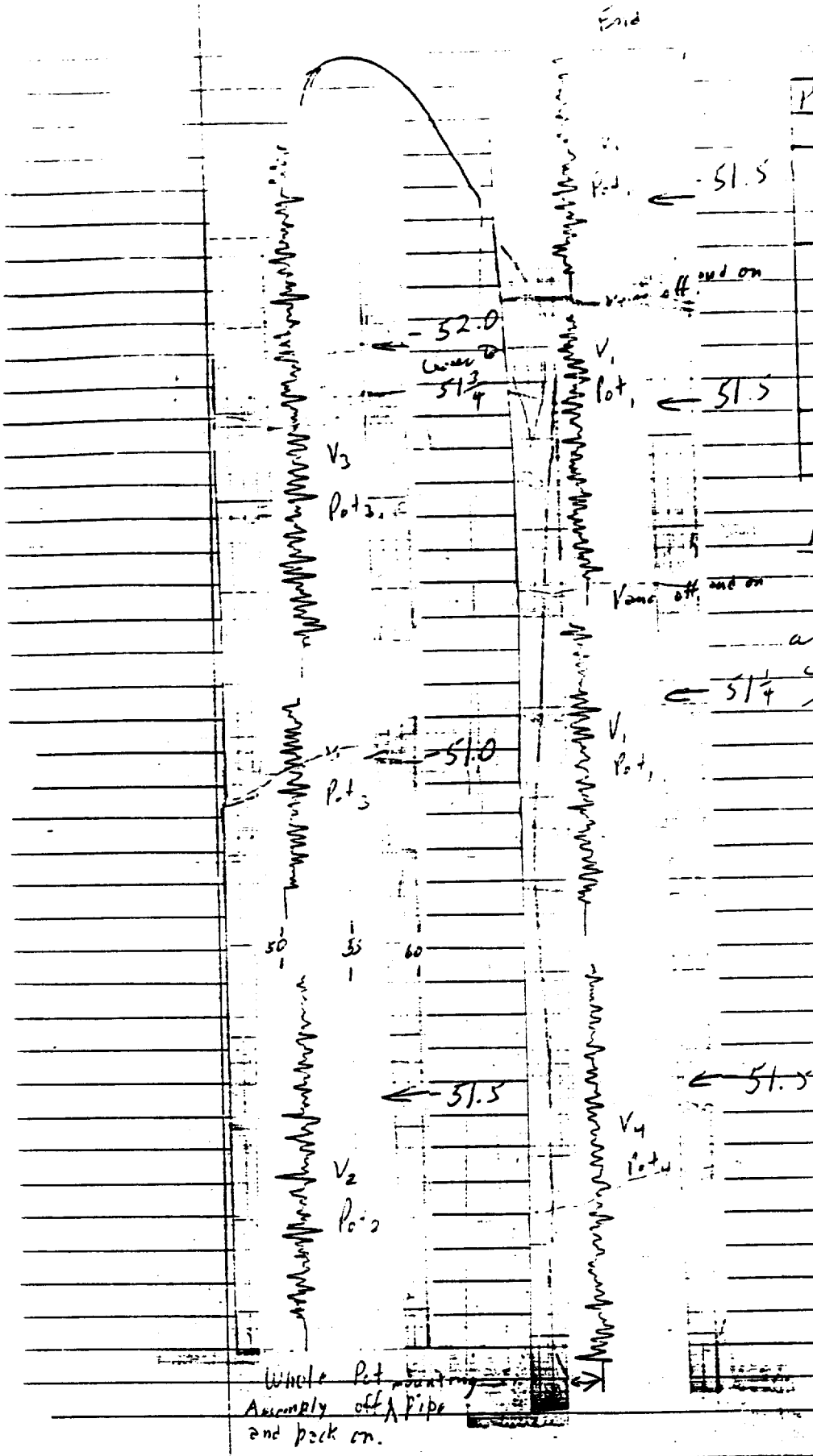
Purpose: To check and perhaps improve on the old orienting method and to determine if different vanes in different potentiometer mounting assemblies will orient differently.

Procedure

All van doors shut. Still blower with a cloth as "strainer" inserted in the exit stream was used as ~~a source of~~ the "constant" air stream. Vane assemblies were then placed one after the other at exactly the same position in the air stream.

Data:





Summary of Chart Records

Pot ↓	Vane V1	V2	V3	V4
1	51.25 51.5 51.5			
2	51.0	51.5 51.5 51.5 51.5	52.0	52.5
3	51.0		51.75	
4				51.5

Discussion and Conclusion

Only Pot 4 required an adjustment in its mounting clamp to bring it to a reasonable orientation. The other three were well oriented by the "sighting along the vane" method.

Conclusions:

1. Different vanes with different pots give slightly different results. Vanes should always be used with the pot used during orientation.
2. The set-screw used to precisely set vane in its shaft works satisfactorily (as evidenced by 5 settings of V_3 in Pot 2 and 3 of V_1 in Pot 1.)
3. Assuming the boom are all parallel, relative orienting of vanes can be accomplished prior to mounting them on the mast.

Paul H. Nichols

1100414

Height of Portable Mast Instruments Above Surface as of 7 Nov 55

Boom No	Vane	Anemom	TC	Impactor
1	1.2'	1.2'	1.1'	0.9'
2	5.4'	5.5'	5.1'	~~14.7~~
3	—	9.2	8.5'	—
4	15.2	15.2	15.0'	14.7'
5	—	25.1	24.9'	—
6	41.8	41.8	41.6'	41.3'

Malcolm

28 Nov 55

Investigation into Significance of Impactor Slide Counts

Purpose: To investigate the variations in impactor slide counts due to (1) differences in time of counting, (2) differences in areas (traverses) counted, and (3) differences in counting personnel.

Procedure:

The first series of counts were made by the same observer counting the same traverses more than once and at essentially the same time for any given traverse. This was done to get an idea of the reproducibility of the counts [illegible] under identical conditions.

Case I — Same man, same traverse, "same" time.

Observer	Sample and Traverse	Date Counted	Magnification	Impactor Stage	Part in Size Range A Count	A % Count	B Count	B %	C Count	C %	D Count	D %	Σ
DMH	XX-a	11 Nov 55	100X	1	43*	132%	98	95	12	89	4	133	* Graticule size #1 only counted
✓	✓	✓	✓	✓	22*	68	108	105	15	111	2	67	
✓	XX-c	✓	✓	✓					6	46			
✓	✓	✓	✓	✓					17	131			
✓	✓	✓	✓	✓					16	123			
PWN	✓	✓	✓	✓					23	93			
✓	✓	✓	✓	✓					25	101			
✓	✓	✓	✓	✓					26	105			
MFS	✓	✓	✓	✓					35	118			
✓	✓	✓	✓	✓					26	88			
✓	✓	✓	✓	✓					28	94			

Sample Calculation of % of count

$$\begin{array}{r} 43 \\ 22 \\ \hline \Sigma\ 65 \end{array} \qquad \overline{\text{Count}} = 65/2 = 32.5 \qquad \frac{43}{32.5} = 132\% \qquad \frac{22}{32.5} = 67\%$$

Case I - Table of 90% Confidence Limits and σ of Parent Population (from data on page 95) (This book)

Observer	Sample-Tumor	Date	A	B	C	$\bar{\sigma}$
DMH	XX-a	11 Nov 55	100 ± 202%	100 ± 32	100 ± 72	
✓	✓	✓	σ = 57%	σ = 9	σ = 20	35%
DMH	XX-c	✓			100 ± 77%	
✓	.	✓			σ = 50%	
PWN	.	.			100 ± 11	
✓	.	.			σ = 7%	
MFS	.				100 ± [illegible]	
.	.				σ = [illegible]	
				$\bar{\sigma}$ =	33%	overall = 33%

Sample calculation of 90% Conf. Limits and σ:

σ refers to parent population

$\sigma = \frac{\text{Range of sample}}{j}$ ~~[illegible]~~ where j and k = constants dependent on sample size* (p 165)

$S = k\sigma$

$\text{Limit} = \bar{X} \pm \frac{t_s}{\sqrt{n}}$ (refers to sample)

t = student's "t" (p 28)

S = sample stand. dev.

$\sigma = \frac{64\%}{1.128} = 57\%$

$S = (0.798)(57\%) = 45\%$

$\text{Conf. Limit}_{90\%} = 100\% \pm \frac{6.3 \times (\text{[illegible]})}{\sqrt{2}} = 100 \pm 202$

$\bar{\sigma} = \left[\left(\sigma_1^2 + \sigma_2^2 + \sigma_3^2 + \ldots \sigma_n^2\right)\frac{1}{n}\right]^{\frac{1}{2}}$ Perhaps this is wrong symbol $\bar{\sigma}$ but it's here defined anyhow

*Page numbers refer to Bennett and Franklins Statistical Analysis in Chemistry and the Chemical Industry

[illegible] Case II data are presented below.

Case II – Same Observer, Same Traverse, Different Times.

Observer	Month and Traverse	Date Counted	Mag.	Int. Stage	Particle Size Range A Count	A %	B Count	B %	C Count	C %	D Count	D %	
DMH	XX-a	11Nov	100X	1	43*	102	91	96	12	50	4	166	* Size 1 only
"	"	14Nov	"	"	41*	95	106	104	15	111	1	40	
"	"	"	"	"	41*	130	106	99	15	100	1	67	
"	"	21Nov	"	"	22*	70	105	101	15	100	2	133	
"	XX-b	11Nov	"	"	29*	91	100	98	20	125	1	200	
"	XX-b	14Nov	"	"	35*	109	104	102	14	75	0	0	

Case II – 90% Confidence limits and σ:

	1	3	C	σ
25	100 ± 139	100 ± 25	100 ± 70	
	σ = 47	7	26	12
2 hour	100 ± 190	100 ± 6	100 ± 0	
	53	2	0	31
	100 ± 57	100 ± 13	100 ± 158	
	16	4	44	27
σ	32	5	28	25% – overall

Discussion: [illegible] data [illegible] aspects, [illegible] comparison of the data for cases I and II show that the 90% confidence limits and σ are smaller for Case II than for Case I. The conclusion is that there is no difference between Case I & II. Thus time is not a factor — at least ~~not~~ in the day interval is not.

In considering both above cases, size D particles were not compared. The number present was not statistically significant. Also, a check of the results of these large particles (D) showed that the deionized water, filter papers, silicone stickers etc used and the slides were ~~[illegible]~~ stored in a vertical position for two days. Of five ~~[illegible]~~ particles between 70 and 140 μ which were checked, the smallest movement on the vertically stored slide was 0.4 mm. Three of the 5 had moved a distance greater than 0.7 mm. Thus, the comparison of Size D counts on the same traverse at different time is invalid.

If the smaller particles participate in a movement across the slide, apparently there are enough particles to balance the particles moving off the counting area with those moving on.

The best procedure in case of relatively few large particles is to count ½ or the entire sample area on the slide

Case III - Same Observer, Different Traverses

Observer	Sample and Traverse	Date Counted	Magnification	Imp. Stage	Particle Size Range A Count	A % of [illegible]	B Count	B %	C Count	C %	90% Conf. Limits σ Particle Size Range A	B	C
DMH	XX-a	1400 11 Nov 55	100X	1	43*	119	98	99	12	80	100±120%	100±2%	100±47%
	XX-b	✓	✓	✓	29*	81	100	101	20	133	34	1	31
	XX-c	15 Nov	✓	✓	—	—	98	99	13	87			
	XX b	11 Nov	✓	✓	29*	114	100	98	20	125	±88%	±9	±39
	XX a	1500 11 Nov	✓	✓	22*	86	105	106	15	94	25	6	26
	XX c	15 Nov	✓	✓	—	—	98	96	13	81			
	XX b	11 Nov	✓	✓	29*	83	100	99	20	125	±67%	±7%	±39%
	XX a	14 Nov	✓	✓	41*	117	106	105	15	94	30	[illegible]	26
	XX c	15 Nov	✓	✓	—	—	98	97	13	[illegible]			
	XX b	14 Nov	✓	✓	35*	90	104	104	14	10[illegible]	±63	±5	±14
	XX a	1400 11 Nov	✓	✓	43*	110	98	98	12	92	18	4	9
	XX c	15 Nov	✓	✓	—	—	98	98	13	100			
	XX b	14 Nov	✓	✓	35*	133	104	101	14	100	±208	±9	±12
	XX a	1500 11 Nov	✓	✓	22*	77	105	105	15	107	59	6	[illegible]
	XX c	15 Nov	✓	✓	—	—	98	95	13	[illegible]			
	XX b	14 Nov	✓	✓	35*	92	104	101	14	100	±51	±7	±12
	XX a	✓	✓	✓	41*	102	106	[illegible]	15	107	14	5	6
	XX c	15 Nov	✓	✓	—	—	98	[illegible]	13	[illegible]	33%	5	21
DMH	I-a	27 Oct 55	✓	✓	55*	117	125	92	47	96			
✓	I-b	10 Nov 55	✓	✓	41*	83	146	107	51	104	±18	±8	±4
PWN	UU-a	20 May 54	✓	✓	15*	84	224	98	67	101	σ=16	7	4
✓	UU-b	✓	✓	✓	25*	116	234	102	66	99	27	6	16
PWN	12-a	19 May 54	430X	2	185	91	249	106	21	98	±19	±7	±13
✓	12 b	✓	✓	✓	224	109	220	94	22	102	σ=1[illegible]	6	14
DMH	I-a	27 Oct 55	✓	✓	324	118	114	107	4¾	—			
✓	I-b	10 Nov 55	✓	✓	225	82	100	92	3	—			
✓	I-a	27 Oct 55	✓	3	557	10[illegible]	8	—	—	—	±50	—	—
✓	I-b	10 Nov 55	✓	✓	478	9[illegible]	3	—	—	—	σ=14	—	—
DMH	I-a	27 Oct 55	970X	4	109	97	7	—	—	—	15	6	14
✓	I-b	10 Nov 55	✓	✓	111	101	2	—	—	—	±6		
											σ=2		

Overall σ = 17%

* Size 1 only counted

1100418

Comparison of σ for cases I, II and III

Magnification	Particle Size Range A 100x	A 430x	A 970x	B 100x	B 430x	B 970x	C 100x	C 430x	C 970x	All (σ) 100x	All (σ) 430x	All (σ) 970x
Case I	579^{2}			9^{2}			33^{11}			35^{15}		
Case II	32^{6}			5^{6}			28^{6}			25^{18}	~~25~~	
Case III	27^{10}			6^{10}			16^{10}			18^{30}		
		15^{6}			6^{4}			14^{2}			12^{12}	
			2^{2}			—			—			2^{2}
Total Imp. Count, Case III		18^{2}			9^{2}			5^{2}			12^{6}	

Green indicates no of samples on which σ's are based

Case III – Total Computed No of particles on all impactor stages by same observer making two different traverses

Observer	Sample and Traverse	Date Counted	Magnification	Impactor Stage	Particle Size Range A Computed No	A %	B No.	B %	C No.	C %
JMH	I-a	27 Oct 55	100, 430, 970	All	170,000	[illegible]	31,000	105	4000	103
✓	I-b	10 Nov 55	✓	✓	140,000	[illegible]	28,000	95	3500	97
						18		9		5

Discussion

Examination of the table at the top of this page reveals a decrease in the standard deviation of counts from Case I thru Case III. However since Case I can be considered as a measure of the precision of the counting technique, it must be embodied in both cases. Also since counts were made at different times in case II and since it was concluded that differences in time at which counts were made made no difference (Comparison of Cases I and II) the downward trend of σ from case I thru III can be attributed to chance. To put it another way, it would be quite easy natural to put forth reasons as to why the standard deviation should increase as you add possible errors due to time and differences in areas counted; but one

is hard put (to say the least) to advance a reason as to why $\bar{\sigma}$ should decrease when these possible sources of error are added. Thus one may reasonably conclude the ~~to~~ trend is a chance event.

Summarizing the results of the examination of Cases I, II, it can be stated that a negligible differences are found ~~in counting when the same~~ when a given counter counts the same sample at ~~two~~ different times or at different places. Of course some qualifications must be placed on this conclusion. For instance, care must be taken to avoid exposure of a sample to further contamination or, a count should be made at a reasonable position on the sample area of the exposed slide (ie not at or near an edge or place where stickum is not properly applied.)

Sample Calculation on $\bar{\sigma}$ for 100 X Mag on case III

$$\bar{\sigma} = \left\{\left[6\left(\sigma_{xx}^2\right) + 4\left(\sigma_{xy}\right)^2\right]\frac{1}{100}\right\}^{\frac{1}{2}}$$

$$\bar{\sigma} = \left\{\left[6(33)^2 + 4(18)^2\right]\frac{1}{100}\right\}^{\frac{1}{2}} = 27$$

The σ^2 were weighted in the ratio of 5 to 4 since that is the ratio of the number of traverse counts made to compute the respective σ's.

