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RESULTS OF THE MARCH 9, 1990 DUST COLLECTOR PERFORMANCE TEST ON THE NO. 1 CRUSHER SECONDARY COLLECTOR AT THE CYPRUS NORTHSHORE MINING FACILITY IN BABBIT, MINNESOTA

Submitted to:
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Attention: Dennis Wagner

Approved by:

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Report Number 0-2972
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KE/des

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ABBREVIATIONS

ACFM	actual cubic feet per minute
cc (ml)	cubic centimeter (milliliter)
DSCFM	standard cubic foot of dry gas per minute
DSML	dry standard milliliter
DEG-F (^{0}F)	degrees Fahrenheit
DIA.	diameter
FP	finished product for plant
FT/SEC	feet per second
g	gram
GPM	gallons per minute
GR/ACF	grains per actual cubic foot
GR/DSCF	grains per dry standard cubic foot
g/dscm	grams per dry standard cubic meter
HP	horsepower
HRS	hours
IN.	inches
IN.HG.	inches of mercury
IN.WC.	inches of water
LB	pound
LB/DSCF	pounds per dry standard cubic foot
LB/HR	pounds per hour
LB/10^6BTU	pounds per million British Thermal Units heat input
LB/MMBTU	pounds per million British Thermal Units heat input
LTPD	long tons per day
MW	megawatt
mg/Nm^3	milligrams per dry standard cubic meter
ug/Nm^3	micrograms per dry standard cubic meter
microns (um)	micrometer
MIN.	minutes
ng	nanograms
ohm-cm	ohm-centimeter
PM	particulate matter
PPH	pounds per hour
PPM	parts per million
ppmC	parts per million carbon
ppm,d	parts per million, dry
ppm,w	parts per million, wet
ppt	parts per trillion
PSI	pounds per square inch
SQ.FT.	square feet
TPD	tons per day
ug	micrograms
v/v	percent by volume
w/w	percent by weight
<	$\leq$ (when following a number)

Standard conditions are defined as 68 ^{0}F (20 ^{0}C) and 29.92 IN. of mercury pressure.

1 INTRODUCTION

On March 9, 1990, Interpoll Laboratories personnel conducted a dust collector performance test on the No. 1 Crusher Secondary Collector at the Cyprus Northshore Mining Facility located in Babbitt, Minnesota. On-site testing was performed by R. Rosenthal, E. Trowbridge, M. Kaehler and T. Hogan. Coordination between testing activities and plant operation was provided by Ron Swanson of Cyprus Northshore Mining. The test was not witnessed by a member of the Minnesota Pollution Control Agency.

The Secondary Dust collector tested is a Allis Chalmers Model #70-9 dust collector equipped with a cyclone precleaner. The multiclone collects dust from the No. 1 Crusher which has a rated capacity of 3000 TON/HR.

Evaluations were performed in accordance with EPA Methods 1-5 and 9, CFR Title 40, Part 60, Appendix A (revised July 1, 1988). A preliminary determination of the gas linear velocity profile was made at each test site before the first particulate determination to allow selection of the appropriate nozzle diameter required for isokinetic sample withdrawal. Interpoll Labs sampling trains, which meet or exceed specifications in the above-cited reference were used to extract particulate samples simultaneously at the dust collector inlet and outlet by means of heated stainless steal or glass-lined probes.

Testing on the dust collector inlet was conducted from a set of four test ports located 10'-6" downstream and 6'-6" upstream from any flow disturbances. A 24-point traverse was used to collect representative particulate samples. Each traverse point was sampled 2.5 minutes to give a total sampling time of 60 minutes per run.

Testing at the dust collector outlet was conducted from two test ports oriented at 90 degrees on the stack and located 3.4 stack diameters

downstream of any flow disturbance and less than one diameter upstream of stack exit. A 24-point traverse was used to collect representative particulate samples. Each traverse point was sampled 2.5 minutes to give a total sampling time of 60 minutes per run. A visible emission determination was performed by B. Drake, an EPA-certified observer.

The important results of the test are summarized in Section 2. Detailed results are presented in Section 3. Field data and all other supporting information are presented in the appendices.

2 SUMMARY AND DISCUSSION

The results of the dust removal performance test on the No. 1 Crusher Secondary Collection System are summarized in Table 1. As will be noted, the particulate removal efficiency averaged 85.5%. Opacity averaged 11%.

No difficulties were encountered in the field or in the laboratory evaluation of the samples. On the basis of this fact and a complete review of the entire data and results, it is our opinion that the results reported herein are accurate and closely reflect the actual values which existed at the time the test was performed.

Table 1. Summary of the Results of the March 9, 1990 Dust Collector Performance Test on the No. 1 Crusher Secondary Collection System at the Cyprus Northshore Mining Facility in Babbitt, Minnesota.

ITEM		RUN 1		RUN 2		RUN 3	
		Inlet	Stack	Inlet	Stack	Inlet	Stack
Date of Test		03-09-90	03-09-90	03-09-90	03-09-90	03-09-90	03-09-90
Time Runs Were Done	(HRS)	1142-1248	1142-1245	1324-1430	1324-1427	1540-1644	1540-1642
Process Rate	(TON/HR)		1825		2016		1763
Volumetric Flow							
Actual	(ACFM)	20404	22851	20906	22866	20889	22700
Standard	(DSCFM)	19881	22500	20356	22472	20384	22351
Gas Temperature	(DEG-F)	41	41	42	41	41	41
Moisture Content	(%V/V)	0.63	0.76	0.62	0.88	0.62	0.76
Gas Composition	(%V/V,dry)						
Carbon Dioxide		0.03	0.03	0.03	0.03	0.03	0.03
Oxygen		20.90	20.90	20.90	20.90	20.90	20.90
Nitrogen		79.07	79.07	79.07	79.07	79.07	79.07
Isokinetic Variation	(%)	99.70	98.80	99.40	99.60	100.00	99.80
Particulate Concentration							
Actual	(GR/ACF)	1.14	0.156	1.83	0.231	1.77	0.233
Standard	(GR/DSCF)	1.17	0.159	1.88	0.235	1.81	0.237
Part. Emission Rate	(LB/HR)	200.2	30.64	32.88	45.30	317.1	45.39
Part. Removal Efficiency	(%)		84.7		86.2		85.7

Note: Dry Catch Only

40.414

3 RESULTS

The results of all field and laboratory evaluations are presented in this section. Gas composition are presented first followed by the computer printout of the particulate results. An Orsat analysis was not performed on the exhaust gas, since only ambient air is exhausted from the process. The composition of the gas reported is the average geophysical composition of air. The moisture contents reported were measured as per EPA Method 4. Preliminary measurements including test port locations are given in the appendices.

The results have been calculated on a personal computer using programs written in Extended BASIC specifically for source testing calculations. EPA-published equations have been used as the basis of the calculation techniques in these programs. The particulate emission rate has been calculated using the product of the concentrations times flow method.

3.1 Results of Orsat and Moisture Analyses

Test No. 1
No. 1 Crusher Secondary Inlet

Results of Orsat & Moisture Analyses-----Methods 3 & 4(%v/v)

Date of run	Run 1 03-09-90	Run 2 03-09-90	Run 3 03-09-90
Dry basis (orsat)			
carbon dioxide.....	0.03	0.03	0.03
oxygen.....	20.90	20.90	20.90
carbon monoxide.....	0.00	0.00	0.00
nitrogen.....	79.07	79.07	79.07
Wet basis (orsat)			
carbon dioxide.....	0.03	0.03	0.03
oxygen.....	20.77	20.77	20.77
carbon monoxide.....	0.00	0.00	0.00
nitrogen.....	78.57	78.58	78.58
water vapor.....	0.63	0.62	0.62
Dry molecular weight.....	28.84	28.84	28.84
Wet molecular weight.....	28.77	28.77	28.77
Specific gravity.....	0.994	0.994	0.994
Water mass flow.....(LB/HR)	356	358	355
FO	0.000	0.000	0.000

Test No. 1
No. 1 Crusher Secondary Collector Stack

Results of Orsat & Moisture Analyses-----Methods 3 & 4(%v/v)

Date of run	Run 1 03-09-90	Run 2 03-09-90	Run 3 03-09-90
Dry basis (orsat)			
carbon dioxide.....	0.03	0.03	0.03
oxygen.....	20.90	20.90	20.90
carbon monoxide.....	0.00	0.00	0.00
nitrogen.....	79.07	79.07	79.07
Wet basis (orsat)			
carbon dioxide.....	0.03	0.03	0.03
oxygen.....	20.74	20.72	20.74
carbon monoxide.....	0.00	0.00	0.00
nitrogen.....	78.47	78.37	78.47
water vapor.....	0.76	0.88	0.76
Dry molecular weight.....	28.84	28.84	28.84
Wet molecular weight.....	28.76	28.74	28.76
Specific gravity.....	0.993	0.993	0.993
Water mass flow.....(LB/HR)	486	563	481

FO 0.000 0.000 0.000

3.2 Results of Particulate Loading Determinations

Test No. 1
No. 1 Crusher Secondary Inlet

Results of Particulate Loading Determinations-------Method 5

Date of run	Run 1 03-09-90	Run 2 03-09-90	Run 3 03-09-90
Time run start/end.....(HRS)	1142/1248	1324/1430	1540/1644
Static pressure.....(IN.WC)	-3.80	-3.80	-3.80
Cross sectional area (SQ.FT)	6.02	6.02	6.02
Pitot tube coefficient.....	.840	.840	.840
Water in sample gas			
condenser.....(ML)	0.0	0.0	0.0
impingers.....(GRAMS)	0.0	0.0	0.0
desiccant.....(GRAMS)	5.0	5.0	5.0
total.....(GRAMS)	5.0	5.0	5.0
Total particulate material..			
.....collected(grams)	2.8093	4.5953	4.4622
Gas meter coefficient.....	0.9994	0.9994	0.9994
Barometric pressure..(IN.HG)	28.13	28.13	28.13
Avg. orif.pres.drop..(IN.WC)	1.29	1.36	1.40
Avg. gas meter temp..(DEF-F)	62.9	74.3	79.5
Volume through gas meter....			
at meter conditions...(CF)	38.77	40.40	41.12
standard conditions.(DSCF)	36.89	37.63	37.94
Total sampling time....(MIN)	60.00	60.00	60.00
Nozzle diameter.....(IN)	.185	.185	.185
Avg.stack gas temp ..(DEG-F)	41	42	41
Volumetric flow rate.....			
actual.....(ACFM)	20404	20906	20889
dry standard.....(DSCFM)	19881	20356	20384
Isokinetic variation.....(%)	99.7	99.4	100.0
Particulate concentration...			
actual.....(GR/ACF)	1.14437	1.83390	1.77036
dry standard.....(GR/DSCF)	1.17494	1.88423	1.81493
Particle mass rate...(LB/HR)	200.22	328.75	317.11

Test No. 1
No. 1 Crusher Secondary Collector Stack

Results of Particulate Loading Determinations--------Method 5

	Run 1	Run 2	Run 3
Date of run	03-09-90	03-09-90	03-09-90
Time run start/end.....(HRS)	1142/1245	1324/1427	1540/1642
Static pressure.....(IN.WC)	0.52	0.52	0.52
Cross sectional area (SQ.FT)	6.78	6.78	6.78
Pitot tube coefficient.....	.840	.840	.840
Water in sample gas			
condenser.....(ML)	0.0	0.0	0.0
impingers.....(GRAMS)	-4.0	2.0	2.0
desiccant.....(GRAMS)	10.0	5.0	4.0
total.....(GRAMS)	6.0	7.0	6.0
Total particulate material..			
.....collected(grams)	0.3780	0.5636	0.5657
Gas meter coefficient.....	0.9910	0.9910	0.9910
Barometric pressure..(IN.HG)	28.13	28.13	28.13
Avg. orif.pres.drop..(IN.WC)	1.27	1.31	1.31
Avg. gas meter temp..(DEF-F)	55.6	65.9	72.0
Volume through gas meter....			
at meter conditions...(CF)	38.37	39.41	39.72
standard conditions.(DSCF)	36.72	36.98	36.84
Total sampling time....(MIN)	60.00	60.00	60.00
Nozzle diameter.....(IN)	.185	.185	.185
Avg.stack gas temp ..(DEG-F)	41	41	41
Volumetric flow rate.....			
actual.....(ACFM)	22851	22866	22700
dry standard.....(DSCFM)	22500	22472	22351
Isokinetic variation.....(%)	98.8	99.6	99.8
Particulate concentration...			
actual.....(GR/ACF)	0.15635	0.23104	0.23320
dry standard.....(GR/DSCF)	0.15885	0.23518	0.23693
Particle mass rate...(LB/HR)	30.64	45.30	45.39

3.3 Results of Opacity Observations

Test No. 1
No. 1 Crusher Secondary Collector Stack

Results of Opacity Observations ---------- EPA Method 9

PERCENT OPACITY	OPTICAL DENSITY	RELATIVE FREQUENCY (%)
0	0.0000	0.00
5	0.0223	0.00
10	0.0458	78.75
15	0.0706	21.25
20	0.0969	0.00
25	0.1249	0.00
30	0.1549	0.00
35	0.1871	0.00
40	0.2219	0.00
45	0.2596	0.00
50	0.3010	0.00
55	0.3468	0.00
60	0.3979	0.00
65	0.4559	0.00
70	0.5229	0.00
75	0.6021	0.00
80	0.6690	0.00
85	0.8239	0.00
90	1.0000	0.00
95	1.3010	0.00
99	2.0000	0.00
Avg Opac11.06	Avg OD 0.0511	Time average

Observer: B. Drake
Cert. Date: 10-18-89
Date of Observation: 03-09-90
Time of Observation: 1145-1245

APPENDIX A

RESULTS OF PRELIMINARY VOLUMETRIC FLOW RATE DETERMINATIONS

Test No. 1
No. 1 Crusher Secondary Inlet

Results of Volumetric Flow Rate Determination-------Method 2

Date of Determination.....	03-09-90
Time of Determination.....(HRS)	940
Barometric pressure.....(IN.HG)	28.13
Pitot tube coefficient.....	.84
Number of sampling ports.....	4
Total number of points.....	24
Shape of duct.....	Rectangular
Duct width.....(IN)	27.5
Duct length.....(IN)	31.5
Duct area.....(SQ.FT)	6.02
Direction of flow.....	UP
Static pressure.....(IN.WC)	-3.8
Avg. gas temp.....(DEG-F)	39
Moisture content.....(% V/V)	0.63
Avg. linear velocity.....(FT/SEC)	55.3
Gas density.....(LB/ACF)	.07359
Molecular weight.....(LB/LBMOLE)	28.84
Mass flow of gas.....(LB/HR)	88161
Volumetric flow rate.....	
actual.....(ACFM)	19966
dry standard.....(DSCFM)	19541

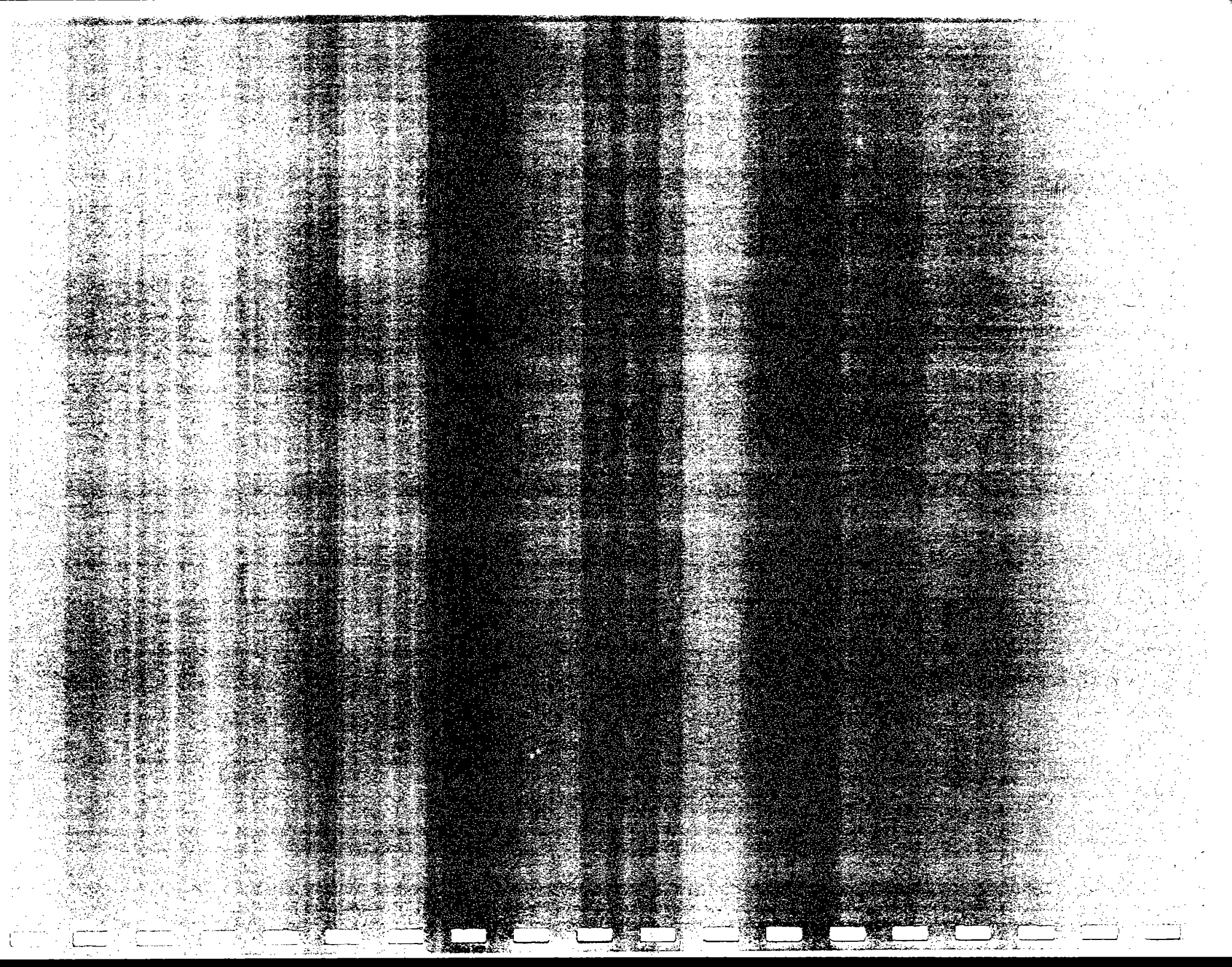
Test No. 1
No. 1 Crusher Secondary Collector Stack

