Background Report Reference

AP-42 Section Number: 10.6.1

Background Report Section: 4

Reference Number: 18

Title: Results of The February 24-26, 1992 Air Emission Compliance Tests at the Louisian Pacific Waferboard Plant In Sagola, Michigan

Interpoll Laboratories, Inc.

March 1992

Ref. 18

'SABOLA
(PRESS)

Ref 18
Sec 4

In the proceedings

(PRESS ONLY)

- WOOD SPECIES ??

- UNCONTROLLED OUTLET EMISSIONS ONLY

- PRESS PRODUCTION RATE INCLUDED

PM_{10} EMISSION RATE > $PM_{.}$ EMISSION RATE !!!

Source category: Reconstituted wood products
Plant name : L-P, Sagola (press)
Test date : 2/24 - 2/26, 1992
Process : wafer board

Date:
Location:
Ref. No.: 18

Basis for process rate :

Source	Type of control	Pollutant	Run No.	Emission rate, lb/hr	Process rate, ton/hr	Emission factor kg/Mg	Emission factor lb/ton
Press	None	filt. PM	1			ERR	ERR
		filt. PM	2			ERR	ERR
		filt. PM	3			ERR	ERR
				AVERAGE		ERR	ERR
		condens. PM	1			ERR	ERR
		condens. PM	2			ERR	ERR
		condens. PM	3			ERR	ERR
				AVERAGE		ERR	ERR
		PM-10	1	5.05	26.27	0.10	0.19
		PM-10	2	4.63	26.27	0.088	0.18
		PM-10	3	5.01	26.27	0.10	0.19
				AVERAGE		0.093	0.19
		condens. PM	1	1.11	26.27	0.021	0.042
		condens. PM	2	0.37	26.27	0.0070	0.014
		condens. PM	3	0.52	26.27	0.010	0.020
				AVERAGE		0.013	0.025
		CO	1			ERR	ERR
		CO	2			ERR	ERR
		CO	3			ERR	ERR
				AVERAGE		ERR	ERR
		CO2	1/1			ERR	ERR
		CO2	1/2			ERR	ERR
		CO2	1/3			ERR	ERR
		CO2	2/1			ERR	ERR
		CO2	2/2			ERR	ERR
		CO2	2/3			ERR	ERR
		CO2	3/1			ERR	ERR
		CO2	3/2			ERR	ERR
		CO2	3/3			ERR	ERR
				AVERAGE		ERR	ERR
		formaldehyde	1			ERR	ERR
		formaldehyde	2			ERR	ERR
		formaldehyde	3			ERR	ERR
				AVERAGE		ERR	ERR
		total hydrocarbon	1			ERR	ERR
		total hydrocarbon	2			ERR	ERR
		total hydrocarbon	3			ERR	ERR
				AVERAGE		ERR	ERR

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PRES VES-1

RESULTS OF THE FEBRUARY 24 - 26, 1992 AIR EMISSION COMPLIANCE TESTS AT THE LOUISIANA PACIFIC WAFERBOARD PLANT IN SAGOLA, MICHIGAN

Submitted to:

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

Attention:

Sue Somers

5/22
LT (3a)

Approved by:

Daniel J. Despen
Manager
Field Testing Division

Report Number 2-3507
March 25, 1992
KE/kce

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ABBREVIATIONS

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

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

1 INTRODUCTION

During the period February 24-26, 1992 Interpoll Laboratories personnel conducted Federal air emission compliance tests on the Press & Unloader vents at the Louisiana Pacific Corporation (LP) Waferboard Plant located in Sagola, Michigan. On-site testing was performed by E. Trowbridge and Curt Mosser. Coordination between testing activities and plant operation was provided by Sue Somers of LP. The test was witnessed by Larry Lins of the Environmental Protection Agency.

The press vents tested are the exhaust from general ventilators positioned over the board press and unloader. The press and unloader vent exhausts are emitted to the atmosphere via a common stack which extends 105 feet above grade and has a diameter of 72 inches.

Particulate evaluations were performed in accordance with EPA Methods 2-5, CFR Title 40, Part 60, Appendix A (revised July 1, 1991). 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 to provide samples for methylene chloride extraction to determine total condensible organic compounds. A yaw angle determination was performed in accordance with EPA Method 1, Section 2.4 using an S-Type pitot tube system which allows rotation of the pitot tube on its long axis for nulling and measurement of the yaw angle. The average of the absolute value was found to be 4.5° which meets the EPA specification of less than 20°.

PM-10 determinations were performed in accordance with EPA Method 201A (Ibid, Part 51, Appendix M). An Interpoll Labs sampling train which meets or exceeds specifications in the above-cited reference was used to

extract PM-10 samples by means of an Anderson PM-10 cyclone and a stainless steel probe. The cyclone used in this work meets or exceeds the specifications of Method 201A. Velocity pressure measurements were made prior to each run to determine the proper dwell times at each traverse point.

Formaldehyde samples were collected in accordance with EPA Draft Method 0011 (SW 846 3rd Ed.). The samples were collected isokinetically using a Method 5 sampling train with an aqueous acidic 2,4-dinitrophenylhydrazine absorbing solution and analyzed by high performance liquid chromatography.

Total gaseous hydrocarbon concentrations were determined instrumentally using a Ratfisch Model RS55 heated flame ionization detector (HFID) calibrated against propane in air standards. The THC concentration was continuously monitored by extracting a slipstream of exhaust gas by means of a heated probe and filter holder. A heat-traced teflon line was used to transport the sample gas from the filter holder outlet to the analyzer inlet.

Carbon monoxide determinations were performed in accordance with EPA Method 10 (Ibid). Concentrations were determined using a non-dispersive infrared (NDIR) continuous emission monitor.

Testing on the Press and Unloader vents was conducted from two test ports oriented at 90 degrees on the stack. A 24-point traverse was used to collect the particulate and formaldehyde samples. Each traverse point was sampled 2.5 minutes for a total sampling time of 60 minutes per run. A 12-point traverse was used to collect the PM-10 samples. PM-10 run times varied from 74.9 to 76.5 minutes.

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 and PM-10 emission compliance tests are summarized in Tables 1 and 2. The particulate and PM-10 results have been calculated using the dry catch only ("a" Tables) and again with the organic wet catch added ("b" Tables). As will be noted, the particulate emission rates averaged 0.099 LB/TFP and 0.0047 LB/(KLB Flue Gas) (dry catch only), and 0.105 LB/TFP and 0.0049 LB/(KLB Flue Gas) (dry + wet catch). The PM-10 emission rate averaged 4.9 LB/HR (dry catch only), and 5.56 LB/HR (dry + wet catch).

The carbon monoxide results are summarized in Table 3. The carbon monoxide emission rate averaged 3.8 LB/HR.

A summary of the formaldehyde results are presented in Table 4. The formaldehyde concentration averaged 5.82 mg/m^3 @70 °F. The corresponding average emission rate was 2.97 LB/HR and 0.11 LB/TFP.

The results of the Total Hydrocarbons test are summarized in Table 5. The total hydrocarbon emission rate averaged 7.25 LB/HR and 0.27 LB/TFP.

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.

Table 1a Summary of the Results of the February 25, 1992 Particulate Emission Compliance Test on the Press & Unloader Vents at the Louisiana Pacific Waferboard Plant Located in Sagola, Michigan.

ITEM		Run 1	Run 2	Run 3
Date of test		02-25-92	02-25-92	02-25-92
Time runs were done	(HRS)	1336/1439	1507/1609	1628/1731
Process rate	(LB/HR)	52617.0	52617.0	52617.0
Volumetric flow				
actual	(ACFM)	134902	137435	135925
standard	(DSCFM)	123256	124668	123717
Gas temperature	(DEG-F)	81	85	85
Moisture content	(%V/V)	2.10	2.16	1.76
Gas composition	(%V/V,dry)			
carbon dioxide		0.03	0.03	0.03
oxygen		20.90	20.90	20.90
nitrogen		79.07	79.07	79.07
Isokinetic variation	(%)	100.5	100.2	99.9
Particulate concentration				
actual	(GR/ACF)	.00299	.00189	.00186
standard	(GR/DSCF)	.00327	.00209	.00205
Part. emission rate	(LB/HR)	3.46	2.23	2.17
(LB/TFP)		0.13	0.085	0.083
(LB/KLB Flue Gas)		0.0062	0.0039	0.0039

Note: Dry Catch Only (filterable PM)

Table 1b Summary of the Results of the February 25, 1992 Particulate Emission Compliance Test on the Press & Unloader Vents at the Louisiana Pacific Waferboard Plant Located in Sagola, Michigan.

ITEM		Run 1	Run 2	Run 3
Date of test		02-25-92	02-25-92	02-25-92
Time runs were done	(HRS)	1336/1439	1507/1609	1628/1731
Process rate	(LB/HR)	52617	52617	52617
Volumetric flow				
actual	(ACFM)	134902	137435	135925
standard	(DSCFM)	123256	124668	123717
Gas temperature	(DEG-F)	81	85	85
Moisture content	(%V/V)	2.10	2.16	1.76
Gas composition	(%V/V,dry)			
carbon dioxide		0.03	0.03	0.03
oxygen		20.90	20.90	20.90
nitrogen		79.07	79.07	79.07
Isokinetic variation	(%)	100.5	100.2	99.9
Particulate concentration				
actual	(GR/ACF)	.00310	.00202	.00197
standard	(GR/DSCF)	.00339	.00223	.00217
Part. emission rate	(LB/HR)	3.58	2.38	2.30
(LB/TFP)		0.14	0.090	0.087
(LB/KLB Flue Gas)		0.0064	0.0042	0.0041

Note: Dry + Organic Wet Catch (Total PM)

(Back half

Table 2a. Summary of the Results of the February 26, 1992 PM-10 Emission Compliance Test on the Press & Unloader Vents at the Louisiana Pacific Waferboard Plant Located in Sagola, Michigan.

ITEM		Run 1	Run 2	Run 3
Date of test		02-26-92	02-26-92	02-26-92
Time runs were done	(HRS)	900/1018	1046/1204	1238/1400
Process rate	(LB/HR)	52547.0	52547.0	52547.0
Volumetric flow				
actual	(ACFM)	137991	137866	139598
standard	(DSCFM)	127158	127618	129546
Gas temperature	(DEG-F)	75	72	69
Moisture content	(%V/V)	1.17	1.29	1.54
Gas composition	(%V/V,dry)			
carbon dioxide		0.03	0.03	0.03
oxygen		20.90	20.90	20.90
nitrogen		79.07	79.07	79.07
Isokinetic variation	(%)	100.1	102.0	100.6
PM-10 concentration.....				
actual.....(GR/ACF)		.00427	.00392	.00419
dry standard.....(GR/DSCF)		.00464	.00423	.00451
PM-10 mass rate.....(LB/HR)		5.05	4.63	5.01
		0.19	0.18	0.19

0.19 lb/hour

Note: Dry Catch Only

Table 2_b. Summary of the Results of the February 26, 1992 PM-10 Emission Compliance Test on the Press & Unloader Vents at the Louisiana Pacific Waferboard Plant Located in Sagola, Michigan.

ITEM	Run 1	Run 2	Run 3
Date of test	02-26-92	02-26-92	02-26-92
Time runs were done (HRS)	900/1018	1046/1204	1238/1400
Process rate (LB/HR)	52547.0	52547.0	52547.0
Volumetric flow			
actual (ACFM)	137991	137866	139598
standard (DSCFM)	127158	127618	129546
Gas temperature (DEG-F)	75	72	69
Moisture content (%V/V)	1.17	1.29	1.54
Gas composition (%V/V,dry)			
carbon dioxide	0.03	0.03	0.03
oxygen	20.90	20.90	20.90
nitrogen	79.07	79.07	79.07
Isokinetic variation (%)	100.1	102.0	100.6
PM-10 concentration.....			
actual.....(GR/ACF)	.00521	.00423	.00462
dry standard.....(GR/DSCF)	.00565	.00457	.00498
PM-10 mass rate.....(LB/HR)	6.16	5.00	5.53
	0.23	0.19	0.21

0.21 lb/ton

Note: Dry + Organic Wet Catch

Table 3. Summary of the February 26, 1992 Carbon Monoxide Emission Compliance Test on the Press & Unloader Vent at the Louisiana Pacific Waferboard Plant in Sagola, Michigan.

Test/Run	Volumetric Flow Rate (DSCFM)	Concentration (ppm,w)	Emission Rate (LB/HR)
3/1	123260	5.9	3.2
3/2	124670	5.9	3.3
3/3	123720	8.8	4.9
Avg.		6.9	3.8

Table 4 Summary of the February 25, 1992 Formaldehyde Emission Compliance Test on the Press & Unloader Vent at the Louisiana Pacific Waferboard Plant in Sagola, Michigan.

Test/Run	Volumetric Flow Rate (DSCFM)	Concentration (ppm,w)	Concentration (mg/m^3)*	Emission Rate (LB/HR)	Emission Rate (LB/TFP)
2/1	127203	5.09	6.51	3.09	0.12
2/2	126070	3.99	5.07	2.38	0.090
2/3	125341	5.75	5.88	3.43	0.13
Avg.		4.94	5.82	2.97	0.11

* mg/m^3 @70 °F and 29.92 IN HG

Note: TFP = Ton Finished Product (26.3/HR)

Table 5. Summary of the Results of the February 26, 1992 Total Hydrocarbon Determinations on the Press & Unloader Vent at the Louisiana Pacific Waferboard Plant Located in Sagola, Michigan.

Test/Run	Time (HRS)	Concentration (ppmC,w)	Emission Rate (LB/HR)	Emission Rate (LB/TFP)
5/1	1045-1155	27.6	6.67	0.25
5/2	1215-1320	24.9	6.02	0.23
5/3	1330-1430	36.9	9.07	0.34
Average		29.8	7.25	0.27

Note: TFP = Ton Finished Product (26.3/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, PM-10, carbon monoxide and formaldehyde 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. 2
Press & Unloader Vent Stack

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

	Run 1	Run 2	Run 3
Date of run	02-25-92	02-25-92	02-25-92
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.....	20.46	20.61	20.52
carbon monoxide.....	0.00	0.00	0.00
nitrogen.....	77.39	77.97	77.63
water vapor.....	2.13	1.39	1.82
Dry molecular weight.....	28.84	28.84	28.84
Wet molecular weight.....	28.61	28.69	28.64
Specific gravity.....	0.988	0.991	0.989
Water mass flow.....(LB/HR)	0.00	0.00	0.00
FO	0.000	0.000	0.000

Test No. 3
Press & Unloader Vent Stack

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

Date of run	Run 1 02-25-92	Run 2 02-25-92	Run 3 02-25-92
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.....	20.46	20.45	20.53
carbon monoxide.....	0.00	0.00	0.00
nitrogen.....	77.41	77.36	77.68
water vapor.....	2.10	2.16	1.76
Dry molecular weight.....	28.84	28.84	28.84
Wet molecular weight.....	28.61	28.61	28.65
Specific gravity.....	0.988	0.988	0.990
Water mass flow.....(LB/HR)	7409	7738	6208
FO	0.000	0.000	0.000

Test No. 4
Press & Unloader Vent

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

	Run 1	Run 2	Run 3
Date of run	02-26-92	02-26-92	02-26-92
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.....	20.66	20.63	20.58
carbon monoxide.....	0.00	0.00	0.00
nitrogen.....	78.15	78.05	77.85
water vapor.....	1.17	1.29	1.54
Dry molecular weight.....	28.84	28.84	28.84
Wet molecular weight.....	28.71	28.70	28.67
Specific gravity.....	0.992	0.991	0.990
Water mass flow.....(LB/HR)	4212	4684	5682
FO	0.000	0.000	0.000

3.2 Results of Particulate Determinations

Test No. 3
Press & Unloader Vent Stack

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

	Run 1	Run 2	Run 3
Date of run	02-25-92	02-25-92	02-25-92
Time run start/end.....(HRS)	1336/1439	1507/1609	1628/1731
Static pressure.....(IN.WC)	-1.30	-1.30	-1.30
Cross sectional area (SQ.FT)	27.69	27.69	27.69
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)	24.0	25.0	20.0
total.....(GRAMS)	24.0	25.0	20.0
Total particulate material..			
.....collected(grams)	0.0116	0.0077	0.0074
Gas meter coefficient.....	0.9957	0.9957	0.9957
Barometric pressure..(IN.HG)	28.73	28.73	28.73
Avg. orif.pres.drop..(IN.WC)	2.82	2.88	2.82
Avg. gas meter temp..(DEF-F)	85.0	84.4	84.8
Volume through gas meter....			
at meter conditions...(CF)	56.62	57.05	56.50
standard conditions.(DSCF)	52.80	53.27	52.71
Total sampling time....(MIN)	60.00	60.00	60.00
Nozzle diameter.....(IN)	.190	.190	.190
Avg.stack gas temp ..(DEG-F)	81	85	85
Volumetric flow rate.....			
actual.....(ACFM)	134902	137435	135925
dry standard.....(DSCFM)	123256	124668	123717
Isokinetic variation.....(%)	100.5	100.2	99.9
Particulate concentration...			
actual.....(GR/ACF)	0.00310	0.00202	0.00197
dry standard.....(GR/DSCF)	0.00339	0.00223	0.00217
Particle mass rate...(LB/HR)	3.581	2.383	2.297

dry catch 0.0116 0.01121
wet catch 0.00039

3.3 Results of PM-10 Determinations

Test No. 4
Press & Unloader Vent

Results of PM-10 Determinations

	Run 1	Run 2	Run 3
Date of run	02-26-92	02-26-92	02-26-92
Time run start/end.....(HRS)	900/1018	1046/1204	1238/1400
Static pressure.....(IN.WC)	-1.00	-1.00	-1.00
Cross sectional area (SQ.FT)	27.69	27.69	27.69
Pitot tube coefficient.....	.840	.840	.840
Water in sample gas			
condenser.....(ML)	0.0	0.0	0.0
impingers.....(GRAMS)	1.0	1.0	2.0
desiccant.....(GRAMS)	7.0	8.0	9.0
total.....(GRAMS)	8.0	9.0	11.0
Total PM-10 material.....			
.....collected(grams)	0.0117	0.0096	0.0107
Gas meter coefficient.....	0.9957	0.9957	0.9957
Barometric pressure..(IN.HG)	28.34	28.34	28.34
Avg. orif.pres.drop..(IN.WC)	0.63	0.65	0.65
Avg. gas meter temp..(DEF-F)	71.6	79.6	81.2
Volume through gas meter....			
at meter conditions...(CF)	34.06	35.10	36.00
standard conditions.(DSCF)	31.94	32.43	33.17
Total sampling time....(MIN)	75.45	74.90	76.47
Nozzle diameter.....(IN)	.130	.130	.130
Avg.stack gas temp ..(DEG-F)	75	72	69
Volumetric flow rate.....			
actual.....(ACFM)	137991	137866	139598
dry standard.....(DSCFM)	127158	127618	129546
Isokinetic variation.....(%)	100.1	102.0	100.6
PM-10 cutpoint.....(um)	10.03	9.87	9.82
PM-10 concentration.....			
actual.....(GR/ACF)	0.00521	0.00423	0.00462
dry standard.....(GR/DSCF)	0.00565	0.00457	0.00498
PM-10 mass rate.....(LB/HR)	6.160	4.996	5.527

Test No. 4
Press & Unloader Vent

Results of PM-10 Determinations

	Run 1	Run 2	Run 3
Date of run	02-26-92	02-26-92	02-26-92
Time run start/end.....(HRS)	900/1018	1046/1204	1236/1400
Static pressure.....(IN.WC)	-1.00	-1.00	-1.00
Cross sectional area (SQ.FT)	27.69	27.69	27.69
Pitot tube coefficient.....	.840	.840	.840
Water in sample gas			
condenser.....(ML)	0.0	0.0	0.0
impingers.....(GRAMS)	1.0	1.0	2.0
desiccant.....(GRAMS)	7.0	8.0	9.0
total.....(GRAMS)	8.0	9.0	11.0
Total PM-10 material.....			
.....collected(grams)	0.0096	0.0089	0.0097
Gas meter coefficient.....	0.9957	0.9957	0.9957
Barometric pressure..(IN.HG)	28.34	28.34	28.34
Avg. orif.pres.drop..(IN.WC)	0.63	0.65	0.65
Avg. gas meter temp..(DEF-F)	71.6	79.6	81.2
Volume through gas meter....			
at meter conditions...(CF)	34.06	35.10	36.00
standard conditions.(DSCF)	31.94	32.43	33.17
Total sampling time....(MIN)	75.45	74.90	76.47
Nozzle diameter.....(IN)	.130	.130	.130
Avg.stack gas temp ..(DEG-F)	75	72	69
Volumetric flow rate.....			
actual.....(ACFM)	137991	137866	139598
dry standard.....(DSCFM)	127158	127618	129546
Isokinetic variation.....(%)	100.1	102.0	100.6
PM-10 cutpoint.....(um)	10.03	9.87	9.82
PM-10 concentration.....			
actual.....(GR/ACF)	0.00427	0.00392	0.00419
dry standard.....(GR/DSCF)	0.00464	0.00423	0.00451
PM-10 mass rate.....(LB/HR)	5.054	4.632	5.011

3.4 Results of Carbon Monoxide Determinations

Test No. 3
Press & Unloader Vents

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

	Run 1	Run 2	Run 3
Date of run	02-25-92	02-25-92	02-25-92
Time run start/end.....(HRS)	1336-1439	1507-1609	1628-1731
Total sampling time....(MIN)	60.0	60.0	60.0
Moisture content.....(%V/V)	2.10	2.16	1.76
O2 Concentration.....(%V/V)	20.90	20.90	20.90
Volumetric flow rate (DSCFM)	123260	124670	123720
CO concentration.....			
(GR/DSCF).....	0.0031	0.0031	0.0046
(MG/DSCM).....	6.99	6.99	10.48
(PPM-WET).....	5.87	5.87	8.84
(PPM-DRY).....	6.00	6.00	9.00
(PPM-DRY @ 7% O2).....	840.00	840.00	1260.00
CO emission rate.....(LB/HR)	3.225	3.262	4.856

CO = Carbon monoxide

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

3.5 Results of Formaldehyde Determinations

Test No. 2
Press & Unloader Vent Stack

Results of Formaldehyde Tests ---------- EPA Method 0011

	Run 1	Run 2	Run 3
Date of run	02-25-92	02-25-92	02-25-92
Time run start/end.....(HRS)	840/ 942	1025/1127	1200/1302
Static pressure.....(IN.WC)	-1.30	-1.30	-1.30
Cross sectional area (SQ.FT)	27.69	27.69	27.69
Pitot tube coefficient.....	.840	.840	.840
Water in sample gas			
condenser.....(ML)	0.0	0.0	0.0
impingers.....(GRAMS)	0.0	2.0	0.0
desiccant.....(GRAMS)	25.0	14.0	21.0
total.....(GRAMS)	25.0	16.0	21.0
Formaldehyde in sample..(uG)	9900	7600	11000
Gas meter coefficient.....	0.9957	0.9957	0.9957
Barometric pressure..(IN.HG)	28.73	28.73	28.73
Avg. orif.pres.drop..(IN.WC)	2.94	2.87	2.92
Avg. gas meter temp..(DEF-F)	75.0	79.3	85.0
Volume through gas meter....			
at meter conditions...(CF)	57.10	56.77	57.40
standard conditions.(DSCF)	54.26	53.51	53.54
Total sampling time....(MIN)	60.00	60.00	60.00
Nozzle diameter.....(IN)	.190	.190	.190
Avg.stack gas temp ..(DEG-F)	81	83	81
Volumetric flow rate.....			
actual.....(ACFM)	139124	137256	136727
dry standard.....(DSCFM)	127203	126070	125341
Isokinetic variation.....(%)	100.0	99.5	100.2
CH2O concentration.....			
(GR/DSCF).....	0.0028	0.0022	0.0032
(MG/DSCM).....	6.49	5.05	7.31
(PPM-DRY).....	5.20	4.05	5.86
(PPM-WET).....	5.09	3.99	5.75
CH2O emission rate...(LB/HR)	3.09118	2.38463	3.42966

CH2O = Formaldehyde

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

APPENDIX A

RESULTS OF VOLUMETRIC FLOW RATE DETERMINATIONS

Test No. 2
Press & Unloader Vent Stack

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

Date of Determination.....	02-25-92
Time of Determination.....(HRS)	1640
Barometric pressure.....(IN.HG)	28.73
Pitot tube coefficient.....	.84
Number of sampling ports.....	2
Total number of points.....	24
Shape of duct.....	Round
Stack diameter.....(IN)	71.25
Duct area.....(SQ.FT)	27.69
Direction of flow.....	UP
Static pressure.....(IN.WC)	-1.3
Avg. gas temp.....(DEG-F)	76
Moisture content.....(% V/V)	2.13
Avg. linear velocity.....(FT/SEC)	77.1
Gas density.....(LB/ACF)	.07004
Molecular weight.....(LB/LBMOLE)	28.84
Mass flow of gas.....(LB/HR)	538146
Volumetric flow rate.....	
actual.....(ACFM)	128050
dry standard.....(DSCFM)	118152

Test No. 4
Press & Unloader Vent

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

Date of Determination.....	02-26-92
Time of Determination.....(HRS)	835
Barometric pressure.....(IN.HG)	28.34
Pitot tube coefficient.....	.84
Number of sampling ports.....	2
Total number of points.....	12
Shape of duct.....	Round
Stack diameter.....(IN)	71.25
Duct area.....(SQ.FT)	27.69
Direction of flow.....	UP
Static pressure.....(IN.WC)	-1
Avg. gas temp.....(DEG-F)	83
Moisture content.....(% V/V)	1.17
Avg. linear velocity.....(FT/SEC)	83.5
Gas density.....(LB/ACF)	.06845
Molecular weight.....(LB/LBMOLE)	28.84
Mass flow of gas.....(LB/HR)	569503
Volumetric flow rate.....	
actual.....(ACFM)	138670
dry standard.....(DSCFM)	125804

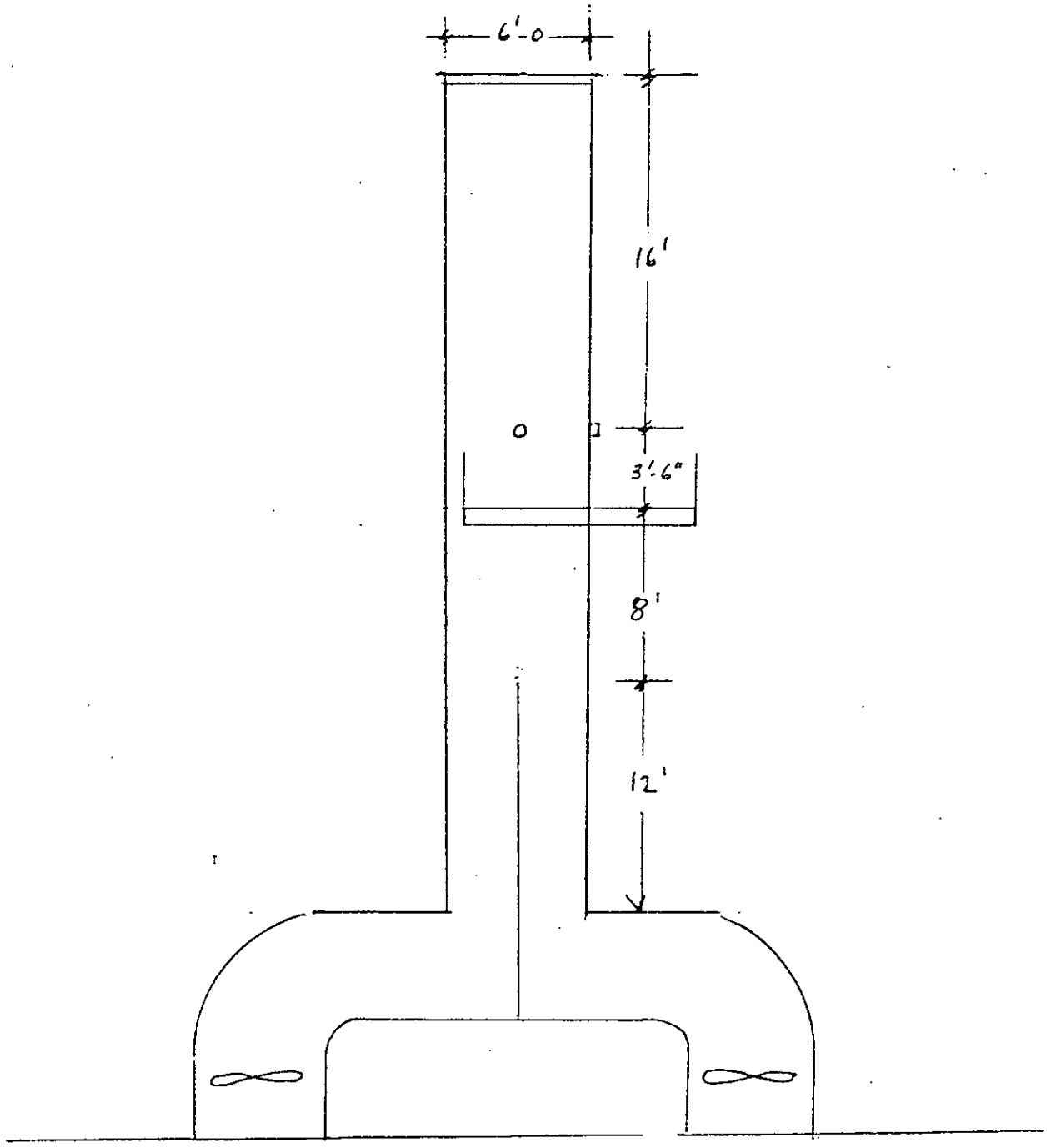
APPENDIX B

LOCATION OF TEST PORTS

LOUISIANA PACIFIC

SAGOLA PLANT

PRESS VENT STACK



LP 2/92

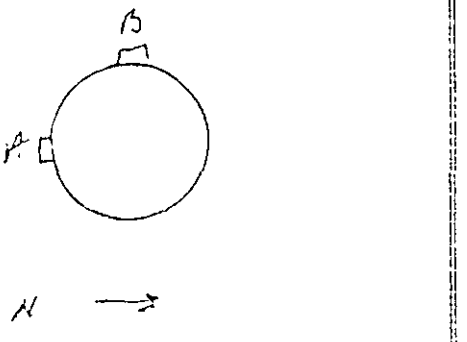
NOT TO SCALE

APPENDIX C

FIELD DATA SHEETS

INTERPOLL LABORATORIES EPA METHOD 2 FIELD DATA SHEET

Job LP/SAGOLA
Source Glass Unloader Vents
Test 1 Run 1 Date 2-24-92
Stack dimen. 71¼ IN.
Dry bulb ____ °F Wet bulb ____ °F
Manometer: ☐ Reg. ☐ Exp. ☒ Elec.
Barometric pressure 28.70 in Hg
Static pressure -1.30 in WC
Operators E.Trowbridge - C.Musser
Pitot No. 22V-6 Cp .85



Schematic of Cross Section

CYCLONIC FLOW

Traverse Point No.		Fraction of Diameter	Distance from Stack Wall (in)	Distance from End of Port (in)	Velocity Pressure (in WC)	Temperature of gas (°F)
			Port length: 5 in.		Time start: 1600 hrs	
A	1	.021	1.50	6.50	+2	55
	2	.067	4.77	9.77	0	
	3	.119	8.40	13.40	0	
	4	.177	12.61	17.61	+5	
	5	.250	17.81	22.81	+7	
	6	.356	25.36	30.36	+4	
	7	.644	45.88	50.88	-4	
	8	.750	53.44	58.44	-6	
	9	.823	58.64	63.64	-9	
	10	.882	62.84	67.84	-10	
	11	.933	66.47	71.47	-8	
	12	.979	69.75	74.75	-2	
B	1				+4	55
	2				+3	
	3				0	
	4				0	
	5				0	
	6				-6	
	7				-4	
	8				-4	
	9				-7	
	10				-8	
	11				-8	
	12				-6	
				Avg = 4.5°		
Temp. meas. tool & S/N: PDT-12					Time end: 1640 hrs	

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

INTERPOLL LABORATORIES EPA METHOD 2 FIELD DATA SHEET

Job Louisiana Pacific/Segola, MI

Source Press & Unloader Vents - Stack

Test 2 Run 1 Date 2-25-92

Stack dimen. 71 1/4 IN.

Drv bulb ____ °F Wet bulb ____ °F

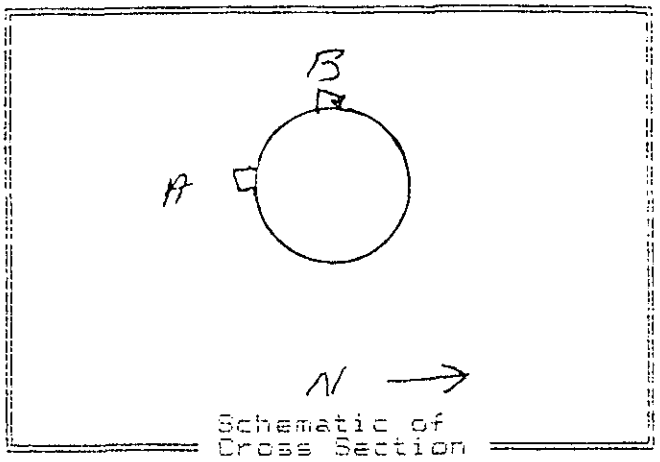
Manometer: ☐ Reg. ☐ Exp. ☐ Elec.