Discussion & Data

Now we may reinvestigate the variation of the counts of the same observer at different or the same times or traverses (since differences in time and traverse have been demonstrated to be of small consequence)

[illegible]	[illegible]	[illegible]					
Drill H XX-a [illegible] 100X	1	43	[illegible]	[illegible]	90	[illegible]	[illegible]
XX-b		22	[illegible]	[illegible]	[illegible]	15	[illegible]
XX 2		41	121	106	104	15	[illegible]
XX 2 14 Nov		24	83	100	95	20	[illegible]
XX [illegible]		35	[illegible]	104	[illegible]	14	94
XX 14 Nov				98	96	13	[illegible]
XX 11 Nov		—					
I 2 [illegible]		58	117	125	92	47	96
I b [illegible]		41	133	140	101	51	[illegible]
			2576		92		17[illegible]
			2576/4 = 644	92/5 = 18.4		[illegible] = 9.3	
			S_{xx} = 25%		4.3		19%
			(11)(2.326) = 26%		3.9		21%
			24(1.128) = 3.7		14		7
			27%		5		18
			3154	(18.1)(12) = 220		17.[illegible] = 32	
			237	[illegible]	5.6	[illegible]	16
			24%		6%		17%
			23%		6%		19%

$\bar{\sigma}_{[illegible]} = 18\%$

[illegible] K [illegible] constants determined by sample size. (see [illegible] p. 96)

$\Sigma(\Delta X)^2$ (1)

$\Sigma XX/n-1$ (2)

$\sqrt{(2)} = S_{xx}$ (3)

(Range)/K = $\sigma_{xx(est)}$ (4)

(Range/K) = σ_I (estimate) (5)

$\sigma_{[illegible] I}$ ([illegible]) (5 ½)

$\Sigma XX^2 + \Sigma I^2$ (6)

(6) / $n_{xx} + n_I - 1 = S_{All}$ (7)

$S_{All} [illegible] = \sigma_{All}$ (8)

Range / K = σ_{All} (estimated)

	[illegible]								
P[illegible] [illegible] 2	22 [illegible] 100X	1	1	84	224	95	[illegible]	101	
P[illegible] [illegible] b	[illegible]	1	25	116	234	102	6[illegible]	96	
				28		.5		1.[illegible]	
Drill I 2	270[illegible] 430X	2	324	118	114	1.7	4%	—	
Drill H I b	11 Nov 55 430X	2	225	[illegible]2	100	93	3	—	
Drill H I 2	27 Oct	3	557	[illegible]	8	—	1	—	
Drill H I b	11 Nov 55	3	478	92	3	—	0	—	
				17		12		—	
PWIV 12 2	19 Aug 54 430X	2	185	91	249	1[illegible]	21	9	
PWIV 12 b	✓ ✓	2	224	104	226	44	22	[illegible]	
				16		11		3.[illegible]	
Drill H I-a	270[illegible] 470X	4	104	99	7	—	—	—	
Drill H I-b	11 Nov 55 470X	4	111	101	2	—	—	—	
				1.8		—		/	

$\bar{\sigma}_{[illegible]} = 16\%$

$\sigma_{[illegible]}$ = (Range)(K)

$\bar{\sigma}_I = 15\%$

$\sigma_{[illegible]}$

$\bar{\sigma}_I = 12\%$

$\sigma_{[illegible]}$

$\bar{\sigma} = 1.[illegible]\%$

$\sigma_{[illegible]}$

[illegible] counting [illegible] DMA), and that only [illegible] DMA [illegible] magnifications, particle size [illegible] DMA data [illegible] in computing the σ is for the same individual. The validity [illegible] data supplied by one man is [illegible] that where comparisons of σ's between PWN & DMA are available, there is good agreement.

The σ now may be considered the standard error of counting on any given man and will be designated hereafter as σ_d. It's an estimate of precision. A table of σ_d for the various magnifications and particle size ranges follows:

σ_d Values %

(Number of particles in indicated stage and [illegible] particle size [illegible])

Magnification	Stage	Particle Size Range A	B	C	
100X	1	23	6	19	* PWN's σ_d [illegible] DMA data available
300X	2	17	12	4*	# Any [illegible] supplied, no data available [illegible] the number of particles of size B impacting on stage 4 is ≤ 15% of [illegible] number of size C collected
750X	3	17	12	4*	
970X	4	2	12#	No cases	

in all stages for all cases investigated (mean [illegible]). The [illegible] should not be [illegible] with respect to the [illegible] particles.

In order to assess the effect of the above [illegible] the σ_d [illegible] the [illegible] number of a given size collected in an impactor, [illegible] the distribution of particles on the [illegible] is necessary.

[illegible] replication ← [illegible]

[illegible] replication — replication [illegible] to [illegible] from impactor to impactor

Stage I					Stage 2					Stage 3				Stage 4		
Run	Start	X	X		num	X	.17X	.17X	X	.17X	.17X		X			Σ
λ λ	[illegible]	13.	5.6	[illegible]	25/66	3[illegible]	6.[illegible]	[illegible]	[illegible]	32	[illegible]	[illegible]	[illegible]	17		
I	36/17[illegible]	2			6/17	35	6.0	36	10/17	54	10[illegible]	1[illegible]	11/[illegible] 6	—		12[illegible]
40 [illegible]	4/1[illegible]	2			44/1[illegible]	20	4.1	17	13/18	72	12[illegible]	144	[illegible] 2	—		166
12	25/18[illegible]	14	3.[illegible]	1.[illegible]2	31/1[illegible]	17	2.9	8	43/1[illegible]	52	8.8	77	[illegible] 14	—		95
12	34/1[illegible]	2			5/18	28	4.8	23	[illegible]/18	56	9.[illegible]	90	31/18[illegible] 17	[illegible]		113
11	12/1[illegible]	1			47/150	19	3.2	10	47/15[illegible]	31	[illegible]	2[illegible]	16/15[illegible] 31	1.0	1	39
11	14/240	1			57/240	37	6.3	40	5/24	21	3.6	13	[illegible]/24 42	.8	1	34
1[illegible]	15/142	1			25/147	19	3.2	10	35/147	26	4.4	19	3[illegible]/47 54	1.1	1	30
11	5/450	1	—	[illegible]	44/410	23	3.9	15	14/41	34	5.8	34	17/41 41	[illegible]	1	50
12	53/130	4	.9	[illegible]	11/130	5	1.4	2	[illegible]/13[illegible]	70	11.9	142	23/130 17	—		145

		Stage I	Stage 2	Stage 3	Stage 4	
	Σx	411	248	493	261	902%
	$\bar{x} \approx$	41%	25%	45%	26%	
	$\Sigma(x-\bar{x})^2$	229	852	2463	3225	
	$\frac{\Sigma(x-\bar{x})^2}{n-1}$	25	95	305	358	
With respect to [illegible] Absolute [illegible] = [illegible] %	S_{Adr}	5[illegible]	97	196	189	
[illegible]	$S_{Adr}/\sqrt{\ }=\sigma_{Adr}$	5%	10%	20%	1[illegible]%	
With respect to $\bar{x}$ = [illegible] %	σ_{Adr}	125%	40%	44%	73%	
[illegible]	(incomplete) σ_{Ad}	23	17	17	2	

σ_{A} [illegible]
σ_{Ad}
σ_{A}

$\Sigma\, \sigma_{A}$ [illegible] — 90[illegible]
÷ 10 — 9[illegible]
σ_{T} (all stages) — 10[illegible]

$$\sigma_{Ad} = \left[\left(\frac{\bar{x}\,\sigma_{Ad1}}{100}\right)^2 + \left(\frac{\bar{x}_2\,\sigma_{Ad2}}{100}\right)^2 + \left(\frac{\bar{x}_3\,\sigma_{Ad3}}{100}\right)^2 + \left(\frac{\bar{x}_4\,\sigma_{Ad4}}{100}\right)\right]^{\frac{1}{2}} = \left[\left(\frac{41\cdot 23}{100}\right)^2 + \ldots\right]^{\frac{1}{2}} = \sqrt{777} \quad - \quad 9[illegible]$$

σ_{Ad} for All stages was computed in two ways. They compare [illegible]. The 10% value is the most valid computation.

$$\sigma_{Adr\,All} = \left[\left(\frac{\bar{x}_1\,\sigma_{Adr1}}{100}\right)^2 + \ldots \left(\frac{\bar{x}_4\,\sigma_{Adr4}}{100}\right)^2\right]^{\frac{1}{2}} = \left[25 + 100 + 400 + 361\right]^{\frac{1}{2}} = \sqrt{886} = 30\%$$

$$\sigma_{Ar\,All} = \left[\sigma^2_{Adr\,All} - \sigma^2_{Ad\,All}\right]^{\frac{1}{2}} = \sqrt{886 - 91} = \sqrt{795} = 28\%$$

Interesting.

Wait a minute! The σ_{Ar} [illegible] is [illegible] [illegible] larger than the [illegible]. For instance, if the σ_r were zero in all tests, there would still be a large variation in particle concentration during the tests. All that is actually proven here is the calibration of a stage by a count of particles [illegible] only (no sizing) would be [illegible]

						Stage 1			Stage 2			Stage 3					
		X															
XX	44/71	62	3.1	9.6	35/71	43	5.3	27.6	27/40	5	0.6	0.4	—	—	—		37.0	6
I	78/300	25	1.5	2.2	21/31	68	8.2	67.2	15/100	5	0.6	0.4	73/300	2	0.[illegible]	0.0	64.[illegible]	8
	13/29	45	2.7	7.3	8/20	29	3.5	12.2	27/40	27	3.2	10.2	—	—	—		27.7	5
FT 12	14/27	52	3.1	9.6	12/27	44	5.3	25.1	16/[illegible]	2	0.2	0.0	—	—	—		37.7	3
✓	26/83	31	1.9	3.6	56/83	67	8.0	67.0	11/830	4	0.5	0.2	—	—	—		67.8	7
FT 11	64/300	21	1.3	1.7	12/30	40	4.8	23.0	85/300	28	3.4	11.6	30/300	12	1.4	2.0	3[illegible].0	2
✓	17/43	40	2.4	5.8	10/43	23	2.8	7.8	10/43	23	2.8	7.8	64/400	15	1.8	3.2	24.6	5
✓	69/490	14	0.8	0.6	20/44	41	4.9	24.0	17/49	35	4.2	17.6	47/49[illegible]	10	1.2	1.4	43.6	7
✓	29/92	32	1.9	3.6	37/92	40	4.8	23.0	17/92	18	2.2	4.8	92/920	10	1.2	1.4	32.8	6
FT 10	25/40	28	1.7	2.9	62/40	69	8.3	68.9	28/400	3	0.4	0.2	—	—	—		72.0	8
	Σ	340				464				150				49			453.3	
	$\bar{x}$	34				46				15				5			45.3	
	$\sigma_{\bar{x}}$	6				12				12				12			$\sigma_{B_0} = \sqrt{453.3} =$	7
XX	6/10	60	16.7	279	1/150	16	0.9	—	—	—							279	17
I	29/40	72	13.7	189	87/400	22	0.9	1	18/400	7	0.2	—					189	14
[illegible]	mm	100%	19.5	361	—	0	—	—	—	—	—	—					361	19
FT 12	26/300	76	16.3	266	31/300	10	0.4	—	79/3000	2	0.1	—					266	16
✓	99/110	90	17.1	292	61/1100	6	0.2	—	—	—	—	—					292	17
FT 11	11/34	32	6.1	372	17/34	50	2.0	4.0	50/340	16	0.6	0.4					41.6	6
✓	93/110	85	16.2	262	17/110	16	0.6	—	—	—		—					262	16
✓	23/47	60	11.4	130	37/470	8	0.3	—	15/47	32	1.3	2					132	11
✓	26/26	77	14.6	213	50/260	21	0.8	1	—	—		—					217	15
FT 12	11/13	85	16.2	262	15/130	14	0.6	—	—	—		—					262	16
	Σ	775				157				57				0			2294	
	$\bar{x}$	78				16				5				0			230	
	$\sigma_{\bar{x}}$	19%				4%				4%				—			$\sigma_{\bar{x}} = \sqrt{230} =$	15%
XX	63/63	100																
I	39/39	100																
[illegible]	121/121	100																
FT 12	15/27	56			12/27	44												
✓	73/73	100																
FT 11	63/[illegible]	26			1[illegible]/[illegible]	74												
✓	93/93	100																
✓	6[illegible]/[illegible]	26			1[illegible]/[illegible]	74												
✓	93/93	100																
H 12	63/63	100																
	Σ	868				192												
	$\bar{x}$	81				19												

Not for data

Not for

1100494

Should be

$$\sigma^2 = \sum \left(\frac{\sigma_i N_i}{N_T} \right)^2$$

2 11 pr. [illegible]

[illegible]

In view of the following

1. Negligible differences are found when a given counter counts the same sample at different times or at different places on the ~~[illegible]~~ sample (p 100); and
2. The σ of a man's ability to count (as tabulated on p 100) is given for all stages. This σ includes the difference inherent in counting under conditions (1) above.

We can now compute the σ's associated with a specific sample by the formula

$$\sigma_A = \sqrt{\left(\frac{(\sigma_{A1})N_{A1}}{100}\right)^2 + \left(\frac{\sigma_{A2}\ N_{A2}}{100}\right)^2 + \left(\frac{\sigma_{A3}\ N_{A3}}{100}\right)^2 + \left(\frac{\sigma_{A4} + N_{A4}}{100}\right)^2}$$

where σ_A = σ for size A particles on entire sample (4 slides)
σ_{A1} = σ for " A " " stage 1 slide
σ_{A2} = " " " " " " " 2 "
σ_{A3} & σ_{A4} = etc
N_{A1} = Number of particles counted of size A on stage 1 slide
N_{A2} = " " " " " " " " " 2 "
etc.

σ_B & σ_C can be computed in a similar manner

Data on 0 size particles cannot be computed until greater numbers are found on the same sample.

Example computation for Size A Particles

Stage 1 Total (Computed) on Slide	Stage 2 Total on slide	Stage 3 Total on Slide	Stage 4 Total on Slide	Total on Impactor
3600	60,000	100,000	11,000	170,000 σ_A = 19,900

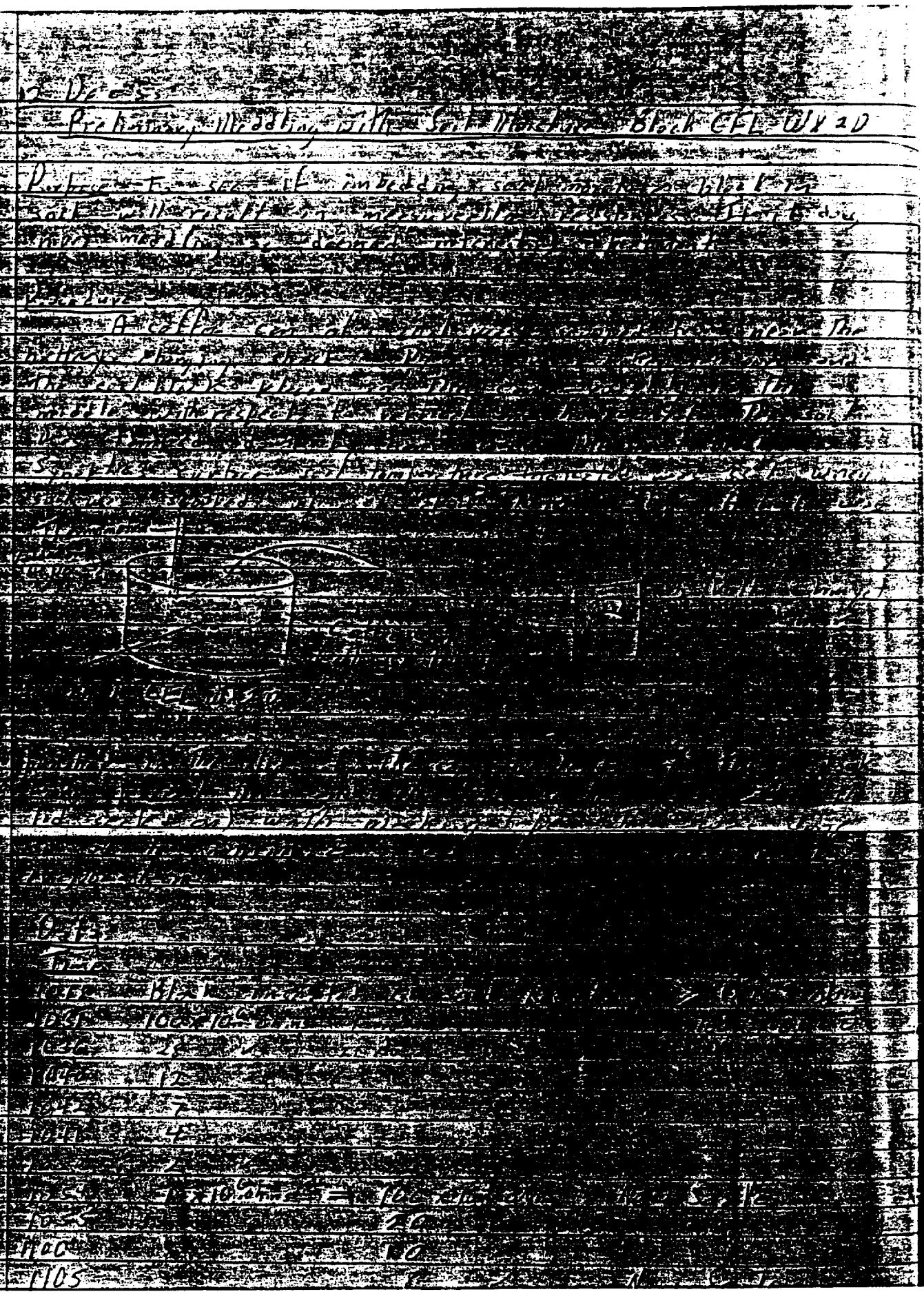
$$\sigma_A = \sqrt{\left[\frac{(23)3600}{100}\right]^2 + \left[(17)(600)\right]^2 + \left[(17)(1000)\right]^2 + \left[(2)(110)\right]^2}$$

