Background Report Reference

AP-42 Section Number: 10.6.1

Background Report Section: 4

Reference Number: 34

Title: Results of The February 1, 1994 Air Emission Compliance Tests on the GEKA at the Louisian Pacific Waferboard Plant In Tomahawk, WI

Interpoll Laboratories, Inc.

February 1994

Interpoll Laboratories, Inc.
4500 Ball Road N.E.
Circle Pines, Minnesota 55014-1819

TEL: (612) 786-6020
FAX: (612) 786-7854

RESULTS OF THE FEBRUARY 1, 1994 AIR EMISSION COMPLIANCE TEST ON THE GEKA AT THE LOUISIANA PACIFIC WAFERBOARD PLANT IN TOMAHAWK, WISCONSIN

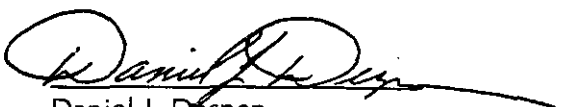
Submitted to:

LOUISIANA PACIFIC CORPORATION
Route 8, Box 8263
Hayward, Wisconsin 54843

Attention:

Sue Somers

Approved by:



Daniel J. Despen
Manager
Stationary Source Testing Department

Report Number 4-2197
February 4, 1994
KE/kce

Louisiana-Pacific Corporation

Route 8, Box 8263
Hayward, Wisconsin 54843
715/634-3454

14)
4-34)

February 17, 1994

Director, Stationary Source Compliance Division
Director, Office of Civil Enforcement
Environmental Protection Agency
401 M. Street, S.W.
Washington, D.C. 20560
ATTN: Mr. Laxmi Kesari

EPA Regional Administrator
USEPA - Region 5
Mail Code: R-19J
77 W. Jackson Blvd.
Chicago, IL 60604
ATTN: Mr. Ferro Assadi

Wisconsin DNR
Bureau of Air Management
P.O. Box 7921
101 S. Webster
Madison, WI 53703
ATTN: Joe Perez

SUBJECT: Emissions testing at the Tomahawk OSB Manufacturing Facility - Thermal Oil Heater testing conducted February 1, 1994.

Gentlemen:

Enclosed please find one copy of Interpoll Laboratories report no. 4-2197 entitled "Results of the February 1, 1994 Air Emission Compliance test on the Geka at the Louisiana-Pacific OSB Plant in Tomahawk, Wisconsin."

Particulate testing was performed to demonstrate compliance with the air emission permit issued for this facility by the State of Wisconsin, and in response to a Notice of Violation issued to the facility on November 9, 1993.

The NOV resulted from the failure of this equipment to perform as designed during initial compliance testing conducted August 1993. In addition, CO testing was conducted to demonstrate compliance under high winter loading rates.

My review of these results indicate that the unit is operating within permit limits with particulate emissions of 0.018 lb/MM BTU (permit limit of 0.15 lb/MM BTU), and CO emissions of 4.0 lb/Ton of dry fuel (permit limit of 17.8 lb/Ton of dry fuel).

If you have any questions or comments regarding this information please contact me.

Sincerely,

S. M. Somers

Susan Somers

cc: Chris Forslund w/enc.
Elizabeth Smith w/enc.
Biren Patel w/enc.
Norman Radford w/enc.
Bert Krages w/enc.
Jim Evensen w/enc.
Michele De Brock-Owens w/enc.

ABBREVIATIONS

ACFM	actual cubic feet per minute
cc (ml)	cubic centimeter (milliliter)
DSCFM	dry standard cubic foot of dry gas per minute
DSML	dry standard milliliter
DEG-F (°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
<	≤ (when following a number)

Standard contitions are defined as 68°F (20°C) and 29.92 IN. of mercury pressure.

g:\stack\wp\misc\abbrev.frm

TABLE OF CONTENTS

1 INTRODUCTION

On February 1, 1994 Interpoll Laboratories personnel conducted a particulate and carbon monoxide emission compliance test on the Thermal Oil Heater at the Louisiana Pacific Corporation (LP) Waferboard Plant located in Tomahawk, Wisconsin. On-site testing was performed by R. Rosenthal and D. Marso. Coordination between testing activities and plant operation was provided by Sue Somers of LP. The test was witnessed by Biren Patel of the Wisconsin DNR.

The Thermal Oil Heater tested was manufactured by GEKA in 1992. It is equipped with a ram-type stoker and is fired with a mixture of wet bark and wood. The unit has a design heat input capacity of 30 10^6BTU/HR. Particulate emissions from the GEKA are controlled by a large diameter cyclone in series with a fabric filter dust collector manufactured by C.E. Preheater. The baghouse has a pulsed air cleaning system. Cleaned flue gas is emitted to the atmosphere by a 75-foot high radial steel stack which has a diameter of 42 inches.

Particulate evaluations were performed in accordance with EPA Methods 2-5, CFR Title 40, Part 60, Appendix A (revised July 1, 1992). A preliminary determination of the gas linear velocity profile was made before the first particulate determination to allow selection of the appropriate nozzle diameter for isokinetic sample withdrawal. An Interpoll Labs sampling train which meets or exceeds specifications in the above-cited reference was used to isokinetically extract particulate samples by means of a heated glass-lined probe. Wet catch samples were collected in the back half of the Method 5 sampling train and analyzed in accordance with Wisconsin DNR protocol.

Integrated flue gas samples were extracted using a specially designed gas sampling system. Integrated flue gas samples were collected in 44-liter Tedlar bags housed in a protective aluminum container. After sampling was complete, the bags were sealed and analyzed on site or returned to the laboratory for Orsat analysis. Prior to sampling, the Tedlar bags are leak checked at 15 IN.HG. vacuum with an in-line rotameter. Bags with any detectable inleakage are discarded. The integrated flue gas samples were also analyzed for carbon monoxide in accordance with EPA Method 10 (NDIR).

Testing on the Thermal Oil Heater was conducted from two test ports oriented at 90 degrees on the stack. These test ports are located 6.1 stack diameters from the nearest flow disturbance and 2.3 diameters from the stack exit. A 24-point traverse was used to collect representative samples. Each traverse point was sampled for 2.5 minutes to give a total sampling time of 60 minutes per run.

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 important results of the particulate emission compliance test are summarized in Tables 1a and 1b. As will be noted, the particulate concentration averaged 0.0031 GR/DSCF (dry + organic/inorganic wet catch) and 0.00075 GR/DSCF (dry catch only) and the particulate emission factor averaged 0.018 LB/10^6BTU (dry + organic/inorganic wet catch) and 0.0043 LB/10^6 BTU (dry catch only).

A summary of the carbon monoxide results is presented in Table 2. The carbon monoxide concentration averaged 67 ppm,d with a corresponding emission factor of 0.20 LB/10^6BTU.

No difficulties were encountered in the field by Interpoll Labs or in the laboratory evaluation of the samples which were conducted by Interpoll Labs. 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.

2 SUMMARY AND DISCUSSION

The important results of the particulate emission compliance test are summarized in Tables 1a and 1b. As will be noted, the particulate concentration averaged 0.0031 GR/DSCF (dry + organic/inorganic wet catch) and 0.00075 GR/DSCF (dry catch only) and the particulate emission factor averaged 0.018 LB/10^6BTU (dry + organic/inorganic wet catch) and 0.0043 LB/10^6 BTU (dry catch only).

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Table 1a Summary of the Results of the February 1, 1994 Particulate Emission Test on the GEKA Stack at the Louisiana Pacific Plant Located in Tomahawk, Wisconsin.

ITEM		Run 1	Run 2	Run 3
Date of test		02-01-94	02-01-94	02-01-94
Time runs were done	(HRS)	1105/1213	1315/1425	1516/1627
Dry fuel burned	(TON/HR)	1.22	1.22	1.22
Volumetric flow				
actual	(ACFM)	29644	30110	29939
standard	(DSCFM)	16457	16642	16671
Gas temperature	(DEG-F)	365	362	359
Moisture content	(%V/V)	6.88	7.70	7.35
Gas composition	(%V/V,dry)			
carbon dioxide		4.50	4.30	4.50
oxygen		16.10	16.30	16.10
nitrogen		79.40	79.40	79.40
Isokinetic variation	(%)	99.4	100.0	99.7
Particulate concentration				
actual	(GR/ACF)	.00181	.00195	.00137
standard	(GR/DSCF)	.00327	.00352	.00247
Part. emission rate	(LB/HR)	0.461	0.502	0.352
Part. emission factor	($LB/10^6BTU$)	0.0188	0.0211	0.0142

Note: Dry + Organic/Inorganic Wet Catch

Emission Factor calculated using the dry oxygen F-Factor method (F-Factor = 9240 $DSCF/10^6BTU$)

Table 1b Summary of the Results of the February 1, 1994 Particulate Emission Test on the GEKA Stack at the Louisiana Pacific Plant Located in Tomahawk, Wisconsin.

ITEM		Run 1	Run 2	Run 3
Date of test		02-01-94	02-01-94	02-01-94
Time runs were done	(HRS)	1105/1213	1315/1425	1516/1627
Dry fuel burned	(TON/HR)	1.22	1.22	1.22
Volumetric flow				
actual	(ACFM)	29644	30110	29939
standard	(DSCFM)	16457	16642	16671
Gas temperature	(DEG-F)	365	362	359
Moisture content	(%V/V)	6.88	7.70	7.35
Gas composition	(%V/V,dry)			
carbon dioxide		4.50	4.30	4.50
oxygen		16.10	16.30	16.10
nitrogen		79.40	79.40	79.40
Isokinetic variation	(%)	99.4	100.0	99.7
Particulate concentration				
actual	(GR/ACF)	.00032	.00032	.00061
standard	(GR/DSCF)	.00058	.00057	.00110
Part. emission rate	(LB/HR)	0.082	0.082	0.157
Part. emission factor	($LB/10^6BTU$)	0.0033	0.0034	0.0063

Note: Dry Catch Only

Table 2. Summary of the February 1, 1994 Carbon Monoxide Emission Compliance Test on the Thermal Oil Heater at the Louisiana Pacific Waferboard Plant in Tomahawk, Wisconsin.

Time	Concentration (ppm,d)	Emission Rate (LB/HR)	(LB/TDF)	Emission Factor (LB/10^6BTU)
1105-1213	78	5.6	4.6	0.23
1315-1425	61	4.4	3.6	0.18
1745-1850	61	4.5	3.7	0.18
Avg.	67	4.8	4.0	0.20

TDF = Ton of Dry Fuel (1.22 TPH 2/1/94)

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 carbon monoxide results. 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 emission rates have been calculated using the product of the concentration times flow method.

3.1 Results of Orsat and Moisture Determinations

Test No. 1
GEKA Stack

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

Date of run	Run 1 02-01-94	Run 2 02-01-94	Run 3 02-01-94
Dry basis (orsat)			
carbon dioxide.....	4.50	4.30	4.50
oxygen.....	16.10	16.30	16.10
nitrogen.....	79.40	79.40	79.40
Wet basis (orsat)			
carbon dioxide.....	4.19	3.97	4.17
oxygen.....	14.99	15.05	14.92
nitrogen.....	73.94	73.29	73.56
water vapor.....	6.88	7.70	7.35
Dry molecular weight.....	29.36	29.34	29.36
Wet molecular weight.....	28.58	28.47	28.53
Specific gravity.....	0.987	0.983	0.985
Water mass flow.....(LB/HR)	3410	3892	3712
FO	1.067	1.070	1.067

3.2 Results of Particulate Determinations

Test No. 1
GEKA Stack

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

	Run 1	Run 2	Run 3
Date of run	02-01-94	02-01-94	02-01-94
Time run start/end.....(HRS)	1105/1213	1315/1425	1516/1627
Static pressure.....(IN.WC)	-0.35	-0.35	-0.35
Cross sectional area (SQ.FT)	9.62	9.62	9.62
Pitot tube coefficient.....	.840	.840	.840
Water in sample gas			
condenser.....(ML)	0.0	0.0	0.0
impingers.....(GRAMS)	48.0	52.0	51.0
desiccant.....(GRAMS)	6.0	10.0	8.0
total.....(GRAMS)	54.0	62.0	59.0
Total particulate material..			
.....collected(grams)	0.0073	0.0080	0.0056
Gas meter coefficient.....	0.9981	0.9981	0.9981
Barometric pressure..(IN.HG)	27.91	27.92	27.92
Avg. orif.pres.drop..(IN.WC)	1.22	1.28	1.29
Avg. gas meter temp..(DEF-F)	61.9	71.5	75.4
Volume through gas meter....			
at meter conditions...(CF)	36.49	37.78	38.04
standard conditions.(DSCF)	34.47	35.06	35.04
Total sampling time....(MIN)	60.00	60.00	60.00
Nozzle diameter.....(IN)	.249	.249	.249
Avg.stack gas temp ..(DEG-F)	365	362	359
Volumetric flow rate.....			
actual.....(ACFM)	29644	30110	29939
dry standard.....(DSCFM)	16457	16642	16671
Isokinetic variation.....(%)	99.4	100.0	99.7
Particulate concentration...			
actual.....(GR/ACF)	0.00181	0.00195	0.00137
dry standard.....(GR/DSCF)	0.00327	0.00352	0.00247
Particle mass rate...(LB/HR)	0.461	0.502	0.352