Results of Volumetric Flow Rate Determination--------Method 2

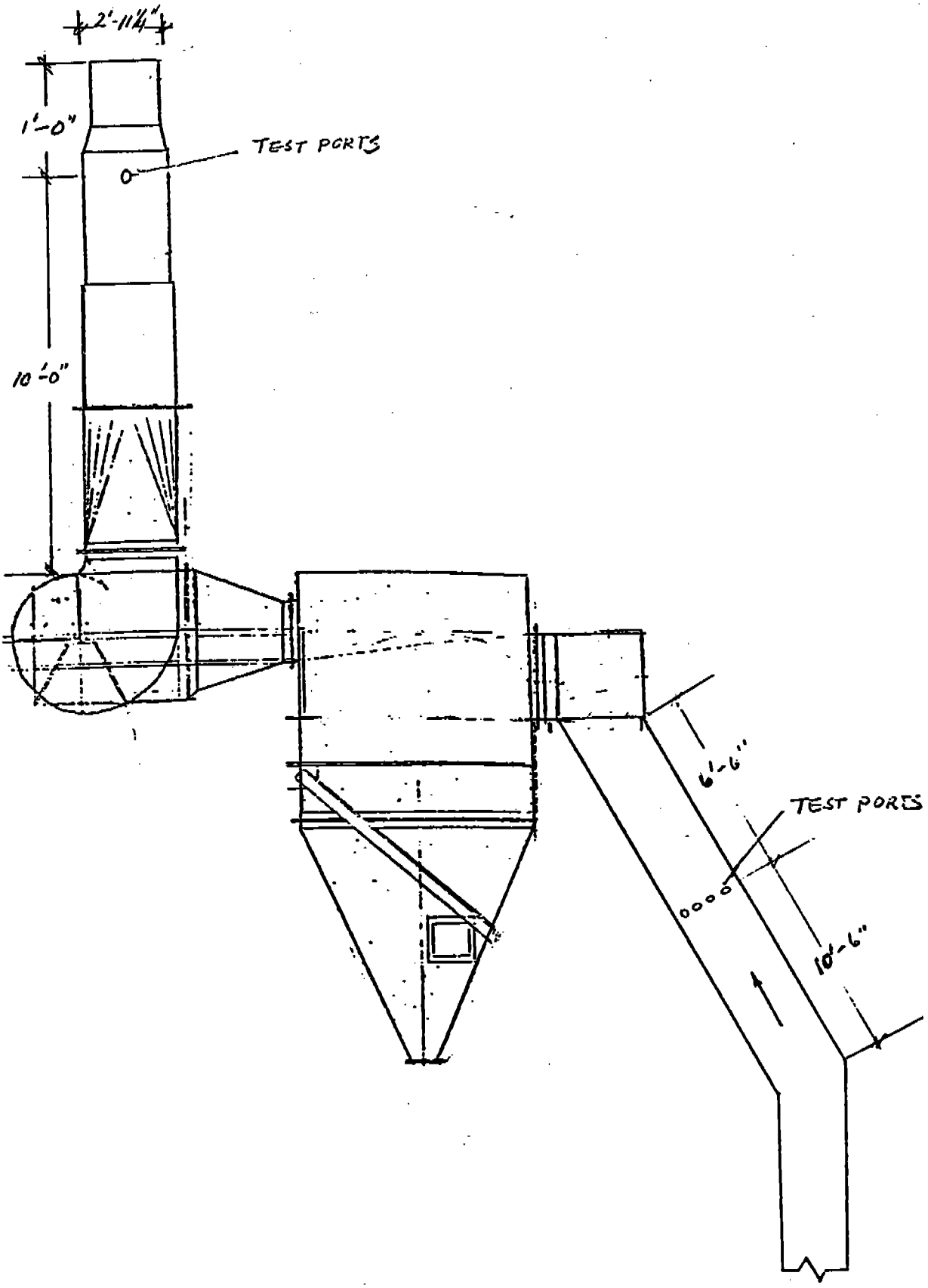
Date of Determination.....	03-09-90
Time of Determination.....(HRS)	1030
Barometric pressure.....(IN.HG)	28.13
Pitot tube coefficient.....	.84
Number of sampling ports.....	2
Total number of points.....	24
Shape of duct.....	Round
Stack diameter.....(IN)	35.25
Duct area.....(SQ.FT)	6.78
Direction of flow.....	UP
Static pressure.....(IN.WC)	.52
Avg. gas temp.....(DEG-F)	40
Moisture content.....(% V/V)	0.76
Avg. linear velocity.....(FT/SEC)	55.9
Gas density.....(LB/ACF)	.07425
Molecular weight.....(LB/LBMOLE)	28.84
Mass flow of gas.....(LB/HR)	101176
Volumetric flow rate.....	
actual.....(ACFM)	22712
dry standard.....(DSCFM)	22407

APPENDIX B

LOCATION OF TEST PORTS



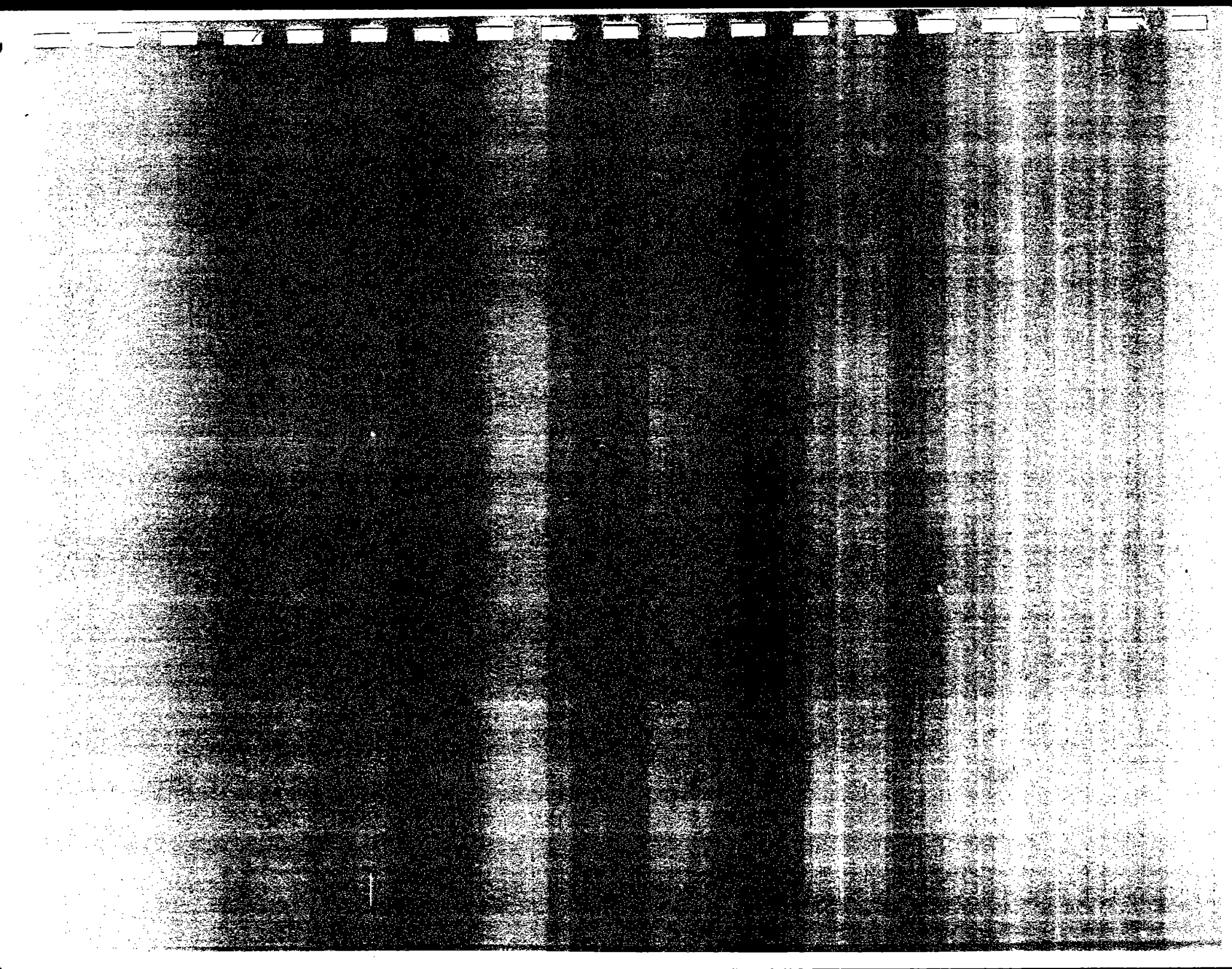
CYPRUS NORTHSHORE MINING
SECONDARY CRUSHER DUST COLLECTOR



NOT TO SCALE

APPENDIX C

METHODS 2-5 FIELD DATA SHEETS - INLET



INTERPOLL LABORATORIES EPA METHOD 2 FIELD DATA SHEET

Job CYPRUS NORTHSHORE MINING - BABBITT, MN

Source NO 1 PRIMARY CRUSHER - INLET

Test 1 Run 1 Date 3-9-90

Stack dimen. 27.5 X 31.5 IN.

Dry bulb ____ °F Wet bulb ____ °F

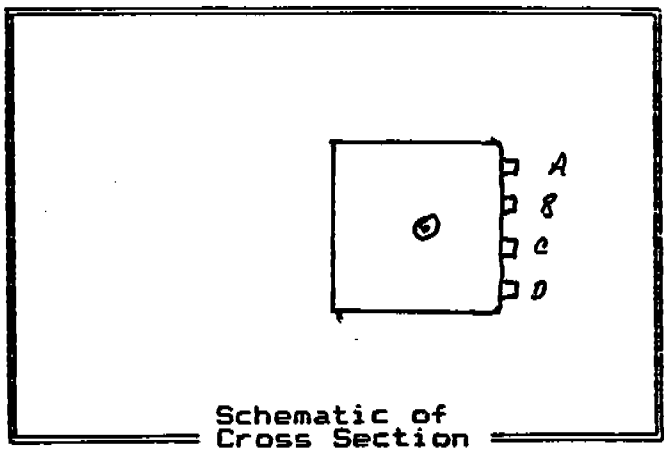
Manometer: ☒ Reg. ☐ Exp. ☐ Elec.

Barometric pressure 28.13 in Hg

Static pressure -3.8 in WC

Operators E. TROWBRIDGE - T. NIGEN

Pitot No. 2½ - 17V Cp .840



Schematic of Cross Section

Traverse Point No.	Fraction of Diameter	Distance from Stack Wall (in)	Distance from End of Port (in)	Velocity Pressure (in WC)	Temperature of gas (°F)
		Port length: 5 in.		Time start: 0940 hrs	
A- 1		2.29	7.29	.54	39
2		6.87	11.87	.66	
3		11.45	16.45	.66	
4		16.03	21.03	.60	
5		20.61	25.61	.65	
6		25.19	30.19	.80	
B 1				.88	39
2				.90	
3				.90	
4				.94	
5				.98	
6				1.05	
C-1				.98	39
2				1.05	
3				1.10	
4				1.20	
5				1.05	
6				1.10	
D-1				1.05	39
2				1.20	
3				1.30	
4				1.10	
5				1.40	
6				1.10	

Temp. meas. tool & S/N: PD-4

Time end: 1000 hrs

R or nothing= reg. manometer; S= expanded; E = electronic

S-392.1

INTERPOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job CYPRUS NORTHSHORE MINING Date 3-20-90 Test 1 Run 1
Source NO 1. SECONDARY CRUSHER - INLET No. of traverse points 24
Method 5 Filter holder: GLASS Filter type: 4" GLASS FIBER

Sample Train Leak Check:

Pretest: ≤ 0.02 cfm at 15 in. Hg. (vac) ☒
Postest: 0 cfm at 5 in. Hg. (vac) ☒

Particulate Catch Data:

No.s of filters used: 1983

Recovery solvent(s)
☒ acetone
☐ other(s)

No. of probe wash bottles: 1
Sample recovered by: ET

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1			
Impinger No. 2			
Impinger No. 3			
Condenser			
Desiccant	1250	1245	5
Total			5

Integrated Gas Sampling Data:

Bag Pump No. _____ Box No. N/A Bag No. _____

Bag Material: 5-layer Aluminized Tedlar Size: 44 L

Pretest leak check: _____ cc/min at _____ in. Hg.

Time start: _____ (HRS) Time end: _____ (HRS)

Sampling rate: _____ cc/min Operator: _____

S/N of O_2 Analyzer used to monitor train outlet: ___

CF-023

INTERPOLL LABORATORIES EPA METHOD 5 FIELD DATA SHEET

Job: Cyprus Northshore Mining
Source: No 1 Secondary Crusher-Inlet
Date: 3-8-90 Test 1 Run 1

Operators: E. Trowbridge - T. Hagan
Meter Box No. 7 ^H@ 1.80 IN WC
Gasmeter coeff. .9884

Pitot No. 4-17V Cp .840
Bar. Press. 28.13 inHg H2O x
Nozzle No. 7-3 Nozzle Dia .185 IN.

Traverse Point No.	Sampling Time (min)	Sample Volume (cf)	Velocity Head (inWC)	Orifice Meter (inWC)	Dgs. Vol. (cf)	VAC. inHg	Stack (°F)	Probe (°F)	Oven (°F)	Impg. (°F)	Gas/In (°F)	Gas/Out (°F)	Oxygen (xv/v)
	1148	195.32											
D - 6	2.5	196.70	.74	.94	6.68	2.2	43	245	247	38	54	53	
5	5	197.99	.62	.78	7.94	2.0	43				55	53	
4	7.5	199.29	.64	.80	9.21	2.0	42	247	249	38	55	53	
3	10	200.64	.74	.95	0.60	2.1	42				57	55	
2	12.5	202.12	.85	1.07	2.08	2.2	42	247	250	38	60	56	
1	15	203.40	.60	.76	3.33	2.0	41				60	56	
C 6	17.5	205.03	1.05	1.33	4.98	2.2	41	245	251	38	60	56	
5	20	206.60	.98	1.24	6.57	2.2	41				60	56	
4	22.5	208.17	.87	1.10	8.07	2.2	42	247	250	38	62	56	
3	25	209.63	.90	1.14	9.59	2.2	42				64	57	
2	27.5	211.20	.93	1.19	1.15	2.2	40	245	249	38	64	57	
1	30	212.65	.84	1.07	2.64	2.2	40	.			64	57	
B 6	32.5	214.32	1.05	1.34	4.29	2.3	40	246	250	38	64	57	
5	35	216.03	1.15	1.47	6.03	2.5	40				66	58	
4	37.5	217.72	1.05	1.34	7.69	2.4	41	245	251	39	68	61	
3	40	219.42	1.10	1.41	9.40	2.4	41				70	62	
2	42.5	221.29	1.30	1.67	1.24	2.8	41	248	252	39	71	63	
1	45	222.86	.98	1.26	2.88	2.2	41				72	63	
A - 6	47.5	224.71	1.30	1.68	4.74	2.8	41	246	250	39	75	65	
5	50	226.60	1.30	1.69	6.61	2.8	41				77	67	
4	52.5	228.60	1.40	1.82	8.57	2.9	41	244	248	39	77	67	
3	55	230.42	1.30	1.69	0.45	2.8	41				77	67	
2	57.5	232.28	1.20	1.56	2.25	2.7	41	243	247	39	79	69	
1	60	234.07	1.20	1.57	4.07	2.7	41				79	69	
	(1248)												
	θ = 60	Vm = 38.77		^H = 1.29							Avg. = 62.9		

S-0037R

INTERPOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job CYPRUS NORTHSHORE MINING — Date 3-9-98 Test 1 Run 2
Source NO1 SECONDARY CRUSHER - INLET — No. of traverse points 24
Method 5 Filter holder: GLASS — Filter type: 4" GLASS FIBER

Sample Train Leak Check:

Pretest: < 0.02 cfm at 15 in. Hg. (vac) ☒
Postest: 0 cfm at ✓ in. Hg. (vac) ☒

Particulate Catch Data:

No.s of filters used: 1884

Recovery solvent(s)
☒ acetone
☐ other(s)

No. of probe wash bottles: 1
Sample recovered by: ET

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1			
Impinger No. 2			
Impinger No. 3			
Condenser			
Desiccant	1300	1295	5
Total			5

Integrated Gas Sampling Data:

Bag Pump No. _____ Box No. N/A Bag No. _____

Bag Material: 5-layer Aluminized Tedlar Size: 44 L

Pretest leak check: _____ cc/min at _____ in. Hg.

Time start: _____ (HRS) Time end: _____ (HRS)

Sampling rate: _____ cc/min Operator: _____

S/N of O_2 Analyzer used to monitor train outlet: ___

CF-023

INTERPOLL LABORATORIES EPA METHOD 5 FIELD DATA SHEET

Job Cullins Northshore Mining
Source Hot Secondary Crusher - Inlet
Date 3-9-90 Test 1 Run 2

Operators ET-TH
Meter Box No. 7 ^H@ 1.80 IN WC
Gasmeter coeff. .9899

Pitot No. 4-10W Cp .840
Bar. Press. 28.73 inHg H2O x
Nozzle No. 2-3 Nozzle Dia .175 IN.