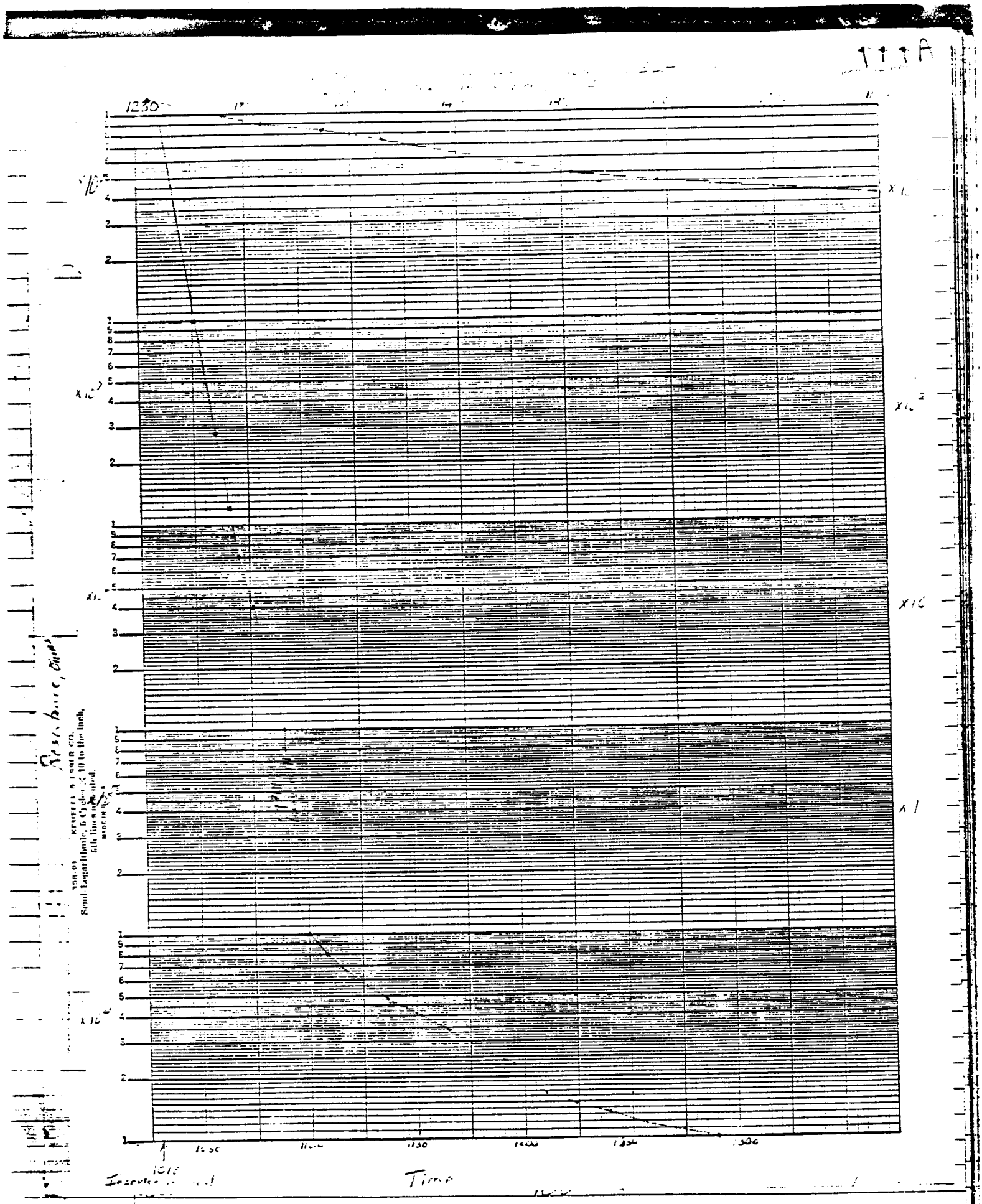
$$\sigma_A = \sqrt{393,000,000} = 19,900$$

Note that the [illegible] computed include only the [illegible] introduced by counting a sample and first the say word one about the validity of the sample taken.

Paul W Nichols

1100429




111A
1230
Time
Resistance, Ohms
KEUFFEL & ESSER CO.
Semi-Logarithmic, 5 Cycles X 10 to the inch,
5th lines accented.
MADE IN U.S.A.

[illegible]			
[illegible]	[illegible]	=	[illegible]
1116	[illegible]	=	[illegible]
1122	[illegible]	=	[illegible]
1130	[illegible]	=	34,000
1157			23000
1206			16500
1214			14[illegible]
1224			13200
1234			11[illegible]
1254			[illegible]
1300			9000
1322			3400
1334			7500
1334	Changed ranges		~~5000~~
1433			5000
1437			4500
[illegible]			3700

Time	Ohms
1345	900
1400	900
1415	900
1430	900
1445	890
1500	890
1515	900
1530	890
1545	890
1600	890

14 Dec 55

0807	1300
0820	1320
0910	1360
0911	Reset "ohms adjust"
[illegible]	[illegible] drilled
[illegible]	1930
Temp	76 F

13 Dec 55

[illegible]	920
[illegible]	1130
[illegible]	1000
[illegible]	1070
[illegible]	1000
[illegible]	960
[illegible]	930
[illegible]	960
[illegible]	935
1157	930
1203	930
1209	930
1215	930
1221	920
1227	910
1233	920
1245	910
1300	920
1315	890
1330	900

14 Dec [illegible] Soil Moisture Block Experimentation continued Temperature Dependence

To the test setup diagrammed on page 110, a thermometer was added. The whole apparatus was moved from atop the file cabinet to the drawing table at about 0915 and then a hole drilled for insertion of the thermometer. The base of the thermometer is apparently resting atop the moisture block during the process of moving, drilling, insertion, etc., the reading of the ohmmeter increased noticeably. No explanation right now (0955).

Time	Temp.	Ohms Resistance	Remarks
0807	—	1300	
0820	—	1320	
0910	—	1300	
0911	—		
0914	—	~1400	Reset "ohms" adjust and checked Zero adjust
0920	—		Hole for thermometer drilled
0945	76 F	1930	
0959	75 F	2000	
1005	75	2000	
1022	75	2100	
1027	75	2100	Immersed in ice water
1029	73	2100	
1033	70	2350	
1036	66	2450	
1041	60	2600	
1047	54	2850	
1055	48	3050	
1059	42	3300	
1107	39	3500	
1116	36	3600	
1122	35	3700	
1140	34 1/3	3800	
1157	34 1/3	3850	
1211	34 1/2	3900	
1225	34 3/4	3900	— Removed from ice bath
1231	36 1/2	3700	— Hot Water Added
1233	39	3300	
1235	44	3000	
1238	55	2850	
1240	61	2600	
1242	68	2450	

Time	Temp	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	
[illegible]	90	[illegible]	
1255	[illegible]	1800	
1257	104	1800	
1304	106	1800	Since 1231,
1312	110	1750	[illegible] Water has been added from time to time
1319	111	1750	Last water added at about 1226
1322	118	[illegible]	
1324	120	1700	
1326	123	1675	
1328	125	1675	
1332	125	1700	
1335	126	1700	
1340	124	1725	
1352	118	1825	
1400	114	1900	Out of warm water
1404	109½	1975	
[illegible]	102	2100	
1437	95	2250	
1447	91½	2350	
1449	—	—	Back in ice water

Comment

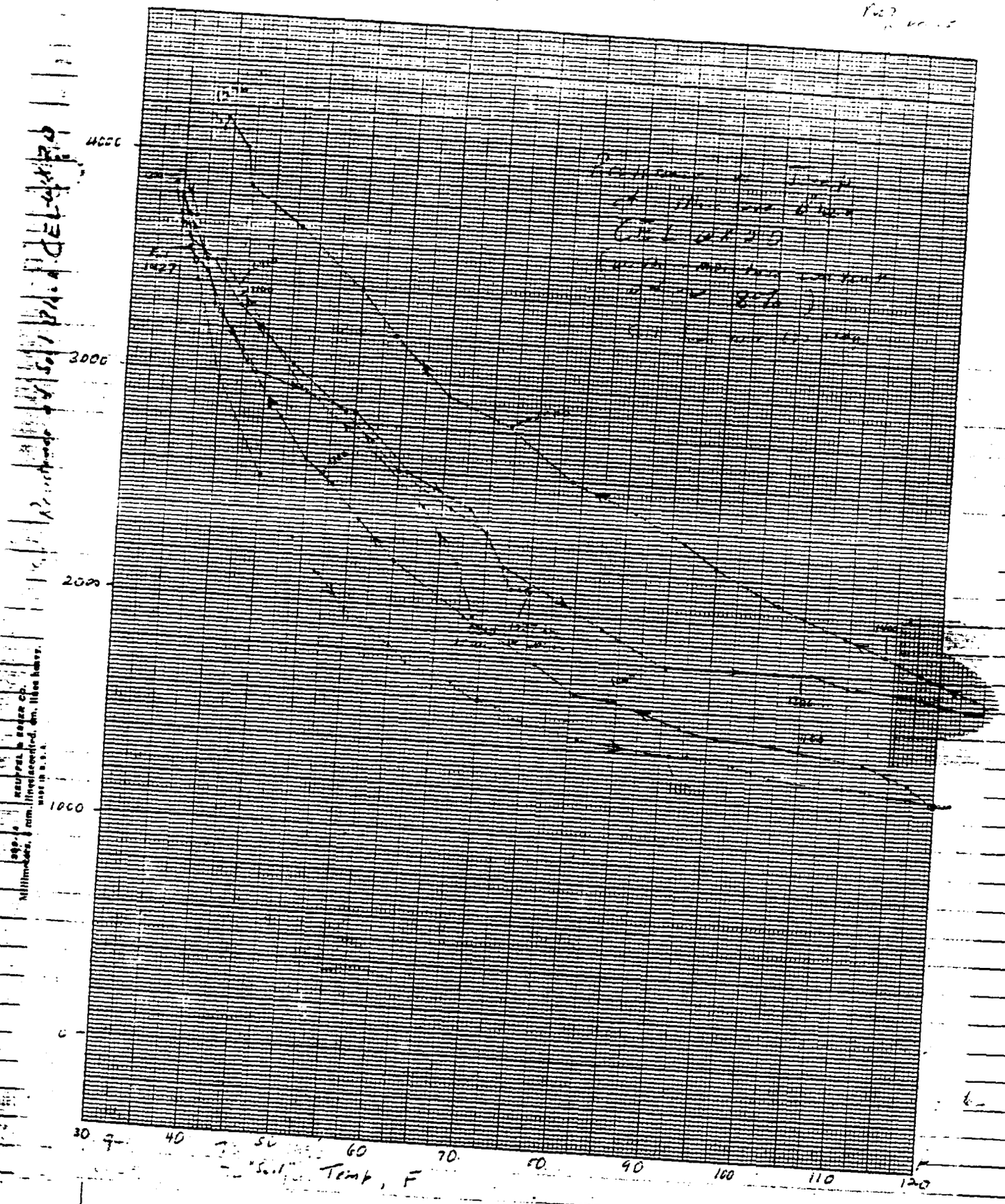
It seems possible that at the temperature of roughly 90 F that the [illegible] the can lost [illegible] of its moisture to the [illegible] [illegible] the can — or should [illegible] may, began to lose some.

1453	86	2475	
1456	79	2600	
1500	72	2825	
1505	65	2950	
1510	59	3200	
1514	55	3400	
1523	48	3675	
1530	44½	3850	
1539	[illegible]	4025	
1552	39½	4150	
1556	39	4100	Out of ice water
15 Dec 55			
0808	69	2100	
0809			Reset zero + ohms adjust on motor

1100435

[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]
			[illegible]
			[illegible]
			[illegible]
			[illegible]
			[illegible]
			[illegible]
			[illegible]
			[illegible]
0830	[illegible]	[illegible]	In [illegible]
0838	67	2[illegible]	
0841	63	2[illegible]	
0844	58	2650	
0851	44	2950	
0855	57 ?	3100	Misread thermometer
0857	~~42~~ 47?	3300	
0901	42	3700?	Misread meter – [illegible]
[illegible]	39	[illegible]	
0910	38	[illegible]	
[illegible]	36	3700	
0931	35	3775	
0937	35	3800	Out of [illegible]
[illegible]	37	[illegible]	In hot water [illegible]
[illegible]	45	[illegible]	
[illegible]	[illegible]	[illegible]	
0947	[illegible]	[illegible]	
0949	52	2125	
0949	55	1975	
0950	58	1900	
0950	60	[illegible]	
0951	62	1750	
0952	67	1675	
0952	75	16[illegible]	
[illegible]	7[illegible]	[illegible]	
0955	74	[illegible]	
0956	81	[illegible]	
1000	91	[illegible]	
1001	93	14[illegible]	
1006	98	1375	
1008	100	1350	Move hot water added
1009	102	1325	

1100436



1100437

Time	Temp	Resistance	Remarks
1011	104F	132 ohms	
1017	109½	1200	
1018	110	1200	
1020	111	1300	More hot water added
1029	115	1270	
1031	117	1275	
1035	120	1250	
1038	122	1250	Out of hot water bath
1048	120	1250	
1046	117	1330	
1051	112	1460	
1101	104	1460	
1108	100	1480	
1116	96	1490	
1128	92	1525	
1158	84¾	1630	
1231	80½	1650	
1238			In Ice-water bath
1241	76	1780	
1244	71	1900	
1246	68	1970	
1251	60	2200	
?	56	2375	
1258	53	2525	
1301	50	2625	
1306	47	2790	
1314	43	3050	
1323	40	3250	
1335	38	3450	
1351	36¾	3500	
1407	36	3550	
1427	35¾	3575	Out of Bath
1500	76	1525	
1510			
1550	74	1620	Sample No. 1 Removed from coffee can.
16 Dec 55			(Effect of adding moisture - drying out)
0815	71½	3000	
0820			Reset zero and ohms adj Meter was off over
0828	71½	2750	
0913	72½	2190	Perhaps the volt ohmyst needed a warm up
0941	73	1990	
0949	74	1910	

At about 1510 on 15 [illegible] the sealed coffee can containing the [illegible] was opened and a sample of the [illegible] was placed in a covered pointment can (#14). The can, lid, and moist soil sample were then immediately taken to 222V and weighed on the "right-hand" Christian-Becker balance. The sample was then placed in the meteorology oven to bake dry. Results: (Sample dried for 4 days at 105 C)

Sample No. 1

(1) Can + lid + moist soil = 57.3864 g
(2) Can + lid + dried soil = 54.4632 (19 Dec 55)
(3) Δ = water content = 3.0

(4) Can + lid = 15.2287
(5) (2) − (4) = Dried Soil = 39.2
(6) 100 × (3)/(5) = % water = 7.7%

To Sample 1 we added 29.5 cc of water (considering the area of the can, this amount ≈ 0.1 in of rain)

Time	Temp	Ω	Remarks
16 Dec 55 0949	74	1910	
1007	74	1900	
1012			29.5 cc of water added
1015	73½	1710	
1023	74	1760	
1030	74½	1720	
1045	74½	1700	
1100	74¾	1680	
1115	75	1620	
1130	75	1630	
1145	75	1610	
1205	75	1630	
1230	75	1600	
1234			Added 11 cc H_2O ≈ 0.4" rain
1235	73½	1425	
1245	74	1400	
1308	75	1350	
1312		1658 g	Wet coffee can, [illegible] soil + H_2O, + block (with cord dragging)
1333	75	~~1120~~	Invalid - meter was disconnected and is only regaining equilibrium

Time	Temp	Ω	Remarks
1334			Coffee can lid off - soil definitely saturated with [illegible]
1336			Coffee can in boiling water bath
1345	74C = 165F	890	
1351	96 = 205	850	
1415	205	975	
1433	203	1100	
1441	92 198	1190	No more water in puddles.
1501	94 201	1280	
1525	205	1370	
1548	56 133	1330	
1552	121	1400	
1559	111	1450	