3.3 Results of Carbon Monoxide Determinations

Test No. 1
GEKA Stack

Results of CO Determinations ----------Method 10

	Run 1	Run 2	Run 3
Date of run	02-01-94	02-01-94	02-01-94
Time run start/end.....(HRS)	1105/1213	1315/1425	1516/1627
Total sampling time....(MIN)	60.0	60.0	60.0
Moisture content.....(%V/V)	6.88	7.70	7.35
O2 Concentration.....(%V/V)	16.10	16.30	16.10
Volumetric flow rate (DSCFM)	16457	16642	16671
CO concentration.....			
(GR/DSCF).....	0.0395	0.0309	0.0311
(MG/DSCM).....	90.52	70.83	71.30
(PPM-WET).....	72.35	56.12	56.70
(PPM-DRY).....	77.70	60.80	61.20
(PPM-DRY @ 7% O2).....	222.00	181.11	174.86
CO emission rate.....(LB/HR)	5.577	4.413	4.450
CO emission factor ($LB/10^6BTU$)...	0.23	0.18	0.18

Emission factor calculated using the dry O_2 F-factor method
F-factor = 9240 $DSCF/10^6BTU$

CO = Carbon monoxide

A trailing '<' symbol indicates that the true value is less than or equal to the reported value

4 RESULTS OF FUEL ANALYSIS

INTERPOLL LABORATORIES, INC.
Fuel Laboratory
(612) 786-6020

2/11/94

Client : LOUISIANA PACIFIC/TOMAHAWK

Laboratory Log Number : 2197-08-7111

Sample Type: WOOD/BARK

Sample Identification : TEST 1, RUNS 1,2,3

Short Proximate Analysis WT %

Parameter	Moisture & Ash Free	Moisture Free	As Received
Moisture, Total			46.47
Ash		1.79	0.96
Sulfur	0.23	0.23	0.12
Heating Value, BTU/LB.	9582	9410	5037

Respectfully submitted,

Jeannie F. O'Neil, Manager
Inorganic Chemistry Group

APPENDIX A

RESULTS OF VOLUMETRIC FLOW RATE DETERMINATIONS

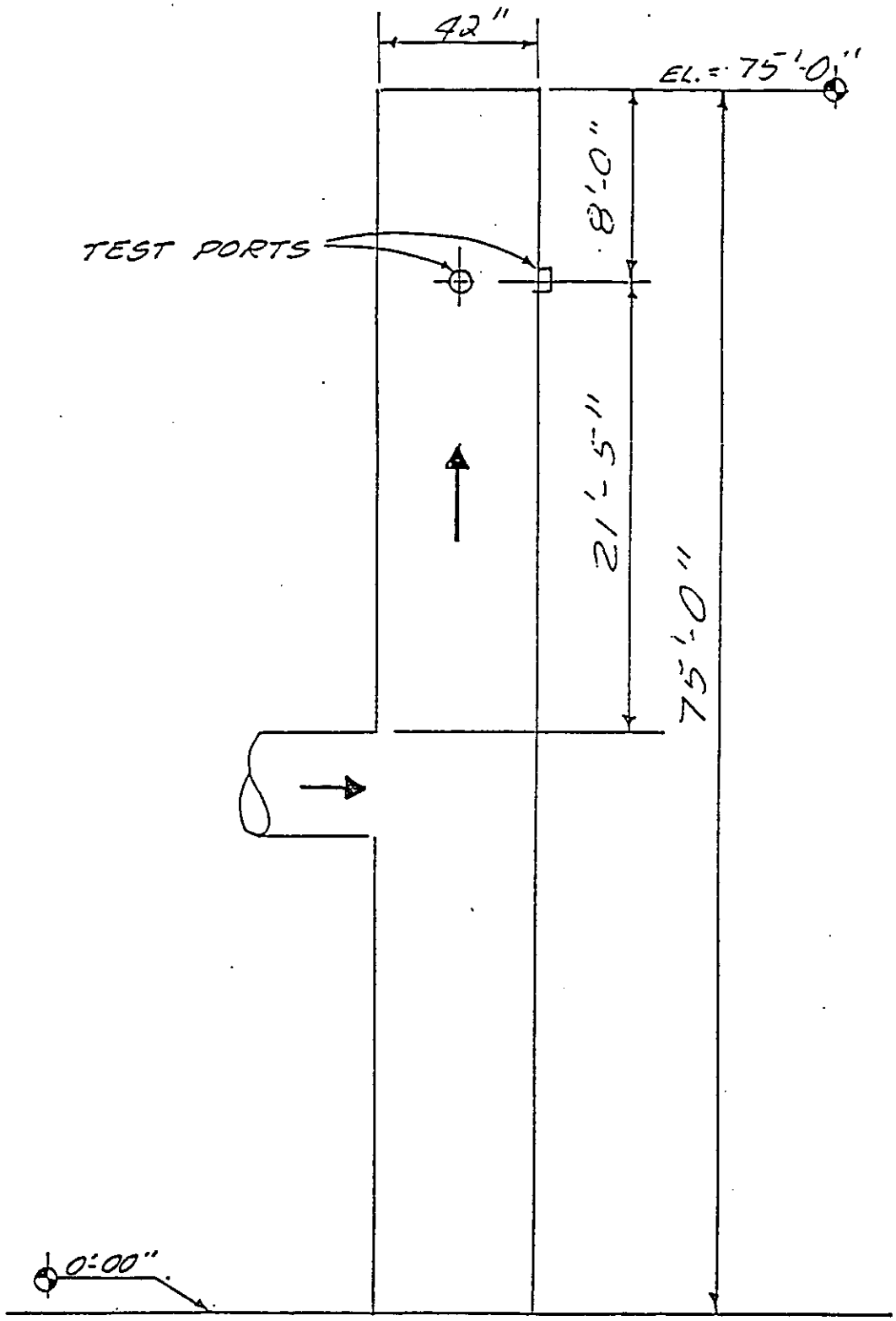
Test No. 1
GEKA Stack

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

Date of Determination.....	02-01-94
Time of Determination.....(HRS)	1000
Barometric pressure.....(IN.HG)	27.92
Pitot tube coefficient.....	.84
Number of sampling ports.....	1
Total number of points.....	12
Shape of duct.....	Round
Stack diameter.....(IN)	42
Duct area.....(SQ.FT)	9.62
Direction of flow.....	UP
Static pressure.....(IN.WC)	-.35
Avg. gas temp.....(DEG-F)	365
Moisture content.....(% V/V)	8.15
Avg. linear velocity.....(FT/SEC)	53.3
Gas density.....(LB/ACF)	.04406
Molecular weight.....(LB/LBMOLE)	29.36
Mass flow of gas.....(LB/HR)	81375
Volumetric flow rate.....	
actual.....(ACFM)	30779
dry standard.....(DSCFM)	16868

APPENDIX B

LOCATION OF TEST PORTS



L-P TOMAHAWK
THERMAL OIL HEATER STACK

20,000 - 32,600 ACFM

250 - 350° F

N.T.S.

APPENDIX C

FIELD DATA SHEETS

INTERPOLL LABORATORIES - EPA METHOD 2 FIELD DATA SHEET

Job L.P. / TOMAHAWK 2197
Source GEKA STACK
Test 1 Run 0- Date 2-1-94
Stack dimen. 42 IN.
Dry bulb 365 °F Wet bulb 131 °F
Manometer: ☐ Reg. ☐ Exp. ☐ Elec.
Barometric pressure 27.92 in Hg
Static pressure -.35 in WC
Operators RON ROSENTHAL; DENNIS TARSO
Pitot No. 31Y-4' C_p .840

Cross-section View	Elevation View

Drawing of Test Site

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: 1.75 in.		Time start:	hrs
A- 1	.021	1.00	2.75	.39	
2	.067	2.81	4.56	.44	
3	.118	4.96	6.71	.51	
4	.177	7.43	9.18	.55	
5	.250	10.50	12.25	.58	
6	.356	14.95	16.70	.56	
7	.644	27.05	28.80	.57	
8	.750	31.50	33.25	.55	
9	.823	34.57	36.32	.57	
10	.882	37.04	38.79	.55	
11	.933	39.19	40.94	.55	365
12	.979	41.00	42.75	.56	
B- 1					
2					
3					
4					
5					
6					
7				FT/SEC 5334	
8				ACFM 30776	
9				DSCFM 16905	
10					
11					
12					

Temp. meas. device & S/N: Time end: hrs

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

INTERFOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job LP/Tomahawk 2197 Date 2-1-94 Test 1 Run 1
Source GEKA STACK No. of traverse points 24
Method 5 Filter holder: 4" glass Filter type: glass fibre

Sample Train Leak Check:

Pretest: 0.02 cfm at 15 in. Hg. (vac) ☒
Postest: .00 cfm at 8 in. Hg. (vac) ☒
PZ70% @ 10 zw h.g. 0 cc/mzw

Particulate Catch Data:

No.s of filters used: 5500

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

No. of probe wash bottles: 1
Sample recovered by: R.R. & D.M.

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1	537	489	48
Impinger No. 2			
Impinger No. 3			
Condenser			
Desiccant	1397	1391	6
Total			54

Integrated Gas Sampling Data:

Bag Pump No. 31A Box No. 16 Bag No. 1
Bag Material: 5-layer Aluminized Tedlar Size: 44 L
Pretest leak check: 0 cc/min at 8 in. Hg.
Time start: 1105 (HRS) Time end: 1213 (HRS)
Sampling rate: 400 cc/min Operator: RR
S/N of O_2 Analyzer used to monitor train outlet: 4

CF-023

INTERPOLL LABORATORIES EPA METHOD 5 FIELD DATA SHEET

DF-011

Job LP/TOMAHAWK 2197 Operators R.R. & D.M. Pitot No. 31v. 4' Cp .840

Source CEKA STACK Meter Box No. 12 ΔH 1.86 IN WC Bar. Press. 27.91 inHg H2O ☐ X

Date 2-1-94 Test 1 Run 1 Cosmeter coeff: .9981 Nozzle No. 9-4 Nozzle Dia .249 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	Impy.	Gas/In	Gas/Out	Oxygen (%v/v)
	1105	313.47											
B- 12	2.5	315.08	.55	1.32	5.03	5	362	267	269	53	53	50	17.0
11	5	316.67	.59	1.42	6.67	5	362	267	269	52	54	52	16.2
10	7.5	318.29	.59	1.42	8.30	5	366	267	268	53	56	52	16.0
9	10	319.85	.52	1.25	9.83	5	372	271	269	53	58	57	16.2
8	12.5	321.42	.51	1.23	1.35	5	372	263	263	54	59	54	16.4
7	15	322.86	.48	1.16	2.83	5	372	259	269	56	60	55	16.3
6	17.5	324.32	.47	1.13	4.29	5	372	254	271	56	62	55	16.1
5	20	325.78	.50	1.21	5.81	5	369	250	270	56	63	55	16.2
4	22.5	327.30	.51	1.24	7.34	5	368	245	268	57	64	57	15.9
3	25	328.69	.44	1.08	8.77	5	364	235	264	58	65	657	16.2
2	27.5	330.15	.40	1.05	0.19	5	365	232	273	59	65	58	16.1
1	30	331.55	.38	.93	1.52	5	365	230	273	60	67	59	15.9
A- 12	32.5	333.12	.53	1.31	3.10	5	362	229	269	57	62	58	16.2
11	35	334.70	.55	1.35	4.71	5	361	233	266	57	65	59	16.1
10	37.5	336.29	.54	1.33	6.30	5	363	238	272	57	67	60	16.1
9	40	337.90	.56	1.38	7.92	5	362	241	267	58	68	61	16.3
8	42.5	339.49	.55	1.36	9.54	5	363	242	264	58	70	61	16.4
7	45	341.14	.57	1.41	1.18	5	366	244	265	59	71	62	15.9
6	47.5	342.72	.52	1.28	2.75	5	367	245	267	60	72	63	16.4
5	50	344.40	.58	1.44	4.41	6	365	246	268	60	72	63	16.6
4	52.5	346.03	.54	1.34	6.02	6	366	243	269	60	73	64	16.6
3	55	347.50	.43	1.07	7.46	5	362	241	264	60	73	64	16.5
2	57.5	348.93	.38	.95	8.81	4	362	240	269	60	74	65	15.9
1	60	349.96	.25	.62	9.91	4	362	236	272	61	74	65	16.1
	(1213)												
	θ = 60	Vm = 36.49		ΔH = 1.22							Avg. = 61.9		

C-3

S-0037R

INTERPOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job LP/TOMAHAWK 2197 Date 2-1-94 Test 1 Run 2
Source GEKA 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 7 in. Hg. (vac) ☒
PITOTS 0 cc/min @ 10 in Hg.

Particulate Catch Data:

No.s of filters used: 5501

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

No. of probe wash bottles: 1
Sample recovered by: R.R. & D.M.