Traverse Point No.	Sampling Time (min)	Sample Volume (cf)	Velocity Head (inWC)	Orifice Meter (inWC)	Des. Vol. (cf)	VAC. inHg	Temperatures (°F) Stack	Probe	Oven	Impg.	Gas/In	Gas/Out	Oxygen (%v/v)
	1524	234.30											
A-6	2.5	235.78	.76	1.00	5.75	2.2	40	248	255	38	68	67	
5	5	237.10	.62	.81	7.04	2.0	40				70	67	
4	7.5	238.40	.65	.85	8.37	2.0	40	250	254	38	70	67	
3	10	239.98	.86	1.12	9.90	2.2	40				73	67	
2	12.5	241.40	.75	.98	1.33	2.2	40	249	257	38	73	67	
1	15	242.85	.77	1.01	2.78	2.2	40				73	68	
B-6	17.5	244.50	1.05	1.36	4.41	2.3	43	250	256	38	73	68	
5	20	246.20	.98	1.27	6.10	2.3	43				75	70	
4	22.5	247.74	.93	1.21	7.69	2.2	43	249	255	38	77	70	
3	25	249.35	.90	1.18	9.26	2.2	43				78	70	
2	27.5	250.90	.90	1.18	0.84	2.2	42	251	254	38	78	70	
1	30	252.48	.87	1.14	2.38	2.1	42				78	70	
C-6	32.5	254.12	1.10	1.44	4.12	2.3	42	250	252	38	79	72	
5	35	256.02	1.25	1.64	5.96	2.8	42				80	72	
4	37.5	257.80	1.15	1.51	7.77	2.7	42	248	254	38	80	73	
3	40	259.56	1.10	1.45	9.51	2.8	42				80	73	
2	42.5	261.50	1.30	1.71	1.41	3.0	42	249	253	39	82	74	
1	45	263.10	1.00	1.32	3.08	2.6	42				82	74	
D-6	47.5	265.02	1.30	1.72	4.99	3.0	42	258	252	39	82	74	
5	50	266.94	1.30	1.72	6.89	3.0	42				82	74	
4	52.5	268.90	1.40	1.85	8.87	3.0	42	251	250	39	83	75	
3	55	270.90	1.50	1.98	0.92	3.1	42				83	75	
2	57.5	272.80	1.50	1.72	2.82	3.0	42	250	252	39	83	75	
1	60	274.70	1.20	1.59	4.66	3.0	41				83	75	
	(1430)												
	θ = 60	Vm = 40.40		^H = 1.36							Avg. = 74.3		

S-0037R

INTERPOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job CYPRUS NORTHSTAR MINING — Date 3-9-90 — Test 1 — Run 3
Source NO 1 SECONDARY CRUSHER - INLET — No. of traverse points 24
Method 5 — Filter holder: GLASS — Filter type: 4" GLASS FIBER

Sample Train Leak Check:

Pretest: < 0.02 cfm at 15 in. Hg. (vac) ☒
Postest: 0 cfm at ✓ in. Hg. (vac)

Particulate Catch Data:

No.s of filters used: 1985

Recovery solvent(s)
☒ acetone
☐ other(s)

No. of probe wash bottles: 1
Sample recovered by: ET

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1			
Impinger No. 2			
Impinger No. 3			
Condenser			
Desiccant	1255	1250	5
Total			5

Integrated Gas Sampling Data:

Bag Pump No. _____ Box No. N/A Bag No. _____

Bag Material: 5-layer Aluminized Tedlar Size: 44 L

Pretest leak check: _____ cc/min at _____ in. Hg.

Time start: _____ (HRS) Time end: _____ (HRS)

Sampling rate: _____ cc/min Operator: _____

S/N of O_2 Analyzer used to monitor train outlet: ___

CF-023

INTERPOLL LABORATORIES EPA METHOD 5 FIELD DATA SHEET

Job CYPRUS NORTHSHORE MINING
Source NO 1 SECONDARY CRUSHER - INLET
Date 5-9-90 Test 1 Run 3

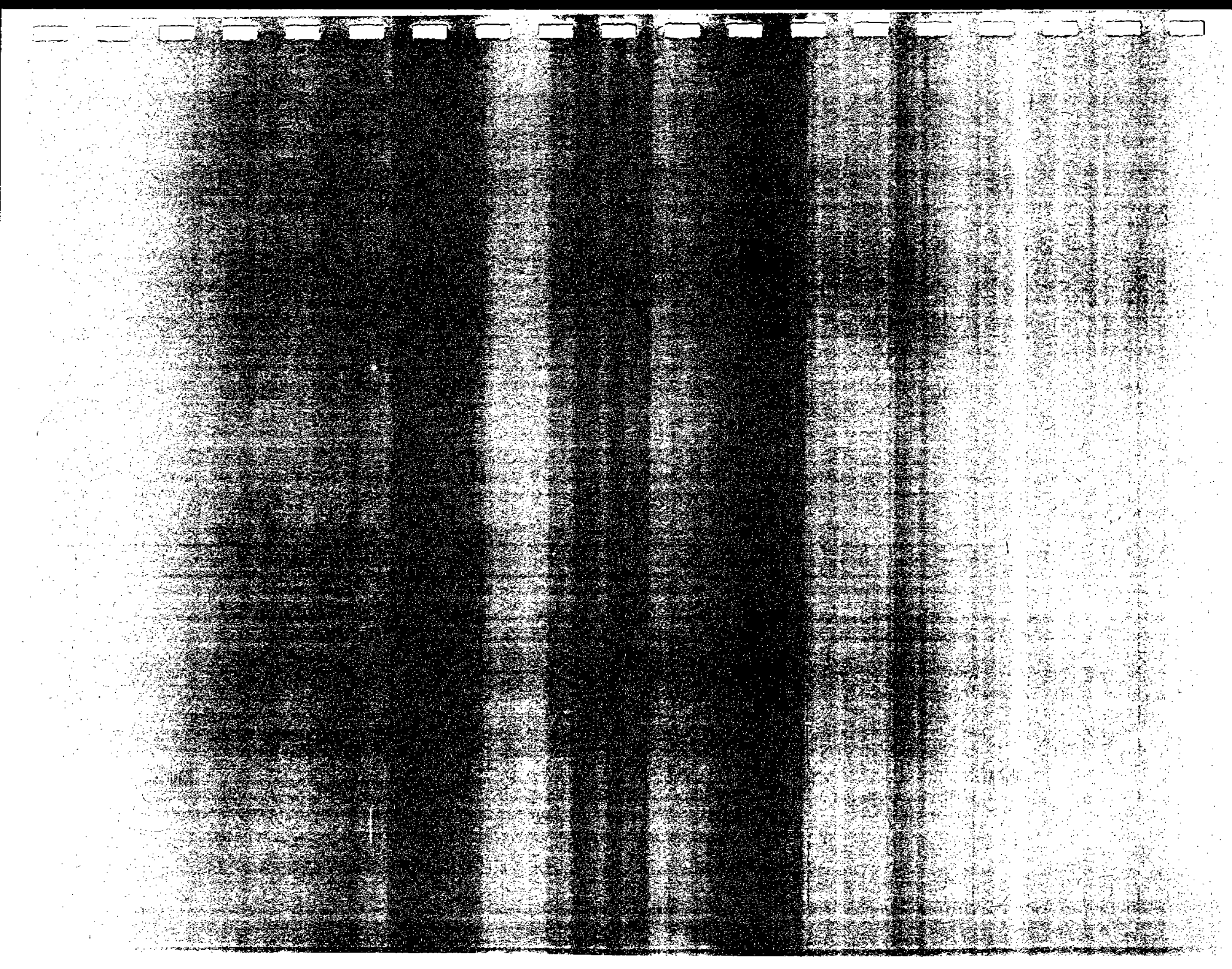
Operators ET - TH
Meter Box No. 7 ΔH 1.80 IN WC
Coeaster coeff. .9994

Pitot No. 4-PTY Cp .84
Bar. Press. 28.13 inHg H2O x
Nozzle No. Z-3 Nozzle Dia .183 IN.

Traverse Point No.	Sampling Time (min)	Sample Volume (cf)	Velocity Head (inWC)	Orifice Meter (inWC)	Dgs. Vol. (cf)	VAC. inHg	Temperatures (°F) Stack	Probe	Oven	Impg.	Cyclin	Cyc/Out	Oxygen (x v/v)
	1540	279.90											
A-6	2.5	276.50	.87	1.15	6.46	2.2	40	248	250	38	73	72	
5	5	277.89	.66	.86	7.80	2.0	41				74	72	
4	7.5	279.26	.66	.87	9.15	2.0	41	246	251	38	76	72	
3	10	280.75	.85	1.12	10.69	2.1	41				78	73	
2	12.5	282.20	.80	1.06	12.18	2.1	41	249	248	38	78	74	
1	15	283.70	.77	1.02	13.64	2.1	41				79	74	
B-6	17.5	285.44	1.05	1.39	15.35	2.3	41	251	250	38	79	74	
5	20	287.10	1.00	1.32	17.02	2.3	41				81	76	
4	22.5	288.70	.95	1.26	18.66	2.2	41	250	253	38	82	76	
3	25	290.33	.90	1.19	20.25	2.1	41				82	76	
2	27.5	291.86	.91	1.21	21.85	2.1	41	248	254	38	82	76	
1	30	293.40	.88	1.17	23.42	2.1	40				83	77	
C-6	32.5	295.20	1.15	1.53	25.23	2.5	40	250	252	38	84	78	
5	35	297.14	1.30	1.73	27.14	2.8	40				85	78	
4	37.5	298.97	1.15	1.53	28.95	2.6	41	248	252	38	85	78	
3	40	300.75	1.10	1.47	30.77	2.5	41				86	78	
2	42.5	302.56	1.20	1.60	32.56	2.7	41	247	250	39	84	79	
1	45	304.24	.97	1.30	34.22	2.5	40				86	79	
D-6	47.5	306.21	1.30	1.74	36.15	2.7	40	245	251	39	87	79	
5	50	308.13	1.40	1.87	38.14	2.9	40				87	79	
4	52.5	310.13	1.35	1.81	40.11	2.9	40	248	250	39	87	79	
3	55	312.25	1.50	2.01	42.17	3.0	40				87	79	
2	57.5	314.17	1.30	1.74	44.10	2.9	40	250	249	39	87	79	
1	60	316.02	1.25	1.67	45.94	2.9	40				87	79	
	(1644)												
	θ = 60	Vm = 41.17		ΔH = 1.40							Avg. = 79.5		

APPENDIX D

METHODS 2–5 FIELD DATA SHEETS — STACK



INTERPOLL LABORATORIES EPA METHOD 2 FIELD DATA SHEET

Job Cyprus / Babbzt

Source No. 1 Crusher secondary collecton stack

Test 1 Run 0-3 Date 3-9-90

Stack dimen. 35.25 IN.

Dry bulb ____ °F Wet bulb ____ °F

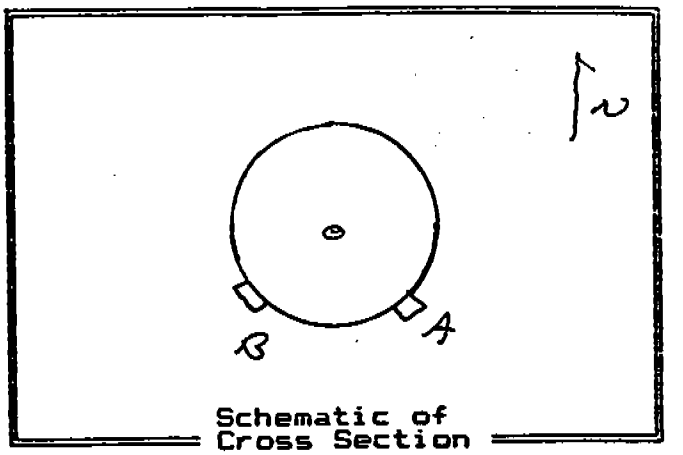
Manometer: ☒ Reg. ☐ Exp. ☐ Elec.

Barometric pressure 28.13 in Hg

Static pressure +.52 in WC

Operators R. Rosenthal, M. Kahler

Pitot No. ____ Cp .840



Schematic of Cross Section

Traverse Point No.	Fraction of Diameter	Distance from Stack Wall (in)	Distance from End of Port (in)	Velocity Pressure (in WC)	Temperature of gas (°F)
		Port length: 3.0 in.		Time start: 1030 hrs	
A- 1	.021	.74	4.00	.85	40°
2	.067	2.36	5.36	.91	
3	.118	4.16	7.16	1.00	
4	.177	6.24	9.24	.99	
5	.250	8.81	11.81	1.00	
6	.356	12.55	15.55	.98	
7	.644	22.70	25.70	.99	
8	.750	26.44	29.44	.98	
9	.823	29.01	32.01	1.05	
10	.882	31.09	34.09	1.00	
11	.933	32.89	35.89	1.05	
12	.979	34.51	37.25	1.00	
B- 1				.82	
2				.83	
3				.83	
4				.82	
5				.80	
6				.84	
7				1.00	
8				1.10	
9				1.20	
10				1.30	
11				1.35	
12				.95	

Temp. meas. tool & S/N: Digital T/c PDT-2 | Time end: hrs

R or nothing= reg. manometer; S= expanded; E = electronic

INTERPOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job Cyprus / Babbitt Date 3-9-90 Test 1 Run 1
Source No. 1 Crusher Secondary Collector Stack No. of traverse points 24
Method 5 Filter holder: 4" glass Filter type: glass fiber

Sample Train Leak Check:

Pretest: < 0.02 cfm at 15 in. Hg. (vac) ☒
Postest: .00 cfm at 8 in. Hg. (vac) ☒

Particulate Catch Data:

No.s of filters used: 1955

Recovery solvent(s)
☒ acetone
☐ other(s)

No. of probe wash bottles:
Sample recovered by:

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1	481	485	-4
Impinger No. 2			
Impinger No. 3			
Condenser			
Desiccant	1230	1220	10
Total			6

Integrated Gas Sampling Data: Ambient Air

Bag Pump No. _____ Box No. _____ Bag No. _____

Bag Material: 5-layer Aluminized Tedlar Size: 44 L

Pretest leak check: _____ cc/min at _____ in. Hg.

Time start: _____ (HRS) Time end: _____ (HRS)

Sampling rate: _____ cc/min Operator: _____

S/N of O_2 Analyzer used to monitor train outlet: ___

CF-023

INTERPOLL LABORATORIES EPA METHOD 5 FIELD DATA SHEET

Job CYPRUS / Babbitt Operator R.R. / M.K. Pitot No. 4-17V Cp .840
Source No. 1 CRUSHER SECOND ARY COLLECTOR STACK Meter Box No. 6 ΔH 1.83 IN WC Bar. Press. 28.13 inHg H2O 2.0 x
Date 3-9-90 Test 1 Run 1 Calibration coeff. .9978 Nozzle No. 6-3 Nozzle Dia .185 IN.

Traverse Point No.	Sampling Time (min)	Sample Volume (cf)	Velocity Head (inWC)	Orifice Meter (inWC)	Dec. Vol. (cf)	VAC. inHg	Temperatures (°F) Stack	Probe	Oven	Impg.	Gas In	Gas Out	Oxygen (v/v)
	11:42	291.30											
B 12	2.5	293.00	1.10	1.36	2.93	4.5	43	250	250	34	48	48	20.9
11	5	294.72	1.20	1.50	4.66	4.5	43				50	48	20.9
10	7.5	296.37	1.10	1.38	6.33	4	42				51	49	20.9
9	10	298.06	1.15	1.45	8.03	4	42	250	252	34	52	49	20.9
8	12.5	299.75	1.10	1.39	9.70	4.5	42				53	50	20.9
7	15	301.31	.93	1.18	1.24	4	41				54	50	20.9
6	17.5	302.75	.87	1.10	2.73	4	41	250	252	34	54	50	20.9
5	20	304.25	.90	1.14	4.25	4	41				55	51	20.9
4	22.5	305.78	.84	1.07	5.72	3.5	41				56	51	20.9
3	25	307.23	.89	1.13	7.23	3.5	41	245	252	36	56	52	20.9
2	27.5	308.71	.83	1.06	8.70	3.5	40				57	52	20.9
1	30	310.15	.81	1.03	0.15	3.5	40				58	52	20.9
A 12	32.5	311.76	.97	1.24	1.73	4	40	247	253	36	57	53	20.9
11	35	313.42	1.05	1.34	3.38	4	41				58	53	20.9
10	37.5	315.07	1.10	1.40	5.07	4	41				59	54	20.9
9	40	316.76	1.10	1.41	6.76	4	41	243	248	38	60	55	20.9
8	42.5	318.45	1.05	1.35	8.41	4	41				62	56	20.9
7	45	320.06	1.00	1.29	0.04	4	41				62	57	20.9
6	47.5	321.64	.98	1.26	1.64	4	41	244	248	37	63	57	20.9
5	50	323.32	.98	1.26	3.25	4	41				64	58	20.9
4	52.5	324.92	.97	1.25	4.85	4	40				64	59	20.9
3	55	326.50	1.00	1.29	6.48	4	40	248	253	37	65	59	20.9
2	57.5	328.10	.96	1.24	8.08	4	40				65	60	20.9
1	60	329.67	.95	1.23	9.67	4	40	248	253	37	65	60	20.9
	(1245)												
	θ = 60	Vm = 38.37		ΔH = 1.27							Avg. = 55.6		

INTERPOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job CYPRUS / Babbzt Date 3-9-90 Test 1 Run 2
Source No.1 CRUSHER Secondary collector stack No. of traverse points ____
Method 5 Filter holder: 4" glass Filter type: glass fiber

Sample Train Leak Check:

Pretest: ≤ 0.02 cfm at 15 in. Hg. (vac) ☒
Postest: .08 cfm at 7 in. Hg. (vac) ☒

Particulate Catch Data:

No.s of filters used: 1946

Recovery solvent(s)
☒ acetone ____
☐ other(s) ____

No. of probe wash bottles: ____
Sample recovered by: ____

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1	497	495	2
Impinger No. 2			
Impinger No. 3			
Condenser			
Desiccant	1234	1229	5
Total			7

Integrated Gas Sampling Data: Ambient Air

Bag Pump No. ____ Box No. ____ Bag No. ____

Bag Material: 5-layer Aluminized Tedlar Size: 44 L

Pretest leak check: ____ cc/min at ____ in. Hg.