PM

1100439

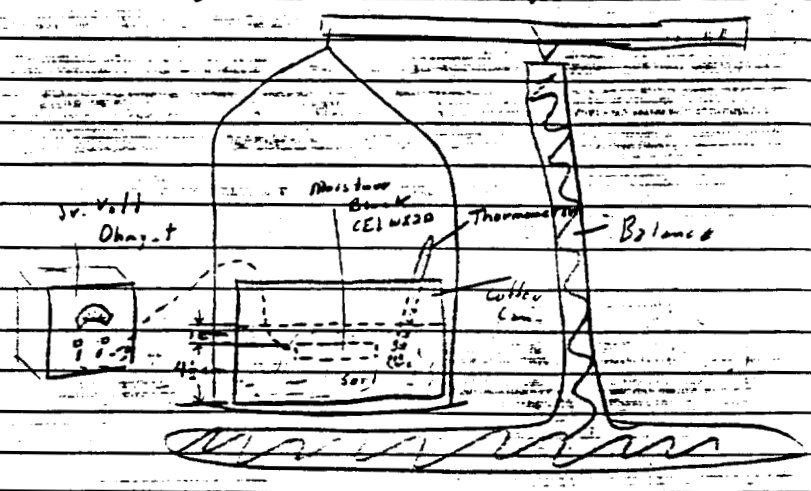
19 Oct

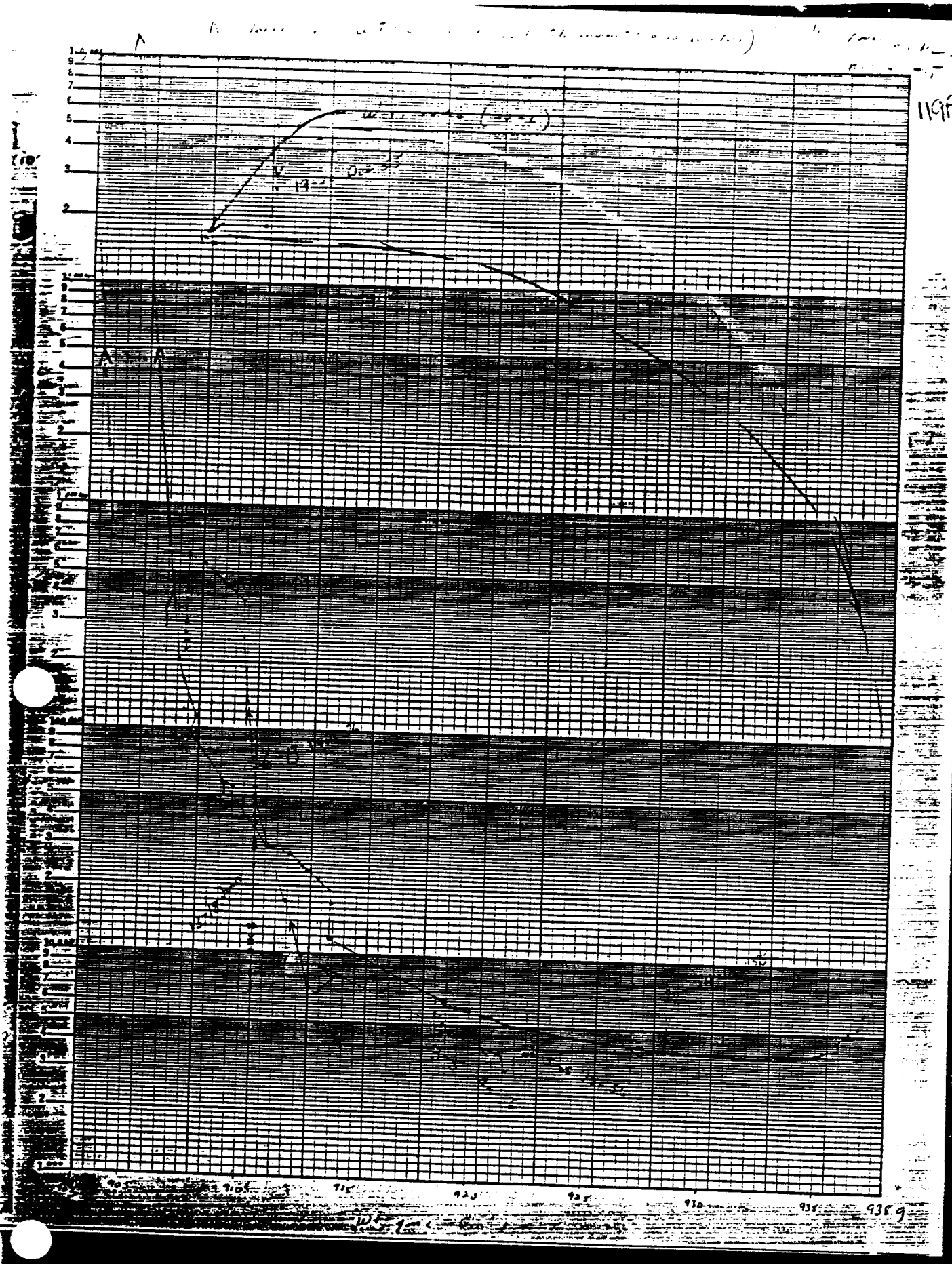
Time	Temp	Resistance	Remarks
0822	69	9400	Lite on [illegible] can for warming
0824			150 W exhibit place about 3" above soil in can - attempt to further dry out soil.
0821	71	9000	Probably increased temp lowered resistance more than soil ~~the dryer~~ drying out has increased resistance in these first few minutes
0833	83	8000	
0847	118	5400	
0904	124	4600	Lite off and on
0912	130	4300	
0913	127	4600	Lite moved back to about 6" from soil
0938	132	4400	
0947	135	4400	
1018	142	5500	
1031	144	6300	
1052	145	8900	
1115	146	15100	
1118	146	22,000	Weight* *wt of can, thermometer, soil and hanging cords
1130	146	33,000	~~923.5 g~~ Can now placed on scales
1134	149	50,000	
1137		100,000	~~922.7~~
1138			
1140	154	300,000	~~923.5~~
1143	155	1,000,000	
1147	158	1,700,000	
1153	160	9,000,000	
1206	162	10,000,000	~~921.2~~
1219	163	24,000,000	~~920.2~~
1236	165	70,000,000	~~919.9~~
1239			Lite off for good
1242	150	95,000,000	
1249	147	90,000,000	919.3
1259	131	65,000,000	~~~~
1321	106	50,000,000	910.7 Now (first) thermometer inserted - wt. difference not
1349	91	40,000,000	910.7 now comparable.
1453	80	26,500,000	910.7
1503	79	25,000,000	910.7 Is this dropping resistance due to drying out of
1547	77	18,000,000	910.3 soil at top (especially where temp was low) and the readjustment of the moisture in the soil.

1100440

	20 [illegible]			[illegible]
	Time	Temp	Ohms	Wt.	Remarks
	0900	72F	15,000,000	907.7	Measured depth of block [illegible]
	0907	72	15,000,000	"	
	0923	72	16,000,000	907.7	
	0934	73	16,000,000	"	
	1010	73	16,000,000	907.7	
1012	1014			939.0	Added 20 cc of H_2O ≈ 0.1" moisture
	1015				Recording down Point
	1017	73	40,000		
	1017.5	73	30,000		
	1019	73	14,300		
	1021	73	11,000		
	1022.5	73	10,000		
	1025	72	9,000	937.4	
	1030	73	7,900	"	
	1035	73	7000	"	
	1045	72	6200	937.1	
	1105	72	5400	936.6	
	1140	72	4600	935.9	
	1215	73	4250	"	
	1229	74	4175	935.3	
	1249	74	4000	935.1	
	1304	74	4000	934.9	
	1316	74	4000	"	
	1331	74	3950		
	1349	74	3925	934.2	
	1437	74	3875	933.5	
	1557	73	3950		
	1939	69	4200		
	2233	68	4200		
21 Dec	0905	68	5050	921.7	
	0840	69	5150	921.5	
	0935	70	5500	920.7	Adjusted "ohms adjust"
	1000	71	5500	920.8	
	1100	72	5600	920.5	
	1200	73	5800	920.0	
	1300	73	5850	919.8	
	1400	73	6000	919.4	
	1500	72	6150	918.9	
	1600	74	6400	918.8	
	2400	71	8500	916.4	

Experimental Setup





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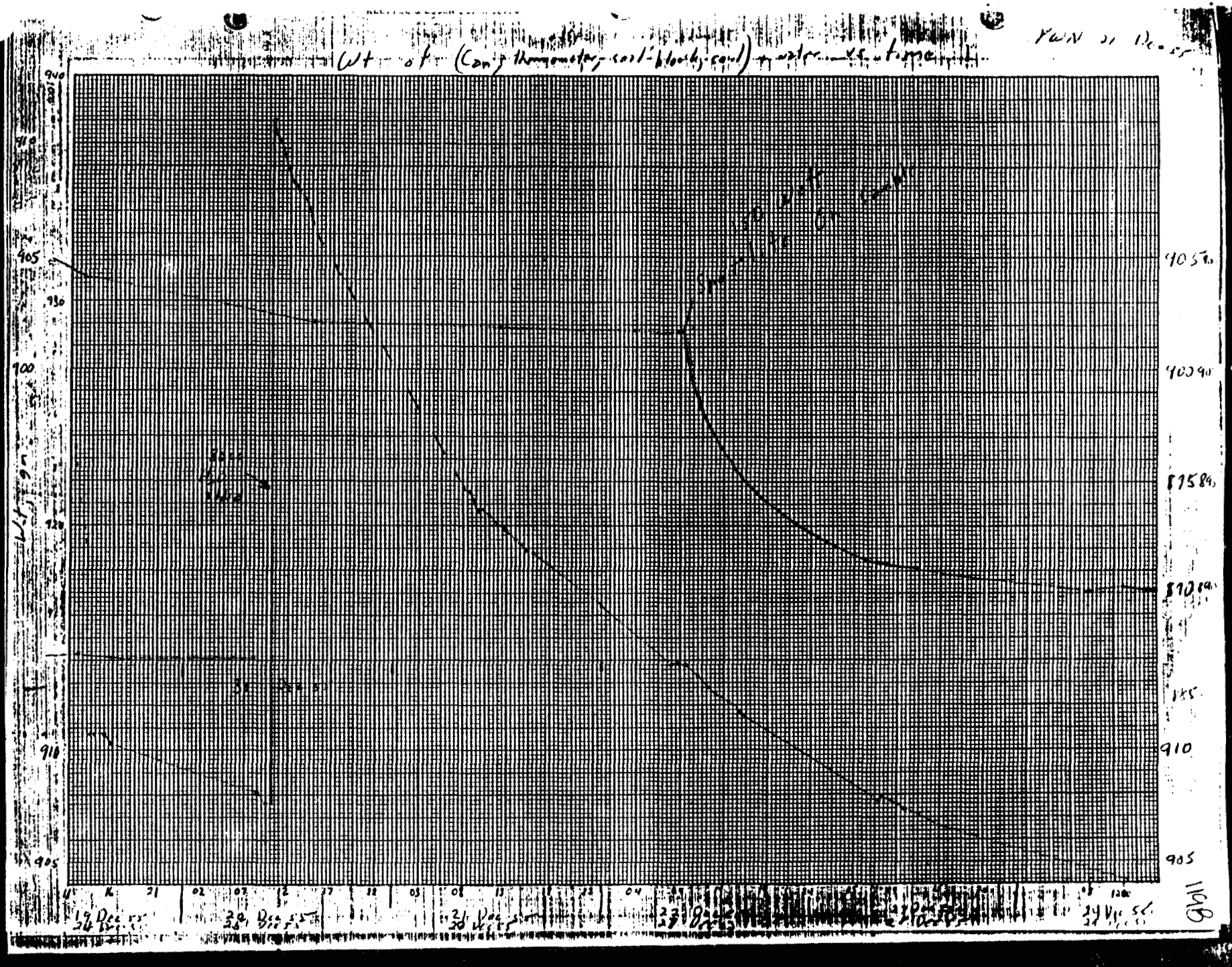
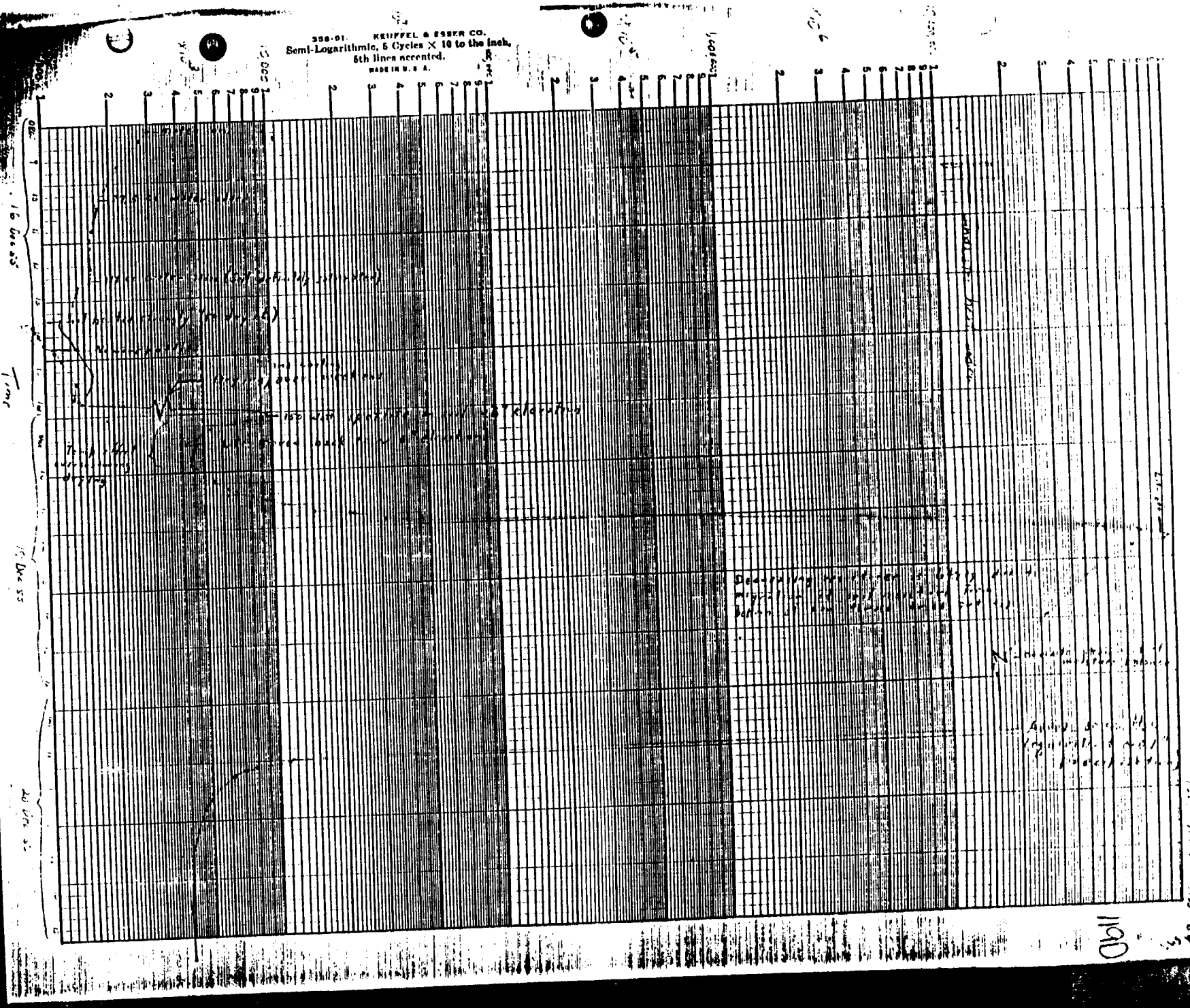
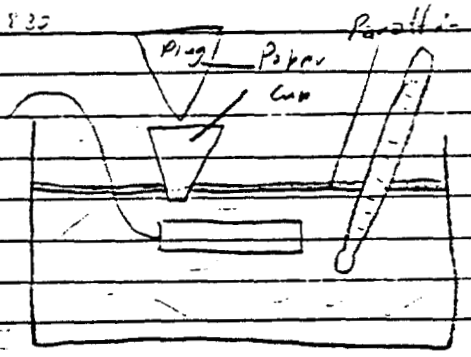

Wt of (Can, thermometer, coal-block, coal) + water vs time
Wt, gm
940
910
905
930
900
920
910
905
905
900
895
890
910
905
11
16
21
02
07
12
17
22
03
08
13
18
23
04
08
12
19 Dec 55
20 Dec 55
21 Dec 55
24 Dec 55

1100443

119C


356-01 KEUFFEL & ESSER CO.
Semi-Logarithmic, 5 Cycles X 10 to the inch,
5th lines accented.
MADE IN U.S.A.

	Time	Temp	[illegible]	[illegible]	[illegible]
	0805	72 F	11,700 Ω	91[illegible]	Reserved volt [illegible]
	0840	73	16,[illegible]	913.[illegible]	
	0930	75	19,[illegible]	91[illegible]	
	1100	76	21,500	9[illegible]	
	1205	77	2350	912.8	
	1303	75	2500	912.5	
	1430	73	28000	912.1	
	1600	73	30000	911.6	
23 Dec 55	0750	78	96,000	907.7	Readjusted zero and ohms adjust
	0818	78	114,000	907.4	
	1100	75	164,000	907.3	
	1235	75	203,000	907.1	Went to megohm scale
	1500	76	600,000	906.6	
24 DEC	1224	73	700,000,000 off scale	904.1	WAS
25 DEC	1453	74	"	902.1	WAS
27 Dec	0845	75	"	901.7	
	0915				Spotted on to further dry coil
	1110			898.7	
	1330			896.5	
	1600			895.2	
28 Dec	0800			891.3	
	1230			891.0	
	1600			890.8	
29 Dec	0800			890.1	
	1200			890.3	
	1600			890.1	
30 Dec	0800			890.1	
	1300			889.8	
	1600			889.9	Lite off
3 Jan 56	0800	70		892.9	Increase in wt. Must be either [illegible] convective effect or (2) atmospheric condensation
	0830				



To the Experimental setup sketched on page 118 was added a paraffin layer with a hole thru which to add water. The hole was kept intact by inserting an one-clipped conical paper cup before the paraffin was poured. The hole will be plugged after water is inserted by adding (w. his The clipped cup) a "non-clipped cup"

	0820	81 F	∞	935.7	No unclipped cup yet

Excluding H_2O 935.7
Wt added so far = 893.9
41.8 g

(Continued on page 123)

1100446

Bulk Sampler Weighings

23 Nov 54

Papers 60-75 inclusive in oven this date

P W Nichols

	60	61	62	63	64	← Paper No.	In oven 23 Nov
	0.8072g	.8100	.8039	.8170	.8187	7 Dec	
	.8084	.8092	.8041	.8174	.8156	13 Dec	Out of oven
weighed 8/3/55		.8163	.8148	Y	.8205		
11/3/55		.8133	.8110		.8203		

	65	66	67	68	69
	.8114	.8017	.8031	.7984	.7927
	.8136	.8018	.8026	.7975	.7913
8/3/55	.8162	.8068			
11/3/55	.8187	.8044			

	70	71	72	73	74	In 23 Nov 54
	.8115	.8075	.7948	.8327	.8232	7 Dec 54
	.8102	.8071	.7935	.8325	.8228	13 Dec Out

	75	← In 23 Nov 54	76	77	78	In 13 Dec 54
	.8217	7 Dec 54	.8134	.8282	.8080	4 Jan 55
	.8227	13 Dec Out	.8135	.8286	.8065	10 Jan 55 - Out

	79	80	81	82	83	~~84~~ In 13 Dec 54
	.8029	.8005	.8063	.8127	.8121	4 Jan 55
	.8034	.7996	.8077	.8127	.8108	10 Jan 55 Out

Oven temp ~ 100 C

	84	85	86	87	88	In 13 Dec 54
	0.8017 g	.7998	about 0.8000	.8060	.8079	4 Jan 55
	0.8000	.8.008	0.8021	.8062	.8074	10 Jan 55 Out

	89	90	91	← In 13 Dec 54
	.8033	.8125	.7999	← 4 Jan 55
	.8038	.8137	.7989	10 Jan 55 - Out

Exposed filters F Test 9 (27 May 55)	52	53	55	56	58	In 3 Jun 55 Exposed
	.8177	.8020	.8016	.7967	.8033	Dry wt from page 55
	.8154	.8043	.8016	.7959	.8023	Exposed dry wt.