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1	545	493	52
Impinger No. 2			
Impinger No. 3			
Condenser			
Desiccant	1332	1322	10
Total			62

Integrated Gas Sampling Data:

Bag Pump No. 3/A Box No. 16 Bag No. 2
Bag Material: 5-layer Aluminized Tedlar Size: 44 L
Pretest leak check: 0 cc/min at 10 in. Hg.
Time start: 1315 (HRS) Time end: 1425 (HRS)
Sampling rate: 400 cc/min Operator: RR
S/N of O_2 Analyzer used to monitor train outlet: 4

CF-023

S-0046RR

LF-011

INTERPOLL LABORATORIES EPA METHOD 5 FIELD DATA SHEET

Job LP/TOMAHAWK 2197 Operators R.R. D.M Pitot No. 31r-4' Cp .840
Source GEA STACK Meter Box No. 1 ΔH 1.92 IN WC Bar. Press. 27.92 inHg H2O δ x
Date 2-1-94 Test 1 Run 2 Counter coeff. .9981 Nozzle No. 9-4 Nozzle Dia .249 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	Dwyr	Impy.	Gas/In	Gas/Out	Oxygen (x v/v)
	(1315)	350.40											
A-12	2.5	351.95	.50	1.24	1.94	5	357	230	233	51	64	63	16.8
11	5	353.60	.58	1.44	3.60	5	360	232	236	52	67	64	16.3
10	7.5	355.27	.59	1.47	5.27	6	360	239	237	52	68	64	16.1
9	10	356.98	.57	1.42	6.92	6	362	244	243	51	71	65	16.5
8	12.5	358.59	.55	1.37	8.55	6	362	244	246	51	71	65	16.5
7	15	360.23	.57	1.42	0.20	5	361	244	242	51	73	67	16.4
6	17.5	361.84	.54	1.35	1.82	5	361	244	246	52	73	67	16.2
5	20	363.44	.54	1.35	3.44	5	360	244	259	52	74	67	16.1
4	22.5	364.99	.51	1.28	5.02	5	358	244	268	52	75	67	16.4
3	25	366.52	.48	1.21	6.55	5	357	243	265	51	76	68	16.3
2	27.5	368.02	.43	1.08	8.00	5	359	243	268	50	76	68	16.0
1	30	369.42	.38	.96	9.36	5	360	241	269	50	77	69	16.1
B-12	32.5	371.12	.52	1.31	0.96	5	360	238	266	49	71	69	16.2
11	35	372.67	.58	1.45	2.64	5	360	243	270	49	74	69	16.3
10	37.5	374.37	.59	1.48	4.33	5	363	244	270	49	75	69	16.1
9	40	376.09	.55	1.38	5.96	5	365	246	269	49	76	70	16.5
8	42.5	377.72	.57	1.43	7.63	5	367	247	268	49	77	70	15.9
7	45	379.31	.54	1.35	9.25	5	368	246	261	48	77	71	16.3
6	47.5	380.84	.50	1.25	0.81	5	367	244	267	49	78	70	16.2
5	50	382.35	.48	1.21	2.35	5	364	243	270	49	79	71	16.2
4	52.5	383.89	.47	1.19	3.87	5	363	240	270	49	79	71	16.1
3	55	385.33	.48	1.21	5.41	5	363	240	269	49	80	72	16.1
2	57.5	386.86	.46	1.16	6.91	5	365	240	269	49	80	72	16.2
1	60	388.18	.31	.78	8.15	5	365	240	269	48	80	73	15.9
	(1425)												
	θ = 60	Vm = 37.78		ΔH = 1.28							Avg. = 71.5		

C-5

S-0037R

INTERPOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job LP/TOMAHAWK 2197 Date 2-1-94 Test 1 Run 3
Source GEKA STACK No. of traverse points 24
Method 5 Filter holder: 4" glass Filter type: glass fibre

Sample Train Leak Check:

Pretest: < 0.02 cfm at 15 in. Hg. (vac) ☒
Postest: .00 cfm at 7 in. Hg. (vac) ☒
Pitots 0 cc/min @ 10 in h.g.

Particulate Catch Data:

No.s of filters used: 5847

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

No. of probe wash bottles: 1
Sample recovered by: R.R. & D.M.

Condensate Data:

Item	Weight (g)		
	Final	Tare	Difference
Impinger No. 1	549	498	51
Impinger No. 2			
Impinger No. 3			
Condenser			
Desiccant	1405	1397	8
Total			59

Integrated Gas Sampling Data:

Bag Pump No. 31A Box No. 16 Bag No. 3
Bag Material: 5-layer Aluminized Tedlar Size: 44 L
Pretest leak check: 0 cc/min at 10 in. Hg.
Time start: 1516 (HRS) Time end: 1627 (HRS)
Sampling rate: 400 cc/min Operator: RR
S/N of O_2 Analyzer used to monitor train outlet: 4

CF-023

S-0046RR

INTERPOLL LABORATORIES EPA METHOD 5 FIELD DATA SHEET

CF-011

Job LP/TOMAHAWK 2197
Source GEKA STACK
Date 2-1-94 Test 1 Run 3

Operators R.R. ; D.m.
Meter Box No. 7 ΔH@ 1.96 IN WC
Gasmeter coeff. .9981

Pitot No. 3IV-4 Cp .84
Bar. Press. 27.82 inHg H2O 5 %
Nozzle No. 9-4 Nozzle Dia .244 IN.

Traverse Point No.	Sampling Time (min)	Sample Volume (cf)	Velocity Head (inWC)	Orifice Meter (inWC)	Des. Vol. (cf)	VAC. inHg	Stack (°F)	Probe (°F)	Oven (°F)	Impg. (°F)	Gas/In (°F)	Gas/Out (°F)	Oxygen (%v/v)
	1576	388.45											
B- 12	2.5	390.20	.58	1.46	0.13	6	360	227	227	45	69	68	17.0
11	5	391.90	.59	1.47	1.81	6	361	228	227	45	71	69	16.8
10	7.5	393.58	.60	1.50	3.52	6	361	229	228	45	72	69	16.6
9	10	395.27	.58	1.45	5.19	6	361	229	229	45	74	70	16.5
8	12.5	396.90	.57	1.43	6.86	5	361	231	234	46	75	71	16.3
7	15	398.48	.55	1.39	8.50	5	361	234	236	46	77	71	16.4
6	17.5	400.07	.54	1.36	0.13	5	361	235	239	47	77	71	16.5
5	20	401.67	.51	1.29	1.72	5	360	235	240	47	78	72	16.2
4	22.5	403.23	.50	1.27	3.29	5	358	233	241	48	79	73	16.6
3	25	404.84	.48	1.22	4.84	5	355	230	243	49	79	73	16.6
2	27.5	406.21	.42	1.07	6.29	4	357	229	245	49	80	73	16.1
1	30	407.59	.33	.84	7.57	4	360	228	248	49	80	73	16.7
A- 12	32.5	409.21	.53	1.35	9.19	5	360	228	247	49	74	72	16.7
11	35	410.82	.51	1.29	0.77	5	360	236	253	50	77	73	16.6
10	37.5	412.42	.54	1.38	2.41	5	355	240	256	50	78	73	16.3
9	40	414.00	.50	1.27	3.99	5	356	244	258	51	79	73	16.6
8	42.5	415.58	.53	1.35	5.62	5	356	245	259	51	81	74	16.4
7	45	417.23	.57	1.46	7.30	5	357	246	259	51	81	74	16.2
6	47.5	418.91	.54	1.38	8.95	5	357	244	263	52	82	74	16.3
5	50	420.53	.52	1.32	0.56	5	360	244	264	52	82	75	16.3
4	52.5	422.17	.51	1.30	2.16	5	361	240	263	52	83	75	16.5
3	55	423.78	.48	1.23	3.71	5	359	245	263	52	83	76	16.4
2	57.5	425.23	.43	1.10	5.18	5	359	243	264	54	83	76	16.4
1	60	426.49	.32	.82	6.45	5	360	244	265	53	83	76	16.4
	(1627)												
	θ = 60	Vm = 38.04		ΔH = 1.29							Avg. = 75.4		

S-0037R

APPENDIX D

INTERPOLL LABORATORIES ANALYTICAL DATA

TABLE OF CONTENTS

Interpoll Laboratories
(612) 786-6020

EPA Method 3 Data Reporting Sheet
Orsat Analysis

Job L. P. Tomahawk
Team Leader RB
Date Submitted 2-2-94
Test No. 1
Date of Analysis 2-3-94

Source Geka
Test Site Stack
Date of Test 2-1-94
No. of Runs Completed 3
Technician C. Helgeson

Test/ Run	Sample Log Number and Type	No. of An.	Buret Readings (ml)			Conc. CO_2 %v/v Dry	Conc. O_2 %v/v Dry	F_o
			Zero Pt.	After CO_2	After O_2			
1/1	2197-05	1	0.00	4.50	20.60	4.50	16.10	1.07
		2	0.00	4.50	20.60	4.50	16.10	1.07
	☑ B ☐ F	Avg				4.50	16.10	
1/2	-06	1	0.00	4.30	20.60	4.30	16.30	1.07
		2	0.00	4.30	20.60	4.30	16.30	1.07
	☑ B ☐ F	Avg				4.30	16.30	
1/3	-07	1	0.00	4.50	20.60	4.50	16.10	1.07
		2	0.00	4.50	20.60	4.50	16.10	1.07
	☑ B ☐ F	Avg				4.50	16.10	
		1						
		2						
	☐ B ☐ F	Avg						
		1						
		2						
	☐ B ☐ F	Avg						
		1						
		2						
	☐ B ☐ F	Avg						
		1						
		2						
	☐ B ☐ F	Avg						
		1						
		2						
	☐ B ☐ F	Avg						
		1						
		2						
	☐ B ☐ F	Avg						

☑ Ambient Air QA Check
☑ Orsat Analyzer System Leak Check
☐ F_o Within EPA M-3 Guidelines for fuel type.

Where $F_o = \frac{20.9 - O_2}{CO_2}$

F=Flask (250 cc all glass)
B=Tedlar Bag (5-layer)

EPA Method 3 Guidelines

Fuel Type	F0 Range
Coal:	
Anthracite/Lignite	1.016-1.130
Bituminous	1.083-1.230
Oil:	
Distillate	1.260-1.413
Residual	1.210-1.370
Gas:	
Natural	1.600-1.836
Propane	1.434-1.586
Butane	1.405-1.553
* Wood/Wood Bark	1.000-1.130

LSC-04-BR

Interpoll Laboratories
(612) 786-6020

EPA Method 5 Data Reporting Sheet
Impinger Catch/Wisconsin Protocol

Job G.P. Tomahawk — Source Geka
Team Leader RR — Test Site Stack
Date Submitted 2-2-94 — Date of Test 2-1-94
Test No. 1 — No. of Runs Completed 3
Date of Analysis 2-3-94 — Technician C. Helgeson

		Solvent Phase	Aqueous Phase
0	Test 1 Run 0 Field Blank Log Number 2197-01I Comments	Dish No. 29 Dish Tare Wt. 48.8855 g Dish+Sample Wt 48.8859 g Sample Wt. 0.0004 g	Dish No. 51 Dish Tare Wt. 48.8511 g Dish+Sample Wt. 48.8515 g Sample Wt. 0.0004 g
1	Test 1 Run 1 Log Number ~02I Comments	Dish No. 36 Dish Tare Wt. 43.5635 g Dish+Sample Wt 43.5656 g Sample Wt. 0.0021 g	Dish No. 52 Dish Tare Wt. 50.8892 g Dish+Sample Wt 50.8939 g Sample Wt. 0.0047 g
2	Test 1 Run 2 Log Number ~03I Comments	Dish No. 39 Dish Tare Wt. 49.4365 g Dish+Sample Wt 49.4403 g Sample Wt. 0.0038 g	Dish No. 53 Dish Tare Wt. 47.4053 g Dish+Sample Wt. 47.4090 g Sample Wt. .0037 g
3	Test 1 Run 3 Log Number ~04I Comments	Dish No. 41 Dish Tare Wt. 45.3205 g Dish+Sample Wt. 45.3234 g Sample Wt. 0.0029 g	Dish No. 54 Dish Tare Wt. 49.6693 g Dish+Sample Wt. 49.6703 g Sample Wt. 0.0010 g
4	Test ____ Run ____ Log Number ____ Comments ____	Dish No. ____ Dish Tare Wt. ____ g Dish+Sample Wt. ____ g Sample Wt. ____ g	Dish No. ____ Dish Tare Wt. ____ g Dish+Sample Wt. ____ g Sample Wt. ____ g
5	Test ____ Run ____ Log Number ____ Comments ____	Dish No. ____ Dish Tare Wt. ____ g Dish+Sample Wt. ____ g Sample Wt. ____ g	Dish No. ____ Dish Tare Wt. ____ g Dish+Sample Wt. ____ g Sample Wt. ____ g

Results Solvent Phase: Blank Solvent Wt. ____ g

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.0017	0.0034	0.0025		

Results Aqueous Phase:

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.0043	0.0033	0.0006		

LSC-03WYR

Interpoll Laboratories
(612) 786-6020

EPA Method 5 Data Reporting Sheet
Probe/Cyclone Wash

Job L.P./Tomahawk
Team Leader RR
Date Submitted 2-2-94
Test No. 1
Date of Analysis 2-3-94
Transport Leakage [X] None [ ] _____ ml

Source Geka
Test Site Stack
Date of Test 2-1-94
No. of Runs Completed 3
Technician C. Helvesen
Solvent Acetone

