Background Report Reference

AP-42 Section Number: 11.23

Background Chapter: 4

Reference Number: 44

Title: Results of the March 12, 1991 Efficiency Test on the No. 1 Primary Crusher Dust Collector at the Cyprus Northshore Mining Facility in Babbitt, MN

Interpoll Laboratories, IncInterpoll Laboratories, Inc

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April 1991

AP-42 Section 11.23
Reference —
Report Sect. 4
Reference 44

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RESULTS OF THE MARCH 12, 1991 EFFICIENCY TEST ON THE NO. 1 PRIMARY CRUSHER DUST COLLECTOR AT THE CYPRUS NORTHSHORE MINING FACILITY IN BABBITT, MINNESOTA

Submitted to:

CYPRUS NORTHSHORE MINING
10 Outer Drive
Silver Bay, Minnesota 55614

Attention:

Dennis Wagner

Reviewed by:

Daniel J. Despen
Manager
Field Testing Support Group

Report Number 1-3257
April 9, 1991
DD/djd

Ref BR 4-44

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APPENDICES:

1 INTRODUCTION

On March 12, 1990, Interpoll Laboratories personnel conducted a dust collector performance test on the No. 1 Crusher Primary Dust Collector at the Cyprus Northshore Mining Facility located in Babbitt, Minnesota. On-site testing was performed by Ed Trowbridge, Mark Kaehler, Curt Mosser and Erich Stefanyshyn. Coordination between testing activities and plant operation was provided by Matt Baudek of Cyprus Northshore Mining. The test was not witnessed by a member of the Minnesota Pollution Control Agency.

The Primary 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 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 glass-lined probes.

Testing on the dust collector inlet was conducted from a set of four test ports located 4'-11" downstream and 1'-9" upstream of 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 on 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 2.0 diameters upstream of the 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 not performed due to interference from the secondary crusher.

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 collector performance test are summarized in Table 1. As will be noted, the particulate removal efficiency averaged 72.1%. A visible emission determination could not be performed due to interference from the secondary crusher.

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 12, 1991 Particulate Emission Efficiency Test on the No. 1 Crusher Primary Dust Collector at Cyprus Northshore Mining in Silver Bay, Minnesota.

ITEM	RUN 1		RUN 2		RUN 3	
	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet
Date of test	03-12-91	03-12-91	03-12-91	03-12-91	03-12-91	03-12-91
Time runs were done (HRS)	830/ 937	830/ 932	954/1059	954/1056	1553/1658	1553/1655
Process rate (KLB/HR)						
Volumetric flow						
actual (ACFM)	30315	30980	30027	29379	30528	33346
standard (DSCFM)	30083	31075	29762	29374	29848	32861
Gas temperature (DEG-F)	41	41	42	42	49	49
Moisture content (%V/V)	0.62	0.55	0.52	0.69	0.52	0.72
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
carbon monoxide	0.00	0.00	0.00	0.00	0.00	0.00
nitrogen	79.07	79.07	79.07	79.07	79.07	79.07
Isokinetic variation (%)	98.6	98.5	99.9	99.7	100.0	99.4
Particulate concentration						
actual (GR/ACF)	2.7833	0.5940	1.7987	0.49379	1.1449	0.36655
standard (GR/DSCF)	2.8058	0.5924	1.8154	0.49406	1.1714	0.37210
Part. emission rate (LB/HR)	723	157.78	463	124.39	300	104.81
Part. removal efficiency (%)		78.19		73.14		65.03

Avg. 128.99 lb/hr

3 RESULTS

The results of all field and laboratory evaluations are presented in this section. Gas composition (Orsat and moisture) are presented first followed by the computer printout of the particulate and opacity 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 concentration times flow method.

3.1 Results of Orsat and Moisture Analyses

Test No. 1
No. 1 Crusher Primary Dust Collector Inlet

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

	Run 1	Run 2	Run 3
Date of run	03-12-91	03-12-91	03-12-91
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	20.79	20.79
carbon monoxide.....	0.00	0.00	0.00
nitrogen.....	78.58	78.66	78.66
water vapor.....	0.62	0.52	0.52
Dry molecular weight.....	28.84	28.84	28.84
Wet molecular weight.....	28.77	28.78	28.78
Specific gravity.....	0.994	0.994	0.994
Water mass flow.....(LB/HR)	529	435	435
FO	0.000	0.000	0.000

Test No. 1
No. 1 Crusher Primary Dust Collector Stack

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

	Run 1	Run 2	Run 3
Date of run	03-12-91	03-12-91	03-12-91
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.....	20.79	20.76	20.75
carbon monoxide.....	0.00	0.00	0.00
nitrogen.....	78.64	78.53	78.50
water vapor.....	0.55	0.69	0.72
Dry molecular weight.....	28.84	28.84	28.84
Wet molecular weight.....	28.78	28.77	28.76
Specific gravity.....	0.994	0.994	0.994
Water mass flow.....(LB/HR)	480	570	666
FO	0.000	0.000	0.000

3.2 Results of Particulate Loading Determinations

Test No. 1
No. 1 Crusher Primary Dust Collector Inlet

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

	Run 1	Run 2	Run 3
Date of run	03-12-91	03-12-91	03-12-91
Time run start/end.....(HRS)	830/ 937	954/1059	1553/1658
Static pressure.....(IN.WC)	-3.90	-3.90	-3.90
Cross sectional area (SQ.FT)	12.39	12.39	12.39
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)	6.0	5.0	5.0
total.....(GRAMS)	6.0	5.0	5.0
Total particulate material..			
.....collected(grams)	8.2009	5.3199	3.4445
Gas meter coefficient.....	0.9942	0.9942	0.9942
Barometric pressure..(IN.HG)	28.62	28.62	28.62
Avg. orif.pres.drop..(IN.WC)	1.99	2.02	2.00
Avg. gas meter temp..(DEF-F)	68.0	79.5	70.4
Volume through gas meter....			
at meter conditions...(CF)	47.20	48.35	47.70
standard conditions.(DSCF)	45.10	45.22	45.37
Total sampling time....(MIN)	60.00	60.00	60.00
Nozzle diameter.....(IN)	.240	.240	.240
Avg.stack gas temp ..(DEG-F)	41	42	49
Volumetric flow rate.....			
actual.....(ACFM)	30315	30027	30528
dry standard.....(DSCFM)	30083	29762	29848
Isokinetic variation.....(%)	98.6	99.9	100.0
Particulate concentration...			
actual.....(GR/ACF)	2.78328	1.79867	1.14485
dry standard.....(GR/DSCF)	2.80584	1.81541	1.17141
Particle mass rate...(LB/HR)	723.499	463.110	299.693

Test No. 1
No. 1 Crusher Primary Dust Collector Stack

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

	Run 1	Run 2	Run 3
Date of run	03-12-91	03-12-91	03-12-91
Time run start/end.....(HRS)	830/ 932	954/1056	1553/1655
Static pressure.....(IN.WC)	0.45	0.45	0.45
Cross sectional area (SQ.FT)	14.05	14.05	14.05
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	6.0	7.0
total.....(GRAMS)	5.0	6.0	7.0
Total particulate material..			
.....collected(grams)	1.6422	1.3105	1.1013
Gas meter coefficient.....	1.0053	1.0053	1.0053
Barometric pressure..(IN.HG)	28.62	28.62	28.62
Avg. orif.pres.drop..(IN.WC)	1.62	1.56	1.84
Avg. gas meter temp..(DEF-F)	58.4	72.5	49.4
Volume through gas meter....			
at meter conditions...(CF)	43.51	42.77	45.62
standard conditions.(DSCF)	42.78	40.93	45.67
Total sampling time....(MIN)	60.00	60.00	60.00
Nozzle diameter.....(IN)	.245	.245	.245
Avg.stack gas temp ..(DEG-F)	41	42	49
Volumetric flow rate.....			
actual.....(ACFM)	30980	29379	33346
dry standard.....(DSCFM)	31075	29374	32861
Isokinetic variation.....(%)	98.5	99.7	99.4
Particulate concentration...			
actual.....(GR/ACF)	0.59396	0.49379	0.36655
dry standard.....(GR/DSCF)	0.59238	0.49406	0.37210
Particle mass rate...(LB/HR)	157.783	124.394	104.809

3.3 Results of Opacity Determinations

Test No. 1
No. 1 Primary Crusher

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

Percent Opacity	Optical Density	Relative Frequency(%)
0	.0000	
5	.0223	
10	.0458	
15	.0706	
20	.0969	
25	.1249	
30	.1549	
35	.1871	
40	.2219	
45	.2596	
50	.3010	
55	.3468	
60	.3979	
65	.4559	
70	.5229	
75	.6021	
80	.6990	
85	.8239	
90	1.0000	
95	1.3010	
99	2.0000	

Observer: C. Mosser
Cert. Date: 10-17-90
Date of Observation: 03-12-91

* Interference from the secondary crusher made it impossible to perform this test.