Barometric pressure 28.73 in Hg

Static pressure -1.30 in WC

Operators E.T Rawbridge - C. Mosser

Pitot No. 22V-6 Cp .840



Schematic of Cross Section

Formaldehyde

Traverse Point No.		Fraction of Diameter	Distance from Stack Wall (in)	Distance from End of Port (in)	Velocity Pressure (in WC)	Temperature of Gas (°F)
			Port length: 5 in.		Time start: 1640 hrs	
A	1	.021	1.50	.650	.65	75
	2	.067	4.77	4.77	1.30	
	3	.118	8.40	13.40	1.45	
	4	.177	12.61	17.61	1.50	
	5	.250	17.81	22.81	1.60	
	6	.356	25.36	30.36	1.50	
	7	.644	45.88	50.88	1.90	
	8	.750	53.44	58.44	2.00	
	9	.823	58.64	63.64	1.90	
	10	.882	62.84	67.84	1.90	
	11	.933	66.47	71.47	1.60	
	12	.979	69.75	74.75	1.60	
B	1				1.20	78
	2				2.05	
	3				2.30	
	4				2.20	
	5				2.00	
	6				2.00	
	7				1.90	
	8				1.90	
	9				1.90	
	10				2.10	
	11				2.30	
	12				2.20	

Temp. meas. tool & S/N: TDT-12 Time end: 1655 hrs

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

INTERFOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job LP/SAGOLA Date 2-25-92 Test 2 Run 1
Source PRESS & UNLOADER VENTS - STACK No. of traverse points 24
Method 5001/ Filter holder: _____ Filter type: _____

Sample Train Leak Check:

Pretest: (0.02 cfm at 15 in. Hg. (vac)
Postest: 0 cfm at 13 in. Hg. (vac)

Particulate Catch Data:

No.s of filters used: _____ _____

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		100	
Impinger No. 2	200	100	0
Impinger No. 3		0	
Condenser			
Desiccant	1325	1300	25
Total			25

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 LP/SAGOLA — Operators E.T[illegible]-C.MOSSER — Pitot No. 22V-6 — Cp .840
Source PLANT X ANCILLARY UNITS-STACK — Meter Box No. 8 — ΔH 1.97 IN WC — Bar. Press. 28.73 inHg H2O x
Date 2-25-92 — Test 2 — Run 1 — Coeff: .9957 — Nozzle No. 4-3 — Nozzle Dia .450 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 (xx/x)
	0840	434.90											
A 12	2.5	437.63	2.70	3.82	7.62	10.0	78	242	246	40	61	58	
11	5	440.32	2.70	3.72	0.26	11.0	79				65	60	
10	7.5	442.93	2.60	3.62	2.88	12.0	76	245	251	44	67	61	
9	10	445.68	2.60	3.63	5.51	12.0	76				71	64	
8	12.5	448.10	2.30	3.20	7.99	10.0	82	246	250	47	71	65	
7	15	450.47	2.10	2.94	0.37	9.0	79				73	65	
6	17.5	452.90	2.10	2.97	2.76	9.0	75	244	252	49	75	67	
5	20	455.30	2.15	3.04	5.18	9.0	78				78	69	
4	22.5	457.70	2.20	3.09	7.62	9.2	84	242	250	48	78	69	
3	25	460.12	2.10	2.94	0.01	9.0	85				78	69	
2	27.5	462.60	2.20	3.09	2.46	9.2	83	240	247	50	80	72	
1	30	465.05	2.30	3.22	4.96	9.3	88				80	72	
B 12	32.5	467.48	2.00	2.82	7.31	8.0	84	245	251	47	80	72	
11	35	469.85	2.10	2.97	9.71	8.1	83				80	73	
10	37.5	472.18	2.00	2.84	2.07	8.0	80	248	253	48	82	74	
9	40	474.58	2.10	3.02	4.50	8.1	76				83	76	
8	42.5	476.00	2.05	2.92	6.89	8.1	83	247	254	50	84	76	
7	45	479.42	2.15	3.08	9.35	8.3	80				85	77	
6	47.5	481.82	2.15	3.11	1.82	8.3	76	245	253	52	86	78	
5	50	483.98	1.50	2.16	3.88	6.7	80				86	78	
4	52.5	486.03	1.50	2.15	5.94	6.7	82	242	251	52	86	79	
3	55	488.20	1.60	2.28	8.07	7.0	85				86	79	
2	57.5	490.25	1.60	2.28	0.19	7.0	85	240	248	54	87	80	
1	60	492.00	1.10	1.57	1.96	6.0	85				87	80	
	(0942)												
	θ = 60	Vm = 57.10		ΔH = 2.9							Avg. = 75.0		

C-4

INTERPOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job LP/SAGOLA Date 2-25-92 Test 2 Run A
Source PRESS + UNLOADER VENTS-STACK No. of traverse points 24
Method 5001/1 Filter holder: _____ Filter type: _____

Sample Train Leak Check:

Pretest: (0.02 cfm at 15 in. Hg. (vac) ☒
Postest: 0 cfm at 9 in. Hg. (vac) ☒

Particulate Catch Data:

No.s of filters used: _____ _____

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

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

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1		100	
Impinger No. 2	202	100	2
Impinger No. 3		0	
Condenser			
Desiccant	1395	1381	14
Total			16

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 LP/SAGOLA
Source CROSS & UNLOADER VENTS-STACK
Date 2-25-92 Test 2 Run 2

Operators E.TROWBRIDGE-C.MIOSSEK
Meter Box No. 8 ΔH@ 1.91 IN WC
Gasmeter coeff. .9957

Pitot No. 22V-6 Cp .840
Bar. Press. 28.73 inHg H2O x
Nozzle No. 4-3 Nozzle Dia .190 IN.

Traverse Point No.	Sampling Time (min)	Sample Volume (cf)	Velocity Head (inWC)	Orifice Meter (inWC)	Dgs. Vol. (cf)	VAC. inHg	Stack (°F)	Probe (°F)	Oven (°F)	Impg. (°F)	Gas/In (°F)	Gas/Out (°F)	Oxygen (xv/v)
	102.5	492.40											
B 12	2.5	494.80	2.00	2.84	4.76	7.1	84	242	247	50	71	70	
11	5	497.18	2.00	2.90	7.09	7.1	81				72	71	
10	7.5	499.55	2.10	2.97	9.49	7.5	77	245	243	52	74	71	
9	10	501.94	2.00	2.82	1.82	7.2	79				75	72	
8	12.5	504.30	2.00	2.81	4.16	7.2	82	247	250	52	76	73	
7	15	506.73	2.05	2.91	6.54	7.2	78				77	74	
6	17.5	508.10	2.10	3.01	8.96	7.2	73	248	253	54	78	75	
5	20	511.32	1.70	2.45	1.14	6.2	77				80	76	
4	22.5	513.45	1.60	2.26	3.25	5.8	84	245	251	55	80	77	
3	25	515.50	1.60	2.28	5.36	5.8	80				80	77	
2	27.5	517.60	1.50	2.13	7.40	5.3	84	244	252	57	82	79	
1	30	519.50	1.20	1.69	9.23	4.0	88				83	79	
A 12	32.5	522.10	2.60	3.66	1.91	8.8	88	247	255	55	85	81	
11	35	524.65	2.30	3.28	4.46	8.3	83				85	81	
10	37.5	527.10	2.30	3.33	7.02	8.3	76	248	252	56	85	82	
9	40	529.62	2.15	3.10	9.49	8.0	79				85	82	
8	42.5	532.10	2.10	3.00	1.93	7.8	83	247	250	57	84	81	
7	45	534.50	2.10	3.01	4.37	7.8	80				84	81	
6	47.5	536.95	2.20	3.15	6.86	8.0	81	245	248	57	84	81	
5	50	539.42	2.20	3.12	9.34	8.0	87				84	81	
4	52.5	541.90	2.20	3.11	1.81	8.0	88	244	250	58	84	81	
3	55	544.35	2.20	3.11	4.29	8.0	88				84	81	
2	57.5	546.80	2.30	3.25	6.82	8.2	88	244	252	57	84	81	
1	60	549.17	1.90	2.67	9.12	7.6	72				84	81	
	(1127)												
	θ = 60	Vm = 56.77		ΔH =							Avg. = 79.3		

S-0037R

INTERPOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job LP/SAGOLA Date 2-25-92 Test 2 Run 3
Source CROSS & UNLOADR UNITS No. of traverse points 24
Method 5001 Filter holder: _____ Filter type: _____

Sample Train Leak Check:

Pretest: (0.02 cfm at 15 in. Hg. (vac) ☒
Postest: 0 cfm at 12 in. Hg. (vac) ☐

Particulate Catch Data:

No.s of filters used: _____ _____

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		100	
Impinger No. 2	200	100	0
Impinger No. 3		0	
Condenser			
Desiccant	1397	1376	21
Total			21

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 LP/SAGOLA
Source Press & Unloader Vents
Date 2-25-92 Test 2 Run 2

Operators ETrowbridge-CMossir
Meter Box No. 5 ^HP 1.91 IN WC
Gasmeter coeff. .9957

Pitot No. 22V-6 Cp .840
Bar. Press. 28.73 inHg H2O ___ x
Nozzle No. 4-3 Nozzle Dia .190 IN.

Traverse Point No.	Sampling Time (min)	Sample Volume (cf)	Velocity Head (inWC)	Orifice Meter (inWC)	Obs. Vol. (cf)	VAC. inHg	Stack (°F)	Probe (°F)	Oven (°F)	Impg. (°F)	Gas/In (°F)	Gas/Out (°F)	Oxygen (xv/v)
	1200	549.50											
A 12	2.5	552.22	2.70	3.88	2.25	10.0	81	250	248	47	80	78	
11	5	554.90	2.50	3.62	4.91	10.2	77				81	80	
10	7.5	557.52	2.40	3.47	7.52	10.2	79	247	251	48	82	80	
9	10	560.05	2.30	3.16	0.01	9.0	84				84	81	
8	12.5	562.62	2.20	3.21	2.52	9.0	77	248	253	50	84	81	
7	15	565.14	2.20	3.24	5.05	9.0	72				85	82	
6	17.5	567.70	2.20	3.20	7.56	9.0	79	246	250	51	85	82	
5	20	570.20	2.20	3.14	0.05	9.0	89				85	82	
4	22.5	572.70	2.20	3.21	2.57	9.0	78	245	248	51	86	82	
3	25	575.21	2.25	3.25	5.10	9.0	84				87	83	
2	27.5	577.59	2.10	3.00	7.55	8.8	91	243	249	52	87	84	
1	30	579.90	1.80	2.59	9.80	7.0	87				88	85	
B 12	32.5	582.36	2.10	3.04	2.26	8.8	85	240	245	50	88	85	
11	35	584.85	2.15	3.15	4.75	8.8	82				88	85	
10	37.5	587.34	2.15	3.16	7.26	8.8	76	243	249	51	88	85	
9	40	589.80	2.10	3.10	9.74	8.8	74				89	85	
8	42.5	592.23	2.10	3.08	2.21	8.8	78	246	251	55	89	85	
7	45	594.65	2.10	3.06	4.68	8.8	81				89	85	
6	47.5	596.85	1.50	2.21	6.78	6.2	76	248	250	54	89	85	
5	50	599.06	1.60	2.34	8.94	6.3	81				89	85	
4	52.5	601.10	1.60	2.30	1.08	6.3	89	244	249	54	89	85	
3	55	603.25	1.50	2.17	3.16	6.3	87				89	85	
2	57.5	605.20	1.30	1.90	5.11	5.5	81	240	244	54	90	85	
1	60	606.90	1.10	1.61	6.40	5.3	81				90	86	
	(1300)												
	θ = 60	Vs = 57.40		H = 2.72							Avg. = 85.0		

S-0037R

INTERPOLL LABORATORIES EPA METHOD 2 FIELD DATA SHEET

Job *Louisiana Pacific / Sagola, MI*

Source *Press unloader vent - Stack*

Test *3* Run *1* Date *2-25-92*

Stack dimen. *71.25* IN.

Dry bulb ____ °F Wet bulb ____ °F

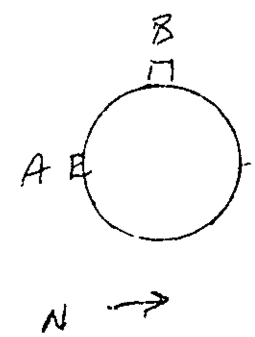
Manometer: [X] Reg. [ ] Exp. [ ] Elec.

Barometric pressure *28.73* in Hg

Static pressure *-1.30* in WC

Operators *G. Trowbridge - C. Krosser*

Pitot No. *224-6* Cp *.840*



Schematic of Cross Section

Particulate

Traverse Point No.		Fraction of Diameter	Distance from Stack Wall (in)	Distance from End of Port (in)	Velocity Pressure (in WC)	Temperature of gas (°F)
			Port length:	*5* in.	Time start:	*1315* hrs
A	*1*	*.021*	*1.50*	*6.50*	*1.70*	*83*
	2	*.067*	*4.77*	*9.77*	*2.10*	
	3	*.118*	*8.40*	*13.40*	*2.10*	
	4	*.177*	*12.61*	*17.61*	*2.20*	
	5	*.250*	*17.81*	*22.81*	*2.20*	
	6	*.356*	*25.36*	*30.36*	*2.10*	
	7	*.644*	*45.88*	*50.88*	*2.10*	
	8	*.750*	*53.44*	*58.44*	*2.20*	
	9	*.823*	*58.64*	*63.64*	*2.70*	
	10	*.882*	*62.84*	*67.84*	*2.60*	
	11	*.933*	*66.47*	*71.47*	*2.70*	
	12	*.979*	*69.75*	*74.75*	*2.70*	
B	*1*				*1.20*	*87*
	2				*1.30*	
	3				*1.50*	
	4				*1.50*	
	5				*1.60*	
	6				*1.60*	
	7				*2.10*	
	8				*2.10*	
	9				*2.10*	
	10				*2.10*	
	11				*2.15*	
	12				*2.00*	
Temp. meas. tool & S/N:			*PDT-12*		Time end:	*1323* hrs

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

INTERPOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job LP/SAGOLA Date 2-25-92 Test 3 Run 1
Source CROSS & UNLOADR VENTS No. of traverse points 24
Method M-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 20 in. Hg. (vac) ☒

Particulate Catch Data:

No.s of filters used: 4082

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

No. of probe wash bottles:
Sample recovered by:

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1		100	
Impinger No. 2	200	100	0
Impinger No. 3		0	
Condenser			
Desiccant	1419	1395	24
Total			24

Integrated Gas Sampling Data:

Bag Pump No. B3 Box No. 20 Bag No. 1
Bag Material: 5-layer Aluminized Tedlar Size: 44 L
Pretest leak check: 0 cc/min at 15 in. Hg.
Time start: 1337 (HRS) Time end: 1438 (HRS)
Sampling rate: 400 cc/min Operator: EF
S/N of O_2 Analyzer used to monitor train outlet:

CF-023

INTERPOLL LABORATORIES EPA METHOD 5 FIELD DATA SHEET

Job LP/SAGOLA
Source Press & ... Vents
Date 2-25-93 Test 3 Run 1

Operators E.T.../C.Mosser
Meter Box No. C ΔH@ 1.97 IN WC
Counter coeff. .9957

Pitot No. 22V-6 Cp .840
Bar. Press. 28.73 inHg H2O x
Nozzle No. 4-3 Nozzle Dia .140 IN.

Traverse Point No.	Sampling Time (min)	Sample Volume (cf)	Velocity Head (inWC)	Orifice Meter (inWC)	Obs. Vol. (cf)	VAC. inHg	Temperatures (°F) Stack	Probe	Oven	Impg.	Cas/In	Cas/Out	Oxygen (xv/v)
	1336	607.30											
B 12	2.5	609.76	2.10	3.06	9.76	7.8	78	240	245	50	81	80	
11	5	612.22	2.10	3.00	2.19	7.8	81				83	80	
10	7.5	614.65	2.10	2.98	4.61	7.8	87	242	247	50	84	82	
9	10	617.07	2.10	3.04	7.06	7.8	76				85	82	
8	12.5	619.52	2.10	3.02	9.51	7.8	81	252	247	52	85	83	
7	15	622.01	2.20	3.19	2.02	8.0	77				85	83	
6	17.5	624.15	1.50	2.19	4.10	6.0	75	247	250	52	85	83	
5	20	626.30	1.60	2.30	6.23	6.0	83				85	83	
4	22.5	628.45	1.60	2.29	8.36	6.0	84	248	252	53	86	82	
3	25	630.45	1.40	2.01	0.36	5.5	82				86	82	
2	27.5	632.40	1.30	1.87	2.29	5.0	82	245	250	54	86	82	
1	30	634.19	1.10	1.57	4.06	4.0	87				86	82	
A 12	32.5	636.90	2.40	3.71	6.76	10.0	85	247	253	55	86	82	
11	35	639.50	2.50	3.59	9.42	10.0	81				86	82	
10	37.5	642.05	2.20	3.19	1.94	9.0	76	245	250	56	86	82	
9	40	644.60	2.20	3.15	4.43	9.0	84				88	84	
8	42.5	646.99	2.10	3.04	6.89	9.0	79	240	242	57	90	85	
7	45	649.45	2.10	3.06	9.35	9.0	78				90	85	
6	47.5	651.98	2.10	3.08	1.83	9.0	74	244	247	58	91	85	
5	50	654.42	2.15	3.12	4.32	9.0	81				91	85	
4	52.5	656.90	2.20	3.14	6.82	9.0	89	243	251	58	91	85	
3	55	659.42	2.30	3.30	9.38	9.2	97				91	85	
2	57.5	661.79	2.0	2.90	1.79	8.2	91	240	247	58	91	85	
1	60	663.92	1.30	1.87	3.72	5.0	87				91	85	
	(1439)												
	Θ = 60	Vm = 56.62	√ΔP	ΔH = 2.82							Avg. = 85.0		

S-0037R

INTERPOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job LP/SAGOLA Date 2-25-92 Test 3 Run 2
Source PRESS + UNLOADER VENTS 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 11 in. Hg. (vac) ☒

Particulate Catch Data:

No.s of filters used: 4083

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

No. of probe wash bottles:
Sample recovered by:

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1		100	
Impinger No. 2	200	100	0
Impinger No. 3		0	
Condenser			
Desiccant	1325	1300	25
Total			25

Integrated Gas Sampling Data:

Bag Pump No. B3 Box No. 20 Bag No. 2
Bag Material: 5-layer Aluminized Tedlar Size: 44 L
Pretest leak check: 0 cc/min at 15 in. Hg.
Time start: 1508 (HRS) Time end: 1608 (HRS)
Sampling rate: 400 cc/min Operator: EF
S/N of O_2 Analyzer used to monitor train outlet:

CF-023

CF-011

INTERPOLL LABORATORIES EPA METHOD 5 FIELD DATA SHEET

Job LA / SAGOLA
Source PRESS & UNLOADER VENTS
Date 2-25-92 Test 3 Run 2

Operators E.TROWBRIDGE-C.MIOSSIK
Meter Box No. 8 ΔH@ 1.91 IN WC
Gasmeter coeff. .9951

Pitot No. 22V-6 Cp .840
Bar. Press. 28.23 inHg H2O x
Nozzle No. 4-3 Nozzle Dia .190 IN.

Traverse Point No.		Sampling Time (min)	Sample Volume (cf)	Velocity Head (inWC)	Orifice Meter (inWC)	Del. Vol. (cf)	VAC. inHg	Temperatures (°F) Stack	Probe	Oven	Impg.	Gas/In	Gas/Out	Oxygen (%v/v)
		1507	664.60											
A	12	2.5	667.40	2.70	3.90	7.37	9.0	79	242	245	48	75	74	
	11	5	670.20	2.70	3.82	0.09	9.5	80				77	75	
	10	7.5	672.80	2.50	3.53	2.71	9.2	83	245	244	49	80	78	
	9	10	675.50	2.70	3.82	5.44	10.0	84				82	79	
	8	12.5	678.10	2.70	3.15	7.93	8.5	80	246	251	52	84	81	
	7	15	680.48	2.10	3.01	0.37	8.0	81				86	82	
	6	17.5	682.70	2.10	3.00	2.80	8.0	85	249	254	52	86	82	
	5	20	685.40	2.10	2.97	5.23	8.0	90				86	82	
	4	22.5	687.82	2.20	3.13	7.72	8.1	87	251	256	52	86	82	
	3	25	690.25	2.20	3.10	0.19	8.1	93				86	82	
	2	27.5	692.70	2.10	2.97	2.61	8.0	91	250	249	53	86	82	
	1	30	694.85	1.70	2.41	4.80	6.5	91				86	82	
B	12	32.5	697.22	2.00	2.84	7.17	7.5	88	244	250	52	87	83	
	11	35	699.62	2.10	3.03	9.62	8.0	80				87	83	
	10	37.5	702.10	2.10	3.03	2.07	8.0	81	248	253	54	87	83	
	9	40	704.50	2.10	3.04	4.52	8.0	78				89	84	
	8	42.5	707.00	2.10	3.07	6.99	8.0	75	245	251	54	89	84	
	7	45	709.45	2.10	3.05	9.45	8.0	79				89	84	
	6	47.5	711.51	1.52	2.15	1.52	6.0	87	242	249	55	90	86	
	5	50	713.64	1.60	2.29	3.66	6.1	89				90	86	
	4	52.5	715.75	1.50	2.16	5.73	6.0	86	240	250	55	90	86	
	3	55	717.90	1.50	2.16	7.81	6.0	85				92	86	
	2	57.5	719.90	1.30	1.85	9.74	5.0	92	242	241	55	92	86	
	1	60	721.65	1.20	1.73	1.60	4.5	86				92	86	
		(1607)												
		θ = 60	= 57.05		= 2.88							Avg. = 84.4		

S-0037R

INTERFOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job LP/SAGOLA Date 2-25-92 Test 3 Run 3
Source CROSS 4 UNLOADER VENTS - STACK No. of traverse points 2-4
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 11 in. Hg. (vac)

Particulate Catch Data:

No.s of filters used: 4054

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		100	
Impinger No. 2	7.0	100	0
Impinger No. 3		0	
Condenser			
Desiccant	1425	1405	7.0
Total			7.0

Integrated Gas Sampling Data:

Bag Pump No. B3 Box No. 20 Bag No. 3
Bag Material: 5-layer Aluminized Tedlar Size: 44 L
Pretest leak check: 0 cc/min at 15 in. Hg.
Time start: 1629 (HRS) Time end: 1730 (HRS)
Sampling rate: 400 cc/min Operator: ET
S/N of O_2 Analyzer used to monitor train outlet: ___

CF-023

CF-011

INTERPOLL LABORATORIES EPA METHOD 5 FIELD DATA SHEET

Job LA/SAGALA
Source Moss & Alexander Units
Date 2-25-92 Test 3 Run 3

Operators E.Trowbridge-C.Mosser
Meter Box No. 5 ΔH@ 1.87 IN WC
Gasmeter coeff. 1.9957

Pitot No. 22Y-6 Cp .840
Bar. Press. 28.73 inHg H2O x
Nozzle No. 4-3 Nozzle Dia .___ 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 (xv/v)
	1628	722.00											
B 12	2.5	724.44	2.10	2.98	4.39	7.5	78	245	249	49	80	79	
11	5	726.85	2.00	2.87	6.76	7.5	79				82	79	
10	7.5	729.30	2.10	3.00	9.19	7.5	82	248	251	51	85	80	
9	10	731.70	2.00	2.85	1.56	7.6	86				86	82	
8	12.5	734.10	2.10	3.01	4.00	7.7	83	252	254	52	86	82	
7	15	736.60	2.10	3.03	6.44	7.7	80				86	83	
6	17.5	738.60	1.50	2.15	8.51	6.0	84	248	251	53	86	83	
5	20	740.70	1.60	2.26	0.64	6.0	92				86	83	
4	22.5	742.72	1.50	2.14	2.70	6.0	87	245	250	54	86	83	
3	25	744.75	1.40	1.99	4.64	5.9	88				86	83	
2	27.5	746.66	1.30	1.84	6.61	5.8	92	247	250	55	86	84	
1	30	748.50	1.20	1.71	8.45	5.0	90				86	84	
A 12	32.5	751.14	2.60	3.72	1.16	9.8	85	242	249	53	86	84	
11	35	753.90	2.70	3.90	3.93	10.0	79				88	85	
10	37.5	756.42	2.20	3.17	6.44	9.0	81	245	252	54	88	85	
9	40	758.97	2.20	3.14	8.93	9.0	87				88	85	
8	42.5	761.45	2.10	3.02	1.58	8.8	83	247	250	55	88	85	
7	45	763.90	2.10	3.05	3.83	8.7	77				88	85	
6	47.5	766.32	2.10	3.02	6.28	8.7	84	245	248	55	88	85	
5	50	768.90	2.10	2.97	8.71	8.6	93				88	85	
4	52.5	771.30	2.20	3.15	1.20	8.7	90	242	244	55	88	85	
3	55	773.72	2.20	3.15	3.70	8.7	87				88	85	
2	57.5	776.16	2.10	2.97	6.15	8.5	94	240	246	55	89	86	
1	60	778.50	1.90	2.71	8.48	6.3	89				89	86	
	(1731)												
	θ = 60	Vm = 56.50		ΔH = 2.86							Avg. = 84.8		

S-0037R

INTERPOLL LABORATORIES EPA METHOD 2 FIELD DATA SHEET

Job LOUISIANA PACIFIC/SUSANVILLE

Source PRESS + UNLOADER VENT-STACK

Test 4 Run 1 Date 2-26-92

Stack dimen. 71¼ IN.

Dry bulb _____ °F Wet bulb _____ °F

Manometer: ☒ Reg. ☐ Exp. ☐ Elec.

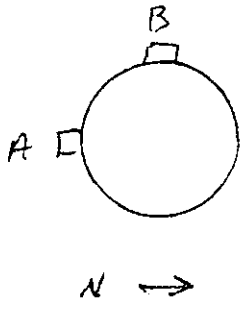
Barometric pressure 28.34 in Hg

Static pressure −1.00 in WC

Operators E. TROWBRIDGE - C. MASSEY

Pitot No. 22V-6 Cp .840

PM-10



Schematic of Cross Section

Traverse Point No.	Fraction of Diameter	Distance from Stack Wall (in)	Distance from End of Port (in)	Velocity Pressure (in WC)	Temperature of gas (°F)
		Port length: 5 in.		Time start: 0835 hrs	
A 1	.044	3.14	8.14	1.70	84
2	.146	10.40	15.40	2.40	84
3	.296	21.09	26.09	2.10	82
4	.704	50.16	55.16	2.20	80
5	.854	60.85	65.85	2.30	80
6	.956	68.12	73.12	2.60	80
B 1				1.30	84
2				1.70	84
3				1.80	85
4				2.20	86
5				2.10	86
6				2.00	86
Temp. meas. tool & S/N: PDT-12				Time end: 0845 hrs	

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

INTERFOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job LP/SAGOLA — Date 2-26-92 Test 4 Run 1
Source PRESS & UNLOADR VENTS — No. of traverse points 12
Method 201A Filter holder: EAC — Filter type: 2 1/2 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: 5662

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		(100	
Impinger No. 2	201	100	1
Impinger No. 3		0)	
Condenser			
Desiccant	1409	1402	7
Total			8

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 LP/SAGOLA
Source PRESS & UNLOADER VENTS
Date 3-24-93 Test 1 Run 1

Operators E. TROWBRIDGE - C. MOSSER
Meter Box No. 8 ΔH@ .491 IN WC
Barometer coeff.: .9957

Pitot No. 228-6 Cp .840
Bar. Press. 25.54 inHg H2O x
Nozzle No. 1A-10 Nozzle Dia .130 IN.

Traverse Point No.	Sampling Time (min)	Sample Volume (cf)	Velocity Head (inWC)	Orifice Meter (inWC)	Gas Vol. (cf)	VAC. inHg	Temperatures (°F) Stack	Probe	Oven	Impg.	Gas In	Gas Out	Oxygen (xx/x)
	0700	783.00											
A 6	7.15	786.20	2.60	.61	7.15	2.0	80	240	242	38	57	56	
5	13.89	789.10	2.30	.62	6.72	2.0	71	242	245	40	61	60	
4	20.60	792.00	2.30	.62	6.72	2.0	73	245	243	40	67	63	
3	27.03	794.94	2.10	.63	6.42	2.0	75	248	250	41	73	68	
2	33.76	798.00	2.30	.63	6.72	2.0	73	245	249	41	76	70	
1	39.54	800.60	1.70	.63	5.78	2.0	78	242	249	42	78	73	
B 6	45.65	803.40	1.90	.63	6.11	2.0	78	245	251	42	78	73	
5	52.08	806.35	2.10	.63	6.42	2.0	74	247	253	43	78	74	
4	58.66	809.30	2.20	.63	6.57	2.0	71	244	250	43	78	74	
3	64.44	811.99	1.70	.63	5.78	2.0	78	242	248	43	78	74	
2	70.46	814.70	1.80	.64	5.95	2.0	74	240	247	45	79	76	
1	75.45	817.06	1.50	.63	5.05	2.0	75	242	250	44	79	76	
	(1018)												
	Θ = 75.45	Vm = 34.06		ΔH = .63							Avg. = 71.6		

C-18

INTERFOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job LP/SAGOLA Date 2-26-92 Test 4 Run 2
Source CROSS + UNLOADR VENTS-STACK No. of traverse points 12
Method 201A Filter holder: ERC Filter type: 2½" 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: 5661

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		100	
Impinger No. 2	201	100	1
Impinger No. 3		0	
Condenser			
Desiccant	1358	1350	8
Total			9

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

CF-011

INTERPOLL LABORATORIES EPA METHOD 5 FIELD DATA SHEET

Job LP/SAGOLA
Source PRESS & UNLOADER VENTS
Date 2-26-92 Test 4 Run 2

Operators E.TROWBRIDGE-C.MOSCOR
Meter Box No. 8 ΔH@ 1.91 IN WC
Calculated coeff: .9957

Pitot No. 22Y-6 Cp .846
Bar. Press. 28.37 inHg H2O x
Nozzle No. Nano Nozzle Dia .130 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 (xv/v)
	10/6	817.60											
A 6	7.18	820.94	2.70	.64	7.18	2.0	72	245	252	40	75	74	
5	13.81	824.05	2.30	.64	6.63	2.0	70	247	250	41	77	74	
4	20.45	827.20	2.30	.64	6.63	2.0	69	249	250	41	78	75	
3	26.95	830.14	2.20	.65	6.49	2.0	76	238	248	42	82	78	
2	33.71	833.30	2.40	.65	6.77	2.0	68	239	242	42	83	79	
1	39.41	836.02	1.70	.65	5.70	2.0	70	242	247	43	84	79	
B 6	45.75	838.99	2.10	.65	6.33	2.0	71	240	248	42	84	79	
5	51.94	841.90	2.00	.65	6.18	2.0	77	242	250	43	84	79	
4	58.42	844.90	2.20	.65	6.48	2.0	72	245	249	43	84	79	
3	64.13	847.70	1.70	.65	5.70	2.0	78	246	251	44	83	78	
2	69.91	850.35	1.75	.65	5.78	2.0	69	248	250	44	83	78	
1	74.90	852.70	1.30	.65	4.98	2.0	71	245	243	45	84	79	
	(120')												
	θ = 74.90	Vm = 35.10		ΔH = .65							Avg. = 79.6		

C-20

S-0037R

INTERFOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job LP/SAGOLA Date 2-26-92 Test 4 Run 3
Source PRESS 4 UNLOADR VENTS-STACK No. of traverse points 12
Method 201A Filter holder: ERC Filter type: 2 1/2" 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: 5660

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		100	
Impinger No. 2	202	100	2
Impinger No. 3		0	
Condenser			
Desiccant	1409	1400	9
Total			11

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 LP/SAGOLA
Source PRESS & UNLOADER VENTS-STACK
Date 2-26-92 Test 1 Run 3

Operators E.TROWBRIDGE-C.MOSSOR
Meter Box No. 8 ΔH@ 1.81 IN WC
Gasmeter coeff. .9957

Pitot No. 22Y-6 Cp .840
Bar. Press. 28.34 inHg H2O x
Nozzle No. CH 10 Nozzle Dia .130 IN.