Exposed Filters Fld Test 8 (4 May 55)	54	59	57	49	51	Exposed In oven 31 May 55
	.782	.814	.814	.816	.814	Dry wt from page 55
	.781	.813	.813	.816	.813	3 Jun 55
	.783	.812	.813	.815	.813	14 Jun 55

	"3 Jun Test"	"3 Jun Control"	Undried filters for rough check when get high winds	A	B	Athur G 14 Jun 55 Undried for rough determinations
	.810	.861		.842	.846	
Check (V unexposed) 14 Jun 55	.805	.857				Weighed on Right → Balance
Exposed (p 78) 16 Jun	.808	Control .859				

C	D	E	F	G	
.824	.719	.709	.689	.704	
			.694		

1100448

Oven Temp 100 C

	H	J	K	L	13 (Sept 50)		2 (Sept 50)
ven 21 Jun 55					.8370		.8196
24 Jun 55 Dry Clean	.664	.648	.653 g	.684			.827
		.651	.666				
		0.003 g	0.013				0.007

K J + 13 [illegible] in oven 1 Jul 55

5 Jul 55

27 Jul 55

— 004

1100449

Time	Temp	Resistance	WT	
1 Jan 0800	80	∞ ohm	937g	Trap still [illegible] from oil [illegible] hot [illegible]
0930		—		~ 30 cc of water added
0930		1 million		Water still trickling in cup
0936	83	11,000		" " " "
0945			962.7	Water all evaporated in cup
0950			963.9	963.4 Vacuum cup and [illegible] (42.7 + 1.2 = 44.0 g added including new thermistor plug)
1000				Grade. Different readings of resistance occur [illegible] when the leads to the volt ohmyst are reversed.
1008	80	6400 Ω	962.8-962.9	Why is it being weight??
1010				Switched leads to volt ohmyst.
1025	79	5400	962.5	
1026	79	5400	9[illegible]	"
1027				Switched leads again
1052	80	6575	962.6	
1053				" " "
1112	80	6600 B	962.6	
1135	80	7400 B	"	
1250	78	6[illegible]	"	
1350	77	5[illegible]	962.7	
1600	77	5050	962.7	
6 Jan 0100	71	4700	962.7	"
1120	75	4500	"	"
1530	77	4550	962.7	962.7
5 Jan 0800	71	4500	962.6	962.6
0800			966.8	966.8 Water added; Also reset zero and chang[illegible]
0810	71	4350	966.8	"
0813	71	4150	"	"
0830	72	4100	"	"
0945	73	3950	"	"
1130	75	3850	966.6	966.6
1600	76	3800	966.5	966.5
6 Jan 1100	77	3950	966.2	966.2
1410	79	3950	966.1	966.1 End test. [illegible]

6 January [illegible] 1)

The [illegible] Exp [illegible] the [illegible] was [illegible] [illegible] and the [illegible] expected to [illegible] from [illegible] [illegible] Spectrum.

Time	Temp	Resistance	Lt	Ref	Remarks
1415	79	3450	966.1	9[illegible].1	Position still on
1420					Some Position [illegible] removed (see above) but still two [illegible] = [illegible] (position [illegible])
1425	86	3300	960.6		Spot lite [illegible] [illegible] [illegible]
1415	105	3300	960.6	"	
1520	105	3250	960.1	921.6	Lite off
1600	89	3800	959.8	921.3	
0 Jan 0750	68	8900	952.0	913.5	
0755					Lite on Adjusted Voltmeter
0820	78	7900	952.5	914.0	Increased with [illegible] [illegible] [illegible] more
0935	90	6700	951.8	913.3	
1100	97	7200	951.5	913.0	
1240	99	9700	951.2	912.7	
1500	100	17,200	950.4	911.9	
10 January 0810	76	41,000	949.2	910.7	
0811					Changed meter scales, recalibrated
0940	97	49,500	949.0	910.5	
1030	100	75,000	948.8	910.3	
1200	100	260,000	948.5	910.0	Lite off
1345	84	375,000	948.3	909.7	
1440	79				Switched meter scales two scales don't give (reading from [illegible] 40,000 ohms to 140,000 ohms [illegible])
11 January 0800	71	500,000	947.0	908.5	
1120	76	520,000	946.9	908.4	
1600	78	540,000	946.6	908.1	Negative scale
12 January 0800	71	600,000	945.9	907.4	
1120					Changed scale
1121	75	240,000	945.8	907.3	N. [illegible] still drifting up
1240	77	400,000	945.8	"	
1330	77	380,000	"	"	
1331					Changed polarity
1333		170,000			Still drifting up

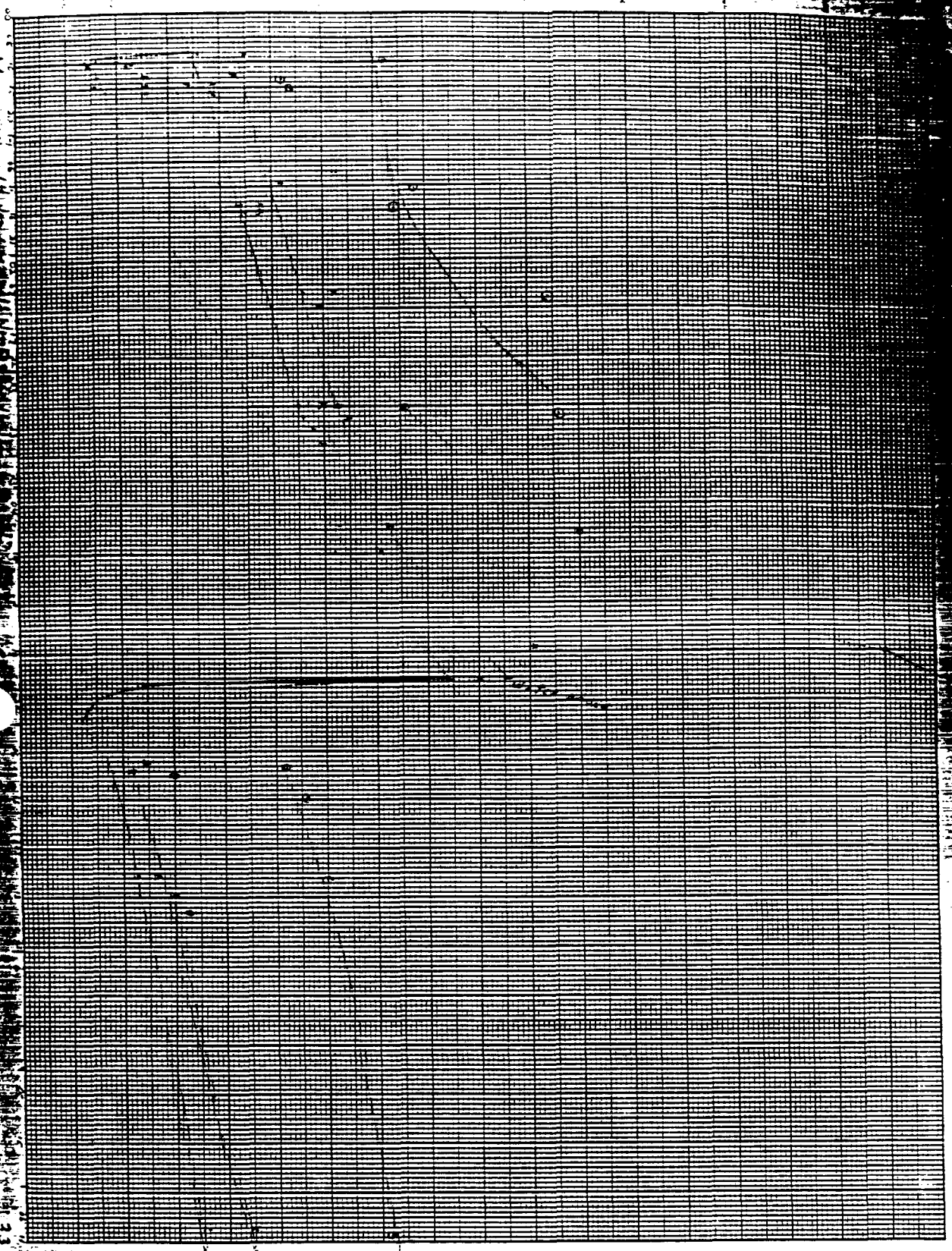
Gordon Driver suggests that an ionization may be occurring ~~near~~ in the black or coil which is due to the voltage in the coil supplied by the volt-ohmyst. This could cause discrepancies upon reversal of resistance leads. It could also account for the discrepancy between scales. Different scales, different voltages.

Time	Temp	Ω	[illegible]		Remarks
1335	[illegible]	[illegible]	[illegible]		[illegible]
					[illegible]
					[illegible]
1450	78	36,2000	[illegible]	"	
1450				"	Volt-Ohm-meter turned off
1555		~~290,000~~			" " " on
1555:15		290,000	"	"	15 sec after turning on
1556		300,000	"	"	1 min " " "
13 Jan 0810	67	400,000	945.2	906.7	1 min after turning on.
0811					Reversing leads to block gave very nearly the same reading shortly after turning on meter for first time. Also the readings on megohm scale were 300,000 Ω in contrast to 400,000 for 10,000 X scale when measurements were made quickly.
0850	65	350,000	945.0		Re-test reading on [illegible] at a follows:
0900	69	340,000	"		(1) Meter on and warm with no leads - Meter
					(2) Leads from soil block inserted
					(3) Resistance read within 5 seconds.
			996.0		(4) Reverse leads and repeat step (3) then take mean.
0930			~~996.0~~		Now [illegible] Position [illegible] + Cup - plug
0955	80	290,000	996.0		
0955			1000.0		4.0 g H_2O added
0950	82	8,000	1000.3		Paraffin mix - Take out H_2O from [illegible]
0953		→ 6,900	"		
0955		10,000 X	1000.4		X = Meter 2 readings made after waiting 1 min
1015	82	7150	"		after inserting leads (removing leads,
1017	"	11,500 X	"		waiting another minute, and reading
1040	80	7300	1000.8		
1042	"	11,000 X	"		
1240	78	8,750	1000.7		
1242	"	13000 X	"		
1425	78	7800	999.7		Why the loss in weight??
1425	"	13000 X	"		
1600	"	9000	"		
1603	"	13,000 X	"		
16 Jan 0800	72	24,000	999.9		
0802	"	31,500 X	"		
0815	"	30,000	"		Old method resistance; lead plugged to meter since 0802.
1230	77	24,500	"		
1232	"	29,000 X	"		

	Time	Temp	Ω	[illegible]	[illegible]	
	16[illegible]	77	25,0[illegible]	99[illegible]	9[illegible]	
	[illegible]	"	30,0[illegible] x	"		
17 Jan	10[illegible]	7[illegible]	31[illegible]	"	"	
	0517	"	36,500 x	"	"	
	0945	76	55,000 0	"	"	Lost in since 0845
	1345	79	31,000	"	"	
	13[illegible]8	"	35,500 x	"	"	
	1600	"	31,500	"	"	
18 Jan	0400	72	42,500	"	"	
	0903	"	50,500 x	"	"	
	1000	"	85,000 0	"	"	
	1530	78	40,000	"	"	
	1533	"	45,500 x	"	"	
				Equiv		
	1550					About 4 cc of water added.
	1600	"	14,500 0	913.8 g		All water [illegible] into soil
19 Jan	0815	73	8,600			
	[illegible]	"	12,500 x			
	0910	74	26,000 0			
	1010	75	9,100			
	1012	"	11,000 x			
	1050	"	15,000 0			
	1550	75	28,000 0			
20 Jan 6	0830	73	11,500			
	0832	"	13,500 x			
	0910	74	30,000 0			
	1230	75	11,500			
	1232		15,000 x			
	1600		16,500 0			
23 Jan 56	0815	73	18,000			
	0817		22,500 x			
	0940		36,000 0			
	1230		17,500			
	1232	78	21,500 x			
	131[illegible]		26,000 0			
	1420	78	17,000			
	[illegible]		19,500 x			
	1520		27,000 0			
	1600	78	16,000			
	1602		19,000 x			
27 Jan 56	1015		20,000			

127A

Resistance [illegible] Glass WX-20, Ohms



1100454

Time	Temp	Ω	Fluid wt
1017	76	26000	x 913.6
1130		39000	0
1445	77	22000	
1447		24000	x
1530		33000	0
1600	77	22500	
1602		24000	x
Jan 56 0850		28000	
0852	66	31000	x
0950	79	52000	0
1125	73	25000	
1127		29500	x
Jan 56 0800	72	27500	
0802	72	30000	x
0930		53000	0
1020	73	28000	
1022		32000	

End This experiment.

27 Jan 56 Comments & Conclusions:

The discrepancies in wt meter were one there were likely due to "kicking" the trailing lead wire around.

There is definitely an effect in the indicated resistance as measured by the Jr Volt-Ohmyst which is due to the voltage applied to the coil block in measuring the resistance. Since this voltage is different for each resistance range on the meter, resistances read on different scales are likely not comparable. (This explanation is not a proven fact, but a good hypothesis.) The effect is likely due to ionization either in the block or at the block terminals.

On the graph preceding this page (p 126 A) the resistance never seems to plateau. Why not? Possible explanations: (1) Water was evaporating from system. This is not likely. The weight was essentially the same thru the period. The layer of paraffin was apparently very good. (2) Measurement with present setup is impossible. Hope not — and the non-randomness of the data (even when the meter was turned off and on over nite) hints otherwise (3) The water in the soil was migrating toward the bottom of the can. This seems the most likely and was qualitatively confirmed when the experimental setup was dismantled.

Paul W Hutchison

1100455

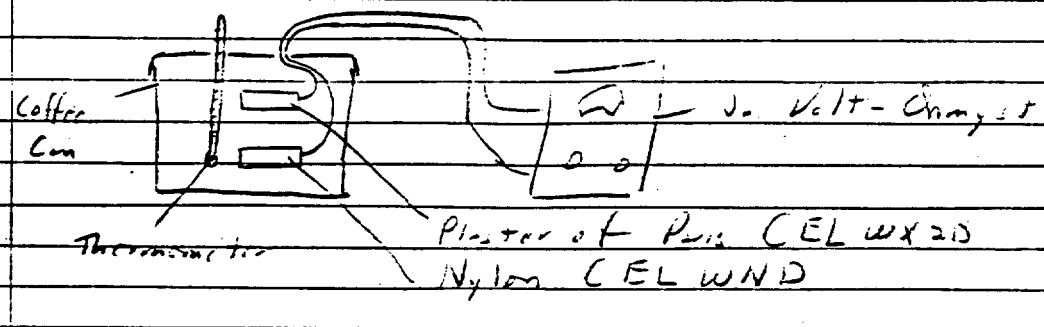
27 [illegible]

[illegible] Attempt to Calibrate Bouyoucos Soil Moisture Blocks — CEL WX2D (Plaster of Paris) and CEL WND (Nylon impregnated)

Pu[illegible] To calibrate soil moisture blocks CEL WX2D and CEL WND ~~[illegible]~~ while impedded in soil of type near Benson Ranch. Also to determine temperature corrections.

Procedure

A coffee can was filled to the top with soil in which was impedded a Plaster of Paris and a Nylon soil moisture block. A Thermometer was inserted with its bulb at the depth of the Nylon block. The can lid with "appropriate" holes was placed on the can, and sealed as well as possible at the edge and at the holes with masking tape.



The leads of the soil blocks were inserted alternately in a Jr Volt Ohmyst for measurement of resistance.

The can, blocks, lid, Thermometer, block leads and sealing masking tape were weighed prior to insertion ~~[illegible]~~ of the soil in the can, and the entire assembly weighed after the soil was inserted. Thus the weight of moist soil ~~[illegible]~~ was determined.

The percentage of moisture is to be determined by drying two samples of the soil in the Exp. Met. oven after weighing the moist soil. When the soil is dry the samples will be reweighed and the wt of the sample cans subtracted from the wet and dry wts.