Time start: ____ (HRS) Time end: ____ (HRS)

Sampling rate: ____ cc/min Operator: ____

S/N of O_2 Analyzer used to monitor train outlet: ____

CF-023

INTERPOLL LABORATORIES EPA METHOD 5 FIELD DATA SHEET

Job CYPRUS / Babbitt — Operators R.R. / M.K. — Pitot No. 4-17v — Cp .840
Source No.1 Crusher Secondary Collector stack — Meter Box No. 6 — ΔH 2.83 IN WC — Bar. Press. 28.13 inHg — Nozzle No. 2-6 — Nozzle Dia .185 IN.
Date 3-9-90 — Test 1 — Run 2 — Counter coeff. .9910 — H2O 4.0 x

Traverse Point No.	Sampling Time (min)	Sample Volume (cf)	Velocity Head (inWC)	Orifice Meter (inWC)	Dev. Vol. (cf)	VAC. inHg	Temperatures (°F) Stack	Probe	Oven	Impg.	Gas In	Gas Out	Oxygen (x v/v)
	1324	329.95											
A - 12	2.5	331.57	.97	1.22	1.50	3.5	40	245	240	35	61	60	20.9
11	5	333.15	.98	1.28	3.11	3.5	43				62	61	20.9
10	7.5	334.80	1.05	1.37	4.79	3.5	43				62	61	20.9
9	10	336.45	1.00	1.31	6.43	3.5	43	251	243	35	63	61	20.9
8	12.5	338.11	1.10	1.44	8.15	4.0	43				64	62	20.9
7	15	339.75	1.05	1.38	9.83	3.5	43				65	62	20.9
6	17.5	341.50	1.00	1.32	1.48	3.5	40	251	245	37	65	62	20.9
5	20	343.03	.99	1.31	3.12	3.5	40				66	63	20.9
4	22.5	344.72	1.00	1.32	4.77	3.5	41				66	63	20.9
3	25	346.32	1.00	1.32	6.42	3.5	41	255	245	37	67	64	20.9
2	27.5	348.03	.98	1.30	8.06	3.5	41				67	64	20.9
1	30	349.68	.91	1.20	9.63	3	42				67	64	20.9
B - 12	32.5	351.35	1.05	1.39	1.33	3.5	42	250	245	38	66	64	20.9
11	35	353.13	1.15	1.52	3.10	3.5	40				68	65	20.9
10	37.5	354.84	1.10	1.46	4.84	3.5	40				69	66	20.9
9	40	356.58	1.15	1.55	6.62	3.5	40	250	248	37	69	66	20.9
8	42.5	358.34	1.10	1.46	8.36	3.5	40				70	66	20.9
7	45	360.00	.98	1.30	0.00	3.5	40				70	67	20.9
6	47.5	361.67	.96	1.27	1.63	3.5	42	250	248	37	71	67	20.9
5	50	363.24	.92	1.22	3.23	3.5	42				71	68	20.9
4	52.5	364.83	.89	1.18	4.80	3	42				71	68	20.9
3	55	366.37	.85	1.13	6.33	3	41	250	248	37	71	68	20.9
2	57.5	367.88	.83	1.11	7.85	3	41				72	69	20.9
1	60	369.36	.81	1.08	9.36	3	41				72	69	20.9
	(0427)												
	θ = 60	Vm = 39.41		ΔH = 1.31							Avg. = 65.9		

1.39

INTERPOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job CYPRUS / Babbit Date 3-9-90 Test 1 Run 3
Source No.1 CRUSHER SECONDARY COLLECTOR STACK No. of traverse points _____
Method 5 Filter holder: 4" glass Filter type: glass fiber

Sample Train Leak Check:

Pretest: < 0.02 cfm at 15 in. Hg. (vac) ☒
Postest: .00 cfm at 10 in. Hg. (vac) ☒

Particulate Catch Data:

No.s of filters used: 1954

Recovery solvent(s)
☒ acetone _____
☐ other(s) _____

No. of probe wash bottles: _____
Sample recovered by: _____

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1	497	495	2
Impinger No. 2			
Impinger No. 3			
Condenser			
Desiccant	1334	1330	4
Total			6

Integrated Gas Sampling Data:

Bag Pump No. _____ Box No. _____ Bag No. _____

Bag Material: 5-layer Aluminized Tedlar Size: 44 L

Pretest leak check: _____ cc/min at _____ in. Hg.

Time start: _____ (HRS) Time end: _____ (HRS)

Sampling rate: _____ cc/min Operator: _____

S/N of O_2 Analyzer used to monitor train outlet: ___

CF-023

CF-D11

INTERPOLL LABORATORIES EPA METHOD 5 FIELD DATA SHEET

Job CYPRUSS / BABBETT
Source No. 1 CRUSHER SECONDARY COLLECTOR STACK
Date 3-9-90 Test 1 Run 3

Operators R.R. / M.K.
Meter Box No. 6 ΔH 1.83 IN WC
Coeffic. coeff. .9910

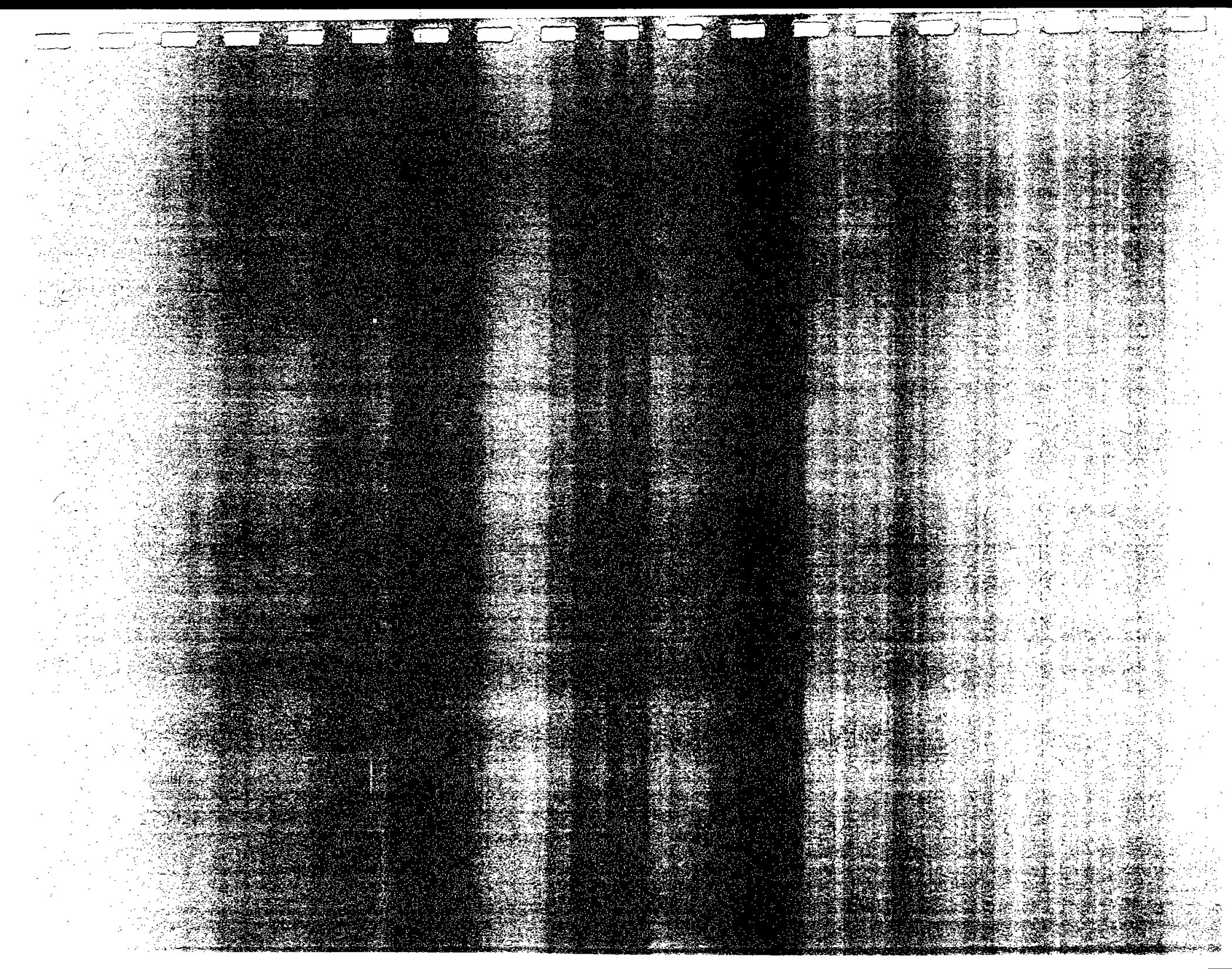
Pitot No. 4-17J Cp .840
Bar. Press. 28.13 inHg H2O 1.0 x
Nozzle No. 7-8 Nozzle Dia .185 IN.

Traverse Point No.	Sampling Time (min)	Sample Volume (cf)	Velocity Head (inWC)	Orifice Meter (inWC)	Dec. Vol. (cf)	VAC. inHg	Temperatures (°F) Stack	Probe	Oven	Impg.	Gas In	Gas Out	Oxygen (xv/v)
	1540	369.60											
A-12	2.5	371.29	1.00	1.33	1.25	4	40	250	250	37	69	69	20.9
11	5	373.07	1.10	1.47	3.00	4	40				69	69	20.9
10	7.5	374.80	1.15	1.53	4.78	4	41				69	69	20.9
9	10	376.53	1.10	1.47	6.53	4	41	255	250	37	70	69	20.9
8	12.5	378.26	1.05	1.40	8.24	4	41				71	70	20.9
7	15	379.89	.92	1.23	9.84	4	41				71	70	20.9
6	17.5	381.45	.92	1.23	1.44	4	42	255	250	39	71	70	20.9
5	20	382.98	.89	1.19	3.01	4	42				72	71	20.9
4	22.5	384.60	.86	1.15	4.56	4	41				72	71	20.9
3	25	386.07	.82	1.10	6.08	3.5	41	245	250	38	73	71	20.9
2	27.5	387.57	.82	1.10	7.59	3.5	41				73	71	20.9
1	30	389.03	.80	1.07	9.09	3.5	40				73	71	20.9
1A 12	32.5	390.78	1.05	1.41	0.81	4	40	247	250	38	73	71	20.9
11	35	392.52	1.10	1.47	2.57	4	40				74	72	20.9
10	37.5	394.20	1.00	1.34	4.24	4	41				74	72	20.9
9	40	395.80	.95	1.27	5.88	4	41	247	250	38	74	72	20.9
8	42.5	397.58	1.05	1.41	7.60	4.5	41				75	73	20.9
7	45	399.28	1.00	1.34	9.28	4.5	41				75	73	20.9
6	47.5	401.04	1.10	1.47	1.04	4.5	42	245	255	36	75	73	20.9
5	50	402.79	1.05	1.41	2.75	4.5	42				75	73	20.9
4	52.5	404.42	.94	1.26	4.38	4	42				75	73	20.9
3	55	406.10	.98	1.32	6.05	4	41	245	252	37	75	73	20.9
2	57.5	407.70	.96	1.29	7.69	4	41				75	73	20.9
1	60	408.32	.90	1.21	9.29	3.5	47				75	73	20.9
	(1642)												
	θ = 60	Vm = 39.72		ΔH 1.31							Avg. = 72.0		

S-0037R

APPENDIX E

METHOD 9 FIELD DATA SHEET



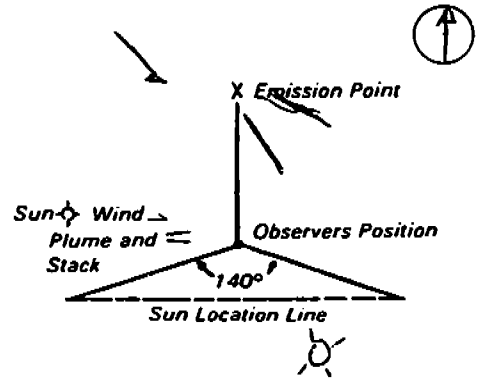
Interpoll Laboratories
(612)786-6020

Visible Emissions Form

SOURCE NAME: Cyprus Northshore Mining	OBSERVATION DATE: 3-9-90
ADDRESS:	START TIME: 1145
CITY: Babbit / STATE: MN / ZIP:	STOP TIME: 1245
PHONE: / SOURCE ID NUMBER: No. 1	
PROCESS EQUIPMENT: Crusher Secondary Collector Stack / OPERATING MODE:	
CONTROL EQUIPMENT: Multicline Collector / OPERATING MODE:	
DESCRIBE EMISSION POINT: START Stack outlet STOP Stack outlet	
HEIGHT ABOVE GROUND LEVEL: START 60' STOP 60' / HEIGHT RELATIVE TO OBSERVER: START 60' STOP 60'	
DISTANCE FROM OBSERVER: START 120' STOP 120' / DIRECTION FROM OBSERVER: START N STOP N	
DESCRIBE EMISSIONS: START Grey STOP Grey	
EMISSION COLOR: START Grey STOP Grey / PLUME TYPE: CONTINUOUS ☒ FUGITIVE ☐ INTERMITTENT ☐	
WATER DROPLETS PRESENT: NO ☒ YES ☐ / IF WATER DROPLET PLUME: ATTACHED ☐ DETACHED ☐	
POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED: START one diameter above Stack outlet STOP Same	
DESCRIBE BACKGROUND: START White overcast sky STOP Same	
BACKGROUND COLOR: START White STOP White / SKY CONDITIONS: START Overcast STOP Overcast	
WIND SPEED: START 15 STOP 20 / WIND DIRECTION: START NW STOP NW	
AMBIENT TEMP.: START 32 STOP 34 / WET BULB TEMP. / RH percent 80	

SEC / MIN	0	15	30	45	SEC / MIN	0	15	30	45
1	15	15	15	15	31	15	15	10	10
2	10	10	10	10	32	10	10	10	10
3	15	15	15	15	33	10	15	15	15
4	15	15	10	10	34	15	15	10	10
5	10	10	10	10	35	10	10	10	10
6	10	10	10	10	36	10	10	10	10
7	10	10	10	15	37	10	10	10	10
8	10	10	10	10	38	15	15	15	15
9	10	10	10	10	39	10	10	10	10
10	15	15	15	15	40	10	10	10	10
11	10	10	10	10	41	10	10	10	10
12	10	10	10	10	42	15	15	15	10
13	10	10	10	10	43	10	10	10	10
14	10	10	10	10	44	10	10	10	10
15	10	10	10	10	45	10	10	15	15
16	10	10	10	10	46	15	15	10	10
17	10	10	10	15	47	10	10	10	10
18	15	15	15	15	48	10	10	10	10
19	10	10	10	10	49	10	10	10	10
20	15	15	15	10	50	15	15	15	15
21	10	10	10	10	51	15	10	10	10
22	10	10	10	10	52	10	10	10	10
23	10	10	10	10	53	10	10	10	10
24	10	10	10	10	54	10	10	10	10
25	10	10	10	10	55	10	10	10	10
26	15	15	15	15	56	10	10	10	10
27	15	10	10	10	57	10	10	10	10
28	10	10	10	10	58	10	10	10	10
29	10	10	10	10	59	10	10	10	10
30	10	10	10	10	60	10	10	10	10

Source Layout Sketch — Draw North Arrow



AVERAGE OPACITY FOR HIGHEST PERIOD:

NUMBER OF READINGS ABOVE % WERE:

RANGE OF OPACITY READINGS: MINIMUM / MAXIMUM

OBSERVER'S NAME (PRINT): William J. Drake

COMMENTS:

OBSERVER'S SIGNATURE: William J Drake — DATE: 3-9-90

ORGANIZATION: Interpoll Laboratories

I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS
SIGNATURE:

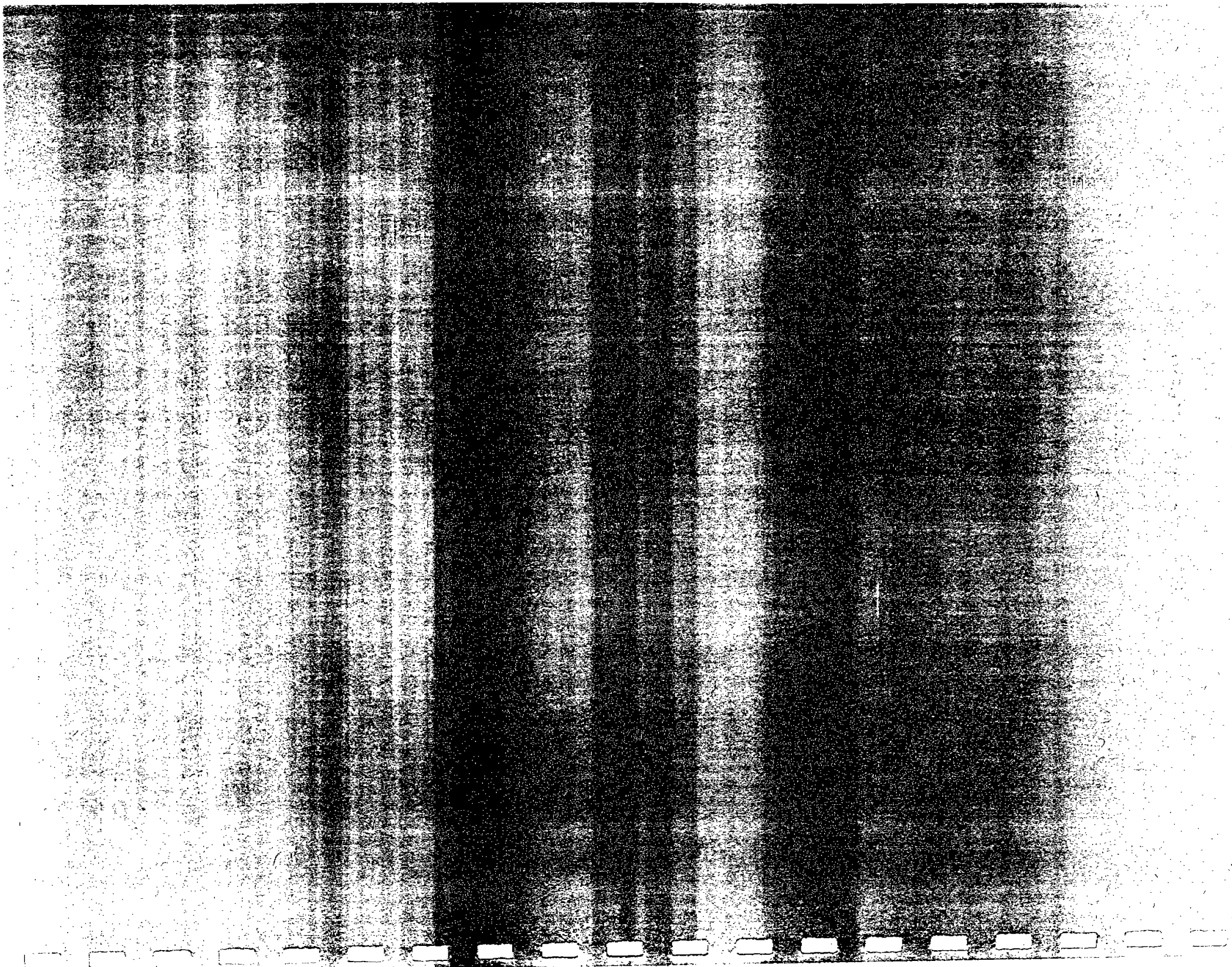
CERTIFIED BY: MPCA — DATE: 10-18-89

TITLE: — DATE:

VERIFIED BY: — DATE:

APPENDIX F

LABORATORY DATA SHEETS



Interpoll Laboratories
(612) 786-6020

Chain of Custody
Sample Deposition Sheet

Job CYPRUS NORTHSHORE MINING/BABBITT Source NO 1 SECONDAYER CLASSIFIER
Team Leader E TROWBRIDGE Test Site INLET
Date Submitted _____ Date of Test 3-9-90
Test No. 1 No. of Runs Completed 3

No. of Samples	Type of Sample	Analysis Required	Comments
4	Probe Wash: ☒ Acetone ☐ D.I. Water	☒ As per EPA M-5 ☐ Other _____	
4	Filter: ☒ 4" G.F. ☐ S.S. Thimble ☐ 2.5" G.F. ☐ 47 mm G.F.	☒ As per EPA M-5 ☐ As per EPA M-17 ☐ Other _____	
	Impinger Catch: ☐ D.I. Water ☐ 3% H_2O_2 ☐ 4M5 Hg Only ☐ 4M5 Metals ☐ 1.0 N NaOH ☐ Other _____	☐ MN Protocol ☐ WI Protocol ☐ EPA M-6 or 8 ☐ Acid Gases ☐ Formaldehyde ☐ Metals ☐ Other _____	
	Integrated Gas sample	☐ As per EPA M-3 ☐ As per EPA M-10 ☐ Other _____	
	Oxides of Nitrogen (NO_x)	☐ As per EPA M-7A ☐ Other _____	Date _____ Time (HRS) _____
	☐ Fuel Sample ☐ Aggregate	☐ Attached fuel Form #S-0163RRR	
	Particle Size	☐ X-Ray Sedigraph ☐ Bahco Method ☐ Other _____	
	Audit Samples ☐ Sulfur Dioxide ☐ Oxides of Nit. ☐ Other _____	☐ As per EPA M-6 ☐ As per EPA M-7A ☐ Other _____	

Source Information

1) Type of Source: ☐ Boiler ☐ Asphalt Plant ☐ Incinerator ☐ Dryer ☒ Other _____
2) Fuel: ☐ Coal ☐ Wood ☐ Gas ☐ Oil ☐ RDF ☐ Other _____
3) Is sample combustible? ☐ No ☐ Yes
4) Does sample need special handling? ☐ No ☐ Yes If yes, explain _____

S-278RRRR

Interpoll Laboratories
(612) 786-6020

EPA Method 5 Data Reporting Sheet
Probe/Cyclone Wash

Job Cyprus Northshore Mining
Team Leader ET
Date Submitted 3-10-90
Test No. 1
Date of Analysis 3-12-90
Transport Leakage [X] None [ ] _____ ml

Source P.O. 1 Crusher
Test Site Secondary Inlet
Date of Test 3-9-90
No. of Runs Completed 3
Technician RE
Solvent acetone

0	Test 1 Run 0 Field Blank Log Number 9161-01 Vol. of Solvent 150 ml *Solvent Residue 2.7 ug/ml	Dish No. 52 Dish Tare Wt. 49.8047 g Dish+Sample Wt. 49.8051 g Sample Wt. 0.0004 g
1	Test 1 Run 1 Vol. of Solvent 75 ml Log Number 9161-03 Comments	Dish No. 55 Dish Tare Wt. 47.7771 g Dish+Sample Wt. 49.6677 g Sample Wt. 1.8906 g
2	Test 1 Run 2 Vol. of Solvent 75 ml Log Number 9161-05 Comments	Dish No. 61 Dish Tare Wt. 44.5894 g Dish+Sample Wt. 47.9181 g Sample Wt. 3.3287 g
3	Test 1 Run 3 Vol. of Solvent 50 ml Log Number 9161-07 Comments	Dish No. 66 Dish Tare Wt. 48.3090 g Dish+Sample Wt. 51.2922 g Sample Wt. 2.9832 g
4	Test ____ Run ____ Vol. of Solvent ____ ml Log Number ____ Comments	Dish No. ____ Dish Tare Wt. ____ g Dish+Sample Wt. ____ g Sample Wt. ____ g
5	Test ____ Run ____ Vol. of Solvent ____ ml Log Number ____ Comments	Dish No. ____ Dish Tare Wt. ____ g Dish+Sample Wt. ____ g Sample Wt. ____ g

*Solvent Residue 27 ug/ml = [(Sample Wt 0.0004 g)(10^6)]/Vol. of Sol. 150 ml
EPA-M5 Acetone Residue Blank Spec. ≤ 7.8 ug/ml

Results:

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	1.8904	3.3285	2.9831		

LSC-01YR

Interpoll Laboratories
(612) 786-6020

EPA Method 5 Data Reporting Sheet
Filter Gravimetrics

Job Cyprus Northshore Mining
Team Leader ET
Date Submitted 3-10-90
Test No. 1
Date of Analysis 3-12-90

Source NO 1 Crusher
Test Site Secondary Inlet
Date of Test 3-7-90
No. of Runs Completed 3
Technician RE

0
Test 1 Run 0
Field Blank
Log Number 9161-02
Comments

Filter No. 2051
Filter Type 4" GF
Filter Tare Wt. .9144 g
Filter+Sample Wt. .9144 g
Sample Wt. 0.0000 g

1
Test 1 Run 1
Log Number 9161-04
Comments

Filter No. 1873
Filter Type 4" GF
Filter Tare Wt. .9470 g
Filter+Sample Wt. 1.8659 g
Sample Wt. 0.9189 g

2
Test 1 Run 2
Log Number 9161-06
Comments

Filter No. 1884
Filter Type 4" GF
Filter Tare Wt. .9645 g
Filter+Sample Wt. 2.2313 g
Sample Wt. 1.2668 g

3
Test 1 Run 3
Log Number 9161-08
Comments

Filter No. 1885
Filter Type 4" GF
Filter Tare Wt. .9638 g
Filter+Sample Wt. 2.4429 g
Sample Wt. 1.4791 g

4
Test ____ Run ____
Log Number ____
Comments

Filter No. ____
Filter Type ____
Filter Tare Wt. ____ g
Filter+Sample Wt. ____ g
Sample Wt. ____ g

5
Test ____ Run ____
Log Number ____
Comments

Filter No. ____
Filter Type ____
Filter Tare Wt. ____ g
Filter+Sample Wt. ____ g
Sample Wt. ____ g

Results:

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.9189	1.2668	1.4791		

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	2.8093	4.5953	4.4622		

LSC-02PR

Interpoll Laboratories
(612) 786-6020

Chain of Custody
Sample Deposition Sheet

Job Cyprus / Babbitt
Team Leader R. Rosenthal
Date Submitted
Test No. 1

Source No. 1 CRUSHER Secondary
Test Site Collector STACK
Date of Test 3-9-90
No. of Runs Completed 3

No. of Samples	Type of Sample	Analysis Required	Comments
4	Probe Wash: ☒ Acetone ☐ D.I. Water	☒ As per EPA M-5 ☐ Other	
4	Filter: ☒ 4" G.F. ☐ S.S. Thimble ☐ 2.5" G.F. ☐ 47 mm G.F.	☒ As per EPA M-5 ☐ As per EPA M-17 ☐ Other	
4	Impinger Catch: ☒ D.I. Water ☐ 3% H_2O_2 ☐ 4M5 Hg Only ☐ 4M5 Metals ☐ 1.0 N NaOH ☐ Other	☒ MN Protocol ☐ WI Protocol ☐ EPA M-6 or 8 ☐ Acid Gases ☐ Formaldehyde ☐ Metals ☐ Other	
	Integrated Gas sample	☐ As per EPA M-3 ☐ As per EPA M-10 ☐ Other	
—	Oxides of Nitrogen (NO_x)	☐ As per EPA M-7A ☐ Other	Date Time(HRS)
—	☐ Fuel Sample ☐ Aggregate	☐ Attached fuel Form #S-0163RRR	
—	Particle Size	☐ X-Ray Sedigraph ☐ Bahco Method ☐ Other	
—	Audit Samples ☐ Sulfur Dioxide ☐ Oxides of Nit. ☐ Other	☐ As per EPA M-6 ☐ As per EPA M-7A ☐ Other	

Source Information

1) Type of Source: ☐ Boiler ☐ Asphalt Plant ☐ Incinerator ☐ Dryer ☒ Other ORE CRUSHER dust collector
2) Fuel: ☐ Coal ☐ Wood ☐ Gas ☐ Oil ☐ RDF ☐ Other
3) Is sample combustible? ☒ No ☐ Yes
4) Does sample need special handling? ☒ No ☐ Yes If yes, explain

S-278RRRR

Interpoll Laboratories
(612) 786-6020

EPA Method 5 Data Reporting Sheet
Probe/Cyclone Wash

Job Cyprus / Babbit
Team Leader R.R.
Date Submitted 3-10-90
Test No. 1
Date of Analysis 3-13-90
Transport Leakage [x] None [ ] _____ ml

Source No. 1 Crusher Secondary
Test Site Collector Stack
Date of Test 3-9-90
No. of Runs Completed 3
Technician RE
Solvent acetone

0	Test 1 Run 0 Field Blank Log Number 9161-09 Vol. of Solvent 70 ml *Solvent Residue 4.3 ug/ml	Dish No. 13 Dish Tare Wt. 51.9141 g Dish+Sample Wt. 51.9144 g Sample Wt. 0.0003 g
1	Test 1 Run 1 Vol. of Solvent 200 ml Log Number 9161-12 Comments	Dish No. 90 Dish Tare Wt. 49.7431 g Dish+Sample Wt. 50.0273 g Sample Wt. 0.2842 g
2	Test 1 Run 2 Vol. of Solvent 205 ml Log Number 9161-15 Comments	Dish No. 97 Dish Tare Wt. 46.3603 g Dish+Sample Wt. 46.7796 g Sample Wt. 0.4193 g
3	Test 1 Run 3 Vol. of Solvent 795 ml Log Number 9161-18 Comments	Dish No. 103 Dish Tare Wt. 42.8792 g Dish+Sample Wt. 43.2967 g Sample Wt. 0.4175 g
4	Test ____ Run ____ Vol. of Solvent ____ ml Log Number ____ Comments	Dish No. ____ Dish Tare Wt. ____ g Dish+Sample Wt. ____ g Sample Wt. ____ g
5	Test ____ Run ____ Vol. of Solvent ____ ml Log Number ____ Comments	Dish No. ____ Dish Tare Wt. ____ g Dish+Sample Wt. ____ g Sample Wt. ____ g

*Solvent Residue 4.3 ug/ml = [(Sample Wt. 0.0003 g)(10^6)]/Vol. of Sol. 70 ml
EPA-M5 Acetone Residue Blank Spec. < 7.8 ug/ml

Results:

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.2833	0.4184	0.4467		

LSC-01YR

Interpoll Laboratories
(612) 786-6020

EPA Method 5 Data Reporting Sheet
Filter Gravimetrics

Job Cyprus / Babbit
Team Leader RR
Date Submitted 3-10-90
Test No. 1
Date of Analysis 3-12-90

Source NO. 1 Crusher Secondary
Test Site Collector Stack
Date of Test 3-9-90
No. of Runs Completed 3
Technician RE

0	Test 1 Run 0 Field Blank Log Number 9161-10 Comments	Filter No. 1945 Filter Type 4"6F Filter Tare Wt. .9515 g Filter+Sample Wt. .9515 g Sample Wt. 0.0000 g
1	Test 1 Run 1 Log Number 9161-13 Comments	Filter No. 1955 Filter Type 4"6F Filter Tare Wt. .9543 g Filter+Sample Wt. 1.0490 g Sample Wt. 0.0947 g
2	Test 1 Run 2 Log Number 9161-16 Comments	Filter No. 1949 Filter Type 4"6F Filter Tare Wt. .9681 g Filter+Sample Wt. 1.1133 g Sample Wt. 0.1452 g
3	Test 1 Run 3 Log Number 9161-19 Comments	Filter No. 1954 Filter Type 4"6F Filter Tare Wt. .9619 g Filter+Sample Wt. 1.1109 g Sample Wt. 0.1490 g
4	Test ____ Run ____ Log Number ____ Comments	Filter No. ____ Filter Type ____ Filter Tare Wt. ____ g Filter+Sample Wt. ____ g Sample Wt. ____ g
5	Test ____ Run ____ Log Number ____ Comments	Filter No. ____ Filter Type ____ Filter Tare Wt. ____ g Filter+Sample Wt. ____ g Sample Wt. ____ g

Results:

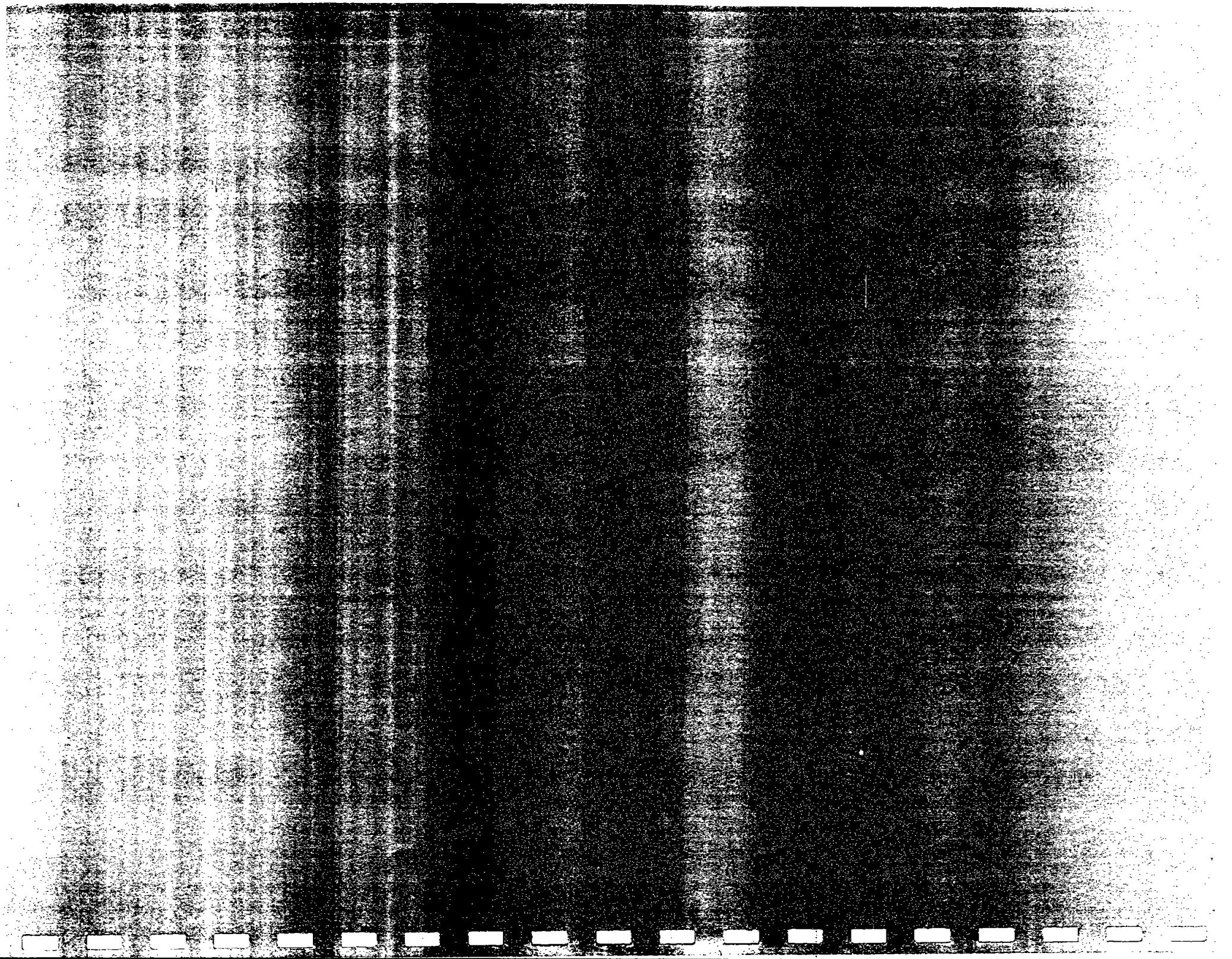
Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.0947	0.1452	0.1490		

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.3780	0.5636	0.5657		

LSC-02PR

APPENDIX G

MPCA EXHIBIT C



Interpoll Laboratories
(612)786-6020

MPCA Exhibit C for Process Emissions

JOB Cyprus Northshore-Babbitt
SOURCE # 1 Crusher - Secondary Collector
DATE March 9, 1990

C. Equipment & Operating Data

1. Process Equip. No./Ident. # Primary Crusher #1A.
2. Process Equip. Description Multiclone with Cyclone Precleaner.
3. Process equipment operating under normal operating conditions:
   No ___. Yes X.