Traverse Point No.	Sampling Time (min)	Sample Volume (cf)	Velocity Head (inWC)	Orifice Meter (inWC)	Obs. Vol. (cf)	VAC. inHg	Temperatures (°F) Stack	Probe	Oven	Impg.	Gas/In	Gas/Out	Oxygen (%v/v)
	1253	853.00											
A-6	7.10	856.40	2.70	.65	7.10	2.0	73	242	240	50	74	78	
5	14.07	859.68	2.50	.65	6.97	2.0	75	244	243	50	82	79	
4	20.91	862.90	2.40	.65	6.83	2.0	73	246	250	51	82	79	
3	27.44	865.94	2.20	.65	6.53	2.0	81	240	246	52	82	79	
2	34.42	869.05	2.50	.65	6.97	2.0	78	242	249	52	82	79	
1	40.95	872.38	2.20	.65	6.53	2.0	76	240	244	52	82	79	
B-6	47.19	875.20	2.00	.65	6.23	2.0	76	245	249	53	82	79	
5	53.58	878.20	2.10	.65	6.38	2.0	70	243	248	52	84	80	
4	60.12	881.20	2.20	.65	6.53	2.0	71	243	245	53	85	81	
3	65.87	883.99	1.70	.65	5.74	2.0	78	241	246	53	85	81	
2	71.44	886.63	1.60	.65	5.57	2.0	71	240	244	53	85	81	
1	76.47	888.00	1.30	.65	5.02	2.0	75	240	245	53	85	81	
	(1400)												
	θ = 71.47	Vm = 35.00		ΔH = .65							Avg. = 81.2		

S-[illegible]7R

APPENDIX D

INTERPOLL LABORATORIES ANALYTICAL DATA

TABLE OF CONTENTS

Interpoll Laboratories
(612) 786-6020

EPA Method 5 Data Reporting Sheet
Impinger Catch/~~Minnesota~~ Protocol

Job LP/Scioto
Team Leader ET
Date Submitted 2-27-92
Test No. 3
Date of Analysis 3-2-92

Source Press or Unloader Vent
Test Site Stack
Date of Test 2-25-92
No. of Runs Completed 3
Technician C. Helgesen

0	Test 3 Run 0 Field Blank Log Number 5444 - 07 Comments	Dish No. 37 Dish Tare Wt. 48.8511 g Dish+Sample Wt. 48.8515 g Sample Wt. 0.0004 g
1	Test 3 Run 1 Log Number -14 Comments	Dish No. 57A Dish Tare Wt. 47.9155 g Dish+Sample Wt. 47.9163 g Sample Wt. 0.0008 g
2	Test 3 Run 2 Log Number -15 Comments	Dish No. 110 Dish Tare Wt. 49.7380 g Dish+Sample Wt. 49.7389 g Sample Wt. 0.0009 g
3	Test 3 Run 3 Log Number -18 Comments	Dish No. 406 Dish Tare Wt. 49.6190 g Dish+Sample Wt. 49.6198 g Sample Wt. 0.0008 g
4	Test ____ Run ____ Log Number Comments	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

Blank Solvent Wt. 0.0004 g

Results:

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.0004	0.0005 D-1	0.0004		

LSC-03 BP

Interpoll Laboratories
(612) 786-6020

EPA Method 5 Data Reporting Sheet
Probe/Cyclone Wash

Job LP / Segola
Team Leader ET
Date Submitted 2-26-92
Test No. 3
Date of Analysis 2-27-92
Transport Leakage ☐ None ☐ _____ ml

Source Press & Unloader Vent
Test Site Stack
Date of Test 2-25-92
No. of Runs Completed 3
Technician C. Helgesan
Solvent Acetone

0	Test 3 Run 0 Field Blank Log Number 5444-05 Vol. of Solvent 140 ml *Solvent Residue 2.86 ug/ml	Dish No. 24 Dish Tare Wt. 56.8245 g Dish+Sample Wt. 56.8249 g Sample Wt. 0.0004 g	
1	Test 3 Run 1 Vol. of Solvent 90 ml Log Number -08 Comments	Dish No. 36 Dish Tare Wt. 43.5670 g Dish+Sample Wt. 43.5755 g Sample Wt. 0.0085 g	
2	Test 3 Run 2 Vol. of Solvent 70 ml Log Number -12 Comments	Dish No. 100 Dish Tare Wt. 45.9701 g Dish+Sample Wt. 45.9741 g Sample Wt. 0.0040 g	
3	Test 3 Run 3 Vol. of Solvent 60 ml Log Number -16 Comments	Dish No. 102 Dish Tare Wt. 44.3250 g Dish+Sample Wt. 44.3292 g Sample Wt. 0.0042 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. 0.0004 g)(10^6)]/Vol. of Sol. 140 ml
EPA-M5 Acetone Residue Blank Spec. ≤ 7.8 ug/ml

Results:

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.0082	0.0038 D-2	0.0040		

LSC-01YR

Interpoll Laboratories
(612) 786-6020

EPA Method 5 Data Reporting Sheet
Filter Gravimetrics

Job LP/Scioto MI
Team Leader CT
Date Submitted 2-26-92
Test No. 3
Date of Analysis 2-27-92

Source Press + unloader Vent
Test Site Stack
Date of Test 2-25-92
No. of Runs Completed 3
Technician C. Helgeson

0
Test 3 Run 0
Field Blank
Log Number 5444-06
Comments
Filter No. 4056
Filter Type 4" 6F
Filter Tare Wt. .9678 g
Filter+Sample Wt. .9680 g
Sample Wt. 0.0002 g

1
Test 3 Run 1
Log Number -09
Comments
Filter No. 4082
Filter Type 4" 6F
Filter Tare Wt. .9607 g
Filter+Sample Wt. .9637 g
Sample Wt. 0.0030 g

2
Test 3 Run 2
Log Number -13
Comments
Filter No. 4083
Filter Type 4" 6F
Filter Tare Wt. .9660 g
Filter+Sample Wt. .9694 g
Sample Wt. 0.0034 g

3
Test 3 Run 3
Log Number -17
Comments
Filter No. 4084
Filter Type 4" 6F
Filter Tare Wt. .9633 g
Filter+Sample Wt. .9663 g
Sample Wt. 0.0030 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
	0.0030	0.0034	0.0030		

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.0116	0.0077	0.0074		

TOTALS

LSC-02PR

Interpoll Laboratories
(612) 786-6020

201A

EPA Method ~~5~~ Data Reporting Sheet
Impinger Catch/~~Minnesota~~ Protocol

Job LP / Seoola
Team Leader E.T
Date Submitted 2-28-92
Test No. 4
Date of Analysis 3-2-92

Source Press d unloader Vent
Test Site Stack
Date of Test 2-26-92
No. of Runs Completed 3
Technician C. Helgeson

0	Test ____ Run 0 Field Blank Log Number ____ Comments ____	Dish No. ____ Dish Tare Wt. ____ g Dish+Sample Wt. ____ g Sample Wt. ____ g
1	Test 4 Run 1 Log Number 5444-24 Comments ____	Dish No. 402 Dish Tare Wt. 47.5800 g Dish+Sample Wt. 47.5825 g Sample Wt. 0.0025 g
2	Test 4 Run 2 Log Number -27 Comments ____	Dish No. 505 Dish Tare Wt. 48.4525 g Dish+Sample Wt. 48.4526 g Sample Wt. 0.0011 g
3	Test 4 Run 3 Log Number -30 Comments ____	Dish No. 514 Dish Tare Wt. 48.7144 g Dish+Sample Wt. 48.7159 g Sample Wt. 0.0015 g
4	Test ____ Run ____ Log Number ____ Comments ____	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

Blank Solvent Wt. 0.0004 g

Results:

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.0021	0.0007 D-4	0.0010		

LSC-03 3R

PM-10

Interpoll Laboratories
(612) 786-6020

201A
EPA Method ~~5~~ Data Reporting Sheet
Filter Gravimetrics

Job LP/Segula
Team Leader ET
Date Submitted 2-26-92
Test No. 4
Date of Analysis 2-27-92

Source press + unloader
Test Site stack
Date of Test 2-26-92
No. of Runs Completed 3
Technician C. Halgerson

	Test 4 Run 0	Filter No.	5569	
	Field Blank	Filter Type	2.5" ERC	
0	Log Number 5444-20	Filter Tare Wt.	.2260	g
	Comments	Filter+Sample Wt.	.2261	g
		Sample Wt.	0.0001	g
	Test 4 Run 1	Filter No.	5662	
	Log Number -22	Filter Type	2.5" ERC	
1	Comments	Filter Tare Wt.	.2550	g
		Filter+Sample Wt.	.2643	g
		Sample Wt.	0.0093	g
	Test 4 Run 2	Filter No.	5661	
	Log Number -26	Filter Type	2.5" ERC	
2	Comments	Filter Tare Wt.	.2550	g
		Filter+Sample Wt.	.2635	g
		Sample Wt.	0.0085	g
	Test 4 Run 3	Filter No.	5660	
	Log Number -29	Filter Type	2.5" ERC	
3	Comments	Filter Tare Wt.	.2530	g
		Filter+Sample Wt.	.2622	g
		Sample Wt.	0.0092	g
	Test ____ Run ____	Filter No.		
	Log Number	Filter Type		
4	Comments	Filter Tare Wt.		g
		Filter+Sample Wt.		g
		Sample Wt.		g
	Test ____ Run ____	Filter No.		
	Log Number	Filter Type		
5	Comments	Filter Tare Wt.		g
		Filter+Sample Wt.		g
		Sample Wt.		g

Results:

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.0093	0.0085	0.0092		

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.0117	0.0096	0.0107		

LSC-02PR

PM-10

INTERPOLL LABORATORIES
(612) 786-6020

S-305R
(1/90)

EPA Method 10 NDIR Analysis

Job Name LP Segolo
Source Press & Unloader Vent
Date of Analysis 2-27-92
Technician R. Cattoor

NDIR Analyzer:
Fuji ACS Model 3300
Man. Lab Model 8310
✓ Dasibi Model 3003
Range: 0 - 200 ppm
Flow rate: 1000 cc/min

Pretest Calibration

	Conc.	Reading	
Zero gas:	0.00 ppm	0.00 ppm	Vendor: Linde
Upscale gas:	38 ppm	38 ppm	Vendor: "
Upscale gas:	148 ppm	148 ppm	Vendor: "
Upscale gas:	ppm	ppm	Vendor:

Post-test Calibration

	Conc.	Reading	
Zero gas:	0.00 ppm	0.00 ppm	Vendor: Linde
Upscale gas:	38 ppm	38 ppm	Vendor: "
Upscale gas:	148 ppm	147.9 ppm	Vendor: "
Upscale gas:	ppm	ppm	Vendor:

Sample Description Test/Run	Sample Log Number	CO Conc. (ppm, Dry)		
		Dilution Factor	Reading	Actual ppm
3/1	5444-11	1	6	6
3/2	-15	1	6	6
3/3	-19	1	9	9

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 than 100,000: 1 and the Man. Labs Model 8310 and Dasibi Model 3003 have rejection ratios greater than 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, INC.
(612)786-6020

Louisiana Pacific/Sagola
Laboratory Log No. 5444

Results of Formaldehyde Analysis

Test: 2
Source: Press & Unloader Vent
Sample Type: Impinger Catch

Sample Log No.	Sample Description	Formaldehyde[a] Total ug
5444-01	Run 0, Field Blank	10
5444-02	Run 1	9900
5444-03	Run 2	7600
5444-04	Run 3	11000

[a]EPA Method 0011

Interpoll Laboratories
(612) 786-6020

Chain of Custody
Sample Deposition Sheet

Job LP/SBEQLA
Team Leader E Trautman
Date Submitted 2-26-92
Test No. 2

Source Paint Unloading-Vent
Test Site Shop
Date of Test 2-25-92
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 MEC	
0	Filter: ☐4" G.F. ☐S.S. Thimble ☐2.5" G.F. ☐47 mm G.F.	☐As per EPA M-5 ☐As per EPA M-17 ☐Other	
4	Impinger Catch: ☐D.I. Water ☐3% H_2O_2 ☐4M5 Hg Only ☐4M5 Metals ☐1.0 N NaOH ☒Other	☐MN Protocol ☐WI Protocol ☐EPA M-6 or 8 ☐Acid Gases ☒Formaldehyde ☐Metals ☐Other 5001	
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 #C-016JARR	
	Particle Size	☐X-Ray Sedigraph ☐Bahco Method ☐Other	
	Audit Samples ☐Sulfur Dioxide ☐Oxides of Nit. ☐Other	☐As per EPA M-6 ☐As per EPA M-7A ☐Other	

Source Information

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

S-278RRRR

Interpoll Laboratories
(612) 786-6020

Chain of Custody
Sample Deposition Sheet

Job 2P15268A
Team Leader E Pawlowski
Date Submitted 2-26-92
Test No. 5

Source Quench & Unloader Vent
Test Site Steel
Date of Test 2-25-92
No. of Runs Completed 5

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

Source Information

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

S-278RRRR

Interpoll Laboratories
(612) 786-6020

Chain of Custody
Sample Deposition Sheet

Job 20/SOGLA
Team Leader E Thompson
Date Submitted 2-26-92
Test No. 4

Source Scrubber Inlet
Test Site Stack
Date of Test 2-26-92
No. of Runs Completed 3

No. of Samples	Type of Sample	Analysis Required	Comments
3	Probe Wash: ☐Acetone ☐D.I. Water	☒As per EPA M-5 ☐Other _____	
3	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 _____	
3	Impinger Catch: ☒D.I. Water ☐3% H_2O_2 ☐4M5 Hg Only ☐4M5 Metals ☐1.0 N NaOH ☐Other _____	☒MICH 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-016CRRR	
	Particle Size	☐X-Ray Sedigraph ☐Bahco Method ☐Other _____	
	Audit Samples ☐Sulfur Dioxide ☐Oxides of Nit. ☐Other _____	☐As per EPA M-6 ☐As per EPA M-7A ☐Other _____	

Source Information

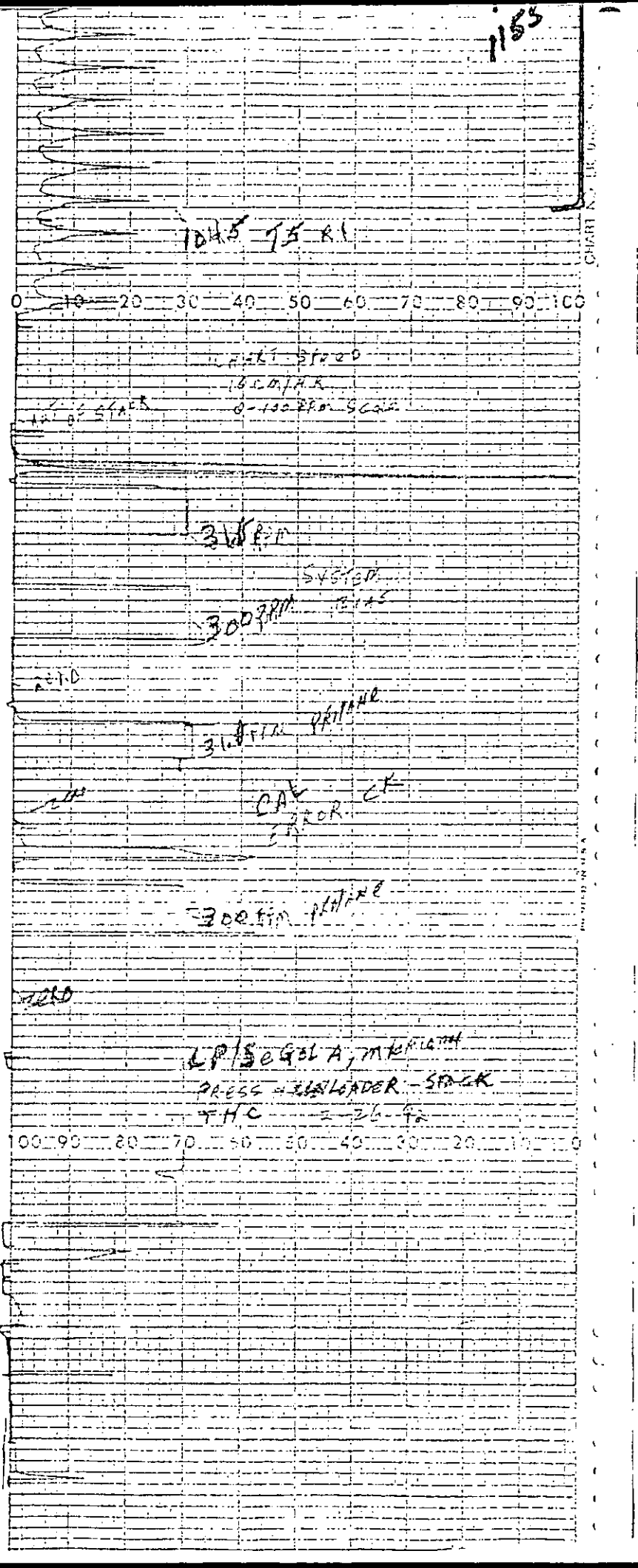
1) Type of Source: ☐ Boiler ☐ Asphalt Plant ☐ Incinerator ☐ Dryer ☐ Other _____
2) Fuel: ☐ Coal ☐ Wood ☐ Gas ☐ Oil ☐ RDF ☐ Other _____
3) Is sample combustible? ☐ No ☐ Yes
4) Does sample need special handling? ☐ No ☐ Yes If yes, explain _____

S-278RRRR

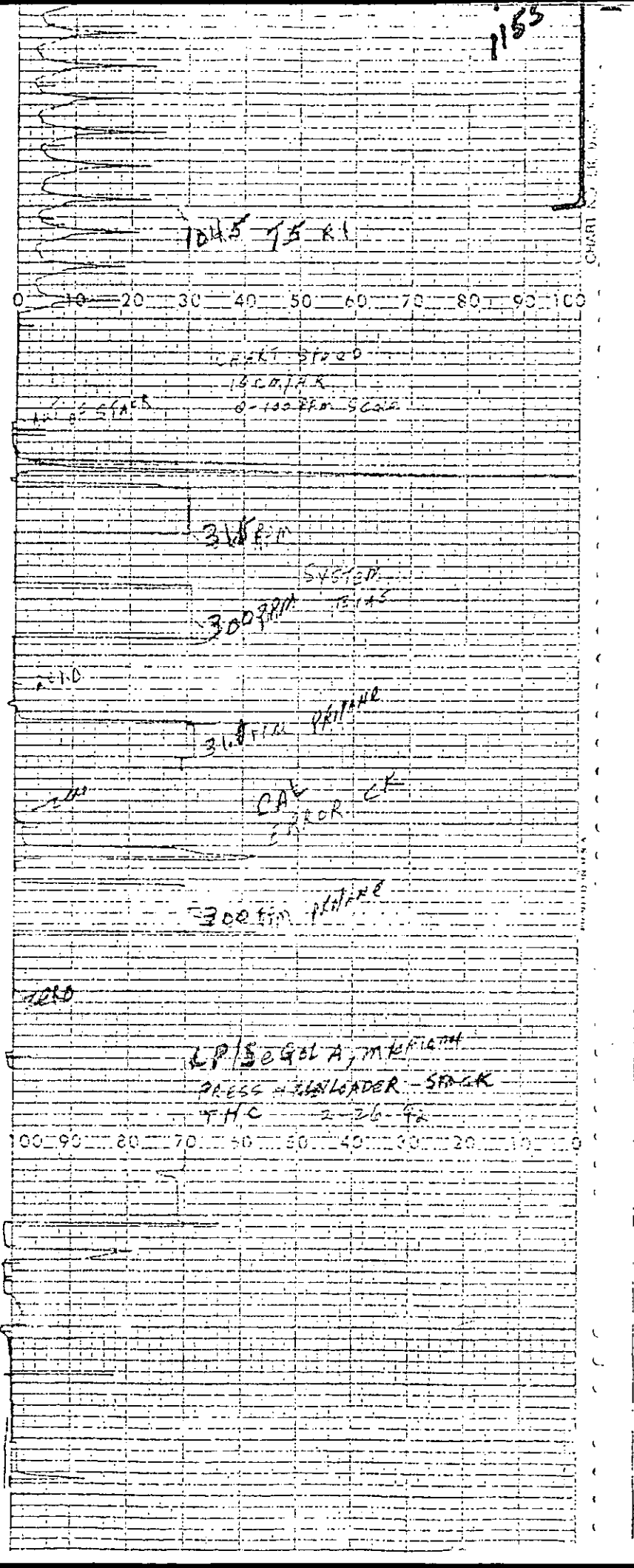
APPENDIX E

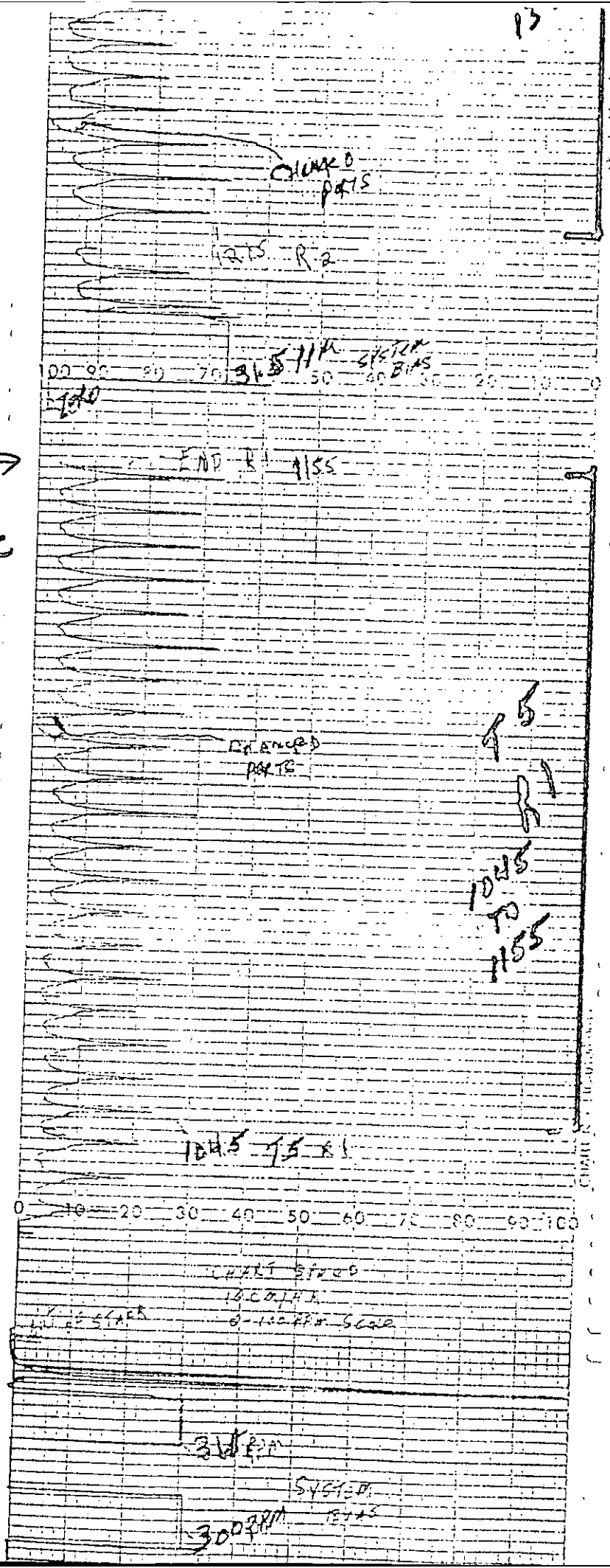
TOTAL HYDROCARBONS STRIPCHART

Louisiana Pacific
Sagola
Press & unloader
Vents
2-26-92

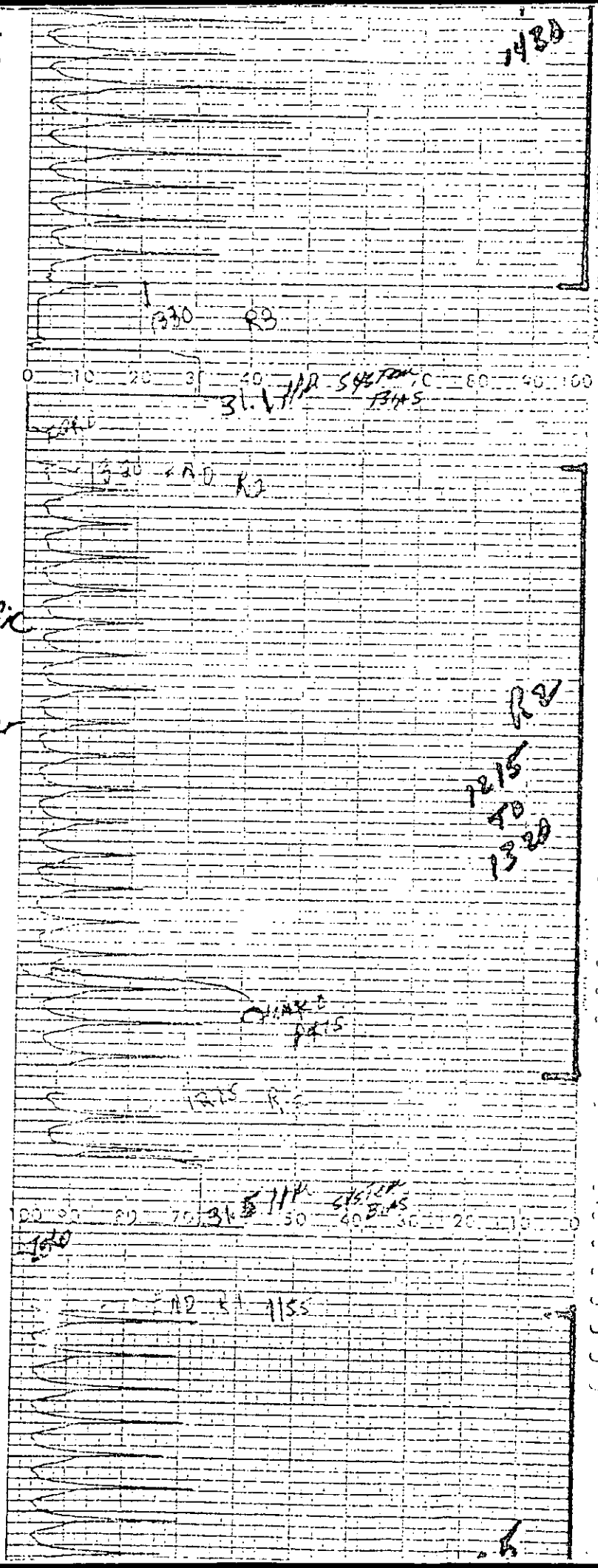


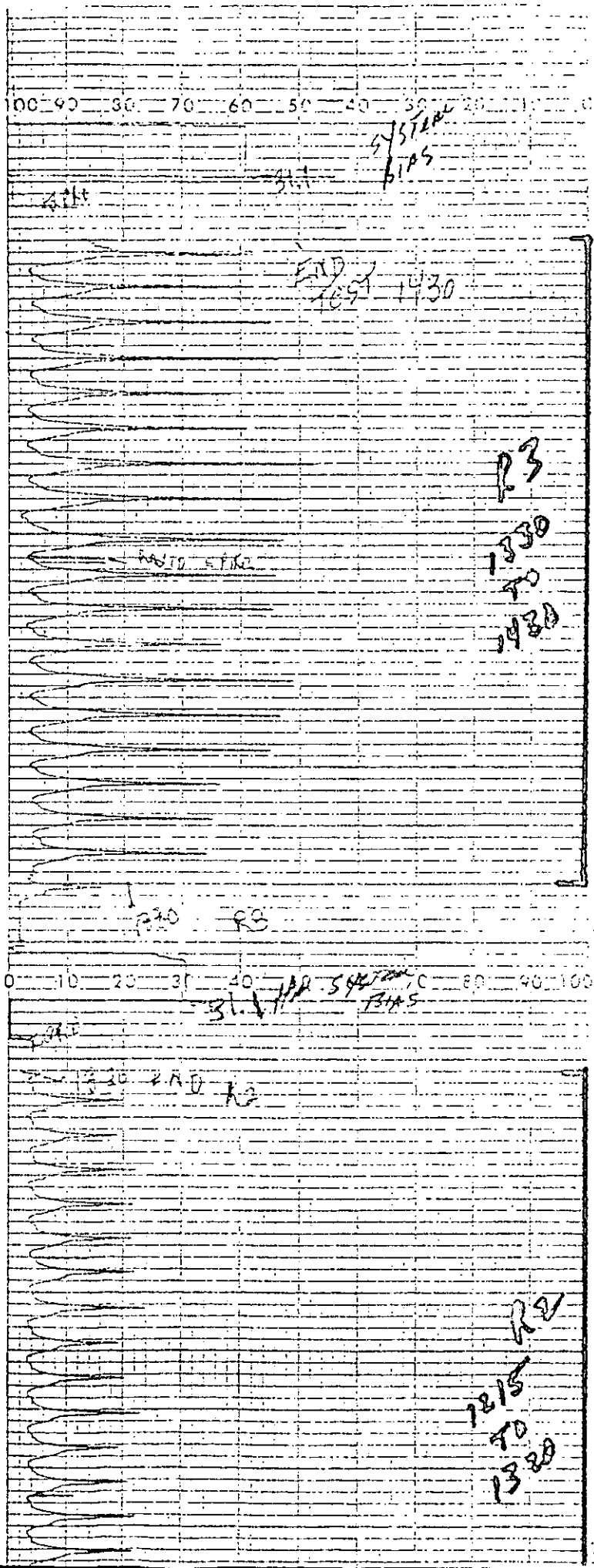
Louisiana Pacific
Sagola
Press & unloader
Vents
2-26-92





Louisiana Pacific
Sagola
Press & Unloader
vents
2-26-92
Run 1


STOP →
START →
Louisiana Pacific
Sagola
Truck Unloader
Units
2-26-92
Run 2


STOP →
Louisiana Pacific
Sagola
Truck Unloader
Units
2-26-92
Run 3
START →
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
STEP
BIAS
END
1654
1430
P3
1330
TO
1430
P10
P8
BIAS
P2
1215
TO
1330

APPENDIX F

THC ANALYZER SPECIFICATIONS

Ratfisch INSTRUMENTE

TOTAL HYDROCARBON ANALYZER (FLAME IONIZATIC
Model RS 55

TECHNICAL DATES

MAINS : 115V/60H

RECORDER OUTPUT : 0 - 5 V / 4-20mA

MODEL: X Manual switching
__ Solenoid valves

HOUSING: __ Case, __ 19"-Rack

MEASURING RANGES:

1 = 0 —	10	C_1
2 = 0 —	100	C_1
3 = 0 —	1,000	C_1
4 = 0 —	10,000	C_1

SPECIAL OPTIONS:

Flame out alarm .....
1 Alarm .....
Sample line .....
.....