0	Test 1 Run 0 Field Blank Log Number 2197-01P Vol. of Solvent 100 ml *Solvent Residue 4.0 ug/ml	Dish No. 23 Dish Tare Wt. 46.0841 g Dish+Sample Wt. 46.0845 g Sample Wt. 0.0004 g
1	Test 1 Run 1 Vol. of Solvent 80 ml Log Number -02P Comments	Dish No. 25 Dish Tare Wt. 44.3436 g Dish+Sample Wt. 44.3446 g Sample Wt. 0.0010 g
2	Test 1 Run 2 Vol. of Solvent 50 ml Log Number -03P Comments	Dish No. 26 Dish Tare Wt. 48.3844 g Dish+Sample Wt. 48.3856 g Sample Wt. 0.0012 g
3	Test 1 Run 3 Vol. of Solvent 50 ml Log Number -04P Comments	Dish No. 28 Dish Tare Wt. 46.0410 g Dish+Sample Wt. 46.0422 g Sample Wt. 0.0012 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)(10^6)]/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
	0.0007	0.0010	0.0010	D-3	

LSC-01YR

Interpoll Laboratories
(612) 786-6020

EPA Method 5 Data Reporting Sheet
Filter Gravimetrics

Job LP/Tomahawk
Team Leader RR
Date Submitted 2-2-94
Test No. 1
Date of Analysis 2-3-94

Source GEKA
Test Site stack
Date of Test 2-1-94
No. of Runs Completed 3
Technician C. Helgeson

0
Test 1 Run 0
Field Blank
Log Number 2197-01F
Comments
Filter No. 5502
Filter Type 4"GF
Filter Tare Wt. .9309 g
Filter+Sample Wt. .9312 g
Sample Wt. 0.0003 g

1
Test 1 Run 1
Log Number -02F
Comments
Filter No. 5500
Filter Type 4"GF
Filter Tare Wt. .9304 g
Filter+Sample Wt. .9310 g
Sample Wt. 0.0006 g

2
Test 1 Run 2
Log Number -03F
Comments
Filter No. 5501
Filter Type 4"GF
Filter Tare Wt. .9273 g
Filter+Sample Wt. .9276 g
Sample Wt. 0.0003 g

3
Test 1 Run 3
Log Number -04F
Comments
Filter No. 5847
Filter Type 4"GF
Filter Tare Wt. .9405 g
Filter+Sample Wt. .9420 g
Sample Wt. 0.0015 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
	0.0006	0.0003	0.0015		

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.0073	0.0080	0.0056		

LSC-02PR

INTERPOLL LABORATORIES
(612) 786-6020

S-305RR
(9/90)

EPA Method 10 NDIR Analysis

Job Name L.P. Tomahawk
Source Coke Stack
Date of Analysis 2-3-94
Technician C. Helgeson

NDIR Analyzer:
- ☐ Fuji ACS Model 3300
- ☐ Mon. Lab Model 8310
- ☑ Dasibi Model 3003

Range: 0 - 200 ppm
Flow rate: 1000 cc/min

Pretest Calibration

	Conc.	Reading	Vendor	Cyl. Number
Zero gas:	0 ppm	0 ppm	T.C.Ox	0793-27
Upscale gas:	40 ppm	40 ppm	Scott	ALM030329
Upscale gas:	144 ppm	144 ppm	National	CC114302
Upscale gas:	ppm	ppm		

Post-test Calibration

	Conc.	Reading	Vendor	Cyl. Number
Zero gas:	0 ppm	0 ppm	T.C.Ox	0793-27
Upscale gas:	40 ppm	40 ppm	Scott	ALM030329
Upscale gas:	144 ppm	144 ppm	National	CC114302
Upscale gas:	ppm	ppm		

Sample Description Test/Run	Sample Log Number	CO Conc. (ppm, Dry)		
		Dilution Factor	Reading	Actual ppm
1	2197-05	—		77.7
1/2	-06	—		60.8
1/3	-07	—		61.2

Sample Description Test/Run	Sample Log Number	CO Conc. (ppm, Dry)		
		Dilution Factor	Reading	Actual ppm

Note 1: If sample dilution is required the sample is diluted with CO-free gas prior to analysis.
Note 2: The Fuji ACS model 3300 has a rejection ratio for CO to CO_2 greater then 100,000: 1 and the Mon. Labs Model 8310 and Dasibi Model 3003 have rejection ratios greater then 200,000:1 and thus CO_2 removal prior to analysis is not required.
Note 3: The analyzer must be zeroed and spanned immediately before and after sample analysis. Additional checks may be performed between sample analyses if required.

Interpoll Laboratories
(612) 786-6020

Sample Deposition

Job LP / Tomahawk
Field Engineer R. ROSENTHAL
Date Submitted 2-2-94
Test No. 1
Source GEKA
Test Site STACK
Date of Test 2-1-94
No. of Runs Completed

No.	Sample Type	Analysis	Comments
4	Probe Wash: ☒ Acetone ☐ $MeCl_2$ ☐ DI Water ☐ _____	☒ As per EPA M-5 ☐ As per EPA M-29 ☐ As per EPA M-201A ☐ Other _____	
4	Filter: ☒ 4" Glass ☐ SS Thimble ☐ 2.5" Glass ☐ Pallflex	☒ As per EPA M-5 ☐ As per EPA M-29 ☐ As per EPA M-201A ☐ As per EPA M-17 ☐ Other _____	
4	Impingers: ☒ DI Water ☐ 3% H_2O_2 ☐ 1N NaOH ☐ KOH (Cr VI) ☐ H_2SO_4 (HCl) ☐ 2,4-DNPH ☐ _____ ☐ _____	☐ MN Protocol ☒ WI Protocol ☐ As per EPA M-202 ☐ As per EPA M-6,8 ☐ Acid Gases ☐ Formaldehyde ☐ As per EPA M-29 ☐ As per EPA M-26 ☐ Other _____	
3	Integrated Gas Sample ☒ Tedlar Bag ☐ _____	☒ As per EPA M-3 ☒ As per EPA M-10 ☐ Other _____	
—	Oxides of Nitrogen (NO_x)	☐ As per EPA M-7A ☐ Other _____	
1	☒ Fuel Sample ☐ Aggregate	☒ Attached Form S-0163	SHORT PROX
—	Particle Size	☐ X-Ray Sedigraph ☐ Cascade Impactor ☐ Other _____	
—	Misc Samples ☐ _____ ☐ _____	☐ As per EPA M-6 ☐ As per EPA M-7A ☐ Other _____	

Type of Source: BOILER (GEKA)

Fuel Type:

Coal: ☐ Bituminous ☐ Anthracite ☐ Lignite
Wood: ☒ Wood Waste ☐ Dust ☐ Bark
Oil: ☐ Waste Oil ☐ No. 2 ☐ No. 6
☐ Natural Gas ☐ RDF ☐ Other _____

Received 2/2/94 BR 0930

S-278
G:\STACK\WP\FORMS\S-278.LAS

APPENDIX E

PROCESS RATE INFORMATION

TOMAHAWK THERMAL OIL HEATER TESTING FEB. 1,1994
PROCESS DATA

CONTENTS PAGE

TOMAHAWK THERMAL OIL HEATER TESTING FEB. 1,1994
TEST SCHEDULE

THERMAL OIL HEATER TESTING 2-1-94 - TSP and CO

DATE	POLLUTANT	RUN #1	RUN #2	RUN #3
2-1	CO	1105-1213	1315-1425	1516-1627
2-1	TSP	1105-1213	1315-1425	1516-1627

PRETEST INFORMATION FOR TOMAHAWK, WISCONSIN

1. Description of the air pollution control equipment associated with the process:

THERMAL OIL HEATER

a) Particulate emissions from the GEKA thermal oil heater are controlled by a cyclone installed in series with a baghouse.

b) The baghouse is designed to operate at a pressure drop of 2 to 6 inches of water column.

c) The maximum design airflow through the stack is 32,600 acfm. The rated heat input capacity of the heater is 30mm BTUs. Control efficiencies of the cyclone and baghouse are estimated to be 50% and 99% respectively.

d) Collected material is presently stored temporarily on site. In the future this material will be either landfilled or spread as a soil amendment.

DRYER

a) Particulate emissions from each MEC dryer are controlled by a set of multicyclones installed in series with a E-TUBE wet electrostatic precipitator.

b) Specific multicyclone operating parameters are not monitored. The wet electrostatic precipitator operates within the following ranges:

voltage - 45 to 65 kv

amperage - 50 to 600 ma

spark rate - up to 300 sparks per minute

c) The maximum design airflow through the stack is 100,000 acfm. The rated heat

input capacity of each burner is 32mm BTUs. Control efficiencies of the multicyclones and wet electrostatic precipitators are estimated to be 60% and 90% respectively.

d) Collected material is mixed with bark and sold or burned in the thermal oil heater.

2. Diagrams of the sampling trains are enclosed in the attachments.

3. Descriptions of the sampling and analysis procedures are enclosed in the attachments.

4. Sketches indicating the flow of the exhaust gases through the equipment are enclosed in the attachments.

5. a) Elevation views of each stack are shown in the attachments.

b) Cross-sectional views of each stack are provided in the attachments.

6. Estimated flue gas conditions are indicated on the attached stack drawings.

7. PROCESS AND CONTROL EQUIPMENT OPERATING DATA

a) THERMAL OIL HEATER OPERATING DATA:

1) Design heat input is 30mm BTU's per hour. Operating heat input will be determined by f factor. Heat output will be estimated based on an efficiency of 66%.

2) Type of fuel to be burned is green wood bark and fines.

3) Acfm of exhaust gas through the thermal oil heater will be determined.

4) Tons of fuel burned in the thermal oil heater on a dry basis during testing will be determined based on the number of ram infeed counts and moisture content of the fuel during testing.

5) Plant production rate during testing will be determined from board weights and press charts.

6) Thermal oil heater operating parameters to be recorded during testing include the following:

•refractory temperature

•incoming oil temperature

•outgoing oil temperature

•Fuel feed setting

•thermal oil temperature setpoint

7) Thermal oil heater control equipment operating parameters to be recorded during testing include the following:

•baghouse pressure drop

b. DRYER OPERATING DATA

1) The moisture content of wet and dry wafers will be recorded during testing.

2) It is anticipated that the plant will process a minimum of 99% green wood and a maximum of 1% dry dead wood.

3) It is anticipated that the plant will process approximately 90% hardwood and 10% softwood as required by the air emission permit during testing.

4) The dryer inlet and outlet temperatures during testing will be recorded.

5) Design airflow rate is 80,000 acfm. Actual airflow rate will be determined during testing.

TOMAHAWK THERMAL OIL HEATER TESTING FEB. 1,1994

PROCESS DATA SUMMARY

THERMAL OIL HEATER TESTING 12-14-93

8.04 =PLANT PRODUCTION RATE IN TONS PER HOUR

1.22 = ESTIMATED TONS OF DRY FUEL INPUT BASED ON FUEL MEASUREME
21.93 = ESTIMATED MMBTU/HR INPUT BASED FUEL MEASUREMENT

1.36 = ESTIMATED TONS OF DRY FUEL INPUT BASED ON F FACTOR
24.5 = ESTIMATED MMBTU/HR INPUT BASED ON F FACTOR

THERMAL OIL HEATER TESTING 2-1-94 - TSP and CO
DATA TIME: START= 11:00 END= 16:30 HOURS= 5.50

BOARD WEIGHTS - LBS
WEIGHTS OF APPROXIMATELY EVERY 25TH
UNTRIMMED BOARD FROM TAPES

183	194
191	190
197	197
197	189
188	187
183	184
189	183
194	
187	
187	
191	
192	
190	
187	
190	
193	