D. Instrument Data on Process Equipment

1. Include copy of production records or instrumentation which indicates rate of production or operation of the equipment, i.e. units per hour, lbs. per hour, pressure, air flow, etc.

E. Air Pollution Control Equipment

1. Type/model control equipment Allis Chalmers Model 20-9
2. Air pressure drop across the control equipment Not Applicable.
3. Air flow through the control equipment 20,000 ACFM.
4. Was the control equipment operating normally? Yes.
5. Data of last major maintenance/cleaning of control equipment
   Major maintenance/Renovation during Reactivation Oct to Dec. 1989
   Emptied once per shift & Cleaned and Blowed Down once per week.

F. Plant Manager's Certification

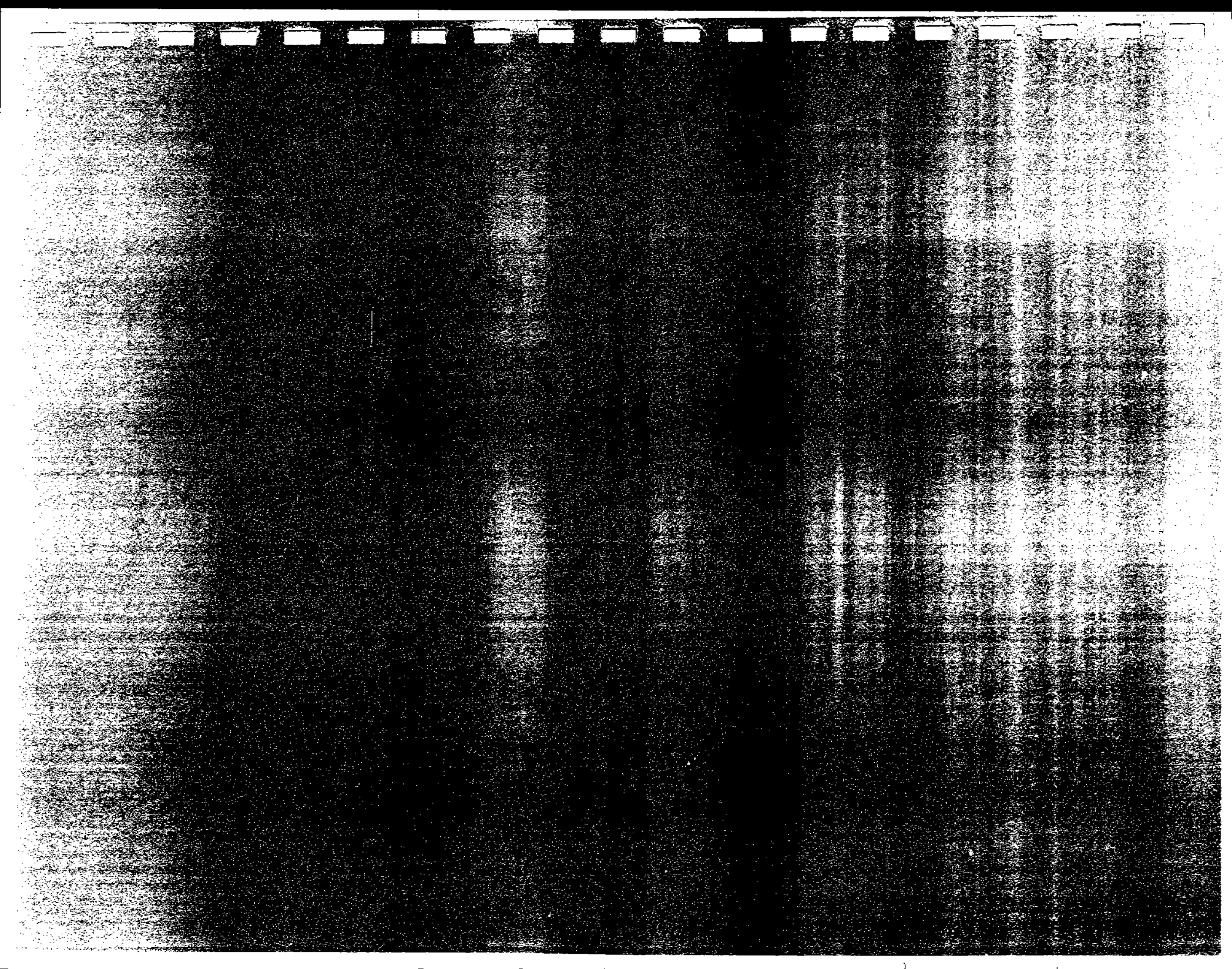
I certify that the information submitted herein is accurate and correct and that no information requested was withheld from MPCA, Division of Air Quality.

By Dennis M Wagner, Position Environmental Engineer

S-349R

APPENDIX H

PROCESS RATE DATA



CYPRUS NORTHSHORE MINING
CRUSHER SHIFT REPORT

ATE: 3-9-90 SHIFT: 7-3 CREW NO. _____

HR	TRKS	TOTAL	TONNAGE	MAG FE	CRUSHER REMARKS	PIT REMARKS
8			983			
9			1837			
10			2228			
11			2119			
12			1217			
1			1525			
2			2136			
3			1896			

PAN FEEDER

ALE READING END OF SHFT

ALE READNG START OF SHFT

OTAL TONS CRUSHED

DAILY 30" CR. METER READINGS

CR #1 CR #2

CR #3 CR #4

SSAY START OF SHIFT _____ GLYCOL USED _____
SSAY END OF SHIFT _____

VEMENT DIRECTOR _____ CARS LOADED _____
" CR. OPERATOR _____ EMPTY CARS _____
RKS TO STOCKPILE: 85T _____ BIN LEVELS _____
50T _____ TOTAL TRKS TO STOCKPILE _____

SHUTDOWN PROCEDURE

S. DRIVE _____ 60" OIL PUMP _____
OOLING PUMP/FAN _____ 30" OIL PUMP _____
0" CRUSHERS _____ BIG DUST COLLECTOR _____
ALL DUST COLLECTORS _____

CYPRUS NORTHSHORE MINING
CRUSHER SHIFT REPORT

DATE: 3-2-90 SHIFT: 3-11 CREW NO. _____

HR	TRKS	TOTAL	TONNAGE	MAG FE	CRUSHER REMARKS	PIT REMARKS
4			1222			
5			2304			
6			864			

PAN FEEDER	DAILY 30" CR. METER READINGS
SCALE READING END OF SHFT	CR #1 CR #2
SCALE READNG START OF SHFT	CR #3 CR #4
TOTAL TONS CRUSHED	

ASSAY START OF SHIFT _____ GLYCOL USED _____
ASSAY END OF SHIFT _____

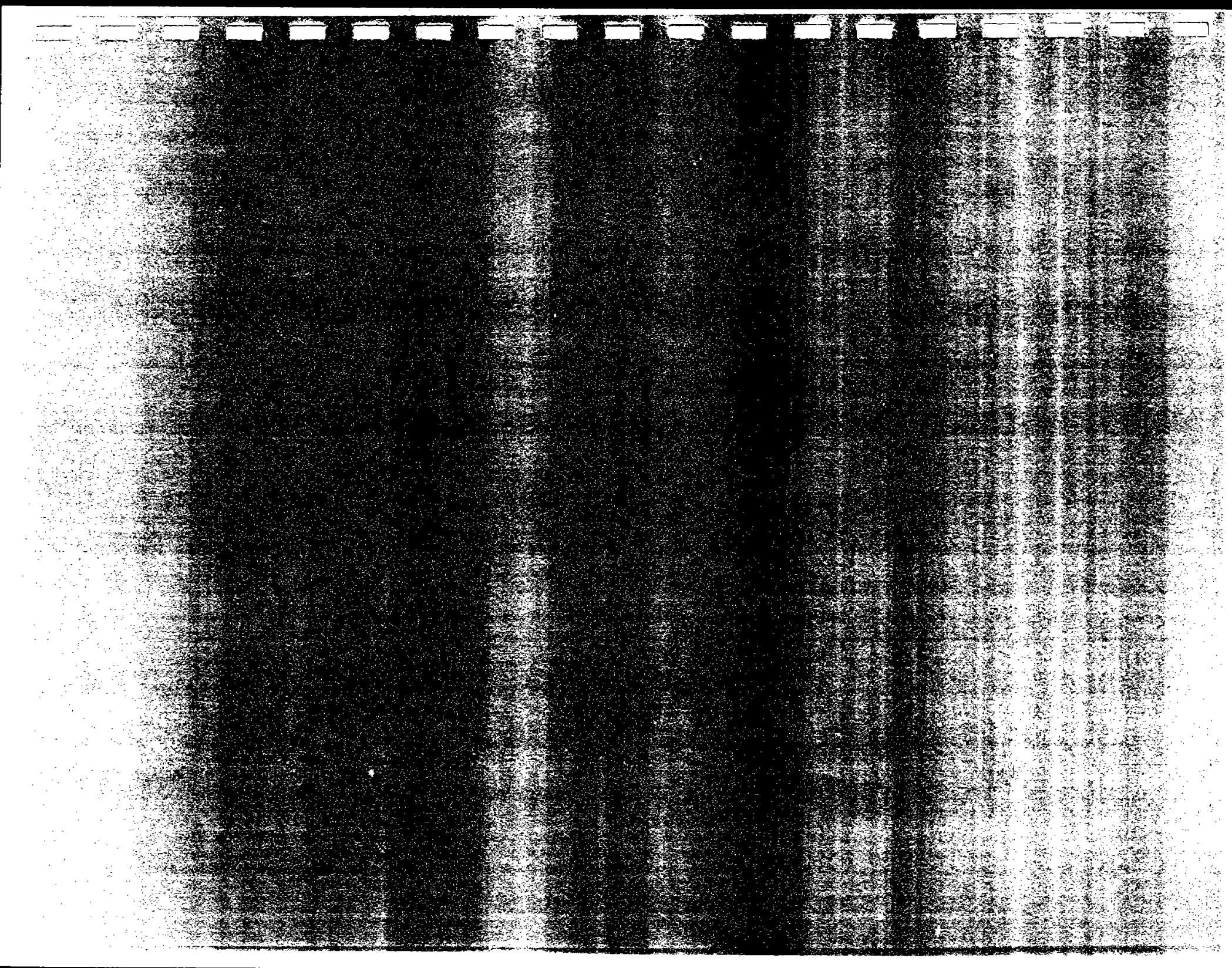
MOVEMENT DIRECTOR _____ CARS LOADED _____
30" CR. OPERATOR _____ EMPTY CARS _____
TRKS TO STOCKPILE: 85T _____ BIN LEVELS _____
50T _____ TOTAL TRKS TO STOCKPILE _____

SHUTDOWN PROCEDURE

A. S. DRIVE _____ 60" OIL PUMP _____
COOLING PUMP/FAN _____ 30" OIL PUMP _____
30" CRUSHERS _____ BIG DUST COLLECTOR _____
SMALL DUST COLLECTORS _____

APPENDIX I

PROCEDURES



Particulate Loadings and Emission Rates

The particulate emission rates were determined per EPA Methods 1-5, CFR title 40, Part 60, Appendix A (revised July 1, 1988). In this procedure, a preliminary velocity profile of the gases in the flue is obtained by means of a temperature and velocity traverse. On the basis of these values, sampling nozzles of appropriate diameter are selected to allow isokinetic sampling, a necessary prerequisite for obtaining a representative sample.

The sampling train consists of a heated glass-lined sampling probe equipped with a Type S pitot and a thermocouple. The probe is attached to a sampling module which houses the all-glass in line filter holder in a temperature controlled oven. In addition, the sampling module also houses the impinger case and a Drierite drying column. The sampling module is connected by means of an umbilical cord to the control module which houses the dry test gasmeter, the calibrated orifice, a leakless pump, two inclined manometers, and all controls required for operating the sampling train.

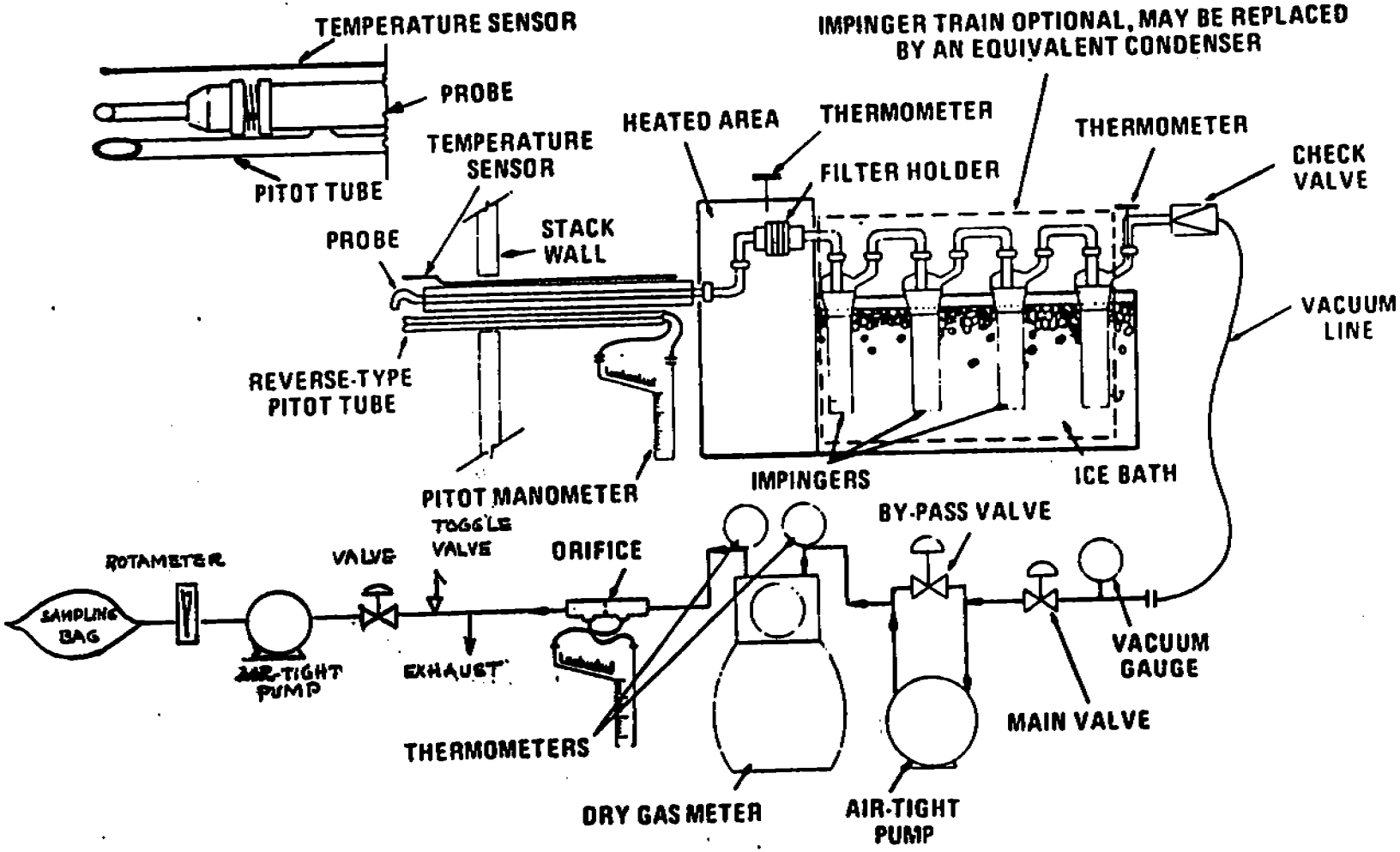
Particulate samples were collected as follows: The sample gas was drawn in through the sampling probe isokinetically and passed through a 4-inch diameter Gelman Type A/E glass fiber filter. The particulates were removed at this point and collected on the filter. The gases then passed through an ice-cooled impinger train and a desiccant-packed drying column which quantitatively absorb all moisture from the sample gas stream after which the sample gas passes through the pump and the dry test gasmeter which integrates the sample gas flow throughout the course of the test. A calibrated orifice attached to the outlet of the gasmeter provides instantaneous flow rate data.