ANALYZER CONDITIONS:

Temperature : 160 °C

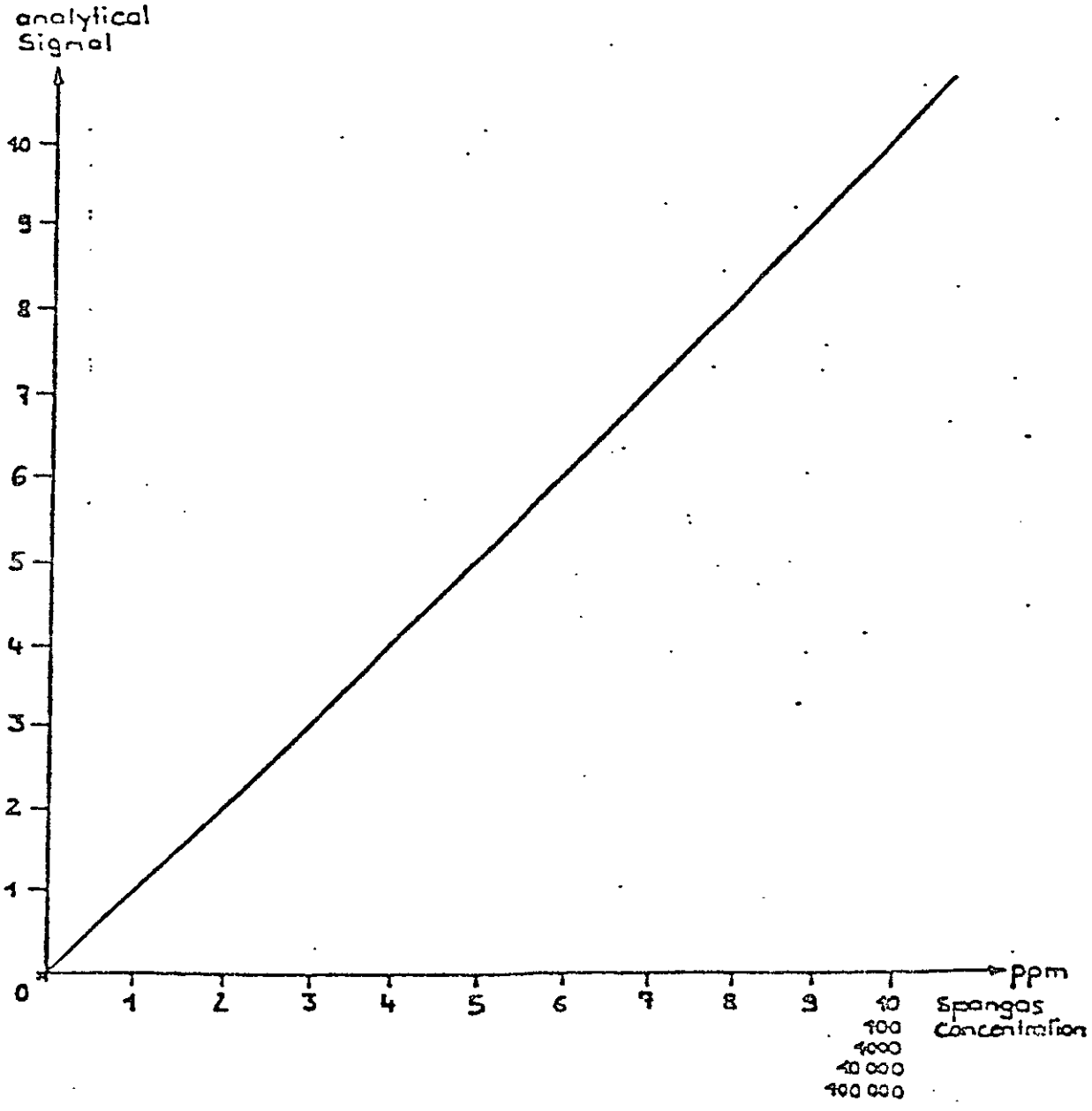
Zero Point : 3,90
Gain : 7,70

Pressure Setting: Sample/Spangas/Zerogas: 200 mbar
Fuel: Hydrogen : 0,35 bar
Combustion Air : 0,80 bar

Span Gases : 300 ppm C_1
24.000 ppm C_1

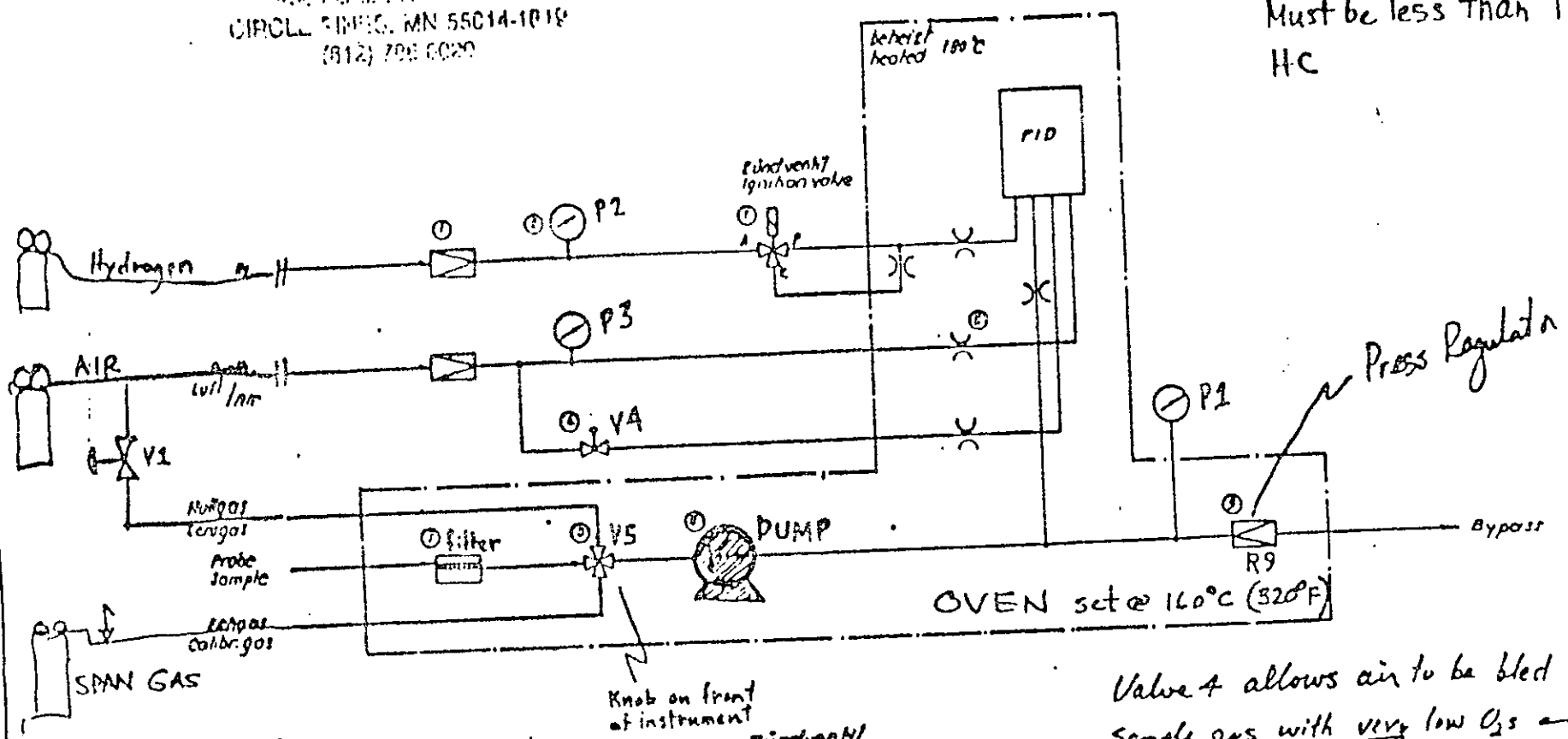
INTERPOLL LABORATORIES
4500 BALL ROAD N.E.
CIRCLE PINES, MN 55014-1819
(612) 786-6020

CALIBRATION DIAGRAMM



INTERPOLL LABORATORIES
4500 BALL ROAD N.E.
CIRCLE PINES, MN 55014-1819
(612) 786-6020

[redacted]



V1 Move selector valve. V5 to base gas and open V1 until pressure on P1 is identical to that for sample gas

1 Druckregler Pressure regulator
2 Manometer Gauge
3 Filter
4 Nadelventil Needle valve
5 3 Wege Ventil 3 way valve
6 Kapillare capillary
7 Magnet Ventil Solenoid valve
8 Pumpe pump
9 Kleindruckregler Low pressure regulator

Zündventil Ignition valve

P-A angezogen energised
R-A stromlos at rest

Valve 4 allows air to be bled into sample gas with very low O_2s and very high HC conc, which might not combust completely before passing by the collector electrodes (O_2 < 0,5 %) and THC > 5000 ppm)

* Must hold ignition switch in until red light goes off!

Handumschaltung
Manual switching

Ratfisch Instruments

FLAMMEN IONISATIONS DETEKTOR
Flame Ionization Detector

Fließplan
Flow diagram

RS 55
13.04.23

APPENDIX G

MEASUREMENT SYSTEMS PERFORMANCE SPECIFICATIONS

INTERPOLL LABORATORIES
(612) 786-6020

___ System Bias Check

Job [illegible] Source [illegible] Vent
Test 5 Run 12 43 Date 2-26-92 Site STACK
Operator [illegible]

Run	Time (HRS)	***	Cylinder Value (ppm)	Analyzer Resp (ppm) Cal Err	Analyzer Resp (ppm) Sys Bias	Diff. CE-SB (ppm)	Span Val (PPM)	% of span
1	1000	Zero gas	0	0	0	0	100	0
		Upscale	31.1	31.5		.4	100	.4
2	1157	Zero gas	0		1	1	100	1
		Upscale	31.1		33	1.9	100	1.9
3	1321	Zero gas	0		.5	.5	100	.5
		Upscale	31.1		31	.1	100	.1
4	1432	Zero gas	0		.4	.4	100	.4
		Upscale	31.1		31	.1	100	.1
5		Zero gas	0					
		Upscale						
6		Zero gas	0					
		Upscale						
7		Zero gas	0					
		Upscale						
8		Zero gas	0					
		Upscale						
9		Zero gas	0					
		Upscale						
10		Zero gas	0					
		Upscale						
11		Zero gas	0					
		Upscale						
12		Zero gas	0					
		Upscale						

Must be within 5% of the span for the zero or upscale cal. gas.

S420-11R

Interface Engineering
EPA Method 25A
Calibration Error Check & Drift Determination

Job CP/SE60LA

Test 5 Run 1 Date 2-26-92
Operator E Tabachnick

THC Calibration (Low Range): Time(HRS) 0945

***	Cylinder Value (ppm)	Analyzer Response (ppm)	Difference (ppm)	Span Value (ppm)	Percent of Span
Zero gas	0	0	0	100	0
Low level	31.1	31.5	.4	100	.4
Mid level	300	300	0	1000	0
High level					

THC Calibration (High Range): Time(HRS) _____

***	Cylinder Value (ppm)	Analyzer Response (ppm)	Difference (ppm)	Span Value (ppm)	Percent of Span
Zero gas	0				
Span					

O_2 Calibration: Time(HRS) _____

***	Cylinder Value (%)	Analyzer Response (%)	Difference (%)	Span Value (%)	Percent of Span
Zero gas	0				
Mid level					
High level					

CO_2 Calibration: Time(HRS) _____

***	Cylinder Value (%)	Analyzer Response (%)	Difference (%)	Span Value (%)	Percent of Span
Zero gas	0				
Mid level					
High level					

Must be within 2% of the span for each calibration gas S-420-14

APPENDIX H

CALIBRATION GAS CERTIFICATION SHEETS

LINDE

Union Carbide Industrial Gases, Inc.
Linde Division
4550 Kennedy Avenue
East Chicago, IN 46312

DATE : JUNE 25, 1990

OXYGEN SERVICE COMPANY
1111 PIERCE BUTLER ROUTE
ST PAUL, MN 55104

LINDE ORDER NUMBER : 166.053.02
CUSTOMER PO NUMBER : 1834WW
CUSTOMER REL NUMBER :

AR SIR/MADAM:

HIS IS YOUR CERTIFICATE OF ANALYSIS FOR:

YLINDER UMBER	MIXTURE COMPONENTS	REQUESTED COMPOSITION	CERTIFIED COMPOSITION	CERTIFICATION ACCURACY
8524	PROPANE	300 PPM	300 PPM	± 1% RELATIVE
	AIR	BALANCE	BALANCE	

APPROVED BY

COA-6MP

Scott Specialty Gases
a division of
Scott Environmental Technology, Inc.
1290 COMBERMERE STREET, TROY, MICHIGAN 48084 (313) 589-2950

Shipped From : Scott Michigan

Our Project # : 528651

Your P.O. # : 4571-SA

Expiration Date : 4-16-93

Cylinder Number : ALM-001720

Cylinder Pressure 1900 psig

Customer :
OXYGEN SERVICE
111 PIERCE BUTLER ROUTE
ST. PAUL, MN. 55104

CERTIFICATE OF ANALYSIS - EPA PROTOCOL GASES # # #
PERFORMED ACCORDING TO SECTION 3.0.4

Certified Per Traceability Procedure # G1
Protocol # 1

File # PO-1356

Certified Accuracy 1 % NBS Traceable

ANALYZED CYLINDER		REFERENCE STD			INSTRUMENTATION		
COMPONENT	CERTIFIED CONC.	SRM # (CRM #)	CYLINDER NUMBER	CONC.	INSTR/MODEL/SERIAL #	LAST CALIBRATION DATE	ANALYTICAL PRINCIPLE
PROPANE	31.10 PPM	1668B	CLM-000694	95.30 PPM	BECKMAN	9-25-91	FLAME IONIZATION DETECTOR
		GMIS#	ALM-008846	31.20 PPM	400		
					1002059		
BALANCE GAS : AIR							

H-2

ANALYSIS DATE : 10-16-91

ZERO GAS (mV)	TEST GAS (mV)	RESULTS PPM	REFERENCE GAS CONC.	(mV)	RESULTS PPM
0.00	31.40	31.10	95.30 PPM	95.30	95.30
0.00	31.40	31.10		95.30	95.30
0.00	31.40	31.10		95.30	95.30

CALCULATED RESULTS 31.10
31.10
31.10

AVERAGE : 31.10 PPM

CALIBRATION CURVE 2 nd DEGREE

SRM # (CRM #)	CONC. PPM	SPLIT PT (%)	DVM (mV)	FITTED VALUE	PERCENT ERROR
1668B	95.30	100	95.30	95.30	-0.00
	31.20	33	31.60	31.30	0.32
	22.61	24	22.70	22.45	-0.72
	8.171	9	8.30	8.171	0.00
	0.0000	0	0.00	0.0000	0.00
		0		0.0000	0.00
		0		0.00	0.00
GMIS	8.171	LOW	8.30	8.171	0.00
1668B	95.30	HIGH	95.30	95.30	-0.00

GMIS - GAS MANUFACTURER'S INTERNAL STANDARD

Analyst : L P Dorn

Approved By : L Shapiro

APPENDIX I

PROCESS RATE INFORMATION

SAGOLA 1992 TESTING
PERMIT LIMITS TO BE COMPARED TO TEST RESULTS

	PARTICULATE	CARBON MONOXIDE	VOLATILE ORGANIC COMPOUNDS	FORMALDEHYDE	PM-10
DRYERS	– 0.82 LB/TFP	– 1.45 LB/TFP	– 0.25 LB/TFP	– 0.20 LB/TFP	N/A
		– 1.41 LB/mm BTU	0.26 LB/mm BTU	– 25.79 mg/m³ @ 70° F AND 29.92 mm Hg	
T.O. HEATER	– 8.89 LB/HR	– 29.6 LB/HR	– 3.6 LB/HR	n/A	N/A
	– 0.15 LB/ mm BTU	– 0.41 LB/ mm BTU	– 0.06 LB/ mm BTU		
929	– 0.10 LB/ 1000 LB GAS @ 50% EXCESS AIR				
PRESS VENTS	– 35.48 LB/HR	N/A	– 18.46 LB/HR	– 5.32 LB/HR	N/A
	– 1.44 LB/TFP		– 0.98 LB/TFP	– 0.217 LB/TFP	
	– 0.038 LB/ 1000 LB GAS			– 10.76 mg/m³ @ 70° F AND 29.92 IN. Hg	

SAGOLA PRESS VENT TESTING FEB 25+26 1992

PROCESS DATA, CONTENTS

SAGOLA PRESS VENT TESTING FEB 25 & 26 1992

TEST SCHEDULE

TEST #	ITEM	DATE	RUN # 1	RUN # 2	RUN # 3
2	HCHO	2-25	0840-0942	1025-1127	1200-1302
3	P.M	2-25	1336-1459	1507-1609	1628-1731
4	PM-10	2-26	0900-1018	1046-1204	1238-1400
1.	VOC	2-26	1045-1145	1215-1315	1330-1430

PROCESS SUMMARY

2-25-92
PRODUCTION RATE = 26.3 TONS FINISHED PRODUCT PER HOUR
MDI USAGE = 547 lb/HR - 1.04%
PHENOLIC RESIN USAGE = 863 lb/HR - 1.64%
WAX USAGE = 331 lb/HR - 0.63%

2-26-92
PRODUCTION RATE = 26.3 TONS FINISHED PRODUCT PER HOUR
MDI USAGE = 537 lb/HR - 1.02%
PHENOLIC RESIN USAGE = 870 lb/HR - 1.66%
WAX USAGE = 317 lb/HR 0.60%

7c. PRESS OPERATING DATA:

7c1. Board thickness. 7/16"

7c2. Number of sheets produced per hour to be determined by press chart. SEE ATTACHED

7c3. Pounds of resin used per hour to be recorded. SEE ATTACHED

7c4. Pounds of wax used per hour to be recorded. SEE ATTACHED

7c5. Type of resin used to be recorded. MDI + LIQUID PHENOLIC

7c6. Press temperature to be recorded. 400°F

7c7. Press vent hooding to be verified. 20'H x 20'W x 60'L

7c8. There are two exhaust fans.

7c9. Design airflow is 75,000 acfm each. Actual acfm will be determined during sampling.

7c10. Tons of finished product produced during test will be determined by board weights and press charts.

8. Copies of field data forms are included in attachment.

9. The names and titles of personnel are not available at this time. Testing will be performed by Interpoll Laboratories, Inc.

10. Procedures for maintaining sample integrity and chain of custody are provided in the attachments. Interpoll Laboratories QA-QC manual will be followed. Due to the size of this document, it has not been included here but can be provided on request.

11. Calibration sheets will be provided prior to testing.

12. Filter lists will be provided prior to testing.

SAGOLA PRESS VENT TEST 2-25-92

BOARD WEIGHTS

WEIGHT OF APPROX. EVERY 50th BOARD FROM SCALE TAPE IN LBS, 0830 - 1800, 11.5 HRS.

278	274	281	278
274	275	278	277
276	273	268	267
274	278	272	283
276	277	271	283
274	276	273	289
282	272	275	
273	285	277	
272	284	281	
273	280	272	

AVG UNTRIMMED BOARD = 276.4 lb

TRIMMED = 276.4 x 1 - 0.061 = 259.5 lbs (6.1% TRIM)

PRODUCTION RATE - LINE SPEED 85

203 PRESSLOADS FOR 12 HOUR SHIFT
203 P.L. ÷ 12 = 16.9 P.L./HR

BOARDS PRODUCED DURING TESTING 0830-1800
= 16.9 x 10.5 HRS x 12 BOARDS/P.L.
= 2129

LBS FINISHED PRODUCT =
2129 x 259.5 lbs = 552,476 lb

LBS FINISHED PRODUCT PER HOUR =
552476 ÷ 10.5 HRS = 52,617 lb F.P./HR

TONS F.P. PER HOUR
52617 / 2000 lb = 26.3 TONS FINISHED PRODUCT/HR

SAGOLA DRESS VENT TESTING 2-25-92

RESIN AND WAX USAGE

LIQUID PHENOLIC RESIN

GAL. FROM 0800 - 1730 = 1534 GAL

@ 10.09 #/GAL AND 53% SOLIDS

TOTAL LBS = 1534 x 10.09 x 0.53
= 8203 lbs

LBS/HR = 8203 lbs / 9.5 HRS
= 863 lb PER HOUR

863 lb RESIN ÷ 52617 lb F.P. = 1.64% PHENOLIC RESIN

MDI RESIN

GAL. FROM 0800 - 1730 = 507 GAL.

@ 10.257 # / GAL

TOTAL LBS = 507 GAL x 10.257 lb = 5200 lbs

LBS/HR = 5200 lb / 9.5 HRS = 547 lb /HR

547 lb /HR ÷ 52617 lb F.P. = 1.04% MDI RESIN

WAX USAGE

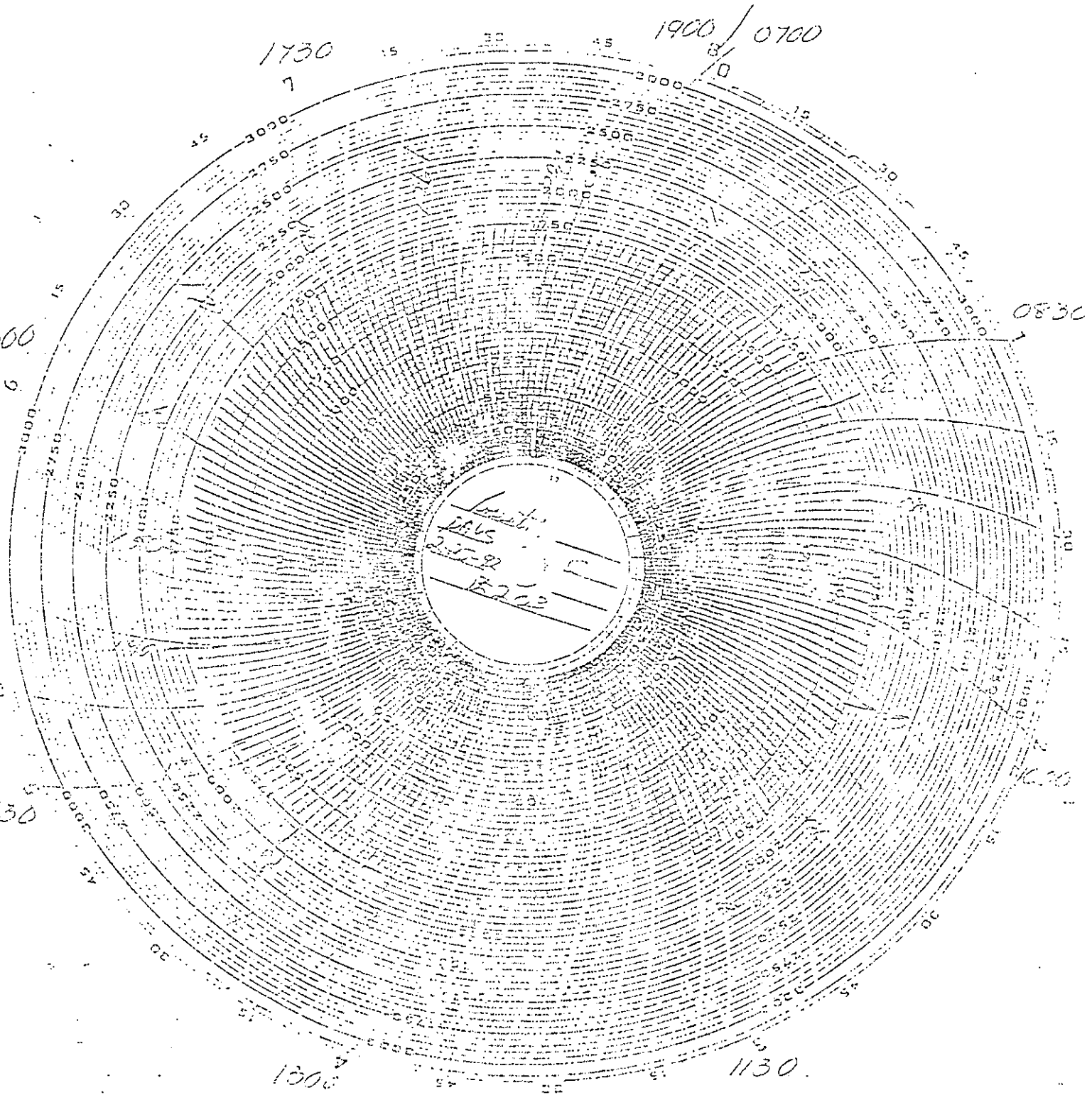
LBS FROM 0700 - 1730 = 5601 lb @ 62% SOLIDS

TOTAL LBS = 5601 lb x 0.62 = 3473 lbs

LBS/HR = 3473 lb / 10.5 HRS = 331 lb/HR

331 lb /HR ÷ 52617 lb F.P. = 0.63% WAX

SAGOLA
PRESS CHART
2-25-92
DAYS



PRESSLOADS
0700 - 1900 = 203 7/8"

6

LOUISIANA-PACIFIC CORPORATION

RESS REPORT* SAGOLA MICHIGAN *PRESS REPORT*

ERATOR Rossato/Kreek DATE 2-25-92

IFT DAY CREW C

BLOW OUT:

L. RADIATORS . .		GREASE COLUMNS .	3:15
L. COOLING FANS .	6:00	FLUSH BLENDER . .	
ESS COOLING FANS.	6:00	BAGHOUSE PRESSURE	7.5
C.O.S.	6:00	HYD. OIL TEMP . .	124°
MER DECK		✓ PIT/RETURN CONVS	
ADER	2:00	CLEAN DECKLE CHAIN	
ADER	2:00	CLEAN BLENDERS . .	
ISS	6:00	CLEAN TAIL PULLEYS	2:00

e Speed	From	To	Thickness	Press Loads
25	2:00	2:00	3/16	203

DOWNTIME FROM	TO	M	E	O	DOWNTIME HRS.	REASON FOR DOWNTIME

DOWNTIME CODES: M-Mechanical E-Electrical O-Operator

I-8 (7)

TIME OF POSITION (seconds)

1 42	43 44	85 44	127 44	169 46
2 43	44 45	86 44	128 44	170 47
3 42	45 45	87 44	129 44	171 48
4 43	46 44	88 42	130 43	172 47
5 44	47 45	89 43	131 44	173 47
6 41	48 44	90 43	132 44	174 47
7 43	49 45	91 44	133 43	175 48
8 44	50 43	92 44	134 44	176 47
9 42	51 44	93 44	135 45	177 48
10 43	52 43	94 42	136 44	178 43
11 43	53 44	95 43	137 44	179 47
12 42	54 44	96 43	138 44	180 47
13 43	55 43	97 44	139 45	181 47
14 43	56 44	98 44	140 44	182 48
15 43	57 44	99 44	141 44	183 49
16 42	58 44	100 44	142 44	184 50
17 42	59 44	101 44	143 46	185 50
18 42	60 44	102 44	144 46	186 50
19 42	61 46	103 44	145 44	187 47
20 43	62 46	104 44	146 44	188 49
21 42	63 46	105 45	147 47	189 48
22 42	64 47	106 44	148 44	190 49
23 43	65 45	107 44	149 44	191 47
24 43	66 43	108 46	150 44	192 48
25 42	67 47	109 43	151 45	193 48
26 43	68 46	110 44	152 44	194 48
27 43	69 45	111 44	153 44	195 48
28 43	70 44	112 44	154 44	196 48
29 42	71 46	113 44	155 44	197 48
30 43	72 46	114 44	156 45	198 47
31 43	73 46	115 44	157 44	199 47
32 43	74 45	116 44	158 44	200 47
33 42	75 44	117 44	159 44	201 47
34 43	76 43	118 43	160 44	202 47
35 42	77 43	119 43	161 44	203 47
36 43	78 43	120 42	162 44	204 47
37 42	79 43	121 43	163 44	205 47
38 43	80 43	122 42	164 44	206 47
39 43	81 43	123 42	165 44	207 47
40 43	82 43	124 42	166 43	208 47
41 43	83 44	125 42	167 43	209 47

			53% solids	100% solids		
			10.09 #/gal	10.25 #/gal	Date: 2-25-97	
			Gallons	Gallons		
			Liquid Phenol	MDI	Wax Reading	Wax Reading
Time	Product	Line Speed	Totalizer	Totalizer	North Tank	South Tank
7:00 am	7/16	85	0	0	7'-9 1/4"	8'-11/16"
8:00 am	7/16	85	177	59		
9:00 am	7/16	85	345	115		
10:00 am	7/16	85	497	164		
11:00 am	7/16	85	650	219	7'-7 3/8"	7'-10 1/4"
12:00 PM	7/16	85	808	271		
1:00 PM	7/16	85	970	326		
2:00 PM	7/16	85	1141	383		
3:00 PM	7/16	85	1283	430	7'-5 7/16"	7'-8 3/4"
4:00 PM	7/16	85	1450	483		
5:00 PM	7/16	85	1517	536		
5:30 PM	7/16	85	1711	566	1'-2"	1'-7 1/2"
		Gal / min.	2.72	.898		
		Wt. Av.	24.55	9.21	2.99 #/min.	
					5.51 #/min. @ 100%	

104,434 #

was 62% sol.

98,833 #

5,601

per min.

per min.

E-Wax: 7.8 #/gal @ 62% solids

Hourly — totalizer (don't zero)

MDI

LPH — totalizer (don't zero)

WAX

Every 4 hrs. — Take readings

Every 12 hrs. — Take readings

SAGOLA PRESS VENT TEST 2-26-92

BOARD WEIGHTS

WEIGHT OF APPROX EVERY 50th BOARD FROM SCALE TAPE IN LBS, 0900-1430

279	280	281
269	271	284
264	269	282
273	270	283
272	272	283
277	273	280
275	272	289
278	271	
271	279	
275	281	

AVG UNTRIMMED BOARD = 276.0 lb

TRIMMED = 276.0 x 1-0.061 = 259.2 lbs

PRODUCTION RATE - LINE SPEED 85'

16.9 PRESSLOADS/HR

BOARDS PRODUCED DURING TESTING 0900-1430
= 16.9 P.L./HR x 5.5 HRS x 12 BOARDS/P.L.
= 1115

LBS FINISHED PRODUCT =
1115 BOARDS x 259.2 lbs = 289,008 lb FINISHED PRODUCT

LBS FINISHED PRODUCT/HR
289,008 lb ÷ 5.5 HRS = 52,547 lb F.P./HR

TONS F.P. PER HOUR
52,547 / 2000 lb = 26.3 TONS FINISHED PRODUCT/HR

9

SAGOLA PRESS VENT TESTING 2-26-92

RESIN AND WAX USAGE

LIQUID PHENOLIC RESIN

GAL. FROM 0900 - 1500 = 976 GAL

@ 10.09 lb/GAL AND 53% SOLIDS

TOTAL LBS = 976 x 10.09 x 0.53
= 5219 lbs

LBS/HR = 5219 lbs ÷ 6 HRS = 870 lb/HR

870 lb RESIN ÷ 52547 lb F.P. = 1.66% PHENOLIC RESIN

MDI RESIN

GAL. FROM 0900 - 1500 = 314 GAL

@ 10.257 lb/GAL

TOTAL lbs = 314 GAL x 10.257 lb = 3221 lb

LBS/HR = 3221 lb ÷ 6 HRS = 537 lb/HR

537 lb MDI ÷ 52547 lb F.P. = 1.02% MDI RESIN

WAX USAGE

LBS FROM 0700 - 1500 = 4089 @ 62% SOLIDS

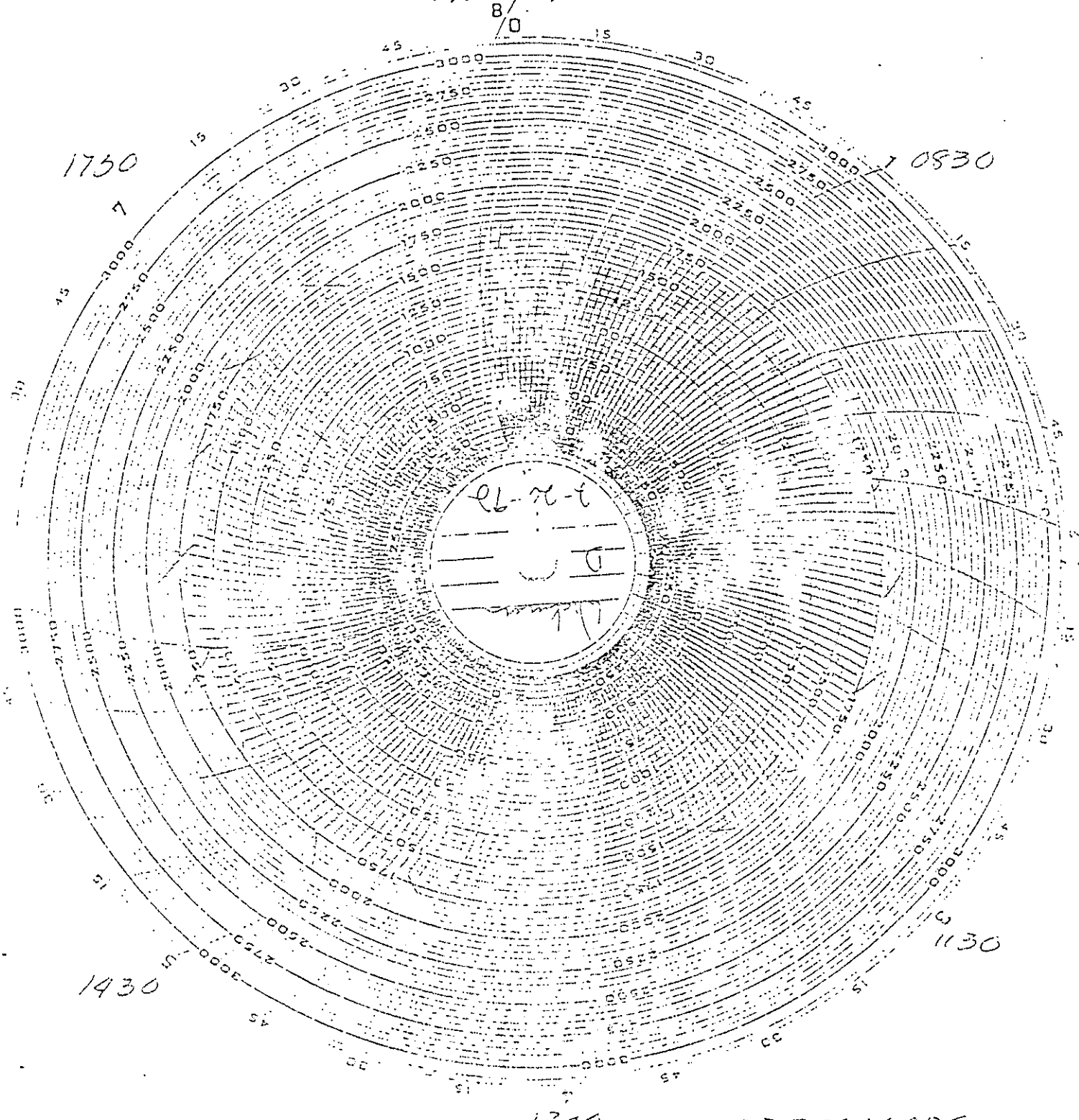
TOTAL LBS = 4089 x 0.62 = 2535 lbs

LBS/HR = 2535 ÷ 8 HRS = 317 lb/HR

317 lb WAX ÷ 52547 lb F.P = 0.60% WAX

SAGOLA
PRESS CHART
2-26-92 DAYS

1900 - 0700



PRESSLOADS
0700 - 1900 =
302 7/16"

11

LOUISIANA-PACIFIC CORPORATION

PRESS REPORT SAGOLA MICHIGAN *PRESS REPORT*

OPERATOR Wickman DATE 2-26-92

SHIFT D CREW D

BLOW OUT:

F.L. RADIATORS . . . . ✓

HYD. COOLING FANS . . ✓

PRESS COOLING FANS . ✓

F.C.O.S. . . . . . . [illegible]

FORMER DECK . . . . [illegible]

LOADER . . . . [illegible]

UNLOADER . . . . . . [illegible]

PRESS . . . . [illegible]

GREASE COLUMNS . [illegible]

FLUSH BLENDER . . . ✓

BAGHOUSE PRESSURE 7

HYD. OIL TEMP . . 127

✓ PIT/RETURN CONVS [illegible]

CLEAN DECKLE CHAIN [illegible]

CLEAN BLENDERS . . [illegible]

CLEAN TAIL PULLEYS [illegible]

Line Speed	From	To	Thickness	Press Loads
45	[illegible]	[illegible]	[illegible]	205

DOWNTIME FROM	TO	M	E	O	REASON FOR DOWNTIME
[illegible]	[illegible]		✓		Loader

DOWNTIME CODES: M-Mechanical E-Electrical O-Operator

TIME OF POSITION (seconds)

1 47	43 44	85 40	127 44	169 [illegible]
2 49	44 43	86 40	128 45	170 [illegible]
3 49	45 44	87 40	129 45	[illegible]
4 47	46 44	88 40	130 46	172 [illegible]
5 47	47 [illegible]	89 40	131 46	173 [illegible]
6 47	48 44	90 40	132 47	174 [illegible]
7 47	49 44	91 41	133 47	175 [illegible]
8 46	50 44	92 41	134 44	176 [illegible]
9 45	51 45	93 43	135 45	177 [illegible]
10 45	52 43	94 43	136 45	[illegible]
11 44	53 44	95 43	137 45	[illegible]
12 44	54 45	96 [illegible]	138 44	180 [illegible]
13 44	55 45	97 [illegible]	139 44	181 [illegible]
14 44	56 45	98 [illegible]	140 44	[illegible]
15 44	57 44	99 [illegible]	141 44	[illegible]
16 45	58 44	100 43	142 44	[illegible]
17 45	59 45	101 43	[illegible] 45	[illegible]
18 44	60 46	102 43	144 45	[illegible]
19 43	61 46	103 [illegible]	145 45	[illegible]
20 43	62 45	104 43	146 45	[illegible]
21 42	63 45	105 43	147 44	[illegible]
22 42	64 45	106 44	148 44	[illegible]
23 41	65 45	107 43	149 44	[illegible]
24 41	66 44	108 43	150 [illegible]	[illegible]
[illegible] 41	[illegible] 41	109 43	[illegible]	[illegible]
26 41	68 45	[illegible] 43	152 43	[illegible]
[illegible]	[illegible] 43	[illegible] 43	[illegible] 43	[illegible]
[illegible]	70 43	[illegible] 45	154 44	[illegible]
[illegible] 41	[illegible] 42	[illegible] 43	[illegible] 45	[illegible]
[illegible] 42	[illegible] 42	[illegible] 43	156 [illegible]	[illegible]
[illegible] 42	[illegible] 42	[illegible] 42	157 44	[illegible]
[illegible] 42	[illegible] 40	[illegible] 42	158 [illegible]	[illegible]
[illegible] 41	75 42	[illegible] 42	159 45	[illegible]
[illegible] 41	[illegible] 42	[illegible] 43	[illegible] 45	[illegible]
35 42	[illegible] 42	[illegible] 43	[illegible] 44	[illegible]
36 42	78 41	[illegible] 43	[illegible] 44	[illegible]
37 42	[illegible] 41	[illegible] 43	[illegible]	[illegible]
38 42	80 41	[illegible] 44	164 43	[illegible]
39 42	81 41	123 45	165 43	[illegible]
40 42	82 41	124 45	166 45	[illegible]
[illegible] 42	[illegible] 41	[illegible]	[illegible] 47	[illegible]

Target usage: Wax: .6 %
MDI: 1.90 %
LPH: 3 05 %

2-28-92

			10.04 #/gal	10.25 #/gal	Date: 2-26-92	
			53 % solid		62 % solid	62 %
			Liquid Phenol	MDI	Wax Reading	Wax Reading
Time	Product	Line Speed	Totalizer	Totalizer	North Tank	South Tank
7:00 am	7/16	85	0	0	6' 10 5/8"	7' 2 1/16"
8:00 am	7/16	85	157	51		
9:00 am	7/16	85	319	103		
10:00 am	7/16	85	495	157		
11:00 pm	7/16	85	65"	2.11	6' 2 3/4"	7' 1/16"
1 pm	7/16	85	915	286		
1 pm	7/16	85	992	317		
2 pm	7/16	85	1141	362		
3 pm	7/16	85	1204	417	6' 1 1/8"	6' 10 7/16"
			2nd: 2.17 #/min	.869 gal/min		
			1st: 14.42 #/min	1.91 #/min		
			100% rich			
					7.3 #/gal	

92,750#

88,661

4,089# used @ 62 % solids

529 gal used

.516 gal/min per nozzle

13

APPENDIX J

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 absorbed all moisture from the sample gas stream after which the sample gas passed 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.