APPENDIX A

RESULTS OF VOLUMETRIC FLOW RATE DETERMINATIONS

Test No. 1
No. 1 Crusher Primary Dust Collector Inlet

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

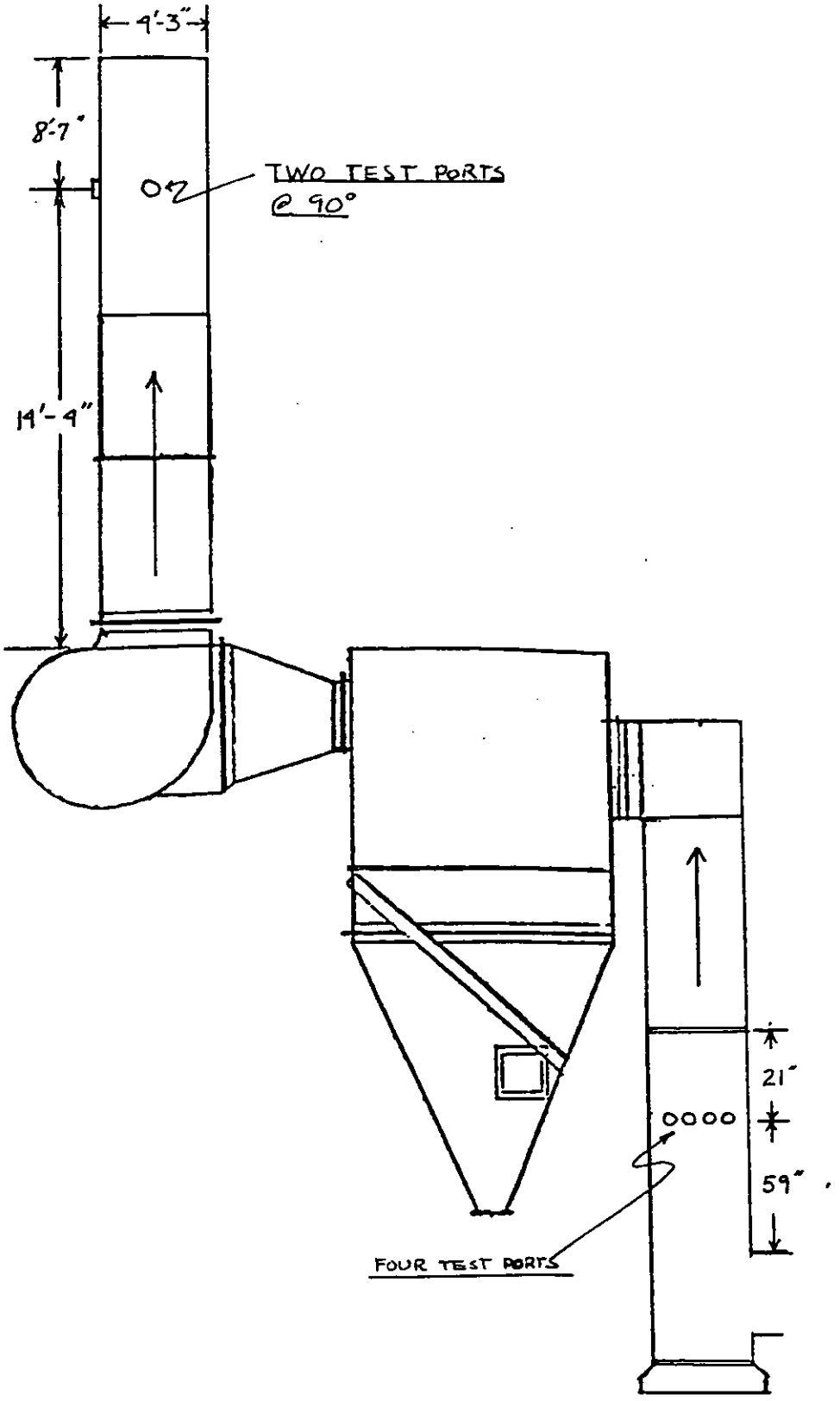
Date of Determination.....	03-12-91
Time of Determination.....(HRS)	800
Barometric pressure.....(IN.HG)	28.62
Pitot tube coefficient.....	.84
Number of sampling ports.....	4
Total number of points.....	24
Shape of duct.....	Rectangular
Duct width.....(IN)	43
Duct length.....(IN)	41.5
Duct area.....(SQ.FT)	12.39
Direction of flow.....	UP
Static pressure.....(IN.WC)	-3.9
Avg. gas temp.....(DEG-F)	40
Moisture content.....(% V/V)	0.62
Avg. linear velocity.....(FT/SEC)	40.1
Gas density.....(LB/ACF)	.07472
Molecular weight.....(LB/LBMOLE)	28.84
Mass flow of gas.....(LB/HR)	133804
Volumetric flow rate.....	
actual.....(ACFM)	29846
dry standard.....(DSCFM)	29659

APPENDIX B

LOCATION OF TEST PORTS

CYPRUS NORTHSHORE

No. 1 PRIMARY CRUSHER DUST COLLECTOR



APPENDIX C

FIELD DATA SHEETS

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INTERPOLL LABORATORIES EPA METHOD 2 FIELD DATA SHEET

Job Cyprus North Stobo Mining, Babb, Tenn

Source No1 Crusher Primary Dust Collector-Inlet

Test 1 Run 1 Date 3-12-91

Stack dimen. 43 X 41.5 IN.

Dry bulb ____ °F Wet bulb ____ °F

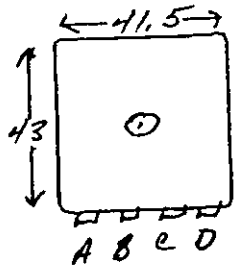
Manometer: ☒ Reg. ☐ Exp. ☐ Elec.

Barometric pressure 28.62 in Hg

Static pressure -3.9 in WC

Operators E. Trowbridge - E. Stefanyshyn

Pitot No. 21V-4 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: 3.5 in.		Time start: 0800 hrs	
	A-1		3.58	7.08	.82	40
	2		10.75	14.25	.52	40
	3		17.92	21.42	.45	40
	4		25.09	28.59	.37	40
	5		32.26	35.76	.26	40
	6		39.43	42.93	.16	40
B	1				.90	40
	2				.70	40
	3				.36	40
	4				.32	40
	5				.30	40
	6				.32	40
C	1				.70	40
	2				.75	40
	3				.57	40
	4				.46	40
	5				.38	40
	6				.33	40
D	1				.80	40
	2				.96	40
	3				.78	40
	4				.56	40
	5				.43	40
	6				.30	40

Temp. meas. tool & S/N: PDT-12 Time end: 0815 hrs

R or nothing= reg. manometer; S= expanded; E = electronic S-392.1

INTERFOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job Glass N.S.M. Date 3-12-91 Test 1 Run 1
Source NO1 CRUSHER PRIMARY No. of traverse points 24
Method 5 Filter holder: 4" GLASS Filter type: 4" GLASS FIBER

Sample Train Leak Check:

Pretest: 0.02 cfm at 15 in. Hg. (vac)
Postest: 00 cfm at 5 in. Hg. (vac)

Particulate Catch Data:

No.s of filters used: 2920

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	1495	1489	6
Total			6

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 No1 Crusher Primary, Inlet
Date 5-12-91 Test 1 Run 1

Operators F.Trowbridge-E.Stephyshyn
Meter Box No. 4 ΔH 1.80 ΔP WC
Calibration coeff. .9942

Pitot No. 214-4 Cp .840
Bar. Press. 28.62 inHg H2O x
Nozzle No. 1-4 Nozzle Dia .392 IN.