189.7 LB = AVERAGE UNTRIMMED MAT WEIGHT

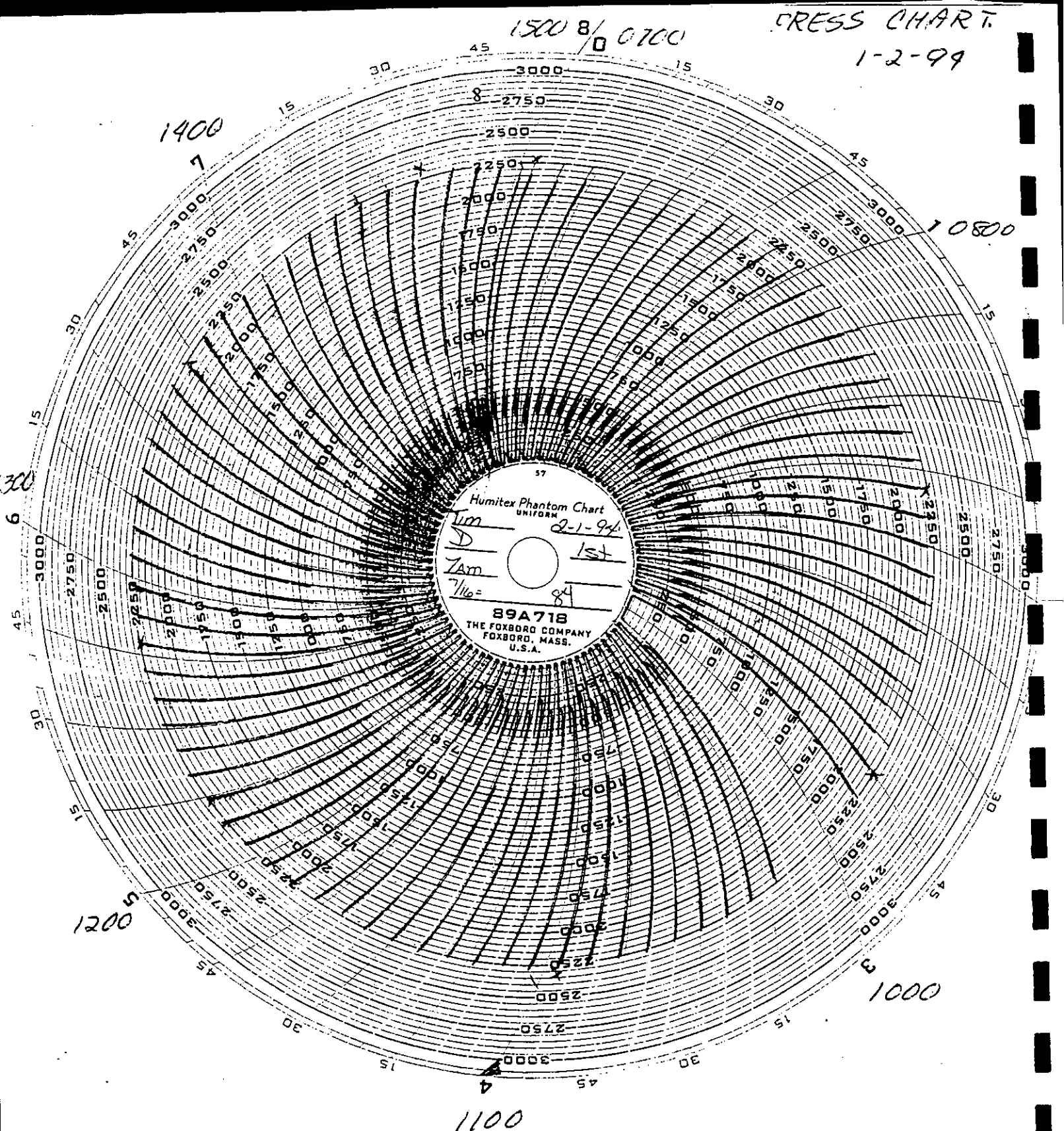
172.63 LB = AVERAGE FINISHED BOARD WEIGHT (UNTRIMMED MAT WEIGHT - TRIM WEIGHT)

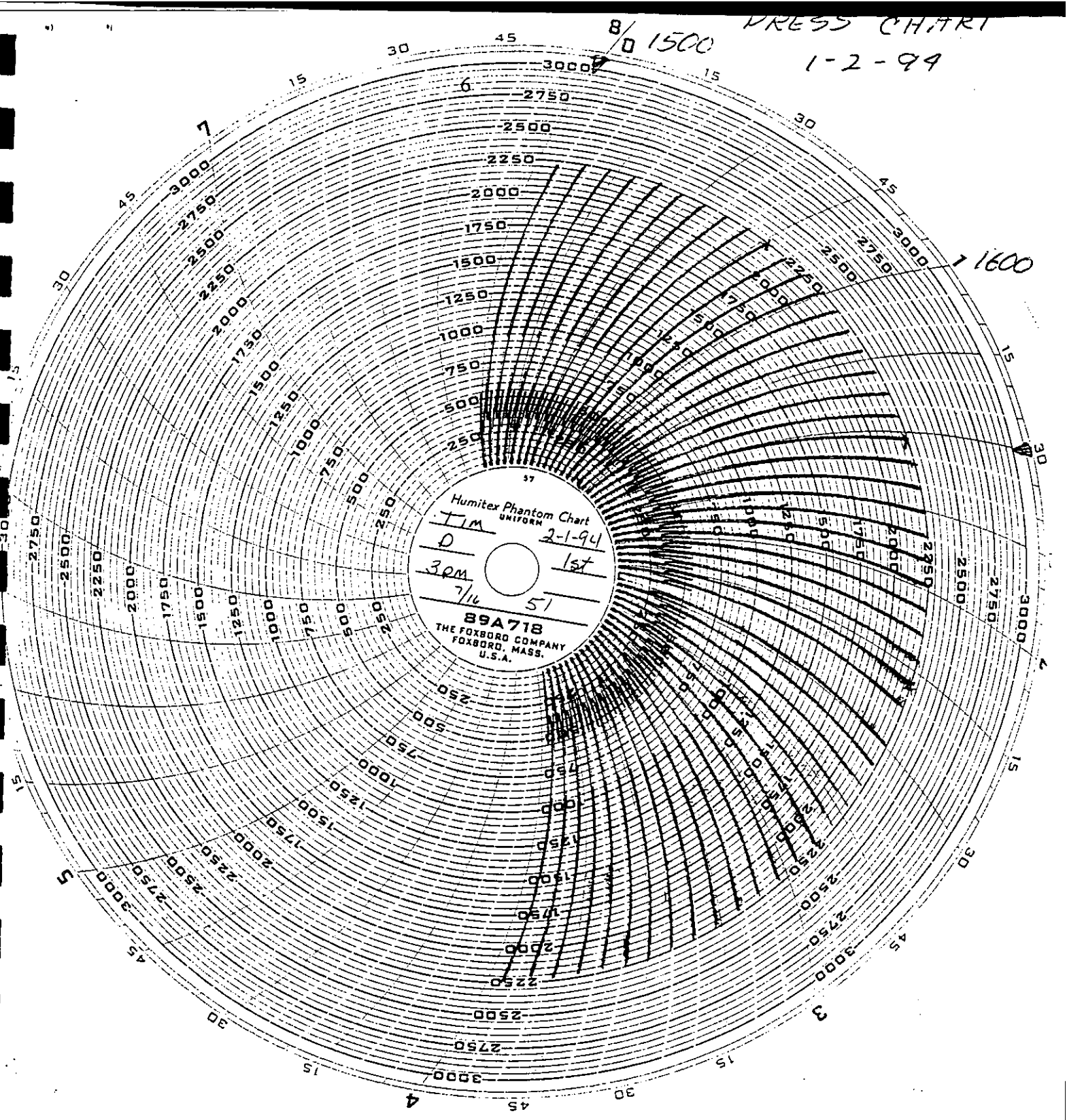
9.0% = TRIM

PLANT PRODUCTION RATE

5.5 =HOURS DURING TESTING
64 =PRESSLOADS
512 =NO. OF (8' X 16') BOARDS PRODUCED (PRESSLOADS x 8 BOARDS/LOAD)
88387 =LBS FINISHED PRODUCT (BOARDS x WEIGHT OF FINISHED BOARD)
16070 =LBS FINISHED PRODUCT PRODUCED PER HOUR (LBS FINISHED PROD./TESTING HOURS)
8.04 =TONS FINISHED PRODUCT PRODUCED PER HOUR (LB FINISHED PRODUCT PER HR / 2000 LB)

note: the press production rate during testing was lower than the rate proposed in the original test protocol due to cold weather. The ambient temperature was approximatley -25 deg. f. the morning of the test and warmed to approximatley +10 deg. f during the afternoon. The press ran at the maximum rate possible considering the rate of material being dried. The dryers were required to dry cold/frozen material within the temperature limitations contained in the operating permit.
During testing the thermal oil heater operated at a rate which was approximatley 1/3 greater than in August 1993.


1500 8/0 0700
CRESS CHART.
1-2-99
1400
7
1300
6
1200
5
1100
4
1000
3
0800
Humitex Phantom Chart
UNIFORM
Tim
2-1-94
1st
7Am
84
89A718
THE FOXBORO COMPANY
FOXBORO, MASS.
U.S.A.
DRESSLOADS
1100 - 1500 = 49



PRESSLOADS

1500 - 1630 = 20

PRESS REPORT

Line Speed			Press Temp.	214°C	Date: 2-1-94		LOUISIANA – PACIFIC CORP. TOMAHAWK WI	
Spd.	From	To	Prs. Blwdwn		Operator: Tim			
505	700	250	Former		Crew: D			
616	250	700	Hyd. Radtr.		Shift: 1			
			FCOS Hyd.		Thkns.	7/16		
			Radiator		# P/L's	135		
			Spnrhds.		3/8 Ftg.	161,285		
			Flushed	12:00	Downtime	19		

From	To	M	E	O	Explanation of Downtime
952	10:09	17			LOW FLAKE KC. FILLING FOR STACKTEST
5:23	5:25	2			#6 OVERTAKE

M – Mechanical E – Electrical O – Operator

PRESS LOADS	E – Tube Shutdowns / Hammermill Dumps	
	Face Shutdown	
	Face Shutdown	
	Core Shutdown	
	Core Shutdown	
	Hammermill Dump	7:44 - 806 - 22 / 11:00 - 11:24 / 12:20 - 1247 - 27 / 1:58 - 159 - 21
	Hammermill Dump	3:35 - 355 - 20 - 450 5:30 - 40 -
	Hammermill Dump	
	Hammermill Dump	

13.6

THERMAL OIL HEATER TESTING 2-1-94 - TSP and CO
DATA TIME: START= 11:00 END= 16:30 HOURS= 5.50

FUEL BURNING RATE ESTIMATED BY BARK INPUT

105 =GEKA FUEL CALIBRATION IN LB/COUNT
228 =COUNTS DURING TESTING HOURS
23940 =LB. OF WET FUEL BURNED DURING TESTING

5.50 =HOURS DURING TESTING
23940 =TOTAL LB. OF WET FUEL BURNED DURING TESTING
44.0% =AVERAGE MOISTURE CONTENT OF FUEL
13406 =TOTAL LB. OF DRY FUEL BURNED DURING TESTING (LB WET FUEL X (1- % MOISTURE)
2437 =LB. OF DRY FUEL BURNED PER HOUR (TOTAL LB OF DRY FUEL BURNED / TESTING HOURS
1.22 =TONS OF DRY FUEL BURNED PER HOUR (TOTAL LB OF DRY FUEL BURNED PER HOUR / 2000 LB)
9000 = ESTIMATED BTU CONTENT OF DRY FUEL (BTU / LB)
21.93 = ESTIMATED MMBTU INPUT PER HOUR (LB OF FUEL/HR x BTU CONTENT)

FUEL BURNING RATE ESTIMATED BY f Factor (see test report)
24.5 = ESTIMATED MMBTU INPUT PER HOUR
1.36 = ESTIMATED TONS OF DRY FUEL INPUT BASED ON F FACTOR

T-O HEATER LOG PLANT: TOMAHAWK
DATE: BY:

1. READINGS EVERY 10 MINUTES.
2. BARK MOISTURE ONCE PER HOUR.
3. NOTE IF SET-POINTS ARE CHANGED.

TIME	OIL TEMP IN	OIL TEMP OUT	FUEL COUNT	FURNACE TEMP
7:24	451	493	23	1600
7:30	451	489	27	1556
7 44	447	479	30	1546
7:56	442	488	36	1517
8:03	444	485	50	1595
8 30	451	487	64	1601
8 40	452	490	69	1609
8 47	451	491	73	1603
8 57	451	491	74	1585
9 07	452	492	83	1586
9 21	452	492	92	1600
9 29	451	492	98	1595
9 54	490	489	117	1584
1006	454	491	126	1599
1024	454	489	142	1553
1050	451	492	158	1611
1059	450	491	164	1609
1209	452	491	172	1613
11 19	450	493	178	1611
1124	451	491	184	1606
1146	452	492	196	1618
1154	452	492	199	1613
1203	448	491	204	1625
1215	452	491	211	1624
1229	450	490	222	1621
1238	452	490	230	1618
1248	451	490	236	1606
1257	450	492	243	1626
108	452	492	251	1629
117	451	492	255	1644

T–O HEATER LOG
DATE:

PLANT: TOMAHAWK
BY:

1. READINGS EVERY 10 MINUTES.
2. BARK MOISTURE ONCE PER HOUR.
3. NOTE IF SET–POINTS ARE CHANGED.

TIME	OIL TEMP IN	OIL TEMP OUT	FUEL COUNT	FURNACE TEMP
128	451	480	264	1622
148	453	490	277	1619
154	452	491	283	1627
207	452	492	293	1631
250	453	491	316	1630
319	449	489	336	1638
341	450	492	354	1658
347	447	492	359	1657
356	450	493	363	1641
413	451	492	377	1649
427	450	489	392	1659

Tomahawk test Feb 1994

T-O HEATER LOG
DATE:

PLANT: TOMAHAWK
BY:

1. READINGS EVERY 60 MINUTES.
2. BARK MOISTURE ONCE PER HOUR.
3. NOTE IF SET-POINTS ARE CHANGED.

TIME	airflow mb / in	bark moisture	baghouse pressure
7:30	0.5/0.23		3.4
8:10	0.25/0.15		
8:23	0.23/0.20		
8:45	0.15/0.2		
9:00	0.16/0.19		3.6
9:27	0.18/0.20		
10:00			3.6½
11:00	0.18/0.20		3.7
12:00	0.16/0.20		3.7
1:00			3.7
2:00			3.7
3:00			3.7
3:42	0.15/0.18		3.7
4:06	0.17/0.19		3.7

GEKA WOODFUEL CALIBRATION

Nine barrels with a tare weight of 6.8 lbs each were used.
Total weight of fuel in feed hopper was 629.8 lbs.
Feed hopper ram pushed 6 complete times to empty hopper.
105 lbs per ram stroke.
40.4 % moisture content.