The present plan of attack is to allow the soil block resistance readings to come to ~~[illegible]~~ a "constant" value and then run a temperature effect test. Dry the soil some and then rerun a temp effect test. Repeat several times. — Oh! Coffee can on balance ~~[illegible]~~ part of time (see sketch p 118).

1100456

Data:

(1) 1665.0 g = Wt of coffee can, lid, block, [illegible], Thermometer and Tape, 2.10 original moist soil
(2) 329.3 " " " " " " " "
(3) 1335.7 g = Wt of moist soil that initially in coffee can.

Ointment can samples for determining original soil moisture content

	Sample 14	Sample 44	(Balance # 5444)
(4)	50.23 g	48.43 g	= Wt of moist sample, can and lid
(5)	38.91	37.88	" " dry " " " " (p131)
	11.32	10.55	Wt of water in original soil sample
(6)	38.91	37.88	Wt of dry sample, can and lid (see p131)
(7)	15.23	13.44	Wt of can and lid
(8)	23.68	23.94	Wt of dry sample
(9)	~~47.8%~~	~~44.1%~~	~~= (Wt of water / Wt of Dry Sample) 100 = % Moisture~~
(10)	46.0%		= (% Sample 14 + % Sample 44) / 2 = (Mean) % Moisture in original sample.
(11)	~~122.8 g~~		Computed wt of ~~[illegible]~~ in coffee can = $\left[\frac{110}{100+110}\right]$ % × 1335.7

	Time	Nylon	Plastic of Pris	Temp	Ind. Wt *	Wt of Water #	% Moisture †	Remarks
27 Jan 80	0845							Nylon block in soil
	0850							P of P block in soil
	0400	38,000	2,100			420.6	46%	
	1030	150,000	2,400					
	1030	245,000*	4900*	69F	1603.9			
	1110	245,000°						
	1245	100,000	14,000°		1602.9			
	1245	160,000*						
	1315	200,000°						
	1515	84,500	1950	78	1603.5			
		120,000*	3400*					

* Weight indicated by metrology balance (of can, moist soil, lid blocks, etc. minus the amount of weight supported by the trailing block leads. These leads were taped solidly to table near balance.

\# Weight of water in soil in coffee can; Originally ~~[illegible]~~. (11)

† ~~[illegible]~~ (10)

The Procedure:

Resistance marks with x were obtained by inserting black leads in meter for 30 sec, reading, reversing leads, waiting 30 sec, reading again, and taking the mean of the two readings.

Resistance readings with no distinguishing marks were obtained by the above method except the time periods were 5 sec.

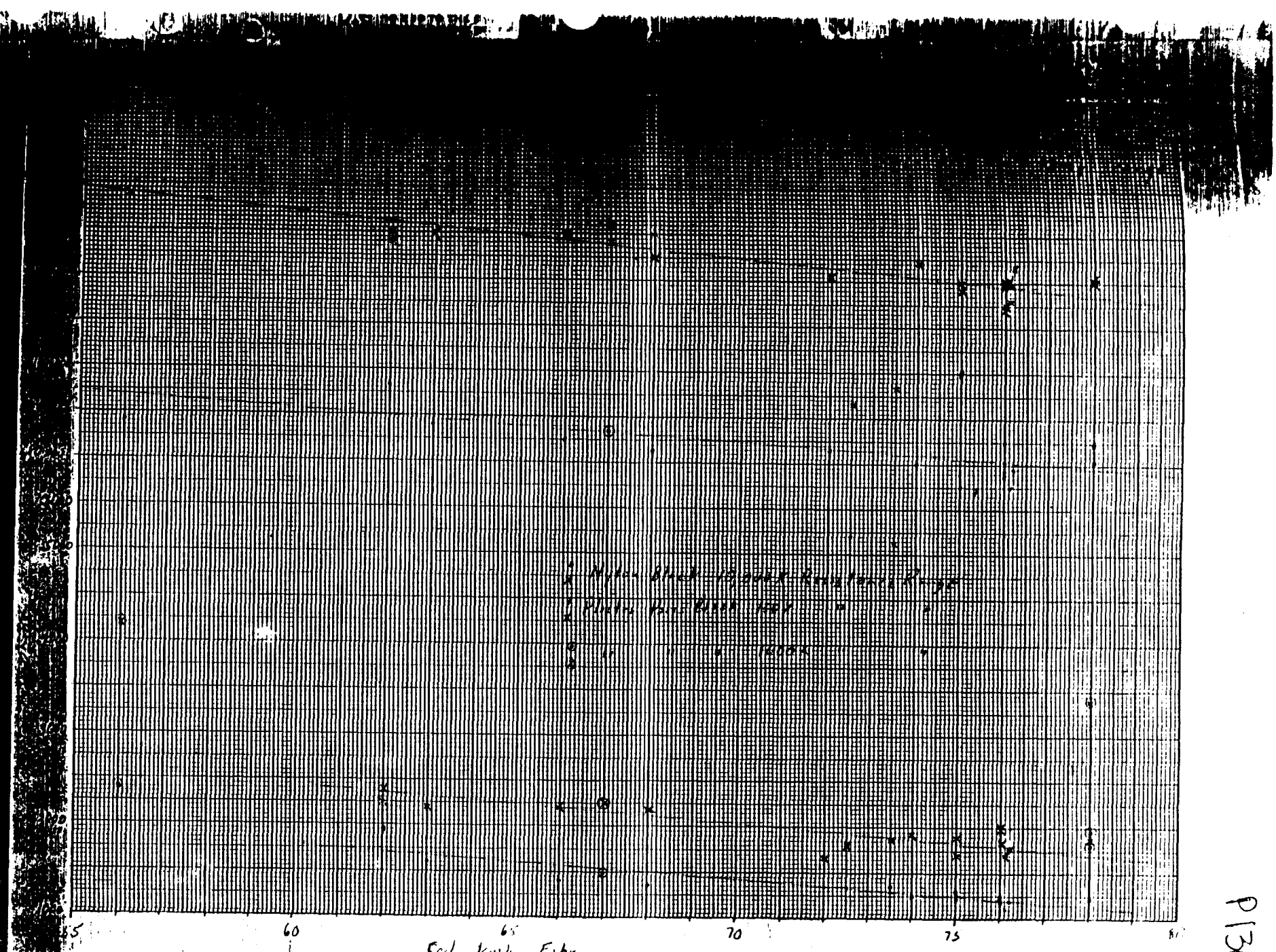
Resistance readings noted 0 were obtained by allowing the leads to remain inserted in the meter for comparatively long periods of time — at least 30 min.

Data:

	Time	Nylon Ω	POP Ω	Temp	Ind wt	Wt H₂O	% H₂O	Remarks
27 Jan 56	1600	80,500	1800	78		~~[illegible]~~	46%	
30 Jan 56	0810	88,500	2400	56	1602.2	~~[illegible]~~	46%	So far Nylon measures on 10,000 range POP on 1000 Range
	"	138,000x	4200x			420.8		
	0940	96,500	1950	62	1602.4			
	"	130,000x	2400x					POP at 100x range
	1030	87,000	1500	67	"			" " " " until noted otherwise
	"	132,000x	2250x					
	1230	100,000	1300	75	"			
	"	120,000x	1900x					
	1525	78500	1250	76				
	"	120,000x	1990x	76	1602.0			Can off balance on side overnite.
31 Jan 56	0800	88,000	1600	67	1602.5			Can on scale again. Obviously can get it on balance to duplicate yesterday's setting due to trailing 1600.
	"	130,000x	2200x					
	1015	85,000	1400	66	1603.8			
	"	130,000x	2200x					
	1230	83000	1340	72				
	"	121,000x	1670x					
	1350	85000	1220	76	1603.0			
	"	120,000x	2020x					
	1545	106,000	1220	78	1602.8			"Wt of dry sample can & lid" #14 - 37.90
	"	120,000x	1860x					#44 - 37.93
1 Feb 56	0810	87,000	1500	67	~~[illegible]~~			Nylon Resistance likely bad due
	"	128,000x	2250x		1605.4			to a poor connector on black lead
	0920	82,500	1350	68				
	"	125,000x	2180x					
	1230	80,000	1240x	74	1602.2			
	"	124,000x	1940x					
	1600	75,000	1170	76	1601.9			
	"	114,000x	2000x					

[redacted]

1100458



P130A

1100459

Date	#12	#44	Remarks
27 Jan 50	50.[illegible]	71.[illegible]	[illegible]
31 Jan 50	31.46	37.93	[illegible] ~105°C
6 Feb 50	35.91	37.[illegible]	Dry!

	Time	Nylon Ω	Pt Ω	Temp	Imp wt	Wt H_2O	% H_2O	Remarks
2 Feb	0815	77,500	1200	75	1605.9	[illegible]	46%	Each rite can is overturned or turned on side in an attempt to avoid migration of water (by force of gravity) to bottom of can
	"	115,000 x	1700 x					
	1100	80,500	1275	76	1603.7			
		115,000 x	1850 x					
	1410	75,000	1120	76.1				
	"	116,000 x	1700 x					
	1550	79,000	1200	76.2	1603.0			
	"	123,000 x	1720 x		[illegible]			
3 Feb 50	1030	62,500	1350	73.5	1602.5			Neglected to overturn can. Intrite. Perhaps water migrating to bottom of can overturned ≈5 (1605)
		96,500 x	1870 x					
	1545	64,000	1350	72.5	-			
	"	93,000 x	1900 x		-			
6 Feb 50	0830	52,000	1350	71.6	-			Commutation scale Begin Temperature graph
	"	77,000 x	2000 x					
	1240	50,000	1300	73.0	-			
	"	73,000 x	1900 x	73.0	-			
	1600	50,500	1250	75.0				
	"	75,000 x	1900 x	75.6				
7 Feb 50	0900	52,500	1800	66.3				
	"	78,000 x	2010 x					
	1020							Turn on water on small burner. Burner set at about 160°
	1025			50.2				
	1105			105				
	1110	34000	965	111				~~Freezing out at equilibrium~~
	"	50,000 x	1600 x	111				
	1145	32,000	735	110				
	1215	31,000	910	107.5				
	"	47,500 x	1060 x	"				
	1445	33,500	870	105.5				
	"	48,500 x	1425 x	"				
	1600	34,000	1030	105.3				
	"	50,500 x	1530 x					
		?						

	Time	Nom. Sp.	Fluid Sp.	Temp				Remarks
[illegible]	8-[illegible]	[illegible]	97[illegible]	101.6				[illegible]
		56,000 x	1610 x					
	0[illegible]	34,[illegible]	97[illegible]	102.0				
	"	56,[illegible] x	[illegible]					
	0[illegible]							Burner turned to [illegible]
	1015	34,700	890	100.7				
	"	52,000 x	1430 x	"				
	1230	36,000	925	96.0				
	"	52,500 x	1650 x	"				
	1205							Heat turned to "[illegible]"
	1310	34,100	895	93.0				Adjusted zero + changed [illegible]
	"	52,700 x	1430 x	"				
	1520	35,500	875	91.1				
	"	53,500 x	1410 x	"				
	1550	36,500	1025	90.5				
	"	54,000 x	16,500 x	"				
9[illegible]	0700	36,[illegible]	9[illegible]	8[illegible]				
	"	5[illegible],000 x	15500	"				
	0[illegible]	36,250	1035	85.8				
	"	55,750 x	1480 x	"				
	1020	37,1[illegible]	925	82.0				
		57,000 x	1[illegible]	"				
	1100	35,750	930	79.0				
	"	58,000 x	1530 x	"				
	1230	35,500	1015	75.0				
	1230	60,500 x	1550 x	"				
	1305	37,[illegible]50	1050	69.9				
	"	60,500 x	1610 x	"				
	1410	39,500	1125	65.8				
	"	64,700 x	1730 x	"				
	1500	37,200	1075	66.8				
	"	61,000 x	1740 x	"				
	1555	37,500	1050	68.0				
	"	62,500 x	1660 x	"				Connection from new to
13 [illegible]	1[illegible]	37,500	1040	71.3				-new.
	"	59,000 x	1,800 x	"				Con[illegible]
14 Feb 16	09[illegible]	37,500	970	73.5				[illegible]
	-	60,500 x	1725 x	"				
	0920							In ice bath
	0925			62.8				

Time	Nylon	[illegible]	Temp	[illegible]	wt H2O	% H2O	Remarks
0445	40,000	1100	51.0	—	~~[illegible]~~	46%	
0950	64,000 x	1790 x	53.0		420.8		
1050	43,200	1360	42.8				
1052	70,000 x	2190 x	41.3				
1250	43,500	1400	45.0				
"	70,750 x	2180 x	"				
1430	47,000	1425	39.6				
"	73,600 x	2490 x	"				Heat on
1535	35,000	1125	55.0				
"	62,500 x	2070 x	55.5				
1555	34,500	1050	59.5				Out of water bath
15 Feb 0815	45,000	1020	71.7				
"	58,500 x	1725 x	"	—	420.8	46%	End of temp check for 46% H_2O

~~721.3 g = wt dry soil in coffee can~~
~~614.4 " " H_2O~~

~~$(100)\frac{x}{721.3} = 30\%$ when x = wt of H_2O desired in can~~

~~x = 216.4 g of H_2O~~

From page 129 — Wt of moist soil in coffee can (3) — 1335.7 g
Wt of H_2O in " " (11) 420.8 at 46%
" " Dry soil " " — 914.9 g

$(100)\frac{\text{desired wt } H_2O}{914.9} = 30\%$ — Desired wt of H_2O required for 30% moisture content

$Wt\ H_2O_{30\%} = (0.3)(914.9) = 274.5$ g

$Wt\ H_2O_{46\%} = 420.8$
" " $_{30\%} = 274.5$
146.3 — Required loss in wt for 30% moisture content

Lid removed from coffee can previously sealed with 46% moisture and 300 wet spot shined on soil.

Feb	1010	—	—	1609.2	420.8	46%
Feb	1600			1502.7	314.3	34.4%

1609.2
146.3
1463.9 Can rescaled

	Time	Volume	KPa	Temp	Sample wt	Dry wt	% wt	Remarks
16 Feb 56	1600	–	–	–	1502.7	314.3	34 wt%	Can sealed at dry
– 22 Feb								Can sealed to reduce
24 Feb	1030	155,000	1800	76.0	—			moisture equilibrium.
		200,000*	2625*					
	1250	155,000	1675	75.9				Can stored on side
27 Feb 56	0805	160,000	1825	70.5				till 27 Feb 56
	0940	165,000	1725	71.8				
	1120	172,500	1690	72.9				
28 Feb 56	0820	172,500	1625	74.4				
	1035	176,000	1650	75.2				
	1140	175,000	1675	75.8				
29 Feb 56	0805	202,500	1775	68.1				Ice bath supplied
	0950	570,000	2900	38.0				still 10,000 and 100x scale.
	1045	410,000	2950	37.6				
	1130	430,000	2950	38.0				
	1300	380,000	2850	39.5				
	1330	245,000	2550	46.1				
	~1400	290,000	2200	61.5				
	1422	242,500	1875	71.0				
	1438	207,500	1640	74.5				
	1500	189,000	1640	76.3				
	1550	175,000	1560	77.1				
	1602	177,500	1560	77.1				
1 Mar 56	0830	200,000	1610	70.0				
	0920	210,000	1590	88.0				
	0945	160,000	1250	102.0				
	1025	129,000	1090	108.6				
	1045	120,000	1085	108.7				
	1115	122,500	1110	105.0				
	1245	160,000	1300	94.3				
	1405	180,000	1400	88.2				
	1500	140,000	1440	85.5				
	1550	196,000	1500	83.5				
2 Mar 56	0805	255,000	1700	71.1				

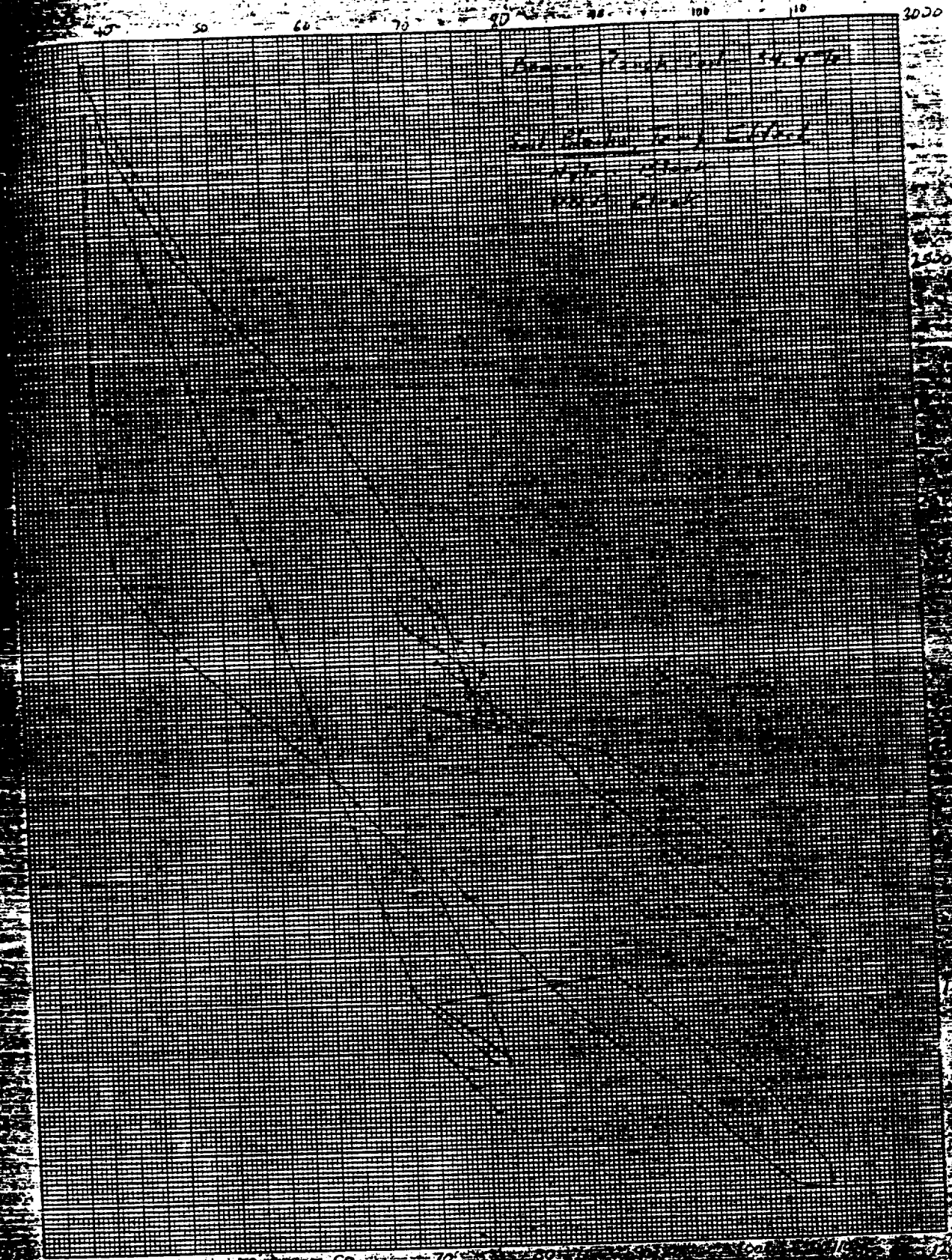
Present wt of H_2O = 314.3 gm W_T dry soil = 914.9 g Wet soil = 1571.7 − 314.3 = 1257.4

~~Permit wt of H_2O for ≈ 20% content = (.20)(914.9) = 183.0 g~~ 314.3 − 183.0 = 131.3 g

Loss of H_2O required for 20% content = 314.3 − 183.0 = 131.3 g

	0830	–	–	–	1502.7			Underwater wt of X
13 Mar 56	1400	–	–	–	1370.7	183.3	20.0%	Out from spot, sealed or can inverted.