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 absorbs 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 °F. At this elevated temperature condensation of atmospheric moisture is prevented. The acetone-free sample is then dried at 105 °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 °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)

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 E.A 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 °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):

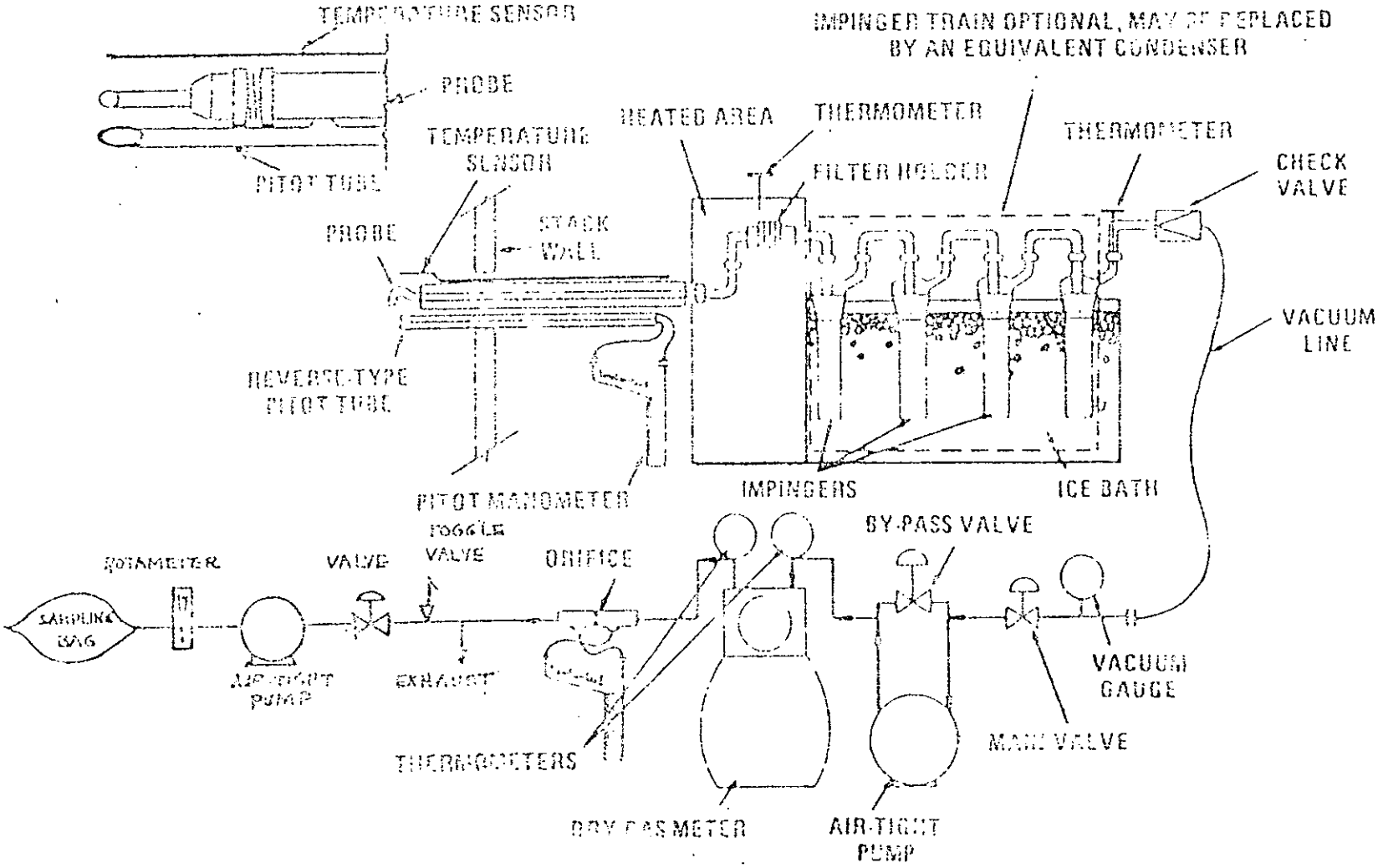
$$\text{grams} = \frac{(\text{grams recovered from aliquot}) \times (\text{total volume (ml) or grams of sample})}{(\text{aliquot volume (ml) or grams used})}$$

   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 ØLSC-036.

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



Particulate-sampling train.

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Current as of 3-26-91

METHOD 201A - DETERMINATION OF PM_{10} EMISSIONS (Constant Sampling Rate Procedure)

(55 FR 14246)

1. Applicability and Principle

1.1 Applicability. This method applies to the in-stack measurement of particulate matter (PM) emissions equal to or less than an aerodynamic diameter of nominally 10 μm (PM_{10}) from stationary sources. The EPA recognizes that condensible emissions not collected by an in-stack method are also PM_{10}, and that emissions that contribute to ambient PM_{10} levels are the sum of condensible emissions and emissions measured by an in-stack PM_{10} method, such as this method or Method 201. Therefore, for establishing source contributions to ambient levels of PM_{10}, such as for emission inventory purposes, EPA suggests that source PM_{10} measurement include both in-stack PM_{10} and condensible emissions. Condensible emissions may be measured by an impinger analysis in combination with this method.

1.2 Principle. A gas sample is extracted at a constant flow rate through an in-stack sizing device, which separates PM greater than PM_{10}. Variations from isokinetic sampling conditions are maintained within well-defined limits. The particulate mass is determined gravimetrically after removal of uncombined water.

2. Apparatus

NOTE: Methods cited in this method are part of 40 CFR Part 60, Appendix A.

2.1 Sampling Train. A schematic of the Method 201A sampling train is shown in Figure 1. With the exception of the PM_{10} sizing device and in-stack filter, this train is the same as an EPA Method 17 train.

2.1.1 Nozzle. Stainless steel (316 or equivalent) with a sharp tapered leading edge. Eleven nozzles that meet the design specifications in Figure 2

This version is a corrected version of (55 FR 14246 Apr 17 1990)

are recommended. A large number of nozzles with small nozzle increments increase the likelihood that a single nozzle can be used for the entire traverse. If the nozzles do not meet the design specifications in Figure 2, then the nozzles must meet the criteria in Section 5.2.

2.1.2 PM_{10} Sizer. Stainless steel (316 or equivalent), capable of determining the PM_{10} fraction. The sizing device shall be either a cyclone that meets the specifications in Section 5.2 or a cascade impactor that has been calibrated using the procedure in Section 5.4.

2.1.3 Filter Holder. 63-mm, stainless steel. An Andersen filter, part number SE274, has been found to be acceptable for the in-stack filter. NOTE: Mention of trade names or specific products does not constitute endorsement by the Environmental Protection Agency.

2.1.4 Pitot Tube. Same as in Method 5, Section 2.1.3. The pitot lines shall be made of heat resistant tubing and attached to the probe with stainless steel fittings.

2.1.5 Probe Liner. Optional, same as in Method 5, Section 2.1.2.

2.1.6 Differential Pressure Gauge, Condenser, Metering System, Barometer, and Gas Density Determination Equipment. Same as in Method 5, Sections 2.1.4, and 2.1.7 through 2.1.10, respectively.

2.2 Sample Recovery.

2.2.1 Nozzle, Sizing Device, Probe, and Filter Holder Brushes. Nylon bristle brushes with stainless steel wire shafts and handles, properly sized and shaped for cleaning the nozzle, sizing device, probe or probe liner, and filter holders.

2.2.2 Wash Bottles, Glass Sample Storage Containers, Petri Dishes, Graduated Cylinder and Balance, Plastic Storage Containers, Funnel and Rubber

Policeman, and Funnel. Same as in Method 5, Sections 2.2.2 through 2.2.8, respectively.

2.3 Analysis. Same as in Method 5, Section 2.3.

3. Reagents

The reagents for sampling, sample recovery, and analysis are the same as that specified in Method 5, Sections 3.1, 3.2, and 3.3, respectively.

4. Procedure

4.1 Sampling. The complexity of this method is such that, in order to obtain reliable results, testers should be trained and experienced with the test procedures.

4.1.1 Pretest Preparation. Same as in Method 5, Section 4.1.1.

4.1.2 Preliminary Determinations. Same as in Method 5, Section 4.1.2, except use the directions on nozzle size selection and sampling time in this method. Use of any nozzle greater (less flow) that 0.16 in. in diameter require a sampling port diameter of 6 inches. Also, the required maximum number of traverse points at any location shall be 12. ? See p. 22

4.1.2.1 The sizing device must be in-stack or maintained at stack temperature during sampling. The blockage effect of the CSR sampling assembly will be minimal if the cross-sectional area of the sampling assemble is 3 percent or less of the cross-sectional area of the duct. (i.e. $D_s \leq 17.5$ inches) If the cross-sectional area of the assembly is greater than 3 percent of the cross-sectional area of the duct, then either determine the pitot coefficient at sampling conditions or use a standard pitot with a known coefficient in a configuration with the CSR sampling assembly such that flow disturbances are minimized.

* when $D_s \leq 17.5$ inches, blockage exceeds 3 %

4.1.2.2 The setup calculations can be performed by using the following procedures.

4.1.2.2.1 In order to maintain a cut size of 10 μm in the sizing device, the flow rate through the sizing device must be maintained at a constant, discrete value during the run. If the sizing device is a cyclone that meets the design specifications in Figure 3, use the equations in Figure 4 to calculate three orifice pressure drop heads (ΔH): one at the average stack temperature, and the other two at temperatures ±28°C (±50°F) of the average stack temperature. Use the ΔH calculated at the average stack temperature as the orifice pressure head for the sample flow rate as long as the stack temperature during the run is within 28°C (50°F) of the average stack temperature. If the stack temperature varies by more than 28°C (50°F), then use the appropriate ΔH.

4.1.2.2.3 To select a nozzle, use the equations in Figure 5 to calculate Δp_{min} and Δp_{max} for each nozzle at all three temperatures. If the sizing device is a cyclone that does not meet the design specifications in Figure 3, the example worksheets can be used.

4.1.2.2.4 Correct the Method 2 pitot readings to Method 201A pitot readings by multiplying the Method 2 pitot readings by the square of a ratio of the Method 201A pitot coefficient to the Method 2 pitot coefficient. Select the nozzle for which Δp_{min} and Δp_{max} bracket all of the corrected Method 2 pitot readings. If more than one nozzle meets this requirement,

select the nozzle giving the greatest symmetry. Note that if the expected pitot reading for one or more points is near a limit for a chosen nozzle, it may be outside the limits at the time of the run.

4.1.2.2.5 Vary the dwell time, or sampling time, at each traverse point proportionately with the point velocity. Use the equations in Figure 6 to calculate the dwell time at the first point and at each subsequent point. It is recommended that the number of minutes sampled at each point be rounded to the nearest 15 seconds.

4.1.3 Preparation of Collection Train. Same as in Method 5, Section 4.1.3, except omit directions about a glass cyclone.

4.1.4 Leak-Check Procedure. The sizing device is removed before the post-test leak-check to prevent any disturbance of the collected sample prior to analysis.

4.1.4.1 Pretest Leak-Check. A pretest leak-check of the entire sampling train, including the sizing device, is required. Use the leak-check procedure in Method 5, Section 4.1.4.1 to conduct a pretest leak-check.

4.1.4.2 Leak-Checks During Sample Run. Same as in Method 5, Section 4.1.4.1.

4.1.4.3 Post-Test Leak-Check. A leak-check is required at the conclusion of each sampling run. Remove the cyclone before the leak-check to prevent the vacuum created by the cooling of the probe from disturbing the collected sample and use the procedure in Method 5, Section 4.1.4.3 to conduct a post-test leak-check.

4.1.5 Method 201A Train Operation. Same as in Method 5, Section 4.1.5, except use the procedures in this section for isokinetic sampling and flow rate adjustment. Maintain the flow rate calculated in Section 4.1.2.2.1

throughout the run provided the stack temperature is within 28°C (50°F) of the temperature used to calculate ΔH. If stack temperatures vary by more than 28°C (50°F), use the appropriate ΔH value calculated in Section 4.1.2.2.1. Calculate the dwell time at each traverse point as in Figure 6.

4.2 Sample Recovery. If a cascade impactor is used, use the manufacturer's recommended procedures for sample recovery. If a cyclone is used, use the same sample recovery as that in Method 5, Section 4.2, except an increased number of sample recovery containers is required.

4.2.1 Container Number 1 (In-Stack Filter). The recovery shall be the same as that for Container Number 1 in Method 5, Section 4.2.

4.2.3 Container Number 2 (Cyclone or Large PM Catch). This step is optional. The anisokinetic error for the cyclone PM is theoretically larger than the error for the PM_{10} catch. Therefore, adding all the fractions to get a total PM catch is not as accurate as Method 5 or Method 201. Disassemble the cyclone and remove the nozzle to recover the large PM catch. Quantitatively recover the PM from the interior surfaces of the nozzle and cyclone, excluding the "turn around" cup and the interior surfaces of the exit tube. The recovery shall be the same as that for Container Number 2 in Method 5, Section 4.2.

4.2.4 Container Number 3 (PM_{10}). Quantitatively recover the PM from all of the surfaces from the cyclone exit to the front half of the in-stack filter holder, including the "turn around" cup inside the cyclone and the interior surfaces of the exit tube. The recovery shall be the same as that for Container Number 2 in Method 5, Section 4.2.

4.2.6 Container Number 4 (Silica Gel). The recovery shall be the same as that for Container Number 3 in Method 5, Section 4.2.

4.2.7 Impinger Water. Same as in Method 5, Section 4.2, under "Impinger Water."

4.3 Analysis. Same as in Method 5, Section 4.3, except handle Method 201A Container Number 1 like Container Number 1, Method 201A Container Numbers 2 and 3 like Container Number 2, and Method 201A Container Number 4 like Container Number 3. Use Figure 7 to record the weights of PM collected. Use Figure 5-3 in Method 5, Section 4.3, to record the volume of water collected.

4.4 Quality Control Procedures. Same as in Method 5, Section 4.4.

4.5 PM_{10} Emission Calculation and Acceptability of Results. Use the procedures in Section 6 to calculate PM_{10} emissions and the criteria in Section 6.3.5 to determine the acceptability of the results.

5. Calibration

Maintain an accurate laboratory log of all calibrations.

5.1 Probe Nozzle, Pitot Tube, Metering System, Probe Heater Calibration, Temperature Gauges, Leak-check of Metering System, and Barometer. Same as in Method 5, Section 5.1 through 5.7, respectively.

6. Calculations

Calculations are as specified in Method 5, Sections 6.3 through 6.7, and 6.9 through 6.11, with the addition of the following:

6.1 Nomenclature.

B_{ws} = Moisture fraction of stack, by volume, dimensionless.

C_1 = Viscosity constant, 51.12 micropoise for °K (51.05 micropoise for °R).

C_2 = Viscosity constant, 0.372 micropoise/°K (0.207 micropoise/°R).

C_3 = Viscosity constant, 1.05×10^{-4} micropoise/°K^2 (3.24×10^{-5} micropoise/°R^2).

C_4 = Viscosity constant, 53.147 micropoise/fraction O_2.

C_5 = Viscosity constant, 74.143 micropoise/fraction H_2O.

D_{50} = Diameter of particles having a 50 percent probability of penetration, μm.

f_o = Stack gas fraction O_2, by volume, dry basis.

K_1 = 0.3858 °K/mm Hg (17.64 °R/in. Hg).

M_w = Wet molecular weight of the stack gas, g/g-mole (lb/lb-mole).

M_d = Dry molecular weight of stack gas, g/g-mole (lb/lb-mole).

P_{bar} = Barometric pressure at sampling site, mm Hg (in. Hg).

P_s = Absolute stack pressure, mm Hg (in. Hg).

Q_s = Total cyclone flow rate at wet cyclone conditions, m^3/min (ft^3/min).

$Q_{s(std)}$ = Total cyclone flow rate at dry standard conditions, dscm/min (dscf/min). DSCFM

T_m = Average absolute temperature of dry meter, °K (°R).

T_s = Average absolute stack gas temperature, °K (°R).

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

$V_{w(std)}$ = Volume of water vapor in gas sample (standard conditions), scm (scf).

θ = Total sampling time, min.

μ_s = Viscosity of stack gas, micropoise.

6.2 Analysis of Cascade Impactor Data. Use the manufacturer's recommended procedures to analyze data from cascade impactors.

6.3 Analysis of Cyclone Data. Use the following procedures to analyze data from a single stage cyclone.

6.3.1 PM_{10} Weight. Determine the PM catch in the PM_{10} range from the sum of the weights obtained from Container Numbers 1 and 3 less the acetone blank.

6.3.2 Total PM Weight (optional). Determine the PM catch for greater than PM_{10} from the weight obtained from Container Number 2 less the acetone blank, and add it to the PM_{10} weight.

6.3.3 PM_{10} Fraction. Determine the PM_{10} fraction of the total particulate weight by dividing the PM_{10} particulate weight by the total particulate weight.

6.3.4 Aerodynamic Cut Size. Calculate the stack gas viscosity as follows:

$$\mu_s = C_1 + C_2 T_s + C_3 T_s^2 + C_4 f_{c2} - C_5 B_{ws}$$

No! Use equation on page 24

$V_{w(std)} = .04707 (V_f - V_i)$

$T_s = \bar{t}_s + 460$

but $Q_{s(std)} = \frac{V_{m(std)}}{\theta}$

$K_1 = 17.64$

Substituting gives:

$Q_s = \frac{5.664 \times 10^{-2} (\bar{T}_s + 460)}{\theta P_s} [V_{w(std)} - .04707 V_i]$

6.3.4.1 The PM_{10} flow rate, at actual cyclone conditions, is calculated as follows:

$$Q_s = \frac{T_s}{K_1 P_s} \left[Q_{s(std)} + \frac{V_{w(std)}}{\theta} \right]$$

6.3.4.2 Calculate the molecular weight on a wet basis of the stack gas as follows:

$$M_w = M_d (1 - B_{ws}) + 18.0 (B_{ws})$$

6.3.4.3 Calculate the actual D_{50} of the cyclone for the given conditions as follows:

$$D_{50} = \beta_1 \left[\frac{T_s}{M_w P_s} \right]^{0.2091} \left[\frac{\mu_s}{Q_s} \right]^{0.7091}$$

actual cut point achieved during run

where $B_1 = 0.027754$ for metric units (0.15625 for English units).

6.3.5 Acceptable Results. The results are acceptable if two conditions are met. The first is that 9.0 $\mu m \leq D_{50} \leq 11.0$ μm. The second is that no sampling points are outside Δp_{min} and Δp_{max}, or that 80 percent $\leq I \leq 120$ percent and no more than one sampling point is outside Δp_{min} and Δp_{max}. If D_{50} is less than 9.0 μm, reject the results and repeat the test.

7. Bibliography

1. Same as Bibliography in Method 5.

2. McCain, J.D., J.W. Ragland, and A.D. Williamson. Recommended Methodology for the Determination of Particle Size Distributions in Ducted Sources, Final Report. Prepared for the California Air Resources Board by Southern Research Institute. May 1986.

3. Farthing, W.E., S.S. Dawes, A.D. Williamson, J.D. McCain, R.S. Martin, and J.W. Ragland. Development of Sampling Methods for Source PM_{10} Emissions. Southern Research Institute for the Environmental Protection Agency. April 1989. NTIS PB 89 190375, EPA/600/3-88-056.

4. Application Guide for Source PM_{10} Measurement with Constant Sampling Rate, EPA/600/3-88-057.

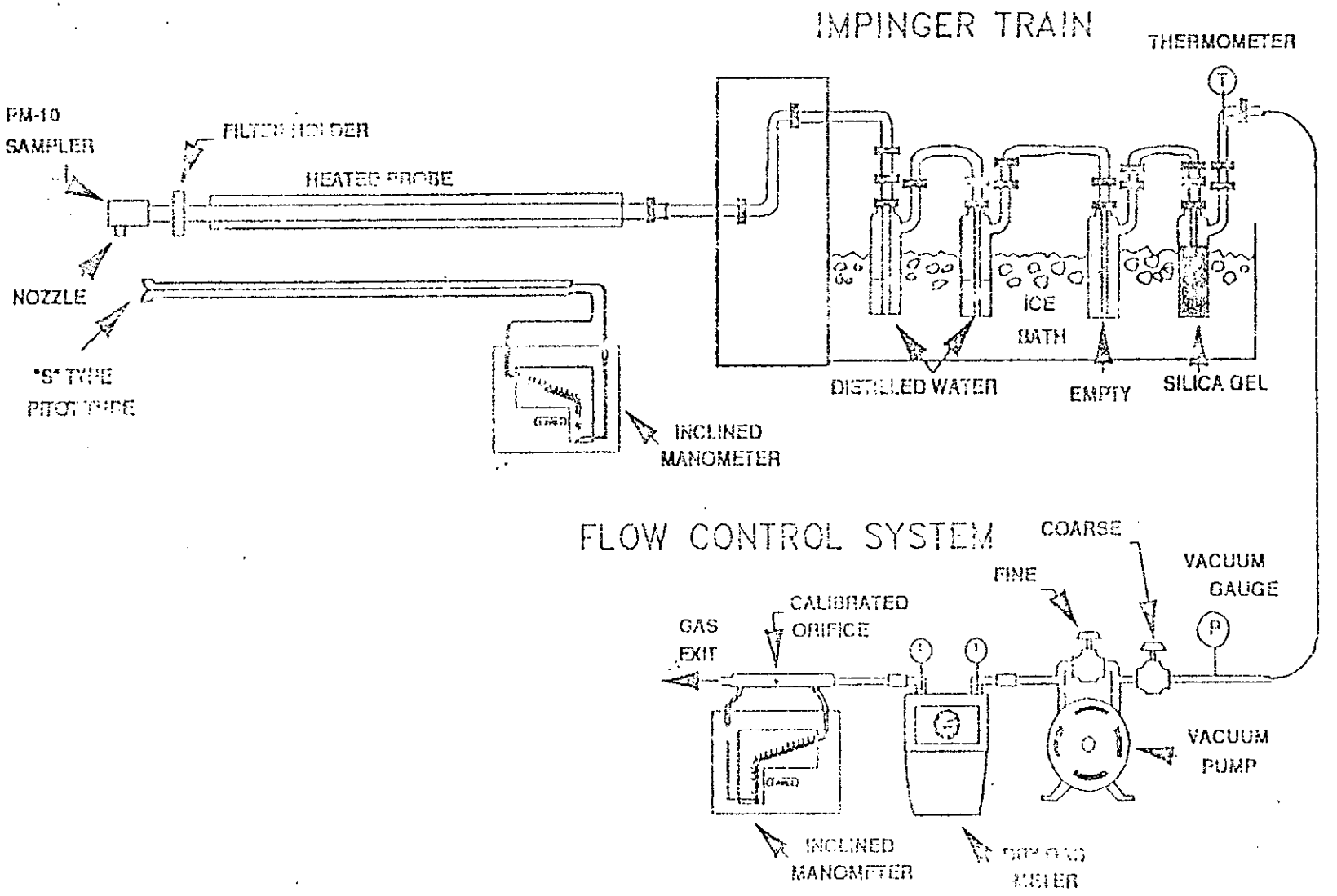
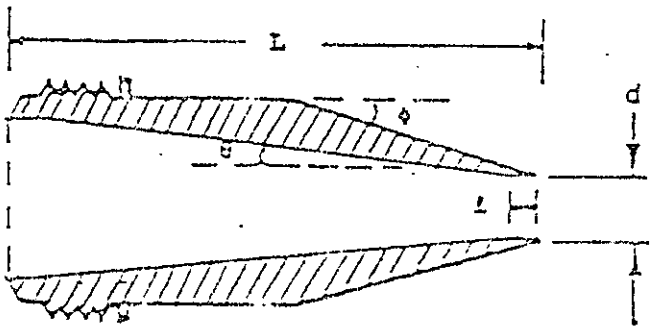


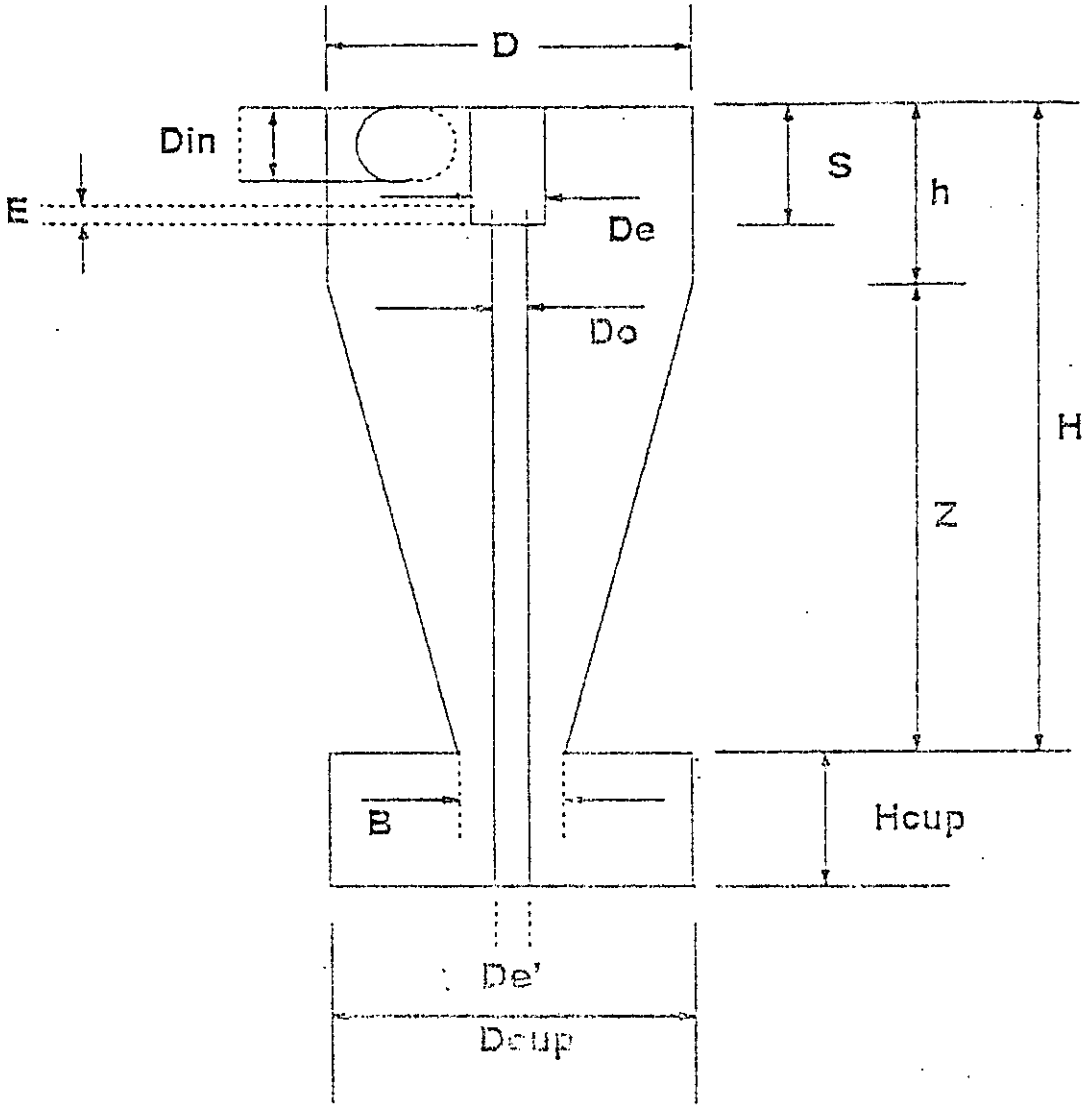
Figure 1. CSR Sampling Train



Nozzle Diameter (inches)	Cone Angle, θ (degrees)	Outside taper, ϕ (degrees)	Straight inlet length, ℓ (inches)	Total Length L (inches)
0.136	4	15	<0.05	2.65?±0.05
0.150	4	15	<0.05	2.55?±0.05
0.164	5	15	<0.05	1.97?±0.05
0.180	6	15	<0.05	1.57?±0.05
0.197	6	15	<0.05	1.49?±0.05
0.215	6	15	<0.05	1.45 ±0.05
0.233	6	15	<0.05	1.45 ±0.05
0.264	5	15	<0.05	1.45 ±0.05
0.300	4	15	<0.05	1.45 ±0.05
0.342	4	15	<0.05	1.45 ±0.05
0.390	3	15	<0.05	1.45 ±0.05

Figure 2. Nozzle design specifications.

Cyclone Interior Dimensions



	Dimensions (±0.02 cm, ±0.01 in.)												
	Din	D	De	E	H	h	Z	S	Hcup	Dcup	De'	Do	E
cm	1.27	4.47	1.50	1.88	6.95	2.24	4.71	1.57	2.23	4.45	1.02	1.27	0.38
in.	0.50	1.76	0.59	0.74	2.74	0.88	1.85	0.62	0.88	1.75	0.40	0.50	0.15

Figure 3. Cyclone design specifications.

Barometric pressure, P_{bar}, in. Hg = _____
Stack static pressure, P_g, in. H_2O = _____
Average stack temperature, t_s, °F = _____
Meter temperature, t_m, °F = _____
Orifice ΔH_a, in. H_2O = _____

Gas analysis:

$\%CO_2$ = _____
$\%O_2$ = _____
$\%N_2 + \%CO$ = _____
Fraction moisture content, B_{ws} = _____

Molecular weight of stack gas, dry basis:

$$M_d = 0.44(\%CO_2) - .32(\%O_2) + 0.28(\%N_2 + \%CO) = \_\_\_\_\_ \text{lb/lb mole}$$

Molecular weight of stack gas, wet basis:

$$M_w = M_d(1 - B_{ws}) + 18(B_{ws}) = \_\_\_\_\_ \text{lb/lb mole}$$

Absolute stack pressure:

$$P_s = P_{bar} + \frac{P_g}{13.6} = \_\_\_\_\_ \text{in. Hg}$$

Viscosity of stack gas:

$$\mu_s = 152.418 + 0.2552\ t_s + 3.2335 \times 10^{-5}\ t_s^2 + 0.53147\ (\%O_2) - 74.143\ B_{ws} = \_\_\_\_ \text{micropoise}$$

Cyclone flow rate:

$$Q_s = 0.002837\ \mu_s \left[\frac{t_s + 460}{M_w\ P_s}\right]^{0.2649} = \_\_\_\_ \text{ft}^3/\text{min}$$

Figure 4. Example worksheet 1 (Page 1 of 2), cyclone flow rate and ΔH.