Barrel Number	Gross Weight	Tare Weight	Net Weight
1	79.5	6.8	72.7
2	76.5	6.8	69.7
3	85.0	6.8	78.2
4	75.0	6.8	68.2
5	75.0	6.8	68.2
6	75.0	6.8	68.2
7	75.0	6.8	68.2
8	75.0	6.8	68.2
9	75.0	6.8	68.2
Total	691.0	61.2	629.8

Tomahawk test Feb 1994

APPENDIX F

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.

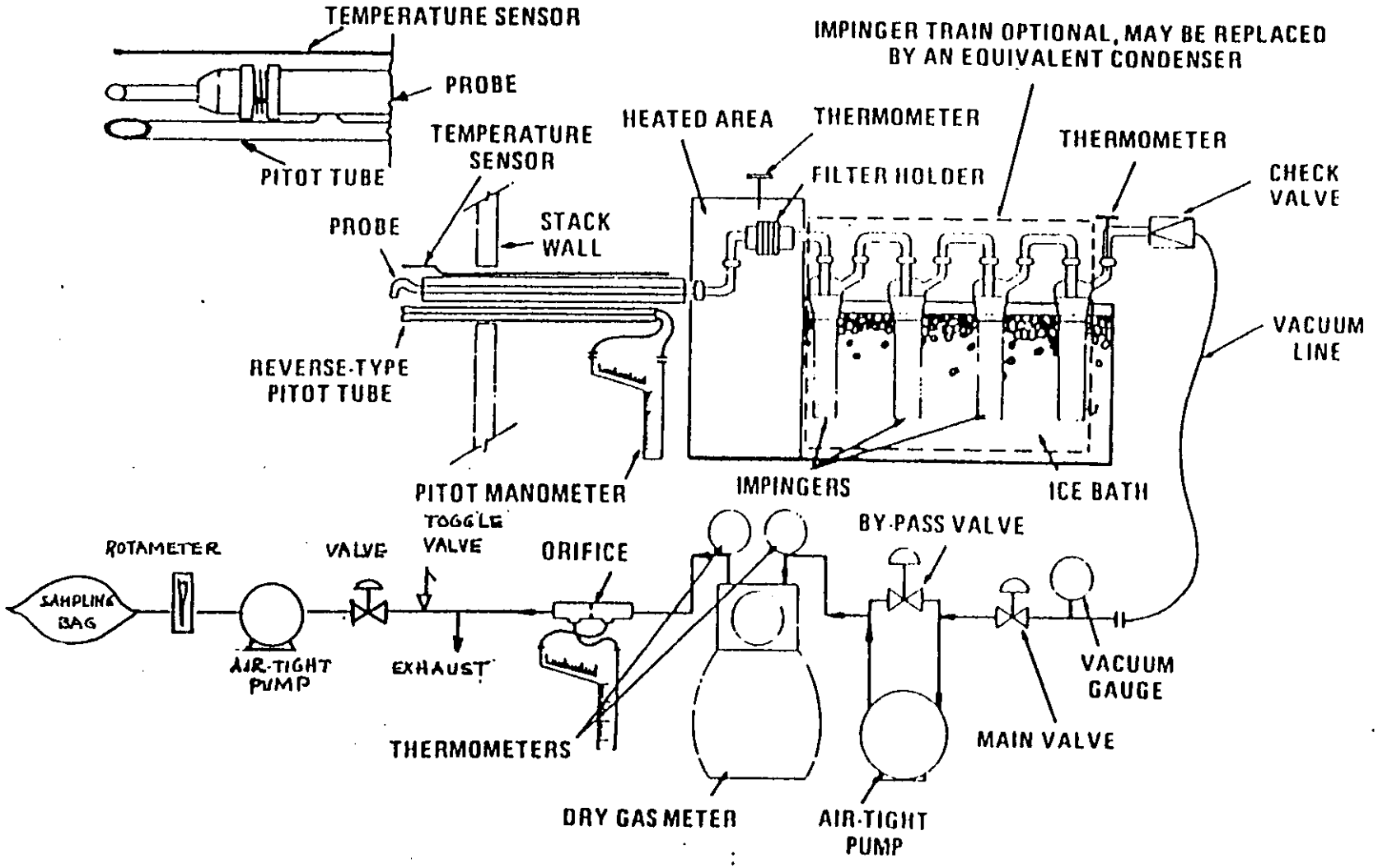
The sampling train consists of a heated glass-lined sampling probe equipped with a Type S pitot and a thermocouple. The probe is attached to a sampling module which houses the all-glass in line filter holder in a temperature controlled oven. In addition, the sampling module also houses the impinger case 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 °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 °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 °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 flue gas samples for Orsat analysis were collected simultaneously from the stack and from the breeching at the inlet to the wet scrubber. The samples were collected in 15-liter gas sampling bags at a constant flow rate throughout each particulate run. The bags were then returned to the laboratory and analyzed by Orsat analysis. Standard commercially prepared solutions were used in the Orsat analyzer (sat. KOH for carbon dioxide and reduced methylene blue for oxygen).



Particulate-sampling train.

Version 1.3
1/88

Interpoll Laboratories
(612)786-6020

Condensible Organic Compounds Analysis

(State of Wisconsin - EPA Method 5)

Method II-8672-WI

Equipment: Separatory funnel - 500 cc with Teflon stopcock

Powder funnel - 75 mm ID with a glass wood plug

Evaporating dish(es) - 200 cc or 250 cc beaker

Reagents: Methylene chloride

Sodium sulfate - (ACS) granular anhydrous (purified by heating for four hours in a shallow tray)

SAMPLING:

An all-glass impinger assembly is used in the back half of the EPA Method 5 sampling train when an organic wet catch is to be collected. The impinger assembly consists of a modified impinger, a Greenburg Smith impinger followed by another modified impinger. The third impinger should have a temperature measuring device at the outlet upstream of a final impinger or desiccant column to monitor the temperature of the outlet gas stream. Prior to the start of the test, each of the first two impingers should be charged with 100 g of Class I water. The Method 5 train should be operated as provided for in EPA Method 5. Ice should be added to the impinger bath to keep the temperature of the gas at the outlet at or less than 68 ^{o}F. After the post test leak check, the impinger train is removed and impinger contents poured into a tared all-glass sample bottle and closed with a Teflon-lined cap. The sample bottle is then weighed and the total condensate calculated by subtraction of the bottle tare weight and the

weight of initial water added to the impingers (200 g). A label is affixed and the sample is returned to the laboratory for analysis. The sample should be stored at 4 °C if the analysis is not conducted within 48 hours.

ANALYSIS:

1. Sample bottles are removed from storage and the contents quantitatively transferred to a clean 500 cc separatory funnel equipped with a Teflon stopcock.

2. Rinse the sample container with distilled water and add to separatory funnel.

3. Then rinse the sample container with acetone and pour through sodium sulfate into a tare beaker marked A.

4. The sample is then extracted consecutively with three 50 cc aliquots of methylene chloride. The extraction is performed according to normal laboratory practice observing the customary safety precaution of releasing excess pressure after each shaking.

5. After each of the three extractions are completed, the organic solvent should be dried by passing it through a funnel containing anhydrous sodium sulfate and collecting it and two 50 cc rinses in the tared beaker marked A (the same one used to catch the acetone container rinse).

6. Evaporate to dryness in a hood at 70 °F or less. Do not evaporate so quickly as to allow evaporative cooling to lower the temperature of the container below the dew point otherwise water will be condensed in the container.

7. Desiccate for two hours in a sealed desiccator and final weigh. Report all results in grams. All weighings should be made to nearest 0.1 mg (four places).

8. The remaining liquid in the separatory funnel is then transferred to a tared beaker marked B and is evaporated to dryness at 220 °F ± 10 °F. The analyst may take an aliquot of the sample, transferring it to a tared beaker and evaporate to dryness at 220 °F ± 10 °F. If an aliquot is used, the weight of the sample and aliquot will have to be taken to correct for the total sample weight.

9. After the drying step, the sample is cooled in a desiccator and weighted to a constant weight to the nearest 0.1 mg.

   Calculation (if aliquot is taken):

$$\text{grams} = \frac{(\text{grams recovered from aliquot}) \times (\text{total volume (ml) or grams of sample})}{(\text{aliquot volume (ml) or grams used})}$$

   If volume is used, it must be used for both the aliquot and sample. The same goes for using weight.

10. A field blank should be analyzed in an identical manner. If a field blank is not submitted, take an aliquot of Class I water equal in volume to the samples and analyze in a similar manner.

11. The results for container A are to be marked in the organic section of Interpoll Form #LSC-036.

12. The results for container B are to be marked in the inorganic section of Interpoll Form #LSC-036.

4.2 Performance Evaluation Tests. The owner of a lidar system shall subject such a lidar system to the performance verification tests described in Section 3, prior to first use of this method. The annual calibration shall be performed for three separate, complete runs and the results of each should be recorded. The requirements of Section 3.3.1 must be fulfilled for each of the three runs.

Once the conditions of the annual calibration are fulfilled the lidar shall be subjected to the routine verification for three separate complete runs. The requirements of Section 3.3.2 must be fulfilled for each of the three runs and the results should be recorded. The Administrator may request that the results of the performance evaluation be submitted for review.

5. *References*

5.1 The Use of Lidar for Emissions Source Opacity Determination, U.S. Environmental Protection Agency, National Enforcement Investigations Center, Denver, CO. EPA-330/1-79-003-R, Arthur W. Dybdahl, current edition [NTIS No. PB81-246662].

5.2 Field Evaluation of Mobile Lidar for the Measurement of Smoke Plume Opacity, U.S. Environmental Protection Agency, National Enforcement Investigations Center, Denver, CO. EPA/NEIC-TS-128, February 1976.

5.3 Remote Measurement of Smoke Plume Transmittance Using Lidar, C. S. Cook, G. W. Bethke, W. D. Conner (EPA/RTP). Applied Optics 11, pg 1742, August 1972.

5.4 Lidar Studies of Stack Plumes in Rural and Urban Environments, EPA-650/4-73-002, October 1973.

5.5 American National Standard for the Safe Use of Lasers ANSI Z 136.1-176, March 8, 1976.

5.6 U.S. Army Technical Manual TB MED 279, Control of Hazards to Health from Laser Radiation, February 1969.

5.7 Laser Institute of America Laser Safety Manual, 4th Edition.

5.8 U.S. Department of Health, Education and Welfare, Regulations for the Administration and Enforcement of the Radiation Control for Health and Safety Act of 1968, January 1976.

5.9 Laser Safety Handbook, Alex Mallow, Leon Chabot, Van Nostrand Reinhold Co., 1978.

Method 10—Determination of Carbon Monoxide Emissions From Stationary Sources

1. *Principle and Applicability*

1.1 Principle. An integrated or continuous gas sample is extracted from a sampling point and analyzed for carbon monoxide (CO) content using a Luft-type nondispersive infrared analyzer (NDIR) or equivalent.

1.2 Applicability. This method is applicable for the determination of carbon monoxide emissions from stationary sources only when specified by the test procedures for determining compliance with new source performance standards. The test procedure will indicate whether a continuous or an integrated sample is to be used.

2. *Range and Sensitivity*

2.1 Range. 0 to 1,000 ppm.

2.2 Sensitivity. Minimum detectable concentration is 20 ppm for a 0 to 1,000 ppm span.

3. *Interferences*

Any substance having a strong absorption of infrared energy will interfere to some extent. For example, discrimination ratios for water (H_2O) and carbon dioxide (CO_2) are 3.5 percent H_2O per 7 ppm CO and 10 percent CO_2 per 10 ppm CO, respectively, for devices measuring in the 1,500 to 3,000 ppm range. For devices measuring in the 0 to 100 ppm range, interference ratios can be as high as 3.5 percent H_2O per 25 ppm CO and 10 percent CO_2 per 50 ppm CO. The use of silica gel and ascarite traps will alleviate the major interference problems. The measured gas volume must be corrected if these traps are used.

4. *Precision and Accuracy*

4.1 Precision. The precision of most NDIR analyzers is approximately ±2 percent of span.

4.2 Accuracy. The accuracy of most NDIR analyzers is approximately ±5 percent of span after calibration.

5. *Apparatus*

5.1 Continuous Sample (Figure 10-1).

5.1.1 Probe. Stainless steel or sheathed Pyrex[1] glass, equipped with a filter to remove particulate matter.

5.1.2 Air-Cooled Condenser or Equivalent. To remove any excess moisture.

5.2 Integrated Sample (Figure 10-2).

5.2.1 Probe. Stainless steel or sheathed Pyrex glass, equipped with a filter to remove particulate matter.

5.2.2 Air-Cooled Condenser or Equivalent. To remove any excess moisture.

5.2.3 Valve. Needle valve, or equivalent, to to adjust flow rate.

5.2.4 Pump. Leak-free diaphragm type, or equivalent, to transport gas.

5.2.5 Rate Meter. Rotameter, or equivalent, to measure a flow range from 0 to 1.0 liter per min (0.035 cfm).

[1] Mention of trade names or specific products does not constitute endorsement by the Environmental Protection Agency.

5.2.6 Flexible Bag. Tedlar, or equivalent, with a capacity of 60 to 90 liters (2 to 3 ft^3). Leak-test the bag in the laboratory before using by evacuating bag with a pump followed by a dry gas meter. When evacuation is complete, there should be no flow through the meter.

5.2.7 Pitot Tube. Type S, or equivalent, attached to the probe so that the sampling rate can be regulated proportional to the stack gas velocity when velocity is varying with the time or a sample traverse is conducted.