135A



1100464

	Time	Nylon Ω	RP Ω	Temp	Indicated wt	wt H_2O	% H_2O	Remarks
6 Apr 52	1410	20 megohms	850,000 Ω	78 F	~~75~~	183.3	20.0%	Lots of resistance, high
9 Apr 52	0800	50 "	1,500,000	69				Megohm & 10,000 Ω scale respectively

11 Apr 52 This would seem to be too high a resistance to use with the indicated (20%) moisture content. Two samples of soil were removed from the coffee can (between the imbedded soil blocks) and weighed. These were inserted in the mtgy oven at 222 V to dry. A check on the computed 20% water content will be made.

Balance used was "left balance" in 222 V balance room

	Sample # 14		Sample # 44
RM	57.184 g	Wt of can, lid, soil, water	47.463 g
		Wt of can, lid, soil	
		Wt of water	
		Wt of can, lid, soil, ~~[illegible]~~	
		Wt of ~~water~~ can-lid	
		Wt of soil	

$$\frac{\text{wt of water}}{\text{wt of soil}} = \%\ H_2O$$

GRH reports (after visit to Kansas State and discussions with Chepil) that soil blocks were found to be very unreliable.

B Nichols

H

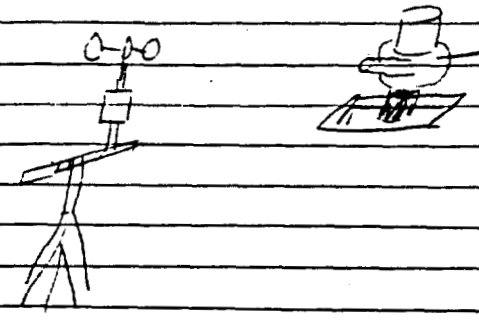
1100465

25 Mar

Reason: Check of Computed Input of Wind Speed Range on Cool Climate Survey System

Purpose: See as Title

~~Hi Pro~~ Experimental Setup: Diagrammed, Location check



Procedure: Blower was oriented toward anemometer and turned on. Blower was allowed to continue steady for some time at R&W Low Range speed. Then switch was turned to Hi Range and the indicated speeds compared. As a further check Casella totalizing anemometer 23y was ~~held~~ inserted in the same position as the R&W instrument had been before. No blower position or speed was investigated. R&W was calibrated for full scale and zero per instruction manual prior to operating. No clay control adjust was required.

	R&W Range Low	R&W Range High	Casella Speed	Count	Time	Cp min	Speed, fpm
	20.2 mph (20.8)	22.6 mph (21.5)	12.3 mph	281	2 min	140.5	18 fpm
	14.8 14.6	17.4 16.0	8.9	302	3	100.7	13.1
	6.0 5.6	7.6 6.6	7.7	172	2	86.0	11.3
Casella & R&W Exposed simultaneously outdoors	Est ~~1.4~~ 2.9 (2.8)	—	2.0	337	15	22.5	3.0
	~~Est~~ 2.9	—	1.6	94	5	18.8	2.4
	8.0 7.5	—	7.0	156	2	78.0	10.3
	8.8 8.3	—	7.8	176	2	88.0	11.5
	—	11.2 10.0	8.5	192	2	96.0	12.5
	—	9.8 8.6	7.2	159	2	79.5	10.5
	3.4 5.1	—	4.5	97	2	48.5	6.6
	—	6.1 5.1	3.6	76	2	38.0	5.3
	5.6 5.3	—	4.8	105	2	52.5	7.1

Indicated Speeds
Corrected Speeds

All but the first three sets of observations were made outdoors with the B&W and Casella (totalizing) anemometers mounted side by side ⊥ to wind direction.

Since Casella and B&W cups rotate opposite in direction, the comparison of these instruments in the narrow jet of the blower is not valid.

Conclusions:

1. The speed indicated by the B&W high range is "consistently" higher than that indicated by the high range. For the three comparable cases the High Range gave speeds 3.4%, 9.6% and 17.8% higher than the Low Range (20.8 + 3.4%) (14.6 + 9.6%, 5.6 + 17.8%)

2. The Casella consistently gave lower speeds than either B&W range.

Hold it! The calibration procedure was wrong. The zero adjustment was made for 0.5 mph on the recorder scale which is really 1 mph on the alternate chopper drive unit on our anemometer. -- Require rerunning experiments. [illegible]

21 Mar 56.

First experiments outdoors as described paragraph top this page.

Beckman & Whitley				Casella Totalizer 734					Remarks
Low Range		High Range		Speed mph	Count	Time	cpm	Speed fps	
Scale Rdg	Corrected mph	Speed per Scale Rd.	Corrected mph						
4.70 mph	4.4 mph	—	—	4.3	92	2 min	46	6.3 fps	Outdoors
4.81	4.5	—	—	4.3	92	2	46	6.3	
6.55	6.2	—	-	6.2	137	2	68.5	9.1	
6.98	6.5	—	-	6.5	144	2	72	9.5	
6.95	6.5	—	—	6.5	144	2	72	9.5	
—	—	6.56 mph	5.7 mph	6.3	138	2	69	9.2	Recalibrated
—	-	7.93	7.0	7.7	172	2	86	11.3	
—	-	10.00	8.9	9.3	211	2	105.5	13.6	
—	-	9.96	8.9	9.3	211	2	105.5	"	
-	-	9.72	8.6	9.3	211	2	105.5	"	
5.32	5.1	4.96	4.2	1					Intake with skill blower. 2 min averages by 5 sec inst. readings
5.35	5.1	5.15	4.4						
5.23	5.0	4.94	4.2						
9.48	9.3	10.46	9.3	2					
10.00	9.3	10.31	9.2						
10.04	9.3	10.31	9.2						

B + W

[illegible]		[illegible]		Remarks
Scale Reading	Corrected	Scale	Corrected	
3 ~~15~~ 13 mph	18.1	19.10	18.3	For these three pairs and the two preceding groups of three pairs each, blower - anemometer relationships were not changed (within the time of recording each 6 readings.)
18.45	18.5	19.12	18.3	
18.32	18.3	19.06	18.3	

Discussion & Conclusions:

Comparison of Casella and B + W low range results shows good agreement. We now (somewhat) arbitrarily decide to use the B + W low range as the standard for speeds up to 20 mph. The last ~~[illegible]~~ pairs of data (between B + W Hi + Low) - sets 2 and 3 - show good agreement also.

It remains to bring the set 1 Hi Range results in line with those of the set 1 Low Range speeds. This will be done by changing the correction factor for the high range ~~[illegible]~~ for low wind speeds.

The disconcerting aspect of the data is the agreement of set 2 data Hi and low range in the vicinity of 9 mph. It had previously been demonstrated that the Casella did not agree with Hi range speeds indicated in the vicinity of 10 mph. At any rate the two speed ranges should agree now that the correction curves for the high range is adjusted.

Paul M. Nichols

27 Mar 6 – 28 Mar 6

Weighing of Fluorescent pigment 2210

Sample No. of arrangement of Figures

Sample No	2210 Pigment originally in Jar ~~Added 2210~~ Total 2210	Wt 2210 + Dupanol + Paper Wt Dup + Paper Wt 2210 added
2	0.02 g 2.02 2.04	3.34 g 1.32 2.02
3	0.02 2.04 2.06	3.40 1.36 2.04
4	0.03 1.98 2.01	3.05 1.07 1.98
1	0.02 2.07 2.09	3.49 1.42 2.07
13	0.00 2.02 2.02	3.32 1.30 2.02
14	0.00 2.10 2.10	3.36 1.26 2.10

Paul V. Hickola

3 Apr 56 More 2210 Pigment Weighings

~~Sample No~~

~~Sample arrangement of Figures~~

Sample No	15	16	17	18	19	20
Wt Dup + Paper + 2210	12.06 g	11.43 g	11.30 g	8.70 g	8.61 g	9.27 g
Wt Dup + Paper	6.09	5.40	5.33	4.64	4.56	5.17
Wt 2210	5.97	6.03	5.97	4.06	4.05	4.10

~~Sml~~

Sample No	21	22	23	24
Wt Dup + Paper + 2210	8.84	10.21	10.39	9.50
Wt Dup + Paper	4.95	6.15	5.97	5.58
Wt 2210	3.89	4.06	4.42	3.92

P W Hickola

[redacted]

1100469

31 May 56

Instrument Heights on Portable Mast — Benson Ranch Location

Boom	Vane	Anemom	Thermocouple	Impactor
1	1.2'	1.2'	0.9'	0.6'
2	5.5'	5.[illegible]	5.2'	x
3	x	9.2'	8.7'	x
4	15.2'	15.2	15.0'	14.7'
5	x	25.1	24.9'	x
6	41.8'	41.8'	41.6'	41.3'

BM

29 Aug 56

Comparison of Wind Speeds Indicated by Casella, Hastings and 405' Tower Anemometers.

All anemometers at ht 200'.

Time Period	Casella Counts/min	Cpm	Speed	Hastings Probe #		Gurley
1406-1416	3263	326.3	26.7 mph	2.5	~~29.5~~ 29.2	3.7 23 mph
1417-1427	3350	335.0	27.3	1.7	~~26.6~~ 29.0	3.3 24
1428-1438	3521	352.1	28.6	2.2	~~32.4~~ 30.8	3.6 25

Hastings

	1406-1416	1417-1427	1428-1438
1	29	28	30
2	28	28	31
3	27	31	35
4	31	32	35
5	34	28	33
6	29	28	28
7	27	28	35
8	31	29	35
9	32	29	33
10	27	33	29
Mean	29.5	26.6	32.4

[signature]

1100410

31 Aug 56

Closer look at Hastings Wind Data for Previous Page.

1406 - 1416		1417 - 1427			
Scale	mph	Scale	mph	Scale	mph
60.5	28	60.5	21	57.5	26
60.5	28	60	28	59	27
59.5	28	60	28	60.5	28
59.5	28	59.5	28	62.5	31
59	27	58	26	62	30
58.5	27	62.5	31	62.5	31
62.5	31	61	29	64	34
63.5	33	63	32	64.5	35
63.5	33	61	29	64.5	35
61.5	29	60.5	28	63.5	33
61	29	59.5	28	63.5	33
60	28	59.5	28	57.5	26
58.5	27	58	26	60	28
61.5	29	59.5	28	56	24
62.5	31	59.5	28	64.5	35
62.5	31	61	29	64.5	35
63	32	60.5	28	64.5	35
62	30	60.5	28	63.5	33
59.5	28	63	32	61	29
60	28	63.5	33	60.5	28
		63.5	33		
		62	30		
Σ	585		638		616
$\bar{X}$	29.2		29.0		30.8

Paul W Nichols

31 Aug 56

Mean Differences Between Casella, Hastings, Gurleys (see previous two entries)

	Gurley	Casella	Hastings
	-3.7 mph	"Standard"	+2.5 mph
	-3.3	"	+1.7
	-3.6	"	+2.2
Mean	-3.5 mph		+2.1 mph

P W Nichols

#Oct 56

Size distribution of fluorescent pigment 2210 in suspension and after generation through TIFA Generator

Procedure—

Ten grams (10.0 g) of pigment 2210 were mixed with roughly 50 grams of Duponol and suspended in 3840 cc of water. The suspension was distributed to the atmosphere by means of a TIFA Generator. Three samples covering an arc of 30° were taken at 50 meter and 100 meter radial distances. In addition 4 samples were taken over a 30° arc at a 200 m radial distance. The samplers used were millipore discs white with grid.

Two samples of roughly 50 ml each were removed from the source formulation suspension. From one of these formulation strength samples was removed a sample of 5.0 ml (by pipette) which was added to 10,000 ml of water. The ratio of formulation to added water was 5 parts to 10,000 parts. A 5 ml aliquot was removed from the 5/10000 suspension and passed thru a millipore filter disc. The density of flourescent particles was too high for counting and sizing with any degree of confidence.

The 5/10,000 suspension was again diluted by adding 5 ml to 995 ml of water. The dilution of the original suspension now being 25/9,950,000 or nominally; 25 part to 10,000,000 = 1 to 400,000. A 5 ml aliquot again was taken and washed thru a millipore disc. The result was a flourescent particle density deemed satisfactory for counting.

An effort was made to wash the equipment used in the procedure outlined. Also the suspensions were thoroughly agitated before samples were withdrawn. Purging of particles remaining—say in the pipette after removal of sample for filtering—was accomplished by washing the pipette with water which was then passed thru the filter.

Examination of the backing used with the millipore filters revealed no flourescent particles. (The reference is to the millipore backing used with the filters thru which the suspensions were passed.)

Data:

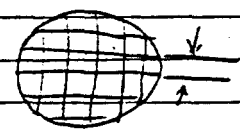
Location of Field Samples - Millipores

Centered on Roughly 120°

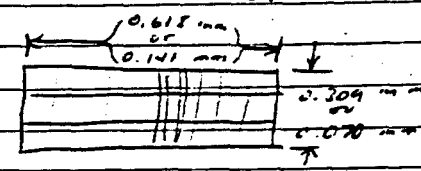
At 50 meters, filters # 13, 20, 12
" 100 m, " # 14, 15, 16
" 200 m, " # 11, 18, 19, 17

10 Oct 56 Microscope and Filter Area Measurements and Calculations

At 100X and tube length ~ 160mm – 200 graticule units = 0.618 mm
" 430X " " " – 200 " " = 0.141 mm



Grid Spacing = 3.09 mm



Expected Filter Area = 330.06 mm²

Porton Graticule Calibration

Area traversed in traversing one filter block (100X) = (3.09)(.309)
= 0.955 mm²

Area traversed in one filter block traverse at 430X = (0.070)(.309)
= 0.216 mm²

Fraction of filter examined on traverse of one block at 100X magnification = $\frac{0.955}{330.06}$

" at 430X magnification = $\frac{0.216}{330.06}$

Total on filter = $\frac{(\text{Filter Sampling Area})(\text{No counted all traverses})}{(\text{Area traversed in counting one filter block})(\text{No Blocks Traversed})}$

~~Total on filter (100X mag) = 346 (Count / Blocks Traversed)~~

Total on filter (430X mag) = 1530 (Count / Blocks Traversed)

Data (cont'd):

No. particles on millipore with $\frac{1}{2000}$ suspension =

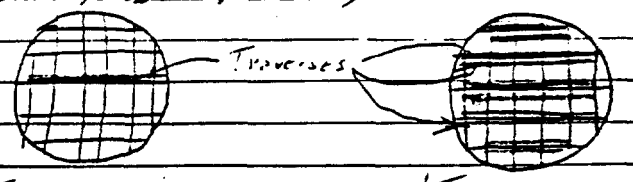
$$= 1530\left(\frac{238}{5}\right) = (306)(238) = 787,000 \text{ particles}$$

No particles on millipore with $\frac{1}{400,000}$ suspension =

$$= 346\left(\frac{320}{42}\right) = 2,640 \text{ particles.}$$

A more detailed description of the counting procedure is in order:

A single traverse of the 5 blocks of the $\frac{1}{2000}$ suspension filter was made at 430 X magnification. (The sizing done here was less careful than in subsequent sizings with the $\frac{1}{400,000}$ suspension.)