A representative particulate sample was acquired by sampling for equal periods of time at the centroid of a number of equal area regions in the duct. The sampling rate is adjusted at each site such that an isokinetic sampling condition prevails. Nomographs are used to aid in the rapid determination of the sampling rate.

After sampling is complete, the filter is removed and placed in a clean container. The nozzle and inlet side of the filter holder are quantitatively washed with acetone and the washings are stored in a second container. A brush is often used in the cleaning step to help dislodge deposits. The samples are returned to the laboratory where they are logged in and analyzed. The volume of the acetone rinse ("probe wash") is noted and then the rinse is quantitatively transferred to a tared 120 cc porcelain evaporating dish and the acetone evaporated off at 97-105 ^{o}F. This temperature is used to prevent condensation of atmospheric moisture due to the cooling effect induced by the evaporation of acetone. The acetone-free sample is then transferred to an oven and dried at 105 ^{o}C for 30 minutes, cooled in a desiccator over Drierite, and then weighed to the nearest .01 mg. The filter sample is quantitatively transferred to a 6-inch watch glass and dried in an oven at 105 ^{o}C for two hours. The filter and watch glass are then cooled in a desiccator and the filter weighed to the nearest .01 mg. All weighings are performed in a balance room where the relative humidity is hydrostatted to less than 50% relative humidity. Microscopic examination of the samples is performed if any unusual characteristics are observed. The weight of the acetone rinse is corrected for the acetone blank. The Drierite column is weighed on-site and the water collected by Drierite is added to the condensate so that the total amount of absorbed water may be ascertained.

Integrated gas samples for Orsat analysis were collected at a constant flow rate throughout each particulate run. The gas samples were analyzed using an all-glass Orsat analyzer. Standard commercially prepared solutions were used in the Orsat analyzer (sat. KOH for carbon dioxide and reduced methylene blue for oxygen). In addition to the above, the oxygen content of the flue gas was measured at each traverse during the particulate determinations using a Teledyne Model 320P-4 Portable Oxygen Analyzer to sample the effluent from the Method 5 train.

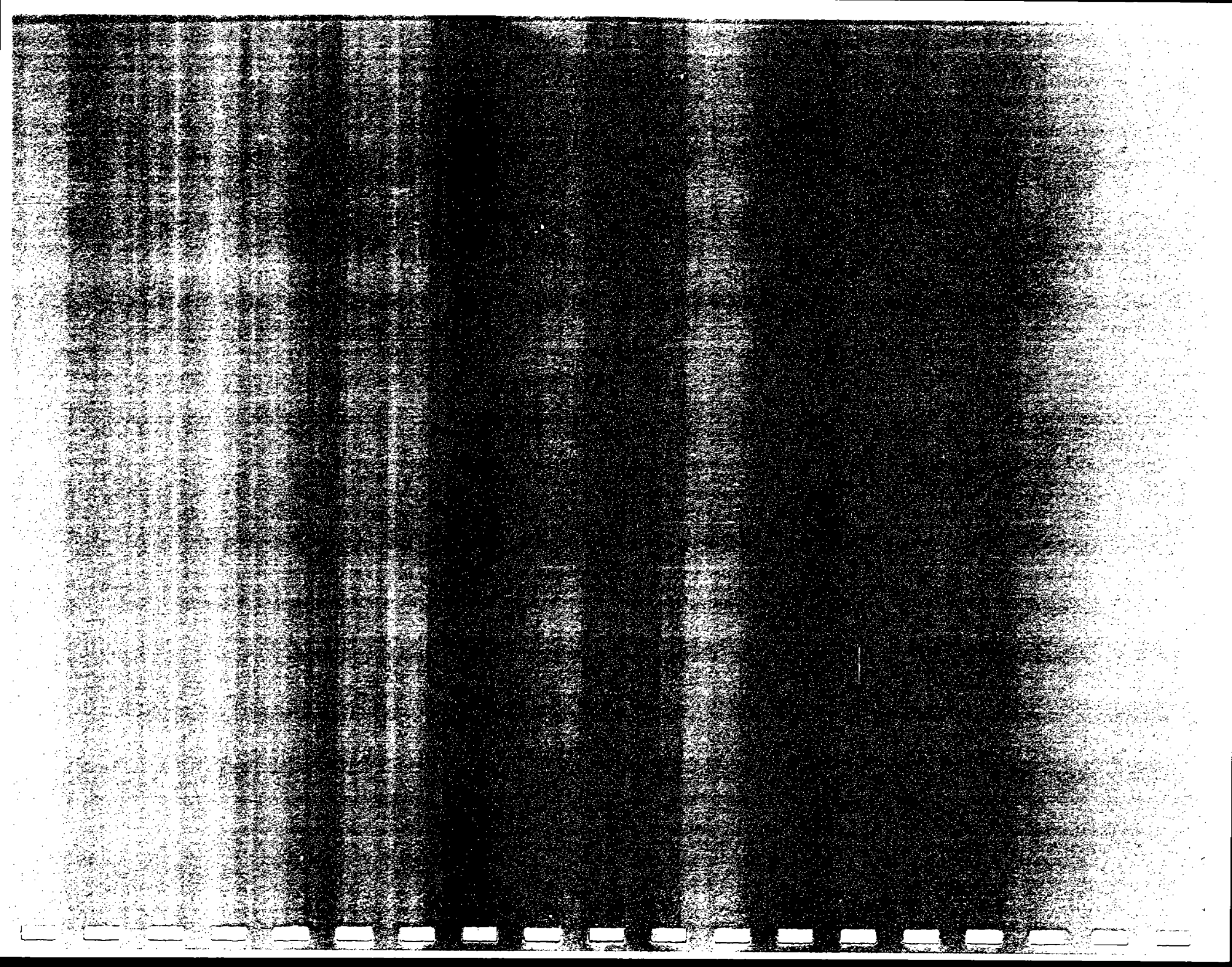
3a P2(7)



Particulate-sampling train.

APPENDIX 4

CALCULATION EQUATIONS



CALCULATION EQUATIONS

METHOD 2

$$\bar{V}_s = 85.48\ C_p\ (\sqrt{\Delta p})_{avg}\ \sqrt{\frac{T_{s(avg)}}{P_s\ M_s}}$$

$$Q_{s,d} = 60(1 - B_{ws})\ \bar{V}_s\ A\ \left(\frac{528}{T_{s(avg)}}\right)\ \left(\frac{P_s}{29.92}\right)$$

$$Q_a = 60\ \bar{V}_s\ A$$

$$\dot{m}_g = \frac{4.995\ Q_{s,d}\ G_d}{1 - B_{ws}}$$

$$RH^* = 100\ (vp_{twb}\ 0.0003641\ P_s\ (T_{db} - T_{wb}))/vp_{tdb}$$

$$B^*_{ws} = RH(vp_{tdb})/P_s$$

$$= \frac{4.585 \times 10^{-2}\ P_s M_s}{T_s\ (avg)}$$

*Alternate equations for calculating moisture content from wet bulb and dry buld data.

CALCULATION EQUATIONS

METHOD 3

$$\%EA = \frac{100(\%O_2 -).5\%\ CO)}{0.264\%\ N_2 - \%O_2 + 0.5\%\ CO}$$

$$M_d = 0.44(\%CO_2) + 0.32\ (\%O_2) + 0.28\ (\%N_2 + \%CO)$$

$$M_s = M_d\ (I - B_{ws}) + 0.18\ B_{ws}$$

$$B_{ws} = \frac{V_{w(std)}}{V_{w(std)} + V_{m(std)}}$$

CALCULATION EQUATIONS

METHOD 5

$$V_{m(std)} = 17.65\ V_m\ \gamma\ \left(\frac{P_{bar} + \overline{\Delta H}/13.6}{T_{m(avg)}}\right)$$

$$V_{w(std)} = 0.0472\ V_{Is}$$

$$B_{ws} = \frac{V_{w(std)}}{V_{w(std)} + V_{m(std)}}$$

$$I = 0.0944\ \left(\frac{T_{s(avg)}\ V_{m(std)}}{P_s\ V_s\ A_n\ \theta\ (1 - B_{ws})}\right)$$

$$C_s = \frac{15.43\ M_p}{V_{m(std)}}$$

$$C_a = \frac{272.3\ M_p\ P_s}{T_{s(avg)}\ (V_{w(std)} + V_{m(std)})}$$

$$(\dot{m}_p)_1 = 8.5714 \times 10^{-3}\ C_s\ Q_{s,d}$$

$$(\dot{m}_p)_2 = \frac{1.3228 \times 10^{-1}\ M_p\ A}{0\ A_n}$$

$$\dot{m}_p = \frac{(\dot{m}_p)_1 + (\dot{m}_p)_2}{2}$$

SYMBOLS

A = Cross sectional area of stack, SQ. FT.

A_n = Cross sectional area of nozzle, SQ. FT.

B_{ws} = Water vapor in gas stream, proportion by volume

C_p = Pitot tube coefficient, dimensionless

C_a = Concentration of particulate matter in stack gas, wet basis, GR/ACF

C_s = Concentration of particulate matter in stack gas, dry basis, corrected to standard conditions, GR/DSCF

EA = Excess air, percent by volume

γ = Dry test meter correction factor, dimensionless

G_d = Specific gravity (relative to air), dimensionless

I = Isokinetic variation, percent by volume

M_d = Molecular weight of stack gas, dry basis, g/g - mole.

$\dot{m}_g$ = Mass flow of wet flue gas, LB/HR

$\dot{m}_p$ = Particulate mass flow, LB/HR

M_s = Molecular weight of stack gas, wet basis, g/g, mole.

M_p = Total amount of particulate matter collected, g

P_{bar} = Atmospheric pressure, IN. HG. (uncompensated)

P_g = Stack static gas pressure, IN. WC.

P_s = Absolute pressure of stack gas, IN.HG.

P_{std} = Standard absolute pressure, 29.92 IN. HG.

A_a = Actual volumetric stack gas flow rate, ACFM

$Q_{s,d}$ = Dry volumetric stack gas flow rate corrected to standard conditions, DSCFM

RH = Relative humidity, %

T_{db} = Dry bulb temperature of stack gas, ^{o}F

T_{wb} = Wet bulb temperature of stack gas, ^{o}F

$T_{m(avg)}$ = Absolute average dry gas meter temperature, ^{o}R

$T_{s(avg)}$ = Absolute average stack temperature, ^{o}F

T_{std} = Standard absolute temperature, 528 ^{o}F (68 ^{o}F)

θ = Total sampling time, min.

V_{lc} = Total volume of liquid collected in impingers and silica gel, ml

V_m = Volume of gas sample as measured by dry gas meter, CF

$V_{m(std)}$ = Volume of gas sample measured by the dry gas meter corrected to standard conditions, DSCF

$V_{w(std)}$ = Volume of water vapor in the gas sample corrected to standard conditions, SCF

$\bar{V}_s$ = Average actual stack gas velocity, FT/SEC

vP_{tdb} = Vapor pressure at T_{db}, IN. HG.

vp_{twb} = Vapor pressure at T_{wb}, IN. HG

$\overline{\Delta H}$ = Average pressure differential across the orifice meter, IN. WC.

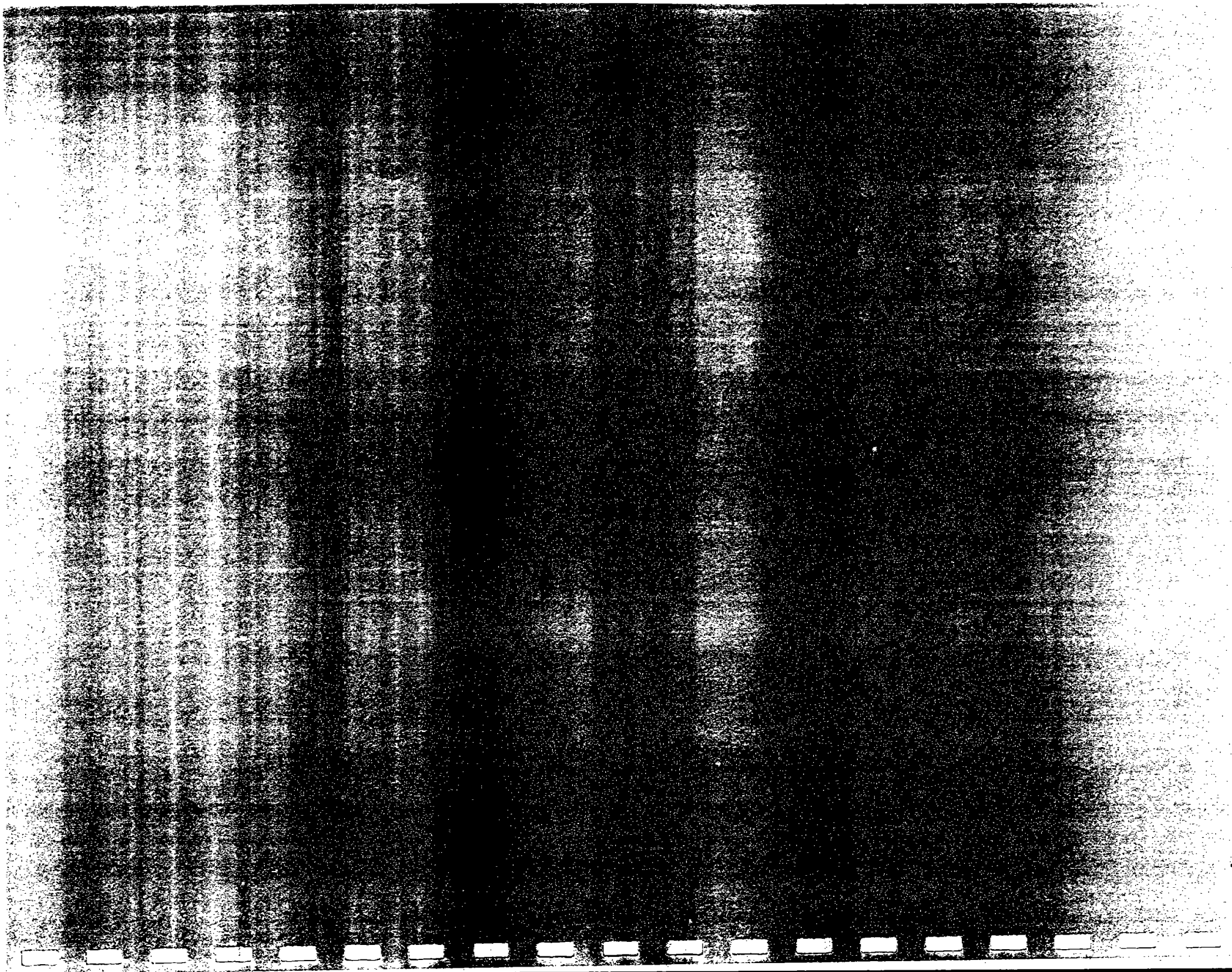
ΔP = Velocity pressure of stack gas, IN. WC.

γ = Dry test meter correction coefficient, dimensionless

ρ = Actual gas density, LB/ACF

APPENDIX K

SAMPLING TRAIN CALIBRATION DATA



Interpoll Laboratories, Inc.
(612) 786-6020

Meter Box Calibration and Usage Status

Date of Report: April 18, 1990

Meter Box No. : 6 (Rockwell Dry Test Meter Serial No. 64711)

Date of Last Calibration: January 3, 1990
Calibration Technician: E. Trowbridge
Wet Test Meter No.: American Meter AL-20

Date of Use	Report No.	Initial Meter Reading	Final Meter Reading	Volume/Job (cu. ft.)	Total Volume* (cu. ft.)
January 16, 1990	0-2926	997.90	1143.40	145.50	145.50
January 17, 1990	0-2928	152.00	291.80	139.80	285.30
January 30, 1990	0-2936	297.00	685.65	388.65	673.95
February 10, 1990	0-2948	690.50	838.46	147.96	821.92
March 1 and 2, 1990	0-2964	839.40	1282.82	443.42	1265.34
March 9, 1990	0-2972	283.50	409.32	125.82	1391.16

* Total volume through meter since last calibration.

Date 1-3-90

Bar. Press. 28.86 in. Hg

INTERPOLL LABORATORIES, INC.
METER CALIBRATION SHEET
EPA METHOD 5

Control Module No. 6
Serial No. DTM 64710
Wet Test Meter No. AL-20
Technician [signature]

ΔH (in. WC) nominal	ΔH (in. WC) actual	Gas Volume Wet Test Meter (ft^3)	* Cal. Index θ (%)	* Diff. Wet Test Meter ΔP_w (in.WC)	Gas Volume Dry test meter (ft^3) V_{d1}	Gas Volume Dry test meter (ft^3) V_{df}	Gas temperatures Wet Test t_w (°F)	Gas temperatures Dry Test t_{d1} (°F)	Gas temperatures Dry Test t_{do} (°F)	Time θ (min/sec)	Meter Coeff. Y	Orifice Const. ΔH@	C_f
0.5	.5	2	99.70	0.01	979.000	981.020	71.5	76	73	4/57.81	.9914	1.79	
1.2	1.2	3	99.77	0.03	974.000	977.025	71.5	75	73	4/49.74	.9910	1.81	
2.0	2.0	3	99.87	0.05	982.000	985.038	71.3	78	75	3/47.09	.9906	1.84	
3.3	3.3	5	100.00	0.08	986.000	991.065	71.3	80	75	4/55.86	.9901	1.85	
4.7	4.7	5	100.20	0.11	992.500	997.560	71	81	76	4/09.79	.9919	1.86	
											.9910	1.83	
		3	4	5	6	7	8	9	10	11/12			

Meter was in tolerance ☑
Meter was not in tolerance ☐; readjusted linkage
Meter was not in tolerance ☐; changed dry test meters

Approved by [signature] Date 1-17-90

* Based on AL-20 wet test meter calibration in August 1989 against Bell Prover (NBS Traceable) - Carl Poe Co.