5.3 Analysis (Figure 10-3).

5.3.1 Carbon Monoxide Analyzer. Nondispersive infrared spectrometer, or equivalent. This instrument should be demonstrated, preferably by the manufacturer, to meet or exceed manufacturer's specifications and those described in this method.

5.3.2 Drying Tube. To contain approximately 200 g of silica gel.

5.3.3 Calibration Gas. Refer to section 6.1.

5.3.4 Filter. As recommended by NDIR manufacturer.

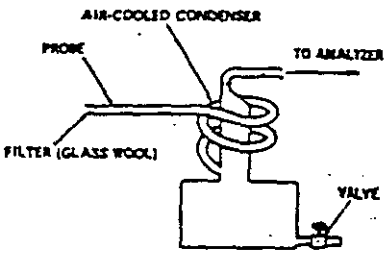


Figure 10-1. Continuous sampling train.

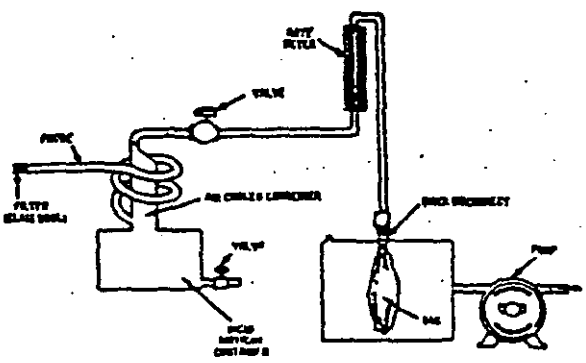


Figure 10-2. Integrated gas sampling train.

5.3.5 CO_2 Removal Tube. To contain approximately 500 g of ascarite.

5.3.6 Ice Water Bath. For ascarite and silica gel tubes.

5.3.7 Valve. Needle valve, or equivalent, to adjust flow rate

5.3.8 Rate Meter. Rotameter or equivalent to measure gas flow rate of 0 to 1.0 liter per min (0.035 cfm) through NDIR.

5.3.9 Recorder (*optional*). To provide permanent record of NDIR readings.

6. *Reagents*

6.1 Calibration Gases. Known concentration of CO in nitrogen (N_2) for instrument span, prepurified grade of N_2 for zero, and two additional concentrations corresponding approximately to 60 percent and 30 percent span. The span concentration shall not exceed 1.5 times the applicable source performance standard. The calibration gases shall be certified by the manufacturer to be within ±2 percent of the specified concentration.

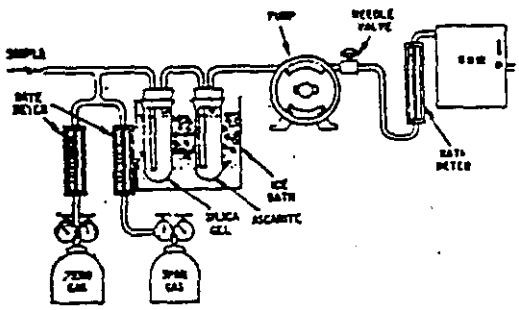


Figure 10-3. Analytical equipment.

6.2 Silica Gel. Indicating type, 6 to 16 mesh, dried at 175° C (347° F) for 2 hours.

6.3 Ascarite. Commercially available.

7. *Procedure*

7.1 Sampling.

7.1.1 Continuous Sampling. Set up the equipment as shown in Figure 10-1 making sure all connections are leak free. Place the probe in the stack at a sampling point and purge the sampling line. Connect the analyzer and begin drawing sample into the analyzer. Allow 5 minutes for the system to stabilize, then record the analyzer reading as required by the test procedure. (See section 7.2 and 8). CO_2 content of the gas may be determined by using the Method 3 integrated sample procedure, or by weighing the ascarite CO_2 removal tube and computing CO_2 concentration from the gas volume sampled and the weight gain of the tube.

7.1.2 Integrated Sampling. Evacuate the flexible bag. Set up the equipment as shown in Figure 10-2 with the bag disconnected. Place the probe in the stack and purge the sampling line. Connect the bag, making sure that all connections are leak free. Sample at a rate proportional to the stack velocity. CO_2 content of the gas may be determined by using the Method 3 integrated sample procedures, or by weighing the ascarite CO_2 removal tube and computing CO_2 concentra-

tion from the gas volume sampled and the weight gain of the tube.

7.2 CO Analysis. Assemble the apparatus as shown in Figure 10-3, calibrate the instrument, and perform other required operations as described in section 8. Purge analyzer with N_2 prior to introduction of each sample. Direct the sample stream through the instrument for the test period, recording the readings. Check the zero and span again after the test to assure that any drift or malfunction is detected. Record the sample data on Table 10-1.

8. *Calibration*

Assemble the apparatus according to Figure 10-3. Generally an instrument requires a warm-up period before stability is obtained. Follow the manufacturer's instructions for specific procedure. Allow a minimum time of 1 hour for warm-up. During this time check the sample conditioning apparatus, i.e., filter, condenser, drying tube, and CO_2 removal tube, to ensure that each component is in good operating condition. Zero and calibrate the instrument according to the manufacturer's procedures using, respectively, nitrogen and the calibration gases.

TABLE 10-1—FIELD DATA

	Comments
Location	
Test	
Date	
Operator	

Clock time	Rotameter setting, liters per minute (cubic feet per minute)

9. *Calculation*

Calculate the concentration of carbon monoxide in the stack using Equation 10-1.

$$C_{CO\ stack} = C_{CO\ NDIR}(1 - F_{CO_2})$$

Eq. 10-1

Where:

$C_{CO\ stack}$ = Concentration of CO in stack, ppm by volume (dry basis).

$C_{CO\ NDIR}$ = Concentration of CO measured by NDIR analyzer, ppm by volume (dry basis).

F_{CO_2} = Volume fraction of CO_2 in sample, i.e., percent CO_2 from Orsat analysis divided by 100.

10. Alternative Procedures

10.1 Interference Trap. The sample conditioning system described in Method 10A sections 2.1.2 and 4.2, may be used as an alternative to the silica gel and ascarite traps.

11. *Bibliography*

1. McElroy, Frank, The Intertech NDIR-CO Analyzer, Presented at 11th Methods Conference on Air Pollution, University of California, Berkeley, CA. April 1, 1970.
2. Jacobs, M. B., et al., Continuous Determination of Carbon Monoxide and Hydrocarbons in Air by a Modified Infrared Analyzer, J. Air Pollution Control Association, 9(2): 110-114. August 1959.
3. MSA LIRA Infrared Gas and Liquid Analyzer Instruction Book, Mine Safety Appliances Co., Technical Products Division, Pittsburgh, PA.
4. Models 215A, 315A, and 415A Infrared Analyzers, Beckman Instruments, Inc., Beckman Instructions 1635-B, Fullerton, CA. October 1967.
5. Continuous CO Monitoring System, Model A5611, Intertech Corp., Princeton, NJ.
6. UNOR Infrared Gas Analyzers, Bendix Corp., Ronceverte, WV

ADDENDA

A. PERFORMANCE SPECIFICATIONS FOR NDIR CARBON MONOXIDE ANALYZERS

Range (minimum)	0-1000 ppm.
Output (minimum)	0-10mV.
Minimum detectable sensitivity.	20 ppm.
Rise time, 90 percent (maximum).	30 seconds.
Fall time, 90 percent (maximum).	30 seconds.
Zero drift (maximum)	10% in 8 hours.
Span drift (maximum)	10% in 8 hours.
Precision (minimum)	±2% of full scale.
Noise (maximum)	±1% of full scale.
Linearity (maximum deviation)	2% of full scale.
Interference rejection ratio	CO_2—1000 to 1, H_2O—500 to 1.

B. *Definitions of Performance Specifications.*

Range—The minimum and maximum measurement limits.

Output—Electrical signal which is proportional to the measurement; intended for connection to readout or data processing devices. Usually expressed as millivolts or milliamps full scale at a given impedance.

Full scale—The maximum measuring limit for a given range.

Minimum detectable sensitivity—The smallest amount of input concentration that can be detected as the concentration approaches zero.

Accuracy—The degree of agreement between a measured value and the true value; usually expressed as ± percent of full scale.

Time to 90 percent response—The time interval from a step change in the input concentration at the instrument inlet to a reading of 90 percent of the ultimate recorded concentration.

Rise Time (90 percent)—The interval between initial response time and time to 90 percent response after a step increase in the inlet concentration.

Fall Time (90 percent)—The interval between initial response time and time to 90 percent response after a step decrease in the inlet concentration.

Zero Drift—The change in instrument output over a stated time period, usually 24 hours, of unadjusted continuous operation when the input concentration is zero; usually expressed as percent full scale.

Span Drift—The change in instrument output over a stated time period, usually 24 hours, of unadjusted continuous operation when the input concentration is a stated upscale value; usually expressed as percent full scale.

Precision—The degree of agreement between repeated measurements of the same concentration, expressed as the average deviation of the single results from the mean.

Noise—Spontaneous deviations from a mean output not caused by input concentration changes.

Linearity—The maximum deviation between an actual instrument reading and the reading predicted by a straight line drawn between upper and lower calibration points.

Method 10A—Determination of Carbon Monoxide Emissions in Certifying Continuous Emission Monitoring Systems at Petroleum Refineries

1. Applicability and Principle

1.1 Applicability. This method applies to the measurement of carbon monoxide (CO) at petroleum refineries. This method serves as the reference method in the relative accuracy test for nondispersive infrared (NDIR) CO continuous emission monitoring systems (CEMS's) that are required to be installed in petroleum refineries on fluid catalytic cracking unit catalyst regenerators [40 CFR Part 60.105(a)(2)].

1.2 Principle. An integrated gas sample is extracted from the stack, passed through an alkaline permanganate solution to remove sulfur and nitrogen oxides, and collected in a Tedlar bag. The CO concentration in the sample is measured spectrophotometrically using the reaction of CO with p-sulfaminobenzoic acid.

1.3 Range and Sensitivity.

1.3.1 Range. Approximately 3 to 1800 ppm CO. Samples having concentrations below 400 ppm are analyzed at 425 nm, and samples having concentrations above 400 ppm are analyzed at 600 nm.

1.3.2 Sensitivity. The detection limit is 3 ppm based on three times the standard deviation of the mean reagent blank values.

1.4 Interferences. Sulfur oxides, nitric oxide, and other acid gases interfere with the colorimetric reaction. They are removed by passing the sampled gas through an alkaline potassium permanganate scrubbing solution. Carbon dioxide (CO_2) does not interfere, but, because it is removed by the scrubbing solution, its concentration must be measured independently and an appropriate volume correction made to the sampled gas.

1.5 Precision, Accuracy, and Stability.

1.5.1 Precision. The estimated intralaboratory standard deviation of the method is 3 percent of the mean for gas samples analyzed in duplicate in the concentration range of 39 to 412 ppm. The interlaboratory precision has not been established.

1.5.2 Accuracy. The method contains no significant biases when compared to an NDIR analyzer calibrated with National Bureau of Standards (NBS) standards.

1.5.3 Stability. The individual components of the colorimetric reagent are stable for at least 1 month. The colorimetric reagent must be used within 2 days after preparation to avoid excessive blank correction. The samples in the Tedlar [1] bag should be stable for at least 1 week if the bags are leak-free.

2. Apparatus

2.1 Sampling. The sampling train is shown in Figure 10A-1, and component parts are discussed below:

[1] Mention of trade names or commercial products in this publication does not constitute the endorsement or recommendation for use by the Environmental Protection Agency.

APPENDIX G

CALCULATION EQUATIONS

CALCULATION EQUATIONS

METHOD 2

$$\overline{V_s} = 85.48\ C_p\ (\sqrt{\Delta p})_{avg}\ \sqrt{\frac{T_{s(avg)}}{P_s\ M_s}}$$

$$Q_{s,\,d} = 60(1 - B_{ws})\ \overline{V_s}\ A\ (\frac{528}{T_{s\ (avg)}})\ (\frac{P_s}{29.92})$$

$$Q_a = 60\ \overline{V_s}\ A$$

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

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

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

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

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

12-2893-G:\STACK\WP\METHODS\EQ.M5

CALCULATION EQUATIONS

METHOD 2

$$\overline{V_s} = 85.48\ C_p\ (\sqrt{\Delta p})_{avg}\ \sqrt{\frac{T_{s(avg)}}{P_s\ M_s}}$$

$$Q_{s,\,d} = 60(1\ -B_{ws})\ \overline{V_s}\ A\ (\frac{528}{T_{s\ (avg)}})\ (\frac{P_s}{29.92})$$

$$Q_a = 60\ \overline{V_s}\ A$$

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

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

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

$$\text{P=}\ \frac{4.585\ x\ 10^{-2}\ P_sM_s}{T_s\ (avg)}$$

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

12-2893-G:\STACK\WP\METHODS\EQ.M5

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, °F
T_{wb}	=	Wet bulb temperature of stack gas, °F
$T_{m(avg)}$	=	Absolute average dry gas meter temperature, °R
$T_{s(avg)}$	=	Absolute average stack temperature, °F
T_{std}	=	Standard absolute temperature, 528 °F (68 °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 Tdb, IN. HG.
vp_{twb}	=	Vapor pressure at Twb, 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

122893-G:\STACK\WP\METHODS\EQ.M5

CALCULATION EQUATIONS

METHOD 3

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

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

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

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

122893-G:\STACK\WP\METHODS\EQ.M5

CALCULATION EQUATIONS

METHOD 5

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

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

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

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

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

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

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

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

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

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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, °F

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T_{wb}	=	Wet bulb temperature of stack gas, °F
$T_{m(avg)}$	=	Absolute average dry gas meter temperature, °R
$T_{s(avg)}$	=	Absolute average stack temperature, °R
T_{std}	=	Standard absolute temperature, 528 °F (68 °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.