Traverse Point No.	Sampling Time (min)	Sample Volume (cf)	Velocity Head (inWC)	Orifice Meter (inWC)	Dry. Vol. (cf)	VAC. inHg	Temperatures (°F) Stack	Probe	Oven	Impg.	Gas/In	Gas/Out	Oxygen (x v/v)
	0830	946.50											
C - 6	2.5	946.20	.38	1.32	8.11	1.0	40	NOT HEATED		33	43	39	
5	5	944.85	.39	1.34	9.73	1.0	42				48	42	
4	7.5	951.54	.45	1.56	1.48	1.0	42			34	52	45	
3	10	953.52	.56	1.95	3.46	1.5	42				57	48	
2	12.5	955.82	.82	2.89	5.86	2.0	42			34	62	51	
1	15	958.20	.79	2.80	8.23	2.0	42				65	53	
A - 6	17.5	959.25	.15	.53	9.27	1.0	42			34	64	57	
5	20	960.63	.26	.93	0.65	1.0	41				68	59	
4	22.5	962.24	.37	1.33	2.30	1.0	41			34	70	60	
3	25	964.20	.50	1.81	4.22	1.5	41				71	61	
2	27.5	966.60	.78	2.82	6.62	2.0	41			34	72	64	
1	30	969.15	.88	3.18	9.17	2.4	40				72	61	
D - 6	32.5	970.65	.28	1.01	0.61	1.0	41			34	72	61	
5	35	972.43	.43	1.56	2.40	1.0	40				72	61	
4	37.5	974.42	.57	2.07	4.46	1.5	40			34	73	64	
3	40	976.82	.78	2.84	6.88	2.0	40				74	65	
2	42.5	979.60	.96	3.49	9.55	2.2	40			34	76	68	
1	45	981.95	.78	2.86	1.98	2.0	40				78	69	
B - 6	47.5	983.96	.52	1.91	3.98	1.0	40			34	79	72	
5	50	985.58	.30	1.11	5.50	1.0	40				79	72	
4	52.5	987.10	.30	1.11	7.02	1.0	40			34	79	72	
3	55	988.72	.36	1.33	8.69	1.0	40				79	72	
2	57.5	991.00	.70	2.58	1.61	2.0	40			34	79	73	
1	60	993.70	.92	3.39	3.66	2.1	40				80	74	
	(0937)												
	θ = 60	Vs = √H 1.20		ΔH = 1.99							Avg. = 68.0		

INTERFOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job CYPRUS NORTH SHORE MINING Date 3-12-91 Test 1 Run 2
Source NO1 CRUSHER PRIMARY INLET No. of traverse points 24
Method 5 Filter holder: 4" 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: 2990

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	1500	1495	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 North Stockpiling — Operators ET-ES — Pitot No. 214-4 — Cp .840
Source NO1 Crusher Hourly FNLET — Meter Box No. 9 — ΔH 1.80 IN WC — Bar. Press. 29.62 inHg H2O — X
Date 3-12-91 — Test 1 — Run 2 — Counter coeff. .9942 — Nozzle No. 1-4 — Nozzle Dia .240 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)
	0954	993.90											
B — 6	2.5	995.50	.30	1.11	5.41	1.0	40	NOT-HEATED		34	71	70	
5	↓	997.10	.32	1.20	7.00	1.0	40				73	71	
4	7.5	998.77	.41	1.52	8.77	1.0	40			34	74	72	
3	10	1000.86	.58	2.16	10.89	1.5	40			34	77	74	
2	12.5	1003.32	.78	2.90	3.35	2.0	41			34	81	76	
1	15	1005.96	.89	3.34	5.99	2.0	40				81	76	
D — 6	17.5	1007.47	.28	1.05	7.48	1.0	40			34	79	76	
5	20	1009.32	.42	1.58	9.29	1.0	40				79	76	
4	22.5	1011.40	.58	2.17	1.43	1.5	40			34	79	76	
3	25	1013.80	.74	2.77	3.83	1.5	40				81	76	
2	27.5	1016.50	.98	3.67	6.60	2.2	40			34	82	76	
1	30	1019.04	.77	2.89	9.06	2.0	40				82	77	
A — 6	32.5	1020.30	.20	.75	0.32	1.0	40			35	83	79	
5	35	1021.72	.26	.98	1.76	1.0	41				83	80	
4	37.5	1023.40	.35	1.31	3.43	1.0	45			35	84	80	
3	40	1025.07	.35	1.31	5.09	1.0	45				84	80	
2	42.5	1027.02	.48	1.80	7.04	1.0	45			35	84	80	
1	45	1029.50	.78	2.92	9.52	2.0	45				84	80	
C — 6	47.5	1031.25	.38	1.43	1.26	1.0	44			35	84	80	
5	50	1033.00	.38	1.42	2.99	1.0	45				84	80	
4	52.5	1034.92	.46	1.73	4.90	1.0	44			35	85	80	
3	55	1037.15	.65	2.44	7.17	1.7	43				87	82	
2	57.5	1039.77	.84	3.17	9.76	2.0	43			35	87	83	
1	60	1042.25	.76	2.87	2.23	2.0	43				87	83	
	(1059)												
	θ = 60	Vm = 49.35		ΔH = 2.02							Avg. = 79.5		

S-0037R

C-5

INTERFOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job CYPRUS NORTH SHORE MINING Date 3-12-91 Test 1 Run 3
Source NO1 CRUSHER PRIMARY INLET No. of traverse points 24
Method 5 Filter holder: 4" 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: 2991

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

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

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1			
Impinger No. 2			
Impinger No. 3			
Condenser			
Desiccant	1505	1500	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

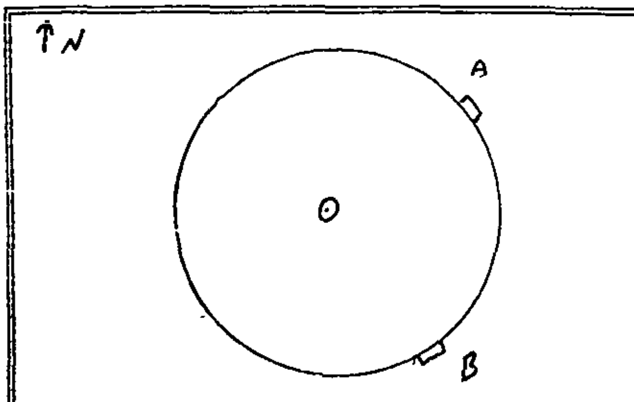
Job CYPRUS NORTH STAR MINING — Operators ET-ES — Pitot No. ZIV-4 — Cp .840
Source NO1 CRUSHER PRIMARY EXHST — Meter Box No. 4 ΔH 1.80 IN WC — Bar. Press. 28.63 inHg H2O x — Nozzle No. 1-4 Nozzle Dia .242 IN.
Date 5-12-92 Test 1 Run 3 — Gasometer coeff. .9942

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)
	1553	42.60											
A – 6	2.5	43.92	.24	.87	3.94	1.0	50	NOT-HEATED		38	64	63	
5	5	45.28	.25	.90	5.30	1.0	50				64	63	
4	7.5	46.92	.37	1.33	6.95	1.0	50			38	67	64	
3	10	48.41	.50	1.81	8.88	1.0	50				69	64	
2	12.5	51.25	.82	2.97	1.34	1.9	50			40	70	66	
1	15	53.80	.85	3.08	3.85	2.0	50				72	66	
C – 6	17.5	55.30	.30	1.09	5.35	1.0	50			41	72	67	
5	20	56.88	.33	1.20	6.93	1.0	50				73	67	
4	22.5	58.72	.42	1.53	8.71	1.0	49			41	74	68	
3	25	60.80	.60	2.19	0.84	1.0	49				75	68	
2	27.5	63.30	.82	2.99	3.33	2.0	49			43	75	69	
1	30	65.65	.78	2.85	5.75	1.9	49				76	69	
B 6	32.5	67.10	.26	.95	7.16	1.0	49			44	76	69	
5	35	68.68	.31	1.14	8.70	1.0	49				75	66	
4	37.5	70.40	.40	1.46	0.45	1.0	49			44	75	69	
3	40	72.52	.60	2.20	2.58	1.0	49				75	69	
2	42.5	74.95	.80	2.94	5.04	2.0	47			44	75	69	
1	45	77.43	.78	2.86	7.47	2.0	47				75	69	
D 6	47.5	78.99	.30	1.10	8.99	1.0	47			44	74	69	
5	50	80.76	.42	1.54	0.78	1.0	47				74	70	
4	52.5	82.86	.57	2.09	2.86	1.0	47			44	75	70	
3	55	85.26	.76	2.79	5.26	1.5	47				75	70	
2	57.5	87.92	.97	3.56	7.97	2.1	47			44	75	70	
1	60	90.30	.72	2.65	0.31	2.0	47				75	70	
	(1658)												
	θ = 60	Vm = 47.70		ΔH = 2.00							Avg. = 70.4		