Orifice pressure head (ΔH) needed for cyclone flow rate:

note

$$\Delta H = \left[\frac{Q_s(1-B_{ws})P_s}{t_s+460}\right]^2 \frac{(t_m+460)\ M_d\ (1.083)\ \Delta H_a}{P_{bar}} = \_\_\_\_\_ \text{ in. } H_2O$$

Calculate ΔH for three temperatures:

t_s, °F			
ΔH, in. H_2O			

Figure 4. Example worksheet 1 (Page 2 of 2), cyclone flow rate and ΔH.

Stack viscosity, μ_s, micropoise = _____
Absolute stack pressure, P_s, in. Hg = _____
Average stack temperature, t_s, °F = _____
Meter temperature, t_m, °F = _____
Method 201A pitot coefficient, C_p = _____
Cyclone flow rate, ft^3/min, Q_s = _____
Method 2 pitot coefficient, C_p = _____
Molecular weight of stack gas, wet basis, M_w = _____
Nozzle diameter, D_n, in. = _____

Nozzle velocity

$$v_n = \frac{3.056\ Q_s}{D_n^2} = \_\_\_\_\_ \text{ft/sec}$$

Maximum and minimum velocities:

Calculate R_{min}.

$$R_{min} = 0.2457 + \sqrt{0.3072 - \frac{0.2603\ (\sqrt{Q_s})\ \mu_s}{v_n^{1.5}}} = \_\_\_\_$$

If R_{min} is less than 0.5, or if an imaginary number occurs when calculating R_{min}, use Equation 1 to calculate v_{min}. Otherwise, use Equation 2.

Eq. 1 $v_{min} = v_n\ (0.5) =$ _____ ft/sec

Eq. 2 $v_{min} = v_n\ R_{min} =$ _____ ft/sec

Calculate R_{max}.

$$R_{max} = 0.4457 + \sqrt{0.5690 + \frac{0.2603\ (\sqrt{Q_s})\ \mu_s}{v_n^{1.5}}} = \_\_\_\_$$

Figure 5. Example worksheet 2 (page 1 of 2), nozzle selection.

If R_{max} is greater than 1.5, use Equation 3 to calculate v_{max}. Otherwise, use Equation 4.

Eq. 3 $v_{max} = v_n\ (1.5) =$ _____ ft/sec

Eq. 4 $v_{max} = v_n\ R_{max} =$ _____ ft/sec

Maximum and minimum velocity head values:

$$\Delta p_{min} = 1.3686 \times 10^{-4}\ \frac{P_s\ M_w\ (v_{min})^2}{(t_s + 460)\ C_p^2} =$$ _____ in. H_2O

$$\Delta p_{max} = 1.3686 \times 10^{-4}\ \frac{P_s\ M_w\ (v_{max})^2}{(t_s + 460)\ C_p^2} =$$ _____ in. H_2O

Nozzle Number				
D_n, in.				
v_n, ft/sec				
v_{min}, ft/sec				
v_{max}, ft/sec				
Δp_{min}, in. H_2O				
Δp_{max}, in. H_2O				

Velocity traverse data:

incorrect

$$\Delta p(\text{Method 201A}) = \Delta p(\text{Method 2}) \left[\frac{C_p}{C_p}\right]^2 = \Delta p^{M2} \left(\frac{C_p^{M2}}{C_p^{201A}}\right)^2$$

4-11-91 F

Figure 5. Example worksheet 2 (page 2 of 2), nozzle selection.

Total run time, minutes = _____

Number of traverse points = _____

$$t_1 = \sqrt{\frac{\Delta p_1'}{\Delta p_{avg}'}} \left(\frac{\text{Total run time}}{\text{Number of points}} \right)$$

where:

t_1 = dwell time at first traverse point, minutes.

$\Delta p'_1$ = the velocity head at the first traverse point (from a previous traverse), in. H_2O.

$\Delta p'_{avg}$ = the square of the average square root of the Δp's (from a previous velocity traverse), in. H_2O.

At subsequent traverse points, measure the velocity Δp and calculate the dwell time by using the following equation:

$$t_n = \frac{t_1}{\sqrt{\Delta p_1}} \sqrt{\Delta p_n}, \text{ where } n = 2,3,....\text{total number of sampling points}$$

where:

t_n = dwell time at traverse point n, minutes.

Δp_n = measured velocity head at point n, in. H_2O.

Δp_1 = measured velocity head at point 1, in. H_2O.

Figure 6. Example worksheet 3 (page 1 of 2), dwell time.

Port No_____ Port No_____ Port No_____ Port No_____

Point Number	Δp	t	Δp	t	Δp	t	Δp	t
1								
2								
3								
4								
5								
6								

Figure 6. Example worksheet 3 (page 2 of 2), dwell time.

Plant _____

Date _____

Run no. _____

Filter no. _____

Amount of liquid lost during transport _____

Acetone blank volume, ml _____

Acetone wash volume, ml (4) _____ (5) _____

Acetone blank conc., mg/mg (Equation 5-4, Method 5) _____

Acetone wash blank, mg (Equation 5-5, Method 5) _____

Container number	Weight of PM_{10} (mg)		
	Final weight	Tare weight	Weight gain
1			
3			
		Total.....	
		Less acetone blank....	
		Weight of PM10.....	

Figure 7. Method 201A analysis sheet.

TABLE 1. PERFORMANCE SPECIFICATIONS FOR SOURCE PM_{10} CYCLONES AND NOZZLE COMBINATIONS

Parameter	Units	Specification
1. Collection efficiency	Percent	Such that collection efficiency falls within envelope specified by Section 5.2.6 and Figure 8.
2. Cyclone cut size (D_{50})	μm	10 ± 1 μm aerodynamic diameter

TABLE 2. PARTICLE SIZES AND NOMINAL GAS VELOCITIES FOR EFFICIENCY

Particle size (μm)[a]	Target gas velocities (m/sec)		
	7 ± 1.0	15 ± 1.5	2[illegible] ± 2.5
5 ± 0.5			
7 ± 0.5			
10 ± 0.5			
1[illegible] ± 1.0			
20 ± 1.0			

(a) Mass median aerodynamic diameter.

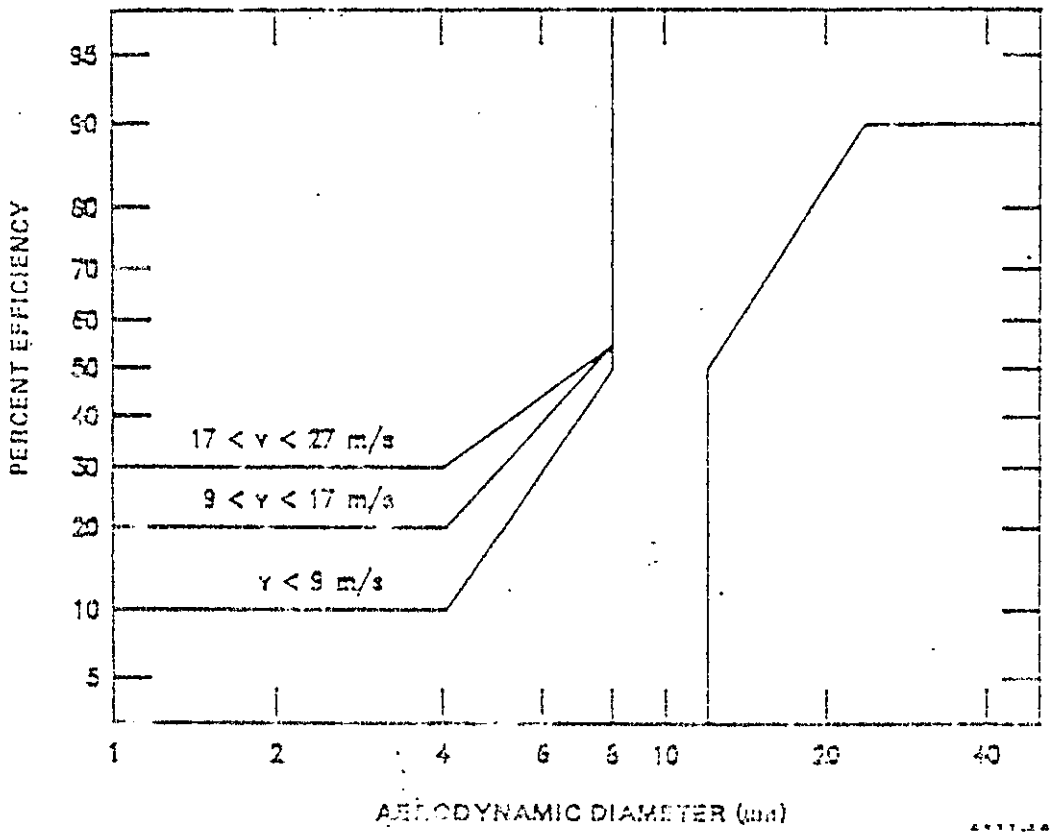


Figure 8. Efficiency envelope for the PM_{10} cyclone.

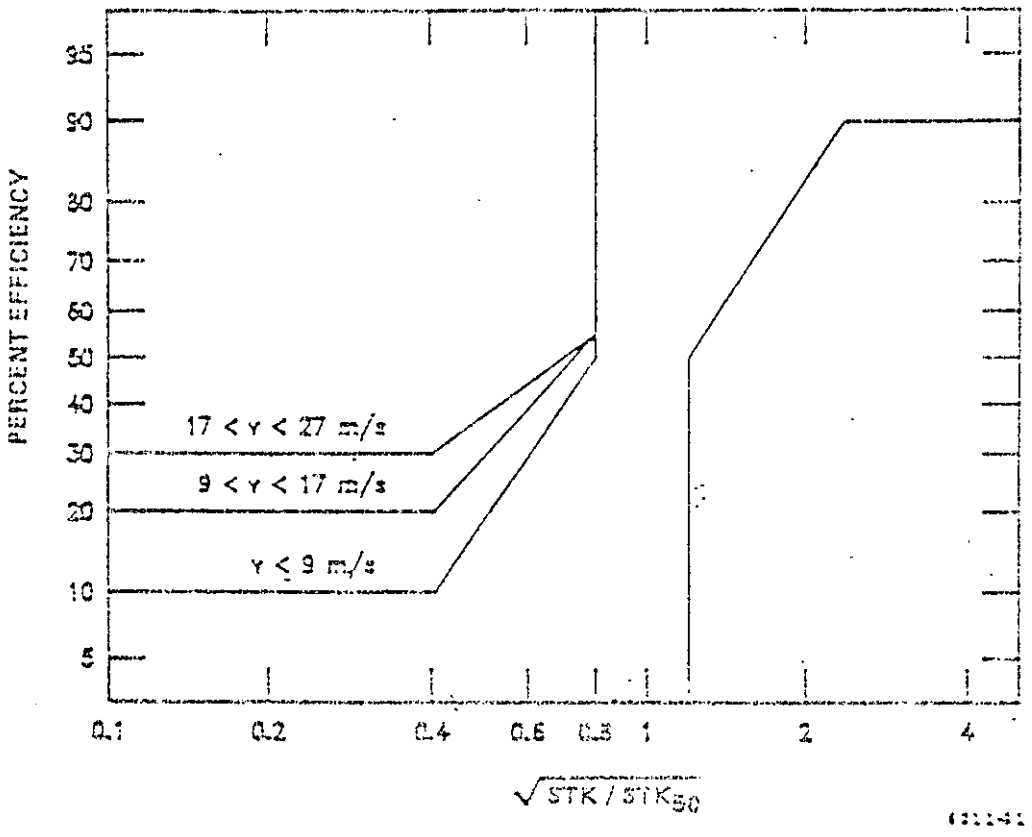


Figure 9. Efficiency envelope for first calibration stage.

DETERMINATION OF CARBON MONOXIDE EMISSIONS FROM STATIONARY SOURCES

Carbon monoxide concentrations were determined in accordance with CFR Title 40, Part 60, Appendix A (revised July 1, 1990), EPA Method 10 using the integrated sampling technique. An integrated gas sample is extracted from a three-point sampling traverse and analyzed for carbon monoxide content using a ACS Model 3300 nondispersive infrared analyzer (NDIR). This analyzer has a measuring range of 0-500 and 0-1000 ppm. The measuring method is single beam. Linearity is better than ± 2% full scale and the noise is less than 0.5 fs. The minimum detectable concentration is 5 ppm. Zero drift is rated at ± 1% fs per 24 hours and the span drift is less than 1% in a 24-hour period. Response time is less than 15 seconds to 90% of final reading. Precision is rated at better than ± 0.5% fs on low range and ± 1% fs on high range. The flow rate through the analyzer is 1.0 ± 0.5 LPM..

Integrated flue gas samples are collected over a 21-minute period using a three or more point traverse. The flue gas samples are collected at a flow rate of 400-1000 cc per minute. The flue gas is dried using a desiccant column filled with silica gelor Drierite. Integrated gas samples are collected in 44-liter Tedlar bags. The bags are leak-checked immediately before initiation of sampling. The integrated bags are housed in aluminum housings to eliminate any contact with sharp objects which might cause puncture and leakage.

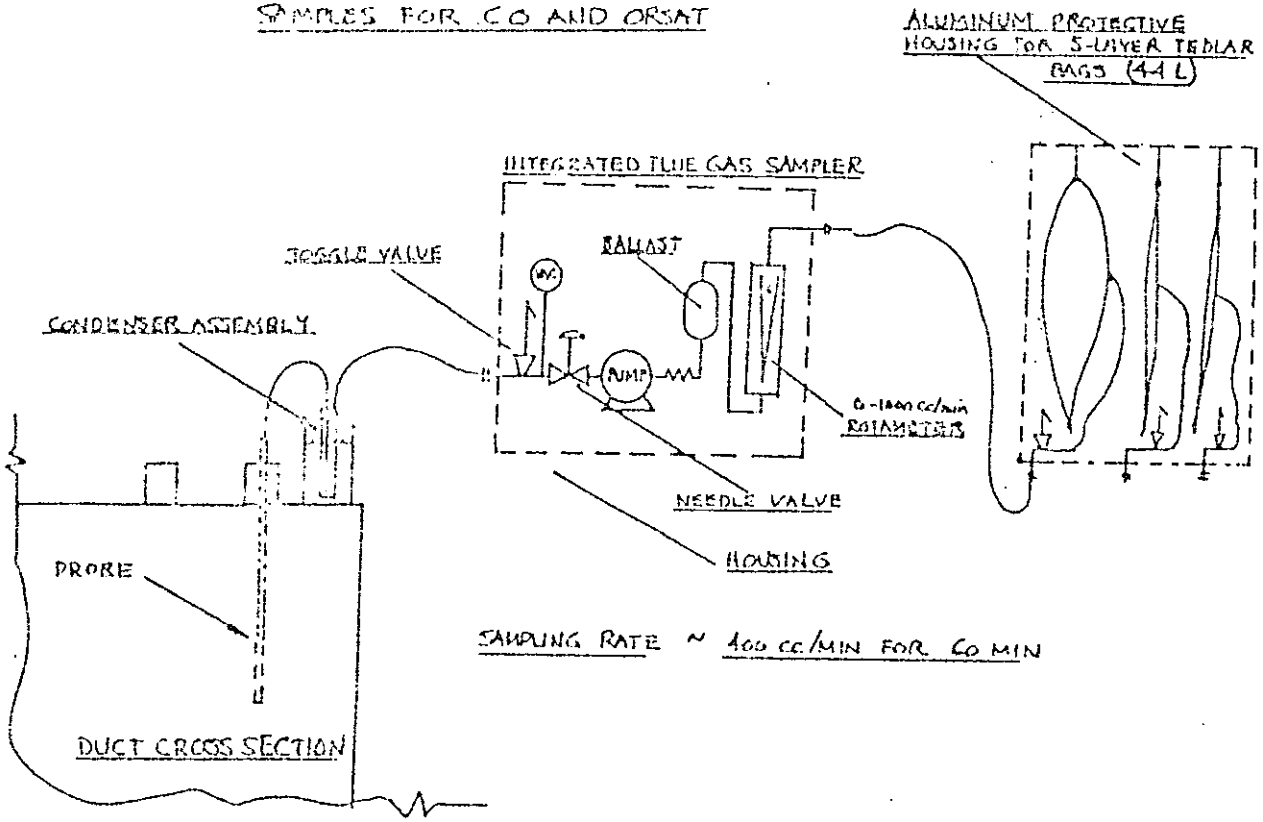
After sampling is complete, the bags are transported to the laboratory for analysis. The bags are analyzed using a flow system whereby any residual moisture and carbon dioxide are quantitatively removed prior to introduction into the NDIR. This is accomplished using two cartridges in series immersed in an ice bath. The first cartridge contains silica gel or Drierite and the second cartridge Ascarite as prescribed in EPA Method 10. The analyzer is then zeroed and calibrated

using NBS traceable standard gases (Scott Specialty Gases). These gases are introduced directly into the system and passed through the two adsorbent cartridges. A high purity nitrogen zero gas is used to zero the analyzer. Several concentrations of carbon monoxide in air standards are used to calibrate the analyzer and to quality assure intermittently the analysis of the individual flue gas samples.

The integrated bag samples are also analyzed for carbon dioxide and oxygen by means of a standard Orsat analyzer equipped with a 100 cc buret using standard commercially available absorption reagents in accordance with EPA Method 3. The moisture content of the flue gas is determined independently in accordance with EPA Method 4 (large impinger version) to allow mathematical conversion of the dry, CO_2-free concentrations to actual flue gas conditions.

The reported carbon monoxide concentrations, unless otherwise noted, have been mathematically corrected for both carbon dioxide and moisture content in accordance with the equations given in EPA Method 10.

SAMPLING SYSTEM TO COLLECT INTEGRATED FLUE GAS SAMPLES FOR CO AND ORSAT



SAMPLING RATE ~ 100 cc/MIN FOR 60 MIN

REVISIONS			EPA METHOD 3 & 10 SAMPLING TRAIN		
NO.	DATE	BY			
1					
2					
3			DRAWN BY LP	SCALE N/A	MATERIAL
4			CHK'D	DATE 10/85	DRAWING NO. S-310
5			TRACED	APP'D	

EPA
METHOD 0011

SAMPLING FOR FORMALDEHYDE EMISSIONS FROM STATIONARY SOURCES

1.0 SCOPE AND APPLICATION

1.1 This method is applicable to the determination of Destruction and Removal Efficiency (DRE) of formaldehyde, CAS Registry number 50-00-0, and possibly other aldehydes and ketones from stationary sources as specified in the regulations. The methodology has been applied specifically to formaldehyde; however, many laboratories have extended the application to other aldehydes and ketones. Compounds derivatized with 2,4-dinitrophenylhydrazine can be detected as low as 6.4×10^{-8} lbs/cu ft (1.8 ppbv) in stack gas over a 1 h sampling period, sampling approximately 45 cu ft.

2.0 SUMMARY OF METHOD

2.1 Gaseous and particulate pollutants are withdrawn isokinetically from an emission source and are collected in aqueous acidic 2,4-dinitrophenylhydrazine. Formaldehyde present in the emissions reacts with the 2,4-dinitrophenylhydrazine to form the formaldehyde dinitrophenylhydrazone derivative. The dinitrophenylhydrazone derivative is extracted, solvent-exchanged, concentrated, and then analyzed by high performance liquid chromatography.

3.0 INTERFERENCES

3.1 A decomposition product of 2,4-dinitrophenylhydrazine, 2,4-dinitroaniline, can be an analytical interferent if concentrations are high. 2,4-dinitroaniline can coelute with the 2,4-dinitrophenylhydrazone of formaldehyde under high performance liquid chromatography conditions which may be used for the analysis. High concentrations of highly oxygenated compounds, especially acetone, that have the same retention time or nearly the same retention time as the dinitrophenylhydrazone of formaldehyde and that also absorb at 360 nm will interfere with the analysis.

Formaldehyde, acetone, and 2,4-dinitroaniline contamination of the aqueous acidic 2,4-dinitrophenylhydrazine (DNPH) reagent is frequently encountered. The reagent must be prepared within five days of use in the field and must be stored in an uncontaminated environment both before and after sampling in order to minimize blank problems. Some level of acetone contamination is unavoidable, because acetone is ubiquitous in laboratory and field operations. However, the acetone contamination must be minimized.

4.0 APPARATUS AND MATERIALS

4.1 A schematic of the sampling train is shown in Figure 1. This sampling train configuration is adapted from EPA Method 5 procedures. The sampling train consists of the following components: Probe Nozzle, Pitot Tube, Differential Pressure Gauge, Metering System, Barometer, and Gas Density Determination Equipment.

4.1.1 Probe Nozzle: Quartz or glass with sharp, tapered (30° angle) leading edge. The taper shall be on the outside to preserve a constant inner diameter. The nozzle shall be buttonhook or elbow design. A range of nozzle sizes suitable

for isokinetic sampling should be available in increments of 0.16 cm (1/16 in), e.g., 0.32 to 1.27 cm (1/8 to 1/2 in), or larger if higher volume sampling trains are used. Each nozzle shall be calibrated according to the procedures outlined in Section 8.1.

4.1.2 Probe Liner: Borosilicate glass or quartz shall be used for the probe liner. The tester should not allow the temperature in the probe to exceed 120 ± 14°C (248 ± 25°F).

4.1.3 Pitot Tube: The Pitot tube shall be Type S, as described in Section 2.1 of EPA Method 2, or any other appropriate device. The pitot tube shall be attached to the probe to allow constant monitoring of the stack gas velocity. The impact (high pressure) opening plane of the pitot tube shall be even with or above the nozzle entry plane (see EPA Method 2, Figure 2-6b) during sampling. The Type S pitot tube assembly shall have a known coefficient, determined as outlined in Section 4 of EPA Method 2.

4.1.4 Differential Pressure Gauge: The differential pressure gauge shall be an inclined manometer or equivalent device as described in Section 2.2 of EPA Method 2. One manometer shall be used for velocity-head readings and the other for orifice differential pressure readings.

4.1.5 Impingers: The sampling train requires a minimum of four impingers, connected as shown in Figure 1, with ground glass (or equivalent) vacuum-tight fittings. For the first, third, and fourth impingers, use the Greenburg-Smith design, modified by replacing the tip with a 1.3-cm inside diameter (1/2 in) glass tube extending to 1.3 cm (1/2 in) from the bottom of the flask. For the second impinger, use a Greenburg-Smith impinger with the standard tip. Place a thermometer capable of measuring temperature to within 1°C (2°F) at the outlet of the fourth impinger for monitoring purposes.

4.1.6 Metering System: The necessary components are a vacuum gauge, leak-free pump, thermometers capable of measuring temperature within 3°C (5.4°F), dry-gas meter capable of measuring volume to within 1%, and related equipment as shown in Figure 1. At a minimum, the pump should be capable of 4 cfm free flow, and the dry gas meter should have a recording capacity of 0-999.9 cu ft with a resolution of 0.005 cu ft. Other metering systems may be used which are capable of maintaining sampling rates within 10% of isokinetic collection and of determining sample volumes to within 2%. The metering system may be used in conjunction with a pitot tube to enable checks of isokinetic sampling rates.

4.1.7 Barometer: The barometer may be mercury, aneroid, or other barometer capable of measuring atmospheric pressure to within 2.5 mm Hg (0.1 in Hg). In many cases, the barometric reading may be obtained from a nearby National Weather Service Station, in which case the station value (which is the absolute barometric pressure) is requested and an adjustment for elevation differences between the weather station and sampling point is applied at a rate of minus 2.5 mm Hg (0.1 in Hg) per 30 m (100 ft) elevation increase (vice versa for elevation decrease).

4.1.8 Gas Density Determination Equipment: Temperature sensor and pressure gauge (as described in Sections 2.3 and 2.4 of EPA Method 2), and gas analyzer, if necessary (as described in EPA Method 3). The temperature sensor ideally should be permanently attached to the pitot tube or sampling probe in a fixed

configuration such that the tip of the sensor extends beyond the leading edge of the probe sheath and does not touch any metal. Alternatively, the sensor may be attached just prior to use in the field. Note, however, that if the temperature sensor is attached in the field, the sensor must be placed in an interference-free arrangement with respect to the Type S pitot tube openings (see EPA Method 2, Figure 2-7). As a second alternative, if a difference of no more than 1% in the average velocity measurement is to be introduced, the temperature gauge need not be attached to the probe or pitot tube.

4.2 Sample Recovery

4.2.1 Probe Liner: Probe nozzle and brushes; Teflon® bristle brushes with stainless steel wire handles are required. The probe brush shall have extensions of stainless steel, Teflon®, or inert material at least as long as the probe. The brushes shall be properly sized and shaped to brush out the probe liner, the probe nozzle, and the impingers.

4.2.2 Wash Bottles: Three wash bottles are required. Teflon® or glass wash bottles are recommended; polyethylene wash bottles should not be used because organic contaminants may be extracted by exposure to organic solvents used for sample recovery.

4.2.3 Graduated Cylinder and/or Balance: A graduated cylinder or balance is required to measure condensed water to the nearest 1 mL or 1 g. Graduated cylinders shall have divisions not >2 mL. Laboratory balances capable of weighing to ±0.5 g are required.

4.2.4 Amber Glass Storage Containers: One-liter wide-mouth amber flint glass bottles with Teflon®-lined caps are required to store impinger water samples. The bottles must be sealed with Teflon® tape.

4.2.5 Rubber Policeman and Funnel: A rubber policeman and funnel are required to aid in the transfer of materials into and out of containers in the field.

5.0 REAGENTS

Reagent grade chemicals or better grades shall be used in all tests. Unless otherwise indicated, all reagents shall conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available.

5.1 Water: HPLC-grade water is used in preparation of DNPH reagent and in all other applications in the sampling train.

5.2 Silica Gel: Silica gel shall be indicating type, 6-16 mesh. If the silica gel has been used previously, dry at 175°C (350°F) for 2 h before using. New silica gel may be used as received. Alternatively, other types of desiccants (equivalent or better) may be used.

5.3 Crushed Ice: Quantities ranging from 10-50 lb may be necessary during a sampling run, depending upon ambient temperature. Samples which have been taken must be stored and shipped cold; sufficient ice for this purpose must be allowed.

5.4 2,4-Dinitrophenylhydrazine Reagent: The 2,4-dinitrophenylhydrazine reagent must be prepared in the laboratory within five days of sampling use in the field. Preparation of DNPH can also be done in the field, with consideration of appropriate procedures required for safe handling of solvent in the field. When a container of prepared DNPH reagent is opened in the field, the contents of the opened container should be used within 48 hours. All laboratory glassware must be washed with detergent and water and rinsed with water, methanol, and methylene chloride prior to use.

NOTE: The glassware must not be rinsed with acetone or unacceptable levels of acetone contamination will be introduced. If field preparation of DNPH is performed, caution must be exercised in avoiding acetone contamination.

Reagent bottles for storage of cleaned DNPH derivatizing solution must be rinsed with acetonitrile and dried before use. Baked glassware is not essential for preparation of DNPH reagent.

NOTE: DNPH crystals or DNPH solution should be handled with plastic gloves at all times, with prompt and extensive use of running water in case of skin exposure.

5.4.1 Preparation of Aqueous Acidic DNPH: The following materials and reagents are required for preparation of the reagent.

5.4.1.1 Bottles/Caps: amber 1- or 4 L bottles with Teflon®-lined caps are required for storing cleaned DNPH solution. Additional 4-L bottles are required to collect waste organic solvents.

5.4.1.2 Large Glass Container: at least one large glass container (8 to 16 L) is required for mixing the aqueous acidic DNPH solution.

5.4.1.3 Stir Plate/Large Stir Bars/Stir Bar Retriever: a magnetic stir plate and large stir bar are required for the mixing of the aqueous acidic DNPH solution. A stir bar retriever is needed for removing the stir bar from the large container holding the DNPH solution.

5.4.1.4 Buchner Filter/Filter Flask/Filter Paper: a large filter flask (2-4 L) with a buchner filter, appropriate rubber stopper, filter paper, and connecting tubing are required for filtering the aqueous acidic DNPH solution prior to cleaning.

5.4.1.5 Separatory Funnels: at least one large separatory funnel (2 L) is required for cleaning the DNPH prior to use.

5.4.1.6 Beakers: beakers (150 mL, 250 mL, and 400 mL) are useful for holding/measuring organic liquids when cleaning the aqueous acidic DNPH solution and for weighing DNPH crystals.

5.4.1.7 Funnels: at least one large funnel is needed for pouring the aqueous acidic DNPH into the separatory funnel.

5.4.1.8 Graduated Cylinders: at least one large graduated cylinder (1 to 2 L) is required for measuring HPLC-grade water and acid when preparing the DNPH solution.

5.4.1.9 Top-Loading Balance: a one-place top loading balance is needed for weighing out the DNPH crystals used to prepare the aqueous acidic DNPH solution.

5.4.1.10 Spatulas: spatulas are needed for weighing out DNPH when preparing the aqueous DNPH solution.

5.4.1.11 HPLC-Grade Water: water (HPLC-grade) is required to mix the aqueous DNPH solution.

5.4.1.12 Hydrochloric Acid: reagent grade hydrochloric acid (approximately 12N) is required for acidifying the aqueous DNPH solution.

5.4.1.13 2,4-Dinitrophenylhydrazine: a supply of moist solid 2,4-dinitrophenylhydrazine (DNPH) is required for preparation of aqueous acidic DNPH solution. The quantity of water may vary from 10 to 30%. Reagent grade or equivalent is required.

5.4.1.14 Methylene Chloride: methylene chloride (suitable for residue and pesticide analysis, GC/MS, HPLC, GC, Spectrophotometry or equivalent) is required for cleaning the aqueous acidic DNPH solution, rinsing glassware, and recovery of sample trains.

5.4.1.15 Cyclohexane: cyclohexane (HPLC grade) is required for cleaning the aqueous acidic DNPH solution.

NOTE: Do not use spectroanalyzed grades of cyclohexane if this sampling methodology is extended to aldehydes and ketones with four or more carbon atoms.

5.4.1.16 Methanol: methanol (HPLC grade or equivalent) is required for rinsing glassware.

5.4.1.17 Acetonitrile: acetonitrile (HPLC grade or equivalent) is required for rinsing glassware.

5.4.1.18 Formaldehyde: Analytical grade or equivalent formaldehyde is required for preparation of standards. If other aldehydes or ketones are used, analytical grade or equivalent is required.

5.4.2 Preparation of Aqueous Acidic DNPH Derivatizing Reagent: Each batch of DNPH reagent should be prepared and purified within five days of sampling, according to the procedure described below.

5.4.2.1 Place an 8-L container under a fume hood on a magnetic stirrer. Add a large stir bar and fill the container half full of HPLC-grade water. Save the empty bottle from HPLC-grade water. Start the stirring bar and adjust the stir rate to be as fast as possible. Using a graduated cylinder, measure 1.4 mL of concentrated hydrochloric acid. Slowly pour the acid into the stirring water. Fumes may be generated and the water may become warm. Weigh the DNPH crystals on a one-place balance (see Table 1 for approximate amounts) and add to the stirring acid solution. Fill the 8 L container to the 8 L mark with HPLC water and stir overnight. If all of the DNPH crystals have dissolved overnight, add additional DNPH and stir for two more hours. Continue the process of adding DNPH with additional stirring until a saturated solution has been formed. Filter the DNPH solution using vacuum filtration. Gravity filtration may be used, but a

much longer time is required. Store the filtered solution in an amber bottle at room temperature.

TABLE 1. APPROXIMATE AMOUNT OF CRYSTALLINE DNPH USED TO PREPARE A SATURATED SOLUTION

Amount of Moisture in DNPH	Weight Required per 8 L of Solution
10 weight percent	31 g
15 weight percent	33 g
30 weight percent	40 g

Within five days of proposed use, place about 1.6 L of the DNPH reagent in a 2 L separatory funnel. Add approximately 200 mL of methylene chloride and stopper the funnel. Wrap the stopper of the funnel with paper towels to absorb any leakage. Invert and vent the funnel. Then shake vigorously for 3 minutes. Initially, the funnel should be vented frequently (every 10 - 15 sec). After the layers have separated, discard the lower (organic) layer.

Extract the DNPH a second time with methylene chloride and finally with cyclohexane. When the cyclohexane layer has separated from the DNPH reagent, the cyclohexane layer will be the top layer in the separatory funnel. Drain the lower layer (the cleaned extracted DNPH reagent solution) into an amber bottle that has been rinsed with acetonitrile and allowed to dry.

5.4.3 Quality Control: Take two aliquots of the extracted DNPH reagent. The size of the aliquots is dependent upon the exact sampling procedure used, but 100 mL is reasonably representative. To ensure that the background in the reagent is acceptable for field use, analyze one aliquot of the reagent according to the procedure of EPA Draft Method 8315. Save the other aliquot of aqueous acidic DNPH for use as a method blank when the analysis is performed.

5.4.4 Shipment to the Field: Tightly cap the bottle containing extracted DNPH reagent using a Teflon®-lined cap. Seal the bottle with Teflon® tape. After the bottle is labeled, the bottle may be placed in a friction-top can (paint can or equivalent) containing a 1 -2 inch layer of granulated charcoal and stored at ambient temperature until use.

If the DNPH reagent has passed the Quality Control criteria, the reagent may be packaged to meet necessary shipping requirements and sent to the sampling area. If the Quality Control criteria are not met, the reagent solution may be re-extracted or the solution may be re-prepared and the extraction sequence repeated.

If the DNPH reagent is not used in the field within five days of extraction, an aliquot may be taken and analyzed as described Draft Method 8315. If the reagent meets the Quality Control requirements, the reagent may be used. If the reagent does not meet Quality Control requirements, the reagent must be discarded and new reagent must be prepared and tested.