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CALCULATION EQUATIONS

METHOD 10

$$CO\text{-}PPM\text{-}DRY = CO_{CO_2\text{-free,dry,avg}} \ (1 - CO_{2,d}/100)$$

$$CO\text{-}PPM\text{-}WET = CO\text{-}PPM\text{-}DRY \ (1 - MC/100)$$

$$GR/DSCF = 5.0885 \times 10^{-4} \ (CO\text{-}PPM\text{-}DRY)$$

$$mg/dscm = 1.165 \ (CO\text{-}PPM\text{-}DRY)$$

$$\dot{m} = 8.5714 \times 10^{-3} \ (GR/DSCF)(Q_{s,d})$$

$$E = \frac{2.9857 \times 10^{-3} \ F_d \ (GR/DSCF)}{20.9 - O_{2,d}}$$

Where

$CO_{CO_2\text{-free,dry,avg}}$ = average of two determinations of carbon monoxide on a dry, CO_2-free integrated flue gas sample reported in ppm by volume

$CO_{2,d}$ = carbon dioxide concentration of flue gas on a dry percent by volume basis

$O_{2,d}$ = oxygen concentration of flue gas on a dry percent by volume basis

MC	= moisture content of flue gas on a percent by volume basis
CO·PPM·DRY	= carbon monoxide concentration in ppm by volume on a dry basis
CO·PPM·WET	= carbon monoxide concentration in ppm by volume on a wet or actual basis
GR/DSCF	= concentration of carbon monoxide in flue gas on a grains per dry standard cubic foot basis (68 ^{O}F, 29.92 IN.HG.)
mg/dscm	= concentration of carbon monoxide in flue gas on a milligrams per dry standard cubic meter basis (60 ^{O}F, 29.92 IN.HG.)
$\dot{m}$	= emission or mass rate of carbon monoxide on a LB/HR basis
$Q_{s,d}$	= volumetric flow rate of flue gas in dry standard cubic feet per minute
E	= emission factor of carbon monoxide in pounds of carbon monoxide emitted per million BTU heat input (LB/MMBTU)
F_d	= F-Factor of respective fuel in dry standard cubic feet of exhaust gas at 0% oxygen per million BTU of heat input (DSCF/MMBTU)

APPENDIX H

SAMPLING TRAIN CALIBRATION DATA

INTERPOLL LABORATORIES
EPA Method 5 Gas Metering System
Quality Control Check Data Sheet

Job LP / TOMAHAWK 2197 Date 2-1-94

Operator R.R. Module No. 7

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 27.91 in. Hg. T = .9981 ^H@ 1.96 in. W.C.

Time (min)	Volume (CF)	Meter Temp. (°F)	
		Inlet	Outlet
[redacted]	305.90)	[redacted]	
2.5	307.80	45	45
5.0	309.60	47	45
7.5	311.56	48	46
10	313.47	50	47
[redacted]	V_m = 7.57	Avg(t_m) = 46.63 °F	

Calculate Y_{cn} as follows:

$$Y_{cn} = \frac{1.786}{\frac{T}{7.556}\ V_m}\left[\frac{(t_m + 460)}{P_b}\right]^{0.5}$$

4.2605

$$Y_{cn} = \frac{1.786}{(\quad)(\quad)}\left[\frac{(\quad) + 460}{(\quad)}\right]^{0.5}$$

Y_{cn} = 1.007

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

S-432

Interpoll Laboratories, Inc.
(612) 786-6020

Meter Box Calibration and Usage Status

Date of Report: February 2, 1994

Meter Box No. : 7 (Rockwell Dry Test Meter Serial No. 965550)

Date of Last Calibration: January 07, 1994
Calibration Technician: D. Brennan
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 11, 1994	4-2085	759.00	1074.03	315.03	315.03
January 21, 1994	4-2163	1082.50	1304.34	221.84	536.87
February 01, 1994	4-2197	1313.47	1426.49	113.02	649.89

* Total volume through meter since last calibration.

Date 1-7-94

Bar. Press. 29.15 in. Hg

INTERPOLL LABORATORIES, INC.
METER CALIBRATION SHEET
EPA METHOD 5

Control Module No. 7
Serial No. DTM 961550
Wet Test Meter No. AL-20
Technician D. BRENNAN

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. ΔH@	C_f
nominal	actual				V_{dl}	V_{df}	Wet Test t_w (°F)	Dry Test t_{dl} (°F)	Dry Test t_{do} (°F)				
0.6	.50	2	99.85	0.01	673.000	675.064	65.5	83	76	5:13	.9920	1.90	
1.2	1.2	(5)3	99.91	0.025	667.500	672.647	65.5	86	77	8:28	.9970	1.91	
2.0	2.0	3	99.93	0.055	664.000	667.075	65.5	87	77	3:58	1.0003	1.94	
3.3	3.3	5	100.00	0.09	658.500	663.625	65.5	88	77	5:14	.9986	2.00	
4.7	4.7	5	100.02	0.12	653.000	658.074	65.5	86	76	4:25	1.0025	2.03	
										Avg.	.9981	1.96	

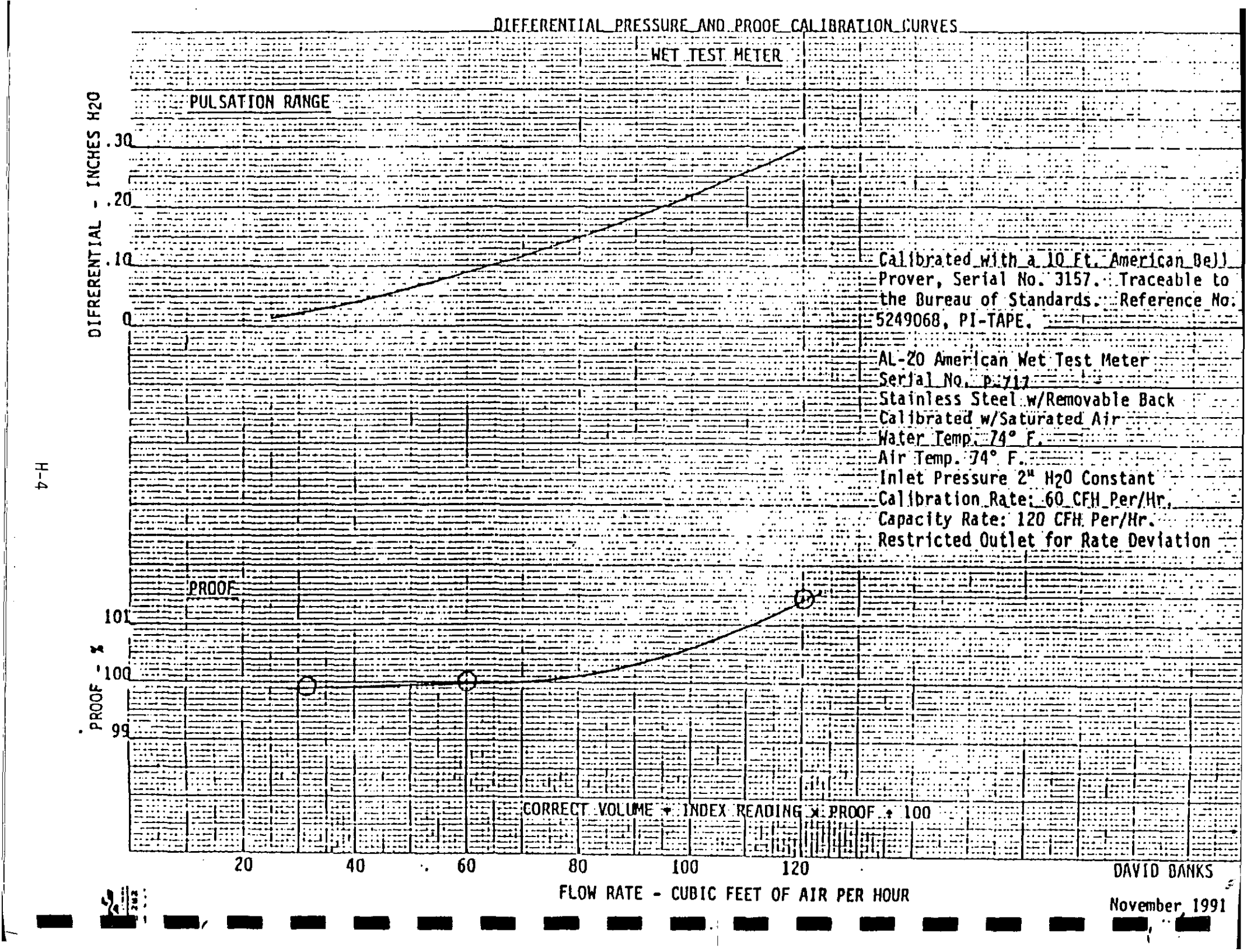
Positive leak check performed by D. BRENNAN
Meter was in tolerance ■
Meter was not in tolerance ☐; readjusted linkage
Meter was not in tolerance ☐; changed dry test meters

Approved by [signature] Date 1/14/94

* Based on AL-20 wet test meter calibration in Nov. 1991 against Bell Prover (NBS Traceable) - Carl Poe Co.

H-3

S0102RR 11/91


DIFFERENTIAL PRESSURE AND PROOF CALIBRATION CURVES
WET TEST METER
PULSATION RANGE
DIFRERENTIAL - INCHES H20
.30
.20
.10
0
Calibrated with a 10 Ft. American Bell Prover, Serial No. 3157. Traceable to the Bureau of Standards. Reference No. 5249068, 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
PROOF
101
100
99
PROOF - %
CORRECT VOLUME = INDEX READING x PROOF ÷ 100
20
40
60
80
100
120
FLOW RATE - CUBIC FEET OF AIR PER HOUR
DAVID BANKS
November 1991

H-4

Interpoll Laboratories, Inc.
(612) 786-6020

Nozzle Calibration
Data Sheet

Date of Calibration: 02-01-94 Nozzle Number 9-4

Technician: Ron Rosenthal

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	.248
2	.250
3	.249
Average:	.249

Interpoll Laboratories, Inc.

Temperature Measurement Device Calibration Sheet

Unit under test:
Vendor Beckman Industries PDT-20
Model HO 1107 Serial Number 10530098
Range ____ °F Thermocouple Type K
Date of Calibration 11-15-93 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		-2	2	.43
100		94	6	1.07
200		198	2	.30
300		296	4	.79
400		394	6	.70
500		493	7	.73
600		596	4	.38
700		697	3	.26
800		802	2	.16
900		904	6	.44
1000		1010	10	.68
1100		1113	13	.83
1200		1220	20	1.20
1300		1320	20	1.14
1400		1425	25	1.34
1500		1523	23	1.17
1600		1625	25	1.21
1700		1720	20	.99
1800		1819	19	.84
1900		1911	11	.74
2000				
2100				
		Averages:	11.4	.77

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.
(612) 786-6020

S-Type Pitot Tube Inspection Sheet

Pitot Tube No. 31-5

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) .460 IN.

Alignment:

4. α_1 < 10° 0
5. α_2 < 10° 0

6. B_1 < 5° 0
7. B_2 < 5° 0

8. Z <.125" 0
9. W <.0625" .02

Distance from Pitot to Probe Components:

10. Pitot to 0.500 IN. nozzle .750 IN.
11. Pitot to probe sheath 3.0 IN.
12. Pitot to thermocouple (parallel to probe) 3.0 IN.
13. Pitot to thermocouple (perpendicular to probe) .760 IN.

☒ Meets all EPA design criteria thus C_p = 0.84
☐ Does not meet EPA design criteria - thus calibrate in wind tunnel.
C_p = _____

Date of Inspection: 4-8-93

Inspected by: [signature]

CFR Title 40 Part 60 Appenidix A Method 2

S-348
4-7-93 C:\STACK\WP\FORMS\S-348

INTERPOLL LABORATORIES
(612)786-6020

Stack Sampling Department - QA
Aneroid Barometer Calibration Sheet

Date 11-15-93
Technician R. Rosenthal
Mercury Column Barometer No. NOVA-1
Aneroid Barometer No. _____

Actual Mercury Barometer Read	Ambient Temp.	Temperature Correction Factor	Adjsted Mercury Barometer Read	Initial Aneriod Barometer Read	Difference (P_{ba}-P_{bm})
29.36	72	.116	29.244	29.24	0

Has this barometer shown any consistent problems with calibration? Yes/(No.) If yes, explain. _____

Has problem been alleviated? Yes/No. How? _____

*Note

Aneroid barometers will be calibrated periodically against a mercury column barometer. The aneroid barometer to be calibrated should be placed in close proximity to the mercury barometer and left to equilibrate for 20-30 minutes before calibrating. Aneriod barometer will be calibrated to the adjusted mercury barometer readings.

S-312