C-7

INTERPOLL LABORATORIES EPA METHOD 2 FIELD DATA SHEET

Job *Cyprus North Shore / Babbitt, MN*
Source *No. 1 Primary Crusher / Stack*
Test *1* Run *1,2,3* Date *3-12-91*
Stack dimen. *50.75* IN.
Dry bulb *41* °F Wet bulb ____ °F
Manometer: ☒ Reg. ☐ Exp. ☐ Elec.
Barometric pressure *28.62* in Hg
Static pressure *+.45* in WC
Operators *M. Kaehler, C. Mosser*
Pitot No. *24V-5* Cp *.84*



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 in.		Time start: hrs	
A-1	.021	1.07	4.07	.34	41
2	.067	3.40	7.40	.37	
3	.118	5.99	8.99	.40	
4	.177	8.97	11.97	.40	
5	.250	12.69	15.69	.39	
6	.356	18.07	21.07	.39	
7	.644	32.67	35.67	.39	42
8	.750	38.05	41.05	.41	
9	.823	41.77	44.77	.41	
10	.882	44.75	47.75	.42	
11	.933	47.35	50.35	.38	
12	.979	49.67	52.67	.40	
B-1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
Temp. meas. tool & S/N: *PDT-4 / TC*				Time end: hrs	

R or nothing= reg. manometer; S= expanded; E = electronic S-392.1

INTERPOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job Cyprus North Shore / Babb. H, MN
Source No. 1 Primary Crusher / Stack
Method 5 Filter holder: 4" Glass

Date 3-12-91 Test 1 Run 1
No. of traverse points 24
Filter type: 4" G.F.

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: 3051

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

No. of probe wash bottles: 1
Sample recovered by: M. Kaechler, C. Nasser

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1			
Impinger No. 2			
Impinger No. 3			
Condenser			
Desiccant	1500	1495	5
Total			5

Integrated Gas Sampling Data: NA

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 North Shovel Rabbitt, MSE
Source No. 1 Primary Crusher
Date 2-12-91 Port 1 Run 1

Operators M. Gaebler, C. Mosser
Meter Box No. 4 ΔH 1.73 IN WC
Counter cont't. Loose

Pitot No. 24V-5 Cp .84
Bar. Press. 28.62 inHg H2O 2 x
Nozzle No. 2-4 Nozzle Dia .245 IN.

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 (xv/v)
	(0830)	932.02											
A-12	2.5	933.62	.35	1.26	3.60	2	41			42	29	27	20.9
11	5	935.36	.44	1.54	5.33	2.5	42				42	35	20.9
10	7.5	937.36	.57	2.04	7.34	3	42			42	46	38	20.9
9	10	939.24	.49	1.77	9.21	3	42				53	43	20.9
8	12.5	940.99	.42	1.53	0.97	2.5	42			43	58	47	20.9
7	15	943.19	.63	2.32	3.14	3.5	42				62	49	20.9
6	17.5	945.31	.61	2.26	5.29	3.5	42			43	63	50	20.9
5	20	947.38	.57	2.11	7.37	3	42				66	53	20.9
4	22.5	949.38	.52	1.94	9.37	3	41			42	68	55	20.9
3	25	951.35	.50	1.88	1.34	3	41				68	56	20.9
2	27.5	953.37	.51	1.92	3.35	3	41			44	68	56	20.9
1	30	955.28	.47	1.76	5.24	3	42				68	56	20.9
B-12	32.5	957.28	.52	1.95	7.25	3	42			44	66	55	20.9
11	35	959.23	.49	1.84	9.20	3	41				67	56	20.9
10	37.5	960.99	.47	1.63	0.96	2.5	42			45	69	58	20.9
9	40	962.89	.45	1.69	2.84	2.5	42				71	60	20.9
8	42.5	964.65	.40	1.51	4.61	2.5	43			45	73	62	20.9
7	45	966.29	.34	1.29	6.26	2	41				75	64	20.9
6	47.5	967.85	.31	1.18	7.84	2	41			44	76	66	20.9
5	50	969.32	.28	1.07	9.34	2	40				77	68	20.9
4	52.5	970.85	.28	1.08	0.85	2	40			43	76	67	20.9
3	55	972.48	.32	1.23	2.46	2.5	40				74	66	20.9
2	57.5	974.10	.32	1.22	4.07	2.5	40			44	74	66	20.9
1	60	975.53	.25	.96	5.49	2	40				75	67	20.9
	(0932)												
	θ = 60	Vm = 43.51		ΔH = 1.62							Avg. = 58.4		

Low Moisture, Did Not Use Heat

Low Moisture, Did Not Use Heat

Dying Column Only

INTERFOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job Cypress North Shore / Babbitt #2 Date 3-12-91 Test 1 Run 2
Source No. 1 Primary Crusher / Stack No. of traverse points 24
Method 5 Filter holder: 4" Glass Filter type: 4" Gl. Fi.

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: 3078

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

No. of probe wash bottles: 1
Sample recovered by: M. Baehler, C. Mosser

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1			
Impinger No. 2			
Impinger No. 3			
Condenser			
Desiccant	1463	1557	6
Total			6

Integrated Gas Sampling Data: NA

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: 0954 (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 Cypress North Shore / Bobcat, LA Operators M. Koehler, C. Mosser Pitot No. 24V-5 Cp .84
Source No. 1 Primary Crusher / Stack Meter Box No. 4 ΔH 1.73 IN WC Bar. Press. 29.62 inHg H2O 1 x
Date 3-12-91 Test 1 Run 2 Counter coeff. 1.0053 Nozzle No. 2-4 Nozzle Dia .245 IN.

Traverse Point No.	Sampling Time (min)	Sample Volume (cf)	Velocity Head (inWC)	Orifice Meter (inWC)	Dep. Vol. (cf)	VAC. inHg	Temperatures (°F) Stack	Probe	Oven	Impg.	Gas In	Gas Out	Oxygen (v/v)
	(0454)	975.75											
13 - 12	2.5	977.74	.50	1.90	7.72	3	40			41	57	57	20.9
11	5	979.61	.43	1.64	9.56	2.5	40				62	60	20.9
10	7.5	981.24	.34	1.29	1.20	2	42			40	66	63	20.9
9	10	982.60	.24	.92	2.59	2	42				71	67	20.9
8	12.5	983.98	.22	.85	3.93	2	41	Low Moisture, Did not use Heat	Low Moisture, Did not use Heat	40	73	68	20.9
7	15	985.09	.15	.58	5.04	2	40			Dry, 39	76	71	20.9
6	17.5	986.38	.22	.86	6.39	2	41			39	75	70	20.9
5	20	987.75	.22	.86	7.74	2	41				74	69	20.9
4	22.5	989.15	.23	.89	9.12	2	41			Column 40	74	68	20.9
3	25	990.56	.24	.93	0.52	2	41				73	68	20.9
2	27.5	992.03	.26	1.01	1.98	2	41			40	72	67	20.9
1	30	993.45	.25	.97	3.41	2	41			Only 41	73	68	20.9
A - 12	32.5	995.64	.59	2.29	5.60	3.5	42				76	70	20.9
11	35	997.75	.55	2.14	7.73	3	42				79	72	20.9
10	37.5	999.81	.52	2.03	9.81	3	42			42	81	74	20.9
9	40	1001.94	.54	2.11	1.93	3	44				81	74	20.9
8	42.5	1004.10	.55	2.15	4.07	3	45			42	80	73	20.9
7	45	1006.24	.55	2.15	6.20	3	45				79	73	20.9
6	47.5	1008.40	.57	2.22	8.37	3.5	44			42	78	72	20.9
5	50	1010.67	.60	2.33	0.60	3.5	44				78	72	20.9
4	52.5	1012.77	.56	2.17	2.74	3	45			43	79	72	20.9
3	55	1014.82	.50	1.95	4.78	3	44				81	74	20.9
2	57.5	1016.73	.44	1.72	6.69	2.5	43			43	83	76	20.9
1	60	1018.52	.38	1.50	8.49	2.5	43				84	78	20.9
	(1058)												
	θ = 60	Vm = 42.77		ΔH 1.56							Avg. = 72.5		

INTERPOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job Cyprus Northshore / Babb. H, MN Date 3-12-91 Test 1 Run 3
Source No. 1 Primary Crusher / Stack No. of traverse points 24
Method 5 Filter holder: 4" Glass Filter type: 4" G.F.