$\frac{1}{2000}$ suspension filter — $\frac{1}{400,000}$ suspension filter

A total of 6 traverses across 5 blocks and 4 traverses across 3 blocks on the 1/400,000 suspension filter gave a total of 42 blocks traversed.

Size Distributions

Count $\frac{1}{2000}$ Filter	%	Nearest Diameter Size	Count $\frac{1}{400,000}$ Filter	%	Percent both [illegible]
42	17.6	$\leq 1.1\mu$	64	20.0	19.0
58	24.4	1.5	57	17.8	20.6
57	23.9	2.2	63	19.7	21.5
48	20.1	3.1	56	17.5	18.6
30	12.6	4.3	61	19.1	16.3
3	1.3	6.1	17	5.3	3.6
0		8.6	2	0.6	.4
0*	0.001%*	12.2*	0*		
Σ 238	99.9		320	100.0	

* See first entry at top of page 146.

The method of counting and sizing on the 1/2000 suspension was a direct traverse at 430 X with estimation of the size of each particle as it passed across a 0.70 "face" of the Porton graticule. Particles were not moved to a position beside the sizing circles on the graticule etching for precise comparison, but merely sized by comparing at the particle passed across the field of the microscope.

Counting and sizing of the 1/100,000 filter was as follows: A horizontal traverse was begun at 100 X magnification. When a fluorescent (2210) particle was sighted the objective on the microscope was flipped so as to give a 430 X magnification. The particle was manipulated so as to be close to the sizing circles on the graticule, and then sized — more precisely than was the case with the 1/2000 suspension particles. The objective was then flipped back to a 100 X magnification and returned to the original traverse position, and another particle located and sized as before. Only those particles "passing" across a 0.309 mm face of the etched graticule are counted.

A check of the total number of particles sized on a traverse across the filter was made by merely counting only those particles on the same traverse after the sizing was completed. Results follow:

Traverse	Total Number Sized	Counted only
A	22	22
B	40	40
C*	33*	32*
D	29	29
E	27	27

*Traverse C was sized by PWN, counted by MFS. Others were both sized and counted by PWN.

[illegible] large size particles to 1 case significance of count and ascertain largest particle size.
Complete scan of 1/400,000 sample revealed a total of 8 particles of 8.6 μ diameter, none of size 12.2 μ.
A complete examination of the 1/2000 sample revealed a total of 1 particle of size 12.2 μ.

Density of Particles in formulation Mixture

Determined from 1/2000 aliquot

5 cc of suspension used

$(5)\left(\frac{1}{2000}\right) = \frac{5}{2000}$ cc of formulation mixture

Multiply count by $\frac{2000}{5}$ or 400 for number particles in 1 cc of formulation mixture.

Thus from top of page 144,

$(400)(787,000) = 3.15 \times 10^8$ particles/cc

Determined from 1/400,000 aliquot

5 cc of suspension used

$(5)\left(\frac{1}{400,000}\right) = \frac{5}{400,000}$ cc of formulation mixture

Multiply count by $\frac{400,000}{5} = 80,000$ for particles/cc

$(80,000)(2640) = 2.11 \times 10^8$ particles/cc

Formulation was 10.0 g pigment / 14,860 cc of ~~water~~ formulation

(By $\frac{1}{2000}$ sample) Thus $\frac{\text{particles}}{\text{gm of pigment}} = \left(3.15 \times 10^8 \frac{\text{part}}{\text{cc}}\right)\left(\frac{\cancel{14,860}\ 38,600\ \text{cc}}{10.0\ \text{g}}\right)$

$= \cancel{[illegible]}\ 1.21 \times 10^{12}$ particles / gm of pigment.

(By $\frac{1}{400,000}$ sample) $(2.11)(\cancel{1486}\ 3840) \times 10^8 = \cancel{[illegible]}\ 0.810 \times 10^{12}$ particles/gm. pigment.

P.H. Nichols

1100476

Millipore Air Sample Size-Counts

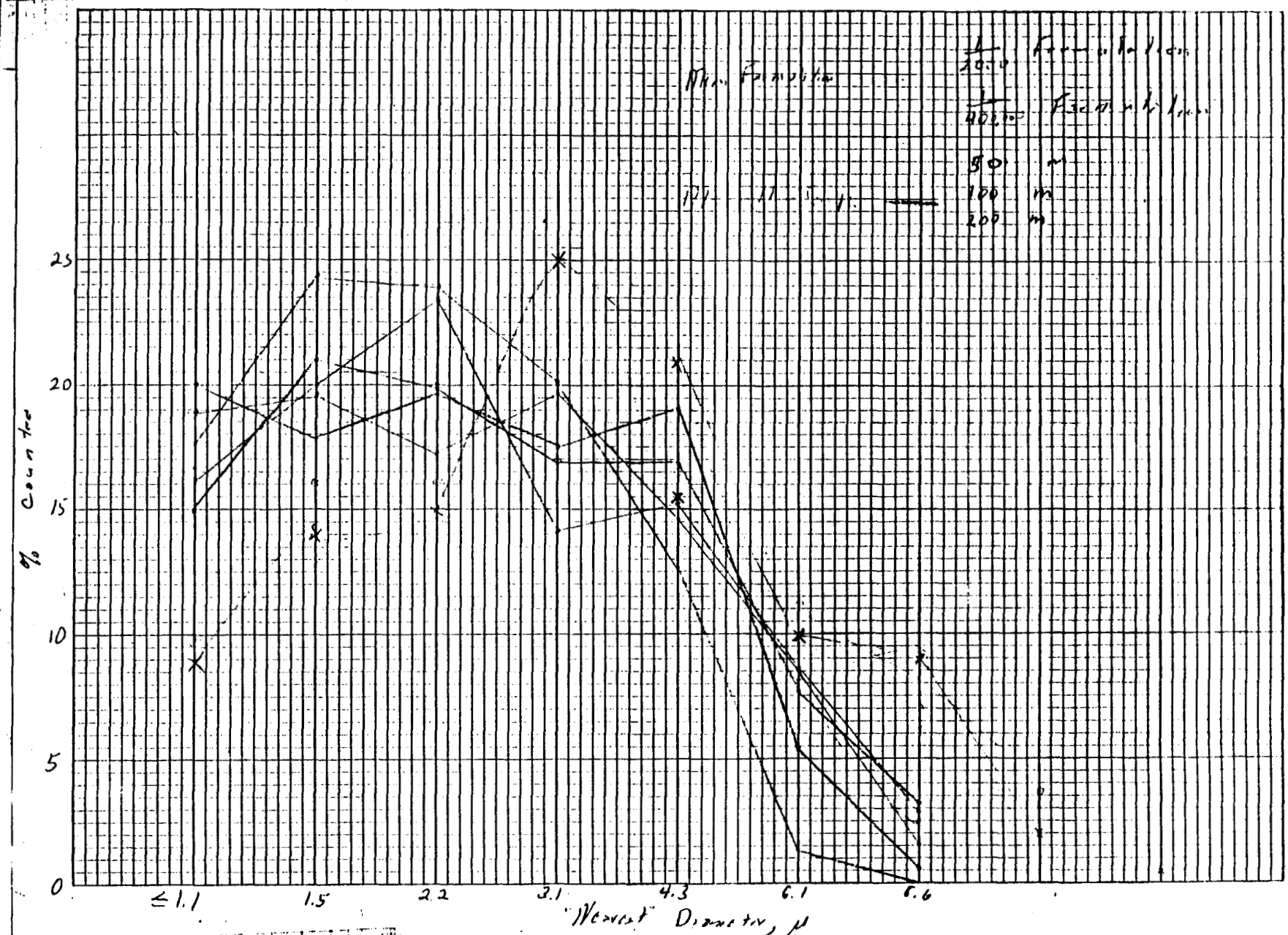
Size of nearest diameter particle

Millipore Sample No	≤ HN	1.5 2	2 2	3 1	4.3	6.1	8.6	12.2	Total Counted	
20	24	34	42	27	~	17	3	-	175	50 m
19	6	11	16	11	9	4	2		59	
	7	13	4	11	10	4	3		52	
	4	9	8	6	8	1			36	
17	13	11	9	7	5	3	1		52	
	10	15	18	11	8	11	1		74	200 m
11	0	6	5	4	6	2	1		24	
	3	3	8	1	6	1	1		23	
18	6	13	6	12	12	3	2		54	
	12	5	7	6	2	2	2		36	
Σ	61	86	81	69	69	31	13		410 / 410	
%	14.9	21.0	19.8	16.8	16.8	7.6	3.2		100.1 %	
16	33	24	25	23	19	16	2		142	
14	21	30	21	33	21	7	2		135	100 m
15	22	25	23	23	19	11	2		125	
Σ	76	79	69	79	59	34	6		402 / 402	
%	18.9	19.6	17.2	19.6	14.7	8.5	1.5		100.0	
12	26	25	29	13	20	12	7		132	50 m
	18	25	27	19	16	7	2		114	
Σ 20 & 12	68	84	98	59	64	36	12		421 / 421	
%	16.2	20.0	23.3	14.0	15.2	8.6	2.9		100.0	
Σ 50, 100, 200 m	205	249	248	207	192	101	31		1233 / 1233	
%	16.6	20.2	20.1	16.8	15.6	8.2	2.5		100.0 %	
Cum %	100.0	[illegible]	63.2	43.1	26.3	10.7	2.5			

Scanning Filter (total area) #19 gave 28 of size 8.6 μ and 10 of size 12.2 μ

% Mean of all Air Samples

HW-6454-T PIUO 17 Oct 56



17 Oct 56

Discussion

It seems that the count of large particles made in order to increase significance was a bust. Comparison of the percentage of particle of large size on the 1/400,000 formulation suspension which can be made from the 8 particles (noted at top p. 46) on a scan of the whole filter with the percentage computed from the regular traverses (bottom page 144) reveals a large discrepancy.

% Size 8.6 μ per scan of whole filter $= \frac{8}{2640} \times 100 = 0.3\%$

% " " " traversing 42 blocks ~~at [illegible]~~ $= \frac{2}{320} \times 100 = 0.6\%$

Well, well! My "in the head computations weren't so good. For the number of particles counted, this agreement isn't bad at all. My mistake.

Paul N Nichols
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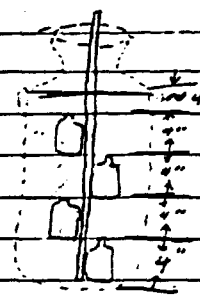
18 Dec 50

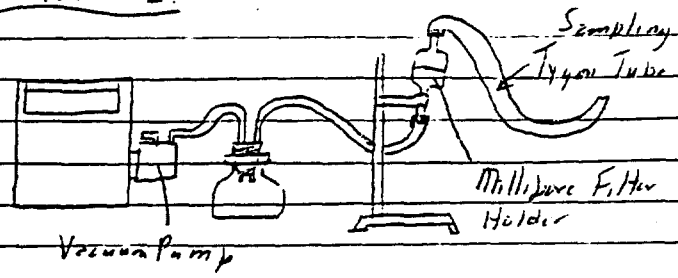
Determination of Particles per Gram of Fluorescent Pigment 2210 and Uniformity of Mixture in Milk Can (Formulation)

Procedure - 4.00 grams ~~were~~ of pigment 2210 were added to about 5 grams of "Duponol C" and subsequently added to ~~[illegible]~~ cc of water in a 10 gallon milk can. The 6 volt bilge pump was lowered into the can, and the pump as well as the bazooka from the J/FA generator were allowed to agitate the suspension for 35 minutes. Four samples of the suspension were then removed simultaneously by dunking a stick with four 130 ml bottles attached into the suspension (see Sketch 1). Treatment for a sample in the 130 ml bottles was as follows.



Sketch 1

1. Agitate about 60 seconds
2. Take 500ml aliquot from bottle; add aliquot to 10,000 cc wet
3. Agitate ~ 45 seconds
4. Take 500ml aliquot from "10,000" sample; add to 500 cc water
5. Agitate ~ 20 seconds
6. Insert ~ 5 ml of water in sampling tygon tube (see Sketch 2)
7. Take 5.00 ml aliquot from "500 cc" sample and add to sampling tygon tube.
8. Apply suction
9. Wash sampling tygon tube with 15 to 20 ml of water (added with pipette)



Sketch 2

An effort was made to observe good experimental technique with respect to the purging of pigment from pipette and sampling tube between uses. (eg, the pipette was purged first with the suspension into which its contents had just been placed, and then with plain water before being used to draw another aliquot.)

The procedure for the processing of a sample from a 130 ml bottle was done 3 times for each of the four bottles. Then the entire procedure was repeated with a second can of 12,860 cc of water with 4.00 g of pigment.

Microscopic Examination -

First backings from 6 of the white grid millipore filters were examined under UV lite. No fluorescent particles were found. (These blotter-like backings were inserted to give added support to millipores)

Counts of the particles on the millipore filter paper were then made. The order in which the sample counts

below appear are the order in which the samples were taken and not the order in which the filters were counted. This latter order was completely random. Magnification was 100X. Monocular microscope used.

Milk Can No. 1

Sample Height (with respect to bottom of can.)	Filter No.	Particles Counted: Four Traverses	Grid Traverses	Blocks	5 Blocks Traverses	Total Blocks Traversed	Total Particles Counted	Mult Factor	Total Particles on Filter	Total Particles Sampled from Specific Can Level	
						17	~~342~~	~~20.3~~	~~7960~~	~~[illegible]~~	
	13	98	69	107	96, 107	15	280	23.1	6240	20,700	Recount on 19 Dec 56
16"	15	113	124	127	137	17	501	20.3	10,170	~~14,630~~	
	6	45	35	60	71		211		4280		
	8	61	63	88	80		292		5930	18,000	
12"	11	86	82	90	106		364		7390	~~13,600~~	
	12	55	39	59	76		229		4650		
	16	78	65	60	104		307		6230	16,700	
8"	3	70	77	62	97		306		6210	~~21,580~~	
	18	49	51	47	61		208		4220		
	19	81	72	88	93		334		6780	~~[illegible]~~	
4"	5	33	31	33	60		157		3190	~~21,160~~	
	1	44	23	34	46		147		2980	13,000	
										68,480	Grand Total

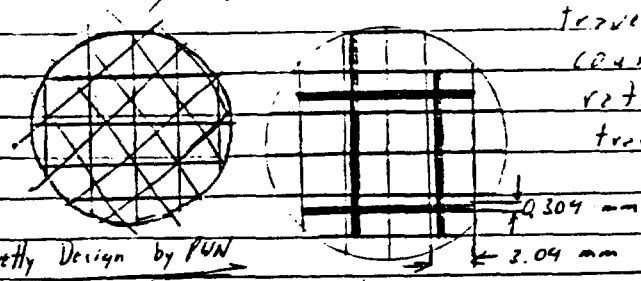
Milk Can No. 2

	14	77	71	78	112	17	338	20.3	6860		
16"	13	52	36	42	42		172		3490	14,600	
	19	46	46	50	69		211		4280		
	6	55	53	67	62		237		4810		
12"	2	40	56	46	60		202		4100	13,600	
	12	51	50	~~[illegible]~~ 52	78		231		4690		
	7	85	119	71	133		408		8280		
8"	20	70	73	55	59		257		5220	21,600	
	4	76	110	95	117		398		8080		
	10	86	61	56	87		290		5890		
4"	9	91	90	110	132		423		8590	21,600	
	17	69	84	67	133		353		7170		
										71,400	Grand Total

From two cans we find the total particles ~~counted~~ sampled at the indicated depth as:

"Depth"	Particles
16"	35,300
12"	31,600
8"	38,300
4"	34,600

The particle were counted at 100X magnification with a monocular microscope – 160 mm tube length. The porton graticule was used to define traverses in the counting procedure. Sketch 3 shows the areas traversed in making the particle counts. (The actual ~~relation~~ ratio of grid block width to traverse width is 10 to 1.)



Pretty Design by PUN

Sketch 3

Note: The dilution of the formulation mixture prior to placing on microslide is approx. 1/200,000.

$\frac{5}{10,000} \times \frac{5}{500} = \frac{25}{5,000,000} \approx \frac{1}{200,000}$

Calculations of No of Particles per Gram of Pigment

Can No. 1		Can No. 2
~~70,100~~ 68,400	particles per 1225 ml of $\frac{1}{200,000}$ suspension	71,400
68,400/60	" " ml	71,400/60
$\frac{(68,400)(200,000)}{60}$	particles per ml of can formulation	$\frac{(71,400)(200,000)}{60}$
$\frac{(68,400)(200,000)(\cancel{12,400}\ 36,400)}{60}$	particles ~~per~~ total formulation	$\frac{(71,400)(200,000)(\cancel{12,400}\ 36,400)}{60}$
$\frac{(68,400)(200,000)(\cancel{12,400}\ 36,400)}{(60)(4)}$	particles per gram of pigment	$\frac{(71,400)(200,000)(\cancel{12,400}\ 36,400)}{(60)(4)}$
~~2.07×10^{12}~~ ~~7.25×10^{11}~~	particles per gram of pigment	~~2.16×10^{12}~~ ~~7.68~~ 2210

For the record, the previous ~~can~~ attempts (by a similar method) to determine the no of particles per gram of pigment 2210 gave the following results (see p 146)

12.1×10^{11} ~~4.64×10^{11}~~ part/gm

and 8.10×10^{11} ~~3.14×10^{11}~~ part/gm

Finis!

J. W. Nichols