5.4.5 Calculation of Acceptable Levels of Impurities in DNPH Reagent: The acceptable impurity level (AIL, µg/mL) is calculated from the expected analyte level in the sampled gas (EAL, ppbv), the volume of air that will be sampled at standard conditions (SVOL, L), the formula weight of the analyte (FW, g/mol), and the volume of DNPH reagent that will be used in the impingers (RVOL, mL):

$$AIL = 0.1 \times [EAL \times SVOL \times FW/22.4 \times (FW + 180)/FW]/(RVOL \times 1000).$$

where 0.1 is the acceptable contaminant level, 22.4 is a factor relating ppbv to g/L, 180 is a factor relating the underivatized analyte to the derivatized analyte, and 1000 is a unit conversion factor.

5.4.6 Disposal of Excess DNPH Reagent: Excess DNPH reagent may be returned to the laboratory and recycled or treated as aqueous waste for disposal purposes. 2,4-Dinitrophenylhydrazine is a flammable solid when dry so water should not be evaporated from the solution of the reagent.

5.5 Field Spike Standard Preparation: To prepare a formaldehyde field spiking standard at 4.01 mg/mL, use a 500µL syringe to transfer 0.5 mL of 37% by weight of formaldehyde (401 mg/mL) to a 50 mL volumetric flask containing approximately 40 mL of methanol. Dilute to 50 mL with methanol.

6.0 SAMPLE COLLECTION, PRESERVATION, AND HANDLING

6.1 Because of the complexity of this method, field personnel should be trained in and experienced with the test procedures in order to obtain reliable results.

6.2 Laboratory Preparation:

6.2.1 All the components shall be maintained and calibrated according to the procedure described in APTD-0576, unless otherwise specified.

6.2.2 Weigh several 200- to 300-g portions of silica gel in airtight containers to the nearest 0.5 g. Record on each container the total weight of the silica gel plus container. As an alternative to preweighing the silica gel, it may instead be weighed directly in the impinger or sampling holder just prior to train assembly.

6.3 Preliminary Field Determinations:

6.3.1 Select the sampling site and the minimum number of sampling points according to EPA Method 1 or other relevant criteria. Determine the stack pressure, temperature, and range of velocity heads using EPA Method 2. A leak-check of the pitot lines according to EPA Method 2, Section 3.1, must be performed. Determine the stack gas moisture content using EPA Approximation Method 4 or its alternatives to establish estimates of isokinetic sampling-rate settings. Determine the stack gas dry molecular weight, as described in EPA Method 2, Section 3.6. If integrated EPA Method 3 sampling is used for molecular weight determination, the integrated bag sample shall be taken simultaneously with, and for the same total length of time as, the sample run.

6.3.2 Select a nozzle size based on the range of velocity heads so that it is not necessary to change the nozzle size in order to maintain isokinetic sampling rates below 28 L/min (1.0 cfm). During the run, do not change the nozzle.

Ensure that the proper differential pressure gauge is chosen for the range of velocity heads encountered (see Section 2.2 of EPA Method 2).

6.3.3 Select a suitable probe liner and probe length so that all traverse points can be sampled. For large stacks, to reduce the length of the probe, consider sampling from opposite sides of the stack.

6.3.4 A minimum of 45 ft^3 of sample volume is required for the determination of the Destruction and Removal Efficiency (DRE) of formaldehyde from incineration systems (45ft^3 is equivalent to one hour of sampling at 0.75 dscf). Additional sample volume shall be collected as ecessitated by the capacity of the DNPH reagent and analytical detection limit constraints. To determine the minimum sample volume required, refer to sample calculations in Section 10.

6.3.5 Determine the total length of sampling time needed to obtain the identified minimum volume by comparing the anticipated average sampling rate with the volume requirement. Allocate the same time to all traverse points defined by EPA Method 1. To avoid timekeeping errors, the length of time sampled at each traverse point should be an integer or an integer plus 0.5 min.

6.3.6 In some circumstances (e.g., batch cycles) it may be necessary to sample for shorter times at the traverse points and to obtain smaller gas-volume samples. In these cases, careful documentation must be maintained in order to allow accurate calculation of concentrations.

6.4 Preparation of Collection Train:

6.4.1 During preparation and assembly of the sampling train, keep all openings where contamination can occur covered with Teflon® film or aluminum foil until just prior to assembly or until sampling is about to begin.

6.4.2 Place 100 mL of cleaned DNPH solution in each of the first two impingers, and leave the third impinger empty. If additional capacity is required for high expected concentrations of formaldehyde in the stack gas, 200 mL of DNPH per impinger may be used or additional impingers may be used for sampling. Transfer approximately 200 to 300 g of pre-weighed silica gel from its container to the fourth impinger. Care should be taken to ensure that the silica gel is not entrained and carried out from the impinger during sampling. Place the silica gel container in a clean place for later use in the sample recovery. Alternatively, the weight of the silica gel plus impinger may be determined to the nearest 0.5 g and recorded.

6.4.3 With a glass or quartz liner, install the selected nozzle using a Viton-A O-ring when stack temperatures are <260°C (500°F) and a woven glass-fiber gasket when temperatures are higher. See APTD-0576 (Rom, 1972) for details. Other connecting systems utilizing either 316 stainless steel or Teflon® ferrules may be used. Mark the probe with heat-resistant tape or by some other method to denote the proper distance into the stack or duct for each sampling point.

6.4.4 Assemble the train as shown in Figure 1. During assembly, do not use any silicone grease on ground-glass joints upstream of the impingers. Use Teflon® tape, if required. A very light coating of silicone grease may be used on ground-glass joints downstream of the impingers, but the silicone grease should be limited to the outer portion (see APTD-0576) of the ground-glass joints to

minimize silicone grease contamination. If necessary, Teflon® tape may be used to seal leaks. Connect all temperature sensors to an appropriate potentiometer/display unit. Check all temperature sensors at ambient temperature.

6.4.5 Place crushed ice all around the impingers.

6.4.6 Turn on and set the probe heating system at the desired operating temperature. Allow time for the temperature to stabilize.

6.5 Leak-Check Procedures:

6.5.1 Pre-test Leak Check:

6.5.1.1 After the sampling train has been assembled, turn on and set the probe heating system at the desired operating temperature. Allow time for the temperature to stabilize. If a Viton-A O-ring or other leak-free connection is used in assembling the probe nozzle to the probe liner, leak-check the train at the sampling site by plugging the nozzle and pulling a 381-mm Hg (15 in Hg) vacuum.

NOTE: A lower vacuum may be used, provided that the lower vacuum is not exceeded during the test.

6.5.1.2 If an asbestos string is used, do not connect the probe to the train during the leak check. Instead, leak-check the train by first attaching a carbon-filled leak check impinger to the inlet and then plugging the inlet and pulling a 381-mm Hg (15 in Hg) vacuum. (A lower vacuum may be used if this lower vacuum is not exceeded during the test.) Then connect the probe to the train and leak-check at about 25 mm Hg (1 in Hg) vacuum. Alternatively, leak-check the probe with the rest of the sampling train in one step at 381 mm Hg (15 in Hg) vacuum. Leakage rates in excess of 4% of the average sampling rate or >0.00057 m^3/min (0.02 cfm), whichever is less, are acceptable.

6.5.1.3 The following leak check instructions for the sampling train described in APTD-0576 and APTD-0581 may be helpful. Start the pump with the fine-adjust valve fully open and coarse-adjust valve completely closed. Partially open the coarse-adjust valve and slowly close the fine-adjust valve until the desired vacuum is reached. Do not reverse direction of the fine-adjust valve, as liquid will back up into the train. If the desired vacuum is exceeded, either perform the leak check at this higher vacuum or end the leak check, as shown below, and start over.

6.5.1.4 When the leak check is completed, first slowly remove the plug from the inlet to the probe. When the vacuum drops to 127 mm (5 in) Hg or less, immediately close the coarse-adjust valve. Switch off the pumping system and reopen the fine-adjust valve. Do not reopen the fine-adjust valve until the coarse-adjust valve has been closed to prevent the liquid in the impingers from being forced backward into the sampling line and silica gel from being entrained backward into the third impinger.

6.5.2 Leak Checks During Sampling Runs:

6.5.2.1 If, during the sampling run, a component change (i.e., impinger) becomes

necessary, a leak check shall be conducted immediately after the interruption of sampling and before the change is made. The leak check shall be done according to the procedure described in Section 6.5.1, except that it shall be done at a vacuum greater than or equal to the maximum value recorded up to that point in the test. If the leakage rate is found to be no greater than 0.00057 m^3/min (0.02 cfm) or 4% of the average sampling rate (whichever is less), the results are acceptable. If a higher leakage rate is obtained, the tester must void the sampling run.

NOTE: Any correction of the sample volume by calculation reduces the integrity of the pollutant concentration data generated and must be avoided.

6.5.2.2 Immediately after a component change and before sampling is re-initiated, a leak check similar to a pre-test leak check must also be conducted.

6.5.3 Post-test Leak Check:

6.5.3.1 A leak check is mandatory at the conclusion of each sampling run. The leak check shall be done with the same procedures as the pre-test leak check, except that the post-test leak check shall be conducted at a vacuum greater than or equal to the maximum value reached during the sampling run. If the leakage rate is found to be no greater than 0.00057 m^3/min (0.02 cfm) or 4% of the average sampling rate (whichever is less), the results are acceptable. If, however, a higher leakage rate is obtained, the tester shall record the leakage rate and void the sampling run.

6.6 Sampling Train Operation:

6.6.1 During the sampling run, maintain an isokinetic sampling rate to within 10% of true isokinetic, below 28 L/min (1.0 cfm). Maintain a temperature around the probe of 120° ± 14°C (248° ± 25°F).

6.6.2 For each run, record the data on a data sheet such as the one shown in Figure 2. Be sure to record the initial dry-gas meter reading. Record the dry-gas meter readings at the beginning and end of each sampling time increment, when changes in flow rates are made, before and after each leak check, and when sampling is halted. Take other readings required by Figure 2 at least once at each sample point during each time increment and additional readings when significant adjustments (20% variation in velocity head readings) necessitate additional adjustments in flow rate. Level and zero the manometer. Because the manometer level and zero may drift due to vibrations and temperature changes, make periodic checks during the traverse.

6.6.3 Clean the stack access ports prior to the test run to eliminate the chance of sampling deposited material. To begin sampling, remove the nozzle cap, verify that the filter and probe heating systems are at the specified temperature, and verify that the pitot tube and probe are properly positioned. Position the nozzle at the first traverse point, with the tip pointing directly into the gas stream. Immediately start the pump and adjust the flow to isokinetic conditions. Nomographs, which aid in the rapid adjustment of the isokinetic sampling rate without excessive computations, are available. These nomographs are designed for use when the Type S pitot tube coefficient is 0.84 ± 0.02 and the stack gas equivalent density (dry molecular weight) is equal to 29 ± 4. APTD-0576 details the procedure for using the nomographs. If the stack gas molecular weight and

the pitot tube coefficient are outside the above ranges, do not use the nomographs unless appropriate steps are taken to compensate for the deviations.

6.6.4 When the stack is under significant negative pressure (equivalent to the height of the impinger stem), take care to close the coarse-adjust valve before inserting the probe into the stack in order to prevent liquid from backing up through the train. If necessary, the pump may be turned on with the coarse-adjust valve closed.

6.6.5 When the probe is in position, block off the openings around the probe and stack access port to prevent unrepresentative dilution of the gas stream.

6.6.6 Traverse the stack cross section, as required by EPA Method 1, being careful not to bump the probe nozzle into the stack walls when sampling near the walls or when removing or inserting the probe through the access port, in order to minimize the chance of extracting deposited material.

6.6.7 During the test run, make periodic adjustments to keep the temperature around the probe at the proper levels. Add more ice and, if necessary, salt, to maintain a temperature of <20°C (68°F) at the silica gel outlet. Also, periodically check the level and zero of the manometer.

6.6.8 A single train shall be used for the entire sampling run, except in cases where simultaneous sampling is required in two or more separate ducts or at two or more different locations within the same duct, or in cases where equipment failure necessitates a change of trains. An additional train or additional trains may also be used for sampling when the capacity of a single train is exceeded.

6.6.9 When two or more trains are used, separate analyses of components from each train shall be performed. If multiple trains have been used because the capacity of a single train would be exceeded, first impingers from each train may be combined, and second impingers from each train may be combined.

6.6.10 At the end of the sampling run, turn off the coarse-adjust valve, remove the probe and nozzle from the stack, turn off the pump, record the final dry gas meter reading, and conduct a post-test leak check. Also, leak check the pitot lines as described in EPA Method 2. The lines must pass this leak check in order to validate the velocity-head data.

6.6.11 Calculate percent isokineticity (see Method 2) to determine whether the run was valid or another test should be made.

7.0 SAMPLE RECOVERY

7.1 Preparation:

7.1.1 Proper cleanup procedure begins as soon as the probe is removed from the stack at the end of the sampling period. Allow the probe to cool. When the probe can be handled safely, wipe off all external particulate matter near the tip of the probe nozzle and place a cap over the tip to prevent losing or gaining particulate matter. Do not cap the probe tip tightly while the sampling train is cooling because a vacuum will be created, drawing liquid from the impingers back through the sampling train.

7.1.2 Before moving the sampling train to the cleanup site, remove the probe from the sampling train and cap the open outlet, being careful not to lose any condensate that might be present. Remove the umbilical cord from the last impinger and cap the impinger. If a flexible line is used, let any condensed water or liquid drain into the impingers. Cap off any open impinger inlets and outlets. Ground glass stoppers, Teflon® caps, or caps of other inert materials may be used to seal all openings.

7.1.3 Transfer the probe and impinger assembly to an area that is clean and protected from wind so that the chances of contaminating or losing the sample are minimized.

7.1.4 Inspect the train before and during disassembly, and note any abnormal conditions.

7.1.5 Save a portion of all washing solutions (methylene chloride, water) used for cleanup as a blank. Transfer 200 mL of each solution directly from the wash bottle being used and place each in a separate, pre-labeled sample container.

7.2 Sample Containers:

7.2.1 Container 1: Probe and Impinger Catches. Using a graduated cylinder, measure to the nearest mL, and record the volume of the solution in the first three impingers. Alternatively, the solution may be weighed to the nearest 0.5 g. Include any condensate in the probe in this determination. Transfer the impinger solution from the graduated cylinder into the amber flint glass bottle. Taking care that dust on the outside of the probe or other exterior surfaces does not get into the sample, clean all surfaces to which the sample is exposed (including the probe nozzle, probe fitting, probe liner, first impinger, and impinger connector) with methylene chloride. Use less than 500 mL for the entire wash (250 mL would be better, if possible). Add the washings to the sample container.

7.2.1.1 Carefully remove the probe nozzle and rinse the inside surface with methylene chloride from a wash bottle. Brush with a Teflon® bristle brush, and rinse until the rinse shows no visible particles or yellow color, after which make a final rinse of the inside surface. Brush and rinse the inside parts of the Swagelok® fitting with methylene chloride in a similar way.

7.2.1.2 Rinse the probe liner with methylene chloride. While squirting the methylene chloride into the upper end of the probe, tilt and rotate the probe so that all inside surfaces will be wetted with methylene chloride. Let the methylene chloride drain from the lower end into the sample container. The tester may use a funnel (glass or polyethylene) to aid in transferring the liquid washes to the container. Follow the rinse with a Teflon® brush. Hold the probe in an inclined position, and squirt methylene chloride into the upper end as the probe brush is being pushed with a twisting action through the probe. Hold the sample container underneath the lower end of the probe, and catch any methylene chloride, water, and particulate matter that is brushed from the probe. Run the brush through the probe three times or more. With stainless steel or other metal probes, run the brush through in the above prescribed manner at least six times since there may be small crevices in which particulate matter can be entrapped. Rinse the brush with methylene chloride or water, and quantitatively collect these washings in the sample container. After the brushings, make a final rinse

of the probe as described above.

NOTE: Two people should clean the probe in order to minimize sample losses. Between sampling runs, brushes must be kept clean and free from contamination.

7.2.1.3 Rinse the inside surface of each of the first three impingers (and connecting tubing) three separate times. Use a small portion of methylene chloride for each rinse, and brush each surface to which sample is exposed with a Teflon® bristle brush to ensure recovery of fine particulate matter. Water will be required for the recovery of the impingers in addition to the specified quantity of methylene chloride. There will be at least two phases in the impingers. This two-phase mixture does not pour well, and a significant amount of the impinger catch will be left on the walls. The use of water as a rinse makes the recovery quantitative. Make a final rinse of each surface and of the brush, using both methylene chloride and water.

7.2.1.4 After all methylene chloride and water washings and particulate matter have been collected in the sample container, tighten the lid so that solvent, water, and DNPH reagent will not leak out when the container is shipped to the laboratory. Mark the height of the fluid level to determine whether leakage occurs during transport. Seal the container with Teflon® tape. Label the container clearly to identify its contents.

7.2.1.5 If the first two impingers are to be analyzed separately to check for breakthrough, separate the contents and rinses of the two impingers into individual containers. Care must be taken to avoid physical carryover from the first impinger to the second. The formaldehyde hydrazone is a solid which floats and froths on top of the impinger solution. Any physical carryover of collected moisture into the second impinger will invalidate a breakthrough assessment.

7.2.2 Container 2: Sample Blank. Prepare a blank by using an amber flint glass container and adding a volume of DNPH reagent and methylene chloride equal to the total volume in Container 1. Process the blank in the same manner as Container 1.

7.2.3 Container 3: Silica Gel. Note the color of the indicating silica gel to determine whether it has been completely spent and make a notation of its condition. The impinger containing the silica gel may be used as a sample transport container with both ends sealed with tightly fitting caps or plugs. Ground-glass stoppers or Teflon® caps may be used. The silica gel impinger should then be labeled, covered with aluminum foil, and packaged on ice for transport to the laboratory. If the silica gel is removed from the impinger, the tester may use a funnel to pour the silica gel and a rubber policeman to remove the silica gel from the impinger. It is not necessary to remove the small amount of dust particles that may adhere to the impinger wall and are difficult to remove. Since the gain in weight is to be used for moisture calculations, do not use water or other liquids to transfer the silica gel. If a balance is available in the field, the spent silica gel (or silica gel plus impinger) may be weighed to the nearest 0.5 g.

7.2.4 Sample containers should be placed in a cooler, cooled by although not in contact with ice. Sample containers must be placed vertically and, since they are glass, protected from breakage during shipment. Samples should be cooled during shipment so they will be received cold at the laboratory.

8.0 CALIBRATION

8.1 Probe Nozzle: Probe nozzles shall be calibrated before their initial use in the field. Using a micrometer, measure the inside diameter of the nozzle to the nearest 0.025 mm (0.001 in). Make measurements at three separate places across the diameter and obtain the average of the measurements. The difference between the high and low numbers shall not exceed 0.1 mm (0.004 in). When the nozzles become nicked or corroded, they shall be replaced and calibrated before use. Each nozzle must be permanently and uniquely identified.

8.2 Pitot tube: The Type S pitot tube assembly shall be calibrated according to the procedure outlined in Section 4 of EPA Method 2, or assigned a nominal coefficient of 0.84 if it is not visibly nicked or corroded and if it meets design and intercomponent spacing specifications.

8.3 Metering system:

8.3.1 Before its initial use in the field, the metering system shall be calibrated according to the procedure outlined in APTD-0576. Instead of physically adjusting the dry-gas meter dial readings to correspond to the wet-test meter readings, calibration factors may be used to correct the gas meter dial readings mathematically to the proper values. Before calibrating the metering system, it is suggested that a leak check be conducted. For metering systems having diaphragm pumps, the normal leak check procedure will not detect leakages within the pump. For these cases, the following leak check procedure will apply: make a ten-minute calibration run at 0.00057 m^3/min (0.02 cfm). At the end of the run, take the difference of the measured wet-test and dry-gas meter volumes and divide the difference by 10 to get the leak rate. The leak rate should not exceed 0.00057 m^3/min (0.02 cfm).

8.3.2 After each field use, check the calibration of the metering system by performing three calibration runs at a single intermediate orifice setting (based on the previous field test). Set the vacuum at the maximum value reached during the test series. To adjust the vacuum, insert a valve between the wet-test meter and the inlet of the metering system. Calculate the average value of the calibration factor. If the calibration has changed by more than 5%, recalibrate the meter over the full range of orifice settings, as outlined in APTD-0576.

8.3.3 Leak check of metering system: The portion of the sampling train from the pump to the orifice meter (see Figure 1) should be leak-checked prior to initial use and after each shipment. Leakage after the pump will result in less volume being recorded than is actually sampled. Use the following procedure: Close the main valve on the meter box. Insert a one-hole rubber stopper with rubber tubing attached into the orifice exhaust pipe. Disconnect and vent the low side of the orifice manometer. Close off the low side orifice tap. Pressurize the system to 13 - 18 cm (5 - 7 in) water column by blowing into the rubber tubing. Pinch off the tubing and observe the manometer for 1 min. A loss of pressure on the manometer indicates a leak in the meter box. Leaks must be corrected.

NOTE: If the dry-gas-meter coefficient values obtained before and after a test series differ by >5%, either the test series must be voided or calculations for test series must be performed using whichever meter coefficient value (i.e., before or after) gives the lower value of total sample volume.

8.4 Probe heater: The probe heating system must be calibrated before its initial use in the field according to the procedure outlined in APTD-0576. Probes constructed according to APTD-0581 need not be calibrated if the calibration curves in APTD-0576 are used.

8.5 Temperature gauges: Each thermocouple must be permanently and uniquely marked on the casting. All mercury-in-glass reference thermometers must conform to ASTM E-1 63C or 63F specifications. Thermocouples should be calibrated in the laboratory with and without the use of extension leads. If extension leads are used in the field, the thermocouple readings at ambient air temperatures, with and without the extension lead, must be noted and recorded. Correction is necessary if the use of an extension lead produces a change >1.5%.

8.5.1 Impinger and dry-gas meter thermocouples: For the thermocouples used to measure the temperature of the gas leaving the impinger train, three-point calibration at ice water, room air, and boiling water temperatures is necessary. Accept the thermocouples only if the readings at all three temperatures agree to ±2°C (3.6°F) with those of the absolute value of the reference thermometer.

8.5.2 Probe and stack thermocouple: For the thermocouples used to indicate the probe and stack temperatures, a three-point calibration at ice water, boiling water, and hot oil bath temperatures must be performed. Use of a point at room air temperature is recommended. The thermometer and thermocouple must agree to within 1.5% at each of the calibration points. A calibration curve (equation) may be constructed (calculated) and the data extrapolated to cover the entire temperature range suggested by the manufacturer.

8.6 Barometer: Adjust the barometer initially and before each test series to agree to within ±2.5 mm Hg (0.1 in Hg) of the mercury barometer or the corrected barometric pressure value reported by a nearby National Weather Service Station (same altitude above sea level).

8.7 Triple-beam balance: Calibrate the triple-beam balance before each test series, using Class S standard weights. The weights must be within ±0.5% of the standards, or the balance must be adjusted to meet these limits.

9.0 CALCULATIONS

Carry out calculations, retaining at least one extra decimal figure beyond that of the acquired data. Round off figures after final calculation.

9.1 Calculation of Total Formaldehyde:

To determine the total formaldehyde in mg, use the following equation:

Total mg formaldehyde = $C_d \times V \times DF \times$

([g/mole aldehyde]/[g/mole DNPH derivative]) x

10^{-3} mg/μg

where:

C_d = measured concentration of DNPH-formaldehyde derivative, μg/mL

V = organic extract volume, mL

DF = dilution factor

9.2 Formaldehyde concentration in stack gas:

Determine the formaldehyde concentration in the stack gas using the following equation:

C_f = K [total formaldehyde, mg] / $V_{m(std)}$

where:

K = 35.31 ft^3/m^3 if $V_{m(std)}$ is expressed in English units

= 1.00 m^3/m^3 if $V_{m(std)}$ is expressed in metric units

$V_{m(std)}$ = volume of gas sample as measured by dry gas meter, corrected to standard conditions, dscm (dscf)

9.3 Average Dry Gas Meter Temperature and Average Orifice Pressure Drop are obtained from the data sheet.

9.4 Dry Gas Volume: Calculate $V_{m(std)}$ and adjust for leakage, if necessary, using the equation in Section 6.3 of EPA Method 5.

9.5 Volume of Water Vapor and Moisture Content: Calculate the volume of water vapor and moisture content from equations 5-2 and 5-3 of EPA Method 5.

10.0 DETERMINATION OF VOLUME TO BE SAMPLED

To determine the minimum sample volume to be collected, use the following sequence of equations.

10.1 From prior analysis of the waste feed, the concentration of formaldehyde (FORM) introduced into the combustion system can be calculated. The degree of destruction and removal efficiency that is required is used to determine the maximum amount of FORM allowed to be present in the effluent. This amount may be expressed as:

Max $FORM_i$ Mass =

[(WF) ($FORM_i$ conc) (100 - %DRE)] / 100

where:

WF = mass flow rate of waste feed per h, g/h (lb/h)

$FORM_i$ = concentration of FORM (wt %) introduced into the combustion process

DRE = percent Destruction and Removal Efficiency required

Max FORM = mass flow rate (g/h [lb/h]) of FORM emitted from the combustion source

10.2 The average discharge concentration of the FORM in the effluent gas is determined by comparing the Max FORM with the volumetric flow rate being exhausted from the source. Volumetric flow rate data are available as a result of preliminary EPA Method 1 - 4 determinations:

Max $FORM_i$ conc = [Max $FORM_i$ Mass] / $DV_{eff(std)}$

where:

$DV_{eff(std)}$ = volumetric flow rate of exhaust gas, dscm (dscf)

$FORM_i$ conc = anticipated concentration of the FORM in the exhaust gas stream, g/dscm (lb/dscf)

10.3 In making this calculation, it is recommended that a safety margin of at least ten be included.

$[LDL_{FORM} \times 10] / [FORM_{i\ conc}] = V_{sbc}$

where:

LDL_{FORM} = detectable amount of FORM in entire sampling train

V_{sbc} = minimum dry standard volume to be collected at dry-gas meter

10.4 The following analytical detection limits and DNPH Reagent Capacity (based on a total volume of 200 mL in two impingers) must also be considered in determining a volume to be sampled.

Table 2. Instrument Detection Limits and Reagent Capacity for Formaldehyde Analysis[1]

Analyte	Detection Limit, ppbv[2]	Reagent Capacity, ppmv
formaldehyde	1.8	66
acetaldehyde	1.7	70
acrolein	1.5	75
acetone/propionaldehyde	1.5	75
butyraldehyde	1.5	79
methyl ethyl ketone	1.5	79
valeraldehyde	1.5	84
isovaleraldehyde	1.4	84
hexaldehyde	1.3	88
benzaldehyde	1.4	84
o-/m-/p-tolualdehyde	1.3	89
dimethylbenzaldehyde	1.2	93

[1] Oxygenated compounds in addition to formaldehyde are included for comparison with formaldehyde; extension of the methodology to other compounds is possible.

[2] Detection limits are determined in solvent. These values therefore represent the optimum capability of the methodology.

11.0 QUALITY CONTROL

11.1 Sampling: See EPA Manual 600/4-77-027b for Method 5 quality control.

11.2 Analysis: The quality assurance program required for this method includes the analysis of field and method blanks, procedure validations, and analysis of field spikes. The assessment of combustion data and positive identification and quantitation of formaldehyde are dependent on the integrity of the samples received and the precision and accuracy of the analytical methodology. Quality Assurance procedures for this method are designed to monitor the performance of the analytical methodology and to provide the required information to take corrective action if problems are observed in laboratory operations or in field sampling activities.

11.2.1 Field Blanks: Field blanks must be submitted with the samples collected at each sampling site. The field blanks include the sample bottles containing aliquots of sample recovery solvents, methylene chloride and water, and unused DNPH reagent. At a minimum, one complete sampling train will be assembled in the field staging area, taken to the sampling area, and leak-checked at the beginning and end of the testing (or for the same total number of times as the actual sampling train). The probe of the blank train must be heated during the sample test. The train will be recovered as if it were an actual test sample. No gaseous sample will be pulled through the Blank sampling train.

11.2.2 Method Blanks: A method blank must be prepared for each set of analytical operations, to evaluate contamination and artifacts that can be derived from glassware, reagents, and sample handling in the laboratory.

11.2.3 Field Spike: A field spike is performed by introducing 200 µL of the Field Spike Standard into an impinger containing 200 mL of DNPH solution. Standard impinger recovery procedures are followed and the field spike sample is returned to the laboratory for analysis. The field spike is used as a check on field handling and recovery procedures. An aliquot of the field spike standard is retained in the laboratory for derivatization and comparative analysis.

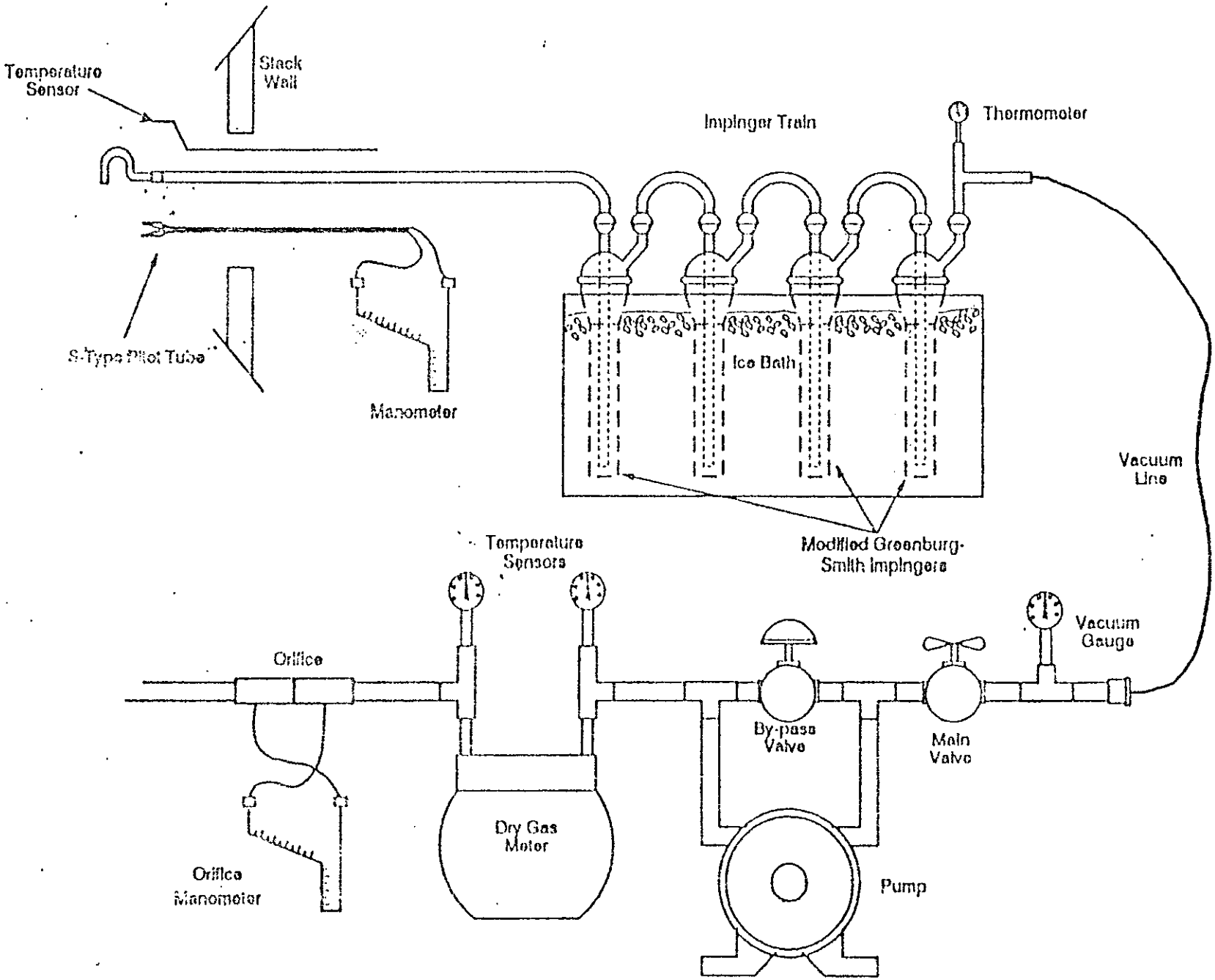
12.0 METHOD PERFORMANCE

12.1 Method performance evaluation: The following expected method performance parameters for precision, accuracy, and detection limits are provided in Table 3.

Table 3. Expected Method Performance for Formaldehyde

Parameter	Precision	[1]Accuracy[2]	Detection Limit[3]
Matrix: Dual trains	±15% RPD	±20%	1.5×10^{-7} lb/ft^3 (1.8 ppbv)

[1] Relative percent difference limit for dual trains.
[2] Limit for field spike recoveries.
[3] The lower reporting limit having less than 1% probability of false positive detection.