Sample Train Leak Check:

Pretest: < 0.02 cfm at 15 in. Hg. (vac) ☒
Postest: 0 cfm at 7 in. Hg. (vac) ☒

Particulate Catch Data:

No.s of filters used: 3079

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

No. of probe wash bottles: 1
Sample recovered by: M. Kaehler, C. Nosser

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1			
Impinger No. 2			
Impinger No. 3			
Condenser			
Desiccant	1507	1500	7
Total			7

Integrated Gas Sampling Data: NA

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 North Shore / Babb. H, MN
Source: No. 1 Primary Crusher / Stack
Date: 3-12-91 Test 1 Run 3

Operators: M. Gaahler, C. Mosser
Meter Box No.: 4 ΔH@ 1.23 IN WC
Counter coeff.: 1.005-3

Pitot No.: 24V-5 Cp .84
Bar. Press.: 29.63 inHg H2O 1 x
Nozzle No.: 2.4 Nozzle Dia .245 IN.

Traverse Point No.	Sampling Time (min)	Sample Volume (cf)	Velocity Head (inWC)	Orifice Meter (inWC)	Dgc. Vol. (cf)	VAC. inHg	Temperatures (°F) Stack	Probe	Oven	Impg.	Gas/In	Gas/Out	Oxygen (x v/v)
	(1553)	18.70											
B-12	2.5	20.41	.35	1.34	0.38	2	50			42	39	38	20.9
11	5	22.05	.38	1.36	2.02	2	50				39	38	20.9
10	7.5	23.73	.39	1.40	3.69	2.5	50			42	41	39	20.9
9	10	25.45	.41	1.47	5.40	2.5	50				42	39	20.9
8	12.5	27.12	.39	1.41	7.07	2.5	49			43	43	40	20.9
7	15	28.50	.27	.98	8.47	2	49				45	40	20.9
6	17.5	29.85	.26	.94	9.84	2	49			43	45	41	20.9
5	20	31.28	.29	1.05	1.29	2	48				46	41	20.9
4	22.5	32.84	.32	1.16	2.82	2	50			42	47	42	20.9
3	25	34.49	.36	1.31	4.44	2	50				48	42	20.9
2	27.5	36.15	.38	1.38	6.10	2	51			41	49	42	20.9
1	30	37.86	.42	1.52	7.85	2.5	51				49	43	20.9
B-12	32.5	39.84	.55	1.92	9.81	3	51			41	49	43	20.9
11	35	41.89	.58	2.11	1.87	3	50				51	44	20.9
10	37.5	44.09	.63	2.30	4.02	3.5	50			42	51	44	20.9
9	40	46.23	.66	2.40	6.21	3.5	52				52	45	20.9
8	42.5	48.51	.69	2.51	8.46	4	52			43	53	45	20.9
7	45	50.74	.70	2.56	0.73	4	50				53	45	20.9
6	47.5	53.05	.70	2.57	3.01	4	48			43	53	45	20.9
5	50	55.35	.72	2.64	5.31	4.5	48				54	46	20.9
4	52.5	57.61	.67	2.47	7.55	4	47			44	54	46	20.9
3	55	59.79	.67	2.47	9.78	4	47				54	46	20.9
2	57.5	62.01	.66	2.43	2.00	3.5	47			45	55	47	20.9
1	60	64.32	.68	2.51	4.25	4	47				55	47	20.9
	(1655)												
	θ = 60	Vm = 2		ΔH = 1.84							Avg. = 49.4		

Low Moisture, D.C. Not Use Heat
Low Moisture, Do Not Use Heat
Low Moisture, Do Not Use Heat
Do Not Use Heat
Do Not Use Heat
Impingers Only

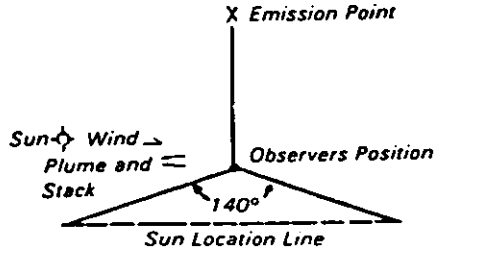
Interpoll Laboratories
(612)786-6020

Visible Emissions Form

SOURCE NAME: CYPRES North Shore	OBSERVATION DATE: 3-12-91
ADDRESS:	START TIME:
	STOP TIME:
CITY: BABBITT	STATE: MN
ZIP:	
PHONE:	SOURCE ID NUMBER:
PROCESS EQUIPMENT:	OPERATING MODE:
CONTROL EQUIPMENT:	OPERATING MODE:
DESCRIBE EMISSION POINT: START	STOP
HEIGHT ABOVE GROUND LEVEL: START	STOP
HEIGHT RELATIVE TO OBSERVER: START	STOP
DISTANCE FROM OBSERVER: START	STOP
DIRECTION FROM OBSERVER: START	STOP
DESCRIBE EMISSIONS: START	STOP
EMISSION COLOR: START	STOP
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	STOP
DESCRIBE BACKGROUND: START	STOP
BACKGROUND COLOR: START	STOP
SKY CONDITIONS: START	STOP
WIND SPEED: START	STOP
WIND DIRECTION: START	STOP
AMBIENT TEMP.: START	STOP
WET BULB TEMP.	RH.percent

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

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): Curtis Mosser	
COMMENTS: UNABLE to READ due to INTERFERENCE	OBSERVER'S SIGNATURE: Curtis Mosser — DATE: 3-12-91
From SECONDARY CRUSHER	ORGANIZATION: Interpoll Labs
I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS SIGNATURE	CERTIFIED BY: ETA/MPCA — DATE: 10-17-96
TITLE — DATE	VERIFIED BY — DATE

S-0079R

APPENDIX D

INTERPOLL LABORATORIES ANALYTICAL RESULTS

TABLE OF CONTENTS

Interpoll Laboratories
(612) 786-6020

EPA Method 5 Data Reporting Sheet
Probe/Cyclone Wash

Job: Cyprus North Shore Mining
Team Leader: ST
Date Submitted: 3-15-91
Test No.: 1
Date of Analysis: 3-15-91
Transport Leakage: [X] None [ ] _____ ml

Source: No 1 Crusher Primary
Test Site: Inlet
Date of Test: 3-12-91
No. of Runs Completed: 3
Technician: _____
Solvent: Acetone

0	Test 1 Run 0 Field Blank Log Number 2486-01 Vol. of Solvent 150 ml *Solvent Residue 1.3 ug/ml	Dish No. 93 Dish Tare Wt. 49.2001 g Dish+Sample Wt. 49.2003 g Sample Wt. 0.0002 g
1	Test 1 Run 1 Vol. of Solvent 110 ml Log Number -06 Comments _____	Dish No. 57 Dish Tare Wt. 50.0209 g Dish+Sample Wt. 53.8319 g Sample Wt. 3.8110 g
2	Test 1 Run 2 Vol. of Solvent 150 ml Log Number -08 Comments _____	Dish No. 39 Dish Tare Wt. 49.4394 g Dish+Sample Wt. 51.6105 g Sample Wt. 2.1711 g
3	Test 1 Run 3 Vol. of Solvent 140 ml Log Number -07 Comments _____	Dish No. 55 Dish Tare Wt. 47.7801 g Dish+Sample Wt. 48.0729 g Sample Wt. 0.2928 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 1.3 ug/ml = [(Sample Wt. 0.0002 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
	3.8109	2.1709	0.2927	D-1	

LSC-01YR

Interpoll Laboratories
(612) 786-6020

EPA Method 5 Data Reporting Sheet
Filter Gravimetrics

Job: Cyprus North Shore Mining
Team Leader: ET
Date Submitted: 3-13-91
Test No.: 1
Date of Analysis: 3-15-91

Source: No. 1 Crusher Primary
Test Site: Inlet
Date of Test: 3-12-91
No. of Runs Completed: 3
Technician: B. Dube