S0102R 8/89

Interpoll Laboratories, Inc.
(612) 786-6020

Meter Box Calibration and Usage Status

Date of Report: April 18, 1990

Meter Box No. : 7 (Rockwell Dry Test Meter Serial No. 904554)

Date of Last Calibration: March 5. 1990
Calibration Technician: E. Trowbridge
Wet Test Meter No.: American Meter AL-20

Date of Use	Report No.	Initial Meter Reading	Final Meter Reading	Volume/Job (cu. ft.)	Total Volume* (cu. ft.)
March 9, 1990	0.2972	187.50	316.02	128.52	128.52

* Total volume through meter since last calibration.

Date 3-5-90

Bar. Press. 29.36 in. Hg

INTERPOLL LABORATORIES, INC.
METER CALIBRATION SHEET
EPA METHOD 5

Control Module No. 7
Serial No. DTM 964550
Wet Test Meter No. AL-20
Technician E Trowbridge

ΔH (in. WC) nominal	ΔH (in. WC) actual	Gas Volume Wet Test Meter (ft^3)	* Cal. Index θ (%)	* Diff. Wet Test Meter ΔP_w (in.WC)	Gas Volume Dry test meter (ft^3) V_{dl}	Gas Volume Dry test meter (ft^3) V_{df}	Gas temperatures Wet Test t_w (°F)	Gas temperatures Dry Test t_{dl} (°F)	Gas temperatures Dry Test t_{do} (°F)	Time θ (min/sec)	Meter Coeff. Y	Orifice Const. ΔHθ	C_f
0.5	.5	2	99.70	0.01	163.000	165.000	71	75	72	4/49.45	1.0004	1.67	
1.2	1.2	3	99.77	0.03	165.500	168.513	71	77	73	1/51.18	.9978	1.80	
2.0	2.0	3	99.87	0.05	169.000	172.01	71	78	73	3/47.21	.9986	1.81	
3.3	3.3	5	100.00	0.08	172.500	177.51	71	80	74	4/54.06	1.0008	1.82	
4.7	4.7	5	100.20	0.11	178.000	183.012	71	81	74	4/44.82	.9997	1.91	
1	2	3	4	5	6	7	8	9	10	11/12	.9994	1.80	

Meter was in tolerance ☒
Meter was not in tolerance ☐; readjusted linkage
Meter was not in tolerance ☐; changed dry test meters

Approved by Perry Lonnes Date 3-15-90

* Based on AL-20 wet test meter calibration in August 1989 against Bell Prover (NBS Traceable) - Carl Poe Co.

S0102R 8/89

Interpoll Laboratories, Inc.
(612) 786-6020

Nozzle Calibration
Data Sheet

Date of Calibration: March 9, 1990 Nozzle Number 6-3
Technician: R. Rosenthal

Nozzle rotated by 60 degree increments and diameter measured to nearest 0.001 inch. Observed readings and average:

Position	Diameter (inches)
1	0.186
2	0.185
3	0.185
Average:	0.185

Interpoll Laboratories, Inc.
(612) 786-6020

Nozzle Calibration
Data Sheet

Date of Calibration: March 9, 1990 Nozzle Number 7-3
Technician: E. Trowbridge

Nozzle rotated by 60 degree increments and diameter measured to nearest 0.001 inch. Observed readings and average:

Position	Diameter (inches)
1	0.185
2	0.185
3	0.185
Average:	0.185

Interpoll Laboratories
(612)786-6020

S-Type Pitot Tube Inspection Sheet

Pitobe No. 2½ - 17

Pitot tube dimensions:

1. External tubing diameter (D_t) .316 IN.
2. Base to Side A opening plane (P_A) .462 IN.
3. Base to Side B opening plane (P_B) .462 IN.

Alignment:

4. $\alpha_1 < 10^0$ 0
5. $\alpha_2 < 10^0$ 0

6. $B_1 < 5^0$ 1
7. $B_2 < 5^0$ 1

8. Z <.125" .01
9. W <.0625" .01

Distance from Pitot to Probe Components:

10. Pitot to 0.500 IN. nozzle .760 IN.
11. Pitot to probe sheath 3.00 IN.
12. Pitot to thermocouple (parallel to probe) 3.00 IN.
13. Pitot to thermocouple (perpendicular to probe) .762 IN.

Date of Inspection: 12-8-89

Inspected by: E Crowhurst

S-348(1)

Interpoll Laboratories
(612)786-6020

S-Type Pitot Tube Inspection Sheet

Pitobe No. 4-17

Pitot tube dimensions:

1. External tubing diameter (D_t) .316 IN.
2. Base to Side A opening plane (P_A) .461 IN.
3. Base to Side B opening plane (P_B) .462 IN.

Alignment:

4. $\alpha_1 < 10^0$ 0
5. $\alpha_2 < 10^0$ 0

6. $B_1 < 5^0$ 1
7. $B_2 < 5^0$ 1

8. Z <.125" .02
9. W <.0625" .02

Distance from Pitot to Probe Components:

10. Pitot to 0.500 IN. nozzle .760 IN.
11. Pitot to probe sheath 3.00 IN.
12. Pitot to thermocouple (parallel to probe) 3.00 IN.
13. Pitot to thermocouple (perpendicular to probe) .760 IN.

Date of Inspection: 12-8-89

Inspected by: [signature]

S-348(1)

Interpoll Laboratories, Inc.
(612) 786-6020

EPA Method 5 Gas Metering System
Quality Control Check Data Sheet

Module No. 6 Date 3-9-90

Job CYPRUS Operator R. Rosenthal

Instructions: Operate the control module at ΔH_a for 10 minutes without the umbilical. Note the following data:

Barometric pressure (P_b) 28.13 IN.HG. ΔH_a 1.83 IN.WC.

Time (MIN)	Volume (CF)	Gas Meter Temperature (°F)	
		Inlet	Outlet
0	(283.50)	40	37
2	285.03	43	38
4	286.56	45	39
6	288.09	47	40
8	289.60	47	40
10	(291.12)	48	40
	V_m = 7.62 CF	Average Meter Temp (t_m) = 42°F	

Calculate Y_{cn} as follows:

$$Y_{cn} = \frac{1.786}{\gamma V_m}\left[\frac{(t_m + 460)}{P_b}\right]^{1/2} = .99912$$

7.5514 4.2244

If Y_{cn} is not within the range of 0.97 to 1.03, "the volume metering system should be investigated before beginning the test".

CFR Title 40, Part 60, Appendix A, Method 5, Section 4.4.1

Interpoll Laboratories, Inc.
(612) 786-6020

EPA Method 5 Gas Metering System
Quality Control Check Data Sheet

Module No. 7 Date 3-9-90

Job Cyprus Northshore Mining Operator T Trawhedge

Instructions: Operate the control module at ΔHe for 10 minutes without the umbilical. Note the following data:

Barometric pressure (P_b) 28.13 IN.HG. ΔHe 1.80 IN.WC.

Time (MIN)	Volume (CF)	Gas Meter Temperature (°F)	
		Inlet	Outlet
0	(187.50)	37	37
2	189.01	44	40
4	190.53	46	41
6	192.07	48	42
8	193.58	49	43
10	(195.20)	49	43
	V_m = CF	Average Meter Temp (t_m) = 43.3 °F	

Calculate Y_{cn} as follows:

$$Y_{cn} = \frac{1.786}{\gamma V_m}\left[\frac{\sqrt{\Delta H}\,(t_m + 460)}{P_b}\right]^{1/2} = \frac{1.786}{7.595}\left[\frac{\sqrt{1.80}\,(43.3 + 460)}{28.13}\right]^{1/2} = .9944$$

If Y_{cn} is not within the range of 0.97 to 1.03, "the volume metering system should be investigated before beginning the test".

CFR Title 40, Part 60, Appendix A, Method 5, Section 4.4.1

S-432

Interpoll Laboratories, Inc.

Temperature Measurement Device Calibration Sheet

Unit under test:

Vendor AT KINK

Model 39658-K — Serial Number PDT-4

Range −112.0 °F to +1999 °F °F — Thermocouple Type CL-30D

Date of Calibration 2-2-90 — Technician E Trumbull

Method of Calibration:

☐ Comparison against ASTM mercury in glass thermometer using a thermostatted and insulated aluminum block designed to provide uniform temperature. The temperature is adjusted by adjusting the voltage on the block heater cartridge.

☒ Omega Model CL-300 Type K Thermocouple Simulator which provides 22 precise temperature equivalent millivolt signals. The CL-300 is cold junction compensated. Calibration accuracy is ± 0.1% of span (2100 °F) ± 1 degree (for negative temperatures add ± 2 degrees. The CL-300 simulates exactly the millivoltage of a Type K thermocouple at the indicated temperature.

Desired Temp (°F) Nominal	Temperature of Standard or Simulated Temp (°F)	Response of Unit Under Test (°F)	Deviation Δt (°F)	Deviation (%)
0	0	−2.7	2.7	.58
100	100	95	5	.89
200	200	198	2	.30
300	300	296	4	.52
400	400	392	8	.93
500	500	491	9	.93
600	600	592	8	.75
700	700	692	8	.68
800	800	796	4	.31
900	900	897	3	.22
1000	1000	1000	—	—
1100	1100	1102	2	.12
1200	1200	1207	7	.42
1300	1300	1305	5	.28
1400	1400	1408	8	.43
1500	1500	1505	5	.25
1600	1600	1603	3	.14
1700	1700	1697	3	.13
1800	1800	1793	7	.30
1900	1900	1883	17	.72
2000	2000	1977	23	.93
2100				
		Averages:	6.36	.46

OF = off scale response by unit under test (°F)

% dev = 100 Δt / (460 + t)

☒ Unit in tolerance

Unit was not in tolerance: recalibrated - See new calibration sheet.

S-433

Interpoll Laboratories, Inc.

Temperature Measurement Device Calibration Sheet

Unit under test:

Vendor ATKINS

Model 39658-K Serial Number POT-2

Range 0 - 1999 °F Thermocouple Type K

Date of Calibration 2-2-90 Technician R. Rosenthal

Method of Calibration:

☐ Comparison against ASTM mercury in glass thermometer using a thermostatted and insulated aluminum block designed to provide uniform temperature. The temperature is adjusted by adjusting the voltage on the block heater cartridge.

☒ Omega Model CL-300 Type K Thermocouple Simulator which provides 22 precise temperature equivalent millivolt signals. The CL-300 is cold junction compensated. Calibration accuracy is ± 0.1% of span (2100 °F) ± 1 degree (for negative temperatures add ± 2 degrees. The CL-300 simulates exactly the millivoltage of a Type K thermocouple at the indicated temperature.

Desired Temp (°F) Nominal	Temperature of Standard or Simulated Temp (°F)	Response of Unit Under Test (°F)	Deviation Δt (°F)	Deviation (%)
0	0	1.3	1.3	.28
100	100	98.3	1.7	.30
200	200	201	1	.00
300	300	300	0	0
400	400	396	4	.47
500	500	495	5	.52
600	600	597	3	.28
700	700	697	3	.26
800	800	801	1	.08
900	900	902	2	.15
1000	1000	1006	6	.41
1100	1100	1108	8	.51
1200	1200	1213	13	.78
1300	1300	1312	12	.68
1400	1400	1415	15	.81
1500	1500	1511	11	.56
1600	1600	1611	11	.53
1700	1700	1704	4	.19
1800	1800	1800	0	0
1900	1900	1891	9	.38
2000	—	—	—	—
2100	—	—	—	—
		Averages:		

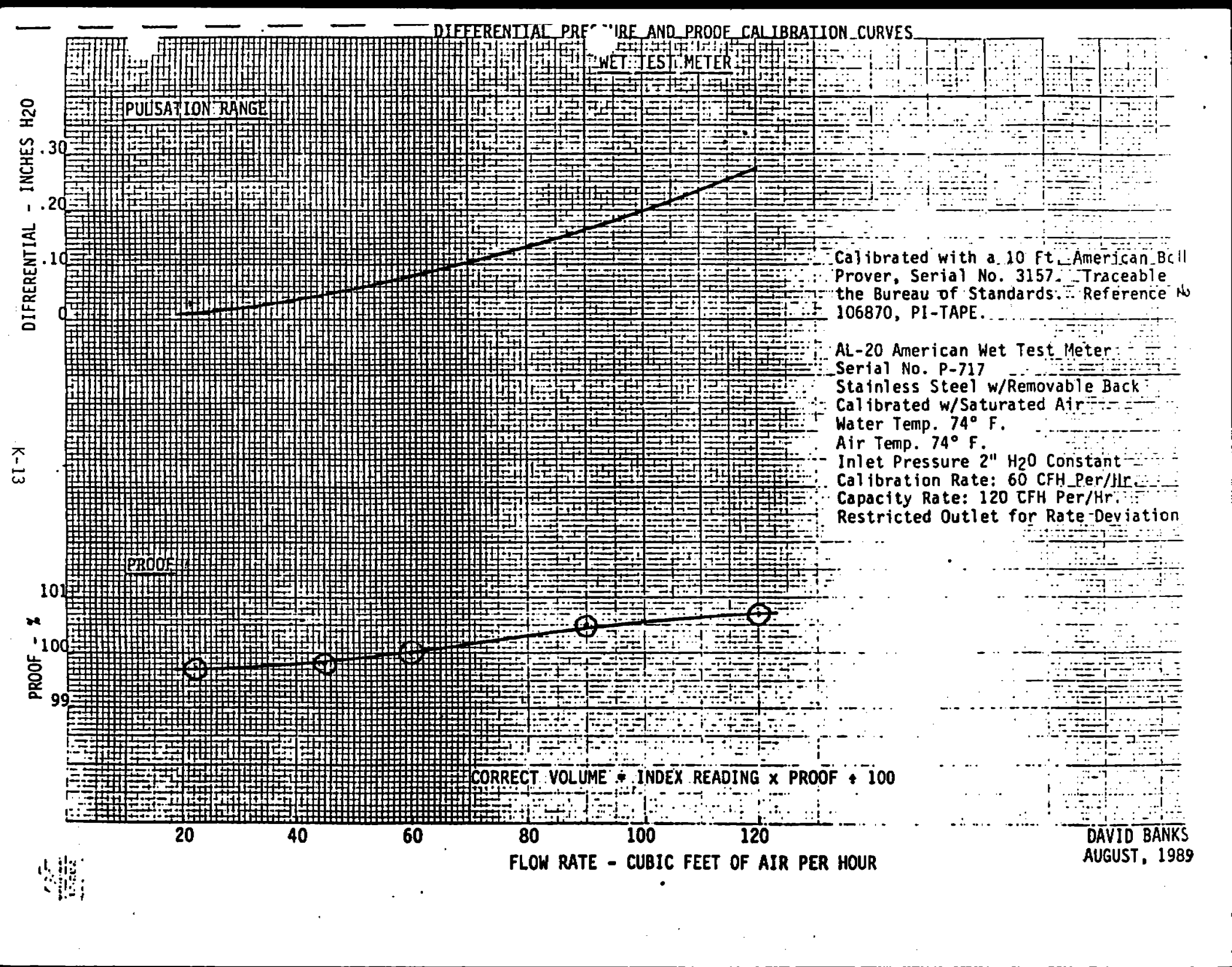
OF = off scale response by unit under test (°F)

% dev = 100 Δt / (460 + t)

☒ Unit in tolerance

☐ Unit was not in tolerance: recalibrated - See new calibration sheet.

S-433


DIFFERENTIAL PRESSURE AND PROOF CALIBRATION CURVES
WET TEST METER
PULSATION RANGE
DIFRENTIAL - INCHES H2O
.30
.20
.10
0
PROOF
101
100
99
PROOF - %
Calibrated with a 10 Ft. American Bell Prover, Serial No. 3157. Traceable the Bureau of Standards. Reference No 106870, PI-TAPE.
AL-20 American Wet Test Meter
Serial No. P-717
Stainless Steel w/Removable Back
Calibrated w/Saturated Air
Water Temp. 74° F.
Air Temp. 74° F.
Inlet Pressure 2" H2O Constant
Calibration Rate: 60 CFH Per/Hr.
Capacity Rate: 120 CFH Per/Hr.
Restricted Outlet for Rate Deviation
CORRECT VOLUME = INDEX READING x PROOF ÷ 100
20
40
60
80
100
120
FLOW RATE - CUBIC FEET OF AIR PER HOUR
DAVID BANKS
AUGUST, 1989

TACON 10

Source category: Taconite ore processing
Plant name : Cyprus Northshore Mining
Test date : March 9, 1990
Process : Crusher

Date:
Location:
Ref. No. 11

Basis for process rate :

Source	Type of control	Pollutant	Run No.	Emission rate, lb/hr	Process rate, ton/hr	Emission factor kg/Mg	Emission factor lb/ton
Primary Crusher	Cyclone and multi-cyclone	filt. PM	1	30.64	1825	0.008	0.017
		filt. PM	2	45.30	2016	0.011	0.022
		filt. PM	3	45.39	1763	0.013	0.026
		AVERAGE				0.011	0.022
		CO2	1	0.0	1825	0.0000	0.0000
		CO2	2	0.0	2016	0.000	0.000
		CO2	3	0.0	1763	0.000	0.000
		AVERAGE				0.0000	0.000
Primary crusher	Cyclone	filt. PM	1	200.20	1825	0.055	0.11
		filt. PM	2	328.75	2016	0.082	0.16
		filt. PM	3	317.10	1763	0.090	0.18
		AVERAGE				0.075	0.15
		CO2	1	0.0	1825	0.0000	0.0000
		CO2	2	0.0	2016	0.000	0.000
		CO2	3	0.0	1763	0.000	0.000
		AVERAGE				0.0000	0.000