Formaldehyde Sampling Train

Plant _____

Location _____

Operator _____

Date _____

Run No. _____

Sample Box No. _____

Meter Box No. _____

Meter H@ _____

C Factor _____

Pitot Tube Coefficient C_p _____

Schematic of Stack Cross Section

Ambient Temperature _____

Barometric Pressure _____

Assumed Moisture % _____

Probe Length, m(ft) _____

Nozzle Identification No. _____

Average Calibrated Nozzle Diameter, cm (in) _____

Probe Heating Setting _____

Leak Rate, m^3/min. (cfm) _____

Probe Liner Material _____

Static Pressure, mm Hg (in. Hg) _____

Filter No. _____

Traverse Point Number	Sampling Time (θ) Min.	Vacuum mm Hg (in. Hg)	Stack Temperature (T_s) °C (°F)	Velocity Head (P_s) mm (in) H_2O	Pressure Differential Across Orifice Meter mm (H_2O) (in H_2O)	Gas Sample Volume m^3 (ft^3)	Gas Sample Temp. at Dry Gas Meter		Filter Holder Temperature °C(°F)	Temperature of Gas Leaving Last Impinger °C(°F)
							Inlet °C(°F)	Outlet °C(°F)		
Total							Avg.	Avg.		
Average										

Figure 2. Field Data Sheet

Method 25A—Determination of Total Gaseous Organic Concentration Using a Flame Ionization Analyzer

1. *Applicability and Principle*

1.1 Applicability. This method applies to the measurement of total gaseous organic concentration of vapors consisting primarily of alkanes, alkenes, and/or arenes (aromatic hydrocarbons). The concentration is expressed in terms of propane (or other appropriate organic calibration gas) or in terms of carbon.

1.2 Principle. A gas sample is extracted from the source through a heated sample line, if necessary, and glass fiber filter to a flame ionization analyzer (FIA). Results are reported as volume concentration equivalents of the calibration gas or as carbon equivalents.

2. *Definitions*

2.1 Measurement System. The total equipment required for the determination of the gas concentration. The system consists of the following major subsystems:

2.1.1 Sample Interface. That portion of the system that is used for one or more of the following: sample acquisition, sample transportation, sample conditioning, or protection of the analyzer from the effects of the stack effluent.

2.1.2 Organic Analyzer. That portion of the system that senses organic concentration and generates an output proportional to the gas concentration.

2.2 Span Value. The upper limit of a gas concentration measurement range that is specified for affected source categories in the applicable part of the regulations. The span value is established in the applicable regulation and is usually 1.5 to 2.5 times the applicable emission limit. If no span value is provided, use a span value equivalent to 1.5 to 2.5 times the expected concentration. For convenience, the span value should correspond to 100 percent of the recorder scale.

2.3 Calibration Gas. A known concentration of a gas in an appropriate diluent gas.

2.4 Zero Drift. The difference in the measurement system response to a zero level calibration gas before and after a stated period of operation during which no unscheduled maintenance, repair, or adjustment took place.

2.5 Calibration Drift. The difference in the measurement system response to a mid-level calibration gas before and after a stated period of operation during which no unscheduled maintenance, repair or adjustment took place.

2.6 Response Time. The time interval from a step change in pollutant concentration at the inlet to the emission measurement system to the time at which 95 percent of the corresponding final value is reached as displayed on the recorder.

2.7 Calibration Error. The difference between the gas concentration indicated by the measurement system and the known concentration of the calibration gas.

3. *Apparatus*

A schematic of an acceptable measurement system is shown in Figure 25A-1. The essential components of the measurement system are described below:

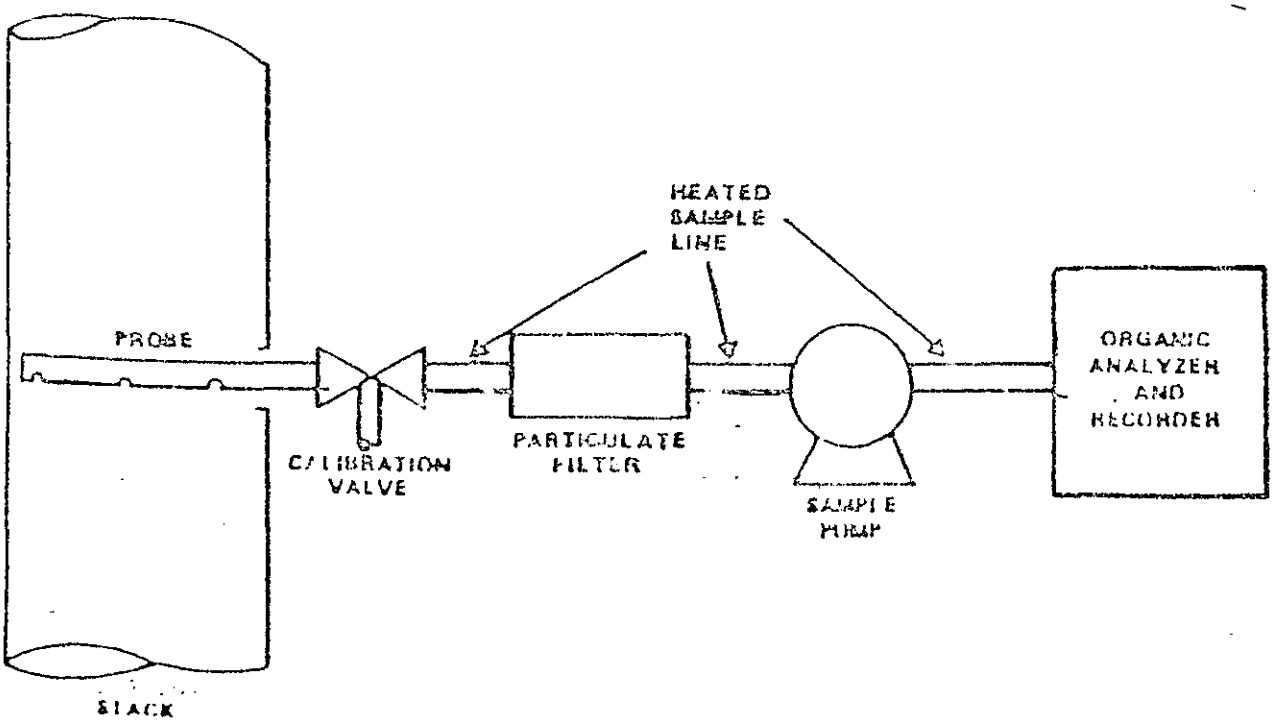


Figure 25A-1. Organic Concentration Measurement System.

3.1 Organic Concentration Analyzer. A flame ionization analyzer (FIA) capable of meeting or exceeding the specifications in this method.

3.2 Sample Probe. Stainless steel, or equivalent, three-hole rake type. Sample holes shall be 4 mm in diameter or smaller and located at 16.7, 50, and 83.3 percent of the equivalent stack diameter. Alternatively, a single opening probe may be used so that a gas sample is collected from the centrally located 10 percent area of the stack cross-section.

3.3 Sample Line. Stainless steel or Teflon* tubing to transport the sample gas to the analyzer. The sample line should be heated, if necessary, to prevent condensation in the line.

3.4 Calibration Valve Assembly. A three-way valve assembly to direct the zero and calibration gases to the analyzers is recommended. Other methods, such as quick-connect lines, to route calibration gas to the analyzers are applicable.

3.5 Particulate Filter. An in-stack or an out-of-stack glass fiber filter is recommended if exhaust gas particulate loading is significant. An out-of-stack filter should be heated to prevent any condensation.

3.6 Recorder. A strip-chart recorder, analog computer, or digital recorder for recording measurement data. The minimum data recording requirement is one measurement value per minute. Note: This method is often applied in highly explosive areas. Caution and care should be exercised in choice of equipment and installation.

4. *Calibration and Other Gases*

Gases used for calibrations, fuel, and combustion air (if required) are contained in compressed gas cylinders. Preparation of calibration gases shall be done according to the procedure in Protocol No. 1, listed in Reference 9.2. Additionally, the manufacturer of the cylinder should provide a recommended shelf life for each calibration gas cylinder over which the concentration does not change more than ±2 percent from the certified value. For calibration gas values not generally available (i.e., organics between 1 and 10 percent by volume), alternative methods for preparing calibration gas mixtures, such as dilution systems, may be used with prior approval of the Administrator.

Calibration gases usually consist of propane in air or nitrogen and are determined in terms of the span value. Organic compounds other than propane can be used following the above guidelines and making the appropriate corrections for response factor.

4.1 Fuel. A 40 percent H_2/60 percent He or 40 percent H_2/60 percent N_2 gas mixture is recommended to avoid an oxygen synergism effect that reportedly occurs when oxygen concentration varies significantly from a mean value.

4.2 Zero Gas. High purity air with less than 0.1 parts per million by volume (ppmv) of organic material (propane or carbon equivalent) or less than 0.1 percent of the span value, whichever is greater.

4.3 Low-level Calibration Gas. An organic calibration gas with a concentration equivalent to 25 to 35 percent of the applicable span value.

4.4 Mid-level Calibration Gas. An organic calibration gas with a concentration equivalent to 45 to 55 percent of the applicable span value.

4.5 High-level Calibration Gas. An organic calibration gas with a concentration equivalent to 80 to 90 percent of the applicable span value.

5. *Measurement System Performance Specifications*

5.1 Zero Drift. Less than ±3 percent of the span value.

5.2 Calibration Drift. Less than ±3 percent of span value.

5.3 Calibration Error. Less than ±5 percent of the calibration gas value.

6. *Pretest Preparations*

6.1 Selection of Sampling Site. The location of the sampling site is generally specified by the applicable regulation or purpose of the test; i.e., exhaust stack, inlet line, etc. The sample port shall be located at least 1.5 meters or 2 equivalent diameters upstream of the gas discharge to the atmosphere.

6.2 Location of Sample Probe. Install the sample probe so that the probe is centrally located in the stack, pipe, or duct and is sealed tightly at the stack port connection.

6.3 Measurement System Preparation. Prior to the emission test, assemble the measurement system following the manufacturer's written instructions in preparing the sample interface and the organic analyzer. Make the system operable.

FIA equipment can be calibrated for almost any range of total organics concentrations. For high concentrations of organics (>1.0 percent by volume as propane) modifications to most commonly available analyzers are necessary. One accepted method of equipment modification is to decrease the size of the sample to the analyzer through the use of a smaller diameter sample capillary. Direct and continuous measurement of organic concentration is a necessary consideration when determining any modification design.

6.4 Calibration Error Test. Immediately prior to the test series, (within 2 hours of the start of the test) introduce zero gas and

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

high-level calibration gas at the calibration valve assembly. Adjust the analyzer output to the appropriate levels, if necessary. Calculate the predicted response for the low-level and mid-level gases based on a linear response line between the zero and high-level responses. Then introduce low-level and mid-level calibration gases successively to the measurement system. Record the analyzer responses for low-level and mid-level calibration gases and determine the differences between the measurement system responses and the predicted responses. These differences must be less than 5 percent of the respective calibration gas value. If not, the measurement system is not acceptable and must be replaced or repaired prior to testing. No adjustments to the measurement system shall be conducted after the calibration and before the drift check (Section 7.3). If adjustments are necessary before the completion of the test series, perform the drift checks prior to the required adjustments and repeat the calibration following the adjustments. If multiple electronic ranges are to be used, each additional range must be checked with a mid-level calibration gas to verify the multiplication factor.

6.5 Response Time Test. Introduce zero gas into the measurement system at the calibration valve assembly. When the system output has stabilized, switch quickly to the high-level calibration gas. Record the time from the concentration change to the measurement system response equivalent to 95 percent of the step change. Repeat the test three times and average the results.

7. *Emission Measurement Test Procedure*

7.1 Organic Measurement. Begin sampling at the start of the test period, recording time and any required process information as appropriate. In particular, note on the recording chart periods of process interruption or cyclic operation.

7.2 Drift Determination. Immediately following the completion of the test period and hourly during the test period, reintroduce the zero and mid-level calibration gases, one at a time, to the measurement system at the calibration valve assembly. (Make no adjustments to the measurement system until after both the zero and calibration drift checks are made.) Record the analyzer response. If the drift values exceed the specified limits, invalidate the test results preceding the check and repeat the test following corrections to the measurement system. Alternatively, recalibrate the test measurement system as in Section 6.4 and report the results using both sets of calibration data (i.e., data determined prior to the test period and data determined following the test period).

8. *Organic Concentration Calculations*

Determine the average organic concentration in terms of ppmv as propane or other calibration gas. The average shall be determined by the integration of the output recording over the period specified in the applicable regulation.

If results are required in terms of ppmv as carbon, adjust measured concentrations using Equation 25A-1.

$$C_c = K\,C_{meas} \qquad \text{Eq. 25A-1}$$

Where:

C_c = Organic concentration as carbon, ppmv.

C_{meas} = Organic concentration as measured, ppmv.

K = Carbon equivalent correction factor.

K = 2 for ethane.

K = 3 for propane.

K = 4 for butane.

K = Appropriate response factor for other organic calibration gases.

9. *Bibliography*

9.1 Measurement of Volatile Organic Compounds—Guideline Series. U.S. Environmental Protection Agency. Research Triangle Park, NC. Publication No. EPA-450/2-78-041. June 1978. p. 46-54.

9.2 Traceability Protocol for Establishing True Concentrations of Gases Used for Calibration and Audits of Continuous Source Emission Monitors (Protocol No. 1). U.S. Environmental Protection Agency, Environmental Monitoring and Support Laboratory. Research Triangle Park, NC. June 1978.

9.3 Gasoline Vapor Emission Laboratory Evaluation—Part 2. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, NC. EMB Report No. 75-GAS-6. August 1975.

APPENDIX K

CALCULATION EQUATIONS

CALCULATION EQUATIONS

METHOD 2

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

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

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

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

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

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

$$= \frac{4.\ \lambda\ 10^{-2}\ P\ M_s}{{}_s\ (\quad)}$$

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

Y = 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

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

$$\%EA = \frac{100(\%O_2 - \ ).5\%\ CO)}{0.[illegible]\%\ N_2 - \%O_2 + 0.5\%\ CO}$$

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

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

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

CALCULATION EQUATIONS

METHOD 5

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

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

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

$$I = 0.0944\ \left(\frac{T_{s(avg)}}{V_s\ A_n\ C\ (1 - B_{ws})}\right)$$

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

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

$$(M_p)_1 = 8.7714 \times 10^{-4}\ C_s\ C_{s,d}$$

$$(M_p)_2 = \frac{1.4228 \times 10^{-4}\ M_n\ A}{n}$$

$$M_p = \frac{(M_p)_1 - (M_p)_2}{L}$$

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

Y = 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

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

$T_{m(avg)}$ = Absolute average dry gas meter temperature, °F

$T_{s(avg)}$ = 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

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.

Y = Dry test meter correction coefficient, dimensionless

ρ = Actual gas density, LB/ACF

Interpoll Laboratories
PM-10 Equations

Preliminary Run Calculations:

$$M_d = 0.44\,B_{C[illegible]} + 0.32\,B_{O_2} + 0.[illegible]8\,(B_{N_2} + B_{[illegible]})$$

$$M_s = M_d\left(1 - \frac{MC}{100}\right) + 0.18\,(MC)$$

$$P_s = P_b + \frac{[illegible]}{13.6}$$

$$\mu = 152.418 + 0.2552\,t_s + 3.2355\times10^{-5}\,t_s^2$$

$$+ 0.33147\,(B_{O_2}) - 0.74143\,MC$$

$$Q_s = 2.837\times10^{-3}\,\mu\left[\frac{(t_s + 460)}{([illegible])}\right]^{0.2949}$$

$$\Delta H = \frac{1.083\,(t_m + 460)\,M_d\,\Delta H_@}{P_b}\left[\frac{Q_s\left(1 - \frac{MC}{100}\right)P_s}{t_s + 460}\right]^2$$

$$\Delta_p^{[illegible]} = \Delta_p^{[illegible]}\left(\frac{[illegible]}{t_s [illegible]}\right)^2$$

Dwell Times:

First Point $\quad \Delta t_1 = \left[\frac{\sqrt{[illegible]}}{(\sqrt{\Delta p})_{[illegible]}}\right]$

Other Points $\quad \Delta t_n = \left(\frac{\Delta t_1}{[illegible]}\right)\sqrt{[illegible]_n}\quad$ where $n = 2, 3, \ldots, 10$

9[illegible]-[illegible]01/[illegible]L

Post Test Calculations:

$$V_{m(std)} = 17.64\,\gamma\,V_m\left(\frac{P_b + \frac{\Delta H}{13.6}}{(t_m + 460)}\right)$$

$$Q_s = \frac{5.649\times10^{-2}\,(\bar{t}_s + 460)}{\bar{C}_p\,\bar{P}_s}\left[V_{m(std)} + 0.04707\,(V_t - V_i)\right]$$

$$P = 152.419 + 0.2552\,\bar{T}_s + 3.2255\times10^{-4}\,\bar{T}_s + 1.5314\,B_{O_2} - 0.74143\,MC$$

$$M_s = M_d\left(1 - \frac{2}{100}\right) + 0.18\,MC$$

$$D_{50} = 0.1125\left(\frac{\bar{t}_s + 460}{M_s\,\bar{P}_s}\right)^{0.2091}\left(\frac{\mu}{Q_s}\right)^{0.7091}$$

where

M_d = dry molecular weight of exhaust gas

B_{CO2} = percent volume of CO_2 in exhaust gas on a dry basis

B_{O2} = percent by volume of O_2 in exhaust gas on a dry basis

B_{N2} = percent by volume of N_2 in exhaust gas on a dry basis

B_{CO} = percent by volume of CO in exhaust gas on a dry basis

MC = percent by volume of water vapor in exhaust gas

M_s = actual molecular weight of exhaust gas

P_s = absolute pressure of exhaust gas, IN.HG

P_g = static pressure of exhaust gas, IN.HG

P_b = absolute barometric pressure, IN.HG

t_s = average exhaust gas temperature from preliminary determination or point gas temperature, °F

Q_s = cyclone flow rate at actual (or stack) conditions, ACFM

$Q_{s(std)}$ = cyclone flow rate at dry standard conditions, DSCFM

ΔH = pressure drop across calibrated orifice, IN.WC

$\Delta H_{@}$ = orifice coefficient or pressure drop across calibrated orifice @ 0.75 DSCFM, IN.WC

t_m = temperature of dry test meter, °F

Δp^{M201A} = velocity pressure of gas stream as measured with S-type pitot attached to cyclone, IN.WC

Δp^{M2} = velocity pressure of gas stream as measured with S-type pitot tube as per EPA Method 2 (preliminary traverse), IN.WC

C_p^{M201A} = pitot tube coefficient of S-type pitot tube attached to cyclone, dimensionless

C_p^{M2} = pitot tube coefficient of S-type pitot tube used in preliminary traverse, dimensionless

Δt_n = dwell time at traverse point n, where n = 2, 3, ..., 12, minutes

Δt_1 = dwell time at the first sampling point, minutes

$\bar{t}_s$ = average stack gas temperature during test run, °F

θ = total run time, minutes

$V_{m(std)}$ = total dry volume of gas sampled, DSCF

V_f = final volume of water in sampling train condenser system, ml

V_i = initial volume of water in sampling train condenser system, ml

$\bar{t}_m$ = average temperature of dry test meter during run, °F

Y = dry test meter coefficient, dimensionless

$\overline{\Delta H}$ = average pressure drop across the calibrated orifice for the sampling train during the run, IN.WC

V_m = volume of dry gas sampled as measured by the dry test meter at meter conditions, CF

D_{50} = actual or achieved 50% cut size for a given run of the [illegible] or cyclone used [illegible] the [illegible] particulates with aerodynamic equivalent diameters greater than or equal to 10 microns, microns

CALCULATION EQUATIONS

METHOD 10

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

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

$$GR/DSCF = 5.0085 \times 10^{-4} \left(CO\text{-}PPM\text{-}DRY\right)$$

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

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

$$E = \frac{2.9077 \times 10^{-3} F_d \left(GR/DSCF\right)}{20.5 - O_{2,d}}$$

Where:

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

$CO_{2,d}$ = carbon dioxide concentration of flue gas in 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 °F, 29.92 IN.HG.)
mg/dscm	= concentration of carbon monoxide in flue gas on a milligrams per dry standard cubic meter basis (60 °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	= factor of proportionality for fuel in dry standard cubic feet of combustion gas at 0% oxygen per million BTU of heat input (DSCF/MM BTU)

CALCULATION EQUATIONS

Chromotropic Acid Method for Formaldehyde

$$m_t = \frac{m_a \times V_{soln}}{V_{aliq}}$$

where m_t = mass of formaldehyde in total sample in ug

m_a = mass of formaldehyde in aliquot in ug

V_{soln} = volume of total sample in cc (500 cc normally)

V_{aliq} = volume of aliquot taken for analysis in cc

$$PPM\text{-}DRY = \frac{.0263\ m_t}{V_{std}}$$

PPM-WET = PPM DRY (1-MC/100)

GR/DSCF = 5.45×10^{-4} (PPM-DRY)

mg/dscm = 1.249 (PPM-DRY)

$\dot{m}$ = 8.3754×10^{-3} (GR/DSCF) ($Q_{s,d}$)

where PPM-DRY = concentration of formaldehyde in parts per million by volume on a dry basis

PPM-WET = concentration of formaldehyde in parts per million by volume on an actual or wet basis

MC = moisture content of gas on a percent by volume basis

GR/DSCF = concentration of formaldehyde in gas in grains per dry standard cubic foot basis (68°F, 29.92 IN.HG.)

$\dot{m}$ = emission or mass rate of formaldehyde in pounds per hour (LB/HR)

Method 25A

Total Gaseous Organics Calculation Equations

$$GR\ C/SCF = 2.160 \times 10^{-4} (ppm,w)$$

$$GR\ C/DSCF = 2.160 \times 10^{-4} (ppm,w)/(1 - MC/100)$$

$$LB\ C/HR = 8.5714 \times 10^{-3} (GR/DSCF)\ (DSCFM)$$

Where:

GR C/SCF = grains of total gaseous organics as carbon per actual (wet) standard cubic foot

GR C/DSCF = grains of total gaseous organics as carbon per dry (wet) standard cubic foot

LB C/HR = pounds of total gaseous organics as carbon emitted per hour

Note 1: [illegible]

Note 2: [illegible]

Interpoll Laboratories, Inc.
(612) 786-6020

Calculation of (LB/KLB FLUE GAS)
Louisiana Pacific - Sagola, Michigan
Press & Unloader Vent Particulate Emission Rate

Parameter	Run 1	Run 2	Run 3
(Q_{sd}) DSCFM	123256	124668	123717
m_{fg} (LB/HR)	560815	567239	562512
m_{fg} (10^3LB/HR)	560.8	567.2	562.9
m_p (LB/HR)	3.46	2.23	2.17
E (LB/KLB)	0.0062	0.0039	0.0039

m_{fg} = 560815/123256 = (LB/HR)/(DSCFM) = 4.51 Q_{sd}
From Method 2 Determination

APPENDIX L

SAMPLING TRAIN CALIBRATION DATA

Interpoll Laboratories, Inc.
(612) 786-6060

EPA Method 5 Gas Metering System Quality Control Check Data Sheet

Job LP/5096LA Date 2-24-92

Operator [illegible] Module No. 8

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

Bar press 28.70 in. Hg. t_f = .995 ΔH@ 1.91 in. W.C.

Time (min)	Volume (CF)	Meter Temp. (°F)	
		Inlet	Outlet
[illegible]	426.50	[illegible]	
2.5	428.60	60	56
5.0	430.28	62	57
7.5	432.17	65	58
10	434.05	67	60
[illegible]	V_m = 7.55	Avg(t_m) = 61.6	°F

Calculate Y_{em} as follows:

$$Y_{em} = \frac{1.716}{T_{amb}} \left[\frac{(t_m + 460)}{P_b} \right]^{0.5}$$

$$Y_{em} = \frac{1.716}{(.995)(7.55)} \left[\frac{(61.6) + 460}{(28.7)} \right]^{0.5} 4.2590$$

$$Y_{em} = 1.6119$$

If Y_{em} 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-432R

Interpoll Laboratories, Inc.
(612) 786-620

Meter Box Calibration and Usage Status

Date of Report: March 11, 1992

Meter Box No. : 8 (Rockwell Dry Test Meter Serial No. 984553)

Date of Last Calibration: February 14, 1992
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.)
February 19, 1992	2-3503	195.00	421.95	226.95	226.95
February 24, 1992	2-3507	426.50	889.00	462.50	689.45

* Total volume through meter since last calibration.

Date 2/14/92

Bar. Press. 29.05 in. Hg

INTERPOLL LABORATORIES, INC.
METER CALIBRATION SHEET
EPA METHOD 5

Control Module No. 8

Serial No. DTM 924-552

Std. Test Meter: AL-20

Technician D. BRENNAN

ΔH (in. H_2O)		Gas Volume Wet Test Meter (ft^3)	Cal. Index θ (%)	Diff. Press. Wet Test Meter ΔP_w (in. H_2O)	Gas Volume Dry Gas Meter (ft^3) V_{di}	V_{df}	Gas Temperature Wet Test Meter t_w (°F)	Dry Test t_{di} (°F)	t_{do} (°F)	Time θ (min/sec)	Meter Coeff. Y	Orifice Coeff. ΔH@	C_r
Nominal	Actual												
0.5	.50	1	22.95	0.03	178.000	180.036	64.5	76	69	5:11	.9945	1.50	
1.2	1.2	3	22.91	0.025	181.000	184.091	64.5	80	70	4:58	.9980	1.85	
2.0	2.0	3	99.93	0.049	162.500	165.521	64.5	75	65	3:53	.9976	1.90	
3.7	3.3	5	100.00	0.09	166.500	171.551	64.5	79	67	[illegible]	.9774	1.91	
4.7	4.7	5	100.02	0.12	172.500	177.595	64.5	82	70	4:20	.9910	1.98	
										Average	.9957	1.91	

Positive leak check performed by D. BRENNAN

[illegible]

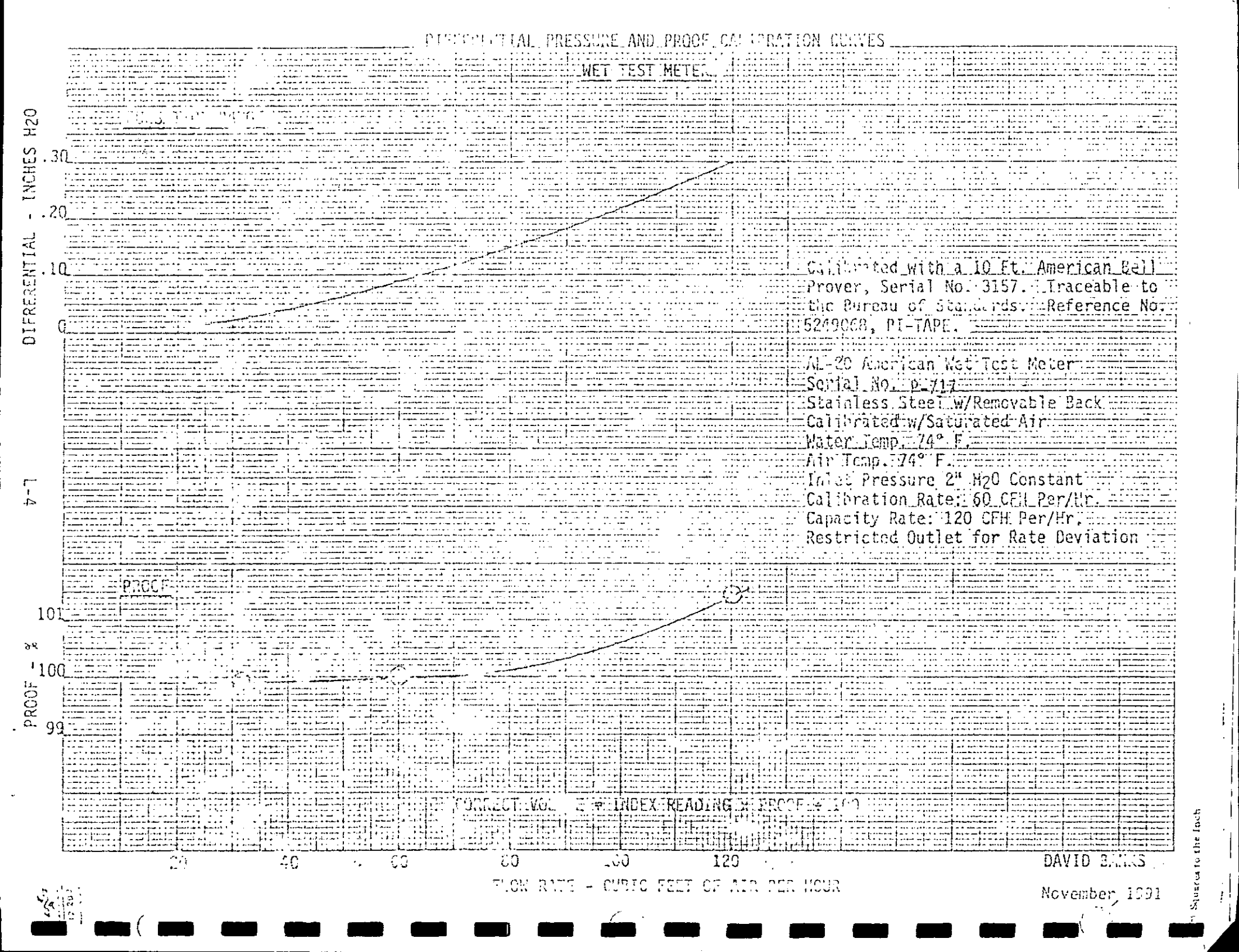
[illegible] Leakage

[illegible]

Approved by [signature] Date 2/14/92

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

SOT02RA 11/91


DIFFERENTIAL PRESSURE AND PROOF CALIBRATION CURVES
WET TEST METER
DIFFERENTIAL - INCHES H2O
.30
.20
.10
0
PROOF
101
100
99
PROOF - %
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
CORRECT VOL. = INDEX READING X PROOF ÷ 100
20
40
60
80
100
120
FLOW RATE - CUBIC FEET OF AIR PER HOUR
DAVID BANKS
November 1991
L-4

Interpoll Laboratories, Inc.
(612) 786-6020

Nozzle Calibration
Data Sheet

Date of Calibration: 2-25-92 Nozzle Number 4-3

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	.190
2	.190
3	.191
Average:	.190

Interpoll Laboratories, Inc.
(612) 786-6020

Nozzle Calibration
Data Sheet

Date of Calibration: 2-26-92 Nozzle: PM-10

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	.130
2	.130
3	.130
Average:	.130

Interpoll Laboratories, Inc.

Temperature Measurement Device Calibration Sheet

12

Unit under test:

Vendor	Fluke		
Model	51	Serial Number	5030?75
Range	0 - 2100 °F	Thermocouple Type	[illegible]
Date of Calibration	1-3-92	Technician	[illegible]

Method of Calibration:

☐ Comparison against ASTM mercury in glass thermometer [illegible] 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 72 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	+1.0	.21
100	100	[illegible]	[illegible]	.10
200	[illegible]	[illegible]	[illegible]	.45
300	[illegible]	[illegible]	+1.3	[illegible]
400	[illegible]	[illegible]	[illegible]	[illegible]
500	[illegible]	[illegible]	[illegible]	[illegible]
600	[illegible]	[illegible]	[illegible]	[illegible]
700	[illegible]	[illegible]	[illegible]	[illegible]
800	[illegible]	[illegible]	[illegible]	[illegible]
900	[illegible]	[illegible]	[illegible]	[illegible]
1000	[illegible]	[illegible]	[illegible]	[illegible]
1100	[illegible]	[illegible]	[illegible]	[illegible]
1200	[illegible]	[illegible]	[illegible]	[illegible]
1300	[illegible]	[illegible]	[illegible]	[illegible]
1400	[illegible]	[illegible]	[illegible]	[illegible]
1500	[illegible]	[illegible]	[illegible]	[illegible]
1600	1600	[illegible]	[illegible]	[illegible]
1700	1700	[illegible]	[illegible]	[illegible]
1800	[illegible]	[illegible]	[illegible]	[illegible]
1900	[illegible]	[illegible]	[illegible]	[illegible]
2000	[illegible]	[illegible]	[illegible]	[illegible]
2100	[illegible]	[illegible]	[illegible]	[illegible]
		[illegible]	1.47	[illegible]

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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(612)784-6020

S-Type Pitot Tube Inspection Sheet

Pitot No. 23-6

Pitot tube dimensions:

1. External tubing diameter (D_t) _____ .316 IN.
2. Base to Side A opening plane (P_A) _____ .962 IN.
3. Base to Side B opening plane (P_B) _____ .962 IN.

Alignment:

4. $\alpha_1 < 10^0$ _____ 2 _____
5. $\alpha_2 < 10^0$ _____ 1 _____

6. $\beta_1 < 5^0$ _____ 1 _____
7. $\beta_2 < 5^0$ _____ 2 _____

8. Z <.125" _____ .03 _____
9. W <.0625" _____ .02 _____

Distance from Pitot to Probe Components:

10. Pitot to 0.500 IN. nozzle _____ .288 IN.
11. Pitot to probe sheath _____ .00 IN.
12. Pitot to thermocouple (parallel to probe) _____ [illegible] IN.
13. Pitot to thermocouple (perpendicular to probe) _____ [illegible] IN.

☐ Meets all EPA design criteria thus C_p = 0.84

☑ Does not meet EPA design criteria - must calibrate in wind tunnel
C_p = _____

Inspected by: _____ Inspection: _____

CFR Title 40 Part 60 Appendix A Method 2

INTERPOLL LABORATORIES
(612)786-6020

Stack Sampling Department - QA
Aneroid Barometer Calibration Sheet

Date 1-6-92
Technician [illegible]
Mercury Column Barometer No. ______
Aneroid Barometer No. [illegible]

Actual Mercury Barometer Read	Ambient Temp.	Temperature Correction Factor	Adjsted Mercury Barometer Read	Initial Aneriod Barometer Read	Difference (P_{ba}-P_{bm})
			29.66	29.66	0

Has this barometer shown any consistent problems with calibration? Yes/No (No circled) 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.

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