0	Test 1 Run 0 Field Blank Log Number 2496-02 Comments	Filter No. 2992 Filter Type 4"GF Filter Tare Wt. 0.9362 g Filter+Sample Wt. 0.9364 g Sample Wt. g
1	Test 1 Run 1 Log Number -04 Comments	Filter No. 2920 Filter Type 4"GF Filter Tare Wt. 0.9305 g Filter+Sample Wt. 5.3205 g Sample Wt. 4.3900 g
2	Test 1 Run 2 Log Number -06 Comments	Filter No. 2990 Filter Type 4"GF Filter Tare Wt. 0.9318 g Filter+Sample Wt. 4.0808 g Sample Wt. 3.1490 g
3	Test 1 Run 3 Log Number -08 Comments	Filter No. 2991 Filter Type 4"GF Filter Tare Wt. 0.9315 g Filter+Sample Wt. 4.0833 g Sample Wt. 3.1518 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
	4.3900	3.1490	3.1518		

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	8.2009	5.3199	3.4445		

LSC-02PR

Interpoll Laboratories
(612) 786-6020

EPA Method 5 Data Reporting Sheet
Probe/Cyclone Wash

Job Cyprus North Shore
Team Leader AK
Date Submitted 3-15-91
Test No. 1
Date of Analysis 3-15-91
Transport Leakage [X] None [ ] _____ ml

Source No 1 Primary Crusher
Test Site Stack
Date of Test 3-12-91
No. of Runs Completed 3
Technician _____
Solvent Acetone

0	Test ____ Run 0 Field Blank Log Number _____ Vol. of Solvent ____ ml *Solvent Residue 1.3 ug/ml	Dish No. _____ Dish Tare Wt. _____ g Dish+Sample Wt. _____ g Sample Wt. _____ g
1	Test 1 Run 1 Vol. of Solvent 230 ml Log Number 2186 - 09 Comments _____	Dish No. 9 Dish Tare Wt. 47.9751 g Dish+Sample Wt. 49.3844 g Sample Wt. 1.4093 g
2	Test 1 Run 2 Vol. of Solvent 200 ml Log Number -11 Comments _____	Dish No. 106 Dish Tare Wt. 43.0159 g Dish+Sample Wt. 44.1857 g Sample Wt. 1.1698 g
3	Test 1 Run 3 Vol. of Solvent 190 ml Log Number -13 Comments _____	Dish No. 96 Dish Tare Wt. 44.7127 g Dish+Sample Wt. 45.6273 g Sample Wt. 0.9146 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 ___ ug/ml = [(Sample Wt. ____ g)(10⁶)]/Vol. of Sol. ____ ml
EPA-M5 Acetone Residue Blank Spec. ≤ 7.8 ug/ml

Results:

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	1.4090	1.1695	0.9144	D-3	

LSC-01YR

Interpoll Laboratories
(612) 786-6020

EPA Method 5 Data Reporting Sheet
Filter Gravimetrics

Job: Cyprus North Shore Mining
Team Leader: MK
Date Submitted: 3-13-91
Test No.: 1
Date of Analysis: 3-15-91
Source: No.1 Primary Crusher
Test Site: Stack
Date of Test: 3-12-91
No. of Runs Completed: 3
Technician: R. Hunter

0	Test ___ Run 0 Field Blank Log Number ___ Comments ___	Filter No. ___ Filter Type ___ Filter Tare Wt. ___ g Filter+Sample Wt. ___ g Sample Wt. ___ g
1	Test 1 Run 1 Log Number 2486-10 Comments ___	Filter No. 3051 Filter Type 4"GF Filter Tare Wt. 0.9390 g Filter+Sample Wt. 1.1722 g Sample Wt. 0.2332 g
2	Test 1 Run 2 Log Number 2486-12 Comments ___	Filter No. 3078 Filter Type 4"GF Filter Tare Wt. 0.9380 g Filter+Sample Wt. 1.0790 g Sample Wt. 0.1410 g
3	Test 1 Run 3 Log Number -14 Comments ___	Filter No. 3079 Filter Type 4"GF Filter Tare Wt. 0.9425 g Filter+Sample Wt. 1.1294 g Sample Wt. 0.1869 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
	0.2332	0.1410	0.1869		

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	1.6422	1.3105	1.1013		

LSC-02PR

Interpoll Laboratories
(612) 786-6020

Chain of Custody
Sample Deposition Sheet

Job City Rues Mining Babbitt
Team Leader E Trowbridge
Date Submitted 3-12-91
Test No. 1

Source NA/ Crusher Primary
Test Site Inlet
Date of Test 3-12-91
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	
0	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	
0	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

Interpoll Laboratories
(612) 786-6020

Chain of Custody
Sample Deposition Sheet

Job Cyprus North Shore / Babb. H, M N
Team Leader M. Laehler
Date Submitted 3-12-91
Test No. 1

Source Primary Crusher
Test Site Stack
Date of Test 3-12-91
No. of Runs Completed 3

No. of Samples	Type of Sample	Analysis Required	Comments
3+B	Probe Wash: ☒ Acetone ☐ D.I. Water	☒ As per EPA M-5 ☐ Other _____	
3+B	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 _____	
— B	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 Rock Crusher
2) Fuel: ☐ Coal ☐ Wood ☐ Gas ☐ Oil ☐ RDF ☒ Other None
3) Is sample combustible? ☒ No ☐ Yes
4) Does sample need special handling? ☒ No ☐ Yes If yes, explain

S-278RRRR

APPENDIX E

MPCA EXHIBIT C

(Not supplied by client before time of publication)

APPENDIX F

PROCESS DATA

(Not supplied by client before time of publication)

APPENDIX G

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, 1987). 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.

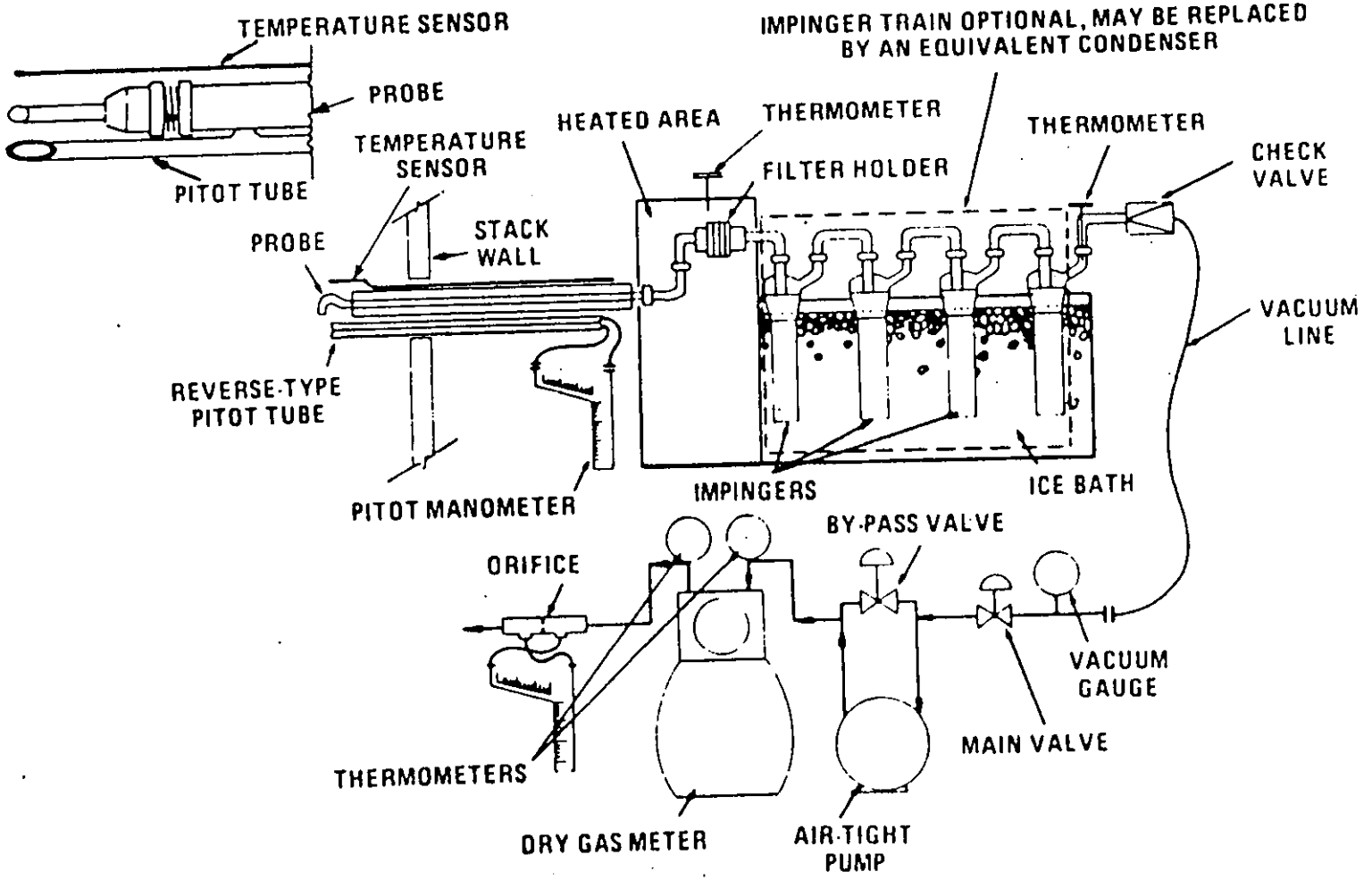
The sampling train consists of a heated glass or stainless steel-lined sampling probe equipped with a Type S pitot and a thermocouple. The probe is attached to a sampling module which houses the all-glass in line filter holder in a temperature controlled oven. In addition, the sampling module also houses 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.

When sampling is complete the filter is removed with tweezers and placed in a clean container. The nozzle, pitot tube 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 the rinse is transferred to a tared 120 cc porcelain evaporating dish. The acetone is then evaporated off at 97 - 105 ^{0}F. At this elevated temperature condensation of atmospheric moisture is prevented. The acetone-free sample is then dried at 105 ^{0}C for 30 minutes, cooled in a desiccator over Drierite, and weighed to the nearest 0.01 mg. The filter sample is transferred to a 6 inch watch glass and dried at 105 ^{0}C for two hours. The filter and watch glass are then cooled in a desiccator and the filter weighed to the nearest 0.01 mg. All weighings are performed in a balance room where the relative humidity is maintained at less than 50%. Microscopic examination of the samples is performed if any unusual characteristics are observed. The weight of the acetone rinse blank is subtracted from the samples. The Drierite column is weighed on-site and the water absorbed by the Drierite is added to the condensate to give the total amount of absorbed water.

3aP2(7)



Particulate sampling train.

APPENDIX H

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.

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

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

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

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

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

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

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

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

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

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

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

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

$\overline{V}_s$ = 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 I

SAMPLING TRAIN CALIBRATION DATA

Interpoll Laboratories, Inc.
(612) 786-6020

Meter Box Calibration and Usage Status

Date of Report: March 18, 1991

Meter Box No. : 4 (Rockwell Dry Test Meter Serial No. 964551)

Date of Last Calibration: March 1, 1991
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 4-8, 1991	1-3256	186.30	915.09	728.79	728.79
March 12, 1991	1-3257	924.40	1064.32	139.32	868.71

* Total volume through meter since last calibration.

Interpoll Laboratories, Inc.
(612) 786-6020

Meter Box Calibration and Usage Status

Date of Report: March 18, 1991

Meter Box No. : 9 (Rockwell Dry Test Meter Serial No. 949230)

Date of Last Calibration: January 18, 1991
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 25-29, 1991	1-3233	172.86	405.03	232.17	232.17
February 4, 1991	1-3239	406.30	530.43	124.13	356.30
February 8, 1991	1-3240	532.10	800.83	268.73	625.03
February 19, 1991	1-3244	806.00	935.10	129.10	754.13
March 12, 1991	1-3257	939.00	1090.30	151.30	905.43

* Total volume through meter since last calibration.

Date 3-1-91

Bar. Press. 28.57 in. Hg

INTERPOLL LABORATORIES, INC.
METER CALIBRATION SHEET
EPA METHOD 5

Control Module No. 4
Serial No. DTM 964553
Wet Test Meter No. AL-20
Technician E Townsend

ΔH (in. WC)		Gas Volume Wet Test Meter (ft^3)	* Cal. Index ♦ (%)	* Diff. Wet Test Meter ΔP_w (in.WC)	Gas Volume Dry test meter (ft^3)		Gas temperatures			Time θ	Meter Coeff.	Orifice Const.	C_f
							Wet Test	Dry Test					
nominal	actual				V_{di}	V_{df}	t_w (°F)	t_{di} (°F)	t_{do} (°F)	(min/sec)	Y	ΔHθ	
0.5	.5	2	99.70	0.01	164.500	166,516	73	83	79	4/46	1.0056	1.66	
1.2	1.2	3	99.77	0.03	161.000	164.027	73	81	78	4/40	.9977	1.70	
2.0	2.0	3	99.87	0.05	167.000	170.022	73	86	81	3/40	1.0056	1.73	
3.3	3.3	5	100.00	0.08	171.000	176,030	73	89	82	4/19	1.0085	1.77	
4.7	4.7	5	100.20	0.11	176,500	181,540	73	93	83	4/03	1.0095	1.77	
		2	3	4	5	6 7	8	9	10	11/12	1.0053	1.73	

Positive leak check performed by ET

Meter was in tolerance ☒

Meter was not in tolerance ☐; readjusted linkage

Meter was not in tolerance ☐; changed dry test meters

Approved by Daniel J Dwyer Date 3/4/91

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

S0102RR 5/90

Date 1-18-91

Bar. Press. 29.05 in. Hg

INTERPOLL LABORATORIES, INC.
METER CALIBRATION SHEET
EPA METHOD 5

Control Module No. 9
Serial No. DTM 949230
Wet Test Meter No. AL-20
Technician E Trevino

ΔH (in. WC)		Gas Volume Wet Test Meter (ft^3)	* Cal. Index ♦ (%)	* Diff. Wet Test Meter ΔP_w (in.WC)	Gas Volume Dry test meter (ft^3)		Gas temperatures			Time θ (min/sec)	Meter Coeff. Y	Orifice Const. ΔHθ	C_f
							Wet Test	Dry Test					
nominal	actual				V_{d1}	V_{df}	t_w (°F)	t_{d1} (°F)	t_{do} (°F)				
0.5	.5	2	99.70	0.01	134.000	136,056	78	90	88	5/01.20	.9912	1.82	
1.2	1.2	3	99.77	0.03	125,000	128,072	78	91	89	4/48.72	.9929	1.78	
2.0	2.0	3	99.87	0.05	136,500	139,570	78	93	89	3/45.05	.9943	1.80	
3.3	3.3	5	100.00	0.08	141,500	145,600	78	94	89	4/51.17	.9964	1.78	
4.7	4.7	5	100.20	0.11	146,500	151,601	78	95	90	4/09.60	.9964	1.95	
	2	3	4	5	6	7	8	9	10	11/12	.9942	1.80	

Positive leak check performed by ET

Meter was in tolerance ☒

Meter was not in tolerance ☐; readjusted linkage

Meter was not in tolerance ☐; changed dry test meters

Approved by Dennis J. Dyer Date 1/21/91

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

S0102RR 5/90

Interpoll Laboratories, Inc.
(612) 786-6060

EPA Method 5 Gas Metering System Quality Control Check Data Sheet

Job Cypress North Shore / Babbitt, MN Date 3-12-91

Operator M. Baehler Module No. 4

Instructions: Operate the control module at a flow rate equal to ^H@ for 10 minutes before attaching the umbilical. Record the following data:

Bar press 28.62 in. Hg. γ = 1.0053 ^H@ 1.73 in. W.C.

Time (min)	Volume (CF)	Meter Temp. (°F)	
		Inlet	Outlet
[redacted]	924.40	[redacted]	
2.5	926.28	28	22
5.0	928.18	30	23
7.5	930.07	31	24
10	931.90	32	25
[redacted]	V_m= 7.50	Avg(t_m) = 26.88	°F

Calculate Y_{cm} as follows:

$$Y_{cm} = \frac{1.786}{\gamma\ V_m}\left[\frac{(t_m + 460)}{P_b}\right]^{0.5}$$

$$Y_{cm} = \frac{1.786}{(1.0053)(7.50)}\left[\frac{(26.88) + 460}{(28.62)}\right]^{0.5}$$

$$Y_{cm} = .977$$

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

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

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EPA Method 5 Gas Metering System Quality Control Check Data Sheet

Job Cyprus North Mine Date 3-12-91

Operator [redacted] Module No. 9

Instructions: Operate the control module at a flow rate equal to ^H@ for 10 minutes before attaching the umbilical. Record the following data:

Bar press 28.62 in. Hg. γ = .994 ^H@ 1.80 in. W.C.

Time (min)	Volume (CF)	Meter Temp. (°F)	
		Inlet	Outlet
[redacted]	739.00	[redacted]	
2.5	40.78	35	31
5.0	942.70	37	32
7.5	944.54	39	33
10	946.40	40	33
[redacted]	V_m= 7.40	Avg(t_m) = 35.0	°F

Calculate Y_{cn} as follows:

$$Y_{cn} = \frac{1.786}{\gamma\ V_m}\left[\frac{(t_m + 460)}{P_b}\right]^{0.5}$$

$$Y_{cn} = \frac{1.786}{(.994)(\quad)}\left[\frac{(35\quad) + 460}{(28.62)}\right]^{0.5} 4/155$$

$$Y_{cn} = 1.01$$

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

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

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Nozzle Calibration

Data Sheet

Date of Calibration: 03-12-91 Nozzle Number 1-4

Technician: E. Trowbridge

The nozzle is rotated in 60 degree increments and the diameter at each point is measured to the nearest 0.001 inch. The observed readings and average are shown below.

Position	Diameter (inches)
1	.240
2	.241
3	.240
Average:	.240

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Nozzle Calibration
Data Sheet

Date of Calibration: 03-12-91 Nozzle Number 2-4
Technician: M. Kaehler

The nozzle is rotated in 60 degree increments and the diameter at each point is measured to the nearest 0.001 inch. The observed readings and average are shown below.

Position	Diameter (inches)
1	.244
2	.244
3	.246
Average:	.245

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S-Type Pitot Tube Inspection Sheet

Pitobe No. 4-21

Pitot tube dimensions:

1. External tubing diameter (D_t) .316 IN.
2. Base to Side A opening plane (P_A) .460 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" .00
9. W <.0625" .00

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) .761 IN.

Date of Inspection: 2-1-91

Inspected by: E Trautwolf

S-348(1)

Interpoll Laboratories
(612)786-6020

S-Type Pitot Tube Inspection Sheet

Pitobe No. 5-21

Pitot tube dimensions:

1. External tubing diameter (D_t) .316 IN.
2. Base to Side A opening plane (P_A) .460 IN.
3. Base to Side B opening plane (P_B) .461 IN.

Alignment:

4. α_1 <10° 0
5. α_2 <10° 0

6. B_1 < 5° 1
7. B_2 < 5° 2

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

Distance from Pitot to Probe Components:

10. Pitot to 0.500 IN. nozzle .762 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: 2-1-91

Inspected by: E Clark

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Interpoll Laboratories, Inc.

Temperature Measurement Device
Calibration Sheet

Unit under test:
Vendor Gordon
Model 5310 -K Serial Number PDT #9
Range -112 to 1999 °F °F Thermocouple Type K
Date of Calibration 12/14/90 Technician Duane Van Hoeven

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		-4.4	4.4	.96
100		92.8	8.2	1.28
200		197	3	.45
300		294	6	.79
400		390	10	1.16
500		489	11	1.14
600		591	9	.85
700		690	10	.86
800		794	6	.48
900		895	5	.37
1000		999	1	.06
1100		1101	1	.06
1200		1204	4	.24
1300		1304	4	.22
1400		1407	7	.38
1500		1503	3	.15
1600		1602	2	.1
1700		1695	5	.23
1800		1792	8	.35
1900		1882	18	.74
2000		1975	25	1.02
2100				
		Averages:	7.12°	.57%

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.

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Interpoll Laboratories, Inc.

Temperature Measurement Device Calibration Sheet

Unit under test:

Vendor FLUKE #12

Model 51 Serial Number 50303775

Range 0 – 2100 °F Thermocouple Type K

Date of Calibration 1/15/91 Technician E. TROWBRIDGE

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	1.0	+1	.21
100	100	100.6	+.6	.10
200	200	203.0	+3.0	.45
300	300	301.6	+1.6	.21
400	400	400	—	—
500	500	501	+1.0	.10
600	600	602.8	+2.8	.26
700	700	700.6	+.6	.05
800	800	802.4	+2.4	.19
900	900	900.6	+.6	.04
1000	1000	1002.2	+2.2	.15
1100	1100	1101.6	+1.6	.10
1200	1200	1203.8	+3.8	.22
1300	1300	1301.0	+1.0	.05
1400	1400	1404.0	+4.0	.21
1500	1500	1501.4	+1.4	.07
1600	1600	1602.4	+2.4	.11
1700	1700	1701.2	+1.2	.05
1800	1800	1802.6	+2.6	.11
1900	1900	1900	—	—
2000	2000	2002.2	+2.2	.08
2100	2100	2099.4	-.6	.02
		Averages:	1.66	.12

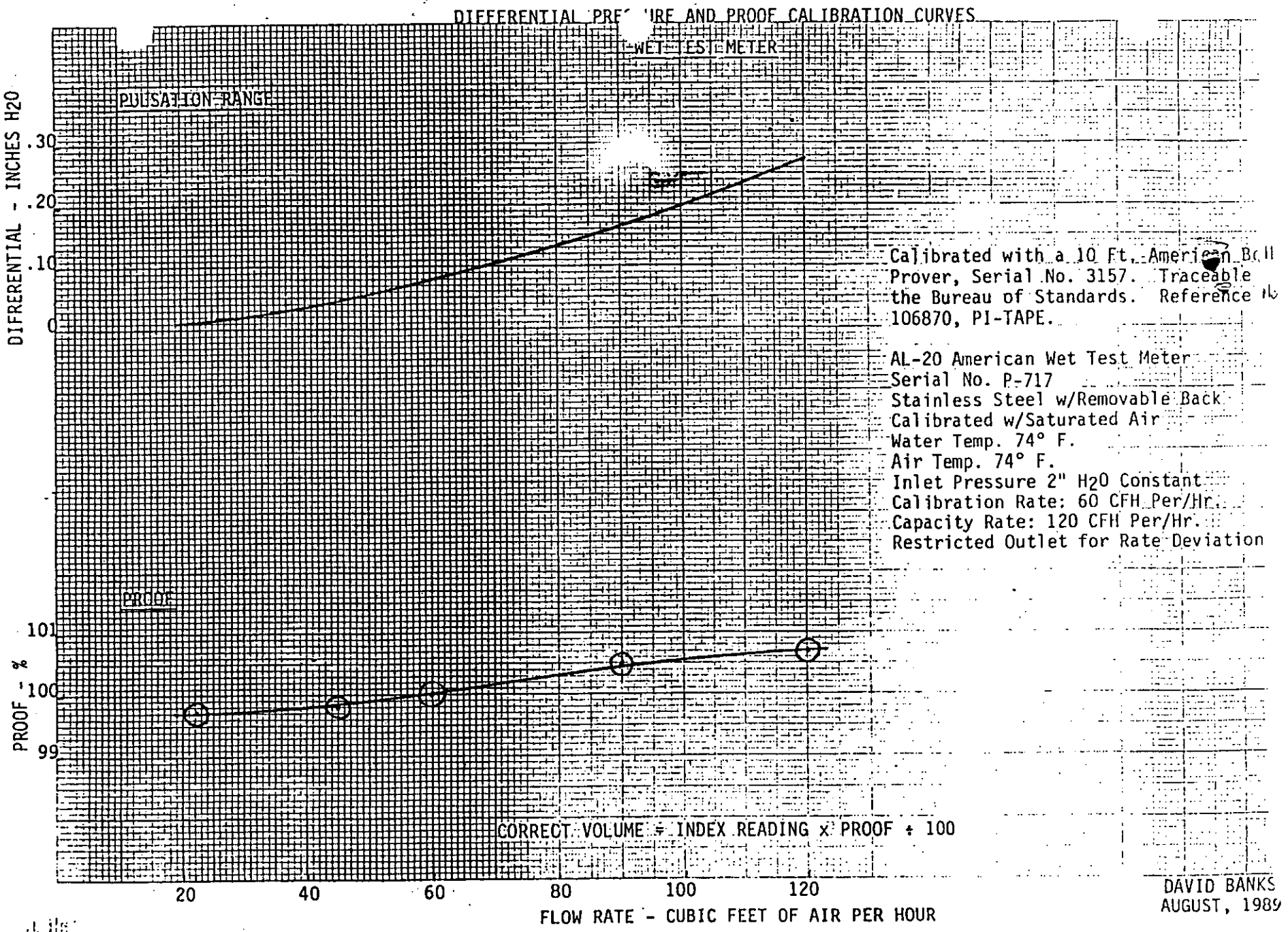
OF = off scale response by unit under test (°F)

% 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
DIFRERENTIAL - INCHES H20
.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